The Improved Browning-Drake Receiver

In last week's issue we gave the full drawing of the wiring design of the improved Browning-Drake receiver. "Megohm" now gives the detail for the wiring and a description of the components. His article will be continued in next week's number.

The Wiring Diagram.

In order to show the wiring as clearly as possible in conjunction with the position of components, the wires are shown running as directly as possible from point to point, although they will not all occupy the exact, same position in the finished set, but should follow the same route in every case. Where possible, all filament leads are run under the baseboard as shown by the dotted lines. On the audio side, wires running between transformers and valves may be kept well up from the baseboard as may seem convenient. It is on the radio-frequency side that special care is required in wiring up. All R.F. leads should take the shortest possible route from point to point, just as shown, and their height from baseboard may be regulated where necessary in order to keep well away from other wire or component. The leads to the variable condensers will be much shorter than appears on the diagram, where the front panel is turned down flat for convenience of illustration. Square or other suitable wire, not less than 18's gauge, may be used for all connections. In the case of using American valves there will be the different way of connecting the sockets to allow for, but if the plate terminal of each is put in the same position as shown for the plate of the British, the remaining connections will present no difficulty. In the case of the detector, the plate terminal could be placed towards the tickler, in order to shorten the grid connection.

The aerial terminal connects to the midget series condenser, the other side of which connects to the tap on the aerial coil. From the earth terminal the lead runs along the baseboard, connects to bottom turn of coil, proceeds under coil and up to moving plates of aerial condenser. From the fixed plates of this condenser a wire runs to the grid of R F valve: soldered to this wire, as shown, are short connections running to top of aerial coil and neutralising condenser respectively This lead should be kept high and away from aerial coil The plate of R F. valve connects to the beginning of R.F transformer (marked A); the negative filament through the R.F bradleystat to the negative A lead connected to earth via the wire from aerial condenser to earth terminal, and proceeding under the baseboard in the other direction to the audio end. The positive filament lead proceeds under the baseboard to the positive filament terminal of each valve socket, and under the board a branch is taken to join the beginning of the R.F. transformer secondary coil, still under the board, and continuing up through a hole near the panel to moving plates of secondary condenser The fixed plates of this condenser are wired to the tickler end of transformer coil, and a branch soldered on to run to one end of grid leak and condenser, the other end of both being connected to grid of detector valve If the tickler has been wound in the direction shown, connecting as in the diagram, this will save the necessity of reversing the leads at a later stage One end of tickler, as shown, goes direct to detector plate, the other end is soldered to the connecting wire from "out primary" or its equivalent on the first audio transformer A fixed condenser of at least 001 mfd capacity s shown across the two ends of the primary winding of this transformer and as this condenser has a great influence on tone it should not be omitted It pays to experiment with different values and ascertain which is best suited; too large a capacity tends to woolliness especially on speech

There should be no difficulty in wiring up the audio side if the diagram is followed Many of the connections cross one another in the diagram, but it should be noted that none of these join at the intersection unless specially mentioned. and those shown dotted are under the baseboard A common terminal is provided for positive A and negative B, and for positive C and negative A. respectively The connection from positive A terminal goes under the board and connects there to the positive A wire running to each valve The negative A lead, shown running round the extreme edge of baseboard, may actually be brought further in, as there will be a narrow strip of wood under two sides of the baseboard, in order to raise it to leave room for wiring underneath Solder all joints where the wires are not connected to terminals. Care must be taken to place the loudspeaker or output jack high enough to clear the choke and Mansbridge condenser behind the panel. The exact position of the two variable condensers depends upon their exact size, but care must be taken to leave clear room for the sweep of the vanes, keeping the condensers as far apart as practicable.

Grid Leak and Condenser.

A good make of fixed grid leak of a value from 2 to 3 megohms, as recommended by the makers of the particular detector valve is to be used. The grid condenser will be a fixed one of small capacity, usually given as .00025, but experiment has shown that one of smaller value is in some cases an advantage. Condensers that slide into clips instead of being bolted down are handy, as different values can so easily be tried.

The R.F. Transformer Secondary Condenser.

With 75 turns on the secondary coil the value of this variable condenser should be .00025. The points mentioned in connection with the aerial tuning condenser apply equally to this one. Only the straight-line frequency type or its modified form should be considered. If a .00035 mfd. condenser is used, only 62 turns will be required on the secondary coil.

Audio Transformers.

In the set being described there are two audio transformers, Igranic shielded type, large size, 5 to 1 ratio. A 3 to 1 ratio was tried in the second stage, but gave less volume with no improvement in tone. Whatever make the constructor decides to adopt, care must be taken to see that they are of ample size and properly shielded. Good quality in transformers is highly imperative, as only a high-grade transformer is capable of giving good tone combined with volume.

