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increases the current through Q3 and R17 thereby increasing the base current drive to Q4. Increasing the base current drive of Q4 further increases collector current required through Q4 thus reducing the input to Q3 even further. This loop action provides saturation of Q4 thus bringing the collector near ground potential. CR11, connected to the regulated circuit at the divider point between resistor R22 and R28 serves as a ground for the feedback correction circuit and thus reduces the +20 volt regulated output voltage to 0 volts. The only way to reset this circuit is to turn off the ac input power and allow the voltage to restore itself to normal condition, then turn it back on again. If the overcurrent is sensed again, the circuit will turn off the regulated B+ output. C9 serves as a ripple filter for the base of Q3. R9 and R16 serve as current limiting resistors for monitoring the unregulated dc input at the exciter front panel when the test switch on the front panel is in the UNRGLTD position.

4-80. BATTERY CHARGING CIRCUIT. The battery charging circuit consists of a constant current drive source which is Q1 on PS1A1, and its associated drive circuitry on PS1A2. The unregulated dc voltage is applied to R3 and R4 and is coupled out through pin 12 of PS1A2 to pin 2 of TB2 on PS1A1. This connects the input to the emitter of Q1. The collector of Q1 is connected to pin 3 of TB2, with the base connected to pin 1 of TB2. R3 and R4 on PS1A2 serve as constant current source resistors when a fixed base voltage is applied to regulating transistor Q1. The fixed base voltage is derived from the network consisting of CR7, CR8 and CR9 in series with resistor R5 to ground. The voltage at the cathode of CR7 is approximately 2.1 volts less than the unregulated input voltage which is applied to the emitter of Q1. This causes Q1 to conduct allowing diode CR6 to be forward biased and allows voltage to be applied through pin 14 to the battery circuit. Diode CR6 serves as a reverse protection in the event of a battery hook-up in the reverse polarity. Q2, with bias resistors R1 and R2, serves as a transistor protect circuit in the event of connecting the battery in the reverse mode or in the event of a short circuit at a battery charging terminal. In either case, Q2 conducts heavily, which shorts the potential derived from CR7, CR8 and CR9 and returns the base voltage of Q1 to the same potential as the unregulated input, which turns off current flow through Q1 and protects the battery charging circuit.

4-81. On PS1A2, R15 serves as a multiplier resistor for a monitor test point on the exciter front panel associated with the regulated voltage output. When the test switch is in the REG +20 position, a reading of 20 on the meter should be obtained when the regulated output voltage is +20 volts. A battery monitoring point provides a dc input from the external battery to pin 10 of PS1A2, which is divided through R6 and R7 which serve as current limiting resistors for the metering test point associated with the battery monitoring position on the front panel of the exciter. When the test switch is in the BAT position, the battery voltage will be monitored and should be read directly in volts on the test meter. The battery voltage should be monitored with the ac power ON-OFF switch OFF, so that a monitor of the battery charging voltage is not read on this position. C6 serves as an output ripple filter capacitor on the +20 volt line.

4-82. POWER AMPLIFIER

4-83. GENERAL. The power amplifier is a self-contained unit which amplifies the 10-watt exciter output to 50 watts. See figure 6-24. The power amplifier utilizes a 350 watt plate dissipation beam power tetrode vacuum tube in a tuned cavity configuration. The amplifier operates Class AB_1 linear. The 50-watt output is maintained by means of a closed-loop automatic power control action which is coupled back into the exciter. A TEST meter and meter function switches provide metering indications of the various modules' performance under operating conditions. The tetrode vacuum tube amplifier is cooled by forced air. The power supplies required for filament grid, and plate voltages for the power amplifier vacuum tube are contained within the unit.

4-84. TUNED CAVITY A7.

4-85. GENERAL. The tuned cavity is a separate self-contained module that plugs into the power amplifier chassis through the front panel. It is held in place by four screws. The tuned cavity module contains input and output tuning circuitry, a low pass filter and a power sensor. To change the VHF tuned cavity to UHF operation it is necessary to change the input tuning cavity, the plate high voltage cable assembly, the vacuum tube socket, the low pass filter and the power sensor. A plunger located in the front of the cavity and behind the front panel changes the output tuning cavity from VHF to UHF depending on its position. For UHF operation the plunger should be in. A snap lock holds the plunger in place when all the way in or all the way out.

