POPULAR WIRELESS WEEKLY, JULY 21st, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

ARE YOU MAKING THE "P.W." SET?

Popular Wireless

PRICE 3d.

No. 60. VOL. III. SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc. July 21st, 1923.

"Uncles" Jeff, Caractacus and Rex of 2 L O.

FEATURES IN THIS ISSUE.

Switches and the Home-made Set.
Neat Tuner for H.F. Work.
A Variometer for Crystal Working.
Summertime Wireless.
Loud-speaker Trouble.
Cardiff Station Notes.

And a Long Interesting Article on "The Valve," by Capt. P. P. Eckersley (Chief Engineer of the B.B.C.).

POPULAR WIRELESS

July 21st, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

2 L O's Studio.

IT is whispered that the studio of the London station is to be increased in size. If this is true, the operators' room will have to be used, as this seems to be the only available space, and the operator will have to go out on the landing. Personally, I do not see why this should be necessary, for the studio appears to be quite large enough; it easily accommodates at least thirty musicians.

* * *

Sheffield.

MANY readers hold the idea that the Sheffield station is to be opened as a broadcasting station. This is not the case; it will only be a relay station, and if the experiments being carried out do not prove successful, the station may not be opened at all. Captain Eckersley tells me that it is unfortunate that so much publicity should have been given to this station, as it has raised false hopes among a great many amateurs.

* * *

Small Power.

SHOULD the tests prove satisfactory, the Sheffield station will be opened at the end of August, but the power will only be about 100 watts. This means that a comparatively small area will be covered. The station is merely a sub-station, and will pick up 2 L O by wireless and re-transmit their concerts on another wave-length.

* * *

Two New Stations.

AS regards Aberdeen and Bournemouth, it is hoped that the former will be opened in August and the latter soon after. I understand that the call signs and wave-lengths of these stations have not yet been allotted. Indeed, with the narrow band of wave-lengths available, 350-425 metres, it is no easy matter to squeeze in any more broadcasting stations.

* * *

Meeting of Amateur Transmitters.

AMATEUR transmitters in the London area should make a point of being present at King's College, Strand, to-night, the 20th, at 6 p.m., when a meeting is to be held to discuss the formation of a Society of London Transmitting Licence-holders.

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Holiday Wireless.

WIRELESS has obtained a firm footing among holiday-makers, and many boarding-houses and hotels are including "radio dances" among their amusement programmes.

* * *

2 L O's Dance Programmes.

IN this connection 2 L O and the other stations would do well to provide more appropriate dance programmes than those given on Saturday evenings.

The producers and chief artistes of 2 L O's Shakespearian items. Left to right: Capt. Lewis, Rex Palmer. Bottom row: Phyllis Thomas, Gerald Lawrence, Lesley Winter, Cathleen Nesbit.

Undoubtedly, during the summer months, a dance programme from 8 to 11 on Saturdays would be very popular; but the items must be made longer if the idea is to meet with the success it deserves.

* * *

Longer Items.

IT must be remembered that dance items should be of from 7 to 10 minutes' duration, with about 3 minutes' "sitting-out" time between them. If these small matters were attended to, I feel sure that the weekly dance programme would provide one of the most popular evenings for a great many people.

* * *

Ford's Wireless Station.

THE largest broadcasting station in the world is being erected in great secrecy at Detroit, according to a letter I have received from a friend of mine. It is believed that Mr. Henry Ford is responsible for its erection, and that he intends to use it in his campaign for the Presidency next year.

* * *

Wireless Complaints.

THE Postmaster-General recently stated in the House that he had received very few complaints as to the efficiency of the present system of wireless broadcasting. The whole question of broadcasting was being considered by the broadcasting committee that was formed last April. Up to the moment of writing, no definite statements have been issued by this committee.

* * *

Mr. L. Page Leaves 2 L O.

MR. L. PAGE, who is one of the announcers of 2 L O, has left London for Cardiff. I am given to understand that he may be back in a month or so, and, meanwhile, Mr. Honey is taking his place.

* * *

Radio Exhibition.

THE local branch of the Radio Association is holding an All-British Wireless Exhibition at Wakefield on July 28th and 29th. The exhibition will take place in Unity Hall, and all communications respecting it should be addressed to the hon. sec., J. E. Watson, Ash Lea, Outwood, Wakefield, Yorks.

* * *

Reception of Nauen.

THE Editor informs me that he has received quite a number of letters from readers in answer to the one from "Birdcage," which was published in POPULAR WIRELESS of July 7th.

It seems that the recepton of P O Z (Nauen) on a crystal set is by no means a record, and several of the more interesting replies appear in the Correspondence columns of this issue.

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The New 5 I T.

THE new situation of the studio at 5 I T should have a direct effect on the character of that station's programmes. Being so conveniently situated

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NOTES AND NEWS.

(*Continued from page 797.*)

it will offer great facilities for the engagement of artistes, and also the transmission of the various productions at the theatres and other places of amusement.

* * *

Studio to be Blanketed.

THE transmitting plant is about half a mile away, and a special cable will connect it to the studio. I understand that 5 I T's studio will be blanketed somewhat after the fashion adopted by 2 L O. The alterations will probably be completed early next month, and the new station is due to commence operations during the second week of August.

* * *

6 D W.

SIR STANLEY JOHNSON, M.P., tells me that his transmitting station, 6 D W, a photo of which appeared in our issue of July 7th, is all home-made, having been constructed by his son, who also operates the station.

* * *

Protection Against Lightning.

IN view of the prevalence of atmospheric and lightning discharges at this time of the year, amateurs should take special care over the earthing arrangements of their aerials. A very useful article on "Protection Against Lightning" has been specially written for POPULAR WIRELESS by Mr. H. Cotton, M.B.E., M.Sc., M.I.E.E., and will appear next week. Remember that a well-earthed aerial is a safeguard against lightning, while a badly constructed aerial system is likely to be dangerous when thunder is about.

* * *

Cause of Thunderstorms.

TALKING about lightning, it seems that broadcasting is to be the black sheep for all sorts of things. Coming up in the train the morning after that tremendous storm we had a week or so ago, I heard one or two anti-wireless people blaming the storm on the B.B.C. !

* * *

"Filling the Air with Lightning."

THEY were quite conclusive about it, too. "It's all because of that wretched broadcasting," said one. "Of course it is, we never had storms like that before. They're filling the air with electricity, and something like that is bound to happen." I left them still muttering their reproaches on wireless and all its machinations.

* * *

A Gathering of "Uncles."

A CHANGE from the monotony of the studio was provided by the invitation of "Uncle Dick," of the "Daily Mirror," when he asked the Uncles and Aunt of 2 L O and myself if we would care to look over the printing works of that paper. The visit was most interesting and was thoroughly enjoyed by all, though I heard Aunt Sophie bewailing the fact that "Uncle Dick" had not brought Pip, Squeak, and Wilfred along too.

* * *

"Request Night" at 2 L O.

THE idea of the B.B.C. to have a "request night" has been wonderfully successful. The interest taken by listeners-in was made apparent by the enormous numbers of postcards received at 2, Savoy Hill, each giving its ideas as to the most suitable items.

* * *

Thousands of Postcards.

I AM told that the staff of the London Station were simply inundated with suggestions—in fact, the number of cards received ran well into four figures.

* * *

Future Events.

FORTHCOMING programmes at the Manchester Station have many attractive items, among which are the following: July 22nd, a Sunday orchestral concert: July 24th, concert night, when well-known concertos by Mozart, Tchaikowsky and Saint Saëns will be broadcast.

Interesting Facts.

WE are informed by Sir L. Worthington-Evans, the Postmaster-General, that the approximate capital expenditure upon the following wireless stations was: Leafield, £115,000; Cairo, £136,000; Northolt, £43,000; Stonehaven, £31,000.

* * *

Underground Wireless.

A WIRELESS test was recently carried out between the Blue John Mine, Castleton, Derbyshire, which is 300 feet deep, over a distance of 12 miles, to the Bradshaw Cavern, 150 feet deep, with quite successful results.

* * *

Broadcast Plays.

THE broadcasting of "Oliver Cromwell" from His Majesty's was a great success, and the box office of that theatre should receive many visits from listeners-in who wish to see the play after hearing it last Thursday. The transmission was practically perfect and every word was clear.

* * *

A party of M.P.'s examining the "lead-in" on the occasion of their visit to the Ongar Wireless Station.

From 2 L O.

PROGRAMMES from 2 L O will include many interesting features, such as: July 21st, the Kalamazoo Concert Party from Birmingham will broadcast "One Hour in a Somerset Inn," and the 2 L O Dance Band will give the usual Saturday programme of dance items. July 22nd, the Eclipse Prize Singers will give items during the afternoon and evening. May Blythe, of the British National Opera Co. July 23rd, Mr. Norman Long.

* * *

Bush House.

A MEMBER of the United States Shipping Board, London, tells me that a wireless installation for receiving messages from the U.S. Government station at Annapolis has been installed on the great Aldwych building, Bush House.

ARIEL.

BROADCASTING TRANSMISSIONS.

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily press.

London	2 L O	369	metres
Birmingham	5 I T	420	„
Manchester	2 Z Y	385	„
Newcastle	5 N O	400	„
Glasgow	5 S C	415	„
Cardiff	5 W A	353	„

Other stations of interest to listeners-in in Great Britain are :—

Eiffel Tower	F L	2,600	metres	Throughout the day.
Radio-Electrique, Paris	S F R	1,780	„	5.5 to 6 p.m. 8.45 to 10 p.m.
School of Posts and Telegraphs	—	450	„	7.45 to 10 p.m. (Tuesdays and Thursdays.) 4.30 to 7.30 p.m. Saturdays.
The Hague	P C G G	1,050	„	3 to 5.40 p.m. (Sundays.) 8.40 to 9.40 p.m. (Mondays and Thursdays.)

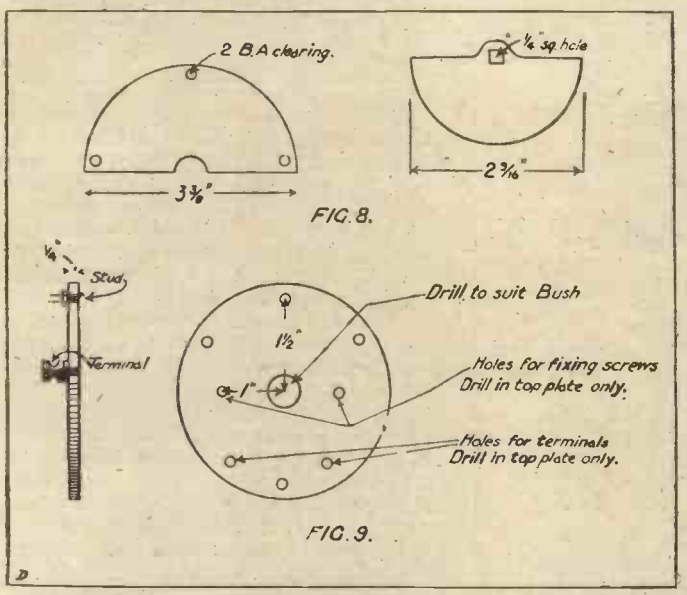
THE "P.W." COMBINATION SET.

Built and Described by the Technical Staff.

This is the second part of the article, which will be completed in five issues, describing a unique receiver capable of providing six useful combinations of two valves and a crystal by means of switches, without trouble arising from "howling."

THE next consideration is the aerial tuning condenser for which the ordinary standard parts are to be used; 29 fixed and 28 moving vanes will be required, giving a capacity of ·001 mfd. The usual types of vanes are shown in Fig. 8.

Ebonite end plates, which should be drilled as shown in Fig. 9, should next be prepared. These may be either rectangular or circular. The sizes of the holes should suit the rods and terminals available. The terminals and studs should be tapped into the end plates as shown, so that the top ebonite end plate will be flush with the panel when mounted.



Assembling Condenser Parts.

Look over the spacing washers and free them from burrs left by the parting tools. This is important, or the vanes will be thrown out of line when assembled. Commence on the centre shaft when assembling by screwing the bottom nut hard against the square shoulder thread on the moving vanes and large spacers, commencing with a vane and locking the whole of them together by means of the top nut. It is, of course, unnecessary to say that these vanes should be assembled in line.

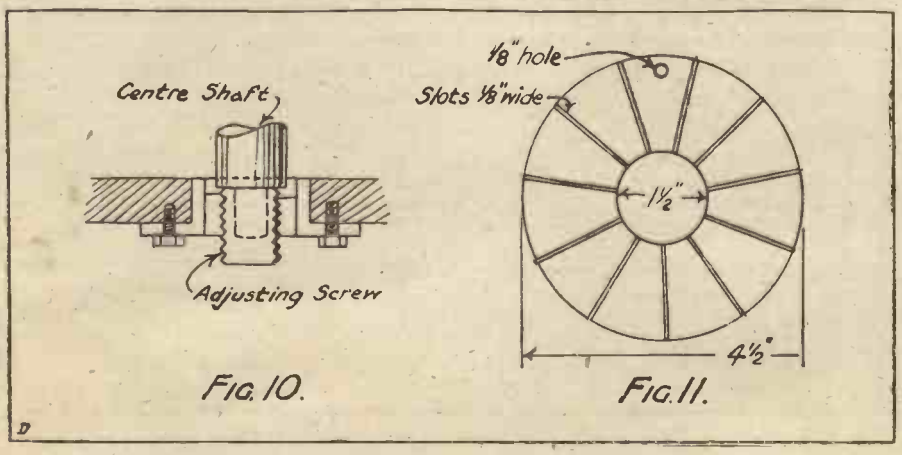
The foil connecting the terminals to the stud for the fixed vanes and the bush for the moving vanes should next be put into position. The four studs should then be screwed into the top plates and locked by nuts.

Commencing with a plate, assemble the fixed vanes and small spacers, and lock them in position with nuts.

The two sets of vanes should now be assembled; the bottom plate, which should have a special bush with adjusting screw, as shown in Fig. 10, being fitted in position.

If the vanes come in contact, adjustments of the moving set up or down will have to be made by means of spacing washers, which may have to be filed down on the top of the spindle until they lie dead central between the fixed vanes. In no circumstances should any attempts be made to bend the vanes to clear contacts. The ·0002 mfd. variable condenser should be made in the same way, using 7 fixed and 6 moving vanes.

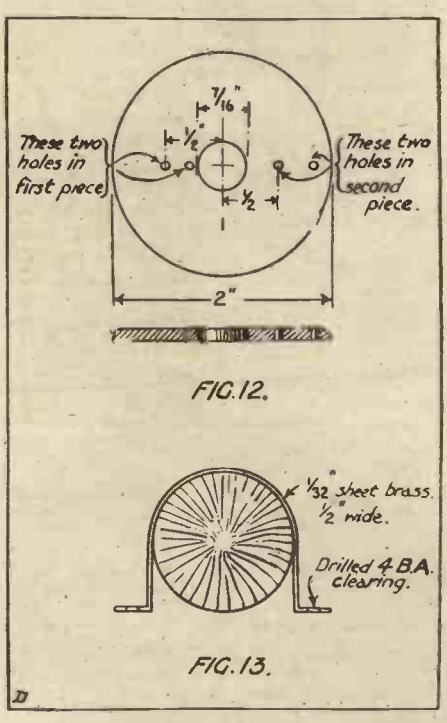
The basket coil for the aerial tuning inductance is wound on a cardboard former of the dimensions shown in Fig. 11, having 11 slots ⅛ in. wide. This former should be thoroughly dried and shellacked before any winding is done. Forty-five turns of No. 24 D.C. wire should then be wound on, leaving sufficient ends for making the connections when assembling. The anode coil is wound on a similar former 4 in. in diameter, and this consists of 70 turns of No. 28 D.C. wire.



The low-frequency transformer should next receive attention. Two pieces of ebonite, 2⅛ in. square by 7/16 in. thick, are required for the end pieces. A circle 1 in. in diameter should be marked on each piece, as shown in Fig. 12, and by a judicious use of saw and file the ebonite should be cut to this shape. One edge should be rounded as shown. A hole ¾ in. in diameter should be drilled through the centre for the core wires; and two ⅛ in. holes, which should be given rounded edges, drilled as shown for the leads to the primary and secondary.

The L.F. Transformer.

