POPULAR WIRELESS AND WIRELESS REVIEW, December 6th, 1924. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

OVER HALF A MILLION READERS MONTHLY.

Popular Wireless

and Wireless Review

PRICE 3d. EVERY THURSDAY.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

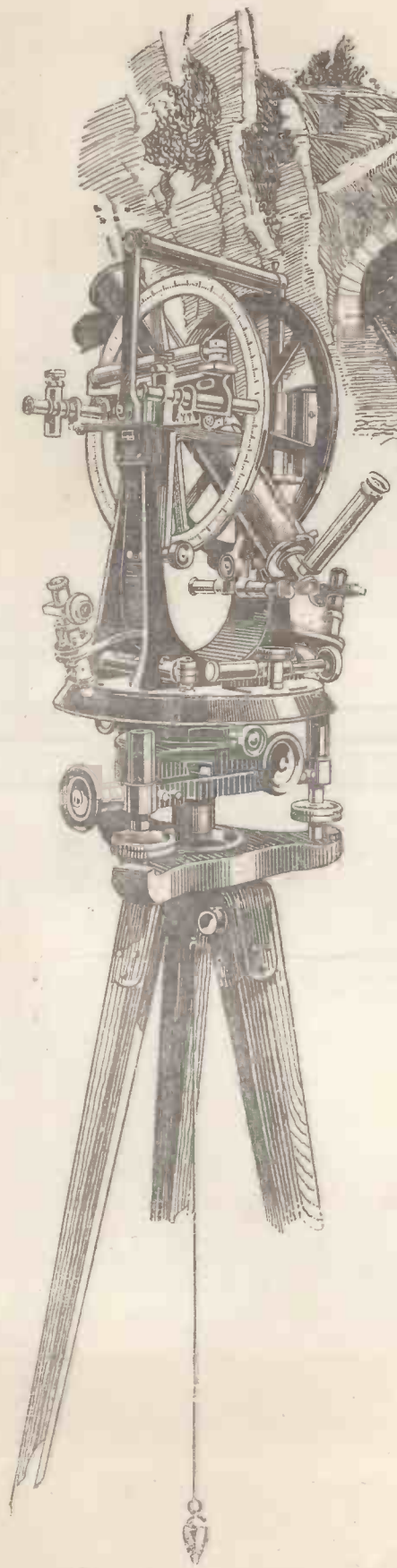
"Uncle Leslie" and a young friend who gave a solo concert at the Zoo recently.

SPECIAL FEATURES IN THIS ISSUE.

G. B. S. AT 2 L O.

Some Interesting Valve Circuits.
The Square Law Condenser.
Three New Unidyne Circuits.
L.F. and 'Phone Transformers.
Wireless in a Coal Mine.
Making a Wall Bracket Set.

No. 132. Vol. VI. December 6th, 1924.



Let the Cobbler stick to his last

THE Railway Engineer requires his instruments to be of the greatest precision.

When he chooses a theodolite, he goes not to an upholsterer, nor to a maker of gramophones, but to a firm whose speciality is the manufacture of surveying instruments.

He knows that instruments if defective may cost him thousands of pounds, so he is careful to buy them only from a firm whose long specialised knowledge is a guarantee of good results.

The small fixed condensers in your wireless set are perhaps not so delicate as surveying instruments, nor is a faulty choice likely to cost you thousands of pounds. But the manufacture of good condensers most emphatically is the work of specialists, and a poor condenser will certainly ruin your reception of broadcasting and cost you many disappointing evenings.

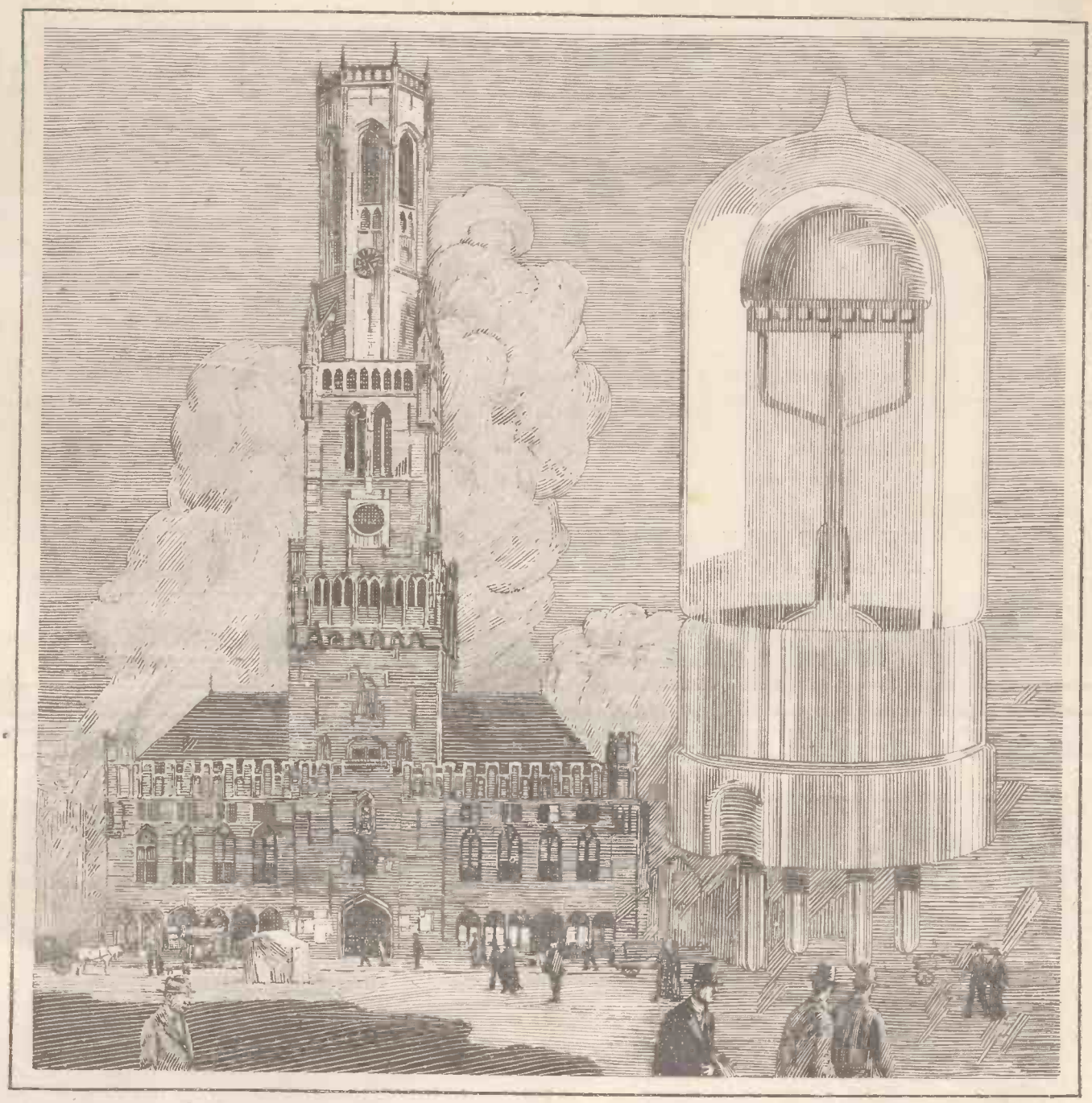
Many thousands of constructors have found that in spite of appearance condensers *are* specialised instruments, and that best results can only be expected if they buy condensers backed by long specialised experience.

That explains why 60,000 Dubilier Condensers are sold each day throughout the world.

YOU should specify Dubilier.

DUBILIER
CONDENSER CO LTD

E.P.S. 33.



Continental Series, No 4

Broadcasting from Belgium

Using a wave-length of 265 metres the only Belgian Broadcasting Station is situated at Brussels. To receive it on the average Set it is necessary to use a 35-turn Coil (in some cases, dependent upon the conditions of the Aerial, a 25-turn Coil may give better results). See that your Aerial tuning condenser is in series with the Coil. The wave-length of Brussels at present is particularly free from interference, and being some 100 metres or so below any of our own main stations it is fairly easy to pick up.

Brussels uses a power of 2½ kilowatt and should be received in any part of the country on a 2-Valve Set using one Cossor P.1 and one P.2

A Trip to the Continent

—available to everyone using the Cossor long-distance valve

No longer can we complain of the lack of variety of the Broadcasting programmes available for us. If those being transmitted from near-by Stations are not to our liking we can readily take a trip to some of the nearer Continental Stations such as Brussels or Paris. Transmissions from these Stations are so good and usually so free from interference that they can be relied upon for a programme that is a welcome change.

Numbers of people would take an interest in Continental transmissions but for the fact that they are handicapped by unsuitable apparatus. Although in the hands of an expert a single valve receiver can be made to give astounding results, yet it is generally recognised that a stage of high-frequency amplification is necessary to make reception a certainty.

If yours is a single valve set why not convert it at once for long distance work by adding a stage of high frequency—diagrams and instructions are constantly appearing in all the Wireless Magazines. Until you are in a position to enjoy long distance reception you have not experienced one of the great thrills of Wireless.

If your Receiver is supposed to be capable of receiving over several hundred miles and does not do so in your hands it is very probably because you are using the wrong kind of Valves. No one is foolish enough to put a racehorse between the shafts of a farm cart or to enter a cart horse in a race. Each animal—through generations of breeding—has been reared for its own particular job. And it is the same with wireless valves.

The valve for long-distance reception must be so sensitive as to pick up signals constantly impinging on the aerial that are much too weak to be rectified by the Detector Valve. And if these oscillating currents are not rectified any number of low-frequency valves will not make the slightest difference.

That is exactly why the Cossor P.1 and the Cossor P.2 are two entirely different valves. The first can only commence to function on signals that are sufficiently strong as to be capable of rectification. It is the purpose of the P.2 (the valve with the red top) to build up the signals so that the P.1 Valve can easily rectify them.

Working in perfect harmony it is only natural that the Cossor P.1 and the P.2 should be capable of producing exceptional results. Indeed, in the two short years that they have been on the market they have enjoyed a measure of appreciation which has been accorded to no other Valves.

Experimenters first, then the general Wireless public afterwards, were quick to realise that the hood-shaped Grid and Anode in conjunction with the arched filament were responsible for a more efficient use being made of the electron stream.

It is obvious that the ordinary valve with its long straight filament and tubular Anode is most wasteful and permits a serious escape of electrons from each end of the Anode. It has not been difficult to convince a man that if reducing the filament current decreases the electron stream—and consequently the signal strength—then any proportion of the electron stream not being used will have much the same effect.

In the same way those enthusiasts who have been keen to obtain *pure* loud speaker reception readily appreciate that the ordinary spiral grid is far from rigid. Its weakness permits microphonic noises and distortion which can only be entirely eliminated by such a design as the Cossor. Here we see a grid that is a magnificent piece of engineering work. Built up on a stout metal grid band, each wire is anchored *no less than three times*—thus making a network which is wonderfully rigid.

Undoubtedly—as satisfied users seem to be never tired of telling us—the P.1 and the P.2 are remarkable valves. If you are in any way dissatisfied with your present Set—if you cannot get far beyond your local stations, fit Cossor Valves, recognised as the country's most popular Valves.

Remember all Cossor Valves are now sold in patented sealed cartons—the only valve in the world that can come direct from factory to user without being used for demonstration or other purposes.

Not only do you get a better Valve, therefore, but you know perfectly well that it is a brand new one.

BRIGHT EMITTERS

P.1. For Detector and L.F. use 12/-
P.2. (With Red top) for H.F. use 12/6

WUNCELL DULL EMITTERS

Model A. (*With resistance in base for use with 2-, 4- or 6-volt accumulator.*)
W.R.1. For Detector and L.F. use 23/6
W.R.2. (With Red top) for H.F. use 23/6

Model B. (*Without resistance, working direct from 2-volt accumulator*).
W.1. For Detector and L.F. use 21/-
W.2. (With Red top) for H.F. use 21/-

Valves

POPULAR WIRELESS

AND WIRELESS REVIEW.

December 6th, 1924] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Thursday, Price 3d

Technical Editor: G. V. DOWDING, Grad.I.E.E. | Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.G.S. | Scientific Adviser Sir OLIVER LODGE, F.R.S.

RADIO NOTES AND NEWS OF THE WEEK.

Radio in India.

THE amateur who recently succeeded in picking up Chelmsford at Bombay was formerly a resident of Leeds, and his record reception was widely discussed in both cities. The result is that his feat has already been out-done by another Leeds man living in India.

This is Mr. G. Shank, of Kachina, a hill-town about 350 miles north of Calcutta. On a three-valve set he succeeded in picking up music from 5 X X, at a distance of well over 5,000 miles.

Mr. Godfrey Isaacs, who has announced his resignation from the Marconi Co. Mr. Isaacs has for many years been managing-director of the Marconi Co. and has been chiefly responsible for the company's great success. His brother is Lord Reading, the Viceroy of India.

* * *

A Remarkable Success.

THE set used on this occasion was made by Mr. Shank's father and a friend, who is a member of the Leeds Radio Society.

In order to send it by post its weight was limited to not exceeding 11 lb. Success was partly due to the aerial, which was 50 ft. long and 100 ft. high.

* * *

A Bit Monotonous!

AMERICA advertises by radio, but the B.B.C. prides itself upon keeping all taint of commercialism from British microphones. Yet every week listeners' feelings are harrowed by that stirring and impassioned appeal not to forget to buy the B.B.C.'s official organ. Not that we mind—but it does get a bit monotonous!

* * *

The Difference.

WHEN you heard that a power of only 200 watts was employed by amateurs to communicate with New Zealand, you may not have been very impressed. But if you realise that *one million watts* are used by the Bordeaux station (on 19,000 metres) for transatlantic work, you get a better idea of the wonderful accomplishment of the British amateurs.

* * *

Glasgow's New Studio.

THE change to Glasgow's new studio has proved beneficial all round. The staff like the new quarters, and a number of 5 S C's audience have remarked upon an improvement in transmission: Personally, I have not discovered the latter, but perhaps my aerial is too far away to respond to the improvement.

OUR CHRISTMAS NUMBER.

Order your copy of next week's "P.W." NOW, and do not miss our greatly enlarged Christmas Number. Among the many special features is included an exclusive article by Mr. Ridley, the first British amateur to receive signals from Mexico. Since the issue of No. 1, 12,497,610 copies of "P.W." have been sold. Help swell that number and buy next week's magnificent issue.

A "Talk" Suggestion.

PERHAPS I shall not be thanked for suggesting another "Talk" to the B.B.C., but there is one subject upon which I think that listeners would appreciate a brief weekly criticism, and that is "New Gramophone Records." Would not a resumé of the week's productions and a chat about outstanding features have an even wider appeal than a talk to playgoers?

The "P.W." Constructors' Competition.

The Prizewinners.

The "P.W." Constructors' Competition at the White City Wireless Exhibition proved a great success, and the judges—consisting of Mr. W. S. Sholl, Mr. Dowding, and the Editor of "Popular Wireless"—made the following awards:

1st Prize (Senior Section), A Silver Cup, won by W. M. Crippin, 4, Clovelly Road, Ealing, W.5.

2nd Prize, Gold Medal, won by P. Riley, 95, Minor Street, Failsworth, Manchester.

3rd Prize, Silver Medal, won by Louis J. Collins, Special Surgical Hospital, Shepherd's Bush.

1st Prize (Junior Section), A Silver Cup, won by Alfred G. Haslan, 40, Lauradale Road, Fortis Green Road, N.2.

2nd Prize, Gold Medal, won by G. Hogbin, 130, Smawthorn Lane, Castleford, Yorkshire.

3rd Prize, Silver Medal, won by C. H. Leech, 12, Ashford Avenue, Hornsey, N. 8.

* * *

A Good Training Ground.

BIRMINGHAM is establishing quite a reputation as a place for promotion. A station-director and an engineer-in-charge were provided from there for Liverpool, whilst Belfast called upon 5 I T for an engineer-in-charge and a maintenance engineer. Now Mr. Pelham is leaving Birmingham to become senior-assistant-director at the Ulster station.

"Hippo and Rhino."

A GREAT many readers who were engaged on wireless work during the war were interested in last week's letter from an Edinburgh correspondent regarding "Hippo" and "Rhino." These early "uncles" diverted half the Western Front with their cheery conversations, and I often wondered what the Germans thought of them. Their testing used to come through uncommonly well on the North Sea also, and there was hardly a man in the wireless section of the Navy who did not take a lively interest when "Husky" got a dressing-down from "Captain Baker" one day!

* * *

Mr. Kipling Next?

THEIR star turn was "If," by Rudyard Kipling, and they would recite this poem to one another with the utmost gusto, for hours on end. Which reminds me that now "G.B.S." has broadcast, perhaps the B.B.C. could prevail upon Mr. Kipling himself to face the microphone for the benefit of his countless admirers?

* * *

Money Wanted.

IF sufficient capital were available, television would be an accomplished fact within five years. Pilotless aeroplanes, controlled by wireless, could be operated by an "aviator" on the ground. They could be equipped with six lenses to show everything above, below, in front, behind, and on either side, and the six pictures could be thrown on a screen in the control room so that there would be no advantage in risking life in the air.

* * *

The Pilotless Plane.

MR. HUGO GERNSBACK, the American scientist, thinks such a machine but the next step in aerial evolution. He is supported by Dr. Eccles, who is enthusiastic about the idea, and indeed the advantages of the pilotless 'plane cannot be over-estimated. For one thing, all transport problems would be side-tracked by such an application of the principles of television and wireless control.

* * *

5 X X's New "Earth."

BOROUGH HILL, near Daventry, Northants—where the B.B.C. propose to erect the new super station to replace 5 X X—is the site of an extensive Roman encampment.

It is therefore quite likely that in order to earth this most modern station some very ancient relics may be disturbed, after a sleep of centuries.

(*Continued on page* 814.)

NOTES AND NEWS.

(*Continued from page* 813.)

"Sound Signs."

WHY should not each of the B.B.C. stations have a "characteristic sound," like London's Big Ben? One of the American stations always "signs-on" and "signs-off" with a cock-crow, and Hamburg's gong and Breslau's "ticking" are already becoming quite a recognised feature of those stations' programmes. I suggest that all the B.B.C.'s stations also might evolve a characteristic sound—why not, for instance, a ship's syren for Cardiff and bagpipes for Aberdeen?

* * *

Berlin's New Tower.

UNDOUBTEDLY the finest mast in the world is the Eiffel Tower, and I hear from Berlin that a similar building is being constructed there as a site for a wireless transmitting station. It will

Broadcasting the Zoo. A "close-up" of one of the performers.

be about 400 feet high, and a large restaurant will be built into the structure about one-third of the way up.

* * *

Broadcasting at Sea.

DID you hear the "Leviathan" broadcasting at sea? During a recent voyage the great American liner carried out broadcasting tests, and night after night the signals came through with great clearness. The ship's call sign is W S M, and the wave-length used was 316 metres.

* * *

Gossipy Travellers.

AN Abbotts Bromley (Staffs) correspondent tells me he heard the "Leviathan" announce that she was then 750 miles west of Cherbourg. Several other readers had logged the ship soon after she left New York, and they all speak of the effective broadcasting of the ship's bells. After a chat with the "George Washington," W S M called up K O B M, and these two ships compared notes about the weather and the ports they were making for just like a pair of gossipy travellers on the road!

Rather Mixed.

"THE wave-lengths employed in commercial radio-telegraphy extended from about 20 kw. down to about 400 metres . . ." says the "Electrician."

The voltage in amps. is not stated, but it was presumably of the order of 1 mfd.

* * *

More Super Stations.

THE success of 5 X X has stimulated the erection of similar high-power broadcasting stations in other parts of the world. France, Germany, and America have all been experimenting successfully with super stations, and the power of 25 kilowatts to be used by the B.B.C.'s new Midland station has already been exceeded in the U.S.A.

WHAT THEY SAY.

"Shakespeare and Shaw are both very good in their way, but the mixture would be a bore and a failure."—George Bernard Shaw.

* * *

"Anonymous letters containing merely abusive criticism, are of little use to anyone. What we need from our listeners are appreciations of the items they like, criticisms of the items they did not like, and suggestions as to the sort of programme they desire."—Mr. E. Liveing, Station Director, Nottingham.

* * *

"Generally speaking, for ordinary broadcast reception, high frequency amplification is unnecessary, ranges up to two hundred miles being easily obtainable with a set consisting of a detector valve and two stages of low frequency amplification." — "Electrical Industries."

* * *

"Happily great strides are being made in loud speaker design.....and we trust it may not be long before such results are available to the general public."—Mr. W. K. Alford, of the Transmitter and Relay Section, R.S.G.B.

* * *

". . . Undoubtedly when allocated wave-lengths of about 100 metres most amateurs imagined that they were being driven into a barren desert, but it now turns out that they were being driven into a land flowing with milk and honey. . . ."—Prof. G. W. O. Howe, D.Sc., M. I. E. E., writing in the "Electrician."

* * *

". . . One could understand and sympathise with those who feared that to sleeping-in on the Sabbath morning would be added listening-in on Sabbath evening. The fear, however, was groundless. . . ."—Rev. Dr. John White of Glasgow.

* * *

". . . He (Mr. J. H. Clynes) is something of a wireless 'fan,' and may be remembered as the first Minister who introduced 2 L O into the domestic interior of Downing Street, for he had a wireless set installed at No. 11."—London Mail."

* * *

". . . The chief criticism one hears nowadays is that the B.B.C. in its hunt for novelty is overdoing it, and that the programmes are becoming too mixed and too scrappy. . . ."—"Birmingham Daily Mail."

* * *

The Week's Query:

Would a variable one-to-one megohm leak improve reception?

Encouraging Results.

LITTLE has been published regarding the German high-power plans, but America has provisionally decided upon a super station near New York. Meanwhile East Pittsburg (K D K A) and Schenectady, N.Y. (W G Y), are experimenting with high-power and short waves, and, working along rather different lines, some very encouraging results have been obtained at both stations.

Captain Eckersley at K D K A.

CAPTAIN ECKERSLEY has disclosed some interesting details regarding his recent visit to K D K A. He saw the new experimental aerial there—which is built up of copper tube—and whilst grasping the hand-rail which guards the set he noticed a queer burning sensation due to H.F. currents warming the skin. The aerial is supported on a 50 ft. wooden telegraph pole, and its normal power is 15 kilowatts.

* * *

B.B.C. Xmas Plans.

ARRANGEMENTS whereby those living over-seas will be kept in touch with England for Christmas by means of a special broadcasting programme are now being arranged by the B.B.C.

Those who possess long-distance receivers will be able to establish communication direct. For others, special plans for relaying a Christmas programme sent out by 2 L O, the London station, from the various local stations over-seas are now being thought out, although no decision has yet been arrived at.

* * *

New German Stations.

TWO new broadcasting stations are to be erected at Cassel and Dresden. There are three already in operation at Hanover, Bremen, and Nürnberg.

* * *

"P.W." Short-Wave Tests.

SHORT-WAVE tests have recently given such interesting results that many readers are keen to continue this class of reception. All such will be interested in tests which "P.W." is arranging with Mr. E. T. Flewelling, inventor of the famous circuit, who is confident that his 70 metre signals from 9 X B G (Chicago) will be received in this country when a suitable time-table has been drawn up.

* * *

International Radio Week.

THE biggest draw of International Radio Week, as far as American listeners were concerned, was the chiming of Big Ben. In America there is no national time-piece, but the fame of the Westminster clock is world-wide, and it proved the most popular item of the European concert.

* * *

Blowing the Trumpet.

WE don't often blow it, but for the benefit of advertisers we would like to point out that last week's issue was a record one for POPULAR WIRELESS as regards advertisements. The issue had 76 pages, including cover, of which 46 were devoted to advertisements. Extra editorial pages were, of course, included, and the reader had considerably more for his money. The last four issues of POPULAR WIRELESS were purchased by readers to the extent of well over 500,000 copies, and POPULAR WIRELESS is undoubtedly more than ever the most popular and influential of radio journals in Great Britain.

"P.W." now closing down until next week.

ARIEL.

HOW TO MAKE
A WALL BRACKET VALVE RECEIVER.
A USEFUL SET FOR THE HOME.

By SEXTON O'CONNOR.

This very neat and proved efficient receiver makes a useful living-room set. It can be fixed to a wall, and is easily operated by listeners ignorant of wireless technique.

GIVEN the felicity of owning both a wireless set and a wife, there are times when one rather gets in the way of the other, particularly, say, when the set is occupying valuable table-space required by the wife for commissariat or other domestic duties.

The present article shows how to construct a compact single-valve set specially suitable for use in a flat where room is valuable and there is no accommodation for a special "wireless table." It is designed to be hung up out of the way in some convenient corner, preferably by the fireside, as shown in the photograph. Incidentally, if there are small children about, it had better be located somewhat higher up than shown—i.e. where it will be out of the reach of inquisitive fingers.

Preparing the Cabinet.

It will be observed that the casing is designed to contain both high and low tension batteries (provided that a dull-emitter valve is used). The earthing wire is shown connected to the pipe of the gas-fire, whilst the aerial consists of an insulated wire running up the side of the adjacent wall and then across the room. This aerial system will be found to give quite satisfactory strength on several pairs of 'phones if the flat is situated within four or five miles of the transmitting station—although, of course, reception will be considerably strengthened by using an outside aerial.

The following are the materials required, and their approximate cost:

	£	s.	d.
Ebonite panel 6½ by 4½ by ¼ inch ..	0	1	6
4 W.O. terminals	0	0	8
4 valve sockets of the flush type ..	0	0	6
1 rheostat with dial	0	3	6
1 variable condenser, ·0005 mfd. ..	0	6	0
1 double coil-holder	0	4	6
Mahogany, ⅜ in. thick, for sides and bottom and three-ply wood for front and back	0	2	6
1 brass mirror-hanger	0	0	2
1 grid leak and condenser (Edison-Bell)	0	2	6
Wood screws, stain, varnish	0	1	6
Total	£1	3	4

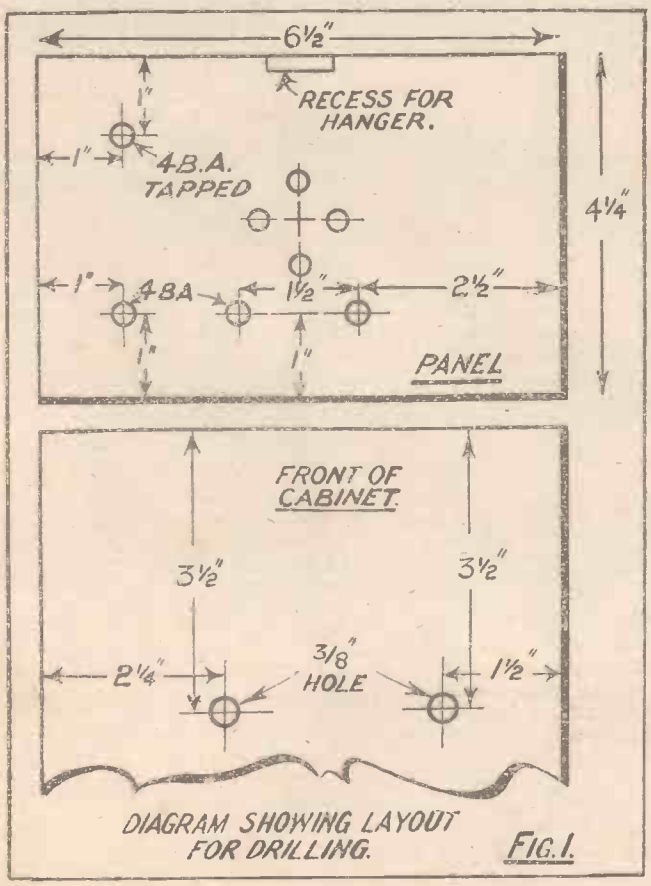


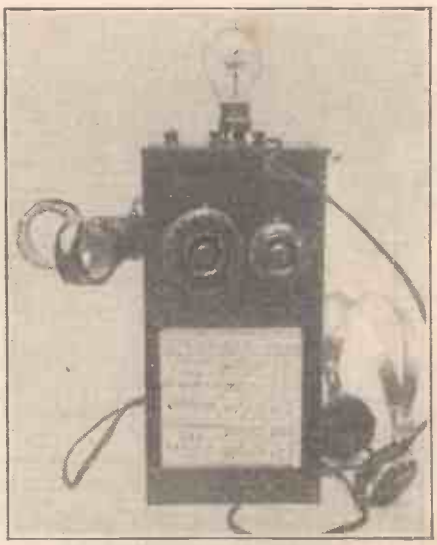
DIAGRAM SHOWING LAYOUT FOR DRILLING. FIG. 1.

The cabinet should be made first, so that the panel can be tackled while the varnish is still drying. First cut from the ⅜ in. mahogany two pieces 12⅜ by 3¾ in. for the sides, and one piece 5½ by 3¾ in. for the bottom. From the three-ply wood cut two pieces for front and back, 12⅜ by 6¼ in. Assemble the sides and bottom together and fix by two brass screws at each side. It should be noted that the sides overlap the bottom, and not vice versa. The front of the case may then be fixed.

Drilling.

The two holes in the front of the case for the condenser and rheostat respectively should now be marked out according to the measurements given in Fig. 1, but before actually drilling, both the purchased components should first be measured to make sure that they will go into the casing as shown. It may happen that the sizes are slightly different from those of the components used by the writer, in which case a corresponding adjustment of the holes may be needed.

The bar of wood to which the hanger is fixed, as shown in Fig. 2, is next cut to size and secured in place by small nails or screws driven through the sides of the cabinet. The bar should be fixed a little below the surface of the back of the casing, so that the hanger will not prevent the back of the cabinet from lying flat. The rear edge of the ebonite panel must also be slightly recessed in the middle in order to receive the neck of the brass hanger.

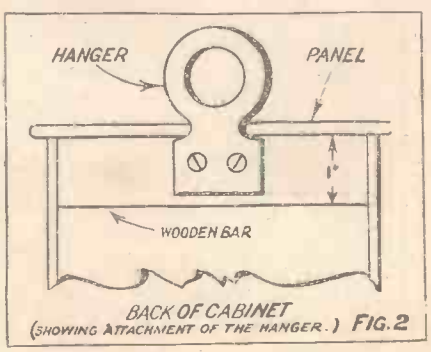


A photograph of the complete receiver.

Varnishing the Case.

Now carefully sandpaper the outside of the case, and apply a coat of mahogany spirit varnish stain. Allow this to dry for a day. Smooth the surface with fine sand-

(*Continued on page* 816.)



BACK OF CABINET (SHOWING ATTACHMENT OF THE HANGER.) FIG. 2

A WALL BRACKET VALVE RECEIVER.

(*Continued from page 815.*)

paper, and apply a coating of good elastic carriage varnish. Allow this to get quite hard before touching it. Two days drying, in a warm room, will suffice.

The Panel.

Round off the front and side edges and sandpaper both surfaces to remove the glossy outer layer, for this is sometimes electrically conductive. If a polished surface is desired, this can be produced by rubbing with rottenstone, or similar fine abrasive, and lubricating oil. Drill in accordance with the drilling diagram of Fig. 1, and preferably tap the holes.

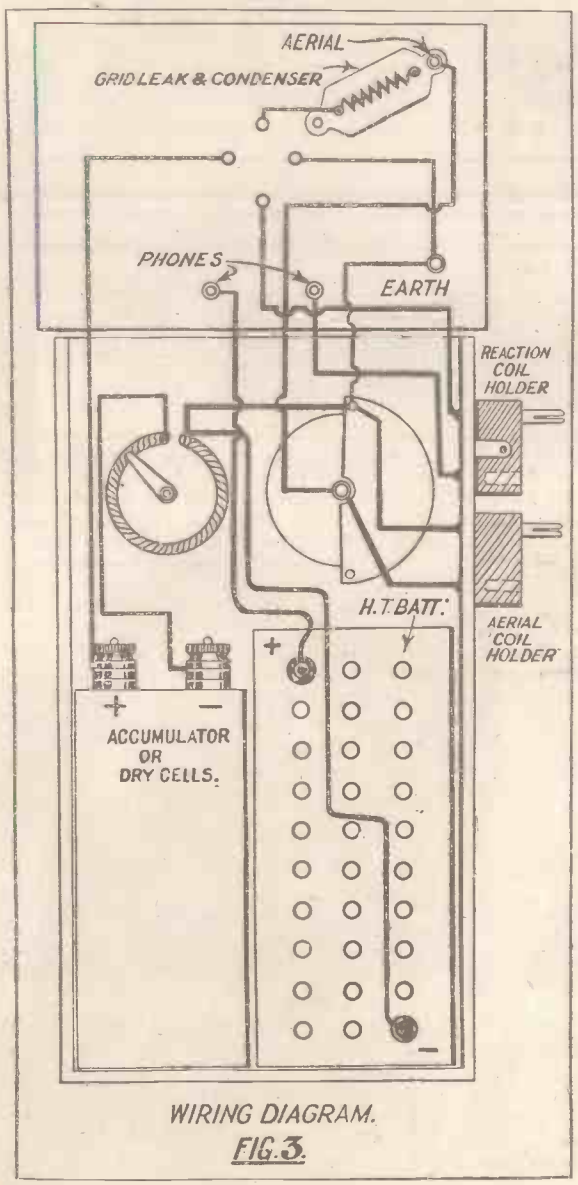
If the flush type of valve socket is used the holes should be tapped No. 2 B.A. These valve sockets are recommended as having less capacity than the older kind. They should, however, be carefully handled, as they are somewhat likely to break when being screwed in place.

The grid condenser is most conveniently fixed by simply enlarging one of the end holes so that it will pass over the lower protruding stem of the aerial terminal, as shown in Fig. 3. A single nut will then secure it in place together with the short wire which connects the aerial terminal and one side of the grid condenser. Connect the other side of the grid condenser to the grid valve socket, and the earth terminal to the nearer filament socket.

Next secure to the other filament socket, and also to the aerial and earth terminals, bare wires long enough to reach to the rheostat and condenser when the panel is in place. These wires should be covered with sleeving when connecting up later on. Insulated flex leads are next connected to the 'phone terminals and plate valve socket, and should be long enough to make the connections (shown on the wiring diagram, Fig. 3) to the H.T. battery (wander plugs), and the reaction coil.

Assembling.

The double coil-holder is now fixed on the left-hand side of the box, and the necessary holes drilled in the side through which the four wires may pass. Also put the condenser and rheostat in place, and secure the ebonite panel by two screws at each side. Now complete the wire connections as shown in Fig. 3, using sleeving where necessary to prevent undesired contacts.



WIRING DIAGRAM.
FIG. 3.

The back of the set can be secured by hinges and any suitable catch, but a very simple and effective fastening can be contrived by making two keyhole slots near each of the side edges of the back and putting in four screws in corresponding positions in the sides of the cabinet so that their heads project a little to the rear. The back can then be slipped on to the four screws and pushed down, so that the heads of the screws engage over the narrow part of each keyhole slot. Make the slots in the back panel before putting the screws into the sides of the cabinet. This will ensure getting them in the proper places to register with the slots.

Operation.

It is convenient to mount a calibration card on the lower front of the cabinet, as indicated in the photograph, showing the condenser readings and appropriate coils for your favourite stations. The card is arranged to slide sideways into two sockets, formed by bending strips of thin sheet brass, about 1 in. wide, almost double, and securing them to the case screw by small countersunk-headed screws.

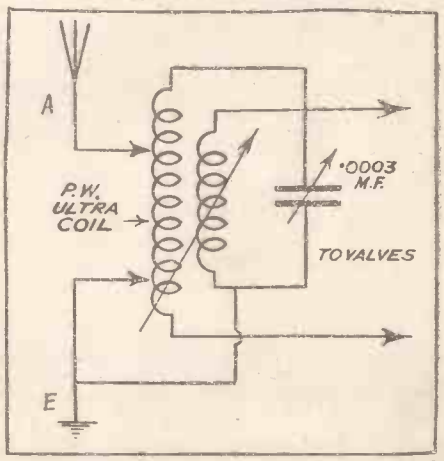
If the dull-emitter valve is of the two-volt type, a small Exide D.T.G. accumulator can be used. If it is of the ·06 amp. 3 volt type, either a dry battery of two cells or a small two-cell accumulator will do. For instance, an Ever-Ready 3-volt No. 2,062, costing 3s., or a No. R 479, costing 5s. 6d., will fit in the case in addition to the H.T. battery, preferably a 36-volt Ever-Ready. The accumulator must be kept scrupulously clean or acid fumes may corrode the internal metal parts of the set. Each time it is returned from charging it should be thoroughly dried and then rubbed over with a swab of cotton-wool moistened with strong ammonia, so as to neutralise any acid left on the surface.

The set in operation by the fireside.

A SUPER-SELECTIVE CIRCUIT.

As many amateurs have experienced, reception of broadcasting by the majority of valve sets is anything but selective. The accompanying circuit removes this objection entirely. The writer made the "P.W." Ultra set, and obtaining good results with a crystal, tried the coil on a one-valve set.

The result was deafening, but several stations were received at once. Trying to stop this, he came across the accompanying circuit, which is the ideal. The smaller coil consists of 90 turns of 36 S.C.C. wire on 2¼ in. former, and the parallel condenser is of ·0003 mfd. capacity. The two coils are coupled but not variable. A movement of 2° of the condenser caused Manchester, 60 miles away, to fade completely out.



Similar results have been obtained with other stations. The extra coil makes no difference whatsoever to the volume, and its addition only makes one extra knob to manipulate. The circuit can be entirely recommended as very selective.

MR. GEORGE BERNARD SHAW AT 2 L O.

A Visit To The Pictures And What Came Of It.

THE STORY OF AN "INTERVIEW."

By "ARIEL."

Mr. Shaw is such a humorist himself that I feel sure he will find a little humour in the following article. After all, he came off best, and whether "Ariel" can claim to have interviewed him is doubtful. But the story of the attempt may interest and amuse readers and, I hope, Mr. Shaw, for I am specially sending him a copy of this issue.—The Editor.

READERS will no doubt remember that a few days ago Mr. George Bernard Shaw broadcast a reading of his play, "O'Flaherty, V.C.," from the studio at 2 L O.

For the benefit of those who have not heard of Mr. George Bernard Shaw I might say that he is universally recognised as being Britain's greatest living playwright.

Mr. Bernard Shaw is an Irishman, and, like many of his compatriots, he has little idiosyncrasies which have made him a familiar figure even to a public which does not go to see his plays and which even refuses to read the prefaces to his plays. And one of Mr. Shaw's peculiar idiosyncrasies is that, despite the fact that in his early days he was a musical critic on the London evening newspaper "The Star," he absolutely refuses to be interviewed by representatives of the Press.

The Iron Gate.

So it may interest readers to know that on the night he broadcast from 2 L O practically every news editor in Fleet Street had made up his mind that, by some means or another, a representative of his paper should obtain some sort of an interview with G. B. S. In fact, it is a sort of game in Fleet Street—a game with considerable rivalry—to attempt the seemingly impossible—i.e. to make G. B. S. talk to a Pressman.

Now, being in the bad books of the Editor of POPULAR WIRELESS, I received for my sins a commission to try and get an interview with Mr. Shaw when he broadcast from 2 L O. So, in company with another member of the staff, I set out to interview this famous playwright.

First of all I called at his house in Adelphi Terrace, and, having successfully negotiated the young lady who opened the door, was allowed to ascend the stairs leading to Mr. Shaw's apartments. Here I found my way barred by an iron gate, which, rumour has it, Mr. Shaw has had specially erected for the discomfiture of journalists.

Under Charing Cross Bridge.

Learning that Mr. Shaw had left for the B.B.C., my friend and I wandered round to 2 L O, and here we found many other Pressmen from Fleet Street, all bent on getting the views of Mr. Shaw on broadcasting. Whilst waiting outside 2 L O my companion had a brain wave. We hailed a taxi and drove at a tremendous pace back to the "P.W." office and there routed out the famous "P.W." portable set.

Hastening back to our taxi we made for 2 L O again, listening-in to Mr. Shaw reading his play as we rode. As we passed under Charing Cross bridge we listened to the great author giving a *bel canto* rendering of "Tipperary," and, though we hurriedly searched the pages of a newspaper, we could not find any reference to Mr. Shaw giving excerpts from the national songs of his country.

Mr. Shaw's Guardian.

Once more outside 2 L O, my companion and I decided not to join the other Pressmen who had invaded the building, but to wait and see if we could induce Mr. Shaw to speak when he came out.

Mr. George Bernard Shaw.

Presently I espied the lift descending and a minute or two later Mr. Shaw walked out of 2, Savoy Hill—but closely guarded by our old friend, Captain C. A. Lewis, obviously bent on playing the rôle of Cerberus.

Several Pressmen dashed up to Mr. Shaw, who clung close to Captain Lewis. In response to the agitated questions of the Pressmen Mr. Shaw replied with not a word, but with a characteristic gesture, placed his first finger against his lips as though enjoining silence.

Captain Lewis, tall and frowning, waved away some of the leading lights of Fleet Street with a long stretch of his arm. Realising that it was impossible to approach Mr. Shaw under these conditions, my companion and I fell into step and followed him and Captain Lewis. They walked up past the Savoy kitchens and the laundry, up Savoy Street and into the Strand, and so along until they came to the glaring lights of the Tivoli Picture House. Here Mr. Shaw gave a glance at the contents bill. There was a short consultation between them, and Captain Lewis was seen to be counting the change in his pocket.

Obviously finding he had enough money with him, Captain Lewis led his distinguished companion into the *foyer* of the Tivoli Picture House, and, for a moment, leaving Mr. Shaw unguarded, proceeded to buy two 8s. 6d. tickets at the box-office.

His Peculiar Reticence.

Like a hawk swooping from the sky another Pressman, who happened by chance to recognise Mr. Shaw, fell upon him, and rattled out some questions. Again Mr. Shaw exercised his peculiar reticence and, placing his forefinger on his lip, slowly shook his head. There was nothing doing.

My companion and I, realising that Captain Lewis was treating Mr. Shaw to the pictures, proceeded hurriedly to search our pockets, and, having found the necessary cash, parted with it at the box-office, and managed to secure seats next to those occupied by Mr. Shaw and Captain Lewis. Personally, I dare not let Captain Lewis see me, because he would at once have warned his companion that one of the most pernicious journalists of Fleet Street was at his heels. But my colleague, not being so well known, sat himself next to Mr. Shaw, while I sat cringing behind.

For two hours not a word passed between Mr. Shaw and Captain Lewis, which, of course, was a great disappointment to us! Only once, I think, when some peculiarly rabid caption was thrown on the screen, did Mr. Shaw break into a short, rasping laugh, and so we stayed until the band hurriedly scampered through "God Save the King."

"Congratulations."

Then we found ourselves once more in the Strand. Here, to our immense delight, Mr. Shaw said "good-night" to his guardian, and it was with real pleasure that we saw the back of Captain Lewis disappear in an opposite direction.

Mr. Shaw made his way slowly along the Strand, and finally turned into his own quiet street that leads to Adelphi Terrace. At last, thought I, I had him at my mercy, and strolling up to him and raising my hat with that innate courtesy so peculiar to journalists, I said:

"Good evening, Mr. Shaw, may I be the first of your radio audience to congratulate you upon the broadcasting of your play tonight."

(*Continued on page* 818.)

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P.

Transmitting Colours by Wireless.

AN apparatus for the wireless transmission of coloured pictures was recently demonstrated in London by Capt. G. A. Taylor, President of the Association for Wireless Development in Australia and New Zealand. The actual method employed for the transmission is somewhat similar to that used by Belin, the well-known French inventor, the pictures to be transmitted being placed around a cylinder making contact with a microphone control, and the reproduced pictures at the receiving end being thrown upon another cylinder revolving synchronously with the first one.

The coloured picture for transmission, however, is photographed through screens on to metal plates, as in the method used for ordinary printing purposes, in the three colours—red, yellow and blue. Each plate is separately printed in black and the print is enlarged so that when acid-etched on metal a bold relief is obtained. The three pictures thus obtained are separately transmitted by the method mentioned above, and the three pictures received at the other end are reduced and printed in the appropriate colour—red, yellow or blue. These three pictures are then combined together, in a well-known manner, to give the proper tints to the final picture.

Capt. Taylor, in demonstrating the machine, also explained a process by which drawings could be shown, by wireless, whilst being made at a distant station, and how coloured pictures and cartoons may soon be broadcast whilst actually in process of being made.

Simple H.F. Transformer.

A correspondent of "Science and Invention" describes a simple and readily made H.F. transformer used, in his case, with a super heterodyne, and consisting essentially of a pair of similar honeycomb or duolateral coils. Two 500-turn coils are placed side by side, and a ·0005 variable condenser shunted across each. They are then lapped together with tinfoil cut into half-inch strip, the foil passing along the inner surface, over the edge, along the outer surface, over the edge, and so on, like a bandage.

A piece of the strip is left at each end for earthing, the foil lapping serving the purpose of a shield. Insulating tape is then lapped over the foil, in the same manner, and the job is complete. Great claims are made for the efficiency of this simple H.F. transformer. I have not actually tried it, but I should imagine that it would be better without the foil lapping connected to earth.

Discharge Microphone.

Several microphones have lately been developed which do not make use of any diaphragm, and I hear that considerable improvements have been made in the "glow discharge microphone" of Dr. Philip Thomas, which was first brought out about a year or two ago.

This device makes use of a small high-tension discharge between two fine electrodes about a millimetre apart, a small trumpet being arranged to concentrate the sound waves upon the spark-gap. The actual oscillations of the air in the region of the discharge cause variations in the current passing in the discharge, and in this way the sound variations are converted into electrical variations. There seems to be great promise in these diaphragm-less microphones, and many people believe that the microphone of the future, at any rate for large-scale work such as broadcasting, will be on some such lines as this.

A Novel Transformer.

A new low-frequency transformer, of French design and manufacture, appears to violate one of the first rules governing the arrangement of L.F. transformers; in that it places two, and sometimes three, transformers together in the same case, with the cores parallel. The transformer in question is the "Monopole," and the reason this liberty is not attended with serious consequences, in the way of interaction and distortion, is that the cores are of the closed-ring kind, so that there is practically no magnetic leakage. The windings are placed one upon the other.

In the double type, the ratios of the windings were 3 to 1 and 5 to 1. Some tests of this transformer have recently been carried out by "Wireless Trader," and it was found that "on wiring both transformers simultaneously for the first and second stages their performance was exactly the same as when used separately, no interaction being apparent." The double-type transformer thus replaces two ordinary transformers. The journal quoted above further remarks: "The results as regards strength were exceptionally good. As regards tone, both the units gave really admirable results after the crystal; but in the later stages, they gave rather a high tone, a small condenser across the secondary (about ·0007) giving improved richness."

Valve Vibration.

I saw a very neat and simple method of preventing microphone noises in the valve described in "Radio Digest." The individual valve-holder is provided with four tiny screw hooks, one at each corner of the base (the circular holder being secured to a rectangular base), and through each pair of these, that is, along two parallel sides, is passed a stout rubber band. Two strips of wood, about half an inch in height, are laid along the panel or baseboard, at a distance apart about twice the width of the valve base, and the rubber bands are stretched across between these two strips.

In this way the valve holder is suspended, as it were, on the rubber bands, and the mechanical vibrations of the table are practically without effect upon the valve.

Two-Filament Valves.

Many types of multiple-filament valve have been patented within the past two years, and some of them have appeared on the market. The usual purpose is to provide extra filaments for prolonging the useful life of the valve in case of a burn-out of one of the filaments.

The "Junot" two-filament valve, which is a comparative newcomer, is claimed, in

(*Continued on page* 871.)

MR. SHAW AT 2 L O.

(*Continued from page* 817.)

Mr. Shaw stopped and glanced keenly at me from behind his bushy eyebrows.

"This is very kind of you," he said with a charming smile; "but how did it come through?"

"Well," I said, "it was really wonderfully good. Excellent transmission, and undoubtedly a great success, and it gives me great pleasure to be the first British listener to thank you for such an entertaining evening."

The End of the Interview.

Mr. Shaw again smiled and his voice was very kindly when he spoke.

"Thank *you*," he said, and began to fumble in his trouser pockets, not, as I thought at first, for a small coin of the realm with which to reward me, but for his front door key.

Things were getting desperate, and there were still many questions I wanted to put to him, and just as he put his foot on his front door step I said:

"But where do you think I was when I heard you, Mr. Shaw?"

This somewhat cryptic question obviously intrigued him and he turned round again in surprise.

"Well, and where were you?" he asked.

"Driving through the City in a taxicab," I replied, "with a portable wireless set, and struck dumb with amazement when passing under Charing Cross bridge I heard you singing 'It's a long way to Tipperary.' Never," I said, "did I expect to hear Mr. George Bernard Shaw singing 'Tipperary' while I passed under Charing Cross bridge."

Mr. Shaw raised his eyebrows.

"Oh, indeed," he said, "that *is* very interesting."

Perhaps his long experience of journalists stood him in good stead at that moment, for my next question was as follows:

"So I came to ask you," I said, "for your impressions of the broadcast play."

Mr. Shaw smiled, hesitated, and smiled again, and then, to my intense annoyance, placed his forefinger on his lips and shook his head.

Only one sound passed his lips, and that was a long-drawn "Ah": he was going indoors.

He put the door key in the lock, but, at the last minute, he relented (or seemed to), turned, was about to speak, but again put his finger on his lips, relented, took me warmly by the hand and said "Good-night." The door banged. I addressed something distressingly audible to the door, and so ended my somewhat brief "interview" with G. B. S.

ALL ABOUT

THE SQUARE LAW CONDENSER.

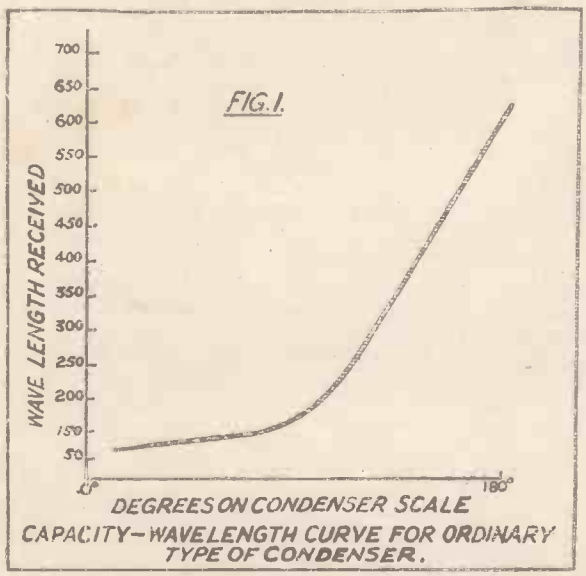
PRACTICAL HINTS FOR EXPERIMENTERS.

By J. F. CORRIGAN, M.Sc., A.I.C.

The Square Law Condenser is not a "new-fangled gadget" at which the amateur need look askance. It represents a decidedly important advance in condenser construction, and our contributor has much useful information to give concerning it.

THERE are fashions in everything, even in wireless, and probably it is on account of this fact that there exist a good many wireless amateurs who are inclined to look askance at the newly introduced "square law condenser," and to regard it more in the light of a new constructional fad than anything else.

Such a viewpoint, however, is totally wrong. The square law condenser represents a decided advance in the theory and construction of variable condensers for amateur use, and the radio constructor who is wise enough to incorporate one or two of these instruments into his set will be quick to appreciate the great advantage which they have over the ordinary type of condenser for increasing the tuning abilities and general selectivity of any radio circuit.



CAPACITY–WAVELENGTH CURVE FOR ORDINARY TYPE OF CONDENSER.

Let us for a moment consider what happens when a variable condenser of the ordinary pattern is brought into action in a wireless set. Any variable condenser, as we all know, possesses a maximum and a minimum capacity, and between these two extremes its capacity may be varied simply by rotating the knob of the instrument. When the movable condenser vanes are rotated so that they slide completely in between the fixed vanes, the condenser is imparting its maximum amount of capacity to the circuit, and, conversely, when the fixed and movable vanes of the condenser are separated as much as possible from each other, the capacity of the condenser is at its minimum point.

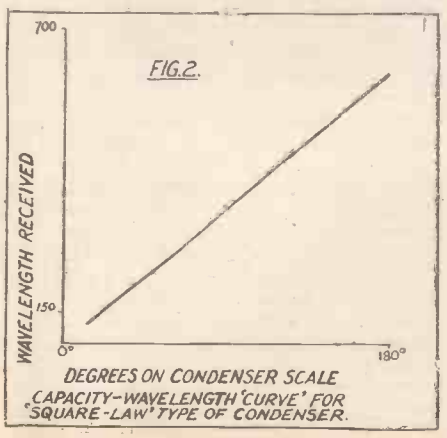
Now, from the above it follows that each equal increment of distance through which the knob of the condenser is rotated must result in equal increments of capacity being given to the condenser.

The Principles of Tuning.

For instance, suppose the increase in capacity above the minimum which is imparted to the condenser by rotating the pointer through an angle of from one to five degrees be represented by the symbol x, the amount of extra capacity which will be given to the condenser when its pointer is rotated again from five to ten degrees will again be represented by x. So that when the pointer of the condenser has been moved through an angle of ten degrees from its point of minimum capacity, the extra capacity included in the circuit will be represented by $2x$.

In a very large number of wireless sets, the tuning is carried out by having a variable condenser fixed in parallel with a plug-in inductance coil, such as a basket, spider, or honeycomb coil. The amateur will recollect, of course, the fact that the wave-length to which a tuned circuit will respond is governed by the product of the square root of its capacity and inductance into a certain factor.

The precise equation does not concern us here. But what is of importance to our consideration of the square law condenser is the fact that, in order to tune your set to receive on a certain given wave-length, you must have in the circuit definite amounts of capacity and inductance. If you have a large inductance value you will require only a small capacity, and, vice versa, if the set possesses a large capacity it will only require a small amount of inductance in order to enable it to tune to the required wave-length.

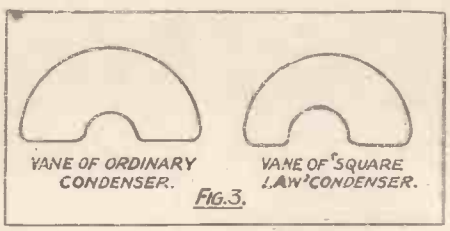


CAPACITY–WAVELENGTH 'CURVE' FOR 'SQUARE-LAW' TYPE OF CONDENSER.

A Cause of "Jamming."

Now, when a condenser is used in parallel with an inductance of fixed value, such as a basket coil, the effect of the constant increase in capacity resulting from each equal turn of the condenser knob is very noticeable.

The effect of this is that, when receiving on fairly low wave-lengths, a small turn of the condenser makes a very big difference in the wave-lengths which are received, so that, using this form of tuning, all the stations tend to come in at the lower end of the condenser scale, and thus they are very difficult to separate from one another.



Hence the selectivity of many otherwise excellent radio receivers is impaired by the employment of ordinary variable condensers for purposes of tuning.

The chart illustrated at Fig. 1 will perhaps go a long way to make the meaning of foregoing matter somewhat clearer.

What "Square Law" Means.

On one side of the scale is plotted the wave-length which the set is able to receive when different amounts of capacity are imparted to the circuit by the condenser. Along the other side of the chart is set out the scale of degrees through which the condenser dial is rotated.

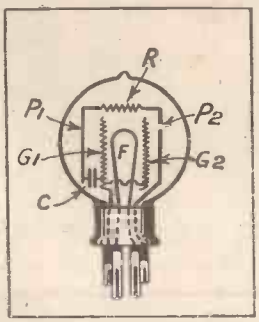
From this chart it will be seen that each equal amount of rotation of the condenser dial, although it imparts an equal increment of capacity to the circuit, does not result in an equal increase in the wave-length received. During the first period of its rotation from its position of minimum

(*Continued on page* 820.)

AN INTERESTING VALVE DEVELOPMENT.

By SEXTON O'CONNOR.

IT is well known that, in addition to its ordinary function of controlling the electron stream between filament and plate, the grid, on account of its physical size and proximity to the plate, forms a condenser with the latter, thus setting up an electrostatic coupling between the input and output circuits of the valve.



Generally speaking, this is an undesirable effect, as the back-coupling so brought into play may become sufficiently powerful to set the whole system into self-oscillation. This often occurs, for example, when using high-frequency amplifiers with tuned anode circuits. Although there is no external reaction, the electrostatic transfer of energy which takes place through the internal coupling between grid and plate is quite sufficient to cause the set to oscillate. Special circuit arrangements, such as the neutrodyne, have, in fact, been designed for the particular purpose of counteracting such static coupling and so stabilising the valve system.

An Ingenious Invention.

On the other hand, it may be convenient, and in some cases advantageous, to deliberately increase the internal coupling between grid and plate, and so dispense with the necessity of using any coupling coils or condensers in the external circuits. Such a method would, for example, be useful when generating oscillations of extremely short-wave lengths or high frequency.

Messrs. Robinson & Derriman have recently invented a valve in which both the grid and plate are made in the form of spiral wires, so that not only electrostatic but also electromagnetic coupling takes place between them. Both the grid and plate are wound in close proximity to a central filament, and each is provided with two terminals, so as to allow circuit connections to both ends. Additional external coils may be provided in order to vary the magnetic coupling existing inside the valve, or, if necessary, to "load" the circuit when generating oscillations of greater wave-length.

A Similar Method.

Another innovation along the same general lines is due to Mr. E. K. Hunter, and is illustrated by the diagram. Here two sets of grids and plates are mounted inside the same bulb, and are coupled together in cascade by resistances and capacities so as to form a multiple unit amplifier. Two of the valve terminals connect up to the filament, a third is joined to the grid G1, whilst the fourth takes the output from the second plate, P2.

The plate P1 is connected to the plate P2 through a high resistance, R, so that, when the valve is lit, P2 carries a higher voltage than the P1. The input is applied to the grid G1, and the resulting voltage variations on the plate P1 are transferred to the grid G2 through a condenser, C. These in turn give rise to amplified variations in the electron stream between the filament and plate P2, the resultant currents being passed through the 'phones.

ALL ABOUT THE SQUARE LAW CONDENSER.

(*Continued from page* 819.)

value a small increase in capacity results in a considerably large wave-length band being covered, whilst after the condenser dial has been rotated half-way it takes a greater amount of additional capacity to make such a difference in the wave-length received.

Such is the inherent disadvantage of the more usual type of variable condenser. Now we come to an explanation of the principle of the "square law" condenser.

In the first place, it would be an advantage to consider, for a moment or two, the exact meaning of the term "square law," for there are square laws *and* square laws. In this case, however, the square law is really a general type of law. Any law which gives an equal result for each equal cause, as it were, is a square law.

Spacing Out Wave-lengths.

To take a very well-known example of a square law. We have all in the far-away days of our youth been more or less tortured with text-book demonstrations of the well-known "Boyle's Law." Boyle's law, of course, relates to the connection which exists between the pressure of a gas and its volume. The law states that each equal addition of pressure to a gas—at constant temperature—results in a constant decrease of volume.

Boyle's law is, therefore, a square law, or, at any rate, practically speaking, it is; for if we plot the pressure of a gas against its volume we shall obtain a straight line graph—the typical "curve" of a square law.

Well, after all this preamble about square laws, we are now in a position to apply the principles therein contained to our discussion of square law condensers.

In brief, a square law condenser is one which gives a constant increase of *wave-length* —*not* actual capacity, mind—for each equal number of degrees through which the condenser dial is rotated. Thus the graph which would be obtained by plotting the wave-lengths obtained for each equal distance through which the rotating vanes of the condenser were moved would turn out to be a straight line, similar to the one shown at Fig. 2.

The result of all this is not very difficult to see. In the first place, the use of such a condenser spreads out more evenly the different wave-lengths which can be received by the set when the condenser is manipulated. On a square law condenser the tuning is fine, but the low wave-lengths are not brought in by comparatively small turns of the dial, as is the case with the ordinary condenser. Thus the use of a square law condenser in a wireless receiving set enables the amateur to separate the congested range of lower wave-lengths, and to bring them in more equally and evenly by the rotation of the condenser dial.

The mode of working of the square law condenser is really very simple.

Fig. 3 illustrates diagrammatically the shape of an ordinary condenser vane, and also the characteristic formation of a square law condenser vane. It will be noticed in the latter case that a considerable portion of one side of the condenser vane is cut away.

The result of this is that when the condenser is assembled the vanes come into close proximity more slowly when the dial is rotated. Thus during the first portion of the complete rotation of such a condenser the capacity is only increased slowly, but as the surfaces of the vanes increase in area, the capacity of the instrument undergoes a similar increase.

To sum up, therefore, when you rotate the dial of a square law condenser from its zero position through 18 degrees, the capacity increase at first is only small, but it is sufficient enough to bring in all the lower wave-lengths at regular intervals of rotation. However, after the dial of the condenser has been rotated through a certain angle, the amounts of capacity which are added to the set for each equal increment of rotation are increased, and, therefore, stations having a higher wave-length are brought in when the condenser dial is rotated towards the end of its scale.

A Cure for Non-selectivity.

The square law condenser is merely a sort of very efficient device for spacing out more equally the wave-lengths which can be received by the set in which the condenser is employed. Unlike the ordinary type of variable condenser, each equal turn of the knob or dial does not result in an equal amount of capacity being added to the circuit.

At first the increments of added capacity are small, but as the dial is rotated they become larger. The square law condenser does, however, give an equal increment in wave-length for each equal rotation of its dial. This is the main thing which the use of such a condenser results in, and for many receiving sets which suffer for want of sufficient selectivity the inclusion of a square law condenser in the circuit in place of the ordinary one may very often turn out to be an action which will result in the complete cure of that greatly annoying trouble of non-selectivity.

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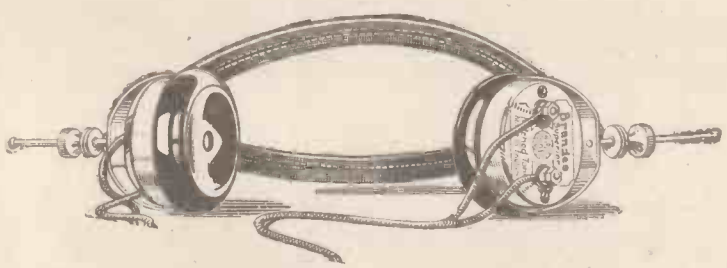

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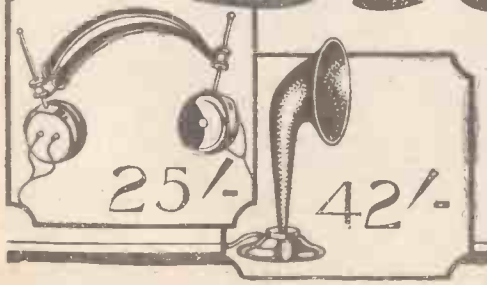

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WIRELESS FOR THE BEGINNER.

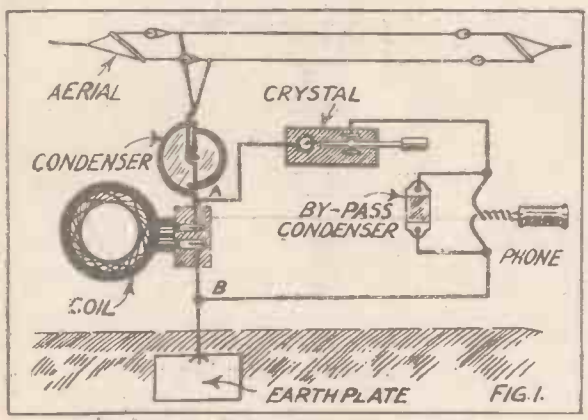
A NEW SERIES FOR AMATEURS.

By E. BLAKE, A.M.I.E.E.

PART V. THE WORKING OF A TYPICAL RECEIVER.

IN this article I propose to take to pieces some simple receiving apparatus such as the majority of beginners probably possess, and describe the functions of the parts and accessories.

Every receiver must contain the means of tuning to the desired wave-length and some means of "detecting" (sometimes called "rectifying") the received and tuned waves. Amplifiers may be added at discretion to increase the strength of the signals or to make the receiver more sensitive to signals coming from long distances, but tuning and detection are absolutely essential, and the simplest set is a device for these two processes only.



Pictorial representation of a simple crystal set.

Fig. 1 is a picture of a simple crystal set. Its parts are shown separated for the sake of clearness. The aerial is the "feeler" which is thrust into space to intercept the wireless waves, or, more exactly, to intercept some of their electrical energy. As previously explained, when such interception takes place an H.F. oscillating current rushes up and down the "aerial circuit," which in this instance is the aerial, the condenser, the coil, and the earth. The free electrons in the wire are alternately concentrated at the earth and aerial ends of this path, the alternations taking place about a million times per second.

The Tuner.

The coil depicted is supposed to be one of those compact "honeycomb" or "basket" coils which are so popular, and indeed so useful and efficient. Some crystal sets have a coil wound on a cylinder and provided with a slider. The object of the coil is the same in both cases, though in the instance of the slider there is a means of varying the number of turns of wire brought into action; by using a coil of fixed value (such as in Fig. 1) and a condenser, we obviate the somewhat bothersome sliding, the condenser being easier to adjust.

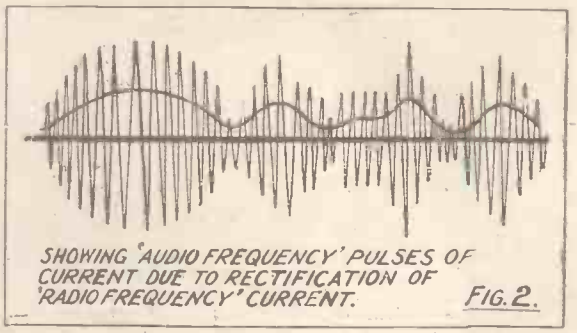
Referring to Fig. 1, it is seen that the detector (crystal) and the telephone are connected across the coil at A and B; this is called "direct coupling," for an obvious reason. In this way we apply the detector or demodulator to the aerial.

Now it is easily understood that in order to hear speech in the telephone, the diaphragm of the telephone must vibrate in the same way as the transmitting microphone; then the speech (or sound waves) which caused the microphone to vibrate in that particular way will be reproduced by the diaphragm of the telephone. It is just a case of reversing the transmitting process.

Rectification.

The diaphragm of a telephone—a very thin iron disc—is caused to vibrate by means of variations in the strength of an electric current flowing round coils of fine wire inside the instrument. Hence, if we wish it to vibrate in a certain manner, that is, at certain frequencies, then the current must vary in the same ratio, or in other words, we must produce a current which is the electrical model or counterpart of the sound waves made by the speaker at the microphone in the studio. Well, in our aerial we have an H.F. oscillating current moulded by the sound waves, and our task is to take a copy of that moulding.

The H.F. current cannot flow through the windings of the telephone, because of their high "impedance"; otherwise we should need only to connect the telephones to the aerial in order to receive broadcasting. This is where the crystal is utilised. It has the peculiar property of allowing an electric current to pass through it in one direction only, and this is, in simple language, tantamount to cutting the waves in half, so that we get a condition of things as represented in Fig. 2, which shows the upper halves of the modulated carrier waves.



Now the frequency of the vibrations of the telephone diaphragm determines the pitch of the sounds it emits, and thus, if the frequency of vibration varies, notes of different pitches, or the sounds characteristic of human speech or of music, etc., will be emitted. Referring to Fig. 2, it will be understood that although the telephone diaphragm cannot respond to the extremely rapid variations of the carrier wave current (which are of "radio" frequency) it can and does respond to the variation of the *average* strength of that current, which is indicated by the wavy line. As the height of the line above the horizontal represents the amplitude or strength, it will be seen that this average current varies between a maximum and almost zero, and it does this far less frequently than the carrier wave. In a word, this current is of "audio" frequency, which means that the telephone can respond to its variations *audibly*. That is, of course, the object we have in view, because the variations of this audio-frequency current correspond to the modulations of the carrier wave by the speaker in the studio.

It will be observed in Fig. 1 that a small condenser is connected across the telephones. It is a "fixed" condenser, that is to say, it is not adjustable. The reason for using this is as follows. The currents set up in the coil-crystal-telephone circuit are H.F., and as these cannot pass through the telephones a path must be provided; this path takes the form of the small condenser. What actually passes through the telephones is the *average* current shown in Fig. 2.

The Final Process.

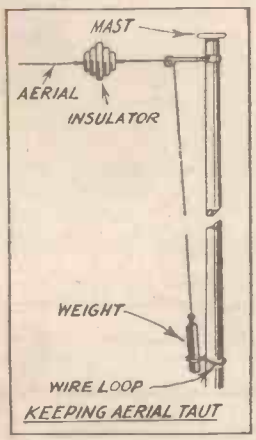
The telephone diaphragm, vibrating at varying frequencies in accordance with the varying strength of the "audio" current flowing through the coils of wire round its magnet, causes waves in the air which are fairly faithful reproductions of those caused by the vibrating vocal cords of the speaker. These sound waves strike the ear-drum—and the seeming miracle is accomplished. In a valve set exactly the same principles are applied, the first valve acting in the same way as a crystal, by stopping the half waves. The way in which the valve does this is a subsidiary matter; the effect is the point to grasp. In more elaborate sets there are employed valves whose function is to make stronger the "radio-frequency" currents before they are rectified, and also other valves which magnify the "audio-frequency" currents *after* rectification.

Constructional Notes

Conducted by Dr. J. H. T. Roberts, F.Inst.P.

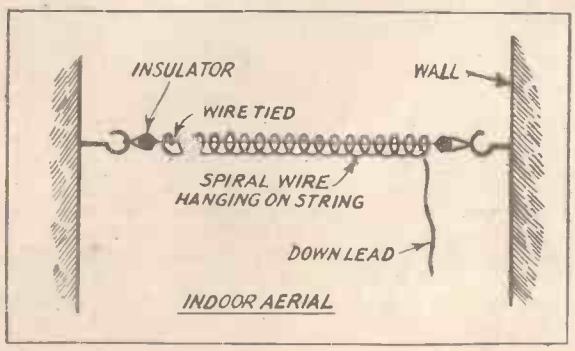
Keeping Aerial Taut.

VARIOUS methods are suggested for keeping a constant tension on the aerial. It is very desirable to have the aerial in a reasonably constant state of tension, as swinging and sagging are apt to cause peculiar "fading" effects in the reception. Probably the simplest way is to use a counter-weight, in the manner shown in the illustration. This is, of course, applied at the remote end of the aerial, that is, the end opposite to the lead-in. If the pulley-block is secured to a mast, a wire loop should be passed around the weight and the mast (very loosely around the mast) to keep the weight close to the mast in case the latter is not truly vertical. If the pulley is fastened to a wall, this is not really necessary. The tension on the wire can be adjusted by merely increasing or decreasing the amount of the weight. A small wood box or tin canister, into which small weights (such as pieces of metal, or stones) are placed may be used, but this does not look so well as a proper cylindrical iron weight, such as those used in old-fashioned clocks.



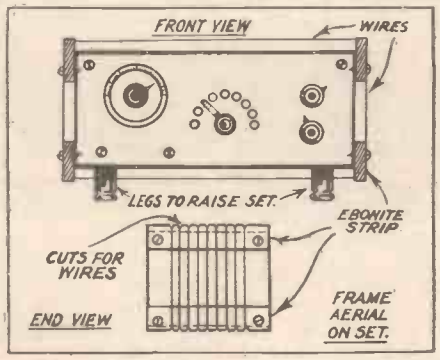
Indoor Aerial.

Here is a description of a very simple indoor aerial made by a reader of "Radio Digest." He says: "I secured 100 feet of No. 20 single-cotton-covered wire and two small insulators. The wire was tightly wound around a broom-handle, the layers being placed as close together as possible. On removing the wire from the broom handle. it was in the form of a spiral spring. The insulators were then attached to the two ends of the spring. A piece of strong, dry string was threaded through the spring, and was tied to it at one end, leaving about six inches of the string free. This end was attached to a hook on one wall of a 16 feet room. The other end of the string was similarly attached to another hook on the opposite wall, and the spiral spring was drawn out to within a few inches of the other end, a down lead being taken from the aerial in the usual way. Using a single-valve regenerative set, I was able to tune in stations up to 1,500 miles distance."



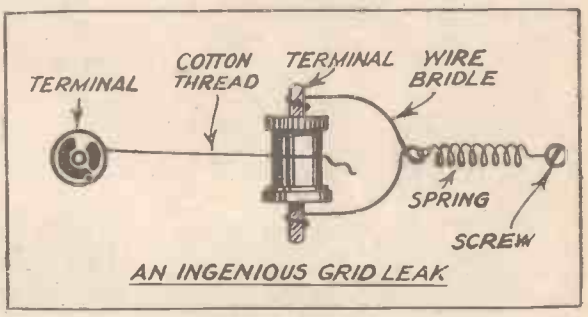
Frame Aerial on Set.

In some cases it is desirable to have the frame aerial stored away as compactly as possible. An example of this is the super-regenerative set in a suit-case, with the loop aerial in the lid. The method of placing the aerial shown herewith, which the reader who sends it says he has tried with great success, certainly makes for compactness. The drawing will provide practically all the information necessary. The loop aerial is wound around the cabinet. Four strips of ebonite or hardwood are screwed to the corners and in each strip a series of notches are made for spacing the turns. In order to prevent any possibility of the wires beneath the set touching the table, the cabinet should be provided with feet or short legs, as shown, so as to raise it up a little.



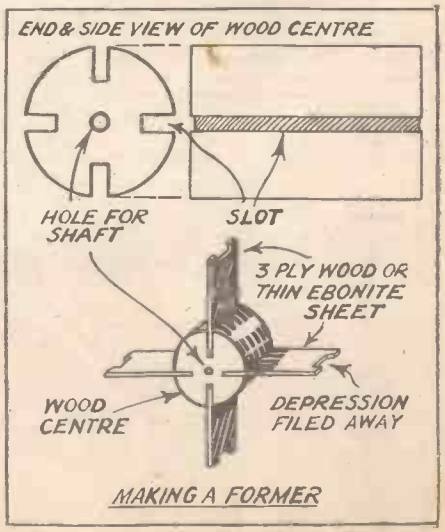
Ingenious Grid Leak.

Here is an ingenious idea for a variable grid leak. All you require are two terminals, of the kind shown in the figure, some wire, and some cotton thread. One terminal is screwed into a small piece of ebonite, in the usual way, whilst the other one lies loosely upon the surface of the ebonite, with its axis horizontal. A piece of cotton thread is soaked in Indian ink and allowed to dry. It is then clamped between the two terminals, and a tension is put on it by means of a wire bridle and a fairly long fine spiral spring; the other end of the latter is fixed by a screw, which also forms one of the connections to the grid leak. The resistance of the leak may be adjusted by unscrewing the loose terminal, moving it farther up the thread towards the fixed terminal, and clamping up again. If the shortest convenient length of the single thread does not give a sufficiently low value of resistance, two or more threads may be used in parallel, or a thicker piece of thread may be used.



Making a Former.

The method shown below is a very simple one for the making of a low-loss former for coil-winding. The centre-piece of wood is shown as a solid cylinder, but for this a wooden cotton-reel may very conveniently be used, the notches being cut in the flanges of the reel. These notches or slots may be cut by means of a hacksaw to a depth of about a quarter of an inch, and of a width to suit the thickness of the wood to be used for the spokes. The latter should preferably be three-ply wood, although any other wood in sufficiently thin strips will serve the purpose; thin ebonite sheet is desirable, but is rather more expensive than the wood. The spokes should be a fairly tight fit into the slots, and before assembling the slots should be smeared inside with seccotine or Chatterton's compound.



SOME INTERESTING ONE-VALVE CIRCUITS.

G. V. DOWDING, Grad.I.E.E.
(*Technical Editor, "Popular Wireless."*)

The first of a short series of articles which will prove of value to those readers who desire to obtain maximum results with one valve and who do not desire to employ a crystal detector.

THE real value of a circuit is not proved until it has been tried out by many different amateurs, in many different localities, under all conditions and found in the majority of cases to be capable of what is claimed for it. For this reason, no doubt, many of the interesting one-valve circuits which have been published in POPULAR WIRELESS have failed in the first place to attract but momentary interest. It has been left to the more speculative experimenter to bring them into prominence in the Correspondence columns of this journal, and it is to this type of amateur we are indebted for much of the valuable information we are able to give.

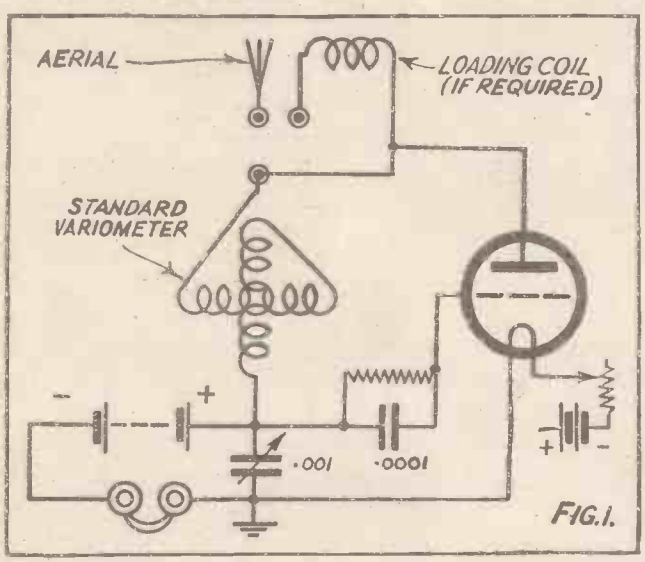


FIG. 1.

Not for Beginners.

Obviously, every amateur has not the time even if he has the inclination to try out every new "hook up." We therefore consider that these articles, which will give a summary of the most interesting one-valve circuits published in this journal during the last two years, together with information derived from our own experiments and those of our readers who have been kind enough to send us reports, will prove of utmost value to the "one-valve man."

It must be pointed out that no reader should attempt the construction of a set in accordance with any of the following circuits unless he has had previous experience of valve work, as most of them require more or less skilful handling to avoid causing serious interference by oscillation.

It will be seen that all of them are of a very simple nature in respect of composition, as it were, and that very little apparatus is required to try most of them out. As, of course, local conditions vary enormously, one particular "hook up" may give excellent results in one case, but on another aerial and earth and in a different locality it may be outshone completely by another.

Therefore the experimenter is advised to give, if possible, every one of them a trial. This is not such a difficult proposition as it sounds, and in any case we can think of nothing more fascinating than research of this nature. It is worthy of mention that we have upon occasion assembled a receiver on a particular aerial that with no ordinary "freak" element to be considered has defied competition against all other sets tested against it under similar conditions, simply for the reason that something, possibly the tuning circuit, has been so varied as to give optimum results on the one particular aerial system. Doubtless similarly good results would have been obtained on the latter with many other circuits had similar experimenting and research been carried out.

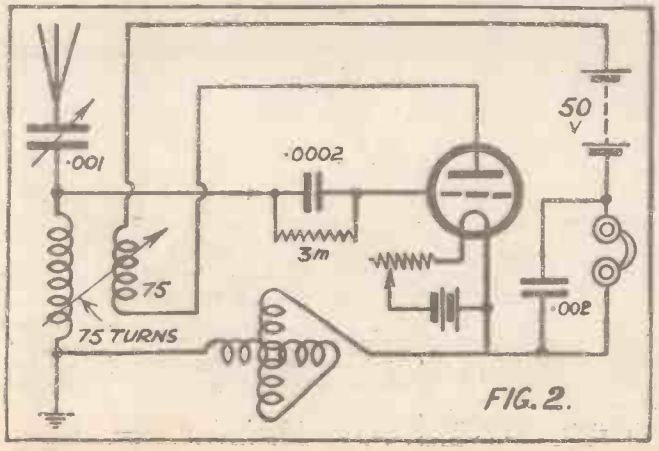


FIG. 2.

Doubtless also many of our readers will have experienced that difficulty in duplicating results with a favoured receiver on a strange aerial. They will notice, too, in the Correspondence columns of this journal that sometimes one amateur will declare he gets better results on "X" circuit than on "Y" circuit, while another writes that he employs "Y" circuit and obtains results that outshine all others, particularly "X" circuit, and so on.

Anticipating Further "Supers."

All the following circuits have been proved to be worth trying out, and they should include something to suit everybody under all conditions within, of course, reasonable limits. It is not reasonable to *expect* three-valve results with one valve, although one valve has often been known to produce results that some unfortunates vainly endeavour to emulate with even more than three.

Take the reception of American broadcasting as an example. It has been regularly accomplished by hundreds of amateurs on one valve, while others fail to hear a U.S. whisper on five. Operation? Receiver efficiency? Not always. However, amateurs will discover in the following circuits ample scope for comparison, and we trust ample scope for further "brain waves." One thing leads to another. A number of these circuits originated in the fertile brains of readers of POPULAR WIRELESS. We anticipate with pleasure further "long-range," "selective," and "loud speaker" one-valve "hook-ups" from the same source.

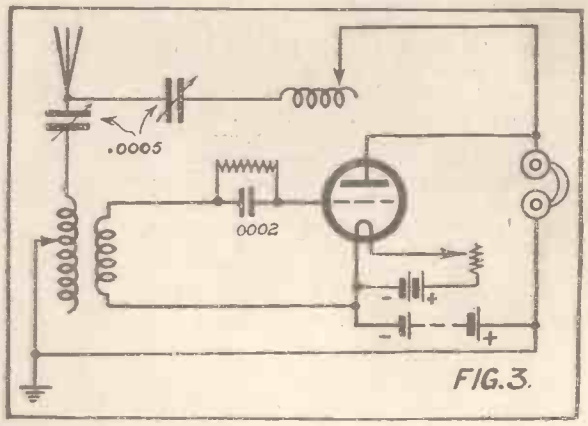


FIG. 3.

"May" and "Hopwood" Circuits.

Fig. 1 is a diagram of the now almost famous "May" circuit, of which readers have written to the effect that it is the "Simplest and most effective one-valve super ever evolved." On the other hand,

(*Continued on page* 828.)

SOME INTERESTING ONE-VALVE CIRCUITS.

(*Continued from page 827.*)

others have reported that it is more unstable than a Flewelling and less efficient in operation. The general concensus of opinion is that using the best of components, including a variable grid leak and a filament resistance fitted with "vernier," and with skilful and careful handling, it can, under fair conditions, and with a good aerial, operate a small loud speaker from the local station and bring in all the other B.B.C. stations at fair telephone strength.

The "Hopwood," Fig. 2, is another circuit which has achieved great popularity. Experience has shown that it is very similar in characteristics to the "May" circuit, and is capable of similar ranges of reception under similar conditions. It has been suggested that a ·0002 variable condenser across the reaction coil improves results, but we have found that this is quite unnecessary if the proper coils are used. Except for the variometer it is quite an ordinary one-valve circuit with reaction and coils of ordinary value should be used. The variometer should be of standard value for the wave-length range it is desired to cover.

Operating the "Hopwood."

The "Hopwood" circuit should be tuned by first placing the variometer at "zero" and tuning in the loudest signals by means of the variable condenser and reaction in the usual way. The variometer should then be adjusted for loudest signals, and the capacity of the variable condenser simultaneously slightly reduced. The variometer must be kept as far away from the tuning coils as possible.

A very interesting circuit was published two years ago in "P.W." with which it was claimed by the author that "jamming" stations could be very efficiently eliminated (Fig. 3). Curiously enough, it is about the only circuit ever published in this journal which did not occasion one report from readers. For this reason, then, if for no other, it must be considered unique.

Unconventional but Popular.

Very different is the case of Fig. 4, which was published under the title of a "One-Valve Loud Speaker Circuit." Hundreds of correspondents have written us in respect of this unconventional "hook up," and in the majority of cases everything claimed for it has been accomplished. Its originator, a reader of "P.W.," stated that in operation it was as simple to handle as a "straight" circuit, while it provided the range and volume of a reflex circuit—i.e. the local station on a small loud speaker, and all the other B.B.C. stations on 'phones with careful handling and under good conditions.

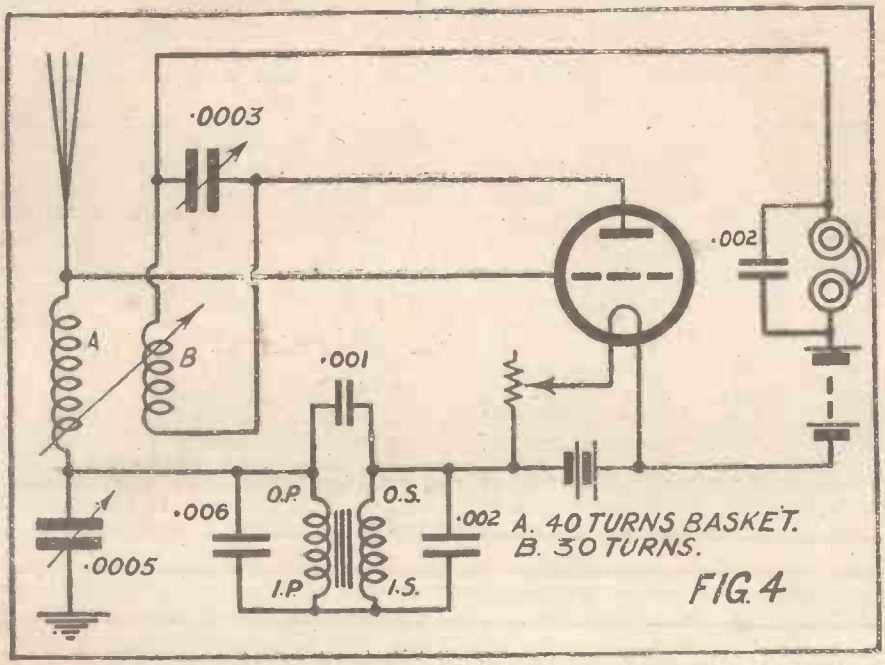


FIG. 4

It is a similar circuit to the "Hopwood," but instead of the variometer it has an L.F. transformer around which is grouped a series of fixed condensers.

The experiences of our readers indicates that to ensure successful results a vernier on the A.T.C. is essential, while the filament control is so delicate that the slightest variation can cause complete loss of signals. It is therefore an ultra-critical circuit in which stray capacity effects which might be caused by crowding of components and careless wiring should be avoided as far as possible. In some cases larger coils have improved results, a 75-turn A.T.I. and a 50-turn reaction appearing to prove necessary for the normal B.B.C. band of wave-lengths. Also, it has been proved that not all L.F. transformers are suitable, but the R.I. has figured with success in many cases.

L.F. and H.F. Amplification.

It will be noticed that neither a grid condenser nor a grid leak is used, and, curiously enough, but few of our readers have discovered that the introduction of such does anything else but reduce the sensitivity of the circuit.

It has been found that a stage of L.F. amplification can be added and that the same batteries can be used, but H.F. amplification is a different matter. As a matter of fact, very few of these ultra-sensitive one-valve "hook-ups" lend themselves to extension in the latter respect unless considerable modifications are made. The effect of this, however, generally tends to reduce the effectiveness of the circuit to such an extent that it becomes quite normal in its capabilities.

Where these remarks *do not* apply we will specifically mention the fact, but there is no reason why amateurs should not experiment in that direction.

In the next article among others De Forest's famous Ultra Audion circuit will be dealt with.

The staff at the new Stoke-on-Trent relay station.

LOW-FREQUENCY AND TELEPHONE TRANSFORMERS.

HOW TO MAKE THEM.

By "GRID LEAK"

ALMOST every wireless amateur has some empty wire reels in his workshop, but is he aware that they can be used as formers for transformers? A common size is about 3 inches long by 2 inches diameter, and having a centre hole

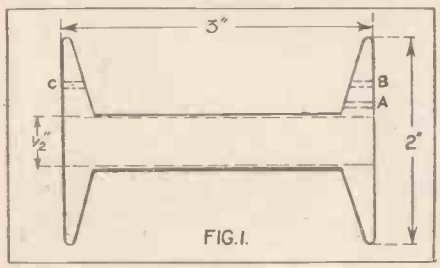


FIG. 1.

about ⅜ inch in diameter. This centre hole should be increased to, as near as possible, ½ inch in diameter. Drill three small holes, as shown at A, B, and C in Figs. 1 and 2, each sufficiently large to take a piece of insulation sleeving, and then give the reel about three coats of fairly thick shellac varnish, allowing each coat to dry.

Method of Winding.

An easy method of winding the reel, provided one has no lathe, is to mount a bench or breast drill in a vice, so that the chuck is horizontal. Now mount the reel in the chuck, and support the bobbin of wire (No. 44 S.S.C.) on a piece of round rod so that it will run freely. Solder the end of the No. 44 wire to a piece of thicker wire (No. 28 S.S.C. or enamelled is a very convenient size), about one yard long,

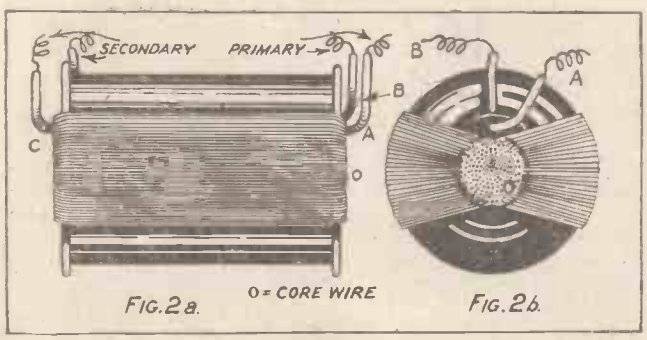


FIG. 2a. FIG. 2b.

pass the free end through the insulation sleeving at A, and commence to wind evenly along the reel. At every two or three layers give a coat of shellac. After winding a full ounce of wire, break off, and solder the end to another piece of No. 28 wire, wind for a dozen or two turns, and then pass the free end through the insulation sleeving at B. This completes the primary winding.

Thoroughly shellac the primary and wrap round it a piece of empire cloth, or some other good insulating material. Starting from the hole C, wind the secondary in exactly the same way. This will require 3 ounces of No. 44 S.S.C. wire. When completed, the whole should be well shellacked and wrapped round with more insulating cloth, the free end of the wire being passed through insulation sleeving.

Procure some No. 24 or 26 soft iron wire, and thoroughly anneal by dropping it into the kitchen fire at night, and leaving it until the morning. Thread this iron wire through the centre hole of the former, round the outside, and back again through the hole, as shown in Fig. 2. Wind as much as possible on both sides of the former, and fill up any spaces in the hole with 3-inch lengths of the iron wire. The transformer is now complete.

A condenser of about ·002 mfd. should be connected across the primary, and may be made as follows: From a piece of ⅛ inch thick ebonite cut two pieces each 5 cm. long by 2½ cm. wide. Six pieces of brass or copper foil, 4 cm. by 2 cm., five pieces of ·002-inch thick mica, 4 cm. by 2½ cm., and two 4 B.A. brass terminals, are all the materials required.

The Condenser Included.

Drill 4 B.A. clearance holes in the ebonite, ½ cm. from each end, and 4 B.A. tap holes ½ cm. from one end only in each of the pieces of foil. Put the terminal shanks through the holes in the ebonite, and mount the pieces of foil (with one piece of mica between each) alternately. This will give an overlap of 3 by 2 cm. Fig. 3 shows the arrangement before tightening the nuts.

If desired, the transformer and condenser may be mounted in a small wood box, having an ebonite top. In this case, the ebonite top may be used as part of the condenser, and only one piece of ebonite, 5 by 2½ cm., used on the underside to hold the plates together, the terminals (primary) being fixed to the top, as in Fig. 4, which shows the end removed. The secondary leads will, of course, be taken to two terminals at the opposite end of the ebonite top. Mark the terminals P. and S. respectively to avoid connecting up wrongly.

A similar method may be adopted to make a telephone transformer, except that for the primary winding 3 ounces of No. 44 S.S.C. wire, and for the secondary winding 6 ounces of No. 30 S.S.C. wire would be required, and, of course, a large

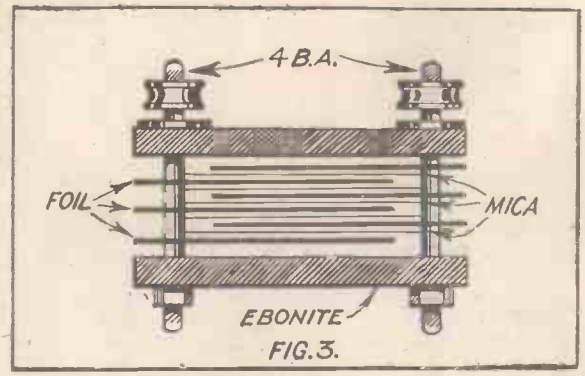


FIG. 3.

reel would be necessary. A condenser of the same dimensions, but with twice the number of plates, would be suitable for the telephone transformer.

An intervalve transformer made on the above lines by the author was tested *on*

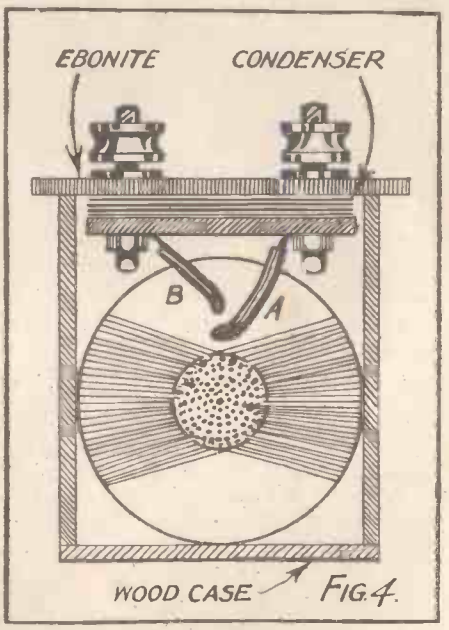


FIG. 4.

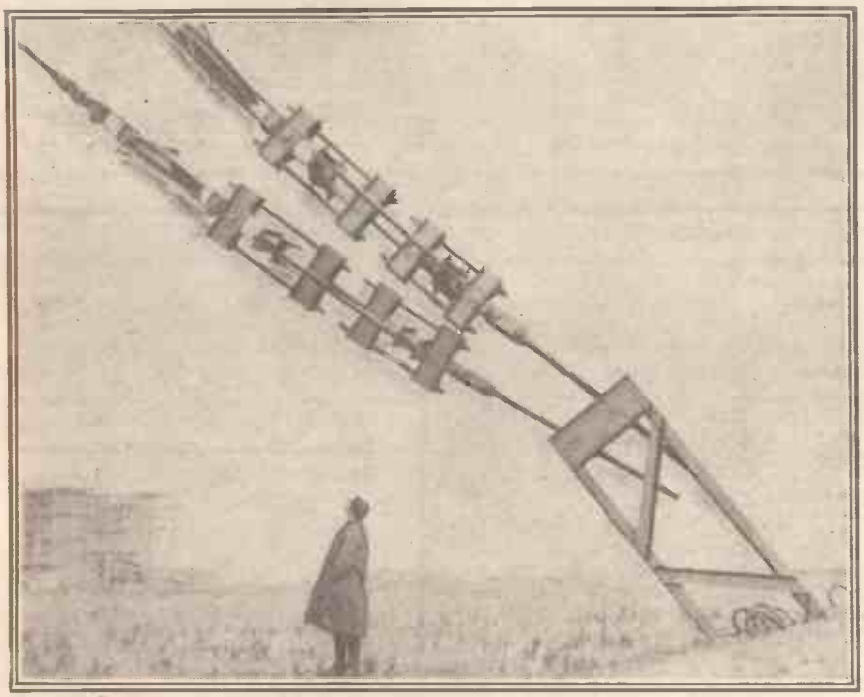
signals against a standard Army type, and proved to be much more silent in operation, and also possessed greater amplification powers. As many as three stages of L.F. amplification, have been used with the above type of transformer.

"BROADCASTING for EVERYONE."
The Editor's Book Reviewed.

By Dr. J. H. T. ROBERTS.

THIS book, published by Herbert Jenkins, price 3/6 net, by the Editor of POPULAR WIRELESS, aims to give to the lay reader an easily understandable outline of the fundamental technical principles involved in broadcasting, as well as a history of wireless development and a peep behind the scenes at 2 L O. As stated in the Preface: "It is not a book for the serious student or experimenter; it is a book for the new amateur who has been attracted by the world's most fascinating hobby."

The book has many merits, but, to my mind, one outstanding fault, and perhaps it is just its merits that throw this fault into bold relief. And the fault is this—more than half the book is devoted to the semi-technical side of broadcasting, leaving less than half for the social and artistic side. The wisdom or otherwise of this choice will, of course, be a matter of opinion, but the author is so eminently at home when describing the social and artistic side of broadcasting that it is a pity he should not have allowed himself a larger proportion of space for this purpose.



One of the gigantic guy ropes to one of the masts at the super station being built at Rugby.

The Scope of the Book.

In making this criticism, I do not suggest that the technical descriptions given are not useful or interesting. As a matter of fact, the author has succeeded in giving a popular and readable account of much of the science of wireless that is often found most difficult for the layman to grasp. In these chapters, his intimate knowledge of the needs of the beginner derived from his experience as Editor of POPULAR WIRELESS, is everywhere evident. The scope of this part of the work may be briefly indicated by some chapter headings as follows: Ether and Ether Waves; The Birth of Wireless; the Aerial; the Valve as Detector and Amplifier; Care and Maintenance of Receiving Sets; the "Unidyne" Principle; Sidelights on Wireless; and Glossary.

At Random.

Unless I am much mistaken, the average reader will be very much intrigued and delighted with the parts of the book where the author takes him around behind the scenes and introduces him to the personnel of the B.C.C., with whom he has long been familiar.

In a particularly interesting chapter headed "At Random," Mr. Edwards retails conversations with various well-known people on the subject of the much-vaunted educational value of broadcasting which in my opinion (and, I was glad to note, in the opinion of most of those mentioned) is of infinitely less importance than its entertainment value. Some of the remarks are very refreshing.

Mr. Mark Hambourg, asked if the programmes were what he would choose, replied, "Ah, that is a different matter. The things I should want to hear would not make a programme for a big radio audience. Still, the idea of listening to a Beethoven Sonata whilst in my bath has often struck me as being very entertaining."

Mr. Bernard Shaw expressed himself characteristically as follows: "I suggest getting Sir J. Forbes Robertson to speak good English to them (the listeners-in) for half an hour every day to give them some idea of their own language—that would be a startling novelty to most of the subscribers."

Education by Wireless.

Miss Rebecca West's observations, however, have the most human touch of all. She first of all emphasises that radio, like the cinema, is a "gorgeous toy," and urges those responsible for it rather to glory in this fact than to endeavour, quite unnecessarily, to excuse it on the ground that it is a means of "education."

Miss West continues: "The 'educational' work the cinematograph does in showing our little dears how mustard is quarried in Boni-boola does not matter a twopenny dash: the work it does in enlarging their hearts and their imagination by showing them Charlie Chaplin is beyond all praise. The 'educational' work you will wireless on the little dears will also not be worth a twopenny dash; but the work to be done in bringing music into the home, in making drab lives beautiful and eventful by such devices as the bedtime story, in bringing the welcome sound of the human voice to those souls who find themselves marooned in loneliness, and in making the universe easier for poor struggling mankind by quicker communication—that is something to be proud of."

It is in this spirit, with which so many will be in sympathy, that I have ventured to express regret that Mr. Edwards has not devoted more of his book to the purpose of the last few chapters. It may be hoped that in his next work he will give us a whole volume of those delightful personal reminiscences and matters of human interest in the recounting of which he has such a special gift.

SENSITIVE SYNTHETIC CRYSTALS.

SUPER-SENSITIVE crystals at 1/- per gross are easily made. Obtain some pure lead (Pb.), not solder or lead alloy. Also some flowers of sulphur—ordinary powdered sulphur. Cut the lead in small pieces and mix with the sulphur in the ratio of seven parts by weight of lead to one part of sulphur. Place the mixture in a crucible, a tin cup or some convenient container other than glass or porcelain.

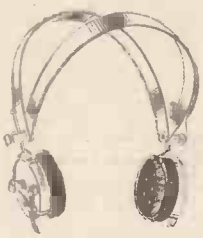
Heat over a Bunsen burner or over red coals in a stove. In a very short time the mixture will begin to glow, and the lead and sulphur will fuse together. At this point remove the mixture from the heat and place the container in a basin of cold water to cool.

Do not let any water get on the crystals, as it will ruin them. If you have had things just right, you will have a lump of material that is supersensitive over its entire surface. If the lump is crumbly, you have "cooked" it too long, and if it is streaked with lead, you did not cook it long enough or else you used too much lead.

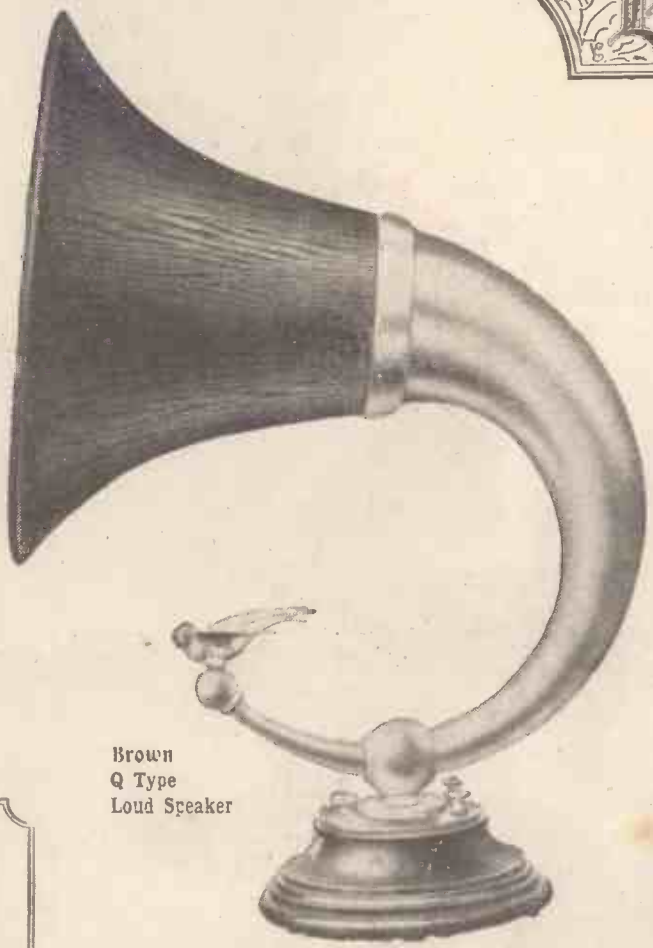
GIFTS

Left:
Brown
A2 Type
Headphones

Right:
Brown
A Type
Headphones



Left:
Brown
F Type
Headphones



Brown
Q Type
Loud Speaker

Prices :

LOUD SPEAKERS

Type H1, 21 inches high	£ s. d.	Type H2, 12 inches high	£ s. d.
120 ohms ..	5 5 0	120 ohms ..	2 5 0
2,000 „	5 8 0	2,000 „	2 8 0
4,000 „	5 10 0	4,000 „	2 10 0

Type Q—The Loud Speaker-de-luxe. All resistances £15 15 0

GRAMOPHONE ADAPTORS

Type H1	£ s. d.	Type H 2	£ s. d.
120 ohms. ..	4 7 6	120 ohms ..	2 0 0
2,000 „	4 10 0	2,000 „	2 2 0
4,000 „	4 12 0	4,000 „	2 4 0

The CRYSTAVOX Loud Speaker
For use direct from Crystal Set £6 15 0

HEADPHONES

A type	120 ohms, per pair	58/-
	2,000 and 4,000 ohms, per pair	62/-
	8,000 ohms, per pair	66/-
D type	120 ohms, per pair	48/-
	2,000 and 4,000 ohms per pair	52/-
F type	120 ohms, per pair	22/6
	4,000 ohms, per pair	25/-

A2 type—Ready for issue shortly.

MICROPHONE AMPLIFIERS

Type C—(For use with Crystal Sets)
4,000 ohms input—2,000 ohms output .. £6 0 0

Type V—(For use with Valve Sets)
120 ohms input—120 ohms output £5 5 0
2,000 ohms input—120 ohms output .. £5 8 6
2,000 ohms input—2,000 ohms output .. £5 13 0

TELEPHONE TRANSFORMERS

Mounted .. .. 25/- Unmounted 15/-

Brown
Type H1
Loud Speaker

Wireless Instruments

Gilbert Ad. 1873

UNIDYNE DEVELOPMENTS IN AMERICA.

By G. V. DOWDING, Grad. I.E.E.

Among the latest Unidyne circuits published in the U.S. is a single-valve reflex. Although we have not yet tested it, we see no reason why it should not be capable of the good results claimed for it. Reports from readers in connection with the circuits shown on this page will be welcomed.

EVER ready to give attention to anything new and assist it in its development, America has received the Unidyne with such keenness that remarkable progress is being made in that country both in extending its uses and improving the original circuits. In no single American radio journal is the Unidyne, which is known in that country as the Solodyne, treated with anything but respect, and what is more gratifying, the greatest monthly radio journal in the world, the "Radio News" of America, has taken it "under its wing."

We are, in fact, indebted to the December issue of its companion journal, "Science and Invention," for the three Unidyne (Solodyne) "hookups" which appear on this page. That they are interesting goes without saying, and the diagrams, which are reproduced as they stand, are so clear that no amateur will be unable to follow them.

The Three New Circuits.

Fig. 1 shows a straight H.F. and detector circuit with reaction, which is stated to be good for approximately 1000 miles on an average outdoor aerial. The coils are wound on a 3½ inch diameter former, with a closely-fitting reaction "rotor." The H.F. transformer can, instead of honeycomb coils, consist of closely-coupled basket coils or an ordinary plug-in type H.F. transformer. "A" Battery refers to the filament lighting battery. It differs but little from the original H.F. and det. Unidyne.

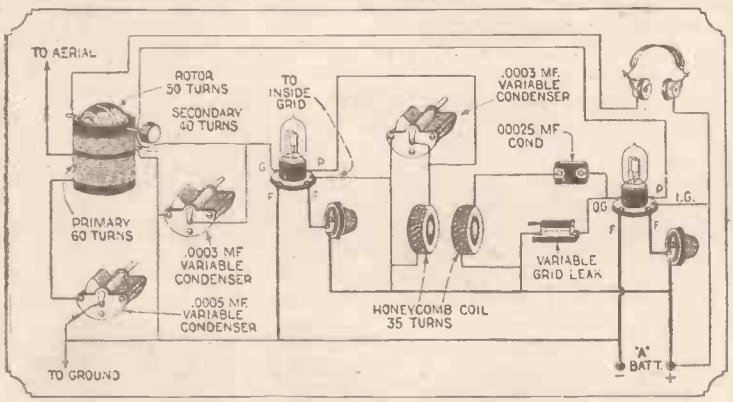


Fig. 1. A "straight" H.F. and detector circuit.

Fig. 2 will prove an even more interesting circuit as it is the first single valve and crystal reflex Unidyne to be published. We have not yet had time to try it out ourselves, but in the words of "Science and Invention," it is "A rare combination that gives unexcelled purity in tonal qualities," and "has shown promising results."

The aerial coil, which is wound on a 3½ in. former, is tapped at every fourth turn up to the centre of the coil, which is, of course, at the 30th turn. It is stated that a sensitive crystal detector is necessary, and that for maximum amplification a 4 to 1 ratio L.F. transformer should be used.

The variometer should be of standard value. The two H.F. chokes could, we imagine, consist of 250 turn basket coils instead of the honeycomb type. They should not be coupled together.

Fig. 3, which employs a similar aerial tuning coil, is a more or less "straight" detector and L.F., and it will be noticed that the usual L.F. grid condenser and leak is replaced for a grid biasing battery. Other new features are the introduction of an H.F. choke and special tuning circuit. An encouraging statement is included in the description of this circuit, which reads: "It must be remembered that all Solodyne circuits eliminate 'B' batteries, and give unexcelledclarity" Good though these circuits may be, and we have yet to report upon their capabilities, we must not forget that it was an English amateur, viz., Mr. Davies, of Hastings, who first developed a Unidyne reflex circuit, although, of course, the single valve dual shown on this page is entirely new, and for the first time proves the possibility of Unidyne single-valve dual amplification.

Then, again, we consider the evolving of a Unidyne neutrodyne reflex by Mr. Marcus, a circuit recently detailed in this journal, is an advancement of utmost importance. Was more attention given to the improvement in the design of suitable valves on the part of valve manufacturers, the Unidyne would soon extend itself beyond all limits.

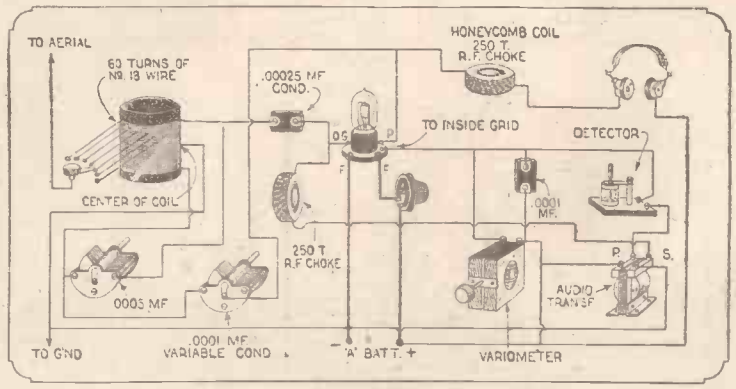


Fig. 2. A single valve and crystal reflex.

Few Hints to Constructors.

But what has been in the few past months is really extraordinary, and we as experimenters cannot fail to pay tribute to those indefatigable wireless enthusiasts in both this country and the U.S. who have shown such keen interest, and who have proffered such helpful suggestions in respect of the "P.W." Unidyne. It almost makes us feel that beside this, our own efforts were almost insignificant.

Now a word to those who intend to try out one or all of the above circuits. Do not forget that Unidyne receivers require careful handling both in assembly and in operation. To obtain good results first class components must be used; slight faults can cause more trouble in Unidyne than in ordinary circuits. Generally speaking, it is not wise to attempt the construction of a reflex multi-valve Unidyne unless previous H.T. valve experience or experience with a single valve Unidyne circuit has been obtained. Finally, component values as specified should be strictly adhered to.

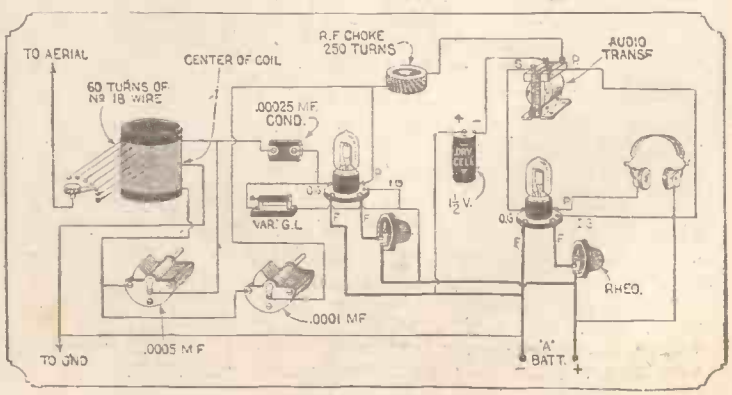
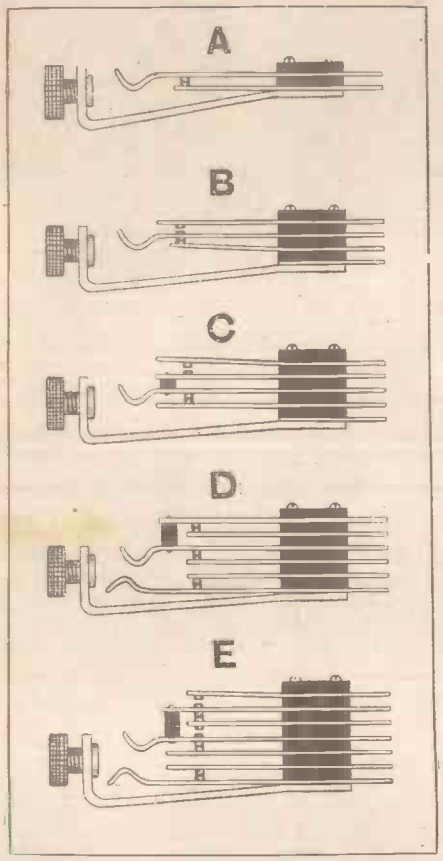


Fig. 3. Detector and L.F. with grid bias in the latter stage.

CONCERNING SPRING JACKS.

By O. J. RANKIN.

ALTHOUGH the common plug and jack switch is extensively used in modern multi-valve receivers, it is by no means a new invention, and was probably never intended as a wireless component, for long before radio became a practical proposition these remarkably compact switching devices had played a very important part in the development of the



telegraph and telephone industry. It is true that some of these have been modified to meet the requirements of present-day wireless enthusiasts, but, nevertheless, the fundamental designs date back to the early days of the telegraph. It is perhaps only natural that radio should inherit from its predecessor any suitable development which applies, and so the plug and jack becomes a *comme il faut* modern radio component.

Important Points.

Both in theory and design the average spring jack is a very simple affair, yet there are several points in their design that largely determine their general efficiency. These may be tabulated as follows: (1) Good electrical conductivity at all times; poor contact can only result in failure. (2) Perfect insulation of all parts without an excessive "piling up" of insulating material. (3) A rigid metal frame, or support, with a convenient and reliable means of attachment. (4) Heavy phosphor-bronze springs having a low resistance. (5) Good contacts, preferably of silver, which will not oxidise or corrode; and (6) Ample space for soldering connecting wires to the ends of the spring strips. These essential points should not be overlooked when purchasing the device.

Now, concerning their use, it would, of course, necessitate writing a book if one attempted to describe the various methods of employing all the different types of jacks in wireless receiving circuits, and therefore it is only intended to describe briefly the most common types. These are shown in the accompanying sketch. At A we have a simple two-spring or "one break contact" jack, which can obviously be used for many different purposes, in the same way as an ordinary S.P.S.T., or cut-out switch, would be used.

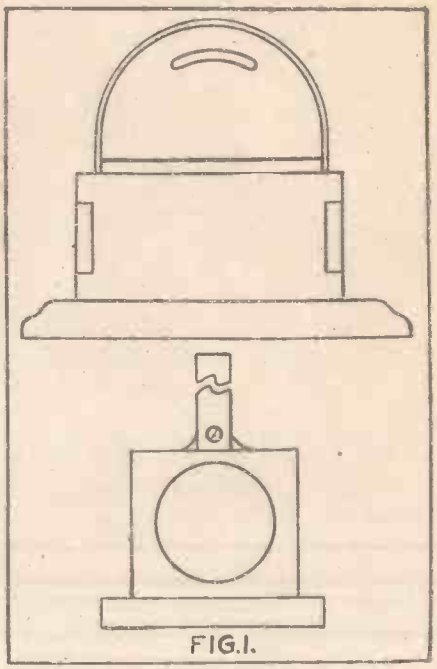
Various Types of Jacks.

At B there are three springs, the insertion of the plug making one and breaking one contact, and at C the same operation is effected, but an additional insulated contact is provided on the movable spring, so that two parts of a circuit may be brought into contact with the top or bottom spring as desired. The jack shown at D appears to be rather more complicated, this having six springs, which break three contacts. It is, however, extremely simple, and the advantage to be gained by using this should be obvious. At E we have a seven-spring jack, which breaks three and makes two contacts, this being used in complicated neutrodyne circuits.

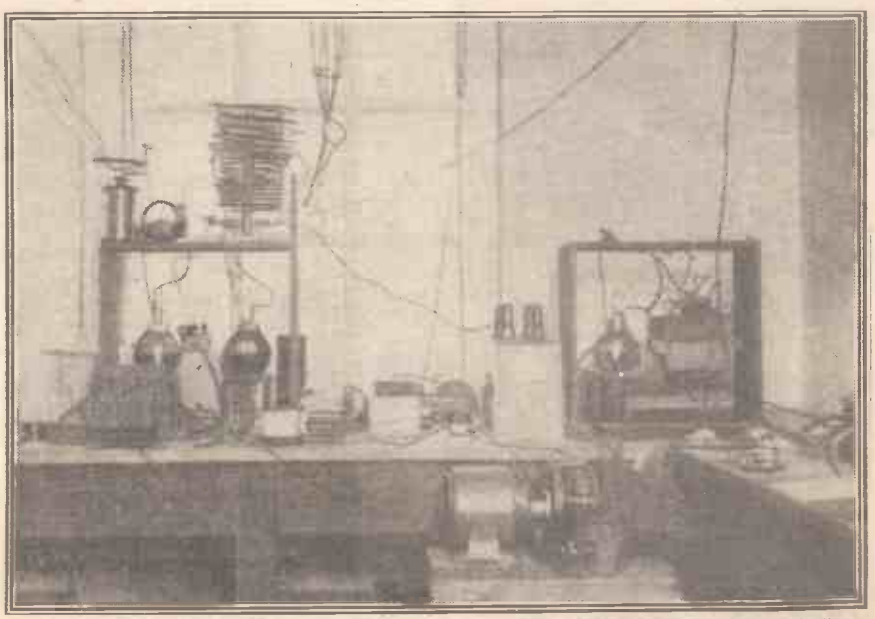
The greatest care should be exercised when considering the use of spring jacks in a multi-valve set, for we must not overlook the capacity effects produced by the close proximity of the springs, the thin insulating strips, etc., and therefore they should rigidly be excluded from high-frequency circuits.

A 'PHONE STAND.

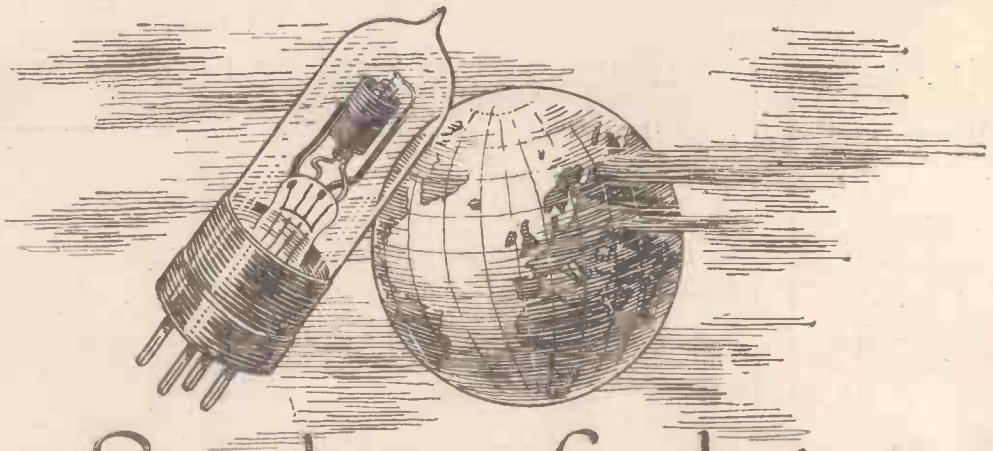
HERE is a useful fitment on which to rest the 'phones near the set when not in use, and will save damage from an accidental fall.



It consists of a baseboard, on which is mounted a rectangular block of wood, with a recess in each end to take the ear-pieces. Let into this along its length is a semi-circular piece of 3-ply, cut to correspond with the radius of the head-bands. Along the edge of this and at right-angles to it is fitted a narrow strip of the same wood, held down to the block at each end by wood screws.



The transmitting set at Mill Hill school. With this set Mr. Goyder established two-way communication with New Zealand.



Learn the joys of exploring

IT may be that you are one of the people who are content with a "crystal." You get entertainment direct from your local station. It is "good enough." But *is* it? Only the man with the valve realises the fascination of exploring. Out in the ether are wandering music and voices—they are coming from every corner of the broadcasting world. Your aerial is picking them up, but you cannot hear them.

That valve would lend a new meaning to your "listening in." It gives to a wireless set all the romance of a big adventure.

Ediswan Valves give uniform and excellent results in conjunction with an "all stations" set. They are noiseless in use and combine a high degree of sensitivity with a length of life which makes them very economical in service.

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

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The first valve ever made, was produced in the Ediswan laboratory

EDISWAN VALVES

An interesting study of early wireless history may be made at the Science Museum, South Kensington, London, where the complete series of Dr. Fleming's experimental valves can be inspected.

162-9

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1. EFESCA HIGH FREQUENCY TRANSFORMER. Can be employed immediately preceding a reactance coupling to form two High Frequency stages or any number of separate transformers may be used in combination. Can also be used as a Tuned Anode Transformer by shunting the primary with a ·0003 mfd. variable condenser in any number of stages. Wavelength range, 150–2600 metres. Complete as illustration, wound on Ebonite former, **21/-**. Ditto embodying Grid Leak and (·0003) condenser for use as Transformer connected to Detector Valve, **25/-**.

2. EFESCA SPEECH AMPLIFYING TRANSFORMER, TYPE "C." This Transformer is designed to give the amplification of a power Transformer without the loss in purity of reproduction generally experienced with power amplification. The coil is wound in a special manner to neutralise resonant effect, while the laminations of the core are extra carefully insulated from each other to localise eddy currents and thus prevent distortion. Ratio 2-1 one hole fixing, **25/-**.

3. EFESCA ANTI-CAPACITY SWITCH (Pat. applied for). A double pole, double throw switch specially designed to minimise the capacity which exists in most change-over switches. The contact brushes are of phosphor bronze and present only their *edges* to each other with a comparatively wide air gap—thus practically eliminating all capacity effects. Specially suitable for High Frequency and aerial circuits and for all inter-valve change-over combinations. Price **8/-** each.

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For those not interested in the constructional side there is a wide range of complete Efescaphone Sets, from the simple crystal set to the multi-valve receiver for loud speaker and long-range work.

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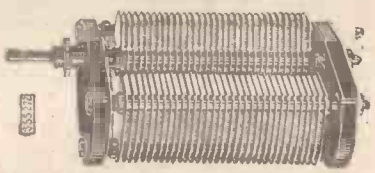

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Dial and Knob 1/- extra. Postage 9d. extra.

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British Reputation.—Your Condensers are not FALLON'S unless the name FALLON appears on same. Write direct for Trade Terms.

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Fixed Condenser and Grid Leak COMBINED.

2 or 3 megohms, 2/6 each.

—They're as good as the Best

HOW TO MAKE A UNIVERSAL TELEPHONE DISTRIBUTING BOARD.

By W. S. SHOLL A.M.I.E.E.

This ingenious board will make a handy and useful addition to any wireless set. "Telephones for Anyone, Anyhow," is its keynote.

THE useful piece of apparatus described and illustrated in the following article was designed by a friend, a keen experimenter, to whom the writer's acknowledgments are due, and gratefully tendered. The device comprises a telephone transformer and a panel upon which are arranged a number of circuits with terminals which connect almost any number of telephones of all types, high resistance, low resistance, complete double head sets or single earpieces, in series or parallel at the convenience of the user.

