LONDON'S NEW STATION—SPECIAL ARTICLE

A DISTORTIONLESS LOUD-SPEAKER SET

Amateur Wireless
And Electrics

Vol. VI. No. 144. SATURDAY, MARCH 7, 1925 Price 3d

PRINCIPAL CONTENTS

WELL ILLUSTRATED

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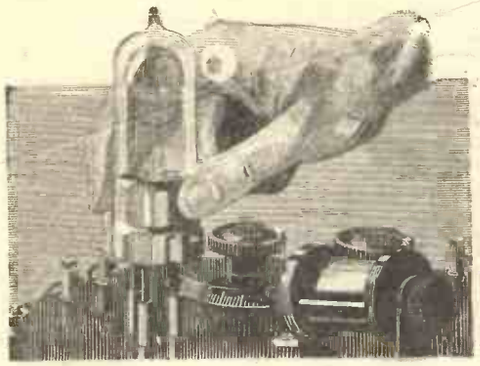
THE NEW HIGH-POWER STATION AT DAVENTRY

Mr. H. W. Litt, to be seen in the photograph, has been appointed engineer-in-charge of the new high-power station now in process of erection at Daventry.



TEMPERATURE —and length of life

THE one principal factor that determines the length of life of any valve is the temperature at which the filament is run. If such a discovery were possible, a "cold" valve requiring no heat—from electric batteries or otherwise—to drive off its electron stream would possess an indefinite life.

* * * * * *

It was with this thought at the back of our minds that we set about designing the Wuncell Valve. *At all costs filament temperature must be kept down to the very minimum.* That our efforts have been crowned with complete success can be gauged from the fact that when the Wuncell is working in daylight its glow is practically invisible—while even in the dark it is merely comparable to the dull red embers of a dying match.

* * * * * *

But filament temperature is closely related to filament thickness. The coated filament of the Wuncell Dull Emitter is exceptionally stout—in fact the eye will hardly perceive any difference between the thickness of the Wuncell filament and that of a Cossor Bright Emitter, for example. But compare it with the filament used in other Dull Emitters and you will immediately appreciate the fact that its robustness obviously means a much longer life. Pyrometer tests, indeed, have proved that while many Dull Emitters function at a filament temperature of 2,000 degrees, the Wuncell working point is approximately 800 degrees—or much less than half the temperature.

* * * * * *

The Wuncell Valve gives exceptional results because it has been built upon radically different lines. Instead of obtaining low consumption by thinning down the wire used in the filament at the risk of fragility, the Wuncell filament has been specially manufactured to throw off a greatly increased electron emission. As a result, considerably less heat (or battery current) is required to operate it.

* * * * * *

Before you buy your next Valve be sure to see the Wuncell. Examine the filament for yourself—compare it with any other Dull Emitter and you will readily understand why it has such a phenomenally long life. After all, it is the length of time that a valve lasts that will count most with you.

Wuncell exclusive advantages featured:

No. 2

THE patent features which have built up such a reputation for Cossor Bright Emitter Valves are fully retained in the Wuncell. As every experimenter knows, the whole secret of valve reception depends on the correct use being made of the electron emission from the heated filament. In Valves with ordinary straight filaments much of this emission escapes from each end of the tubular Anode. In the Cossor, however, the hood-shaped Anode almost entirely encloses the Grid and the arched filament. Little, if any, of the electron stream can escape.

Obviously this increased efficiency means louder signals and reception over longer distances through the use of a more sensitive valve.

Prices:

W.1 For Detector or L.P. Amplifier

W.2 (With red top) for long distance reception

18/- each

*W.R.1 Corresponding to W.1

*W.R.2 Corresponding to W.2

20/- each

**Fitted with internal resistance so that Valve can be used with 2-, 4-, or 6-volt Accumulator without alteration to Set.*

Cossor Wuncell Valves

THE ONLY DULL-EMITTER VALVES SOLD IN SEALED BOXES

Dead Reckoning

To make a long flight by "dead reckoning," to cross islands and seas without reference to landmarks or other visible guides, and finally to break through the clouds exactly above the intended spot—it is here that the pilot displays his utmost skill.

It is here, too, that he needs to feel complete confidence in the accuracy of his instruments. If he knows that they are designed and chosen with great care, then he can safely entrust his machine and himself to their unfailing performance. If not——

* * * *

This is only another instance which shows the vital importance of selecting the component parts of a machine with the utmost care.

And it is so with your wireless set.

If you desire good results and freedom from trouble choose your components—especially your condensers—with great care.

It is certainly worth the small extra outlay to

Specify Dubilier.

DUBILIER
CONDENSER CO LTD

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

Amateur Wireless and Electrics

Vol. VI. No. 144 March 7, 1925

SELECTING A VALVE

WHEN one goes to the average retailer to purchase a valve one does so all in good faith, for it is difficult to persuade that individual to test other than the filament of any valve selected. Of course this is one of the most delicate parts of the valve and liable to fracture,

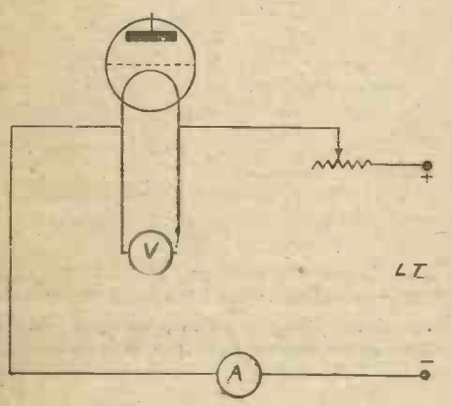


Fig. 1.—Test for Current Consumption.

but a valve can be perfect in its filament and yet be worse than useless when put into a receiver. In the circumstances details of a few tests which can be made will no doubt be of interest to readers of this journal.

Simple valve tests can be divided into two classes, (*a*) mechanical and (*b*) electrical. The mechanical tests are chiefly of a visual character, as noting the disposition of the electrodes. It may be found that filament and grid are in contact or that the anode is displaced, and in this latter connection it should be remembered that the spacing of the electrodes is chiefly responsible for the shape of the characteristic curve. Sometimes we find that the anode and grid supports are weak and actually break away or become displaced on gently tapping the glass bulb. Details of a few electrical tests are given below, but no attempt has been made to cover testing the characteristic curves, as it is felt that these do not come within the scope of this article.

Insulation Test

Sometimes the insulating material on which the four connections are mounted is faulty. Such a fault would cause very poor results when the valve was used in a receiver and probably produce hissing and crackling noises. For this test a megger or some other form of insulation-testing set should be used. With this, the insulation resistance between the filament and grid and between the filament and plate should be tested, when the former should exceed 15 megohms and the latter 10 megohms.

Filament-current Test

With valves of a similar type the filament current for a given voltage should be the same within narrow limits. Fig. 1 shows the connections for making a test to prove this; the diagram is otherwise self-explanatory. Insecurely attached filaments can be detected during this test by tapping the valve, when the fault will make itself apparent by a varying current being shown on the ammeter.

Backlash Test

This test is made in order to ascertain the degree of the vacuum of the valve, which is another main factor in the characteristic curve. The testing circuit is shown in Fig. 2. Now a valve with a perfect vacuum will allow all the electrons emitted from the filament to be attracted to the anode, which is positive with respect to the filament. The grid of the valve in the circuit shown, having a negative

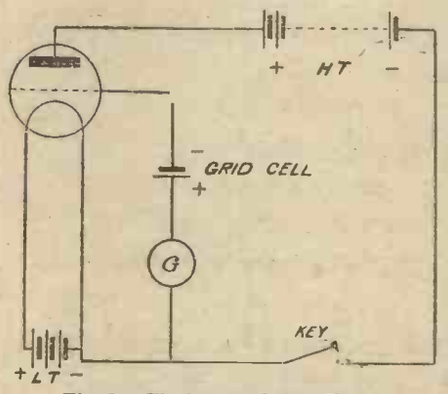


Fig. 3.—Electron-emission Test.

potential due to the cell provided for the purpose, chokes the emission to a certain extent and no current will flow in the grid circuit due to the repulsion of electrons from it. If, however, there is a slight trace of gas left in the valve, electrons will start from the filament to the anode, but during their passage will collide with gas molecules which will cause one or more electrons to be forced out of these molecules. These electrons will join with the general stream towards the anode.

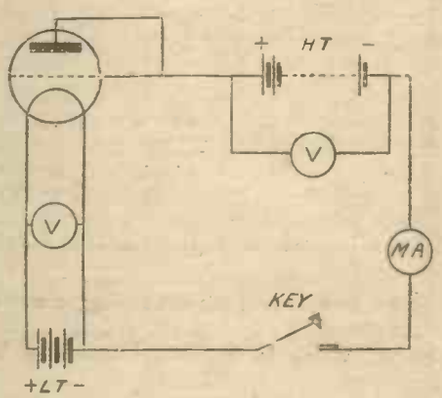


Fig. 2.—Backlash Test.

This causes the gas molecule to become positive, due to the freed electrons, which are now attracted towards the grid, resulting in a current flowing in that circuit which is indicated by the galvanometer. Thus the amount of current in the grid circuit will register the amount of gas present in the valve.

Filament-emission Test

Any given filament of particular construction will emit a definite number of electrons proportional to the temperature of the filament for a known value of high tension on the anode. The connections for this test are shown in Fig. 3, from which it will be noted that the grid and anode are connected together and a high-tension battery of known voltage connected between the anode and negative end of the filament. A key and milliammeter is also connected in this circuit. If the key is closed the circuit is completed and a current due to the electron emission flows and is indicated by the milliammeter. A given emission for a known value of anode volts is kept as a standard.

The foregoing tests are the more important, and it is hoped these few remarks will enable experimenters to test their valves.

S. J. M.

TUNED EARTH CONNECTIONS

IN these days of many thousand miles reception on one valve it is detail efficiency that counts, and one of these details well worthy of attention is an efficient low-resistance earth connection.

Trouble taken over this point not only gives greater signal strength, but, what is more important, it improves selectivity. It is in the matter of fine tuning that the amateur scores who has a low-resistance aerial-to-earth circuit.

Multi Earth Connections

Now it is often found, where trouble has been taken to obtain a number of different earth connections, that the results obtained by using them all in parallel are no better than—indeed in some cases distinctly inferior to—those obtained when one alone is used. The reason for this is not difficult to discover. As the different earth wires vary in length, so will their natural wavelength vary, so that when all the earth leads are attached to the set, the high-frequency oscillations in the aerial will be offered several alternative paths of different frequency to earth. This, as is well known, leads to inefficiency and broad tuning.

Now how should we tune all our earth connections up to the same natural wavelength, which is, in fact, often done in the case of transmitting sets. This can be effected either by putting condensers in series with the longer earth leads, or by adding inductance to the shorter ones. The latter method, which is that used by the writer, is the cheapest and perhaps the best. The coil L (see diagram) may conveniently be a helix of bare aerial

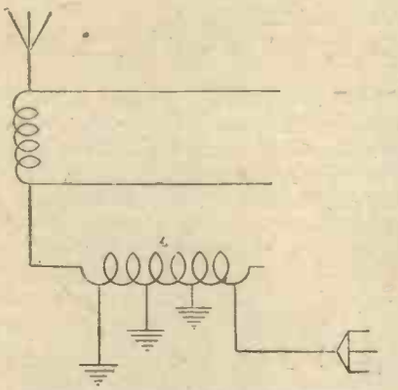


Diagram showing Tuned Earth Leads.

wire, and if this is made 5 or 6 in. in diameter twenty turns will be ample. One end of this coil should be connected to the earth terminal of the set. The different earth leads may now be temporarily attached to the coil by means of clips at varying distances from the end, the earth with the shortest lead requiring most inductance in series with it.

If a counterpoise is also being used, this will require most inductance of all in order to bring it into balance. The most difficult part of all is getting the earths into balance, and to do this the experimenter will have to rely on his own judgment to a certain extent.

Earth Leads in Tune

Apart from the fact that the shortest earth lead and the counterpoise will need the most inductance in series with them, the only guide as to when the earths are all in tune with each other is that the tuning of the set will be finer, signal strength slightly greater (especially on a crystal), and the set will oscillate more readily. Another result will be the possibility of reception on shorter wavelengths than before.

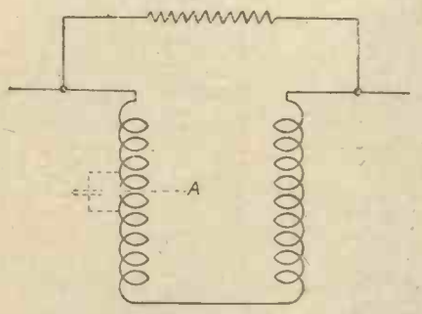
The writer uses a buried earth (an old galvanised pail), a main water-pipe and two other water-pipe connections, a gas-pipe and a counterpoise. The counterpoise requires most turns in series with it, next comes the buried earth, then the main tap earth, after that the two other water-pipe connections, and finally, with least inductance of all, the gas-pipe. Using a direct-coupled single-valve set, 100-ft. single-wire aerial, and this multiple earth connection, the writer is able to tune down to KDKA without any trouble.

R. H. J. McC.

LOUD-SPEAKER "BURN-OUTS."—A REMEDY

HERE is a tip for anyone unfortunate enough to have his loud-speaker "burn out" in the middle of a particularly interesting programme. The idea is to connect a high-resistance, or a choke coil of high impedance, across the terminals of the instrument, which will in many cases start working again in a way which may at first seem very puzzling. A variable anode resistance (of the compressed carbonised pellet type) screwed up to the position of least resistance or the secondary winding of an old intervalve transformer may be pressed into service. Sometimes even placing the fingers across the loud-speaker terminals will have the same effect, although this is apt to be rather painful if a power valve with a good high-tension voltage is being used for low-frequency amplification.

The reason why this idea is effective can be best explained by reference to the diagram, which represents the magnet coils of the loud-speaker. If the wire breaks about the middle of one of these coils (which it generally does), say at the point marked A, the path of the direct anode current necessary for the functioning of the valve is broken, and consequently



Method of Remedying Defective Loud-speaker.

nothing is heard from the instrument. Now this winding consists of several thousands of turns of fine enamelled or otherwise insulated copper wire lying in close proximity to one another. Therefore if the winding is broken about the middle the capacity between the two halves is quite considerable owing to the thinness of the insulating medium and the comparatively large surface of the copper exposed. This capacity (shown dotted in the diagram), while offering no path to direct current, will pass fairly easily the audio-frequency pulsations normally present in the anode circuit and which affect the loud-speaker diaphragm at sound frequencies. The effect, then, of connecting a resistance or choke across the loud-speaker is to allow the direct current from the high-tension battery to flow through the anode circuit of the valve, while choking back to a great extent the undulations in this current which work the loud-speaker.

R. H. J. McC.

Your lead-in counts in the wavelength of your aerial. Be sure it is well insulated.

It is a good idea to have a series-parallel switch for your aerial condenser.

CRYSTAL SET WITH MULTI-STRAND INDUCTANCE

MUCH has been heard lately about the efficiency of multi-strand wire for carrying high-frequency currents compared with ordinary single-strand wire. The crystal set shown has coils which are wound with 7/22 bare aerial wire. The winding of the coils requires a good deal of patience, but the results obtained from the set are the loudest that the writer has heard. Ordinary flexible wire would be equally suitable.

The formers for the coils are two 12-in. diameter gramophone records, each record having seven equally spaced radial rows of holes drilled in it as shown in Fig. 1. There are eighteen holes in each row $\frac{5}{32}$ in. in diameter and ¼ in. pitch. The holes were drilled by means of a simple jig made out of a piece of three-ply-wood (Fig. 2). The holes were first marked off and drilled in the piece of wood, which is then used as a jig for drilling the records.

The jig is placed in position for the first row of holes on the record, and a ½-in. thick piece of wood is placed on the opposite side of the record to prevent the drill breaking the record when it comes through. The jig and the backing piece of wood are clamped in position or held in a vice during the drilling operation.

The 7/22 bare aerial wire is then laced through the holes so as to form a basket coil, starting at the outside and leaving about 6 in. at the start and finish for connecting up. Both coils are wound in the same direction, and mounted with the windings in the same direction, on the wooden upright as shown in Fig. 3, an ordinary bobbin aerial insulator being used to keep the coils separate. A piece of 2 B.A. screwed rod and two nuts are used to fix the complete assembly to the upright.

The only other parts required to complete the set are a crystal detector, two telephone terminals and a .0005-microfarad variable condenser. These are mounted on pieces of gramophone record, which are in turn fastened to the baseboard, which is 1 in. thick and 8 in. square.

The completed set is shown in Figs. 3 and 4 and the photographs.

The wiring throughout is carried out with 7/22 aerial wire.

Either of the circuits shown in Figs. 5 or 6 can be tried out by having suitable wander clips

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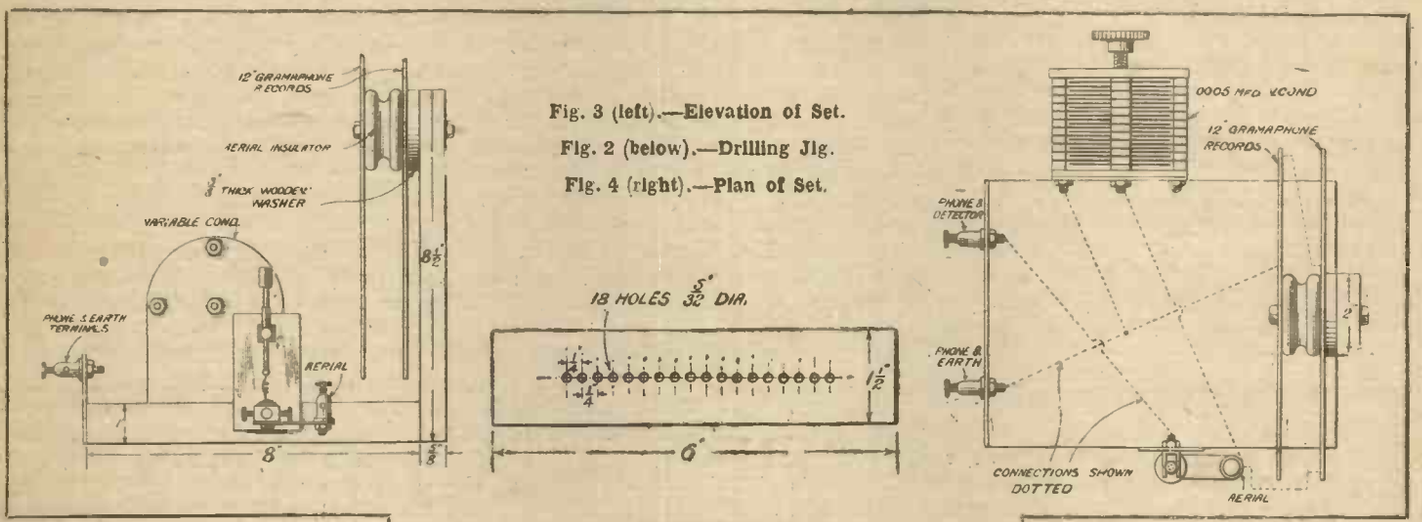


Fig. 3 (left).—Elevation of Set.