The core wires, which should be of No. 22 S.W.G. iron wire, perfectly straight and 9½ in. long, should then be laid up until a tight core ½ in. in diameter is formed. The bobbin



cheeks should be fitted to a paper tube 2⅞ in. long and 1/16 in. thick, and carefully secured by shellac. This tube should be thoroughly dried and shellacked.

Short leads of No. 30 S.W.G. about 6 in. long, should be cut, and one soldered to No. 46 S.C.C. used for winding the transformer. This short end is inserted through the hole in the end cheek nearest the core and winding commenced. For a man with a lathe the winding is a comparatively simple matter, but by the exercise of ingenuity it is usually possible to arrange some means by which this winding can be done by those not so fortunately situated.

The utmost care must be exercised in winding to prevent breakage of the wire;

(*Continued on page* 800.)

A NOVEL BASKET-COIL TUNING DEVICE.

A simple three-coil holder suitable for panel mounting.

THE following description of a novel basket-coil tuning device has been in use by the writer for some time past, and has proved extremely adaptable and efficient, lending itself to many improvements and modifications.

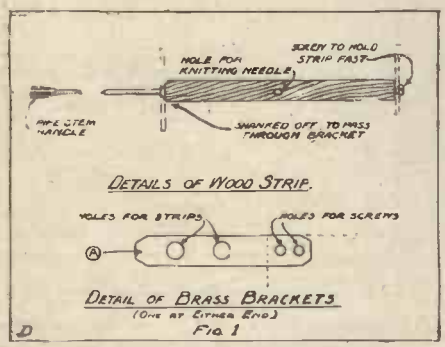
Fig. 1 gives a general idea of the tuner complete, fitted to the side of the writer's two-valve panel. Fig. 2 shows method of adapting coils to tuner.

To make terminal clips from thin springy brass, bend to U shape, as shown in Fig. 2 C, and solder well to the top of the terminal heads—this should not interfere with the usual function of the terminal—care being taken that they are in alignment.

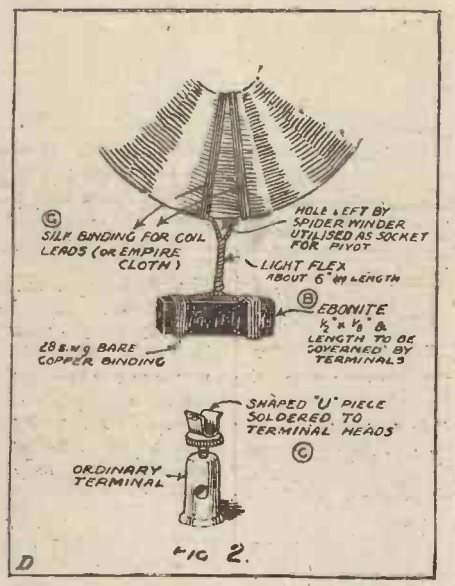
The Extension Handles.

Plugs are constructed of ¼ in. ebonite ½ in. wide, the length being governed by the distance between the pairs of terminals in use. Connection to clips and basket coils is formed either by fitting plugs with small bands of copper foil, or by a binding of No. 28 S.W.G. bare copper wire to the width of the clip. These should make good contact

To each connecting band is soldered a length of light twin flex about 6 in. long, and bound to plug by silk thread in manner ndicated at B in Fig. 2. This prevents leads being accidentally torn off, and makes a strong and firm connection and a neat finish. The other end of the twin flex is now to be connected to the ends of the basket coils by soldering each lead thereto, and binding leads to edge of coil by a few turns of narrow Empire cloth or insulating tape, in manner indicated at G, Fig. 2. This enables coil to be swung round on its pivot in the tuner.



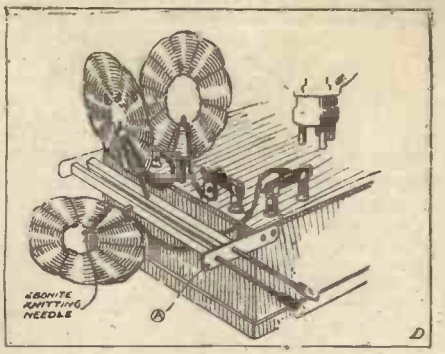
The tuner consists of three small strips of ebonite or wood—the writer used meat-skewers with pieces of a disused pipe-stem as knobs—about ⅜ in. square, the length being governed by the width of the tuner plus desired length of the extension handles. It is desirable to keep the outer one longer than the inner one to facilitate manipulation, and it should be at least 4 in. longer than the tuner to minimise body capacity effects.



The coil pivots are made from 2½ in. lengths of 8 in. ebonite knitting needles, pointed each end and one end screwed into the centre of each strip at the point indicated (see Fig. 1). These rods are supported by brass brackets 1½ in. by 1½ in. by 1/16 in. thick, holed to receive the strips and screws for fixing at A, Fig. 1.

The coils are now plugged into terminal clips, and the holes left by spider winder in coil serve as a socket for the pivot and permit any other coils to be coupled and adjusted to a nicety.

It will be noted that the coils are capable of being varied in two directions at once, which is a most desirable factor in circuits demanding delicate coupling adjustments.



The device is admirably suited for many circuits, including the now popular H.F. tuned anode.

A FEW HINTS CONCERNING JOINTS.

JOINTS should be avoided if possible. A badly made joint, or one that has become loose, may introduce sufficient resistance into a circuit, or branch of a circuit, to cause the failure of the apparatus. It has been well said that, in all electrical work, cleanliness is of the very utmost importance. Certainly in the matter of joints cleanliness is the first and great requirement.

The ends of the two wires that are to be jointed should be thoroughly cleaned; all the insulating material should be removed. By the aid of a pocket knife the whole of the insulating envelope can be removed, and the wire left clean and bright. The danger is, when jointing insulated wires, that some of the insulating material may be left between the surfaces of the wires that are brought into contact. If sufficient is left, the passage of the current across the joint may be stopped altogether.

Use of Pliers.

Having cleaned the ends of the two wires thoroughly, for say a few inches, "marry" them, as sailors express it. Cross the two wires so that they touch at about the middle of the lengths that have been cleaned; twist them sharply round each other, so that they will hold together if pulled, and then wrap each end round the wire it is against.

Wrap it very closely, using a pair of pliers if necessary, and complete the wrapping with the aid of pliers. If the twist has been carefully made, and the wrapping of the two ends carefully done, it will be found that a good, strong joint results that will stand pulling and that will offer very little resistance to the passage of the small currents employed.

THE "P.W." COMBINATION SET.

(*Continued from page* 799).

no sudden jerks must be given to it, and the bobbin from which it is being unwound should be mounted so that it will revolve easily. The primary is wound on over the whole length of the tube to a diameter of 1⅛ in. Another short end of No. 30 D.S.C. should then be soldered to the wire, which is, of course, broken from the bobbin and pushed through the second hole on the same side as the commencing end.

Mounting the Transformer.

The secondary is wound in the same way to a diameter of 1¼ in., after the primary has been carefully covered with three layers of empire cloth, using the same size of wire and bringing the ends through the holes in the opposite bobbin to which the primary was brought. Two layers of empire tape over the secondary complete the winding of the transformer.

The core wires should now be inserted in the tube until they project equally from both ends. They are then spread out from a point at the exact centre of each end, and bent down evenly all over the windings and interlaced. Care should be taken to get the wires evenly spread out all round the bobbin and carefully interlaced. A brass band clipped over the core wires will hold them securely in position. A further band, as shown in Fig. 13, should be made for securing the transformer to the panel.

(*To be continued.*)

A CHAT ABOUT TRANSFORMERS.

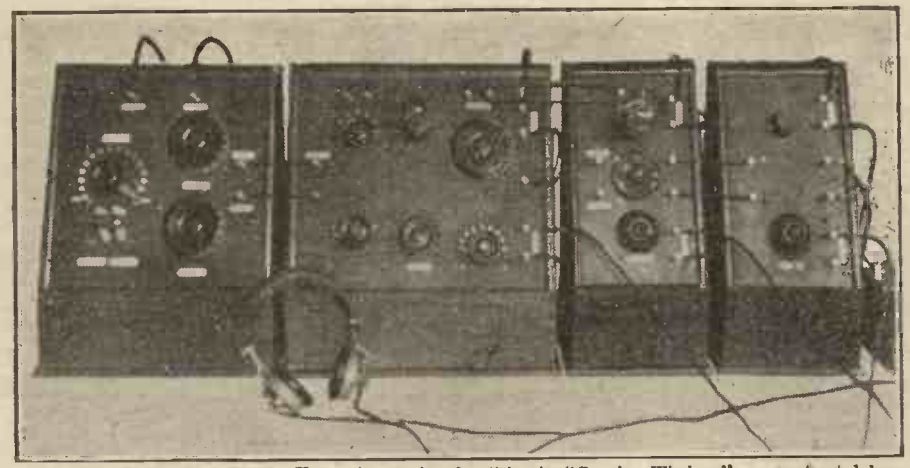
By C. E. FIELD, B.Sc.

The final article of a series of three, dealing with the various types of transformers employed in wireless.

III.—HIGH-FREQUENCY INTERVALVE TRANSFORMERS.

HIGH-FREQUENCY transformers are used to transfer energy from the plate circuit of one valve to the grid circuit of the next, when the energy is in the form of unrectified oscillations at radio frequencies. The problem here is rather different from that of the low-frequency transformer, for when high-frequency oscillations are being dealt with, any capacity, however small, has a great effect upon what is taking place in the circuit.

Consider first what would happen if we were to use an iron-core low-frequency transformer as a coupling between two high-frequency valves. The opposition offered to the flow of an alternating current by a coil of wire depends, among other things, upon the frequency of the current, and upon the value of the magnetic flux produced through the coil. Since the frequency of the impulses sent through the plate circuit of a detector or L.F. valve is of the order of 1,000 per second, while that of the output of an H.F. valve is of the order of 1,000,000, it follows that the current which we would get through this misplaced L.F. transformer would be about 1,000 times as small as it would be if the transformer were in its usual position. (This, of course, neglects amplification of the current due to the valves.) In order to reduce this opposition, therefore, as the frequency is fixed by the wave-length of the signals, we must reduce the flux produced by the coil of wire. The only satisfactory way of doing this is to take out the iron core, which reduces the flux to something like one thousandth of its former value.



The Unit Set described by Mr. Hersey in a series of articles in "Popular Wireless," as constructed by Mr. M. C. Gibson, 190, Portnall Road, Maida Hill, London, W.9.

Self-Capacity.

If, however, we were to use as an H.F. transformer, simply an L.F. transformer with the iron core removed, we should not get even moderately good results, for this reason. When a circuit contains both inductance and capacity, there is one frequency of current which will encounter very little resistance in the circuit, for at that particular frequency, which is called the *natural frequency* of the circuit, the opposition effects of the capacity and the inductance exactly neutralise one another. At slightly higher or lower frequencies, both the capacity and the inductance offer opposition to the flow of current.

In the case we are considering, although we have not deliberately added capacity to the circuit, there is a condenser action between the turns of wire in the transformer and between the plate and filament of the valve to which the primary winding is connected. Hence the circuit has a natural frequency of its own, and will only carry appreciable H.F. currents at that frequency.

Aperiodic Circuits.

This difficulty is overcome by reducing the number of turns of wire on the transformer windings, and adding capacity (by means of a variable condenser) until the circuit is tuned to the frequency or wave-length of the signals to be received. An H.F. transformer with a fixed winding can thus only be used over a small range of wave-lengths.

The capacity between the two windings of an H.F. transformer has a very great influence upon its method of working. When the oscillatory circuit, which consists of the primary winding and the variable condenser (in addition to "accidental" capacities) is tuned to the required wave-length, the voltage across the winding is at a maximum value, and so maximum amount of energy is transferred to the secondary winding by condenser action—i.e. by electrostatic induction. In fact, it is probable that the transformer behaves more as a condenser than as what its name implies. On account of the strong electrostatic coupling existing between the windings (providing that they are wound very close together) the two are highly inter-dependent, and so one variable condenser suffices to tune both windings to the required wave-length.

Another important point is the effect of the resistance of the windings. In an oscillatory circuit, resistance produces a decrease in the *selectivity* of the circuit, but also in the *sensitivity*. That is, by increasing the resistance of a circuit, a larger band of wave-lengths can be covered by any particular winding, but at the same time a drop in efficiency is produced.

We will now see how these principles are applied to the construction of high-frequency transformers. Fig. 1 shows diagrammatically four useful types of H.F. transformer, all of which are quite simple to construct.

(*a*) This consists of basket coils wound upon cardboard spiders, the distance between which can be varied by sliding them along the wooden rod upon which they are mounted.

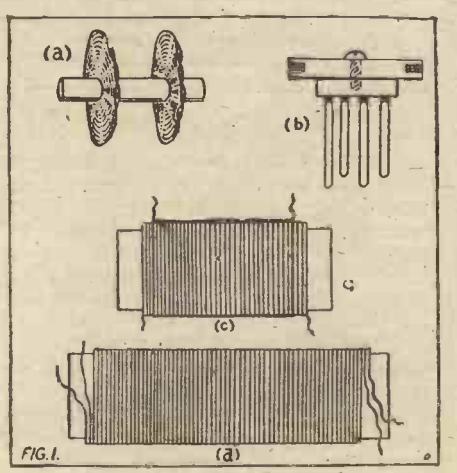


FIG. 1.

Useful Types of Transformers.

This is essentially a very selective transformer, and when the coupling is loose each coil should be tuned by a separate condenser, as the coils are behaving like ordinary transformer windings without much capacity coupling between them.

Wire from No. 32 to No. 36, should be used, and a series of coils wound with, say, 50 turns each can be constructed. For long wave-lengths, two or more can be coupled together in series to form each winding.

If a fairly tight, fixed coupling is desired, the primary and secondary coils should be alternated along the rod. Where loose and widely variable coupling is required, all the primaries can be grouped at one end of the rod, and the secondaries at the other end, the coupling taking place only between the two inner coils. Details of the construction of such a transformer were given in the

(*Continued on page* 802.)

A CHAT ABOUT TRANSFORMERS.

(*Continued from page* 801.)

March 31st, 1923, issue of POPULAR WIRELESS.

(*b*) This is perhaps the most widely used type of H.F. transformer, and is very simple to construct. The coupling is very tight, and so a tuning condenser is required across the primary winding only. For broadcasting wave-lengths, a groove one-eighth of an inch wide by quarter of an inch deep cut in a disc of ebonite 1¾ in. in diameter makes a suitable former. About fifty turns of wire should be used on the primary winding, but the best number can only be determined by experiment, for much depends upon the tightness of the winding. No. 44 S.S.C. copper wire may be employed, but the use of the same gauge of Eureka wire would give less critical tuning, and for a range of wave-lengths of, perhaps, two or three hundred metres, no tuning condenser would be required.

As the two windings possess a certain small degree of independence, the tuning condenser raises the natural wave-length of the primary winding slightly above that of the secondary. This should be compensated for by the addition of an extra fifteen or twenty turns on the secondary winding.

Important Considerations.

The best results are obtained by winding the primary and secondary coils in opposite directions, one over the other, and connecting the end of the primary and the beginning of the secondary, i.e. the two ends from the middle of the winding, to plate and grid respectively, for full use is then being made of the capacity coupling.

The leading out wires can be secured to valve pins or terminals as required. A multi-range transformer of this type can be constructed by cutting a series of grooves in a length of ebonite rod, and winding them as above, two or more windings being joined in series according to the wave-length desired.

(*c*) This is a very simple type of transformer to construct, but is not easily made variable. For use on broadcast wave-lengths, the windings can be laid on a piece of round, varnished wood, or fibre or ebonite rod, 1½ in. in diameter. The primary winding should consist of 250 turns of No. 36–40 S.S.C. wire, and the secondary of a few more turns, the primary being tuned with a variable condenser. It is convenient to wind the secondary first, and the slightly shorter primary over the top of it in the same direction, both being single-layer windings. The beginning ends of the two windings are connected to plate and grid respectively.

(*d*) This transformer is similar to the one just described, with the exception that both windings are run on together in a single layer, so that primary and secondary turns are alternated along the core. The same windings as in the previous case may be used, and a tuning condenser connected across either winding.

In all H.F. transformers care must be taken to insulate the windings carefully from one another, for the full potential of the high-tension battery exists between them. In cases where both windings are run on together, it is advisable to use D.S.C. wire.

