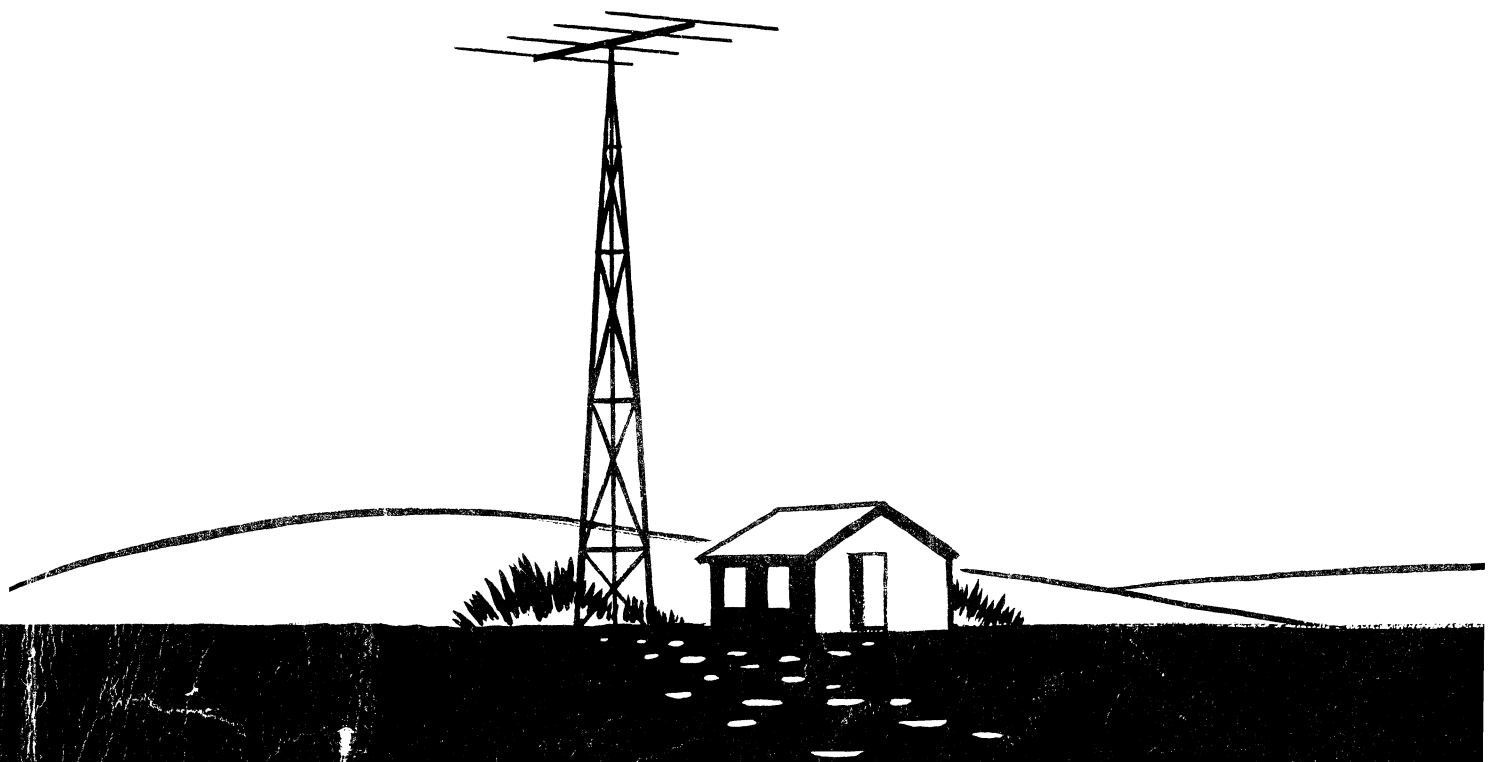


Instruction Book



KW-1 AMATEUR
TRANSMITTER



COLLINS AMATEUR EQUIPMENT GUARANTEE

The Collins Amateur equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship, or materials, and which are returned to Collins at its factory, transportation prepaid, provided:

- (a) Buyer has completed and returned to Collins promptly following his purchase the Registration Card included in the Instruction Book furnished with the equipment.
- (b) Notice of the claimed defect is given Collins within 90 days from the date of purchase and goods are returned in accordance with Collins' instructions.
- (c) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.
- (d) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal and proper manner.
- (e) Any failure due to use of equipment in excess of that contemplated in normal amateur operations shall not be deemed a defect within the meaning of these provisions.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements contained in these paragraphs. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

IMPORTANT! It is necessary that the business reply card included herewith be filled out and mailed to the Company promptly in order for this guarantee to be effective.

HOW TO RETURN MATERIAL OR EQUIPMENT. If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

- (A) Type number, name, and serial number of equipment
- (B) Date of delivery of equipment
- (C) Date placed in service
- (D) Number of hours of service
- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
- (H) Item or symbol number of same obtained from parts list or schematic
- (I) Collins' number (and name) of unit sub-assemblies involved in trouble
- (J) Remarks

HOW TO ORDER REPLACEMENT PARTS. When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

- (A) Quantity required
- (B) Collins' part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins' type number, name, and serial number of principal equipment
- (E) Unit sub-assembly number (where applicable)

INSTRUCTION BOOK
for
KW-1 1000 WATT
AMATEUR TRANSMITTER

COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

520 9516 00
23 JANUARY 1952

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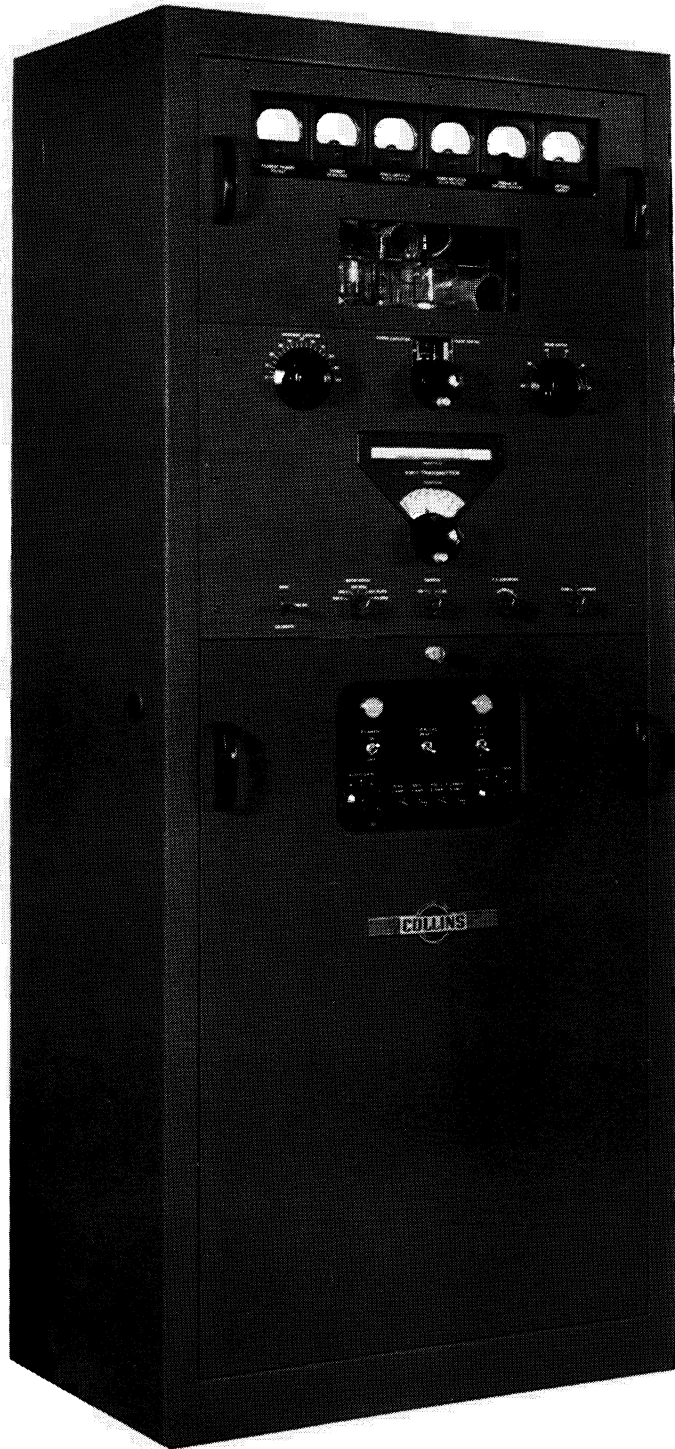


Figure 1-1. Collins KW-1 1000 Watt Amateur Transmitter

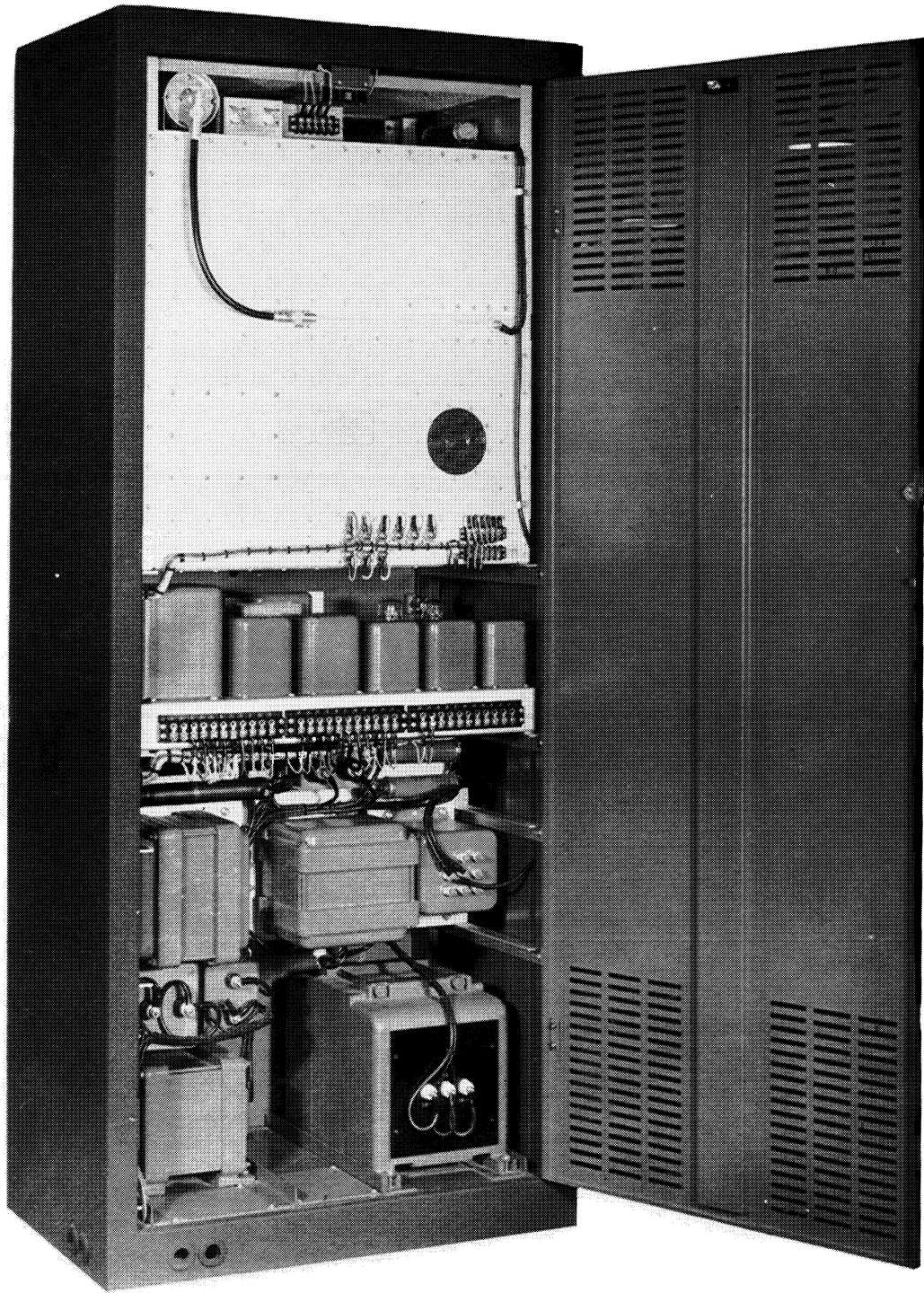


Figure 1-2. Collins KW-1 Transmitter, Rear View

SECTION I

GENERAL DESCRIPTION

1.1. GENERAL DESCRIPTION

The Collins KW-1 amateur transmitter is a vfo controlled, bandswitching, gang tuned, high power phone and cw transmitter. Power amplifier input is 1000 watts on the 80, 40, 20, 15, 11, and 10 meter bands, and 500 watts on the 160 meter band. Other features include TVI reduction, cw receiver muting for a 75A receiver, cw sidetone oscillator, a blower for additional cooling, door interlock switches, fuses, and an overload relay. Direct indication of frequency is provided on the accurately calibrated exciter tuning dial for all bands. Only the scale for the band in use is visible. The stable, hermetically sealed oscillator is followed by suitable buffer and multiplier stages to provide adequate excitation on all bands. The oscillator and multiplier stages are permeability tuned by powdered iron cores. The rf driver stage is tuned by a variable air capacitor. Tuning of the exciter is gauged on one control. When the frequency selector dial is tuned to any frequency, the entire rf section, with the exception of the power amplifier output circuit, is tuned for operation at that frequency. The pi-L output circuit is designed to work into an unbalanced resistive load of 52 ohms with maximum standing wave ratio of 2.5 to 1.

Either crystal or high impedance dynamic microphones may be used. A 600 ohm phone patch is incorporated in the speech amplifier. Increased sideband power without overmodulation is made possible by a speech clipper followed by low-level low-pass and high-level low-pass filters. The push-pull 810 modulator tubes fully modulate the power amplifier when running 1000 watts input.

The KW-1 transmitter is self-contained in a heavy gauge cabinet 28 inches wide, 18 inches deep, and 66-1/2 inches high. All that is needed to place the transmitter in operation is a 52 ohm antenna system, a power source, and a microphone or telegraph key.

The description and function of each part is included in the parts list in section 5 of this book. Section 3, operation, lists the function of all controls. Trimmer adjustment is included in maintenance, section 4.

1.2. GENERAL DESCRIPTION OF RF SECTION

The 70E-14 oscillator unit, shown in figure 6-10, consists of a 6BA6 oscillator, V-001, and a 6BA6 isolation stage, V-002. The oscillator was baked

dry before sealing and should not be opened. If service other than tube replacement is required, it should be removed from the transmitter and returned to the factory as outlined in the maintenance section of this book. High oscillator stability is made possible through regulation of the filament voltage as well as the plate voltage. 0C3/VR105 gas type regulator tubes, V-202 and V-203, control the oscillator plate supply voltage. A 6A10 current regulator tube, V-201, is used in series with the filaments.

The 6BA6 oscillator tube, V-001, the 6BA6 isolation stage, V-002, and the 6AK6 buffer, V-301, always operate on 160 meters. The 6AQ5 first multiplier operates either straight through on 160 meters or as a doubler to 80 meters. The 6AQ5 second multiplier, V-303, is used only as a 40 meter doubler. The 6AQ5 third multiplier doubles to 20 or triples to 15 meters. The 6AQ5 fourth multiplier doubles to 10 meters. Double tuned circuits are used in the frequency multiplier stages to provide the necessary sub-harmonic and higher-harmonic attenuation.

Output from the proper multiplier stage is selected by S-301G to drive the 807 rf driver stage, V-204. This stage is always operated as a straight amplifier to drive the 4-250A power amplifier grids.

V-101 and V-102, the parallel 4-250A power amplifier tubes, operate at inputs up to 1000 watts on all bands except 160 meters. On the 160 meter band the power amplifier is designed for inputs up to 500 watts. A pi section followed by an L section forms the power amplifier output circuit. A high voltage gap is provided to ground from the output of each section. L-117 is a static drain choke. A variable, high vacuum capacitor is used for plate tuning in the pi network output circuit. This network matches between the power amplifier plate impedance and the input impedance of the L matching section. The matching section output impedance is 52 ohms and is designed to feed a standard 52 ohm transmission line such as RG-8/U. Use of the L section in addition to the pi section aids in decreasing the amplitude of the higher harmonics to a very low value. A gear-driven band switch ganged with the band switches of the exciter selects the proper value of inductance in the L and pi sections. While the pi-L network used in this application will match into a wide range of load impedances, for reasons of harmonic attenuation and high voltages the standing-wave ratio must be held to 2-1/2 or 1 or less. Use of RG-8/U coaxial line is recommended for all transmission lines within the building.

Power and control leads from the exciter and power amplifier TVI shield are brought out through low-pass filters, thus reducing radiation of undesired signals from these leads. All controls normally operated for transmission and reception are available on the front panel.

During open key conditions with cw emission, a blocking bias is applied through a wave shaping filter to overcome the excitation voltage and cut off the plate current on buffer V-301 and first multiplier V-302. Plate current to the remaining doubler stages, the rf driver and the power amplifier is reduced to a safe value by fixed bias voltage.

1.3. GENERAL DESCRIPTION OF AUDIO SECTION.

The speech amplifier may be used with either crystal or high-impedance dynamic microphones. Suitable filtering is used at the input of the speech amplifier to keep rf voltages out of the first audio grid. The microphone input, J-401, incorporates provisions for push-to-talk operation. A 600 ohm phone patch input, J-402, is included in the second audio stage input circuit. When used with a remote line, an isolation transformer must be used to separate the dc voltages involved.

A peak clipper consisting of a series diode gate limits the amplitude of the input signal to a predetermined value so as to provide a high average level of modulation without danger of overmodulation. The output of the second audio stage is coupled to the series clipper, V-402, through C-407. R-408 and R-411 serve as clipper input and output resistors. The clipper plates are connected together and tie to the clipping level control, R-410, through series resistor R-409. R-410 acts as a voltage divider between the B+line and ground. The exact point at which clipping will occur is set by R-410 which controls the positive potential applied to the plates of V-402.

Under static conditions a dc voltage is tapped off on voltage divider R-410 and applied through R-409 to both plates of V-402. Current flows from the power supply through voltage divider R-410 and the 330,000 ohm series resistor R-409. The current then divides through the diode sections of V-402 and their 220,000 ohm load resistors, R-408 and R-411. Under static conditions, the dc voltage drop maintains all parts of the clipper circuit at a positive potential above ground. The voltage drop between the plate and cathode of each diode section of V-402 is very small compared to the drop across 330,000 ohm resistor R-409 in series with the plates. Each diode's plate and cathode are therefore maintained at approximately equal potentials as long as there is current flow between them. Clipping does not occur until the peak audio input voltage reaches a value greater than the static voltage at the plates of the diodes.

Assume that voltage divider R-410 has been set to a point that will give 4 volts at the plates of V-402. When the peak audio input voltage is less than 4 volts, both halves of V-402 conduct at all times. As long as V-402 conducts, its resistance is very low compared with the 330,000 ohm resistor, R-409, in

series with the plates. Whenever a voltage change occurs across input resistor R-408, the voltage at all of the tube elements increases or decreases by the same amount as the input voltage change, and the voltage drop across R-409 changes by an equal amount. This action permits all of the tube elements to be at the same dc level above ground. As long as the peak input voltage does not exceed the value of 4 volts to which the plates were assumed to have been set by R-410, V-402 acts merely as a conductor and the output cathode is permitted to faithfully follow all voltage changes at the input cathode.

If under static conditions 4 volts appears at the diode plates, then twice this voltage or 8 volts will appear if one of the diode circuits is opened so as to interrupt its current flow and remove its dc load from the circuit. As long as one of the diode sections continues to conduct, as is always the case with a clipper of this type, the voltage at the diode plates cannot rise above twice the voltage to which it was set by R-410. In our example this voltage cannot rise above 8 volts. If the audio input voltage through C-407 is increased to any peak value between zero and plus 4 volts, the first cathode of V-402 will increase by the same amount to the proper value between 4 and 8 volts. The remaining tube elements will assume the same value as the first cathode. However, the plates of V-402 cannot increase more than 4 volts above their 4 volt static level. When the input voltage through C-407 increases to more than plus 4 volts, the input cathode potential increases to more than 8 volts and the plates and output cathode increase to 8 volts and remain there until the input voltage through C-407 drops below 4 volts.

When the input voltage swings in a negative direction, it will subtract from the 4 volt drop across R-408 and decrease the voltage on the input cathode by an amount equal to the input voltage. The plates and output cathode will follow the voltage level at the input cathode as long as the input voltage does not swing more than 4 volts negative. If the input voltage changes more than 4 volts in a negative direction, the plates will also become negative. The potential at the output cathode will follow the voltage at the input cathode and decrease from its normal value of 4 volts positive until it reaches zero potential. As the input cathode voltage decreases to less than zero, the plates will follow. However, the output cathode, which is connected to ground through R-411, will stop at zero potential as the plate becomes negative. Conduction is impossible under these conditions. The output cathode remains at zero potential until the voltage at the input cathode swings back up to zero.

The voltage across output resistor R-411 follows the voltage variations across input resistor R-408 as long as the input voltage does not swing to a peak value greater than the static voltage at which the plates are set by voltage divider R-410. When the static plate voltage is set at 4 volts, input voltage peaks

greater than 4 volts in either direction cause the output voltage to swing 4 volts in the direction of the peak and remain at that level during the time the peak is above 4 volts. Effective clipping may thus be obtained at any desired level.

The square topped audio waves generated by the clipper are high in harmonic content, but these higher order harmonics are greatly reduced in amplitude by a low-level speech filter consisting of C-409, L-401, and C-410, which attenuates all audio frequencies above 3000 cycles. A 12AU7 phase inverter follows the speech filter and excites a pair of 6B4G tubes used as a driver stage. The driver provides sufficient grid swing for the push-pull 810 tubes in the class B modulator. A second low pass filter, C-503, L-503, and C-504, at the output of the modulation transformer further attenuates the high frequencies caused by the speech clipper and eliminates distortion products generated in the speech amplifier subsequent to the low-level speech filter. The modulator provides sufficient power to fully modulate 1000 watts input to the power amplifier.

When the transmitter is keyed on cw, a sidetone oscillator, V-406, is also keyed to provide an audio sidetone signal that may be used for monitoring purposes as described in paragraph 2.14. Each time the key is pressed, the voltage drop across the cathode of V-406B is made available for receiver muting as described in paragraph 2.13.

1.4. GENERAL DESCRIPTION OF POWER SUPPLIES

The bias and plate power required by the transmitter is furnished by a bias supply, two low voltage supplies, and a high voltage supply. Improved voltage regulation in the high voltage supply has been obtained by connecting a 0.15 mfd capacitor across the input choke. This capacitor resonates with the choke at approximately 120 cycles at no-load conditions. The resulting parallel tuned circuit presents a high impedance to the lowest (120 cycle) ripple frequency and aids in limiting the no-load voltage. In the interest of safety, electrical interlocks are used to disable the 2500 volt and 500 volt supplies when the rear door, upper front panel, or lower front panel is opened. As shown in figures 6-2, 6-3, and 7-2, high voltage shorting switches, S-501 and S-502, are provided to mechanically short circuit the high voltage filter capacitors after the electrical interlocks have operated. This protection is in addition to the usual bleeder resistor. By making the proper connections, as outlined in paragraph 2.6, the transmitter can be operated from a source of either 115 or 230 volts. Overload protection is assured by the use of an overload relay in the power amplifier filament center tap and fuses in the bias and low voltage supplies as well as the ac line. Power for the control circuit is furnished by the bias supply, making operation of the transmitter impossible unless bias voltage is present. The bias supply rectifier is a slow-heating type and acts as

a time delay device to prevent operation of the control circuit and application of plate voltage to the 872A mercury vapor rectifiers before they have reached operating temperature. When 872A tubes are first placed in the transmitter, they must be operated with only the filaments energized for 10 minutes to allow the mercury to condense to the bottom of the tube envelope.

1. 5. KW-1 SPECIFICATIONS

Power Amplifier Input	1000 watts (500 watts on 160 meters)
RF Output Impedance	52 ohms
Maximum Permissible Standing Wave Ratio	2.5 to 1
Amateur Bands Covered	160, 80, 40, 20, 15, 11, 10 meters
Frequency Range	1800-2000 Kc 3500-4000 Kc 7000-7300 Kc 14000-14400 Kc 21000-21450 Kc 26960-29700 Kc
Emission	Voice or cw
Frequency Control	70E-14 Master Oscillator, 1675 to 2050 Kc
Microphone	High impedance crystal or dynamic
Phone Patch Impedance	600 ohms, unbalanced to ground
Weight	600 pounds
Dimensions	66-1/2" high, 28" wide, 18" deep
Circuit Protection	Overload relay, fuses, high voltage arc gaps
Tuning Controls	Bandswitching, frequency selector, PA tuning, PA loading

Other Controls	Filament switch, filament voltage adjustment, plate switch, overload reset switch, overload relay adjustment, send-standby-calibrate switch, emission selector switch, tune-operate switch, meter switch, power amplifier excitation control, modulator bias control, audio driver bias control, clipping level, audio gain control, bandsread adjustment.	
Accessories Required	High impedance microphone, telegraph key, 52 ohm antenna, wiring to power source.	
Power Source	230 v, 3 wire, 50/60 cycle, single phase, grounded neutral; or 115 v, 2 wire 50/60 cycle, single phase.	
Typical Power Demand, CW	Key closed	2000 w
	Key open	800 w
	Calibrate, key closed	660 w
	Standby	500 w
Typical Power Demand, Phone	100% sine wave mod.	3100 w
	No modulation	2280 w
	Calibrate	780 w
	Standby	600 w
Tube Complement:	See following page.	

