The Improved Browning-Drake Circuit

This instalment concludes the series by "Megohm" giving details for the construction of the Improved Browning-Drake Receiver. Carefully made and operated this set will be found to have exceptional selectivity.

Practically all the constructional and assembling work has now been described, with the exception of the choke filter. The inclusion of this item in the circuit is recommended, but it is not indispensable. Its use preserves the windings and magnets of both speaker and 'phones, as, instead of direct current flowing through the windings, only voltage impulses are used to actuate the diaphragms of reproducers. The two parts of this filter consist of a Mansbridge condenser of two microfarads capacity, and a choke coil. There is more diversity in the values assigned to these two accessories than to any others used in radio. The value of the condenser is sometimes recommended as low as one-tenth microfarad, but too small a capacity gives poor tone, and the two microfarad mentioned will give good results. Then, again, the value of the choke coil is given by a reliable source as 20 henries, and from other sources various figures above this up to an inductance value of more than 100 henries. Unless the constructor is winding his own choke coil, it will be a matter of taking the most suitable value that is available, and probably between 30 and 50 henries will be the value. The choke used in the set described was made from an old Dayton L.F. transformer by taking it to pieces, making a new bobbin of cardboard to fit, and filling it with 36's enamel wire, irregularly wound. The core was then reassembled, and the ends of the winding connected to two of the terminals, the other two being discarded. Although a closed core choke, this gives excellent tone, and answers the purpose well. Using an old transformer without rewinding is not recommended, as the wire would probably be of too thin a gauge for the purpose, and in that case would mar the tone of reproduction.

The Condenser.

A fixed condenser across the output is not shown in the wiring diagram, but it must on no account be omitted, as its influence upon tone is very marked. Here, again, there is considerable latitude, but .002 mfd. may be used as a fair average. If tone is not pure when the set is put into commission, then a different value may be tried. This condenser is connected to the two wires running from the choke and 2 mfd. condenser to the single open circuit jack above. A jack for cutting out the last stage of audio is not shown, but there is ample room to include it if desired, altering the wiring accordingly. Where the speaker is likely to be used away from the set in another room, it is a convenience to include above the jack shown a similar one connected in parallel to the other. By this means 'phones can be used at any time to vary tuning without cutting out the speaker. The filament switch included cuts off all filaments without altering adjustment of the rheostats The constructor must arrange the most convenient way of cutting off the high-tension supply. If an eliminator is in use no switch will be required, as cutting the eliminator off the mains is all that is necessary.

A Warning.

A reminder is given as to the small capacity required in the neutralising condenser when the low-loss winding is adopted for the coils. Two plates of rather less than a square inch each are all that is required, and if readers have any difficulty in procuring the necessary small capacity in a ready-made article instructions will be given for the construction of a simple and effective condenser. The neutraliser must be placed in the position shown, and, if possible, a slot like that in a screw head should be cut in the control knob Then a hole can be made opposite in the panel and alteration of the condenser can be made by means of a dowel stick sharpened at one end like a screwdriver and pushed through the hole in the panel. This eliminates any trouble from hand-capacity when neutralising.

How to Neutralise.

When the set is completed and ready for use the first operation is to carry out neutralisation as follows:—Tune in a loud station near centre of broadcast wave band, 1YA or 3YA, maximum volume being carefully obtained without oscillation, reaction being turned well down. Next turn out the filament of the R.F. valve, then with the neutralising stick turn the neutralising condenser until signals are inaudible or at minimum strength, then turn on filament of R.F. valve and the station should come through well Now see that the condensers are both at maximum tuning, if not, they must be altered to get the best tuning and the process of neutralising is gone through again. The second attempt is practically certain to be correct. If neutralisation cannot be obtained, reverse the connections to the R.F. primary marked A and B and try again. If it cannot be obtained either way it may be an indication that the neutralising condenser is too large or too small, and in that case the correct value must be substituted.

There must be no crowding together of components on the radio-frequency side, and everything should be placed as nearly in the position shown as is possible.

Achieving Selectivity.