Audio Valves.

A Mullard P.M. 4 in the first and a P.M. 254 in the second stage are in use in the set described. These valves take up to four volts for the filament, and have an impedance of 7000 and 3500 ohms. respectively. The H.T. voltage is up to 100 and 125 volts, respectively, but both valves give very good volume with less than the full H.T. voltage, so that an eliminator or B battery, giving a voltage approaching 100, will give good results. Grid bias must be provided for the audio valves. For the P.M. 4 at 75 volts, bias will be 4 volts, and at 100 volts 7 volts grid bias; for the power valve at 100 and 125 volts H.T the grid bias will be 12 and 17 volts respectively. A P.M. 4 can be used in both stages with good results, but with a decrease of volume.

The American U.X. 201A amplifier, taking 6 volts on the filament, is suitable for the first audio stage, and for the last stage the U.X. 112 or U.X. 171 power amplifiers, both requiring six volts on the filament and up to 150 (10) and 180 (40½) volts H.T., respectively, with appropriate grid bias as in parentheses. At 90 volts H.T the grid bias for these valves is 6 and 16½ volts, respectively.

Dry-cell valves requiring two volts on the filament are often the only means of obtaining filament battery power in remote districts, and quite good results can be obtained with them. For this purpose P.M. 2's and U.X. 120's can be used in the last audio stage and other suitable amplifier in the first stage.

(To be concluded.)

EFECTS OF LIGHTNING

FIRE UNDERWRITERS' REGULATIONS.

A Kelburn reader wishes to know the possible and probable effects fo lightning upon a set or user without an arrester in the aerial circuit. If the set was in use when lightning struck the aerial, the chances are that there would not be much left of the wiring of the set, as the track of the discharge would be through the aerial circuit to earth. This would offer an indirect path for the lightning to get to earth, and would also offer resistance. When lightning meets with any opposition to its progress the tendency is to branch off in all directions, seeking an easier path, and this tendency would probably lead it through the whole of the set wiring, which would at least receive considerable damage. A listener with headphones might get a severe shock direct from the 'phones, but in any case a person situated anywhere in a house without a wireless installation sometimes gets what is known as a "return shock" when the lightning discharge is close at hand. When a highly electrified cloud passes overhead it attracts to the nearest point of all conductors below it a charge of the opposite electricity to its own, so that a person standing about has a strong charge of electricity attracted from the earth to his head. When the discharge of the cloud takes place to a lightning conductor, chimney, or other high object near at hand, the charge in the person's head suddenly returns to earth, giving the "return shock," which may be slight or fairly severe, but not fatal.

Not very much is usually known about lightning, and on that account there is a tendency to overrate the danger from it. When we take into account the large number of aerials in use and the rare occasions upon which one is struck, the danger is shown to be fairly slight. But when an arrester is properly fixed on the outside of the building a lightning discharge will jump the arrester and find its way direct to earth, and, provided that the discharge is not abnormally large, there is a good chance that the set would be unharmed.

The function of an arrester is only to provide an easier path to earth than through the set when the latter is in use. When the set is not in use the putting over of the switch to earth the aerial should never be neglected, as by that means the set is protected, and the aerial, acting as a lightning conductor, affords an actual protection against the house itself being struck. When the aerial is so earthed the lightning arrester is out of action for the time being. The earthing switch should also be placed outside the house in a convenient position by the window.

The foregoing remarks show that in neglecting to instal a lightning arrester a certain amount of risk, though small, is being run, but there is another aspect of the case. The fire underwriters' regulations require that no less gauge than fourteens wire shall be used for the lead-in and earth connection, that an earthing switch shall be provided, and that a lightning arrester of good pattern be installed, and it is very much to listeners' own interests that they should comply with these three important regulations, as it is only in case of such compliance that the company insuring the property waives any right to make an increase in the premium on account of extra risk.

When a thunderstorm is close at hand it is wise to discontinue listening, earth the aerial, and disconnect both aerial and earth wires from the terminals of the set as a simple precaution, but there should be no nervous apprehension about it.

ANSWERS TO CORRESPONDENTS

A correspondent inquires as to the effect of an aerial 150ft. long when used for crystal reception. There appears to be nothing against using such an aerial for crystal reception, and several readers have reported good results from aerials of similar dimensions.

A number of letters have been received asking for an article on oscillating crystals, and this will appear in due course.

SHORT-WAVE HINTS

In operating a short wave set there are a number of points to be considered in addition to those common to both broadcast and the short wave. The following hints are given as the result of practical experience, and may be of assistance to readers who are starting out on short-wave reception.

Keep detector filament voltage as low as possible. This makes for quiet working and smooth oscillation.