Tube Complement:

V-001	6BA6	Oscillator
V-002	6BA6	RF Isolation Stage
V-101	4-250A	Power Amplifier
V-102	4-250A	Power Amplifier
V-201	6A10	Filament Regulator
V-202	OC3/VR-105	Voltage Regulator
V-203	OC3/VR-105	Voltage Regulator
V-204	807	RF Driver
V-301	6AK6	RF Buffer
V-302	6AQ5	{ 160 Meter Buffer,
		{ 80 Meter Doubler
V-303	6AQ5	40 Meter Doubler
V-304	6AQ5	{ 20 Meter Doubler,
		{ 15 Meter Tripler
V-305	6AQ5	10 Meter Doubler
V-401	12AX7	Audio Amplifier
V-402	6AL5	Audio Clipper
V-403	12AU7	Phase Inverter
V-404	6B4G	Audio Driver
V-405	6B4G	Audio Driver
V-406	12AU7	Sidetone Oscillator
V-407	5V4G	Bias Rectifier
V-408	5V4G	300 Volt Rectifier
V-409	5V4G	300 Volt Rectifier
V-410	5R4GY	500 Volt Rectifier
V-501	872A	2500 Volt Rectifier
V-502	872A	2500 Volt Rectifier
V-503	810	Modulator
V-504	810	Modulator

SINCE PUBLICATION OF THIS BOOK, THE
6AK6 TUBE USED IN THE RF BUFFER STAGE,
V-301, HAS BEEN REPLACED BY A 6BA6 TUBE.

SECTION II

INSTALLATION

2.1. UNPACKING

Each KW-1 transmitter is partially disassembled before shipment. The parts are packed in a number of wooden crates. To avoid damaging the equipment while opening the crates, use a nail puller rather than a hammer or bar. Remove the packing material and carefully lift the units out of their cases. Search all of the packing material for small packages. Inspect each unit for loose screws or bolts and be certain that all controls such as switches and dials are in good mechanical order. All claims for damages should be filed promptly with the transportation company. If a claim is to be filed, the original packing cases and material should be preserved.

2.2. LOCATION OF THE TRANSMITTER

When deciding on a location for the transmitter, give consideration to its 600 pound weight and to the location of power, antenna, and ground connections. There should be a clearance of approximately four feet behind the transmitter to allow room for installation of units and their removal for servicing. Entrance of external wiring is discussed in paragraph 2.4.

2.3. REPLACEMENT OF UNITS REMOVED FOR SHIPPING.

The rf unit, figure 6-4, the speech amplifier chassis, figure 6-11, and all tubes except those with metal shields, have been removed from the transmitter and packed separately for safety in shipping. The cabling diagram, figure 7-3, and the photographic illustrations will be of assistance when replacing and connecting these components in the transmitter. Wires and cables that were removed from the units to which they connect were tagged before shipment. Should any of these tags become lost, refer to the cabling diagram, figure 7-3, for assistance in identifying the leads.

The following installation procedure is recommended:

- a. Place the transmitter cabinet in its permanent location.
- b. Remove all cords, tape, and wooden blocks that were installed to hold the transmitter parts in place for shipment.
- c. Remove the upper front panel (the one with handles) from the rf unit by pulling straight out on the two handles. Do not remove any screws

on this panel. Slide the rf unit, figure 6-4, into position from the front of the transmitter. Do to the bulk of this unit, two men will be required to lift it into position. Figure 6-2 and 6-3 show the rf unit in place. Line up the tapped holes in the rf unit with the holes in the mounting rails. Insert the proper screws through the rails and into the tapped holes in the rf unit.

d. Replace the two 4-250A power amplifier tubes, V-101 and V-102 and the neutralizing capacitor, C-106, in their proper positions as shown in figure 6-5. Replace the metal strap that connects to the 4-250A plate terminals the top of C-106, and one end of C-105 as shown in figure 6-5. Replace the metal screen in front of the 4-250A tubes and tighten the 18 mounting screws to hold it in position as shown in figure 6-2.

e. The 807, 6A10, and two OC3/VR105 tubes have been removed from the exciter chassis. Refer to figure 6-7 and replace these tubes in their sockets through the inspection hole to the left of the name plate. The 807 plate lead has been tied underneath the power amplifier chassis for safety in shipping. After the tubes have been installed, replace the inspection plate and tighten the 10 screws as shown in figure 6-4.

f. A 5R4GY, two 6B4G and three 5V4G tubes have been removed from the speech amplifier chassis, figure 6-11. Replace these tubes in their sockets. Open the cabinet door wide and slide the speech amplifier chassis, figure 6-11, into position from the rear of the cabinet. Figures 6-2 and 6-3 show the chassis in place. Position the chassis on its mounting rails so the holes in the rails line up with the holes in the lower lip of the chassis. Insert the proper bolts up through the mounting rails and the chassis lip. Secure the bolts on the inside of the chassis with the nuts provided for this purpose.

g. Install two 872A rectifier tubes and two 810 modulator tubes behind the lower front panel as shown in figure 6-2.

h. Refer to the illustrations as well as to the tags on the cables in order to make all connections between units. There are four connections to be made to E-110 at the top of the rf unit as shown in figure 6-3. The long black wire taped in the rear of the rf unit should be run down the side of the cabinet between the cabinet and the mounting rails. Connect the end of this wire to terminal 7 on L-503 as shown in figure 6-3. On early models of the KW-1 it will be necessary to connect two wires to interlock S-602. This interlock is shown in figure 6-2. The two wires originate under the speech amplifier chassis. Slide the tinned end of one wire into each of the two holes at the rear of S-602. Tighten the two screws at the side of the interlock to hold the wires in place. Similar interlocks are used on the rear door and the upper front panel.

i. Shorting bar S-502 at the rear of the transmitter cabinet, figure 6-3, has been removed for shipment. Shorting bar S-501, figure 6-2, has not been removed and should be referred to when installing S-502. The free end of each bar should rest against the secondary terminals of the modulation transformer. If a shorting bar rests on the cabinet floor, loosen the single bolt holding the bar so that it may be moved to its proper position. Tighten the mounting bolt. When either the rear door or lower front panel is opened, the electrical door interlocks operate and turn off the 500 volt and 2500 volt power supplies as shown in figure 7-2. A shorting bar then falls against the modulation transformer secondary terminals and shorts the 2500 volt wiring to ground.

2.4. EXTERNAL CONNECTIONS

The external connections described below may be brought into the transmitter through any of the large grommets in the cabinet base or through a hole in the floor beneath the transmitter. The two access plates illustrated in figure 6-3 may be removed to provide admittance to the cabinet base. All external wiring is connected to the transmitter on or above the speech amplifier chassis. Two wiring channels are provided to conduct the wiring from the cabinet base to the vicinity of this chassis. The wiring channels, one of which may be seen in figure 1-2, are located between the chassis supports and the cabinet wall at either side of the rear door. All wiring that is brought into the cabinet base should be routed upward through these channels. A rubber grommet is provided in the cabinet wall near the microphone and phone patch connectors. Two large grommets are located in the cabinet roof directly above the coaxial antenna terminals. Microphone and antenna connections may be brought in through the grommets or through the cabinet base.

2.5. GROUND CONNECTIONS

A ground connection must be provided on the KW-1 transmitter. Bring a number 12 or larger wire into the transmitter from a good ground such as a cold water pipe. Run the wire up the right-hand wiring channel, as viewed from the rear, and connect it to the stud just to the left of terminal board E-202 on the back of the rf unit. This stud is identified in figure 6-3.

2.6. POWER INPUT CONNECTIONS

A 50/60 cycle 115 volt two-wire system or a 50/60 cycle 115/230 volt three-wire single-phase system may be used to power the KW-1. In most installations, regulation of the input voltage will be better when a 115/230 volt source is used. All KW-1 transmitters are wired at the factory for 230 volt operation. The transmitter draws 3100 watts at 100% sine wave modulation.

The primary connections should go from the service outlet directly to the transmitter. Bring the wiring into the cabinet base and up through the wiring channel near terminal board E-401, the terminal board to the left on the rear of the speech amplifier chassis. Make sure plate switch S-401 is in the off position before connecting power to the transmitter.

For 230 volt operation use three number 8 wires. Connect them to terminal board E-401 as shown in figures 7-2 and 7-3. Connect one hot wire to terminal 1 and the other hot wire to terminal 2. The neutral wire goes to terminal 7. The high voltage power transformer, T-503, must be connected for 230 volt operation as shown in figure 7-3. Connect the orange wire to terminal 1, the white-orange wire to terminal 4, the white wire that comes out the end of the cable to terminal 3, and the two white wires that come out the side of the cable to terminal 2. These connections are for 230 volt operation.

For 115 volt operation, use two number 6 wires. Connect them to terminal board E-401 as shown in figures 7-2 and 7-3. Terminals 1 and 2 on E-401 connect together and to the hot wire. Connect the neutral wire to terminal 7. Connect the high voltage power transformer, T-503, for 115 volt operation as shown in figure 7-3. When shipped from the factory the wires to T-503 are tagged for 230 volt operation. Connect the orange wire to terminal 1, the white-orange wire to terminal 3, the white wire that comes out the end of the cable to terminal 4, and the two remaining white wires to terminal 2. These connections are for 115 volt operation.

2.7. ANTENNA CONNECTIONS

Antenna connector E-108 is located on a bracket at the top of the rf unit as shown in figure 6-3. A right angle mating plug for E-108 is included with the transmitter. An additional plug is included for the other end of the cable. Bring a piece of RG-8/U coaxial cable through a grommet on the cabinet roof or in through the base of the cabinet and up the left-hand wiring channel as seen from the rear. Connect the coaxial cable to the E-108 mating plug. Use of RG-8/U coaxial cable is recommended for all transmission lines within the building.

The pi-L output circuit is designed to work into a 52 ohm resistive load. The standing wave ratio must be held to a maximum of 2.5 to 1. Do not attempt to use any antenna or feed system that will result in a standing wave ratio larger than 2.5 to 1. The transmission line must incorporate some method of line balancing in order to match between the unbalanced pi-L output circuit and a balanced antenna system. Section 7 of this book shows some antennas that may be used with this transmitter. The American Radio Relay League Antenna Book contains information on matching coaxial cable feed-lines to balanced antenna systems. The tuned antenna couplers shown in the ARRL Antenna Book

may also be used for coupling to a feed line or antenna; however a method of checking standing wave ratios must be available.

2.8. RECEIVER ANTENNA CONNECTIONS

Receiver antenna connector E-107 is located on a bracket at the top of the rf unit as shown in figure 6-3. A right angle mating plug for E-107 is included with the transmitter. An additional plug is included for the other end of the cable. Bring a piece of RG-8/U or RG-58/U coaxial cable in through the cabinet roof or through the base of the cabinet and up the left-hand wiring channel, as seen from the rear. Connect the coaxial cable to the E-107 mating plug. The other end of the coaxial cable goes to the antenna connections on the receiver. The antenna changeover relay connects the transmitting antenna to the receiver when send-standby-calibrate switch S-204 is in the standby or calibrate positions and to the transmitter when this switch is in the send position.

2.9. MICROPHONE AND PUSH-TO-TALK CONNECTIONS

The microphone and push-to-talk connector, J-401, is located on top of the speech amplifier chassis as shown in figure 6-11. Terminal 1 of J-401 is the audio input. Terminal 2 is the push-to-talk line. If a push-to-talk switch is not available on the microphone, terminal 2 may be disregarded and send-standby-calibrate switch S-204 used to control the transmitter. **TERMINAL 1 IS AUDIO; TERMINAL 2 IS PUSH TO TALK. IF THESE TERMINALS ARE REVERSED WHEN ASSEMBLING THE MICROPHONE PLUG, THE MICROPHONE MAY BE DESTROYED.** The cable that connects to J-401 can be brought into the cabinet through the large rubber grommet near the speech amplifier chassis or through the cabinet base. A mating plug for J-401 is included with the transmitter. Either crystal or high impedance dynamic microphones may be used.

2.10. PHONE PATCH CONNECTIONS.

Phone patch connector J-402 is located on top of the speech amplifier chassis as shown in figure 6-11. Terminal 1 of J-402 is the audio input. Terminal 2 is ground. Bring a twisted pair into the transmitter as outlined in paragraph 2.4. A mating plug for J-402 is included with the transmitter. A 600 ohm load is presented by the phone patch circuit. In order to isolate the dc voltages involved, a 500 ohm or 600 ohm 1 to 1 ratio line to line transformer such as the Stancor A-4407 must be connected between the remote line and phone patch connector J-402. Connect the primary of the transformer across the remote line. Connect the secondary between terminals 1 and 2 of J-402.

2. 11. KEY CONNECTIONS.

Terminals 25 and 26 of terminal board E-403 are used for key connection. This terminal board may be seen in figures 6-3. Bring a twisted pair into the cabinet base and up through a wiring channel. Terminal 25 is ground and should be connected to the base of the key. In order to prevent higher than normal grid currents in the first multiplier and rf buffer stages, do not close the key when operating on phone. The slight spark that occurs at the key may cause clicks in receivers within a few feet of the operating position. This may be prevented by connecting a 2.5 millihenry rf choke in each lead at the key terminals. The rf chokes are used only to prevent local radiation from the key leads and will have no effect on the transmitted signal. Wave shaping of the keyed signals is controlled by keying circuits within the transmitter and will not be effected by the rf chokes.

2. 12. RECEIVER DISABLING CONNECTIONS

The receiver disabling connections, terminals 27 and 28 on terminal board E-403, are connected only to a pair of contacts on the send-receive relay, K-403. When K-403 is in the receive position, these contacts are closed and terminals 27 and 28 on terminal board E-403 are shorted together. Most receivers have a pair of terminals at the rear connected by a jumper that may be opened to disable the receiver. If it is desired to automatically disable the receiver whenever the transmitter carrier is turned on, remove the jumper from the rear of the receiver, bring a twisted pair from the receiver terminals into the transmitter, and connect to terminals 27 and 28 on E-403. Do not attempt to break currents larger than four amperes with this relay.

2. 13. RECEIVER MUTING CONNECTIONS

Collins 75A receivers have provisions for muting the receiver audio system whenever the transmitter key is closed. A small positive voltage is required from the transmitter to silence the receiver. In the KW-1 transmitter this voltage is available between terminals 29 and 30 on terminal board E-403. Terminal 30 is ground. Terminal 29 is at zero potential when the key is open, and approximately 20 volts above ground when the key is closed. If receiver muting is desired, bring a twisted pair from the rear of the receiver into the transmitter and connect to terminals 29 and 30, being careful to observe that terminal 30 is ground.

2. 14. SIDETONE OUTPUT

A sidetone oscillator, V-406, is included in the KW-1 transmitter to provide a keyed audio signal for cw monitoring. Sidetone output connections

are provided on terminal board E-403 located on the rear of the speech amplifier chassis. When the sidetone output is to be used with a Collins 75A receiver, connect terminal 31 (ground) on terminal board E-403 to the ground terminal on the receiver audio terminal strip. Connect terminal 32 on terminal board E-403 to the 500 ohm terminal on the receiver's audio terminal strip. A twisted pair for making these connections may be brought into the transmitter base and through a wiring channel to terminal board E-403. Sidetone output will now be heard from the receiver speaker or earphones whenever the transmitter is keyed. Muting or disabling the receiver during transmitting periods will not prevent the side-tone from being heard.

If it is desired to match the sidetone output into a high impedance source such as the output transformer associated with a small speaker, connect terminals 31 and 32 together. The sidetone output may then be taken from between terminals 32 and 33.

SECTION III

OPERATION

Capital letters are used in this section of the book to indicate lettering that appears on the transmitter panels or chassis.

3.1. FILAMENT SWITCH. See figures 6-1 and 7-2.

As shown in the primary control circuit diagram, figure 7-2, operation of FILAMENT switch S-404 energizes the filament pilot light, the dial lights, all filaments except the modulator tubes (the modulator filaments will be energized if AM-CW switch S-203 is in the AM position), the blower, bias supply, 300 volt supply, and FILAMENT PRIMARY VOLTAGE meter, M-101. The 6A10 filament regulator tube, V-206, holds down the starting current through the filaments of the two 6BA6 tubes in the 70E-14 oscillator unit. The oscillator will begin operation about 40 seconds after the FILAMENT switch is turned on.

3.2. FILAMENT VOLTAGE ADJUSTMENT. See figures 6-1 and 7-2.

The proper tap on auto transformer T-405 can be selected by FILAMENT VOLTAGE control S-403 to apply the correct voltage to the filaments of the power amplifier, high voltage rectifier, exciter, and oscillator tubes. FILAMENT PRIMARY VOLTAGE meter M-101 is connected across the auto transformer output. Whenever the voltage read by this meter is adjusted to 120 volts $\pm 5\%$, the correct filament voltage will be applied. For convenience in wiring, blower B-101 and cw-phone relay K-501 are operated from the auto transformer. When FILAMENT VOLTAGE switch S-403 is in position 3, the auto transformer output voltage is the same as the input voltage. FILAMENT PRIMARY VOLTAGE meter M-101 then reads the line voltage.

3.3. TIME DELAY CIRCUIT.

When the transmitter is first placed in operation or when new 872A mercury vapor rectifier tubes are installed, the filaments should be operated for 10 minutes to condense the mercury to the bottom of the tubes before application of plate voltage. After this initial period, the proper time delay is automatically provided by the slow heating 5V4G rectifier tube used in the bias supply. Send-receive relay K-403 is inoperative in the absence of bias voltage. Plate power cannot be applied until the bias rectifier tube reaches operating temperature and makes bias voltage available for operation of the relay. This method of time delay has the additional feature that the delay period is very short following a momentary power interruption.

3.4. PLATE SWITCH. See figures 6-1 and 7-2.

PLATE SWITCH S-401, located on the transmitter front panel, is in series with the control circuit consisting of the door interlocks, overload relay contacts, and a parallel combination consisting of the microphone push-to-talk switch and a set of contacts that close when the SEND-STANDBY-CALIBRATE switch is in the SEND position. When the PLATE switch and the switches and interlocks in series with it are closed, power is applied to the coil of send-receive relay K-403. In the send (operated) position of send-receive relay K-403, a potential of 300 volts is applied to the exciter, plate contactor K-402 and antenna relay K-101 are closed, the 500 volt power supply is energized, and the receiver disabling contacts are opened. Contacts on the SEND-STANDBY-CALIBRATE switch are connected in parallel with certain send-receive relay contacts in order to apply 300 volts to the exciter and energize the 500 volt power supply for calibration purposes.

3.5. OVERLOAD RESET SWITCH. See figure 6-1 and 7-2.

OVERLOAD RESET S-405 is a momentary-contact switch located on the front panel. When closed, it energizes the reset coil on overload relay K-401 and, if the overload no longer exists, returns the relay to the normal operating position.

3.6. OVERLOAD RELAY ADJUSTMENT. See figures 6-2 and 7-2.

Overload adjustment R-433 is a screwdriver adjustment on overload relay K-401. This relay is located on the speech amplifier chassis behind the lower front panel. Turning the control clockwise will increase the amount of power amplifier cathode current required to open the overload relay. The relay has been set at the factory to open at 600 milliamperes.

3.7. SEND-STANDBY-CALIBRATE SWITCH. See figures 6-1 and 7-2.

The three position SEND-STANDBY-CALIBRATE switch, S-204, is located on the front panel. In the send position a pair of contacts short the microphone push-to-talk switch and another pair of contacts connect the side-tone plate circuit to the 300 volt line, provided that EMISSION switch S-203 is in the CW position. In the CALIBRATE position the exciter 300 volt circuit is completed and the 500 volt power supply is energized. In the STANDBY position all switch contacts are open.

3.8. CW-AM EMISSION SELECTOR SWITCH. See figures 6-1 and 7-2.

All circuit modifications required to change from cw to phone emission are performed by EMISSION switch S-203 located on the front panel. Section

S-203A is not used. Section S-203B connects the keying line to ground through a 10,000 ohm resistor for phone operation. S-203C energizes phone-cw relay K-501 for phone operation. This relay shorts the modulation transformer secondary for cw operation. In the phone (energized) position of K-501 the short is removed from the modulation transformer secondary and the modulator tube filaments are lighted. Switch section S-203D applies 300 volts to the sidetone oscillator in the CW position, provided that SEND-STANDBY-CALIBRATE switch S-204 is in the SEND position. Switch section S-203E connects a 47 ohm resistor in parallel with power amplifier audio screen choke L-201 in the CW position. In order to prevent higher than normal grid currents in the first multiplier and rf buffer stages, do not close the key while EMISSION switch S-203 is in the AM position.

3.9. FREQUENCY SELECTOR CONTROL. See figures 6-1 and 7-3.

The frequency selector control tunes the 70E-14 oscillator unit, all doubler stages, and the 807 rf driver stage. Only the band in use is visible on the main frequency indicating dial. A red pointer on the band-spread dial, located just below the main dial, subdivides the large divisions of the main frequency indicating dial by means of a mechanical bandspread arrangement. If any difficulty is encountered in combining the two dial readings, start at the low end of an amateur band (with the transmitter turned off) and tune slowly up the band. Notice the correlation between the two dials. Stop at the 50 or 100 kilocycle points and read the two dials, noticing how the bandspread dial interpolates between the divisions of the main tuning dial. The bandspread calibration may be adjusted as outlined in the maintenance section of this book.

3.10. TUNE-OPERATE SWITCH. See figures 6-1 and 7-2.

TUNE-OPERATE switch S-202 on the front panel connects the 500 volt line to power amplifier screen resistor R-102 in the OPERATE position. In the TUNE position 20,000 ohm resistor R-220 and 5,000 ohm resistor R-219 are connected in series to form a bleeder resistor. The power amplifier screen circuit connects to the junction of the two resistors. Under these conditions the screen voltage is reduced to about 50 volts under key-down conditions and the power amplifier plate current is limited to a safe value.

3.11. METER SWITCH. See figures 6-1 and 7-3.

METER SWITCH S-201 and 0-1 milliampere CURRENT-VOLTAGE METER M-102 may be used to check any one of the following circuits:

<u>Switch Position</u>	<u>Full Scale Meter Reading</u>	<u>Normal Reading</u>
300 V	500 V	280 V
500 V	1000 V	540 V
807 Grid	5 Ma	2 to 5 Ma
807 Plate	100 Ma	20 to 80 Ma
PA Grid	50 Ma	18 to 22 Ma

3.12. PA EXCITATION CONTROL. See figures 6-1 and 7-3.

Power amplifier excitation may be changed by varying the screen voltage applied to the 807 rf driver stage, V-204. PA EXCITATION control R-226 on the transmitter front panel acts as a voltage divider to increase or decrease the rf driver screen voltage and thereby change the rf power applied to the power amplifier grid circuit. Normal power amplifier grid current is 22 milliamperes. This may be reduced to 18 milliamperes for CW operation.

3.13. MODULATOR BIAS CONTROL. See figures 6-2 and 7-3.

MODULATOR BIAS control R-427 located on the speech amplifier chassis is one of four series resistors used as the bias supply bleeder. This screwdriver adjustment has been set at the factory to bias the modulator grids to approximately -65 volts. The bias is adjusted to give 50 milliamperes modulator static plate current.

3.14. AUDIO DRIVER BIAS CONTROL. See figures 6-2 and 7-3.

AUDIO DRIVER BIAS CONTROL R-428 located on the speech amplifier chassis is one of four series resistors used as the bias supply bleeder. This screwdriver adjustment has been set at the factory to bias the audio driver grids to -60 volts.

3.15. CLIPPING LEVEL. See figures 6-2 and 7-3.

Speech clipping level is adjusted by CLIPPING LEVEL control R-410 on the speech amplifier chassis. This resistor controls the positive voltage applied to the plates of V-402. The screwdriver CLIPPING LEVEL control is adjusted at the factory to clip at 100% voice modulation. If this control is to be adjusted, an oscilloscope must be available for checking modulation percentage. Clipping level is controlled by CLIPPING LEVEL CONTROL R-410 but the amount of clipping is controlled by the AUDIO GAIN control as outlined in paragraph 3.16. CLIPPING LEVEL control R-410 may be adjusted as

follows: Modulate the transmitter with a sine wave of about 1000 cycles and observe the modulation percentage on an oscilloscope. Vary the AUDIO GAIN control until the oscilloscope indicates approximately 90% sine wave modulation. CLIPPING LEVEL control R-410 should then be adjusted until a barely noticeable flattening of the peaks occurs. The CLIPPING LEVEL is now set to clip at 90% sine wave modulation. This setting will cause clipping at approximately 100% modulation when speech is used.

