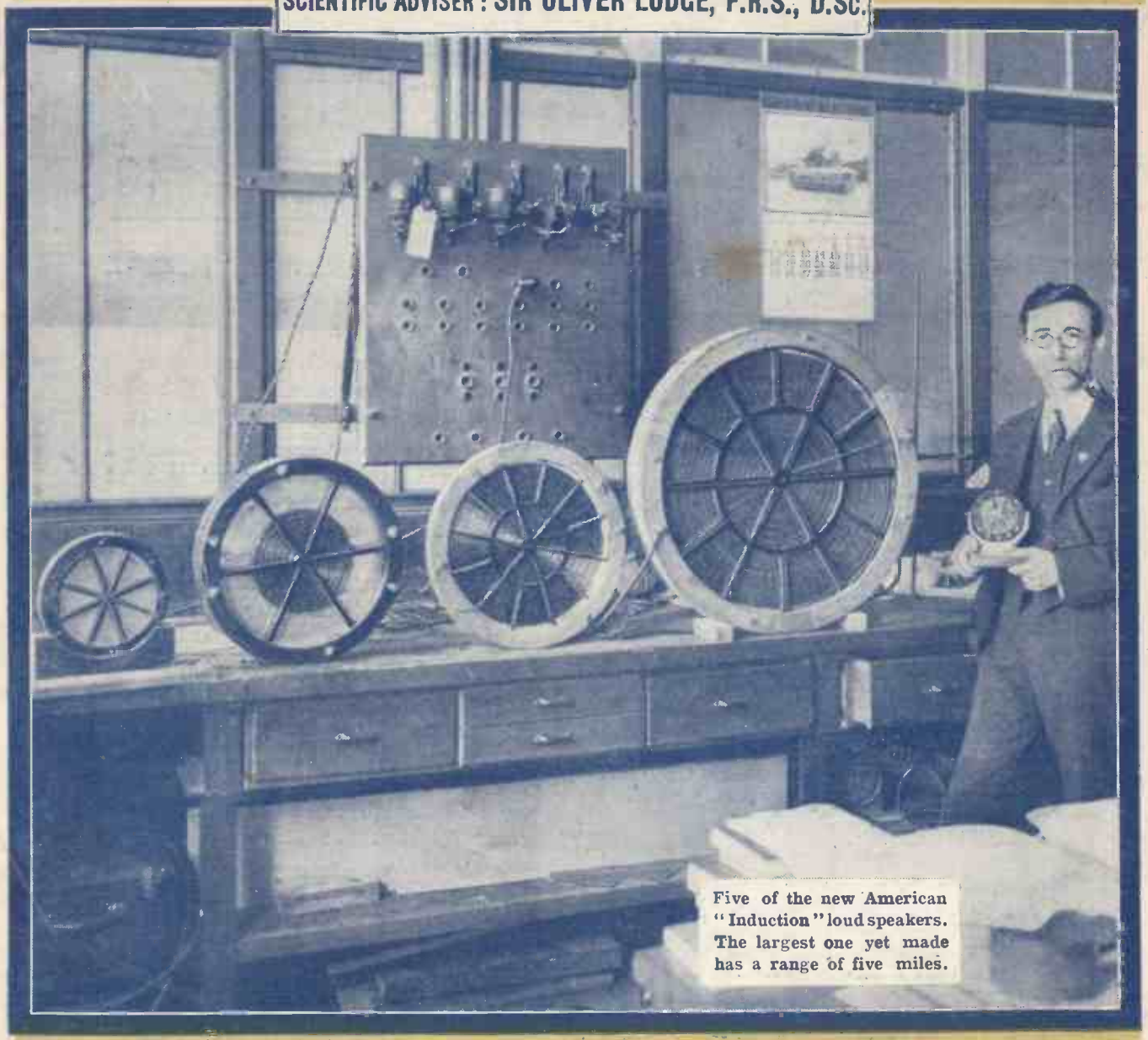
POPULAR WIRELESS AND WIRELESS REVIEW, February 7th, 1925. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE "P.W." BROADCASTING TIME TABLE.

Popular Wireless and Wireless Review

PRICE 3d. EVERY THURSDAY.

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



Five of the new American "Induction" loud speakers. The largest one yet made has a range of five miles.

FEATURES IN THIS ISSUE.

How to Make a "D" Coil Variometer.
Further Notes on Short-Wave Work.
A Simple Coil Holder.
Suggestions for "D X" Amateurs.
The Art of Tuning.
Duolateral Coil Winding.

"How to Make" Articles:

CONSTRUCTING A "HOUSEHOLD" LOUD-SPEAKER SET.

THE THREE-VALVE REFLEX RECEIVER (Part II).

No. 141. Vol. VI. February 7th, 1925.

The Thrill

NO thrill can equal that of sweeping over the crest of a long hill at the wheel of a superb car.

The hum of the wheels on the crisp road; the tang of the rushing winter air; and the valley below becoming dim in the mist.

The giant engine at your feet is droning a happy song, but you are content to forget his existence. You forget—and quite rightly so—the minute care which the makers bestowed, not only upon the design as a whole, but upon each individual component part. And yet it is the care with which the component parts are selected and tested that decides the success of the whole car.

The same is true of a wireless set.

We have specialised for over 12 years on the production of better and still better condensers, because we realise how important it is for a wireless set to have only condensers of the highest possible efficiency.

That is why we advise you, in your own interests to

Specify Dubilier.

DUBILIER
CONDENSER CO LTD

Advt. of the Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

Telephone: Chiswick 2241-2-3.

E.P.S. 90.

POPULAR WIRELESS
The Radio Weekly with the Largest Circulation
Editor: NORMAN EDWARDS, M.Inst.R.E. F.R.S.A., F.R.G.S.
Scientific Adviser Sir OLIVER LODGE. F.R.S.
Technical Editor G. V. DOWDING. Grad.I.E.E

RADIO NOTES AND NEWS OF THE WEEK.

In the Future.

SOME day we shall tune-in to Calcutta as easily as we now twist the knobs for Cardiff, and, according to the local Press, this is the kind of thing we shall hear: "7 p.m., Clarionet, Babu Harish Chandra"; followed by "Babu Satish Chandra Gupta and Babu Khagendra Nath Roy, in a spirited Sitar Duet." Then Renoo Mukherjee will play the piano, and Babu Sourendra Mohan Mukherjee will recite. I understand that several announcers have already been invalided out of the Calcutta service.

* * *

The Valve Puzzle.

DID you solve the "P.W." Crossword Puzzle? It was a very stiff one, but the Editor was confident that it was not too difficult; and sure enough, the first correct solution arrived at "P.W.'s" offices on January 23rd, the day after publication. The sender was Mr. F. W. Hill, 23, Hornsey Lane Gardens, Highgate, London, N.6, to whom the prize of Two Guineas has been forwarded.

* * *

The Solution.

THE solution was as follows:

Across:

(1) Crystal.
(3) L.F.
(4) Grid.
(7) S.I.C. (Specific Inductive Capacity. Note: Polyphemus had only one eye).
(8) E L E (the "whole" is Electron).
(10) E R G (the "whole" is Energy).
(12) G.M.T.

Down:

(1) Cells (slang word "Sells").
(2) Lodge (see Isaiah i., 8).
(5) R E E (call letters of Murmansk).
(6) A.C.
(9) Energy.
(11) G. M. (initials of Mr. Guglielmo Marconi).

* * *

Towards Perfection.

THE care which Mr. Arthur Burrows bestows upon the B.B.C. programmes does not cease when he leaves 2, Savoy Hill, in the evening. His house is connected by a private wire to the control room, and from five o'clock every night one or other of the stations is switched through to his loud-speaker. He hopes that programmes and procedure will be perfect some day—then perhaps he will get a rest.

* * *

Still Coming In.

SINCE the opening of the Nottingham relay station last September, nearly twenty-five thousand licences have been issued to listeners in that neighbourhood. This represents about £12,500, and the ten-shillings are still coming in at the rate of several hundred per week. Well done, Nottingham!

General Harbord, President of the Radio Corporation of America, inspecting the latest apparatus for transmitting photographs by wireless, recently exhibited in New York.

* * *

Another Record.

WHILST the moon was eclipsing the sun on January 24th, Mr. J. A. Partridge, the well-known Wimbledon amateur, was eclipsing previous radio records at his station, 2 K F. He listened in all the afternoon, and at 4 p.m., when the shadow across the sun was at a maximum, he tuned to Mosul, Mesopotamia. This was good, but soon after he heard 3 B G, an Australian amateur, who was in touch with America at the same time. Previously Mr. Partridge had never heard Australia until 7 p.m., and it was the first time that 3 B G (whose station is at Melbourne) had succeeded in communicating with both continents at once.

* * *

Effects Noted.

FROM the point of view of listeners in the London area, the much-talked-of eclipse was a complete failure. With a clouded sky there was no clear-cut shadow effect, and although reception seemed better during the period of greatest obscurity there was no exceptional improvement on short-distance signals. When it was all over, the end of the eclipse tailed off into ordinary evening signal strength; but in two years' time there is a *total* eclipse, and the effect of this upon wireless should be well worth watching.

* * *

The Leeds Exhibition.

THE Leeds Wireless Exhibition was a great success, and local interest was strongly aroused by the visit of Captain Eckersley, and by his characteristic sallies against the ubiquitous oscillator.

I hear that Newport (Mon.) is now planning a Radio Exhibition, and the date has been courageously fixed for May (2nd to 9th inclusive). Evidently wireless in Wales is not to be confined to the winter months only.

* * *

A Novel "Stunt."

NEXT week Nottingham station is enlivening a discussion upon economics by broadcasting the views of listeners, as well as those of the lecturer. Instead of the students being present in the studio, they will call upon the B.B.C. by telephone, and the calls will be put through the amplifier circuit just as though they were coming in through a microphone.

* * *

The Old Problem.

ONCE again there is an outcry against the old-fashioned apparatus used by many ships, which drowns the reception of broadcasting for people who live near the coast. It is being stated that the installa-

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from page* 1345.)

tion of more modern gear would solve the problem, but unfortunately this is not the entire truth. Selective apparatus could easily be fitted, but under present-day conditions it is often undesirable at sea. Many a distress call would have been tuned out completely if the transmitter had not been broadly tuned, so as to interfere over a wide band of wave-lengths.

* * *

Say it to Music.

JAMMING is not always a nuisance. I wonder how many readers noticed the pleasant overlapping of 5 X X and Radio-Paris, when the former was announcing the news recently? A piano was being played at the French station, and the effect was to form a pleasing background, which transformed the copyright of "Reuter's, Press Association, Exchange Telegraph, and Central News" into a kind of musical monologue.

* * *

Marseilles Calling!

THE proposal to erect a broadcasting station at Marseilles has now taken definite shape. I hear that the Cie. Française de Radiophone is seeking to obtain permission for the project, and if this is granted a powerful installation will be erected in the near future.

* * *

Australian Broadcasting

FOLLOWING my remark that neither Sydney nor Melbourne broadcasting had been picked up in this country, comes the news that a Woodford listener—Mr. Leon J. Duyck, of 108, High Road—believes that he has picked up both Sydney and Melbourne stations on the same morning, at 8.30 a.m.

At the time of writing his claim has not been confirmed by the stations in question, but it has brought to light the interesting fact that Mr. Duyck has previously picked up Cape Town, Johannesburg, Buenos Aires, and Athens, on a 3-valve set.

* * *

2 L O to Move.

TRANSFERRING 2 L O to the West End is not a very difficult task for the B.B.C., and by the middle of February the new station should be in operation on doubled power. London listeners are delighted at the prospect, except the distance-seekers, who already find difficulty in tuning-in other stations. It is not certain that double-power (3 kw) will be authorised permanently, but the B.B.C.'s aim is to make crystal reception easy over a wider area and to ensure that no section of 2 L O's audience is worse off as a result of the move.

SHORT WAVES.

He: The wife I shall choose will charm me with music when I feel like it, and have the sense to shut up when I don't.

She: You don't want a wife, you want a valve set!—"News of the World."

* * *

"Depend upon it, the Universe is intelligible—ultimately intelligible—however complicated and hopeless it may appear."—Sir Oliver Ldge.

* * *

". . . I say without any hesitation that the broadcasting of plays can be in no way a substitute for the seeing of them in the theatre, and cannot possibly damage the theatrical business. What it will damage is the broadcasting business, if they go on with it on the present scale. . . ."—Filson Young, in the "Sunday Chronicle."

* * *

Nobody ever built a good set who didn't secretly imagine that he invented a good part of the circuit himself.—"Radio World."

* * *

MODERN MISUNDERSTANDINGS.

He: How many reception rooms have you got?"

She: Oh, only one. You see, we've only got one crystal set.—"Sunday Pictorial."

* * *

THE WEEK'S QUERY.

"And what's the good of these Educational Talks anyhow? How many people wants to be learnt English?"

The B.B.C.'s studio at the Nottingham relay station.

The Cut in Valves.

THE cut in valve prices is the best news that listeners have heard this year.

Prices are down from 10 to 15 per cent. on all the well-known makes. Even on the cheaper types the saving is considerable—for instance, the 12/6 valves now cost 11/- only.

* * *

Successful French Amateur.

THE French amateur, 8 T M, has been specialising on low-power work, and has scored some splendid successes. He has managed to communicate with amateurs in Britain, France, Spain, Switzerland, and Italy, using an input of only one and a half watts.

* * *

A Radio Congregation.

THAT sermons by radio have proved of the greatest value to religion is the opinion of some of America's foremost preachers. The Rev. S. Parkes Cadman, who speaks every Sunday from Brooklyn, stated: "My father preached continuously for sixty years, and throughout his lifetime he addressed fewer people than I reach by radio in a single afternoon." The radio congregation of the Rev. Cadman is estimated to number anything from half a million to two million souls.

* * *

No Cause for Complaint.

"THERE are many experimenters like myself who have no complaints whatever to make against the splendid programmes or transmissions of any of the stations belonging to the B.B.C.," says Mr. Wm. Carter, of Kettering (2 A P T). People are *too apt* to complain without cause, aren't they, 2 A P T?

* * *

New Station for "D X" Amateurs.

THE new American station which has opened at Atlantic City is going to prove one of the most interesting ever heard in this country. Its wavelength is 296 metres, and its call sign—at the time of writing—is a complete mystery. Every correspondent who heard the opening transmission heard the call-sign as well, but unfortunately they were all different! Mr. Davies, of Highgate, thought it was "W B G," whilst a Gloucester reader heard it as "W D E." Another "D X" merchant asks, "Who is this W E B that is now coming over on about 300 metres?" whilst a Brighton correspondent says, "I picked up W G B, New England. The call-sign was clear and distinct. It was repeated several times, and I am sure it was W G B." Finally, an Acton reader says, "I was listening from 2.30 to 3.25 a.m. (as no doubt you were), and it was either W B E, W B D, or W E D"! As a matter of fact, I was in my BED at that hour!

* * *

What is Wrong at 5 W A.

WHAT is the matter with Cardiff lately? Several aggrieved correspondents have grumbled to me about the programmes, and expressed a wish for more Welsh items, now that about 50 per cent. of Swansea's entertainments come from 5 W A. There seems to be a hurry to close down, which on New Year's Eve lost listeners the chimes enjoyed by the other stations. Is the first enthusiasm wearing off?

* * *

Cause and Effect.

SINCE a Cape Town enthusiast picked up New Year wireless greetings from Bournemouth, listeners in South Africa have done nothing but recite records of radio reception to one another. This is how radio "Boers" are made.

ARIEL.

HOW TO BUILD A "HOUSEHOLD" LOUD-SPEAKER SET.

ONE CONTROL FOR TUNING.

Built and Described by J. C. JEVONS.

This neat and inexpensive receiver is pre-eminently suitable as a standard fool-proof, easily handled "family" receiver. Its construction is comparatively simple, and its advantages many, as the reader will see from the following article.

THIS set has been specially designed to give full-toned, high-class loud-speaker reception free from distortion, combined with simplicity of working, so that it can be handled with excellent results by inexperienced members of the household without any assistance from the family "expert."

The following materials and components are required :

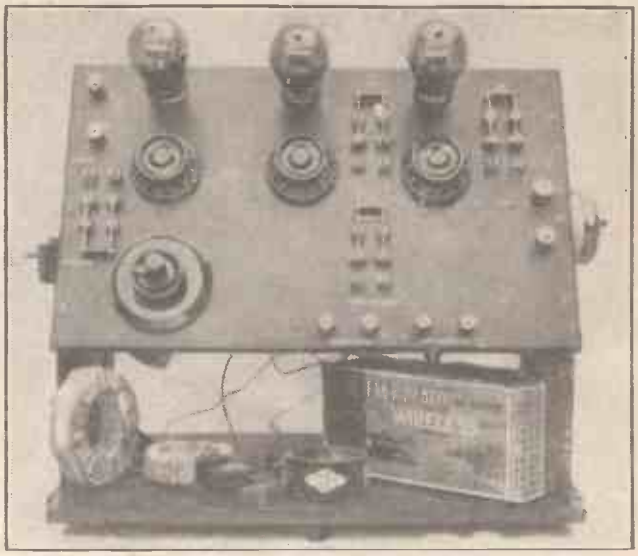
Ebonite panel 15½ in. by 9 in. by ¼ in.
Variable condenser ·0005 mfd. with vernier.
3 Rheostats suitable for the valves used.
1 dozen valve sockets, flush type.
2 L.F. transformers.
1 Grid condenser and leak.
4 D.P.D.T. switches.
8 W.O. terminals.
1 double coil holder.
4 Wander Plugs for H.T. leads (3 red, 1 black).
1 Tumbler switch (electric light type).
2 Fixed condensers ·001 mfd.
¾ in. thick planed mahogany or walnut for the cabinet.
3-ply wood for back of same.
1 No.4 B.A. ebonite knob for front door.
A few yards of 16 or 18 gauge square section tinned copper wire for internal connection.
A few feet of twin electric light flexible wire.
Sundry screws, varnish and wood stain.

Although primarily intended for loud-speaker work, a very convenient and simple switching arrangement is provided for cutting out one or both of the amplifying stages at will, thus enabling the set to be readily converted into a single-valve receiver for headphone reception, if desired.

In order to ensure a high quality of reproduction, provision is made for the use of a different plate potential on the separate valves, whilst each grid is given an appropriate bias. In addition, a suitable power valve is used for the second stage of L.F. amplification.

The Cabinet.

As regards simplicity of control, only one tuning condenser is used, and, when once this has been set for any desired station, the receiver can be put into, or out of action, as desired, merely by operating a tumbler switch mounted on the side of the cabinet. Finally, the cabinet is conveniently designed so as to house the H.T. battery, and also the filament battery when dull-emitter valves are used.



View of the set with part of the front case removed, showing room for stowing batteries, coils, etc.

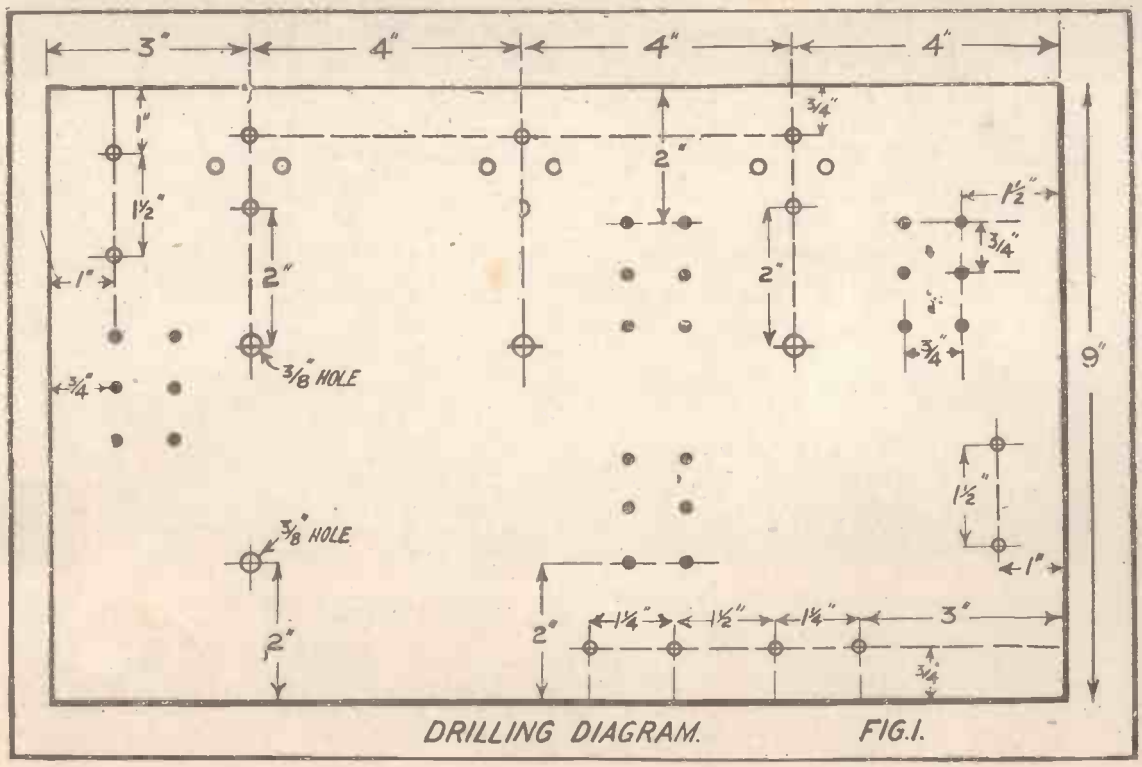
It is advisable to make this first so that ample time may be allowed for the varnish to dry before assembly. Cut pieces of mahogany 15½ in. by 7½ in. and 14¾ in. by 3½ in. for the base and top respectively. For the sides, two pieces are required, 11⅛ in. high at back, 7½ in. along bottom, 4 in. high at front, and 3½ in. along top.

Before actually cutting these out it is well to see that the ebonite panel is of the correct size. If not, it is a simple matter to make a slight alteration in the size of the cabinet in order to accommodate any small error in the panel dimensions.

The cutting of the front door or flap is best left until after the shell of the cabinet has been put together so as to get a good fit. Its size should be 14 in. by 4 in.

Smooth the wood thoroughly with

(*Continued on page 1348.*)



DRILLING DIAGRAM. FIG. 1.

HOW TO BUILD A HOUSEHOLD LOUD-SPEAKER SET.

(*Continued from page* 1347.)

glass paper, starting with a coarse grade and finishing off with a fine grade of paper. Fix the sides, top and bottom together with ¾-in. countersunk brass wood screws. Bevel the top front edge with a plane so that the panel lies snugly against it.

Now cut the front flap as directed above, and also the 3-ply back. Give all the woodwork a coating of mahogany or walnut spirit varnish stain. It is better to thin the average stain with a little methylated spirit in order to get a smooth and even application without patches or streaks.

Mounting the Switches.

When thoroughly dry, smooth with fine glass paper and apply a coat of copal carriage varnish, using a soft brush. This will result in a fine, hard glossy surface if left to dry for two days in a warm, dust-free room.

The front flap is attached by a couple of brass hinges to the base, and is provided in the centre, near the top, with a small No. 4 B.A. black ebonite knob. A small screw is then inserted into the interior of the case, at each side, to form a stop or abutment for the flap, whilst a bolt or catch is added to prevent the flap from opening accidentally. The three-ply back can be conveniently fixed in place by making four keyhole slots at the sides and inserting four projecting screws in the rear edges of the cabinet sides to correspond. The back is first placed in position over the screws and then firmly secured by pushing it downwards so as to force the projecting screwheads into the narrow part of the keyhole slots.

It is hardly necessary to say that this should be of high-quality ebonite. See that it has been cut with square corners and straight sides. Round the edges with a file and smooth them carefully with glass paper.

If the surface is glossy the gloss should be removed with emery cloth or glass paper, and re-polished with rotten stone and oil if a polished surface is wanted. First mark out the position of the holes in accordance with the drilling diagram, Fig. 1, and then drill them out carefully at right angles to the surface. The terminal holes should be ⅛ in. and should be tapped No. 4. B.A.

The finished set connected up and ready for use.

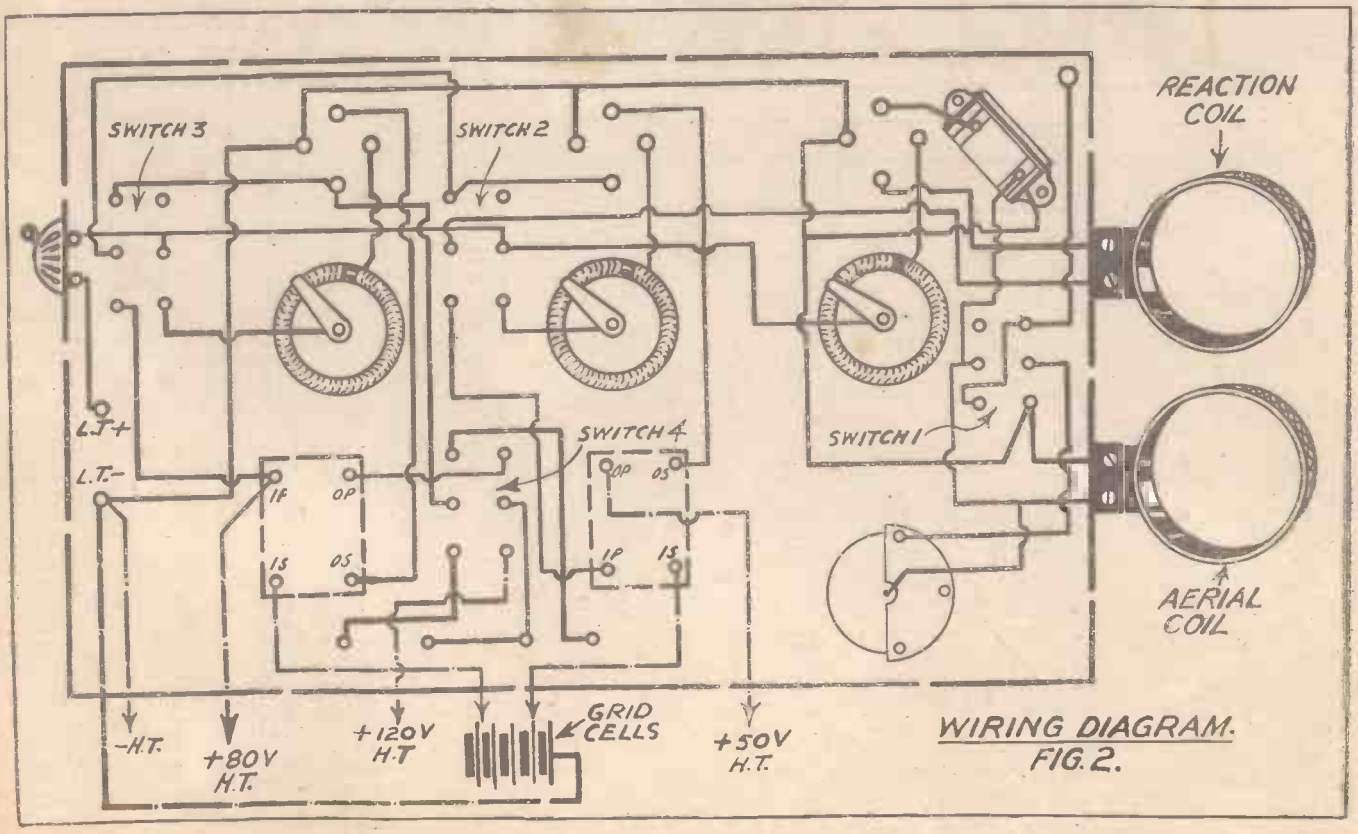
The condenser will need either a 7/16 in. or ⅜ in. plain hole, according to the particular make purchased, and so will each of the rheostats. The valve sockets are usually No. 1 B.A. The holes for the latter are best drilled out with the aid of one of the templates now on the market. They may either be tapped into the ebonite, or else fixed by a nut at the back.

The holes for the double-pole, double-throw switches must be drilled accurately to suit the particular switch purchased. The free working of these depends very largely on the accuracy with which this is done, so that it is worth while taking extra pains. Having settled the *relative* positions of the six holes, it is advisable first to make a paper template and then use this to prick through the correct places for each of the four switches in turn.

The Grid Condenser.

The exact location of the two L.F. transformers necessarily depends upon the particular make chosen, and precise measurements are therefore not given. It is quite easy, however, to place them in convenient positions on the back of the panel, when the latter is laid horizontally on the table, and then to mark out the places for the fixing screws. The holes should be drilled not quite through the panel, and then tapped No. 4. or 5 B.A. with "plug" or "bottoming" tap.

(*Continued on page* 1349.)



WIRING DIAGRAM. FIG. 2.

HOW TO BUILD A HOUSEHOLD LOUD-SPEAKER SET.

(*Continued from page* 1348.)

All the components may now be fixed firmly in position by their respective clamping nuts, etc. A simple and convenient way of fixing the grid condenser in place is to pass one of the holes in the end lugs over the "earth" terminal shank, and then clamp it by a No. 4. B.A. nut. This will be found to hold the condenser firmly in position. It does not make electrical contact with the terminal, nor does it prevent the subsequent connection of a wire to the "earth" terminal.

These should be made with square section No. 18 or No. 16 gauge tinned copper wire, usually known as "bus-bar." There is no fear of this wire sagging down and causing short circuits, whilst owing to the tin coating it is easily soldered.

Whilst the use of right-angled bends is certainly neat and attractive in the finished set, this convention need not be slavishly adhered to, as is the habit with many constructors, for in some cases a slanting connection is more rigid and therefore the better practice.

Point Worth Noting.

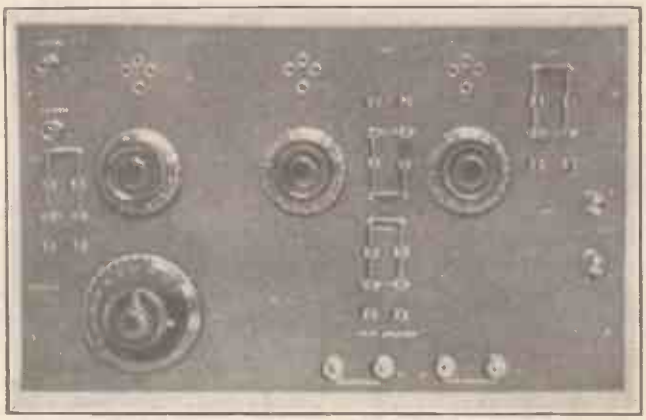
The actual connections of the wires to the various terminals should preferably be soldered, but nuts may be used without any appreciable loss of efficiency since they make a large surface contact with square wire—unlike round wire, with which only a line contact is made. After soldering a terminal or screw it should, if possible, be tightened, since heat tends to loosen metal fittings attached to ebonite.

Turn the panel face downwards on the table and commence by connecting the three rheostats to the corresponding right-hand filament valve socket. Next run a wire from the right-hand bottom screw, No. 1 switch (near the variable condenser) to the L.T. – terminal by way of the left-hand filament sockets of the valves. This wire should be kept about 1 in. above the surface of the panel, short vertical connections being dropped to each of these three-valve sockets.

The right-hand rheostat should now be connected to the right-hand middle screw of No. 3 switch, a drop connection being made to the middle right screw of No. 2 switch. This wire should be a trifle lower than the above.

Wiring Details.

Next connect top left screw of No. 3 switch with the third valve plate socket by a wire about 1½ in. high and carry on in a slanting direction to middle left screw of No. 4 switch. Connect second transformer O.P. by a slanting wire to right top screw of switch 4; then first transformer I.P. by slanting wire to left bottom screw of switch No. 2; second valve grid to first transformer O.S.; aerial terminal to right top screw of switch 1 by wire 1½ in. high, and on by a wire near panel surface to left bottom screw of same switch; fixed plates of tuning condenser to left middle screw of switch No. 1; movable condenser plates to left middle screw of switch No. 1, and on to one terminal of grid condenser; then the other grid condenser terminal to grid socket of first valve.



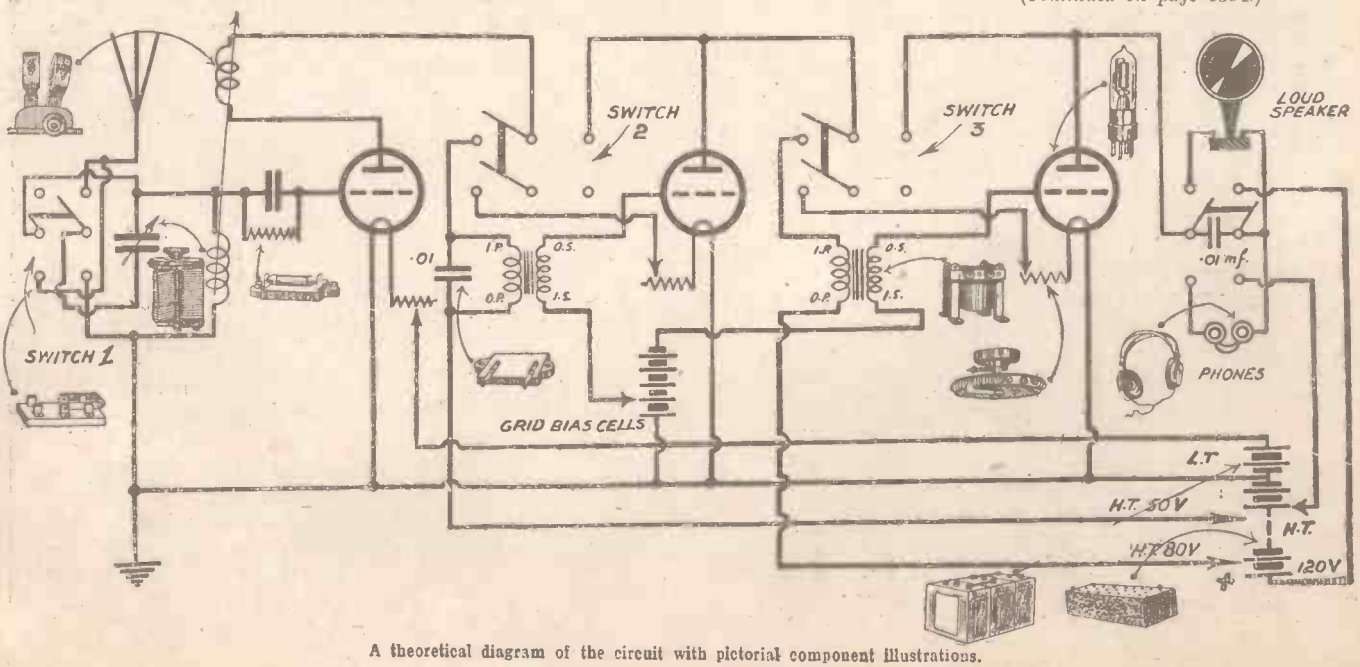
Close up view of the lay-out of the front of the panel.

The connections for the aerial coil and tumbler switch should come next. Thinner wires should be used for these, say 24 gauge, each about 6 in. long. The reason is that they are to be passed through holes in the cabinet later on, and will be covered with insulating sleeving. Solder one on to each of the following: (1) The L.T. positive terminal shank. (2) The wire connected to the right centre screw of switch No. 3. (3) The wire attached to the right bottom screw of switch No. 1. (4) The wire attached to the movable condenser plates (centre terminal of condenser). The connections to the telephone and loud-speaker terminals are as shown.

The following wires should be of stranded rubber-covered electric-light flex. (1) 10 in. long, attached to O.P. of first transformer, and provided at its free end with a red wander plug marked "50" on top with ink. (2) 12 in. long, attached to O.P. of second transformer with red plug marked "80." (3) 12 in. long, attached to bottom right screw of switch No. 4 with red plug marked "120." (4) 14 in. long, soldered to L.T. negative terminal, with *black* plug for negative H.T. (5) 9 in. long, attached to I.S. of first transformer. (6) 7 in. long, attached to I.S. of second transformer. (7) 7 in. long, attached to L.T. negative. (8) 13 in. long, attached to left middle screw of switch No. 2. (9) 9 in. long, attached to plate (or anode) socket of first valve. Nos. 5, 6, and 7, above, are for grid battery connections, whilst the last two are for the reaction coil.

Fix the double coil holder on the left of the cabinet about 6 in. from the base and 3 in. from the back, with the movable reaction coil holder nearer the front. Next fix the tumbler switch on the right side in a similar position. Drill four holes $\frac{5}{32}$ in. in diameter for the coil connections to pass

(*Continued on page* 1394.)



A theoretical diagram of the circuit with pictorial component illustrations.

THE ART OF TUNING.

By C. E. FIELD, B.Sc.

PART I.

THERE are many wireless experimenters who, although they may be able to construct quite an efficient receiving set, and can talk learnedly about such mysteries as "resistance coupling," "grid bias," and so on, operate their sets in the most haphazard manner. They endeavour to tune-in distant stations by turning condenser knobs in all directions, changing inductance coils at random, and indiscriminately trying the effect of a series parallel switch, a reversal of reaction coil connections, or even a change in the size of a variable condenser.

Much time and patience can be saved if the relations existing between the coils and condensers, and the signals to be received, are properly understood.

How it is Accomplished.

If the lead-in wire from an aerial were joined directly to the earth plate, at any moment *every transmitting station in the world* which happened to be then working would cause a tiny electric current to flow in alternate directions between the aerial and the earth. The number of times per second at which these pulses of current succeed one another is dependent upon the wave-length on which the transmitting station is working, and it is the purpose of the tuning apparatus in a receiving set to select and make use of the current produced by the signals which it is desired to receive, and to allow all the other currents to flow straight to the earth.

Every electric circuit possesses two properties, known as *capacity* and *inductance*, and the tuner of a receiving set is simply a circuit of which the capacity, the inductance, or both are variable. It is not proposed here to discuss the theory of tuning, but it may be said that the greater the capacity or the inductance in a tuning circuit, the greater is the wave-length of the signals which it will select and pass on to the remainder of the receiving apparatus.

Inductance is introduced into a circuit by means of a coil of wire, the amount of inductance being dependent upon the number of turns of wire in the coil. Hence, a circuit containing a coil wound with a great many turns of wire will select signals of a higher wave-length than it would if the coil were wound with only a few turns.

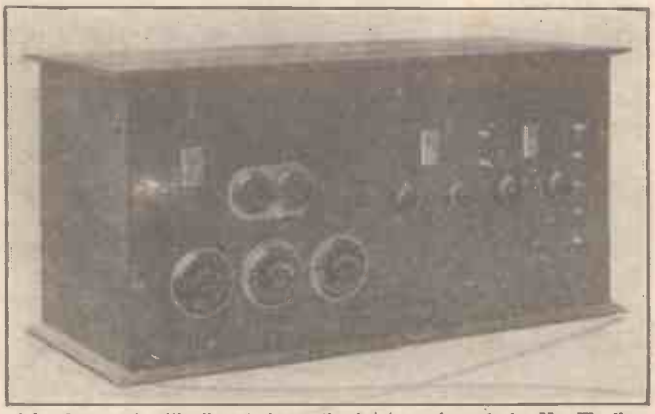
The Action of Variable Condensers.

Capacity is produced by means of a condenser, which consists of a number of metal plates, interleaved and separated by air spaces, alternate plates being joined together to form two groups. The capacity of a condenser can be increased by bringing the plates closer together, by increasing the number of plates, or by increasing the area by which the two groups of plates overlap one another.

In a variable condenser, such as is used for tuning purposes, the capacity is usually adjusted by this last method, one set of plates being stationary, and the other set mounted on a spindle to which is attached a moving dial, or a pointer.

A tuning circuit will thus select signals of the highest wave-length when the moving plates of the variable condenser are "all in," i.e. when they are entirely overlapped by the fixed plates.

In order that the operator shall be able to tell the relative position of the fixed and moving plates, the moving dial, or fixed scale of the condenser is graduated in degrees from 0 to 180. When a condenser is assembled, it should always be adjusted so that when the moving plates are "all in," the pointer indicates 180, a reading of 0 then indicating that the plates are "all out."



A handsome set, with all controls on the front panel, made by Mr. Wardle, 7, Empress Drive, Vickerston, Barrow-in-Furness.

It is only by this means that tuning can be made at all systematic, because when this is carried out, the readings on the condenser scale give an indication of the wave-length of the signals being received—the higher the wave-length, the higher the scale-reading, and vice versa.

Affecting a Compromise.

Since the wave-length of a circuit can be made greater by increasing *either* the size of the tuning coil, or the capacity of the condenser, obviously a given wave-length can be obtained by means of a large coil and a relatively small condenser capacity, or by means of a small coil and a large condenser.

How, then, can we decide which arrangement to employ?

As with many other wireless problems, it is usually necessary to effect a compromise, for although in most cases the best results are obtained by the use of the maximum inductance and the minimum capacity, it is sometimes advisable, especially in high-frequency intervalve circuits, deliberately to introduce capacity in order to render the set more easy to handle and less liable to self-oscillation.

This is not so important in the case of the aerial tuning circuit, but here a fairly large condenser is desirable when plug-in coils are employed, in order that the large wave-length band may be covered by the condenser in conjunction with one coil. A suitable capacity is ·0005 mfd.

If the tuning coil is variable by means of tappings or a slider, the condenser need only have a very small capacity, say ·0002 mfd., and when an infinitely variable inductance, known as a variometer, is employed, no tuning condenser is necessary, and the best results are obtained. A variometer, however, does not cover a very wide band of wave-lengths without the addition of loading coils, and presents difficulties to the introduction of reaction into the aerial circuit. Consequently, most experimenters prefer to use plug-in coils in conjunction with a variable condenser.

Choosing the Right Coil.

It will be seen from the foregoing that, given a variable condenser of any particular capacity, a broadcasting station can be received with many different plug-in coils.

Let us suppose that we can receive 2 L O, working on 365 metres, by the use of a 35-turn coil, with the condenser scale reading 170. If, now, a 50-turn coil were plugged in, and the condenser turned back, we might find that 2 L O came in at about 10 degrees, and the results would probably be better. Alternately, we might find that the signals were getting louder, but had not reached full strength by the time that the condenser was at 0 degrees. This would show that the 50-turn coil was too large, and that unless we possessed an intermediate coil, we would have to be satisfied with the results obtained with that wound with 35 turns.

Suppose now that we wanted to tune-in Birmingham, working on 475 metres. It would be foolish to turn the condenser knob at random, because if we turned it to a smaller reading we should only receive stations whose wave-length is less than 365 metres. We are already reading 170 degrees on the condenser scale, so that there is not much likelihood that the odd ten degrees will make a wave-length difference of more than 100 metres. The remedy is another coil, obviously a larger one since we wish to tune to a higher wave-length, and we might find that with the 50-turn coil, Birmingham was received with the condenser about half-way in.

(To be concluded next week.)

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless and Wireless Review." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.

SUGGESTIONS FOR "D X" AMATEURS.

The Relative Values of L.F. and H.F.

By LIEUT.-COMMANDER H. W. SHOVE, D.S.O., R.N.

"D X" amateurs are so numerous these days that any practical information on the question of long-distance reception is of interest and value. In the following article every reader interested in "ether searching" will find some very helpful suggestions.

THERE has lately been a good deal of controversy amongst those who specialise in long-distance reception regarding the relative merits of H.F. and L.F. amplification. For a long time the statement that "H.F. amplification increases range, but not volume; L.F., volume but not range," was repeated as a sort of

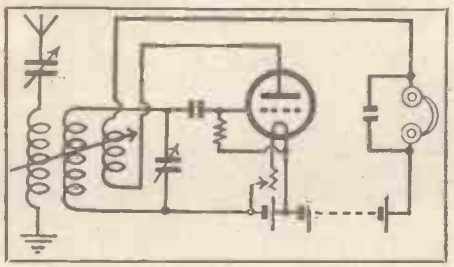


Fig. 1. Loose-coupled regenerative circuit.

catch-phrase, into the truth of which nobody seemed to take the trouble to examine. Now, the school of the "Detector and 1 L.F." has scored a great triumph in the establishment of direct amateur communication with New Zealand.

"Super-Hets" Ruled Out.

Its only rival, in the field of long-distance, short-wave, and low-power communication, seems to be the "Supersonic Heterodyne." Having no practical experience of this last, which seems to be rather in the nature of a "Rolls Royce," or multi-millionaire's receiver, the writer will not discuss it here. Only, it may be remarked that it does not seem likely that it will ever become a general, everyday, "poor man's" receiver, for the multiplicity of valves required is bound to keep it permanently in the expensive class. The receivers with which this

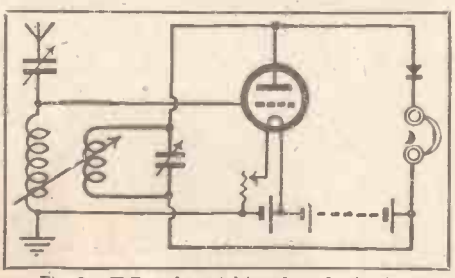


Fig. 2. H.F. and crystal tuned anode circuit.

article deals are of the one- or two-valve type, such as are within the reach of the less opulent, and more numerous, section of radio amateurs.

It is apt to be lost sight of by some who read of the wonderful "D X" work of, for instance, Mr. C. W. Goyder and his confrères, that all this work is C.W. telegraphy and not the telephony with which the ordinary amateur is most concerned. The principle of the reception of C.W. is that the detector valve (or a specially arranged "oscillator") must be in that state of actual oscillation which is generally to be avoided in telephony. The C.W. signals as heard, are, in fact, that very heterodyne note or "howl," the elimination of which engages the attention of every decent broadcast listener. For the production of this there is probably nothing to compare with the ordinary "straight regenerator" of Fig. 1, especially if, as shown, loose-coupled tuning is employed.

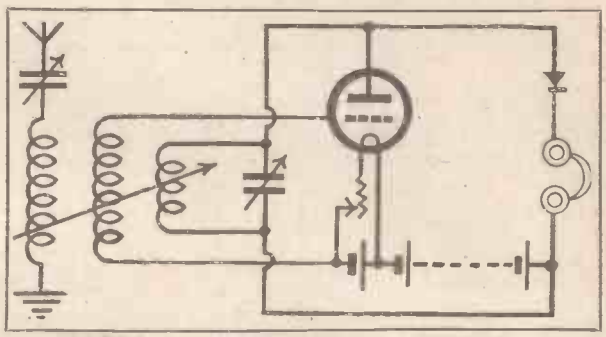


Fig. 3. Loose-coupled tuned anode circuit.

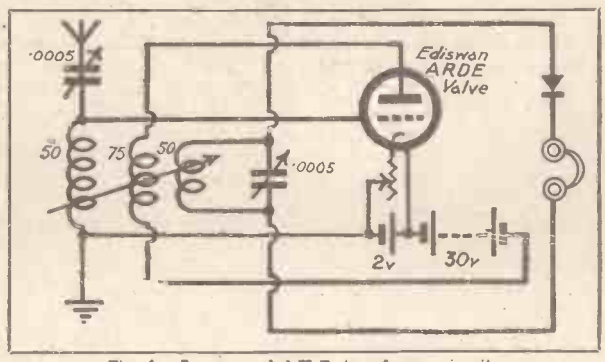


Fig. 4. Loose-coupled H.F. transformer circuit.

Clarity Before Volume.

In C.W. work purity of reproduction is not a factor. So that, having produced our "howl," any means of rectifying it which causes a detectable note in the 'phones may be employed. The simplest method, and one which is quite efficient, is to make the oscillating valve do this work by the provision of a leaky grid condenser. Hence the ordinary "straight detector" circuit seems to hold the field.

But when we turn to telephony the case is very different. Here pure reproduction, if not everything, is still a very big item in "DX," as in shorter range, work. Apart from the question of the enjoyability of music, the intelligibility of speech depends far more on its clarity than on its volume. It is, therefore, of the highest importance to use a means of rectification which will give a sound in the telephones not only detectable but, as nearly as possible, a replica of the sound transmitted, and unmixed with extraneous noises. It may be taken for granted that, in the present stage of radio science, the crystal is the best means of doing this.

For long-range telephony work with one valve it would, therefore, seem correct to use the valve purely as an amplifier and rely on a crystal for rectification. This brings us to the great question of H.F. v. L.F. amplification pure and simple. In a former article ("L.F. Amplification and Increase of Range," "P.W." No. 126, of Oct. 25th, 1924), the writer has considered the use of L.F. amplification for increasing the range of crystal sets.

(*Continued on page* 1352.)

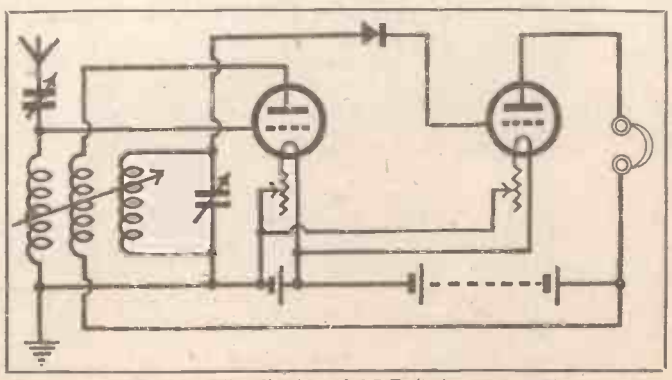


Fig. 5. Adding direct coupled L.F. (to increase range).

SUGGESTIONS FOR "D X" AMATEURS.

(*Continued from page* 1351.)

The addition of one L.F. valve as there described should enable reception, at good headphone strength, to be obtained up to 40 or 50 miles from a 1½ kw. broadcasting station. But the increase is limited by the fact that reaction cannot be used in this method. And it is reaction that has been the greatest factor in extending the range of the single-valve receiver. To allow of its use with crystal rectification we must connect our valve as an H.F. amplifier. There are several ways of doing this, but the most generally popular, and one which is quite efficient on the "broadcast band" of wave-lengths, is the ordinary "tuned anode" (Fig. 2).

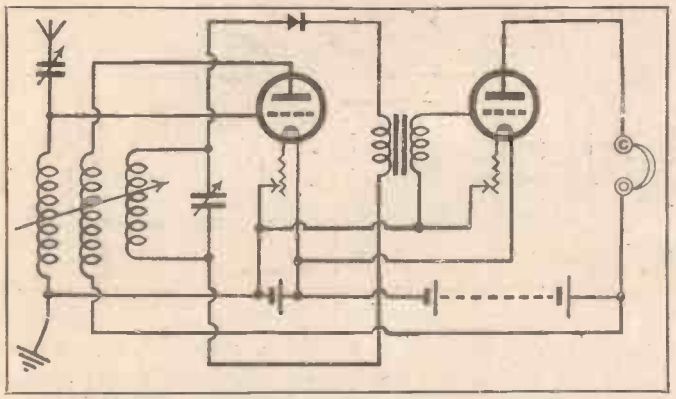


Fig. 6. Use of L.F. transformer (to increase volume).

A Crystal's "Damping" Effect.

Below about 200 metres it is difficult, though not impossible, to employ H.F. amplification. But the only "serious" telephony at present "on the ether" in this region is the famous short wave K D K A. Frankly, for this (on 65 metres) the writer would advise the abandonment of the attempt to maintain "crystal purity" and the employment of the single-valve regenerator of Fig. 1.

But let us here consider the broadcast band, from 200 to 1,000 metres. The circuit of Fig. 2 is an excellent one in many respects. It is true that it involves two tuning controls and so departs from the "sweet simplicity" of L.F. amplification or the direct-coupled single-valver. But the writer is not aware of any really efficient receiver for long range telephony on these wave-lengths, which does not. (Judging from past experience he will probably hear of at least a dozen from different correspondents as a result of having written this !).

The objection to the "straight-tuned anode" seems to the writer to be that the direct-coupled aerial, associated with the "damping" effect of the crystal, is apt to spoil that ultra-selectivity which is the great advantage of the loose-coupled single-valve detector, whose control is, of course, practically the same. This tends to re-introduce the extraneous noises whose elimination is almost equally important with the fidelity of reproduction which was our reason for preferring the crystal to the valve rectifier.

If we adopt a circuit such as that of Fig. 3, wherein both a loose-coupler and a tuned anode are incorporated, we have to face rather formidable complications. For we now have *three* circuits to tune and the closely interacting undamped grid circuit and tuned anode will be very apt to cause instability. The circuit, in fact, does not seem worth while.

Obtaining Selectivity.

But the advantage of selectivity, among others, can be gained by making use of the arrangement shown in Fig. 4. This is what is called a "loose-coupled transformer" circuit, and is one with which the writer has had great success. It is not, of course, by any means novel, though it is less used than its merits seem to warrant. The idea of this circuit is that the valve acts exactly as in the single-valve regenerator, except that the signals are not rectified. Instead, there is a second tuned circuit, precisely similar to the secondary of a loose-coupled crystal set, but coupled to the *untuned* anode circuit of the valve. The three coils are mounted in a "3-coil holder," the anode coil being in the middle, so that the amplified H.F. impulses are transferred by magnetic coupling into both the tuned circuits—into the aerial as ordinary reaction and into the detector circuit as in a loose coupler.

There is also, of course, a certain amount of coupling, depending on the setting of the coils, between the aerial and detector circuits. By bringing these two coils fairly close, and switching out the valve, we get a plain loose-coupled crystal set, which will give excellent results within ordinary crystal range. The writer has not found that the presence of the middle coil, under these conditions, makes much difference. But it can be removed if desired.

When using H.F., the value of the anode coil is rather critical. If too large a coil is inserted the set will be unstable. If too small, it may be difficult to approach the oscillating point. As with an ordinary reaction coil, a good deal depends on the other constants of the circuit. Fig. 4 shows the values used in the writer's set for 300–500 metres. This is on a very large indoor aerial with which a series condenser is always necessary. But the reader who desires to try out the circuit is advised to find the best values for his own set and aerial by trial.

Selectivity is, of course, increased, without serious loss of signal strength, by loosening the coupling of the anode and detector coils. Reaction is applied by bringing the aerial coil up to the anode. The change of setting of the coils will necessitate readjustment of the condensers, as in other reaction or loose-coupled sets. Both condensers should be fitted with verniers, or fine tuning attachments, as the tuning is extremely sharp. Practice is necessary to get the best results, but the trouble entailed will be amply repaid. The circuit is *not* recommended to the absolute novice.

The addition of a "direct-coupled" L.F. valve may be tried to bring very weak signals up to proper 'phone strength (see Fig. 5). This makes one of the most sensitive two-valve sets known to the writer. The method of Fig. 5 should not, however, be used to increase the volume of signals already easily readable. It is only efficient on weak signals. In other cases a transformer should be introduced, as Fig. 6.

"Reflex" Limitations.

Very slight modifications will adapt a set wired on this system for use as a straight one-valver. The necessary terminals, etc., are indicated in Fig. 7, which should be self-explanatory. The constructor will then have three possible combinations :—

1. Plain loose-coupled crystal; 2. H.F. and crystal; 3. "Straight" single-valve.

A word as to "dual" amplification. This system is now popular and is certainly useful up to a limited range. But I think most experienced operators will concur with me in saying that the L.F. side generally predominates and that its chief usefulness is in enabling considerable volume to be obtained from a station within, say, 50 miles. A valve *can* handle both H.F. and L.F. currents simultaneously, but it will not do the two jobs as efficiently as when only called upon to do one of them.

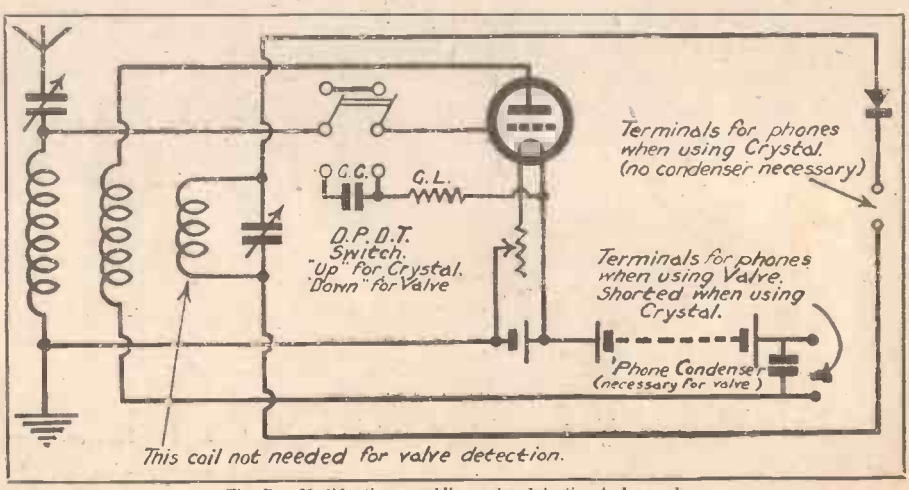
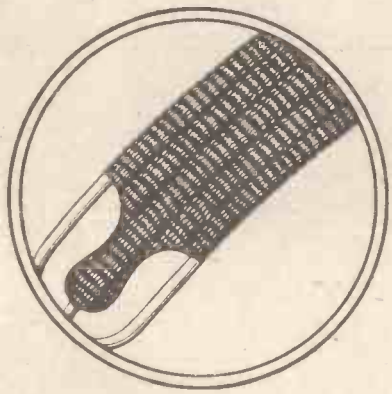


Fig. 7. Modifications enabling valve detection to be used.

All Brandes products carry our official money-back guarantee enabling you to return them within 10 days if dissatisfied. This really means a free trial.

The unusual constructive theory of Brandes *Matched Tone* Headphones secures a tremendous improvement in accurateness, sensitivity and volume. A simple explanation is this: strike the same note at the same instant on any two musical instruments of the same kind. It's a hundred chances to one against both notes being of the same strength and pitch. Consequently it jars, and you would much rather hear one alone. If both notes were exactly similar it would be pleasing, and you would have greater volume and clarity. Brandes, with both receivers matched to exactly the same degree, achieve this desired end.

Ask your Dealer for Brandes.



The headbands are made of piano wire covered in soft, corded webbing. At both ends the wire is firmly clamped together so that the original shape may be easily bent to fit the natural line of the head without fear of injuring the headband. They mean comfort without hard and irritable constriction.

British Manufacture (B.C.C. Stamped.)

The *Table-Talker* is another Brandes quality product at moderate price. Its full round tones are wonderfully clear and pleasing. The 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. Gracefully simple of line, it is finished a shade of neutral brown and is twenty-one inches high. **42/-**

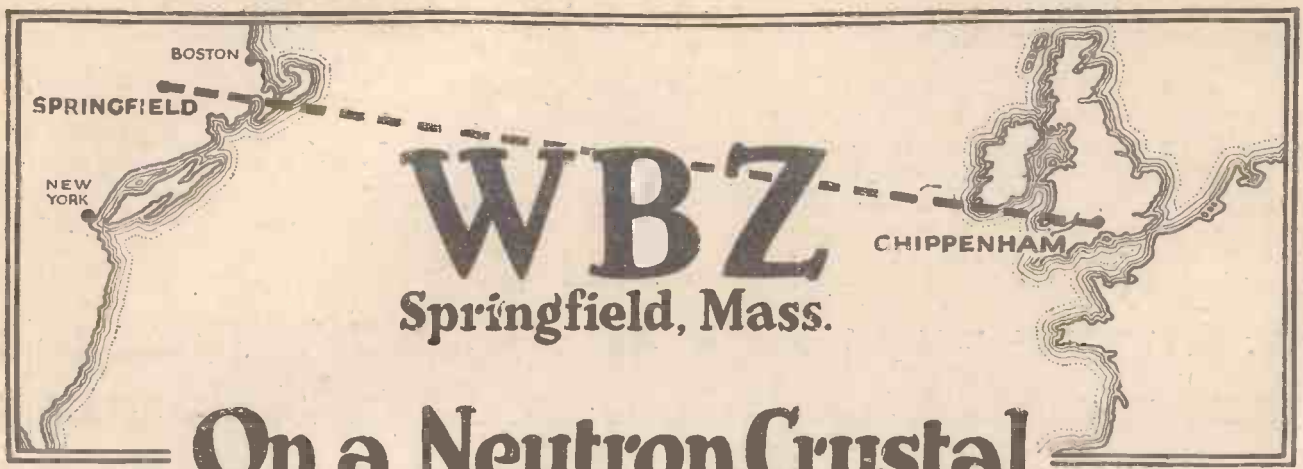
Brandes

The Name to know in Radio

25/-

Superior "Matched Tone" Headphones

TRADE MARK



On a Neutron Crystal
with 2 stages of Low Frequency

Chippenham, Wilts.,
December 14th, 1924.

Messrs. Neutron, Ltd.,

DEAR SIRS,

NEUTRON CRYSTALS.

As an enthusiastic owner of a 5-Valve set, I write to tell you of my surprising results with a small Crystal set. Owning the above-mentioned set and having been connected with Wireless Theory for the last 10 years and actual practice with a set for the past 5 years, I was, as I always have been, very sceptical about results when I bought one of your crystals a week ago. The results, however, have simply astounded me.

The first night, not having the ebonite ready, I just twisted some bare wire round the end of the detector and across the end of a plug-in (Standard size) Coil block, the other end I connected with a pair of 'phone tags and condenser, a .0003 mfd. variable condenser for tuning completed my very crude "outfit."

Coupling up Aerial and Earth I was astounded by easily tuning **5 WA** (40 miles), **6 BM** (62 or 4 miles). I listened to the latter till close-down, and then picked up **Madrid** quite easily.

Of course, my mind was immediately filled with theories of re-radiation and such things as that. I will, however, admit that I made frantic haste to have everything properly mounted and soldered the next evening, when I again repeated the same performance. Subsequent tests have proved that **5 XX** (100 miles, approx.) is absolutely comfortable strength, and **2 ZY** (Manchester) is also audible.

Coupling a 2-valve **LOW FREQUENCY** amplifier to the above-mentioned set at 1.50 a.m. this morning, I picked up Music and Solos (Soprano and Baritone) from **WBZ** (Springfield, Mass.), and was in good touch for about 10-12 minutes, when the signals faded away.

A continued watch was kept for 1½ hours, during which time I was in touch for about 60 per cent. of the time. Not so bad for the much-despised Crystal. Needless to say, I am now very much converted.

It is my hope now to be able to receive America direct with Crystal only, and with the strength that different stations have been coming in at this address I am feeling quite confident that it can be done. Needless to say, the Crystal will be Neutron.

My aerial is 100 ft. long, 34 ft. high leading-in end, 28 ft. high far end. Please particularly note that all current was switched off from the valve set during these tests, and every precaution taken to give the Crystal a "fair chance."

Very sincerely yours,
(Signed) R. A. H.

P.S.—During reception of Springfield, Mass., I distinctly heard the announcer give the call letters of the station *twice*, so that there is no doubt as to the accuracy of the reception.—R. A. H.

THIS is, we believe, the record for long-distance broadcasting reception on land.

Note that the only amplifier used was a **low**-frequency one; interpreted to the non-technical, this means that the signals were actually received and rectified by the **NEUTRON CRYSTAL**, the two valves serving merely as note-magnifiers, and not as "range-increasers."

The original letter, a copy of which is given here, may be inspected at the NEUTRON Offices.

Here is sufficient proof of the super-sensitiveness of **NEUTRON CRYSTAL** to justify you in selecting this as **your** Crystal. Sooner or later you will come to it, in any case, and in deciding NOW for NEUTRON, you will easily **save the price of another pair of phones**, by saving the expense of further tests.

and you can get the same results with a

NEUTRON
TRADE MARK

Concert Tested and Guaranteed.

Stocked by the best Radio Dealers. Packed in tin with silver cat's-whisker. Insist on Neutron in the Black and Yellow Tin—or send 1/6 and Dealer's name, and this wonderful Crystal will be mailed by return. **1/6**

Sole Distributors:—V. Zeitlin and Sons, 144, Theobald's Rd., London, W.C.1. Phones: Museum 3795 and 6841. Produced by:—Neutron Ltd., Sicilian House, Southampton Row, London, W.C.1 'Phone: Museum 2677.

E.W.9

A COMBINED PARALLEL—SERIES AND D.P.T. SWITCH.

A Novel Switching Device for Experimenters.

By R. S. RUDLAND.

AT some time or other the occasion has arisen, generally when one is most busy, when a friend brings along his new pair of 'phones or loud speaker and asks if you would mind "trying them out" against yours. Yours, of course, being the last word in efficiency, which is as it should be.

He usually wants to hear one against the other, and then the two together "just to see if there is much difference." Now the one against the other is a tolerably simple matter with a D.P.D.T. switch, but to make a *quick* change from D.P.D.T. to P. and S. without losing the strength of the signal as carried by the brain wants a bit of doing.

The Materials Required.

So on one of the very rare occasions when I was not busy I took pencil and paper and started to design a switch that would give me the aforementioned changes, without disconnecting any leads and with a maximum of speed. The outcome was an arrangement as shown in the photo (Fig. 1.)

To make this switch the diagram (Fig. 3) will show that the parts are fairly simple and easy to make. The dimensions need not be strictly adhered to, but can be made to suit any existing "junk" that usually accumulates in any enthusiastic experimenter's den. For instance, the circular plate of brass may be square, the thickness be anything up to, say, a quarter of an inch.

The component parts required are:—

1 piece of ebonite 3½ in. square by ⅜ in. thick.
1 dozen 6 B.A. countersunk brass screws.
2 wander plugs.
1 piece of brass 2½ in. square by $\frac{3}{16}$ in. thick.
4 terminals.

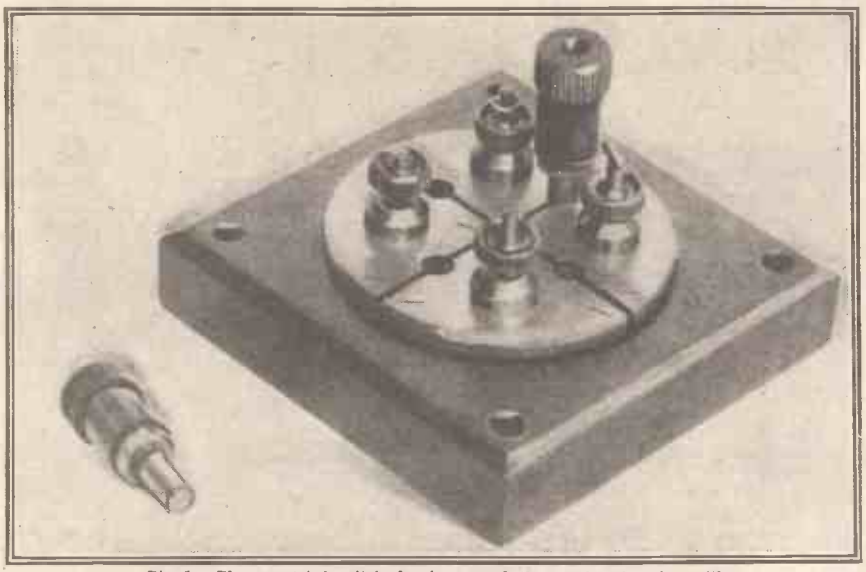


Fig. 1.—The completed switch showing one of the wander plugs in position.

If the following operations are carried out in the order mentioned a great deal of time will be saved.

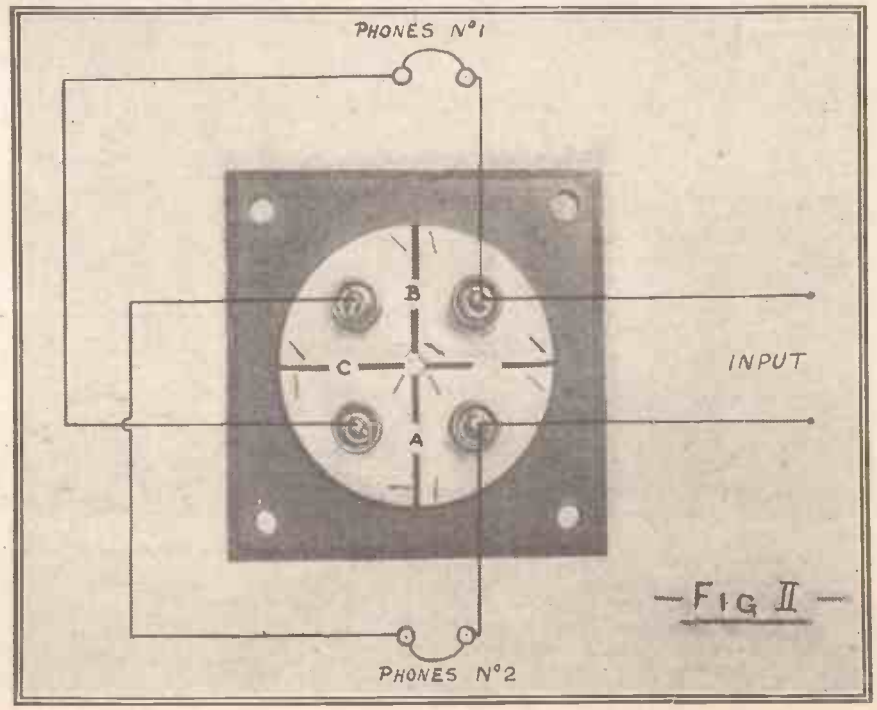
First square up the ebonite and finish with a matt surface and a slight chamfer round the edges. After deciding on the shape of the brass plate, nicely polish and radius the edges. Now mark off, with a scratch, a line through the centre point of the face and another at right angles to it, also through the centre; this gives the lines taken by the saw-cut (see Fig. 3) and divides the whole piece into four equal parts.

The Switch In Operation.

Take a pair of dividers and mark off the position of the holes, which will be noticed are symmetrically placed in each segment. Place the brass plate in the centre of the ebonite square and firmly secure it in position; then drill one of the holding-down screw holes with a 6 B.A. tapping drill. Drill right through the ebonite.

Now remove the brass plate and open out the hole to 6 B.A. clearance, and countersink; then tap the hole in the ebonite 6 B.A. Place the plate back again in position and screw firmly home. Having got one screw tightly in, proceed to drill the other screw holes. After drilling the rest of the screw

(*Continued on page* 1358.)



—FIG II—

Technical Notes

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

Noisy Battery Chargers.

IT is a great convenience to have a battery charger for recharging accumulators, as it is much more economical to use such a charger on the D.C. mains than it is to employ a step-down resistance, whilst on the A.C. supply it is practically impossible to charge batteries otherwise than by the use of one or other of the standard types of charger. These chargers, however, sometimes emit a loud and disagreeable humming sound, which may be due to the vibrating reed or other form of rectifier.

It is impossible, of course, to eliminate the sound altogether, but a good deal can be done by placing the charger upon felt or other absorbent pads. The sound is largely radiated from the containing-box, and the vibrations of the flat sides of the box may be considerably reduced by the following method: Take four corks, about 1 to 2 in. in diameter and at least 1 in. in length, and placing one at the centre of each of the four sides of the container, on the outer surface. Secure in position by tying tightly round with two or three layers of insulating tape, or preferably by means of a stout rubber band. You will find that the two precautions mentioned above will have the effect of minimising the disagreeable noise of the charger, and they are quite simple to carry out.

Removing Enamel Insulation.

It is not particularly easy to remove enamel insulation from wires, particularly if the wire is at all fine, and a good deal of patience is generally necessary. Scraping by means of a knife or file is not very satisfactory, as the wire has to be gradually turned round, and is very liable to be broken.

Probably the best method for mechanical removal of the enamel is to grip the wire by means of a folded piece of very fine emery-cloth or glass-paper, and then to draw the wire through the paper several times. Another method, however, and an easier one, is to heat the wire at the part where it is to be cleaned to a dull-red heat, and then plunge it into methylated spirit; this procedure will generally be found to remove the enamel covering quickly and completely.

Insulating Tubing.

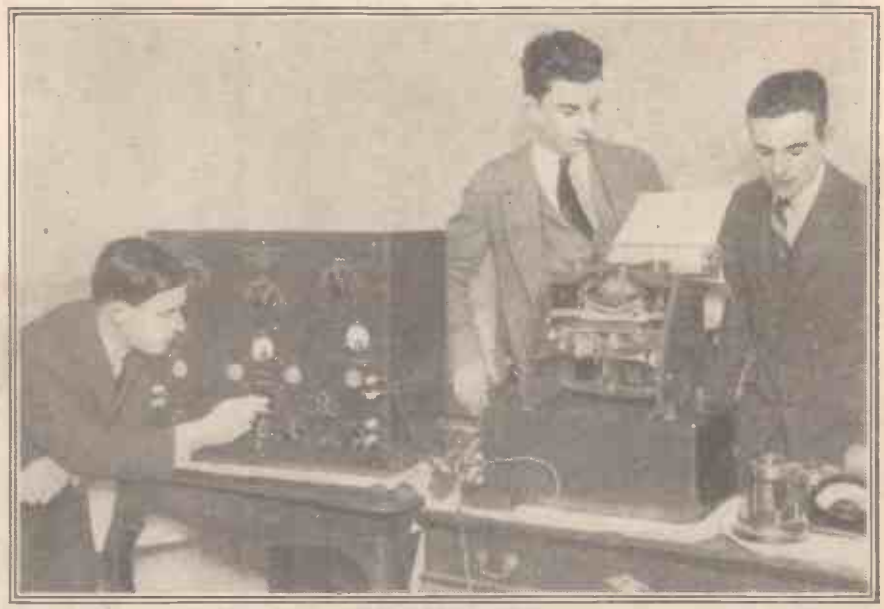
Systoflex or other insulating tubing should be used sparingly, if at all, in radio-frequency circuits. In audio-frequency circuits, however, it may with advantage be used to prevent high-voltage plate leads from touching at all points where they cross. It may also, of course, be used on filament leads to prevent short circuits.

Loud-Speaker Hints.

There are so many loud speakers on the market that many people have great difficulty in deciding which particular type they should buy. Of course, no doubt some are better than others, but it is probably a fair statement to say that most of those which have survived the test of competition are quite satisfactory, and it then becomes, to some extent, a question of price and size, as well as of the elaboration of the exterior of the instrument. The difficulty of saying which is the best of a number of loud speakers is emphasised by the fact that different people will give different verdicts, showing that the choice is, to some extent, probably to a large extent, a matter of personal taste.

Most of the instruments will reproduce a pure note with fair accuracy, but if this be accompanied by a rattle or scratching sound, or if the tone be muffled, it is pretty certain that the instrument will not faithfully reproduce a complicated wave, such as that representing an orchestra, or more especially a combination of voices. Probably no test is more searching than the reproduction of a single-speaking voice, particularly where the nature of the information is unknown,

(*Continued on page* 1399.)



High speed automatic reception of morse code radio signals. This apparatus has been fitted up in the offices of a well-known New York newspaper.

A COMBINED PARALLEL—SERIES & D.P.T. SWITCH

(*Continued from page* 1357.)

holes, and before removing the plate, drill the four holes to suit the wander plugs.

Now remove the plate, open out the screw holes to 6 B.A. clearance, and countersink. The last operation before assembling is to saw the plate into four equal parts. Take off the burrs on the rough edges and leave no sharp corners.

Tap the holes in the ebonite 6 B.A. for the holding-down screws. This done, assemble the four segments on the ebonite and a gap of $\frac{1}{8}$ in. will be found between each segment (see Fig. 3).

The job is now complete except for drilling and tapping the holes for the four terminals, which may be of 4 B.A. or 6 B.A. size. All screws should be short enough so as not to penetrate through the ebonite.

The complete switch should now look like the photograph (Fig. 1).

To bring the switch into operation, connect up as shown in diagram Fig. 2.

Having connected up, and it is desired to test 'phones No. 1, place one of the plugs in position A. This will gives 'phones No. 1 separately. The plug placed in position B will give 'phones No. 2 separately. By the quick and simple method of removing a plug from one hole to another two pairs of 'phones have been tested against each other. Should it be wished to try them in series, simply place the plug in C. By utilising the second plug and placing one plug in B and one in A the two pairs of 'phones are thrown in parallel.

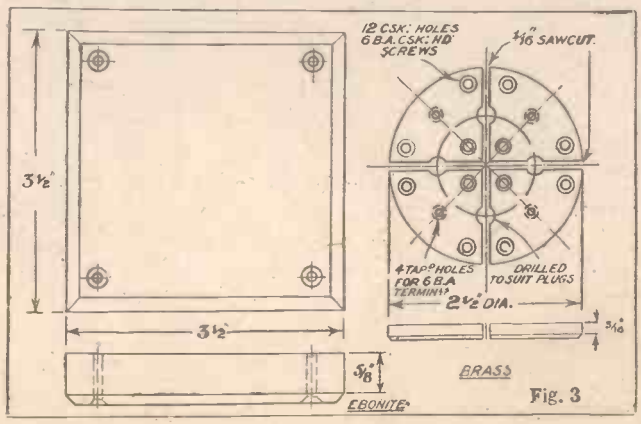


Fig. 3

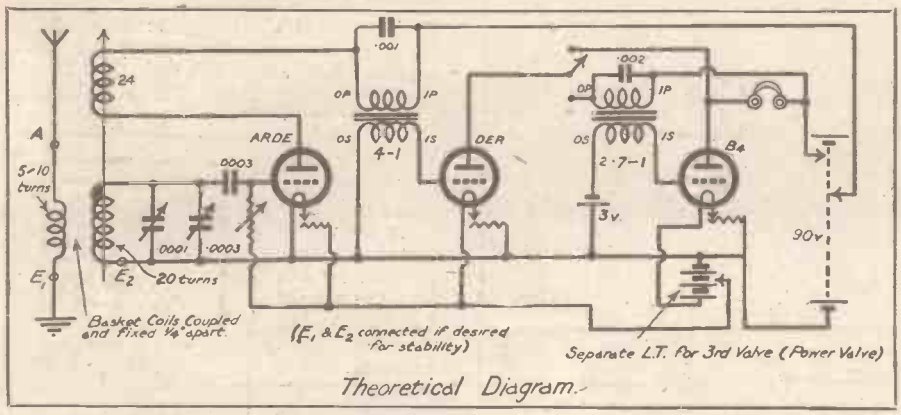
FURTHER NOTES ON SHORT-WAVE WORK.

A Three-Valve Set of Merit.

By K. D. ROGERS.
Assistant Technical Editor.

IN this article I propose to describe briefly a short-wave receiver that has given really good results, and one which is fairly easy to handle. Easy, that is, as it is possible to make short-wave tuning, for this must always be a delicate business owing to the tremendous variation of frequency for the slightest increase or decrease of inductance or capacity.

The circuit was given last week, but is repeated again for the benefit of those who did not see it in the first instance. In order to make the set accessible as well as efficient, the American system of mounting the components was employed, and an exceptionally long panel was used in order to enable the components to be well spaced out.



Theoretical Diagram.

This explains the reason for the 20-in. panel, and with a panel of this length it was found unnecessary to exceed 4 in. depth. As lay-out and exact disposition of the connecting wires are of the utmost importance in a receiver of this nature, it was decided to keep the grid leads as short as possible, and the plate leads not only short but well separated from any other leads.

This gave rise to the panel on the left of the receiver, stretching from front to back of the set. On this are mounted the aerial terminal, earth terminals, coil holder—of the single-hole mounting type—and the variable grid leak.

Eliminating Hand Capacity.

The main or front panel only supports the two variable condensers—well separated to keep down the minimum capacity, the three filament rheostats, out of the way on the right, so that they can be varied without giving rise to hand capacity effects, and the telephone and grid bias terminals, and of course the S.P.D.T. switch for cutting out the last valve.

All battery connections—i.e. for H.T. and L.T., are made to a narrow terminal strip on the right of the set, and running from front to back. This strip is about 7¾ in. long and 1¼ in. wide, made of ¼ in. ebonite, and holds 6 terminals. These terminals provide two H.T. positives, 2 L.T. positives, and, of course, the negative connection for each battery.

"Freak" Results.

This arrangement leaves the front of the panel tolerably free from wires and other things likely to prove a nuisance when careful adjustments are being made; and when dealing with wave-lengths of 50–100 metres very careful adjustments are necessary if good results are to be obtained.

The capacity, or, I should say, the stray capacity of the set has been kept down as low as possible, as the receiver was designed for low-wave telephony reception rather than for the logging of long range amateur C.W. stations.

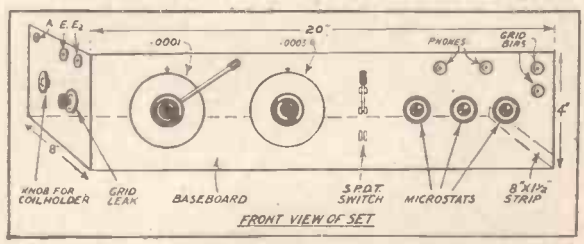
This does not mean, however, that the set is not suitable for the latter purpose; it has done exceedingly well on C.W. reception, but when resolving distant and perhaps faint carrier waves into speech and music, it is essential that no stray capacity shall be present to upset the stability of the set.

Before going any further into the details of the receiver, I should like to say a word or two about the aerial and earth used. This was mentioned in the previous article on this subject, but is repeated, as I feel that it is difficult to pay too much attention to the aerial-earth system if you are to obtain *good* results. I know it is possible to pick up K D K A, for instance, on any old aerial and without an earth. As a matter of fact, on the set in question the East Pittsburg station has been repeatedly received without aerial or earth, but this is not *reception* in the proper sense of the word. Amateurs are too apt to pay attention to distance rather than to quality, or to noise rather than pureness of reproduction. By this I mean that many an amateur is far prouder of the fact that he "got" K D K A, or some other distant broadcasting station on *one valve* with only a mattress aerial or some peculiar circuit, than he would be if he used 3 or 4 valves and "got" him really well, intelligibly, and so that one could really enjoy the transmission either on headphones or loud speaker. It is not so very difficult or wonderful to "get" the American stations, but it is a different problem to "get" them well and to pick them up *regularly*.

After all, this is, or should be, the aim of all wireless research and development in receiving apparatus, to enable those in possession of the required sets—which must be *fairly* simple and within the grasp of the average man—to pick up and *enjoy* transmission from various stations, not to merely produce a jumbled tangle of words, shrieks and growls, and to say, "Ah, that is so and so."

The Most Suitable Aerial.

Difficulties there are, and plenty of them, but we can all help to overcome them, as they will be overcome, if we keep on experimenting, first with this and then with that, gradually improving the results until, possibly with the assistance of those in charge of the transmitting side, we reach our goal. And these articles are not intended to give the details of the *ideal* receiver or receivers, but merely to enable those who desire to experiment on short waves to have something to *start* upon, and, as all will agree, as a certain amount of experience is necessary before sets can be successfully handled, especially on short waves, the theoretical circuits and component lay-out diagrams only will be given. It is assumed that all amateurs who really wish to carry out experiments will be far enough advanced to understand these types of diagrams, while it is doubtful if those who *must* be provided with exact point to point wiring instructions will have yet had enough experience to be able to handle a set on these high frequencies. They will advance to that stage soon, no doubt, but we must all learn to walk before we can run, or else we come to grief.



FRONT VIEW OF SET.

But to get back to the aerial. Various kinds of aerials and earths were tried, and it was found that a nearly vertical single

(*Continued on page* 1360.)

FURTHER NOTES ON SHORT-WAVE RECEPTION.

(*Continued from page* 1359.)

wire aerial of about 50 feet was best. This, which has proved exceedingly efficient on all broadcast wave-lengths, as well as for short-wave reception, and is still in use at the writer's home, consists of a single wire (Mars aerial) running straight from the wireless "den," which is situated upstairs, to a wire stretched between an oak tree 60 ft. high and a 40-ft. pole. Allowing for the weight of the four insulators at the far end of the *aerial* (the wire between pole and tree is not electrically connected to the set, and is only used as a supporting wire) and the sag of the wire at the top end, the aerial, which, of course, has no horizontal portion, is about 40 ft. high.

The earth consists of one of the patent earth pins now on the market, directly underneath the aerial where it enters the house, with an alternative water-pipe connection. The earth should be made as efficient as possible, as the stability of the set, let alone signal strength, will depend largely upon it.

How the Coils are Wound.

It will be seen from the diagram of the circuit how the various components are connected up, while the Figs. showing the lay-out of the components will give some indication of the spacing of the various parts. It is essential that the aerial circuit be as close to the detector valve as possible, and that the detector circuit, including the ·0001 mfd. variable condenser, should be well away from the next valve. The other variable condenser, although connected in parallel with the ·0001 (which is, by the way, of the square-law type, is at least 4 in. away from the latter. This avoids unwanted capacity effects when tuning on low wave-lengths is being carried out.

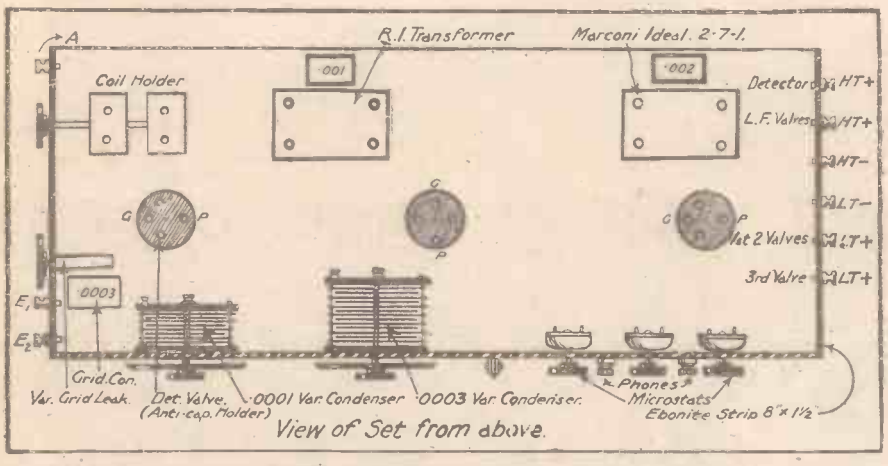
Wiring should be carried out with stout wire. The writer used 16 gauge square tinned wire throughout, all connections being soldered.

It will be noticed that no telephone or H.T. condenser is included, and this is for the simple reason that the particular set under consideration would not take either of these on low wave-lengths. The inclusion of either at once cut down signal strength, and as the set was perfectly stable without them, there was no need to worry about the matter. Readers who construct this set, however, should try the effect of condensers at those points, as all receivers, even of the same design, do not have the same characteristics.

The coils are all of the basket type, and are wound either on cardboard formers 1½ in. diameter with 11 slots, or a proper basket former with 11 pins, the latter coils being tied with thread to keep them rigid. No shellac should be used, and 20 or 22 gauge D.C.C. wire should be employed.

Well-spaced Components.

The aerial coil consists of 6–10 turns, sometimes as many as 14 are found useful, fixed ¼ in. away and coupled to the secondary, which is a coil of 20 turns. The reaction has 24 turns, but the best size of this may vary. It should be less if the set oscillates too easily, and can be up to 30 if the set will not oscillate.



View of Set from above.

The two ends of the aerial coil go to the terminals A and E, to which also go aerial and earth leads. The secondary, plugged into the stationary side of the coil holder, is connected to the grid condenser and the ·0001 condenser on one side, and the terminal E_2, ·0001 condenser (other side) and filament negative on the other side. Should too much oscillation be present the terminals E_1 and E_2 can be connected externally, but I do not think readers will find the set uncontrollable if they space out the components well.

For tuning in on short waves (50–120 metres), the ·0003 condenser is set at zero and the ·0001 condenser varied slowly, using a small extension handle. If the aerial is rather long and low, a ·0001 fixed condenser in series with it may help, but this will not affect the sizes of the coils. The grid leak will be found to be a useful vernier reaction control, and will also assist in keeping the reception as free as possible from distortion.

The Valves to Use.

The following valves have been used with success, the L.F. transformers being an R.I. (1st stage) and a Marconi Ideal 2·7–1 ratio for the second stage:

A.R.D.E., B5, as detectors.

D.E.R., A.R.D.E., B5, as 1st stage L.F.

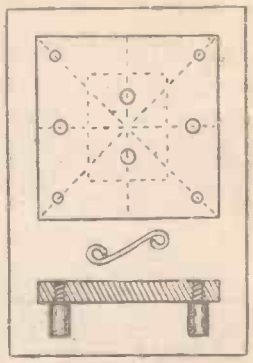
B6 or B4 as second stage L.F. with 3 volts grid bias.

The arrangement of the H.T. and L.T. allows separate H.T. on the detector valve, and separate L.T. on the last valve, the power valve. So that even if 2-volt valves are being used for the first two stages, a 6-volt power valve, such as the B4, can be used on the last stage. The L.T. batteries have a common negative connection, of course.

In conclusion, I should like to repeat that I shall be glad to hear from readers who make this set, and to receive reports as to its successes or failures, though I do not think there will be many of the latter.

A SIMPLE COIL HOLDER.

A VERY simple holder for standard plug-in honeycomb coils can be easily constructed from a piece of 3/16 in. matted sheet ebonite about 2 in. square; two ordinary terminals; four contact studs, and a coil socket, as shown in the photograph and sketch. The coil socket is preferably of the heavy type, having tapered sides, and four extra long contact studs should be used for the legs, the shanks being cut so that they are equal in length to the thickness of the ebonite. The ebonite is marked off and drilled as shown in the sketch, the small holes in each corner being tapped to take the shanks of the studs. The two central holes accommodate the pins of the coil socket, the other two holes being provided for the terminals.



Two short links of thick bare copper wire, bent as shown, are then clamped tightly under the nuts of the terminals and socket pins, the projecting ends of which are then cut off flush with the nuts.

Although this holder is extremely simple to make, it possesses a very pleasing appearance, and is a most useful addition to any experimenter's outfit.

Two views of the simple coil holder.

HOW TO MAKE "D" COIL VARIOMETERS.

A Useful Panel Type.

By H. BRENCHLEY.

The advantages of this type of variometer are many and the constructor wishing to economise in the matter of space when making a wireless receiver will find them worthy of attention.

THE "D" coil variometer is of considerable value to the constructor who desires to put together a set taking up as little space as possible. The diameter of the former decides the amount of space required on the panel for any given wave-length, and this type of variometer can, therefore, be mounted behind the panel, if desired, and manipulated without risk of the movable coil fouling other apparatus. Best results are obtained by working the

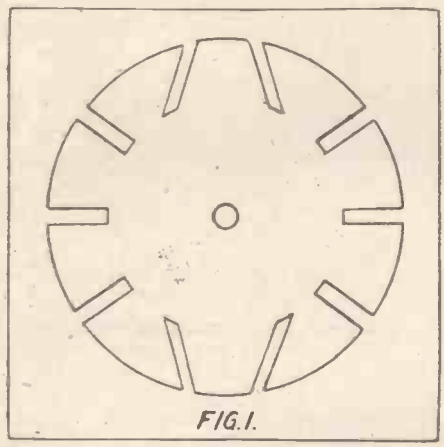


FIG. 1.

coils as closely together as possible, and if the coils are joined with the usual piece of flex tucked carefully away between the two formers, the minimum amount of separation cannot be obtained. On the other hand, if the coils are adjusted closely and the flex allowed to run loose, there is the danger of the flex fouling the many points on the inner side of the panel. The method described below obviates the need for a flex connection between the coils, and is found to be quite reliable in action.

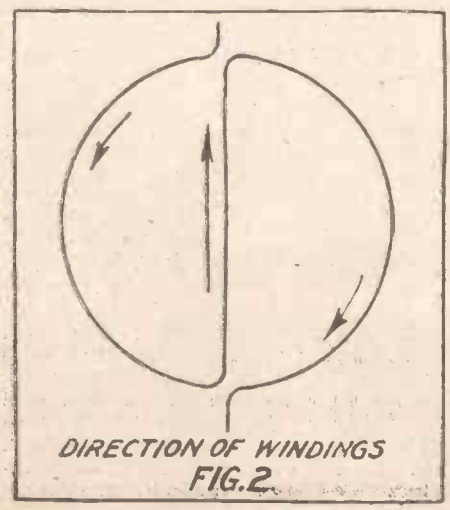


FIG. 2.

The variometer the writer has in mind was designed for the B.B.C. wave-lengths. It consists of two flat cardboard formers 3¾ in. in diameter, each former carrying two "D's" of 28 turns of 26 D.C.C. copper wire. Fig. 1 shows the position of the slots to be cut in the formers. The depth of the slots should be ¾ in., with a width of about ⅛ in. In Fig. 2 the direction of the windings is indicated. The latter is important as the success of the variometer depends upon the proper winding and connection of the two formers.

An Experimental "Try-Out."

Having wound the coils, they may be given a *thin* coat of shellac varnish. This stiffens them slightly and assists to keep the wire in position, and if the varnish is thin the added capacity is negligible for ordinary purposes.

The next step is to ascertain the sides of the coils which will be together when the variometer is assembled. The end of one coil and the beginning of the other may be connected with a short length of flex. Fix up an experimental crystal circuit as shown in Fig. 3. The "bits" can be laid on the table and the wires twisted together, as we are not out for maximum strength of signal at this stage, but merely ascertaining which position gives the louder result. Lay the coils upon each other and move the top one round until the signals are at their strongest. Now reverse the top coil and see if greater strength can be obtained. The arrangement giving the loudest result will be the position to be finally adopted. This decided, the coils should be marked on their sides 1 to 4, Nos. 2 and 3 being the inner sides.

The piece of flex can now be removed. The next step will be to solder a washer to the end wire of the coil bearing the Nos. 1 and 2 and to the beginning of the other. The length of the wire should allow the washer to come over the centre of the cardboard former, at the point through which the rod will pass. The variometer is now ready to be assembled.

Assembling the Coils.

The method of assembling is most easily described, perhaps, in the form of a sketch, and Fig. 4 shows the method of fixing the variometer behind a panel. The back or moving coil is first firmly fastened to a piece of threaded rod, by means of a nut on each side, the nut on the inner side clamping down the washer, whilst a lock nut holds the back one tightly.

The fixed coil should now be fastened to the panel by means of two screws or contact studs. Next pass the rod carrying the movable coil through the centre of the fixed one and through a hole previously drilled in the panel. The hole should allow the rod to turn easily without side play. Slip a washer on the rod from the front of the panel, then a spring washer followed by another of the ordinary variety. Now screw on a nut and adjust until the back

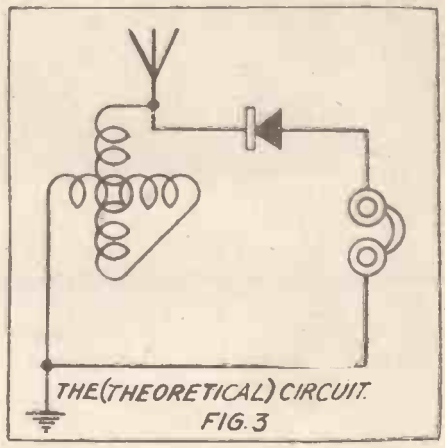


FIG. 3.

coil can be rotated easily but not too loosely. The knob is now screwed down tightly on the nut, and to do this without risk of it working loose later on, hold the nut firmly with a pair of thin pliers or a suitable spanner.

Smooth, Noiseless Operation.

It will be seen on reference to Fig. 4 that contact is made between the two coils by means of the two washers and the clamping nut on the inner side of the back coil. These are kept in contact by means of the spring washer. The writer has found this arrangement to work smoothly and without noise, and has adopted it on all sets, using the flat former type of variometer.

FIG. 4.

It may be of interest to add that suitable variometers of the same type may be constructed for anode tuning by winding a similar size of former with 56 turns of 30 D.C.C. on each "D."

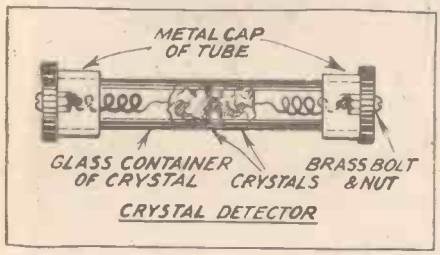
The nut separating the two coils should be of as little thickness as will allow clearance between the two coils.

Constructional Notes

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

Crystal Detector.

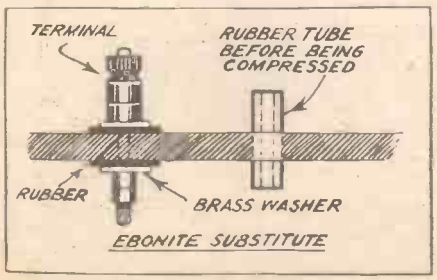
HERE is an ingenious crystal detector sent to me by a reader, Mr. P. Hainsworth, of Bradford. The glass container consists of the glass tube in which the crystal is purchased (crystals such as Tungstalite are sold in small glass bottles like that illustrated). The bottom is knocked out of the bottle by means of a pencil, and the sharp



edges are rubbed down by means of a small file or by rubbing the glass tube upon a piece of emery paper laid on a flat surface. Two of the metal caps are obtained, and through each of these a hole is drilled and fitted with a small brass bolt and nut. A wire spiral for the contact is secured beneath each of the nuts, two pieces of crystal of appropriate size are placed in the tube, and the metal caps pushed on, connection being taken from the two caps. The whole forms a very simple and cheaply made crystal detector.

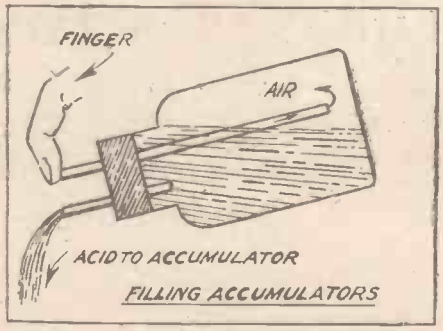
Substitute for Ebonite.

Mr. Hainsworth, of Bradford, also sends me a model of an insulator which he uses as a bush for the insertion of terminals, etc., into a wooden panel, so avoiding the need for an ebonite panel or for ebonite bushes. The bush which he uses consists of a short length, about ½ in., of thick-walled rubber tubing, known in scientific laboratories as "pressure tubing," and of about ¼ in. outside diameter. The shaft of the terminal is inserted through the rubber tube, with a brass washer at each end of the tube, and the whole is then screwed up. As the nuts are tightened, the rubber is squeezed out, and eventually assumes the flattened form shown in the figure. This ingenious little idea provides a cheap and effective insulating bush and one which has the merit of adaptability.



Filling Accumulators.

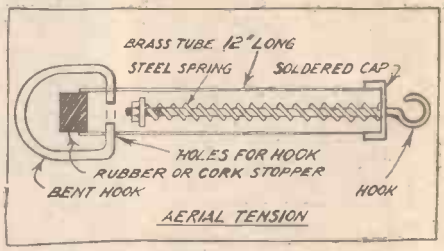
Where only a very small amount of electrolyte is to be added to an accumulator to make up to the proper level, a small filler, such as a small syringe, may be used, or even a funnel with a piece of rubber tubing attached, the latter being pinched between the fingers to arrest the flow of the liquid when necessary. But when an accumulator has been emptied out and has to be refilled, the simple bottle-filler shown in the drawing will be found useful. It consists simply of a wide-mouth bottle, with a suitable cork stopper through which two glass tubes are passed, one reaching down nearly to the bottom of the bottle, and the other passing just through the cork. When the bottle is held in the position shown, the electrolyte can only run out—assuming that the tubes are not too wide, say internal bore not more than $\frac{3}{16}$th inch—so long as the upper tube is not closed by the finger. The moment the finger is replaced upon that tube, the flow



stops. This bottle device is easily made and saves trouble, as well as danger of splashing the acid upon surrounding objects.

Aerial Tension.

The device illustrated in the accompanying figure is an easily made version of the commercial tensioning devices for maintaining the tautness of the aerial without danger of breakage. A device of this kind was mentioned recently in "Technical Notes," and is very useful in variable weather when the supporting ropes of a tight aerial are liable to break owing to shrinkage. The device illustrated consists of a brass tube, about 12 in. long, with a metal cap soldered at one end, through which a brass or steel rod is passed, with a hooked end and a thread-and-nut at the opposite end. A spiral spring is provided, as shown, and at the opposite end of the tube two holes are drilled, through which the ends of a horseshoe hook are inserted. A quantity of vaseline or thick oil should be put into the brass tube to prevent the steel spring from being attacked by the weather, the open end of the tube being then stopped by means of a cork. This device is inserted in series at any suitable part of the aerial support.



Choke-Amplification.

Choke-coupled stages are becoming increasingly popular for L.F. amplification, but many experimenters do not get the best results that might be obtained, owing to more or less simple errors in the choice of the value of the choke, or of the type of valve, these being the two commonest causes of inefficient working. If the value of the choke is too low, distortion will occur and this will be more marked in the lower frequencies.

Choice of Valves.

There are many convenient methods by which the necessary chokes may be made up, but intervalve transformer windings, connected in series, are usually suitable for the purpose. It should also be remembered that where high degrees of amplification are used, the load upon the grid of the last valve may be very considerable, and distortion can only be avoided if the valve is of the proper type to deal with such a load. A valve having a long characteristic is required. There is, however, no need to go into details of actual valves, as these are well known. These remarks apply, as a matter of fact, whether the amplifier is of the choke-coupled or any other variety. In the choke-coupled amplifier, it is preferable, though not essential, to use valves with a good amplification factor.

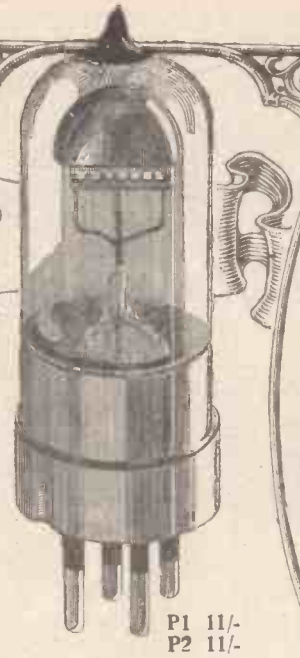
Separate H.T. Control.

A final piece of advice that has often been given in the pages of POPULAR WIRELESS, and which I should like to repeat is the necessity for separate H.T. control of the various valves. This is really essential if successful L.F. amplification is to be obtained, whether or not a power valve is used. Grid bias should also be employed on all but the first stage of a L.F. amplifier, though it may sometimes be found desirable on the first stage if signals are very strong.

Variable Grid Leaks.

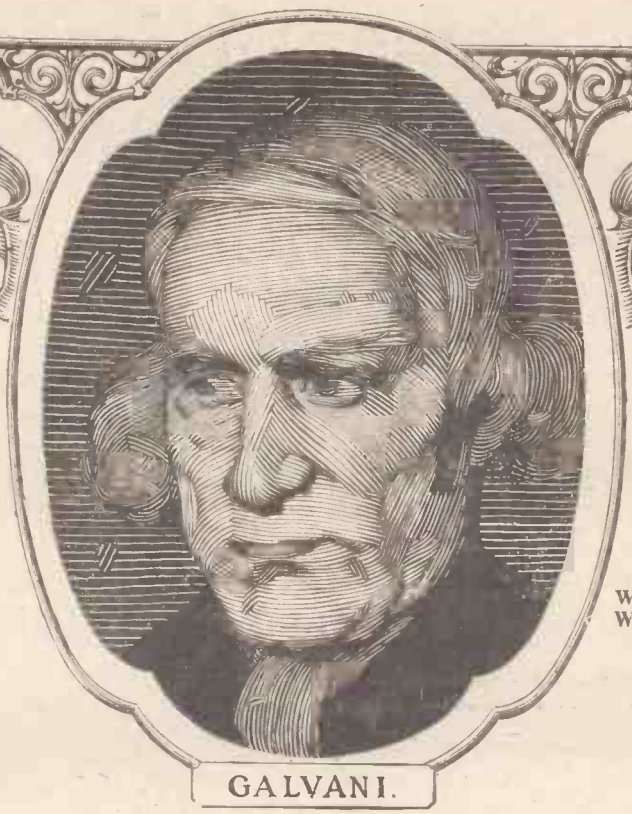
Many people fit fixed leaks on their sets, choosing a value somewhere near what they believe to be commonly used, and hoping for the best, but a variable grid leak is better, however, as it is only by trial that the best value can be determined. Even then, for various curious reasons, the value of the leak may need to be adjusted from time to time.

Many of the variable grid leaks on the market are correctly named in the sense that they vary when you don't want them to. It is, as a matter of fact, a very difficult problem to get a really satisfactory and stable high resistance (of the order used in grid leaks) which will at the same time stand the mechanical manipulation entailed in the use of a sliding contact or its equivalent.



P1 11/-
P2 11/-

Cossor
Bright Emitter



GALVANI.

W1 18/-
W2 18/-

WR1 20/-
WR2 20/-

Wuncell
Dull Emitter

The twitching of a frog's legs!

UNIMPORTANT and trivial details have often lead to epoch-making discoveries. Just as we are told that the evolution of the first steam engine came from James Watt and the kettle boiling on the hearth, so the twitching of a frog's legs played no small part in the discovery of the first electric battery.

Professor Galvani—a noted Italian Scientist—it is said, had passed a copper skewer through the limbs of a dead frog, and was about to hang them up on an iron nail in his laboratory. As soon as the copper touched the iron he noticed a convulsive twitching of the legs. That this was due to some electrical influence he proved by touching a nerve in the frog's limb with a piece of zinc, and a muscle with a piece of copper. As soon as these two metals were connected together a convulsive kick took place.

And so came into being the first recorded instance of the electric battery.

From the crude cell filled with acidulated water of 150 years ago we come to the modern dry battery and the accumulator—truly a great stride forward.

And in the design of Wireless Valves an evolution no less remarkable has taken place during the past two or three years.

Instead of Valves with a big current consumption glowing at a temperature of upwards of 2,000 degrees, there is now available the wonderful Wuncell Valve that operates with a glow that is well-nigh invisible. This long-life Valve is fully described in a Folder obtainable from any Dealer free of charge or direct from us.

No. 4 of Series

All Cossor Valves reduced in price.

Cossor Valves

HOW TO START AN EXPERIMENTAL RECEIVING STATION.

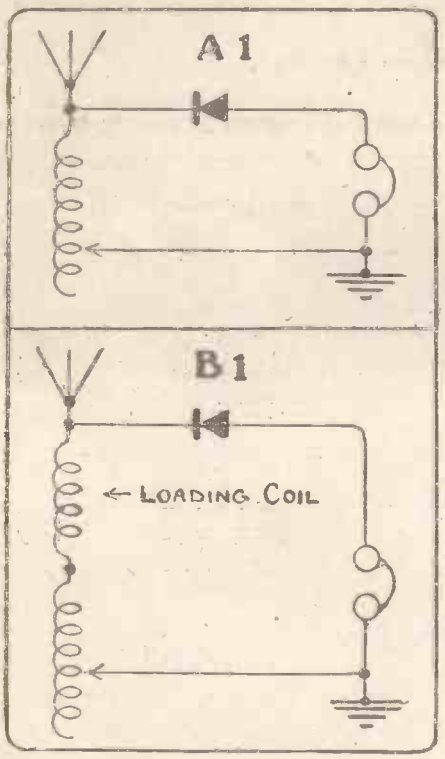
By OSWALD J. RANKIN.

The first of a series of articles dealing exclusively with the practical side of experimental wireless reception wherein the author presents an unique opportunity to all beginners who wish to become experts.

THE question, "What apparatus do I require to commence operations as an experimenter?" is seldom satisfactorily answered, because in most cases the querist, knowing little or nothing about radio, is not able to give his informant the least idea of what he wants to do; and therefore it usually becomes necessary to point out that if our would-be experimenter wishes to gain a complete knowledge of the subject, he must start, not from the middle rung of the ladder, but from the bottom, and at first confine his ambitions to as simple an outfit as possible.

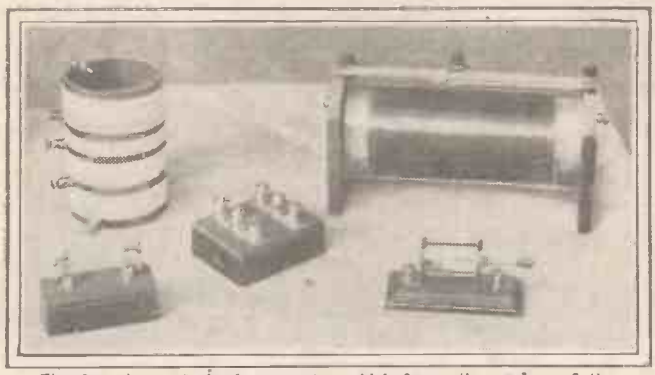
The Apparatus Required.

Experimental radio, the king of hobbies, is something to be taken very seriously,



and although there is at present absolutely no limit to its scope and possibilities, there is, however, a very definite starting-point which, like most other good things, is at the beginning. Many beginners are under the impression that when they have advanced themselves sufficiently to use more elaborate apparatus, the old "lesson one" components will no longer be required. This is a great mistake, which invariably leads to a still greater mistake—that of skipping the first and most important part of the undertaking.

If each component is arranged separately, to be connected up on the experimental bench, then, no matter how simple it may be, it will *always* be useful. This is a fact which should be constantly observed, and it should also inspire the amateur constructor to make a thorough good job of even the most insignificant unit.



The five pieces of simple apparatus which forms the nucleus of the experimenters' equipment.

To return to the question, "What apparatus do I require?" this is answered, in what is intended to be a convincing manner, in the accompanying photograph. I can think of no softer path on which to place the feet of the young radio pilgrim. Here we have only five pieces of simple apparatus—a slide inductance, a loading coil, a crystal detector, and two terminal blocks—and it is even possible to make a start minus the loading coil and one terminal block.

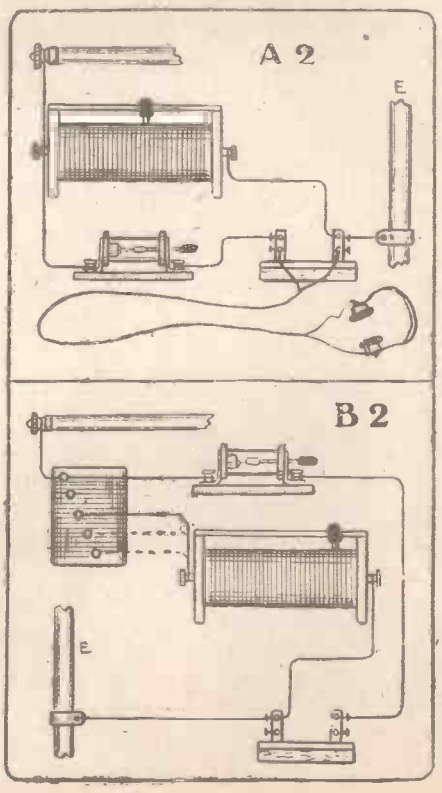
Specially Designed Loading Coil.

It is not proposed to describe the construction of these components in the present article, since the constructional details of all, with the exception of the crystal detector, will be found on other pages in this and future issues of POPULAR WIRELESS. It is, of course, assumed that the beginner has acquired a good pair of high-resistance headphones, and that his aerial and earth system has been satisfactorily installed, and preferably examined by an experienced enthusiast; and, since these articles are of a purely practical nature, the reader is also advised to acquire a little theoretical knowledge from a reliable text-book.