Fig. 2 (below).—Drilling Jig.

Fig. 4 (right).—Plan of Set.

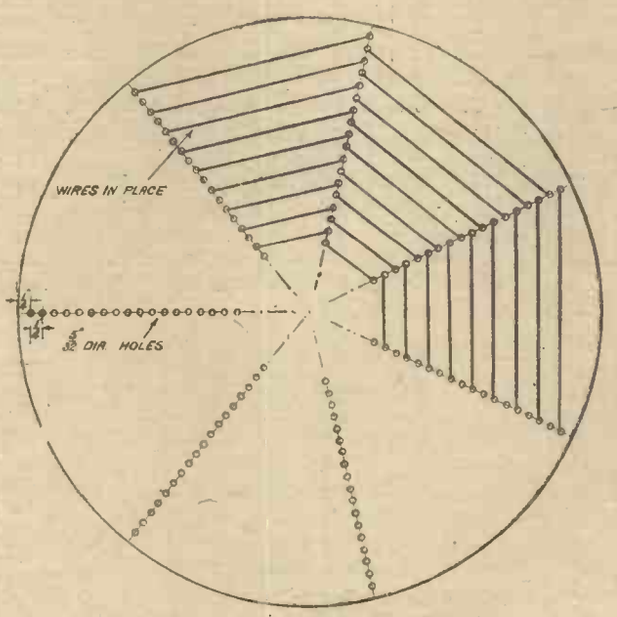


Fig. 1.—Details of Inductance.

RECORDING YOUR MORSE

THE recorder which it is proposed to describe in the following article will doubtless appeal to amateurs on account of its simplicity of construction; this at the same time is combined with a high degree of efficiency. As will be seen, it makes use of the reed phone described in No. 123 of "A.W."

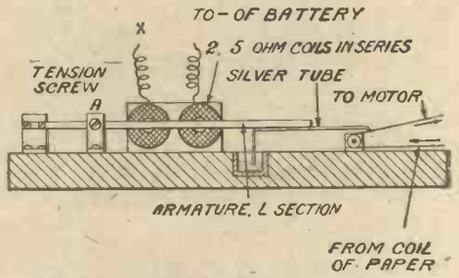


Fig. 1.—Sectional Elevation of Recorder.

Its cost is trifling, since practically everything required for its construction can be found on every amateur's workbench. At the present time there is much scope for the recording of morse transmissions, since there are always high-power, high-speed stations working, and many amateur stations, for those who are favourably situated. For those who do not know morse much of the interest of wireless is lost when they hear these transmissions and cannot understand them. With this recorder and any efficient two-valve set, good reproduction is obtained from most of the European high-power stations.

At speeds as slow as thirty words per minute recording is done with ease, while with a little care and delicate adjustment speeds up to one hundred words a minute can be obtained. This instrument is the result of a considerable amount of experimenting in order to simplify it as far as possible. The recorder, as stated, employs the reed phone as a relay. If desired, a Brown "A"-type phone can be used instead.

Operation

The telephone is operated directly from the receiver, each dot or dash causing a short or long buzz in the relay and thus causing a temporary increase in the average resistance at the relay contacts. This variation in resistance is sufficient to serve the purpose, and is more easily obtained than a definite make and break.

The movement of the pen is controlled by a P.O. buzzer magnet and a light steel armature. Fixed at one end of the latter is a short length of silver capillary tube. The armature is under gentle tension away from the pole ends, being adjusted by the tension screw A (Fig. 1). The silver tube is soldered to the armature, and is so shaped that one end dips into the ink in the pot, while the other rests on the paper strip as nearly perpendicularly as possible.

A second-hand gramophone motor is used for drawing the tape along, and guide pulleys are provided, that nearest the pen being adjustable so as to enable the pressure of the pen on the paper to be varied. The extension fitted on the phone reed is made of very thin sheet brass, .008 in. thick, bent U shape. This gives a light but rigid arm. The other arm of the relay is made of brass sheet .01 in. thick, small silver contacts being fitted to each arm. Further details of the relay can be gathered from the sketch Fig. 2.

It will be found that a movement of $\frac{1}{16}$ in. at the pen point is required to give clear readable signals.

The ink was an item which at first gave much difficulty. Ordinary ink is useless, as it dries in the pot and in the pen, leaving sediment. The best results are obtained from a mixture consisting of 1½ oz. of glycerine and as much resin as can be piled on a threepenny piece. This has been standing now for five months with the occasional addition of a few drops of water.

When not in use a pot should be placed beneath the pen-point to catch the ink, which slowly siphons out at the rate of one drop every eight or ten hours.

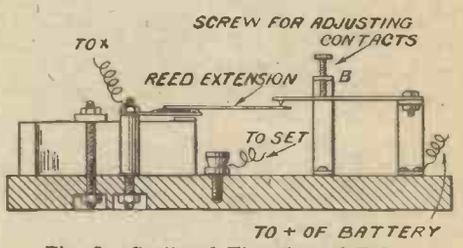


Fig. 2.—Sectional Elevation of Relay.

A 1-volt dry cell is found sufficient to work the pen. The magnets consist of two 5-ohm coils in series wound on soft iron pole-pieces.

The Recorder in Use

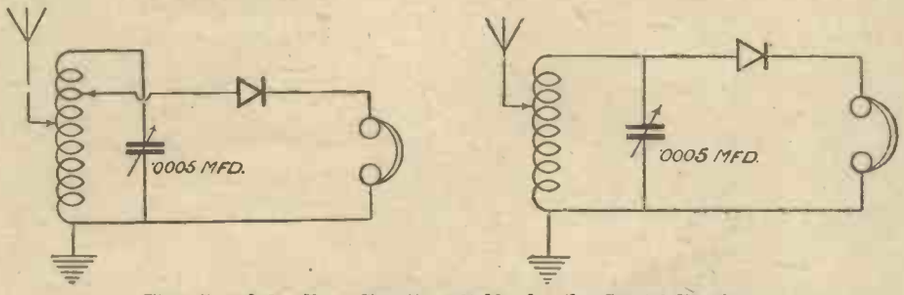
The method of operating the recorder is as follows: The fixed contact on the relay is advanced by means of the screw B (Fig. 2) until the circuit is *just* closed on "no signals." Upon the fineness of this adjustment depends the efficient working of the instrument. The local-circuit current is switched on and the armature is drawn over to the magnet poles. As stated above, signals will cause vibrations at the relay contacts, thus reducing the current in the local circuit and releasing the armature. As each signal ceases the pen returns to its normal position, giving an undulating record.

With the above remarks for guidance a very efficient recorder can be made without any expense or intricate material. It could be improved in several points of detail, which will doubtless suggest themselves to those who may construct this instrument. In conclusion I may say that an identical instrument to the one described above has functioned successfully on my two-valve set (1 H.F., 1 Det.) for the past six months. W. B. T.

"CRYSTAL SET WITH MULTI-STRAND INDUCTANCE" (*Continued from preceding page.*)

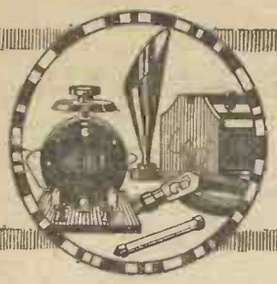
on the aerial lead and the metal crystal cup. The circuit Fig. 5 has already appeared in "A.W.," but without the variable condenser, and this addition considerably improves the tuning, which is very sharp.

The results, as stated before, are very good, and on an outside single-wire aerial 45 ft. long and three miles from 5 S C the signals are audible about 8 ft. from the telephones. D. P. M.



Figs. 5 and 6.—Two Circuits suitable for the Crystal Receiver.

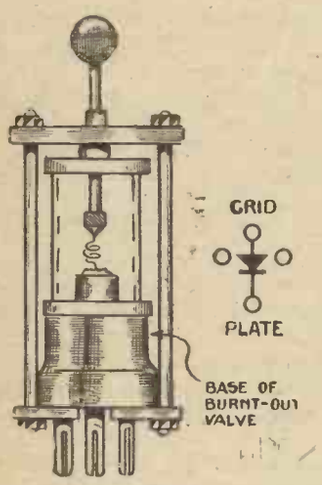
Many people think that since Mr. George Grossmith has been appointed to advise on the programmes side of the B.B.C., Mr. Arthur Burrows is not taking the same active interest that he was. Mr. Burrows continues, however, as director of programmes of the B.B.C. He is almost the only official on the programmes side that has not changed his duties since broadcasting began.



PRACTICAL ODDS AND ENDS

Plug-in Detector

A CRYSTAL detector of the plug-in type is very convenient if the valve should burn out, as the detector can be plugged in the valve holder.

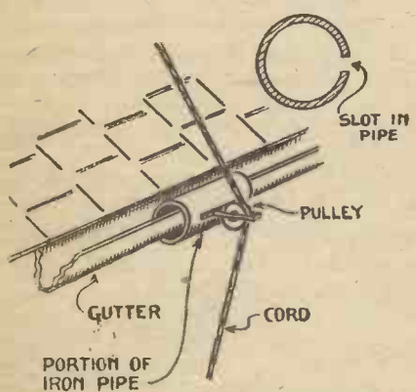


Plug-in Detector.

A simple detector of this type is shown in the diagram. The method of construction is clearly shown, and a diagram of connections is given. It is, of course, necessary to remove the H.T. battery from the circuit and short-circuit the H.T. terminals. A. B.

An Aerial Tip

WHEN the aerial pulley is fastened to a chimney-stack it is often difficult to prevent the aerial cord from fouling the gutter.



Fixing the Aerial Cord.

A small pulley bolted on to a short length of slotted iron pipe will prevent any swaying of the cord. The pipe is slipped over the edge of the gutter, and the pulley will then keep the cord in place. The slot should not be made too large or the pulley arrangement will not be a fixture.

The diagram should be self-explanatory. M. B.

Soldering Fine Wires

DIFFICULTY is often experienced in attempting to solder two fine wires, especially when a soldering-iron having a large bit is employed.

The best plan is to place a small piece of tinfoil round the joint, dab on some flux and flick a lighted match underneath.

The heat of the match will be sufficient to melt the "solder," and a firm job should result. L. C.

A Crystal Hint

AFTER a lengthy search for the sensitive point on a crystal it is very annoying when the catwhisker is jogged out of position and the search has to be carried out all over again. Many crystals suffer from the disadvantage that they possess but few sensitive spots, but the fact that these spots are good makes it worth while to retain the specimen.

When a successful search for the sensitive point has been made, some method is desirable in order to keep it.

A drop of sealing-wax should be put on the crystal after the catwhisker has been placed in position on a sensitive spot, care being taken that the detector adjustment is not disturbed. Provided that the wax is not put on too hot, no ill-effects will be caused, and a permanent detector will result. K. U.

A Novel Loud-speaker

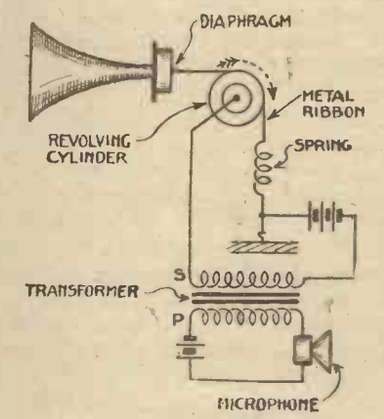
AMATEURS who are interested in the reproduction of pure undistorted speech may be interested in this type of Johnsen-Rahbek loud-speaker.

In the circuit diagram a microphone is shown in the input circuit, but these terminals could, of course, be connected to the output of the receiving set.

The cylinder is made of a non-conductive or badly conductive material such as lithographic stone. A metal ribbon passes over this and is attached at one end to the speaker diaphragm. A battery of about 100 volts maintains a potential difference between the ribbon and the cylinder.

The variation of the speech currents causes a varying amount of friction between the drum and the metallic band, thus producing sound waves by the pull on the diaphragm.

While this sort of loud-speaker is, of course, rather difficult to construct, the inventors claim to have obtained excellent results and exceptional purity of tone reproduction. D. L.

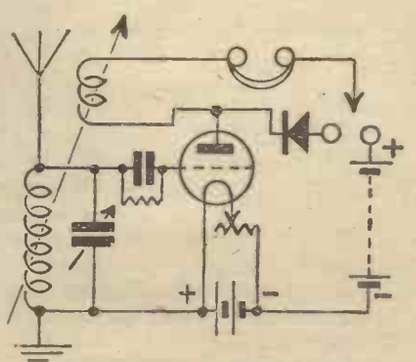


Novel Loud-speaker.

Valve to Crystal

FOR the reception of local broadcasting it is not always necessary to use a valve detector, and it is often convenient to have some sort of switching arrangement to change from valve to crystal.

The diagram shows a very convenient form of switch in which it is possible to use either a valve with reaction or a loose-coupled crystal circuit.



Changing from Valve to Crystal.

When the crystal is used alone it will be necessary to couple the reaction tightly to the aerial coil for the best results. B

EXPERIMENTAL TRANSMISSION.—X

MODULATION

SO far no method has been described for interrupting or modulating the emitted waves for telegraphy or telephony transmission.

The waves naturally transmitted by any of the oscillators previously described will be of the undamped C.W. nature (provided that the high-tension current is direct and uninterrupted) and as such will only be audible if the autodyne or heterodyne method of reception is employed. If it is only desired to emit such waves, it is necessary only to employ a telegraphic key to form the code characters in the normal way.

Key Connections

The key may be connected in many different ways, namely:

(1) In the plate circuit, so that the anode current cannot flow when the key is up, and hence no oscillations are produced. This method is very effective for low-power transmissions, as it is decidedly economical, but for large transmissions there is the obvious disadvantage that the key is at high potential to earth and may cause serious shocks; lag effects may also be introduced by this method in large transmitters.

(2) The key may be connected in the grid circuit so that the latter is broken when the key is not depressed, or it may be placed in series with the grid leak so that the latter is only connected across the condenser or to the filament when the key is down. If it is connected in the grid circuit where the current is comparatively small, current will still flow in the plate circuit when the key is open unless by opening the key a negative potential is put on the grid sufficient to stop the plate current.

The key may be so arranged that, when depressed, it shorts a sufficient number of turns in the grid circuit to stop oscillation.

(3) The circuits can be so arranged that the key opens both grid and plate circuits simultaneously, as in Fig. 41.

(4) The key may be so arranged that either aerial or earth are disconnected when the key is up, so that although oscillations are continuously being generated, no wave motions will be set up. Tappings off the aerial inductance may be taken so that the included number of turns will be shorted either when the key is up or down as arranged. This is known as the "marking-and-spacing-wave" method, since oscillations are always being maintained, but the waves emitted when the key is up are thus slightly detuned (about 5 per cent.) and are thus inaudible at the receiving end. This method has the disadvantage from the operator's point of view that power is being continuously absorbed and also that, as two waves are going out, he is occupying a broader band on the ether.

Where it is desired to work stations

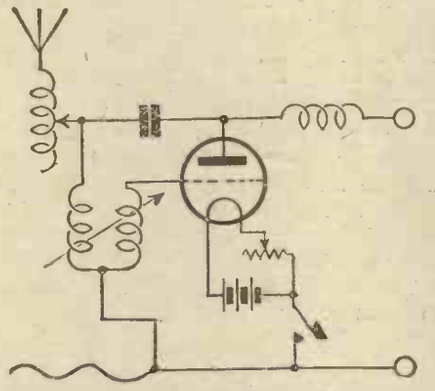


Fig. 41.—Keying Two Circuits Simultaneously.

during broadcast hours this method should be employed, as although C.W. is theoretically inaudible on a set not employing the heterodyne method of reception, clickings will be heard by near-by receivers when the aerial or power circuits are broken or closed.

The marking-spacing-wave method obviously has not this disadvantage, as a change of wavelength is inaudible to such receivers.

(5) A method that was much employed in army transmitters was to arrange matters so that a fixed resistance was connected in the filament circuit having a high enough resistance to reduce the fila-

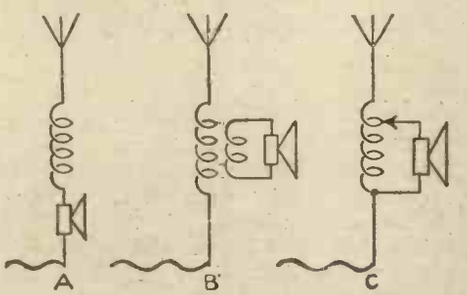


Fig. 42.—Three Methods of Aerial Modulation.

ment temperature so that no oscillations were produced. The key was connected in parallel with this and the filament increased in brightness as the key was depressed, and so oscillations were produced. Lag effects may be introduced, and so the method is not to be particularly recommended.

If it should be desired to transmit code signals with a C.W. set that may be audible to a receiver not employing the autodyne or heterodyne methods of reception, all that is necessary is an interrupter that will make and break the circuit (at any of the points mentioned in the five sections above) at any audible frequency.

Any of the normal methods of keying may be used for this tonic-train or I.C.W. (interrupted-continuous-wave) method.

Telephony Modulation

The experimenter who has established a satisfactory valve-oscillating system will very soon turn his mind to the question of modulating the radio-frequency output so as to be able to transmit radio telephony. His final circuit will embody all of the following principles, as they represent broadly the only possible effective methods of modulation.

(1) Aerial-absorption control in which the microphone is coupled to the aerial circuit, either directly or by means of some absorbing element.

(2) Grid control; that is the potential of the grid of the oscillating valve is controlled by the voice through a microphone system.

(3) Constant-current control, in which the anode-supply current is made to fluctuate with the impressed speech.

The principle of aerial-absorption control is illustrated in (a), (b) and (c) of Fig. 42, in which (a) the microphone is connected directly in the earth lead, and (b) is coupled inductively to the aerial circuit, or (c) in which it is tapped across a few turns of the aerial inductance. c is probably the most practical scheme of the three, but the characteristics of the methods are the same in each case, and may be treated *en masse*.

The obvious disadvantage to the scheme is that if powers greatly in excess of about 5 watts are used the microphone will pack or become heated, and will then cease to function or else burn out.

Control on this system is particularly effective, since there is no iron in circuit to cause distortion, and many experimenters have devoted themselves to the task of employing this method on high powers.

Microphones may, of course, be used in parallel to minimise heating-up effects, and many weird and wonderful contrivances were constructed on the multi-microphone principle, especially in the days of arcs and Chaffee gaps when aerial modulation was the only known means. Contrivances of this sort, however, are of a complicated nature.

KENNETH ULLYET.

(To be continued)

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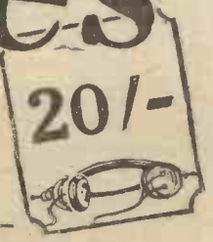


Superior "Matched Tone" Headphones

TRADE MARK

On Your Wavelength!