3. 16. AUDIO GAIN CONTROL. See figure 6-1 and 7-3.

AUDIO GAIN control R-404 controls the amount of grid swing applied to the second audio amplifier, V-401B. R-404 will control the modulation percentage up to the point where clipping occurs. When the audio level is high enough to cause clipping, an increase in the AUDIO GAIN control setting cannot increase the modulation percentage but will increase the amount of clipping and the sideband power. Since heavy clipping results in less desirable quality, even though the intelligibility may be better for working through interference, the signal should be monitored and the AUDIO GAIN control adjusted to the point which produces a balance between more audio power and good quality.

3. 17. BAND SWITCH. See figures 6-1 and 7. 3.

Only the front panel BAND SWITCH need be operated to change bands. Switch sections S-301A through S-301F connect the required multipliers into the circuit. S-301G selects output from the proper multiplier stage to drive the 807 stage, V-204. Switch section S-301H parallels a portion of the 807 screen voltage circuit with resistors to reduce the input and output of this stage on all bands except 15 and 10 meters. Switch section S-102A parallels the 807 plate tuning capacitor, C-126B, with capacitor C-126A on the 80 and 160 meter bands. S-102B selects the proper 807 plate coil and padding capacitor for the band in use. The proper L section inductance is selected by switch section S-101A while S-101B selects the required pi section inductance and switches in the required number of antenna loading capacitor sections.

3. 18. POWER AMPLIFIER PLATE TUNING AND ANTENNA LOADING CONTROLS. See figures 6-1 and 7-4.

The power amplifier is tuned to resonance by POWER AMPLIFIER PLATE TUNING control C-103. There are 1400 dial divisions on this control. Antenna loading is increased by increasing the dial reading of the ANTENNA LOADING CONTROL, thereby decreasing the capacitance of antenna loading capacitor C-101/C-102. With a pi-L output network of the type used in the KW-1 transmitter, any adjustment of the POWER AMPLIFIER LOADING CONTROL will detune the output network and cause the power amplifier

plate current to soar. Care must be exercised to keep the power amplifier tuned to resonance whenever the ANTENNA LOADING control is adjusted. If any extensive tuning is to be done, turn the TUNE-OPERATE switch to the TUNE position. This does not reduce the power amplifier plate voltage but reduces the screen voltage and limits the plate current to a safe value. If the power amplifier is loaded to approximately 120 milliamperes while the TUNE-OPERATE switch is in the TUNE position, the power amplifier plate current will be approximately 400 milliamperes when the TUNE-OPERATE switch is turned to the OPERATE position. The ANTENNA LOADING control should be set at half scale when the tuning-loading operation is started. Do not load the power amplifier to more than 200 milliamperes on the 160 meter band.

High voltage gaps are provided between the output network and ground. An arc-over across one of these gaps probably indicates that the antenna system is not presenting the proper load to the transmitter. To prevent arc-over, the standing wave ratio must be held to less than 2.5 to 1. Do not increase the settings of the arc gaps above the values recommended in the maintenance section of this book.

3.19. STARTING THE EQUIPMENT. See figures 6-1 and 7-2.

- a. Turn PLATE SWITCH S-401 to OFF.
- b. Close the transmitter rear door and front panels.
- c. Turn TUNE-OPERATE switch S-202 to the TUNE position.
- d. Turn on FILAMENT switch S-404.
- e. Turn FILAMENT VOLTAGE switch S-403 to the position that causes FILAMENT PRIMARY VOLTAGE meter M-101 to read 120 volts $\pm 5\%$.
- f. Operate the BAND SWITCH to the desired band.
- g. Operate the frequency selector to the desired frequency.
- h. Select the desired type of emission with EMISSION switch S-203.
- i. Operate METER SWITCH S-201 to the PA GRID position, causing CURRENT OR VOLTAGE meter M-102 to read power amplifier grid current.
- j. Operate SEND-STANDBY-CALIBRATE switch S-204 to the CALIBRATE position.

k. Adjust PA EXCITATION control R-226 to give 22 milliamperes grid current on M-102.

l. Operate SEND-STANDBY-CALIBRATE switch S-204 to the SEND position.

m. Turn PLATE SWITCH S-401 ON.

n. Operate the POWER AMPLIFIER PLATE TUNING and ANTENNA LOADING controls as outlined in paragraph 3.18 to give approximately 120 milliamperes power amplifier plate current at resonance, (60 MA on 160).

o. Turn TUNE-OPERATE switch S-202 to the OPERATE position.

p. Adjust power amplifier plate current to 400 milliamperes (200 MA for 160 meters) and grid current to 22 milliamperes.

q. The transmitter is now tuned up and operating at full power. If a microphone push-to-talk switch is available, it may be used to energize the transmitter when the PLATE switch is ON and the SEND-STANDBY-CALIBRATE switch is in the STANDBY position. When the microphone push-to-talk switch is not used, the transmitter will normally be controlled by SEND-STANDBY-CALIBRATE switch S-204.

3.20 TELEVISION INTERFERENCE

The design of the KW-1 transmitter is such that spurious radiation has been reduced to a very low value, particularly on television frequencies.

The rf unit is completely shielded in a metal box inside the main cabinet. All circuits passing through this shield are well filtered for attenuation at television frequencies. These features minimize direct radiation from the cabinet and external leads.

Spurious radiation from the antenna is attenuated by careful design of the rf circuits. There are always three or more tuned circuits at the carrier frequency. The variable vacuum capacitor used for power amplifier plate tuning provides a low-impedance circuit to ground at television frequencies.

In the power amplifier the use of a pi section followed by a L section is very effective in reducing harmonics of the carrier frequency. To this is added the attenuation of the 35C-2 low pass filter. Use of a coaxial

transmission line from the transmitter to the transmitting antenna is recommended.

However, when a television receiver is operated within a few hundred feet of a powerful transmitter, even though the transmitter does not radiate an interfering signal on the TV channel, it is to be expected that interference may be caused by lack of enough selectivity in the television receiver input circuit.

In such cases, improve the receiver selectivity by installing a high pass filter at the receiver antenna terminals. If a booster is used at the television receiver, install the high pass filter at the antenna input terminals of the booster and use very short leads between the booster output and the television receiver input.

The following publications contain information on the elimination of television interference at the receiver: *The Radio Amateur's Handbook*, published by The American Radio Relay League, West Hartford, Connecticut; and *Television Interference*, published by Remington Rand Laboratory of Advanced Research, South Norwalk, Connecticut.

SECTION 4

MAINTENANCE

4.1 ROUTINE MAINTENANCE

Periodic inspections should be made to determine that all transmitter parts, both mechanical and electrical, are operating properly. The greatest enemies of electronic equipment are corrosion and dirt. High voltage circuits accumulate dust rapidly. Remove foreign material with a soft brush or a dry oil-free jet of air. Moving parts, such as tap switches, should be kept clean to prevent excessive wear. A burnishing tool (never emery cloth or sandpaper) may be used to clean relay contacts.

4.2 LUBRICATION

The blower should be lightly oiled every six months with SAE 20 oil. Gears and bearing surfaces will also require an occasional light oiling. The bandswitch rack-and-pinion gear, figure 6-6, should be lubricated every six months with a mixture of powdered graphite and SAE 20 oil. Use only enough oil to make the oil-graphite mixture a liquid. Protect the exciter chassis with a cloth while applying the lubricant. Lubricants used in the vicinity of electrical equipment should be applied carefully and sparingly. It is better to apply too little lubricant than too much.

4.3 VACUUM TUBES

The best way to check tubes in equipment of this type is to replace them with tubes that are known to be good and to note any change in performance. Tubes should not be replaced when there is a possibility that a fault in the transmitter may cause the new tubes to be damaged. A complete list of tube types is included in the General Description section of this book.

4.4 FUSES

All fuses are located on the lower control panel or behind the removable lower front panel as shown in figures 6-1 and 6-2. The Parts List section of this book identifies and describes the fuses. Operation of the overload reset switch and overload relay adjustment are described in the Operation section.

4.5 70E-14 OSCILLATOR UNIT

Maintenance of the oscillator unit should be limited to changing tubes. If any difficulty arises within the oscillator that cannot be corrected by replacing the two 6BA6 tubes, the oscillator should be removed from the transmitter and returned to the Collins Radio Company, Cedar Rapids, Iowa, for repair.

To remove the oscillator from the transmitter, take off the 10-1/2" x 23-1/2" aluminum plate that covers the lower half of the rf unit as shown in figure 6-4. Hold the plate tightly while removing it, as the additional weight of the blower causes it to be quite heavy. When the plate is loose, reach behind it and remove the blower plug from J-202. Be sure to replace this plug when the transmitter is reassembled.

Carefully unsolder the oscillator's electrical connections at the terminal strip beside the oscillator. Support the oscillator and remove the four screws holding the oscillator bracket to the panel. Three of these screws are visible in figure 6-7. The oscillator is now mechanically free. Remove it by pulling it straight back. The shaft coupling slides apart as the oscillator is moved away from the panel. After the 70E-14 is clear of the transmitter, remove the mounting bracket and shaft coupling from the oscillator. Return only the oscillator to the factory.

When reinstalling the oscillator in the transmitter, care must be used to make the dial reading coincide with the oscillator frequency. The following procedure is recommended:

- a. Use a number 6 Bristo wrench to loosen the set screw on the shaft coupler connecting to the main tuning dial.
- b. Reassemble the oscillator in its proper position, using a mirror to make sure that the shaft coupler meshes correctly.
- c. Make all electrical connections. The rf output wire is a small coaxial cable. Filaments are color coded green and white. The plate-voltage lead is red and white.
- d. Move the pointer on the bandsread dial to the vertical position by means of the slotted screwdriver adjustment located to the left of the frequency selector knob and above the meter switch.
- e. Remove 6AQ5 buffer tube V-302 from its socket to avoid applying excitation to the ganged exciter stages while they are not tuned to the oscillator frequency.

- f. Couple the oscillator output to a receiver.
- g. Remove fuse F-403. This fuse is located on the lower control panel. Turn the plate switch off, the filament switch on, and the send-standby-calibrate switch to the calibrate position. If the 500 volt primary fuse, F-403, was removed, only the 300 volt power supply will be energized.
- h. Allow the oscillator to warm up for about a minute, then tune the receiver in the vicinity of the 160 meter band to find the approximate oscillator frequency.
- i. Bring the oscillator frequency to 1800 kilocycles, as indicated on the receiver dial, by carefully turning the oscillator tuning shaft clockwise to increase the frequency or counter clockwise to decrease the frequency.
- j. Turn the transmitter bandspread dial to 1800 kilocycles, while maintaining the oscillator frequency at 1800 kilocycles.
- k. Replace the 6AQ5 tube, V-302, in its socket.
- l. Beat the oscillator fundamental frequency against the 1800 kilocycle harmonic of a 100 kilocycle crystal calibrator, or other accurate frequency standard, that has been checked against VWV. With the receiver beat frequency oscillator turned off, carefully rotate the oscillator tuning shaft until the oscillator is zero beat with the frequency standard at 1800 kilocycles. If tuning the receiver effects the beat frequency of the two signals, an image frequency of one of the signals is involved. A check must be made to find and correct the frequency error.
- m. While maintaining the two signals at zero beat, use a mirror and a number 6 Bristo wrench to tighten the shaft coupling. The oscillator frequency is now set to correspond to the dial reading.
- n. If desired, an additional adjustment may be made to the bandspread dial as outlined below in paragraph 4. 6.

4. 6 BANDSPREAD DIAL ADJUSTMENT

If a slight discrepancy exists between the oscillator bandspread dial and the true oscillator frequency, it may be corrected by using the bandspread adjustment to move the bandspread dial pointer to the right or left. Beat the oscillator's fundamental frequency or one of its harmonics against any accurate frequency standard such as WWV. The bandspread dial adjustment is located to the left of the frequency selector dial and above the meter switch. Turn

this slotted shaft carefully to the right or left with a small screwdriver until the bandsread pointer indicates the true oscillator frequency.

4.7 HIGH VOLTAGE ARC GAP ADJUSTMENT

The arc gaps protect the circuits associated with them. Under no circumstances should they be increased beyond the following maximum settings. Modulation transformer secondary (protects transformer) .050 inches. Pi section output (protects C-101/C-102) .040 inches. L section output (protects coax connectors) .015 inches. An automobile feeler gauge may be used to adjust the gaps to the proper settings.

If either of the output network gaps arc over, it is an almost certain indication that the transmitter is not working into the proper impedance.

4.8 TYPICAL CONTROL SETTINGS

The following control readings were taken on a KW-1 transmitter at 1000 watts input (500 watts on 160 meters) operating into a 52 ohm resistive load:

Frequency Selector Reading (Megacycles)	Power Amplifier Plate Tuning	Antenna Loading
1.8	4.84	62
2.0	8.26	75
3.7	6.42	77
4.0	9.95	90
7.0	9.23	77
7.3	9.80	83
14.0	13.13	83
14.4	13.32	87
21.0	13.22	78
21.45	13.38	82
26.95	12.50	76
29.7	13.30	89

4.9 ALIGNMENT OF EXCITER STAGES

To align the exciter stages the rf unit, figure 6-4, must be operated outside the transmitter cabinet. Under these conditions, the plate switch must remain in the off position to prevent accidental application of the high voltage.

Operate the transmitter with the send-standby-calibrate switch in the calibrate position, the meter switch in the 807 grid position, and the tune switch in the tune position. Remove the rear inspection plate. Adjust the multiplier stages for maximum 807 grid current as indicated in the chart. **USE AN INSULATED SCREWDRIVER OR TUNING WAND.**

EXCITER TUNING CHART

BAND	FREQUENCY	COMPONENTS TO BE TUNED
160 meter	1.7 mc	L-301
	2.0	C-308
80	3.4	L-302
	4.0	C-311, C-313
40	6.8	L-303, L-304
	7.5	C-316, C-319, C-321
20	13.6	L-305
	15.0	C-324, C-328
15	20.4	L-306
10-11	27.2	L-307
	29.8	C-335

When all of the components have been tuned, make a check over each amateur hand. The 807 grid current should not show any abrupt changes or unstable conditions.

4.10 After the multipliers have been tuned for proper operation, set the meter switch to the PA grid position. Remove the two inspection plates on the side of the rf unit, figure 6-4, and adjust the driver plate tanks for maximum power amplifier grid current as indicated in the following chart. The capacitor adjustments and many surrounding objects including the 807 plate tuning capacitor, C-126, and its mounting plate are 500 volts above ground. **USE AN INSULATED SCREWDRIVER OR TUNING WAND.**

Operate the transmitter with the send-standby-calibrate switch in the calibrate position, the meter switch in the 807 grid position, and the tune-operate switch in the tune position. Remove the rear inspection plate. Adjust the multiplier stages for maximum 807 grid current as indicated in the following chart. **USE AN INSULATED SCREWDRIVER OR TUNING WAND.**

EXCITER TUNING CHART

BAND	FREQUENCY	COMPONENTS TO BE TUNED
160 meter	1.7 mc	L-301
	2.0	C-308
80	3.4	L-302
	4.0	C-311, C-313
40	6.8	L-303, L-304
	7.5	C-316, C-319, C-321
20	13.6	L-305
	15.0	C-324, C-328
15	20.4	L-306
10-11	27.2	L-307
	29.8	C-335

When all of the components have been tuned, make a check over each amateur hand. The 807 grid current should not show any abrupt changes or unstable conditions.

4.10 After the multipliers have been tuned for proper operation, set the meter switch to the PA grid position. Remove the two inspection plates on the side of the rf unit, figure 6-4, and adjust the driver plate tanks for maximum power amplifier grid current as indicated in the following chart. The capacitor adjustments and many surrounding objects including the 807 plate tuning capacitor, C-126, and its mounting plate are 500 volts above ground. **USE AN INSULATED SCREWDRIVER OR TUNING WAND.**

DRIVER TUNING CHART

BAND	FREQUENCY	COMPONENTS TO BE TUNED
160	1.8	L-11
	2.025	C-125
80	3.5	L-116
	4.05	C-124
40	7.0	L-115
	7.3	C-123
20	14.0	L-114
	14.4	C-122
15	21.0	L-113
	21.45	C-121
10-11	27.2	L-112

Check the power amplifier grid current across each band for abrupt changes or unstable operation. The grid current may be slightly higher at one end of the band but variations should be gradual.

4.11 TYPICAL TEST VOLTAGES

With the exception of filaments, the following voltages were measured with a vacuum tube volt meter between ground and the indicated test point on a typical KW-1. RMS filament voltages were measured with an ac voltmeter. The transmitter was operating on 28 megacycles with the plate switch off, the send stand-by calibrate switch in the calibrate position, the tune-operate switch in the tune position, and the emission switch in the AM position. Line voltage 120 volts.

Maintenance

<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-301 6BA6	1 grid 1 2 grid 3 3 heater 4 heater 5 plate 6 grid 2 7 cathode	-7.6 0 6.3 ac 0 88 80 0	V-302 6AQ5	1 grid 1 2 cathode 3 heater 4 heater 5 plate 6 grid 2 7 grid 1	-21.5 0 0 6.3 ac 260 100 -21.5
<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-303 6AQ5	1 grid 1 2 cathode 3 heater 4 heater 5 plate 6 grid 2 7 grid 1	-90 0 0 6.3 ac 260 100 -90	V-304 6AQ5	1 grid 1 2 cathode 3 heater 4 heater 5 plate 6 grid 2 7 grid 1	-78 0 0 6.3 ac 250 200 -78
<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-305 6AQ5	1 grid 1 2 cathode 3 heater 4 heater 5 plate 6 grid 2 7 grid 1	-54 0 0 6.3 ac 260 170 -54	V-204 807	1 heater 2 grid 2 3 grid 1 4 cathode 5 heater CAP plate	6.3 ac 240 to 380 -44 0 0 540
<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-101 V-102 4-250A (note 1)	1 filament 2 grid 2 3 grid 1 4 grid 2 5 filament	2.5 ac 10 -180 10 2.5 ac	V-401 12AX7 (note 2)	1 plate B 2 grid 1B 3 cathode B 4 heater 5 heater 6 plate A 7 grid 1A 8 cathode A 9 heater CT	125 +0.6 1.5 3.1 ac 3.1 ac 68 -0.4 0 3.1 ac

<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-402	1 cathode	18	V-403	1 plate B	170
6AL5	2 plate	18	12AU7	2 grid 1B	0
(note 3)	3 heater	3.1 ac	(note 2)	3 cathode B	6.5
	4 heater	3.1 ac		4 heater	3.1 ac
	5 cathode	18		5 heater	3.1 ac
	6 no connection			6 plate A	165
	7 plate	18		7 grid 1A	0
				8 cathode A	6.5
				9 heater CT	3.1 ac
<u>Tube</u>	<u>Pin</u>	<u>Volts</u>	<u>Tube</u>	<u>Pin</u>	<u>Volts</u>
V-404	1 no connection		V-503	1 no connection	
V-405	2 heater	3.1 ac	V-504	2 filament	5.0 ac
6B4G	3 plate	300	(note 5)	3 no connection	
(note 4)	4 no connection			4 filament	5.0 ac
	5 grid 1	-64		SIDE	
	6 no connection			CAP grid	-75
	7 heater	3.1 ac		TOP	
				CAP grid	0

Switch positions: cw, send, tune, plate switch off.

<u>Tube</u>	<u>Pin</u>	<u>Key Closed</u>	<u>Key Open</u>
V-406	1 plate A	300	300
12AU7	2 grid 1A	0	135
(note 2)	3 cathode A	2.5	0
	4 heater	3.1 ac	3.1 ac
	5 heater	3.1 ac	3.1 ac
	6 plate B	300	300
	7 grid 1B	+ 7.5	-60
	8 cathode B	23.5	0
	9 heater CT	3.1 ac	3.1 ac

Note 1 - 5 volts ac between pins 1 and 5. Transformer center tap grounded

Note 2 - 6.3 volts ac between pins 4, 5 and 9. Transformer center tap grounded

Note 3 - 6.3 volts ac between pins 3 and 4. Transformer center tap grounded

Note 4 - 6.3 volts ac between pins 2 and 7. Transformer center tap grounded

Note 5 - 10 volts ac between pins 2 and 4. Transformer center tap grounded

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF VOLTAGES THAT ARE DANGEROUS TO LIFE. OBSERVE PROPER SAFETY PRECAUTIONS AT ALL TIMES.

