13. RECEIVER TUNING.

In order to prepare the receiver for tuning, place the RADIO-INTERPHONE switch in the RADIO position. Place the P-G BOTH P-P switch in the BOTH position. Plug a power output meter in one TEL jack and a set of headphones in the other TEL jack. Temporarily disable the squelch circuit by connecting a short-circuiting strap across capacitor C30R (mounted on socket VS7R). Connect the signal generator to the 50-ohm artificial antenna by a properly terminated coaxial line. Plug the TS-79/ARC-4 phantom receiver antenna into the ANT jack.

Variable air capacitors which can be rotated continuously in either direction are used to tune the ANT, INT COUP and GRID circuits of both the plane-to-ground and plane-to-plane input filters. There are, therefore, two settings for each capacitor for which the same capacity is obtained and, hence, for which the circuit is tuned to the same frequency.

The setting for maximum and minimum capacity can be determined from the position of an index on the rim of each adjustment nut. This index is a file notch in line with the screwdriver slot. For the plane-to-ground adjustments, maximum capacity is obtained with the screwdriver slot horizontal and with the index on the left. For the plane-to-plane adjustments, maximum capacity is obtained with the screwdriver slot vertical and with the index on top. In order to make the direction of capacity variation with rotation the same for each capacitor, the same 180 degrees of rotation must be used. On the plane-to-ground adjustment, the 180-degree arc above the horizontal should be used. On the plane-to-plane adjustment, the 180-degree arc to the right of the vertical should be used. Clockwise rotation within these arcs in both cases decreases capacity or, in other words, increases frequency.

The two receiver input circuits may now be tuned independently by the procedure outlined below in Par. 14.

14. PLANE-TO-PLANE UNIT TUNING.

The tuning procedure for the plane-to-plane unit is straightforward, since there is only one crystal associated with this unit. Provisions are made for grid current measurements, but in this case the circuits are not permanently connected to the test meter. Instead, a pin jack, designated P TO P H-G IG TEST, mounted on the left hand side of the chassis near the front, is permanently connected to the test meter position marked RF AMP IG OR P TO P H-G IG. The other terminals for the grid current measurements are located on top of the plane-to-plane unit chassis. The P-P CH G-G Test Terminals shown on Fig. 14 and Fig. 6 as OSC IG, 2ND H-G IG and 3RD H-G IG are identified on the apparatus as X, 4 and 8, respectively.