4-86. TUNED CAVITY (VHF). The rf output from the exciter is fed through a coax line to P4 on the cavity module. See figure 6-25. From P4 the rf is fed to J1 on the input cavity and to the impedance matching network consisting of C2, C1, R1, and coupling capacitor C3. This network serves as a 50-ohm matching network to the grid of V1. Grid bias enters at P1E from the control grid power supply through L1 and L2 serving as rf chokes, with C22 and C4 serving as decoupling capacitors to remove any rf that might be on the grid input lead. Filament voltage enters at P1B from the filament supply and is connected to the tube filaments through filter decoupling capacitors C10 and C11. The filament return is ground. The cathode of V1 is grounded through R2, R3, R4 and R5 in parallel which maintains a constant rf gain at V1. Screen grid voltage for V1 is brought in at P1K with C12 serving as a feedthrough and decoupling capacitor along with C17, C18, C19 and C20. The screen grid operating voltage is a nominal +390 volts dc. An additional decoupling capacitor is built into the tube socket. The arc suppressor E1 prevents damage to screen grid circuitry when short duration flash over or internal shorts exist within the vacuum tube.

4-87. The rf output from V1 is taken from its plate and coupled to the output tuning cavity through coupling capacitors C15 and C21. This cavity is plunger-tuned. The rf output is coupled through C13 at the output of the cavity. The B+ voltage for the plate of V1 is supplied from P2 through feedthrough filter FL1. The proper operating voltage for the plate of V1 is a nominal +2000 volts dc. The rf output from J2 of the cavity is coupled through P9 to low pass filter FL2. FL2 passes the frequencies of 116 to 149.95 mhz and suppresses unwanted harmonics above the desired frequency. The output from FL2 is on P8 which connects to P7 of power sensor DC1. The power sensor detects forward and reverse power and is used in closed-loop operation similar to power detector DC1 in the exciter unit; however, when the exciter is driving the power amplifier, power sensor DC1 takes control of loop operation and output power reference is controlled from this power sensor. In the event of a vswr greater than 3 to 1, the system switches from power amplifier operation to exciter operation to protect the output of the cavity amplifier. The rf output from the power sensor is on P6 which connects to P3 on the rear of the cavity module. This output couples through the rear panel of the power amplifier chassis and is connected back to the exciter coaxial relay. Pins F and H of P1 provide an interlock to prevent the high voltage power supply from turning on in the event that the cavity is not plugged into the unit. Amplifier tube V1 requires forced air cooling to remove the heat, and an air flow path exists through the mechanical structure of this cavity with a thermal sensing element in the exhaust air flow duct. The thermal sensor unit provides the detection action required to determine if an over-temperature condition exists. The blower must always be operating whenever the power amplifier is operating.

4-88. **TUNED CAVITY (UHF).** The UHF tuned cavity operates essentially the same as the VHF tuned cavity. To properly tune the higher frequencies the cavity sizes are different from the UHF; filter frequency requirements are different and component values are changed. The plunger behind the front panel must be locked in the "in" position for UHF operation. The rf output from the exciter is fed through a coax line to P4 on the cavity module. See figure 6-26. From P4 the rf is fed to J1 on the input cavity and to the impedance matching network consisting of C2, C1 and coupling capacitor C3. This network serves as a 50-ohm matching network to the grid of V1. Grid bias enters at P1E from the control grid power supply through L1 and L2 serving as rf chokes, with C4 serving as a decoupling capacitor to remove any rf that might be on the grid input lead. Filament voltage enters at P1B from the filament supply and is connected to the tube filaments through filter decoupling capacitor C10 and C11. The filament return is grounded. The cathode of V1 is grounded. Screen grid voltage for V1 is brought in at P1-K and C12 serving as a feedthrough and decoupling capacitor and rf choke L3 to the screen grid of V1. The screen grid operating voltage is a nominal +390 volts dc. An additional decoupling capacitor is built into the tube socket. The arc suppressor E1 prevents damage to screen grid circuitry when short duration flash over or internal shorts exist within the vacuum tube.

4-89. The rf output from V1 is taken from the plate and coupled to the output tuning cavity through coupling capacitor C15. This cavity is plunger-tuned. The rf output is coupled through C13 at the output of the cavity. The B+ voltage for the plate of V1 is supplied from P2 through feedthrough filter FL1. The proper operating voltage for the plate of V1 is a nominal +2000 volts dc. The rf output from J2 of the cavity is coupled through P9 to low pass filter FL2. FL2 passes the frequencies of 225 to 399.95 mhz and suppresses unwanted harmonics above the desired frequency. The output from FL2 on P8 connects to P7 of power sensor DC1. The power sensor detects forward and reverse power and is used in closed-loop operation similar to power detector DC1 in the exciter unit; however, when the exciter is driving the power amplifier, power sensor DC1 takes control of loop operation and output power reference is controlled from this power sensor. In the event of a vswr greater than 3 to 1, the system switches from power amplifier operation to exciter operation to protect the output of the cavity amplifier. The rf output from the power sensor is on P5 which connects to P3 on the rear of the cavity module. This output couples through the rear panel of the power amplifier chassis and is connected back to the exciter coaxial relay. Pins F and H of P1 provide an interlock to prevent the high voltage power supply from turning on in the event that the cavity is not plugged into the unit. Amplifier tube V1 requires forced air cooling to remove the heat, and an air flow path exists through the mechanical structure of this cavity with a thermal sensing element in the exhaust air flow duct. The thermal sensor unit provides the detection action required to determine if an over-temperature condition exists. The blower must always be operating whenever the power amplifier is operating.