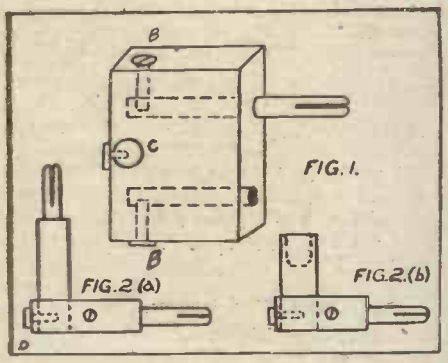
Many other varieties of H.F. transformer can be designed, but the most suitable type can only be determined by the requirements of the user, who should not rest content until he has tried out several different designs.

A NEAT TUNER FOR H.F. WORK.

A compact little device suitable for panel mounting.

THE following particulars of a two coil tuner for mounting on flat panels should prove of interest.

In the present case one holder takes the tuned anode coil of the H.F. valve, and the other is used to bring reaction on to the anode coil, thus obviating danger of radiating.



Obtain three coil mounts of the flat type,

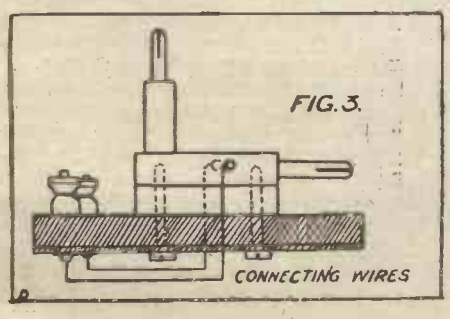
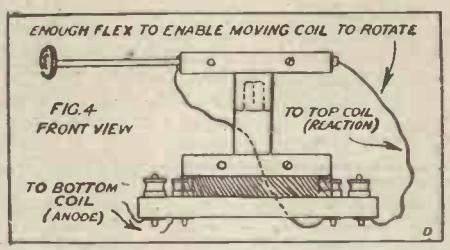


Fig. 1. After removing the contact screws (B) of one of the mounts, it will be found quite an easy matter to remove the plug and socket. Take one of the mounts and drill a hole at C to take the brass plug and tap a smaller one to take the contact screw on the rear end. After inserting the plug screw the contact screw well home to make the plug secure, Fig. 2 (a). The other mount should now be similarly treated and the brass socket secured, Fig. 2 (b).

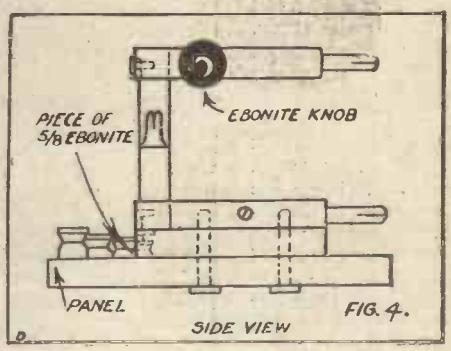
If it is intended to mount the tuner separately, a piece of ¼ in. ebonite, 4 in. by



4 in., should be obtained, and the mount with brass plug fixed firmly on to the ebonite on the top of a small piece of ebonite, about ½ in. to ⅝ in. thick, the same size as the mount, in order that the bottom tuning coil may be clear above the surface of the panel, Fig. 3.

The Connections.

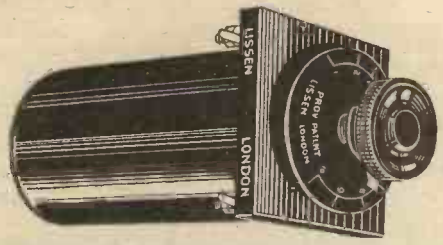
Two wires should then be soldered to the contact screws and taken either through the ebonite or direct on top to two terminals; this is not necessary if the tuner is incorporated into an existing panel. In the latter case the wires should go direct to the plate of H.F. valve and that of the H.T. battery.



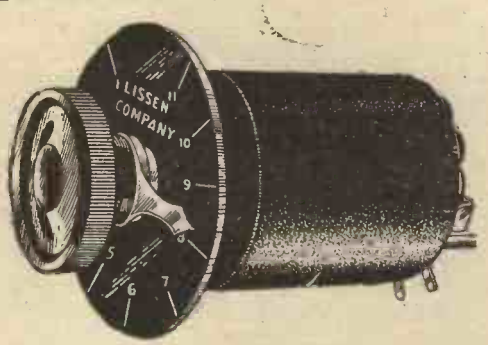
The mount into which the socket has been fitted should also have two connecting wires soldered and a small hole tapped to take a handle, which in my case consists of a piece of ⅛ in. brass with an old accumulator (ebonite) knob attached. The tuner when completed should look like Fig. 4.

Miss V. Olney, of Edmonton, listening-in on the 2-valve set that she has constructed.

Links in a chain—



Lissen Components that Matter.



RADIO FREQUENCY.—1st Stage—Use the LISSEN REGENERATIVE-REACTANCE (P. PATENT)—CUTS OUT 2 L O and brings in the other Broadcasting and Continental Stations—SO SENSITIVE that under many conditions aerial and earth connections may be dispensed with. Range 150 to 4,000 metres—REGENERATION OVER THE WHOLE RANGE WITHOUT A BREAK—tune with a LISSEN VERNIER CONDENSER (designed for fine tuning in H.F. circuits, barely 1 in. diameter, price 12/6). LISSEN ONE HOLE FIXING—no switch to connect—no soldering—Price **£2 12s. 6d.** complete.

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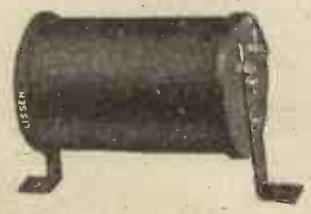
INDUCTANCE.—LISSEN TUNER—Its efficiency is in the unique LISSEN multi-winding—its convenience is in the design—its price makes it undesirable to wind your own—dead end loss eliminated—11-point switch already mounted and connected—no taps to solder—no switch to connect—panel or table mounting—also makes a very highly efficient ANODE COIL—LISSEN ONE HOLE FIXING—range 150 to 4,000 metres when used with a ·0005 condenser (preferably use a LISSEN MICA VARIABLE CONDENSER, price 17/6)—combines greatest inductance with lowest H.F. resistance and least distributed capacity—length 4 ins., diameter 4 ins.—goes compactly into any set—LISSEN ONE HOLE FIXING—Price **22/6**

CAPACITY.—LISSEN MICA VARIABLE CONDENSER—maximum capacity ·0006. Losses in condensers taking place through faulty materials or BAD WORKMANSHIP reduce signal strength—a condenser increases in efficiency as these losses are reduced. The LISSEN MICA VARIABLE CONDENSER is made so that these losses shall be the minimum possible. Panel or table mounting by slight ingenious alteration—tuning over 360 degrees of scale—small changes of capacity for a given movement of the scale on the lower readings—diameter 3½ ins, depth 1 in.—LISSEN ONE HOLE FIXING. Price **17/6**

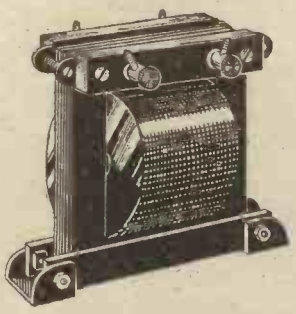
CRITICAL VALVE CONTROL.—LISSENSTAT—the new device for perfect filament control—utilises the critical tuning characteristics of the Detector Valve—each H.F. Valve and the Detector Valve should have LISSENSTAT control—gives greatly improved control of fine detection, so absolutely essential in tuning-in on long distance reception. The ordinary rheostat sets up noises in your detector valve without your knowing it. The LISSENSTAT gives smooth, finely graduated, noiseless control. Permits getting on the very spot necessary for perfect reception. Saves your valves and its own cost many times over, because with the LISSENSTAT it is impossible suddenly to throw a heavy current on to the delicate valve filament. It has an off position. LISSEN ONE HOLE FIXING.

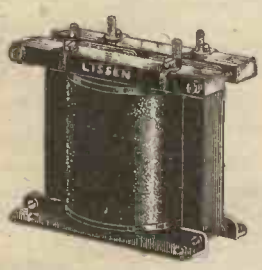
Price **7/6.**



AUDIO FREQUENCY.—LISSEN TYPE T1 L.F. TRANSFORMER—MAKES A WHISPER LOUD—the only transformer that has a coil which matches average valve impedance—should be used in every good receiver immediately after the detector valve—every turn of its expensive coil is wound by patent process—Price **30/-**

LISSEN TYPE T2 TRANSFORMER—where LISSEN Type T1 not used throughout, use the LISSEN Type T2—it is not essential that the primary of transformers for 2nd and 3rd stages of L.F. should have such high impedance value as is required of the transformer following the detector valve. Price **25/-**





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LISSEN APPARATUS—WELL THOUGHT OUT, THEN WELL MADE.

LOUD SPEAKER TROUBLES.

By G. H. DALY.

An article that will prove very useful to all who possess loud speakers.

ONE of the so-called unavoidable noises is the hum of the lighting mains caused by dynamo "ripples" and irregularities. This, however, can frequently be stopped by slight alteration of the aerial circuit.

A favourite arrangement is to insert a choke coil across the aerial and earth terminals of the receiver. If the correct value is ascertained by experiment, this will only weaken signals very slightly while obviating the hum.

Another method is to have a variable inductance in series with the aerial and earth circuit, and a variable condenser in parallel with this inductance, one side of the inductance being connected direct to the aerial terminal, and the other side of the inductance direct to the earth terminal.

Balanced Aerial Systems.

A third method is to join the aerial lead to two variable inductances in parallel, each inductance being connected to a separate earth. One side of one of these inductances is connected to the aerial terminal of the receiver through a variable condenser, while the other side of the same inductance is connected to the earth terminal of the receiver.

All three of the above methods have been used successfully for eliminating dynamo noises.

In some cases dynamo noises are caused by the fact that the wireless earth lead is connected to the same place on the water pipe (or whatever the earth happens to be) as the lighting or telephone circuit. This should be altered.

In cases where dynamo noises persist, in spite of alterations such as given above, it is advisable to try a balanced aerial system, thus doing away with earth conductions. This is another aerial stretched parallel to, and directly below, the ordinary aerial at the foot of the masts. This second aerial should then be connected to the earth terminal on the set.

When the lighting mains are tapped for H.T. current, induction from the dynamo frequently occurs. If no filter circuit is in use, it should be constructed; and if such an arrangement is in use and dynamo hum is still heard, the filter condensers or chokes are probably faulty.

Capacity Effects.

Having tuned in with the 'phones and obtained good signals, you switch on the loud speaker only to find that the voice is horribly distorted. This is usually owing to the fact that the amplifier is not suited to the loud speaker.

A very important point when using a loud speaker is to keep the horn—especially the narrow part—free from dust and also moisture. It is a good plan to cover up the mouth of a loud speaker over night.

Another nuisance with the sensitive multi-valve set is capacity effect due to the operator's body. When, for instance, the operator moves his hand from one instrument to another, the receiver emits a loud moan.

The usual remedy for capacity effects is to use long handles for manipulating the various instruments. Another method is to shield the set with copper gauze or tin foil, and earthing the shield. Slight capacity effects can often be obviated by shielding the telephone leads with tin foil, and earthing this foil.

Dealing with "Howling."

Howling is a common trouble when tuning-in with a valve receiver. This may be due to incorrect values of the grid leak, or too much plate voltage, or too many turns of wire on the reaction coil. In some cases the removal of the grid leak will stop the trouble, for with some valves there is sufficient leakage in the valve itself, or it may happen that the condenser may have a slight imperfect insulation, so that a grid leak is unnecessary.

A typical amateur receiving station assembled specifically for loud speaker work.

Where, however, the insulation is perfect a grid leak is necessary. If the resistance of the grid leak is too high, a spluttering howl will be heard; and if the resistance is too low—resulting in too rapid leakage of the charge—the signals heard will be very weak. For experimental sets it is advisable to use a variable grid leak and variable grid condenser, as every other valve requires a grid leak and condenser of different value to give maximum efficiency.

Howling is often a case of low-frequency oscillations in the amplifying circuits caused by reaction, and, of course, the more powerful the amplifier the greater the howling is liable to be.

A favourite method of reducing howling is to lower the filament currents below its normal value. But this is a poor way of getting rid of the trouble, for it is merely reducing the amplification properties of the receiver.

The best thing to do is to look to the wiring of the various circuits. All leads should be as short as possible, and grid and plate leads should be as far apart as possible, and should never be run parallel to each other.

If transformer coupling is used, the transformers should be of the smallest type obtainable, and arranged so that the cones and coils are at right angles to each other. If possible, the transformers should be placed in earthed iron cases.

While on the question of coupling, it should be mentioned that while the transformer coupling gives the loudest signals these are liable to distortion, whereas with resistance coupling signals are invariably clear, and howling does not take place. Resistance coupling is very unpopular, however, owing to the amount of energy wasted through heating, and is not often used on waves below 900 metres. Reactance-capacity coupling is generally supposed to be the most efficient.

Wherever plenty of gear is available maximum results will be obtained by having separate L.T. and H.T. batteries for the amplifiers; and with all high-frequency amplifiers a potentiometer of about 300 ohms should be employed between the filament battery and the grids of the amplifying valves.

Various "Noises."

Too great or too small a voltage in the plate circuit will frequently cause what is known as overlap, and when it is found difficult to adjust the receiver for reception, the probability is that the set is suffering from this complaint. As the reaction is tightened the set suddenly starts to oscillate when distorted signals will be heard. In order to get rid of this distortion it is necessary to loosen the reaction coil beyond the sensitive point, and consequently the telephony becomes very weak. If, after considerable trouble, fairly good signals are obtained, atmospherics or strong signals will frequently cause the circuit to oscillate again. If alteration of the high and low-tension batteries does not alter this, the grid leak should be changed, and one of higher resistance inserted.

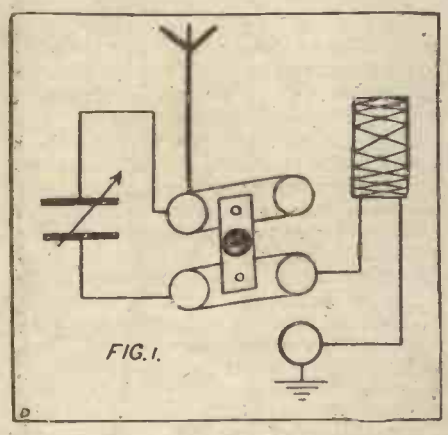
Sudden scratches, growls or rumblings are caused by "dud" or run-down cells of the H.T. battery or a loose contact. A good test for the latter is to tap the table on which the set is resting; if a melody of scratches is the result, there is a loose contact.

Hissing on the telephones is often caused by charged rain falling on the aerial wires. To test, disconnect the aerial and see if the hissing continues. In such a case as this the indoor aerial or loop is the only solution, especially in a rainy district. In fact, the loop aerial is to be recommended for use with the multi-valve set wherever possible, for in the first place atmospherics can be reduced to a minimum; and, secondly, harmonics from any nearby high-power station can be cut out by making use of the frame aerial's directional properties.

SWITCHES AND THE HOME-MADE SET.

The elimination of loose wiring is a step towards efficiency and neatness; this can be accomplished by means of switches and additional facilities for rapidly "changing over" provided.

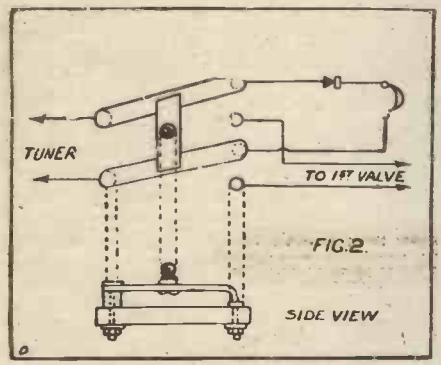
ONE of the commonest forms of switch is shown in Fig. 1, where it is seen in use for placing the A.T.C. in series or parallel. For this purpose only three studs are needed. The switch arms, which may be made of brass strip, look well held in place by a couple of contact studs, while



separation from the base is achieved by means of large size condenser washers. Bifurcated rivets or small screws fix the ebonite spacing piece to the two arms (See Fig. 2).

Matter of Precaution.