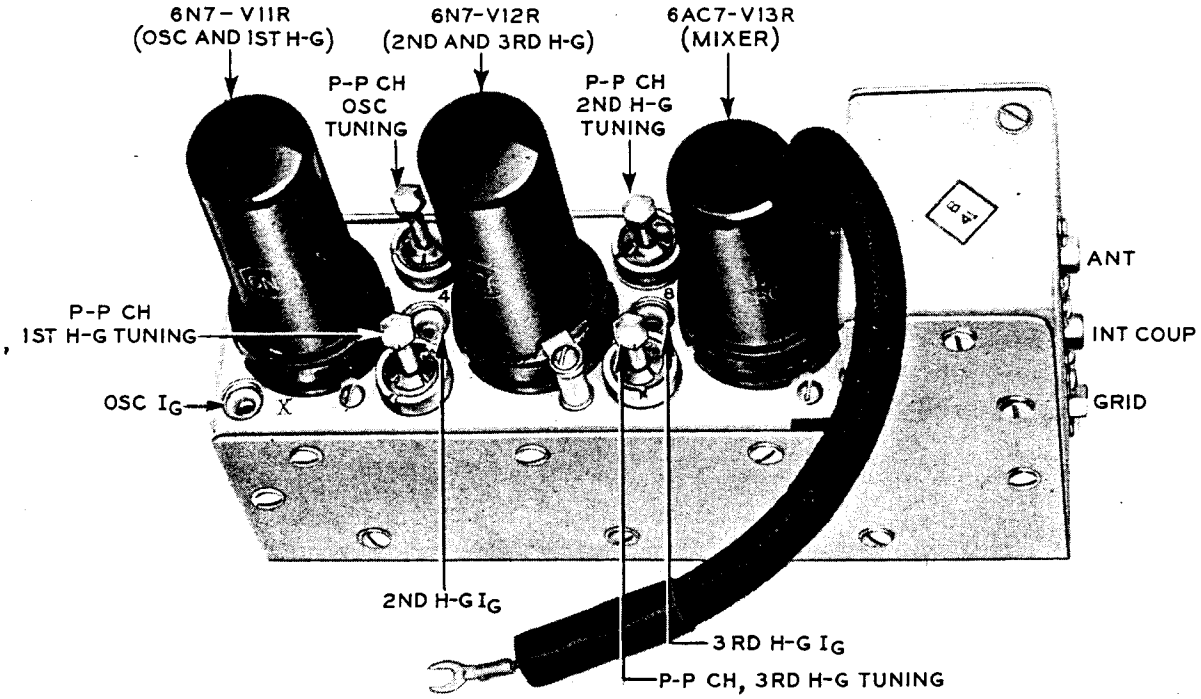

Figure 6—Receiver Plane-to-Plane Unit: External View

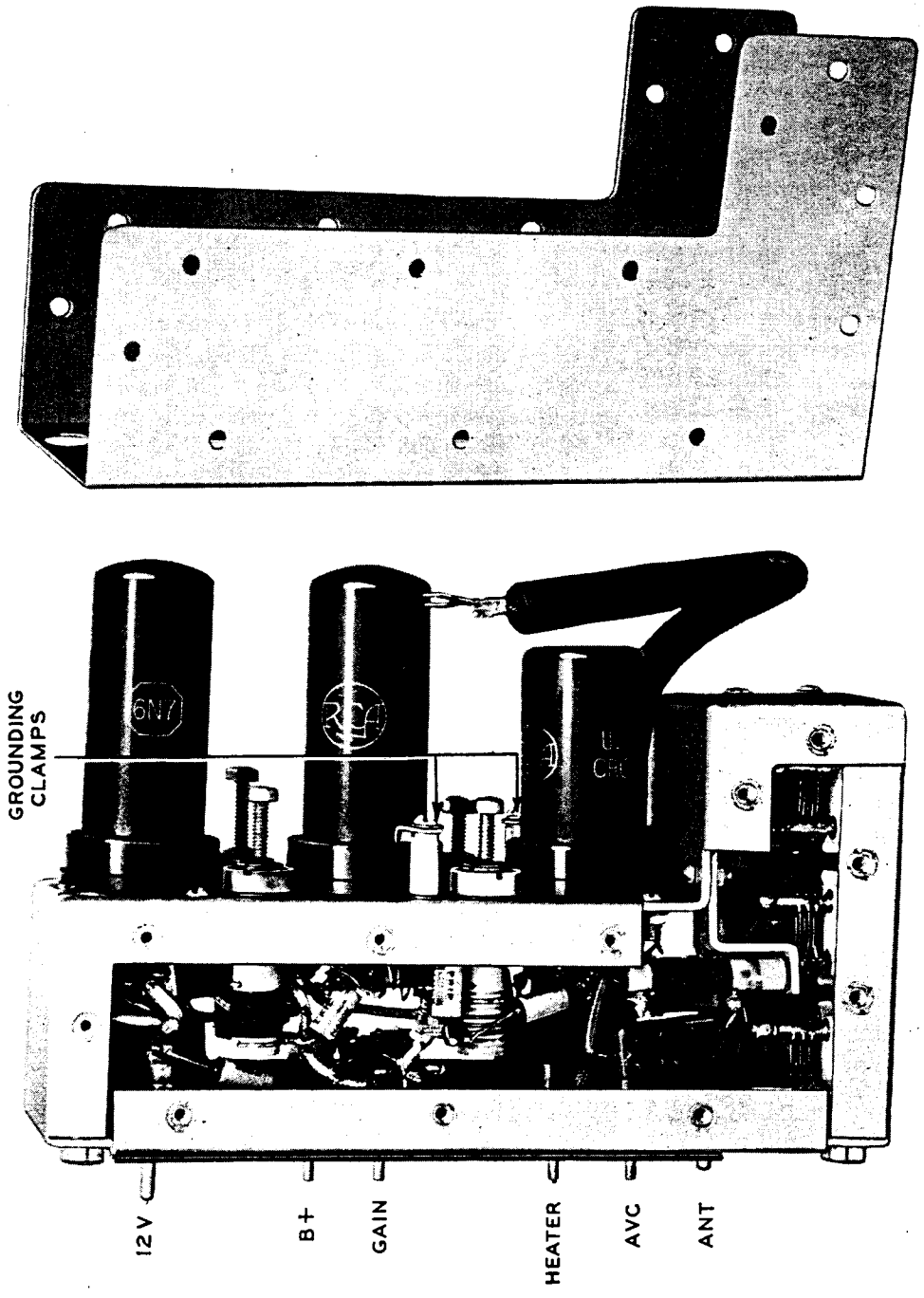

Figure 7—Receiver Plane-to-Plane Unit: Internal View

(1) Place the meter switch in the RF AMP IG OR P TO P H-G IG position.