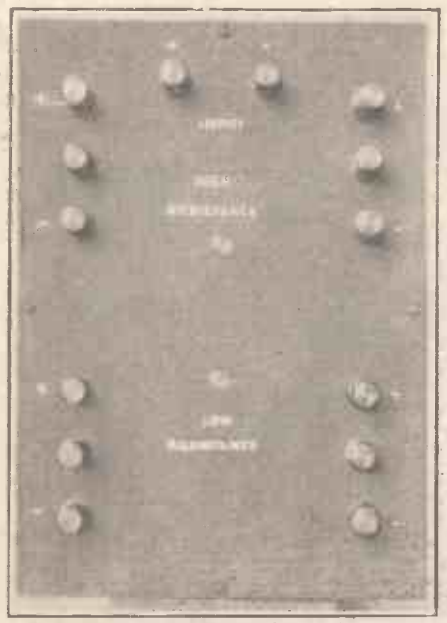


Fig 1. Panel view of the completed instrument.

Should the wireless demonstrator have a considerable audience his resources may be strained to the utmost to provide telephones for everybody, and where visitors are requested to bring their own 'phones it will probably be found that the instruments are a pretty "mixed team" and not capable of being connected to the output terminals of the set just as they are.

The Panel Lay-out.

Fig. 1 is a photograph of the instrument complete, from which it will be seen that the whole affair is very neat and simple, the design being commendably free from switches and other complications. Fig. 2 shows the lay-out of the panel, in which A, B, are the input terminals and C, D, E, and F, G, H, the primary terminals for the *high*-resistance 'phones.

At T is the transformer, of the "step-down" type—i.e. the output is of lower voltage than the input.

The transformer can be made quite cheaply if the worker can fit up a satisfactory winding gear, and if also he has a very large amount of patience in the tedious operation of putting on the primary winding, which consists of 15,000 turns of No. 42 S.W.G. wire.

A suitable design will have a core of soft iron wires of about 22 S.W.G. 8 in. long by ½ in. diameter. The winding space is 3 in. long and provided upon a bobbin with a central tube ½ in. clear internal diameter fitted with end cheeks 2½ in. square by ¼ in. thick.

Constructing the Transformer.

The bobbin should have the centre plugged, centred, and put in the lathe, or a very good winder may be rigged up with a hand drill fixed in the vice. The secondary, 800 turns No. 38 D.S.C., has first a short piece of 26 gauge wire soldered to it, and run on for one layer, to make a sufficiently strong connection for securing to the terminals.

A layer of empire cloth is now put on quite evenly, and the secondary winding run on and finished off with a layer of stouter wire, as at the beginning.

Having covered the finished secondary with a layer of cloth the primary is provided similarly with a layer of stouter wire and the whole winding proceeded with, which will account for about 2 oz. of wire, and the end layer finished off as before.

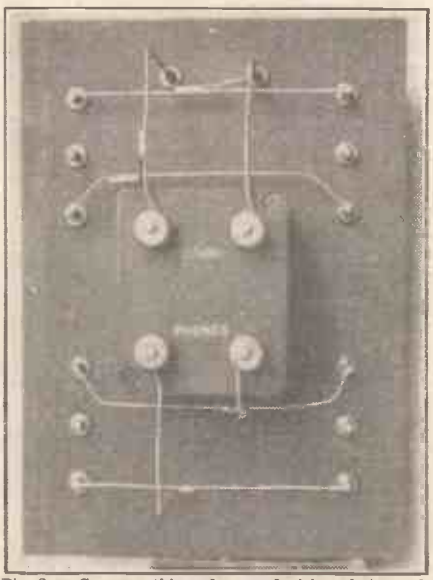


Fig. 2a. Compare this under-panel wiring photograph with Fig. 2

The wire core should be assembled as truly as possible, and the centre, for a space of 3 in., bound tightly with silk ribbon; the whole is now immersed in molten paraffin wax for about twenty minutes, removed and allowed to drain free of superfluous wax.

The core should next be inserted tightly into the centre of the bobbin, and the protruding ends bent up to meet and interlaced, to make a closed magnetic circuit, along the two sides of the bobbin. The wires should be bound down with copper binding wire to keep the core in place, and the whole may very well have a layer of adhesive tape as a finish.

For a transformer which is used well away from the set a straight core 3½ in. long will prove quite satisfactory, and easier to construct. The completed transformer should have the primary and secondary ends led to 4 B.A. screws tapped into the ends of cheeks, and the top edges should be drilled and tapped

(*Continued on page* 840.)

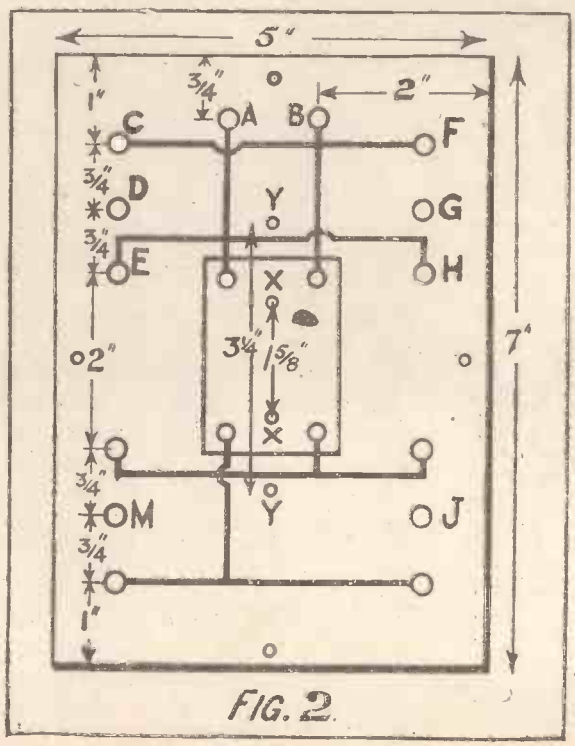


FIG. 2.

"AMERICA CALLING!"

From a Staff Member visiting America.

IN the recent competition inaugurated by "Radio Digest" when readers were invited to vote for their favourite announcer, Mr. Arthur Burrows, of 2 L O, managed to poll just over 50 votes. Now 50 is not a tremendous lot when it is realised that the winner, George Dewey Hay, of W L S, Chicago, had about a hundred times the amount; but in all probability, if the competition had had its birth in this country Uncle George would perhaps have had Uncle Arthur's fifty and Uncle Arthur probably a million, possibly a billion, or perhaps a trillion.

Mr. Hay received the microphone trophy offered by the "Radio Digest" at the recent World's Radio Fair, which I mentioned in my last article, and in a speech he made after the presentation he said—to use his own words—"it is very amusing to note the reaction an announcer has on the radio public. In my experience I have met only one person who ever thought I looked like I do. Voices are perhaps deceptive, but let us keep them deceptive on the right side. Brevity is not only the soul of wit, but the soul of radio announcing (note this, some members of the B.B.C.). An announcer can talk himself out of every radio receiving set in the country in less than a minute. Then, again, some would like to hear more from other announcers. A smile will break up more static than a 5,000 watt broadcasting station."

Well, that's what Mr. Hay thinks about the subject, and he must be right, otherwise he would not have won the trophy. Brevity—yes, that is the essence of announcing.

Breaking Amateur "D X" Records.

C K A C, the station heard so often in the British Isles last winter, is said to be the only French station on the North American continent, and the only French and English station in the world. It caters especially to some five millions of French scattered throughout the various provinces of the Dominion, several states of the Union, the island of St. Pierre-Miquelon, and in the West Indies and the Guianas.

The new apparatus being installed at this station which I mentioned previously consists of fourteen Mullard valves, each of 2,000 watts.

The rating of the aerial energy is approximately 25 amperes, and the increase of 5,000 watts should enable this station to be heard in the British Isles fairly regularly when atmospheric conditions are good.

America's giant dirigible, the Shenandoah, has recently been carrying out some experiments with a short wave transmitter while on cruises. The reason that a short-wave transmitter was employed was because storage batteries were the only source of power employed and a short-wave transmitter does not require so much power input as does one of the long-wave type. This transmitter contrasts strikingly with the one employed on the new Zeppelin made by the Germans as spoil of war for the United States, which employs a wave-length of over a thousand metres.

The world's record for amateur radio long distance telephone has just been captured from a South American operator by a "ham" in San Pedro, California, who got into touch with an amateur in Waihemo, New Zealand, a distance of nearly 7,000 miles. Previous to this, the world's record was 6,400 miles.

[This record has now been beaten by Mr. Goyder, Mr. Simmonds, and others in communicating with New Zealand.—ED.]

A Wireless College.

The new record was made during the trans-pacific tests arranged by the American Radio League, and B. Mager, who now holds it, has been notified by the A.R.R.L. that he wins the Australian boomerang offered to the first amateur of North America to establish communication with Australasia.

K. L. Riedman, of Long Beach, operator of station 6 C G W, has been informed that he is to receive a consolation gift of a pair of green suspenders, as he got into touch with New Zealand half an hour after Mager did.

It's about time now that a London manager got in touch with Frisco, but please note, any amateurs contemplating any such attempt, that radio waves should be directed out of the way of Detroit, as it is rumoured that Henry Ford is now using condensed radio waves as a very essential part of his new model flivvers.

New York now has a real "Air College." The New York University, recognising the penetrating and far-reaching power of radio and its stimulating influences in presenting the popular arts and sciences, has established a Radio Educational Committee of well-known professors and other personalities of note.

The air college only recently made its debut through W J Z, and the autumn term consists of fifty-four lectures, each of twenty minutes duration. Eight different subjects are to be covered, and these will be broadcast every weekday evening from 8.10 p.m. to 8.30 p.m. New York time. British amateurs desiring to take these courses should set their alarm clocks for about 2.30 a.m., London time—and trust to luck for the rest.

A UNIVERSAL TELEPHONE DISTRIBUTING BOARD.

(*Continued from page* 839.)

4 B.A. also, for screwing to the under side of the panel as shown at Y, Y, Fig. 2.

The panel should now be drilled and all terminal holes tapped 4 B.A.; the holes Y, Y, being 4 B.A. clearance, and countersunk on the outer side, being 3¼ in. centres for the home-made transformer.

The four holes for the holding-down screws are clearance for about 4 gauge by ¾ in. brass wood screws. All terminals are now run in and fitted with a washer and back nut.

The shanks of the terminals are next tinned, and the wiring carried out with 18 S.W.G. bare tinned copper wire. Terminals D, G, J, M, are not connected in any way, as they are for series connections, and these terminals may with advantage be reamered out to take two tag ends at a time.

This idea has been added to the original design subsequently, having been suggested by several years' use, in which the panel has fully justified its adoption. The complete panel is now screwed down to a box flush at the sides, and therefore measuring 5 in. by 7 in. by 3 in. deep.

In use a flexible lead of about 9 ft. in length is run from the output terminals of the receiving set to terminals A, B, and the high-resistance 'phones connected to the terminals above the transformer, viz., C, E, F, H, for parallel working.

For series connecting, as in using single earpieces, the two centre ends of the 'phone leads are put together into the middle terminals D and G. The connections will, of course, be similar for the lower set which, being fed from the secondary of the transformer, will be suitable for low-resistance telephones.

It is a good idea to put a dome-type "castor" at each corner of the wood base, which will enable the panel to be drawn easily over the carpet to suit the convenience of the listeners.

To those readers who may not be desirous of making their transformer the photograph, Fig. 3, will be of interest showing a good example of a high-class instrument which is well screened and functions excellently.

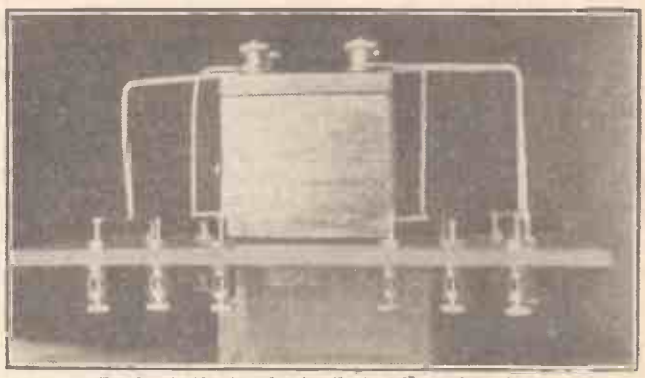


Fig. 3. A side view showing the transformer in position.

The holes for attaching the transformer shown to panel are as indicated at X, X, in Fig. 2, viz. 1⅝ in. centres.

The panel should be of really good ebonite even for audio-frequency work, the material shown being "Becol" first grade matt surface. The telephones should be tested out for polarity and the terminals marked as shown in the photograph, Fig. 1, as this increases signal strength and maintains the magnets in good condition instead of gradually weaking their magnetism in course of use.

WIRELESS IN A COAL MINE

INTERESTING AMERICAN TESTS.

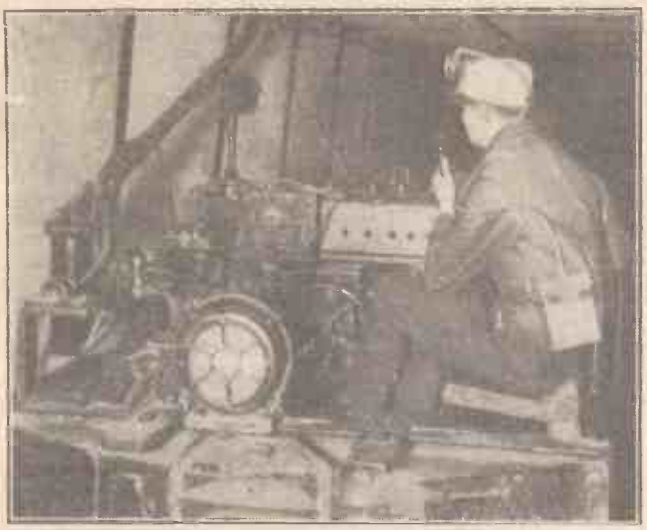
By L. W. CORBETT.

(Former Member of the "P.W." Staff and now our Correspondent in New York.)

In this exclusive article a former member of the "P.W." Staff describes some interesting radio experiments recently carried out by the U.S. Bureau of Mines.

ALTHOUGH somewhat costly in initial installation and maintenance, the present mine telephone is giving satisfaction in most mines. However, in cases of disaster, such as fires, explosions, falls of rock, flooding, etc., the cables are likely to be broken and the telephone put out of commission, and just at the time when it is most urgently needed for entombed men to get into touch with the rescuers.

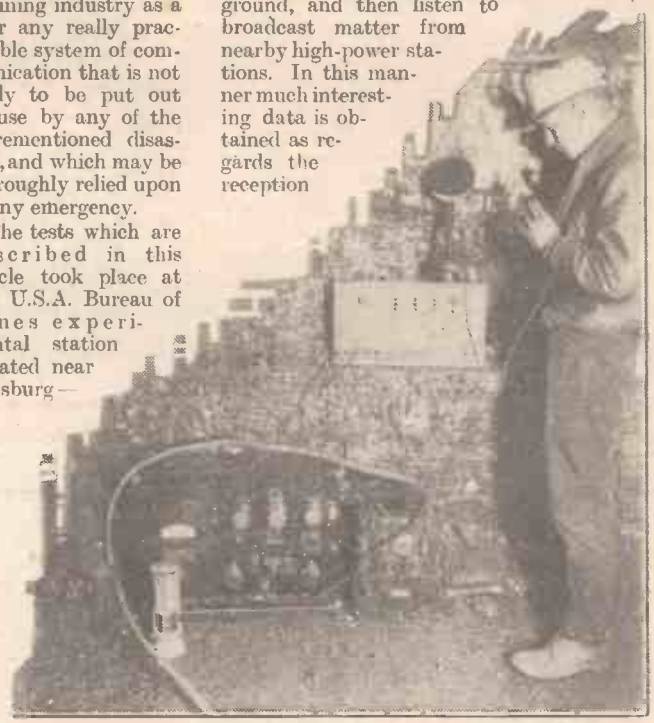
On this account the mining industry as a whole is looking out for any really practicable system of communication that is not likely to be put out of use by any of the aforementioned disasters, and which may be thoroughly relied upon in any emergency.



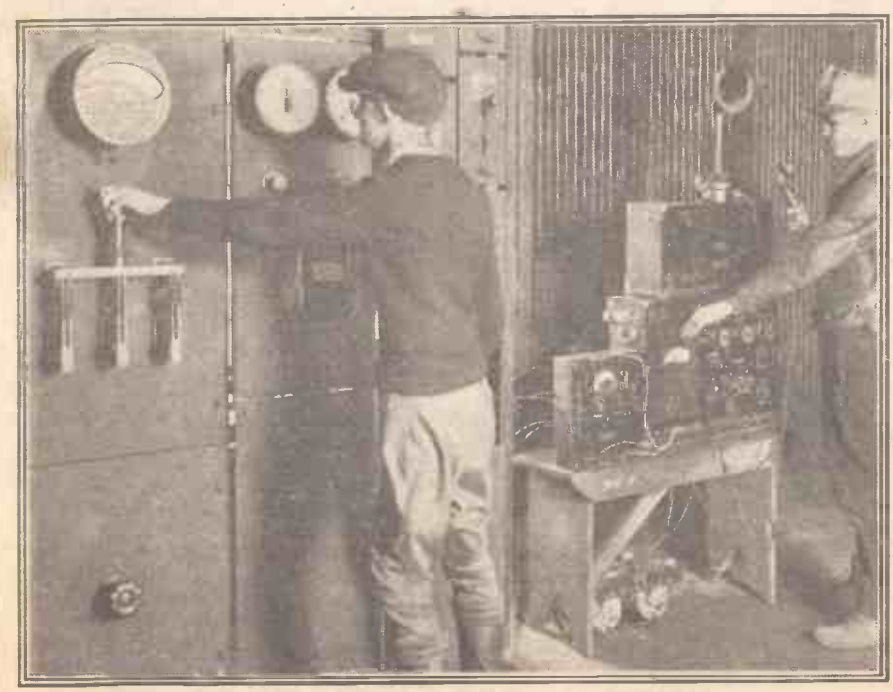
The line radio transmitter and receiver mounted on a trolley car locomotive.

The tests which are described in this article took place at the U.S.A. Bureau of Mines experimental station situated near Pittsburg—where the famous K D K A is also located.

In most tests the procedure has been to take a receiving set of varying degrees of sensitivity underground, and then listen to broadcast matter from nearby high-power stations. In this manner much interesting data is obtained as regards the reception of telephony signals underground, but for really practicable purposes two-way communication is desirable.



The line radio set in one of the mine galleries, using power lines as carriers for the H.F. currents.



The main set in the power house at the surface of the mine.

The Bureau of Mines has advocated that refuge chambers be built in the main sections of mines into which men might retreat during a disaster and close themselves in until help arrived. Such chambers would be provided with compressed air, tinned foods, and water. Some owners have already constructed these chambers in their mines, and they have been instrumental in saving lives. The addition of a really practicable form of communication, preferably for transmitting telephony, not telegraphy, in these chambers would be invaluable.

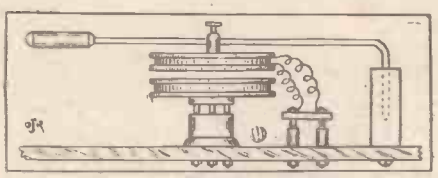
Previous to these wireless experiments, a form of signalling known as the T.P.S. method was tried. The T.P.S. method is a means of communication which requires no wire connection between the sending and receiving stations, and differs from wireless in that the transfer of energy from the transmitter to the receiver takes place mainly by conduction and, to a much less extent, induction through the ground.

The two output terminals of the T.P.S. transmitter are connected to earths 50—1,000

(Continued on page 842.)

HOW TO OBTAIN IMPROVED REACTION COUPLING.

THE usual method of arranging intervalve reaction on to the H.F. plug-in transformer is to mount the reaction coil on one end of a strip of ebonite which is swivelled at the other end to an upright support secured to the panel. This is quite



satisfactory providing one's ambitions are confined to a limited band of wave-lengths, but the experimenter will find that changing the coils is a somewhat tedious undertaking.

Vernier Control.

The simple device outlined in the accompanying illustration has been designed with a view to improving matters in this direction. A number of reaction coils (wound as usual on grooved ebonite formers) are fitted with small 'phone terminals as shown, and the ends of the windings are connected to simple two-pin plugs which engage a pair of sockets mounted on the panel. A length of round brass rod, small enough in diameter to slide freely through the terminal, is bent at one end and hinged as shown to an upright support.

The other end is fitted with a small handle which may be easily drawn off the rod when it is desired to change a coil. Besides providing a most convenient means of changing the coils, the device permits very fine adjustments, since it is possible to first place the coil in any position on the rod and then again vary the degree of coupling by means of the swivelling movement.

DOUBLE TUNING WITH A CRYSTAL SET.

TO receive two stations both having different wave-lengths using only one crystal has been the writer's aim for several years. After many experiments the following results have been obtained with success. By the diagram it will be seen that the circuit is simple, in fact, common, the only difference being the values of LI and LII.

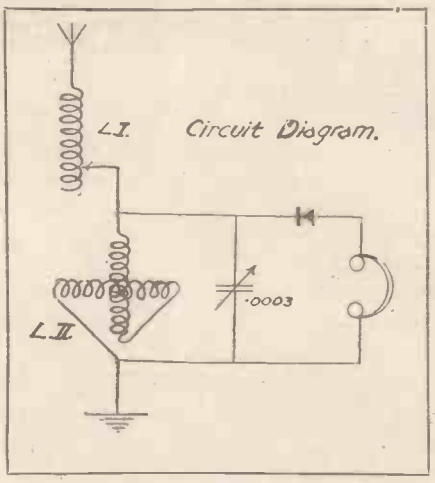
If we have a receiver made for the broadcast band of wave-lengths, and wish to receive, say, 5 X X, we add a loading-coil in the position occupied by LI which adds inductance to the circuit, thereby increasing the wave-length. In the case of double tuning, however, we have to reverse the positions of LI and LII, thus LI becomes smaller than LII.

Simultaneous Reception.

The following comprised the first test which was made with G N F, on 600 metres and 40 miles distant, and 5 X X, 1,600 metres, 35 miles distant. LI was tuned to approximately 600 metres, and LII to 1,600 metres. 5 X X came in well, and when LI was increased a trifle, G N F, etc., came in at usual strength, with 5 X X jamming at full strength. 2 L O and G N F were then tried, and on increasing the 2 L O tuner LI, the same results were obtained, G N F jamming 2 L O; 2 L O and 5 X X were then tried while 5 X X was silent. LI to 2 L O and LII to 5 X X was the order of tuning.

2 L O was heard at usual strength at 7 p.m.; when 5 X X commenced with 2 L O's programme all was well, but not up to the expectations of the writer, who was working for 2 L O's usual volume, coupled with 5 X X's. No extra volume was noticeable, as might have been expected. Anyhow, the experiments have not yet finished, and should any reader try this circuit and obtain the desired result, the writer will be pleased to know the details.

It is needless to add, perhaps, that the balancing of the two circuits calls for



extreme care. The final tuning is done by the condenser. LII should be a trifle smaller than is used in an ordinary circuit.

Those who try this method of double tuning will find scope for a great many very interesting experiments and will no doubt introduce improvements into the circuit. Whether that extra volume for which the original set was designed can be obtained is a doubtful point, though the writer may be on the wrong track altogether and may be missing some very important point both in theory and practice which have prevented him from achieving his object.

WIRELESS IN A COAL MINE.

(*Continued from page* 841.)

ft. apart. Likewise the input terminals of the receiver are connected to earth separately.

The current from the transmitter, which has been greatly stepped up by means of a transformer, flows from one earth terminal down its earth lead, and through the earth to the second terminal. But the current flowing between these two points does not confine itself to the straight line connecting the two terminals. It spreads out in the shape of a sphere, and in this manner reaches the two input terminals of the receiver through its (the receiver's) earth connection.

But there are too many governing factors in this form of signalling. Very wet ground will more or less "short" the two earth connections of the transmitter and thus greatly reduce the range. Ground containing a great deal of metal ore will act similarly. Again, very dry ground will offer so much resistance to the output current as to make it ineffective. It would appear then that the ground through which the signals are to be transmitted by the T.P.S. method must be only just damp. A river or a brook in the neighbourhood of the mine would make this method almost impracticable. The chief drawback of such a system is that it can only be used for the transmission of code, and speech cannot be sent in this manner.

Telephony Tests.

On a series of recent tests a 10-watt telephony transmitter was mounted upon an electric locomotive. The receiver on the surface consisted of a three-valve receiver set and two stages of L.F. amplification.

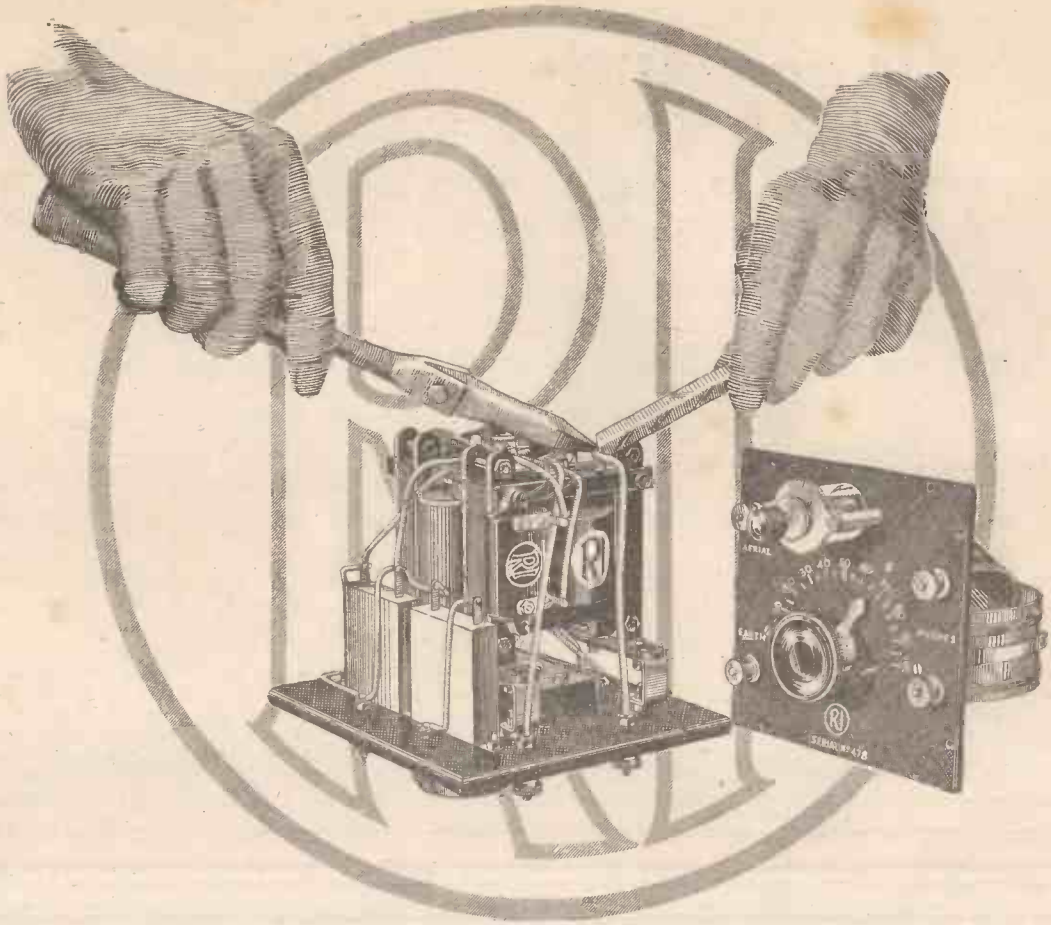
There was no difficulty in picking up the signals from the underground transmitter as long as the receiving aerial was placed in the immediate vicinity of any electrical conductor such as cables, truck lines, etc., which extended into the mine. A short break in either of these did not greatly affect the results.

The range appeared to depend entirely on the type of conductors present, and while the range was only a few hundred feet where no conductors were nearby, it would be increased to several thousand feet when operating in the vicinity of any such conductor.

In practically every case where a frame aerial receiver is placed at a sufficient distance underground to be shielded, it was found that the frame aerial near metallic "carriers" receives best when pointed in a certain direction irrespective of the direction of the transmitting station on the surface.

It appears then that the transmission of radio waves from a deep mine depends too much on the nearby conductors available to make it really practicable, although when these are available and well situated, very excellent results are obtainable.

However, such experiments as the above have provided much very interesting information, and in fact the use of wireless for life-saving will no doubt supersede the present-time telephone, which, as I have mentioned, is very likely to be cut off when any disaster occurs.



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I shall be fitting two into my wireless set at a later date.

Yours faithfully,
(Sgd.) Harry V. McCalla,
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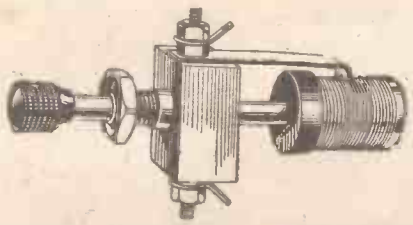

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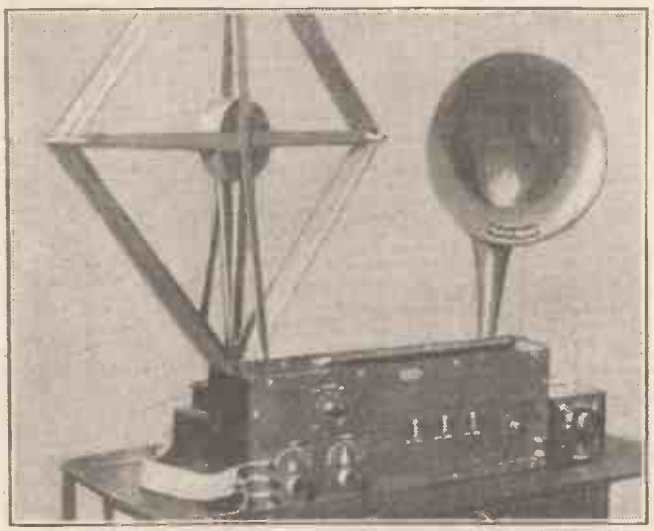
WAVES AND STRAYS.

By HIGHAM BURLAC.

THE INCREDIBLE CONFESSION.

INDULGENT reader—for such, indeed, you must be to interrupt your ebonite boring in order to listen to Higham—accept a slight family sketch, a simple domestic vignette.

I have a dog, a confirmed chaser of chickens. I have a small son with warlike instincts, and a longish daughter who studies net-ball and toadstools at one of these new-fangled schools where, it seems to me, they teach a girl how to be an "old fruit" or a "dear old bean," and to say "Hallo-eee." but neglect to instil a proper respect for daddy and a knowledge of thermionic valves and Shakespeare. I possess a vote and a plumber's bill and a dress suit that saw life red and purple in the early nineteen hundreds. I have a half-share in a collection of cigarette pictures, and a loganberry bush which has never loganned. But I have no wireless set.



A super-sonic seven-valve set. Signals have been received at 3,000 miles on the 2ft. frame aerial.

Higham Listens In.

What do I say? Yes, I have no wireless set. Why should I have one? I am no advocate of the "busman's holiday." My existence passes amidst the things for which the "home constructor" pines. These pretty grid leaks, these cunning condensers and cute coils and these telephones—all these are the stern facts of my career; with them I purchase the baby's frock and butter my bread. I will not have them about my place, a constant reminder that I am a wage-slave. Give me Mah Jongg or a History of the Frozen Meat Trade or chemical experiments, anything but——

They let me run on like this till I am tired, and then they begin to coax. I am not amenable to coaxing. I have a strong, Cromwellian character. The gipsy at Epsom said so—for a shilling. I believe it would have been Napoleonic for eighteenpence.

Thalia—that's my longish daughter (see above)—heard about somebody's brother's triumphs with a wireless set, and came home on fire.

"I wish we could listen-in, daddy," she began, poking me winningly three inches below the cardcase.

"I listen, you listen, we all list. Hark at the Brown's parrot swearing. I wish we were detached."

"Don't be silly. I mean listen to the wireless. We *ought* to. You know all about it."

"That is a fair estimate," I replied; "but it sounds suspiciously like cupboard love. Christmas is *miles* away yet."

"Just a *teeny* set, daddy. Bertha Benger says it's *lovely*."

"Bertha's judgment, my child, is immature. Besides, what about home-work?

You know you told mummy you *dish-prove* of homework. I heard you."

"Oh, you did! Well, you've wireless ears, at any rate. But where could you put the thing?"

"Mummy's cleared a place."

(T-r-raitor).

"Oh! Hum! Has she? Well, go and listen, my infant. Where is the set coming from?"

"Oh—*tha-at!* Oh, I've got it downstairs. I want you to put up the aerial."

"What's this? Telephones, eh? Do I put 'em on like this? Oh, be careful, I'm thin on top. What a nasty noise. Oh, here he is. What's that? Who is this chap with the style in his voice? Ha! Did you hear *L'apres midi d'une faun?* Swanker! Learnt that from 'Hugo's Weekly' I guess."

"Dad*dee!* That's Uncle Agrippa. He's a perfect bean!"

"I've no shadow of a doubt but that he's full of beans. Young to be an uncle. What?"

"Dad-*dee!* They're all uncles, except the aunties. That's what they *call* them."

"Oh! The aunties are not uncles, eh? Well, that's something. But what has uncling to do with wireless?"

"Do listen. Here's a talk."

"Why?"

"I don't know. Listen. O-o-oh! 'Chinese Cubism of the Ming Dynasty'!"

"Galloping goats! Is *this* listening?"

An Eventful Evening.

(Later). "Daddy, here's 'Polyphemus Speaks.'"

"Is he an uncle? Why does he speak?"

"He's lovely! All about life and art and things."

"What's he saying? 'Through my casement shines the gilded planet of love.' Why does he lug casements about? Is he paid for that? If anyone gilded that planet I guess it was the 'Mail.'"

"Dad-*dee!* You are *au*-ful." (Later) "Ping—ping—ping," etc.

"Good heavens! What's this? I was just sizing up Unky Poly—what's-his-name——"

"That's the time signal."

"Why does it have to compete with Unky? He hasn't finished about his casement yet. Ah, what did he say? 'Band of His Majesty's Royal Bundoons will now play *March of the Tin Hats!* This is a sudden transition!"

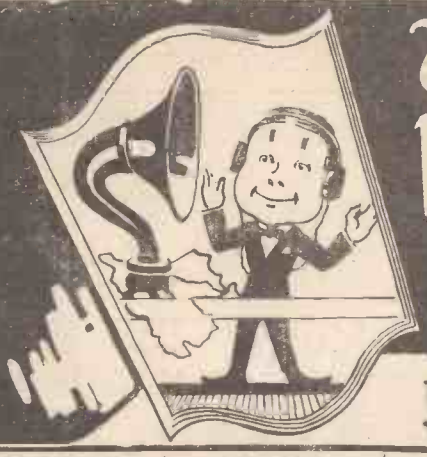
"It's lovely! We get it every week."

"The deuce you do! I saw such a dinky bike at Layard's to-day. Interested?"

"*Dad-dee-ee!*

And that was *that*. I have no wireless set, as I mentioned before.

The first concert given in the studio of the Stoke-on-Trent station



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„ New Junior de Luxe, wooden horn	3	5	0
Brandes Table Talker	2	2	0
T.M.C. Copper Baby	2	17	6
B.T.H. C2	5	0	0
„ C3 (gramophone attachment)	2	2	0
„ C1	2	10	0
Fellows	4	10	0
Brown Baby	2	10	0
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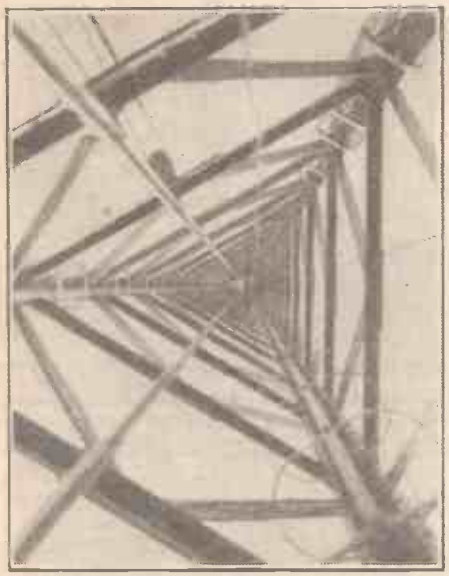
Mainly About Broadcasting

by The Editor

ONE of the best-known French amateurs is Monsieur Menars, who has been doing some very excellent short-wave reception work. M. Menars, writing in connection with his experiments, makes the following observations, which may be of interest to readers:

"It is well known," he says, "that wave-lengths between 100 and 500 metres travel very poorly during the day. At a certain distance from the transmitting station it becomes impossible to receive such wave-lengths at all during the day, especially in the summer-time. Observations have shown that during July it is impossible to receive certain broadcasting stations before 10 p.m., while in December the same broadcasting station can be clearly heard after 3 p.m.



Looking up one of the masts at the Rugby station.

"Entirely different results obtain for wave-lengths between 40 and 80 metres. The earliest experiments in January, 1924, proved that these wave-lengths were perfectly able to cross distances quite as great during the day as during the night, and it was recently noticed that audibility was greater during the day on these wave-lengths.

A Contradiction.

"Experiments carried out in common with Monsieur Deloy, of Nice, have confirmed these facts. Communication was never possible during the evening, while the first attempt made at 1.30 p.m. was received on a loud speaker. The trials of military radio-telegraphy signals led to the same conclusions. It would be interesting to know if geographical conditions have anything to do with the varying results obtained. It is necessary to repeat our experiments on a much greater scale in which the collectivity of amateurs must take part, in order to ascertain the continuity of facts that have been only partly demonstrated."

M. Menars, who lives at Le Blancat, Gan, near Pau, recently received signals from Australia in daylight hours—to be precise, on November 19th. The station 2 C M was received on his set quite clearly at a time when the whole distance traversed by the messages was lit by the sun. This was in striking contradiction to his previous experiments in communicating with the Antipodes—the wave-length was 71 metres. 2 C M is situated in Sydney, and is operated by one of the best-known amateurs in Australia—Mr. MacLurchan. M. Menars is the first amateur to receive daylight signals from Australia. He was using a three-valve set, home-made, and with a circuit which, he says, has not yet been made public.

K D K A Relayed.

At the time of going to press the B.B.C. have made their most successful experiment of relaying K D K A. On Saturday, November 22nd, K D K A, the Pittsburg station of Pennsylvania, was relayed for 40 minutes. K D K A was picked up in a South London suburb about ten miles from the city, was then passed on to 2 L O, and thence to listeners in this country. Amateurs probably noticed that atmospherics were very bad at first, but the B.B.C. engineers, by very careful adjustments, got rid of a good deal of these parasitic noises, and K D K A could be heard quite well. But, as Captain Eckersley pointed out at the close of the transmission, although the experiments make a great advance in relaying, they do not, as yet, foreshadow the regular relaying of America. But when one compares these transmissions with those of last year's, amateurs will agree that there is an all-round improvement, which augurs well for the future of relay work.

Monday, November 24th, also proved a good evening for long-distance work. I heard W B Z very clearly.

The principal stations on the American side, which participated in the tests, may be noted from the following table:

Call Sign.	Station.	Wave-Length
WMAQ	Daily News, Chicago	448
WEBH	Edgewater Beach Hotel, Chicago	370
WOR	Bamberrge Co., Newark, N.J.	405
WFAA	Dallas News, Texas	476
WGY	General Electric Co., Schenectady	380
WCBD	W. G. Voliva, Zion, Ill.	345
KDKA	Westinghouse Co., Pittsburg	326
WGR	Federal Tel. Mfg. Corp., Buffalo	319
WHAS	Times, Louisville	400
WEEI	Edison Electric Co., Boston	303
WBZ	Westinghouse Co., Springfield	337
WLS	Sears Roebuck Co., Chicago	345
KFNF	H. Field Steel Co., Shenandoah	266
CKAC	La Presse, Montreal	425

Mr. E. J. Simmonds, of Gerrard's Cross, has again been in communication with a very distant station—that of the Australian amateur, MacLurchan. On the evening of November 24th Mr. Simmonds received the following message:

"To His Majesty the King. Greetings from Australian radio experimenters.—Signed: MacLurchan, President, Wireless Institute, Australia."

Mr. Simmonds stated that half an hour earlier he was in two-way communication with the Australian amateur station, 2 D S.

If any "P.W." reader has heard this station I should be obliged if he would at once get into touch with me—if possible by telegram or telephone.

The "P.W." 4-valve set at the Nottingham Wireless Exhibition.

Artistes of the Aether

By "Ariel"

Some of the artistes who have given you pleasure when listening-in.

THOUGH rather late in the day to talk about the Lord Mayor's Show, there is one point that will make it a memorable one, because many of us were enabled to "hear" it at the time of its passing, and see it some few hours later.

Mr. R. E. Jeffrey.

Wireless and the presence of the microphone in Northumberland Avenue gave us the surge of the crowd, the music, the cheering, and all the excitement which these sounds create, plus the "remarks" of those two inimitable artistes, "John Henry" and Helena Millais. Later, on the screen, came the actual pictures. I suppose but a few years now and the two processes will be made simultaneous.

For the Shakespeare night recently a capital choice of composers was found in Coleridge-Taylor, Mendelssohn, Edward German, and Sullivan, while the fact that John Coates and Winifred Fisher were due to sing the Shakespearean songs made headphones impossible to beg, borrow, or steal. "The Taming of the Shrew" really makes the best of his plays for broadcasting purposes, and an ideal cast was engaged in Miss Joy Chatwynd, Mr. Tarver Panna, Mr. George Baxter, and Mr. R. E. Jeffrey, the B.B.C.'s dramatic director.

Dramatic Director at 2 L O.

Late dramatic director of Aberdeen station, Mr. Jeffrey is one of the most prominent figures in the Scottish entertainment world, for he has been to the front in this direction over sixteen years, particularly in Glasgow. Actor, author, producer, lecturer, there are very few branches of theatrical art that he does not know, and his two books, "Practical Public Speaking" and "Talks for Talkers," are the most useful guides possible.

Dr. Adrian Boult.

Coming to 2 L O, he was again a familiar personality, for in 1920 he leased the Aldwych Theatre and presented "Macbeth," with Mrs. "Pat" Campbell and J. K. Hackett. He also presented, with Mr. Gilbert Porteous and Ethel Irving, "La Tosca." and while with Miss Viola Tree for the production of "The Unknown" produced his own play, "The Dragon." With six other plays to his credit, one can understand that his knowledge and experience have been greatly valued by the B.B.C., first at the Glasgow station, then at Aberdeen, and now at 2 L O itself.

Famous Pianists.

On the instrumental side, 2 L O has had some famous pianists lately, chief amongst them Miss Irene Scharrer, the exponent of Chopin, Mr. Herbert Fryer, one of the best-known interpreters of Beethoven, and an equally famous classical player in Mr. Evlyn Howard-Jones. All three are givers of recitals at the classical concert-halls, and one of the most successful recently was that of Mr. Howard-Jones.

He made his début almost, as one might say, a child prodigy, and at the ripe age of thirteen was appointed deputy-organist at a well-known church. At fifteen he was chief organist, and won several scholarships at the Royal College of Music.

6 B M.

This station, noted for its artistic programmes, has found a capital medium under the baton of Captain Featherstone in "Music of All Nations." For the recent Scandinavian night two eminently characteristic works were found in the Norwegian rhapsodies of Lalo and Svendsen, while Grieg was, of course, represented by the pianoforte concerto in A minor, with Miss Juliette Folville as soloist. On the vocal side were Miss Doris Vane and Mr. Madoc Davies.

Miss Winifred Fairlie.

This station's "Armistice night" was another particularly well-arranged performance.

Broadcast Humour.

A clever little humorous entertainer who has visited Bournemouth, as well as other stations, is Miss Winifred Fairlie.

She is well known for her professional work apart from broadcasting, and amongst her touring engagements was that to precede the big play "The Lure." A most appropriate title this, for Miss Fairlie's work is quite clever enough to lure an audience, apart from the play. During wartime she was a member of Miss Lena Ashwell's concert parties in France, and entertained innumerable British troops in the camps.

Though 2 Z Y has been giving its listeners-in a taste of real high-brow music, with the aid of the Ethel Midgley Trio, it has obviously proved successful. The programme, however, was decidedly on the heavy side, with Brahms' "Trio" in C major, Arensky's in D minor, and the "Dumsky" Trio of Dvorak. Between ourselves, I am almost glad I wasn't within tuning distance that night.

Miss Gwen Godfrey.

Still, its programme two days later served to dispel the over-impressiveness of the week. The microphone was subjected to a number of experimental shocks that must have left it gasping for breath. Concertina solos, xylophone selections, while the 2 Z Y Mermaids' Club gave a performance of Judge Parry's play, "The Tallyman."

5 I T's Birthday.

5 I T celebrated its birthday with due rejoicings. An infant of two years old, it showed all the precocity of one of the earliest of the stations, and its programme was one that, indeed, one can say, "We can leave the rest to your imagination."

5 I T is to have another noteworthy vocal event shortly, in a visit from the clever singer, Gwen Godfrey.

She has been heard at 2 L O, as well as relayed from the Piccadilly Hotel, and her singing radios finely by reason of her clear enunciation.

An Interesting "Talk."

Another big classical event for Birmingham was the talk by the great British conductor, Dr. Adrian C. Boult.

At the present conductor of the Birmingham Symphony Orchestra, he has conducted most of the big London orchestras at Queen's Hall, and is one of the most noteworthy pioneers for spreading music from West to East, especially in London. His talk last week at Birmingham was on "Musical Appreciations."

Mr. Evlyn Howard-Jones.

As the relay stations depend on S B for most of their programmes, we cannot blame them if they are not always up to scratch. Their transmissions from a technical point of view, however, leave little to be desired

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Filament current.....0.12 amp.
Maximum plate voltage...120 volts
Plate resistance ..... 9,000 ohms.

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Filament voltage.....6 volts
Filament current.....0.06 amp.
Maximum plate voltage...120 volts
Plate resistance ..... 9,000 ohms.

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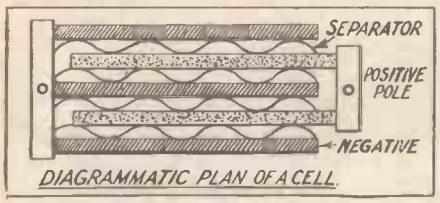
ABOUT ACCUMULATORS.

THEIR GOOD POINTS AND THEIR BAD.

By F. YOULE, B.Sc., A.C.G.I.

In this instructive and useful article the amateur will find many practical hints about the upkeep, care, etc., of accumulators, and by carefully noting the author's instructions owners of accumulators will be able to avoid many mistakes which would eventually result in battery troubles.

THE cost of running a valve set is largely determined by the expenditure on accumulator charging, which is the only item recurring frequently in ordinary use. The first cost of the cells is greater than that of practically any other component, and they require more care to give of their best. Nevertheless, they are generally the most neglected and abused part of



DIAGRAMMATIC PLAN OF A CELL.

the set, being regarded somewhat in the light of a necessary evil. A consideration of their peculiar advantages may, therefore, be introduced by a short study of the construction.

How Accumulators are Made.

Let us examine a new accumulator of the usual type. Each cell consists of two sets of plates, alternately interleaved and kept apart by wood, ebonite or celluloid grids. One set of plates is a medium brown. These are the positives, and are connected to the red painted terminal. The others are a pale grey, and are joined to the negative terminal, generally coloured black or blue.

Each plate consists of a grid of solid lead, filled in with a porous paste. The negative filling is pure spongy lead, and the positives are filled with lead peroxide, a coating of which also covers the exposed parts of the grid.

To store a maximum quantity of energy the largest possible surface of material has to be in contact with the acid, and by using grids filled with a porous material this object is attained. The positives are filled with a paste of red lead and sulphuric acid, and the negatives with a mixture of acid and lead oxide. They are then placed in sets in a sulphuric acid solution, and by passing a current through the cells thus obtained the plates are quite easily "formed," the positives becoming lead peroxide and the negatives turning into pure lead. They are then washed and dried and made up into cells of the required size.

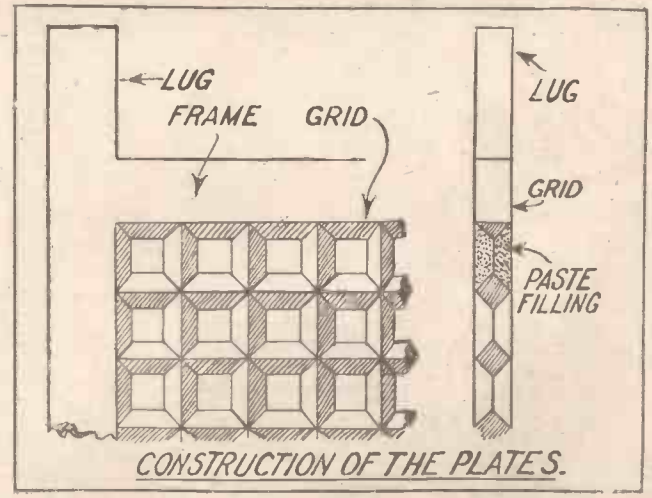
It will be noticed that both outer plates are negative. This is firstly because an unevenly loaded positive has a tendency to buckle if a heavy current is taken from the cell. Also, since the capacity depends on the amount of useful surface, and the positive plate is more costly than the negative, the waste of a negative surface is of less account, as the introduction of the extra plate raises the capacity. The use of five or more small plates entails the loss of much less surface than if two large ones were employed.

Size and Capacity.

As the liquid electrolyte is acid the container has to be made of some substance unaffected by it, celluloid being the most generally used for small cells. Glass, ebonite, specially treated wood, or a vulcanite compound are also used. A filling hole has to be left for each cell, and the cover or stopper is constructed so as to allow of the escape of gases, but to trap all liquid spray.

In the case of unspillable cells of fair size, the container is much heavier and the stopper screws in, as the stronger cell will stand the pressure of the accumulated gas. The acid in small portable batteries is often kept in by filling the cell with glass wool, which absorbs it without interfering with the action.

Terminals are generally made of brass, sometimes covered with insulation. They are sealed where they emerge from the container by a rubber washer or sleeve. As brass is attacked by the acid, they should be cleaned periodically and thinly smeared with vaseline, which is a protection. Larger batteries often have lead terminals, or lugs, which do not need this attention, but are clumsier.



CONSTRUCTION OF THE PLATES.

An accumulator will store energy in large quantities. A pound of steel made into a spring will store, if wound up, only one hundredth of the energy which a pound of accumulator material will absorb. To get back from compressed air this same quantity of energy five times the amount has to be used in the compression, while the modern battery has an efficiency of 75 per cent.

It will take energy from a dynamo when the load is small, store it, and give it back when a heavy load comes on, so that a smaller machine may be used, saving expense. It will give light, heat, or power in the cleanest form. It can be large enough to supply a town with light and power, or small enough to fit in a pocket lamp. Last, but not least, it is not expensive if properly treated.

The proper treatment should commence before it is purchased. This somewhat paradoxical statement is justified by the many who buy a battery before they know what load it is likely to have. The first thing to do is always to determine how many valves and of what type are likely to be used, making allowance for possible additions. Then the total current consumption is calculated, and the result multiplied by twelve. This gives the minimum capacity of the battery required, in ampere hours.

The Happy Medium.

Thus, if four R valves taking 0·6 amp. each are used, the total current will be 2·4 amps. The battery must have a capacity of at least 29 amp. hours. This will work the set for two hours a day for six days. Generally it is inconvenient to have such frequent charging, so that this value may be doubled or trebled, but it must not be reduced.

To keep a battery in perfect condition it should be charged at least once a month, so that if the capacity is so great that it will last longer one is disinclined to pay for the seemingly unnecessary charge, resulting in a bad effect on its life. There is, therefore, a happy medium to be struck, and a useful size from all points of view is that which will give about 40 hours' running per charge, which generally means re-charging every three weeks or so. Where four or five valves are used the battery becomes unwieldy if this rule is observed, so a 40 amp. hour accumulator might be adopted, and charged weekly.

It will be as well to note that there are two capacities given for every accumulator.

(*Continued on page* 856.)

ABOUT ACCUMULATORS.

(*Continued from page* 855.)

The "actual" capacity is that which the cells will give under a continuous load such as filament heating, provided the maximum given discharge rate, generally about one-twelfth of the capacity, is not exceeded. The "ignition" capacity is given as double the actual, and only applies to cases where very small intermittent loads are put on, as with bells or petrol engine ignition. A rating should always be stipulated as actual or ignition when ordering, as required.

Testing Voltage.

A small voltmeter, costing about 6s. is very useful for keeping an eye on the condition of the battery. The voltage of a freshly charged cell should be about 2·2 volts or over. This will probably drop to 2·0 volts on load. The voltage on load, that is, when the valves are alight, will drop as the cell runs down, and by measuring the value directly across the battery terminals whilst the set is working a reliable indication of its condition is obtained. When the voltage has dropped to 1·8 v. per cell on load, the battery needs charging. Do not leave it until the voltage is 1·8 with no load, as is so often taken to be the correct procedure.

It is advisable to test any small voltmeter against a good standard one, and take note of any necessary corrections. A large error is often found. For the first four or five charges do not let the battery run more than three-quarters down.

An accurate method of determining the state of the cell is by means of a hydrometer. There are two types of this instrument, both depending on the same principle. A glass tube is drawn out to a fine nozzle at one end, and is fitted with a rubber bulb at the other. Inside the tube there is, in the first case, a small thermometer-shaped glass float, graduated from about 1·17 to 1·26. To take a reading, the cell filler cap is removed and the nozzle placed in the acid. The bulb is pressed and released slowly, drawing acid into the tube until the float rises.

Using a Hydrometer.

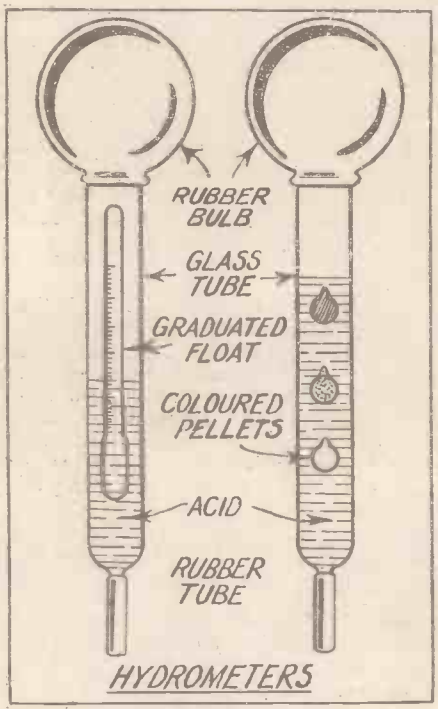
Making sure that it is floating freely, the level of the acid is read off on the stem. The acid is then carefully returned to the cell. The reading for a fully charged cell should be given on the instructions attached to it. Makers differ in the specific gravities recommended, but 1·23 to 1·25 are general. The value is, of course, settled by the strength of acid put in. When the cell shows a reading below 1·19 it should be re-charged.

The second type of hydrometer consists of the same tube and bulb, but instead of the "thermometer" there are three small glass pellets, generally coloured yellow, blue, and red. When the acid is drawn into the tube one or more of these will rise. If all rise the cell is well up. When the red stays down the cell is half discharged. If only the yellow rises the cell is three parts down, and if all stay down the cell needs charging. This is a more simpler type of instrument, and one maker embodies the idea in the cell itself.

When testing a six-volt battery, all three cells should be tried. The first two may be passable when the third is down, and failure to discover this may result in some harm.

A Dangerous Symptom.

As regards the care of the cell, the acid strength is very important. Losses due to spilling are made up with fresh acid of the correct specific gravity. Evaporation and loss due to the escape of gas when charging are made up with distilled water. The latter is the most general case. It has been explained how lead sulphate is formed on the plates during discharge. This is very finely divided and remains soluble, so that it can be acted on by the acid when re-charging. If, however, the cell is run down to the extent where the sulphate coagulates, it becomes insoluble, and at each subsequent discharge the trouble spreads, the cell eventually being ruined, as it is impossible to re-charge.



HYDROMETERS

Careful Handling Essential.

This is why a battery should never be allowed to drop below the limit given. If by any chance a trace of the white deposit is noticed it should be taken to a competent man at once, as careful treatment in the early stages will probably effect a cure.

Beware of the man who does not give the battery a full charge every time. A few partial charges followed by discharge lead to trouble. If your cells do not give their rated capacity try someone else. That will show if the battery is at fault. A cell returned clean, with terminals scraped and greased, is a good sign that the job is well done.

In conclusion, one might mention the "block" type of cell, in which the plates are replaced by triangular section blocks. They are rather more robust than the usual type, and will stand heavy discharge for short periods, but have the disadvantage of being more bulky. The principles of action and care are identical with those of the plate type.

A VERNIER COIL HOLDER.

THE coil holder about to be described is intended for basket coils having a two-plug mounting rather larger than the more usual plug and socket mounting. In any case, the mounts may be easily changed, only the dimensions will be smaller.

The coil holder consists of two pieces of wood $2\frac{1}{4} \times 2 \times \frac{5}{8}$ in., the insulation being made by a piece of $\frac{3}{16}$ in. ebonite $2 \times \frac{5}{8}$ in., with two valve legs $1\frac{1}{4}$ in. apart.

Two holes are drilled through a "Meccano" contrate wheel, and a $\frac{1}{4}$ in. hole countersunk into the body of the moving coil holder in the centre.

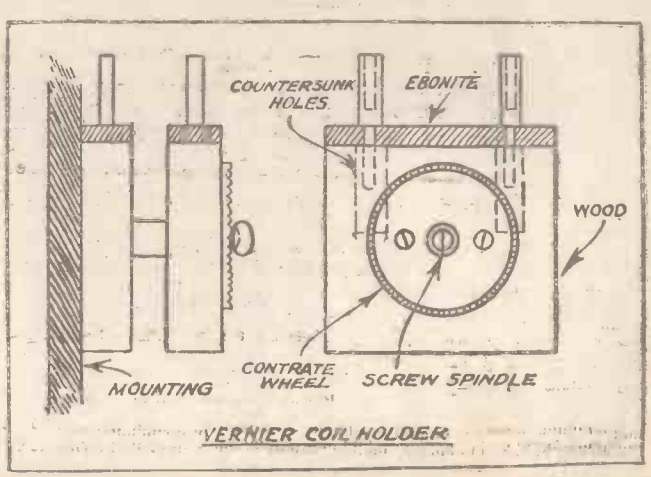
A long brass cheese-head screw passed through a spring washer, the gear wheel, the holder, a distance piece, and into the fixed holder. By means of the spring washer the tension is regulated.

The fixed coil holder, which carried the moving holder, may be mounted on some kind of base, but in my own case it is mounted directly in the lid of the cabinet containing the set.

An Adjusting Pinion.

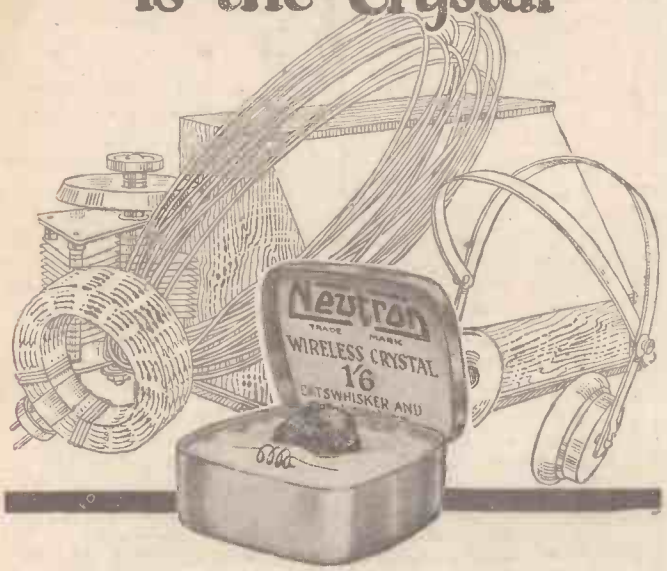
Fine control is obtained by a $\frac{1}{2}$-in. "Meccano" pinion engaging with the contrate wheel, and a pulley or knob with set screw.

This pinion can, of course, be mounted either horizontally or vertically.



VERNIER COIL HOLDER

The most important item in your outfit is the Crystal



Upon the choice of a really good crystal depends your success in clear, loud and faithful reception.

A good aerial, heavy-gauge, efficiently-wound coils, minimum self-capacity, good phones, all these *count*, but the most important of all is your Crystal . . . There are many efficient Crystals; but you may try *twenty* before you find a *good* one—unless you ask for NEUTRON, in the black-and-yellow tin. *If you take this precaution*, you will undoubtedly secure a crystal that will give you full efficiency first time, requiring no "searching" for sensitive spots, and giving you continued joy-in-listening.

"The Best Crystal Obtainable."

"T. C." of Radcliffe, Lancs., writes: "I am writing to say that without doubt NEUTRON is the best Crystal obtainable. . . . I have no difficulty in tuning in Liverpool relay, about 40 miles away. This is on a home-made Crystal set, single slider, in a cigar box . . . I have tried the following, and none are equal to Neutron." (Here follow names of seven different crystals.)

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Ask your Dealer for Diagram, given free on request to purchasers of NEUTRON, of the circuit used by "5 B T" in receiving Brussels from Chiswick on a NEUTRON.

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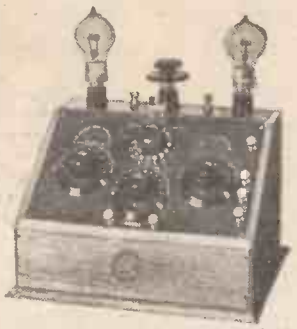

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A Customer writes from Elgin, 19/9/24. "*I have tested the Set and brought in most of the B.B.C. Stations with wonderful strength.*" Hundreds of such testimonials have been received.

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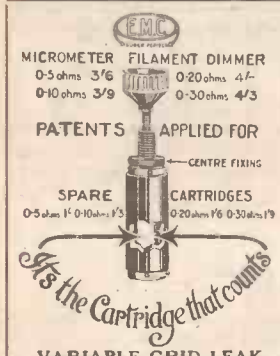

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·2-5 meg. 3/6 5-10 meg. 4/-

Variable Anode Resistance
25/50,000 50/100,000 70/140,000 ohms, 3/6 ohms, 4/- ohms, 4/6

LOOK! YOU MUST HAVE THESE IF YOU WANT to get the best from your set.

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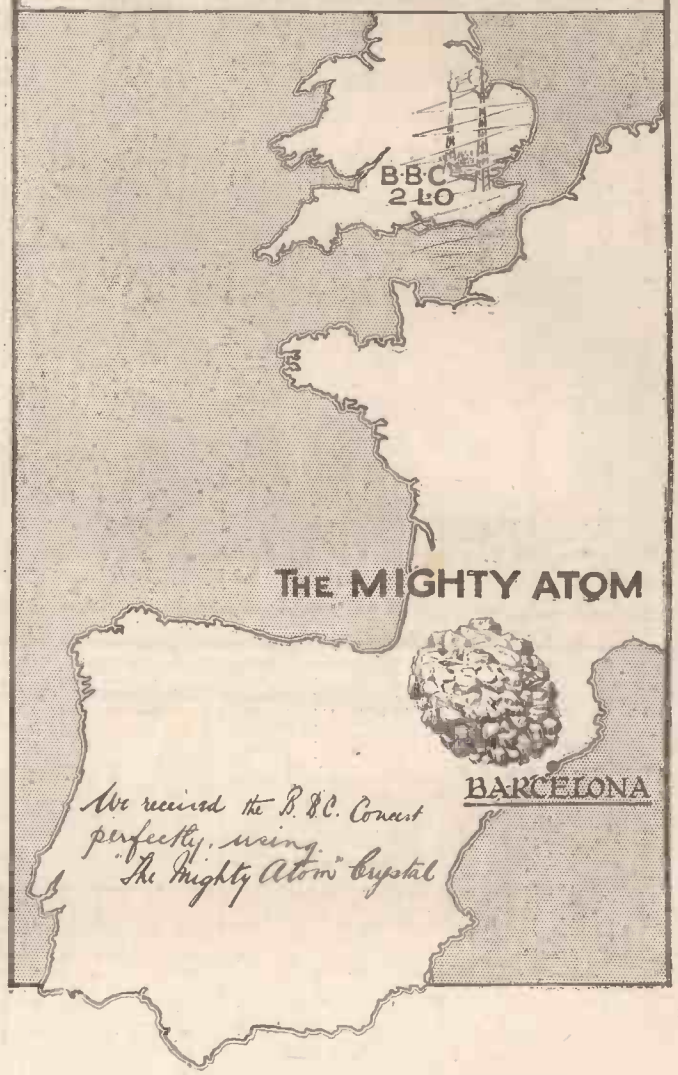
A Triumph of Science



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Equal units of ·00025 or ·0003 9/6
Complete with Knob and Dial.

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Standard	Super	Micro-denser
·001	8/6	9/6 – 11/6
·00075	8/–	9/– – 11/–
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·0003	5/9	6/9 – 8/9
·00025	5/9	6/9 – 8/9
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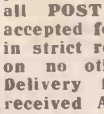

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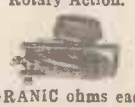

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No. 1	2 for 2/-
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Coils: 25, 5/–; 35, 5/–; 50, 5/2; 75, 5/6; 100, 7/–; 150, 7/10; 200, 8/8; 250, 9/–; 300, 9/5; 400, 10/3; 500, 10/6
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(New Model)
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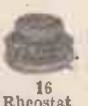
No. 4.	900-2000 ..	4/6
No. 5.	1600-3000	4/9
No. 6.	2200-5000	4/11

14 Voltmeter, 4/6

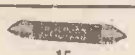
21 C and S, one-hole fixing, 1/3



16 Rheostat, with Dial, extra value, 2/6

44 Bretwood Valve-holder, 1/9

D.P.D.T., 1/5
S.P.D.T., 1/2



15 Grid Leak, 1/-, 1/3 2/6

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Var. Grid Leak .. 2/6
Anode Resistance 3/6

51 Enclosed Detector Micrometer Adjustment, 1/9 By post 2/3.

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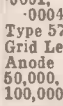

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PARTS FOR 2-VALVE "UNIDYNE" RECEIVING SET

The 4-electrode valve, Thorpe K4 each	17/6
6 Terminals for	10d.
2 Microstat Filament Resistances each	2/9
1 Variable Grid Leak	2/6
1 Single-Pole Double-Throw Switch	1/3
1 ·0005 Variable Condenser, with Vernier	7/3
1 Cam Vernier 2-way Coil Holder	9/-
Panel 5½ in. x 1½ in, drilled to hold two 5-pin valve holders for	2/-
2 5-pin Valve Holders each	1/6
1 Fixed Condenser, ·001 1/2, 2/2, 3/-	
1 Fixed Condenser, ·0002 1/2, 2/2, 3/-	
1 Shrouded L.F. Transformer, 10—1	20/-
8 yds. No. 18 Gauge Tinned Copper Wire	1/2

Necessary Screws, Nuts, and Washers Free if above lot purchased, and Post Free.

FERRANTI L.F.
BETTER THAN THE BEST
17/6

Try our **10/11** light as a Feather Phone, 4000 ohms.

L.F. TRANSFORMERS

Eureka Concert Grand	£1 10/-
No. 2. (Second Stage)	£1 2/6
Igranic, 5-1 Ratio	21/-
The Ferranti, 4-1	17/6
The Silverton, 5-1	21/-
The G.R.C. 5-1	15/-
The G.R.C. 10-1	20/-
Marconi Ideal Power	35/-
Burndept L.F. 5-1 Ratio	25/-
Lissen T. 1 L.F.	30/-
„ T. 2 L.F.	25/-
„ T. 3 L.F.	16/6

LOUD SPEAKERS
BABY MODELS

Sterling, 4000 ohms	£2 15/-
Sterling Dinkie	1 10/-
Brown's 2000 ohms	2 8/-
Amplion Junior	1 7/6
Dragon Fly	25/-
Ultra	27/6

TOOLS

Set of Spanners	1/8
Taps, 0, 2, 4, 6 B.A. set	2/-
Small Soldering Irons	1/-
7 Twist Drills	1/11

SHIPTON

STRIP RHEOSTAT, 7 ohm (with fuse),	3/-
30 ohm,	3/-
60 ohm,	3/-
POTENTIOMETER, 600 ohm,	4/6

DUBILIER TYPE FIXED CONDENSERS.

The cases are a moulded composition of extremely high insulation quality, and are non-hygroscopic; ·002 Ruby mica only is used for dielectric, and the conductive surfaces are cut from the best copper sheet.

·001 to ·0005.. each	1/-
·002 to ·006 .. each	1/3

Post Free.

RAYMOND PLUG IN COILS.

25 ..	3/9	150 ..	6/-
35 ..	3/9	200 ..	7/-
50 ..	3/9	250 ..	7/6
75 ..	4/-	300 ..	8/-
100 ..	5/6	400 ..	9/6

Set of 4 for B.B.C. wave lengths .. 14/11

FOR NEUTRODYNE CIRCUITS.

"Colvern" Ind. Vernier. The low maximum of any vernier is adversely affected by capacity effects and any vernier which is employed to give fine tuning MUST NOT be in association with the main tuning condenser.
PRICE 2/6. .. Post 3d.

MYERS VALVES

UNIVERSAL. **12/6** D.E. **21/-**

"RAYMOND" FIXED CONDENSERS.

Ebonite Base, Terminal Fittings. Post Free.

·001, ·0001 to ·0005,	1/2
·002 to ·004	1/3
·006	1/6
·01 and ·02	1/9
·05	3/3

MANSBRIDGE TYPE CONDENSERS:

Best quality obtainable. Accurate, permanent, noiseless, unaffected by atmosphere, beautifully cased, double insulators, two extra fixing lugs, made entirely of finest materials, pass all tests, guaranteed.

1 mfd. 3/6
2 mfd. 3/11
Post 3d. each.

NEWEY SNAP TERMINALS.

Complete Set.. .. 2/6

DIAMOND WEAVE BASKET COILS (5) EXTRA AIR SPACE (DUPLEX WAXLESS)

Equal to Honeycomb. 25, 35, 75, 100 (wavelengths marked). Set of 5, **3/9**

"POLAR" MICROMETER CONDENSER. 5/6

West End Stockist—Polar, Edison Bell, Ferranti, Silvertown, Dubilier, Lissen, Energo, Unidyne, Eureka, G.R.C., Sterling parts, etc.

Tape Aerial, 100 ft.	3/-
Sausage Aerial ..	2/6
Bus Bar, ¼ square, 15 feet	1/-
Bus Bar, 18 square, 15 feet	10d.
16 D.C.C. Wire per lb.	3/-
100 ft. 7/22 and 6 Insulators	3/6

PARTS FOR 7 CIRCUIT CRYSTAL SET (Percy Harris).

·0003 Sq. Law Condenser, Panel, 10 x 8, Burndept Detector, Terminals, Clix, Cardboard Tube, 3 x 7 in., 16 D.C.C., and square tinned, Radio Press Transfers. 22/6 the Lot. Post free.

CHELMSFORD 5XX.
Post Price.

D.C.C. Coil	1/3
With adapter ..	2/3
D.C.C. Extra Air Space	2/11

PARTS FOR ST. 100
(Less Box & Ebonite)
Absolutely Inclusive
£6 6s. 0d. to £10.

N and K
No. 3
17/6 LATEST MODEL **17/6**

New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size earpieces and leather headbands of standard "N & K" comfortable design. Technically, "N & K" Headphones represent the last word in Wireless Reception.
IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.

Lead-in tubes: 6d., 7d., 8d.	
Valve Pins and Nuts 2 a 1d.	
Stop Pins and Nuts 2 a 1d.	
Nickel Terminals	2d.
Nickel Contact Studs 2 for	1½d.
Nickel Switch Arm (one-hole fixing)	1/-
Loading Coil and plug	8d.
Gamages Permanite	1/-
Condenser Brushes	6d.

2-meg. Leaks ..	10d.
Cheap Fixed.. ..	6d.

RAYMOND FIXED CONDENSERS.

·001, ·0001 to ·0005	10d.
·002, ·003, ·004 ..	1/-
·006, 1/3 ; ·01 1/9 ; ·02	1/9
D.C.C. Wire, per ¼lb.—	
13 g. .. 9d. 20 g...	9d.
22 g. .. 10d. 24 g...	1/-
26 g. .. 1/1 28 g...	1/3
30 g. .. 1/6 Etc.,	etc.

Terminals complete—	
Brass Pillar ..	1d. 1½d.
W.O. or 'Phone	1d. 1½d.
Fancy Patterns	1d. 1½d.
Extra large ..	2d. 3d.
Valve Sockets 2 for	1½d.
Machine cut Screws. Stocked (Best).	
Pulleys	4½d.
4 Taps and Wrench	2/11
Screwdrivers ..	6d.

LARGE NUMBER OF BARGAINS TO CALLERS ONLY

ACCUMULATORS

2 v. 40 amps. ..	9/6
4 v. 40 amps. ..	16/6
4 v. 60 amps. ..	18/6
4 v. 80 amps. ..	23/6
6 v. 60 amps. ..	27/6
6 v. 80 amps. ..	33/-
6 v. 105 amps. ..	38/6

Hart's Stocked. All High Quality.

"DE LUXE" SUPER LOUD SPEAKER
2,000 ohms **24/-**
A "REAL" BARGAIN

Legless Valve Holder	1/-
Solid Rod Ditto. ..	1/-
Under Panel Ditto.	1/6
Ebonite Dials ..	8d., 1/-
Valve Templates	2d. 4d.
Electron Aerial ..	1/3½
Adhesive Tape Roll	2½d.
Copper Foil per foot	2½d.
1 in. Fibre Strip 3 ft.	2d.
Insulated Hooks 4 for	3d.
Ditto Staples	5 a 1d.

"ORMOND" L.F. 13/11
A Wonderful Transformer

DUTCH ·06 VALVES 12/6

16d D.C.C.
USUALLY IN STOCK

Twin Flex 4 yds.	6d.
Twin Silk Small 6 yds.	6d.
D.C.C. Bell Wire 10 yds.	5d.
Knobs, 2 B.A.	2d. 3d. 4d.
Small Knobs 6 B.A.	3d.
Small Knobs 4 B.A.	3d.
Wander Plugs pair	3d.
Egg Insulators each	1d.
Tape Aerial 100 ft.	2/-
Valve Windows 4d. to	9d.
Mica	2d.

BROWNIE "IMPROVED" WIRELESS SET - 7/6

RAYMOND CRYSTAL SETS
7/11 9/11 12/11

2 B.A. rod per ft.	2½d.
4 B.A. Rod per ft.	2d.
Basket Holders ..	8½d.
Also at 10d., 1/-, 1/3, 1/6	
2-way Coil Stands	1/11
3-way ditto ..	3/11
2-way with ex handles	2/11
3-way ditto	4/9
4·5 Batteries	4½d. 5d.
Brass Coil Former	2/11
Twist Drills	1/4

Neutron Crystal ..	1/6
Uralium	1/-
Midite	6d.
Enclosed Detectors	9d.
Large, Brass, on base	1/3
Ditto, Nickel, on base	1/6
MicMet Type	2/8
Variometers (special)	1/6
Ditto, with clips, etc.	2/3
Ebonite D.C.C. and Dial	3/9
Also at 3/11, 4/3, 4/6 up.	

PHILLIPS' ·04 TYPE VALVE 15/11
BUS-BAR
1/16 sq. - 15 feet **6d.**
18 sq. - 15 feet **5d.**

Microstat	2/6
Switch Arms 8d. to	1/-
Flex (Red and Black) per yd.	3d.
Shellac	5d.
Loading Coil and Plug	8d.
Contact Studs 4 for	1½d.
Nickel ditto 2 for	1½d.
Nickel Switch arm	1/-
Sorbo ear caps pair	1/4
Tumbler Switches	1/4

PHILLIPS 12/6
4 ELECTRODE VALVE FOR "UNIDYNE"

"METAL" (FRENCH) ·06 VALVES, 15/11

'Phone Cords 6 ft.	1/-, 1/3
Nugraving	
Empire Tape 2 yds.	1d.
Allen Var. Grid Leak	1/3
Best Sleeving 3 yds.	10d.
Rubber Lead-in 10 yds.	1/-
Thick ditto., 1d., 2d., & 3d.	
Aerial, 7/22 100 ft.	1/10½
Ditto, Extra Heavy 100 ft.	2/3
Anti Cap. Handles	8d.
Tumbler Switches	1/-

NOTE!
Our Wonderful Micrometer Adjustment Glass-enclosed Detector. Why pay more? Post 6d. each **1/9**

5 Waxless Coils 200/2000	1/5
5 equal 25 to 100 ..	1/11
5 ditto., Extra Air Space	2/8
6 waxed 200/3600	1/8
7 waxed 150/3600	1/11
Chelmsford D.C.C. 1/-, 1/3,	2/6

With adapter, 9d. extra.

Switch Arm 12 Studs, 12, Nuts, 12 Washers. Lot 10½d.

H.T. BATTERIES

66 N. & K.	7/11
60 v.	7/6
30 v.	4/6
60 B.B.C.	9/6
36 B.B.C.	5/6
9v. B.B.C.	2/6
1·5 (D.E.)	1/9
Ditto	2/- to 3 -

MANSBRIDGE TYPE FIXED CONDENSERS

1 MFD.	3/6
2 MFD.	3/11

D.P.D.T. SWITCHES.

Min Panel	1/-
On China Base ..	1/7½
On Ebonite Base	1/11 2/6

S.P.D.T. SWITCHES.

Miniature Panel ..	10½d.
On China Base ..	1/1
On Ebonite	1/3 to 1/9
Murray Valve Holder	1/3
Spring Washers 4 a	1d.
Coil Plug on Base	10d.

FIBRE STRIP (For Coils)
3 ft. long, 1 in. wide, 2d.

BREAST DRILLS 0 to ¼ chuck
Cut Bevel and Gear 4/9

De Luxe Crystal Set	7/11
4 Whiskers, 1 Gold	2d.
Coil Plugs (ebonite)	4½d.
Ditto .. .. 6d.	8d.
Shaped .. 8½d.	1/-
5 ohm Rheostat ..	1/3
Various 1/3, 1/6, 1/9,	1/11
With Dial	1/11
Ormond	1/9
'Phone Connector	1d.
Nuts 2, 4, 6 B.A. doz.	2d.
Washers ..12 a	1d.

BOXES

7 × 5	9 × 4	12 × 9
8 × 6	10 × 8	12 × 12

BUY RAYMOND GOODS

EBONITE STOCK SIZES 3/16 in.

6×6 ..	1/4
7×5 ..	1/4
8×6 ..	1/10
9×6 ..	2/-
10×8 ..	3/-
12×6 ..	3/-
12×9 ..	4/3
12×12	5/6
14×10	5/6

Cut to size WE STOCK ¼-in. ½d. sq. in. EBONITE.

RIGHT OPPOSITE DALY'S GALLERY DOOR

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

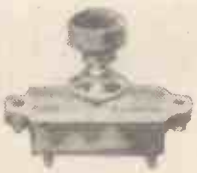
No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to the firm. Moneys sent must be registered

HOURS OF BUSINESS:
DAILY . 9 to 7.45
SUNDAY . 10 to 1

'Phone: GERRARD 4637.

The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

WE were very pleased when we were informed that that great firm "Metro-Vik" had joined the ever-swelling ranks of valve manufacturers, and with the Cosmos D.E.11 they have jumped off at a point where many fail to reach. It is, as its name would indicate, a dull-emitter valve, and it takes ·25 amps at 1·0 to 1·1 volts. It is an "all purpose" designed for either accumulator or dry battery work. With each valve very concise instructions are included in the carton in which, by the way, the valve is very carefully packed in a roll of cotton-wool.



An "Atlas" variable grid leak of original design — manufactured by Messrs. Clarke & Co., Manchester.

The instructions give full details of what filament resistance should be used in varying circumstances, and full details concerning the use and operation of the valve in various circuits are included.

For instance, we learn with interest that when used as a detector the grid leak should be connected to the POSITIVE side of the L.T., while when used as an amplifier separate grid bias to the value of approximately one-fifteenth of the anode voltage used should be employed.

The valve itself (we had two samples sent us) is a neat, well-made, and well-finished little article, with very closely spaced elements somewhat similar in appearance to an American "toob." In our opinion it is a distinct advance over many D.E.'s inasmuch as its bulb is as clear as glass can be. This is a great advantage, as the colour of the filament can be closely watched in order that the "dull red" which is specified is not exceeded.

We have tested them in several circuits, and results so far obtained have been very encouraging. We have not yet completed the exhaustive series of tests to which we invariably subject new valves, and so we shall reserve our full judgment until these have been concluded. After this we shall have something more to say about what appears to be one of the most interesting wireless innovations of the year.

* * *

Another new crystal! We believe it would almost make this page look as though there was something missing if we were unable to announce at least one new crystal per week. However, as long as such continue to uphold the average reputation of their numerous predecessors, we have no just cause to complain. Mr. H. de Koningh, of 14-15, D'Arblay Street, London, W.1, has sent us a sample of his new crystal, "Exolo," which is to be retailed at 1/1 post free. Enthusiastic "crystalists" cannot go far wrong if they give "Exolo" a trial, as we have found it to be very sensitive. In appearance it is strikingly similar to pure galena in its natural state, is as sensitive, but, in our opinion, more stable. Mr. de Koningh informs us that he is prepared to supply the trade in bulk.

A Climax "Sure Set" Crystal Detector which was reviewed in our last issue. The above is slightly larger than the full size of this neat little instrument.

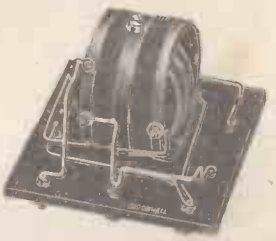
(*Continued on page* 864.)

An unusual Set
-at an *ordinary* price

The Woodhall Crystal Set, incorporating the special No. 3 Variometer, covers the entire B.B.C. wave-lengths—300 to 500 metres—without the use of a condenser. This means that capacity is at a minimum, and efficiency accordingly high.

Loading-Coil Socket—Plated Fittings—Bus-Bar Wiring.

Provision is made for a loading Coil (Chelmsford). All fittings are nickel-plated, and best quality matt ebonite is used. The detector has screw pattern cup and opal-backed dust cover to reduce eye-strain.



Particular attention is paid to the internal wiring, which is of square-section wire (all joints being soldered) in accordance with the best modern practice.

Sold by all Wireless Dealers, who can obtain supplies through their usual Factors **21/-**

Sole Distributors:
PRESSLAND ELECTRIC SUPPLIES, LTD., Hampton-on-Thames.

The Woodhall-Wireless Manfg. Co., Ltd.

For distance——

You need tension-wound Coils.

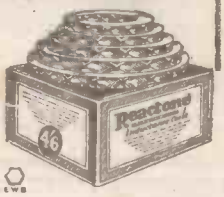
It is in the reception of the distant stations that the higher efficiency of Reactone Tension-Wound Inductances is most apparent—when every "five-O's-one" too much self-capacity tells, and when you need to pick out one narrow wave-band from a jargon of jamming.

It is then that the Sharp tuning of Reactone Coils counts—and the unique construction that gives, without shellac or wax, a highly efficient, rigid and uniform inductance.

. . . . . If you use a Valve Set, note how readily even No. 25 Reactone will oscillate.

Supplied in sets of 5 (Nos. 25, 35, 50, 75 and 100), and each set is boxed. Be sure to see the name "Reactone." 4/6. No. 150 (Chelmsford), price, 2/6.

Reactone
TENSION WOUND
Inductance Coils



Ask your Wireless Dealer. In case of difficulty send P.O. for 4/9 (or 2/9 for the Chelmsford), with your Dealer's name and address, to Sole Distributors for U.K. and Ireland.

V. ZEITLIN & SONS,
144, Theobald's Road, LONDON, W.C.1.
'Phones: Museum 3795, 6841.

Manufactured by Lewis Harforth & Co., London.

SECURITY
BEHIND BONTONES
SECURITY
TO THE DEALER
SECURITY
TO THE USER

BONTONE PHONES—Britain's best, backed by Generous Guarantee.

SENSITIVE, DURABLE, COMFORTABLE, & BEAUTIFULLY FINISHED.

Manufactured entirely by BRITISH LABOUR.

14/6 BONTONE ORIGINAL.

BONTONE LIGHTWEIGHT **15/6**

BONTONE PHONES ARE MANUFACTURED—UP to a high efficiency. DOWN to a low and popular price.

We agree to replace any phone, not giving complete satisfaction, if returned to us within seven days of purchase undamaged. We further agree to repair, adjust and re-test any Bontone Phone, irrespective of the date of purchase, for the sum of 3/-, plus 6d. postage, if returned to us, intact, with remittance.
This is our Bond. What does it mean? Why, an assurance for all time to users of Bontone Phones.
Compare these advantages over other makes of phones, particularly the cheap, continental type.
Have you recognised all the better qualifications which make BONTONE the distinctive type?
Mainly, they are backed by a most generous guarantee.
Sensitive! Why? Simply that the magnets are made in our own works under our own supervision. **BONTONE** will respond to the weakest signals.
Durability? BONTONE are made of the best materials procurable, and their beautiful finish is highly creditable to skilled craftsmanship.
Comfort? Throughout exhaustive tests we have worn BONTONE and claim a maximum success. BONTONE are easily adjusted. See you buy **BONTONE.**

Apply to your local dealer or apply direct giving your dealer's name to:—

B. D. & Co. (EDWARD A. BOYNTON).
Works: GOSWELL ROAD and CITY ROAD, LONDON, E.C.1.
Offices: 167-173, GOSWELL ROAD, LONDON, E.C.1.
Admiralty, War Office and India Office Contractors.

A CRYSTAL *of* RARE VIRTUE

Possessing remarkable sensitivity at every point and giving loud and perfect reception over maximum ranges—such is "URALIUM," Nature's wonder crystal.

Read what an expert says:
". . . . I must say that URALIUM is certainly second to none . . . and deserves to be given every praise."

Uralium
NATURE'S WONDER CRYSTAL

Obtainable in boxes including Silver Catswhisker 1/6 of all Dealers

BOWER·ELECTRIC·LIMITED
15, GRAPE ST, SHAFTESBURY AVENUE, LONDON, W.C.

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BOWER ELECTRIC (Bristol) LTD.,
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Lancashire & Cheshire
HENRY HOLLINGDRAKE & SON, LTD.;
Wireless Factors, Princes St., Stockport,

Scotland & Ireland
V. ZEITLIN & SONS (Wireless Dept. U),
144, Theobald's Road, London, W.C.1

Leeds
T. B. MORLEY & CO.,
67, Basinghall Street, Leeds.

APPARATUS TESTED

(*Continued from page 862.*)

Merton Davis, Parnell & Co., 359, Strand, W.C.2, have sent us a sample of "Valpo," a synthetic crystal which is retailed at 1/6 per specimen with silver cat's-whisker included. It is a good crystal, and reveals on test that our radio chemists are getting nearer and nearer the crystal ideal of stability and sensitivity. We notice that in the advertisements concerning "Valpo" it is claimed that it is the "Wireless Crystal with the Power of a Valve," and if this is meant to apply to a single-valve detector WITHOUT reaction, such is not an exaggeration, although, of course, such a valve circuit inversely has always been regarded as having "crystal limitations." Therefore it would be equally correct to style any valve as "having the power of a crystal" when used in such a manner, although to do so would naturally be ridiculous.

However, we suppose we must allow a certain amount of "advertisement licence," and certainly the above firm has evolved a striking catchline, although we fear it may tend to create just a little prejudice among many listeners against what is undoubtedly a really good crystal.

* * *

The H.T. supply, more especially in the case of reflex and multi-valve receivers, is always rather a trouble unless really large, expensive batteries are used; indeed, it is hardly an exaggeration to say without reservation that the majority of H.T. batteries fail to stand up to heavy work. For this reason many amateurs employ groups of what are known as "flash-lamp" batteries, and, indeed, this is an excellent scheme as such are not expensive, and single units can easily be replaced should they develop faults. Therefore, the "Adico" battery board, which is designed to take up to 14 4½-volt "flash-lamp" batteries should command a ready market. We have had a sample sent us for test, and can recommend it to the attention of our readers. The usual wander plugs can be used, and the batteries can be removed and replaced singly with the greatest of ease. At 3/-, minus, of course, batteries, it should be the cause of a great increase in the sale of "flash-lamp" batteries for wireless purposes.

* * *

Dull-emitter valves for the Unidyne have lately made their appearance, so it was with great pleasure that we received one of this type for test from E. George, 70, Hailsham Avenue, Streatham Hill, S.W. This particular valve costs 30s., and is rated to consume ·15 amp. with a filament voltage of 1·6 to 1·8 volts. The voltage, therefore, happens to be well within the scope of a 2-volt accumulator even when it is "down" a little, and the current consumption is a usefully small one. (At this figure a 20-actual ampere-hour accumulator would last well over 120 hours on a one-valve set.) The valve is one of the Phillips type, with four pins and an extra terminal, and by means of an adaptor it was plugged into a standard one-valve Unidyne set. Without the slightest trouble four B.B.C. stations were immediately tuned in (on an average aerial), but the valve did not oscillate easily on the longer waves. A fixed condenser (·001) across the telephones remedied this tendency, and then five more B.B.C. stations were logged, making a total of nine at the first sitting. This performance compared favourably with a favourite 5-pin valve which is kept for comparison, and in view of its moderate battery requirements we consider this dull-emitter valve a very interesting and efficient product.

A crystal set wired up with "Radiostrip," a new product of the Radio Manufacturing Co. of Birmingham

RADIOTORIAL.

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All contributions to be addressed to The Editor, POPULAR WIRELESS AND WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

Technical queries are answered by post at a charge of 6d. a query or 1s. for three. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the queries sent should be kept, as the original query cannot be reproduced in the answer. Cash should be sent in the form of postal orders.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

PATENT ADVICE FOR READERS.

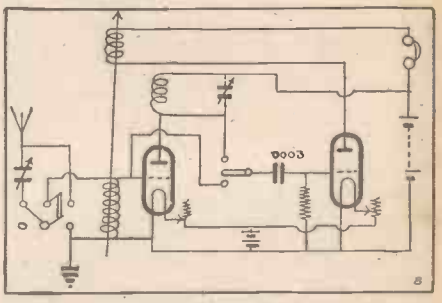
The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

Questions and Answers

"D X WORKER" (Kingston-on-Thames).—Can you give me a circuit for a long-distance two-valve set employing H.F. amplification (tuned anode) and detector valve, with reaction? As I already have a set on hand I should like to use plug-in coils. I also have a double-pole double-throw switch, and should like to know how the connections may be arranged to place the aerial condenser in series or in parallel?

Can another switch be arranged to cut out the first valve when it is desired to use only the single-valve detector with reaction?

The accompanying diagram shows the connections for a circuit of this description, which is capable of extremely good long-distance reception upon 'phones. The switch on the left places the aerial condenser in series when thrown over to the left, and in parallel with the coil when thrown to the right. The capacity of this condenser is not important, and is generally somewhere between ·001 or ·0005. The value of the anode condenser should not be greater than ·0005, and generally ·0003 or ·0002 gives better results.



Between the valves is shown a single-pole double-throw switch, with the grid leak and condenser lead connected to its central terminal. The outer terminals go to aerial and anode circuits, so that when the switch is "up" both valves are in circuit, and when it is "down" the detector valve is connected direct to the aerial circuit. The H.F. valve's filament may in the latter case be turned off, and the set used as a single-valve detector with reaction.

The usual fixed 'phone condenser may be placed across the 'phone terminals if desired, or a fairly large fixed condenser may be connected across both

(*Continued on page* 867.)

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 866.)

the H.T. battery and 'phones. If the circuit oscillates too readily the leads from the L.T. battery to the first valve may be reversed so that the grid will be indirectly connected to the L.T. × terminal instead of to L.T. —.

The grid leak shown is of the fixed type and has a value of 2 megohms, but generally rather better results on long-distance work are obtainable with a leak which is variable.

The reaction coil is shown coupled to the aerial coil. This is essential when the first valve is not in use, but for two-valve work it should be coupled to the anode coil for best all-round results. If the coils are mounted in a 3-way coil-holder, with the reaction coil in the middle, this arrangement will generally obviate the necessity for using a D.P.D.T. switch to reverse the connections to the reaction coil.

The correct voltage of the L.T. and H.T. batteries depends upon the type of valve which is to be used. Dull emitters are quite O.K. for this circuit, but in all cases the battery voltages should be those recommended by the makers of the valves which you are employing.

If, however, a reversing switch is employed, the plate lead is connected to one of its centre points, whilst the opposite one goes to primary or 'phones. The reaction coil is connected across one of the outer pairs of points (say the left-hand pair), and then a lead is taken from the top left-hand contact to the bottom right-hand one, and the top right-hand contact is crossed over and connected to the bottom left-hand contact. It will then be seen that by throwing over the switch the connections to the reaction coil are reversed.

A diagram showing a switch of this kind is given on page 607, POPULAR WIRELESS, No. 108 (Fig. 1).

New readers of POPULAR WIRELESS should note that back numbers of POPULAR WIRELESS are obtainable from the Amalgamated Press (1022) Ltd., Back Number Dept., Farringdon Street, E.C. 4, price 4d. each, post free.

* * *

"SIGNAL-STRENGTH" (Warrington).—What is the usual method of classifying signal strength according to a scale? I have often heard the term "R 4" signals, but have never seen the scale set out, and should be glad to know how the different signals are graded.

There are several scales in use by different authorities, some of which apply to Morse signals and some to telephony. They are all based on the numbers 1 to 9, the former indicating weak and the latter strong signals. The following list shows the different numbers, with their corresponding variations.

R 1—Signals dead weak and almost inaudible.
R 2—Signals audible, but not continuously readable.
R 3—Signals just readable (but not easily).
R 4—Signals clear and easily readable.
R 5—Signals fairly strong.
R 6—Strong 'phone signals.
R 7—Signals loud.
R 8—Signals very loud ("small loud speaker").
R 9—Signals extremely loud ("large loud speaker").

(*Continued on page* 868.)

Our Query Department.

In future a charge of Sixpence per Query will be made for answering all technical questions submitted to the Technical Staff of POPULAR WIRELESS. A group of three queries will be answered for One Shilling. Postal Orders must be enclosed with all queries and a stamped addressed envelope in addition.

THIS NEW ARRANGEMENT IS NOW IN FORCE.

Since the inception of POPULAR WIRELESS, readers have had all their problems settled for them free of charge, but with the great increase in the circulation and the corresponding increase in the number of queries sent in, the task of dealing with the latter has become gigantic. A large Technical Staff is now employed answering queries, and it is with the object of relieving the pressure on them that we have decided to make the small charges mentioned.

Readers of POPULAR WIRELESS know that the Editor and Staff of this journal have always had, and always will have, their best interests at heart.

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from page 867.)

C. M. G. (Billericay).—I wish to construct a three-valve set, with an H.F. valve transformer coupled, but am in doubt as to the details of transformer to use, and as to how many turns they should have to cover various wave-lengths. I wish to use plug-in transformers, and to know the approximate number of turns and manner of winding.

The transformers should be wound on small ebonite bobbins similar in appearance to grooved pulley wheels. The two windings, primary and secondary, are both wound in the same groove, each consisting of an exactly similar number of turns.

Opposite valve legs are used for each of the windings.

The secondary winding should have about 10 per cent. more turns than the primary.

In order to obtain fine tuning, a small variable condenser of the order of ·0002 mfd. is placed in parallel with the primary winding. The above value will prove quite suitable to cover the band of wave-lengths for each transformer detailed in the following table:

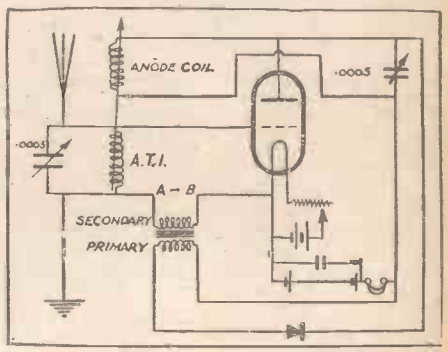
Turns	Inside Flange Diameter	Outside Flange Diameter	Wave-lengths in Metres
30	1¾	2″	190—240
45	1¾	2¼″	240—300
80	1¾	2¾″	300—400
240	1¾	3″	550—750
340	1¾	3¼″	950—1200
900	1¾	3½″	2500—3500

* * *

G. N. E. S. (Trowse, Norwich).—Can reaction be used on a dual receiver? (One-valve and crystal detector.) I understand that reflex circuits are non-selective unless reaction is employed, and I wish to use the circuit for receiving from several B.B.C. stations. I have two ·0005 variable condensers, but do not wish to use any fixed condensers unless they are absolutely essential. Plug-in coils are to be used, and I have both duolateral and basket types on hand. Can they be used in conjunction with one another in this circuit, or must both coils be of one type?

The connections for such a set are shown in the accompanying diagram. For the B.B.C. main stations the A.T.I. consists of a coil of about 40 turns, when the condenser is placed in parallel as shown, but if placed in series for sharper tuning the number of turns should be increased up to about 75 (the exact number depending upon the aerial used). The anode coil has about 65 turns when used with a ·0005 condenser, but a coil of 75 turns with a ·0003 or ·0002 condenser is to be preferred.

Only one fixed condenser is shown, and occasionally they can all be dispensed with. In most cases, however, a great improvement is noticed when a ·001 fixed condenser is placed across the primary of the transformer. Similarly, a small condenser (say



·0002) placed across the secondary (at A—B) will often improve signals, and a similar effect may be obtained by connection across the 'phones.

It will be noticed that the aerial and anode coils are coupled together to obtain reaction. The effect of reversing the L.T. leads should be tried, and it is sometimes advantageous to disconnect the earth from the aerial circuit and place it at the point B, where the L.F. secondary is joined to L.T. and filament.

Regarding the plug-in coils, any type may be used, and two different types may be employed for aerial and anode. For ordinary working basket coils give extremely good results.

Correspondence

THE BARCELONA STATION?

The Editor, POPULAR WIRELESS.

Dear Sir,—On Friday evening, 31st ult., and again recently, I have picked up a station which I believe is Barcelona on 325 metres. At present he appears to be testing, as only speech is given, which is very similar to Madrid, the announcer "rolling" his r's. This, I believe, one can notice very quickly on Madrid. Although this station is very good on three valves (V 2), and is at fair loud speaker strength, he "fades" very badly. I have heard him on each occasion between 9 and 10 p.m.

Conditions here have been extremely bad for the last month, only one or two evenings being free from "X's." I hope it will improve for the B.B.C. Transatlantic Tests, which I am hoping to follow very closely.

Yours very truly, EDWARD TARPLEE.

97, Seymour Road, Gloucester.

LONG RANGE CRYSTAL RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—In the August 2nd, 1924, issue of POPULAR WIRELESS, which has just reached here, I noticed a letter from Mr. H. Whyte in regard to long range crystal reception. I thought that some of your readers might be interested in my experiences with crystal receivers, which have been my hobby for a number of years.

Several nights a week I can receive K C O, the General Electric Co. at Oakland, Cal., quite clearly. The wave-length is 312 metres and the power just under 1 kilowatt; the distance is over 600 miles air line. I can also receive several other stations several hundred miles away on good evenings when the air is free from static and interference.

In the afternoon I can often hear C J C E at Vancouver, a distance of roughly 60 miles. All these results are accomplished with a moderately priced crystal receiver and 2200 ohm headphones. Every night I can get spark signals easily readable five and six hundred miles away, and sometimes farther still in the winter.

As a tuner I use a vario-coupler with a tapped primary and condenser tuned secondary, with a ·001 mfd. 'phone condenser. Another tuner I get results from is a 75 turn pancake coil primary and a 100 turn coil secondary, tuned with two 23-plate variable condensers.

My aerial is 130 ft. long, including the lead in, with tested 45,000 volt insulators. The ground system is a 5 ft. brass rod and the house water pipes with soldered connections.

As a few parting hints to users of crystal tuners I would say always use a crystal detector that is adjustable enough to cover every spot on the surface of the crystal; use a test buzzer to find a sensitive spot, and keep a few spare crystals handy and clean them occasionally with pure alcohol. Keep the end of the cat's-whisker clean with a little sandpaper; see that all connecting wires are as short as possible, and all joints tight and making good contact, for the secret of long distance reception is utilising as much of the incoming radio current as possible. I find that the vario-coupler tuner gives slightly better results than the pancake type, although the pancakes are a little more selective. I hope that this letter will help some of those enthusiasts who are using "rock tuners."

Yours sincerely,

G. BONAVIA.

Metropolis Hotel, Victoria, B.C.

EXPERIENCES WITH A "P.W." ULTRA.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having made the "P.W." Ultra Crystal Set and the improvements in your issue of August 9th, I have much pleasure in informing you that the results far exceeded my expectations. I was agreeably surprised at the great increase of signal strength.

I now enclose a diagram showing certain alterations, which in my case are improvements, and I think many of the public would be glad to know that they can listen with several sets of phones to 2 L O at a distance of 20 miles.

As it occurred to me a greater number of listeners would be benefited if the circuit could be tuned to Chelmsford wave-length, I, in conjunction with a friend, have added a loading coil which brings in that station quite as loud as a straight single valve circuit employing reaction (not close coupled), but of course, the purity and clearness of reception of the crystal is far superior.

The aerial and lead-in in my case are 100 ft., and about 45 ft. high. It is, however, screened by trees, and there is a good deal of lead on the roof. The earth is an insulated wire 25 ft. long, connected to a 6 ft. iron pipe driven into the clay soil and filled with water.

The hum of the A.C. transformer was so loud when I first listened, that I had to add a capacity Æ. This was an iron bedstead. The effect was to almost completely neutralise the hum, and I found the

(Continued on page 870.)

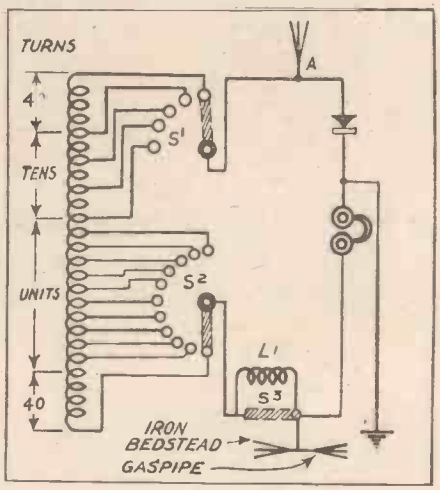
CORRESPONDENCE.

(*Continued from page 869.*)

reception deliciously loud, clear, and sweet, and tuning very broad, so that there was no difficulty in searching, the crystal detector being a perikon.

Two studs have been added, one to the Tens studs, making five in number, and one to the Unit studs, making eleven in number. In the first case to these studs were soldered the aerial end of coil, and the second case the E end of coil was soldered to the eleventh stud.

I found I could dispense with the 1250 Igranic coil and get the same result. Possibly if I had divided the coil at its centre turn, and taken these two wires to a loading coil holder, I should have done better still. This you will no doubt know better than I, as all my experiments have been with valve circuits.



At present the circuit, with the addition of a variable condenser, battery, and buzzer, with the detector disconnected, forms an excellent wave-meter.

In conclusion I must congratulate you on your circuit.

The following explains the diagram:

S^1 switch arm for Tens; S^2 switch arm for Units; S^3 shorting switch for Loading Coil; L1 Loading Coil. When S^1 and S^2 are in position shown and S^3 open, "Radio Paris" and F L can comfortably be heard with suitable coil in L1.

Yours faithfully,
H. VAUGHAN WILLIAMS.
Manor Lodge, Old Windsor.

L.F. AMPLIFICATION AND THE "ULTRA."

The Editor, POPULAR WIRELESS.

Dear Sir,—It is generally believed, I understand, that L.F. amplification does not increase the range of a receiver. As the result of some experiments I have come to the conclusion that this is not, strictly speaking, correct.

I have rigged up a rough crystal set, using the "P.W." ultra circuit (on a wooden board with no ebonite), and have had remarkable results, using two stages of L.F. amplification. When 6 L V is working I can get Manchester at comfortable strength (35 miles) and Birmingham (100 miles) faintly at any time. To-day, just before 7 p.m., when neither Manchester nor Liverpool was working, I heard a play (in German) and the announcement was: Frankfurt am Main auf 469 metre. This is the most remarkable crystal reception I have ever experienced, and could only be heard with the "P.W." Ultra set and two L.F. valves.

Trusting this is sufficiently interesting to be given a place in your journal.

Yours truly,
F. DIETTERLE.
33, Mayville Road, Mossley Hill, Liverpool.

ANOTHER GENEROUS READER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have copies of POPULAR WIRELESS dating back to the end of 1922, and was just on the point of giving them away when I noticed Mr. Eatwell's letter in your correspondence column of the 15th inst. If any of your readers would like to avail themselves of these copies, I should be pleased to let them have same free of charge.

Above includes booklets given away recently by yourselves, and application should be made to address as below.

Yours faithfully,
R. DUNSEATH.

P.S.—I have all copies with only few exceptions. "Appletec," 25, Green Walk, Whalley Range, Manchester.

TECHNICAL NOTES.

(*Continued from page* 818.)

addition to the advantages mentioned, to permit of "auto-regeneration" without additional accessories.

The filaments can, of course, be used simultaneously or separately, one of them being permanently in circuit and the other being thrown into circuit by means of a little catch beneath the valve base. It is stated that the detector, when the two filaments are functioning in parallel, produces voluminous reception, far greater than that obtained with ordinary valves of similar consumption. The valve is made in two types, known as the Junot Triode No. 1 (detector) and ditto No. 2 (amplifier), each consuming 0·75 amps. at 4 volts, with H.T. 40 to 80 volts.

Wireless Research.

The annual report of the National Physical Laboratory, which has recently been issued, gives particulars of the research work carried out in the laboratory during last year, and it is interesting to note what a large amount of attention has been given to wireless subjects, in particular to the accurate measurement of radio-frequencies and wave-lengths. The multi-vibrator wave-meter, used for frequency measurements, gives results accurate to less than 1 in 10,000, and provides an important precision standard.

The investigations with this apparatus were undertaken at the request of the Radio Research Board, and the results have been applied in the services. A good deal of work has also been done in connection or collaboration with Colonial wireless organisations.

Broadcast on Shipboard.

The ship's operator is quite naturally inclined to listen-in to broadcast, especially when in port, and in order to cover this and prevent him becoming a "pirate," the Post Office is now issuing a special form of licence which may be obtained by the shipowners. Rules have also been made to prevent absorption in broadcasting from interfering with the ship's ordinary wireless work. Except when in port, the main aerial must not be used for broadcast reception; in no case must the broadcast receiver be connected in any way with the main installation, and the wireless operator is forbidden to use the broadcast receiver during his spell of duty.

Aerial Laws.

A landlord recently applied to the Greenwich magistrate for advice as to how a tenant could be compelled to take down an aerial. The magistrate replied that, except in case of actual damage being caused to the premises, there was no authority at present in law to prevent a man from putting up an aerial to receive messages or broadcast.

The Pleated Diaphragm.

Opinions on the new "Primax" loud speaker seem to vary considerably, some users being very enthusiastic about the quality of the reproduction, whilst others prefer the more conventional trumpet form of amplifier. Certainly the new diaphragm is of striking appearance, and has special

(*Continued on page* 872.)

TECHNICAL NOTES.

(*Continued from page* 871.)

tonal qualities of its own which will appeal to some, if not to all. This type of reproducer appears to be manufactured under Lumiére's patents, and I notice that the Gramophone Co. (H.M.V.) have now a gramophone operated on somewhat similar lines.

A New Aerial.

The inventor of a new kind of aerial called upon me the other day and showed me the parts of his aerial, the principal feature of which was a number of loops of magnetised steel wire which were strung upon the aerial wire proper, and separated from one another by short pieces of copper wire about four inches long, which were given a single turn round the aerial wire, the end of each steel wire loop being thus separated from the beginning of the next by the thickness of the copper wire, a matter of perhaps a sixty-fourth of an inch. The inventor, I understand, claims that the magnetic fields set up by the presence of the magnetised steel wire loops produce a condition in the region of the aerial which gives advantages, either as to sensitivity or quality, in the reception of wireless signals. I understand from those who have tried this system that the advantages were very doubtful. Theoretically, however, the matter appears to me to be very interesting, and I should be glad to have my readers' opinions as to what the effect of a magnetic field, or a series of magnetic fields, in the region of the aerial would be.

Next Week's Xmas Number.

Order your copy of next week's special Christmas number NOW. It will contain many fine features, including an exclusive article by Mr. Ridley, the first British amateur to hear signals from Mexico. Readers will be interested to hear that, up to and including last week's issue, 12,497,610 copies of "P.W." have been sold since the issue of No. 1. Help swell this record, and don't fail to buy next week's special and greatly-enlarged issue.

R/R

Printed and published every Thursday by the proprietors, The Amalgamated Press (1922), Ltd., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices : Messrs. J. H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates : Inland and Abroad, 17/4 per annum, 8/8 for six months. Sole agents for South Africa : Central News Agency, Ltd. Sole agents for Australia and New Zealand : Messrs. Gordon & Gotch, Ltd. : and for Canada : The Imperial News Co. (Canada) Ltd. Saturday, December 6th, 1924.

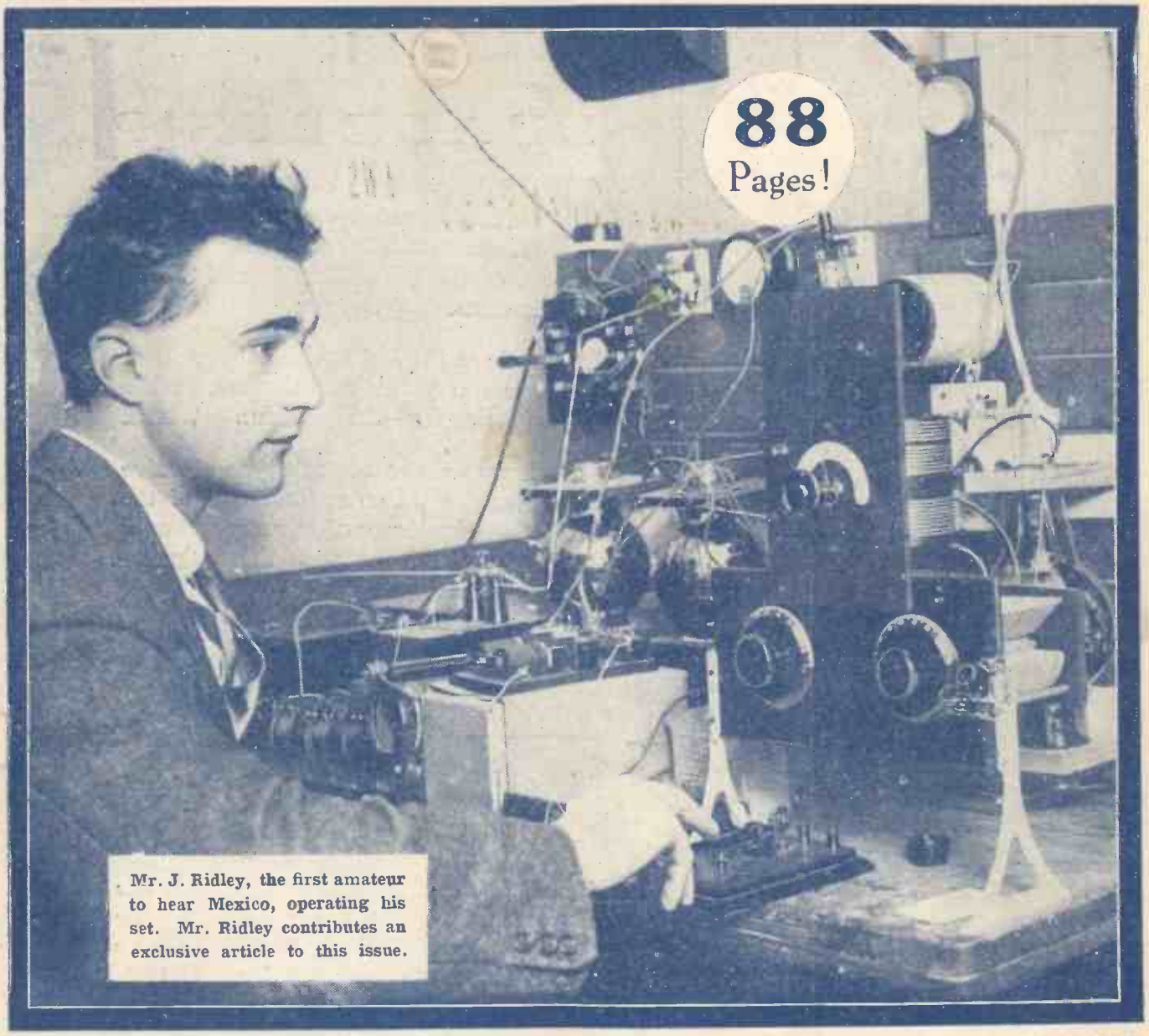
R/R

POPULAR WIRELESS AND WIRELESS REVIEW, December 13th, 1924. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

SPECIAL XMAS NUMBER

Popular Wireless

PRICE 3d. WIRELESS REVIEW EVERY THURSDAY.



Mr. J. Ridley, the first amateur to hear Mexico, operating his set. Mr. Ridley contributes an exclusive article to this issue.

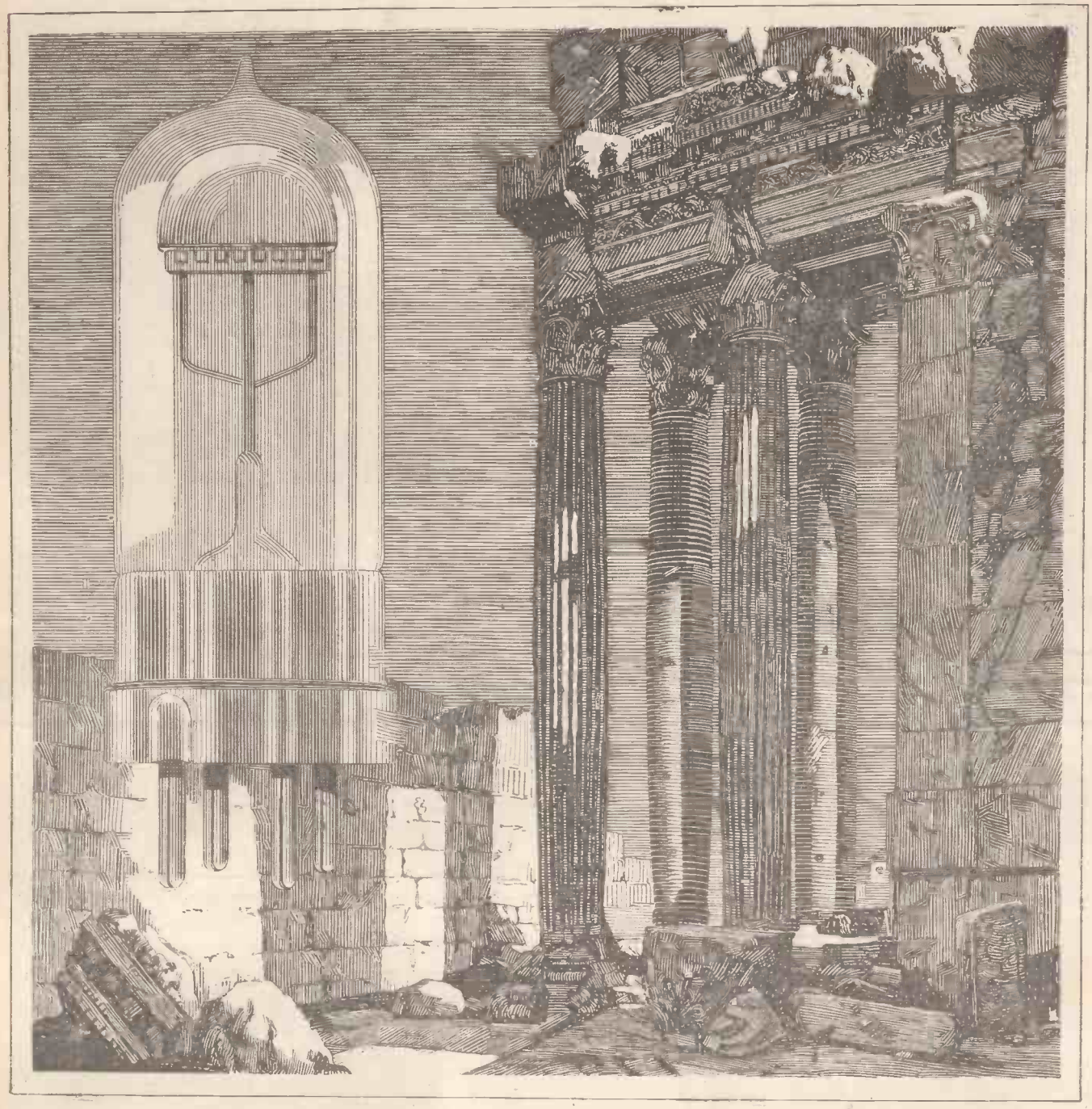
SPECIAL FEATURES.

HOW I RECEIVED MEXICO.
By J. Ridley.

Wireless in Spain.
The Year's Progress.
Which Valves Shall I Use?
Christmas Radio Presents.
A Family 2-Valve Set.
A Straightforward Crystal Set.

"ON BROADCASTING."
By Sir Oliver Lodge, F.R.S.

No. 133. Vol. VI. December 13th, 1924.



Continental Series, No. 5

Broadcasting from Italy.

The only Broadcasting Station working regularly in Italy is Rome, which operates on 422 metres.

This Station uses greater power than Madrid—which has even been heard in London on a Crystal Set—and therefore any standard 2-Valve Set should pick it up quite easily.

Rome broadcasts every evening at 8 p.m., beginning with a News Bulletin and followed by a Concert. As may be expected, Concerts from Rome are of a very high level. Why not tune in to 422 metres to-night!

Radiofonica Italiana!

—Rome Calling.

WHO can listen to a Broadcasting Station hundreds of miles away without feeling a thrill?

That sounds can be picked up, converted into waves, flung into space, received at a vast distance, reconverted into a facsimile of the original, is a marvel which even yet is not fully grasped by the multitude.

Its significance surely means that the whole world must become more musically inclined, that the barriers of language will be destroyed, that understandings between nation and nation must be more intimate, that, in effect, international Broadcasting must become a more potent factor in preserving peace and goodwill throughout the world than even the League of Nations.

From the Continental Stations, which but a year ago could be counted upon the fingers of the hand, we now have available for our amusement and instruction a most formidable list. And hardly a week goes by without some new name being added.

France, Holland, Spain, Portugal, Italy, Denmark, Switzerland, Belgium, Germany—all these and many more are being regularly heard in this country practically any evening on 2 and 3 valve Sets.

If you own a good Set why not spend an evening logging some of these Continental Stations? But first see that you are using the correct type of Valve.

Obviously you would not expect to get the same good results from a Valve designed for Loud Speaker use as if you used one specially designed for long distance work.

The Valve recognised throughout the country as the standard H.F. (long distance) Valve is the Cossor P.2—the Valve with the red top. This Valve—the first, we believe, ever designed in this country for D.X. work—utilises the same principles that are rapidly making Cossor Valves famous throughout the world.

Its arched filament, working in conjunction with a hood-shaped Grid and Anode, makes use of practically the whole of the electron stream, and results in a Valve considerably more sensitive than any other.

It should be remembered that the sole object of an H.F. Valve is to amplify the minute oscillations impinging on the aerial that are much too weak to be rectified by the Detector Valve.

Obviously oscillations must be of a certain strength before they can be rectified, and if rectification is not effective even several L.F. Valves will not create loud signals.

The golden rule for long distance work is to use a Valve which will extract the last fraction of efficiency from the H.F. side of your Set, and volume will follow automatically. See, therefore, that you use a Cossor P. 2 (with red top) and a Cossor P.1, and you will obtain a combination of valves unequalled for sensitiveness.

Remember all Cossor Valves are now sold in patented sealed cartons—the only valve in the world that can come direct from factory to user without being used for demonstration or other purposes.

Not only do you get a better valve, therefore, but you know perfectly well that it is a brand new one.

BRIGHT EMITTERS

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

WUNCELL DULL EMITTERS

Model A. (*With resistance in base for use with 2-, 4- or 6-volt accumulator.*)

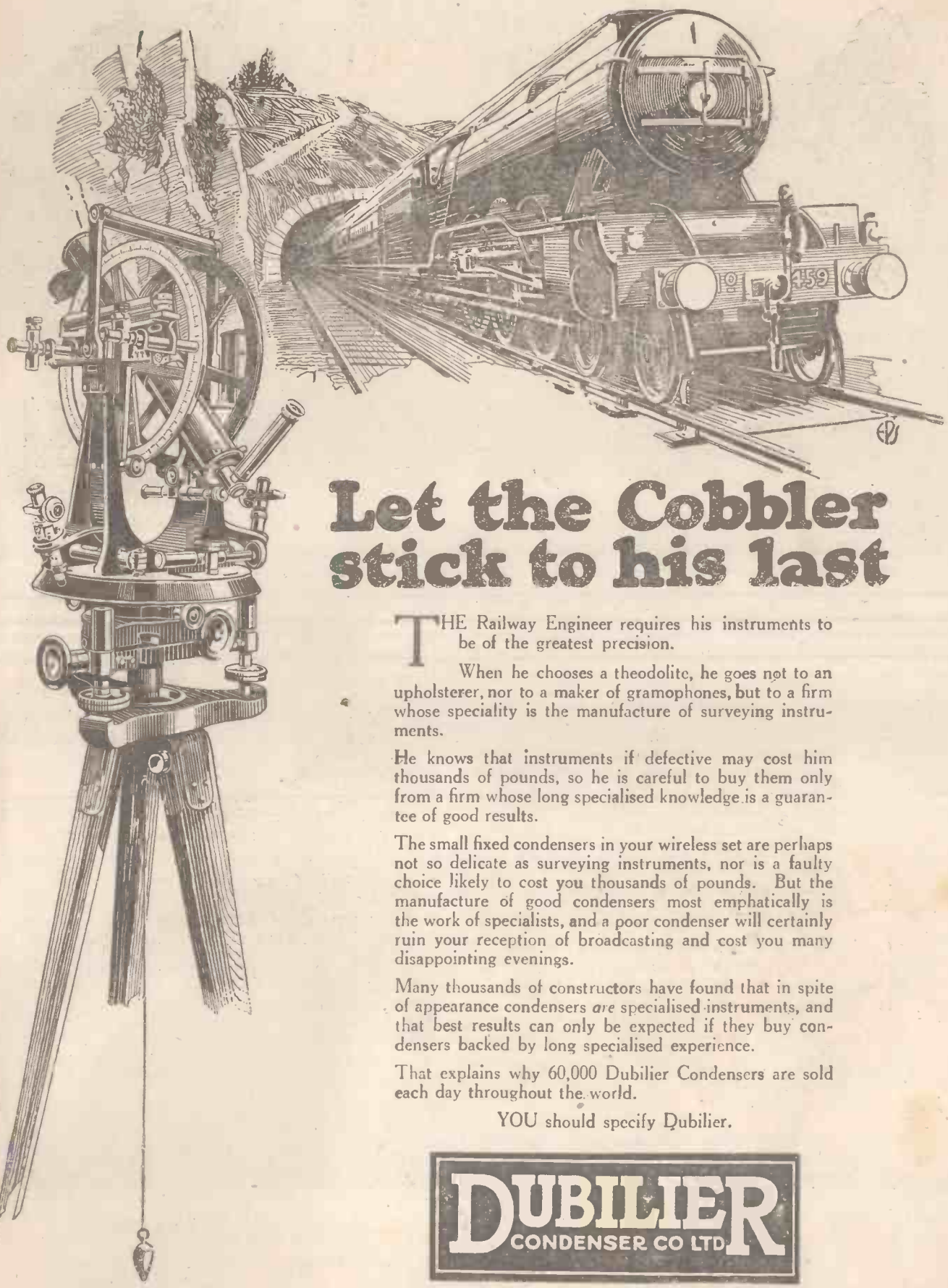
W.R.1. For Detector and L.F. use	23/6
W.R.2. (With Red top) for H.F. use	23/6

Model B. (*Without resistance, working direct from 2-volt accumulator*).

