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HANDBOOK
OVERHAUL INSTRUCTIONS

**VARIABLE MASTER OSCILLATOR
TYPE 115 MODEL 1**

(NORTHERN RADIO CO., INC.)

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AND THE CHIEF OF THE BUREAU OF AERONAUTICS

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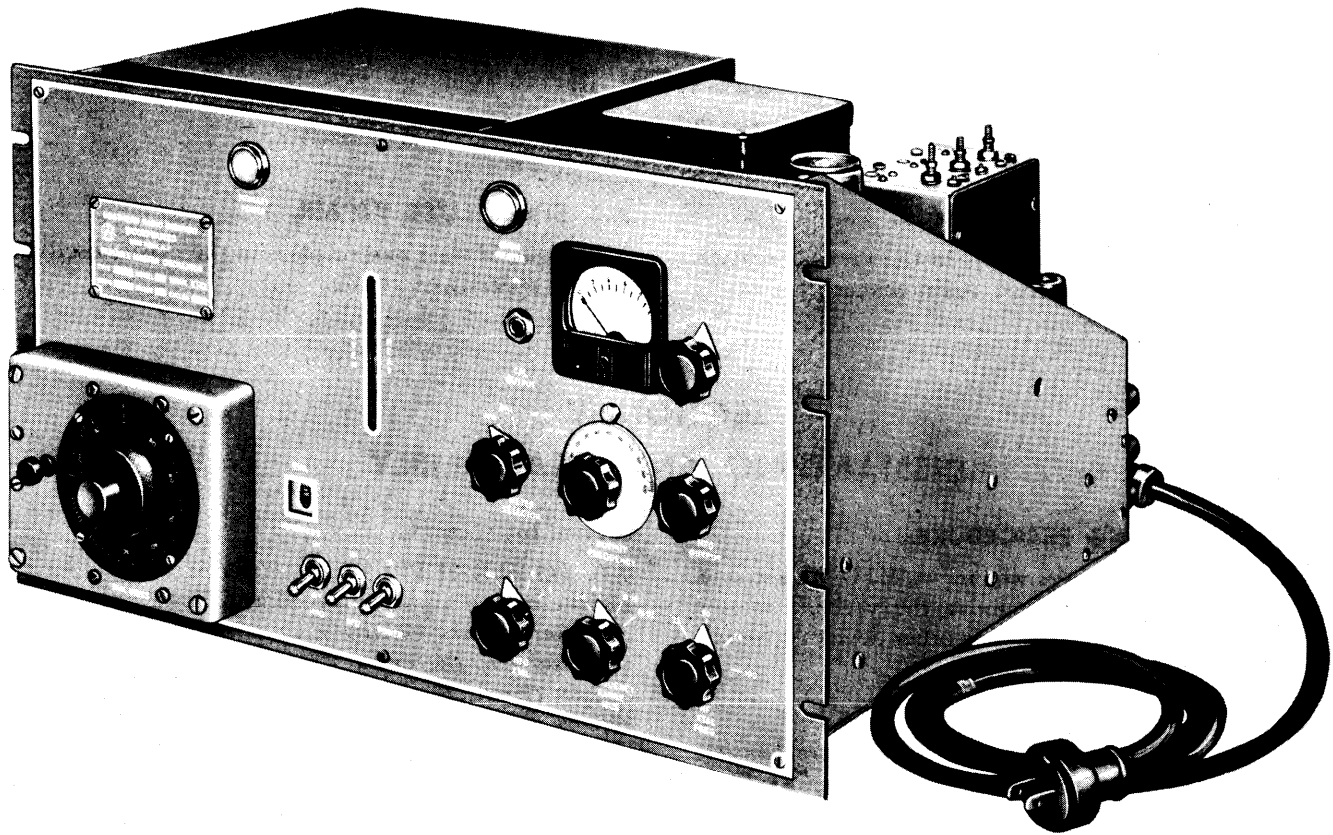


Figure 1-1. Variable Master Oscillator Type 115 Model 1

SECTION I DESCRIPTION AND LEADING PARTICULARS

1-1. SCOPE OF HANDBOOK.

