A Simple Short-Wave Superhet.

Constructional Details and Operating Notes

By "Cathode."

THE final circuit of the short-wave super complete, with such frills as are considered necessary, is given in Fig. 1. It will be seen that the design follows very closely that developed in the explanatory discussion given last week, the principal changes being the replacement of two of the tuned plate intermediates by a transformer coupling for the input and a tuned grid coupling next following.

A very crude volume control in the form of a variable resistance across the phones is also shown. This may be replaced by some less primitive control (e.g., a potentiometer across the audio transformer secondary) if desired. The arrangement shown was chosen by the writer because of its simplicity.

The receiver was intended for use in an amateur transmitting station, and the small output valve employed overloaded on any signal above a certain strength. The resulting distortion on broadcast reception was anything but pleasant, but the rig had the considerable advantage (for reception of Morse) of reducing even a bad burst of static to something the same level as the signal being received.

Using an Ordinary Set.

THE oscillator-detector part of the circuit is so arranged as to enable anyone possessing a short-wave receiver of normal type to use it for this part of the super. The short-wave set is, of course, set to oscillate steadily all the time.

The autodyne first detector shown is tuned by a .0001 mfd. variable condenser used in conjunction with valve-base coils. For the 80-metre coil it will be necessary to fit a celluloid or thin bakelite extension over the valve base.

The tickler coils are wound between the last two turns at the filament end of the secondary coil. Such close coupling is normally to be avoided, owing to the tuning effect of the reaction control. Here, however, where the adjustment for oscillation is set once and then left alone, the tuning effect of the oscillation control is immaterial, while a more compact coil is achieved.

Oscillation of the first detector is controlled by a 100,000-ohm variable resistance. This is shunted by a 1 microfarad condenser to absorb the clicks and noises which would otherwise result from its adjustment.

The Intermediate Stage.

FOR the input transformer to the intermediate amplifier any commercial 30 k.c. transformer (e.g., the R.C.A. UV 1716) may be used, the secondary being tuned by a semi-variable condenser of .0003 mfd. maximum capacity. If the transformer has a small laminated iron core this should be removed. A suitable transformer may also be constructed in the following manner: A turned former of bakelite, ebonite, or thoroughly paraffined wood, should be finished to a diameter of about 2¼ inches. A winding groove should then be turned to a depth of ⅛-inch, its width being ¾-inch. Alternatively, a former of the same dimensions may be built up of discs of ebonite or bakelite bolted together with a thin brass screw. The secondary is wound on first, and consists of 1000 turns of No. 30 d.c.c. Two or three layers of Empire cloth, silk, or paper, are then wound on, followed by a primary comprising 250 turns of the same wire.

	SECONDARY COIL.			TICKLER.	
Band.	Turns	Spacing.	Size.	Turns.	Size.
10 metre	2	One diameter	20 d.c.c.	2	34 d.s.c.
20 metre	5	One diameter	20 d.c.c.	4	34 d.s.c.
40 metre	15	Close wound	26 d.c.c.	9	34 d.s.c.
80 metre	32	Close wound	26 d.c.c.	15	34 d.s.c.

This transformer will tune to about 30 kilocycles, this frequency having been chosen as about the lowest which can be used without introducing noise and difficulty in keeping i.f. out of the audio amplifier. If a higher intermediate frequency is used, signal strength is reduced as a result of the greater detuning of the oscillating detector necessary in order that the oscillation frequency and the signal frequency have the requisite greater frequency difference.

The .01 mfd. mica condenser connected between the condenser tuning the input i.f. transformer and the low potential end of the secondary is to allow one side of the condenser to be grounded and the low side of the secondary to be brought to the battery side of the fixed filament resistance, thus securing the necessary grid bias for the first screen-grid valve. A somewhat similar expedient is adopted in the tuned circuit following this valve in order to ground one side of the semi-variable tuning condenser; the grid bias in this case is applied through a grid leak.

The coils for the second and third intermediate couplings are ordinary 1000-turn honeycomb coils obtainable at very low prices from firms specialising in clearance stock. A 250-turn honeycomb coil is employed as a tickler for the last intermediate, the control being by the old-fashioned swinging-coil method; a two-coil holder is very handy here. It is not a bad idea to replace the semi-variable tuning condenser in this stage by a fully-variable type; by this means the beat-note heard in Morse reception may be adjusted to any desired pitch; moreover, the tuning effect of the swinging coil when putting the second detector in and out of oscillation may be compensated for by this control.