4-90. POWER SUPPLY CONTROL GRID/THERMAL CONTROL/AC CONTROL A3. This module contains the filament supply, the grid voltage supply, the thermal control detector circuits, the blower failure sensor circuits and the ac control circuits. See figure 6-27. The operation of each of these will be described separately.

4-91. AC CONTROL. Figure 6-28 shows the ac control circuits. Included are the power supply control grid/thermal control, the high voltage power supply, the cavity interlocks, and the interlock on top of the chassis, as well as the chassis wiring, switches and lamps on the front panel. S1 is the POWER ON-OFF switch on the front panel of the power amplifier. The ac line goes in to module A3, the power supply control grid/thermal control through fuses F1 and F2 and into pins 15 and 16 of P1. These pins tie to TB1 which requires strapping for various primary source voltages. The strapping arrangement for this terminal board is shown on the insulated cover of the module. When the straps are inserted properly for the source voltage, pins 1 and 7 will maintain a 120 volts ac and the POWER ON lamp is across pins 14 and 15 of P1 and DS1 illuminates, giving an indication of ac power to this chassis. The ac input also goes through F3 on one side of the line to the high voltage power supply module A4 to TB1 which, in addition, requires the proper strapping for the various primary source voltages. The strapping arrangement for this terminal board is identical to the strapping arrangement for TB1 in module A3. The ac return comes through the relay logic circuits and ac control circuits which will be defined as follows: When the ac is turned on, pin 1 and 7 of TB1 in module A3 will provide 120 volts to relay K3, a 60-second time delay relay. In 60 seconds the contact associated with the relay coil is closed allowing current to flow through the printed circuit board containing relay K1 through pins E6 and E7 to relay K2 through pin 11 of P1 through chassis wiring to the cavity interlock wire shown on the drawing as C7 and C8 and returns to pin 14 of module A3 providing an energizing path for K2. When K2 energizes the switch contact A2 contacts A1 which provides a continuous or holding input into K2 from P1 pin 15 side of the ac line, thus holding K2 energized.

4-92. Time delay relay K3 returns to the normal position and is unused until turn-on of the ac input again. Relay K2 current path is through K1 in module A2 and through the cavity interlock. In the event that the cavity is not plugged into the power amplifier chassis, no current can flow through K2 and thus K2 will not be energized. In addition, K1 shown above K2 and associated with the thermal sensing circuits and blower failure sensing circuits when energized also breaks the line to de-energizing it. Energizing K2 closes contact B2 to B1, which applies the ac line associated with pin 15 P1 through the cover interlock out through P1, pin 10 through the high voltage switch S4 to the high voltage power supply, to pin 1 TB1 thus completing the ac to the high voltage power supply transformer input energizing the high voltage power supply. Thus, the high voltage power supply is not turned on until the time delay relay period of 60 seconds has elapsed or in the event of any of the interlocks being opened to relay K2. If the cover interlock is open, or the HV ON-OFF switch on the front panel is OFF no high voltage will be available from the high voltage power supply. The latter two switches, however, can be turned on and high voltage will be regained immediately. In the case of the interlocks associated with relay K2, the elapsed time of 60 seconds must complete before the high voltage power supply will be energized. Lamp DS2 on the front panel will turn on by 120 volts ac rms applied from pins 1 and 7 of TB1, the terminal board in the high voltage power supply. This lamp indicates the presence of high voltage.

4-93. FILAMENT SUPPLY. Transformer T1 supplies the filament voltage on pins 8 and 7 with pin 7 being the ground for the system. See figure 6-27. It is necessary to have the proper straps in place on TB1 in order to obtain the proper output voltages from T1.