Pipless Valves

ALL the American manufacturers now appear to be turning out as standard articles valves which have no "pips." This is a very great advantage to the user, for, as many of us know by experience, the most vulnerable part of the valve, like that of an electric-light bulb, is the pip. Somehow or other you do not notice it as you reach across the set to change a coil or to make an adjustment. Your hand strikes it and bang goes the valve. The pip at the top of the valve is the result of the method generally used for the final sealing of the bulb. There is no particular reason why the pip should be at the top of the bulb, and it appears that American makers are placing theirs at the other end so that when the valve is assembled it goes inside the cap and is thus out of harm's way. It is to be hoped that our own makers will adopt the same idea, for, besides making valves less liable to breakage, the absence of the pip gives them a particularly neat appearance.

How Valves "Go"

I suppose that there is no wireless man who has not "done in" a certain number of valves in his time. It is rather interesting to keep a record of the ways in which they meet their ends. I generally keep a rough record of the doings of each of my valves, which begins with its original curves, records the number of hours that it is used, and ends with a brief account of the way in which its fate overtook it.

Of eleven valves which have ended up in the dustbin in recent months, I find that one was accidentally dropped, one was burnt out by an overdose of current in a moment of temporary insanity, two developed sagging filaments which came into contact with the grid, rendering them useless, and the remainder expired quite naturally by burning out after doing various amounts of good work. You will notice that this list of casualties does not contain a single broken pip. I appear to have been lucky in this respect of late, though I can remember finishing off several valves in earlier batches by accidents of this kind.

I have also had broken leads within the cap, and in the case of dull-emitters I have known filaments lose almost all their emission as the valves became very old. When this happens to a dull-emitter, by the by, and the usual remedy of leaving it for some time with the filament just glowing and the high-tension battery switched off fails, the valve will usually function pretty well as a bright-emitter—for a time, at any rate.

I should add that when I speak of the dustbin I do so metaphorically, for as a matter of fact the caps and pins of old valves should always be kept, since they can be put to a variety of useful purposes. A further point is that valve repairing has become nowadays such a fine art that unless a "toob" has been flattened out by a steam roller it can usually be made to work once more. There are several firms which fit new filaments at very reasonable cost, and one, at any rate, will provide even a new bulb for a modest sum. This means that there is still hope so long as the cap, the pinch, the plate and the grid are in existence. By the way, it does not occur to everybody that when a weary filament sits down upon the grid, one course is to send the valve to be re-filamented.

Repaired Valves

I used to be rather sceptical about repaired valves, for some of those that I have had done when the process was in its early days were not particularly successful. When you sent up a valve to be repaired it came back *looking* very much like its old self, but its performances upon the set were different as different could be. Now I am quite converted to valve repairing—in the case of bright-emitters at any rate.

Not long ago I made a rather severe test which gave surprising results. Here is the form which it took. The characteristics of three new valves of different makes were first of all recorded; the filaments were then deliberately burnt out and the valves were sent off to be repaired. On their return they were put through the same set of tests as they had undergone when new and in every case they came through with flying colours. It was not, of course, to be expected that the curves would be identical; they were not; but everyone of them was perfectly satisfactory and one valve had actually been improved. One thing that I noticed about the new filaments was that they were remarkably economical in their current requirements. Two of the valves after repair used less current than they had in their new state. I cannot claim to have tested the merits of re-filamented dull-emitters, but friends who have done so tell me that they obtain quite good results with them. So far as I know the repairing process is confined to valves of ordinary shapes and sizes and those of the test-tube pattern cannot be dealt with.

Those High Notes

I wonder if you found during the excellent programme given the other week by the Barnardo Boys that your set could not deal properly with the music of the sleigh bells. The notes produced were very high pitched indeed, and these are a searching test of the efficiency of the low-frequency components of the set. I do not suppose that two receiving sets in a hundred could bring them in with their proper tone. On my own set they were not bad, though one realised that some of the notes approached very nearly the highest limits with which it could deal. Some friends tell me that on their sets the bells produced sounds which resembled sharp clicks rather than notes.

The trouble is that we have not so far been able to design either low-frequency transformers or telephone receivers which can deal equally well with notes of low, medium and high pitch. They respond much better to notes in the middle of the scale than to those on its upper and lower ends. It is largely for this reason that the organ does not come in well on many sets; its deep pedal notes are hardly heard at all, so that the music has not its proper fullness. The designers of both transformers and receivers are hard at work upon this problem. The instruments that we have to-day are infinitely better than those of even eighteen months ago, and there is no doubt that before long we shall have wireless receiving sets capable of dealing adequately with all the frequencies of speech and music. Still, on the whole, they are not so bad now, are they?

Interference Again

I have been having a very bad time lately owing to the misdeeds of my neighbours, several of whom have just installed valve sets in place of crystals. One fellow in particular has nearly driven me mad, for on the last two evenings he has been testing out a set for two or three hours on end during broadcasting hours. Obviously the thing is not working properly; I do not think that he has ever heard anything with it, for his howls always become loudest during the intervals. He has not heard the announcer state that next item will be given in two or three minutes' time, and he imagines that his tuning has gone wrong. Therefore he seizes his controls and turns them first in one direction and then in the other, causing alarm and despondency amongst all his wireless neighbours.

This kind of thing is most unfair. One selfish person has utterly ruined several good programmes for an entire town, in which there are hundreds of receiving sets. I do not think that it is deliberate; I believe that people simply cannot realise that the squeaks which they hear can possibly be audible to others. If you have a set which is liable to oscillate, do please remember that every squeak or howl of

On Your Wavelength! (continued)

yours is audible within a radius of three or four miles. Another point is that it is not cricket to try out experimental sets on broadcast transmissions if they are of kinds that are likely to produce oscillation. For experimental purposes you can always be sure of finding something going on either 600 metres, where the ships are never silent, or on 800, on which wavelength the air stations work. If all wireless men would try to impress upon their friends, especially upon those who have just taken to valves, the necessity for being careful and considerate to others, we should, I think, find that there was very much less interference due to radiation.

5 X X and Radio-Paris Again

Certain remarks of mine in these columns recently have drawn from Capt. Eckersley a reply concerning the possibility of tuning out 5 X X in favour of Radio-Paris. It is perhaps unnecessary for me to emphasise the fact that my remarks were directed to "The Man in the Wireless Street," and not to experts, but I am glad to hear that the B.B.C. are able to select Radio-Paris while 5 X X is working. I should like to hear a programme from Radio-Paris relayed from 5 X X. Capt. Eckersley emphasises a point I made myself when he states that there is "A great deal between the Man in the Wireless Street and the expert operating a really selective set. The contents of these columns are not intended mainly for the experts. Perhaps I have been mistaken, but it has been my impression that the B.B.C. also did not cater mainly for the expert, being rather ambitious to serve the inexpert broadcast listener—the Man in the Wireless Street. Nothing that Capt. Eckersley states in any way controverts my own remarks that the average listener cannot eliminate Radio-Paris in favour of 5 X X without constructing a set specially for the job—or buying one at a probably prohibitive price.

Why the Fuss?

But, after all, why all the bother? Very few of the remarks concerning 5 X X and Radio-Paris are made in a grousing sense. We all knew that when 5 X X came into being Radio-Paris was likely to disappear from our ken. We were even warned to that effect and we accepted the chance. Capt. Eckersley now admits the fact that reception of Radio-Paris is difficult when 5 X X is working; that is all that we need, for it coincides with our own experience. It is when the experts begin to tell us, as they have done, that there is no difficulty that we begin to wonder and that the question becomes one of sufficient interest to occupy valuable space in wireless periodicals. With Capt. Eckersley's admission the controversy ends.

Regarding the construction of receivers which will be sufficiently selective to eliminate Radio-Paris, there is no controversy and never has been. A good aerial with reaction, a really satisfactorily arranged coupled circuit, and a well-designed tuned-anode is probably the ideal. Personally, for general reception I use a set comprising two stages of H.F. This set covers a wave range of from fifty to several thousand metres. It will not cut out 5 X X in favour of Radio-Paris unless alterations are made which impair its efficiency over the other ranges.

Use a Wave-trap

But probably the best thing the average listener can do if he wishes to listen to Radio-Paris is to construct a wave-trap With a wave-trap it will be found that almost any set will cut out 5 X X and bring in Radio-Paris. It is rather curious that so few listeners use a wave-trap on this range, for it helps tremendously in the task of eliminating much of the morse that is so prevalent over a thousand metres. In conclusion, I am glad to be able to say that Radio-Paris is now becoming more easy to get here. Whether alterations are being made in the power or tuning I do not know, but there is no doubt that the transmissions from this station are improving rapidly. Before long it seems probable that only very close proximity to 5 X X will prevent listeners receiving Radio-Paris with ease. If I have said anything to upset Capt. Eckersley's feelings I hope he will accept my apologies, for there is no greater admirer of his work and knowledge than myself.

Accumulator Charging in Excelsis

I had, what was for me, quite a pleasant experience the other evening. I was sitting by the receiver and spending a pleasant half-hour or so "around the stations," when a neighbour knocked at my front door and inquired whether Mr. Thermion would kindly call around and see his set because he had attached the mains to the gear to supply H.T. and there was rather a lot of hum. Needless to say I went. I simply love to visit scenes of trouble, and this particular visit promised to be particularly interesting. When the amateur dabbles with the electric-light supply mains without knowing exactly what he is doing things always promise to be exciting.

I smelled trouble directly I entered the house. It took the form of a very faint burning rubber smell—a thing to which I have a great aversion. I immediately and without further parley switched off the set, which was undoubtedly humming both to the ear and to the nose. A little investigation showed that his true negative wire was joined to the earth negative—that was the cause of the nasal hum. The apparatus consisted of a neon tube with a pair of 1,000-ohm chokes joined up and bridged by two 2-microfarad condensers. An extra pair of chokes put the audible hum right. But the crowning moment of the evening was when my neighbour gravely informed me that he was charging a set of accumulators through this neon tube and innocently asked whether that would make any difference! Five milliamperes to charge a 60-ampere-hour accumulator.

Cleaning the Aerial

I have noted with some interest that many amateurs make a habit of religiously cleaning their aerial wires once a week. I say religiously, because the operation generally takes place on a Sunday morning. Now whilst it is true that the surface oxidation on a copper wire increases the H.F. resistance of the aerial, it is doubtful whether any amount of cleaning will improve matters, because it is obviously not possible to clean between the strands, where the London atmosphere attacks the copper just as thoroughly as it does the outer surface. Much saving of labour would result if the discriminating amateur installed enamelled wire aerials instead of bare copper in the first instance. With such an aerial the maximum of H.F. conductivity is obtained and the wire will literally last for ever if it is erected with due care being taken not to crack the enamel.

Dundee "Bitters"

No, this is not a new drink, but another educational innovation of the town where the marmalade comes from, and personally I think the introduction of talks on scientific subjects into the magic of the Children's Hour is like giving them that hated "preserve" marmalade instead of jam; don't you? Still, as the modern child has a healthy disbelief in fairies and all the other myths we elders revelled in, perhaps a lively chat on the ways and habits of triangles, germs, or atoms may prove more exciting than its appears. These are to be tried every Thursday. Then we elders are to have three afternoons of classical music as a regular feature: very interesting, very praiseworthy, meritorious, but, all the same, marmalade.

Dancing Round the World

If any youngsters catch Cardiff on Saturday night they won't have a leg to stand upon by the time the programme is finished, for the national dances of Spain, Russia, Finland, Poland, to say nothing of Japan and Czecho-Slovakia, are written more, I should say, with a view to listening than to dancing to them. Anyhow the young people can try what they can do.

THERMION.

SOLVING THE CURRENT-SUPPLY PROBLEM

The second and concluding article describing how both plate and filament current may be obtained from the mains.

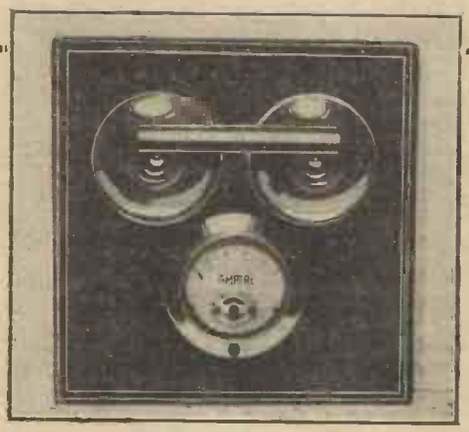


Fig. 8.—Switchboard.

Obtaining Plate Current

PERHAPS the greatest bugbear to the amateur in these days of dull-emitter valves is the supply of plate current. H.T. dry batteries deteriorate even if not used, and they are a source of anxiety and annoyance. The lighting mains may again provide a solution of the problem with an expenditure which need not exceed 15s. and a negligible running cost. The most timid of amateurs may install the gear without fear of damaging his valves.

The Apparatus

The method is illustrated diagrammatically in Fig. 4. It consists of using a neon tube for the purpose of limiting the current supplied by the mains to the anodes of the valves. The apparatus described also comprises a smoothing circuit which will eliminate the ripple caused by the rotating commutator of the dynamo at the generating station. The neon tube (or Osglim lamp, as it is known in the trade) has the peculiar property of passing more current in one direction than in the other, so that two different voltages are obtainable according to which way the tube is inserted in the holder. When the glow is seen around the large electrode (generally in the shape of a spiral hive-shaped wire or a letter of the alphabet) the voltage may be from 65 to 70 volts, whilst if it is around the smaller electrode it will be in the neighbourhood of 50 volts. Some dealers supply the tube without the resistance for wireless purposes generally, but for this particular purpose the resistance should be obtained. It must be explained that should the resistance be omitted the tube may discharge intermittently and thus cause troublesome noises. This is owing to the "threshold" effect of the tube, a consideration of which is beyond the scope of this article.

It is impossible to damage the valve filaments when using this device, as the tube will not pass more than 50 milliamperes when on full load. The tube is also interesting, as it is possible to read C.W. signals by its flashes when two stages of L.F. amplification are used, and, furthermore, it will readily show when the detector is oscillating, as the glow will decrease in brilliancy when this is the case.

The condensers should be of good quality (it is wise to purchase new ones for the job); the chokes need not as a rule exceed a resistance of 2,000 ohms—in fact 500 ohms is generally sufficient. Ordinary telephone chokes will suffice. The method is strongly recommended, for no more H.T. battery troubles will be experienced and much unnecessary expense will be saved. The diagram Fig. 5 shows a method of obtaining multiple stages of voltage by placing a number of the tubes in series and parallel.

Another Method of Lighting Valves Direct

A further method of lighting the valve filaments by a direct means is shown in Fig. 6. This consists of utilising the current passed by the room lights, but it has its limitations inasmuch as there is danger of burning out the valves should any person switch on an extra light on the same circuit when the set is in use. Furthermore, if the set is switched off the lights will also go out unless an extra switch is provided to short-circuit the control switch.

We have seen that one valve requires approximately .6 ampere, so that sufficient lamps must be in the switch circuit to pass this amount of current. In the case of a single-valve set, as illustrated, two 60-watt lamps on a 240-volt circuit will suffice, so that those amateurs who have such a set installed in a room where there are two such lamps for lighting purposes will be able to run their set without adding to the lighting bill. All that is required is a clip bridge to press into the switch contacts. Such a device is illustrated in Fig. 7; it is connected by two flexible leads to the L.T. terminals of the set.

Accumulator Charging

If accumulators are used the problem of getting them charged is gener-

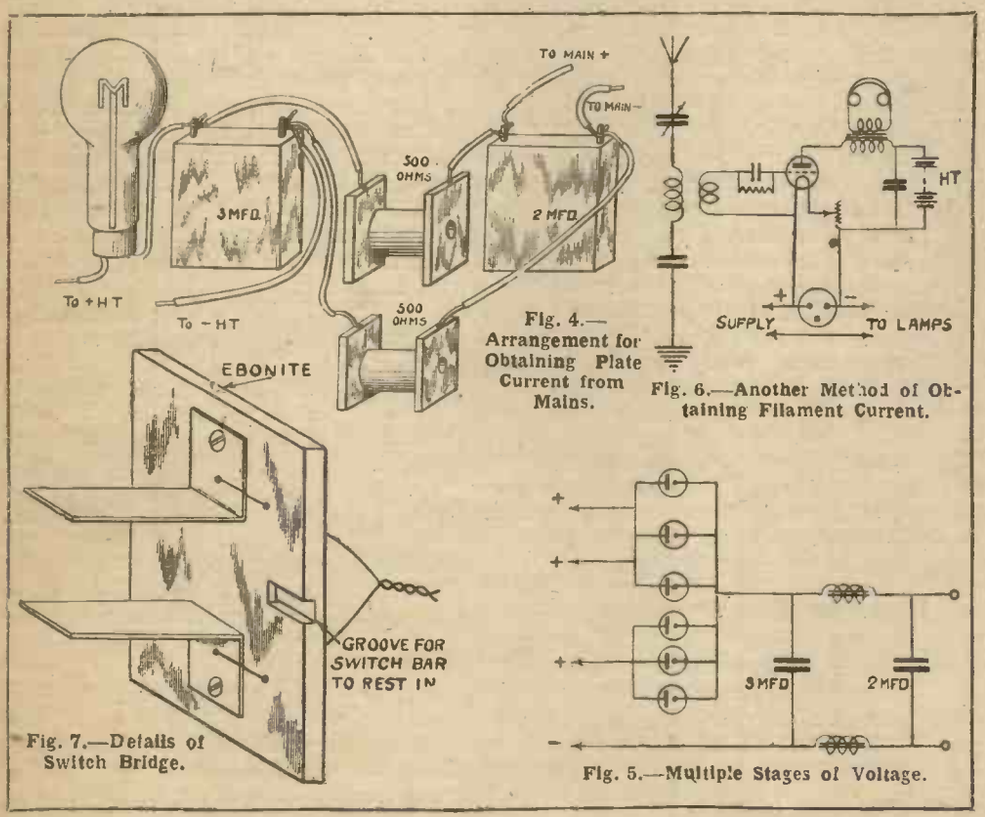


Fig. 4.—Arrangement for Obtaining Plate Current from Mains.

Fig. 7.—Details of Switch Bridge.

Fig. 6.—Another Method of Obtaining Filament Current.

Fig. 5.—Multiple Stages of Voltage.

ally an important one, as the cost and labour of getting them to the charging station are a consideration.

There are one or two devices on the market whereby it is claimed that the batteries can be charged without adding to the lighting bill. These consist of a switch and an ammeter, as shown in the photograph Fig. 8. These devices have the disadvantage that unless upwards of half a dozen lamps are run normally, the charging, etc., is extremely slow. The switch is simply placed in the mains lead on the negative side of the lighting supply (if the earth is negative) and the current passed by the lamps utilised for charging purposes. The switch, which is of the tumbler type, is what is known as a double-pole switch, with the difference that one switch is inverted and the wiring carried out as shown in Fig. 9. It will be seen that when the switch bar is in the up position the accumulators are on charge, whilst when in the downward position the house lamps are connected and the accumulators isolated. The method is, of course, useful for charging small accumulators intended for dull-emitter valves, but care must then be taken that the charging rate does not exceed that stated by the makers of the cells.