(2) Place the plug end of a test meter lead in the pin jack marked P TO P H-G IG TEST. Hold the test prod end of the test meter lead on the recessed test terminal "X" (designated OSC IG) on top of the plane-to-plane chassis. Adjust the control designated P-P CH OSC TUNING for maximum meter reading, and then adjust it for 0.8 of the maximum value on the inductive or high-frequency side of resonance by turning the control clockwise (Equipment Serial Nos. 101 to 400) or counterclockwise (Equipment Serial Nos. above 400). See the note in Par. 15 below.

(3) Shift the test prod to the recessed test terminal "4" (designated 2ND H-G IG). Adjust the control designated P-P CH 1ST H-G TUNING for maximum meter reading.

(4) Shift the test prod to test terminal "8" (designated 3RD H-G IG). Adjust the control designated P-P CH 2ND H-G TUNING for maximum meter reading.

(5) Operate the P-P BOTH P-G switch to P-P. Before the input filter circuits are aligned, the harmonic generator control designated P-P CH 3RD H-G TUNING should be turned in a counterclockwise direction until the slug is at the bottom of the coil form. Then introduce a strong modulated carrier (30 per cent modulation) from the signal generator, adjusted to the frequency associated with position 1 on the channel selection switch. Adjust the Input Filter Tuning Controls designated ANT, INT COUP, and GRID, for maximum audio output. Keep the audio output level at a value less than 50 milliwatts as the tuning progresses, by reducing the input signal level. After the input filter is aligned, turn the harmonic generator control designated P-P CH 3RD H-G TUNING in a clockwise direction, until the 400-cycle tone heard in the headphone is at maximum level. Check the adjustment of the grid filter control for maximum audio output on the output meter, after returning the signal generator.

15. PLANE-TO-GROUND UNIT TUNING.

The tuning procedure for the plane-to-ground unit is as follows:

(1) Operate the P-G BOTH P-P switch to P-G. Operate the 4-position CHANNEL SELECTION switch to the channel position of the highest frequency, normally position 4. Place the ON-OFF switches in the ON position. Operate the test meter switch to the OSC IG position. Adjust the control designated on Fig. 15 as P-G CH OSC TUNING for maximum deflection on the test meter. Note this value and then readjust by turning the control clockwise (Serial Nos. 101 to 400) or counterclockwise (Serial Nos. above 400), until a meter reading of 0.8 of the maximum value is obtained. Operate the 4-position CHANNEL SELECTION switch to the other three positions, noting that the test meter readings are slightly less than that obtained at the highest frequency. This checks for the proper operation of the crystal on each channel.

NOTE

In the original manufactured lot, Serial Numbers 101 to 400, a copper tuning core was used and must be rotated clockwise in tuning, in order to approach resonant frequency of the coil. At the completion of this first lot, a modification in design of the receiver oscillator and harmonic generator coils was made; and in Serial Numbers above 400, smaller coil forms are used and tuned with iron dust cores, which must be rotated counterclockwise to approach resonant frequency. This information also applies to step (1) of "Plane-to-Plane Unit Tuning" and to the notes of steps (1) and (8) of "Supplementary Receiver Unit Tuning Instructions" on Fig. 14.

(2) Operate the 4-position CHANNEL SELECTION switch to the mid-band P-G frequency, normally position 3. Operate the test meter switch to the 2ND H-G IG position. Adjust the control designated P-G CH 1ST H-G TUNING for maximum test meter deflection. This reading should be approximately 0.1 milliampere.

(3) Operate the test meter switch to the 3RD H-G IG position. Adjust the control designated P-G CH 2ND H-G TUNING for maximum meter deflection. This reading should be approximately 0.08 milliampere.

(4) Before the input filter circuits are aligned, the harmonic generator control designated P-G CH 3RD H-G TUNING should be turned in a counterclockwise direction until the slug is at the bottom of the coil form. Then introduce a strong modulated carrier (30 per cent modulation) from the signal generator adjusted to the frequency associated with position 3 of the channel selection switch. Adjust the Input Filter Tuning Controls designated ANT, INT COUP, and GRID for maximum audio output. Keep reducing the input signal level as the tuning progresses, so that the audio output level is less than fifty milliwatts. After the input filter is aligned, turn the harmonic generator control designated P-G CH 3RD H-G TUNING in a clockwise direction, until the 400-cycle tone heard in the headphones is a maximum. Now adjust the potentiometer

P1C, so that a five-microvolt input produces 100 milliwatts of audio. Lock the potentiometer in this position.

(5) Operate the CHANNEL SELECTION switch to position 4, readjusting the frequency of the signal generator and noting the input required for 100 milliwatts output without changing any of the tuning adjustments. The input required for 100 milliwatts output should not exceed 10 microvolts.