The question of range or distance will be the first consideration when commencing operations with this outfit. I would estimate 15 miles as the maximum for good results for telephony from the usual broadcasting stations, and 100 to 120 miles from the high-power station 5 X X; and should the reader reside outside these limits, then I would say "nil desperandum"—have a shot at something. It is better to dabble in Morse signals (which are almost sure to be picked up) than to miss the first lesson in tuning. It might be well to mention here that each subsequent article will deal with apparatus and devices to be used in conjunction with, or alternately to, the apparatus described in previous articles; and thus, in order to achieve my object, I would again emphasise the importance of commencing here at the beginning. Remember that *every one* of the components described in this article will play a very important part later, when we arrive at the multi-valve stage.

The tapped loading coil shown in the photograph has been specially designed to obviate the use of a multiple switch, the tappings and contact points being integral with the coil itself. At certain points the wire is bared and wound once round the shank of a small telephone terminal, which is then clamped to the

(*Continued on page* 1366.)



SIMPLIFIED DUOLATERAL COIL WINDING.

From A CORRESPONDENT.

THE winding of duolateral coils of the higher numbers of turns can be most irksome. After having made the end of the wire fast to a pin to start a steady counting of 9 pins in the staggered row, to take the fine wire over the 10th pin and so on again always counting 9 in the opposite row of pins quickly reduces one's usual amiable disposition to one of irritation. But this procedure can be greatly improved.

The first thing to do is to make a 2-in. former of 2 rows of 24 pins (staggered) in each row, as instructed in "P.W." No. 130, of Nov. 22nd last, taking care to leave a full ½ in. of wood outside each row of pins.

Then, if a paper be taken and on it 24 short lines in column are made to represent 24 pins, with 24 more short lines staggered opposite, we will imagine the bottom line on the right to represent the point at which the coil is supposed to be started; if 9 lines in the opposite column commencing from the bottom be counted and the 10th line crossed through, that line (the 10th) will represent the first pin over which wire is taken. Then count 9 more lines in the opposite row (as for duolateral winding), cross through the 10th line and put 2 opposite the cross. Proceed in the same way to line number 3 and carry on; and if the lines are counted correctly it will be found eventually that each line will be crossed through once, each line will have its own number and number 48 will be the line from which the start was first made.

The numbers in the columns from the top downwards will be as follows:

5		29	
	10		34
15		39	
	20		44
25		1	
	30		6
35		11	
	40		16
45		21	
	2		26
7		31	
	12		36
17		41	
	22		46
27		3	
	32		8
37		13	
	42		18
47		23	
	4		28
9		33	
	14		38
19		43	
	24		48

Now glue two strips of paper, one outside each row of pins, on the former and write the numbers above given opposite each pin in order, taking care that the staggered numbers are in correct position.

Having made the wire fast to pin number 48, carry it to pin number 1, thence to 2, 2 to 3, and so on to number 48, each pin thus getting its portion of wire and *no counting of pins being necessary.*

Part of the transmitting gear at the Nottingham relay station.

Enumerating goes on from 48 as before, and, according to the length of coil to be wound, so are the necessary number of layers put on the pins.

The same procedure can be carried through when counting 7 pins (missing 6) though, of course, the order of numbers is changed, but they can be ascertained in the same simple manner as above (10 missing 9).

SOME HIGH-POWER STATION FACTS.

THE notorious "mush" and harmonics originating from the Leafield station have been completely eliminated by introducing coupled transmitting circuits, stated Mr. Shaughnessy in an address to the wireless section of the Institution of Electrical Engineers, of which he is the chairman.

Further interesting facts brought forward by Mr. Shaughnessy in connection with the above station are as follows: The primary condenser consists of steel tanks containing 17 aluminium plates immersed in oil. Of the latter 5,000 gallons is required for this purpose, and the whole condenser weighs 25 tons, and can handle 260 amperes and up to some 68,000 volts.

The Leafield station employs the largest coupled arc system in existence working regularly and satisfactorily. The whole of the constructional work was carried out by the Post Office Engineering Dept. It was found that American whitewood is as good an insulating material for use in the building of transmitting inductances as anything else, and this substance was tested up to 58,000 volts without suffering the slightest damage. It is used at the Northolt station, and carries a current up to 115 amps. with an aerial pressure approaching 60,000 volts.

The cost of a single 820-foot mast is between £12,000 and £15,000. Twelve such masts, with aerial and earth system complete, cost from £70,000 to £90,000.

The working expenses, depreciation, etc., of a high-power wireless station are between £70,000 and £90,000 per year.

The Marconi Beam.

Experience shows that there is little to choose between the Poulsen arc, H.F. alternator, and valve systems of transmission; and far from the first-mentioned proving less efficient than the valve, as seems to be commonly thought, it has certain very important advantages, more especially now the problem of eliminating disturbances has been solved.

The Marconi short-wave beam system, although being adopted for relieving traffic, is not likely to cause high-power long-wave stations to become obsolete.

HOW TO START AN EXPERIMENTAL STATION.

(*Continued from page* 1366.)

former in the manner shown. The coil contains 200 turns of No. 28 D.C.C. wire, wound on a 3-in. diameter cardboard former, tappings being made at the 75th, 100th, and 150th turns. The ends of the winding are also connected to terminals. The slide inductance coil is 3 in. in diameter by 7 in. long, and this is wound with No. 24 enamelled wire. The crystal detector is of the Hertzite and fine wire tentacle variety, this being preferably purchased complete with ebonite base and terminals. The terminal blocks are very easily constructed, or they may be purchased ready made.

The First Tests.

Without the use of a variable condenser the scope for experimenting with the above apparatus is, naturally, not very great, and so for the present we must content ourselves with the simple direct coupled crystal circuit shown in Diagrams A and B.

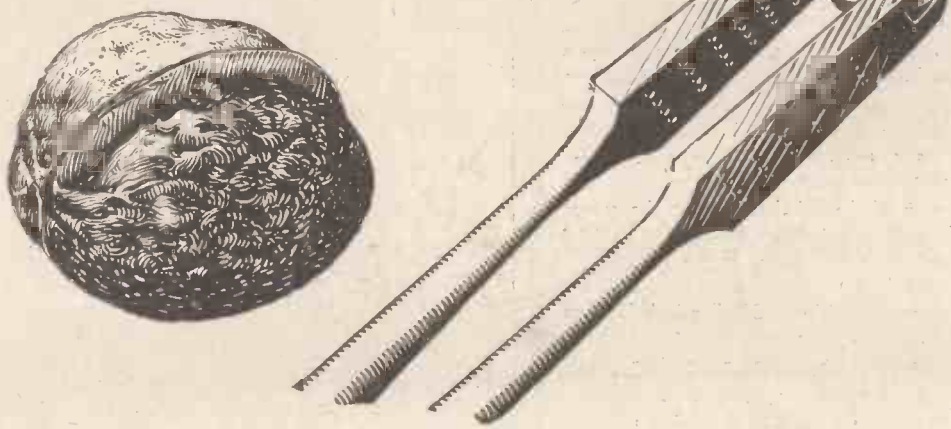
In Diagrams A1 and A2 we require the slide inductance, the crystal detector, and one terminal block; and if the operator should reside near a B.B.C. station he should be able to tune it in with the inductance slider about 2½ in. from the aerial end of the coil.

For the higher wave-length of 5 X X it will, of course, be necessary to increase the amount of inductance, and so we use the loading coil in the manner indicated in Diagrams B1 and B2. Here the inductance slider should be set temporarily at about 1 in. from the earth end of the coil, while experiments are made by altering the position of the lead from the loading coil to the slide inductance, final adjustments then being made by means of the slider.

A simple direct-coupled circuit is not selective, and thus it is quite likely that a little interference will be experienced. In the next article it is proposed to show how a good deal of this may be eliminated; meanwhile, the reader should acquire the following additional components; a ·0003 mfd. variable condenser, a ·0005 mfd. ditto, a ·0003 mfd. fixed condenser, and a standard broadcast variometer.

(*To be continued.*)

Is It Right Inside?



A self capacity of only 18 micro microfarads, dependent on the remarkable construction of the core; the unique system of placing the primary and secondary windings in sections, the six primary being placed outside the six secondary; the extremely high ratio of insulation to wire, and the accuracy of determining the ideal number of turns in the windings, are all fundamental points that make the core of the R.I. transformer so vital.

Any transformer without such a core is not Right Inside.

Any set without an R.I. is not Right Inside.

Make sure to get the transformer you know to be Right Inside.

Obtainable from all reputable dealers.

The New R.I. Transformer - - - 25/-

Write for New R.I. catalogue.

RI LTD

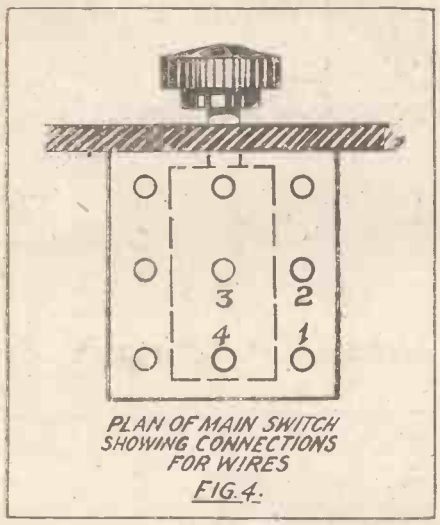
Radio Instruments Ltd.
12 Hyde Street, Oxford Street
Telephone: REGENT 6214 (3 lines) W.C.1. Telegrams "Instradio London"

HOW TO CONSTRUCT A THREE-VALVE REFLEX RECEIVER.

By CAPTAIN RICHARD TWELVETREES, A.M.I.M.E.

This is the second and concluding article dealing with the construction of a three-valve dual-amplification set which has, on test, given exceedingly good results.

IN determining the position of the two-way coil holder, two very important points must be borne in mind. First, the position must allow of a sufficient clearance when the moving coil is at the extreme range of its movement; and secondly, the distance between the coil and panel must be such as to allow ample anti-capacity effects when tuning in. Incidentally, this is a special feature of this particular set and assists very materially in avoiding hand effects, liable to confuse the operator when selecting distant stations, or those working on narrowly separated wave-lengths.



PLAN OF MAIN SWITCH SHOWING CONNECTIONS FOR WIRES

FIG. 4.

The fixed coil T.A.I.1 is arranged diagonally on the base, so as to clear the two condensers on the panel and also the moving member of the two-coil holder. Furthermore, this lay-out reduces interaction effects between the fixed and moving coils, a very important point in arranging the design.

While the space available for the A.T.C. condenser is somewhat limited, care should be taken to keep this condenser as far as possible from the variable condenser T.A.C.1, to avoid capacity effects.

It will be noted that the two Eureka transformers are located at right angles to one another, partly for the convenience of lay-out, but primarily to minimise interaction between their windings and also between them and other components. These transformers are particularly well screened, being entirely surrounded by a copper-ed steel case, with a wax insulation between the latter and the windings, the total length of which amounts to 2¼ miles on each component.

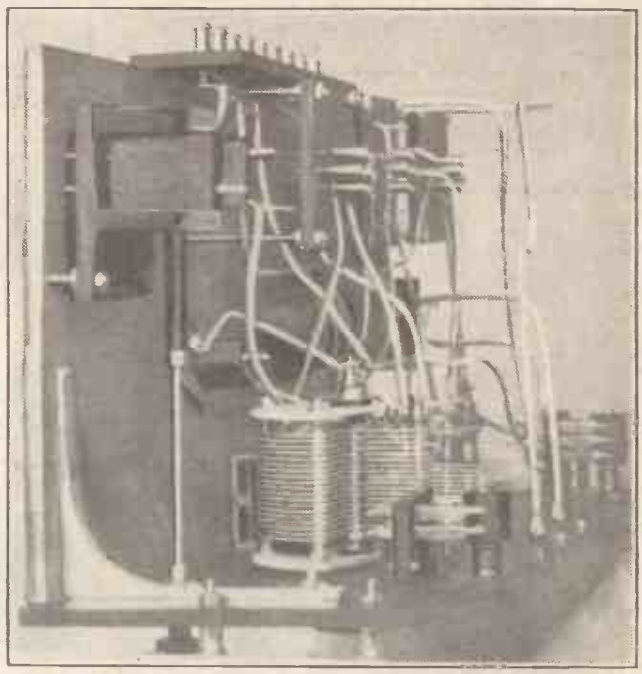
In previous sets constructed with this circuit some little difficulty has been experienced from L.F. "howling," owing to an unintentional coupling between one of the transformer windings and the tuned anode coils. After several experiments, the Eureka No. 2 transformer was adopted with signal success.

Wiring Up.

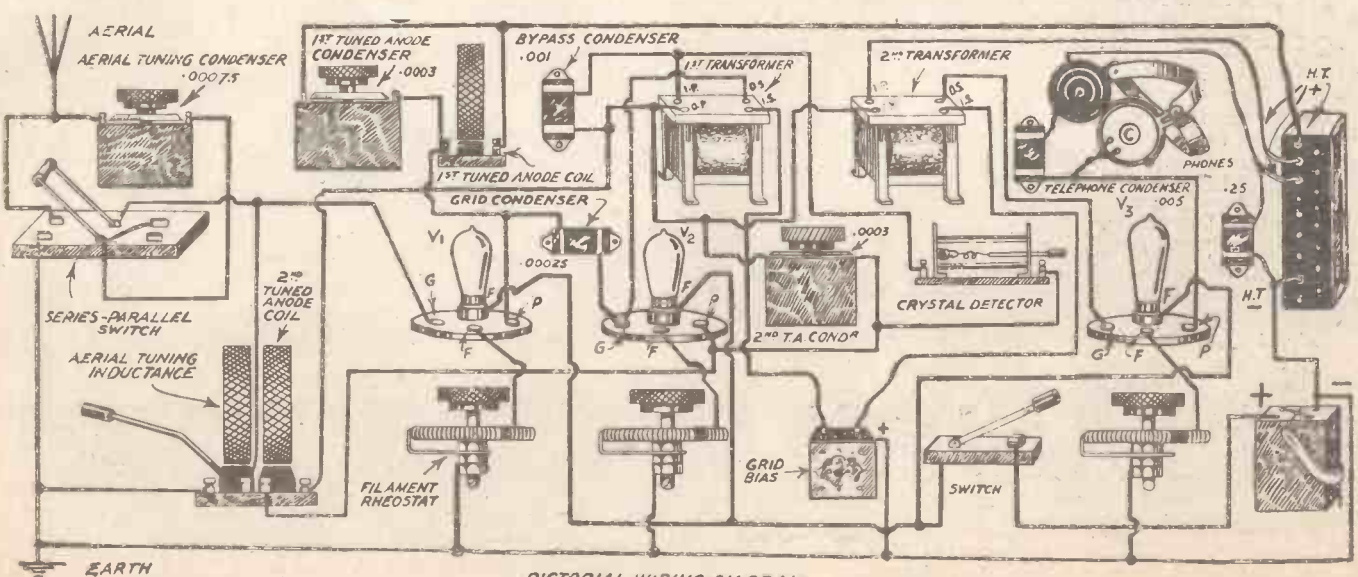
The position of the Dubilier condensers will be noted from the diagram, as well as that for the brass brackets supporting the ebonite panel on the wooden instrument base.

Having completed the preliminary work of assembling the components on the panel and base respectively, the remainder of the constructional operations consists in wiring the set, which will be enormously facilitated if the following instructions are carried out stage by stage. Though the connections between the various components can be followed by reference to the diagram Fig. 1,

(*Continued on page* 1370.)



Back view of the panel, showing support brackets and lay-out of components.

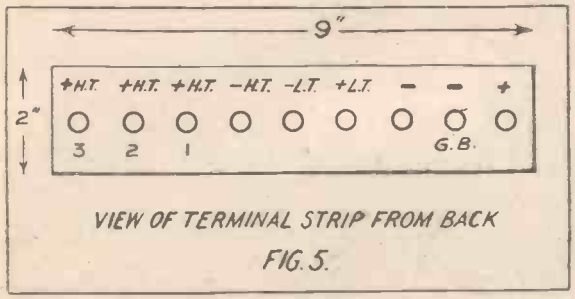


PICTORIAL WIRING DIAGRAM.

HOW TO CONSTRUCT A THREE-VALVE REFLEX RECEIVER.

(Continued from page 1369.)

the actual lay of the wires will be seen more clearly from the photographs, the whole idea of the wiring being to use direct leads wherever possible, spacing them well apart and arranging that crossed wires shall be at right angles to each other. Systoflex is recommended for insulating all the wires, and all joints must be soldered carefully, avoiding the use of acid as a flux on account of its corrosive properties.



VIEW OF TERMINAL STRIP FROM BACK

FIG. 5.

All the terminals on the ebonite terminal strip are first wired up and, commencing from left to right, the first lead is taken to the tag No. 1 on the main switch (see Fig. 4). The second terminal is connected to the I.P. terminal of transformer T2. The third terminal is connected to the fixed vane terminal of the variable condenser T.A.C.1.

Transformer Connections.

The fourth, fifth, and ninth terminals are connected together, the wire leading from these three terminals to the winding on each of the three filament resistances.

Fig. 5 shows how the terminals on the strip are marked for connecting with the high and low tension batteries.

The eighth terminal is connected to the I.S. terminal of the transformer T2, thus completing the wiring of the terminal strip.

Continuing to look at the back of the panel, the transformers are wired up as follows, commencing with transformer T1. The O.S. terminal of this transformer T1 connects with the left-hand side of the fixed condenser ·00025 (see Fig. 3), and the O.P. terminal of the same transformer has a branch lead, one end of which connects with the cup of the crystal detector, C.D., and the other is joined to the right-hand tag of the ·001 fixed condenser (see Fig. 3). Another branch lead is joined to the I.P. terminal of transformer T1, one end connecting with the moving vane terminal of the variable condenser T.A.C.2, the other branch of the lead going to the left-hand tag of the ·001 fixed condenser.

On the second transformer, T2, the O.S. terminal is joined direct to the grid leg of the valve V3, and, as previously mentioned, the I.P. terminal of this transformer is connected with the second terminal of the terminal strip (+ T.H.3).

The O.P. is connected with the moving vane terminal of the variable condenser T.A.C.2, which completes the wiring as far as the transformers are concerned.

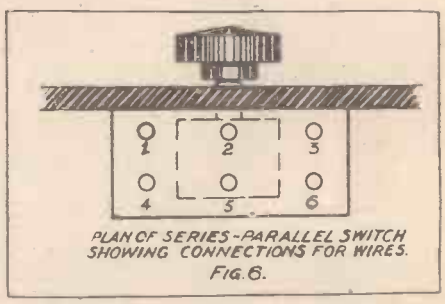
The series-parallel switch (in Fig. 6) is wired as follows: No. 3 terminal is "dead," and has no wire attached. No. 6 is joined by a short wire to No. 2, the latter being joined to the fixed vane terminal of the variable condenser A.T.C. No. 5 is connected to one terminal of the fixed coil of the two-way coil holder, the other terminal of the latter being joined with the earth terminal on the panel. Another wire goes from the earth terminal to No. 1 on the series-parallel switch.

Terminal No. 4 of the S.P. switch has a branch lead, one end going to the moving vanes of the variable condenser A.T.C., and the other to the aerial terminal on the panel.

Completing the L.T. Circuit.

The next step is that of wiring up the valves, and is commenced by connecting a lead from the grid of valve V1 to the aerial side of the aerial tuning inductance A.T.I., the earth side of the latter being connected to terminals 4, 5 and 8 on the terminal strip.

The filament legs nearest the terminal strip are joined by one lead, which is connected to tag No. 3 of the main switch (Fig. 4). The other filament leg of valve V1 is connected to the moving member of the filament resistance F.R.1. A branch lead is connected to the plate leg of this valve, and joins respectively with the right-hand tag of the fixed condenser ·00025. One wire has already been connected to one filament leg of the third valve, and the opposite filament leg is joined to the moving member of the filament resistance F.R.2.

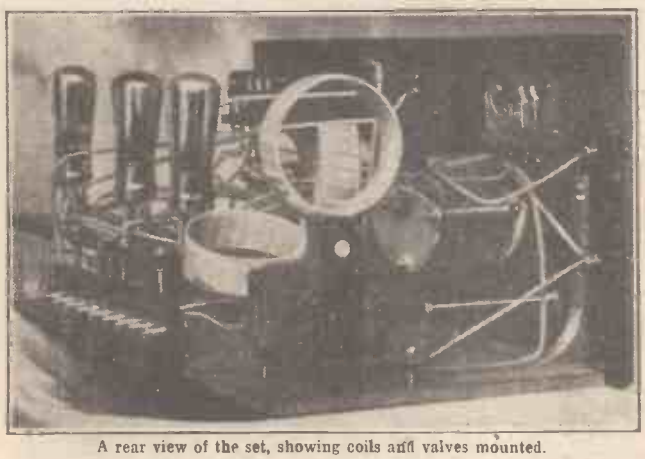


PLAN OF SERIES-PARALLEL SWITCH SHOWING CONNECTIONS FOR WIRES.

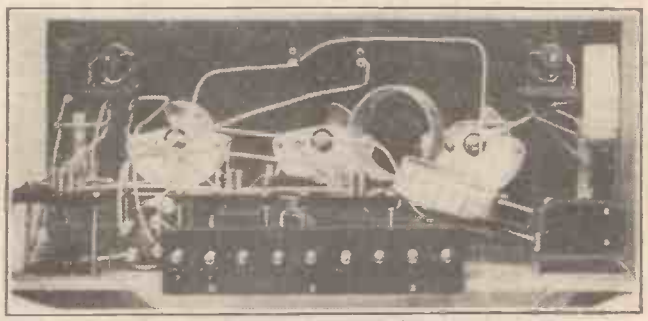
FIG. 6.

From the plate leg of this second valve a

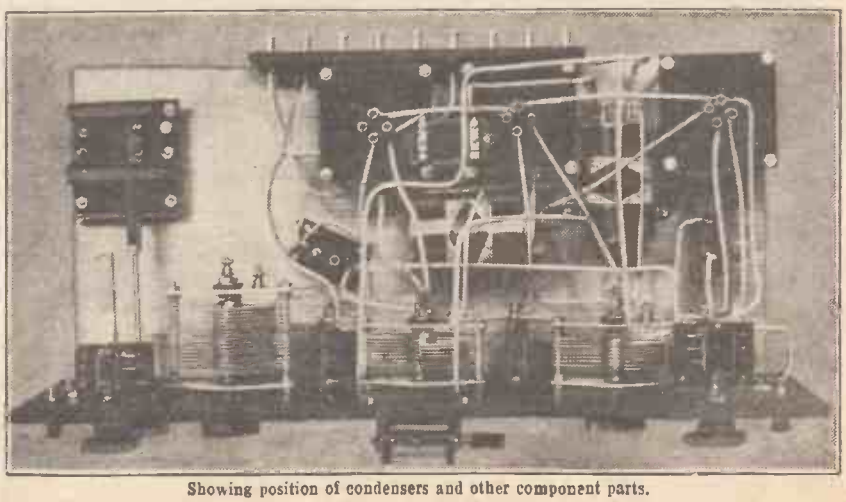
(Concluded on page 1393.)



A rear view of the set, showing coils and valves mounted.



Another view of the back of the set.



Showing position of condensers and other component parts.

Mainly About Broadcasting

by The Editor

HERE is a quotation from "The Stage," a journal devoted to the interests of all those connected with theatrical enterprise:

"What may be good news for 'booers' of first night shows appears in the daily press, for premiéres of plays are to be broadcast. . . . . Now all will be changed, so that while frantic applause may be heard, there may also be caught the broadcast comments of the caustic critics in front, and the 'booers' will groan the louder, knowing that their crude noises will be heard, not by a mere theatreful, but by millions seated at their firesides listening to the mixed reception of the production."

Perhaps this quotation is a clue to the fears expressed by many managers with regard to the broadcasting, not only of first night performances, but of excerpts of plays and musical comedies.

The Critic's Cap.

Every reader of POPULAR WIRELESS knows that the audience at a theatre on the occasion of a first night performance is very mixed. It so happens that it is a hobby of mine to attend first night performances, and so I am able to justify these remarks.

To my mind, a first night audience is utterly unreliable in the matter of giving an opinion on a new play, and, from my personal knowledge of actors and managers, no reliance is placed on the expressions of applause, or otherwise, made by a first night audience.

People in the stalls at a first night play are there, primarily, for social reasons. Also, fully fifty per cent of the people in the stalls are what are technically known as "dead-heads." This means that they have been presented with free tickets; all the dramatic critics are, of course, admitted free; and the author's friends, the friends of the chief actors and actresses and personal friends of the management, etc., are admitted, as a rule (if there is room), free on the first night of a play.

The only critical part of a theatre on a first night is the gallery, and the unfortunate part about it is that gallery fans know it. Consequently the gallery strongly feels its own importance. If it likes a thing it likes it riotously and applauds vociferously, often at inopportune moments, and if it finds itself dissatisfied with part of the production it resorts to the crude and decidedly unfair practice of booing.

I have been to many "first nights," and have been astounded at the enthusiastic reception afforded to what has undoubtedly proved to be a bad play. On the other hand, I have been to first nights when an excellent play has received the most disgraceful and unfair treatment at the hands of the gallery.

Sometimes the gallery has a little grievance to make. The price of the seats may not be right. People in the gallery may have been standing some hours in the rain waiting to get in, for your galleryite is something of a fanatic.

But I should like to ask readers of POPULAR WIRELESS who listen in to any first night performance which is broadcast to don their critic's cap; in other words, to suspend judgment until the whole play is finished and they have had time to form an opinion, which has not been biassed either by the enthusiastic applause or by the equally enthusiastic disapproval expressed by people in the theatre itself.

The people in the stalls are usually gregarious by nature; they cling together like sheep, and, if one section of the stalls starts to get excited and applaud with undue vehemence, it is a hundred to one that the remainder of the stalls will follow suit.

Judging What You Hear.

Ladies in full evening dress, with an excess of diamond rings, etc., find enthusiastic clapping something of an advantage at first nights, apart from the merits of the play, and the gallery fans, having bottled up their feelings for several hours waiting to get in the theatre, are apt to be rowdy one way and another.

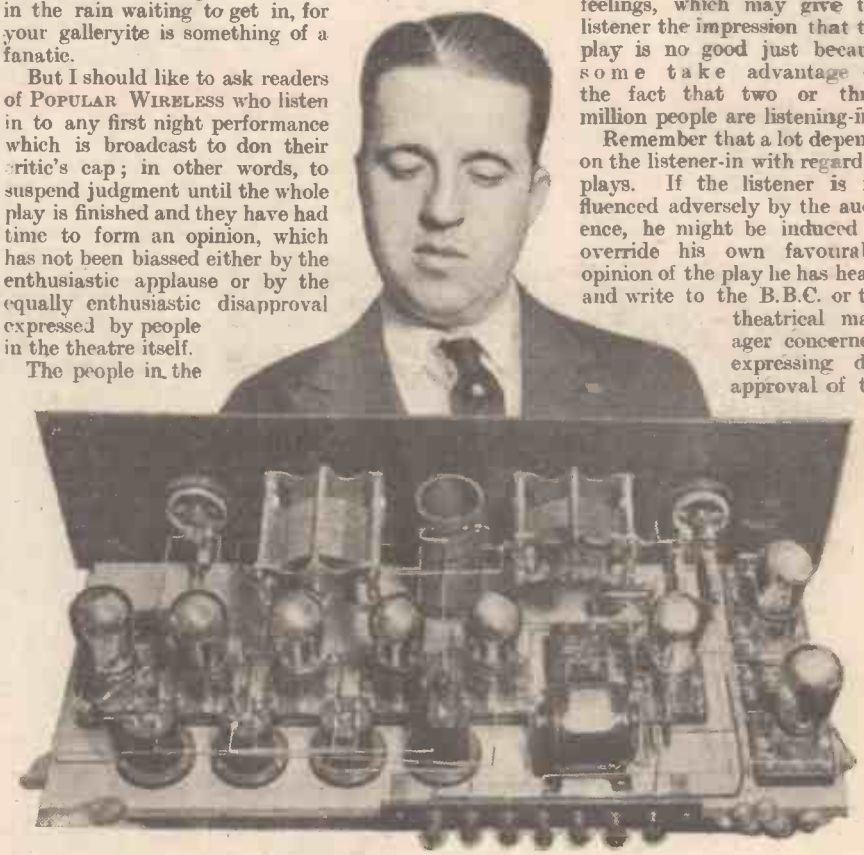
So, when you listen-in to the broadcast excerpts of a first night play, treat the noise you hear from the audience as you would treat the noise emanating from the Zoological Gardens at feeding time. Do not judge the play by the row you hear from the audience, because you are bound to be misled in forming a correct opinion.

Listeners Can Help.

I am sorry that the gentleman who wrote the quotation with which I commenced this article should think that listeners-in are likely to be influenced by those boorish booers who may, or may not, decide to take advantage of the fact that a play is being broadcast, and so vent their feelings, which may give the listener the impression that the play is no good just because some take advantage of the fact that two or three million people are listening-in.

Remember that a lot depends on the listener-in with regard to plays. If the listener is influenced adversely by the audience, he might be induced to override his own favourable opinion of the play he has heard and write to the B.B.C. or the theatrical manager concerned, expressing disapproval of the play, with the consequence that, if this adverse effect is widespread amongst listeners, managers will again get panicky, with the result that there will be a fresh outburst of hostility to the broadcasting of plays.

It has taken a long time and it has been a long fight to make certain managers of the London theatres realise that the broadcasting of excerpts from plays is to their own good, and, if the listener will only do his share and be perfectly fair about the whole business, there is no reason why the opposition with regard to the broadcasting of plays should not be amicably settled once and for all.



The latest type of the Reflex Super-Heterodyne. Eight valves are used in this set.

THE "MULTIDYNE."

THE first of a series of articles dealing with the construction of a very useful type of receiver will be published in next week's "Popular wireless."

EVERY Amateur interested in "trying out" various circuits will find the "Multidyne" of extraordinary value.

ORDER YOUR next week's copy of "Popular Wireless" NOW!

Artistes of the Aether

By "Ariel"

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

WITH the extension of wireless one can rapidly foresee that society will be roughly divided into two classes only—Valve and Crystal, and it is evident that the B.B.C. are going to have a very hard task to satisfy both parties. The relaying each night of a different station and the different programmes on 5 X X would, of course, solve this problem, but meanwhile, the policy of giving each party the wrong programme still exists.

Miss Murray Lambert.

At the present moment it is the "highbrow" who is getting the best of the game, and it is only the fact that artistes with big names are engaged which helps to cover the "powder," for if they do not really enjoy the actual music, it is to be feared that the majority like to say with all unction that they heard Miss So-and-so sing this aria, or Mr. This-and-That-ski play that concerto, and even if they went to sleep over the aria or the concerto, it is best to retain a discreet silence.

However, 2 L O has certainly scored. In chamber music we had the performance of the quartet led by Mr. Charles Woodhouse, an earnest violinist whose style is eminently suited to the works he performs.

On the instrumental solo side, a noted executant was Miss Murray Lambert, a violinist who has a successful career behind her, a soloist of the Royal Philharmonic Society concerts, the Hallé, London Symphony, and Queen's Hall, besides the biggest of provincial halls.

Miss Helen de Frey.

With a strong, virile tone, and a repertoire of every known sonata and concerto, she is one of our foremost players, and should become more widely known over the aether.

In addition to the second of the international symphony concerts, conducted by M. Ansermet at Covent Garden, some outstanding arrangements have been the broadcasting of "Yoicks," despite provincial managerial wrath, the "Midnight Follies" of the Hotel Metropole—though both these suffered from the lack of television—and the complete performance of Mozart's opera "Figaro." The Sunday programmes gained also by the inclusion of well-known artistes. One recently had the work of Miss Helen de Frey, a coloratura singer with a surprising range.

Well-known Harpist.

In the same programme, also, was the well-known harpist, Jeanne Chevreau, of the British National Opera Company and one time first harp to the Sir Thomas Beecham, Quinlan, and Covent Garden Opera companies. She has been associated with all the important orchestral movements of recent years, including the Philharmonic Society, London Symphony, and Scottish Orchestras. She made her debut with the latter orchestra, at an age when most players are still in the elementary stages of study.

The famous St. Hilda Colliery Band with a few of their many trophies.

Glasgow.

Some ambitious programmes have been framed by 5 S C, amongst them the scenes from Scott's novel, "The Heart of Midlothian," and the Robert Louis Stevenson play, "Will of the Mill," produced under the personal direction of the B.B.C. dramatic producer, Mr. R. E. Jeffrey. A Bach chamber concert relayed from the Engineers and Shipbuilders Institute included part of the Brandenburg Concerto No. 3 in G minor.

5 N O's Programmes.

Bach's music has formed an integral part of Newcastle's scheme, for a festival lasting several days must have rejoiced the heart of every "high-brow" in the surrounding district. The augmented orchestra, under the brilliant conductor, Edward Clark, and the 5 N O Choral Society made fine hearing, while the solo violin was Mr. Albert Sammons. Many well-known artistes have appeared recently at this station, including Miss Marjorie Booth, Mr. Denis Noble, and Mr. William Anderson, both the latter singers of the British National Opera Company, and Miss Dorothy Helmrich.

Miss Dorothy Helmrich.

The latter is the Australian mezzo-soprano, who has hitherto only been heard at the big concert halls of London and the provinces. Her name is a familiar one to patrons of the promenade concerts at Queen's Hall, while her recital in February last at Wigmore Hall, London, placed her amongst the front rank of classical singers.

Concerto Music.

To most people this only consists of "string" music, but there is a far larger public that cares for military and brass bands, as can be proved by any visit to the Crystal Palace, London, when a brass band contest is taking place.

However, one brass band at a time is quite enough, and good enough, too, if it is the best, and most listeners-in will admit that it has been found in the famous St. Hilda Colliery Band, heard on many occasions at the various broadcasting stations. The St. Hilda Band may truly claim to be the world's champions, for, consisting of twenty-six members, each a medallist of his respective instrument, it is not surprising that they have gained over eighty first prizes, eleven challenge cups, including the famous Crystal Palace 1,000 Guinea Trophy, no less than four times, including the contest of last September, and setting up a world's record.

Mr. Michael Head, a popular artiste.

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE.

Specially compiled by ROBERT R. PECORINI, 2 R I.

Transmission Starts G.M.T.	Transmission Ends G.M.T.	Station and Call Sign	Wave-length in Metres	Days of Week	Nature of Transmission
06.00	06.06	Koenigswusterhausen (L P)	4000	Daily ..	News during day to 20.00.
06.25	08.00	Hamburg	392	Weekdays	Time, News, and Talk.
06.25	08.00	Hanover	296	,,	Relay Station.
06.25	08.00	Bremen	330	,, ,, ,,	Press Service (Woolf).
06.30	07.35	Koenigswusterhausen (L P)	2450	Daily ..	
06.40	06.46	Eiffel Tower (F L) ..	2650	Weekdays	Weather.
06.45	06.53	Eberswalde	3150	Daily ..	Press Service (U. Telegraph) and during day
06.50	06.55	Buda-Pesth (M T 1)	950	,, ..	News, Bourse, etc., and frequent intervals during day.
06.55	08.15	Münster	410	,, ..	Time, News, Women's Talk.
07.05	07.12	Lausanne (H B 2)	850	,, ..	Weather, Markets, News.
07.30	08.00	Leipzig	454	Sundays	Concert.
07.30	08.30	Frankfurt-am-Main	470	Sun., Fri.	Religious Service and Music.
07.30	08.30	Cassel	292	,, ,,	Relay.
07.40	07.50	Toulouse (M R D)	1525	Daily ..	Weather for 'planes.
07.45	07.52	Buda-Pesth (M T I)	950	,,	News, Bourse, etc.
07.55	10.00	Hamburg	392	Sunday	Time, Weather, News, and Talk.
07.55	10.00	Hanover	296	,,	Relay Station.
07.55	10.00	Bremen	330	,, ,,	
07.55	08.05	Amsterdam (P C F F)	2125	Daily ..	News, Markets, etc.
08.00	08.09	Vienna (Radio-Wien) (O R V).	530	,, ..	Markets.
08.00	09.00	Voxhaus (Berlin) (430	505	Sunday	Religious Music.
08.00	09.00	Leipzig	454	,,	,, ,,
08.00	09.00	Dresden	280	,,	Relay Station.
08.00	08.45	Koenigsberg	463	,,	Religious Music.
08.15	08.20	Buda-Pesth	950	Daily ..	News, etc.
08.20	08.30	Marignane (S.W. France)	1525	,, ..	Weather.
09.00	10.30	Voxhaus, Berlin ..	505	,, ..	Market, News, Weather, Concert.
09.00	09.12	Kbely (O K P) ..	1160	,, ..	Weather, News.
09.00	10.05	Komarov (O K B)	1800	Sunday	Sacred Concert.
09.42	09.50	Toulouse (M R D) ..	1525	Daily ..	Weather.
09.55	10.03	Amsterdam (P C F F)	2125	,, ..	Time Signals.
10.00	11.45	Hamburg	392	Sunday	Sacred Music.
10.00	11.00	Leipzig	454	,,	Educational Talk.
10.00	11.45	Buda-Pesth (M T I)	950	Daily ..	Concert and News.
10.00	11.00	Kbely	1160	Sunday	Concert.
10.00	11.30	Stockholm	427–440	,,	Church Service.
10.00	11.50	Vienna (Radio-Wien) (O R V)	530	Daily ..	Concert.
10.00	11.55	Breslau (G F U) ..	418	Sunday	Concert, Market, Weather.
10.10	11.30	Malmoe	270	,,	Religious Service.
10.10	10.55	Frankfurt-am-Main	470	Daily ..	Bourse.
10.10	11.10	Amsterdam (P C F F)	2125	Mon.,Sat.	News, Bourse (at intervals).
10.15	11.55	Breslau (G F U) ..	418	Weekdays	Market, News, Weather, Concert.
10.15	11.55	Koenigsberg	463	Daily ..	Bourse.
10.15	10.35	Norddeich (K A V)	1800	,, ..	Weather (following spark transmission).
10.30	11.30	Stuttgart	443	Sunday	Concert.
10.30	11.30	Munich	485	,,	Religious Talk, occasional Music.
10.30	11.30	Nuremburg	340	,,	Relay from Munich.
10.30	11.45	Station de la Doua, Lyons	470	Daily	Concert.
10.30	11.45	Voxhaus, Berlin (430	505	Sunday	Educational Talk.
10.30	11.30	Lyons	550	Daily	Gramophone.
10.30	11.40	Kbely	1160	Weekdays	Bourse.
10.30	11.50	Koenigswusterhausen (L P)	2800	Sunday	Concert and Lecture.
10.45	10.50	Lyons (Y N)	470	Weekdays	Bourse.
10.55	12.08	Leipzig	454	Daily ..	Bourse, Concert and Time Signals.
10.55	11.06	Frankfurt-am-Main	470	Weekdays	Time and News.
11.00	11.10	Zurich—Höngg ..	*515	,,	Weather (*also sends on 645 occasionally).
11.00	11.15	Eiffel Tower (F L)	2650	Tues. to Sat.	Markets.
11.00	11.50	Münster ..	410	Sunday	Religious Music and News.
11.15	11.22	Koenigswusterhausen (L P)	2450	Weekdays	Markets.
11.15	11.55	Hamburg	392	,,	Markets and Lecture.
11.15	11.19	Eiffel Tower (F L) ..	2650	Daily ..	Time and Weather.
11.15	11.20	Voxhaus .. .. (430	505	Weekdays	Bourse.
11.30	11.50	Münster	410	,,	News.
11.45	12.40	Hamburg	392	Sunday	Chess.
11.50	12.00	Radio-Lyons	387	Weekdays	News and Weather.
11.55	12.05	Münster	410	,,	Time Signals.
11.55	12.05	Breslau	418	Sunday	,, ,,
11.55	12.00	Koenigsberg	463	Daily ..	Time Signals and Weather.
11.55	12.08	Zurich	515	Weekdays	Time Signals and Markets.
12.00	12.05	Voxhaus .. .. (430	505	Daily ..	Time Signals and Markets.
12.00	13.00	Radio-Lyons	387	Tues, Th., Sat.	Concert.
12.05	12.08	Vienna (O R V) ..	530	Daily ..	Time Signals.
12.10	12.35	Hamburg	392	Weekdays	Concert.
12.15	12.50	Geneva (H B I) ..	1100	,,	Lecture.
12.20	12.25	Vienna (O R V) ..	530	Daily ..	Weather.
12.25	12.30	Breslau (G F U) ..	418	Weekdays	Weather and Bourse.
12.30	12.45	Lausanne (H B 2) ..	850	,,	Weather, Markets, Time and News
12.30	14.00	Radio-Paris S.F.R. ..	1780	,,	Orchestral Concert.
12.30	12.40	Vossegat (B E) ..	1050	Daily ..	Weather.
12.45	12.52	Kbely (O K P) ..	1160	Weekdays	Bourse.
12.45	13.30	Hamburg	392	Sunday	Concert.
12.45	14.00	Radio-Paris	1780	,,	,,
12.45	12.54	Amsterdam	2125	Daily ..	Market and News.
13.00	13.10	Munich	485	,, ..	News, Weather, and Time.
13.00	13.10	Nuremberg	340	,, ..	News, Weather, and Time (Relay).
13.00	13.10	Brussels (B A V) ..	1100	,, ..	Time, Weather.
13.00	13.25	Komarov (O K B)	1800	Weekdays	Bourse, News, Weather.
13.10	13.22	Voxhaus .. (430	505	,,	Bourse.
13.15	13.30	Koenigsberg	463	,,	Market.
13.30	13.42	Hamburg	392	Thurs. & Fri.	Markets.
13.45	14.00	Radio-Paris	1780	Sunday	News.
13.45	14.00	Hamburg	392	Mon., Tu., Wed.	Markets.
14.00	14.10	Breslau (G F U) ..	418	Weekdays	News.
14.00	15.00	L'Ecole Superieure de P T T	458	Thurs. ..	(Irregular) Lecture.
14.00	17.00	Munich	486	Sunday	Concert, Lecture.
14.00	15.00	Voxhaus .. (430	505	,,	Lecture.
				Weekdays	Bourse.
14.00	15.00	Prague	1160	Sat.	Concert
14.15	14.28	Hamburg	392	Weekdays	News, Talk (Domestic).
14.30	17.00	Münster	410	,,	Markets, Weather, Lecture, Concert (Children, Saturdays).
14.30	14.40	Vienna (O R V) ..	530	Daily ..	Bourse.
14.30	15.30	Voxhaus .. (430	505	Sun.,Wed.	Children.
14.40	14.50	Amsterdam (P C F F)	2125	Weekdays	Bourse and News.
14.45	14.54	Eiffel Tower (F L)	2650	,,	Bourse.
15.00	16.00	Ryvang	1100	Sunday	Concert.
15.00	15.30	Voxhaus	505	Saturday	Educational Talk.
15.00	17.00	Münster	410	Sunday	Concert and Children.

(Relay stations have not been quoted after initial entry.)

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE

(Continued from page 1377).

Transmission Starts G.M.T.	Transmission Ends G.M.T.	Station and Call Sign	Wave-length in Metres	Days of Week	Nature of Transmission
15.00	17.00	Leipzig	452	Mon., Tu. Wed., Fri., Sat.	Markets and Concert.
15.00	16.00	Hamburg	392	Sunday	Children.
15.00	15.45	Breslau (G F U)	418	Sun., Fri.	Children and Concert.
15.00	17.00	Stuttgart	443	Sun., Wed., Th., Fri.	Time, Concert.
15.00	15.08	Vienna (O R V)	530	Daily	News.
15.00	15.10	Centocelle (I C D)	1800	„	„
15.00	17.30	Frankfurt-am-Main	470	„	Markets, News, Concert. (Children Sunday).
15.00	17.00	Zurich	515	„	Concert.
15.10	17.00	Vienna (O R V)	530	„	„
15.30	17.00	Leipzig	452	Sun., Th.	Markets. Concert
15.30	16.05	Hamburg	392	Weekdays	Lecture.
15.30	16.30	Koenigsberg	463	Daily	Concert. Children (Wednesday).
15.30	16.35	Munich	486	Mon. to Sat.	Concert
15.30	17.00	Voxhaus (430	505	Daily	„
15.35	15.40	Eiffel Tower (F L)	2650	Weekdays	Bourse.
15.45	16.30	L'Ecole Supr. de P.T.T.	458	Wed.	Lecture.
15.50	15.58	Brussels (O P O)	1100	Daily	Weather.
15.55	16.10	Amsterdam (P C F F)	2125	„	Market, News.
16.00	17.00	Hamburg	392	„	Concert.
16.00	16.30	Breslau (G F U)	418	„	Time (Sunday) Children (Wednesday)
16.00	17.00	Lausanne (H B 2)	850	Wed.	Children.
16.00	16.10	Kbely (O K P)	1160	Weekdays	Bourse.
16.00	17.00	Kbely (O K P)	1160	Wed., Sat.	Concert.
16.10	16.14	Amsterdam (P C F F)	2125	Daily	Time Signals.
16.30	17.30	Leipzig	452	Tues.	Lecture.
16.30	16.45	Stuttgart	443	Daily	Market News, Weather.
16.30	17.30	Rome (U R I)	425	„	Concert.
16.30	16.40	Eiffel Tower (F L)	2650	Tu. to Sat.	Bourse.
16.30	17.45	Radio-Paris	1780	Sunday	Concert.
16.45	18.00	Stuttgart	443	Daily	Concert. Children (Wed. and Saturday).
16.45	18.00	Lyons	550	Daily	Concert.
16.45	17.45	Radio-Paris (S F R)	1780	Weekdays	Concert.
16.50	17.00	Brussels (B A V)	1100	Daily	Weather.
17.00	18.15	Breslau (G F U)	418	Wed., Sat.	Educational Talk and Games.
17.00	17.30	Frankfurt-am-Main	470	Sun. and Thurs.	Concert.
17.00	17.25	Munich	486	Monday	Time.
17.00	17.12	Kbely (O K P)	1160	Weekdays	Bourse.
17.00	17.45	Radio-Paris (S F R)	1780	Saturday	Concert.
17.00	18.00	Radio-Belgique (S B R)	265	Sun., Mon. Th., Fri.	Concert.
				Tu., Sat.	Dance.
				Wed.	Children.
17.00	18.00	Hamburg	392	Tu., Wed., Th., Fri. Saturday	Educational Talk.
				Wed.	Concert.
17.05	19.00	Voxhaus (430	505	Daily	Lecture.
17.15	18.30	Radio-Lyons	482	Mon., Wed., Fri.	Concert, News.
17.15	18.00	Zurich	515	Mon., Wed., Fri.	Children
17.15	18.45	Komarov (O K B)	1800	Thurs.	Concert.
17.30	18.30	Frankfurt-am-Main	470	Mon., Tu., Th., & Sat.	Lecture.
17.30	20.40	Munich	486	Tu. to Sat.	Concert, News. Lecture.
17.40	20.00	Boden	2500	Snnday	News, Weather, and Concert.
17.40	18.10	Voxhaus (430	505	Tues	Educational Lecture.
17.40	18.45	Hilversum	1060	Monday	Children.
17.45	18.55	Hamburg	392	Sunday	Educational Talk.
17.45	18.30	Belgrade (H F F)	1650	Tu., Th., & Sat	Concert.
17.55	18.05	Lausanne (H B 2)	850	Daily	Weather, News.
18.00	18.05	Stuttgart	443	Sun., Mon., Th., Fri., Sat.	News, Weather.
18.00	21.00	Madrid (E A J 2)	310	Daily	Concert, News, Dance.
18.00	19.00	Barcelona (E A J 1)	325	„	„
18.00	19.00	Hamburg	392	Wed.	Educational Talk.
18.00	19.15	Zurich	515	Weekdays	Weather, News, Concert.
18.00	18.10	Kbely (O K P)	1160	Daily	Weather.
18.00	19.10	Eiffel Tower (F L)	2650	„	Concert, News, Weather.
18.15	19.30	Seville (E A J 5)	350	Mon., Tu., Wed., Sat.	Concert, News.
				„ Thurs.	Lecture, Concert, News.
18.15	19.00	Leipzig	452	Mon., Tu.	Educational Talk.
18.20	18.30	Lyngby (O X E)	2400	Weekdays	News.
18.30	19.30	Frankfurt-am-Main	470	Friday	Educational Talk.
18.30	19.00	Breslau (G F U)	418	Mon. to Wed.	„ „
18.30	19.30	„ „	„	Th. & Fri.	„ „
18.30	19.00	Stuttgart	443	Friday	Lecture.
18.30	19.00	Koenigsberg	463	Mon., Wed. to Sat.	„
18.30	18.45	Copenhagen	775	Daily	Programme and Tests
18.35	18.45	Münster	410	Daily	Time, News.
18.40	18.50	Toulouse (F N T)	1525	„	Weather.
18.40	20.00	Boden	2500	Tu., Fri.	Concert
18.45	19.00	Vienna (O R V)	530	Daily	News.
18.45	19.00	Stockholm	427	„	„
18.45	20.30	Copenhagen	510	Sun. Mon., & Th.	Concert.
19.00	20.30	Kbely (O K P)	1160	Daily	Concert.
19.00	20.00	Ryvang	1100	Tu. and Friday	Concert.
19.00	20.15	Stuttgart	443	Daily	Concert, News, Time
19.00	21.00	Stockholm	427	„	Concert.
19.00	21.00	Hamburg	392	„	News, Weather, Concert.
19.00	19.30	Münster	410	„	Talk.
19.00	23.00	Breslau (G F U)	418	Sun. Mon., Tu., Wed.	Concert. Weather, News.
„	„	„ „	„	Saturday	Opera.
19.00	20.00	Stockholm (Svenska)	445	Mon. and Thurs.	Concert.
19.00	21.00	Gothenburg (P M Z X)	445–460	Sun., Tu., and Fri.	Concert, News, Lecture.
19.00	19.15	Leipzig	452	Tuesday	Educational Talk.
19.00	20.30	Koenigsberg	463	Daily	Concert and News.
19.00	19.30	Frankfurt-am-Main	470	Sun. and Monday	Lecture and Educational Talk.
19.00	20.30	Vienna (O R V)	530	Daily	News, Concert.
19.00	20.00	Jorcks Passage	775	Sun., Wed., Th.	Lecture, Concert, News
19.00	21.30	Lausanne (H B 2)	850	Tu., Sat.	Concert or Dance.
19.00	20.00	Malmoe	270	Mon., Th.	Concert.
19.05	19.25	Voxhaus (430	505	Monday	Educational Talk.
19.15	22.00	Zurich	515	Sun., Tu. to Sat.	Concert, News, and Weather.
19.15	21.00	Leipzig	452	Daily	Concert.
19.15	22.15	„	„	Wed.	„
19.15	21.30	Lausanne (H B 2)	850	Sun., Mon., Wed., Th., Fri.	Concert, Dance, Music.
19.25	19.30	Soesterberg	1050	Daily	Weather.
19.30	22.00	Zurich	515	Monday	Concert.
19.30	21.15	Voxhaus (430	505	Daily	„
19.30	20.30	Munich	486	„	„
19.30	22.00	Frankfurt-am-Main	470	„	Concert and News.
19.30	21.00	Münster	410	„	Lecture, Concert.
19.30	19.40	Centocelle (I C D) (Rome)	1800	„	News.
19.40	20.10	Rome (U R I)	425	„	Concert, Lecture.
19.40	19.50	Amsterdam (P A 5)	1050	„	News.
19.40	22.10	Hilversum (N S F)	1060	Sunday	Concert.
19.40	19.50	Vossegat (B E)	1050	Daily	Weather.
19.40	Ir'g'lar	Christiania	448–475	„	Testing.
19.45	23.30	Breslau (G F U)	418	Tu. & Fri.	Concert, Weather, News.
19.45		L'Ecole Superièure de P.T.T.	458	Sunday	Concert.
19.50	20.50	Amsterdam	1050	Wed.	„

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME TABLE (*Continued from page* 1378).

Transmission Starts G.M.T.	Transmission Ends G.M.T.	Station and Call Sign	Wave-length in Metres	Days of Week	Nature of Transmission
20.00	20.15	Stockholm (Svenska)	445	Mon. and Thurs.	News.
20.00	20.15	Radio-Belgique (S B R)	265	Wed. ..	Time.
20.00	21.30	Prague (P Q R) ..	1000	Daily ..	Concert, News.
20.00	20.13	Koenigswusterhausen (L P)	2450	„ ..	News.
20.00	20.05	Lyngby (O X E) ..	2400	Weekdays	News, Weather, Time.
20.10	21.40	Ijmuiden (P C M M)	1050 to 1100	Saturday	Concert.
20.15	22.15	Radio-Belgique (S B R)	265	Sun., Tu., Fri., Sat.	Concert, News.
20.15	22.15	Radio-Belgique (S B R)	„	Mon. and Wed.	Opera.
20.15	21.00	Radio-Belgique (S B R)	265	Thursday	Concert, News.
20.15	21.30	Stuttgart	443	Daily ..	Concert, Cabaret (Sun. and Wed.)
20.15	21.00	Stockholm (Svenska)	445	Mon. and Thurs.	Concert.
20.30	22.00	Radio-Lyons	482	Mon., Wed., & Friday	Concert, News.
20.30	22.30	L'Ecole Superièure de P.T.T.	458	Mon., Wed., & Thurs.	Concert.
20.30	22.30	L'Ecole Superièure de P.T.T.	„	Tu. & Sat.	Talk.
20.30	20.40	Munich	486	Daily ..	News, Weather, Time.
20.30	21.30	Jorcks Passage ..	775	Sun. and Thurs.	Dance Music.
20.30	21.00	Radio-Paris (S F R)	1780	Sunday ..	News.
20.30	22.00	Lyons	550	Daily ..	Band, News, Concert.
20.40	22.10	Hilversum	1060	Friday ..	Lecture, Concert.
20.45	22.30	L'Ecole Superièure de P.T.T.	458	Sun. and Friday	Concert (occasionally).
20.50	22.30	Munich	486	Sun. & Tu.	Concert.
21.00	21.30	Münster	410	Daily ..	Educational Talk and News. Sunday: Concert and News.
21.00	21.15	Radio-Iberica	392	„ ..	News and Weather.
21.00	23.00	Barcelona (E A J 1)	325	„ ..	Concert, News, Dance.
21.00	22.10	Radio-Belgique (S B R)	265	Mon., Thurs.	Dance.
21.00	21.50	Hamburg	392	Daily ..	Weather, Market, News, Concert.
21.00	22.00	Zurich	515	Weekdays	News, Concert.
21.00	22.30	Vienna	530	Mon., Tu., Wed., Saturday	Dance Music.
21.00	22.00	Radio-Paris (S F R)	1780	Daily ..	Concert or Dance (Sun., Wed.).
21.00	21.15	Lyngby (O X E) ..	2400	Weekdays	News, Weather, Time.
21.15	24.00	Radio-Iberica	392	Daily ..	Talk, Concert, News.
21.15		Rome	425	„ ..	Dance. (Thurs. at 21.00, Sunday at 21.05.)
21.30	23.30	Le Petit Parisien ..	345	Sun., Tu., Thurs.	Concert.
„	„	„ „	„	Saturday	Dance.
21.30	24.00	L'Ecole Superièure de P.T.T.	458	Sunday	Concert.
22.00	22.45	Radio-Paris (S F R)	1780	Wed. ..	Concert
22.10	22.18	Eiffel Tower (F L)	2650	Weekdays	Weather.
		AD	DE	NDA.	
11.10	11.30	Amsterdam (P C F F)	2125	Weekdays	Market and News.
12.00	12.15	Amsterdam (P C F F)	„	„	„ „

Voxhaus (505) also sends on a wave-length of 430 for extra-morning transmissions only.

CONTINENTAL STATION DIRECTORS.

Station.	Address.
Brussels S.B.R.	The Station Director, Radio-Belgique S.B.R., Brussels, Belgium.
Barcelona E.A.J.1	Hotel Colon, Barcelona, Spain.
Nuremberg ..	Herr Karl Rudolf, Rundfunk-Stunde, Annenhatten, Nuremberg.
"Le Petit Parisien"	16, Rue d'Enghien, Paris (10°).
Hamburg	Dr. Stapalfeldt, N.R.A., Gr. Bleichen 49-59, Hamburg.
Bremen	Herr Direktor, Nordische Rundfunk Aktiengesellschaft, Bremen, Germany.
Münster	Herr Direktor Krosne, Rundfunksender, Münster, Westphalia, Germany.
Breslau	Herr Direktor Alexander Vogt, Schlesiche Funkstunde A-G., 93 Hohenzollernstrasse, Breslau, Silesia.
Stockholm ..	Karl Lenberg, R.B.S.T., Telegafverkets forsoksstation, 19B, Malmskillnadsgatan, Stockholm.
Stuttgart ..	Herr Leon Hauser, Suddeutsche Rundfunk A-G., 54, Friedrichstr., Stuttgart.
Stockholm (Svenska) ..	Capt. Comdr. S. J. Wiborn, Svenska Radiobolaget, Stockholm.
Gothenburg SMZX ..	Ing. Karl G. Eliasson's Laboratorium, 8, Vallgatan, Gothenburg, Sweden.
Leipzig	Herr Direktor, Mitteldeutsche Rundfunk A-G., 4, Markt, Leipzig.
L'Ecole Superièure de P.T.T.	103, Rue de Grenelle, Paris, or 20, Rue Las Cases, Paris (7°).
Koenigsberg ..	Dr. Erich Geissler, Ostmarken-Rundfunk, A-G., Koenigsberg-i-Pr., Germany.
Frankfurt ..	Dr. N. Flesch, Sudwestdeutscher Rundfunkdienst A-G., Frankfurt-am-Main.
Munich	Herr Direktor Richard Staab, Deutsche-Stunde in Bayern, 21, Karlstrasse, Munich, Bavaria.
Voxhaus ..	Dr. Ing M. Hausdörff, F.S.A-G., 4, Potsdamerstr., Berlin W.9.
Zurich	Ing. A. Spœni, Radio-Genossenchaft-in-Zurich, Höngg, Zurich, Switzerland.
Koenigswusterhausen	Herr Direktor, Haupt-Funkstelle, Koenigswusterhausen, Germany.
Jorcks Passage	Engineer C. Gerald-Koebenhavns Radiofonistation, Jorcks Passage, Copenhagen, K.
Lausanne .. HB2	Mons. P. L. Mercanton, Station Radiotelegraphique, Champ de l'Air, Lausanne, Switzerland.
Ijmuiden .. PCMM	Mr. P. H. Middelraad, Ijmuiden, Holland.
Hilversum N.S.F.	Dr. A. Dubois, Nederlandsche Seintossllen Fabriek, Postbox 32, Hilversuin, Holland.
Ryvang	Capt. O. C. Thomson, Ryvang Radio, Copenhagen Str., Copenhagen.
Radio-Paris ..	Station Director, S.F.R., Compagnie Française R-E, Boulevard Haussman, Paris.
Amsterdam .. PCFF ..	Persbureau Vas Diaz, Amsterdam, Holland.
Eiffel Tower ..	Mons. Directeur, La Société de la Station Radiotéléphonique, de la Tour Eiffel, Paris.
Vienna	Herr Czeija Oskar, Osterr Radio-Verkehrs-A-G., 1, Stuben-ring 1, Vienna (Wien), Austria.

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

So popular has the "super-selective" circuit recently published in POPULAR WIRELESS proved to be that a considerable demand has arisen for the special 10,000 to 100,000 ohms resistances required. To meet this, the Watmel Wireless Co. have placed resistances of this value in production and can now supply them by return of post.

Similarly the Enterprise Maufacturing Co. are also manufacturing special variable resistances for the above circuit.

* * *

Messrs. Fuller's United Electric Works, Ltd., of Chadwell Heath, have sent us a sample of "Leakfree" Red-line Ebonite which they have recently placed on the market. It is supplied in various standard sizes in $\frac{3}{16}$ in. and $\frac{1}{4}$ in. thicknesses, and is distinguishable by a central layer of red ebonite. The panels are supplied cut true to size, ground square and finished with a pleasing matt surface. "Leakfree" works easily and cuts and "threads" with gratifying constancy. It also appears to be a most excellent insulator, and can be purchased by contemplative constructors with every confidence.

* * *

A "Sparta" one-valve amplifier.

Crystal detector design is receiving very close attention, and it is frequently possible to announce interesting developments. For instance, we have recently received from Messrs. The Associated Wireless of 289A, King's Road, Chelsea, S.W.3, a "Bi-Recto" Microphonic Detector which is distinctly novel in design.

In appearance it is somewhat reminiscent of a diminutive pair of scales. A small brightly nickeled arm loosely anchored in the centre carries at one end a piece of crystal, and at the other two small screws, and both the crystal and screws rest on bright discs of metal. No adjustment is necessary; if the detector does lose its sensitivity, a slight tap will immediately restore it. On test very good results indeed were recorded, at least standard crystal signals were immediately obtained, and as the makers of the "Bi-Recto" claim, no "fumbling" was necessary. Also we noticed that mechanical vibration did not affect it, except perhaps to increase its sensitivity. In fact, the "Bi-Recto" is something more than a mere novelty, and at 3/-, mounted and complete with crystal, we consider it rather a "fetching" proposition.

* * *

Coil-holders can invariably be classed as either good or very bad indeed, but undoubtedly the "Lotus" cut-geared vernier coil-holder must be given a rather high place in the former category. Indeed, it embodies features worthy of special commendation.

For instance, we particularly like the thorough method of taking the connecting screws *right through* the plugs and sockets,

(*Continued on page* 1386.)

APPARATUS TESTED.

(Continued from page 1382.)

thus leaving no possible chance of a disconnection arising.

The action, too, is very good. Two complete revolutions of the knob are made before the moving holder assumes a horizontal position, and the movement is smooth and positive throughout. The holder cannot be moved independently of the knob, and this is a feature the owner of a cheap coil holder which adopts a "loose coupling" immediately a largish moving coil is used, will appreciate. The two-way type retails at 7/-, and the three-way at 10/6, and both are good value for money, being well designed and made and cleanly finished instruments. The makers are Messrs. Garnett, Whiteley & Co., Ltd., Lotus Works, Broadgreen Road, Liverpool.

* * *

Messrs. Gratton Preston, of Whitfield Place, Tottenham Court Road, W.1, have sent us samples of the "Ubique" soldering iron, which is a special type designed particularly for small instrument work, such as is met with in the construction of wireless sets. It is supplied with three differently shaped copper "bits," any one of which can be slipped into position in cases where one particular shape proves to be required to carry out a difficult piece of work expeditiously. The only criticism we have to offer is that the "bits" are rather small and not likely to retain heat for any but short periods. However, this is a small point, and one cannot employ a one-pound bit when working on rather inaccessible wiring. The "Ubique," anyway, at 3/6 carriage paid, will form a useful addition to the wireless constructor's kit.

* * *

From the Reflex Radio Co., of 45, Stamford Hill, London, N. 16, we have received a range of "Reflex" coils for test. They are lattice wound, but are not provided with plugs, although we are informed that special holders for them are to be placed on the market. They are completely self-supporting and no tape, wax, shellac or similar substance is employed. Nevertheless they appear to be perfectly rigid, and the absence of anything similar to the above is commendable. They function quite well, and their marked values appear to correspond with the normal ranges anticipated. Including a special Chelmsford loading coil, the complete range of "Reflex" coils includes eleven different sizes,—from 35 to 500 turns. The No. 35 is priced at 8d. and the prices graduate up to 5/3 for the No. 500, the whole set being obtainable at 24/6. This is very low, but of course it must be remembered that they are coils of wire and not complete plug-in coils.

* * *

Some Interesting Books.

Pitman's Radio Year Book for 1925 (1/6 net, Sir Isaac Pitman & Sons, Ltd.). We have just received the 6th. edition of this most useful work of reference, and note that it includes an article on the broadcasting conditions in U.S.A. during 1925, by Martin P. Rice, of the G.E.C. of America, which was not received by the publishers in time for the 5th edition, a review of which appeared in this journal a few weeks ago.

"The Book of the Wireless Valve" (1/6, Arks Publicity, Ltd.). An interesting brochure dealing with every technical and interesting phase, historical, theoretical, and practical, of thermionic valves, more particularly those manufactured by the Mullard Radio Valve Co.

The "Chronicle" Wireless Guide (6d., Allied Newspapers, Ltd.). One of the best purely practical "sixpenn'orths" we have ever seen. Useful to both the crystal and valve enthusiast.

The W.P. Ezi Wiring Series No. 4. The Four-Valve Combination Receiver (2/- net, The Wireless Press, London). The fullest possible details concerning the construction of a four-valve set, 1 H.F., Det. and 2 L.F., which incorporates several ingenious novelties and is very carefully designed to give the utmost efficiency.

Up-to-Date Gramophone Tips (H. T. Barnett, M.I.E.E., Gramophone Publications, Ltd., 1/- post free). A most interesting work of reference which will prove useful to all possessors of gramophones and may help to improve the "gramophonic transmissions" of some of our amateur transmitters.

Calvert's Mechanic's Almanack for 1925 (John Heywood, Ltd., 6d. net) contains data concerning metals, wire, screws, etc., which will prove very useful to the wireless constructor. Subjects are dealt with primarily from the mechanical point of view.

HULLO EVERYBODY!!

ALL GOODS ON THIS PAGE SENT BY POST, EXCEPT ACCUMULATORS.

U.K. POST FREE, EXCEPT WHERE MARKED. FOREIGN PACKING AND POST EXTRA. ORDERS DESPATCHED IN STRICT ROTATION AT EARLIEST POSSIBLE MOMENT.

CALLERS PRICES ELSEWHERE.

Aerial 7/22, 100 feet 3/–
„ Copper Strip, do. 2/9
Allen Variable Grid Leak 1/9

Burndept Detector .. 5/6
Basket Coil Holders 1/3, 1/6
Battery Links .. doz. 1/3
Bretwood
Var. Grid Leak .. 3/–
Anode Resistance 3/–
Bushes, Ebonite, doz. 1/4

Crystals—
Neutron or Gilray 1/6
Hertzite or Permanite 1/–
Coil Stands—
2-way Baby .. 3/6
2-way De Luxe .. 3/11
2-way Vernier .. 5/6
2-way Geared .. 5/11
2-way Polar .. 6/3
2-way with ex. hdles. 3/11
2-way Shipton Vernier 4/6
3-way Baby .. 4 6
3-way De Luxe .. 4/9
3-way ex. handles 5/6
3-way Shipton Vernier 8/–
Crystal Sets—
For B.B.C. and 5 X X 9/11
Neutron Long Distance 32/6
Re-Echo, Sloping 17/6
Brownie 8/6
Coils D.C.C.
1,600 metres .. 2/–
With Adapter .. 2/9
No. 50, 75, 100 set 2/3
Coil Plugs .. 2 for 1/6
" Wedge .. 2 for 2/0
Edison Bell do., 2 for 2/6

Detectors Enclosed—
Micrometer .. 2/9
Nickel Large .. 2/3
Micmet 6/3
Burndept 5/6

Fixed Condensers—
Raymond ·001 to ·0005 .. .. 1/2
Raymond ·002 to ·006 .. .. 1 3
Raymond ·02 or ·01 1/9
(Above Ebonite Base)
Mansbridge 2 mfd. 4/3
Mansbridge 1 mfd. 3 9
Mansbridge ·25 mfd. 3/6
Edison Bell ·001 to ·0005 .. each 1/3
Edison Bell ·002 to ·006 .. each 2/–
Edison Bell 2 meg. Grid Leak .. 1/6
McMichael's 2 meg. Grid Leak .. 2/6
McMichael's ·100000 Ohm Resistance 2 6
Dubilier ·0001 to ·0005 .. .. 2/6
Dubilier ·001 to ·006 3/–
Dubilier ·01 (for loud speakers).. 7/6
Dubilier 2 meg. Grid Leak .. 2/6

Fixed Condensers (*contd.*)
Dubilier Anode Resistance 5/6
(50,000, 70,000, 80,000, 100,000 ohms on Stand complete.)
Flex—
2-Colour Twin 12 yds. 2/6
Lighting 12 yds. 2/–
Min. Silk Twin 12 yds. 2'–

Goswell—
Valve Legs, Set 4 1 3
Valve Holder .. 1 9
2-way Cam Vernier 9/–
3-way Cam Vernier 12/6
3-way Ordinary .. 7/6
2-way Panel .. 3/–
3-way Panel .. 5/–
Basket Holders .. 1/4

H.F. Transformers—
McMichael's
300/600 .. .. 10/–
1100/3000 .. 10 –
Energo, 250/700 3 11
„ 450/1200 4/3
„ 900/2000 4/6
Raymond B.B.C 2/9
„ 5 X X 2 9

Igranic Rheostat .. 4/6
„ 30 ohms .. 7/–
„ Potentiometer 7/–
„ Variometer .. 10 6
„ Coils (all numbers)
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

Lissen—
Minor, 3/6 ; Stat 7/6
Universal 10/6
Switch 2-way .. 2/9
Series Parallel .. 3/9
Anode Res. .. 2/6
Var. Grid Leak .. 2/6
Choke 10/6
L.F. T.1 .. .. 30/–
T.2 .. .. .. 25/–
L.F. T.3 .. .. 16/6
Coils—
25..4/10 35, 40, 4/10
50..5/– 60 .. 5/4
75..5/4 100 .. 6/9
150..7/– 200 .. 8/5

Polar Condensers
·001, ·0005 or ·0003 10/6
Micrometer .. 5/6
2-way Junior .. 6/–

Rheostats
One hole fixing .. 1/6
C. & S. fixing .. 1/5
De Luxe and Dial 2/6
Burndept 4/6
McMichael Dual 7/6
Shipton Strip—
7 ohm (with fuse) 3/6
30 or 60 ohm .. 3/6
Potentiometer 600 ohms 4/6
Crown for DE or R 2/6
L.E.S. Micro Control 3/6

Switches
Panel DPDT .. 1/6
Panel SPDT .. 1/4
Ebonite DPDT .. 2/6
Ebonite SPDT .. 1/9
Simplex Lead in .. 1/9
Sq. Bus Bar .. 1/–
Switch Arms 1/6
(Inc. studs and nuts.)

Terminals
Phone or W.O. doz. 1 9
Pillar large .. doz. 1 9
Pillar medium doz. 1/3
Nickel 6d. doz. extra.
(All with nuts)

Transformers, L.F.
Ferranti 17/6
Igranic 21/–
R.I. 25/–
Ormond 14/–
G.R.C. 83 .. .. 15/–
Super Success .. 21/–
Standard Success 16/–
Brunet Shrouded 13 6
Formo Shrouded 18/–
Formo open .. 12/6
French 9/3

Valve Windows 2 for 1/–

Valve Holders
Murray Anticap 1/3
Legless Anticap .. 1/3
Bretwood 1/9
Climax UN panel 1/6
(Similar to H.T.C.)
Solid Rod Standard 1/3
Goswell 1/6

Valves
Myers Universal 12/6
French "R" .. 7/6
Dutch Detector 5 6
Dutch "R" .. 5 11
Metal ·06 .. .. 13/11
Radio Micro ·06 13/11
Bright Emitter
B.T.H. "R," Ediswan A.R., Marconi Osram "R" or "R5," Mullard ORA, Cossor L.F. P1, Cossor H.F. P2, Mullard H.F., Mullard L.F. .. 12/6
Dull Emitter
B.T.H. B3. Ediswan A.R.D.E., Marconi D.E.R., Myers, each 21/–
Dull Emitters
B.T.H. B5, Ediswan A.R. "06," Mullard D.F. ORA 25/–
D.E. Power Valves
Marconi D.E. 6 25/–
Power Valves (for ·06)
B.T.H., B6 .. 35/–
Marconi D.E. 4 30/–
Mullard D.F.A. 30/–
Power Valves, for B.E., B.T.H. B4, Marconi, Mullard 35/–
(Valves posted buyer's risk.)

Watmel
Var. gd. Leak .. 2/6
Anode Res. .. 3/6
Wates Microstat .. 2/9

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 ohms (featherweight).. 25/–
STERLING 4,000 ohms 25/–

DR. NESPER HEADPHONES

(Genuine)

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.

Owing to fraudulent imitations of Dr. Nesper phones being offered, we guarantee ours to be genuine.

4,000 ohms 13/3
Post 6d. pair.

NOT BEING ABLE TO GET BURNDEPT DUAL RHEOSTATS

I have made special arrangements to stock

McMICHAEL'S DUA., 7 6

FRENCH THOMSON-HOUSTON

4000 ohm Phones, 15/11.

TELEFUNKEN.

(adjustable)
4000 ohms .. 17/11
(Lighter than a feather)

N and K

GENUINE (Stamped)
Limited number old model 1,900 ohms, 12/11 pair.
Post 6d. pair.

NEW MODEL
GENUINE (stamped)
Sold in America at £2 pr.
Wonderful Value.
Great for Crystal Sets.
17/6 pair.

Genuine BRUNET L.F. TRANSFORMER

(Shrouded)
5-1 : 5,000 Primary turns, 25,000 Secondary turns. Post free 13/6

LOUD SPEAKERS.

C.A.V. Tom Tit .. 30/–
C.A.V. Junior .. 55/–
Sterling Baby .. 55/–
Sterling Dinkie .. 30/–
Amplion Junior .. 27/6
Amplion Dragonfly 25/–
Dr. Nesper 21/–
All models stocked of leading makers.

BRUNET PHONES.

New Model. Black Cords.
4000 ohms 16/6
Post 6d. pair.

LEDION COILS.

Set of 5. ½ in. wide.
EXTRA AIR SPACE.
Faraday House Calibration
25, 35, 50, 75, 100
Post free 2 6 set.
All wave-lengths marked.
Ledion 1,600 metres 1/6

PANELS DRILLED FREE WITH ORDERS OVER 20/-

PANELS DRILLED and ENGRAVED FREE WITH ORDERS OVER £5.

West End Stockist of Edison Bell, Igranic, Goswell (quality), Polar, Jackson Bros. (J.B.), Marconi, Cossor, Mullard, Ediswan Valves, Sterling, B.T.H., McMichael's, Lissen, Dubilier goods.

THORPE K.4 VALVE

(For Unidyne)
5 pin (holder free).. 17/6

EBONITE PANELS

3-16th in.

6× 6	1/8	10× 8	3/6
7× 5	1 8	12× 9	5/–
8× 6	2/6	12×12	5/9
9× 6	2/9	14×10	5/9

T.C.B.

NEW TYPE RHEOSTATS
6, 13, 30 ohms .. 4/–
600 ohms 5/–
(Potentiometer)

NEUTRODYNE MICRO-CONDENSER.

A useful adjustable condenser of small capacity and dimensions, soundly constructed, essentially designed for providing feed back and oscillation neutralising potentials.

ONE HOLE FIXING.

Fitted with Terminals and Soldering Tags.

Price **2 3** each, post free.

ACCUMULATORS
FOR CALLERS ONLY at present.
(See Callers' List.)

Rheostat with Dial, extra value, 2/6
Bretwood Valve-holder. 1/9

Manchester "Powquip," 15/6
Ormond 14/6

Shrouded "Powquip," 18/–
Standard "Powquip," 14/6

"R.I." NEW MODEL IN SEALED BOX

Don't Buy Otherwise.
Post **25/-** Free

FERRANTI L.F.

BETTER THAN THE BEST 17/6

IMPORTANT NOTICE

TRADE COUNTER OPEN

will oblige you with any lines in stock, less 20% on Proprietary articles.

NO POST ORDERS TRADE.

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!!

RAYMOND'S VARIABLE CONDENSERS

HIGH QUALITY.

SENT BY POST 6d. SET EXTRA.

"DE LUXE" MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

·001 - 6/11
·0005 - 5/6
·0003 - 5/-
·0002 - 4/9

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

NEW MODEL

With Knob and Dial.

WITH VERNIER.

·001 - 8/9
·0005 - 6/11
·0003 - 6/9

With EBONITE DIAL and Two Knobs. Post 6d. Set.

NEW MODEL SQUARE LAW

With Vernier.

With Knob and Dial.

Aluminium Ends. Ebonite Ends.

·0003 - - 8/6 - - 10/-
·0005 - - 8/11 - - 10/6

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. Complete with Knob and Dial. 9/-

Post 6d. Set.

To meet the requirements of amateurs who need a reliable Square Law ask for

No. 7 { ·0005 Sq. Law..5/11 / ·0003 Sq. Law..5/6

Complete with Knob and Dial.

POST FREE.

LONDON'S LARGEST Stockist of

JACKSON BROS.'

"J.B." Variable Condensers, Complete with Knob.

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." Post 4d.

CALLERS! THESE 4 COLUMNS FOR YOU NO POST ORDERS FROM SAME

Warning! Note name RAYMOND on windows. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

SUNDRIES

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/-
Voltmeter 4/6
Gamages Permanite 1/-
Condenser Brushes 6d.

RAYMOND FIXED CONDENSERS.

·001, ·0001 to ·0005 10d.
·002, ·003, ·004 .. 1/-
·006, 1/3 ; ·01, 1/9; ·02 1/9

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.

Microstat 2/6
Switch Arms 8d. to 1/-
Leatherette Boxes with Lid .. 2/3 & 2/11
Shellac .. .. 5d.
Shorting Plug and Socket .. .. 4½d.
Contact Studs 4 for 1½d.
Nickel ditto 2 for 1½d.
Nickel Switch Arm 1/-
Sorbo Ear Caps pair 1/4
Tumbler Switches 1/4

'Phone Cords 6 ft. 1/-, 1/3
Nugraving .. .. 6½d.
Empire Tape 2yds. 1d.
Allen Var. Grid Leak 1/3
Best Sleeving 3yds. 10d.
Rubber Lead-in 10 yds. 1/-
Thick ditto., 1d.,2d.,& 3d.
Aerial, 7/22 100 ft. 1/11
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? **1/9**

5 Waxless Coils 200/2000 .. .. 1/3
5 equal 25 to 100 .. 1/8
5 ditto, Extra Air Space 2/-
6 waxed 200/3600 .. 1/8
7 waxed 150/3600 .. 1/11
Chelmsford D.C.C. 1/-, 1/3, 2/6
Basket Holders 9d. 1/- 1/3

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

VERY SPECIAL OFFERS

Crystal Set fitted for Chelmsford 7/11
RE ECHO set, worth 25/-, for 15/-

SPECIAL. To callers only. To customers purchasing 20/- worth of our own goods at full prices, we supply a first-class pair of 4,000 ohm 'phones for 5/- as an advertisement only.

SPECIAL BARGAIN.

Variable Condensers

SQUARE LAW

with Knob

Caller's Price

·0003 4/9
·0005 5/-

Splendidly Finished.

Legless valve holders 1/-
ANTI CAP valve holder 1/-
2 mfd. Mansbridge 3/9
1 mfd. Mansbridge 3 3
·25 Mansbridge .. 2/11
Colvern Vernier .. 2/6
Neutrodyne ditto .. 3/6

Radio panels "KENITE" (stand 5,000 volts), 6 x 6, 9d. ; 7 x 5, 9d. ; 8 x 6, 10d. ; 9 x 6, 1/- ; 10 x 8, 1/- ; 12 x 9, 2/- ; 12 x 12, 2/3. Above 3/16 in. thick Out of stock at moment.

Legless valve holder 1/-
Solid Rod Ditto .. 1/-
Under Panel Ditto 1/6
Ebonite Dials.. 8d., 1/-
Valve Templates 2d. 4d.
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.

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.

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 3/6
2-way with ex-handles 2/11

2-WAY COIL STANDS 1/3, 1/9
VARIOMETERS 1/-, 1/3
DUTCH VALVES .. 4/3
LARGE DETECTORS 11d.
5 WAXLESS COILS.. 1/3
Do. EXTRA AIR SPACE 1/8
'PHONES 4,000 OHMS 6/11
N. & K. PATT. 4,000 OHMS 8/11
VARIABLE GRID LEAKS 1/2
VALVES FOR UNIDYNE 12/-
5-PIN Ditto 13/11
PORCELAIN D.P.D.T. 1/4
Ditto, S.P.D.T. .. .. 11d.
L.F. TRANSFORMERS 8/11
SPECIAL BASKET HOLDERS .. .. 8½d.
Ditto, for Chelmsford Coils 9d.
SINGLE COIL formers with spokes .. .. 8½d.
BRUNET 4,000 ohms, NEWEST MODEL.. 16/6
ACCUMULATOR CARRIER 2/3
FLUSH PANEL sockets complete .. 4 for 5d.
EBONITE BUSHES 1d. dozen 10d.
C.W. BATTERY LINKS 2 for 1½d.
"LEDION" sets of 5 COILS .. .. 1/8 and 2/3
GEARED 2-WAY COIL STAND 5/3
CAM VERNIER ditto 4/6
CLIMAX U.P. VALVE HOLDERS 1/3
RHEOSTAT for D.E. or R. VALVES 2/2
2-WAY COIL STAND, ex handles 1/11
Ditto nickel fittings .. 2/9
Half opal and ebonite enclosed DETECTOR, worth 2/-. My price 1/-
TAPPED COILS for CHELMSFORD .. 1/6
Ditto for Broadcasting 1/-
GRID LEAK CLIPS .. pr. 1d.
Valves : PHILLIPS "R" type 6/11
Valves : FRENCH METAL "R" .. 6/6
Valves : DUTCH ·06 (good) 11/-
Valves : DUTCH DETECTORS 4/3 and 4/9
Valves : DUTCH "R" TYPE 4/11
Valves : FRENCH METAL ·06 .. .. 12/11
Valves : RADIO MICRO ·06 .. .. 12/11
VARIOMETERS. Finest Value in London. 1/4, 1/6, 2/3. JUST TRY THEM.
WEDGE-SHAPE COIL PLUGS Extra value. 7½d. and 8½d.
EDISON BELL ditto 11d.
Fine little RHEOSTAT, 1 H.F. 1/-
H.F. TRANSFORMERS, B.B.C. 2/6
Red and Black TWIN FLEX .. .. 6 yds. 10d.

This is the shop for BARGAINS See the name RAYMOND.

SUNDRIES

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.

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.

H.T. BATTERIES

60 v. 7/6
30 v. 4/6
60 B.B.C. 8/11
30 B.B.C. 5/6
9 v. B.B.C. 2/6
1.5 (D.E.) 1/9
Ditto .. .. 2/- to 3/-

D.P.D.T. SWITCHES.

Min Panel 1/-
On China Base .. 1/4
On Ebonite Base 1/11, 2/6
S.P.D.T. SWITCHES.
Miniature Panel .. 10½d.
On China Base .. 11d.
On Ebonite 1/3 to 1/9
Murray Valve Holder 1/3
Spring Washers 4 a 1d.
Coil Plug on Base 10d.

De Luxe Crystal Set 7/11
4 Whiskers, 1 Gold 2d.
Coil Plugs (ebonite) 6d.
Ditto .. .. .. 9d.
Shaped 8½d., 1/-
5 ohm Rheostat .. 1/-
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

WE STOCK Cut to size 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.

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 1388.)

In case this is not perfectly clear, we will take one more case in detail. Suppose an accumulator marked 60-ampere hours (ignition) is used for a three-valve set. How many hours will it last?

The first thing to find is the current consumption of each valve. This is generally marked on the box in which the valve is packed, but in any case can always be obtained from the makers or dealer. Suppose, in this instance, one valve takes ·6 and two take ·7 amperes each. The total consumption of the three valves is thus two amperes.

The accumulator is rated at 60-ampere hours "ignition," so it will only give 30 hours actual discharge. Therefore, when two amperes are taken from it for the three valves, it will need recharging every 15 hours.

* * *

"SELECTIVITY" (Birmingham).—With regard to the super-selective circuit recently published in POPULAR WIRELESS, I find I cannot obtain a variable leak of the right value. Is this value critical, and, if so, how can I obtain the correct leak?

The 10,000 to 100,000 variable leak is essential, and *must* have a minimum of not *more* than 10,000 ohms. Since the details of the circuit were published two firms have brought out special leaks, so that now there should not be any difficulty in obtaining the correct resistances. Probably many more manufacturers will be making these leaks in the near future, but at present they are obtainable from the Enterprise Manufacturing Co., of Grape Street, Shaftesbury Avenue, W., and from the makers of the well-known "Watmel" resistances.

* * *

P. B. (Chadwell Heath).—As I live fairly near the London Broadcasting Station, I have decided to build the one-valve Armstrong "Super," the circuit for which was given in the 19 pictorial circuits in POPULAR WIRELESS No. 139. This set will be used with a frame aerial, but as no values were given of the coils, etc., I should be glad if you would let me have them.

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement is now in force:—

(1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.

(2) A charge of 1/- is made for supplying full wiring diagrams.

(3) All queries, together with postal orders and stamped and addressed envelope, to be addressed to—

TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.

(4) Technical queries will not be answered by telephone.

The frame aerial should have about 15 turns on a 14-in.-sided frame, with a 50-turn aerial coil in series with it. A ·0005 mfd. variable condenser (with vernier) is used for tuning. The reaction coil has about 75 turns, and the two large coils in the centre of the bottom of the diagram (Fig. 15) have 1,250 and 1,500 turns respectively (from left to right). These should be of duolateral or other low capacity type. The two fixed condensers are ·003 and ·004 mfds. respectively, though these values should be varied until best results are obtained. A hard valve should be used, and H.T. up to 150 volts should be available.

* * *

A. T. S. (Berkhamstead).—With regard to the Super-Selective Circuit recently published in "P.W.," can the set be made to cover 5 X X or other wave-lengths by means of plug-in coils? Will larger condensers be advantageous?

We regret that it is not possible to load this set satisfactorily. Experiments upon it are being carried out, but up to the present it has not been found satisfactory on wave-lengths above 500 metres. The set as it was described covers about 250–430 metres, but this can be raised slightly by increasing the number of turns on the coils in their correct proportions. We do not recommend the use of larger condensers as the set is so selective that at 10 miles from 2 L O it is quite difficult to find that station until the handling of the set has been mastered. Vernier condensers *must* be used, as it is possible to tune out the local station at half a mile by the use of the verniers *alone*. Further details of the circuit will appear in "P.W." shortly.

* * *

W. E. G. (Harrow).—In photographs showing back of panel connections (such as on page 553, "P.W." No. 128), fixed condensers are sometimes shown with wires connected under screws.

I have found that this alters the capacity of the condenser. Would it not impair the efficiency of a set?

The effect appears to be quite negligible except in the case of extremely small condensers. The manufacturers give soldering tags as well as screws in order to make the wiring easier, and generally speaking, either connection is quite satisfactory. With very small condensers such as those used in conjunction with the neutrodyne, it is, however, advisable to pay attention to the shape and position of the lead which connects to the condenser.

A THREE-VALVE REFLEX SET.

(*Continued from page* 1370.)

wire is led to the fixed vanes of the condenser T.A.C.2, with a branch lead to the cat's-whisker side of the crystal detector C.D., and from thence to one terminal of the moving member of the two-way coil holder, the opposite terminal of which is joined to the moving vane terminal of the variable condenser T.A.C.2.

The connection for the grid of valve V3 has been dealt with already, as has one filament leg, which leaves the other filament leg for connection with the filament resistance F.R.3. The plate leg has a branch wire, connecting respectively with the lower 'phone terminal and to one tag of the fixed condenser ·005, the other tag of which has a branch lead joining to the upper 'phone terminal and to tag No. 4 on the main switch. Another wire from tag No. 4 of the main switch is joined to one side of the T.C.C. condenser ·25, the other tag being joined to the end of the winding on the filament resistance F.R.3.

T.A.I.1. This coil has two terminals, one of which is joined to the fixed vane terminal of the condenser T.A.C.1, the other joining with the moving vane terminal on the same condenser, this completing the wiring of the set.

External Connections.

Referring to Fig. 5, the following hints will be useful in regulating the amount of current to use with each set of terminals: 1. The + H.T. terminal connects with the + terminal of a 120-volt H.T. battery. 2. + H.T.2 should be connected to a 100-volt tapping of the same battery. 3. + H.T.1 connects with a 50-volt tapping. 4. — H.T. obviously connects with the — terminal of the battery. 5. — L.T. is connected with the — terminal of a 4-volt accumulator, or 4·5-volt dry battery, of suitable capacity for working three valves. 6. The + L.T. should be connected with the like terminal of the L.T. battery. 7. G.B. — should join with a 3-volt tapping on a 9-volt grid battery. 8. + G.B. is connected with the corresponding terminal of the 9-volt grid battery.

For ordinary broadcast bands, the coils mentioned in the list of parts will be found quite suitable, the S.2 coil being plugged into the fixed unit of the two-coil holder. The two S.5 coils fit respectively in the moving member and in the fixed coil holder.

On commencing to tune in, the main switch is turned on and the series-parallel switch set for "parallel." The coils of the two-way holder are then separated as widely as possible, after which the filament resistances are turned half on and the crystal detector is adjusted.

The two condensers A.T.C. and T.A.C.1 are then regulated until the local station is heard, using the headphones for tuning. Next the condenser T.A.C.2 is adjusted until the signals become loud, after which the crystal detector is adjusted further and the coils made to approach each other. This should bring about an increase in signal strength, until the two coils are so near as to create oscillation. If oscillation does not occur, the wires of the moving unit of the two-coil holder should be reversed.

HOW TO BUILD A "HOUSEHOLD" LOUD SPEAKER SET.

(*Continued from page* 1349.)

through the left side and two more for the switch wires to pass through the right side.

Lay the cabinet on its back and place the panel in position. See that it just clears the front flap when the latter is opened. Fix it with two ¾-in. brass wood screws at each side and one at the top. Connect the loose ends of the 24 gauge wires at the right-hand end to the tumbler switch. Both these should be covered with sleeving where they pass through the wood.

Connect the loose end of the 24-gauge wire attached to the centre condenser terminal to the *socket* of the fixed coil holder and the other 24 gauge wire to the *pin* of the same holder. Use sleeving as above. Now connect the flexible wire from the left centre screw of switch No. 2 to the *socket* of the movable holder and the flex from the first valve anode to the *pin* of the same holder.

The Fixed Condensers.

The set now only lacks its quota of fixed condensers. Opinion differs a good deal as to the number and capacity value of these, the requirements varying with the particular type of transformers and loud speaker employed. Use what the makers recommend. In any case one cannot go far wrong in putting a ·001 mfd. condenser across the primary (I.P. to O.P.) of the first transformer, and another of the same size across the loud speaker. Connect the terminals of the latter condenser to wires leading from the two centre screws of switch No. 4, and it will then serve both for loud speaker and 'phones. If stout wires are used for all four connections, the condensers will need no other support.

The first step is to insert the necessary H.T. and grid batteries inside the cabinet, and to connect them to the appropriate leads. The best working conditions vary with the make of valve employed, and therefore the makers' instructions should be consulted. To make matters clear, however, we will assume that the detector and first L.F. valve are "general purpose" dull-emitter valves, such as the D.E.R., and that the second L.F. valve is of the small "power" type, such as the D.E.6.

Taking two 60-volt H.T. batteries connected in series, place the black H.T. wander plug in the negative battery socket, and the red plug marked "120" into the positive end socket of the other battery so as to get 120 volts between these leads. Put the "50" and "80" plugs in the appropriate sockets so as to give the detector and first L.F. valves these plate voltages respectively.

The Use of Grid Bias.

The grid battery may consist either of torch cells connected in series, or, better still, of the special small cells, such as the Ever-ready U.W.1, or K types sold expressly for the purpose. The latter are easier to connect up and last a very long time. The D.E.6 "power" valve, when worked at 120 volts H.T., usually requires about 7½ volts negative bias, so that the grid battery should consist of five cells.

Connect flexible wire (7), referred to above, to the positive end of the grid battery

(*Continued on page* 1395.)

Correspondence

THE MODIFIED FLEWELLING.

The Editor, POPULAR WIRELESS.

Dear Sir,—Noticing a description of the modified Flewelling circuit under "Interesting Single-Valve Circuits" recently, I thought perhaps my experience with this might be of interest to other readers.

My own set differs from the one described only in that I use a parallel A.T.C. instead of series, with an 80 turn reaction coil (home made). This is quite stable if kept at about 45° from the A.T.I. for 2 L O (five miles away), but for the distant stations I couple the two coils closely. I tried a ·0001 fixed condenser in series with the aerial, but this rather upset the set, and it howled almost through thinking of reaction. A very critical component is the rheostat, as a station can be cut right out on this, and I find my microstat all that can be desired in this direction. Another point is H.T. supply; when I am after the continental stations and the distant B.B.C. people, I use about 10 to 15 volts, but for London I use 80 volts—this on a Dutch valve, and a variable grid leak makes the final tuning. Another necessity is a vernier on the A.T.C. as a station can be tuned right out on this alone. As regards volume, London is loud enough to be comfortably heard on a small loud speaker (when I can borrow one) and about six German, three French (Petit Parisien included, a very strong transmitter), and all the B.B.C. stations are comfortable on the 'phones. I might mention that it is difficult to separate the close wave-lengths of London, Bournemouth, and Manchester, when the former is going strong.

Aerial? Three strands of 26 D.C.C., 15 ft. long, 6 in. from the ceiling of a second-floor room, with a "lead-in" that hugs the walls. Earth, 15 ft. run to water-pipe, still on the second floor. The panel of the set is plain wood, and either I have made up something good, or else I am very lucky. I think the latter.

I am, dear sir,
Yours faithfully,
FRANK H. LEA.

6, Ferron Road, Clapton, London, E. 5.

CONCERNING CRYSTAL RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I be allowed a few words in reply to a letter, "The P.W. Ultra," in a recent issue of POPULAR WIRELESS?

While I do not doubt the accuracy of Mr. O'Connor's statement that he has received Bournemouth, I do doubt the accuracy of any map which gives the distance between Huddersfield and Bournemouth as 270 miles. No doubt there are hundreds of amateurs in this country who, with the simple crystal set, regard long-distance reception as the rule rather than the exception, and have so got used to tuning these distant stations in, that they have ceased to find anything wonderful in the achievement. It is not every amateur, though, who cares to write to "P.W." bragging about the number of stations they have received, but we are not prepared to allow any sort of statement to go unchallenged. While a certain allowance must be made for enthusiasm, the serious amateur is out for facts, and facts alone.

(*Continued on page* 1396.)

HOW TO BUILD A HOUSEHOLD LOUD SPEAKER SET.

(*Continued from page* 1394.)

and wire (5) to the negative terminal of the *same* cell so as to give a negative bias of 1½ volts to the first L.F. grid. Connect the negative terminal of the fifth cell to wire (6) and so impart a 7½-volt bias to the last grid.

The left-hand D.P.D.T. switch in its lower position places the aerial inductance in parallel with the tuning condenser. In its upper position the two are in series. The switches at the top right-hand of the panel cut one or both of the L.F. amplifiers out of circuit, whilst the lower centre switch feeds the output either into the headphones or loud speaker at will.

Once the tuning condenser, rheostats, and switches have been adjusted, the set as a whole is switched on or off, as desired, by means of the tumbler switch at the side of the cabinet.

CORRESPONDENCE.

(*Continued from page* 1395.)

We must be forgiven if we indulge in a quiet smile when reading some of the letters that have appeared from time to time on "D X" work. I wonder if it would interest Mr. Thomas to know that I have received Bournemouth loud enough to hear every word distinct ever since I built my first set. This distance is actually 270 miles, as any reader can see for himself, if he cares to glance at a map.

Had I known that 110 miles was considered a record, I would have written months ago and claimed the honour, but there are so many of us hearing this station up here that we failed to realise we were making history.

There are times when I wonder what must be wrong with crystal reception in this country. Some time ago, having occasion to buy another set of 'phones, I paid a visit to the local dealer's. Although the second pair of 'phones were of the same make as the first and identical in every respect, the quality of tone was not the same, and I took them back. Imagine my surprise when the dealer told me that reception from Newcastle over 40 miles was bound to be poor. No one could expect decent reception on a crystal set over 20 miles. What a fallacy!

Being a trifle curious to have an expert's advice on the subject, I asked him if he had ever tried it. "Oh no," was the answer. "It is not worth bothering with."

All very well for those with plenty of money, but a poor look out for those who cannot afford valve sets.

When will dealers and manufacturers wake up to the fact that fine wire coils and fancy cabinets may be all right from the showman's point of view, but if the trade in ready-made sets is looking for a boom, it will not find it in some of the sets on the market to-day.

There must be many who agree with me when I say the humble crystal set is only in its infancy, and may the day be not far distant when expensive valve sets are things of the past. Not until then will the humble crystal come in for the attention it deserves.

Yours, etc.,
H. W. SMITHIES.

28, The Fleet, Dormanstown, Redcar.

"D X" ON AN INDOOR AERIAL.

The Editor, POPULAR WIRELESS.

Dear Sir,—Can any of your readers beat the following results obtained on an *indoor* aerial 16 ft. long?

Between 1.30 and 2.15 a.m. on Sunday morning I picked up six American stations at good 'phone strength. I was able to identify W G Y, W O R, and W H A, but did not hear the call signs of the others, although their musical transmissions were good. The set used was arranged as 1 H.F., D., and 1 L.F., except for W G Y and W O R, which were audible on the detector valve alone. The set is only roughly assembled for experimental work. No connections are soldered, and the panel is a wooden one! Coils, rheostats, condensers (fixed and variable) are all "home made."

Trusting that this may be of interest;

I am,
Yours truly,
A. J. H. GAUNTLETT.

Manor House, 50, Shepherd's Bush Green, London, W. 12.

(*Continued on page* 1397.)

A PRIZE COMPETITION RESULT.

WE are advised that the prize winners in the competition conducted by Messrs. British Radio Valve Service, Ltd., Hazlitt House, Southampton Buildings, Holborn, London, W.C.1—the terms of which were advertised in these columns when the competition was announced—are as follows:

1st prize, £100.—W. H. Graham, Esq., Red House, Tywardreath, Cornwall. 2nd prize, £50.—J. H. Childs, Esq., 5, Hill Road, Barrow-in-Furness. 3rd prize, £20.—J. Donald, Esq., 4, Oakend Waye, Gerrard's Cross. 4th prize, £10.—E. H. Bysshe, Esq., P.O. Box 19, Cape Town, South Africa. 5th prize, £10.—Rev. E. S. Spooner, The Manse, Henley-on-Thames. 6th prize, £10. A. A. Davies, Esq., 39, Upper Northgate Street, Chester. Free entry prize, £50. F. H. Matthews, Esq., Knap Villa, Shaftesbury, Dorset.

CORRESPONDENCE.

(*Continued from page* 1396.)

ANOTHER CRYSTAL ENTHUSIAST.

The Editor, POPULAR WIRELESS.

Dear Sir,—On looking through this week's "P.W.," I notice a great deal of items on ranges of crystal sets.

May I take a little of your time in adding, I hope, to the unbeatable crystal. With a set wound with 18 S.W.G. copper wire on a 12 in. former, air spaced, I can tune-in all the B.B.C. Main Stations and Nottingham Relay, 5 X X, and the following foreign stations: Radio Paris; Petit Parisien; Ecole Sup. Des. Postes et Telegraphes; and Lyons la Doua. On the night of the German elections a week or two ago, I picked up a German station, somewhere about 400 metres, broadcasting election results very clearly, and I still hope for further successes. I trust I may be of some use in bringing Dame Nature into her own, for I am longing to see the day when the lowly crystal will equalise with the valve.

Thanking you for your kind attention and wishing "P.W." every success.

I remain,

Yours faithfully,

S. H. BROOKS.

P.S.—I consider the reception on this set equal to a one-valver. I have it wired for all rooms of the house, and with three pairs of 'phones in any room it is perfect, on 5 I T, Birmingham.

15, Warwick Road, Wolston, near Coventry.

THE CHITO'S CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—Perusal of Mr. Pitchford's communication in your 1364th issue, and re-perusal of the author's original letter of August last, provided the necessary incentive to try out a circuit which has received so much praise from several of your correspondents in the interval. Accordingly I tried my 'prentice hand.

Accepting Mr. Pitchford's warning as to the sharpness of tuning and capacity effects, I provided therefore by fitting Naylor's Fulstop Condensers of ·0005 and ·0003 (variable).

The valve used was Marconi Osram DER, with about 50 volts on the plate.

Although, as observed by the gentleman mentioned above, a fixed condenser might suffice in the grid circuit, I found that the ·0005 variable permitted final adjustments and increase in volume.

Quite good results on the local station at 20 miles was obtained with a 60-turn basket coil in the aerial, and a similar coil of about 50 turns in the anode. With this combination, Cardiff was received with slightly better strength than with any previous single-valve of mine. The aerial condenser reading was then at about 120. Not expecting to find any of the B.B.C. relays below this, I however tried for same, and tuned-in a few, but was unable to identify them. I was, however, surprised to get S B R at 265 metres with very good strength, and little fading.

I then tried 100 basket coil in the aerial, with the previous 60 in the anode. All the B.B.C. main stations came in with these, but reaction was much too fierce, so to remedy this, I reverted to the previous 50 coil, which simplified control and improved the reception; there is therefore little doubt that your previous correspondents have obtained the best results as to coils.

None of your previous correspondents appear to have touched upon the high-power stations 5 X X or Radio-Paris, so in this connection I appear to break new ground. 5 X X came in with a home-made 250 duolateral coil in the aerial, and a similar 200 in the anode, or the 100 previously mentioned in the latter position. There was not such an improvement over the ordinary straight one-valver as on the lower wave-lengths. The A.T.C. reading was about 120 degrees, but Radio-Paris could not be reached with the above aerial coil, but I have little doubt that a 300 would do the trick. Tuning was comfortably sharp on the high wave-length of 5 X X, but of course not so sharp as on the B.B.C. band, as intimated by your previous correspondents.

I also made the discovery that while a ·002 fixed condenser across the 'phones in a usual straight circuit affects an improvement, the reverse was the result with this circuit.

Another advantage of this circuit is that the usual L.F. amplifier can be used, and thus differing from some of the unorthodox one-valvers.

While not commending the circuit to an absolute beginner, I recommend it to the amateur of a few months' experience.

Yours, etc.,

J. H. COLLINS.

3, Tyisaf Road, Ystrad, Rhondda.

C N R A RECEIVED.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to "Ariel's" query in a recent issue of "P.W." of the reception of station C N R A, I would like to inform you that this station was received by me at my address on the morning of December 27th last, at about 2 a.m.

As we are able to listen to several of the nearer American stations, the reception of the above was not regarded as of any special importance until reading your article.

(*Continued on page* 1398.)

CORRESPONDENCE.

(*Continued from page 1397.*)

That particular morning, we heard from C N R A a transmission by a Salvation Army band, as announced by the announcer, and also solos by a soprano with pianoforte accompaniment. Fading was, of course, noticeable, bad at times, but on the whole very clear.

The reception was by a home-made set Det. and 2 L.F. and a straight circuit.

Trusting this may be of interest to you, and wishing "P.W." every success.

Yours faithfully,
WM. G. JERMYN.

15 Essex Street, Unthank Road, Norwich.

A REFLEX ENTHUSIAST.

The Editor, POPULAR WIRELESS.

Dear Sir,—As one who considers that a reflex circuit provides as much scope for study, as well as amusement, as most of us get time for after business, I would like to express my thanks to Mr. E. Chatterton for his article on these circuits in No. 123 of October last.

I have always got good results under very badly screened conditions with my single-valve and crystal reflex, but felt that a stage of H.F. in front, if it could be managed, would be a very desirable and beneficial addition, but hadn't the time (and perhaps not sufficient knowledge) to work it out for myself.

Mr. Chatterton's article then appeared, solving the problem for me, and this I suppose is the reward of being a regular reader from the first number of "P.W."

With only slight modifications to suit my available components, I have made up the three-valve combination, and with only a very imperfect temporary indoor "zig-zag" aerial in the attic, pending the erection of a proper one outdoors, the results are so exceedingly good that I feel there is no need to hurry the outdoor job—the set gives both range and power.

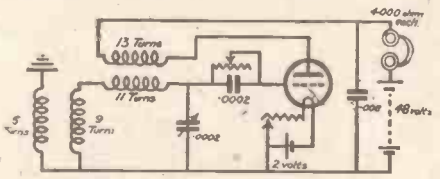
I write this with a feeling of indebtedness to Mr Chatterton and "P.W."

Yours faithfully,
Lewisham. C. G.

RECEIVING K D K A WITHOUT AN AERIAL.

The Editor, POPULAR WIRELESS.

Dear Sir,—I read Mr. Rogers' article in No. 129 of "P.W." and was especially interested in the method of winding the coils. I had been trying to receive on ultra-short waves for a month or so, but could not get down low enough. K D K A was my chief object, having received it several times on 326 metres on one valve. I then saw the article on receiving New Zealand, so I decided to wind coils of exactly the same type, only slightly smaller. I did not get a chance to wind these until recently. Having wound them, I decided to wait till later in the week to sit up. On Thursday morning, I woke at 3 o'clock and turned on the filament. Turning the condenser round, I was astonished to hear loud music, at the very lowest capacity on the condenser. Thinking it must be some near-by amateur testing, I waited for the call-sign. I was more astonished when a loud, clear voice said, "K D K A, East Pittsburg, Pennsylvania, calling." This was about 3.3 G.M.T. Choral and musical items followed until 4 o'clock, when the announcer stated that they were signing off. Its strength during the whole time was about the same as London is received on a fairly good crystal set at ten miles distant. No fading or atmospherics were experienced, reception being nearly as clear as a crystal set. As you will notice from the circuit enclosed, it is very much the



same, the only difference being the size of coils and an earth used instead of an aerial, as this was found to give better results than the aerial. Faint Morse signals have been received about 6 o'clock, but I am sorry to say I cannot read Morse. Allow me to thank you for publishing such an interesting article; I will forward you any more results and experiments which I may try.

Yours faithfully,
C. S. HUNT.

53, London Road, Bromley, Kent.

P.S.—Valve is Marconi-Osram D.E.R. No L.F. stage used.

TECHNICAL NOTES.

(*Continued from page* 1358.)

as, for example, in the announcing of the news bulletin, or the titles of items of a programme.

A Good Test.

If a loud speaker gives a really clear and readily intelligible reproduction of the voice in these circumstances, it may be reckoned to be a very good instrument. Another point to notice in this connection is that the intelligibility of the voice becomes less as the distance from the loud speaker becomes greater, so that the test should be applied at the average working distance at which the loud speaker in question is intended to be used.

On the other hand, it is quite useless to judge the qualities of a loud speaker by the reproduction of a single instrument, particularly a stringed instrument—such as a violin, 'cello, or pianoforte—as even the worst loud speaker will generally give a fair reproduction of instruments of this type.

Of course, there are a great many other points to be attended to in the making of a comparative test of different loud speakers.

Other Factors.

For example, it is assumed that the wireless receiver is functioning properly, and that no undue distortion is being introduced by the low-frequency transformers, that excessive reaction is avoided, and that the various other well-known causes of distortion and lack of faithfulness in the reproduction are carefully attended to.

After all, the best of loud speakers can do no more than reproduce, in the form of sound, the electrical variations which are applied to its terminals. Again, the extent to which lack of faithfulness in the speech-currents delivered to the loud-speaker terminals affects the reproduced sound depends also upon the electro-magnetic mechanism employed in the loud-speaker under test, and whereas of two loud speakers, A might be superior to B with a certain receiver, it might quite well be that B would appear superior to A with another type of receiver.

Difficulties of a Comparison.

There are a hundred and one other points which require attention when comparing loud speakers, but lack of space prevents me from dealing with these at present. What has been said, however, will indicate that a really true comparison of different loud-speaker instruments on anything that might be called scientific lines is a very difficult matter indeed, almost as difficult, perhaps, as comparing the merits of two singing voices, and for this reason the choice of a loud speaker is, and must perhaps for a long time remain, very largely, as I have already said, a matter of personal taste.

By-Pass Condenser.

I forgot to mention one other simple precaution, which seems generally more neglected than observed—that is, the shunting of a small fixed condenser across the terminals of the loud speaker. This often has the effect of improving the functioning of the set in a marked degree.

(*Continued on page* 1400.)

TECHNICAL NOTES.

(*Continued from page 1399.*)

Reaction.

When using variable reaction it is important to remember that the reaction coil is liable to be connected the wrong way round, but this mistake in wiring can easily be detected (if the set will oscillate at all), as the reaction will diminish when the coils are brought closer together.

If closing the coupling (or apparent closing the coupling) has the effect of diminishing the strength of the signals received, the leads to the reaction coil should be reversed. Of course, the test must be made over a fairly large range of motion of the reaction coil, as in any case it will generally be found, even when the coil is properly connected, that a position of maximum loudness is obtained, after which the further approach of the coils results in diminution of signal strength.

If reaction cannot be obtained at all, the reason for the trouble is usually that the reaction coil is too small or too large, and different coils should be tried, the final adjustment being made by means of a variable condenser connected across the terminals of the reaction coil. Lack of reaction may also indicate a partially short-circuited secondary, or the lack of a by-pass condenser in the reaction plate circuit (across 'phones or primary of L.F. transformer). It will also be found that the reaction is sometimes largely dependent upon a sufficient value of the plate voltage on the detector valve.

The Proprietors of Britain's Best Crystal, Ltd., hope to give the result of their Cross Word Puzzle Competition in our next issue, time not allowing for publication this week.

LISSENIUM

TYPES OF MAGNETIC CONCENTRATION——

With many types of coils the magnetic field is mostly concentrated in the centre of the coil, and the field does not extend to any appreciable degree. The characteristics of the magnetic field in such coils are closely analogous to the ordinary solenoid inductance.

In the case of LISSENAGON (pronounced LISSEN-AGON) coils, however, the magnetic field, in addition to being very strong in the centre of the coil, is also distributed on each side of the coil. This accounts for the remarkably strong magnetic linkage obtained with LISSENAGON coils in reaction circuits, and ALSO FOR THE PECULIAR EFFICIENCY OF THE COILS WITH EDDY CURRENT TUNING.

LISSENAGON TUNING CHART. Note the Intermediate Coils 30, 40, and 60.

TABLE I. Wave-length range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wave-length range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/9
150	965	2,300	703	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2

IF YOU EVER WANT COILS WHICH INTENSIFY TUNING —USE LISSENAGON COILS.

SIGNALS ARE ALWAYS STRONGER—

when capacity is low and inductance is high. If, where, say, a No. 35 coil is ordinarily used with added capacity to tune it to a given wave-length, a No. 60 coil can be used, AND WITHOUT ADDED CAPACITY, other things being equal, it follows that signals would be stronger.

In the new LISSEN CRYSTAL SET a form of tuning has been introduced which permits of a No. 60 LISSENAGON (pronounced LISSEN-AGON) coil being used, and dispenses with the need of added capacity to tune it. A big signal voltage is built up. But, apart from its high inductance efficiency, too, there are other considerations which place this receiver far above all other crystal sets, NO MATTER WHAT THE PRICE.