4-94. GRID SUPPLY. The grid supply provides a negative dc voltage to the control grid of the cavity amplifier tube. The voltage is obtained from the rectifier circuit shown in figure 6-27. The output of T1, pins 9 and 10 is applied to the bridge rectifier consisting of diode CR5, CR6, CR7 and CR8 with the positive side of this bridge connected to ground. The negative side feeds through a filter consisting of C1, R12 and zener diode VR1 which provides a −100 volt dc output to the resistive divider network consisting of R14, R16 and potentiometer R15. This dc output is further filtered by C2. The output can be adjusted from 66 to 95 volts. R17 and R18 provide current limiting and divider action for metering the output voltage through E11 to pin 4 of P1 which is connected to the front panel TEST meter V-GRD position.

4-95. THERMAL CONTROL CIRCUITS. The thermal control circuits provide power amplifier turn-off if the thermal sensor in the exhaust heat duct indicates excessive temperature or if a blower failure occurs. The thermal sensing circuit has a thermistor in the air flow exhaust which operates in a voltage divider line consisting of resistors R8, R9, and the thermistor as connected to pin 9 of P1. Plus 20 volts is necessary for the operation of these circuits which is obtained on P1, pin 6. The voltage source is from the exciter 20-volt power supply. In the event of an excessive temperature at the thermistor, its resistance decreases and the voltage at the base of Q3 decreases, increasing the voltage of Q3. The voltage increased at the collector of Q3 is applied through R6 to the base of Q2. The increase of voltage on the base of Q2 decreases the collector voltage energizing relay K1. This disables the primary voltage to relay K2 in the high voltage power supply ac line, and turns off the 2 kv dc power supply. A detected dc voltage from the blower is brought into the input connector P1, pin 7 through R1 to the base of Q1. If this voltage decreases due to a failure of the fan voltage, the voltage on the collector of Q1 increases coupling the voltage increase through R4 to the base of Q2. An increase at this point decreases the output on the collector of Q2, thus energizing relay K1 which disables the high voltage power supply. CR2, CR3 and CR4 provide a fixed emitter voltage of approximately +2 volts for the emitters of Q1, Q2 and Q3. CR1 serves as a transient protector across K1 to protect the transistor from the coil inductance of K1. R4 and R6 serve as summing resistors to the base of transistor Q2. R11 is a current limiting resistor for voltage to the TEST meter on the power amplifier front panel. This current is coupled out through P1, pin 8 to the power amplifier front panel TEST meter when the switch is in the OVER TEMP position.

4-96. AC TO AC CONVERTER SOURCE VOLTAGE. In addition pins 11 and 12 of the transformer provide 13.5 volts rms to the AC-AC converter, which drives the blower motor.

4-97. POWER SUPPLY PLATE/SCREEN GRID A4.

4-98. See figure 6-29. The ac input to this module comes in to connector P1, pins B and C, to terminal board TB1 which requires the proper straps for the proper line voltage input. T1 is the power supply transformer. The secondary output is fed to pins E2 and E4 to a bridge rectifier consisting of CR1, CR2, CR3 and CR4. The dc output from the bridge rectifier connects to E3 to a pi section filter consisting of C1A, C1B and L1. The dc output is connected to E1 on the printed circuit board and is a nominal +2000 v. Terminal E1 is the tie point for the high voltage output wire feeding the plate of the cavity amplifier tube. R4, R5, R6, R7 and R8 serve as a resistor-divider to divide down the voltage for metering at the front panel of the power amplifier TEST meter V-PLATE position. The negative side of the bridge is tied to ground through R1 and R2 in parallel and the voltage drop across these resistors provides the monitor of the current required by the high voltage power supply. R3 is a current limiting resistor to the TEST meter on the power amplifier front panel which is coupled out on connector P1, pin L, to the meter position CUR-PLATE. The screen voltage is derived from the 2 kv power supply by dropping dc voltage across R12 and R15 to a zener regulated output consisting of VR1, VR2 and VR3 in series. C3 serves as a ripple filter for the screen voltage. The output voltage available from pin E22 is +390 volts dc.

4-99. The screen voltage is at the operating +390 volt condition at all times. R24 is a current limiting resistor to the TEST meter on the front of the power amplifier and is coupled out through P1, pin E, to the test switch KEY position, which gives a direct reading of the keying voltage. The screen voltage is fed to the power amplifier vacuum tube V1, through R22 to P1, pin F. R19, R20 and R21 serve as a voltage divider for the screen voltage and, in addition, serve as a current limiting resistor network for monitoring the screen voltage and, in addition, serve as a current limiting resistor network for monitoring the screen grid voltage on the power amplifier front panel when the test switch is in the V-SCREEN position. A voltage divider network consisting of R16, R17, R18 and R26 provides a voltage at P1 pin H, which is a sample of the screen voltage for the logic circuit in the exciter unit. When the screen voltage is at +390 volts, the output voltage on pin H of connector P1 is a nominal +35 volts dc. R23 is a current limiting resistor for monitoring the V-LPA test voltage point on the power amplifier front panel when the test switch is in the V-LPA position.