W.1. For Detector and L.F. use	21/-
W.2. (With Red top) for H.F. use	21/-

Valves

Advt. of A. C. Cossor, Ltd., Highbury Grove, N.5



Let the Cobbler stick to his last

THE Railway Engineer requires his instruments to be of the greatest precision.

When he chooses a theodolite, he goes not to an upholsterer, nor to a maker of gramophones, but to a firm whose speciality is the manufacture of surveying instruments.

He knows that instruments if defective may cost him thousands of pounds, so he is careful to buy them only from a firm whose long specialised knowledge is a guarantee of good results.

The small fixed condensers in your wireless set are perhaps not so delicate as surveying instruments, nor is a faulty choice likely to cost you thousands of pounds. But the manufacture of good condensers most emphatically is the work of specialists, and a poor condenser will certainly ruin your reception of broadcasting and cost you many disappointing evenings.

Many thousands of constructors have found that in spite of appearance condensers *are* specialised instruments, and that best results can only be expected if they buy condensers backed by long specialised experience.

That explains why 60,000 Dubilier Condensers are sold each day throughout the world.

YOU should specify Dubilier.

DUBILIER
CONDENSER CO LTD

Advt. of the Dubilier Condenser Co., Ltd., Goldhawk Rd., London, W.12.

E.P.S. 88.

Xmas Gifts

Brown
H 2 Loud Speaker

Brown
A. Type Headphones
The most sensitive headphone in the world.

120 ohms	per pair	58/-
2000	„ „	62/-
4000	„ „	62/-
8000	„ „	66/-

Brown
D Type Headphones
Used in large quantities by Marconi's Wireless Telegraph Co., Ltd.

120 ohms	per pair	48/-
2000	„ „	52/-
4000	„ „	52 -

Brown
F Type Headphones
Featherweight pattern weighing only 6 ounces.

120 ohms	per pair	22/6
4000	„ „	25/-

The
Crystavox

Brown H 2 Loud Speaker
12 inches high with adjustable reed movement.

120 ohms	£2 5 0
2000 „	£2 8 0
4000 „	£2 10 0

Crystavox Loud Speaker
The only Loud Speaker in the world working direct from a Crystal Receiver without valves.
Price £6 15 0

Brown
Gramophone Adaptors
Convert any Gramophone into a Loud Speaker.

Type H1		
120 ohms	.. ..	£4 7 6
2000 „	.. ..	£4 10 0
4000 „	.. ..	£4 12 0
Type H2		
120 ohms	.. ..	£2 0 0
2000 „	.. ..	£2 2. 0
4000 „	.. ..	£2 4 0

Brown Microphone Amplifier
This Microphone Amplifier gives practically the equivalent of a 2-valve amplification without the expense of valves or accumulators. In two types: Type C for use with a Crystal Set so that a large number of 'phones may be used without diminution of signal strength. Type V for use with a Valve Set to work a Loud Speaker.

Type C
4000 ohms input—2000 ohms output £6 0 0

Type V
120 ohms input—120 ohms output £5 5 0
2000 ohms input—120 ohms output £5 8 6
2000 ohms input—2000 ohms output £5 13 0

Brown
Microphone
Amplifier

Brown H 1 Loud Speaker
Renowned for volume and purity of tone.
Type H 1, 21 inches high.

120 ohms	£5 5 0
2000 „	£5 8. 0
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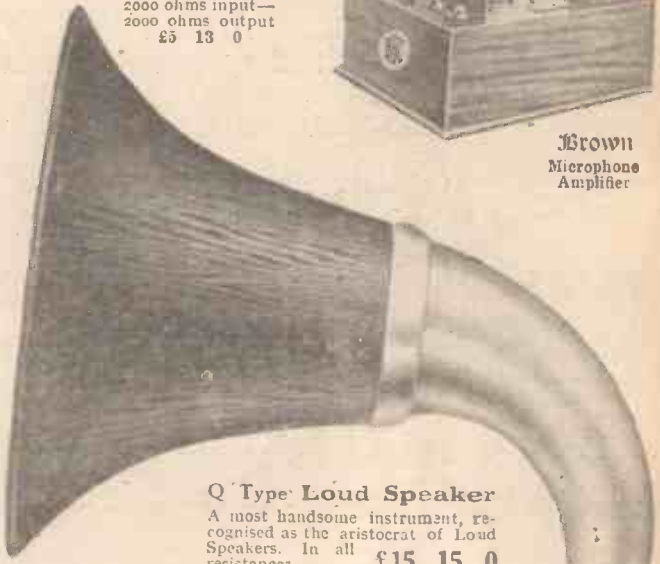

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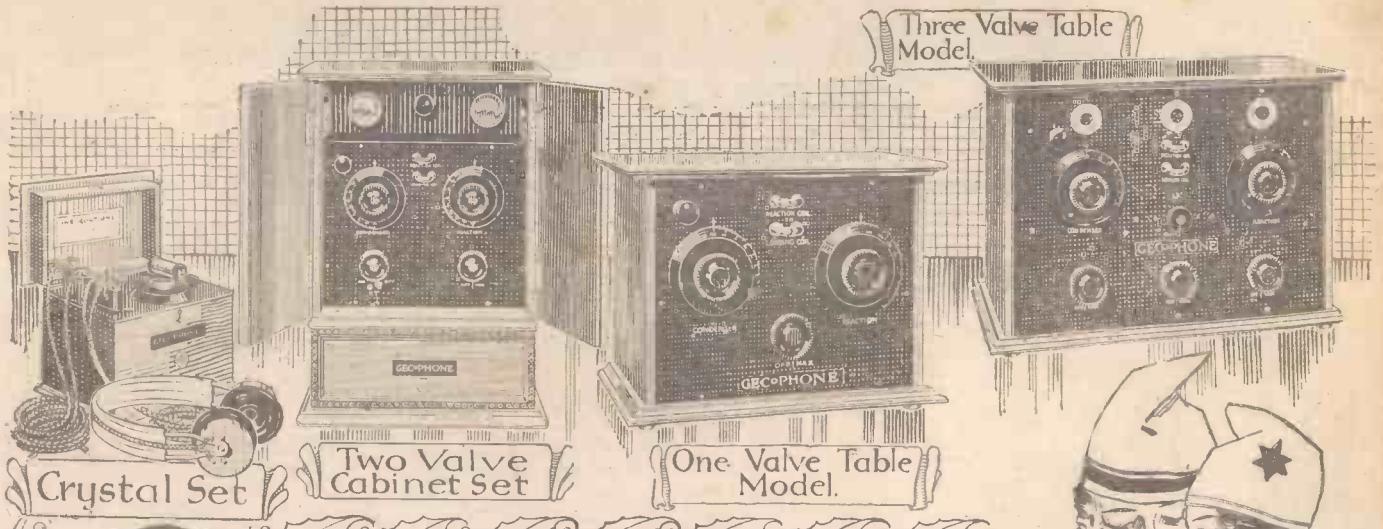

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POPULAR WIRELESS

AND WIRELESS REVIEW.

December 13th, 1924] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Thursday, Price 3d

Technical Editor: G. V. DOWDING, Grad.I.E.E. | Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.G.S. | Scientific Adviser Sir OLIVER LODGE, F.R.S

RADIO NOTES AND NEWS OF THE WEEK.

The Fall of the Mighty.

THE recent gale played havoc among amateur aerials, and several of the most aristocratic affairs in London came down with a bang. I noticed that the famous Mill Hill School aerial was laid low, and so was the one at Radlett, which "Uncle Jeff" worked so hard upon not long ago!

* * *

Erecting a Mast.

A THREE-HUNDRED-FEET mast has just been erected by the Marconi Company, at Drummondville, Quebec; and within twelve months it is expected that fourteen more will be in place there. The installation of the transmitting aerial at a short-wave station of this kind is quite an easy matter, but there are some tricky engineering problems to solve before the "reflector" is in readiness.

* * *

A Remarkable Feat.

THE reception of American broadcasting at 3 p.m.—when broad daylight covered the Atlantic—is the remarkable feat claimed by Mr. E. C. Davies, the well-known Highgate amateur. "Reception was not good owing to mush," he reported, "but KDKA (Pittsburgh) was quite audible upon the low wave-length of seventy-five metres."

* * *

Mr. Haddon's Resignation.

MR. ARCHIBALD HADDON, the popular and entertaining dramatic critic of the B.B.C., has resigned his appointment at 2, Savoy Hill, to take up a position as publicity organiser at the London Coliseum. Mr. Haddon is an admirable critic, and a great many listeners have expressed the hope that his appointment with Sir Oswald Stoll will not prevent an occasional reappearance before the microphone.

* * *

The Swansea Station.

SWANSEA relay station, which is due to open on December 12th, has been rather a difficult one to provide with a programme. Like all the other relay centres, there was a strong local demand for the relaying of 2 L O, but, owing to the large number of welsh-speaking listeners, the B.B.C. expect that Cardiff's programme will furnish a large proportion of the Swansea items.

* * *

Radio Warnings.

A DRAMATIC turn was given to the announcements recently, when a message from the Birmingham police was broadcast to all stations via Scotland Yard and 2 L O. This description of the four men wanted for alleged murder and shopbreaking is the first of its kind in the history of British broadcasting, and radio warnings of this type are likely to prove of great value in catching criminals and conveying clues to police cordons.

* * *

The Daventry 5 X X.

AFTER the B.B.C. has announced Daventry as the site selected for their new high-power station, there was a hitch in the negotiations, but at the time of writing it appears that this will be overcome successfully.

Situated near the Grand Junction Canal, Daventry is a small manufacturing town, lying about four miles north-west of Weedon, Northamptonshire.

* * *

To Our Readers.

Once again we make our bow to our readers with a special Christmas number—a number which, we venture to think, is good value for the three small coins of the realm which represent the cash price for a copy of "P.W."

Much water has flowed under London Bridge since our last Christmas Number and many wireless waves have sought a home via the aerials of "D X" fans—waves from Australia, New Zealand and quite a number from B.B.C. stations. . . . We hope you will continue the good work: that your efforts to receive China and Japan, etc., will be crowned with success, and that every reader of "Popular Wireless" will find in our pages some help and plenty of incentive to continue to delight in the greatest hobby in the world. To one and all "Popular Wireless" wishes

"A Happy Radio Christmas."

No Increase in Power.

MUCH disappointment has been caused by the B.B.C.'s announcement that 5 X X's power will *not* be increased when the station moves to its permanent home in the Midlands.

Listeners, who were resigning themselves to programmes from a greater distance, had hoped that a few more kilowatts at Daventry would have helped to make the transfer less damaging to their signal strength.

* * *

Cold Comfort.

CRYSTAL-USERS situated on the fringe of Chelmsford's range are certainly to be sympathised with, and the B.B.C.'s idea that greater efficiency is expected from the employment of a better aerial and more reliable gear is but cold comfort for them.

There is, however, no doubt about the wisdom of a move to the north-west, which will bring an enormous increase in the number of listeners within crystal-range of broadcasting.

* * *

Via Brussels.

FIRED by the success of the man in the street, and in response to the public desire for distance, the B.B.C. is going to relay a foreign programme occasionally through Chelmsford. The first will be via the Brussels station on December 15th, when a performance of "Prince Igor" will be relayed from the Brussels Opera House.

* * *

A Radio Strike?

COUNTRYMEN are notoriously contemptuous of the fuss that townsmen make when a strike of electricians paralyses the underground railways and cuts off the electric light.

In future they may be more sympathetic when they find the broadcasting station's power gets cut off suddenly some day for the same reason, especially if they waste half the evening trying to tune-in signals that aren't there.

* * *

Dundee à la Russe.

DUNDEE is "for it" to-morrow night (Friday, December 12th), when a Russian Composers' Evening will be on the air. Selections will be given from the works of Tchaikovsky, Moskowsky, Rimsky-Korsakov, Wieniawsky, Arensky, and Ippolitov-Ivanov, so the announcer will probably be heartily glad when it is all over.

* * *

Record Breaking.

WHEN all the claims have been sorted and checked, International Radio Week will prove to have been a record-breaking radio achievement. The reception of 2 L O in California is no more striking than the great success of all the British stations compared with last year's reception in America. It was a wonderful week, and undoubtedly its outstanding feature was the great skill shown by the world's amateurs in tuning-in.

* * *

You Never Know Your Luck!

ONE very interesting feature of the International Tests was the success attained on bad and indifferent aerials. In this connection a Walsall correspondent tells me that he picked up three American stations on a Det. and L.F. set, using a "clothes-line" aerial only 10 ft high at the free end, rising to 18 ft. at the lead-in end!

(*Continued on page* 882.)

NOTES AND NEWS.

(*Continued from page* 881.)

A Compliment.

THE broadcasting station at Oakland, California (K G O), has just paid a very fine compliment to the amateurs of New Zealand and Australia. These enthusiasts receive from Oakland with such remarkable regularity that K G O has extended his transmission hours especially for their benefit, although the station is separated from this part of its audience by 6,000 miles of Pacific Ocean!

* * *

News from New Zealand.

I AM indebted to a Gisborne correspondent for further particulars of the wonderful long distance records set up by New Zealand amateurs. One of their star turns is Mr. I. H. O'Meara, who from his station at Gisborne has worked two-way Morse with Boston (7,300 miles) and Rio de Janeiro (6,500 miles), and has also been in *telephonic* communication with a ship off Cape Horn (5,100 miles). As my correspondent's letter left New Zealand in October, I cannot help wondering what ever sort of records Mr. O'Meara has set up since, if he really let himself go "all out" for International Radio Week!

* * *

The Beam.

WERE the claims premature or unfounded which heralded a great future for the "Beam" system?

According to a Reuter message the Melbourne "Age" announces that it is practically certain that the beam system will be abandoned for reciprocal working between British and Australian stations.

* * *

Mr. Ford's Licence.

MR. R. M. FORD—who recently asked the Postmaster-General to prosecute him for not paying his wireless licence—has now forwarded a subscription direct to the B.B.C. in recognition of its broadcasting service. No part of the amount forwarded is to be applied to a P.O. licence, and the company has accepted the subscription upon this condition. Mr. Ford is still corresponding with the P.M.G. with the avowed object of preventing further official threats and processes of intimidation to listeners.

* * *

2 L O in the U.S.A.

THE democratic aspect of broadcasting is one of the reasons why it is so popular in the U.S.A. During one of the tests there was great amusement because a certain important Army station was unable to hear anything of Britain, whilst close by, on an inferior aerial and home-made "junk" apparatus, a 16-year-old fan was receiving 2 L O quite clearly!

* * *

Extraordinary Non-Interference Claims.

A NOVEL receiving circuit called the "Unitenna" has been evolved by the U.S. Navy Department.

It allows reception of various selected wave-lengths on one aerial simultaneously, and recent tests showed that a message can be received on 600 metres, whilst 10 yards away a parallel aerial is transmitting on a power of six kilowatts.

A Famous Conductor.

PIERRE MONTEAUX, conductor of the B.B.C.'s first international symphony concert, held at Covent Garden on December 10th, is a Parisian who has conducted famous orchestras all over the world. After serving as a private during the war he went to America to wield the baton at the Metropolitan Opera House, New York, and later he was appointed conductor of those modern-music magicians, the Boston Symphony Orchestra.

WHAT THEY SAY.

"Every cot and bed in every hospital and nursing home should be equipped with a pair of headphones for the use of the individual patient as and when required. . . ."—Dr. C. W. Saleeby, writing in the 'Daily News."

* * *

"The B.B.C. is . . . beginning to receive a very fair amount of public appreciation. That will probably, in the long run, be of far more use to it than any blowing of its own trumpet or trumpets, and the more sedulously it refrains from doing the latter, the more completely will the mistakes which disfigured its earlier proceedings be forgotten, and the more kindly will be the future attitude of the public towards it . . . . . "—"Glasgow Herald."

* * *

"In other words, unless we could make broadcasting broad, it would make us narrow. He (Mr. G. K. Chesterton) was asked some time ago whether he did not think it was wonderful that by the operation of broadcasting ten thousand people—that was to say, multitudes of middle-class and poor people—could hear what Lord Curzon was saying. He replied that he thought it would be more wonderful and desirable if there were scientific machines by which Lord Curzon could hear what ten thousands of people were saying."—Mr. G. K. Chesterton's speech at the Edinburgh Station (reported in "The Scotsman").

* * *

"But he is a rash rather than a bold man who predicts what may be the ultimate developments of wireless, especially if Mr. Shaw takes it in hand."—"Daily News."

* * *

"If Mr. Shaw gives us no more radio entertainments, we shall go and sit on his doorstep, wailing "Ochone! Ochone!" until he does."—"Daily Herald."

* * *

"It was the amateur who initiated broadcasting in this country, and it was the amateur who in the last year or two drew public attention to the vast possibilities of the use of relatively short wave-lengths and low power for long-distance transmissions."—Captain Ian Fraser, C.B.E., M.P.

* * *

"Shingled hair, in my opinion, is not due to the emancipation of women. They cut it short so that it won't interfere with the headphones. Again, there is the traffic problem. Would everybody be rushing to get home by six o'clock if there were no crystal sets?" Robert Magill, writing in the "Radio Times."

* * *

THE WEEK'S QUERY.

And now I have built up a set for my old father to listen-in with, how much loyalty do I owe Mr. Marconi on it?

Waiting and Hoping.

WHEN is something going to be done about licence-dodging? The B.B.C. have just announced a pious hope "that those who may be enjoying our programmes whilst indifferent to the financial side of the matter, will take out their licences forthwith."

What is needed is a final appeal to the Britisher's sense of fair play, followed, if necessary, by decisive action against delinquents.

Photographs by Wireless.

THE recent wireless transmission of photographs from this country to America is reported to have been remarkably successful. A photograph taken in London at 3 p.m. was in New York within an hour, and even better results are anticipated by the Marconi Co. experts when certain improvements in the system have been effected.

* * *

Radio Photos.

APPARATUS by means of which photographs taken in New York can be received in London is now being erected, and will probably be in operation before the New Year. At first the invention will be used chiefly for newspaper photographs, but it has great possibilities in police work, and will probably be adopted for commercial purposes.

* * *

Was It Deliberate?

IT has been suggested that much of the interference experienced during International Radio Week was caused intentionally. Attempts to read some of the morse interference led to the conclusion that in certain cases it was not morse at all, but a mere jumble of deliberate jamming. The statement that a certain European country was trying to stop international attempts to exchange programmes does not meet with much support, as such interference could be traced easily by direction finders.

* * *

Rest for the "Uncles."

RATHER a novel idea is to be tried by the B.B.C. on December 23rd. In order that the 2 L O staff may be provided with a brief interval for rest, four of the provincial programmes will each provide half an hour's entertainment for the London audience. The stations chosen will be Birmingham, Cardiff, Bournemouth, and Manchester.

* * *

Pantomime to be Broadcast.

ONE of the best Christmas items promised by the B.B.C. is the pantomime "Cinderella," which will be broadcast on Saturday, 27th December. The entertainment has been modified for the microphone, and will be presented by the "Roosters" Concert Party.

* * *

Decisive Action.

FOLLOWING a threat for patent infringement by the Amalgamated Wireless (Australia) Co., all the New Zealand broadcasting stations were forced to close down recently.

The Postmaster-General took a strong line of action and introduced an amendment to the Post and Telegraph Act, which in effect made all the broadcasting stations agents of the Crown, and placed them in a strong position for defying the monopoly. Further developments should therefore prove very interesting.

* * *

That Interference Eliminator.

MR. BERNARD GRIPTON has drawn my attention to an error appearing with his article, "An Interference-Eliminating Circuit," which was published in POPULAR WIRELESS on November 29th. He points out that the value of the fixed condenser across the primary of the 'phone transformer (Fig I.) should be ·001 instead of ·004.

ARIEL.

HOW I RECEIVED SIGNALS FROM AMERICA, NEW ZEALAND & MEXICO.

The Art of "D.X." Work.

AN EXCLUSIVE ARTICLE FOR "P.W."

By J. RIDLEY.

Mr. Ridley has contributed this special and exclusive article to our Christmas number, and in it the amateur will find many sound and useful tips in connection with long-distance reception of very short waves.

TO say that the happenings of the past two months have been the most momentous in the whole of amateur radio history would not, I think, be over-rating the achievements about which we have heard so much recently. Time was when the sceptic laughed at the very idea of being able even to hear amateurs in America; in due course those amateurs were heard, and immediately reception was put down to extraordinary weather conditions and other "freaks." Despite this fact, American calls persisted in wending their—one cannot say weary—way across "the Pond," until at long last the tables were turned and British amateurs were heard in the United States.

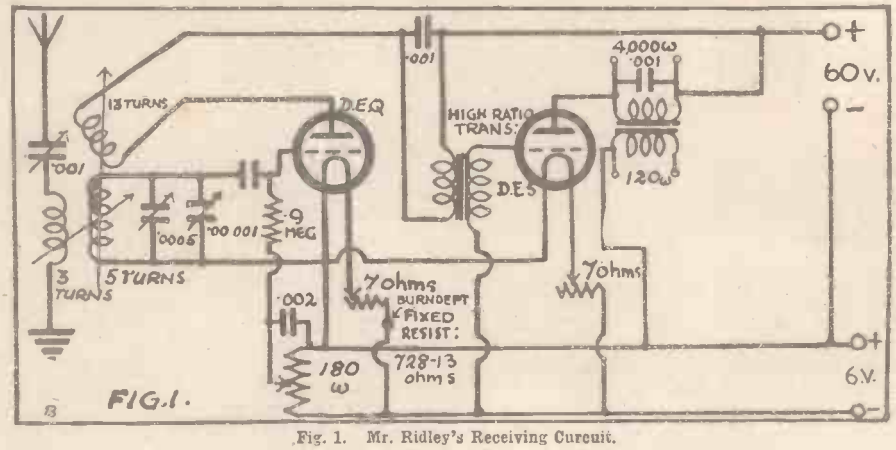


Fig. 1. Mr. Ridley's Receiving Circuit.

Gratified, as, I suppose, one naturally would be at these results, watch was kept every morning from 5 a.m. till 7 a.m. for further signals from New Zealand. Although these were received with more or less regularity, I was unable again to carry out two-way working. One morning a message was passed to me to the effect that my signals were being heard by Z 2 A C, who was calling me. I endeavoured to receive him, but owing to the fact that the sun had already been up some 40 or 50 minutes, and that Z 2 A C's signals were almost inaudible, I was unable to receive a New Zealander who had only on a few occasions been heard in England.

A Great Surprise.

Things then started to grow apace. Optimists hinted at two-way communication ere long; barely had they time to convince their scanty audience than two-way communication with America was established. No sooner had this achievement been placed on a more or less firm basis than two-way communication was carried out between England and New Zealand.

I was one of the first British amateurs to communicate with the United States, and also, more recently, one of the first half dozen transmitters to be heard in New Zealand. I subsequently carried out my first two-way working with the Antipodes on October 29th, when a very brief signal exchange was made with Z 4 A G. Further work was carried out with Z 4 A A on the morning of November 6th, when signals from my station, G 5 N N, were copied in New Zealand without a single repeat and were reported to be of exceptional strength and readable through heavy ship jamming.

However, watch was still kept on each morning with the hope of hearing the signals from the other side of the earth. I was so intent upon these signals that I had almost forgotten that there were still amateurs in other countries who had not yet been heard. You can imagine my surprise, then, when at 6.40 a.m. on the morning of November 25th I heard Mexican Stations B X and D Z working on approximately 91 metres. Signals from these stations were practically pure c.w. and fading badly. Their strength was varying between R 2 and R 4 and only just readable through the atmospherics. In all, these stations were heard for about 10 to 12 minutes, although at times it was impossible to read them owing to the interference and fading mentioned above.

Super "D X" Work.

I hope soon to be able to connect up with the Mexicans, but difficulties will doubtless be experienced in effecting two-way communication owing to the terrific interference caused by atmospherics in Mexico, where, situated as it is on the Tropic of Cancer, it is subjected to the type of weather which provides an almost endless supply of static all the year round.

Now I expect that as there are readers who have yet to hear even American amateur signals, a brief outline of the methods used to carry out this super long-distance work may prove of interest to those who aspire to listen to New Zealand or perhaps, with luck, Mexico.

Before commencing this outline let me

(*Continued on page* 884.)

Mr. J. Ridley at his operating table at his home in South London.

HOW I RECEIVED SIGNALS FROM AMERICA, NEW ZEALAND & MEXICO

(*Continued from page 883.*)

emphasize the fact that it is useless commencing to listen for these signals if you have no idea of the strength of the signals that you wish to receive. They are almost sure to be weak, so weak perhaps that you may have even to hold your breath to hear them: the strength not depending so much upon the distance as the weather. Personally, although I used to be a firm believer in the cold, frosty nights for long-distance work, I have since found that by far the best reception is carried out when the barometer is falling rapidly and when it is raining. Then on these mornings signals are as strong again as on frosty mornings.

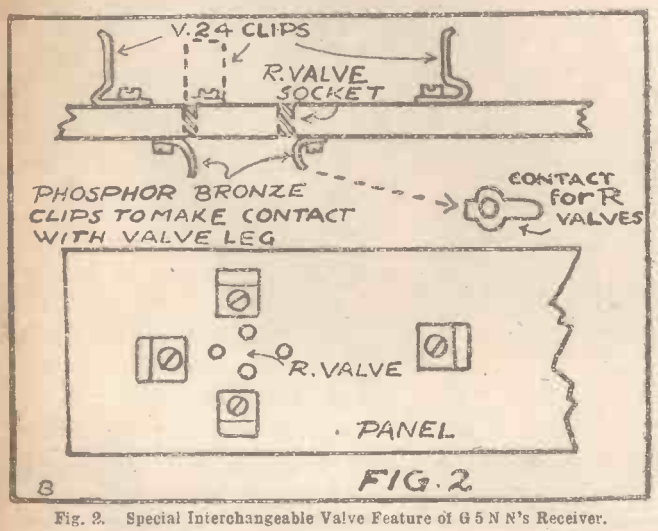


Fig. 2. Special Interchangeable Valve Feature of G 5 N N's Receiver.

When to Listen.

The next thing to consider is the time when to listen. One can safely say that the best time for all-round long-distance reception of practically every description is between 4 a.m. and 7.30 a.m. during the months of October to January. Wavelengths have also to be considered, as all the long-distance work has been done on waves which I look upon as ultra short, a band of search from 60 to 98 metres may be decided upon. The reason why I term waves below 100 metres as ultra short is in the main to differentiate between them and the short waves of 100 to 250 metres.

The Secret.

These details having been settled, let me describe the procedure that I adopt when searching for foreign signals. First of all, the secondary circuit is adjusted to within 10 or 20 metres of the wave upon which I expect to find the station that I am looking for. The aerial condenser is then rotated until the aerial circuit is in tune with the secondary. Reaction coil is then adjusted to a point where the set is just on the oscillation point. This done, the secondary condenser should be swung for 15 to 20 degrees on either side of the point decided upon, in order to cover a band of 20 or so metres.

Whilst this is being done the reaction should always be adjusted to just on oscillation to give the maximum sensitivity of the receiver. Be prepared to listen for anything weak. That is the secret. Once you have got it, stick on to it until you have read the call sign. It comes quite easily after a little practice, although atmospherics are at first apt to disconcert beginners.

The receiver at G 5 N N consists of a practically standard Burndept Ultra III Receiver, the only alterations made from standard are the substitution of tuned anode H.F. coupling for the usual arrangement of tapped coil, the addition of a potentiometer to control the grid of the detector valve and the use of V.24 clips instead of the regular R. valve holders, although these valves can be used without an adapter, as shown elsewhere in these columns.

On the tuner, which, by the way, is let into the desk top on the left-hand side for ease of operation, standard Burndept equipment is used in the form of Low Loss condensers and a three-way coil holder: a vernier condenser is in parallel with the secondary condenser and is absolutely indispensable for final tuning-in. The coils were specially wound to give a lower minimum wave-length value than the standard Extra Short Wave Burndept coils. Their values may be of interest and are as follows: Aerial Coil, 3 turns 20 gauge D.S.C. wire on 3-inch former; Secondary Coil, 5 turns; Reaction Coil, 13 turns of the same type of wire on similar formers to the aerial coil. The secondary, when tuned with a ·0005 condenser, gives an approximate wave range from 30 to 100 metres.

TO OUR "D X" READERS.

The Editor of "Popular Wireless" invites readers to contribute articles dealing with their experiences in long-distance reception work. Should any reader succeed in "breaking a record," he is requested to communicate with the Editor, who will be pleased to pay special rates for exclusive articles dealing with this branch of amateur wireless work.

Circuits Used.

Figure 1 shows the receiver circuit together with values of the various components. As the H.F. valve in the receiver was not used, it has been omitted from the diagram for the sake of clarity. Brown's "A" type 4000-ohm 'phones were used. Detector valve is a Marconi D.E.Q., a valve of exceptional detecting qualities, whilst a D.E.5 valve was used for low-frequency amplification. Burndept fixed resister No. 728 of 13 ohms is inserted in series with the 7 ohm rheostat of the detector valve to provide the necessary 3 volts drop for the filament of the D.E.Q.

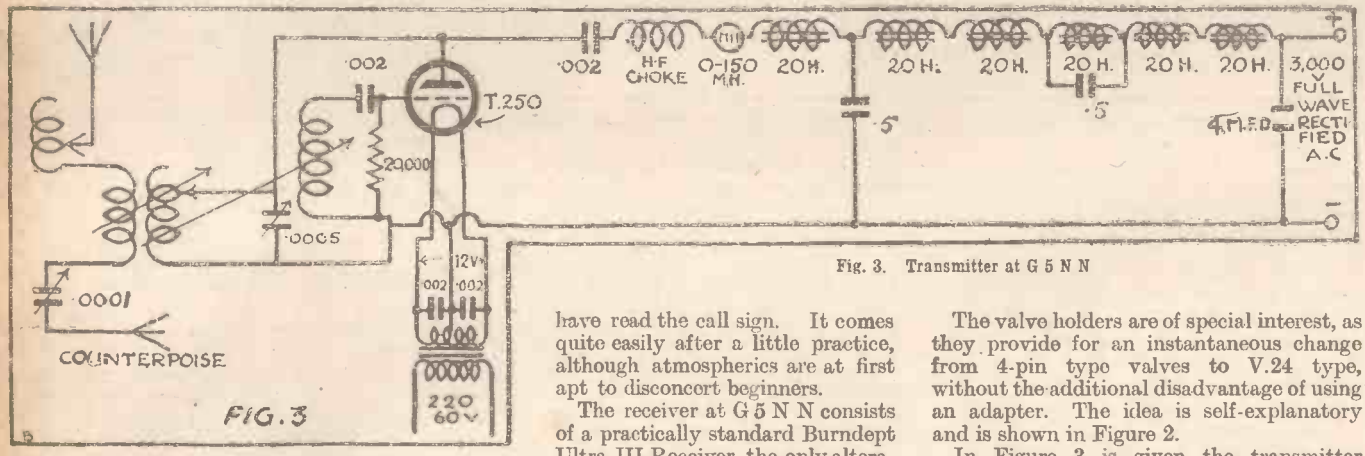


Fig. 3. Transmitter at G 5 N N

The valve holders are of special interest, as they provide for an instantaneous change from 4-pin type valves to V.24 type, without the additional disadvantage of using an adapter. The idea is self-explanatory and is shown in Figure 2.

In Figure 3 is given the transmitter circuit of 5 N N, with the exception of the rectifier portion. The power is taken from the mains and supplied to the primary of a 6000-volt transformer: it is then stepped up and rectified by two Marconi U.1 rectifying valves, smoothed and passed to the oscillator, a T.250 valve.

The Meissner circuit is employed and puts 1·8 amperes in the aerial at 94 metres with 250 watts input. The aerial at 5 N N is a 6 wire cage, 98 ft. long, 56 ft. high at one end and 38 ft. high at the lead-in end; a counterpoise consisting of 6 wires on 12 ft. spreaders directly underneath the aerial and 12 ft. above the ground. The receiving earth consists of an old aerial buried 18 in. deep in moist soil.

A STRAIGHTFORWARD CRYSTAL SET.

A CONSTRUCTIONAL ARTICLE FOR BEGINNERS.

By A. B. WHITTAKER.

The crystal set described in the following article employs a tapped inductance, and can be made by the novice with very little trouble or cost. This set has been tested and can be recommended to readers as a very reliable instrument.

THOUGH crystal receiving sets bear very considerable resemblance to each other, there are nevertheless many methods by which tuning is effected, and in the receiver to be described we employ what is known as a tapped inductance.

The meaning of this term is that by means of tapping certain of the turns of the inductance coil it is possible to use as many turns as are wanted, cutting the unwanted turns out of the circuit.

The best arrangement permitting this condition is a "units" and "tens" system whereby any one turn may be added or deducted from any other number of turns within the total possible; the exact performances of this arrangement will be described in full when dealing with the operation of the receiver.

The receiver with loading coil as used for long wave-lengths

Necessary Components.

The components and materials embodied in the receiver under description, and seen in the photographs, are as follow:

1 Ebonite panel measuring 9 in. × 5¾ in. × ¼ in.
17 Contact studs.
4 Stop pins.
1 Cardboard former measuring 4 in. long × 4 in. diameter.
½ lb. No. 20 S.W.G. D.C.C. (double cotton covered) wire.
2 Laminated switch arms with knobs.
1 Crystal cup.
4 Terminals.
1 Fixed condenser of ·0002 mfd. capacity.
Small quantity of tinned copper wire for connecting purposes.
1 Containing box to fit panel and 4½ in. deep.

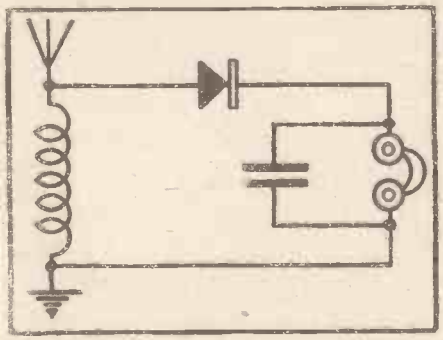


Fig. 1.

Winding the Coil.

The aerial tuning inductance consists of 69 turns of No. 20 S.W.G. D.C.C. wire, wound upon the 4-in. × 4-in. cardboard former, the first nine turns being tapped at every turn, the remaining 60 being tapped at every tenth turn.

Before commencing the winding the cardboard should be gently baked in an oven to drive out any moisture there may be within its composition, and when thoroughly dry should be immersed in melted paraffin wax to render it waterproof.

To commence the winding, bore two small holes about ¼ in. along the former, and thread the free end of the wire through until there is about 6 in. free for making connections. Pull the wire tight, when it will be found to be sufficiently secure to prevent slipping. Now wind upon the former ten complete turns, taking care in so doing that the former is turned so as to "take up" the wire instead of passing the wire over the former in a manner similar to winding cotton upon a reel, as this latter method will cause the wire to twist and kink. With the complete turns satisfactorily wound, make the first tapping. This is accomplished by holding the turns under the thumb of the left hand to prevent unravelling, and making in the spare wire, with the right hand, a loop of 6 in., and twisting it until the loop is sufficiently tight to prevent the wound turns from becoming loose.

Ebonite Should be Matted.

With the first tapping finished, wind in the same direction a further ten turns, and make the next tapping; wind a further ten turns, and then a tapping, a further ten turns and another tapping, and so on until six tappings have been made. At this stage we have a total number of 60 turns, and are ready to commence with the single turns.

Wind upon the former one complete turn and make a tapping; wind another turn with a further tapping; still another turn followed by another tapping, and so on until nine tappings have been made, making in all a total of 70 turns. The finish of the coil is secured in the same way as is the beginning of the winding, namely, by threading the wire through the two small holes bored in the former, not forgetting to leave sufficiently free wire for connecting purposes.

The dimensions of the panel, together with the lay-out, are given in Fig. 3. After all the drill holes have been made the panel should be treated to a very thorough rubbing with smooth emery paper in order to remove any conductive matter there may be adhering to the glossy surface.

Certain manufacturers are marketing a specially finished ebonite which has a highly polished surface guaranteed to be non-conductive, and in cases where purchasers are assured that the material is of this type the removing of the surface skin is not in any way necessary.

A theoretical form of the circuit used in the receiver is given in Fig. 1, whilst the actual circuit used is given in Fig. 2. It will be seen that at the points X and Y provision is made for the incorporation of a loading coil, thus permitting, when desired, the reception of the long wave-lengths; for the reception of short wave-lengths the points X and Y are short-circuited by means of a short-circuiting plug or piece of wire.

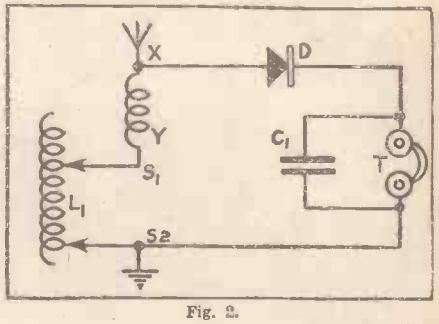


Fig. 2.

The photograph of the complete receiver shows the loading coil in position, ready for the reception of long wave-lengths.

The first operation towards assembling the receiver is the securing into position on the panel of the 17 contact studs, the four stop pins, and two switch arms. Before fixing the former upon the panel, however, make all soldered connections to the studs so that the maximum amount of freedom may be enjoyed, the length of the tappings affording easy access.

The Connections.

The simplest method of doing this is to begin with the single turn tappings by connecting that end of the coil which constituted the end of the winding to the first stud of the ten intended for single-turn tappings—that is, the first on the right-hand side, and numbered 0 in Fig. 4.

(*Continued on page* 886.)

A STRAIGHTFORWARD CRYSTAL SET.

(*Continued from page 885.*)

The first single turn tapping is connected to the second stud of the same series, the second tapping to the third stud, and so on until the ninth tapping is connected to the tenth stud. The last *single*-turn tapping is connected to the last stud of the tenth turn tapping series numbered 0 in Fig. 4. The next, a tenth tapping is connected to the next stud of the same series, the continuation of the winding connected in a similar manner until the end of the coil reaches the seventh stud number 60.

Tuning the Receiver.

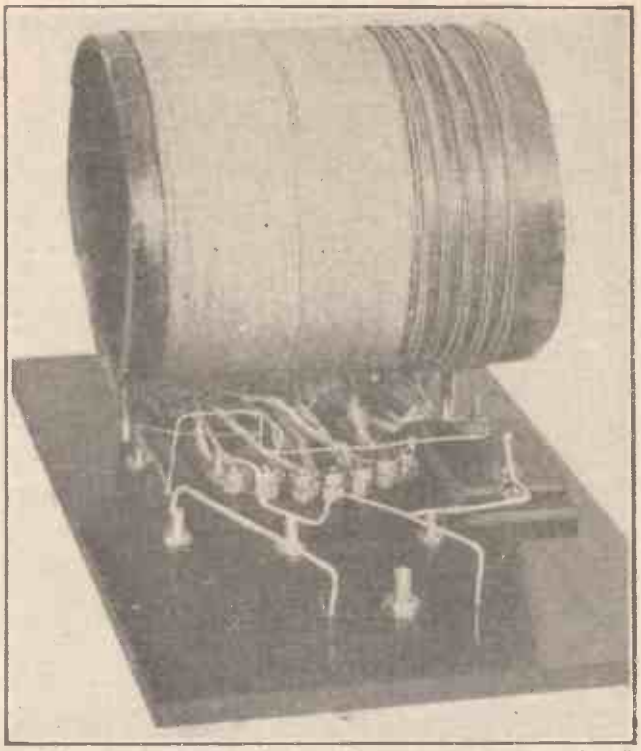
The disposition of the various components may be gathered from the photographs and also from the panel layout and wiring diagram. The actual connections are made in compliance with the latter, and should be soldered for the best results.

The switch S1 controlling the single-turn tappings is connected to one side of the loading coil Y. The aerial terminal A is connected to the other side of the loading coil X.

The switch S2 controlling the tenth turn tappings is connected to the earth terminal in order that with the large end of the inductance on this side no unduly large number of unwanted turns may be on the aerial end of the inductance.

The tuning of this receiver is accomplished by adjusting the two switch arms until the proper number of turns of the inductance form the aerial-earth circuit, the number of turns required being dependent upon the wave-length used by the station it is desired to receive.

If the desired station has a wave-length of not more than 600 metres the coil socket XY should be short-circuited and the switch controlling the large tappings should be first placed on the second stud, whilst the single-turn switch should be on the first stud. With the switches in this position the number of turns in circuit is eleven, and subject to no signals being heard with the switches so placed, the single turns should be added one by one.



This photograph clearly shows the " tens " tappings and the position of the coil.

In the event of 19 turns being reached and there still being no audible signals, then the single-turn switch should be turned back to the first stud whilst the tenth turn tapping switch is advanced to the first stud, thus putting 21 turns in circuit. If signals are still inaudible, advance the single-turn switch as before, following, if necessary, with a further advancement of the switch S2 until the desired station is obtained. In this manner the whole range of the coil may be covered, commencing with eleven turns and completing with 70.

Loading-coils.

In the event of the desired station using a wave-length higher than 600 metres, remove the short-circuiting device from across X and Y, and insert a coil of a size suitable for the wave-length of the station required. With this done, all further operations are precisely the same as when X and Y are short-circuited, and, as explained in the previous paragraph, suitable plug-in coils for long wave-lengths and for use with this receiver are as follow:

Aircraft ..	.. .. ..	No. 100
New Station	1,600 metres	No. 100 or 150
Eiffel Tower	(Time Signals)	No. 250 or 300

The receiver as illustrated and described has been used with very good success up to distances of 15 miles with an outdoor aerial, and eight miles with an indoor aerial. Its effective range may, in the case of ordinary broadcasting be taken as being 20 miles or so, using the average amateur aerial.

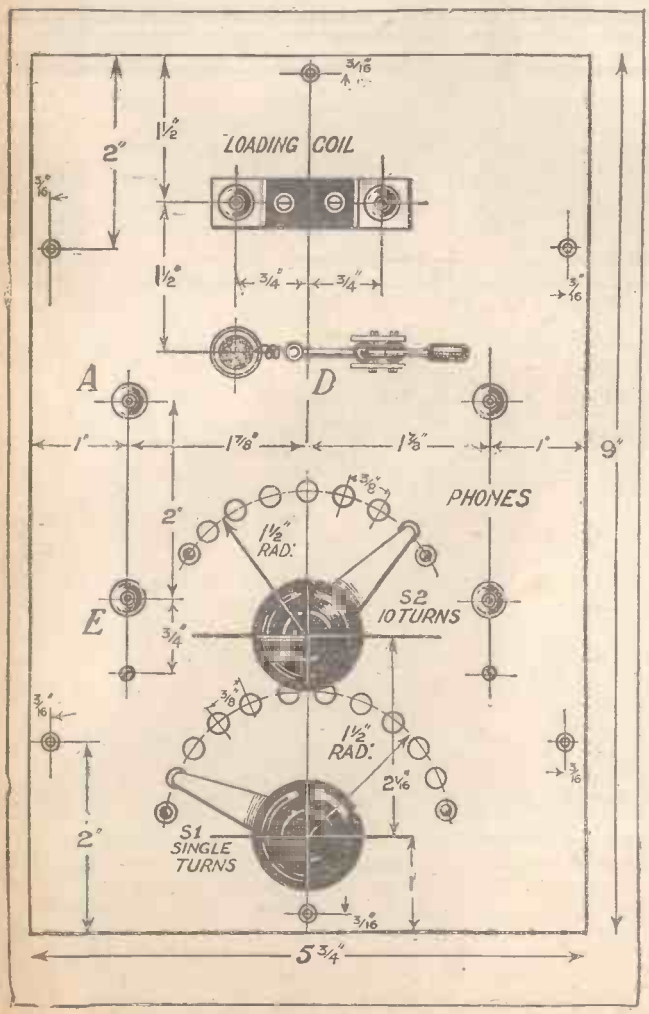


Fig. 3

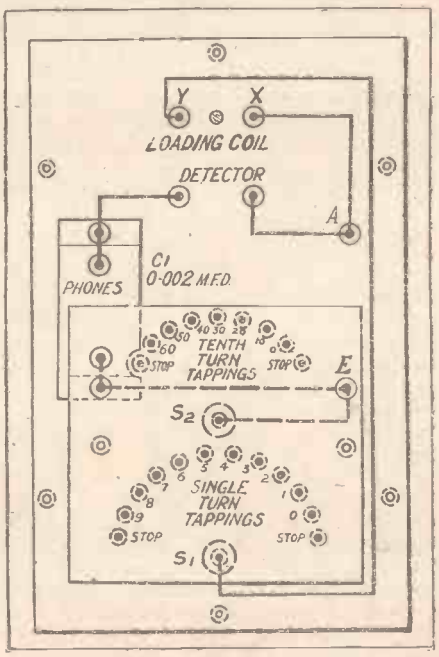


Fig. 4.

Christmas Radio Presents

THE Christmas present problem is beginning to loom up, and every day it grows bigger and bigger. Careful, methodical people will by now have their "lists" arranged in skeleton form and settled their Christmas quarter debts in preparation for the great "hardy annual" which, imbued as it is with sterling traditional sentiments, reminds us that it is "better to give than to receive." Others, less wise, will postpone their shopping activities until the very last moment, join the huge crowds which storm all the shops on Christmas Eve, and endeavour to illustrate "the survival of the fittest."

Choosing presents is not an easy matter, and considerable tact and careful observation is necessary in order to avoid the evil of "duplication." Then, again, there is the question of suitability; and one does like a present to be really appreciated. And that brings me to the *raison d'être* of this article.

Mr. G. V. Dowding, Technical Editor of POPULAR WIRELESS, has specially written this article for the benefit of readers who contemplate the purchase of Radio Presents. Although many wireless firms are mentioned in the article, it must be understood that Mr. Dowding does not specifically advise readers to deal with them only. There are dozens of excellent firms not mentioned owing to pressure on our space, and readers are invited to pay very careful attention to the advertisements appearing in this special issue.

The Editor.

Gifts That Do Not Last.

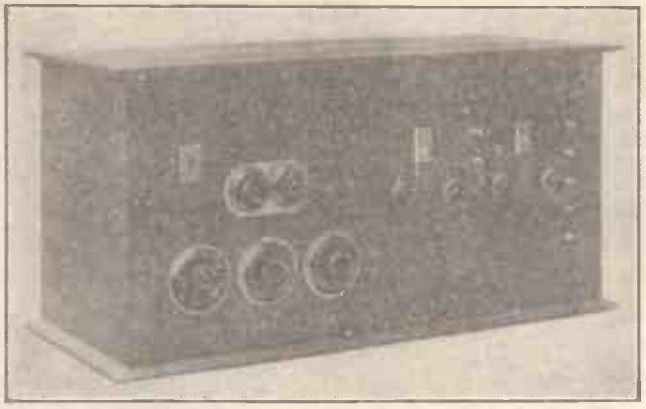
Wireless, or rather broadcasting, is now a national institution, shared and, in varying degrees, enjoyed by all. A home without a wireless set is not complete these days, and none will realise this fact more than those who have joined the ranks of listeners during the past two years. We may have our grumbles, possibly there may be a "little too much education," "a slight excess of the high or low-brow element," etc.; but, then, it is a Britisher's privilege to grumble. I wonder, anyway, how many "listener grumblers" have dismantled their aerials? Therefore, to get back to Christmas presents, we have in the radio stores a vast range of potential gifts, each of which possesses more power of giving pleasure than a whole shopful of anything else.

A pair of slippers will wear out; a piece of jewellery gives but passing pleasure; but the humblest little crystal set ever made is a key to a little door which gives access to a vast chamber replete with thousands of mystery parcels—one for every day of every year, and each filled with its own particular "surprise."

Buying a Crystal Set.

Some may, of course, prefer a "larger door" in the shape of a valve set and loud speaker, apparatus which, if more expensive, is equally more social; but if you know of someone who would like to hear "this wireless," and your pocket is not deep, I assure you a crystal set will be appreciated. As a matter of fact, thousands of listeners would not welcome a newcomer to replace their treasured crystal, and whether this is the case or not must be discreetly ascertained. Of course, one can ask right out what presents are expected or which would be most appreciated, but in most cases this tends to embarrass the contemplated recipients. Would they all submit lists headed, say, with an eight-valve "Super Het." and tailing down to a piece of "Wonderite" crystal, it would be easy to adjust matters to suit both sides; but although this scheme works admirably with the kiddies, it is not a practical proposition with older folk.

Where funds are limited and wireless has not arrived, or where a crude home-made crystal set provides but shaky wireless fare, a nice little crystal receiver makes an admirable present, whether it be given to one of the elders or to one of the older kiddies. There are dozens of different makes on the market at prices to suit everyone. Gamages' are selling quite an efficient little set known as the "Brownie" at 7/6 the set alone, or complete with 'phones, aerial, etc., at 24/-.



If you are going to build a set as a present for a friend, bear in mind that neatness is just as essential as efficiency. The above set, made by Mr. J. Wardle, of 7, Empress Drive, Barrow-in-Furness, is an excellent example of fine finish and good workmanship.

Then there is the Ediswan crystal set which retails at 17/6, or, if 5 X X is required, at £1 10s. 2d. While the "Sparta," which is made by Fuller's, of Sparta Loud Speaker fame, costs 21/-, and is provided with special loading attachments for the high-power station. Of course, it is no use buying a crystal set for anyone residing outside the "crystal range" of a receiving station. This is one of the little points which must be considered before "making the plunge." Higher up the financial scale there is an even larger range of excellent crystal sets to choose from. A "Vennophone" at 35/- is quite a good investment. The "Cosmos" (Metropolitan-Vickers) at 30/-, the Curtiss' "Silver Ghost" 30/-, "Gecophone" 50/-, R.I. 42/-, Siemens' 45/-, Western Electric 30/-, Sterling 75/-, B.T-H. "Radiola" 75/-, are each and every one worthy of serious consideration.

It must be remembered, however, that to give a crystal set without 'phones to a not over-rich friend or relation is like giving a dog a bone in an iron-barred cage. Telephone receivers, by the way, can form a most useful and acceptable present. Although "he" or "she" may possess two pairs, they will not look askance at a third.

A More Difficult Proposition.

Of telephone receivers there are many makes, and any of those which are better known and which are manufactured by reputable firms can be purchased without fear that they will prove insensitive or provide harsh reproduction. We have actually tested all the following ourselves, and can recommend them all to our Christmas-present buyers. Brandes' "Matched Tone" 25/-, B.T-H. 25/-, Fellowes' 18/6, Ericsson's 26/6, Brown's "Featherweight" 25/-, Sterling 25/-, Ediswan 24/-, Siemens' 25/-, Western Electric 25/-, T.M.C. 22/6, Gecophone 25/-. All these prices are for receivers having a total resistance of 4,000 ohms, which is perhaps the most suitable value of all for possessors of either crystal or valve sets.

A chance remark, or it may be of course a hint, sometimes gives the clue as to outstanding requirements. One of the most frequent, at least in the former category, is to the effect, "I *do* enjoy the wireless, but, of course, it isn't very loud."

Now, in a case such as this, a valve amplifying panel, together, if possible, with batteries and valve, will be very much appreciated. Here the field of choice is by no means limited, and, without accessories, one can pay anything from about two to seven pounds for a one-valve panel of this nature.

More limitless still is the range of complete valve receivers, and prices vary enormously with type and make. The question of accessories, too, must be given very careful attention, as these can, in cases, represent a greater financial outlay than the actual set itself. Again, the question of bright and dull emitter valves must be considered, as obviously accumulator charging is in some circumstances a problem difficult to solve. In fact, if a valve set is to be given as a Christmas present, I consider it is almost essential to consult the contemplated recipient.

(*Continued on page* 888.)

CHRISTMAS RADIO PRESENTS.

(*Continued from page 887.*)

Many mistakes are made in the bestowal of presents, and a mistake in the giving of a valve set is a more or less expensive one and is liable to prove harassing on both sides. To give a maiden aunt in the country a reflex set is not only foolish but absolutely criminal (analogy—giving a dog a live bomb to play with). One must consider the "wireless peace" above all things!

Anyway, having considered all possibilities, including the capabilities, of both the set and the "human element," one can go ahead and choose the model. As a rough guide—nothing more can be given within the limits of one article—I will detail just a few of the better-known makes and their prices, all of which are more or less safe investments. Radio Instruments, one-valve £5 18s. 6d., two £14 18s. 6d., three £21 15s., four £26; Sterling Instruments, £7 7s., £9 9s., £15 15s., £21; Gecophone, £5 17s., £7 10s., £15 3s., five valves (no four-valve models being quoted) £31. Then there is a "Chakaphone" four-valve set with all accessories at £26 11s. 9d.; Cosmos (Metropolitan-Vickers) four valves at £32 10s. without accessories; "Dorco" two valves at £2 19s. 6d. A.J.S. receivers, excellent throughout, from £12 to £27 ordinary types, or the more ambitious four-valve cabinets with loud speaker combined at £52 10s.

Sure To Be Appreciated.

As already indicated, it must not be imagined for an instant that the above makes represent the only apparatus worth buying. They are quoted as typical examples, and there are, of course, many other well-made and efficient instruments on the market. This applies to all the items mentioned in this article.

A very pleasing gift to the possessor of a valve set is that of a good loud speaker. Messrs. Graham have an exhaustive series of Amplion models at prices varying from 25/- ("Dragonfly") up to £14 10s. for the Concert Grand; while other makes include the Gecophone, A.J.S., T.M.C., Brandes', Ericsson's, Sterling, Fellowes', Siemens', Brown's, B.T-H., C.A.V., etc. We advise readers, if possible, to hear the chosen loud speaker in operation—although lamentably few wireless retailers arrange demonstrations—before making a purchase, as, although the majority of well-known makes leave little to be desired, there are many loud speakers on the market which, to say the least of it, were better silent, and which are the cause of great prejudice against loud speakers in general and drive thousands of potential possessors of "table-talkers" to a life of the "still small voice" of telephone receivers.

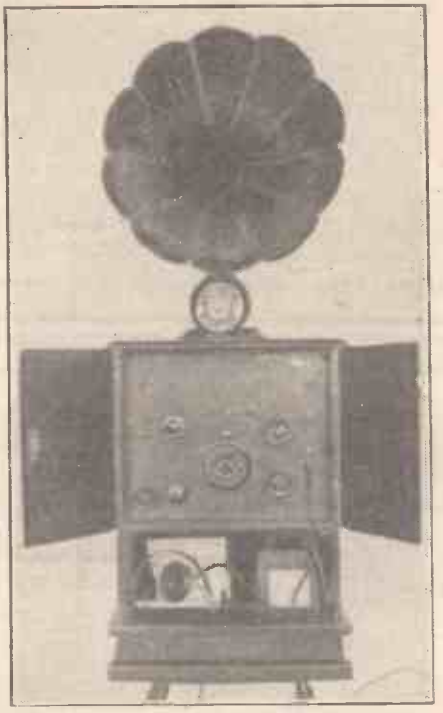
A very suitable present for a boy with mechanical inclinations is a complete set of parts for a wireless set, and many types of them at various prices are displayed in the wireless sections of such stores as Gamage's and Harrod's.

Wireless accessories, which term includes everything radio except the receiving sets themselves, afford an endless choice of suitable gifts for brother wireless amateurs or relatives and friends who already possess installations.

For instance, what would delight someone who possesses a set which includes two L.F. stages of amplification more than a B.T-H. dull emitter power valve for use in the last stage? Then, again, one who bemoans accumulator troubles would be overjoyed at receiving a complete set of dull emitter valves, or perhaps a new accumulator would be gratefully accepted. Just a little discreet "sounding" is needed.

The accidental burning out of a valve or valves near Christmas can be providential—to the seeker of suitable presents; and a timely replacement will render sincere appreciation a pleasing sequel to the bestowal of such a present.

Then, again, if funds are low or the sum reserved for a certain party's present is not great, one or two cheap but good



A 2-valve Unidyne made by Mr. P. Handley, "Winterdyne," Red Hill, Worcester.

components will prove money well spent on both sides if the choice of such is made carefully. Tact here is necessary, for although, for instance, Lissen parts are excellent, it might not prove wise to present the very proud owner of a "junk" set, which has received America, with one of their bright efficient little pieces of apparatus. It might cause misunderstanding.

Talking about accessories, the advertisements which appear weekly in "P.W." above the name of K. Raymond should appeal to the radio present-hunter as being of real assistance in his search. It is, indeed, a general catalogue of almost all the leading lines.

Always Useful.

In the case of the amateur who appears to have almost everything in his possession the choice becomes more difficult, but even here there are little refinements that will be appreciated. For instance, the square law condenser has only recently become really popular and there are but few who would not appreciate a Peto-Scott square law condenser, which only costs from 7/- or so, or a J.B. at about the same price.

Then there are innumerable gadgets such as Newey snap terminals, Climax "Sure Set" crystal detector, "Taggards," "Clix," Wates' "Dominoe" connectors, "Adico" battery boards, etc., which will give almost unexpected pleasure if bestowed with discretion.

Then there are coils. Very few amateurs or listeners whose sets employ plug-in coils possess a really comprehensive range of such, and one or two—"Igranic," "Atlas," Lissen or "Tangent" coils of tactfully chosen values—will always be received with genuine pleasure, more especially if shaky home-made coils are in use.

Suitable for Boys.

Again, a discreet glance at an aerial will reveal whether a length of, say, "Mars Aerial" wire would form a useful gift.

A really cheap gift to a young boy is a nice crystal detector such as is marketed by A. H. Hunt at 4/6, together with a piece of "Tungstalite," "Neutron," or other good crystal.

It should also be remembered at Christmas time that few wireless "fans" possess a superfluity of L.F. transformers, which, after all, are generally the most expensive components in "that new circuit," or in extending an existing "hook-up." Here, once more, is provided a really excellent selection of instruments of proved efficiency, including such well-known names as R.I., Ferranti, "Success," Lissen, "Eureka," etc. etc.

A Fallon variometer, too, can prove exceedingly useful and would seldom figure among the unused components of the recipient.

I notice Messrs. Oldham and Son, Ltd., are announcing a new portable and non-spillable accumulator for dull emitter valves, and the announcement of this is most timely, as, if such an item were given as a Christmas present, it would be a gift that would prove its intrinsic value over a period of long constant use.

Then there are books, which are unfailing "last resources" to all classes of despairing Christmas-present donors. The Editor's recently published book, "Broadcasting For Everyone," is a present which would prove interesting and useful to anyone who has the slightest interest in wireless, and might even produce recruits to the great pastime—hobby—science in bestowals on those who have hitherto refrained from participating.

To the constructor, one or two of the new Wireless Press "Ezi-Wiring" series would prove essentially useful.

Indeed, the choice of wireless Christmas presents is limitless, and without a little assistance such as I am able through circumstances to render, the reader who is not too well acquainted with wireless folk, and those who have inclinations to join the happy throng of nightly listeners, might be more confused than anything else with the extraordinary variety presented.

Finally, remember that a wireless present is a lasting present. Chocolates get eaten, gloves and slippers, etc., wear out, but a radio set or radio components are useful lasting reminders. Now get down to it and don't wait until the shops are crowded and the post is uncertain. Best Wishes and a Happy Radio Christmas.

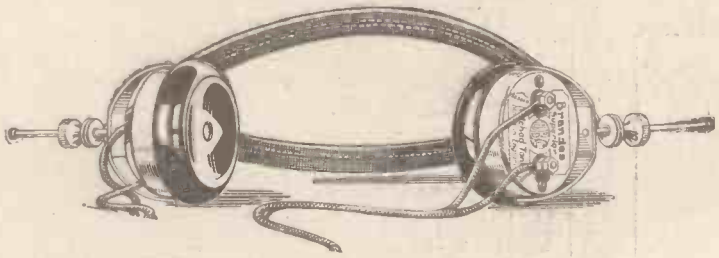
Tune the Table-Talker with the "Matched Tone" Headphones

The Brandes Family Series.

GRANDPA is well content with the comfortable companionship of the Brandes "*Matched Tone*" Headphones and their clear, full-blooded tone. He watches the joyful exuberance of the younger members of the Brandes family under the influence of the Savoy Orpheans in amusedly tolerant mood. The *Table-Talker* brings the rhythmical vigour of this famous dance band with intoxicating naturalness, and nothing loath, he will join in the frolic. They'l have a jolly time at Christmas. Amaryllis artfully defies him. Grandpa will then execute a gay *pas seul* with paper cap at rakish angle, to the intense amusement of all. He says he is as young as any of 'em.

Ask your Dealer for Brandes.

British Manufacture (B.B.C. Stamped).



All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This practically constitutes a free trial.

The "*Matched Tone*" feature was embodied as the distinctive characteristic of Brandes Headphones in 1908, and means that both your ears hear exactly the same sound at the same instant—and you learn a new beauty of tone. They are tested and re-tested for just this one vital point, and, in addition, their strength, long-wearing comfort and reliable efficiency make them undoubtedly superior **25/-**

The *Table-Talker* is a Brandes quality product at a moderate price. The non-resonant, specially constructed horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance and remarkable tone qualities. It is twenty-one inches high, and is finished a shade of neutral brown .. **42/-**

Crown Farm House,
Walton-on-Thames, Surrey.

Dear Sirs, 19/11/24.

It may interest you to know that I received Australia on your 'phones. I consider that they are the most sensitive 'phones that I have used, and I am much pleased with their general performance.

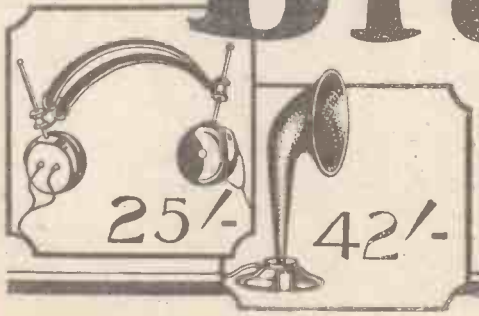
Yours faithfully (Sgd.) F. WALKER.

For Christmas!

An excellent family gift to the family. Club together and get yourselves Brandes Products for the receiver. They provide good fun during Christmas festivities, and all the year round.

Brandes

Result of 16 Years Experience



The name to know in Radio

B.T.H. Headphones

WE couldn't improve the technical qualities of B.T.H. Headphones. They were and are perfect in tone, clarity and volume. We have, however, embodied a great many constructional improvements in the latest pattern, which make it the most comfortable and convenient instrument of its kind. Here are some of the more important features of the new B.T.H. Headphones :—

Weight, with cord, only 9½ ozs.

No hair-catching projections.

No "scissors" movement of headbands.

Adjustable to any head by a single movement, without the manipulation of screws or nuts.

No screws or nuts employed in construction, and therefore nothing to work loose.

Minimum number of separate parts.

Body of ear-piece made of non-resonating material.

Diaphragm rigidly clamped around periphery between surfaces of non-resonating material.

Permanent magnets are really permanent and are not affected by lapse of time or external changes of polarity.

B.T.H. Headphones are unequalled for sensitiveness, volume, comfort and appearance.

Price 25/ per pair

(4000 *ohms.*)

Obtainable from all Electricians & Radio Dealers

Advertisement of The British Thomson-Houston Co. Ltd. Crown House, Aldwych, London, W.C 2

You can get the same long-distance results

Mr. L. V. Clark, of Experimental Station 5 B T Chiswick, reports receiving Brussels (200 miles) and Birmingham (125 miles) on a Neutron, without the aid of amplifiers.

Mr. C. S. Miller, Bellingham, S.E., receives Birmingham (125 miles) and Bournemouth (90 miles) on a Neutron without amplifiers.

"A.E.," Bakewell, receives Manchester (38 miles) on a Neutron plain crystal circuit.

"E. C. D.," York, received Chelmsford (160 miles) on a single slider crystal set with a Neutron.

"T. C.," Radcliffe, receives Liverpool (40 miles) on a cigar-box crystal set, with a Neutron.

If you follow these simple hints you can reach the same standard of efficiency, and can either bring in the distant stations, or (if a town-dweller) double the strength of reception from your near-by station.

The Aerial. Have a single-wire aerial for choice; stranded and enamelled wire, with leading-in wire of the same material is the best. Look to the insulation, and avoid running the leading-in wire too close to the wall. See that wet weather does not cause leakage from aerial to earth.

The Earth. Run a stout copper wire to a plate, buried in the earth, for preference. If connected to a water-pipe, run the wire downstairs and connect there if possible. Avoid gas-pipes, which have faulty connections. If you use a water-pipe use one that goes to earth, not to a cistern. Use an earth-clip.

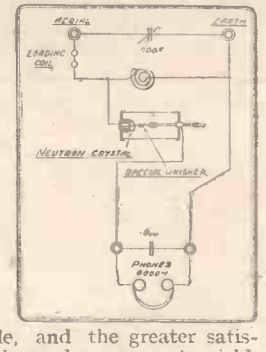
The Coil. Use 16-gauge wire, cotton-covered, straight-wound (on cardboard, not ebonite) or spider-wound. Use no shellac or wax. Variometers are often inefficient through damping when the coils are in opposition, and through capacity between the coils. Use a coil of nearly exact size, rather than a long-wave coil tapped. If you want long-wave stations, bring them in with a removable loading coil.

Variable Condensers. Avoid cheap composition end-plates. Ebonite for preference; or if metal-ended, see that the washers are ebonite and large in diameter. Use as small a condenser as possible, having the coil large enough to require only a small amount of condenser for tuning. Connect moving plates to earth end of coil.

The Detector. Enclosed type for preference. One that is not easily vibrated out of adjustment. Micrometer type, if possible. Neutron requires very light pressure. Ensure good contact between crystal and crystal-cup. Set in Woods' metal, or pack tight with tin-foil—not lead-foil.

The Phones. High-resistance (4,000 ohms). Be sure to obtain good leads. Poor reception is often due to faulty 'phone-leads. Don't remove ear-caps; they are often adjusted for maximum sensitiveness by the makers.

The Circuit, The circuit given here is not a freak circuit, but just a good standard circuit, exactly as used by Mr. L. V. Clark (see report above). Amateurs are advised to use the best materials throughout—the difference in price is only small compared with the freedom from trouble, and the greater satisfaction which good components yield.



and the Crystal: it must be—

NEUTRON

TRADE MARK

Concert Tested and Guaranteed.

A good aerial, heavy-gauge, efficiently-wound coils, minimum self-capacity—all these *count*; but most important of all is your Crystal. There are many efficient Crystals, but you may try *twenty* before you find a *good* one—unless you ask for NEUTRON, in the black-and-yellow tin. *If you take this precaution* you will undoubtedly secure a crystal that will give you full efficiency first time, requiring no "searching" for sensitive spots, and giving you continued joy in listening.

Stocked by the Best Radio Dealers. Packed in tin, with silver cats-whisker. Insist on Neutron, in the Black and Yellow Tin. **1/6**

Sole Distributors:—

V. Zeitlin & Sons,

144, Theobald's Rd., London, W.C.1. 'Phones: Museum 3795 & 6841. Produced by:—Neutron Ltd., Sicilian House, Southampton Row, London, W.C.1. 'Phone: Museum 2677.

E.W.B

WHICH VALVES SHALL I USE?

By E. J. WYBORN, A.C.G.I., B.Sc.

So many different types of valves are advertised these days that many amateurs find it difficult to memorise the special advantages of each type of valve. This article gives an admirable summary of this important subject, and will repay the reader for studying it closely.

THE newcomer to the world of wireless when he comes to choose the valves for his new set will certainly be considerably puzzled by the array of valves advertised by the different manufacturers. There are now over a dozen recognised valve manufacturers, each of whom turns out several types of valve, and as each manufacturer has his own system of nomenclature, the result is very puzzling for the novice and sometimes even for the more advanced worker. The situation is still further obscured by the fact that in some cases a particular valve is advertised by the makers as equally suitable for all purposes, whilst in other cases a valve is advertised as specially suitable for one particular duty only.

Whilst not pretending to be familiar with every valve on the market, the writer has used a sufficiently large variety to realise the great advantage which accrues to the experimenter who uses the most suitable valve for each particular purpose, and in these notes an attempt is made to classify the different valves and to assist the amateur in his choice.

To begin with, let us run through the characteristics of the general classes into which the different valves may be divided, starting with the older type, known as the "R" type. The Marconi "R" and "R5v," the Ediswan "A.R.," the B.T.H. "R," and the Mullard H.F., L.F., and R.A. valves, belong to this type, which is generally described as an all-purpose valve, unless otherwise specified by the maker. The filament is very similar to that of the ordinary metal filament electric lamp, and it is run at a bright incandescence in order to obtain a sufficient emission of electrons. The various valves of this type differ somewhat in such details as filament current, but they have the same general properties. The filament current is of the order of 0·6 ampere at 4 volts.

An Accumulator more satisfactory.

The next type of valve, and one which represents a considerable advance in valve manufacture, is that known as the "dull emitter," in which the tungsten filament is impregnated with thoria, or some kindred substance, the effect of which is to produce an emission of electrons at a much lower temperature, the filament being normally run at a dull incandescence.

The filament consumption of these valves, of which the Marconi D.E.R., Mullard L.F. Ora, and B.T.H. B.3, are typical, is considerably less than that of the R type, being generally of the order of 0·35 ampere at 1·8 volts. The life of these valves is generally three or four times as long as that of the R type, whilst their quietness and uniformity of operation make them very satisfactory to the experimenter.

They are naturally more expensive than the older bright emitter, but in most cases they are cheaper in the long run owing to their longer life and lower filament current consumption. It will be found that a 2-volt accumulator is the most satisfactory source of filament current for this type of valve, the current being too great for the economical use of a dry battery.

The Latest '06's.

Valves of the latest super dull-emitter type have now been on the market sufficiently long for their general satisfactory service to be established. They require the extremely low filament current of 0·06 ampere, at 2·4 to 3·0 volts, and are thus real dry-battery valves. The Marconi D.E.3, the B.T.H. B.5. the Mullard D.F. Ora, and the Ediswan A.R.O.6 are of this type. Of these four valves the Ediswan A.R.O.6 has the greater magnification, and is perhaps superior for H.F. amplification.

Its higher impedance, and low power-handling capacity, however, render it inferior to the D.E.3 and B.5 for low-frequency amplification. The low filament current of these valves is obtained by the use of a very thin thoriated filament, which is rendered possible by the introduction of an improved method of producing the very high vacuum which is, of course, essential for the operation of a thermionic valve.

Further New Types.

The thin filament renders the valves somewhat fragile, and they should be handled with care. For the isolated country experimenter, for whom accumulator charging is an expensive and troublesome business, the introduction of these valves was a great boon, but the town dweller who has easy access to charging facilities at a reasonable price will perhaps be well advised to keep to the older type of dull emitter with its longer life and greater robustness.

Another type of super dull emitter is that represented by the Cossor Wuncell, the Cosmos D.E.11, and Mullard Weco and 1-volt Ora valves, which take approximately a quarter of an ampere at one volt. This type has a shorter, thicker filament, and is somewhat more robust, although the higher filament current renders it a less satisfactory dry cell proposition.

Now let us consider briefly the most suitable valves for the different duties.

Making the elephant broadcast. "The Wireless Pram" can be seen in the background.

For the purpose of H.F. amplification a valve is required which, whilst having a good amplification, has a high impedance in the plate circuit in order to prevent too great a tendency to self-oscillation. For one or even two stages, valves of either the R, D.E.R., or D.E.3 classes are suitable; but when more than two stages of high-frequency amplification are employed, resort must be had to a special type of low-capacity valve such as the V.24, or its dull emitter counterpart, the D.E.V.

Low Capacity Valves.

In this type of valve the ordinary four-pin socket is abandoned, the filament connections being brought to small metal caps at the opposite ends of the bulb, whilst the grid and plate connections are on opposite sides of the bulb, the valve being held in four metal clips. By this form of construction the capacity between the grid and plate is considerably reduced, thus reducing the energy fed back from the plate to the grid, and consequently the tendency to go off into self-oscillation.

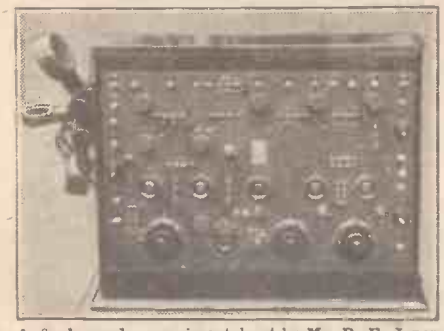
(*Continued on page* 894.)

WHICH VALVES SHALL I USE?

(*Continued from page* 893.)

For grid leak rectification almost any type of valve may be employed, so long as the grid is maintained positive, by connecting it to the positive filament lead. When little or no high-frequency amplification is used and the power to be handled by the rectifier is small, it is often advantageous to employ a "soft" valve—i.e. one from which the air has not been so thoroughly exhausted, as better rectification is thus obtained.

When it is desired to employ "anode" rectification, in which no grid leak and condenser are employed, and which depends



A finely made experimental set by Mr. R. E. Jones, 64, Bonner Road, Victoria Park, E. 2.

for its action entirely on the shape of the plate-current-grid-voltage curve, it is advantageous to use a special valve such as the D.E.Q., which has a sharp bend in the curve and a high magnification factor.

Suitable Valves for L.F. Work.

On the type of valve employed for low-frequency amplification, especially in the last stage, very often depends the good quality or otherwise of the reproduction. For the first stage almost any type of valve may be used, but for the subsequent stage or stages a type of valve which has a low anode impedance and greater power handling capacity should be employed.

The lower the impedance of a low-frequency amplifying valve, the better will be both the quality of reproduction and the amplification (if the amplification factor of the valve is the same). The older, bright emitter types of special low-frequency amplifying valves are the L.S.1, L.S.2, and L.S.3.

The last named is very similar to the R type, but the mesh of the grid is more open, and the impedance is thus lower, this being attained at the expense of a lower amplification factor. The Ediswan P.V.3, and Mullard P.A.3, are of this type. In the case of the L.S.1 and L.S.2 the lower impedance is obtained by the use of a greater filament current, 1·6 amperes at 6 volts.

The Ediswan P.V.1 and P.V.2 valves are similar to the L.S.1 and L.S.2. These valves have now been largely replaced by the new dull-emitter low-frequency power valves. For use with valves of the D.E.R. type, we have the D.E.5, which takes the same filament current as the D.E.R., and has somewhat similar characteristics to the L.S.3.

Where it is required to handle somewhat greater power, the D.E.5 is available, and this is perhaps the finest low-frequency amplification valve which has yet been produced at a moderate price. With an amplification factor of 7, and a very low impedance, it yet takes only 0·25 ampere filament current at 50 volts, and will handle all the power that most amateurs will require.

Dull Emitter Power Valves.

Where greater power still is required, the more expensive L.S.5 valve should be used.

The B.T.H. B4, and Mullard D.F.A.1, are very similar to the D.E.6. This type of valve is especially appropriate where a 6-volt accumulator is already in use. Where a 4-volt accumulator is installed, the D.E.4 class, which is very similar and which requires 3·8 volts on the filament, should be used. In the same class with this valve are the Mullard D.F.A.O. and D.F.A.2, the latter of which handles a little less power.

We will consider for a moment the most suitable valves to use in each stage of a four-valve receiver, one high-frequency, detector, and two low-frequency stages, as representing the most common arrangement for giving good volume from a loud speaker and at the same time reaching distant stations.

Comparing Running Cost.

If the older bright filament type is to be used, three R type and an L.S.3, the latter, of course, being in the last stage, are suitable. If it is desired to use more power than can be handled by the L.S.3, a D.E.4 or D.E.5 should be used, the former if a 4-volt accumulator is employed, and the latter with a 6-volt accumulator.

If the more economical D.E.R. type is favoured, three D.E.R. and one D.E.6 should be employed, a 2-volt accumulator being then used. If a D.E.4 or D.E.5 is fitted to handle more power, a 4 or 6-volt accumulator must, of course, be supplied.

For dry battery working an Ediswan A.R.O.6, for the high-frequency stage, and D.E.6's for detector and low-frequency are to be recommended. If it is desired to use more power than can be handled by a single D.E.3 valve, two such valves may be used in parallel in the last stage—i.e. with their grids and plates connected together, or a B.T.H. B.6 valve may be used.

The question of which class of valve to adopt, bright emitter, dull emitter, or super dull emitter, is one which depends largely on local conditions. The super dull emitter will naturally be chosen by those who live in districts where charging facilities are not available, but for the ordinary town dweller the problem resolves itself into one of lowest cost, and in the next column are given the respective costs per hour for running each of the three classes of valve.

BRIGHT EMITTER TYPE

Fil. current 0·6 amp. at 4 volts. Cost 12s. 6d. Life 1,000 hours.

Cost of current per hour.

A 40 ampere hour 6-volt accumulator would give $\frac{40}{0{\cdot}6} = 66\frac{2}{3}$ hours, and would cost say 2s. 6d. to charge.

$\therefore$ Cost per hour $= \frac{30}{66\frac{2}{3}} = 0{\cdot}45$d.

Depreciation cost per hour $= \frac{150}{1{,}000} =$ 0·15d.

Total running cost per hour = 0·6d.

DULL EMITTER TYPE

Fil. current 0·4 amp. at 1·8 volts. Cost 21s. Life say 2,000 hours.

Cost of current per hour.

A 40 ampere hour 2-volt accumulator would give $\frac{40}{0{\cdot}4} = 100$ hours, and would cost say 1s. to charge.

Cost per hour $= \frac{12}{100} = 0{\cdot}12$d.

Depreciation cost per hour $= \frac{252}{2{,}000} =$ 0·126d.

Total running cost per hour = 0·246d.

SUPER DULL EMITTER TYPE

Fil. current 0·06 amp. at 2·8 volts. Cost 25s. Life say 1,000 hours.

Cost of current per hour.

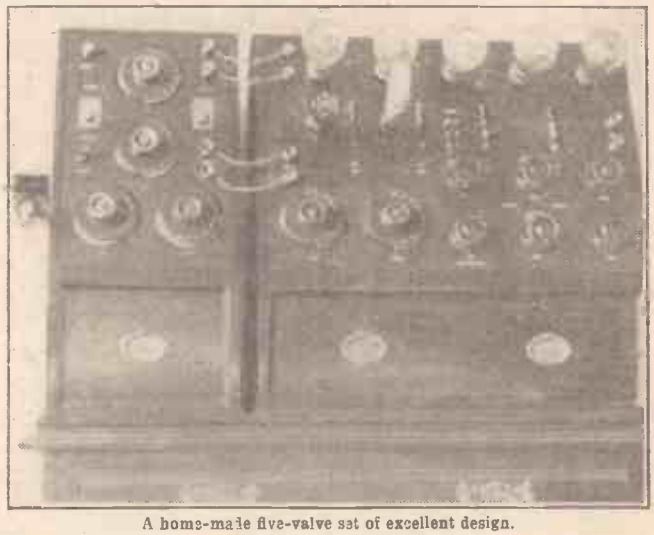
A 40 amp. hour 4-volt accumulator would give $\frac{40}{\cdot 06} = 666\frac{2}{3}$ hours, and would cost say 2s. to charge.

Cost per hour $= \frac{24}{666\frac{2}{3}} = \cdot 036$d.

Depreciation cost per hour $= \frac{25 \times 12}{1{,}000} =$ ·3d.

Total running cost per hour = ·336d.

This latter figure will be somewhat higher if a dry battery is used for filament lighting.



A home-made five-valve set of excellent design.

From these figures it would appear that for the town dweller the D.E.R. type of valve is the most economical in the generality of cases.

It should be remembered, however, that accumulators should not be allowed to run down to the limits of their capacity or sulphating will inevitably occur.

Mainly About Broadcasting

By The Editor

HEREWITH our Special Christmas Number—and I hope readers will agree that it is very good value for the money!

I should like to take this opportunity of thanking very heartily all the old friends who have stood by the paper, and have thus enabled us to publish such large issues at the low price of 3d. per copy. Without an extraordinarily fine circulation and the whole-hearted support of advertisers, it would not be possible to publish such large issues at such a low price.

But it seems that the fare provided for readers meets with general approval, and I hope each succeeding issue of POPULAR WIRELESS will continue to merit that approval and to provide larger and larger issues. The staff and myself wish our readers the very merriest and most prosperous of Christmases, and hope that many more records will still be broken by enthusiastic listeners-in, and that those who have not yet heard American, Australian and New Zealand stations will achieve their heart's desire this Christmas.

In this issue of POPULAR WIRELESS we again publish an exclusive article by an amateur who has set up another record for long-distance reception.

Mr. Ridley is a very well-known experimenter in the employ of the firm of Burndept Ltd. A few days ago it was announced in the Press that Mr. Ridley had received signals from Mexico, and I asked him to contribute an exclusive article to our Christmas Number, telling the story of his feat and advising amateurs on long-distance reception.

New Features.

Sir Oliver Lodge is another contributor to this special issue, whose article, I feel sure, readers will thoroughly appreciate. I specially asked Sir Oliver to contribute a non-technical article, and his timely and thoughtful essay, which appears on another page, merits the most careful reading.

For early future issues of POPULAR WIRELESS I have secured many fine constructional articles which will have a wide appeal. Rather than publish several constructional articles in one issue, I have decided to adopt the policy of publishing only one or two at a time. But these articles will be so clearly written and so well illustrated with diagrams and photographs that the amateur attempting to make a set from the instructions given cannot go wrong.

If any amateur reading POPULAR WIRELESS does not find the type of constructional article he is looking for, I hope he will drop me a line and let me know. Suggestions are of great value to an editor, and it is only by the friendly co-operation of his readers that he is able to supply the wants of the many.

At the time of going to Press the full results of International Radio Week are not yet known, but sufficient evidence is to hand to show that some very extraordinary results have been achieved. Successful reception of British stations is reported from many Canadian and American cities, and General Harbord, President of the Radio Corporation of America, declares his belief that an international system of radio communication will soon take definite shape.

Reception of American stations in England was, on the whole, rather disappointing. K D K A, the East Pittsburgh station, was, admittedly, relayed with considerable success by the B.B.C.; but reception with other American stations was not very successful. W G V, the Schenectady station, was received in this country with moderate volume, but B Y F, believed to be a British Naval station working on about 350 metres, spoiled reception rather badly. 6 L V, the Liverpool relay station, caused a lot of interference by testing while American experiments were being carried out.

Glasgow (5 S C) also took a lot of pains to impress on everybody that 5 S C was its call-sign and that "Glasgow on the Clyde, Scotland, was calling America."

MR. MARCONI AND THE "UNIDYNE."

To the Editor, POPULAR WIRELESS.

Dear Sir,—During my last experimental cruise on the yacht "Elettra," I had the opportunity of testing the "Unidyne" two-valve set loaned by you for that purpose.

I am glad to say that the little receiver worked well. It behaved quite normally as regards ease of tuning and selectivity, and I believe that the mechanical device employed to facilitate the fine adjustment of the reaction by means of which the first valve is easily brought almost to the oscillating point, is largely responsible for the sensitiveness observed.

Fairly good to weak telephony signal strength was obtained at distances varying from one hundred to six hundred miles, and compared favourably with the strength one would expect to obtain with two ordinary three-electrode valves using anode tension.

In the case of weak signals, the amplification obtained by the use of the second valve was normal, but rapidly decreased as the strength of signals increased.

This, I quite anticipated, as the power available from a four-electrode valve, used without an anode battery, is necessarily limited.

That an amplification can be obtained using these valves, without an anode battery, I have never doubted, but, as I pointed out at the time of my first statement on the "Unidyne," it is not an original idea.

Referring, for instance, to the article by H. Barkhausen, published as early as the year 1919, in the German technical paper "Der Jahrbuch der Drahtlosen Telegraphie," Vol. 14, book 1, you will find that on page 45 it is clearly stated that by using a four-electrode valve connected as in your "Unidyne" circuit, the plate tension is no longer essential.

In the same article you will also find clearly stated that it is possible to obtain the same output power with 10 volts anode tension, using a four-electrode valve, as would be available with 100 volts anode tension using an ordinary single-grid valve.

Conversely, that by using 100 volts anode tension on a two-grid valve, it is possble to obtain ten times the power output, which is about three times the amplification obtainable from a single-grid valve.

Bearing this in mind, I considered previously that double-grid valves, used without anode tension, were comparatively inefficient, and stated accordingly.

I admit, however, that the results obtained with your set have somewhat exceeded my expectations, and I must now say that, from the amateur's point of view, the "Unidyne" presents many interesting possibilities.

Yours faithfully,
(Signed) G. MARCONI.

Birmingham's announcement that it would transmit music from a "pneumatic gramophone" aroused a mild interest, but the result was not exactly startling. Manchester was very perky and played the American National Anthem and "Yankee Doodle" with great verve, adding somewhat unnecessarily, "for your benefit—America." Manchester was certainly optimistic when it called "Good morning, Europe" and "Good-night, America!"

"D X" Results.

I have had reports that Mr. F. R. Hoyt, a New York radio engineer, made a double-faced phonograph record from one of the transmissions from 2 L O, and Mr. F. B. Ostman, of California, reports that he received Aberdeen in sufficient strength to be heard 100 ft. from the loud speaker.

Continental stations, including Paris, Rome, Brussels and Madrid, were heard in various parts of America. American stations in Nebraska and in California report good reception from London, Glasgow, Aberdeen, Newcastle and Bournemouth.

Just before going to Press with this issue, I have received a letter from Mr. G. Marconi, who has just returned from an experimental cruise on his yacht "Elettra." His letter is in full on this page, and although it contains one or two reservations regarding the Unidyne, I think readers will agree that, on the whole, it is a very striking tribute to the efficiency of the set designed by Mr. Dowding and Mr. Rogers, which, as readers will remember, caused such a great controversy when details concerning it were first announced.

Can You Beat It?

A "Daily Mail" correspondent states that he has heard ten broadcasting stations in sixty seconds on a one-valve set, but this does not beat the record of Mr. Francis G. Highe, of King's Lynn, Norfolk, who recognised twelve stations in eighty seconds.

The new claim is from Dr. E. Reginald Dingle, of York Road, West Hartlepool. The ten stations, two unrecognised, tuned-in between 7.50 and 7.51 p.m. recently were:

Belfast—orchestra.
Foreign station—orchestra.
Glasgow—dance music.
Newcastle—orchestra.
Bournemouth—bass singing.
Manchester—soprano singing.
London—orchestra.
Aberdeen—man speaking.
Birmingham—chorus from "Elijah."
German station—opera.

No one seems to have beaten the plain crystal set achievement of Mr. W. H. Thomas, of the Swansea Radio Society, who heard Bournemouth, 110 miles away.

I am sure there must be readers of "P.W." who can beat the above results. Send along a letter and state *your* record for "quick change D X work."

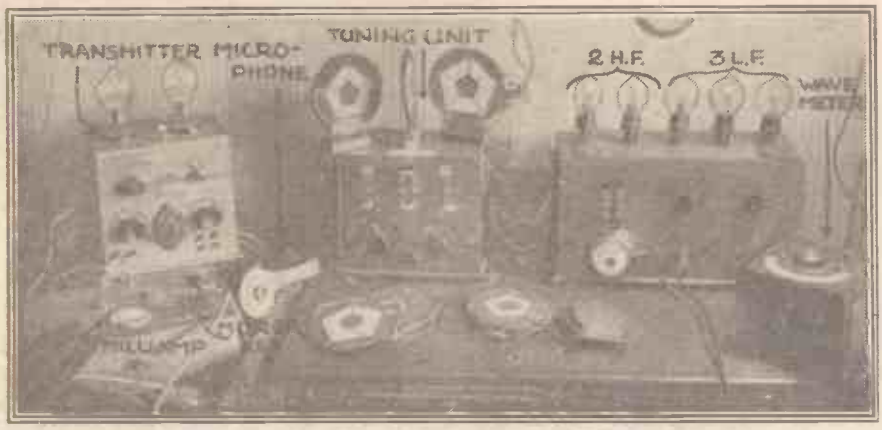
Technical Notes

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P.

Measuring the Earth.

AN interesting experiment is to be made, or rather begun, next month, by General Ferrie, the well-known French wireless expert, and chief of the French Army Wireless Department, in collaboration with experts of other countries. The object of the experiment is to discover whether certain suspected changes are taking place in the size and configuration of the earth.

This necessitates accurate measurements of the earth, and for this purpose it is now proposed to adopt wireless methods. Very careful readings will be taken and placed on record, and after the lapse of several years, similar measurements will again be taken. It is expected that any changes will be detectable in the interval.



Transmitter and Receiver belonging to the Belgian expert Professor Daismont.

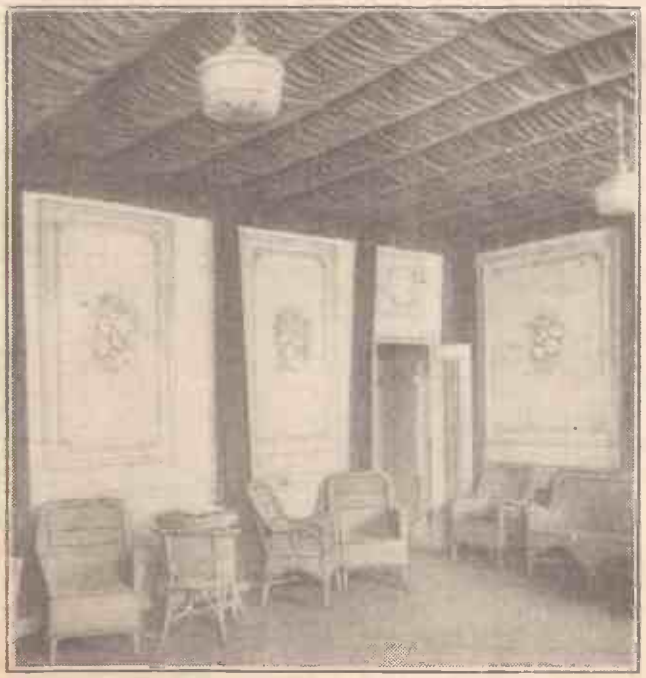
Improvised Electric-light Aerial.

I had a letter a few days ago from a reader who described a simple device which he adopted, in an emergency, for use as an aerial, and from which he says he got quite good results. Having just finished the wiring-up of his set in time for the programme, and having no regular aerial ready at the time, he pasted a strip of tinfoil round the glass bulb of an electric lamp, and attached a wire from this to the aerial terminal of the set.

He has since fitted up a proper aerial and obtained better results from it; but he states that the results from the aerial mentioned above were remarkably good. I do not think this device is original, as I seem to have seen drawings or descriptions of it before.

But as it is very easy to try, and in case it may not be well known, I pass it on. I should imagine it is the sort of thing which might work very well in certain cases and not at all in others, so the experiences of different individuals may vary very considerably.

It is well known, for example, that the Ducon aerial sometimes functions well at the first shot, and sometimes requires quite a deal of trial and error work before it gives its maximum efficiency.



The Studio at the La Presse Station, Montreal.

High-Frequency Transformers.

Iron cored high-frequency transformers seem to be an innovation, but a patent application for transformers of this kind has recently been made in this country by an American firm of wireless manufacturers. It is stated that in previous types of high-frequency transformers there are either considerable capacity effects or restricted coupling.

One of the drawings accompanying the patent specification shows a transformer with a core consisting of a number of strips of very thin enamelled sheet silicon steel, the windings being placed upon square-section formers sliding on the core. The coils are laid in separate grooves in the formers, in a well-known manner.

Variable Grid Leak.

A variable grid leak on a somewhat novel principle employs, as the essential element, a strip of rubber tape, or other extensible material, upon which graphite is rubbed so as to form a conducting surface. A strip of the rubber known as "aeroplane elastic" is useful for the purpose. The actual device is arranged in such a way that one end of the graphited rubber is attached to the end of a screw, operated through the panel by means of a knob at the front in the usual way, whilst the other end of the rubber is secured to a fixed support behind the panel, which may be a strip of brass attached to the back of the panel and bent twice at right angles.

As the control knob is turned, the rubber is stretched or released. When the rubber is stretched, the resistance is decreased. Care must be taken that the rubber is well graphited, or there may be a break in the continuity of the conducting layer when the strip is stretched.

Coke as Crystal.

A small fragment of coke interposed between the crystal and the cat's-whisker appears to offer little or no hindrance to the passage of signals. The coke probably acts by providing a large number of points of contact with the crystal, and if placed vertically above the crystal, it also has the effect of shielding the latter from dust. Some interesting experiments on these lines have been reported to me lately.

I have also been informed that if coke is impregnated with mercury, it serves well as a crystal itself. Without having tried it, I am not inclined to give much credence to this latter, however. For one thing, I do not quite see what is meant by "impregnating" coke with mercury. But if any readers can give me particulars of any experiments on this matter I shall, of course, be very pleased to have them.

Wireless Power Transmission.

The great success which has lately been attained in the transmission of wireless waves in a definite direction, or "beam" transmission as it is sometimes called, has revived the idea of transmitting large amounts of energy by the same method. One of the main difficulties is that whereas it is desirable, for the transmission of power, to employ long wave-lengths, 20,000 metres or more, it is just in this part of the wave-scale that the projection of the beam becomes difficult.

(*Continued on page* 958.)

ON BROADCASTING.

THE GREATEST MARVEL AND THE GROWING POWER OF THE HUMAN RACE.

By SIR OLIVER LODGE, D.Sc., F.R.S.
(*Scientific Adviser to "Popular Wireless."*)

The following non-technical article has been specially contributed to our Christmas Number. It is, in fact, a philosophical essay, and one which every wireless amateur—and, for that matter, every thinking man and woman—should read with care. The microphone and the telephone are wonderful instruments; but, as Sir Oliver Lodge remarks, the real miracle is, as always, the human ear and human eye, which are receiving instruments able to interpret mere vibrations or tremors into actual thought.

THE chief feature which distinguishes humanity from the rest of the animal creation is the power they have gradually acquired of communicating their experiences consciously and explicitly to each other and to subsequent generations. This is the basis of Education in its widest sense. Individuals are not limited to their own experience; they have the benefit of the accumulated experience of their fellows and of all past generations since the dawn of civilisation.

Some kind of race memory seems to exist among animals, too, but it is of a vague and indefinite and rather mysterious kind; and if it can be called communication at all, it must be of an entirely unconscious order. Mankind, however, is able to transmit, consciously, information and experience. Contemporary information is conveyed through the newspaper press; while historical and scientific information of the most varied and multifarious kind is contained in books: in other words the art of speech and the permanent record of speech enabled by printing render accessible more information than any one individual can hope to assimilate.

The Language Difficulty.

The educated man is one to whom all these resources are open; but the least laborious method of getting at it, to all except the serious student, is through the ear rather than the eye; in other words, most people prefer to learn by hearing rather than by reading. The living voice has a power of attracting attention more vivid than the pages of a book.

Unfortunately, humanity, having learnt to speak, was not satisfied with a single code or language; but each large community developed a language or code of its own, and accordingly much misunderstanding exists between different communities, since they cannot freely converse with each other, and this must have been, and still is, a fruitful cause of misunderstanding and disputes, and even of wars. This planet is not a very large one; and it may reasonably be hoped that at no distant future every part of humanity, every section of mankind, will have a better understanding of each other's outlook and aims and ambitions and hopes, through the medium of a common tongue; and every step that is taken towards intercommunion and the annihilation of distance must be of the utmost importance.

Already books can circulate all over the world, and by means of translation can be made accessible, even when their language is unknown. Moreover, the English-speaking race has spread over so great a part of the world that already the continents of America, Africa, and Australasia, and parts of Europe, are inhabited in great part by English-speaking people, and thus communities and families spread over an immense area have friends and relations with whom intercourse is not only a matter of political and social understanding, but can be of a personal and domestic and affectionate character also.

Interpreting Ether Waves.

The invention of the telegraph, and the laying down of cables, has, in the day and generation of many now living, come into active being, and has linked up the world in a way which was never experienced before. Not only information about the past is now accessible, but the living and daily experience of the present is also distributed to the ends of the earth.

Quite a short time ago the information so distributed was, however, only accessible by reading; the transmission was effected by expert operators, and then found its way into print. Now, however, in the memory of those still young, a still more rapid and efficient mode of contemporary intercourse has become possible.

The hearing of speech at one place is not limited to those within the reception of acoustic waves in the air; but means has been found of converting those sound waves into ether waves, which, though they do not produce any effect on the human organisms and by our unaided senses are inapprehensible, yet by the use of instruments of reconversion, the ether waves can be received and transmuted back into sound waves; so that that wonderful instrument the human ear can receive them when thus reconverted.

The human mind can thus interpret indirectly the ether waves, so as to extract from them information, in the same way as it used to interpret air waves in the case of the speech of neighbours and friends close at hand.

This is a step in advance, of the utmost importance, and the consequences of it we do not yet fully foresee. This new method of communication is still in its infancy, and how it will develop no man can certainly tell; but already we may reasonably look forward to the time when friends and relations in New Zealand will be able to communicate with those in the older countries, not through the medium of skilled operators and writing, but by direct speech. However that may be, we know already that the inhabitants of any one country can be linked together, irrespective of distance, in a way which was never before possible in the history of the world.

Receiving a broadcast concert in a coal mine.

(*Continued on page* 898.)

ON BROADCASTING.

(*Continued from page* 897.)

The extraordinary way in which the ether links up the worlds together, so that ether waves bring information about the physical and chemical constitution of distant stars, has been known for half a century, or to a minor degree for several centuries. The waves travel through the ether without loss, carrying their information with them, ready to be interpreted by any whose minds are open and who have the instruments necessary.

The Present Stage.

The conscious utilisation of ether waves is a modern and growing art, at first depending wholly on the human eye, enlarged and extended first by the telescope, and then by the spectroscope. Twenty or thirty years ago no other instrument seemed possible; light seemed the only method of inter-communication through the ether.

But the discoveries of Maxwell and Hertz made possible the artificial production of ether waves; and the discoveries of some still living made it possible to control and modify those waves, so that they should have any desired rate of vibration, and so that they should be made to correspond with the intricacies and peculiarities of the consonants and vowel sounds which are used in ordinary speech.

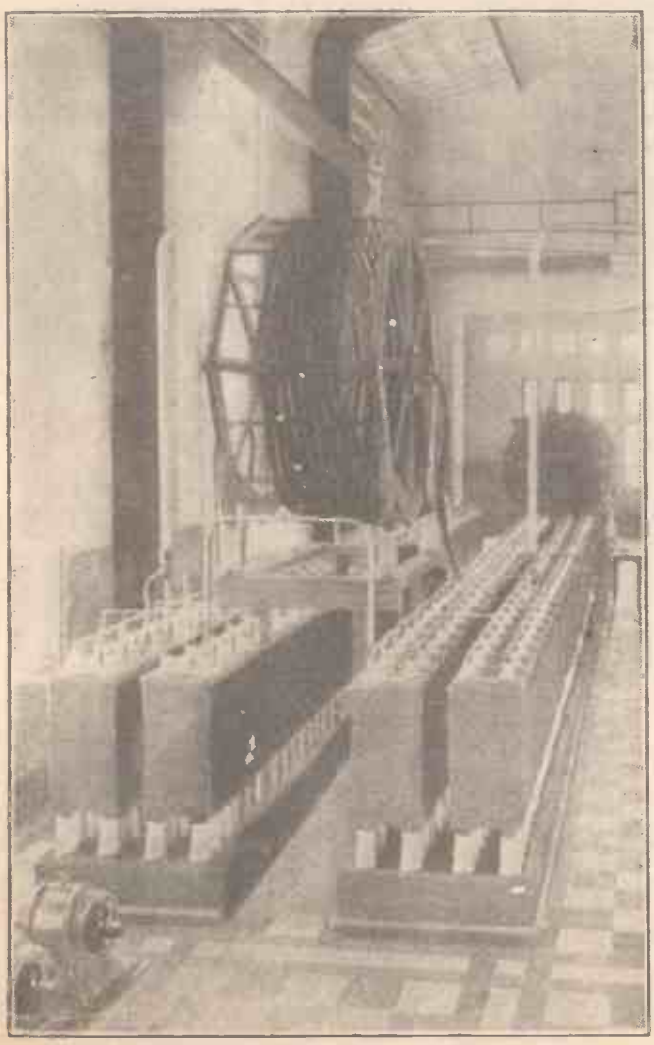
Thus the present stage has been reached:

(1) By discovering how to produce the waves;
(2) By discovering how to receive them;
(3) By discovering how to modify them; and
(4) By discovering how to receive the modifications in detail.

In these stages the invention of the telephone, one of the most remarkable inventions of last century, has played an extensive part. But the real miracle is, as always, the human ear and human eye; which are receiving instruments able to interpret mere vibrations or tremors into actual thought. Not that the instruments themselves affect the conversation; there is a step here which is really mysterious, and which we do not understand, namely, the way in which the physiological mechanism is able to affect the mind.

Getting Results

This is a mystery we have grown so accustomed to that we fail to realise the wonder of it. It is sometimes felt that wireless inter-communication itself is mysterious; but it is no more mysterious than any other method of communication: in common speech we utilise the vibrations of the air; in wireless speech we utilise the vibrations of the ether. The wonder is that we can utilise the vibrations at all; for that a thought can be conveyed from one mind to another by the motion and quivering of material particles is, or ought to be, astonishing.



The condenser banks at the Monte Grande Radio Station, Argentina.

This power, long possessed by the human race and utilised by them in a commonplace and customary manner, has now been extended. Some of the results we already begin to see. People living in remote country districts can now listen to the sound vibrations which are produced in any lecture or concert hall, and accordingly the entertainments of a town have become accessible to dwellers in remote valleys among the hills, or in the great plains of a continent. They know nothing about the sound vibrations, nor about the ether vibrations into and from which they have been converted; they get the results.

Hitherto life in the depths of the country has been felt by many to be isolated, dull, and monotonous; it ought not to be so, and would not be so if people were educated, so that they could appreciate the marvellous processes of Nature which are going on around them; they should be able to read and cultivate their minds even to greater advantage away from the distractions of a town; but for the majority of people that is too much to expect, and accordingly there was a tendency to flock to the towns and desert the country. There is some hope that that uneconomical and rather sad movement can now be stemmed. Every village can now be supplied with sufficient light to make the winter evenings tolerable, and can be provided with sufficient entertainment, through the labours of those who are producing and broadcasting speech and music.

The Greatest Marvel.

Poetry and Literature can be brought home to them in an easy way, and even scientific information can be imparted; so that their minds need no longer lie fallow and idle; they can have something to think about which will relieve the monotony, and cause them to take a rational interest in the universe and in the wonders of existence.

For existence itself is the greatest marvel. A study of the processes by which it is continued and adapted and beautified, and the attempt to apprehend the meaning of it all—problems which have long occupied the minds of philosophers and students—should be, in their respective and relative degree, a source of enjoyment and recreation and rational meditation to every human being.

It is easy to become supine, with mind closed to everything but material needs and comfort: it is easy, but it is unworthy; it is a reversion to the animal type. The animals must be mainly occupied with these things, but humanity should rise above them. Some outlook beyond seems possible even to the animals. What the lark means by his song we do not know; it seems to be an instinctive outpouring of joy in existence—a joy which too many of mankind have lost, but which must sooner or later be recovered.

A Worthier Object.

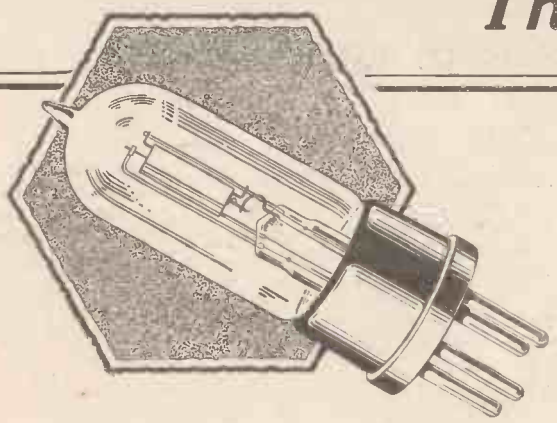
Sooner or later a greater number of mankind will be satisfied with a moderate attention only to material needs; they will feel that the cultivation of their souls is a worthier object; they will learn that they have an immortal existence which cannot be really satisfied except by those faculties and emotions which from time to time, in the higher members of the race, have called forth spontaneous expression of worship, and which should arouse in all rational beings the feelings of wonder, love, and praise.

SIR OLIVER LODGE'S WORKS.

Sir Oliver Lodge has written many books which will have a great appeal to the general reader. The Editor would like to recommend the following to his readers.

"Signalling Through Space Without Wires" (5/- net). "Pioneers of Science" (4/6 net). (Both obtainable from Cornish Bros., Birmingham.)
"The Survival of Man." (2/- net. Methuen).
"The Making of Man." (Hodder and Stoughton).

The New Valve



The "Cosmos" Type D.E 11 Dull Emitter Valve is the result of prolonged experiment and research. Thoroughly tested and tried out and manufactured commercially at their Cosmos Lamp Works at Brimsdown, the Metropolitan-Vickers Electrical Company, Limited, now confidently offer it to the public as being characteristically reliable and efficient.

COSMOS
D.E 11 VALVE

Here are Six Reasons why you should use this new "Dry Battery" valve:

1—The Filament "lights" off a single Dry Cell
2—It has a robust filament which is practically unbreakable ... ...
3—It has a remarkably long life, due to its platinum filament, heavily coated with active material ... ...
4—It is a highly sensitive valve for all reception purposes ... ...
5—It is an exceptionally good Amplifier, being capable of handling considerable output without distortion ... ...
6—It is the best "Dry Battery" Valve for Loud Speaker work ... ...

CHARACTERISTICS:
Low Capacity Cap . . .
Standard 4-pin Contacts
Filament Voltage 1·1 V.
Filament Current 0·25. A.
Anode Volts (Detector) 20-45 V.
Anode Volts (Amplifier) 40-100 V.
Amplification 6.5 . . .

PRICE:
25/-
from all Wireless Dealers

Ask your dealer for a copy of the leaflet P.P. 4117/3.

COSMOS
DULL EMITTER TYPE D.E 11 VALVE

The Valve that is "M" *"Crystal Clear."*

Advertisement of Metro-Vick Supplies Ltd., London.

R
Vo2

THE VALVE

Are you avoiding accident to your valves by using Mullard Safety Discs? Ask your dealer for them.

FOR XMAS VOLUME

WHY not have good dance music this Christmas? You will need increased volume and clarity from your loud speaker for the special festive broadcasting programmes.

THEN TAKE OUT YOUR LAST L.F. STAGE VALVE AND INSERT A MULLARD D.F.A.

You will be delighted with the immediate increase in the volume of your reception.

The special construction of these Master Valves gives powerful and pure amplification and yet requires LESS current than your present valves.

Ask for a MULLARD D.F.A.0 if you use a 4-volt battery — price 30/- each.

Ask for a MULLARD D.F.A.1 if you use a 6-volt battery — price 35/- each

Leaflet V.A.4. gives full information.

Mullard

THE · MASTER · VALVE

(P.W.)

Advt.: THE MULLARD RADIO VALVE CO., LTD., NIGHTINGALE WORKS, BALHAM, S.W.12.

THE MUSIC HALLS AND BROADCASTING.

SIR OSWALD STOLL'S VIEWS.

"NO SURRENDER."

"Ariel" recently interviewed Sir Oswald Stoll, the Managing Director of the Coliseum Syndicate and the greatest entertainment magnate in the country. The views expressed by Sir Oswald, as published below, are not necessarily the views of "Popular Wireless." An invitation has been extended to the Managing Director of the B.B.C. to reply in our columns to Sir Oswald Stoll.—[Editor.]

EVERY listener-in knows that the music-halls and the theatres have never really come to an understanding with the B.B.C. for the purpose of mutual co-operation, and it was with the intention of getting the latest ideas as to the position now existing between the music-halls and the B.B.C. that I recently called upon Sir Oswald Stoll, the managing director of the Coliseum Syndicate, in order to obtain his views on this important question.

The first question I put to Sir Oswald was as follows: "Have you changed your opinion about broadcasting since I saw you last?"

"No," replied Sir Oswald, "my opinion remains the same, although I have gained more knowledge of the attractions of broadcasting and now know more about their programmes. But I am still of the opinion that broadcasting is a serious and dangerous competitor to the legitimate music-hall entertainment industry.

"But," added Sir Oswald, "I thought the controversy on this subject was dead and done with a long time ago."

"No," I said, "the controversy is still in existence, and will be, I suppose, until one side gives in. It is either for you and your associates to welcome broadcasting or for the B.B.C. to give up broadcasting entertainment and devote themselves to educational and news propaganda. It is hardly likely this will ever happen, so it would seem that the next move must come from the entertainment industry."

Sir Oswald smiled.

Satisfying Everybody.

"My colleagues and I," he said, "will not, under present conditions, give in. We are ready and willing to broadcast on our own account when the broadcasting monopoly is annulled. Have you ever thought the matter out in a fair and unbiased fashion? Forget, for one moment, the marvellous invention of wireless and the scientific novelty side of broadcasting and go direct to the programme quarter and the entertainment side first of all," continued Sir Oswald, "and I will give my case for my profession, and then you can defend the case for broadcasting.

"I represent a gigantic entertaining industry. I have under my direction leading specialists and experts in the various branches of the music-hall industry. I have singers, musicians, dancers, and other artistes—hundreds of people, working not for me, but for the public; and we cater and satisfy every class of the public from the gallery to the boxes.

"Every day we do this, and it may or may not surprise you to know that we have regular audiences. My managers recognise hundreds of patrons who are weekly visitors to the various music-halls under my direction. We are willing to broadcast to those audiences, but we are not prepared to have those audiences, or any part of them, filched from us by a broadcasting monopoly.

No Malice.

"Now, my experience of the public and the entertainment industry is of long standing, and dates considerably before wireless began in this country, or, for that matter, before you were born. The variety entertainment is the oldest means of amusement in the country. Now, in the case of broadcasting, we cannot expect any of its members to have any experience in comparison to ours, and we are certainly not out to help them. No, we are not out to lift one finger to assist them. Not because

Sir Oswald Stoll.

we bear malice. Oh, no! But because the Postmaster-General has that power to give the B.B.C. a monopoly, and by a monopoly I mean the freedom of the air.

"Furthermore, it appears, the B.B.C. may broadcast news, music, talks, lectures, etc., without any real official censure or censor; they may broadcast when they like and practically what they like, excepting one or two minor cases. But, excepting for these unimportant restrictions, they do what they like.

"But with us in the entertainment industry we have to consider what we may put before our public, and we have to work under the very strict supervision of the L.C.C. and the Lord Chamberlain. We do not want our entertainments confused with anything and everything open to the Broadcasting Monopoly."

"But, Sir Oswald," I said, "broadcasting has not the advantage you have. You possess the leading artistes by agreement, and the B.B.C. have to seek artistes who are not under agreement—a very different matter."

"Quite," answered Sir Oswald. "In fact, that is one of the points I rejoice in—the fact that artistes under agreement with the music-halls are not allowed to broadcast. As a matter of fact, many prominent theatrical and music-hall artistes do not want to broadcast, because by broadcasting the show is finished in one night, whereas in our case it takes some time—often weeks and weeks—to cater for the public. And, of course, during that time it means employment and money far in excess of what the B.B.C. are prepared to offer. If we are permitted to broadcast on our own account we can adapt ourselves more easily to these inevitable consequences."

"Reasonable Competition."

I then asked Sir Oswald Stoll what programmes he might consider suitable for broadcasting, if by any chance he was to occupy the position of Director of Programmes for the B.B.C.

Said Sir Oswald: "Your question is ridiculous; I shall never be in such a position. But if the freedom of the ether were given to artistes and competition was allowed in broadcasting, I should be the first to urge all the entertainment associations and societies to form a company and erect a station, and then we should broadcast programmes which, from experience, we know would please everyone.

"And we would not say to our critics that we regret any item which has displeased anyone or offer the excuse of catering to the majority; we should not need to do so."

"Supposing," I said, "the monopoly was broken. What would the effect be other than improvement in the programmes?"

"I should get the best brains and the best technical skill," said Sir Oswald Stoll, "and I should carry out a broadcasting scheme on very different lines. It stands to reason," he concluded, "that reasonable competition is the greatest thing for improvement and development. Competition as regulated by sound economics is healthy, and this sort of competition would do the Broadcasting Company a world of good."

THE YEAR'S RADIO PROGRESS.

IMPROVEMENTS AND INVENTIONS OF INTEREST.

By SEXTON O'CONNOR.

Valve Improvements.

DURING the past twelve months an amazing amount of inventive genius has been brought to bear on the problem of improving the thermionic valve. In some cases the result is a more complicated appliance than before. For instance, in one new type of valve there are four plates, the electron stream being forced by an external magnetic field to pass over each plate in rapid succession. This is intended to allow four different signals to be received simultaneously, and should prove useful in catering for mixed "highbrow" and "jazz" tastes on the family receiver.

Attempts are also being made to obtain improved results (*a*) by the use of special radio-active or photo-electric materials for the grid and plate elements; (*b*) by so shaping these elements that a more complete control of the electron stream is secured as between filament and plate; and (*c*) by employing filaments of higher emissivity at lower temperatures than any at present in use on the so-called dull-emitter tubes.

Valve Substitutes.

This brings us to another class of invention, in which the object is not to improve the valve, but to find an effective substitute for it. The most promising of the various efforts in this direction appears to be the colloid amplifier, which consists of a solution or "suspension" of finely divided silver, arsenic, and certain other metals.

It has long been known that in such metallic colloids the individual particles show rapid and irregular movements when examined under the microscope. This "Brownian movement" is due to electronic charges on the particles, created in some manner not as yet thoroughly understood. Professor Nienhold and others have recently demonstrated that two electrodes immersed in a colloidal solution, and connected across a high-tension battery of 150 volts, will not only rectify but also amplify wireless signals. The chief drawback, at present, to the practical use of such "cold valves" is that their sensitivity falls off considerably after they have been in use for some time.

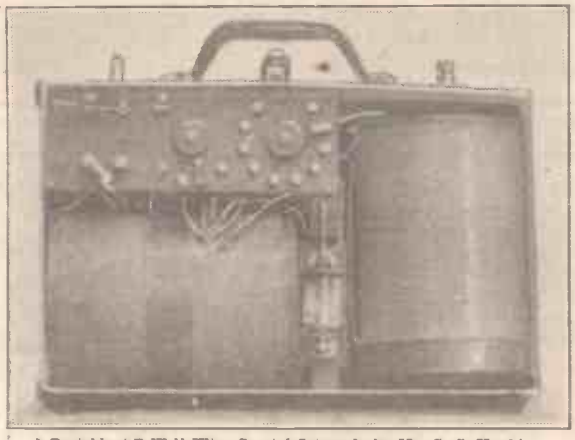
Various Accessories.

A third class of inventor is apparently prepared to accept the present type of valve, much as it is, but is anxious either to simplify its operation, or else to protect it against the ordinary vicissitudes of use. A notable example of this type of improvement is the Unidyne circuit, so well-known to readers of POPULAR WIRELESS. In this circuit, not only is a troublesome accessory eliminated in the shape of the H.T. battery, but all risk of burning out the filament is avoided, thus killing two birds with one stone.

Other methods of minimising the risk of burning out comprise the use of various safeguards such as high-resistance fuses, cut-outs, and even relays, inserted between the H.T. battery and the filament. One inventor, presumably pessimistic from sad experience, mounts several filaments in parallel on the same valve, so that should an inexperienced beginner persist in getting across the H.T., he has only to "switch on" the next spare filament in succession, and all is well!

Crystals.

Turning next to crystal reception, the most interesting feature in this direction is to be found in the recent discovery by M. Lossev that an ordinary crystal can be caused to generate sustained oscillations when set up in a simple circuit in series with a dry-cell battery of twenty volts and a high resistance. This amazing result has since been verified by other independent workers, so that it should be only a matter of a few months before the crystal amplifier will be seen in active competition with the valve.



A Portable "P.W." Ultra Crystal Set made by Mr. G. C. Hopkins, 35, Oakley Road, Redditch.

As regards reception generally, certain designers are specialising on the problem of preventing interference caused by self-oscillating valve sets. Now that the broadcast regulations no longer forbid the use of reaction direct on the aerial, it is felt that some means should be devised which will positively prevent the inexperienced operator from annoying his neighbours.

One ingenious solution is to so wind and mount the grid, aerial, and plate coils that the two latter are mutually at right-angles, thus preventing any transfer of energy to the aerial from the valve even when the valve is oscillating violently. In another method, the connections between the valve and aerial are so arranged that any oscillations set up in the plate circuit of the valve are fed to the aerial through two parallel paths which mutually oppose each other and cancel out in the aerial circuit. The aerial accordingly remains undisturbed by any local oscillations existing in the valve itself.

In yet another design of receiver the high-frequency coils are all mounted in a separate compartment from the main casing. Two or more separable compartments are provided if it is desired to cover a wide range of wavelengths, but in each unit the disposition and size of the various coils is such that it is impossible to set up self-oscillation, no matter what extent of "condenser swinging" is indulged in.

Uni-Control Sets.

Special attention has been given to the design of "uni-control" sets in which several tuned circuits are controlled simultaneously from one tuning knob, either by using more or less elaborate barrel-switches, or by rigidly connecting the various condensers and variometers to a common spindle. In the latter case, the inductance value is generally varied by the so-called "spade" tuning, wherein a metal sheet is moved towards or from the coil windings.

Wired-Wireless Broadcasting.

An interesting extension of the ordinary Broadcasting system is being developed, more particularly in America and Germany, but also to some extent in this country, in the form of wired wireless. It is intended for use in large towns where an extensive network of electric supply mains is available.

High-frequency signalling currents, carrying music, speech, etc., are superposed upon the normal power supply carried by the mains, and are separated out at each house by means of suitable filter circuits. The presence of the power currents does not affect the clearness and purity of the high-frequency signals, whilst the receiver and 'phones are carefully safeguarded from the high voltage on the mains.

The main advantages of this system of broadcast distribution are: (1) the power necessary to give clear reception over the supply wires on the cheapest form of receiver (e.g. crystal) is much less than that necessary to cover the same distance by radiation; and (2) it is possible to superimpose on the same wire at least four different programmes simultaneously, and to separate these out clearly and separately at the receiving end, so that a subscriber can at any time select the particular programme that appeals most to him; further, he can switch over from one programme to another at will, without trouble or delay.

Reflex and Triplex Circuits.

In reflex circuits an interesting development is the Grimes "inverse" method of feed-back. Instead of feeding the low-frequency currents through a series of amplifying valves in the same sequence as the high-frequencies, the Grimes circuit is arranged to reverse this usual procedure, so that if the order of the valves is 1, 2, 3 for the incoming signals, the rectified currents are passed back for a second amplification in the order 3, 2, 1, thus equalising the load on each individual valve.

An ingenious method of causing a valve to act as a triple amplifier has recently been evolved in connection with supersonic receivers. Here there are three frequencies present, viz., the signal frequency, the supersonic frequency, and the rectified or audible frequency. By means of a somewhat elaborate arrangement of filter circuits, each of these frequencies is passed in succession through the same valve, which therefore acts as a triplex amplifier.

Misdirected Energy!

Blissfully unconscious of its futility, he pipes manfully away—perhaps inwardly reflecting upon the lack of results obtained.

Many Wireless enthusiasts provide equally pointed examples of misdirected energy. Whilst devoting much of their time to the study of radio, they fail to realise the primary importance of carefully choosing the Wireless literature best suited to their needs. Actually their ultimate success depends upon the books which guide them.

Books issued by the Wireless Press are entirely dependable. They are written by men who have years of experimental work to their credit—men who know the troubles most likely to beset the amateur. Here are just a few W.P.-books which should be on every amateur's book-shelf.

THE WIRELESS PRESS, LIMITED,
12-13, Henrietta St., Strand, London, W.C.2.

Explanatory Books.

"Your First Steps in Wireless."—By *Hugh S. Pocock.* **9d.**

"Captain Eckersley Explains—A Reply to His Numerous Correspondents."—By *Captain P. P. Eckersley.* **2/-.**

"Uncle Jack Frost's Wireless Yarns on Good Reception and How to Get It."—By *Captain C. C. J. Frost.* **2/-.**

"The A B C of Wireless and How to Manage your Broadcast Receiver."—By *Percy W. Harris.* **1/6.**

"The Wireless Telephone: What it is and How it Works."—By *P. R. Coursey.* **2/6** cloth, **2/-** paper covers.

"Wireless Telephony—A Simplified Explanation."—By *R. D. Bangay.* **2/6.**

"The Elementary Principles of Wireless Telegraphy."—By *R. D. Bangay.* 2 parts, **4/-** each. One vol. **7/6.**

"Morse Code Card." **2d.**

"Morse Made Easy." By *A. L. Rye.* **3d.**

"The Perry Auto-Time Morse System."—By *F. W. Perry.* **6d.**

"Dictionary of Technical Terms used in Wireless."—By *H. Ward.* **2/6.**

Home Constructional Books.

"Crystal Receivers for Broadcast Reception."—By *P. W. Harris.* **1/6.**

"How to Build Amateur Valve Stations."—By *P. R. Coursey.* **1/6.**

"Practical Wireless Sets for All-Home Construction Made Easy."—By *Percy W. Harris.* **1/6.**

"Construction of Amateur Valve Stations."—By *A. L. M. Douglas.* **1/6.**

"The Home Constructor's Wireless Guide."—By *W. James.* **3/6.**

"Mast and Aerial Construction for Amateurs."—By *F. J. Ainsley.* **1/6.**

He was distinctly annoyed!

His pal had told him how easy it was to build a set and now look at the mess he was in—couldn't ma e head or tail of the connections. The trouble was he hadn't gone the right way about it—neglected the most important point. He'd omitted to ask for the "EZI-WIRING" Series. He hadn't realised that these books, with their simple wiring diagrams in FOUR COLOURS and easy explanations, were just the thing for the man who knew nothing about Wireless.

4-Valve Combination Set (EZI-WIRING SERIES No. 4. By W. JAMES).

A four-valve receiver of this type is ideal for general reception both with telephones and a loud speaker. Switches are provided so that two, three or four valves may be used at will. An entirely new principle is used to cut out the H.F. valve, no switches being employed. Loud Speaker results from most of the British and Continental Broadcasting Stations can be obtained with this receiver.