THERE IS AN UNDISTURBED ELECTRICAL CIRCUIT, for instance. The only moving part is the metal plate, and although this is entirely unconnected with the electrical circuit, its influence on the inductance is effectively applied through the medium of the magnetic field created.

In conjunction with the principle of EDDY CURRENT TUNING employed in this new LISSEN CRYSTAL SET, LISSENAGON COILS ARE PECULIARLY EFFICIENT. No other coils give the same results.

By fitting the appropriate LISSENAGON (pronounced LISSEN-AGON) coil, the LISSEN CRYSTAL SET can be used for any station within range. Two coils would be needed for London and Chelmsford, for instance—to change over from one station to the other, take one LISSENAGON coil out, and plug the other one in.

On long aerials it would be possible to use a coil one size less in each case, *e.g.*, No. 40 instead of 50; 50 instead of 60; 60 instead of 75; 200 instead of 250.

NOTE.—One LISSENAGON coil must be ordered with each set—the receiver will not be sold without a LISSENAGEN coil because the use of these coils ensures very high efficiency.

No paper — no cardboard — no loose contacts — no loose wires — connections are stamped-out strips — the whole receiver is an instrument throughout — robust — and THE MOST EFFICIENT CRYSTAL SET MADE — WITH THE MOST EFFICIENT INDUCTANCE.

Price of receiver (includes crystal), patent pending **10/-**

No. 50 LISSENAGON coil (covers 300 to 350 metres on this receiver) **5/-**

No. 60 LISSENAGON coil (covers 350 to 400 metres on this receiver) **5/4**

No. 75 LISSENAGON coil (covers 400 to 500 metres on this receiver) **5/4**

No. 250 LISSENAGON coil for Chelmsford **8/9**

LISSEN LIMITED

8-16 Woodger Road, Goldhawk Road, Shepherd's Bush, London, W.12.

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

All applications for Advertisement Space in POPULAR WIRELESS AND WIRELESS REVIEW to be made to JOHN H. LILE, LTD. (Sole Agents) 4, Ludgate Circus, London, E.C.4. Phone: 1080 Central.

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, February 7th, 1925.

R/R

POPULAR WIRELESS AND WIRELESS REVIEW, February 14th, 1925. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

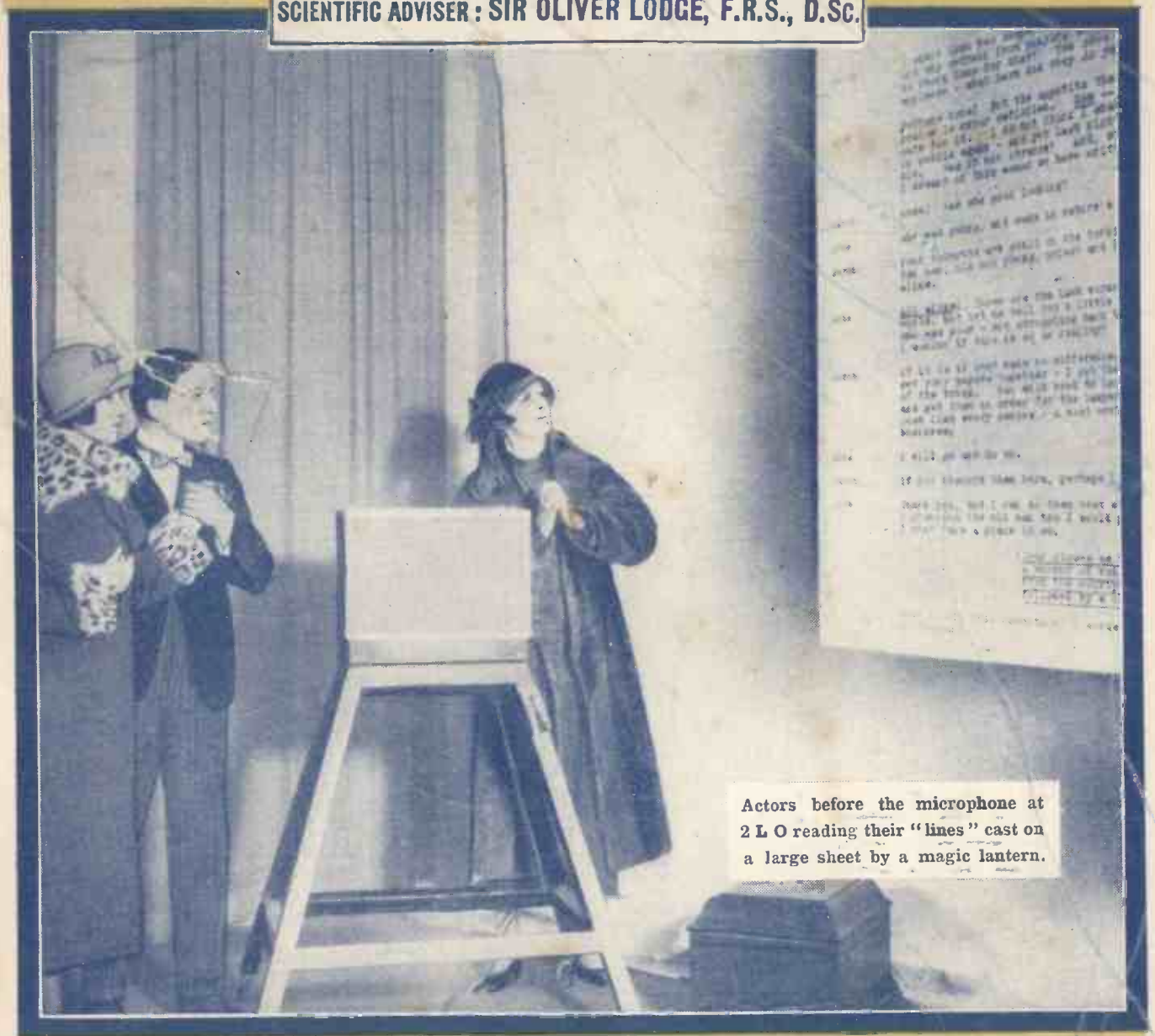
HOW TO MAKE THE "MULTIDYNE" RECEIVER.

Popular Wireless

and Wireless Review

PRICE 3d. EVERY THURSDAY.

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



Actors before the microphone at 2 L O reading their "lines" cast on a large sheet by a magic lantern.

FEATURES IN THIS ISSUE.

THE HOYT AUGMENTOR: A NOVEL AMERICAN CIRCUIT.

No. 142. Vol. VI. February 14th, 1925.

The Thrill

NO thrill can equal that of sweeping over the crest of a long hill at the wheel of a superb car.

The hum of the wheels on the crisp road; the tang of the rushing winter air; and the valley below becoming dim in the mist.

The giant engine at your feet is droning a happy song, but you are content to forget his existence. You forget—and quite rightly so—the minute care which the makers bestowed, not only upon the design as a whole, but upon each individual component part. And yet it is the care with which the component parts are selected and tested that decides the success of the whole car.

The same is true of a wireless set.

We have specialised for over 12 years on the production of better and still better condensers, because we realise how important it is for a wireless set to have only condensers of the highest possible efficiency.

That is why we advise you, in your own interests to

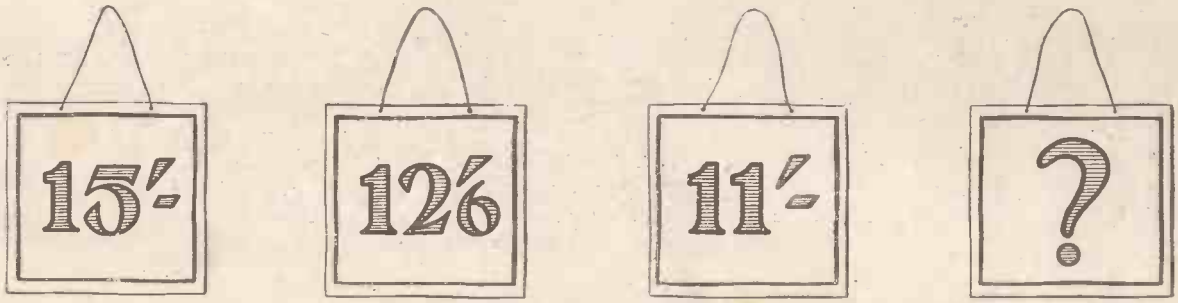
Specify Dubilier.

DUBILIER
CONDENSER CO LTD.

Advt. of the Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

Telephone: Chiswick 2241-2-3.

E.P.S. 90.



Months ago we decided that a first-class bright filament valve could be manufactured to sell at 10/- and yet contain the very best materials and workmanship.

We still find this true to-day.

The price of the Silver Clear Louden remains at 10/-.

LOUDEN 10/- VALVES

Louden Valves - Silver Clear

B.P.S. 11. *Advt. of the Fellows Magneto Co., Ltd., Park Royal, London, N.W.10.*

POPULAR WIRELESS

The Radio Weekly with the Largest Circulation

Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.S.A., F.R.G.S.

Scientific Adviser: Sir OLIVER LODGE, F.R.S.

Technical Editor: G. V. DOWDING, Grad.I.E.E.

VALVE PRICES—2 L O's MOVE—A RECORD CLAIM.

Copenhagen Concerts.

CONCERTS from Copenhagen are now being sent upon two wave-lengths, 775 and 445 metres. The shorter wave-length is not used by the Copenhagen station itself, but by the s.s. "Aalborghus," which relays the Danish station's programme on Tuesdays, Thursdays, and Saturdays. The vessel is then lying in the harbour of Aalborg (Jutland), so any reader who has logged "Copenhagen" on the shorter wave was really listening to a re-transmission by the steamer.

* * *

The Drop in Valve Prices.

THE recent reduction in the price of dull emitter valves came just in time to be specially welcomed. A good many listeners who had toyed with the idea of purchasing a half-price Continental valve, and taking a chance upon results, were glad to be able to buy a really reliable British valve instead. And if valves came down to five shillings each there would be just as much money spent upon them, for—confess it or no—it's everyone's secret ambition to own a seven valve super-set.

* * *

2 L O's New Aerial.

THE new aerial for 2 L O will be of the inverted-L type, and will consist of two "cages" or "sausages," each having five wires. The two steel lattice-towers which have been erected on the roof of a West End stores are each 125 ft. high. As they are standing 100 ft. above surface level, the total height of the aerial is 225 ft. above the roadway. One mast stands upon the roof of Selfridge's, and the other upon a square lattice-steel base.

* * *

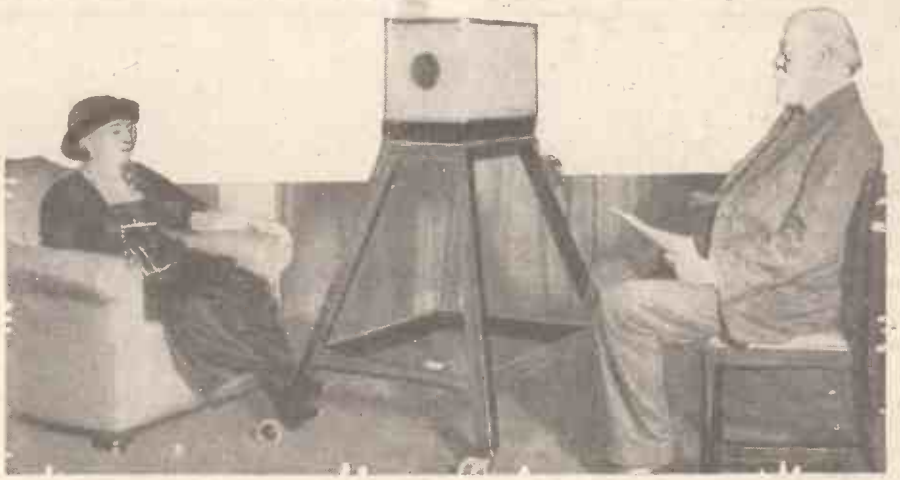
Power to be Increased.

THE distance between the two masts is 250 ft., but of this span only about 70 ft. will be utilised by the actual aerial. The lead-in is 220 ft. long, so that only about a quarter of the aerial will be contained in its flat top. The transmitting apparatus will be contained in a hut upon the roof, situated in line between the masts. The power-input is to be doubled, but whether it will remain at three kilowatts permanently depends upon the effect of the increase upon the jamming in the London area.

* * *

A Joke Which Came True.

THE Canadian National Railway was the first, and is still the only, railway in the world to give a wireless service to its travelling patrons. Mr. W. B. Robb, vice-president of the C.N. Rly., who addressed British listeners on February 4th from C N R A, paid a visit to "P.W." last summer. As a matter of fact, he gave me a good hint of future developments, for he laughingly remarked to me, "You will soon be hearing our railway-stations." But at the time I thought he was joking.



Sir Oliver Lodge delivering one of his lectures before the microphone at 2 L O. Lady Lodge is also seen in the photograph.

Marconi House.

LONDONERS are already wondering what Marconi House will look like without an aerial when 2 L O is moved from the Strand to Oxford Street. But if the familiar double-sausage is taken down it is unlikely that the site will be without an aerial. Long before 2 L O was thought of there was an experimental aerial on the roof, and during the war a whole network of them spread out to neighbouring buildings.

* * *

The C.N.R.'s Radio.

THE new Canadian station at Moncton, New Brunswick (C N R A), is situated about 150 miles from Halifax (N. Scotia), close to the famous commercial transatlantic station, Glace Bay (G B). Moncton belongs to the Canadian National Railways (hence its call-sign), and its transmissions upon 313 metres are already quite familiar to "D X" listeners in this country, although the station has only been working for a few weeks.

* * *

New Use for Valves.

DID you know that valves can be used to melt steel into a white-hot liquid?

According to Dr. C. H. Desch—who is Dean of the Faculty of Metallurgy at the University of Sheffield, furnaces of this kind will be working at Sheffield within a few months. By means of powerful H.F. currents—handled by large thermionic valves—the metal itself can be made hotter than the crucible containing it. The method will be of special value in the melting of certain valuable nickel alloys.

* * *

A Wireless Wink.

SOME of the experimenters with television are convinced that before the close of 1925 we shall be able to see as well as to hear by wireless. Amongst others, I hear that Mr. J. L. Baird is making good progress in this connection, and he certainly surprised some Press representatives who witnessed a demonstration recently. Mr. Baird, who was at the transmitter in the next room, focused the apparatus upon his own face. Whilst the fascinated pressmen were watching his features in the receiver, Mr. Baird slowly and solemnly winked at them—the world's first wireless wink!

* * *

The Record Claim.

MY query as to the best place in Britain to receive broadcasting has brought me an interesting letter from a reader in the Oxford district. His claim is a wonderful one—*all* British, *all* German, and *all* French broadcasting on the loud speaker! He receives plenty of other

(*Continued on next page.*)

NOTES AND NEWS.

(Continued from previous page.)

stations, including two American, at loud-speaker strength, despite the fact that Leafield is only 30 miles away. His circuit is a "straight" one—H.F., det., and 2 L.F.

* * *

Heard in Palestine.

THE music of the Savoy Bands is now being picked up quite regularly in the Holy Land. Last month Paris and London concerts were clearly heard at Sarafand, 12 miles north of ancient Tyre. Sarafand is really Zarephath or Zarepta, where Elijah's widow lived.

* * *

Sir Oliver's Address.

THE new Theory of Vision, outlined by Sir Oliver Lodge in his presidential address to the Radio Society of Great Britain, makes the connection between light and radio seem closer than ever.

"What the nerves feel is the shock of the ejected electron, which strikes them with the speed of some thousands of miles per second," said Sir Oliver.

This looks as though an eyeglass is a sort of control grid, so conversely the Unidyne may be regarded as a radio telescope. It certainly does seem to bring the distant stations up closer!

* * *

Overheard.

HEARD in the workmen's train:

"How did the old crystal go last night, Jack?"

"Awful, mate!"

"Why, you said it was clear yestiddy."

"Too clear, mate. I never missed a word o' them Oxford poets!"

* * *

The B.C.L.'s.

ACCORDING to the latest figures issued by the Post Office, there are now about 1,140,000 people in Great Britain who hold broadcasting licences. Allowing for multi-'phone sets, loud-speaker sets, and pirates, there are probably between 4,500,000 and 5,000,000 broadcast listeners—or B.C.L.'s, as they call them in the U.S.A.

* * *

On 40 Metres.

THERE was a very interesting discussion upon short-wave working at a meeting of the Radio Society of Great Britain recently, when Mr. Stanley Ward demonstrated a "straight" circuit upon which he can tune down to 40 metres. There are signs of a considerable growth in the number of amateurs who are going "down the scale," and there is little doubt but that this is the most promising field for research in radio to-day.

* * *

Broadcasting the Ashes!

WILL the B.B.C. ever broadcast Test matches? This interesting query is raised by a writer in the "Daily News," who evidently felt he could not stand the strain of waiting for the cables again! He goes on to say that broadcasting baseball in the U.S.A. has been carried to a fine art. Big boards are erected in the streets, and moving lights show the track of the ball. When the ball is hit a light out in the field shows where it falls, and a big light runs round a square to show the batsman gaining a run. Thousands of spectators cheer themselves hoarse at the spectacle.

* * *

Relaying K D K A.

PROGRESS in South African broadcasting can be gauged from the fact that Johannesburg (J B) has already succeeded in relaying K D K A, despite the fact that 8,000 miles separate the two stations. The Union's third broadcasting station was opened at Durban recently, and the ceremony was successfully relayed to Johannesburg. It was S.A.'s very first S.B.!

* * *

A Unidyne in S.A.

I WAS very interested to notice that the Unidyne has already made a name for itself in South Africa. One experimenter wired up the simplified single-valve circuit—more in curiosity than hope, for he was 250 miles from the nearest station—and astonished himself by receiving

SHORT WAVES.

Wireless and the telephone are to be linked. The operators, having used up all the wrong numbers in this country, are jubilant at the chance of tapping-in to America.—"Sunday Pictorial."

* * *

Radio waves don't care where they go, so you may as well get your share.—"Radio World."

* * *

"The region of Art, Beauty, Love and Aspiration is a region higher and beyond anything apprehended in physical science."—Sir Oliver Lodge.

* * *

"Greater powers were required by the Post Office for detecting unlicensed sets, and there was every probability of a bill for that purpose being introduced in Parliament this year."—Mr. F. J. Brown, C.B., C.B.E. (Asst.-Secretary to the Post Office), in an interview with the "Daily Telegraph."

* * *

Apt use was made of a familiar wireless phrase by a bored-looking husband when a very "gossipy" lady acquaintance hove in sight. Turning to his wife he whispered, "In one minute you will be receiving the local news." He had listened-in before.—"News of the World."

* * *

THE WEEK'S QUERY.

"I want to become a wireless operator. What is the best way to learn the Moscow?" (He meant Morse Code!—ED.)

a programme from Cape Town and a carrier-wave which he could not quite identify. As H.T. batteries are the biggest bugbear imaginable in hot countries (I've had some), there has been a tremendous run on "P.W." there since the news leaked out.

* * *

Dublin's Radio Show.

DUBLIN'S wireless exhibition, which was announced for mid-February, has now been postponed until the autumn. The organisers have taken this step in consultation with prominent trade representatives, probably because of the disappointing delays in the preparations for an Irish Free State broadcasting scheme.

* * *

"Mon Desir."

A HERTFORDSHIRE reader, Mr. C. Gattiker, tells me that on January 21st, about 1.30 a.m., he received Porto Rico (W A K U) on about 370 metres. When Porto Rico closed down at 2.45, he announced the time as 10.45 p.m., so the station is four hours west of Greenwich and situated well south of the Tropic of Cancer!

Mr. Gattiker's address at Boreham Wood is "Mon Desir." I should think he has it now!

* * *

Heard in Borneo.

"BIG BEN" in Borneo is the latest radio record, and as Borneo is 10,000 miles away, it is one which will want a lot of beating. The station heard was not 5 X X, but our old friend 2 L O (listeners in Finchley who complain of "fading," please note). The distant listener was Mr. C. F. Wade, superintendent of telegraphs at Jesselton, British North Borneo, and although located on the extreme edge of the East, he has succeeded in tuning in to the Thames-side station no less than three times.

* * *

No Action!

ACCORDING to the "Glasgow Herald," a sub-committee of Edinburgh Town Council agreed to take *no action* on a letter from the B.B.C.'s Edinburgh station director inquiring whether there would be any objection to having the proceedings at a session of the council broadcast. They might have replied to the letter, anyhow, don't you think?

* * *

Spirit Voices.

LONDON spiritualists have been trying to persuade the B.B.C. to broadcast spirit voices, and the B.B.C. has gently but firmly declined to try the experiment. There is, however, no need for the spiritualists to despair; anyone in the Ilford area will tell them where they can hear thousands of lost souls moaning every night all over the broadcast band of wave-lengths.

* * *

Another European Wireless Exhibition.

CZECHO-SLOVAKIA is expecting a big increase in broadcasting business as a result of the recent revisions in laws and licences. The cost of the latter has been reduced by 60 per cent, and new stations are being planned all over the country. It has been decided to hold a big exhibition there, from March 22nd to 29th, when the great Prague Spring Fair draws merchants and customers from all over Europe.

* * *

Wireless as Cancer Cure.

WILL wireless ever cure cancer? French scientists have been investigating the possibilities for some time, and now two American doctors claim to have developed a system of treatment by radio. The receiver is a sheet of tin suspended over the patient's head, and the doctors say that their radio apparatus has proved beneficial hundreds of miles away from the source of treatment.

* * *

"The Wireless Trader's" Investigation.

CONGRATULATIONS to the "Wireless Trader," and in particular to its very clever editor, Mr. P. K. Turner, who recently dispatched a special investigator to Germany to obtain details as to the progress made by German Radio Manufacturers. The report published in the last issue of "The Wireless Trader" seems, to my mind, to indicate that the wireless industry has little to fear from serious German competition for some time to come.

ARIEL.

The "MULTIDYNE."

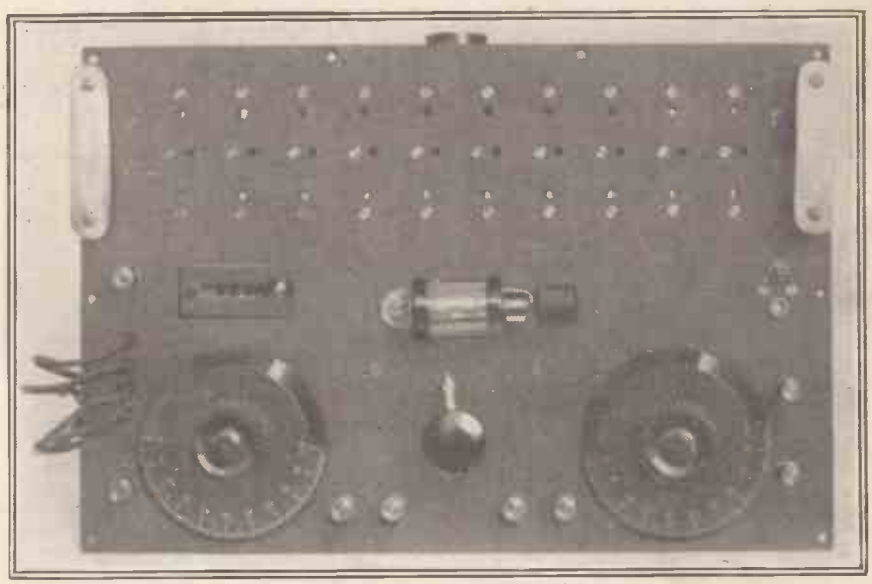
CHANGING A CIRCUIT INSTANTANEOUSLY.

Designed and Built by B. W. WILLANS.

PART I.

In this, the first of a series of articles, we are introducing to our readers an improved development in connection with combination receiving sets. This receiver, which we have called the "Multidyne," on account of the almost infinite diversity of uses to which it can be put, is of a kind which will appeal both to the experimenter and to those whose chief interest is in obtaining as perfect broadcast reception as possible.

EXPERIMENTERS' sets have from time to time been suggested in the technical press for the purpose of providing convenient means for changing over from one circuit to another. The disadvantages of these arrangements have been two-fold. In the first place the instruments, for the most part, have been of the experimental type, and in no sense complete receiving sets; and secondly, the process of connecting up was always a matter of some considerable time, or, at any rate, of concentrated thought.



The front of the panel of the "Multidyne" Receiver.

Instantaneous Change.

By means of the special feature which gives the "Multidyne" set such overwhelming advantages over any of these "universal" receivers, both of these difficulties are avoided. The instrument can be produced in as highly a finished form as is desired, and yet lose none of its flexibility, and the interchanging of two of the most elaborate circuits imaginable is a matter of one or two seconds' manipulation and no thought at all.

The secret of this remarkable result is the separation of the circuit from the wireless components altogether, the latter being contained in a box of the usual type associated with the best finish of receivers, and the circuits being located in detachable circuit units, which can be fitted on to the component box in a matter of seconds, thus automatically connecting up components according to the desired circuit.

The immense advantages of an *instantaneous* change of circuit will appeal to the experimenter when investigating circuit efficiency. Conditions of reception vary so much from minute to minute that unless a really quick change-over between one arrangement and another can be effected there is practically no possibility of good comparisons being made. On the other hand, the advantages to "listeners" in general are equally apparent in view of the fact that even in the same locality conditions of reception are so different on different wave-lengths and for different stations that it is impossible to say what type of receiver would be the most satisfactory for the particular circumstances of the moment.

The original feature employed in the "Multidyne" type of receiver, which enables these advantages to be obtained, lies in the provision of two ebonite panels, the first being an assembly of spring contacts, from which connections are made to the various components, condensers, coils, etc., and the second, which is detachable, incorporating an assembly of fixed contacts registering with the spring contacts previously mentioned.

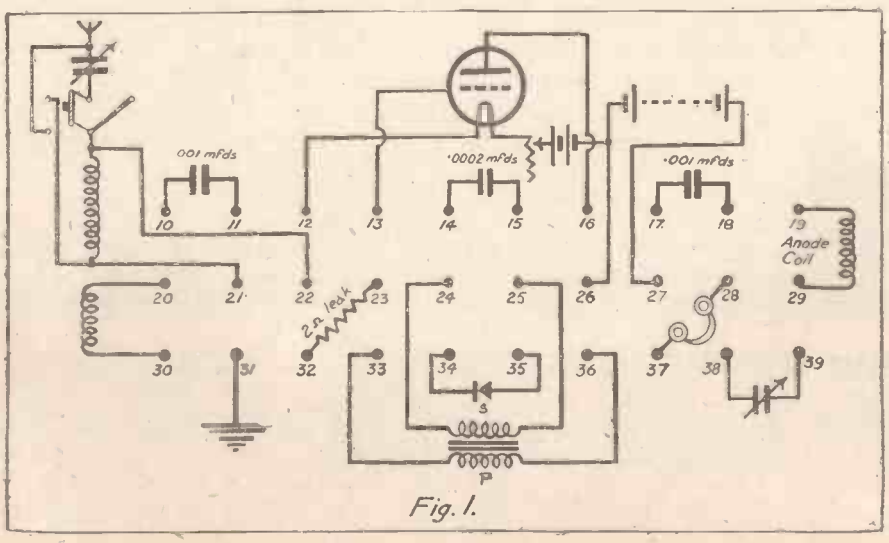


Fig. 1.

"Plug-in" Circuits.

These fixed contacts are connected to each other according to the circuit required. The essential feature of the invention is that these may remain *permanently* interconnected, the detachable panel thus constituting the means for setting up at any moment the particular circuit which it is desired to use. The number of detachable panels depends on the number of circuits it is desired to have available for instantaneous use, but as these panels can be very cheaply made it is possible for the experimenter to provide himself with a large number, and to increase the number from time to time.

(*Continued on page* 1408.)

THE "MULTIDYNE."

(*Continued from page 1407.*)

In order to make the principle of the "Multidyne" set absolutely clear, I will proceed to describe the first model "Multidyne," which has been tested by the Technical Staff of "P.W." Fig. 1 gives the theoretical diagram of connections between the spring contacts of what I may call the "component unit" and the various components which it comprises.

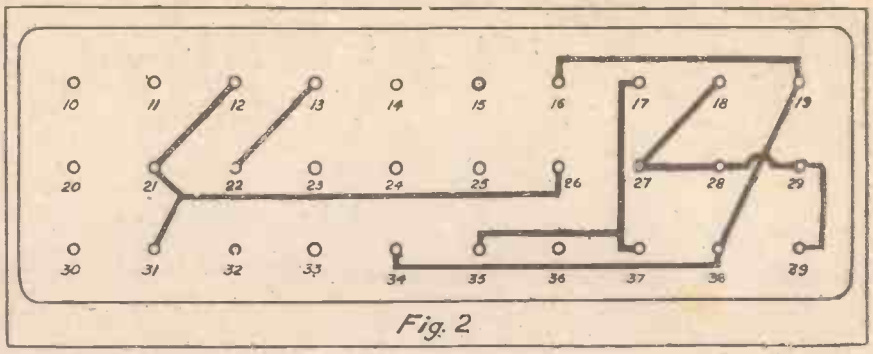


Fig. 2

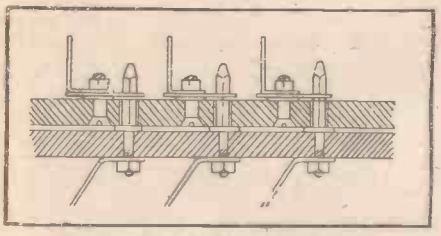


Fig. 2A. Sectional view of circuit panel.

This early model of Multidyne was provided with the following components:

Necessary Components.

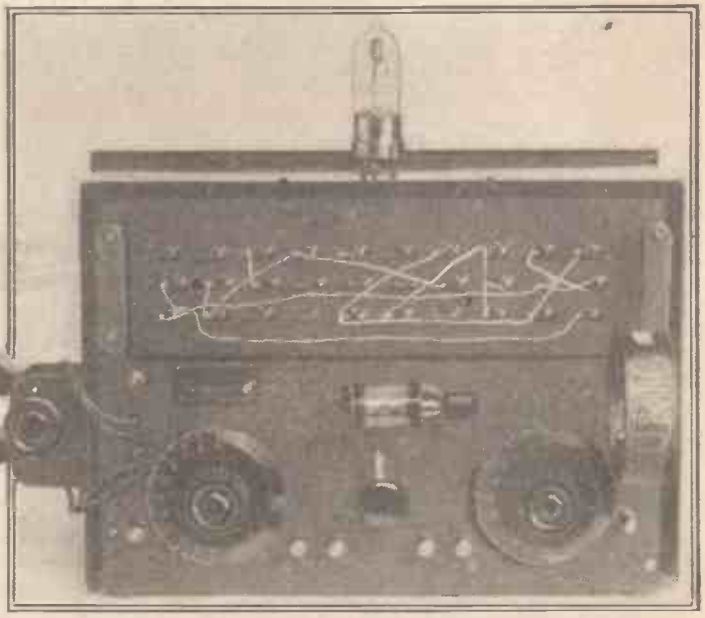
1. Aerial tuning condenser and plug-in coil, the latter being mounted on the fixed member of a two-coil holder. A series-parallel switch was provided.
2. Reaction or coupling coil mounted on movable member of two-coil holder.
3. Anode coil mounted in fixed coil holder.
4. ·0003 mfd. variable condenser for anode or closed circuit tuning.
5. Valve.
6. L.F. transformer.
7. Grid leak (2 megohms).
8. 3 fixed condensers (2 of ·001 mfd. and 1 of ·0002 mfd. capacity).
9. Crystal detector.
10. Terminals.

Connections were also made to the terminal board from the earth terminal, the common negative of high and low tension batteries and the positive of high tension.

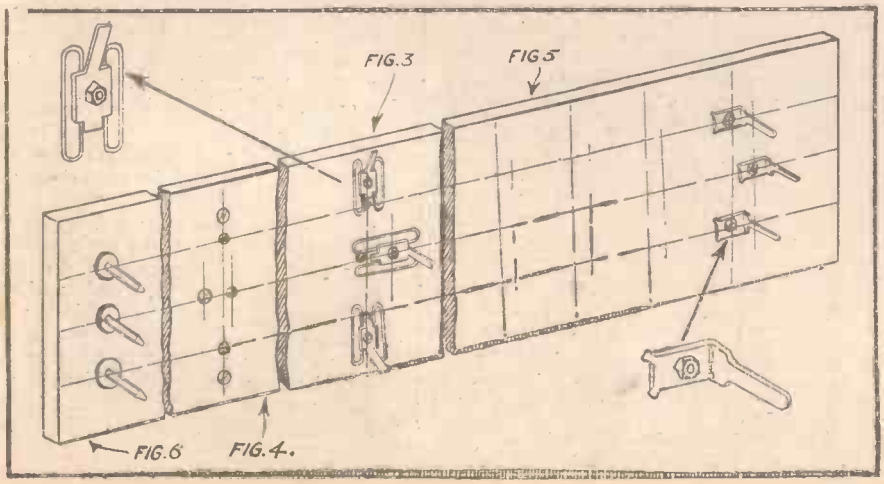
As will be seen from Fig. 1 there are altogether 30 spring contacts comprised in the component unit, these being arranged in three rows of ten, and mounted on the instrument panel itself. In order to fix on a convenient notation these have been numbered as shown, from 10 to 39, all terminals in the top row being "tens," in the second row "twenties," and in the third row "thirties."

With the apparatus connected up as described and illustrated in Fig. 1, it is perfectly clear that there is essentially no circuit at all, unless the aerial circuit be counted, though even that is disconnected from earth. In order to convert the component unit, as above described, into a wireless receiver having any desired circuit, it is necessary to provide means for inter-connecting the various spring contacts. This is effected by means of a small panel, a diagram of which is given in Fig. 2A.

Here is arranged a collection of fixed contacts which register with the 30 spring contacts of the component unit on one side, while on the other side they project to a convenient distance to enable permanent soldered interconnecting leads to be attached to them. For every circuit it is desired to employ there is one of these circuit panels provided, and it is only necessary to "hook up" the contacts mounted on this panel to have the particular circuit available for instantaneous use whenever required.



Showing position of one of the circuit panels, with ebonite face removed.



Twenty Circuits.

In Fig. 2 is illustrated the means for interconnecting these contacts, so as to set up on the main instrument the circuit of a single-valve high-frequency amplifier with crystal rectification, and if reference is made to Fig. 1 the connections can readily be verified.

It is, perhaps, worth while referring at this stage to the generally advised procedure of employing very heavy square tinned wire for interconnecting sensitive high-frequency points in wireless circuits. I have made a practice in connection with my work on "Multidyne" sets of using the finest gauge of wire compatible with safety, and, wherever possible, have connected up the parts of the apparatus with a simple straight lead, without any bends in it at all.

The result of the procedure has been a remarkable degree of stability on the part

(*Continued on page 1409.*)

Technical Notes

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

Transformer Windings.

IT occasionally happens that the primary and secondary terminals of an L.F. amplifying transformer become reversed during assembly, and this may be the cause of non-operation of reflex sets in which such transformers are used. In some cases also, as in the case of shielded transformers, it is impossible to determine the correctness of terminal connections by inspection.

Experimenting with a high speed wireless recorder now used regularly in the offices of a big New York newspaper.

The two windings, can, however, be identified by a rough measurement of their resistance, using a milliammeter and dry cells, or by testing with telephone receivers, the lower-resistance winding giving a louder click. In the case of a reflex circuit, if trouble has been experienced in getting the set to function, and the more usual sources of trouble have been explored without result, it is worth while reversing the connections to the L.F. transformers or testing them out as indicated above.

New Aerial Principle.

M. Latour, the well-known French wireless engineer, describes in Pat. 224,586/24 an aerial system for which special directional properties are claimed, and which appears to involve a somewhat novel principle. The aerial consists of a number of wires, which are arranged in line directional to the station to be received, and spaced apart at distances equal to one-half the wave-length of that station. It will be seen from this that, in the case of broadcast wave-lengths, the aerial would need a considerable space for its erection, and it is therefore unlikely to be of special value to experimenters, although it is claimed to be of importance in commercial reception.

'Phone Connections.

One of the easiest ways to spoil a pair of 'phones is to leave them connected in the wrong direction on a one or two stage amplifier. There is a right and wrong way to connect 'phones, and if they are connected incorrectly, they become de-magnetised and lose their sensitivity. The best

(*Continued on page* 1418.)

THE "MULTIDYNE."

(*Continued from page* 1408.)

of the various circuits, and I am confident that provided care is taken in laying out the components in relation to the spring contacts, the "Multidyne" is just as satisfactory from this point of view as any other receiver, and considerably more so than some.

Figs. 3 and 4 show a back and front view of the spring terminal arrangement of the first model of "Multidyne." In this model 30 holes were drilled in the ebonite panel on which the receiving apparatus was also mounted, and behind the panel small bent phosphor-bronze wire contacts were assembled and provided with soldering tabs, to which connections could be made to the various components employed.

Figs. 5 and 6 illustrate similar views of a circuit panel, the contacts of the latter consisting of pins, which fit into the holes in the instrument panel of the component unit.

Soldering tabs were provided on the back of this panel so as to make it easy to connect up, and the pins themselves were made of hexagonal brass rod, so that they could be tightened up with a pair of pliers in case they became loose during the process of soldering.

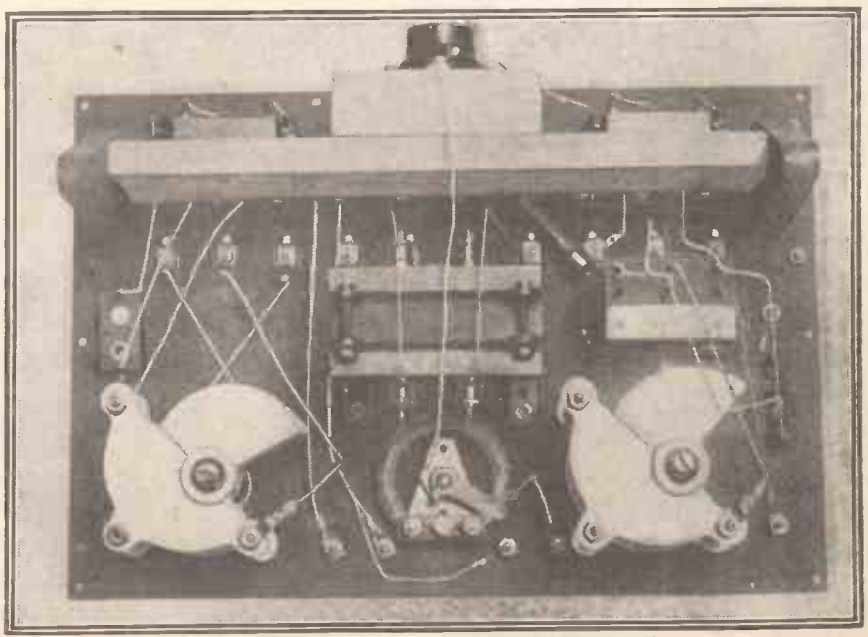
On this page is shown a photograph of a rear view of the "Multidyne" component unit when completely wired up, from which it will be noted that great pains have been taken in the lay-out to make the connections between the spring contacts and the components as short as possible.

A noteworthy feature of design is the arrangement whereby the valve holder is made to project through a hole in the top of the box containing the components. This has enabled us to form a really compact receiver, and has materially assisted in keeping the sensitive leads as short as possible.

It has been estimated that at least twenty separate and distinct circuits can be set up by the use of the above components. In particular, any valve and crystal reflex circuit can be tried out, and very interesting results are obtained on the comparison.

The performance of such circuits has been found to be at least as good as if they were set up only for the particular circuit in question.

(*To be continued.*)



This photo shows a close up rear view of the "Multidyne."

THE ART OF TUNING.

By C. E. FIELD, B.Sc.

PART II.

WHILE it is a comparatively simple matter to tune a receiving set in which there is only one tuner, such as a variable condenser, or variometer, tuning becomes rather more difficult when there are two tuned circuits with separate controls, and well-nigh impossible when there are more than three.

In a valve receiving set in which high-frequency amplification is employed, the best results are obtained if the output from the first valve is sent through a tuned circuit. Although this is not necessary for reception on long wave-lengths, and is not practicable when more than two stages of high-frequency amplification are employed, for the reception of broadcasting a tuned transformer, or "tuned anode" coupling gives the greatest signal strength, and a high degree of selectivity.

H.F. Amplification.

Let us consider the tuning of a three-valve receiver, consisting of a detector and one stage each of H.F. and L.F. amplification with tuned anode (Fig. 1).

No tuning is required after the detector, because the output current from this valve is no longer oscillating at high-frequency, and so is not seriously influenced by small values of inductance and capacity.

We have, therefore, two tuned circuits, each consisting of a fixed inductance and a variable condenser. The difficulty here lies in the fact that the receiver is not tuned until the two circuits and the incoming signals are all three in tune with one another.

Let us suppose that the correct readings for the reception of a certain station are 60 degrees on each condenser, and, moreover, that the two circuits are always in tune with each other when the readings are the same—although this would be a remarkable state of affairs to occur in practice.

Adjusting the Condensers.

When we first try to tune in, we may hear faint signals with the aerial condenser at, say, 70. On turning the anode condenser until the best results are obtained, we will find that this occurs, not when the pointer is at the correct value of 60, and not when it indicates 70, showing that it is in tune with the aerial condenser, but probably at some intermediate value. The correct settings can only be determined by a systematic series of trials. In this particular case, having got weak signals with aerial and anode condensers reading, say, 70 and 65 respectively, the former must then be moved one or two degrees, the latter being adjusted until the best results are obtained. If these results are definitely weaker than before, the aerial condenser has been moved in the wrong direction, and must be moved three or four degrees back. This process is repeated, the anode condenser being adjusted each time, until the maximum signal strength is obtained. The important point to note, which is often misunderstood, is this: If a movement of either condenser, in either direction, weakens the signals, it does not follow that the set is correctly tuned, for there are a hundred and one different settings at which this may occur, but only one correct pair of readings.

The introduction of a reaction coil, coupled either to the aerial circuit, or to the intervalve coupling, renders the set both more sensitive and more selective, and is advisable for long distance reception.

When tuning a set in which reaction is employed, it must be remembered that variation in the reaction coupling upsets the tuning, the controls require readjusting, especially that which tunes the circuit into which reaction is introduced.

It is not sufficient to place the coils in a certain relative position, tune-in with the variable condensers, and then increase the reaction coupling for best results.

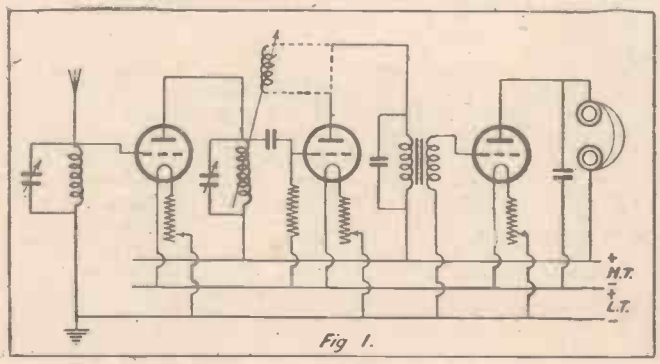


Fig 1.

If we were tuning-in a nearby station on the set indicated in Fig. 1, reaction on the anode coil being employed, as shown by dotted lines, it would be a good plan to commence with no reaction—i.e. with the fixed and moving coils at right angles. Having tuned the circuit to give the maximum signal strength under these conditions, we would then move up the reaction coil, and signals would increase in strength up to a certain point. As well as introducing reaction, however, we would be adding inductance to the anode circuit, and so throwing the set slightly out of tune. As soon as the signals showed the slightest sign of becoming harsh, we would turn the anode condenser *back*.

Reaction Control.

If this brought the signals up loud and clear, we could then advance the reaction coil a little farther. It would very likely happen, however, that on turning the condenser back, a whistle would be heard, indicating that the reaction coil had been advanced too far. In this case, the coil would have to be moved back, and the condenser again advanced a little. Having obtained the best possible results by this means, a readjustment of the two condensers in conjunction with one another would still further strengthen the signals. This, again, might produce the whistle, indicating that the valve was oscillating, the remedy of course being a slight weakening of the reaction coupling.

It is when tuning a set for the very last ounce of signal strength by the adjustment of a reaction coil and condenser in conjunction with one another, that the need is felt for a vernier on the condenser, and such an attachment is always to be recommended.

When a set is perfectly tuned, it should be in such a condition that a movement of any of the controls in either direction reduces the signal strength, whilst a slight increase in the reaction coupling causes the set to oscillate.

Faults in Tuning.

The following are a few of the faults commonly encountered in the tuning of a receiving set.

Flat Tuning.—This may be produced by excessive resistance or capacity in the circuit. If plug-in coils are employed, these should be wound with wire not thinner than No. 26 S.W.G., and the windings should be well spaced, and not clogged with shellac or wax. In the case of a cylindrical coil, the unused turns of wire should be cut out or short-circuited. The inductance should be kept at such a value that only a small portion of the condenser capacity is employed. Tuning is always rendered sharper by the introduction of reaction.

Tuning too Sharp.—The inductance should be adjusted until the condenser has to be nearly "all in" when the circuit is tuned. The condenser should be fitted with a vernier and extension handle, and the reaction coupling reduced if this does not cause a serious loss of signal strength. In order to avoid tuning being excessively sharp at the lower end of the condenser scale, a "square-law" condenser may be employed with advantage.

Hand Capacity.—A set is frequently thrown out of tune when the operator's hand is removed from the controls. To reduce the effects of hand capacity, the condensers should be arranged so that the plate nearest to the underside of the panel is "earthed." All wiring should be well away from the back of the panel. Extension handles may be fitted to the condensers, and in an extreme case, earthed metal shields placed under the condenser dials.

Self Oscillation.—A set will sometimes burst into oscillation as soon as the slightest reaction is introduced. A smaller reaction coil should be employed, and, if reaction is on the anode coil of a circuit such as that shown in Fig. 1 (a circuit which is particularly prone to self-oscillation), the size of the anode coil may be reduced, the wave-length being made up if necessary by means of a small fixed condenser connected in parallel with that tuning the anode circuit. The bottom end of the aerial coil should be connected to the positive low tension terminal, and the filament rheostat inserted in the positive battery lead. All wiring should be well spaced, parallel wires avoided, and, for very short wave work, ebonite valve holders should be replaced by separate valve legs.

PRACTICAL ADVICE ON

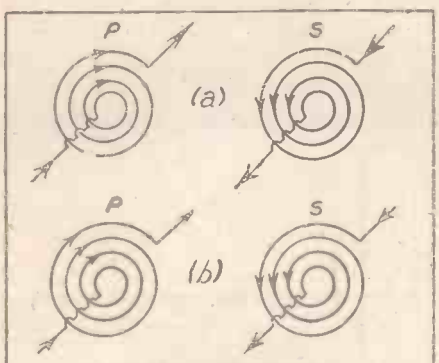
THE DESIGN OF H.F. TRANSFORMERS.

Points the Constructor Should Remember.

By E. CHATTERTON, B.Sc. (Eng.)

Apart from the fact that a knowledge of theoretical principles is always desirable, the construction of high-frequency transformers of various types provides an extremely interesting field for experiment and research. These items can be easily constructed, and when the principles involved are easily understood, it is possible by careful design to obtain much better results than with standard apparatus, which is designed with a larger "factor of safety" than the experimenter requires.

THE duty of a high-frequency transformer is to transfer electrical energy from the anode, or output circuit of one valve, to the grid or input circuit of the following valve. In this connection an important point to remember is that the thermionic valve is a potentially operated arrangement—that is to say, maximum efficiency is obtained when the signal voltage impressed



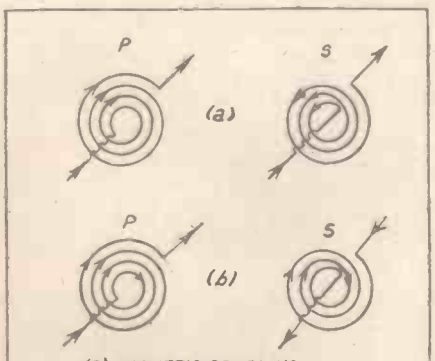
(a) MAGNETIC COUPLING
(b) CAPACITY COUPLING.

BASKET COILS COUPLED WITH WINDINGS IN SAME DIRECTION.

FIG. 1.

on the grid of the valve is at maximum. Bearing this in mind, it will be seen that the object of a high-frequency transformer is to ensure that any fluctuation in the anode current of one valve shall produce the maximum possible variation in the *voltage* applied to the grid of the following valve.

A radio-frequency transformer consists of two separate windings, the primary winding being connected to the anode of one valve, the secondary being connected between the grid and filament of the next valve. In some cases the windings are loosely coupled and both are tuned by means of condensers, but for the sake of simplicity it is usual to tune only one winding, this being quite as effective when the coils are tightly coupled.



(a) MAGNETIC COUPLING
(b) CAPACITY COUPLING

BASKET COILS COUPLED WITH WINDINGS IN OPPOSITE DIRECTIONS

FIG. 2.

Methods of Coupling.

The primary and secondary windings are, of course, insulated electrically from one another, the transfer of energy being accomplished partly by means of mutual inductance and partly by capacity. For reasons which will be given later, this capacity coupling is undesirable, and should be eliminated as far as possible.

For the moment, let it be assumed that the coupling is purely magnetic. From the laws of natural inductance the reader will be aware that the ratio of the voltage across the ends of the secondary to the voltage across the primary depends directly upon the ratio of secondary turns to primary turns. For example, if the secondary winding has twice as many turns as the primary, the voltage fluctuation produced across the secondary will be twice that across the primary, *assuming that no capacity coupling is present, and that all the magnetic flux set up by the primary interlinks with the secondary.* From this it would appear that the coupling between the windings should be kept as tight as possible, and that the secondary should have more turns than the primary. This, within limits, is true, although the result stated above is considerably modified by the presence of capacity between the windings.

Effects of Capacity.

The presence of capacity between the primary and secondary circuits of the transformer seriously reduces the step-up in voltage which it is possible to obtain, for when a condenser is connected between any two points, the effect is to make the potentials at those points equal in value but opposite in sign. Hence capacity between windings tends to keep the voltage across the secondary down to the same value as that existing across the primary. This is the chief reason why the desirable step-up in voltage is so difficult to obtain, for however carefully the transformer is designed, a fair amount of capacity is present.

It would be possible to reduce capacity by spacing the windings well away from each other, but this reduces the degree of magnetic coupling and, therefore, introduces a further loss in efficiency. In fact, to obtain tight magnetic coupling with low

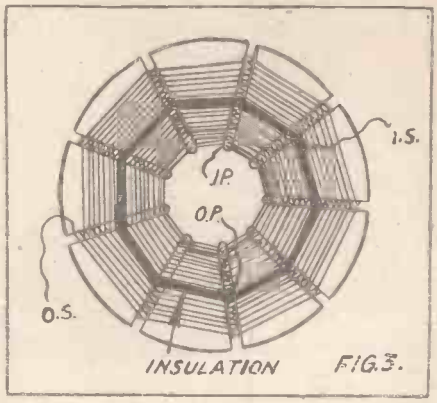


FIG. 3.

capacity coupling is an extremely difficult matter, and is the chief problem in high-frequency transformer design. In many transformers sold at the present time, the energy transfer takes place almost entirely

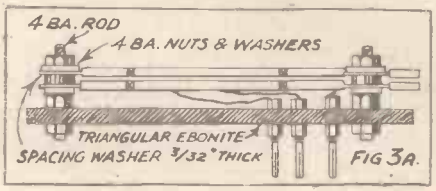


FIG 3A.

by means of capacity, and these are, therefore, relatively inefficient.

Unless care is taken to couple the primary and secondary windings in the correct

(*Continued on page* 1412.)

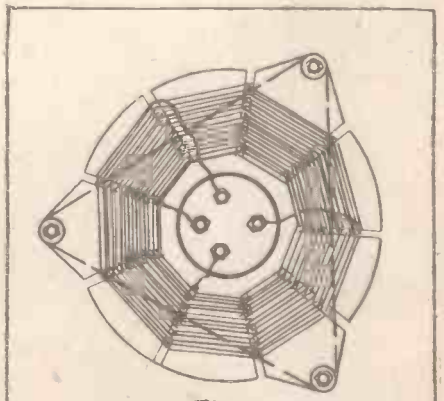


FIG. 4.

ARRANGEMENT OF HIGH FREQUENCY PLUG-IN TRANSFORMER

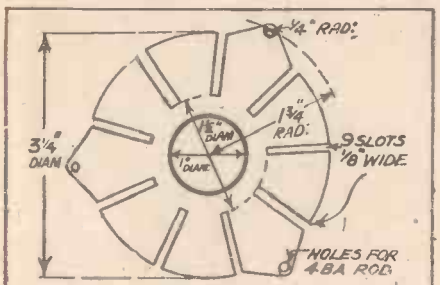
THE DESIGN OF H.F. TRANSFORMERS.

(*Continued from page* 1411.)

manner, it is possible for the voltage induced in the secondary by capacity coupling to oppose and tend to neutralise that set up by the magnetic coupling, this, of course, being undesirable.

It therefore becomes necessary to give careful consideration to the way in which the coils are coupled and connected, in order that the magnetic and capacity couplings shall assist each other.

Firstly, as far as magnetic coupling is concerned, it is known that an oscillating



DETAILS OF FORMER ON WHICH COILS ARE WOUND.
FIG. 5

current flowing in one wire will induce a current in an adjacent wire which is always opposite in direction to that flowing in the first wire.

Direction of Winding.

In Figs. 1 and 2 are shown diagrammatically two basket or spider-web coils which are coupled together, the direction of current assumed to be flowing in the primary winding being indicated by means of arrows. In Fig. 1 the coils are coupled with their windings running in the same direction; in Fig. 2 the reverse is the case. The direction of current induced in the secondary by magnetic coupling is indicated for each case in Fig. 1 (a) and 2 (a).

If now the effect of capacity coupling is considered, it will be realised that when the outside edge of the primary winding is positive, the effect of capacity will make the outside edge of the secondary negative, and vice-versa; hence when current is flowing from the outside to the inside of the primary, the current in the secondary is flowing from inside to outside, this being indicated in Figs. 1 (b) and 2 (b).

An examination of these two cases of coupling will show that, in Fig. 1, where the windings are in the same direction, capacity coupling assists magnetic coupling, but in Fig. 2 when the windings are opposite in direction the two methods of coupling oppose each other. Basket coils should, therefore, always be coupled with the windings running in the same direction, this remark applying also to single layer cylindrical windings wound one over the other. In the type of transformer illustrated in Fig. 3, where the windings are wound one over the other on the same basket coil former, and in the usual type, where the windings are wound in a slot, one over the other, the windings should be in opposite directions, for in this case the outside of one winding is coupled by capacity to the inside of the other.

Having considered the manner in which the windings should be coupled together, it now remains to investigate the points to which the ends of the windings should be connected.

The primary winding is connected at one end to the anode of a valve, and at the other end to the high-tension battery, the anode end of the coil being the point where maximum variations of potential occur. It is important that the end of the secondary which corresponds to the anode end of the primary shall be connected to the grid of the second valve, in order that maximum voltage variations shall be transferred.

Some Constructional Details.

When the windings run in the same direction this will be the case when opposite ends of the windings are connected to the plate and grid respectively. That is to say, if the inside or beginning of the primary is connected to the anode, the outside or end of the secondary should go to the grid.

When the windings run in opposite directions the reverse of this is the case, and if the inside primary goes to the anode, the grid should be connected to inside secondary.

Both windings of a high-frequency transformer are connected in oscillating circuits, and any resistance at these points introduces damping, which reduces efficiency and flattens tuning. At the same time, a certain amount of damping is desirable to reduce the tendency to oscillate, and for this reason commercial transformers are constructed with very fine wire, in order that stable working shall be assured in the hands of unskilled operators.

In the case of experimenters, who possess some operating skill, extreme stability is not so essential, and the results obtainable justify the use of heavier wire than is generally used. The writer has found that wire of 30 S.W.G. D.C.C. functions excellently in transformers for broadcast wave-lengths.

The coils should be wound in a way which reduces self-capacity to a minimum, and in this respect basket coils can be recommended.

The conditions which must be satisfied in a well-designed transformer may, therefore, be summarised as follows, the best design of transformer being that which forms the best compromise between the various points:

1. The windings should be coupled together in a manner which gives strong magnetic and weak capacity coupling, and should be connected so that capacity coupling assists the magnetic.
2. The ratio of secondary to primary turns should be made as high as can be usefully employed.
3. The ohmic resistance of each winding must be as low as possible, consistent with stable working.
4. Self-capacity in the windings must be kept small.

Fig. 4 shows the design of a transformer which has given extremely good results. The windings consist of basket coils wound on stout cardboard, celluloid, or presspahn formers of the shape shown in Fig. 5. The primary has 45 turns of 30 S.W.G. D.C.C. wire, while the secondary has 65 turns of the same wire. The coils are coupled together with the windings running in the same direction, and are mounted with one sixteenth of an inch air space between them, the connections being as follows:

The inside of the primary is connected to the anode, outside primary going to H.T. +. Outside secondary goes to grid, inside secondary to L.T. −.

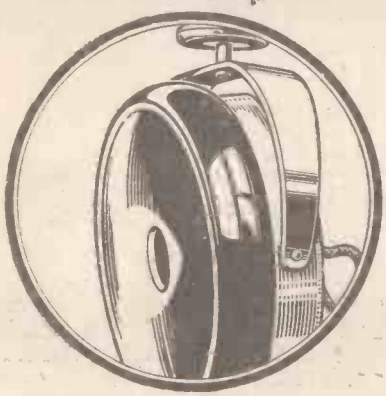
The secondary winding is tuned by means of ·0003 variable condenser.

When two of these transformers are used in the same receiver, great care must be taken to provide ample spacing, as magnetic coupling between them will be strong, owing to the comparatively large diameter. In this case potentiometer grid control will also be desirable.

The transformer described above is intended to be used for coupling a high-frequency valve to a second high-frequency valve or a valve detector. When the transformer is used for coupling a crystal detector to a high-frequency valve the step-up in voltage from primary to secondary is not required, best results being obtained when a step down ratio is employed. In this case the primary winding should consist of 65 turns of 30 D.C.C., the secondary having 40 turns, the primary winding being tuned.

An experimental D.F. wagon recently employed during Army manœuvres.

All Brandes products carry our official money-back guarantee enabling you to return them within 10 days if dissatisfied. This really means a free trial.



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

The ebonite cap of the earpiece is screwed on by special apparatus to a marked degree of tightness. It is almost impossible to unscrew it without a wrench. This means more accurate clearance distance between the diaphragm and the faces of the pole pieces and guards against distortion. But what is more important, it defeats any casual attempt to unscrew the caps which, once done, destroys the *Matched Tone* adjustment.

British Manufacture (B.C.C. Stamped.)

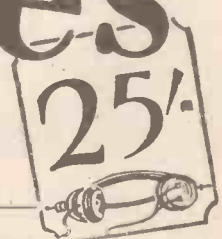
When we assemble the *Matched Tone* Headphones we select, by means of special apparatus, two earpieces whose electrical properties closely agree. One by one the earpieces are tested by vibrating the diaphragm of a fixed telephone receiver with an oscillating current. The vibration is transmitted by a closed column of air to the diaphragm of the one on test which is adjusted immediately beneath the permanently fixed example. It then vibrates in sympathy, thus causing a current to flow through the bobbins. The volume of the current is indicated on the dial of the testing apparatus, and any two 'phones which closely agree are matched and are assembled in one headphone, hence *Matched Tone*. This means greater purity, strength and sensitivity. Obviously, the joint energies of both earpieces in perfect unison means redoubled effectiveness in all these three qualities.

Ask your Dealer for Brandes.

The *Table Talker* is another Brandes quality product at moderate price. Its full round tones are wonderfully clear and pleasing. The 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. Gracefully simple of line, it is finished a shade of neutral brown and is twenty-one inches high. **42/-**

Brandes

The Name to know in Radio



Superior "Matched Tone" Headphones

TRADE MARK

ALL communications respecting advertising must be made to the
SOLE ADVERTISEMENT AGENTS—
JOHN H. LILE LTD.
4 Ludgate Circus
London, E.C.4.
Note New 'Phone No.:
CITY 7261 (*2 lines*)

"POPULAR WIRELESS" ADVERTISEMENT RATES

WHOLE PAGE £40:0:0 | QUARTER PAGE £10:0:0
HALF PAGE £20:0:0 | EIGHTH PAGE £5:0:0

Narrow Column Advts. (3 cols. to page) per inch 30/-
Minimum Space accepted - - half inch 15/-

SPECIAL POSITIONS BY ARRANGEMENT. **NO SERIES DISCOUNTS.** ALL ADVERTISEMENT COPY SUBJECT TO EDITORIAL APPROVAL.

Cover pages close for press 11 days prior to day of issue.
Inside pages close for press 9 days prior to day of issue.

COPY AND BLOCKS MUST BE IN HAND AT LEAST 3 DAYS EARLIER TO ENSURE PROOFS.

"POPULAR WIRELESS" HAS THE LARGEST SALE OF ANY WIRELESS WEEKLY IN :: GREAT :: BRITAIN.

THE HOYT AUGMENTOR.

A Novel American Circuit.

By L. W. CORBETT.

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

Our Correspondent in New York has forwarded to "P.W." the following details concerning the Hoyt Circuit—one which is enjoying much favour with American amateurs just now.

REFERRING to the article "Mainly About Broadcasting" in "P.W.'s" Christmas number, you will see reference to a Mr. Hoyt, who received many European stations from New York during the recent Radio Week, and recorded some of these phonographically. According to the "Telegram Mail" (Radio Section), Mr. Hoyt recorded about fifty different selections from British, French, Spanish, Belgian and German broadcasting stations—truly a record, not necessarily phonographically.

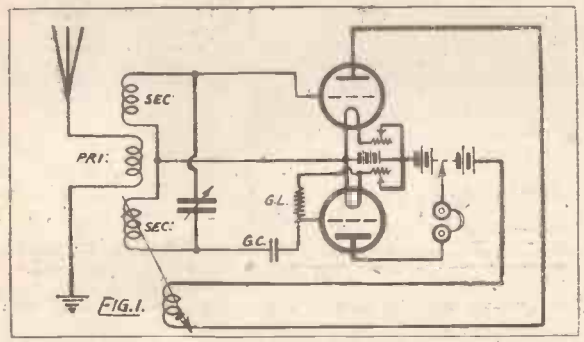


FIG. 1.

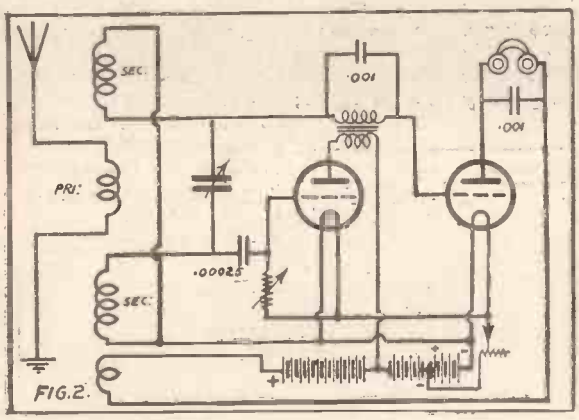


FIG. 2.

The circuit employed was somewhat unusual, one of Mr. Hoyt's own design, and he has styled this new method of reception "Augmentation." Custom has been laid aside and the systems of the past ignored, and Mr. Hoyt's experiments have resulted in a novel circuit which apparently satisfies the most severe requirements which can be imposed on present-day broadcasting.

And selectivity has not been overlooked in order to obtain maximum range. The circuit is unusually selective, and the augmentor is quite capable of tuning-out a broadcaster within a mile and receiving other more distant stations on a wave-length varying by only ten metres or so from the local station's wave-length. The locality in which Mr. Hoyt obtained his excellent results is particularly bad for radio reception — certainly worse than any locality in London, which all adds to the credit of this really remarkable receiver.

The diagram, Fig. 1, shows the fundamental circuit stripped of all except the essential parts, and by just glancing at this circuit you will see that it is entirely unique. As will be seen from the diagram, the incoming impulses are transferred to the secondaries from the aperiodic primary, one terminal of each of the former being connected to the grid circuit of a valve, while the remaining two secondary connections are common, and go to the filament circuits of the valves. A single variable condenser is employed to tune both the secondaries, and thus the two grid circuits are each brought into resonance with the incoming signal and respond to the impulses in opposite phase; so when the grid of one valve is going positive the other grid is swinging negatively. Therefore, the incoming signal is causing the simultaneous fluctuation of the two grids. One of these valves functions as an amplifier, while the second valve is detecting the same impulse at the same time. By simply removing the augmentation valve an ordinary single-valve circuit remains. A coil is placed in the plate circuit of the augmentation valve, and this is coupled variably to the secondary coil. Its use is to properly phase the amplified high-frequency variations in that circuit and to inductively add their effect to the high-frequency variations in the grid circuit of the detector valve.

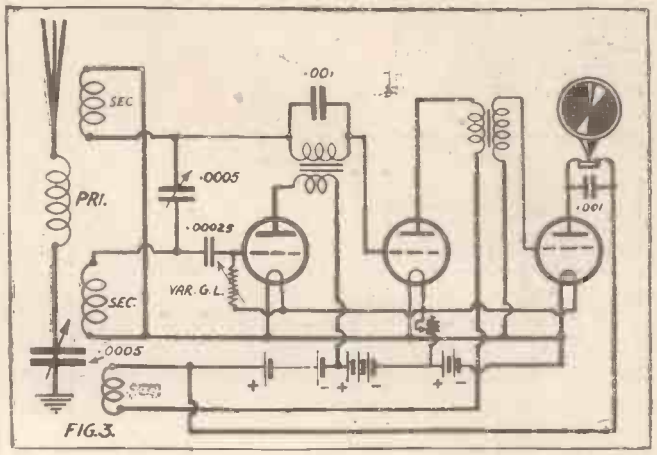


FIG. 3.

Efficient Amplification.

Now this circuit gives us a stage of H.F. followed by a detector valve, much more efficient than the conventional H.F. and detector circuit.

If we desire to add a stage of L.F. amplification, this may be accomplished quite simply without the addition of a further valve, the augmentation valve doing the work. The primary of the transformer is placed in the plate circuit of the detector valve, and the secondary in the grid circuit of the augmentation valve, as Fig. 2 shows.

(*Continued on page* 1418.)

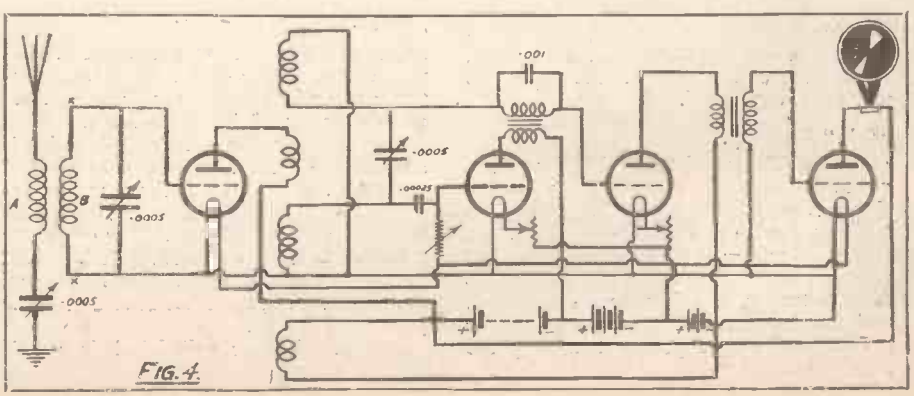
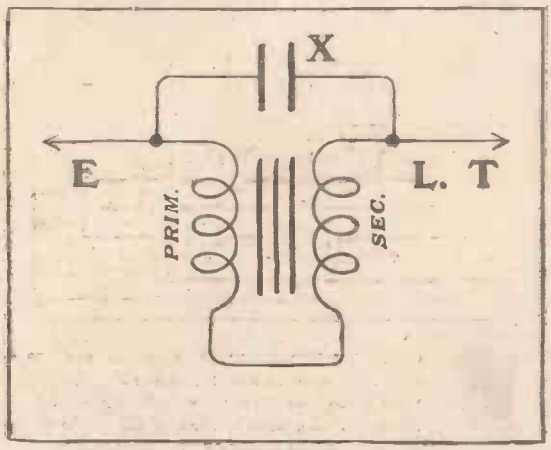


FIG. 4.

UTILISING ODD TRANSFORMERS.

EXPERIMENTING with super circuits which employ very large honeycomb low-frequency quenching coils (such as those used in the Armstrong circuits) is a somewhat expensive proposition to those who purchase ready-made coils, since the price of these is rather high, but if an ordinary 5 to 1 step-up low-frequency transformer is arranged as shown in the accompanying sketch it will give quite good results as an alternative arrangement. The In Primary and In Secondary terminals are short-circuited with a piece of copper wire, so that the same effect is obtained as when using the two large coils—i.e., a suitable quenching oscillation is set up in order to keep the valve on its critical oscillation point. The fixed condenser, X, which is connected in shunt with both windings, should have a value of about ·0001 mfd.

Of course, this substitution of the 1500 and 1200 turn quenching coils in the Armstrong may not necessarily be as effective as the employment of the proper coils, but it is well worth trying. The condenser is the only critical point, and the value of this component should be varied until best results are obtained.

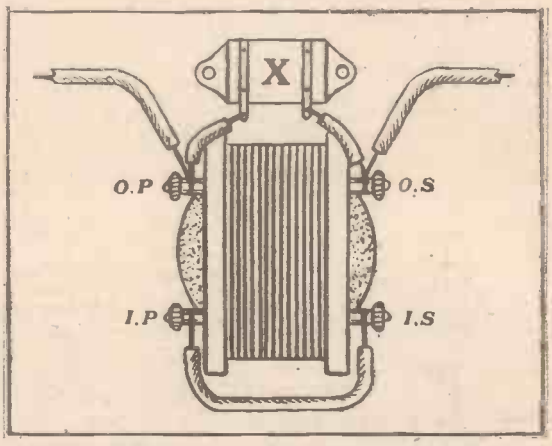


TECHNICAL NOTES.

(*Continued from page* 1409.)

way to tell which is the correct connection is to plug the 'phones in the second stage of amplification and tune-in loud signals.

The 'phone-caps should then be removed, and one edge of the diaphragm should be lifted up about an eighth of an inch with the finger. When the 'phones are connected in one direction, a very much greater pull will be noticed than when connected in the other direction. After this has been determined, some kind of mark may be placed on the 'phone terminal that was connected to the plate of the valve when the greater pull was exerted upon the diaphragm, and the 'phone should always be connected with the marked terminal to the plate. ("Radio," Australia).



Helium Valves.

Great advances have been made in the use of transmitting valves containing traces of pure helium, and a number of foreign broadcasting stations regularly use valves of this type for the transmission of their programmes. Hitherto it has been found impossible to obtain the residual helium in the tube in a state of sufficient purity, and

(*Continued on page* 1451.)

THE HOYT AUGMENTOR.

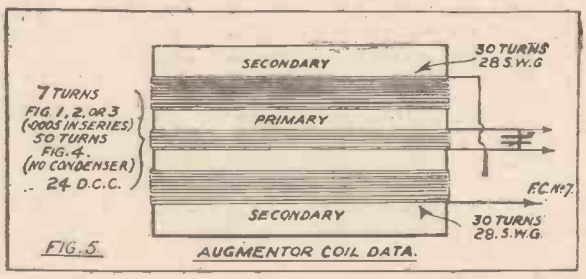
(*Continued from page* 1417.)

The fixed condensers shown in the circuit are essential. Sometimes a fixed condenser of low capacity placed across the primary of the L.F. transformer will also help. It is highly important that a really reliable grid leak should be employed, and preferably a variable one. It should be capable of variation up to five or six megohms. The ideal receiver for reception of local stations with a frame aerial and on the loud speaker is shown in Fig. 3, and employs three valves, giving a stage of H.F., a detector, and two stages of L.F. amplification. The primary is shown tuned here with a series variable condenser, which is perhaps desirable when utmost selectivity is essential, although for local work the aperiodic primary is very useful.

"D X" Reception.

For selectivity and real "DX" work it would be impossible to improve on the circuit shown in Fig. 4, employing an additional stage of H.F. amplification. Of course, here we have more controls, but although difficulty may be experienced at first in tuning, it will soon be mastered, and the amateur will be amply repaid for his trouble and expense in adding the extra valve.

As regards the coils A and B in Fig. 4, these may be ordinary plug-in basket coils of the usual size, primary about 75 turns, and secondary 50 turns. Perhaps a slightly smaller primary will be best for the lower wave-length B.B.C. stations. This primary



coil may be omitted if required, and aerial and earth connected to X—X on coil B. This will, of course, simplify tuning, and selectivity will still be very good, although not quite so good as if A were included.

Now if either Figs. 1, 2 or 3 are used, it is advisable to place a variable condenser of ·0005 mfd. in series with the primary of the augmentor coil, although not essential if selectivity is not aimed at. This condenser is not shown in Figs. 1 and 2, but is in Fig. 3. In the four-valve receiver this primary, shown here as C, need not have a series or parallel condenser.

A 3-in. diameter cylindrical former is used for winding the augmentor coil, and the directions are as follows: The two secondaries each have 30 turns of 28 D.C.C. wire, while the primary, which is wound between the secondaries with approximately ¼-in. spacings, has 7 turns if it is to be untuned as in Fig. 4; but if the series condenser is to be included as recommended for Figs. 1, 2 and 3, it should have about 50 turns. The secondaries will, however, be the same.

The booster coil is arranged to rotate within the former of the augmentor coil, and is mounted to obtain maximum coupling with the secondary coil, shown in the lower position in each diagram. It should be wound on a former slightly less in diameter than that on which the primary and two secondaries are wound, about 2¼ inches, and should have 40 turns of 30 D.C.C. wire.

Successful Circuit.

Although particulars of this circuit have only recently appeared in the New York "Telegram Mail" (Radio Section), many "fans" in the States have built this receiver, and highly illuminative reports of success have been received from all over the country.

The technical staff of POPULAR WIRELESS *has not yet fully investigated the possibilities of this circuit, but is doing so, and will report upon same at an early date.*

HOW TO CONSTRUCT A STRAIGHTFORWARD SINGLE-VALVE SET.

Easy To Make and Operate.

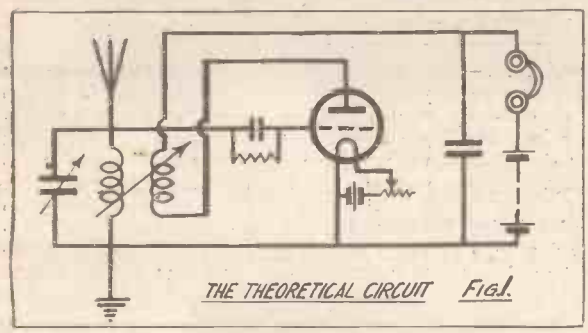
Built and Designed by G. V. DOWDING, Grad.I.E.E.
(Technical Editor, "Popular Wireless.")

The constructor will find it difficult to go wrong in building this useful one-valve set. The photographs alone should prove a most reliable guide, while the text is concise and can be easily followed by the veriest tyro.

THE construction of a one-valve receiver presents nothing at all in the way of difficulties or complications, and the set, the full constructional details of which will be given in this article, is perfectly orthodox in both circuit and design. Also, it is not claimed that it is capable of abnormal ranges of reception, but it must be remembered that America has frequently been heard on home-made receivers employing a similar circuit. Using a good aerial and earth, it should be possible to hear 5 X X on this set anywhere in this country, while ordinary B.B.C. stations should be clearly heard up to 50 miles or so. However close to a B.B.C. station, it will not satisfactorily operate even a small loud speaker; to do this at least one stage of L.F. amplification will be necessary, and this can very easily be added after, if desired.

Here is a list of the parts that will be required, together with approximate costs.

	s.	d.
·0005 mfd. variable condenser ..	7	0
Filament resistance (Microstat) ..	2	9
Coil holder (two-way for panel mounting, Goswell Engineering)	3	0
Grid leak and condenser	4	6
·001 mfd. fixed condenser	1	6
8 terminals, 4 valve sockets	2	0
Ebonite	3	0
Wire, wood for case, etc., say ..	2	6
Cost of completed set	26	3



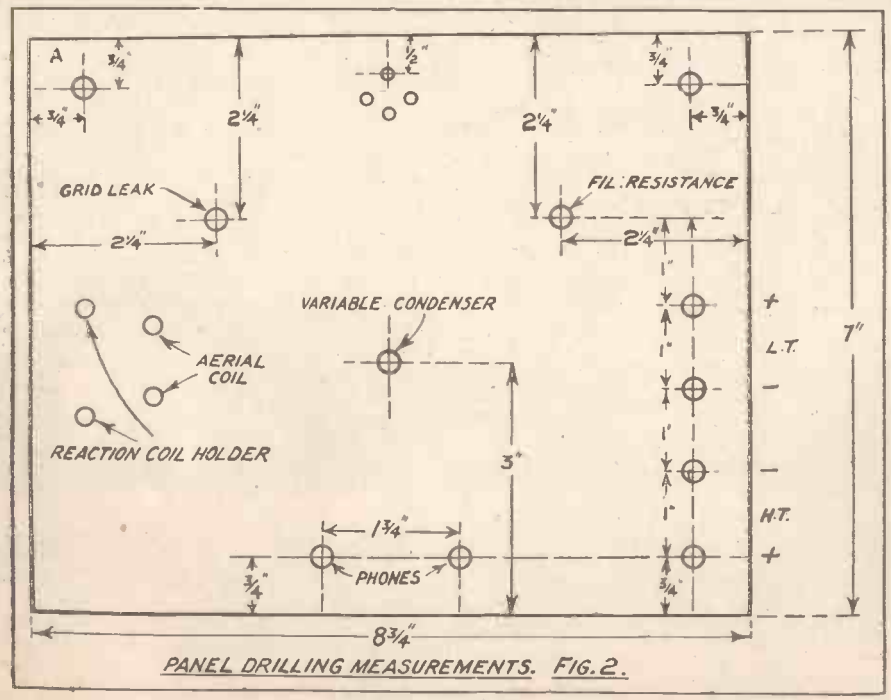
THE THEORETICAL CIRCUIT FIG.1.

In a receiver of this nature the question of components is not so very important, although to ensure maximum results they should be of good make and above suspicion. This applies more particularly to the grid leak and condenser. It will be noticed that a variable grid leak is used in the original model, but this is by no means essential; it is a useful refinement, but the fixed type can be used if desired.

Fig. 1 shows the theoretical circuit employed. If the constructor is unable to understand the symbols used, it need not worry him as long as he adheres closely to the following instructions.

The very first item to receive attention is the panel-drilling, and referring to Fig. 2, it should be noticed that the hole marked "Grid-leak," will not be needed if the fixed type is used. $\frac{3}{16}$-in. ebonite should be employed, and this should be cut and smoothed down to the overall size indicated. Preliminary drilling should be carried out with a small drill. The eight terminal holes should be tapped, if possible, to take the thread of the terminals employed. This is not essential, but is to be advocated as an added precaution against loosening terminals and broken connections. The other holes can be "reamed" out to the sizes required to take the various components. A "reamer," by the way, is an excellent tool which costs but a few pence and can be obtained at any ironmongers.

The completed set.



PANEL DRILLING MEASUREMENTS. FIG. 2.

Wiring Instructions.

Should a Goswell Engineering panel-mounting coil holder be purchased, it will be found that a drilling template is provided, while in the case of the valve sockets a pin, with the assistance of Fig. 2A, will give the exact drilling points. The valve sockets should be mounted first, and after this the terminals can be secured in position. The coil holder should then be fixed to the panel and the other components mounted.

The fixed condenser and the grid leak and condenser, if the former is of the fixed type, need not be mounted on the panel by any other means than their own connecting wire, for 16-gauge tinned wire is to be used, and this will hold them as securely as screws.

The wiring up can now be proceeded with. If the terminals were screwed in threaded holes, soldering to these is not essential; loops will prove sufficient. Soldering the leads to the valve sockets should be carried out as per Fig. 4. With round-nosed pliers a small loop should be fashioned in the

(*Continued on page* 1420.)

HOW TO CONSTRUCT A STRAIGHTFORWARD SINGLE VALVE SET.

(*Continued from page 1419.*)

end of the wire, and this loop slipped over and pinched on the end of the screw. A drop of solder will now make a good firm job of it. "Spot" soldering where the two points to be joined are laid together and a spot of solder used to cement them is bad practice.

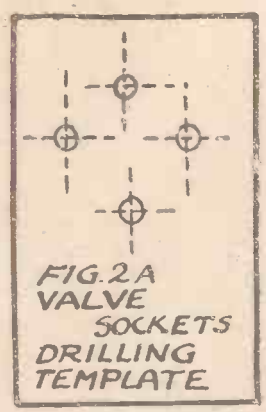
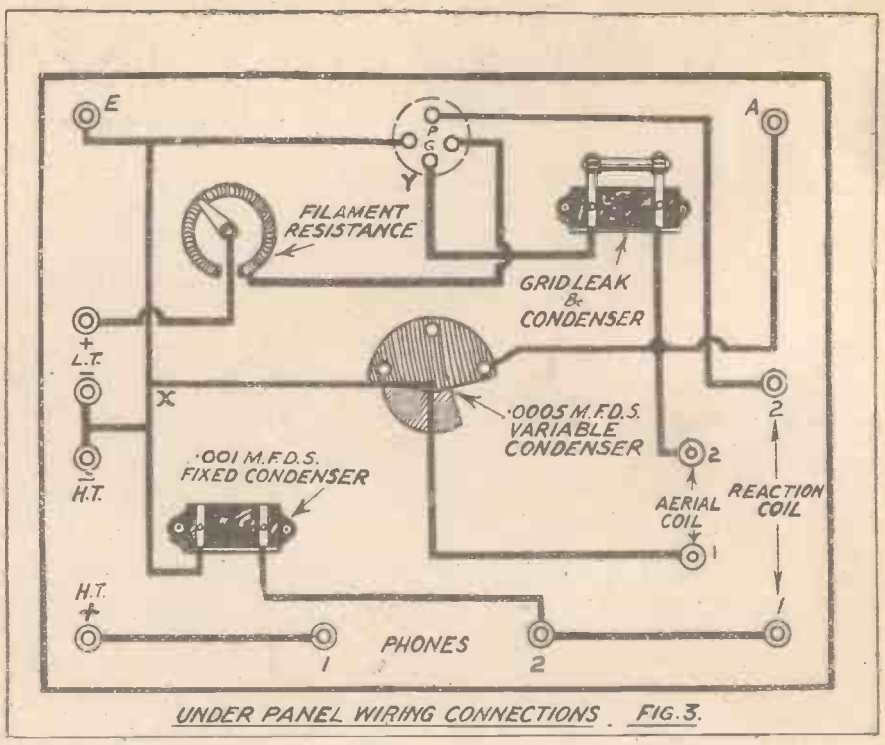


FIG. 2A VALVE SOCKETS DRILLING TEMPLATE

Figs. 4A and 4B show how the wire should be bent to make such connections as are indicated in Fig. 3 at Y and X. The photograph will show this too. The first connections that should be made are between E and filament valve socket, L.T.— and H.T.—, H.T. + and phones 1, phones 2 and reaction coil 1, grid valve socket and grid leak and condenser. The L.T. + can be connected to one terminal of the filament resistance, the other being taken to the remaining filament valve socket.

Aermonic bending pliers prove very useful, as with their aid nice right-angle bends can be made in the wire. The connection between the earth lead and the fixed condenser can now be made, and then that one between this lead and H.T.— L.T.—(see Fig. 3). The remaining connections should not prove difficult after consulting the photographs and Fig 3, the latter being a more or less exact representation of the actual wiring.



UNDER PANEL WIRING CONNECTIONS. FIG. 3.

Concerning the Case.

Traces of soldering flux and all dust should be carefully removed, and then, if self-indicating terminals were not employed as in the original set, transfers can be brought into use.

The last constructional requirement is that of the case. Now, this can be of the simple flat type as illustrated in the photographs and Fig. 4, the more ambitious desk type, or the still more ambitious upright cabinet type. We feel that detailed instructions respecting the making of the case will not be necessary, as those able to make it will not need them, while those who cannot will prefer to purchase one

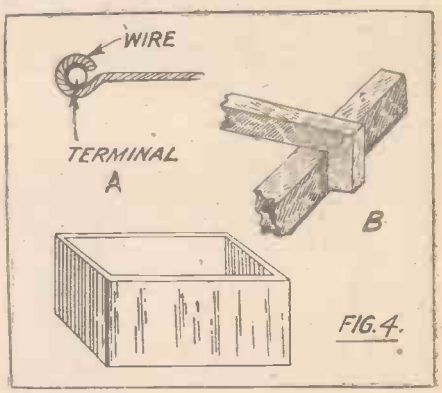
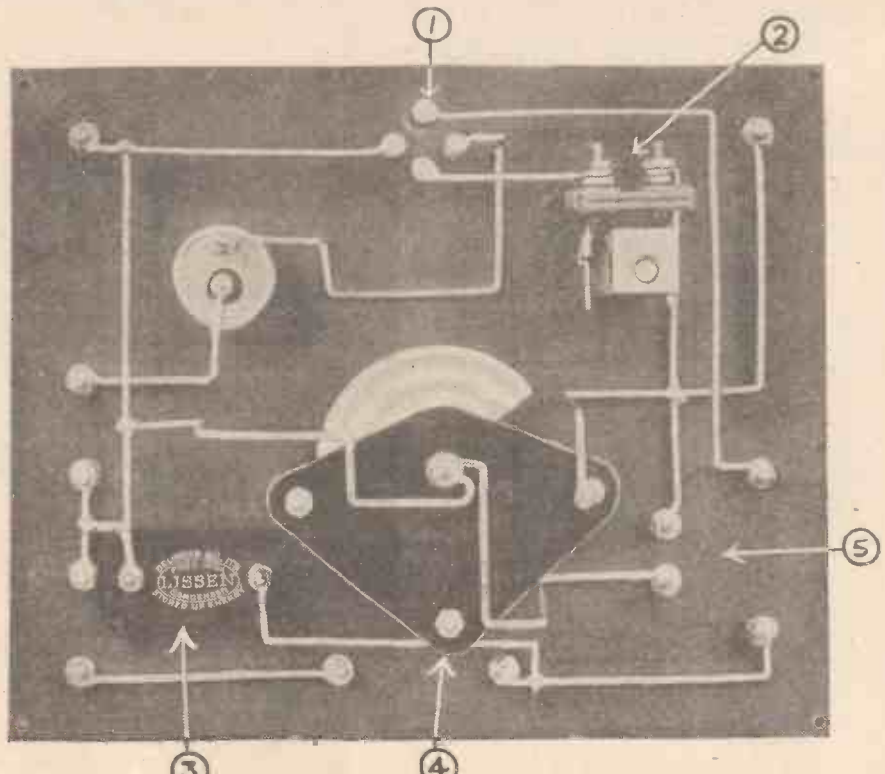


FIG. 4.

ready made. In any case, it will require to be 8¾ in. by 7 in. outside measurements, not less than 3 in. deep inside, and should be of ⅜ in. material, teak or mahogany to be preferred.



Back of panel wiring. 1. Valve sockets. 2. Variable grid leak and condenser. 3. ·001 mfd. fixed condenser. 4. ·0005 mfd. variable condenser. 5. Coil holder.

The Coils to Use.

Everything is now ready for the "try out." For normal broadcast wave-lengths a 35-turn coil should be used for the aerial and 50 or 75 for the reaction, while coils of 150 and 100 turns will be required for 5 X X.

Should signals be very weak and strengthen when the reaction coil is moved AWAY from the aerial coil, then it indicates that the connections to the reaction coil require to be reversed, but if Lissen coils are used this trouble will not arise, as the connections are correct for these and a Goswell coil holder.

HOW TO MAKE A USEFUL H.T. BOX.

FROM A CORRESPONDENT.

ANY amateur can construct this neat and handy H.T. box with little trouble, and only a few tools are required.

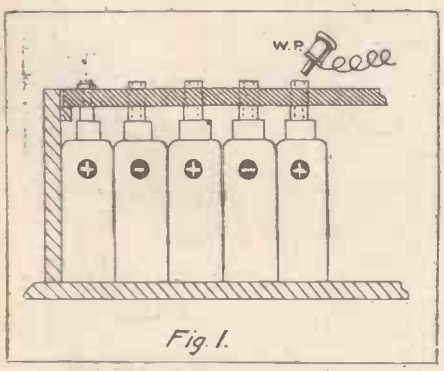


Fig. 1.

First construct a case to take about a dozen flash-lamp batteries, or the number needed.

The inside measurements necessary to contain one dozen flash-lamp batteries are as follows: 3 in. deep, $2\frac{3}{8}$ in. wide, and $9\frac{1}{4}$ in. long. Only hard or thick wood should be used, such as oak, teak or mahogany, but if deal or other soft wood is employed, it should be double the thickness of a hard wood. To proceed with the making of the box first deal with the base. This should have an overlap of $\frac{1}{4}$ in. all round.

This gives a better finish and provides a more solid foundation. The overall length of the base should be, presuming we are using $\frac{1}{4}$ in. oak, $10\frac{3}{4}$ in. long and $3\frac{7}{8}$ in. wide.

Now mark off $\frac{1}{2}$ in. all around inside the base, and another line $\frac{3}{4}$ in. from the side. The $\frac{1}{4}$ in. space between these lines are for the position of the sides and ends.

The Socket Connections.

The $\frac{1}{2}$ in. outside these lines may be chamfered or rounded as desired. Next comes the ends. Cut two pieces of the same wood 3 in. by $2\frac{3}{8}$ in., these should be fixed to the base on the allotted space between the two lines. They can be glued and two $\frac{1}{2}$ in. screws placed about $\frac{1}{2}$ in. in from each end.

Make sure that these are firmly affixed to stand the strain of the batteries. After this the sides require to be prepared; these should measure $9\frac{3}{4}$ in. by 3 in. See that these also are firmly affixed to the base and end.

All that remains now is the lid. This should preferably be of ebonite, measuring $9\frac{1}{4}$ in. by $2\frac{3}{4}$ in. by $\frac{1}{4}$ in. thick. This should be marked for drilling, as illustrated in Fig. 3, using a $\frac{1}{4}$ in. drill.

Now take a piece of tubing about a foot long. This should be $\frac{1}{4}$ in. in diameter, with a bore of about $\frac{1}{8}$ in. Cut this into a number of $\frac{5}{8}$ in. pieces. To one of these solder a piece of copper wire, 18 gauge or thereabouts, $\frac{1}{8}$ in from the end. Place this piece of tubing into the first hole in lid, and taking another piece of tubing affix wire from first piece by giving it two turns, then solder and cut off any surplus wire. Then tap this into the lid (Fig. 4). Do not solder connections after the tubing is fixed in lid, this must be done before.

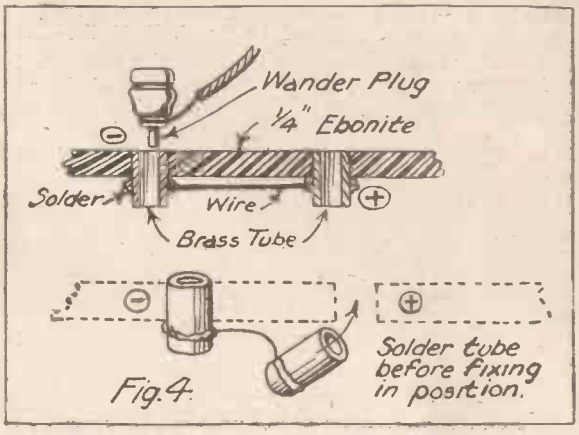


Fig. 4.

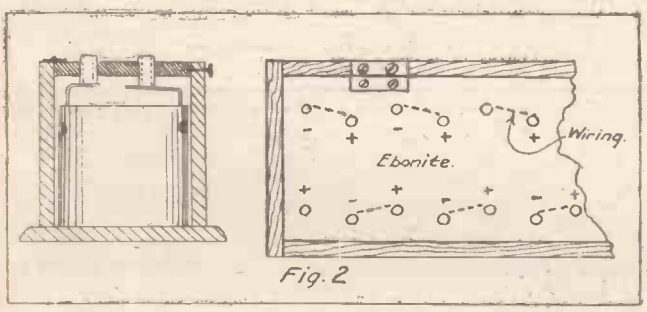
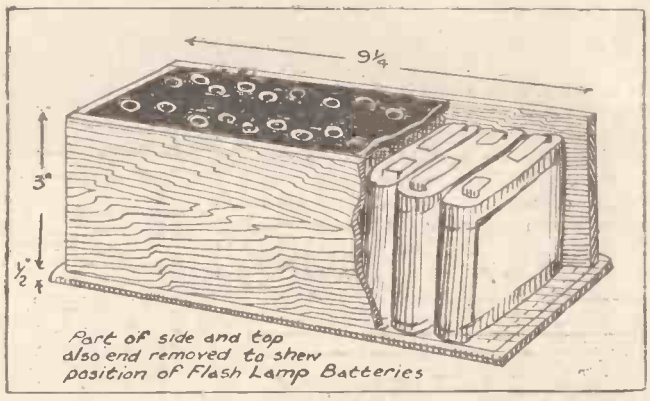


Fig. 2.

A Necessary Fastening.

It will be seen in the diagrams, and more particularly in Fig. 2, that these small pieces of tubing act as sockets, and are connected up in pairs to link the batteries together.



One socket at each end only fails to make "a pair."

The fixing of the lid is the last item; this should be affixed with two strong hinges at about 2 in. in from each end. The front of the lid will need a clip or pin, driven through the side, as in Fig. 2. This is to hold lid down so as to enable the tappings to maintain perfect contact.

Referring to the accompanying diagrams, Fig. 1 represents a sectional view of the case, showing how the sockets are arranged. Fig. 2 illustrates the method of making contact between the sockets and the batteries and how the wiring is carried out. Fig. 3 gives drilling details of the ebonite panel, and Fig. 4 shows the method of fixing the sockets, while Fig. 5 clearly shows the positions of the batteries in the case.

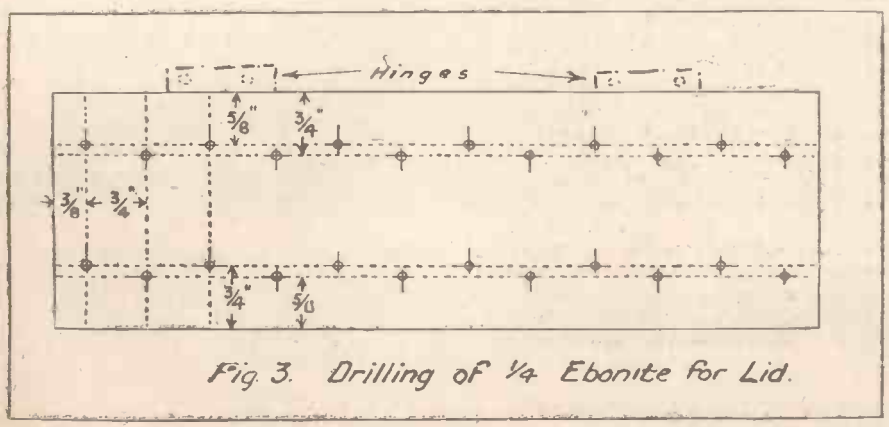


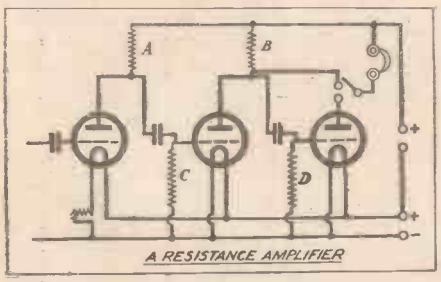
Fig. 3. Drilling of ¼ Ebonite for Lid.

Constructional Notes

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

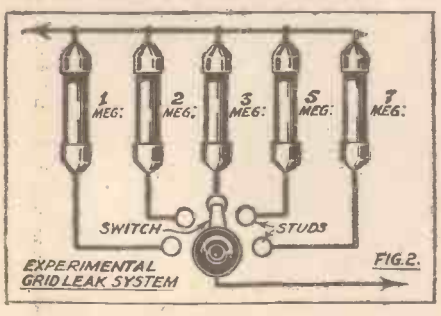
A Resistance Amplifier.

EXPERIMENTERS who specialise in resistance-coupled amplification will be interested in the circuit herewith (Patent 220,488), the special feature of which is the values of the resistances. The object of the invention is to make the first valve operate as a detector amplifier, and the subsequent valves as amplifiers. It is stated that the circuit



A RESISTANCE AMPLIFIER

operates with R type valves, using H.T. of 60 to 100 volts, thereby dispensing with the extra large battery generally required for resistance amplifiers. The resistance A has the high value of 5 megohms. This anode is capacity-coupled to the grid of the first amplifier, the grid leak of which is of the high value of 20 megohms. The anode resistance B in the anode circuit of the second valve is also high, 3 megohms, whilst the last grid leak is 10 to 15 megohms. It is stated that, owing to the values chosen, the first two valves operate on the bottom bend of their characteristic curves, whilst the third valve operates on the straight portion. Readers interested will find some useful characteristic curves given in the specification (which is obtainable from the Patent Office, London, price 1/-), and many interesting experiments with the circuit will readily occur to them.



EXPERIMENTAL GRID LEAK SYSTEM FIG.2.

Experimental Grid-Leak System.

The value of the grid leak controls to a large extent the distance-getting qualities of the circuit. Strong, loud signals from local stations, for example, in general require a greater leakage to prevent the grid from being paralysed. If the same large value of the leak (that is, small value of the resistance) is used for weak distant signals, it is probable that the signals will not build up sufficiently to produce efficient operation. In many cases a commercial or experimentally made grid leak of the variable variety is sufficient, but where an experimental board or panel is used, on which circuits are tried out differing considerably in their characteristics, the somewhat elaborate system of grid leaks shown in the figure is worth while. Its arrangement will readily be understood from the figure. It consists simply of a number of fixed grid leaks, of values, say, 1, 2, 3, 5 and 7 megohms, which can be thrown into circuit by means of a selector switch. It is a further advantage if an ordinary variable grid leak, of low resistance value, be included in series with the selector, so as always to be in series with the fixed leaks.

Safety Battery Plug.

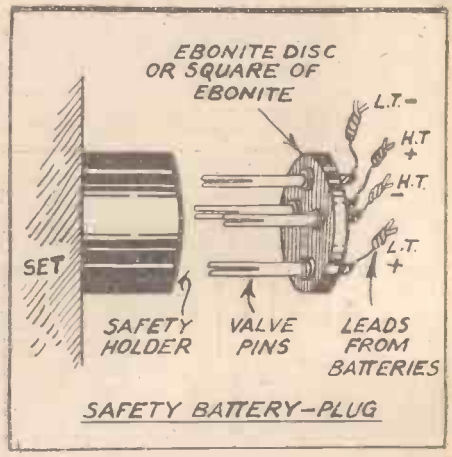
In spite of frequent warnings contained in the many articles for constructors, perhaps the commonest cause of mishaps to valves is the mistake in connecting in the H.T. battery. The terminals for the two batteries being so close together, it is only with great precaution that accidents can be avoided. The little device shown in the accompanying figure, however, goes a long way to the prevention of trouble. It depends upon the well-known artifice of making a plug which can be inserted only one way round. Any type of such plug may, of course, be used, but the base of a discarded valve comes in handy for the purpose, or failing this, a disc of ebonite may be used, in which four valve pins are inserted in the proper positions. These positions are obtained in the same way as the drilling positions for a valve holder on the panel.

Risk Eliminated.

Against the side of the cabinet of the set, or upon the top of the panel, a valve holder is placed. This should be of the "safety" variety, that is, having the tops of the metal socket tubes not quite reaching to the top of the ebonite, so that contact is not established until the plug is making entry into the correct sockets. Having made your connections to the proper sockets of the holder within the cabinet, you then make the corresponding connections of the battery leads to the valve pins of the plug, and thereafter you can afford to forget about accidental wrong connections of the batteries. Great care must be taken to make the connections properly in the first instance, and afterwards the plug should be left connected to the batteries. Every time there is any need for disconnection, there is the possibility of a mistake in again connecting up. But with this device there is practically no need to disconnect from the battery.

Variable Grid Leak.

Here is an addition to the many kinds of variable grid leak. This particular invention is the subject of Patent 224,295, and has certain features which make for constancy and reliability in working, which is more than can be said of many variable

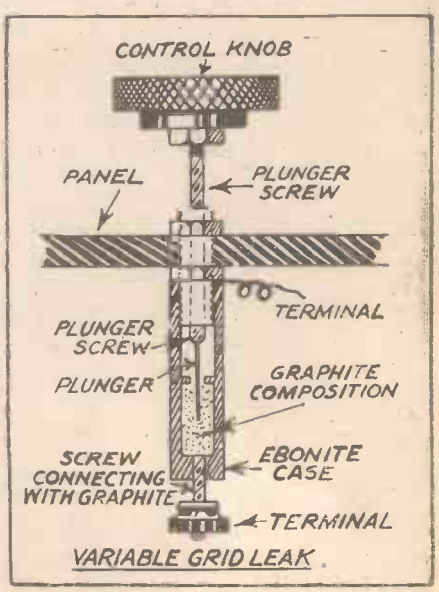


SAFETY BATTERY-PLUG

grid leaks on the market. A threaded brass tube at the top secures the device to the panel by means of lock nuts, and through this passes a threaded brass-rod plunger, to the lower end of which is attached a short length of plain brass wire or fine rod.

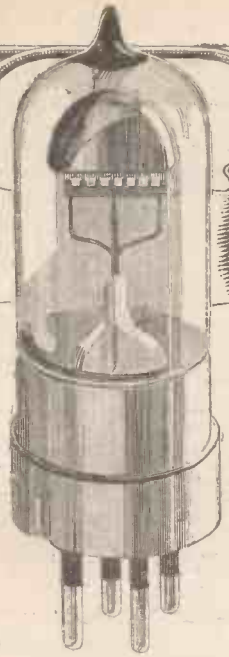
Smooth Variation.

The latter enters a chamber in which is a special graphite paste, which constitutes the resistance element. The case or container is an ebonite or such-like tube, suitably hollowed out as shown, and another brass screw entering the lower end, and fitted with a screw terminal, forms the remaining connection to the leak. The resistance is varied by working the plunger so that different lengths of the column of



VARIABLE GRID LEAK

paste are in circuit between the two terminals. If desired, a disc may be fitted to the control shaft, working alongside a vertical scale, so that the rise and fall of the plunger is indicated on the scale. This is not shown in the figure.



Cossor
Bright Emitter

Edouard Branly

Wuncell
Dull Emitter

Iron filings put to a new use!

JUST over thirty years ago that grand old man of Science, Edouard Branly, invented one of the first detectors ever used for wireless. In those days, of course, Wireless was little more than an inventor's dream, the very greatest distance that signals had ever been transmitted without the aid of wires was only a few yards. With Branly's iron filings detector—afterwards called the coherer—a new era dawned.

A few years later, as we all know, signals were successfully transmitted—to the wonderment of the whole world—from Cornwall to Newfoundland, and received on the Coherer. Surely one of the most remarkable uses for iron filings ever discovered.

It is a big step forward from Branly's Coherer to Dr. Lee Forest's three-electrode Valve — and from the first valve to the latest Cossor Wuncell Dull Emitter is also another big step forward.

Instead of a Valve having a filament consumption of nearly ¾ of an amp. and operating at 4 volts, there is now available in the Wuncell a Valve that functions at its best when its filament glow is almost invisible.

So small is its filament consumption, in fact, that a very small portable 2-volt accumulator will run the average 2-valve Set more than a fortnight without recharging. And the cost of a recharge is only a few coppers.

But low operating cost is only one of the many exclusive Wuncell advantages. In volume, sensitiveness, long life, freedom from microphonic noises, it is fully the equal of Cossor Bright Emitter Valves. No greater tribute than this could be paid. Before you select your Dull Emitter Valves, get one of our large illustrated Folders, describing the Wuncell, from your dealer free of charge, or send us a post card for one.

All Cossor Valves reduced in price.

Cossor Valves

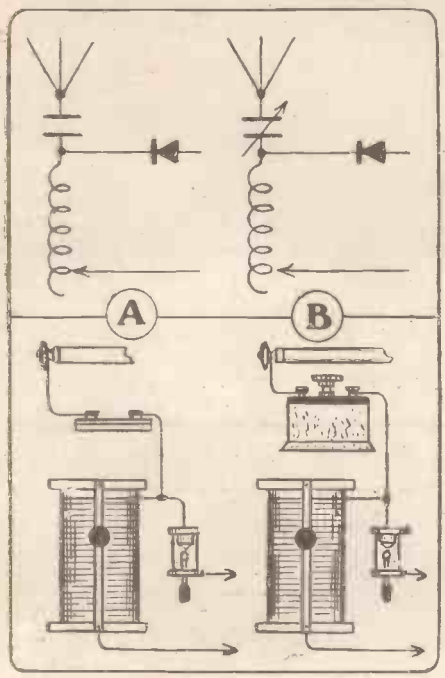
HOW TO START AN EXPERIMENTAL RECEIVING STATION

By OSWALD J. RANKIN.

PART II.

The series of practical experiments outlined by Mr. Rankin will enable the amateur to lay the foundations of a thoroughly comprehensive experimental workshop.

IT is assumed that the would-be experimenter has carefully followed the advice given in the previous article, and that he has now increased his stock of components according to instructions so as to be able to participate in this, the next progressive stage.



Repeat the experiment described in Part 1 (Figs. A1—B1) and (1) connect the ·0003 mfd. fixed condenser in series with the aerial lead-in as shown at A, and then replace this with the ·0003 mfd. variable condenser as shown at B. Carefully note results, and also note that since the condenser is in series the wave-length value of the coil is *reduced*. Therefore it will be found necessary to increase the amount of active inductance by moving the slider further along the coil. At B every adjustment of the condenser will necessitate altering the position of the slider; the best position of the slider in conjunction with a fixed setting of the condenser, and vice-versa, will only be found by trial. The general rule is to use as much inductance and as little capacity as possible.

Obtaining Selectivity.

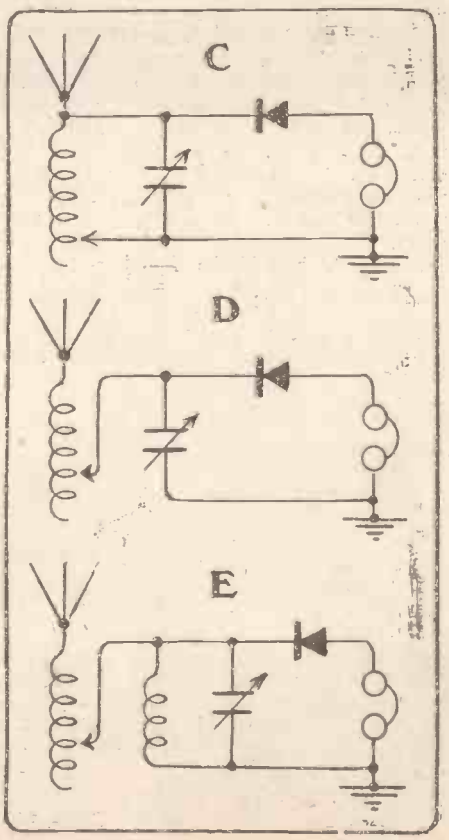
Now connect the variable condenser in parallel as indicated in Diagram C, and note that since the inductance value of the coil is now *increased*, it is necessary to adjust the slider in the opposite direction—i.e. from the previous setting towards the aerial end of the coil. Again, the best adjustment of the slider and condenser will be found by experiment. Now connect up the condenser as shown at D. Do not be surprised if the signal strength falls off slightly, but carefully notice if any interference is now audible. Try both the ·0003 and ·0005 mfd. variable condensers, then tap off 75 turns from the loading coil and connect this in parallel with the condenser as shown at E. This latter arrangement should almost entirely eliminate any interference which may have been troublesome with the ordinary direct-coupled circuit.

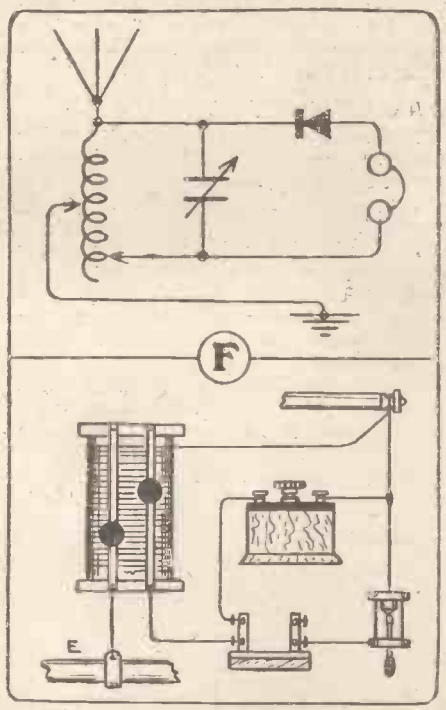
Showing how variometers are mounted for experimental purposes.

Now fit an extra slider to the slide inductance and try out the circuit shown in diagram F, using the ·0005 mfd. variable condenser for tuning the secondary or closed circuit. This, also, will be found a simple and effective means of eliminating interference, providing it is not of a very serious nature.

Now repeat all the above experiments on the wave-length of 5 X X, using the loading coil which is connected in series with the aerial lead-in as before.

Next, take the standard broadcast variometer and connect it up as shown in diagram G. It will be found that tuning is very sharp; that signals are consequently louder, but that the circuit is not sufficiently selective to cut out interference.





Try using the variometer in place of the slide inductance in conjunction with the loading coil for 5 X X; also try the variometer in series with the slide inductance on the ordinary broadcasting and spark station wave-lengths.

The accompanying photograph illustrates a convenient method of mounting variometers for experimental purposes. On the left the instrument is mounted on an

(*Continued on page* 1426.)

AMERICA CALLING.

By L. W. CORBETT.

LET me begin this article by lifting, wholesale, a paragraph which recently appeared in the "New York World" (Radio Section):

"Capt. P. P. Eckersley, chief broadcast engineer of the British Broadcasting Co., who recently paid us a visit to study in our school of broadcast development, says that he does not admire American broadcasting.

"'America can't teach us anything in the radio line. They are working on entirely different lines from us, with a view to making radio broadcasting an electrical hobby and not an artistic enjoyment. The Americans are more interested in listening-in to a distant station, and searching around the continent for new cities than in the message or concert itself.'

"And it was also Captain Eckersley himself who said, when broadcasting from one of our local stations, that the state of broadcast development in this country was astounding and beyond comprehension.

"Like many others who have visited us for a short time, he presumes to criticise a system and a national institution of which he knows nothing—oh, well, we have been criticised by foreigners of considerable note before this and are getting so that we enjoy their humour. And still we can't help feeling somewhat annoyed by their presumptive attitude, and feel with the philosopher that 'criticism is the cheapest thing in the world.'"