SECTION 5

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
B-101	Blower	BLOWER: blower and motor assem, direct connected, 115v AC, 50/60 cps, hp 1/250 at 1550 rpm	505 1158 002
C-001 Thru C-012	Part of 70E-14 Oscillator Unit		
C-101	PA plate loading	CAPACITOR: dual section; variable air; 30-465 mmf each section	920 3510 00
C-101A		CAPACITOR: 30-465 mmf; section of C-101	
C-101B		CAPACITOR: 30-465 mmf; section of C-101	
C-102	PA plate loading	CAPACITOR: dual section; variable air; 30-465 mmf each section	920 3510 00
C-102A		CAPACITOR: 30-465 mmf; section of C-101	
C-102B		CAPACITOR: 30-465 mmf; section of C-101	
C-103	PA plate tuning	CAPACITOR: variable; 15-200 mmf, 10,000 v peak	919 0110 00
C-104	160-80 meter PA plate padding	CAPACITOR: ceramic; 67 mmf p/m 5%, 5000 WV	913 0090 00
C-105	PA plate coupling	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-106	PA neutralizing	CAPACITOR: vacuum; 4 mmf p/m 10%, 10,000 v peak	919 0114 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-107	V-204 plate bypass	CAPACITOR: ceramic; 470 mmf p/m 20%; 5000 WV	913 0605 00
C-108	V-101 screen bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-109	V-102 screen bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-110	PA filament bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-111	PA filament bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-112	PA filament bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-113	PA filament bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-114	PA grid coupling	CAPACITOR: mica; 150 mmf p/m 20%, 2500 WV	936 0195 00
C-115	80 meter V-204 plate padding	CAPACITOR: mica; 68 mmf p/m 20%, 500 WV	935 0100 00
C-116	HV line bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-117	HV line TVI filter bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-118	HV line TVI filter bypass	CAPACITOR: ceramic; 1000 mmf p/m 20%, 5000 WV	913 0101 00
C-119	V-204 plate bypass	CAPACITOR: ceramic; 470 mmf p/m 20%, 5000 WV	913 0605 00
C-120		Not Used	
C-121	V-204 15 meter plate padding	CAPACITOR: variable air; 5-50 mmf	922 4300 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-122	V-204 20 meter plate padding	CAPACITOR: variable air; 5-50 mmf	922 4300 00
C-123	V-204 40 meter plate padding	CAPACITOR: variable air; 5-50 mmf	922 4300 00
C-124	V-204 80 meter plate padding	CAPACITOR: variable air; 5-50 mmf	922 4300 00
C-125	V-204 160 meter plate padding	CAPACITOR: variable air; 5-50 mmf	922 4300 00
C-126	See C-126A and C-126B	CAPACITOR: dual section; variable; 6-100 mmf each section	922 0139 00
C-126A	V-204 80-160 meter padding	CAPACITOR: 6-100 mmf; section of C-126	
C-126B	V-204 plate tuning	CAPACITOR: 6-100 mmf; section of C-126	
C-127	V-204 160 meter plate padding	CAPACITOR: mica; 68 mmf p/m 20%, 500 WV	935 0100 00
C-128	PA bias bypass	CAPACITOR: mica; 3300 mmf p/m 20%, 500 WV	935 4075 00
C-129	M-103 bypass	CAPACITOR: mica; 2200 mmf p/m 20%, 1200 WV	936 0272 00
C-130	M-104 bypass	CAPACITOR: mica; 2200 mmf p/m 20%; 1200 WV	936 0272 00
C-201	VR tube bypass	CAPACITOR: ceramic; 10,000 mmf, 350 WV	913 0566 00
C-202	Exciter plate voltage bypass	CAPACITOR: paper; .1 mf p/m 10%; 600 WV	931 7420 00
C-203	Exciter plate voltage bypass	CAPACITOR: electrolytic; 5 mf minus 15% plus 50%; 450 WV	183 1050 00
C-204	M-102 TVI filter	CAPACITOR: paper; 0.001 mf plus 30% minus 10%; 1000 WV	241 0011 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-205	M-102 TVI filter	CAPACITOR: paper; 0.001 mf plus 30% minus 10%; 1000 WV	241 0011 00
C-206	V-204 coupling	CAPACITOR: mica; 470 mmf p/m 20%; 500 WV	935 0135 00
C-207	V-204 grid bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-208	V-204 screen bypass	CAPACITOR: mica; 3300 mmf p/m 20%; 500 WV	935 4075 00
C-209	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-210	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-211	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-212	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-213	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-214	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-215	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-216	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-217	TVI filter	CAPACITOR: paper; 0.1 mf plus 20% minus 10% 600 WV	241 0006 00
C-218		Not Used	
C-219		Not Used	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-220, C-221, C-222		Not Used	
C-223	Current Voltage meter bypass	CAPACITOR: electrolytic; 25 mf minus 10% plus 100%, 25W	183 1034 00
C-224, C-225, C-226, C-227		Not Used	
C-228	CW wave shaping	CAPACITOR: Paper; 0.1 mf p/m 10%, 600 WV	931 7420 00
C-229	TVI filter	CAPACITOR: Paper; 0.001 mf	241 0011 00
C-301	V-301 grid bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-302	V-301 screen by- pass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-303	V-302 grid coupling	CAPACITOR: mica; 470 mmf; p/m 20%; 500 WV	935 0135 00
C-304	V-302 grid de- coupling	CAPACITOR: ceramic; .01 mf; 350 WV	913 5066 00
C-305		Not Used	
C-306	V-302 160m plate padding	CAPACITOR: mica; 120 mmf; p/m 5%; 500 WV	935 0109 00
C-307	V-302 screen by- pass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-308	V-302 160 meter plate padding	CAPACITOR: variable; 8-50 mmf; 350 WV	917 1038 00
C-309	V-302 160 meter plate padding	CAPACITOR: mica; 510 mmf; p/m 5%; 500 WV	935 0136 00
C-310	V-302 plate padding	CAPACITOR: mica; 120 mmf; p/m 5%; 500 WV	935 0109 00
C-311	V-302 plate padding	CAPACITOR: variable; 8-50, mmf; 350 WV	917 1038 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-312	V-302 plate bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-313	V-303 grid padding	CAPACITOR: variable; 8-50 mmf; 350 WV	917 1038 00
C-314	V-303 grid padding	CAPACITOR: 120 mmf mica; p/m 5%; 500 WV	935 0109 00
C-315	V-303 grid coupling	CAPACITOR: mica; 470 mmf p/m 20%; 500 WV	935 0135 00
C-316	V-303 grid equalizing	CAPACITOR: variable; 3-12 mmf; 350 WV	917 1035 00
C-317	V-304 screen bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-318	V-303 plate padding	CAPACITOR: mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C-319	V-303 plate padding	CAPACITOR: variable; 8-50 mmf; 350 WV	917 1038 00
C-320	V-303 plate bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-321	V-304 grid padding	CAPACITOR: variable; 8-50 mmf; 350 WV	917 1038 00
C-322	V-304 grid padding	CAPACITOR: mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C-323	S-301G bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-324	V-305 grid equalizing	CAPACITOR: variable; 3-12 mmf; 350 WV	917 1035 00
C-325	V-305 grid coupling	CAPACITOR: mica; 470 mmf; p/m 20%; 500 WV	935 0135 00
C-326	Exciter bias decoupling	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-327	V-304 screen bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-328	V-304 plate padding	CAPACITOR: variable; 8-50 mmf; 350 WV	917 1038 00
C-329	V-304 plate padding	CAPACITOR: mica 220 mmf p/m 5% 500 WV	935 0119 00
C-330	V-304 plate padding	CAPACITOR: ceramic; 47 mmf; 500 WV	916 4453 00
C-331	V-304 plate bypass	CAPACITOR: ceramic; 10,000 mmf 350 WV	913 0566 00
C-332	V-303 grid decoupling	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-333	V-204 grid padding	CAPACITOR: ceramic; 39 mmf; 500 WV	916 4463 00
C-334	V-305 grid coupling	CAPACITOR: mica; 470 mmf p/m 20%; 500 WV	935 0135 00
C-335	V-305 grid equalizing	CAPACITOR: variable; 3-12 mmf; 350 WV	917 1035 00
C-336	V-305 screen bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-337		Not Used	
C-338	V-305 plate bypass	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-339	V-304 plate padding	CAPACITOR: mica; 150 mmf p/m 5%; 500 WV	935 0112 00
C-340	V-204 15 meter grid coupling	CAPACITOR: ceramic; .01 mf; 350 WV	913 0566 00
C-401	V-401A grid coupling capacitor	CAPACITOR: mica; .01 mf p/m 10%; 300 WV	935 2117 00
C-402	V-401A grid bypass	CAPACITOR: mica; 47 mmf p/m 20%; 500 WV	935 0093 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-403	Push-to-talk bypass	CAPACITOR: paper; 0.5 mf plus 40% minus 15% 600 WV	961 4314 00
C-404	See V-404A, V-404B, V-404C	CAPACITOR: electrolytic; 3 section, 20 mf each section, minus 15% plus 100%; 300 WV	183 1004 00
C-404A	V-401A plate decoupling	CAPACITOR: electrolytic; 20 mf; section of C-404	
C-404B	V-401B plate decoupling	CAPACITOR: electrolytic; 20 mf; section of C-404	
C-404C	V-403 plate decoupling	CAPACITOR: electrolytic; 20 mf; section of C-404	
C-405	V-401B cathode bypass	CAPACITOR: electrolytic 25 mf minus 10% plus 100% 25 WV	183 1034 00
C-406	V-401B grid coupling	CAPACITOR: mica; .01 mf p/m 10%; 300 WV	935 2117 00
C-407	V-402 cathode coupling	CAPACITOR: paper; 0.1 mf p/m 10%; 600 WV	931 7420 00
C-408	Low level filter coupling	CAPACITOR: mica; .01 mf p/m 10%; 300 WV	935 2117 00
C-409	Low level audio filter	CAPACITOR: mica; 1000 mmf p/m 10%, 500 WV	935 4053 00
C-410	Low level audio filter	CAPACITOR: mica; 820 mmf p/m 10%, 500 WV	935 4050 00
C-411	V-403B grid coupling	CAPACITOR: mica; .01 mf p/m 10%; 300 WV	935 2117 00
C-412	V-404 grid coupling	CAPACITOR: paper; 0.1 mf p/m 10%; 600 WV	931 7420 00
C-413	V-405 grid coupling	CAPACITOR: paper; 0.1 mf p/m 10%; 600 WV	931 7420 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-414	-150V supply filter	CAPACITOR: electrolytic; 20 mf minus 10% plus 50%; 250 WV	183 1047 00
C-415	See C-415A and C-415B	CAPACITOR: dual section; 40 mf each section; 450 WV	183 1009 00
C-415A	Filter, plus 300 volt	CAPACITOR: electrolytic; 40 mf; section of C-415	
C-415B	Filter, plus 300 volt	CAPACITOR: electrolytic; 40 mf; section of C-415	
C-416	500V supply filter	CAPACITOR: paper; 10 mf p/m 20%; 1000 WV	930 0039 00
C-417	Driver transformer center tap bypass	CAPACITOR: electrolytic; 10 mf minus 15% plus 50%; 250 WV	183 1046 00
C-418	V-406A grid tank	CAPACITOR: paper; 0.1 mf p/m 10%; 600 WV	931 7420 00
C-419	V-406 grid coupling	CAPACITOR: mica; .01 mf p/m 10%; 300 WV	935 2117 00
C-420	Sidetone output coupling	CAPACITOR: paper; 0.1 mf p/m 10%; 600 WV	931 7420 00
C-421	V-401B grid bypass	CAPACITOR: mica; 47 mmf p/m 20%; 1200 WV	935 0093 00
C-501	2500 V supply filter	CAPACITOR: paper; 2 mf p/m 20%; 3000 WV	930 4240 00
C-502	2500 V supply filter	CAPACITOR: paper 4 mf p/m 10%; 3000 WV	930 4340 00
C-503	High level audio filter	CAPACITOR: plasticon; .006 mf p/m 10%; 10,000 WV	933 0063 00
C-504	High level audio filter	CAPACITOR: plasticon; .006 mf p/m 10%; 10,000 WV	933 0063 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C-505	2500 V supply resonant choke tuning	CAPACITOR: paper; 0.15 mf p/m 20%; 5,000 WV	930 0036 00
E-101	PA output connector	CONNECTOR: receptacle; single female contact	357 9003 00
E-102	2500 V line connector	FEEDTHRU	
E-103	2500 V line connector	FEEDTHRU	
E-104	V-101 screen parasitic suppressor	SUPPRESSOR: parasitic; three turns #18 AWG wire wnd on 47 ohm 2 w resistor	505 2262 002
E-105	V-102 screen parasitic suppressor	SUPPRESSOR: parasitic; three turns #18 AWG wire wnd on 47 ohm 2 w resistor	505 2262 002
E-106	V-204 plate parasitic suppressor	SUPPRESSOR: 807 plate, 100 ohm 2 w resistor with 6 turns #18 AWG wire	505 1181 002
E-107	Receiver antenna terminal	CONNECTOR: receptacle; single round female contact	357 9003 00
E-108	Transmitting antenna terminal	CONNECTOR: receptacle; single round female contact	357 9003 00
E-109	Antenna relay terminal	CONNECTOR: receptacle; single round female contact	357 9003 00
E-110	RF unit top terminal strip	TERMINAL STRIP: 5 term	367 0103 00
E-111	C-104 parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 100 ohm 2 w resistor	505 2263 002

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
E-112	C-126A parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 100 ohm 2 w resistor	505 2263 002
E-201	RF unit terminal strip	TERMINAL STRIP: 6 term	367 0014 00
E-202	RF unit terminal strip	TERMINAL STRIP: 6 term	367 0014 00
E-401	Audio chassis terminal strip	TERMINAL STRIP: 11 term	367 0042 00
E-402	Audio chassis terminal strip	TERMINAL STRIP: 11 term	367 0042 00
E-403	Audio chassis terminal strip	TERMINAL STRIP: 11 term	367 0042 00
E-501	Modulator tube chassis terminal strip	TERMINAL STRIP: 6 term	367 0037 00
F-401	Bias supply fuse	FUSE: cartridge; 1 amp. 250 v.	264 4050 00
F-402	300 v supply fuse	FUSE: cartridge; 3 amp. 250 v.	264 4080 00
F-403	500 v supply fuse	FUSE: cartridge; 2 amp. 250 v.	264 4070 00
F-404	Auto transformer fuse	FUSE: cartridge; 5 amp. 250 v.	264 4090 00
F-405	Line fuse	FUSE: screw plug, 15 amp. 125 v.	264 1150 00
F-406	Line fuse	FUSE: screw plug, 15 amp. 125 v.	264 1150 00
F-501	872A filament fuse	FUSE: cartridge; 2 amp. 250 v.	264 4070 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
F-502	810 filament fuse	FUSE: cartridge; 2 amp. 250 v.	264 4070 00
I-201	Dial Light	BULB: bayonet base; 6.3 v. 0.15 amp. T-3-1/4 bulb	262 3240 00
I-202	Dial Light	BULB: bayonet base; 6.3 v. 0.15 amp. T-3-1/4 bulb	262 3240 00
I-203	Dial Light	BULB: bayonet base; 6.3 v. 0.15 amp. T-3-1/4 bulb	262 3240 00
I-401	Filament pilot light	BULB: candelabra base; 125 v. .040 amp.	262 3320 00
I-402	Plate pilot light	BULB: candelabra base; 125 v. .040 amp.	262 3320 00
J-201	Exciter chassis cable connector	SOCKET: tube; octal	220 1850 00
J-202	Blower cable socket	CONNECTOR: receptacle; 2 female contacts	368 4500 00
J-401	Mic and push-to- talk plug	CONNECTOR: receptacle; 2 female contacts	369 1004 00
J-402	Phone patch con- nector	CONNECTOR: receptacle; 2 female contacts	369 1004 00
K-101	Antenna relay	RELAY: antenna; 2 pole, double throw, contact rating 2000 v. at 5 amp.	407 1045 00
K-401	Overload relay	RELAY: overload; double pole single throw contact rating 10 amp.	403 0003 00
K-402	Plate contactor	RELAY: power; contact rating 15 amp non-induc- tive at 115 V-AC	401 1194 00
K-403	Send-receive relay	RELAY: armature; contact arrangement right 2A, left 1B, 1C, 150 coil v.	970 1661 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
K-501	Phone-CW relay	RELAY: 2 pole; double throw, cont rating 2000 v. at 5 amp.	407 1045 00
L-001 Thru L-005	Part of 70E-14 Oscillator Unit		
L-101	PA plate circuit choke	COIL, RF: choke; 169 turns of #27 chrome oxide wire	504 3667 003
L-102	PA grid circuit choke	COIL, RF: choke; 2.5 mh 4 pie, duo-lateral wnd.	240 5300 00
L-103	V-204 plate circuit choke	COIL, RF: choke; 2.5 mh 4 pie, duo-lateral wnd.	240 5300 00
L-104	HV TVI filter	COIL, RF: choke; 15 turns #18 AWG tinned copper wire	505 1173 002
L-105	10 meter PA coil	COIL, RF: 5 turns soft cop- per tubing	505 1226 002
L-106	15-20 meter PA coil	COIL, RF: 7-3/4 turns soft copper tubing	505 1228 002
L-107	40-80 meter PA coil	COIL, RF: 2 pie, 1 with 6 turns, 1 with 11 turns #10 AWG wire	505 1084 002
L-108	160 meter PA coil	COIL, RF: 38 turns #14 AWG wire	505 1085 002
L-109	10-15 meter PA coil	COIL, RF: 6 turns soft cop- per tubing	505 1230 002
L-110	20-160 meter PA coil	COIL, RF: 19 turns #10 AWG wire tapped at 8th turn 13th & 17th turn	505 1182 002
L-111	V-204 160 meter plate coil	COIL, RF: 52 turns #28 AWG wire	505 1072 002

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
L-112	V-204 10 meter plate coil	COIL, RF: 3 turns #16 AWG wire	505 1068 002
L-113	V-204 15 meter plate coil	COIL, RF: 5 turns #16 AWG wire	505 1069 002
L-114	V-204 20 meter plate coil	COIL, RF: 9 turns #16 AWG wire	505 1070 002
L-115	V-204 40 meter plate coil	COIL, RF: 19 turns #18 AWG wire	505 1180 002
L-116	V-204 80 meter plate coil	COIL, RF: 25 turns #26 AWG wire	505 1071 002
L-117	Antenna static drain choke	COIL, RF: choke; 169 turns #27 chrome oxide wire	504 3667 003
L-118	M-103 filter	COIL, RF: choke; 5 section duo-lateral wnd 3.5 mh	240 2700 00
L-201	PA screen audio choke	REACTOR: filter; 12 hy, 150 ohms nominal	678 0408 00
L-202	V-204 grid RFC	COIL, RF: choke; 2.5 mh 4 pie, duo-lateral wnd.	240 5300 00
L-301	V-302 plate coil	COIL, RF: 38 turns #28 AWG wire	505 1113 002
L-302	V-303 grid coil	COIL, RF: 38 turns #28 AWG wire	505 1113 002
L-303	V-303 plate coil	COIL, RF: 173 turns #28 AWG wire	505 1111 002
L-304	V-304 grid coil	COIL, RF: 17.3 turns #28 AWG wire	505 1111 002
L-305	V-304 plate coil	COIL, RF: 7.6 turns #26 AWG wire	505 1109 002
L-306	V-204 15 meter grid coil	COIL, RF: 7.6 turns #26 AWG wire	505 1109 002

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
L-307	V-305 plate coil	COIL, RF: 7.6 turns #26 AWG wire	505 1109 002
L-401	Low level, low pass filter audio reactor	REACTOR: audio filter; 3.75 hy	678 0077 00
L-402	Bias supply filter	REACTOR: filter; 12 hy 150 ohm nominal	678 0408 00
L-403	300 volt supply filter	REACTOR: filter; 12 hy	668 0065 00
L-404	500 volt supply filter	REACTOR: filter; 12 hy	668 0065 00
L-405	Side tone osc. coil	REACTOR: audio oscillator 0.25 hy p/m 5%	678 0011 00
L-501	2500 volt supply filter	REACTOR: filter; 6 hy 700 ma 10,000 v.	678 0418 00
L-502	2500 volt supply filter	REACTOR: filter; 6 hy 700 ma 10,000 v.	678 0418 00
L-503	High level low pass filter audio reactor	REACTOR: audio; splatter choke 0.02 to 1.5 hy 10,000 v.	678 0421 00
M-101	Filament voltage meter, measures voltage across primary of filament transformer	METER: AC voltmeter; 0-150 v. AC	452 3150 00
M-102	Current-voltage meter, measures the circuit indicated by meter switch S-201	METER: milliammeter; 0-1 ma 3 scale 100 ohm p/m 10%	458 0197 00
M-103	PA plate current meter	METER: 0-800 ma DC	450 3800 50

Section 5

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
M-104	PA plate voltage meter	METER: DC voltmeter 0-3 kv DC	458 0243 50
M-105	Mod. cathode current meter	METER: 0-500 ma DC	450 3500 00
M-106	Antenna current meter	METER: AC; thermoameter, 0-10 amp. RF	451 3105 00
P-101	Cable connector between PA and exciter chassis	CONNECTOR: receptacle; octal	369 1009 00
P-201	Blower plug	CONNECTOR: plug; 2 prong male cable connector	368 0024 00
R-001 thru R-007	Part of 70E-14 Oscillator unit		
R-101	PA grid resistor	RESISTOR: wire wound; 2500 ohm p/m 10%; 10 w	710 0030 00
R-102	R-102 Screen resistor	RESISTOR: wire wound; 1500 ohm p/m 10%; 50 w	410 0093 00
R-103		Not Used	
R-104	M-104 meter multiplier	RESISTOR: external meter, 3 megohm 3 kv	732 0014 00
R-201	PA screen choke shunt for CW operation	RESISTOR: 47 ohm p/m 10%; 2 w	745 5030 00
R-202	V-204, V-302 bias network	RESISTOR: 10,000 ohm p/m 10%; 1 w	745 3128 00
R-203	V-203 bias voltage divider	RESISTOR: 10 megohm p/m 10%; 1/2 w	745 1170 00
R-204		Not Used	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-205, R-206		Not used	
R-207	V-202, V-203 volt- age dropping	RESISTOR: 6800 ohm p/m 10%; 2 w	745 5121 00
R-208	V-202, V-203 volt- age dropping	RESISTOR: 6800 ohm p/m 10%; 2 w	745 5121 00
R-209		Not used	
R-210		Not used	
R-211	Exciter voltage dropping	RESISTOR: wire wound; 500 ohm p/m 10%; 10 w	710 1500 20
R-212	V-204 bias voltage dividing network	RESISTOR: 33,000 ohm p/m 10%; 2 w	745 5149 00
R-213		Not used	
R-214	Meter shunt, PA grid position	RESISTOR: wire wound; 2 ohm p/m 5%; 1/2 w	707 0068 00
R-215	Meter shunt, 807 plate position	RESISTOR: wire wound; 1 ohm p/m 5%; 1/2 w	707 0047 00
R-216	Meter multiplier, 500 volt position	RESISTOR: 1 megohm p/m 5%; 1 w	745 3211 00
R-217	Meter multiplier, 300 volt position	RESISTOR: 1 megohm p/m 5%; 1/2 w	745 1211 00
R-218	Meter shunt, 807 grid position	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R-219	PA screen voltage divider, tune position	RESISTOR: wire wound; 5000 ohm p/m 10%; 25 w	710 3542 00
R-220	PA screen voltage divider, tune position	RESISTOR: wire wound 20,000 ohm p/m 10%; 25 w	710 3204 20