The "EZI-WIRING" SERIES also includes:—

No. 1. 3-Valve Portable Receiver, by Hugh S. Pocock.

No. 2. 3-Valve Receiver, by F. H. Haynes.

No. 3. 2-Valve and Crystal Reflex Receiver, by W. James.

2/- each. Postage 2d.

Complete with ***4-colour wiring diagrams***, detailed measurements and explanations as to components, progressive diagrams and plates, showing the set in various positions, with disposition of components and full instructions on operation. No loose sheets.

Ask your Bookseller or Wireless Dealer to show you the "EZI-WIRING" Series, and see for yourself how simple and interesting Home Construction really is by this new system.

THE W.P. EZI-WIRING

MORE ABOUT THE "TRIPLE DUAL."

THREE VALVES, EACH DOING DOUBLE WORK.

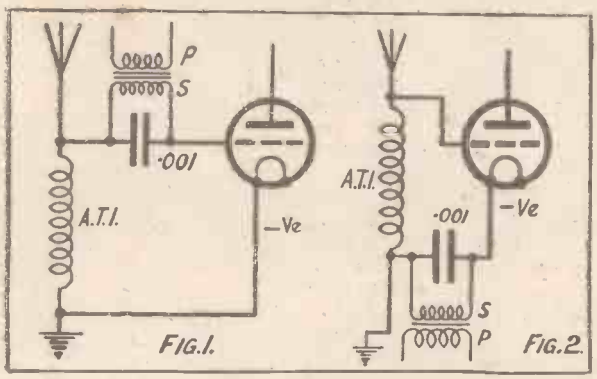
By JAMES MacINTOSH.

This receiver was described by the author in a previous issue of "P.W.," and in this article he supplies further interesting data concerning its theory and operation. For the benefit of new readers two of the most important diagrams are reproduced. The information supplied by Mr. MacIntosh will prove invaluable to all who are interested in reflex receivers.

SINCE writing the original article the following notes have been gathered together, and may be of interest—and possibly help—to the experimenter in reflex sets. Much of the data is, of course, applicable to "Straight" Sets.

As some difference in opinion exists as to the most efficient connection to employ when using a reflex transformer in the grid circuit of a valve directly connected to the aerial circuit, the four best-known methods are given in Figs 1 to 4.

The A.T.I. is shown untuned.



The Fig. 1 method, which is many years old (the writer used it in 1916, and which is due to Round), works quite well, but capacity effects tend to be troublesome. Also, the position of the Secondary of the transformer is undesirable from a technical point of view.

The Circuits' Capabilities.

Fig. 3 method (I believe Voigt originated it) is very good, but when experimented with in the Triple Dual set the first valve evinced a decided tendency to oscillate.

Fig. 4 method—although very noisy when induction is present—works well. This was evolved by Scott-Taggart. The reader will have already observed that the writer uses the method shown in Fig. 2 (Stanley or Franklin).

Lengthy experiments were carried out, and it was decided to adopt the Fig. 2 method. When tested on an outside aerial, and on a frame with earth lead, the Fig. 2 method gave an increase of signal strength over the Fig. 4 method. When no earth is used on the frame aerial the methods Figs. 2 and 4 become common, and are identical.

On one occasion, a slight howling, which was experienced using method Fig. 4, was cured by reverting to Fig. 2. It must be understood, of course, that both L.T. and H.T. batteries should be well insulated from earth. This applies to the crystal battery, if one be used. Correct spacing of components (especially L.F., Telephone, and H.F. transformers), low-capacity wiring, and good insulation are the chief secrets of successful reflex working.

No mention has been made as to the reception on the higher wave-lengths, but the Triple Dual has been tuned up to 5,000 metres. M S K (Moscow) comes in well, Morse usually readable on loud speaker.

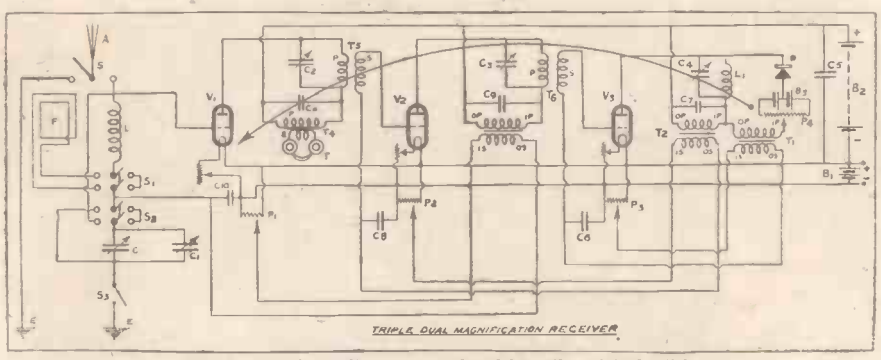


Fig. 1a. A circuit diagram reproduced from the original article.

Eiffel Tower (F L) telephony quite loud, and Morse from both this station and P O Z readable on loud speaker many yards away. F L Morse has been received R 4 to R 5 on set alone—no aerial, no earth. All things considered, however, the set functions best on the B.B.C. band and on 600 metres.

For reception on 100 metres, the circuit shown in Fig. 5 has been used successfully to log K D K A (102 metres) and W G Y (107 metres) at good strength. The reflex transformer is omitted for simplicity.

The A.T.I., L, consists of ten turns of No. 19 S.W.G. D.C.C. wire, wound on a 3-inch diameter former, with a centre tap, as shown. A condenser C of ·0001 mfd. capacity is connected in series with the aerial. This arrangement tends to make the aerial aperiodic over the band of wave-lengths covered by the circuit L C 1. C 1 may be of ·0005 mfd. capacity; actually the writer used a ·001 mfd. condenser with vernier, although this is not recommended. A vernier is almost essential, one of 3 or 5 plates will suit.

The size of L will vary slightly with different aerials. For 100 metres reception, possibly the number of turns on L could be increased if a very "low-minimum" condenser C 1 were used. The method of winding the A.T.I. is shown in Fig. 6.

Suitable H.F. Transformers.

Looking at the diagram, the wire is wound (starting from the socket connection) in a *clockwise direction*, in cylindrical fashion and *away from* the winder. This ensures that the coil has the same connections and mode of winding as adopted in other short-wave coils.

The position of the tapping need not necessarily be in the centre—including a greater or lesser number of turns of L in the aerial circuit could be experimented with.

A suitable H.F. transformer for about 100 metres can be made by winding 12½ turns of 30 S.W.G. D.S.C. wire on a 2-inch diameter former (actually a "Butler's") to form the primary winding, and an equal number of turns for the secondary. If a smaller diameter former be used—a Sullivan's has 1⅛ inch slot—a greater number of turns could be used. I would suggest about 18 to 20 turns P. and S.

For B.B.C. wave-lengths, an efficient transformer can be made up by winding 70½ turns Primary, 80½ turns Secondary of 30 S.W.G. D.S.C. wire on a Sullivan's former. The connections should be as already given, but I find that, owing to a mistake in winding by the manufacturers, the winding in the previous diagram should have been made to run anti-clock-

(*Continued on page* 908.)

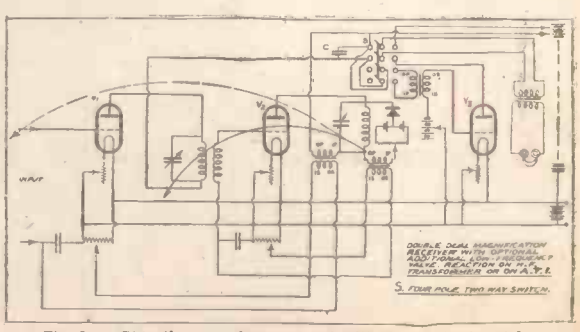


Fig. 2a. This diagram also appeared with the original article.

MORE ABOUT THE TRIPLE DUAL

(*Continued from page 907.*)

wise looking at pins of transformer—not clockwise, as shown.

However, there is no difference whatsoever in the results given by the different methods of winding, as the connections of the P and S in each case are the same—*relative to each other.* When using Sullivan's transformers, therefore, the connections to the reaction coil should be reversed to obtain correct reaction effect. When tested on W G Y, 107 metres, and using a 1.V.O. set, the H.F. transformers wound by the writer gave as good results as did tuned-anode coupling in the same receiver.

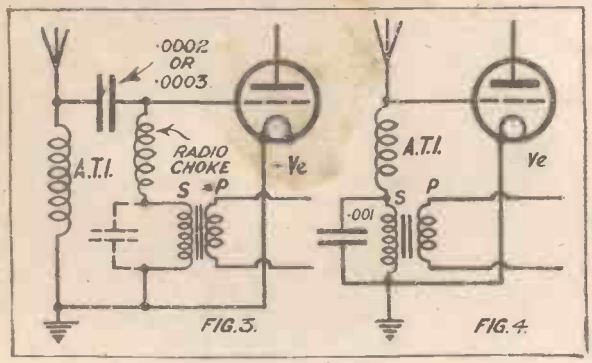


FIG. 3. FIG. 4.

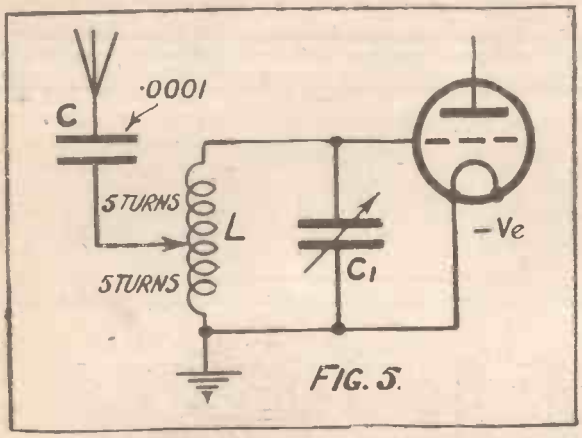


FIG. 5.

The Use of Grid Bias.

In my previous article no mention was made of using grid bias on either set. To get the best results, however, this is essential. With the Fig. 1 circuit (herewith reproduced, and which is figurised as Fig. 1a in this article) a grid battery of 4½ v. should be inserted between the arm of P1 and IS of T3: the negative pole being connected to IS, thus imposing a negative bias on the grid of V1. A variation of grid potential can be given by P1. The above voltage is suitable for D E R valves, with arm of P1 about centre, and a high-tension voltage of 80 100 v. A separate H.T. tapping should be used for V1. V3 does not require grid bias—other than that imposed by P3, when arm is at negative end—and applying additional grid bias to V2 results in howling.

The normal position of the arms of P2 and P3 should be as near the Ve ends as possible. I would suggest a D.E. 6 valve in position of V1—I hope to try these valves shortly—with either D E R's or A R D E's in other positions. I have had an opportunity for trying bright emitters, but results were very disappointing, and not comparable with the results obtained from the dull emitters! I say this because other experimenters may experience the same thing.

In the two sets Figs. 1a and 2a loose-coupled H.F. transformers may be used; in this case the Secondary coils should be tuned. If the two coils forming the H.F. transformer are tightly coupled together, signal strength is about as good as when plug-in transformers are used; loosening the coupling results in increased selectivity, but a most decided loss of signal strength.

During experiments, the following additions or alterations have been tried:

With Set Fig. 1a:
- Additional H.F. valve: worked fairly well.
- Additional L.F. valve: noisy, but workable.

And Set Fig. 2a:
- One or two additional H.F. valves: worked well.
- Additional L.F. valve: noisy (as above).

Loose-coupled aerial circuits have been tried, but are certainly not worth the extra tuning involved, when a frame or selective "loop" is available.

The actual signal strength obtainable from the set shown in Fig. 1a is equal to about 3 c 2. A straight set, employing 6 valves and a crystal (3 c 3) gave, as was expected, a much greater volume. It is a popular fallacy that a "dual" valve gives the output of two separate valves. This is not so, and it should not be expected. Some of the H.F. current is almost bound to be "lost" through the damping, capacity effects, etc., caused by introducing the reflex transformers. Similarly, the L.F. current possibly suffers also.

An amplification of about "one-and-a-half" valves—if I am permitted the phrase—should be obtained from each "dual valve" when working well. A valve rectifier has been tried in place of the crystal and found quite stable provided the reaction coil was untuned. Schematic arrangement shown in Fig. 7.

The H.F. impulses are represented by the dotted lines, the L.F. by the unbroken lines. V1, V2, and V3 are dual amplifiers, V4 being the rectifier. It should be noted that the "inverse" method of "reflexing" is decidedly advantageous.

With the "triple-dual" set an attempt was made to feed the rectified impulses from the crystal to the grid of V1 and thence to V2 and V3, the telephones being in the anode circuit of V3. The first and second stages of L.F. amplification were obtained fairly successfully, but the third stage introduced howling, which could not be eliminated without a great reduction in signal strength.

Aerial Connections Experiments.

In my previous article an "earth-lead aerial" was mentioned. This was obtained by disconnecting and earthing the usual outdoor aerial, leaving the earth lead on its appropriate terminal. Tuning is done in the usual manner, but reaction and critical adjustments are necessary. This is a good test of the sensitivity of any set. Attaching the earth wire to the aerial terminal, with the aerial disconnected (and earthed to prevent any possible transference of energy), yields stronger signals than the previous arrangement, although the latter is not so stable with reflex receivers, possibly owing to the batteries being, so to speak, "in the air."

With the earth-lead on its own terminal, on September 18, 1924, speech from Hamburg (392 metres) came in about R3, and with the earth on the aerial terminal, between the wave-lengths of 385 metres and 500 metres; 6 B M, Hamburg, 5 N O, 5 S C, 2 B E, 2 B D, and two unidentified German stations were all read at fair 'phone strength. Without either aerial or earth (the set is on ground level) Hamburg speech was about R2-3 (*i.e.*, most of the speech could just be understood).

Useful for "D.F." Work.

In this case, the tuning was very sharp and critical. Experimenters who have been used to tuning three circuits should have little difficulty in mastering the four tunings necessary. The writer has had a fair experience in "direction finding" work, and one of the sets he has worked utilised an indoor frame aerial—three tunings and the adjustment of two couplings being necessary.

As the "work" consisted in logging bearings on, and intercepting messages

(*Continued on page 909.*)

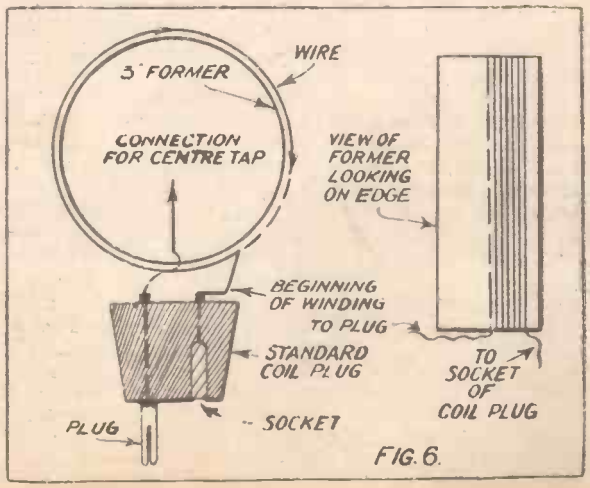


FIG. 6.

MORE ABOUT THE "TRIPLE DUAL."

(*Continued from page 908.*)

from enemy stations, it will be realised that speed and extreme accuracy were essential to good results. Some readers may recognise an old member of "No. 2, G.H.Q., W.O.G.," and, I am sure, will bear me out in what I say.

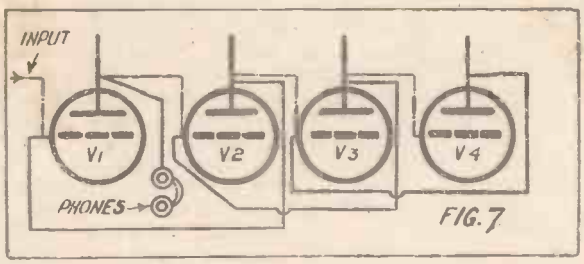


FIG. 7

To tune the Fig. 1a cct. to 600 metres, plug-in two Sullivan H.F. transformers (Nos. 1) or any appropriate plug-in transformers. The aerial coil should be a 50 or 60, L1 being a No. 100. The adjustments of the 4 condensers will be roughly as follows: C1 20°–40° depending on size of aerial used, C2 and C3 140°–160° (using ·0003 mfd. condensers), and C4 15°–30°; using a 75 coil as L1, C4 becomes 80°–100°. The 600 metres wave is one which I can recommend most experimenters to use when wishing to test the little idiosyncrasies of tuning a new set. A knowledge of Morse is most helpful, as distant stations can be recognised by their calls. After dark, the writer gets loud-speaker strength from G K R, P C H, G C K, G C C, F F U, and many stations across the North Sea. G K R (Wick—about 80 miles north) comes in extremely loud at any time.

How Tuning is Accomplished.

When the tuning has been mastered, one or more of the circuits should be calibrated. If square law condensers are used this becomes a comparatively simple matter. A point which should be remembered is the fact that the low-toned howl already spoken about is not obtainable until the circuits are in, or almost in, tune. Therefore, if one adjustment, of say, C2, is known to be 385 metres—the desired wave-length—swing C3 and C4 until the howl is "struck," reaction being fairly tight. Meanwhile, C3 and C4 should be so adjusted that the howl can be just "tipped." Supposing that, with the reaction just coupled enough to generate the howl, 60° on C3 and 70° on C4 brings the howl audible, then the circuits tuned by C2, C3, and C4 are in resonance, and are all in, or almost in, tune to the wave-length, 385 metres.

A Word of Warning.

The aerial circuit should now be brought into tune, and when the desired signal is heard all the circuits should be readjusted. To prevent the slightest risk of radiation occurring the above tuning process could be carried out with the aerial disconnected. With either of the dual sets it is almost impossible to strike a carrier wave of the B.B.C. stations, this being a handicap only when searching for America!

The reprehensible practice of tightly coupling together the reaction to the tuned anode, transformer or aerial coils cannot be too strongly denounced. True, it is easy thus to strike the carrier wave (and incidentally upset the temper of every listener within a half-mile radius), but no two circuits can properly be tuned to each other when the reaction is too tight. It should be possible to swing both tuning condensers so that the signal—Morse or telephony—can be tuned out on either side of the correct adjustment, and this without the set oscillating or the carrier wave being heard.

Of the seven relay stations at present in operation, September 20, 1924, the writer has logged Sheffield, Liverpool, Plymouth, Edinburgh, and Nottingham all at good strength on an outdoor aerial 30 feet in height. All the five have been read on an indoor loop. Sheffield and Plymouth have been read on the frame. Plymouth is almost 500 miles away.

I would emphasise the necessity for obtaining good crystals and adjusting them correctly. It should then be almost impossible to radiate, as the tightening of the reaction coupling results in a violent L.F. howl. This howl is not due to reflex action, as a simple valve and carborundum crysta circuit—with grid and anode coils coupled together—gives the same howl, though much weaker. The reflex transformers only help to magnify the howl. If the crystal is "maladjusted," and the reaction is coupled to the A.T.I., as it is in several much advertised dual circuits, then it is possible to radiate strongly without howling audibly. With the simple valve and carborundum crystal circuit mentioned above it is possible to radiate a low-toned howl over a distance of half a mile or more.

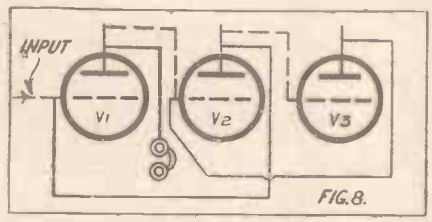


FIG. 8.

If the crystal contact is lifted off in set Fig. 1a, and the potentiometer P3 adjusted, it will generally be found that V3 will rectify, and the resulting circuit is 2 V. 2. See Fig. 8.

Opportunity for Comparison.

To get the best results, however, the crystal circuit should be entirely disconnected, and T1 taken out of circuit. A grid condenser and leak should be connected in grid circuit of V3. V1 and V2 are dual amplifiers, V3 being the rectifier. The tuning of the reaction coil L1 should be dispensed with—for B.B.C. waves a No. 25 or 35 is very suitable here—and it may be coupled to A.T.I. or to T5, care being taken not to allow the set to oscillate. I can recommend this circuit to give excellent results and still be as stable as a good 1. V. 1 set. On September 28 last, when the writer logged W K A Q, San Juan, Porto Rico, he had an opportunity for comparing the "triple dual" against the Fig. 8 set (using aerial reaction), The "triple dual," although more difficult to handle, was slightly superior to the other. The aerial used had an average height of about 22 feet, being rather screened by several telephone wires passing overhead.

In conclusion, the writer would like to state he is at present designing a cabinet set incorporating the circuit shown in Fig. 2a and he hopes to be able to publish full details at some future date.

Mr. Richard Hughes, the well-known radio author, and Mr. R. J. Jeffrey, radio play producer, in 2 L O's control-room.

SUNSPOTS—WIRELESS—AND THE AURORA.

By G. H. DALY.

"Sunspots may even affect the working of the valve."

A WELL-KNOWN French astronomer states that sunspots are at the bottom of all our earthly woes. Sunspots, he says, produce a magnetic tension which irritates our nerves and makes us quarrelsome. Whatever their effect on humanity, there is now every reason to believe that sunspots, with their magnetic tension, very materially affect wireless communication, and many hitherto inexplicable vagaries of reception are believed to be due to these mysterious black spots which move swiftly across the surface of the sun.

Although astronomers have been studying sunspots almost daily for nearly a century, their origin is still unknown. Another mystery about them is the fact that within a specified number of years they increase from a minimum in number to a maximum and then gradually fall off again to a minimum. The interval between one minimum and the next is approximately eleven years. This period is known as the sunspot cycle, and in this year of 1924 we are seeing the wane of one of these cycles.

Sunspots are visible to us as black spots which travel across the surface of the sun and then die out. Some of them we see dying out before our eyes, while others travel round to the other side of the sun and end their existence there. Some spots exist only for a few minutes, others will last weeks. In size they vary from spots measuring 400 miles in diameter to huge areas covering perhaps 60 million square miles of surface.

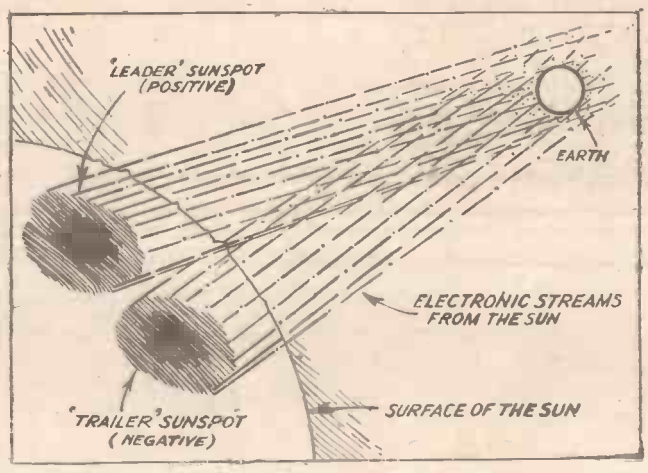
Sunspot Polarity.

The longer a sunspot lasts the larger it grows, until on reaching a maximum it gradually gets smaller, eventually dying out altogether. A sunspot which can last fourteen days will cross the whole of the visible surface of the sun, and as the sun's diameter is 109 times that of the earth, it follows, therefore, that sunspots attain a considerable speed. The fact must be taken into consideration, however, that the sun itself rotates and completes one revolution in 27 days of our earthly time, and, further, it also rotates in the same direction as that in which the earth travels round the sun.

Another important point about sunspots is that our earth, small as it is, appears to kill these spots. It has also been ascertained that the majority of sunspots travel across the sun's surface in pairs, one following the other, and known as the "leader" and "trailer" spot respectively. A curious feature, too, is that they are of different polarity.

For example, a leader spot in the northern hemisphere of the sun is positive, while the trailer spot is negative. In the case of spots in the southern hemisphere, the leader is negative and the trailer positive. Before the year 1912 this order was exactly reversed, but suddenly in that year the spots changed to their present polarity, thus giving the astronomers yet another mystery to solve.

Collected evidence now points to the fact that sunspots are huge electronic cyclones from which streams of electrons pour into space for untold millions of miles. The flames from the sun, known as the coronal streamers, probably emanate from sunspots, and when viewing these we may be seeing the actual electron streams leaving the sun, streams which eventually drench the earth and its atmosphere with electrons both on the daylight and night sides of the earth. The result is that when sunspots



are present our earth is being licked, as it were, by positive and negative electronic streams from the leader and trailer sunspots. (The name electron is used advisedly, as it is a term usually adopted to denote a charge of negative electricity alone.)

These electron streams or flames affect our earthly sphere in two ways. In the first place it is now thought that they light up the frozen dust of nitrogen which forms the Heaviside layer and thus cause the beautiful and delicate tints of the aurora. In addition to this, the effect of the electronic streams on the frozen dust is to make the latter a better conductor of the ordinary electric current than usual, and as a good conductor of the ordinary electric current is a very good reflector of wireless waves, consequently, the waves from earth are subject to exceptionally good reflection from this dust, and extraordinarily good wireless reception on earth is the result. This explains why we invariably get good wireless results when the aurora is visible.

Improved Wireless Reception.

The beneficial effect of these electronic streams on wireless is only felt at night, however, for in the daytime the effects of the streams on wireless communication is counteracted by other rays from the sun, especially the ultra violet light.

In addition to affecting this frozen nitrogen and assisting wireless transmission, it is thought probable that these electrons from the sunspots affect the actual receiving apparatus by reducing the resistance of the aerial-earth system and inductances. Even the electronic flow from the filament of the valve may be affected.

The second way in which sunspots affect the earth is in connection with that mysterious factor known as terrestrial magnetism, and magnetic storms. It is now well known that sunspots, magnetic storms, the aurora, and phenomally long-distance wireless reception all coincide.

Terrestrial Magnetism.

Now, it is generally supposed that wireless waves arrive at a station from two directions—i.e. through the atmosphere, via the Heaviside layer, being known as space waves; and, secondly, via the earth's surface, along which the waves glide.

It has been shown above the method whereby the space waves via the Heaviside layer are assisted owing to the sunspot electronic streams, and it is also probable that the same stream of electrons assists the waves gliding over the earth's surface.

For instance, this stream creates a disturbance in the electric currents which exist deep within the interior of the earth, for it is now thought that the earth's magnetism is not due to permanently magnetised substances in the earth, but to the above-mentioned electric currents buried deep within our globe.

The effect of the electronic streams on these currents is to create what we call a magnetic storm along certain well-defined paths on the earth, say from east to west, and along these paths the wireless waves are propagated much more easily than elsewhere.

Interesting Experiments.

This effect may be likened to a kind of wired wireless if we substitute the path of the magnetic storm for the wire in wired wireless which guides the wireless waves. (It will be remembered that in wired wireless the waves pass more easily along the wire than if broadcast via the ether in the usual way.)

We see, therefore, that sunspots play a very important part in our earthly wireless system. Sunspots, however, are still a mystery, for we have no idea of their cause nor can we predict their appearance.

Readers who are interested in the phenomena mentioned above can easily carry out some very interesting research for themselves during the winter months when the aurora is visible at many places in the British Isles, and especially in the north. Take a known distant station whose power is regular, and see the effect upon the reception on the various nights when the aurora is brightest and when magnetic storms are prevalent.

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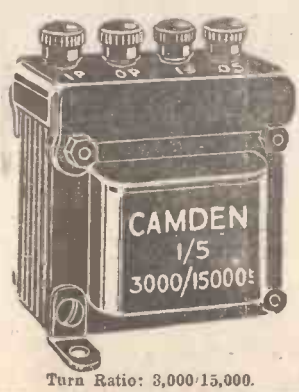

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WIRELESS IN SPAIN.

AN EXCLUSIVE ARTICLE FOR "P.W."

By P. F. MARTIN, F.R.G.S. (*Our Special Correspondent in Spain*).

Barcelona, Spain.

ALTHOUGH not ranking among the first of the European nations to take up radio with enthusiasm, Spain has made a careful study of the new method of world communication. As far back as 1899 commissions were appointed; these, from time to time, issued reports to the Government upon the subject of wireless telegraphy. It was not, however, until May, 1905, that a Permanent Commission, appointed by Royal Decree, was brought into existence under the presidency of the Chief of the General Staff, including representatives of the War Office, the Admiralty, and the Home Office.

Early Experiments.

It is to be observed that this organisation actually anticipated the first International Conference concerning wireless telegraphy, held in Berlin in 1906, and whose proceedings were subsequently modified by the London International Convention of 1912. Two years were expended in trials by the army with field sets, all of which turned out unsatisfactorily. The Navy, with stations on board the *Pelayo*, *Princésa de Asturias*, and *Geralda*, were hardly more successful. Somewhat better results attended the experiments at the aviation station constructed at Prat de Llobregat; and other aviation and meteorological services at Alicante.

Adventures of a Concession.

Encouragement was first given to private enterprise in June, 1908, when La Sociédad Española Oërliken was formed, and eventually became responsible for the erection of 24 land stations, having three different ranges. Shortly afterwards the society formed a separate and distinct company with the somewhat cumbersome title of "Compañia Concesionária del Servicio Público Español de Telegráfia sin Hilos."

Stations were commenced at Cadiz, Teneriffe, and Las Palmas, in the Canary Islands, but the work was not completed. The time granted in the contract lapsed before the terms of the concession could be carried out, and with a promptitude that reflected little credit to the Spanish authorities, the concession was taken from the hands of the construction company and retransferred to the Compañia Nacionál de Telegráfia sin Hilos, formed with the aid, and under the direction of, the Marconi Wireless Telegraph Company. The first step that the new owners of the concession took was to alter the original plans and reduce the number of stations to ten, all of greater range.

No Amateur Stations.

There are in Spain neither experimental nor amateur stations; in fact, the control of radio is still rather erratic. To-day, the only company holding permission to work wireless for public service is the Compañia Nacionál, most capably directed by Señor D. J. Ruiz.

Up-to-date Apparatus Used.

Through this medium wireless traffic with the whole of Europe is conducted by means of transmitting and receiving stations and central offices established at Madrid and Barcelona. Transmission and reception of messages are worked from the Ronda de la Universidad (Barcelona) and the Callé de Alcalá (Madrid). In the first-named, wires connect with the Campo de la Bota receiving station; at Madrid, the office is connected with the Alcobendas receiving station. From these offices likewise run wires connecting with transmitting stations at Prat de Llobregat (Barcelona) and Aranjuez (Madrid).

Our Correspondent in Spain, Mr. P. F. Martin, obtained the information for this article, and the photographs which appear on the next pages, after very considerable difficulty, as the conditions at present existing in Spain prohibit the foreigner from obtaining news concerning wireless, which is controlled by the Government. The photos on the next page are of special interest, as they are exclusive to "P.W.," and have never been published before.

Both are equipped with the most modern apparatus, enabling messages to be transmitted and received in duplex at a speed of from 80 to 120 words per minute. Gell tape-machines, Wheatstone-Creed automatic transmitters, signal registration apparatus, machines for translating the tape messages, and all necessary apparatus and equipment for controlling the distant transmitting stations have been installed. All lines and circuits are the sole property of the Compañia Nacionál, erected at the company's expense, and maintain efficient communication between receiving and transmitting stations and the central offices.

Reserve Stations.

International communication from Aranjuez and Prat de Llobregat is carried out with 15 kw. sets, fitted with independent exciters, supplied by the Marconi Company, and of most modern design.

As a reserve for the continuous wave station at Prat de Llobregat, two smaller sets are provided, one of 12½ kw., and the other of 5 kw. At Aranjuez a reserve set of 25 kw. arc exists. At the Prat de Llobregat is installed a small station of ¼ kw. power, used exclusively for aviation services.

At Campo de la Bota (Barcelona) and Aranjuez (Madrid) the receiving stations are equipped with the latest apparatus for reception of messages, at high speed, from London, Berne, Paris, Berlin, Budapest, and Rome; from each, communications, as well as press messages and ships' calls, are received.

Power for transmission is received from the ordinary industrial electric current, but it can also be generated by a group of Gardner and Diesel motors and high-power accumulator batteries. Reception power is furnished from high and low-tension accumulator batteries for lighting the filaments and tension of the valve-plates which are used on the set.

Checking, classifying, and distributing radio messages are carried on in the central offices. Here have been installed telephone-rooms for the reception and transmission of urgent messages to regular subscribers.

Considerable Traffic.

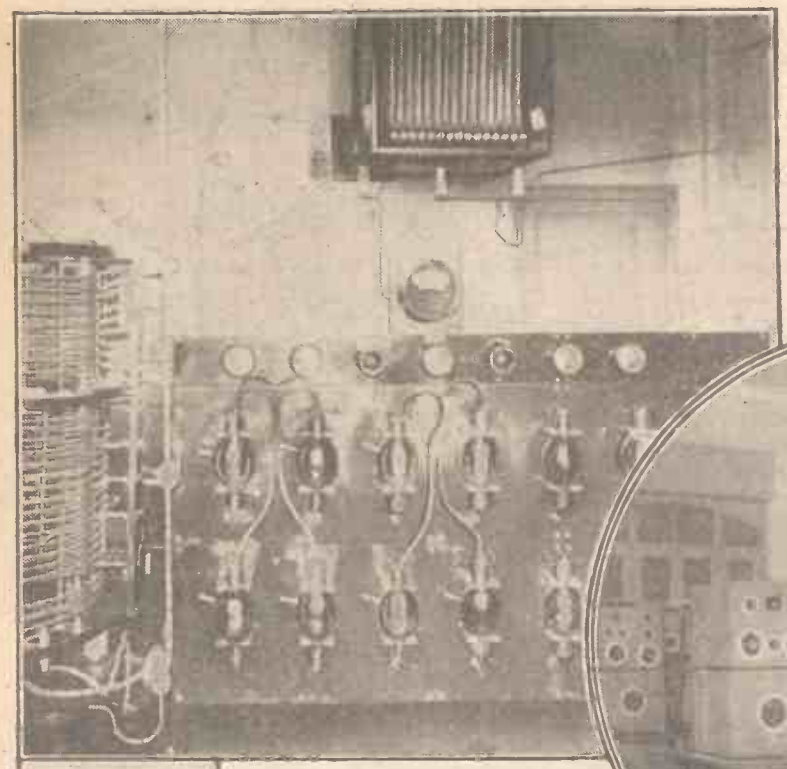
Stations for the exclusive use of ships have been erected at Soller (Mallorca), Barcelona, Cabo de Palos, Vigo, Finisterre, and Santander; others, for the same purpose and for communication with the Canary Islands and other Spanish oversea possessions, have been established at Cabo Juhy (Cadiz), Santa Cruz-de-Teneriffe and Las Palmas (Canaries). A school has been opened in Madrid for the instruction of operators in the various branches of wireless telegraphy. The Compañia Nacionál now employs 107 operators, and the number of words sent and received by wireless have exceeded 1,700,000 monthly. At the Talleres (Works) Talmar, belonging to the company, are constructed large quantities of wireless telegraph and telephone material, and contracts for stations for both Army and Navy and special apparatus for aeroplanes and broadcasting are in hand.

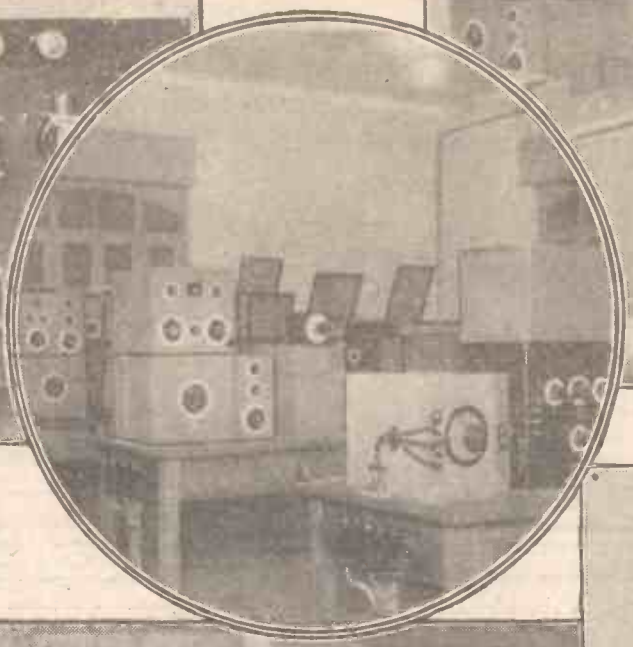
Companies engaged in erecting wireless stations besides those referred to include the A.E.G. Ibérica del Electricidad (Telefünken), Compañia Ibérica de Telecomunicación, Centro Electrotecnico (Army Department), while military engineers control all work for army purposes.

Lighthouse Stations.

At the present time, commissions are considering reports for the erection of a number of stations on the coast for radio-goneometric service; but, at time of writing, nothing definite as to sites has been determined upon. On the other hand, for the services of lighthouses two radio-telegraphic-telephonic stations have been installed at Castellon and Coumbretes, while tenders have been invited for the equipment of various other lighthouses, among them being those of Cabos Villano and Finisterre. Mention must also be made of Radio Ibérica, Madrid, a broadcasting station where nightly programmes are heard throughout Europe.

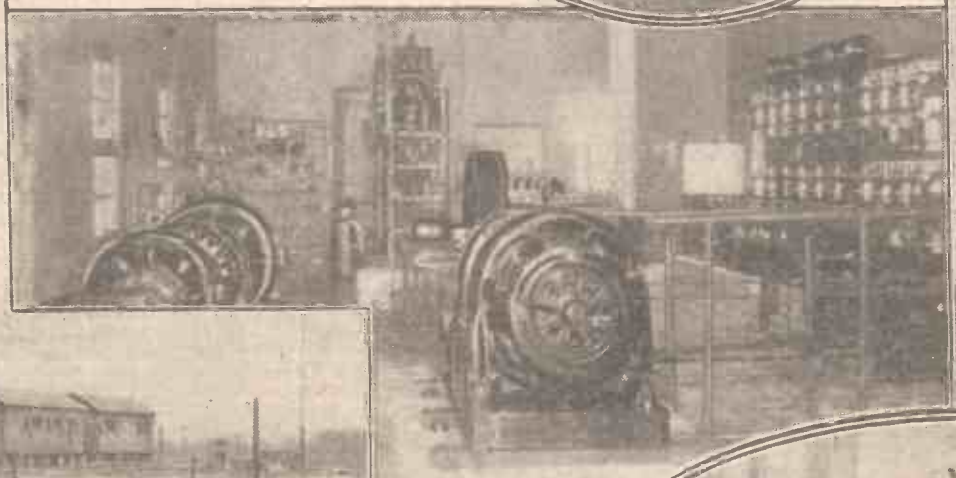
WIRELES

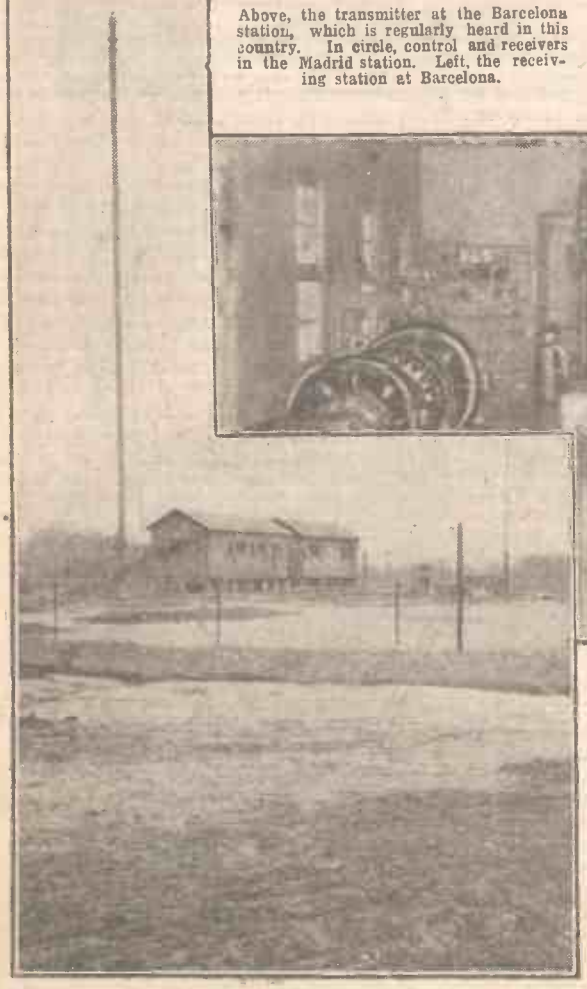




Some of the receivers instrumen

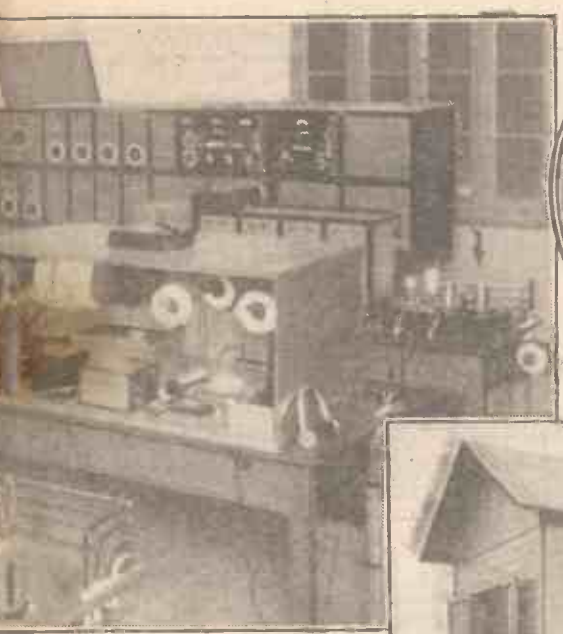
Above, the transmitter at the Barcelona station, which is regularly heard in this country. In circle, control and receivers in the Madrid station. Left, the receiving station at Barcelona.



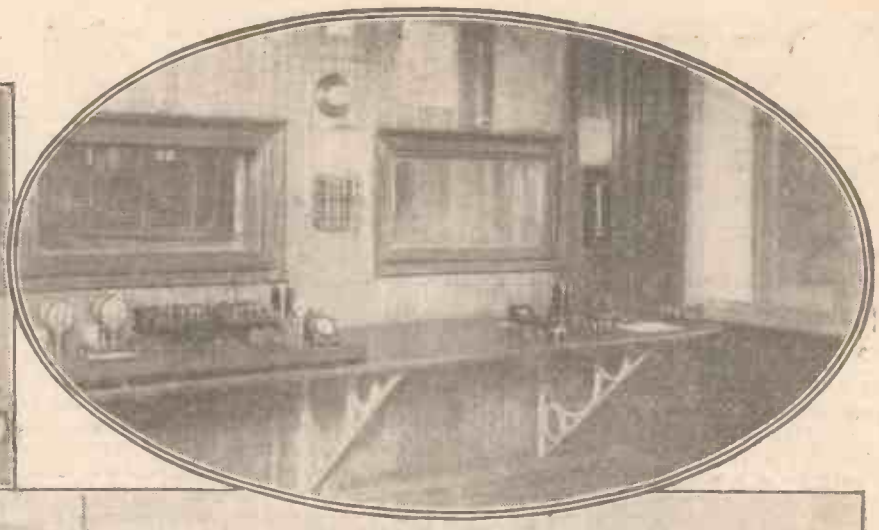


Above, generators and transmitting valve panel at Aranjuez, a Government station near Madrid. Right (in oval), Central Radio Office, Madrid.

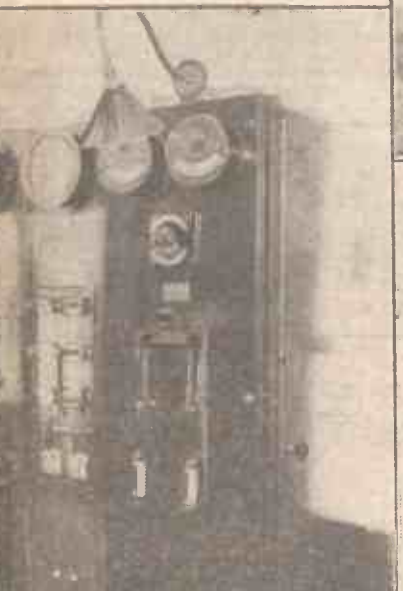
S IN SPAIN.



and automatic high-speed recording
ts in the Madrid station.

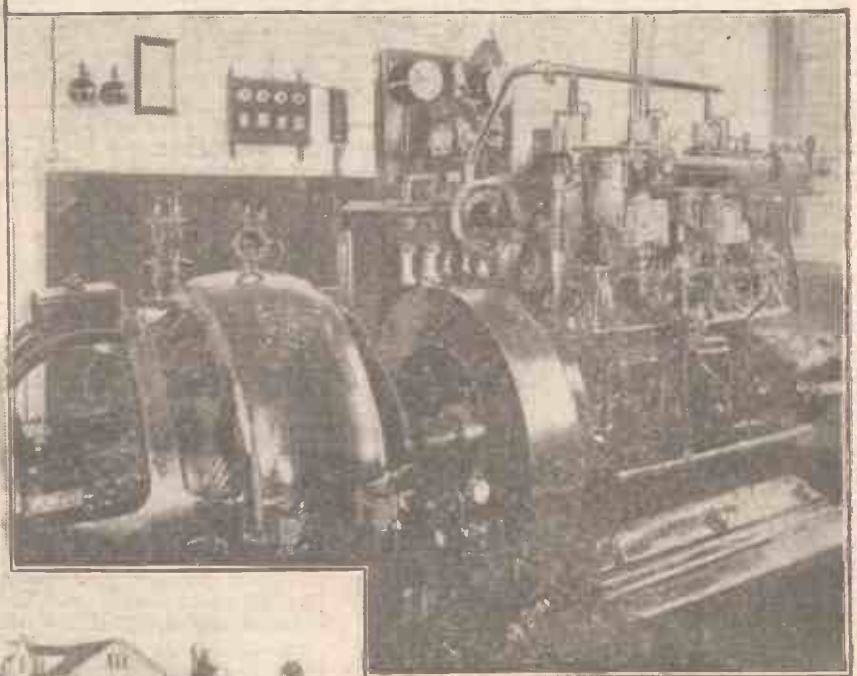


Above, in oval, control room at Aranjuez. Part of the station buildings, Barcelona.



D.C. switchboard at the Barcelona station.

Left, the main mast and buildings at Barcelona.



Main dynamo and oil engine at Barcelona.

Constructional Notes

Conducted by Dr. J. H. T. ROBERTS, F.Inst.P.

Useful Honeycomb Data.

THE following data is quoted from "Radio Digest": "Table A gives the wave-length range of the various size coils with standard capacity condensers, ·001 (43 plate), ·0005 (23-plate), and ·00025 (11-plate).

"The value ·0001 is taken as the approximate capacity of a secondary circuit when the tuning condenser is set at minimum capacity (plates apart), and can be considered as the lowest wave-length that may be reached.

Wave-lengths in Metres with Following Capacities Connected in Parallel with Coils.

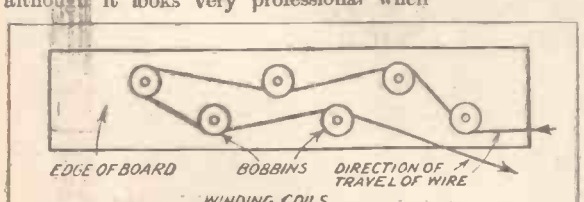
Number of Turns in Coil	·001 mfd.	·0005 mfd.	·00025 mfd.	·0001 mfd.
25	372	267	193	131
35	528	378	277	188
50	743	534	391	270
75	1007	770	560	379
100	1470	1055	771	532
150	2160	1546	1110	746
200	2870	2050	1470	980
250	3910	2800	2020	1355
300	4900	3490	2510	1670
400	6160	4400	3160	2095
500	8070	5750	4140	2740
600	11600	8300	5980	3980
750	13300	9500	6830	4540
1000	17600	12500	9000	5950
1250	20100	14300	10250	6780
1500	24200	17200	12350	8150

Proper Honeycomb Coils for Various Wave-lengths

Wave Length Metres	Primary Coil Turns	Secondary Coil Turns	Reaction Coil Turns
150– 250	25	25	35
200– 350	25	35	50
250– 500	35	50	75
300– 650	50	75	100
400– 850	75	100	150
800– 1850	100	150	150
1500– 2750	150	200	150
2500– 4200	200	300	200
4000– 6350	300	400	300
6200–42500	400	750	400
13000–20000	750	1250	400
18000–25000	1250	1500	500

Easily Made Variometer.

The conventional ball-type variometer, although it looks very professional when properly made, is difficult for the amateur constructor, but the one shown here, if done properly, though less attractive in appearance, is very much more easily made. Two short cardboard tubes are obtained, of the usual type for "formers," and each is bridged at each end, along a diameter, by a strut or bar, through the centre of which a hole is drilled for the shaft. Four small nails or pins are driven into the edge of the tube, in the places indicated, to prevent the first turn of the coil from slipping off. The wire is then wound neatly on, in the manner shown, and the stator and rotor finally assembled in the way shown on the right.



WINDING COILS

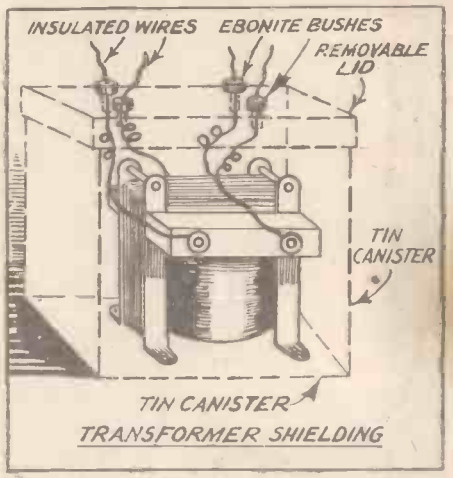
Transformer Shielding.

The practice of building shrouded or completely shielded low-frequency transformers is undoubtedly growing, and is more general in America than here. There are, however, several excellent types of transformer which are not shielded in this way, and if any difficulty due to interaction should be experienced, the shielding may be carried out in the way shown in the drawing. A "tin" canister (that is, tinned *iron*) should be obtained, as near a fit for the transformer as possible; this should preferably be rectangular, but a cylindrical one will do. The transformer is placed inside the shield, and is secured in its place in the set by means of screws passed through the feet of the instrument and right through the bottom of the tin. Well-insulated wire is used for connections to the terminals of the transformer, and leaving two or three turns of slack, each wire is passed through an insulating bush in the lid of the tin. The lid is then placed in position, and the shield is complete. The thicker the metal of the tin canister, the better the shielding.

FINDING STATIONS

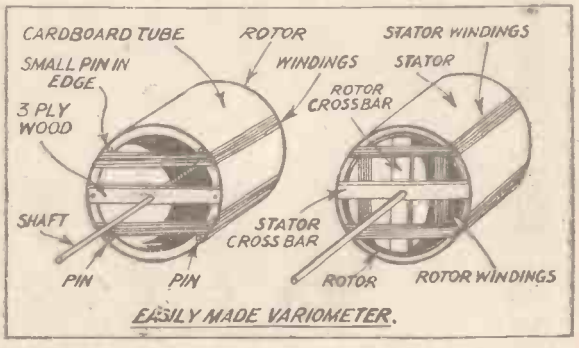
Finding Stations.

The method adopted by most experimenters for the rapid finding of stations is to keep a list of the dial settings. The method shown in the illustration, however, has the advantage of being pictorial, and much more striking, as well as being somewhat more convenient. A semi-circular sheet of paper is pasted against the panel, behind the dial, and projecting about half an inch all round. Upon this the positions of the pointer (or of some mark such as the zero graduation of the dial scale) are marked off for the various stations. This reduces the subsequent finding of the stations to the simplest possible form, and even a person not accustomed to the set should have no difficulty in tuning-in any of the stations logged against the dials.



Winding Coils.

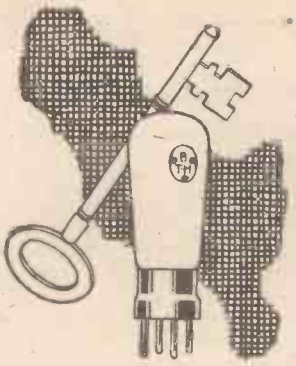
When you are winding a coil, you have probably thought how nice it would be if the bobbin of wire would unwind with just sufficient friction to keep the wire from becoming ravelled, and to make it pay off without kinks. Here is a little arrangement that does this for you. Into the edge of a piece of board, say 1 inch thick, are driven a number of nails, each securing a bobbin (such as a small empty cotton reel), the heads of the nails being large enough to prevent the bobbins from coming off. The board can easily be secured in a vice or otherwise, whilst in use. Matters are arranged in such a way that the wire, as it pays off the bobbin, passes between the reels in the manner indicated.



EASILY MADE VARIOMETER.

It will be found that this imposes a certain amount of friction upon the wire, and also straightens out any kinks, unless these are very sharp ones, in which case they should be straightened out with the fingers. But with care, sharp kinks should never occur. If the friction is insufficient, or too great, try other ways of looping the wire round the bobbins.

The bobbins need not be placed exactly as, shown in the figure (on the left) of course, as should the friction applied to the wire be too little, the bobbins can be staggered still more.



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Type B 3 ... 21/- each

Filament voltage.....1.8 volts
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***Type B5. ... 25/- each**

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Filament current...0.06 amp.(at 3 v.)
Maximum plate voltage...80 volts
Plate resistance.....17,000 ohms.

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Type B4. ... 35/- each

Filament voltage ..... 5—6 volts
Filament current...0.25 amp.(at 6 v.)
Maximum plate voltage...120 volts
Plate resistance ..... 6,000 ohms.

***Type B6 ... 35/- each**

Filament voltage.....3 volts
Filament current.....0.12 amp.
Maximum plate voltage...120 volts
Plate resistance ..... 9,000 ohms.

***Type B 7 ... 37/6 each**

Filament voltage.....6 volts
Filament current.....0.06 amp.
Maximum plate voltage...120 volts
Plate resistance ..... 9,000 ohms.

*For use with Dry Cells

B.T.H.

B.T.H. RADIO VALVES

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2261

Artistes of the Aether

By "Ariel"

Some of the artistes who have given you pleasure when listening-in.

BIRTHDAYS are in the air, literally and metaphorically, and the British Broadcasting Company itself, as well as its Birmingham Station, celebrated the occasions with all due solemnity. Indeed, the party programme of the former was marked by the inclusion of a staff choir, which, though excellent in itself, gave the function a somewhat Sunday-school flavour. One felt one would have liked to have heard those engineers again after the choir had gone home.

Mr. Walter Gieseking.

Sunday Programmes are the "White man's burden" of the company, due, however, entirely to their own over-attention to the minority, rather than to the majority of listeners-in who naturally pay their licences and the maintenance of their sets, no light bill this either, for amusement, and not for religious propaganda or educational purposes. When once these are cut down to the minimum, there will be no lack of supporters.

G.B.S. Broadcasts.

The De Groot Sunday programmes are excellent in themselves, but marred by the total disregard of the composer's pace and time. The recent Wagnerian "musical switch" of "Tannhäuser" and "Lohengrin" was a glaring example.

The predilection for the gipsy element is fast dying out, therefore the "Gipsy Life" episode by Boyle Lawrence was hardly important enough to warrant being transmitted to all stations. The chief interest lay possibly in the utilising of the special "Meny's Gipsy Orchestra," which includes players of the zimbalom, pipe, and tambourine. This, however, was preceded by popular artistes who have toured all stations — the Misses Grace Ivell and Vivian Worth, with Edith Penville the flautist and Mr. Keble Howard the author.

Mr. Herbert Thorpe.

George Bernard Shaw reading his own play was, of course, the piece de resistance of the S.B. week, though possibly G.B.S. reading someone else's play would have caused more astonishment.

As a complete contrast was the performance of a group of pianoforte solos by Walter Gieseking, prior to his recital at Aeolian Hall on the following day. This marks an era in itself as being the first occasion on which a great Continental pianist has broadcast. His appearance in London last season at the same hall placed him immediately amongst the great players, and for his second recital it was computed that more celebrated pianists were amongst his listeners than had ever been gathered under one roof.

Comic Opera Night may, however, for most people be reckoned as 2 L O "at its best," for their scheme ranged from the "Amorous Gold Fish" of "The Geisha," through "Iolanthe," "The Arcadians," "Chocolate Soldier," "Merrie England," "Dorothy," to Stanford's "Shamus O'Brien" and Robert Chignell's "Domheim Days," with the composer himself present.

Northern Programmes.

The northern stations have certainly been to the fore recently, and their programmes have been made almost historic

Miss Gladys Seymour and Mr. Robert Sturtivant.

by the famous artistes who have helped, "directly or indirectly," to form them. We have had the great Scottish Orchestra, under one of the most famous conductors, Felix Weingartner, with Beethoven's "Eroica" Symphony relayed from St. Andrew's Hall; the equally famous Bach Choir and Orchestra from the Engineers' and Shipbuilders' Institute; William Murdoch, the Australian pianist; and Cedric Sharpe, the 'cellist.

"Clan Nights" at 5 S C.

A well-known singer at Glasgow was Mr. Herbert Thorpe, late principal tenor of the Royal Carl Rosa Opera Company, the Old Vic, as well as of the Royal Albert and Queen's Halls.

A new series at 5 S C are "Clan Nights," when the programme is devoted to the history and musical illustrations of one particular clan. That of Clan Maclean was the first, with Professor Magnus Maclean, D.Sc., to give their history, and Pipe Major William Maclean to add the real Scottish element. We shall probably learn soon the true history of the MacDonalds and Macintoshes.

Bournemouth.

This station is again to be congratulated on its work; its programmes are well balanced as well as admirably performed. As well as leading London artistes, well-known local talent often serves to make the programmes of special interest. Two particularly well-known and well-liked entertainers are Miss Gladys Seymour and Mr. Robert Sturtivant. Their work together and in solos make highly acceptable items.

Miss Beryl Nixon.

For the dramatic night, a lucky visit was paid by Miss Helena Millais, with William Macready, the famous actor, and Miss Edna Godfrey Turner.

2 Z Y and the High Brows.

2 Z Y has gone in strongly for "high-brow" music. We have had the Ethel Midgley Trio, for Chamber music, song recitals from Mr. John Perry, and the Night with Russian Composers. The latter must have driven crystal users in the vicinity to the verge of hysteria, for Russian music, though admirable enough in the concert hall, has a trick of fading off, breaking short, or going on for what appears to be aeons, and ending when least expected. Scriabin, Sokolov, Borodin, Medtner, Arensky and Moskowsky, as well as the more familiar works of Tchaikowsky and Rachmaninoff, including the famous Prelude, all went into 2 Z Y's programme. So far no list of casualties has been issued.

We also had, "Captain Swift," in which figured one of the cleverest actresses in the company—Miss Beryl Nixon.

Humour has been well represented with the visits of Foden Williams and Mr. Fred Spencer, the latter giving one of his "Mrs. 'Arris' Adventures." Was it only chance or sheer irony that it preceded the reading of G.B.S.'s play.

Miss Elsie Suddaby.

5 N O.

To broadcast such a play as Henry Purcell's "Dido and Æneas" speaks widely for the faith in the literary culture of Newcastle, and a star cast was obtained for the occasion. The title-rôle. Dido, was played by Miss Elsie Suddaby.

Insulation

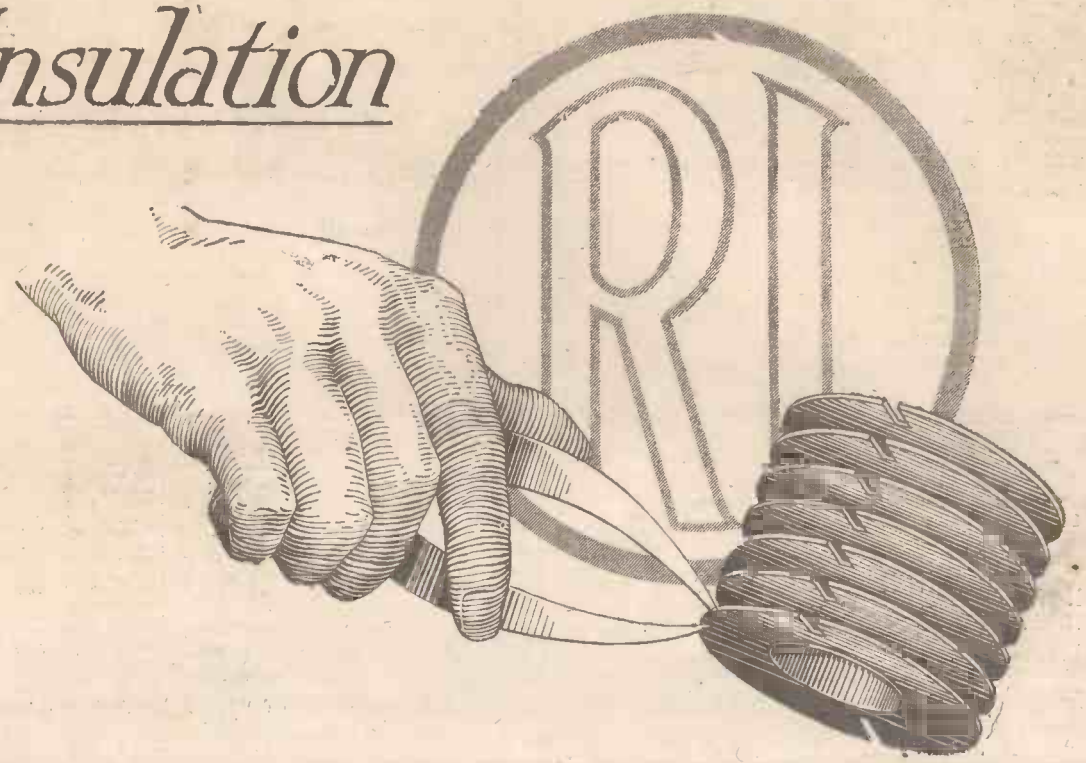

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FIG. No. 1312.
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This illustration shows that by removing the milled terminal from the top of the slide bar, and withdrawing from the headband, each earpiece may, if necessary, be used by different listeners-in. One pair of phones can therefore in an emergency suffice for two persons, thus effecting considerable economy.

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HOW TO BUILD A "FAMILY" TWO-VALVE SET.

EASY TO OPERATE AND EASY TO MAKE.

By J. C. JEVONS.

This two-valve receiver has many merits and will appeal very much to those who do not wish to be bothered by several controls, etc. The set will make an excellent Christmas present for your non-technical friends, and it is one which the Technical Staff can warmly recommend.

THIS set, which has been specially designed for the use of the less technical members of the household, can be left tuned-in to the local broadcast station, with the high- and low-tension batteries, telephones and loud speaker permanently connected up. To bring it into operation, all that is required is to connect up the aerial and earth leads, and turn on one tumbler switch.

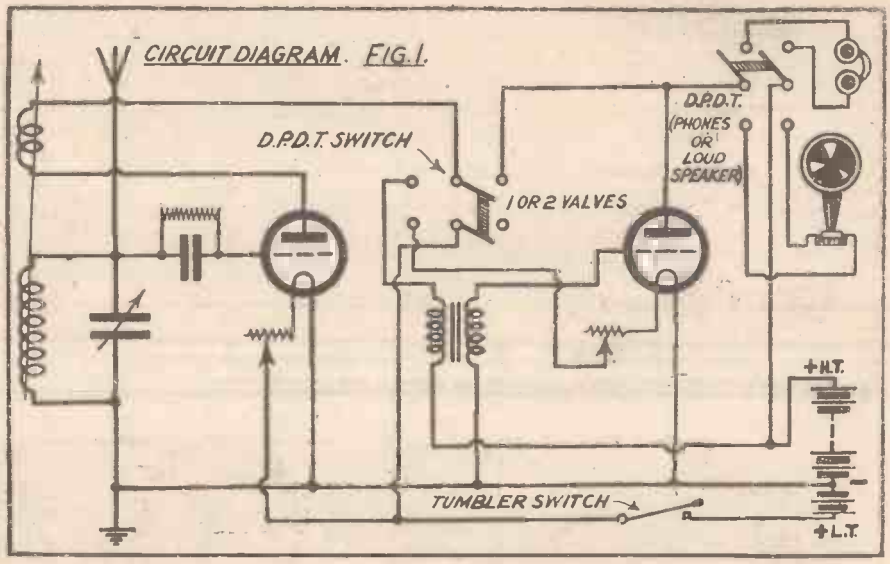
Two other simple switches provide the choice of using only one valve for headphone reception, or two valves for loud-speaker work, as inclination, or a regard for economy in "juice," may indicate. No readjustment beyond actuating the two switches is involved in this selection.

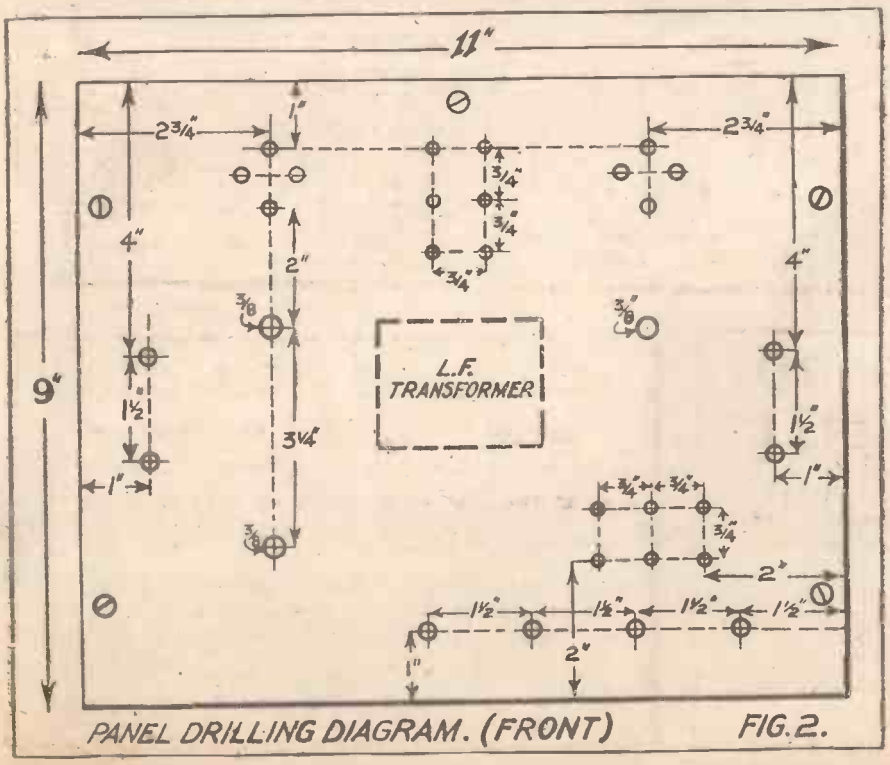
The two valves comprise one rectifier and one L.F. amplifier, as shown in the circuit diagram Fig. 1, so that the set is not primarily intended for long-distance reception. It will, however, give ample loud-speaker strength (when both valves are in use) up to 12 miles from 2 L O, and, of course, excellent headphone reception on one valve at a considerably greater range.

The omission of a high-frequency stage makes tuning a simple matter, a condenser of the combined vernier type being used as an aid to selectivity. At the same time the set can, if desired, be used to receive Continental broadcast (as described under the paragraph headed "Operation.")

The size of the cabinet is sufficient to accommodate both the high-tension battery and also the standard dry or secondary cells used for dull-emitters. If bright emitter valves are preferred, the accumulator should be left outside, and the spare room utilised to store extra coils, etc., which can easily be got at through the front flap.

The tumbler switch shown on the right-hand side of the cabinet cuts off the L.T. (See photo). When the valves are cold, the H.T. battery is open-circuited across the plate filament path, so that the set can be





safely left as it stands at the end of the evening's programme.

The following is a list of the materials and components required:

	s.	d.
1 Variable condenser ·0005 mfd., with vernier	7	6
1 Grid leak and condenser	2	6
1 L.F. transformer, say	21	0
2 D.P.D.T. switches at 2/- each	4	0
2 Rheostats at 3/- each	6	0
1 Ebonite panel, 11 in. × 9 in. × ¼ in.	4	6
1 Double coil holder	4	6
8 W.O. terminals	1	4
8 Flush valve sockets	1	4
⅜-in. mahogany for cabinet (planed both sides)	2	6
3-ply wood for back		6
Wood screws, varnish, and sundries	2	6
1 tumbler switch (electric-light pattern)	1	6

The Cabinet.

Cut from the mahogany board rectangular pieces, 11¼ in. × 7½ in., for the bottom; 10¾ in. × 3½ in., for the top; and 10 in. × 4 in., for the front flap. The two pieces for the sides should measure 11⅝ in. at the back, 7¼ in. along the bottom, 3½ in. along the top, and 4 in. at the front vertical edge. The sloping part of the front will then be

(*Continued on page 926.*)

A "FAMILY" TWO-VALVE SET

(*Continued from page 925.*)

the right length for the panel to lie against, namely, about 9 in., including the thickness of the top of the cabinet.

Smooth the wood on the faces that are to be outside, and bevel or round the front and side edges of the base. Place the top piece in position on the side pieces, and secure by screws passing downwards. Then fix the base by screws passing upwards. Note that the base is intended to project a little beyond the sides, and take care to make the sides parallel with one another. Also see that the front flap fits nicely in place at this stage.

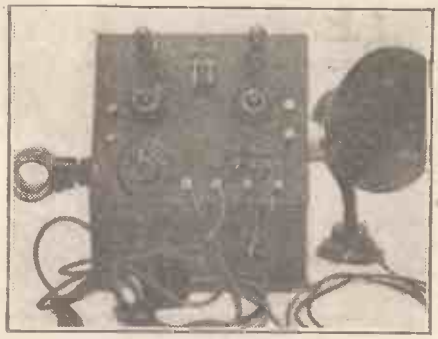
Now give the whole of the woodwork a coat of mahogany varnish stain with a brush. It is advisable to thin the varnish with a little methylated spirit. Otherwise the varnish sets so quickly that it is very difficult to avoid leaving permanent traces of brush marks on the finished surface.

Drilling the Panel

Allow the cabinet to dry for a day, smooth it well externally with fine glasspaper, and apply a coat of good elastic carriage varnish with a soft brush. The varnished cabinet should then be left in a warm room until the coating is quite hard to the touch.

Round the edges of the ebonite panel with a file, and if it is of the "polished" variety, rub both surfaces with fine glasspaper to remove the outer skin, which is frequently a source of leakage. A polished effect can afterwards be produced, if desired, by rubbing the face with rotten-stone and oil. Ebonite with a matt sand-blasted surface is now generally available at most dealers, and its use is to be preferred as avoiding the necessity for glass papering, etc.

Mark the position of the holes in accordance with the drilling diagram, shown in Fig. 2. Before actually drilling, however, make certain that the purchased components will fit correctly, and make due allowance for any variation from the standard dimensions shown.



The complete receiver.

Tap the holes for the valve sockets and terminals, and thus avoid the use of nuts. Special care should be taken to get the holes for D.P.D.T. switches right. This is best done by marking them out on a piece of paper and then pricking through with a needle or scriber.

The transformer is fixed by four screws entering the back of the panel, but not passing quite through, so as to avoid their unsightly appearance on the front of the panel. Drill the holes $\frac{3}{16}$ in. deep and tap them No. 5 B.A., with a "*plug*" tap so as to get down to the bottom of the blind hole.

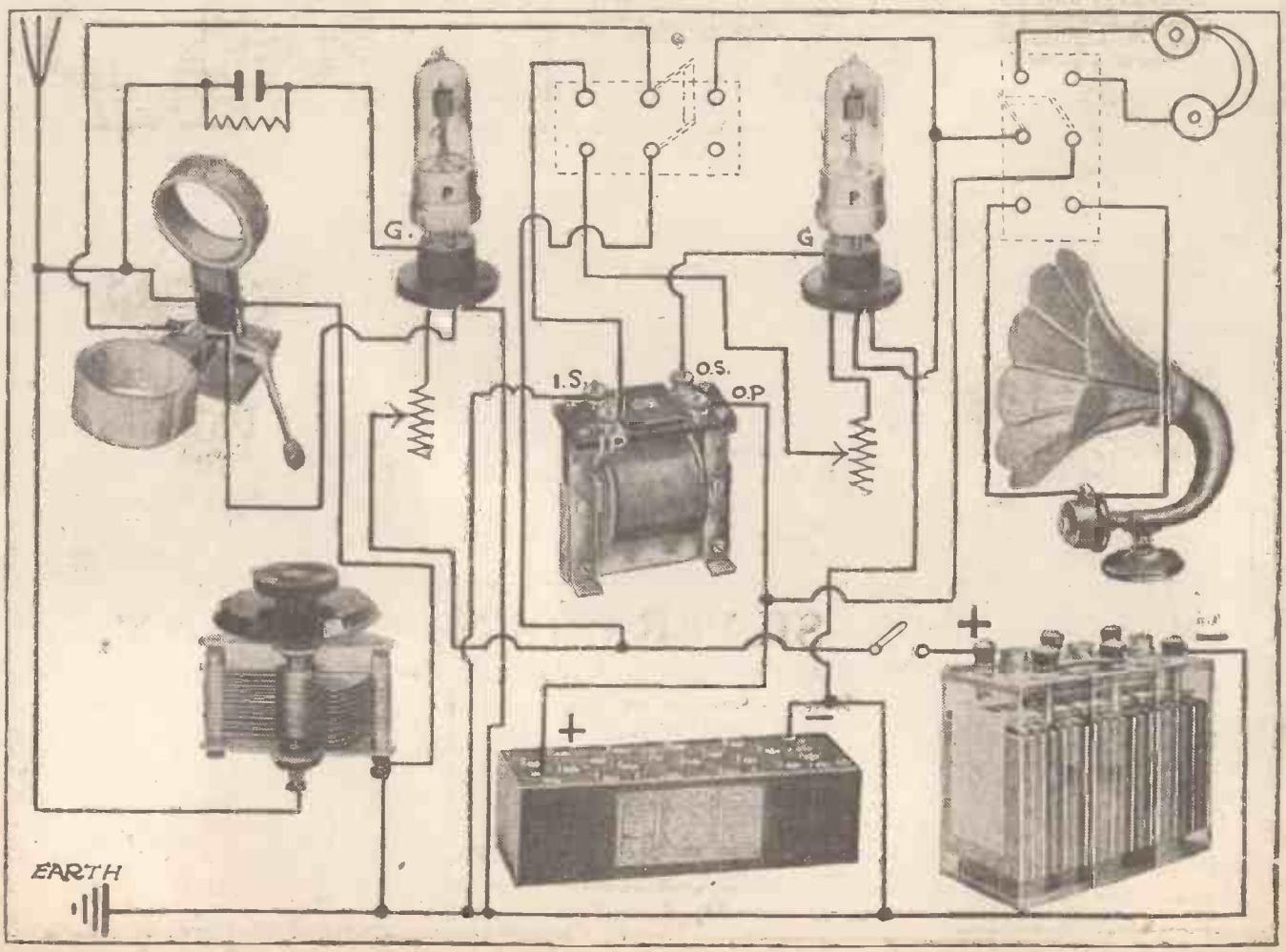
Assembling

Now fix the condenser, rheostats, switches, transformer, valve sockets and terminals in position as shown in Fig. 3 and in the photograph of the rear of the panel. The grid leak and condenser can be fixed in the same manner as the transformer, but if stout wiring is used no other fixing is necessary.

The wiring, Fig. 3, is best done with 18-gauge square tinned copper wire. If soldering is found troublesome, use nuts. It makes little real difference provided the nuts are carefully tightened up. The leads to the movable reaction coil should be of insulated flex.

Lay the cabinet on its back and place the panel in position. Mark the holes for the screws; two at each side and one at the top should be sufficient. Remove the panel and drill the holes and countersink them. Now replace and secure the panel.

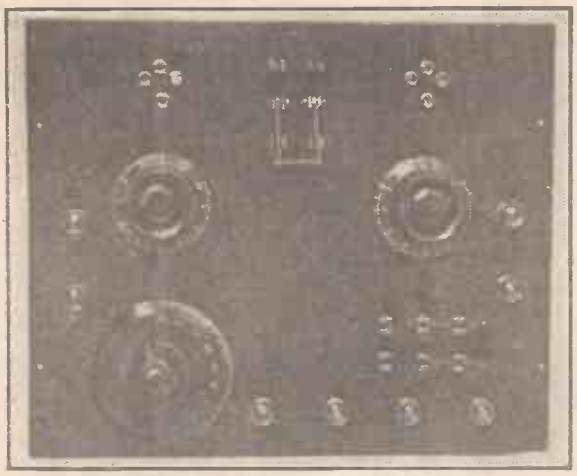
(*Continued on page 931*).



A "FAMILY" TWO-VALVE SET

(*Continued from page 926.*)

Fix the double coil holder on the left of the cabinet, and the "cut-off" tumbler switch on the right. Drill the necessary holes for the leads to pass through with a hand drill and connect up as shown in Fig 3. Sleeving should be placed on the wires where they pass through the wood.



The panel lay-out is clearly seen in the above photo.

Flexible insulated wires should be attached to the O.P. transformer terminal and to the fixed plate terminal of the condenser to take the H.T. wander plugs. See that they are left long enough to reach the holes in the H.T. battery, when this is resting inside the cabinet case.

The front flap may now be fixed by means of hinges at the bottom and any suitable catch or bolt at the top. A small screw is preferably fixed into the wood inside each of the cabinet sides, so as to form an abutment for the flap. A knob should also be fixed to the front of the flap for opening and shutting the latter.

The back of the case is formed of three-ply wood in which key-hole slots may be cut so as to slide over corresponding screws fixed in the rear edges of the cabinet. The board is then placed in position and pushed downwards so that the screw heads engage over the narrow part of the keyhole slots, holding the back firmly in place.

If dull emitter valves are used and the filament battery is to be stored inside the cabinet, a couple of flexible connections are fixed, either by nuts or by soldering, to the shanks of the L.T. terminals on the inside of the panel. The outside terminals are intended for connection to an external accumulator when using ordinary bright emitter valves.

Operation.

Assuming that the telephones are connected to the left-hand pair of terminals and the loud speaker to the right-hand pair, the operation of the switches is as follows:

For headphone reception throw the top switch (between the two valves) into its upper position, and the bottom switch (above the telephone and loud speaker terminals) into its left-hand position. The L.F. amplifier is now cut out and the 'phones are in circuit with the detector only.

For loud speaker work, change the top switch to its lower position and throw the bottom switch over to the right-hand side. Both valves are now lit up and are in circuit with the loud speaker.

For long distance reception keep the upper switch set for two valves, but move the lower switch over to the left so that the output is now fed to the headphones. This is the position shown in the photograph of the complete outfit. With this setting and a careful use of the vernier condenser and reaction coil, many Continental stations (including Madrid) have been clearly heard in the London district.

The feature of having the loud speaker and telephones permanently connected up, with the choice of using either at will, will be found particularly convenient when the loud speaker is in a separate room, as it facilitates tuning in first, on the 'phones, before switching over to the loud speaker.

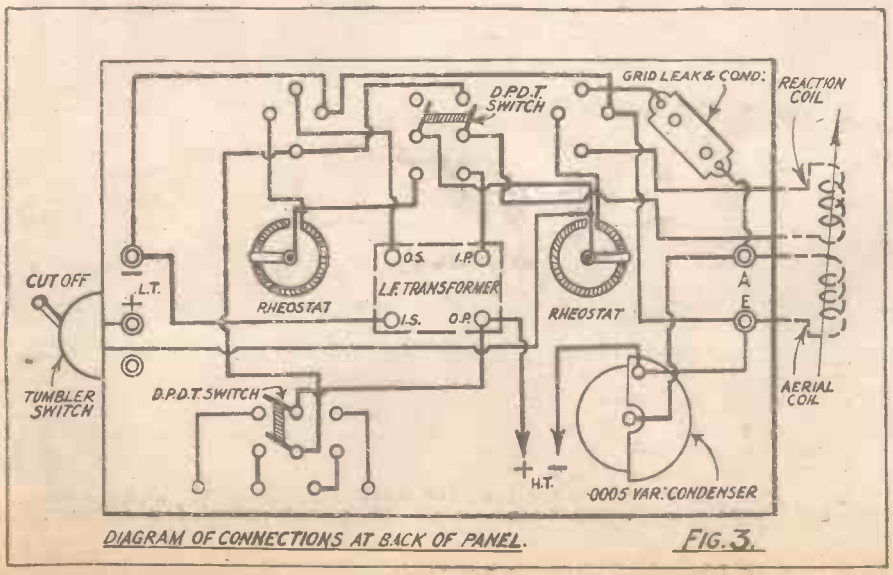


DIAGRAM OF CONNECTIONS AT BACK OF PANEL. FIG. 3.

AMERICA CALLING.

From our Correspondent in New York.

THE average American, it appears, thinks a great deal more of his big sportsmen than he does of his famous statesmen. Babe Ruth would probably draw twice as large a crowd to watch him playing baseball than would President Coolidge to a public meeting. The results of the recent baseball championships were broadcast minute by minute actually from the grounds, and those unable to be present (mighty few, comparatively speaking) relied upon their wireless sets.

Any radio shop without a loud speaker outside roaring forth the progress of the innings was considered very "passé." And the traffic "cops" were helpless to control the enthusiastic crowds who gathered around the loud speakers and gave vent to their feelings by mighty cheers.

However, whenever President Coolidge does broadcast he can always be sure of a big following, for he is not likely to choose a time for broadcasting when there is another attraction of paramount interest being transmitted. Analysis of the correspondence of W G Y reveals that the interest of women has been enlisted in politics this year as never before.

New York's Show.

There were many striking features at the annual National Radio Exhibition which opened in New York in November. At an appointed moment on the opening day Senator Marconi in his London laboratory touched the key of a special transmitting instrument which almost immediately lit up a huge American flag outlined in electric lights at the Grand Central Palace, wherein the exhibition was held. Immediately afterwards three of the most powerful American stations joined in broadcasting to Marconi a message of greeting from the American amateurs.

Another thrilling demonstration was a race of particular interest. Two wireless telegraphic signals were released simultaneously and sent flashing around the globe in different directions, to return to Grand Central Palace after they had completely circumnavigated the world.

This race against time was visualised on a great world map erected in the hall. As each signal was received at and relayed from country to country a white and red light flashed the progress on it and a huge loud speaker repeated the acknowledgments from the various countries.

A pan of flashlight powder in the palace was exploded by wireless control from a point across the Atlantic, and at the moment the flash took place an automatic camera took a photograph of the opening night throngs grouped at the exhibition.

Following the B.B.C.'s example, it has been decided by a committee of the National Radio Conference at Washington to allow the building of super-power broadcasting stations. This class of station will be more or less experimental, and licences may be revoked at any time by the Government if the super-power proves detrimental to the satisfactory working of the existing broadcasting.

MIDLAND WIRELESS NOTES.

By H. S. CATER.

NOVEMBER was the month of birthdays in the broadcast world. On the 15th, the day after 2 L O's birthday, Birmingham attained its second anniversary and received accordingly a very heavy mail of birthday greetings as well as keeping high revel at the Queen's Hotel, Birmingham, which, for the nonce, was 5 I T's broadcast studio.

It was very obvious both from the mail and from the company gathered at the birthday dinner that in two years 5 I T has done much and progressed a long way in broadcasting. Midland listeners have long since claimed that the Birmingham Station is the most popular of all the provincial stations, and it was pointed out during the London celebrations, when Uncle Edgar, the Birmingham Station director, shared in the 2 L O programme, that he was the senior station director.

Staff of Four.

In point of history, however, while it is officially recognised that Birmingham is the second of the B.B.C.'s stations in order of birthday, there was broadcasting from Manchester before there was broadcasting from Birmingham, experiments having been in progress from Trafford Park for several weeks before regular broadcasting started in earnest.

When, however, 2 L O, on November 14th, commenced to entertain London and the home counties, and then made political history by broadcasting election results, Birmingham got into the ether the following night and shared in this work, while Manchester did not start operations proper until a few nights later.

Birmingham, moreover, like London, has always observed its birthday very ostensibly, whereas Manchester last year made little celebration. Since that last birthday Birmingham, it must be admitted, has made remarkable progress. Since its first institution, for example, its staff has grown enormously. At the old station, which was situated on the outskirts of Birmingham at the works of the General Electric Company, and far enough away from the heart of the city to be under great difficulty in obtaining artistes, there were in the first month only four on the staff. At this year's birthday festivities the company numbered considerably over a hundred, and everyone had an active association with the station.

Outside Broadcasts.

From time to time POPULAR WIRELESS has noted important developments at the Birmingham Station, but it is interesting to recall that among outstanding events of the past twelve months has been the marked extension of the outside broadcast idea. During the summer 5 I T was responsible for the first carillon broadcast, this being the opening recital of the new carillon of 33 bells at Bournville, while later they also broadcast the Loughborough carillon, this being the station's first long-distance broadcast.

The station entered into agreements with two or three of the chief musical organisations in the city, with the result that several important concerts at the Town Hall were relayed and broadcast, while the carrying of a landline to the chief city park enabled the station to broadcast during the summer each Saturday night concerts from the park. These were principally band performances, but the vocalists, it is interesting to note, were supplied by the station.

5 I T's Repertory Company.

Another outstanding broadcast of the year was the first wireless pantomime to be produced in this country, this being broadcast last January. More recently still the station has made wireless history by a bold but clever experiment towards finding a new radio-art form, this being attempted in the first radio fantasy, "The Crown of the Year," which combined words and music to express a mood.

The studio at the Hilversum Broadcasting Station.

The idea of a repertory company of singers with which Mr. Joseph Lewis, the musical director, commenced his association with the station in August, 1923, has prospered exceedingly, with the result that often the company is called upon to give outside concerts. An orchestra of marked ability now numbers permanently 20 members, and augmented has 40 players.

The Children's Corner.

During the past year there has also been running in connection with the station a dramatic company organised by Mr. William Macready, the well-known Shakespearean actor, and there have been produced at the station such well-known plays as "The Christian," "Othello," "School for Scandal," "Under Two Flags," "The Merchant of Venice," "She Stoops to Conquer," "Moths," "Caste," "A Tale of Two Cities," and "David Garrick," as well as many other dramatic pieces.

For a considerable time past 5 I T has made a feature of the Children's Corner, and since in the early days of the station there was inaugurated the first Radio Circle, it should be stated that the membership at the present time is over 6,000. Two or three times a week an original sketch is put over in which the characters are played by the various Uncles and Aunties, and it is interesting to notice that on the occasion of the birthday programme a sample Children's Corner included a new sketch in which Mr. Reith, the managing director of the B.B.C., played a part.

"Birthday" Honours.

Such are the main achievements of the past year at 5 I T, and it was from such a list that for the birthday programme there were selected items under the heading of "Samples." For example, Mr. Harold Casey, better known as "Uncle Pat," joint assistant station director, repeated "The Yeoman's Wedding," the first song he broadcast. For upwards of two hours the sample programme was broadcast, and then, while London was relayed, the broadcasters and a few guests, who included Mr. J. C. W. Reith and Mrs. Reith, Sir William and Lady Noble, Dr. Radcliffe (2 O X), president of the Birmingham Wireless Club, enjoyed dinner.

Then Captain Eckersley, speaking by his home-to-England method, made a few remarks from his house at Hampstead through the Birmingham Station to Midland listeners, the company hearing by means of a loud speaker. He paid a tribute to the station management, a tribute which, too, Mr. Reith paid when he spoke of the loyalty, enthusiasm, and efficient service which Mr. Edgar gave the B.B.C., qualities which were reflected in his staff. Tributes were also paid by the managing-director to Mr. Lewis, to Mr. Harold Casey, and Mr. Alan Pelham, the assistant station directors, and Mr. J. C. S. Paterson, the announcer.

Mr. Reith stated that Mr. Pelham would shortly be leaving the station to take up the appointment at Belfast of senior assistant station director. Then the all-star programme continued to a close, amid enthusiastic scenes, ending a memorable Midland broadcast birthday.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.

SOME INTERESTING ONE VALVE CIRCUITS

By G. V. DOWDING, *Grad. I.E.E.*
(*Technical Editor, Popular Wireless*).

In this article Mr. Dowding briefly reviews some further well-known one-valve circuits which will prove of interest to the experimenter.

IN this article we cannot do better than commence with what is known as the "Ultra Audion" circuit, and which is shown in Fig. 1. It will be noticed that it consists of components exactly similar to an ordinary one-valve regenerative circuit,

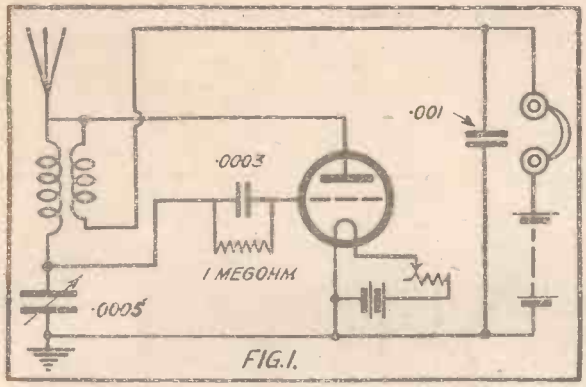


FIG. 1.

but then this is the case of many of the "supers"; most of them look like "straight" circuits incorrectly wired up.

The "Ultra Audion" is a very selective circuit, and the filament control is a very decisive factor in the tuning. It should be of the carbon compression type for choice. It is a simple circuit to operate, although it requires careful handling, and can cause considerable re-radiation.

Single Control Receiver.

It is possible to work a small loud speaker under favourable conditions at short ranges, while it is an excellent circuit for distant reception using telephone receivers.

For wave-lengths up to 400 metres it will be found that two 75-turn coils will generally be most suitable, while for other of the ordinary B.B.C. wave-lengths a 75-

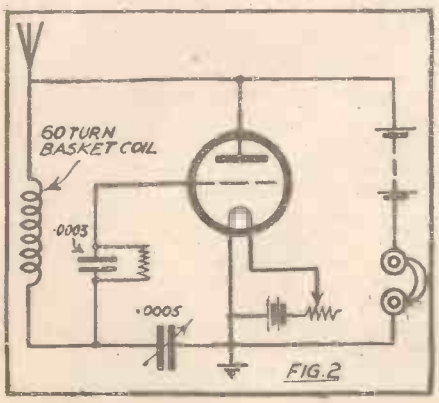


FIG. 2.

turn A.T.I. and a 100-turn reaction should be used. Like practically all the other circuits we have dealt and are going to deal with, a hard valve should be used.

We should like to put in a few words here which apply equally to this circuit and all the others, and that is in connection with adding valves. Hardly any of the circuits lend themselves to extension in respect of H.F. amplification, although in most cases an L.F. stage can be added, but this might necessitate the employment of separate batteries. The experimenter, or rather the constructor, should bear this point in mind, and ask himself whether he is going to be satisfied with just getting the most out of one valve, or whether he is likely to want to go further afield.

Fig. 2 shows a circuit which is very similar to the Ultra Audion, except that it is not provided with a reaction coil. It is, therefore, a single control receiver, except that, as with the Ultra Audion, the filament adjustment is rather critical. It, too, is liable to break too freely into oscillation, and to prevent this not a volt more H.T. than is actually required should be used. It has been proved advantageous to use a variable grid leak with this circuit.

Evolved by a "P.W." Reader.

Rather more than usually interesting is the circuit shown in Fig. 3. It was evolved by a reader of POPULAR WIRELESS, who stated that the idea was given him by De Forest's Ultra Audion, although in our opinion we consider it is too distinctly original for such modesty to be credited.

The circuit has been proved to be both stable and sensitive, and is well worth the amateur's attention.

There are two very critical factors to be considered, and these are the anode coil and the H.F. coil. The anode coil for broadcast reception should consist of 75 turns of 22 D.C.C. on a 3½ in. diameter cylindrical former, a tapping being taken in the middle at the 38th turn.

A Three-Slide Tuner.

The H.F. coil should consist of 100 turns of 36 gauge wire wound basket fashion. A telephone transformer is not essential, although advantageous; 4,000-ohm 'phones can be used. A variable grid leak is useful. The A.T.I. need not necessarily be a variometer; a coil consisting of 60 turns of 22 on a 3½-in. former, tuned with a ·0003 mfd. variable condenser in series or parallel as may be required, can be used instead.

We are not devoting space to a discussion of the theory of operation of these circuits, but it is interesting in this one particular instance to note the double reaction provided by both the capacity and tuned plate, although it is difficult to trace the exact reason why so many readers have found this circuit to be highly selective. It has also been credited with extremely good ranges of reception, although seldom found suitable for even the most modest loud-speaker work.

Fig. 4 depicts a three-slide coil circuit for which not much can be said, except that it provides a very positive reaction control. It is a circuit which may appeal to some as being a "hook up" which can hardly fail to work. It is only capable of normal one-valve performances.

What is a "Super"?

A correspondent writing us in respect of these articles, raises the question as to what exactly is a "super" circuit, and where the line of demarcation is between "super," "freak" and "stunt" circuits.

Of course, none of these words is accepted technically as being indicative of particular circuits, except in the case of "super" when used in combination with another word in the manner of "super-regeneration," "super-heterodyne," etc.

Generally speaking, a "freak" circuit is one whose functioning is more or less inexplicable; a circuit which theoretically should give poor results or no results at all,

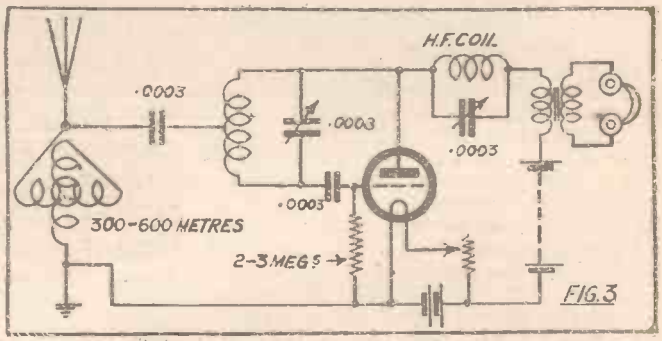


FIG. 3.

but in practice proves capable of useful work.

On the other hand, "stunt" is generally used in quite a broad sense, and covers "freak" and "super" circuits alike. The latter term is frequently used in connection with any "hook-up" proved capable of providing abnormal sensitivity.

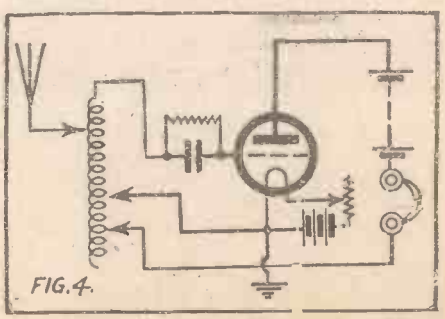


FIG. 4.

A PRACTICAL TWO-VALVE H.F. AMPLIFIER.

By ROWLAND HILL, B.Sc.

VERY many people are under the impression that more than one stage of tuned H.F. amplification is impracticable both from the point of view of stability and ease of operation. This is quite misleading, and if reasonable thought and care are taken over the construction of such an amplifier, successful results will be assured.

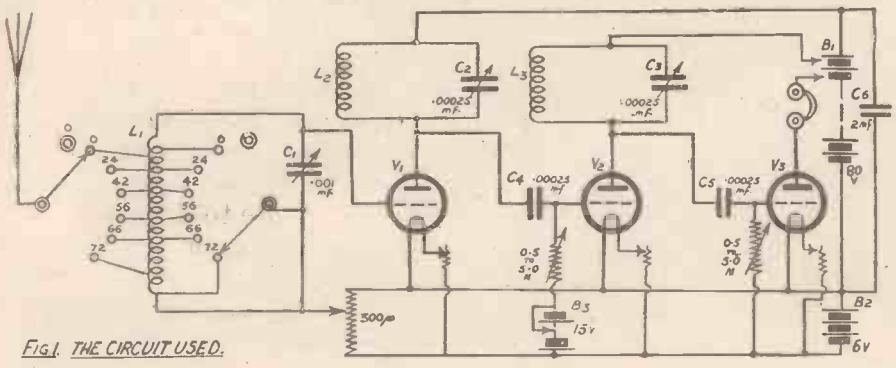


FIG. 1. THE CIRCUIT USED.

A circuit is shown in Fig. 1, and whilst no radical change is made from the conventional tuned anode system, several interesting modifications have been introduced. This method of coupling is used in preference to tuned transformer coupling, since the losses entailed in an air space coil wound with heavy-gauge wire are smaller than in the best of transformers.

The aerial inductance L, forms a departure from the more usual type, and has been used for some time with considerable satisfaction. The coil is wound with No. 18 D.C.C. wire on a skeleton former. This is constructed from two pieces of ebonite or hard dry wood of dimensions shown (Fig. 2), which are fitted together to form a cross resembling somewhat a small frame aerial. Slits are made with a coarse saw so as just to take this gauge wire, the depth of the slots being decreased progressively as the end of the former is approached. Five slits are cut on each side of the former from the centre.

The Tappings.

One layer is now wound in slit 1 at the front of the former, the next in slit 2 at the back, and so on until the end is reached. In the first and second slits 12 turns are wound, in the third and fourth 9 turns, and then progressively in the same order of turns, 7 turns, 5 turns, and finally 3 turns, thus making a total of 72 turns.

Tappings are now taken to two 6-stud switches from points where the wire crosses over from the back to the front of the former—i.e. after 24 turns, 42 turns, 56 turns, 66 turns, and 72 turns. This system of tuning offers many arrangements, but it will be found that best results are obtained when the two switches are in a certain position. The coil is tuned by a ·001 mfd condenser in shunt. A series coil should not be used, as the set will become unstable and oscillate too readily, so that damping will have to be introduced.

The two anode coils should be wound in a similar manner to the aerial coil on a skeleton former, using heavy gauge wire, and should be matched as near as possible. Actually those in use are the Gambrell air space type. They must be well separated so that their fields do not interact and cause a reaction effect; they are tuned by two ·00025 mfd condensers. Originally a double condenser operated from one spindle was tried, but this was found impracticable for several reasons, inferior results being obtained. Firstly, it is almost impossible to match two coils and the wiring underneath the panel, resulting in a certain loss. Secondly, the tuning naturally alters with the impedance of the valve, so that filament temperature has to be taken into account, thus introducing another control. Lastly, it is usually found that the tuning of the first H.F. valve varies more than the second valve if the aerial circuit is detuned; this is probably due to grid plate capacity inherent in the valve itself. Under these conditions it was found advisable to employ two separate condensers. Tuning is not difficult, since the condenser readings never vary more than 2°.

Potentiometer Control.

No intentional reaction is introduced, the valve capacity being sufficient to set up oscillations when the three circuits are tuned to resonance. Thus the only question is stabilisation. This is effected by manipulation of the two switches from the A.T.I., a large ratio of capacity to inductance damping down the aerial circuit and producing a stable state. The set can also be made to oscillate by dimming the filament of the first valve. Potentiometer control is provided, but this is used very sparingly.

Excellent Selectivity.

The grid condensers have the usual value of ·0003 mfd. whilst the leaks are both of the variable type. A grid bias battery B 3 is introduced into the grid circuit of the second valve to prevent partial rectification. Separate anode taps are provided from each valve, this being necessary since the detector is of the soft Dutch type. It cannot be emphasised too heavily that the greatest care should be taken over the wiring, avoiding especially a grid-plate capacity like the plague.

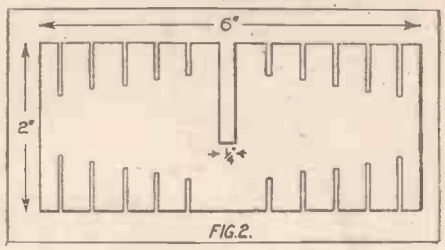


FIG. 2.

All the B.B.C. stations may be read all over the room with the 'phones, whilst the French stations are almost as loud. Some idea of the flexibility, yet ease of operation and selectivity of the set, can be imagined when it is stated that nine of the ten German broadcast stations on wave-lengths 350–600 metres, which are now working, have been heard whilst the British stations are operating. With a 2-valve L.F. amplifier loud-speaker results are obtained from most European stations.

John Henry (left) broadcasting his impressions of the Lord Mayor's Show from the Mansion House.

The Technical Editor of "Popular Wireless and Wireless Review" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

ROUND about Christmas, when social gatherings are the order of the day, even amongst the most recluse of people we should imagine many thoughts must turn to wireless loud speakers, for here is a source of unlimited and economical entertainment. Even in the most musical of families there are bound to be pauses when a loud speaker can be brought into use to fill up gaps in the programme. Therefore, the release on the market of the new "Superatone" two-valve amplifier by Messrs. Wates Bros., Ltd., is almost seasonal.

A variable condenser of interesting design. The "Formo" which is provided with "corrugated" vanes to increase their active surface.

It is a neat little instrument which is particularly designed as a link between the detector and the loud speaker. We have had one sent us for test and consider that in appearance it is one of the neatest pieces of apparatus of this nature yet brought to our notice. The whole instrument, including valves, is totally enclosed in a well-made mahogany case which is supplied with valve inspection windows and hinged top and side, which render the interior entirely accessible.

A grid biasing battery is incorporated, as is an L.F. transformer secondary loading resistance. Other distinctive features are the inclusion of a push pull filament switch which controls both valves, thus permitting the microstats to be left at the most favourable adjustment, two Supra L.F. transformers and readily accessible and sensibly arranged terminals.

The technical design of this amplifier calls for commendation, as the components are arranged with minimum spacing, without a hint of undue crowding. All wiring is neatly carried out with stout square section wire.

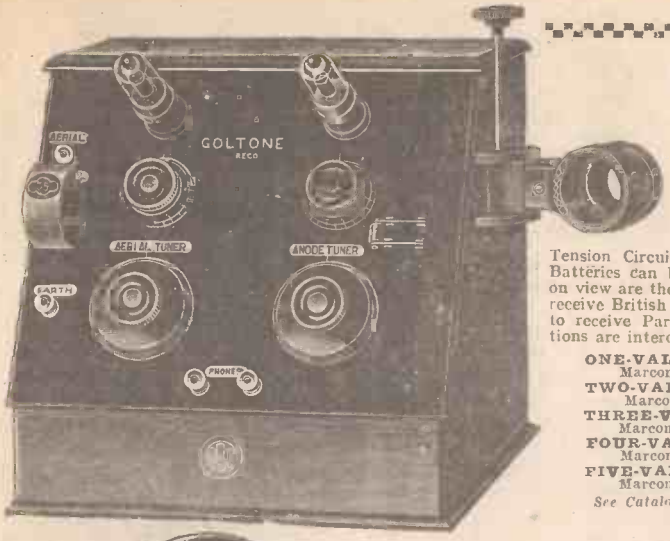
The only fault we had to find with the construction was that the connection from one side of the L.F. transformer resistance had come adrift owing to a rather carelessly soldered joint. But this would not have prevented the instrument from functioning, and on test very excellent results were obtained. Amplification was up to standard and tone excellent. The employment of a B.6 power valve in the last stage proved advantageous, and really surprising magnification was obtained with it in use. The price of the amplifier without accessories is £4, and we consider that Messrs. Wates' claim that it is a real value-for-money proposition is by no means an exaggeration.

* * *

An interesting innovation has been brought to our notice by Engineering Supplies Ltd., of 155a, Upper Thames Street, who have placed on the market a 16-gauge tinned square section wire with insulated sleeving similar to the well-known "Systoflex." It is supplied in bundles of 100 36-in. lengths, and should be received as well by

(*Continued on page 942.*)

A Sterling "Dinkie" loud speaker.



"GOLTONE" (Regd.)
WIRELESS RECEIVING SETS
(BRITISH MADE.)

Elegant appearance. Highly selective. Simplicity in Tuning. Designed for receiving on any Wavelength. The Two-Valve Set clearly receives British Broadcasting and Continental Stations, and for Loud Speaker reception the Three-Four- and Five-Valve Sets have proved entirely satisfactory in all parts of the Kingdom. Polished Cabinet with removable back, Ebonite panel fitted with Valve Holders. Filament Resistances, Condensers for Tuning Aerial and Anode Circuits, Knife Switch for High and Low Tension Circuit, etc. Both the Low Tension and High Tension Batteries can be fitted inside the cabinet, and the only wires on view are the Aerial and Earth. Provided with Plug-in Coils to receive British Broadcasting Stations. Plug-in Coils to receive Paris, Berlin, and other high-wave Stations are interchangeable, and can be supplied.

ONE-VALVE SET **£2 18 0**
Marconi Pat. Royalties, 12/6 net.
TWO-VALVE CABINET .. **£7 10 0**
Marconi Pat. Royalties, 25/- net.
THREE-VALVE CABINET **£10 10 0**
Marconi Pat. Royalties, 37/6 net.
FOUR-VALVE CABINET **£13 10 0**
Marconi Pat. Royalties, 50/- net.
FIVE-VALVE CABINET **£19 10 0**
Marconi Pat. Royalties, 62/6 net.
See Catalogue R/111 for full particulars.

"GOLTONE" ONE-VALVE SET.

"GOLTONE" WAVE TRAP

An extremely effective instrument, when used in conjunction with a variable Condenser ·0005, for eliminating signal interference up to 600 Metres. Easily attached.

No. R5/750
12/6 each.

As illustrated, fitted in polished case, Ebonite Panel ready connected with Variable Condenser. No. R5/1057. **32/6** each

BRITISH MADE LOUD SPEAKERS

Excellent finish. Represents the best possible value. 2,000 ohms. Complete with Cords.

"GOLTONE" CONCERT GRAND

Unequalled for volume of sound and purity of tone. 14 in. Bell mouth, 22 in. high.
£4 : 0 : 0

"GOLTONE" JUNIOR

9 in. Bell mouth, 16 in. high.
£1 : 10 : 0

"GOLTONE" CRYSTAL RECEIVING SET

Licensed under Patent No. 214005/23.
BRITISH MADE.)

SPECIAL FEATURES:

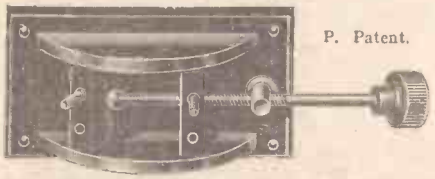
Archimedian fine selective tuning. Improved type Dustproof Detector. Moulded Ebonite Top and Base. Remarkable volume of sound. Equal in results to Sets sold at many times the price. Complete with "Sonyte" Crystal, and all connections fitted ready for connecting to Aerial. High-grade finish and appearance.
Model No. R4/1, wave-length 150 to 600 Metres, **7/6**
Model No. R4/1c, wave-length 150 to 1,800 Metres,
10/6
Packed in attractive Box.

Large fully illustrated Catalogue, No. R/111, showing a wide range of Crystal and Valve Receiving Sets, Constructional Sets, and Component Parts of every description, post free on request. Enclose business card for Trade Terms.

Ward & Goldstone PENDLETON MANCHESTER LTD

These lines are stocked by
HOUGHTON'S LTD., High Holborn, LONDON,
and BRANCHES, and by Leading Radio Stores. Write direct if unobtainable.

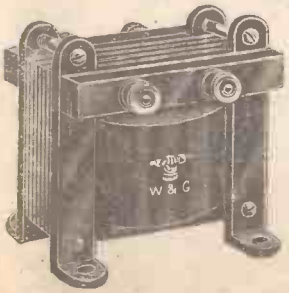
"GOLTONE" Micrometer Regulating COIL HOLDER



P. Patent.

Enables the finest possible tuning, considerably increasing the Efficiency, Selectivity, and Reliability of the Receiving Set.
Two Coil Type, **9/-**; Three Coil Type, **12/6**

"GOLTONE" LOW FREQUENCY TRANSFORMER



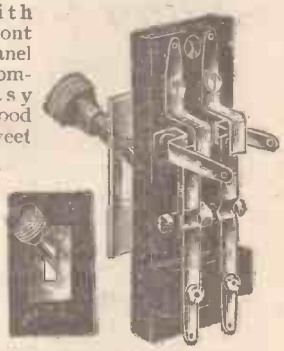
Unsurpassed for silence, efficiency, and reliability. Provides remarkable amplification with freedom from noise and distortion. Equally suitable with every type of valve. No make of Transformer gives better results. Price **17/6**

"GOLTONE" NO-CAPACITY SWITCH

Fitted with screwed front plate for Panel Mounting. Compact. Easy Fitting. Good Contact. Sweet action.

No. R17/100 2-Way Double Pole. **3/6** each.

No. R17/110 4-Way Double Pole. **5/6** each.



"SAMPSON" ACCUMULATOR CARRIER

Patent No. 214037/23.

Light, strong, and exceedingly useful. The inconvenience of handling weighty, cumbersome accumulators is entirely obviated. Suitable for any size accumulator. Folds flat to fit the pocket, **3/-** each.

WARNING. Rigorous proceedings will be taken against infringement of this patent.

Give WIRELESS — the Present of the Future

Write TO-DAY for Special Catalogue POST FREE

LOUD SPEAKERS

	£	s.	d.
Amplion	5	5	0
„ Baby, wooden horn	2	2	0
„ Baby, metal horn	1	7	6
„ Dragon Fly	1	5	0
„ New Junior	2	10	0
„ New Junior de Luxe, wooden horn	3	5	0
Brandes Table Talker	2	2	0
T.M.C. Copper Baby	2	17	6
B.T.H. C2	5	0	0
„ C3 (gramophone attachment)	2	2	0
„ C1	2	10	0
Fellows	4	10	0
Brown Baby	3	10	0
Gecophone	5	10	0
Radio Equipment	2	2	0
Sterling Baby, Floral	2	17	6
„ Black	2	12	6
"Revo" Loud-speaker	4	0	0
Sterling Primax, with parchment diaphragm, without horn	7	7	0
Sparta, 2,000 w.	4	15	0
Sterling Dinkie	1	10	0
Ediswan Dulcivox	2	0	0
„ Televox	5	5	0
Humavoc Loud-speakers	1	7	6

HEADPHONES

B.T.H.	25/-
T.M.C.	22/6
Brown F.	25/-
Sterling	25/-
Fellows	18/6
Siemens	25/-
Western Electric	25/-
Cosmos	24/-
Brandes	25/-
British Ericsson	26/6
"Dainty" Phones	15/-

VALVES

Marconi R5V	12/6
„ DER	21/-
„ DE3	25/-
„ DE6	25/-
Mullard Ora	12/6
„ H.F.	12/6
„ L.F.	12/6
B.T.H. R4	12/6
„ B4	35/-
„ B5	25/-
„ B3	21/-
„ B6	35/-
Ediswan AR	12/6
„ ARDE	21/-
„ SRO6	25/-
„ R	12/6
Cossor R1	12/6
„ P2	12/6
Thorpe K4	17/6
Louden (plain)	10/-
„ (Blue)	10/-

BATTERIES

Phoenix 90 v	15/-
„ 60 v	10/6
„ 36 v	6/6
„ 15 v	2/9
„ 4½ v Eltax	6d.
„ 6 v	1/3
"Perfect" 4½ v	6d.
Siemens 1½ v No. 640	2/8
„ 3 v, No. 665	3/5
„ 66 v, No. 829	13/6
„ 30 v, No. 826	7/6
„ 90 v, No. 830	20/6
„ 100 v, No. 831	21 6
„ 36 v, No. 827	8/-
„ 15 v, No. 832	3/6
„ 4½ v No. 324	9d.
Ediswan, 50 v H.T.	9/-

COIL MOUNTS.

Wedge shaped, Brass ends	1/3
Wedge shaped, Nickel plated ends	1/6
Polished with fibre	1/6
Panel Mounting (flush fitting)	1/-
Panel Mounting with nuts, etc.	1/3
Basket Coil Holders	1/6
Coil Mount, with red fibre strip	1/-
Panel Mounting Coil Plug, horseshoe	1/-
Belling Lee Self-shorting Plug and Socket	8d.

CRYSTALS

Shaw's Hertzite	1/-
Cymosite	2/6
Tungstalite, Blue Label	1/6
SATURNIUM (highly recommended)	2/3
Neutron	1/6
B.T.H. in cup	1/6

TRANSFORMERS (Low Frequency).

Igranic Shrouded (new type)	21/-
Igranic Shrouded (ratio 1–1)	18/6
R.I. (new type)	25/-
„ Telephone	20/-
Ferranti	17/6
Eureka, 1st stage (Concert)	30/-
Eureka, 2nd stage (small)	22/6
Solent	11/6
K.G. (large)	18/6
„ (small)	13/6
Burndept 1st stage	24/-
2nd stage	24/-
Lissen Transformers, T.1.	30/-
Lissen Transformers, T.2.	25/-
Lissen Transformers, T.3.	16/6
Solent King	20/-
Silvertown Transformer	21/-
Marconi Ideal Transformer	35/-
Amplitrons	18/6

CONDENSERS Variable

·001	8/-
·0003	5/6
·0001	4/6
·001 with Vernier	9/6
·0003 „ „	7/-
·0005 „ „	6/-
·0002	4/6
·00005	4/6
·0005 with Vernier	7/6

Ormond Square Law

·001	10/6
·0003	9/-
·001 with Vernier	12/-
·0003 „ „	10/6
·0005	9/6
·00025	8/6
·0005 with Vernier	11/-
·00025 „ „	10/-
Polar ·0005	10/6
„ ·0003	10/6

(All Ormond and Polar Condensers complete with knob and dial.)

"SEAMARK" with internal Reactance for W.T.5. SET 7/6 & 10/-

VARIOMETERS

Solent on Cardboard, one hole fixing, less knob and dial	2/6
"Transocean" on Ebonite	4/6
Igranic Type	10/-
W. & W. Aerial Variometer	10/-
W. & W. Anode with Reactance	12/6
"Seamark" Anode with Reactance	10/-
"Seamark" Junior Anode with Reactance	7/6
Harco Channelled Variometer	3/-
Woodhall Variometer	7/6

RHEOSTATS

Ormond	2/-
Igranic	4/6
„ with Vernier	7/8
„ for Dull Emitter	7/6
Lissenstat	7/6
„ Minor	3/6
Microstat	2/9
Peerless Minor, 6 w.	2/6
„ „ 15 w.	2/6
„ „ 30 w.	2/6
Peerless Ordinary, 6 w.	4/6
Peerless Ordinary, 15 w.	4/9
Peerless Ordinary, 30 w.	5/-
Burndept, 7 w	5/-
„ Dual, 7 w	7/6
„ 30 w.	3/-
Bordac, 6 w.	
Potentiometer, Igranic, 300 w.	7/-
Potentiometer, M.V., 200 w.	6/6

"SATURNIUM" "THE Crystal." Results at all points. 2/3

CABINETS

12½ x 9½ x 5 flat box outside measurement, brush varnished	6/-
12½ x 9½ x 5 flat box, inside measurement, mahogany or oak	13/6
12½ x 9½ x 5 sloping box, inside measurement, mahogany or oak	15/-
16 x 11 x 6 flat box, inside measurement, mahogany or oak	17/-
16 x 11 x 6 sloping box, inside measurement, mahogany or oak	20/-

The Ingersoll WIRELESS COMPANY LTD

Mail Order Dept.—
26, CHANGE ALLEY, SHEFFIELD.
Branches at 2-6, Swinegate, Leeds, and 53, Tyrrel Street, Bradford.

COIL HOLDERS, 2-WAY

Solent Vernier Screw	6/6
Quality 2-way	5/-
Quality Vernier	9/-
Aermonic, Nickel Plated	7/6
Polar, with Vernier	10/6
Polar Junior	6/-
Basket, 2-way Coil Holder	5/-
B.M. 2-way Coil Holder	4/-
Toowai Coil Holder	3/-

COIL HOLDERS, 3-WAY

Quality Nickel Plated	7/6
Polar Junior 3-way	9/6

COILS.

Igranic Coils No. 25	5/-
„ „ 30	5/-
„ „ 35	5/-
„ „ 40	5/2
„ „ 50	5/2
„ 60	5/4
„ „ 75	5/6
„ „ 7/-	
„ „ 100	7/-
„ „ 150	7/10
„ „ 200	8/8
„ „ 250	9/-
„ „ 300	9/5

PANELS EBONITE.

10 x 6 x 3/16	3/-
10 x 6 x ¼	3/6
12½ x 9½ x 3/16	6/-
12½ x 9½ x ¼	6/6
16 x 11 x ¼	10/6

Any size sheet cut from 3/16 in. or ¼ in.

RADIO PRESS ENVELOPES

CRYSTAL DETECTORS

Unassembled for Panel Mounting	1/2
Burndept	5/-
Service Type	2/6
Carded, with terminals	1/6
Carded, less terminals	1/-
Mic-Met	6/-
Magic Tone (permanently fixed)	3/6
Solent, Panel mounting	1/8
Vertical, on Ebonite	2/-
Horizontal, enclosed	2/-
Belling Lee Crystal Detectors	3/9

DOCTOR PETRIE'S PHONES ensure true reception from even the most distant stations. Sensitive. Tested and fully guaranteed **13/6**

ALL GAUGES D.C.C. AND ENAMELLED WIRE.

INSULATORS.

Insulators, Reel	2d.
„ Small Egg	1½d.
„ G.E.C.	1/-
„ Large Shell	6d.
„ Small Shell	1½d.

CONDENSERS. Solent Square Law

·001 without knob or dial	8/3
·0003 without knob or dial	6/3
·0005 without knob or dial	7/-
·0002 without knob or dial	6/-
Sterling ·0005	25/6
„ ·00025	23/-
„ ·001	30/6
Solent Square Law, with Vernier ·001, with knob and dial	15/6
Do., with knob and dial, Vernier ·0005	12/6
Do., with knob and dial, Vernier ·0003	11/6
Solent Square Law, with Vernier ·0002	10/9
Micro Vernier Condenser	3/6
Tameside ·0003	5/-

VARIOMETERS.

Solent Inside Winding Variometer	4/6
Ebonite Variometer Isone)	7/6
Belling Lee Variometer	4/6
Solent 6 w. velvet movement	3/6
„ 6 w, one hole fixing	2/-
„ W.I.	1/6
„ Superior (one hole fixing with n/p dial)	4/6

GRID LEAKS.

Dubilier, Grid Leaks, 1 meg & 2 meg	2/6
„ other values	2/6
Lissen, Variable Grid	2/6
Warmel, Grid Leak	2/6
Filtron Leak	3/6
„ and Condenser	7/6

ANODE RESISTANCES

Dubilier, with clips, 60,000 w	5/6
„ „ 80,000 w	5/6
Lissen Anode	2/6
Watmel Anode Resistance	3/6
Metrovick (Ratio 4 to 1)	15/-
Muzzlephone Power transformer	20/-
Oval Shrouded	20/-

VALVE SETS

The INGERSOLL Two-Valve and Four-Valve Sets are unapproachable for value.

TWO-VALVE RECEIVER with H.T. Battery and L.T. Accumulator, including Marconi Royalty **£9**

FOUR-VALVE RECEIVER for Loud Speaker Results **£21**

Valves and 'Phones extra.

ACCUMULATORS.

L. & No.					Price	Crates Extra	Carr. Extra
440 A	Ediswan	2	volt, 20	actual	11/6		9d.
440 B	„	2	„ 30	„	14/6		1/-
440 C	„	2	„ 40	„	17/-		1/3
440 D	„	2	„ 50	„	19/6	—	1/6
440 E	„	2	„ 60	„	22/6	—	2/-
440 F	„	4	„ 20	„	21/-	—	1/3
440 G	„	4	„ 30	„	25/6	—	1/3
440 H	„	4	„ 40	„	32/-	—	1/6
440 K	„	4	„ 50	„	36/6	—	1/6
440 L	„	4	„ 60	„	46/-	—	2/-
440 ME	Ediswan	6	volt, 20	actual	31/-	—	1/6
440 N	„	6	„ 30	„	38/-	—	2/-
440 O	„	6	„ 40	„	45/-	—	2/-
440 P	„	6	„ 50	„	54/-	—	2/6
440 R	„	6	„ 60	„	63/6	—	3/-
450 A	Hart,	2	„ 20	„	12/7	4/10	9d.
450 B	„	4	„ 20	„	23/8	5/10	1/3
450 C	„	4	„ 30	„	28/11	6/2	1/3
450 D	„	4	„ 40	„	34 2	6/6	1/6
450 E	„	6	„ 20	„	35/6	6/2	1/6
450 F	„	6	„ 30	„	43/11	6/7	2/-
450 G	„	6	„ 40	„	53/1	7/-	2/-

APPARATUS TESTED.

(*Continued from page 936.*)

manufacturers of wireless sets as the amateur constructor desirous of combining safety with neatness in the wiring of radio apparatus.

* * *

An L.F. transformer designed for "one hole" panel mounting is a useful component and is certain of popularity among amateur constructors. Messrs. the "Wireless Warehouse," of 37 Morton Street, Victoria, S.W.1, have sent us a sample of their "Maxima," which embodies this feature, and retails at 15/6. It is a well made instrument and has the appearance of a short brass cylinder with a round ebonite base and top. On the latter is fixed a countersinking brass screw for fixing, and on the latter four brass terminals for connecting purposes. It possesses the useful ratio of 4 to 1.

On test this transformer, which all complete weighs just about a pound, gave quite good results. Amplification with its use proved good and tonal reproduction quite commendable.

* * *

M. Verstracten, of Melvill Chambers, Lord Street, Liverpool, has sent us details of some very handsome wireless cabinets in solid oak which he is marketing. The price of these is £4 10s., and we do not consider it an overcharge if they are according to specifications submitted.

Amateurs desirous of transforming their sets into tasteful pieces of furniture should find them extremely useful.

* * *

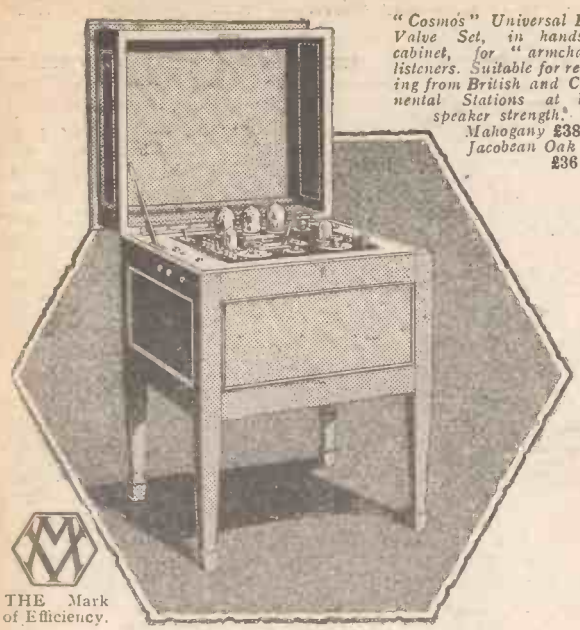
Messrs. Radio Instruments Ltd., of 12, Hyde Street, W.C.1, inform us that Messrs. The Northern Radio Co., Ltd., of 19, Hopwood Avenue, Manchester, no longer hold their agency for the Northern District, and that neither that Company nor Mr. G. Tempest has the authority to represent them in any way.