A "Close Up" of W J Z.

The heading to this paragraph, "Another Country Heard From," I presume, was suggested by the humour which the executives of this particular Radio Section are "getting to enjoy."

It is a pity that such a well-known paper should fail to understand Captain Eckersley's statements (with which, by the way, I am heartily in agreement), misconstruing them to such an extent as to give them an entirely different aspect.

Yet Captain Eckersley's statement from K D K A—I believe it was this station—that the state of broadcast development in America was beyond comprehension is perfectly correct. There are many more broadcasting stations to a given area in America than in England, and the same applies to listeners. Even a week's stay in the States makes this obvious—and criticism by one who is thus in a position to criticise is not necessarily presumptuous.

Had Captain Eckersley announced that the B.B.C. had much to learn from America the "World" would no doubt have informed its readers that broadcasting in England was poor, that the people of England were dissatisfied with the quality of the B.B.C.'s programmes and were hoping for American engineers' help, and such like.

* * *

As I write these notes I am being entertained by W J Z, the Radio Corporation station from whence is being broadcast the whole of "Marjorie," one of Broadway's successful musical shows. Roy Royston, a British actor, is taking one of the leading parts, and, judging by the applause of the audience, they are enjoying the show as much as I am. To-night, being cold, dark, and atmospheric free (on this side), I am wondering how many fans—excuse me, amateurs—in the British Isles are receiving this transmission.

Licences to Increase Power.

I believe that W G Y and W R C (Washington) are linked up with W J Z, and are also broadcasting "Marjorie," which adds to the chance of this play being received in England. I always used to get W G Y better than W J Z from a spot just outside London.

It is a great pity that the B.B.C. are unable to obtain permission to broadcast some of London's plays, but perhaps those responsible for the ban will soon realise what a pulling factor the broadcasting of a "good" play is.

Advertising in all its forms, bear in mind, is much more advanced in America than in Great Britain, and a good playwright is not likely to go to the expense of having his production broadcast if it is likely to adversely affect the box office receipts.

"The Miracle," which has just terminated its run out here at the Century Theatre, New York, was also recently broadcast—in this instance by W G B S, Gimbel's new station.

This latter station, by the way, comes in very poorly, and I think now that my remarks in previous American notes about a new station opening which may be heard in England are rather obsolete. W G B S certainly broadcasts some tip-top programmes and their only hope is extra power.

And while on the point of extra power, it is of interest to note that several stations in the States have been granted licences to increase their power to 5 kw. This increase is to be made in 500-watt steps, and if at any time the increase is found to interfere with other stations, the licence will be cancelled. At present, most of the large stations employ only 1 kw. British "D X hounds" will no doubt benefit by this new power increase arrangement when it comes into force.

HOW TO START AN EXPERIMENTAL RECEIVING STATION

(*Continued from page 1425.*)

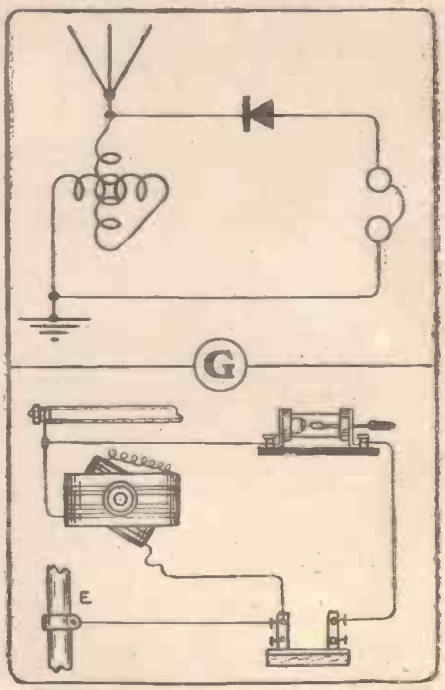
ebonite panel, 3½ in. by 3 in., which is provided with two terminals and then screwed to one edge of a wooden baseboard, 3½ in. square. On the right a wooden panel is used, this being previously well-impregnated with melted paraffin wax, and afterwards given a coat of shellac varnish.

At this stage a few experiments with fixed inductances might also be tried. Take a 3 in. diameter former and wind on three separate coils having 25, 35, and 50 turns respectively. Try each coil in turn, connected up as shown at C with the variable condenser in parallel, and with the lower end of the coil connected to earth.

Generally, it will be found a much easier matter to tune-in 5 X X than any of the lower power stations. This is because the tuning of 5 X X is "flat," owing to the very high power used for transmitting. One should take advantage of this and try out a "no control" circuit. To do this, carefully note the number of turns in use when circuit B1-B2 (Part 1) is accurately tuned to 5 X X, then wind a corresponding number of turns on another former (or construct two or more separate coils and connect them in series) and connect up the circuit as shown at C, minus the tuning condenser and with the lower end of the coil connected direct to earth.

In the next instalment it is proposed to describe other tuning devices which will figure prominently in future experiments. Meanwhile, the reader should acquire another ·0005 mfd. variable condenser and the following plug-in honeycomb coils: Nos. 25, 35, 50, and 75. A set of basket coils should also be made or purchased, these being numbered as follows: 25, 35, 50, 75, and 100.

In concluding the present instalment, I would urge all beginners to carefully preserve their copies of "P.W." Quite apart from the usual features in this journal, one has a whole mine of information in the "Answers to Queries" columns, where the many and varying problems of both beginners and experts are solved week by week, not in the usual progressive order,



but in the order in which each query is received. Thus one is able to study any particular problem which may apply at the moment, or, by preserving each week's issue, refer to a more advanced problem at a more opportune time.

(*To be continued.*)

A CHAT ON CRYSTAL CHEMISTRY.

How Chemical Compositions Influence Rectification.

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

Readers who enjoyed Sir William Bragg's recent talks from 2 L O will find much to interest them in this informative article.

WHEN one comes to consider the number of different forms of crystalline minerals which exist in various quarters of the world, one is often struck by the relatively small proportion of these naturally occurring minerals which are of any practical use for the purpose of radio rectification.

Apart from its crystalline nature and physical form, therefore, it follows from the above observation that a mineral, to be an efficient rectifier, must possess another quality, that of partial electrical conduction. A crystal of rock salt or of quartz (silica) is a

Heating a piece of metal in a spirit lamp flame.

tolerably good insulator, and it is also a non-rectifier. A diamond is also a non-conductor and a non-rectifier, but, at the same time, it forms an extremely well-defined crystal.

At the other end of the scale we find substances which are very good conductors of electricity, but which, at the same time, do not possess any rectifying powers. Such materials may be looked for among all the true metals, their alloys, and one or two of their pseudo-metallic compounds.

Well-known Group of Crystals.

It will thus be evident that a crystalline substance must be intermediate in character between a conductor and a non-conductor if it is to be used as a rectifier of H.F. currents, and, in fact, practically all of the mineral rectifiers which have been found to be of any use at all conform to the above provision.

There are a few rectifying materials which are elementary in nature. That is to say, they are composed entirely of a material which cannot be split up into any simpler forms of matter by the ordinary means of chemical analysis. Such rectifiers are Silicon, Tellurium, Arsenic, and Graphite. The first three of this list are in nature and general characteristics half-way between a metal and a non-metal, and they are generally referred to as "metalloids." With the exception of graphite, which is a good conductor, these elementary rectifying substances are poor conductors. They offer considerable resistance to the passage of direct current, but yet they are capable of producing good rectification.

The other rectifying minerals which are in use for wireless purposes are almost entirely confined to the sulphide and oxide class of chemical compounds, although there are a few other rectifiers besides these which can be used satisfactorily, and which we will deal with later on in this article.

The sulphides of metals form the most widely-used class of mineral rectifiers. If you have a piece of crystal whose composition is unknown to you, you may wager quite a considerable amount that it is composed of a metallic sulphide. Of course, it *may* not have such a composition, but the chances are that it will contain sulphur in some form or other.

A sulphide, of course, is a compound which is formed by the direct union of sulphur and a metal. Thus, for instance, if we heat a few pieces of scrap copper to redness and then throw a quantity of flowers of sulphur over the metal, combination between the two elements will take place. The metal will glow almost to white-heat, and a blackish mass of *copper sulphide* will remain.

A list of the sulphide rectifiers which are used for wireless purposes will be seen in Table 1. It will be seen that Galena, the basic material of all the proprietary "ites," is included in the category of sulphide rectifiers.

Now, just as sulphur can combine with metals to form *sulphides*, tellurium and arsenic are able to enter into a similar combination with metals with the formation of *tellurides* and *arsenides*. Many of these latter compounds behave as efficient rectifiers, *Hessite*, a telluride of silver, is about the best-known mineral of this class, and *Niccolite*, or nickel arsenide, is another example of this category of minerals.

From the Table it will also be seen that the "pyrites" minerals are all sulphides. Some of them are complex sulphides containing more than one kind of metal in their composition. Thus it will be seen that, whilst galena, molybdenite, and iron pyrites contain only one metal, minerals such as copper pyrites, Bornite, and Bournonite contain two or three different metals in each case.

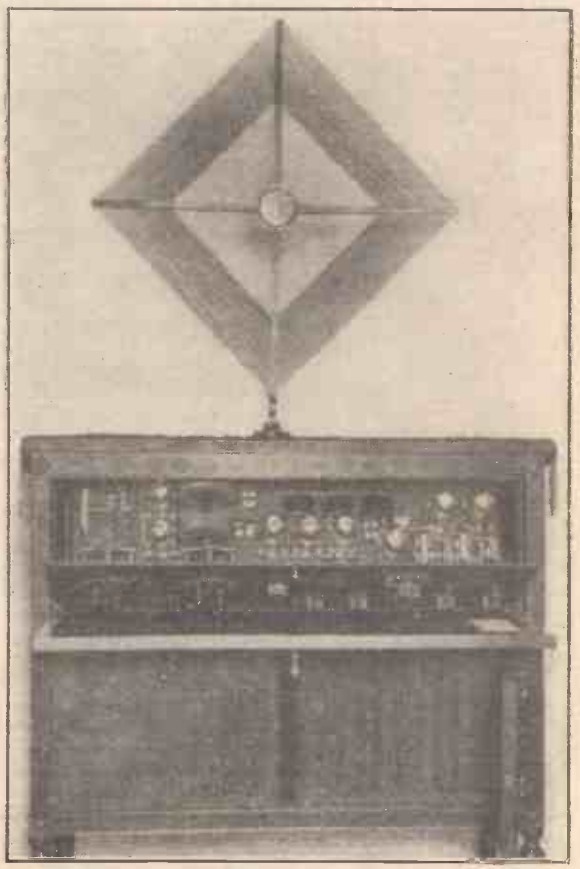
It is interesting to note that Argentite, a sulphide of silver very similar in general type of composition to galena, is, to all intents and purposes, a complete non-rectifier, but, nevertheless, when a small proportion of this mineral is fused with galena it is able to increase the sensitive properties of the latter mineral. Most samples of argentite have a very much lower electrical resistance than galena, and probably this fact may account in some way for their non-rectifying properties.

The Oxide Group.

Passing on to the oxide group of minerals which are able to act as radio rectifiers, we notice from Table 2 that the most important member of the group is the well-known Zincite, which can be used in combination with so many other rectifying minerals.

Zincite is a naturally occurring oxide of zinc, and its ruby-red colour is imparted to

(*Continued on page* 1428.)



An 8-valve super-heterodyne receiver which has an extremely neat lay-out.

A CHAT ON CRYSTAL CHEMISTRY.

(*Continued from page* 1427.)

it by the existence of slight traces of manganese compounds in the mineral. This trace of manganese in the mineral seems to have a lot to do with the efficiency of its rectifying powers, for zincite which has been devoid of such impurities is found to be a poor rectifier.

Metallic Rectifiers.

Attempts have been made to produce zincite artificially, but up to the present time they have not been so successful as the progress which has been made in the production of synthetic galena.

Mineral	Chemical Composition.		
Galena	Lead sulphide	Single sulphides.	Galena forms the basis of most proprietary crystals.
Molybdenite	Molybdenum sulphide		
Covellite	Copper sulphide		
Stibnite	Antimony sulphide		
Iron pyrites	Iron sulphide		
Copper pyrites	Sulphide of iron and copper	Complex or mixed sulphides.	
Bornite	Sulphide of iron and copper		
Bournonite	Sulphide of copper, antimony and lead		
Mispickel	Sulphide of iron and arsenic		
Tin pyrites	Sulphide of copper, iron, and tin		

TABLE I.—The above table indicates the composition of most of the sulphide group of mineral rectifiers. Note that these minerals can be further divided into "single" and "mixed" sulphides.

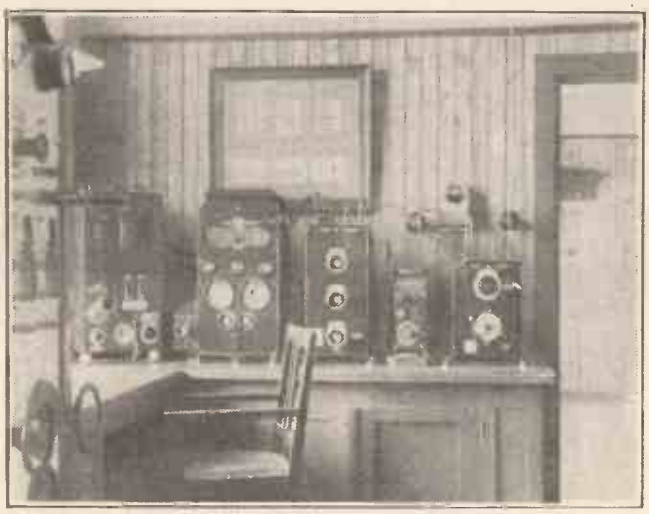
Iron and copper oxides have been used experimentally as rectifiers of H.F. currents under the names of *Magnetite* and *Cuprite* respectively, but owing to the varying sensitivities of different samples of these minerals they are not used with any frequency in general amateur work.

A number of oxide rectifiers which do not give very good rectification under ordinary conditions can have their rectifying powers very much increased by the application of a small local potential across the rectifying contact. Such mineral rectifiers include the two oxides of manganese, *Manganite* and *Pyrolusite*; *Cassiterite*, an oxide of tin; *Anatase*, or titanium oxide; and one or two other similar compounds.

It is the rectifying nature of many metallic oxides which is often responsible for rectification at the point of contact of two metals. For instance, if a strip of clean metallic copper is placed for a minute or two in the flame of a spirit lamp and then withdrawn and allowed to cool, its surface will be covered with a film of tarnish consisting, for the most part, of oxide of copper. Such a strip of copper will give good rectification when an extremely light contact is made with it either with an ordinary fine cat's-whisker or with a fragment of zincite. The illustration, Fig. 1, indicates the manner in which such an "oxide detector" may be prepared, and a few experiments of this nature, using different varieties of metals and alloys, will be of interest to the amateur should he be keen on the fascinating subject of crystal rectification.

An explanation similar to the one given above accounts for the often surprising phenomenon of "rectification by means of the crystal cup alone." In these cases, the crystal cup has become slightly tarnished, and its film of oxide has such a physical form that it is able to display strong rectifying properties.

The last type of rectifier which we have to deal with in our brief survey of the chemistry of crystals is the compound carborundum. Carborundum has the honour of being the first rectifier to be employed for any practical purposes in radio reception, and its use in this direction dates back to the year 1906, when it was brought into service by General Dunwoody, of the United States Army.



The wireless room at the Soesterberg Aerodrome.

Carborundum is really a compound of two elements, carbon and silicon, both of which are rectifiers. The substance is thus a silicon carbide, or, as some prefer to call it, a carbon silicide. Both names, however, mean the same thing.

Carborundum and also silicon are the only commonly used rectifying materials which are not found in Nature, and which have to be produced artificially. Carborundum, as is well known, requires a local potential for its proper functioning, but, all the same, it *can* be used without the application of such a potential if the material is of good rectifying quality to begin with.

Mineral.	Chemical Composition.
Zincite	Zinc oxide (containing traces of manganese).
Magnetite	Iron oxide (magnetic).
Cuprite	Copper oxide.
Cassiterite	Tin oxide.
Anatase	Titanium oxide.
Brookite	
Pyrolusite	Manganese (di)oxide.
Tellurite	Tellurium oxide.
Ilmenite	Oxide of iron and titanium.

TABLE 2.—Indicating the composition of a number of minerals which may be included in the oxide category of rectifiers. A large number of other metallic oxides will produce rectification, but only when they are present in very thin films on the surface of their constituent metals. The above, however, are able to rectify in their mass condition.

Organic Crystals.

The whole range of mineral rectifying substances may thus be divided up into a few classes: the elementary class, the sulphide class, and the oxide class. Apart from a few exceptions to this classification, such as carborundum (silicon carbide) and one or two other little-known materials, all the crystal rectifying substances are contained in the above categories.

Experiments have been made with a view to producing well-defined crystals of an organic nature which contain metallic atoms in their composition and which would be suitable for rectifying purposes. Such experiments appear to have proved fruitless up to the present time, but they represent an interesting line of research, and doubtless, at some future date, they may provide the crystallographer and scientist generally with much interesting data of a theoretical and a practicably applicable nature.

REPAIRING VALVES.

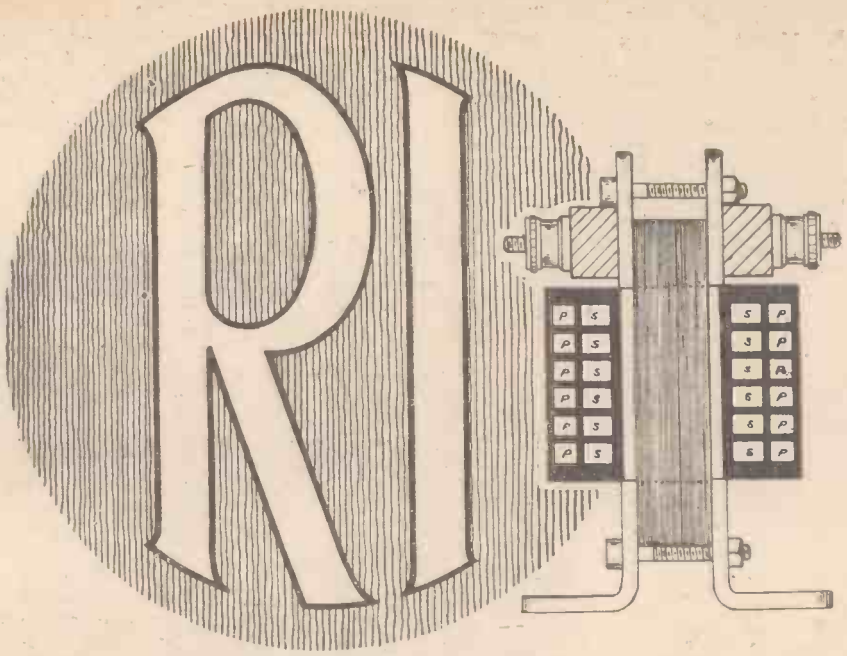
WHEN advertisements for the repairing of burnt-out valves first began to appear, many people not unnaturally regarded the process as uncertain in its results, and of doubtful commercial value. It must be said, however, that within a short space of time, the technique of valve repair has been so developed, and the process has become so specialised, that valve repairing is to all intents and purposes as reliable as valve manufacturing, and there is now no reason why the experimenter who has had bad luck with his filaments should hesitate to avail himself of the excellent valve repairing services advertised.

The Process.

In this connection, you may be interested to learn, very briefly, how the repairing is done. The first step is to remove the "pip" from the bulb and to seal on at this point a short glass tube. The bulb is then cut round its equator by means of a diamond and the two halves separated. The electrodes being now readily accessible, the necessary repairs are carried out, and a skilled glassblower (and those of my readers who have experience of glass-blowing will appreciate that considerable skill is essential for this operation) proceeds to repair the bulb by joining together the two halves.

By sealing the short glass tube, mentioned above, to the vacuum pumps, the valve is again exhausted, and it is then sealed off by means of a blowpipe at the pip as before. The usual combined chemical and discharge process completes the exhaustion, and the valve is then submitted to a series of tests precisely the same as those applied to a new valve, after which it enters upon its second lease of life. The charge for repairing a valve is usually about one-half the price of a new valve, and as to the results I can say from experience that generally they leave little to be desired.

J. R.



The construction that counts

True judgment and appreciation require to be based on more than outward appearance. Time after time the public are persuaded to buy the "just as good" article on the strength of similar outward appearances. The result is disappointment and distrust. Too late we rediscover the knowledge that it's the heart of things that counts.

Just look at the internal construction of the new R.I. Transformer. Note the careful symmetry of design and heavy insulation between coils. The primary and secondary are wound in twelve sections, the six sections of the primary being placed on the outside of the secondary sections, giving the lowest self-capacity (18 micro-microfarads) of a transformer in general use.

The further security of one year's guarantee is given with every new R.I. Transformer. Apart from these strong features of real worth **the monogram R.I. carries more confidence for you of perfect workmanship in wireless components and sets than any other trade mark.**

Price 25/-

Ask your friends, and then write for the New R.I. Catalogue

Telephone—Regent 6214-5-6. *Telegrams—"Instradio, London."*

RI LTD

Radio Instruments Ltd
12 Hyde Street, Oxford Street
Telephone: REGENT 6214 (3 lines) W.C.1. Telegrams: Instradio London

Mainly About Broadcasting

by The Editor

A DECISION to move 2 L O's transmitter has at last been made. Many months ago POPULAR WIRELESS published exclusively the rumour that 2 L O's aerial was to be erected on Selfridge's Store, in Oxford Street. This rumour has proved correct, and the two tall lattice-work masts may now be seen by visitors to Selfridge's. 2 L O's power is also to be increased from 1½ kw. to 3 kw.

This is good news for crystal users on the outskirts of London, for it is anticipated that the crystal range from 2 L O will now be increased from 25 to 35 miles. This increased range will be a great boon to those listeners in the distant suburbs who do not wish to install valve sets and will find themselves just outside the range of 2 L O for good reception.

But it must be borne in mind that double power does not mean double range. Although 2 L O is heard night after night by crystal users at distances greatly exceeding 25 miles, the guaranteed range of a crystal set for reception from a B.B.C. main station of 1½ kw. has always been 20 miles, and for 5 X X, the high-power station, 100 miles, despite the fact that these distances are daily exceeded by listeners-in.

The New Transmitter.

But the doubling of 5 X X's power would not allow technical engineers to state exactly that the range would be doubled, although it is quite likely that in practice many amateurs would receive the broadcast concerts at more than double the usual range. The same applies to 2 L O. The official increase in range is given up to 35 miles, and it will be interesting to note whether amateurs with crystal sets find any great difference for long-distance reception.

Those listeners within 5 or 6 miles of 2 L O will probably not find much appreciable increase in the strength of signals; this will only be noticed by listeners situated at a greater distance; but the quality of reception for listeners within 5 or 6 miles of 2 L O should be greatly enhanced.

The new transmitting set will not have many radical departures from the standard apparatus at present installed at Marconi House. But the aerial masts will be considerably higher from the ground level, and this in itself should greatly help to improve transmission.

* * *

I hear that a number of amateurs residing in the purlieus of New York have been driven to desperation by the interference caused by the transmitting set of one of the U.S.A. Government's ships. This ship is fitted with a spark transmitting apparatus, and has caused so much interference that a number of listeners have forwarded a letter to the U.S.A. Postmaster-General, asking the Post Office Department to scrap the obsolete transmitting equipment on the offending boat. So earnest are they in this request that they have offered to purchase a special C.W. transmitting set to take the place of the spark transmitter!

I do not know whether the U.S.A. Postmaster-General has accepted this offer, but the action of the New York amateurs in starting a fund to collect enough money to buy a new transmitting set for a ship which was causing them interference, is a striking example of the earnest way in which the American amateurs take their hobby.

I wonder how many amateurs in this country, on the south coast of England especially, would band together to collect enough money to offer the Post Office to improve apparatus for the North Foreland Wireless Station, and how many amateurs, especially in the Midlands, would band together to start a fund to pay for improvements in that ever-annoying station, Leafield? In the latter case I should think the fund would have to be a pretty big one, and, short of pulling the station down, there would have to be "some" improvements!

* * *

I have received a number of queries concerning the super-selective receiver recently published in POPULAR WIRELESS. I have received one letter in particular from Mr. A. W. Boothroyd, of Colne Lodge, Lexden, Colchester, which contains some interesting remarks about this super-selective circuit described by our New York correspondent, Mr. L. W. Corbett. Mr. Boothroyd, referring to this circuit, says:

Professor Rankine and his receiver, which enables him to "hear by light"—a novel method he has recently devised.

"In the first place I used plug-in coils in place of the coils described, and I think much wire and time may be saved if others do this instead of making special coils; but with the plug-in coils I have been able to try the circuit on all wave-lengths up to that of the Eiffel Tower.

"The crux of the circuit is the variable anode resistance, and I have not had very happy experiences in this respect. I used a resistance marked from 50,000 to 100,000, but actually going down to zero and upwards. I improved the action by mounting a good-sized ebonite disc for controlling, instead of the tiny knob as fitted; that improved results—but the action was even then too irregular. Something better, with more definite and certain resistance, seems to be required, which resistance can be read on a dial, which should make only one turn to give the full range.

"An alternative control of reaction is by varying the H.T. or filament, if the resistance is not sufficiently delicate. I mounted my coils in two 2-coil holders, and, as I had no vernier condensers, found that the equivalent could be obtained by adjustment of the coupling between the aperiodic aerial coil and secondary. The condensers were both ·0005 mfd.

"As to results, I think the circuit is all that is claimed for it as regards selectivity, providing that a delicate control of reaction by the variable resistance be obtained, and I could cut out Chelmsford—distance 20 miles—and listen to Radio Paris undisturbed. The tuning was very sharp on a large range of stations heard, with no trace of interference.

Operating the "Super Selective."

"As to strength, it appears quite equal to an ordinary single-valve detector circuit, if not better. London—distance 50 miles—was heard at loud telephone strength on one valve. Radio Paris fair 'phone strength with two valves. German stations came in at loud telephone strength. The coils used for Chelmsford and Radio Paris were aperiodic aerial 45; first secondary 200; reaction 70; grid 240; 18 S.W.G. wire was not used, but coils were 26-22 S.W.G."

I hope the above extracts from Mr. Boothroyd's letter will prove of value to the large number of readers of POPULAR WIRELESS who have been experimenting with this receiver.

Our New York correspondent, as I mentioned recently, made one mistake in sending us an account of this set. He said it was an easy receiver to handle. But the tests we have recently made hardly agree with this statement. It must be frankly admitted—and the last thing on earth we wish to do is to deceive readers, hence this candid admission—that the super-selective set, while in every way fulfilling its claim to be the most "super of all selective receivers," is undoubtedly a set which requires some practice before it can be successfully operated.

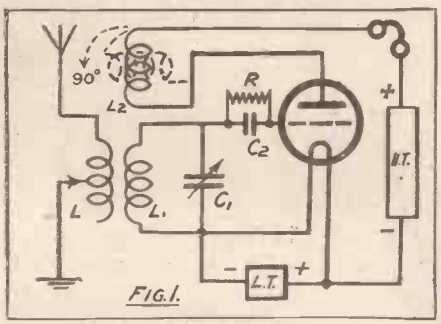
But an hour's practice at this set, and by exercising patience and by noting various adjustments, etc., and by paying particular attention to the resistances, will enable the average amateur to get some very good results. In fact, so many readers seem to have taken a great interest in this set, and so many desire further details, that I am shortly publishing a full constructional article dealing with The Super Selective Set built in "P.W.'s" testing-room.

WIRELESS FOR THE BEGINNER.

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

No. XII. SOME REMARKS ON VALVE CIRCUITS.

IN the previous article we saw that a small change in the potential of the grid of a valve was able to bring about a large change of current in the plate circuit. By connecting the telephones in the plate circuit we obtained in them a current which varied practically in the same way as the modulated "carrier" wave and thus reproduced the sounds broadcast by the speaker.



The signals received by a single-valve set are not loud enough to work a loud speaker properly, and if the transmitting station is very far away they are not as a rule sufficiently loud for comfortable telephone reception. Therefore several methods of increasing signal strength have been devised.

Use of an "Extra Coil."

If we break the plate circuit and join up in it a coil of wire, and bring that coil of wire near to the coil which is influenced by the aerial, we do a very important thing. Refer to Fig. 1. L is the aerial tuning coil. L1 is the "secondary" coil, which receives an alternating E.M.F. from L and alters the potential of the grid which is connected to it through C2, the grid condenser. C1 is the tuning condenser for L1. Now L2 is the extra coil which we have inserted in the plate circuit and brought near to L1.

As has been previously explained, when signals are being received and the valve is rectifying, there is in the plate circuit a current which varies in accordance with that in the circuit L1 C1. Therefore when the coil L2 is connected up in the plate circuit the same current passes through it. And when, further, we bring this coil near to the coil L1—or "couple" it to L1, as electricians say—we begin to put back into the circuit L1 C1 some of the electrical energy which we took out of it from the valve.

Explaining "Reaction."

The process by which this is done is called "induction." If a coil of wire in which there is an alternating E.M.F. is coupled to another coil, there will be "induced" in this second coil an E.M.F. of the same frequency as that in the first coil. That, very roughly, is the action of a transformer, of which more will be said later. Harking back for a moment, I must now point out that this is how the E.M.F. is set up in L1 by the aerial coil L—i.e. by induction.

If the coil L2 is placed at right angles to L1 (see dotted line) no action takes place between the coils, but as it is swung through 90° and gradually brought more and more into the same straight line as L1 it begins to add energy to L1, so that L1 is provided with a more powerful E.M.F. than it would be if the coil L2 were not there. We are, in wireless parlance, "feeding back" into the valve. The result is that the circuit L1 C1 has an increased E.M.F., and this being applied to the grid is able to bring about a bigger change in plate current and thus a louder signal. This method is probably known to most of you as "reaction."

When Receivers Transmit.

It is not my purpose to go into details about self-oscillation and its dangers, especially as Captain Eckersley has done it so well and so frequently. But I may just say that, all factors being favourable, if you couple L2 (the "reaction" coil) so closely that a certain critical point is reached and overstepped, the circuit L1 C1 will begin to oscillate on its own account and will thus become a transmitter of waves something like the carrier wave of the broadcasting station. When you hear that click, followed by that characteristic rushing sound, resulting in screeching in your telephones instead of music, you may know that you have coupled L1 and L2 too closely and have become a public nuisance, because you are sending out waves which nobody wants.

Introducing Additional Valves.

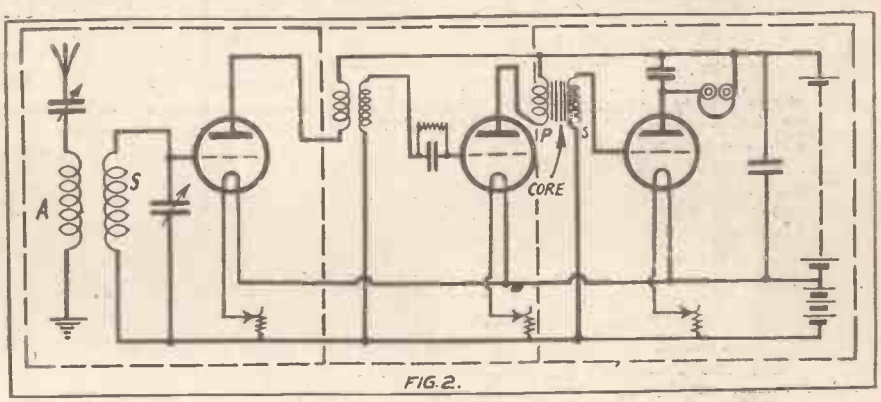
Reaction, then, provides a very convenient way of magnifying signals without the use of another valve or extra apparatus beyond a small coil of wire. One rectifying valve, with reaction, makes an excellent receiver for telephone work, but is hardly powerful enough to operate a loud speaker. There are certain circuits, generally called "reflex" circuits, by means of which one valve can be used to do the work of two, but these form more legitimate studies for people who have gone deeper into the subject of reception than those for whom I write, and we must pursue what in the long run is probably the best arrangement, namely, the use of extra valves for magnifying signals.

As we can control the plate circuit current, and thus the current through telephones or loud speaker, by the grid, it will be obvious to the thinking reader that it is open to us either to magnify the E.M.F. applied to the grid, *before rectification takes place*, or to magnify the *output* of the rectifying valve by means of another valve. Reaction may be taken for granted; if we can use it whilst rectifying we do so.

High- and Low Frequency Amplification.

There is a big difference between magnifying before rectification and magnification afterwards. If we magnify first, we have, obviously, to deal with high-frequency oscillating currents; but if we magnify after rectification we are dealing with currents which change at *audible* frequency, for they are those which would pass through the telephones. We can, of course, magnify both before and after rectification, and these processes are called, respectively, high-frequency amplification and low-frequency amplification. Fig. 2 is a diagram of an H.F. amplifier (1st valve), a rectifying valve, and an L.F. amplifier (3rd valve).

The aerial coil A induces an E.M.F. in the secondary coils, which E.M.F. is applied to the grid of the first valve, and produces a small change of grid potential, which in its turn brings about a bigger change of voltage in the plate circuit. Rectification is performed by the second valve.



Instead of the telephones, we connect in the plate circuit a coil of wire which forms what is called the "primary" of a "step-up" transformer—P in Fig. 2.

Describing Transformers.

A transformer is a device for transferring electrical energy from one circuit to another. It consists of two coils of wire, one wound over the other, and both wound, for our purpose at any rate, over a piece of iron called the "core." An E.M.F. in the first coil, or primary, will induce an E.M.F. in the other, or "secondary." If there is *one* turn in the first coil, and an E.M.F. of *one* volt in it, there will be induced *one* volt in the secondary if the secondary has *one* turn. But if there are twenty turns in the secondary there will be induced twenty volts therein; but the current available in this secondary will be one-twentieth that flowing in the primary. The rule is, for every volt in a turn of primary there is induced the same in each secondary turn. A transformer wherein the number of secondary turns exceeds the number of primary turns is called a "step-up" transformer.

(*Concluded on page* 1449.)

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

THERE is one thing to be placed to the credit of the B.B.C.—it has indeed endeavoured consistently to get the best, and, despite being hampered in the beginning by the prejudice of manager and agent, once freed from this, it has given us the best in singers, instrumentalists, and concerted music.


Mr. Charles Woodhouse.

A striking instance has been found in the constant use of that super-jazz combination the Havana and Orpheans Band at the Savoy Hotel, London, and its broadcasting has helped to make them known to the large public outside. This was evidenced by the crowds that waited patiently in the rain and mist to see as well as hear them at Queen's Hall recently, for their second concert.

The Savoy Bands.

The Savoy Dance Bands have the biggest organisation in the world for this type of music. Unlike other bands they are not imported from America, but made up of the finest soloists of their respective instruments from all parts of the globe. Agents are constantly keeping watch for new combinations and music, some ten thousand tunes having been heard before their present repertoire was framed.

Their instruments, too, range from the world's most wonderful piano—one with two manuals, like an organ, and first used by this orchestra—to the most varied of cornets and their mutes, saxophones, banjos, clarionets, harps, and drums, as well as the many weird instruments and contrivances which give them their "effects." It is reckoned that sometimes forty separate instruments are used by the bands during an evening's programme. It is led by Mr. Cyril Newton, a fine violinist and singer, too, who has lived in America many years before he came over here.


Mr. Ashmoor Burch.

From jazz to Beethoven is a far step, but one appreciated by most listeners-in, and the best exponents of classical work have been diligently sought out.

A Famous Violinist.

A further triumph in broadcast music was gained when Mr. Charles Woodhouse, the famous orchestral violinist, consented to play recently at 2 L O with the other members of his string quartet, Messrs. Frank Howard (second violin), Ernest Yonge (viola), and Charles Crabbe ('cello). It would be hard to find a better combination or a violinist who has had wider experience. He has been a member of the Queen's Hall Orchestra, under Sir Henry J. Wood, since 1900, and its leader this last five years, as well as member of the Royal Philharmonic Society's Orchestra, the Goossens, and the London Symphony Orchestras, as well as at the Royal Opera at Covent Garden. At the Promenade Concerts, or the "Proms," as they are more affectionately dubbed,


Members of the Savoy Havana Band.

Mr. Woodhouse's appearance is the signal for cheers, for the British public is quick to know and recognise the fine work he has done. Not only as violinist is he known, but as conductor, too, for he often relieves Sir Henry in the second part of the heavy programme. As composer and adjudicator for the Associated Board of the R.A.M. and R.C.M., Mr. Woodhouse also finds time for one position of which he is proud, that of Musician in Ordinary to H.M. the King, for which he holds the Royal Warrant.

Two Popular Artistes.

Vocal music is usually well catered for, and, amongst the excellent singers heard round the stations, mention must be made of Ashmoor Burch. A student under Herman Klein, his one aim has obviously been versatility, and there are few branches of vocalism which he has not essayed successfully. Oratorios, choral works, operatic performances, as well as solos with the National Sunday League have all made his name an outstanding one in every programme. Before the microphone, it is evident that he relies not only on actual tone power, but interpretation and a diction that makes every word heard.

A high classical standard is preserved at the provincial stations; indeed, often they are on the "highbrow" side, yet that they are keenly appreciated is self-evident. Amongst the well-known pianists who have played at several of the stations is Angus Morrison.


Mr. Angus Morrison.

He is well known at Manchester, a pupil of the noted Bach player Harold Samuel. He won the Open Scholarship at the Royal College of Music in 1918, which he has held for five years. He has achieved considerable success by his recitals in London at Wigmore Hall, and over the aether he is one of the most popular of players.

"The Beggar's Opera."

Interest will be centred at Birmingham on the 11th inst. by the broadcasting of Maurice Jacobson's latest work, "The Beggar's Opera Fantasia." Set for tenor solo and mixed voice chorus and orchestra, although produced at the Lyric Theatre, Hammersmith, during the run of the opera as revised by Mr. Frederic Austin, this work was composed from copies of the original MSS. at the British Museum. It is, however, dedicated to Mr. Austin, to whom is due the revival of British interest in the old work. As a song writer, composer of works for orchestral instruments, pianist, and conductor, too, Mr. Jacobson is widely known, and his recent appearances with John Coates at the various stations confirmed the successes gained at the big halls in London. He is holder of the Stanford Competition Scholarship, and, amongst other works, he is known for his clever arrangement of Vaughan Williams' Mass in B minor for the Anglican service.


Mr. Maurice Jacobson.

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

MR. N. HEYWOOD, of 27, Moors Meads Road, Twickenham, manufacturer of wireless crystals, has sent us a "Blue Spot" crystal detector fitted with "Idealite" crystal. It is a very neat little component, and is designed for "plug-in" panel mounting. It is supplied complete with two sockets ready for fixing to a panel at 3/3 with crystal, or 2/6 without. The crystal is held in a screw-cup, and can be changed in a moment, while the silver cat's-whisker, too, can be very easily removed if desired. The "Blue Spot" detector should prove very useful in reflex circuits, where it is sometimes advantageous to reverse the connections to the crystal detector.

On actual test we found it quite satisfactory. Adjustments can be made smoothly and, once concluded, the detector will remain "set" for considerable periods. It is a component which should be received well in both crystal and valve-crystal quarters.

* * *

A miniature painting is not a freak of art by any means; miniatures, as a matter of fact, are held in great esteem by collectors, and so with the new Ericsson miniature crystal set. It is neither a freak nor a toy, but a cleverly designed wireless receiver of unusually small dimensions, capable of providing results equal to sets of much larger sizes.

Messrs. The British L. M. Ericsson Manufacturing Co., Ltd., have sent us a sample for test, and as soon as we saw it we were attracted byits neat,small, yet efficient appearance. It is made entirely of ebonite, and is provided with a small tuning control and two crystal adjusting knobs. The crystal itself is hidden beneath the small top circular panel.

An "R.G." Strip Coil, which is wound with copper strip instead of wire.

On test very good signals were received from 2 L O at a distance of nearly ten miles, and the adjustments mentioned above proved to be both smooth and simple to carry out. As the makers claim, in appearance and operation it is a "perfect little set," and at 17/6 it should prove one of the most popular receivers of 1925.

* * *

From Messrs. Aneloy Products, Eton Works, Upland Road, London, S.E.22, we have received a Pliotron S.S. ·07 dull emitter valve for test. It takes ·07 amps. at 2·3 or so volts and 40 to 80 volts on the plate. It is a general purpose valve, and functions well as both a detector and amplifier. It also appears to be fairly strong mechanically, which is a distinct asset to a valve of such low filament consumption.

It operates at a comparatively low filament heat, and can be used with dry cells quite satisfactorily. The price, 12/6, is distinctly reasonable for a product of this nature, and considering the good and consistent results we have found it will give, it should command a very ready sale.

* * *

From Messrs. The Cable Accessories Co., Ltd., we have received a "Revo Valcrys" receiving set. It is a one-valve and crystal "reflex" which retails at 96/-, plus royalties. It is a solid, well-made instrument, and embodies several features usually found only in much more expensive apparatus. For instance, three filament terminals are provided, two alternative "pluses" making

(*Continued on page* 1440.)

APPARATUS TESTED.

(*Continued from page* 1438.)

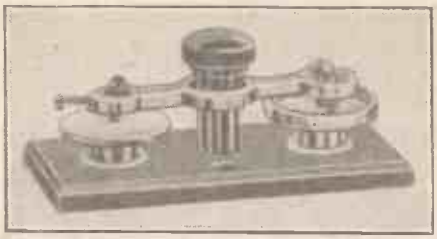
it safe to use either a bright or dull emitter valve with an accumulator. Two aerial terminals are included on the panel, so that the instrument can be used with long or short aerials. In the lid appears a list of instructions sufficiently clearly worded to enable even the absolute tyro to place the set in commission and obtain good results.

On test very good results were obtained, and at a point a little over six miles away from 2 L O it was possible to operate a small loud speaker. Birmingham also was heard during one of 2 L O's brief intervals, and signals were quite clear in the telephone receivers, but in common with most other reflexes it is not very selective. For those listeners who require a practically "fool proof" set capable of providing loud, clear signals, such a receiver as the "Revo-Valcrys" is ideal. It has an appearance of solidity, even the crystal detector is obviously designed for hard work and to resist rough handling. Aerial tuning is accomplished by means of a variometer and the anode by means of a variable condenser. The under panel workmanship is decidedly good, and we particularly like the method adopted of soldering terminal connections. It is one that we ourselves intend to advocate in the case of the home-made set, and is an example of thoroughness it does one good to observe.

In addition to the "Valcrys" receiver which we report upon above, Messrs. The Cable Accessories Co., Ltd., sent us a pair of their "Revo" light-weight telephone receivers for test. These headphones, which retail at 21/- per pair are sold under a twelve-months' guarantee against faulty workmanship or material. They are very comfortable to wear, being light in weight and nicely balanced. On test they proved to be well up to standard in respect of both sensitivity and tone of reproduction. We have no hesitation in recommending them to the attention of our readers.

* * *

The new price of the Cosmos D.E.11 Dull Emitter Valve, a product of Messrs. Metropolitan-Vickers, is 21/- and not 22/6 as was erroneously stated in the advertisement concerning this and other "Metro Vik" valves which appeared in our last issue.



A "Bi-recto" Microphonic Crystal Detector.

* * *

We recently tested a specimen of "Concite," a crystal manufactured by Messrs. Conradi & Braun, of 52, Theobald's Road, W.C. 1, and which is sold at 1/6 complete with cat's-whisker. It is an excellent rectifying material and is sensitive and stable. It functions excellently in simple crystal circuits, and can be used with confidence in all types of valve-crystal combinations.

* * *

A very interesting device has reached us from Messrs. Beswinning's, Connaught Road, Ilford, London, in the form of the "Cozwhy" Calibration Dial, an accessory which will appeal particularly to those interested in "D X" work. It replaces the ordinary knob and graduated scale on a variometer, variable condenser, or reaction control. Mounting is very simple, and it is sold to fit three sizes of spindle—4 B.A., 2 B.A., and 0 B.A. The "Cozwhy" Calibration Dial consists of two essential parts—one, a disc of white material, around the edge of which is printed a graduated scale; this disc remains stationary; while two, an ebonite cover fitted with an extension handle revolves with the adjustment of the instrument with which it is used. The cover is provided with a pear-shaped opening, the top of this forming a pointer. In this opening, on the white disc beneath, the names of stations can be marked in pencil or ink—and wiped off again, if necessary. Thus a receiver can be calibrated to render the tuning-in of one or more stations a very simple matter indeed. In fact, we predict considerable popularity for the "Cozwhy," at 3/- complete, among both listeners, amateurs, and advanced experimenters.

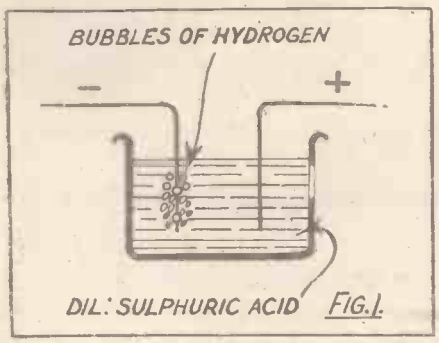
Winner of our Cross-Word Puzzle:
H. HARRIES, Woodview Cottage, Bourne Road, Bushey, Herts.

HOW TO DISCOVER POLARITY.

FROM A CORRESPONDENT.

THE accurate and speedy determination of the polarity of various accumulator and high-tension leads is often a matter the paramount importance of which cannot be over-emphasised.

In accumulator charging operations the polarity of the accumulator and of the charging board leads must, of course, be known with certainty, for it is essential that the positive terminal of the accumulator be connected up to the positive terminal of the charging-board. If the leads



were connected up the wrong way round, the accumulator would be completely exhausted of its residual charge, and injury would occur to it.

Several Chemical Methods.

Similarly, the radio amateur and experimenter must always be in a position to determine at once the polarity of his high-tension battery leads. Most high-tension batteries are, of course, at the present moment sent out by their manufacturers with their polarities plainly indicated on the outer casings of the cells, but with home-constructed batteries the case is often different, and the amateur is generally left to himself to determine the polarities of his batteries.

Leaving aside the several physical methods of polarity determination, such as the magnetic polarity indicator, there are a number of reliable chemical means of determining very simply the polarity of any electrical lead.

A More Delicate Indicator.

In the first place, a little dilute sulphuric acid may be poured into a small saucer and the battery leads held in the liquid at a distance of about half an inch apart. Bubbles of gas will immediately be observed to rise from the electrode which carries the negative current. This is shown at Fig. 1.

Similarly, a solution of copper sulphate (blue vitriol) may be prepared, and the wires from the battery dipped below the surface of this liquid. In this case, a deposit of copper will be formed on the negative lead of the battery.

When carrying out this determination, it is best to wrap the ends of the wires with a little tinfoil so that the deposit of metallic copper at the negative pole may be shown up plainly.

These tests work very well when the E.M.F. of the battery or accumulator cells tested is not below three volts, but there are a number of more delicate tests still, and many of these, when carefully applied, will indicate the polarity of a cell when its total E.M.F. is below one volt.

Probably the most delicate chemical polarity indicator is the chemical compound which is known by the name of *phenolphthalein*. This material takes the form of a white powder. A quarter of an ounce of it should be procured from the local druggist and as much of the material as will fit on a sixpence should be dissolved in a teacupful of warm water, together with about three times as much Glauber's salts (sodium sulphate).

The Use of Potatoes.

A quantity of ordinary white blotting paper is then soaked for a few minutes in this liquid, and then allowed to dry without any rinsing. The paper may then be cut up into suitably shaped strips.

To use this paper for the purpose of polarity determination all that it is necessary to do is to lay a small piece of it on a wooden or ebonite surface, and to moisten it with a little pure water. Bring the leads of the battery on to the moistened surface of the paper and at a distance of about half an inch apart, and a bright pink mark will be evident at the negative lead.

It has been stated that the freshly cut surface of a potato, an onion, or an apple will provide an effective means of determining polarity, a dark stain being produced at the negative pole of the battery when the leads are held on the freshly-cut surface at a little distance apart. This is a rough-and-ready test, but in many cases it works very well. In others, the opposite result is obtained. Thus it would appear that the chemical or physical make-up of the vegetable or fruit concerned has a good deal to do with the efficiency of the test. Needless to say, this test is not suitable for determining the polarity of very small currents.

The ordinary "pole-finding paper" which is obtainable on the market is usually composed of absorbent paper which has been dyed with a solution of turmeric or litmus. With both these papers the negative pole of the high-tension battery or accumulator lead exerts a colour change at its point of contact with the moistened paper.

These papers can very easily be made by the radio amateur who has a little time to spare. The turmeric variety of the pole-finding paper is perhaps the better of the two to use. It can be made by soaking ordinary white blotting-paper in a solution of turmeric, prepared by dissolving about a quarter of an ounce of dried turmeric root in half a teacupful of a mixture of equal parts of water and methylated spirits. After drying, the paper is ready for use, and when the electrodes of the battery are applied to the surface of the moistened paper a brown stain appears at the negative point of contact.

An ordinary photographic blue print will also make quite a good polarity indicator. For this purpose the blue print should be moistened slightly with a very weak salt solution. The negative point of contact of the battery with the paper will be indicated by the appearance of a dirty yellow stain. Generally speaking, this test is not very effective when voltages below six or eight are being dealt with.

In all these cases, of course, the colour change effect at the point of contact of the negative electrode of the battery is dependent upon the presence of local chemical action by which the moist indicating material with which the fibres of the paper are impregnated is converted into a different form. Such colour-change effects are well-known in the realms of analytical chemistry, and they form the basis of all the well-known chemical "indicators."

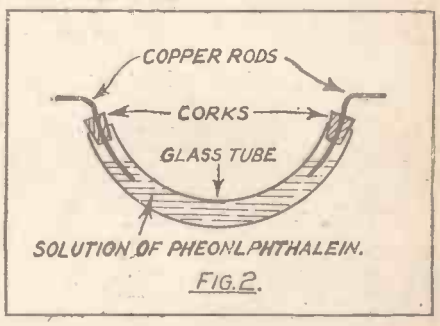
Instrument for Permanent Use.

In conclusion, a very simple polarity indicator may be described. This consists of a bent piece of glass tubing as depicted in the diagram, Fig. 2. Through the corks which are provided at the opposite ends of the tube are placed two stout copper rods reaching about halfway down each arm of the tube.

The tube is then almost entirely filled with a solution of phenolphthalein, made by dissolving a "sixpenceful" of that material in a teacupful of warm water, and then by adding three or four times that amount of sodium sulphate. On attaching the polarity indicator to the terminals of the accumulator or battery, a pink area of liquid will be formed around the negative electrode.

On shaking the tube, the pink colour will disappear, and thus the indicator will be ready for a further test when required.

If the pink colouration is not readily formed, it is a sign that too little of the materials have been dissolved in the water.



This can easily be remedied by adding very small further amounts of sodium sulphate and phenolphthalein to the liquid until the colour is formed almost at the instant of connecting up the battery. The exact proportions of the materials necessary for the purpose varies to some extent with the voltage of the current whose polarity it is desired to test. For all average purposes, however, the proportions given above will be found to be entirely suitable, and satisfactory results will be obtained at the first experiment with the indicator.

HULLO EVERYBODY!!

ALL THESE GOODS SENT POST FREE (U.K. ONLY) EXCEPT WHERE MARKED. FOREIGN POST EXTRA. ORDERS DESPATCHED IN STRICT ROTATION AT EARLIEST POSSIBLE MOMENT.

AERIAL 7/22 100 ft. 3/-
Copper Strip .. „ 3/-
Allen Var. Grid Leak 1/9
BURNDEPT Detector 4/6
Basket Holders 1/3. 1/6
Battery Links. doz. 1/2
Bushes Ebonite „ 1/3

CRYSTALS each 1/6. Neutron, Gilray, Permanite, Blue Label, Tungstalite

COIL STANDS 2-Way—
Vernier .. 4/6, 5/-. 5/6
Geared 5/11 Polar 6/-
Shipton Vernier .. 4/6
"Baby" ordinary 3/3
With ex. handles 3/6
Nickel „ 4/-
Baby 3-way 4/3
Nickel „ 5/6
Vernier 3-way .. 6/6
Shipton V. „ .. 8/-

COILS D.C.C.
For Chelmsford .. 1/11
With Adapter .. 2/8
200/2000 SET of 5 2/6
(Air Spaced Waxless)
Extra Large Air-Spaced Set of 5 Duplex D.C.C. Coils, 25,35, 50, 75, 100 2/9
Coil Plugs, Wedge, pr. 2/-
Edison Bell 2 for 2/6
Plugs with Fibre .. 1/-

DETECTORS (Enclosed)
Micrometer 2/6
Nickel, Large.. .. 2/6
Brass „ 2/-
Burndept 4/6
Mic. Met. 6/-

FIXED CONDENSERS
EDISON BELL—
·001 to ·0005 each 1/3
·002 to ·006 each 2/-
Grid Leaks and clips 1/6
Dubilier ·001 to ·006 ea. 3/-
·0001 to ·0005 each 2/6
Grid Leak, 2 meg. 2/6
·01 for L.S. 7/6
Anode Resistance on stand, 70,000, 80,000, or 100,000 each 5/6
McMichaels' 2-meg. Leak and Clips .. 2/6
100,000-ohm Res... 2/6

RAYMOND (Ebonite Base)
·001 to ·0005 each 1/1
·002 to ·006 each 1/3
·01 or ·02 each 1/9
(Mansbridge Elsewhere.)
Flex, 2 colour, 12 yd. 2/6
Lighting .. 12 yd. 2/-
Small Non-Silk 12 yd. 1/6

COSWELL QUALITY
Valve Legs, Set 4 .. 1/3
Valve Holder 1/9
2-way Cam Vernier 9/-
3-way Cam Vernier 12/6
3-way Ordinary .. 7/6
2-way Panel 3/-
3-way Panel 5/-
Basket Holders .. 1/4

H.F. TRANSFORMERS
McMichael's 300/600 10/-
„ 1100/3000 10/-
Energo. 250/700 .. 3/11
„ 450/1200 .. 4/3
„ 900/2000 .. 4/6
Raymond B.B.C .. 2/9
„ 5 X X .. 2/9

ICRANIC—Rheostat .. 4/6
30 ohms 7/-
Potentiometer .. 7/-
Variometer 10/6
Coils (all numbers)
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

LISSEN—Minor .. 3/6
Stat 7/6
Universal 10/6
Switch 2-way 2/9
Series Parallel 3/9
Anode Res. 2/6
Var. Grid Leak .. 2/6
Choke 10/6
L.F. T.1 .. .. 30/-
T.2 .. .. 25/-
L.F. T.3 .. .. .. 16/6
Coils—
25 .. 4/10 35, 40, 4/10
50 .. 5/- 60 .. 5/4
75 .. 5/4 100 .. 6/9
150 .. 7/- 200 .. 8/5

LOUD SPEAKERS
C.A.V. Tom Tit .. 30/-
C.A.V. Junior .. 55/-
Sterling Baby .. 55/-
Sterling Dinkie .. 30/-
Amplion Junior .. 27/6
Amplion Dragonfly 25/-
All models stocked of leading makers.

POLAR CONDENSERS
·001, ·0005 or ·0003 10/6
Micrometer .. 5/6
2-way Junior .. 6/-

RHEOSTATS
One hole fixing .. 1/6
C. & S. do. 1/5
De Luxe and Dial .. 2/6
Burndept 4/6
McMichael Dual .. 7/6
Shipton Strip—
7 ohm (with fuse) 3/6
30 or 60 ohm .. 3/6
Potentiometer 600 ohms 4/6
Crown for DE or R 2/6
L.E.S. Micro Control 3/6
T.C.B. 6, 13, 30 ohms 4/-
Potentiometer 600 ohms 5/-

SWITCHES
Panel DPDT 1/6
Panel SPDT 1/4
Ebonite DPDT .. 2/6
Ebonite SPDT .. 1/9
Simplex Lead in .. 1/9
Sq. Bus Bar .. 1/-
Switch Arms 1/6
(Inc. studs and nuts.)

TERMINALS
Phone or W.O. doz. 1/9
Pillar large .. doz. 1/9
Pillar medium .. doz. 1/3
Nickel 6d. doz. extra.
(All with nuts)

TRANSFORMERS, L.F.
Ferranti 17/6
Igranic 21/-
R.I. 25/-
Ormond 14/-
G.R.C. 83 .. .. 15/-
Super Success .. 21/-
Standard Success .. 16/-
Brunet Shrouded .. 13/6
Formo Shrouded .. 18/-
Formo open 12/6
French 9/3

VALVE HOLDERS
Murray Anticap .. 1/3
Legless Anticap .. 1/3
Bretwood 1/9
Climax UN panel .. 1/6
(Similar to H.T.C.)
Solid Rod Standard 1/3
Goswell 1/6

VALVES
Myers Universal .. 12/6
French "R" .. 7/6
Dutch Detector .. 5/6
Dutch "R" 5/11
Metal ·06 .. .. 13/11
Radio Micro ·06 .. 13/11

VALVES (*continued*)
Bright Emitter
B.T.H. "R," Edison A.R., Marconi Osram "R" or "R5," Mullard ORA, Cossor L.F. P1, Cossor H.F. P2, Mullard H.F., Mullard L.F. .. 11/-
Dull Emitter
B.T.H. B3. Ediswan A.R.D.E., Marconi D.E.R., Myers, each 18/-
Dull Emitters
B.T.H. B5, Ediswan A.R. "06," Mullard D.F. ORA 21/-
D.E. Power Valves
Marconi D.E. 6 22/6
Power Valves (for ·06)
B.T.H., B6 .. 30/-
Marconi D.E. 4 26/-
Mullard D.F.A. 26/-
Power Valves, for B.E., B.T.H. B4, Marconi, Mullard 30/-
(Valves posted buyer's risk.)

WATMEL
Var. gd. Leak .. 2/6
Anode Res. .. 3/6

WATES MICROSTAT
New Improved Model. Post Free. **2/9**

BRETWOOD
New Model. variable grid leak 3/-
Anode Resistance .. 3/-
Anti-Cap Switch .. 5/-

TELEPHONE DISTRIBUTION BLOCKS. Table Pattern, takes 4 pairs of 'phones 3/6

ENERGO L.F. TRANSFORMER. For supreme Results, Efficiency, Finish, and Permanent Reliability. For 1st stage .. 15/-

THE MIC-MET SUPER CRYSTAL DETECTOR .. **6/-**

ORMOND CONDENSERS with Vernier, one-hole fixing, ·0005. Price 7/6. Post free.

PANEL SWITCHES. On and Off. Connecticut Nickel. Post Free .. 1/6

EASIFIX.
Eliminates all ugly, loose wiring and minimises the risk of burning out valves. Each Conductor is distinctively coloured and enclosed within an outer-braiding. Complete with Wander Plugs 3/-

OLDHAM PORTABLE ACCUMULATOR
For ·06 Valves, 2-in. series will run 6 weeks on one charge. Recharging costs a few pence only. 2 v. 10 amp. continuous 12/6. Will go in your waistcoat pocket.

BRETWOOD
Valve Holder .. 1/9
100 p.c. Efficiency. Eliminates poor reception. No soldering stop over or under panel.

HEADPHONES.

ERICSSON CONTINENTAL.
Your favourite 'phones. Entirely NEW MODEL. Most beautifully finished, exquisite tone. Ridiculous Price, per pair (4000 ohms) **13/11**

BRUNET
New Model "TYPE D." Hygienic Horn Headbands. Nickel-plated Stirrup. Black and White Cord. Each receiver stamped with trade mark. 4000 ohms. per pair **16/6**

For the MAGIC HOUR! When Fairyland becomes reality. Let the kiddies wear Featherweight 'phones.

BROWN'S "F" TYPE. 4000 ohms. **25/-** pair.

N and K
LATEST MODEL. 4000 ohms. Ideal for Crystal reception. Price in AMERICA. £2. All Stamped **N and K.** Price here, **17/6**
Limited number of old models stamped N and K. 4000 ohms. **12/11** pair Post 6d. pair.

TELEFUNKEN (GENUINE). Adjustable. 4000 ohms. Price **17/11**

TELEFUNKEN TYPE
So Near to Originals You can scarcely tell the difference except not adjustable. 4000 ohms. Pair **10/9**
£50 REWARD! given if the

DR. NESPER
PHONES SOLD HERE ARE NOT GENUINE! BEWARE OF FRAUDULENT IMITATIONS!! (Injunctions obtained)
Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head. Per Pair. **12/11** Post 3d. pair,

BRANDES
Matched Tone, **25/-** pair. 4000 ohms.

STERLING Latest Model. 4000 ohms. Wonderful Tone. **25/-** pair

G. R. C. 4000 ohms. **20/-** pair.

SIEMENS. 4000 ohms **25/-** pair.

B. T. H.
Simply cannot be equalled 4000 ohms. **25/-**
Perfection and Quality. Weight negligible.

SUPER L.F. (5-1) TRANSFORMER

Windings have insulated layers of 6 sections each, wonderful for amplification. Made in France, by the world's foremost firm. SPECIAL PRICE .. **10/-**

"SPARTA" VALVE HOLDERS

Contacts marked on both sides. Earthing clip to valve cap. Low self capacity. Made in two types. For front of panel, 2/- each. For underside of panel, 1/9 each.

PERFECT RHEOSTATS

Shipton New Type Strip Rheostat, 7 ohms (with fuse) 3/-
Shipton New Type Strip Rheostat, 30 ohms .. 3/-
Shipton New Type Strip Rheostat, 60 ohms .. 3/-
Shipton Potentiometer, 600 ohm. 4/6
A specially designed spindle gives one-hole fixing and incorporates a tension spring which ensures perfect electrical contact at all times; terminal connections are provided. The 7 ohm Model is fitted with a fuse, which little device may save you the cost of an expensive valve. In operation they are noise free—quite an important consideration.

"UTILITY" SWITCHES
2 Pole c/o Knob .. 4/-
2 Pole c/o Lever .. 5/-
4 Pole c/o Knob .. 6/-
4 Pole c/o Lever .. 7/6
Post 3d. each.

QUALITY (GOSWELL) RADIO COILS

Far more efficient than honeycomb or any other type of coil. Exceedingly strong and rigid, mounted on standard ebonite plugs. Brown finish, no wax or shellac used. MOUNTED.

25 .. 1/6
35 .. 1/9
50 .. 2/0
75 .. 2/3
100 .. 2/9
150 .. 3/0
175 .. 3/6
200 .. 3/9 Post 3d. Coil

MANSBRIDGE CONDENSERS

Octupus, Tested at 350 D.C.

·01 ..	2/3	T.C.C.	
·25 ..	3/-	2 mfd.	5/-
1 mfd.	3/8	1 mfd.	3/1
2 mfd.	4/6	·25 ..	3/6

Post 2d. each.

"WONDER" AERIAL WIRE

49 Strands Special Alloy Phosphor Bronze.
For Frame, Indoor, or Outdoor Aerial.
Each strand is a separate conducting surface. is non-corroding, maintains its wonderful results all the time.
110 feet. 3/9 Post Free
BEWARE of spurious imitations. This is the finest quality.

"HOVIMO" CRYSTAL VALVE. Replaces the old-fashioned detector. Cat's-whiskerless, Battery-less. Worryless, Fuss- and Botherless Wireless 3/6
British Made. Everyone Guaranteed.

ACCUMULATORS
FOR CALLERS ONLY at present.

Rheostat, with Dial, extra value, 2/6

Bretwood Valve-holder 1/9

Manchester "Powquip," 15/6

Ormond 14/6

Shrouded "Powquip," 18/-

Standard "Powquip," 14/6

"R.I." NEW MODEL IN SEALED BOX
Don't Buy Otherwise.
Post **25/-** Free
FERRANTI L.F.

BETTER THAN THE BEST 17/6

IMPORTANT NOTICE

TRADE COUNTER OPEN
will oblige you with any lines in stock, less 20% on Proprietary articles.
NO POST ORDERS TRADE.

EBONITE PANELS
3-16th in.

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

CRITERION CONCERT COILS.
Low Self Capacity. Every turn and layer airspaced. Perfect for Reaction. Mounted on Plug.

25 .. 2/-	50 .. 2/6
30 .. 2/3	60 .. 2/9
35 .. 2/3	75 .. 2/9
40 .. 2/6	100 .. 3/-

SET OF 5 (25, 35, 50, 75, 100) 10/- Post 3d.

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!!

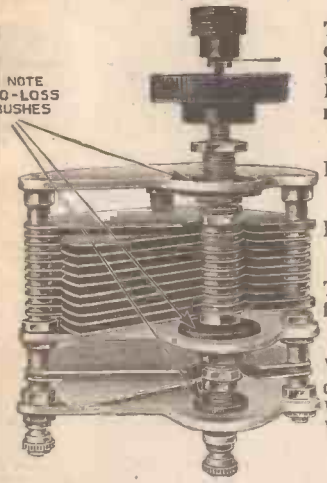
REVOLUTION

IN VARIABLE CONDENSERS

SQUARE LAW LOW-LOSS

(SQUARE-LO-LOSS)

with VERNIER.



The only Condenser with the Low-Loss Bushes. Electrical losses reduced to a minimum.

Full capacity as rated.

Exceptional Low Capacity.

The Condenser for short wave-lengths.

Why buy a Condenser without Vernier when one WITH costs no more.

SQUARE LAW
WITH VERNIER.
Including Knob and Dial
(*Ebonite Ends* 1/- *extra*).
TRADE SUPPLIED.

·001 : : 8/9
·0005 : : 7/9
·0003 : : 7/-
Post 6d. Set.

"DE LUXE" MODEL

As shown, with Dial, Knob and Bush.

·001 - 6/11
·0005 - 5/6
·0003 - 5/-
·0002 - 4/9
POST 6d. SET.

Unsurpassed for fine tuning.

NEW MODEL

With Knob and Dial.

With Vernier.
·001 - 8/9
·0005 - 6/11
·0003 - 6/9
With EBONITE DIAL and Two Knobs.
Post 6d. Set.

NEW MODEL SQUARE LAW

With Vernier.
With Knob and Dial.

	Aluminium Ends.	Ebonite Ends.
·0003 -	8/6 -	10/-
·0005 -	8/11 -	10/5

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. Complete with Knob and Dial, 9/-
Post 6d. Set.

LONDON'S LARGEST Stockist of **JACKSON BROS.'** "J.B." Variable Condensers, complete with Knob.

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." Post 4d.

CALLERS! THESE 4 COLUMNS FOR YOU NO POST ORDERS FROM SAME

Warning! Note name RAYMOND on windows. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

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.

EBONITE, 3/16 in.

Stock Sizes.
Cut to size ½d. sq. 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

¼ in. also Stocked.

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

TAPPED INDUCTANCE COIL

for Chelmsford.
A Real Bargain 1/6

WEDGE COIL PLUGS

Fitted Fibre .. 7d.
Various 7d., 8d., 9d.
Edison Bell .. .. 11d.
Plaincoil Plugs .. 4½d.
Also 5d., 6d., 7d. each.
Fibre Strip .. .. 2d.
(36 in. by 1 in.).
Empire Tape, doz. yds. 6d.

RAYMOND FIXED CONDENSERS

·001, ·0001 to ·0005 10d.
·002, ·003, ·004 .. 1/-
·006, 1/3; ·01, 1/9; ·02, 1/9
Ebonite Base Terminals.

DETECTORS

(Enclosed).

Micrometer	1/6
Half Opal	1/-
Small Brass ..	8d.
Large Brass 1/-,	1/3
Nickel .. 10d. to	1/6
Burndept	4/-

Crystals Stocked.
Neutron, Blue Tungstalite, Permanite .. ..
Shaw's Genuine Hertzite .. .. 10d.
Uralium 1/-
All known makes.
4 Whiskers (1 gold) 2d.
Gold and Silver do. 2d.
7 Waxed Coils .. 1/8
5 Waxless Coils .. 1/3
For B.B.C.

SPECIAL!

Vernier 2-way Coil Stands .. 3/6
Geared do. 5/3

BOXES from 1/11

7×5 9×6 12×9 14×10
8×6 10×8 12×10 etc.

H.T. BATTERIES

60 v.	7/6
30 v.	4/6
60 B.B.C.	8/11
30 B.B.C.	5/6
9 v. B.B.C.	2/6
1·5 (D.E.)	1/8

Eveready 66 v., 36 v., 108 v. stocked.

D.C.C. WIRE

per ¼ lb.

18 or 20 g.	9d.
22 g.	10d.
24 g.	1/-
26 g.	1/1
28 g.	1/3
30 g.	1/6

BASKET COILS

Chelmsford .. .. 11d.
Also at 1/-, 1/3, 1/9
B.B.C. Duplex Waxless set of 5 1/9
Extra air space, ¼ in. (25, 35, 50, 75, 100). Wave-lengths given.

GOSWELL QUALITY COILS

Mounted on Plug.

25 ..	1/6	100 ..	2/6
35 ..	1/9	150 ..	3/-
50 ..	2/-	175 ..	3/6
75 ..	2/3	200 ..	3/9

Why pay high prices?

SWITCHES

D P D T, china base	1/4
S P D T " "	10½d.
Panel D P D T ..	1/-
" S P D T ..	10½d.
Ebonite D P D T	2/3
" S P D T ..	1/3
Tumbler	1/-
On and off	10½d.

VALVE HOLDERS

Legless	10½d.
Solid Rod	1/-
Climax	1/6
Murray	1/3
Under Panel ..	1/3
Templates	1½d.

NEUTRODYNE CONDENSERS

Ormond	2/-
Colvern	3/6
Success	3/6
Vernier (Colvern)	2/6

SPECIAL! VARIABLE CONDENSERS

Square Law with Knob and Dial.

·0003 .. .. 4/11
·0005 .. .. 5/6
Callers' Price.

SPECIAL!

Leatherette Boxes with Lid .. 2/3 and 2/11
Re-echo Crystal Sets 13/11

SPECIAL!

Fine Crystal Set, sloping leatherette Cabinet. Fitted for Chelmsford and B.B.C. Wonderful value .. 9/11
Variometer, Impregnated Board 1/6
With Clips .. 2/3
Formers .. from 4d.
(Impregnated)
Variometers, inside winding, Ebonite former, similar to Fallon, etc. 6/11

VALVES

Dutch Detectors .. 4/9
"R" type .. 4/9
·06 .. .. .. 11/-
Phillips "R" .. 6/11
French "R" .. 5/11

RADIO MICRO ·06 THE WONDER VALVE

H.T., L.T., or D.
3 volts. **12/6**
Can be used on 2 or 4 volt. accumulator.

METAL ·06

Be sure "METAL" is Stamped on Valve and avoid imitations.
One to each Customer at **10/11**
Regular Price **12/6**

ALL VALVES REDUCED

(Marconi, Ediswan, Mullard, Cossor, Myers, etc.

VARIOMETERS

Very Special 200/650 metres. All ebonite. Double silk wound, callers only 4/-

TERMINALS

(Complete)
W.O., Pillar, 'Phone, brass, 1d. each; nickel, 2d. each; stop and valve Pins, ½d.; nuts, various, 6 a 1d.
Valve Sockets 1d., 1½d.
Flush panel do. 1d.
Spade Tags .. 6 a 1d.
Do. Terminals 2 for 1½
do. Pins 2 for 1½d.
Screws and nuts 2 a 1d.
Switch arms .. 7d.
Nickel arms .. 10½d.
Studs, complete 2 a 1d.
'Phone connectors 1d.
2 B.A. Rod ft. 2d.
4 B.A. Rod ft. 2d.
Valve windows .. 4d.
Washers .. 12 a 1d.
Shorting plug and socket .. .. 3½d.
Shellac .. .. 5d.

H.F. TRANSFORMERS

For Chelmsford .. 2/9
For B.B.C. range 2/6
Energo, McMichael, Bowyer-Lowe stocked.

MANSBRIDGE FIXED T.T.C. GREEN

·25 .. .. .. 2/9
1 mfd. 3/6
2 mfd. 4/6

CONCERT COILS

Set of 5: 25, 35, 50, 75, 100, **10/-** set.

Var. gd. Leaks .. 1/-
Fixed 2 meg. .. 9d.
Battery Links 3 for 2d.
Ins. Hooks .. 2 for 1½d.
Egg Insulators .. 1d.
Reel " .. 2 for 1½d.
Ins. Staples .. 5 a 1d.
6 ft. 'phone cords 1/- 1/6
Sleeving 3 yards 9d.
Tinned Copper 18 g. 5d.
Bus bar, hank 6d.
Knobs, 2 B.A. .. 2d.
Wander Plugs .. 1½d.
Strip Aerial, 100 ft. 2/-
7/22 Heavy, 100 ft. 1/11

COIL STANDS

Ebonite, 2-way .. 1/9
With ex. handles .. 2/3
Nickel " .. 2/8
3-way .. .. from 3/11
Basket Holders .. 8½d.
Best quality 1/-
Basket spikes 7d., 9d.
Anti cap. handles 9d.
Lead-in Tubes .. 6d.
Sorbo Ear Caps pr. 1/3

FLEX

2-colour doz. yards 1/6
Lighting doz. yards 1/6
Twin silk doz. yds. 1/-
Lead-in, thick, yd. 3d.
Do., good, 10 yds. 1/-

Rheostats 1/-
Ormond 1/9
Ebonite Former .. 1/6
With dial 1/11
Shipton, Igranic, Burndept, McMichael, etc., etc., etc.

SPECIAL!

Customers purchasing 20/- worth of our own goods (at full prices only) are allowed to buy a first-class pair of phones for 5/-, 4,000 ohms, as an advertisement. One pair to each customer. This offer must be taken advantage of at time of purchase.

CRYSTAL SETS

For 5 X X and B.B.C. **7/11**

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.

RADIOTORIAL

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

Editor:
NORMAN EDWARDS, M.Inst.R.E., F.R.S.A., F.R.G.S.

Technical Editor:
G. V. DOWDING, Grad.I.E.E.

Assistant Technical Editors:
K. D. ROGERS. P. R. BIRD.

Scientific Adviser:
Sir OLIVER LODGE, F.R.S.

Staff Consultant:
Dr. J. H. T. ROBERTS, F.Inst.P.

Foreign Correspondents:
L. S. LEES, Paris; Dr. ALFRED GRADENWITZ, Berlin; R. YATES, New York; P. F. MARTIN, Italy; W. PEETERS, Holland.

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 and 1/- per full wiring diagram. 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 question 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

C. S. D. (Bradford).—Wishing to wind a series of coils to cover broadcasting, I should be glad if you will give me details for aerial, anode, and reaction coils, either duolateral or basket type, and to be used with either a series or parallel ·001 mfd. aerial condenser.

The list of plug-in coils printed herewith shows the coils necessary to tune between 260 metres and 25,000 metres, when used in conjunction with the standard tuning condensers.

The first column gives the size of wire recommended for use in home-made coils, and the second column shows the approximate tuning range in metres. It will be seen that there is a wide overlap between the ranges, so that, for instance, 500 metres, which is in the top range of the second line, is covered by the middle range of the third line, and by the "bottom" range of the fourth line, which tunes from just below 500 metres up to over 1,000 metres.

This flexible tuning is one of the great advantages of condenser-tuned coils, and it not only enables the wave-length to be changed quickly, but covers a very wide range with a limited number of coils.

Nevertheless it must be remembered that in all cases where parallel condensers are used for tuning, it is invariably advantageous to keep the value of the coil high, and the condenser value as low as possible.

Where the aerial tuning circuit is coupled direct to the receiver the "secondary" column may be ignored, and the number of turns for the aerial coil is that shown under "Primary Turns." When loose-coupled tuning is employed the primary or aerial coil remains unaltered, but is coupled (in a coil holder) to a larger coil of the value shown under "Secondary Turns."

For basket coils, a correction factor is given below the table which shows how the wave-length alters when this type of coil is employed; otherwise the values are given as for duolateral coils, though it must not be forgotten that these are covered by letters Patent.

It should be noted that the reaction coil values are only approximate, and generally it is best to experiment with the different coils on hand until the best combination is found.

In the case of a series condenser the size of coil used should be roughly one size larger than that necessary when the same condenser is used in parallel. Thus a 50-turn coil becomes 75 when the condenser is changed from parallel to series.

* * *

B. F. (Sligo).—I have an H.F. and detector straight circuit set with which I can receive all B.B.C. stations at good 'phone strength. I have also received Hamburg on two consecutive nights, and an unknown French station practically any desired night.

PLUG-IN COILS.

Wire for Primary	Wave-length with average aerial	Primary Turns	Secondary Turns	Anode Turns	Reaction Turns (approx.)
24	260–375	25	35	35–50	35–50
24	310–515	35	50	50–75	50–75
26	370–730	50	75	75–100	50–75
26	460–1030	75	100	100–126	75
26	580–1460	100	150	150–200	75
26	790–2200	150	200	200–250	75
26	1060–2850	200	250	250–300	75
26	1430–4000	250	300	300–400	75–100
28	1680–4800	300	400	400–500	75–100
28	2180–6300	400	500	500–600	100
30	3130–8500	500	600	600–700	100
30	4100–12000	600	700	700–800	100
32	5100–15000	750	850	800–900	100
32	6300–19000	1000	1100	1100–1200	100–150
34	7100–21000	1250	1350	1350–1450	100–150
36	8300–25000	1500	1600	1600–1700	100–150
		·001 mfd. in parallel	·0005 mfd. in parallel	·0002–·0003 mfd. in parallel	

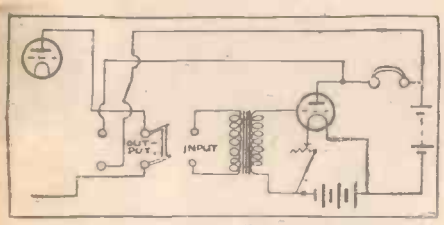
For basket coils allow about 20 per cent. off the maximum wave-length. Wind on a former of 11 slots, with centre diameter of 1¼ in. For a ·0005 mfd. condenser instead of ·001 mfd. allow 35 per cent. off max. Many well-known coils, including the duolateral types, are subject to letters patent and the amateur would be well advised to obtain permission of the patentees to use the patents before doing so.

(*Continued on page* 1447.)

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 1446.)

The connections are shown below, though if reaction is used it must be inserted between the plate of the valve and the switch. It will be noticed that when the switch is thrown over to the left-hand position the 'phones are placed in the plate circuit of the preceding valve. No grid bias is shown in the diagram, but it is generally an advantage to insert this, at the point where the lead from the rheostat joins the lead from L.T. to the secondary of the L.F. intervalve transformer; one or more dry cells are generally connected in series for this purpose and



joined to the lower end of the transformer secondary. The positive pole of the cells is connected to the L.T. negative side, so that the grid is permanently negative with respect to the filament. The number of cells which should be added for this purpose varies with different valves, but generally one or two will be sufficient. It will be necessary to vary the H.T. voltage in accordance with variations of the grid bias, but when once a suitable bias value has been found and the correct H.T. adjustment made there will be little need to alter the values. The chief necessity for alteration arises from the fact that as the batteries deteriorate the set apparently requires a different H.T. voltage, though actually this alteration is due to the voltage of the H.T. battery having dropped so that the figures are no longer a reliable indication of its voltage.

* * *

W. W. F. (no address) has had trouble with his "Unidyne" one-valve set and queries his coils. These, he states, are of the basket type with 15 and 7 turns for reaction and aerial respectively.

If the numbers stated are correct, the coils are hopeless for use in either the Unidyne or any other circuit unless for short wave (80 metres) reception. The coils should be of 100 and 75 respectively, and basket coils (not double wound) are usually quite efficient.

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement is now in force:—

(1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.

(2) A charge of 1/- is made for supplying full wiring diagrams.

(3) All queries, together with postal orders and stamped and addressed envelope, to be addressed to—

TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.

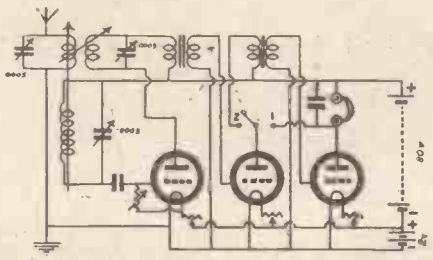
(4) Technical queries will not be answered by telephone.

Correspondence

"D X" RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps some of your readers will find the accompanying circuit of some interest. As no H.F. is used I think the results are rather remarkable. The following are some of the stations heard, and are all loud-speaker strength unless stated otherwise. With the exception of the American stations and the low-power nearer stations, most, including all B.B.C., are moderate loud-speaker strength on two valves only, 5 I T, the local station, being heard 100 yds. away on two valves; while with three, speech is perfect at this distance. The loud speaker is a Junior Amplion. All the German stations come in well; Brussels, Radio



Iberica, Vienna, Rome, Stockholm, Petit Parisien' Posts and Telegraphs, Nice, Société Electrique à Radio Telephonique (Paris), among the Continentals, are all of very good strength. Please note that the set is only built to tune from 250 to 510 metres. I have had the following American stations: W G Y (Schenectady), W B Z (Springfield, Mass.), W M A F (Dartmouth, Mass.), W E A F (New York City), W J A X (last letter uncertain) (——, Ohio), W F I (Philadelphia), K D K A (Pittsburg), and W I P (Philadelphia). The last one mentioned was of 'phone strength only. W B Z and W G Y have been obtained on an indoor aerial consisting of the extension leads to the loud speaker, and about 30 ft. long. When W B Z was obtained on the outdoor aerial, I had to cut out the last stage of low frequency so as not to wake up the rest of the house.

My aerial, I may say, is 27 ft. high at the free end and 23 ft. at the downlead end and badly screened, and, in addition, passes over a roof of a high outbuilding. A waterpipe earth is used, the connection being very short.

Yours faithfully, EDMUND A. BLAND.
Oxendon, Market Harborough.

THE SUPER-SELECTIVE CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—As a serious experimenter for a long time now, I feel I must write you my experience of the one-valve super-selective circuit you published last week.

I have built this up exactly as your instructions in every respect with the exception of the resistance, in this instance I was forced to deviate on account of the fact that I cannot trace one of the variable type on the market that goes down as low as 10,000 ohms, the minimum of mine being 20,000 ohms.

However, this did not prevent exceedingly fine reception of a shade over normal one-valve strength, which surprised me.

As regards selectivity one-third turn of the vernier completely cut out 2 L O. If this is not selectivity then we shall never have it.

In case some readers may be afraid of the range of such a circuit, I may say that I tuned in, on the one valve only, W B Z last evening, and if I had cared to wait up to the early hours of the morning, I could have found several more of the American Stations I feel sure.

I forgot to mention that I used a square law condenser for the ·0005.

In a short letter it is not possible to mention the names of all the component parts, but these were purchased from a Mr. Madden, of Wardour Street, London, who will, I feel sure, extend the same courtesy to builders of this set as he did to me.

Congratulating you on publishing such an excellent circuit and emphasising the need for using first-class parts.

Yours faithfully, G. HEPTINSTALL.
205, Richmond Road, Twickenham.

INTERESTING CRYSTAL EXPERIMENTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—For some time past I have been experimenting with different metals in order to find out whether there could be any advance made upon the ordinary crystals—e.g. hertzite, carborundum, and the like.

I find that an ordinary piece of cinder in contact with either Hertzite or a cat's-whisker yields excellent results. I am using a reflex circuit with an Autoveyors' three-electrode variable condenser. I have carried out this humble experiment again and again and find that the cinder works very well. Theory is all very well, but should be kept in its place. I think we need to-day more laboratory work than that of the "study."

I have used your circuit of H.F. Valve and Crystal, "P.W." No. 131, using the cinder, and found that this circuit gave me all that I desired. With regard to the carborundum crystal, I get beautiful results from this when used with a piece of resistance wire without any voltage being put across it. Also the aerial wire I am using is exactly the same as that with which I wind my coils. Here I find excellent results are obtained. We are told to use fairly thick wire, but experiment proves that this is quite unnecessary. One is apt to forget that in using thin wire the inductance is high even if the resistance is high.

I have been experimenting now with wireless apparatus for nearly twenty years, and I have come to the conclusion that if one desires to advance in the knowledge of wireless telegraphy or wireless telephony the laboratory (and not the study so much) is the place to find out certain things. This applies to the science of physics, and surely this applies also to all radio work, which is a branch of physical science.

I have put these few remarks on paper not so much for what they may be worth as from the light of yielding a little help to other experimentalists.

Wishing you continued prosperity.

Yours faithfully, P. C. ANDREWS.
"Montrose," Sturry, Kent.

A ONE-VALVE UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—With regard to the "Unidyne" set, I feel that I must thank Messrs. Rogers and Dowding for inventing so good a set. I made a one-valve "Unidyne" (transformerless) set last week and find that it is fine, for I can get nine English stations, one French, (Petit Parisien), one Belgian (S B B), one German (Münster). There are also three more stations (Continental) that I get, but I do not know them. I live six miles from 6 S T (Stoke), which comes in well on loud speaker.

Yours truly, F. CHADWICK.
Linley Cottages, Talke, Staffs.

THE "P.W." REFLEX.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have much pleasure in informing you of the excellent results I have obtained with your "P.W." One-valve Reflex Circuit.

I am not exaggerating when I tell you I can switch on, adjust crystal and coils, and tune in right away W G Y, K D K A, and W B Z.

Several of my friends, who can vouch for these results, have been surprised at the quality and clarity, which at times surpass 2 L O at crystal strength.

I work London on a loud speaker (seven miles away), and all stations in the British Isles can be obtained on the 'phones, besides receiving Eiffel Tower, Petit Parisien, Ecole, Bremen, Stuttgart, and numerous other stations. In fact, nothing beyond reach—within reason, of course!

I have constructed and experimented with various other one and two valve circuits, but have always been glad to revert to the old "Reflex," which, in my estimation, properly tuned and adjusted, requires some beating.

Wishing your paper the success it deserves.

Yours truly, H. J. EVANS.
40, Poynton Road, Tottenham, N.17.

THE MODIFIED FLEWELLING.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have received so many letters about my Modified Flewelling Circuit that I think the following particulars may be of interest to your readers.

I have had very successful results, namely, loud-speaker work 30 miles north of London, and also in Maidstone with the set I made for a friend.

The circuit is a straight single-valve circuit, using a D.E.R. valve with 66 volts on the plate, and the super effect is obtained by a specially designed twin variometer. This is made as follows:

The stator consists of a 9 in. cardboard tube four inches diameter. The aerial tuning winding consists of 34 turns of No. 24 D.C.C. wire with a space left in the centre of the winding for the rotor stem. One inch from the end of this winding the anode winding

(*Continued on page* 1449.)

CORRESPONDENCE.

(*Continued from page* 1448.)

is commenced, and consists of 66 turns of No. 28 D.C.C. wire with a space left for anode rotor stem in the centre, as before.

The two rotors consist of a length of cardboard tube, on which are wound 36 turns for the aerial tuning inductance and 66 turns for the anode. A variable grid leak is used, either Watmel or Bretwood.

The grid condenser is of small value, ·0001, but it is advisable owing to varying conditions to test the set with a variable grid condenser of a value ·0002, and when the value is found, replace by a fixed one.

This circuit is also free from the usual whistle found common with other super circuits, and has nothing in common with the Flewelling. A bright-emitter valve may be used with a plate voltage of 100 to 120 with slightly more powerful results.

The success of this circuit, as in my Modified Flewelling Circuit, depends on the capacity of the aerial, and it may be necessary to increase it by bringing the lead-in fastened to a wall for some distance, or on other conditions to slightly shorten the aerial, but there is no doubt when you have got the result right.

Yours truly,
KENNETH COLE (Lt.-Col.).

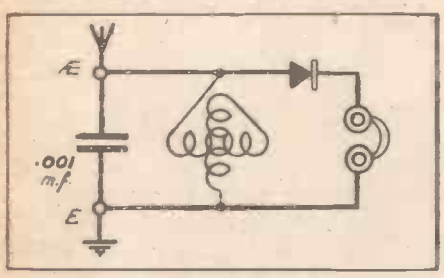
Elsen End, Elsenham, Essex.

TUNING CHELMSFORD IN.

The Editor, POPULAR WIRELESS.

Dear Sir,—The diagram of connections herewith, showing how I have adapted my crystal set to pick up Chelmsford in addition to other stations, may be of interest to some of your crystal set readers, as being simple and effective.

It will be seen that instead of the usual plug-in coil in series with the tuning coil or variometer, which necessitates drilling the panel and fitting an adaptor for the coil, I make use of a ·001 mfd. fixed



condenser connected directly across the earth and aerial terminals. This arrangement gives a reception equal to that obtained by using a plug-in coil, and in addition gives more selective tuning.

I might add that I originally purchased the condenser to shunt my telephones, in the orthodox manner, but have since discovered that this is a quite unnecessary refinement. Some of your readers will doubtless have made a similar discovery, and may be glad to find a use for their discarded condenser.

I am, dear sir,
Yours faithfully,
R. D. WOOSTER.

72, Baldock Road, Letchworth, Herts.

(*Continued on page* 1450.)

WIRELESS FOR THE BEGINNER.

(*Continued from page* 1434.)

vice versa, and we have a step-down transformer.

We apply our plate voltage, therefore, to the primary of a "step-up" transformer, and thus increase the potential to be applied to the grid of the third valve, and with this comes the power to control a still greater change of current in the plate circuit of the third valve. Instead of the telephones we could again insert a transformer in the plate circuit of the L.F. amplifier and "step-up" the potential again, and apply it to the grid of a fourth valve, and so on. This is what is meant when reference is made to several "stages" of L.F. amplification. In a similar way, several stages of L.F. amplification could be coupled together, though the transformers would be of different design and the operation of the valves more difficult to control in order to obtain good results.

CORRESPONDENCE.

(Continued from page 1449.)

FURTHER CRYSTAL "DX" RECORDS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was very interested to read the letters on long-distance reception with the crystal in No. 137.

My own experience may interest readers.

Any night when reception is good, I can receive the Glasgow station, which I believe is nearly 350 miles away. I can get fairly regularly Bournemouth, Cardiff, Manchester, Birmingham, and Newcastle. Peculiarly enough I have never received Belfast or Aberdeen. Brussels comes in very well, and on two occasions I have heard Petit Parisien.

I notice that your correspondent, Mr. B. H. Day, has received what he believes to be Radio Paris on two occasions. This station can be received on this same crystal set at any time during the day. Eiffel Tower telephony has also been heard once or twice.

At present I am experiencing a difficulty in obtaining sharp tuning, but it is hoped to fix up a capacity earth shortly.

Yours faithfully,
G. N. ELAND.

P.S.—Besides the above stations I have received about 55 amateur stations.

26, Croft Road.
Merton, S.W.19.

COLD FILAMENT RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to your paragraph under the above heading in your "Radio Notes and News of the Week" of the issue of your paper dated January 17th.

I have experienced like results to those of your Edinburgh correspondent with a B.T.H. one-valve crystal-reflex circuit instrument, made by Messrs. B.T.H., and the following characteristics were observed:

(1) The valve was a B.T.H. dull emitter and the circuit tuned to receive the local station as for ordinary reception, using the L.T. battery. The filament current was then turned off by means of the rheostat. I made sure that it was really "off." The proceedings of the local station could still be heard at very weak strength, roughly comparable to that of a crystal set 10 miles from 5 N G.

(2) In order to discover whether it was freak or not, the accumulator was next disconnected, when signal strength increased greatly. It was then just less than the strength of crystal reception about 1¼ miles from the station. In order to get the fullest results it was necessary to slightly re-tune and the tuning became most critical from a selective point of view. There did not seem to be enough power to cause self-oscillation.

(3) The circuit is one that, under normal conditions—i.e. using both batteries, requires both aerial and earth to effect reception. The next step was to disconnect the earth, when again slight re-tuning was necessary, but signals remained at similar strength to that mentioned in (2). The aerial was then connected to "Earth" on the set and results continued unchanged. Similarly the earth wire was connected singly to "Aerial" and "Earth" in turn, but there were no results. The effect was then tried of connecting aerial to "Earth" and earth to "Aerial" but again no results were obtained.

I am most interested in developments of this nature, and trust that my observations may be of use to you.

I believe Dr. Roberts, in his "Technical Notes," some time ago referred to a somewhat similar experiment in America (so far as memory serves), when the H.T. battery's voltage was enormously increased and stated that in that case "the poison was worse than the cure." But in the case on which I make observations this battery was only one of 60 v., and I feel it has possibilities. Would that I had the opportunity of experimenting further!

Now, in concluding correspondence with gentlemen of journalistic profession, I understand it is the practice to terminate with compliments to the paper concerned and to say one has been "A Reader from No. 1," or something of that sort (I have, but am not emphasising it). But quite apart from customary considerations, I should like to express my great appreciation of your paper. I haven't agreed with everything printed, but nevertheless it is well worth support, and it shall have mine. My copies are read by two people besides myself, and often come in handy for reference by neighbours and friends, too. I now await with interest the publication of details of a five-valve Unidyne, 2 H.F. tuned anode, det., and 2 L.F.; further information with regard to television; and (inter alia) more articles by "Ariel."

Yours faithfully,
A. H. COUPE.

63, Derby Grove.
Nottingham.

(We wonder whether our correspondent was able to obtain the above results with his crystal contact raised?—Tech. Ed.)

TECHNICAL NOTES.

(Continued from page 1407.)

the helium in the valves now in use is said to be the purest in existence.

The admixture of even a minute quantity of impurity in the gas would have the effect of rendering the tube useless for practical purposes. It has, of course, long been known that the nature of the residual gas exercises an important influence upon the functioning of the valve, and largely for this reason it has been found to be most convenient in practice to exhaust the valves to the highest attainable degree of vacuum.

The development of the helium valve is largely due to F. S. McCullough, a well-known American engineer, who tried a large number of pure gases in valves, with a view to taking advantage of the cooling effect of the gas. In many of his experiments he used a metal air-cooled valve. As a result of these investigations he found that helium, if employed in a high state of purity, gave excellent cooling and a very large space-current. Helium tubes of this type have now been in use continuously for over six months without any failure. An account of this work will be found by those interested, in the November number of "QST," the official journal of the American Radio Relay League.

Radio Pictures.

Several newspaper accounts have lately been given of the experiments in the wireless transmission of photographs between London and New York. These experiments demonstrated the remarkable strides which have been made in this new art. A photograph of President Coolidge, which was transmitted in this way, was perfectly clear and recognisable. The method adopted is similar to that of Monsieur Belin, the famous French wireless engineer, but certain modifications have been introduced, as will be seen from the following interesting brief account, which is quoted from the "Irish Radio Journal."

"The apparatus used consists of a rotating glass cylinder containing a powerful light.

"A negative film is fastened outside the cylinder, and this is revolved; light passes through the film and through a lens, which moves in front of the cylinder, directing a light ray on a photo-electric cell, which sends out a radio wave.

Slow Process.

Whenever the light from the cylinder is obstructed by a dark spot on the film, no ray passes through the lens, and the photo-electric cell remains 'silent.' The contrary is true when the film is transparent, and a complete record of the picture is thus sent by radio across the Atlantic. The receiving apparatus is composed of a rotating drum and a stylus, operated by the radio waves received, and draws a dark mark where strong light has been sent from the other side; it remains motionless when no light is recorded by the photo-electro cell. Thus a positive reproduction is obtained which looks much like an engraving. Technical problems, such as the action of the stylus and the drying of the ink to prevent blotting, are about all that remain to be done before a commercial service can be established. Photographs were sent at the rate of one per half hour."

(Continued on page 1452.)

TECHNICAL NOTES.

(*Continued from page* 1451.)

Jack Connections.

Plug and jack connections, although extremely convenient for certain purposes, do not seem to be so popular in this country as abroad, probably owing to the fact that unless the jack is carefully adjusted, all kinds of bad contacts may arise. Whenever you install a jack in a set, the best plan is not to trust any of the contacts in the jack until each of them has been carefully tested. So far as my experience goes, it will almost invariably be found that one or other of the prongs will require to be adjusted, and this may be done by very carefully bending, by means of small square-nose pliers, which are inserted between the adjacent prongs. In making the adjustment, you must take great care not to overdo it, as otherwise the alternative contacts when the plug is inserted will be thrown out of order.

Keep Contacts Clean.

Before regarding the jack as being properly adjusted, you should repeatedly insert and remove the plug and observe very carefully whether the "stationary" prong (that is, not the one which is principally displaced by the insertion of the jack) moves appreciably from its normal position owing to the pressure against it of the "moving" prong. Unless there is an appreciable movement together of the two engaging prongs, you may be sure that sooner or later you will have trouble with the contact. Sometimes the contact will be uncertain, even when the above conditions are fulfilled. In such a case, the remedy is to introduce a small strip of the finest grade of emery paper between the prongs, and clean up the contact tips. It should be remembered that, although jacks are so convenient and are, of course, enormously used in ordinary manual telephony, they violate one of the main principles of good electrical contacts, in that they rely upon a simple "touch" contact without any rubbing of the contacting surfaces, and it is for this reason that they require rather special attention.

High-frequency Measurements.

A new type of electrometer, which is specially adapted for measuring the voltage of very high-frequency alternating currents, has recently been described before the Paris Academie des Sciences, by Messrs. Gutton & Laville. An aluminium plate 5 mm. in width is supported from a quartz thread 3 mm. long, the suspended system weighing only 15 mg. A spot of light reflected from the moving system is thrown upon a scale several feet away, and voltages can be measured with accuracy to within one-hundredth of a volt. The instrument can be made in portable form, and is expected to be of considerable importance in wireless measurements.

Wiring.

It is interesting to hear the various records established by constructors in the matter of the time occupied in wiring up a set. A friend of mine recently informed me that he constructed a three-valve set (Det. and 2 L.F.), starting with a plain panel at three o'clock in the afternoon and was listening-in by 10.30 p.m. This included drilling of the panel and soldering of all wiring joints, as well as fixing up a temporary indoor aerial. It would be interesting to hear of other examples of record construction—no doubt many of my readers will be able to beat this by yards.

Bending Wire.

In wiring up the components of a set after laying out on the panel, although the formation of neat circular and right-angle bends has not necessarily any great effect on the efficiency of the set, many constructors take a great pride in having the wiring so that the set will bear inspection not only before the panel, but behind as well. The formation of neat bends in either round or square-section wire is not easy with ordinary pliers, and in factories where wire bending of this kind is done on a large scale, pliers are used with special shaped jaws, adapted to the particular work for which they are intended. I saw recently a very useful adaptation of this principle, for the benefit of the wireless experimenter, brought out by the Rockwood Co., Ltd., in which a small steel block is attached by means of a set screw to one of the jaws of a pair of round-nosed pliers. In the block are a number of channels, by means of which different types of bends may readily be given to wire, simply by gripping the latter between the block and the remaining jaw of the pliers.

Glass Panels.

Some time ago I gave in these notes a method of making holes through a glass panel without the necessity for tedious drilling; the method consisted in making a mound of moist sand around the spot where the hole was to be pierced, pushing a pencil through the sand so as to make a vertical tunnel down to the glass and then pouring in molten solder or lead, after which the circular piece of glass might be cracked out. I asked at the same time for accounts of experiments which any readers might make with this method, and I have received a number of letters in which success is reported. But most of the readers point out that there is a certain "knack" in doing the trick, and that it is better for anyone contemplating the use of this method to acquire the said knack by practising first upon a scrap piece of glass before starting upon the panel itself. Neatness in making a clean and accurately-sized tunnel in the sand appears also to be essential.

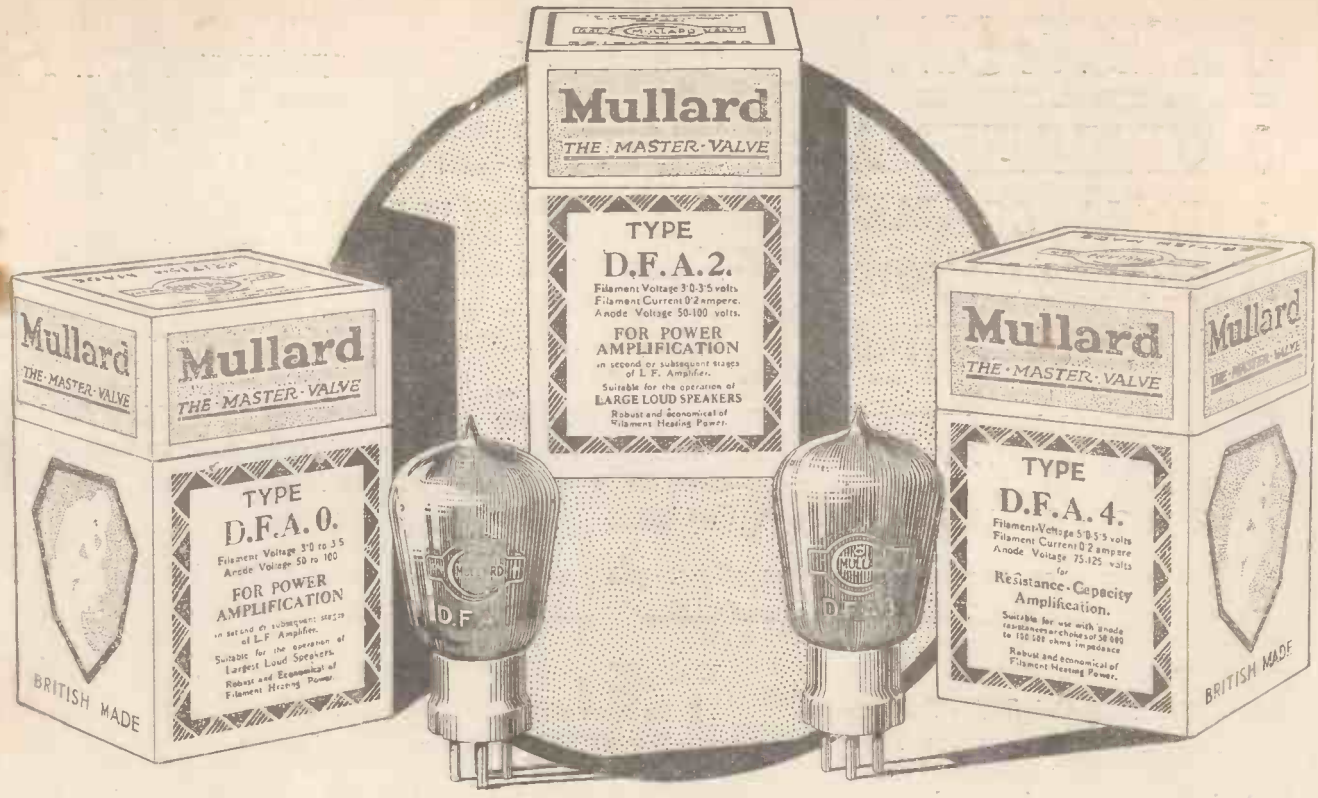
Amateur Transmission to India.

What is claimed to be the first reception of a British amateur in India is that by Mr. George Benzie, at Cachar, India, who received the signals of Mr. Gerald Marcuse (2 N M), of Caterham, Surrey. An arrangement was made between these two experimenters for 11.45 p.m. on December 4th, and the signals of the British amateur were received plainly and at good strength; the distance is about 5,000 miles. The receiving set employed three valves, and a four-wire cage aerial 40 ft. in average height and 80 ft. long.

Dial Vernier.

The following, quoted from the "Radio News of Canada," may be of interest to some experimenters: "To keep the rubber-tipped pencil from moving away from the dial, drive a phonograph needle through the panel at the edge of the dial. The rubber of the pencil can then be forced on to the needle and then on the dial. It cannot slip, and good vernier control will be obtained."

R/R



REAL POWER VALVES

WHEN you want Power Valves for highly efficient power amplification, it will pay you to emphasise

MULLARD D.F.A. MASTER VALVES.

These Valves have been specially designed for maximum power work with a low temperature, long-life filament for minimum current consumption.

THEY'RE MULLARD, SO THEY'RE GOOD.

Note the Distinctive Types for Special Operation.

For large loud speakers giving increased volume and clarity:—

D.F.A. 0, and D.F.A. 2 (for 4-volt Batteries) **26/-** each.
D.F.A. 1 (for 6-volt Batteries) .. .. **30/-** each.
D.F.A. 3 (for 6-volt Batteries) .. .. **32/-** each.

For Resistance Capacity Amplifiers:—

D.F.A. 4 (for 6-volt Batteries) .. .. **30/-** each.

Leaflet V.A. 4 gives full technical information.

WHEN YOU BUY, EMPHASISE—

Mullard

THE·MASTER·VALVE

Printed and published every Thursday by the Proprietors, The Amalgamated Press (1922) Ltd., The Fleetway House, Farringdon St., 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, 19/6 per annum, 9/9 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, February 14th, 1925.

THE P.W. "CONTINENTAL" SET

Popular Wireless and Wireless Review

PRICE 3d. EVERY THURSDAY.

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

Mr. Marcuse, the Caterham amateur, who has been in wireless communication with the Hamilton-Rice expedition up the Amazon.

FEATURES IN THIS ISSUE.

No. 143. Vol. VI. February 21st, 1925.

Names famous in combination. No. 4.

Venus and Adonis

FROM the idealised figures of mythology to affairs of modern interest is perhaps a far cry; yet certain names famous in combination are conceded their due renown whatever the period of conjunction.

To-day the association of the two celebrated names, MARCONI and OSRAM, has resulted in the splendid outcome of their joint effort—"The Valve in the Purple Box."

Read the 40-page wireless book, The Book of MOV. Free from your dealer or the M.O. Valve Co., Ltd., Hammersmith, London, W.6.

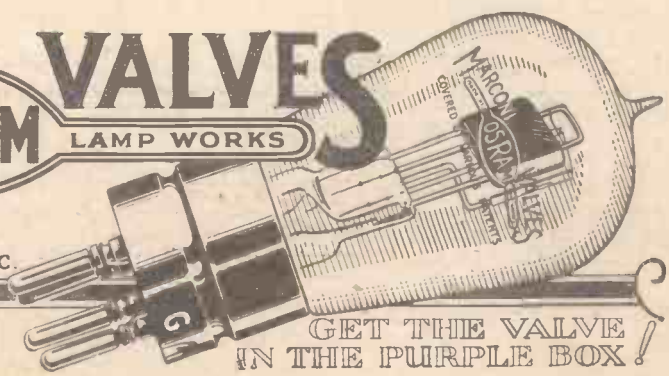
NEW REDUCED PRICES.

Purpose.	Type.	Price.
For 2-volt Accumulators.		
†G.P.	D.E.R.	18/-
†L.S.	D.E.6.	22/6
For 4-volt Accumulators.		
G.P.	R.	11/-
G.P.	*D.E.3.	21/-
L.S.	D.E.4.	26/-
For 6-volt Accumulators.		
G.P.	R.5.V.	11/-
L.S.	D.E.5.	30/-
L.S.	∴D.E.5b.	30/-
L.S.	L.S.5.	50/-

†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

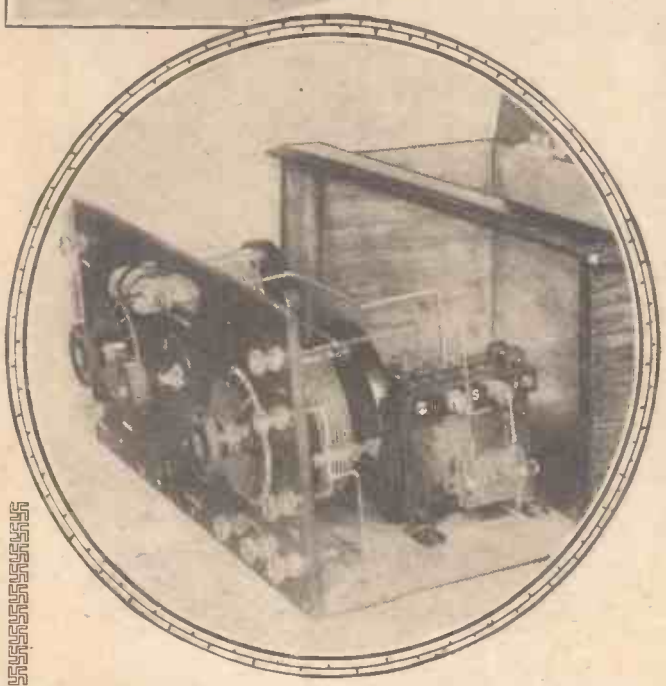


Sold by Wireless & Electrical Dealers, Stores, etc.

ANNOUNCEMENT OF THE M.O.VALVE CO. LTD.

GET THE VALVE IN THE PURPLE BOX!

Wiring up the One Valve Reflex Set fully described in "How to Make Wireless Sets," "Best Way Book" No. 162.



The One Valve Reflex Receiver complete and ready for use.

A STATEM... ar... Proof

Rosslyn,
Irby Road,
Heswall,
Cheshire.
14/10/24.

Messrs. Chloride Electrical
Storage Co., Ltd.,
Clifton Junction,
Nr. Manchester.

Dear Sirs,

I am writing to inform you that I have been successful in receiving several American Broadcasting Stations on one valve and using, both for L.T. and H.T., "Exide" Accumulators. This performance was carried out last year on two separate occasions both after fitting "Exide" H.T. Accumulators.

I feel quite sure that as this is not an everyday affair, you would like to be acquainted with the fact.

Yours faithfully,
(Signed) W. Arthur Maddocks.

Westinghouse Electric and
Manufacturing Company,
82, Worthington Street,
Springfield, Mass.
November 3, 1924.

Mr. W. Arthur Maddocks,
Rosslyn, Irby Road.
Heswall, Cheshire,
England.

Dear Mr. Maddocks,

We wish to thank you for your letter of October 18th, reporting your reception of Westinghouse Radio Station WBZ. It is with pleasure that we enroll you as one of the distant listeners of our station. The program items you mentioned were broadcast by WBZ as mentioned by you.

Station WBZ is owned and operated by the Westinghouse Electric and Manufacturing Company, and is located at Springfield, Mass., with studios in Springfield and Boston, Mass. We operate nightly between the hours of 6.00 and 11.00 p.m. Eastern Standard Time, which is five hours slower than Greenwich Mean Time, at a frequency of 890 kilocycles or on a wave-length of 337 meters. Power, 1,000 watts.

We trust that your receiver will continue to function as well in the future, and shall be pleased to receive your comments and criticisms on our programs.

Yours very truly,
(Signed) A. S. Eisenmann.
Radio Station WBZ.

ASE, IET.

America on One Valve with Exide

BATTERIES for WIRELESS

Made at the largest battery works in the British Empire

Exide THE LONG-LIFE BATTERIES

MANUFACTURED BY

THE Chloride ELECTRICAL STORAGE COMPANY LIMITED.

AT CLIFTON JUNCTION, near MANCHESTER.

LONDON: 219-229, Shaftesbury Avenue.
BIRMINGHAM: 57-58, Dale End.
MANCHESTER: 1, Bridge Street.
BRISTOL: 22, Victoria Street.