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-221	V-303, V-304, V-305 bias voltage divider	RESISTOR: 3300 ohm p/m 10%; 1/2 w	745 1107 00
R-222	V-303, V-304, V-305 bias voltage divider	RESISTOR: 33,000 p/m 10%; 1/2 w	745 1149 00
R-223	V-204 screen para- sitic suppressor	RESISTOR: 47 ohm p/m 10%; 1 w	745 3030 00
R-224	V-204 screen voltage divider	RESISTOR: wire wound 15,000 ohm p/m 10%; 10 w	710 1154 20
R-225	V-204 screen voltage divider	RESISTOR: wire wound 20,000 ohm p/m 20%; 10 w	710 1204 20
R-226	V-204 screen voltage control, controls ex- citation to PA tubes	RESISTOR: variable; 25,000 ohm; 4 w	377 2280 00
R-227	V-204 screen voltage divider	RESISTOR: 39,000 ohm p/m 10%; 2 w	745 5153 00
R-228	V-204 grid suppressor	RESISTOR: 12 ohm p/m 10%; 1 w	745 3006 00
R-229	V-204 80 meter screen voltage divider	RESISTOR: 27,000 ohm p/m 10%; 2 w	745 5146 00
R-230	V-204 40 meter screen voltage divider	RESISTOR: 47,000 ohm p/m 10%; 2 w	745 5156 00
R-231	V-204 20 meter screen voltage divider	RESISTOR: 82,000 ohm p/m 10%; 2 w	745 5167 00
R-232	Meter multiplier, 300 v position	RESISTOR: 1 megohm p/m 5%; 1/2 w	745 1211 00
R-233		Not Used	
R-234	V-204 grid	RESISTOR: 15,000 ohms p/m 10%; 1 w	745 3135 00
R-235	Keying	RESISTOR: 220,000 ohms p/m 10%; 1/2 w	745 1184 00
R-236	Bias divider	RESISTOR: 10,000 ohms p/m 10%; 1 w	745 3128 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-237	Bias divider	RESISTOR: 10,000 ohms p/m 10%; 1 w	745 3128 00
R-301	V-301 grid	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R-302	V-302 bias voltage	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-303	V-301 screen	RESISTOR: 56,000 ohm p/m 10%; 1 w	745 3160 00
R-304	V-301 plate	RESISTOR: 47,000 ohm p/m 10%; 1 w	745 3156 00
R-305		Not Used	
R-306		Not Used	
R-307	V-204, V-302 bias	RESISTOR: 0.15 megohm p/m 10%; 1/2 w	745 1177 00
R-308		Not Used	
R-309		Not Used	
R-310	V-304 grid	RESISTOR: 0.10 megohm p/m 10%; 1/2 w	745 1170 00
R-311	V-302 screen	RESISTOR: .33 megohm p/m 10%; 1 w	745 3191 00
R-312	V-302 plate	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R-313	V-303 grid	RESISTOR: 82,000 ohm p/m 10%; 1/2 w	745 1167 00
R-314	V-303 grid	RESISTOR: 18,000 ohm p/m 10%; 1/2 w	745 1139 00
R-315	V-303 screen	RESISTOR: .22 megohm p/m 10%; 1 w	745 3174 00
R-316	V-303 plate	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R-317	V-304 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-318	V-304 screen	RESISTOR: .22 megohm p/m 10%; 1 w	745 3142 00
R-319	V-304 plate	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R-320	V-305 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-321		Not used	
R-322	V-305 screen	RESISTOR: .15 megohm p/m 10%; 1 w	745 3153 00
R-323	V-305 plate	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R-324		Not used	
R-325		Not used	
R-326	V-303 grid sup- pressor	RESISTOR: 22 ohm p/m 10%; 1 w	745 3016 00
R-401	V-401A grid	RESISTOR: 1 megohm p/m 10%; 1/2 w	745 1212 00
R-402	V-401A plate de- coupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R-403	V-401A plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R-404	Audio gain control	RESISTOR: variable; .50 meg- ohm; 1/2 w	376 3027 00
R-405	V-401B cathode	RESISTOR: 1500 ohm p/m 10%; 1/2 w	745 1093 00
R-406	V-401B plate de- coupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-407	V-401B plate	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-408	V-402 input	RESISTOR: .22 megohm p/m 10%; 1/2 w	745 1184 00
R-409	V-402 plate	RESISTOR: .33 megohm p/m 10%; 1/2 w	745 1191 00
R-410	Speech clipping level	RESISTOR: variable; .10 meg- ohm; 1 w. min	376 0057 00
R-411	V-402 output	RESISTOR: .22 megohm p/m 10%; 1/2 w	745 1184 00
R-412	V-403A grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-413	V-403B grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-414	V-403B grid coup- ling	RESISTOR: 1.2 megohm p/m 10%; 1/2 w	745 1216 00
R-415	V-403 cathode	RESISTOR: 1200 ohm p/m 10%; 1/2 w	745 1090 00
R-416	V-403B plate	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R-417	V-403A plate	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R-418	V-405 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-419	V-404 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-420	V-406A grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R-421	V-406B cathode	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-422	V-406B grid	RESISTOR: 1 megohm p/m 10%; 1/2 w	745 1212 00
R-423	V-406 feedback	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R-424	V-406 feedback	RESISTOR: 1 megohm p/m 10%; 1/2 w	745 1212 00
R-425	V-406 plate	RESISTOR: .18 megohm p/m 10%; 1/2 w	745 1181 00
R-426	Bias supply voltage divider	RESISTOR: ww; 500 ohm p/m 10%; 25 w	710 3500 20
R-427	Bias supply voltage divider	RESISTOR: variable; 100 ohm; 4 w	377 0036 00
R-428	Bias supply voltage divider	RESISTOR: variable; 100 ohm; 4 w	377 0036 00
R-429	Bias supply voltage divider	RESISTOR: wire wound 350 ohm; 25 w	710 3350 20
R-430	Voltage dropping resistor, low power audio stages	RESISTOR: 1800 ohm p/m 10%; 2 w	745 5097 00
R-431	300 volt supply bleeder	RESISTOR: .10 megohm p/m 10%; 2 w	745 5170 00
R-432	500 volt supply bleeder	RESISTOR: wire wound 25,000 ohm p/m 10%	710 3254 20
R-433	Mic input decoupling	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R-434	V-401B grid decoupling	RESISTOR: 220,000 ohm p/m 10%; 1/2 w	745 1184 00
R-435	Phone patch decoupling	RESISTOR: 470,000 ohm p/m 10%; 1/2 w	745 1198 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
R-436	Phone patch load	RESISTOR: 680 ohm p/m 10%; 1/2 w	745 1079 00
R-437	V-204, V-302 bias network	RESISTOR: 10,000 ohm p/m 10%; 1 w	745 3128 00
R-501	2500 volt supply bleeder	RESISTOR: wire wound; 25,000 ohm p/m 10%; 160 w	710 6254 20
R-502	2500 volt supply bleeder	RESISTOR: wire wound; 25,000 ohm p/m 10%; 160 w	710 6254 20
S-101	See S-101A, S-101B, S-101C	SWITCH: rotary; 2 circuit, 6 position	259 0444 00
S-101A	PA bandswitch	SWITCH: rotary; 2 circuit, 6 position; section of S-101	
S-101B	PA bandswitch	SWITCH: rotary; 2 circuit, 6 position; section of S-101	
S-101C	PA bandswitch	SWITCH: rotary; 2 circuit, 6 position; section of S-101	
S-102	See S-102A, S-102B	SWITCH: rotary; 2 circuit, 6 position	259 0445 00
S-102A	Bandswitch, V-204	SWITCH: rotary; 2 circuit, 6 position; section of S-102	
S-102B	Bandswitch, V-204	SWITCH: rotary; 2 circuit, 6 position; section of S-102	
S-103	Door interlock, front top panel	SWITCH: interlock; 2 male cont. SWITCH: interlock; 2 female cont.	260 4040 00 260 4050 00
S-201	See S-201A, S-201B	SWITCH: rotary; 2 circuit, 5 pos. non-shorting	259 0045 00
S-201A	Current-voltage meter switch	SWITCH: rotary; 2 circuit, 5 pos. non-shorting; section of S-201	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
S-201B	Current-voltage meter switch	SWITCH: rotary; 2 circuit, 5 pos. non-shorting; section of S-201	
S-202	Tune-operate switch	SWITCH: 1 circuit, 2 pos. non-shorting	259 0014 00
S-203	See S-203A, S-203B, S-203C, S-203D, S-203E	SWITCH: rotary; 5 circuit, 3 pos. shorting	259 1380 00
S-203A	CW-AM switch section	SWITCH: rotary; 5 circuit, 3 pos. shorting; section of S-203	
S-203B	CW-AM switch section	SWITCH: rotary, 5 circuit, 3 pos. shorting; section of S-203	
S-203C	CW-AM switch section	SWITCH: rotary, 5 circuit, 3 pos. shorting; section of S-203	
S-203D	CW-AM switch section	SWITCH: rotary, 5 circuit, 3 pos. shorting; section of S-203	
S-203E	CW-AM switch section	SWITCH: rotary, 5 circuit, 3 pos. shorting; section of S-203	
S-204	SEND-STANDBY-CALIBRATE switch	SWITCH: lever 150 w. 110 v	375 0031 00
S-301	Band switch ganged with S-101	SWITCH: rotary; 9 circuit, 6 pos.	259 0443 00
S-301A	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301B	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301C	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301D	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
S-301E	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301F	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301G	Selects drive for V-204 from proper exciter circuit	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301H	V-204 screen voltage selector	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-401	Plate switch	SWITCH: toggle; single pole single throw	260 0529 00
S-402		Not used	
S-403	Auto transformer voltage selector switch	SWITCH: rotary; 1 circuit, 6 pos.	259 0038 00
S-404	Filament ON-OFF switch	SWITCH: DPST toggle	266 3057 00
S-405	Overload relay reset	SWITCH: toggle; SPST	266 3074 00
S-501	Front door high voltage shorting switch	BAR: door shorting	505 1194 003
S-502	Rear door high voltage shorting switch	BAR: door shorting	505 1195 003
S-601	Rear door interlock switch	SWITCH: interlock; 2 male cont. SWITCH: interlock; 2 female cont.	260 4040 00 260 4050 00
S-602	Interlock switch	SWITCH: interlock; 2 male cont. SWITCH: interlock; 2 female cont.	260 4040 00 260 4050 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
S-301E	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301F	Exciter bandswitch	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301G	Selects drive for V-204 from proper exciter circuit	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-301H	V-204 screen voltage selector	SWITCH: rotary; 9 circuit, 6 pos.; section of S-301	
S-401	Plate switch	SWITCH: toggle; single pole single throw	260 0529 00
S-402		Not used	
S-403	Auto transformer voltage selector switch	SWITCH: rotary; 1 circuit, 6 pos.	259 0038 00
S-404	Filament ON-OFF switch	SWITCH: DPST toggle	266 3057 00
S-405	Overload relay reset	SWITCH: toggle; SPST	266 3074 00
S-501	Front door high voltage shorting switch	BAR: door shorting	505 1194 003
S-502	Rear door high voltage shorting switch	BAR: door shorting	505 1195 003
S-601	Rear door interlock switch	SWITCH: interlock; 2 male cont. SWITCH: interlock; 2 female cont.	260 4040 00 260 4050 00
S-602	Interlock switch	SWITCH: interlock; 2 male cont. SWITCH: interlock; 2 female cont.	260 4040 00 260 4050 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
T-101	PA filament transformer	TRANSFORMER: filament, pri 115 v, secd 5 v, CT, 2500 TV	662 0062 00
T-201	Filament transformer for all RF stages except PA	TRANSFORMER: filament, pri 115 v secd #1:6.3 v, 5.0 amp, secd #2:26.0 v, 0.6 amp, 1500 TV, 50/60 cps	662 0069 00
T-401	Plate and filament transformer for bias supply	TRANSFORMER: bias, pri 115 v secd #1:150 v CT, secd. #2:5.0 v, 2500 TV	662 0067 00
T-402	Plate and filament transformer for 300 volt rectifier, filament transformer for 500 volt supply and all low level audio stages	TRANSFORMER: power; 300 v. plate; pri 115 v, secd #1:800 v, CT, secd #2:5.0 v, secd #3:5.0 v, secd #4:6.3 v, 2500 TV	662 0066 00
T-403	Plate transformer for 500 volt supply	TRANSFORMER: 500 v plate; pri 115 v, secd 500 v, CT, 2500 TV	662 0059 00
T-404	Audio driver transformer	TRANSFORMER: driver; pri 5000 ohm CT, secd 2225 ohm CT, 1500 TV	667 0068 00
T-405	Autotransformer, filament voltage control	AUTOTRANSFORMER: pri 125 v, tapped at 120, 115, 110, 100, 90, 2500 TV	664 0061 00
T-501	Filament transformer, 2500 volt rectifiers	TRANSFORMER: filament; pri 115 v, secd 5 v CT, 10,000 TV	662 0063 00
T-502	Filament transformer, modulator tubes	TRANSFORMER: filament; pri 115 v, secd 10 v, CT, 2500 TV	662 0060 00
T-503	Plate transformer for 2500 volt supply	TRANSFORMER: HV plate; pri #1 & #2; 115 v, 2500 TV, secd 2900 v CT, 7500 TV	672 0416 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
T-504	Modulation transformer	TRANSFORMER: modulation; pri 12,000 ohm, CT secd 6250 ohm, 10,000 TV	677 0417 00
V-001	Oscillator	TUBE: 6BA6	255 0185 00
V-002	Isolation stage	TUBE: 6BA6	255 0185 00
V-101	Power amplifier	TUBE: 4-250A	256 0089 00
V-102	Power amplifier	TUBE: 4-250A	256 0089 00
V-201	Oscillator filament regulator	TUBE: 6A10	734 0001 00
V-202	Plate voltage regulator for oscillator	TUBE: 0C3/VR105	257 0002 00
V-203	Plate voltage regulator for oscillator	TUBE: 0C3/VR105	257 0002 00
V-204	RF driver	TUBE: 807W	254 0671 00
V-301	Buffer amplifier	TUBE: 6AK6	255 0185 00
V-302	160 meter buffer, 80 meter doubler	TUBE: 6AQ5	255 0195 00
V-303	40 meter doubler	TUBE: 6AQ5	255 0195 00
V-304	20 meter doubler 15 meter tripler	TUBE: 6AQ5	255 0195 00
V-305	10 meter doubler	TUBE: 6AQ5	255 0195 00
V-401	Audio amplifier	TUBE: 12AX7	255 0201 00
V-402	Audio clipper	TUBE: 6AL5	257 0018 00
V-403	Phase inverter	TUBE: 12AU7	255 0199 00
V-404	Audio driver	TUBE: 6B4G	255 0124 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
V-405	Audio driver	TUBE: 6B4G	255 0124 00
V-406	Side tone oscillator	TUBE: 12AU7	255 0199 00
V-407	-150 volt bias rectifier	TUBE: 5V4G	255 0081 00
V-408	300 volt rectifier	TUBE: 5V4G	255 0081 00
V-409	300 volt rectifier	TUBE: 5V4G	255 0081 00
V-410	500 volt rectifier	TUBE: 5R4GY	257 0020 00
V-501	2500 volt rectifier	TUBE: 872A	256 0037 00
V-502	2500 volt rectifier	TUBE: 872A	256 0037 00
V-503	Modulator	TUBE: 810	256 0051 00
V-504	Modulator	TUBE: 810	256 0051 00
XF-401	Holder for F-401	HOLDER: fuse; extractor post for 3AG fuse	265 1002 00
XF-402	Holder for F-402		
XF-403	Holder for F-403		
XF-404	Holder for F-404		
XF-405	Holder for F-405	HOLDER: fuse; receptacle for line fuse	265 1010 00
XF-406	Holder for F-406		
XF-501	Holder for F-501	HOLDER: fuse; extractor post for 3AG fuse	265 1002 00
XF-502	Holder for F-502		
XI-201	Socket for I-201	LAMPHOLDER: bracket for miniature bayonet base bulb	262 1210 00
XI-202	Socket for I-202		
XI-203	Socket for I-203		
XI-401	Socket for I-401	LAMPHOLDER: for candle-labra base bulb	262 0033 00
XI-402	Socket for I-402		
	Pilot light disk	DISK: red	262 2360 00
	Pilot light disk	DISK: green	262 2370 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
XV-101	Socket for V-101	SOCKET: tube; 5 prong giant	220 1016 00
XV-102	Socket for V-102		
XV-201	Socket for V-201	SOCKET: tube; octal	220 1850 00
XV-202	Socket for V-202		
XV-203	Socket for V-203		
XV-204	Socket for V-204	SOCKET: tube; 5 prong	220 1071 00
XV-301	Socket for V-301	SOCKET: tube; 7 contact miniature; accom metal shield	220 1034 00
XV-302	Socket for V-302		
XV-303	Socket for V-303		
XV-304	Socket for V-304		
XV-305	Socket for V-305		
XV-401	Socket for V-401	SOCKET: tube; 9 contact miniature	220 1123 00
XV-402	Socket for V-402	SOCKET: tube; 7 pin minia- ture	220 1134 00
XV-403	Socket for V-403	SOCKET: tube; 9 contact miniature	220 1123 00
XV-404	Socket for V-404	SOCKET: tube; octal	220 1850 00
XV-405	Socket for V-405		
XV-406	Socket for V-406	SOCKET: tube; 9 contact miniature	220 1123 00
XV-407	Socket for V-407	SOCKET: tube; octal	220 1850 00
XV-408	Socket for V-408		
XV-409	Socket for V-409		
XV-410	Socket for V-410	SOCKET: tube; octal	220 5810 00
XV-501	Socket for V-501	SOCKET: tube; 4 prong bayonet lock	220 5420 00
XV-502	Socket for V-502		
XV-503	Socket for V-503		
XV-504	Socket for V-504		

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
70E-14	OSCILLATOR	This unit has been dehydrated and hermetically sealed, and should be returned to the Collins Radio Company, if servicing is required.	
35C-2	LOW PASS FILTER		
C701		CAPACITOR: ceramic, 25 mmf p/m 10%, 1000 WV at 16 mc	913 4253 20
C702		CAPACITOR: ceramic, 25 mmf p/m 10%, 1000 WV at 16 mc	913 4253 20
C703		CAPACITOR: ceramic, 25 mmf p/m 10%, 1000 WV at 16 mc	913 4253 20
C704		CAPACITOR: ceramic, 67 mmf p/m 5%, 1000 WV at 16 mc	913 4673 10
C705		CAPACITOR: ceramic, 25 mmf p/m 10%, 1000 WV at 16 mc	913 4253 20
C706		CAPACITOR: ceramic, 50 mmf p/m 5%, 1000 WV at 16 mc	913 4503 10
C707		CAPACITOR: ceramic, 50 mmf p/m 5%, 1000 WV at 16 mc	913 4503 10
C708		CAPACITOR: ceramic, 67 mmf p/m 5%, 1000 WV at 16 mc	913 4673 10
C709		CAPACITOR: ceramic, 50 mmf p/m 5%, 1000 WV at 16 mc	913 4503 10

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C710		CAPACITOR: ceramic, 50 mmf p/m 5%, 1000 WV at 16 mc	913 4503 10
C711		CAPACITOR: ceramic, 50 mmf p/m 5%, 1000 WV at 16 mc	913 4503 10
C712		CAPACITOR: ceramic, 67 mmf p/m 5%, 1000 WV at 16 mc	913 4673 10
J701		CONNECTOR: receptacle, single female contact	505 3134 001
J702		CONNECTOR: receptacle, single female contact	505 3134 001
L701		COIL: 455 mh	504 3672 002
L702		COIL: 394 mh	504 3673 002
L703		COIL: 346 mh	504 3671 002
P701		CONNECTOR: plug, single male contact	357 9040 00
P702		CONNECTOR: plug, single male contact	257 9040 00