The chief aim in the arrangement and construction of this set has been selectivity, and this has been well achieved. The original set is situated an air-line distance of two miles from 2YA and, as already stated, whilst that station is working it can be cut out and 1YA and 3YA can be received with quite negligible background. Although a wave-trap has been provided, it is not required for New Zealand stations. On 2BL the background begins to obtrude, and a wave-trap is required for stations nearing the wavelength of 2YA. At two miles from such a high-powered station the test is fairly severe for an unshielded set, So that at an increased number of miles from 2YA the selectivity of the set will be more evident.

Loudspeaker Volume and Tone.

Connected to a speaker of good design that is able to carry the volume which the set is capable of giving, the tone is smooth and round, and such as should be the aim of every radio enthusiast. Good tone is secured firstly by audio transformers of good design and secondly by critical testing of fixed condensers for each position, including the grid condenser, in order to suit each one exactly to its place in the audio portion of the circuit.

Volume on main Australian stations under normal conditions is as much as any ordinary loudspeaker will satisfactorily carry.

There is not a great deal of construction in the set as described, the aerial tuning coil and R.F. transformer being the only items of note. There are several good kits on the market for those who wish to cut out the coil-making.

Since the commencement of this article the new P.M.3A valve has been tested as a detector, giving even better results than the P.M.3, with marked increase in volume. This valve filament consumes 1 amp. at a maximum of 4 volts, maximum plate volts 150.

Although a filament supply of four volts has been adopted for the set described, and the valves mentioned have been found to work well, there is no reason why any constructor should not adopt the six-volt A battery, and use any valves he fancies, bearing in mind the general characteristics of each suited to the position it is to occupy in the set.

Some constructors will no doubt prefer to use wire rheostats throughout on a 6-volt circuit, and wisely so, although Bradleystats have worked very satisfactorily on 4 volts in the positions shown.

A finel recommendation, the result of a trial just carried out, is the placing of a Ferranti AF3 transformer in place of the one already mentioned for the second stage of audio. The makers recommend at four volts the PM3 atd PM4 in the first and second stages respectively, but the PM4 and PM254 give very fine results. Whatever valve is used in the first stage, care must be taken to regulate H,T, so that the plate current does not exceed the four milliamps stipulated by the makers.

READING CIRCUIT DIAGRAMS

CONVENTIONAL SYMBOLS.

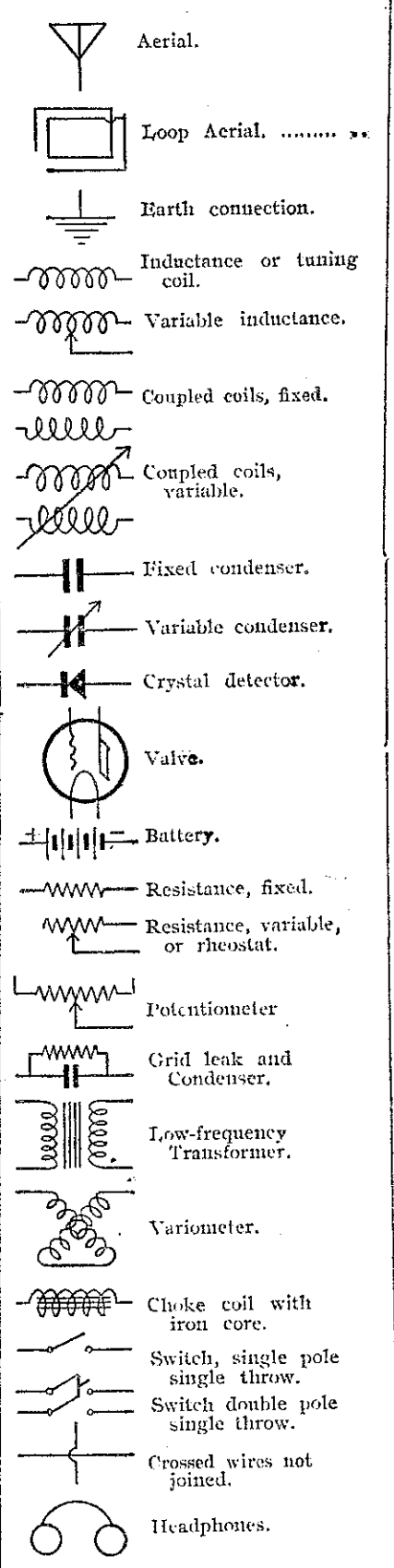
A circuit diagram is more or less a mystery to a beginner in the study of radio, but practice soon develops the ability to see at a glance the main features embodied in a circuit so depicted. It places on paper the working of a circuit in much the same way as musical sounds are represented upon paper, and which a trained musician can interpret and understand perfectly without the use of a musical instrument.

