Mainly about Construction

BY "MEGOHM"

A CRYSTAL RECEIVER WITH TWO-COIL TUNING

SIMPLE TO MAKE, EFFICIENT IN USE

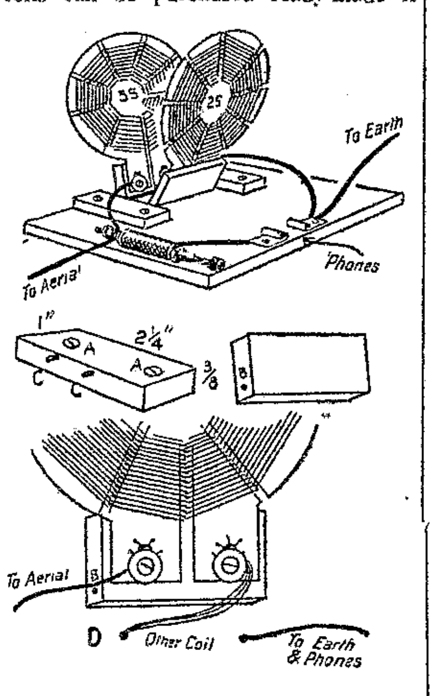
LAST week the making of basket or spider-web coils was dealt with, and it was also shown how one coil could be made to permanently tune-in the local station by finding the correct number of turns to give maximum signals. It will now be shown how two coils may be made with a suitable number of turns and provided with a simple means of varying their distance apart or "coupling," so that any broadcast wavelength may be tuned in.

A coil with 35 turns and another with 25 turns will tune-in 2YA, and will no doubt tune-in 1YA and 3YA also. Possibly for 4YA it might be necessary to increase the 25-turn coil to 30 or so. The correct wire is 26's s.w.g. enamelled.

The circuit and other arrangements will be the same as for the one-coil arrangement described last week, only instead of screwing one coil to the back edge of the board we shall employ two coils and make them both moveable, as by the simple method shown it is easier to make both move than to make one move and have the other fixed. Four pieces of wood 2¼ by 1 by ⅜in. will be required, the amount of finish given to them being determined by the constructor. Two of these are drilled 1-8 in. for two screws as shown (A). The other two, which will support the coils, are to have holes bored at the ends with a thin awl 1-8in. from the lower edge, and central with the two sides (B). The blocks with the screw-holes are now taken, and 1-8in. below the top edge two 1in. nails are driven in part way, ¾in. apart, a shade more, rather than less. The heads are now cut off these nails, leaving less than ¼in. projecting. The next operation is screwing the coils to the moving strips, and this is best done by means of a washer, under which the connecting wires can be clipped. When making basket coils they should all be commenced, wound, and finished in the same way, and a large number indicating the turns marked on the side on which the beginning of the coil comes through the central portion and crosses to commence the turns. Be careful to clean all enamel off top surface of turns of wire round edges of the securing slots before fastening down with the washers. The two coils are to be fastened to the two moving pieces, so that when the coils are put close together the numbered side of each is facing the operator. Then the left-hand of the back coil connects to aerial and crystal; the right hand is connected by two or three thin wires (for flexibility) to the left hand of front coil, and right hand to earth and 'phones. The other end of crystal is connected to the remaining 'phone clip, and all is ready when the earth and aerial are connected.

Tuning is effected by varying the distance between the two coils until the maximum volume is obtained. The higher the wavelength the closer will the coils couple. If the coils are separated as far as possible, and yet a station does not appear to be at maximum, then one of the coils should be exchanged for one of fewer turns. High wavelengths require most turns to tune-in.

This is a simple two-coil outfit, but a regular two-coil holder and plug-in coils can be purchased ready-made if desired. If thicker wire than 26's is used, more turns will be required on the coils, as increasing the gauge decreases the wavelength for a given number of turns.



TRACING FAULTS.

It has been noticed that many amateurs, when searching for elusive faults, show a tendency to place too much confidence in certain components. Either because they are new or the products of firms whose name is well known, the usual tests are not applied, and the source of the trouble may easily be missed. It should be realised that many pieces of wireless apparatus are fragile, and though all reputable manufacturers carry out exhaustive tests before dispatch, accidents can and do happen in transit or during assembly into the receiver. In this matter it is wise to reverse the principles of English law, and to consider every part as guilty until it is proved to be innocent.