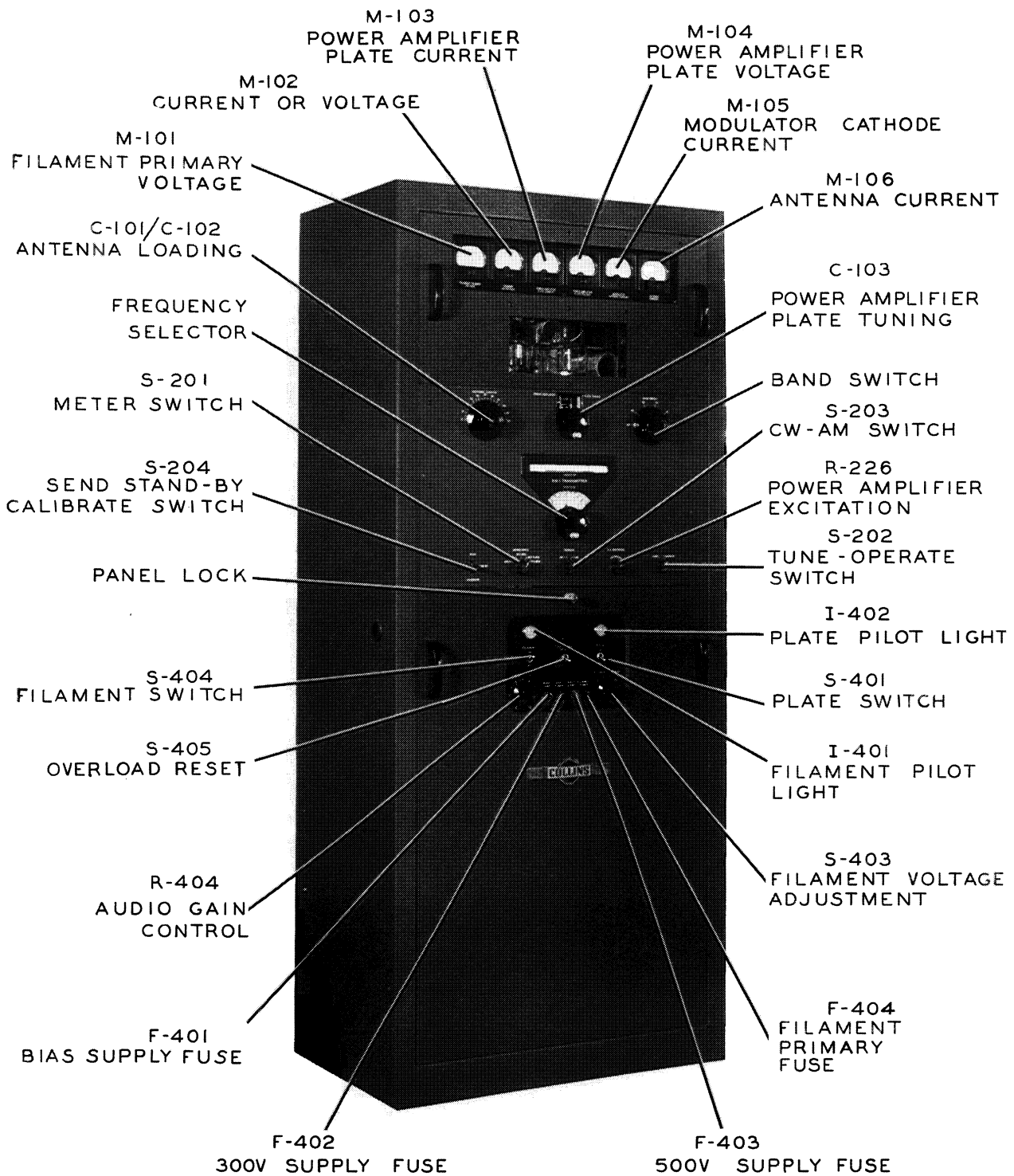


Figure 6-1. Transmitter Control Arrangement, Front View

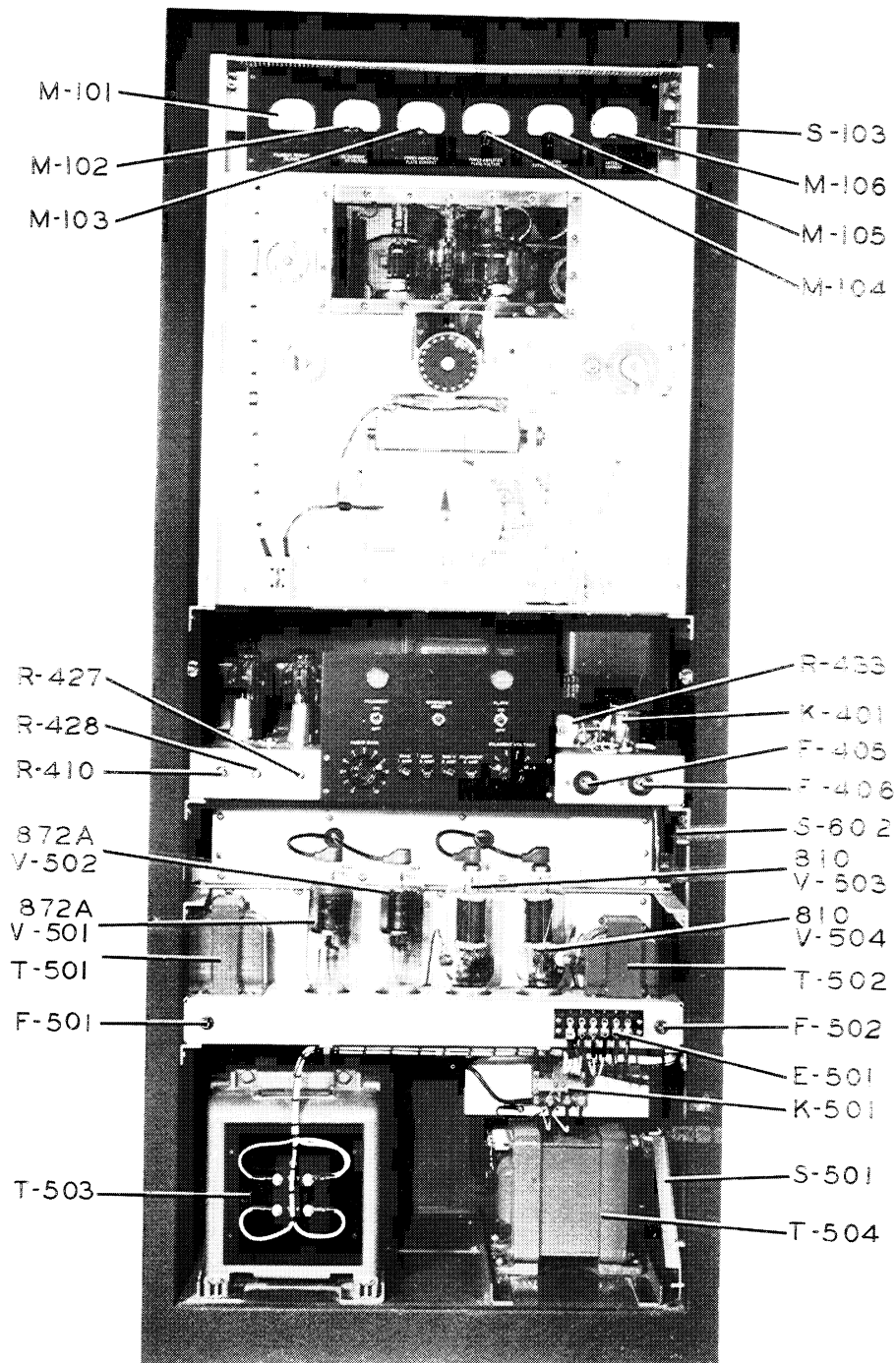


Figure 6-2. Transmitter Parts Arrangement, Front View

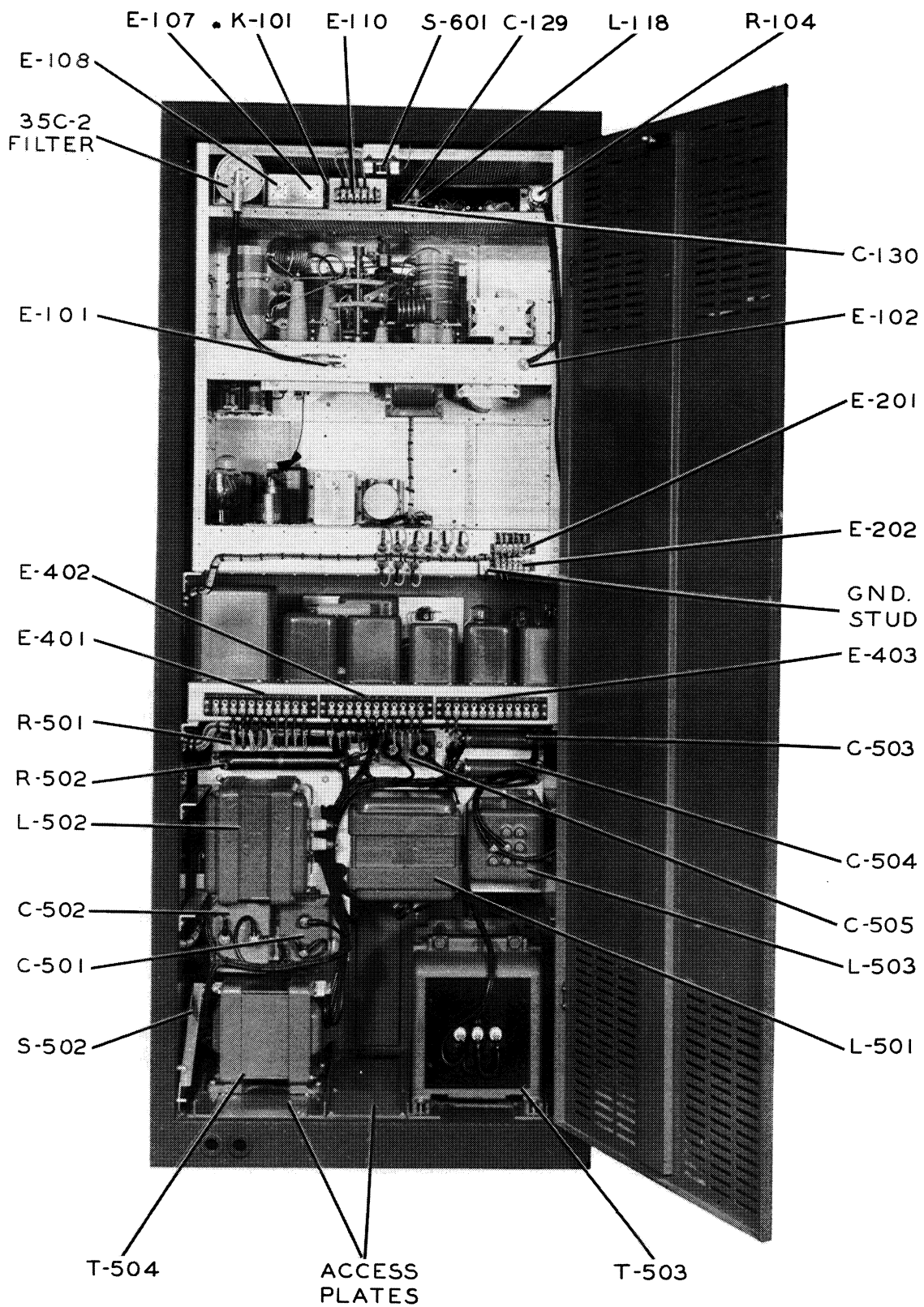


Figure 6-3. Transmitter Parts Arrangement, Rear View

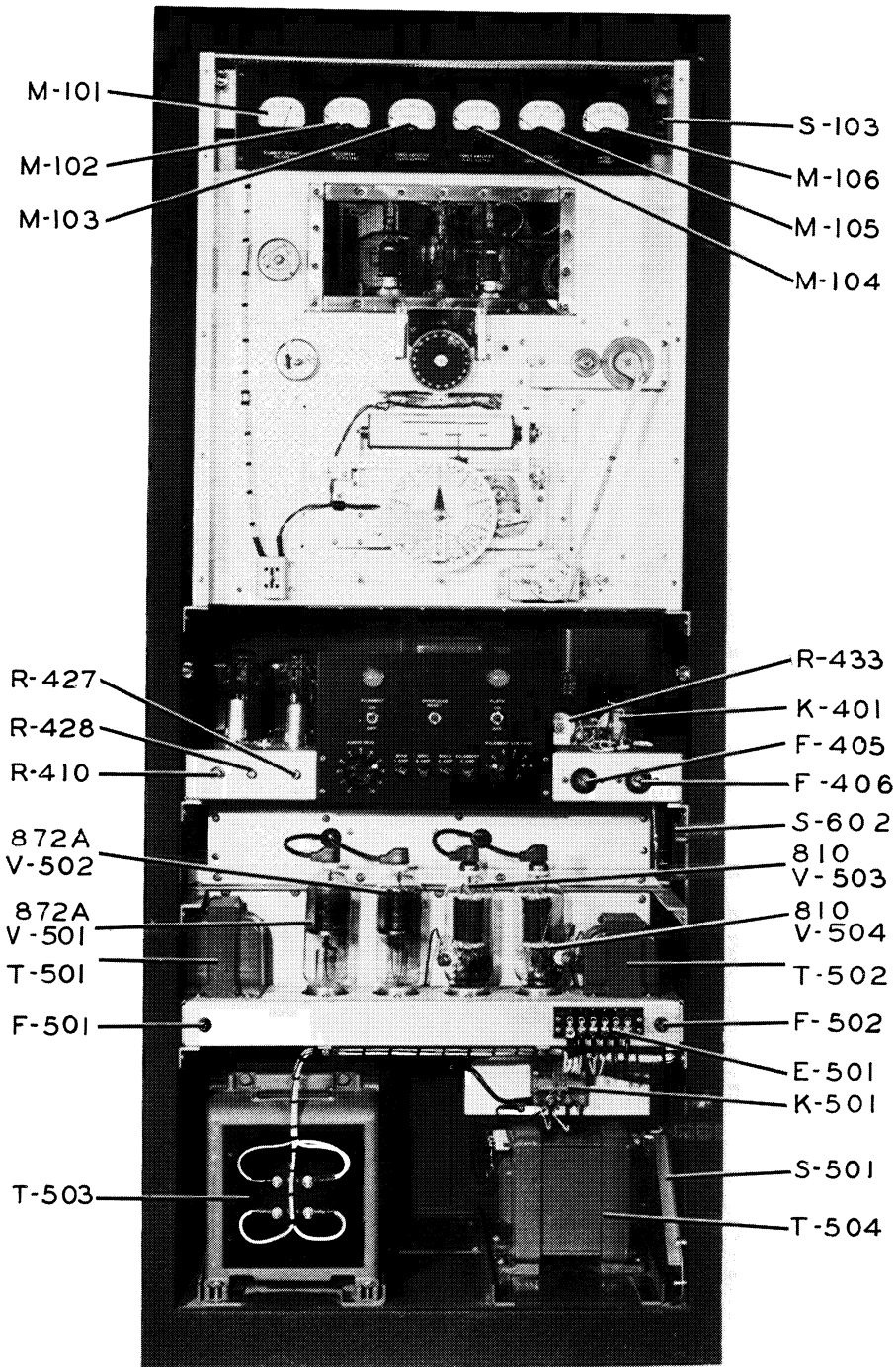
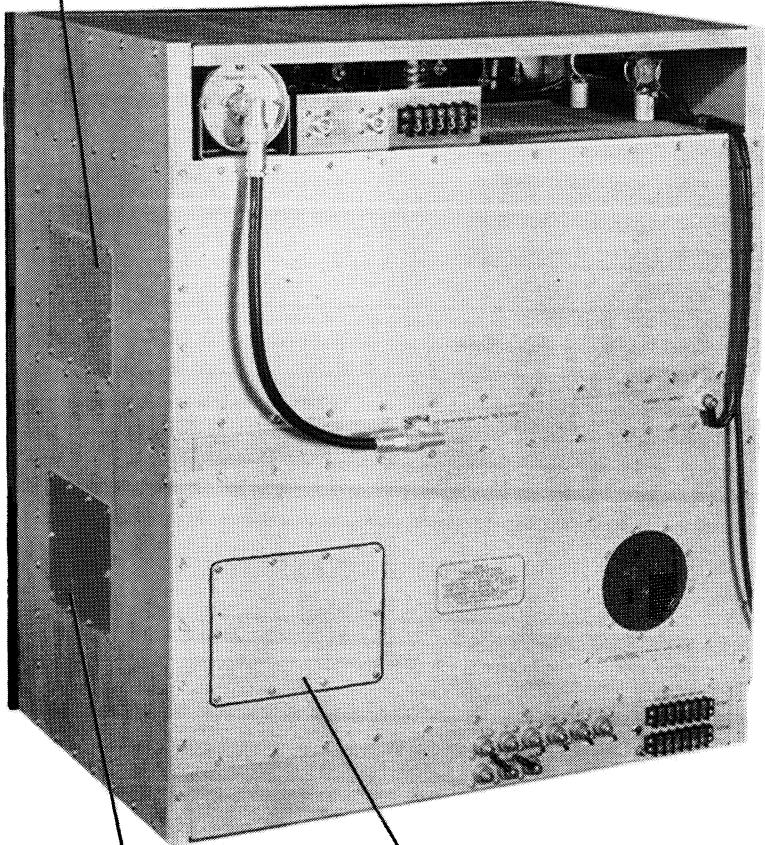


Figure 6-2. Transmitter Parts Arrangement, Front View

RF DRIVER ADJUST.

⊗	⊗	⊗
C-123	L-115	C-125
⊗	⊗	⊗
L-113	C-121	L-111

CAUTION.
 USE AN INSULATED
 SCREWDRIVER FOR
 ALL ADJUSTMENTS.



RF DRIVER ADJUST.

⊗	⊗
L-116	L-112
⊗	⊗
C-124	L-114
⊗	⊗
C-122	

DOUBLER ADJUSTMENTS

	⊗	L-307	
C-335	⊗	⊗	C-328
		⊗	L-305
		⊗	L-306
		⊗	C-319
C-324	⊗	⊗	L-303
		⊗	L-304
		⊗	C-321
C-316	⊗	⊗	L-302
		⊗	L-301
		⊗	C-313
		⊗	C-308

Figure 6-4. Location of RF Unit Adjustments

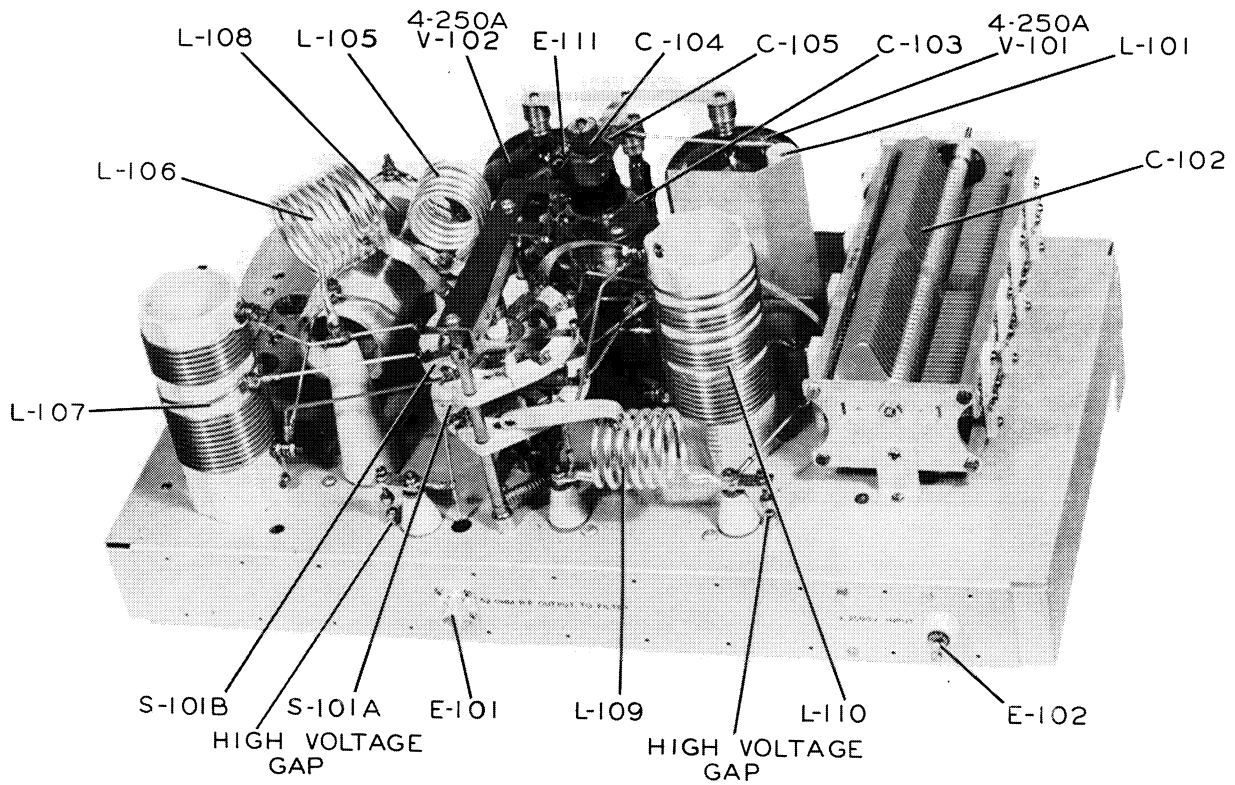
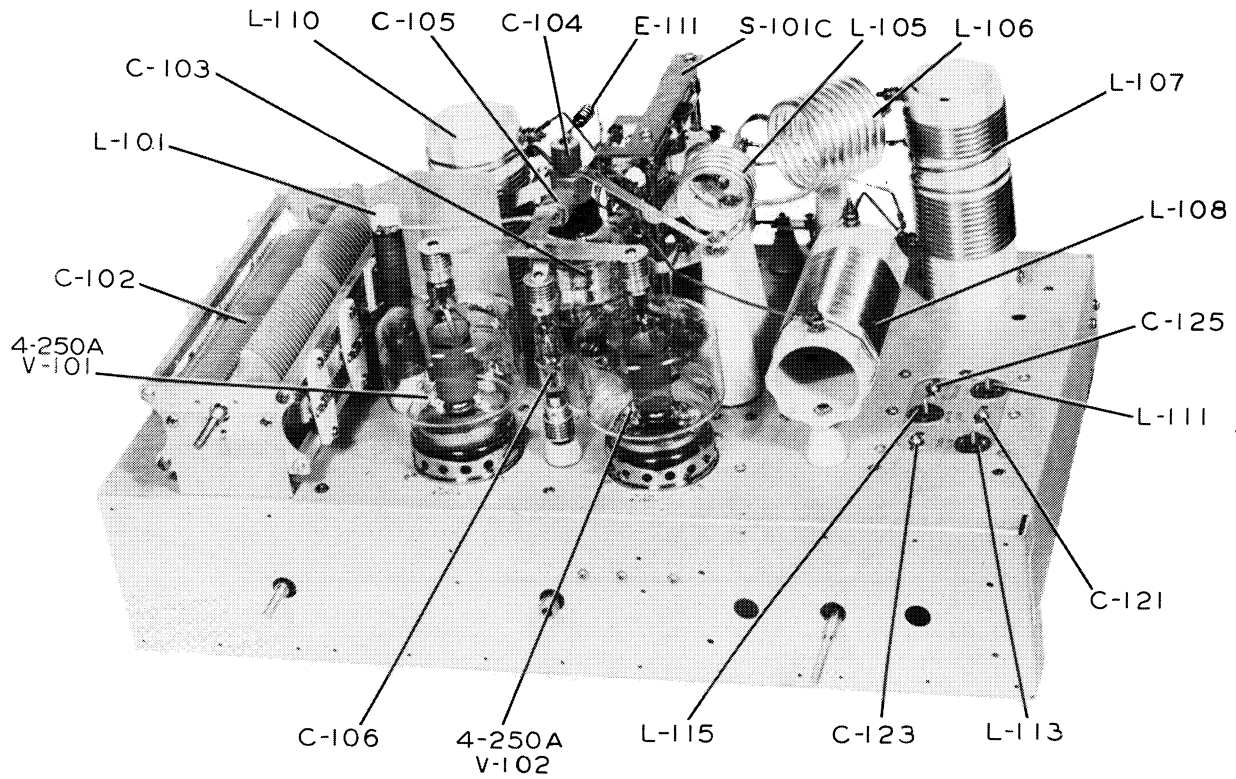