4-100. CONVERTER AC TO AC A2.

4-101. The ac to ac converter converts the input line frequency to a 400 hz output to drive the blower for cooling the tuned cavity. See figure 6-30. The ac input is a nominal 13.5 volts rms at a frequency of from 47 hz to 420 hz. The output ac to drive the blower is a nominal 115 volts rms at 400 hz. The ac to ac conversion is obtained by rectifying the ac input and using the dc to drive a 400 hz oscillator. The output from the 400 hz oscillator is amplified and drives the blower through an output step-up transformer. The 13.5 volts rms input comes to connector P1, pins 2 and 3. The ac input is rectified by a bridge rectifier consisting of CR5, CR6, CR7 and CR8. The negative side is grounded and the positive output is a nominal +15 volts dc. C9 serves as a filter capacitor for the dc output of the rectifier circuit. Q2 is a basic RC phase-shift oscillator with the output from its collector shifted in phase by the phase shifting network consisting of R4, R5, R6, C2, C3 and C4. The output from the phase shifting network is connected to the base of transistor Q1 which is an emitter-follower presenting a high impedance load to the phase shifting network. R1 is the emitter-follower output resistor. C1 serves as the ac coupling capacitor of the phase shifted signal to the base of Q2. The phase shifted feedback is of such a phase as to support oscillations in Q2. R2 serves as a dc biasing resistor for Q2. This phase-shift oscillator circuit provides a 400 hz output to the base of Q3 and can be observed at TP1. Q3 is an emitter follower acting as an isolation stage to prevent loading of the oscillator circuit. The output is taken from the emitter of Q3, with R7 serving as the emitter resistor.

4-102. The output signal is coupled to the base of Q4 through coupling capacitor C5, with resistors R9 and R10 serving as bias resistors for Q4. Q4 is an amplifier stage with the output from its collector driving the base of emitter follower Q5. R11 serves as a load resistor for Q4 and R15 serves as a gain controlling resistor to stabilize the output level from Q4. Q5 operates as an emitter follower, driving the primary of T1. The emitter of Q5 drives pin 3 of T1 with pin 4 grounded. The output from the secondary of T1 is a nominal 115 volts, 400 hz. One side of the output is grounded, the other side drives the blower through J1, pin 6, with the blower return on J1, pin 4, to ground through resistor R14. C6 across the secondary of T1, serves as a resonating capacitor at 400 hz and maintains a sinusoidal 400-hz output from the secondary. CR3 rectifies a sample of T1 secondary output with R12 and R13 serving as a voltage divider network and current limiting resistors to provide the proper dc level output to the front panel TEST meter. When the meter test switch is in the FAN position, a reading of the detected secondary voltage is indicated on the meter. CR4, in conjunction with filter capacitor C8 rectifies a sampling of the return ac from the blower to ground across R14. This sampled voltage is indicative of blower operation and in the event that no voltage is detected at this point, an indication of a blower failure results. The nominal sensing voltage from the output of CR4 on pin E7 is +3 volts dc and is connected to the blower current sensing circuit through connector P1, pin 7. In the event of a blower failure, the thermal control blower sensing circuit senses the fault and disables the high voltage power supply.

4-103. <u>BLOWER B1.</u>

4-104. The blower is a centrifugal type which cools the vacuum tube and associated circuitry in the power amplifier. See figure 6-24. The blower has long life bearings and low acoustical noise output. It operates from 115 volts, 400 hz, single phase, with an external phasing capacitor for a split phase winding. The external starting capacitor is mounted on the blower frame. The ac input to the blower comes from J1, pins 4 and 6, of the ac to ac converter.

4-105. <u>BUFFER AMPLIFIER/MULTIPLIER, ELECTRICAL INSTRUMENT A5.</u>

4-106. The buffer amplifier/multiplier, electrical instrument module contains circuits for a buffer amplifier between the detectors from the power sensor and the rf control unit in the exciter chassis. See figure 6-31. These circuits are similar to the circuits for the forward and reverse power lines in the rf control/modulator in the exciter unit. In addition, this module contains various metering multiplier resistors, current limiting resistors, and a meter-protect circuit for controlling the metering functions on the front panel of the power amplifier. The meter selector switch is wired to this module.

