

# A Superheterodyne Short-Wave Adapter

## A Set for the "Advanced" Constructor

By "CATHODE"

THERE should be no need to enumerate the failings of the usual type of short-wave adapter by way of justification for the piece of apparatus about to be described. The inconvenience of continually plugging it into the detector socket and subsequently disconnecting it, and its failure to make proper use of the broadcast receiver to which it is attached, are in themselves sufficient to render almost certain its eventual discontinuance.

The adapter now described may, by the inclusion of a switch on its panel, be connected permanently to the aerial terminal of the receiver; the receiver requires no alteration whatever, functioning as the intermediate and audio amplifiers of a superheterodyne, of which the first detector and oscillator is provided by the adapter. The intermediate frequency is the minimum frequency to which the broadcast set will tune—usually between 550 and 500 kilocycles.

It is not intended to enter into any discussion of the theory of reception on the superheterodyne principle. The mode of operation of the adapter, however, is as follows:—First, the receiving set is turned on and the dial (if single-control) is set at the minimum frequency, which we will assume is in this instance 500 kilocycles; if the receiver has two or more tuning controls, these must be brought into resonance so that all the tuned circuits are adjusted to the same frequency. Then the first detector in the adapter is tuned to the desired frequency in the short-wave

band (somewhere between 1500 kilocycles and 20,000 kilocycles), and the oscillator is tuned to a frequency 500 kilocycles above or below the detector.

A "beat-note" of 500 kilocycles is generated between these two circuits and carries the original modulation; this new frequency is then applied to the aerial terminal of the receiver end, since it corresponds to the frequency to which the receiver's radio-frequency amplifier and detector circuits have previously been tuned, it is amplified and then rectified by the detector (now the "second detector" of the super).

Finally, signals are stepped up still more by the audio amplifier of the receiver. If the usual type of seven or eight valve a.c. receiver is used, and the apparatus correctly adjusted, it will be possible for the constructor to put his highly developed imagination away on the shelf along with his old-type adapter. Neither will be further required.

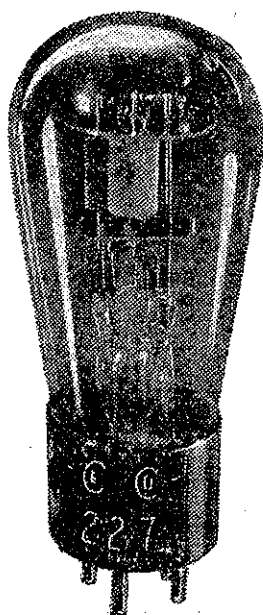
though, the number specified will be about right.

As will be seen from the circuit diagram given in Fig. 2, the adapter is arranged more particularly for broadcast receivers of the all-electric type, certain modifications being necessary if it is desired to use battery-type valves in the adapter itself. It should be made clear, though, that it is quite permissible to employ the adapter as it stands with a battery-operated receiver, so long as lighting mains are available for heating the heater elements of the 227 type valves employed. A separate transformer giving 2.5 volts is used for this purpose in any case; a 60 ohm resistor is connected across the heater terminals and the center tap grounded as a precaution against hum. The plate voltage is secured from the power supply unit or the batteries of the main receiver, and although 45 volts is specified, this may be increased if so low a voltage is not available. Grid bias is provided by resistors in the cathode leads, by-pass condensers of 0.1 mfd. shunting these.

The radio frequency choke in the plate circuit of the oscillator is a critical component, and the constructor should be at some pains to obtain a good one. The effect of a poor choke

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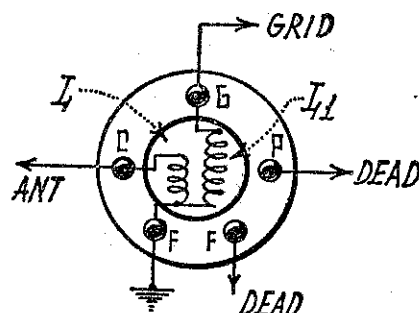


Fig. 1.

The antennae coils L should be separated from the winding L1 only by a sixteenth of an inch or so. The plate coils L4 are wound close to the filament end of L3, and the oscillator coupling coils L2 at the grip end of L3 for 7500 and 15,000 kilocycles; for the 1800 and 3750 kilocycles bands, coils L2 should be wound over the grid end of L3. Details of the connections are given in Fig. 1, while the numbers of turns for the four pairs of plug-in coils are as follow:—

| Frequency band (kilocycles). | L  | L1     | L2        | L3        | L4        |
|------------------------------|----|--------|-----------|-----------|-----------|
| 15,000 ....                  | 2  | No. 22 | 6 No. 22  | 3 No. 28  | 7 No. 22  |
| 7,500 ....                   | 4  | No. 22 | 13 No. 22 | 5 No. 28  | 15 No. 22 |
| 3,750 ....                   | 7  | No. 22 | 25 No. 28 | 10 No. 28 | 31 No. 28 |
| 1875 ...                     | 12 | No. 22 | 45 No. 28 | 18 No. 28 | 60 No. 30 |

All windings may be made with either silk-covered or enamelled wire. It is sometimes necessary to increase the number of turns in L2 slightly to obtain optimum results, as some valves do not give the same output as oscillators as others. Generally speaking,

here will be a cessation of oscillations from the oscillator valve at certain points in the tuning range, and consequent "dead spots" at these points.

THE purpose of the tuned circuit C4 L5 in the plate circuit of the detector is to render the adapter suitable for receivers in which the input stage is untuned. This circuit is peaked at the same frequency as that to which the broadcast receiver is tuned, and, once adjusted, does not have to

be touched again. For this reason a condenser of the semi-variable compression type is used for C4, while the coil L5 may consist of a straightforward single layer winding of 85 turns of No. 30 wire on a 1½ or 1¼-inch former. C4 is also necessary to the proper operation of the oscillator, so do not