Figure 6-5. Power Amplifier Chassis, Top View

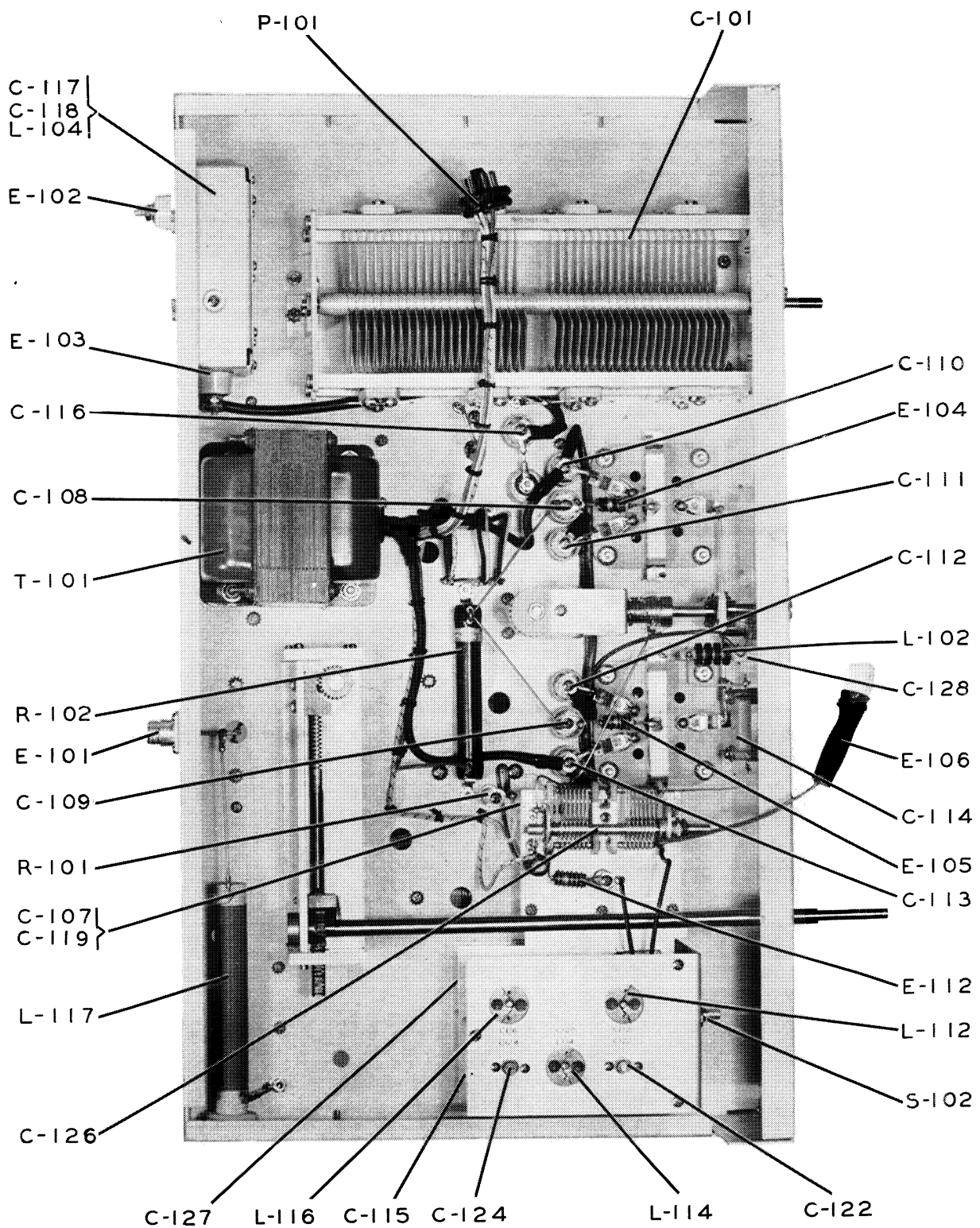


Figure 6-6. Power Amplifier Chassis, Bottom View

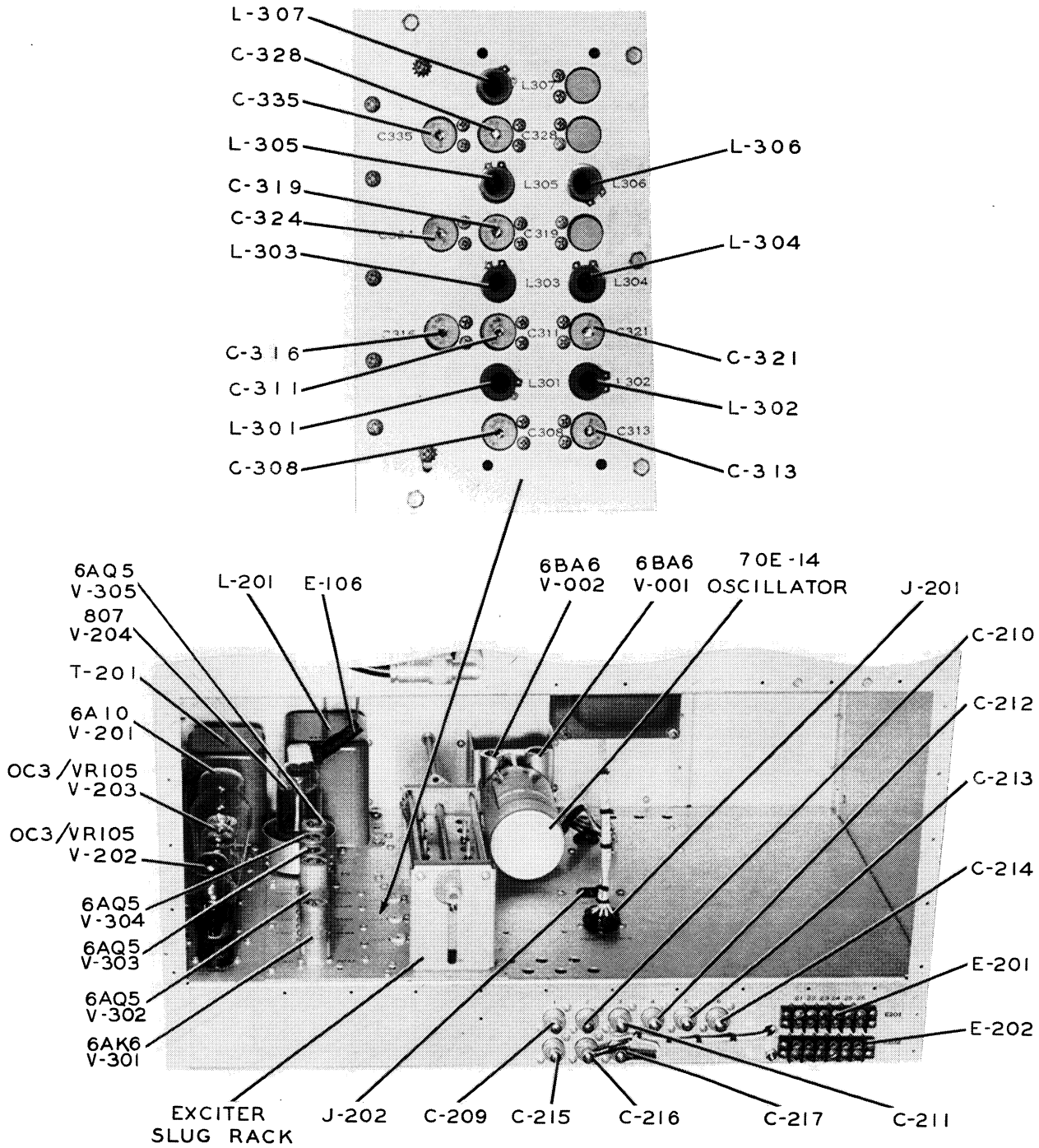


Figure 6-7. Exciter Chassis, Rear View

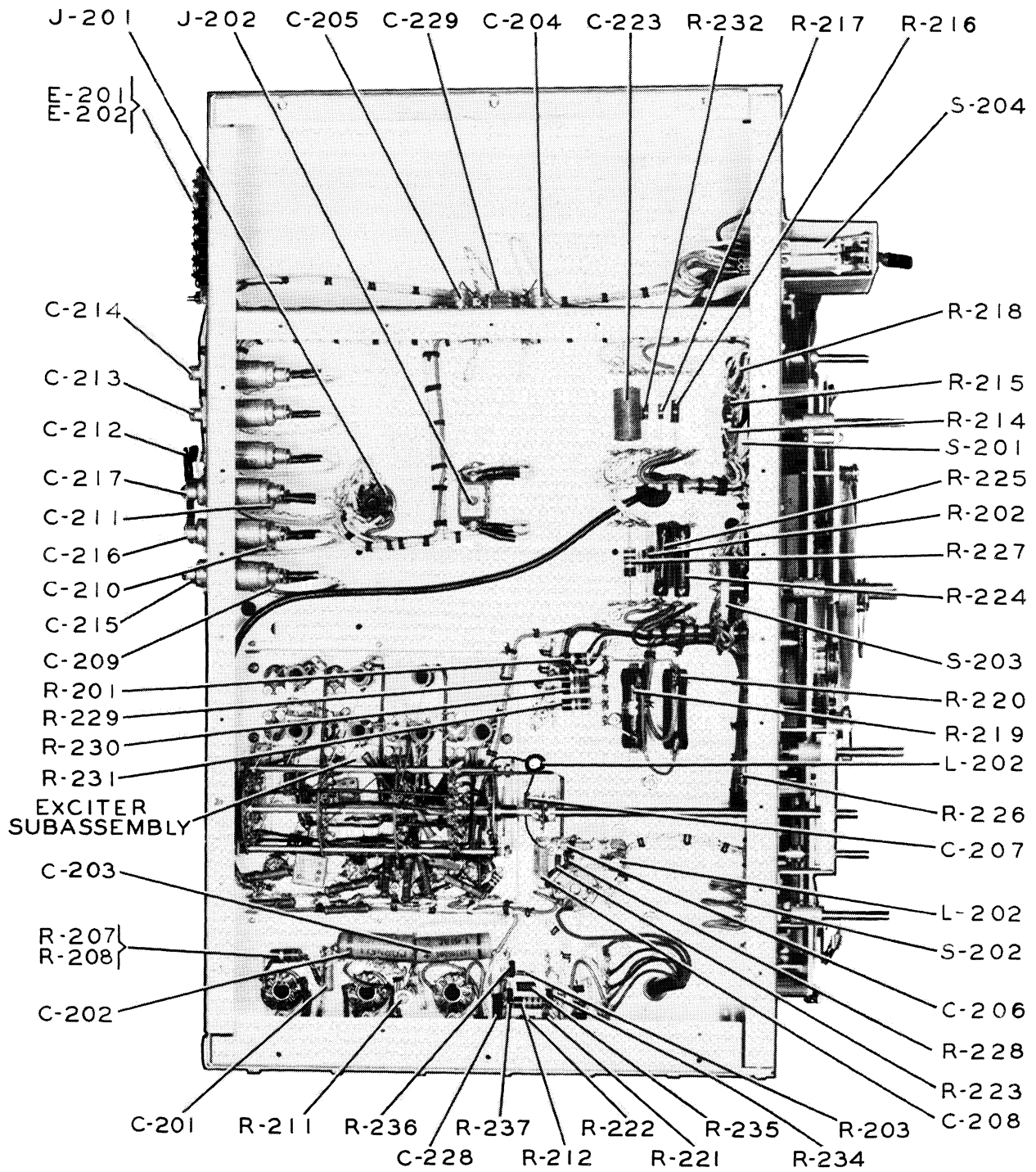


Figure 6-8. Exciter Chassis, Bottom View

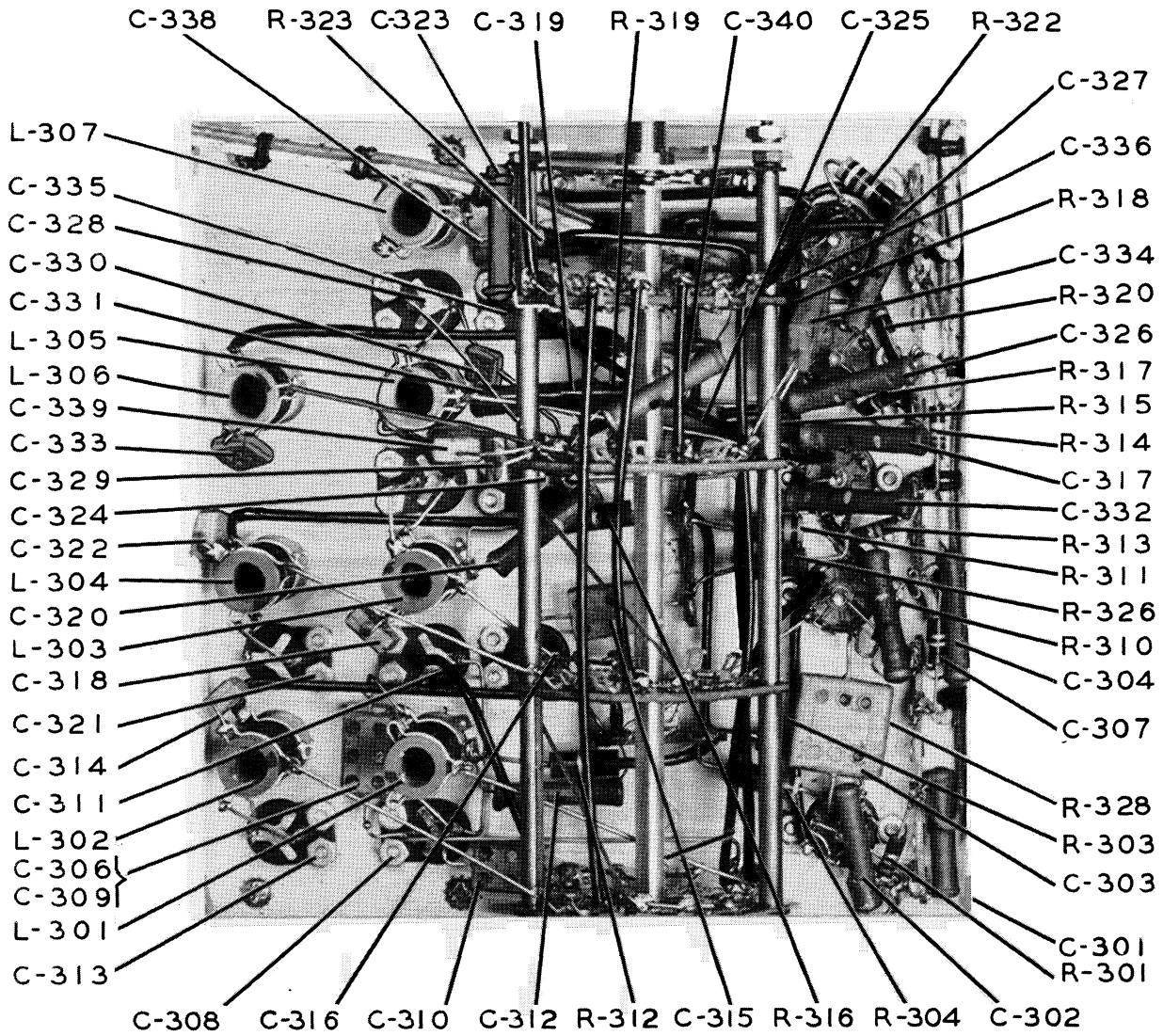


Figure 6-9. Exciter Subassembly, Bottom View

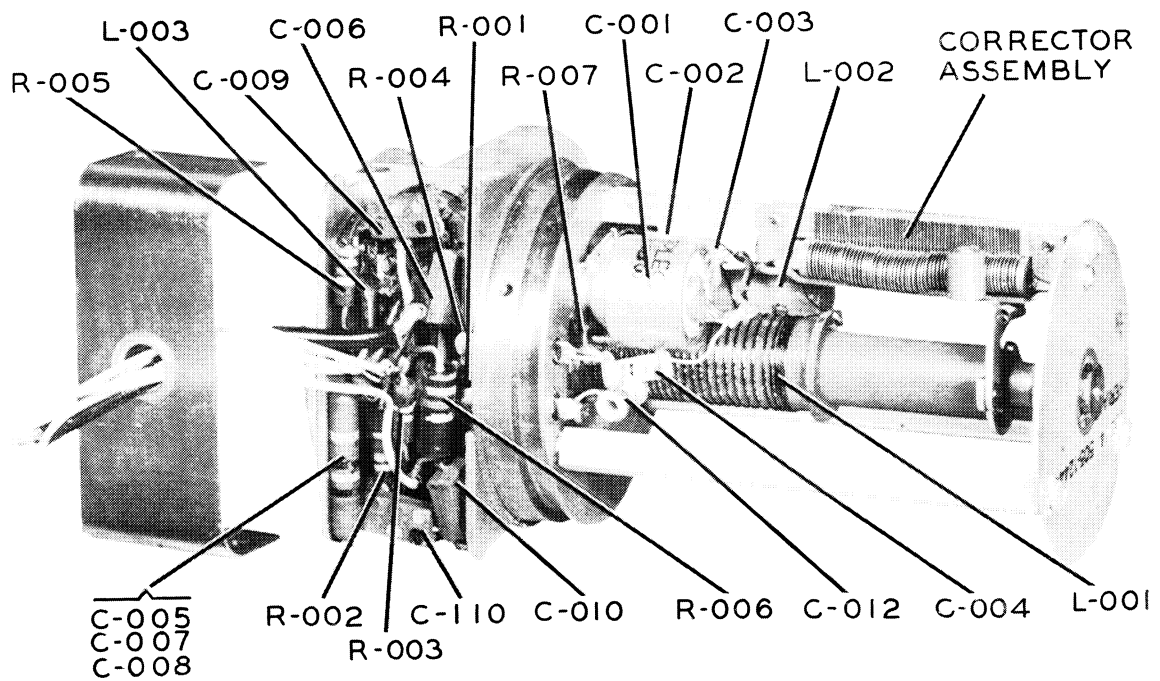
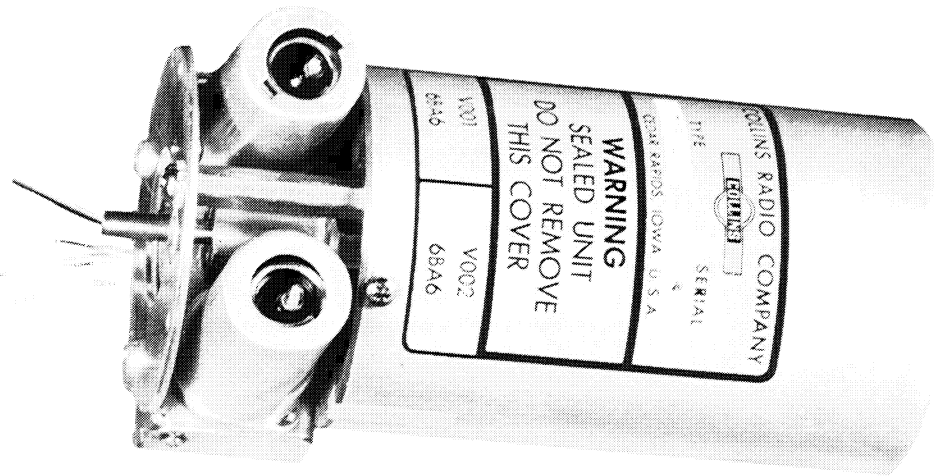


Figure 6-10. 70E-14 Oscillator Unit

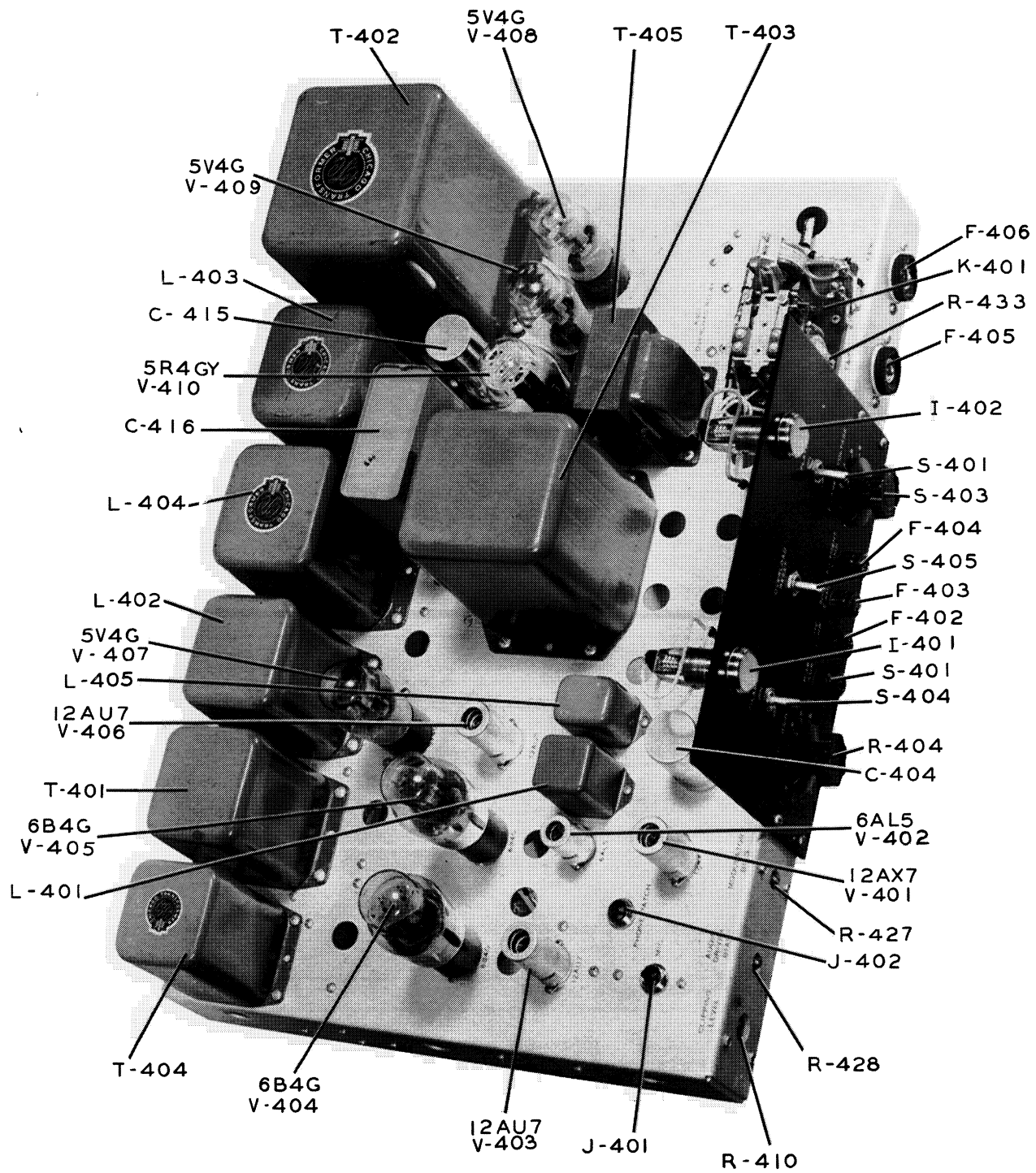


Figure 6-11. Speech Amplifier Chassis, Top View

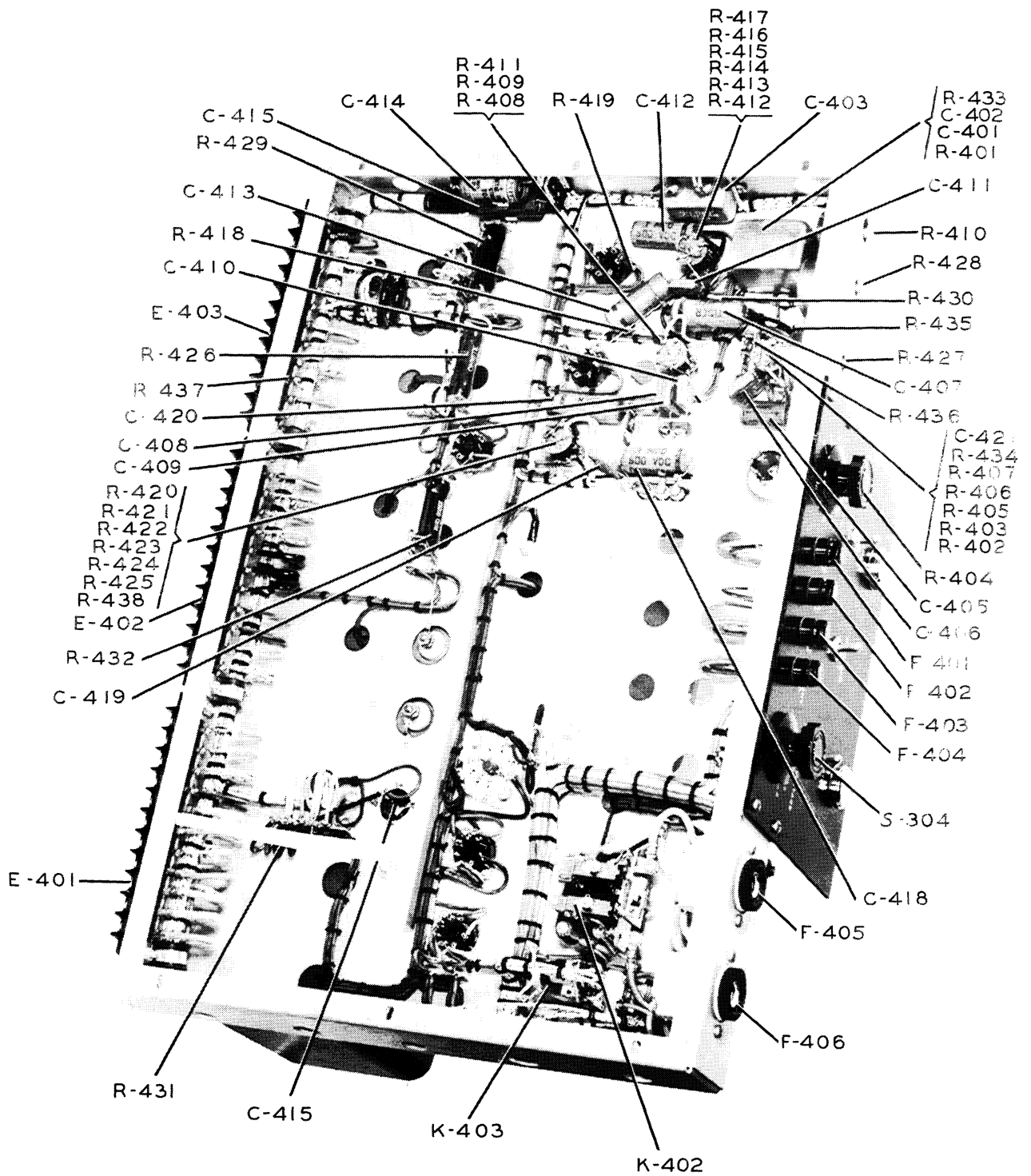


Figure 6-12. Speech Amplifier Chassis, Bottom View

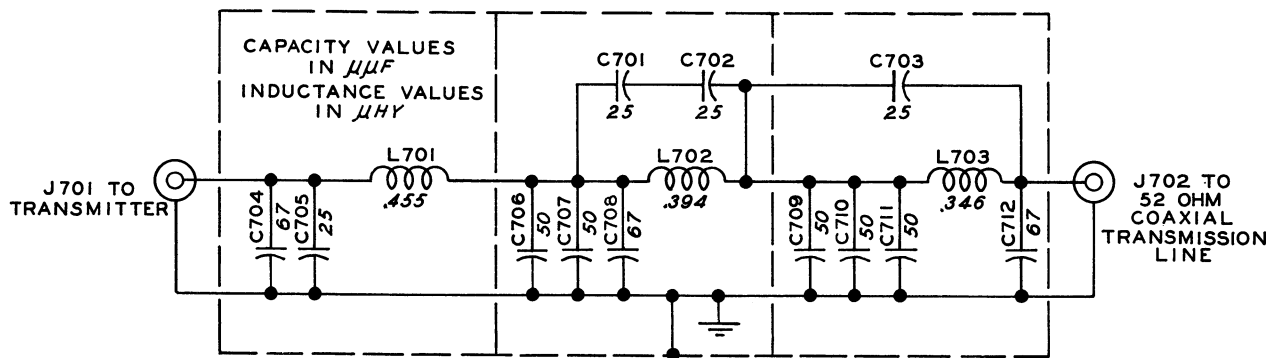
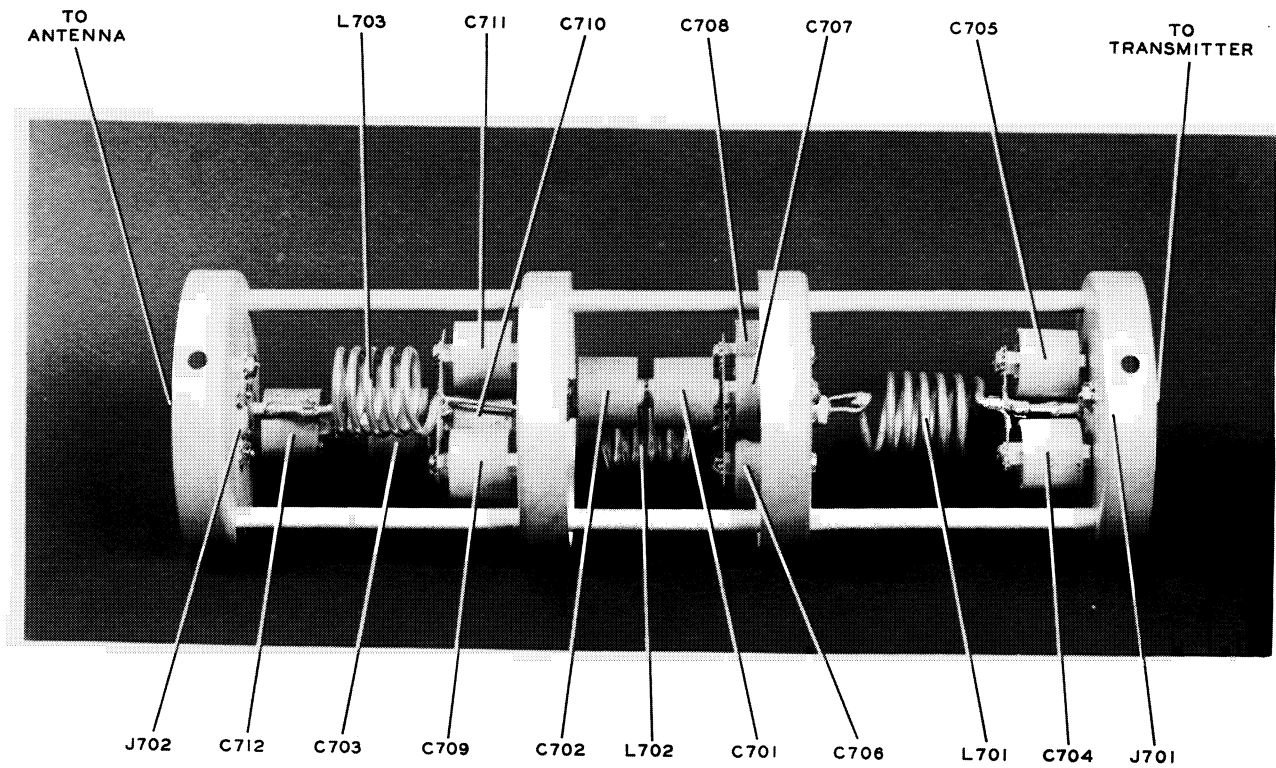


Figure 6-13. 35C-2 Low Pass Filter

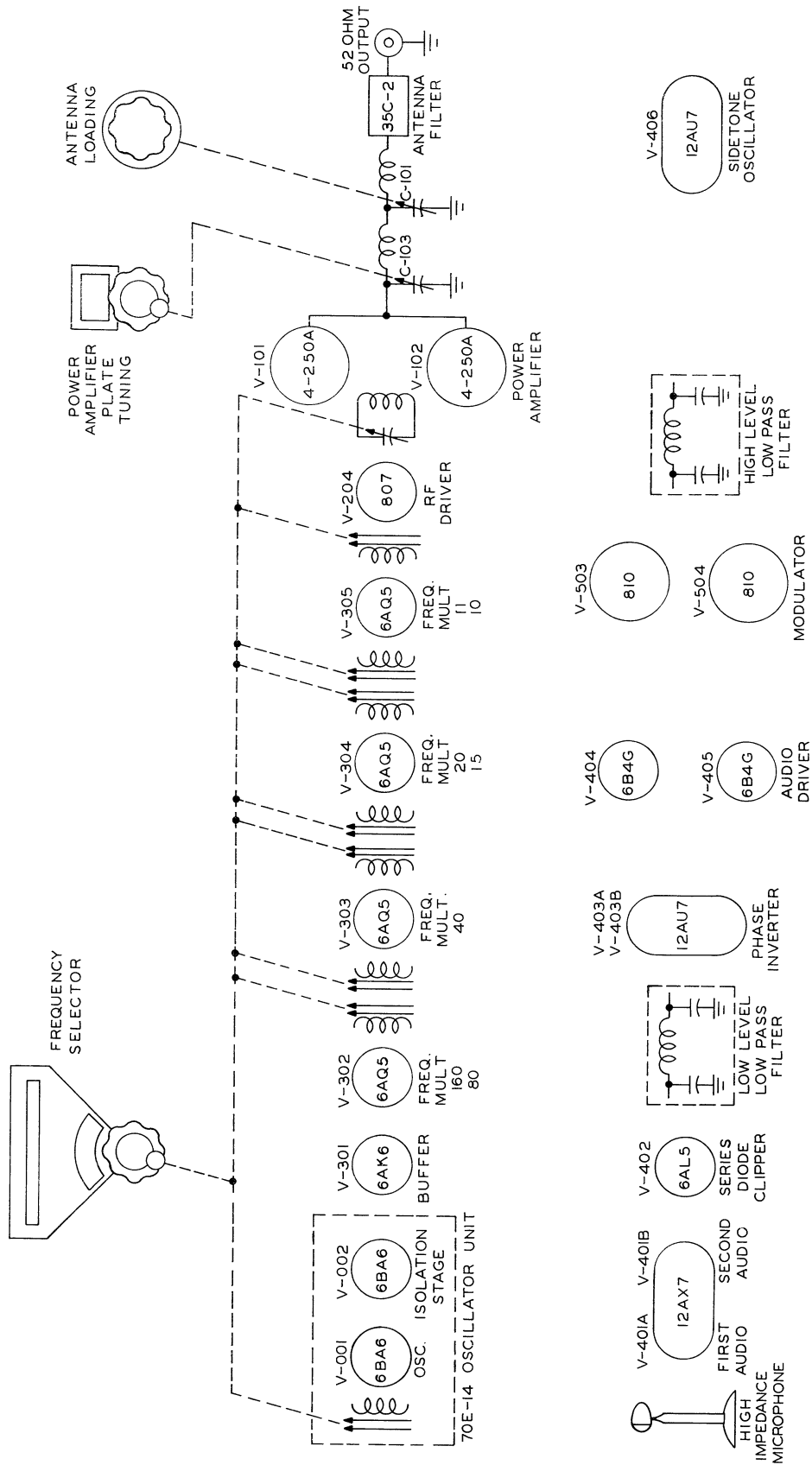
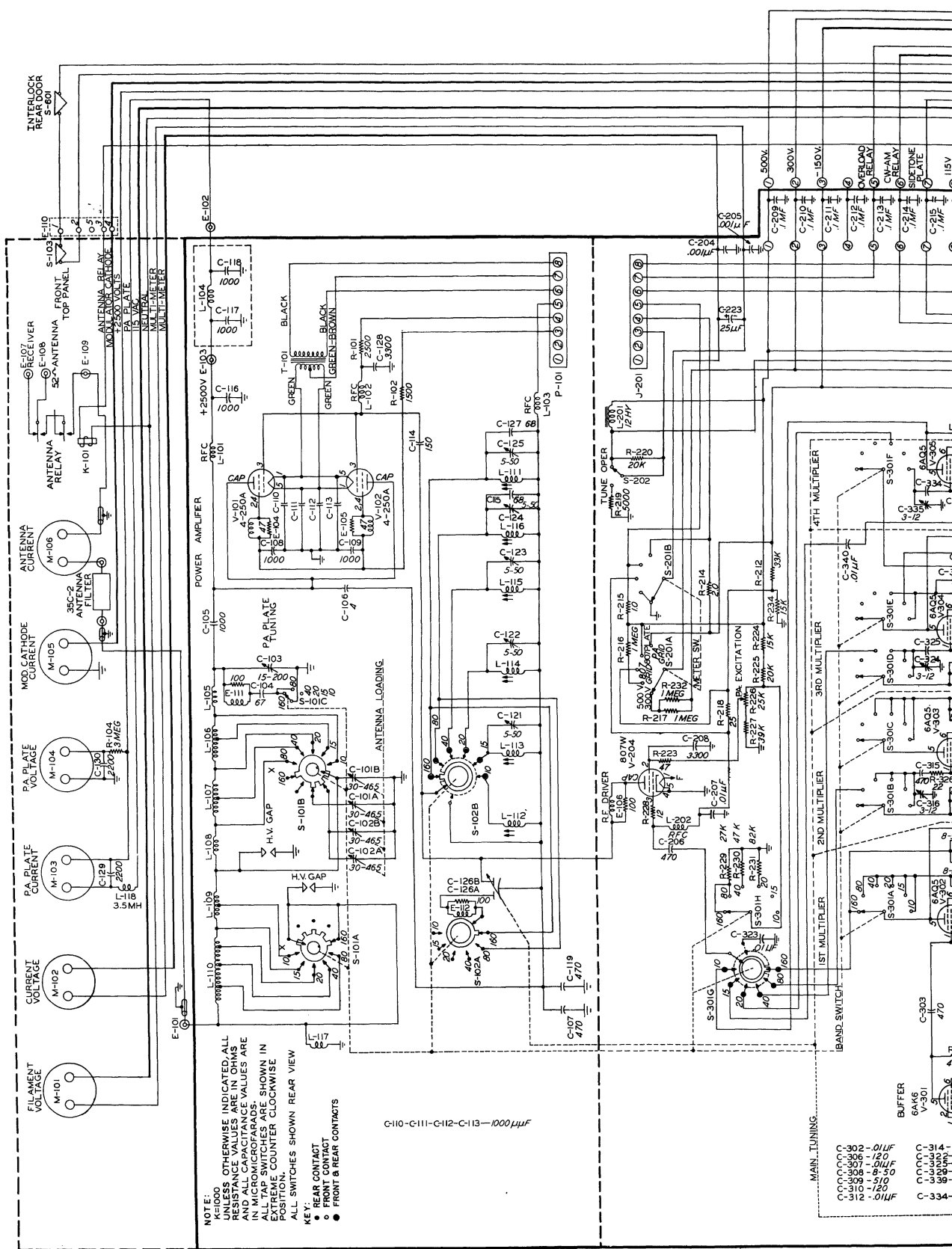


Figure 7-1. KW-1 Block Diagram



NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN MICROFARADS. MICR SWITCHES ARE SHOWN IN EXTREME COUNTER CLOCKWISE POSITION. ALL SWITCHES SHOWN REAR VIEW.

