diode detector, and its amplitude is restricted to the lowest level at which an acceptable beat note is obtained for the reception of c.w. telegraphy When an attempt is made to mix a sideband signal with that from the b.f.o., considerable distortion will occur if the amplitude of the simulated carrier is exceeded by that of the sideband. To reduce distortion to negligible proportions, the maximum amplitude of the s.s.b. signal must be held well below that of the b.f.o. signal. This can be done by reducing the r.f. and i.f. gain but this solution can never be more than a compromise. When the gain is advanced to read a weak signal, splatter becomes unavoidable from any stronger signal which may happen to be adjacent. Increasing the output of the b.f.o. is rarely profitable, because stability is likely to suffer. In some receivers a considerable improvement may be effected by disconnecting the lead from the b.f.o. to the diode detector and connecting it to the grid of the first or second i.f. amplifier valves via a capacitor of 1 or 2 pF. This modification will not, however, work well if the i.f. stage is followed by a highly selective device such as a crystal or mechanical filter.

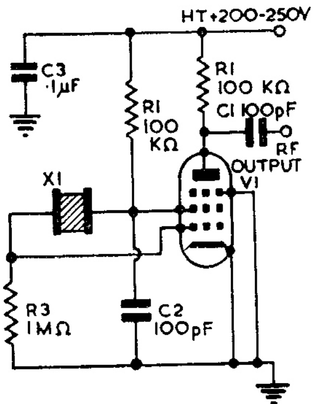

Fig. 64. Crystal-controlled carrier insertion oscillator.

One answer to the problem is to replace the diode detector by a mixer-type demodulator. A representative circuit of this type is shown in **Fig. 63.** With this circuit, which is commonly called the *product detector*, the applied b.f.o. voltage is less critical than with a diode detector, yet the audio output is much cleaner. It is possible to add the double triode and the few associated components into most receivers, but the detector will work equally well if constructed as an outboard accessory. The product detector is also useful for c.w. reception but it will not demodulate conventional a.m. or n.b.f.m. telephony. A switching arrangement such as that indicated on the diagram must therefore be included to enable the receiver to handle all forms of signal.

For successful i.f. carrier reinsertion, it is essential that both the local oscillator and the b.f.o. must be as free from drift as it is possible to make them. A consistent slow drift is not much of a handicap but erratic, short-term frequency jumps are particularly disconcerting. In receivers which are prone to this fault, it is usually more satisfactory to install a crystal oscillator at an appropriate frequency within the i.f. passband than to attempt to cure the offending b.f.o. A typical circuit is given in **Fig. 64.** Suitable crystals are available at low prices from Government surplus sources, and instructions for altering their frequencies will be found earlier in this chapter. If the i.f. passband is wide enough to accept two sidebands, it will suffice to obtain one crystal of which the frequency should be centred in the middle of the passband. If, however, the passband approaches the more desirable selectivity characteristic of 3 kc/s, two crystals will have to be installed in a switchable circuit so that the carrier may be inserted to one side or the other of the passband, thereby permitting either upper or lower sideband reception at will. **Fig. 65** will give the idea much more quickly than a large number of words.

There are a few possible modifications which despite their simplicity may make a considerable improvement to many local oscillators. As drift is primarily caused by changes in the potentials applied to the various electrodes of the oscillator and mixer valves, stabilization of the h.t. supply by a gas regulator such as the VR105 is invariably beneficial. If the mixer valve is included in either the manual or the automatic gain control loops, it should be disconnected therefrom and the cathode and grid returns solidly earthed. An alteration to the send/receive switching is highly recommended in most receivers. The usual function of this switch is to disconnect the h.t. from all valves completely when it is

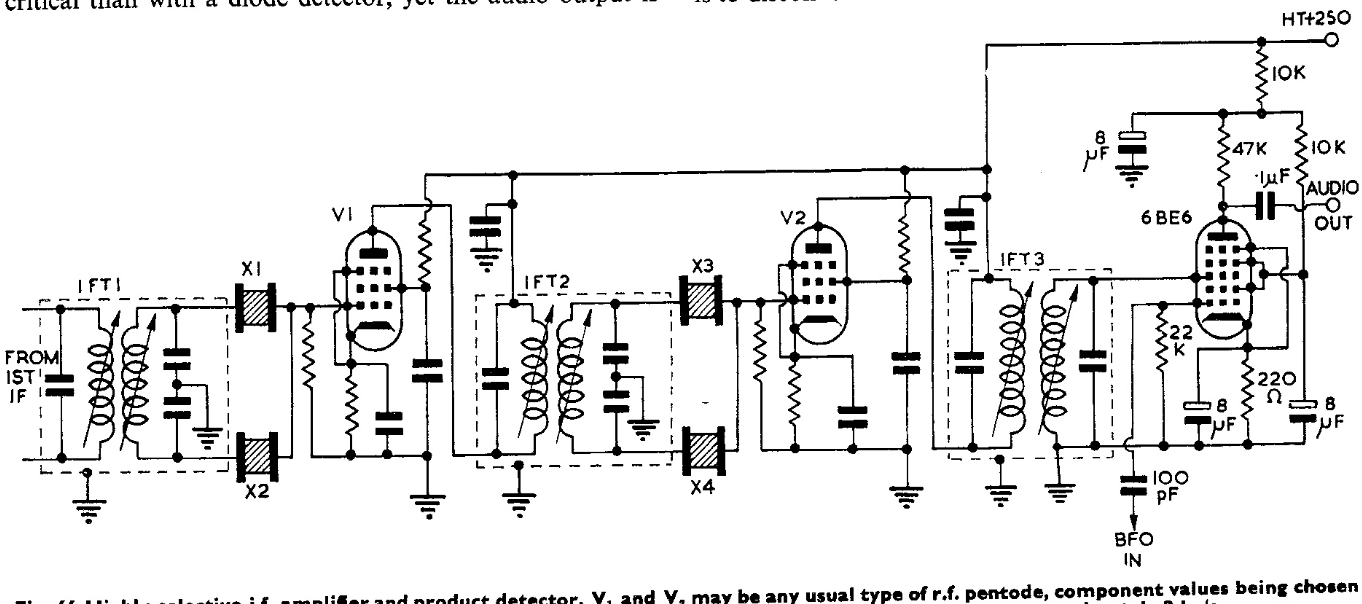

Fig. 66 Highly selective i.f. amplifier and product detector. V_1 and V_2 may be any usual type of r.f. pentode, component values being chosen to suit. X_1 and X_3 should be identical in frequency, and should differ from X_2 and X_4 by approximately 2 kc/s.