1-2. This publication comprises overhaul instructions for Variable Master Oscillator Type 115 Model 1, shown in figure 1-1, manufactured by the Northern Radio Company, Incorporated, New York, N. Y. Complete information for the mechanical and electrical disassembly of the unit is given to enable the technician to perform his duties quickly and accurately.

1-3. The variable master oscillator can be operated as a fixed or variable frequency exciter for driving transmitters, for applying local oscillator injection voltages to receivers, or for other applications where stable radio-frequency (r-f) signals are required. Refer to the Handbook of Service Instructions for technical information and other data pertaining to the unit.

SECTION II SPECIAL OVERHAUL TOOLS AND TEST EQUIPMENT

2-1. SPECIAL TOOLS.

2-2. A long-handled Allen wrench, part number NRC257 (see figure 2-1), is supplied for overhaul purposes.

2-3. SPECIAL TEST EQUIPMENT.

2-4. No special test equipment has been procured by the Government specifically for use with the variable master oscillator.

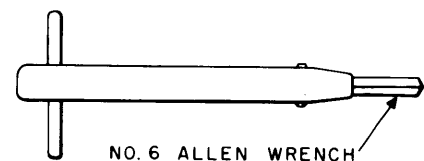


Figure 2-1. Special Allen Wrench,
Part Number NRC 257

SECTION III SPECIALIZED MAINTENANCE AND REPAIR

3-1. SPECIALIZED MAINTENANCE.

3-2. None of the items or parts in the variable master oscillator require specialized maintenance.

3-3. SPECIALIZED REPAIR.

3-4. None of the items or parts in the master oscillator require specialized repair.

SECTION IV DISMANTLING AND DISASSEMBLY

4-1. DISMANTLING PROCEDURE.

4-2. Disconnect all the power input, HFO output, and BFO output lines. Then remove the variable master oscillator from the relay rack or other device on which it is mounted.

4-3. DISASSEMBLY PROCEDURE.

4-4. GENERAL. The disassembly procedure consists of removing those assemblies which are separable from the variable master oscillator framework and chassis. The individual disassembly procedures are described in the paragraphs that follow.

4-5. OVEN DISASSEMBLY. To disassemble the oven, follow the procedures contained in the Handbook of

Service Instructions.

4-6. POWER SUPPLY DISASSEMBLY. To disassemble the power supply, proceed as follows:

a. Remove the electronic chassis bottom cover plate.
b. Remove the eight screws that secure the power supply chassis to the electronic chassis. Four of these screws are located under the wiring bundle running across the rear of the electronic chassis. The other four screws are opposite the first four.

c. Lift up the power supply chassis, taking care not to damage the connecting jack and plug (J12 and P12).

d. Replace individual part in the power supply (see figure 4-1), as required.