The plate voltage must also be kept down, and probably from 20 to 30 volts HT will give satisfactory results.

Very often better results are obtained by discarding the earth connection. In most circuits it is then necessary to connect the A battery side of the secondary tuning coil to the earth terminal.

If the set shows any tendency to squeal when off oscillation point, try lowering filament voltage with the rheostat and also try a larger grid condenser.

The radio choke is not at all critical. 'Megohm" has used half a dozen, some elaborately wound on rest-tubes, with 100, 150, and 200 turns, but 100 turns of 30's roughly wound on an empty cotton spool with a small centre, answers as well as any.

Where plug-in coils are used, the secondary condenser should be small in capacity, and may be made so by removing plates from a variable condenser until only five are left. This spreads out the stations on the dial and makes tuning less critical.

There is no need to shorten a 100ft. aerial for short-wave reception, and a greater length than this is said to be quite suitable.

Loose aerial coupling and tight reaction coupling are usually best.

For the guidance of those contemplating the construction of a set using movable plug-in coils, the following are approximately the three sets required to cover the range from 20 to 100 metres with a small secondary condenser as mentioned above:—

No. of Turns. Pri.	Sec.	Reac.	Metres
3	15	6	50-100
3	8	6	30-55
3	4	4-6	20-35

In houses with an alternating current lighting supply there is sometimes trouble in getting rid of the a.c. hum, and working with an earth connection is sometimes impossible in such a case. The hum has been removed in a particular case by placing a metal plate four or five inches square a few inches above the detector valve in a horizontal position and connecting the plate to ground by means of a thin wire. Other cures must be sought to overcome individual troubles of this kind. Switching the a.c. supply off is sometimes feasible in the daytime.

THE SHORT-WAVE ADAPTER

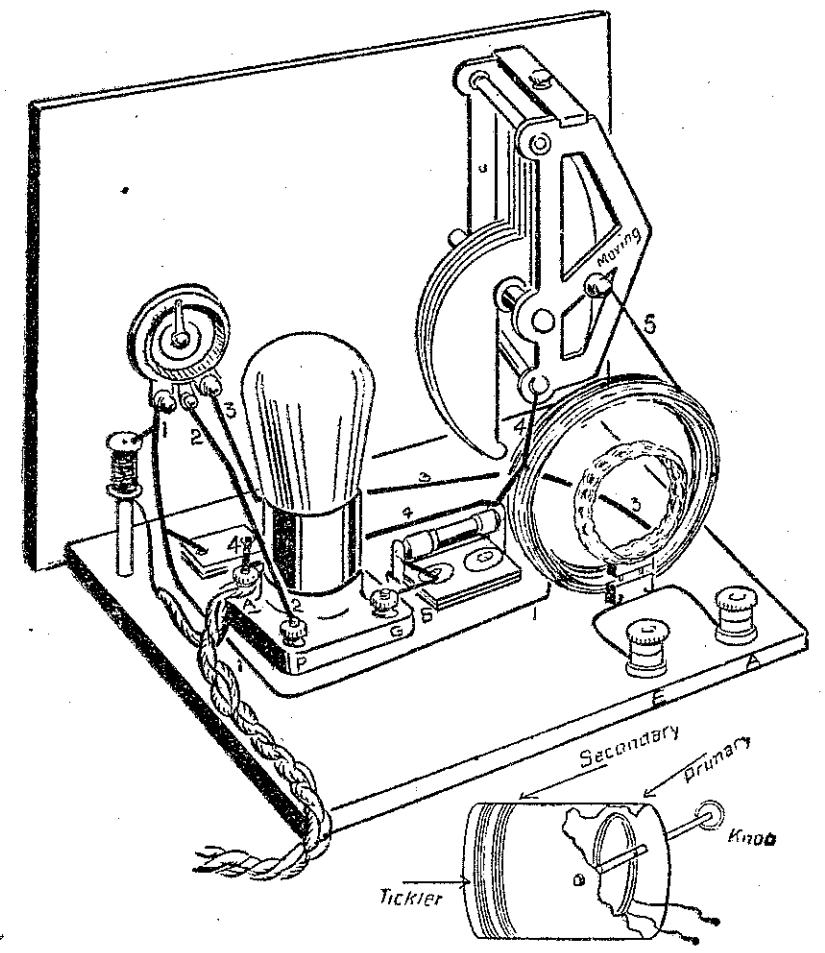
FURTHER DETAILS FOR CONSTRUCTORS

The short wave adapter described in No. 5 of the "Record" has aroused the interest of a large number of readers, several of whom have written asking that the theoretical circuit diagram, already published, be supplemented by an illustration of how the adapter looks when made up. A somewhat indistinct illustration has been supplied by the original contributor of the article, and from this a drawing has been made on which the connections have been distinctly marked. "Megohm" has written up the additional hints that follow.

