

4.2.5. VARIABLE INTERMEDIATE FREQUENCY. -

The variable intermediate frequency section consists of two channels, one for a frequency 2.5 to 1.5 mc and the other for 3.5 to 2.5 mc. The 2.5 to 1.5 mc i-f is used on the even numbered bands which employ double conversion, and the 3.5 to 2.5 mc i-f is used on the odd numbered bands which employ double conversion. The 2.5 to 1.5 mc i-f is also used on band 2 as an additional tuned r-f circuit. The 3.5 to 2.5 variable i-f is used on band 3 as an additional tuned r-f circuit and on band 1, in the usual application, as a variable i-f for the odd numbered bands. Using two variable i-f channels in this manner cuts in half the number of crystals needed by the high frequency oscillator, since each crystal's fundamental frequency or useful harmonic is used for two bands. Inductors L116 and L118 form the lower frequency i-f coils (2.5 to 1.5) and are the coils in which the tuning slug travels. The 3.5 to 2.5 mc i-f is obtained by shunting L117 across L116, and L119 across L118 to lower the inductances of L116 and L118. Switch sections S110 and S111 alternately switch the shunting coils in and out as the BAND CHANGE knob is rotated. The variable i-f coils are in the grid of the second mixer stage.

4.2.6. VARIABLE FREQUENCY OSCILLATOR. -

The receiver circuits described so far have the function of receiving the spectrum in 1 megacycle bands that are presented to the grid of the second mixer. The scheme for obtaining high stability is completed by a method of heterodyning the signals to a lower, fixed intermediate frequency. In this application, a highly stabilized 3 to 2 mc permeability tuned oscillator, Model 70E-15, is employed to heterodyne against the 2.5 to 1.5 and the 3.5 to 2.5 mc output of the variable frequency i-f. The resulting 500 kc signal is amplified by the 500 kc i-f amplifier.

The coil in the oscillator is cam wound to produce extremely linear frequency change with linear movement of the tuning slug. The circuit is temperature-compensated and the components are sealed against changes in humidity. Ten turns of the oscillator lead screw produce a linear frequency change of one megacycle. The inductance of the oscillator coil is trimmed by an iron core series inductor, the value of which is adjusted at the factory and sealed. A type 6BA6 tube, V002, is used for isolation purposes following the oscillator tube and is an integral part of the oscillator. For stabilization purposes, the supply voltages for the oscillator unit are regulated by V116, a type OA2 tube.

NOTE

A MECHANICAL SQUEAK MAY DEVELOP BETWEEN THE LEADSCREW AND CORE IN THE PERMEABILITY TUNED VFO. MATERIAL SELECTION AND THE LOADING NECESSARY TO INSURE UTMOST STABILITY TEND TO CAUSE THIS SQUEAK. HOWEVER, MATERIALS ARE SELECTED FOR THEIR ABILITY TO WORK WELL TOGETHER WITH SMALL WEAR AND THE SQUEAK IS HARMLESS.

4.2.7. CRYSTAL FILTER. - Selectivity of the 51J-4 Receiver is improved greatly by use of a crystal filter in the 500-kc i-f channel. The crystal filter circuit consists primarily of 500-kc i-f input transformer T101, a 500-kc crystal, and a high impedance tuned circuit T102, connected as shown in figure 4-4. When SELECTIVITY switch S114 is in position 0 the crystal is shorted and T101 is connected directly to T102. Thus there is no crystal filter action when S114 is in position 0; selectivity is determined by the receiver's tuned circuits alone. When S114 is in any other position, crystal filter action takes place--position 4 giving the greatest selectivity.

To analyze the operation of this circuit consider only the loop containing T101 secondary, crystal Y112, and tuned circuits T102. Assume that S114 is in position 1. See figure 4-5. The secondary of T101 is a low impedance coil with a grounded center tap. The primary of T101 is tuned to 500 kc. Consider crystal Y112 in series with T102 as a voltage divider, grid voltage to V301 being taken from the point between Y112 and T102. For an i-f of exactly 500 kc, impedance of the crystal is very low--of the order of 2000 to 4000 ohms, and the impedance of T102 is of the order of 100,000 ohms. Thus, at 500 kc practically all the voltage appearing across T101 secondary is fed to the grid of V301.

For frequencies a few kilocycles further away from 500 the impedance of the crystal increases greatly. When the crystal impedance equals that of T102, only one-half the voltage on T101 secondary appears on the grid of V301. As the crystal impedance becomes still greater, the voltage appearing on V301 grid decreases. This results in a narrower i-f response curve, or in greater selectivity, than that obtained without crystal filtering. Switching S114 to positions 2, 3, or 4 merely shunts T102 with resistance, which effectively lowers the impedance