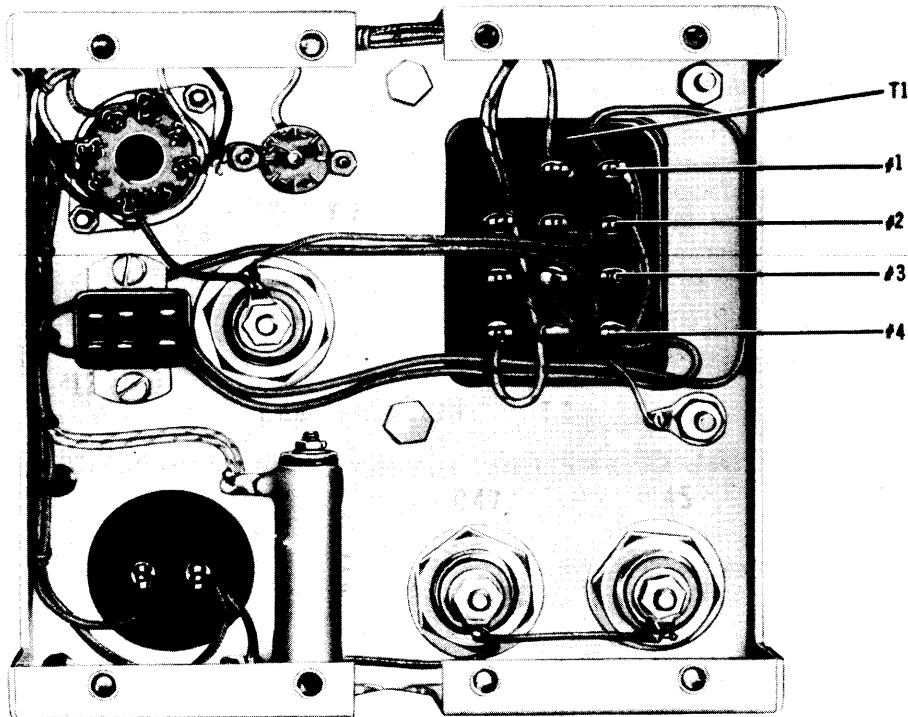


Figure 4-1. Power Supply Chassis, Bottom View

4-7. OUTPUT FREQUENCY TUNING CAPACITOR C24 DISASSEMBLY. For this disassembly, proceed as follows:

- a. Remove the electronic chassis bottom cover plate.
- b. Remove the four screws that secure the tuning capacitor assembly to the electronic chassis.
- c. Unsolder and tag the six leads (see figure 4-2) coming from the tuning capacitor assembly.
- d. Loosen the set screws on the flexible coupling closest to the tuning capacitor (see figure 4-3). Slide the coupling forward and remove the extension shaft.
- e. Gently lift the tuning capacitor assembly as far as it will go.
- f. Remove the four screws that secure each side plate of the tuning capacitor assembly.

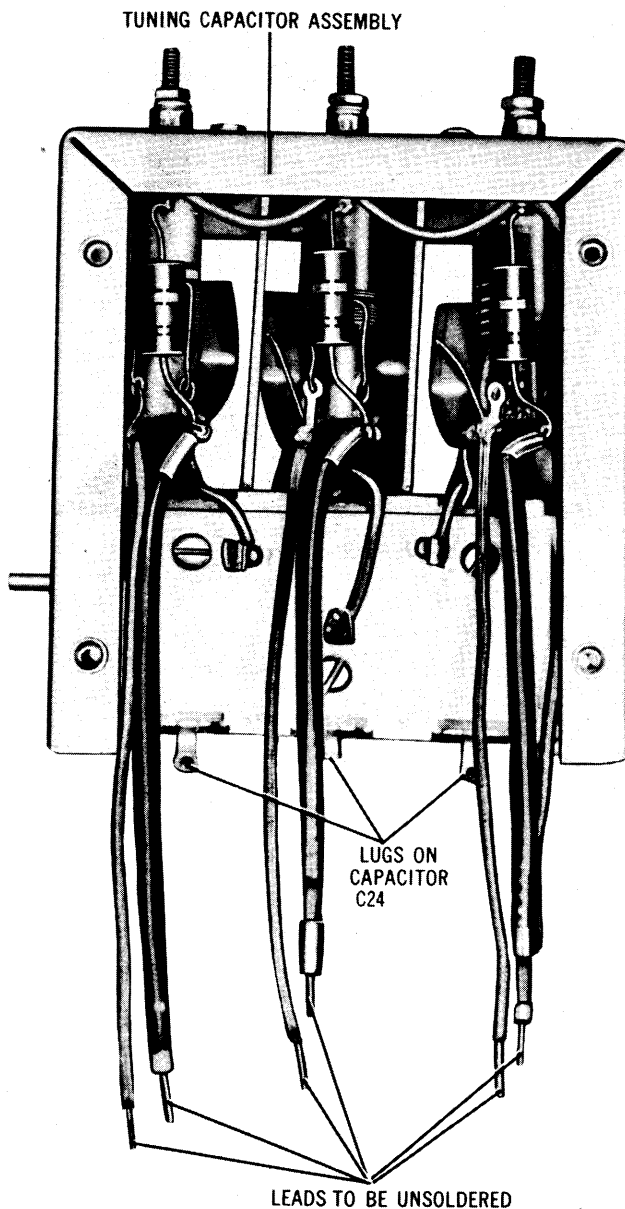


Figure 4-2. Tuning Capacitor Assembly

g. Unsolder the three leads connected to the lugs on OUTPUT FREQUENCY capacitor C24 (see figure 4-3).

h. Replace individual items, as required.