UNGSTALITE

(Regd. No. 447,149)

thetic Crystal Rectifier

BLUE LABEL

IMPORTANT ANNOUNCEMENT

Resulting from the unscrupulous sale of a fraudulent imitation of their product and of infringement of their registered trade mark, the Manufacturers have been forced to take legal action to protect the interests of themselves, the public, and of genuine traders. A summary of some of these actions is set forth below.

ALBERT WEALE.

At the Old Street Police Court on February 5th, Mr. Albert Weale, of Chingford, was found guilty to the charge of attempting to obtain money by false pretences in view of the fact that he had sold crystal described as TUNGSTALITE Registered No. 447,149, and bearing labels similar to, but an imitation of, those adopted by the manufacturers, which crystal he sold in fact proved to be inferior to, and a fraudulent imitation of, the genuine article. The magistrate bound over the accused to the sum of £50 in respect of this charge, and he fined the accused in respect of a summons served by Messrs. Tungstalite Limited on the accused under the Merchandise Marks Act.

MESSRS. BARCLAYS' RADIO STORES LTD., BIRMINGHAM.

In the High Courts of Justice before the Hon. Mr. Justice Romer, on January 30th, 1925, an Injunction with costs and an enquiry as to damages was granted against defendants, Messrs. Barclay's Radio Stores Ltd., 30, Stephenson Street, Birmingham, to restrain them from infringing the plaintiffs' registered trade mark "Tungstalite Registered No. 447,149."

WARNING. Legal proceedings will be taken against any person who knowingly assists in the distribution of this fraudulent material.

THE TRADE are invited to apply to the manufacturers for such information as will enable the dealer to immediately distinguish the fraud from the genuine. No legal action will be taken against any trader who VOLUNTEERS information.

THE PUBLIC are requested to continue to purchase "TUNGSTALITE" with **RENEWED CONFIDENCE.** Genuine Tungstalite is ABSOLUTELY GUARANTEED Perfect, and in the event of any complaint, a replacement (even of a fraudulent specimen) will be immediately supplied by the makers, provided that the dealer's invoice, together with the actual specimen, is sent to us.

TUNGSTALITE LTD.,

LONDON and PROVINCES:
47, FARRINGDON RD., LONDON, E.C.1
'Phone Holborn 2557. 'Grams: Tungslamp, Smith, London.

YORKSHIRE:
41, CALL LANE, LEEDS.
'Grams: Tungslamp, Leeds. 'Phone: 21375 Leeds.

POPULAR WIRELESS
The Radio Weekly with the Largest Circulation
Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.S.A., F.R.G.S.
Scientific Adviser: Sir OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Grad.I.E.E.

RADIO NOTES AND NEWS.

The Puzzle Station—Mr. Flewelling's Transmitter—"A Good Night."

U2X1.

NOW that W G Y, the General Electric Company's main station at Schenectady, New York State, is being received easily in this country on ordinary straight sets, listeners may like to try for the other G.E.C. station at Schenectady. This is U 2 X 1, which sends out a regular programme on Saturdays, on short waves. Signals are transmitted from two sets simultaneously, on 30 and on 100 metres, at the following times: Telegraphy, 6 p.m. to 8 p.m., and 12 a.m. to 2 a.m.; telephony, 8.30 p.m. to 12 p.m. These figures are given in American time, which is five hours behind G.M.T.

* * *

The Pope's Radio Receiver.

MY remarks on this subject in "P.W.," No. 139, have brought me a letter from Mr. F. N. Benazzi, of Rome. He says that according to Comm. Mannucci (Commissioner of Works to the Vatican), the receiver referred to is installed in the private apartment of Cardinal Gasparri. The only receiver accepted by His Holiness, and placed in the Audience Chamber, is an Ethophone V., which is used in conjunction with an Amplion loud speaker.

* * *

The Puzzle Station.

THE World's Playground station at Atlantic City, the call-sign of which was such a puzzle to British listeners when the station first "took the air" recently, has its own initials for its call sign —W P G. Its wave-length is 296 metres, and the power employed is 500 watts. I am indebted for these particulars to Mr. E. Tarplee, of Gloucester, who forwarded me a cheery letter from the station, confirming his reception of its opening programme.

* * *

A Rival.

THE Daventry station will have to look to its laurels, for Harry Tate tells me that he has perfected the "transmitting apparatus" used before the King and Queen at the Alhambra recently in his sketch "Broadcasting." He uses a set which is ideal for home construction, the chief components being an old umbrella, a bucket, a typewriter, a frying-pan, a gas-meter, and a tinker's barrow!

No Easy Task.

FINDING out which is the best place in Britain for the reception of broadcasting is no easy task. Since I raised the question a few weeks ago I have received scores of letters from all over the country, some of them attested by unimpeachable authority, and vouched for by the vicar. County Durham is a warm favourite, and one Seaham Harbour reader tells me of some especially good work upon an indoor aerial there. It is a remarkable fact that most of the star reception is done on straight circuits, det. and L.F. being the favourite and most successful combination for two-valve sets.

* * *

Correspondents Wanted.

"I AM a 'radio-fan,' twenty years of age, and I would like to hear more about radio in other countries," writes a young American who wishes to get in touch with an English amateur by correspondence. Judging by the letter he sends me, he would prove an interesting correspondent. Letters should be addressed to Melvil Youngman, Box 425, Eureka, Illinois.

* * *

Mr. Flewelling's Transmitter.

MR. C. W. GOYDER, whose exploits on the set at Mill Hill School are world-famous, tells me he has been looking out for 9 X B G in connection with a test for "P.W." 9 X B G is the call sign of Mr. Flewelling, but apparently he has not been sending because Mr. Goyder regularly "bags" half the ether. His log is so full of Alabama, Kentucky, Texas, Georgia, and the rest of the coon-country, that it looks like a cotton-field, and darkies who "wanna hear once mo' from the ole home town" couldn't do better than put up a set like the one at Mill Hill School.

Mr. R. E. Jeffrey, Dramatic Producer for the B.B.C., in 2 L O's Control Room.

* * *

"A Good Night."

ON the day I saw Mr. Goyder, he was a trifle tired because the night before had been rather a good one, and had tempted him from his bed. Pressed for details of what "a good night" represented, he modestly admitted to having received 40 reports from the U.S.A. (via 18 different amateurs), and to working with Porto

(*Continued on page* 1458.)

NOTES AND NEWS.

(*Continued from page 1457.*)

Rico and New Zealand. Besides receiving five messages from the Antipodes, he was picked up in India on that same occasion—a record of rapid "travel" that makes the fabulous seven-league-boots look like ten cents, as they say in the U.S.A.

* * *

Canadian Stations.

IN addition to C N R A, the Canadian National Railways own a number of stations all over Canada, and in each case the first three letters of the call-sign are C N R. The fourth letter gives the initial of the town, and the following have been allotted already: C N R—S, Saskatoon, W—Winnipeg, C—Calgary, T—Toronto, E—Edmonton, O—Ottawa, R—Regina, and M—Montreal.

* * *

Those Queries.

THE Technical Queries Editor tells me that no less than three members of the Technical Staff have been ill with influenza. Replies to readers' queries have been delayed in consequence, but at the time of writing arrears are fast being overtaken, and probably normal working will be resumed by next week.

* * *

Amazing Amazon.

ONE of the most romantic radio feats yet recorded is that of Mr. Gerald Marcuse, of Caterham, who has been in wireless touch with the Hamilton Rice Expedition. The party left civilisation last year and have been exploring the Amazon. Infrequent and inadequate news of the adventurers trickled through from the back of Brazil from time to time, but Mr. Marcuse bridged all the difficulties between Surrey and South America at 6.30 a.m. one morning, and took down a message giving full particulars to date. The message concluded: "Objects of the Expedition have been attained. All well."—a fine piece of work that was recorded by radio in fine style.

SHORT WAVES.

". . . Capt. Eckersley said that the announcement of the names (of B.B.C. announcers) had been dropped as a matter of pplicy. They felt it a little undignified and ostentatious to advertise the name of a man who merely carried out an ordinary and necessary function. There would be much justification for giving the names of the engineer and commissionaire on duty. . . . ."—"Yorkshire Telegraph and Star."

* * *

". . . . it was also the spirit of St. Paul, who, if he were in America to-day, would have erected a broadcasting station years ago. . . . ."—Fr. J. Handley, C.S.P. ("Catholic Herald").

* * *

". . . there is a great future for wireless work to be carried on by intelligent women. . . ."—Mr. Wm. Le Queux.

* * *

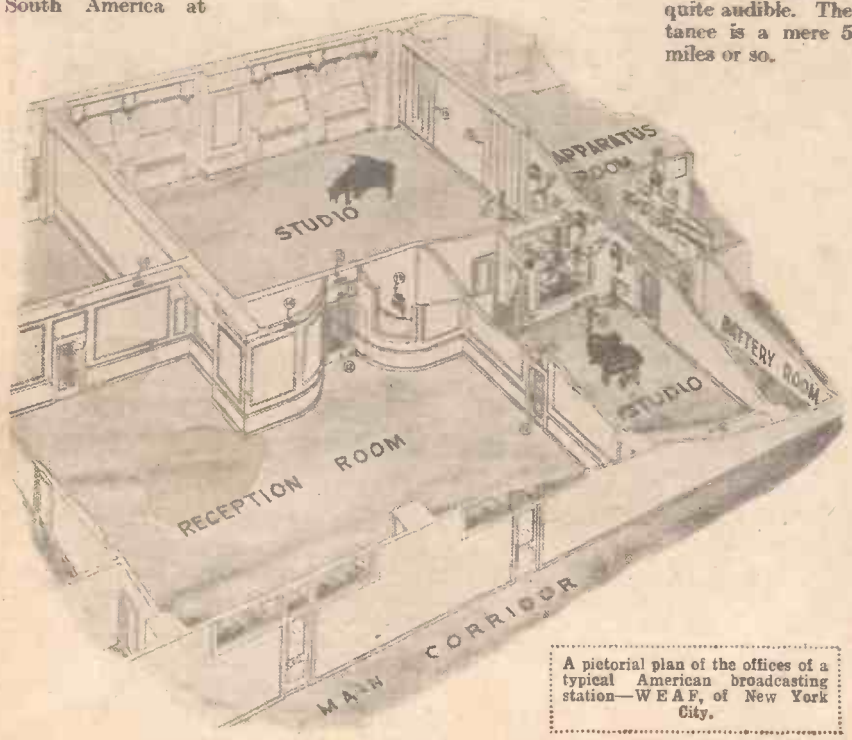
"It is already possible to see across a good-sized room by wireless. Crude and hazy as the results are, yet they are undoubtedly a beginning. Thirty years ago wireless telegraphy would only cross a room."—Commander Duncan Roe, R.N., in the "Evening News."

* * *

"It would be indeed a remarkable thing if we could one day be able to see some notable event when far away from the place at which it is happening. It is not more unlikely than the transmission of speech across the Atlantic Ocean seemed a few years ago."—Dr. J. A. Fleming, F.R.S., in "Great Thoughts."

More Records.

EVERY week sees a new radio record broken, and since I wrote last week's Notes and News, 2 L O has not merely reached Bombay, but has crossed India and has been heard in Madras. No details are yet to hand, except that both music and speech were quite audible. The distance is a mere 5,500 miles or so.



A pictorial plan of the offices of a typical American broadcasting station—W E A F, of New York City.

Mr. Simmonds' Latest.

BUT if the B.B.C. deserves a pat on the back because of 2 L O's performance, what does Mr. Simmonds, the well-known amateur of Gerrard's Cross, deserve? Limited to only a fraction of 2 L O's power, he scorns communication with India and similar just-over-the-way places, and habitually listens in to Australia and New Zealand. (He would strike out farther for real "DX" work, but is unfortunately up against the fact that the world is so small that beyond these places signals have to turn round and come back home again.)

* * *

A Fine Idea!

APPARENTLY Mr. Simmonds had been reading some of the "superior" remarks which have appeared, explaining that long-distance low-power Morse is easy as compared with "real telephony, don't-you-know." So he called another kindred spirit—who lives just outside Melbourne—and suggested they should try trans-world *speech*. His friend, a certain Mr. "3 B Q," thought this was a fine idea, so they tried, and succeeded in talking all over the world!

So British and Australian amateurs share the highest radio honour on earth! And I take off my hat to Mr. Simmonds, and to that other ether-shaking, record-breaking expert, who answers to the call 3 B Q.

* * *

Possible Developments.

BIG developments in the system of ship-to-shore wireless telephony are expected as a result of the tests now being carried out at Southampton by the Marconi Co., in conjunction with those pioneers of public utilities, the Southern Railway, and the General Post Office. It is expected that in the near future all docking-instructions and messages from ships' officers will be wirelessed to the shore. I can only hope that Southampton sailor-language has improved since I was there, or that old ladies in the neighbourhood will refrain from listening-in whilst some of the Atlantic liners are making-fast.

* * *

Progress in Spain.

TWO new broadcasting stations are to be erected in Spain very shortly by a French company (Etablissements Radio L.L.). Sites are being prepared at Bilbao and Cadiz, and it has been decided that a power of 500 watts will be employed.

* * *

Bournemouth in Bulawayo..

"I WAS astonished at the excellent results obtained. The volume was remarkable for 2 valves, considering that Johannesburg is 415 miles, Durban about 700 miles, and Cape Town 1125." writes a Bulawayo reader, who has been trying out a Unidyne set. But what absolutely delighted him was when he picked up Bournemouth at 2 a.m. on New Year's day, just in time to hear the home station ringing out the Old Year, although 1925 was already 2 hours old in South Africa. Well-done Bulawayo, Bournemouth, and the Unidyne!

ARIEL.

WIRELESS IN FRANCE.

AN INTERVIEW WITH GENERAL FERRIÉ.

BY OUR PARIS CORRESPONDENT.

In this interview, granted to our Paris correspondent, the Chief of the French Military Radio Telegraphs discusses the value of amateur research in wireless theory and practice.

"THE work of amateurs is of outstanding importance to the furtherance of wireless research. They must be encouraged and helped, not inconvenienced by the regulations," said General Ferrié, the Chief of the French Military Telegraphs, when I saw him on behalf of POPULAR WIRELESS recently.

The General is fully qualified to make this statement. With high rank and proved knowledge—he is a member of the Academy of Sciences—General Ferrié is a charming man whose modesty seemed almost as great as his attainments.

"By their repeated experiments," he said to me, "amateurs feel their way in channels in which public services cannot follow. These *artisans du progrés* often spare neither time nor money. Their discoveries while working on wave-lengths —of 100 metres or less—using very small power—10 to 50 watts—is amazing. In France they had worked on wave-lengths of two metres and even one metre, over considerable distances, quite successfully."

The Future of "D X" Work.

While admitting the great potentialities of beam wireless, General Ferrié said: "But beam waves become analogous to light waves and will they not be affected as light waves are by obstacles?" Directional wireless, now successful only over short distances and on short wave-lengths, offers a very wide field for discovery."

I received the impression that the general thought that the future of long-distance wireless communication was, as yet, bound up in the study of short wave-lengths.

"The peasant has been brought into contact with civilisation by means of wireless," he said. "Listeners in France hear 5 X X with ease; they are becoming more and more familiar with the English language and through that language they will become familiar with the people's *esprit* and so penetrate their mentality. In that way the bonds of the Entente will be drawn even closer."

General Ferrié predicted that wireless telephony for public use would be realised in the not far distant future.

Standardising Wireless.

Apparatus by which wireless-controlled aeroplanes can drop bombs as accurately as can a man on board has just been invented by a Frenchman, and if war occurred wireless would play a part so great that it is yet unrealised, so the General told me. The powerful stations and the tiny portable sets carried by soldiers—who are now amateurs and listeners-in—would play their part.

An International Congress, such as that projected in 1917, which was to be held at Washington, was necessary, said General Ferrié, to standardise wireless, as for example electrical units had been standardised, to arrange wave-bands and avoid bugbears that may retard the development of the science.

Just before the war there was a strong agitation in Paris for the destruction of the Eiffel Tower on æsthetic grounds, but no suspicion was then held of the great part the 1,000 ft. ready-made "aerial pole" was going to play in wireless science.

"France," said General Ferrié, "now possesses the most powerful wireless stations in the world." The Eiffel Tower (F L) transmits excellent concerts and carries out social work which is heard in many parts of the world.

The Activities of "F.L."

"The Tower belongs to the military. It is used, above all, for scientific study and transmits earthquake reports from the St. Maur Observatory (near Paris), time signals (Greenwich) from the Paris Observatory, and weather reports from the National Metereological Office.

"Included in its work is that of standardisation tests of wave-lengths carried out in co-operation with England, America, and Belgium, a study created by the International Council of Research at the Brussels Conference.

"The French Post Office use the Tower apparatus for radiogram transmissions, and there is an annexe to the Tower at Meudon, near Paris."

General Ferrié said he recently received a letter from a New Zealander saying he had plainly heard the Eiffel Tower's concerts, and he advanced the theory that the carrier waves, girdling the earth, concentrated in the Antipodes.

General Ferrié built the important Lyons (La Doua) and Bordeaux (Croix de Hins) stations which are used by the Post Office in the public service. Bordeaux was started by the Americans during the war, and they called it "Lafayette." On completion it was the biggest station in the world. Now Bordeaux and Ste. Assise (in the department of Seine and Marne) are the two most powerful. Ste. Assise is also in the public service, and is conceded to a private company, Radio-France.

There is a network of smaller stations in the French colonies. They are linked to Paris through the more powerful posts like those at Saigon (Indo-China), Bamakou (Senegal), Cananarive (Madagascar), and Brazzaville (French Congo).

"One can do what one wishes with wireless," concluded General Ferrié. "Problems encountered will be solved. The extraordinary part wireless must play in our lives cannot be over-emphasised."

M. Le General Ferrié, photographed specially for "Popular Wireless."

A PARIS EXHIBITION.

THE 1925 International Exhibition of Decorative Arts, which begins in Paris in May, has put at the disposal of the French Radio-Electrical Syndicate a portion of the exhibition stands. The collection will include only the finest products of the designers' and cabinet-makers' art, as the apparatus must first be submitted to the criticism of a jury.

The Paris Exhibition will out-Wembley Wembley. Already many beautiful buildings have been erected on the Square des Invalides between the Invalides, where Napoleon's tomb is, and the Grand Palais in the heart of Paris, so well known to British tourists.

THE DEVELOPMENT OF THE IDEAL VALVE FILAMENT.

By ELLIS HARROLD.

ALTHOUGH many new types of valves —"bright" and "dull emitter"— have been put on the market during the last few months, few, if any, have incorporated new filaments. For the most part the filaments used are either (*a*) thoriated tungsten—i.e. tungsten with an extremely thin coating of thorium, a metal having remarkable electron-emitting properties; the supply of thorium to the surface from the interior of the filament is maintained continuously when the filament is heated; a typical example is the B.T.H. B5 valve, and (*b*) the "coated" type—i.e. a filament consisting of platinum alone, or alloyed with iridium or nickel, and coated with barium and strontium oxides.

Where Waste Occurs.

There is certainly room for improvement, as the valve, when considered as a device for transforming energy, is far from efficient. This is mainly due to the fact that a great deal of the energy supplied for heating the filament is wasted in heat radiation and conduction, and only a small part is employed usefully in the electron stream which passes through the exhausted space to the plate.

Although, for obvious reasons, manufacturers do not disclose details of new processes for making filaments, the lines along which development is taking place may be considered as follows.

The main problem in making "coated" filaments is to overcome the tendency of the oxides to drop off during working, thereby causing uneven emission. In one new process, instead of applying separate coats of oxides, the filament, which may be of platinum or one of the base metals such as copper or nickel, is coated with a thin layer of metallic barium, and the filament is heated in a non-oxidising gas so that an alloy with barium is formed. The coated wire is then exposed to dry air so as to form barium oxide. By this process the metallic barium is finely divided between the particles of the filament metal, and adhesion is thereby greatly improved.

A New Method.

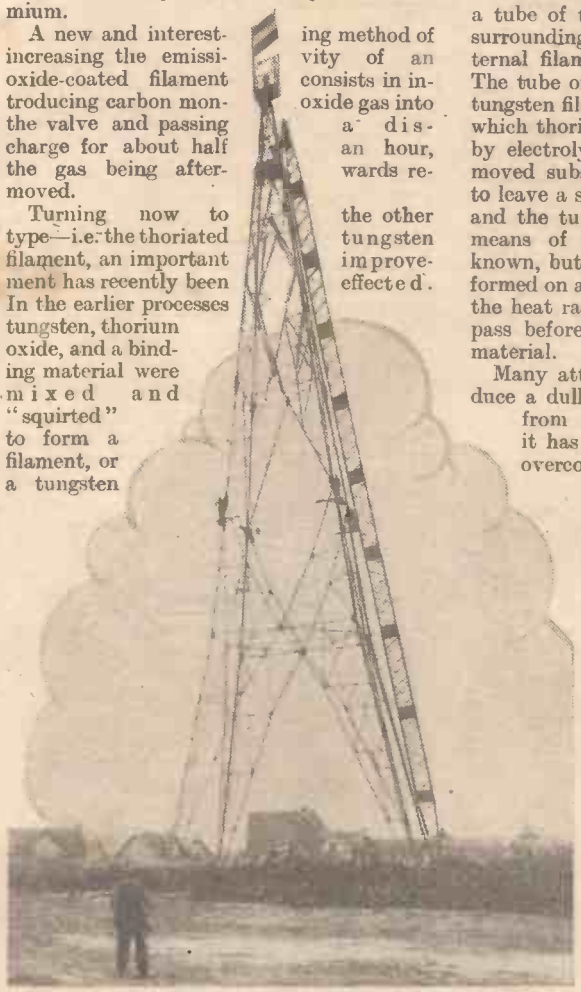
Barium is, in fact, absorbed into the platinum wire, and the surface of the wire may be made porous to facilitate absorption, as by coating platinum with copper and heating, or by depositing a porous layer of platinum by electrolysis. The process of oxidising the barium may be only partial, and the remaining barium is volatilised during the working of the valve and acts as a gas purifier.

The finished filament has a metallic appearance, and, owing to the method adopted, the electron-emitting surface shows no tendency to fall off, the life of the filament being in consequence greater.

In another method of obtaining an adherent coating metallic chromium is deposited on a wire, for instance, of iron, and the oxide coating is then applied and combines chemically with the layer of chromium.

A new and interesting method of increasing the emissivity of an oxide-coated filament consists in introducing carbon monoxide gas into the valve and passing a discharge for about half an hour, the gas being afterwards removed.

Turning now to the other type—i.e. the thoriated tungsten filament, an important improvement has recently been effected. In the earlier processes tungsten, thorium oxide, and a binding material were mixed and "squirted" to form a filament, or a tungsten filament containing a little thorium oxide was heated in a hydro-carbon vapour to absorb carbon, the function of which was to convert thorium oxide into metallic thorium.



One of the masts at the Hilversum station. (*Photo by A. de Jong.*)

In the improved process powdered tungsten, carbon, and thorium oxide are mixed and shaped into a bar, which is then sintered and treated by the mechanical process known as "drawing" to form a filament. The sensitive film of thorium is produced by heating the filament in a vacuum for a few minutes. Filaments formed by this process are more reliable than those produced by the earlier methods.

An "Aging" Process.

In another process, which has the great advantages of cheapness and simplicity, thorium is deposited by electrolysis on tungsten or platinum. The filament, connected as cathode, is passed through an electrolytic bath at such a rate that the filament remains immersed for only half a minute—if this time is exceeded thoria is deposited instead of thorium. In a slight modification of this process a nickel or copper compound is added to the bath, and nickel or copper is deposited with the thorium and serves to bind it on the tungsten filament. The filament is "aged" by heating to an orange-red heat for an hour.

From the A.C. Mains.

A filament of a different kind consists of a tube of thoria of small diameter closely surrounding, but out of contact with an internal filament, which serves as a heater. The tube of thoria is formed by coating a tungsten filament with a layer of copper on which thoria is then deposited, for instance by electrolysis, the copper layer being removed subsequently by electrolysis, so as to leave a small space between the filament and the tube. The method of heating by means of an auxiliary filament is well known, but previously a layer of thoria was formed on a metallic cylinder through which the heat radiated from the filament had to pass before reaching the electron-emitting material.

Many attempts have been made to produce a dull-emitter which can be operated from alternating current mains, but it has always been found difficult to overcome noise due to the hum of the low-frequency current. In a recent valve of American origin which avoids this trouble, the cathode consists of a cylinder of nickel coated with barium oxide. A heating element fits tightly in the cylinder, and consists of a block of insulating material formed with holes in which a heating filament of hairpin shape is mounted. Heat is conducted from the filament through the block to the cylinder and its coating. The legs of the filament are arranged very close together so that the circuit is practically non-inductive and, consequently, the magnetic field set up is very small and insufficient to affect the course of the electrons in the valve. A large amplification ratio of 10 is obtained, and the resistance is 10,000 ohms. The valve is, therefore, suitable as an L.F. power amplifier.

The Use of Hafnium.

In another valve of Dutch origin, which has not yet been placed on the market, a straight filament coated with an electron-emitting material is mounted between two small heating members of inverted U-shape. Heat is transmitted directly to the filament from the curved parts of the heaters, which may be energised from alternating current mains through a transformer, and no current is passed along the filament.

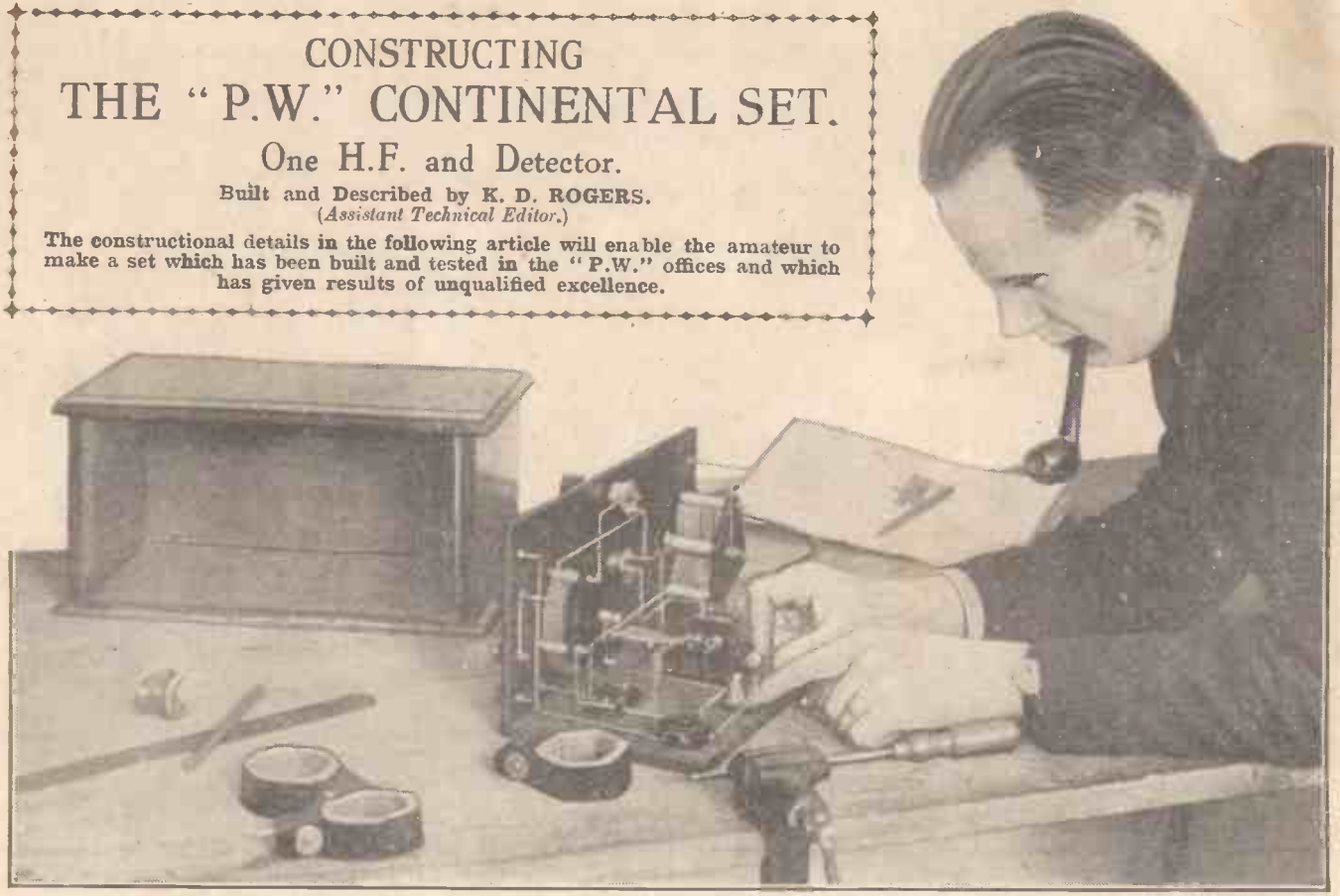
Recently the newly-discovered metal hafnium has been suggested as a filament, either in metallic form or as a compound such as the nitride. As, however, supplies of the metal are at present very limited, it will be some time before the filaments can be made in any quantity, even supposing the results are entirely satisfactory.

CONSTRUCTING THE "P.W." CONTINENTAL SET.

One H.F. and Detector.

Built and Described by K. D. ROGERS.
(*Assistant Technical Editor.*)

The constructional details in the following article will enable the amateur to make a set which has been built and tested in the "P.W." offices and which has given results of unqualified excellence.



One of the members of the "P.W." staff putting the finishing touches to the receiver described in the following article.

BROADCAST listeners can be divided into three main classes as regards the actual listening part of wireless, and though these classes can be split up into numerous sub-sections it is of the three main divisions that I am going to write. In America there are really only two of those divisions—the last two—but I think it is safe to say that the British "fans" can be classified under the following headings:

Three Types of Listeners.

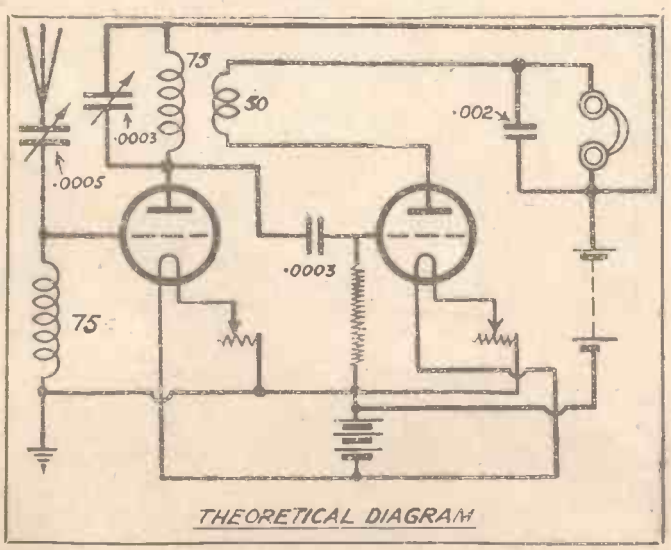
(1) Those who wish to listen to various stations, but are not out for mere noise; (2) those who want their local station only; (3) those who want everything they can get and as loud as they can get it.

Across the Atlantic this latter class is in the majority, and the state of the ether there is, compared with that over here, more or less chaotic—it cannot be otherwise with so many "D X" enthusiasts pushing their sets to bursting point. In Great Britain, however, the second class probably preponderates, with the first coming a fairly good second, and the third a long way behind.

It is with a view to assisting those who wish to join these various classes, as it were, that I have decided to devote at least one article to each, giving details of a set that will answer their respective requirements of range, good local reception, and range and signal strength, dealing with the receivers in the above order.

The sets to be described must not, however, be taken as the *only* ones capable of satisfying those conditions, but as *typical* receivers suited for the three types of reception.

In the first class the two-valve, H.F. and detector, or, as I think is preferable, 1-V-O, is usually the favourite, mainly because it is extremely efficient, and easy to build and handle, while the one described here makes a very pleasing looking receiver.



THEORETICAL DIAGRAM

American Type.

The tuned anode type of H.F. coupling has been adopted, as it is both efficient and allows a method of reaction, which, though not foolproof as regards causing interference due to oscillation, nevertheless is not so likely to cause trouble as one where the reaction coil is coupled direct to the aerial circuit. It is understood, of course, that reaction is *essential* for long-range reception.

The cabinet for the "P.W." Continental set.

Built on the American style, which is becoming more and more popular in this country, the set is easily made and extremely accessible, while all delicate parts, such as valves and coils, are kept out of harm's way and free from dust and dirt.

(*Continued on page* 1462.)

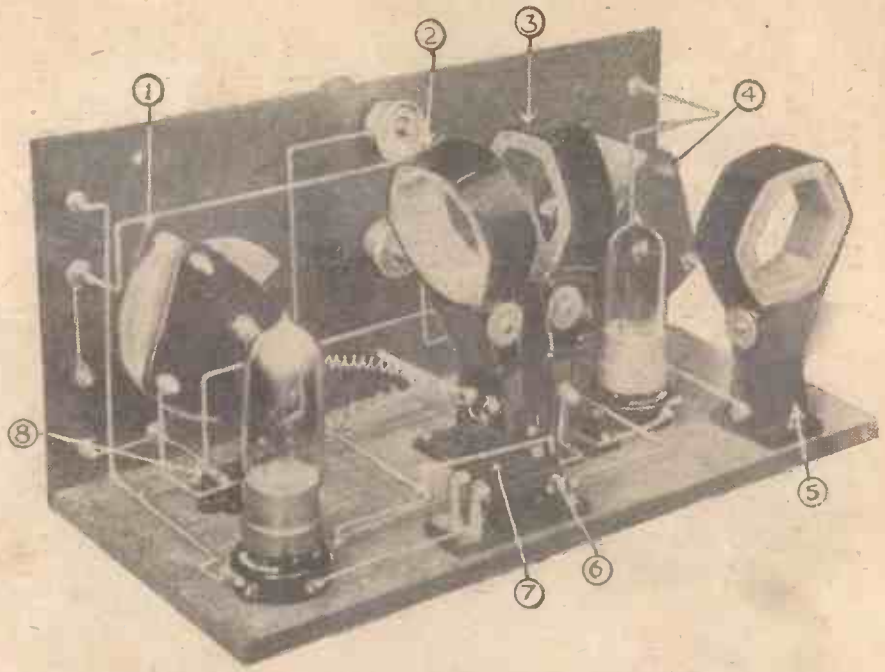
THE "P.W." CONTINENTAL SET

(Continued from page 1461.)

The necessary components are as follow, the approximate prices being given; while the names of the makers of the more important components are also provided as a guide, though other makes of reliability can be used.

	£	s.	d.
Cabinet, Peto-Scott, Ltd.			
13½ in. × 6½ in. × 6½ in. (inside dimensions)	1	1	0
Panel, 13 in. × 6½ in.		4	0
Baseboard, 13 in. × 6 in. (deal or American white wood)		1	0
2 valve sockets (for baseboard mounting), Bretwood		3	6
1 2-coil holder (with fairly long handle)		4	9
1 coil plug		1	0
1 ·0005 v. cond., "J.B."		7	0
1 ·00025 v. cond. "J.B."		5	9
1 ·002 fixed cond., Dubilier		3	0
1 grid leak and cond. (·0003 and 2 meg.)		3	6
2 fil. rheostats (microstats)		5	6
8 W.O. type terminals		1	4
3 coils (broadcast wave-length), Lissen. (Home-made basket coils are O.K.)		17	6
2 valves suitable for H.F. and det. work respectively			
Square tinned wire, 16 gauge screws, etc.		1	6
	£4	0	4

It will be noticed that the type of valve is not specified because it is not necessary to use either one class or another, and this can be left to the choice of the individual listener. As a guide, however, the following types of valves have been tried and can be recommended: any valve specially mentioned by the manufacturers as being suitable for H.F. or detector work should be O.K. (one of each being required), and among the "general purpose" valves the A.R.D.E., D.E.R., B_3 Cossor "Wuncell," of the 2 volt ·25-·4 amp. dull emitter type, and the B_3 A.R.06, D.E.$_3$ of the ·06 type (dry cell valves) have been tried and found suitable



Rear view of the receiver. (1) Anode condenser; (2) Reaction coil; (3) Anode coil; (4) Aerial condenser; (5) Aerial Coil; (6) Grid condenser; (7) Grid leak; (8) 'Phone condenser.

These latter, it will be observed, are all dull emitters, and I am laying stress upon this fact because even now, after this class of valve has been on the market for 18 months or more, the Query Department is still receiving frequent letters from readers asking if the dull emitter valve is "really efficient," as they have been warned not to get them by their friends. What a fallacy! The dull emitter valve, in my opinion, is just as efficient, albeit occasionally more microphonic, and very often more efficient than its corresponding bright emitter. Do not be afraid of getting dull emitters, provided they are of good and well-known manufacture, for though a little more care must be exercised in handling some of them, they are quite as reliable as their more brilliant brothers.

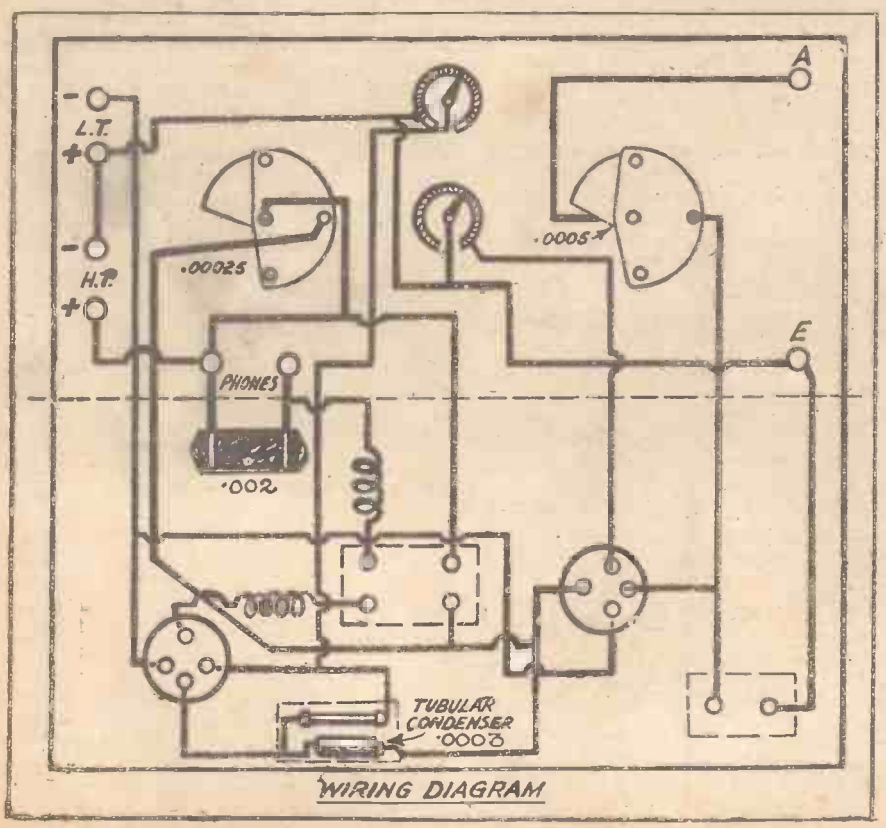
Matt Surface Preferable.

In order to keep the set compact and neat the constructor is advised to follow the dimensions of the panel and case mentioned, and to drill the panel according to the diagram of the panel lay-out on the next page. Good quality ebonite should be employed, and preferably that with the matt surface, unless it is certain that the polished surface is free from the metallic deposit so often found on polished ebonite.

The first thing to do is to "true up" the panel, if it has not been cut exactly, and to make it a comfortable fit in the case. This latter has not been described, as the photograph is self-explanatory. Make sure the panel edges are perfectly square, using a set-square and filing or sandpapering the panel down to fit. The rough dimensioning is best done with a tenon saw, not a hacksaw, as is frequently supposed, the former being very much easier to control and making a better job of it.

Having sized up the panel and made it fit properly, it should be mounted up on its baseboard, as shown in the photographs, while the baseboard is in the case. This ensures the exact fitting of the panel to the

(Continued on page 1463.)



WIRING DIAGRAM

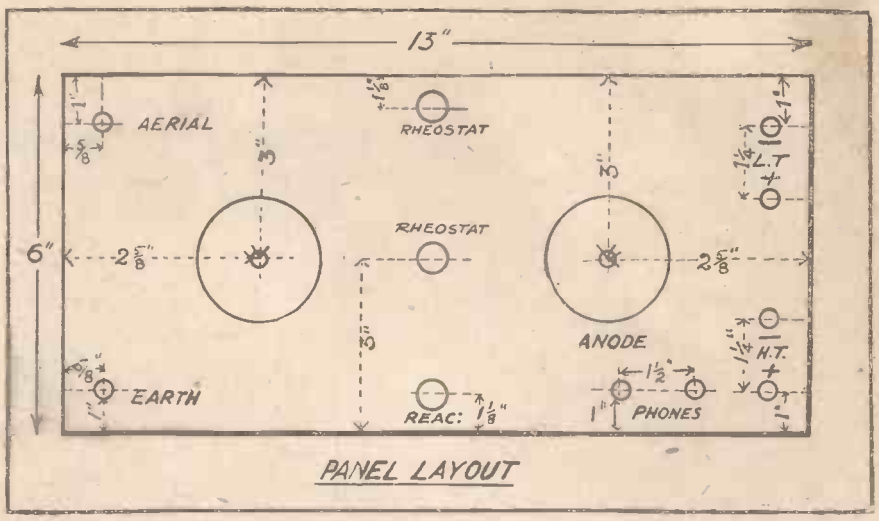
THE "P.W." CONTINENTAL SET.

(*Continued from page 1462.*)

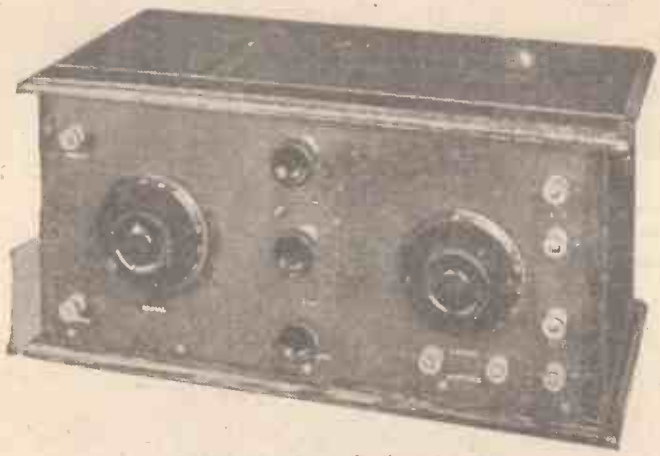
baseboard. Side supports can be provided if desired, but on the original set these were found unnecessary. Five screws are used to fix the panel to the baseboard.

Drilling the Panel.

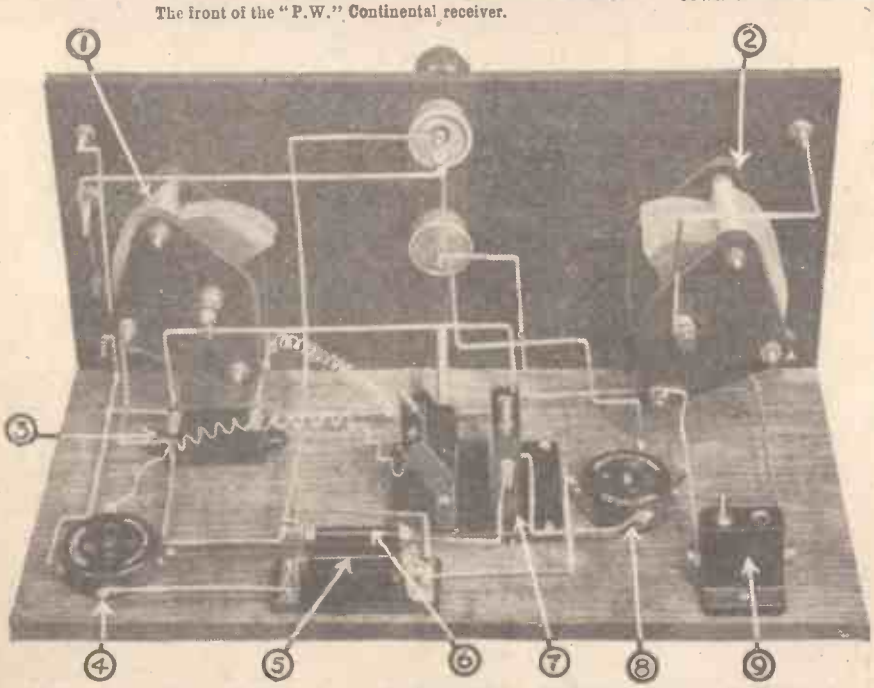
The next thing to do is to remove the panel and, laying it out flat on a table, mark it with ruler and scriber or compass, according to the diagram opposite. This holds good for whatever make of apparatus is employed, though the sizes of the holes may vary. I advise centre-hole fixing throughout, for all apparatus that is to be mounted on the panel. In the case of the coil holder it is, perhaps, better to leave the drilling of the hole for its control knob until the exact position of the holder has been found on the baseboard, which should now be mounted behind the panel and removed from the case. The two-coil holder should be centrally fixed so as to preserve the symmetry of the panel, and should be screwed to the baseboard as soon as its hole has been drilled in the panel.



All the panel components having been mounted—they being the variable condensers, rheostats, and terminals—the valve holders, fixed condenser, single coil holder, and grid leak and condenser should be fixed in their respective positions on the baseboard. The two-coil holder has, of course, already been mounted. The valve holders are mounted by a single wood screw through the centre, and in the case of the first one the plate socket is towards the two-coil holder. The second valve has its plate towards the panel. The relative positions of the various components can be seen from the photographs.



The front of the "P.W." Continental receiver.



Another photo of the back of the set. (1) Anode condenser; (2) Aerial condenser; (3) 'Phone condenser; (4) Grid connection to det. valve; (5) Grid condenser; (6) Grid leak; (7) Anode coil holder; (8) L.F. valve socket (fil. connection); (9) Aerial coil holder.

The next and final step is to wire up. This is done according to the semi-pictorial wiring diagram on the previous page, the square tinned copper wire being used for the purpose. Commence with the filament wiring, and continue in this order. L.T. + to H.T. — and to top rheostat, thence to bottom rheostat and thence to earth terminal. Earth terminal to one side of single coil holder. L.T. — to both valve sockets. Aerial terminal to moving vanes of ·0005 condenser, fixed vanes to the free terminal of single coil holder, aud to grid of first valve. Remaining connections on top and bottom rheostats are now taken to second and first valve remaining filament socket respectively.

Plate of first valve now goes to grid condenser and to outside of anode coil holder (fixed sockets of two-coil holder), and to fixed vanes of ·0003 condenser. The moving vanes of this condenser go to H.T. +, one 'phone terminal and to free side of anode socket. The fixed condenser of ·002 mfd. capacity should now be connected across the 'phone terminals, the second or inner one of which goes to one side of the movable coil socket by means of a flexible wire. The other connection on the same socket is taken by a flexible wire to the plate of the second valve.

Preliminary Test.

The grid of the second valve is now connected to the free side of the grid condenser and to one end of the variable leak, the remaining end of which is taken to the plus lead from the top rheostat to the filament of this valve. All wires except to the coil holder and the variable condenser should be soldered, "Fluxite" or resin being used for the purpose—killed spirits being quite unsuitable, as it will cause corrosion of the connections later on.

After the wiring has been carefully checked and the constructor has made sure that all joints are O.K. and no wires are unintentionally touching one another, the valves and coils should be placed in position and the batteries connected up for the first test. Keep the set out of its cabinet until this test is over.

(*Continued on page 1464.*)

THE P.W. "CONTINENTAL" SET.

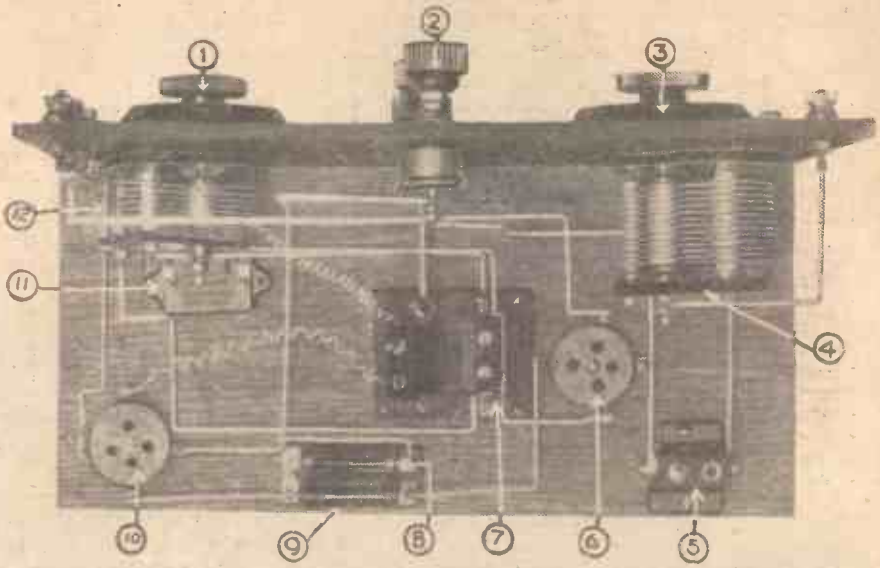
(Continued from page 1463.)

To make sure of connections to the valves connect the L.T. battery to the H.T. terminals at first and, turning on the rheostats, see if the valves light up. If they do not, all is O.K., but if they do, the H.T. leads are shorting to the filaments and must be remedied before the H.T. battery is connected.

The Set in Operation.

Now connect up both batteries properly and see that the coils are making contact in their right positions, the 50-turn coil being in the moving sockets, and turn on the filaments of the valves. The 'phones, of course, have already been connected to the 'phone terminals.

Keeping the coils well apart, vary both condenser settings until a signal of some sort is heard. Now gradually bring up the movable coil by turning the reaction knob to the left. It may be necessary to vary the setting of the condensers; most probably the anode condenser will do all that is necessary, but as the two coils come closer together the signals should become louder and louder until with a "plop" and rushing sound they reach their maximum and immediately become distorted while the rushing noise tends to drown them.



Looking down on the receiver removed from case. (1) Anode condenser; (2) Microstats; (3 and 4) Aerial condenser; (5) A.T.I. socket; (6) H.F. valve holder; (7) Anode coil socket; (8) Grid leak; (9) Grid condenser; (10) Det. valve holder; (11) 'Phone condenser; (12) Anode condenser.

As soon as this point is reached the coils should be separated until the signals once more become clear, final adjustments being made by varying the filament rheostats and the H.T., the condenser always being readjusted for best results.

Results Obtainable.

With practice and under good conditions, this type of set will bring in most of the B.B.C. main stations and several Continental ones, while on favourable nights it is not unlikely that WGY, KDKA (326 metres), or WBZ will be heard, though the tuning-in of such distant transmissions needs considerable skill in the handling of the set, and until this is mastered the reader should not expect too much. All this is done on 'phones, as this type of set cannot be expected to operate a loud speaker without additional low-frequency (or note) amplification.

LATIN AMERICAN RADIO NOTES.

From OUR OWN CORRESPONDENT

A COMPANY has been formed in Lima (Peru) for the purpose of constructing a high-power broadcasting station in that city. The initial capital subscribed is £P.10,000, but it is thought that double this amount will be necessary before the station can be completed.

Argentina is legitimately proud of the progress made by radio in that Republic, both Administration and private enterprise having taken up the industry with enthusiasm. Upon several occasions KDKA, of Pittsburg, U.S.A., one of the broadcasting stations belonging to the Westinghouse Electric Company, endeavoured to send Spanish concerts for reception in Central and South America, especially Buenos Aires. After numerous failures success has at length been achieved. Part of the concert recently broadcast in Spanish by the United States station was heard in Buenos Aires and some other parts of the Argentine Republic.

Brazil Reports.

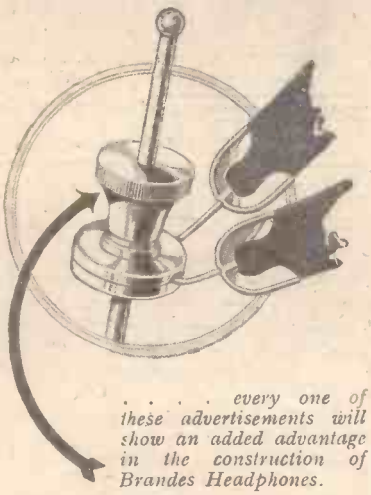
The Brazilian Bureau of Meteorology has now thoroughly organised arrangements for the sending of weather reports by radio twice daily. These are sent out from the Arpoador radio station, at Rio de Janeiro, at 3 and 10 p.m. The first report consists of some of the observations made at 9 a.m. by 38 stations located in Brazil, Uruguay, and Argentina; observations of upper air currents made in nine Brazilian stations, and a forecast of probable weather conditions on the coast of South America between Buenos Aires (Argentina) and Cabo Frio (Brazil). The second, or 10 o'clock report, supplies the customary observations made at 6 p.m., six Brazilian stations; observations made in aerological kite station now in full operation at Alregrete, in the State of Rio Grande do Sul; and a forecast of the weather for the following day along the coast, as in the earlier report. Both messages are issued in strict accordance with the meteorological code adopted by the leading nations, and have already proved of immense benefit to navigators. Notifications in English, French and Portuguese have been sent out to all shipping companies interested, in the form of pamphlets which also contain a description of other work of the Bureau of Meteorology.

The Colombian Government, having expressed its wish that all the important navigation companies operating on the Magdaléna River should fit their vessels with wireless, the enterprise has now been carried out.

In Costa Rica a small radio-receiving apparatus has been erected in one of the schools for the benefit of pupils and residents of the city, who have contributed towards the initial expenses of the receiving station. By this means music and lectures from Cuba and the United States can be clearly heard.

An evening wireless class at the Rugby Central School.

All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This really means a free trial.



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

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

British Manufacture. (B.B.C. Stamped.)

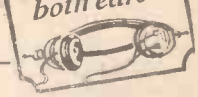
Matched Tone means a technical improvement in telephone construction which should at once grip your attention. If you are intent on better broadcast reception, if you wish to gather the more distant signals with increased strength and clarity, then Brandes Superior *Matched Tone* Headphones are certainly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

The *Table-Talker* is another Brandes quality product at moderate price. Its full round tones are wonderfully clear and pleasing. The 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. Gracefully simple of line, it is finished a shade of neutral brown and is twenty-one inches high.

Brandes

The Name to know in Radio

"The same sound in both ears"



Superior "Matched Tone" Headphones

TRADE MARK

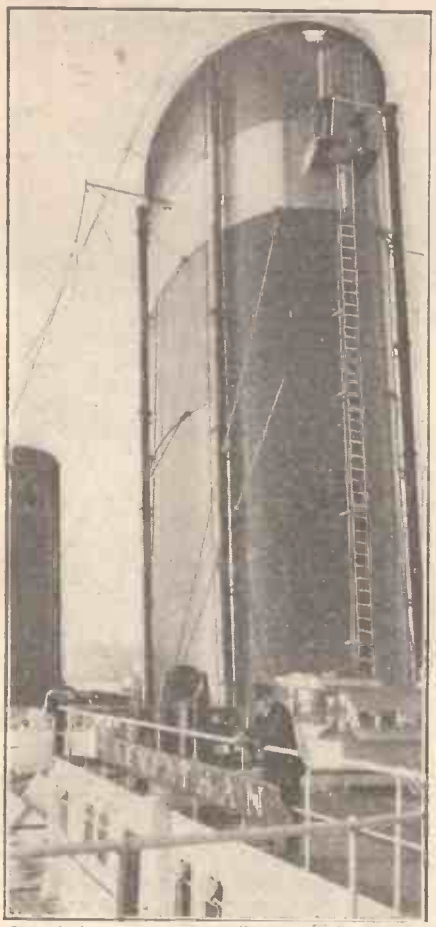
BROADCASTING FROM MID-OCEAN.

THE "LEVIATHAN'S" TRANSMITTER.

By F. M. DELANO.

Several readers of "P.W." have reported, from time to time, the reception of concerts, etc., broadcast from the giant liner "Leviathan," and in this short article Mr. Delano gives an account of the transmitter on this famous ship.

THE giant steamship "Leviathan," noted already for her unusually complete radio equipment, has added a new set of laurels to her wireless crown on her recent trips to Europe and back; as she has actually begun broadcasting the many ship's concerts, entertainments, and other doings while plunging at 24 knots an hour through howling gales and hissing turbulent seas. The



One of the funnels on the "Leviathan." Part of the aerial can be seen.

success of her experiments has been amply proven by the tremendous influx of mail from both sides of the ocean, addressed to her Chief Radio Officer, E. N. Pickerill, one of the veterans of the transoceanic trade.

Sailing Within "Crystal" Range.

Upon the arrival of the "Leviathan" in Europe, November 21st, Mr. Pickerill received over 2,000 letters from all parts of England, France, Belgium, Portugal, Spain, and Holland, complimenting him on his excellent transmissions. Ireland seemed particularly interested in the work, an especially large batch of mail coming from that country.

The first reports of reception indicated that he had been picked up when only some eight hundred miles out of New York, by several English stations, who said that they had been able to dance by the music of the ship's orchestra, at the same time that the passengers were dancing in the vast ballroom on the palatial liner ploughing her way toward the old world. Valve sets were successful at this distance, and in most cases ranged from three to five valves.

As the "Leviathan" neared Europe, the crystal sets owners began to pick up the extra music that was being "put on the air," and letters began to pour into the U.S. Lines office landing station W S N (her call letters). Mr. Pickerill was so impressed by the enthusiasm of the European amateurs and broadcast listeners, that on his return trip to the States he made a special point of broadcasting personal messages to as many as he could, and hopes to hear when he gets back to England that some of these at least were received by the people addressed.

The set is, according to the chief radio officer, the only one of its type put out by the Radio Corporation of America, being a combination telephony and telegraphy set which can, by the simple throwing of a switch to cut in the modulation wave, be transferred from a straight C.W. or interrupted C.W. telegraph set, to a very excellent telephone set. By having a shielded line run from the orchestra gallery of the first-class dining saloon, and one from the stage in the ballroom, the same sort of broadcast conditions apply as in any regular land-line outside studio broadcast.

NEXT WEEK.

THE "SUPER SELECTIVE" RECEIVER.

A detailed article on the construction of this novel and highly Selective American Circuit, by Mr. G. V. Dowding, will appear in next week's "Popular Wireless."

The set used is a four-valve one, each valve being one kw. plate input. Two valves are used for rectifiers for the alternating current, one for oscillation, and one for modulation. The antenna radiation is 750 watts (10 amperes), and a regular broadcasting wave-length, assigned by the U.S. Government, is used. The aerial used for broadcasting is an auxiliary one, strung along the sides of the giant stacks—its length being 150 feet. It is a five-wire cage, as is also the main traffic aerial strung over the stacks between the masts—the latter being 600 feet long, however, and working on wave-lengths from 1,800 to 2,400 metres.

The Object in View.

The actual object of these broadcasts is not one of publicity for the ship, but merely to ascertain clearly the possibilities of eventually establishing a radio-telephone communication system for use by the passengers.

It would be of great use, Mr. Pickerill points out, to allow them to converse with other ships at sea, when the other ships will have installed such apparatus; but his real dream is the time when, two days out of Cherbourg, a passenger can walk into the radio office and telephone, via land-lines relay, to his home or office in St. Louis or Detroit. Then, says the chief, he will consider that radio has reached its highest practical use for the ocean traveller.

The chief operator of the "Leviathan" adjusting the C.W. transmitter.

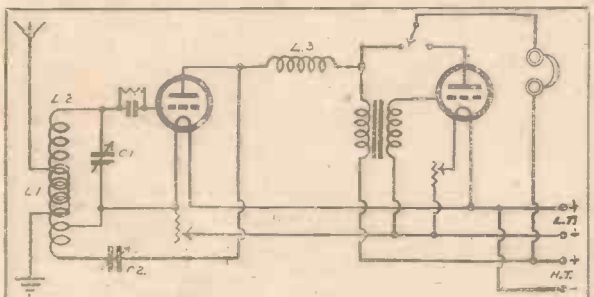
A SUCCESSFUL SHORT-WAVE SET.

30—200 METRES.

By JOHN L. HARMAN.

THE circuit used in this set is a simplified Reinartz; in fact a Reinartz-Weageant. The writer thinks the method employed of changing the wave-length is new to this country, although it is used to a great extent by U.S.A. fans (Fig. 1).

Instead of the old way of changing coils and using series condensers to decrease the wave-length, all we have to do is to put coils having a smaller number of turns in parallel with the main grid tuning inductance, with the result that the inductance of the two is decreased. In this way we do not disturb the original tuner.



L 1. 3 turns 16 d.c.c. over L 2.
L 2. 30 turns 16 d.c.c. tap 18 turns from Grid end.
L 3. Radio Frequency 250 turns 30 s s c on 2" tube.
C 1, C 2. } 300 mmfd (·0003) sq. law.

Fig. 1.

The coils themselves are wound basket fashion on a wooden base having thirteen strong 3 in. nails set in a 4 in. circle, hammered firmly in.

Wave-length Variations.

The main coil has 30 turns of No. 16 S.W.G. D.C.C. wire, with a tap 18 turns down. The smaller coils (for putting in parallel) are wound with the same wire and on the same former, but with 10 and 5 turns. When the coils are wound, before taking the pins out, bind in a few places with strong twine. Do not use tape or wax. The coils will be found to be quite rigid. Over the main coil wind 3 turns (for the primary), next to the filament tap and on the grid side.

As it makes hardly any difference what size of aerial or earth wire is used (as regards change in wave-length), the writer gives the ranges the coils cover on his set, namely:

Main coil only—80-200 metres.
Ten in parallel—45-100 metres.
Five in parallel—30-75 metres.

The radio-frequency choke L3 is wound with 250 turns of No. 30 S.S.C. wire on a 2 in. tube, but it makes no difference whatsoever by using a honeycomb coil instead. It is best to use an anti-capacity valve, but a D.E.R. was used in the set described with excellent results.

If the natural wave-length of the aerial system is within the range of the set, there will be a blank space where this occurs. This can be shifted above the highest wave we wish to go (200 metres) by loading the aerial circuit with a 40-turn basket coil. This decreases signal strength a little, but not appreciably. The set is delightful to use after an ordinary set using variable inductive reaction. On the old set the wave-length with strong reaction might be 30 or 40 metres lower with weak reaction.

Results Obtained.

On this set one can increase the feed-back condenser from minimum to maximum with about ½°-1° difference or change on the A.T.C. Vernier condensers are very necessary on both condensers, as tuning is reasonably sharp. If square-law condensers are not used, the minimum capacity will be much higher, and therefore the range will be decreased by about 20 metres.

When searching for weak signals, it is best to cut out the L.F. amplifier, as there is a great deal of noise with it in. When the station is tuned in, the amplifier can be switched in. The aerial in use is 60 ft. long and only 20 ft. high, with trees under the whole length; the earth is 40 ft. to a cold-water pipe.

During one fortnight recently ninety-five Americans have been heard between 50 and 80 metres, ten Canadians, and three Australians. The best time to listen is between 4.0 and 7.30 a.m. for Americans and Australians, and the writer will be pleased to hear details of any results from sets readers may make up from the information given here.

WIRELESS in YORKSHIRE.

By Our Yorkshire Correspondent.

THERE are many facts to justify the claim that the wireless "craze" is as strong in the Leeds-Bradford area as in any other part of the country, and stronger than it is in many parts. The lines of aerials testify to it; it is credited by the B.B.C., who describe the area as one of the best from the licence point of view; its truth was forced home on the opening day of the Leeds Wireless Exhibition, when the unusual spectacle of the hall being packed all through the opening day was witnessed.

Perhaps to it, too, is due the oscillation epidemic which has been gradually growing worse in the West Riding of Yorkshire. This I believe to be largely due to the popularity of the single-valve set with reaction on the aerial, the possessor of which cannot resist the temptation of searching, with many howls, for distant stations.

The double relay station has a huge audience to serve—far larger than that covered by many main stations. It is not, therefore, surprising to find the station striking out on enterprising lines. A comprehensive series of local talks have just been arranged, and church services will be broadcast in future practically every Sunday.

Excellent Transmission.

The 2 L S Station Director has displayed a great liking for "stunts." The local programmes are certainly getting much better than they were, and some are now very good, while, on the other hand, we still have an occasional bad one. Technically, the transmission is excellent and the eventuality of breakdown has been guarded against by the duplication of the entire control apparatus. In outside broadcasts recently the unusual course has been taken, with very good results, of using the Sykes-Round microphone—as used in the studios—instead of the usual Western.

Transmission complaints are usually of lack of strength. It is not generally realised, as it should be, that the station has a guaranteed crystal reception range of only five miles. Hence, the grumblers have a very poor case in cursing the B.B.C. because they cannot always get good strength on crystal sets eight or ten miles away. In actual fact, in some directions the crystal range extends to ten and fifteen miles. The whole trouble lies in the fact that the majority of listeners ask too much of their sets.

Receiving Sets Too Small?

Captain P. P. Eckersley had something to say about this during the opening ceremony of the Leeds Wireless Exhibition. Sets were often designed with far too little margin of safety, he said. If a station could be just heard on two valves the set actually used should be a four-valve set. The set should have more power than was really required of it.

So great has become the work of the station, which now transmits almost continuously every day from 11.30 a.m. to the close down, that an Assistant Station Director has been appointed. The B.B.C. has again shown its almost uncanny ability to obtain the services of men of intellect who, at the same time, are practical men, ambitious men, and men with the requisite dulcet voice. Their latest "bag" is Mr. R. Green, M.A., M.C., a young man with a very distinguished university and war record, who comes to Leeds from Birmingham.

NEXT WEEK:

HOW TO MAKE

THE "SUPER SELECTIVE RECEIVER."

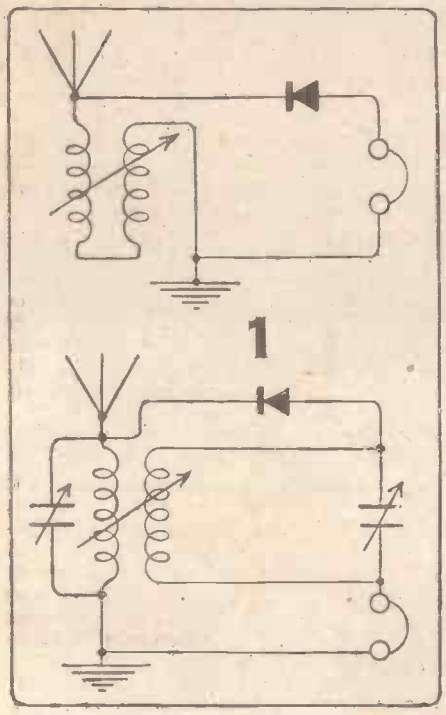
In next week's "P.W." Mr. Dowding will explain the construction of the American "Super Selective" Set recently described theoretically by our New York correspondent, Mr. L. W. Corbett. The "Super Selective" Set has been specially built in the "P.W." Test Room, and the results obtained with it have proved so interesting that Mr. Dowding has written full constructional details for the benefit of "P.W." readers.

STARTING AN EXPERIMENTAL RECEIVING STATION.

By OSWALD J. RANKIN.

PART III.

FIT a No. 35 or 50 honeycomb or basket coil into a single-coil holder, as shown in Fig. 4, connect the ·0005 mfd. variable condenser in parallel with same,



and connect up the fixed inductance crystal circuit as described in the previous article. Now try coupling a secondary or closed circuit tuning inductance to the primary fixed inductance, as indicated in Fig. 2, and connect the other ·0005 mfd. variable condenser in parallel with same. For this experiment a two-coil holder will be required, this being illustrated in Fig. 3.

The component is preferably purchased ready made, and then mounted as shown on an ebonite base, 4 in. long by 2 in. wide, which is provided with four terminals and supported by two small wooden strips. The fixed coil socket which is shown on the left is connected to the two left-hand terminals by short lengths of bare copper wire; the right-hand terminals are connected to the movable socket by flexible leads, which are coiled as shown to permit the necessary movement. At least two of these components should be made up.

Some Tuning Experiments.

Now connect the primary tuning condenser in series with the primary coil, and do not overlook the fact that since such an arrangement reduces the wave-length value of the coil it will be necessary to plug in a larger size coil. With the primary condenser in parallel try a No. 35 or 50 coil for primary and a No. 50 or 75 coil for secondary when tuning to the usual broadcasting stations; with the primary condenser in series try a No. 75 or 100 coil for primary. For 5 X X try a No. 250 primary coil with

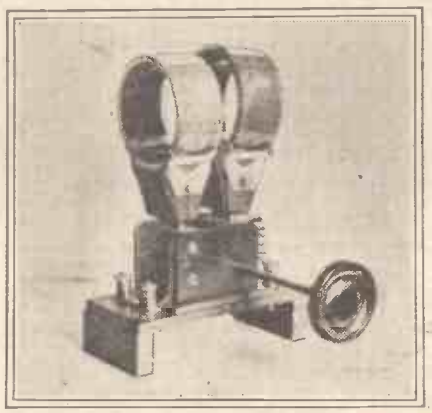
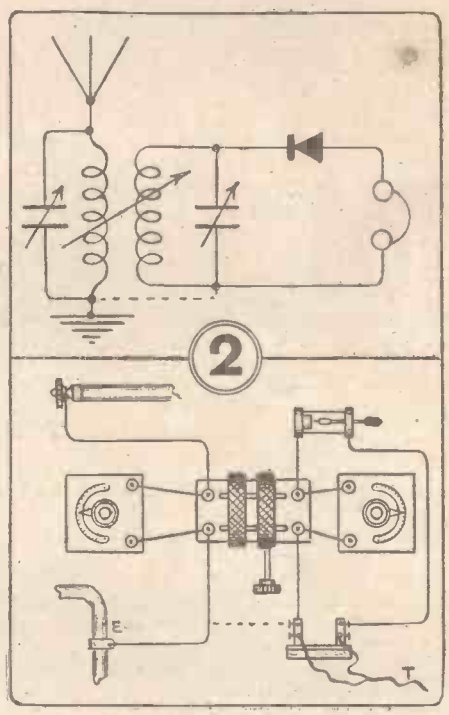


Fig. 3. A two-way coil holder.

honeycomb coil. If results are not satisfactory, reverse the connections of one of the coils; it is important that both windings are in the same direction.



Now take the same components as used in Fig. 2, connect them up as shown in Fig. 1 (lower diagram), and plug in a secondary coil of the same size as the primary coil. (No. 35 or 50 for the broadcasting wave-lengths or No. 250 for 5 X X). The tuning of this circuit will be found rather difficult, but it should be thoroughly

(*Continued on page* 1472.)

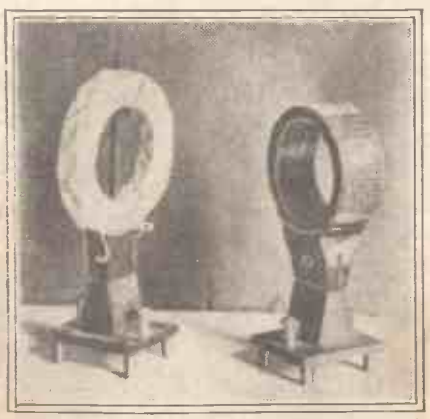


Fig. 4. Single-coil holders, with coils.

parallel condenser, or a No. 300 or 350 with series condenser. A No. 300 coil should be used for secondary.

Now remove both condensers and connect the two coils in series as shown in the upper diagram of Fig. 1. We now have a very simple form of variometer-tuned crystal circuit, using honeycomb or basket coils in place of the orthodox variometer. It will probably be found that the coils are now too large. Experiment with two smaller coils, and try a basket coil in conjunction with a

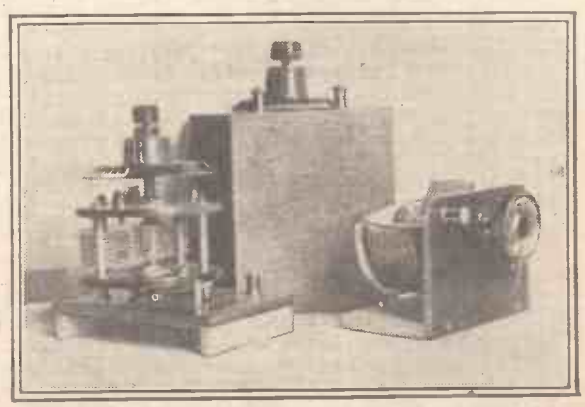


Fig. 5. Three different methods of mounting variable condensers.

Technical Notes

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

Atmospherics.

THE problem of "atmospherics" is very troublesome to some amateurs, whilst others do not appear to experience inconvenience from this cause at all. These differences are hard to explain, more particularly as operators of receiving sets in the same vicinity will report quite different experiences. There is no doubt that atmospherics are experienced to some extent in this country, though not to anything like the same extent as in certain other countries. But I am inclined to think that the noises which are put down to "atmospherics" are frequently, in fact usually, due to other and perhaps less mysterious causes. For example, bad contacts in the filament circuit and the H.T. battery circuit, as well as faulty cells in the H.T. battery, hardly need mention.

Induction from neighbouring telephone wires, electric light mains, and tramway power lines are also responsible for a good deal of interference, though this is usually not of the "crackling" variety. Before concluding that the "crackles" are due to natural causes, it is well to go over the connections of the circuit, as well as those of the aerial, and make certain that the cause does not lie nearer home.

A "Peculiar" Case.

I came across a peculiar case a few days ago. A friend who takes great pride in his multi-valve set found that it had suddenly developed tremendous crackling, rendering reception absolutely impossible. I was asked to listen to it, and can best describe the reproduction by saying that the noises nearly "knocked my head off." He assured me that his aerial was quite all right, as it had never been touched. After going over the usual likely clues, I began to think it was going to be a long job, so went to his telephone to ring up my house and say I should be detained.

On taking up the telephone receiver, the same appalling noises greeted me from the telephone, coming at the same time with increased loudness from the wireless set. After that it didn't take a Sherlock Holmes to guess that his outside telephone wire was touching his aerial.

Touching Aerial.

His aerial wire had been sagged low in order to escape a crossing telephone wire, and his aerial was joined to that of a neighbour whose garden was back to back with his. It transpired that the opposite neighbour had decided, for some reason best known to himself, to tighten his aerial that evening, without noticing that in so doing he had tightened up my friend's aerial until it was contacting with his telephone wire. On slacking down the aerial a little, the noises completely disappeared. The story has an amusing sequel, for the telephone people, having noticed the noises in his telephone line, sent a man round the next day to examine the telephone, which by that time was all right again. What the man found, or how much they told him, I do not know.

Reducing Losses.

There is quite a cry about "low loss" nowadays, some American manufacturers having even gone one better and produced components bearing the legend "No loss." Many amateurs do not seem to be quite clear as to what are the losses referred to, and what are the advantages to be gained by eliminating, or at any rate reducing, the losses.

(*Continued on page* 1503.)

Mr. Lewis Casson, the well-known producer, and other artistes in a recent broadcast play, before the microphone at 2 L O.

AN EXPERIMENTAL RECEIVING STATION.

(*Continued from page* 1471.)

mastered before proceeding further. Considering the small amount of apparatus used this circuit represents what is probably the most effective method of eliminating serious interference.

Having now gained a complete knowledge of operating a few of the most usual types of crystal circuits, it is only natural that our would-be experimenter should desire to try his hand with a valve circuit. The next article will describe the apparatus required for trying out valve circuits; meanwhile, the reader is advised to purchase a small stock of No. 24 or 26 D.C.C. wire, a basket coil "spider," and an assortment of card inductance formers, as shown in Fig. 6. He is then able to construct any particular coil as required, or to make up a selective range of experimental coils which will always be found useful. Fig. 5 shows three different methods of mounting variable condensers to be used on the experimental bench. Undoubtedly the best plan is to enclose the instrument in a wooden casing which is provided with an ebonite panel, as shown in the background.

The cabinet may be made from ordinary white wood, and afterwards covered with imitation leather (as shown), or the wood may be stained and varnished. The condenser shown on the left is bolted to an ebonite panel, 4 in. long by 3 in. wide, which is fitted with two terminals, and supported by narrow strips of wood. The instrument shown on the right is the popular "one-hole fixing" condenser, and this is, for sake of simplicity and cheapness, mounted in the manner shown. All open type condensers should be kept free from dust by occasionally passing an ordinary pipe-cleaner between the plates.

(*To be continued.*)

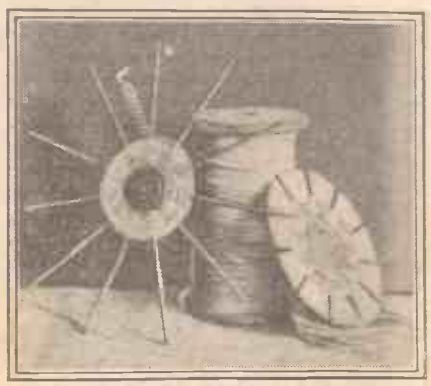


Fig. 6. Showing how (left) basket coils and (right) spiderweb coils are made.

The "MULTIDYNE."

A QUICK CHANGE CIRCUIT SET.

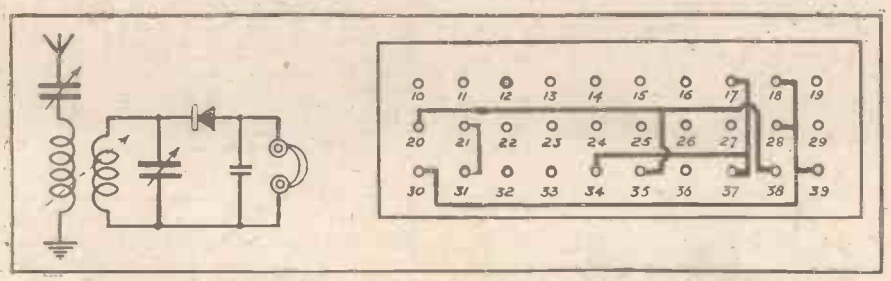
Designed and Built by B. W. WILLANS.

PART II.

In this, the second article of a series describing an improved form of combination receiving set, further circuit examples are given by the author, who shows the ease and simplicity with which the amateur can utilise the "Multidyne" for changing a circuit instantaneously. The author is also making arrangements for a wireless firm to place parts for "Multidyne" sets on the market very shortly.

SINCE my first article more experiments have been made with the POPULAR WIRELESS "Multidyne" which amply confirm my views as to the remarkable usefulness of this method of quickly changing over from one circuit to another.

Before describing the results obtained it is convenient to introduce some useful terms for the various parts of the "Multidyne" set. I shall, in future, reserve the name "Multidyne" for the complete instrument, that is to say, the combination of a panel containing components and a panel containing interconnecting leads. The panel itself on which the components are mounted, as also the spring contacts which form the essential feature of the device, I propose to term a "Multipanel," and the removable unit containing the circuit will be known as a "Multilink."



A loose-coupled crystal circuit. Useful in cases where trouble from jamming is experienced.

Comparative Tests.

Circuit making with the "Multidyne" is a relief to the experimenter in comparison with the trouble experienced in hooking up inaccessible components on an ordinary receiver panel, and, moreover, this effort need never be wasted, inasmuch as the Multilink can be kept and used whenever occasion requires. The labour involved in the ordinary way in carrying out changes of this sort is normally quite sufficient to dull the operator's observation, apart from damping his ardour.

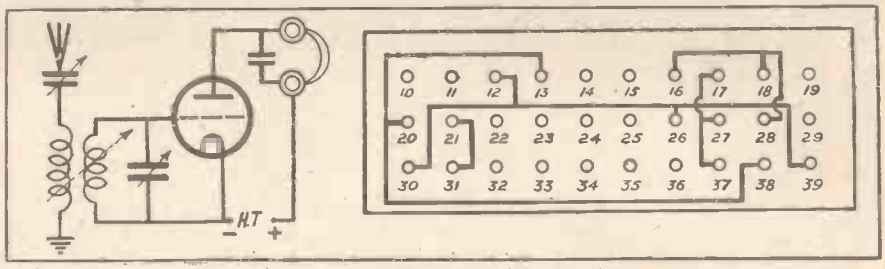
For the simple "listener-in," too, who requires best results but is not sufficiently skilled to command them in the ordinary way, nothing could be better than a few good circuits set up on Multilinks so that he can speedily change from one to the other as the conditions of reception indicate.

Some further tests made confirm entirely my previous opinions in this respect; and the results obtained may be of interest. Three circuits were submitted to comparative tests on an outdoor aerial in a situation a few miles from 2 L O, the following being the ones chosen for test: (See accompanying page of circuits).

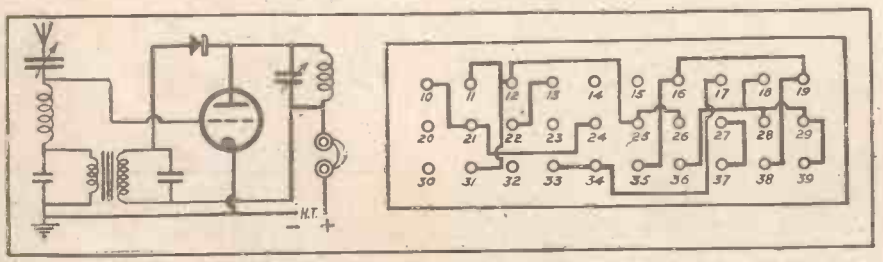
(2) Crystal detector and valve amplifier.

(4) Valve detector with reaction.

(5) High-frequency amplifier with crystal rectification.



A loose-coupled valve circuit without reaction.



The above reflex set, due to Mr. Scott-Taggart, is very popular and should be capable of operating a small loud speaker up to 6 miles or so from a broadcasting station.

Circuit "2" easily took first prize for simplicity in handling, and gave delightfully clear and strong results on London, Chelmsford, and ship stations. As far as the reception of distant stations was concerned, however, no success was obtained, as was only natural.

Long Range Reception.

Circuit "4" involved the replacement of the low-frequency amplifying valve by a valve detector and removal of crystal, and the nett result was a distinct drop in strength of 2 L O. On the other hand, it was possible to pick up distant stations fairly readily, although these were somewhat jammed by London and Chelmsford on the short and long wave-lengths. The reaction adjustment behaved quite normally, and it was readily possible to adjust the circuit so as to deliver its best results. When a change-over was made to circuit "5," a noticeable improvement in performance was obtained, it being now possible for the first time to bring in distant stations free of interference from the above-mentioned sources. On the other hand, the behaviour of a rather indifferent specimen of galena quite clearly indicated that this was not a circuit one would leave set up for "granny's" enjoyment when the rest of the family were out! However, when once the crystal was coaxed into good behaviour the results obtained from Brussels on the short wave and Radiola on the long wave were most surprisingly good, and perfectly steady as far as questions of stability of the set were concerned.

The set was subsequently tested in the neighbourhood of Westcliff-on-Sea, where the first evidence was obtained of its great adaptability to different local conditions. Here, apparently on account of the greater distance from London, and also possibly because of the high capacity aerial that was employed, circuit "4" was more satisfactory in every respect than circuit "5";

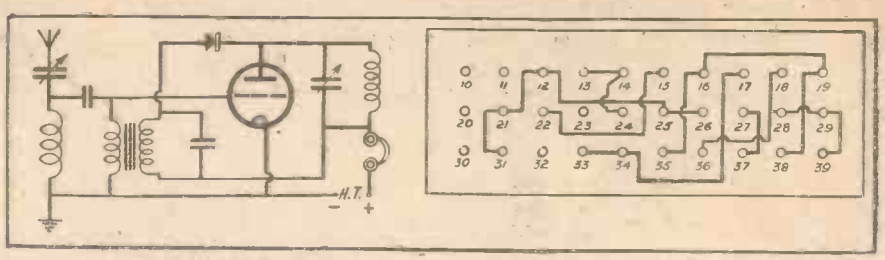
(*Continued on page* 1474.)

THE "MULTIDYNE."

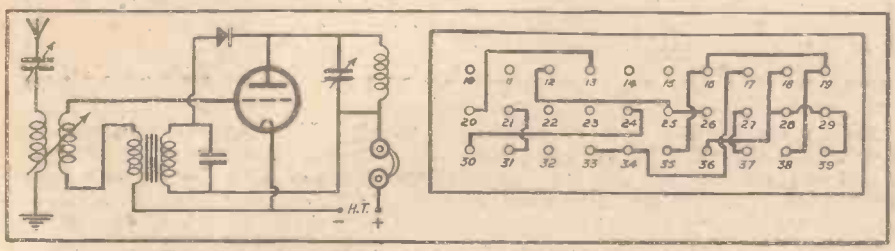
(Continued from page 1473.)

the jamming trouble experienced from 2 L O was, of course, entirely absent, and the usual number of long-distance stations were quite readily picked up.

As a result of these tests the value of the "Multidyne" system has been established beyond the shadow of doubt. It may safely be said that never before has it been possible to compare with such ease two totally different circuits employing identical components, the latter fact ensuring that the comparison is between the circuits and that differences are not due to the relative merits of different transformers or valves.



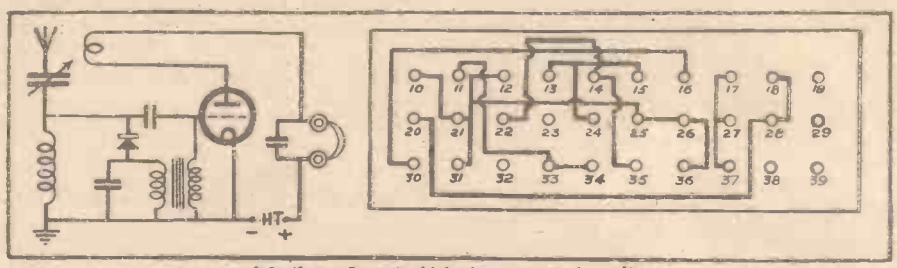
Another form of reflex circuit which is worth trying out.



This reflex receiver utilises two-coil tuning, thus increasing the selectivity.

Several Receivers in One.

Again, as has been implied in the remarks on the above tests, occasions may arise where the issue is between a circuit simple in adjustment and moderate in performance on the one hand, and a circuit complex in adjustment but excellent in performance. By the use of the "Multidyne," with its appropriate collection of Multilinks, not only can one test both of these aspects of the circuits, but instantaneously change over from one circuit to another at will, according to which type of receiver would be most useful. The "Multidyne" is thus as good as six or seven receivers in one, and has no real disadvantages in comparison with a set which is built, according to old-fashioned principles, for one circuit and one circuit only.



A further reflex set which gives very good results.

Circuits Worth Trying.

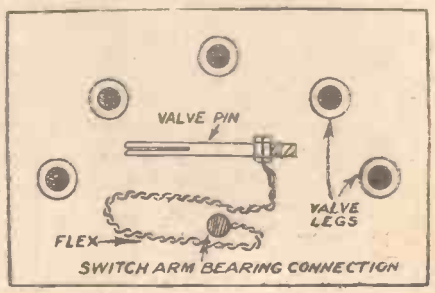
In order to bring home to constructors the unique flexibility of this wonderful instrument, various circuits, all of which can be set up on this first model are given with this article in addition to those discussed above. These circuits have all been published from time to time and are mostly well known.

I am in communication with a firm who have undertaken the production of the special parts, Multipanels and Multilinks, which are necessary to enable the constructor to assemble a "Multidyne" for himself, and am informed by them that a supply of these items will be available almost immediately. They further hope to be able to supply complete "Multidynes" at an early date for those who do not wish to be put to the trouble of assembling these instruments for themselves.

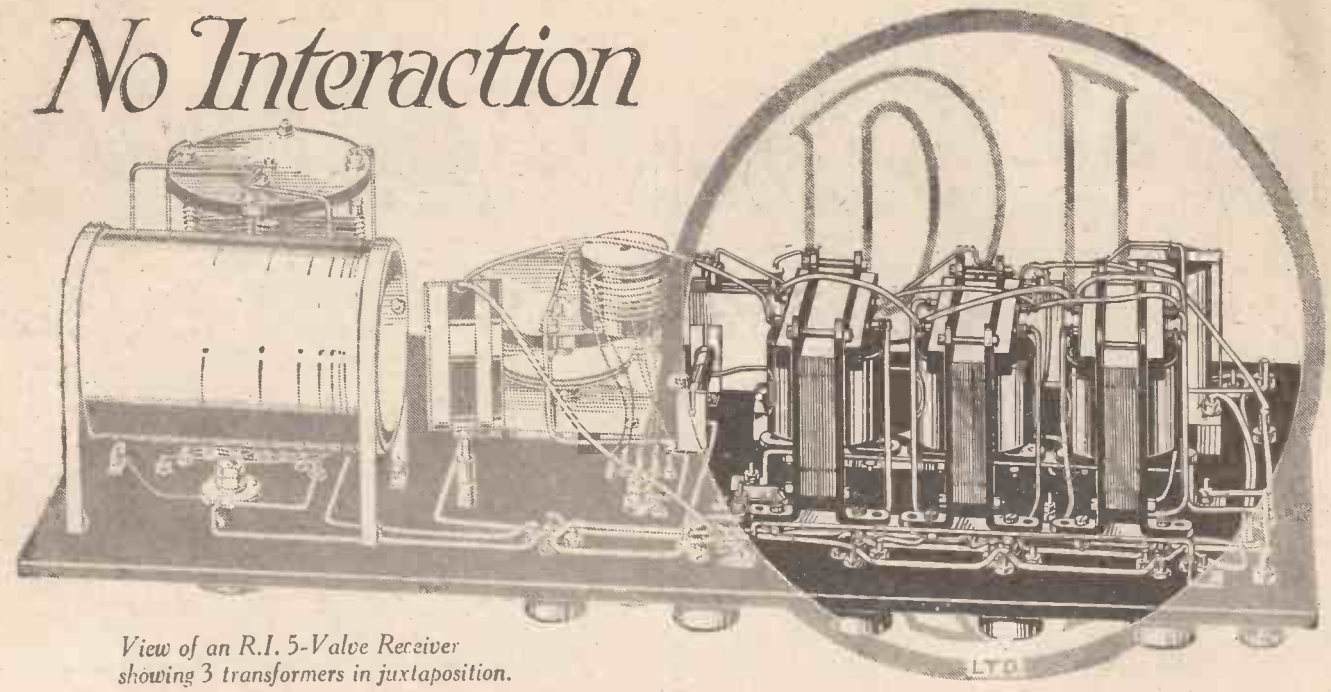
First nights at 2 L O. "Mr. Microphone" enjoys quite impressive social gatherings when important "first night" plays are given in the London studio.

A TUNING HINT.

THOSE who are contemplating making a tapped coil with the studs and switch, may find this idea simpler cheaper, and more efficient. The contact studs are replaced by valve legs, and the switch arm by a piece of flex soldered at one end to the ordinary switch arm bearing, and the other end to a valve pin.



No Interaction



View of an R.I. 5-Valve Receiver showing 3 transformers in juxtaposition.

THREE TOGETHER—WITHOUT INTERACTION

The R.I. TRANSFORMER has been universally admitted to be the world's general purpose transformer for perfect distortionless amplification. Its operation as a result of the special internal coil construction and heavy insulation has an efficiency higher than that of any other transformer on the market, and the world's general standard of transformation has been set as that of the

R.I. STANDARD

The R.I. has not only perfect operation in itself, but can be used in close construction with other R.I. transformers without the slightest interaction, as shown above in the famous R.I. five-valve receivers.

NO DISTORTION—NO INTERACTION

That means that the R.I. is the only transformer for YOU.
See that you ask for an R.I.
No other transformer will ever satisfy you like an R.I.
Ask your dealer.

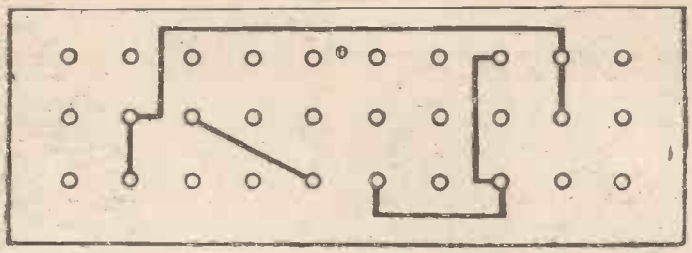
PRICE 25/-

Write for the R.I. catalogue free on request.

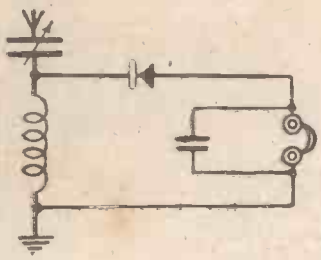
Contractors to the Admiralty and all Government Depts.

Radio Instruments Ltd.
12 Hyde Street, Oxford Street
Telephone: REGENT 6214 (3 lines) W.C.1. Telegrams "Instradio London"

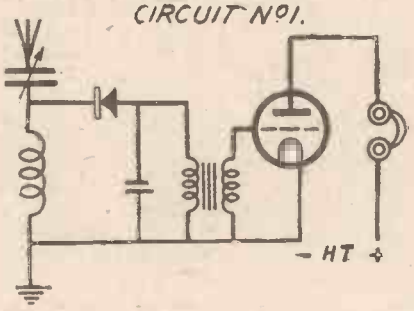
"MULTIDYNE" CIRCUITS.



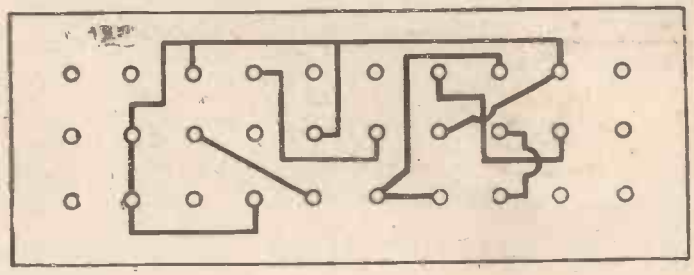
No. 1.—The connections and circuit for a crystal receiver.

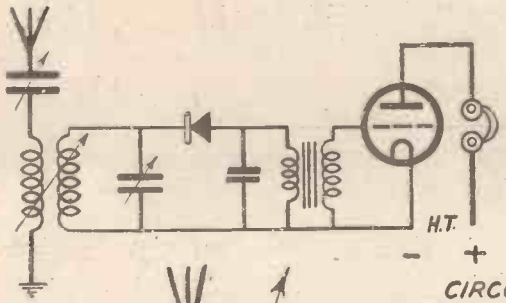


CIRCUIT No1.

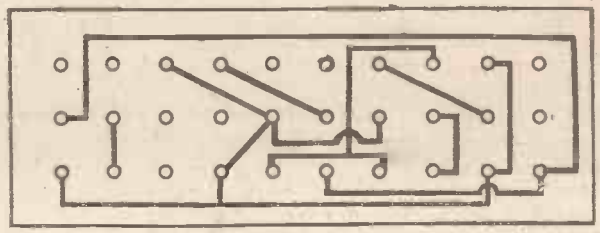


No. 2. — A simple but effective short-range loud-speaker circuit.

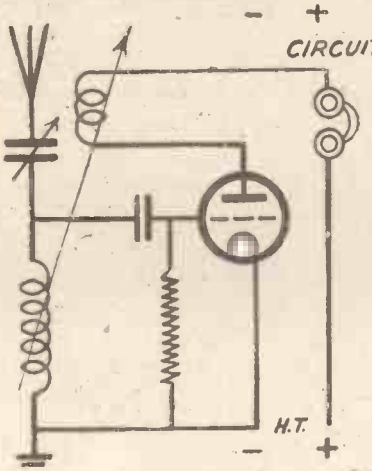




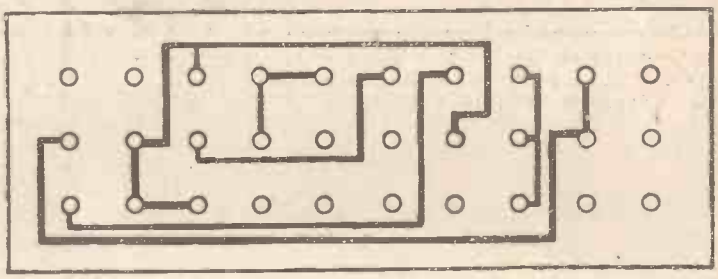
CIRCUIT No2



No. 3. — A loose-coupled crystal set with valve amplifier.

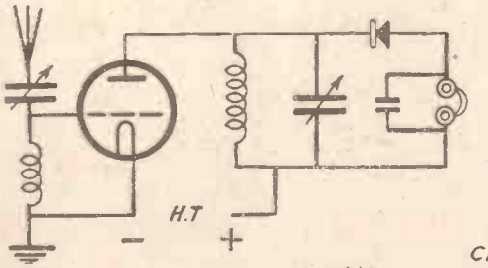


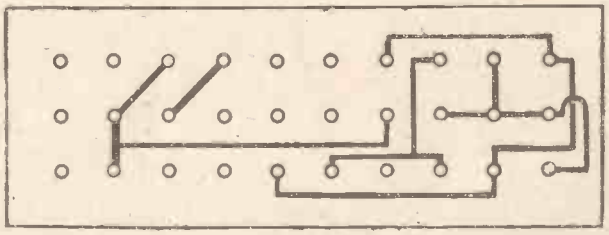
CIRCUIT No3.



No. 4.—A one-valve set with reaction. An exceedingly efficient and useful receiver.

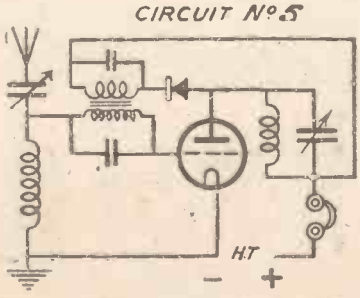
CIRCUIT No4.



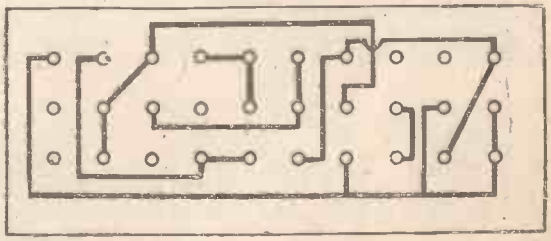


No. 5. — A crystal and H.F. valve set suitable for long range telephone reception.

CIRCUIT No5



No. 6.—One of the most popular of circuits. A one-valve crystal-reflex receiver. This is capable of giving good loud-speaker reception up to six miles from a local station.



CIRCUIT No6.

Mainly About Broadcasting

by The Editor

WITH the death of Dr. Oliver Heaviside the world loses a remarkable mathematical genius and physicist. Dr. Heaviside is perhaps best known to my readers through the connection of his name with the layer of ionised gas now generally supposed to exist in the atmosphere some 30 miles above the earth's surface, and which is known to the world as the "Heaviside layer."

The announcement of his death, which appeared in the daily Press only a few days ago, made one realise how little we knew about this brilliant investigator, and the Press revealed for the first time to the general public details about him which, without exaggerating, invest him with an aura of some mystery.

Dr. Heaviside was born in London on May 13th, 1850, but since 1874 he lived in the closest retirement in a little cottage near Torquay. In fact, since 1874 he lived the life of a hermit, refusing to see any scientific colleagues or any visitors at all, and speaking only to the intimate members of his own family. Even when the Royal Society awarded him the Rumford medal he refused to be present at the presentation ceremony, and the medal had to be sent to him by post.

A Great Debt.

For some years Dr. Heaviside was in the employment of the Great Northern Telegraph Co. at Newcastle-on-Tyne, but, after his retirement in 1874 to the strange seclusion already mentioned, he devoted himself to the study of Clerk Maxwell's theory of electro-magnetic radiation. He showed how this theory can be applied to the solution of many of the problems of practical telegraphy and telephony as applicable to land-line work and to wireless work.

Long-distance telephony owes a great debt to Dr. Oliver Heaviside, for it was he who showed that in a long line the electric waves set up by the speaker at the transmitting end when talking into the microphone are of different lengths, and do not travel all at the same speed. He showed that in consequence the wave form is distorted in its progress, and the sounds caused in the receiver may not necessarily be an intelligible replica of those which were responsible for it at the transmitting end.

Dr. Heaviside recommended as a remedy the increase of the self-inductance of the line, but this remedy clashed severely with a theory for long maintained by the British Post Office officials, that self-inductance was deleterious to purity and clarity of transmission and must, therefore, be avoided at all costs.

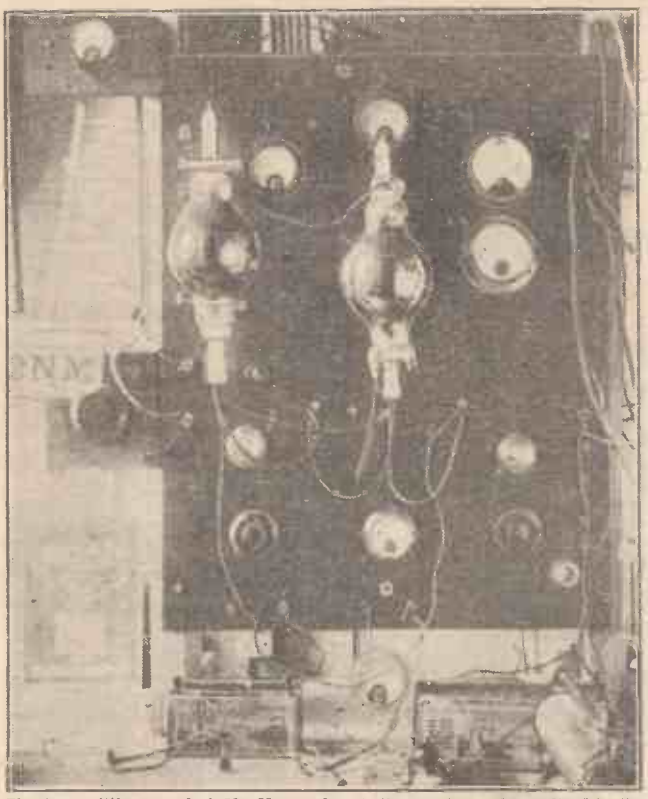
In consequence, Dr. Heaviside's theory and suggestion for increasing self-inductance was, to put it mildly, pooh-poohed. But in the end his theory was demonstrated beyond all possibility of doubt, and his system of introducing loading coils at intervals along the line was subsequently adopted very extensively in Germany and in the United States of America. Practically all the long-distance submarine telephone cables have been adapted at his suggestions on the above lines.

The Heaviside Layer.

But perhaps it was in wireless work that Dr. Heaviside became widely known to the public. Many of my readers know that in the very early days, when wireless telegraphy had scarcely dawned, there were many scientific men who denied the possibility of electro-magnetic waves travelling over the water between England and America. But Dr. Heaviside, basing his theory on Maxwell, maintained that as sea-water has enough conductivity to make it behave as a conductor of electro-magnetic waves, the latter would naturally accommodate themselves to the surface of the water, just as in the same way they follow a metallic wire. And it was at this point that Dr. Heaviside argued the possibility of an ionised layer of gas some 30 miles up in the atmosphere, which, being quite as good a conductor as sea water, would act as an atmospheric guide to wireless waves. This layer was subsequently named the Heaviside layer.

Although Dr. Heaviside was a Fellow of the Royal Society, his early days were beset with vicissitudes, and he found great difficulty in getting many of his scientific papers published. But subsequently they were gathered together, and were published in 1892 under the title of "Electrical Papers." His later work comprises three volumes entitled "Electro-Magnetic Theory," published in 1893, 1899, 1912, and reprinted in 1922.

It is a sad reflection on the value we place on our great scientific men that the closing years of Dr. Heaviside's life should have been marred by poverty. At one time his resources were so low that, living in the most straitened circumstances in his cottage near Torquay, he had to have his gas turned off owing to his inability to pay the necessary charges, and it was not until certain Fellows of the Royal Society intervened on his behalf and obtained for him a civil pension, that he was saved from dire distress.



The transmitting panel of Mr. Marcuse's set, the amateur who radioed to the Hamilton Rice expedition in South America.

Branly and Heaviside.

But the real reason for his hermit-like existence in Devonshire has never been revealed, and probably never will be. One can only conjecture; but it certainly is very sad to think that a man whose genius has been of such beneficial use to civilisation should have been allowed to end his days in such miserable circumstances, while others in the scientific world, far less deserving of merit and official recognition should have reaped rewards out of all proportion to their attainments.

There still exists a parallel to the unhappy life of Dr. Oliver Heaviside. I refer to Professor Edouard Branly, who is still living in very reduced circumstances in Paris. By a strange coincidence, on the day I read of Dr. Heaviside's death, I received from my Paris correspondent an article in the form of an interview with Professor Branly, which I hope to publish in an early issue of POPULAR WIRELESS, and in which readers will realise something of the pathos which clings to the declining years of a pioneer of wireless, without whose work and investigations Mr. Marconi and other wireless research workers in this country would have found themselves most seriously handicapped when seeking for a means of detecting electro-magnetic waves.

But if Dr. Heaviside died in obscurity his work will ever remain in the forefront of the minds of those who have studied wireless sufficiently, and who have followed the work of wireless investigators thoroughly enough to sift the chaff from the grain and to appreciate merit from mere opportunism.

HOW TO MAKE A TWO-VALVE REINARTZ RECEIVER.

Economical to Build and Easy to Handle.

Built and Described by D. HISCOX.

The perfect circuit has not yet been devised, and probably never will be; but in the meantime this very efficient Reinartz set will give the amateur constructor good value for time and money spent on building it.

ENTHUSIASTS who have tried out many circuits have in all probability been struck by the fact that with a given number of valves net results are very much the same.

When a circuit shows wonderful selectivity it may call for most laborious tuning, another may give great volume in reception from the local station but have a small range, and so on. The perfect circuit has no doubt yet to be devised, and in the meantime we must make a satisfactory compromise. The very enthusiastic will probably revel in the surprises of the two-valve reflex circuit, while the "Old Folks" will prefer a "Straight Three" without reaction even.

The front panel appearance of the complete receiver. Note the holes drilled to form valve inspection windows.

In the writer's humble opinion the best compromise is offered by a two-valve Reinartz receiver. Given a reasonably efficient aerial it can be relied upon for good loud speaking over twenty miles or more, and well over a hundred miles range on the headphones. Another advantage potent to most of us is that the set is very economical to construct, consisting, as it does, of quite few parts. Further, it works well on most dull-emitter valves. Tuning is delightfully simple, although it is somewhat critical on distant stations. Owing to this somewhat critical tuning the "Old Folks" are liable to go right over the tuning point without knowing it. This one defect, if it can be called such, is largely overcome in the set described.

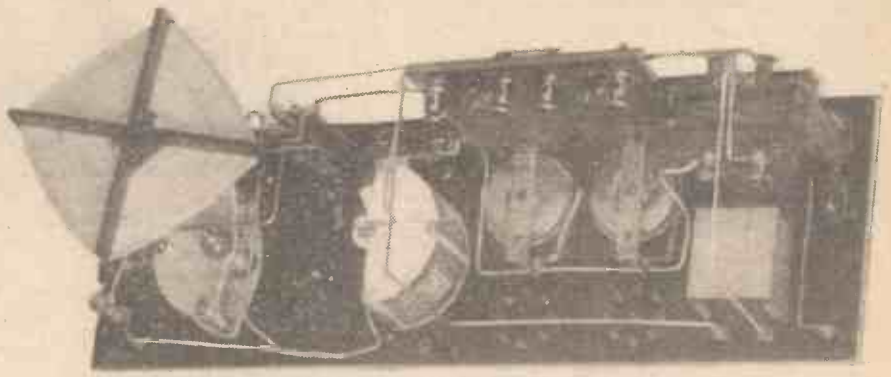
The components required are as follows:

Ebonite panels 18 in. × 6 in. and 5 in. × 4 in.
Var. condenser ·0005 mfd.
Var. condenser ·0002 mfd.
Fixed condenser ·0002 mfd.
Fixed condenser ·0003 with 2 megohms leak.
Fixed condenser 2 mfd.
Two rheostats.
L.F. transformer.
Eight terminals.
Eight valve sockets (Clix).
Three plugs and sockets.
Quarter-pound 22 S.W.G. D.C.C. wire.
Assorted screws, nuts, and washers.
Eight lengths of ⅛ in. sq. tinned copper wire.
Containing case to suit one's own particular taste.
Dewar switch.

These parts can be of any good make as advertised, except the rheostats, in which case Igranic's will be required if the valve platform is to be mounted in the simple yet excellent manner shown.

Having collected the necessary parts, the first operation is to square up the main panel and the smaller piece of ebonite that is to form the valve platform. Mark these

(*Continued on page* 1480.)



A view behind the panel, clearly showing on the left the special "Chapman" coil used

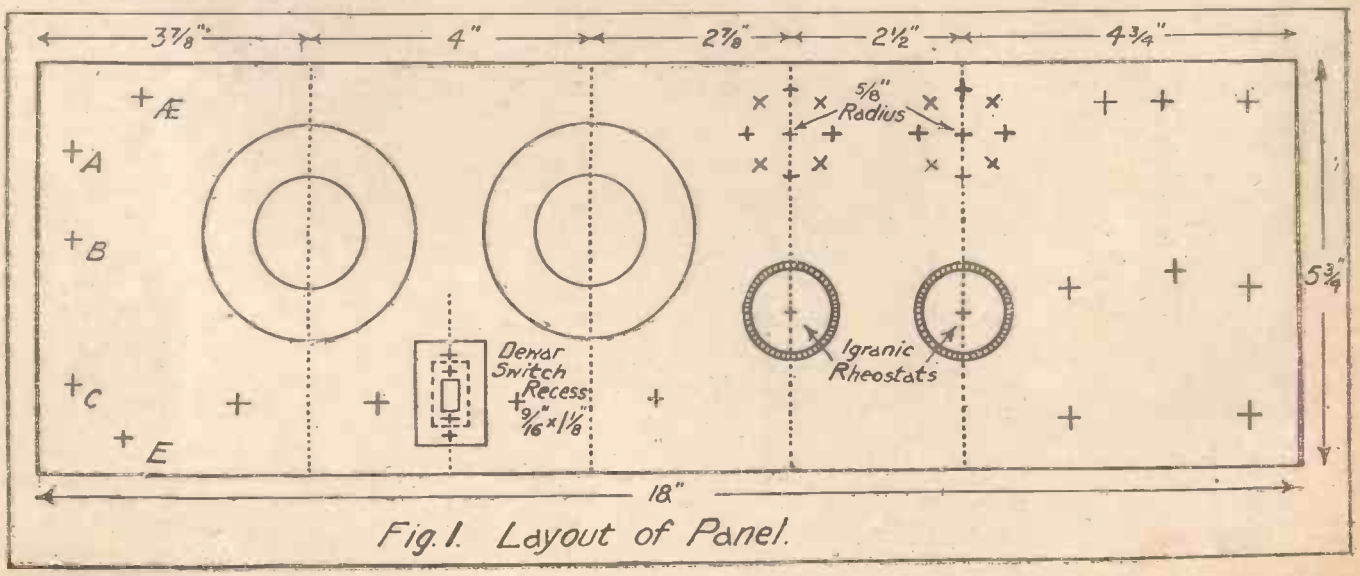


Fig. 1. Layout of Panel.