Fig. 2 shows this type of switch in use as a selector for using, say, either crystal detector or valve. One is not always willing to use the valve during the whole of a prolonged three-minute interval from the local station: listen on the crystal till it starts,



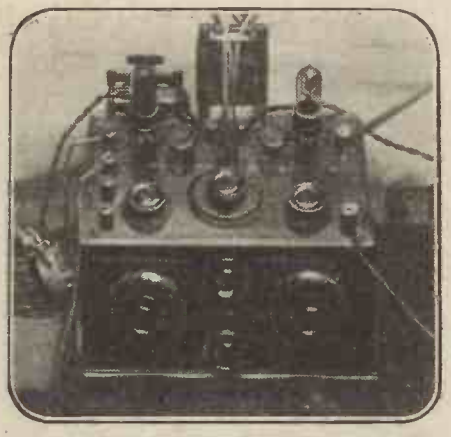
then simply push over the switch and light the filaments. Of course, this type cannot always be used as, in the act of changing over, the switch arms each touch two contacts instead of one, finding sometimes a new path for the H.T. current with disastrous results. In this case an obvious remedy is the provision of two extra "dead" studs in addition to the four studs in use.

A novel use for the single-pole switch with two positions is shown in Fig. 3, where it is made to connect the aerial terminal of the tuner to either the grid of the H.F. valve or the grid condenser of the rectifying valve. Of course, this must be used in conjunction with a H.T. switch, or the two may be combined as in Fig. 4. By turning the two-pole switch the aerial terminal goes to the grid of the H.F. valve, and the high tension finds a path to the plate, or the second valve only is used, in which case no H.T. is supplied to the first plate.

Varying the H.T. Supply.

An alternative arrangement is shown in Fig 5; this needs alteration according to the way the experimenter uses his apparatus. The writer has three valve-panels, but generally uses only two at a time, so he makes use of the H.T. switch to be described.

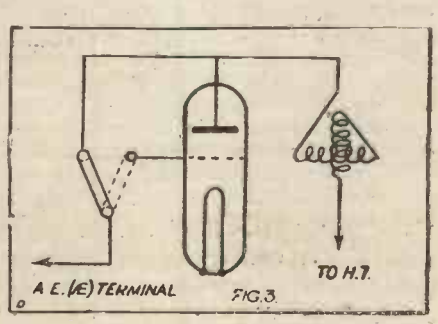
There are two arms mounted together—one for the "off" position, and for selecting

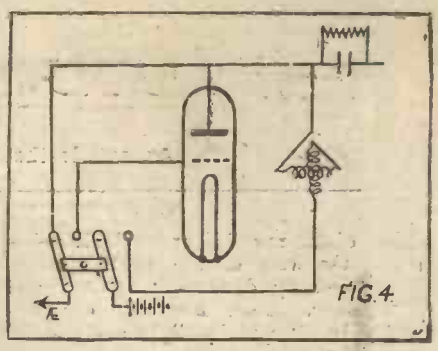


A typical home-made receiver with an excellent and well-finished appearance.

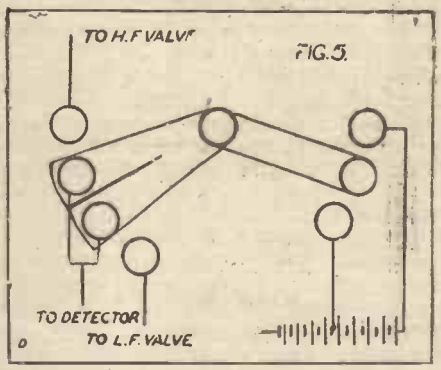
30 v. or 60 v., according to requirements. The other arm is large enough to cover two studs, and is split part of its length to ensure good contact. In one position the arm supplies H.T. to the rectifying valve, in another to detector and H.F., and the third position supplies detector and L.F. valves.

Fig. 6 shows a useful adaption of the ordinary turn switch. A and B are the two proper contact pieces, while in the screw holes C and D, two large-headed screws are fixed, each with a length of wire making good contact for connecting purposes. This



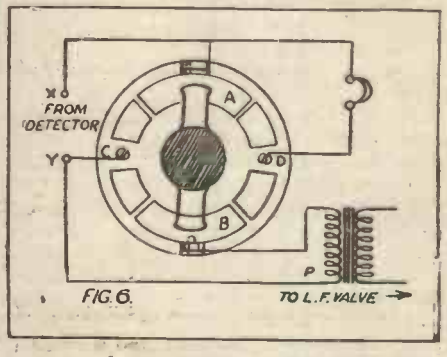


may often be used to take the place of the double-pole change-over switch, being suitable for following on a crystal detector to switch in either the note magnifier or the headphones direct.



General Observations.

In the illustration the note magnifier is shown switched in, the rectified signals passing from terminal X of the detector through the switch from A to B, through the primary coil P of the transformer, and back to terminal Y.



Care should be taken that the wiring necessary for such additional switching arrangements is introduced into the circuit in such a way that there will be no danger from "shorts" occurring. Also, the wires should be kept away from existing connections as far as possible, and inserted so that they do not tend to run parallel with the latter. If this is not done there is always a possibility that capacity effects will be caused, and that circuits previously quite "silent" will develop an annoying tendency to "howl." Again, it is distinctly advisable when experimenting with valve circuits for the purpose of evolving useful switching schemes, to employ a fuse in circuit with the positive lead of the H.T. battery. A small "pea lamp" will do quite well, and may be the cause of saving, by its own destruction, a more expensive item in the form of a valve.

WIRELESS WORRIES.

By L. McMICHAEL, M.I.R.E. (Secretary of the Radio Society of Great Britain).

A little attention paid to a few simple rules in the maintenance of a receiver will obviate future trouble.

III.—CARE OF THE SET AND ACCESSORIES.

THERE must be no doubt left in the mind of the man who has purchased a wireless set that his instrument must be looked after and mothered almost as attentively as a mother cares for her child, as the motorist cares for his car, and as the business man cares for his personal appearance.

No one is surprised when a motor-car refuses to work because of the dirt that has accumulated in the carburettor jet. Likewise no one has cause to grumble when a cold is developed, after having been in the rain all day without an overcoat on. This may all seem by the way, but it merely serves its purpose to point out that a wireless instrument needs as much care and attention as anything else, whether it is one's person or one's own personal property. When one purchases a wireless set it is always well finished, clean, free from dust and foreign particles; the joints are all cleanly made and soldered, the accessories are new, the accumulator is in a prime condition, and if the set is a good one as it should be, everything works extremely well.

If the set is allowed to remain without touching it at all, there will come a day, possibly, when reception of the Opera, for instance, is marred by many varied and intermittent objectionable noises, cracklings, spittings, etc., or else when a party has been arranged to listen to some important item which is to be broadcast, the accumulator will suddenly refuse to pass more current to the valves, and the machine becomes a lifeless being. The question that concerns us is how to prevent these failings and objections in the easiest and most profitable manner.

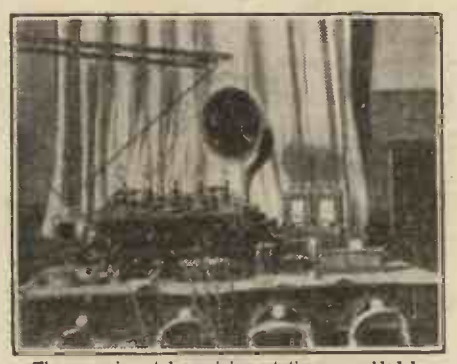
Examine All Connections.

The best and most economical way to keep a wireless set in good condition is to acquire the habit of inspecting every nut, bolt, joint, and wire at least once a week. Each wire should be inspected to see that it is making proper contact on its terminal, and each joint is well soldered in its proper position. Soldered joints, especially with an oscillating current such as is present in a wireless set, have a very nasty habit of developing into what is called a "dry joint." That is to say, instead of the solder forming a connection between a wire and a terminal, it is merely making on the wire or on the terminal, and not on both. A casual and visual inspection would show that the wire was making good contact, but a slight finger pressure would pull the wire away, or show that it is loose in the solder on the terminal. Where alternating current is concerned this makes all the difference between good reception and no reception, because where direct current will pass through a joint where two wires are only touching, alternating current will not pass through and the result is that, instead of good, clear, steady reception, one gets bad, muffled, and intermittent noises.

Wherever possible the set should be totally enclosed, so as to make it free from dust. Dust is a very great enemy of a wireless set, inasmuch that it causes noises and sometimes forms a short circuit between two wires that are ordinarily insulated from one another. This is especially noticeable in the case of valve-holders. A layer of dust on the top of a valve-holder will very often cause a short circuit between two or more of the valve-pins, with disastrous results. If the wireless set is not one of the type which is totally enclosed in a cabinet, it should always be covered with some dust-proof cover when not in use, and in those sets where the valves are either horizontal or fit in the front of the set, the valves should always be removed.

The Capacity of Accumulators.

Valves are very fragile little instruments, and the greatest care should be taken over each one. The slightest knock will sometimes break the very thin wire filament inside, so that when not in use, unless they



The experimental receiving station assembled by Mr. H. B. Robinson, F.Z.S., of the Farm School, Newton-c-Willow, Lancs.

are totally enclosed in the set, they should be replaced in the padded boxes in which they are supplied.

There is nothing in the accessories of a wireless set which pays to be looked after more than the accumulator which supplies the current to light the valves. An accumulator should never be run until it is utterly exhausted. The proper use for an accumulator is to run it for at least two hours less than its limit. Thus, if it is a 30 ampere hour accumulator, it should never be used for more than 28 ampere hours. Perhaps it would be as well here to explain what is meant by the statement that an accumulator is, say, 30 actual ampere hours. Broadly speaking, this statement means that you can draw from an accumulator a certain number of amperes for a certain number of hours, and this figure represents the product of amperes and number of hours. Thus, the 30 ampere-hour accumulator will deliver 5 amperes for six hours, or 1 ampere for thirty hours, or half an ampere for sixty hours. It is always as well to ascertain how many amperes each valve that you are using consumes.

"Crackling" Noises.

For example, if Marconi Osram "R" valves are used, these valves take ·65 amperes each. If four valves are used, it is obvious that four times this number is the total taken from the accumulator, which is equal to 2·6 amperes. By dividing this figure into 30, it can be determined the numbers of hours for which the accumulator will last, which is about twelve.

It will be found in practice that an accumulator will last longer than its specified time, because this figure represents a continuous use. When an accumulator is used for a few hours one night, and not again until the following night, it regains some of its power during the lapse of time. Accumulators should be recharged regularly and by a reliable firm, and it is always as well to invest in a small voltmeter to test the voltage of your accumulator after it has been charged.

Never allow an accumulator to stand unused for too great a length of time, because it begins to what is known as sulphate—that is, a white deposit accumulates on the plates, and is very difficult to remove when next it is to be charged.

The high-tension battery—that is, the battery that is used for the plate of the valve, does not require recharging, as this battery lasts for some months. However, it is always as well to test periodically the voltage of each cell, as sometimes a cell will develop a short circuit, and this will upset the whole battery. If high-tension batteries of the plug-in type are used, see that the wander plugs are clean and make good and tight contact in the sockets of the battery. Loose contact is invariably the cause of unpleasant crackling.

Protection Against Lightning.

Lastly *use* an aerial and earth switch. Always switch the aerial over to the earth when the set is not in use, as a powerful lightning discharge which can possibly run along the aerial will burn out the instrument on its way to earth if the aerial switch is not thrown to earth.

It is to be hoped that these few remarks and the advice will help the man in the street to obtain the most efficient results from the instrument of his choice.

When tapping a coil amateurs sometimes find it difficult to fix the contact studs exactly in position to make good contact with the switch arms, and a tip to obviate the use of these switches should be welcome. If tappings are taken to telephone terminals, which may easily be mounted on the top of the coil, the number of turns can readily be varied by the use of a wander plug of a size that will easily fit into the terminals.

"STAND BY."

Sweet Nothing—Oscillatory Gee-Gees—A Loop Aerial—Insects—Time—Lightning.

Sweet Nothing.

AMONGST a certain company of wireless enthusiasts who travel to town daily together, the quest for the unusual has recently taken the form of making the "cheapest" possible set. The other morning, one, Burban of this company, described a crystal detector built on the rubber heel pad of an old boot, and was nearly thrown out of the window for calling it a "booty." Following him, Goodass, a genial soul who has never yet bought a flag on a flag-day, exhibited his match-box crystal set, the total cost of which worked out at two and a penny, including the matches. One old man, Chester, related an account of his search through half a ton of Derby brights for a cheap bit of pyrites, and how pleased his wife was with him for breaking up such a nice stock of "lighting" coal.

The funny man of the party, usually addressed as Heaviside, then told of his set in which the detector was a piece of sugar stuck on the end of a hatpin, the aerial a wire clothes-line, the inductance the bars of a mousetrap *connected up in series*, and the 'phones a development of the tin-lid string type so well known to the schoolboys of a generation ago. The total cost, he claimed, amounted exactly to what was heard with the set.

* * *

The opening of the Fête of the Dublin Gaelic League at Croke Park being broadcast by the President, Mr. Dan McCarthy, T.D.

Oscillatory Gee-Gees.

Further attempts at jockeyless horse-racing are to be made in France. The latest reports indicate that these interesting experiments are being carried out according to the C.G.S. (cum grano salis) system.

Each racehorse, it is said, is fitted with a small frame aerial, and, instead of a live jockey in the saddle, has a loud-speaker whose terminals are a pair of spurs, one on the positive or "off" side of the horse, and the other on the negative or "near" side. A certain wave-length is allotted to each gee-gee, and the hope is expressed that the horses will respond to the instructions of the jockeys who direct them from the grand stand.

Wonderful, isn't it? Talking about frame aerials on racehorses reminds me of a jolly fine frame aerial that I once made on another kind of horse, a clothes-horse.

Seriously speaking, though, these French experimenters might try the effect of their oscillatory currents on that magnificent oscillatory horse of our childhood days, the rocking-horse. Gee!

I am daily expecting to hear glowing accounts of the wireless progress made by the horse marines of the Swiss Navee.

* * *

A Loop Aerial.

My near neighbour, Schowit, isn't a bad sort of fellow really, but we are a little jealous of each other at times, as most neighbours usually are. Up to now, though, things have panned out pretty evenly between us. If his scarlet runners have done better than mine, sure enough my garden-peas have balanced the account. If his standard roses have been the envy of the suburb, my Dorothy Perkins has been fit to beat the band.

With wireless, however, I have the laugh over my good neighbour. He has only recently succumbed to the broadcasting catching fever. In order to show his independence, he put up his aerial without help from me, an old hand at the game. I suppose he knew I was watching all the time from my sitting-room window, and I daresay he thought he had me over the matter of the mast, since his was a good ten feet higher than mine. The work of erecting Schowit's aerial was not completed until some time after dusk.

Next morning, looking out of my bedroom window, my first glance was at the new aerial. Poor old Schowit. There was a most delightful caught-up loop of about five feet of wire right in the very centre of the aerial.

Insects.

It has been stated by an eminent authority that certain insects signal to each other by electro-magnetic waves. The reference is, of course, to those insects which have an antenna, the butterfly, for example.

Whether or not insects signal to each other by wireless waves, it is a mercy that the mosquito signals to its human victims by means of sound waves. A mosquito has only to hum for the short space of one second anywhere within twenty yards of me for me to be after his scalp. When in Canada, I got disturbed so much at night by these little bloodthirsty insects that I became very proficient in getting up and killing those that intruded in my bedroom without wakening up properly.

* * *

Time.

Did you read that most wonderful exposition of relativity in the first number of "Wireless Review"? We were told that our hours and days are not a measure of time at all, nor is our year. It is a bothering nuisance to be told this, and to have our ancient and respected ideas kiboshed in this ruthless manner. Were the relativists to go and talk to a jolly old party of ex-convicts, burglars, biters of policemen, wireless pirates, and the like, and tell them that what they had done was not time at all, relatively speaking, his time for the return journey would be pretty good, relatively speaking.

Lightning.

* * *

During the recent heavy demonstrations by Nature, who has been wasting considerably more "juice" in sparking across the "terminals" than all the amateurs who "stand by" in the broadcasting station two minutes intervals, with seven or more glowing valves, put together, wireless aerials have become in many cases to be regarded as potential electrocution devices.

I know quite a number of people who, during a display of lightning, oscillate between a burning desire to earth the aerial and an equally burning desire to keep as far away from the set as possible. The inevitable result is that "Bospherine for the Nerves" eventually secures another client. Much less expensive, however, is to include an earthing switch between the aerial lead and earth lead, which, when switched "on," converts the aerial into a lightning conductor.