4-107. BUFFER AMPLIFIER. The inputs to the buffer amplifiers come from power sensor forward and reverse detector outputs, with the forward power detected output coming to connector P1, pin 2 and the reverse power detected output coming to connector P1, pin 3. In the forward power line, the input is connected through terminating resistor R3 and R26 to the emitter of Q1. R26 is a potentiometer for adjusting the forward power output to 50 watts cw when the LPA OPERATE-TUNE switch is in the OPERATE position. R22 is a potentiometer for adjusting the forward power meter reading on the test meter when in the FWD position, so that a reading of 40 on the meter corresponds to 50 watts rf output. This transistor operates as a grounded-base amplifier, with the output from the collector. The nominal gain of this amplifier is approximately 0.6. R6 and R7 serve as biasing resistors to set the output dc level to the proper starting dc voltage. The collector load of Q1 consists of R12 and R13, and frequency compensation network R27 and C3. The output from Q1 collector is coupled to the base of Q3, which is an emitter follower. The output from the emitter of Q3 is connected through E12 on P1, pin 6 and from there to the rf control in the exciter unit and serves the same function as the forward power line in the exciter unit; however, when the power amplifier unit is operating this line takes control of the rf control loop. The detected reverse power line is connected into terminating resistor R4 to the emitter of Q2, R8 and R9 serve as biasing resistors for this stage. The output from Q2 is coupled from its collector to the base of emitter follower Q4. The output from the emitter of Q4 is connected through pin E13 to connector P1, pin 7 and from there to the rf control in the exciter unit. The rf control in the exciter unit determines and acts on any vswr present in the power amplifier unit. A vswr greater than 3 to 1 returns control to the exciter unit. R22, associated with the forward power output, serves as a meter multiplying resistor and connects to the front panel test switch and TEST meter. When the test switch on the front panel of the power amplifier is in the FWD position and the transmitter is unkeyed, the meter should be zeroed by adjusting potentiometer R7 at the emitter circuit of Q1. The return path of the meter is to E2 and to divider resistors R19 and R20. The division voltage at the junction of these divider resistors serves as the reference voltage for both the forward and reverse power returns when in the unkeyed condition. The reverse power line is zeroed in the same way when the test switch on the front panel is in the RVS position and the dc return from the meter connects to pin E-3 through R21 to the divider network of R19 and R20. R9 is adjusted such that a zero meter reading is obtained when the transmitter is in an unkeyed condition.

4-108. The front panel TEST meter is connected to P1, pins 9 and 19. R17 serves as a multiplier resistor for the meter with all test functions to the meter coupled through this resistor. CR4 serves as an overcurrent protect diode for the meter in the forward direction and in the event of an excessive current, damage to the meter will not occur since current will then flow through CR4. CR6 serves to protect the meter from negative voltages or transients. Both sides of the meter input circuit are connected to switch S1A and S1B, which serve as the switch arms for the two-layer multi-position test switch on the front panel below the meter. Various monitored voltages associated with the switch are connected into P1 and are seen as grid voltage on pin 14, plate current on pin 12, fan voltage on pin 15, V-LPA, or sample voltage, on pin 16, screen voltage on pin 13, plate voltage on pin 10, transmitter keyed +20 volts to pin 17, over-temperature indication on pin 18, and the heater voltage on pin 8. These inputs are all connected to the switch and the various switch positions indicate the operation of each of these functions. A +20 volts dc is required for operation of the circuits in this module and the +20 volts is obtained from the exciter unit. Thus, the buffer circuits will not operate when the exciter is not turned on. C2 serves as a B+ filtering capacitor in this module for the +20-volt input. R11 and potentiometer R2 serve as power amplifier tune-function controls with adjustment of R2 controlling the power output obtainable from the power amplifier when in the TUNE position. R2 should be adjusted such that the power output does not exceed approximately 30 watts when tuned to a maximum rf output in the TUNE position. The dc output from this network is connected through P1 pin 5 to the TUNE-OPERATE function switch. Shielding on several of the wires coming from the cavity amplifier sections is required since a strong rf field exists in this module and shielding is required to prevent radiation of the rf to other circuits associated with the buffer amplifier and metered functions.