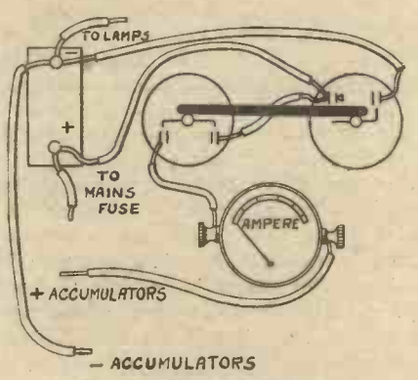


Fig. 9.—Wiring Details of Switchboard.

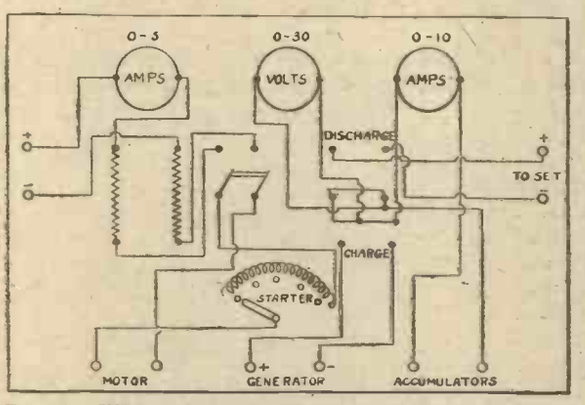


Fig. 10.—Wiring Diagram of Motor-generator Charging Set.

The Motor-generator Set

Further methods of charging are through lamps or other resistances, and by means of a small generator driven by a motor. As regards the former method, this is expensive unless current is available at power rates. For instance, a 40-ampere-hour accumulator charging at the rate of 3 amperes per hour (assuming that 100 per cent. efficiency is obtainable, which is not possible) will cost on an average about 5s. for charging.

The most economical method is to charge by means of a small rotary converter or a motor coupled to a small generator which will generate current at the required voltage. As an example we will assume that we are going to run a ¼-h.p. motor off the 240-volt mains, the current being at ordinary lighting rates of 6d. per unit.

The formula to use when calculating the power consumed by a motor is $I = \frac{B.H.P. \times 746 \times 100}{E \times K}$. K is the efficiency factor, in this case 70 per cent. We have therefore $\frac{1}{4} \times \frac{746}{1} \times \frac{100}{1} \div \left(\frac{240}{1} \times \frac{70}{1}\right)$ which equals just over 1 ampere. We will assume that our accumulator is of 40-ampere hours actual capacity and requires charging at a 4-ampere-hour rate. We will therefore require to run the motor from 10 to 15 hours. Taking 15 hours as a basis for working, we have to take 15 ampere-hours from the mains. As power equals volts × amperes, we have 240 × 1, which equals 240 watts per hour for 15 hours. Hence 240 × 155 equals 3,600 watts, or 3½ Board of Trade units at 6d., which is 1s. 9d. per charge.

If power is obtainable at power rate, say 1½d. to 2d. per unit, the cost is, of course, proportionately lower, for at 2d. it will be 6½d. per charge.

The drawback to this method is perhaps the capital outlay involved, this being somewhere in the neighbourhood of £12 for new apparatus, but surplus Government stores of this nature are still obtainable at very low figures.

The sketch Fig. 10 illustrates diagrammatically a suitable arrangement of the gear for charging accumulators by means of a motor-generator set.

It is hoped that the foregoing notes will be of assistance to those amateurs who have found the questions of power supply the "fly in the ointment" of wireless.

A. J. C.

BOSPHOR PRONZ "REPLIES"

I HAVE burnt out three pairs of telephones recently and am undecided what to do.

We always advise red-headed people to give up wireless unless they are prepared to listen-in with their heads under water.

How can I obtain a really suitable accumulator for my valve set?

By buying one from a dealer who sells cells.

What kind of interference shall I get from a tramway which runs parallel to my aerial before it turns the corner?

You may hear a humming noise in your phones now and then. The biggest nuisance, however, will be that you will often mistake the conductor's ticket-punching bell for the Greenwich time signal.

I possess a three-valve set with which I experience a considerable amount of trouble. Please tell me where the fault lies.

The fault may lie in the set itself, in the aerial, in the earth, in any two of these three things, or in the whole three. As your set is a three-valve set the trouble most likely lies in all three.

Is it advisable to use as reaction coil a coil which is somewhat larger than the aerial-tuning coil?

Certainly, if you wish to make somewhat of a name for yourself amongst your wireless neighbours.

What is a blocking condenser?

You see them at a railway terminus. Train stoppers is another name for them, although some enthusiasts prefer the term platform insulators.

Does an accumulator really cause a lot of trouble?

Really it does now. Listeners-in are continually running them down.

To what station does the call-sign L U X belong?

Port Sunlight.

Why is it necessary for there to be valves in a valve set?

For the same reason that it is necessary for there to be i's in idiot. See?

What is the name given by the Americans to a reaction coil wound on a skeleton former?

A rib tickler.

How can I tell if my set is oscillating and so causing interference to other listeners-in?

By placing a damp finger on the aerial terminal. Should you not desire to damp your finger in company, the nose of a dog in good health makes an effective substitute.

Is there any truth in the theory that wireless waves travel more easily eastwards than westwards?

None whatever. The propounder of this theory was mistaking wireless waves for waves of emigration.

Is it correct that listeners-in will soon be compelled by law to fix corks on their aerial wires to prevent harm to birds?

No. The great objection is that every listener-in would have a terrible influx of visitors with dull-emitter noses.

MAKING A REFLECTOR LOUD-SPEAKER

Back View of Loud-speaker.

Front View of Loud-speaker.

IN designing the loud-speaker described below it was considered that the construction of a circular horn was not possible without a fully equipped workshop. It was therefore decided to make it square. The bowl-shaped back of the loud-speaker is made by cutting a piece of tinned-iron of the shape shown in Fig. 1 and then soldering the edges together.

The neck, which conducts the sound from the phone, is made by soldering four metal pieces together, the details of which are given in Fig. 2. Having made the neck, it is fixed in position by soldering the four projections and the narrow end into the bowl-shaped back as shown in Fig. 3. The mouth of the neck is stiffened by soldering No. 18 square tinned-copper wire all round its edges.

The horn is finished by coating its outer surface with black enamel, the inner surface being left uncoated.

The Frame

The wooden frame is cut out of a piece of three-ply mahogany, $\frac{1}{16}$ in. thick. It is polished on one side, while the second side, which faces the horn, is blackened. The shape of the frame can be altered to suit the taste of the reader, but the one shown will be simple to make. Between the wooden frame and the back of the loud-speaker is fixed a silk screen. The screen consists of a piece of silk glued on a cardboard frame ½ in. wide and cut from a piece of cardboard 7 in. square.

The Earphone

The earphone used should be preferably fitted with an adjustable diaphragm, although an ordinary phone will serve for the purpose. The cap of the earphone is filed flat before it is fixed to the horn and has a rubber washer between.

A clip, details of which are given at C in Fig. 2 is fixed round the earphone, and provides a third leg for the loud-speaker. It is cut from a piece of sheet brass, the free ends being screwed together.

The parts of the loud-speaker are assembled as shown in Fig. 3. The wooden frame W and the horn B are screwed together with the cardboard frame A in between them. The earphone E provided with the clip C is screwed into the ebonite cap, which is fixed to the horn N by screws and nuts with a rubber washer R between them.

This loud-speaker gives excellent reproduction and is free from resonance and other horn effects; it also gives ample volume for a medium-sized room. Its small size makes it specially suitable for a portable receiver, as it can be packed in a box 7¾ in. by 8¾ in. and 3¾ in. deep.

M. J. C.

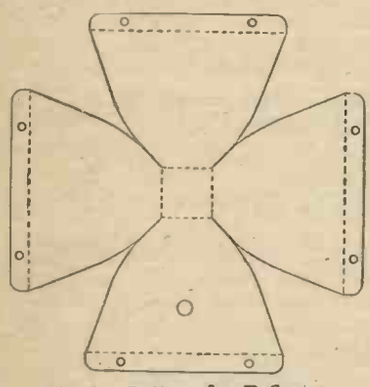


Fig. 1.—Pattern for Reflector.

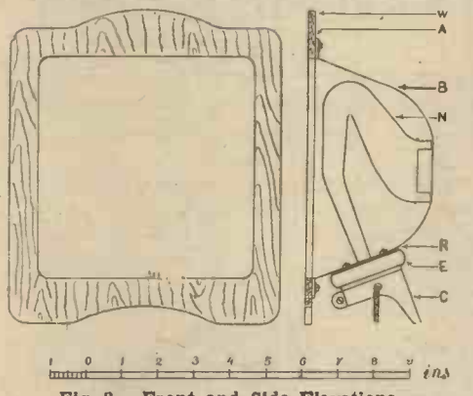


Fig. 3.—Front and Side Elevations.

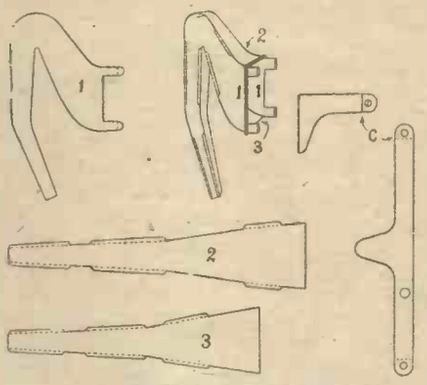
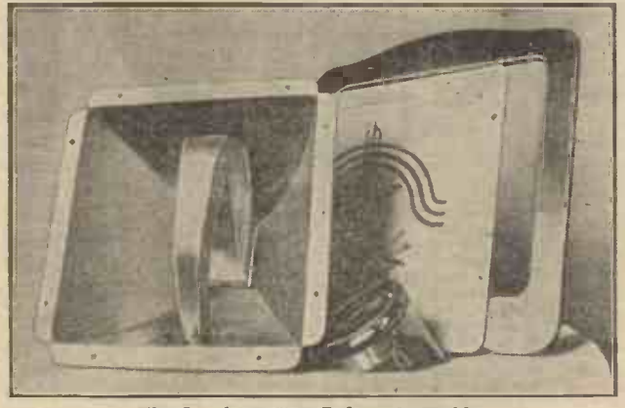


Fig. 2.—Parts of Horn.



The Loud-speaker Before Assembly.

A New Zealand amateur, Z4AG, has been received in England on a single-valve Reinartz receiver.

THE CRYSTAL IN THE REFLEX SET

THESE observations are intended primarily for owners of reflex sets employing crystal rectification, though they will undoubtedly prove of interest also to those who use a crystal detector following a stage or two of H.F. amplification.

Comparative Tests

The results of some recent comparative tests with crystals of many kinds by the writer have led him to the conclusion that for good all-round reception following H.F. amplification a perikon combination is infinitely better than an "ite" and cat-whisker. There may be those who will indignantly exclaim that this is wrong, but their experience will most probably have been with perikon detectors of a certain common type that do not allow of light, though firm, contact between the crystals. Experimenters are earnestly invited to try out this combination again in apparatus capable of giving finer adjustment. They will undoubtedly be surprised at the much better results obtained.

Perikon Detectors

The first perikon arrangement to be tried by the writer was with a cheap type of detector with zincite-bornite crystals. The results in a simple crystal set were inferior to those obtained with good specimens of the synthetic galena varieties with metal contacts. As a matter of fact, the writer has very seldom got good results with perikon in any crystal set.

The great superiority of the perikon arrangement over the crystal-whisker combination is encountered only in valve sets with one or more stages of H.F. amplification. In such conditions the results are really surprising, and with reflex circuits it will be found that the set becomes more stable and reaction can be more definitely brought into use than is the case when the crystal-whisker detector is employed.

This will be more easily realised from the fact that in a 2-valve reflex set giving two stages of H.F. amplification, distant stations were more easily brought in and at greater strength. In many instances reception was often possible with the perikon detector when nothing could be heard with the other. Madrid (Radio-Iberica), for instance, was tuned in recently and reception was good and clear. On switching over to a crystal-whisker detector, which gives excellent results ordinarily, Madrid was gone and could not be coaxed into audibility. Slight retuning still brought nothing. A change back to perikon, and, lo! Madrid was still there.

A further striking instance occurred a few days ago when the writer had the good fortune to receive an American station, again with the perikon detector in use. Changes were made from one detector to the other, as was done in the case of Madrid, with the same results as before.

In receiving the local broadcasting station there is still the same superiority, and apparently it is possible to tune nearer to a station's wavelength with the perikon rectifier than with the crystal-whisker detector; in this possibly lies the secret.

Testing Apparatus

A brief description of the simple apparatus used by the writer in these tests may be of interest. It consists of three upright L-shaped strips of fairly springy brass (two 1⅜ in. by ½ in. and one 1 in. by ½ in.), the feet of each being about ⅝ in. long. Slots cut in the tops of the two longer strips allow crystal cups to be dropped in and secured by their own screws. This permits of quickly changing the crystals.

The shortest strip may be rather stiffer than the others, and through this, near the top, is drilled a hole to clear the threaded shank of a contact stud or valve socket which is used for adjusting the pressure between crystals. Over this hole is soldered a nut to take this adjusting screw. The three uprights are secured by screws through their "feet" to an ebonite or other base. The springy brass permits of firm but light contact between the crystals.

Different lots of crystals bought at different stores were used, so it would seem that these astonishing results were not due to a freak crystal. The crystals were changed from time to time, but the results were always approximately the same.

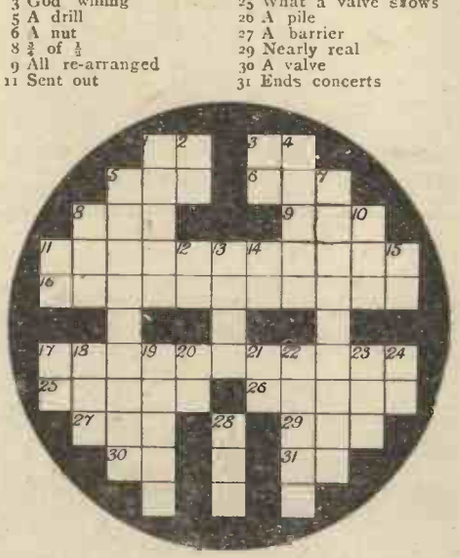
J. D. S.

THE "VALVE" CROSS-WORD PUZZLE

CLUES

ACROSS

1 What we try to do in reception
3 God willing
5 A drill
6 A nut
8 ¾ of ½
9 All re-arranged
11 Sent out
16 A store
17 What watts are
25 What a valve shows
26 A pile
27 A barrier
29 Nearly real
30 A valve
31 Ends concerts



DOWN

1 To remove fastenings backwards
2 A pair of terminals
3 A current
4 A famous electrician
5 A make-shift grid leak
7 Cells
8 A big spark
10 A sign of the Zodiac
11 Begins talk
12 In dismay
13 Starts muddles and ends them
14 Half coil
15 Nearly dry
17 Excellent
18 Aged
19 Subdues
20 Small hours for U.S.A. reception
21 Copper
22 Often a pipe
23 A period
24 German
28 Added to 5 (across) makes it very cold

(The solution will be given in our next issue.)

CONNECTING WITH FLEX

FLEXIBLE stranded copper wire is highly efficient for winding coils or wiring up various components in a set. It frequently happens, however, that when flexible leads are used the strands fray, break off and the wires have to be bared again.

This can be avoided by taking a little care in making the connections and by making some form of protection for the stranded ends.

The wires should be bound with a short length of fine-gauge wire, formed into a loop, and tinned with a small quantity of solder.

If the loop is not wanted the wire can be tinned without completing it and the result is a permanent tag with which connection can easily be made.

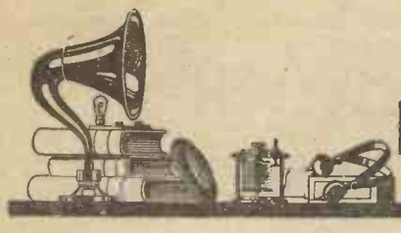
U.

IMPROVING PHONES

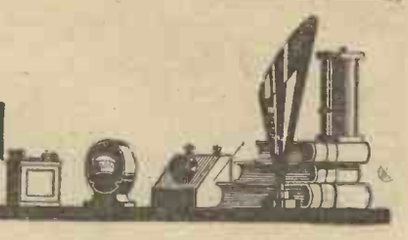
A SLIGHT modification to phone earpieces with the object of improving their tone is suggested by a French experimenter. He says it is a good plan to pierce the diaphragms with a small hole—say about 1/16 in. in diameter. The result, he claims, will be a fineness and clarity of tone not to be had otherwise. He says that he has used this idea both for wire and wireless telephony receivers with great success. The experiment is well worth trying, for at the worst it could only result in a diaphragm being spoilt, which could be replaced for a few pence.

The idea is apparently that the natural period of resonance of the diaphragm is altered by the presence of the hole. It would be a good idea to have a number of diaphragms at hand, drilled so that their frequencies differ.

D.



OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, lay-outs, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 421).

Submarine Wireless

Q.—Can a submarine use wireless?—S. A. (W. 4).

A.—Yes, but only when on the surface. Under-sea working has been attempted but has not succeeded in general practice. The fact that German submarines were forced to come to the surface to use wireless was one of the means by which we were enabled to track them down. Many special D.F. stations were erected in this country for the purpose, and proved very useful.—U.

Variable Grid Leaks

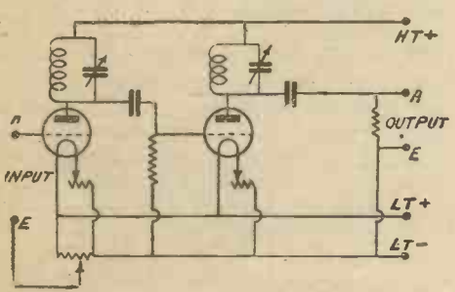
Q.—Is it advantageous to replace a fixed grid leak with a leak which is variable?—P.P. (E.10).

A.—A *good* variable grid leak is generally better than the fixed type. The latter may happen to suit the particular type of valve it is bought for, but where valves are changed over it is generally found advisable to make a change in the value of the leak.—U.

H.F. Amplifiers.

Q.—Please give a circuit showing how I can add two stages of high-frequency amplification to my two-valve receiver (detector and note magnifier). It is not desired to alter the wiring of my receiver, but it is intended to use the same H.T. and L.T. batteries. The tuned-anode system of amplification is to be used, and it is desired to use a grid potentiometer to prevent oscillation.—R. D. (East Farleigh).