"KNOB TURNER."

THE VALVE.

By Captain P. P. ECKERSLEY (Chief Engineer of the B.B.C.)

In this article Captain Eckersley is at his best, and his description of the thermionic valve is both interesting and informative. No reader who remembers "Two Emma Tock, Wr-r-rittle Calling," should pass this page by, even although technically he may consider his knowledge sufficient to do so.

PROBABLY the greatest invention of the century, the Valve, is so common an article of commerce that many may look upon it with little respect, inasmuch as familiarity breeds contempt. The valve can be used in such a multitude of ways—as generator, as magnifier, as trigger, or as rectifier, to name a few.

My readers will thus, I hope, pardon me for a somewhat lengthy, and, to some, perhaps, redundant explanation of its inner mysteries, but I do feel that a lot of people miss the subtleties of the device because its essentials are so easy to understand, and its uses so diverse. Truly, it is the corner-stone of modern wireless practice.

Procession of "Little People."

The name "Valve," given by some to the device, needs perpetuating; the highbrow christenings find little favour with the writer, anyway. There have been attempts to baptise our really very plebeian friend as "Triode," the rectifier as "Diode," to talk about the filament as the "Cathode," and I suppose the two-grid valve as the "Quadrode." Do let's stick to "Valve," because an electric valve it is. The term tube leaves me cold. If we borrow our slang from across the Atlantic, surely we needn't lean on our cousins for technical terms, especially when they are so undescriptive as to use "tube" for a sealed glass vessel containing a vacuum, various spirals, metal masses, and an electrically heated filament.

Now for some popular similes!

What is Electricity? Nobody knows, and this is at first unsatisfactory, but I think the following makes a lot clear.

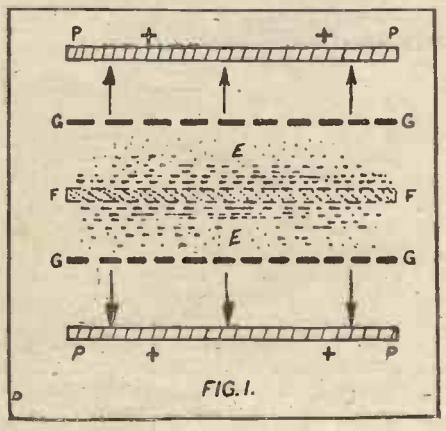


FIG. 1.

When an electric current flows in a wire, I like to imagine a steady procession of energetic little people rushing along a narrow street, jostling, cannoning, but on the whole making steady progress. The street is the wire, the little people are called electrons, and they carry the electricity. Each of the little people, then, has under the arm a parcel containing "Electricity." No one knows what is inside the parcel, but they do know what happens when these parcels are carried from place to place in a steady progress.

Street of "Pubs."

Now, these little people only move when they are urged by pressure behind (difference of potential or voltage), but their progress is not a gentle one. All along the street there are "pubs," called scientifically "positives," and, of course, the negatives or the little people are tremendously attracted to the pubs., and they keep dashing in, and are held glued to the attractive bar. Only when a more eager negative comes rushing in is another dislodged, and is forced drunkenly on his way. In a conductor of electricity there are more people than pubs., and so the parcels get moved on. A progress is thus made—jostling, banging, and confused as it is—and electricity in the parcels is carried along the street.

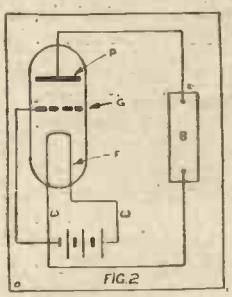


FIG. 2

This jostling progress makes the street or the wire, of course, quite hot, and the heat makes the little people more rude and active and thirsty. If the street is more and more constricted—namely, if the wire is made thinner and thinner—the jostling and banging increases to such an extent that the wire gets red hot. The crowd becomes so intense that certain of the little people get squeezed out of the street, and actually hang about outside the street, eagerly looking for a positive pub.

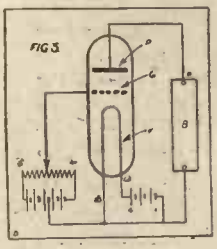
A valve, then, has a filament, which is the crowded street, and so hot does the wire get that a large percentage of the electrons (each with their parcel of negative electricity) get shot out of the wire, and hang about outside.

Now, imagine that this crowded street runs near a sort of Eldorado of pubs. (see Fig. 1), but that the approach to the pubs. is through a row of turnstiles.

The "Turnstiles."

The congested street is at F, and a large crowd, E, collects, pressing up against the turnstiles, G, each member of the crowd, each being negative, repellant to the other, but each urging towards the array of pubs. P, the number of people able to get past the turnstiles being regulated by the ease of opening of the turnstiles.

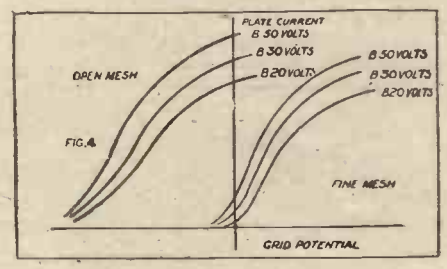
The slightest change in the case of passing the turnstiles makes a tremendous difference to the number of people who can dash into the pubs. at the end. Thus, it only takes, perhaps, ten people at the turnstiles to control the flow of thousands—and this is the principle of the valve. The valve *is* a valve, inasmuch as small forces on the Grid G (the turnstiles) makes a tremendous change in the current (the number of people dashing from street F, filament) to the pubs. (the plate). Remember the accumulator of Fig. 2 is only a reservoir of people who get fairly banged about along the main street, W (the low-tension supply wires), until they arrive in the very constricted filament. Here the crowd becomes so intense that they get jostled right out of the street, and are urged towards the plate via the grid. Once past the grid, the few are free to dash across the intervening space, always provided the pubs. are positive. Thus, the high-tension battery, B (Fig. 2), gives the urge to those who leave the filament, and a current flows round and round from F to P through the high-tension battery, and back to F.



The amount of the high-tension current is largely governed by the potential or voltage (which simply means the "ease of passing") of the grid, and it requires only small forces on the grid to control the high tension current.

Grid Current.

A device is shown in Fig. 2. whereby the grid can be made negative to the filament (turnstiles shut) or positive. Now, when it is made positive, some of the people dash into the grid, and a current flows round F, G, back to F. This is called grid current, and it is often lost sight of. If the grid is entirely disconnected, it gets more and more negative, and automatically shuts, only letting a few bold spirits rush the barriers. The finer the grid—i.e. the closer together the turnstiles, the easier does it shut.



Now turn to Fig. 3, which is a curve showing (1) for a fine mesh grid, and (2) for an open mesh grid, the relation between the

(*Continued on page* 812.)

THE VALVE.

(*Continued from page* 811.)

potential of the grid (how much the turnstiles are shut or open) and the current from F to P (plate current).

Several curves are shown for different values of high tension, or varying attractiveness of the pubs. or plate towards the little people.

It is all very easy and simple really so far, but the great point to remember is that the valve is a magnifier, inasmuch as small forces on the grid make large changes of plate current.

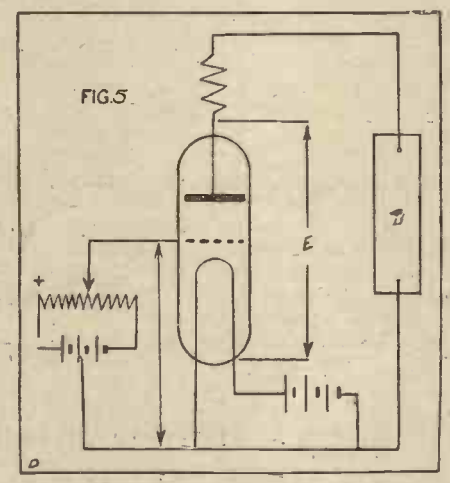
The Valve as a Magnifier.

Now turn to Fig. 5. A resistance, R, is connected in series with the high-tension battery. Now, the voltage from the plate to earth is less than the voltage of the H.T. battery positive to earth by an amount Ri, where i is the plate current and R is the resistance. Now, suppose more current is made to flow through the circuit by putting some positive on the grid (opening the turnstiles more). Then the anode voltage to earth changes and becomes less, because more current is made to flow through R. Now, the ratio between the change of voltage on E the grid to the change of voltage E of the anode is called the magnification value (or, more simply, M value) of the valve.

By applying perhaps one volt to the grid, the voltage of the anode may change by 10 volts. Then the M value of the valve is 10.

This is extraordinarily simple, but it must be fully understood. Without connecting the resistance R in series with the valve, the system cannot become a magnification system, and the valve cannot be applied as a magnifier. It doesn't matter as long as R is a resistance either for direct current or alternating current, for if an alternating voltage is applied to the grid, and an inductance is connected between + H T and the plate, then for every volt of applied *alternating* voltage 10 volts of alternating voltage will be produced at the anode of the valve. Of course, a direct current would do, but with alternating voltages an inductance would do as well.

Here, then, is a magnifier which may magnify 5, 10, or 100 times in one stage, and the whole beauty of the device is that there is no sensible time lag in the system; the little people are so mobile that they can change their motions several million times a second without getting out of step. This, then, is the point—the valve can act as a magnifier for alternating currents and voltages up to any known and used frequency without moving parts, without fuss



and noise, and will serve you faithfully, however much you ask of it within reason.

Soft Valves.

Now, we have seen that when the little people, the electrons, get past the turnstiles, they are free to dash towards the array of pubs. called the plate. Their way is made very easy by removing all matter that human ingenuity can remove, and containing anode grid and filament in an exhausted vessel out of which nearly all gas has been pumped.

This is very necessary, for gas is very crowded with other little people and other big pubs., and the desirable freedom to dash across between the grid and filament would be lost to the electron were its way impeded by what are called "gaseous ores," which simply means pubs. and people. Even a little gas makes for trouble, and the sudden rush of mad people so upsets things if gas is present, that a sort of mad revolution takes place, new people are hurried from their formerly comfortable lassitude inside the bars, and the whole area becomes so excited that a "blue glow" is set up, and we say that the valve has gone soft, or that the gas has become ionised.

Just at the moment of going soft (is not madness akin to genius?) the properties of the valve are extremely complex, and the M value may become very great, but the state of affairs is so unstable that the use of soft valves is uncommercial. Some who have had experience may remember the extraordinary sensitivity one used to be able to obtain by releasing occluded gas in the tip of the valve by the aid of a match.

The agony of the choice between losing the signal or burning one's finger with the gas releasing match applied skilfully to the valve tip has to be experienced to be believed. Nowadays, the really soft valve has been superseded by the more reliable, but certainly less efficient, hard valve, but sometimes one's pet valve that hears Australia with a one-inch frame owes its marvellous sensitivity to a whiff of gas.

The Saturation Point.

There is a maximum current which a valve can pass. Strap together grid and filament, as in Fig. 5, apply a voltage, and go on increasing the voltage and read the current. A time will come when increasing the voltage will no longer result in an increased current—saturation has set in. All this means is that, to go back to the old simile, the number of people that can be drawn from the jostling street is limited; there aren't enough people with their parcels to go on increasing indefinitely. Only a proportion of the population can pass through the street without the street being destroyed, and only a proportion of this proportion are free to be sucked out past the turnstiles to the pubs.

Thus, when anyone says the emission is 50 milliamperes, they only mean that such-and-such a number of people can be drawn out of the street per given time.

CARDIFF STATION NOTES.

Conducted by Major A. Corbett-Smith (Station Director)

WELSH choirs and choral parties are notoriously conservative in their choice of songs. Like the Chinese, what was good enough for their grandfathers is eighty years better now. The Station Director has got over the difficulty by inducing each party broadcasting to specialise from a long prepared list of the best part songs. Thus, the works of the great Elizabethan madrigal composers were quite unknown in the West Country. Now we are to hear some of the finest specimens. Incidentally, too, the William Byrd tercentenary will be honoured through a visit from the Bristol Choir.

Miss Marjorie Unett, leading lady of the Cardiff Station dramatic company.

A recent musical event of importance was the performance of Beethoven's famous Fifth Symphony. An excellent performance, too, eliciting a great number of congratulatory letters. Next Sunday we are promised a programme of Bohemian music, Dvorak and Smetana, and the following Sunday an all-British night.

"Good Evening, Comradios!"

Last Tuesday week we had a rollicking evening in the company of Sir John Falstaff and the two Merry Wives of Windsor. The "letter scene," carried through in the highest spirits by Miss Marjorie Unett (photo herewith) and Miss Netta Wise, was a joy to hear, but Mr. Ivor Thomas unfortunately seemed to miss the gargantuan humour of Falstaff. "The Life and Death of Falstaff" will be continued on successive Tuesday nights.

Thursday last was another red-letter day, when Stephen Phillips's fine tragedy, "Paola and Francesca," was performed. This was the third modern drama broadcast from Cardiff.

For some time past it has been felt that the call, "Hallo! Everybody," was not in keeping with the "happy family" feeling which exists among all listeners-in to the Cardiff station. "Mr. Everyman," as the director is known to all, accordingly started a competition for the most suitable form of address. Two competitors, Mr. Cecil Smith, of Compton Martin, and Mr. J. W. Aspinall, of Cheltenham, each hit upon the term COMRADIOS—a happy compound word—and now each evening the call goes out, "Good-evening, Comradios!" to the content of the majority. A cheque for one guinea has been sent to each of the two winners.

DAMPING AND ITS EFFECT ON RADIO TELEPHONY.

By J. H. REYNER, B.Sc., A.C.G.I.

Some points well worth considering before attempting to obtain "super" results from ordinary circuits.

DAMPING is the name given to the decreasing of current in an oscillatory circuit owing to the losses in the circuit. The effect of damping may be readily understood by consideration of the mechanical analogy of a pendulum. If a simple pendulum, consisting of a light string with a weight at the end, is set in motion, the swings will gradually get smaller and smaller, until eventually the pendulum comes to rest. This slowing down or "damping" is due to air friction caused by the motion of the pendulum itself. As the pendulum slows down, the effect of the air friction decreases, so that the oscillations do not die away at a uniform rate, but follow what is known as an "exponential" law, the rate of decay being proportional to the actual amplitude of the swing at the particular time.

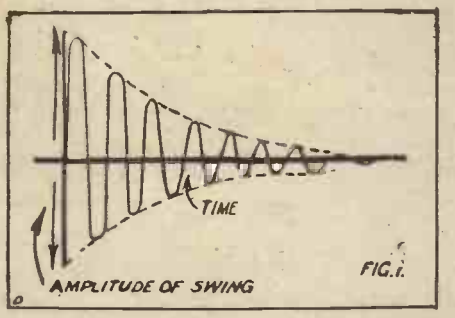


Fig. 1 shows the manner in which the oscillations die away. It will be seen that the time of swing is the same all the while, it is only the amplitude which changes. An exactly similar phenomenon takes place in an electrical oscillatory circuit, the current dying away at a rate depending on the constants of the circuit. The chief factor is the resistance, but the ratio of capacity to inductance has some effect. The higher this ratio, the greater is the damping in the circuit.

When radio telephony is transmitted, the method generally adopted is to send out a wave at a radio frequency, and to modulate this in accordance with the speech vibrations impressed on the microphone. For a faithful reproduction in the receiver the current induced by the wireless waves should follow these modulations exactly. Whether they will or not depends on the damping of the circuit.

Results of Damping.

There are three possible cases, viz. :

1. *Over Damping.*—Here the current in the circuit does not build up sufficiently rapidly, and dies away too quickly to follow the exact variations.

2. *Correct Damping.*—In which case the current variations follow the speech faithfully.

3. *Under Damping.*—When the currents build up too quickly and do not die away rapidly enough.

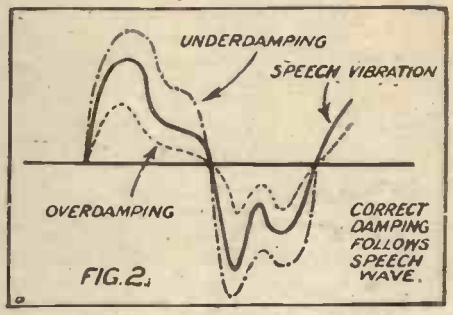
Fig. 2 illustrates the three cases.