4-8. DIAL UNITS MECHANISM DISASSEMBLY. Refer to figure 4-4 and proceed as follows:

a. Remove the dial lock adjustment screw (H69), spacer (H68), washer (H54), fiber washer (H55), and two nuts (H53), by turning the dial lock adjustment screw counterclockwise, after one of the two nuts has been given a quarter turn away from the other.

b. Remove the two screws (H20), lock washers (H44), and flat washers (H43) that secure the dial lock front jaw (O28), dial lock jaw spacer plates (O27 and O29), and dial lock rear jaw (O26) to the units dial housing (A24). Separate the dial lock jaw parts by removing the screw (H21) that binds them together.

c. Loosen the set screw (H18) on the vernier knob (H65). Slide the knob off the planetary drive dial (O30) inner shaft.

d. Loosen the two set screws (H19) on the main frequency dial knob (H66). Pull the knob forward. The dial (I4) and the dial lock plate (H67) will also come out. Remove the three screws (H3) that fasten the dial lock plate and dial to the main frequency dial knob. Be careful not to lose the three spacers (H60) that separate the dial lock plate from the dial.

e. Remove the four screws (H4), lock washers (H10), and nuts (H11) that fasten the dial plate vernier (I5) to the units dial housing (A24).

f. Loosen the two front set screws (H18) on the flexible coupling (O34). Slide the coupling off the extension shaft (O32).

g. Loosen the set screw (H56) on the bevel gear (O33) and slide the gear off the extension shaft.

h. Remove the four screws (H15) and lock washers (H41) that secure the dial housing bracket (A26), shaft bushing (O31), and washers (H33) to the planetary drive mounting plate (A25). Separate the parts listed above by unscrewing the lock nut, which is part of shaft bushing (O31).

i. Loosen the two set screws in the planetary drive dial (O30). Remove the extension shaft.

j. Remove the three screws (H4), lock washers (H11), and flat washers (H12) that secure the planetary drive dial to the planetary drive mounting plate (A25).

k. Remove the four screws (H16) that secure the planetary drive mounting plate to the four spacers (H70) attached to the units dial housing.

l. Remove the four spacers by unscrewing the four screws (H17) and lock washers (H41) attached to the front of the dial units housing.