The Intermediate Amplifier.

THE most important part of the super—the intermediate amplifier—is assembled inside a three-compartment metal screening box, to which the A+ and B— connections, as well as a large number of internal connections, are also made. In the experimental model a box was roughly assembled out of thin sheet copper, the joints being soldered. A much better-looking job could be made with aluminium sections bent and bolted together. If a copper job is decided upon, it will be found that a fairly heavy soldering bit is necessary, a small bit being too readily cooled.

The dimensions of the box are: Length 16 inches, width 8 inches, and depth 7 inches. It is divided lengthwise into three compartments, the first two taking up a space of four inches each, and the third eight inches. The lid may be either hinged or removable. This box is mounted at the rear of a baseboard 12 inches in width, thus leaving a space four inches wide at the back of the front panel. This space is occupied by the main tuning condenser, the reaction and volume controls, the plug-in coil unit, the first detector valve, and such condensers, terminals, etc, as seem best disposed of here. A rough idea of the layout of the original model is given by fig. 2, and while it is quite unnecessary for the constructor to adhere rigidly to the layout suggested, the diagram may be found helpful in rapidly finding a suitable location for the various pieces of apparatus.

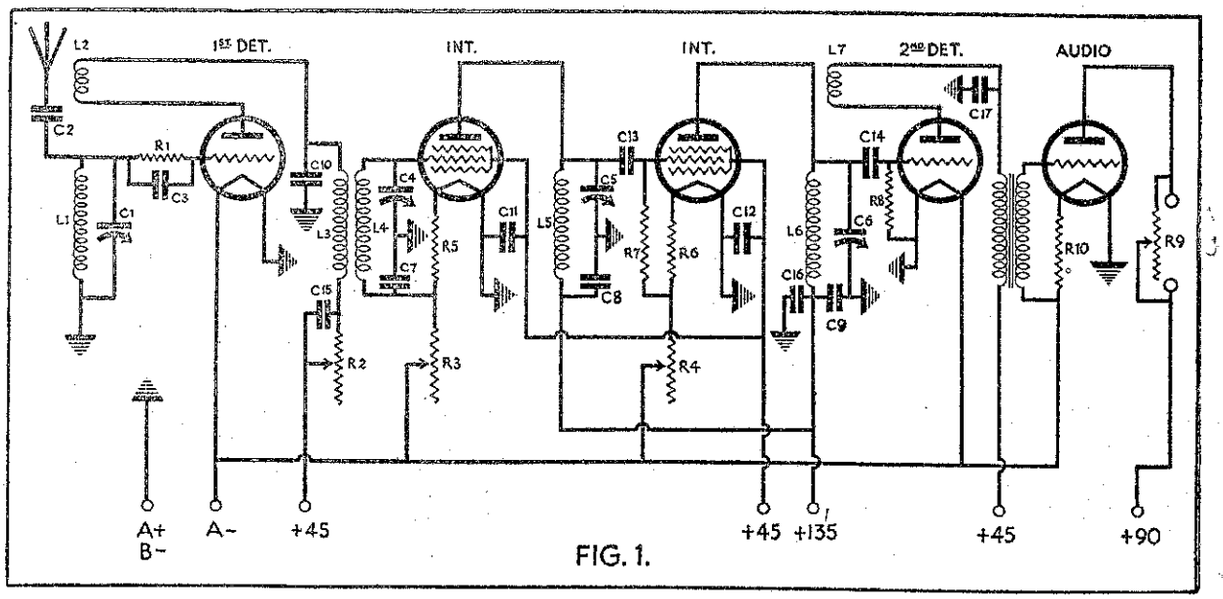

FIG. 1.

Figure I.

C1—.0001 tuning condensers. C2—midget variable condenser or two small brass plates with variable spacing. C3—.00025 mfd. C4, C5, C6—.0003 mfd. semi-variable. C7, C8, C9—.01 mfd. mica condensers. C10, C11, C12—.5 mfd. C13, C14—.002 mfd. C15, C16—1 mfd. C17—.001 mfd. R1—5 megohms. R2—500,000 ohm variable. R3, R4—30 ohm rheostats. R5, R6—10 ohms. R7—1 megohm. R8—2 megohms. R9—50,000 ohm variable. R10—4 ohms.