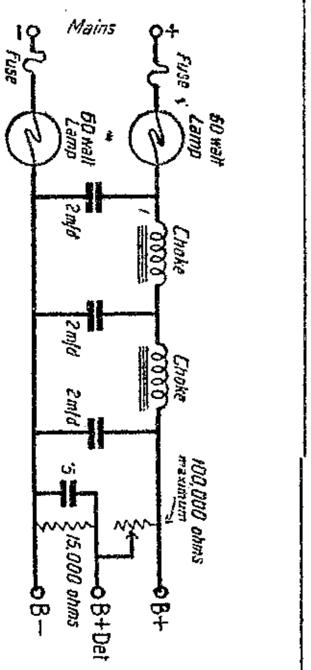
B BATTERY ELIMINATOR FOR D.C. MAINS

ALTHOUGH most places in New Zealand are supplied with alternating electric current, inquiries have at times been sent in regarding an eliminator to work off direct current. Usually this presents a much simpler problem than dealing with alternating current, and certainly entails less expense. Direct current from the mains, however, is not like direct current from a battery, as owing to the method of its production by a dynamo, it carries an objectionable "ripple," caused by the system of rectifying by means of a commutator on the machine. This ripple is not altogether the mere break that might be caused in certain cases by the transfer of the brushes from one segment to the next, but is in many cases a slight back-voltage, which necessitates the use of low-resistance chokes to assist in smoothing current for eliminator use.

Roughly speaking, a d.c. eliminator is the same as one for a.c., minus the transformer and rectifying tube. Direct current does not allow of a step-up in voltage, as may be effected from alternating mains, but where the available voltage is 230 this need cause no concern. In the case of direct current, a certain amount of smoothing takes place in the mains, where the positive and negative leads run alongside, so that current that has travelled the greatest distance in this way will tend to be the smoothest, but at the same time is, perhaps, more liable to pick up interference from trams, etc.

THE CIRCUIT DIAGRAM.

THE diagram shows the general sequence of parts, commencing with a fuse on each main, which may be strips of tinfoil 1-16-inch wide, clamped under washers at each end on a strip of fibre or ebonite, preferably with a strip of mica under each fuse. Then a sixty-watt lamp of the mains voltage is placed in each lead. On the positive side one or two choke coils of 20 or 30 henries impedence are included. One choke should be tried first, and if there is still hum owing to the nature of the ripple in the mains, another choke can be added. If only one choke is used the condenser X will be omitted. The choke may be made as directed in the issue of November 18 for use in the a.c. eliminator. The 2 mfd. condensers may be the ordinary paper insulation type, Dubilier or T.C.C. make. It is important to note that with this eliminator in use a .5 mfd. fixed condenser must be placed in series with the earth lead from the set, and this condenser must be one of high voltage test and reliable make. The reason for its inclusion is that very often the positive main is earthed, and the condenser prevents the current from taking a short-cut return through the set.



The output may be provided with variable resistances as shown, one for each voltage, a fixed condenser being connected across any found to require it, and a fixed resistor totalling, say 15,000 ohms across the last tap and the negative B. A fixed Dubilier or T.C.C. condenser of .5 m.f.d. is also placed across as shown.

A POTENTIAL DIVIDER.

INSTEAD of providing variable resistance across the output, a better plan is to purchase a "potential divider" (climax) which costs about 12s. 6d. This is an arrangement of a continuous resistance with ten taps, each of which may be connected to a socket on the panel, each socket giving a different B voltage. The voltages that may be expected from 230-volt mains should not be less than 160 (max), 136, 112, 88, 64, 56, 48, 40, 32 and 24 volts respectively. Higher voltages may quite likely be obtained, but whatever the maximum voltage, all the tappings will be raised in exact proportion, so that if the maximum turns out to be 180, then the tappings will be 153, 126, 99, 72, 63, 54, 45, 36, and 27 respectively. The low potential end of the divider connects to negative B, which is provided with a terminal, or if preferred a socket, in line with the others.