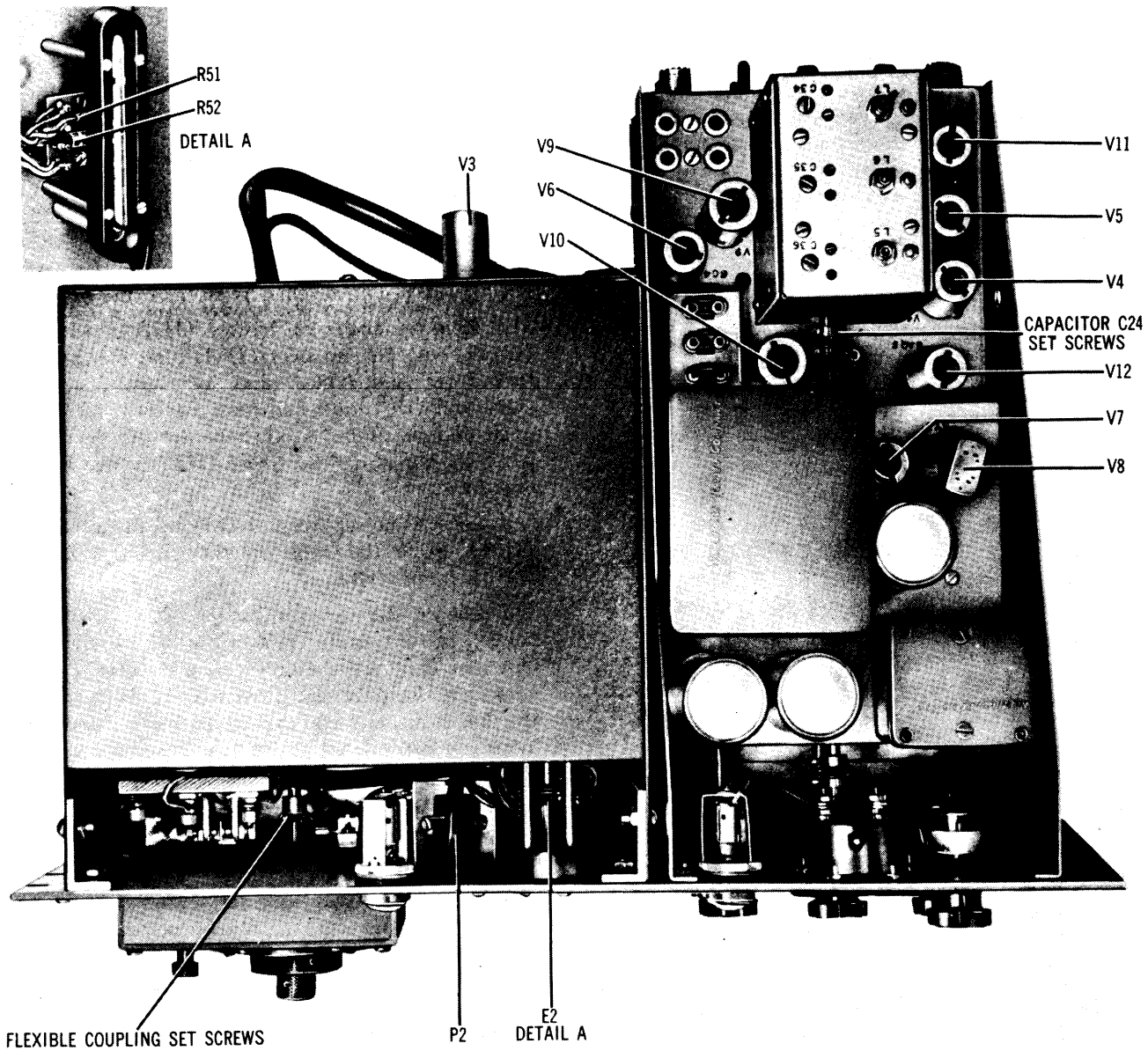


Figure 4-3. Variable Master Oscillator, Top View

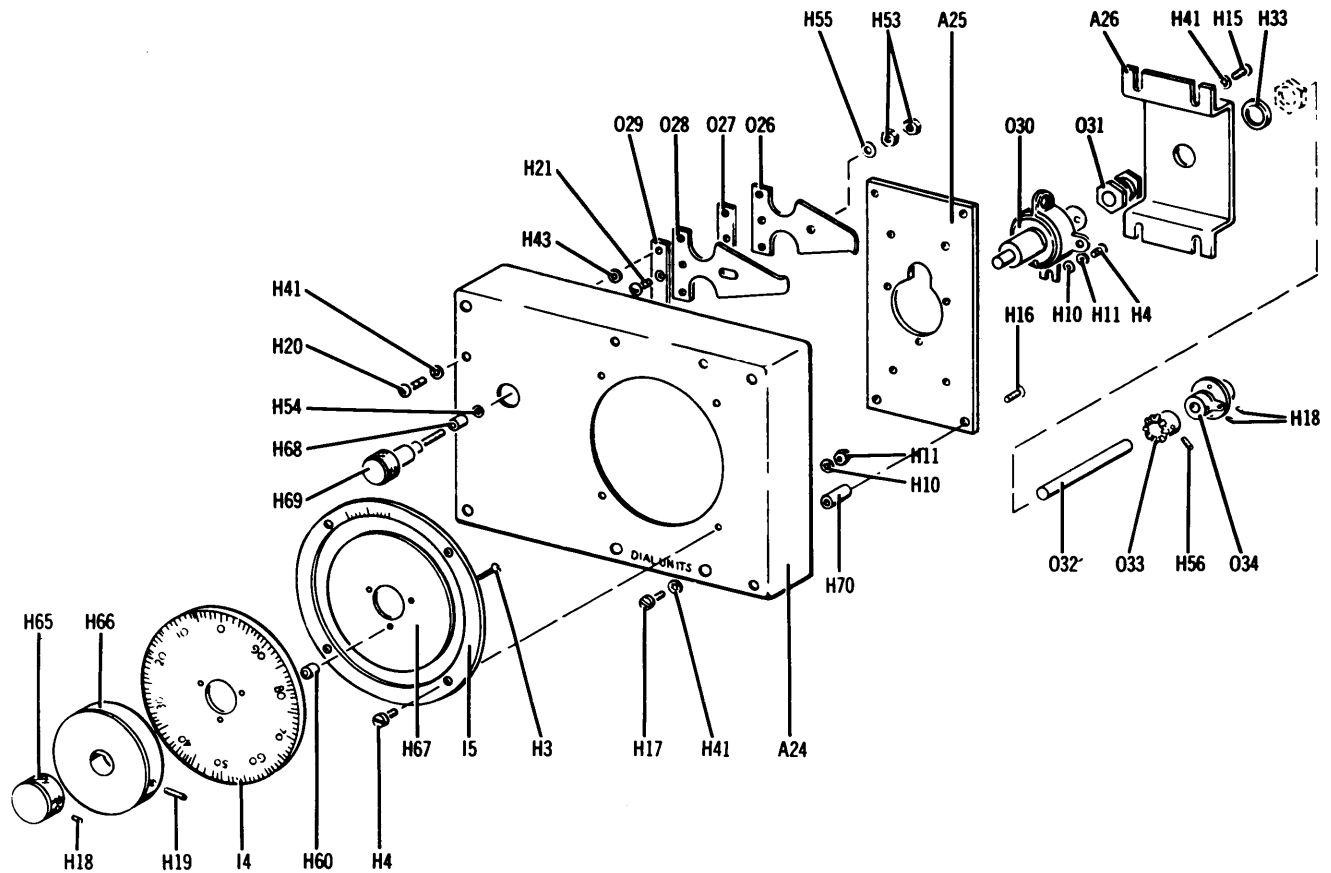


Figure 4-4. Dial Unit Assembly, Exploded View

SECTION V CLEANING

5-1. CLEANING PROCEDURE.

5-2. Use a brush, or compressed air at pressures not exceeding 60 pounds per square inch, to clean out dirt, dust, and foreign particles from the oven and electronic chassis.

Note

Be careful not to strike the plates of any

variable capacitors while cleaning. This may bend the plates and cause erratic operation.

5-3. PRESERVATION.

5-4. It is unnecessary to apply any rust-preventive compounds after cleaning the equipment.

SECTION VI INSPECTION

6-1. INSPECTION PROCEDURES.

6-2. Refer to Table 6-1 and perform the inspection procedures indicated.

TABLE 6-1
INSPECTION PROCEDURES

What to Check	Check for
Resistors	Burned or charred appearance. Secureness of mounting to terminal boards and chassis. If resistor appears discolored check to see that its value has not changed.
Potentiometers	Erratic operation. Use ohmmeter to determine if variable arm makes contact throughout entire range.
Capacitors	Leaking oil or swollen case.
Transformers	Corroded or broken terminals.
Fuse Holder	Broken or cracked case. Loose terminals.

TABLE 6-1
INSPECTION PROCEDURES (cont)

What to Check	Check for
Solder joints	Crystallized joints or frayed wires.
Wiring	Cracked insulation, loose strapping, burned appearance.
Terminal boards	Loose mountings, loose items.
Inductors	Bare insulation, shorted turns, loose connections.
Variable capacitors	Bent, or shorted plates.
Wafer switches	Faulty detent action.

SECTION VII

REPAIR AND REPLACEMENT

7-1. REPAIR.

7-2. It is not practicable to repair any of the parts of the variable master oscillator. Faulty items are normally replaced.

7-3. REPLACEMENT.

7-4. Defective items should be replaced, as necessary, with the aid of common hand tools and soldering iron.

SECTION VIII

REASSEMBLY AND TESTING OF SUB-ASSEMBLIES AND ASSEMBLIES

8-1. REASSEMBLY.

8-2. To reassemble sub-assemblies and assemblies, reverse the disassembly procedures outlined in paragraphs 4-1 through 4-7.