A "Polar" Precision variable condenser. Note the precision.

Readers will probably have noticed the error which unfortunately crept into the two page advertisement concerning the well-known loud speakers of Messrs. S. G. Brown, Ltd. in our last issue. The loud speaker at the bottom of the right hand page should be described as the Brown H.2 and not as the Brown H.1. Doubtless the majority of our readers know these famous instruments by sight so well that the mistake was immediately detected, but it is as well to point out that no reclassification has been made.

* * *

The M.O. Valve Co., Ltd., has sent us a sample of their new valve the D.E. 7, which is a dull-emitter four-electrode valve taking 1·8 volts at ·4 amps. It is an all-purpose valve, particularly designed for use with "low H.T.," 6 to 15 volts being all that is required. A filament consumption of ·4 amps rather precludes the use of a dry battery with these valves—in our tests we used a two-volt accumulator. Using on an average 10–12½ volts H.T. normal results were obtained both in detecting and amplifying capacities. As an experiment we placed a D.E. 7 in a Unidyne receiver with which was being used a 6-volt accumulator (3 valves). With a fixed resistance of about 9 ohms in circuit as a protective measure quite good results were obtained, but as the Thorpe K4 only takes some ·5 amps we can hardly recommend the D.E. 7 for this purpose. However, the D.E. 7, when used in the manner suggested by the makers, effects an economy in H.T. voltage with no reduction in efficiency of operation.



"Cosmos" Universal Five-Valve Set, in handsome cabinet, for "armchair" listeners. Suitable for receiving from British and Continental Stations at loud-speaker strength.
Mahogany **£38 15s.**
Jacobean Oak
£36 15s.

THE Mark of Efficiency.

Your Xmas Party is not complete—

—without this wonderful Radio Receiving Set

Everyone fully appreciates the clever and versatile guest at a Christmas Party. The fellow, or maybe girl who, by his or her exuberance of wit and cleverness, can keep the party alive, is much sought after at this time of the year.

His or her position, however, is being usurped, and to-day it is possible to provide all the entertainment required at a Christmas gathering by means of that wonderful instrument, **The "Cosmos" Universal Valve Set**—such as shown in the illustration above. This set is a real friend to the Christmas Host.

By the **simplest possible method of control** he can "pick up" the entertainment being sent out from any British or Continental Station, and reproduce it at Loud Speaker strength **positively without distortion.**

Singing and Orchestral music is produced with remarkable **mellowness of tone,** while speech comes through with **clarity** and **exactness.**

Your Christmas Party is not really complete without a "Cosmos" Universal Valve Set.

Ask your Radio Dealer about it—and write to the address given below for a Price List P.P. 7117/1 (6d. post free).

Make no mistake, let it be

COSMOS

ADVT. of METRO-VICK SUPPLIES, LTD., 4, Central Buildings, Westminster, London S.W.1.

R
Z80

"Cosmos" Radiophones speak for themselves.

"CLARKE'S ATLAS" SPECIALITIES

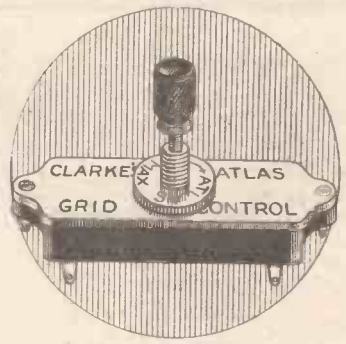
are fully guaranteed, and you can rest assured that before any given wireless part is allowed to carry the "ATLAS" brand it must be essentially practical in design, sound in construction, and moderate in price.

Ask any good dealer's opinion of the "Atlas" range.

Fixed Grid Leak and Condenser.

The condenser casings are made of strong Bakelite, and only the very best copper foil and the finest Ruby Mica as the dielectric. Not only is the condenser of the actual capacity named, but the capacity is kept absolutely constant. The leak is encased in neat ebonite tubes, the ends of which are surmounted by brass nickel-plated caps, also fitted with our latest pattern of Bracket-cum-soldering tag. All values supplied both of leak and condenser. Condenser tested to 1,000 volts.

Prices from **3/6** each



GRID CONTROL
(Variable Grid Leak and Fixed Condenser Combined).

Gives uniform adjustment from ½ to 10 megohms, makes signals clearer, and brings in those long-distance stations. It is absolutely noiseless, and is not affected by atmospheric conditions The condenser which is of .0003 mfd. capacity, is built up from the finest Ruby Mica and pure copper foil clamped under pressure and is perfectly constant The Condenser Shell is made of Bakelite—and encased in this Shell is the special resistance strip forming the Grid Leak. Nickel-plated soldering tags, etc., are also provided, the whole being finished off with a high-class Ebonite Knob. One-hole fixing

Complete as shown 4/6 each.
Var. Grid Leak only 2/6 "

For American Short-Wave Reception use Clark's "ATLAS" Short-Wave Coils (set of four) incorporating the latest "Low-Loss" principles

Say "ATLAS" and be Safe

SOLE MANUFACTURERS:

H. CLARKE & Co. (Manchester) Ltd.

RADIO ENGINEERS

Atlas Works, Old Trafford, Manchester.

'Phones: 683 & 793 Trafford Park 'Grams: "Pirtoid, Manchester"

ATLAS

RADIOTORIAL

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All contributions to be addressed to The Editor, POPULAR WIRELESS AND WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

Technical queries are answered by post at a charge of 6d. a query or 1s for three. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the queries sent should be kept, as the original query cannot be reproduced in the answer. Cash should be sent in the form of postal orders.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

PATENT ADVICE FOR READERS.

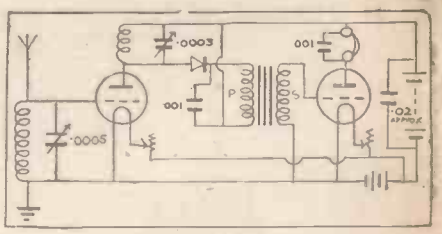
The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

Questions and Answers

P. J. L. (Ashby-de-la-Zouch).—Can you give me a circuit for a two-valve and crystal set where both the valves are employed solely as amplifiers? I am aware of several "dual" or reflex circuits using two valves and a crystal, but I desire to use a "straight" circuit for long-distance work, with the first valve acting as H.F. amplifier, crystal as detector, and the second valve acting as L.F. amplifier. Is it possible to obtain reaction on a circuit of this kind using Nos. 75 and 50 plug-in coils and a ·0005 variable condenser? What other condensers would be necessary?

The accompanying circuit shows how the first valve can be made to act as an H.F. amplifier on the tuned-anode principle. Across the anode coil are connected the crystal detector and primary of an L.F. transformer in series.

The H.F. impulses flowing through the anode coil set up potential differences across its ends. This causes a current flow through the primary and crystal, so rectified impulses are passed on to the secondary of the L.F. transformer, which is connected to grid



and filament of the last valve. This valve will thus act as an L.F. amplifier, with 'phones connected in its plate circuit.

The ·0005 variable condenser, placed across a No. 35 or 50 aerial coil, will tune the aerial circuit over the main station broadcasting wave-lengths when connected to an aerial of average length.

A 75 coil may be used for the anode circuit, and a ·0002 or ·0003 variable condenser will bring this circuit in tune with the aerial circuit.

O.P. and I.P. connections are not shown, as they should be reversed until best positions are found.

A ·001 fixed condenser across the primary is the value in general use for this position, but occasionally it can be improved on, so other condensers may be tried in its place, and the effect noted.

(Continued on page 950.)

HULLO EVERYBODY!!

All these Goods sent by Post. Foreign Packing and Post extra.

"DE LUXE" MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

·001	7/3
·0005	5/11
·0003	5/4
·0002	4/11

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

John Blair, Esq., Rexall Pharmacy, Millom, says:—
Your Condensers are a REVELATION to me as a Dealer. Sept., 1924.
C. Walton, Esq., Andover:—
Tested your Condensers on Megger and got "INFINITY."

NEW MODEL

With knob and dial.

WITH VERNIER.

·001	9/3
·0005	7/3
·0003	6/9

With EBONITE DIAL and Two Knobs. Post 6d. Set.

TWIN CONDENSER

SQUARE LAW

EBONITE ENDS

·00025	12/6
·0003	12/6
·0005	18/11

TWIN (ordinary)

Equal units of ·00025 or ·0003 9/-
Complete with Knob and Dial.

NEW MODEL SQUARE LAW

	AL'MJ ENDS	EBONITE ENDS
·0003	10/-	11/6
·0005	10/11	12/6

With Knob and Dial. Post Free.

LONDON'S LARGEST Stockist of

JACKSON BROS.'

"J.B." Variable Condensers, Complete with Knob and Dial.

SQUARE LAW		STANDARD	
·001	9/6	·001	8/6
·0005	8/-	·0005	7/-
·0003	6/9	·0003	5/9
·0002	5/6	·0002	5/-

Other sizes as advertised by "J.B."

STERLING SQUARE LAW

with Vernier.

·001	30/-
·0005	25/6
·00025	23/6

POLAR

·001 var. Condenser	10/6
·005	10/6
·0003	10/6
Cam Vernier 2-way Coil Holder	11/-
Polar 2-way, with Vernier	11/-
Polar 3-way, with Vernier	17/-
Polar-Junior, 2-way Cam Vernier	6/-
Polar Junior, 3-way Cam Vernier	9/6

GOSWELL ENGINEERING

Patent Valve Holder	1/6
Goswell 2-way coil holder	5/6
Goswell 2-way Vernier Coil Holder	9/-
Goswell 3-way Coil Holder	7/6
Goswell 2-way Panel Mounting	3/-
Goswell 3-way Panel Mounting	5/-
Goswell 3-way Cam Vernier	12/6

LISSEN

Variable Grid Leak	2/6
Anode Resistance	2/6
Lissen Minor	3/6
Lissenstat	7/6
Do. Universal	10/6
2-way Switch	2/9
Series Parallel	3/9
T1 Transformers	30/-
T2, 25/-; T3. 16/6; Coils: 25, 4/10, 30, 35, 40 4/10, 50 5/-, 60 5/4, 75 5/4, 100 6/9.	
5 point switch	4/-
Lissen choke	10/-
Aux. Res.	1/3

ALL VALVES ON POST SENT AT PURCHASER'S RISK.

VALVES

THORPE K4 (5-pin)	17/6
PHILLIPS 4 ELECTRODE (Both for UNIDYNE.)	12/6

BRIGHT EMITTER 12/6 each

B.T.H.	R. Type
Ediswan	A.R. "
Marconi-Osram R. or R 5 V	"
Mullard-Ora	"
Cossor	P.1 "
Cossor	P.1 "
Myers-Universal	
Mullard H.F. (Red Ring)	
Mullard L.F. (Green Ring)	

DULL EMITTER 21/- each

	Type
B.T.H.	B.3
Ediswan	A.R.D.E.
Marconi-Osram	D.E.R.

25/- each

	Type
B.T.H.	B.5
Ediswan	A.R.O.6
Marconi-Osram	D.E.3
Mullard	D.F.Ora

DULL EMITTER POWER VALVES
For use with A.R.D.E. and D.E.R. Valves.
Marconi-Osram, Type D.E.6,2-2·5 volt. ·25 amps. 25/-

DULL EMITTER POWER VALVES
For use with ·06 Valves:

B.T.H. Type B.6	25/-
Marconi-Osram Type D.E.4	30/-
Mullard, Type D.F.A.2	30/-

POWER VALVES
For use with Bright Emitters

B.T.H.,	B.4 35/-
Marconi-Osram	D.E.5 35/-
Mullard	D.F.A.1 35/-
·06 French Metal	16/11
·06 Dutch	13,6
Phillips ·04 Type	16/11

FILAMENT RHEOSTATS
Wire Wound Type.
Rotary Action.

IGRANIC ohms each.

Plain Type	4 & 7	4/6
With Vernier Adjustment	4	7/-
Plain Type	30	7/-
The Raymond	6	1/6
The Ormond		2/-

BASKET COIL HOLDERS

No. 1	2 for 2/-
No. 2	2 for 2/6
(both with plug)	
Coil Stand 2-way for Basket Coils.	4/11
Universal 2-way for Basket Coils.	5/11

"BABY" COIL STANDS

2-way on base	3/-
3-way on base (brass fittings)	4/9
2-way ex. handles	4/6
3-way do (nickel fittings)	5/6
2-way Cam Vernier, high-class	5/9

Several high-grade patterns:

2-way	at 5/-, 5/6
3-way	at 6/11, 7/6

HEADPHONES

We can recommend these as being excellent Headphones, with a great reputation.

B.T.H. 4,000 ohms	25/-
G.R.C. 4,000 ohms	20/-
BRANDES 4,000 ohms (Matched tone)	25/-
BROWN'S 4,000 (featherweight)	25/-
STERLING 4,000 ohms	25/-

ALL POST FREE.

DUBILIER

·001, ·002, ·003, ·004, ·005, ·006, Fixed	3/-
·0001, 0002, ·0003, ·0004, ·0005	2/6
Type 577, ·01	7/6
Grid Leaks, each	2/6
Anode Resistance 50,000, 70,000, 80,000 100,000, on stand complete	5/6

IGRANIC

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/8	
Fil. Rheostat	4/6
Potentiometer	7/-
30-ohm Rheostat	7/-

WATES MICROSTAT

For D.E. or R. Valves 2/9

Post Free.

ACCUMULATORS

FOR CALLERS ONLY at present.
See Callers' List.

2 v. 40 amps	10/6
4 v. 40 amps	17/6
4 v. 60 amps	20/6
4 v. 80 amps	24/6
6 v. 60 amps	29/-
6 v. 80 amps	34/6
6 v. 105 amps.	49/6

Formo, open 12/6

47 Bucks "Powquip" 12/6

Manchester "Powquip," 15/6

Ormond 14/6

Shrouded "Powquip," 18/-

Standard "Powquip," 14/6

BRETWOOD

(New Model)

Var. Grid Leak	3/-
Anode Resistance	3/-

FRENCH THOMSON-HOUSTON

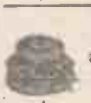
4,000 ohms Phones. Wonderful Tone, Magnificent for Crystal sets. 15/11 pair.

33 ENERGO

H.F. Plug-in Transformers	
No. 1. 150-450	3/6
No. 2. 250-700	3/11
No. 3. 450-1200	4/3
No. 4. 900-2000	4/6
No. 5. 1600-3000	4/9
No. 6. 2200-5000	4/11

14 Voltmeter, 4/6

21 C and S, one-hole fixing, 1/3



16 Rheostat, with Dial, extra value, 2/6

44 Bretwood Valve-holder. 1/9

For DE or R Valves

New type Crown Rheostat. Wonderful value.

POST FREE 2/6

WATMEL

Var. Grid Leak	2/6
Anode Resistance	3/6

N & K MODEL LIGHTWEIGHTS

Beautifully made.

9/11 pair.

Post 6d. pair.

41 AMPLION Dragon Fly. 25/-

46 BASKET 2-way. 4/11

McMICHAEL'S H.F. TRANSFORMERS

150- 300 300- 600 1,100-3,000 eac (Manufacturer's advance.) 10/-

32

100,000 ohms Fixed 2/6

2 meg. Leak 2/6

Both with clips.

N and K No. 3. Latest Model 17/6

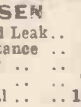
New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size earpieces and leather headbands of standard "N & K" comfortable design. Technically, "N & K" Headphones represent the last word in Wireless Reception. IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.

53 2 for 1/6

29 2 for 2/-

EDISON BELL

·0001 to ·0005 Fixed	1/3
·002 to ·005	2/-
·001	1/3
·0003 with Grid Leak	2/6
Variometer	10/6
Twin Detector	5/6



"R.I." NEW MODEL IN SEALED BOX

Don't Buy Otherwise.

Post 25/- Free

49 FORMO SHROUDED 18/-

POST ORDERS.

Owing to tremendous pressure on Post Dept., all POST ORDERS accepted for delivery in strict rotation and on no other terms. Delivery for orders received AFTER Dec. 15th NOT guaranteed before the holidays, but we will do our best.

46 Cnt iron Solid Rod 1/3 Legless 1/3

48 5—1 11/9

RIGHT OPPOSITE DALY'S GALLERY DOOR

K. RAYMOND

27, LISLE STREET, LEICESTER SQUARE, W.C.2

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

HOURS OF BUSINESS:

DAILY - 9 to 7.45

SUNDAY - 10 to 1

'Phone: GERRARD 4637

HULLO EVERYBODY!!

THESE GOODS ARE SENT BY POST. Foreign Packing and Post Extra.

CALLERS! THESE 3 COLUMNS FOR YOU NO POST ORDERS FOR SAME.

PARTS FOR 2-VALVE "UNIDYNE" RECEIVING SET

The 4-electrode valve, Thorpe K4 each	17/6
6 Terminals for	10d.
2 Microstat Filament Resistances each	2/9
1 Variable Grid Leak	2/6
1 Single-Pole Double-Throw Switch	1/3
1 ·0005 Variable Condenser, with Vernier	7/3
1 Cam Vernier 2-way Coil Holder	9/-
Panel 5½ in. x 1½ in, drilled to hold two 5-pin valve holders for	2/-
2 5-pin Valve Holders each	1/6
1 Fixed Condenser, ·001 1/2, 2/2, 3/-	
1 Fixed Condenser, ·0002 1/2, 2/2, 3/-	
1 Shrouded L.F. Transformer	15/11
8 yds. No. 18 Gauge Tinned Copper Wire	1/2

Necessary Screws, Nuts, and Washers Free if above lot purchased, and Post Free.

FERRANTI L.F. BETTER THAN THE BEST 17/6

Try our **10/11** light as a Feather Phone, 4000 ohms.

L.F. TRANSFORMERS

Eureka Concert Grand	£1 10/-
No. 2. (Second Stage)	£1 2/6
Igranic, 5-1 Ratio	21/-
The Ferranti, 4-1	17/6
The Silverton, 5-1	21/-
The G.R.C. 5-1	15/-
The G.R.C. 10-1	20/-
Marconi Ideal Power	35/-
Burndept L.F. 5-1 Ratio	25/-
Lissen T. 1 L.F.	30/-
" T. 2 L.F.	25/-
" T. 3 L.F.	16/6

LOUD SPEAKERS BABY MODELS

Sterling, 4000 ohms	£2 15/-
Sterling Dinkie	1 10/-
Brown's 2000 ohms	2 8/-
Amplion Junior	1 7/6
Dragon Fly	25/-
Ultra	27/6

"SUCCESS"

2-way Cam Vernier Coil Stand **5/6**

SHIPTON

STRIP RHEOSTAT, 7 ohm (with fuse), 3/-
30 ohm, 3/-
60 ohm, 3/-
POTENTIOMETER, 600 ohm, 4/6

DUBILIER TYPE FIXED CONDENSERS.

The cases are a moulded composition of extremely high insulation quality, and are non-hygroscopic; ·002 Ruby mica only is used for dielectric, and the conductive surfaces are cut from the best copper sheet.

·001 to ·0005.. each 1/-
·002 to ·006 .. each 1/3

Post Free.

RAYMOND PLUG IN COILS.

25	3/9	150	6/-
35	3/9	200	7/-
50	3/9	250	7/6
75	4/-	300	8/-
100	5/6	400	9/6

Set of 4 for B.B.C. wave lengths .. 14/11

FOR NEUTRODYNE CIRCUITS.

"Colvern" Ind. Vernier. The low maximum of any vernier is adversely affected by capacity effects and any vernier which is employed to give fine tuning MUST NOT be in association with the main tuning condenser.
PRICE 2/6. .. Post 3d.

MYERS VALVES

UNIVERSAL **12/6** D.E. **21/-**

"RAYMOND" FIXED CONDENSERS.

Ebonite Base, Terminal Fittings. Post Free.

·001, ·0001 to ·0005,	1/2
·002 to ·004	1/3
·006	1/6
·01 and ·02	1/9
·05	3/3

MANSBRIDGE TYPE CONDENSERS:

Best quality obtainable. Accurate, permanent, noiseless, unaffected by atmosphere, beautifully cased, double insulators, two extra fixing lugs, made entirely of finest materials, pass all tests, guaranteed.

1 mfd. 3/6
2 mfd. **3/11**

Post 3d. each.

NEWEY SNAP TERMINALS.

Complete Set.. .. 2/6

DIAMOND WEAVE BASKET COILS (5) EXTRA AIR SPACE (DUPLEX WAXLESS)

Equal to Honeycomb. 25, 35, 75, 100 (wavelengths marked). Set of 5, **3/9**

"POLAR" MICROMETER CONDENSER, **5/6**

West End Stockist—Polar, Edison Bell, Ferranti, Silvertown, Dubilier, Lissen, Energo, Unidyne, Eureka, G.R.C., Sterling parts, etc.

Tape Aerial, 100 ft.	3/-
Sausage Aerial	2/6
Bus Bar, ⅛ square, 15 feet	1/-
Bus Bar, 18 square, 15 feet	10d.
16 D.C.C. Wire per lb.	3/-
100 ft. 7/22 and 6 Insulators	3/6

PARTS FOR 7 CIRCUIT CRYSTAL SET

(Percy Harris).

·0003 Sq. Law Condenser, Panel, 10 x 8, Burndept Detector, Terminals, Clix, Cardboard Tube, 3 x 7 in., 16 D.C.C., and square tinned Radio Press Transfers.
22/6 the Lot. Post free.

CHELMSFORD 5XX.

Post Price.

D.C.C. Coil	1/3
With adapter	2/3
D.C.C. Extra Air Space	2/11

PARTS FOR ST. 100

(Less box & Ebonite)
Absolutely Inclusive
£6 6s. 0d. to £10.

GENUINE DR. NESPER HEADPHONES

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head.

LOOK FOR THE TRADE MARK.

4,000 ohms 13/6
Post 6d. pair.

Lead-in tubes: 6d., 7d., 8d.	
Valve Pins and Nuts 2 a 1d.	
Stop Pins and Nuts 2 a 1d.	
Nickel Terminals	2d.
Nickel Contact Studs 2 for	1½d.
Nickel Switch Arm (one-hole fixing)	1/-
Loading Coil and plug	8d.
Gamages Permanite	1/-
Condenser Brushes	6d.
2-meg. Leaks ..	10d.
Cheap Fixed.. ..	6d.

RAYMOND FIXED CONDENSERS.

·001, ·0001 to ·0005	10d.
·002, ·003, ·004 ..	1/-
·006, 1/3; ·01 1/9; ·02	1/9
D.C.C. Wire, per ¼lb.—	
13 g. .. 9d. 20 g...	9d.
22 g. .. 10d. 24 g...	1/-
26 g. .. 1/1 28 g...	1/3
30 g. .. 1/6 Etc., etc.	

Terminals complete—	
Brass Pillar ..	1d. 1½d.
W.O. or 'Phone	1d. 1½d.
Fancy Patterns	1d. 1½d.
Extra large ..	2d. 3d.
Valve Sockets 2 for	1½d.
Machine cut Screws Stocked (Best).	
Pulleys	4½d.
4 Taps and Wrench	2/11
Screwdrivers ..	6d.

LARGE NUMBER OF BARGAINS TO CALLERS ONLY

ACCUMULATORS

No Post Order at present

2 v. 40 amps. ..	9/6
4 v. 40 amps. ..	16/6
4 v. 60 amps. ..	18/6
4 v. 80 amps. ..	23/6
6 v. 60 amps. ..	27/6
6 v. 80 amps. ..	33/-
6 v. 105 amps. ..	38/6
Hart's Stocked. All High Quality.	

Neutron Crystal ..	1/6
Uralium	1/-
Midite	6d.
Enclosed Detectors	9d.
Large, Brass, on base	1/3
Ditto, Nickel, on base	1/6
MicMet Type ..	2/8
Variometers (special)	1/6
Ditto, with clips, etc.	2/3
Ebonite D.C.C. and Dial	3/9
Also at 3/11, 4/3, 4/6 up.	

H.T. BATTERIES

60 v.	7/6
30 v.	4/6
60 B.B.C.	9/6
36 B.B.C.	5/6
9v. B.B.C.	2/6
1·5 (D.E.)	1/9
Ditto	2/- to 3/-

"DE LUXE" SUPER LOUD SPEAKER

2,000 ohms **24/-**
A "REAL" BARGAIN

PHILLIPS' ·04 TYPE VALVE **15/11**

BUS-BAR
1/16 sq. - 15 feet **6d.**
18 sq. - 15 feet **5d.**

MANSBRIDGE TYPE FIXED CONDENSERS

1 MFD.	3/6
2 MFD.	3/11

D.P.D.T. SWITCHES.

Min Panel	1/-
On China Base ..	1/7½
On Ebonite Base	1/11 2/6

S.P.D.T. SWITCHES.

Miniature Panel ..	10½d
On China Base ..	1/1
On Ebonite 1/3 to	1/9
Murray Valve Holder	1/3
Spring Washers 4 a	1d.
Coil Plug on Base	10d.

Microstat	2/6
Switch Arms 8d. to	1/-
Flex (Red and Black) per yd.	3d.
Shellac	5d.
Loading Coil and Plug	8d.
Contact Studs 4 for	1½d.
Nickel ditto 2 for	1½d.
Nickel Switch arm	1/-
Sorbo ear caps pair	1/4
Tumbler Switches	1/4

"ORMOND" L.F. 13/11

A Wonderful Transformer

DUTCH ·06 VALVES 12/6

16g D.C.C. USUALLY IN STOCK

Twin Flex 4 yds.	6d.
Twin Silk Small 6 yds.	6d.
D.C.C. Bell Wire 10 yds.	5d.
Knobs, 2 B.A. 2d. 3d.	4d.
Small Knobs 6 B.A.	3d.
Small Knobs 4 B.A.	3d.
Wander Plugs pair	3d.
Egg Insulators each	1d.
Tape Aerial 100 ft.	2/-
Valve Windows 4d. to	9d.
Mica	2d.

PHILLIPS 12/6

4 ELECTRODE VALVE
FOR "UNIDYNE"

"METAL" (FRENCH) '06 VALVES, 15/11

'Phone Cords 6 ft. 1/-.	1/3
Nugraving	6½d
Empire Tape 2 yds.	1d.
Allen Var. Grid Leak	1/3
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Aerial, 7/22 100 ft.	1/10½
Ditto, Extra Heavy 100 ft.	2/3
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FIBRE STRIP (For Coils)

3 ft. long, 1 in. wide, 2d.

BREAST DRILLS 0 to ¼ chuck

Cut Bevet and Gear **4/9**

De Luxe Crystal Set	7/11
4 Whiskers, 1 Gold	2d.
Coil Plugs (ebonite)	4½d.
Ditto .. .. 6d.	8d.
Shaped .. 8½d.	1/-
5 ohm Rheostat ..	1/3
Various 1/3, 1/6, 1/9.	1/11
With Dial	1/11
Ormond	1/9
'Phone Connector	1d.
Nuts 2, 4, 6 B.A. doz.	2d.
Washers ..12 a	1d.

BROWNIE "IMPROVED" WIRELESS SET - 7/6

RAYMOND CRYSTAL SETS 7/11 9/11 12/11

2 B.A. rod per ft.	2½d.
4 B.A. Rod per ft.	2d.
Basket Holders ..	8½d.

Also at 10d., 1/-., 1/3, 1/6

2-way Coil Stands	1/11
3-way ditto	4/3
2-way with ex handles	2/11
3-way ditto	4/9
4·5 Batteries	4½d. 5d.
Brass Coil Former	2/11
Twist Drills	1/4

NOTE!

Our Wonderful Micrometer Adjustment Glass-enclosed Detector. Why pay more? Post 6d. each **1/9**

5 Waxless Coils 200/2000	1/5
5 equal 25 to 100 ..	1/11
5 ditto., Extra Air Space	2/8
6 waxed 200/3600	1/8
7 waxed 150/3600	1/11
Chelmsford D.C.C. 1/-, 1/3,	2/6

With adapter, 9d. extra.

Switch Arm 12 Studs, 12 Nuts, 12 Washers. Lot 10½d.

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7 × 5	9 × 4	12 × 9
8 × 6	10 × 8	12 ×12

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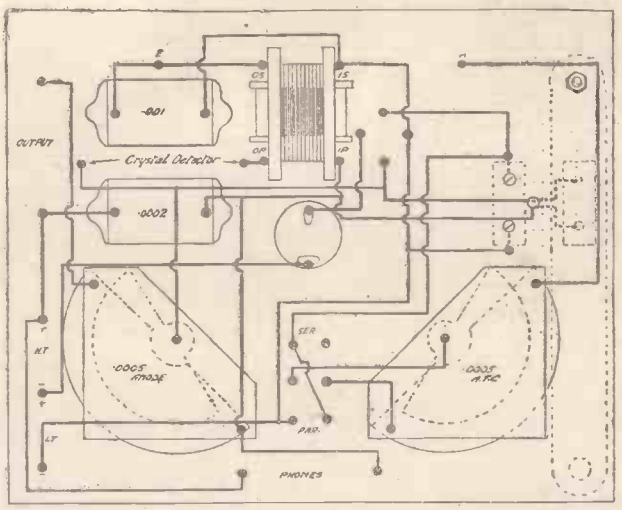
RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page 946.*)

J. P. A. (Edgware Road, London, W.).—Can you supply me with a diagram showing the lay-out and wiring of the Simplified "P.W." Reflex Set (as made up by Messrs. Peto Scott)? The diagram appeared, I believe, in "P.W.," but I am unable to trace it. I am not at all clear as to the connections to the two tuning coils, and as I am quite a novice I should only be able to follow a plain non-theoretical drawing.

The diagram referred to appeared in "P.W." 117 (August 23rd issue) under "Apparatus Tested," and is reproduced herewith. The coil-mounts are shown by the two dotted rectangles on the right-hand side, just above the A.T.C. (aerial tuning condenser).



* * *

T. A. (Walthamstow).—I possess a one-valve reflex receiver which is giving very good results, but signals are loudest when the cat's-whisker is lifted off the crystal. Surely this is not as it should be?

No; most probably if the crystal was made to function properly your results would be even better still. There are two or three causes of such trouble. The most general is when the crystal in use is unsuitable. You should try a different type. Also when the anode is not correctly tuned such trouble eventuates. You should employ minimum capacity, not more than ·0003 mfd., and work with this, the anode variable condenser, at minimum readings compatible with correct tuning. Sometimes such trouble as you are experiencing can be remedied merely by reversing the connections to the crystal detector. Anyway, this simple expedient is very well worth trying before more drastic measures are taken.

* * *

L. B. R. (Leyton).—I am able to hear 2 L O very loudly indeed on a three-valve set (detector and two L.F.), and can work a large loud speaker very well, but I find it impossible to cut the local station out and hear other stations. I can, however, get 5 X X and Radiola quite easily, and free from interference.

Selectivity is not, of course, the strongest point of such a circuit as you are using, and whatever you do you will find it difficult to disentangle other stations from 2 L O. As a matter of fact, your circuit is particularly one which is suitable for comfortable loud-speaker work from the local station. Should you employ a wave-trap such as was recently described in this journal, you might be able to obtain fair telephone results on distance work, but this will not be really satisfactory unless you employ at least one stage of H.F. amplification. It is also worth noting that according to the opinions of many readers residing N.E. of London your district is not too good for wireless purposes, and "D X" work is very difficult to carry out.

* * *

"Beginner" (Glasgow).—I require a wireless set upon which I only wish to listen to the Glasgow station, a distance of less than a mile from me. I do not particularly fancy a crystal set as, according to my friends, a considerable amount of adjustment is necessary with them to keep the music audible. Would a one-valve receiver prove more easily controllable and trouble-free, bearing in mind my closeness to the broadcasting station?

In the circumstances, and providing an outdoor aerial can be erected, we would advise a crystal set in preference to a valve set, with its attendant batteries and all its additional components, any of which *can* cause complete failure. A crystal set, on the other hand, and more especially when used in such circumstances as yours, seldom breaks down completely, and as to the adjustment of the crystal, this will not prove as troublesome as you imagine. Your signals, comparatively speaking, should be so loud that the crystal detector will not require more than one or two cursory adjustments during each programme—perhaps not that.

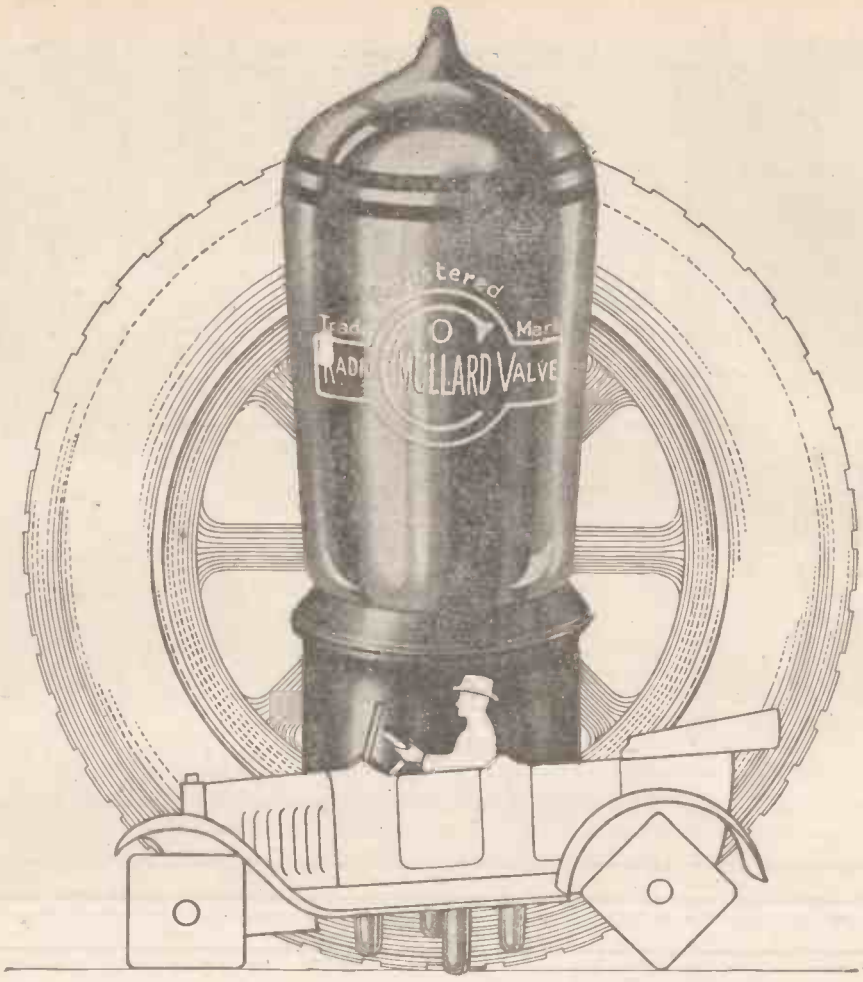
* * *

"Aerial" (Knebworth).—When inductances are placed in parallel, is the result an increase in inductance corresponding to the addition of the two inductances?

If there is no mutual inductance between the two separate inductances there is actually a decrease in the resulting inductance to less than the value of the smaller element. The actual formula is something to the effect that the result is the two values multiplied by each other and divided by their sum. Of course, when there exists mutual inductance this does not obtain, but any increase in the total so caused does not bring the total up to the sum of the two values.

If this is the case, is that the reason why a single-wire aerial is generally specified for

(*Continued on page 952.*)



Running on Square Wheels

There are thousands of wireless enthusiasts who are running their broadcasting reception on square wheels, enduring the constant jar of distortion, and the jolts of expensive upkeep in the full belief that their results are the best obtainable.

How very different is the experience of those who are using Mullard Master Valves!

Are YOU getting square wheel reception? Then for perfect smooth-running reception and powerful results ask for Mullard H.F. Double Red Ring Valves for H.F. AMPLIFICATION, Type D·3 for accumulators, 21/- each; Type D·06 for dry cells . 25/- each.

THE *REAL* LONG DISTANCE VALVE

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RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page 950.*)

broadcast reception when good length can be obtained?

No: here it is purely a question of capacity. The greater capacity possessed by a double aerial of some considerable length tends, in certain cases, to prevent a receiver from efficiently tuning down to the band of wave-lengths it is constructed to cover, and failing the employment of series capacity to assist, it will operate more efficiently with a single-wire aerial of similar dimensions.

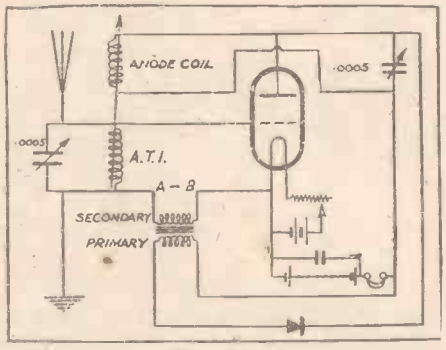
* * *

"DISAPPOINTED" (Long Wittenham).—I have been unable to obtain a "P.W. Set Booklet" describing the one-valve crystal set, but I now wish to erect a similar but rather simpler circuit. I have two ·0005 variable condensers and a two-coil holder, with which I should like to build a one-valve dual set with reaction. What are the connections, and what is the minimum number of fixed condensers that may be employed?

I have several different coils of various types and sizes which I should like to use, unless it is an advantage to employ any particular kind in both circuits simultaneously.

The bare connections for such a set are shown in the accompanying diagram. For the B.B.C. main stations the A.T.I. consists of a coil of about 40 turns, when the condenser is placed in parallel as shown, but if placed in series for sharper tuning the number of turns should be increased up to about 75 (the exact number depending upon the aerial used). The anode coil has about 65 turns when used with a ·0005 condenser, but a coil of 75 turns with a ·0003 or ·0002 condenser is to be preferred.

Only one fixed condenser is shown, and occasionally they can all be dispensed with. In most cases,



however, a great improvement is noticed when a ·001 fixed condenser is placed across the primary of the transformer. Similarly, a small condenser (say ·0002) placed across the secondary (at A—B) will often improve signals, and a similar effect can be obtained by connection across the 'phones.

It will be noticed that the aerial and anode coils are coupled together to obtain reaction. The effect of reversing the L.T. leads should be tried, and it is sometimes advantageous to disconnect the earth from the aerial circuit and place it at the point B, where the L.F. secondary is joined to L.T. and filament.

Regarding the plug-in coils, any type may be used, and two different types may be employed for aerial and anode. For ordinary working basket coils give extremely good results.

* * *

J. A. A. (Shepherd's Bush, London, W.).—I have purchased the parts for a two-valve Unidyne set (detector and L.F. amplifier), but I am in rather a difficulty over connections because my sight is defective, and I cannot follow the diagram easily. Can you describe the connections from point to point so that I could have the description read to me? I am using the following parts: Two Thorpe K 4 5-pin valves, one L.F. transformer (ratio 4 or 5 to 1), two fixed condensers (·001 and ·0002), one two-way coil holder (vernier), one ·0005 variable condenser (vernier), one ·5 to 5 grid leak, two carbon compression rheostats, S.P.D.T. switch, etc.

The point-to-point wiring of detector and L.F. Unidyne is as follows:

Aerial terminal to one side of variable condenser. Other side of variable condenser to one side of aerial coil and to one side of grid condenser. Other side of aerial coil to earth and to L.T. +, and other side of grid condenser to main grid. Grid leak connected between L.T. + and to a point on grid-condenser-to-grid lead.

L.T. − terminal direct to one of filament terminals on 1st and 2nd valves. L.T. plus direct to 1st and 2nd rheostats. Other side of 1st and 2nd rheostats are connected to remaining filament terminals on valves. L.T. + to inner grids of 1st and 2nd valves.

L.T.+ to IP, and then OP to one end of switch. Middle of switch of reaction coil, other side of reaction coil to plate 1st valve. Third point of switch to plate of 2nd valve and to one side of 'phones. Other side of 'phones to L.T.+

OS to main grid of 2nd valve, IS to one side of ·001 condenser and to one side of L.F. grid leak. Other side of ·001 condenser and of L.F. grid leak to L.T.−.

* * *

W. B. L. (Stroud Green).—I am using a two-valve Unidyne set and am very satisfied, but would like to know if Unidyne sets can cause interference when they oscillate. I have been told that the absence of H.T. prevents this,

Our Query Department.

In future a charge of Sixpence per Query will be made for answering all technical questions submitted to the Technical Staff of POPULAR WIRELESS. A group of three queries will be answered for One Shilling. Postal Orders must be enclosed with all queries and a stamped addressed envelope in addition.

THIS NEW ARRANGEMENT IS NOW IN FORCE.

Since the inception of POPULAR WIRELESS, readers have had all their problems settled for them free of charge, but with the great increase in the circulation and the corresponding increase in the number of queries sent in, the task of dealing with the latter has become gigantic. A large Technical Staff is now employed answering queries, and it is with the object of relieving the pressure on them that we have decided to make the small charges mentioned.

Readers of POPULAR WIRELESS know that the Editor and Staff of this journal have always had, and always will have, their best interests at heart.

but on the other hand a friend of mine who lives very close has got a Unidyne and is, I believe, the cause of quite a lot of the "howls" I can always hear at the commencement of the broadcasting transmission.

Unidyne receivers can, when the reaction is mishandled, cause just as much interference as H.T. sets. There is one difference, however, and that is that an interfering Unidyne invariably makes itself known to other listeners in the form of a rather low "moaning" note instead of the usual higher-pitched "shrieks" and "whistles." But there are, of course, other causes for similar heterodyning, and such must not be accepted as a true indication that a Unidyne is misbehaving itself.

* * *

C. O. D. (New York).—Are there any valves on the English market which work on 1 volt and take ·06 amp.? I heard that something like this had recently been retailed by your radio stores.

Not yet, anyway. The ·06's at present on the market require at least 3 volts.

* * *

"AMATEUR" (Southampton).—Is it possible to purchase coils suitable for working with an aperiodic aerial on low wave-length?

Yes; such coils are available in the "Unitunes" manufactured by the Igranic Co.

* * *

P. R. D. (Ilford).—Can the "P.W." Ultra crystal set be used with valve amplifiers in the same way as any ordinary crystal set?

Yes; and this set, with valve amplification added, has recorded excellent results.

Can the original "P.W." Ultra be loaded for long wave-lengths?

Not efficiently, unless the main coil is rewound to coincide with the design of the "P.W." Ultra for 5 X X.

CRIMPED COPPER TAPE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re Mr. Rankin's letter in POPULAR WIRELESS recently.

He says his invention is "a copper tape or ribbon aerial."

May I say that I have been using crimped copper tape, or ribbon, for the last fifteen years. Not for wireless work, of course.

I am writing this because I was interested in the letter, both from a wireless point of view, and also a business point of view.

If Mr. Rankin wishes to know any more about crimped copper tape, I will be pleased to let him know if he will write to the address below.

Yours sincerely,
W. NICHOL.

Chapman Square,
Oldham Road, Manchester.

FORMING A RADIO CLUB.

A. C. (Bridgend, Glam.).

The Editor, POPULAR WIRELESS.

Dear Sir,—I notice your inquiry with regard to the proposed formation of a Radio Club, appearing on page 664 of POPULAR WIRELESS for November 15th. I happen myself to be a member of the Radio Association, and I see that in their Handbook for 1924 instructions are given for the formation of local branches. I have no active connection with the Association apart from ordinary membership, but I am much interested in the development of the amateur movement in Britain, and I therefore suggest that you should write to the secretary of the Radio Association, at Sentinel House, Southampton Row, London, W.C.1, and ask him to send you particulars. The advantage of belonging to a branch of the R.A. is that there is no question of affiliation.

Trusting this information may be of use to you, and wishing you all success in the formation of your proposed club,

I am, yours faithfully,
T. J. BAYLISS.

120, Elborough Street,
Southfields, S.W.18.

A RADIO LINK WITH HOME.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was interested in the article by Capt. P. P. Eckersley in your issue of October 11th, and it might prove of some small consolation to him and of chagrin to the pessimistic amateurs he referred to, to learn that I received Chelmsford the "first go."

I was stimulated by the article into rigging up a couple of home-made duo-lateral coils into a very improvised coil holder. The two coils were mounted gimbal fashion, and are approximately of 900 and 1200 turns for primary and secondary respectively.

My condensers were made on the lines laid down on page 198 of your issue 27/9/24. This was as it should be, as condensers are expensive out here, and I had to study my pocket.

My circuit consisted of the loose-coupled coils, 2 H.F., 1 detector, and 2 L.F.

The detector was critically controlled both as regards grid bias (with a potentiometer) and filament rheostat. The last L.F. was hardly necessary, and the filament and grid of this valve was also controlled. Atmospherics were very bad, but in spite of that and the hastily constructed gear, speech and music came in excellently and fairly loud, with no distortion whatever. Both speech and music could be heard five feet away from the 'phones.

Date—Night of November 3rd, 1924.

I am appending what I heard so that you will be able to realise that I am not romancing, and I would like you kindly to authenticate it. India is five and a half hours in advance of G.M.T. We call it I.S.T.

(Here follows a list of items broadcast during one of the "Old Veterans" programmes.—ED.)

It is over fourteen years since I was at home, and I think it must be over twenty years since I heard Eugene Stratton, Marie Lloyd, Albert Chevalier, and Alfred Lester, besides a host of others, but by sacrificing a little sleep I was transported back to my younger days, and for a few hours those voices were recaptured and broadcast with all their tender, clinging memories for those of us in exile. I really was approaching that sentence with a positive feeling of crisis and pent-up emotion, and can express nothing but gratitude for such an extraordinary treat.

Had it been unfamiliar music and song it would not have hurt so much, but the dear old days of the "Belle of New York." and all the other pieces simply put the tin bat on it.

I would be grateful if you would kindly let me know what the revival was and why the applause and encore if broadcast from a studio.

I must also ask you to very kindly suppress my name and address, as I am a Civil Servant, but you may publish the whole of the remainder, should you

(*Continued on page* 954.)

CORRESPONDENCE.

(Continued from page 953.)

desire, if only to show how grateful those on the outposts of the Empire can feel for such realistic recreation that even now seems but a phantasy of the brain.
Floreat "P.W."

With very best wishes,
Yours sincerely,
"A READER IN QUETTA, BALUCHISTAN."
India.

THE DET. AND L.F. UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am astonished at the present performance and the hint of latent possibilities in the 2-Valve Unidyne (1 L.F.) that it becomes an obligation to offer thanks and appreciation to the inventors. Their claims are well on the side of modesty. Their proposition so clearly defined really delivers the goods, and the use of the circuit "grows on one," yielding ever increasing "dividends." I have to confess that mine is a hook-up job, using odd components on hand. The lay-out also I had to depart from in order to get accommodation in an unsuitable cabinet. To those hesitating building, one is compelled to say "yes, by all means, but utilise the inventors' programme implicitly."

I used Phillips' 4 Electrode Valves, at 12/6, and found them O.K. in every way. Coils Igranic 75 and 100 in R. Found that ·0003 variable J.B. V. condenser more successful than ·0005. Bretwood grid-leak an easy winner over others I tried, in fact, it is a reliable micrometer adjustment of reaction. The transformer, unshrouded and fairly cheap, helped to emphasize the inventors' advice re stressing importance of relative position (magnetic field) to axes of the coils. Attention to this point just made all the difference, especially in control and volume. I have no vernier adjustments, but obtain fine movement so essential by use of anti-capacity 8 in. handles.

The ever increasing ranges of stations brought in is a very gratifying feature of a wireless development that is most remarkable in performance. I might add, finally, I have never had such keen re-action easily aroused and as easily controlled. Well done "P.W." Hats off to the inventors!

H. TYLER.
School House, Wrangle, Boston, Lincs.

AN OVERWHELMED CORRESPONDENT.

The Editor, POPULAR WIRELESS.

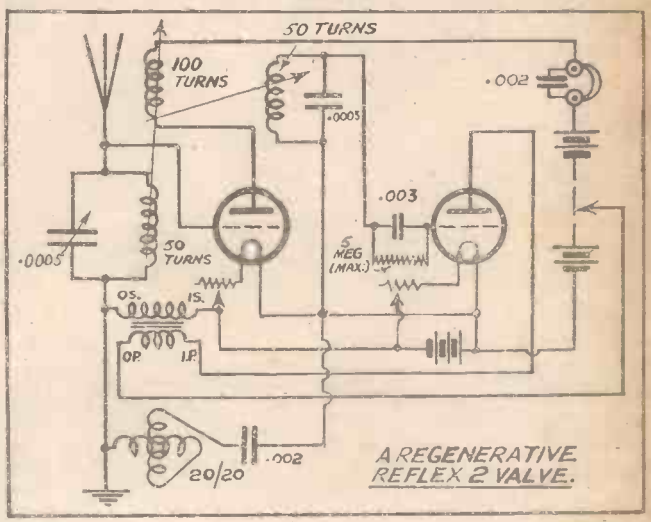
Dear Sir,—In writing to thank you for inserting my letter in POPULAR WIRELESS, 129, stating that I had fifty back numbers to spare, I should like to ask, as a further favour, if you could find space for this letter, to inform the numerous readers who have written to me that it is impossible for me to reply to them all personally. I have received upwards of seventy applications through my offer, and over sixty have asked me to forward them the numbers dealing with the "1 Valve Unidyne Set." Letters have arrived from all parts of the British Isles, and one application is from Holland. I have endeavoured to oblige when single copies have been asked for: but I must confess I am beaten by the applications for "Unidyne numbers." I feel sure there must be many readers who have made the "Unidyne Sets," and now have these numbers to spare. May I ask them to write to me and let me forward them to one of the many applications I have received, so that they may have the pleasure of helping a fellow-reader who is in a less fortunate position than themselves?

Yours faithfully,
F. T. EATWELL.
43, Turnerville Road,
West Kensington, W.14.

A REGENERATIVE REFLEX RECEIVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I enclose circuit diagram of a regenerative reflex two-valve set that I have been trying out. This might interest your readers.



I have tried nearly all two-valve circuits, both straight and reflex, but I venture to say that for loudness and clearness this circuit takes some beating. It is very selective and quite easy to control. 2 L O also comes through on 10° of A.T.C. and about 5° of anode condenser and cannot be heard on any other part of either condensers. I have received all the main stations on this circuit and Radio Paris, Brussels and a German station (call signal missed), all of these while 2 L O was working. 2 L O on loud-speaker is sufficient for a large room and very clear—this with standard 100 ft. aerial. On a 2 ft. frame good loud-speaker results are obtained in small room. Finally, I consider this circuit is 20 per cent louder than any dual L.F. two-valver with the advantage of being 50 per cent more selective. The variometer gives a good control over regeneration, and in tuning in distant stations. Wishing your excellent paper every success,

I remain,
Yours faithfully.
LEONARD HILL.
"Marlborough,"
Woodside Park Road, North Finchley, N. 12.

NO "MUSICAL DOCTOR" REQUIRED.

The Editor, POPULAR WIRELESS.

Sir,—The B.B.C. *don't* require a new Mus. Doc. Listeners-in are a mixed crowd, and not all have musical tastes coincident with that of Mr. G. E. Holloway. Hence the variety of the programme.

My 'phones' hour of rest is when the "Wonderful Savoy Bands" start, except about once a month, when I listen in to them to see if they've discovered any fresh items yet; and the only improvement I can suggest is less synchronisation in the types of items at the different stations; so that anyone who is not interested, e.g., in someone being funny, or a broadcast play, or the Savoy bands, but wants to listen to music, can tune in some other station and get it.

W. H. SPOOR, B.A.
The Hydro, Bristol.

W G Y's PROGRAMMES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have had a confirmation from both W G Y and K D K A re transmissions heard last month, and of which I mentioned to you.

W G Y enclosed a chart of their times of transmission, and I have copied it out and enclose same herewith for your use—if you think it will be of any use for other listeners.

I also had a very interesting folder containing photographs of the studio staff and participants in its programmes.

(Continued on page 955.)

CORRESPONDENCE.

(*Continued from page 954.*)

Early this morning I again received the above stations and three others besides, but of which I was unable to get call signs, owing to the very bad " X's."

Yours faithfully,
EDWARD TARPLEE.

P.S. (November 10th).—As I have been obliged to hold this letter over until this morning I really must mention that extremely good reception of U.S.A. was obtained early yesterday morning, W B Zee being the best, and coming through at very near Cardiff's strength, and operating the loud speaker at good strength. He was relaying from Boston Opera House, so I was able to hear some of the best American singers. So well was he received that other members of the family (who were in bed at the time) were able to listen without coming downstairs.

Altogether eight stations were heard, but Morse interference spoilt speech, two of them being W G Y and K D K A, who also came over at " L.S." strength, but not so clear as W B Zec.

E. T.

97, Seymour Road, Gloucester.

When to Listen-in for W G Y.

Wave-length.	Refer	Eastern Standard Time.
380 Metres. 790 Kilocycles.	Below	
Sunday Morning Services	——	*9.30 or 10.0 A.M.
N.Y. Stock Quotations (Noon)	C	11.30 A.M.
Fruit and Vegetable Report	B	11.40 ,,
Weather Forecast	C	11.50 ,,
Arlington Time Signals	C	11.55 ,,
Music and Talks to Women	A	1.0 P.M.
N.Y. Stock Quotations (Close)	B	5.0 ,,
N.Y. Produce Market Report	B	5.10 ,,
News Bulletins	B	5.15 ,,
Baseball Results	F	5.20 and 7.40 P.M.
Weekly Review of Sports	Monday only	5.20 P.M.
Dinner Music	E	(See Footnote.)
Adventure Story	Wednesday only	5.30 P.M.
Children's Stories	Friday only	5.30 ,,
Sunday School Lesson	Friday only	6.0 ,,
Sunday Evening Services	——	*6.30 or 7.0 P.M.
Farm Bureau Talks	D	7.15 P.M.
Regular Evening Programme	A	7.45 ,,
A Few Moments With New Books	Thursday only	7.45 ,,
Health Talks	Friday only	7.45 ,,
Dance Programme	Saturday only	8.30 ,,
Organ Recital	Tuesday only	10.15 ,,
Late Programme	Friday only	10.30 ,,

A—Monday, Tuesday, Thursday, Friday only. B—Daily except Saturday and Sunday. C—Daily except Sunday. D—Last Monday of each month. E—Tuesday, 6.0 P.M.; Thursday, 5.30 P.M. F—5.20 and 7.40 Monday, Tuesday, Thursday; Wednesday, 5.20 only; Saturday, 9.30 only.
* Schedules vary in different churches.

KGO SCHEDULE

General Electric Company's Station, Oakland, Cal.

Wave length	Refer	Pacific Time
312 Metres. 960 Kilocycles.	Below	
New York Stock Exchange and Weather Report	A	1.30 P.M.
Afternoon Musical Programme	C	3.0 ,,
Symphony Orchestra	D	3.30 ,,
Concert Orchestra	F	4.0 to 5.30 P.M.
Stock Exchange Quotations (Final), Weather Report, News Items	B	6.45 P.M.
Regular Evening Programme	E	8.0 ,,
Dance Programme	Tuesday and Saturday	10 P.M. to 1.0 A.M.

A—1.30 P.M. Monday, Tuesday, Wednesday, Thursday, Friday; 12.30 P.M. Saturday only. B—Monday, Tuesday, Wednesday, Thursday, Friday. C—Monday, Wednesday, Friday. D—Sunday only. E—Monday, Tuesday, Thursday and Saturday. F—Daily except Sunday.

(*Continued on page 956.*)

CORRESPONDENCE.

(*Continued from page 955.*)

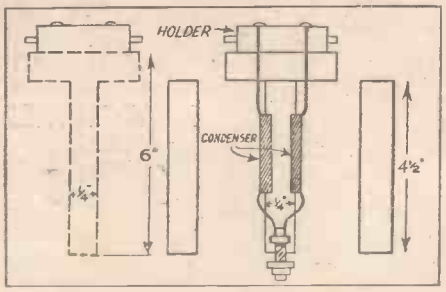
AN ELECTRIC-LIGHT AERIAL.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having seen many different types of aerials, both indoor and outdoor, I wonder if your readers would like to try this idea? I may state that I have made several, and find them most efficient, particularly for hospitals, etc.

This will operate any ordinary crystal set within five miles of any station quite efficiently and loudly, considering, of course, that there is electric light in the building.

The stem is an ordinary broom shank 6 in. long, and an old lamp is utilized for making the connection by breaking an old globe and keeping the brass holder. The small condensers are made with six pieces of copper foil ½ in. by 1½ in. long; six pieces of mica ¾ in. by 2 in. long, placed, of course, between each other, so as to interleave.



The broom shank is cut down 4½ in., leaving ½ in. in the centre, keeping the two pieces, one off each side.

Place one small condenser on each side slightly recessed into the wood, with each copper end soldered to one wire on each side. Then fix terminal in bottom of wood and attach small wire from each condenser to terminal.

The condensers can be kept in position by tying with cotton. Then place the pieces of wood one on each side, and bind with insulating tape. Fix in holder in place of electric globe and attach wire from terminal to aerial terminal on set.

Yours sincerely,
H. AINSLEY.

3, Promontory Terrace, Whitley Bay, Northumberland.

(Readers are reminded that the patents covering the "Ducon" aerial apply to this idea.—Ed.)

INTERESTING "D.X." WORK.

The Editor, POPULAR WIRELESS.

Dear Sir,—During the hours of 11 p.m., November 23rd and 1.15 a.m., November 24th, I tuned in 27 American amateurs on 80 metres.

The U.S.A. is divided into nine radio districts, and I was fortunate in tuning stations from seven of these in two and a quarter hours on one detector and 1 L.F.; 11 p.m. is the earliest time that I have had the "Yanks," and it seems that the time has gone when we had to get up at 3 a.m. to hear America.

Most of the 27 stations heard were in the eastern districts, but others were in Texas and Washington.

By a strange coincidence I received a letter to-day from a boy of 13 in the Transvaal, South Africa, saying that he was looking through some old "P.W.'s" (they keep 'em, you see), and that he saw an account of my reception of New York on a loud speaker in No. 70, and would I give him the circuit.

I have heard the New Zealand amateurs on two occasions recently, and if the ordinary listener-in would only go down to the lower wave-lengths he would get quite a lot of fun out of it.

Wishing "P.W." success.

Yours truly,
H. CONSTABLE.

6, Leysfield Road,
Shepherd's Bush, W.12.

Slogan—POPULAR WIRELESS has made Wireless Popular.

WINDING DUOLATERAL COILS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having experimented with many different types of coils I thought perhaps some of your readers would like to try a coil of the duolateral type which I constructed recently. It is easily constructed and works very efficiently on all wave-lengths. First procure a piece of wood 1½ in. in diameter, and as long as can be conveniently held and turned in the hand. It should be turned smooth and round, otherwise it will be difficult to get the correct spacing for the pins. Eight bicycle wheel spokes 12 in. long will be required, cut these into eight equal pieces of 1½ in. long. Next, with the aid of a pair of dividers, measure round the circumference of the former 31 equally spaced dots; then 1 in. away from these measure the same again, but the second

(*Continued on page 957.*)

CORRESPONDENCE.

(*Continued from page 956.*)

row must be "staggered," meaning that the first dot on the second row must come between the first and second dot on the opposite row. These must be drilled and the pieces of spokes must be fitted in the holes drilled, and the former is complete. Now to wind the coils the end of the wire must be passed round pin number one, leaving enough spare wire for connecting afterwards. Starting from No. 1 cross over to the tenth pin on the other row, counting from the pin opposite to the pin started on. Counting ten each time, the wire must be taken round and round until it eventually comes back on to No. 1. This counts as

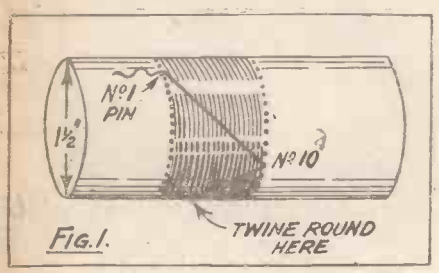


FIG. 1.

one layer. If some twine or thin string is wound over the whole distance between the two rows of pins before starting to wind the coil and pulled out when the winding is finished it will be found that the coil will slip off quite easily and can be temporarily fastened by sewing together with a needle and cotton until ready for mounting.

When making a set of coils they can be graded according to the number of layers. No. 1 having one layer, No. 2 having two layers, and so on.

The mounting must be left to the reader, as everyone has his best way, but it will be found that these coils are easily adaptable to the mounting blocks sold in any wireless accessory shops.

J. W. A. GYMER.

Fire Station,
High Street, Eltham.

CONCERNING CRYSTAL RANGES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wonder if I might ask your courtesy to allow me a question through the medium of your columns to your correspondent, "Crystal," in a recent issue of POPULAR WIRELESS?

With regard to long-distance reception on crystal only he asks for other readers' experiences, and I fear mine will be of little value to him, as the best I have ever been able to manage has been to just faintly get Manchester from here—some 45 miles. This is not always possible by any means, and my best reception of it has been on a B.T.H. Bijou set, which I believe is variometer tuned, with series condenser.

I have once or twice succeeded on a 50 plug coil tuned with .0005 var. con. in series, but have not managed when in parallel with any sized coil.

I may say the best reception from 2 Z Y has been music, on Thursday mornings (before Sheffield started morning transmissions), and the Spanish talks at night after other stations were closed. Sometimes their women's half-hour has come through very faintly, but that appears to me to depend largely on the varying calibre of the voice speaking, and it is not often possible to catch all the words and follow them.

I should be deeply indebted, as I have no doubt many other would-be listeners will be, if your correspondent will describe his set for our benefit, or even give some particulars to help in trying to get results comparable in some degree with his, as I may say I cannot find many people in Sheffield who are able to hear anything at all outside Sheffield on crystal only, and though it is not always desirable from the programme point of view, as we are now getting splendid variety and good number of transmissions daily, to go outside, yet it would be extremely interesting to be able to do so by the construction of such a set if one only knew how.

May I offer my personal thanks to the staff of POPULAR WIRELESS for the splendid information and diagrams so regularly published (including the "P.W." Ultra Set, of which I have built several for friends with every satisfaction, but have never been able to get 2 Z Y on this), and assure you of my appreciation if you can either forward my query via POPULAR WIRELESS, or if not, put me in communication direct with your correspondent.

Remaining yours faithfully,
H. E. FISHBURN.

693, Attercliffe Road,
Sheffield.

TECHNICAL NOTES.

(Continued from page 896.)

That is to say, the beam system works best with short waves, whereas the putting-in of power works best with long waves. If a simple and reliable method could be found for concentrating long waves into a beam, the problem of the wireless transmission of energy would be much nearer solution.

Stationary Waves.

In this connection, an interesting suggestion was put forward by the late Dr. Steinmetz, the famous American engineer. He proposed to set up stationary waves round the earth, that is the waves, after having encircled the globe, being in phase again with the waves just starting out from the generating station. In this way, mutual interference of the waves would be avoided, and the energy would be largely available for tapping off by suitable receivers in different parts of the world.

Aerial Efficiency.

Every crystal user knows that the only energy available in a simple crystal set is that which is tapped from the aerial, and that therefore the employment of an efficient aerial is all important. It is also fairly well known that, if valve amplifiers are used on the high-frequency side the aerial becomes less important, since the signal energy is increased before being applied to the crystal, and therefore an amount of incoming energy which would be too small to actuate the crystal efficiency becomes sufficient for the purpose after adequate amplification. It is in these circumstances that small indoor and even frame aerials may be made use of.

Low-Frequency Amplifiers.

But what is often not properly understood is that the addition of L.F. amplifiers alone does not necessarily obviate the need for a good aerial. Provided the incoming energy (assuming no H.F. amplification is used) is sufficient to actuate the crystal properly, the actual signals as reproduced will, of course, be louder than they would otherwise be, owing to the stage or stages of L.F. amplification.

But if the incoming signals are not strong enough to actuate the crystal efficiently, a great improvement may be obtained by improving the aerial. In fact, it has been stated that the efficiency of the crystal detector is proportional to the square of the incoming signal strength—that is, trebling the signal strength makes the detector nine times as efficient. This proportionality is by no means strict, nor is the relation definitely ascertained, but the observation will indicate that on a certain part of the curve a small increase in signal strength certainly makes a great difference to the efficiency of the crystal detector. And the real practical result of all this argument is this: If you are using a crystal detector, without H.F. amplification, even though you may be using L.F. amplification, see to it that you are getting the best out of your aerial, and, if possible, add height to the latter.

The Crystavox.

I notice that the Crystavox, by S. G. Brown, Ltd., is available in a new and

(Continued on page 959.)

TECHNICAL NOTES.

(*Continued from page 958.*)

improved form, and is claimed to be the only loud speaker in the world that can be used direct from a crystal set without valves or other amplifying apparatus. It should be noted, however, that a certain minimum strength of signals on the crystal set is necessary before the Crystavox can be expected to function efficiently. The makers give the following criterion: Hold the 'phones 12 inches from the ear, and if then the reproduction from the 'phones can still be distinctly heard, the set is sufficiently powerful to operate the Crystavox satisfactorily.

Repairing Panels.

Amongst my correspondence this week is a letter from "Crystal Fan" on the subject of repairing panels, which I recently mentioned in some notes. He says that a substance known as "heel-ball," which apparently can be obtained from boot and shoe manufacturers, is very useful for filling up holes in ebonite panels. His letter continues:

"Gently warm the substance over a flame and allow to drop into the hole in the panel, placing a flat piece of wood or metal on the under-side of the panel. When the hole is filled, any excess of the material may be removed by levelling with the warm blade of a knife. Afterwards a dry cloth should be used for polishing. No further waiting is necessary, and the repair will defy detection except under the closest scrutiny."

A New Insulating Substance.

A new insulating material, which I understand is of the cellulose class, is available, under the trade name of "Trolite." It takes a brilliant finish, and is therefore of artistic merit for knobs, dials, and panels. The dielectric strength and static insulating properties of this material are very good, although, like other cellulose compounds, it suffers from dielectric losses, though not to any serious extent. It is claimed to have the advantage over ebonite that it is not affected by prolonged exposure to sunlight, and, moreover, it is easier to manipulate. In cases of breakage, or for constructional requirements, it has the great advantage that it can be cemented by means of celluloid solvents, such as acetone and amyl-acetate.

H.T. Battery Condenser.

Although it is frequently recommended to shunt a condenser across the H.T. battery, many experimenters neglect this simple precaution as being unnecessary. There are, however, few cases, particularly of multi-valve sets, where an improvement will not be noticed if a condenser of large capacity is connected across the H.T. terminals.

We get so accustomed to the idea of low-resistance accumulators for the filament that we are apt to forget that the H.T. battery has an appreciable resistance; this may be anything up to 100 volts for a good battery, and when the cells are getting old, especially if there are any "bad" ones amongst them, the resistance may be considerably in excess of this figure.

(*Continued on page 960.*)

TECHNICAL NOTES.

(*Continued from page 959.*)

Interference.

Now, owing to the difference of potential at the ends of this resistance, and to the fact that different valves are being supplied simultaneously, interference may take place and "howling" noises be produced. All this is, however, effectively overcome by the use of a condenser of 1 or 2 mfds. capacity. Moreover, this condenser adds to the useful life of the battery, since it enables you to continue using it when it would otherwise be discarded.

Useful Beam Compass.

On reading this title you might think it referred to some form of elaborate radio-goniometer; it refers, however, to nothing more terrifying than a simple device for marking or cutting out circles from sheet material. An ordinary "pair of compasses" will serve for diameters up to, say 6 in., but for larger diameters some form of "beam compass" is useful. A simple way of making one is to take a length of steel rod, about ⅛ in. diameter and about 12 in. long, and sharpen one end to a point, then bend a length of about 1 in. at this end at right angles. Then take an ordinary terminal and sharpen its shank to a point.

Now insert the blunt end of the steel rod into the hole in the terminal, and adjust for the radius required, then tighten up the terminal on the rod, and you have your compass. Using the terminal shank as centre, you can mark off the circle with the sharp end of the steel rod. If another steel rod is similarly bent with 1 in. at right angles to the main length, and the tip heated and flattened out by hammering, then sharpened into a small blade (at right angles to the main length), this may be used for cutting out circles from thin wood, paper, and so on.

Cut out the noises

Cracklings, atmospherics, and other interruptions can be eliminated by using Exide Accumulators instead of Dry Batteries for High Tension supply.

THE LARGEST BATTERY WORKS IN THE BRITISH EMPIRE

Chloride Batteries FOR HOUSE LIGHTING

Exide

THE LONG-LIFE BATTERY

EVIDENCE

Mr. H. Bacon, Sutton Scarsdale, Chesterfield, who in 1923 received a complete programme from W G Y, writes :—

"I have tested with Dry Batteries but there is not the clearness or sharp tuning I can get with your batteries."

Mr. E. C. Davies, who listened-in to the Firpo-Wills fight, says :—

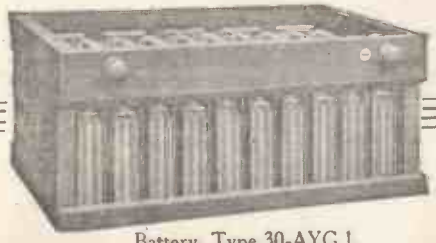
"H.T. must be absolutely silent, and lengthy experiments have led me to the conclusion that up to now you make the only battery that is of the least use for this work."

Type BK in Units of 24 Volts cost 1/- a volt

Types AYG and RG1 cost :—

	32 Volts	48 Volts	60 Volts
RG1	£4 10 0	£6 10 0	£8 0 0
AYG	£5 10 0	£8 0 0	£9 15 0

Battery, Type BK.



Battery, Type 30-AYG 1, with lid removed.

Type RG 1

Showrooms and Depots :

LONDON :

219-229, *Shaftesbury Avenue W.C.2.*

BIRMINGHAM :

58, *Dale End.*

Manufactured by

THE Chloride ELECTRICAL STORAGE COMPANY LIMITED.

at CLIFTON JUNCTION, near MANCHESTER

Showrooms and Depots :

BRISTOL :

22, *Victoria Street.*

MANCHESTER :

1, *Bridge Street.*

LISSENIUM

Use a RADIO SWITCH!

Many switches sold are undesirable for radio work—they have been designed from the purely electrical point of view, which is not good enough for radio, where the currents dealt in are so small.

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

A LITTLE FAMILY OF SWITCHES—You just gently pull or push them all

LISSEN 2-WAY SWITCH 2/9

LISSEN SERIES-PARALLEL SWITCH 3/9

WHAT THE LISSEN 5-POINT SWITCH DOES

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

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

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

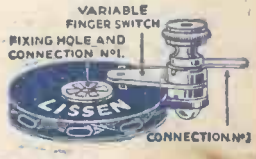
(d) Will also disconnect both the H.T. and L.T. batteries, and short the aerial to earth so that the receiver can be left adjusted ready for switching instantly into commission next time. With diagram 4/-

LISSEN REVERSING SWITCH

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

Protects your dull emitters

This little device, called the LISSENSTAT RESISTOR, can be attached to any rheostat you may be using. Adds another 35-ohms resistance to it, which can be varied by means of the little finger switch shown, or entirely cut out of circuit by lifting the finger switch on to the centre contact. Is worth its price many times over, only 1/3



PARTS THAT PULL TOGETHER—when you know that every vital part in your receiver is pulling strongly with each other, you know that you have a receiver which is the best you can ever get.
BUILD WITH ALL LISSEN PARTS—there is one for every vital place

LISSEN LIMITED

8-16, Woodger Road, Goldhawk Road, Shepherd's Bush, London, W.12

New lines imminent—low wavelength, low loss coils for 100 metres and down.

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R/R

POPULAR WIRELESS AND WIRELESS REVIEW, December 20th, 1924. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

OVER HALF A MILLION READERS MONTHLY.

Popular Wireless and Wireless Review

PRICE 3d. EVERY THURSDAY.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

The B.B.C. Staff outside 2 L O. Lord Gainford, Mr. Reith, Admiral Carpendale, Captain Eckersley, Mr. Burrows, Captain Lewis, Captain Bishop, Mr. Stanton Jefferies, can be seen in the front row.

SPECIAL FEATURES IN THIS ISSUE.

No. 134. Vol. VI. December 20th, 1924.

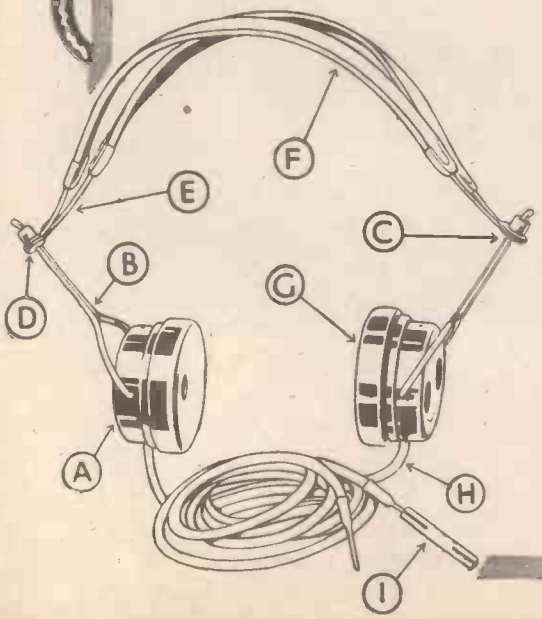
B.T.H. Headphones

The original pattern B.T.H. Headphones achieved a remarkable reputation for sensitiveness and tonal quality. Many improvements have since been made, with the result that to-day B.T.H. Headphones are the most comfortable and convenient instruments of their kind. Some of the more important constructional features are given below :—

Price

per pair 25/-
(4000 ohms)

Weight with cord 9½ ozs.



- **A** *The body is of special non-resonating material.*
- **B** *The stirrup moves freely within the slider, and takes up and retains its position without any locking device.*
- **C** *The stirrup cannot be completely revolved in the slider. Kinking and twisting of the cord are thus avoided.*
- **D** *The special slider adjustment obviates the use of screws*
- **E** *Spring steel headbands give the exact pressure required for perfect hearing without discomfort. There is no "scissors" movement.*
- **F** *The leather covering gives perfect comfort.*
- **G** *The earpieces fit closely to the ears.*
- **H** *Best quality flexible cord.*
- **I** *Nickel plated series connector.*

Obtainable from all Electricians and Radio Dealers.

Advert. of The British Thomson Houston Co., Ltd. Crown House, Aldwych, London, W.C.2

B T-H

2273

The simplest way of enjoying Loud Speaker pleasures

If your receiver gives really good signals in the headphones, it's a perfectly simple matter to add the comfort of a Loud Speaker. All you need to do is connect the "Sparta" Amplifier to your present set, slip leads to the Little "Sparta" Loud Speaker—and the result is Loud Speaker reception as only "Sparta" products can provide it. Rich, pure reproduction—ample volume—and absolute reliability.

The "Sparta" Amplifier.

One Valve.

Designed for ·06 amp. Dull Filament valves. Constructed with the well-known "Sparta" components, including the famous Type "B" Ironclad Transformer, ensuring great amplification combined with distortionless reproduction. Full instructions for use are supplied in the case and each set is fully guaranteed. **63s.** (plus Royalty 12/6.) Valve and Batteries extra.

The Little "Sparta" Loud Speaker.

A small brother of the famous "Sparta." Made in three types, 120, 2,000 or 4,000 ohms resistance, adjustable diaphragm control, **55s.**

FULLER'S UNITED ELECTRIC WORKS, LIMITED,
Woodland Works, Chadwell Heath, Essex.

'Phone: Ilford 1200 (6 lines). Telegrams: "Fuller, Chadwell Heath."
LONDON DEPOT: 58, High Street, W.C.2. 'Phone: Gerrard 5070.

Send for Lists Nos. 325 and 328.

Sir Hall Caine—

will read "A DREAM OF CHRISTMAS DAY"

To be broadcast CHRISTMAS NIGHT

Select Programme—merits select components

You miss half the thrill and pleasure UNLESS your equipment includes a——

TUNGSTALITE

BLUE LABEL **Reg. No 447149. SUPER CRYSTAL.**

17, Upper Park Street,
Barnsbury,
LONDON, N.1.
December 7th, 1924.

Messrs. Tungstalite Ltd.

Dear Sirs,

I am writing these few lines as a delighted listener should do, in obtaining such *unexpected* results as I have obtained, after buying one of your Blue Label Crystals.

I must certainly say that it is more than you claim it to be.

I have been trying to obtain a decent crystal for some time past, about 18 different kinds which have been fairly decent, but yours leaves them in the shade, and carries all before it.

I remain,

Yours faithfully,

EDWIN NEWTON.

Such delightful experience is the privilege of all Tungstalite users

1/6

Obtainable from all wireless dealers' price 1/6 per tube including cat's whisker, or direct from :—

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TUNGSTALITE LTD.

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Messrs. Payne & Hornsby, Ltd., 6, St. Andrew's Buildings, Gallowgate, Newcastle-on-Tyne.

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Messrs. A. Franks Ltd., Opticians and Wireless Equipment Mfrs., 95 & 97, Deansgate, Manchester

GLASGOW
Messrs. Robb Bros. (Glasgow), Ltd., 69a, West Nile St., Glasgow.

BELFAST
D. H. Macleay, 7, Howard Street, Belfast.

POPULAR WIRELESS

AND WIRELESS REVIEW.

December 20th, 1924] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Thursday, Price 3d.

Technical Editor: G. V. DOWDING, Grad.I.E.E. | Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.G.S. | Scientific Adviser Sir OLIVER LODGE, F.R.S.

RADIO NOTES AND NEWS OF THE WEEK.

Mr. Shaw and Captain Lewis.

CAPTAIN LEWIS has asked me to point out that I made a mistake in my article entitled, "Mr. George Bernard Shaw at 2 L O." which appeared in a recent issue of "P.W." It appears that Mr. Shaw paid for Captain Lewis, not, as I erroneously explained to readers, Captain Lewis for Mr. Shaw. I apologise to Captain Lewis for my mistake.

* * *

The Beam in Australia.

THE report that Australia had rejected the "beam" system of wireless communication was quite unfounded. It is now announced by Reuter that the Marconi Co's. tender has been accepted for the erection of two stations in Australia for direct communication with England and Canada. These stations will have a capacity of 86,400 words daily, which is at the rate of 60 words per minute for the whole 24 hours.

* * *

The Royal Trip.

THE Duke and Duchess of York were very interested in the P. & O. liner "Mulbera's" wireless equipment, when they went on board the vessel at Marseilles recently. For the voyage to East Africa a long-range Marconi valve transmitter and receiver had been installed, and the ship had been specially fitted with a marine broadcast receiver, which enables the broadcast programmes to be received throughout the voyage.

* * *

The Doctor's Dilemma

SHOULD a doctor tell—the microphone? Doctors are not allowed to advertise, and any registered medical practitioner who delivers a public address on a professional subject for broadcasting to a lay audience renders himself liable to a charge of advertising if he allows his name to be announced. When it is desirable or necessary that such lectures should be broadcast, permission must be obtained from the Ministry of Health or from the Board of the General Medical Council.

THE MULTIDYNE

Readers of P.W. should watch these columns for early details concerning a new and special series of articles describing the most novel experimental receiver of the year.

The Multidyne will shortly be the rage among experimenters.

A Society Record.

THE Manchester and District Radio Transmitters' Society—which started ten months ago with twenty-five members—now has a membership of forty-two, every one of whom holds a transmitting licence. Outside London this is the strongest society in the country.

Mr. R. Simmonds, of Gerrards Cross, the well known experimenter, who has "worked" stations in New Zealand.

Direct to South Africa.

SIR EDGAR WALTON, the South African High Commissioner in London, has sent a wireless message direct to General Hertzog in Capetown. The stations employed were Poldhu in Cornwall, and Milnerton, South Africa, and the message was transmitted without difficulty shortly after midnight on a low wave-length.

* * *

"George" in Training.

UNCLE JEFF tells me that "George," his dog, who howled before the microphone at 2 L O, appears to be training for another recital. He is now able to get to top C, and his rendering of "Softly Awakes my Heart," is particularly effective, especially when accompanied by "Tibby," the cat.

* * *

An Amateur to the Rescue.

WHEN the landlines between Stoke-on-Trent and London were recently "down," owing to a gale, the President of the Stoke Wireless Society, Colonel Wenger, tuned-in to Chelmsford's programme and relayed it to the B.B.C. for the benefit of Stoke listeners. The programme included a transmission from Brussels, which had been picked up near London and sent to 2 L O, on the land-line, amplified, and passed to Chelmsford. From there it was duly received by Colonel Wenger, and passed through his telephone to the Stoke transmitter. Despite all these stages reception was perfect, and Stoke is certainly to be congratulated upon this resourceful radio achievement.

* * *

The Leeds Exhibition.

LEEDS is arranging a Radio Exhibition, and although full details are not available at the time of writing, there is every indication that it will be an excellent show. Music is to be broadcast from the exhibition by 2 L S, and there will be a demonstration room available for experimental work. The Exhibition will be held from Tuesday, January 20th, to Saturday, January 31st, in the Fenton Street Drill Hall, Leeds.

* * *

The P.W. "Paper Boat."

READERS will be interested to know that one of the most efficient wireless installations ever fitted to a cargo-boat is carried by the S.S. "Geraldine Mary," built by the Anglo Newfoundland Development Company and launched a few months ago. The vessel sails to and from Newfoundland, and brings the paper (from the "Daily Mail" and "Daily Mirror" paper mills) upon which POPULAR WIRELESS is printed.

(*Continued on page* 966.)

NOTES AND NEWS.

(*Continued from page 965.*)

An Important Point.

THE B.B.C. point out that the money sent to them by Mr. R. M. Ford—the man who won't pay his licence—was not accepted in lieu of the P.M.G. licence fee. The money was added to the "Conscience" fund—founded on money sent in by appreciative listeners who consider 10s. a year too small a sum to pay for so much amusement.

* * *

Broadcast the Cup-tie?

WHEN a representative of "The Times" was listening-in to K D K A the other evening, at the station of Mr. J. A. Partridge, of Merton Park (2 K F), he was startled by a sports team giving their characteristic "yell" before the American microphone. Why doesn't the B.B.C. take the wireless pram down to a London Cup-tie, so that we might enliven our Saturday afternoon programmes in the same way, and listen-in to a description of the match from an uncle on the spot?

* * *

A Great Actress.

IT seems impossible that Mrs. Kendal—who played the leading part in "Granny's Juliet" at 2 L O recently—is now nearly 76 years old. Before she retired in 1909 she was the idol of theatre-goers for many years, and her incomparable acting was a legend of the Victorian stage. Nevertheless, her vivacity has not forsaken her, and when sitting before the microphone at 2 L O her gestures were as appealing as ever.

* * *

Freak Letters.

THE Post Office has a rooted objection to freak addresses on letters, which tend to delay more important correspondence. But I hear that letters addressed to "The B.B.C., London," are often delivered, while some tired individuals have abbreviated it still further and simply scrawl "2 L O" on an envelope. They ought to remember that without sufficient amplification there is a risk of non-reception.

* * *

2 L O's Silence Box.

THE problem of communication between studio and control-room has now been solved at 2 L O. Instead of using coloured lights or a window through which the announcer and engineer gesticulate and make faces at one another, a silence cabinet with telephone has been installed. The announcer can go inside and tell the engineer exactly what he thinks whilst the microphone is switched "on"; and I hope he always remembers to shut the door behind him, or listeners may come in for one of those interesting one-sided conversations that can occasionally be heard outside a Post Office call-box.

* * *

W K A Q.

HAVE you heard Porto Rico? A special programme was recently broadcast from there for the benefit of Spanish listeners, and letters have been received from all parts of Europe reporting good reception. The station's call is W K A Q, and the power employed is only half a kilowatt.

* * *

A Monster Christmas Party for the Blind.

A MONSTER Christmas Party for the Blind is to take place on Saturday, December 20th, in the Central Hall, Westminster, at four o'clock.

The Rooster's Concert Party (of wireless fame) have very kindly consented to provide a programme, and the whole of the body of the hall is to be filled with members of various Blind Clubs in the London area. Thanks to the generosity of a number of leading firms, tea will be given to all the blind folk prior to the concert.

To defray expenses, the gallery seats for the concert are to be sold at 1/- and 2/6 each. An early application for these should be made to Miss Ellen Terry, at 3, Upper Woburn Place, W.C.1, where donations will also be gratefully received.

* * *

SHORT WAVES.

". . . . . Captain Eckersley hopes that some day we will be able to receive by following these instructions: 'Take a clothes' line. Damp it slightly. Stick a knife into one end and the other end into a piece of cheese. Put a pair of 'phones across it. Finis."—"Glasgow News."

* * *

"Every user of a receiving set must have noticed a steady decline in the quality of the London programmes during the last few months. . . . . ."—Mr. C. L. Larkin in a letter to the "Daily Express."

* * *

"Those listeners-in who didn't quite catch the barking of Capetown dogs the other evening managed quite satisfactorily with the yelp of a little imagination."—"Sunday Pictorial."

* * *

"One of the most important men connected with the industry predicts that in five years there will be 10,000,000 radio receivers in the United States."—Sir A. Maurice Low, writing in the "Morning Post."

* * *

". . . . . We may grumble occasionally over the company's programmes, but, on the whole, they are wonderful value for the money . . . . . ."—"Newcastle Daily Journal and North Star."

* * *

The meanest man is possibly the one who uses a wireless set without taking out a licence and then writes anonymous letters to the B.B.C. complaining of the programmes.—"Daily Herald."

* * *

". . . . . the voice that comes to us by wireless must be optimistic, and the matter of the speaker must be optimistic. It is not the slightest good bellowing through the ether that all is lost . . . . . ."—Keble Howard writing in the "Radio Times."

* * *

THE WEEK'S QUERY:

Why can't I tune in London with the same coils as for 6BM? When I say "tune-in" I mean at the same strength, as 6BM (30 miles) is "O.K." on the loud-speaker, but London (100 miles) is only loud 'phone strength.

A.D.F. Report.

THE problems of wireless direction-finding are being tackled very thoroughly, and a report has just been issued summarising the first year's results at ten British observing stations. Seven of these are located at the various Universities, and some 41,000 readings have been classified and compared. These show that whilst wireless waves are subject to great variations over long overland journeys, there is very little variation over water. And for short distance marine work, where it is especially needed, wireless direction-finding appears to be completely reliable.

Radio Motoring Lessons.

THE B.B.C. is considering a rather novel suggestion arising out of the motor talks which are taking place this week. It has been proposed that listeners should be switched through to a garage and the noises of the commonest motoring mistakes—mis-firing, starting-up, etc.—should be broadcast as an object lesson to novices. Wouldn't the small boys enjoy it, too?

* * *

Mr. Lang and Broadcasting.

READERS will be interested in the interview with that well-known actor, Mr. Matheson Lang, which appears on another page, especially as I now learn that, owing to the great success achieved by the musical play "Patricia" since it was broadcast, Mr. Lang's publicity manager has approached the B.B.C. with a view to broadcasting extracts from Mr. Lang's play, "The Wandering Jew."

But I gather that there is not much likelihood of this play being broadcast. The Editor tells me that Mr. R. E. Jeffrey, the B.B.C.'s Dramatic Producer, will reply to Mr. Lang's criticism in next week's "P.W."

* * *

A Pioneer Detector.

WHEN Mr. Maurice Child was lecturing to the R.S.G.B. recently upon the subject of recorders, he surprised members by displaying for inspection the actual Lodge Muirhead detector which was used for recording signals 24 years ago. But what surprised them still more—after experience of modern junk—was the fact that it still worked perfectly.

* * *

Christmas Radio Fare.

I THINK that the tit-bit of the B.B.C.'s Christmas fare is due to commence at 7.55 p.m. on Tuesday, December 23rd, when Birmingham will broadcast "A Christmas Carol," by Charles Dickens. It will be S.B. to London also, and unless I am very much mistaken nearly all the valve sets in the country will forsake other local programmes in favour of Old Scrooge and Tiny Tim.

* * *

Swedish Transmissions.

SHORT-WAVE Swedish broadcasting times are now as follows: Stockholm, 440 metres, Mondays, Wednesdays, and Fridays at 7.20 p.m., Saturdays 8 p.m., Sundays from 11 a.m. to 1 p.m.; Stockholm (Svenska Radio), 470 metres, Tuesdays and Thursdays from 8 to 10 p.m., and Sundays from 6 to 7 p.m.; Goteborg, 460 metres, Tuesdays, Fridays, and Sundays from 7 p.m. to 9 p.m.

* * *

The Triumph of "Mic."

FOLLOWING the successful broadcasting of "Patricia" from His Majesty's Theatre comes the pleasing announcement that the management of the Gaiety has agreed that the second act of "Poppy" shall be broadcast early in the New Year. It looks as though the whole question of theatrical broadcasting will be re-opened now that the microphone has demonstrated itself as a stimulant to the box office.

"ARIEL."

SOME HINTS ON
A TUNED ANODE ULTRA-AUDION CIRCUIT.
A PRACTICAL "HOOK-UP" FOR AMATEURS.

By LIEUT.-COMMANDER H. W. SHOVE, D.S.O., R.N.

Amateurs who have experimented with the well-known De Forest's Ultra-audion circuit will be interested in this article. Owners of Unidyne sets will also find an interesting suggestion at the conclusion of this contribution.

IN a favourite variation of the "Ultra-audion" circuit of Dr. de Forest, control is obtained by so proportioning the relative values of the inductance and series A.T.C. that the impedance of the aerial tuning circuit is sufficient to allow the right amount of direct H.F. "feedback" to produce maximum signal strength without "howling." This circuit is shown in Fig. 1. It is evident that there are actually an indefinite number of settings that will tune the aerial to the incoming wave-length. For every setting of the A.T.I. there will be some corresponding value of the A.T.C. to tune in the desired station.

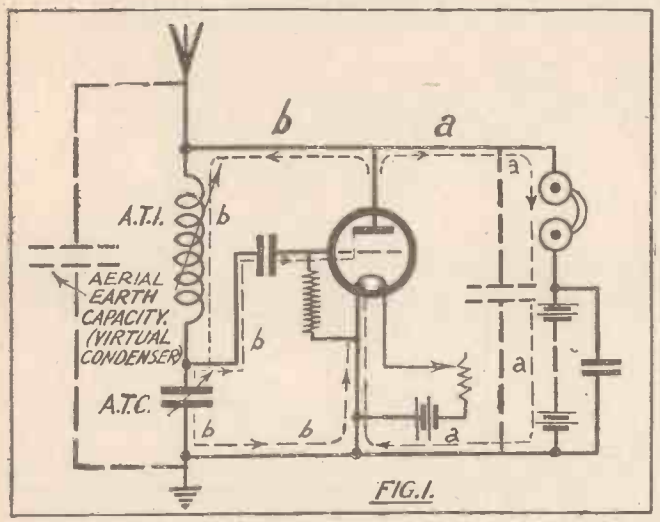


FIG. 1.

But the voltage drop across the condenser, which is the voltage applied to the grid filament circuit, will vary, being greatest when the capacity is least and vice versa. Thus, in general and so far as the grid circuit alone is concerned, we should use as small a capacity as possible. But now consider the anode circuit. There are two branches of this: (*a*) that through the 'phones and battery (and possible 'phone condensers, chokes, etc.), and (*b*) the "feedback" to the aerial. To obtain reaction it is our object to divert H.F. oscillations through (*b*) and L.F. through (*a*). The impedance of a pair of 'phones (or other high value inductance, as, e.g., a choke coil) is relatively much higher to H.F. than to L.F. oscillations. So the circuit (*a*), if it contains one or two pairs of H.R. 'phones (and no by-pass condenser), will generally prevent any appreciable loss of H.F. through it.

Reaction.

The problem of getting H.F. through branch (*b*) is more or less a tuning problem. The circuit involves the A.T.I., A.T.C., aerial to earth capacity and plate to filament capacity of the valve, including also the alternative path via grid condenser and grid, in parallel with the A.T.C. The aerial tuned circuit is aerial inductance, aerial to earth capacity, A.T.I. and A.T.C. *alone*, without involving the valve capacity. Thus it is not normally possible that anode branch (*b*) shall be tuned to the incoming wave. Now, the impedance of a circuit including much inductance and little capacity, as recommended above for the grid circuit, to oscillations other than those to which it is tuned, is high, the circuit being what is called "heavily tuned." *Thus the conditions for high efficiency of the grid circuit are those for low efficiency of the "feedback."*

It is this fact that makes it possible to control the Fig. 1 circuit, by striking a balance between the two so as to get good signal strength without "howling."

In the circuit shown in Fig. 2 a proportion of H.F. from both branches of the anode circuit is utilised. This is a very good circuit and enjoys a fair measure of popularity. The reaction coil adjustment is very critical, and the circuit selective and to be recommended. But those who are out for "the last ounce" may care to try that shown in Fig. 3.

The theory of this circuit is to tune branch (*b*) of the anode circuit by means of the variometer V2. This gives a very fine adjustment of reaction, while allowing the use of the low value of A.T.C. as explained above. Of course, really accurate tuning will cause hopeless instability, but enough can be done considerably to improve signal strength.

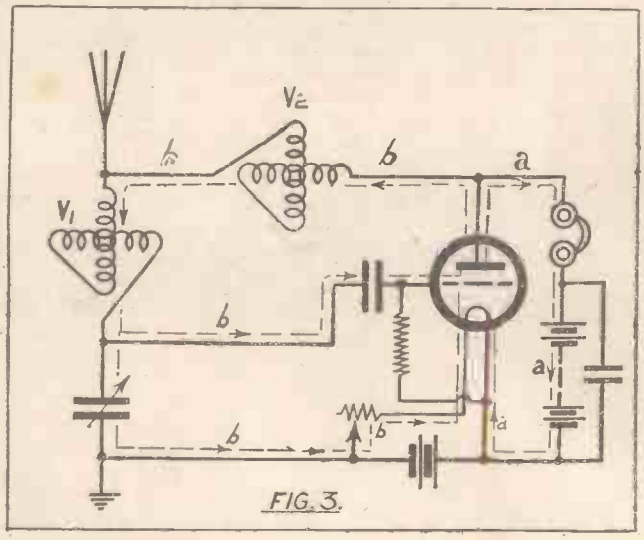


FIG. 3.

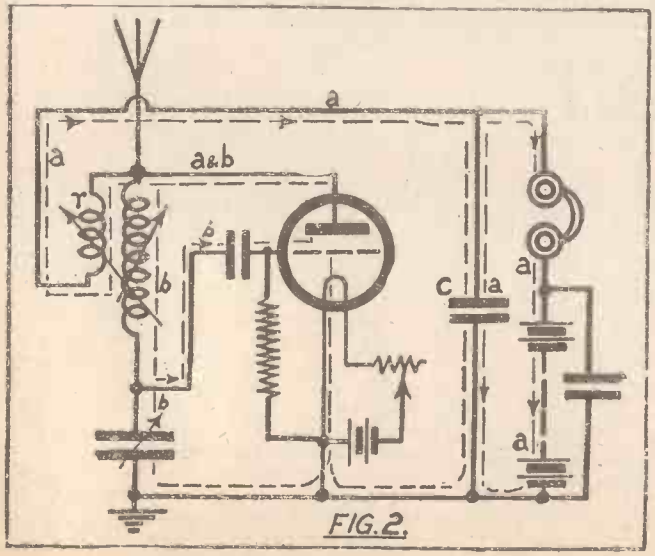


FIG. 2.

Trying the Circuit.

Fig. 4 is a scale plan of a rather rough "hook-up" made by the writer and employing this circuit. The components are mounted on a hardwood base, raised on cross pieces at the ends to keep the wiring clear of the table. Small pieces of ebonite insulate the terminals, etc., from the baseboard. Fig. 5 is the practical wiring diagram and Fig. 6 the theoretical circuit, which, it

(*Continued on page* 968.)

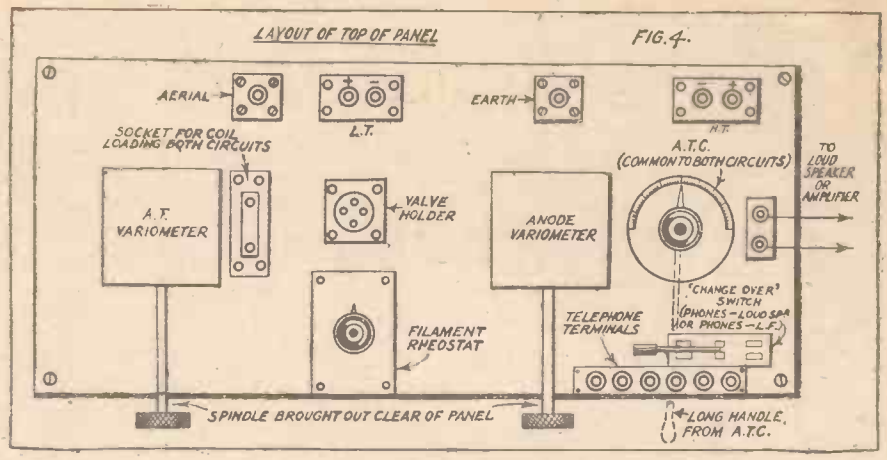
A TUNED ANODE ULTRA-AUDION CIRCUIT.

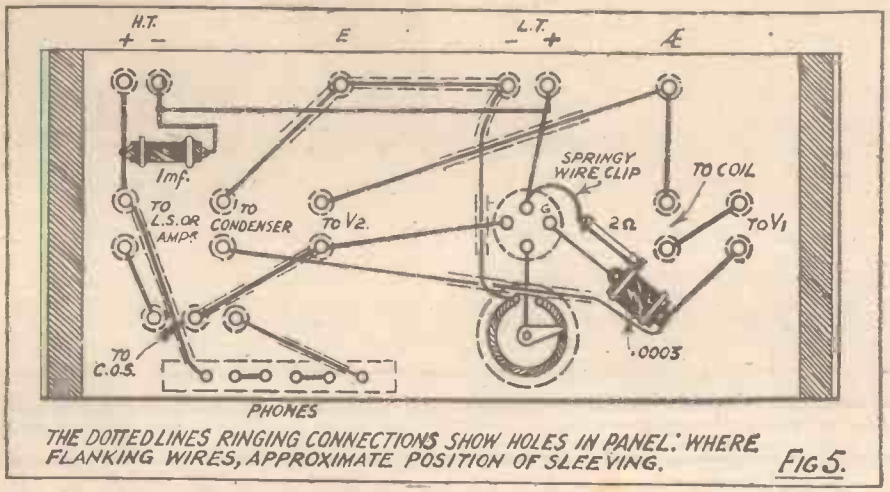
(Continued from page 967.)

will be seen, is only a slight elaboration of Fig. 3. The figures and references should be self-explanatory.

Operating the Set.

Tuning is not so difficult as might be expected. For preliminary searching, set the anode variometer to minimum and the A.T.C. fairly low. Then rotate the A.T. variometer, very slowly, till either speech or a carrier wave is heard. If speech comes in without distortion due to incipient oscillation, reduce the value of the A.T.C. by a couple of degrees and reset the variometer for best signals. Continue this process, gradually increasing inductance and reducing capacity, till really good strength is obtained. Then carefully adjust the anode variometer till the set is just short of the oscillation point. If you hear a carrier wave, increase the capacity at once and follow up by reducing inductance until speech is heard free of oscillation. Then complete the tuning as above with anode and A.T. variometers. If a station cannot be picked up with minimum anode variometer setting, slightly increase it and try again. A little practice will soon enable a careful operator to find the best settings and tune in without heterodyning the carriers.

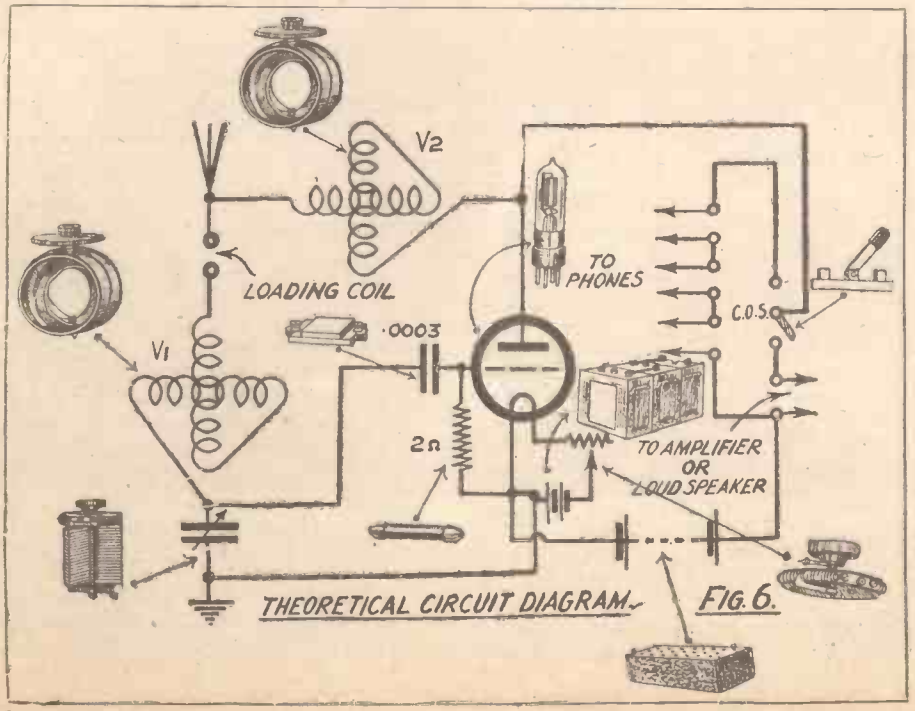




"Unidyne" Principle.

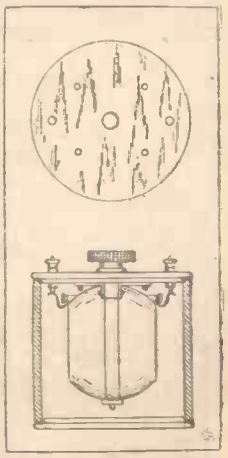
Body capacity effects are somewhat marked, so long handles should be used both for A.T.C. and for the variometers. A good deal of useful adjustment can be done on the filament rheostat, especially if it is of the "vernier" type.

Finally, H.T. voltage should be kept low. The writer uses 25-30 volts with an Ediswan A.R. valve and three sets of 'phones. Quite good results have been obtained with as little as nine volts, and the writer would recommend those possessing four-electrode valves to try the set as a "Unidyne," though he has not done so himself.



MOUNTING VARIOMETERS.

DUST is not only the natural enemy of the crystal, but of all other wireless apparatus, and where variometers or variable condensers are arranged as independent units on an experimental baseboard, protective casings should be provided.



The accompanying sketch depicts a very simple casing which is particularly suitable for a variometer. It consists of three parts—namely, the body, which is a short length of ordinary cardboard coil former about 4 in. in diameter; and the top and base comprising a pair of round ebonite condenser ends, one of these being drilled to take the variometer bush, or the usual fixing screws or bolts; and two terminals which are connected up to the instrument in the usual way. A liberal supply of Seccotine or strong glue is all that is required to hold the casing together.

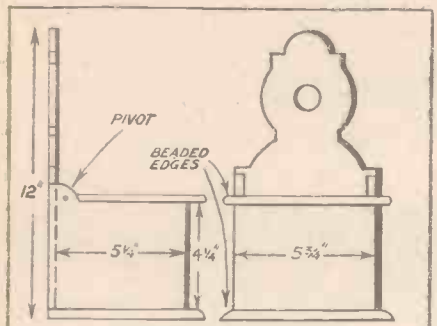
AN INEXPENSIVE CRYSTAL SET.

A "SALT BOX" RECEIVER.

By H. W. S.

This very simple set will appeal to readers who do not wish to make a large outlay. Although cheap to build, this receiver gives very good results.

AT most domestic stores you can obtain what is known as a salt box. These are designed to hang on the wall and to provide a supply of salt always ready to the housewife's hand. A



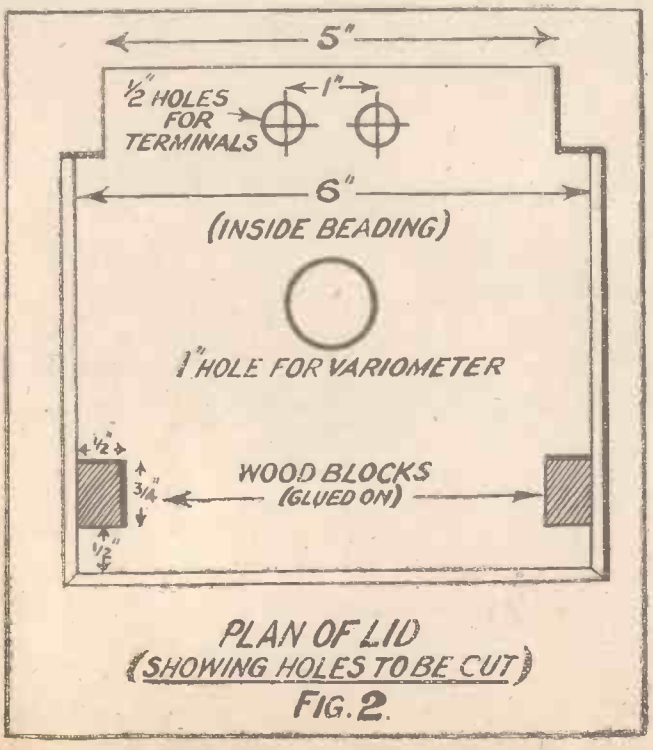
DIMENSIONS OF SALT BOX.
FIG. 1.

sketch of the type of box referred to is given in Fig. 1. Being well made and of hard wood, they make excellent cabinets for small sets. Here is a short account of one, recently made by the writer for a friend who was anxious to receive "5 X X" at small expense.

Construction.

The lid of the box was first removed (it is fitted with pivots and not on hinges, which would be corroded by the salt) and holes cut in it with a centre bit in the positions shown in Fig. 2. The dimensions, of course, may have to be varied if the box is not of the exact size shown in Fig. 1. The size is immaterial, provided the variometer or variable condenser to be used will fit inside. Three pieces of ebonite were next obtained, on one of which (2 in. by 1 in.) a couple of terminals were mounted at the correct distance for the shanks to pass through the ½-in. holes at the back of the lid. This was then secured to the lid in that position.

In the centre of the second piece (actually 2 in. square, though the size is immaterial) a hole was cut for mounting the variometer (one-hole fixing type). This piece was screwed to the lid with the hole in register with the 1 in. hole in the centre. The third piece was ¾ in. wide, its length being equal to the full width of the box (in the set described 6 in.). Upon this were mounted four telephone and two W.O. terminals, as shown in Fig. 3, with shorting wires as indicated in the plan at *b*. Ivorine name washers, indicating "Aerial" and "Earth" can be placed on the top of the strip (the terminal bridge) on the two W.O. terminals.



PLAN OF LID
(SHOWING HOLES TO BE CUT)
FIG. 2.

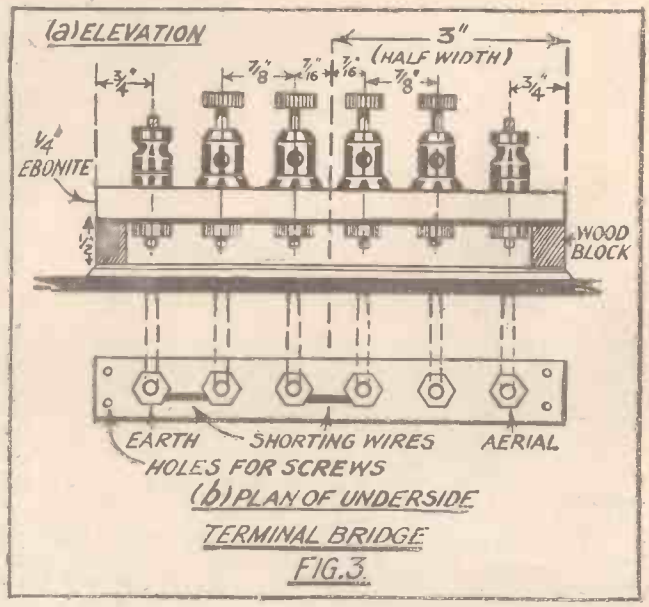


FIG. 3.

Two small blocks of wood were then glued to the top of the lid in the positions shown in Fig. 2, the terminal bridge being laid across them, and small holes were cut in the lid under the aerial and earth terminals and the 'phone terminal at the aerial end. To the aerial and the 'phone terminals were attached flexible leads (about 10 in. long), and to the aerial and earth terminals ordinary No. 22 bare tinned copper wire ones, with insulating sleeving. These being passed through the holes, the bridge was screwed down to the small wooden blocks, as shown in Figs. 3 (*a*) and 6.

Alternative Wiring Plans.

The variometer was then mounted and the set wired up (see Fig. 4). If condenser tuning is employed instead, the wiring will be as in Fig. 5. The crystal detector was mounted vertically in the centre of the front of the box and the flexible leads passed through two small holes and secured

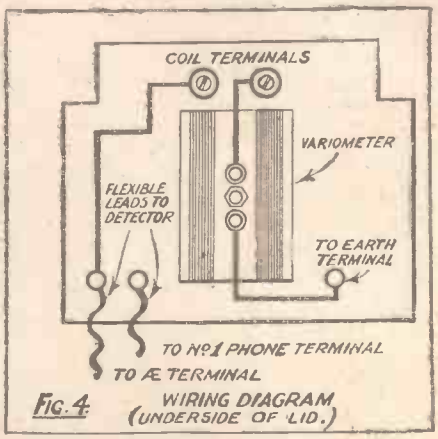


FIG. 4. WIRING DIAGRAM (UNDERSIDE OF LID.)

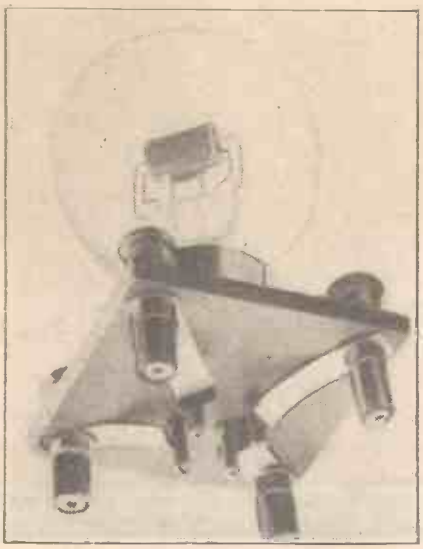
to its terminals. The lid was then replaced and screwed on. A couple of coats of shellac varnish gave a good finish to the receiver.

(*Continued on page 970.*)

A LOW-CAPACITY VALVE HOLDER.

By W. HORSFALL.

THE photograph shows a valve holder which has been found to be particularly useful for experimental work. It is easy to make, has low capacity, ensures good contact, there is no fear of H.T. getting across filament, stands firm on rubber feet which tend to reduce microphonic noises, and, lastly, valves may be changed without much force being used.



The ebonite is 2¼ in. square, $\frac{3}{16}$ in. thick; $\frac{5}{32}$ in. holes are drilled for the valve pins and terminals. The brass contact strips were obtained from pocket-lamp batteries.

When the valve is pulled out, these strips lie close to the underside of the ebonite and project nearly half-way across the valve-pin holes; the action of pressing in the valves pushes them down and outwards.

This same idea may be used on panels, using countersunk screws in place of the terminals. The rubber feet are cut from the outer covering of H.T. cable, but of course any similar covering may be used.

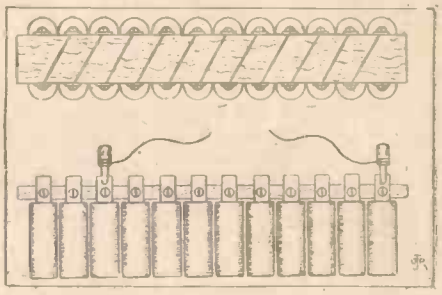
ASSEMBLING H.T. BATTERIES.

By O. J. RANKIN.

FOLLOWING is a description of a very simple method of assembling pocket-lamp refills to form a variable H.T. battery unit.

The contact strips are all bent up parallel with the sides of the batteries, and a strip of perfectly dry hardwood, previously well shellacked, is fitted between them as shown in Fig. 1.

Holes are pierced or drilled through the contact strips, and after assembling the batteries in a straight line, with all the long (negative) strips on the same side, each one is screwed to the edge of the wooden strip as



shown in the diagrams. They are then all connected together in series by means of short pieces of bare copper wire or copper foil as indicated in Fig. 1, and the long strips are then clipped off, leaving about ½ in. of each protruding above the wooden strip as shown in Fig. 2.

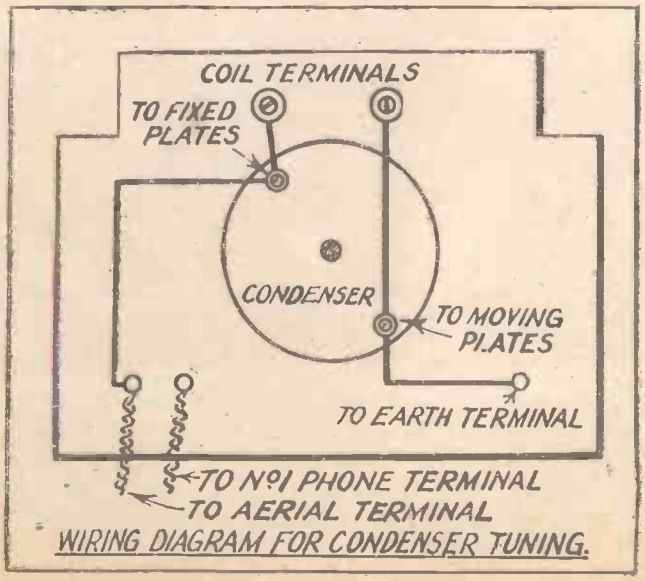
Two ordinary valve pins serve as wander plugs, these being fitted with small ebonite knobs and made to engage the protruding portions of the negative contact strips, which, if necessary, should have their edges neatly trimmed up with a smooth file to ensure good contact.

AN INEXPENSIVE CRYSTAL SET.

(*Continued from page 969.*)

Operation.

To receive 5XX a coil basket of about 150 turns is secured, by a bolt and washer, through the hole in the backboard by which the box is intended to hang on the wall. The ends of this coil are joined up to the two terminals at the back of the lid. For the reception of ordinary broadcasting, these terminals are shorted, and tuning done on the variometer alone. If a condenser is used instead, a second coil, of about 35 or 50 turns, must, of course, be provided. Both coils can remain permanently in position on the same axis and either be connected up as required.



WIRING DIAGRAM FOR CONDENSER TUNING.

The Terminal Bridge.

The object of the terminal bridge is to enable either one or two sets of 'phones to be used. When using one pair, connect to the two outer 'phone terminals; for two pairs, join to Nos. 1 and 2 and Nos. 3 and 4 respectively.

The capacity of the variable condenser (for use where a variometer is not employed) is not critical. It may be anywhere between ·001 mfd. and ·0005 mfd., and thel atter used with a fairly large coil is preferable.

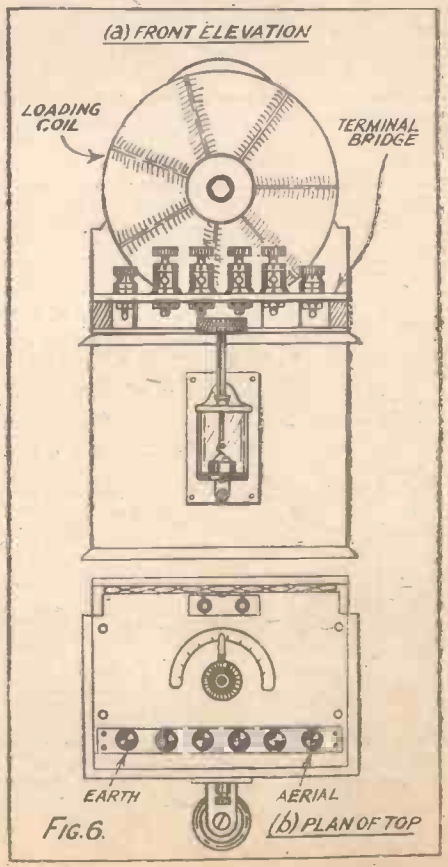


FIG. 6.

CHRISTMAS AND BROADCASTING

GOOD FARE FOR THE LISTENER

By J. C. W. REITH, M.Sc.

(*Managing Director of the British Broadcasting Co., Ltd.*)

"SOMETHING wrong with Christmas nowadays. It isn't what it used to be." I wonder whether people really do feel and talk in this way to any great extent? I am afraid so. I hear a fair amount of comment on the matter, and I know many who seem unable to contribute to the general spirit of good cheer which should distinguish the season, or even to adjust themselves to it when it comes their way.

There is certainly something far wrong if Christmas, which should be one of the happiest times of the year, has come to be anything of a burden and a nuisance to us. It is a horrible thought, and I believe if we feel like that we should each get to grips with the subject, see where the trouble lies, and settle it for ourselves.

Something Wrong.

Of course, there are thousands who find no difficulty in enjoying to the full all that the season offers. There are some, no doubt, whose circumstances, mental and physical, make them so securely happy that they might even fail to understand how anyone could be otherwise than elated as the day draws nearer. How fortunate they are! But there are many who are depressed by the very word "Christmas," and this is so obviously wrong that it may be worth while to enquire into the matter, and see if we can help them to a more natural and kindly frame of mind.

We Must Get Busy.

There are some straightforward reasons for the state of dissatisfaction and unrest which prevails among so many. The world is getting busier and busier, and it is not easy to detach ourselves from the cares and associations of work just because the calendar is registering December 25th. Even if this is achieved, a mere impassive attitude towards the spirit of the season will not carry us far; we must get busy; we must adopt an active mental attitude; we must, as it were, persuade ourselves into a state of interest in the season and co-operation in the universal sentiment of good-will.

The Only Way.

We may possibly feel that if we had plenty of money and plenty of leisure we could soon make things lively, and thoroughly enjoy the season, but because we cannot bring it off in this effortless and material way it should not entail a surrender to depression.

I think there is another trouble, too. It may be because the initiative has devolved upon us, and we resent the necessity for having to make an effort. In our young days the effort was all made by others. All kinds of preparations were made, and we were kept in an eager state of anticipation and suspense. Christmas and the Christmas atmosphere were created for us. Now we must approach the thing in a different way; if we do not find the Christmas spirit coming spontaneously to us, I think we must ourselves search for it, and see what we can make of the season, for others in the first place, for ourselves in the second. The more we can make it mean to them, whether they be children as we were, poor and lonely as I hope we are not, or ordinary grown-ups in normal circumstances as we are, the more it will mean to us.

The best and, indeed, the only satisfactory way of finding true enjoyment is where some personal effort, and usually also some personal sacrifice, is involved. This applies at any time of the year, but Christmas is the opportunity *par excellence* of the whole year for service, if we have but the imagination and the grace to recognise it and use it. I am sure we all really want to believe in Christmas and experience again the happy expectations and realisations of earlier years.

Some members of the B.B.C.'s staff celebrating a recent birthday.

Wider Opportunities.

It is, of course, inevitable that for many of us, especially of the older generation, Christmas and the end of the year should bring some sadness in recollection. We cannot help remembering those with whom the season was particularly associated in days gone by, and who now, through the inevitable circumstances of change in which we live, normal and abnormal, are absent to-day. There are others left; their need of human companionship and human sympathy may be much greater than ours. Destiny, it is said, never locks one door without unlocking another. I expect, if we had only the vision sufficiently clear, we would be able to recognise a dozen new and wider opportunities for every one which is withdrawn. "There are none so blind as those who will not see," says the old proverb.

The spirit of Christmas is not necessarily to be found in mistletoe and holly and plum pudding. The glummest and most cantankerous old Scrooge can sit at the festive board and eat a Christmas dinner. But he will cast a shadow on all the others unless they adjust matters with him.

The Spirit of Romance.

There is something that everyone, however humble, however few his talents, may do, and probably he has no need to seek very far to find what it is. If he has been feeling uneasy and depressed before, and if he seeks and finds, he will recapture something of the spirit of Romance, which, for all our cynicism and unhappy memories, is still abroad in the land. It will carry him through this gate of unselfishness and service and thought for others into the regions where there is abundance of light and music and laughter.

Xmas Broadcasting.

Our broadcasting people all over the country have set themselves to give their listeners a special Christmas and New Year fare. It is their opportunity of contributing to the good cheer of the season. I expect they all have their individual and particular thoughts and desires, but in many cases these must be subordinated to the great responsibility and privilege of contributing to the general happiness of their vast audience. Many will depend on them for it.

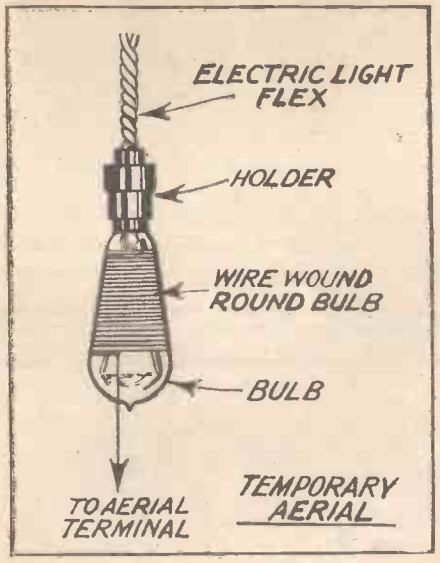
It is good to know we can do this service. If broadcasters and listeners combined there would be enough happiness to go round the whole country, and still leave enough to carry us through till the next Christmas.

Constructional Notes

Conducted by Dr. J. H. T. ROBERTS, F.Inst.P.

Temporary Aerial.

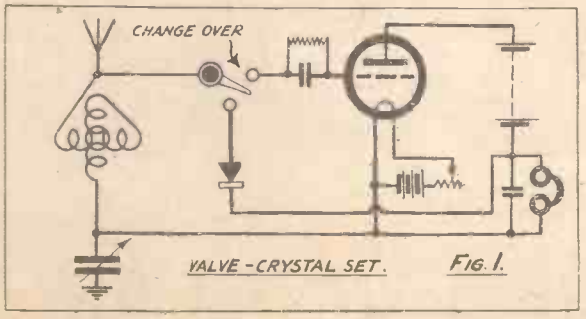
THE arrangement shown in this drawing will sometimes be found to give quite good signals. A length of copper wire, which may be bare or insulated, is wound round the electric lamp bulb in the manner shown. A piece of insulating tape laid below the windings (if a metal filament lamp) will help keep the windings in position. If a carbon lamp is used, it is better not to use



the tape, on account of the heat from the filament. The tape should be laid against the glass, the first turn of wire laid on, then the loose end of tape turned over, and the rest of the wire wound on over the turned up part of the tape. This will prevent the first winding from slipping off. A secure loop at the large end of the bulb will prevent the wire from slipping off at that end also. Tinfoil may be tried instead of the wire, but it is not easy to get the foil to lie evenly on the bulb.

Valve-Crystal Set.