A tin case finished with black cycle enamel forms a neat container, and only a strip of ebonite is required to take the row of sockets and negative B terminal. The B positive voltages are tapped off by wires running to the respective valves, and provided with a pin or wander-plug for making connection. A twin flexible wire of suitable length with an adapter, provides for connection with the lighting circuit. If a lamp-socket is wired in close to the adapter plug, then the latter can be inserted into any convenient light-socket, and the lamp placed in the extra socket, so that the light is not interfered with.

WHEN POSITIVE MAIN IS EARTHED.

SOME constructors of D.C. eliminators have struck trouble, finding it impossible to get a satisfactory B supply. This is sometimes the case when the positive main is earthed, and one remedy recommended is to place an H.F. choke in each lead on the inner side of the fuses. Such a choke was described in the A.C. eliminator article, and consists of 1000 turns of 36's enamelled wire wound in a flat spool with ¼-inch wood centre, two fibre discs 2 1-8-inch diameter, 3-16-inch apart. Instead of placing a second choke in the positive lead, it may be placed in the negative, oposite the one in the positive. A high standard of insulation must be maintained between the A accumulator and earth.

Fuses as shown must on no account be omitted, as their inclusion prevents the house fuses from "blowing" if a short-circuit occurs in the receiver.

The smaller the power supply installation, the more likely is the D.C. to be "rough," and the voltage erratic. The former trouble is reduced by having two chokes, each of high inductance, up to 100 henries, which would however, cause a reduction in voltage output. Increasing the capacity of the 2 m.f.d. condensers to 4 or 6 m.f.d.'s will also help to smooth out any obstinate ripple.

CHOOSING SUITABLE VALVES

Assuming that the experimenter has made himself familiar with the published data regarding the various classes of valve, there remains the question as to which valve should be selected for any specific purpose.

We may deal first with the case of so-called power valves. These are intended for connection to a loudspeaker, or for any other purpose where an output of considerable power is required (as opposed merely to the production of amplified voltage). In the consideration of a valve of this type a distinction must be drawn between its efficiency when reproducing a weak signal and its capacity for handling power without distortion. As an example we may compare the performance of two valves in a receiver which is sensitive enough to produce ample voltage from a strong local station for application to the grid of the last valve. If we insert our valves in such a receiver and adjust the volume until it as loud as possible, while being free from distortion, we shall obtain a reliable estimate of the second characteristic of the valve; but if we tune the receiver in to a very weak station and, in making the comparison, refrain from altering the tuning controls, so that precisely the same small signal voltage is applied to the grid circuit of each of the valves under test in turn, we shall get a comparison under the first heading which may give us an entirely different result. In fact, we may say, as a general rule, that if a valve is constructed so as to be capable of large undistorted output, it will be less efficient as a reproducer of weak stations than a valve of similar type in which the undistorted output is less.

DYNAMIC CHARACTERISTIC.

Power valves are usually designed to have an internal resistance of less than 7000 ohms, and not infrequently as low as 2000 or 3000 ohms. In comparing two valves which have equal internal resistances, the valve with the higher magnification factor is the better, though this does not quite constitute a complete survey of the problem. It is highly desirable that the valve used in the last position should have a straight characteristic of considerable extent, the limits being, on the one hand, the bottom bend, and, on the other hand, the point at which the grid circuit begins to flow. Information on this point can be obtained from published characteristics, and it will be found that in general the lower the resistance of the valve the greater the "straight range."

A word may be said regarding the correct adjustment of grid bias in the case of a loudspeaker valve. Manufacturers' published characteristics are taken without any load in the plate circuit, and it is customary, in the case of a loudspeaker, to make the average impedance of the windings equal to the resistance of the valve, so as to get the optimum efficiency of reproduction. Needless to say, this cannot be achieved at all frequencies, and it is not intended to do more than emphasise that under practical conditions there is impedance in the plate circuit, and in consequence the valve will have a more gentle slope than appears in the published characteristic. We can assume that the theoretical conditions are complied with and that the loudspeaker is in fact a resistance equal to the internal resistance of the valve.

We next come to valves which have been classified in a somewhat indeterminate manner as H.F. and L.F. amplifiers. These valves do not profess to have any very great range of straight characteristic, although the class of L.F. amplifiers may be used for a moderate volume of loudspeaker reproduction. Setting aside this use we may consider for what remaining purposes in a set various types of valves under this heading are suitable.

In a low-frequency amplifier employing transformers it may at first sight

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