A.—A circuit diagram is given showing how two stages of H.F. amplification may be added to your existing set. No modification of the original wiring is necessary, and common H.T. and L.T. batteries are used. No switching

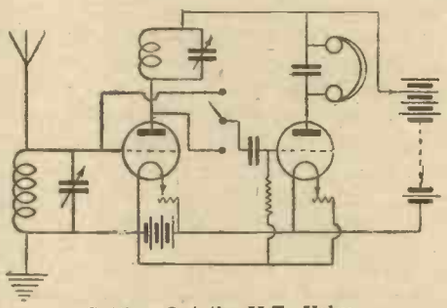


H.F. Amplifier.

arrangements are shown since switching in high-frequency circuits is not advisable, and it is a simple matter to wire up the H.F. amplifier in place of the aerial and earth connections. These two wires are then connected to the input terminals of the amplifier. A potentiometer is shown, and the addition of this simple device will greatly facilitate searching for distant stations. The anode tuning condensers should have a value not greater than .0002 microfarad, though if the anode coils are exactly in tune (and "matched" coils can now be easily obtained) a dual condenser may be employed which tunes both coils simultaneously. The second grid leak and condenser shown are in the grid circuit of the detector.—U.

Switching in H.F. Circuits

Q.—I notice that in a reply to H. S. (S.W. 17) in No. 141, you show a circuit diagram in which the grid condenser and leak are disconnected when the single-valve detector is used alone. I have tried this circuit and find that, with ordinary valves, the strength of



Cutting Out the H.F. Valve.

signals in not equal to that usually obtained when the condenser and leak are present.—V. B. (West Bromwich).

A.—The strength of signals will depend entirely on the valve employed. Should it be desired to use the leaky grid method of rectification the circuit shown above may be used, in which the leak and condenser are employed. It should be noted that if these connections are employed a central insulated stud must be used in the switch, or else the H.T. battery will be shorted when changing over.—U.

Specific Inductive Capacity

Q.—What is the meaning of the letters S.I.C.?—K. G. (Sanderstead).

A.—The property of a dielectric by virtue of which it is able to store up electrical energy is known as its "specific inductive capacity," usually denoted by the letters S.I.C.

Another name for the S.I.C. is dielectric constant."—U.

Inductance of Single-layer Coils

Q.—Please give a simple formula for calculating the inductance of single-layer coils.—J. B. (Anglesey).

A.—This may be found approximately from the formula:

$$L\ (\text{mics}) = \frac{(5\,D\,T)^2}{W + \frac{D}{3}} \times \frac{1}{1{,}000}$$

Where D = diameter in inches.
T = number of turns.
W = length in inches of portion wound.—U.

A Tuner Problem

Q.—I should like to know why a loose-coupled tapped tuner that I possess does not tune to such a high wavelength on my single-valve set as it does when used in conjunction with my two-valve H.F. amplifier and detector.—D. C. (New Cross, S.E.14).

A.—Without a more exact knowledge of the receiver it is difficult to state why this should be so. If the difference is more marked on short waves than on long, it is probable that the self-capacity of the two-valve H.F. amplifier is higher than the capacity present in the single-valve set. This would account for the difference in tuning, but the presence of self-capacity in a set is not so marked on long wavelengths, and the peculiarity would not be so noticeable.—U.

Lightning and Outdoor Aerial

Q.—Is there any possibility of danger from the use of an outdoor aerial?—N. F. (N. W. 10).

A.—In general, no. A properly safeguarded aerial is a potential protector of property. If the aerial were properly struck it would doubtless be entirely destroyed. Nevertheless an earthing switch should be fitted to by-pass static charges that accumulate and that would otherwise strain the insulation of the set.—U.

A Long-wave Tuner

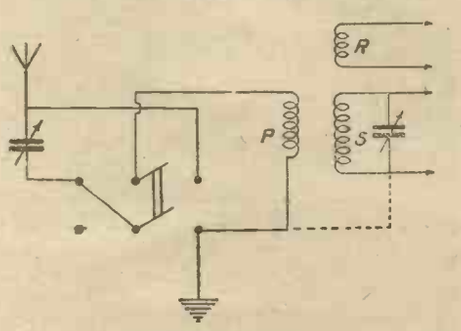
Q.—What weight, gauge and type of wire is suitable for winding a "pile" coil for long wavelengths. The diameter of the former is 2 in., and eight equal tappings are to be taken.—K. F. (Tonbridge).

A.—No. 34 S.W.G. d.s.c. copper wire will be suitable, and about 2½ oz. will be necessary if all wavelengths from 1,600 to 23,000 metres are to be covered.—U.

Selectivity

Q.—I am greatly troubled by jamming and interference on my five-valve set, and should like to make my single-coil tuner really selective. The use of a wave-trap is not desired as it introduces too many extra complications.—W. H. (Ponders End, N.16).

A.—Selectivity is impossible if a single-coil aerial system is used in conjunction with a



A Selective Tuner.

five-valve set, and the use of a loose-coupled tuner is essential if it is not desired to use a wavetrap. A diagram is given showing the connections for a loose-coupled tuner. A series-parallel switch is used with the aerial tuning condenser so that the tuner can be used either for long or short waves. The reaction and secondary coils are loosely coupled to the primary coil, but the coupling between the reaction and secondary windings should be tighter than the coupling between reaction and primary coils. In this manner radiation will be reduced. The connection shown dotted between the primary and secondary coils may be used if capacity effects are noticeable. Both tuning condensers should have a value of about .0005 microfarad.—U.

A DISTORTIONLES

The features of this receiver are great selectivity and purity of reproduction, these being due to

Th

AS the result of several years of experimenting with most types of receivers, the writer has been driven to two strong opinions. The first is rather startling. It is that attempts to secure stages of radio-frequency amplification on the B.B.C. band of wavelengths is in practice a waste of so many valves.

Best Use of Valves

That this opinion is not very far wrong, the writer considers, is proved by the results of reception competitions conducted in America. In these the Reinartz receiver, without high-frequency amplification, is consistently at the top of the lists for D.X. (long-distance) results. A line of reasoning in support of the contention seems to be as follows. No amount of high- or low-frequency amplification can magnify signals that the first valve does not receive. Given an efficient collector of energy, an efficient valve adjusted so as to be at the very brink of oscillation, is the most sensitive device known to science for responding to that energy. The output at the plate or anode of the valve will always be a magnification of the energy received. This is the case whether the valve is adjusted to rectify the received oscillations or not. Whether rectified oscillations are amplified to the same degree as those not rectified is of little consequence so long as it is agreed that the output is greater than the input and therefore fit to be passed on to another valve or cascade of valves.

Next there seems to be no doubt that a valve adjusted to the very brink of oscillation does not lose any sensitiveness because it is adjusted to rectify. Minute high-frequency pulses that reach the tuning device are easily absorbed by losses in the circuit, and what is lost will certainly not reach the valve and appear in the plate circuit as amplified high-frequency oscillations or as rectified energy.

Losses are due in the main to leakage, resistance, eddy currents and dielectric absorption, and high-frequency oscillations are more subject to loss through these causes than low-frequency alternations. Also, presumably, amplified high-frequency alternations are rather more than less likely to suffer dissipation of energy by reason of the causes of losses that must be present in every circuit to a certain degree.

If these conclusions are accurate it seems more expedient to rectify the received oscillations with the first valve and then amplify at a comparatively safe low frequency than to multiply the risks of loss by directing high-frequency oscillations from one circuit to another, as occurs when attempts are made to amplify short-wave high-frequency oscillations.

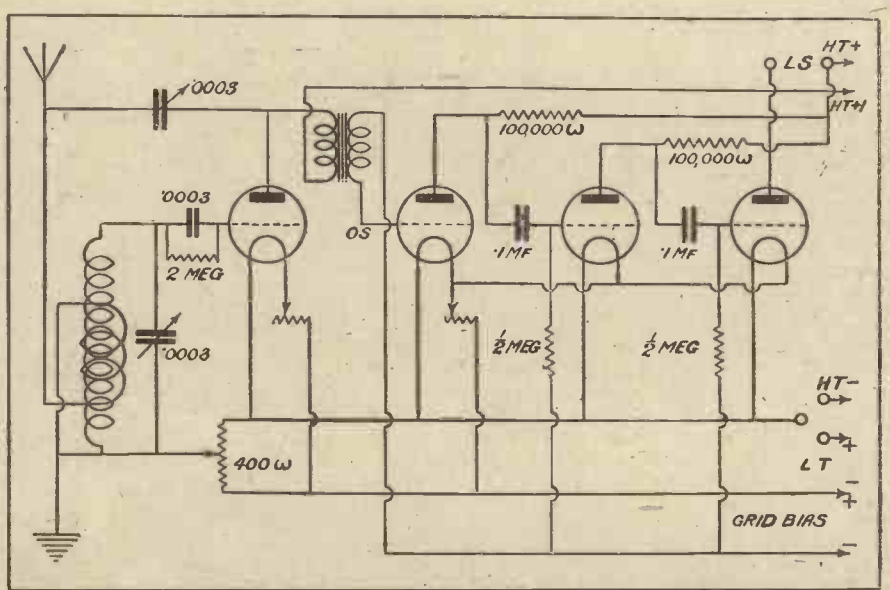


Fig. 1.—Circuit Diagram showing Values of Components.

H.F. v. L.F. Amplifier

Put another way, the opinion offered is that the amount of amplification of radio-frequency oscillations obtained is, in practice, barely enough to outweigh the losses that are at present unavoidable in high-frequency circuits. Therefore a greater output is obtained from a given number of valves by amplifying at low frequency straight from the detector valve without any loss of sensitivity, which means range of reception.

It should be noted that these remarks have been specially directed to wavelengths below 600 metres.

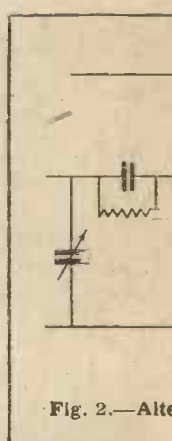
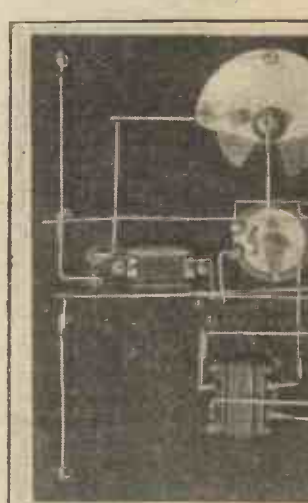


Fig. 2.—Alte

L.F. Amplification

The second opinion refers to low-frequency amplification or the method of obtaining it. The writer is of opinion that no present-day transformer is anything like distortionless when the voltage swing is at all considerable, yet one of good make is nearly enough perfect when the load is small, such as when immediately following the detector valve receiving long-distance signals; then the voltage step-up is of great advantage.

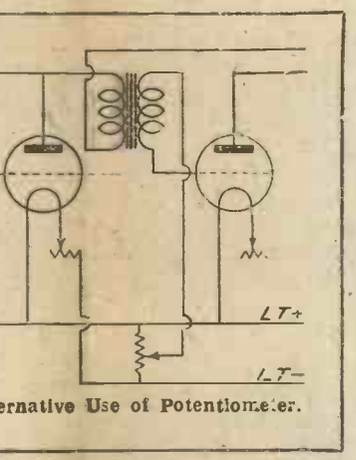


Vie

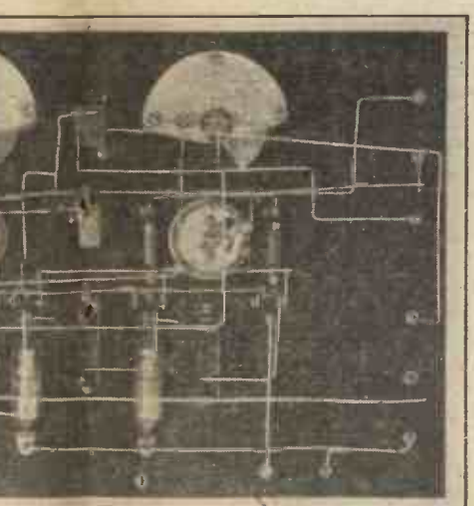
S LOUD-SPEAKER SET

the use of a low-loss tuner, fine reaction control and the resistance-capacity method of coupling.

e Complete Receiver



ernative Use of Potentiometer.



w of Back of Panel.

For the later stages of amplification the resistance-capacity method is absolutely distortionless.

It was to incorporate these conclusions that the four-valve set here described and illustrated was designed. The results seem to justify the conclusions. Under suitable conditions, all B.B.C. stations can be received on the loud-speaker, including several relay stations and many of the Continental stations. Also American broadcasting is satisfactorily received. The set was tried and compared on the same aerial with a five-valve set that incorporates two high-frequency valves, detector and two resistance-coupled amplifiers. It received every station tuned-in on the latter with greater volume in each case, while the time required for tuning it is considerably less owing to the fact that there is only one tuning control in addition to the reaction control.

To obtain the desired results there is incorporated in the set, firstly, a low-loss tuner, and then a system of obtaining reaction that gives fine control, enabling the point of oscillation to be very closely approached whilst still maintaining reasonable stability.

Reaction Control

The tuner selected was the new Igranic aperiodic coil with an Ormond variable condenser with vernier across the secondary, as it was thought that the greatest selectivity would thus be obtained. Control of oscillation is obtained on the Reinartz principle. This comprises a small reaction coil tightly coupled to the tuning inductance, to which it is also connected at the earthed end. The other end of the reaction coil is connected to the plate or anode of the first valve with a variable condenser in series. This variable condenser controls the reaction effect. The reaction coil is, in practice, also the aerial aperiodic coupling coil, these being one and the same.

The Circuit

Fig. 1 is a complete theoretical diagram of the circuit and shows the values of the components. The potentiometer shown is a luxury and is not absolutely necessary. If the set is to be used within ten miles or so of a transmitting station this potentiometer will be more usefully employed for the return of the secondary of the transformer. This arrangement is shown diagrammatically in Fig. 2; it gives excellent control over the strength of signals. The lower end of the tuned circuit is then permanently connected to low-tension positive.

If this arrangement is not incorporated and the set is subsequently found liable to "blast" with certain valves, this can be effectively cured by the simple expedient of reversing the low-tension leads.

The layout of the panel is shown by Fig. 3.

The only values missing in the theoretical diagram are the numbers of turns in the two windings of the Igranic coil used. Should any reader desire to make his own tuning coil, suitable numbers of turns, on a 3-in. former, are 16 turns for aperiodic coupling and 50 turns for the tuned circuit. A completely successful coil for receiving 5 X X was made by converting an ordinary 250 Igranic coil of the new type in which the coil is lashed by thread to the metal angles of the plug attachment. The thread was cut away, the side screws removed and also the strip of celluloid material. This left the coil with the plug hanging to its ends. Thirty turns of No. 26 d.c.c. wire were then neatly wound on the outside of the coil in one layer, the ends being temporarily secured by passing beneath the outside turns. The coil was then reassembled as before.

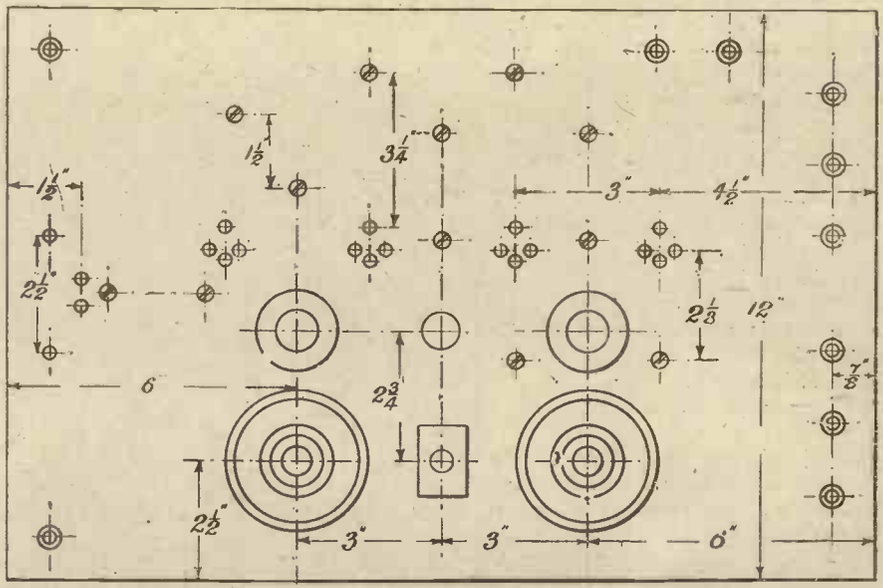


Fig. 3.—Lay-out of Panel.

The tuning of the set is comparatively simple, there being just two controls with no coils to adjust. Before switching on the local batteries the reaction condenser should be set at minimum. Here it should be mentioned that it is necessary

to be generous with the adjustment of the rheostat controlling the last three valves. Even if 4-volt valves are used with a 6-volt accumulator this rheostat will require to be three parts on.

Next increase the value of the reaction condenser until the oscillation point is reached and, keeping as near to this point as possible, slowly search with the tuning condenser until the required station is found. Accurately tune in the station with the vernier, and then judiciously tighten reaction; the closer to the oscillation point this can be set the louder will signals come in.

Low-consumption valves are advised with a B.T.H. B4 or a Marconi-Osram DE5 in the last stage. These valves take only .25 ampere. It is essential that valves working at the same nominal filament voltage should be used in the amplifying stages, which are controlled by the one rheostat.

H.T. Supply

The high-tension supply for this set calls for special attention. Although there are 100,000-ohm resistances in the plate circuits of two of the valves, four valves take more high-tension current than the average battery is meant to give. If ordinary batteries are used, their lives will be short, therefore it is more economical to purchase such a battery as the Burndept "super." Other well-known firms also market double- or triple-capacity batteries. At least 100 volts pressure will be required on the three amplifying valves, and 60/80 volts on the detector valve, depending on the make. The amount of grid bias required, if any, will also depend on the valves used, and can be supplied by flash-lamp batteries.

The following is a list of the components used in making up the set:

Ebonite panel 18 in. by 12 in.; sixteen valve legs; ten terminals (large); two terminals (small); Igranic aperiodic coil (300 to 600 metres); plug and socket for coil; two rheostats with porcelain bodies; Burndept low-frequency transformer; Ormonde .0003-microfarad variable condenser; Ormonde .0003-microfarad variable condenser with vernier; Edison-Bell .0003-microfarad fixed condenser with 2 megohm leak; two Dubilier anode resistances (100,000 ohms with clips); two Dubilier leaks ½ megohm with clips; two Mansbridge condensers (1 microfarad); square wire transfers, screws and leads, etc.

The plug sockets shown on the side of the cabinet are connected by flexible wire to the loud-speaker terminals. A similar set of sockets on the opposite side are connected to the aerial and earth terminals. The flex connections from the terminals pass through holes in the panel to the rear, as will be seen in the photograph on the preceding page. D. H.

AROUND THE SHOWROOMS

Insulating Covering

ONE disadvantage of using bare wire for connecting up a set is that the different circuits cannot be easily followed. Perhaps a more serious object is that the "skin" resistance is likely to increase after prolonged exposure.

Both of these disadvantages can be overcome by covering the wire, after the circuit has been completely connected up, with a liquid insulating compound called Celas.

This compound is applied to the bare wire with a brush; it soon dries on contact with the air. It is made in four colours—red, green, blue and yellow—and can thus be used for differentiating between different parts of a circuit.