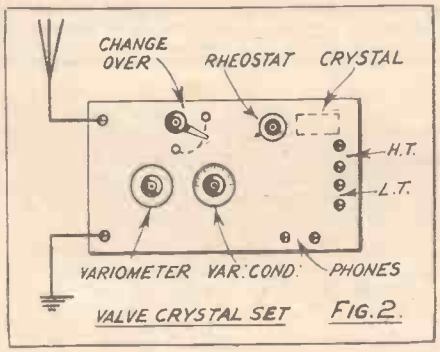
Many experimenters like to arrange their crystal set and single-valve set in such



a way that they can readily change over from the one to the other. The simple arrangement shown in the accompanying sketch enables this to be done with the minimum of inconvenience. It will be seen that the change of a single switch puts the valve or crystal into operation, the other being thrown out of circuit. In the second figure is given a convenient way for arranging the components behind and upon the panel. It will be noticed that variometer control is indicated, but this, of course, is optional.

Series—Parallel Switch.

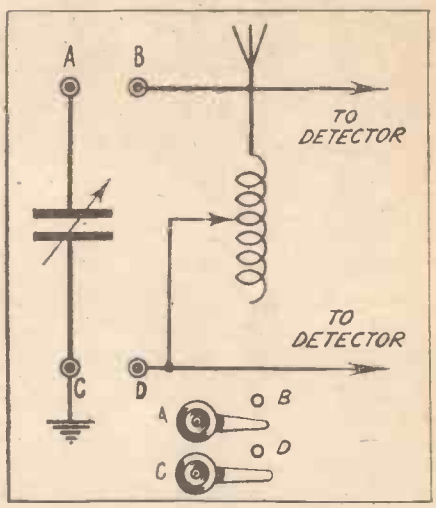
This is an addition to the many ingenious devices for throwing the condenser in series or parallel with the inductance. In the diagram, in the next column, if A and B are connected together, and C and D together, the condenser is in parallel, whilst if A is connected to D, B and C being idle, the condenser is in series. The connections between A and B and C and D may conveniently be by jacks or wander-plugs, or



suchlike simple device. Another method of arranging the change-over is by the double switch illustrated in the lower figure. If the two arms are in the upper position, the condenser is in parallel; whilst if they are in the lower position, the condenser is in series.

Vernier Condenser.

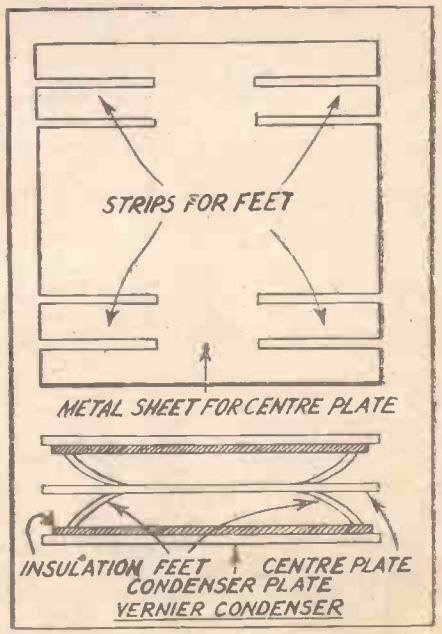
Many designs for small variable condensers have recently been put forward, and the one illustrated here, which forms the subject of Br. Pat. 208,598 (F. K. Crowther) is interesting, as it is based on a somewhat novel mechanical principle as applied to condensers. In the first figure is shown a sheet of thin metal, such as springy brass, with eight slots cut in such a way as to leave eight strips which may be bent (as shown in the lower figure) to form legs, four on one side of the sheet and four on the other. This sheet then forms the centre plate of the condenser, and it is held between two other metal plates, whose distance apart can be regulated by means of a screw with control knob in the usual way. The inner surface of each of the two outer plates is covered with a layer of insulating



material, such as mica, to prevent contact with the legs of the centre plate. The springiness of the legs of the centre plate keeps the outer plates apart against the pressure of the adjusting screw. The distance apart of the outer plates determines the capacity of the condenser.

Electric Wire Aerial.

Many amateurs have from time to time reported good reception by using a length of wire wound round the electric light flex and connecting this wire to the aerial terminal of the set. In one case, an experimenter found that in this way he obtained results quite as good as those obtained on a regular 100 ft. outdoor aerial.



The theory of the arrangement is easily understood when it is remembered that the insulation and air-spacing act as a condenser, connecting the set up in series with the wires of the electric light system. The success of such an aerial entirely depends upon the way in which these wires have been laid and connected.

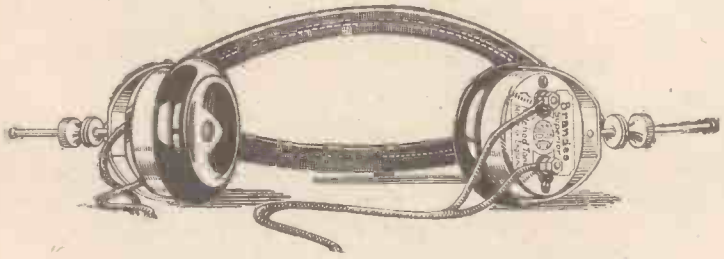
Tune the Table-Talker with the "Matched Tone" Headphones

The Brandes Family Series.

OH, Boy! What fun you'd get with the *Table Talker*, as well as your "*Matched Tone*" Headphones. Ask Father. Can you really think of a better gift for Christmas? Just real fun—fun for the Christmas vac.—fun all the year round. You will hear every blessed word as plain as though your own form-master were speaking—and it's heaps more interesting. You'd hear real music just as loud as you hear that girl thumping on the piano next door—but no false notes. Oh no! And it's so pleasantly natural.

Ask your Dealer for Brandes.

British Manufacture (B.B.C. Stamped).



Crown Farm House,
Walton-on-Thames, Surrey.
19/11/24.

Dear Sirs,

It may interest you to know that I received Australia on your 'phones. I consider that they are the most sensitive 'phones that I have used, and I am much pleased with their general performance.

Yours faithfully (Sgd.) F. WALKER.

All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This practically constitutes a free trial.

The "*Matched Tone*" feature was embodied as the distinctive characteristic of Brandes Headphones in 1908, and means that both your ears hear exactly the same sound at the same instant—and you learn a new beauty of tone. They are tested and re-tested for just this one vital point, and, in addition, their strength, long-wearing comfort, and reliable efficiency make them undoubtedly superior **25/-**

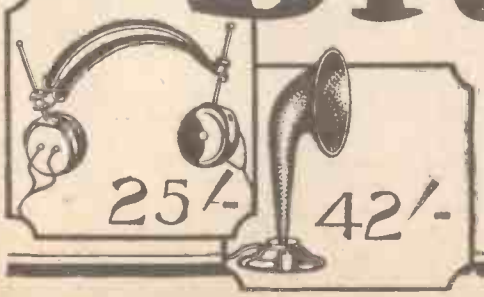
The *Table-Talker* is a Brandes quality product at a moderate price. The non-resonant, specially constructed horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance and remarkable tone qualities. It is twenty-one inches high, and is finished a shade of neutral brown .. **42/-**

For Christmas!

An excellent family gift to the family. Club together and get yourselves Brandes Products for the receiver. They provide good fun during Christmas festivities, and all the year round.

Brandes

Result of 16 Years Experience



The name to know in Radio

THE RIGHT WAY TO WORK L.F. VALVES.

By E. J. WYBORN, A.C.G.I., B.Sc.

The use of unsuitable valves and incorrect operating conditions are the sources of a very great deal of the distortion which is, unfortunately, so often met with in loud-speaker reproduction. This distortion is in general due to the distinct faults—incorrect grid potential and overloading of valves.

MOST amateurs are aware that the grid of a low frequency amplifying valve should be maintained at a negative potential relative to the negative side of the filament; but, unfortunately, some few seem to be under the impression that the greater the value of the negative grid potential, the better the quality! Such an idea is of course quite erroneous. Negative grid potential is necessary in order to prevent the flow of grid current which would take place if the grid became positive, and which would cause distortion. If the negative potential is too great, however, the valve will be operated near the bottom bend of the characteristic curve, and rectification of the low frequency pulsations will take place.

TABLE I.
CORRECT NEGATIVE GRID POTENTIALS.

Valves.	High Tension Voltage. 60	80	100	120	200
D.E.3, D.E.R., B.T.H., B.3 and B.5, Cossor W.R.1. and P.1, Ediswan D.E.O. 6 and A.R.D.E., Mullard D.F. Ora and L.F. Ora, Wecovalve, Cosmos D.E. 11	1½	3	—	—	—
R. R.5 v., Mullard Oro, L.F., and R.A.	1½	3	3	4½	—
L.S.3., D.E.6, Mullard D.F.A.O., and D.F.A.1 and P.A.3	3	4½	6	7½	—
D.E.4, D.E.5, B.T.-H., B.4	1½	3	3	4½	—
Mullard D.F.A.2	4½	6	7½	9	—
D.E.5b.	—	—	1½	3	—
L.S.1, Ediswan P.V.1	—	—	—	—	4½
L.S.2; Mullard, P.A.1, Ediswan P.V.2	—	—	—	—	7½
Mullard, P.A.2	—	—	6	7½	12
L.S.5	3	3	4½	6	12

The higher H.T. voltage should always be used if possible. It should be remembered that one dry battery gives 1½ volts.

Cause of Distortion.

This is a source of distortion quite as bad as that due to grid current, and for a valve to operate under the best conditions the grid potential should be maintained at a value corresponding to the mid point of the characteristic curve between the bottom bend of the curve and the zero grid potential line—at which the flow of grid current commences. The correct value of the negative grid voltage is different for different valves, and also for different values of the high-tension voltage, and in Table I. are given the correct values for most of the more common valves suitable for low frequency amplification.

Even when the grid potential of a valve is maintained at the correct value, distortion will occur if the low frequency pulsations applied to the grid of a valve are so great that the plate current swings right up and down and over the ends of the correct part of the curve. Rectification and grid current will both be produced, resulting in bad distortion. This condition is known as overloading, and should be carefully avoided if good quality is desired. Overloading is, as one would expect, much more common in the case of the last valve of a low-frequency amplifier, owing to the greater power handled by the last valve, and a special valve having a sufficiently large power handling capacity should always be used in the last stage. In fact, the careful constructor will use in each stage of his amplifier a valve suitable for the power to be handled by that stage.

In this connection, it should be remembered that the greater the high-tension voltage—and the corresponding grid negative—the greater the power which can be handled by a valve—up to a certain limit—so that the maximum permissible value of high-tension voltage (given in Table I.) should always be used on the last valve, and, if possible, on all the low frequency valves.

Arrangement of Valves.

In order to assist the amateur to make the best choice of valves, a list is given in Table II. of the valves suitable for use in each stage of a low-frequency amplifier, assuming that signals of good strength in the telephones are passed on from the rectifier. It will be found in general that two stages of transformer coupled low-frequency amplification are quite sufficient to give a volume of sound which will satisfy most requirements.

If signals from the rectifier are very weak, three stages may be used, but trouble will then probably be experienced from howling. This can be usually cured by connecting high resistances of the grid leak type (½ megohm), across the secondary winding of one or more of the transformers, and if due to microphonic noises, by mounting the rectifier valve-holder on a spongy rubber pad. When three stages are used, any of the valves in column I. may be used for the first two stages, and one of those in column II. or III. for the last stage. Any of the valves in column II. or III., of course, can be used in the first stage, a lower high tension being then sufficient.

Importance of Valve Impedance.

The impedance of a valve is of considerable importance in low frequency amplification, and the lower the value of the impedance the better the results which will be obtained. Special low frequency valves of the types in columns II., III., and IV. in Table II. have low inpedances, and for the very best results these valves should be used for each stage of the low-frequency amplifier.

Resistance-Capacity Amplification.

The growing appreciation of faithful reproduction has brought the resistance-capacity method of low frequency amplification into increasing prominence, as by its

(*Continued on page* 978.)

TABLE II.

L.T. Supply	First stage I	Last Stage. II Moderate Volume	III Considerable Volume.	IV Very Great Volume.
Dry Batt.	D.E.3, B.T.-H, B.5* Ediswan D.E.O. 6* Cosmos D.E. 11* Wecovalve* Mullard D.F. Ora* Cossor W.R.1*			
2 volt accumulator	Ediswan A.R.D.E.,* D.E.R.* Mullard L.F. Ora* B.T.-H., B.3*	D.E.6*		
4 volt accumulator	R. Mullard Ora & R.A. and L.F. Cossor P.1	L.S.3 Mullard	D.E.4* Mullard D.F.A.*	
6 volt accumulator	R.5 v. D.E.5b*		D.E.5* B.T.-H. B.4* Mullard D.F.A* and P.A.2 L.S.1 Ediswan P.V.1	L.S.5* L.S.2 Ediswan, P.V.2 Mullard P.A.1 D.E.5a.*

In addition to the dry battery valves, those marked with an asterisk have dull emitter filaments.

Technical Notes

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P.

Strange Aerials.

THE French Navy Bureau of Research has been experimenting to find out whether a jet of sea water, projected high into the air, can be used as a wireless aerial. The water was drawn from the sea and shot vertically upwards by means of the ship's pumps, the column of water being connected to the ship's radio apparatus and used in lieu of the ordinary aerial. Transmission was effected in this way over a distance of about eight miles. The aerial was much less efficient than the metal aerial, but the purpose of the experiment was to find out whether a device of this kind could be used in an emergency, as, for example, when the regular aerial had been shot away.

Gas Aerial.

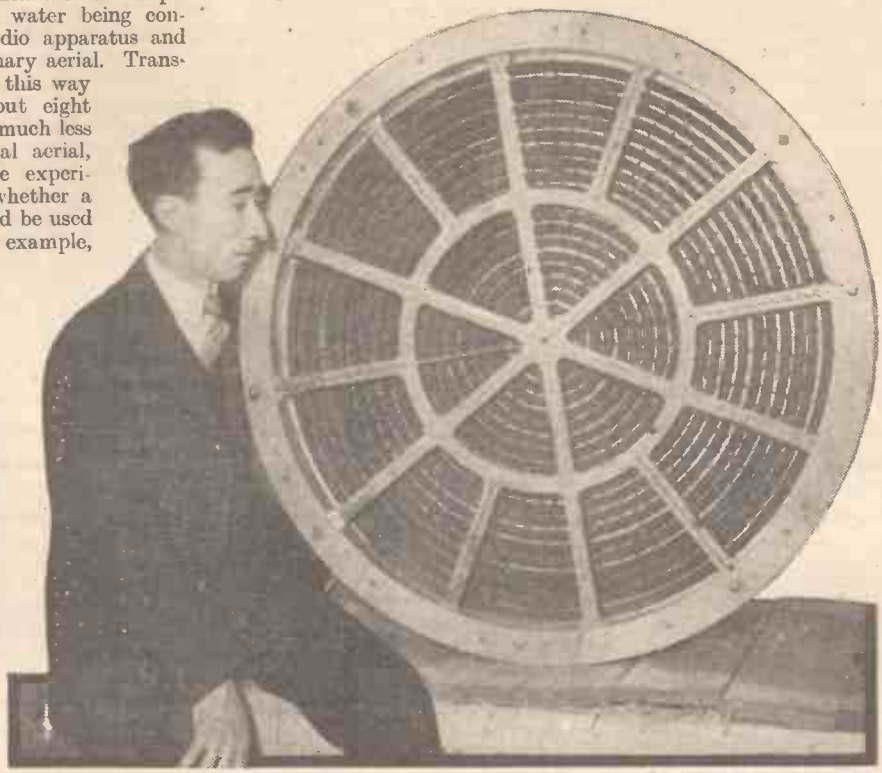
Another strange aerial which was recently patented, for use on aeroplanes, employs the stream of exhaust gas from the engine. This gas, owing to its having been just raised to a very high temperature, is heavily ionised and therefore electrically conducting; furthermore, it has the advantage of being of very considerable length and weightless. It is reported that good success was obtained in the transmission and reception of signals on this gas aerial.

Aerial Insulation.

Some interesting observations on the important subject of aerial insulation were given by Mr. J. E. Nickless, at a recent meeting of the Transmitter and Relay Section of the Radio Society of Great Britain. The speaker pointed out that the shell type of insulator, although an improvement on the reel type, was subject to certain disadvantages. He distrusted all insulators having a hole in the middle through which the wire passed. The ideal insulator, he said, should provide as smooth a surface as possible, and all sharp corners and sharp curves should be avoided, every care being also taken to avoid capacity effects.

The type of insulator particularly favoured by the lecturer was the "mushroom" variety, which not only stood up against practically all weathers, but was capable of standing great mechanical and electrical stresses. The lead-in should be surrounded with an air space or a glass sleeve. The foregoing remarks referred, of course, more particularly to transmitting aerials, but they are applicable in a general way to receiving aerials as well.

Mr. Nickless also made an amusing reference to the efforts of the familiar garden spider to counteract the insulation thus so carefully sought. It is apparently not the material of the web which causes the electrical leakage but the moisture which condenses upon the same. Paraffin judiciously applied in the region of the insulators seems to have a satisfactorily discouraging influence on these anti-insulation agents.



A new inductance type of loud speaker invented by a Mr. C. W. Hewlett. It requires 2½ kilowatts to operate.

Readers' Suggestions.

I continually receive letters from readers giving technical suggestions, accounts of experiments performed, asking questions, and so on. These are always, of course, very welcome and often valuable information for the benefit of the general body of readers becomes available in this way. Owing, however, to the great pressure of my professional duties, quite apart from wireless, it is not always possible to acknowledge letters at once. I trust, therefore, that readers will feel assured that their communications are

(*Continued on page* 1015.)

THE RIGHT WAY TO WORK L.F. VALVES.

(*Continued from page* 977.)

use absolutely distortionless amplification may be obtained. In this, as in the case of the choke coupling method, the maximum possible amplification is equal to the amplification factor of the valve, so that a valve with a high magnification factor should be used. The recently produced D.E.5.B, which has an amplification factor of 20, is the most effective valve for this purpose, and it is also very suitable for the first stage of a transformer coupled amplifier, as its impedance is no greater than that of the ordinary general purpose valve. In considering the grid negative for the valves of a resistance coupled amplifier, it must be remembered that there is a large voltage drop across the anode resistance, so that the actual anode voltage on the valve is only one-third to one-half of the H.T. battery voltage. In the case of choke coupling and transformer coupling, the full voltage of the high tension battery is applied to the anode of the valve, owing to the relatively negligible resistance of the winding.

Typical Cases.

The choice of valve to be used will very often depend on the source of low tension supply which is available, especially when a valve detector is already in operation. For example, if the detector is an R valve working off a four-volt accumulator, the valves for a two-stage L.F. amplifier will be an R (4½ volts grid negative) and an L.S.3 (7½ volts grid negative) with a 120 volt high-tension battery, if moderate volume is desired. For greater volume the L.S.3 will be replaced by a D.E.4 (4½ volts grid negative) with the same high tension voltage.

Similarly if an R.5. v. is in use with a six volt accumulator, another R.5. v. (4½ volts grid negative) and a D.E.5 (4½ volts grid negative) will handle ample volume with 120 volts H.T.

If a dull emitter of the D.E.R. type is already in operation, another D.E.R. and a D.E.6 may be added without necessitating any addition to the two volt accumulator.

In the case of the dry-cell dull emitter, an accumulator must be obtained for the last valve unless the constructor is content with a very moderate volume of sound.

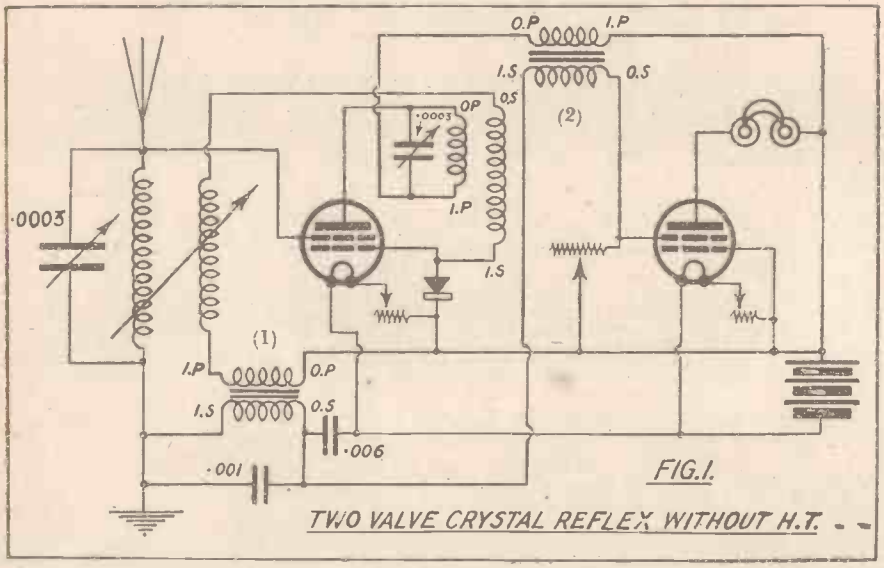
When resistance capacity coupling is chosen, three stages at least must be used owing to the lower amplification per stage, and two D.E.5.B. valves (1½ volts grid negative) and a D.E.5 (7½ volts grid negative) with 200 volts H.T. will be best.

HOW TO MAKE A TWO-VALVE AND CRYSTAL UNIDYNE REFLEX RECEIVER.

By S. W. DAVIES.

In a letter sent recently to the Editor, Mr. Marconi reported on the Unidyne as follows: "I admit, however, that the results obtained with your set have somewhat exceeded my expectations, and I must now say that, from the amateur's point of view, the 'Unidyne' presents many interesting possibilities."
The Two-Valve and Crystal Unidyne Reflex Set described below has not been tested by Mr. Marconi, but readers will find it a circuit well worth trying.

THE circuit about to be described will be found to give much louder signals than the "Two-valve Reflex Receiver" recently described in POPULAR WIRELESS. In strict fairness one cannot say that it has the same purity of tone as the last-mentioned receiver, but the old reflex circuits using high-tension batteries cannot be in any way compared with it for purity and quality.



Economical Receiver

The difference in volume between this and the recently described set will be probably noticed more on distant stations. As a slight indication of its capabilities it may be said that Madrid has been heard on the loud-speaker, though by no means at "loud-speaker" strength. Radio Paris, Eiffel Tower, and Chelmsford, however, all come in at fair loud-speaker strength.

The tuning is not nearly so critical as the "Two-valve Reflex"—in fact, the inexperienced will not find it by any means difficult to manage, but, on the other hand, it has not the same selectivity as the previously mentioned circuit. It must, however, be classed as fairly selective, and it will well repay those who want a thoroughly efficient set with purity of tone, good volume, and a minimum of expense.

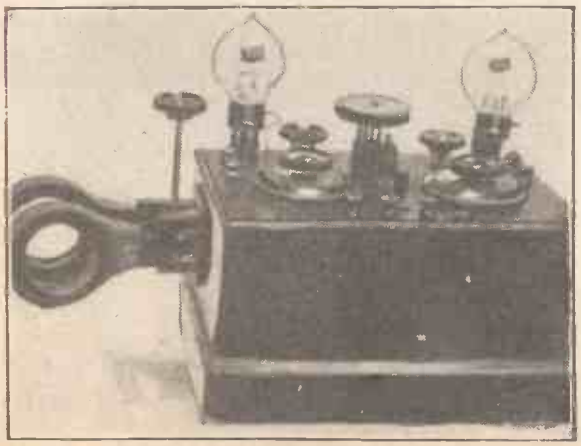


Fig. 2. A view of the completed receiver.

Transformer Coupling

High-frequency transformer coupling has again been used as being, up to the present, the most convenient method of coupling in reflex "Unidyne" circuits. Experiments have been made with the ordinary tuned anode coupling, and, although quite good results have been obtained with this method, the difficulties are such as not to warrant placing it before the public until certain modifications have been carried out. It is hoped that more will be said on this subject at a later date.

The circuit works in the usual way of reflex receivers, and it will be seen from the circuit diagram in Fig. 1 that the first valve amplifies the incoming signals from the aerial, the aerial circuit being tuned by means of the coil and condenser included in that circuit.

The condenser is shown in parallel, but a series parallel switch is recommended, and it will probably be found an advantage to work on the B.B.C. range with the condenser in series.

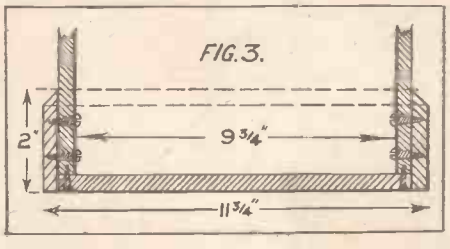
The amplified high-frequency signals are passed through the high-frequency transformer to the crystal detector for rectification, and it will be noticed that the primary of the high-frequency transformer is tuned by means of a ·0003 condenser with vernier.

Position of Reaction Coil

From the crystal detector the rectified signals are passed back through the transformer 1, and thence through the aerial coil to the grid of the first valve, so that this valve is now doing the dual work of high and low frequency amplification.

The amplified low-frequency currents are now passed from the plate of the first valve through the transformer 2 to the grid of the second valve, which performs a second stage of low-frequency amplification, and thence to the 'phones or loud speaker.

It will be noticed that the ·001 fixed condenser across the secondary of the transformer 1 is also used as a series condenser between the secondary of the transformer 2 and earth. This was dealt with by Messrs. Dowding and Rogers in their earlier articles on a one-valve low-frequency amplifier, and readers are again referred to that article.



There is a ·006 fixed condenser between the O.S. of the transformer 1 and the battery negative, but this connection should also be tried to the positive of the battery. The difference is small, but in various sets made by the writer each connection has in its turn proved best.

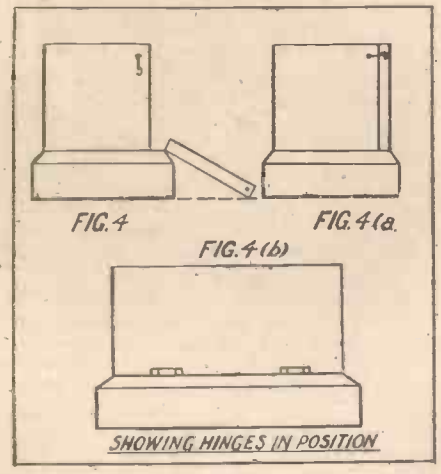
The grid leak is, as usual, a very important item, and only one of repute should be

(*Continued on page* 980.)

A TWO-VALVE AND CRYSTAL UNIDYNE REFLEX RECEIVER.

(*Continued from page 979.*)

used. They are not expensive items, and intending builders should accept none but the very best procurable, as the grid leak is so vital to the successful functioning of the receiver.



Another alternative which may profitably be tried is the connections for the reaction coil. In several instances increased strength signal has been obtained by connecting this coil between the O.P. of the transformer 1 and the battery positive, and it will in all probability be noticed that reaction between the coils is a little more fierce with the connections made this way, thus necessitating their being used a little further apart.

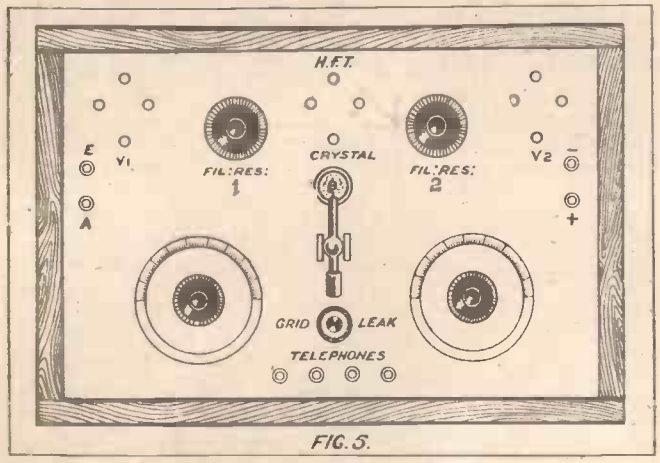


FIG. 5.

Suitable for Outdoor Work.

The photograph, fig. 2, on the previous page shows a compact set, and doubtless the smallness of it will surprise most people. But let it here be stated that the construction of this particular lay-out will require more patience in wiring, and a little more skill in making, than a receiver of the ordinary design, on which a few words will be said before concluding. However, the extra patience and skill are well repaid by the neatness of the set and its compact appearance when finished. It is specially suitable for outdoor work.

Readers requiring a receiver for ordinary purposes are advised not to be put off by the word "compact." This does not mean that it is unsuitable for indoor use. A glance at the photographs of the receiver will show that it is, if anything, more neat than the ordinary set, and being more compact means that it is not so much in the way in rooms where one is cramped for space.

A list of component parts required is given below, and it will be seen that with the exception of an additional low-frequency transformer and a crystal detector, and dispensing with a ·0002 fixed condenser, the components are similar to those required for the "Two-valve Unidyne Reflex Receiver." Care should be taken in the purchase of your high-frequency transformer, firstly that it is a good make, and secondly as to the position of the windings. To those not used to high-frequency transformer coupling a lot of hard thinking can be done, and valuable time wasted through the simple fact of the transformer legs being wired up one way and the receiving sockets in the set being wired differently.

Components Necessary.

I have purposely mentioned the make of the two low-frequency transformers because on all other occasions they have worked excellently together, but it does not necessarily follow that other good makes will not work equally well. The main point is to get good transformers. It is more important in this case than the two-valve set previously referred to, as we now have two stages of low-frequency amplification. As a last word on the purchase of components it is pointed out that there are now several excellent crystal detectors on the market with very fine adjustment control, and one of these should be obtained, as a nicely regulated contact between the whisker and the crystal will in all probability mean a vast difference in your signal strength.

	£	s.	d.
Ebonite panel, 10 in. by 6 in. by ¼ in. (say)		3	6
Variable condenser with vernier (·0005)		8	6
Variable condenser with vernier (·0003)		7	6
Low-frequency transformer (Lissen T.3)		16	6
Low-frequency transformer (Igranic)	1	1	9
2 microstats		5	6
1 two-way coil-holder		4	6
Variable grid leak (Lissen)		2	6
High-frequency transformer (B.B.C. range)		4	6
1 ·006 fixed condenser (Edison Bell)		2	0
1 ·001 fixed condenser (Edison Bell)		2	0

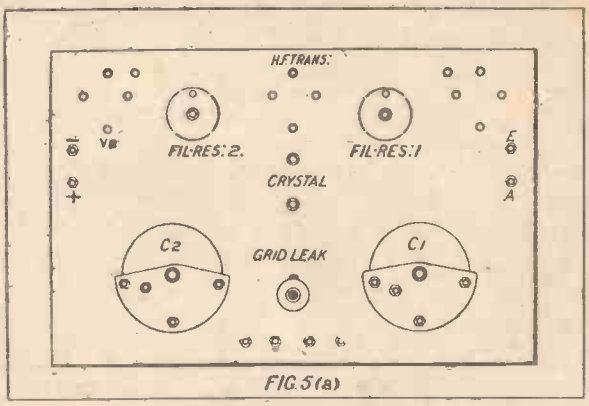


FIG. 5 (a)

12 valve legs		1	0
8 terminals		1	0
Crystal detector		4	6
Sundry wire, etc.		1	10
	£4	7	1

As in the description of the construction of the "Two-Valve Reflex Unidyne Receiver" (see POPULAR WIRELESS of September 13th, 1924), the cabinet should be made before mounting the components, but a slightly different method should be employed in this case, as only three sides are actually built up to the panel. The fourth side, or the back, being hinged like a door, is fitted on later.

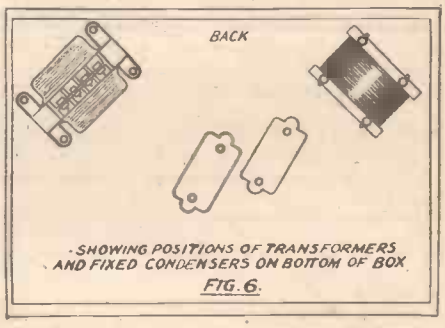


FIG. 6.

Making the Case.

First plane up and sandpaper the front and the two ends. The front should be 10¾ in. full measurement by 5½ in. by ⅜ in., and the edges carefully planed square, but the ends should for the present be left

(*Continued on page 981.*)

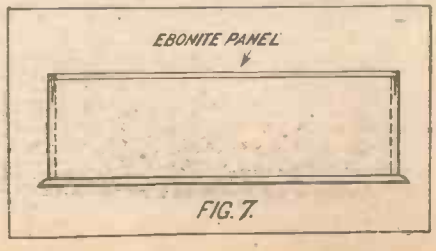


FIG. 7.

A TWO-VALVE CRYSTAL UNIDYNE AND REFLEX RECEIVER.

(*Continued from page 980.*)

untrimmed. The end pieces should now be fitted and screwed to the front of the cabinet. They are, of course, the same depth as the front, and the length should exactly correspond with the width of the panel. Now prepare a strip the same length as the front and 1½ in. wide, the thickness being the same as the ends and the front. This should be fastened along the back flush with the bottoms of the ends and front, after which the ends of both the front piece and the back strip should be trimmed square with the end pieces.

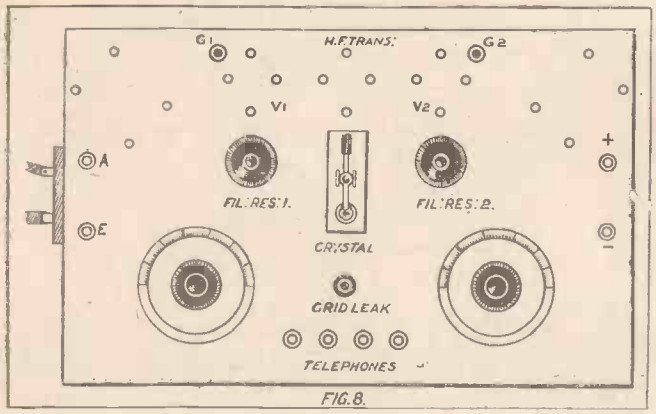


FIG. 8.

Lay-out of Components.

The base should now be prepared. It should be cut and trimmed exactly the same size as the outside measurements of the cabinet, and then screwed on.

It may, of course, be planed and trimmed to the exact size after it is screwed into position.

Next, four strips should be prepared, two for the sides and two for the ends. The side strips should be 11¾ in. by 2 in. by ½ in. thick, and the end strips 6¾ in. by 2 in. by ½ in. The top edge of the strips should be bevelled.

After carefully finishing off and sandpapering the strips should be screwed to the cabinet so as to cover the visible baseboard, and the lower portion of the ends and sides. They should be screwed from the inside of the cabinet so that the means of fastening them is invisible from outside. A glance at the photographs and Fig. 3 will readily explain this.

It is now a comparatively simple matter to make the door for the back. This is a piece of wood 10¾ in. by 4 in. by ½ in. thick. After trimming off to the exact size, this should be fixed to the back strip by means of two hinges so as to open and close from the edge of the ebonite panel. See Figs. 4, 4*a*, and 4*b*.

A little care must be used in fixing the hinges to ensure that they are fixed in a perfectly straight line with each other, or the door might bind in opening and closing. A little hook should now be fixed on each end of the cabinet, with a corresponding eye on each end of the door. This is also shown in Figs. 4 and 4*a*.

Supporting lugs have now to be fixed for the purpose of carrying the ebonite panel. In fixing these, care must be taken to avoid fouling the component parts on the panel.

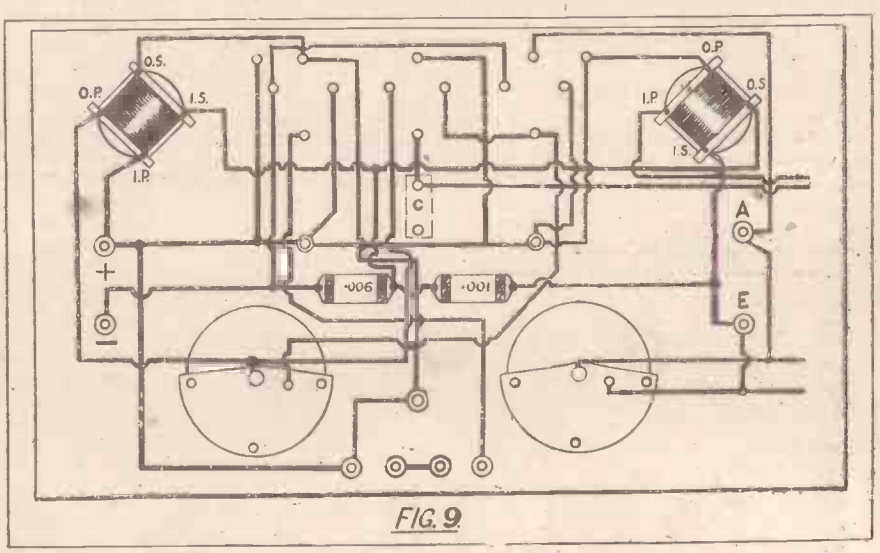


FIG. 9

The lay-out of the components in Fig. 5 is done approximately to scale, and a little care will ensure that sufficient spacing is left between each part.

It will be noticed from the sketch of the underside of the panel given in Fig. 5*a* that the two transformers, the fixed condenser, and the coil-holder are not included. The position of these will be given later; they are left off the panel for economy in space.

A good method—especially for those who have not had much experience in construction—is to draw a full-size, complete plan of the panel, and any little adjustment in position can then be done on the paper to suit the individual taste. In ordinary wiring this method is more useful, as the actual plan of wiring can also be drawn and checked, and it is then a simple matter to carry out the wiring of the set. That point, however, does not apply to the present design under construction.

Fixing the Coil-holder

Very little comment is necessary upon the actual drilling of the panel and mounting of the components thereon, as this matter has been fully dealt with in several recent issues of this journal; and now that most of the components are made with one-hole fixing, little trouble in mounting is experienced.

Having mounted the parts allotted to the panel, we have next to deal with the two transformers and the two fixed condensers. These are fixed in the bottom of the cabinet as shown in Fig. 6.

No measurements are given for fixing these, as they are best arranged as shown, but in a position giving most clearance for the moving vanes of the variable condensers. This position will, of course, be ascertained with the panel and components in position in the cabinet.

The next item is to fix the two-way coil-holder on the end of the cabinet at the aerial side. Fix your coil-holder first, and you will then see exactly where to drill your holes for the flex leads to the coils.

Wiring Connections.

The transformers and fixed condensers being in position, the panel will be reversed in the cabinet and wiring commenced. All wiring will be done, except actual leads to the transformers, coil-holder, and fixed condensers. When all other connections are made the panel may be lifted off, and the ·001 fixed condenser can then be wired in shunt across the secondary winding of the transformer and the connection from the I.S. of transformer 2 to the O.S. of transformer 1 added; likewise the connection from the I.P. of transformer 1 to the coil.

(*Continued on page 1014*)

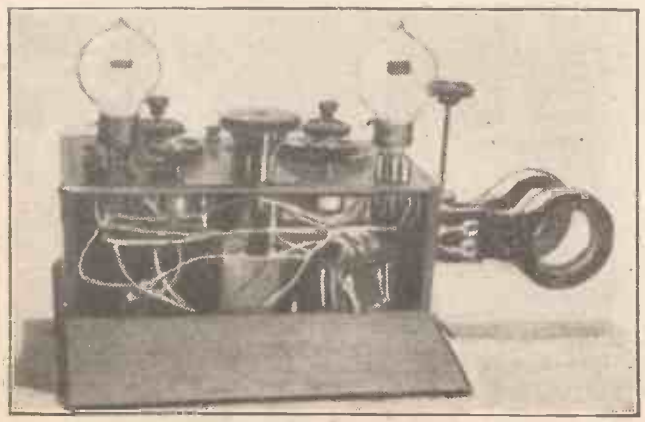
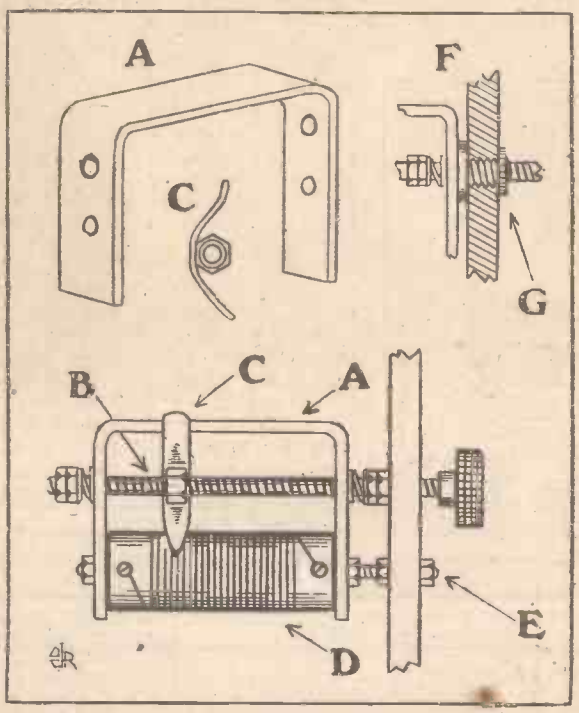


Fig. 10. Showing how the back of the case opens to provide access to the wiring.

AN EASILY MADE POTENTIOMETER

By O. J. RANKIN.

A VERY useful component which can either be used as a potentiometer or a filament resistance for a dull emitter valve, consists of a strip of brass, A, which is about 5 in. long, ¾ in. wide, and ⅛ in. in thickness; a 2¼-in. length of 4 B.A. screwed brass rod, B, with four lock-nuts and two spring washers; a slider, C, consisting of a small strip of spring brass which is soldered to the side of a 4 B.A. brass nut; a piece of ebonite tubing, D, ⅝ in. in diameter, and long enough to fit tightly between the ends of the bent frame, A; a length of threaded brass rod, E, with four nuts, and the necessary wire for winding.



The Slider.

The ebonite tube is first cut to size and wound with (*a*) 185 turns of No. 40 Eureka enamelled resistance wire for a potentiometer, or (*b*) 85 turns of No. 32 gauge ditto wire for a dull emitter rheostat, the ends of the winding being secured to two small screws, which are fitted in the approximate position shown. The coil is then clamped to the frame by means of the rod, E, and the rod, B, with slider, then placed in position. The insulation is carefully scraped off the winding where the slider makes contact with same, care being taken to see that a perfect rubbing contact is obtained, and that the slider does not exert undue pressure on the winding.

The panel, or other mount, may now be drilled to receive the instrument, the attachment being accomplished by means of the two clamping nuts on the projecting end of the rod, E. The rotating rod, B, is passed through a clearance hole and provided with a small ebonite knob.

Diagram F indicates an alternative method of attachment, where a small brass bush, G, is firmly soldered to the frame and clamped to the panel. In this case, however, it will be necessary to make the frame a little longer so that the lock-nuts and spring washers may be placed inside the frame.

How To Use It.

For use as a potentiometer the connections are made from the two screws in the ebonite former, and from any part of the brass frame. If used as a dull emitter rheostat the connections are taken from one of the screws and the frame. Small soldering tags should be fitted under the screw heads, and a small terminal may also be fitted to any convenient part of the frame.

A SIMPLE TUNING DEVICE

THE following tuning device will be found to take up very little room in depth, and will be found excellent in working.

The device takes the form of a variometer built flatwise.

Three discs are necessary. Ebonite will be the best material, but it need only be 1/16 in. thick. The inner one is 3 in. in diameter, and the two outside ones should be 3⅝ in.; this diameter will allow for the rods that hold them together.

The diagram shows the shape that is required to take the winding, and the dimensions will allow for enough 26 gauge D.C.C. wire to tune up to about 500 metres.

As will be seen, the inner coil revolves inside the two outer discs, which are kept separated by means of short pieces of tapped B.A. rod.

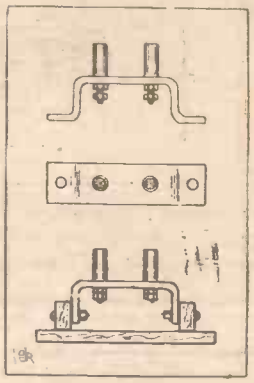
The assembly is quite simple, but it will be necessary to wind and complete the inner portion first, as it is impossible to take the inner portion out when once the outside winding is in place. The writer used the usual condenser bushes for mounting, one hole fixing bush in the top plate and an ordinary screwed bush and nut in the bottom. Using these bushes makes it simple for obtaining contact with the ends of the moving part, or, as it should be called, the rotor. The spring washers make this contact, while the flex on the other end should be of sufficient length to enable the rotor to take one turn.

The remainder of the tuner is really better understood from the diagrams, showing the whole tuner assembled without its windings, and also the completed tuner.

The outer discs should be drilled together to ensure the holes being perfectly opposite.

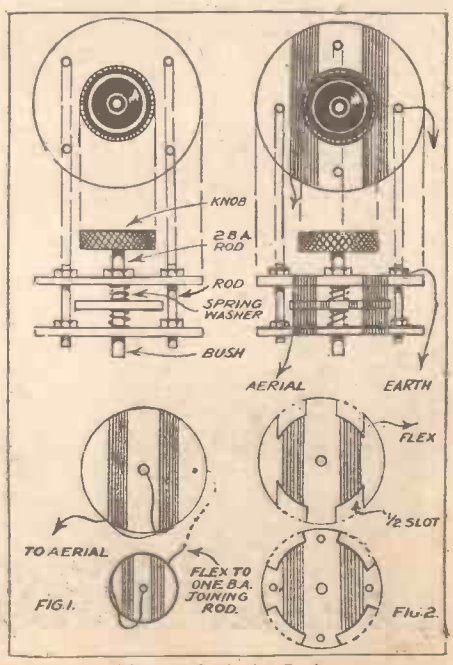
A SIMPLE COIL HOLDER

WHERE an enthusiast constructs his own interchangable coils the greatest difficulty is usually encountered when considering the most suitable method of mounting them. It is hoped that the idea outlined in the accompanying sketch will be of interest.



Two ordinary valve sockets (or one socket and one pin, according to the arrangement on the coils) are mounted on a strip of sheet ebonite about ½ inch wide by 3 inches long.

The ebonite is then heated and carefully bent to the shape shown in the upper and centre illustrations. Such a fitting would, of course, constitute a stationary or fixed socket. Where movable sockets are required these may be arranged as shown in the lower illustration where a shorter strip of ebonite is bent as shown and hinged between two small wooden blocks by means of two bolts.



Diagrams for tuning Device.

AN ACTOR'S VIEWS ON BROADCASTING.

MR. MATHESON LANG INTERVIEWED.

By "ARIEL"

This exclusive interview for "Popular Wireless" will doubtless intrigue many readers and admirers of that well-known actor, Mr. Matheson Lang, whose views on Radio Plays are given in the following article.

THE return of that famous actor, Mr. Matheson Lang, to London after a prolonged absence, suggested to me the idea of obtaining from him his views on broadcast plays, just to see whether they coincided with the pungent criticisms recently passed by Mr. George Bernard Shaw.

Accordingly I looked him up a few nights ago at the New Theatre, and was lucky enough to catch him disengaged for a few minutes. I mentioned Mr. Shaw's recent remarks in connection with radio plays, and asked Mr. Matheson Lang how he thought wireless affected the theatre.

"Well, do you know," said Mr. Matheson Lang, smiling, "I really have not given the matter very much thought. Broadcasting as an entertainment does not appeal to me very much, but, of course, it is undeniably a marvellous business."

"But," I suggested, "as a rival to your own profession do you consider that broadcasting must be taken seriously into consideration?"

Unsuccessful Broadcasting.

"Not yet," said Mr. Matheson Lang. "All experiments in broadcasting plays have, in my opinion, proved so far a failure that they do not endanger our profession in the least. I think that whoever is responsible for these parts of the B.B.C. programmes has not considered with sufficient care the exact treatment which is required to make such a development successful.

"What I mean," he continued, "is that when you are broadcasting part of a play running in any London theatre, you have two things to consider. The episode you broadcast must be complete in itself. One gets so sick of that serial 'continued-in-our-next' effect. It is wholly inartistic. The other thing that must be remembered is that the manager who allows a part of his production to be broadcast does so because he considers that it will be a good advertisement. Thus, the broadcast portion should, as it were, whet the appetite of the listeners to hear more, and also, perhaps, arouse their curiosity to see what it looks like on the stage."

"Then you think," I tentatively inquired, "that these aims have not so far been achieved?"

"Not sufficiently to make the broadcasting of a London show a really satisfactory evening's entertainment. Nor, on the other hand, have the B.B.C. quite succeeded in convincing managers that broadcasting is such good advertisement as they would make out.

"In the matter of broadcasting opera," he continued, "I think they were more successful. For one thing, in most operas each act is more or less a complete whole; while if the music of one act appeals to the listener, he will probably want to hear more of it."

"Then, perhaps you believe," I said, "that a musical production will broadcast better than an ordinary play?"

"Surely," he replied. "After all, it must be a very sustained effort to listen to continuous dialogue and discussion without the distraction of having anything to look at. It would take, I think, a very ardent admirer of Mr. Bernard Shaw to sit, as it were, in the dark, and listen to a long and involved argument on the future of mankind. But with musical comedies, revues, or opera it is quite another matter. The music carries you along with a swing. You may care nothing for the story. That does not matter if you like the tunes."

Mr. Matheson Lang.

"But," I objected, "a story with a sufficiently vivid plot, something on the Grand Guignol lines, would surely prove as enthralling as music?"

Informal Amusement.

"Not a bit of it!" said Mr. Lang decisively. "At least, I don't think so myself. But you must remember that I am no experienced listener-in. It seems to me that the more vivid the plot, the more rapid the sequence of events, the harder will the effort of mind prove for the gentleman with the headphones. After all, in a broadcast play so much is left to the imagination. People talk a lot about letting the audience use its imagination, but my experience has been that in plays, as in novels, people like to have the facts put very clearly before them. They do not care for the strain of a too-intellectual entertainment."

"But do you not think," I asked, "that broadcasting, bringing as it does the theatre into the homes of so many people from whom it would otherwise be debarred, does much to justify its existence?"

"I have no doubt that, as a means of entertaining the multitudes, broadcasting is quite invaluable," replied Mr. Lang. "But I do not see why this entertainment should take the form of rather pointless extracts from a play which they will probably never see. After all, the greater part of a wireless audience is composed, I take it, of rather tired people who, after a long day's work, want to turn on the loud speaker to fill up the gaps in their family conversation, or to pick up the headphones for a moment or two when the mood takes them. They do not want it to be a formal occasion, like going to the theatre, when all must sit silent and listen hard so as not to lose the thread of the discourse.

"Then you do not think that broadcasting is a dangerous rival to the theatrical profession," I suggested.

"I do think it is unfair," replied Mr. Matheson Lang, "to all the entertaining world, that one company should be able to give entertainment to an audience of millions, practically free of charge. After all, it comes to this. Broadcasting openly undercuts those people who make it their living to provide entertainment in the ordinary ways. In the theatrical world wireless ranks as a pirate. It is like a smuggler, who can sell his spirits cheap, since he pays no duty on them."

Old Ideas.

"I am quite sure, that the officials of the B.B.C. are all honourable men, and are quite sincere in their wish to co-operate with, and not to hamper, the theatres. But the fact remains that this new medium does supply nightly entertainment which any owner of a wireless set and a ten-shilling licence can pick up without moving from his own fireside. While we of the theatre must entice our audience to leave their comfortable homes, to spend their hard-earned money, and to come, not once, but over and over again."

"But that surely is the misfortune of broadcasting, not its fault," I interpolated.

"Perhaps," said Mr. Lang. "But if broadcasting is to be an entertainment working side by side with other forms of entertainment, it ought to develop a character of its own. It might be said that, in a way, the cinema has supplanted the theatre. To a certain extent this is true. But the cinema does provide a special and limited form of amusement, and, with a few exceptions, its subject matter and its artistes belong to a special class of their own. I have acted for the films, but still, it is in the theatre that my audiences seek me. It seems to me that broadcasting relies for its programmes, its artistes, and its ideas solely upon what it can glean from the forms of entertainment already in existence. It has brought very little that is new, but has used for its own purposes much of the best that the theatres can offer."

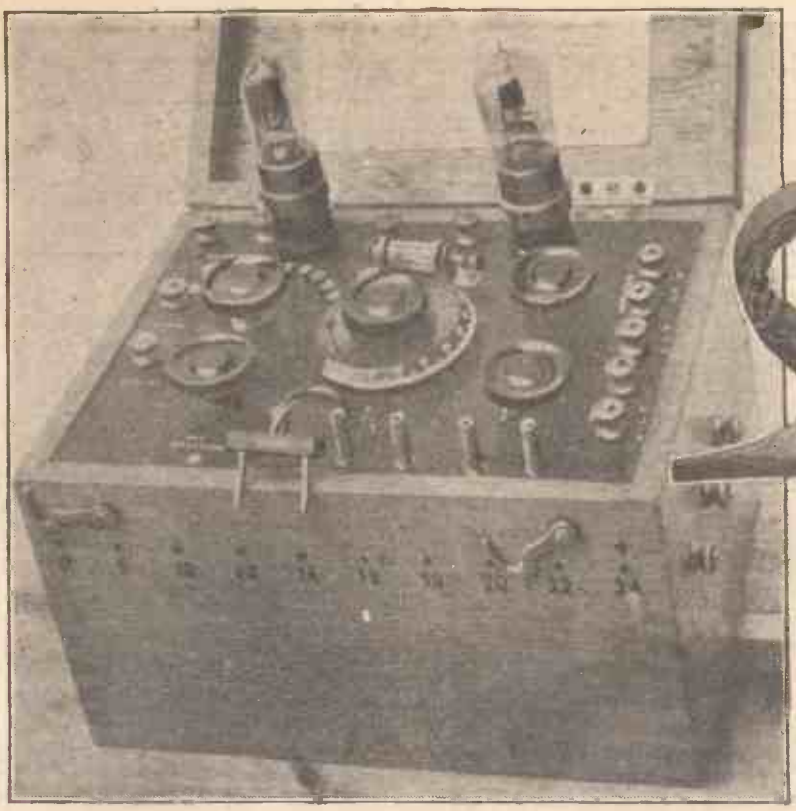
"But wireless is still in its infancy," I remarked, "and any new art would inevitably, I suppose, borrow from its successful sisters. With time and encouragement, broadcasting may develop that distinctive personality whose absence you at present deplore."

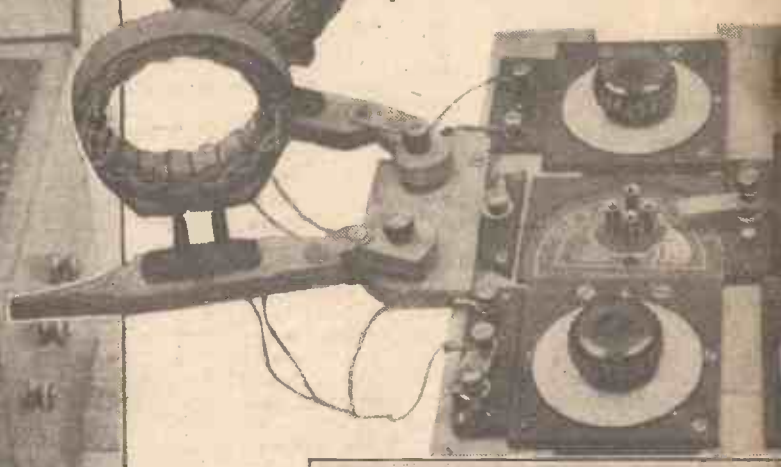
"It may do so," replied Mr. Matheson Lang, "and for the sake of my own profession I trust that it will. It is undoubtedly an important factor in modern life, and one which, in the future, it will be impossible to ignore. Let us hope that it makes full use of its powers and possibilities, and does not allow itself to rely too implicitly on the achievement of the older professions."

Just before going to press we learn that negotiations have been opened up with the B.B.C., by Mr. Lang's Publicity Manager, with a view to broadcasting "The Wandering Jew" from the New Theatre, or from 2 L O one Sunday night.

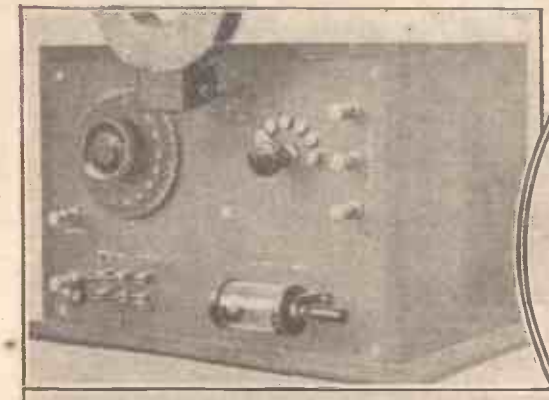
THE AMATEUR

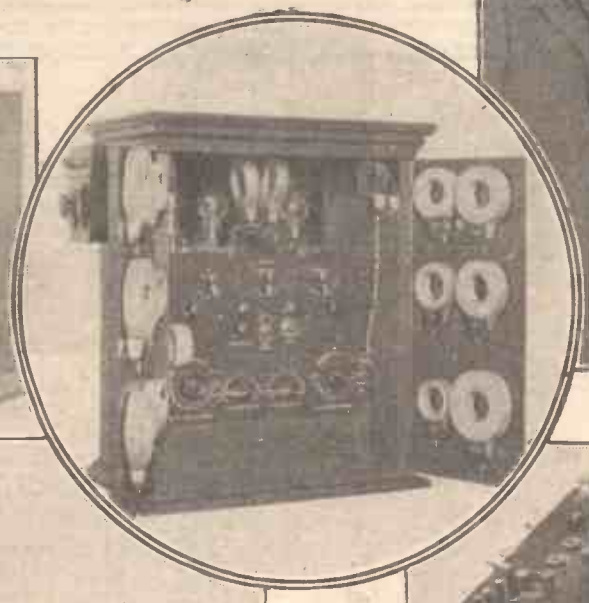
Some examples of the sets entered Competition at the White





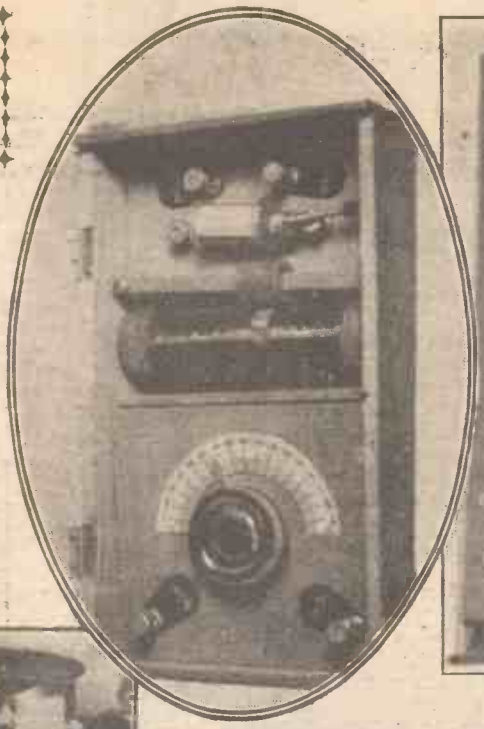
Presenting the prizes. Mr. Collins, winner won the first prize, made by M

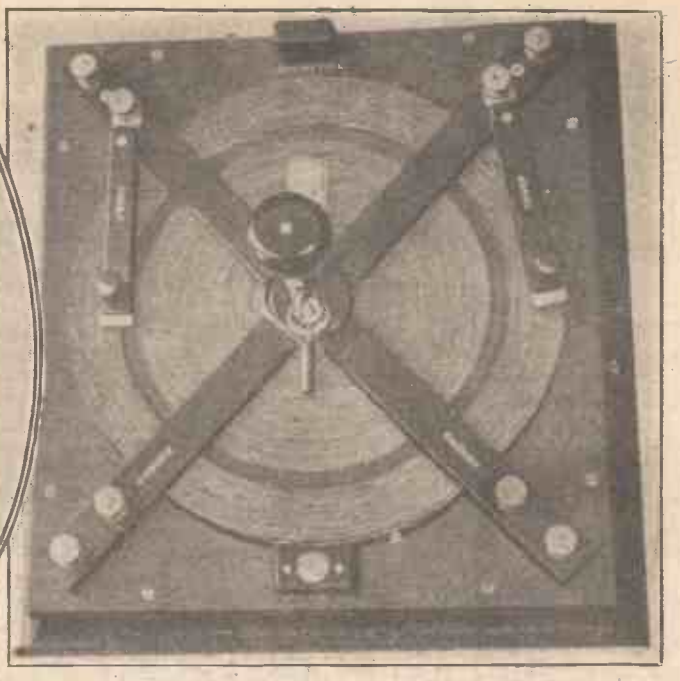




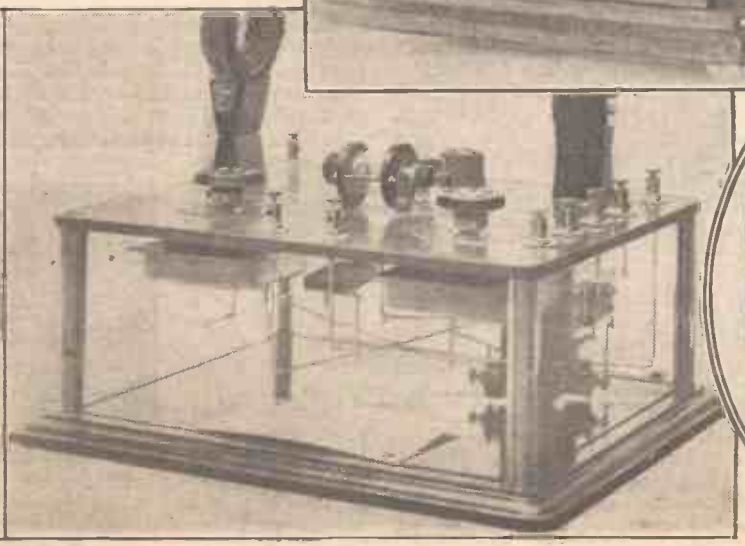
CONSTRUCTOR.

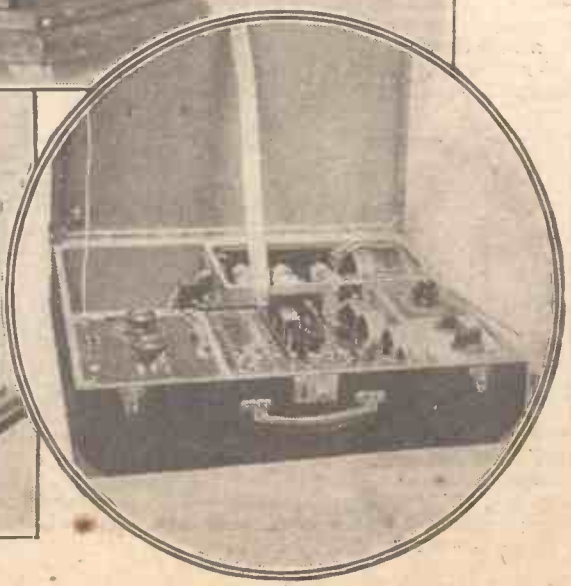
l for the "P.W." Constructors City Radio Exhibition.

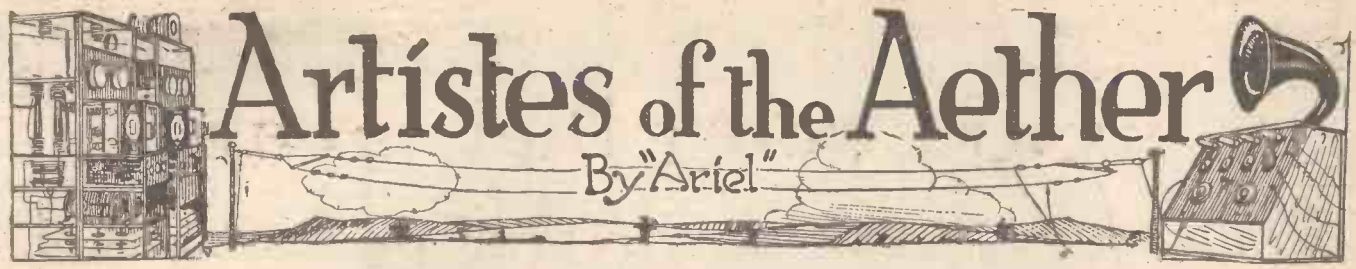




of the third prize, is in the surgical chair. The set which Mr. Crippin, is shown in the circle on the left.







Artistes of the Aether

By "Ariel"

Some of those who have given you pleasure when listening-in.

THERE is as great a vogue in matters musical as in fashions feminine. At the present moment there is a distinct decadence in public taste by its predilection for the American "nigger" music, whether in the form of the wearisome "jazz" in the ball-room, or the so-called "spirituals" of the concert hall. The latter term is the very last word that could be applied to the primitive conceptions and ideals, and it is time that much of this class of music should be "cut" from our broadcast programmes.

Mr. Denis Noble.

That good music is appreciated is proved by the continued success of the J. H. Squire Celeste Octet, and their performances when relayed at Bournemouth, and the still more recent Sunday concert at 2 L O, gave still further proof of their all-round talents.

For the latter concert a brilliant singer was found in the person of Denis Noble, a radio favourite who has "stopped at all stations." He is also a member of the British National Opera Company, and when broadcasting his scheme usually includes operatic arias as well as the usual ballad songs.

S.B. from London.

The S.B. programmes are not always the best-chosen selections likely to suit all stations, although an innovation was made recently in what was held to be a "Children's Corner for Grown-Ups." Many of the items, although each excellent in themselves, were not familiar to the main body of listeners-in.

Miss Ethel Walker.

Many, however, probably recognised Howard Carr's work, the third part of his "Three Heroes' Suite," which was first produced at a Promenade Concert in London under Sir Henry Wood. The three heroes were Captain Scott, Titus Oates, and Captain Warneford, V.C., the first man to destroy a Zeppelin, and it is this number that was played last week.

Later came the first London performance of "Elizabeth," written by Major A. Corbett Smith to his own music, for it is an open secret that the Artistic Director of 2 L O and Aston Tyrrold are one and the same person. Until early this year he was the Station Director at Cardiff. Major Corbett Smith has a right to the letters M.A., Oxford, and commenced his career as barrister, being called to the bar in Middle Temple in 1905.

Bournemouth.

A capital idea was further exploited at 6 B M in "Pictures." At first sight it would seem impossible to "broadcast" works of pictorial art but, by the choice of such well-known works as "A Hopeless Dawn," by Frank Bramley, R.A., and equally well-known works by Sidney Cooper and W. Frith, together with the wise choice of music by Captain Featherstone, the programme was one of the best.

Another good item here is the Children's Corner. This is mainly due to the fact that the uncles and aunts know their business. They know, too, just what they are going to do beforehand and how long it takes to do it.

Uncles "Jumbo," Jack, and Rob of 6 B M.

Here is a happy photo of three uncles of 6 B M. Uncle Jumbo (Mr. Oliphant) has been snatched away to another station, but Uncle Rob (Captain Keen) and Uncle Jack, who is no less than Mr. Bertram Fryer, the Director of the Station himself, are there, with a whole host of others. It is not surprising that Mr. Fryer has achieved such remarkable results, for he has had such a varied experience. With the B.B.C. at Newcastle first, he came direct to them from the Apollo Theatre, where he was playing in "Hawley's of the High Street." Not only known all through the country as actor, theatrical producer and manager, he has played out in South Africa, too.

Glasgow.

Up in the North they are accustomed to the best, both of vocal and instrumental music, and the relaying of the Scottish Orchestra under Felix Weingartner was a proof of this. So, too, was the Scots Play Night.

But on many occasions they have had singers best known to their own citizens, and one of the most striking examples is Miss Amy Murdoch, a native of Glasgow, and principal soprano. She has broadcast on several occasions, not only from 5 S C, but from Aberdeen, and her songs are always well chosen and warmly appreciated.

Choral Singing.

At Nottingham Studio much interest was caused by the performance of the best-known prize choir of ladies, namely, William Turner's Ladies' Prize Choir. Inaugurated at Nottingham in 1902, it has a membership of 140 Nottingham singers, and has won forty competitions, including twenty first prizes, four of them being at the National Eisteddfod of Wales, and at the Birmingham Musical Festival, as well as at Liverpool, Leicester and Nottingham.

Mr. Reginald Whitehead.

The National Instrument Again.

A pianist who will be heard again in a special recital early next month is Miss Ethel Walker. She is a favourite broadcast artist and much of her success is due to her versatility. An ex-student of the Royal Academy, the pianist of the Walker-Docker Orchestra, well known in the provinces, Miss Walker is widely known in London by her recitals at Aeolian Hall, where she gained some wonderful notices, while she has also penetrated to the theatre, when last year, preceding a performance of "The Cat and the Canary" on tour, she joined forces with a singer, Miss Diana Morton.

Manchester.

This station is making an innovation this week of a series of organ recitals relayed from the Town Hall, with Dr. Kendrick Pyne as soloist. One of the most famous organists in the West of England, he was appointed organist of Manchester Cathedral in succession to the late Sir Frederick Bridge in 1875. His programme for the first concert includes that splendid work of Widor, the Organ Symphony in F Minor.

Miss Amy Murdoch.

Manchester has also had some fine singers. One of the most popular is Mr. Reginald Whitehead, a bass singer of wide range and experience that has led him through oratorio, opera, and every form of concert work.

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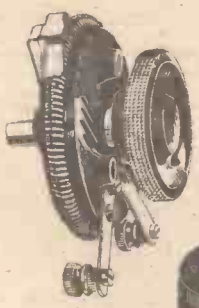

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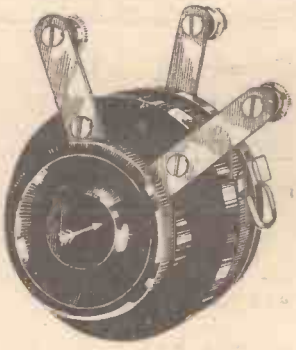

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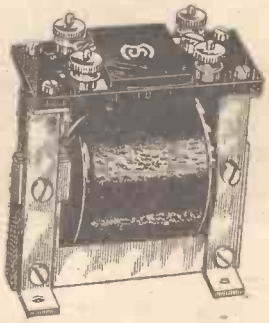

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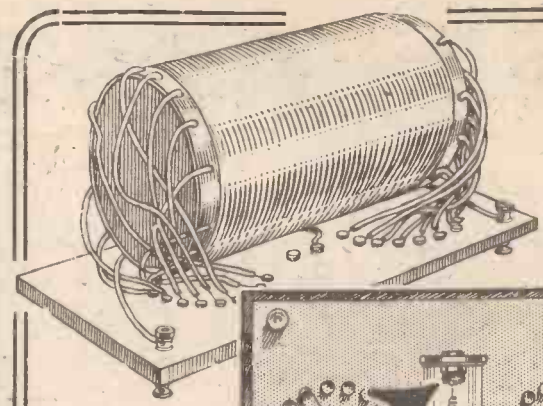

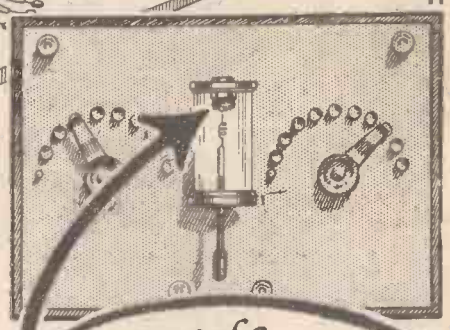

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E.W.B

Mainly About Broadcasting

by The Editor

THE broadcasting of excerpts from "Patricia," the musical play now being staged at His Majesty's Theatre, has added fresh fuel to that flaming controversy—should "outside" plays be broadcast? The producers of "Patricia" say that the enormous difference broadcasting has made to the play proves its worth as a means to increasing the popularity of plays. The West-End Theatre Managers' Association, on the other hand, say that they are still as strongly opposed to the idea of broadcasting plays as ever; and the B.B.C. say "we shall broadcast whenever we can."

That is a concise summary of the present situation as regards broadcasting West-End plays. Readers will find further comments on the situation in another part of this issue of POPULAR WIRELESS.

* * *

Listeners who enjoyed the recent playlet broadcast from 2 L O, in which the leading rôles were taken by Mrs. Kendall and Lady Tree, probably do not realise how much of their enjoyment was due to the clever work of Mr. R. E. Jeffrey, the B.B.C.'s Dramatic Producer.

Before Mr. Jeffrey was appointed Dramatic Producer he was Director of the Aberdeen station, and, although an Englishman, has for some fourteen years played a prominent part in Scottish life. Mr. Jeffrey is a very experienced manager—he has played the part of "Raffles" some four hundred times. In 1920 he leased the Aldwych Theatre, London, and presented "Macbeth." He also presented "La Tosca," and has assisted Miss Viola Tree in the production of the play, "The Unknown." I had the pleasure of meeting Mr. Jeffrey for the first time the other day, and I think the B.B.C. have at last secured the services of a radio-player producer who will render them and listeners conspicuous service.

* * *

What is the matter with Sheffield? From various Press reports I have received, and from information sent to me by correspondents, the B.B.C. are not at all pleased with Sheffield listeners, and vice versa, Sheffield listeners are not at all pleased with the B.B.C.

It appears that Sheffield listeners will not pay their licences and do more grumbling than all the other B.B.C. centres put together. According to one Press report, an official of the B.B.C. is reported to have said of Sheffield that it gives the B.B.C. more trouble than any other station! This official also said that listeners in Sheffield are getting as good quality programmes as any other relay station, and yet the officials at Sheffield are subject to the most irritating criticisms, and, what is more, their patrons seem tremendously reluctant to part with their ten shilling.

After twelve months' broadcasting Sheffield can only show 11,335 licences, while the Leeds station in three months has resulted in 36,500 licences. Compared with Bournemouth, Sheffield has 22 licens ee

ABOUT OURSELVES.

OVER 500,000 copies of POPULAR WIRELESS are sold every month. In our last issue, which consisted of 88 pages—a record value for 3d.—we published over fifty-four pages of paid advertisements, and over twenty special Editorial articles.

* * *

THE Editor is always pleased to consider constructional articles of an original nature and is prepared to pay special rates for such copy. Amateurs who have logged very distant stations, or who have established two-way communication with distant stations, are invited to communicate with the Editor, with a view to selling exclusive articles on their experiments for publication in POPULAR WIRELESS.

out of every thousand people, while Bournemouth has 120 licencees for every thousand people. Sheffield certainly has a bad name! I hear that listeners and amateurs make all their sets out of old scraps of iron (according to the "Daily Herald!"), and they think they can get their concerts for nothing.

Now, Sheffield, what have you to say about this, and also Mr. Station Director at Sheffield, what have you to say, too?

* * *

I hear that listening-in as a cure for nerve trouble is being recognised by certain hospital authorities. There is a lot of sense in this supposition. For instance, Sir Henry Hadow, the famous physician, is firmly convinced that music has a healing influence, and Sir Bruce Bruce-Porter is of the opinion that the installation of wireless at the Third London General Hospital has made that particular hospital very popular. There is no doubt that wireless broadcasting is a great boon to those temporarily bed-ridden, and in several hospitals it is now the practice to provide singing, dancing, etc., for various kinds of patients who seem to thrive on this treatment.

One physician states that for neurasthenic patients brass bands and military music offers the best stimulant, and so it is quite possible that 2 L O's military band is proving a fine asset for a good many listeners-in.

According to the "Daily Mail," temporary wireless sets are to be installed at workhouses all over the country, in order to provide the inmates with a series of broadcast features at Christmas time, which will commence on December 20th. The first of these special features will be a carol concert at the Royal Albert Hall, where the conductor will be Sir Hugh Allen. In orphanages, hospitals, charitable institutions, and, in one or two cases, in prisons, sets will be fixed up. Dickens could doubtless have provided a most amusing description of young Oliver Twist forgetting his desire for more gruel in the delight of being allowed to tune-in a four-valve set, under the supervision of Mr. Bumble.

* * *

The work at the new giant station at Rugby is progressing satisfactorily, and already eight of the twelve 820 ft. masts have been erected. It is possible that the station will be in working order in the spring. I hear that transmission will be by means of very large water-cooled valves made by the Western Electric Co. Arrangements have been made so that a beam wireless station can also be erected near the Rugby site, should the Post Office deem it desirable. The wave-length for the new station has not yet been decided upon, but for ordinary work pretty long wave-lengths will be used.

A fine amateur station, built by Mr. S. W. Heath, of 77, Clifton Place, Plymouth.

MY DEBUT AT 2LO

BEFORE—AND AFTER—THE MICROPHONE.

By a Popular Broadcasting Humourist.

IT seems a long time ago now—back, away back in the old days when 2 L O's studio was situated on the top floor at Marconi House, and before the present palatial offices of the B.B.C. at 2, Savoy Hill had been acquired.

Happening one fine day to glance through the programme list printed in one of the daily papers, I was struck with the idea that it would be rather good fun to give a "radio turn;" and still greater fun if I could persuade the B.B.C. to take me seriously and, in recognition of my services, present me with a slip of paper which, when decorated with my signature on the back thereof, would enable me to visit my bank without cringing before the cashier and the sight of an unhealthy pass-book.

And so I took my courage in a big envelope, neatly stamped and addressed to the director of programmes, personally delivered it at Marconi House, and went home with the firm conviction that I had wasted my time by allowing myself unjustified visions of a rosy future.

Days passed and most of my tin of Nestlé's milk, and the hopes of my landlady for a long-overdue settlement. My temper became frayed like my shirt cuffs, and as variable as a grid leak.

I Undergo an Audition.

I treated myself to a daily concert in which I took the only and leading rôle, and became exceedingly pessimistic about my "turn," which consisted of what was supposed to represent witty "patter" of a gay and imperious nature, followed by a short spasm at the piano.

The "patter" must have been extremely infectious, because I caught a bad cold and had to stay indoors for three days listening to the periodical visits of the postman, but never a letter for me from the B.B.C.

But at last one came. The letter called me "Sir," and begged to acknowledge my "application for an audition," and further requested me to appear before Mr. So-and-so at such and such a time on such and such a date, and to bring my so and so songs, etc., etc.

The writer said he was mine very truly, and for a minute or so I really believed him.

And so, on the such and such a date, with my so and so songs, I betook myself to the audition.

It was a brief one and, as I thought at first, a hopeless one. At the end, when I had struck the last note on the piano and warbled the final dulcet refrain from my finale, I was politely thanked and shown out, with the somewhat stereotyped assurance that "a communication would reach me in due course."

It did, and, happy surprise, stated that I had been "booked" to give my turn at 8.45 on a certain evening. Would I, therefore, appear for the fray at the appointed hour, and bear in mind that the front-door mat could be used free of charge if it was a wet night.

I appeared—half an hour too early—on the fateful night, and kicked my heels in a draughty corridor until suddenly a young man, "immaculately dressed," as they say in novels, appeared from behind a door and asked me if I was ready.

I was. I followed him into the "studio," and promptly banged my head hard against one of the microphones hanging from the ceiling. Members of a small orchestra laughed raucously, and so added to my confusion that it was only by the grace of Darling that I avoided falling

The Prince of Wales before the microphone at a dinner at which H.R.H.'s speech was broadcast.

among the tubular bells which, at that time of the year, were in a most flourishing condition.

Blindly, I allowed the immaculate young man to lead me before the main microphone, in those days an ugly brute of a thing with the appearance of having been hurriedly knocked together by an inebriated soap-box manufacturer and a third assistant to a plumber.

The orchestra, not being allowed out for a—er—breather, as my turn was a short one, regarded me with languid curiosity and fingered their cigarette cases abstractedly. I saw no pity in their faces; only a ghoulish curiosity and a most unseemly interest in my knees, which somehow would attempt to imitate the castanets.

Carrying On!

Through a mist of tears (for that microphone had given me a very hearty welcome) I subconsciously absorbed other details in the studio. At the far end, reclining on a sofa, was a beautiful aunt who was engaged in ardent conversation with another immaculate uncle. Close behind me was a grand piano, above which on the wall was suspended a large clock.

Suddenly a light winked from near the door; the uncle was galvanised into professional activity, and took a hurried farewell of the sofa and its occupant, tripped across the carpet, pushed me in front of the soap-box microphone, did funny things to a harmless single-pole double-throw switch (I am well-versed in the technicalities of wireless, by the way), and in his best Oxford voice proceeded to enlighten his unseen listeners as to the possibilities of the next turn.

As in a dream, I heard my name mentioned. The Oxford voice ceased, and gave way to a fiercely whispered ejaculation in my ear, "Carry on!"

My throat was parched, my head singing instead of my voice. I was alone—alone in front of that grotesque and leering bundle of gadgets which some perverted humorist had given the respectable name of microphone.

I thought of Short's* downstairs, and my temper grew shorter. I thought of my wife and starving children, and suddenly I heard my own voice. I was off; I was broadcasting. I was "Mr. ——, giving you selections from his humorous repertoire from 2 L O, the London station of the British Broadcasting Company." Yes, I was; heaven help you all!

Time passed. Someone in the orchestra laughed, and I realised with acute astonishment that I was being funny. As in a dream, I finished my dialogue and moved over to the piano, and warbled out a catchy refrain in a way which, so my correspondents have since told me, may be described as "in my own inimitable manner."

Not Much "Blasting" Anyway!

Out of the corner of my eye, I saw the aunt laughing on the sofa; even the saturnine and immaculate announcer was reported to have been delivered of a short Oxford laugh. (Hard as this is to believe, I have since verified it.)

A final chord, a fatuous "Good-night, everybody!" and I had finished.

The announcer flicked open the switch; the orchestra woke from a deathly silence and appreciatively tapped their instruments, indicating a mild applause; the aunt flashed me a brilliant smile which I thought might possibly result in a trip to the pictures, and the announcer came up with an affable smile lighting up his Cambridge tie.

"Quite good," he said kindly. "Not so much blasting as one might have expected."

"Excuse me," I said stiffly. "My repertoire does not include verbal verbosities of that nature."

The announcer hurriedly explained and piloted me to the door, to the accompaniment of the wailing of the orchestra as they "tuned up."

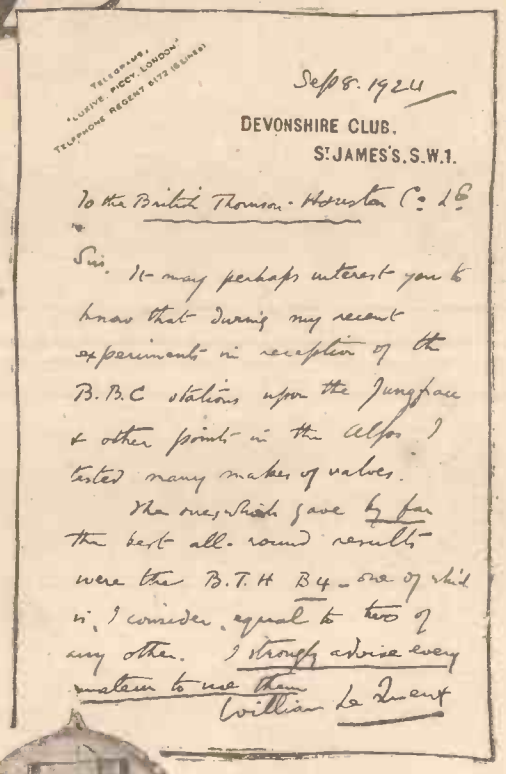
I shook hands with the pilot and limply allowed myself to be wafted into a lift.

My broadcast debut was over. I had a suspicion it had been a success, but for the moment one word only lingered in my mind. It was a *Short* one—and soon it was substituted for a long one.

A most exhausting evening, believe me.

* Short's is a house of refreshment next to Marconi House.

What Mr William Le Queux thinks of the B.T.H. B4 Valve



Sept 8. 1924

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To the British Thomson-Houston Co. Ltd

Sirs. It may perhaps interest you to know that during my recent experiments in reception of the B.B.C stations upon the Jungfrau & other points in the Alps I tested many makes of valves.

The ones which gave by far the best all-round results were the B.T.H B4 — one of which I consider equal to two of any other. I strongly advise every amateur to use them.

William Le Queux

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It may perhaps interest you to know that during my recent experiments in reception of the B.B.C. stations upon the Jungfrau and other points on the Alps I tested many makes of valves.

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B T-H

WIRELESS FOR THE BEGINNER.

By E. BLAKE, A.M.I.E.E.

PART 7.—AN INTRODUCTION TO SIMPLE VALVE THEORY.

IT may be of interest and use to those who have read the first six articles in this series if we now pass on to a more detailed though simple explanation of the action of valves. In order to imitate that famous book, "French Without Tears," we shall try to present readers with "Valve Theory Without Curves," because there is reason to believe that mathematical curves act more as a deterrent than an aid to many people.

The Electron

To begin with, we must learn more about the electric current. All solids, liquids and gases contain associated with their atoms minute particles called electrons. Some of these electrons are more or less firmly held to the atoms, some are free and move about amongst the atoms. Free electrons move haphazardly under normal circumstances, merely roving and bumping about like dogs in a crowd of people; but if they are caused to take on a definite drifting movement, like a cloud of thistledown on the wind, for example, the effect is what is known as an electric current.

A material body with its normal number of electrons is termed neutral. But if a body loses one or more electrons its electrical equilibrium is upset, and it is referred to as being "positively charged." On the contrary, a body having an excess of one or more electrons, is termed "negatively charged." If a positively charged body is touched by a negatively charged body an instantaneous redistribution of electrons occurs, an equilibrium is effected, and both bodies become neutral again. It is analogous to pouring half a pint of water from a jug containing a pint and a half into another jug containing half a pint.

"Positive" Electricity

If a piece of sealing-wax is rubbed briskly with flannel it robs the flannel of some electrons and becomes charged negatively. On the principle that like attracts unlike, this negative bit of wax will attract tiny bits of paper, which, of course, would ordinarily be neutral. Electrons are, in the modern view, nothing else than particles of negative electricity. Therefore they attract, or are attracted by, or, better still, tend to move toward neutral and positive bodies; also they repel other electrons and negative bodies. All electrons are identical in shape, size and properties, irrespective of in what substances they exist. An electron is considered to be the smallest possible division of negative electricity; it is Nature's unit of Electricity. Of *positive* electricity little can be said. It has never been *discovered* or isolated, though it seems logical to assume that there is such a thing. Theory places positive electricity at the core or nucleus of each atom, the electrons being grouped, and revolving around it. Positive electricity is hypothecated in order to explain facts observed in connection with electrons, and thus we will leave it, for our business is with the nimble electron which appears to be the active agent.

Cause of Electric Currents

When an electric current flows through a wire, myriads of electrons, jostling and sidestepping all the time, are moving along the wire much in the same fashion as a crowd moves down a street before the advancing police. Their rate of progress as a crowd is not rapid, perhaps only a small fraction of an inch per second, though the speed of individual electrons during their subsidiary movements may be as much as thirty or forty miles a second, whilst electrons passing through a vacuum can move at enormous velocities, and can be made to "bombard" metal plates in the exhausted vessel till the plates are rendered white hot.

The reason why the electrons drift so slowly through a conductor is because of

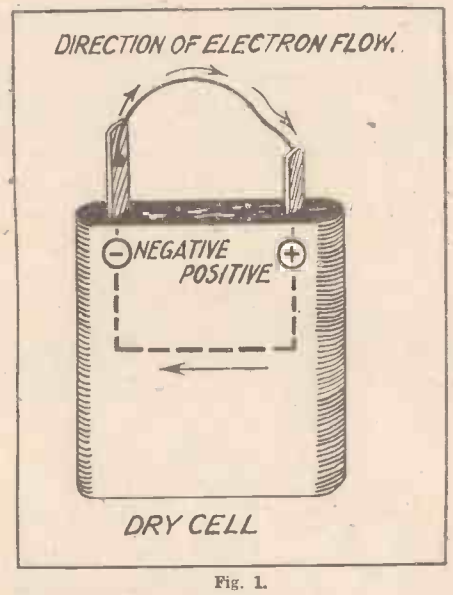

Fig. 1.

the innumerable collisions with the molecules which they undergo. When they are caused to assume a definite drift—that is, when they constitute an electric current—the tendency is for them to speed up and consequently their collisions are harder and more numerous. This causes the temperature of the wire to rise, and as the wire becomes hotter the resistance offered by it to the passage of the current increases also.

What Happens in a Battery

This property is utilised in electric radiators, and in the electric lamp, wherein the temperature of a wire is raised to white heat; it is, of course, also utilised in wireless valves in the same way. Arising from this there is the practical point that it is undesirable in electrical work to let your conductors become hot—unless heat is your requirement—because that spells wasted electricity.

A steady flow of electrons in one direction constitutes a "direct" current. When the electrons oscillate rapidly first in one direction and then in the other, the resultant current is called "high-frequency oscillating current," or "high-frequency current."

Fig. 1 represents a dry battery such as is used in the construction of high-tension batteries for use with valves. The terminals are supposed to be joined by a piece of wire. Why is it that immediately the terminals are so connected an electron procession—electric current—begins to flow through the wire? The reason is that a chemical action takes place between the constituents of the battery which brings into existence a force called "electro-motive force," this is abbreviated to E.M.F., and may be otherwise written as "electron-moving" force.

The effect of the E.M.F. on the wire is to render one end of it positive by withdrawing from it some electrons, which pass into the battery. This renders the other end negative. Owing to the difference between the electrical condition of the two ends of the wire, electrons have to move from the negative end towards the positive end; but as long as the battery is in working order it will continue to maintain one end postive, or, as is said, "at a positive potential" in relation to the other, and so the electrons continue to drift round the circuit—along the wire, through the battery, and into the wire again—until the wire is disconnected and their path broken.

Volts and Amperes

It should be kept clearly in mind, when thinking about electric currents, that they are processions of electrons from places of negative potential to places of positive potential; for where there is a positive potential there is a deficit of electrons, and if possible the surplus electrons at the place of negative potential will seek to remedy the deficit.

As between the two ends of the wire in Fig. 1, there exists a difference of electrical pressure or potential. This is measured in units termed "volts."

Electric current is measured in "amperes," so many amperes represent a flow of so many electrons per second past any given point in a circuit.

The next article will contain some remarks about condensers and tuning coils, and then will pass at once to a description of a typical thermionic valve and what it can do.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.

Duodyne

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The Curtis "Constant Tuned" High Frequency Amplifier is the only automatic high frequency amplifier which, when connected in circuit, guarantees high-efficiency of two stages of radio amplification on any wave-lengths between 300 and 3,000 metres, and requires no additional controls, nor more effort, skill or patience in tuning than is required for the operation of the usual orthodox single stage Tuned Anode Circuit.

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Uniform Accuracy.

The duty of fixed condensers in wirelesss receiving circuits is one of paramount importance. While so small a component may appear innocent of reducing the efficiency of any receiver, the function of a fixed condenser is such that it requires a guaranteed uniform accuracy.

The manufacture is of so precise a nature that any two Paragon-Curtis condensers of the same nominal capacity chosen at random are guaranteed to be of uniform accuracy.

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Grid Condenser with Clips	2/9 each.
Grid Leak	1/6 each.

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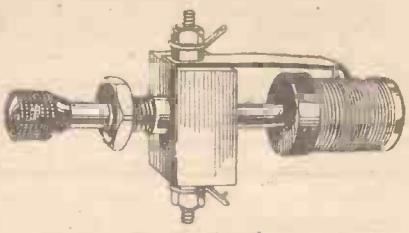
0—40 ohms, single hole fixing, supersedes all others. Permits quick and slow action, and the finest possible degree of filament control. **D.E. Valves may be used quite safely with a 6-volt accumulator if controlled by the CURTIS RHEOSTAT.**



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8 × 6 × ¼ .. 3/3	8 × 5½ × ¼ .. 2/9	7 × 5 × ¼ .. 2/3
10¼ × 8¼ × ¼ .. 5/3	10½ × 7 × ¼ .. 4/7	10 × 9 × ¼ .. 5/8
12 × 10 × ¼ .. 7/3	12 × 6 × ¼ .. 4/6	9 × 5¾ × ¼ .. 3 5
12 × 12 × ¼ .. 8/6	22 × 11 × ¼ .. 15/3	10 × 5 × ¼ .. 3/3
14 × 12 × ¼ .. 10/-	16 × 9 × ¼ .. 9/-	12½ × 9¾ × ¼ .. 7/6
16 × 12 × ¼ .. 11/6	12 × 11 × ¼ .. 8/3	

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CURTIS

The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

MULLARD valves are world-renowned, and in view of the increasing popularity and the proved worth of dull emitter valves, it is not surprising that the Mullard Radio Valve Co. are giving closer attention to this branch of their activities. They have, in fact, put on the market six new types of valves all with dull emitter filaments. There are three ·06's primarily intended for dry cell work, and the others take ·3 and ·2 amps., and are designed for use with small accumulators.

The new Mullard D.3 valve.

It is interesting to note that although the D.F.A. 3 valve is a power amplifier, not only is it an ·06, but it requires the low anode voltage of but 50 to 100 volts. It is capable, nevertheless, of a large output free from distortion.

The D.F.A. 4 is a high impedance valve designed specially for resistance amplifiers.

The following table gives full particulars of both types:

Data	D.06 H.F.	D.3 H.F.	D.06 L.F.	D.3 L.F.	D.F.A. 3	D.F.A. 4
Fil. Voltage (volts)	3·0 (max.)	1·5 to 2·0	3·0	1·5 to 2·0	5·5	5·5
Fil. Current (amps.)	·06	0·3	0·06	0·3	·06	·20
Anode Volts	50-100	50-100	30-100	30-100	50-100	50-125
Impedance (Ohms)	60,000	60,000	15,000	15,000	13,000	27,000
Amplification Factor	17	17	7	7	7½	20
Normal working slope m.a.—volts	·29	·29	·45	·45	·6	·75
Price ..	25/-	21/-	25/-	21/-	37 6	35/-

These new Mullard products are neat little valves, and are provided with the new type Mullard moulded insulating caps. We have partially tested the complete range sent us for this purpose, and results so far obtained have proved very good indeed.

The new Mullard D·06 of which there are two types.

It is not an easy matter to thoroughly investigate the capabilities of new valves, and the perfunctory insertion of the one after the other into a receiving circuit in operation is a test that is by no means fair to the manufacturers or to the buying public we offer our guidance to in these pages. We therefore must delay our complete judgment for a week or two until we have devoted a few more hours to comparative tests with these valves. We are not doubtful as to their efficiency in any respect; on the contrary, we believe them to be worthy products of the great valve makers whose name they bear.

* * *

It is fitting that the next item for review should be an accumulator specially designed for use with dull emitter valves. It is not an ordinary accumulator either, as it possesses several new features which should particularly commend themselves to the wireless amateur. For instance, it is non-spillable, and it can be turned upside down and even

A seasonal poster issued by Messrs. Brandes to advertise their well-known "table-talkers."

(*Continued on page* 1002.)

Does your Volume Vanish in Smoke

The volume that ought to be there.

A GOOD aerial picking up strong signals, a highly efficient circuit, and yet the results . . . most disappointing.

Nine times out of ten what does it mean?

Transformers giving of their best only under particular circumstances, or else cheap and inferior transformers.

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But more than that, it is the *General Purpose Transformer* and gives equally fine tone and efficient amplification in every wireless circuit.

A book of distortionless circuit diagrams supplied free with each instrument. Write for the new R.I. catalogue.

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APPARATUS TESTED.

(*Continued from page* 1000.)

shaken over a valuable carpet without fear. Its popularity on this account alone should be ensured.

Then, again, it is claimed that the special activation process which the plates of these new accumulators undergo is such that their output for size is an exclusive element. In fact, the "Oldham" accumulator "Non-spill" two volts ten amp. actual, at 12/6, is a very interesting proposition. We have had one sent us and have placed it in commission, and very efficiently is the little component behaving itself.

Oldhams, of course, are well-known people in the accumulator business, and we believe are responsible for the majority of batteries used in miners' lamps. And this is no mean recommendation of the trustworthiness of their products, as, needless to say, unless such accumulators were absolutely efficient, they would be useless for such important work — a miner's lamp often being, metaphorically speaking, his life-belt.

Oldhams, too, are well known manufacturers of motor-car lighting and starting set accumulators, and that neat, efficient little "non-spill" has turned our thoughts Oldham direction with regard to the electrical equipment of our own "flivver."

* * *

Crystal enthusiasts will be interested to learn that that well-known name, "Eureka," is now to be found coupled with a new detector of ingenious design. The "Eureka" Gravity crystal detector is, in fact, a noteworthy compromise between the fixed and adjustable types.

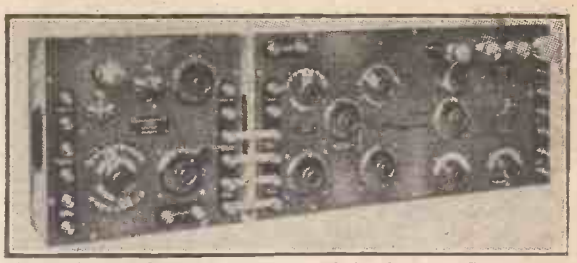
It is hard to describe its action in a few words, but suffice it to say that by merely revolving a container which holds the crystal, this latter is made to adjust itself by making contact with small metal spikes, the pressure on which is merely the weight of the crystal.

The crystal can be changed in a moment and not even unscrewing has to be carried out to do so. We have had a sample sent in for test and were really surprised by the easy manner in which a sensitive point can be found. In every sense the "Eureka" Gravity is an efficient crystal detector which is as "foolproof" as we can imagine a device of this nature could be.

* * *

Wireless and photography are allied sciences in many ways, and radio amateurs with a leaning to the latter will appreciate the "British Journal Photographic Almanac" (Henry Greenwood & Co., Ltd., paper 2/- net, cloth 3/- net).

It contains a mass of information and useful data which will appeal to all and everyone who has handled either film or plate. The copy sent us by the publishers will not go in our bookcase to collect a year's dust, but will prove distinctly useful in view of some special constructional work we are shortly commencing for the benefit of readers of this journal.



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Amplion	5	5	0
„ Baby, wooden horn	2	2	0
„ Baby, metal horn	1	7	6
„ Dragon Fly	1	5	0
„ New Junior	2	10	0
„ New Junior de Luxe, wooden horn	3	5	0
Brandes Table Talker	2	2	0
T.M.C. Copper Baby	2	17	6
B.T.H. C2	5	0	0
„ C3 (gramophone attachment)	2	2	0
„ C1	2	10	0
Fellows	4	10	0
Brown Baby	2	10	0
Gecophone	5	10	0
Radio Equipment	2	2	0
Sterling Baby, Floral	2	17	6
„ Black	2	12	6
"Revo" Loud-speaker	4	0	0
Sterling Primax, with parchment diaphragm, without horn	7	7	0
Sparta, 2,000 w.	4	15	0
Sterling Dinkie	1	10	0
Ediswan Dulcivox	2	0	0
„ Televox	5	5	0
Humavox Loud-speakers	1	7	6

HEADPHONES

B.T.H.	25/-
T.M.C.	22/6
Brown F.	25/-
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Fellows	18/6
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Western Electric	25/-
Cosmos	24/-
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Marconi R5V	12/6
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„ H.F.	12/6
„ L.F.	12/6
B.T.H. R4	12/6
„ B4	35/-
„ B5	25/-
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„ 60 v	10/6
„ 36 v	6/6
„ 15 v	2/9
„ 4½ v Eltax	6d.
„ 6 v	1/3
"Perfect" 4½ v	6d.
Siemens 1½ v No. 640	2/8
„ 3 v, No. 665	3/5
„ 66 v, No. 829	13/6
„ 30 v, No. 826	7/6
„ 90 v, No. 830	20/6
„ 100 v, No. 831	21/6
„ 36 v, No. 827	8/-
„ 15 v, No. 832	3/6
„ 4½ v No. 324	9d.
Ediswan, 50 v H.T.	9/-

COIL MOUNTS.

Wedge shaped, Brass ends	1/3
Wedge shaped, Nickel plated ends	1/6
Polished with fibre	1/6
Panel Mounting (flush fitting)	1/-
Panel Mounting with nuts, etc.	1/3
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Coil Mount, with red fibre strip	1/-
Panel Mounting Coil Plug, horseshoe	1/-
Belling Lee Self-shorting Plug and Socket	8d.

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Shaw's Hertzite	1/-
Cymosite	2/6
Tungstalite, Blue Label	1/6
SATURNIUM (highly recommended)	2/3
Neutron	1/6
B.T.H. in cup	1/6

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Igranic Shrouded (new type)	21/-
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Eureka, 1st stage (Concert)	30/-
Eureka, 2nd stage (small)	22/6
Solent	11/6
K.G. (large)	18/6
„ (small)	13/6
Burndept 2nd stage	24/-
Lissen Transformers, T.1.	24/-
Lissen Transformers, T.2.	30/-
Lissen Transformers, T.3.	25/-
Solent King	16/6
Silvertown Transformer	20/-
Marconi Ideal Transformer	21/-
Amplitrons	35/-

CONDENSERS Variable

·001	8/-
·0003	5/6
·0001	4/6
·001 with Vernier	9/6
·0003 „ „	7/-
·0005	6/-
·0002	4/6
·00005	4/6
·0005 with Vernier	7/6

Ormond Square Law

·001	10/6
·0003	9/-
·001 with Vernier	12/-
·0003 „ „	10/6
·0005	9/6
·00025	8/6
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·00025 „ „	10/-
Polar ·0005	10/6
„ ·0003	10/6

(All Ormond and Polar Condensers complete with knob and dial.)

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Ormond	2/-
Igranic	4/8
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„ for Dull Emitter	7/6
Lissenstat	7/6
„ Minor	3/6
Microstat	2/9
Peerless Minor, 6 w.	2/6
„ „ 15 w.	2/6
„ „ 30 w.	2/6
Peerless Ordinary, 6 w.	4/6
Peerless Ordinary, 15 w.	4/9
Peerless Ordinary, 30 w.	5/-
Burndept, 7 w	5/-
„ Dual, 7 w	7/6
„ -30 w.	3/-
Bordac, 6 w.	7/-
Potentiometer, Igranic, 300 w.	6/6
Potentiometer, M.V., 200 w.	

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W. & W. Anode with Reactance	12/6
"Seamark" Anode with Reactance	10/-
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Harco Channelled Variometer	3/-
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16 x 11 x 6 sloping box, inside measurement, mahogany or oak	20/-

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Polar, with Vernier	10/6
Polar Junior	6/-
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B.M. 2-way Coil Holder	4/-
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Polar Junior 3-way	9/6

COILS.

Igranic Coils No.	25	5/-
„ „	30	5/-
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·0003 without knob or dial	6/3
·0005 without knob or dial	7/-
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Do., with knob and dial, Vernier ·0003	11/6
Solent Square Law, with Vernier ·0002	10/9
Micro Vernier Condenser	3/6
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VARIOMETERS.

Solent Inside Winding Variometer	4/6
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Dubilier, Grid Leaks, 1 meg & 2 meg	2/6
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Valves and 'Phones extra.

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L. & No.					Price	Crates Extra	Carr. Extra
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440 C	„	2	„	40 „	17/-		1/3
440 D	„	2	„	50 „	19,6	—	1/6
440 E	„	2	„	60 „	22/6	—	2/-
440 F	„	4	„	20 „	21/-	—	1/3
440 G	„	4	„	30 „	25,6	—	1/3
440 H	„	4	„	40 „	32/-	—	1/6
440 K	„	4	„	50 „	36,6	—	1/6
440 L	„	4	„	60 „	46/-	—	2/-
440 M	Ediswan	6	volt,	20 actual	31/-	—	1/6
440 N	„	6	„	30 „	38/-	—	2/-
440 O	„	6	„	40 „	45/-	—	2/-
440 P	„	6	„	50 „	54/-	—	2/6
440 R	„	6	„	60 „	63/6	—	3/-
450 A	Hart.	2	„	20 „	12/7	4/10	9d.
450 B	„	4	„	20 „	23/8	5/10	1/3
450 C	„	4	„	30 „	28/11	6/2	1/3
450 D	„	4	„	40 „	34/2	6/6	1/6
450 E	„	6	„	20 „	35/6	6/2	1/6
450 F	„	6	„	30 „	43/11	6/7	2/-
450 G	„	6	„	40 „	52/1	7/-	2/-

RADIOTORIAL.

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All contributions to be addressed to The Editor, POPULAR WIRELESS AND WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

Technical queries are answered by post at a charge of 6d. a query, or 1s. for three. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the queries sent should be kept, as the original query cannot be reproduced in the answer. Cash should be sent in the form of a postal order.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

PATENT ADVICE FOR READERS.

The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

Questions and Answers

J. W. (Forest Gate, E.7).—I have made up a "Universal" four-valve receiver (J. C. Jevons) such as that partly described in your issue of July 12th, with modifications as follow: Valves (Cossor H.F., Marconi "R," and two Phillips) fitted to shelf at back of panel, the latter being increased in length accordingly; the reaction switch placed above the other three switches, this to better allow the transformers to be fixed at right angles to each other. It works a loud speaker fairly satisfactorily on 2 L O, but to get any other stations appears to be an utter impossibility. The only "Universal" part about it is that 2 L O can be got all over it. If plug-in coils are used—100, 150, 200 and 250—the result is the same—2 L O—even, perhaps, more powerful reception. I have tried a wave-trap of ·0003 condenser and plug-in coil shunted across aerial and earth with no improvement. In the concluding articles describing the set in question it was stated that, with, say, a 50 T coil in primary with condenser in series, 2 L O could be obtained without using reaction. I cannot, however, get anything under such conditions. Reaction must be employed. All connections have been carefully checked.

Kindly advise on following points:

(1) What is likely to be the cause of getting no result with only a 50 coil and single detector, using no reaction? A double "L" aerial 40 ft. long, 26 ft. high is employed. Fairly good crystal reception is obtained on same.

The first thing that occurs to us is that possibly you have not read the full four articles dealing with the set in question. Particulars were given in "P.W." Nos. 108, 109, 111, and 112, but see also the separate article on "Tuning" which was published in "P.W." No. 118.

The reason you get London when you plug-in your 100 coil and upwards is that you are getting the Chelmsford radiation. It is, of course, always a difficult matter to disconnect London from the other broadcasting stations, especially when you live so close in to 2 L O.

(2) How best to obtain selectivity, if, of course, this is possible with such a set. Would

(*Continued on page* 1008.)

HULLO EVERYBODY!!

All these Goods sent by Post. Foreign Packing and Post extra.

"DE LUXE" MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

·001	-	7/3
·0005	-	5/11
·0003	-	5/4
·0002	-	4/11

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

John Blair, Esq., Rexall Pharmacy, Millom, says:— Your Condensers are a REVELATION to me as a Dealer. Sept., 1924. C. Walton, Esq., Andover:— Tested your Condensers on Megger and got "INFINITY."

NEW MODEL

With knob and dial.

WITH VERNIER.

·001	-	9/3
·0005	-	7/3
·0003	-	6/9

With EBONITE DIAL and Two Knobs. Post 6d. Set.

TWIN CONDENSER

SQUARE LAW

EBONITE ENDS

·00025	-	12/6
·0003	-	12/6
·0005	-	18/11

TWIN (ordinary)

Equal units of ·00025 or ·0003 9/-
Complete with Knob and Dial.

NEW MODEL SQUARE LAW

	AL'MN ENDS	EBONITE ENDS
·0003	10/-	11/6
·0005	10/11	12/6

With Knob and Dial. Post Free.

HEADPHONES

We can recommend these as being excellent Headphones, with a great reputation.

B.T.H. 4,000 ohms 25/-
G.R.C. 4,000 ohms 20/-
BRANDES 4,000 ohms (Matched tone) .. 25/-
BROWN'S 4,000 (featherweight) 25 -
STERLING 4,000 ohms .. 25/-

ALL POST FREE.

TELEFUNKEN (adjustable) 4,000 ohms 'phones. Lighter than a Feather **17/11**

POST 6d. pr.

DUBILIER

·001, ·002, ·003, ·004, ·005, ·006 Fixed .. 3/-
·0001, ·0002, ·0003, ·0004, ·0005 .. 2/6
Type 577, ·01 .. .. 7/6
Grid Leaks, each .. 2/6
Anode Resistance 50,000, 70,000, 80,000 100,000, on stand complete 5/6

IGRANIC

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6
Fil. Rheostat 4/6
Potentiometer 7/-
30-ohm Rheostat .. 7/-

WATES MICROSTAT

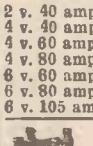
For D.E. or R. Valves **2/9**

Post Free.

ACCUMULATORS

FOR CALLERS ONLY at present.
See Callers' List.

2 v. 40 amps ..	10/6
4 v. 40 amps...	17/6
4 v. 60 amps...	20/6
4 v. 80 amps...	24/6
6 v. 60 amps...	29/-
6 v. 80 amps...	34/6
6 v. 105 amps.	40/6



Formo, open 12/6

47 Bucks "Powquip" 12/6

Manchester "Powquip," 15/6

Ormond 14/6

Shrouded 'Powquip,' 18/-

Standard 'Powquip,' 14/6

BRETWOOD

(New Model)

Var. Grid Leak .. 3/-
Anode Resistance.. 3/-

FRENCH THOMSON-HOUSTON

4,000 ohms Phones. Wonderful Tone, Magnificent Crystal sets. for **15/11** pair.

33 **ENERGO**

H.F. Plug-in Transformers	
No. 1. 150-450 ..	3/6
No. 2. 250-700 ..	3/11
No. 3. 450-1200 ..	4/3
No. 4. 900-2000 ..	4/6
No. 5. 1600-3000	4/9
No. 6. 2200-5000	4/11

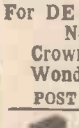
14 Voltmeter, 4/6

21 C and S, one-hole fixing, 1/3

16 Rheostat, with Dial, extra value, 2/6

44 Bretwood Valve-holder, 1/9

For DE or R Valves. New type Crown Rheostat. Wonderful value. POST FREE **2/6**



49 **FORMO SHROUDED 18/-**

WATMEL

Var. Grid Leak .. 2/6
Anode Resistance 3/6

N & K MODEL LIGHTWEIGHTS

Beautifully made. **9/11** pair.
Post 6d. pair.

LONDON'S LARGEST Stockist of

JACKSON BROS.'

"J.B." Variable Condensers, Complete with Knob and Dial.

SQUARE LAW STANDARD

·001	9/6	·001	8/6
·0005	8/-	·0005	7/-
·0003	6/9	·0003	5/9
·0002	5/6	·0002	5/-

Other sizes as advertised by "J.B."

STERLING SQUARE LAW

with Vernier.

·001	30/-
·0005	25/6
·00025	23/6

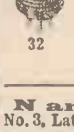
POLAR

·001 var. Condenser	10/6
·005 " "	10/6
·0003 " "	10/6
Cam Vernier 2-way Coil Holder	11/-
Polar 2-way, with Vernier	11/-
Polar-Junior, 2-way Cam Vernier	6/-

41 AMPLION Dragon Fly, 25/-

43 BASKET 2-way, 4/11.

McMICHAEL'S H.F. TRANSFORMERS



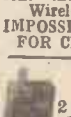
32

150- 300 } 10/-
300- 600 }
1,100-3,000 each (Manufacturer's advance.)
100,000 ohms Fixed .. 2/6
2 meg. Leak 2/6
Both with clips.

N and K 17/6

No. 3, Latest Model

New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size earpieces and leather headbands of standard "N & K" comfortable design. Technically, "N & K" Headphones represent the last word in Wireless Reception. IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.



53

2 for 1/6

29

2 for 2/-

EDISON BELL

·0001 to ·0005 Fixed	1/3
·002 to ·006 ..	2/-
·001	1/3
·0003 with Grid Leak	2/6
Variometer	10/6
Twin Detector ..	5/6

GOSWELL ENGINEERING

Patent Valve Holder	1/6
Goswell 2-way coil holder	5/6
Goswell 2-way Vernier Coil Holder ..	9/-
Goswell 3-way Coil Holder	7/6
Goswell 2-way Panel Mounting	3/-
Goswell 3-way Panel Mounting	5/-
Goswell 3-way Cam Vernier	12/6

LISSEN

Variable Grid Leak..	2/6
Anode Resistance ..	2/6
Lissen Minor	3/6
Lissenstat..	7/6
Do. Universal	10/6
2-way Switch ..	2/9
Series Parallel ..	3/9
T1 Transformers ..	30/-
T2, 25/-; T3, 16/6; Coils: 25, 4/10, 30, 35, 40 4/10, 50 5/-, 60 5/4, 75 5/4, 100 6/9.	
5 point switch ..	4/-
Lissen choke.. ..	10/-
Aux. Res.	1/3

"R.I." NEW MODEL IN SEALED BOX

Don't Buy Otherwise.

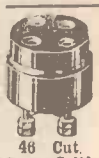
Post **25/-** Free

OPEN

Boxing Day - - 10 to 1
Saturday, December 27th, 9 a.m. to 7 p.m.
Sunday, 10 a.m. to 1 p.m.

POST ORDERS.

Owing to tremendous pressure on Post Dept., all POST ORDERS accepted for delivery in strict rotation and on no other terms. No delivery guaranteed before the holidays but we will do our best.



46 Cut from Solid Rod 1/3 Legless 1/3

48 5—1 11/9

ALL VALVES ON POST SENT AT PURCHASER'S RISK.

VALVES

THORPE K4 (5-pin) 17/6
PHILLIPS 4 ELECTRODE .. .. 12/6 (Both for UNIDYNE.)

BRIGHT EMITTER 12/6 each

	Type
B.T.H. ..	R. Type
Ediswan	A.R. "
Marconi-Osram	R. or R 5 V "
Mullard-Ora	"
Cossor ..	P.1 "
Cossor ..	P.1 "
Myers-Universal	
Mullard H.F. (Red Ring)	
Mullard L.F. (Green Ring)	

DULL EMITTER 21/- each

	Type
B.T.H.	B.3
Ediswan ..	A.R.D.E.
Marconi-Osram	D.E.R.

25/- each

	Type
B.T.H.	B.5
Ediswan ..	A.R.O.6
Marconi-Osram	D.E.3
Mullard ..	D.F.Ora

DULL EMITTER POWER VALVES For use with A.R.D.E. and D.E.R. Valves. Marconi-Osram, Type D.E.6,2-2·5 volt, ·25 amps. 25/-

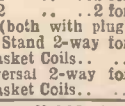
DULL EMITTER POWER VALVES For use with ·06 Valves: B.T.H. Type B.6 .. 25/- Marconi-Osram Type D.E.4 30/- Mullard, Type D.F.A.2 30/-

POWER VALVES For use with Bright Emitters

B.T.H., .. B.4	35/-
Marconi-Osram .. D.E.5	35/-
Mullard .. D.F.A.1	35/-
·06 French Metal	16/11
·06 Dutch ..	13/6
Phillips ·04 Type	16/11

FILAMENT RHEOSTATS

Wire Wound Type, Rotary Action.



IGRANIC ohms each.

Plain Type 4 & 7	4/6
With Vernier Adjustment 4	7/-
Plain Type .. 30	7/-
The Raymond 6	1/6
The Ormond	2/-

BASKET COIL HOLDERS

No. 1 .. .. 2 for	2/-
No. 2 .. .. 2 for	2/6

(both with plug)

Coil Stand 2-way for Basket Coils.. ..	4/11
Universal 2-way for Basket Coils.. ..	5/11

"BABY" COIL STANDS

2-way on base ..	3/-
3-way on base.. ..	4/9

(brass fittings)

2-way ex. handles ..	4/6
3-way do ..	5/6

(nickel fittings)

2-way Cam Vernier, high-class	5/9

Several high-grade patterns.

2-way ..	at 5/-, 5/6
3-way ..	at 6/11, 7/6

RIGHT OPPOSITE DALY'S GALLERY DOOR

K. RAYMOND

27, LISLE STREET, LEICESTER SQUARE, W.C.2

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

HOURS OF BUSINESS: *DAILY - 9 to 7.45 SUNDAY - 10 to 1*

'Phone: GERRARD 4637

HULLO EVERYBODY!!

THESE GOODS ARE SENT BY POST. Foreign Packing and Post Extra.

PARTS FOR 2-VALVE "UNIDYNE" RECEIVING SET

The 4-electrode valve, Thorpe K4 each	17/6
6 Terminals for	10d.
2 Microstat Filament Resistances each	2/9
1 Variable Grid Leak	2/6
1 Single-Pole Double-Throw Switch	1/3
1 ·0005 Variable Condenser, with Vernier	7/3
1 Cam Vernier 2-way Coil Holder	9/-
Panel 5½ in. x 11 in., drilled to hold two 5-pin valve holders for	2/-
2 5-pin Valve Holders each	1/6
1 Fixed Condenser, ·001 1/2, 2/2, 3/-	
1 Fixed Condenser, ·0002 1/2, 2/2, 3/-	
1 Shrouded L.F. Transformer	15/11
8 yds. No. 18 Gauge Tinned Copper Wire	1/2

Necessary Screws, Nuts, and Washers Free if above lot purchased, and Post Free.

FERRANTI L.F. BETTER THAN THE BEST 17/6

Try our **10/11** light as a Feather Phone, 4000 ohms.

L.F. TRANSFORMERS

Eureka Concert Grand	£1 10/-
No. 2. (Second Stage)	£1 2/6
Igranic, 5-1 Ratio	21/-
The Ferranti, 4-1	17/6
The Silverton, 5-1	21/-
The G.R.C. 5-1	15/-
The G.R.C. 10-1	20/-
Marconi Ideal Power	35/-
Burndept L.F. 5-1 Ratio	25/-
Lissen T. 1 L.F.	30/-
„ T. 2 L.F.	25/-
„ T. 3 L.F.	16/6

LOUD SPEAKERS

BABY MODELS

Sterling, 4000 ohms	£2 15/-
Sterling Dinkie	1 10/-
Brown's 2000 ohms	2 8/-
Amplion Junior	1 7/6
Dragon Fly	25/-

"SUCCESS"

2-way Cam Vernier Coil Stand **5/6**

SHIRTON

STRIP RHEOSTAT, 7 ohm (with fuse), 3/-
30 ohm. 3/-
60 ohm, 3/-
POTENTIOMETER, 600 ohm. 4/6

18, Gosford Road, Beccles, Suffolk.
17th October, 1924.

I received the "Square Daw" Condensers, and I think the result may be of interest to you.

I tried them in my "reflex" (single valve), and the results were so remarkable that I have given up all thoughts of building a 3 valve which I had ordered them for.

We received W.G.Y. on Tuesday night.

Thanking you for your prompt attention. I shall be pleased to recommend you to my friends.

(Signed) P. BULTON.

RAYMOND PLUG IN COILS.

25	3/9	150	6/-
35	3/9	200	7/-
50	3/9	250	7/6
75	4/-	300	8/-
100	5/8	400	9/6

Set of 4 for B.B.C. wave lengths 14/11

FOR NEUTRODYNE CIRCUITS.

"Colvern" Ind. Vernier. The low maximum of any vernier is adversely affected by capacity effects and any vernier which is employed to give fine tuning MUST NOT be in association with the main tuning condenser.

PRICE 2/6. Post 3d.

MYERS VALVES

UNIVERSAL. **12/6** D.E. **21/-**

"RAYMOND" FIXED CONDENSERS.

Ebonite Base, Terminal Fittings. Post Free.

·001, ·0001 to ·0005	1/2
·002 to ·004	1/3
·006	1/6
·01 and ·02	1/9
·05	3/3

MANSBRIDGE TYPE CONDENSERS:

Best quality obtainable. Accurate, permanent, noiseless, unaffected by atmosphere, beautifully cased, double insulators, two extra fixing lugs, made entirely of finest materials, pass all tests, guaranteed.

·25 mfd.	3/-
1 mfd.	3/6
2 mfd.	3/11

Post 3d. each.

NEWEY SNAP TERMINALS.

Complete Set.. 2/6

DIAMOND WEAVE BASKET COILS (5) EXTRA AIR SPACE (DUPLEX WAXLESS)

Equal to Honeycomb. 25, 35, 75, 100 (wavelengths marked). Set of 5, **3/9**

"POLAR" MICROMETER CONDENSER. 5/6

West End Stockist—Polar, Edison Bell, Ferranti, Silvertown, Dubilier, Lissen, Energo, Unidyne, Eureka, G.R.C., Sterling parts, etc.

77, Wymering Mansions, Maida Vale, W.9.
20/8/24.

Have just tried out one of your Square-Law variable condensers with vernier attachments. As an instrument, it fully maintains the high standard of efficiency which is to be found in all condensers hitherto sold by you, and I have found it unapproachable by any other type for use in tuned anode circuits. With all good wishes. (Signed) CHARLES HAMBOURG.

PARTS FOR 7 CIRCUIT CRYSTAL SET (Percy Harris).

·0003 Sq. Law Condenser, Panel, 10 x 8, Burndept Detector, Terminals, Clix, Cardboard Tube, 3 x 7 in., 16 D.C.C., and square tinned 21/- the Lot. Post free.

CHELMSFORD 5XX.

Post Price.

D.C.C. Coil	1/3
With adapter	2/3
D.C.C. Extra Air Space	2/11

PARTS FOR ST. 100

(Less Box & Ebonite) Absolutely Inclusive £6 6s. 0d. to £10.

GENUINE DR. NESPER HEADPHONES

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head.

LOOK FOR THE TRADE MARK.

4,000 ohms 13/6

Post 6d. pair.

CALLERS! THESE 3 COLUMNS FOR YOU NO POST ORDERS FOR SAME.

Lead-in tubes: 6d., 7d., 8d.	
Valve Pins and Nuts 2 a 1d.	
Stop Pins and Nuts 2 a 1d.	
Nickel Terminals	2d.
Nickel Contact Studs 2 for	1½d.
Nickel Switch Arm (one-hole fixing)	1/-
Loading Coil and plug	8d.
Gamages Permanite	1/-
Condenser Brushes	6d.
2-meg. Leaks	10d.
Cheap Fixed..	6d.

RAYMOND FIXED CONDENSERS.

·001, ·0001 to ·0005	10d.
·002, ·003, ·004	1/-
·006, 1/3; ·01 1/9; ·02	1/9
D.C.C. Wire, per ½lb.—	
13 g. .. 9d. 20 g...	9d.
22 g. .. 10d. 24 g...	1/-
26 g. .. 1/1 28 g...	1/3
30 g. .. 1/6 Etc., etc.	

Terminals complete—	
Brass Pillar	1d. 1½d.
W.O. or 'Phone	1d. 1½d.
Fancy Patterns	1d. 1 .
Extra large	2d. 3½.
Valve Sockets 2 for	1½d.
Machine cut Screws. Stocked (Best).	
Pulleys	4½d.
4 Taps and Wrench	2,11
Screwdrivers	6d.

LARGE NUMBER OF BARGAINS TO CALLERS ONLY

ACCUMULATORS

No Post Order at present

2 v. 40 amps.	9/6
4 v. 40 amps.	16/6
4 v. 60 amps.	18/6
4 v. 80 amps.	23/6
6 v. 60 amps.	27/6
6 v. 80 amps.	33/-
6 v. 105 amps.	38/6

Hart's Stocked. All High Quality.

Neutron Crystal	1/6
Uralium	1/-
Midite	6d.
Enclosed Detectors	2d.
Large, Brass, on base	1/3
Ditto, Nickel, on base	1/6
MicMet Type	2/8
Variometers (special)	1/6
Ditto, with clips, etc.	2/3
Ebonite D.C.C. and Dial	3/9

Also at 3/11, 4/3, 4/6 up.