A TWO-VALVE REINARTZ RECEIVER

(*Continued from page 1479.*)

out for drilling at the backs with a sharp-pointed instrument, not a black lead pencil.

Fig. 1 shows the drilling plan of the set illustrated, but from the front. This lay-out may have to be slightly modified if different makes of components are used.

Fig. 2 is the plan of the valve platform. This platform is very rigidly and simply held in position by screws and nuts, using the holes in the bottom of the metal loops that form the frames of the Igranic rheostats. The same clamping arrangement also constitutes the connection from the filament battery minus pole through the rheostat to the appropriate valve-leg, by a short piece of wire soldered to the valve leg and to the end of the screw. This connection can be clearly seen in Fig. 3, which is a photo of the back of the panel.

Making the Special Coil.

The theoretical circuit diagram is shown in Fig. 4, and this should be compared with Fig. 5. The latter is the practical circuit and wiring diagram and shows the connections made necessary by the introduction of the switching arrangement. The only other arrangement out of the orthodox is the combined aperiodic aerial and closed circuit tuning coil. This is a "Chapman" coil, efficient and easy to construct. The frame consists of two pieces of ebonite or ply wood about 6 in. by 1 in., both notched in the centre so as to form a cross. Each arm of the frame or cross has a saw slit 2½ in. long. The windings comprise a quarter of a pound of 22 S.W.G. D.C.C. wire.

First cut off 18 ft., then start winding into the slots both this short piece of wire and the wire remaining on the bobbin. Continue this simultaneous winding for 15/18 complete turns round the frame. The short length of wire will be almost used up, and should be fastened off in the usual way by passing the end through a pair of holes drilled in the frame. Continue the other wire in the same direction of winding for another 30 or 35 turns, and finish that off in the same way. The inside end of the short coil is the aerial. The inside end of the bigger coil goes to earth together with the other end of the short wire. The other end of the bigger coil goes to the grid of the first valve.

The switch on the set was Government surplus, cost 4s.6d., and is called "Dewar." It is roughly a double-pole, three-position switch. When in the central or neutral position the connection is as shown in Fig. 4. When the switch lever is moved down an extra fixed condenser ·0002 is brought into circuit parallel with the tuning variable condenser. By this arrangement a lower minimum capacity is possible, and with or without the extra condenser in circuit a given movement of the variable condenser makes a difference in tuning of roughly a third of the amount that would be made by a continuously variable condenser of ·0005 mfd.

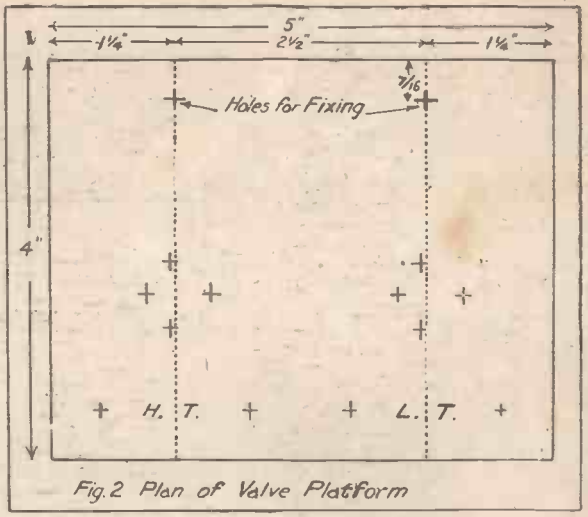


Fig. 2 Plan of Valve Platform

Thus, tuning is less critical in operation, and the action of finding and accurately tuning distant stations is simplified considerably. A further improvement would be the use of an anti-capacity extension handle in place of the knob on the condenser dial.

Operating the Receiver.

With the switch lever in the upper position the aerial is connected directly to earth, and the H.T. and L.T. batteries are both disconnected. Thus when the set has been adjusted for the local broadcasting station it is only necessary to move the switch on and off to completely control the set.

The coil previously described will cover all the B.B.C. stations. The two single and one double lead from the coil are connected to plugs, however, which in turn fit into sockets, so that different sized coils for longer or shorter wave-lengths can be simply plugged in, or even a frame aerial used.

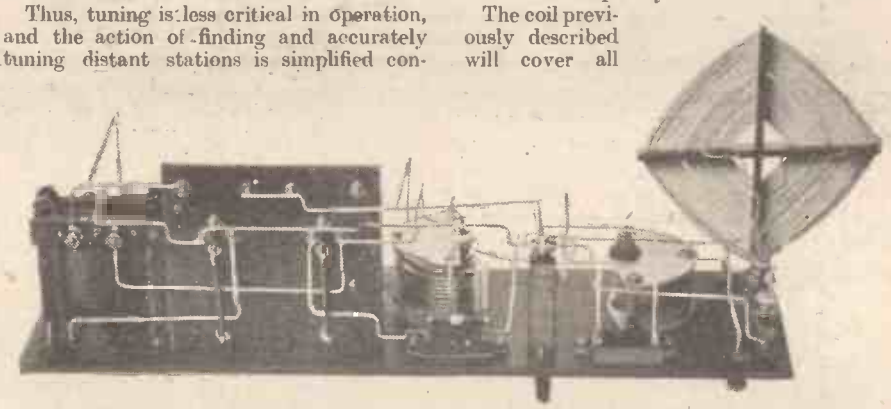


Fig. 3. A view of the back of the panel showing the connections to the valve platform.

It is best to equip the set with an H.T. battery of two 60-volt units, as some valves seem to require 100 volts on the plate to give best results. With other valves, for the local station, a pressure of 36 volts only is necessary. The condenser between plate and aerial gives wonderfully smooth control of reaction. The procedure in tuning is to first locate with the tuning condenser and then intensify by applying capacity by the reaction condenser which is previously set at zero. Reaction can also be controlled to a certain degree by the rheostat of the first valve.

Improving Signal Tone.

With most types of valves and loud speakers the tone of signals is much improved by the introduction of a ·0005 fixed condenser across the secondary terminals of the transformer. This addition is strongly advised for reception of a comparatively near station. On no account may a condenser be placed across the primary of the transformer.

(*Continued on page 1485.*)

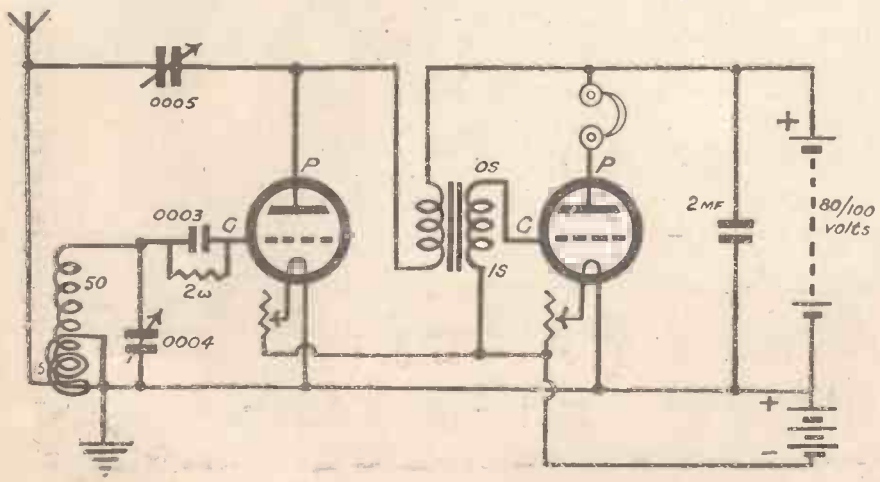


Fig 4 Theoretical Circuit Diagram

Cossor
Bright Emitter

Heinrich Hertz

Wuncell
Dull Emitter

The real discoverer of Wireless waves.

IT is a sad commentary of human nature that a man has to die before he can become famous.

It is no exception to find therefore, that some of the most brilliant of scientists have died with their life work unrecognised except among their most intimate fellow workers. Such a man was Heinrich Hertz, who, with Clerk Maxwell, as far back as 1882, discovered that wireless waves could be transmitted through space. And so it will be with the next generation. The extraordinary developments in valve design, from the first simple two-electrode valve, which really demonstrated the practicability of valve reception, to the three-electrode valve of Lee de Forest have, more or less, been accepted as a matter of course. In fifty years time, however, when television is general, a grateful world will look back upon those manufacturers that are spending thousands of pounds in unceasing efforts to produce better and better valves.

And no small share of praise will be due to the designers of the wonderful new Cossor Wuncell—the Dull Emitter that definitely spells a new era for the broadcast listener. Here is a valve which definitely for the first time carries all the advantages of the standard Bright Emitter. In volume, sensitiveness, freedom from distortion and microphonic noises, the Wuncell sets an entirely new standard of excellence. While for economy of current consumption and length of life this 2-volt Valve is in a class by itself. At 18/- it is the cheapest British Dull Emitter Valve you can buy. You are sure to want to know more about it, so ask your Dealer for a free copy of our large illustrated Wuncell Folder or send us a postcard.

All Cossor Valves are now reduced in price.

Cossor Valves

RADIO HUMOUR.

By HELENA MILLAIS.

The ever-popular Wireless Artiste.

ANYTHING really good is sure of an appreciative audience. But one cannot please all the people all the time, and all entertainers have to face the fact that some people will think them overrated. But the best artiste appeals to the greatest number of people.

People go to a theatre which seems to have the type of show they like; wise people listen-in to the items which they think will appeal to them; unwise people don't use their judgment, they listen to things they might know would not please them, and then write to Savoy Hill complaining. I believe a man once wrote asking why they never had a conjuror on the programme. There is hardly ever a divided opinion about a really great artiste. But there are some people who dislike a particular "type" of entertainment. For instance, I have heard people say they dislike Charles Chaplin, but I have never heard any intelligent person say he was not a fine artiste.

Dreadful!

Humour is always popular, everybody wants to laugh, and to make worried or weary people laugh heartily is by no means as easy as it seems, and if this is difficult in a theatre where they are facing you, waiting to be amused, and you have lights and make-up, costumes, scenery, the atmosphere which only a stage gives, and the inspiration which only a seen audience gives, what can it be like to broadcast humour! It is enough to congeal the warmest blood, and it does; strong men have been known to quake when facing the microphone, and personally I used to be icy with terror; luckily I'm getting used to it.

Imagine jokes and funny lines to silence—dreadful. The quiet atmosphere of the studio is helpful to singers, and when one is doing dramatic things—but for comedy! It's a relief if there are one or two people there who smile, although, in general, people in the studio when one is working are apt to make you self-conscious.

One of the greatest difficulties is getting good and suitable material; things that read well do not always *act* well, other things are funny when one can see the corresponding business and unfunny when unseen. "Local" humour is useless for non-locals; dialect humour is apt to be Greek to people from other counties. Then there is a certain type of wit which can only be used with a sophisticated audience.

Radio Essentials.

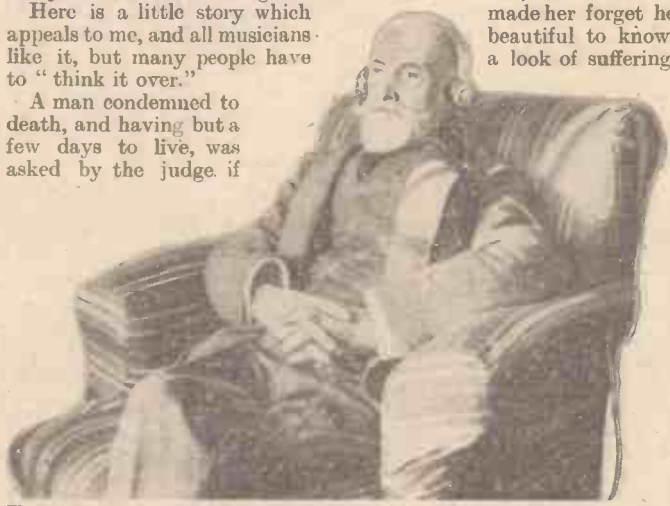
Broadcasted humour must be popular in type, understandable by all ages and classes; it must be well written, fresh in outlook and crisp.

The entertainer needs a good and "friendly" voice, perfect diction, a pleasant personality which must "get over," the power to visualise the audience, and a feeling of "fellowship" for them. He also needs experience to know how to get laughs, and how to wait for the points to carry so that the next lines are not lost. All humour should strike a human note, people can't laugh at something they can't realise. Old jokes and trite stuff are no good; long-winded jokes are no good, people get tired of listening when they can't see.

Remember *all* audiences are intelligent, even when they are not intellectual, and it is humour which is needed, not wit. Wit is likely to be too subtle to get over.

Here is a little story which appeals to me, and all musicians like it, but many people have to "think it over."

A man condemned to death, and having but a few days to live, was asked by the judge if he had any last request to make. The man thought for a moment, and then said: "Well, guv'nor, if it's all the same to you, I'd like to learn the piano." The point, of course, being that he had a few days to live, and it takes years to learn the piano, but you can't explain this to the people who don't "get it" at once.



The originator of Empire Day—the Earl of Meath—succumbs to the pleasures of wireless.

It is much more difficult to be funny than dramatic, but much less fatiguing.

Everybody needs laughter, as they need love and sunlight (I don't mean soap). Here in England we get little sun, so we need more laughter. If anyone has anything really funny to say, the world is waiting for it.

What is Wanted.

At a dinner not long ago, a man asked to meet me, and on being introduced told me that I had given his invalid wife many happy hours; she loved to listen to me and said it made her forget her pain. Now isn't that beautiful to know that one can replace a look of suffering or worry with a smile and a laugh, if it's only for a few moments? Then when one receives kindly letters from people who have never seen you, it makes you realise your large unseen audience, and to like them so much that you want to give them your very best.

And in this worried world humour is wanted, and broadcasted humour has the largest audience in the world. They want to listen and to *laugh*.

A TWO-VALVE REINARTZ RECEIVER.

(*Continued from page* 1480.)

It will be noticed the terminals for both batteries are situated on the back of the valve platform. In the writer's set the cabinet is constructed so that the H.T. battery is in the bottom of the box, and leads to the L.T. battery emerge from a bushed hole on the back of the box. They then actually go out of the window to the garage nearly 100 ft. away where they are plugged into the lighting circuit of the car.

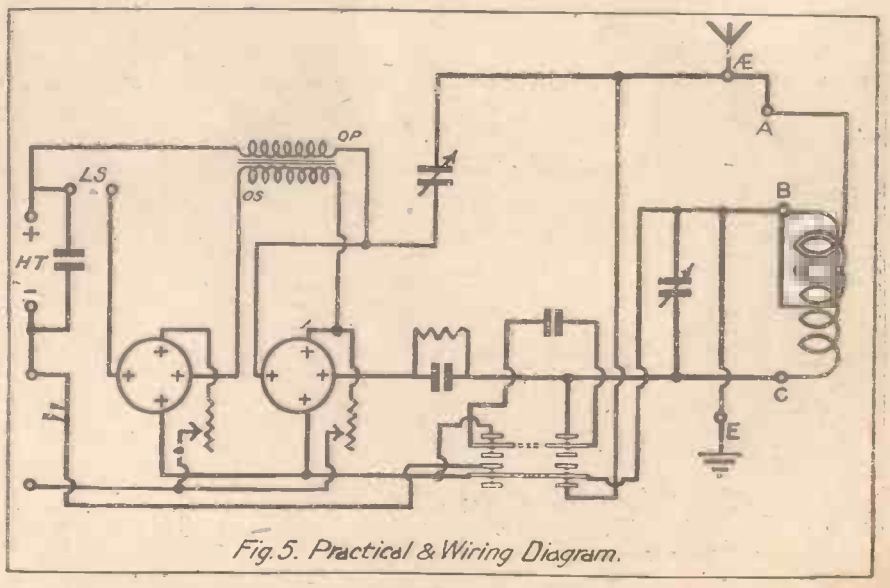


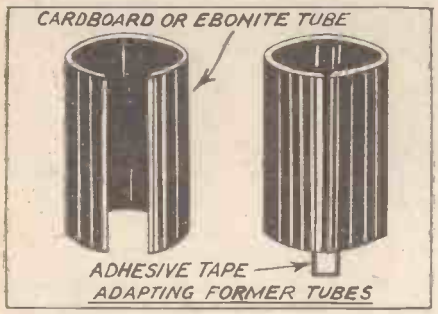
Fig. 5. Practical & Wiring Diagram.

Constructional Notes

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

Adapting Former Tubes.

THE experimenter who winds his own coils often finds that he cannot obtain a tube of just the required size, and the alternative of trimming down an ebonite or cardboard tube may not be practicable. The method shown in the illustration will be found useful in these cases. Take what-

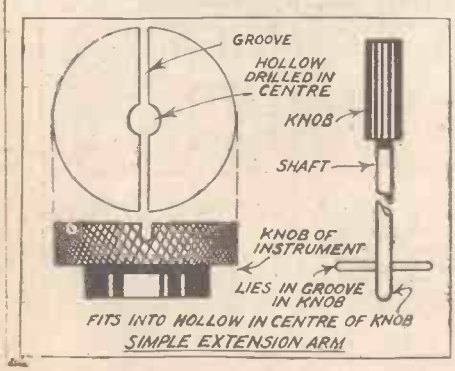


ever tube is obtainable somewhat larger than the required size, measure its outside diameter, subtract from this the outside diameter you require the tube to be, and multiply the difference by 22/7, this will give you the breadth of the strip you will need to cut longitudinally from the tube.

Or, if you prefer to avoid mathematics, cut a strip and then try whether the tube, when pressed together, is about right. If of cardboard the slotted tube may be closed together by means of a round of insulating tape at each end. With an ebonite tube, however, particularly if of thick wall, it will be necessary to stand the tube in hot or boiling water for a few minutes until it has become pliable, then remove it, and hold it in the closed position until the material "sets" or hardens. Or it may be bound with wire and left until quite cold. It will probably be found that the tube will remain in this form, but if it shows a tendency to spring open a little, insulating tape at the ends may be used until the coil is wound, after which the tape may be removed as the coil itself will keep the tube closed.

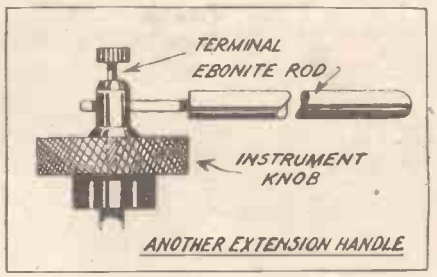
A Simple Extension-Arm.

There are many varieties of extension-arm provided by which to operate the control knob of a condenser, so as to avoid the effect of hand capacity. Here is another. It consists of a length of about four inches of fairly fine ebonite rod, in which a cross-bar, which may be of brass wire or fine brass rod, is inserted at a distance of about one-eighth of an inch from one end. A hollow is drilled in the centre of the knob which is to be operated by this extension-arm, to receive the end just referred to, and a cross-cut is made in the top of the knob to receive the crossbar. The end of the rod is then inserted into the hollow in the knob, the crossbar lying in the groove, and the knob can be manipulated by turning the rod about its own axis.



Another Extension-Arm.

The usefulness of the extension-arm shown in the preceding paragraph is somewhat limited owing to the fact that the arm so used does not provide any vernier control. If, however, the arm is mounted at right angles to the shaft of the instrument, the distant end of the arm moves through a

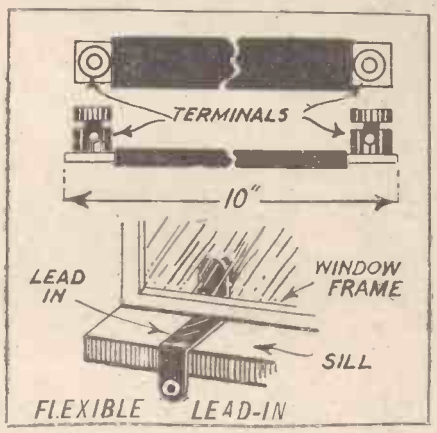


comparatively large distance for a given rotation of the knob, and so vernier control is obtained in a well-known manner. A length of fine ebonite rod is taken, and for a distance of about half an inch from one end it is reduced in diameter so as to be capable of insertion into a terminal of fair size.

A hole is drilled for a depth of about a quarter of an inch into the centre of the control knob, this hole being somewhat smaller in diameter than the shank of the terminal, and the shank is cut down to a length of a quarter of an inch. The terminal is then heated in a spirit-flame, and when sufficiently hot—it should be much below a dull red heat—it is inserted into the hole in the knob, where it melts its way in, and is allowed to set in that position. This then provides a binding screw for the extension-arm, as shown in figure. Care must be taken in melting-in the terminal, and with a good quality knob it is preferable to tap the drilled hole and screw the terminal in; but with the cheap compound used for many knobs, this would result in a breakage, and the melting-in process is a fair alternative.

Flexible Lead-in.

When bringing the lead-in into the house there is a temptation to mutilate the window frames for the purpose of passing through stout ebonite tubes, which temptation, if yielded to, has a tendency to make the wireless set, or the operator, unpopular with the household. Certain forms of strip lead-in



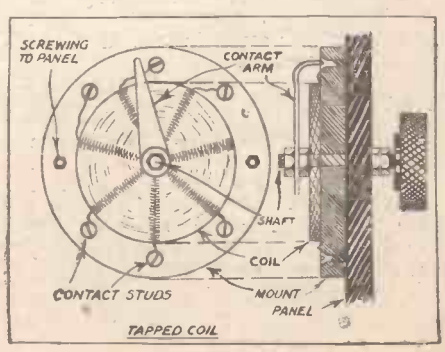
are available on the market, but here is one which you can readily make for yourself.

It consists of a strip of copper about 10 inches in length—the length depends upon the particular condition—$\frac{1}{2}$ in. in breadth, and of suitable thickness. If copper strip is not available, two or three strips of stout tinfoil may be used, laid together. Terminals are provided at the two ends, and the whole is then wound with the thin rubber tape used by electricians, or with ordinary insulating tape, though the former kind is preferable.

The method of using the lead-in is shown in the figure, and it will be seen that it is adaptable to be used beneath the lower sash, or at the middle of the window, between the two sashes. No holes need then be drilled in the frame at all.

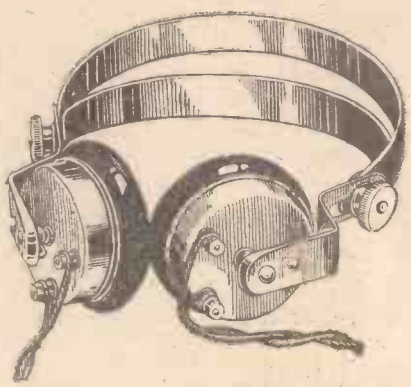
A Useful Tapped Coil.

A tapped coil for back-of-panel mounting may be arranged in the way indicated in the accompanying drawing. The coil is mounted on an ebonite or fibre disc, and tappings are brought to studs countersunk near the edge of this disc. These screws should be inserted into the disc and the projecting ends filed down at the other side flush with the surface. The disc is secured to the back of the panel by means of two small screws near the edge of the disc, these latter screws being placed so as to be out of the way of the rotating selector-arm. (See Fig.)



Extreme Sensitivity

A notable feature of these headphones is their extreme sensitivity. This is the outcome of long experiment and special attention to the manufacture of the magnets. Double headbands—very comfortable in wear—are fitted to polished pressed aluminium bases with moulded earcaps and six feet of receiver cord. Total resistance: 4,000 ohms. Each pair supplied packed in strong cardboard box.



REDUCED PRICES for Headphones

"Ediswan" Head Receivers have been recently reduced in price and are now obtainable everywhere at the new price, per pair **20/-**

EDISWAN LOUD SPEAKERS

"TELEVOX" LOUD SPEAKER.

The "Televox" is made with a two-part base, diaphragm and magnets being permanently parallel at every stage of adjustment. Resistance 2,000 ohms **£5 5 0**

"DULCIVOX" LOUD SPEAKER.

The "Dulcivox" has a fixed diaphragm adjustable by a milled screw device. 2,000 ohms **£2 2 0**

All leading dealers stock "Ediswan."

EDISWAN

SPEAKERS 'PHONES

THE EDISON SWAN ELECTRIC COMPANY LTD.,
QUEEN VICTORIA STREET, LONDON, E.C.4

162'54

Artistes of the Aether

By "Ariel"

Dickens' Anniversary—Request Nights at 2 Z Y—Two Popular Humorists.

THERE is always a tendency towards monotony in anniversary programmes, and one is usually assured of hearing the author or composer's most popular, though by no means best, work. Most recently have we had those of Burns, Mozart, and Charles Dickens, while Cardiff celebrated its second birthday on Friday last.

Mr. Warwick Braithwaite.

The same station also succeeded in making the Dickens' anniversary programme distinctive, with a new overture entitled "Barnaby Rudge," composed by the musical director. Mr. Warwick Braithwaite is not yet thirty years of age, but has crammed a lifetime of work and achievement into this short space. Born in Dunedin, New Zealand, he came early to England to study under the ægis of the Royal Academy of Music. He soon evinced a strong predilection for operatic work, and got his first opportunty by joining the O'Mara Opera Company, first as chorus master, and three months later as conductor, continuing with them for three years.

Request Nights.

Practically the best way to please people is to let them choose their own works, and a plebiscite programme has always worked successfully. So many continual requests for favourite pieces have been made that at last Manchester has decided to devote certain evenings entirely to "request items." I can see "high-brows" literally shivering at the thought of possible programmes, but as that of Friday last included such works as the Finale from Mendelssohn's Italian Symphony, "Puck's Minuet" of Herbert Howells, and sundry excerpts of Verdi, my sympathies are on the side of those who, like Oliver Twist, "ask for more" request nights. I presume that Miss Grace Ivell and Miss Vivian Worth were also part of the "requests."

Miss Sidonie Goossens.

On the orchestral and classical side, Birmingham has also appealed strongly, especially on the occasion recently when Mme. Fanny Davies was heard at the concert relayed to the studio. There was an especial fitness in hearing this famous pianist here, for though born in Guernsey, her first appearance, as a "prodigy" playing the Beethoven Funeral March Sonata, was made at Birmingham Town Hall.

Famous Artiste Broadcasts.

She is one of the finest classical pianists in the world, which is not surprising since she commenced at the age of three, studying later at Leipzig and Frankfort-on-Main Conservatories, and had the tuition of Mme. Clara Schumann, the composer's wife. Mme. Davies has played before more royalty possibly than any other artiste, and at every great musical festival all over the world.

The Virtuoso String Quartette.

On the Lighter Side.

Humour is often the saving grace of many a programme, provided it is of the right type. 2 L O had two clever entertainers in "The Grumblers," as they call themselves, Miss Lois Barker and Mr. Percy Tarling. Both are remarkably clever and artistic performers. Miss Barker, an ex-student of the Guildhall School of Music, is a composer as well, and has given her recitals at Steinway, Acolian, and Wigmore Halls here in London, amongst her compositions being that popular ballad "Jane" (nothing much to look at).

Mr. Tarling writes all his own material, and the two have appeared many times at the London Coliseum, Palladium, and the numerous tours on the Moss Empire, Stoll's, and other circuits. Most people will remember their familiar song, "The Moon."

On the orchestral side, all the members at 2 L O are recruits from the great London orchestras, and included with them is Miss Sidonie Goossens, the brilliant young artiste who was heard also at Newcastle last week, where she played the Danse Sacrée et Profane, of Debussy. Miss Goossens is a member of a famous conductor's family, a sister, too, of Miss Marie Goossens, with whom she joined issue as harpist in the Queen's Hall Orchestra. Miss Goossens played also with the combined orchestras for the three International Symphony Concerts at Covent Garden, the third performed last week under the baton of the German conductor, Bruno Walter.

Miss Lois Barker.

Forthcoming Events.

To-morrow (Friday) Cardiff has a novel interlude when "Old Joe and Company" (including the Dark Town Coon Band), revive the musical atmosphere of the Swanee River and the old minstrels. Cardiff also repeats "A Nasty Night in Nubia," the play which formed a part of 5 W A's "Nubian" programme on New Year's Eve.

Manchester broadcasts a programme on the same evening from the Free Trade Hall, in aid of the Lord Mayor's Unemployment Fund. It has been arranged to suit all tastes; Miss Mavis Bennett will sing solos, and those who like choruses will be able to join in, and have the knowledge that their singing is also being broadcast, so that they can act as subsidiary microphone artistes. Mr. Albert Sammons is the solo violinist, and John Henry has promised to supply the humour interludes. This promises to be a highly entertaining and interesting evening, and many will have an opportunity of seeing the famous humorist for the first time.

Mr. Percy Tarling.

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

FROM Messrs. Bi-Metals, Ltd., of Sugar House Lane, London, E.10, we have received a "Britonol" (Popular) Soldering Outfit, one of the most concentrated groups of "brain waves" we have yet examined. The *chef d'œuvre* is the tin of "Britonol" which is a solder in a paste form that renders the use of flux unnecessary. Next there is a coil of "Britonol" self-fluxing wire solder, having a core of "Britonol" paste solder running through the centre. A soldering iron is included, and this is original inasmuch as it is telescopic. Lastly a *folding* spirit lamp is provided, which, although small in size, is capable of providing with absolute safety a hot four-inch flame using methylated spirits. The whole outfit is retailed at 8s. 6d., and at this price should prove popular among wireless constructors, for whom, generally speaking, soldering must be made as simple an operation as possible.

We have tested the various "Britonol" products—all the items mentioned above can be purchased separately—and find them well up to their claimed standards. We omitted to mention that the "Popular" outfit includes concise directions as to how to use "Britonol" for various jobs. For instance, it is shown how fine wires can be joined merely by smearing them with "Britonol" and heating them with a match.

* * *

Lanite is a new crystal, a specimen of which has been sent us by the Lanite Laboratories, 6, Booth Street East, C.-o-n-M., Manchester, together with an informative leaflet describing, among other things, the "years of patient experiment" which preceded its advent. We do not agree that "in appearance it differs *entirely* from all other crystals" (the italics are our own), although undoubtedly it possesses a "distinctive crystalline structure." However, the question of appearance is not important, and undoubtedly Lanite is an excellent crystal, being sensitive over the whole of its surface, and functioning well in both crystal and valve-crystal circuits. We do not consider it better than any other crystal we have tested, but in a comparative test Lanite proved itself capable of holding its own against other first-class crystals. The question of contact is an important one, and undoubtedly Lanite scores over some of its rivals in that it is sold with a cat's-whisker which suits it very admirably indeed. Lanite, complete with cat's-whisker, is retailed at 1s. 9d. per box.

An Ericsson miniature crystal set.

* * *

Two interesting books are just to hand. "Junior Technical Electricity" (Robert W. Hutchinson, M.Sc., A.M.I.E.E., University Editorial Press, Ltd., 4s. 6d. net) is such that every serious wireless experimenter should have this work on his bookshelf. It is written in a manner that shows the author has not only the necessary knowledge to handle the subject capably, but knows exactly how to impart the knowledge to others. We should imagine that it will form a standard text book.

"The A B C of Wireless and How to Work Your Broadcast Receiver" (P. W. Harris Wireless Press, Ltd., 1s. 6d. net) is an excellent attempt to instruct the "man-in-the-street" in wireless theory and practice, but we cannot help thinking that a few drawings, not necessarily diagrams, would have assisted to engage his attention more completely and help him over some of the knottier points.

(*Continued on page* 1492.)

APPARATUS TESTED.

(Continued from page 1490.)

We note that "Electron" aerial wire is now being sold minus the copper strand which, with the steel strands, used to bring back such tender memories to some of us of "D 3" field telephone cable, which could be purchased in its bright red little coils at 6d. per 50 feet, and—wasn't it £1 per mile?—before "Electron" aerial wire became so well known. As a matter of fact, we could never detect any difference at all between the ex-government telephone wire and "Electron" aerial wire until the disappearance of that copper strand. Now, at any rate, there is a difference.

* * *

From Messrs. A. F. Bulgin & Co., of Cursitor Street, Chancery Lane, W.C., we have received samples of "Decko" Dial Indicators and Push-Pull switches. The dial indicators, which are supplied in nickel-plated or lacquered brass finish at 9d. per pair, meet, to use a hackneyed phrase, a long-felt want. Mounted by means of a nut and screw, they consist of neat little metal pointers for use on a panel in conjunction with graduated scales of variometers, variable condensers, etc. They are both ornamental and useful. The "Decko" push-pull switch, which retails at 1s. 6d., is designed for one-hole panel mounting, and is provided with two small nickel-plated terminals for connecting purposes. It is heavily plated throughout, is a neat little accessory, and would grace the most ambitious of panels.

Messrs. Tungstalite, Ltd., have sent us a sample of their new Gold Label crystal, which is retailed at 2s., together with a silver cat's-whisker and a numbered guarantee, in a glass-covered box. The other Tungstalite crystals are so good that we anticipated great things of this latest product, and we were not disappointed. Tungstalite Gold Label is a worthy follower—or shouldn't it be big brother?—of Tungstalite Blue Label. On test, excellent results were obtained and a high degree of sensitivity was evinced wherever the cat's-whisker was placed in contact with the surface of the crystal, while stable rectification resulted when it was employed in a dual amplification circuit.

* * *

The new crystal "Miltone" at 8d. complete with silver cat's-whisker, or 1s. with a 9 carat gold cat's-whisker, seems to represent very good value for money. We recently received samples from the makers, Messrs. Fuchsiaphone-Installations, of 11, Mill Street, Middleton, Manchester, and after testing them carefully we have no hesitation in recommending "Miltone" to the attention of our readers. It is a sensitive crystal and appears to be moderately stable. Sensitive spots are very quickly to be found, and once located remain sensitive. We cannot say we obtained strikinglybetter results with the gold cat's-whisker, but with the assistance of a little imagination doubtless one could be led to believe that a considerable advantage obtains in the use of the nobler metal. Anyway, "Miltone" at 8d., with silver cat's-whisker in a sealed glass tube, should find a ready market.

An artistic component: the B.T.H. table-lamp loud speaker.

* * *

The "Revo" loud speaker, as manufactured by Messrs. The Cable Accessories Co., Ltd., Tipton, Staffs., is quite an interesting product. We recently had a "Senior," which retails at 80/-, sent us for test, and we tried it out on several receivers of varying output, from a single one-valve reflex to a five-valve "straight." It behaved itself quite well, although it wouldn't stand too much "pushing." It proved to be quite sensitive, however, and handled small inputs very creditably.

* * *

We have recently tested one of the collapsible frame aerials manufactured by Messrs. Peto Scott Co., Ltd., and retailed at 27s. 6d. About three feet square, this instrument was found to be exceedingly efficient, and has a neat appearance, warranting its use with the most elaborate of sets. Each model is provided with a certificate of efficiency before it is allowed to be sold, and we can certainly recommend it to readers desiring an efficient "loop."

* * *

An error unfortunately crept into Messrs. The Electron Co., Ltd.'s advertisement in our last issue, where the price of the "Six Sixty" Dull Emitter Valve was given as 20s. This, of course, should have been 18s.

THE RIGHT WAY TO MOUNT CARD INDUCTANCES.

By O. J. RANKIN.

There is always a right way and always a wrong way. Mr. Rankin explains in this short article the right way, which is the correct way simplified!

THE most usual method of mounting card inductances is shown in Fig. 1, where the ends of the winding are soldered to valve pins which are clamped firmly to the central portion of the card. Almost any type of holder may be used in conjunction with this arrangement, the most important feature being the provision of a pair of sockets to engage the pins.

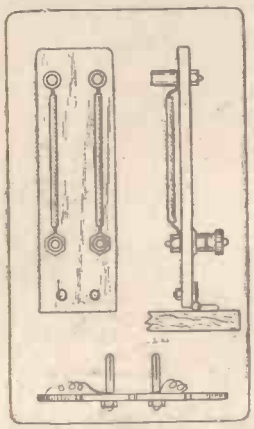


Fig. 1.

The holder shown in Fig. 1 consists of a strip of sheet ebonite about 14 in. long by 1½ in. wide, which is fitted with two sockets, two terminals, and a small hinge, and then attached to a wooden base in the manner shown. The hinge permits the necessary movement between the movable and fixed coils.

A Useful Method.

If one segment of each card is extended to form a handle, as indicated in Fig. 2, then a very useful tuner can easily be made up. A ⅜-in. hole is punched through the handle of each former, and into this is glued a ½-in. length of ebonite or fibre tubing.

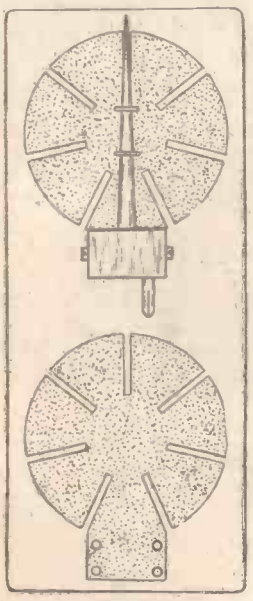


Fig. 4.

The two lower illustrations should make the idea quite clear. The mount consists of an upright brass rod which is clamped to the centre of a small ebonite panel.

The panel is provided with two or three pairs of terminals, according to the number of coils to be used, and then screwed down to a wooden baseboard. The ends of the coil windings are provided with small spade terminals; thus any coil can quickly be slipped over the upright rod and connected up to the terminals.

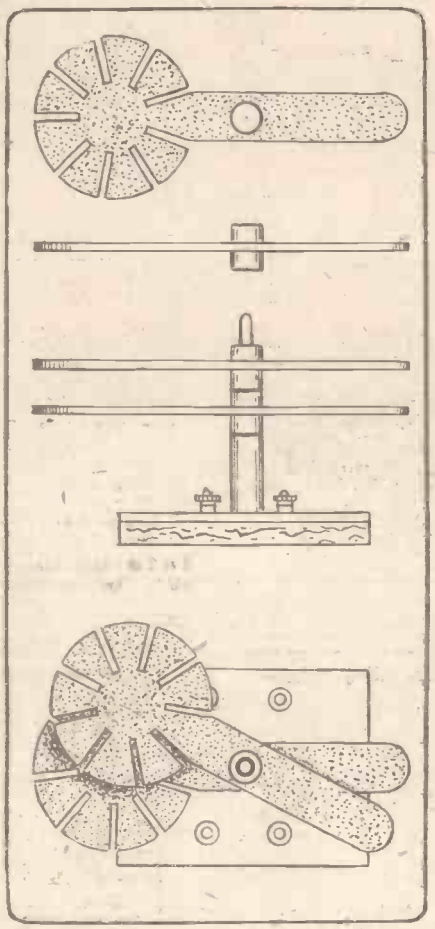


Fig. 2.

Fig. 3 shows another type of tuner where each card is provided with a permanent mount, this consisting of a small block of hardwood or ebonite which is fitted with two small terminals and slotted to accommodate the card.

Plug-in Coils.

A hole is drilled through the block near the base, this being split so that it fits fairly tightly over a horizontal rod which is attached at one end to an upright wooden pillar to form the supporting member.

The ends of the coil windings are firmly attached under the shoulders of the small terminals. A small hole, drilled diagonally with the split hole, permits the use of an anti-capacity handle.

Figs. 4 and 5 show how the card inductance may be conveniently adapted to the standard ebonite coil plug. In the upper illustration in Fig. 4 the card is wired or clipped to the stem of one of the well-known basket-coil mounting plugs, a flat being formed on the lower segment, and in the lower illustration one of the segments of the card is extended and drilled to take four small screws which attach same to one side of the ebonite plug.

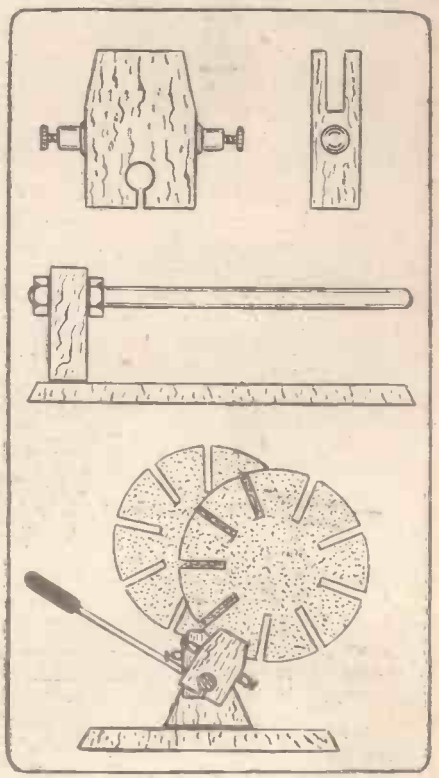


Fig. 3.

The method outlined in Fig. 5 is very similar, except that the attachment is effected by means of the two contact screws on the plug, these being passed through holes provided in the card extension piece which is shaped and bent as shown.

Coils mounted in this way (Figs. 4 and 5) naturally fall a little short in mechanical strength, but are nevertheless perfectly efficient.

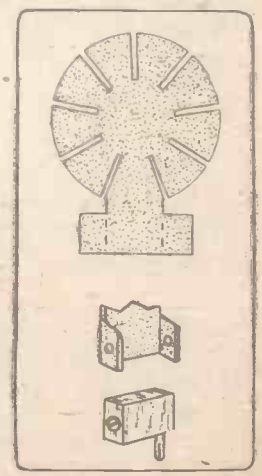


Fig. 5.

HULLO EVERYBODY!!

ALL THESE GOODS SENT POST FREE (U.K. ONLY) EXCEPT WHERE MARKED. FOREIGN POST EXTRA. ORDERS DESPATCHED IN STRICT ROTATION AT EARLIEST POSSIBLE MOMENT.

AERIAL 7/22 100 ft. 3/-
Copper Strip 3/-
Allen Var. Grid Leak 1/9
BURNDEPT Detector 4/6
Basket Holders 1/3. 1/6
Battery Links, doz. 1/2
Bushes Ebonite „ 1/3

CRYSTALS each 1/6. Neutron, Gilray, Permanite, Blue Label, Tungstalite

COIL STANDS 2-Way—
Vernier .. 4/6, 5/-, 5/6
Geared 5/11 Polar 6/-
Shipton Vernier .. 4/6
"Baby" ordinary 3/3
With ex. handle 3/6
Nickel „ 4/-
Baby 3-way 4/3
Nickel „ 5/6
Vernier 3-way .. 6/6
Shipton V. 8/-

COILS D.C.C.
For Chelmsford .. 1/11
With Adapter .. 2/8
200/2000 SET of 5 2/6
(Air Spaced Waxless)
Extra Large Air-Spaced Set of 5 Duplex D.C.C. Coils, 25, 35, 50, 75, 100 2/6
Coil Plugs, Wedge, pr. 2/-
Edison Bell 2 for 2/6
Plugs with Fibre .. 1/-

DETECTORS (Enclosed)
Micrometer 2/6
Nickel, Large 2/6
Brass „ 2/-
Burndept 4/6
Mic. Met. 6/-

FIXED CONDENSERS
EDISON BELL—
·001 to ·0005 each 1/3
·002 to ·006 each 2/-
Grid Leaks and clips 1/6
Dubilier ·001 to ·006 ea. 3/-
·0001 to ·0005 each 2/6
Grid Leak, 2 meg. 2/6
·01 for L.S. 7/6
Anode Resistance on stand, 70,000, 80,000, or 100,000 each 5/6
McMichaels' 2-meg. Leak and Clips .. 2/6
100,000-ohm Res. .. 2/6

RAYMOND (Ebonite Base)
·001 to ·0005 each 1/1
·002 to ·006 each 1/3
·01 or ·02 each 1/9
(Mansbridge Elsewhere.)
Flex, 2 colour, 12 yd. 2/6
Lighting .. 12 yd. 2/-
Small Non-Silk 12 yd. 1/6

COSWELL QUALITY
Valve Legs, Set 4 .. 1/3
Valve Holder 1/9
2-way Cam Vernier 9/-
3-way Cam Vernier 12/6
3-way Ordinary .. 7/6
2-way Panel 3/-
3-way Panel 5/-
Basket Holders .. 1/4

H.F. TRANSFORMERS
McMichael's 300/600 10/-
„ 1100/3000 10/-
Energo, 250/700 .. 3/11
„ 450/1200 .. 4/3
„ 900/2000 .. 4/6
Raymond B.B.C .. 2/9
„ 5XX .. 2/9
IGRANIC—Rheostat .. 4/6
30 ohms 7/-
Potentiometer .. 7/-
Variometer 10/6
Coils (all numbers)
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

LISSEN—Minor .. 3/6
Stat 7/6
Universal 10/6
Switch 2-way 2/9
Series Parallel 3/9
Anode Res. 2/6
Var. Grid Leak .. 2/6
Choke 10/6
L.F. T.1 .. .. 30/-
T.2 .. .. 25/-
L.F. T.3 .. .. .. 16/6
Coils—
25 .. 4/10 35. 40, 4/10
50 .. 5/- 60 .. 5/4
75 .. 5/4 100 .. 6/9
150 .. 7/- 200 .. 8 5

LOUD SPEAKERS
C.A.V. Tom Tit .. 30 -
C.A.V. Junior .. 55 -
Sterling Baby .. 55'-
Sterling Dinkie .. 30'-
Amplion Junior .. 27/6
Amplion Dragonfly 25/-
All models stocked of leading makers.

POLAR CONDENSERS
·001, ·0005 or ·0003 10/6
Micrometer .. 5/6
2-way Junior .. 6/-

RHEOSTATS
One hole fixing .. 1/6
C. & S. do. 1/5
De Luxe and Dial .. 2/6
Burndept 4/6
McMichael Dual .. 7/6
Shipton Strip—
7 ohm (with fuse) 3/6
30 or 60 ohm .. 3/6
Potentiometer 600 ohms 4/6
Crown for DE or R 2/6
L.E.S. Micro Control 3/6
T.C.B. 6, 13, 30 ohms 4 -
Potentiometer 300 ohms 5/-

SWITCHES
Panel DPDT 1/6
Panel SPDT 1/4
Ebonite DPDT .. 2/6
Ebonite SPDT .. 1/9
Simplex Lead in .. 1/9
Sq. ¼ Bus Bar .. 1/-
Switch Arms 1/6
(Inc. studs and nuts.)

TERMINALS
Phone or W.O. doz. 1/9
Pillar large .. doz. 1/9
Pillar medium .. doz. 1/3
Nickel 6d. doz. extra.
(All with nuts)

TRANSFORMERS L.F.
Ferranti 17/6
Igranic 21/-
R.I. 25/-
Ormond .. .. .. 14 -
G.R.C. 83 .. .. 15/-
Super Success .. 21'-
Standard Success .. 16/-
Brunet Shrouded .. 13/6
Formo Shrouded .. 18'-
Formo open 12/6
French 9/3

VALVE HOLDERS
Murray Anticap .. 1/3
Legless Anticap .. 1/3
Bretwood 1/9
Solid Rod Standard 1/3
Goswell 1/6

VALVES
Myers Universal .. 11'-
French "R" .. 7/6
Dutch Detector .. 5 6
Dutch "R" 5/11
Metal ·06 .. .. 13/11
Radio Micro ·03 .. 13/11

VALVES (*continued*)
Bright Emitter
B.T.H. "R," Ediswan A.R., Marconi Osram "R" or "R5," Mullard ORA, Cossor L.F. P1, Cossor H.F. P2, Mullard H.F., Mullard L.F. .. 11/-
Dull Emitter
B.T.H. B3, Ediswan A.R.D.E., Marconi D.E.R., Myers, each 18 -
Dull Emitters
B.T.H. B5, Ediswan A.R. "06," Mullard D.F. ORA 21/-
D.E. Power Valves
Marconi D.E. 6 22/6
Power Valves (for ·06)
B.T.H., B6 .. 30/-
Marconi D.E. 4 26/-
Mullard D.F.A. 26'-
Power Valves, for B.E., B.T.H. B4, Marconi, Mullard 30/-
(Valves posted buyer's risk.)

WATMEL
Var. gd. Leak .. 2/6
Anode Res. .. 3/6

WATES MICROSTAT
New Improved Model. Post Free. **2/9**

BRETWOOD
New Model, variable grid leak 3/-
Anode Resistance .. 3/-
Anti-Cap Switch .. 5/-

TELEPHONE DISTRIBUTION BLOCKS. Table Pattern, takes 4 pairs of 'phones 3/6

ENERGO L.F. TRANSFORMER. For supreme Results, Efficiency, Finish, and Permanent Reliability. For 1st stage .. 15/-

THE MIC-MET SUPER CRYSTAL DETECTOR .. **6/-**

ORMOND CONDENSERS with Vernier, one-hole fixing, ·0005. Price 7/6. Post free.

PANEL SWITCHES. On and Off. Connecticut Nickel. Post Free .. 1/6

EASIFIX.
Eliminates all ugly, loose wiring and minimises the risk of burning out valves. Each Conductor is distinctively coloured and enclosed within an outer-braiding. Complete with Wander Plugs 3/-

OLDHAM PORTABLE ACCUMULATOR
For ·06 Valves, 2-in. series will run 6 weeks on one charge. Recharging costs a few pence only. 2 v. 10 amp. continuous 12/6. Will go in your waistcoat pocket.

BRETWOOD
Valve Holder .. 1/9
100 p.c. Efficiency. Eliminates poor reception. No soldering stop over or under panel.

HEADPHONES.

ERICSSON
CONTINENTAL.
Your favourite 'phones. Entirely NEW MODEL. Most beautifully finished, exquisite tone. Ridiculous Price, per pair (4000 ohms) **13/11**

BRUNET
New Model "TYPE D." Hygienic Horn Headbands. Nickel-plated Stirrup. Black and White Cord. Each receiver stamped with trade mark. 4000 ohms. per pair **16/6**

For the MAGIC HOUR! When Fairyland becomes reality. Let the kiddies wear Featherweight 'phones.

BROWN'S "F" TYPE.
4000 ohms. **25/-** pair.

N and K
LATEST MODEL. 4000 ohms. Ideal for Crystal reception. Price in AMERICA. £2.
All Stamped **N and K.**
Price here, **17/6**
Limited number of old models stamped N and K. 4000 ohms. **12/11** pair
Post 6d. pair.

TELEFUNKEN
(GENUINE). Adjustable. 4000 ohms. Price **17/11**

TELEFUNKEN TYPE
So Near to Originals You can scarcely tell the difference except not adjustable. 4000 ohms. Pair **10/9**

£50 REWARD! given if the **DR. NESPER** PHONES SOLD HERE ARE NOT GENUINE! BEWARE OF FRAUDULENT IMITATIONS!! (Injunctions obtained)
Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head. Per Pair. **12/11** Post 3d. pair.

BRANDES
Matched Tone, **25/-** pair. 4000 ohms.

STERLING .. Latest Model. 4000 ohms. Wonderful Tone. **25/-** pair

G. K. C. 4000 ohms. **20/-** pair.

SIEMENS. 4000 ohms **25/-** pair.

B. T. H.
Simply cannot be equalled 4000 ohms. **25/-**
Perfection and Quality. Weight negligible.

SUPER L.F. (5-1) TRANSFORMER
Windings have insulated layers of 6 sections each, wonderful for amplification. Made in France, by the world's foremost firm. SPECIAL PRICE .. **10/-**
H.T.C. UN panel .. 1/9

Genuine BRUNET L. F. TRANSFORMER
(Shrouded)
5-1 : 5,000 Primary turns, 25,000 Secondary turns. Post free 13/6

PERFECT RHEOSTATS
Shipton New Type Strip Rheostat, 7 ohms (with fuse) 3/-
Shipton New Type Strip Rheostat, 30 ohms .. 3/-
Shipton New Type Strip Rheostat, 60 ohms .. 3/-
Shipton Potentiometer, 600 ohm. 4/6
A specially designed spindle gives one-hole fixing and incorporates a tension spring which ensures perfect electrical contact at all times; terminal connections are provided. The 7 ohm Model is fitted with a fuse, which little device may save you the cost of an expensive valve. In operation they are noise free—quite an important consideration.

"UTILITY" SWITCHES
2 Pole c/o Knob .. 4/-
2 Pole c/o Lever .. 5/-
4 Pole c/o Knob .. 6/-
4 Pole c/o Lever .. 7/6
Post 3d. each.

QUALITY (GOSWELL) RADIO COILS
Far more efficient than honeycomb or any other type of coil. Exceedingly strong and rigid, mounted on standard ebonite plugs. Brown finish, no wax or shellac used. MOUNTED.

25 ..	1/6		
35 ..	1/9		
50 ..	2/0		
75 ..	2/3		
100 ..	2/9		
150 ..	3/0		
175 ..	3/6		
200 ..	3/9	Post 3d. Coil	

MANSBRIDGE CONDENSERS
Octupus, Tested at 350 v.D.C.

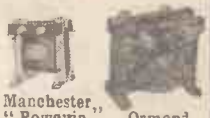
·01 ..	2/3	T.C.C.	
·25 ..	3/-	2 mfd.	5/-
1 mfd.	3/8	1 mfd.	3/1
2 mfd.	4/6	·25 ..	3/6

Post 2d. each.

"WONDER" AERIAL WIRE
49 Strands Special Alloy Phosphor Bronze.
For Frame, Indoor, or Outdoor Aerial.
Each strand is a separate conducting surface, is non-corroding, maintains its wonderful results all the time.
110 feet, 3/9 Post Free
BEWARE of spurious imitations. This is the finest quality.

ACCUMULATORS
FOR CALLERS ONLY at present.

Rheostat, with Dial, extra value. 2/6
Bretwood Valve-holder. 1/9



Manchester, "Powquip." 15/6
Ormond 14/6

Shrouded "Powquip," 18/-
Standard "Powquip," 14/6

"R.I." NEW MODEL IN SEALED BOX
Don't Buy Otherwise.
Post **25/-** Free

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

IMPORTANT NOTICE
TRADE COUNTER OPEN
will oblige you with any lines in stock, less 20% on Proprietary articles.
NO POST ORDERS TRADE.

EBONITE PANELS
3-16th in.

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

CRITERION CONCERT COILS.
Low Self Capacity. Every turn and layer airspaced. Perfect for Reaction. Mounted on Plug.

25 ..	2/-	50 ..	2/6
30 ..	2/3	60 ..	2/9
35 ..	2/3	75 ..	2/9
40 ..	2/8	100 ..	3/-

SET OF 5 (25, 35, 50, 75, 100) 10/- Post 3d.

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!!

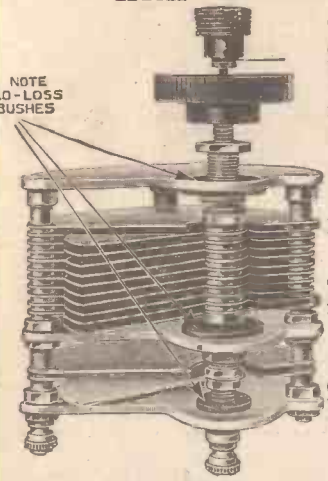
REVOLUTION

IN VARIABLE CONDENSERS

SQUARE LAW LOW-LOSS

(SQUARE-LO-LOSS)

with VERNIER.



The only Condenser with the Low-Loss Bushes. Electrical losses reduced to a minimum.

Full capacity as rated.

Exceptional Low Capacity.

The Condenser for short wave-lengths.

Why buy a Condenser without Vernier when one WITH costs no more.

SQUARE LAW WITH VERNIER. Including Knob and Dial (*Ebonite Ends* 1/- *extra*). *TRADE SUPPLIED.*

·001 : : 8/9
·0005 : 7/9
·0003 : 7/-
Post 6d. Set.

"DE LUXE" MODEL

As shown, with Dial, Knob and Bush.

·001 - 6/11 | ·0003 - 5/-
·0005 - 5/6 | ·0002 - 4/9

POST 6d. SET.

Unsurpassed for fine tuning.

"NEW MODEL"

STARTLING REDUCTIONS.

ORDINARY	SQUARE LAW	
Aluminium Ends Ebonite Bushes.	Aluminium Ends Ebonite Bushes.	Ebonite Ends 1/- extra.
·001 - - 6/6	·001 - - 7/6	All complete with Knob & Dial. Post 6d. set (3 sets 6d.)
·0005 - - 5/-	·0005 - - 5/9	
·0003 - - 4/6	·0003 - - 5/3	

TWIN CONDENSER SQUARE LAW

Ebonite Ends.

·00025 12/6 | ·0003 12/6
·0005 - - - - 18/11

Complete with Knob & Dial. Post 6d. set.

LONDON'S LARGEST Stockist of **JACKSON BROS.'**

'J.B.' Variable Condensers, complete with Knob.

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." Post 4d.

CALLERS! THESE 4 COLUMNS FOR YOU NO POST ORDERS FROM SAME

Warning! Note name RAYMOND on windows. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

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.

EBONITE, 3/16 in. Stock Sizes.

Cut to size	½d. sq. 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

¼ in. also Stocked.

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

TAPPED INDUCTANCE COIL for Chelmsford. A Real Bargain 1/6

WEDGE COIL PLUGS

Fitted Fibre .. 7d.
Various 7d., 8d., 9d.
Edison Bell .. .. 11d.
Plaincoil Plugs .. 4½d.
Also 5d., 6d., 7d. each.
Fibre Strip .. .. 2d. (36 in. by 1 in.).
Empire Tape, doz. yds. 6d.

RAYMOND FIXED CONDENSERS

·001, ·0001 to ·0005 10d.
·002, ·003, ·004 .. 1/-
·006, 1/3 ; ·01, 1/9 ; ·02, 1/9
Ebonite Base Terminals.

DETECTORS (Enclosed).

Micrometer 1/6
Half Opal 1/-
Small Brass .. 8d.
Large Brass 1/-, 1/3
Nickel .. 10d. to 1/6
Burndept 4/-
Crystals Stocked.
Neutron, Blue Tungstalite, Permanite .. ..
Shaw's Genuine Hertzite .. .. 10d.
Uralium 1/-
All known makes.
4 Whiskers (1 gold) 2d.
Gold and Silver do. 2d.
7 Waxed Coils .. 1/8
5 Waxless Coils .. 1/3
For B.B.C.

SPECIAL!

Vernier 2-way Coil Stands .. 3/6
Geared do. 5/3

BOXES from 1/11

7×5 9×6 12×9 14×10
8×6 10×8 12×10 etc.

H.T. BATTERIES

60 v.	7/6
30 v.	4/6
60 B.B.C.	8/11
30 B.B.C.	5/6
9 v. B.B.C.	2/6
1·5 (D.E.)	1/9

Eveready 66 v., 36 v., 108 v. stocked.

D.C.C. WIRE per ½ lb.

18 or 20 g.	9d.
22 g.	10d.
24 g.	1/-
26 g.	1/1
28 g.	1/3
30 g.	1/6

BASKET COILS

Chelmsford .. .. 11d.
Also at 1/-, 1/3, 1/8
B.B.C. Duplex Waxless set of 5 1/9
Extra air space, ½ in. (25, 35, 50, 75, 100).
Wave-lengths given.

GOSWELL QUALITY COILS

Mounted on Plug.

25 ..	1/6	100 ..	2/9
35 ..	1/9	150 ..	3/-
50 ..	2/-	175 ..	3/6
75 ..	2/3	200 ..	3/9

Why pay high prices?

SWITCHES

D P D T, china base	1/6
S P D T " "	10½d.
Panel D P D T ..	1/-
" S P D T ..	10½d
Ebonite D P D T	2/3
" S P D T ..	1/3
Tumbler	1/-
On and off	10½d.

VALVE HOLDERS

Legless	1/-
Solid Rod	1/-
Climax	1/6
Murray	1/3
Under Panel ..	1/3
Templates	1½d.

NEUTRODYNE CONDENSERS

Ormond	2/-
Colvern	3/6
Success	3/6
Vernier (Colvern)	2/6

SPECIAL! VARIABLE CONDENSERS

Square Law with Knob and Dial.

·0003 .. .. 4/11
·0005 .. .. 5/6
Callers' Price only.

SPEC AL!

Leatherette Boxes with Lid .. 2/3 and 2/11
Re-echo Crystal Sets 13/11

SPECIAL!

Fine Crystal Set, sloping leatherette Cabinet. Fitted for Chelmsford and B.B.C. Wonderful value .. 9/11
Variometer, Impregnated Board 1/6
With Clips .. 2/3
Formers .. from 4d. (Impregnated)
Variometers, inside winding, Ebonite former, similar to Fallon, etc. 6/11

VALVES

Dutch Detectors .. 4/6
"R" type .. 4/9
·06 .. .. .. 11/-
Phillips "R" .. 6/11½
French "R" .. 5/11

RADIO MICRO 06 THE WONDER VALVE

H.T., L.T., or D. 3 volts. **12/6**

METAL 06

Be sure "METAL" is Stamped on Valve and avoid imitations.
One to each Customer at **10/11**
Regular Price **12/6**

ALL VALVES REDUCED

(Marconi, Ediswan, Mullard, Cossor, Myers, etc.

VARIOMETERS

Very Special 200/650 metres. All ebonite. Double silk wound, callers only 4/-

TERMINALS (Complete)

W.O., Pillar, 'Phone, brass, 1d. each ; nickel, 2d. each ; stop and valve Pins, ½d. ; nuts, various, 6 a 1d.
Valve Sockets 1d., 1½d.
Flush panel do. 1d.
Spade Tags .. 6 a 1d.
Do. Terminals 2 for 1½
do. Pins 2 for 1½d.
Screws and nuts 2 a 1d.
Switch arms .. 7d.
Nickel arms .. 10½d.
Studs, complete 2 a 1d.
'Phone connectors 1d.
2 B.A. Rod ft. 2d.
4 B.A. Rod ft. 2d.
Valve windows .. 4d.
Washers .. 12 a 1d.
Shorting plug and socket .. .. 3½d.
Shellac .. .. 5d.

H.F. TRANSFORMERS

For Chelmsford .. 2/9
For B.B.C. range 2/6
Energo, McMichael, Bowyer-Lowe stocked.

MANSBRIDGE FIXED T.T.C. GREEN

·25 .. .. .. 2/9
1 mfd. 3/6
2 mfd. 4/6

CONCERT COILS

Set of 5 : 25, 35, 50, 75, 100, **10/-** set.

Var. gd. Leaks .. 1/-
Fixed 2 meg. .. 9d.
Battery Links 3 for 2d.
Ins. Hooks .. 2 for 1½d.
Egg Insulators .. 1d.
Reel " .. 2 for 1½d.
Ins. Staples .. 5 a 1d.
6 ft. 'phone cords 1/- 1/6
Sleeving 3 yards 9d.
Tinned Copper 18 g. 5d.
" Bus bar, hank 6d.
Knobs, 2 B.A. .. 2d.
Wander Plugs .. 1½d.
Strip Aerial, 100 ft. 2/-
7/22 Heavy, 100 ft. 1/11

COIL STANDS

Ebonite, 2-way .. 1/9
With ex. handles .. 2/3
Nickel " .. 2/8
3-way .. .. from 3/11
Basket Holders .. 8½d.
Best quality 1/-
Basket spikes 7d., 9d.
Anti cap. handles 9d.
Lead-in Tubes .. 6d.
Sorbo Ear Caps pr. 1/3

FLEX

2-colour doz. yards 1/6
Lighting doz. yards 1/6
Twin silk doz. yds. 1/-
Lead-in, thick, yd. 3d.
Do., good, 10 yds. 1/-

Rheostats 1/-
Ormond 1/9
Ebonite Former .. 1/6
With dial 1/11
Shipton, Igranic, Burndept, McMichael, etc., etc.

SPECIAL!

Customers purchasing 20/- worth of our own goods (at full prices only) are allowed to buy a first-class pair of phones for 5/-, 4,000 ohms, as an advertisement. One pair to each customer. This offer must be taken advantage of at time of purchase.

CRYSTAL SETS

For 5 X X and B.B.C. **7/11**

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.

Correspondence

THE SUPER-SELECTIVE CIRCUIT.

(The following extracts are from the numerous letters received from readers with regard to the Super-Selective Circuit described in "P.W." of January 10th and 17th.—ED.)

"I made this up during the same week-end and found it to be very selective as stated. Two days ago I came to the conclusion that the resistance was not working properly and removed it from the set. Its removal made not the slightest difference as regards reception of London.

"Recently, at 9 p.m., I was searching for something outside 2 L O and found music coming in very strongly indeed with first condenser at 65 and second at 98. This proved to be Brussels on 265 metres. The music was extraordinarily clear and very powerful on the large Amplion, and from 9.10 until 9.40 p.m. was practically regular. From the latter time until 10.5 p.m. (when I closed down), however, the transmission suffered from fading which got very bad towards the finish.

M. R. FITZWILLIAM.

"Stroud Green."

* * *

"Tuning cannot be described as easy, but once a station is tuned in it is nearly always possible to get it on the speaker. The following is a list of stations tuned in in one evening: Manchester*, Liverpool*, Leeds, Bradford*, Stoke-on-Trent*, Bournemouth, Cardiff*, Brussels*, Madrid. This is working 8 miles from 2 Z Y.

"The stations marked * were received a very good strength on the loud speaker (Sterling Primax)

F. W. SPENCER.

"Hale, Cheshire."

* * *

"I have tried quite a few sets but find the set is the only one that cuts out the local station (4 miles away) efficiently, and I certainly think it is capable of fulfilling the authors' claims. It has only been in operation a few nights during which the following were tuned in without any trouble: Bournemouth, excellent 'phone strength; Hamburg, excellent 'phone strength; Glasgow, good 'phone strength; Local Station, loud speaker strength.

A. WATSON.

"Belfast."

* * *

"The local station came in loud enough to work a small loud speaker. Later on, for the first time, I was able to tune it out completely and get other stations.

"So selective was the circuit that I was not aware that the local near-by station was transmitting until I happened to move the various parts to try for some fresh stations. Then, as when I was getting the distant band my set was dangerously near the oscillation point, I closed down to avoid annoying others in the immediate vicinity.

"I find the circuit extremely selective, and the values of the condensers, resistance, and H.T. voltage rather critical.

H. F. W.

"Leeds."

ONE-VALVE UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following results may be of some interest to you. The set was a "hooked up" Unidyne (Det.).

All B.B.C. Stations, 5 Relays, weak to good 'phone during news bulletin; Brussels, very good 'phone; 2 German, moderately good below 350; Petit Parisien, good 'phone; 1 Foreign (speech), weak 'phone, between 2 Z Y and Bournemouth; 2 German above Bournemouth, good 'phones; Madrid, moderate 'phone; Italian, good 'phone, fraction above 5 S C; Ecole Superieure, good 'phone; Berlin (?), steam organ just above Aberdeen, very good 'phone; 5 X X, very good 'phone; R. Paris, good 'phone; 1 Dutch (Hilversum ?), weak 'phone.

The above were obtained between 9 and 9.30 p.m. in two nights.

Trusting the above will be of use to you.

Yours faithfully,

W. L. PATTULLO.

A CRYSTAL "D X" CHALLENGE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I observe from this week's issue that yet another reader claims to receive all B.B.C. main stations on a crystal set, and I shall be obliged if any of your readers living within a reasonable distance of the undermentioned address, who regularly receive more than two stations (excluding Chelmsford) on a crystal set without any amplification whatever, would afford me an opportunity of hearing same, especially one who is fortunate enough to hear them all. In the meantime, however, my opinion is that Ananias has been put very much in the shade by some wireless enthusiasts, and beg to sign myself as

"FRANK DISBELIEVER."

S. H. WHITE, 46, Central Rd., Wembley, Mddx.

(*Continued on page* 1499.)

CORRESPONDENCE.

(Continued from page 1498.)

CHELMSFORD LOADING COILS ON CRYSTAL SETS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following experience and deductions may be of interest to crystal users in search of 5 X X, and also to manufacturers who are supplying "double wave-length" sets for 5 X X and the broadcast bands.

I recently made up a variometer-tuned crystal set for these two purposes, working out the loading coil for the long wave-length by a trial and error method with the help of a variable condenser, and finally got the loading required, the condenser being then, of course, discarded. I assembled the set in portable form, with the loading coil controlled by a D.P.D.T. switch. I was rather surprised to find that the variometer, which has a range of about 200–500 metres with 2 L O at about 100° on my aerial, did not affect the tuning at all when on the 5 X X length, though, of course, in series with the coil.

I have lately, however, had the curiosity to tackle the question from the mathematical standpoint, and the results are illuminating in the extreme. Taking 1,600 metres as in tune with the variometer at 90°, the wave-lengths with the 200–500 metres variable inductance—not necessarily, of course, a variometer—in series come out at approximately maximum, 1,634, and minimum, 1,566. This being a variation of very little over 2 per cent each way, is quite enough to account for the trouble, particularly with a crystal detector, which is inherently on the "flat" side in tuning.

But the crux of the matter is that there may be a difference of 8 or 10 per cent on quite normal aerials, owing to local characteristics, which would make the loading coil suitable for one a complete wash-out on the other, as happened in my case.

It certainly seems, therefore, that the ordinary inductance-tuned crystal set with loading coil cannot be generally successful, and that the only universal way of working is either by plug-in coils and variable condenser tuning or, in the case of purely inductance tuning, to have the long wave-length loading coil tapped for tuning as well as the short wave-length coil.

Yours faithfully,
HAROLD F. A. KINDER, A.M.I.E.E.
Taunton, Coulsdon, Surrey.

GOOD RESULTS ON REFLEX SET.

The Editor, POPULAR WIRELESS.

Dear Sir,—I think you will be interested to know the really astonishing results I am obtaining with a one-valve and crystal reflex receiver which I have made up from the instructions in your issue of November 29th, No. 131.

The set was only made a week ago, but I have given it a thorough try-out, and can confidently recommend it to anyone requiring a cheap, efficient set.

I am about fifty miles from Chelmsford in a straight line, and this is a good spot for reception, but my aerial is only 100 ft. of Electron wire attached to a 30-ft. pole at one end, and from that to the eaves of the house, and through the open window to the set. No insulators are used.

Chelmsford comes in at really good loud-speaker strength on an Amplion Junior; in fact, it can be heard in any part of the house, which is a fairly large one of seven rooms.

Our reception of the lower wave-lengths in this spot is spoiled by Morse, and the high-power station is really the only one worth listening to, but, to test the set, I tried some small coils on Saturday afternoon. I at once tuned in a French or Belgian station, and then got on to 2 L O. Both of these came through at comfortable 'phone strength.

I think you will agree that these results for such a small set are marvellous. I never expected anything approaching them.

I am by no means an expert, for I had never handled a valve set of any kind until Christmas, when I made up a straight three-valve set, and this is the only reflex set I have made and used.

I find that the type and size of coil used make a great difference to the strength of reception. I tried several kinds, and I obtain by far the best results with "Tandco" enamelled wire basket coils, the best combination I have found being a No. 10 in the fixed and a No. 11 in the movable coil holder.

All connections are soldered, using square wire, and keeping wires well spaced and as short as possible. I only used between six and seven feet of wire to make the set.

Lastly, reception is beautifully pure—in fact, very nearly as pure as a crystal set—and there are no extraneous noises. Although tuning is critical to obtain the best results, the set is not difficult to handle. Of course, it oscillates easily, but when once set is very stable.

Yours faithfully,
S. H. GILL.
"Hazlemere," Adisham, nr. Canterbury.

FURTHER SUCCESSES FOR UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I add one more to your correspondents in praise of the Unidyne?

As you may remember, I had some little trouble at the outset with the two-valve Unidyne, and I think it is only right that you should know that the

(Continued on page 1502.)

RADIOTORIAL

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

Editor:
NORMAN EDWARDS, M.Inst.R.E., F.R.S.A., F.R.G.S.

Technical Editor:
G. V. DOWDING, Grad.I.E.E.

Assistant Technical Editors:
K. D. ROGERS. P. R. BIRD.

Scientific Adviser:
Sir OLIVER LODGE, F.R.S.

Staff Consultant:
Dr. J. H. T. ROBERTS, F.Inst.P.

Foreign Correspondents:
F. DELANO, Paris; Dr. ALFRED GRADENWITZ, Berlin; L. W. CORBETT, New York; P. F. MARTIN, Italy; W. PEETERS, Holland.

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 and 1/- per full wiring diagram. 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 question 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

H. R. H. (Worcester).—In using the Ultra coil should both primary and secondary be tuned, or is it any advantage to do so?

They can both be tuned if desired, but we have found it unnecessary as a rule. In valve sets the secondary should be tuned, the primary being left aperiodic, but in crystal sets it is often useful to tune the primary, the secondary being untuned. In the case of the crystal set it is possible to use a larger secondary than is advisable for use with a valve set, owing to the damping effect of the crystal. Thus it will be remembered that a 120 turn (total) coil was used in the "P.W." Ultra crystal set, the primary being tuned. There are many advantages of the Ultra coil not yet mentioned, and further articles on the subject will probably be published shortly in P.W. The coil can be used as an ordinary coil if desired, the centre tappings thus providing a coil of either 30, 70, or 100 turns, if the three sections are of 30, 70, and 30 turns respectively.

* * *

"THREE VALVE" (Reading).—With reference to the three-valve receiver by Mr. J. Pritchard in "P.W.," No. 139, on page 1244, the wiring diagram appears to be faulty at one or two points. Should the small condenser be in *series* with the loading coil and earth?

There are two points in the diagram mentioned which should be altered. One is the marking of the H.T. plus and minus; these obviously should be reversed. The connections should be left as shown, but the lettering H.T. + and H.T. − reversed, H.T. − going with L.T. −. The condenser on the right of the diagram should be connected as shown, and also a lead should be taken from the top tapping arm of the A.T.I. to the top connection of the variable condenser.

* * *

N. M. T. (Worcester).—Having decided to make the three-valve receiver shown in Fig. 19 of the supplement given away with "P.W." of January 24th, I am at a loss with regard to the connections of the L.F. transformer, and do not know which are primary and which secondary terminals, as these are not marked in the diagram.

The primary terminals are those across which the ·001 fixed condenser is connected. As regards actual connections, in nearly all transformers it is safe to take I.S. to grid of valve and O.P. to plate side of the primary, the I.P. of course going to H.T. +. In Fig. 19 the correct connections will therefore be: O.P. to switch, I.P. to H.T. +, O.S. to L.T. negative and I.S. to grid. Some transformers have the correct connections marked on them, and these should of course be followed, but in most cases the above connections hold for all ordinary sets.

* * *

D. R. S. (Canterbury).—While listening on a 3-valve set the other evening, I heard a foreign station on about 300 metres, and I should be glad if you could tell me what station it was.

This is not an easy task, as approximate wavelengths do not help very much. One can be tuned in to 300 metres approximately and yet be really at 260 or 330 metres without knowing it, unless a wavemeter is available. Therefore, the station you heard could be either Brussels, 265 metres, though this is not so likely as the others, Cassel *was* 288, but now is 228, Hanover 296, Bremen 330 metres. Hanover is the nearest to 300 metres, and as this station usually comes over very well it is most likely that this was the actual station heard. Cassel, Hanover, and Bremen are relay stations, the former relaying the transmissions of Frankfort, and the latter two the programmes of Hamburg. Nuremberg and Petit Parisien work close together, but it is not likely that your tuning was so far out as to pick up either of these. Their respective wave-lengths are 340 and 345 metres, though these change very frequently in the case of Le Petit Parisien, whose wave-length does not remain constant for many days at a time.

(*Continued on page* 1501.)

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1500.)

"SHORT WAVE" (King's Lynn).—Having built a set similar to the one described in "P.W.," No. 141, for short-wave reception, I find that though it will oscillate quite O.K., the tuning is too sharp to allow me to tune a station in. Hand-capacity effects are fairly marked, and on varying the ·0003 condenser the stations sweep by so fast that it is impossible to tune them in. I nearly "got" K D K A one night, but had the same trouble in tuning.

There are four main points that will cause difficult tuning in this set, and these should be guarded against. Firstly, the wiring must be as short and direct as possible; do not go in for right-angle bends, but take wires direct, keeping grid and plate leads as short as you can. Secondly, see that the two variable condensers are at least 3 in. apart—more, if possible—and use extension handle on the ·0001 condenser for preference. You should not use the ·0003 at all for wave-lengths below 100 metres, and even above this wave-length it is only "set" at various positions and the tuning done on the smaller condenser. You will have found this quite critical enough. For reception of K D K A, keep ·0003 condenser at zero and search very carefully with the ·0001 condenser. Thirdly, the set should not be oscillating violently. This will cause difficulty in handling—the reaction coil should be adjusted so that the set is only just "rushing," and not oscillating so violently that it is silent. Fourthly, see that the aerial is not swaying. Read the remarks about aerials in the article. All aerial leads should be kept away from the house until the lead-in enters the room, as a swaying lead-in or badly swaying horizontal portion of the aerial will so alter the tuning that it is impossible to tune the station in properly. That is the reason the author prefers a vertical or semi-vertical aerial. In this case the aerial can sway as much as it likes, for, if no leads come near the house, the variation in tuning is very little; and, indeed, K D K A has been received on 68 metres in a gale of wind *without fading*, though the aerial was not by any means "bar taut."

* * *

J. E. J. (King's Langley).—Desiring to build up the circuits described by Lt.-Com. Shove in "P.W." of February 7th, I find I have all the necessary components except the second ·0005 variable condenser. Could I use a ·001 in series with the aerial?

This could be done, but it is not altogether advisable unless it has a vernier control, for it will tend to make tuning very sharp, and consequently the set will be more difficult to handle.

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement is now in force:—

(1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.

(2) A charge of 1/- is made for supplying full wiring diagrams

(3) All queries, together with postal orders and stamped and addressed envelope, to be addressed to—

TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.

(4) Technical queries will not be answered by telephone.

CORRESPONDENCE.

(Continued from page 1499.)

set is now working fine. I can receive most B.B.C. stations and a few Continental ones on one valve only, and that with the local station (2 Z Y) working. I get fair loud-speaker strength with two valves.

Between 7.30 and 9.30 p.m. on January 19th I had a beautiful reception of the Vienna station, the transmission coming in very strongly, so much that the music could be just heard with 'phones in hand.

I also received W G Y on the morning of January 12th, though badly hampered by a Manchester amateur transmitting near the same wave-length.

I must say that the Unidyne is the most selective circuit I have known, and I shall be glad if you will please accept my thanks and my congratulations to Messrs. Dowding and Rogers.

Yours faithfully,
HAROLD SMITH.

185, Whitehall Street, Rochdale.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I join in the chorus of "Unidyne" worshippers? I constructed the one-valve set, but for nearly three weeks it failed to oscillate. One fault found was a dud contact in coil holder. Still it failed. I returned valve to Bower's, who replaced it by return of post! Then away she went!

I have already logged Petit-Parisien, 5 W A, 2 L O, 2 Z Y, 6 B M, Radio Lyon, R. Iberica, Hamburg (?), 5 N O, 5 S C, 1 R O, S A S A, 2 B E, Ecole Superieure, Frankfort-on-Main, 5 I T, 5 S X, 2 B D, and one German at 180° and full vernier. I judge Berlin, with several continentals not recognised.

I cannot praise the circuit too highly. Two of my friends are already making Unidynes, after watching what happened to my efforts.

Faithfully yours,
FREDK. J. MARCH.

Rosebank, Boar's Hill, Oxford.

CUTTING OUT 2 L O.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I warmly congratulate your contributor, Mr. M. C. Pickard on an excellent set—the "Four-Circuit Two-Valve Set"?

I am two miles from 2 L O (or less), but (*with the addition of an extra coil forming a loose-coupled aerial tuning inductance*) I can *completely* tune out London and receive, for example, Münster on 410 metres, and Hamburg on 395 at almost loud-speaker strength. London vanishes with about 4 to 6 degrees turn of the H.F. condenser dial. Apart from the convenience of the four circuits, the general tuning arrangements and lay-out are extremely pleasing and convenient.

Yours faithfully,
A. N. PRELYAN.

358, City Road, E.C. 1.

C. W. TRANSMISSION.

To the Editor, POPULAR WIRELESS.

Dear Sir,—On page 1366, column 3, of your issue of the 7th inst., the following statement, purporting to be based on an assertion made by Mr. Shaughnessy to the Institution of Electrical Engineers, occurs:

"Experience shows that there is little to choose between the Poulsen arc, H.F. alternator, and valve systems of transmission; and far from the first-mentioned proving less efficient than the valve, as seems to be commonly thought, it has certain very important advantages, more especially now the problem of eliminating disturbances has been solved.

"The Marconi short-wave beam system, although being adopted for relieving traffic, is not likely to cause high-power long-wave stations to become obsolete."

Such an assertion is either meaningless or misleading without some explanation of what is meant by "there is little to choose between the three systems." In what respect is there little to choose?

In order to understand what is meant, a statement of the relative cost of installations for the three different systems, and the relative cost of working under commercial traffic conditions, is essential.

If Mr. Shaughnessy's declaration was correctly reported, and is true in a commercial sense, one can only conclude that radical improvements in the Poulsen arc and H.F. generator systems must have been effected, which have not been revealed.

Yours truly,
P. A. RISDON.

30, Wilbury Villas, Hove, Sussex.

A SELECTIVE THREE VALVE SET.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re "P.W." No. 139. I would like to make a remark concerning the 3-valve circuit as described by Mr. Lawrence Pritchard. I possess at present a set exactly the same with the exception of the coil and condenser for tuned anode. I have a G.R.C. varioneter, which answers admirably. Of course; also a G.R.C. variocoupler for tuner, a G.R.C. transformer, and I agree with Mr. Pritchard that it is well worth making. As yet it is the best circuit I have ever heard, for selectivity and clarity it cannot be beaten, and would urge your readers to give it a trial.

I am, yours truly,
A. RICHARDS.

5, Mead Row, Kennington Road, S.E. 1.

TECHNICAL NOTES.

(Continued from page 1472.)

The most obvious seats for losses of energy are, of course, coils and condensers. The dissipation of energy when an alternating current, particularly one of very high frequency, passes through coils having inductance (and every coil must have inductance) will be evident even to the beginner in wireless, and no doubt he will be aware also of the fact that similar dissipation of energy takes place in the dielectric of a condenser which is being rapidly charged and discharged. The dielectric losses in air are extremely small, and amongst solid dielectrics mica holds a high place for low loss. Celluloid is not so good as mica.

Other Causes of Losses.

But what I wanted to refer to more particularly was not the unavoidable losses, such as those mentioned above, but rather the accidental losses, which can be avoided by the experimenter himself with a certain amount of care. The choice of a low-loss condenser dielectric is a matter for the manufacturer, as is also the choice of suitable materials for the "former," varnish and insulation of a coil. The losses of energy at a bad contact, as between aerial and lead-in, or in a long earth-lead, or one badly connected to earth, or connected to a poor earth, are all fruitful sources of inefficient working of the circuit. In a condenser, also, there is often bad contact between the vanes which are supposed to be in perfect metallic connection with one another. At all these points the high-frequency currents meet with resistance, and loss of energy occurs; in other words, the power factor is high.

It is, in fact, well worth while for the experimenter to give serious attention to the question of "low loss," which is not a mere parrot cry, but a motto of considerable significance in wireless reception. It is impossible to attain a condition of "no loss," but there are very many places in the circuit where the losses can be considerably reduced by a little care judiciously applied.

Heating of Insulators.

The properties of the insulating material used for supporting the turns of high-power inductance coils was the subject of an interesting lecture by Mr. E. H. Shaughnessy before the I.E.E. recently. The important result of the experiments described was that American white wood was found to have remarkable properties not possessed by many other apparently more likely substances. It is found in practice that a material such as vitrified porcelain, for instance, when used as the support for the coils, becomes very hot, and eventually cracks, and it was stated that small portions of the material had even been observed to become liquefied under the conditions.

High Voltage Tests.

Tests were made upon a number of samples of different kinds of wood, small test pieces, uniform in size, being interposed between copper electrodes connected across the tuning inductance of an arc oscillating circuit tuned to 6,800 metres. The voltage was gradually raised and different samples

(Continued on page 1504)

TECHNICAL NOTES.

(Continued from page 1503.)

in turn began to burn. These were removed, and the voltage was still further increased until finally the only sample remaining was that of American white wood. This wood was eventually tested up to 55,000 volts, at which pressure a flash-over occurred, but the wood remained undamaged by the oscillatory currents. A coil on this wood at Northolt has carried 115 amperes at an aerial voltage of about 60,000.

Indoor Aerials.

There is often some confusion amongst newcomers to wireless between indoor aerials and frame (or "loop") aerials. It is true that both are indoor aerials, but when a frame or loop aerial is meant it is usual to describe it so specifically. When an "indoor" aerial is mentioned, this is taken to mean an extended aerial, or antenna, stretched across the room either in a single length or in several strands, or stretched round the walls of the room, or disposed in some other such way.

Speaking generally, the most sensitive aerial is the outdoor antenna, the next in order of sensitivity of reception is the extended indoor aerial, and the least sensitive is the frame aerial or loop.

Comparisons.

Indoor aerials have become very popular latterly, chiefly owing to the facility with which they can be erected, and to the fact that there is no trouble with insulators becoming wet in bad weather. A frame aerial is still more convenient, in that it is portable, but it should be borne in mind that only on a specially sensitive set may a frame aerial be used.

The frame aerial has one advantage not possessed, or practically not possessed, by the other types of aerial mentioned, and that is, that it is strongly directional, and may be rotated until it is in the best position for picking up desired signals. This directional feature makes the frame-aerial very useful inside a steel building, that is, a building in which a large amount of steel girder and lath is used in the construction. In such a building, the room in which the receiving set is located may be surrounded by an immense network of metal, concealed within the masonry, and thus is largely shielded from electro-magnetic waves. Further more, owing to the distortion of the waves making their way through the metal network, the direction in which they eventually arrive at the receiving set may be altogether different from the direction given by the bearing of the set on the broadcast station. But by rotating the loop aerial, the best position may be found. In the case of a steel building, however, it is very desirable, if really good reception is expected, to use an outdoor antenna, preferably above the roof.

New Telephone Receiver.

A wireless telephone receiver of a somewhat novel character has appeared on the market in Germany. It is very light in weight, and the receiver proper is surrounded by a thin cap of rubber, the opening in which is large enough to permit the whole contrivance being hung upon the ear.

Printed and published every Thursday by the Proprietors, The Amalgamated Press (1922) Ltd., The Fleetway House, Farringdon St., 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, 10/6 per annum, 5/3 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, February 21st, 1925.

R/R

POPULAR WIRELESS AND WIRELESS REVIEW, February 28th, 1925. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE WIRELESS BILL: Write To Your M.P. About It.

Popular Wireless

and Wireless Review

PRICE 3d. EVERY THURSDAY.

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

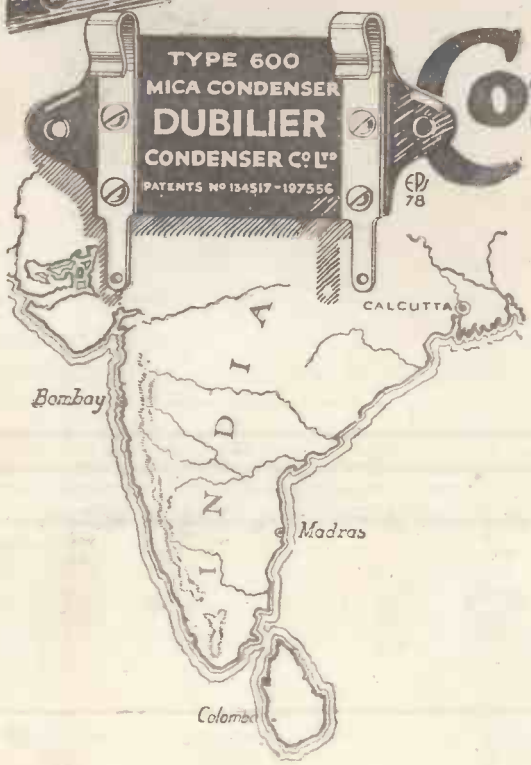
Some of the transmitting gear at the Nash Point, South Wales, wireless beacon station.

FEATURES IN THIS ISSUE.

HOW TO BUILD THE "SUPER-SELECTIVE" RECEIVER.

No. 144. Vol. VII. February 28th, 1925.

A consignment of Indian Ruby Mica for Dubilier Condensers arriving at the London Docks.



Concerning Mica

THE "Dielectric" in all Dubilier fixed condensers is of the best Ruby Mica, specially imported from the quarries of India.

It has long been recognised that there are numerous reasons, both mechanical and electrical, which account for the superiority of Mica over other dielectric materials employed in Fixed Condensers of small capacity.

Perhaps the best known of these are high insulation resistance and high dielectric strength which enable an exceedingly thin sheet of Mica to withstand very high voltages.

The Mica sheets in Dubilier Condensers measure only a few thousandths of an inch in thickness, yet each one of them before it can qualify for a place in a condenser has to withstand an alternating current pressure test of 5,000 volts.

A condenser made up of such sheets will resist, for example, the continued application of the full voltage from a high tension battery, whereas a condenser with an inferior dielectric may develop a short circuit, a fault which may possibly ruin a succession of high tension batteries before it is located.

Apart from insulation resistance, however, there are still very powerful arguments in favour of the Mica Condenser. The use of Mica enables Condenser losses (due to hysteresis, leakage, etc.), to be reduced to a minimum, especially as Mica has a high "specific inductive capacity," so that the volume of the dielectric in a condenser in which losses can occur is reduced to a minimum.

From the above it will be seen that for every receiving circuit the best condenser is a Mica Condenser; and you will be assured of obtaining the best Mica Condenser if you

Specify Dubilier.

DUBILIER
CONDENSER CO LTD

Advt. of the Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

Telephone: Chiswick 2241-2-3.

E.P.S. 78.

GREAT CRYSTAL DISCOVERY

BROADCAST RECEPTION PERFECTED

IMPORTANT ANNOUNCEMENT

Twelve months of untiring research and scientific investigation has found its reward in the production, on a commercial scale, of the most perfect and ideal crystal rectifier yet known.

This new product, to be known henceforward as

GOLD **TUNGSTALITE** LABEL

2/- **2/-**

Regd. Trade Mark 447149

is a synthetic crystal of entirely British manufacture. It is distinguished by a very fine crystalline structure, and its peculiar molecular architecture is such as to secure complete electrical uniformity, thus enabling the manufacturers to give the following remarkable **WRITTEN GUARANTEE with every specimen,** namely, that **ANY and EVERY POINT of CONTACT WILL GIVE PERFECT 100% RECEPTION.**

TUNGSTALITE (GOLD LABEL) is packed in specially constructed glass-covered boxes, each of which contains an identification number and written guarantee. These precautions are calculated to render fraudulent imitations almost impossible.

TUNGSTALITE (GOLD LABEL) possesses an exceptional range and a remarkable capacity for receiving MORSE and distant signals undetected by other crystals. **It is unaffected by heat, by handling, or by exposure to the atmosphere.**

Try a specimen of TUNGSTALITE (Gold Label). Make a thousand different contacts on a thousand different points—AND SECURE PERFECT 100% RECEPTION EVERY TIME.

OBTAINABLE FROM ALL DEALERS AND FROM

LONDON: 47 Farringdon Road, E.C.

TUNGSTALITE, Ltd.

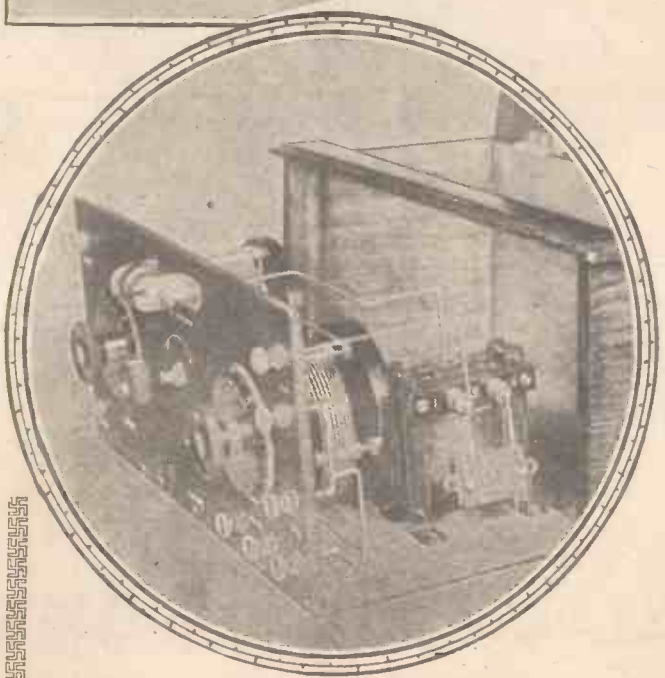
'PHONE: HOLBORN 2557.

YORKSHIRE: 41 Call Lane LEEDS

LONDON: Messrs. Brown Bros., Ltd., Gt. Eastern Street; Messrs. Houghtons, Ltd., 83, High Holborn. MANCHESTER: Messrs. Franks (Wholesale), Ltd., 3, South King Street. NEWCASTLE-ON-TYNE: Messrs. Payne & Hornsby, Ltd., 6, St. Andrew's Buildings, Gallowgate. SCOTLAND: Messrs. Robb Bros. (Glasgow), Ltd., 69a, West Nile Street. NORTHERN IRELAND: Messrs. D. H. Macleay, 7, Howard Street, Belfast.

SECURE YOUR GOLD LABEL TO-DAY

Wiring up the One-Valve Reflex Set fully described in "How to Make Wireless Sets," "Best Way Book" No. 162.



The One-Valve Reflex Receiver complete and ready for use.

An Aristocrat of LOUD SPEAKERS

Illustration shows Swan Neck Model, fitted with highly-finished mahogany horn.
A.R. 15 **£6 : 5 : 0**
Also the same instrument, but with oak horn **£6**
Other models from 25/-

AESTHETIC in appearance and ranking highest in technical efficiency as a Loud Speaker—the AMPLION may be especially recommended to discriminating purchasers.

The beautifully polished mahogany trumpet, the rich black crystalline finish of the Sound conduit and case, and the highly nickel-plated base, all contribute to make this model eminently suitable for the most tastefully furnished room.

Possession of an AMPLION adds to your enjoyment of Radio, without being an "eyesore" in your home. If your furniture is oak, there is also a trumpet to match it.

Ask your local dealer to show you a sample.

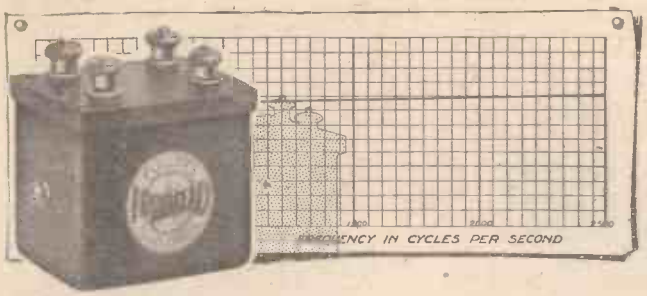
The World's Standard **AMPLION** Wireless Loud Speaker

Obtainable from AMPLION Stockists and Wireless Dealers everywhere.

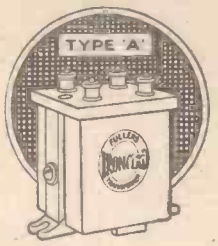
Illustrated folder post free from the Patentees and Manufacturers:

ALFRED GRAHAM & CO. (E. A. GRAHAM),
ST. ANDREW'S WORKS, CROFTON PARK, LONDON, S.E. 4.

Demonstrations gladly given during broadcasting hours at these showrooms:—
25-6, Savile Row, W.1--------and---------73-82, High Street, Clapham, S.W.4.



What an amplification characteristic curve shows



Type "A" Intervalve.
Ratio 1—5.
Size 2 × 2¾ × 2⅝ ins.
Price **20/-**

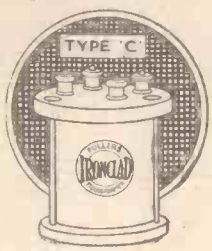
Type "TA" Telephone.
Ratio 1—10.
Price **18/-**

When an artiste sings a note or an instrument is played, the quality of the tone depends upon the proportion in which the "natural harmonics" of that tone are present. Middle C, for example, has a frequency of 512, and the natural harmonic one octave higher has a frequency of 1,024. Thus, the fidelity of reproduction of the singer's note depends on the evenness with which all the harmonics present in that particular tone are amplified in the receiving set.

Glance at the characteristic curve of the Type "B" Ironclad Transformer—note the flatness throughout practically the whole range of audible harmonics. This shows why its amplification is so extraordinarily *natural*.

Then there are all manner of constructional refinements. It is completely enclosed mechanically and screened magnetically, preventing inter-action. Layer-wound, moisture proof, spaced coils are employed, which, in conjunction with the special form of insulation, successfully prevents turns becoming loose.

For the music-lover, for the man who is only satisfied with reproduction in all the purity of its original rendering, there can only be one amplifying instrument — the "Sparta" Ironclad Transformer.



Type "C" Intervalve.
Ratio 1—4.
Size 2⅞ ins. diameter × 2¾ ins. deep.
Recommended for Power Amplifiers.
Price **24/-**

Type "TC" Telephone.
Price **24/-**

Type "B" Intervalve.
Ratio 1—4. Size 2 × 2⅜ × 2½ ins.
Recommended for Power Amplifiers.
24/-

Type "TB" Telephone for Loud Speakers.
23/-

SPARTA
IRONCLAD TRANSFORMERS

FULLER'S UNITED ELECTRIC WORKS LTD., WOODLAND WORKS, CHADWELL HEATH, ESSEX.

FALLON
SQUARE LAW CONDENSER

Features include: **One hole fixing, tag connections, heavy aluminium top and bottom plates.** Metal to metal adjustable bearings, stout, well-cut aluminium vanes. Complete as illustrated

The New Fallon Square Law Condenser is absolutely the last word in perfect condenser construction.
Extremely handsome appearance, all parts being heavily plated; ·068 spacing (the closest possible). In the new model the overall length of the ·001 condenser is only 4¼ in. as against 5½ in. in the old model, and by a new idea in spacing washers, rigidity of construction, never before achieved in any make of condenser, has been obtained.

SQUARE LAW TYPE
(As illustrated.)

Price.		Price.
·001 .. 9/6	·00025 ..	6/9
·0005 .. 8/6	·0002 ..	6/-
·0003 .. 7/-	Vernier, 3 or 5	4/6

STANDARD TYPE
With Ordinary Vanes.

Price.		Price.
·001 .. 8/9	·00025 ..	6/-
·0005 .. 7/-	·0002 ..	5/6
·0003 .. 6/6	Vernier, 3 or 5	4/-

FALLON FIXED CONDENSERS
—improve results in all Sets

Made of the highest quality mica and copper foil; each one tested and guaranteed. FALLON Fixed Condensers are right up to FALLON standard. Fitted with soldering tags and nuts for making clean connections. **British Reputation.**—Your Condensers are not FALLON'S unless the name FALLON appears on same.

Fixed Condenser and Grid Leak COMBINED.
(As Illustrated.)
2 or 3 megohms, **2/6** each.

FALLON Fixed Condensers
Capacities up to ·001, 1/3 each.
Capacities up to ·004, 2/- each.

FALLON'S —*The Premier* VARIOMETER

Inside winding, suitable for broadcast reception on any P.M.G. Aerial, extraordinary close coupling ensuring large tuning range. Inductance, the highest possible—9·5 to 1. Metal feet can be adjusted to four different positions. As used in the Single Valve receiver for all wave-lengths, described and illustrated in "Modern Wireless," July issue.

PRICE **10/-**
Postage 6d.

All Post Orders, Correspondence and Applications for Trade Terms to:

FALLON CONDENSER Co., Ltd.,
White Ribbon Works, Broad Lane, Tottenham, N.15.
BRANCHES: 3, King's Street West, Deansgate, Manchester: 120, Wellington Street, Glasgow.

POPULAR WIRELESS
The Radio Weekly with the Largest Circulation
Editor: NORMAN EDWARDS, M.Inst.R.E., F.R.S.A., F.R.G.S.
Scientific Adviser: Sir OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Grad.I.E.E

RADIO NOTES AND NEWS.

8 L S CALLING—NEW STATIONS TO AUSTRALIA HEAR—THE WAR ON "PIRATES"—IN A TRAIN!

The Savoy Band's Surprise.

I HEAR there is to be a somewhat sensational musical surprise about the third concert of the Savoy Bands which is to be given at Queen's Hall, W., on Tuesday, March 10th. This is a new syncopated symphony which is to be played for the first time, and it has been specially written for the Savoy bands by a famous musician whose name for the moment is being kept secret. I am assured, however, that it will be revealed immediately after the concert, and will come as a big surprise. The only hint I can give now as to his identity is that he is the son of a musician whose name was known all over the world. There is not much doubt that for the third time the Savoy bands will again fill Queen's Hall—some achievement, when you remember all the distinguished soloists who more often than not have to face rows and rows of empty seats. But then, of course, the Savoy bands would never be able to give enough concerts to satisfy all their friends of the ether.

* * *

Listen for 8 L S.

SHORT-WAVE broadcasting is now being tested in France, and a station at Montpelier (8 L S) is transmitting daily on low power. Programmes are sent from 8.30 to 9.0 p.m. on a wavelength of 186 metres, and have been picked up all over France. If any British listeners succeed in logging 8 L S, the Société Languedocienne, Montpelier, would be very glad of a report.

* * *

Better and Better.

NEVER since broadcasting started has the outlook for the future been so promising as it is to-day. I wonder how many people realise that there are about a dozen new stations in Europe alone which will be on the air in a few weeks, and the total number contemplated for the future must run into hundreds? Any night that you are searching round you may find a total stranger on your condenser dial, with a name you never heard before, such as Graz, or Strasnice, or Pic-du-Midi.

A Popular Octette.

LISTENERS mired the the J. H. Octette will be know that it institution, foreigners are J. H. Squire is figure in metro being connect- Adelphi, house, and Theatres, as rector.

*

Relaying from

THE Stutt- has re- experi- relaying, and ed in present- ence with from three of stations, and Newcastle,

One of 2 L O's new masts now erected on an Oxford Street store.

who have ad- broadcasting of Squire Celeste interested to is a British from which all excluded. Mr. a prominent politan music, ed with the Apollo, Play- St. James' musical di-

*

Stuttgart.

gart station cently been menting with has succeed- ing its audi- programmes the British from K D K A. Chelmsford,

and London were the British Stations chosen, all of whom were relayed upon 443 metres with great success.

* * *

New Station Testing.

AMONGST the new stations actually carrying out tests at the present time are Oslo (Norway), Sundsvall (Sweden), Glenwitz and Telefunken (Germany), and Graz and Innsbruck (Austria). In Portugal, Lisbon and Monsanto are in operation, whilst Hongg (Switzerland) and Strasnice (Czecho-Slovakia) are also waiting to be stalked by the wary "D X" fiend, who explores every strange carrier-wave he hears.

* * *

"Mayday."

HAVE you heard a "Mayday"? Aeroplanes or airships do not send out S.O.S. when in distress, but instead use the word "Mayday" to clear the ether of all interfering traffic. Officially adopted as the international signal of distress for airships and 'planes, the word "Mayday" is derived from the French expression "m'aider."

* * *

L.S.D.

LISTENERS' licence fees collected by the Post Office in 1923-4 amounted to no less than £250,055. Of this amount £189,183 was paid to the B.B.C. under the arrangement whereby the Postmaster-General deducts a certain proportion for expenses, etc. I believe that in several cases members of the public were thanked when paying in their money.

* * *

War on "Pirates"?

THE Government's Wireless Telegraph and Signalling Bill has now been issued, and a very formidable document it is. A summary conviction for unlicensed installations, formerly punishable by a £10 fine, may now be punished by three months' hard labour or a £50 fine, and other penalties have been stiffened up in like fashion. Most members of the

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from page 5.*)

House of Commons listen-in, so we may hear some diverting technical talk at Westminster before the Bill becomes law. I believe the Editor has something to say about this Bill in "Mainly About Broadcasting."

* * *

The Latest B.B.C. Recruit.

THE appointment of Mr. George Grossmith to be Advisory Director of Programmes to the B.B.C. is one that listeners will view with satisfaction. Not only will Mr. Grossmith undertake the arranging of special programmes periodically, but his position and prestige will tend to develop liaison with the entertainment industry in general.

Mr. Grossmith has unofficially been assisting the B.B.C. since January, and he tells me that none of his theatrical engagements will be affected by the new arrangement.

* * *

Australia in a Train.

PICKING up Australian and American stations whilst travelling at top speed in an express train is the latest feat of M. Menars, the well-known French experimenter. He was using a two-valve set, without aerial, but connected by a short lead to the electric-light bulb. For 35 miles, whilst the train swept through tunnels and over bridges, reception was perfectly clear.

* * *

The Super-Het.

THE super-heterodyne is steadily becoming more popular in this country. A Harrow reader tells me that his "super-het." is getting quite nicely now, and he has managed to tune in *eighteen* American broadcasting stations up to date. Can any other owner of a similar set beat this?

* * *

What the Inventor Says.

"REFRIGERATION by radio" is the essential claim made by a Scandinavian inventor, whose radio-ice can be tuned-in by means of a special receiver, which will keep food, etc., perfectly cool in the hottest weather. The receiver is installed in an ice-box and tuned-in to the central station, and will then freeze away for one year at a cost of about two shillings—at least, that is what the inventor says!

* * *

Plymouth Gets Busy.

FIRED by the phenomenal long-distance feats recently recorded, and burning to emulate same, the staff at Plymouth Relay Station recently dusted up their transmitter very carefully, cleaned all contacts, and "took the air" on full power, with the idea of shaking up the universal ether and making 5 X X feel jealous. They certainly succeeded in astonishing a Vienna listener who was searching round on Det. and 2 L F; but the most appreciative man in their audience was a New-Yorker, who had no idea that Plymouth had a radio station (until he heard it), and who had only known of the Devonshire port as a place famous for its export of Pilgrim Fathers.

2 L O's Aerial.

THE new aerial for 2 L O will take the form of two "sausages" spaced by a spreader 15 ft. long. Each "sausage" will have five wires spread out on 3 ft. 6 in. hoops, and the lead-in from the aerial to the transmitter will be 220 ft. long.

* * *

The Transmitting Hut.

BOTH of the masts on Selfridge's roof are earthed to the framework of the building, and they are both fitted with lightning conductors. Besides the main hut on the roof which contains the actual transmitter and the batteries required for filament lighting, there is a second hut. It stands near the base of one mast, and contains the running machinery—i.e., alternators for the transmitter and the dynamos for battery charging.

SHORT WAVES.

". . . When B.B.C. gives a concert at Covent Garden it gives a very fine concert indeed, and the silent listeners do not begrudge the storms of applause which come over. But if B.B.C. broadcasts loud applause from an unseen audience for some of the very thin fare which is sometimes provided from its own studio it will only annoy the public."—The "Star."

* * *

"People coming round from the anæsthetic after an operation say some odd things. A doctor friend tells me that a day or two ago one of his patients returned to consciousness by crying out in a loud voice, 'Is that London calling?'"—A Writer in the "Daily News."

* * *

When television comes shall we be asking "What can the B.B. See?"—The "Star."

* * *

". . . Up to the present I cannot discern any signs of a policy at all behind the programmes provided by that institution. (The B.B.C.) They seem so far to be trying to please everybody; and that, as we all know from our school-room days, will result in their pleasing nobody. . . ."—"Barabbas," writing in "Musical Opinion."

* * *

". . . Five years from now there should be ten million valve-set users in these islands. The best way to help with this growth is for the (wireless) industry to continue control of the British Broadcasting Company.—Mr. R. Ferguson (General Manager of the Radio Communication Co.).

* * *

The B.B.C. recently took part in a Rugby match at Lower Sydenham. I understand that as soon as one of their opponents was on the point of scoring a try several voices were heard announcing an interval of three minutes.—A writer in the "Sunday Pictorial."

* * *

THE WEEK'S QUERY.

"Why didn't you send me a series-parallel switch for the anode condenser?"

On 21 metres.

JOHN L. REINARTZ, the well-known American amateur, has succeeded in setting up a new short-wave trans-Continental record for American amateurs to beat. On a wave-length of 21 metres, Mr. Reinartz, from his home in Hartford, Conn., communicated with Newkirk Willis, in Santa Monica, California, the remarkable feature of the performance being that it was carried out in full daylight.

* * *

Beam Station Sites.

I HEAR that one of the new beam stations which will link up this country with the Dominions will probably be erected on a site near Bridgwater. Negotiations are now proceeding with landowners there, and if successful, two aerial systems, each half a mile long, will shortly be erected upon 300-ft. masts.

From America.

HAVE you heard the story of the young lady who completely lost her memory and who was taken by the police to the nearest broadcasting station? It is said that the announcer explained the situation to listeners, and then the young lady asked everybody through the microphone, "Who am I?" Three hundred miles away her aunt happened to be listening-in, recognised her niece's voice, and within a few hours the girl's identity was established. I hardly need add that the story comes from America.

* * *

Changes at Sheffield.

I HEAR that the Sheffield Relay Station will have a new studio shortly. The existing one is very small, and is separated from the transmitting room by only a few feet. Although no definite site has been announced at the time of writing, it is probable that the new studio will be housed on the top floor of the Old Imperial Hotel on Castle Street. The transmitting gear will remain at Corporation Street, the two buildings being connected by land line.

* * *

Broadcasting in Italy.

ITALY is planning a radio chain, with stations at Palermo, Naples, Florence, and Venice. In addition to the Rome station—which is often heard in this country—another station is already under construction at Milan. When the scheme materialises there should be plenty of chances to receive broadcasting from Italy, which hitherto has been among the backward European countries, as regards radio entertainment.

* * *

When the Heart is Young.

ARISING out of the Children's Corner, Nottingham has organised a Radio Circle, the membership of which has reached over 4,200. The oldest member is "Grannie" Greensmith, of 10, Fenton St., Sneinton, who is 92 years of age, and a very keen listener!

* * *

"Mespot Calling."

HAVING apparently tried all the official channels without success, and failing to get a reply from the Government wireless stations, a resourceful wireless operator in Mesopotamia broadcast the following message: "Will some British amateur help to get an urgent message through to the Air Ministry immediately?" Mr. G. Leslie Morrow, of Berkhampstead, Herts., who happened to be listening-in on the short waves, promptly gave "Go" on his transmitting set, and within a few minutes he had copied down the message and given "O.K.—Stand by 30 mins."

* * *

The Value of the Amateur.

MR. MORROW hurried to the police-station through the Hertfordshire mud, and a few minutes later was 'phoning the message through to the headquarters of the Air Ministry. Meanwhile the operator at Mosul, Mesopotamia (which is 3,000 miles away), was no doubt picturing to himself the progress of his message, and anxiously guarding his tuning controls?

ARIEL.