4-109. <u>TUNE-OPERATE CONTROL.</u>

4-110. The TUNE-OPERATE switch in the power amplifier provides an artificial tune voltage to the logic circuit in the exciter so that the exciter will continue to drive the power amplifier when no forward power is being sensed at the power amplifier output. See figure 6-24. Otherwise, the rf control relay circuit would switch back to exciter output, indicating a fault in the power amplifier. A +20 volts is applied from the dc input through TUNE-OPERATE switch S3 through R1 to the inter-chassis connector, J7, pin G, which is the reverse power line to the exciter. The reverse power is raised to a high positive voltage indicating to the logic circuit in the exciter unit that a power amplifier forward power exists at the differential amplifier input. The other half of the double-pole, double-throw switch S3 delivers the voltage and current associated with potentiometer R2 in the buffer amplifier to the rf control forward power detector circuit which cuts down the rf power in the exciter loop to a nominal 2.5 to 3.0 watts so that a maximum 30-watt output can be obtained from the power amplifier in the TUNE position. When operating in the TUNE position, the loop through the power amplifier is not used and the basic forward power loop in the exciter only is used and the power amplifier is merely serving as a final amplifier with no relation to controlling the rf loop. When switched to the OPERATE position, the forward power functions return to normal and must be delivered from the power amplifier power sensor or a power amplifier fault will be detected and rf control returned to the exciter 10-watt output.

4-111. <u>HIGH VOLTAGE SWITCH.</u>

4-112. A high voltage switch on the front panel of the power amplifier allows disabling of the high voltage. It allows enabling of the high voltage without having to wait for the time delay relay to enable. High voltage will not come on until time delay has completed after initial ac turn-on. This switch is used when tuning the exciter and the power amplifier is to be disabled.

SECTION III

FUNCTIONAL OPERATION OF MECHANICAL ASSEMBLIES

(Not Applicable)

5-22. **POWER SENSOR AND LOW PASS FILTER.** To remove the power sensor, unscrew the two connectors from the top of power sensor noting their marking. Remove coaxial cable from LOAD end of module. Remove coaxial cable from input of low pass filter. Remove four 8-32 Phillips head screws from front portion of mounting plate. Loosen the two 8-32 Phillips head screws at rear of the mounting plate. Lift the mounting plate and slide forward to remove. (Use caution when sliding forward or damage may be done to switch contacts.) The power sensor and the low pass filter are each attached to the mounting plate by four 6-32 pan head screws.

CAUTION

Cards are keyed to prevent complete insertion into wrong slot; do not force, check to see if card is in right location.

5-23. **PRINTED CIRCUIT CARDS.** To remove any of the printed circuit cards from the nest, grasp the top of the board at each side with a thumb and forefinger and lift straight upwards. Replacement is the reverse of removal.

5-24. **POWER SUPPLY.** To remove the power supply make sure the ac input connector at rear of chassis is disconnected. Remove two 10-32 Phillips head screws from tuner front rail, two 10-32 Phillips head screws from rear of power supply, and two 1/4 inch hex head screws from rear of chassis. Remove four Phillips head screws from fiberglas cover. Remove leads from terminal board noting the strapping arrangement for replacement. The power supply may now be lifted from the chassis. Replacement is the reverse of removal.

CAUTION

Before replacing the power supply brush on a thin coating of Thermal Joint Compound (ITT part no. 502371-1) to all surfaces of the module that contact the chassis. This is necessary to provide maximum thermal conduction from the module to the chassis.

5-25. **POWER AMPLIFIER.**

5-26. **TOP COVER.** To remove the top cover loosen the four 6-32 flat head Phillips head captive screws. Replacement is the reverse of removal.

NOTE

Make certain all four screws are tightened to assure positive RFI shielding effectiveness.

5-27. **POWER SUPPLY CONTROL GRID/THERMAL CONTROL/AC CONTROL.** Before attempting to remove this module make sure that the exciter AC POWER ON-OFF switch is OFF and that the power amplifier POWER ON-OFF switch is OFF. Loosen four 8-32 Phillips head captive screws at top of module. Using a long shank Phillips screwdriver loosen the single 8-32 Phillips head captive screw at bottom right center of module. Remove P1 from J4. Lift out module. Replacement is the reverse of removal. (Potentiometer R15 must be turned fully clockwise.)

5-28. **BUFFER AMPLIFIER/MULTIPLIER, ELECTRICAL INSTRUMENT.** Before attempting to remove this module the power supply control grid/thermal control/ac control module must be removed as detailed in paragraph 5-27. Remove knob from TEST meter function switch using an Allen wrench to loosen the two 4-40 set screws. Observe indexing of knob to shaft for reassembly in the same position. Remove lock nut from switch shaft using a 17/32 inch open end wrench, allowing switch to be removed. Remove five 6-32 Phillips head screws hodling printed circuit card to front panel. Remove P1 from J6. Lift out module and meter function switch. Replacement is the reverse of removal.

5-29. **BLOWER.** Remove ac connector from rear of chassis. Loosen the four 8-32 Phillips head captive screws holding blower bracket. Remove P1 on blower from J1 on converter, ac to ac. Tilt and lift assembly upwards to remove.