The circuit diagram cannot be replaced by a method of making a pictorial representation of each component wired up in its correct position. That is only a wiring diagram, usually provided to indicate the best method of placing connecting wires.

Certain symbols are used to indicate upon a diagram the various components made use of, the more frequently used of these symbols being shown.

The first three symbols need no explanation, but that signifying an inductance embraces a somewhat comprehensive variety of coils. It may indicate a solenoid coil wound upon or without a tube former, it may represent a honeycomb or low-capacity winding of any kind, and may also represent a coil wound to a special pattern exclusively for a particular circuit. If the inductance is to be tuned by means of a slider, an arrow is placed against the side to indicate a moving contact.

When two inductances are placed near to each other they are said to be coupled, a condition which allows the transfer of radio oscillations from one to the other. If each inductance is permanently fixed in position the coupling is said to be "fixed;" but if a means is provided whereby the distance apart may be varied, then the coupling is said to be "variable," and to indicate this a long arrow is drawn through the two coils so arranged. "Close coupling" is when the coils are placed in close proximity, and "loose coupling" when only a small part of the flux set up by one links the other, that is, when far apart.



A condenser of any capacity whatever is shown by a pair of heavy parallel strokes, and if the condenser is variable, an arrow is drawn through to indicate this. The "rotor" or set of moving vanes or plates may be indicated by curving one of the lines, and an arrow head may be placed at one end of this curved line.

A crystal detector is indicated in graphic form, the pointed section being the cat's-whisker. A valve is indicated by a heavy circle, in which are shown symbols for the square plate, the more or less spiral grid, and the filament. Sometimes the enclosing circle is omited, but its inclusion makes for clearness.

A resistance of any kind is shown by a zig-zag line, which may indicate resistance wire, composition, carbon discs, under compression, pencil lines, or the fine deposits upon glass thread now used in the construction of certain grid-leaks. If the resistance can be varied by rotating an arm or by other means, one end of the resistance is left unconnected, and an arrow placed against the side indicates a movable arm, or its equivalent, which is connected through its bearing to the circuit. In some cases a resistance is required to be connected to the circuit at both ends, and a rotatable arm is provided, that may "tap" current from any part of the resistance, and so divert a portion of the current to another part of the circuit. Such a tapped resistance is usually called a potentiometer.

A battery of any kind, dry or accumulator is indicated by a succession of thick and thin strokes, the thin ones representing positive plates, or electrodes; but in most diagrams the batteries are marked at each end to show the positive or plus and negative or minus ends.

A low-frequency transformer has two separate windings of fine wire, and through the centre of these windings is a soft iron core, built up of a number of thin plates, or "laminated." The symbol for this shows the core by a few strokes, with the "primary" and "secondary" windings placed on either side.

A variometer usually consists of two coils of special form, one moving inside the other. The fixed portion is called the "stator," and the moving the "rotor." The two windings are generally connected in "series," that is, the end of one to the beginning of the other, and the two free ends to the other parts of the circuit.

A choke coil is wound in such a way as to give a large choking, or self-inductance, effect to the passage of an alternating current. A low-frequency choke is wound over a soft iron core, which is indicated in the symbol by a few strokes through the coil.

ANSWERS TO CORRESPONDENTS

An Otago reader is inquiring as to the likelihood of getting more volume from a cage aerial in place of a single wire, having heard that the cage will give increased volume. Such good results are now obtained on a single wire that the cage finds little favour except for transmitting, where low radiation resistance is required. Fairly large capacity effect is produced by a cage aerial, and this is a distinct disadvantage in the case of aperiodic aerial coupling, as used in the Browning-Drake and other recent circuits. Volume may often be increased by careful adjustment of fixed condenser and grid condenser values, a more suitable detector valve, placing a condenser across 'phones or output. Sometimes the loudspeaker is not delivering the volume it should, owing to distortion on a heavy load, so that the full output of the set cannot be utilised.