In use I have found Celas to be both neat and effective. It is made by Headson's, of 183, Helmsley Road, Newcastle-on-Tyne.

Cheaper Phones

As the demand for apparatus and components becomes steadier and manufacturers are better able to judge exactly the market for any particular product, we may expect to see prices lowered all round.

A week or two ago I noted the reduction in the prices of valves. Now I am able to write appreciatively of the reduction in the price of 25s. phones, which has been lowered to 20s.

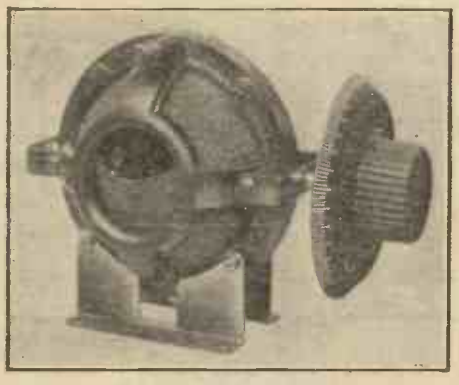
Cheaper valves affect only one section of listeners, but cheaper phones affect everybody, for whether you have a crystal or a valve set you must have phones with which to listen.

Igranic Variometer

It is well known that the efficiency of a variometer depends on the self-capacity and dielectric losses, and that the wavelength range depends upon both these things and the air gap between the two windings.

The ideal variometer would be entirely self-supporting; that is, there would be no dielectric material to support the windings.

Variometers can be made that have very little dielectric material; such, for instance, as the Igranic F-type shown by the photograph.



Igranic Variometer

In this variometer the stator is protected by a skeletonised former, which also affords ample mechanical support. The rotor is entirely self-supporting, and no moulded composition enters into its construction.

The result is an efficient and selective instrument, in which the dielectric losses are kept at a minimum.

This variometer is supplied by the Igranic Electric Co., Ltd., of 149, Queen Victoria Street, E.C., complete with knob and dial, and fixing brackets that can be mounted in four different positions.

Chaslyn Hydrometer

VOLTMETERS are of no use for gauging the amount of "juice" left in an accumulator; the readings are too misleading. The only satisfactory instrument to use is a hydrometer, an instrument that shows the specific gravity of the electrolyte.

Hydrometers are of various types, and perhaps the best for the amateur wireless enthusiast to use is one that is self-reading.

Such a hydrometer is the Chaslyn, an American product handled in this country by J. H. Collie and Co., of 8, Harrington Street, Liverpool. I believe that the price is 5s.

The Chaslyn is a syringe-type hydrometer containing three beads—white, green and red. When acid has been sucked up into the hydrometer, the state of the accumulator can be gauged from the positions of the beads.

If all three beads float, the battery is fully charged. If the white bead sinks, things are still all right. If the green sinks, the charge is getting low; while if the red bead sinks, you should run the battery round to the charging station at once.

Louden Valves

AT last English valve manufacturers are beginning to compete with the cheap Continental product.

I note with interest that an English firm is now able to sell valves—Louden valves—at 8s. 6d. each.

It seems that we are not so far from the days of 5s. valves as we might suppose.

Let us hope that manufacturers will be able to reduce valve prices still further during the next few months. VANGUARD.

AN EXTENSIBLE UNIT SET—*(Concluding Article)*

THE WAVE-TRAP UNIT

IN the description of this, the last unit of the set, it is unnecessary to go into details of construction as precisely as hitherto. The unit follows the same general principles as the others. The shell is prepared in exactly the same way. The panel is marked and drilled in accordance with Fig. 43, A being 4 B.A. clearance and countersink, B 6 B.A. clearance and countersink, C 6 B.A. clearance and D ¼-in. clearance.

The following is a list of the necessary parts to build this unit: One ebonite panel 8 in. by 4 in. by ¼ in.; one variable condenser .0005 microfarad; one potentiometer (300 ohms resistance); two flashlamp batteries; four coil plugs; one coil plug with base (see Fig. 40); four 4 B.A. countersink-head screws ½ in. long; two 6 B.A. countersink-head screws ½ in. long; one Igranic coil (L75); 17½ in. 2 B.A. screwed brass rod; connecting wire, etc.

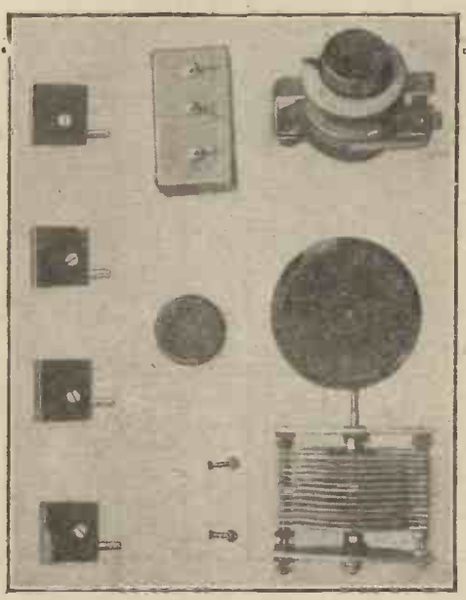


Fig. 40.—Component Parts of Wave-trap Unit.

The variable condenser in this unit can be of the usual type air-dielectric pattern shown in the illustrations, as room is not required to mount a valve behind as is the case in all other units. The assembly is evident from the photographs, so that no explanation is necessary. Fig. 44 is a pictorial diagram of the wiring circuit, while Fig. 45 is the theoretical circuit of the whole set of four units without regard to actual positions of components in separate units or the incorporation of the several switches.

In Use

To eliminate interference with the wave trap the set is tuned in the usual way to the signal it is desired to cut out. For simplicity this can be done with the detector alone in operation. The dial of the wave trap is then turned slowly until the signal fades and disappears. The set can then be retuned at will to the required wavelength. A final slight readjustment of the wave trap may be necessary. It is not claimed for this simple form of trap that it will eliminate very loud signals if the signals which it is desired to receive are on a wavelength very close to the former; it will, however, go a long way to reduce the interference in every case, and in conjunction with a sharply tuned H.F. circuit it will be possible to cut out all but the loudest signals as might, for instance, come from a local B.B.C. station within half a mile or so.

The potentiometer will be found invaluable for tuning in very weak signals and in stabilising the high-frequency valve. The method of applying the voltage bias to the grid is one of several, and it will be advantageous to try other ways until the best arrangement is found to suit the particular valve in use. The method shown has been successfully tried out with the ordinary bright-emitter valve and should therefore be made a starting-point for experiment. The potentiometer will be found most generally useful when the set shows a tendency to oscillate audibly. A slight adjustment of the control will then save complicated readjustment of the tuning controls. Both the foregoing refinements, if they may be so called, make the set more selective and more sensitive.

There is, of course, no reason why other units should not be added as the constructor finds need for them.

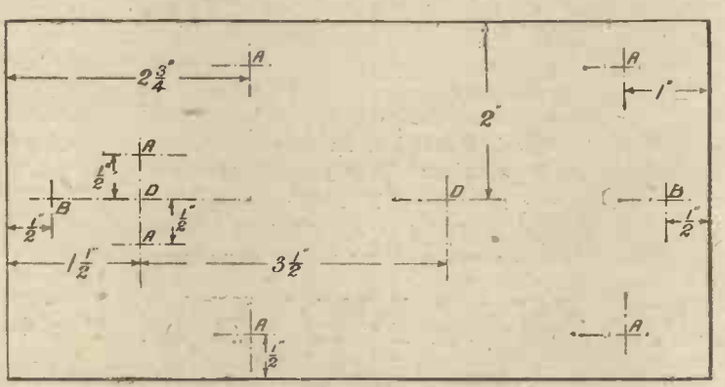


Fig. 43.—Lay-out of Panel

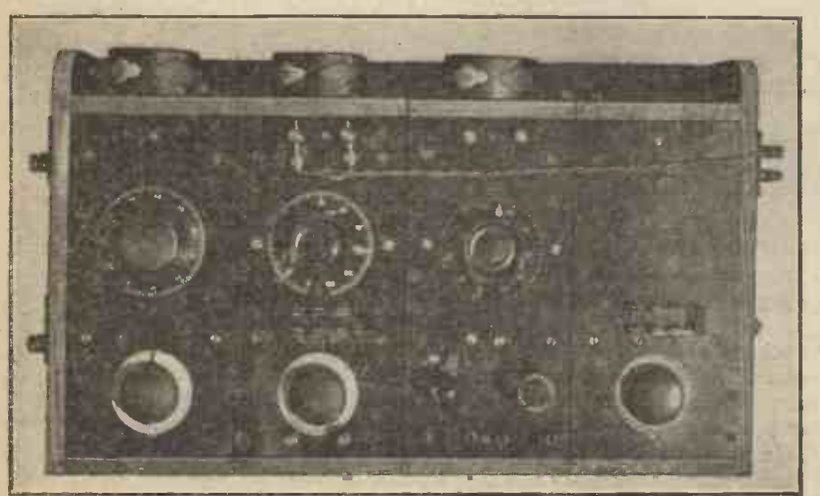


Fig. 41 (left).—The Extensible Unit Set with the Four Units Built Up Into a Complete Set.

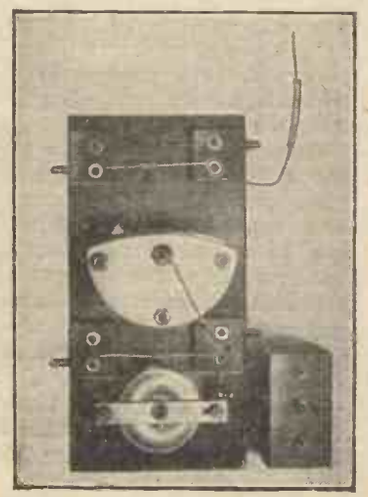
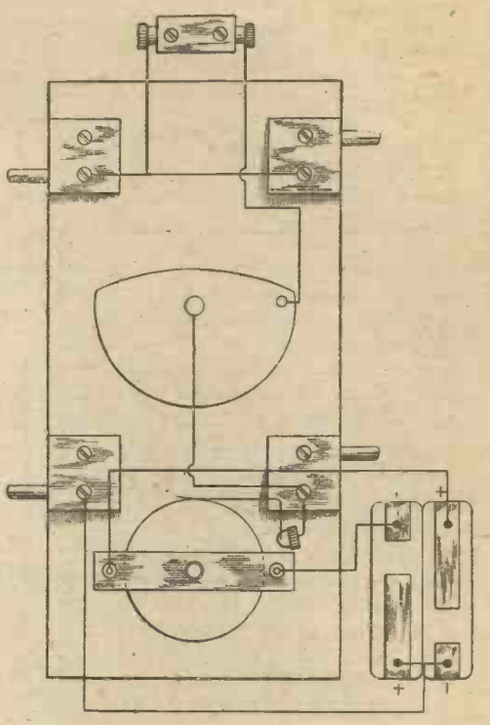


Fig. 42 (right).—Back of Wave-trap Panel showing Connectors, etc.



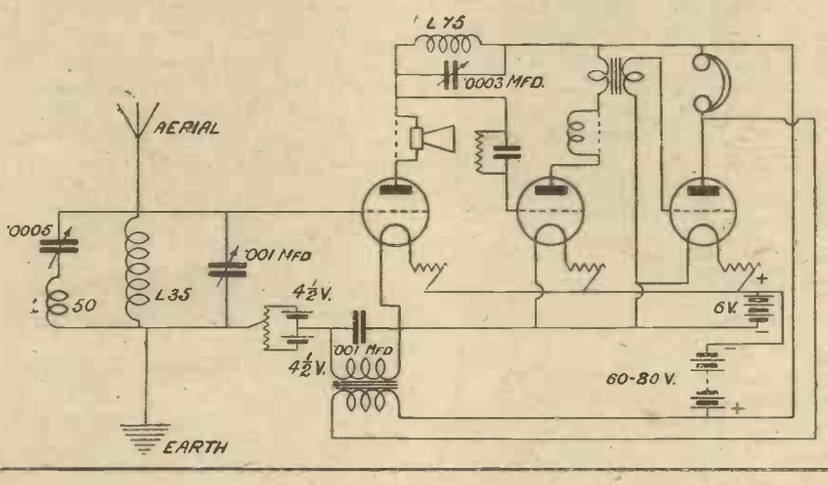


Fig. 44 (above).—Wiring Diagram of Back of Panel.

Figs. 46 and 47 (top left).—Two Views of Wave-trap Unit.

Fig. 45 (left).—Wiring Diagram of Complete Set.

Another H.F. unit, for example, may be plugged in its appropriate position in the set, or a second L.F. panel to work a loud-speaker when it is not desired to use the reflex circuit. A crystal might be mounted on the detector panel with a switch to change over from valve to crystal. Endless improvements and additions will suggest themselves to the constructor. The writer has found it an excellent plan to make a unit, shell, panel and connectors for experimental purposes. The experimental unit can be coupled into the set in any position and taken out again in a few seconds without any interference with the connections of the standard set or disarrangement of the parts comprising any of the units.

DAVID GREY.

PROGRESS AND INVENTION

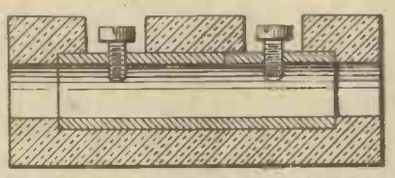
Wire Connector

THE use of solder to join wires in an experimental receiver is not always desirable, since a rapid change of connections is often necessary.

Many types of connector to overcome this difficulty have been tried, but have been inconvenient in use or expensive to construct. A connector is needed which can be manufactured cheaply in large numbers and which will provide a good electrical and mechanical connection, together with ease of operation.

Quite a neat type of wire connector is described in Patent No. 226,957/23 (Glover and Co., Ltd., Trafford Park, Manchester), which is in the form of a length of metallic tubing having two screws to clamp the inserted wires.

An insulated covering is provided, since the joint of two wires is usually in a conspicuous position and likely to "short" to some other part of the receiver.



Wire Connector (Patent No. 226,957/23).

Various methods of insulating the connector are described in the specification, but it is necessary, of course, to employ an insulator that can easily be moulded into the shape required if it is to be a commercial success.

Loud-speaker Improvement

MANY attempts have been made to obtain a sufficiently fine adjustment of the magnets in a loud-speaker in order to balance the natural pull on the diaphragm by means of magnetic tension. Patent No. 226,310/23 (The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2) describes a new method of adjusting the tension of the moving diaphragm. The magnet is mounted on a screw thread, as is usual in adjustable loud-speakers, and the diaphragm is supported at its edges by three or four screws, instead of being clamped between the phone cap and the case.

By adjusting these screws the diaphragm may be pulled taut or held loosely in position, and its natural period is thus altered.

Names famous in combination No. 5.

Darby and Joan

HOW it began we can imagine. How it continued, we know; and knowing, give to all well-met and happily-married couples the names that stand for marital felicity long enjoyed.

In modern times we see united two celebrated names—MARCONI and OSRAM. These names on a wireless valve are your assurance of perfect design and efficiency in performance.

Read the 40-page wireless book, The Book of M O V. Free from your dealer or the M.O. Valve Co., Ltd., Hammersmith, London, W.6.

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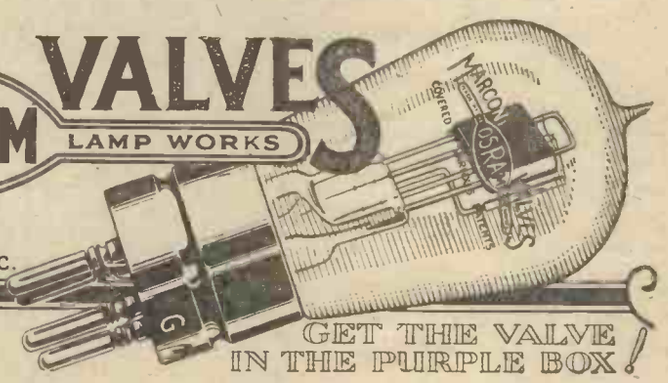

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2 LO's NEW TRANSMITTER

Interesting Details of the B.B.C.'s West End Transmitting Station

MANY small items have been published from time to time regarding the British Broadcasting Company's new transmitting station, which is now in the final stages of completion.

In order to give listeners a more concise idea of this undertaking, the following brief explanation, by kind permission of Capt. P. P. Eckersley, chief engineer of the British Broadcasting Company, will be of great interest

The Station

The station consists of two rooms, namely, the power or machine room and the transmitting room. In the power-room there are two 12-kilowatt motor-alternator sets with automatic starting gear, each capable of generating 500 volts at 300 cycles, for supplying power to the transmitter, and two motor generators of 10½ B.H.P. 32 volts, 400 amps, for battery charging. These also have automatic starting gear, and all the machines are worked by remote control from the transmitting room. A switchboard some 15 ft. long has the necessary switches, fuses and meters for the control of the power supply.

Transmitter

The transmitting room contains a 12-kilowatt Marconi-type Q transmitter. This consists of four panels, namely, rectifier, independent oscillator, master oscillator and modulator, containing in all fifteen valves of various types. Behind the rectifying panel there are two step-up transformers for transforming the output from the alternator to the voltage necessary for the operation of the set.

The battery-charging board, which consists of two panels, one for battery charging and the other for machine input, is situated conveniently near the transmitting panels, thus facilitating the lighting of valves from this board.

Adjoining this room is the battery-room, containing two complete batteries of eleven cells, each of 800 ampere-hours capacity, for lighting the filaments of the modulators, master and drive oscillating valves. Some idea of the power that is dissipated in filament lighting can be obtained from the fact that these batteries discharge at a rate of 90 amperes.

All music lines and control lines running direct from the control room at Savoy Hill terminate on a jack-board in the transmitting room, which is placed close to the modulator.

Masts and Aerial

The masts are very imposing structures of the steel-lattice self-supporting type, and taper from a base of 20 ft. square to 2 ft. square at the top. The tops of the masts are approximately 220 ft. above the street level.

The aerial is of the twin-sausage type, leading up to each side of the first mast from the roof of the transmitting room and then on a heavy-gauge stranded wire to the second mast, the halyards being secured through a winch at the foot of the mast. The two legs of the aerial are led into the transmitting room and are secured by means of tail wires to two anchors at the side of the transmitting room, the lead-in being brought to a large pot insulator on the roof.

Double Power

The set is rated at 12 kilowatts, as against 6 kilowatts of the existing main stations (with the exception, of course, of the high-power station at Chelmsford), and embodies all the improvements which have brought these stations to their present state of perfection.

It should be noted, however, that although this station is double the input power of the other stations, this does not mean that reception will be double the strength, but the range will, it is expected, be greater than the present 2 L O, possibly one-and-a-half times the present range.

The power is supplied from the alternators and passes through inter-locking oil-immersed switch gear (this switch gear is to prevent the filament switch being taken out before the power switch is broken, or the power switch being put in before the filaments are alight) through a choke to the high-tension transformers and also to the filament-lighting transformers, which are also oil immersed. The oil used in these transformers has a very high flash point to ensure against danger of leakage to earth. The power switch being made, connection is then established through the transformers on to the plates of the rectifier valves, of which there are four. These valves are of two-electrode type.