LOUD-SPEAKER RECEPTION AND REPRODUCTION.

By K. D. ROGERS.
(Assistant Technical Editor.)

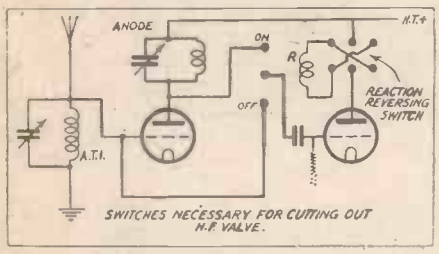
The amateur will find valuable advice in this article concerning the correct method of handling a set for good, clear, loud-speaker reception.

Mr. T. H. Studley, of Harrow School, who has received signals from 9 T C. of Chili.

RECENTLY I was invited to spend the evening at a friend's house, and was "treated" to 2 L O on the loud speaker. Asking if I was interested in wireless, my friend took me to have a look at his set, of which he was very proud.

It was certainly a magnificent instrument, in a beautiful cabinet, and covered with awe-inspiring yet fascinating knobs. So enthusiastic was the owner that he allowed me to see the inside, and finding that I was interested explained how the set worked, what valves he used, and what he could get on it.

A glance at the inside, the types of valves he was using and the H.T. battery, together



SWITCHES NECESSARY FOR CUTTING OUT H.F. VALVE.

with a further look at the loud speaker fully explained the reasons for the peculiar mixture of asthmatical wheezing and hoarse, guttural sounds that I had been told was the "London station," and with which I had been greeted as soon as I entered the house. The set, by the way, was situated at about 12 miles from 2 L O, and all the valves were doing their utmost.

Causes of Distortion.

Let us consider the possible causes of the frightful distortion that was being pushed out under the guise of wireless "reception."

In the first place the loud speaker, though of a very well-known make, was far too small for the task that had been set for it. It was doing its best, but you cannot, or rather should not, expect a small loud speaker to handle energy enough to fill a hall. Properly treated, the loud speaker would no doubt give excellent reproduction, but when overloaded, let alone being supplied with the output of a badly constructed and worse handled four-valve set, you can hardly expect anything but "bad gramophone" results.

Now let us consider the set which, while giving loud results, was perhaps the worst thing that could have been used for the purpose.

As the idea of this article is not so much a discussion upon the ideal loud speaker set as a guide by which amateurs may be able to improve their existing results without having to scrap their apparatus, we shall consider the more usual types of faults, and those that are confined to the most popular form of L.F. amplification, namely transformer coupled.

Admittedly, resistance coupling is the best if ultra purity is desired, but with both transformer or even choke amplification excellent results can be obtained and really enjoyable reproduction secured, though the former is preferable as a rule.

The set under consideration was of the usual type, namely tuned anode H.F., detector, and two stages of L.F. amplification. Though a switch was included for cutting out the first valve, this was not being properly used, and all four valves were going "all out."

Faulty Grid Leak.

The first valve at 12 miles from 2 L O was, of course, unnecessary, and should have been cut out. Reaction was being used, and this accounted for a certain amount of the distortion, as did a poor grid leak. However good the rest of the set may be, if the detector valve is giving out distorted currents the total output will be still further distorted, as all the distortion given by the detector will be amplified by the succeeding valves.

It is best if possible to avoid the use of reaction altogether when loud-speaker results on the local station are desired. I mention the local station because it is impossible as a rule to obtain clear reception from any other station, the music or speech always being interrupted by some other station, or those peculiar noises so familiar to amateurs that go in for DX work.

The next and most fruitful source of distortion is the L.F. side of a set, so that the first stage of L.F. amplification must be examined.

If this consists of a transformer-coupled valve, as my friend's set did, the effect of changing over the primary leads to the transformer should be tried. Most transformers work best when OP goes to the plate or reaction coil of the preceding valve, IP going to H.T. positive, while IS goes to the grid of the next valve.

There are exceptions, however, so that although the foregoing may be taken as a general rule, and the set connected up in that way, it is always advisable to try reversing both the primary and secondary leads, first alternately and then together.

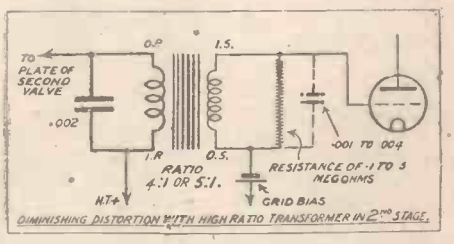
Need for Grid Bias.

A ·001 fixed condenser should be placed across the primary terminals for the time being, and attention can then be paid to the valve wiring, which should be so arranged as to have the filament rheostat in the negative lead of the L.T. battery. This ensures the grid of the valve being kept at a negative potential, and as this is the first stage of L.F. amplification it is probable that no other negative bias will be necessary. At any rate, we can leave this stage and have a look at the next.

If transformer or choke coupling is used it is generally advisable to make this, the second, stage the last, unless special power amplification is desired, for open-air demonstrations or large halls. In the average set this should be the final stage and when properly used and constructed will give ample volume, even for a small hall.

As I expected, the set I was examining used a transformer-coupled last stage, and also had an ordinary 5-1 ratio transformer of doubtful design included in it.

This, coupled with unsuitable valves and



DIMINISHING DISTORTION WITH HIGH RATIO TRANSFORMER IN 2ND STAGE.

no grid bias, was the cause of the majority of the distortion I had been enduring.

Readers who desire good loud speaker reception from a set with two transformer-coupled L.F. valves will have to go very carefully over the circuit of the last valve in order to cut out any distortion that may be present in the output of the set.

If, as is often the case, an ordinary L.F. transformer is used, the effect of changing over the leads as before should be tried

(Continued on page 8.)

LOUD-SPEAKER RECEPTION.

(Continued from page 7.)

and then grid bias should be given due consideration. This will vary with the valve used, which, by the way, should be a power valve, either of the dull or bright emitter type. It is useless to expect an ordinary valve to carry the energy supplied to it with any degree of success, and although the extra volume obtained by the use of a power valve may not be desired, the use of this kind of valve is very strongly recommended, the set being *detuned* to cut down the volume to the desired intensity.

Choice of Transformers.

The grid bias should consist of a small dry battery of either 1½, 3, 4½ or 6 volts—this will have to be found by experiment—connected in series between the negative L.T. terminal and the transformer secondary connection remote from the grid of the valve. This will probably be the OS terminal. The negative of the battery goes to OS, while the positive goes to the L.T. negative.

The best thing to do now is to replace the transformer by a proper "second stage" transformer such as the Eureka No. 2, or the Marconi Ideal 2·7–1, but if this alteration is not desired, though for really good results it is advisable, the use of a few little "wangles" may be beneficial.

First of all, vary the fixed condenser across the primary of the first transformer till least distortion (with both valves going) is found, adjusting the H.T. and filament at the same time, of course. Separate H.T. for the last valve will be useful here, though it is not absolutely essential. Next try a ·002 or ·003 fixed condenser across the primary of the second transformer, and then turn your attention to loading the secondary.

This is an expedient that often has the desired effect, though it is apt to cut down the volume somewhat. It is based on the fact that the majority of L.F. transformers, when not designed properly for the task they have to undertake, have a certain resonance about them, much as a bad loud speaker has.

Preventing L.F. Resonance.

This resonance is electrical, however, and in the same way that the loud speaker magnifies certain notes or frequencies of sound more than others, so the transformer steps up the voltage of certain frequencies of current more than others. Obviously the result of this is to produce uneven amplification, some frequencies being over amplified and others not receiving enough magnification. The result makes itself known by distorted results, the high notes being harsh, while orchestral pieces in particular are blurred, and the various instruments jumbled up in an indistinguishable medley of unmusical sounds.

There are two easy methods of loading the transformer, and both should be tried until best results are obtained. The first consists of placing a resistance across the secondary terminals, and the second in connecting a condenser across the same points.

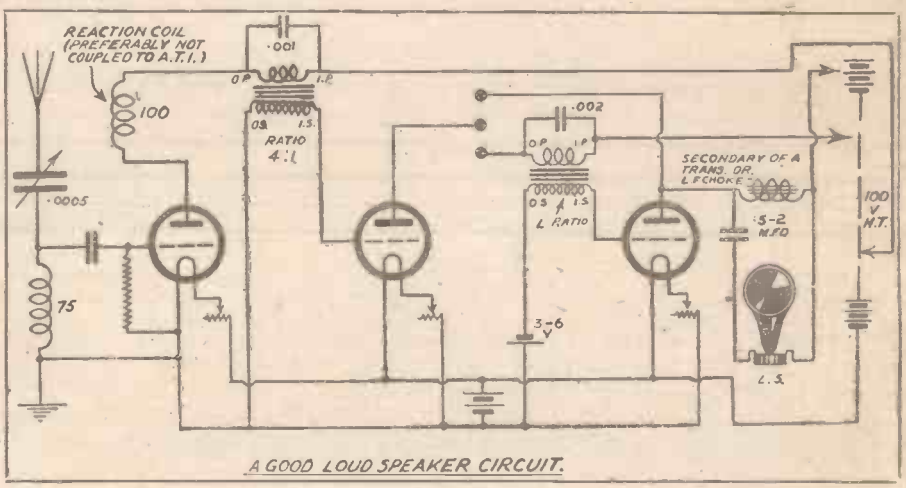
A resistance of about 500,000 ohms across the IS and OS terminals of the transformer should have the desired effect, though various resistances should be tried until the best value is found. In the same way different fixed condensers should be tried until the most satisfactory results are obtained. As a guide, a ·001 mfd. and one of ·002 mfd. may be tried first.

It will be found that the pitch of the received signals is lowered by the addition of capacity or the decrease of resistance across the transformer, but at the same time the harshness is reduced and a more mellow tone results.

Suitable Valves Essential.

If the amateur has nearly succeeded in eliminating the distortion by the various means suggested in the foregoing, he will do well to look at his valves, H.T. control, and tuning.

In the former case all valves, in whatever set they are to be used, should be chosen for the purpose they are to fulfil. For instance, it is sheer waste of money to buy a valve designed for H.F. or detector work and to expect it to give good service in the second stage of an L.F. amplifier.



A GOOD LOUD SPEAKER CIRCUIT.

With regard to the four-valve set of which we were speaking, i.e. a typical four-valver; the first valve should be one suited for H.F. amplification, not that it should be used at all for short range work, and this valve should not be expected to operate as an L.F. valve unless the makers claim that it is suitable for that purpose. A good detector valve should be chosen and *kept* as a detector. It very often ruins the sensitivity of a good rectifier to use it elsewhere in a set, and this valve especially should be detailed for one job, and that one job only.

Use a Power Valve.

Any good L.F. valve will do for the first L.F. stage, but in the last stage the valve should be carefully chosen. A power valve, either of the dull emitter or ordinary type should be used, and as it is easy to get a valve to suit the filament voltage of the battery used for the others, there should be no difficulty in picking out a satisfactory one. The power valve will be more expensive than the ordinary type, but the capability to handle strong signals makes it desirable and well worth the extra outlay. The extra cost of upkeep is negligible now that D.E. power valves are available. A separate H.T. tapping is advised, and this and careful adjustment of grid bias should give really good results.

Handling the Set.

Careful control of the H.T. should be used in all stages if clear music and speech are to be obtained, and all the valves should be worked at their best values of H.T. and L.T. It is a mistake to turn down the filament, or cut down the H.T. of a valve in order to make the reproduction "softer." This should always be done either by cutting out a stage of amplification altogether, or by detuning the set. This latter always results in an improvement of tone where loud-speaker reproduction is required, and it assists in preventing "blasting." Reaction should be avoided wherever possible, especially when loud results are required. On the local station, within a distance of 20 miles, it should not be necessary at all, and if the set will not work a loud speaker without it the best thing to do is to add another valve.

Finally, always remember that a loud speaker should never be overloaded. The larger the loud speaker the less it has to be loaded to fill the room for which it is intended, so that it is much better to have a moderate-sized speaker and just let the sounds "fall out" as it were, than to have a small one and have to force it in order to get a sufficient volume of sound.

The diagrams given should be quite self-explanatory, though a few words about the one on this page may not be amiss.

The circuit shown is one very commonly in use, and is a good loud-speaker circuit for general purpose use. By this I mean that it need not be confined to loud-speaker reproduction of the local station, but can be used very satisfactorily for telephone reception of distant stations.

The choke is provided to keep the steady plate currents away from the 'phones or loud speaker, the L.F. impulses only going through them. The valves are chosen for the positions they will occupy, the last valve being a power valve.

A final refinement not shown would be a series of 1 mfd. condensers across each H.T. tap to H.T. negative, and these would assist in cutting out any H.T. noises due to a heavy discharge of that battery or a faulty cell.

MORE ABOUT OSCILLATING CRYSTALS.

By LESLIE MILLER.

The author of this article has made experiments with oscillating crystals a special study, and some new and interesting facts about them are revealed in this article.

A CRYSTAL, suitable for generating oscillations, may, at the present time, be taken to be a specially selected one, of zincite, with the point of a thin steel wire pressing on it, as cat's-whisker. In the case of pieces of zincite suitable for oscillation purposes, if no battery current is used, this combination makes a very poor rectifier, though some

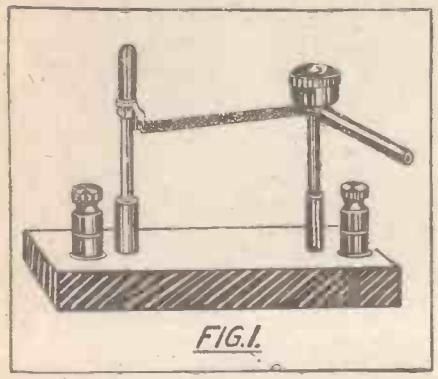


FIG. 1.

samples of zincite rectify very fairly with steel. There seems to be no connection between the properties necessary for rectification and those for oscillation, though, as will be mentioned later, the latter must be very similar to the requirements for microphonic action.

The great distinction between a crystal used for rectification, and one for oscillation, is that the former, offering a high resistance, always absorbs energy, and weakens the received signal; whereas the latter, when used properly, gives out energy derived from a local battery. Consequently, it can be employed to strengthen reception, or for transmitting purposes. This will, of course, be evident to valve users, but not to those crystal experimenters who know nothing of valve work.

It is the act of forcing current through the contact on the crystal, from a local battery, that completely alters the state of affairs, and turns some small percentage of zincite into a sort of cold valve, although the difference in the degree of coldness between the two electrodes exerts a marked influence on the result.

Similar to an Arc.

When a rising voltage is applied to the contact, the resistance of it, till then reaching hundreds of ohms or even more, vanishes when a certain strength of current is reached (the top of its voltage-current curve); and, if the voltage is still further increased, becomes what is termed negative. This merely means it is neither positive nor zero. A lower voltage than was used to make it become so will then drive a large current through it. The contact can now usually be set in oscillation, like the make-and-break of a buzzer, when the current through the electro-magnet becomes strong enough, by very gently flicking the flexible steel cat's-whisker. The resistance again goes up and the crystal will at once cease to absorb any more energy from the battery uselessly; on the contrary, it will give some out. This may take the form of low, or high frequency oscillations, or both, in suitable circuits, shunted across the contact. A small spark can often be seen there, and this behaves almost exactly like a very short arc. The zincite, where the steel touches it, becomes luminous, and weak whistles and gurgles can be heard. The oscillations are, however, not influenced by a magnetic field, and they can readily be stopped and restarted by breaking-and-making the battery circuit, as well as the oscillating one.

Research has now reached a point where there is no longer any difficulty in making a crystal oscillate, and keep on doing so for hours, or even days. A convenient circuit for this purpose is shown in Fig. 1. It will be seen that it is similar to that for a buzzer wave-meter, and practically the same as for a short arc generator, or for obtaining alternating current from a Neon lamp.

Ten per cent of the zincite on the market, at most, will generate oscillations freely, and only ten per cent of this will be good enough for heterodyning with success. Of this, nearly the whole would be rejected

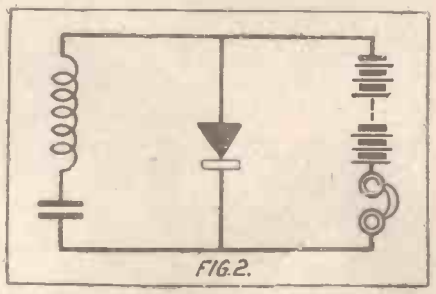


FIG. 2.

by anyone of experience, choosing it simply for rectification. Pieces suitable for oscillation can be bought, but if amateurs having zincite in their possession would like to see if it is of the oscillating variety, they should break up the blackest looking, non-transparent pieces into rather small fragments, and set each in fusible metal so deeply that only a few sharp points or a sharp ridge stands out.

Special Detector necessary.

On the sharp edge, or point of the crystal, some kind of steel wire point, about No. 32, should be arranged to touch, with a pressure slightly heavier than would be right for rectification of rather strong signals. Steel is best for the actual contact, but the spring that presses it on is another matter. For this, the writer naturally prefers his own type of cat's-whisker (prov. patent), consisting of a strip of silver, copper, or other metal gauze, used sideways on. This is shown in Fig. 1. For oscillating purposes, half an inch of steel wire should be fixed across the gauze at the acting end.

A straight piece of steel wire, about ¾ in. long, with the end just bent round at right angles will also answer very fairly, but is rather liable to vibrate in two planes. The Russian physicists employ the ordinary spiral cat's-whisker, but this will be found very difficult to set in oscillation. Steel is not the only metal that will work with zincite. The writer finds silver and nickel

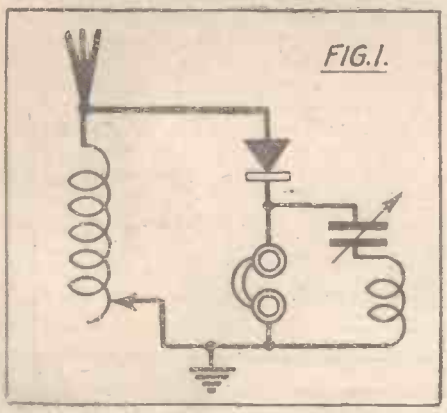
(*Continued on page* 10.)

An operator at the Nash Point Station adjusting the wave-length of the C.W. sets by means of a wave-meter.

A "DX" CRYSTAL CIRCUIT.

By PHILIP MASON.

QUITE a number of wireless enthusiasts at the present time claim to be able to pick up distant broadcasting on a crystal set, but these are still only a small minority in comparison with those who can only receive their local station. Generally, the causes of long-distance crystal reception are a more than usually sensitive crystal, a high and efficient aerial, a good earth, or a combination of these. What is



wanted is a circuit with which distant stations can be received, using an ordinary crystal in conjunction with an aerial and earth of average efficiency. The writer claims that the circuit described here supplies this want.

Connecting an Ordinary Set.

The "Long Range" circuit is shown in Fig. 1. It will be noticed that the circuit differs from the conventional type in that an inductance and condenser are connected across the telephones. This inductance, hereafter referred to as the 'phone inductance, should have a wave-length of about a hundred metres or so more than the aerial tuning inductance. Any of the usual types of inductance may be used. The variable condenser should have a capacity of ·0005 mfd.

Theoretically, you may use a variometer, coil and condenser, slider or tapped inductance, or loose coupler, with equal effect for the aerial tuning. In practice, however, the method which gives the finest tuning will be the best.

A crystal set using the ordinary type of circuit may be quite readily converted to the "Long Range" circuit by the method shown in Fig. 2.

The mode of operation of the circuit is not at all complicated. The station to be received is first tuned in with the aerial inductance in the usual manner. After this the condenser, which tunes the 'phone coil, is adjusted until loudest signals are obtained.

Some Results Obtained.

Using the "Long Range" circuit, the writer has succeeded in receiving Bournemouth, Newcastle, Cardiff, and Glasgow, at Birmingham, using an indoor aerial and a water-pipe earth. The reception of Bournemouth and Glasgow was fairly regular, but the other two stations could only be received when conditions were especially favourable. In order to test whether this reception was due to the circuit used, the writer had a switch connected so that the 'phone coil could be short-circuited. Transmissions which were received quite clearly when the 'phone coil was in circuit, disappeared entirely when it was cut out.

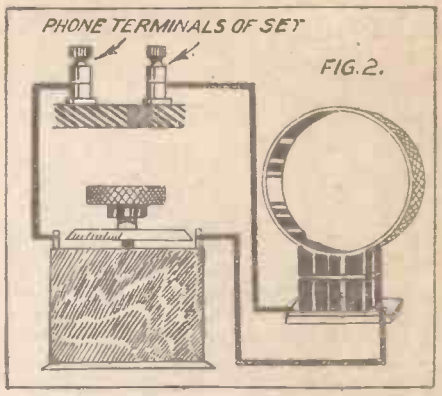
Well Worth Trying.

Providing that the aerial and earth are of the average efficiency, and a good crystal is used, any listener should be able to receive distant broadcasting stations, using this circuit.

Long-distance reception is not the only interesting property of the circuit, for it will also make the signals from the local station louder. The farther away from the station the set is situated, the greater the increase in signal strength will be. At one or two miles distant the improvement may be so small that it is scarcely noticeable, while at ten miles or so the signals will be markedly improved in strength.

In conclusion, the writer would like to invite those readers who are inclined to be sceptical to try the circuit for themselves.

A 4-valve set (1 H.F., det., 2 L.F.) made by Mr. L. Hook, of the Streatham Radio Society. WGY and all B.B.C. and many Continental stations have been heard.



MORE ABOUT OSCILLATING CRYSTALS.

(Continued from page 9.)

quite good, and no doubt other metals also, but copper is bad.

The subject has not been half investigated in this country, though Dr. Eccles was the first to discover that crystals oscillated. As usual, we have left other countries to try to make practical use of our discoveries. The Russian research workers especially should be thanked for throwing open their results to the world.

Referring to Fig. 2, which is a diagram of the simplest circuit for generating low-frequency oscillations, a dry-cell battery of the usual H.T. type will be needed, to give up to about 15 volts (or 30 volts, if required), with a contact to each cell after about 8 volts. A potentiometer connected across four or more cells is, of course, better, when it is necessary to adjust the volts on the crystal very accurately. In series with the battery is a resistance of 2,000 to 4,000 ohms. One regulating by means of a screw thread is very convenient, as it affords an additional means of adjusting the voltage across the crystal contact. This will normally be about 6 volts.

Using a Chelmsford Coil.

Instead of a resistance, an ordinary pair of headphones may be used, but these are of course inductive. Inductance is wanted to block oscillations and prevent them being wasted in this circuit, but very little of it, or it will react on the real oscillation circuit shown on the left, and cause beats, which may be as slow as two or three a minute. As a telephone put in this circuit acts not only as resistance, but as a detector of oscillations, it is often convenient to use it in this position.

Otherwise it may be connected across a secondary coil coupled to the inductance in the oscillating circuit, for which purpose an ordinary subdivided tuning solenoid with a sliding secondary for the telephones is useful. The inductance, in millihenrys, should have a ratio to the capacity, in microfarads, of about 1 : 3 to start oscillating most easily, and a coil for Chelmsford or Paris, in series with a 2 mfd. paper and tin-foil condenser, or one of the Mansbridge type, will approximate to this. The ratio is not at all critical. For a refinement, two condensers of one microfarad each may be used in series or parallel as required.

(Continued on page 51.)

STARTING AN EXPERIMENTAL RECEIVING STATION.

By OSWALD J. RANKIN.

PART IV.

AS the above title implies, the main purpose of these articles is to indicate a simple and practical method of *starting* an experimental receiving station.

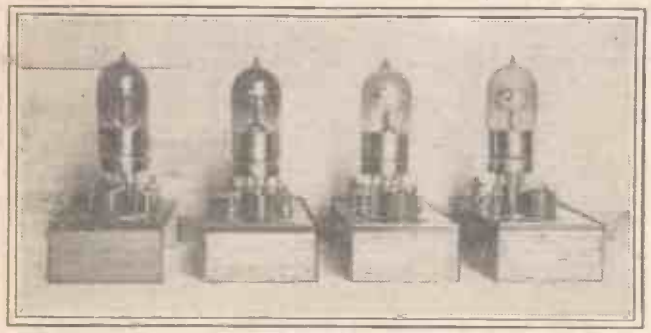


Fig. 1.

The present instalment deals with simple valve apparatus, and some single valve amplifying circuits, but this by no means signifies that previous experiments with crystal circuits have been exhausted. It should be remembered that all circuit diagrams are intended only as simple examples; the reader should experiment with all the possible modifications of each example before passing on to the next.

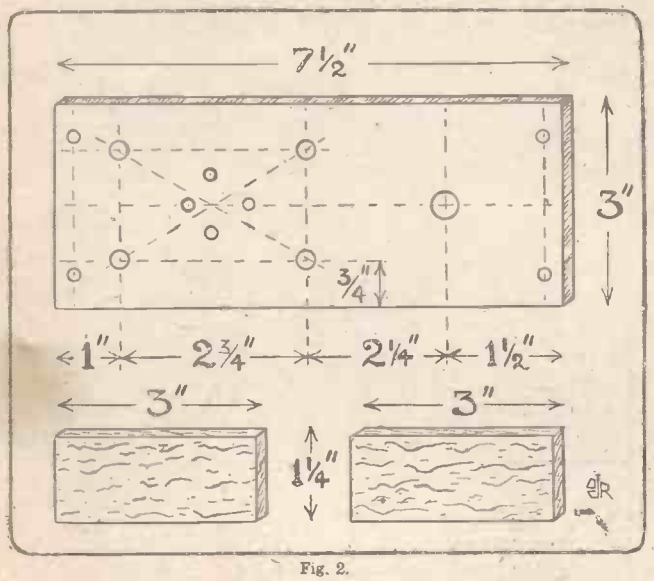


Fig. 2.

In order to gain *knowledge*, which is best acquired by practical experience, the reader is left to think out many problems for himself—to experiment, in fact. For instance, in the preceding article we were mainly concerned with inductively coupled crystal circuits employing honeycomb or basket coils. There the reader was left to think out and try other methods of coil coupling; the loose-coupler or vario-coupler, for example.

Even with a very simple form of crystal circuit it is possible to effect many changes; is there a limit, therefore, to the scope presented in the multi-valve stage? This is a question to be answered by the reader himself. He will think there is a limit if his *knowledge* is limited, but if he becomes thoroughly acquainted with the many modifications of a comparatively simple circuit, then he will feel confident that his scope for experimenting is increased at every step towards the multi-valve stage.

Construction of Valve Panels.

Fig. 1 shows a set of experimental valve panels which should now be made up. The ebonite panels are ¼ in. in thickness and 7½ in. long by 3 in. wide, these being marked off and drilled as shown in Fig. 2 and fitted with four terminals, a set of valve sockets, and filament rheostat.

Two strips of wood, each 3 in. long by 1¼ in. wide, form the supports, or a complete cabinet may be fitted to each panel if desired. The panels are wired up in the manner indicated in Fig. 3, which shows the back and front views of one of the completed panels. Viewing the panel from the front, or top (right-hand photograph, Fig. 3), the two top terminals are (left to right) grid and plate, and the two lower terminals (left to right) L.T. negative and positive.

Fig. 3.

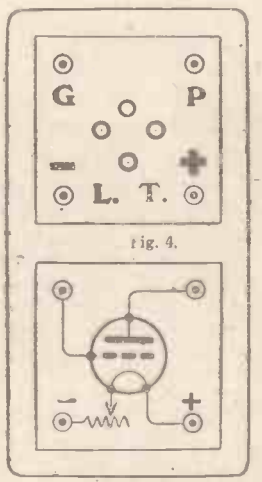


Fig. 4.

The filament rheostat is placed in the negative lead; that is, between the terminal marked L.T negative and one of the filament valve sockets.

All panels are identically wired, the first made being used as a pattern for the others. The fact should not be overlooked that when the panel is reversed (left-hand photo

(*Continued on page* 12.)

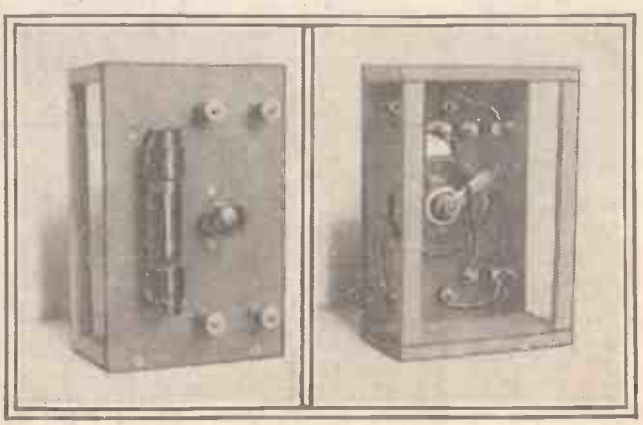


Fig. 5.

STARTING AN EXPERIMENTAL STATION.

(*Continued from page 11.*)

in Fig. 3) the plate and L.T. positive terminals will then be on the left-hand side. The terminals may be marked by means of transfers, or either of the small charts may be used as shown in Fig. 4. The chart shown in the lower diagram is probably the most instructive, and this should be marked out on paper and fastened to the operator's table. Both charts represent front or top views of the valve panel, one with the wiring diagram wiring connections. After a very short time, however, such a guide will not be required, for the operator will soon memorise the connections.

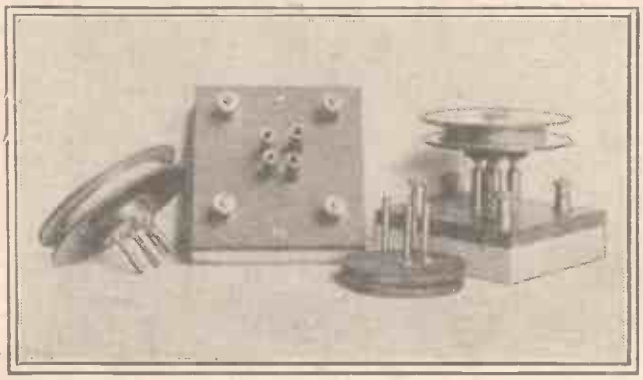


Fig. 6.

Different Types of Valve.

Fig. 5 shows the front and back of panel views of an experimental valve panel for the Myers type of valve. The ebonite panel is 5 in. long by 3½ in. wide, this being supported in an upright position by the simple wooden structure as shown. A complete cabinet would, of course, improve the appearance of the instrument, but the author prefers to arrange experimental apparatus on the easily "get-at-able" system portrayed in this and other components described in these articles. Viewing the panel from the front the terminals are arranged to correspond with the position of the valve clips as given in the template provided with this type of valve—i.e. top (red end of valve), plate and L.T positive; and bottom, grid and L.T. negative.

Fig. 6 shows a simple holder for plug-in H.F. transformers, and the reader is advised to make up at least two of these. The ebonite panels are 3 in. square by ¼ in. in thickness, these being fitted with four valve sockets or a valve holder, and four terminals which are wired up to same. The sockets should be fitted in a direct line with the terminals, from corner to corner of panel, as shown. The terminals are marked I.P., O.P., I.S., and O.S. to correspond with the markings on the transformers, the panel then being screwed down to a small wooden base which is well recessed to accommodate the terminal and socket nuts and the connecting wires.

Now in most circuit diagrams the symbols are arranged progressively from the aerial and earth on the left, to the telephones and H.T. battery on the right, and therefore, if we adopt the same system in actual practice and arrange our experimental components to correspond as near as possible with the positions of the components in the diagram, the wiring up of any circuit will be a very simple matter. On the other hand, should we commence to wire up the circuit from the right, while reading the diagram from the left, then naturally we create an unnecessary difficulty which will result in confusion and consequent loss of time. A glance at the circuit shown in Fig. 7 should make this quite clear. The correct position for the aerial tuning coils and condensers is on the left-hand side of the operator's table; the H.T. battery and telephone terminal block should be on the extreme right, and the accumulator should be placed on the floor, under the table.

Having now arrived at the early valve stage, the beginner will want to know something about the best types of valves, the capacity of the accumulator, etc. I would advise him to purchase any ordinary bright-emitter valve, a 4-volt 60-ampere hour accumulator, and a 60-volt variable H.T. battery. If the accumulator is of a larger capacity then so much the better, and it will not matter very much if it is a 6-volt accumulator providing the filament rheostats are capable of cutting down the voltage to about 4 volts.

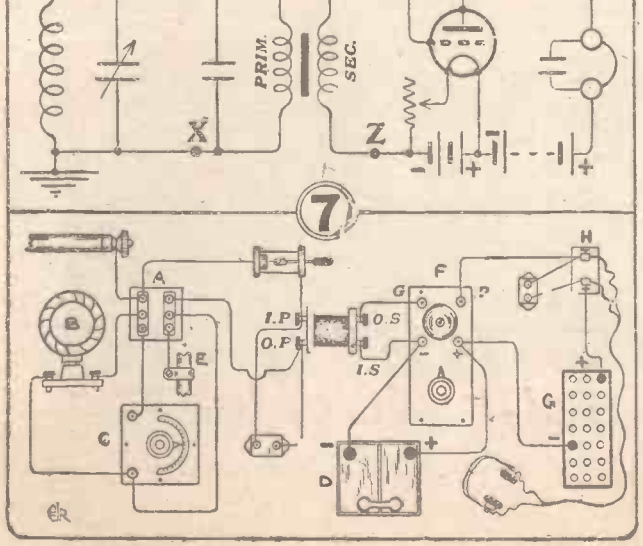
So far we have dealt exclusively with direct and inductively coupled crystal circuits where the headphones were connected to the points marked W X in Fig. 7. We will now connect these points to the primary winding of an L.F. intervalve transformer, place a ·001 mfd. fixed condenser in shunt with same, connect the secondary winding to the grid of the valve and the L.T. negative, and place the telephones in series with the plate of the valve and the positive wander plug of the H.T. battery. The negative side of the H.T. battery is connected to the L.T. positive, and a ·002 mfd. fixed condenser is connected in shunt with the telephones. We have now added a single stage of audio or L.F. amplification, or *note magnification*, to a crystal detector circuit, and providing the L.T. and H.T. current is properly applied the volume of sound in the headphones should now be considerably increased. The circuit may be tried minus transformer by connecting W to Y and X to Z. Any of the crystal circuits previously described may be used in conjunction with this single valve L.F. amplifying circuit. The actual lay-out of the components is shown in the lower diagram, where it will be seen that the large terminal block, A (described in Part 1), is now a very important piece of apparatus. B is the plug-in unit coil which is tuned by the ·0005 mfd. variable condenser, C; D is the accumulator; E represents the earth; F is the valve panel; G the H.T. battery, and H the 'phone terminal block. The components not marked should be obvious.

Now, for increased range or *distance* the valve should be made to function as a radio or high-frequency amplifier by arranging the circuit as shown in Fig. 8a. Here the valve precedes the crystal detector circuit and magnifies or *strengthens* the oscillations in the aerial circuit prior to rectification. The "tuned anode" coil C, which is shunted with a ·0003 or ·0005 mfd. variable condenser, should be one size larger than the coil used in the aerial circuit, and in order to balance out the capacity o the aerial it is often necessary to load the variable condenser (or, in effect, the coil) with a fixed condenser of ·0003 mfd. capacity, as shown. A ·002 mfd. fixed condenser is connected across the telephones.

Useful Reflex Circuit.

In the lower diagram (Fig. 8b) the valve is made to function as a high and low frequency amplifier simultaneously. This is a simple single valve "reflex" circuit which might also be tried. The coils C and D are mounted in the two-coil holder, their best values being found by trial. Alternatively an H.F. plug-in transformer may be used, the ·0003 mfd. variable condenser being connected across the primary winding which then replaces the coil C. The primary and secondary windings of the L.F. intervalve transformer are shunted with ·001 mfd. fixed condensers, and a ·01 mfd. fixed condenser shunts the telephones and H.T. battery. Alternatively the ·01 (or larger) condenser may be connected across the H.T. battery and a separate ·002 mfd. condenser provided for the telephones. Both arrangements should be tried and experiments should be carried out with condensers of various capacities until maximum results are obtained. The positive pole of the telephones should *always* be connected to the positive H.T., otherwise the 'phone magnets will soon become depolarised. The positive tag is easily distinguished by small portions of red cotton interwoven in the covering.

The reader is now advised to obtain a reliable selection of circuit diagrams. I would recommend the supplement of pictorial diagrams recently given away in "P.W." (Jan. 24th).



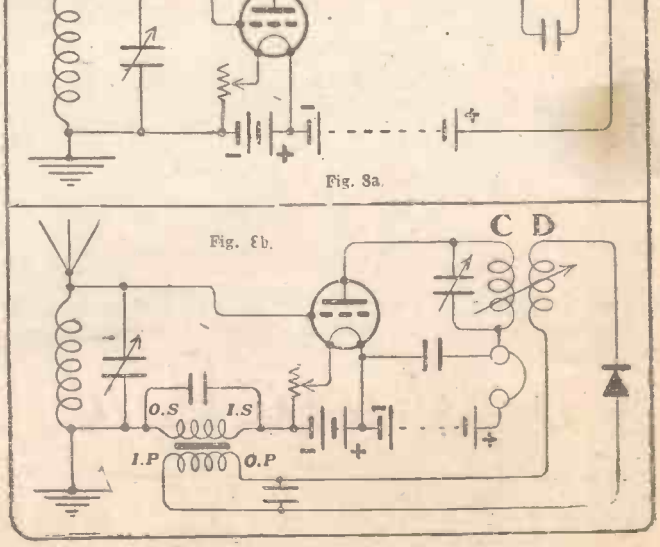
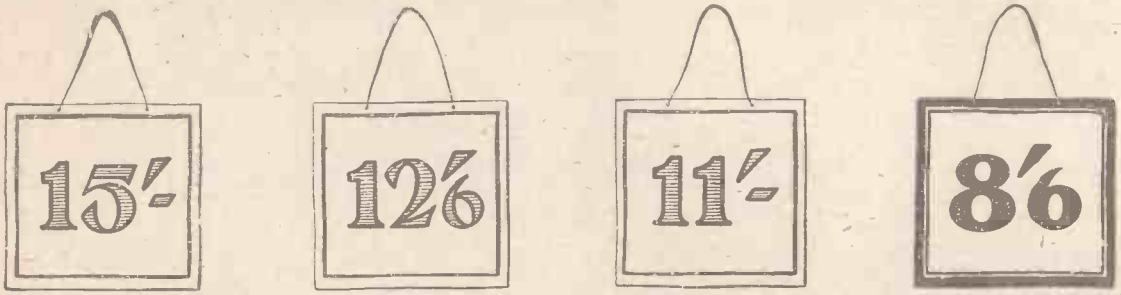


Fig. 8a.

Fig. 8b.



When bright filament valves cost 13/6, the Silver Clear Louden was put on the market at 10/-.

In the last 4 months it has more than trebled its sales.

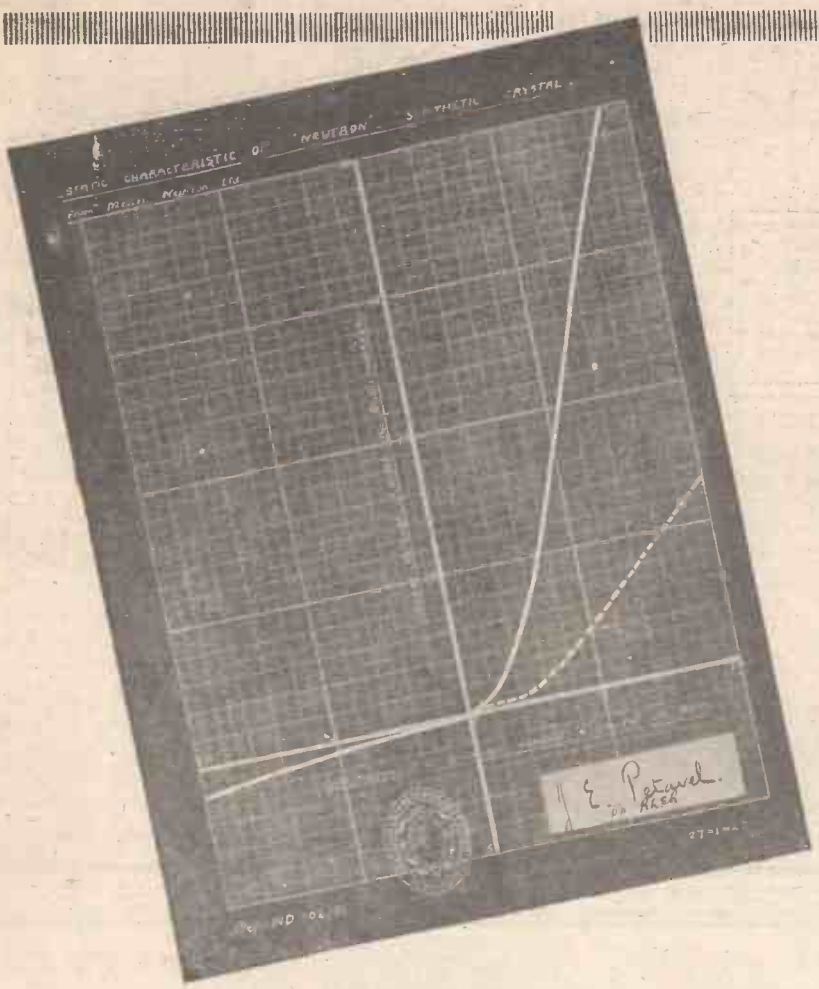
New prices are now in force for valves, and once more the Silver Clear Louden maintains its lead. From February 23 the price of the Louden Valve is reduced to 8/6.

LOUDEN 8/6 VALVES

Louden Valves - Silver Clear

E.P.S. 45.

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



THIS is a photographic reproduction of a curve supplied by the National Physical Laboratory, Teddington—part of a complete report, the other sections of which will be published from time to time. The only addition made to this photograph is the DOTTED curve, which is explained below.

What this Curve means to every Crystal User

THE Neutron Curve is the solid white line. Vertically, the reading is representative of the strength of current operating your head-phones; horizontally, the reading represents the strength of the incoming signal.

The *dotted* Curve represents an average taken from six Curves of other Crystals which have been published in the Press; and since these other curves have been obtained by similar methods of testing, it will be seen that Neutron Crystal passes more than twice as much current to operate your headphones.

Inferior Crystals (dotted line) whilst sensitive to *strong* signals, are insensitive to *weak* signals, as shown by the "kink" in the lower part of the dotted "curve." No known crystal is proportionately sensitive to weak signals as to strong signals; in other words, no crystal shows the ideal *straight line*; but it is claimed that Neutron Crystal presents the *nearest approach* to the "straight line curve" that it is possible to attain. Neutron detects, and makes audible in your 'phones, weak, distant transmissions that other Crystals are powerless to detect.

A *Laboratory proof* of what every Neutron user knows; great sensitivity, particularly to weak *distant* signals.

Put Neutron Crystal in your Detector, and you will discover that not only does Neutron give you the fullest possible volume from your local Station, but also its remarkable sensitiveness enables you to listen (if your aerial equipment and other apparatus are efficient, of course) to two, three, four, or even five stations at will.

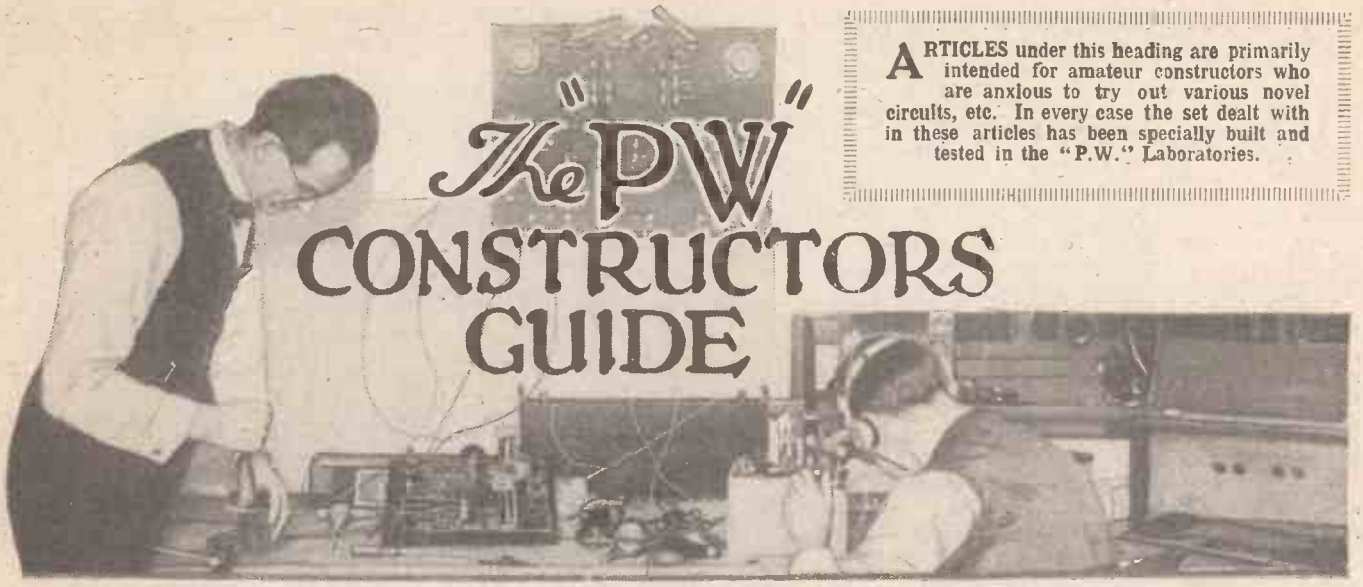
Stocked by the Best Radio Dealers. Packed in tin, with silver cats-whisker. Insist on Neutron, in the Black and Yellow Tin. If unable to obtain, send 1/6 with dealer's name, and this wonderful crystal will be mailed by return. **1/6**

NEUTRON
TRADE MARK

Concert Tested and Guaranteed Radio Crystal

Sole Distributors for United Kingdom:—**V. ZEITLIN & SONS, 144, Theobald's Road, London, W.C.1.** *'Phones:* Museum 3795 & 6841.

Produced by:—NEUTRON, LTD., Sicilian House, Southampton Row, London, W.C.1. *'Phone:* Museum 2677



"P.W." CONSTRUCTORS GUIDE

ARTICLES under this heading are primarily intended for amateur constructors who are anxious to try out various novel circuits, etc. In every case the set dealt with in these articles has been specially built and tested in the "P.W." Laboratories.

THE "SUPER-SELECTIVE" RECEIVER.

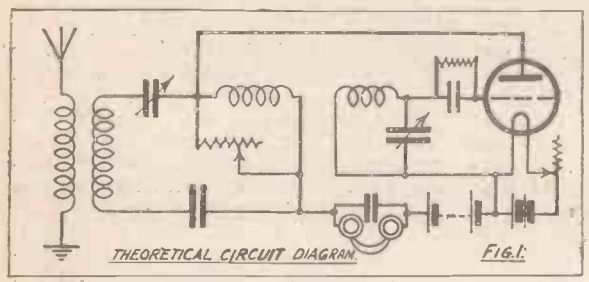
Specially Built and Described by G. V. DOWDING, Grad.I.E.E.

(Technical Editor "P.W.")

SUPER-SELECTIVITY cannot be obtained with present-day apparatus without employing a "super" number of valves, a "super" number of controls, or controls of a "super" critical nature. That is my own personal opinion, but, of course, I am open to be corrected.

The "super-selective" circuit recently published with full details for the first time in this country by POPULAR WIRELESS, is, anyway, no exception to such a rule, although it has certain advantages which render it a "hook-up" that can be very useful in certain circumstances.

For instance, no receiver could be made that would provide greater possibilities of instruction in "tuning sense," but the amateur must not endeavour to obtain this during broadcasting hours, as the circuit is a very bad "oscillator."



Then, again, it is hardly a set that a novice could or should be allowed to handle. It can be assembled with comparative ease—there are no outstanding constructional "snags" to be encountered.

It is a rather difficult circuit to handle, but when it is thoroughly mastered its selective properties are surprising. A local station really can be entirely cut out, even if it is only a mile or so away, and distant stations whose wave-lengths vary but 15 or so metres from the local station can be tuned in.

Signals are Loud.

It takes a few minutes to do this—it is a question of resolving carriers by skilfully balancing the three main tuning controls, and it is impossible to explain exactly how it is accomplished—it is purely a question of "tuning sense," a vague term which covers such requirements as the compensating hand capacity adjustment, etc.

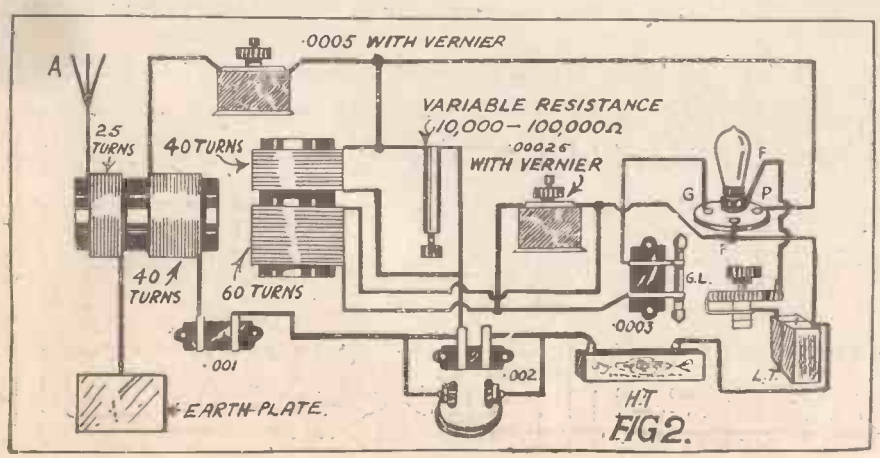
The "super-selective" is, apart from being selective, rather a "super" in respect of volume obtainable, and if handled with care it is possible to get louder signals with it than is possible with a "straight" one-valve circuit.

A front view of panel of the Super-Selective Receiver. An L.F. amplifier can be added, but tends to cause great instability unless separate batteries are used.

Up till quite recently readers have experienced a difficulty in obtaining the 10,000 to 100,000 ohm variable resistance that is required. This variable resistance, by the way, is a very necessary item and it is essential that it should be capable of providing the specified range.

The "Watmel," "Bretwood" and "Enterprise" people are now supplying special resistances for the circuit. In

(*Continued on page* 18.)



THE "SUPER-SELECTIVE" RECEIVER.

(*Continued from page* 17.)

the model illustrated an ordinary Lissen anode variable resistance is employed.

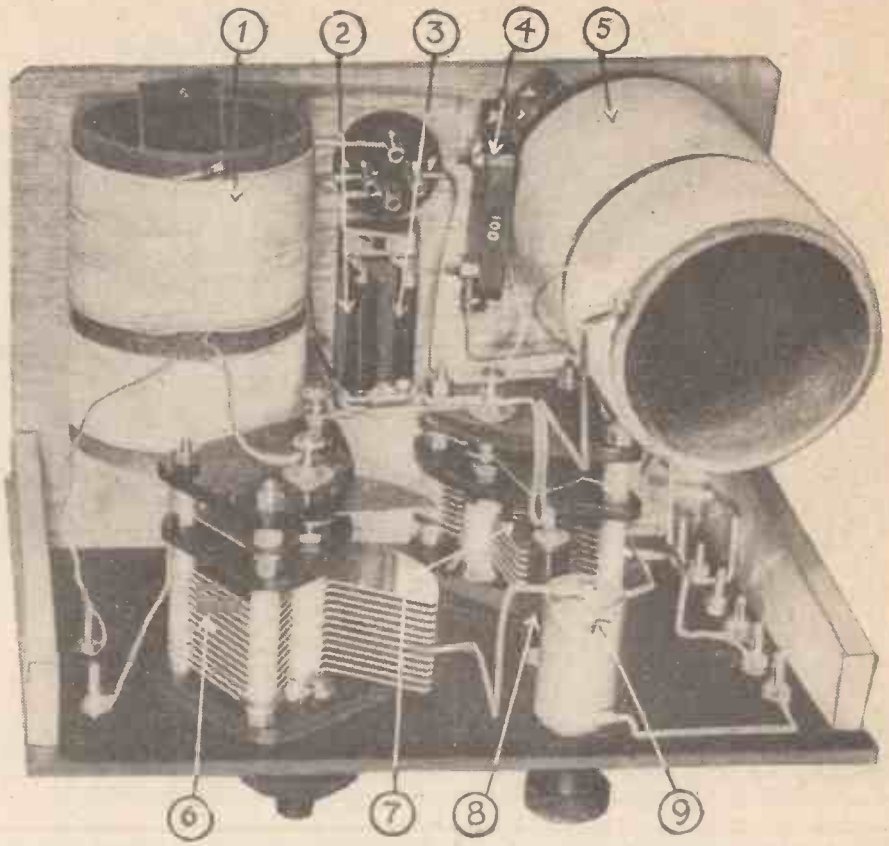
This component has, however, been rendered suitable for the purpose by having five of its pellets removed. It was found to be quite a simple matter to do this. The metal base was unscrewed, five of the little black discs and their accompanying metal separators extracted, and a small piece of brass rod inserted to make up the requisite length of the resistance element.

To Obtain Good Results.

Experiments proved that even if the question of general "lay-out" is not of great importance, strict attention must be paid to the details concerning the winding and disposition of the coils if it is desired to obtain good results. Three-inch diameter formers are essential, and so is 20-gauge D.C.C. wire.

For the benefit of readers a pictorial diagram of the circuit is again given, Fig 2. and this explains more clearly than could words exactly how the coils are wound. In each case the two windings on the former should be separated by a space of ¼-in. The aerial and first filter coil require a former 4 in. long and the secondary and its filter coil require one of 6 in. in length.

It is distinctly advantageous to employ a Lissenagon *Major* filament resistance, which, although rather expensive, provides the perfect filament control which the really



The view looking down on the baseboard behind the panel. (1) Aerial and filter coils; (2) Grid condenser; (3) Grid leak; (4) ·001 mfd. fixed condenser; (5) Secondary and filter coils; (6) ·005 mfd. variable condenser; (7) ·00025 mfd. variable condenser; (8) Variable resistance; (9) Filament resistance.

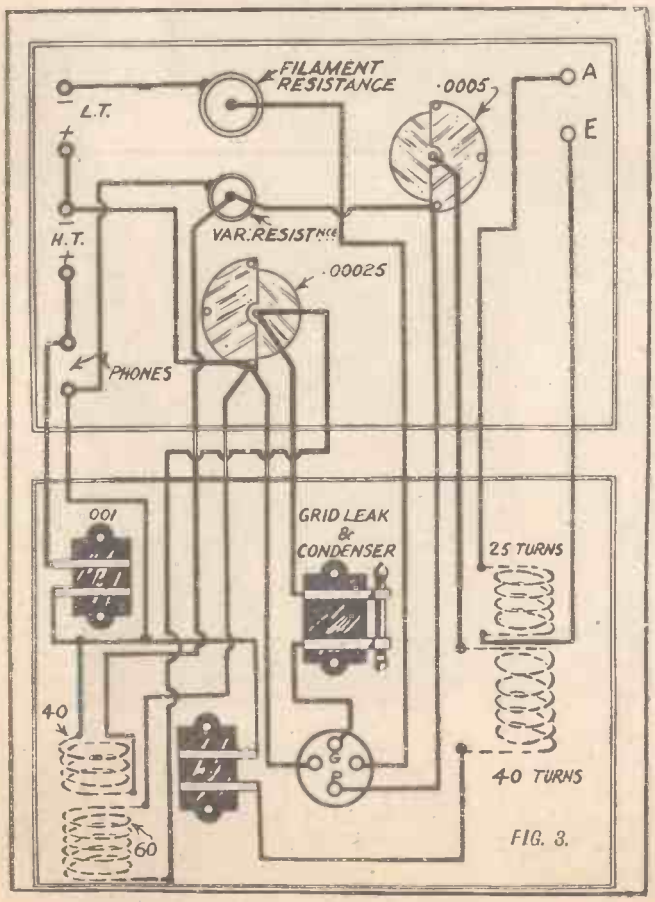


FIG. 3.

successful operation of the circuit necessitates.

Vernier condensers are absolutely essential, and when it is stated that a station even at fairly close range can be tuned in and totally lost again with but a slight movement of but *one* of the verniers, perhaps the necessity of such will be realised. ·0005 and ·00025 mfd. J.B. square law vernier condensers are obtainable and are to be advised.

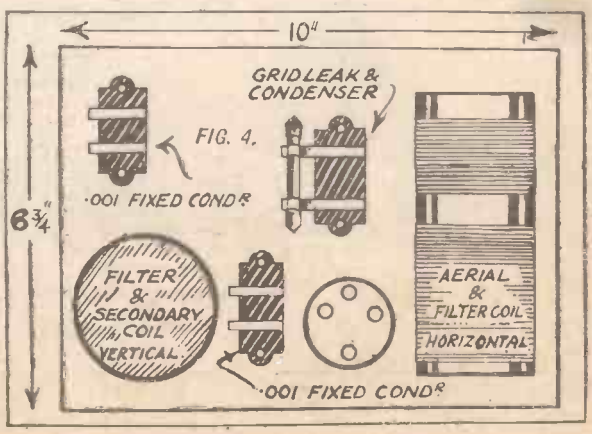
The mounting of the two coil formers is liable to present difficulties, for they must be at right angles to each other. The method adopted in the set illustrated can be clearly seen, and it will be agreed that it is about the only method that can be adopted to ensure adequate spacing and yet permit the set to be confined within a case of reasonably compact dimensions.

Suitable Valves.

It will be noticed that the valve holder is placed centrally between the two coils, while the grid leak is situated immediately behind it. Referring to the panel, accessibility has been given preference at the expense of true symmetry, but after handling the receiver the constructor will agree that it is wise to do so.

We have found that almost any general purpose valve can be used with the "super-selective" with varying degrees of success. We used for testing this set Cosmos D.E.11, Cossor "Wuncell," and a B.T.-H. B.5, all of which, it will be noted, are dull emitters; but bright emitters can be used, too, and

(*Continued on page* 20.)



THE "SUPER-SELECTIVE" RECEIVER.

(*Continued from page* 18.)

very good results were obtained with an Edison A.R., a Marconi "R.," a Mullard, and a foreign valve of doubtful origin.

Varying H.T. voltages were employed according to the valve in use. The fixed condensers were experimented with and we have an idea that slightly better results were obtained with one of ·001 mfd. capacity across the 'phones, instead of ·002 mfd., as was originally specified.

A "Worth-While" Circuit.

Capacity effects are rather noticeable, and it is fairly certain that the stability of the receiver could be improved by introducing a telephone transformer.

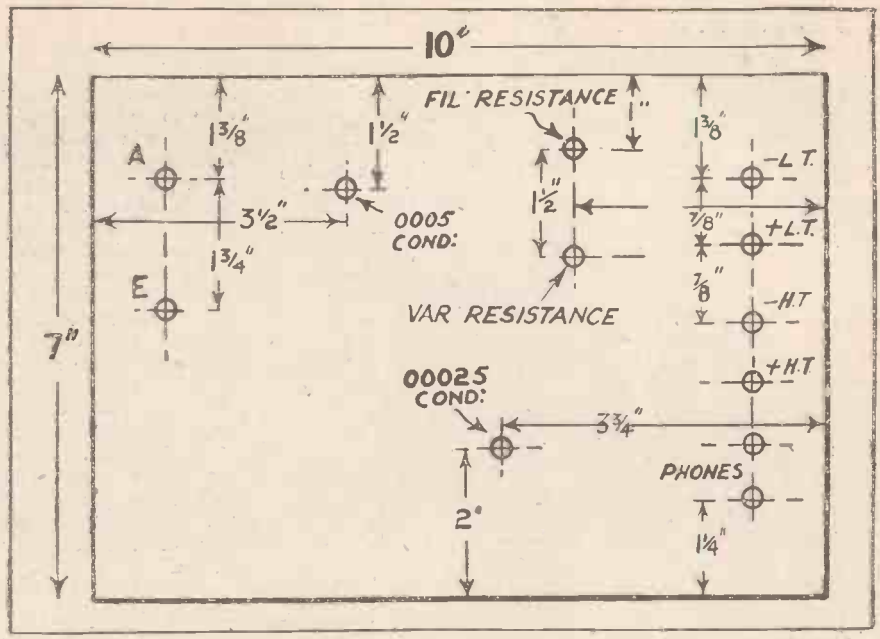
Referring to the diagrams, Fig. 1 shows the theoretical circuit which is given in Fig. 2 in pictorial form as well in order to make the coil and other connections perfectly clear.

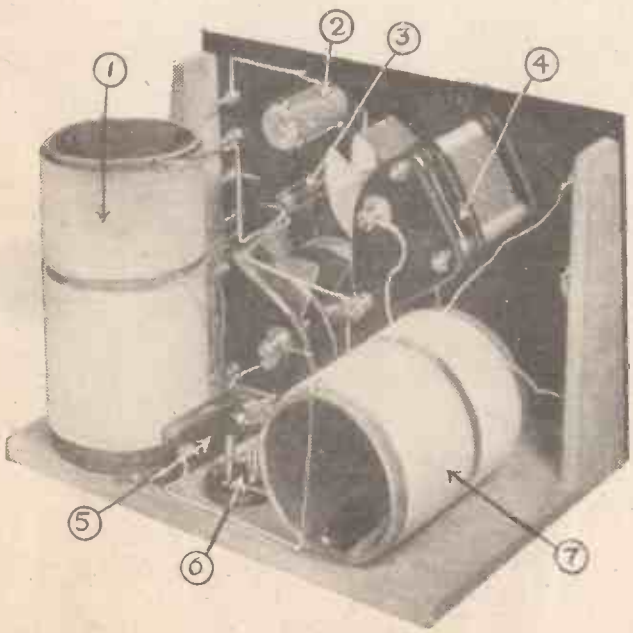
Fig. 5 gives panel drilling details, and Fig. 4 the lay-out of the baseboard. It will be noticed that one coil is mounted horizontally and is fixed in position by means of a strip of ebonite which, passing right through it, is screwed at each end into the baseboard.

The vertical coil is mounted by means of two small brackets bolted to the bottom of the former and screwed to the base, by these it is held firmly and rigidly.

Fig. 3 is a wiring diagram and with the assistance of this and the pictorial diagram it should be impossible for the constructor to go wrong. As a matter of fact, I would almost go so far as to say that this last diagram is unnecessary, for the constructor who is unable to wire up a set directly from a theoretical circuit is not likely to be able to handle the "super-sclective" with much success.

Finally, and to summarise my opening remarks, the "super-selective" is a really worth-while circuit, but our New York correspondent was at fault in saying it is a set any amateur can handle with ease. For really good results it does require skilful handling.





Another view behind the panel. (1) Filter and secondary coils; (2) Filament resistance; (3) Variable resistance 10,000-100,000 ohms; (4) ·0005 mfd. variable condenser; (5) ·001 mfd. fixed condenser; (6) Valve holder; (7) Aerial and filter coils.

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

What is Hysteresis?

I HAD a letter the other day from a reader wanting to know what was meant by magnetic hysteresis. Well, a full account of hysteresis and the effects which it produces, would take the whole of this journal several times over. But briefly the answer is this. When a piece of iron is placed in a magnetic field, there is a certain intensity of magnetisation produced in the iron. If the strength of the field is increased the magnetisation of the iron is also increased but not necessarily in the same ratio. Eventually, there comes a point when the iron is "saturated." Now, if the strength of the field is reduced, the magnetisation of the iron does not exactly follow suit: there is a "lag," and when the strength of the field has been reduced to zero, the magnetisation of the iron still has an appreciable value. In order to bring the magnetisation of the iron to zero the field has, in fact, to be reversed. It is easy to see that if the iron is taken round a "cycle" of changes, that is, the magnetic field raised to a given value, then reduced to zero, then taken to the same value in the opposite direction, then to zero, and so on, a certain amount of energy will be lost in the iron. If a piece of iron is surrounded by a coil through which an alternating current is passing, the iron is evidently going through this cycle many times per second. In these circumstances, a considerable amount of energy is lost, owing to this property of lagging, or "hysteresis"; this energy appears mostly as heat, and the iron core is raised in temperature. Losses of this kind are known in electrical engineering as "hysteresis losses." Of course, different specimens of magnetic material vary enormously in their hysteresis, and a low hysteresis is, for most purposes (though not for all), a desideratum of considerable importance.

The Derivation of Electron.

The word "electron" is now so common, one might almost say a "household word," at any rate, in households where wireless has established itself, that it is interesting to trace its origin. This subject was brought up by a recent discussion between some wireless enthusiasts who held widely different opinions as to its origin. It is certain that it had something to do with the Greek word for "amber" (a fossilised gum) which was one of the first substances known to have the property of becoming electrified by friction. But in reference to a fundamental particle or unit of electricity, the word "electron" appears first to have been proposed by Dr. Johnstone Stoney about 1891, and mentioned in a paper before

(*Continued on page* 55.)

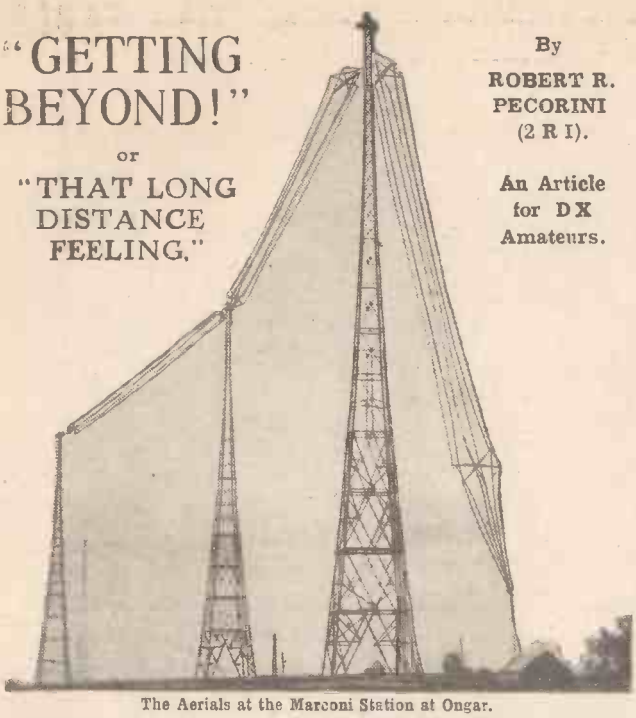
"GETTING BEYOND!"

or

"THAT LONG DISTANCE FEELING."

By
ROBERT R. PECORINI
(2 R I).

An Article for DX Amateurs.



The Aerials at the Marconi Station at Ongar.

THE numerous letters from POPULAR WIRELESS readers on the subject of the "P.W." Telephony Time Schedules, have kept me busy during the last few days. The general query seems to be a big "HOW?" To that I really must crave the indulgence of a general reply. Presumably the set is O.K.—aerial and earth system O.K.—'phones and valves O.K. Then we must not be dud on the human factor of personal patience. The knob-swisher will never get "Beyond." DX work is a matter of patient and loving search. Whilst on the subject of search I would like to issue a warning.

The majority of broadcast listeners' trouble is caused by the fiend who *will* search out on the heterodyne method. He might occasionally beat himself by getting into the No-Man's-Land of the overlap, but more often than not he beggars his neighbour. Reaction should not be a means of search, it should be used to strengthen obtained signals. That is where patience becomes a long suit. It is more than a virtue. Patience is better than 2 H.F. stages.

Ultra DX Work

I have been offsetting my southern extraction by a gruelling and deliberate course of patience in radio work. During the last week a new system designed especially for POPULAR WIRELESS work has been in course of preparation at 2 R I. Misfortune attended the old system, which was temporarily thrown out of commission. My infant son had also dismantled my pet loop for his own nefarious experiments in transmission by means of an "osculating cristal!" I therefore spent the evening curing a bad temper by trying to get them in without aerial or earth. The first result was Hamburg, then 2 L O, then Hilversum. I concluded a thoroughly exhausting evening by getting in Iberica with its "here-we-go-gathering nuts-in-May" programme. Physically, I could not stand up to a trial for K D K A, so quit, satisfied that I had made progress along the placing of a vernier upon my patience.

Times are very favourable for reception of Continental stations just now. A few of the German stations particularly seem to be pumping out the watts in great style. Hamburg is a great big fellow in this respect, and, personally, I have no difficulty in putting him on the loud speaker without an under-current of 2 L O. Actually in some cases the Bremen relay is found easier to pick up because it gets below the British band. Iberica is quite a good turn after 2 L O goes to bed. Hilversum roars in. Zurich has an orchestra that I consider one of the best in Europe—that of l'Hotel Baur au Lac.

Esperanto?

What a pother there is just now about Continental call signs and the international language. Whilst it is desirable that the DX listener should be able to recognise the station, and then go on to further conquests, what about the locals who object to their "uncle" continually telling the world who he is? That is where the wave-meter comes in when accurately calibrated. One is independent of language or call signs. The question of the international language is also a wee bit selfish. Why English? Why Ido?

NEXT WEEK—

An Exclusive Article on

"The Ether"

Sir OLIVER LODGE, F.R.S.

Every amateur who has followed Sir Oliver Lodge's broadcast "talks" on the Ether should read this article, which will be used as an Epilogue to his forthcoming book on the Ether.

Why Esperanto? Radio broadcast is essentially democratic. The Tower of Babel rather messed up the tongues of the world, and we have to stand by it. Merely to gratify my sense of having achieved a DX record, I cannot see why my tongue should be inflicted upon the peasant of Komarov with his crystal set. I candidly confess that I do not understand half the stations I pick up—save in the international language of music—but I derive great benefit from the announcers I partially understand, because my language "ear" is becoming tuned in. That and my wave-meter put me right as to where I am.

P.S.I. Cards.

I append my specimen reception card. I think this embraces all the station director wants to know, and I give a free translation into French, Italian, Spanish, and German. These four will do to go on with. I propose to give you Dutch, Swedish, and Danish on another occasion. I cannot tackle Japanese yet.

How to Write to a Foreign Station Director.

ENGLISH EXAMPLE.

Sir,—Your telephonic signals heard here at a.m.
p.m. Greenwich mean time on .... H.F., Detector, ... L.F.
weak,
Strength of signals medium,
strong.
Fading nil,
badly.
Yours faithfully,
(Signed).....

FRENCH EXAMPLE.

Monsieur,—Vos signaux téléphoniques entendus ici à .... matin, temps moyen de
soir,
Greenwich, sur .... Haute Fréquence, Détecteur,.... Basse Fréquence.
faible,
Force moyenne,
forte.
Evanouissement du son nul,
extrême.
Salutations distinguées,
(Signed).....

ITALIAN EXAMPLE.

Signor,—I vostri segnali telefonici sono stati uditi qui alle ore .... a.m. tempo medio di
p.m.
Greenwich con .... Alta Frequenza, Detettore, ... Bassa Frequenza.
debole,
Forza medio,
forte,
Indebolimento nulla,
grande.
Devotissimi vostri,
(Signed).....

GERMAN EXAMPLE.

Euer Hochwohlgeboren,—Ihre Telephon-Signale wurden hier vernommen um .... vormittags,
nachmittags, nach Greenwich Zeitangabe, mit.... Hochfrequenzröhren, Detektor, ... Niederfrequenzröhren.
schwach,
Starke mittelstark,
stark.
Abschwächung keine,
sehr gross
Hochachtungsvoll,
(Signed).....

SPANISH EXAMPLE.

Señor,—Oído aqui vuestras señales telefónicas a .... a.m. tiempo medio de Greenwich
p.m.
en .... Alto frecuencia, detector, ... baja frecuencia.
debil,
Intensidad mediana,
fuerte.
Desvanecimento nada,
mucho.
De Usted atento y S.S.,
(Signed).....

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE

Specially compiled by ROBERT R. PECORINI, 2 R I.

Transmission Starts G.M.T	Transmission Ends G.M.T	Station and Call Sign	Wave-length in Metres	Days of Week	Nature of Transmission
06.00	06.06	Koenigswusterhausen (L P)	4000	Daily ..	News during day to 20.00
06.25	07.00	Hamburg (*See below*)	395	Weekdays	Time, Weather, News.
06.25	07.00	Hanover	296	,,	Relay Station.
06.25	07.00	Bremen	330	,,	,, ,,
06.30	07.35	Koenigswusterhausen	2450	Daily ..	Press Service (Woolf).
06.40	06.46	Eiffel Tower (F L) ..	2600	Weekdays	Weather.
06.45	06.53	Eberswalde	293	Daily ..	Press Service (U. Telegraph) and during day
06.50	06.55	Buda-Pesth (M T 1) ..	950	,, ..	News, Bourse, etc., at frequent intervals.
06.55	08.15	Münster	410	,, ..	Time, News, Women's Talk.
07.00	08.00	Hamburg	395	Weekdays	Dramatic critique.
07.05	07.12	Lausanne (H B 2) ..	850	Daily ..	Weather, Markets, News.
07.30	08.00	Leipzig	454	Sundays	Concert. [Music.
07.30	08.30	Frankfurt-am-Main	470	Sun., Fri.	Religious Service and
07.30	08.30	Cassel (*See below*)	228–288	,, ,,	Relay.
07.30	07.40	Rome (I R O)	425	Daily ..	News.
07.40	07.50	Toulouse (M R D) ..	1525	Daily ..	Weather for 'planes.
07.45	07.52	Buda-Pesth (M T I) ..	950	,, ..	News, Bourse, etc.
07.55	10.00	Hamburg	395	Sunday	Time, Weather, News, Drama.
07.55	10.00	Hanover	296	,,	Relay Station.
07.55	10.00	Bremen	330	,,	,, ,,
07.55	08.05	Amsterdam (P C F F)	2100	Daily ..	News, Markets, etc.
08.00	08.09	Vienna (O R V)	530	,, ..	Markets.
08.00	09.00	Voxhaus (Berlin)	505	Sunday	Religious Music.
08.00	09.00	Leipzig	454	,,	,, ,,
08.00	09.00	Dresden	280	,,	Relay Station.
08.00	08.45	Koenigsberg	463	,,	Religious Music.
08.15	08.20	Buda-Pesth	950	Daily ..	News, etc.
08.20	08.30	Marignane(S.W.France)	1525	,, ..	Weather. [Concert.
09.00	11.50	Voxhaus (Berlin) ..	505	,, ..	Market, News, Weather.
09.00	09.12	Kbely (O K P)	1150	,, ..	Weather, News.
09.00	10.05	Komarov (O K B) ..	1800	Sunday	Sacred Concert.
09.42	09.50	Toulouse (M R D) ..	1525	Daily ..	Weather.
09.55	10.03	Amsterdam (P C F F)	2100	,, ..	Time Signals.
10.00	11.00	Blümendaal	332	Sundays	Church Service relayed.
10.00	11.45	Hamburg	395	Sunday	Sacred Music.
10.00	11.00	Leipzig	454	,, ..	Educational Talk.
10.00	11.45	Buda-Pesth (M T I) ..	950	Daily ..	Concert and News.
10.00	11.00	Kbely	1150	Sunday	Concert.
10.00	11.00	Koenigsberg	463	Daily ..	Concert.
10.00	11.30	Stockholm .. 427–	440	Sunday	Church Service.
10.00	11.50	Vienna (O R V) ..	530	Daily ..	Concert.
10.00	10.15	Gothenburg	700	Daily ..	Fishing Report.
10.00	11.50	Graz	692	Daily ..	Relay from O R V, experimental stage.
10.00	11.55	Breslau (G F U) ..	418	Sunday	Concert, Market, W'ther.
10.10	11,30	Malmoe	270	,, ..	Religious Service.
10.10	10.56	Frankfurt-am-Main ..	470	Daily ..	Bourse.
10.10	11.10	Amsterdam (P C F F)	2100	Mon., Sat.	News, Bourse (at intervals). [Concert
10.15	11.55	Breslau (G F U) ..	418	Weekdays	Market, News, Weather.
10.15	11.55	Koenigsberg	463	Daily ..	Bourse.
10.15	10.35	Norddeich (K A V) ..	1088	,, ..	Weather (following spark transmission).
10.30	irreg.	Pic du Midi	350	Weekdays	Tests on Music.
10.30	11.30	Stuttgart	443	Sunday	Concert, [sional Music.
10.30	11.30	Munich	485	,,	Religious Talk, occa-
10.30	11.30	Nuremberg ..	340	,,	Relay from Munich.
10.30	11.45	Lyons-la-Doua	470	Daily ..	Concert and Bourse.
10.30	11.45	Voxhaus, Berlin ..	505	Sunday	Educational Talk.
10.30	11.40	Kbely	1150	Weekdays	Bourse.
10.30	11.50	Koenigswusterhausen (L P)	2800	Sunday	Concert and Lecture. (Esperanto).
10.55	12.08	Leipzig	454	Daily ..	Bourse, Concert, and Time Signals.
10.55	11.06	Frankfurt-am-Main ..	470	Weekdays	Time and News.
11.00	11.10	Zurich—Höngg	*515	,,	Weather (*also sends on 645 occasionally).
11.00	11.50	Eiffel Tower (F L) ..	2600	Tu.to Sat.	Markets. [News.
11.00	11.50	Münster	410	Sunday	Religious Music and
11.10	11.30	Amsterdam	2100	Weekdays	Market and News.
11.15	11.22	Koenigswusterhausen (L P)	2450	Weekdays	Markets.
11.15	11.55	Hamburg	395	,,	Markets and Lecture.
11.15	11.19	Eiffel Tower (F L) ..	2600	Daily ..	Time and Weather.
11.15	11.20	Voxhaus	505	Weekdays	Bourse.
11.30	11.50	Münster	410	,,	News, Bourse, Weather.
11.30	12.05	Stockholm .. .. (427–	440		Weather, Bourse, Time.
11.45	12.40	Hamburg	395	Sunday	Chess.
11.55	12.05	Hamburg	395	Daily ..	Time Signals.
11.55	12.05	Münster	410	,,	,, ,,
11.55	12.05	Breslau	418	,,	,, ,,
11.55	12.00	Koenigsberg	463	Daily ..	Time Signals, Weather.
11.55	12.08	Zurich	515	Weekdays	Time Signals, Markets.
11.55	12.05	Voxhaus	505	Daily ..	Time Signals, Markets.
12.00	12.15	Amsterdam	2100	Weekdays	Market and News.
12.05	12.08	Vienna (O R V)	530	Daily ..	Time Signals.
12.10	12.35	Hamburg	395	Weekdays	Language School.
12.15	12.50	Geneva (H B I) ..	1100	,,	Lecture.
12.20	12.25	Vienna (O R V)	530	Daily ..	Weather.
12.25	12.30	Breslau (G F U) ..	418	Weekdays	Weather and Bourse.
12.30	12.45	Lausanne (H B 2) ..	850	,,	Weather, Markets, Time and News.
12.30	14.15	Radio-Paris (S.F.R)*	1780	,,	Concert, News, Bourse.
12.30	12.40	Vossegat (B E)	1050	Daily ..	Weather.
12.45	12.52	Kbely (O K P)	1160	Weekdays	Bourse.
12.45	13.30	Hamburg	395	Sunday	Concert.
12.45	14.00	Radio-Paris*	1780	,,	Concert, News.
12.45	12.54	Amsterdam	2100	Daily ..	Market and News.
12.45	13.30	Moscow	1500	Weekdays	Talk.
13.00	13.15	,, ...	,,	Sunday	News.
12.45	13.15	Leningrad	1450	Daily ..	News.
13.00	13.10	Munich	485	,, ..	News, Weather, Time.
13.00	13.10	Brussels (B A V) ..	1100	,, ..	Time, Weather.
13.00	13.25	Komarov (O K B) ..	1800	Weekdays	Bourse, News, Weather.
13.10	13.22	Voxhaus	505	,,	Bourse.
13.15	13.30	Koenigsberg	463	,,	Markets.
13.30	13.42	Hamburg	395	Th. & Fri.	Markets.
13.45	14.00	Hamburg	395	Mon., Tu., Wed.	Markets.
14.00	14.10	Breslau (G F U) ..	418	Weekdays	News.
14.00	15.00	L'Ecole Superièure de P T T	458	Thurs. ..	(Irregular) Lecture.
14.00	17.00	Munich	486	Sunday	Concert, Lecture.
14.00	15.00	Voxhaus	505	,, Weekdays	Lecture. Bourse.
14.00	15.00	Kbely	1160	Sat. ..	Concert.
14.00	15.05	Hamburg	395	Weekdays	Politics and Bourse.
14.30	17.00	Münster	410	,,	Markets, Weather, Lecture, Concert, Children (Saturdays).
14.30	14.40	Vienna (Q R V)	530	Daily ..	Bourse.
14.30	15.30	Voxhaus	505	Sun., Wed.	Children.
14.40	14.50	Amsterdam (P C F F)	2100	Weekdays	Bourse and News.
14.45	14.54	Eiffel Tower (F L) ..	2600	,,	Bourse.
15.00	16.00	Ryvang	1100	Sunday	Concert.
15.00	15.30	Voxhaus	505	Saturday	Educational Talk.
15.00	17.00	Münster	410	Sunday	Concert and Children.
15.00	17.00	Leipzig	452	Mon., Tu., Wed., Fri., Sat.	Markets and Concert.
15.00	16.00	Hamburg	395	Sunday	Children.
15.00	15.45	Breslau (G F U) ..	418	Sun., Fri.	Children and Concert.
15.00	17.00	Stuttgart	443	Sun., Wed. Th., Fri.	Time, Concert.
15.00	15.08	Vienna (O R V)	530	Daily ..	News.
15.00	15.10	Centocelle (I C D) ..	1800	,, ..	,,
15.00	17.30	Frankfurt-am-Main ..	470	,, ..	Markets, News, Concert. Children (Sunday). 15.30 Weekdays.
15.00	17.00	Zurich	515	,, ..	Concert.
15.10	17.00	Vienna (O R V)	530	,, ..	,,
15.30	16.15	Moscow	1500	Daily ..	News.
15.30	17.00	Leipzig	452	Sun., Th.	Markets, Concert. Children (Wednesday).
15.30	16.05	Hamburg	395	Weekdays	Lecture.
15.30	16.30	Koenigsberg	463	Daily	Concert.
15.30	16.35	Munich	486	Mon.toSat	Concert.
15.30	17.00	Voxhaus	505	Daily ..	,,
15.35	15.40	Eiffel Tower (F L) ..	2600	Weekdays	Bourse.
15.45	16.45	Rome (U R I)	425	Daily ..	Children, Orchestra.
15.45	16.30	L'Ecole Supr. de P.T.T.	458	Wed. ..	Lecture.
15.50	15.58	Brussels (O P O) ..	1100	Daily	Weather.
15.55	16.10	Amsterdam (P C F F)	2100	,, ..	Market, News.
16.00	17.00	Hamburg	395	,, ..	Concert. [(Wednesday).
16.00	16.30	Breslau (G F U)	418	,, ..	Time (Sunday). Children
16.00	16.40	Stockholm .. (427–	440	Sunday	Children.
16.00	17.00	Lausanne (H B 2) ..	850	Wed. ..	Children.
16.00	16.10	Kbely (O K P) ..	1150	Weekdays	Bourse.
16.00	17.00	Kbely (O K P) ..	1150	Wed.,Sat.	Concert.
16.10	16.14	Amsterdam (D C F F)	2100	Daily ..	Time Signals.
16.15	17.00	Moscow	1500	Daily ..	Concert.
16.30	17.30	Leipzig	452	Tues. ..	Lecture.
16.30	16.45	Stuttgart	443	Daily ..	Market, News, Weather.
16.30	16.40	Eiffel Tower (F L) ..	2600	Tu. to Sat.	Bourse.
16.30	18.00	Radio-Paris (S F R) ..	1780	Daily ..	Bourse, Concert, News.
16.45	17.30	Rome (U R I)	425	,, ..	Dance Music.
16.45	17.50	Blümendaal	332	Sundays	Church Service relayed.
16.45	18.00	Stuttgart	443	Daily ..	Concert. Children (Wed. and Saturday)

NOTE.—Bremen and Hanover relay Hamburg, Nuremberg relays Munich, and Cassel relays Frankfurt, so that when Hamburg, Munich, and Frankfurt are transmitting, the relay stations are also "on."

(*Radio-Paris—contemplating wave 1125 metres.)

(Radioraldo and Lyons (*pro. tem.*) ceased transmitting.)

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE

(Continued from page 21).

Transmission Starts G.M.T	Transmission Ends G.M.T	Station and Call Sign	Wave-length in Metres	Days of Week	Nature of Transmission
16.45	16.55	Eiffel Tower (F L) ..	2600	1st & 15th	Bourse.
16.50	17.00	Brussels (B A V) ..	1100	Daily ..	Weather. [Games
17.00	18.15	Breslau (G F U) ..	418	Wed.,Sat.	Educational Talk and
17.00	17.30	Frankfurt-am-Main	470	Sun.& Th.	Concert.
17.00	17.25	Munich	486	Monday..	Time.
17.00	17.12	Kbely (O K P)	1150	Weekdays	Bourse.
17.00	17.45	Radio-Paris (S F R) ..	1780	Saturday	Concert.
17.00	18.10	Radio-Belgique (S B R)	265	Sun.,Mon. Th., Fri.	Concert and News.
				,, Tu., Sat.	Dance.
				,, Wed. ..	Children.
17.00	18.00	Hamburg	395	Tu.,Wed., Th., Fri., Saturday	Educational Talk.
				,, Wed. ..	Concert.
17.15	18.00	Zurich	515	Mon., Wed., Fri.	Children.
17.15	18.45	Komarov (O K B) ..	1800	Thurs. ..	Concert.
17.30	19.00	Barcelona	325	Sunday	Lecture, Band, Opera.
17.30	18.30	Frankfurt-am-Main	470	Mon.,Tu., Th.,&Sat.	Lecture, English, etc.
				Sunday	Opera relay [etc.
17.30	19.30	Voxhaus	505	Daily ..	Women's Talk, Lecture,
17.30	17.45	Belgrade (H F F) ..	1650	Mon., Wed., Fri.	News. [Languages.
17.30	20.40	Munich	486	Tu.toSat.	Concert, News, Lecture,
17.40	20.00	Boden	2500	Sunday	News, Weather, Concert.
17.40	18.10	Voxhaus ..	505	Tues. ..	Educational Lecture.
17.45	18.55	Hamburg	395	Sunday	Educational Talk.
17.45	18.30	Belgrade (H F F) ..	1650	Tu., Th., & Sat.	Concert.
17.55	18.05	Lausanne (H B 2) ..	850	Daily ..	Weather, News.
18.00	18.05	Stuttgart	443	Sun.,Mon. Th., Fri., Sat.	News, Weather.
18.00	21.00	Madrid (E A J 2) ..	310	Daily ..	Concert, News, Dance.
18.00	19.00	Barcelona (E A J 1) ..	325	Weekdays	,, ,, ,,
18.00	19.00	Hamburg	395	Wed. ..	Educational Talk.
18.00	19.15	Zurich	515	Weekdays	Weather, News, Concert.
18.00	18.10	Kbely (O K P)	1150	Daily ..	Weather.
18.00	19.10	Eiffel Tower (F L) ..	2600	,, ..	Concert, News, Weather.
18.15	19.30	Seville (E A J 5).. ..	350	Mon.,Tu., Wed.,Sat.	Concert, News.
				,, Thurs. ..	Lecture, Concert, News.
18.15	19.00	Leipzig	452	Mon., Tu.	Educational Talk.
18.20	18.30	Lyngby (O X E) ..	2400	Weekdays	News.
18.25	19.00	Hamburg (R)	395	Weekdays	Language School, W'ther
18.30	19.30	Frankfurt-am-Main	470	Friday ..	Educational Talk.
18.30	19.00	Breslau (G F U) ..	418	Mon. to Wed.	,, ,,
18.30	19.30	,, ,, ..	,,	Th & Fri.	,, ,,
18.30	19.00	Stuttgart	443	Daily ..	Lecture.
18.30	19.00	Koenigsberg	463	Mon.Wed. to Sat.	,,
18.30	18.45	Copenhagen .. .. also relay "Aalborghus"	775 470	Daily ..	Programme and Tests.
18.35	18.45	Münster	410	Daily ..	Time, News.
18.40	18.50	Toulouse (F N T) ..	1525	,, ..	Weather.
18.40	20.00	Boden	2500	Tu., Fri.	Concert.
18.45	18.55	Eiffel Tower (F L) ..	2600	Wed., Sat.	Dress Talk (English).
18.45	19.00	Vienna (O R V)	530	Daily ..	News.
18.45	19.00	Stockholm	427-440	,, ..	News.
18.45	20.30	Copenhagen	775	Sun.,Mon. & Th.	Concert.
18.55	20.10	Hilversum (H D O) ..	1050	Monday..	Children.
19.00	20.30	Kbely (O K P)	1150	Daily ..	Concert.
19.00	20.00	Ryvang	1100	Tu. &Fri.	Concert.
19.00	20.15	Stuttgart	443	Daily ..	Concert, News, Time.
19.00	21.00	Stockholm	427-440	,, ..	Concert.
19.00	21.00	Hamburg	395	,, ..	News, Weather, Concert.
19.00	19.30	Münster	410	,, ..	Talk.
19.00	23.00	Breslau (G F U)	418	Sun.,Mon. Tu.,Wed.	Concert, Weather. News.
,,	,,	,, ,, ..	,,	Saturday	Opera.
19.00	20.00	Stockholm (Svenska)..	445	Mon. and Thurs.	Concert.
19.00	21.00	Gothenburg (S M S B)	700	Sun., Tu., Fri.	Concert, News, Lecture. Stockholm Relay.
19.00	19.07	Eiffel Tower (F L) ..	2600	Weekdays	Weather.
19.00	19.15	Leipzig..	452	Tuesday	Educational Talk.
19.00	20.30	Koenigsberg	463	Daily ..	Concert and News.
19.00	19.30	Frankfurt-am-Main	470	Sun. and Monday	Lecture and Educational Talk.
19.00	20.30	Vienna (O R V)	530	Daily ..	News, Concert.
19.00	20.00	Jorcks Passage	775	Sun., Wed., Th.	Lecture, Concert, News.
19.00	21.30	Lausanne (H B 2) ..	850	Tu., Sat.	Concert or Dance.
19.00	21.00	Malmoe	270	Mon., Th.	Concert, as Stockholm.
19.00	20.00	Moscow	1500	Daily ..	Concert and News.
19.00	20.00	Leningrad	1450	Daily ..	Concert.
19.05	21.00	Barcelona	325	Sunday ..	Concert, Sport, etc.
19.05	19.25	Voxhaus ..	505	Monday..	Educational Talk.
19.15	22.00	Zurich	515	Sun., Tu. to Sat.	Concert, News, and Weather..
19.15	21.00	Leipzig..	452	Daily ..	Concert.
19.15	22.15	,, ...	,,	Wed. ..	,,
19.15	21.30	Lausanne (H B 2) ..	850	Sun., Mon. Wed. Th., Fri.	Concert, Dance, Music.
19.25	19.30	Soesterberg	1050	Daily ..	Weather.
19.30	22.00	Zurich	515	Monday..	Concert.
19.30	21.15	Voxhaus	505	Daily ..	,,
19.30	20.30	Munich	486	,, ..	,,
19.30	22.00	Frankfurt-am-Main	470	,, ..	Concert and News.
19.30	21.00	Münster	410	,, ..	Lecture, Concert.
19.30	19.40	Centocelle (I C D) (Rome) ..	1800	,, ..	News. [Lecture.
19.35	20.10	Rome (U R I)	425	,, ..	Concert, Weather,
19.40	19.50	Amsterdam (P A 5) ..	1050	,, ..	News.
19.40	22.10	Hilversum (H D O) ..	1050	Sunday ..	Concert.
19.40	19.50	Vossegat (B E) ..	1050	Daily ..	Weather.
19.40	Irreg	Christiania (Oslo) 448	475	,, ..	Testing.
19.45	23.30	Breslau (G F U) ..	418	Tu. & Fri.	Concert, Weather, News.
19.45	22.30	L'Ecole Superièure de P.T.T	458	Sunday ..	Concert.
19.50	20.50	Amsterdam	1050	Wed. ..	,,
20.00	20.15	Stockholm (Svenska)..	445	Mon., Th.	News.
20.00	20.15	Radio-Belgique (S B R)	265	Daily ..	Time, Lecture.
20.00	21.30	Prague (P Q R) ..	1000	Daily ..	Concert, News.
20.00	20.13	Koenigswusterhausen (L P)	2450	,, ..	News.
20.00	20.05	Lyngby (O X E) ..	2400	Weekdays	News, Weather, Time.
20.00	22.00	Mont de Marsan.. ..	365	Wed.	Concert.
20.10	21.40	Ijmuiden (P C M M) ..	1050 to 1100	Saturday	Concert.
20.10	22.30	Rome (U R I)	425	Daily ..	Lecture, Concert.
20.15	22.15	Radio-Belgique (S B R)	265	Sun., Tu., Fri., Sat.	Concert, News.
20.15	22.15	Radio-Belgique (S B R)	,,	Mon. and Wed.	Opera.
20.15	21.00	Radio-Belgique(S B R)	265	Thursday	Concert, News.
20.15	21.30	Stuttgart	443	Daily ..	Concert, Cabaret (Sun. and Wed.)
20.15	21.00	Stockholm .. .. .. (Svenska)	445	Mon. and Thurs.	Concert.
20.30	22.30	L'Ecole Superièure de P.T.T.	458	Mon. Wed. Thurs.	Concert.
20.30	22.30	L'Ecole Superièure de P.T.T.	,,	Tu. & Sat.	Talk.
20.30	20.40	Munich	486	Daily ..	News, Weather, Time.
20.30	21.30	Jorcks Passage	755	Sun., Th.	Dance Music.
20.30	22.00	Radio-Paris (S F R) ..	1780	Daily ..	News Chat, Concert, Dance (Sun., Thurs.).
20.40	22.10	Hilversum (N D O) ..	1050	Friday ..	Lecture, Concert.
20.45	22.30	L'Ecole Superièure de P.T.T.	458	Sun. and Friday	Concert (occasionally).
20.50	22.30	Munich	486	Sun.& Tu.	Concert.
21.00	21.30	Münster	410	Daily ..	Educational Talk and News. Sunday : Concert and News.
21.00	21.15	Radio-Iberica	392	,, ..	News and Weather.
21.00	23.00	Barcelona (E A J 1) ..	325	Weekdays	Concert, News, Dance.
21.00	22.10	Radio-Belgiquo (S B R)	265	Mon., Thurs.	Dance.
21.00	21.50	Hamburg	395	Daily ..	Weather, Market, News, Concert, Dance(not Mon.)
21.00	22.00	Zurich	515	Weekdays	News, Concert.
21.00	22.30	Vienna	530	Mon., Tu., Wed., Saturday	Dance Music.
21.00	22.00	Munich	486	Tu., Sat., Sun.	Concert, Lecture.
21.00	21.15	Lyngby (O X E) ..	2400	Weekdays	News, Weather, Time.
21.15	24.00	Radio-Iberica	392	Daily ..	Talk, Concert, News.
21.15	23.00	Rome (U R I)	425	,, ..	Dance. Thurs. at 21.00 Sunday at 24.05).
21.30	23.30	Le Petit Parisien ..	345	Sun., Tu., Thurs.	Concert.
,,	,,	,, ,, ..	,,	Saturday	Dance.
21.30	24.00	L'Ecole Superièure de P.T.T.	458	Sunday	Concert.
21.30	23.00	Voxhaus	505	Sat.Sun.,Th. Mon.	Dance. Chess.
22.00	22.45	Radio-Paris (S F R) ..	1780	Wed. ..	Concert.
22.10	22.18	Eiffel Tower (F.L) ..	2600	Weekdays	Weather.

"If you're using 7/22's you're sitting in the back row of the gallery. The 'Mars' will put you on the front row of the stalls—"

This heading makes no appeal to the technically-minded, but it graphically suggests the difference in efficiency between 7/22's aerial wire and "Mars" aerial wire which supercedes 7/22's.

If your crystal set's volume gives you the impression that you're on the back row of the gallery, don't blame the set—take down your present aerial and fix a "Mars." The increase in strength and clarity will put you on the front row of the stalls. You will be able to hear every word—every whispered aside. You will be able to hear every note—even when the bars are marked pianissimo.

This announcement is not technical, but it is by no means wholly imaginative. 40,000 "Mars" enthusiasts have proved the claims implied by the comparison we have made.

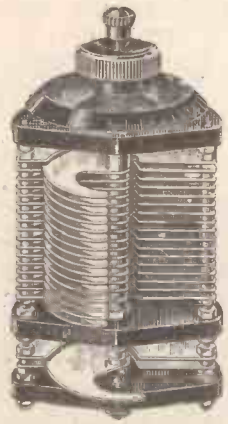
You can buy 7/22's at "gallery" prices—two shillings or so for a hundred feet, but 9/6, the price of the "Mars," gives you a seat in the stalls of wireless for the long life of this durable super cable.

The "Mars" consists of 84 strands—not 7. Each strand in the "Mars" cable is spirally wound and thus air-insulated—an exclusive "Mars" characteristic. The "Mars" has 80% greater surface area than 7/22's, and gives 50% greater efficiency.

E. & W. G. MAKINSON, LTD.,
Wellington Works, Wellfield Road, Preston. *Telephone:* 122 *Preston. Telegrams:* "*Gold, Preston.*"
MA 37

THE MARS AERIAL

K CONDENSERS



The Condensers described here are recommended by well-known experts. They are absolutely reliable, and our full guarantee ensures complete satisfaction. Their first-class finish and quality commends them for use with the most fastidious work.

SQUARE-LAW.

A few points in our Condensers that make them different: The high-class workmanship; the beautifully moulded knob and dial; the robustness and quality of the moulded end plates; and the special shape of the vanes. These are distinctive features which, together with the delightfully smooth movement and accurate spacing, place the "K" Square-Law Condenser in a class alone.

0·001, 10/-; 0·0005, 8/3; 0·0003, 7/9; 0·0002, 7/3; 0·0001, 6/6.
With Vernier: 0·001, 12/6; 0·0005, 11/6; 0·0003, 10/6.

"KINGSWAY" MODEL.

The Kingsway Condenser has all the good points of the above, but has ordinary pattern vanes. It can also be recommended as a first-class all-round condenser.
0·001, 8/-; 0·00075, 7/-; 0·0005, 6/-; 0·0003, 5/6; 0·0002, 4/6; 0·0001, 4/-; 3-plate Vernier, 3/9.

"K" FIXED CONDENSERS.

Something quite new—a tubular fixed condenser of absolute accuracy. Taking up a minimum of space, it can be fitted direct to wires by the two screws, or by means of brackets supplied free with each condenser.
0·001, 0·002, 0·003, 0·006, 2/- each. 0·0001, 0·0002, 0·0003, 0·0005, 1/9 each

Send now for free copy of our catalogue—just published.

WATES
BROS., LTD.
12-14, Gt. Queen St., KINGSWAY, W.C.2.

'Phone: Gerrard 575-576. *Works:* LONDON, BIRMINGHAM, and WESTCLIFF

THE **ANTIVIBRO** Regd.
VALVE HOLDER
(PATENT PENDING, 27946/24)

REDUCES CAPACITY AND VIBRATION

If unable to obtain at your Local Wireless Stores, send direct to the manufacturers:

2/- EACH

PHIPPS & READ,
10 & 10a, Baron Street, Pentonville Road London, N.1.

LAKER
STEEL
MASTS

Send postcard for our new illustrated Catalogue. It will interest you.

JOHN & JAMES LAKER CO., *Engineers,*
457, Romford Road, LONDON, E.7.

Don't tickle the Crystal—use

Harlie
FOOL-PROOF
DETECTOR

Provisional Patent 26791/24.

Continuous reception in any position at all times, owing to the special design of both crystal and cats-whisker, always in contact.

GUARANTEED TONE—VOLUME—PURITY.

SOME NOVEL FEATURES:—

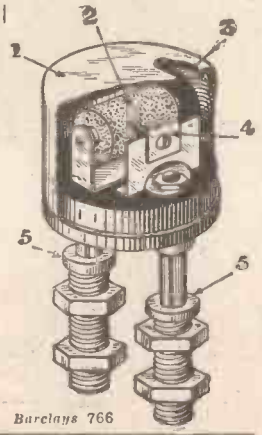
1. Nickel-plated detachable dustproof cover.
2. Special "Harlie" super-sensitive crystal.
3. Ebonite wheel for rotating crystal.
4. Catswhisker on slider for covering whole surface of crystal.
5. Nickel-plated sockets for panel mounting.

Obtainable from all dealers or direct from patentees and manufacturers.

PRICE COMPLETE, 5/6.

Generous Trade Terms. Telephone: Clissold 293.

HARLIE BROS., 183, Dalston Lane, HACKNEY, LONDON, E.8.

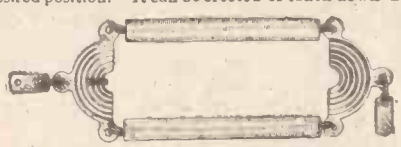


Barclays 766

THE SEASON'S NOVELTY.
THE FORMO PORTABLE AERIAL.

This wonderful aerial can be used in or out of doors, on a car or punt, in fact in almost any desired position. It can be erected or taken down in a few moments

7/6 Postage Extra



7/6 Postage Extra.

We guarantee this aerial to receive up to 10 miles from a broadcasting station on a valve set, although many users are getting all the British Stations, and many Continental stations. It is sold complete with insulators, hooks, and lead-in terminal.

A customer writes: "Reception perfect on crystal set with your aerial, indoors, at 8½ miles."

THE FORMO COMPANY
(ARTHUR PREEN & CO., LTD.)
Crown Works, Cricklewood Lane, London, N.W.2.

THE "MULTIDYNE."
ADDING AN EXTRA VALVE.

Designed and Built by B. W. WILLANS.

PART III. (Conclusion).

In this last article the author explains how a valve can be added to the "Multidyne" receiver, and concludes with further details of tests carried out with this ingenious set.

WHILE the tests previously described were in progress on the valve and crystal Multidyne, it became increasingly clear that a material addition to the number of possible circuits could be made if another valve were added, and, further, that these would be of a more generally useful type than circuits employing only a valve and crystal, the latter,

22	15				
14	13	23	*FIG. 3 B.*		
16	20				
30	24	11			
25	10	27	28		
37	18				
17	36				
33	32	31	21	26	12

though very frequently giving remarkable results, being troublesome to adjust and somewhat critical in performance.

Accordingly, consideration was given to the possibilities in this direction, the main object of simplicity being borne in mind, both from the standpoint of the construction of the set and also from the point of view of the user.

Useful Two-Valve Circuits.

The original connections to the Multipanel are shown in Fig. 1 (Pt. 1). It will be noted that two condensers are shown, each of value ·001 mfd., these being required for the purpose of certain reflex circuits. It was evident on consideration that one of these must be connected permanently to the transformer primary, as whenever the latter was used it would be in a first stage of amplification. This releases two contact points for other purposes, and accordingly it is possible to employ a second valve in the set by attaching its grid and filament to these points.

The revised connections to the Multidyne are thus shown in Fig. 1 in this article, the second valve being always connected in circuit by external filament leads. This is entirely satisfactory, as when one valve only is being employed it can just as readily be the second as the first, and the latter is only lit when the appropriate leads are connected up on the Multilink.

We now have at our disposal, therefore, all the circuits which can be set up with two valves and a crystal, and foremost among these are the standard "straight circuits" which are found most generally useful in wireless practice, viz.:

H.F. amplifier and valve detector, as shown in Fig. 2.

Valve detector and L.F. amplifier, as shown in Fig. 3.

H.F. amplifier, crystal detector, and L.F. amplifier, as shown in Fig. 4.

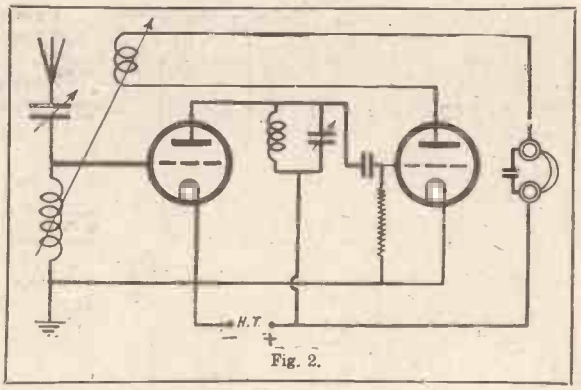


Fig. 2.

Two have been reproduced in the form of practical Multilink wiring diagrams in Figs. 2a and 4a, the latter indicating the manner in which the Multilinks are to be connected up so as to give the corresponding circuits in the Multidyne.

I am proposing to add two more convenient terms to the present list of Multidyne, Multipanel, and Multilink. The first of these is Multigram, which represents, as its name implies, the Multilink wiring diagrams referred to in previous paragraphs. Examples of Multigrams are thus given in Figs. 2a and 4a.

The second term, Multicode, I propose to use in respect of an entirely novel method of providing in a condensed and readily comprehensible form the exact information which is required to enable the user to connect up his Multilink.

In the previous articles a system was adopted whereby each of the Multipanel and Multilink points was designated by a two-figure number. According to the Multicode, any group of points that are connected together are simply represented by a row of figures, each pair of the latter denoting one point, according to the standard system, and the user in interpreting this code has only to take each group of figures separately and join the corresponding points by a suitable lead.

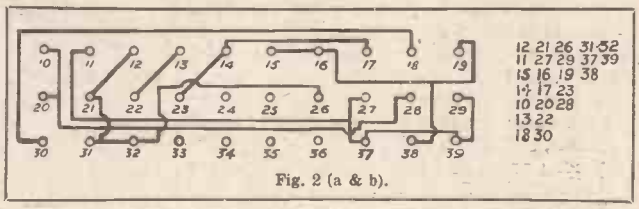


Fig. 2 (a & b).

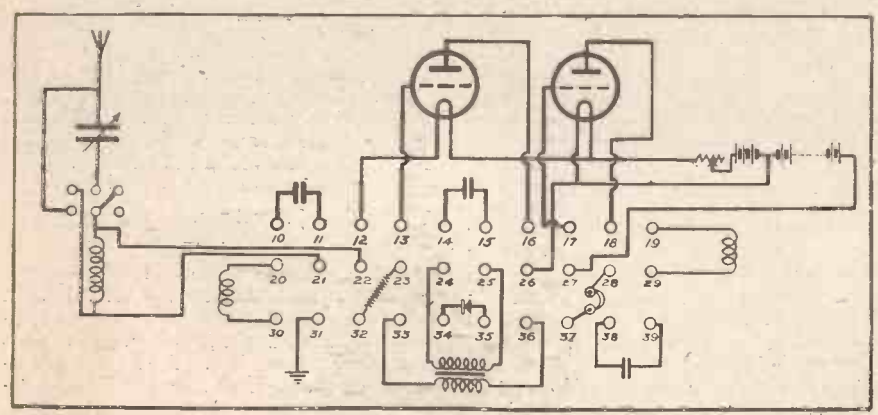


Fig. 1. Diagram of connections for 2 valve multipanel. Note, however, that the condenser, 38-39, should be variable and not fixed, as shown.

Results on Test.

The Multicodes corresponding to the above circuits are shown in Figs. 2b, 3b, and 4b. It is convenient to arrange these as indicated, with the largest group of points in the top or bottom row and the successive groups arranged in order according to the number of points which each comprises.

The tests carried out on these two Multidyne circuits again gave a number of interesting comparative results. On this occasion all the testing was done at Westcliff-on-Sea, and, in consequence, the general behaviour of the circuits was similar to that observed

(*Continued on page* 23.)

THE "MULTIDYNE."

(Continued from page 27.)

previously in the case of the analogous circuits with the valve and crystal Multidyne.

The circuit of Fig. 2 (H.F. and valve detector) was the best for the reception of distant stations, the results being admirably clear and the selectivity all that could be desired. A number of Continental stations, as well as practically all the British broadcasting stations, were received with very little interference, notable results being achieved from Madrid, the signals from which station were easily readable with the telephones on the table.

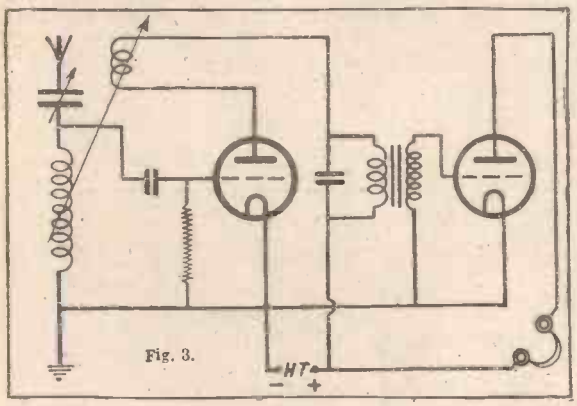


Fig. 3.

Effects of Local Conditions.

On changing over to the circuit of Fig. 3 (valve detector and L.F.) louder results were obtained from short range stations, as, for instance, London and Chelmsford, but the results from the distant ones were not quite so satisfactory. Madrid was also very strong, but not quite so strong as with the previous circuit, and the signals were accompanied by slightly more noise.

The circuit shown in Fig. 4 turned out to be less satisfactory, its behaviour being closely in accordance with that shown by the H.F. and crystal detector circuit described in our previous issue. The reasons in both cases for this result are probably the same, and dependent upon some local conditions prevailing at the testing station at Westcliff which were not found when the set was tried out in London.

So much, then, for the experiments. My experience up to date has indicated the exact requirements which a satisfactory Multidyne set must fulfil. Letters from readers giving their experiences will be welcomed. It would also be interesting if they send up details of any further circuits they may have tried and found successful, so that other amateurs may have the benefit of their experiences. The use of the Multidyne system will enable all wireless enthusiasts, whether they are experienced in the technicalities of the subject or not, to enter into the delights of experimental work under their own conditions and at their own convenience, and without the necessity for laborious mechanical operations.

Multidyne Parts.

It is not intended to lay down the law with regard to the efficiency of the circuits which are suggested, though it is proposed to publish from time to time results of tests which readers have carried out. My wish is to put each owner of a Multidyne in a position to judge for himself and to form his own opinions as a result of his personal achievements in the art, and I feel that in bringing forward this new principle, under which circuit-testing can be carried out with a degree of ease and precision hitherto unattainable, it is possible to serve the interests of wireless users as a whole. At any rate, it is to this end that these efforts have been directed, and I anticipate with confidence that my belief in this principle will be increasingly shared as time goes on by an ever-growing crowd of Multidyne enthusiasts.

All inquiries with regard to the Multidyne sets and parts should be addressed to The British Radio Valve Service, Ltd., Hazlitt House, Southampton Buildings, Holborn, W.C.1, by whom I am informed that supplies of Multipanels and Multilinks are now available, and the manufacture of Multidyne sets is well in hand. These parts, I understand, will be sold at reasonable prices that will be inclusive of royalties.