H.T. BATTERIES

60 v.	7/6
30 v.	4/6
60 B.B.C.	9/6
36 B.B.C.	5/6
9v. B.B.C.	2/6
1·5 (D.E.)	1/9
Ditto	2/- to 3/-

"DE LUXE" SUPER LOUD SPEAKER

2,000 ohms **24/-**
A "REAL" BARGAIN

PHILLIPS' ·04 TYPE VALVE 15/11

BUS-BAR

1/16 sq. 15 feet	6d.
18 sq. - 15 feet	5d.

Legless Valve Holder	1/-
Solid Rod Ditto.	1/-
Under Panel Ditto.	1/6
Ebonite Dials	8d., 1/-
Valve Templates 2d.	4d.
Electron Aerial	1/3½
Adhesive Tape Roll	2½d.
Copper Foil per foot	2½d.
1 in. Fibre Strip 3 ft.	2d.
Insulated Hooks 4 for	3d.
Ditto Staples	5 a 1d.
Microstat	2/6
Switch Arms 8d. to	1/-
Flex (Red and Black) per yd.	3d.
Shellac	5d.
Loading Coil and Plug	8d.
Contact Studs 4 for	1½d.
Nickel ditto 2 for	1½d.
Nickel Switch arm	1/-
Sorbo ear caps pair	1/4
Tumbler Switches	1/4

MANSBRIDGE TYPE FIXED CONDENSERS

1 MFD.	3/6
2 MFD.	3/11

D.P.D.T. SWITCHES.

Min Panel	1/-
On China Base	1/7½
On Ebonite Base	1/11 2/6

S.P.D.T. SWITCHES.

Miniature Panel	10½d.
On China Base	1/1
On Ebonite	1/3 to 1/9
Murray Valve Holder	1/3
Spring Washers 4 a	1d.
Coil Plug on Base	10d.

"ORMOND" L.F. 13/11

A Wonderful Transformer

DUTCH ·06 VALVES 12/6

PHILLIPS 12/6

4 ELECTRODE VALVE FOR "UNIDYNE"

FIBRE STRIP (For Coils)

3 ft. long, 1 in. wide, 2d.

BREAST DRILLS 0 to ¼ chuck

Cut Bevel and Gear **4/9**

16g D.C.C. USUALLY IN STOCK

Twin Flex 4 yds.	6d.
Twin Silk Small 6 yds.	6d.
D.C.C. Bell Wire 10 yds.	5d.
Knobs, 2 B.A. 2d. 3d.	4d.
Small Knobs 6 B.A.	3d.
Small Knobs 4 B.A.	3d.
Wander Plugs pair	3d.
Egg Insulators each	1d.
Tape Aerial 100 ft.	2/-
Valve Windows 4d. to	9d.
Mica	2d.
'Phone Cords 6 ft.	1/-
Nugraving	6½d
Empire Tape 2 yds.	1d.
Allen Var. Grid Leak	1/3
Best Sleeving 3 yds.	10d.
Rubber Lead-in 10 yds.	1/-
Thick ditto., 1d., 2d., &	3d.
Aerial, 7/22 100 ft.	1/10½
Ditto, Extra Heavy 100 ft.	2/3
Anti Cap. Handles	8d.
Tumbler Switches	1/-
De Luxe Crystal Set	7/11
4 Whiskers, 1 Gold	2d.
Coil Plugs (ebonite)	4½d.
Ditto	6d.
Shaped	8½d. 1/-
5 ohm Rheostat	1/3
Various 1/3, 1/6, 1/9,	1/11
With Dial	1/11
Ormond	1/9
'Phone Connector	1d.
Nuts 2, 4, 6 B.A. doz.	2d.
Washers 12 a	1d.

BROWNIE "IMPROVED" WIRELESS SET - 7/6

RAYMOND CRYSTAL SETS 7/11 9/11 12/11

NOTE!

Our Wonderful Micrometer Adjustment Glass-enclosed Detector. Why pay more? **1/9**

BOXES

7 × 5 9 × 4 12 × 9
8 × 6 10 × 8 12 × 12

BUY RAYMOND GOODS

2 B.A. rod per ft.	2½d.
4 B.A. Rod per ft.	2d.
Basket Holders	8½d.
Also at 10d., 1/-, 1/3, 1/6	
2-way Coil Stands	1/11
3-way ditto	4/3
2-way with ex handles	2/11
3-way ditto	4/9
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RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 1004.)

any of the advertised anode tuners, etc., be of use; or would transformer coupling be preferable for H.F.? I wish to switch on to other B.B.C. stations or Radiola at such times as when birthday or similar business is being put over by 2 L O.

You should carefully examine the switch blades, particularly the H.F.-L.F. switch, to see that these are making good contact with the studs.

As regards your difficulty with the detector—try changing your grid leak; the one you have at present may be defective. Also try changing the valve. We cannot understand at all why you do not get reception on the single detector without reaction. On the set that was built by the author of the article ample signal strength to feed several pairs of 'phones is received without reaction on a single valve, at a distance of 12 miles. With reaction the set will operate a big Amplion loud speaker on a single valve.

We are afraid your ambition to cut out London in favour of some other station operating at approximately the same wave-length is, at the present moment, impossible to satisfy on a straight set, such as that described by Mr. Jevons.

(3) A diagram (rough) showing rearrangement of wiring for separate H.T. to detector valve and last L.F. valve.

In order to apply separate H.T. to detector valve, you should disconnect the present wire from the OP of the first transformer—(i.e. the one in the middle of the panel), and leave it "in the air." Connect a flexible lead with a wander plug to the OP terminal thus set free. Plug this wander plug in at 40 or 50 volts on H.T. battery. This gives the full H.T. voltage to both the L.F. valves, leaving only 40-50 on the detector. If the detector, for any reason, should be used alone, the full H.T. will be on it, so that the wander plug must be readjusted under the circumstances.

* * *

"PHONEOK" (Southfields, S.W.).—Is there an easy way to test if 'phones are sensitive? I think I saw an article dealing with this in a back number of "P.W." But I am unable to trace it now, and should be glad if you can restate it for the benefit of other readers and myself.

The article you have in mind was probably "Headphone Hints," which appeared in "P.W." of March 29th, 1924.

Under the heading "Testing for Selectivity" it says: The "wet fingers method" of testing headphones is about the best way of estimating their sensitivity—at least, it is the best which can be employed with convenience. Place one of the tags of the 'phones between the moistened thumb and index finger of one hand, and allow a moistened finger of the other hand to come into contact with the other lead of the 'phones. If the 'phones are in good condition, with each contact of the latter finger a slight, but decidedly audible, "click" will be heard in the ear-pieces.

* * *

R. A. F. E. (High Street, Kensington, W.).—I have always understood that a Unidyne transformer (of about 10 to 1 ratio) should be used in the Unidyne one-valve set, but the diagram (pictorial) published in "P.W." of November 22nd (No. 130) does not show this component. Is the diagram incorrect, or has the transformer been purposely omitted? Would you also state the necessary voltage of the accumulator for this set, when using a standard 5-pin four-electrode valve?

The connections shown in the diagram in Radiotorial "P.W." No. 130, are quite correct. The transformer mentioned is not used at all in this circuit, which has been simplified since it was originally published in May.

As a certain amount of confusion still appears to exist regarding transformers for Unidyne circuits, the following facts will be of assistance to those who are not clear upon this point.

The *original* one-valve (detector) Unidyne circuit employed a transformer with a ratio of 10 to 1, and this circuit was described in detail when the particulars of the invention first appeared in "P.W." No. 103.

As a result of further experiment the circuit was improved and modified, and with the introduction of suitable valves it was found possible to leave out the transformer altogether, and to simplify the wiring considerably. This simplified circuit is the "One-Valve Unidyne," and is the circuit which has proved so successful for long-distance work. It was originally described fully in "P.W." No. 112, and the diagram which appeared in "P.W." No. 130 shows its connections pictorially.

The only point likely to afford the slightest confusion is that in marking the grids the letters M.G. (main grid) were reproduced as "IN. G." (owing to a draughtsman's error), but this is really unimportant, because the actual connections are as shown, when looking down at the valve socket.

The accumulator for a 5-pin four-electrode valve may be either 4-volts or 6-volts.

The 4-volt is perfectly satisfactory, but if other valves are added later it does not leave a sufficient working margin, so for two valves or more a 6-volt accumulator must be used.

When L.F. amplifying valves are added to the Unidyne an L.F. transformer becomes necessary, but this component is an ordinary inter-valve L.F. transformer with a ratio of 4 or 5 to 1.

* * *

A. R. E. (Finsbury Park, London, N.).—I have purchased a crystal set employing a coil with two sliders, but it is not connected up, and I cannot find a diagram of such a set. Can you describe the connections in words, as I think I could follow this more easily than a drawing?

The following connections should be employed: Aerial to one end of coil and to one terminal of the crystal detector. Other side of detector to one 'phone terminal, the second 'phone terminal going to one of the sliders. The remaining slider is connected to earth. It is sometimes advantageous to take the remaining end of coil also to earth.

* * *

A.S.C. (Crewe).—On page 419 of POPULAR WIRELESS, Oct. 25th, 1924, you issued directions for making a family two-valve set. I have built up a set according to the instructions, but have *failed to obtain any results.* You say that helpful notes on working this set will follow, but no reference has been made to this set in any subsequent issue. Will you please give further advice?

As stated on page 419, the description of the set in question is reprinted from another journal, where it appeared as a contribution. The sentence "Helpful notes on working this set will follow" applied to the original readers, and doubtless if such information were published it can be obtained direct from the offices of the "Daily Dispatch," Manchester. Failing this, you should communicate with our Query Department, under the conditions laid down under the heading "Radiotorial."

* * *

F. W. S. (Teignmouth).—In the booklet "Five Special Crystal Sets," which was presented with POPULAR WIRELESS, No. 125, is given a very useful table for ascertaining the wave-length value of coils, but in the columns giving the diameters I am not quite certain whether these are the diameters of the coil former, or

(*Continued on page* 1010.)

Our Query Department.

In future a charge of Sixpence per Query will be made for answering all technical questions submitted to the Technical Staff of POPULAR WIRELESS. A group of three queries will be answered for One Shilling. Postal Orders must be enclosed with all queries **and a stamped addressed envelope in addition.**

THIS NEW ARRANGEMENT IS NOW IN FORCE.

Since the inception of POPULAR WIRELESS, readers have had all their problems settled for them free of charge, but with the great increase in the circulation and the corresponding increase in the number of queries sent in, the task of dealing with the latter has become gigantic. A large Technical Staff is now employed answering queries, and it is with the object of relieving the pressure on them that we have decided to make the small charges mentioned.

Readers of POPULAR WIRELESS know that the Editor and Staff of this journal have always had, and always will have, their best interests at heart.

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page 1008.*)

of the completed coil, outside measurement. Kindly say which of these measurements is indicated.

The figures give the diameter of the former itself before the wire is wound on.

* * *

"THREE-VALVE REFLEX" (Twickenham). I wish to build up the Three-Valve Reflex Receiver described by Captain Twelvetrees in POPULAR WIRELESS, No. 94, but I find difficulty in following the wiring as I have not had much experience of constructing sets. What are the connections from point to point?

The connections are as follow:

Aerial terminal to one side of aerial coil and to one side of aerial condenser, also to grid of first valve. Other sides of coil and condenser to earth terminal. Earth terminal to grid bias (negative). L.T. (positive) to the three rheostats. Other sides of rheostats to one of filament connections on each valve socket. Other side filament connections to L.T. (negative). L.T. (positive) to H.T. (negative) and to one side of ·005 condenser. Other side of condenser to H.T. (positive).

H.T. (positive) to one side of first anode coil and one side of ·0003 condenser. Other side of coil and condenser to plate of first valve, and to one side of ·0002 grid condenser. Other side of grid condenser to grid of second valve.

H.T. (positive) to I.P. (second transformer) and to one side of ·001 condenser. O.P. and other side of ·001 to second anode coil and variable ·001 anode condenser. Other side of anode coil and condenser to plate of second valve. O.P. second transformer to I.P. of first transformer. O.P. of first transformer to crystal. Other side of crystal to plate of second valve. O.S. of first transformer to grid, I.S. to grid bias minus and to I.S. of second transformer. O.S. of second transformer to grid of third valve.

H.T. (positive) to 'phones and to ·002 condenser. Other side of 'phones and condenser to plate of third valve.

* * *

R. A. B. M. (Brixton Road, London, S.W.9).—What are the chief rules to be remembered when constructing a Unidyne set? I have seen a great many hints in the various articles, but am anxious if possible to get a summary of the general principles to be remembered when one has had no experience of H.T.-less receivers.

The following summary of the chief points to be remembered gives the gist of the experience gained in dealing with sets which readers were unable to operate satisfactorily. Every point named is vital, and failure in one of these respects is quite sufficient to spoil the efficiency of the set.

1.—To ensure successful construction. Use first-class components throughout and adhere strictly to the details given, particularly in respect of values. A 10 to 1 ratio L.F. transformer is useless in the Det. L.F. circuit.

Pay attention to the spacing of components and wiring. Be as careful in respect of insulation as you would be if 100 volts H.T. were to be used.

Ensure that all contacts and connections are perfectly clean, and see that where such are soldered all traces of flux are removed.

2.—When a One-Valve Unidyne Fails to Work. Possible causes. Faulty grid resistance. Unsuitable coils. Reaction coil connections reversed. Valve pins making inefficient contact with their sockets. Grid connections reversed. Faulty grid condenser. Faulty contact or connection in wiring. Error in wiring.

3.—Inefficient Amplification on the L.F. Side. Possible causes. Unsuitable L.F. transformer, L.F. grid resistance of unsuitable value (instead of pencil lines an ordinary variable grid leak can be used). The *position* of the L.F. transformer requires reversing. More L.T. required. See also Rule 2.

4.—Failure to Obtain Efficient H.F. Amplification. Possible causes. "Crowding" of components. Parallel and badly spaced wiring. H.F. transformer not as per specification. H.F. transformer in too close proximity to tuning coils or L.F. transformer. See also Rules 2 and 3.

5.—General Notes on the Operation of Unidyne Receivers. Careful tuning is essential. Make primary adjustments of A.T.C. with reaction loosely coupled. When reaction coupling is being tightened, use the vernier condenser adjustment simultaneously. Use the variable grid resistance freely when tuning in, always making this a final adjustment. Run the filaments as low as possible; never increase their brightness above actual requirements. Use the detector filament control lightly for tuning purposes.

When tuning has been carried out on one valve only, it will be necessary slightly to retune when the L.F. stage is brought in. When an H.F. stage is brought in it may be necessary to reverse the reaction coil connections. Series A.T.C. should be used for ordinary broadcast wave-lengths; parallel for 5 X X and higher.

Correspondence

THAT "PREHISTORIC" BROADCASTING.

The Editor, POPULAR WIRELESS.

Dear Sir,—In your issue dated 29th ult. is a letter from Mr. Maccabe drawing attention to very early broadcasting. He may be interested to know that in all probability the station heard by him was a Royal Flying Corps experimental station at one time situated at Biggin Hill, Bromley, Kent.

Early in 1918 I was wireless telephony officer with No. 22 Squadron R.F.C., and when we were at Vert Galant Aerodrome (a few miles south of Doullens) we heard the same calls given, followed by a gramophone record, "The Washington Post." I sent in a report to Wireless H.Q. France, and was later informed that the station heard was the one mentioned above.

Yours faithfully,
C. E. STEWART (late R.F.C.).

Palace Hotel, Bloomsbury Street, London, W.C.1.

WIRELESS ACTIVITIES IN INDIA.

The Editor, POPULAR WIRELESS.

Dear Sir,—It may be of interest to your readers to know of the rapid progress that wireless in making in India, and some of the long-distance records that are being set up under tropical conditions will testify to the keenness of our amateurs.

There are now four broadcasting stations: Bombay (2 F V), 387 metres on 100 watts; Calcutta (5 A F), 425 metres on 1½ kw.; Madras, on 20 watts, and Colombo in Ceylon. All are run by the private enterprise of Radio Clubs in the respective provinces, the apparatus employed for transmission being provided by the Marconi Co. from stocks held in India. It is expected that Rangoon will also commence broadcasting shortly. An Indian Broadcasting Company on the lines of the B.B.C. is in process of being formed, and it is hoped that when they commence activities transmissions will be given on higher power than at present. The existing programmes, however, provide excellent entertainment; Indian tastes are very largely catered for, and news bulletins with time signals and weather reports are a regular feature.

Reports of reception in various parts of the country show great disparity; 2 F V has been reported from such distant places as Madras, Rawalpindi, Malabar (650 miles), and Ranikhet in the Himalayas (850 miles); yet others at Poona and Belgaum have experienced great difficulty. Just to what extent the Western Ghats, with their luxurlant afforestation, are responsible for this is yet only a matter for conjecture. There is no doubt, however, that signal strength under the lee of these mountains is not what it should be, and fading is annoyingly frequent. Calcutta, with 1½ kw., is heard regularly over a large area, and presents little difficulty on three valves even up to 1,000 miles.

European transmissions are also reported from various parts of the country. Chelmsford has been received on three valves in the West, while five valves have brought in Aberdeen and London at Bombay. A Marconiphone V2 in the hands of a Marconi engineer also brought in the Armistice Day programme from Bournemouth at good 'phone strength in the same city. Now that Cape Town and Durban have commenced operations on 6 kw. it is expected that they will also be regularly picked up, and reports are eagerly awaited. The difference in time between India and the U.K. is 5½ hours, and South Africa 3½ hours. These receptions are therefore a parallel to the transatlantic feats being performed at home. Sitting up into the small hours has as great a fascination in the Tropics as in the North, in spite of the prevalence of static.

I am, Sir, very truly yours,
E. W. S. DUCKETT, B.E.

East Street, Poona, India.

THE GRAPHITE-GALENA DETECTOR.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to my article on "A Graphite Galena Detector" (POPULAR WIRELESS, No. 130), I have received a letter from Messrs. L. and C. Hardtmuth, 29, Kingsway, W.C.2, the makers of the well-known "Koh-i-Noor" pencils, the use of which was recommended in the article. Messrs. Hardtmuth state that they have received several inquiries as to the exact grade of lead recommended, which they are unable to answer. May I therefore crave the hospitality of your correspondence column to supply what information I can? The actual pencil whose lead gave best results in the detector described was one of HH grade. As a general rule, however, I find a *soft* lead—even as soft as BBBB—has the best rectifying properties. A hard one was specified for this particular type of detector because of the greater ease of obtaining a fine point able to stand up to the contact with the crystal. (It is an advantage, by the way, to slip a short piece of insulating tubing over the end of the lead, so that it is insulated from the hand during adjustment).

(*Continued on page* 1012.)

CORRESPONDENCE.

(*Continued from page* 1011.)

I am still conducting experiments with graphite rectifiers, and have asked Messrs. Hardtmuth to let me have samples of all grades available. I hope to be able to submit some interesting results shortly. The leads can be obtained separately as "refills." It is not necessary to waste a cedar pencil for this purpose.

I think it should be made clear that I have no business connection with Messrs. Hardtmuth. There may be other makes of pencils equally suitable for detector work. But my personal experience favours the "Koh-i-Noor," which, by the way, it may interest both your readers and Messrs. Hardtmuth to know was the make used in the Navy and recommended in the Service W/T Handbooks many years ago.

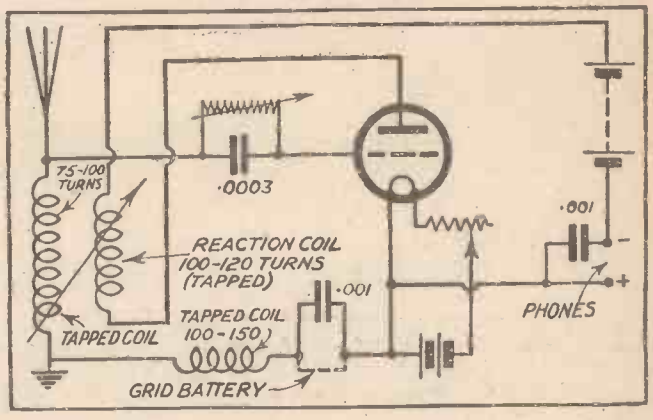
Yours faithfully,
HERBERT SHOVE (Lieut.-Commander R.N., D.S.O.).
Hallett's Farm, Litchling Common, Hassocks.

GOOD ONE VALVE RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The several references in your issues of September 27th and October 11th prompt me to write to you about my experiences with a one-valve set, which I made myself. I am fourteen years old.

The set is based upon the "Hopwood" circuit, of which I enclose a copy, and I use in it a Marconi "R" type of valve with 50–70 volts H.T. and occasionally 1-4 volts grid bias, which is used if the L.T. voltage upon the valve is too high. My aerial is 30 ft. high, 100 ft. long, and not screened by any trees or buildings.



The results which can be obtained nearly any night are as follows: London (16 miles distant, can be heard about 7 yards away from the 'phones), Chelmsford, Bournemouth, Birmingham, Manchester, Aberdeen, Glasgow, Newcastle, Cardiff, Belfast, Plymouth, Nottingham, Leeds, Bradford, Radio-Paris, L'Ecole Supérieure, Le Petit Parisien, Lyons, Berlin (Vox Haus), Hamburg, Breslau, Stuttgart, Leipzig, Koenigsberg, Frankfort-on-Main, Munich, Brussels, Zurich, and Madrid.

Seeing that these results are not freaks, I think they constitute a record for "Summer Time" reception. Since "Winter Time" has come I have received many more stations, but have been unable to identify them.

Yours sincerely
J. R. HARVEY.
"Lynton," Haynes Park, Hornchurch, Essex.

RE THAT SIMPLE SUPER CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been very much interested in Mr. Mason's circuit, constructional details of which you published in a recent issue, and have had it in use, hooked up on an experimental board, since you first gave it. All the B.B.C. main stations have been received, except Cardiff, also three Paris stations and Madrid while 2 L O comes in louder than any other single valve circuit I have tried out. This signal strength is especially noticeable on an indoor aerial.

I have used an ·001 variable condenser for tuning the A.T.I., and find that a variable grid leak across the ·0003 variable condenser in the E. and L.T. lead, in addition to the existing fixed grid leak, helps to increase signal strength and control reaction. An additional ·002 across the 'phones is also an advantage.

I notice that in Mr. Everard's circuit diagram (POPULAR WIRELESS, Nov. 8th) he omits the ·005 variable condenser in the E lead, which may be due to the L.F. amplifying valve he has added, but in trying with and without this condenser I think its inclusion, in a one-valver anyhow, is desirable.

I should like to take this opportunity of thanking you for one or two prompt replies to queries of mine, and wishing your excellent paper continued success.

Yours faithfully,
C. H. MARRIOTT.
25, Esmond Road, Bedford Park, W.4.

FURTHER RECEPTION IN INDIA.

The Editor, POPULAR WIRELESS.

Dear Sir,—In continuation of my last letter, and, for the further confounding of Captain Eckersley's critics, I must inform you that I got Chelmsford recently at loud speaker strength on a FRAME AERIAL.

Valves used were 4 H.F., 1 D., 2 L.F. I consider this, personally, nothing short of remarkable. Atmospherics were very bad, and jamming experienced from I C W and R D J.

It must have been a bit late for the Londoners, as it was an early morning for me.

Again I cannot understand the plaudits and encores of the crowd.

To authenticate, you began with the "King" (one o'clock Indian standard time), and I chucked in at 5.30 to the tune of the "Blue Bells of Scotland."

This information may perhaps prove of some help in aiding your many readers, situated so far from England, not to give up the ghost. I do not refer to those who are lucky enough to live within the bounds of our tight little island, but to those overseas. 5,000 miles on a frame is not bad!

Once more I must request you not to disclose my identity or station, and will subscribe myself with best wishes for yourself and POPULAR WIRELESS.

"AUDAX."
India.

THE "GOYDER" SET IN OPERATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—In answer to your request in "P.W." of date November 15th, for reports on reception of D X amateurs on the set of Mr. Goyder's, as described by Mr. Rogers, I enclose a list of amateurs, logged between the hours of 23·00 and 07·00 G.M.T. on the wave-band covered by the described coils.

BRITISH: 5 T Z, 2 K T, 2 T M, 2 J F, 2 S H, 2 W J, 2 O D, 2 N M, 2 C C, 5 N N, 5 U Q, 2 F J, 2 W B, 4 A X (?), 6 L J, 6 G H, 6 N H, 2 S Z, 5 L F, 2 W Y, 5 R Z, 2 N B, 5 C X, 5 W V, 8 B R, 6 V P, 2 G M, 2 V W, 5 SI, 6 T M.

FRENCH: 8 H S M, 2 A W F, 8 A A, 8 M N, 8 D E, 8 P A, 8 S G, 8 W A, 8 D U, 8 U I U, 8 M G, 8 F Q, 8 G K, 8 G G, 8 D F, 8 Q G, 8 C S, 8 H S D, 8 S S U, 8 G O, 8 S M, 8 U I M, 8 U I V, 8 B M, 8 X U, 8 U A R, F L Tower testing, and M. Deboy's station, 8 A B.

FINNISH: F N 1 F N, F N 2 N C A, F N 3 N B, F N 7 E C.

DUTCH: O X F, O R E, O B Q, O B A.

GERMAN: X O X, 4 Y Z.

ITALIAN: i 3 A F.

BELGIAN: W 2.

AMERICAN AND CANADIAN: 1 C A N, 1 M L, 4 I O, C I A R, 3 W B D.

NEW ZEALAND: Z 4 A A, Z 4 A G, and about 15 stations which did not give a nationality signal.

Hoping that the above may be of use,
I remain, yours truly,
E. P. CAUSEY.
44, King Street,
Southsea.

CRYSTAL RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—In crystal reception there appears to be no end to its mysteries, judging by the following experiences just lately.

My set is on the slider principle, 6in. by 2½ former wound for 5 in. with 24 G. enamelled wire. Circuit as simple as possible with a plug-in coil holder.

(*Continued on page* 1013.)

CORRESPONDENCE.

(*Continued from page* 1012.)

On two occasions of the "Round the Stations" programme from 2 L O I have by mere accident plugged in a 200 Igranic coil I have by me while, say, Birmingham was transmitting a musical item, and I get Glasgow. If I revert to shorting the coil holder, Birmingham comes on again. On a previous occasion, after Aberdeen had been transferred to Glasgow, I got Aberdeen by sliding the plunger to the far end of the slider, and back again I got Glasgow.

Another thing I can do is to detach the earth lead from terminal, slide the plunger half-way along the coil and hear quite distinctly. In fact, I adopt the practice of tuning-in without the earth and afterwards replace the earth lead, thus getting the loudest signal possible.

I have two earths, one on the main stopcock, the other outside in the ground.

Yours faithfully,
HAROLD CLARKE.

42, Isham Road,
Norbury, S.W.16.

A Unidyne Test.

The Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps you would be interested to hear of the results I have obtained with a two-valve "Unidyne," one detector, and one L.F. In the first place I constructed a single valve on the lines described in "P.W.," then a two-valve as described, and finally a two-valve, open panel, with valves and coils on top of the panel. Results with all three sets have been remarkably good, more so with the last set. Leaving England last Saturday, I have received 2 LO and 6 BM on each night clearly on two pairs of 'phones, except Wednesday night, when the weather was too bad to rig an aerial or chance having an accident with the set. Last night, Thursday, I rigged up about 8 p.m., and received the programme from 2 LO quite clearly, including the second news bulletin (copyright by Reuter, etc.). The only thing I was troubled with was the wash of the sea, and the noises of the ship rolling about, the reception, however, being quite clear, and the distance from 2 LO being roughly about 1,200 miles (Mediterranean Sea). Of course, I had to do a good deal of experimenting with various sized coils to obtain such good results. The standard size Igranic, 75 aerial, and 100 reaction were quite good, but the best results were obtained with home-made duolateral coils, wound with a Lokap pattern machine, 24-gauge D.C.C. wire, 75 turns aerial, and 150 turns reaction. In the place of the pencil leak across the ·001 condenser I used a Lissen variable grid leak. The other components were: K4 Thorpe valves, Bretwood variable grid leak, Ormond ·0005 variable condenser, with vernier, Dubilier fixed condensers, Ormond filament rheostats, and an old Igranic transformer, which I had repaired myself. The valve filaments were burning as low as I could get them, using 6 volts, and no connections were soldered. However, they will be soldered when I put in a Eureka transformer, then I hope to get even better results. The foregoing reception was on the low wavelength, of course. Now, sir, I would be much obliged to you if you would let me have a wiring diagram of a four-valve "Unidyne"; any expenses that may be incurred I will gladly send along to you. I noticed on the front cover of "P.W." a picture of Mr. Dowding and Mr. Rogers wiring up a four-valve set, and would like to try one myself, and see what its capabilities are. I really want it for loud-speaker work when I get back to England, but would like to build it now, and carry out a few experiments with it. Finally, if you make use of any part of this description of the results obtained with a two-valve "Unidyne," will you please withhold my name and the name of the ship I am in, as the Naval regulations concerning wireless are very strict. However, it could be described as results obtained by a correspondent in the Mediterranean Sea. Well, sir, I must congratulate the inventors of the "Unidyne" principle, and wish them every success in their future experiments. It is indeed a set worth having. Trusting you will send me a reply to my request, I will close, and remain,

Yours faithfully,
C. P. O.,
H.M.S. ——,
Malta.

P.S.—I forgot to say that my aerial was about 40 feet long, straight up and down, and screened by the ironwork of the ship badly. The direction of 2 LO was on the port side of the ship, and the aerial on the starboard side. I should imagine that the conditions were the worst possible for an aerial.

I have also received the programme from Bournemouth from here (Malta), but had a lot of interference with Morse signals from the H.P. stations on shore.

A TWO-VALVE AND CRYSTAL UNIDYNE REFLEX RECEIVER.

(*Continued from page* 981.)

Pieces of loose flex should now be attached to all the remaining points on the panel, and when the panel is placed in position it is not a very difficult matter to attach the loose ends to their respective connections on the transformers, condensers, and coils.

A photograph showing the disposition of component parts is given, and from this it will be seen that the wiring is not excessively complicated. In fact, the compact appearance of the whole receiver amply repays one for the little extra trouble in making this arrangement.

Mounting the Panel.

Nothing has been said regarding the polishing of the cabinet, as this subject has been so frequently dealt with in recent issues of POPULAR WIRELESS. It should present no great difficulties to the constructor, so with this brief reference the matter is left to his discretion and taste.

For those who prefer the orthodox method of mounting all their component parts on the ebonite panel, a larger panel and cabinet will be necessary; but even so a panel 12 in. by 9 in. will give sufficient room for all components, excepting, of course, the coil-holder, which is really more convenient and less trouble when it is placed on the aerial side of the cabinet in such a manner as to carry the coils in a vertical position. There is in this way no strain on the bearings of the movable coil-holder, as in the case of the coil-holder opening out to a horizontal position.

The depth of the cabinet will be governed by the measurement of your deepest component (probably your transformer). If one inch is allowed below this depth, it should leave ample space for wiring.

It will be found most convenient, in this case, to screw the ebonite panel directly on to the sides of the cabinet as shown in Fig. 7. This has quite a neat appearance when finished.

In Fig. 8 a plan is given showing the lay-out of the components on the panel. The four screw holes shown in each top corner show the position of the two transformers, which should be placed more or less at right angles to each other.

Various Reaction Coils.

A complete wiring plan is given for ready reference.

As previously recommended, basket or other home-made coils may be used. They will probably be found more efficient than many of the bought ones, and as the coils play such an important part in these circuits, the reader cannot do better than construct his own. A 35 A.T.I. and a 100 reaction coil seem to be the most suitable for the lower B.B.C. range, while for Chelmsford and Radio Paris a 150 A.T.I. and a reaction coil of anything from 250 to 400 turns seems to be most adequate. Various sizes of coils for the reaction should be tried, especially on the higher wavelengths.

A TWO-VALVE AND CRYSTAL UNIDYNE REFLEX RECEIVER.

(*Continued from page* 1014.)

When tuning-in the coils should be fairly tight at first (say, about 30 or 49 degrees apart), and the grid leak should be screwed down fairly tight. In the case of poor reception or no signals at all, try reversing the leads of one of your coils and, when your signals improve, varying the position of the coils and re-tuning on the condensers after each variation until the best signals are obtained. Two other important factors that must not be overlooked are the variation of the grid leak, which is extremely critical, and the filament control of the valves. These both need a very careful control, as they have a big bearing on reception, both as regards tone and volume. One other experiment might be tried with advantage; that is, to reverse the leads of the secondary winding of your transformers.

In all diagrams the four pin valves have been provided for, but this does not in any way mean that the five pin valves are less efficient. The diagrams are simply drawn from sets which have been made up by the writer.

In conclusion, it may be stated that in St. Leonard's, on the south coast, Aberdeen, Glasgow, Newcastle, and Birmingham have all been heard at very full strength in the headphones, and, of course, all the nearer stations have been heard at quite a powerful strength. This should be a sufficient indication of the efficiency of the receiver.

TECHNICAL NOTES.

(*Continued from page* 978.)

always appreciated, even though they may not, in all cases, be dealt with immediately.

Long-Distance Crystal Reception.

A remarkable case of long-distance crystal reception was recently reported to the Marconi International Marine Co., Ltd., by one of their sea-going staff, who received the 2 L O concerts clearly at Algiers on a standard Type 31 ship receiver, using carborundum crystal. The distance between the points in question is stated to be about 950 miles, and it is also to be noted that the waves would have to pass largely overland, where the attenuation would be more marked than when passing entirely over sea. Another interesting report of good crystal reception refers to the Chelmsford station being heard in Denmark, again on a Type 31 carborundum receiver: in this case the distance is about 550 miles.

The Marconi crystal receiver supplied to ships has a wave range of 300 to 2,800 metres. In the aerial circuit is a series inductance, part of which is variable, inductively coupled to a secondary coil, shunted by a tuning condenser. It is probably the extremely fine adjustment of the crystal, which is obtained by means of a biasing potential controlle by a potentiometer, which makes this crystal so sensitive.

(*Continued on page* 1016.)

TECHNICAL NOTES.

(*Continued from page* 1015.)

Short-Wave Reflectors.

Now that the experiments in short-wave transmission are proceeding rapidly, the following short description of the reflectors used for directing short-wave wireless beams should prove interesting. It is taken from the "Western World" (Perth, W. Australia). The "reflectors" used in wireless in no way resemble the highly polished optical mirrors used in connection with searchlights. They consist of a curved screen of vertical wires, and it is in the design of the screen and the arrangement of the position of its focus that the skill of the wireless engineer must be exercised.

A short wave has been chosen for certain specific reasons, and the actual wave-length generally understood when speaking of "short-wave" transmission is something like one-half or one-quarter of the wave-lengths ordinarily used at present for broadcast purposes. The length of the vertical wires that compose the reflector bears a definite relation to the wave-length sent out from the station, and it is obvious that a station can be so designed that the reflecting screen may be set for continual transmissions in a particular direction. In non-technical language, such reflectors resemble most nearly a parrot's cage cut in halves vertically through the suspending ring.

(*Continued at top of next column.*)

BIG GIFTS FOR LITTLE CHILDREN

THE best thing you can buy for any tiny tot is a copy of one of the wonderful new toy books which are now on sale at all newsagents and booksellers. The titles are the PLAYHOUR TOY BOOK and the JOLLY TOY BOOK, and both books contain a wonderful variety of coloured models of toys, soldiers, dolls, and their dresses, puzzles, masks, games, and all kinds of amusing novelties which can be cut out of thick paper pages to be played with at once. With a pair of scissors and a little paste, a marvellously cheap collection of toys can be made by any little child in no time.

Boys and girls who are just beginning to read should be given a copy of CHICKS' OWN ANNUAL. This is a large book with extra big pages, with splendid pictures and simple jokes. All long words are divided into syllables to make reading easy. For children who are in the early stages of reading, nothing could be better than a copy of BUBBLES ANNUAL or RAINBOW ANNUAL. In the first there are fairy stories, tales of adventure, and endless pictures. In the second the ever-fascinating Tiger Tim and his funny companions, the Bruin Boys, play all kinds of funny pranks. All the toy books and Annuals mentioned are 3/6 each, and finer value in Christmas or Birthday gifts cannot be obtained anywhere.

Measuring Small Current.

Probably something of a record in the measurement of minute electric currents has been made by Dr. C. G. Abbott, of the Smithsonian Institute, U.S.A., who has actually measured the electric current produced by the transformation, by a special instrument, of the heat received from a star. The current was so small that it was computed that it would need to flow continuously for 60,000 years in order to accumulate the same amount of electricity as flows through a filament lamp in one second.

Handy Stripper.

The stripping of the insulation from copper wires is often troublesome, particularly where there is a braided cotton fabric over rubber. A correspondent to "Radio Digest" (U.S.A.) describes a very simple device which he uses for this purpose. A piece of steel bar or stiff strip is taken, about 3 inches long, 1½ inches wide, and ⅛ to ¼ thick. In one end is made a V-shaped notch, fairly long and narrow, with sharp edges: this can be done by means of a fine file, and finished at the narrow end by a hack saw or fine tube saw. At the other end of the strip two holes are drilled, by means of which it can be screwed down to the bench, the notched end projecting over the edge of the bench. To strip a wire, this is inserted in the jaws, until these cut into the insulation, and then given a quick downward pull.

R/R

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R/R

POPULAR WIRELESS AND WIRELESS REVIEW, December 27th, 1924. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

OVER 500,000 READERS MONTHLY.

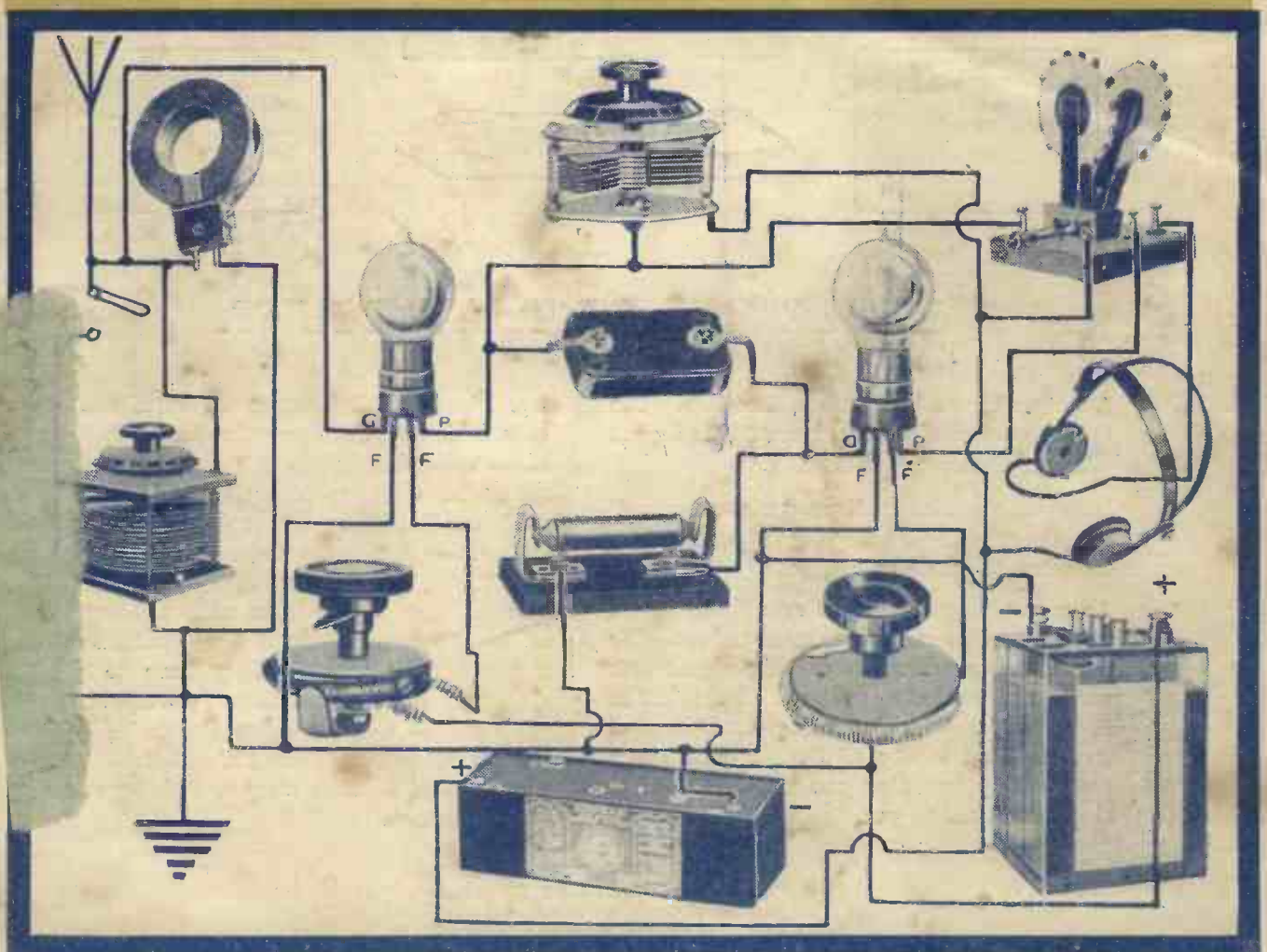
Popular Wireless and Wireless Review

PRICE 3d. EVERY THURSDAY.

No. 135. Vol. VI. SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc. December 27th, 1924.

HOW TO CONSTRUCT AN H.F. AND DETECTOR RECEIVER

(Pictorial Diagram Below).

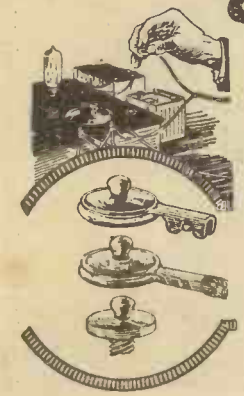


SPECIAL FEATURES IN THIS ISSUE.

The "P.W." Broadcasting Time-Table.
Reply to Mr. Matheson Lang.
Fixed Crystal Detectors.
Constructional Notes.
Converting Condensers to Square Law Type.
Low Loss Basket Coils.
More About the Neutrodyne Reflex.
Loud-Speaker Hints.

HOW TO BUILD A NOVEL FOUR-VALVE SET.

Let them all come



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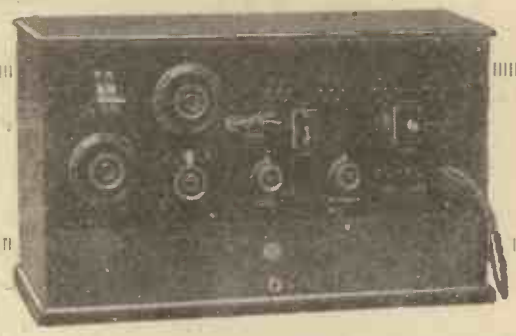

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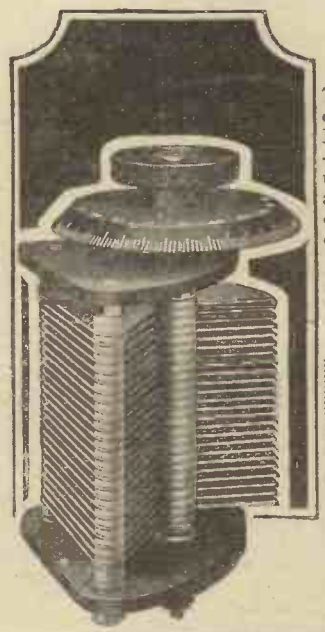

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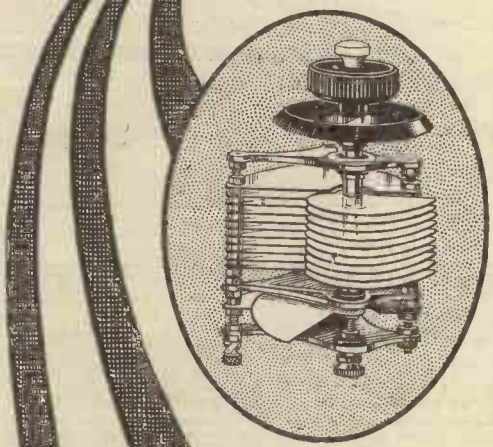

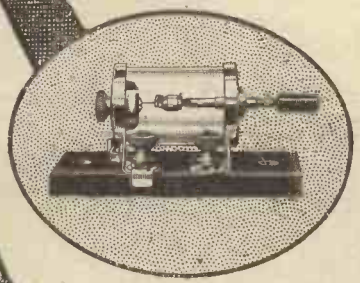

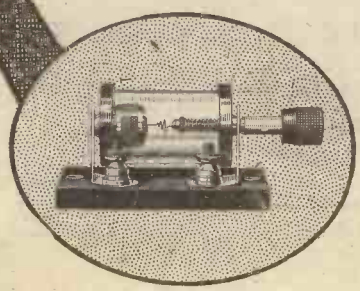

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POPULAR WIRELESS

AND WIRELESS REVIEW.

December 27th, 1924] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Thursday, Price 3d.

Technical Editor: G. V. DOWDING, Grad.I.E.E. | Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.G.S. | Scientific Adviser Sir OLIVER LODGE, F.R.S

RADIO NOTES AND NEWS OF THE WEEK.

An Amateur Hears Japan.

THE well-known French amateur, M. Menars—whose station is in the Basses-Pyrénées district (south of France)—states that he has picked up an amateur, transmitting from Tokio, Japan. He tuned-in to a wave-length of about 90 metres, and heard the transmission clearly for ten minutes or so. This is thought to be the first time that a Japanese amateur's signals have been received in Europe.

* * *

"Friendly Relations."

Mr. W. M. Crippin, of 4, Clovelly Road, South Ealing, who won the silver cup—1st Prize in the senior section of the "P.W." Constructors Competition held recently at the White City Radio Exhibition.

THE B.B.C.'s relations with the theatre-managers continue to be perfectly friendly, in spite of the wide divergence of opinion upon the broadcasting of plays. They made one good point in the example they gave of broadcasting benefiting the box-office. They had heard from a Cornishman who was detained on business in London, and went to see "Patricia" because he had heard it over the microphone. Sitting next to him in the theatre was a man who had come to London from Forfar, and who had gone to His Majesty's for exactly the same reason.

* * *

The Theatre and Broadcasting.

I HEAR that the negotiations with the B.B.C. for the broadcasting of "Poppy" from the Gaiety Theatre have broken down again; but the B.B.C. will carry their point sooner or later.

* * *

The Latest Fad.

RADIO stamp collecting is the latest fad in the U.S.A. All the important broadcasting stations have a supply of steel engraved stamps, and all long-distance enthusiasts have a stamp album. If they hear a long-distance transmission they write off to the station at once, describing the reception, and, if satisfactory, they receive that station's stamp in return. Their albums therefore show at a glance how many other "scalps" they have collected.

What is the Multidyne?

Shortly after Christmas a series of articles dealing with the construction of a novel experimental receiver will be published exclusively in POPULAR WIRELESS. The "Multidyne" will prove the most economical experimental set ever devised.

* * *

Mayors by Wireless.

IT is a good sign of the increasing importance of broadcasting that not only do new stations call for an address by the Mayor of the city, but even the extension of premises gets a civic blessing also. Glasgow made quite an occasion of their move to new quarters, and just recently at Manchester the Lord Mayor consented to speak on the occasion of the opening of 2 Z Y's new studio.

* * *

About Announcers.

WHAT may be called the "personal" element at 2 L O has not been so prominent of late months as formerly. But it is possible, perhaps, to be over-drastic when any new line of policy is decided upon, and I know many people who regret the cutting out of the announcers' names from the programmes. Listeners of my acquaintance were wont to take great interest in discussing the merits of one announcer as against another. Now it is left to their quickness of perception to distinguish one from the other. The announcer is just as much part of the programme, some folks assert, as the chairman of a meeting. Personally, I do not think the matter of any great importance.

* * *

A Suggestion.

BUT this I do know: and it is that Arthur Burrows is fondly remembered by tens of thousands of people all over the country as the first and best announcer of all. Only the other day I heard a man say, in a company of radio fans, that he never could hope to capture again the sense of charm which possessed him at 8.30 on Sunday evenings when Uncle Arthur's fine voice broke the silence with spoken words which contained the very essence of vocal music. Why doesn't Burrows make an occasional appearance just for the sake of old times?

* * *

The Johannesburg Station.

THE Johannesburg broadcasting station, where a Western Electric transmitter has been installed, is now working upon a wave-length of 450 metres. The power employed is 500 watts in the aerial, so that the radiation is exactly the same as that at Birmingham.

* * *

Duke and Duchess of York Listen-In.

The loud speaker in the music room of the s.s. "Mulbera," on which the Duke and Duchess of York are travelling to East Africa.

Signs of Growth.

THE year which is now drawing to a close has seen a remarkable growth in wireless. Not only has the number of British licences issued passed the million mark, but the European ether has definitely become congested with broadcasting stations. Twelve months ago it was possible to identify an unknown station by such particulars as "a violin solo on a wave-length between 2 L O and Brussels at — p.m."; but now such vague details are quite insufficient for indentification.

(*Continued on page* 1022)

NOTES AND NEWS,

(Continued from page 1021.)

Station Sounds.

DID you notice how quickly the B.B.C. took up my suggestion in these columns of a characteristic call-sound for each of the main stations? Apparently they passed it on to the daily papers, whose readers have been asked to suggest suitable sounds which they think would broadcast well. Captain Eckersley tells me that the B.B.C. is decidedly keen on the notion.

* * *

5 N G's Progress.

NOTTINGHAM is making quite a name for itself amongst the relay stations, and there is no doubt that the city has taken 5 N G to its heart. The work there has grown with the local interest, so an assistant director has been appointed, in the person of Mr. Laurence Bagshaw, to help with the increasing responsibilities.

* * *

Japan's Service.

LAST week's news that a Japanese amateur transmission had been picked up in France reminds me that Japan is going to have quite a big broadcasting service in operation soon. At present the only station in the country is the one at Tokio, an experimental Government station; but six new broadcasting stations are to be erected by the end of next month.

* * *

Ocean Broadcasting.

THOSE readers who enjoyed the concerts broadcast from the s.s. Leviathan will be glad to hear that the United States Shipping Board hope to extend the idea to some of their other vessels. Probably within a year several of them will be broadcasting their own or relayed concerts regularly as they cross the Atlantic, as the Leviathan's programmes have proved highly successful.

* * *

Sir J. M. Barrie's Appeal.

ON the very day that Sir James Barrie charmed his Dumfries audience—and the world in general—by his whimsical speech on "Walnuts," I received a letter from him. He is trying to help the Greater London Fund for the Blind, and says:

"I wonder how many 'P.W.' readers realise that to some five thousand men, women, and children in London, the largest city in the world is but a gigantic *sound?* To them a battle lasts not a day, but all their days, and each day a fine courage and unfailing hope, a steadfast faith, must be kept bright and untarnished, so that poverty and suffering may not darken their minds even as their eyes are darkened."

Contributions to the fund should be sent to him at 224, Great Portland Street, London, W.1.

Members of the Coventry Co-operative Radio Society and some of the society's home-made apparatus.

"Unidyne" Lectures.

RADIO societies have come into much greater favour this winter, and one of the most popular subjects for discussion has been the "Unidyne." I notice that the "Unidyne" figured on the fixture-card of the Englefield Green Radio Society recently. The society meets in the lounge of the "Barley Mow," Englefield Green, and, reading the report, one instinctively feels that on a cold winter's night a lecture on the "Unidyne" there must have been a very attractive proposition.

* * *

German "Relays."

GERMANY is going to supplement her main stations by relays, in the same way that Britain has done, and already stations of this type are in operation at Nuremberg and Bremen. The former relays Munich on 350 metres, whilst the latter relays the Hamburg programmes on a wave-length of 345 metres.

* * *

"P.P.S."

THE Petit Parisien station has been coming over well of late, and during last month it beat its previous record transmission for crystal reception. This was discovered on receipt of a report from Glasgow stating that an amateur there had clearly heard the call-sign and a request for reports from listeners. The wave-length was 361 metres, and the distance between the two points is 625 miles.

* * *

A New Valve.

EXPERIMENTS have recently been carried out with a new type of dull-emitter valve which is claimed to possess the valuable advantage that it will not burn out if the H.T. is accidentally connected to the filament. The filament consists of a thorium coating on a wire of molybdenum.

* * *

A Correction.

SEVERAL readers have drawn our attention to an anomaly in the article on the Square Law Condenser which appeared in "P.W." No. 132. It should be noted that the curve in Fig. 1 (page 819) is shown bending the wrong way. **ARIEL.**

Captain Ian Fraser, M.P., the blind radio amateur of St. Dunstan's, at his transmitting set.

Technical Queries.

THE Technical Editor tells me that readers are still sending in their sets for him to test, although it has been announced repeatedly that neither he nor members of the technical staff can undertake this class of work. In all such cases the sets have to be returned unexamined, and the risk of injury in transit is run unnecessarily. Technical troubles can only be dealt with through the query department.

HOW TO BUILD

AN H.F. & DETECTOR RECEIVER WITH TUNED ANODE COUPLING

By LAURENCE J. PRITCHARD.

This extremely efficient receiver can be made for a small outlay and with very little labour. A pictorial lay-out of the circuit will be found on the cover of this issue of "Popular Wireless."

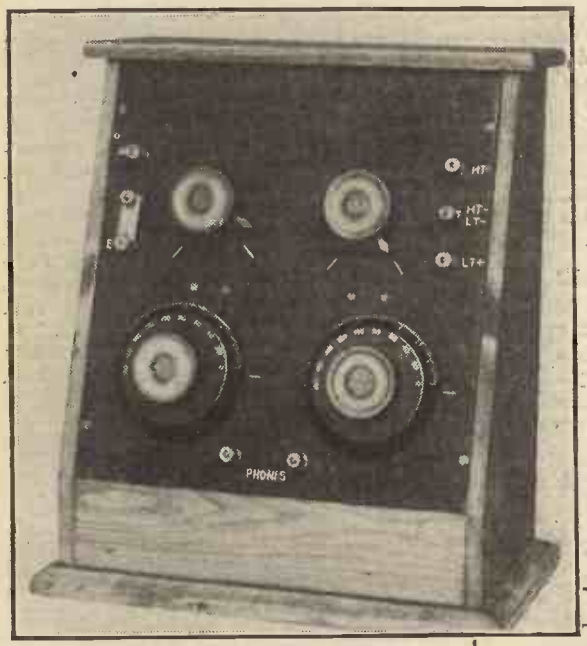


Fig. 1. The completed receiver.

OF the several methods of obtaining H.F. amplification the tuned anode coupling of H.F. amplifying valves is the best in the majority of cases for the broadcast wave-lengths. There are undoubtedly many who obtain excellent results from H.F. valves employing transformer coupling. If these cases were examined, it would probably be found that the constructor had made his own transformers to suit his particular set or that the H.F. transformers were extremely well made.

With H.F. valves using tuned anode coupling, good results can be obtained without expensive apparatus, providing care is taken in the construction of the set.

Useful Long Range Set.

Tuned anode H.F. amplifiers give sharper tuning in the majority of cases than transformer-coupled sets owing to the sharply tuned anode circuit.

A receiving set of considerable merit embodying one-stage tuned anode H.F. amplification with a valve detector with reaction is illustrated in Fig. 1. The extremely neat appearance of the panel lay-out should be noted. In order that a two-stage L.F. amplifier may be added if required, the battery terminals are located at the right side of the instrument. The coils and valves are housed within the interior of the set, which, besides safeguarding them from injury, adds to the appearance of the set.

Peepholes are provided in the panel through which the valves may be inspected. Although the coils are placed inside the set they are easily accessible, two doors being provided to form the back.

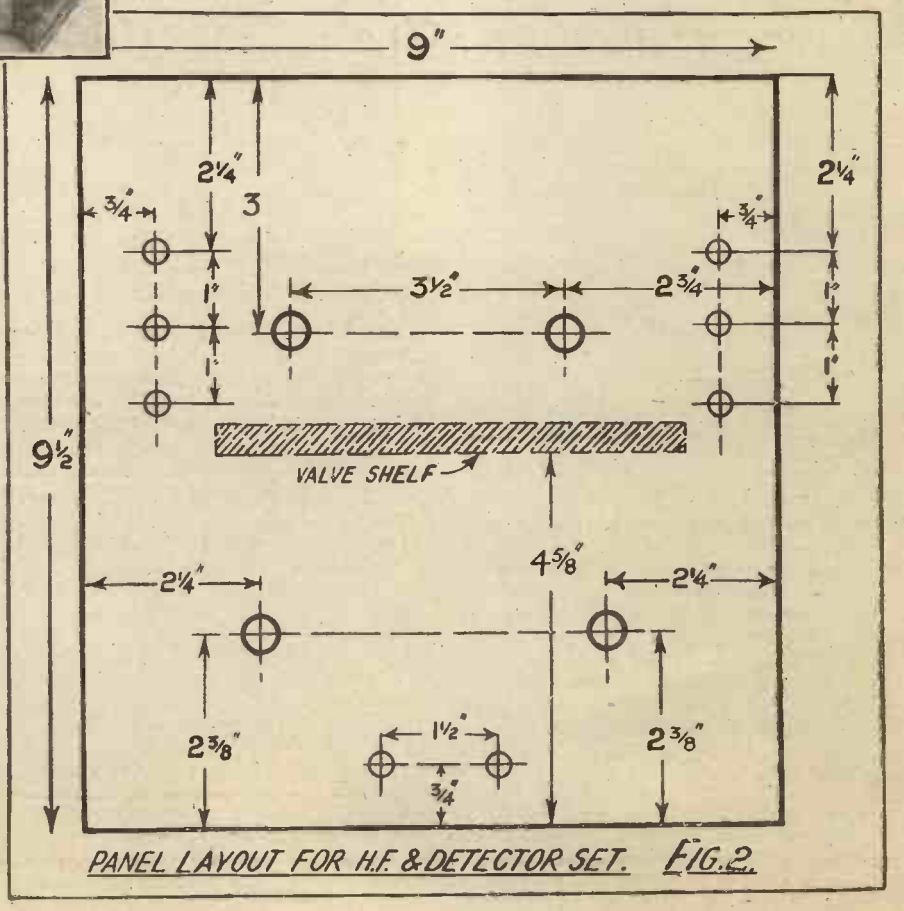
The case is made from $\frac{3}{8}$ in. well-seasoned deal or other wood, with the exception of the base, which is an oblong board $\frac{5}{8}$ in. thick, having the top edges bevelled and measuring $10\frac{3}{4}$ in. by $6\frac{1}{2}$ in. The sides are cut from two oblong pieces of wood 11 in. long and $5\frac{1}{2}$ in. wide. The sloping front edges are obtained by cutting off one corner $2\frac{1}{2}$ in. along the width and 9 in. along the length of each side.

The two sides should be clamped together in a vice in the truing-up process in order that they may be of identical size. The top overlaps at the front and side edges, and measures $10\frac{1}{2}$ in by $3\frac{1}{4}$ in. Between the two sides a front piece 9 in. by 2 in. is required.

The two halves forming the back of the case are hinged at top and bottom to swing flush with the back edges of the case. A fillet of wood is tacked to the inside of the base, and prevents the two halves of the back from swinging inside the case. Two fillets are also attached $\frac{1}{4}$ in. in from the sloping edges of the case. These fillets support the panel and should be at least $\frac{3}{8}$ in. square. The panel is 9 in. wide and $9\frac{1}{2}$ in. high when fitted. A dimensioned lay-out of the panel is given in Fig. 2.

The first thing to assemble is a valve shelf, which fits at the back of the panel. On this shelf are assembled two valve holders and a fixed condenser and a grid leak placed between them. The shelf

(*Continued on page* 1024.)



PANEL LAYOUT FOR H.F. & DETECTOR SET. FIG. 2.

HOW TO BUILD AN H.F. AND DETECTOR RECEIVER.

(*Continued from page* 1023.)

measures 7½ in. long and 2¾ in. wide. It is cut from ¼ in. ebonite. The valve holders consist of valve sockets, each set of four being assembled round a point 1½ in. from the end of the panel and midway between the sides.

Fig. 3. Assembling the coil holders.

The combined grid leak and condenser is not suitable as it stands for this set. The reason for this is that, when the grid leak is shunted across the grid condenser, a path for the H.T. current is opened, through which it would adversely affect the grid of the detector valve by applying a strong positive potential, therefore, a slight alteration is required.

The Aerial Earthing Switch.

The method adopted in the set under construction is to employ two entirely separate grid leak clips screwed to the valve shelf. The grid leak has a resistance of two megohms, and the grid condenser has a capacity of ·0003 mfd. The shelf is secured to the panel with two right-angle brass brackets placed towards each end of the shelf.

Immediately above the valve shelf two filament resistances are placed. Below the shelf two variable condensers are fixed. The one to the left of the panel seen from the front is the aerial tuning condenser, having a capacity of ·0005 mfd. The tuned anode condenser has a capacity of ·0003 mfd. Both condensers are of the one-hole centre-fixing type, this type being specially recommended for quick assembly.

An aerial to earth switch is incorporated with the aerial and earth terminals. The centre terminal, which is wired to the top (and aerial) terminal, carries a flat strip of brass capable of being moved round to make contact with either the aerial terminal or the bottom terminal which connects to earth.

In Fig. 1, the illustration of the completed set, the brass strip is shown with the aerial shorted to earth.

Careful Coil Holder Selection Necessary.

The aerial tuning coil and the tuned anode coil are mounted side by side to the inside of the wooden front of the case. Special holders are made for these coils from good quality ebonite. The coil holders may be bought, if desired, but if this course is adopted their insulation qualities should be tested as considerable electrical loss has been found in moulded coil holders made of composition materials. For each coil holder to be constructed a base of ⅜ in. ebonite 2 in. long and 1 in. wide is required. Four countersunk holes are required at each corner. In the middle of the block two ⅛-in. holes are drilled, their spacing being that of the coil contacts to be used.

Fixing the Coil Holders.

The socket is made from ¼ in. diameter brass rod drilled at one end to fit the split plug of the coil. At its lower end it is drilled and tapped to take a small screw under which the connecting wire is clamped. The back end of the socket is drilled and tapped out 4 B.A. size. The plug is constructed to suit the socket of the coil, and is split at its end by means of a saw-cut. This end is slightly rounded. Its length is about ½ in. longer than the socket. The holes by which the plug and socket are screwed to their base are well countersunk on the underside so that electrical leakage to the wooden case is impossible.

The way to fix the socket to its base is illustrated in Fig. 3. Before the coil holders are screwed to the inside of the case the heads of the 4 B.A. countersunk screws are covered over with melted paraffin wax, which is afterwards scraped off flush.

The position of the coil holders is shown in Fig. 4, where one coil is being fitted to the coil holder to ascertain that it has sufficient clearance from the sides of the case. The second coil holder occupies a similar position on the opposite end of the

(*Continued on page* 1025.)

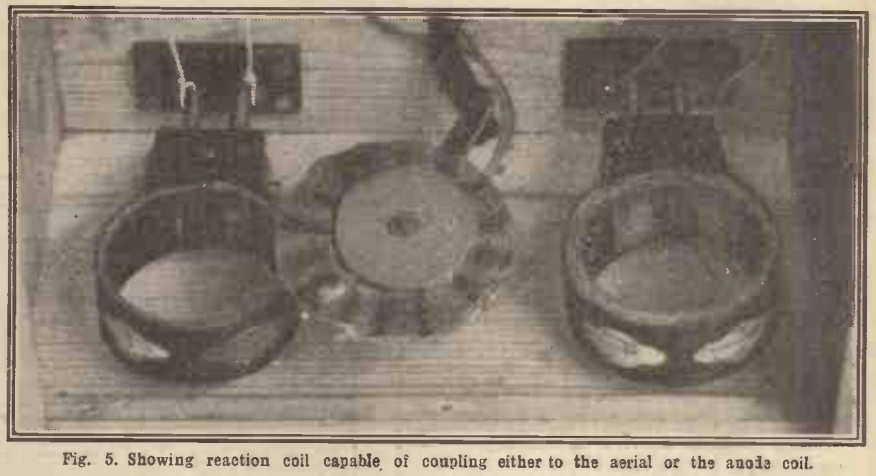


Fig. 5. Showing reaction coil capable of coupling either to the aerial or the anode coil.

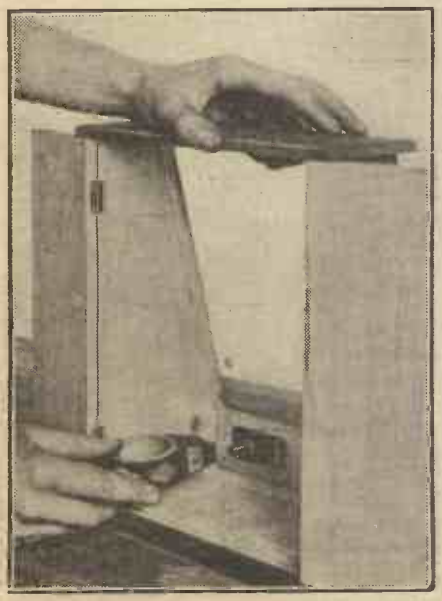
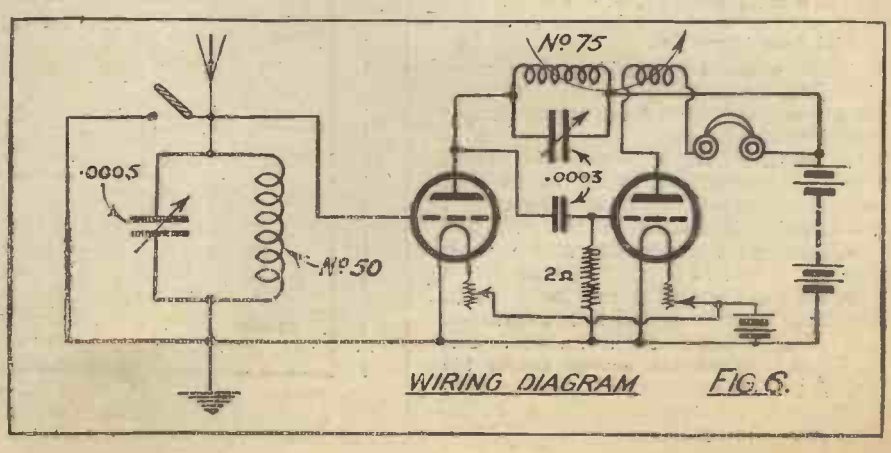


Fig. 4. Back view of case: fitting the coil in its holder.



WIRING DIAGRAM FIG. 6.

Technical Notes

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P.

Soldering Pencil.

I HAD an interesting little appliance brought to my notice the other day, which is something of a cross between an electric soldering iron and a spot welder. It is only about the size of a pencil or a fountain-pen, and is operated by means of the current from an ordinary 6-volt accumulator. At the tip of the pencil is a piece of exposed graphite, and this is connected, through the instrument, to one pole of the battery: the other pole of the battery is connected to the work.

When contact is made between the carbon tip and the work, the resistance of the circuit is almost all at the contact, which, consequently, is immediately raised in temperature. By this means, very small soldering jobs can be readily and neatly done. There is the further important advantage that no current is used except whilst the device is actually in operation, and practically nothing is heated except the spot intended.

A.C. for Filaments.

A writer in "Radio" (Sydney, N.S.W.) states that he has operated his two-stage amplifier from the A.C. mains by the simple expedient of using a potentiometer across the filament terminals. A bell-ringing transformer, or any other small similar transformer, is used for stepping-down the A.C. main voltage to the required value, and across the terminals of the secondary of this transformer (i.e. the low-voltage side) a 400-ohm potentiometer is shunted. The primary of the transformer is connected, with fuse, into the A.C. mains. The negative end of the H.T. battery is connected to the positive of the grid bias battery and also to the centre or slider of the potentiometer. The A.C. hum is not entirely eliminated, but by the judicious use of the potentiometer, and by not lighting the filaments too brightly, the hum will not be objectionable on stations coming in with fair volume.

The slider of the potentiometer should be moved slowly until the hum is reduced to the least value: the quietest spot is usually found somewhere about the centre of the potentiometer. Good results are said to have been obtained using a valve detector, but best results were got with crystal detector. The writer adds, "This amplifier should not be connected to a receiving set using parallel filament connections for both detector and amplifier, but if your set is all in one unit, the wires may be cut, thus separating the detector from the amplifier."

High-Power Broadcast Stations.

Some important observations on the question of erecting high-power broadcast stations were made recently by Mr. David Sarnoff, Vice-President and General Manager of the Radio Corporation of America, in a speech broadcast from K G O, General Electric Station. Speaking in

(*Continued on page* 1066.)

HOW TO BUILD AN H.F. AND DETECTOR RECEIVER.

(*Continued from page* 1024.)

front of the case. A special feature of the receiver is the reaction coil, which is arranged so that a variable coupling is provided either to the tuned anode or to the aerial tuning coil direct. In this way the comparative merits of the two methods of coupling may be quickly ascertained. The extent of re-radiation in the alternative methods of coupling forms an interesting subject for experiment which should not, however, be carried out during broadcasting hours.

The reaction coil consists of a basket coil having 30 turns of No. 24 S.W.G. S.C.C. wire wound on a former of 1 in. diameter to which 15 radial spokes are fixed. The completed coil is waxed and then mounted between two cardboard discs to a square ebonite pencil, $\frac{1}{4}$ in. square and $2\frac{1}{2}$ in. long. This rod is hinged to a similar rod of the same length, screwed by a right-angle bracket to the front side of the case. The second rod is also hinged to the brass bracket to provide a double hingeing movement. Flexible connecting wires are employed for connection to the reaction coil.

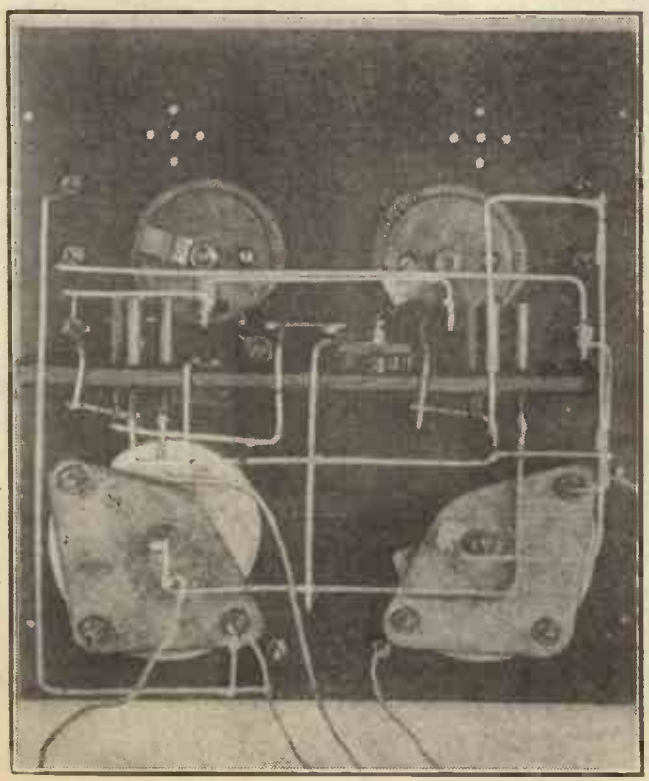


Fig. 7. The back view of the panel with wiring complete.

Details of the coil and its supports are shown in Fig. 5. Wiring is carried out with $\frac{1}{16}$ in. square tinned wire with the exception of the leads to the coil holders, which are of insulated flexible wire. The wiring diagram is given in Fig. 6. The completed wiring of the panel is shown in Fig. 7. The flexible leads from the condenser connect to the coil holder immediately underneath them in each case. In wiring it must not be forgotten to connect the two aerial terminals together.

The positions of the valve shelf enables any suitable hard valve to be used, the old-type Marconi Osram R valves being employed in the set constructed.

The completed receiver ready for operation is illustrated in Fig. 8. It will be noticed that the brass strip is now removed from the aerial to earth position, and is connected to the upper aerial terminal to prevent the possibility of its dropping down and making contact with the earth terminal.

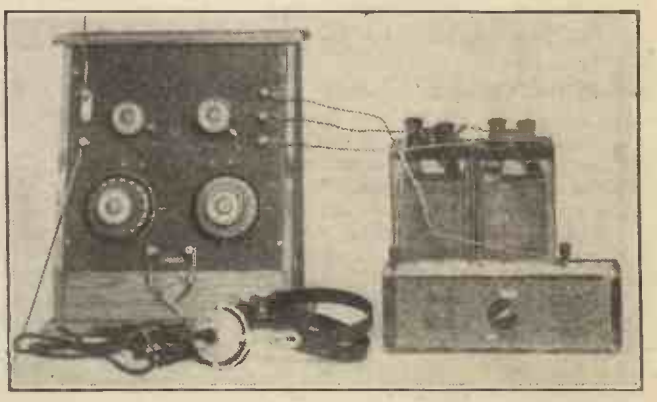


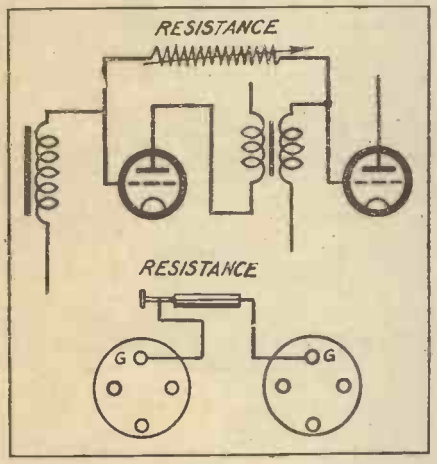
Fig. 8. The receiver ready for use. Note position of brass clip on the aerial terminals.

In tuning on the broadcast wave-length a No. 35 or No. 50 Igranic coil is used in the aerial circuit, and a No. 75 Igranic coil in the tuned anode circuit. Once the correct reaction setting has been found for any particular wave-length, the station can be tuned in again by the condensers only.

LOUD-SPEAKER HINTS.

By H. W. GAMBRELL, A.Rad.A.

INNUMERABLE amateurs are confirmed in their opinions that headphone reception is far superior to that of the "nasty, rasping and distorting" loud speaker. My experience goes to prove that although such opinions are not entirely unfounded, there exist very simple and practicable remedies which, if applied, make loud-speaker reception, if not absolutely perfect, at least bearable. To resort to the use of resonance curves on a subject of this description is to defeat one's ends.



The majority of listeners neither understand them nor desire to do so. It is therefore my intention to give a few practical hints which, I am sure, will prove invaluable to the loud-speaker user.

So far as modulation or correct resonance is concerned, this is purely a matter of science to the high-brow and individuality to the low-brow. As to the latter, some like proper rendering of the high notes to the exclusion of the low ones; some are just the reverse; and others prefer a flat rate throughout.

The Use of Fixed Condensers.

The methods I am about to put forward will meet all these cases, but in my opinion the feature which requires most attention is the exclusion of unwanted noises in the loud speaker, due to a combination of the effects of the electrical circuits in the receiver, and the incoming carrier with its parasitic noises such as atmospherics, mush, etc. Many readers will have noticed that when standing by there is an unpleasant roar from the loud speaker. The volume of the roar varies, of course, with the transmitting station and the receiver.

The first step towards remedying this defect is to consider the condensers across the H.T. battery and the loud speaker. A 2 mfd. fixed condenser of the Mansbridge type will eliminate any disturbance due to H.T. batteries. Most receivers have a fixed condenser across the telephone terminals, but the same is often of too low a capacity to make any material difference to the loud speaker.

I find that a capacity of ·005 mfd. is a good general capacity, the condenser being fixed across the terminals of the loud speaker itself. The latter condenser will make an appreciable difference, but is still insufficient to ensure absolute purity.

If, however, we take a variable resistance with a medium resistance of about ½ megohm, and attach one end thereof to the grid of the last L.F. amplifying valve and the other end to the grid of the preceding L.F. amplifying valve, we have at our disposal a very simple and efficient method of control. The characteristic roar, atmospherics, spark stations and unwanted noises of all descriptions are practically eliminated with but low loss in volume.

A Grid Resistance.

An ordinary variable grid leak at its lowest value of resistance will usually give the necessary amount of correction. The accompanying diagram will show where to fix the resistance. I have found that with some transformers the inclusion of this resistance has a tendency to set up low-frequency howling, but in every case by either changing over the transformer leads, or, in the case of different makes of transformer, changing over the transformers, I have been able to entirely eliminate this howling.

It may seem ridiculous to state that considerable distortion can be caused even if the actual and primary output of the loud speaker is in perfect resonance. In a few plain words the source of the trouble does not lie in what issues from the mouth of the loud speaker, but on what enters there.

If my reader will connect his headphones in series with a loud speaker and the receiving set, and get someone to speak into the loud speaker, he will hear the voice of the speaker. Conduct the experiment during reception of radio speech, and it will be found that the result of the two voices is distortion. The diaphragm of the loud speaker is vibrating to both voices, and the result is the resultant of both voices.

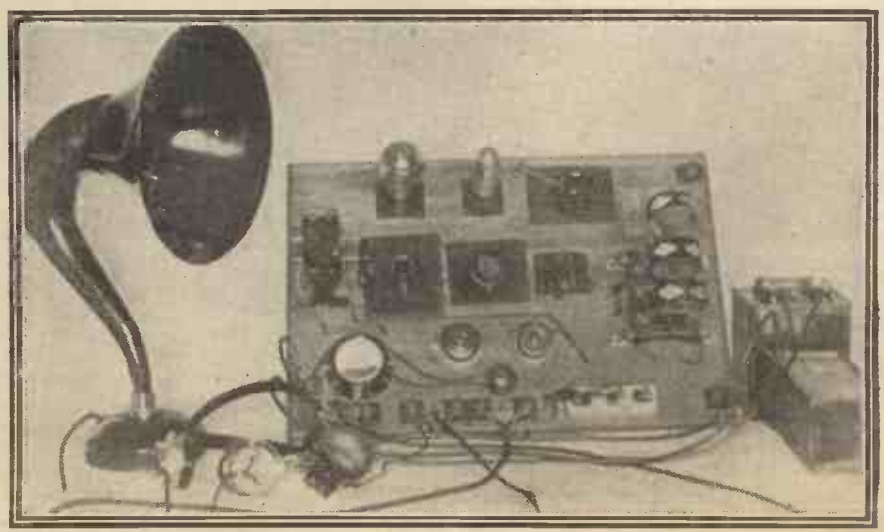
The first thing we deduce from this experiment is that if we are to get perfect reception we must not create any noise in the vicinity of the loud speaker. This problem becomes more complicated in a room which is liable to echo or reflection of sound. If a person speaks in such a room

A home-made loud speaker by L. Conway, 528, Portland Place, Portslade, Sussex.

the echoes of his voice superimpose themselves one upon the other, each a fraction of a second later than the other, with the result that we get distortion.

It does not, however, reflect back upon to the tongue of the speaker and thus affect the source of sound. In the case of the loud speaker this is the case, for the echo not only distorts the sound waves but distorts the true vibrations of the loud speaker diaphragm.

We must not, therefore, place the loud speaker in such a manner as to permit its output to be reflected back to its diaphragm. In large halls, when it is too expensive to eliminate echo by draping, it is best to turn the loud speaker upon the audience preferably by hanging the loud speaker vertically from the roof and throwing the sound upon the heads of the listeners.



A home-made 1 D., 1 L.F. experimental set, by A. W. Arnott, Hillside, Colenton, Midlothian, Scotland.

LOW-LOSS BASKET COILS.
SOME HINTS FOR THE CONSTRUCTOR.

FROM A CORRESPONDENT.

Now that so many amateurs are concentrating on short-wave work, the design and construction of efficient short-wave basket coils is a subject of wide interest, and the hints given in this article will prove extremely useful.

NOW that so much interest is displayed in the reception of short waves, any method of eliminating stray capacities in the receiver will no doubt be welcome.

It can be said, without fear of contradiction, that the best form of tuning

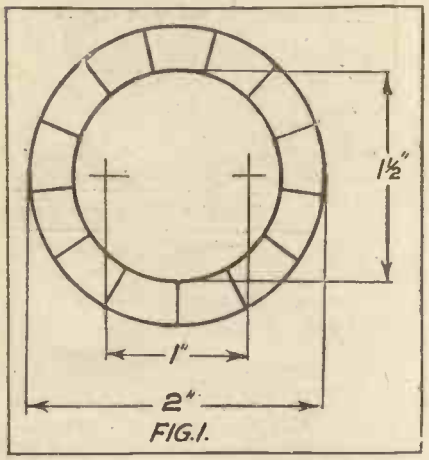
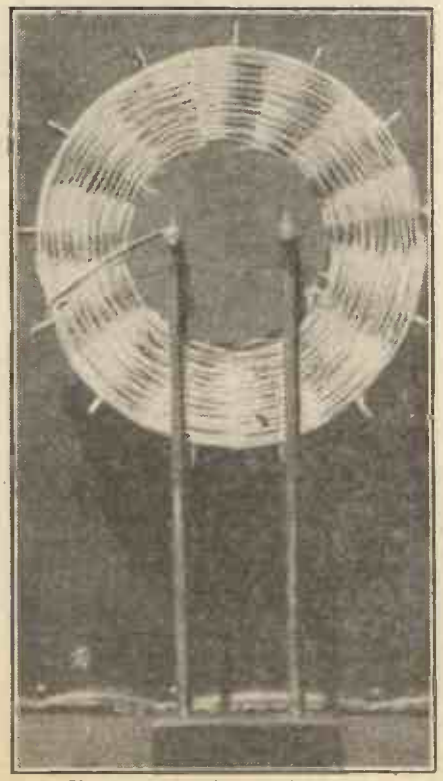


FIG.1.

inductance for the reception of short waves is undoubtedly a self-supporting helix of bare wire, well spaced between turns and wound to the approximate wave-length of the station it is desired to receive.


The appearance of a completed coil.

tuning being effected by means of a variable condenser of not more than ·0003 mfd. maximum capacity.

Unfortunately, a receiver incorporating this desirable form of inductance covers a very limited wave-band, and a receiver which will cover the broadcast band and, at the same time, tune down to about 50 metres, is a very desirable instrument, especially when the extra cost of a special short-wave receiver, in addition to the broadcast set, is prohibitive.


Side view of a low-loss coil.

The inductances here described have been designed to fulfil the above requirements, and have proved remarkably efficient in practice.

The method of construction can be clearly seen from the photographs. The centre disc is cut from ¼ in. thick ebonite, and 13 slots ¼ in. deep are cut radially round the outside edge (Fig. 1). Next, 13 strips of hard fibre or wood ⅛ in. thick and ¼ in. wide are cut (Fig. 2), their length being determined by the size of the inductance it is desired to wind. One end of the fibre or wood strips are chamfered with a sharp knife, glued, and stuck into the slots cut in the ebonite disc.

The wire is wound on in the usual basket coil fashion, the two ends being taken to two terminals spaced 1 in. apart in the centre of the ebonite disc. The coils are mounted on two brass rods, as shown in the photograph.

The Wire to Use.

Where coupling between two coils is required, the necessary arrangement can be quite easily made up.

If preferred, the coils can be fixed to the basket coil adaptors now on the market by drilling a hole in the centre of the ebonite disc and fixing with a nut and bolt. In this case they would, of course, fit the standard coil-holder.

The above method of making the coils is quite efficient for waves down to about 150 metres. For waves below this, however, it is an improvement to cut notches ⅛ in. apart on both edges of the fibre or wood strips (Fig. 3). The wire is then led into the notches when winding. The finished coil has the appearance of a spider's web; this is clearly shown in the photograph.

A coil of this type is very efficient, and is almost equal to the self-supporting type. It cannot, however, be used for inductances above 200 metres, as the large diameter necessary is prohibitive.

The question as to the best gauge wire to use for short-wave inductances is a

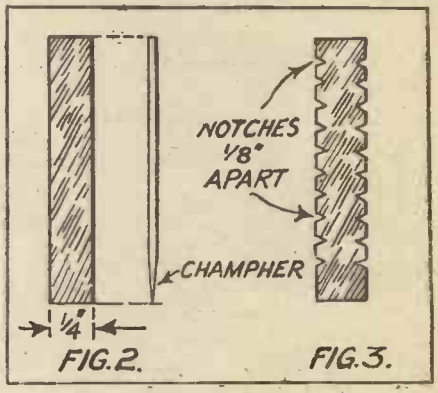
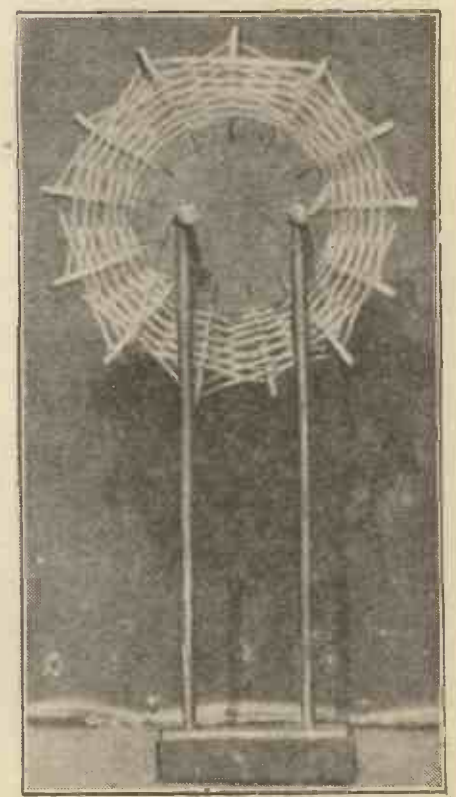


FIG.2. FIG.3.

debatable point, but the writer has found that No. 22 gauge D.C.C. wire gives good results. It should be emphasised that on no account should shellac be used on the wire, as it will greatly increase the capacity of the inductance.

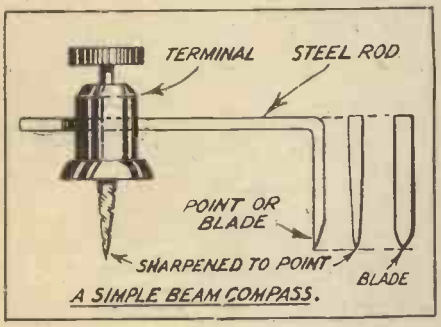

The coil wound with separating notches for very low wave-lengths.

Constructional Notes

Conducted by Dr. J. H. T. ROBERTS, F.Inst. P.

A Simple Beam Compass.

HERE is a drawing of the simple beam compass recently mentioned in these columns. It consists of a screw terminal, the lower part of which is sharpened to a point, and a steel rod, which may be of any convenient length for the purpose in view. This rod is bent over at the end for a length about equal to the distance between the hole in the terminal and the sharpened point of the terminal. The turned-over

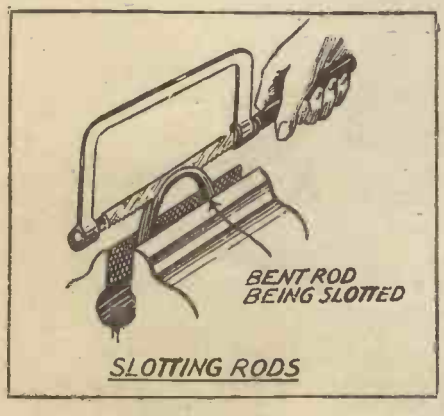


A SIMPLE BEAM COMPASS.

end of the steel rod is then also sharpened to a point, or it may be flattened in a plane at right-angles to the main length of the steel rod and sharpened up as a small blade at its lower edge. When it is desired to mark out circles, or to cut out circular discs from thin ebonite or cardboard sheet, or for any suchlike material, this beam compass is set so that the distance between the steel point and the terminal point is equal to the radius of the required circle.

Slotting Rods.

If you were asked to put a fine slot in a metal rod, without any starting holes, perhaps you might wonder how it was to be done. A glance at the figure will, however, make clear a very simple method of

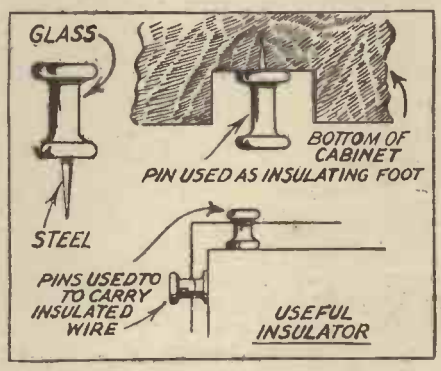


SLOTTING RODS

getting out of the difficulty. First bend the rod to about a right-angle, secure in the vice, make the cut, and then straighten the rod again. In straightening the rod, take care that no twist sets in, and that the slot does not become closed by hammering.

Tapping a Coil.

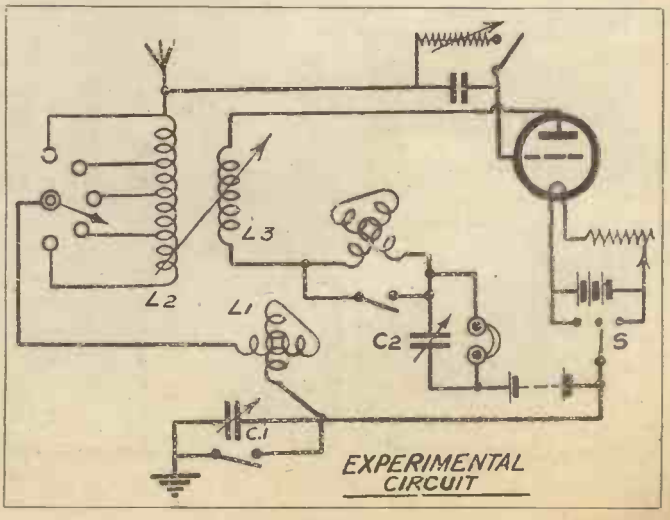
Many of the methods recommended for taking tappings from a coil are difficult to carry out, or the coil is unsightly when finished. The method indicated in the figure, however, is about the easiest and neatest I have seen for some time. Small holes are drilled through the tube at the desired positions, and as the winding reaches each hole the wire is looped through and the loop hooked, from inside the tube, upon a projection at the end of the tube, made by cutting notches in the edge. The wire is then pulled tight and the winding proceeds. This method is specially suitable when the tube is to be mounted end-on behind a panel, as shown, the tappings coming in the most convenient position for soldering to the studs. The tube may be



secured to the panel by a central rod and ebonite cross-piece, or in any other convenient way.

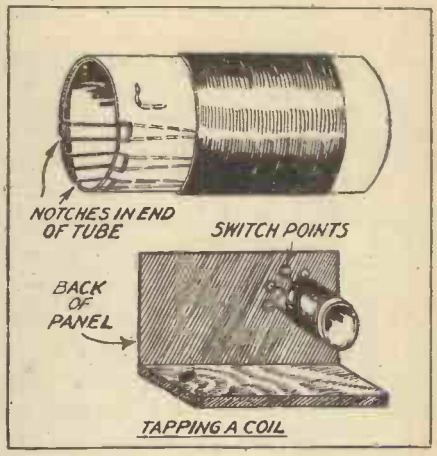
Experimental Circuit.

The circuit shown herewith is stated by a contributor to "Radio Digest" to have given results equal to detector and two stages of L.F. The following particulars are given. The grid condenser should be about ·00025, and a variable grid-leak, of about 4 to 5 megohms, should be used for preference, although a fixed leak of about that value will serve. The variometer, L.1, should have about 15 ft. of wire, and in any case not more than 25 ft. The condenser, C.1, is 43-plate or ·001, but a 23-plate ·0005 may be used. The condenser, C.2, is ·001 or higher.



EXPERIMENTAL CIRCUIT

L.2 and L.3 are the primary and secondary of a vario-coupler; the primary should have about 60 turns, the secondary should have between 30 and 60 turns, the actual number on the secondary being found by trial. The rheostat should be tried on both the negative and positive sides, for the best position. In the switch, S, three contacts are used, a blank in the centre



TAPPING A COIL

so as not to shorten the filament battery when changing over. Plate voltages from 30 to 90 were used.

Useful Insulators.

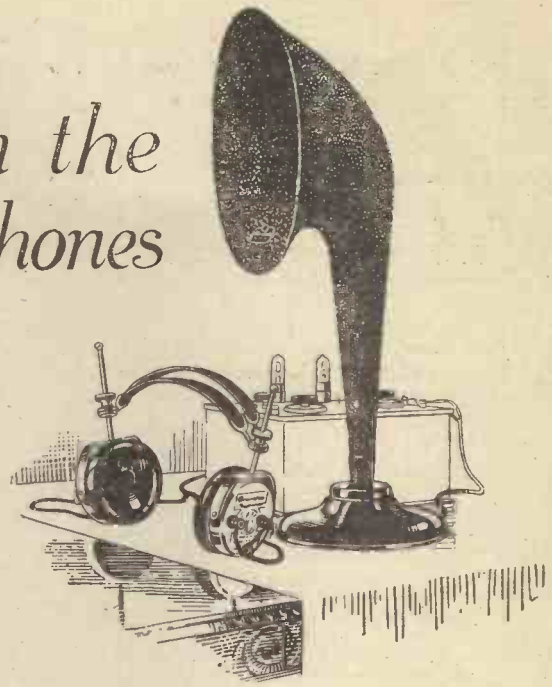
The glass-headed pins used for securing photographic prints make useful insulators, since the steel spear easily penetrates hard wood and does not leave any appreciable mark behind if it has to be removed, whilst the glass head makes a very good insulating covering. The shape of the head also is adapted for securing a wire loop around it. In the accompanying figure a method is shown by which the glass-headed pins may be used as insulating feet for the set, the figure showing a pin partly let into the wood. This, however, is not necessary; the pin may be just pushed into the underside of the wood without any recessing. The figure also indicates the way in which a number of the pins may be used as carriers for wire which is to be insulated. Other uses for these pins will occur to the reader. The pins are quite cheap, and can be obtained from photographic dealers.

Tune the Table-Talker with the "Matched Tone" Headphones

The Brandes Family Series.

AMARYLLIS holds the floor. "We're going to have a snappy time with the *Table-Talker*, and you, Bill," with imperious gesture, "will see to it. If you just dare to have the tummy out of the receiver for one of your confounded experiments"—she tailed off in vague threats of dire disaster for young Bill. "You, Father, need not blow through your fungus and look fierce, 'cos the carpet's coming up any way. And you've got to shell out for a new valve." Grandpa removed the "*Matched Tone*" 'phones from his ears as the strains of the Savoy band welled up in the *Table-Talker*. Amaryllis pirouetted, favoured him with a covert smile and executed a successful retreat. Father snorted behind his paper, but he knows really that the *Table-Talker* makes for a jolly time. *Ask your Dealer for Brandes.*

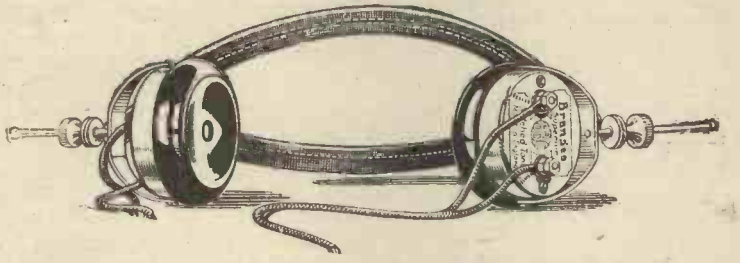
British Manufacture (B.B.C. Stamped).



All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This practically constitutes a free trial.

The "*Matched Tone*" feature means that both your ears hear exactly the same sound at the same instant—and you learn a new beauty of tone. They are tested and re-tested for just this one vital point, and, in addition, their strength, long-wearing comfort, and reliable efficiency make them undoubtedly superior **25/-**

The *Table-Talker* is a Brandes quality product at a moderate price. The non-resonant, specially constructed horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance and remarkable tone qualities. It is twenty-one inches high, and is finished a shade of neutral brown .. **42/-**



Crown Farm House,
Walton-on-Thames, Surrey.
19/11/24.

Dear Sirs,

It may interest you to know that I received Australia on your 'phones. I consider that they are the most sensitive 'phones that I have used, and I am much pleased with their general performance.

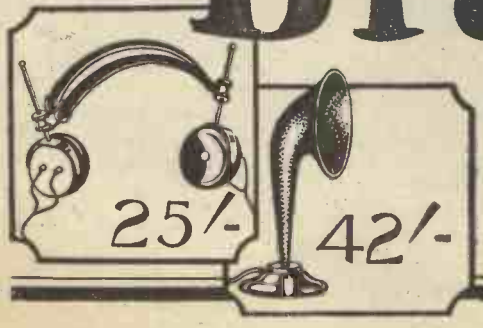
Yours faithfully (Sgd.) F. WALKER.

For 1925!

An excellent family gift to the family. Club together and get yourselves Brandes Products for the receiver. They provide good fun all the year round.

Brandes

Result of 16 Years Experience



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Hello! Hello!! "Uncle Tom" Calling

"Uncle Tom," Newcastle's First Station Director, Calling "Uncle Tom," of PAYNE & HORNSBY, LTD.

The Pioneers of Cheap Prices in the North and the only Firm in Great Britain with actual Broadcasting Experience

AERIAL WIRE.—7/22 Stranded Copper, 100 ft., 1/11; 7/22 Stranded Copper, per 50 ft., 1/-; "Electron" Aerial Wire, per 100 ft., 1/3.

ACCUMULATORS.—Fuller's 2 volt 40 amp., in Ebonite, 9/6; 2 volt 60, 11/9; 4 volt 40, 18/6; 4 volt 60, 22/6; 6 volt 20, 27/6; 6 volt 60 33/9.

BRASS RODS.—Screwed 2 B.A., 12 in. lengths, 2½d.; Screwed 4 B.A., 12 in. lengths, 2½d.

BRASS ROD, SQUARE.—Cut any length, per 12 in., 3d.

BASE BOARDS.—6 in. by 6 in., 9d.; 9 in. by 6 in., 1/-.

BUZZERS for testing, 2/-.

BUSHES for Condensers and Variometers.—Condenser top bush, 1½d.; Condenser bottom bush, 1½d.; Variometer, screwed bush, 2½d.

BELL WIRE.—Single, 2 yds., 1½d.; double, 1 yd., 1½d.

BOXES.—All sizes stocked or made to order.

CATWHISKERS.—Silver, 1d.; Gold, 2d.; Spear-point (Silver), 2d.; Gold Whiskers in tubes, 5d.; Experimenter's Envelopes of 4 & 5 Whiskers, 3d.

CONNECTORS (Brass), useful for many jobs, 1½d.

COIL HOLDERS.—Single, 9d. to 2/6; 2-way, 3/-; 3/6, 3/8, 4/-, 4/6, 5/6; 3-way, 4/-, 4/6, 5/-, 5/8. Cam Vernier, 2 Coil Holders, 5/6; Polar Cam Vernier, 6/-; Coil Plugs for attaching Basket Coil to Plug into ordinary 2 or 3 Coil Holder, 7d., 1/-, 1/3; Coil Plugs for making own Coils, Plain Flat Type, 7d.; Wedge Type, 9d., 10d., and 1/-; Fitted with Ebonite Wings, 1/3.

COILS.—Duplex Waxless Coils, per set of 5, 2/6; Duplex Coil, wound to 1,600 metres for Chelmsford, 2/-; Tapped Coils, d.c.c., 20 Tappings, 1/11; Enamel Wound Coils, 6 by 2½, 1/4; O'Keefe, Burodept and Igranic Coils always in stock.

DIAPHRAGMS, 2d. and 3d.

DIALS, 1/-.

DIALS AND KNOBS, 1/3.

EAR CAPS for all makes of 'Phones, 6d. to 1/9.

EMPIRE TAPE, per yd., 1d.

EARTH CLIPS, 4½d. to 6d.

EBONITE.—Cut to any size, ¼ to 1 in., per lb., 3/6.

EBONITE TUBE.—All sizes stocked.

FILAMENT RHEOSTATS.—Velvet Perfecta, 1/6; Microstat, 2/9; Igranic (with Vernier), 7/6; Igranic (Plain), 4/6; Lissenstat Minor, 3/6; Lissenstat Major, 7/6; 30 ohm Special for ·06 Valves, 2/6.

FORMERS.—Cardboard, very stout, from 2 in. to 4 in. diameter, 1d. to 4d.

FORMERS, VARIOMETERS, in Black Composition, per pair 3d.

FLEX.—For 'Phone Cords, H.T. Leads to many other jobs, per yd., 2d.; Red and Black Twisted, per yd., 2d.; Silk Covered, per yd., 1½d.

GRID LEAKS.—"Dubilier," 2 meg., 2/6; "Lissen" Variable, 2/6; "Watmel," 2/6; "Bretwood," 3/-.

HYDROMETERS (ACID TESTERS), 5/6.

HEADPHONE CORDS, 1/6 and 2/3.

HIGH TENSION BATTERIES.—"Phœnix," M.A.L., S.D.H., 15 volts, 2/9; 30 volts, 5/6; 36 volts, 6/6; 60 volts, 10/6; 90 volts, 16/6.

HIGH FREQUENCY PLUG-IN TRANSFORMERS.—All wave-lengths from 150 to 8,000 metres, prices from 3/9 to 5/6; Leslie McMichael H.F. Transformers, 300 to 600 metres, 10/-; 1,000 to 3,000 metres, 10/-.

INSULATORS.—Large Reel, 1d.; Small Reel, ½d.; Egg Type, 1d.; Shell Type, 1d.; Hook (for indoor use), 1d.

CONDENSERS.—Fixed, All Capacities, ·001 to ·003 and ·0001 to ·0005, 8d.; "Edison Bell" Fixed Condensers, All Capacities, ·002 to ·006, 2/-; All Capacities, ·001 to ·0005, 1/3; "Dubilier" Fixed Condensers, ·001 to ·006, 3/-; ·0001 to ·0005, 2/6; "Manasbridge" Condensers, ·006, 2/6; ·25, 2/9; ·5, 3/3; 1 mf., 3/6; ·2 mf., 4/-.

CONDENSERS (Variable).—"Ormond," ·001 8/-; ·00075, 7/-; ·0005, 6/-; ·0003, 5/6; ·0002, 5/-; ·0001 4/-; "Vernier," 4/-; Condensers, with "Vernier," ·001, 9/6; ·0005, 7/6; ·0003, 7/-. Also all Square Law stocked.

CONTACT STUDS.—5d. per doz., complete with nuts and washers; Nickel, per doz., 1/3.

CONTACT STOPS.—Two for 1½d., complete with nut and washer.

CRYSTALS.—Small Box Hertzite, 9d.; Large Box Hertzite, 1/-; Midite, 1/-; Tungstalite (Blue Label), 1/6; Geosite, 1/3; Carborundum, 4d.; Bornite, 6d.; Zincite, 9d.; Crystal Cups, patent screw tops, 2½d.; 3 screw tops, 1½d.

CRYSTAL SETS.—Excellent results are being obtained on these Sets, which are all guaranteed. Slope Panel, 12/6; "Hawker's" Mark III Set, Maker's Price, 21/-; Our Price, 17/6; "Service Set," splendid value, 30/-, with Variometer, Tuning Plug, 1,600 Metre Station.

Valves and High Tension Batteries sent through post at purchaser's risk only and are not returnable.

Price Lists Free.

Mail orders dispatched same day. Please send ample postage. Excess will be returned.

Business Hours - - - 9 to 8 daily.

TRADE SUPPLIED.

All Mail Orders to be sent to Head Office and Stores: GALLOWGATE, NEWCASTLE-ON-TYNE.

"UNCLE TOM" PAYNE & HORNSBY, Ltd., Gallowgate, Newcastle-on-Tyne

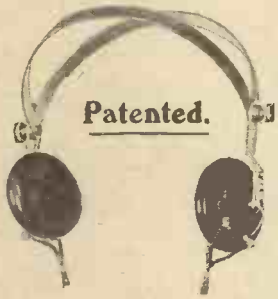
Telephone: 3804 CENTRAL — Call Signs: 6 I R, 6 K W.

10, QUEEN VICTORIA STREET, LEEDS. — Phone: 22267 Leeds.

66, Camden Street, North Shields. — Russell Street, & Ocean Road, South Shields. — Roker Avenue, Sunderland.

GIBSON'S BLDGS., CASTLE ST., BELFAST. & 4, STONEY ST., NOTTINGHAM.

4,000 ohms Per pair British Made. **10/6**



Patented.

4,000 ohms Per pair British Made. **10/6**

"RIPPLEPHONE"

(Regd. Trade Mark)

HEADPHONES

Beautiful tone. Light in weight. Very loud. Elegant finish

A most important discovery has enabled us to produce a head Receiver whereby the *whole of the diaphragm is in the magnetic field.* The result is obvious to all who use them, as the tone is beautiful to a degree. All musical notes are reproduced with astounding exactness, very sensitive, very light and comfortable, strongly made and beautifully finished.

Enquire of your local dealer.

GUARANTEED BRITISH MADE.

RIPPLEPHONE ELECTRIC COMPANY,

18, Boundaries Road, Balham, London, S.W.

'Phone: LATCHMERE 5380.

GRID LEAK ·5 to 5 megohms 2/6

ANODE RESISTANCE 50,000 to 100,000 ohms 3/6.

Suitable for ANY Circuit.

WatMel

VARIABLE GRID LEAK

(Patent No. 206098)

Continuously Variable.
Silent in operation.
Constant in any temperature.
Dust and Damp Proof.
Each tested and guaranteed.
Neat and well made.

SEND P.C. FOR DESCRIPTIVE FOLDER.

THE WATMEL WIRELESS Co.,
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Tel. 7990 Clerkenwell.

NE CRYSTAL

ANY SPOT

KRYSTAL CERTON

Liberal discounts both to the trade and to factors.

Break up your own crystals from bulk!

The most economical means of obtaining really good reception.

We are now arranging to supply our customers with our famous brands: "NE" and "CERTON" crystals, at the price of **2/3** and **2/11** per oz., post free.

All our crystal is triple-tested, and the results obtained have been highly satisfactory.

THE IMPANDEX TRADING CO., LTD.,
Import & Export,
5, Victoria Avenue, Bishopsgate, London, E.C.2

Names famous in combination.
No. 1—Gilbert and Sullivan.

Sir Wm. S Gilbert
(1836—1911)

A Scene from
"The Yeoman of the Guard"

Sir Arthur S. Sullivan
(1842—1900)

COLLABORATION

THE joint work of Gilbert and Sullivan is one of the most notable instances of successful collaboration. Each won fame individually, but it is in combination that their names are most recalled.

Another outstanding example of successful collaboration is that of the two famous organisations, MARCONI and OSRAM. These names on a wireless valve are your assurance of perfect design and efficiency in performance.

Read the 40-page wireless book, The Book of M O V. Free from your dealer or The M.O. Valve Co., Ltd., Hammersmith, London, W.6.

HOW TO ORDER YOUR VALVES.

For 2-volt Accumulators.

Purpose.	Type.	Price.
†G.P.	D.E.R.	21/-
†L.S.	D.E.6.	25/-

For 4-volt Accumulators.

G.P.	R.	12/6
G.P.	*D.E.3.	25/-
L.S.	D.E.4.	30/

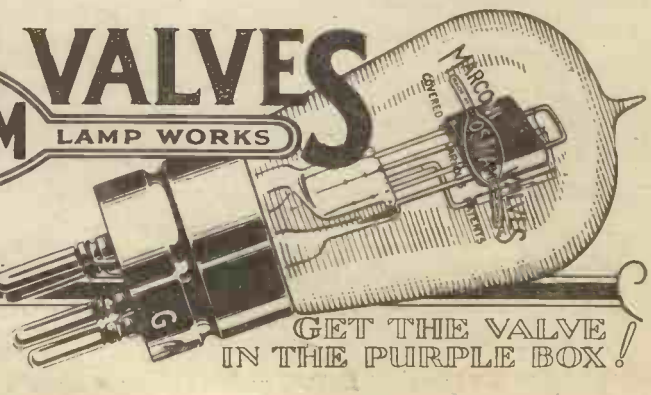
For 6-volt Accumulators.

G.P.	R.5.V.	12/6
L.S.	D.E.5.	35/-
L.S.	∴D.E.5b.	35/-
L.S.	L.S.5.	55/-

†G.P. = General Purpose.
†L.S. = Specially suitable for low frequency amplification for Loud Speakers.
*Can be used with Dry Batteries.
∴For Resistance – capacity Amplification.

MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS



Sold by Wireless & Electrical Dealers, Stores etc.

ANNOUNCEMENT OF THE M.O.VALVE CO. LTD.

GET THE VALVE IN THE PURPLE BOX!

THE "P.W." BROADCASTING TIME-TABLE.

Revised and Corrected up to Date.

BRITISH TELEPHONY TRANSMISSIONS.

LIST OF BRITISH STATIONS.

Station.	Call Sign.	Wave-length in Metres.	Station.	Call-Sign.	Wave-length in Metres.
Aberdeen	2 B D	495	§Hull	6 K H	335
Belfast	2 B E	435	*Leeds	2 L S	346-310
Birmingham	5 I T	475	§Liverpool	6 L V	315
Bournemouth	6 B M	385	London	2 L O	365
*Bradford	2 L S	310	Manchester	2 Z Y	375
Cardiff	5 W A	351	Newcastle	5 N O	400
†Chelmsford	5 X X	1,600	§Nottingham	5 N G	322
‡Croydon	G E D	900	§Plymouth	5 P Y	335
§Dundee	2 D E	331	§Sheffield	6 F L	301
§Edinburgh	2 E H	328	§Stoke-on-Trent	6 S T	306
Glasgow	5 S C	420	§Swansea	5 S X	318

* Twin relay station. † Experimental high-power station. ‡ Air Ministry Station. § Relay station.

TIMES OF TRANSMISSIONS.*

Time (G.M.T.)	Station.	Days.	Remarks.
13.00	London	Tues., Th., and Fri.	Time Signal and Concert.
15.00	Cardiff	Weekdays	Concert, etc.
15.00	Bournemouth	Friday	,, ,,
15.15	London	Mon., Tu., Wed., Th., and Fri.	Talk to Schools, etc.
15.30	Aberdeen, Birmingham, Glasgow, and Manchester	Weekdays	Concert, etc.
15.30	Bournemouth	Mon., Tu., Wed., Th., and Sat.	,, ,,
15.45	Newcastle	Weekdays	,, ,,
16.00	London	,,	Time Signal and Women's Topics.
16.00	Belfast	,,	Concert, etc.
16.45	Newcastle	,,	Women's Topics, etc.
17.00	Cardiff and Birmingham	,,	,, ,,
17.00	Bournemouth and Manchester	,,	Children's Topics.
17.15	Aberdeen	Tues., Th., and Fri.	,, ,,
17.30	Birmingham Belfast and London	Weekdays	,, ,,
17.30	Aberdeen	Mon., Wed., and Sat.	,, ,,
17.45	Cardiff	Weekdays	,, ,,
18.00	Glasgow	,,	Farmers' Weather Forecast.
18.00	Newcastle	Weekdays	Scholars' Talk.
18.00	Bournemouth	Tuesday	,, ,,
18.30	Birmingham	Weekdays	,, ,,
18.30	Aberdeen	Mon. & Th.	Girl Guide and Boys' Brigade
18.30	Manchester	Thursday	Boys' Brigade, etc.
18.35	Newcastle	Irregular	Weather Forecast (Farmers').
19.00	All Stations	Weekdays	Time Signal, 1st. Bulletin, Talks, & Weather Forecast.
19.30	,, ,,	,,	Concert, etc.
21.30	,, ,,	,,	Time Signal, 2nd News Bulletin, Talks & Weather Forecast.
22.00	,, ,,	Mon., Wed., and Sat.	Savoy Bands.
Throughout Day	Croydon and other Air Stations	Daily	To aeroplanes, etc.
15.00	All Stations (except Belfast)	Sunday	Concert, etc.
17.00	,, ,, ,,	,,	Children's Talks, etc.
20.00	,, ,, ,,	Sunday (Irregular)	Religious Service.
20.30	,, ,, ,,	Sunday	Religious Address. Concert, etc.
21.00	Belfast	,,	,, ,, ,,
22.00	All Stations	,,	Time Signal, Weather Forecast, News, etc.

(* NOTE.—Time is indicated by four figures (the first two representing the hour). The hours from midnight to midday are covered by "00" to "12," and 1 p.m. to 11 p.m. is represented by "13" to "23," etc. Thus 10.30 a.m. and 11.15 p.m. would be indicated by "10.30" and "23.15" respectively.)

THE "P.W." BROADCASTING TIME-TABLE.

CONTINENTAL TELEPHONY TRANSMISSIONS.

(*Continued from page 1033.*)

G.M.T.	Station.	Wavelength in Metres	Days.	Nature of Transmission and Remarks.
06.25	Hamburg	395	Weekdays	Time signal, etc.
06.55	Münster	410	Daily ..	Time signal.
07.00	Frankfurt	470	Sundays	Religious service.
07.00	Berlin (L P) ..	3150	Weekdays	News and market quotations almost hourly during day.
07.05	Lausanne (H B 2)	850	,,	Weather report.
07.40	Eiffel Tower (F L)	2600	,,	,, ,,
07.55	Hamburg	395	Sundays	Time signal.
07.55	Amsterdam (P C F F)	2100	Weekdays	News and market quotations almost hourly during day.
09.00	Berlin (Voxhaus)	430	,,	News, etc.
09.00	Komarov	1800	Sundays	Concert.
09.15	Berlin (Voxhaus)	430	Weekdays	News, etc.
09.40	Berlin (L P) ..	2450	Sundays	Concert.
10.00	Kbely	1150	,,	,,
10.00	Münster	410	,,	Religious service.
10.00	Vienna	530	,,	,, ,,
10.15	Hamburg	395	,,	Concert.
10.15	Breslau	418	Weekdays	Weather, etc.
10.15	Königsberg ..	463	Weekdays	Market News.
10.30	Lyons (Y N) ..	470	Daily ..	Concert.
10.30	Stuttgart	443	Sundays	Religious service.
10.30	Kbely	1150	Daily ..	News.
10.40	Eiffel Tower (F L)	2600	Weekdays	Marketquotations
10.50	Berlin (L P) ..	2800	Sundays	Concert.
10.55	Eiffel Tower (F L)	2600	Daily ..	Time signal.
10.55	Leipzig	454	Weekdays	News, etc.
10.55	Frankfurt	467	Weekdays	Time signal.
11.00	Eiffel Tower (F L)	2600	Tu. to Sat.	Market reports.
11.00	Leipzig	454	Weekdays	Concert.
11.00	Frankfurt	470	,,	News.
11.00	Stockholm ..	440	Sundays	Divine Service.
11.00	Stuttgart	443	Weekdays	News.
11.05	Breslau	418	,,	Talk.
11.10	Zurich	650	Sundays	Concert (irregular).
11.15	Eiffel Tower (F L)	2600	,,	Time signal.
11.15	Berlin (Voxhaus)	430	Weekdays	News.
11.30	Münster	410	,,	Market news.
11.40	Berlin (L P) ..	680	Sunday (irregular)	Concert.
11.45	Hamburg	395	Weekdays	Market News.
11.55	Berlin (Voxhaus)	430	,,	Time signal.
11.55	Hamburg	395	,,	,, ,,
11.55	Münster	410	Daily ..	,, ,,
11.55	Leipzig	454	Weekdays	,, ,,
11.55	Breslau	418	Sundays	Time signal and weather.
11.55	Königsberg ..	463	Daily ..	Time signal.
12.00	Leipzig	454	Weekdays	Market report.
12.00	Rome (i C D) ..	3200	,,	Concert (irregular).
12.00	Cartagena (E B X)	1200	,,	,, ,,
12.00	Ryvang (Denmark)	1025	Thursdays	Concert.
12.00	Münster	410	Sundays (irregular)	Religious Service.
12.05	Berlin	430	Weekdays	News.
12.15	Kbely	1150	,,	,,
12.15	Hamburg	395	Sundays	Concert.
12.15	Geneva (H B 1)..	1100	Weekdays	Weather.
12.15	Eiffel Tower (F L)	2600	,,	News.
12.25	Breslau ..	418	,,	Time and weather report.
12.30	Lausanne (H B 2)	850	Weekdays	News, time, signal, etc.
12.30	Moscow	3200	Irregular	Talk.
12.45	Radio Paris (SFR)	1780	Weekdays	Tzigane Orchestra.
12.45	Kbely	1150	,,	News, etc.
13.00	Brussels (B A V)	1100	,,	Weather report.
13.00	Eberswalde.. ..	2930	Irregular	Concert.
13.00	Munich	485	Weekdays	Time, weather, and news.
13.00	Radio Paris (SFR)	1780	Daily ..	News & concert.
13.00	Komarov	1800	Weekdays	News, etc.
13.15	Königsberg.. ..	463	,,	Market news.
13.15	Berlin (Voxhaus)	430	,,	News.
13.30	Hamburg	395	Th., Fri.	Market news.
13.45	,, ...	395	Mon, Tu., Wed.	,, ,,
14.00	Berlin (Voxhaus)	430	Mon. to Friday	Market prices.
14.00	Hamburg	395	Weekdays	Talk.
14.00	Breslau	418	,,	,,
14.00	Rome (Centocelle)	1800	,,	News, etc.
14.30	Münster	410	,,	,,
14.40	The Hague (PCGG)	1070	Sundays	Concert.
15.00	Münster	410	Weekdays	News, etc.
15.00	Königsberg ..	463	,,	,,
15.00	Berlin	430	,,	,,
15.00	Leipzig	454	Mon., Tu., Wed., Fri., and Sat.	,,
15.00	Frankfort	470	Sundays	Concert.
15.00	Breslau	418	,,	,,
15.00	Stuttgart	443	,,	,,
15.00	Paris (School of Posts)	450	Irregular	,,
15.10	Frankfurt	470	Weekdays	News.
15.30	,, ...	470	Daily ..	Concert.
15.30	Munich	485	Weekdays	,,
15.30	Berlin	430	Daily ..	,,
15.30	Königsberg ..	463	,, ..	,,
15.30	Hamburg	395	Sundays	,,
15.30	Leipzig	454	Weekdays	,,
15.35	Eiffel Tower (F L)	2600	Tues. to Friday	Stock Exchange quotations.
15.40	,, ,, ,,	2600	Weekdays	News.
15.45	Paris (School of Posts)	450	Wed. ..	Talk (irregular).
16.00	Breslau	418	Weekdays	Concert.
16.00	Frankfurt	470	Sundays	Talk.
16.00	Lyngby (O X E)	2400	,,	News.
16.00	Lausanne (H B 2)	850	Weekdays	Talk (irregular).
16.00	Kbely	1150	,,	News.
16.00	Zurich	650	,,	Concert.
16.05	Hamburg	395	Mon., Wed. and Fri.	Talk.
16.30	Paris (School of Posts)	450	Thursdays	Concert.
16.30	Radio Paris (S F R)	1780	Weekdays	News.

THE "P.W." BROADCASTING TIME-TABLE.

CONTINENTAL TELEPHONY TRANSMISSIONS.

(*Continued from page 1034.*)

G.M.T.	Station.	Wave-length in Metres	Days.	Nature of Transmission and Remarks.
16.30	Stuttgart	443	Weekdays	News.
16.30	Breslau	418	Sundays	Concert.
16.30	*Eiffel Tower (F L)	2600	Tu. to Fri.	Stock Exchange.
16.45	Radio Paris (SFR)	1780	Daily	Concert.
16.45	Stuttgart	443	Weekdays	,,
16.45	Hamburg	395	Sundays	Talk.
17.00	Leipzig	454	Daily	,,
17.00	Komarov	1800	Irregular	Concert and news
17.00	Cartagena (E B X)	1200	,,	Concert.
17.00	Hamburg	395	Weekdays	News, etc.
17.00	Frankfurt	470	,,	,,
17.00	Munich	485	Daily	,,
17.00	Brussels (S B R)	265	,,	Concert.
17.00	Barcelona (E A J 1)	325	Weekdays	,,
17.15	Zurich	650	Mon. Wed. and Fri.	Talk, etc.
17.20	Berlin	430	Daily	Talk.
17.30	Stuttgart	443	Irregular	,,
17.30	Munich	485	Weekdays	,,
17.30	Frankfurt	470	Mon., Tu., Thur., Fri. and Sat.	,,
17.30	Eiffel Tower	2600	Weekdays	Closing Prices.
17.40	Hilversum	1050	Irregular	Concert.
17.45	Radio Paris	1780	,,	Racing results.
17.50	Lausanne (H B 2)	850	Weekdays	Weather report.
18.00	Stockholm	470	Sundays	Concert.
18.00	Hamburg	395	,,	News, etc.
18.00	Stuttgart	443	Mon., Tu., Wed., Th., and Fri.	Time sig. and weather report.
18.00	Eiffel Tower (F L)	2600	Mon., Wed., Fri.	Concert.
18.00	Eiffel Tower (F L)	2600	Sun., Tu., and Th.	Talk.
18.00	Zurich	650	Weekdays	Weather report.
18.00	Brussels (S B R)	265	Daily	Concert.
18.15	Kbely	1150	,,	News, etc.
18.30	Seville (E A J 5)	350	Weekdays	Talk, etc
18.30	Hamburg	395	Sun. and Friday	Talk.
18.30	Breslau	418	Daily	,,
18.30	Leipzig	454	Weekdays	,,
18.30	Königsberg	463	Mon., Wed., Fri.	,,
18.30	Frankfurt	470	Mon., Wed., Th., Fri., and Sat.	,,
18.40	Münster	410	Daily except Sat.	Weather.
18.55	Hilversum	1050	Mondays	Children's hour.
19.00	Vienna	530	Irregular	Concert.
19.00	Königsberg	463	Daily	,,
19.00	Hamburg	395	,,	,,
19.00	Gothenburg	460	Tues., Fri. and Sun.	,,
19.00	Stuttgart	443	Daily	,,
19.05	Seville (E A J 5)	350	Weekdays	Concert, etc.
19.15	Zurich	650	Daily	Concert.
19.15	Lausanne (H B 2)	850	Irregular	,,
19.15	Leipzig	454	Daily	Concert, etc.
19.20	Eberswalde	2930	Th. & Sat.	
19.20	Stockholm	440	Mon., Wed. and Fri.	Concert.
19.20	Lyngby (O X E)	2400	Weekdays	News.
19.30	Stuttgart	443	Daily	Concert, etc.
19.30	Munich	485	Daily except Sats.	Concert.
19.30	Münster	410	Daily	,,
19.30	Berlin	430	,,	,,
19.40	Hilversum	1050	Sundays	,,
19.40	Seville (E A J 5)	350	Weekdays	Concert, etc.
19.40	Rome (I R O)	425	,,	,,
19.50	Berlin	430	Irregular	Racing results.
20.00	Stockholm	440	Saturday	Concert
20.00	,,	470	Tues., Thurs. & Sun.	,,
20.00	Königsberg	463	Mon., Tu., Th., Fri., Sat.	Concert.
20.00	,,	463	Sundays	,,
20.00	Geneva	1100	Irregular	,,
20.00	Lyngby (O X E)	2400	Weekdays	News.
20.00	Copenhagen	†750	Irregular	Talk.
20.00	Ryvang	1025	Tu. & Fri.	Concert.
20.00	Lyons	480	Weekdays	News & concert.
20.10	Ymuiden (PCMM)	1050	Saturdays	Concert.
20.10	Hague, The (PCGG)	1070	Irregular	,,
20.15	Brussels (S B R)	265	Daily	News and concert.
20.15	Stuttgart	443	Daily except Wed.	Concert.
20.15	Königsberg	463	Daily except Sun. and Wed.	,,
20.30	Paris (School of Posts)	450	Daily	,,
20.30	Radio Paris (SFR)	1780	,,	News & concert.
20.30	Rome (I C D)	1800	Irregular	Concert.
20.30	Frankfurt	470	Daily	Talk.
20.30	Leipzig	454	Weekdays	,,
20.30	Munich	485	Irregular	,,
20.40	Hilversum	1050	Fri. and Sun.	Concert.
21.00	Berlin	430	Daily except Tues.	Time signal and weather report.
21.00	Frankfurt	470	Daily except Tues.	Concert.
21.00	Hamburg	395	Daily	Talk.
21.00	Eiffel Tower	2600	Irregular	,,
21.00	Barcelona (EAJ1)	325	Weekdays	Concert.
21.00	Lyngby (O X E)	2400	,,	News, etc.
21.15	Stuttgart	443	Sun., Mon., Th., Fri. and Sat.	Time signal and weather report.
21.30	Paris (Petit Parisien)	345	Irregular	Concert (generally Tu., Th. & Sun.)
21.30	Frankfurt	470	,,	Talk.
21.30	Madrid (Radio Iberica)	392	Daily	Concert.
21.40	The Hague	1050	Irregular	,,
21.50	Hamburg	395	Weekdays	Ten-minute talk.
22.00	Radio Paris (SFR)	1780	Irregular	Dance music.
23.00	Eiffel Tower (F L)	2600	Weekdays	Weather, etc.