In the case of the rectifier filaments, the voltage is transformed down to 18 volts. The power which is supplied to the valves is rectified and passed through the smoothing equipment at the back of the panel. This smoothing equipment consists of two large iron-core chokes weighing approximately 4 cwt. each and a bank of condensers. This ensures that the high voltage applied to the set is absolutely without ripple. The power is led to the independent oscillator, master oscillator and modulator panels by means of heavy-gauge copper and thus on to the plates of the valves.

Oscillator

The independent oscillator is a separate oscillatory circuit using one 3-electrode valve of the MT2 type. This circuit is tuned to the same wavelength as the master oscillator, with an input of 1-1½ kilowatts. This oscillator works independently, but, being coupled to the master oscillator, acts as a buffer and so prevents any possible fluctuation in wavelength due to the aerial swaying in a strong wind or other causes.

It has been said by some listeners that they are certain that the wavelength of the transmitting station has varied three or four metres between transmissions, and also during transmissions, but this can hardly be accurate, as the engineers are constantly checking the wavelength during *all* transmissions and would detect any alterations. Further, the drive circuit prevents any fluctuation whilst transmission is going on.

The panel for the master oscillator is similar to the independent oscillator in structure, but with two MT2 valves in parallel. The input to the valves is approximately 3 kilowatts, of which about 2 kilowatts is radiated from the aerial. On the top of this panel is a very large iron-core speech choke similar in size to the smoothing chokes in the rectifying panel.

Modulator

The modulating panel consists of seven main-control valves run in parallel and one sub-control valve. This ensures that maximum modulation is obtained without distortion. The sub-control valve acts as a low-power magnifier between the control room and the modulator valves. This valve is coupled by a resistance-capacity coupling to the grids of the main control valves.

The station is now being tested, and if the results are satisfactory the change over from the present transmitter will be made almost immediately.

A New Zealand amateur, Z 4 A G, transmitting on a wavelength of 80 metres, has been received in England on a single-valve Reinartz receiver.

Wireless enthusiasts in Bristol are urging that a local relay station is almost a necessity. Cardiff is too far away to give satisfactory crystal reception.

The station at Washington, N K F, is making a special series of tests for the benefit of amateurs on a wavelength of 1,400 metres.

Louden Valves

Filament Volts 4.8—5
Filament Amps. 0.4
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"A thousand melodies unheard before."—ROGER.

If you would appreciate to the full the delicate texture and beauty of stringed music, fit your set with Louden Valves.

They have a long life. They are economical to use, and they cost only eight shillings and sixpence; but their outstanding quality is the "Silver Clear" reproduction which they give.

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The Plain Louden for Detecting and Low Frequency Amplifying.
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All Loudens are Silver Clear and free from "mush." Their current consumption is very low and their life long.

Price 8/6.

Louden Valves - Silver Clear

Cutting Out the H.F. Valve

SIR,—In a letter published in No. 142 issue under the above heading and over the initials P. S. B. (Newcastle, Staffs), the writer states that he uses a three-pole double-throw switch for cutting out the H.F. valve, which is, I imagine, tuned-anode coupling. I think he has wired up his switch incorrectly, and a two-pole double-throw switch will cut out the valve, including filament. The centre terminal should be connected to the grid condenser, while one of the side ones goes to aerial and the other to the plate of the H.F. valve.—G. W. (Bromley).

"Seeing Music"

SIR,—With reference to C. E. W.'s criticism of THERMION in No. 141, it is perfectly obvious that a milliammeter connected in the H.T. lead of a L.F. amplifier would fluctuate. If there was no fluctuation no signals would be heard, as it is the variation in the steady plate current which affects the telephone diaphragm.

Also, I can assure you that a dip of 5 m.a. does not cause "appalling overloading" nor yield "very distorted reception."—E. E. H. (London, E.).

Atmospheric Conditions

SIR,—With reference to the remarks of THERMION on varying atmospheric conditions in No. 142, I feel sure that a good deal of useful information could be obtained, and possibly some light thrown on the present somewhat obscure subject of fading and night distortion, if amateurs could be induced to participate and co-operate in a properly-organised series of observations and reports over certain fixed periods.

The tremendous difference in reception that can be caused by the state of the atmosphere is particularly noticeable when one is using a set which has to be forced to the limit of its power to bring in distant signals. Under such conditions there are many stations which can only be picked up clearly on a good night, as we say.

I am beginning to formulate a theory that these atmospheric effects are by no means general (from every direction at once), but frequently seem somewhat directional. I should be interested to know whether THERMION has ever noticed this, or can confirm it in any way. What I mean to say is this: Suppose on a given night signals emanating from the north are extraordinarily good, it may be found that signals coming from the south are much more difficult to pick up than usual.

If this point could be definitely determined it might be found that there was some relation between prevailing wireless conditions and the numerous "depressions," which, according to the weather experts, are constantly assailing our shores.—B. H. R. (Sale).

Other Correspondence Summarised

A. H. B. (Stamford Hill), referring to a paragraph in "On Your Wavelength" in No. 141, states that he received the Canadian station Montreal (C K A C) during the Transatlantic tests of December.

E. S. P. (Kenilworth) has received all B.B.C. stations and many Continental stations on his one-valve convertible regenerative set made from instructions given in No. 138.

A. T. N. (Clapton) wishes to draw attention to the considerate treatment he has received from the Economic Electric Co., Ltd. They promptly replaced a faulty "Dextraudion" valve in spite of the fact that he had had it in use for some months.

R. W. (Poplar) has repeatedly picked up K D K A, Pittsburg, on his one-valve modified Flewelling set, using a counterpoise of Electron wire with the aerial switched off.

G. L. (Newark), referring to Capt. Eckersley's letter on "Radio-Paris and 5 X X" in No. 141, states that he regularly receives Radio-Paris when 5 X X is working on his three-valve set.

Calcutta has a new broadcasting station, transmitting on 425 metres. Other stations in India are operating at Bombay, Madras, Colombo and Rangoon.

WIRELESS IN PARLIAMENT

From Our Own Correspondent.

THERE appears every likelihood of strong opposition to the Wireless Telegraphy and Signalling Bill when, at some future date, it comes up for second reading in the House of Commons. Mr. Johnston, a Labour member, is to move the rejection, and Capt. W. Benn and a number of other Liberal members have put down the following motion for its rejection: "That this House declines to give a second reading to a Bill which gives immense powers to a Government department, inflicts excessive fines for infringement of regulations made under such powers, creates new rights of search which unduly infringe the personal liberties of the subject, while at the same time discouraging scientific research and experiments in this new industry."

Licences

Lord Wolmer informed Sir F. Wise that the total number of annual broadcasting licences issued from November, 1922, when the broadcasting service was introduced, up to the end of last month, was about 1,942,000, including the renewals of expired licences. Of this total about 1,200,000 were now current. The total revenue collected was £1,108,000, of which about £850,000 accrued to the British Broadcasting Company. Payments to the company in respect of licence fees were made by monthly instalments in arrear, and the total amount paid to them up to February 1 was about £500,000.

Sir William Mitchell-Thomson informed Mr. Crawford that on February 20 2,181 amateur "sending" licences were in force and 126 applications were under consideration. From June 1, 1924, to the end of January, 1925, 265 applicants were granted such licences and 126 refused.

Answering Capt. Garro-Jones, who asked whether the present facilities given to amateur wireless experimenters, which terminated at the end of April, should be extended and the right given to work in the day-time and to use a wave-band of between 180 and 200 metres, Sir Wm. Mitchell-Thomson said that special facilities had been given during the winter months to a number of experimenters for the use of higher power than that authorised in their licences in order that they might take part in organised experiments in transmission between this country and the United States and other countries. He understood that the winter months were the most favourable for such experiments; but if there was a desire on the part of the organisers of the experiments to continue them during the summer months, he would be happy to consider any definite proposals which they might submit.

RADIOGRAMS

CZECHO-SLOVAKIA is to have a wireless exhibition at Prague from March 22 to March 29.

Rome wireless enthusiasts have for some days past been receiving the Western Electric Company's concerts from Schenectady at great strength on simple sets.

The British Broadcasting Company have arranged to devote half an hour every Friday afternoon for the purpose of transmitting talks to school children in Bradford.

The Long Eaton Council have agreed to invite a wireless company to give a demonstration with a view to providing a wireless receiving set in the public park.

There has been a remarkable rush for wireless licences in the West Riding of Yorkshire since the new Wireless Bill was announced. Nearly 2,000 licences were taken out in Leeds last week.

The Royal Air Force Band will give its second "Request" programme on March 13, all its items being chosen from a list of the most popular numbers it has broadcast.

In Scotland a large majority of the population live in tenement dwellings, and ground-floor residents are complaining about the tremendous advantage which the "top-flat" man has with an aerial that is 20 or 30 ft. above the highest they can have.

A new type of broadcast, to be known as "phono-flights," is being tried by the Glasgow station. The intention is to take listeners on tours of various parts of the British Empire, in which, with speech, music and drama, a picture will be given of the Colonies to-day, along with glimpses of the early pioneering struggles of the past.

Since the publication of the proposed new legislation, applications for wireless licences in Swansea have increased tremendously. Six hundred and twenty-three licences have been granted in two days.

The Postmaster-General is to be asked by the Radio Society to receive a deputation on the new Wireless Bill.

Notices have been served on nearly 200 wireless users in Edinburgh to remove within fourteen days, under threat of prosecution, aerials which have been placed across the city streets.

Ten representations on the subject of the destruction of racing pigeons by wireless aerials have been received by the Post Office.

The scheme for an Empire chain of wireless stations is now within sight of early completion.

In view of misleading statements concerning the lengthening of broadcasting hours, the British Broadcasting Company announce that nothing definite has been settled.

A programme of chamber music will be broadcast on March 5, items being given by Mr. John Coates and the Philharmonic Pianoforte Quartet. Mr. Coates will sing a group of modern English songs and a group of foreign songs, including works by Brahms, Schubert, Beethoven and Weckerlin.

The council of the Institution of Electrical Engineers have asked the Postmaster-General to defer any immediate further proceedings with the Wireless Bill in order that they may have an opportunity of submitting their views to him. They point out that the new provisions are likely to prove detrimental to the progress of wireless telegraphy.

An international conference of the League of Health was held recently at Singapore, and it is proposed that a weekly telegram summarising the most important information regarding the prevalence of epidemic disease in the Far East and elsewhere should be broadcast throughout Australasia.

An S.B. programme of "Ballads Old and New" will be broadcast on March 10, which contains orchestral selections of songs by favourite composers such as Tosti, Wilfrid Sanderson and W. H. Squire, and two special selections, one of old-time ballads and another of old music-hall songs, both arranged by Mr. Robert Chignell.

Another instance of the usefulness of the Marconi direction-finder in locating a ship in distress was provided during recent heavy gales, when the mail steamer *Sarthe*, having developed engine trouble while crossing the Bay of Biscay, was compelled to ask for assistance. The *Sarthe's* call was received by the *Demerara* and the *Port Darwin*. The *Port Darwin* carried a Marconi direction-finder, with which she took a bearing on the *Sarthe* and set her course accordingly. The *Demerara* made use of the *Port Darwin's* direction-finding equipment in checking her own position, and she too was able to set an accurate course towards the *Sarthe*. Fortunately no lives were lost.

(*Continued on page* 416)

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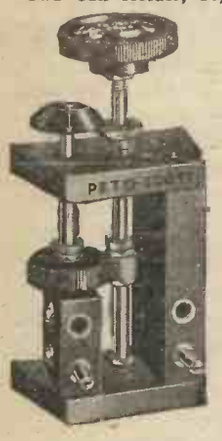

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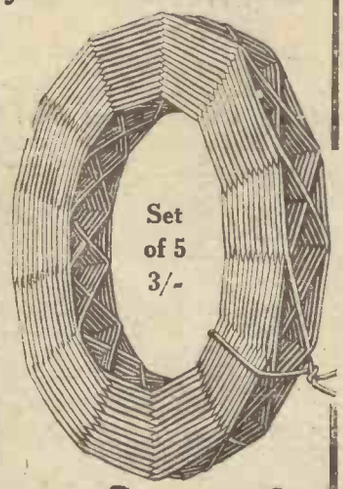

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RADIOGRAMS (*continued from page 414*)

A public broadcasting studio is the latest idea which the B.B.C. is considering. In the near future an evening's programme will be given in a suitable London hall to which the public can be admitted.

Complaints of oscillation have been received from listeners in Bradford. Continuously during the last three weeks an amount of oscillation has been going on in the Grenfell Road district which has caused much annoyance to listeners.

The organ recital to be relayed from the National Institute for the Blind, Great Portland Street, on March 8 will be given by William Wolstenholme, one of the favourite organists who has been heard by wireless.

The programme for March 11 reflects London from many aspects. The orchestral items are all appropriate to the scheme, as are the songs by Miss Nancy Royle and Mr. Michael Head, and the humour dispensed by Ernest Wellbeloved and Miss Dorothy Boyd.

The White Star liner *Majestic*, the largest steamer in the world, received and sent over 35,000 messages, totalling 750,000 words, during 1924, a considerable increase on her record for the previous year.

The Radio Society of Great Britain is so strenuously opposed to the Wireless Bill that each of the two hundred branches has been instructed to petition its local M.P. to oppose the Bill in Parliament.

At the January meeting of Norwich City Council a resolution was passed inviting the B.B.C. to consider the advisability of building a wireless station at Norwich.

Radio-Paris often retransmits 5 X X programmes late in the evening.

"An Italian night to-night!" is the motto of the evening of March 6, and the artistes who will sing the favourite old arias are Mavis Bennett, Enid Cruickshank, and Sydney Russell, the tenor of the B.N.O.C.

A symphony concert on March 9 will be conducted by Mr. Percy Pitt, the artistes being Miss Helen de Frey and Mr. Maurice Cole.

Experiments are being conducted by the Marconi Company in conjunction with the General Post Office and the Southern Railway Company (whose cross-Channel steamer *Princess Ena* is being used for the purpose) in establishing a wireless telephone service between ships and the shore. A duplex wireless telephone set has been specially designed by the Marconi Company for these experiments, and the technical problems connected with duplex telephony and the linking of such a system with the Post Office land telephone lines have been solved.

A new high-power broadcasting station is being erected at Gratz, Austria, and will shortly be working with a power of 10 kilowatts.

Vienna is making its transmissions of the foreign exchange rates in code to prevent unauthorised listening-in. Listeners who have subscribed to the service are furnished with the code book.

NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to Greenwich Mean Time.

London (2LO), 365 m. 1-2 p.m., con.; 3.15-3.45 p.m., lec.; 4-5 p.m., con.; 5.30-6.15 p.m., children; 6.40 p.m. talk; 7-7.30 p.m., time sig., news, talk; 7.30-9.30 p.m., music; 9.30-10.0 p.m., time sig., news, talk; 10.0-10.30 p.m., music. Mon. and Wed. the Savoy Bands are relayed until 11.0 p.m., and on Sat. until midnight. Sat. only, 4-5.30 p.m., con.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 435 m. **Birmingham** (5IT), 475 m. **Bournemouth** (6BM), 385 m. **Cardiff** (5WA), 351 m. **Glasgow** (5SC), 420 m. **Manchester** (2ZY), 375 m. **Newcastle** (5NO), 400 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 331 m. **Edinburgh** (2EH), 465 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 346 m. **Liverpool** (6LV), 315 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 335 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 481 m.

CONTINENT

The times are according to the Continental system; for example, 16.30 is 4.30 p.m., and 08.00 is 8 a.m. (G.M.T.).

AUSTRIA.

Vienna (Radio Wien), 530 m. (1 kw.). Daily: 08.00, markets (exc. Sun.); 10.00, con.; 12.05, time sig.; 12.20, weather; 14.30, Stock Ex. (exc. Sun.); 15.00, news, con.; 15.10, children (Wed.); 17.00, lec. (Tues., Wed., Thurs., Sat.), children (Mon., Fri.); 17.20, women (Tues.); 18.00, news, weather; 19.00, time sig., con., news; 21.00, dance (Wed., Sat.).

Graz (relay), 675 m. Testing.

BELGIUM.

Brussels, 265 m. (1½ kw.). 17.00, orch., children (Wed. and Thurs.); dance (Tues. and Sat.); 18.00, news; 20.15, lec., con., news (opera, Mon. and Wed.).

Haeren (BAV) (250 w.), 1,100 m. (250 w.). 13.00, 14.00, 16.50, 18.50, weather.

CZECHO-SLOVAKIA.

Kbely (OKP), 1,160 m. (1 kw.). Weekdays: 09.00, 10.30, 12.30, 16.00 and 17.00, con. (Wed. and Sat.); 18.30, lec., news, weather, con. (time sig., 19.00), daily; 10.00, con. (Sun.).

Komarov (OKB), 1,180 m. (1 kw.). Weekdays: 13.00, Stock Ex., weather, news; 17.30, con. (Thurs.); 09.00, con. (Sun.).

Strasnice 430 m. (1 kw.). Testing.

DENMARK.

Copenhagen (Kjobenhavns Radiofoni station), 475 m. (1 kw.). 18.35, notices, lec., con.* (Tues., Thurs., Sat.). * This con. is also relayed by the Aalborghus ship station on 510 m.

Lyngby (OXE), 2,400 m. and 2,700 m. Weekdays: 18.20, news, Stock Ex. (2,700 m.); 20.00 and 21.00, news, weather, time sig. (2,400 m.). Sundays: 15.00 and 20.00, news (2,400 m.).

Ryvang, 1,190 m. Concert, 14.00 (Wed.), 15.00 (Sun.), 19.00 (Fri.), 19.30 (Tues.).

FRANCE.

Eiffel Tower, 2,600 m. (6 kw.). 06.40, weather (exc. Sun.); 11.00, markets (exc. Sun. and Mon.); 11.15, time sig., weather; 14.45, 15.35, 16.30,* Stock Ex. (exc. Sun. and Mon.); 18.00, con. (not daily); 18.45, Paris fashions (in English)—temp—(Wed. and Sat.); 19.00, weather; 20.30, con. relayed from PTT (Fri.); 22.10, weather (exc. Sun.). Frequent tests on 1,500 m.

* On 1st and 15th of each month at 16.45.

Radio-Paris (SFR), 1,780 m. (3-4 kw.). Sundays: 12.45, orch.; 13.45, news; 16.45, con.; 20.30, news, &c.; 21.00, dance music. Weekdays: 12.30, orch., Stock Ex., news; 16.30, markets, Stock Ex., con.; 17.45, Stock Ex., news, women; 20.30, lec., news, con.; 21.00, dance (Thurs.). Tests probable on 1,125 m.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 450 m. (400 w.). 14.00, lec. relayed from Sorbonne University (Thurs.); 15.00, outside relay (Sat., irr.); 15.45 and 17.00, lec. relayed from Sorbonne (Wed.); 16.00, outside relay (irr.); 20.00, Eng. talk (Tues.); 20.30, lec. or con., almost daily, con. relayed by F. L. (Fri.); 20.45, lec. (Sun.), organ recital 3rd Sun. each month; 21.30, con. (Sun.).