Absolutely correct damping is impossible, because the speech frequencies are varying the whole time, while the damping rate or "decrement" of the circuit remains constant. But the circuit may be adjusted to have correct damping at about 800 cycles per second—the mean speech frequency—or may be over damped for low notes, but correctly damped for high notes, so obtaining good detail.

The effect of reaction is to vary the damping, since it reduces the effective resistance of the circuit. By increasing the reaction, therefore, it is possible to go from over damping through the correct adjustment to under damping.

Regulation of Reaction.

The amount of reaction employed should only be great enough to bring the damping up to its correct value. If this value is exceeded much, distortion will result. Line detail and quality of tone is due to harmonics in the speech, and this will be entirely lost if the circuit is under damped; where it can be done, it is even advisable to over damp a little, since this ensures that the high tones are faithfully reproduced. The correct value,



of course, can only be found by trial; but it should be remembered that too much reaction will mean loss of clearness and quality.

Ultra-efficient circuits of the usual type are, therefore, unsuitable for telephony. Either more valves should be employed, or arrangements such as the reflex circuit should be adopted in which a single valve is made to do more work by means other than the forcing up of reaction.

Crystal circuits should be made with stout wire, and a reasonably small condenser (the aerial capacity is the best, tuning being done with a variometer, or other form of variable inductance). The aerial circuit itself has sufficient inherent resistance to introduce all the damping required.

TUNGSTEN WIRE MANUFACTURE.

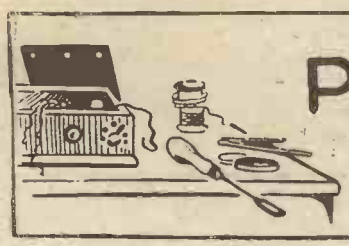
SCHEELITE ore (crude calcium tungstate) is decomposed by boiling with conc. hydrochloric acid in iron pans. The impure tungstic acid which remains in the pan as a sludge is dissolved in ammonium hydrate and the solution filtered. This solution is then run slowly into boiling hydrochloric acid in a large silica pot. The tungsten trioxide which is precipitated as a heavy powder is washed repeatedly by decantation, and filtered on a vacuum filter. The oxide is then dried in silica basins, ground and sieved.

The reduction of the oxide is carried out at a red heat in a current of hydrogen, electric furnaces being used for this and the subsequent high temperature operations. The reduction furnishes tungsten metal powder in a dense form, which is pressed into ingots in a hydraulic press. The compressed ingot will not stand handling until after the "carbonising" process which consists in heating to 1,200° Cels. in a current of hydrogen for an hour. During this process the crystalline tungsten grains begin growing and give sufficient mechanical strength to the ingot to stand handling.

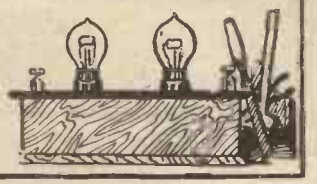
Drawing the Wire.

The carbonised ingot is mounted between electrodes in an atmosphere of hydrogen, and sufficient current passed through the ingot to raise its temperature to about 3,000° Cels. Crystal growth in the ingot takes place, accompanied by a shrinkage of about 15 per cent. in its linear dimensions and elimination of all voids. The sintered ingot is mechanically strong, though not appreciably ductile at room temperature, and after the corners have been ground off is ready for working. This consists in swaging hot, from 6 mm. diameter to about 1 mm. diameter, and thereafter drawing through diamond dies to the required diameter. The metal is worked hot throughout, but the temperature is gradually reduced during working from about 1,350° Cels. for the initial swaging to 600° Cels. for the final drawing operation.

Chief Wireless Officer Stanley M. Brown, operating the 3 kw. transmitter of the ss. "Mauretania."

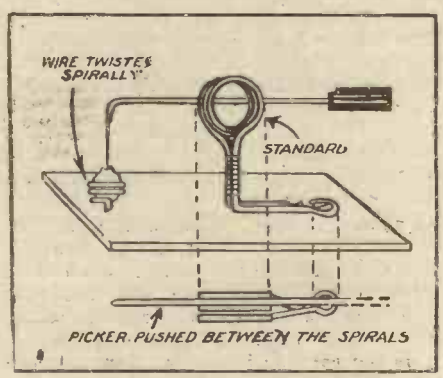


PRACTICAL IDEAS FOR THE AMATEUR



A SIMPLE CRYSTAL DETECTOR.

CRYSTAL detector making has been exploited in many forms, which applies generally to all wireless apparatus; but the following detector will permit the amateur to try any crystal or



any point in a few moments, and, at the same time, is extremely simple to make.

The drawing shows clearly the nature of the construction, which consists of a standard formed out of a piece of brass or G.S. wire, a helix being formed at the top of two or three turns for the various points to be pressed in at will. The spring shaped cup should be made slightly spiral, allowing for a better grip of the irregular shape of the crystals.

HINTS FOR THE AMATEUR'S POCKET-BOOK.

THE following hints will be found useful to the amateur who builds everything for himself.

Very often he finds that at the last moment he wants a spring washer for some particular purpose, and cannot find one. This may be easily remedied by simply cutting through one side of an ordinary washer with a cold chisel or a pair of snips, when, as a rule, the washer will open out spirally and answer quite well.

Securing Terminals.

Another annoying little thing that very often happens is that terminals come loose on the completed set through the continual tightening up of wires in them. Of course, the best remedy will be to secure them with two nuts, but if these are not available, the best way to overcome the difficulty is to make a few nicks in the base of the terminal so that they will dig in to the ebonite.

This is easily accomplished by drilling some holes in the edge of a piece of wood that will just take the body of the terminal, then pressing the terminal into one of the holes and pinching it up in the vice. The wood will close very tightly round the terminal and hold it very secure, and, at the same time, will not damage it in any way. This dodge will serve also for holding small screws and other fittings that require filing up, etc., the threads not being damaged in the process

Drilling and Lacquering.

To drill ebonite with clean holes is sometimes a little tedious. The best way to do it is to mark the panel on the wrong side—avoid pencil marks—drill four of the screw holes that will eventually be the screwing-down holes, and screw the whole panel to a piece of flat wood. Then drill the desired holes right through into the wood. This will leave a clean hole on both sides of the ebonite.

When making up a multiple switch on the panel it is better to solder the taps to the bolts instead of screwing the wires under the nuts. This will be made easier if a small saw cut is made in the end of the bolt before assembling, as the wires will lie snugly in the cut during the process of soldering.

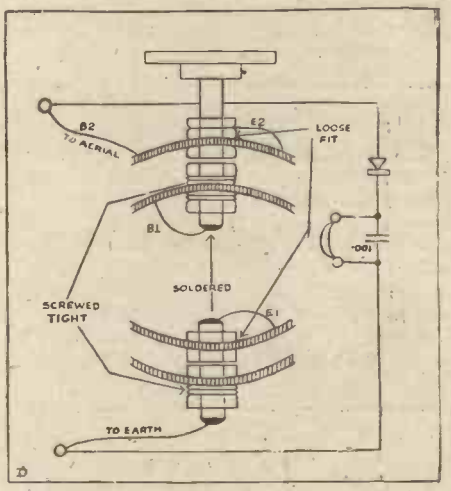
All the bright brass parts should be lacquered before they are put on to the panel. This is really an easy job. The best way to polish them up is to use the drill as a means of holding the parts, and whilst revolving the drill, pinch the parts to be polished with a piece of fine emery cloth, which will give them a good finish. Then place them in the lid of an old tin and put them on a gas-ring to get warm. Whilst warm wipe them with a piece of rag or cotton-wool that has a little lacquer on it; they will dry at once, being warm. Lacquer is very cheap, and about three pennyworth will do two or three panels.

Ordinary solder may be much improved in quality if you re-melt it and add all your tinfoil cuttings to it; stir it well, and re-cast into little grooves in a piece of wood made with a gouge.

A VARIOMETER FOR CRYSTAL WORKING.

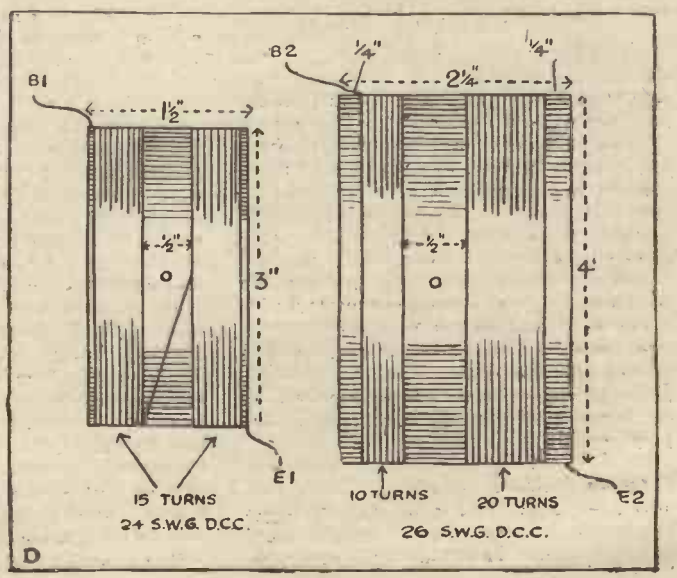
OBTAIN two pieces of cardboard tube, as per dimensions given. Give these a good coat of shellac to keep moisture out. If it is possible to get a piece 3¾ in., instead of 4 in. for the stator it will be better, as this will improve reception.

On fitting up, see that the two points marked "screwed tight" *are* tight. I think the dimensions given need no further



comment, only that B means beginning, and E means end.

If this inductance is used on a valve circuit, from one up to five valves, it will give better reception of broadcast telephony than multi-layer coils.



SUMMERTIME WIRELESS.

By OSWALD J. RANKIN.

Describing practical methods of conducting out-of-door wireless work.

THERE is no doubt that the usual counter-attractions of the summer will experience a slump this year through the challenge of this super-hobby. Radio is equally as simple and fascinating in the countryside or on the river during the summer as it is in the home during the winter months. A country picnic with town music is no longer a poet's dream, but a practical proposition.

We might hear the same music in any high-class city restaurant, but at the same time there is the restless crowd and the vitiated atmosphere. By means of our picnic de luxe we can tune out these two undesirables, and enjoy the pure music in true hermit style. The temporary erection of a portable receiving installation is an extremely simple matter. It is proposed to first deal with temporary aerial systems, and describe a number of suitable receivers in articles which will appear later in POPULAR WIRELESS.

Trials of Aerial Erection.

The efficiency of any outdoor aerial depends chiefly on four things: height, length, insulation, and directional properties. If the aerial is lacking in general efficiency it becomes necessary to install a receiver which is sufficiently sensitive to make up for this loss. In other words, this receiver will essentially be rather more elaborate and efficient than the one employed with the perfect aerial. This fact

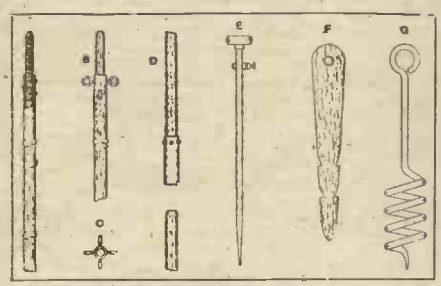


Fig. 1.

should not be lost sight of, especially when one is concerned with a temporary aerial and portable set.

The erection of the average aerial at home has perhaps proved to be a rather more complicated proposition than was at first anticipated, embodying one or two heavy scaffold poles and various other paraphernalia, not to mention a few "pounds" of brute strength. One might well shudder at the thoughts of a repetition of this performance every time it was desired to try an experiment with a portable set, and, unless the party were accompanied by a small battalion of navvies, some simple makeshift, and consequently less efficient method, must be adopted.

A Collapsible Mast.

It will be seen, therefore, that the most important consideration concerning portable outfits is the efficiency of the receiver

There are doubtless many enthusiasts who possess a suitable unit, but, on the other hand, there are probably still more who do not, but, as mentioned above, this matter will be fully dealt with in another article. We are here mainly concerned with the construction and erection of a simple temporary aerial which will be as efficient as possible, under the existing conditions.

The mast, which is essentially made in sections, is built up from 5-feet lengths of bamboo, provided at one end with a tight-fitting wooden peg, as shown at A, Fig. 1, each peg being firmly secured in one end of each section, allowing at least 4 in. inside and 6 in. outside the bamboo tube. One of

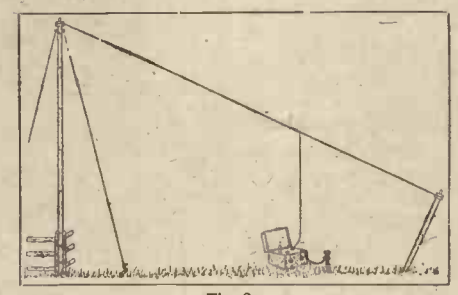


Fig. 2.

the pegs is attached by means of four screw-eyes, as shown at B and C. This section will form the top of the mast, and lengths of strong blind-cord are attached to the screw-eyes and made to function as guy wires.

The main mast is built up from six of these sections, and two other sections form the short mast at the receiving end. Ordinary reel-type insulators are made to fit over the pegs in the top sections of the masts and the aerial wire is attached to these in the usual way. A rubber-covered "lead-in" wire is soldered to the aerial wire.

The Complete Station.

An alternative method of arranging the sectional mast is shown in diagram D, where a 6-in. length of brass tubing is screwed to one end of a length of stout broom-handle so that the end of the next length will fit tightly into this tubular socket.

The earth-spike consists of a 15-in. length of copper rod not less than $\frac{3}{8}$ in. and preferably $\frac{5}{8}$ in. in diameter, filed to a sharp point and fitted with a terminal and small knob as shown at E. Three or four pegs are cut out from well-seasoned oak board to the shape indicated at F, and drilled through at the top to take the lower ends of the guying cords.

Diagram G shows a still better arrangement for anchoring the guying cords. This is a small "corkscrew" as used during the war for erecting barbed-wire entanglements. They may be obtained from almost any Government Surplus Depot, or, failing this, the local blacksmith would no doubt manufacture a set of four for a trifling sum.

The general arrangement of the portable aerial system is shown in Fig. 2. Good strong fences are a special feature of country life, and it is usually only necessary to lash the mast to a substantial-looking post with a few turns of rope or blind-cord. The main mast is first erected, and if a suitable fence is not available four guying cords are provided instead of two as shown. The short mast and earth-spike are temporarily pegged into the ground and the outfit connected up and tuned in.

"Directional" Properties.

The receiver, earth-spike, and short mast are then transferred to another position, keeping the aerial wire tight by moving round in a circular direction. This is continued, trying a new position every few yards until maximum results are obtained. Thus the aerial is made as efficient as possible as far as the directional effect is concerned, the idea being clearly indicated in the diagram Fig. 3, where Y represents the best position for the short mast and receiver in relation to the incoming waves indicated by the arrows, and Z, or directly opposite, the worst possible position. If the correct position of the broadcasting station is known, the aerial, of course, may be permanently fixed at the outset.

If the receiver is firmly secured to the ground by means of a piece of cord and two or three pegs, the lower end of the aerial wire may be connected direct to the aerial terminal of the receiver, and the short mast dispensed with. This method, however, is not so satisfactory as the use of the short mast and "lead-in" shown in Fig. 2. The spot chosen should, of course, be situated as high up as possible, preferably on the brow of a hill free from trees and outbuildings. A bottle of water should be included in the outfit, and this should be poured all round the earth-spike.

If desired, a horizontal L aerial could be used, though this would necessitate the construction of two masts. The results, however, would be well worth the extra trouble in construction and the increased bulkiness of the outfit.

(To be continued.)

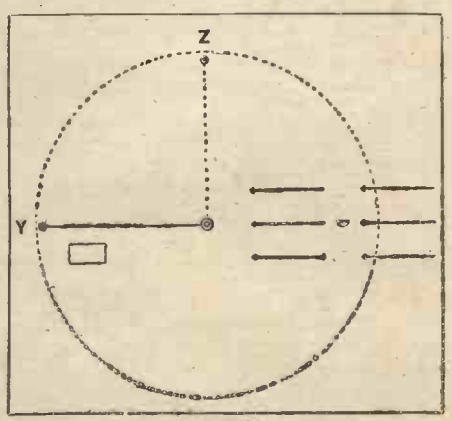


Fig. 3.