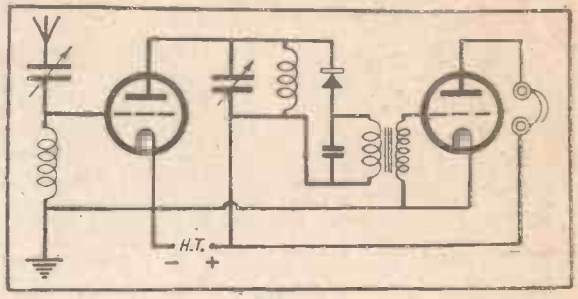


Fig. 4.

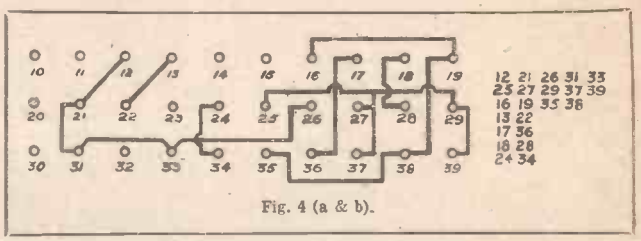


Fig. 4 (a & b).

UNIDYNE VALVE HOLDER CONNECTIONS.

IN constructing Unidyne sets with the "valve tray" mounted on a baseboard, the writer, like many others, found some difficulty in making the connections to the five pins under the valve tray, and after trying many methods the following was found to be very satisfactory.


Fig. 1.

Take a piece of ebonite of the required size for the valve tray, drill this to take the five-pin valve holder, and, after fitting this, screw the nuts up tight. Mount five terminals, two at one side of the holder for the filament connections, and three at the other side for the plate and the two grids as shown in Fig. 1. Turn the tray over, and after filing the ends of pins and terminals flat, "tin" them with the soldering iron, and make soldered connections with short pieces of square section tinned copper wire, as shown in Fig. 2. The tray can now be mounted on the wood base, and the various connections made easily to the five terminals on top by soldering to the tags of the spade terminals, or the latter can be dispensed with, and the wire bent and screwed down with the terminal nuts in the usual manner.

This method possesses the advantage of allowing the constructor to change connections over, if necessary, without disturbing the valve tray or any other connections.


Fig. 2.

While discussing "Unidyne" valve holders the writer would like to point out that it is *essential* that the proper grids be connected to their correct portions of the circuit. For instance, the inner grid (on the left looking down on the valve holder with filament connections at the bottom) must be connected to L.T. + and the other grid to the input from the aerial or previous valve. If these precautions are not carried out, failure with the L.F. amplifier is certain, while it is more than probable that the detector also will fail to function.

Wrong Grid Connections.

It has been found in rare cases, however, that the detector valve will only operate when its grid connections have been reversed, but this operation is very unsatisfactory, and as a rule it is impossible to get the valve to oscillate. All amateurs constructing "Unidyne" sets should make absolutely sure about those grid connections and see that all joints are well-made.

Mainly About Broadcasting

by The Editor

WIRELESS LAW—THE NEW BILL—INTOLERABLE POSITION—WRITE TO YOUR M.P.

THE Bill to amend the law relating to wireless telegraphy, as presented by the Postmaster-General, Sir Wm. Mitchell-Thomson, M.P., the other day, is one which every owner of a wireless set should do his utmost to protest against. The powers sought by the Government, under this wireless telegraphy and signalling Bill, have aroused indignation and apprehension among the public.

A Strong Clause.

One clause in the Bill proposes that:

"If a justice of the peace is satisfied by information on oath that there is reasonable ground for supposing that a wireless telegraph station has been established, or is being maintained, without a licence in that behalf, or that any apparatus for wireless telegraphy has been installed, or is being worked or maintained in any place, or on board any ship or aircraft within his jurisdiction, without a licence in that behalf, he may grant a search warrant to any police officer or any officer appointed in that behalf by the Postmaster-General, the Admiralty, the Army Council, the Air Council, or the Board of Trade, and named in the warrant, and a warrant so granted shall authorise the officer named therein to enter and inspect the station, place, ship, or aircraft and to seize any apparatus which appears to him to be used, or intended to be used, for wireless telegraphy therein."

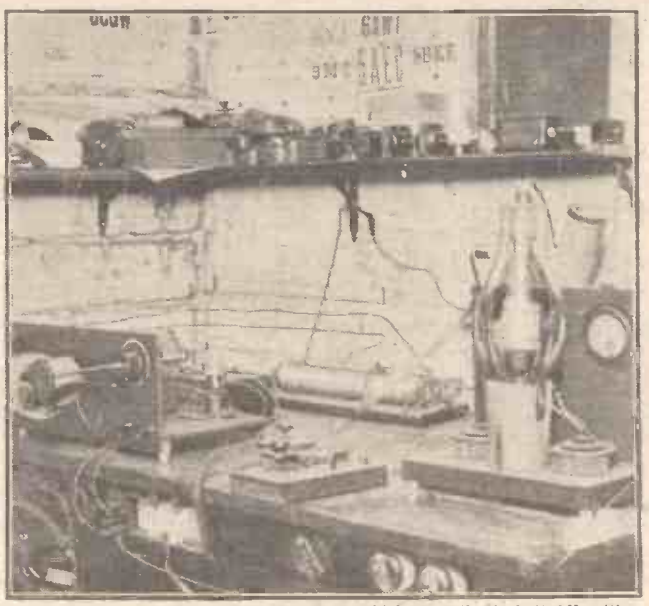
And in the clause following it is obviously meant that wireless telegraphy can be interpreted as wireless telephony, as transmitted by broadcasting stations. Any amateur fixing up a wireless set in his house can, for the purposes of the Bill, be regarded as working a wireless station, and, if he has not taken out a licence, the Bill proposes to enforce penalties ranging up to 12 months' imprisonment or a £100 fine.

An Absurd Idea.

But the most surprising thing about this Bill is that it is suggested that means should be provided for officials to be allowed to enter and search the home of a man who has no wireless licence. This is frankly a suggestion which no listener-in should tolerate. An Englishman's home has always been regarded as his castle, and the mere thought of an official having powers to demand entrance into one's home, because he has a suspicion that one has a wireless set installed is absurd.

Admittedly the wireless pirate is deserving of little sympathy, and a practical and reasonable scheme for bringing to book the people who are mean enough to refrain from taking out a licence should be encouraged. But the present proposals as put forward by the P.M.G. are "outside the bounds," and I strongly advise every reader of POPULAR WIRELESS to make a point at once of sending a postcard to his M.P., protesting against this Bill. I cannot stress this point sufficiently, but, if every reader of POPULAR WIRELESS was to make up his mind to send a postcard to his Member of Parliament, strongly protesting against this Bill, there would be little chance of it ever becoming law.

The sympathies of every honest listener are naturally with the Government and the B.B.C. No doubt the latter may eventually find themselves in a very serious position if some means are not taken to enforce the payment of the wireless licence fee; but that is no excuse for the Government attempting to impose on the public such absurdly stringent regulations. Under the present Act (of 1904), which this new Bill seeks to repeal, an offender is liable on summary conviction to a penalty not exceeding £10, but the new Bill proposes that the liability on summary conviction should be imprisonment with or without hard labour for a term not exceeding three months, or a fine not exceeding £50, and, in the case of a further offence, another fine not exceeding £5 for each day on which the offence is continued. If guilty on indictment the term of imprisonment may be up to 12 months, or a fine not exceeding £100.



The famous Australian station, 3 B Q, which recently "chatted" with Mr. Simmonds, of Gerrard's Cross.

As a matter of fact, readers are no doubt aware that only a few weeks ago a listener challenged the P.M.G. to prosecute him for non-payment of his licence fee to the Government. No steps were taken, and it is a curious fact that counsel's opinion for the Crown has never been taken on the question of the validity of the 1904 Wireless Telegraphy Act as regards offences by listeners-in in respect of not taking out a licence. It would seem that the recent action of this amateur in challenging the P.M.G. has been primarily responsible for bringing matters to a head, and one does not blame the P.M.G. for wishing to strengthen his powers in the matter of wireless licences.

But the powers he seeks are beyond the boundary line which the public might justifiably allow him to approach, and very vigorous steps should be taken at once to make it quite clear that the public will not tolerate an imposition of the nature suggested by this new Bill.

One is not treated with such extraordinary harshness (as is proposed in this new Bill) when one forgets, or deliberately forgets, to take out a dog licence, or a gun licence, and the difference in the penalties is out of all proportion when one compares the "crime" of not taking out a wireless licence and not taking out a dog licence.

A Possible Alternative.

Many people will accuse the Government, if this Bill is passed, of supporting the B.B.C. monopoly, as it is called, and the accusation will undoubtedly be justified. It would be much better if the present form of licensing sets was entirely scrapped. The present system never will work well because, however much one might appeal for fair play, there are always a large number of people who, quite apart from the fair play aspect of the case, are always forgetting little things of this nature. I am quite convinced that of the thousands of pirates in this country many of them have not taken out licences because they have been too lazy to take the trouble, or else too forgetful.

When one listens-in, in ninety-nine cases out of a hundred one has to use a crystal or a valve set, and it might be feasible to revive the regulation in force two or three years ago that anybody buying a valve must first of all produce the licence granted him by the P.M.G. to work a valve set. There is no reason why this regulation could not be enforced in respect of crystals, so that, if any listener wished to buy a new valve or a new crystal he could not do so unless he produced his licence. After all, motorists have to carry their licences in their pockets, and it would not be a great imposition to make it compulsory for listeners to do the same. But that is by the way.

THE MAIN THING IS THAT READERS OF "POPULAR WIRELESS" MUST ADDRESS A PROTEST TO THEIR MEMBER OF PARLIAMENT.

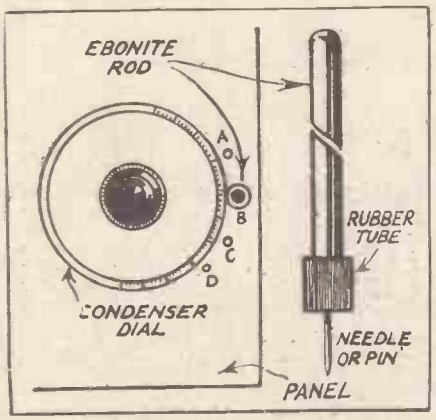
Constructional Notes

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

Vernier Control.

HERE is a little idea which will be found very useful for exercising a vernier control on condensers, and for avoiding hand capacity trouble when tuning in distant stations.

The apparatus consists of an ebonite or wooden rod about eight inches to a foot long, and preferably stiff enough not to bend easily. Into the end of this a needle, or pin with the knob cut off, is forced. A small hole is then drilled near the edge of the condenser dial,

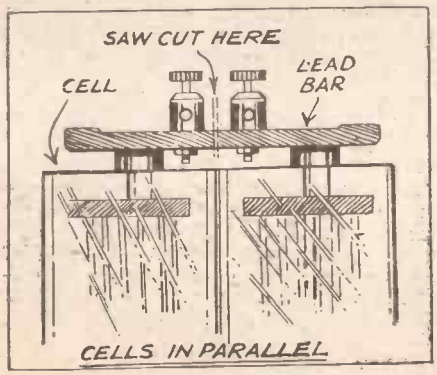


nearer or farther away, according to the thickness of the rod used, as shown at A, B, C, D.

By inserting the needle in this hole and lightly pressing the rod against the dial, minute adjustments can be made, while the hand is kept well away from the condenser. An improvement is the addition of a small piece of rubber tube, as shown, but this is not absolutely necessary.

Cells in Parallel.

A number of resistances in series can be converted to parallel (without disconnecting) by connecting alternate connections to opposite terminals, but this cannot be done with cells, as it would result in short-circuiting them. Suppose you have a 6-volt accumulator and you wish to use it for 2-volt dull emitters. If it is of the kind in which the separate cells can be disconnected, you have only to connect the three cells in parallel. But in many cases there are no separate terminals for the individual cells, the cells being permanently connected together by lead bars. In such a case you have either to separate the cells for yourself, or use a rheostat to reduce the voltage; the latter course means wasting a large proportion of the energy of the battery.



If you should decide on the somewhat bold procedure of separating the cells, the illustration will show you the best way to do it. First drill two holes in the lead bar, and secure two terminals in position. Then with a hacksaw, very carefully and slowly saw through the lead bar. It is very important that the drilling of the holes shall be done before the sawing through; after the sawing, no further operations should be carried out on the lead bar.

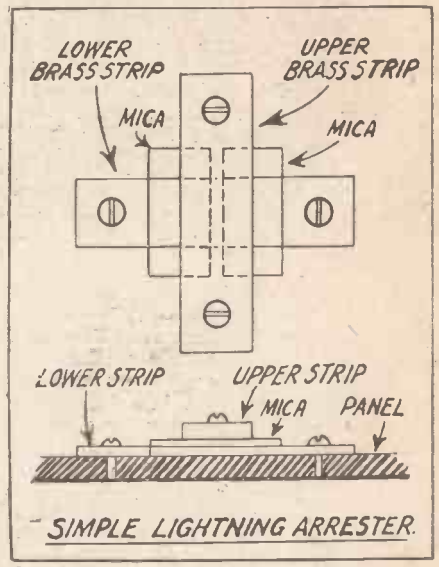
If you are averse to sawing through the lead bar, the only other way is to put a clip round each bar, after the style of an earthing clip, and use first one cell, until it is discharged, then the next, and so on; but this is a good deal of trouble, and is not very satisfactory. The method of sawing the bar is sent to me by a correspondent, who says he found it quite easy and satisfactory.

'Phone-Hook Switch.

The little device illustrated in the diagram herewith provides a hook for the headphones, and at the same time ensures that the aerial shall be connected to earth when the set is not in use. The essential part of the device is the strip or arm of brass forming the hook. This may be $\frac{1}{4}$ in. thick and from $\frac{1}{4}$ to $\frac{1}{2}$ in. in breadth; the length of the projecting portion should be at least 2 in. The strip is drilled with a small hole, through which a short piece, say 1 in. in length, of brass rod or stout wire is passed, and soldered to form the axis or shaft on which it pivots.

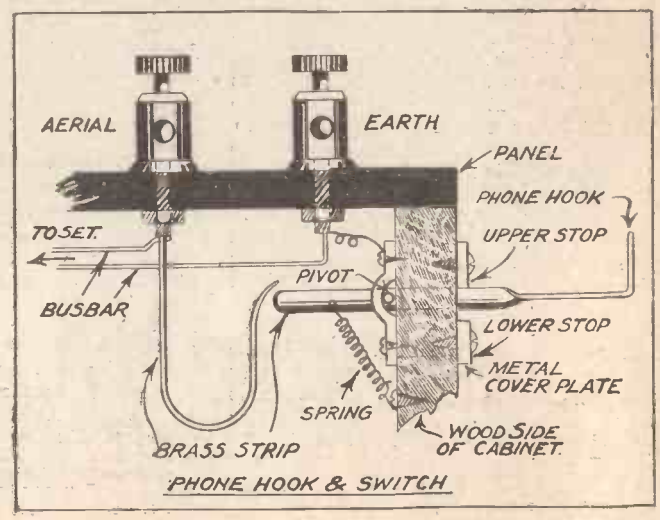
A short strip of brass (which may be the same as that used for the arm) is bent as shown, and slotted for the arm to pass through; this strip is secured by two wood screws upon the inner side of the cabinet, and serves to hold the shaft. A similar strip is slotted and screwed to the outer side of the cabinet, as a cover-plate, and also serves to limit the up-and-down motion of the arm. The arm is given a right-angle twist, as shown, so as to enable the end to be bent at right-angles to form the hook. Two terminals are secured into the panel, and to the aerial terminal is soldered a strip of brass, which in this case may be $\frac{1}{8}$ in. thick. This strip is bent in the manner indicated, so that the arm makes contact with it when the 'phones are hung on the hook, but does not make contact when the 'phones are removed.

Another small hole in the arm enables a small spiral spring to be secured to it, to keep the arm down when phones are removed.



Simple Lightning Arrester.

A lightning arrester is an important adjunct to a receiving set, and the one shown here would be difficult to beat for simplicity. It consists of two pieces of brass strip, identical in every way, crossed as shown, and screwed to the panel or baseboard. These are separated by means of two small pieces of mica, with a gap left between them beneath the upper brass strip. In case of X's the discharge will jump across from the aerial strip to the earth strip at the exposed part between the two pieces of mica. One of the brass strips is, of course, connected to the aerial terminal and the other to the earth terminal of the set.



ECONOMY —real and false

THE point is just this: Can you afford *not* to use Wuncell Dull Emitters.

Or, let us put it in another way. You own, perhaps, a 3-valve Set. Now the average bright emitter valve consumes about .7 of an ampere every hour. Three of them, therefore, will consume 2.1 amps. every hour you are using them. If your accumulator is rated at 6 volts 30 amp. hours (that is a good average size) you will get about 15 hours' use from it on a charge.

The cost for this may be anything up to 2/-. Eight shillings for a month's broadcasting—practically £5 per year. Not much when compared with the pleasure you obtain, but still quite an appreciable item in the family exchequer.

* * * * * *

Now let us see what you would be paying if you used Wuncells. First of all you would re-connect your accumulator to give 2 volts only by connecting all the cells in parallel instead of series. This will triple its capacity and give you 2 volts 90 amp. hours, but the charging cost won't be any higher.

Wuncell Valves function best at 1.8 volts and consume .3 of an amp. per hour—your 3-valve Set, therefore, will consume .9 amp. per hour, and your accumulator will last six weeks on one charge.

In other words, you get 5 weeks' broadcasting for nothing every time you get your accumulator charged if you are using Wuncells. And they will save their cost in a couple of months or so.

* * * * * *

That is not all. The filament of a bright valve is naturally incandescent. It glows at a white heat and becomes brittle. No matter how careful you are, sooner or later the filament breaks and your valve is useless . . .

But see the Wuncell working. You'll have to look pretty hard before you will realise that the filament is glowing. In daylight it is almost invisible. In fact, it is the nearest approach to the cold valve yet produced.

Isn't it obvious that such a low temperature must mean an exceptionally long life? And to make the Wuncell even stronger, we have inserted a centre support to the filament. No wonder *Amateur Wireless* reported that its filament "is practically unbreakable."

* * * * * *

So you'll readily admit that not only do you save quite a considerable amount in running costs, but you get a valve that is likely to last at least three times as long as the ordinary bright emitter. Surely this is real economy.

Wuncell exclusive advantages featured:

No. 1

THE man with a multi-valve Set using bright emitters can replace his valves one by one as they become useless by Wuncells W.R.1 and W.R.2. These are the only dull emitters on the market that can be used with a 2-volt, 4-volt or 6-volt accumulator without any alteration to the Set.

Every W.R. type of Wuncell has incorporated in its base a special resistance which can be short-circuited when not required by the screw shown above. When *all* the bright valves have been replaced by Wuncells these resistances can be short-circuited and the accumulator altered to give 2 volts with a greatly increased capacity. Full instructions for this simple alteration are supplied with every Wuncell valve:

Prices:

W.1 For Detector or L.F. Amplifier

W.2 (With red top) for long distance reception

18/- each

*W.R.1 Corresponding to W.1

*W.R.2 Corresponding to W.2

20/- each

* *Fitted with internal resistance as above.*

Cossor Wuncell Valves

THE ONLY DULL-EMITTER VALVES SOLD IN SEALED BOXES

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

Portmanteau Words

I'm afraid I must confess a distinct weakness for Portmanteau Words; chiefly, I suppose, on account of their descriptive convenience. They always seem to mean exactly what they say, and, except perhaps in a rare case such as that of the immortal "Brugglesmith," their meaning is evident at sight.

Take, for instance, the word Volutone. No doubt can rest in anyone's mind as to what that means. Volume and Tone—the two essentials of a first-class Loud Speaker. Full Volume and Perfect Tone, a joy to listen to and a treasure to possess.

But even this all-embracing word fails to convey its handsome appearance. The instrument's pleasing lines have a beauty rarely found in something that hitherto has usually been regarded purely as a piece of mechanism.

Go and have a look at a Volutone. Your local retailer is almost certain to have one in stock.

And when you have satisfied yourself as to its appearance, make a point of hearing it as well.

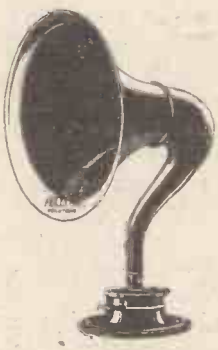
I think you'll agree then that I was quite right when I coined that essentially accurate word—VOLUTONE.

Mueb Fellows

YEATES, LTD.,

20, Store Street, Tottenham Court Road, London, W.C.1

Well equipped demonstration and sales offices of Fellows Wireless Products. Wholesale and Retail.



FELLOWS WIRELESS

The Volutone Loud Speaker gives really large volume without sacrificing the quality of reproduction. The diaphragm is adjustable.

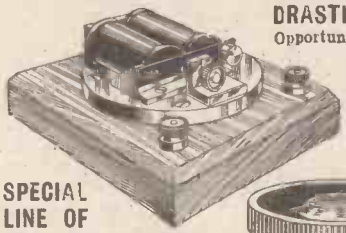
PRICE:
£4 : 10 : 0

ADVT. OF THE FELLOWS MAGNETO CO. LTD., PARK ROYAL, LONDON, N.W.10
E.P.S 97.

WIRELESS ON EASY TERMS

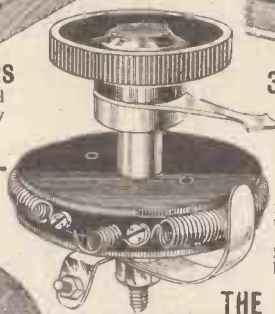
GAMAGES have now extended their easy payment system to Wireless, and you may now secure on payment of first deposit Wireless Sets and Apparatus from £5 upwards, balance being payable in monthly instalments. Write for details to Wireless Dept.

GAMAGES GREAT Wireless SALE



DRASTIC REDUCTIONS!
Opportunity to secure at lowest prices of the Year! Order by Post if unable to call—money back if not satisfied!

SPECIAL LINE OF PRACTICE BUZZERS
Well made and finished throughout of high quality materials. Usual Price 7/6. Sale Price **6/-** Post 4d. Send for yours right away to secure at this price!

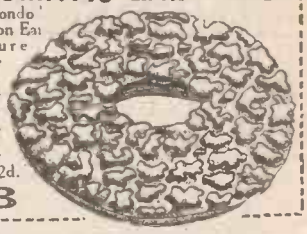


3-COIL HOLDERS
Beautifully finished throughout. Suitable for Honeycomb and Burndept Coils. Simple in construction and most practical in use. Usual price 10/6. Sale Price **9/6** Post 6d.

THE GAMAGE VELVET FILAMENT RESISTANCE
Smooth contact ensures extremely smooth action. Secure connection with the wing is obtained by the phosphor-bronze strip attachment. Usual Price 2/6. Sale Price **2/-** Post 6d.

SALE OFFER OF AERIAL WIRE
150 ft. Coils of Best Quality Enamelled Aerial Wire. A limited number of coils only is available—therefore, order by return. Sale Price per coil **5/7** Post 6d.

PNEUMATIC EAR PADS
The Macondo Air Cushion Ear Pads ensure absolute comfort when using headphones. Try them. Price per pair. Post 2d. **1/3**



FAMOUS CRYSTAL DETECTORS

The Best Crystal on the market is Gamages famous "PERMANITE"
Clear, powerful results, remains in adjustment longest. Highly sensitive. Price per large piece. **1/6** Post free. Smaller size to fit the Cup 1/-

Order by post direct from this announcement or from Sale Catalogue.

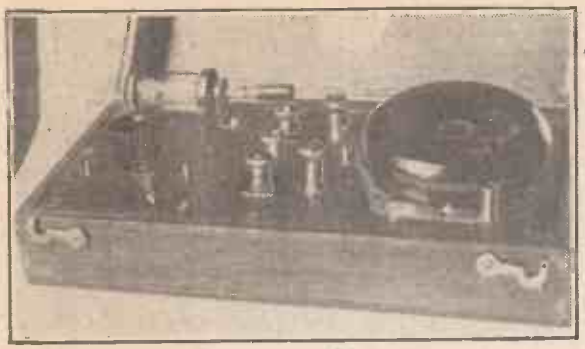
Money refunded if not satisfied.

Two examples from Gamages remarkable range of Crystal Detectors—both offered at a reduced Sale Price.

DUSTPROOF DETECTOR
Supplied complete with a piece of famous "Permanite" Crystal. The dustproof cover protects the crystal. Usual price 3/9. Post 6d. Sale Price **3/3**

CRYSTAL DETECTOR
Well made and finished. Lacquered Brass, mounted on ebonite, ball joint and cat's whisker. Fitted with our famous "Permanite" Crystal. Usual price 2/6. Post 6d Sale Price **2/2**

GAMAGES, HOLBORN, LONDON, E.C.



The receiver ready for use.

THE AMATEUR'S PORTABLE CRYSTAL SET.

Full Constructional Details.

By J. CHUGHTAI, B.Sc.

Compactness and efficiency are the chief characteristics of this very handy and useful crystal set, and the cost of the parts, etc., is extremely small.

THE receiver to be described was designed with the object of keeping its size as small as possible. Its external dimensions are 7¼ in. by 3⅝ in., and 2 3/16 in. high, including an aerial 65 feet long, a single earphone and an extra length of wire. The aerial employed can be classified as a single-wire inverted L type aerial, although when out of use it is contained in the cabinet of the receiver itself. It consists of a brass ribbon ¼ in. wide and 65 feet long, which is kept wound on an ebonite disc. One end of the ribbon is in metallic connection with the aerial terminal of the set, while the free end is connected to an ebonite handle. This insulated handle can be attached to anywhere in a room or to a tree if the receiver is being used out-of-doors.

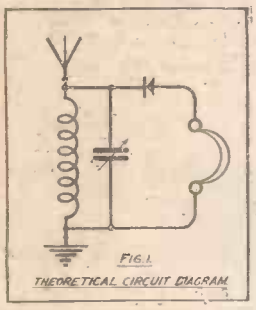


FIG. 1.
THEORETICAL CIRCUIT DIAGRAM.

The tuning circuit of the receiver consists of a basket coil inductance shunted by a variable condenser of about ·0005 mfd. capacity. This condenser, due to the limited space available, consists of a single moving vane, working between two fixed vanes separated by mica sheets. The vanes are fixed so close to one another that practically no air space is left between them, thus providing a high capacity.

The lay-out of the panel is shown in Fig. 2, drawn to the given scale, from which the positions of the necessary holes can be marked on the ebonite sheet, which is 3¼ in. by 4⅜ in., and 3/16 in. thick. The panel is given a matt finish, after necessary drilling, by rubbing its surface with fine glass paper.

The components, which will be described later, are fitted on the panel, which is then wired with No. 18 S.W.G. square tinned copper wire. Fig. 3 shows the actual wiring of the panel, while the theoretical circuit diagram is shown in Fig. 1.

A medium-sized soldering iron will be found more useful than a larger one, as the latter is liable to make the components too hot and affect the insulating properties of the ebonite parts. Care should be taken that as little flux as possible is used, in fact, it will be much better to solder the terminals and the ends of the connecting wires separately, and to remove the extra flux with a rag before making the actual joint.

The ribbon aerial is wound on an ebonite disc.

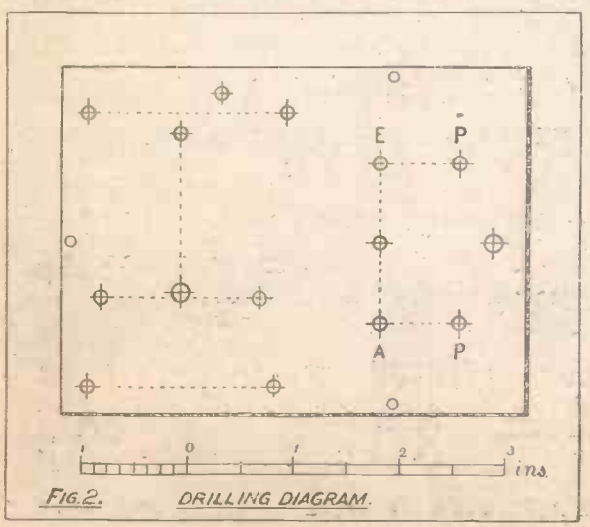


FIG. 2. DRILLING DIAGRAM.

The inductance consists of 50 turns of No. 32 S.W.G., D.C.C. copper wire, wound on a thin ebonite former of 2 in. diameter with 9 slots cut in it each ⅜ in. deep. When wound the coil is coated thinly with shellac varnish to keep the wires in position and free from the accumulation of dust. The exact shape of the coil is given in Fig. 3, and is shown in dotted lines to avoid confusion.

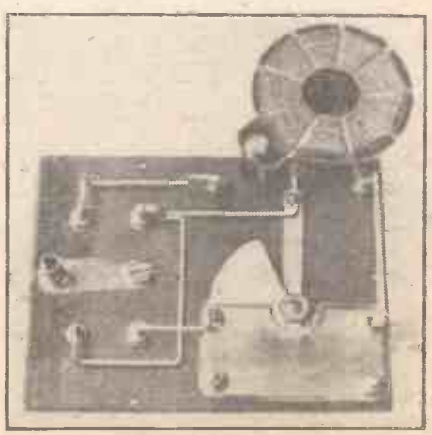
Close up view of the panel.

Fig. 6 shows the constructional details of the variable condenser. The moving vane, V, is fixed to the central 2 B.A. rod by means of two nuts, to which is also attached the pointer, I, and the adjusting knob, Q. The fixed vanes, F, of brass are cut rectangular in shape, and are separated from the moving vane, which is also of brass, by thin sheets of mica, M, projecting 1/16 in. beyond the fixed vanes.

The Variable Condenser.

These vanes are fixed to the panel by two screws and nuts, N, and separated from the panel by small pieces of ebonite tube, L, ¼ in. long, but nuts can be used instead as shown in the enlarged diagram, which gives the details of fixing the condenser to the panel. The free corners of the fixed vanes are kept in position by soldering brass clips, S, which also serve for soldering the connecting wires to the fixed vanes. The connection to the moving vane is made by soldering the connecting

(*Continued on page* 34.)



Back of panel wiring.

AMATEUR'S PORTABLE CRYSTAL SET.

(Continued from page 33.)

wire to one end of the brass strip, O, as shown in Fig. 3.

Using thin mica sheets and a little skill, it is possible to get a capacity more than ·0005 mfd., but a condenser ordinarily made will give a capacity of about ·0005 mfd. Stops must be fixed on the panel in such a position that the vane can only move through 165° and in the lowest position of the pointer; about one-tenth of the moving vane should be inside the fixed vanes. This is essential as the moving vane will not go in between the mica sheets if completely taken out. This means a permanent small capacity in parallel with the inductance which is consequently wound with only 50 turns of wire.

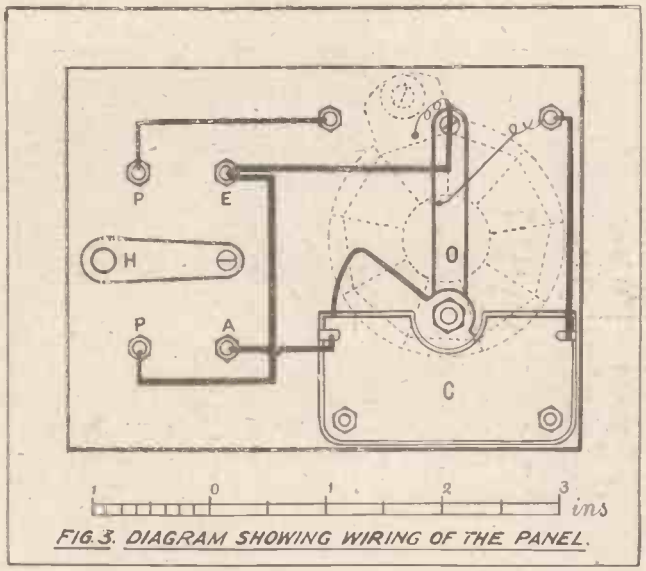
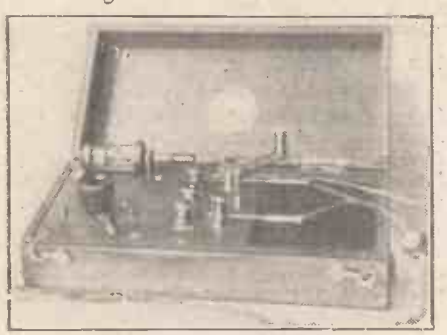


FIG. 3. DIAGRAM SHOWING WIRING OF THE PANEL.



The set connected with 'phones.

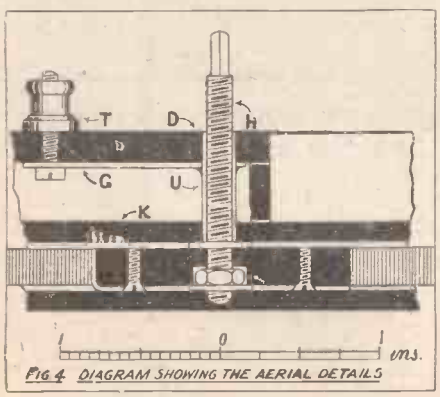


FIG. 4. DIAGRAM SHOWING THE AERIAL DETAILS.

The details of the aerial are shown in Fig. 4. It consists of an ebonite disc 1⅝ in. diameter and ¼ in. thick, fixed at one end of a 2 B. A. rod, H. A brass strip ½ in. wide, soldered to the end of the rod with a nut to strengthen the soldered point, is screwed to the ebonite disc. One end of the strip is bent over the disc to which is soldered one end of the brass ribbon serving as an aerial.

Thus, the ribbon is in electrical contact with the central rod, H, which fits in a short length of brass tube, U, connected to the terminal, T, by means of a brass strip, G.

The terminal, T, where necessary, can be connected to the aerial terminal of the receiver either by a flat brass strip, as shown in the diagram, or by a short length of copper wire.

For winding the aerial ribbon on to the ebonite disc, a detachable handle is used, which in its simplest form may consist of a brass strip with a square hole at one end to fit the squared end of the rod, H, and a valve socket soldered at the other end. Fig. 7 also shows the method of fixing the aerial and the details concerning the ebonite handle, R, fixed to the free end of the aerial ribbon. The handle is provided with a forked brass strip which fits into two narrow vertical strips, B, in order to keep it in position. The vertical strips, B, also prevent the brass ribbon from twisting.

The components, when fitted on the panel, should have an appearance as shown in Fig. 5. The aerial and earth terminals are marked A and E respectively, while those marked P are used for the 'phones. H is the central rod of the aerial, to which is attached the handle for winding the ribbon. The variable condenser for tuning is marked C, while the crystal detector is fitted on the left-hand top corner of the panel.

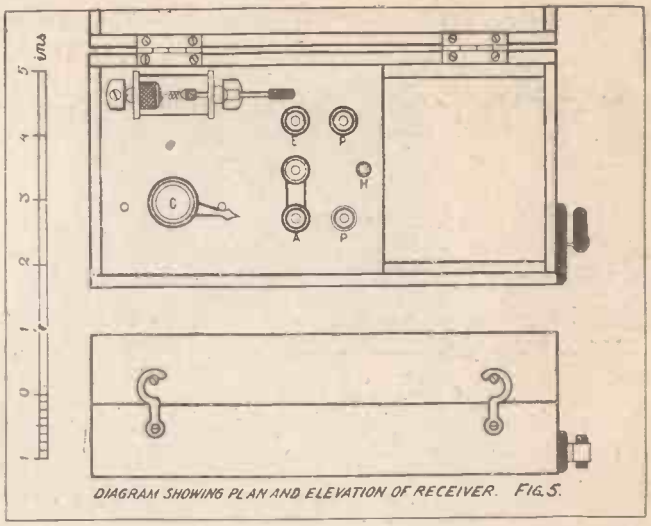


DIAGRAM SHOWING PLAN AND ELEVATION OF RECEIVER. FIG. 5.

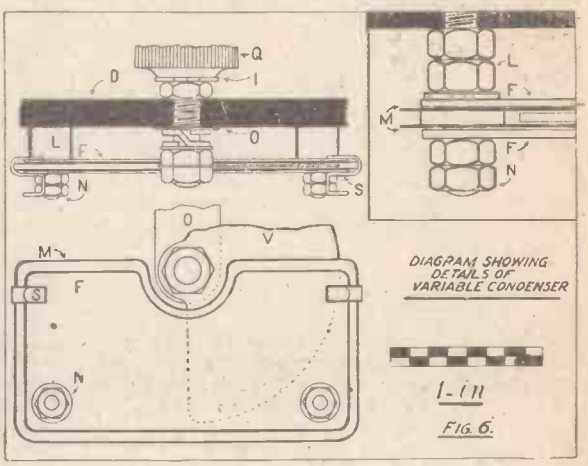
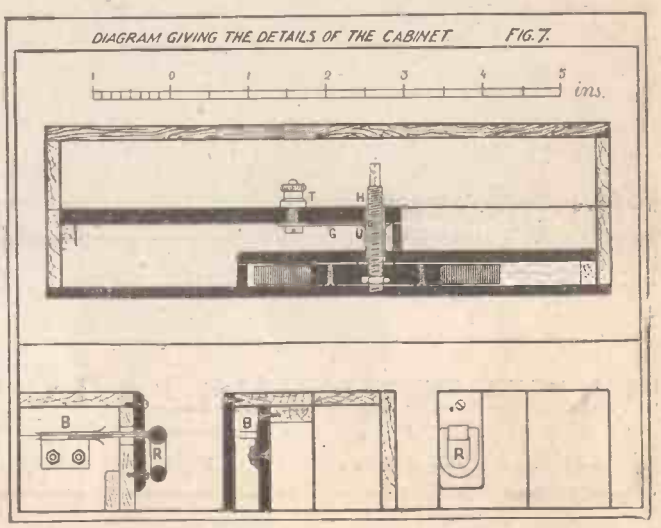


FIG. 6.

In order to make the cabinet compact it was necessary to use an ebonite sheet, ⅛ in. thick, as its bottom. The constructional details are better shown in Figs. 5 and 7, all the ebonite parts being

(Continued on page 37.)



ELECTRIC TELEVISION.

The Position To-day.

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

THE problem of reproducing visible images at a distance by electrical means is one that has appealed to the inventor as the logical outcome of the transmission of speech and music which is now so popular a development of wireless telephony. The man in the street has a most confused idea as to what television really is, which, after all, is not surprising.

There has been a quite understandable mistake current in the confusion of electric telephotography, the mere copying of a fixed picture, and television, which is, of course, the art of seeing the living scene in its actuality.

Years ago photography was a great marvel, and the ultimate development of the art has materialised in the production of living pictures.

These, as is well known, are a reproduction of past scenes, and bear the same relationship to television as the gramophone does to wireless telephony—i.e. the reproduction of permanent records of bygone events.

What the inventor is attempting to achieve is the simultaneous transmission and reception of scenes at the living moment, which factor undoubtedly makes wireless telephony so fascinating, and so far ahead of any reproduction of "back numbers." Just as in radio telephony we must have the "electric ear"—the microphone—so in television we require the "electric eye" which nature has bestowed upon us in the element selenium.

This mineral possesses the remarkable quality of changing its electrical resistance in response to the action of light, very much as the microphone varies in resistance in response to sound. Very considerable progress has been made in the Baird system of television, which in its present state is capable of transmitting images and reproducing them in visible form by electrical means.

A ten-valve super-heterodyne receiver of novel design. It includes a special four valve resistance complex amplifier.

The Baird System.

In this system the image is picked up by a revolving disc, on which is mounted an optical system of sixteen lenses arranged in spiral form.

These lenses traverse the image and feed it piece by piece through a revolving serrated disc, which sets up "beats" of light, on to a light-sensitive cell.

A local battery in this circuit therefore sends feeble currents which naturally vary in intensity in proportion to the intensity of the light-waves.

These feeble currents are passed through six stages of low-frequency amplification, and if a telephone is placed in circuit varying notes are audible, ranging from a deep note at the darker end up to a shrill whistle at the lighter end of the scale.

If a neon, or other suitable lamp, is put in circuit, in place of the 'phones, a pulsating illumination is set up, varying in intensity with the light which is reflected from the various portions of the transmitted image. At this point we naturally receive only a series of light waves which, while representing the light values of the image, convey no meaning to the eye.

To build up the disintegrated image we have to fall back upon the physical property of the human eye known as "persistence of vision."

This property is taken advantage of in the optical illusion known as cinematography which gives the beholder the impression of seing "living pictures."

In the Baird system a third revolving disc is employed in which slots pass in rapid succession between the eye and the illuminant.

This "integrating" disc builds up the image again which, after being passed through the circuit as a series of electrical impulses, appears to the eye in its original form. So far as the principle has been seen demonstrated, by the writer, conductors have been used between the transmitter and the receiver.

The system, however, has been reduced to two wire working, and, as it is only necessary to send "notes" representing light values, the transmission of the image by wireless over distances within the bounds of pure telephony appears to be perfectly feasible.

For projection on a screen the slots in the integrating disc would be replaced by an optical system similar to that employed in the transmitting disc and a high-power illuminant used.

This, briefly, then, is the principle of this interesting contribution to the science of television, which in the near future promises to bring the distant scenes into our homes by the agency of wireless.

In conclusion it should be particularly borne in mind that the system described is capable of transmitting images by *reflected* light and not silhouettes or shadows only.

This elementary stage has been passed and, while the results are at present admittedly crude, and produced by apparatus which leaves much to be desired, the system does at least demonstrate the practicability of its claims in reproducing actual images; which crude facts are worth any amount of the academic speculations so often voiced by the high-brow and the dreamer.

AMATEURS' PORTABLE CRYSTAL SET.

(*Continued from page* 34.)

sectioned black. The lower half of the cabinet is $1\frac{1}{8}$ in. high, while the lid has a height of $1\frac{1}{16}$ in., thus making the total height of the receiver $2\frac{3}{16}$ in., which is $7\frac{1}{4}$ in. long and $3\frac{5}{8}$ in. broad. The wood used for the cabinet was three-ply mahogany $\frac{3}{16}$ in. thick. Further constructional details are given in the accompanying photographs and diagrams, which are drawn to the given scales, and no difficulty should be experienced in making the receiver.

For listening purposes the brass ribbon is stretched across the room, using an ordinary nail or a hook as the support, while a water pipe can be used as an earth. The tuning can be affected by adjustment of the condenser until the loudest signals are heard.

A Good Earth Essential.

The receiver can be successfully used on the river or on other outdoor trips up to a distance of about twelve to fifteen miles from a broadcasting centre. The earth connection employed should be efficient, as this is vitally important for satisfactory reception. In case of the river the earthing question is easily solved by tying a weight to the end of a bare copper wire and letting it sink in the water, while the other end is attached to the earth terminal of the receiver.

The finished set closed up.

Where no river is available a long brass rod sharpened at one end can be driven into wet or moist soil, and the wire attached from the end of this to the receiver.

The receiver has been made extremely compact, so that it can be easily carried in the pocket, and it is for this reason that a single earphone is included in the box, as a pair of 'phones will probably require a space equal to the complete receiver itself.

The receiver, when used in a room worked a pair of 'phones, when 20 feet of the aerial ribbon was outside it; the earth used was an ordinary gas pipe.

Artistes of the Aether

By "Ariel"

CHAMBER MUSIC—"SAMSON AND DELILAH" AT 2ZY—NEXT WEEK'S STARS.

EVERY week sees the gradual broadening of the various programmes, and as the prejudice of agents and managers is replaced by the belief in wireless as a sheer epic in advertisement, the scope and variety increases.

Classical Music.

Notwithstanding the sneers, and possibly just a few plaints for more "jazz," classical music is superabundant throughout the various stations, and 2LO once more chose one of the best in The Kutcher String Quartet, already well known to listeners, with whom it has attained as high a reputation as with the patrons of the classical concert halls. It was formed in 1923 by Samuel Kutcher, a virtuoso violinist, formerly a pupil of Albert Sammons, and a member of the Philharmonic String Quartet. Associated with him was the brilliant young 'cellist, John Barbirolli (who is now also conductor of the Guild of Singers and Players Chamber Orchestra), Mr. George Whitaker, and Mr. Leonard Rubenstein. At their first performance in London their rendering of the big quartets of Delius and César Franck established them amongst the chief of quartet players, and "The Times" likened their playing to that of the famous Joachim Quartet.

Mr. Samuel Kutcher.

Amongst the Vocalists.

2LO is also to be depended upon for its soloists, and last week again was heard Miss Elsie Suddaby. She is a great favourite, too, at Manchester, where she was one of the first artistes to broadcast at that station. Intended for a pianist, Miss Suddaby commenced her career by winning the Gold Medal of the Associated Board of the Royal College of Music, then finding herself possessed of a voice of exceptional range and tone, she settled down to perfect it, and her work before the microphone alone proves her wisdom.

Old-World Music.

Chamber music has become so marked a feature of our concerts that it is not surprising that some of the old-time instruments have been tried again, and have vied well with their modern prototypes. Everyone remembers the spinet and harpsichord solos of Mrs. Gordon Woodhouse at 2LO and the viola d'Amour solos by Percy Frostick at Leeds-Bradford station. The programme of Tuesday last of Old English Music was particularly appropriate, preceding as it did the "tabloid" version, if we may use the term, of the Lyric, Hammersmith, success, "The Beggar's Opera," with the music arranged by Frederick Austin, and the cast including the name of Frederick Ranalow. For the former part of the programme was engaged "The Chaplin Trio."

Mr. Edward Clark. (*Photo. Hay Wrightson.*)

These three sisters have become famous for this type of music, and Miss Nelly Chaplin at the harpsichord, Miss Kate at the viola d'Amour, and Miss Mabel with the viola de Gamba, may be said to have united two centuries in music.

Modern instrumental playing was represented on Friday by the well-known classical pianist, Phyllis Emanuel, and Peter Yorke on Saturday, the latter taking the place of the well-known pianist, Miss Toni Farrell.

Newcastle's Programmes.

Some excellent concerts have been given at this station, and one of the best announced was that of Monday when, instead of from the studio, it was to be broadcast from the Old Assembly Rooms. Some of the best known artistes in the musical world were included in the programme, amongst them the names of Miss May Blyth and Mr. Joseph Farrington of the B.N.O.C., Grace Ivell and Vivian Worth, and Mr. Percy Merriman of "The Roosters," with a play by the 5NO Repertory Theatre and solos on violoncello from Miss Hetty Page. We understand that all profits were divided among local charities.

Newcastle has, too, a fine musical director in the person of Mr. Clark. Son of Mr. James Clark, famous for his interest in Northern and provincial music, he has had the advantage of travelling and studying all over the world. Amongst his numerous recitals will be remembered those at Queen's and Wigmore Halls, London, last year.

Miss Phyllis Emanuel.

"Dramatic Wireless."

2ZY may be really called the pioneer of dramatic wireless, for most of the important plays have been broadcast from this station. As a change from the more serious drama Mr. Victor Smythe, assisted by Eric Fogg, produced a belated but nevertheless charming fairy pantomime, "Cinderella," on Friday last, with the 2ZY Repertory Company in full force.

To-morrow (Friday) the company present their sixth play of the series of monthly plays, "The Case of Lady Camber," by Horace Annesley Vachell. Playgoers will probably remember its success at the Savoy in 1915, and as it depends more on witty dialogue than actual situation, it is an excellent choice for broadcasting purposes. The play serves to introduce a new recruit to the 2ZY Dramatic Company in the person of Miss Mary Eastwood, who recently scored a success in a performance of "Discovery," given by the Unnamed Society.

Miss Elsie Suddaby.

On Saturday Manchester reverts to grand opera with a performance of "Samson and Delilah" (via 5XX also), the latter part being taken by a known favourite, Miss Enid Cruickshank, who also sings at 2LO next week. Included in the cast is Mr. Walter Widdop of the B.N.O.C., and Mr. Lee Thistlethwaite, the brilliant singer who has been so long connected with the musical side of Manchester's station.

Birmingham.

There is a distinct high-brow atmosphere at Birmingham for to-morrow (Friday), when the first act of "Boris Goudonov," by Alexander Pushkin, will be broadcast.

Stars of Next Week.

Amongst the artistes down for next week are Mr. Olly Oakley, the banjoist, with Mr. Frank Colley.

On Tuesday, Miss Vivvien Chatterton.

On Wednesday, The Philharmonic String Quartet, and Miss Wynne Ajello, Leonard Lovesey, and Joseph Farrington.

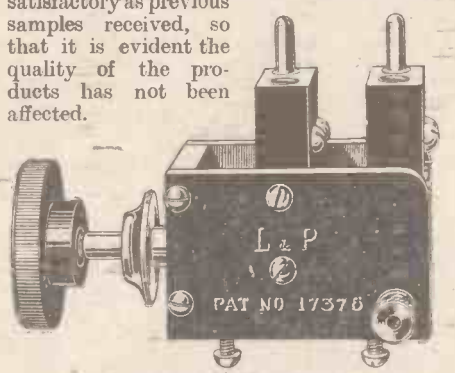
On Friday, Mr. Sydney Russell of the B.N.O.C., and on Sunday the great Wagnerian singer, Mr. Horace Stevens.

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

WITH the assistance of "Glazite," a new product of the London Electric Wire Co. and Smith's, Ltd., the wiring of a wireless set can be made quite striking in appearance. Glazite is a tinned copper wire, covered with an insulating material of a highly glazed nature. It is obtainable in four colours—red, blue, yellow, and black—at 1/6 per coil of 10 ft. Glazite is damp-proof and flame-proof, and its covering possesses excellent insulating properties. Samples have been sent us, and we have tested them very thoroughly and find the product to be well up to the standard expected of its very well-known makers. A receiver wired up with "Glazite" will look very nice, and doubtless it will be very easy indeed to follow the connections, but we trust it will not tend to make constructors careless in this most important part of their work. One thing about bare square section tinned copper wire, it does tend to make the amateur do his wiring slowly and methodically.

* * * *

We are informed that the firm of Cook and Co., of 76, Estcourt Road, S.E.25, has ceased to operate as such, and that the business has come under the sole proprietorship of Mr. George P. Cook, who will carry on its activities at 23, Brockenhurst Road, Addiscombe, Croydon. Mr. Cook sent us further samples of "Receptite" and "Hertzite" crystals, and these on test proved to be quite as sensitive and generally satisfactory as previous samples received, so that it is evident the quality of the products has not been affected.



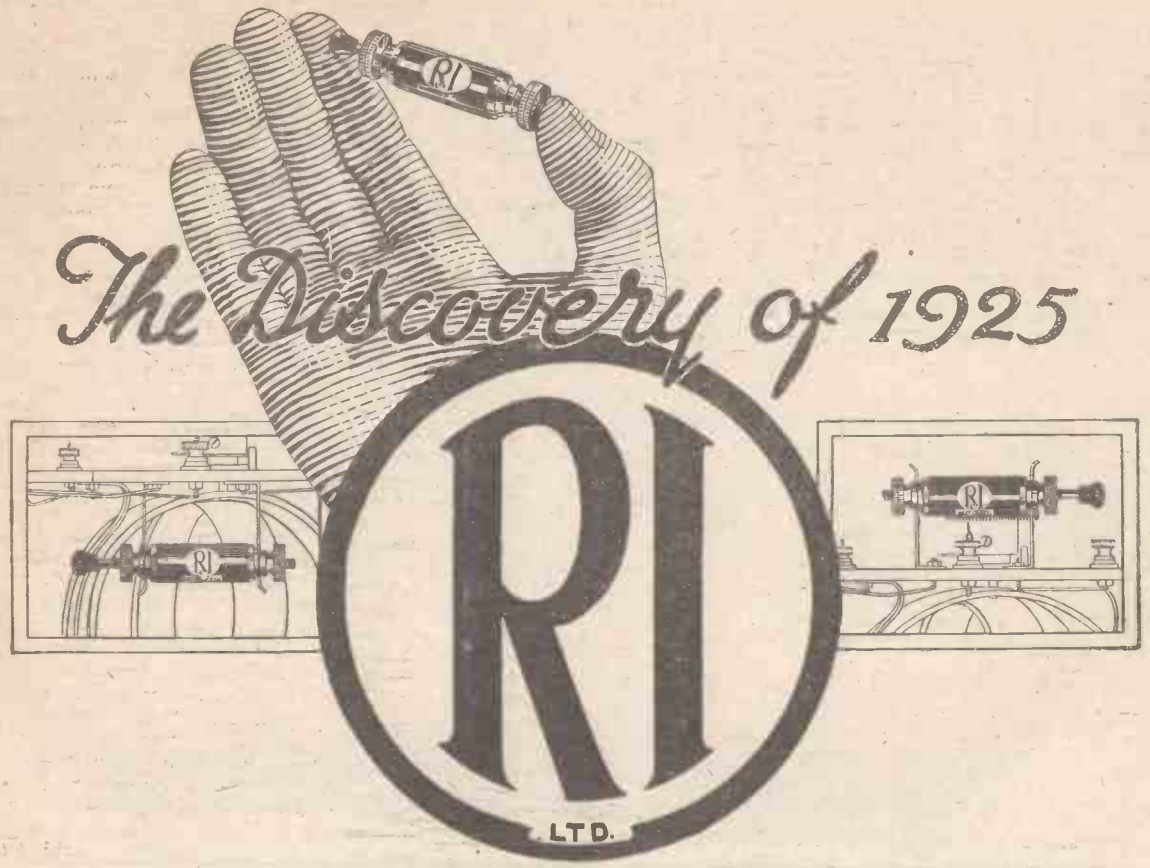
The L. and P. universal coil holder.

Messrs. The London and Provincial Radio Co., Ltd., recently sent us an "L and P" universal coil holder. It is a component particularly designed for baseboard mounting "American fashion," the moving coil falling backwards from the panel instead of sideways. The movement, which is particularly positive and smooth, is obtained by means of a "worm" gear, which, of course, is a reducing gear and enables a "vernier" action to be obtained; also it is impossible for the moving coil, however heavy it may be, to move a fraction of an inch unless the control knob is turned. It is very well made, and well worth 11/6—its retail price.

* * *

A permanent crystal detector originating from the famous house of Radio Instruments, Ltd., is sure to create more than usual interest. For some considerable time we have known of the existence of the R.I. P.M. (permanent mineral) detector, and to some extent the lengthy tests to which it was subjected before being placed on the market. The P.M. comprises two crystals, one of which is of a highly refractory nature, and of which but a small, sharp splinter is used; the other being a special alloy. These two crystals are kept in contact by means of a spring and plunger. The whole detector is quite small—being something of the size of a variable grid leak of average dimensions. Two types are obtainable, the one which is quite "permanent," and the other which is provided with a small "trigger" adjustment. The addition of this latter is, in our opinion, most commendable, and we strongly advise purchasers to choose the model that embodies it. Even the most perfect of

(*Continued on page 44.*)



THE DISCOVERY OF 1925

A CRYSTAL DETECTOR THAT DOES NOT REQUIRE ADJUSTMENT.

Only a wonderful scientific discovery, backed by the R.I. reputation, could have made this permanent mineral detector a possibility.

So many vain attempts have been made to attain the ideal of a detector, free from all adjustment, that the radio public have doubted that it could be ever achieved.

HERE IS THE WAY OF IT.

The combination of a new mineral of high refractive index, and another suitable mineral, were found to give perfect detection irrespective of surface condition and free from the bane of catswhiskers.

There is no question of hunting for the sensitive spot. It is always everywhere on this wonderful discovery. However, the spirit of the experimenter demands satisfaction, and so one of the elements is mounted with a trigger action to change the point of contact *if desired*, not if *necessary*.

As a proof of this, the manufacturers are prepared to supply the detector without the trigger adjustment.

The advantages of the P.M.

Absolute permanency under vibration.

Extreme sensitivity always everywhere.

Easy operation of any circuit in which it is employed.

Elimination of distortion if used as a rectifier.

Its inherent stability makes it particularly suitable for all valve and reflex circuit users. If you are interested, write for descriptive leaflet. If you are keen, buy one to-day.

The R.I. reputation is behind it.

Everybody is talking about this sensation of 1925. They will ask you if you have got one.

PRICE: including metal brackets and necessary screws for mounting 6/-

RI LTD

Contractors to the Admiralty and all Government Departments.

Radio Instruments Ltd
12 Hyde Street, Oxford Street
Telephone: REGENT 6214 (3 lines) W.C.1. Telegrams "Instradio London."

APPARATUS TESTED.

(*Continued from page 42.*)

permanent detectors are apt to become insensitive, or, at least, there is always a possibility or the *belief* that there is a possibility of such happening, whereas the mind is set at rest for all time by the inclusion of that little trigger which permits a new setting to be obtained should it be thought necessary.

We have tested the numerous samples of both types sent us by the R.I. people, and there is no doubt that the "P.M." is a good proposition. Not only is it a good *permanent* detector, acting perfectly well in both crystal and valve circuits, but it is a better all-round detector than the average. The combination is one of the most sensitive and stable ones yet devised. The R.I. people have undoubtedly scored another success, and we predict a popularity equalling that of the famous R.I. L.F. transformer for the R.I. P.M. crystal detector.

* * *

From Messrs. The Electron Co. Ltd., we have received a "Six-Sixty" dull emitter valve, fitted with the new thorium-covered molybdenum filament. It will be remembered that this was developed by Dr. Leonard Levy, M.A., and Mr. D. W. West, A.C.G.I. The "Six-Sixty" always was quite a good valve, and undoubtedly anything that tends to increase its efficiency is deserving of special note. On test very good results were obtained, and there was every evidence of quite extraordinary filament emissivity. The valve operates well in all three positions (H.F., det., L.F.) on an H.T. as low as 15 volts and up to considerably over 100 when used in a second L.F. stage. In this last position amplification proved to be such that the "Six-Sixty" could almost be termed a power valve.

* * *

For some reason transformer-coupling has hitherto been far more popular than resistance-capacity coupling, but lately the adherents of the latter method have grown rapidly in numbers, and there is every sign that the advantages of the system are becoming more and more widely appreciated. Most listeners have favoured transformer-coupling because of the voltage step-up obtainable in this way, but as low-ratio transformers are necessary for the final stages the gain here is less than is often supposed. Resistance-capacity coupling cannot give a voltage step-up, but it *can* give almost perfectly-distortionless amplification. We have just tested the new Polar resistance-capacity coupling unit, and the results were certainly very gratifying. Mounted upon an ordinary-sized fixed condenser, and standing only about 3 inches high, the instrument is not only compact in itself, but it has no large magnetic field to cause spacing troubles. The resistance is wire-wound, and is arranged so that the voltage difference between adjacent turns is small. The unit embodies a Mullard leak and a Dubilier condenser, and its terminals are arranged so that symmetrical wiring can connect the units and their valves with a minimum of trouble. On test the units gave perfectly clear L.F. amplification, and when three units were connected after the detector, the volume was just about equal to that given by two stages of L.F. transformer coupling. The price of the complete unit is 15/-, which compares very favourably with that of an L.F. transformer, but, of course, an extra H.T. voltage is necessary with resistance-capacity coupling (generally of the order of 120 volts, instead of the normal 60 or 80). Certainly the tone obtained is delightful, and the Polar resistance-capacity coupling unit will be warmly welcomed by those who prefer pure reproduction to volume, and the ease of symmetrical units to the difficulty of matching transformers.

* * *

Mr. Guy Vandervell, son of "C.A.V.," has been appointed head of the newly established wireless department of the famous firm identified by the above initials. He is a well-known racing motorist.

* * *

Messrs. Siemens Brothers and Co., Ltd., announce a reduction in the price of double headphone receivers to 20/-. This applies to any of the usual resistances, viz., 120, 2,000, and 4,000 ohms.

* * *

We regret to have to announce the death which occurred recently of Mr. J. S. Brown, one of the original managing directors of Brown Bros., Ltd., wireless manufacturers and wholesalers.

Made in three sizes

80/-
48/-
30/-

Don't just say "a loud speaker" —ask for a REVO *and be satisfied!*

THERE are loud speakers *and* loud speakers. Some are merely headpieces attached to a horn, some are just poorly sounding "gramaphones." Above all these towers the REVO in construction and performance. Carefully made with special non-resonating horn and superb magnets. Ask to hear one at your local dealers—you'll be amazed at its bell-like purity and absence of distortion. The Senior at 80/-, the Junior at 48/-, and the Baby at 30/-, we claim to be the best things in Loud Speaker value on the market, and guarantee them for 12 months.

The Telephones we guarantee for 12 months

So confident are we of the satisfaction that REVO Lightweight Telephones give that, like our Loud Speakers, *we guarantee them for 12 months.* Wonderfully sensitive, comfortable and robust, they are ideal headphones for long listening-in periods.

Price 19/6

If unable to obtain REVO goods locally write us direct :—

THE CABLE ACCESSORIES CO., LTD.
Tividale, Tipton, Staffs.

"Revo"

"The Name for Perfect Radio"

Prove this by your own knowledge

The reasoning behind the Bowyer-Lowe Square Law Condenser is so conclusive that it convinces every experimenter who follows it.

Your own experience tells you that the wave-length range of a Condenser depends on its capacity ratio ; that is, the ratio between its maximum and minimum capacity. Reduce the minimum capacity and up goes the ratio.

Now, the fixed plates of the Bowyer-Lowe Square Law Condenser present so little edge to the moving plates in the minimum position that the capacity ratio is equal to 150 to 1, the highest in wireless.

You know, too, that low losses make for richness and purity of reception. See how losses are reduced to a minimum in the Bowyer-Lowe Square Law Condenser through the use of Grade "A" Ebonite, careful design and scrupulous manufacturing methods. These things *must* result in better reception.

You understand how the square law effect makes a set selective and easy to calibrate. The Bowyer-Lowe Square Law Condenser is *no* larger than ordinary condensers. You can fit it in your sets without altering them in any way. *Therefore*, by installing this condenser you must be able to increase the efficiency of any set.

The Bowyer-Lowe Square Law is the ONLY Condenser which obtains the square law effect with INCREASED selectivity and REDUCED losses. Insist on having it in every receiver you make.

All good dealers sell it at prices from 11/6.

Bowyer-Lowe Tested SQUARE-LAW CONDENSERS

For best results use Bowyer-Lowe Condensers in conjunction with Bowyer-Lowe MATCHED H.F Transformers. Every one is guaranteed to match perfectly every other in the same range. All ranges and Neutrodyne model at uniform price of 7/-.

Write for our FREE Catalogue

containing 36 pp. of information about all the Bowyer-Lowe Tested Components with blanks for your notes. Send 1½d. stamp to cover postage.

Bowyer-Lowe Tested Radio Components

BOWYER-LOWE Co., Ltd., Letchworth.

-HULLO EVERYBODY!!-

ALL THESE GOODS SENT POST FREE (U.K. ONLY) EXCEPT WHERE MARKED. FOREIGN POST EXTRA. ORDERS DESPATCHED IN STRICT ROTATION AT EARLIEST POSSIBLE MOMENT.

AERIAL 7/22 100 ft. 3/-
Copper Strip 3/-
Allen Var. Grid Leak 1/9

BURNDEPT Detector 4/6
Basket Holders 1/3. 1/6
Battery Links. doz. 1/2
Bushes Ebonite 1/3

CRYSTALS each 1/6. Gilray, Permanite, Blue Label, Tungstalite

COIL STANDS 2-Way—
Vernier .. 4/6, 5/-. 5/6
Geared 5/11 Polar 6/-
Shipton Vernier .. 4/6
" Baby " ordinary 3/3
With ex. handles 3/6
Nickel " 4/-
Baby 3-way 4/3
Nickel " 5/6
Vernier 3-way .. 6/6
Shipton V. 8/-

COILS D.C.C.
For Chelmsford .. 1/11
With Adapter .. 2/8
Extra Large Air-Spaced Set of 5 Duplex D.C.C. Coils, 25,35, 50, 75, 100 2/9
Coil Plugs, Wedge, pr. 2/-
Edison Bell 2 for 2/6
Plugs with Fibre 1/-

DETECTORS (Enclosed)
Micrometer 2/6
Nickel. Large.. .. 2/6
Brass 2/-
Burndept 4/6
Mic. Met. 6/-

FIXED CONDENSERS
EDISON BELL—
·001 to ·0005 each 1/3
·002 to ·006 each 2/-
Grid Leaks and clips 1/6
Dubilier ·001 to ·006 ea. 3/-
·0001 to ·0005 each 2/6
Grid Leak, 2 meg. 2/6
·01 for L.S. 7/6
Anode Resistance on stand, 70,000, 80,000, or 100,000 each 5/6
McMichaels' 2-meg. Leak and Clips .. 2/6
100,000-ohm Res. 2/6

RAYMOND (Ebonite Base)
·001 to ·0005 each 1/1
·002 to ·006 each 1/3
·01 or ·02 each 1/9
(Mansbridge Elsewhere.)
Flex, 2 colour, 12 yd. 2/6
Lighting .. 12 yd. 2/-

COSWELL QUALITY
Valve Legs, Set 4 .. 1/3
Valve Holder 1/9
2-way Cam Vernier 9/-
3-way Cam Vernier 12/6
3-way Ordinary .. 7/6
2-way Panel 3/-
3-way Panel 5/-
Basket Holders .. 1/4

H.F. TRANSFORMERS
McMichael's 300/600 10/-
" 1100/3000 10/-
Energo. 250/700 .. 3/11
" 450/1200 .. 4/3
" 900/2000 .. 4/6
Raymond B.B.C .. 2/9
" 5 X X .. 2/9

IGRANIC—Rheostat .. 4/6
30 ohms 7/-
Potentiometer .. 7/-
Variometer 10/6
Coils (all numbers)
25 .. 5/- 35 .. 5/-
50 .. 5/3 75 .. 5/6
100 .. 7/- 150 .. 7/10
200 .. 8/8 250 .. 9/-
300 .. 9/5 400 .. 10/3
500 .. 10/6

LISSEN—Minor .. 3/6
Stat 7/6
Universal 10/6
Switch 2-way 2/9
Series Parallel 3/9
Anode Res. 2/6
Var. Grid Leak .. 2/6
Choke 10/6
L.F. T.1 .. .. 30/-
T.2 .. .. 25/-
L.F. T.3 .. .. .. 16/6
Coils—
25 .. 4/10 35, 40, 4 10
50 .. 5/- 60 .. 5/4
75 .. 5/4 100 .. 6/9
150 .. 7/- 200 .. 8/5

LOUD SPEAKERS
C.A.V. Tom Tit .. 30 -
C.A.V. Junior .. 55/-
Sterling Baby .. 55/-
Sterling Dinkie .. 30/-
Amplion Junior .. 27/6
Amplion Dragonfly 25/-
All models stocked of leading makers.

POLAR CONDENSERS
·001, ·0005 or ·0003 10/6
Micrometer .. 5/6
2-way Junior .. 6/-

RHEOSTATS
One hole fixing .. 1/6
C. & S. do. 1/5
De Luxe and Dial .. 2/6
Burndept 4/6
McMichael Dual .. 7/6
Shipton Strip—
7 ohm (with fuse) 3/6
30 or 60 ohm .. 3/6
Potentiometer 600 ohms 4/6
Crown for DE or R 2/6
L.E.S. Micro Control 3/6
T.C.B. 6, 13, 30 ohms 4/-
Potentiometer 300 ohms 5/-

SWITCHES
Panel DPDT 1/6
Panel SPDT 1/4
Ebonite DPDT .. 2/6
Ebonite SPDT .. 1/9
Simplex Lead in .. 1/9
Sq. Bus Bar .. 1/-
Switch Arms 1/6
(Inc. studs and nuts.)

TERMINALS
Phone or W.O. doz. 1/9
Pillar large .. doz. 1/9
Pillar medium .. doz. 1/3
Nickel 6d. doz. extra.
(All with nuts)

TRANSFORMERS L.F.
Ferranti 17/6
Igranic 21/-
R.I. 25/-
Ormond 14/-
J.R.C. 83 .. .. 15/-
Super Success .. 21/-
Standard Success .. 16/-
Brunet Shrouded .. 13/6
Formo Shrouded .. 18/-
Formo open 12/6
French 9/3

VALVE HOLDERS
Murray Anticap .. 1/3
Legless Anticap .. 1/3
Bretwood 1/9
Solid Rod Standard 1/3
Goswell 1/6

VALVES
Myers Universal .. 11/-
French " R " .. 7/6
Dutch Detector .. 5/6
Dutch " R " 5/11
Metal ·06 .. .. 13/11
Radio Micro ·06 .. 13/11
Marconi, Ediswan, B.T.H., Cossor, Mullard, etc.
BRITISH VALVES.
All bright emitters.
11/-
D.E.R. all makes 18/-
·06, all makes .. 21/-
Power valves 22/6 to 30/-
AS PER MAKERS' LISTS.
Valves posted buyer's risk.

" FINSTON "
Fixed Condensers. Wonderful Line.
·001 to ·0005 .. 1/3
·002 to ·006 .. 2,1
" FINSTON "
Filament Rheostat with dial 2/-

WATMEL
Var. gd. Leak .. 2/6
Anode Res. .. 3/6

WATES MICROSTAT
New Improved Model. Post Free. **2/9**

BRETWOOD
New Model, variable grid leak 3/-
Anode Resistance .. 3/-
Anti-Cap Switch .. 5/-

TELEPHONE DISTRIBUTION BLOCKS. Table Pattern, takes 4 pairs of 'phones 3/6

ENERGO L.F. TRANSFORMER. For supreme Results, Efficiency, Finish, and Permanent Reliability. For 1st stage 15/-

THE MIC-MET SUPER CRYSTAL DETECTOR .. **6/-**

STERLING
Square Law and Vernier Variable Condensers.
·001 .. .. .. 30 6
·0005 .. .. .. 25/6
·00025 .. .. 23 6

GENUINE " BRUNET " L.F. Transformers.
Shrouded type.
Ration 5 : 1—5,000 Primary, 25,000 Secondary. 13 6 Post Free.
3 to 1 Ratio can be obtained.

BRETWOOD
Valve Holder .. 1/9
100 p.c. Efficiency. Eliminates poor reception. No soldering stop over or under panel.

HEADPHONES.

ERICSSON E. V.
CONTINENTAL.
Your favourite 'phones. Entirely NEW MODEL. Most beautifully finished, exquisite tone. Ridiculous Price. per pair (4000 ohms) **13/11**

BRUNET
New Model " TYPE D." Hygienic Horn Headbands. Nickel-plated Stirrup. Black and White Cord. Each receiver stamped with trade mark. 4000 ohms. per pair **16 6**

For the MAGIC HOUR ! When Fairyland becomes reality. Let the kiddies wear Featherweight 'phones.
BROWN'S "F" TYPE. 4000 ohms. **25/-** pair.

N and K
LATEST MODEL
Stamped N and K.
4000 ohms. **17/6**
(Price U.S.A. £2)
Limited number old model Stamped N and K. Post 6d. **12/11**

TELEFUNKEN
(GENUINE). Adjustable. 4000 ohms. Price **17/11**

SUPER L.F. (5-1) TRANSFORMER
Windings have insulated layers of 6 sections each, wonderful for amplification. Made in France, by the world's foremost firm. SPECIAL PRICE .. **10/-**

Genuine BRUNET L. F. TRANSFORMER
(Shrouded)
5-1 : 5,000 Primary turns, 25,000 Secondary turns. Post free 13/6

PERFECT RHEOSTATS
Shipton New Type Strip Rheostat, 7 ohms (with fuse) 3/-
Shipton New Type Strip Rheostat, 30 ohms .. 3/-
Shipton New Type Strip Rheostat, 60 ohms .. 3/-
Shipton Potentiometer, 600 ohm. 4/6

B.T.C.
Valve Holders.
Under panel 1/6
Over panel 1/9
Now Stocked.

THORPE K 4
5 pin valve
For Unidyne Circuit
Post Free **17/6**
5-pin holder **1/3**

"UTILITY" SWITCHES
2 Pole c/o Knob .. 4/-
2 Pole c/o Lever .. 5/-
4 Pole c/o Knob .. 6/-
4 Pole c/o Lever .. 7/6
Post 3d. each.

TELEFUNKEN TYPE
So Near to Originals You can scarcely tell the difference except not adjustable. 4000 ohms. Pair **10/9**

£50 REWARD !
given if the
DR. NESPER
PHONES SOLD HERE ARE NOT GENUINE ! BEWARE OF FRAUDULENT IMITATIONS ! !
(Injunctions obtained)
Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head. Per Pair. **12/11** Post 3d. pair.

Brandes Matched Tone.
4,000 ohms .. 20/-
B.T.H., ditto. .. 20/-
Siemens, ditto. .. 20/-
Sterling, ditto .. 25/-
G.R.C., ditto. .. 20/-
BROWN'S Featherweight 4,000 ohms 20/-

QUALITY (GOSWELL) RADIO COILS
Far more efficient than honeycomb or any other type of coil. Exceedingly strong and rigid, mounted on standard ebonite plugs. Brown finish, no wax or shellac used. MOUNTED

25 .. 1/6
35 .. 1/9
50 .. 2/0
75 .. 2/3
100 .. 2/9
150 .. 3/0
175 .. 3/6
200 .. 3/9 Post 3d. Coil

MANSBRIDGE CONDENSERS
Octupus, Tested at 350 v.D.C.
·01 .. 2/3 T.C.C.
·25 .. 3/- 2 mfd. 5/-
1 mfd. 3/8 1 mfd. 3/1
2 mfd. 4/6 ·25 .. 3/6
Post 2d. each.

"WONDER" AERIAL WIRE
49 Strands Special Alloy Phosphor Bronze.
For Frame, Indoor, or Outdoor Aerial.
100 feet 3/6
Post 2d.

RAYMOND
"LIGHT AS A FEATHER"
4000 ohms.
Post 6d. **8/11**

ACCUMULATORS
FOR CALLERS ONLY at present.

Rheostat, with Dial, extra value, 2/-

Bretwood Valve-holder. 1/9

Manchester, " Powquip," 15/6

Ormond 14/6

Shrouded "Powquip," 18/-

Standard "Powquip," 14/6

"R.I." NEW MODEL IN SEALED BOX
Don't Buy Otherwise.
Post **25/-** Free

FERRANTI L.F.

BETTER THAN THE BEST 17/6

IMPORTANT NOTICE
TRADE COUNTER OPEN
will oblige you with any lines in stock, less 20% on Proprietary articles.
NO POST ORDERS TRADE.

EBONITE PANELS
3-16th in.
6×6..1/8 10×8..3/6
7×5..1/8 12×9..5/-
8×6..2/6 12×12..5/9
9×6..2/9 14×10..5/9

CRITERION CONCERT COILS.
Low Self Capacity. Every turn and layer airspaced. Perfect for Reaction. Mounted on Plug.
25 .. 2/- 50 .. 2/6
35 .. 2/3 75 .. 2/9
100 .. 3/-
SET OF 5 (25, 35, 50, 75, 100) 10/- Post 3d.

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!!-

RAYMOND VARIABLE CONDENSERS SQUARE LAW

One-hole fixing. EBONITE Bushes. Aluminium ends. Highly recommended.

Prices include Knob and Dial.

Post 6d. Set.

WITH VERNIER		WITHOUT VERNIER	
·001	8/9	·001	7/7
·0005	7/9	·0005	5/9
·0003	7/-	·0003	5/3
Ebonite ends 1/- extra.		Ebonite ends 1/- extra.	

DE LUXE ORDINARY

Complete with Knob & Dial

·001	alum. ends	6/11
·0005	,, ,,	5 6
·0003	,, ,,	4/11
·0002	,, ,,	4/6

POST 3d. Set.

TWIN CONDENSERS

Equal parts of ·0005, ·0003 and ·00025.

With Knob and Dial.

Ebon te Ends.

·0005	ebonite ends	18/11
·0003	,, ,,	12/6
·00025	,, ,,	12/6

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." Post 4d.

CALLERS! THESE 4 COLUMNS FOR YOU NO POST ORDERS FROM SAME

Warning! Note name RAYMOND on windows. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

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.

EBONITE, 3/16 in. Stock Sizes.

Cut to size	½d. sq. 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

¼ in. also Stocked.

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

TAPPED INDUCTANCE COIL

for Chelmsford. A Real Bargain 1/6

WEDGE COIL PLUGS

Fitted Fibre	7d.
Various	7d., 8d., 9d.
Edison Bell	11d.
Plaincoil Plugs	4½d.
Also 5d., 6d., 7d. each.	
Fibre Strip	2d.

(36 in. by 1 in.).

Empire Tape, doz. yds. 6d.

RAYMOND FIXED CONDENSERS

·001, ·0001 to ·0005 10d.
·002, ·003, ·004 .. 1/-
·006, 1/3; ·01, 1/9; ·02, 1/6

Ebonite Base Terminals.

DETECTORS (Enclosed).

Micrometer	1/6
Half Opal	1/-
Small Brass	8d.
Large Brass	1/-, 1/3
Nickel	10d. to 1/6
Buradept	4/-

Crystals Stocked.
Blue Tungstalite, Permanite
Shaw's Genuine Hertzite .. 10d.
Uralium .. 1/-
All known makes.
4 Whiskers (1 gold) 2d.
Gold and Silver do. 2d.
7 Waxed Coils 1/8
5 Waxless Coils 1/3
For B.B.C.

SPECIAL!

Vernier 2-way Coil Stands .. 3/6
Geared do. .. 5/3

BOXES from 1/11

7×5 9×6 12×9 14×10
8×6 10×8 12×10 etc.

H.T. BATTERIES

60 v.	7/6
30 v.	4/6
60 B.B.C.	8/11
30 B.B.C.	5/6
9 v. B.B.C.	2/6
1·5 (D.E.)	1/9

Eveready 66 v., 36 v., 108 v. stocked.

D.C.C. WIRE per ½ lb.

18 or 20 g.	9d.
22 g.	10d.
24 g.	11d.
26 g.	1/-
28 g.	1 2

16 D.C.C. 2,6 lb.

BASKET COILS

Chelmsford .. 11d.
Also at 1/-, 1 3, 1/6
B.B.C. Duplex Waxless set of 5 1/6
Extra air space, ½ in. (25, 35, 50, 75, 100).
Wave-lengths given.

GOSWELL QUALITY COILS

Mounted on Plug.

25	1/6	100	2/9
35	1 9	150	3/-
50	2/-	175	3/6
75	2 3	200	3/9

Why pay high prices?

SWITCHES

D P D T, china base	1 4
S P D T ,, ,,	10½d.
Panel D P D T	1/-
,, S P D T	10½d
Ebonite D P D T	2/3
,, S P D T	1/3
Tumbler	1/-
On and off	10½d.

VALVE HOLDERS

Legless	1/-
Solid Rod	1/-
Climax	1/6
Murray	1/3
Under Panel	1 3
Templates	1½d.

NEUTRODYNE CONDENSERS

Ormond	2/-
Colvern	3/6
Success	3/6
Vernier (Colvern)	2,6

WARNING!

Customers entering premises adjoining without seeing the name RAYMOND on windows, do so at their own risk.

SPECIAL!

Leatherette Boxes with Lid .. 2/3 and 2/11
Re-echo Crystal Sets .. 13/11

VARIOMETERS

Inside Winding	6/11
Edison Bell	10/-
Igranic	10/-
Very good value	1/6

Many others

HEADPHONES

N & K Model 4,000	8/11
Telefunken Type	8/11
Lightweight	7/11
Dr. Nesper	11/9
Ericsson EV	11/9

VALVES

Dutch Detectors	4/6
"R" type	4/6
·06 Dutch	11/-
Phillips "R"	6 6
French "R"	5/11

RADIO MICRO ·06 THE WONDER VALVE

H.T., L.T., or D. 3 volts. 11/-

METAL ·06

Be sure "METAL" is Stamped on Valve and avoid imitations.

One to each Customer at 10/- Regular Price 11/-

ALL VALVES REDUCED

(Marconi, Ediswan, Mullard, Cossor, Myers, etc.

VARIOMETERS

Very Special 200/650 metres. All ebonite. Double silk wound, callers only 4/-

TERMINALS (Complete)

W.O., Pillar, 'Phone, brass, 1d. each; nickel, 2d. each; stop and valve Pins, ½d.; nuts, various, 6 a 1d.
Valve Sockets 1d., 1½d.
Flush panel do. 1d.
Spade Tags .. 6 a 1d.
Do. Terminals 2 for 1½
do. Pins 2 for 1½d.
Screws and nuts 2 a 1d.
Switch arms .. 7d.
Nickel arms .. 10½d.
Studs, complete 2 a 1d.
'Phone connectors 1d.
2 B.A. Rod ft. 2d.
4 B.A. Rod ft. 2d.
Valve windows .. 4d.
Washers .. 12 a 1d.
Shorting plug and socket .. .. 3½d.
Shellac .. .. 5d.

H.F. TRANSFORMERS

For Chelmsford .. 2/9
For B.B.C. range 2/6
Energo, McMichael, Bowyer-Lowe stocked.

MANSBRIDGE FIXED T.T.C. GREEN

·25	2/9
1 mfd.	3/6
2 mfd.	4/6

CALLERS' SNIP SQUARE LAW VARIABLE CONDENSERS

·0005	5/-
·0003	4 11

Complete with Knob and Dial.

Var. gd.-Leaks	1/-
Fixed 2 meg.	9d.
Battery Links	3 for 2d.
Ins. Hooks	2 for 1½d.
Egg Insulators	1d.
Reel ,,	2 for 1½d.
Ins. Staples	5 a 1d.
6ft. 'phone cords	1/-, 1/3
Sleeving	3 yards 9d.
Tinned Copper 18 g.	5d.
½ Bus bar, hank	6d.
Knobs, 2 B.A.	2d.
Wander Plugs	1½d.
Strip Aerial, 100 ft.	2/-
7/22 Heavy, 100 ft.	1/10

COIL STANDS

Ebonite, 2-way	1/9
With ex. handles	2/3
Nickel ,,	2/8
3-way	from 3/11
Basket Holders	8½d.
Best quality	1/-
Basket spikes	7d., 9d.
Anti cap. handles	9d.
Lead-in Tubes	6d.
Sorbo Ear Caps pr.	1/3

2-col. Flex, 36 ft.	1/6
Lighting do. 36 ft.	1/6
Twin silk doz. yds.	1/-
Lead-in, thick, yd.	3d.
Do., good, 10 yds.	1/-

Rheostats, C. & S.	1/-
Ormond	1/9
Ebonite Former	1/6
With dial	1/11

Shipton, Igranic, Burndept, McMichael, etc.

SPECIAL!

Customers purchasing 20/- worth of our own goods (at full prices only) are allowed to buy a first-class pair of phones for 5/-, 4,000 ohms, as an advertisement. One pair to each customer. This offer must be taken advantage of at time of purchase.

VALVES for UNIDYNE Circuit 11/-

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.

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 and 1/- per full wiring diagram. 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 question 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

R. M. L. (Manchester).—I have built the "Household Loud Speaker Set" described in "P.W." of Feb. 7th, except for the purchasing and wiring up of the L.F. transformers. As no particular makes seemed to be advised I decided to write and ask whether it was an important feature or whether any type of transformer would do.

The exact make, so long as it is a good one, is not important, but for best results the transformers should be chosen for the task they have to perform. For instance, the second transformer should be properly designed for second stage amplification, or distortion may occur. You should stipulate a second stage transformer when ordering, or else buy one of about 2·7 or 3 to one ratio. If distortion occurs a ·002 mfd. fixed condenser across the primary of the second transformer may help, while a power valve should be used for the last valve if good reproduction is to be obtained.

* * *

D. M. T. (Chesham).—I wish to build a valve set capable of picking up most of the B.B.C. stations on 'phones. As this place is situated in a hollow a 3-valve receiver will probably be necessary. I should like to use the tuned anode method of H.F. coupling, and separate H.T. tappings for each valve. What apparatus shall I require (apart from H.T., L.T., valve and coils), and how shall I connect it up?

The necessary components are as follow: 3 fil. rheostats, 3 valve holders, 1 two-coil holder, 1 single coil holder, 1 L.F. transformer, 4 : 1 or 5 : 1 ratio, 1 grid condenser and grid leak, arranged so that the grid leak can be connected to L.T. instead of across the condenser, ·0005 mfd. variable condenser, ·00025 variable condenser, 1·001 mfd. fixed condenser, 4 H.T. wander plugs, 1 D.P.D.T. switch, and about 10-12 terminals and wire for connecting up the set. The point to point wiring is given below, the series parallel switch being included. Aerial terminal to centre of ·0005 variable condenser, and to top right of D.P.D.T. switch. (The switch is pictured as lying on the panel so that its 6 connections form three vertical columns of 2 points each. The arm therefore moves from left to right and vice-versa.)

Other side of condenser to top left of switch and to bottom centre.

Top centre of switch to aerial coil and grid of 1st valve, and bottom right of switch to aerial coil (other end) and earth terminal. The bottom left of

(*Continued on page* 50.)

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 48.)

switch is not connected to anything. (Double coil holder used for aerial coil and reaction, of course.)

Continuing the circuit we have plate of 1st valve to one end of single coil holder (anode coil), and to one side of ·00025 variable condenser, and to one side of grid condenser. Other side of anode coil to other side of ·00025 condenser and to H.T. pos. wander plug. Other side of grid condenser to grid of second valve and to one end of grid leak.

Plate of second valve to one end of reaction coil, other side of which goes to O.P. of transformer. I.P. to H.T. + wander plug No. 2. The ·001 fixed condenser is connected one side to O.P. and one side to I.P. of L.F. transformer. I.S. of transformer to grid of third valve, plate of third valve to 'phones, and 'phones on to H.T. + wander plug No. 3. H.T. − to L.T. + and to earth. L.T. + to one side of two of the 3 fil. rheostats, and the other side of these two to one fil. connection on either of the 1st and 2nd valves. The remaining filament connections of the 1st two valves go to L.T. −. L.T. + goes also to free end of grid leak and to filament connection of 3rd valve. The remaining fil. leg of this valve is then connected to the fil. resistance (No. 3) and thence to L.T. −. The final connection is O.S. to L.T. −.

* * *

E. B. W. (Weston-super-Mare).—Having built a two-valve Unidyne, I am having trouble in making the valve oscillate when the L.F. valve is switched in. With the detector only, everything is quite O.K., but on switching the L.F. in I find very tight reaction coupling is necessary before the set will oscillate. Amplification seems to be O.K., and changing the connections of I.P. and O.P. and O.S. and I.S. of the transformer only decrease the amplification without assisting in the oscillation problem.

In all probability you would find that a ·002 mfd. fixed condenser across the I.P. and O.P. connections of the transformer would assist matters, while the reversal of the transformer itself may be beneficial. This means leaving the *connections* to the transformer as they are at present, but moving the whole instrument so that the secondary side faces where the primary used to face, and vice-versa. It has been found that occasionally the field of a transformer will oppose reaction, and until the transformer has been reversed all efforts at obtaining satisfactory reaction have been fruitless.

* * *

J. M. H. D. (Cheltenham).—Having a 3-valve set (H.F., det., and L.F.), I wish to add a 2-valve resistancecoupled amplifier. The last valve, of course, is now transformer

(*Continued on page* 51.)

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement is now in force:—

(1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.

(2) A charge of 1/- is made for supplying full wiring diagrams.

(3) All queries, together with postal orders and stamped addressed envelope, to be addressed to—

TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.

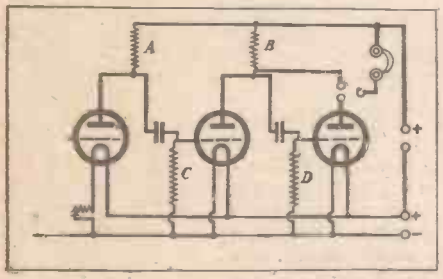
(4) Technical queries will not be answered by telephone.

RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page 50.*)

coupled, so that I presume the plate of that valve will go to the resistance coupling for the first resistance coupled valve. Will it be possible to switch off the last valve so as to use one resistance-coupled valve only ?

The required circuit is enclosed, and the grid of the first valve shown is the grid of your present L.F. valve, coming from the L.F. transformer, of course. Its plate should now be taken to A instead of to



'phones, and thence to H.T.+. This H.T.+ can have a common tapping with the other resistance-coupled valves, but should not be common with the H.F. and det. valves, as the resistance-coupled amplifiers need a much higher voltage than is necessary for H.F. and det. stages.

As regards the values of resistances and condensers, the following should be about correct :- A = 70,000 to 100,000 ohms, B = 70,000 – 100,000 ohms, C = ·5 – 1 megohm, D = ·5 – 1 megohm. The grid condensers in each case should be about ·02. mfd.

* * *

P. K. (Colchester).—I have made several ultra coils, and have used them with very good results. They certainly increase both signal strength and selectivity, but can an ultra coil be used as a wave-trap additionally to another coil-ultra or ordinary—for tuning ?

Yes, an ultra coil can be used in several ways purely as a wave-trap and additionally to an existing circuit. It can be placed in both series and shunt positions and it is both interesting and instructive to experiment with it in this manner. Further articles describing the numerous applications of an ultra coil will shortly appear in this journal.

* * *

A. D. P. (London, E.).—Are vernier condensers essential in the Super-selective circuit ?

Absolutely, and they should also be of the square-law type if possible.

OSCILLATING CRYSTALS.

(*Continued from page 10.*)

On switching in the 15-volt battery, a current of 4 to 10 milliamperes may pass through the contact. Sometimes oscillations will commence at once, and be heard in the telephone like the note of a very distant steam syren, or the whistle that announces 2 L O is about to broadcast. Sometimes these can be heard many yards away, with the telephones lying on the table, but a convenient position for them is round the neck. More often it is necessary to stir up the steel contact for a minute or two, with the point of a pen or anything handy, in order to start the oscillations.

To raise the note, cut out inductance or capacity in the oscillating circuit, or reduce the blocking resistance, so as to add to the volts on the crystal. It will be noticed that the oscillating are itself gives out the musical note, and when suitably mounted on a diaphragm, no ordinary telephone is wanted. In general, it will be found more difficult to keep the frequency constant than the amplitude ; or, in other words, the pitch than the loudness.

(*Continued on page 52.*)

OSCILLATING CRYSTALS.

(Continued from page 51.)

High-Frequency Oscillations.

Up to this point no difficulty will have been met with that a fairly able experimenter cannot easily overcome, but L.F. crystal oscillations are of no known use, except perhaps to make a buzzer wave-meter. The L.F. must be turned into high frequency before it can be used to amplify weak signals and to heterodyne. Also, it must be generated in a steady stream, not in bursts, even if the waves are of the right frequency and amplitude. We cannot amplify with a buzzer wave-meter, although we can tune-in with it. Steady sine wave oscillations from the crystal are most essential.

This difficulty of generating constant H.F. oscillations seems to be entirely one of obtaining a good point on a good crystal. It should be borne in mind that H.F. amplification, even with valves, is not easy. It will be found a simple matter to start a tuned H.F. circuit in oscillation when joined in parallel with an L.F., but not to switch off the latter without stopping the H.F. A two-stud switch should be used, with an idle stud in between, and neither inductance nor capacity should be common to the two circuits. Unless the L.F. is switched off, the H.F. can only be used for tuning-in purposes, not for heterodyning.

Amplification.

There can be no doubt the best purpose an oscillating crystal can serve would be to amplify weak broadcast telephony, so that it could be heard perhaps for another ten miles radius. If this could be done without alteration to existing crystal sets it would be an advantage, and luckily this is possible of accomplishment.

If the wireless signal is so weak as to be almost, or quite, inaudible—i.e. below the strength at which the galena or other rectifying crystal begins to rectify, the added energy from the crystal, though small, may cause the signal to be amplified many times, and heard when it would not be so otherwise. If then we put our oscillating crystal direct in the aerial circuit of an ordinary crystal receiver and shunt it with a battery and blocking resistance, on slowly and gradually raising the volts on the crystal we shall finally reach the top of the curve, where the resistance vanishes, and amplification will be called into operation by each H.F. wave that comes down the aerial, positively or negatively.

Any rectifying action there may be at the zincite should not oppose the rectifier in the set. The zincite should be joined to the aerial, the negative (zinc) pole of the battery to the zincite, and the steel to the galena of the ordinary rectifier.

It will be seen that the aerial current does its own tuning by a kind of trigger action in this circuit, but, of course, there remains amplification by means of a separately tuned, coupled oscillation circuit; and reception by slightly detuning one circuit so as to give a beat note of audible frequency. This method brings in C.W. signals, and probably explains why they have occasionally been heard with a crystal not known to be oscillating.

Low resistance crystals are said to work best for giving the necessary continuous stream of waves without which heterodyning is impossible.

Various circuits have been devised for rectifying and amplifying with one crystal only. Theoretically, it can be done by working just on the top of the curve, but it must always need great delicacy of adjustment, and may well be left out of consideration at present.

Transmission.

To anyone able to obtain a licence for transmission, there is no need to explain how to use an oscillating crystal for the purpose, after heterodyning with it has been mastered. The energy available must be small, as switching the oscillating circuit on or off makes very little difference to the current taken from the cells which give out, perhaps, one-twentieth of a watt when the crystal is oscillating freely.

Oscillation can seldom be started till the tick of a watch, placed close to the oscillator, can be heard microphonically; and when the oscillation note ceases the tick does also. With one particular crystal, a low note could be heard in the telephone with 3 milliamperes and became too high to be audible when 12 ma. was reached. An exceptional low-loss specimen began with 1½ ma. and became inaudible with 10 ma. With still more current it might be possible to tune-in some of the very long-wave stations without switching over to a separate H.F. circuit. L.F. crystal amplification still remains untried, so far as the writer is aware.

"D.X." WITH A UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Up to a week ago I regarded my Unidyne set as a common radio receiver, just about equal to an ordinary H.T. one-valve set. To-day I regard it as worth ten one-valve H.T. sets.

My set is a two-valve Unidyne in construction, but as yet I only use *one* valve. Owing to some slight defects I re-wired it, and now receive most excellent results. Last evening, after ten o'clock, I tuned in to Cardiff (twenty miles away), Bournemouth, Belfast, London, Petit Parisien, and two unknown foreign stations. All came through quite loud; in fact, all were as loud as I have usually got Cardiff, which means to say that every syllable was plain enough to be heard, without stopping the usual household talk.

Taking into consideration that I live in an area where it is considered a miracle almost to get 5 W A on a crystal, and no mean feat to get a one-valve H.T. set working, this is extremely good.

With a suitable transformer I hope to get my two valves working, and then I'll start a sort of S.P.U. (Society for the Propagation of Unidyne) in this area.

Thanking you for your most valuable discovery, and helpful articles in "P.W."

Yours respectfully,
N. LUKEY-DAVIES.

75, High Street, Mountain Ash, Glam.

(Continued on page 53.)

CORRESPONDENCE.

(Continued from page 52.)

EIGHT U.S. STATIONS IN ONE NIGHT.

The Editor, POPULAR WIRELESS,

Dear Sir,—I cannot allow the post-script to Mr. W. J. H. Croom's letter, in your issue for January 1st, to go unchallenged. In October I received the following eight American stations in a single night from 2.30 a.m. to 4.30 a.m.: W G Y, Schenectady, N.Y., 380 m.; W B Z, Springfield, Mass., 337 m.; K D K A, E. Pittsburg, Pa., 326 m.; W J A X, Cleveland, Ohio; W F I and W I P, Philadelphia, 395 and 509 m. respectively; W M A F S, Dartmouth, Mass., 360 m.; W E A F, New York City, N.Y., 492 m.; and in addition four others which I was unable to identify, owing to shortage of time. All were of good 'phone strength on two valves, W G Y, W B Z and W J A X coming in on the loud speaker, and with an extra stage of L.F. W B Z could be heard upstairs, and all the others, except W I P, were comfortably audible. In addition to these I have had W T A M, Cleveland, Ohio, 395 m.; W O R, Newark, N.J., 405 m.; C K A C, Montreal, Can., 425 m.; and another station, presumably on the west coast, of which I could only get the letters K W. Perhaps one of your readers may be able to identify it for me. Its wave-length was 330-340 m., date about 5 a.m., Dec. 14th last, and it was giving orchestral selections.

I can receive W G Y at almost any time after dark. The earliest time I have heard it is 7.15 p.m., and for the past week I have regularly had it at 11 p.m.—I experience no interference from either 2 Z Y or 6 B M.

The circuit is a special regenerative one with two stages of L.F. (with a switch for one or two at will). The last valve is very little used, as most of the B.B.C. come in quite loud enough on an Amplion Junior Loud Speaker for most rooms on the two valves (M O, D E R'S). Speech from 5 I T and 5 N G, the two nearest, can be distinctly and easily heard 100 yards from the mouth of the instrument.

Yours faithfully,

The Cot, Oxendon, Market Harborough. E. A. BLAND.

SAFEGUARDING OF BRITISH INDUSTRIES.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Concerning the scheme proposed by the Government for safeguarding certain industries, we beg to state that we have extremely pronounced feelings in regard to this matter, as it is one of the very greatest importance to the radio industry. The writer has for some time been collecting information with regard to the highly serious position with reference to loud speakers and headphones which are coming from the Continent, particularly Germany.

Quite recently a manufacturer called and handed to the writer a sample pair of headphones, and offered to supply 20,000 from London stock at 4s. each. Two days previously a German manufacturer who had already sold 200,000 offered at 5s. 3d. In the same week an Italian instrument was quoted at 5s. These instruments are comparable with the average British made headphone which sells at four times the price.

If some serious steps are not taken immediately we are convinced that the new industry which is being built up in this country and giving employment to tens of thousands of people who would otherwise be unemployed, will gradually be lost to the foreigner, thus involving the manufacturer who has embarked his capital in very heavy losses.

At the present moment, still taking headphones to support our argument, there are probably ten foreign instruments sold out of every twelve in this country. When one remembers that the British manufacturer shouldered the original financial burden which enabled broadcasting to become possible in this country—the Germans paid nothing—it will be seen that the radio industry has a very strong claim to rank as one of the proposed protected industries.—Yours faithfully,

C. A. VANDERVELL & Co., Ltd.
(Signed) F. S. Hooker,
Director and General Manager.

Acton, London, W.3.

IMPROVING "P.W." SET TONE.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Among various sets with which I have experimented, I have had a "P.W." Combination Set in use practically ever since the little book in which it is described was published, but never until a quarter of an hour ago have I heard the bottom notes of the organ boom out as they should do.

This result was achieved by putting a ·006 mfd. (two noughts six) condenser across the secondary winding of the transformer, in place of what I believe was originally ·001 mfd. The result is astounding. I am listening to the Hallé Concert relayed from Manchester whilst writing this, and apart from the bottom notes of the organ crashing forth as they should do, the clapping sounds like clapping—not that usual cracked sound.

If any of your other readers are interested in this point, they may find that ·005 mfd. is preferable to ·006 mfd., as I have rather overdone the suppression of the higher notes.

I am impatiently waiting to hear the boom of Big Ben.

Yours faithfully,

S. H. DENNINGTON.

52, Hemberton Road, Stockwell, S.W.9.

(Continued on page 54.)

CORRESPONDENCE.

(Continued from page 53.)

THE TWELVETREES REFLEX.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have constructed Captain Richard Twelvetrees' three-valve reflex set, as published in P.W. No.'s 140-141, and am writing to you to let you know how grateful I am to have such a set. I have been two years looking for this circuit. These are some results, living about one and a half miles from 2 L O:

*2 L O. Terrible roar on Amplion A R 19.
*2 German stations loud on Amplion A R 19.
*School of P. and T. loud on Amplion A R 19.
F.L. France loud on Amplion A R 19.
Newcastle loud on Amplion A R 19.
*Birmingham, very loud on Amplion A R 19.
Chelmsford, same as London on Amplion A R 19.
Radio-Paris, not very good, but put this down to coils not being correct for wave-length, as I had not two the same so loaded one.

*This means with 2 L O working, using a wave-trap.

Well, I think that you will agree with me that this is very good for one evening, and one hour on Sunday. Some components used:

R.I. Transformers (old type).
Gambrell coils.
Ormond condensers, ·0003.
Raymond condensers, ·001 A.T.C.
Neutron crystal, very important as to crystal.
Edison Bell fixed condensers.

Thanking you once again,
I remain, yours faithfully,
W. O. MANNERINGS.

27, Richmond Crescent,
Barnsbury, N.1.

A YEAR'S D X WORK.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Your readers may perhaps be interested in the following:

On a detector and 1 L.F. set, during 1924, I logged over 1,000 different American and Canadian amateurs. About 5,000 log entries were made during that time. I have also received signals from Mexico, North Greenland (W N P), Argentine, Australia, New Zealand, etc. The Americans often come in at midday here when the whole of the Atlantic is in sunlight. The earliest I have heard them is 6.30 p.m., G.M.T. One-day, at 3.40 p.m., I heard G H H, Mosul. His signals were much weaker than usual. Signals from my own station, 6 L J, have been received in many parts of North America, including San Leandro, California. The best D X is Z 4 A B, Dunedin, New Zealand. I have worked with 30 Americans and two Canadians (44 times) in one month. On Christmas Day I worked with G H H, Mosul, operated by Capt. Durrant, and took a message from him for his relatives.

My station is located in a valley and the aerial is very short, and is 10 to 20 feet below the tops of the neighbouring trees and houses.

Yours faithfully,
S. K. LEWER,
G 6 L J.

32, Gascony Av., West Hampstead, London, N.W.6.

THE "TWO-FOUR" VALVE SET.

To the Editor, POPULAR WIRELESS.

Dear Sir,—I feel I must send you a line in praise of the "Four Circuit" two-valve set published in your issue of 17th January. I wired it up as a "dual," omitting the switches, and the results are much better than any I have yet tried.

Just within two miles of the Hull relay station, it gives more than I want on the loud speaker. Further, I am able to get Manchester when Hull is working, and this without any wave trap. I may say that with circuits I have previously tried Hull has drowned everything up to 400 metres.

Last night I got Birmingham at very good 'phone strength—a station I have found very difficult to hear in Hull. I also got Hilversum, and several German stations.

The tuning of the secondary condenser is extremely sharp, and I was also a bit puzzled as to the correct coils to use, but this is only a matter for experiment, and no doubt I shall get further results.

I can without hesitation say it is the best two-valve circuit.

Yours faithfully,
E. W. GRESSWELL.

16, Arnold Street, Hull.

W G Y ON UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—You may be interested to hear that at one a.m. on Tuesday morning last (February 3rd) I picked up W G Y, Schenectady, N.Y. (380 metres), on a one-valve Unidyne set which I built about two months ago from particulars given in POPULAR WIRELESS. A mixed concert programme came through at quite good strength, with the call sign of the station given clearly between each item.

There was very little distortion—far less than when I have heard American stations relayed through a British station—neither was there much fading.

I listened until about 1.45 a.m., and then switched off.

Yours faithfully,
HUGH OVENDEN.

Holmfield, Whitestake, Preston.

TECHNICAL NOTES.

(*Continued from page 19.*)

the Royal Society. It was by no means certain, at that time, that such a thing as an electron, in the modern meaning of the term, really existed.

Electrons in Valves.

Talking about electrons, the question is often asked as to how many electrons travel across from the filament to the plate in a wireless receiving valve. Obviously, it depends upon the current which is passing in the plate circuit, but I believe that for each milliampere there are something like 6×10^{15} electrons per second (that is, 6 with fifteen noughts after it). I haven't troubled to work it out, but all you have to do is to look up the electronic charge and divide it into the current (in the same units). I believe, if I remember rightly, the actual value is more like 6·13 multiplied by 10 to the power 15. Somebody with a passion for popular statistics once made the computation that the number of electrons that pass every second through the filament of an ordinary 16-candle-power electric lamp is so great that it would take two-and-a-half million people, each counting two electrons every second, twenty thousand years, of 24-hour working days, to count an equivalent number. So it is evident that quite a number of electrons pass over per second from the filament to the plate of your valve.

Thunderstorms.

A French scientist, M. l'Abbé Gabriel, has put forward a theory, with a good deal of evidence to support it, that thunderstorms have a definite cycle of maxima and minima of activity. He claims to have discovered that, for a period of seven years, electrical storms will be at a minimum, then for twenty years they will occur at a more or less average rate, and this period will be followed in turn by ten years of exceptionally heavy rain and electrical disturbances. In order to reassure wireless listeners, it should be mentioned that M. Gabriel states that we are just entering upon a period of *minimum* activity.

Musical Valves.

The singing arc was a favourite scientific toy many years ago, and during more recent years the singing valve has been much experimented with. In fact, one inventor in America actually made a miniature "organ" with different valve circuits, differently tuned, so that when set into oscillation they produced different notes in the reproducer. In this field of research, although it does not appear to be of great importance at the moment, it should be noted that Dr. Lee de Forest was probably the pioneer, as he was in so many other branches of wireless development. He described experiments with singing circuits some years ago.

Short Waves.

I have remarked on previous occasions in these notes upon the growing importance of short-wave wireless, and now comes the news from France that the cathode-ray oscillograph has been successfully used for the detection and examination of wireless waves down to 30 cm. (about one foot)

(*Continued on page 56.*)

TECHNICAL NOTES.

(Continued from page 55.)

wave-length. The frequency of these waves is about one thousand million vibrations per second. The shortest wireless waves which have ever been produced by wireless methods, and detected by similar methods, were of a wave-length of ½ mm. This work was carried out by Nichols and Tear about a year or two since, but the waves were not used for the transmission of messages. It seems very probable that short waves will become of extreme importance in the future of wireless transmission, and the serious experimenter should keep a careful watch in this direction.

Saving Time.

The experiment suggested in the following (quoted from "Popular Radio," N.Y.), although it is simple in the wireless sense, is an interesting example of the great facilities introduced by radio. "Mr. Paul Specht, an American musician who recently completed an English concert tour with his band, has recommended some additional American bands and orchestras for English engagements. In order that the British agents may hear these bands and judge of them without the necessity of crossing the Atlantic, Mr. Specht will arrange, it is announced, that the performance of these bands shall be broadcast in New York, picked up in England, and submitted to the English agents in that way."

Tuning Signal.

To correspond with the tuning note used in this country, the Breslau (Germany) broadcast station uses a loud-ticking metronome. This is operated for some time before the regular programme is broadcast. The ticks enable listeners to distinguish clearly the loudness of their reception and so to finish their tuning arrangements before the programme starts.

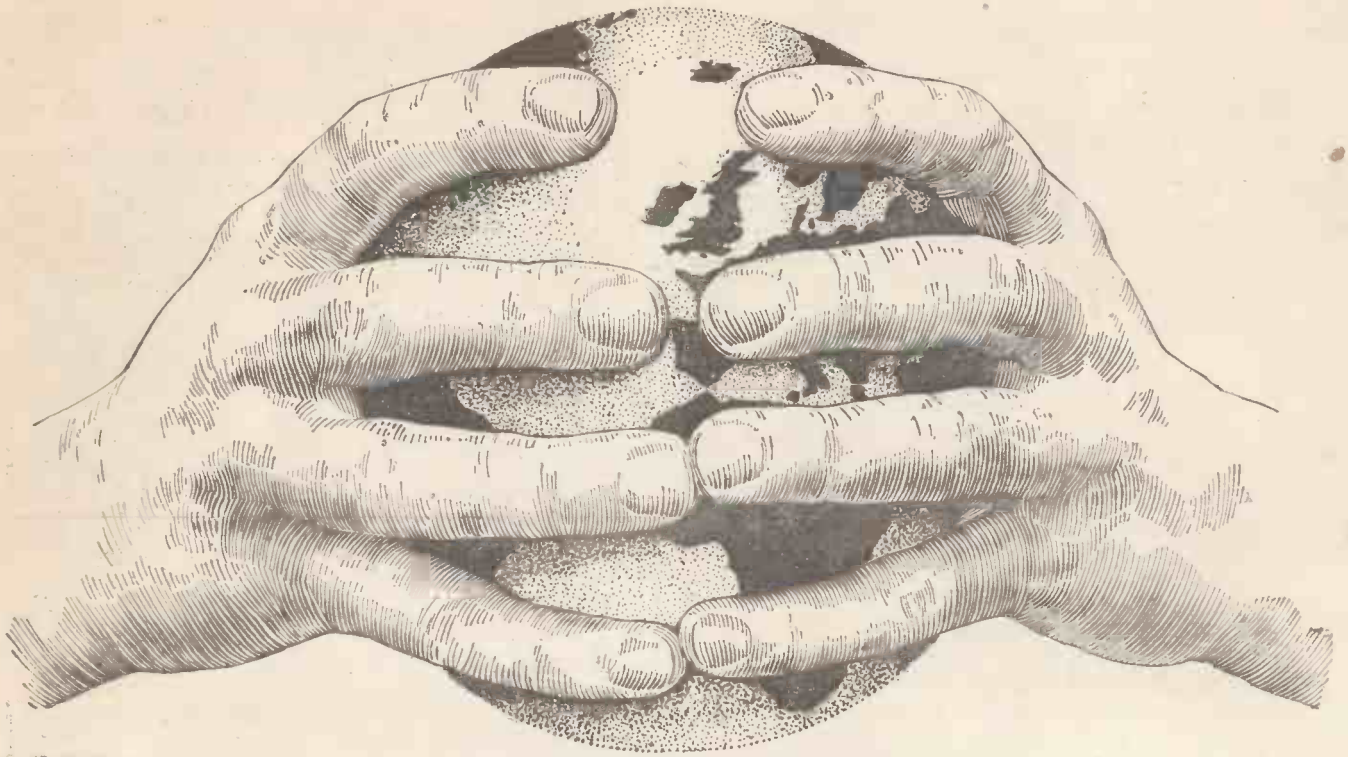
Another Method.

The Hamburg station employs a brass gong, which after being struck continues to sound for some considerable time. After each number, two-minute intervals are recorded by two strokes on this gong to assist listeners in tuning. These are followed by a single stroke which indicates the commencement of a new selection.

New Sodion Valve.

The sodion "tube" which has been referred to in these columns on several occasions, has now been produced in a new and improved form. It will be remembered that the sodion valve contains sodium metal, which is heated by means of a special heating coil so as to cause it to emit ions, upon which the functioning of the valve depends. The original form of this valve would not oscillate, nor could it be used in most ordinary circuits without some modifications to the circuits. The new sodion valve will oscillate, and may be introduced into standard circuits without any adjustment, moreover, it has been made so that it will plug into standard valve-holders. A full account of this new valve, together with results of tests, will be found in "QST" (the Journal of the American Relay League), Dec., 1924.

R/R



Spans the World

How wonderful to listen to a fellow creature talking on the other side of the globe! More wonderful to be able to reply to him.
With Mullard Valves the first **two-way connection between England and U.S.A., Australia, Argentine and New Zealand** was established, and these valves that can pick up and give you this wonderful power of communication are just the **standard Mullard Receiving Valves,** obtainable from all dealers. They will give perfect reception from *your* local Broadcasting or Relay Station. Why **shouldn't they?**

Mullard
THE · MASTER · VALVE

Printed and published every Thursday by the Proprietors, The Amalgamated Press (1922) Ltd., The Fleetway House, Farringdon St., 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, 19/6 per annum, 9/9 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, February 28th, 1925.

R/R