(6) Operate the CHANNEL SELECTION switch to position 2, readjusting the frequency of the signal generator and noting the input required for 100 milliwatts output. The input required for 100 milliwatts output should not exceed 10 microvolts. Some difficulty might be experienced in getting the sensitivity of channel 2 within the limit of 10 microvolts. This is due to the coupling between the plane-to-ground antenna circuit and the plane-to-plane antenna circuit. This coupling can be reduced by detuning the plane-to-plane ANT tuning slightly. Just a slight turn of the capacitor is required. Next operate the channel selector switch to position 3 and retune the plane-to-ground ANT tuning. Operate the channel selector switch to channel 2, and measure the signal input required for 100 milliwatts output. Operate the P-G BOTH P-P switch to P-P. Measure the signal input required for 100 milliwatts output. If the sensitivity has been reduced to a value less than 10 microvolts, retune the plane-to-plane ANT tuning, bringing the sensitivity within the 10-microvolt requirement. Recheck plane-to-ground channel 2 sensitivity if the plane-to-plane ANT circuit had to be retuned.

16. STAGE-BY-STAGE I-F GAIN MEASUREMENTS.

Stage-by-stage gain measurements are helpful in isolating and locating trouble. The values given below are the average on several equipments, taken with a Ferris 16C Signal Generator modulated 30 per cent at a frequency of 400 cycles per second. A similar set of readings should be taken with the signal generator used for maintenance work to allow for differences in per cent modulation and in attenuators. The gain potentiometer P1R is set at maximum gain position for these values.

Input through 0.006 mf capacitor applied at junction of	*Microvolts for 50 Milliwatts 30 per cent modulation with 400 cps*	
	Ferris 16C	*Other Sig. Gen.*
C16R and L9.3R	125	
V4R Grid	200	
V5R Grid	2,600	
V6R Grid	76,000	

17. PLANE-TO-PLANE UNIT TESTING.

Simultaneous operation of two crystals in a confined space dictated that the plane-to-plane unit should be shielded completely from the rest of the equipment to prevent undesired beats between crystal harmonics. This arrangement makes servicing of this unit inconvenient, since the components cannot be inspected without removing the unit from the equipment. For this reason the unit is a plug-in type which may be quickly removed by loosening the four mounting screws on the bottom of the chassis and by disconnecting the shielded lead to FL1R by loosening the screw terminal through the hole on top of FL1R.

The voltages listed in the tabulated data for the tubes associated with this unit can be measured by partially removing the tubes from their sockets. The voltage measurements, the oscillator and harmonic generator grid current measurements mentioned under Receiving Tuning Instructions, Par. 15, and the following plug-in jack terminal measurements provide sufficient information to analyze any trouble that might develop. The unit then can be removed and the trouble rectified. The wiring diagram for this unit is shown on Fig. 12.

JACK TERMINAL VOLTAGE MEASUREMENTS

Plane-to-Plane Unit Jack Terminal (Numbers start at front end of equipment)	*DC Volts (1000 ohms per volt)*	*Connection (see Fig. 10)*
1	0	ANT
2	−2.8*	AVC
3	6.5	L13R (Heater)
4	100	R62R (Screen)
5	265	R61R (Plate)
6	13	L12R (Heater)

*This voltage is measured with an RCA Volt Ohmyst Junior (Navy Type 60044) because of the high impedance of the circuit.

18. SQUELCH OPERATION CHECK.

Introduce a 30 per cent modulated 10,000 ± 5 kc signal by connecting the signal generator to the grid of tube V4R. Remove any squelch-disabling jumper. Starting with a signal output of 100 microvolts, increase the output of the signal generator until the squelch circuit operates. This is the point at which a ten-microvolt change in signal increases the audio output at least six times. The signal input level at the squelch operating point should be approximately 80 per cent of the signal required to produce 50 milliwatts of audio with the squelch disabled.

19. INSTALLATION OF NEW TUBES.

If it becomes necessary to replace any tube in the transmitter or receiver, it is desirable to replace it with one of the same type as the defective tube. However, in some tube positions, glass replacements are permissible and this information will be found in the Table of Replaceable Parts, Section VII.

NOTE—TYPE 1614 IS A 6L6 TUBE WHICH HAS PASSED AN R-F TEST. NOT ALL 6L6 TUBES ARE TESTED FOR THIS CHARACTERISTIC, BUT ABOUT 95% OF THEM WILL PASS THE TEST. IN THE EVENT A 1614 TUBE IS NOT AVAILABLE, A 6L6 SHOULD BE TRIED IN THE SOCKET. IF IT OPERATES SATISFACTORILY, IT CAN BE CONSIDERED TO BE A 1614, SINCE IT HAS PASSED AN EQUIVALENT R-F TEST.