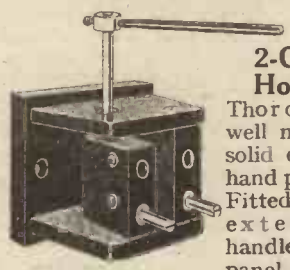
10% Sale

PRIOR to stock taking we have decided to offer all Radio goods at a reduction of 10% (except such fixed price articles as Valves, etc.).

July 18th—31st

Between these dates you can deduct 10% from your order. This is a genuine sale, and no prices have been altered in any way. Carriage paid on all orders of £2 and over.

Humavox Phones
Very latest design adjustable magnet, gives wonderfully clear tone. Magnets are circular—one pole within the other—therefore the centre pull on the diaphragm gives absolutely distortionless reproduction. 4,000 ohms only.
Per pair .. **25/-**



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Finest quality intervalve Transformer. Fully guaranteed. Tested to 500 volts between windings. Very silent in action and free from all distortion. Each **21/-**
Particularly suitable for S.T. 100 Circuit.

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Brass. Single leaf, complete with two nuts and spring washer **10½d.**

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For single coils, solid ebonite base **1/10**
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Takes all coils.

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Tumbler switch pattern concealed mounting **2/-**
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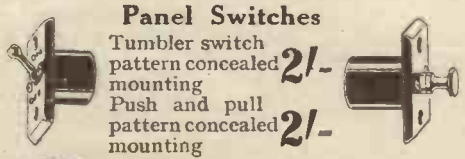

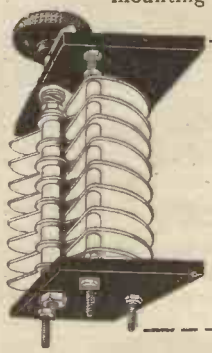

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To callers 1d. in the 1/- discount off condensers.

Variometer on ebonite, W. 250/750 metres, internally wound. Very fine. Sell at sight, 17/11.
Fixed Condensers (from .0002 to .006), 9d., 10d., 1/-, 1/6.
Ebonite Dials (with knob 0-180), 1/4 and 1/6.
Turned Ebonite Valve Holders, 8 nuts, 1/-.
Fil. Resistance, 1/8, 1/10, 2/3.
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Glass Dustproof high-class Detector (whisker), 3/-.
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2 B.A. Nuts, 3 doz. 7d., 1/10 gross.
4, 5, 6 B.A. Nuts, 3 doz. 6d., 1/6 gross.
Terminals, special offer with nut, 4 for 3½d.
Valve Legs and Nuts, 1d. each, 9d. doz.
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Switch Arms, very good, 8d., 10d., 1/3.
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15 v. H.T. Batteries, 2 plugs, 2/6.
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100 feet 7/22 Aerial wire, 4 Insulators, the lot, 2/6. No post orders.
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Marconi R Valves, latest type, 45-60 v., 14/11.
Brunet 4,000 ohm genuine 1st quality Headphones, 17/11.
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H.T. Batteries, 2 Wander plugs, 66 volt, 8/6.
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Aerial Wire, 7/22 per 100 feet, 2/3½ and 2/1½. No post orders.
Rotax Accumulators, 4 v. 40 amp., 15/6.
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Wound Coils, 6 x 3, Turns 180, W.L. 1,100, 1/6.
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Basket Coils (6 in set), up to 3,000 metres, well made and efficient, 2/6.
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4 yards Copper 18-gauge connecting wire, 2d.
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Radio Instruments, Ltd., L.F. Intervalve, 25/-.

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We want your business by post, but MUST have postal charges as follows: Up to 10/- 2d. in the 1/- (or any part); Up to 20/- 1½d. in the 1/- (or any part). Over 20/- carriage paid. (Condensers excluded).

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Wireless Club Reports

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary, Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Radio Society of Great Britain.

Grimsby and District Radio Society.*

At the meeting on Tuesday, June 19th, various pieces of apparatus were exhibited. Mr. Wood outlined the circuit of a rejector set, which had been specially built to cut out local interference, which is generally very prominent in this district.

Hon. sec., M. M. Bennett, c.o. Club Room, Wellowgate, Grimsby.

The Stoke-on-Trent Wireless and Experimental Society.*

A field day was recently held by the Stoke-on-Trent Wireless and Experimental Society, when the Cheadle district was visited. Portable sets were erected, and some experimental work carried out.

On Thursday, June 28th, an exchange and sale was held, among members, of all spare apparatus.

Hon. sec., F. K. Goodson, B.Sc., G.I. Mech. E., Tontine Sq., Hanley.

The Radio Society of Highgate.*

On June 1st an interesting lecture was given by Mr. F. H. Haynes on "Electrostatic Loud Speakers." A demonstration of a Johnsen & Rabbek loud speaker (made by the lecturer) was then given. The first of two lectures on "Amplification" was given by Mr. G. A. V. Sowter, B.Sc., on Friday June 8th. In this lecture high-frequency amplification was dealt with. On Friday, June 15th, Mr. Sowter dealt with low-frequency amplification.

On Friday, June 22nd, a lecture entitled "Why Oscillatory Circuits Oscillate," was given by Mr. J. F. Stanley, B.Sc., A.C.G.I., F.R.A.

Hon. sec., J. F. Stanley, B.Sc., A.C.G.I., F.R.A., 49, Cholmeley Park, Highgate, N. 6.

The Bishop's Stortford School Wireless Society.

The first meeting of the above society was held on June 26th, when a president, chairman, and vice-chairman, secretary, and treasurer, were elected.

Hon. sec., J. Bullivant, The School, Bishop's Stortford, Herts.

Dewsbury and District Wireless Society.*

Members of the Dewsbury Wireless Society spent a very interesting evening on Thursday, when they were permitted to view the interior of the local telephone exchange The authorities had kindly arranged for an engineer to explain the various circuits and other intricacies connected with the system. The general meeting of the society was held on July 5th.

Hon. sec., Fred Gomersall, A.S.A.S., 1, Ashworth Terrace, Dewsbury.

Hendon Radio Society.

At the meeting of the above society on Thursday, June 18th, Mr. C. J. Stadden Lea was elected hon. secretary of the society. It is proposed to hold shortly an exhibition at the Town Hall.

Hon. sec., H. W. Sexton, Esq., 1, John's Avenue, Hendon, N.W. 4.

North Middlesex Wireless Club.*

This club held a very successful meeting at Shaftesbury Hall, Bowes Park, N., on June 27th.

Some members of the Wireless and Experimental Association visit the London Broadcasting Station.

Mr. A. J. Dixon, who gave a lecture on "Wireless Sets and Wireless Sets," is always sure of an appreciative audience.

The hon. sec. will be pleased to forward particulars of membership to wireless enthusiasts who will send him a postcard.

Hon. sec., H. A. Green, 100, Pellatt Grove, Wood Green, N. 22.

Bath Radio Club.

At two recent meetings of the Bath Radio Club, members welcomed the return of Mr. L. E. R. Boxwell, whose lectures had proved so popular at the commencement of the year.

The subject of Mr. Boxwell's first lecture was "Aerials and Earths." Mr. Boxwell's second lecture was an exhaustive exposition of batteries.

Hon. sec., G. H. Barron Curtis, F.S.A.A., F.C.I.S., 6, Pierrepont Street, Bath.

Proposed East Ham Radio Society.

It is proposed to form an amateur radio society at East Ham. All desirous of obtaining information should communicate with Mr. Charles Bull, 26, Keppel Road, East Ham, E. 6.

Hackney and District Radio Society.*

The above society met as usual at the Y.M.C.A., Mare Street, Hackney, on Thursday, June 21st, and was presided over by the chairman, Mr. H. A. Epton.

The next meeting of the society took place on Thursday, June 28th, same hour and same place. Mr. A. Valins gave a fine, instructive lecture on "Variometers and Variometer Winding."

Programme.—July 26th: "Flewelling Circuit," Mr. Bell. August 2nd: "Accumulators and Care of Same," Mr. Wall.

Hon. sec., Mr. C. C. Phillips, 57, Highfield Avenue, Golder's Green, N.W. 11.

The Thornton Heath Radio Society.

The first public meeting of the above society was held on Thursday, June 21st, 1923, at the Polytechnic, High Street, Thornton Heath, when a good attendance was recorded.

Hon. sec., R. S. Keeler, 72, Bensham Manor Road, Thornton Heath, Surrey.

The Kensington Radio Society.*

At the June meeting of the above society, Mr. P. Voight, B.Sc., delivered a lecture and showed several successful experiments on "Dual Amplification."

Hon. sec., Mr. J. Murchie, 33, Elm Bank Gardens, Barnes.

Ipswich and District Radio Society.*

By the courtesy of the Ipswich Postmaster, the members of the Ipswich and District Radio Society were enabled to spend a very interesting and instructive afternoon, on Saturday, June 23rd, inspecting the Ipswich Telephono Exchange.

Hon. sec., H. E. Barbrook, 46, Foundation Street, Ipswich.

Catalogues, Book Reviews, etc.

Messrs. Wright, Layman & Umney, Ltd., have sent us one of the headphone pads they are giving away to listeners-in sending six outside wrappers from tablets of Wright's Coal Tar Soap. It certainly is "very soft rubber," as stated in their recent advertisement, and would prove exceptionally useful to "one-ear-piece" amateurs.

* * *

A good accumulator is essential to the satisfactory working of every set. Such an accumulator is the "J.W.B." These can be supplied for wireless work in four or six volts with an actual capacity of from eleven to sixty amp. hours. Special grease cups in lugs are fitted to prevent corrosion of terminals.

* * *

Very neat crystal and three and four valve sets are the features of a catalogue received from C. L. Malone. These sets are of the highest finish, and bear the B.B.C. stamp. Components are also listed. With the catalogue we received a leaflet describing the "Alva" Self-Charging Accumulator, which can be used to light three valves, and which is kept up to full charge where direct current is available. By the use of an "Alva" rectifier this accumulator may also be used with alternating current.

* * *

Abbey Industries, Ltd., have just issued a new catalogue describing their complete valve and crystal sets. Every set is sold with a guaranteed minimum range.

RADIOTORIAL.

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

In this issue appears the first of a useful series of articles on Wireless in Summer Time—a series of especial interest when taking into account the heat wave and the fact that amateurs are anxious to get out of doors of an evening as much as possible.

Part two of the series on the POPULAR WIRELESS Combination Set is also contained in this issue, and, judging from the number of letters already received from readers, this set is likely to prove the most popular one ever described in any British wireless journal.

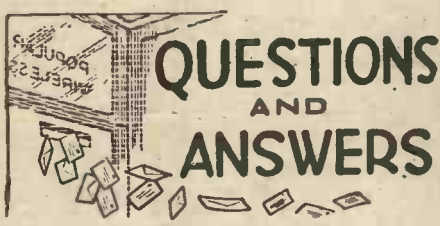
The technical staff will be pleased to answer any questions on this set which readers may care to send in. In fact, we are out to do everything in our power to assist the amateur to successfully make this apparatus, for we feel it to be a real winner and well worthy of POPULAR WIRELESS traditions.

THE EDITOR.

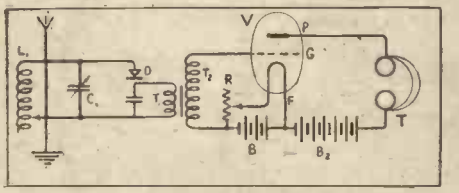
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply.

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.



D. T. (N.W. 7).—I have a crystal set which gives good results, but I wish to add an L.F. valve to make the signals louder. What would be the simplest circuit? Would it work a loud speaker?



The diagram given shows the simplest circuit for adding a valve L.F. amplifier to a crystal set. The coil T_1 is the primary of an L.F. intervalve transformer and is connected to the two 'phone terminals of your crystal set. T_2 is the secondary, while R is the filament resistance. There is nothing difficult or unusual about the circuit, and you should have no trouble in getting it to function satisfactorily. This will hardly operate a loud speaker from where you are situated, but if you require signals loud enough for that purpose, why not use a set employing double magnification? The combination set described in POPULAR WIRELESS last week gives you an easily constructed set which can be used as a crystal set alone or with the valve acting either as an H.F. amplifier, for use in long distance work, or as an H.F. and L.F. amplifier at the same time, giving loud signals which should operate a loud speaker quite well at your address. As a matter of fact the set is capable of operating a loud speaker at a distance of 15 miles from 2 L O, this having actually been performed while the set was on test.

* * *

"FRAME AERIAL" (London).—I am unable to erect an outdoor aerial. Would the POPULAR WIRELESS set work satisfactorily with a frame? I am only two miles from 2 L O.

The set will work quite satisfactorily with a frame aerial; it has been tested with one at one mile distant and gave signals quite audible from a loud speaker. The frame aerial should take the place of the A.T.I., the tuning condenser being in parallel. You will not get loud speaker strength, of course, but on 'phones the signals should be quite loud. Before trying a frame aerial, however, we would advise you to see what results can be obtained with three wires hung across the room and joined to the set in the usual manner. This aerial, if placed so that it is directional for 2 L O, should give better results than the frame, while the usual tuning apparatus of the set will need no modification.

* * *

"MAROON" (Ascot).—What is the best aerial that I can make conforming to P.M.G. regulations. Do you advise single or twin aerial. What is the best earth?

You will probably find that a 100 ft. single aerial will be best for the reception of broadcasting. See that it is well insulated at both ends. Loudest signals will be obtained if the lead-in end of the aerial points towards the station that it is required to receive. Use 7/22 enamelled copper wire, and keep your aerial as far away from trees as possible, and, as height is the all-important factor, get it as high as practicable. It should be at least 30 ft. high for really good results. For an earth plate you will find that a sheet of copper will give excellent results, or a large sheet of galvanised metal will be quite O.K. Bury to a depth of about 3ft., or more if possible, in damp ground and make sure that the earth lead is well soldered to the metal sheet. You will find that a water pipe or tap will make quite an efficient earth if it is impossible to use the direct method.

* * *

P. R. D. (Southampton).—Is it essential to have a fixed condenser across the 'phones and H.T. and across the primary of the intervalve transformers? I have a four-valve set, using two stages of L.F. amplification.

The condensers are not absolutely necessary in either case—that is, so far as the actual "working" of the set. But you will probably find that the apparatus will not function with its maximum efficiency unless the condensers are used. The presence of these condensers—they should be about ·002 to ·003 mfd., is required to provide a path for the H.F. currents that are passing through the plate circuit. If the condensers were not there the high resistance and inductance of the H.T. battery and the 'phones would form a path, but it would have a very high value of impedance and would choke back the H.F. impulses. This would result in a loss of efficiency, and therefore a decrease in signal strength. There is no need to have a condenser across the primaries of all the transformers, if there is one in shunt with the first L.F. transformer that will be sufficient. If you require the absolute maximum out of your set, a great deal can often be accomplished by a little experimenting with the values of these fixed condensers. For instance, you will probably find that large deviations in the size of the condenser across the H.T. battery will not have any noticeable effect, but that if you alter the capacity across the L.F. transformer to any great extent the signal strength will be impaired or increased according as you vary away from or towards the correct value. There is a correct value, though it is not so critical in this case as it is when you are dealing with H.F. circuits.

(*Continued on page* 822.)

THE PROBABLE EFFECT OF EQUIPPING FIRE-BRIGADES WITH PORTABLE WIRELESS OUTFITS.

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 820.*)

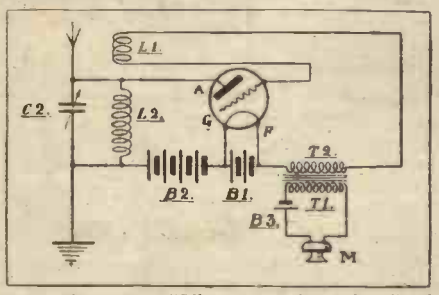
"No. 7" (Chester).—Which coils do you prefer for all-round reception—honeycomb coils, basket, slab, or the slide type (single or double)?

You will find that honeycomb coils will be best for all-round reception. For low wave-lengths we prefer the basket type of coil, but you will find that these lose efficiency above 3,000 metres. Slab coils are not very satisfactory, as they have a considerable amount of self capacity which results in flat tuning and damping of the circuit. This, of course, means a waste of energy.

* * *

M. W. P. (Golder's Green).—What is the simplest telephony transmission circuit that can give fairly satisfactory results. I have just received my transmitting licence, and wish to commence with a very simple circuit, afterwards working up to more complicated apparatus.