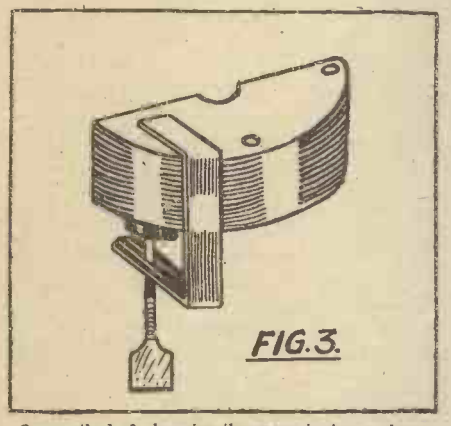
* Note.—Time altered to 16.45 on 1st and 15th of the month. † Subject to alteration.

CONVERTING A CONDENSER TO SQUARE LAW TYPE.

By R. H. COWTAN.

THE writer ventures to suggest that once a reader has used a square law condenser in his tuning circuit he is never likely to revert to the older type.

When one considers the huge number of the older type of variable condensers that must have been sold during the past two years, it cannot be expected that the great majority of readers will scrap these instruments in order to purchase the later and certainly more useful square law type. Further, many of our existing condensers are good jobs, and worth keeping.

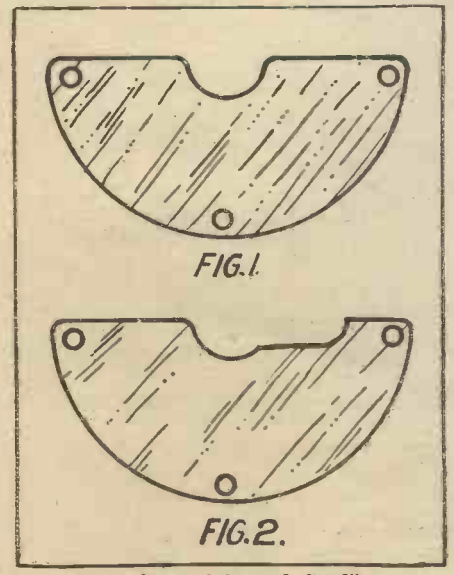


One method of clamping the vanes is shown above.

Easier Tuning.

The writer, after some experimenting, has hit upon quite a simple and practical plan for converting existing variable condensers into the modern square law type, and he is pleased to give fellow-readers the benefit of these experiments in the following detailed explanation.

As a foreword, let me explain that I do not pretend that the converted variable condenser will in every case give the exact straight line "curve" of the best square law type now manufactured by the people who give their particular attention to condensers, but what I do claim is that in every case the conversion will repay every reader for his trouble by more gradually increasing the capacity of the condenser as the moving vanes are closed, and so do away with the grouping of several stations within a degree or two of each other.



The fixed vanes before and after filing.

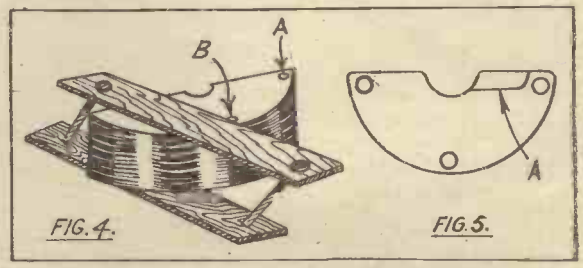
In the case of an ordinary standard variable condenser recently converted I found that several stations that had come in within 10 degrees, after conversion required 30 degrees to bring them all in. Tuning becomes more simple and satisfactory, although the conversion reduces the total capacity of the condenser slightly.

Removing the Vanes.

The method of conversion employed by the writer is to change the shape of the fixed vanes from the usual shape (Fig. 1) to the shape as shown in Fig. 2. The two halves of the fixed vanes no longer being equal, the capacity more gradually increases as the movable vanes are closed.

To secure the result, remove your condenser from the set, take off the bottom end of aluminium or ebonite, then carefully remove the moving vanes and lay them aside intact. Now carefully remove the fixed vanes and spacers from the three rods and put the spacers into a box so as not to lose them. Pack all the fixed vanes evenly together and clamp them as in Fig. 3. If you do not possess a clamp, the vanes may be securely held together by two strips of wood, screwed together at the ends as in Fig. 4.

Having got the fixed vanes securely fixed together, it is a good plan to scrape a couple of scraps of wood and push them tightly through the holes A and B in the vanes, thus preventing any possibility of the vanes shifting.



Another method of clamping before filing, as in Fig. 5.

Reassembling.

Now mark out a curve on the top vane as in Fig. 5 (A). Fix the group of vanes in a vice, and with a file—preferably a half-round file—rub down the vanes to the curve, leaving them as in Fig. 2.

Having filed the group quite evenly, remove the vanes from the vice and clamp, and very carefully trim up any burr the filing has left.

Reassemble the condenser, mounting the fixed vanes and spacers on the three rods exactly as you found them. Replace the moving vanes and end plate, and, only if necessary, adjust the set screw that varies the spacing of the moving from the fixed vanes. If the fixed vanes are of fairly stout gauge, and have been carefully filed, the condenser will be easily refitted. Should, however, the moving vanes touch the fixed ones in any place, and the fault cannot be remedied by the adjustable screw in the end plate, then the offending vane should be carefully eased with the flat of a screw-driver.

A valve set in a bottle. A New York "freak" set.

Before finally replacing the condenser into the set, make quite sure that the clearance of the vanes is perfect by testing with a pair of 'phones and dry battery in series placed across the terminals of the fixed and moving vanes. If a click is heard in the 'phones as the moving vanes are rotated, then the vanes are touching, and the fault must be found and cured. The task is not so difficult as would appear.

In conclusion, it is, of course, quite easy to build up square law condensers from ordinary parts by following the instructions given above.

MORE ABOUT THE NEUTRODYNE REFLEX RECEIVER.

By G. J. MARCUS.

Further helpful details are given in this article about the popular Unidyne Neutrodyne Reflex Set recently described in "Popular Wireless."

IN consequence of the large number of inquiries received by the writer regarding this circuit, it is thought that these further details may be of help to those enthusiasts desirous of constructing this Unidyne Reflex set.

In the first place, there is nothing complicated about the receiver; it is just an ordinary reflex set, which has been gradually modified and improved until the best possible results were obtained.

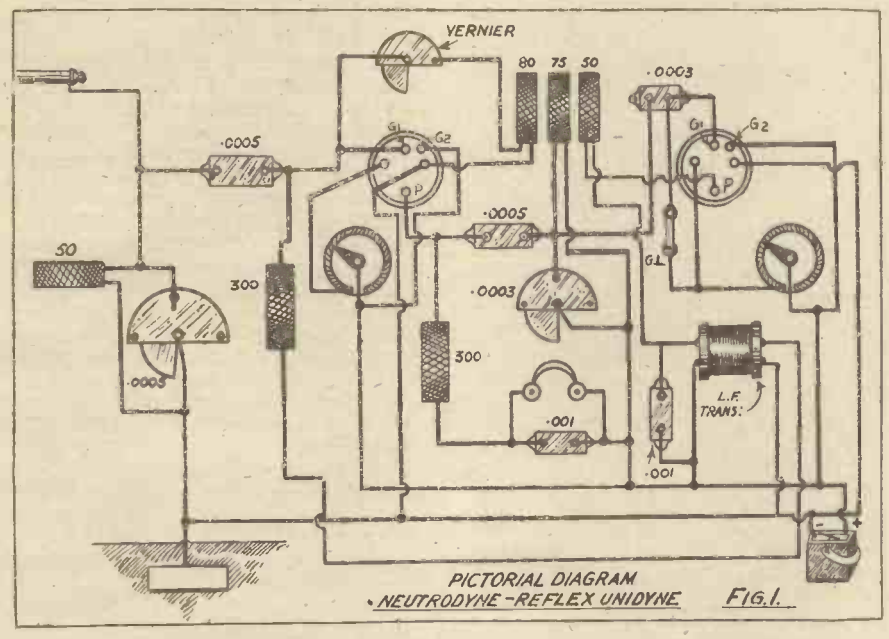
The neutrodyne principle was incorporated in order to get the most out of the H.F. valve and, at the same time, to prevent howling. This alteration was a complete success, and more than doubled the range of the set. The Unidyne circuit was added to cut out the H.T. battery, and has been a great improvement; all the troublesome internal noises associated with the H.T. supply were at once eliminated, and reception became wonderfully "silent."

Constructional Details.

The set is quite easy to construct, and if due care is observed in regard to spacing, etc., there is no reason why excellent results should not be obtained.

Another point about which correspondents seemed to be rather uncertain was the radio choke. This consists of two simple basket coils (each wound with a hundred and fifty turns of No. 30 D.C.C. copper wire) connected in series and mounted not less than an inch apart. It is important to keep down the self-capacity of the choke in order to prevent leakage by H.F. losses.

The components need not be of any special make so long as they are thoroughly efficient. It is, however, necessary to exercise great care in the choice of the L.F. transformer, because a poor or unsuitable transformer will spoil the performance of the whole set; the ratio must not be higher than 4 to 1. A pictorial diagram of the connections is given in Fig. 1.



PICTORIAL DIAGRAM NEUTRODYNE-REFLEX UNIDYNE FIG. 1.

The circuit described in the last article on the Unidyne Reflex was designed principally for the broadcast wave-lengths. Since then a few simple alterations have been introduced to adapt the set to the higher wave-bands (Fig. 2).

The Neutrodyne Control.

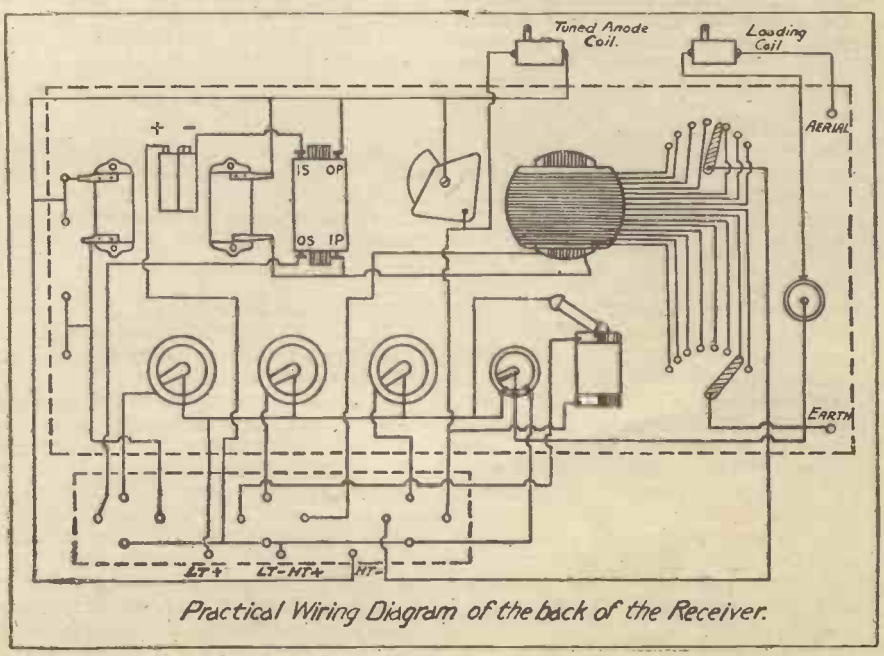
It will be noticed that transformer has been substituted for tuned anode coupling, and that the No. 300 radio chokes have been replaced by larger coils of 450 turns. With this circuit very satisfactory reception is possible on all wave-lengths.

Finally, it is necessary to emphasise the importance of the neutrodyne control, for the range and selectivity of the receiver depend upon the correct setting of the vernier condenser. It is therefore essential to adjust this condenser to its best value.

HOW TO WRITE FOR "P.W."

Readers of "Popular Wireless" are cordially invited to submit constructional articles for publication at our usual rates.

Articles should deal in detail with the construction of receivers and at least six clear photographs should accompany the MSS. A fee of 10s. 6d. is paid for each photo used. MSS. should not exceed 2,000 words in length and if not typed should be written on one side of the paper only. Diagrams may be submitted in pencil. Accuracy and lucidity are essential in any constructional article submitted.



Practical Wiring Diagram of the back of the Receiver.

A REPLY TO MR. MATHESON LANG.

By PHYLLIS PANTING.

Our contributor, Miss Phyllis Panting, has performed in several of the Radio Plays broadcast from 2 L O, and in this article has something interesting to say about the recent interview with Mr. Lang, which was published in "P.W."

I WAS annoyed—very annoyed! How could Mr. Matheson Lang be so absurd? How could he even suggest such things? How could—— But I had better begin at the beginning.

My telephone rang. It was the editor of POPULAR WIRELESS.

"Good afternoon," said he. "I am told that you have performed in a number of wireless plays?"

"Yes, quite right," I murmured, trying hard not to sound pleased.

"Then perhaps you would care to give us your views on broadcast plays. In one person's opinion they are utter failures!"

"Really!" I replied coldly. "But then one person doesn't matter at all compared——"

"Ha! Wait a moment!" rasped the Editor of POPULAR WIRELESS. "This opinion happens to belong to Mr. Matheson Lang!"

And so, considerably humbled, I have read Mr. Matheson Lang's views on the broadcasting of plays, and with all due deference I will give mine.

Why Worry.

Doesn't Mr. Matheson Lang really give himself away right at the commencement of his interview? "*I really have not given the matter very much thought,*" he says. That left me wondering what prolonged thought might evolve from the busy brain of Mr. Lang—the molehill might certainly develop into a mountain! And again, "*Broadcasting as an entertainment does not appeal to me very much.*" That surely puts him out of court either as a witness for the prosecution or the defence.

Later, Mr. Lang observes: "All experiments in broadcast plays have, in my opinion, proved so far a failure that they do not endanger our profession in the least." Then why worry about it? Have every one of Mr. Lang's experiments been so successful that he can afford to throw stones?

A Good Training.

I am not quite clear whether or not Mr. Lang's chief objection is to the broadcasting of plays running in any London theatres, or the one act wireless plays performed by artistes engaged specially by the Broadcasting Company.

The short wireless plays that have been broadcast once a month or so have, far from being "a smuggler who can sell his spirits cheap," been a blessing to actors and actresses who are not in the fortunate position of Mr. Lang. To actors and actresses no longer young enough to appear on the legitimate stage, to young actors disfigured in the war, or actresses who can never be successful on the stage because they are too plain or too awkward, the radio play has proved a God-send. I performed in a wireless play quite recently where four professional actors were engaged, and one of them no less a person than Mr. Matheson Lang's own understudy! It keeps the pot boiling between engagements and lessens the terror of the forced rest so many are obliged to take nowadays. Irrespective of personal attractions, you can succeed if you have a suitable voice and can act with it.

What training it is too! There is no harder taskmaster than the microphone. Every little false inflection or mispronounced word is magnified a hundred times, and the knowledge that when the little red light over the studio door lights up, you are then—mentally speaking—face to face with

Miss Phyllis Panting.

a million people, is sufficient to make you put all your endeavours and acting powers into your voice.

This is not always the case when on the stage, where a beautiful face or dress will serve as the greater attraction. Personality, dresses, make-up, lights, and the audience count for so much. When left with nothing but the voice to convey all these things it can be realised that to achieve the success the radio play has already achieved must have been the result of great effort and hard work.

The wireless actor has not an easy task; we would far rather play on the stage and feel the approval, sympathy, delight, and, above all, to hear the applause at the end of our effort. I wish people would realise how much we miss this, and would, when they have particularly enjoyed a play, write at once and tell us so.

Mr. Lang also attacks the selection of plays. If the British Broadcasting producers need defence it surely is in this: That while Mr. Matheson Lang, who as a successful actor has fortunately only to consider an occasional change of programme, the selectors of the programme for the B.B.C have to select not one but many, and that while Mr. Lang has only the tastes of the few—comparatively speaking—who make up the audience of a theatre to consider, the producers at the B.B.C. have the varied tastes and requirements of the innumerable unseen throng, who compose the audience of radio plays, to please.

Broadcasting is still in its infancy—and a very wonderful infant it is. The mere fact that Mr. Lang hopes for the sake of his profession that broadcasting will soon develop a distinctive personality of its own proves it.

I do not agree when he states that one gets so sick of the serial "continued in our next" effect. I have met numbers of people who, in the ordinary way before they possessed a wireless set, hardly ever went to the theatre. Now they hear part of a play, or the opera, and are tempted to "leave their comfortable homes and to spend their hard-earned money" to go and see the end. It most certainly induced people who had never seen the opera to go and go again countless times during the last season.

The Order of the Bath.

The greatest weakness of the radio plays, in my opinion, is the difficulty of getting over the right sounds for different noises, such as bullets, wind, rain, sea, swords, etc. But I think listeners-in will agree that recently these effects have been getting more and more realistic. I once saw a very amusing incident in connection with this.

During a certain play a large bath of water was put in front of the microphone to get some effects needed, and one actor who was terribly anxious that the right sound should be got, in his anxiety slipped and fell right into the bath! How he and his fellow actors finished the play I will leave to your imagination.

And now to conclude. I hear that Mr. Matheson Lang is now willing to give us of his bounty a scene from "The Wandering Jew" from 2 L O. I am sure it will whet the appetite of at least one amongst his numerous admirers—to see as well as listen to the rest. To be "continued in our next," you know!

THE RADIO PLAY.

By R. E. JEFFREY.

THAT the broadcast play is daily becoming more popular is evinced by our increasing mail on the subject. As we gain in experience with special studio plays, artistes, and effects, so will radio drama be made even more acceptable than it is at present.

It took some ten or fifteen years to develop the film industry, and to present screen plays which would interest the majority and survive criticism. We shall not, in fact, cannot allow ourselves such a protracted period. Excellent broadcast studio plays are things of the immediate future.

As a result of the recent repeat broadcast of Richard Hughes' play, "Congo Night," our programme correspondence department is overwhelmed with letters containing encouraging messages and many helpful suggestions. How can we fail to develop this new art when the goodwill and the assistance

(*Concluded on page* 1061.)

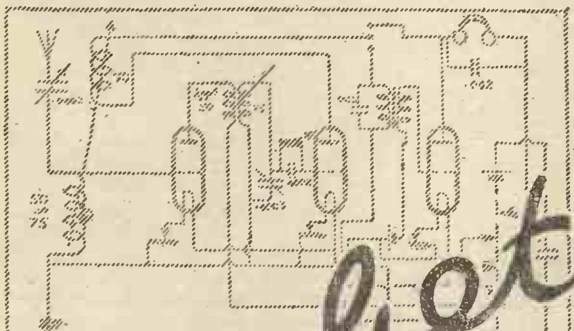
(Reproduced by permission from "Popular Wireless" of May 17th, 1924).

HINTS ON H.F. AMPLIFICATION.

Some useful points that will help amateurs to get the best out of their receivers.

Get that "long distance" feeling with Cossor valves!

NEARLY every amateur who has taken up valve reception has joyfully graduated from one valve to two valves or more by adding L.F. amplification, and has felt very pleased with himself and with the volume of sound he has obtained. Then, one day, he has decided that his set is not quite sensitive enough, and has decided to add an H.F. stage. This has probably proved more of a problem, for not only has



he to decide on the type of amplifier, but has also to get it to work after the construction has been completed.

There is nothing difficu[illegible] getting good results out of a set wit[illegible] H.F. stage, provided one goes ab[illegible] struction carefully, and realise[illegible] dealing with H.F. impulses, [illegible] the frequency of these currents [illegible] constantly changing with the wave-length. A great many amateurs fail to get the b[illegible]t out of their sets because they do not p[illegible] sufficient attention to the tuning of the [illegible] ci[illegible] —that is, those circuits before [illegible] valve.

Efficient Type of Coupling.

Another point that does [illegible] receive sufficient consideration from those who go in for multi-valve sets having [illegible] or more stages of H.F. amplification [illegible] the method of coupling the various circ[illegible]. [illegible] practically no use to emp[illegible] capacity coupling if you w[illegible] in stations on 400 metres or [illegible], unless a large number of valves are used.

For average reception on wave-lengths between 300 and 1,500 metres the tuned anode type of coupling is usually considered to be the most efficient, though transformer coupling runs it very close, especially as the wave-length increases.

For very short wave-lengths the tuned anode coupling tends to become ungovernable owing to its tendency to cause self oscillation. This trouble, therefore, naturally becomes more prominent as the frequency increases, and every little bit of unwanted capacity has a surprising effect upon the operation of the receiver.

Potentiometer control of the grids of the H.F. valves should be avoided as much as possible by paying great care to the lay-out and spacing of the components when the set is constructed. Grid and plate leads should be kept as far apart as possible and should never run parallel. Valves should also be kept apart, and the capacity between the electrodes eliminated as far as is practicable by using short valve legs.

The Neutrodyne.

There are various ways of stabilising H.F. circuits, such as potentiometer control, inserting resistances in the plate circuits and reverse reaction, as is utilised in the neutrodyne circuits. The least troublesome method is the potentiometer, though [illegible] may not be the [illegible] efficient. [illegible] well-adjus[illegible] n[illegible] ne[illegible] probably [illegible] stabilis[illegible].

Among [illegible] types of H.F. coup[illegible] there is one that has been little used up to the present—that of loose coupled transformer coupling. [illegible] class the [illegible] of [illegible] transform[illegible] of the [illegible] usual, and the [illegible] and satisfactory [illegible] amplification.

U[illegible] three [illegible] and loose coupled H.F. sta[illegible] with reaction, all the B.B.C. [illegible] with the exception of Aberdeen [illegible] on a large loud speaker [illegible] touch [illegible]. Situated [illegible] west of [illegible] no difficulty [illegible] tuning [illegible] out [illegible] any of the other [illegible] exception of Cardi[illegible] Cardiff [illegible] but London [illegible] and carrying on [illegible] the [illegible].

[illegible] the circuit, as will be [illegible] diagram, is quite convention[illegible] two-coil holder t[illegible] the pl[illegible] the usual tuned an[illegible] the socket for an H.F. [illegible] connections to the two-[illegible] similar to those [illegible] to the four legs of the H.F. [illegible], with the exception mentioned before, namely, that the secondary coil is tuned instead of the plate circuit of the H.F. valve.

Increased Selectivity.

This proceeding enables great selectivity to be obtained, and also, provided the coils are kept fairly loosely coupled, renders the H.F. stage more stable, as there is less likelihood of oscillation taking place because of the capacity reaction due to the inter-electrode capacity, which makes itself so felt if the grid and plate circuits of a valve are in tune. By using a fixed coil in the plate circuit of the valve there is little chance of the grid and plate circuits becoming in tune unless the coupling between the two transformer coils is tightened so as to cause a certain amount of mutual tuning between the tuned and untuned coils.

Tuning with this circuit is, of course, sharp, though not unduly so, and it has been found to be best to commence tuning with the H.F. coils fairly tightly coupled, even if oscillation is likely to occur, for this can be cured by slight loosening of the coupling.

When rough tuning has been accomplished the coupling should be varied, together with the tuning, until maximum results are obtained. It will be found that there is a "best point" of coupling for each wave-length, though the difference between the positions for adjacent wave-lengths is not very noticeable.

For [illegible] loud loud speaker work on dista[illegible] stations an additional note magnifier can [illegible] added. In this case the input of [illegible] transformer should be connected to the [illegible] terminals while a separate H.T. [illegible] be necessary. A separate grid bias battery would be an advantage while a power valve could be used if desired.

It will be noticed that each valve has an adjustable [illegible] potential so that each valve [illegible] under the best con[illegible] individual control is really [illegible] H.F., Det., and L.F. stages [illegible], if the utmost is to be obtained out of the receiver. The high tension battery sho[illegible] be capable of supplying up to 120 [illegible] especially if four valves are to be used.

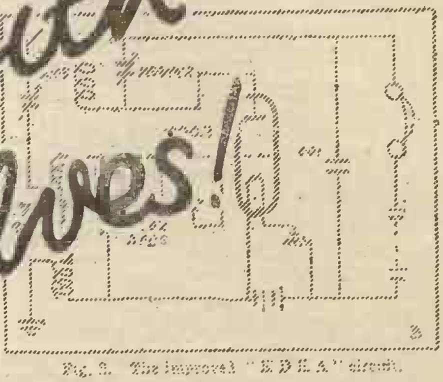


Fig. 2. The improved "K D K A" circuit.

By this time W G Y and K D K A had both been clearly received, but it was considered that greater freedom from static and other interference could be obtained. Ordinary tuned transformer coupled high-frequency amplification was tested, from four down to two stages being used with good results, and it is interesting to note that greater trouble was experienced from "X's" when the transformers were [illegible]

Separate H.T. Control.

Finally, as regards coils, it is best to use the basket type of coil, wound with fairly heavy gauge wire. Duolateral coils have not proved so satisfactory as the home-made basket coils wound on cardboard formers, though they can be used if desired.

For those who are badly jammed by the local station, two stages of this type of coupling should be very valuable, as it is undoubtedly the most selective method of coupling yet tried, and has the added advantage of a very fair degree of stability

HOW TO CONSTRUCT
A NOVEL FOUR-VALVE SET.

By J. E. DORRIAN.

This receiver will bring in several B.B.C. stations at good loud speaker strength, and is more selective than many types of "straight" circuit receivers.

THE four-valve set described below possesses the following advantages.

It receives several B.B.C. stations at good strength on the loud speaker. The quality of tone and speech is irreproachable.

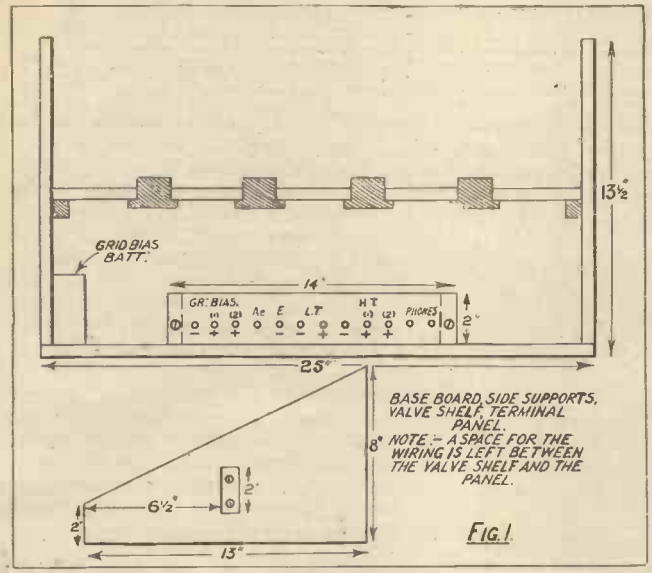


FIG. 1.

It is more selective than many average "straight circuit" receivers, and is designed so as to strike no discordant note in an ordinary living-room. As terminals and leads are excluded from the panel, the set rivals in appearance as well as in performance a fifty or sixty-guinea commercially made set. The tuning range is about 200–4,000 metres, but there are no coils to change or manipulate. The set, if tuned, can be set in operation by turning one knob—a master filament control. The cost of the complete station, using first-class materials throughout, is not great.

An account of the actual making of the set of which the photographs are reproduced will probably be of most service to anyone contemplating the construction of something similar to it.

In the writer's case, the apparatus fits into a china-cabinet and the dimensions given were adapted to this end. The circuit consists of one H.F. valve followed by a detector and two L.F. stages, either or both of which may be cut out by double-pole double-throw switches. The components required, and those which are actually in use in the writer's set, are as follows:

Tapped coil aerial tuner. Tested: Lissen. (Avoid "dead end" effects.)

Regenerative Anode Reactance. Tested: Lissen.

Aerial tuning condenser. Tested: Sterling square law ·0005 with vernier. (Square-law type gives easier tuning.)

Anode tuning condenser. Tested: Ormond Vernier.

Four valves. Tested: H.F.—Cossor Pink Top; Det.—Cossor; L.F.—(1) Cossor, (2) Marconi L.S.3. (A power valve as last stage prevents distortion.)

Use Efficient Transformers.

Two L.F. transformers. Tested: (1) Silverfown, (2) Radio Instruments. (Don't attempt to economise here.)

Four filament rheostats. Tested: Igranic.

One master rheostat. Tested: 2 amp. Metro.-Vickers. (Must be capable of passing 2 amps without heating.)

Grid leak. Tested: Bretwood Variable. Fixed condensers—·0003, ·001, ·001, ·002. Tested: Edison Bell.

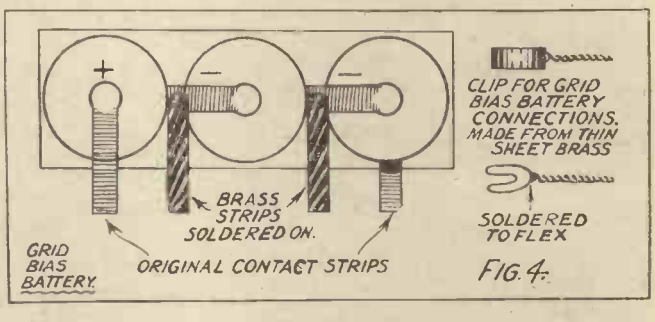


FIG. 4.

100,000 ohm. variable resistance. Tested: Lissen.

Four valve windows. Tested: Circular, nickel-plated.

(*Fig. 2 appears on page 1042, the continuation of this article.*)

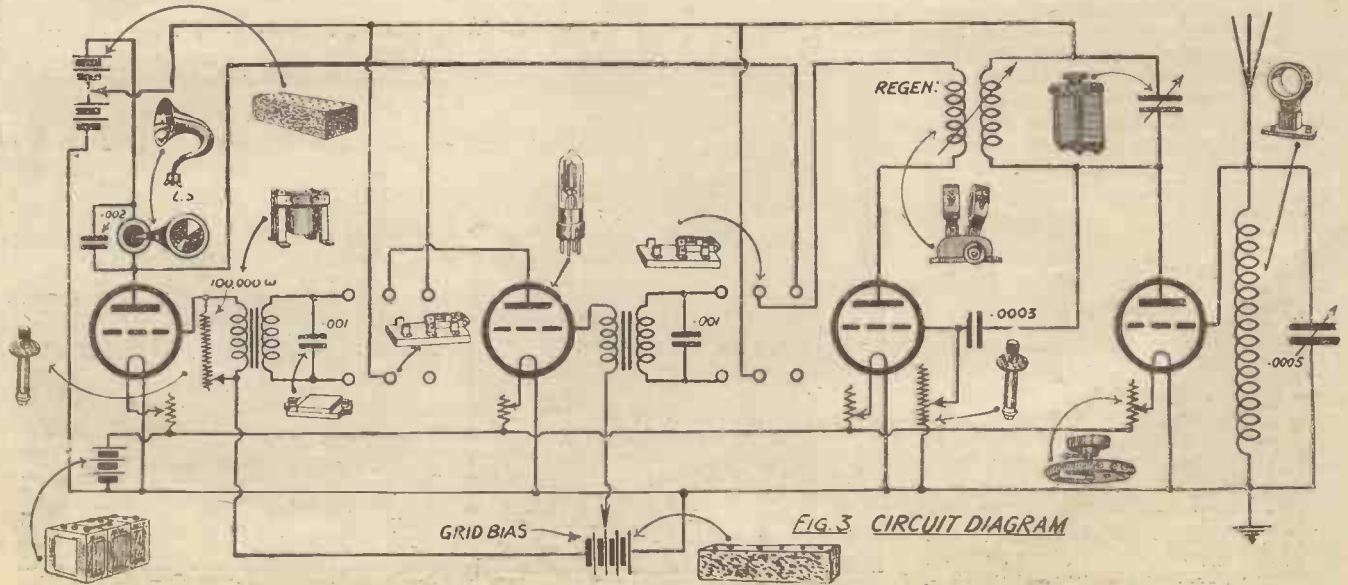


FIG. 3 CIRCUIT DIAGRAM

A NOVEL FOUR-VALVE SET.

(*Continued from page* 1041.

Two D.P.D.T. switches. Tested: "Miniature," nickel-plated.

Earth and aerial plugs and sockets. Tested: "Gecophone" type.

Telephone plug and jack.

Four-valve holders. Tested: Bushed type.

Twelve terminals. Tested: Telephone type.

Connecting wire—9 yards. Tested: Busbar (square section).

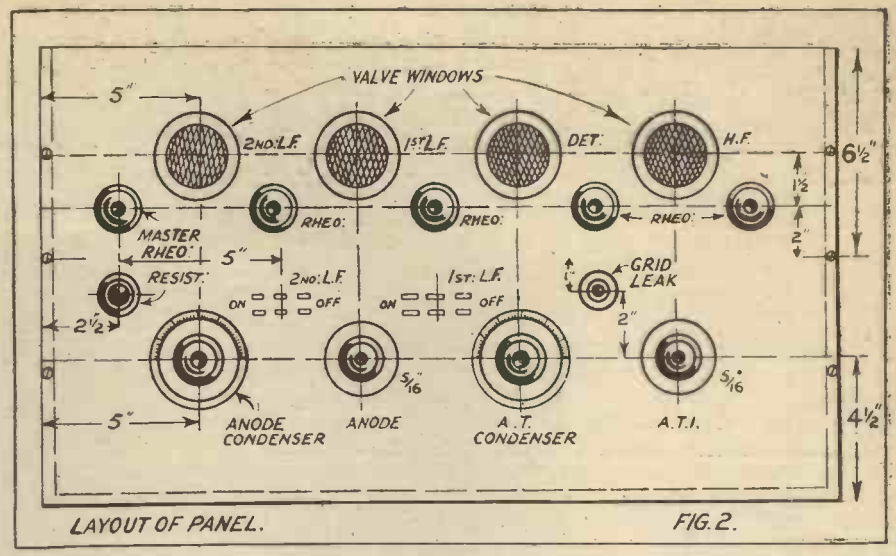
Ebonite: 25 × 13½ × ¼ in. panel; 3 × 3 × ¼ in. aerial and earth and 'phones panel; 14 × 2 × ¼ in. terminal strip.

Wood: 25 × 8 × ½ in. base board; 24 × 2½ × ½ in. valve shelf; 13 × ½ × 2 in. sloping to 8 in. side supports.

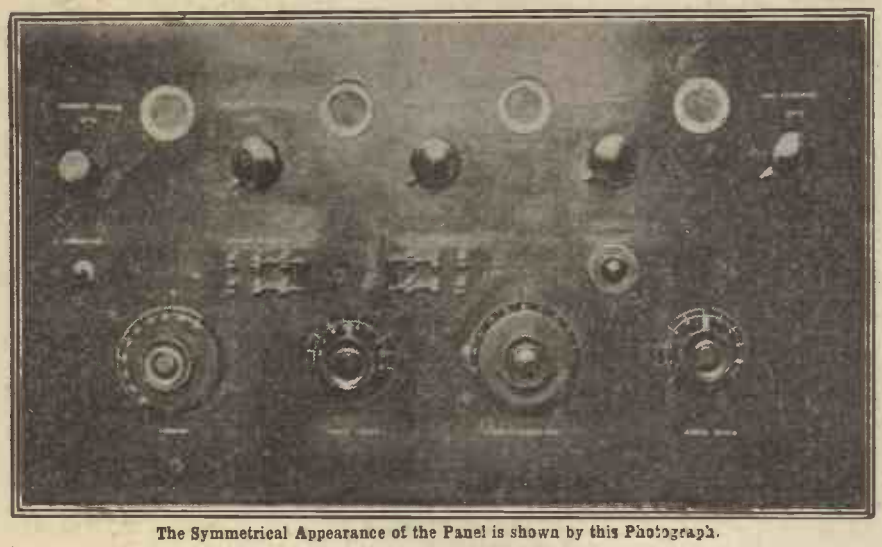
Grid bias batteries. Tested: Two Ever-ready 4½ v.

H.T. battery. Tested: Three Siemens' 66 v.

Accumulator. Tested: 6 v. 80.



LAYOUT OF PANEL. FIG. 2.



The Symmetrical Appearance of the Panel is shown by this Photograph.

The components were all set out on a table, and with a circuit diagram in sight, a drawing on a scale of 3 inches to 1 foot was made of the panel showing the proposed arrangement of the components. As will be seen by the diagrams and photographs reproduced, the transformers are placed on the base-board, at right-angles to one another, thus relieving the panel of their considerable weight.

Neat Lay-Out.

The terminals are mounted on the long strip of ebonite, and placed about 1½ inches from the edge of the base-board, so that they clear the back of the cabinet. The aerial, earth, and 'phones' plugs are mounted on the 3 in. square of ebonite, and fixed to the side of the cabinet, clearance holes being drilled in the wood. These plugs and the batteries which lie hidden on a lower shelf are connected to the terminals of the set itself by pieces of well-insulated flex, long enough to permit of the set being drawn off the shelf, or out of the cabinet sufficiently to give one room to disconnect the leads for removal.

As will be seen, the position of the components on the panel is fixed by reference to certain lines. One, drawn 6½ in. from the top of the panel, represents the level of the valve shelf, another fixes the level of the valve windows, another that of the filament resistances, and so on. When the drawing was completed it was checked over several times in order to detect any mistake or discover a possible improvement, the cost of the panel being an incentive to care. Meanwhile, the panel was prepared by removing the surface skins with No. 0 glass-paper. The front face was then finished by rubbing with a paste of linseed oil and fine whiting, followed by vigorous polishing.

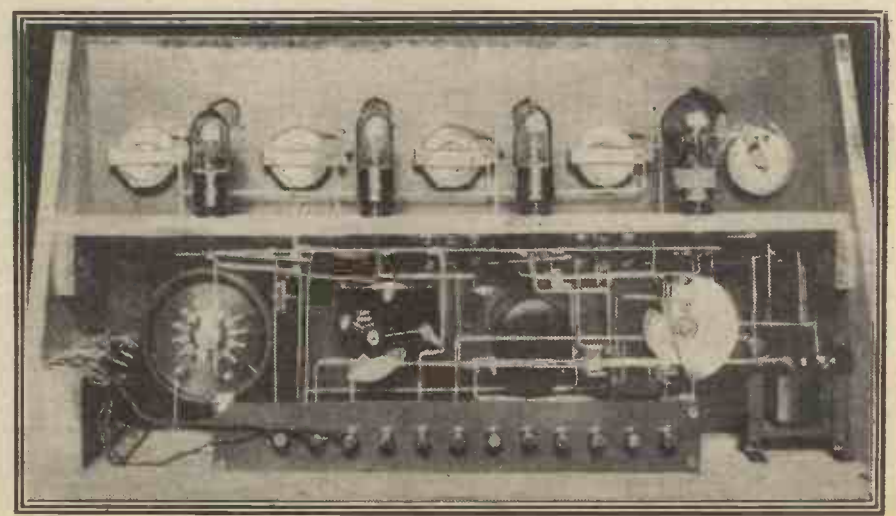
When the panel arrangement had been definitely decided upon, the guide lines and drilling centres were drawn with a scriber on the back of the panel. Care must be taken in this operation, rule and set-square being more reliable than a "true eye." Templates were supplied with most apparatus and made accurate drilling possible. It is worth while noting that some templates must be marked from the front of the panel, but by pricking through the centres they can be turned over and used on the back.

Drilling the Panel.

Each hole was started with a rose-bit to prevent the drill from "wandering." A one-sixteenth-inch drill was then sent through each position from back to front of the panel, and then, working from the front, each hole was made the correct size, a carpenter's brace and bits being used. By this means every hole on the front of the panel had a clean edge.

The panel was then fixed to the base-board, and the components, valve shelf, and

(*Concluded on page* 1065.)



This View of the Interior shows the Lay-Out and Neat Wiring of the Set.

Mainly About Broadcasting

by The Editor

THE decision made by the producers of the musical comedy "Poppy" to cancel their arrangements with the B.B.C. for broadcasting extracts from the show did not come as a very great surprise to those connected with the theatre.

The power of the managers of provincial theatres is very considerable, and their threat to refuse to book "Poppy" when it toured in the provinces was too serious a one for those financially interested in the show to contemplate with equanimity. And so the play will not be broadcast. Stupidity, narrow-mindedness and obstinate prejudice have triumphed.

People with a little vision and more capacity for the impartial consideration of proved facts, will probably smile at the West End Managers Association and those who side with them and their opinion that the broadcasting of plays affects box-office receipts adversely.

But the broadcasting of extracts from "Patricia" has done a lot of good.

Curiously enough, some days before I heard that the B.B.C. contemplated relaying from His Majesty's Theatre, I asked "Ariel" to interview Mr. Matheson Lang on the question of theatre broadcasting.

A Cul-de-Sac.

Now Mr. Lang is at present acting in the play "The Wandering Jew," at the New Theatre, London, and the result of his talk with "Ariel" was published recently in "P.W." But a few days after the interview, "Patricia" was broadcast, with the result that the box-office bookings went up 200 per cent. and several theatre managers began to wonder if they had jumped to wrong conclusions about broadcasting.

Anyway, noting how strong were Mr. Lang's views on the broadcasting of theatre plays, and how adverse he seemed to the whole idea, it was rather amusing to hear that, after the success of broadcasting "Patricia," he was one of the first of the "Die-hards" to make overtures to the B.B.C. with a view to broadcasting part of "The Wandering Jew."

I understand that two proposals were made. One, that part of the play should be broadcast from the New Theatre; or, two, that Mr. Lang should bring his company to 2 L O one Sunday evening and do the job solely for the benefit of listeners!

But from what I can gather, "The Wander-Jew" will not be broadcast. The powers that be at the New Theatre—and most of the power is vested in Lady Wyndham—have rooted objections to the broadcasting of plays, and Mr. Lang will probably not be allowed to have his play broadcast from the New Theatre. And as 2 L O refuses to broadcast plays on a Sunday, Mr. Lang is now in a *cul-de-sac*.

* * *

It is only fair to the B.B.C. to say that that company does not care two straws whether theatre managers agree or disagree about the broadcasting of plays. The B.B.C., quite rightly, do not attach enormous importance to the broadcasting of plays.

True, an occasional transmission of a theatre play makes a pleasing novelty, but the progress of the B.B.C. will not be retarded one jot if the ban is never lifted.

In fact, all this controversy about the broadcasting of plays is doing the B.B.C. a world of good.

The company is young enough yet to be a little amateurish and aloof about publicity matters; broadcasting itself is sufficiently novel to provide a good deal of free publicity for the company; but a day will come, and quite soon, I believe, when publicity will prove vital to the B.B.C.

In the early days of railways a publicity manager was superfluous; to-day, every railway company—in fact, every public transport company—employs a trained publicity staff.

Paid advertisements alone are not sufficient, and the B.B.C. will eventually find this out. It is the "story" in the news columns of papers and periodicals—the "Editorial Mentions" that are valuable; and just lately the B.B.C. have had a wealth of free publicity of a news character, thanks to this controversy over broadcast plays. And so have the theatres, for that matter.

But I firmly believe that the radio play will eventually so develop that "outside" transmissions from theatres will compare ill with the specialised art of radio play production.

Let me quote Mr. A. B. Walkley, the famous dramatic critic of "The Times," who recently wrote in that journal an interesting article about broadcasting.

"High comedy, the comedy of brilliant dialogue and verbal wit is, of course, outside their range (of the cinema producers). That must be left to the regular stage. . . . When all is said, however, I think the fascination of 'wireless' is the greater."

"Sound Plays.

Mr. Walkley propounds a most interesting problem. Which, he asks, of the two fragmentary worlds (the worlds of films and wireless broadcasting) is further removed from the real complete world: the invisible or the inaudible?

Mr. Walkley thinks that when listening-in the imagination always tends to complete the sounds heard with a picture of a scene.

Leslie Henson and some "stars" at the Winter Garden Theatre listening to the broadcasting of "Patricia"

And if the B.B.C. produce the right kind of play for the microphone—a play in which the dialogue is of paramount interest and importance, and which does not demand an excessive strain on the listeners' imagination, both as regards following the sense of the text and the visualisation of the scene and the play, they will soon make "Sound Plays" very popular indeed.

At the moment they show signs of decided improvement—thanks to the skill and imagination of the newly-appointed radio play producer—but I hope that later on the B.B.C. will produce plays which need no spice in the shape of "off stage" effects, etc., to hold the attention and interest of the listeners.

In conclusion to this somewhat wandering article, I would like to suggest that the B.B.C. endeavour to persuade Mr. Michael Arlen to let them produce, in the form of a radio play, that most amusing tale of his—"Shelmerdine at the Telephone," I believe it is called, the last story in the book of stories, "These Charming People."

There you have an ideal example of an ideal radio play.

Artistes of the Aether

By "Ariel"

Some of those who have given you pleasure when listening-in.

BY the time this appears in print, the music-hall system of "two houses nightly" will have been adopted for wireless purposes. One programme, we presume, will be confined to the dull—I mean the most classical of compositions, while the other will endeavour to "soothe the savage beast" after his day's work at the office. At any rate, let us hope that this is so, for thereby lies satisfaction for all parties. Not that I believe for a moment it will stop grumbles, for, to quote Sir W. S. Gilbert, "Isn't our life extremely flat when there's nothing whatever to grumble at?" It is to be hoped that the new high-power station to be built near Daventry, in the Midlands, will answer all requirements.

M. Pierre Monteaux.

5 X. X.'s Future.

Naturally, the engineers are the most important people to settle this point, and one of the best is Captain Herbert W. Litt, who has been appointed as engineer-in-chief, commencing from the New Year. Few people realise the great work Captain Litt has done in connection with simultaneous broadcasting, and it is due to his work that so many of the difficulties have been overcome. Captain Litt has had charge of nearly all the S.B. of important speeches and functions, and will be specially remembered for his work in broadcasting the King's speech at the opening of the Wembley Exhibition.

S.B. to All Stations.

Light operas appear to be a satisfactory medium for "all stations" programmes, and the recent performances of Bizet's "Carmen" and "The Rose of Persia" had excellent casts, including several B.N.O.C. stars, William Heseltine, Joseph Farrington, Denis Noble, and Gertrude Johnson, but just lately returned from Italy, as well as another popular singer, Mr. John Huntingdon.

Miss Edith James.

"The Rose of Persia" was the first opera written by Sir Arthur Sullivan after his break with W. S. Gilbert. It has a strong Eastern plot, and for broadcasting purposes an exceptionally strong cast was gathered, including Miss Marguerite Davis, Olive Sturgess, and Dorothy Bennett, with Stuart Robertson and Frederick Lloyd.

The B.B.C. Symphony Concert.

For their first concert, on the 10th of this month, of their new series of symphony concerts at the Royal Opera House, Covent Garden, the B.B.C. had the well-known 'cellist Miss Beatrice Harrison, and as conductor M. Pierre Monteaux. One of the most distinguished of French musicians and violinists, winning first prize at the Paris Conservatoire for this instrument, he made his debut at the famous Colonne orchestral concerts in 1894. Later he became assistant conductor, and in 1911 conductor of the Russian Ballet produced by Serge Diaghileff, conducting orchestras under that organisation all over the Continent until the war.

Plays and Players.

There is a slight tendency to overdo the broadcasting of plays. Naturally, the histrionic art must necessarily suffer when sight and action are lost, but in Herbert Swears' little comedy, "Granny's Juliet," slight though it is in itself, it gave opportunity for listeners to hear one of the finest actresses in the world—namely, Mrs. Kendal, or, as she was long known throughout the provinces, Madge Robertson.

Mrs. Kendal.

She comes from an old and numerous acting family, for she herself is stated to be the twenty-second child of her parents. Amongst her brothers is the famous dramatist Tom Robertson. Making her debut at the old Marylebone Theatre in 1854, she played the child in "The Orphan of the Frozen Sea." Her first adult part was as Ophelia. After her marriage with Mr. Kendal, the pair made triumphal progress, a special dinner being given in their honour by Joseph Chamberlain prior to their departure for their American and Canadian Tour in 1889.

The work of Lady Tree, who broadcast with her, is too well known to need detailed comment. So closely identified has she become with the stage that few realise that, as a student, she took high honours in Classics at Queen's College, and on one occasion acted in the Greek plays there. She made her debut on the London stage, the same year as she married Herbert Beerbohm Tree, as Jenny Northcott in Gilbert's play "Sweethearts."

Lady Tree.

She takes great interest in charitable affairs, and on the outbreak of the South African War, in 1889, she was instrumental in handing over to the war funds no less than £1,700 earned in ten weeks by reciting Kipling's war poem, "The Absent-Minded Beggar." She has played every kind of part, from Clytemnestra in "Electra" to Ophelia and the modern grande dame parts in which she still appears; and, as one admirer was overheard to say, "she is not a tree but an evergreen."

Birmingham.

Some excellent work has been heard from Birmingham, though the relaying of Rutland Boughton's Christmas drama "Bethlehem" was premature and would have come more appropriate later.

Far better musical and wireless value was the second of "The Radio Fantasies," arranged by Mr. Joseph Lewis. Most listeners-in will remember "The Crown of the Year" (Autumn), and the second "Life's Slumber Time," representing winter, is an adequate sequel.

For the request night some good singing was heard, while the entertainer was Miss Edith James at the piano. Miss James was originally trained for the concert platform in singing and solo pianoforte, but a chance discovery of her humorous talents led her to devote herself entirely to this class of performance.

Capt. Herbert W. Litt.

She had enjoyed success for some few years in London and the provinces when wireless came along, and in this new form of entertainment she was an immediate success, and quickly established herself as one of the radio favourites by reason of her clear diction. Since she first broadcast from Birmingham, she has already performed over seventy different items from her répertoire

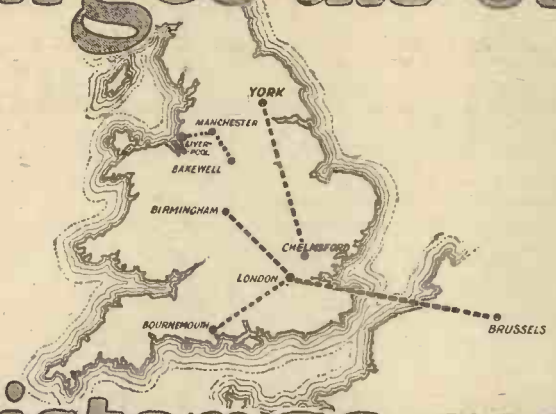
NEXT WEEK

A valuable article for the new amateur on "How To Operate Your New Set" will appear in next week's issue. Tell your friends who have just made or bought a set about this special article.

You can get the same long-distance results

Mr. L. V. Clark, of Experimental Station 5 B T Chiswick, reports receiving Brussels (200 miles) and Birmingham (125 miles) on a Neutron, without the aid of amplifiers.

Mr. C. S. Miller, Bellingham, S.E., receives Birmingham (125 miles) and Bournemouth (90 miles) on a Neutron without amplifiers.



"A.E.," Bakewell, receives Manchester (38 miles) on a Neutron plain crystal circuit.

"E. C. D.," York, receives Chelmsford (160 miles) on a single slider crystal set with a Neutron.

"T. C.," Radcliffe, receives Liverpool (40 miles) on a cigar-box crystal set, with a Neutron.

If you follow these simple hints you can reach the same standard of efficiency, and can either bring in the distant stations, or (if a town-dweller) double the strength of reception from your near-by station.

The Aerial. Have a single-wire aerial for choice; stranded and enamelled wire, with leading-in wire of the same material is the best. Look to the insulation, and avoid running the leading-in wire too close to the wall. See that wet weather does not cause leakage from aerial to earth.

The Earth. Run a stout copper wire to a plate, buried in the earth, for preference. If connected to a water-pipe, run the wire downstairs and connect there if possible. Avoid gas-pipes, which have faulty connections. If you use a water-pipe use one that goes to earth, not to a cistern. Use an earth-clip.

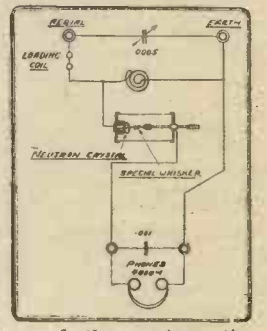
The Coil. Use 16-gauge wire, cotton-covered, straight-wound (on cardboard, not ebonite) or spider-wound. Use no shellac or wax. Variometers are often inefficient through damping when the coils are in opposition, and through capacity between the coils. Use a coil of nearly exact size, rather than a long-wave coil tapped. If you want long-wave stations, bring them in with a removable loading coil.

Variable Condensers. Avoid cheap composition end-plates. Ebonite for preference; or if metal-ended, see that the washers are ebonite and large in diameter. Use as small a condenser as possible, having the coil large enough to require only a small amount of condenser for tuning. Connect moving plates to earth end of coil.

The Detector. Enclosed type for preference. One that is not easily vibrated out of adjustment. Micrometer type, if possible. Neutron requires very light pressure. Ensure good contact between crystal and crystal-cup. Set in Woods' metal, or pack tight with tin-foil—not lead-foil.

The Phones. High-resistance (4,000 ohms). Be sure to obtain good leads. Poor reception is often due to faulty 'phone-leads. Don't remove ear-caps; they are often adjusted for maximum sensitiveness by the makers.

The Circuit. The circuit given here is not a freak circuit, but just a good standard circuit, exactly as used by Mr. L. V. Clark (see report above). Amateurs are advised to use the best materials throughout—the difference in price is only small compared with the freedom from trouble, and the greater satisfaction which good components yield.



and the Crystal: it must be—

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A good aerial, heavy-gauge, efficiently-wound coils, minimum self-capacity—all these *count*; but most important of all is your Crystal. There are many efficient Crystals, but you may try *twenty* before you find a *good* one—unless you ask for NEUTRON, in the black-and-yellow tin. *If you take this precaution* you will undoubtedly secure a crystal that will give you full efficiency first time, requiring no "searching" for sensitive spots, and giving you continued joy in listening.

Stocked by the Best Radio Dealers. Packed in tin, with silver cats-whisker. Insist on Neutron, in the Black and Yellow Tin. If unable to obtain, send 1/6 with dealer's name, and this wonderful crystal will be mailed by return. **1/6**

Sole Distributors:—

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144, Theobald's Rd., London, W.C.1. 'Phones: Museum 3795 & 6841. Produced by:—Neutron Ltd., Sicilian House, Southampton Row, London, W.C.1. 'Phone: Museum 2677.

FIXED CRYSTAL DETECTORS.

Making and Adjusting Them.

By OSWALD J. RANKIN.

Thousands of amateurs employ the crystal for detection and of that number many are often sorely troubled by the cat's-whisker's impishness. These hints on fixed detectors should comfort many a crystal "knob twister."

THE construction and final adjustment of a set or fixed crystal detector calls for more patience than skill, and if, in the ordinary way, one regards the usual crystal detector as a perpetual source of trouble, then he is certainly not likely to succeed with the fixed type of detector.

On the whole, fixed detectors are not entirely satisfactory, for one must unavoidably resort to a little "chancing," since the device is not by any means an "up and above board" piece of apparatus. Half an hour or so may be spent in making the necessary adjustments. It may happen that a good "point" has been found, but perhaps the pressure between the two crystals is not adjusted to maximum efficiency; yet in most cases the enthusiast will not take the trouble to pay attention to this all-important matter, for fear of upsetting the adjustment already obtained.

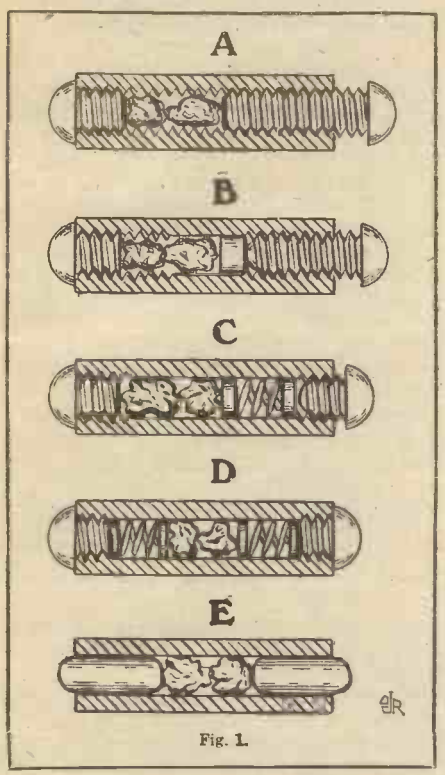


Fig. 1.

Perikon Detectors.

In one sense, he cannot be blamed for this. On the other hand, if the detector is to remain permanently set for a very long time, then one must surely expect to pay the price of such convenience by making a sacrifice at the outset.

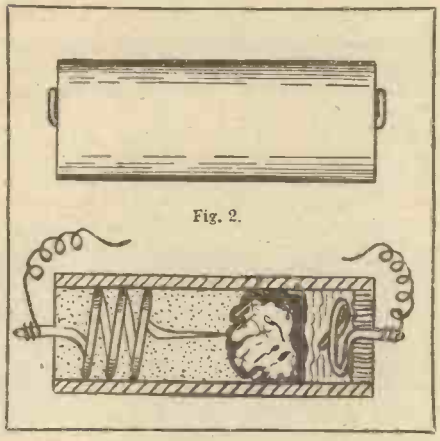


Fig. 2.

The most usual form of set detector is arranged on the well-known Perikon principle, where a piece of zincite or bornite is in contact with a piece of copper pyrites; and should the reader anticipate the construction of such a device, he would do well to first purchase a simple Perikon detector in order to become thoroughly acquainted with its use. A "hard point" should always be obtained, for such is an essential feature in the set detector.

Simple Type of Rectifier.

A few convenient methods of arranging the crystals are shown in Fig. 1. In each instance a short length of ebonite tubing forms the casing or support, this being internally threaded to take ordinary brass machine screws at each end. In Diagrams A to C the left-hand screw is permanent, the adjustments being carried out by means of the right-hand screws. The chief drawback with the arrangement shown in Diagram A is that the crystals invariably turn with the adjusting screw; but this can often be prevented by providing a small metal plunger, as shown at B. Now, if we use two of these plungers and place a small compression spring between them, as shown at C, we have, of course, a more efficient arrangement which permits very fine pressure adjustments; and by placing a spring and a pair of plungers behind each crystal, as shown at D, then a still finer adjustment is obtained.

Diagram E (Fig. 1) illustrates an extremely simple arrangement where two brass pins are made to slide accurately into the ends of the ebonite tube, the pressure on the crystals being applied by means of a pair of spring brass clips, as shown in the lower illustration in Fig. 3. The upper illustration in the same diagram depicts a suitable mount for either of the models A to D.

Now, although the set detector is almost essentially a modified Perikon detector, many interesting experiments might be carried out with the hertzite and wire tentacle combination, as indicated in Fig. 2. The tube, which is preferably of glass, is supported in an upright position, the lower end being plugged with a shallow cork and sealed with Chatterton's Compound.

Easy Adjustment Necessary.

A small hole is then drilled through the centre of this plug to accommodate the contact from the crystal, which consists of a piece of bare copper wire coiled round inside the tube and packed down very tightly with small wads of soft tin foil. The crystal is then dropped down the tube and gently pressed into the tiu foil. The cat's-whisker helix is made to slide inside the tube as shown, and when a good hard point has been found, the tube is then filled with melted paraffin wax which, when thoroughly set, should hold the point of the cat's-whisker permanently in position.

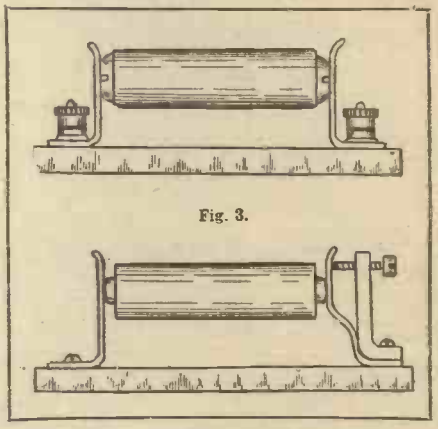


Fig. 3.

The tube should be warmed before pouring in the wax, otherwise the wax will set too quickly and cause undesirable contraction.

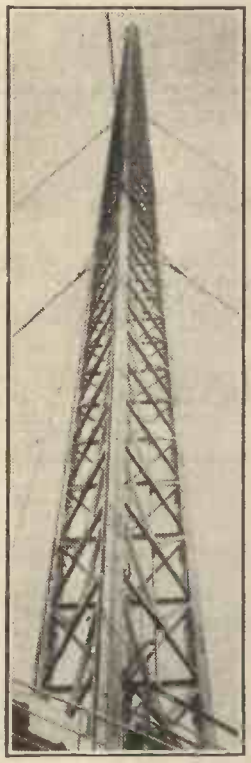
Fig. 4 shows a very simple arrangement particularly suitable for use inside the cabinet of a receiver, and once this detector is properly set to a hard point it should give no further trouble whatever unless, of course, the receiver is subjected to excessive vibration or careless handling. Two strips of $\frac{1}{8}$ in. sheet brass are screwed to the ends of an ebonite block which is provided with a saw-cut to accommodate one end of a strip of spring brass, which is pushed tightly into same to support the movable crystal cup. The free end of this strip is slotted to take the shank of a small terminal, this being attached to the movable

(*Continued on page* 1050.)

ELECTRON STREAMS AND THE THERMIONIC VALVE.

By C. S. PARSONS, B.Sc., F.C.I.P.A.

MANY radio amateurs who had previous knowledge of electricity are apt to be confused between current and electron streams when considering the direction of flow of either. At first sight it seems wrong to imagine any flow taking place from a negative point to a positive point, as we are assured is the case with an electron stream, and the common mistake is made of considering that, for wireless, currents flow in the opposite direction to that which prevails in other electrical apparatus. Of course, nothing of the kind takes place, for in spite of what the electron stream does, the flow of current always takes place from a point of higher to a point of lower potential, as it always has done.



A view of one of the giant masts at the new wireless station at Rugby.

The matter may be rendered somewhat clearer and easier to remember by regarding electrons as carriers for positive electrical charges. On this assumption we have, in any body conducting electricity, a stream of electrons bringing positive charges of electricity down a potential gradient and thus producing a current of electricity, and a stream of empty electrons passing in the opposite direction and going back to the higher level of potential to collect another positive charge of electricity to carry down the potential gradient.

Action of the Valve.

In fact, the conductor may be likened to an inclined pipe up which travels a stream of ants empty-handed, and down which the ants travel again after they have collected eggs at the top of the pipe. There is thus a current of eggs produced from top to bottom of the pipe, although, at the same time, there is a constant stream of ants in the opposite direction.

The above theory may be very instructively applied to the action of the thermionic valve. A current flows from the filament battery which heats the filament, and the heat and the vacuum of the valve together acting on the filament release some of the negative charges of electricity or electrons from the atoms of the filament. These electrons break away from the filament on seeing a queue of positive charges from the H.T. battery waiting at the high potential anode of the valve to cross the interior space of the valve to the low potential filament of the valve, and set to work to carry them across the gap. The electrons from the filament may be regarded as ferrymen proceeding from the filament to the anode to carry passengers across the anode to the filament, each electron combining with its passenger so as to be no longer a mere electron during the joint passage of the gap, but separating again as soon as its positive charge has been delivered to the filament and joining again in the electron stream from filament to anode.

Controlling the Electron Stream

It is interesting now to examine the action of the grid. This may be regarded as a pier under which the electrons have to pass from the filament to anode or in the contrary direction, and on which there is a crowd of electrical charges which, in the case of a detecting valve, constantly change in number and polarity. If the electrical charges are positive, they act as an additional attraction to passage of electrons towards the anode, whilst if the electrical charges are negative, they repel a proportionate number of electrons in the stream passing under the pier and prevent them from passing the pier to the anode. Thus the flow of electrons from the filament to the plate of the valve will be proportional to the polarity and magnitude of the total electrical charge on the grid. As the electron stream passes under the pier the positive charges will all commandeer electrons, and will be carried away by them to the filament, to supplement the charges brought to the filament from the anode. The positive charges which come from the grid constitute what is known as grid current, which does not, however, affect the telephone receivers because it does not pass through the anode circuit.

The Grid Leak.

Owing to the passage of grid current, there will gradually accumulate on the grid or pier nothing but negative charges of electricity, which will prevent further positive charges from coming on to the grid or pier, and will also stop the electron stream tending to flow from filament to anode beneath the pier. Consequently, for a detecting valve a means must be provided for enabling the negative charges to leave the pier, and this is done by means of the grid leak, which opens up a side passage or by-pass through which the excess negative charges can escape to earth to make room for more charges on the pier or grid.

FIXED CRYSTAL DETECTORS.

(*Continued from page* 1049).

crystal cup in the manner shown in the small sectional diagram. The end of the strip supporting the fixed cup is also slotted, and thus both cups may be revolved or moved up and down as required. This cup may also be provided with a terminal, if desired. The adjustment is made by means of an ordinary machine screw and lock-nut, fitted as shown to the right-hand brass strip.

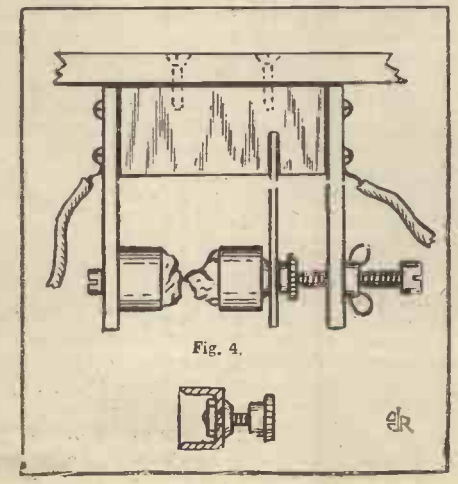


Fig. 4.

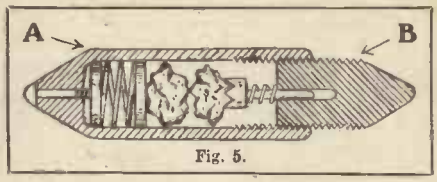
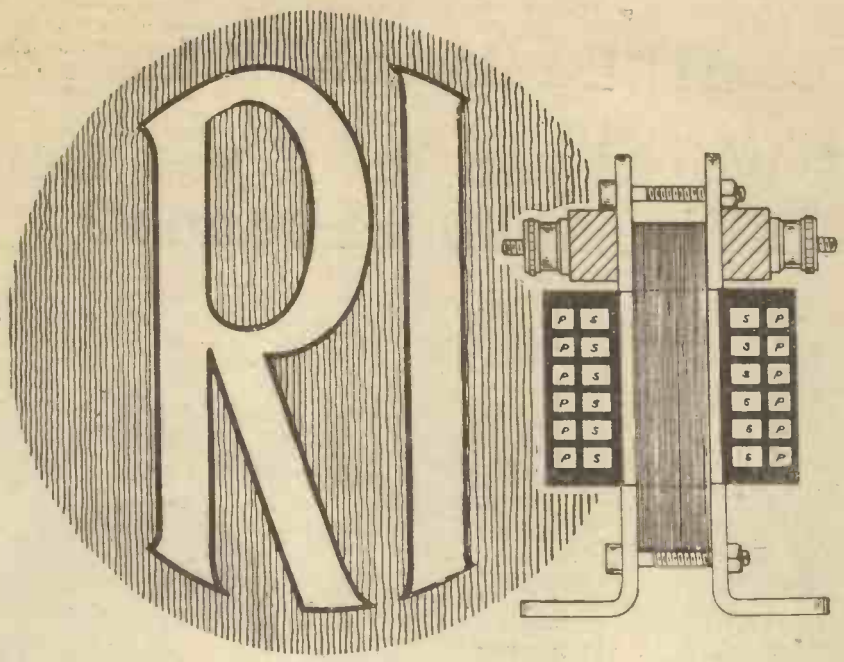


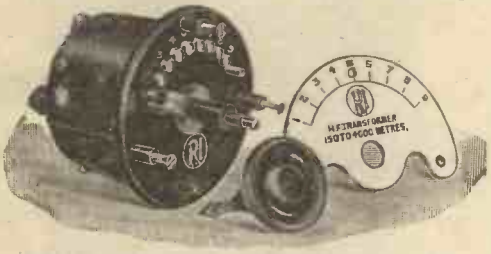
Fig. 5.

Readers who are fortunate enough to possess a small screw-cutting lathe are advised to experiment along the lines suggested in Fig. 5. Here the insulated casing, A, is machined from a short length of solid ebonite rod, the open end being threaded to receive a solid brass plug, B, which is drilled accurately in the centre and fitted with a sliding pin to which is attached a suitable metal grip and a small compression spring. The closed end of the ebonite casing is drilled and fitted with a machine screw, which is kept in position by screwing the end of same into the centre of the left-hand brass plunger. The general idea will be clearly understood by referring to the diagram.

When engaged on the design of a set detector, no matter how simple it may be, the first consideration should be rigidity. It must be perfectly robust throughout, even if its appearance is sacrificed. Accuracy and good workmanship come next in importance, and then a little patience at the final stage.



The construction that counts



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The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

WE shall have to do some more scouting around the retailers, for "junk" is again to the fore in many of the stores. The other day we purchased some valve holders with terminals from a wireless shop in the City. We had had our suspicions and they proved not to be groundless. Those terminals made contact with the filament socket merely by pressure, the terminal screws being screwed into the ebonite and the ends pressing against the screwed sections of the sockets. This is a method of making contact which is too popular in the cheap trade, and is doubtless the cause of innumerable failures. Readers will be well advised to purchase only such material and components which are associated with the name of a firm of repute, and ban all that for various reasons bear no maker's name at all.

A new loud-speaker—the "Little Sparta."

* * *

Messrs. Wilkinson and Co., of Harris Street, Bradford, have sent us a sample length of their new "Triumph" aerial wire, which is to be sold retail at 7/- per 100 ft., or 10/6 enamelled.

In appearance this new aerial wire is similar to the ordinary steel and copper stranded heavy gauge telegraph wire of "ex-government" repute, over which fine copper wire is braided. That it is an efficient collector of ether wave energy is immediately apparent in view of the extent of its active surface, while its tensile strength must be enormous, and we cannot imagine it breaking, even if used on the top of a mountain and exposed to a gale. It is not unduly heavy, and refuses to kink when being unwound. Altogether, we consider it well worth recommending to the attention of our readers, but we do hope the manufacturers will not claim that it will increase signal strength by "at least 200 per cent"!

* * *

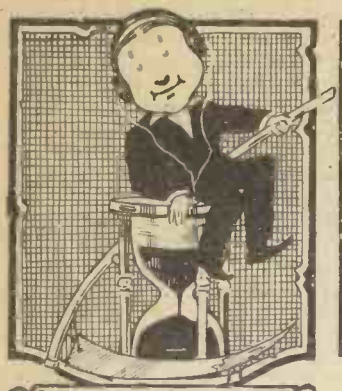
As an outcome of some remarks made recently in "P.W." by Dr. Roberts concerning originality in crystal detector design, Mr. W. E. Poole, of Walsall Wood, Staffs, has sent us a specimen of his Poole "Crystal-Valve" which is to be retailed at 2/6. His claim that it is "somewhat on new lines" we leave others to judge, but we ourselves, at least, have seen nothing very similar.

It is a small instrument and consists of a glass globe mounted on a round ebonite base, to which is connected two small flexible leads. The glass globe is filled with a semi-transparent fluid in which is immersed the crystal; this rests on three stiff, vertical "cat's-whiskers."

In operation the detector provided standard results proving to be both stable and sensitive. It is adjusted merely by shaking and tapping it. Whether the principle be new or not, it certainly is an interesting little component, and should sell well, if for nothing else, on account of its neat and rather mysterious appearance.

An "Efesca" Low-capacity Variometer, designed for one-hole panel mounting.

(*Continued on page* 1056.)



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Brown Baby	2	10	0
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Sterling Baby, Floral	2	17	6
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„ DER	21/-
„ DE3	25/-
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„ H.F.	12/6
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B.T.H. R4	12/6
„ B4	35/-
„ B5	25/-
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(All Ormond and Polar Condensers complete with knob and dial.)

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Igranic	4/6
„ with Vernier	7/6
„ for Dull Emitter	7.6
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„ Minor	3/6
Microstat	2/9
Peerless Minor, 6 w.	2/6
„ „ 15 w.	2/6
„ „ 30 w.	2/6
Peerless Ordinary, 6 w.	4/6
Peerless Ordinary, 15 w.	4/9
Peerless Ordinary, 30 w.	5/-
Burndept, 7 w	5/-
„ Dual, 7 w	
„ 30 w.	7/6
Bordac, 6 w.	3/-
Potentiometer, Igranic, 300 w.	7/-
Potentiometer, M.V., 200 w.	6/6

"SEAMARK" with internal Reactance for W.T.5. SET 7/6 & 10/-

"SATURNIUM" "THE Crystal." Results at all points. 2/3

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Quality Nickel Plated	7/6
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COILS.

Igranic Coils No.	25	5/-
„ „	30	5/-
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„ „	40	5/2
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„ „	60	5/4
„ „	75	5/6
„ „	100	7/-
„ „	150	7/10
„ „	200	8/8
„ „	250	9/-
„ „	300	9/5

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10 x 6 x 3/16	3/-
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Any size sheet cut from 3/16 in. or ¼ in.

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Tip Top (plugs and sockets) pair	4½d.
Tip Top, medium „	2d.
Tip Top, red „	1½d.
Tip Top, black „	1½d.
Collett, No. 1, small doz.	8d.
Collett, No. 2, large doz.	1/-
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Contact Studs, Brass, without nuts and washers	6d.
Contact Studs, Nickel Plated, without nuts and washers, small	7d.
Contact Studs, Nickel Plated, without nuts and washers, large	7d.
Contact Stops, Brass	6d.
Contact Stops, Nickel Plated, small	6d.
Contact Stops, Nickel Plated, large	7d.
NUTS. 0 B.A.	3d.
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SCREWS, 2 B.A., ¾ in. long, countersunk head	4d.
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SCREWS, 6 B.A., ¾ in. long, countersunk head	3d.
SCREWS, 8 B.A., ¾ in. long, countersunk head	3d.
Slider Bars, 12 in. each	3d.
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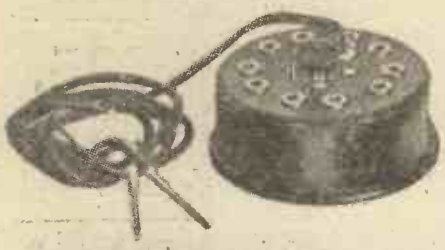
„ „ Ebonite, with springs and two brass contacts each	4d.
Crystal Cups, with screws each	3d.
Crystal Cups, with chuck each	4d.
Wander Plugs, each	3d.
„ „ superior each	4½d.

APPARATUS TESTED

(*Continued from page 1054.*)

It will be remembered that we postponed our final remarks concerning the new "Metro-Vik" D.E. II. Valves until such



A neat and useful multi-way switch for connecting 'phones in series, as made by Messrs. B.T-H.

time as our tests were completed. We can now consider that we have put these new dull emitters through sufficient tests in all types of sets to warrant us classing them as really "worth-while" propositions. Our experiments have been for the most part essentially practical, and whether it is the design (which is distinctly American in style), or whether it is the filament, there is no doubt that "weight-for-weight," from an electrical viewpoint, these little valves are as good as anything on the market. They are, in fact, better than any valve taking 1·1 volts or thereabouts that we have tested—and our comparative tests are very thorough—although this field is, of course, mostly limited to American types.

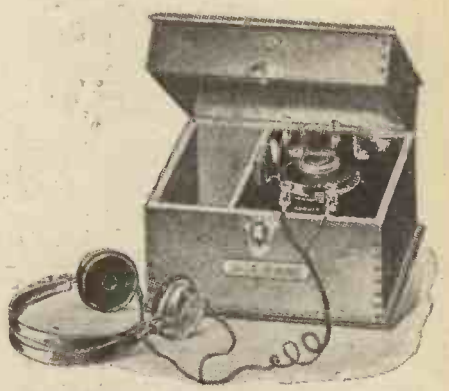
* * *

From the Formo Co., Ltd., has arrived a Formo Shrouded L.F. transformer of 5 to 1 ratio, which retails at 18/-. The first thing we noticed, and that with pleasure, is that all Formo transformers are unconditionally guaranteed, both as to quality and performance. This rather takes the wind out of our sails, for even if we discovered a really bad fault with the instrument on test, people would say, "Why didn't you send it back and get it replaced?" However, we couldn't find anything wrong with the transformer when in operation, and amplification was good and tonal qualities quite up to average standard throughout the most worked range of frequencies, and we had to go pretty high before we reached the awkward part of its "curve."

The "Formo" is one of the few shrouded transformers that keeps to the conventional shape of such a component. We may be old-fashioned in our views in this respect, but somehow we do like more or less standardised shapes and designs, besides, it makes it so much easier for the new amateur to recognise the various pieces of apparatus used for wireless purposes.

* * *

It is a long time since the words "Peto-Scott—the Condenser King" appeared in the advertising columns of this journal. Messrs. Peto-Scott's activities are nowadays much more varied, but it is, in the circumstances, fitting that this company should be one of the first to place square law variable condensers on the market. Recently they had commenced the production of a de-luxe type of variable condenser, and a very "clean" job it is, too. We have recently had sent us a range of these of different values, and note that several commendable features are included in their design. They are, for instance, "one-hole" panel mounting, and yet they can be stood on their heavy ebonite bases, and without fixing screws be used in an experimental capacity. Two accessible terminals are provided for connecting purposes, and neither is associated mechanically with the moving parts—in fact, connection from the moving vanes is made by means of a spring helix. The only fault we have to find with them is that they are rather on the massive side or tend to occupy rather a lot of room on a panel, but then we suppose something must be sacrificed to retain the qualities detailed above.



The "Benbow" Efescaphone Crystal Set, an interesting product of Messrs. Falk, Stadelmann & Co.

RADIOTORIAL

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All contributions to be addressed to The Editor, POPULAR WIRELESS AND WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

Technical queries are answered by post at a charge of 6d. a query, or 1s. for three. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the queries sent should be kept, as the original query cannot be reproduced in the answer. Cash should be sent in the form of a postal order.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

PATENT ADVICE FOR READERS.

The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

Questions and Answers

H. E. A. (Handsworth, Birmingham).—Early this morning I had the great pleasure to get my first American station, but I was not able to clearly get the call sign, although I could plainly hear the announcer saying the next item would be by the Westinghouse Harmonic Trio. I first got this station at 12.30 a.m. this morning, and heard the concert until 1.30 a.m. The call sign as I heard it was W B G or W B D. Could you possibly find out what station this was for me, as being my first American station I am very interested?

We are not able to identify transmissions of this kind definitely, owing to the very great number of stations now broadcasting. However, we think that in this instance there is little doubt but that the station you heard was W B Z, which is situated at Springfield, Massachusetts, and is operated by the Westinghouse Electric and Manufacturing Company. The wave-length is 337 metres, and the power employed is usually 1000 watts.

The reason that the call sign sounded like W B G or W B D is the fact that in America the letter Z is not pronounced "zed" as in this country, but is always called "zee," and what you heard the announcer say was "W B Zee."

In order to make certain that this was the station you heard you should write to the authorities there, giving all particulars and asking them to kindly confirm. They are generally very willing to do so, and such a letter from the station director confirming your reception is the only really satisfactory way of proving long distance results of this kind.

Address your letter to:
The Station Director,
The Westinghouse Electric and Manufacturing Co.'s Broadcasting Station (W B Z),
Springfield, Mass., U.S.A.

* * *

W. M. C. P. (Stratford-on-Avon).—I have just completed a four-valve set, using single coil aerial tuning, and tuned anode coupling with reaction on the anode. Wishing to use duolateral coils (Igranic make), I should be obliged if you would tell me what coils are needed for the following stations: B.B.C. stations, 5 X X, Paris, Brussels, Madrid, K D K A, W G Y.

For the B.B.C. stations the following coils will probably be necessary, and as you do not state whether series or parallel tuning for the aerial is given, we give the values for both, denoted by S and P after the coil number, first for a ·001 mfd.

(*Continued on page* 1060.)

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ALL OUR CONDENSERS HAVE BEEN TESTED AND RECOMMENDED BY LEADING JOURNALS (Unsolicited).

"DE LUXE" MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

·001	7/3
·0005	5/11
·0003	5/4
·0002	4/11

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

SQUARE LAW TWIN VARIABLE CONDENSERS

Ebonite Ends, Knob and Dial.

Equal Parts of—

·00025 or ·0003 12/6

Ditto ·0005 18/11

NEW MODEL SQUARE LAW

With Vernier.

Knob and Dial Free.	Aluminium Ends.	Ebonite Ends.
·0003	10/-	11/6
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Post 6d. set.

NEW MODEL

With Knob and dial.

WITH VERNIER.

·001	9/3
.0005	7/3
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With EBONITE DIAL and Knobs. Post 6d. Set.

LONDON'S LARGEST STOCKIST OF JACKSON BROS.

"J.B." VARIABLE CONDENSERS

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·001	9/6	·001	8/6
·0005	5/-	·0005	7/-
·0003	6/9	·0003	5/9
·0002	5/6	·0002	5/7

Post 4d. set.

POST DEPT. will be closed Dec. 20 to Jan. 1

CALLERS SERVED

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Lead-in tubes, 6d., 7d., 8d.
Valve Pins and Nuts 2 a 1d.
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Nickel Terminals .. 2d.
Nickel Contact Studs 2 for 1½d.
Nickel Switch Arm 1/- one-hole fixing)
Loading Coil and Plug 8d.
Gamages Permanite 1/-
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RAYMOND FIXED CONDENSERS

·001, ·0001, to ·0005 10d.
·002, ·003, ·004 .. 1/-
·006, 1/3; ·01, 1/9; ·02, 1/9
D.C.C. Wire, per ¼ lb.—
13 g. .. 9d. 20 g. 9d.
22 g. .. 10d. 24 g. 1/-
26 g. .. 1/1 28 g. 1/3
30 g. .. 1/6 etc., etc.

Terminals complete—
Brass Pillar 1d. 1½d.
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4 Taps and Wrench 2/11
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Hart's Stocked. All High Quality.

Neutron Crystal .. 1/6
Uralium 1/-
Midite .. .. .. 6d.
Enclosed Detectors 9d.
Large, Brass, on base 1/3
Ditto, Nickel, on base 1/6
MicMet Type .. 2/8
Variometers (special) 1/6
Ditto, with clips, etc 2/3
Ebonite, D.C.C. and Dial 3/9
Also at 3/11, 4/3, 4/6, no.

H.T. BATTERIES

Wonderful Value

60 v. 7/6
30 v. 4/6
60 B.B.C. 9/6
36 B.B.C. 5/6
9 v. B.B.C. 2/6
1·5 D.E. 1/9
Ditto .. .. 2/- to 3/-

BOXES

7 x 5 10 x 8 12 x 12
8 x 6 10 x 9 14 x 10
9 x 6 12 x 9
Any Size to Order.

PHILLIPS' ·04 Type Valve 15/11

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1 16 sq. ..12 ft. 6d.
18 g. sq. ..15 ft. 5d.

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1 mfd. 3/6
2 mfd. 3/11

Legless Valve Holder 1/-
Solid Rod Ditto .. 1/-
Under Panel Ditto 1/6
Valve Templates 2d., 4d.
Electron Aerial .. 1/3½
Adhesive Tape Roll 2½d.
Copper Foil per foot .. .. .. 2½d.
1 in. Fibre Strip 3 ft. 2d.
Insulated Hooks 4 for 3d.
Ditto Staples .. 5 a 1d.

Microstat 2/6
Switch Arms 8d. to 1/-
Flex (Red and Black) 12 yds. 2/-
Shellac .. .. .. 5d.
Loading Coil and Plug 8d.
Contact Studs 4 for 1½d.
Nickel Ditto 2 for 1½d.
Nickel Switch Arm 1/-
Sorbo ear caps pair 1/4
Tumbler Switches 1/4

D.P.D.T. SWITCHES
Min Panel 1/-
On China base .. 1/7½
On Ebonite Base 1/11 1/6
S.P.D.T. SWITCHES
Miniature Panel .. 10½d.
On China base .. 1/1
On Ebonite 1/3 to 1/9
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Coil Plug on Base 10d.

LISSEN

Variable Grid Leak 2/6
Anode Resistance .. 2/6
Lissen Minor .. 3/6
Lissenstat 7/6
Do. Universal .. 10/6
2-way Switch .. 2/9
Series Parallel .. 3/9
T1 Transformers .. 30/-
T2, 26/-; T3, 16/6; Coils: 25, 4/10; 30, 35, 40, 4/10 50, 5/-; 60, 5/4; 75, 5/4; 100, 6/9.
5 point switch .. 4/-
Lissen choke 10/-
Aux. Res. 1/3

DUBILIER

·001, ·002, ·003, ·004, ·005, ·006, Fixed. 3/-
·0001, ·0002, ·0003, ·0004, ·0005 .. 2/6
Type 577, ·01 .. 7/6
Grid Leaks, each .. 2/6
Anode Resistance 50,000, 70,000, 80,000, 100,000, on stand complete .. 5/6

IGRANIC

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6
Fil. Rheostat .. 4/6
Potentiometer .. 7/-
30-ohm Rheostat .. 7/-

EDISON BELL

·001 to ·0005 Fixed 1/3
·002 to ·006 .. .. 2/-
·001 .. .. .. 1/3
·0003 with Grid Leak 2/6
Variometer 10/6
Twin Detector .. 5/6

POLAR VARIABLE CONDENSERS

·001, 0005, ·0003 each 10/6
2-way C.V (Junior) stand 6/-
2-way Universal .. 11/-
Others not Obtainable.

GOSWELL ENGINEERING (QUALITY)

2-way Cam Vernier 9/-
3-way ,, ,, 12/6
3-way Ordinary .. 7/6
2-way Panel .. 3/-
3-way Panel .. 5/-
Post 3d. each.

HEADPHONES

4000 ohms

Sterling 25/-
B.T.H. 25/-
Brandes Matched 25/-
Brown's Featherweight 25/-
G.R.C. 20/-
Latest Model Brunet 16/11
Etc., Etc.

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BRIGHT EMITTER 12/6
B.T.H., Ediswan, Marcom, Mullard, Cossor, Myers, Green and Red Ring, etc.

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Var. Grid Leak to 10 Meg. 3/-
Anode Resistance .. 3/-
Anti-capacity Valve Holder 1/9

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Myers, Cossor, Mullard, Ediswan, Marconi, etc. Valves sent by post (purchasers' Risk)

N and K

GENUINE PHONES
Latest Model No. 3 (3 pole) 17/6
Great for Crystal Sets

TELEFUNKEN HEADPHONES

4000 ohms 17/11
4000 Patterns .. 12/6

DR. NESPER

(See Trade Mark.)
Genuine
4000 ohms 13/3
Various others stocked.
Post 6d. pair.

LOUD SPEAKERS

Sterling Dinkie .. 30/-
Dragon Fly 25/-
Junior Amplion .. 27/6
"De-Luxe" Raymond 22/6
Various others stocked.

THORPE K4 FOR UNIDYNE 17/6

(5 Pin Valve holder 1/6)

PHILLIPS 4-ELECTRODE FOR UNIDYNE 12/6

(4 pin valve holder 1/3)

FILAMENT RHEOSTATS

Shipton 30 or 60 ohms 3/6
Shipton 600 ohm Potentiometer .. 4/6
T.C.B. 6, 13, 30 ohm 4/-
Potentiometer 300 ohms 5/-

STERLING VARIABLECONDENSERS

Square Law with Vernier ·00025, ·0005 in stock.

ORMOND L.F. 13/11

A Wonderful Transformer.

·06 VALVES 12/6

16g D.D.C. USUALLY IN STOCK.

PHILLIPS 12/

4 ELECTRODE VALVE FOR "UNIDYNE"

"METAL" (FRENCH) ·06 VALVES 15/11

Twin Flex, 4 yards 6d.
Twin Silk Smalt 6 yds. 6d.
D.C.C. Bell Wire 10 yds. .. .. 5d.
Knobs, 2 B.A. 2d., 3d., 4d.
Small Knobs 6 B.A. 3d.
Small Knobs 4 B.A. 3d.
Wander Plugs pair 3d.
Egg Insulators each 1d.
Tape Aerial 100 ft. 2/-
Valve Windows 4d. to 9d.
Mica .. .. 2½.

Phone Cords 6 ft. 1/- & 1/3
Nugraving .. 6½d.
Empire Tape, 2 yds. 1d.
Allen Var. Grid Leak 1/3
Best Sleeving 3 yds. 10d.
Rubber Lead-in 10yds. 1/-
Thick ditto, 1., 2d., & 3d.
Aerial, 7/22 100 ft. 1/10½
Ditto, Extra Heavy 100 ft. 2/3
Anto Cap, Handles 8d.
Tumbler Switches .. 1/-

FIBRE STRIP (For Coils)

3 ft. long, 1 in. wide, 2d.

BREAST DRILLS 0 to ¼ chuck

Cut Bevel and Gear 4/9

De Luxe Crystal Set 7/11
4 Whiskers, 1 Gold 2d.
Coil Plugs (ebonite) 4½d.
Ditto 6d. 8d
Shaped .. 8½d. 1/-
5 ohm Rheostat .. 1/3
Various 1/3, 1/6, 1/9, 1/11
With Dial 1/11
Ormond 1/9
'Phone Connector .. 1d.
Nuts 2, 4, 6 B.A. doz. 2d.
Washers .. .. 12 a 1d.

RAYMOND CRYSTAL SETS 7/11 9/11 12/11

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OUR WONDERFUL MICROMETER ADJUSTMENT GLASS-ENCLOSED DETECTOR. WHY PAY MORE? 1/9

CHEAP LINES

between 12 & 2 p.m.

Of our own manufacture

4 B.A. rod, per ft... 2½d.
4 B.A. Rod, per ft. 2d.
Basket Holders .. 8½d.
Also at 10½., 1/-, 1/3, 1/6
2-Way Coil Stands .. 1/11
3-way ditto 4/3
2-way with ex handles 2/11
3-way ditto 4/9
4·5 Batteries 4½d., 5d.
Brass Coil Former 2/11

5 Waxless Coils 200/2000 .. .. 1/5
5 equal 25 to 100 .. 1/11
5 ditto, Extra Air Space 2/8
6 waxed 200/3600.. 1/8
7 waxed 150/3600.. 1/11
Chelmsford D.C.C. 1/-, 1/3, 2/6
With adapter 9d. extra.
Switch Arm, 12 Studs 12 Nuts, 12 Washers, Lot 10½d.

EBONITE STOCK SIZES

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

3/16 in.

Cut to size ½d. sq. in.

WE STOCK ¼-in. EBONITE.

RIGHT OPPOSITE DALY'S GALLERY DOOR

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WIRELESS DEPOT

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'PHONE: GERRARD 4367.

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HOURS OF BUSINESS:

DAILY 9 to 7.45

SUNDAYS 10 to 1

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 1058)

condenser and then for a ·0005 mfd. condenser. We presume that a ·0003 mfd. is used for the anode tuning.

B.B.C. Stations. (300/400 m.) (aerial) 50 S., 25 P.) 50 S., 35 P.; (anode) 50, (reac.) 75; (400/500 m.; (aerial) 75 S., 50 P.; 75 S., 50-75 P.; (anode) 75, (reac.) 75. As there are four Paris stations we will give them according to the wave-length. *Petit Parisien* (see 300/400). *Ecole Superieure* (450 m.) See 400/500. *Radiola* (1780 m.). (Aerial) 200 S., 150 P., 250 S., 200 P. (anode) 200, (reac.) 150. (This will cover 5 X X also.) *Eiffel Tower* (2600 m.). (aerial) 300 S., 200 P.; 400 S., 250 P.: (anode) 300, (reac.) 200. *Brussels* (265 m.). (aerial 35 S., 25 P.; 35-50 S., 25-35 P.: (anode) 50 (reac.) 75. *Madrid* (392 m.). See 300/400 metres. *K D K A.* As you will be unable probably to get down to 65 metres with your set—special design being necessary on the low wave-lengths—we only give the higher wave-length of the East Pittsburg station (326 m.). See 300/400 metres. *W G Y* (Schenectady, 380 m.). See 300/400 metres.

* * *

K. C. (Marple).—What coils, etc., are necessary for the reception of short waves such as K D K A uses?

Full details of coils, etc., were given in an article on short-wave work in POPULAR WIRELESS, No. 129, obtainable from the Back No. Dept., Amalgamated Press, Ltd. (1922), Bear Alley, Farringdon Street, E.C.4. A series of articles on the same topic will appear shortly in POPULAR WIRELESS, and these will give further details of tuners, etc., besides describing fully the construction of a set suitable for the reception of K D K A.

* * *

B. E. M. (Radlett).—As I am desirous of winding some short-wave coils fairly accurately I should like to know the various thicknesses of the insulation on the most useful gauges of wire.

The following table should be found useful, and is quite accurate enough for most purposes.

TURNS PER CM. FOR VARIOUS GAUGES.

Gauge S.W.G.	Enamelled.	S.S.C.	D.S.C.	S.C.C.	D.C.C.
18	7·8	7·9	7·6	7·3	6·9
20	10·0	10·1	10	9·7	8·5
22	13	13	12·5	10·5	10·1
24	16·5	16·5	15·5	14·0	12·0
26	19·5	19·4	18·5	16·5	14·0
28	24·0	23·5	22·0	19·5	15·5
30	28·5	28·0	26·0	21·0	17·5
34	38·5	36·5	33·5	27·5	21·5

* * *

"CRYSTOL" (Fordingbridge, Hants).—I have arranged my aerial so that it comes through a bedroom window and leads are taken downstairs for reception. Does it matter if the set is upstairs, using long telephone leads, or would a long lead-in with set downstairs be more efficient?

Generally, the set should be placed as near the ground as possible, but where the lead-in has to pass through several walls it is sometimes better to have the set upstairs and use long telephone leads instead.

No rule holds good for all circumstances, so both positions should be tried.

* * *

F. P. E. (Nuneaton).—What are the neutroformers of the Hazeltine circuit, and which is the most useful type of neutrodyne receiver now being used?

The neutroformers are the transformers used in the aerial circuit and the H.F. plate and grid circuits. Usually they consist of wire wound round cardboard cylinders so as to give primary and secondary windings. The primaries have about 16 turns, and are untuned even in the aerial circuit, while the secondaries are tuned by means of ·0002 mfd. variable condensers. The secondaries of the neutroformers have about 64 turns.

It is difficult to say which is the most useful type, as a great deal depends upon the skill of the operator. Probably the four-valve receiver using three H.F. and one detector is best. L.F. amplifiers can be added as usual. The circuit is extremely selective, and considerable practice is required before it can be handled successfully.

* * *

G. B. S. (London, W.C. 2).—What is the average range of a crystal set, employing a solenoid coil and a single slider—both for telephony and telegraphy?

This will vary a great deal, as local conditions, height of aerial, and efficiency of the apparatus, etc. play a very important part. We do not, however, recommend a crystal set for distances exceeding 15 to 20 miles from a broadcasting station, although it is not uncommon for satisfactory results to be obtained up to 30 or so miles. Telegraphy can be received over much greater distances than this, however, and it is not unusual to regularly receive such high-power stations as Paris, Nanen, etc., on this type of receiver in various parts of this country.

* * *

F. S. E. (Partington, near Manchester).—I had been getting fairly good results on an aerial 26 ft. high, but reading that an aerial should always be placed as high as possible, I took the wire to the other end of my garden and fastened it to a gasometer, at a height of about 50 ft. Instead of being an improvement, signals have ceased altogether. Why is this?

You have screened your aerial by the only thing which wireless waves will not pass through—an earthed metal shield. Keep the aerial as far away from the gasometer as you possibly can.

* * *

"AERIAL NOVICE" (Bristol).—Is a "single wire" or "twin" aerial better for broadcast reception, and should the wire be insulated or bare in order to give best results?

There is little to choose between "single" or "twin," and no law can be laid down, because the best form for the aerial to erect depends upon local conditions—i.e. surrounding buildings or trees, height from ground, etc. The best wire is 7/22 copper, or a larger wire if single stranded, No. 16 S.W.G. if possible. It need not be insulated, but it is certainly advantageous to use enamelled wire, because the coating is a protection against corrosion, although this insulation would not affect reception in any way.

* * *

G. K. D. (Forest Gate, London, E.).—How many hours should a 6-volt 40 amp. accumulator last when used for a 3-valve set?

This can be easily calculated when the current taken by each valve is known. (It is always stated by the makers.) If the consumption averages ·7 each, the three valves will take 2·1 amps, and this figure divided into the "ampere-hour" capacity will give the number of hours—in this case

$$\frac{40}{2 \cdot 1} = 19 \text{ hours (approx.)}.$$

It will be seen that for three valves a 60 ampere-hour battery is necessary to avoid the necessity for constant re-charging.

* * *

C. C. (Brockwell Park).—How is the wave-length of a coil found out?

By first calculating its inductance in microhenries, adding this to the inductance of the aerial in micro-

(*Continued on page* 1061.)

Our Query Department.

In future a charge of Sixpence per Query will be made for answering all technical questions submitted to the Technical Staff of POPULAR WIRELESS. A group of three queries will be answered for One Shilling. Postal Orders must be enclosed with all queries and a stamped addressed envelope in addition.

THIS NEW ARRANGEMENT IS NOW IN FORCE.

Since the inception of POPULAR WIRELESS, readers have had all their problems settled for them free of charge, but with the great increase in the circulation and the corresponding increase in the number of queries sent in, the task of dealing with the latter has become gigantic. A large Technical Staff is now employed answering queries, and it is with the object of relieving the pressure on them that we have decided to make the small charges mentioned.

Readers of POPULAR WIRELESS know that the Editor and Staff of this journal have always had, and always will have, their best interests at heart.

QUESTIONS & ANSWERS.

(*Continued from page* 1060.)

henries, taking the capacity of the aerial in microfarads, and applying the formula :

Wave-length = 1,885 $\sqrt{K}$ (in mfds.). L (in mhs.)

Most results of mathematical measurements in wireless are very approximate, and even with the greatest of care this particular instance is liable to at least 10 per cent. error, so that one can afford to be approximate with the minor factors. The average capacity of the amateur aerial is between ·0002 and ·0003 mfd., while the inductance will be somewhere round about 15 mhs. Check this roughly by multiplying the length of the aerial plus lead-in in feet by 1·5, this will give you approximately its fundamental wave-length in metres. Call this Y ; suppose we take the capacity to be ·0002, then the inductance must equal in microhenries

$$\frac{Y}{(1885)^2} \div \cdot 0002.$$

That will bring the K and L coefficients of the aerial to as nearly correct as possible, or, rather, as near as we require them. Calculate the inductance of the coil by means of this formula : L = 9·8 D^2N^2LK, where D = diameter of the coil in cms. N = number of turns per cm. L = length of the coil in cms. K = the correction factor, which is based on the ratio of the length of the coil to the diameter. It varies from ·96 where the diameter is ·1 of the length to ·2 to where the length is ·1 of the diameter. Where the diameter is similar to the length, this factor is ·69. Where the length is twice the diameter it is ·82, where the length is five times the diameter ·92, and from these you must guess somewhere about the figure that will meet the case of the coil you have under consideration. Having then worked the above out, the result will not be in microhenries, but cms. ; and must be divided by 1,000 to bring it to microhenries. Take this, and add it to the inductance of the aerial, take the capacity of the aerial and apply the first formula given above—i.e. $\sqrt{1885\ K\ L}$. Where a parallel condenser is employed the various degrees of capacity can be added to the capacity co-efficient in the above, and will give quite a fair approximation, but remember that the only accurate method of calculating wave-length is by means of a calibrated wave-meter.

THE RADIO PLAY.

(*Continued from page* 1038.)

of our listeners provide us with such a mine of information ? Those looking in from the outside can invariably help those who look out from the inside.

Concerning the broadcasting of a play during actual performance at a theatre, it is obvious that suitability must be studied. A play with little literary and dramatic pretension, but with great spectacular effect, would not be considered for transmission. It must also be remembered that blind people enjoy many plays immensely. The type of play which such people would enjoy is one which would broadcast well.

We contend that there are factors in broadcasting from the theatre which cannot fail to be of ultimate advantage to the play promoters themselves. The crowd psychology of the theatre definitely effects the listener by wireless. Once the broadcast performance of a portion of a play has planted its suggestion of comedy, tragedy, gaiety, intensity, or other idea in the listener's mind, it is a psychological certainty that the desire to complete the pleasurable experience will be strong and cumulative. This desire can be satisfied only by a visit to the theatre itself.

One could theorise for a considerable space and still find oneself involved in more or less unprofitable argument, but "facts are chiels that winna ding." Here are a few : Definite information for some two thousand seats for "Battling Butler" and "The Last Waltz," sold as a result of broadcast. Similar definite information concerning "The Beggar's Opera," "Polly," "The Farmer's Wife," and this is proof of our contention that theatre managers, by giving listeners facilities to hear good material, are materially assisting themselves.

Correspondence

SIGNALS FROM CHILI.

The Editor, POPULAR WIRELESS.

Dear Sir,—In a recent issue of "P.W." you were asking your readers to let you know of any long-distance reception.

At 7.25 G.M.T., on Sunday, November 23rd, 1924, I heard Chilean 9 T C, the wave-length was 85 metres, system C.W., and the note was a plain D.C. one.

9 T C is situated at Los Andes, at the foot of the highest mountain in Chili, near Valparaiso, and is over 8,000 miles from me. My set is only a one-valve, straight circuit, home-made set with reaction.

It came in at R. 3 quite plainly, and it was just daylight over here.

Perhaps some of your readers have received a Chilean amateur, for I hear several have just started up.

Mr. Galpin, of 5 N F, seems to be the first to have received 9 T C. I have written for confirmation.

It is only during the last week I have risen early to receive U.S.A., and I have logged 36 American amateurs, and one Canadian in about four days, all on one valve.

Wishing you and POPULAR WIRELESS every success.

I remain,
Yours sincerely,
T. A. STUDLEY.

6, Rutland Row, Harrow.

"P.W." ULTRA RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps the following might interest your readers who like myself use and experiment with crystal sets, especially those who possess the "P.W." Ultra.

I have found that to short the 'phone terminal (the one that is connected to coil directly) to earth, brings the signals up very much louder, both for 5 X X and local station. For the sake of experts (?) may I say at once that this is not due to flux, or poor ebonite, causing a short circuit in any other part of set.

My aerial joins on to the same pole as the aerial possessed by a wireless dealer, who uses everything from a crystal set to a multi-valve set, and he has never cut me out. This is one case to confirm the remarks of Capt Eckersley a week or so back. As regards tuning, I get very little trouble; in fact, sometimes it seems to lend more power to my set.

My aerial is single, 50 feet long, with a straight drop lead-in, 30 feet, and makes an angle with the other aerial of 45°; Where they meet at pole they are 5 feet apart.

Yours truly,
S. WM. HOWES.

141, Woodboro Road, Nottingham.

REPORTS ON EVENING TRANSMISSIONS.

International Radio Week.

The Editor, POPULAR WIRELESS.

Dear Sir,—May we beg your readers while the impressions are still fresh in memory, to forward brief reports on the quality of reception they experienced of the 10.30–11.30 p.m. transmissions, whether such reception was:

(*a*) Direct from the country broadcasting.
(*b*) Via the B.B.C. relays.

Observations, opinions, and criticism (especially constructive) are invited, since such comment will be invaluable.

Out of deference to the expressed wish of the B.B.C., practically no preliminary publicity was given to the institution of these evening transmissions. Consequently great numbers of the public are doubtless quite unaware of the aims and objects of the movement, and it may be desirable here to mention that the aim is to bring nations into closer touch by means of national programmes broadcast by each country in turn, for the benefit of other participating countries. Such programmes, containing amongst other items addresses by leading personalities, native music by native composers, and other material peculiar to the country broadcasting, will, it is hoped, tend towards the creation of better international understanding and good will.

These transmissions must not be confused with the 3–5 a.m. scientific tests, with which they have little in common. The evening transmissions were designed for the purpose stated, rather than for their scientific value, and were arranged so that even the crystal user might enjoy a "glimpse" of foreign lands.

The criticisms of the lady who has written charging the promoters with causing the bad weather and consequent loss of life through storm havoc is unkind, but everyone is entitled to his or her own opinion.

All communications will be welcomed—even a line on a postcard.

Yours faithfully,
CLIFFORD & CLIFFORD,
Hon. Secretaries.

70, Finsbury Pavement, London, E.C.2.

(*Continued on page* 1063.)

CORRESPONDENCE.

(*Continued from page* 1062.)

CONSTRUCTIVE CRITICISM WANTED.

The Editor, POPULAR WIRELESS.

Dear Sir,—It is said that discontent is the royal road to progress, and one may feel quite sure that were we all contented with our lot—even if it isn't a lot—that things would remain as they are. Judging from some of the grumbles printed in your journal, I should imagine that some emanate from those suffering with the discontent which is the muddy road to stagnation. On our journeys to and fro by 'bus or train, we hear their loud laments, but I have adopted a counter-argument, somewhat hackneyed in style. I hear: "What a rotten programme from Cardiff!" I reply: "Yes; but what about Birmingham or Manchester? They had some fine items," etc., etc. "Ah, that's all very well, I've only got a crystal." And I say, "Serve you right—progress, add a valve or two, and take your choice of programmes and cease grumbling."

Life is very funny. The very people who grouse will pay 5/- to go once to a music-hall to see a third-rate show lasting some two hours, but when they spend 7/6 for a set, sling an aerial, and buy a licence, they expect 365 all-star programmes (about 1,500 hours) from their local station. In the words of John Henry, "It's all wrong—ah, well!"

If the discontents would only formulate some definite scheme for improvement and forward to the B.B.C., perhaps some good might accrue; but my experience of this element is that they only criticise without even a ghostly idea of running a village concert at a profit.

ANOTHER DISCONTENT.

W. A. Bayliss, 8, Summerleaze,
Hillfields Park, Bristol.

THAT SIMPLE SUPER CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir—The following is the result of a desire to understand the theory of "That simple super circuit," and to find the reason for the wonderful results it gave when I roughly connected it up for test.

Not having my usual facilities at present, I have had to use a two-valve dual, and a few yards of flex as an indoor aerial. I find that the super effect can be applied to the first valve of this receiver, which acts at both high and low frequency. No grid leak or grid condenser is required, as this valve is not a detector. Also, no reaction condensers appear necessary. A coil is merely substituted for the wire connecting the A.T.I. to the grid. This coil is put in a coil holder, so that it may be coupled to the anode coil, but it must be connected up the reverse way to the plate coil. Also, the value of this grid coil does not appear to be very critical. A 35 coil would be closer coupled than a 50.

Now for the theory.

There is a plate coil and a grid coil, which latter is connected what I shall call the wrong way round, so that fluctuations in the plate circuit induce fluctuations of opposite phase in the grid coil. We are thus able to neutralise the plate to grid capacity of the valve by a suitable coupling of these two coils. In other words, the circuit is a neutrodyne, and allows the valve to work under the best conditions.

I accordingly put forward in all due humility, and so that experimenters can try it out, the statement that a high frequency valve can be controlled on the neutrodyne principle, and without a neutrodyne condenser, by the simple introduction into the circuit of a grid coil in the manner described.

Yours truly,
A. M. STUART.

Edinburgh.

Re A "NOVEL CIRCUIT."

The Editor, POPULAR WIRELESS.

Dear Sir,—It is with the greatest pleasure that I desire through your correspondence columns to thank Mr. H. G. Chitos, of Ealing, and POPULAR WIRELESS, for the publication of the above one-valve circuit.

With an average P.M.G. aerial, using the Ediswan valve (bright emitter type), with a plate voltage of 60, I successfully logged in one evening alone all the B.B.C. stations (including the relays Hull and Liverpool), Radio Iberico (Madrid), and two German stations, whose call sign I was unable to distinguish.

I have a friend who has also assembled this circuit, who has on two occasions picked up the American station K D K A (on the second occasion I was present, and can vouch for its accuracy). S.W. coils (home-made) were used in this instance.

I now intend to add one stage of low frequency, when I hope to have at least five B.B.C. stations on the loud speaker.

I was persuaded to try an American circuit, which, however, in performance fell much below that of the "Novel Circuit."

In closing may I suggest to both Mr. Bates and Mr. Worth, who have since its publication commented on this circuit, that hand capacity can be entirely eliminated by the use of the new anti-capacity handles which are now on the market.

Believe me, sir,
Yours very faithfully,
FRANK W. SPENCER.

Gateway House, Chester.

(*Continued on page* 1064.)

CORRESPONDENCE.

(*Continued from page* 1063.)

Re THAT NOVEL CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I beg to be allowed to add my appreciation of Mr. Chitos' circuit. The volume it gives is certainly amazing.

With the fireguard as an aerial, and a near-by gas-pipe for an earth (in semi-basement room) I got 2 L O equally as loud as on my outside aerial.

My situation is a badly screened one, with large trees round a garden only 30 feet long, and an unavoidable long lead-in renders crystal reception inaudible.

I have tried several one-valvers (including reflex) with disappointing results, and thank Mr. Chitos and "P.W." for alleviating my distress.

With an L.F. unit I can tune in a Spanish station to good 'phone strength any night after 2 L O has closed down.

Yours faithfully,
A. J. WRIGHT.

33, Palace Square, S.E.19.

"ANOTHER UNIDYNE SUCCESS."

The Editor, POPULAR WIRELESS.

Dear Sir,—You will no doubt be interested to hear of still another Unidyne success.

After two years of very successful crystal reception, like most amateurs who do not live on the top of a broadcast station, I decided to go in for valves.

I have been deeply interested in the Unidyne from your first announcement, as I feel that only the purest reception of music that I can possibly get is any use to me, and the elimination of the H.T. "fizz" (as I have heard it) seemed very desirable.

I may say here that the two grid leaks I tried—both of well-known make, proved to be absolute duds, and it may interest your readers to know that if they take a faulty leak to pieces they will probably see at a glance what the trouble is.

In both the cases mentioned the carbon (?) resistance had been dropped into the ebonite tube "wet" and screwed down! Consequently they had dried in a solid lump and it took a nail and a hammer to drive them out!

When they were carefully separated with a sharp knife and pressed flat and replaced in the tube, they worked perfectly.

With regard to the set under test, I am rather disappointed as to distant stations, but that is no doubt due to there being no H.F. amplification.

I have only had it working 3 or 4 odd hours, and I have had Nottingham (23 miles), signals could be distinctly understood a foot from a "junior" loud speaker. Birmingham (35 miles), London, and Manchester (90 miles): good headphone strength, and there appears to be others which might be sorted out by careful tuning.

I have also heard one French and one Spanish Station, quite understandable.

The music that comes through is worth all the trouble I have had and is undeniably of "crystal purity."

I am looking forward to further developments of the Unidyne principle.

Yours faithfully,
FRANK W. GREGORY.

145, Hampden Road,
Gipsy Lane, Leicester.

AN INUNDATED CORRESPONDENT.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re my recent offer, could I beg a little of your valuable space to apologise to all those readers whose requests I was unable to satisfy.

When I say that I had over one hundred applications they will realise the difficulty I had in the matter. It might also be of interest to know that at least sixty per cent. of these were for Unidyne circuits, and therefore I suggest that you could publish another of your booklets dealing with this matter.

Yours faithfully,
R. DUNSEATH.

Appletee, 25, Green Walk,
Whalley Range, Manchester.

THE "P.W." ULTRA CRYSTAL SET.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have recently completed the above set, and have been amazed at the results obtained. This is the first set I have built. No doubt I am favourably situated. My station is on a hill 300 ft. high, overlooking Swansea Bay. The aerial is 30 ft. high, and directional to the Cardiff (35 miles) and Bournemouth (110 miles) Stations, which I can tune in every day even in broad daylight. On Sunday evening last I was surprised to receive the Glasgow station (310 miles) enabling me to follow every part of the Church Service. Curiously enough it was received about three times as loud as Cardiff. Some of my friends seem to think it was due to re-radiation, but I do not know of a multi-valve set near me. Last night I received broadcast obviously from a liner bound for U.S.A., from 11 to 11.30 p.m., and shortly afterwards I received a foreign station on about 350-400 metres, which I strongly suspect to be Madrid, about 800 miles. It was too weak to recognise any call sign, but the lady singer could be plainly followed. On several nights I have tuned in a

(*Continued on page* 1065.)

CORRESPONDENCE.

(*Continued from page* 1064.)

French station, about 400 metres, enabling the music to be followed. The speech comes in too gruff to be understood. My earth is 4 ft. of 7-22 aerial wire soldered to the water main which passes under the instrument, and enters the ground almost immediately. All connections are soldered. The choice of 'phones is B.T.H. and the crystal the D.L. 5.

Yours faithfully,
T. IVOR WILLIAMS.

18, Sea View Terrace, Swansea.

BROADCAST PLAYS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The B.B.C. seem wedded to the idea that plays, and generally ones with a large number of characters, are suitable for broadcasting. They have had a good trial of these and I feel sure that other people's opinions must be the same as mine, namely, that they are wholly unsuitable and a sheer waste of time.

I have written on more than one occasion to the B.B.C. pointing out why long plays, and particularly those which are S.B., are unsuitable, but I think they have made up their own minds and do not much care what listeners think.

The B.B.C. seem to expect that one is going to sit for two hours, and sometimes longer than that, listening to one continuous play which starts just at the same time that most people are sitting down to dinner. Also they do not appear to have listened to these plays "from outside," particularly if they are S.B. If so they would soon realise the almost impossibility of sorting out the number of characters. Even where the number of characters is small one constantly misses words or phrases due presumably to the action on the stage, and the sense is lost.

I have talked a good deal about this subject to other listeners, and have not found anybody yet who was not of the same opinion, though possibly those favoured people in London who can hear a good play on a crystal set may be in a different position.

It seems to me that the airing of this subject in your paper might have some influence on the B.B.C.

Yours faithfully,
E. W.

"Gables," Stoneleigh, near Kenilworth.

A NOVEL FOUR-VALVE SET.

(*Continued from page* 1042.)

terminals were mounted as shown. Wiring-up was then commenced. The ordinary circuit is reproduced here, and was modified slightly to suit the Lissen tuning. The instructions provided with such components will usually solve any difficulty in adapting the circuit to one's own requirements.

All connections were firmly soldered, soldering tags being frequently used for connecting up transformers, condensers, etc. The "right-angled" system of wiring shown in the accompanying photograph is most efficient, as well as presenting a neat and professional appearance to the interior.

Fig. 4 shows the method of taking tappings from the flash-lamp batteries used for grid bias. These batteries are most important in their effect on the resulting tone of the set, and are essential with power valves.

The panel front was neatly, cheaply, and easily lettered by means of the transfers now sold for the purpose.

Operation.

Instructions for working the set would, of course, be useless to anyone using different tuning arrangements, but in general, it may be remarked that the adjustment of voltages of the grid bias and H.T. batteries is important, as is also the value of the grid leak if the best tone is to be obtained. When adjusted to a suitable value, the resistance across the secondary of the last L.F. transformer has a marked effect in cutting down transformer noises and in improving the quality of speech and music.

A friend of the writer was good enough to affirm that the set as it stood (in the cabinet) was worth one hundred guineas. Such praise from one who is "in the trade" is, to say the least of it, encouraging, the more so in that the cabinet itself is a home-constructed article.

TECHNICAL NOTES.

(*Continued from page* 1025.)

support of "giant" broadcasting, Mr. Sarnoff said:

"The problem of interference need not stand in the way of better broadcasting, for the Third National Radio Conference has wisely recommended that high-power broadcasting stations shall be located outside, and at some distance from, populous centres. I regard super-broadcasting as a stimulating form of competition for other systems of national broadcasting. It provides an effective substitute for wire line networks, connecting a multitude of low-power stations. I can say that we are ready and willing to demonstrate the measure of service that super-broadcasting can render by erecting an experimental station, suitably located, that will prove the promise that super-broadcasting holds."

It is gratifying to note that we cannot be accused in this country of being behind the times in the matter of high-power broadcasting, at any rate.

Working Ebonite.

Owing to the fact that ebonite is comparatively soft—that is, soft compared with most metals—many experimenters conclude that ordinary tools should cut ebonite much more easily than they do metal. The fact is, however, that although ebonite is not particularly hard, it is very tough, and has a peculiar way of heating the tip of the tool and blunting it very rapidly. Ordinary twist drills, used in the lathe for drilling ebonite, get very hot indeed unless the drilling is done slowly and a little oil or turpentine used as a lubricant. The heating is not only bad for the tool, but it quickly makes the ebonite "cheesy" and throws up a heavy burr round the hole, giving anything but a satisfactory result to the work. Wood-screws should not be used for insertion into ebonite; they may be used in a clearance hole in the ebonite, for holding wood at the back of a panel, but not into the ebonite itself. The wood-screws, being tapered, are liable to split the ebonite, or to break off themselves at the head. Metal screws should be used, and for cutting ebonite sheet a hack-saw is best, the edges being afterwards trimmed up with a file, not with a plane.

Tightening Aerials.

Someone sent me recently a simple dodge which he had found useful, for supporting the aerial wire, in lieu of a pulley. Attached to the top of the mast by means of a few inches of rope is a shell insulator, and the rope passes over this insulator, and is then attached to the insulator on the aerial wire in the usual way. The shell insulator at the top of the mast thus does duty for a pulley; it is simpler and cheaper, and there is nothing to rust or otherwise get out of order.

Transformer Insulation.

The insulation of coils, condensers, and other kinds of electrical apparatus is often completed by a process of "impregnating" them with shellac or other varnish. The articles in question are first placed in a special metal vessel, which is heated to vaporise moisture, etc., and then the interior is evacuated, with the result that

(*Continued on page* 1067.)

TECHNICAL NOTES.

(*Continued from page* 1066.)

most of the vapours are withdrawn. The varnish is then allowed to run in until the articles are immersed, and then the air pressure is allowed to rise to normal, after which steam pressure is applied. In this way the varnish penetrates right through the windings to the core. Molten paraffin-wax is often introduced into coils, made for ordinary telephone purposes, in this way, and on cutting through a coil it will usually be found that the wax is solid right to the core.

Preventing Eddy Currents.

Whilst on the subject of using varnish or insulation, one of the important uses of this substance in wireless apparatus is in connection with the laminations for L.F. transformers. These are, or should be, insulated from one another, for the purpose of preventing eddy-currents from being set up, which would cause loss of energy and heating of the core. After the laminations have been assembled, care should be taken that they are only pressed together, not scraped together, or otherwise treated in any way which would tend to bring them into electrical contact with one another. Some amateurs, noticing a little irregularity in the edges of the laminations of a low-frequency transformer, feel tempted to smooth matters out with a file. This would be a very undesirable thing to do, as the burrs which would so be pushed over would certainly put the various laminations into electrical contact with one another. Of course, the effect would not be as serious as if the whole core were made of one solid block of metal, but nevertheless, since much trouble is taken by the manufacturers of reliable transformers to keep the laminations apart, their efforts in that direction are largely wasted if the laminations are tampered with in the way mentioned above.

Single-Wire Aerials.

The belief in the advantages of the multiple-wire aerial, like many other wireless beliefs, is undergoing a certain amount of revision. Experiments have been conducted lately on an extensive scale by the United States Shipping Board, in order to ascertain whether there is any very decided advantage in the multiple-wire transmitting aerial for ships using up to 1 kw. A single strand of 7–18 antenna was used, and tests were made of the inverted "L" and "T" types.

Energy Radiation.

It was found that considerably more than 1 kw. could be "pumped" into this antenna without excessive sparking, although the results of the experiments would seem to indicate that such an aerial would not be suitable for power of 2 kw. and upwards.

Mechanical Advantages.

The Radio Inspector of New York reported on these experiments as follows: "This type of antenna has many evident mechanical advantages, both in regard to the original installation and the maintenance, and if the reports of its operation when transmitting and receiving are both satisfactory, it will probably be generally adopted by the radio companies. It is

(*Continued on page* 1068.)

TECHNICAL NOTES.

(Continued from page ~~1066~~ 1067.)

particularly advantageous for ships at this time when the neutrality regulations demand frequent lowering and raising of the antenna."

It should be added that there are many amateurs and experimenters who still believe, probably rightly, that they gain little or no advantage, at any rate no advantage worth while, in using a multiple-wire aerial in reception, and the single aerial is evidently much easier to manipulate.

Worn Out D.E.'s

A problem which frequently puzzles the beginner using dull-emitter valves is to know when the valves have ceased to function efficiently. It is well-known that the action of the dull-emitter filament depends upon an additional substance which is within or upon the filament, and that, in course of time, this substance becomes exhausted, the emissivity of the filament then falling off. Of course, when a dull-emitter has fallen behind, so to speak, it can always be raised to a somewhat higher temperature, until eventually it is being used practically as a bright emitter. But dull-emitter filaments do not function for very long in this stage before they break or burn out, and it is very desirable to take every care never to exceed the rated temperature, and generally, if not to "nurse" the valves, at any rate, to treat them with respect.

A Simple Test.

A contemporary discusses how the amateur is to know when his dull-emitter filaments are not working to standard, and makes the very simple recommendation that a new dull emitter should be kept on hand, for the purpose of comparing the working valves from time to time, in order to see which is the better. It is true that this simple test will enable the user always to keep a check on his valves, but it has the evident drawback that it means investing in one more valve than you actually require. If you regard this extra valve, however, as a spare or stand-by, to be used when one of the working valves "goes," it comes to the same thing in the long run, only you buy your next valve sooner than you otherwise would do.

D.E.'s for H.F.

It is also useful to note, whilst on this subject, that when a valve has become quite poor as a low-frequency amplifier, it may generally be used, with fair results, as a high-frequency amplifier. The reason for this, of course, is that the working load or anode current, in the case of a high-frequency valve is much less than in the case of a low-frequency valve. If your valves are interchangeable in the high-frequency and low-frequency sides, and you should find your low-frequency going off, try changing the bad ones over to high-frequency.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.