As described in the original article, the coils may be arranged in different ways to suit the constructor and to give the necessary range of wave-length. The three coils are shown at the right of the illustration, the small near one is the primary, for which five turns are specified. The next coil is the secondary of ten turns, and close behind is the tickler of six turns.

The method of fixing the two latter coils to the baseboard is not shown, but the constructor will soon plan a suitable way with celluloid strips and cement, keeping the lower portion of the coils clear of the baseboard by about half an inch. This arrangement of coils is said to tune up to Schnectady's 89 metre transmission, but there is no statement as to the lowest wave-length that can be tuned in, but this will probably be about 45 metres.

A small inset drawing is given of a suggestion for winding the coils upon a short tube three inches diameter, of celluloid or bakelite.



The tickler and secondary of six and ten turns respectively are wound with 26's double cotton-covered wire as already specified, a space of one-eighth inch being left between the two coils. At one and a quarter inches from the secondary coil a hole is drilled in each side of the tube to take a quarter inch ebonite rod, to which the primary coil of five turns is attached, the ends being brought out to connect to aerial and earth. If the set will not tune as low as is required, the primary turns may be reduced to three. The ebonite rod is passed through a hole in the front panel clear of the moving part of the condenser, and is rotated by means of a knob.

The wiring is shown as clearly as possible, but does not indicate the exact position of the wires as regards height from baseboard. Leads 4 and 5 from the condenser are shown connected to the top of the secondary coil for clearness, but they could actually be put in this position to keep clear of the leads on the baseboard.

Taking the connecting wires in turn, No. 1 comes from one end of the resistance and to it is soldered the wire from the top of the radio choke, then a soldered branch to the .0001 mfd. fixed condenser, situated behind the valve. The lead marked 1 then proceeds along the baseboard to one end of the tickler coil. The flexible cable contains three wires, and reference to the theoretical diagram will show where each is to be connected according to the corresponding valve pin to which it is attached on the plug. One of these flexible wires goes to the lower end of the choke, and the other two each to a filament connection on valve base. To show the lead (4) to fixed condenser, grid leak, grid condenser, secondary coil and tuning condenser, the left-hand filament terminal has been made negative. This No. 4 lead comes from the fixed condenser to each point as mentioned and finishes at the fixed plate terminal of the secondary condenser. Lead No. 2 goes direct from arm of resistance to plate terminal of socket. No. 3 connects the other end of the resistance to the remaining end of tickler. It is possible that the connections on tickler will have to be reversed when the set is first being tested. No. 5 connects the remaining end of secondary coil to the moving plates of secondary condenser, and No. 6, a very short lead, connects grid of valve to grid condenser and leak. The aerial and earth terminals are connected to respective ends of the primary coil.

The choke is shown wound on a piece of dowel-stick fitted with flanges of celluloid or other insulating material. A sewing-cotton reel may be used, but should have a centre of small diameter. The choke must be kept away as far as possible from the tuning coils.

As .00025 is a rather large capacity condenser to use for short wave work, a high ratio vernier dial should be procured, and a type should be chosen that gives absolutely correct movement, free from any backlash, looseness or uncertain action of any kind, for any such shortcomings will be very apparent when tuning-in short wave. Friction-drive is very suitable for noiseless working. Some types of geared condensers will give a grating sound when moved, and this makes tuning-in more difficult, so any condenser of this class should be tested before final adoption.

The parts required for construction of the adapter are as follow, approximate price being shown.

	s.	d.
Panel, ebonite, about 10 x 7	5	0
Baseboard, about 10 x 8 ..		
Variable condenser with vernier, .00025	20	0
Tapped resistance potentiometer	10	6
Grid Leak 1/6, grid condenser 2/3	3	9
Fixed condenser, .0001	2	3
Coils, or wire to make them		
Valve socket	2	0
Terminals, each		4

All the coils, including the choke, could be made by the constructor, but the tuning coils can be bought if desired. A set of three Hammarlund-Roberts short-wave coils, unmounted, for waves of 9 to 90 metres, is listed at 20/-. Short-wave coils are not much in evidence in catalogues to hand. Hammarlund short-wave receiving coils are wound in long lengths with 16's insulated wire, ten turns to the inch, and any length can be cut as ordered, thus if 15 turns are required, 1½ inches would be supplied. Price 2/3 per inch. Connections or plug-in arrangements would have to be added to these by the constructor. The price given for the variable condenser is only an average one. There are cheaper makes, but in such a vital component, quality is more important than price.

For short-wave reception the best results are often obtained by discard-

(Continued on page 15).