One of the most simple circuits that is at all operative over a reasonable distance is the one shown in the diagram. As will be seen, this consists of one valve with only two inductances and a microphone transformer. The inductances can be of any suitable size, depending upon the wave-length that is required.



An ordinary hard "R" valve may be employed and will work quite well up to a distance of 5 or 8 miles. It can be an ordinary basket coil of heavy gauge wire—about 16 or 18 D.C.C. for preference—containing the requisite number of turns. It is quite a good plan to wind the coil with a rather larger centre than usual, a centre of about 2½ inches being about right. C_2 is the usual tuning condenser, while L_1 is the reaction coil. The size of this coil should be found out by experiment though it is wound on the same system as L_2 and with heavy gauge wire. L_1 and L_2 are variably coupled together. The microphone transformer should be of the open iron core type—an iron wire core would do quite well. It should be about ½ in. diameter and 4 to 5 inches long. The primary consists of about 150 to 200 turns of 22 D.S.C., while the secondary should have about 8,000 to 10,000 turns of 36 D.S.C. You require up to 200 volts on the plate, according to the valve used, and 6 volts on the filament. It would be better to use a small transmitting valve if possible as the "R" valve can hardly be expected to give very good results, owing to its size and the readiness with which it becomes saturated.

* * *

A. J. M. (Slough).—Is there any rule whereby I can work out the correct values of grid leak and condenser to use in any circuit?

It has been proved by experiment that quality of speech received is impaired if the product of the capacity of the grid condenser in micromicrofarads and the resistance of the grid leak in millions of ohms exceeds 200. Generally speaking, the higher resistance and less capacity factor is advisable. Owing to the different qualities of apparatus it is always advisable to experiment in the values of these two items if optimum efficiency is desired. For instance, the grid "leg" or wiring insulation or the grid condenser may be "leaky," in which cases it may be advantageous to dispense with the leak altogether.

* * *

D. C. (Letchmore Heath).—I have a one-valve set and find great difficulty in getting my accumulator charged, having to send it a considerable distance and wait a long time before I get it back. Is there no way of charging other than by a generator? Would it not be possible to charge the battery from a Daniell cell such as was described in POPULAR WIRELESS last week?

Yes, the accumulators may be charged by means of a Daniell cell. For a 4-volt accumulator you need about 6 cells, while 9 or 10 will be O.K. for a 6-volt accumulator. Large cells should be used, and they will need no attention for quite a considerable time. See that the zincs are renewed when eaten away, and that the copper solution is kept to its original strength. The copper solution should be a saturated solution, and the liquid in the porous pot is, of course, dilute sulphuric acid. The Daniell cells are, of course, connected in series, the end being connected to the negative of the accumulator and the copper to the positive terminal.

* * *

"THUNDERER" (Aylesbury).—Could I use a sparking plug as a lightning arrester?

Yes, the method you propose is quite a good one. Connect the aerial to the centre electrode of the plug and the earth to the outside part of the plug. The points of the sparking plug will have to be closed considerably so that only a tiny gap occurs between the centre electrode or aerial and the earthed points. The gap should be just sufficient to allow a thin piece of paper to pass between the points. The lead to the A terminal of the set, of course, is connected to the same electrode as the aerial. A lightning arrester of some sort is absolutely necessary at this time of the year, as heavy atmospherics are very frequent, and these may do considerable damage even though no lightning flash is visible.

This is a copy of a letter sent to a "P.W." reader by Mr. Harold J. C. Forrester (Fellow of the Chartered Institute of Patent Agents).

Dear Sir,—Your letter dated the 24th ultimo has been forwarded to me by the Editor of POPULAR WIRELESS for reply.

Improvements in patented inventions are generally of two kinds. One kind are improvements which depart from the basic principle of the main patent, and the other kind are those which still preserve the basic principle of the main patent. The first kind cannot, but the second kind can be protected by a patent or patents of addition, and either may be protected by patents which are entirely independent of the main patents if desired.

Patents of addition are only granted to the registered proprietors of the main patent, and they carry the privilege of requiring no renewal fees other than those which are paid in respect of the main patent. It would obviously be wrong for this privilege to be given to any patentee other than the patenteee who keeps in force the main patent, for obviously if there are two different patentees they should each keep their own patents in force.

Improvements on Patents.

It is very difficult for persons unacquainted with patent procedure to appreciate exactly what is an improvement on a main patent which can be protected by a patent of addition. The word "Improvement" is used by the public, and technically very loosely to denote something which is better than an existing article. For example, the use of a valve in wireless telephony is commonly spoken of as an improvement on the use of a crystal; but it is extremely doubtful whether, speaking from the patent point of view, it could form good subject matter for a patent of addition to a patent for a crystal detector.

If you have an improvement of an existing patent, whether it can form subject matter for a patent of addition or not, it is highly important to have it protected immediately and particularly before any publication of the improvement occurs, as any other person applying in the meantime for a patent for the same idea would obtain priority and grant of the patent, so that any later application in which you might be interested, whether for a patent of addition or for an ordinary patent, would be anticipated and therefore refused.

I trust that I have made the position clear to you, but if not, I shall be pleased to advise you further if you will communicate with me.

Yours faithfully,
HAROLD J. C. FORRESTER.

To the Editor, POPULAR WIRELESS.

Dear Sir,—With reference to the letter from "Birdcage" on the subject of Nauen (P O Z) time signals, readers who have not picked up this station for the purpose of putting the clocks right may be interested to know the method of time signalling used by P O Z.

As a matter of fact, it is similar to the 9.30 a.m. (G.M.T.) time transmission from Eiffel Tower, but is entirely different to the better known 10.45 a.m. and p.m. signals from F L.

The wave-length is 3,100 metres, but it can be heard on a 3,000 metre coil, and the signals are as follows:

At 12.55 (B.S.T.) a series of V's, followed by "P O Z" and "M G Z," the latter being the German equivalent for "time signals."

12.57	— . . — (7 times)	— — —	12.58
	— . (5 times)	— — —	12.59
	— — . (5 times)	— — —	1.0
	. — . — .		

The termination of the last dash indicates the exact time for each minute.

"Birdcage" has done well in the reception of P O Z on a crystal, I should imagine. I have not been able to get it in Birmingham with a crystal alone, although with one H.F. valve and crystal it is quite strong.

Yours faithfully,
H. Brenchley, "ANODE."
98, Springfield Road,
Moseley, Birmingham.

To the Editor, POPULAR WIRELESS.

SIR,—Referring to the letter from "Birdcage" which you published this week, I would inform you that I also regularly get the time signal from P O Z (Nauen), using a Hertzite crystal. (My set is a "Gecophone" No. 1, with a special "Paris" loading coil fitted).

I might add that the signals both during the daytime and night time, are quite clear.

Yours faithfully,
CHARLES W. BURFIELD.
49, Moormead Road,
St. Margaret's-on-Thames.

To the Editor, POPULAR WIRELESS.

SIR,—In answer to your correspondent "Birdcage," I should like to state that I also have received the time signals from P O Z (Nauen, Germany) on a crystal set, at the address below, which is still a few miles farther away from P O Z than "Birdcage" is. I use a loose coupled crystal set, which cuts out a great deal of the interference mentioned in his letter, and the station "comes in" very clearly. Unfortunately the transmission is of a very short duration, and gives very little chance for experiment.

Faithfully yours,
GILBERT M. HARRIS.
Glendora,
Marlborough Road,
Coventry.

(*Continued on page 824.*)

RECENT WIRELESS INVENTIONS.

The following abstracts are specially contributed by Mr. Harold J. C. Forrester, Fellow of the Chartered Institute of Patent Agents, 88-90, Chancery Lane, W.C.2.

Grant of the following patents can be opposed and printed copies of the full specifications obtained.

197,689.—WESTERN ELECTRIC CO., LTD.—VALVES.—A large output valve rectifier or oscillation generator has an earthed cathode and a high resistance anode (10,000 ohms) which is cooled by a cooling medium forming a high resistance passage to earth. An alarm is automatically given on shortage of cooling medium. For generating oscillations the anodes are supplied by rectifiers connected across the secondary of a transformer, the primary of which is in the power supply circuit. The input circuit is connected between the grids and cathodes, and the output circuit is coupled through a transformer with the aerial, the input and output circuits being coupled together and used in conjunction with a condenser.

197,799.—E. D. YOUNG.—MICROPHONES.—A cup containing conductive particles is mounted on the centre of one diaphragm, and is closed by an electrode carried by a mica-diaphragm. The diaphragms are strained so that the cup is under tension or compression, and one or both diaphragms may be used to receive sound.

197,836.—E. S. PRIDHAM & P. L. JENSEN.—LOUD SPEAKERS.—The current is passed through a coil rigidly connected to the centre of a diaphragm and moving in a concentric magnetic field formed by two poles, one within the coil and the other formed by a cover supporting the edge of the diaphragm, external to the coil. A socket for the horn is attached to the cover under the diaphragm.

197,853.—W. R. BULLIMORE.—VALVES.—An arched filament is employed enclosed in an arched grid having flattened sides and a singularly shaped plate. The turns of wire forming the grid are maintained in the desired shape by a suitable support.

197,854.—ELWELL, LTD. & B. E. G. MITTELL.—TRANSFORMERS.—An inter-valve transformer is combined with a valve holder to form one unit.

197,864.—WARD LEONARD ELECTRICAL CO. & A. E. WALLER.—RESISTANCES.—A composite conductor consists of strands of wire of different specific resistances, and is wound on a porcelain or other insulating tubular support, whereafter the whole is coated with vitreous enamel.

197,904.—C. G. HILL.—CONDENSERS.—A variable condenser has two moving elements, each of which consists of a resilient coil which can be tightened or loosened to alter the capacity. The two coiled elements are interleaved and separated by insulating varnish or paper, their outer ends being attached to fixed supports, and their inner ends to the same hub rotated by a knob. A friction washer holds the parts in any adjusted position.

CORRESPONDENCE.

(Continued from page 822.)

To the Editor, POPULAR WIRELESS.

SIR,—With reference to "Birdcage's" letter in this week's POPULAR WIRELESS, concerning his reception of P O Z. I can get him quite clearly on crystal any day, giving his 11.55 (G.M.T.) time signal for 12.00 (G.M.T.)

The crystal is "Permanite" with copper foil contact; the 'phones are Brown's "F" type, and the inductance a "Burndept" 300 tuned with a ·0005 V.C.

My aerial is a twin-wire 70 ft. long with an average height of 30 ft.

I can also receive 2 L O any evening well enough to understand the announcements, the orchestra coming through particularly well.

Other spark stations readable are: G N F, G N I, G C S, G N V, B Y K, B Y M, P C H, K A V, O S T, F U D, F F B, F F I, F F H, F U C, E G C, etc.

Yours truly,
"AMATEUR."

Onward House,
Appledore, Kent.

To the Editor, POPULAR WIRELESS.

SIR,—I have read with interest the letter from "Birdcage" in this week's (7th) POPULAR WIRELESS of his reception of P O Z on an ordinary cat's-whisker crystal set. I have also a cat's-whisker crystal set, and am able to get the time signals from P O Z whenever I wish to. I am situated another 100 miles west of "Birdcage." Does this constitute a record for crystal reception?

Another station I have heard frequently is Karlsborg, in Sweden, S A J, also Bergen (600). Crystal reception of Cardiff telephony can also be heard in Dorchester, a distance of about 60 miles! The latter is not a freak, as it is heard every evening.

Yours truly,
"CRISMLUTVAL."

8, Culliford Road,
Dorchester, Dorset.
6th July, 1923.

To the Editor, POPULAR WIRELESS.

SIR,—In reply to your correspondent "Birdcage," who receives P O Z in London with a crystal receiver, I should like to state that I have, on several occasions, received that station with a set employing a crystal detector only—a combination of zincite and copper pyrites—without potentiometer.

Yours, etc.,
C. H. L.

279, Crow Road,
Glasgow.
6th July, 1923.

To the Editor, POPULAR WIRELESS.

SIR,—I notice in the current issue of POPULAR WIRELESS a letter from "Birdcage" re long distance crystal reception.

Situated in North-East Lancashire I have not much difficulty in hearing P O Z at 11.55 (G.M.T.) faint, but clear. Aerial is none too good. Critical crystal adjustment is an important consideration for long distance listening.

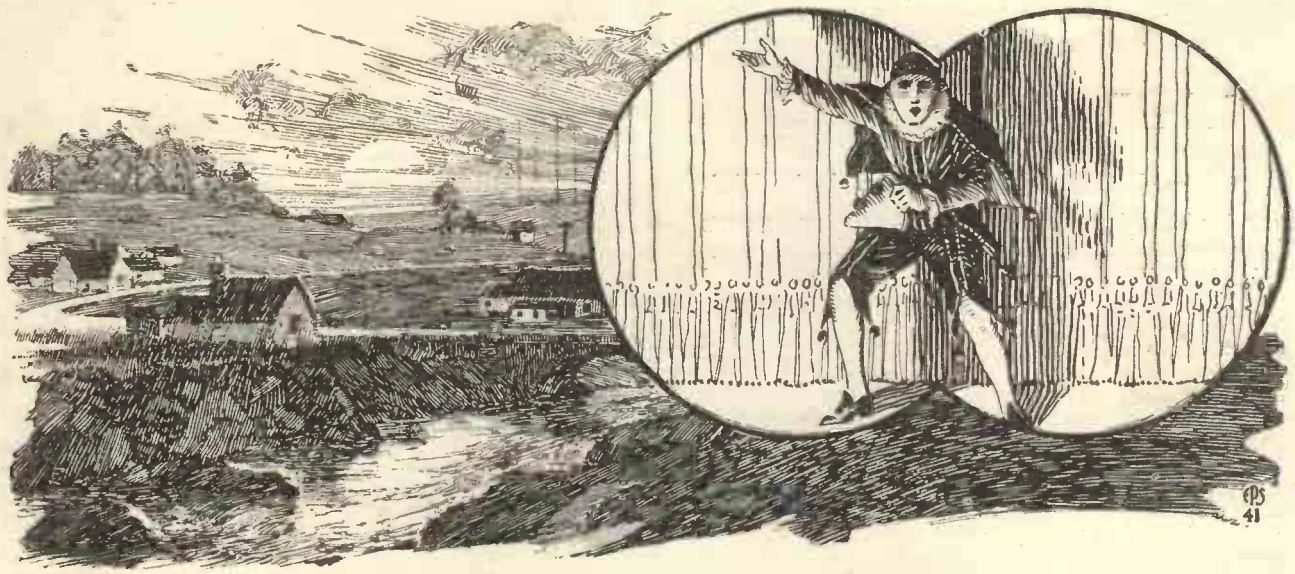
Has "Birdcage" ever tried for Karlsborg, S A J, at 12.15 (G.M.T.), 2,500 metres, and 20.00 (G.M.T.)? This is received here about same signal strength as P O Z.

Yours faithfully,
T. COOPER.

P.S.—Using valve of course one can guarantee hearing above stations.

122, Royds Street,
Accrington, Lancs.
7th July, 1923.

The Editor of "Popular Wireless" welcomes photographs of amateur sets from readers, or anything else of particular wireless interest. 10s. 6d. will be paid for each photograph used.

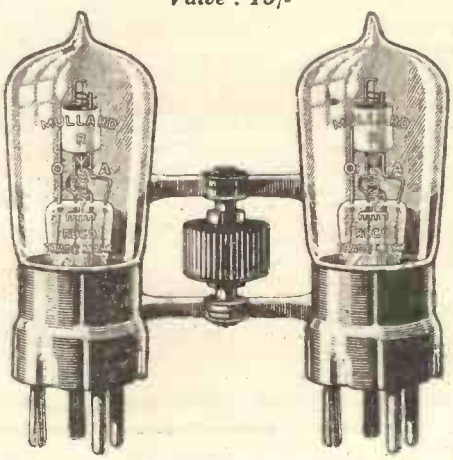


Distance lends enchantment

THE power to see your opera in the summer evening sky, as you sink back in your easy chair, is a fascination possible to you when the opera glasses of your wireless receiver are

MULLARD
SUPER IOR
WIRELESS
VALVES.

Reduced price of the Mullard "R" Valve : 15/-



Mullard

Obtainable from all high - class electricians, wireless dealers, &c.

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R/R