8-3. TESTING OF SUB-ASSEMBLIES AND ASSEMBLIES.

8-4. INNER OVEN TEST. To test the inner oven, proceed as follows:

- a. Insert a 100-kc quartz crystal in socket X20.
- b. Turn HFO, BFO, and POWER switches to ON.
- c. Tune a standard communications receiver to station WWV (5 mc or 10 mc).
- d. Loosely couple the output of the master oscillator to the receiver and vary the DIAL UNITS control until a zero beat is obtained at the receiver output.
- e. Connect a headset to the CAL. OUTPUT jack.
- f. Turn the CAL. OUTPUT control fully clockwise.
- g. Adjust capacitor C49 (see figure 8-1), accessible

from the rear of the oven, until a zero beat is obtained in the headset.

h. Tune the variable oscillator to 4 mc by varying capacitor C1 (DIAL UNITS control).

i. Connect the d-c probe of a VTVM to grid 6 of V2 and adjust capacitor C30 (see figure 8-1), accessible from the rear of the oven, until a reading of zero volts is obtained.

j. Adjust the plates of capacitor C1 so that they are fully meshed.

k. Adjust the plates of capacitor C2 (see figure 8-1) so that they are half meshed.

l. Adjust the DIAL UNITS counter so that a reading of 0000.0 is obtained when the plates of C1 are fully meshed, then tighten the set screws on the flexible shaft coupling.

m. Set the DIAL UNITS control for a reading of 0030.0 and adjust L2 (see figure 8-1) until a zero beat is obtained, at the receiver output. Tune the receiver to 4 mc to pick up the 2nd harmonic of this 2-mc