R.C.S. (Winton): Particulars you seek have now been published.

Study the Advertisements for News.

Letters are received from readers asking for information that may often be obtained more easily. It pays constructors to look through the advertisements, for they are often much more than a mere exhortation to buy. Information is obtained from them as to where many components, and often out-of-the-way ones at that, may be obtained when required at a future date.

The Short-wave Adapter.

J.N. (Frankton) states that he has constructed the short-wave adapter but substituted a .00037 variable condenser for the potentiometer. He gets amateurs on Morse, but complains that his set will not oscillate. The connections of tickler must be correct for the Morse to be received, and the set must oscillate in that position to receive C.W. Listen carefully for the point of oscillation, which is heard at a certain setting of the reaction condenser, when an unmistakable hiss starts, and if the condenser happens to be swung quickly by accident, a "plop" is heard. If reaction is not obtained, try reversing the tickler leads, increasing number of tickler turns, or increasing capacity of condenser, though this latter should not be necessary.

Various Questions.

R.D. (Marlborough): (1) There are several good home chargers on the market for both A and B batteries. Any reliable dealer will furnish particulars. (2) Sulphuric acid of good quality is diluted with distilled water for use in accumulators, the usual proportion being approximately one part of acid to four and half of water by volume. A hydrometer is used to test the strength. The acid must always be added to the water, and never water to the acid. (3) There are a number of reliable constructors available that would make up the Browning-Drake for you. (4) A speaker should be personally selected and tried out if possible. Some of the new cone types are very fine, but they do not all give the maximum volume possible with a horn type. The cones excel on low notes that are suppressed and distorted in horn types.

Charging the Accumulator.

A number of correspondents have sent in queries as to whether the 112-volt accumulator can be charged with an existing charger. Several have been given particulars, but others give no details of their charger, so that it is difficult to give advice. As a rule an A battery charger is unsuitable, but there are cases where it might be adapted. The main point is to provide a small charging current of about one-tenth ampere and not more than one quarter ampere at not less than say 150 volts. The charging current is regulated by introducing resistance into the circuit until a reasonable rate of charging is arrived at, neither too quick nor too slow. The plain plates should charge up in from an hour to an hour and a half when formed. Pasted plates would take several hours, according to their capacity. When introducing resistance into a charging circuit care must be taken that the voltage is not cut down so much as to be nearly equal to that of the battery, when charging would become very slow or nil. When charging off 230 volts there is plenty of margin to work on.

SHORT-WAVE ITEMS

When a short wave set is constructed a good deal of careful experiment is necessary before full efficiency is secured. There is considerable variation in the number of turns required on tuning coils, and each experimenter must find out by actual trial those best suited to reach the wave-length required.

A coupling of about 1½in. between secondary and aerial coils will, as a rule, give best results.

The small capacity variable condenser, which may be used to replace the resistance control of reaction in the short-wave adapter, should be .00025 mfd., but if there is a .00035 on hand, it can be used. The smaller condenser spreads the tuning over a large number of degrees on the dial. A vernier dial is necessary, preferably friction drive.

In order to reduce hand capacity when tuning a short-wave set, a metal panel may be employed. The grid lead between detector, leak, and coil should be kept as short as possible, and away from the panel.

Ebonite is not recommended as an insulator for the high frequencies of short-wave, owing to its tendency to decompose. Mr. Marcuse recommends in preference well-dried American white wood. Celluloid is also convenient to work, easily obtained, and highly efficient.

As a short-wave detector valve the P.M.3 has been found very efficient, its maximum filament voltage of 3.7, however, should not be reached if best results are required. H.T. voltage may be from 20 to 28.

Mr. Marcuse, in directions as to how to operate a short-wave set, says: "Do not oscillate violently. If you oscillate violently you only pass over weak signals. Above all, do not swish your condensers while you are oscillating; think of the other fellow. Nothing is more annoying when listening to weak signals than to have someone continually swishing over your carrier."

A one-microfarad condenser across the H.T. battery is practically a necessity, and a great help in obtaining smooth and silent movement from non-oscillation to oscillation. Any tendency for the circuit to go into oscillation with a