5-30. **HIGH VOLTAGE POWER SUPPLY.**

CAUTION

Before attempting any removal procedures on the high voltage power supply make sure the ac input connector at rear of chassis is disconnected.

WARNING

To gain access to the high voltage power supply, carefully lift off high voltage cover. Do not let fingers get under cover during removal. Follow instructions printed on top of the high voltage safety switch. This will ensure the discharging of high voltage capacitor C1.

Remove high voltage lead from capacitor. Remove hold down clamp adjacent to K15 at front right hand side of printed circuit board. Loosen six 8-32 Phillips head captive screws from left outer side of chassis. Loosen three 10-32 Phillips head captive screws from center rail. Remove P1 from J15 using flat blade screwdriver. Loosen screws together to avoid bind. Lift module up using front and rear rails. Replacement is the reverse of removal.

5-31. TUNED CAVITY. Prior to removal make sure ac power switch is OFF on power amplifier. To remove the tuned cavity loosen the four 8-32 Phillips head captive screws at the front panel and pull the cavity straight out. Replacement is the reverse of removal.

5-32. TUNED CAVITY VACUUM TUBE. To remove the tuned cavity vacuum tube, proceed as follows:

a. Remove tuned cavity from chassis (paragraph 5-31).

b. Loosen four captive screwdriver head screws at corners of air duct housing at rear right side of cavity and lift off housing.

c. Lift off plastic ring noting recess in ring fitting over tube.

d. Remove tube by lifting straight up.

NOTE

It may be necessary to assist tube out of socket by pushing against ring at base of tube using a screwdriver through bottom of socket.

e. Replacement is the reverse of removal.

CAUTION

After replacing the vacuum tube, care should be exercised when replacing the white teflon air duct (Part No. 8004679-1) around the tube for proper seating. This is necessary to prevent all leakage and thereby insure proper cooling of the vacuum tube.

5-33. CHASSIS MAINTENANCE.

5-34. EXCITER CHASSIS. The following chassis components are replaceable at field level in accordance with the following instructions:

Switch, Coaxial.
APC drive transistor.
Audio input transformer.
CARRIER LEVEL potentiometer.
MOD LEVEL potentiometer.
TUNE-OPR switch.
All front panel switches, indicators, and jacks.

CAUTION

Before proceeding with any of the following maintenance procedures make sure primary power is disconnected from chassis.

5-35. SWITCH, COAXIAL. The coaxial switch is mounted on the rear apron of the chassis on the right hand side. It is removed by removing the upper and lower hex nuts on the threaded output connectors on back of chassis. Carefully unsolder + (green) and – (blue) leads.

5-36. APC DRIVE TRANSISTOR Q1. The apc drive transistor is located on a U shaped bracket mounted on the right side wall at the front of the chassis adjacent to the rear of the front panel meter. The U bracket must be removed from the chassis to replace transistor Q1. Remove the three meter mounting screws from the front panel releasing meter. Pull meter out from front panel. This allows access to both Phillips head screws holding U shaped bracket. Remove Phillips head transistor retaining screws releasing transistor. Observe placement of insulator bushings, insulator plate and color coding of leads.

5-37. AUDIO INPUT TRANSFORMER. The audio input transformer is mounted on the chassis bottom at the left front directly behind the LOCAL MICROPHONE input jacks. It is removed by removing the high voltage safety cover and printed circuit boards XA1 and XA2 then removing the Phillips head screws and hex nuts at each end of the transformer. Observe color coding of leads.

5-38. CARRIER LEVEL AND MOD LEVEL POTENTIOMETERS. These two potentiometers are located behind the front panel access door on the left side. It is necessary to remove the oscillator and doubler/quadrupler modules to gain access to these items. Remove shaft lock nut then remove hex nut holding potentiometer to its panel. Observe color coding of leads.

5-39. TUNE-OPR SWITCH. This switch is located to the right of the CARRIER LEVEL and MOD LEVEL potentiometers and on the same panel. It is necessary to remove the oscillator and doubler/quadrupler modules to gain access to the switch. Remove hex nut holding switch to panel. Observe color coding of leads.

5-40. FRONT PANEL SWITCHES, INDICATORS, AND JACKS. These items are all standard hardware and normally accepted removal and replacement procedures apply.

CAUTION

The indicator knobs on TEST meter switches 1 and 2 each have two setscrews holding the knob to the switch shaft. Make sure when replacing either knob that the same setscrew is on the flat of the shaft as when it was removed. There is no end-of-travel stop on the switches. Seating the wrong setscrew on the shaft will cause an incorrect pointer indication.