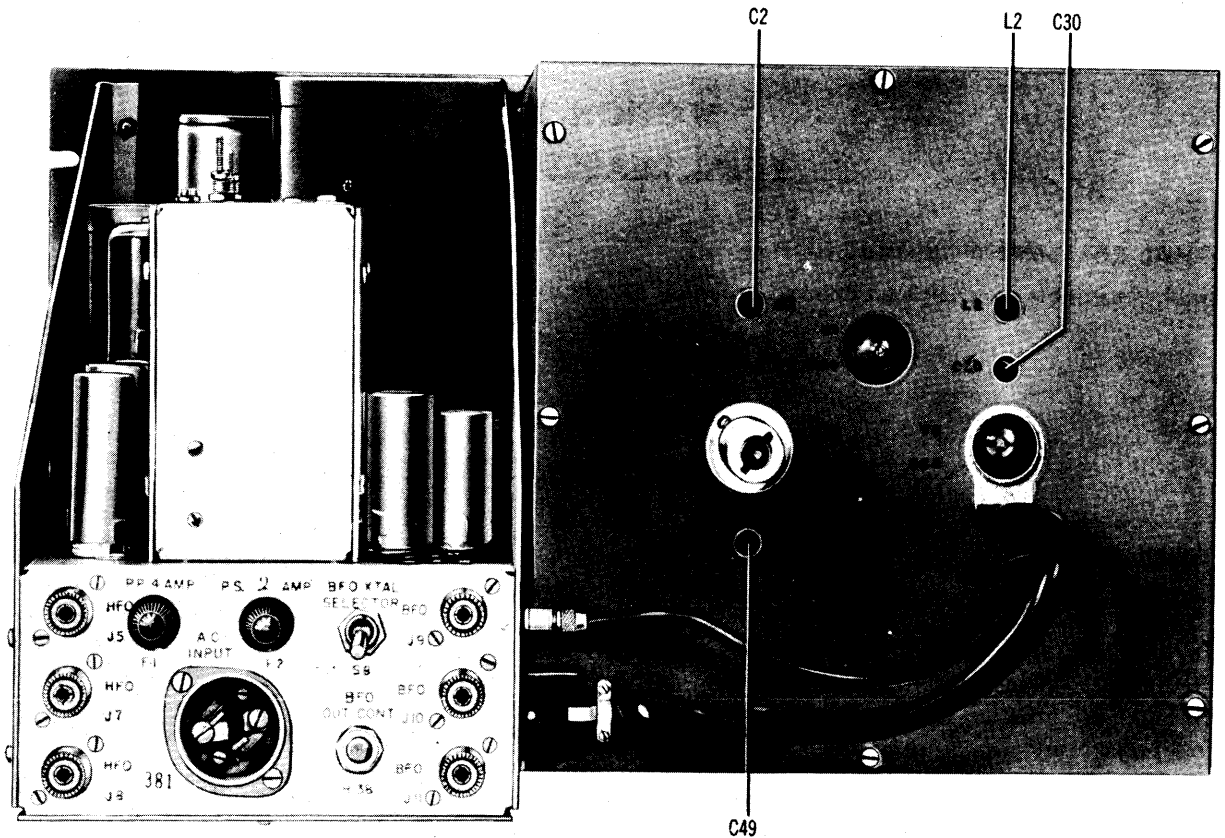


Figure 8-1. Variable Master Oscillator, Rear View

oscillator output.

n. Set the DIAL UNITS control to 4700.0 divisions above the reading of step m and vary C2 until a zero beat is obtained.

o. Turn the DIAL UNITS control counterclockwise until a zero beat is obtained (indicating the 3950-kc check point). If the DIAL UNITS reading is more than 140 divisions away from 3950 (i.e., 4590 or less), repeat steps m through o, this time setting the DIAL UNITS control to the number $n = f_1 - 2 (4590 - f_2)$ where $f_1 =$ Original reading (0030.0)

$f_2 =$ DIAL UNITS reading at 3950-kc check point

Example: Assume that the 3950-kc check point occurs at a reading of 4580.0,

$$\begin{aligned} \text{then } n &= 0030.0 - 2 (4590 - 4580.0) \\ &= 0030.0 - 2 (0010.0) \\ &= 0030.0 - 0020.0 \\ &= 0010.0 \end{aligned}$$

p. If the 3950-kc check point occurs less than 140 divisions away from the 4-mc point, increase the DIAL UNITS control setting in step m to the number n, where $n = f_1 + 2 (f_2 - 4590)$.

q. Reset the DIAL UNITS counter so that 0000.0 corresponds to 2 mc.

SECTION IX

REASSEMBLY AND TESTING OF COMPONENTS

9-1. REASSEMBLY.

9-2. Remount the variable master oscillator. Connect all power and signals lines.

9-3. TESTING.

9-4. Perform the alignment and adjustment procedures described in the Handbook of Service Instructions.

SECTION X FINAL REASSEMBLY

10-1. FINAL REASSEMBLY INSTRUCTIONS.

10-2. Final reassembly is complete upon completion of the reassembly discussed in Section VIII.

SECTION XI INSPECTION AND TESTING

11-1. INSPECTION.

11-2. Inspect the equipment to see that all connections are secure.

11-3. TESTING.

11-4. To make the final test of the equipment, use the following procedure:

a. Connect a pair of handphones to the CAL. OUTPUT jack.

b. Connect a 0 to 250-ma r-f ammeter (with 75-ohm non-inductive series load resistor) to one of the HFO output jacks.

c. Set DIAL UNITS control for a reading of 0000.0 (2 mc).

d. Throw the FREQUENCY RANGE switch (S7) to each of its positions, adjusting, in turn, L4, L5, L6, and L7 for a maximum reading on the r-f ammeter (i.e., adjust L4 in the 2-4 position, L5 in the 4-8 position, etc.).

e. Set the DIAL UNITS control to 4700.0 (4 mc).

f. Throw the FREQUENCY RANGE switch to each of its positions, adjusting, in turn, C36, C35, and C34 for a maximum reading on the r-f ammeter (i.e., adjust C36 in the 4-8 position, C35 in the 8-16 position, etc.).

g. Repeat steps c through f until both ends of the band are aligned.

h. The output should be at least 160 ma in the 2-4 mc band, and at least 80 ma in the other bands.

Note

Marking of equipments required by Government T.O.'s or other instructions, to indicate overhaul or incorporation of changes, shall be applied during inspection and test (if not previously applied to sub-assemblies, assemblies, or components during overhaul and assembly).