"Le Petit Parisien," 345 m. (500 w.). 21.30, con. (Sun., Tues., Thurs.), dance (Sat.).

Lyon (Radio Sud-Est), 87 and 440 m. Testing.

GERMANY.

Berlin (2), 505 m. (1½ kw.). 08.00, sacred con. (Sun.); 09.00, markets, news, weather; 10.00, factory con. and tests; 10.30, educat. hour (Sun.); 11.15, Stock Ex.; 12.00, time sig., news, weather; 13.15, Stock Ex.; 14.00, lec. (Sun.), markets; 14.30, children (Sun., Wed.); 15.00, Esperanto (Sat.); 15.30, orch., French (Tues.); 17.30, lec., women; 18.00, French (Mon.), lec. (Tues.); 18.30, lec., Engl. (Thurs.), theatre news (Tues.); 19.30,* con., weather, news, time sig.; 21.30, chess (Mon.), dance until 23.00 (Thurs., Sat., Sun.). * If opera relayed, at 18.30.

Königswusterhausen (LP), 2,450 m. (5 kw.). Wolff's Buro. Press Service: 06.00, 20.00. 2,900 m. (5 kw.): 10.30, con. (Sun.), Esperanto lec. 3,150 m.: Telegraphen Union, 06.45-18.45, news. 4,000 m. (10 kw.): News, 06.00-20.00 (daily).

Bremen, 330 m. (1 kw.). Relay from Hamburg.

Breslau, 418 m. (1½ kw.). 10.15, Stock Ex., weather; 11.00, factory con. (weekdays), sacred con. (Sun.); 11.55 (Sun.), time sig., weather, Stock Ex.; 14.00, news (weekdays); 15.00, children (Sun.); 16.00, orch., children (Fri.); 16.45, con. (Sat.); 17.00, shorthand (Sat.); 18.00, Esperanto (Mon.), Engl. (Thurs.), lec. (other days); 19.00, con., weather, time sig.; news; 20.30, dance (Sun.); 21.15 (Mon.).

Cassel, 288 m. (1½ kw.). Relay from Frankfort.

Dresden, 280 m. (1½ kw.). Relay from Leipzig.

Frankfort-on-Main, 470 m. (1½ kw.). 07.30, sacred con. (Sun.); 10.10, Stock Ex.; 10.55, time sig., news; 15.00, children (Sun.), Stock Ex. (weekdays); 15.30, con., women; 16.00, con. (Sun.); 17.00, markets, lec., children (Wed.); 18.00, lec. (daily), shorthand (Wed.), Esperanto (Fri.); 18.30, educat. hour; 19.00, lec., Engl. (Mon.); 19.30, con. (daily), jazz band (Fri.); 20.30, time sig., weather, news; 21.00, dance or late con. (not daily).

Hamburg, 395 m. (1½ kw.). Sunday: 07.55, time sig., weather, news, lec., women; 10.00, sacred con., chess; 12.00, con., lec.; 16.00, children; 17.00, con.; 18.00, Engl. conv.; 19.00, sport, weather, news, con. or opera; 21.00 onwards, as weekdays. Weekdays: 06.25, time sig., news; 07.30, theatre news; 11.55, time sig.; 12.20, Engl. (Wed.); 14.00, political news, markets; 15.00, women; 15.30, lec., Esperanto; 16.05, orch., 17.00, con., lec.; 18.25, lec., Engl. conv. (Tues. and Fri.), Spanish (Mon. and Thur.); 19.00, weather, con. or opera; 21.00, weather, markets, news; 21.50, news (in English), dance (not daily). Will shortly be increased to 5 kw.

Hanover, 296 m. (1½ kw.). Relay from Hamburg. Also own con., 16.00.

Königsberg, 463 m. (1 kw.). 08.00, sacred con. (Sun.); 10.15, markets; 11.55, time sig., weather; 13.15 and 15.00, markets; 15.30, children (Tues., Wed., Sat.), orch.; 18.30, lec., Esperanto (Thurs., Sat.); 19.00, con. or opera; 20.00, orch., lec., weather, news, dance (Thurs., Sun.).

Leipzig, 454 m. (700 w.). 07.30, sacred con. (Sun.); 10.00, educat. hour (Sun.); 11.00, markets, orch.; time sig.; 15.00, markets; 15.30, orch., children (Wed.); 16.30, lec. (Tues.); 17.30, lec. (Tues.), experimenters (Wed. and Sat.); 18.00, lec.; 19.00, lec. (irr.); 19.15, con. or opera, weather, news; 21.00, con. (not daily). Will shortly be increased to 5 kw.

Münich, 485 m. (1 kw.). 10.30, lec., con.; 13.00, news, weather, time sig., snow forecast; 14.00, con., lec. (Sun.); 15.30, orch. (16.00 Sun.), children (Wed.); 17.00, agric. talk (Mon.), con.; 18.00, lec., Engl. (Mon. and Fri.), Italian (Tues.), Russian (Sat.), Esperanto (Thurs.); 19.30, con.; 20.30, news, weather, time sig.; 21.00, late con. (Sun.), lec. (Tues.), dance (Sat.).

Munster, 410 m. (1½ kw.). 11.00, sacred con., news (Sun.); 11.30, news (other days); 11.55, time sig.; 14.30, markets; 15.30, children (Sun.), lec. (weekdays); 18.40, weather, lec., time sig.; 19.20, women, con. or opera, news, dance (Sat.); 21.00, English, Spanish or Esperanto, news, dance (Sat.).

Nuremberg, 340 m. (800 w.). Relay from Munich.

Stuttgart, 443 m. (1 kw.). 06.30, time sig., weather (weekdays); 10.30, con. (Sun.); 15.00, time sig., con., news (Sun.), children (Sat.); 16.45, children (Wed.); 18.30, lec. (weekdays); 19.00, con. (daily); 20.15, time sig.; 22.00, weather, news, dance (Sun.).

FINLAND.

Haelsinkki, 400 m. (temporary w.l.). Testing daily.

HOLLAND.

Amsterdam (PCFF), 2,125 m. (1 kw.). Daily: 07.55-16.10 (exc. Mon. and Sat., when 10.10-11.10), news, Stock Ex. (PX9), 1,070 m. (400 w.): con., 20.40 (Mon.).

Hilversum (HDO), 1,090 m. (2½ kw.). 17.40, children (Mon.); 19.40, lec. (Fri.); 19.40, con. (Sun.), relay of Mendelberg orch. (Thurs.); con. (Sun.); 19.55, Radio talk (Wed.); 21.40, lec. (Sun.).

Bloemendaal, about 345 m. 09.40 and 16.40, sacred service (Sun.).

ITALY.

Rome (1RO), 425 m. (3 kw.). Weekdays: 16.00, orch., Stock Ex.; 19.30, time sig., news, con.; 20.15, news, Stock Ex., con.; 21.10, dance, weather. Sundays: 09.30, sacred con.; 15.45, children, Stock Ex.; 16.15, orch; 16.45, jazz band, con., dance.

Milan, 650 m. (temp. W.L.). Testing shortly.

JUGO-SLAVIA.

Belgrade, 1,650 m. (2 kw.). 17.30, con., news, weather (Tues., Thurs., Sat.), weather, news only (Mon., Wed., Fri.).

NORWAY.

Christiania, 320 m. (500 w.). Testing, daily, about 19.30.

POLAND.

Warsaw (Radiopol), 390 m. 17.00, tests.

PORTUGAL.

Lisbon (Aero-Lisboa), 375-410 m. 21.30, tests, music, speech (Wed. and Fri., irr.).

RUSSIA.

Moscow Central Wireless Station, 1,450 m. Sundays: 12.45, lec.; 15.30, news and con. Weekdays: 13.00, markets; 15.30, news or con.

Sokolniki Station, 1,010 m. Sundays: 14.30, con.; 17.00, lec. and con. (Tues, Thurs., Fri.).

Trades Union Council Station, 450 m. 17.00, con. (Mon., Wed.).

SPAIN.

Madrid (Radio-Iberica) (3 kw.), 392 m. 22.00, weather, Stock Ex., time sig., con., news.

(*Continued on page* 420)

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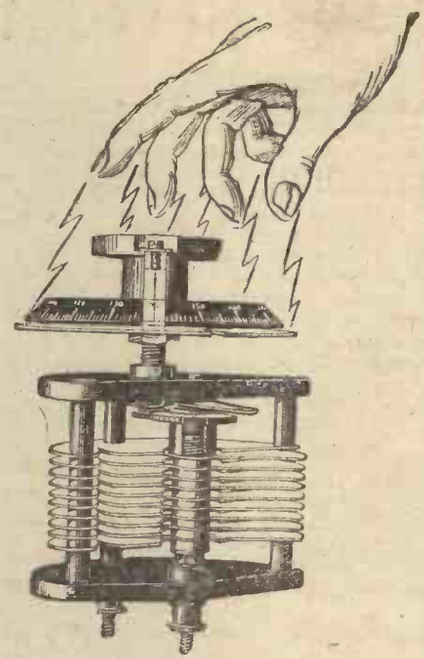

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"BROADCAST TELEPHONY" (*cont. from page 418*)

Barcelona (EAJ1), 325 m. 18.00, lec., Stock Ex. markets, con. or relay of opera; 20.30, news and con.

Seville (EAJ5), 350 m. 18.30, lec., con., news.

SWEDEN.

Stockholm (SASA), 430 m. (500 w.). Sundays: 09.55, sacred service; 16.00, children; sacred service; 19.00, con., news, weather. Weekdays: 11.30, weather, Stock Ex., time sig.; 18.00, lec. (irr.); 19.00, con., lec., news, weather.

Gothenburg (SASB), 290 m. (500 w.), also 700 m. 10.00, fishery reports (700 m.); 11.55, time sig.; 19.00,* programme s.b. from Stockholm.

Malmoe (SASC), 270 m. 11.00, weather; 19.00,* programme s.b. from Stockholm.

Boden (SASE), 2,500 m. 18.00, con. (Tues., Fri., Sun.)—temp.

* Local programmes are also broadcast at times.

SWITZERLAND.

Geneva (HB1), 1,100 m. (500 w.). 13.15, lec. No Sun. transmissions.

Lausanne (HB2), 850 m. (500 w.). 07.05, weather; 12.30, weather, markets, time sig. news; 16.00, children (Wed.); 17.55, weather, news; 20.15, con. (exc. Wed.), dance (Thurs. and Sat.).

Zurich (Höngg), 515 m. (500 w.). 11.00, weather; 11.55, time sig., weather, news, Stock Ex.; 15.00, con. (exc. Sun.); 17.15, children (Mon., Wed., Thurs., Sat.); 18.00, weather, news (exc. Sun.); 19.15, lec., con., dance (Fri.); 20.45, news.

"A THREE-VALVE EXPERIMENTAL RECEIVER." Owing to the pressure upon our space we have been obliged to hold over the concluding instalment of this article.

CHIEF EVENTS OF THE WEEK

SUNDAY, March 8

London and 5 X X	3.0	Organ Recital.
Birmingham and 5 X X	9.0	The Opera *Pagliacci* (Leoncavallo). British National Opera Company.
Cardiff	8.10	Symphony Concert.
Manchester	3.0	Chamber Music.
Newcastle	3.0	Recital of Ancient Hebrew Melodies.
Aberdeen	9.0	Cantata, *The Crucifixion* (Stainer).

MONDAY

London and 5 X X	7.30	Symphony Concert.
Bournemouth	7.30	Wagner Evening.
Manchester	7.30	Symphony Concert.
Newcastle	7.30	The Dance Music Tradition.
Glasgow	7.30	"A Night in Holland."
Belfast	7.30	Operatic Programme.

TUESDAY

5 X X	7.30	*Evening Standard* Concert.
London	7.30	Ballads Old and New. S.B. to all Stations except 5 X X.
Liverpool	7.30	The Liverpool Philharmonic Society's 10th Concert.

WEDNESDAY

London and 5 X X	7.30	A London Programme.
Birmingham	8.30	Old English Music.
Cardiff	7.30	*Tannhauser* (Wagner).
Manchester	7.30	"The Seven-Thirty Revue."
Newcastle	7.30	Garden Scenes from Opera.
Belfast	7.30	Symphony Concert.
Hull	7.30	*The Dream of Gerontius* (Elgar).

THURSDAY

ALL STATIONS	8.0	The Musical Miracle Play Relayed from the Royal Opera House, Covent Garden.

FRIDAY

London and 5 X X	7.30	The Band of H.M. Royal Air Force.
Cardiff	7.30	Song Cycle "The Fair Maid of the Mill" (Schubert)
Aberdeen	8.0	"An Hour with Elgar."
Glasgow	7.35	"Scots Night."

SATURDAY

London	8.30	"A New Feature by Old Friends."
Bournemouth and 5 X X	8.0	"Pictures"—Well known paintings brought to life.
Aberdeen	7.30	The Catterall Quartet.

"How to Remedy a Leaky Roof" is title of a timely article appearing in the current issue of "The Amateur Mechanic and Work" (3d.), and will doubtless prove of great use to many readers. Other articles and features appearing in the same number are: "The Sealing-wax Art," "Simple Terra-cotta Work," "Re-fixing Loose Switch Blocks," "A Corner Umbrella-stand," "Our Small Car Page," "A Long-distance Two-valve Set," "What Crystal Do You Use?" "Fixing Wireless Tackle: The Cleat," "Connecting Tags for Wire Ends," "Notes by the Way," "Gilt Titles for Home-bound Books," "Domestic Lubrication," "Fittings for a Doll's House: A Kitchen Range and a Boiling Stove," "Motor-cycle Practicalities," "Making Money by Inventing," "How a Weather-house Works," "Questions and Answers," etc. etc.

ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell & Co., Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

Crewe and District Radio Society

Hon. Sec.—MR. R. PEACH, 84, West Street, Crewe.

THE first meeting was held on February 11, when the officers were elected. New members will be cordially welcomed.

Coventry and District Co-operative Society

Hon. Sec.—MR. A. CURTIS, West Orchard, Coventry.

ON February 11 the members submitted papers on "Soldering and Tapping," which the secretary read to the meeting. A monetary prize was offered for the paper which secured the most votes, and was awarded to Mr. Izeley.

Kensington Radio Society

Hon. Sec.—MR. H. JOHNSON, 36, Cromwell Grove, W.6.

THE monthly meeting took the form of a debate, with the president, Dr. Gordon Wilson, in the chair. The subject was "Different Means of Obtaining H.T. Supply. Numerous questions were put and answered.

Cork Radio Association

Hon. Sec.—MR. T. A. CONROY, M.A., Smithville, Sunday's Well Rd., Cork.

ON February 9 an interesting lecture-demonstration on the wiring of a set was given by Mr. A. Smith. A soldering and wiring demonstration followed, and members' questions were dealt with.

Coventry and District Co-operative Radio Society

Hon. Sec.—MR. A. CURTIS, West Orchard, Coventry.

THE meeting held on February 4 was principally devoted to members' queries, and concluded with a brief lecture by the chairman, Mr. Beaumont, on the discovery of wireless waves and the subsequent developments.

Beckenham and District Radio Society

Hon. Sec.—MR. A. WEST, Manor House, High Street, Beckenham.

ON February 19 a representative of Messrs. Dubilier, Limited, explained the whole process of manufacturing condensers, and illustrated his talk by means of a very comprehensive selection of slides.

PREPAID ADVERTISEMENTS.

Advertisements under this head are charged FOURPENCE PER WORD, minimum charge FOUR SHILLINGS.

AGENTS and [illegible] Marks obtained.—H. T. P. Gee, Patent Agent, Member R.S.G.B., 51, 52, Chancery Lane, London, W.C.2. Phone, Holborn 1895.

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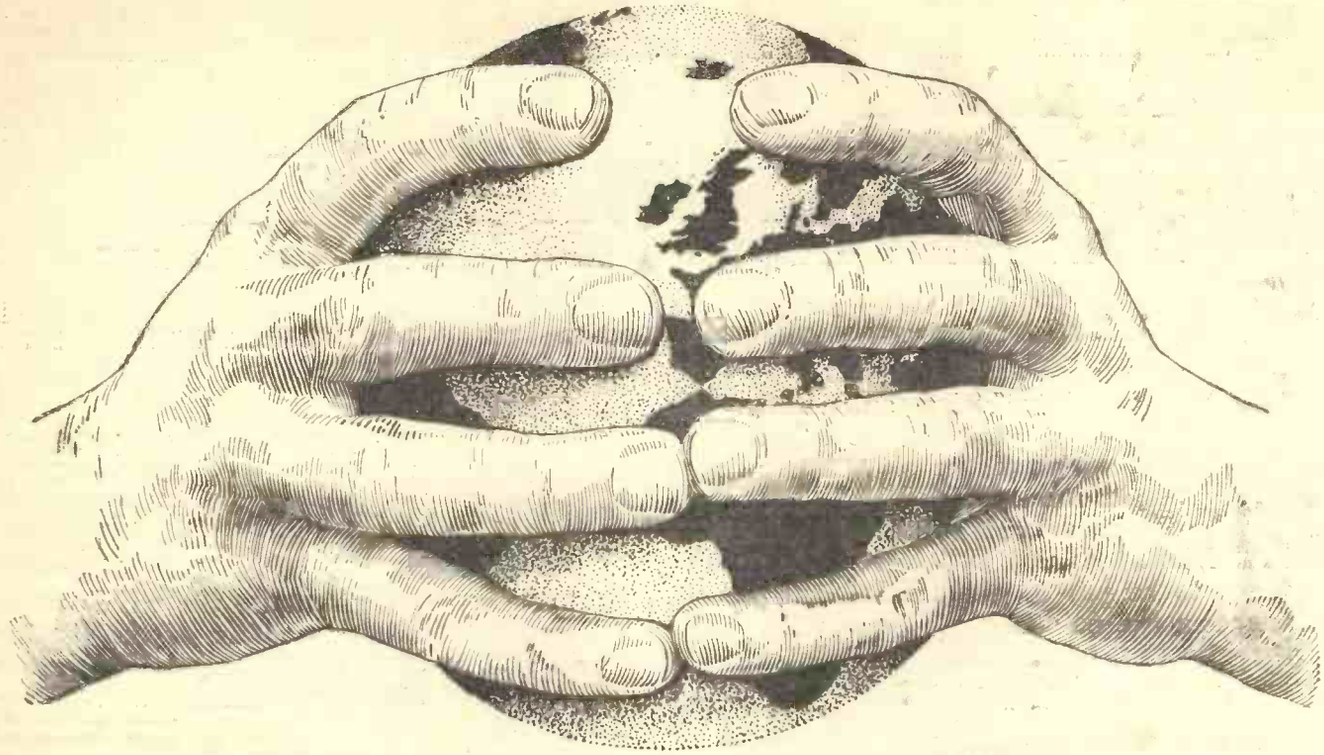

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