KEY:
 ○ REAR CONTACT
 ● FRONT CONTACT
 ● FRONT & REAR CONTACTS

C-110 - C-111 - C-112 - C-113 - 1000 μF

MAIN TUNING

C-301	500V	120 μF
C-302	500V	120 μF
C-303	500V	120 μF
C-304	500V	120 μF
C-305	500V	120 μF
C-306	500V	120 μF
C-307	500V	120 μF
C-308	500V	120 μF
C-309	500V	120 μF
C-310	500V	120 μF
C-311	500V	120 μF
C-312	500V	120 μF
C-313	500V	120 μF
C-314	500V	120 μF
C-315	500V	120 μF
C-316	500V	120 μF
C-317	500V	120 μF
C-318	500V	120 μF
C-319	500V	120 μF
C-320	500V	120 μF
C-321	500V	120 μF
C-322	500V	120 μF
C-323	500V	120 μF
C-324	500V	120 μF
C-325	500V	120 μF
C-326	500V	120 μF
C-327	500V	120 μF
C-328	500V	120 μF
C-329	500V	120 μF
C-330	500V	120 μF
C-331	500V	120 μF
C-332	500V	120 μF
C-333	500V	120 μF
C-334	500V	120 μF
C-335	500V	120 μF
C-336	500V	120 μF
C-337	500V	120 μF
C-338	500V	120 μF
C-339	500V	120 μF
C-340	500V	120 μF

POWER AMPLIFIER

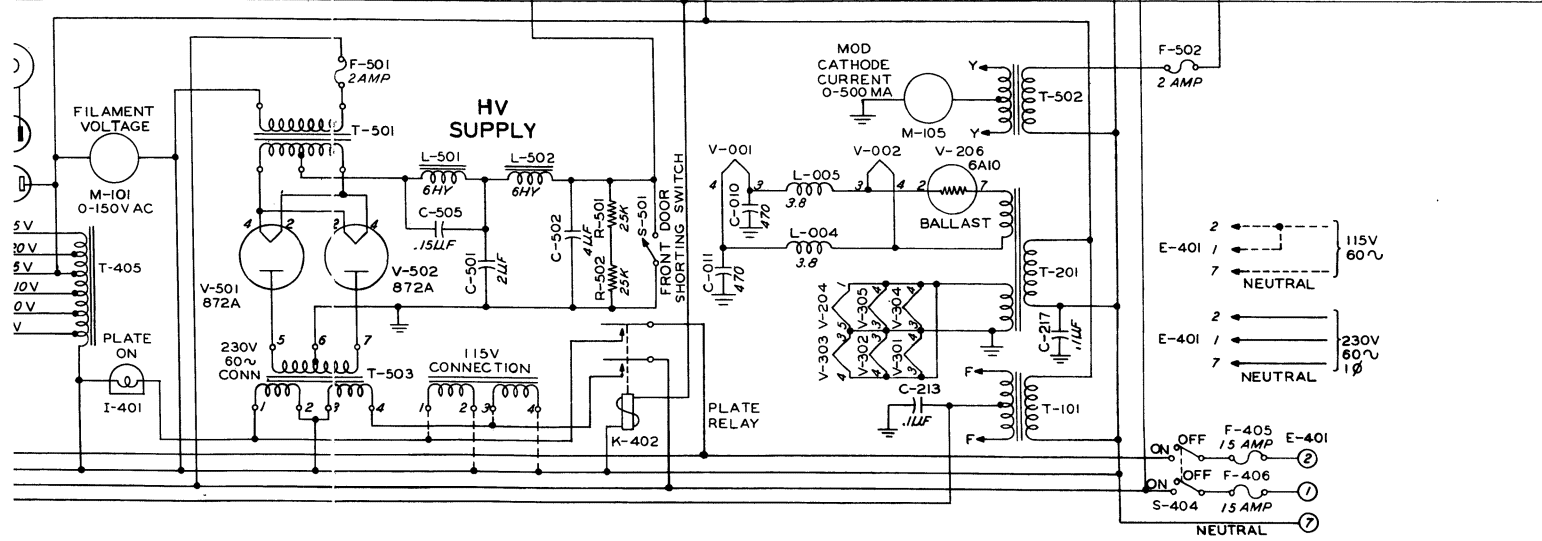
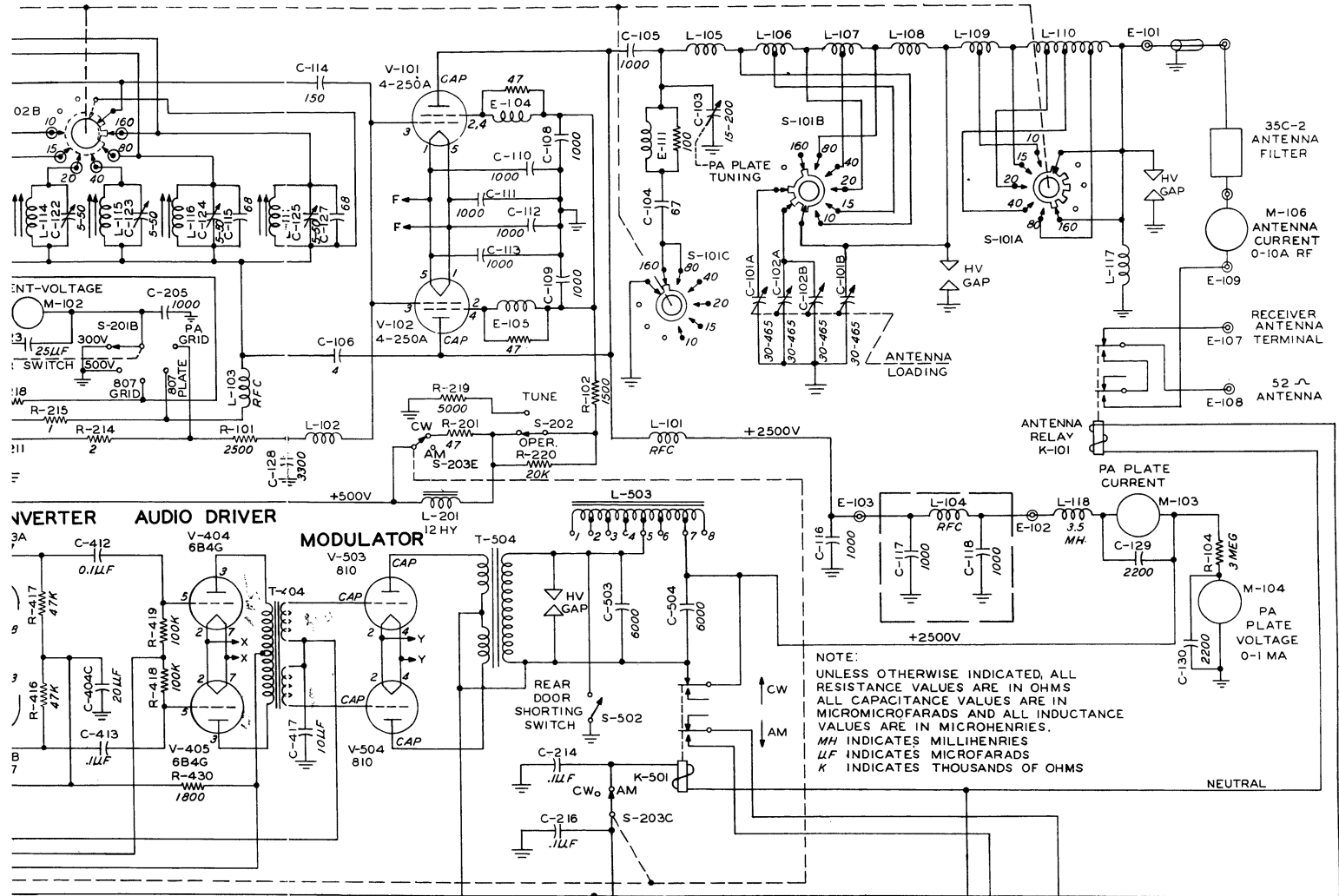
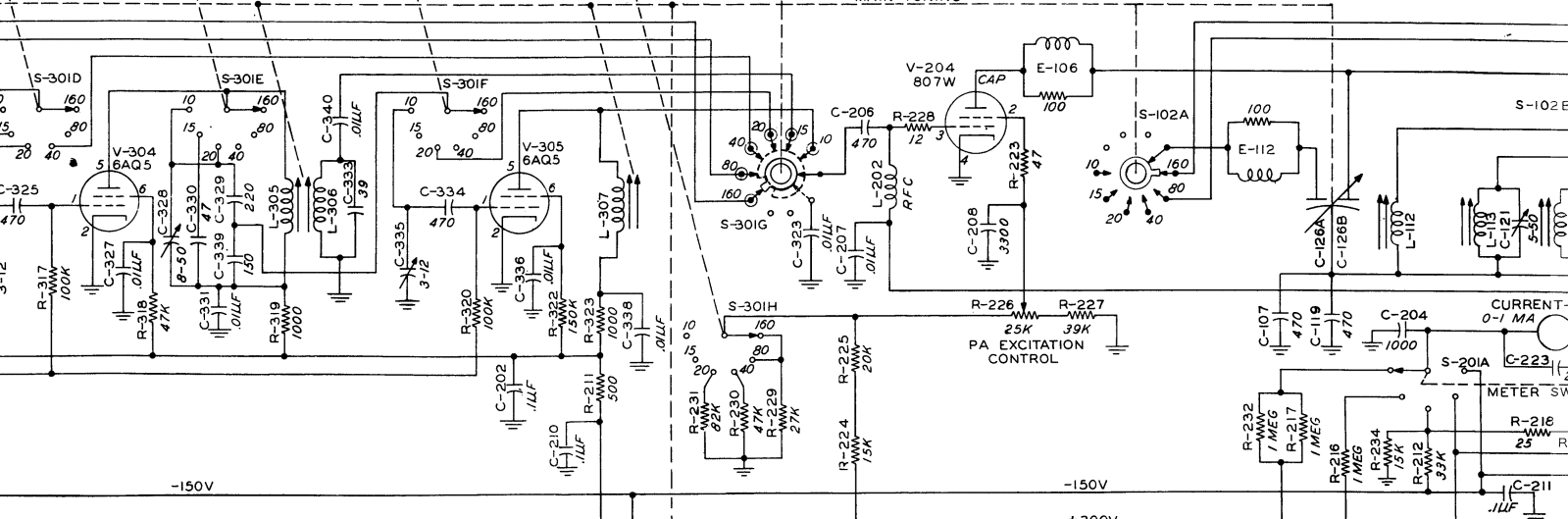
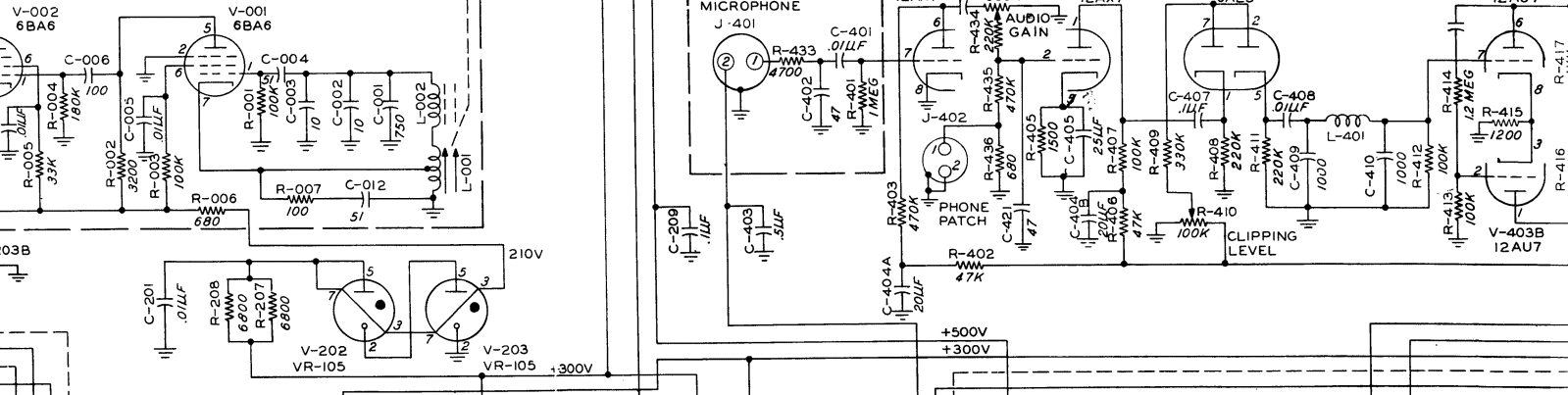


Figure 7-4. KW-1 Main Schematic

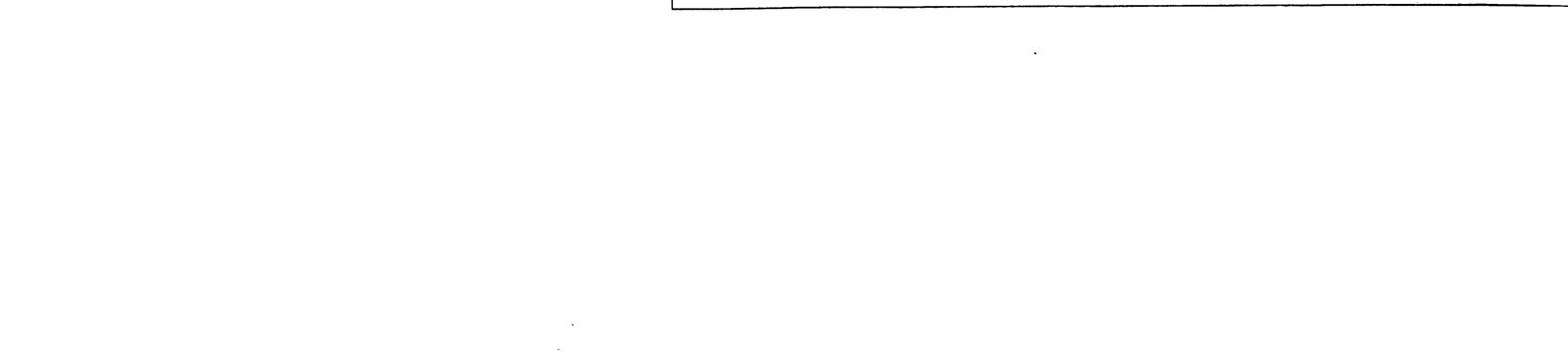
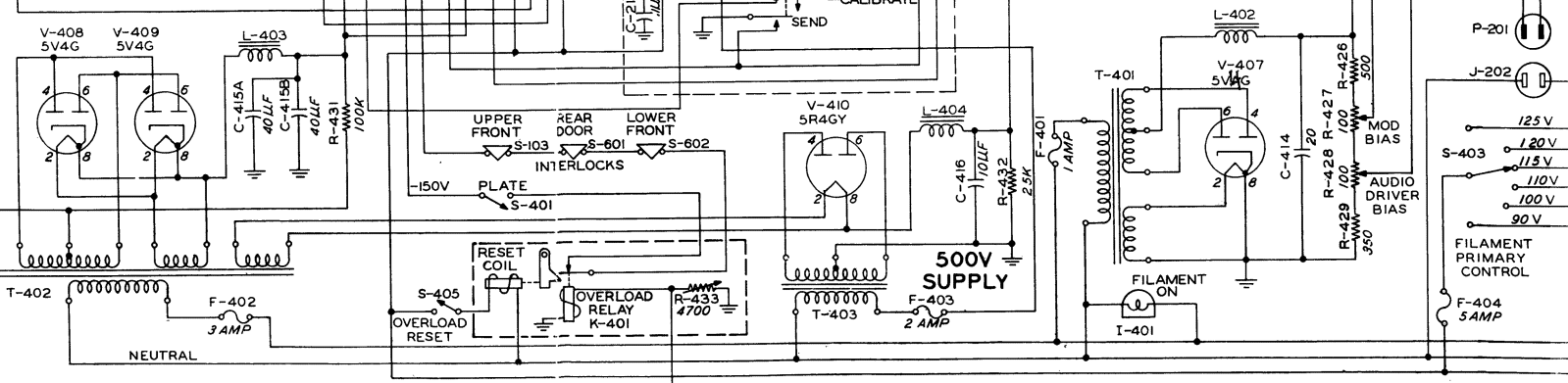
3RD MULTIPLIER 4TH MULTIPLIER RF DRIVER MAIN TUNING BAND SWITCHES

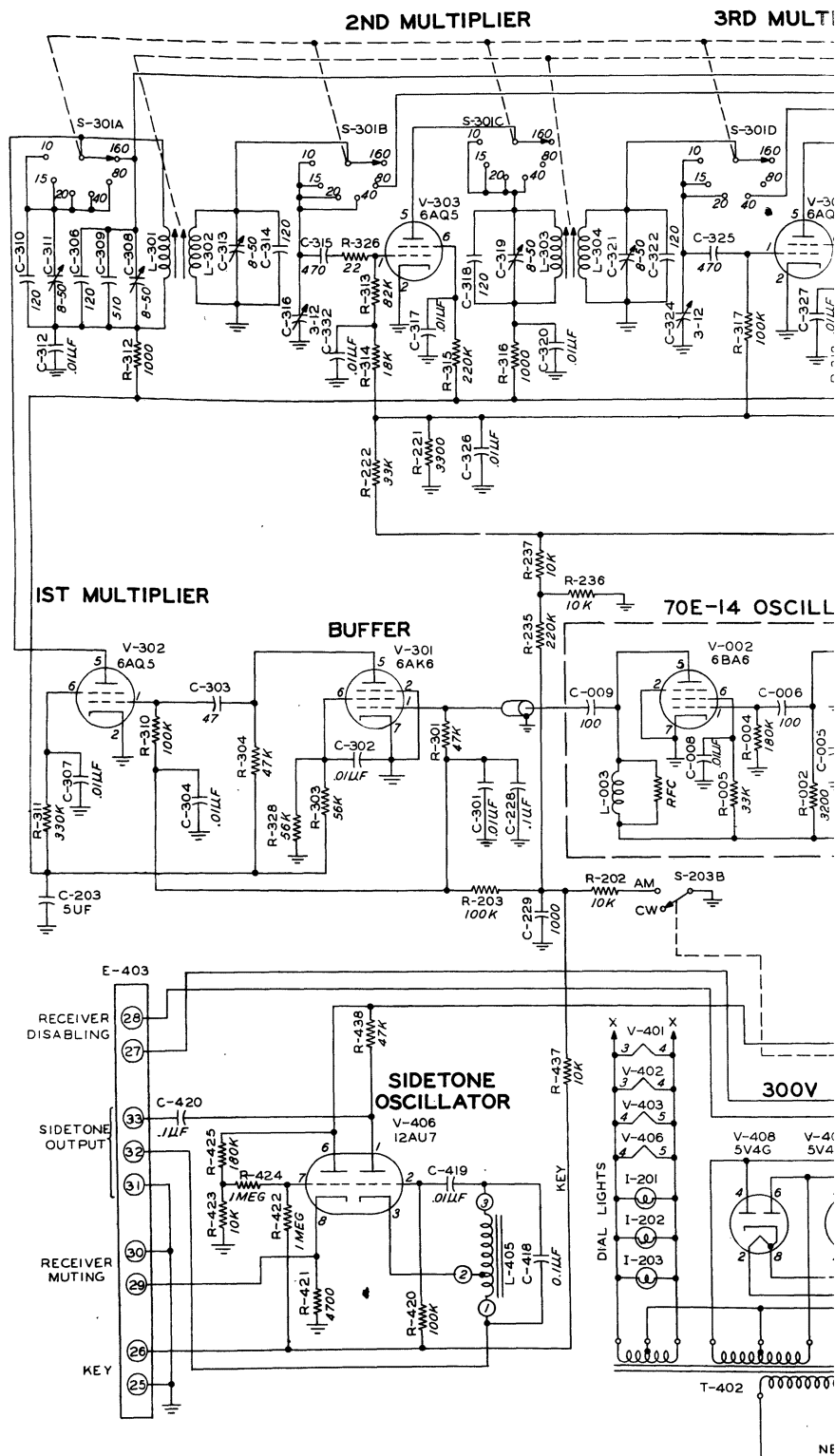


E-14 OSCILLATOR (1675-2050 KC) AF AMPLIFIER CLIPPER PHASE INVE

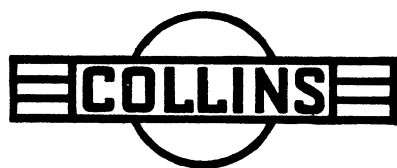


300V SUPPLY -150V SUPPLY 500V SUPPLY



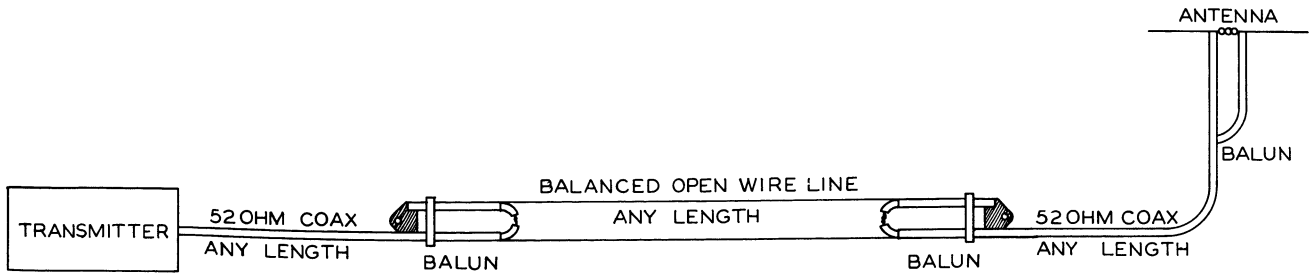


ANTENNAS
WITH
52 OHM COAXIAL FEED LINES

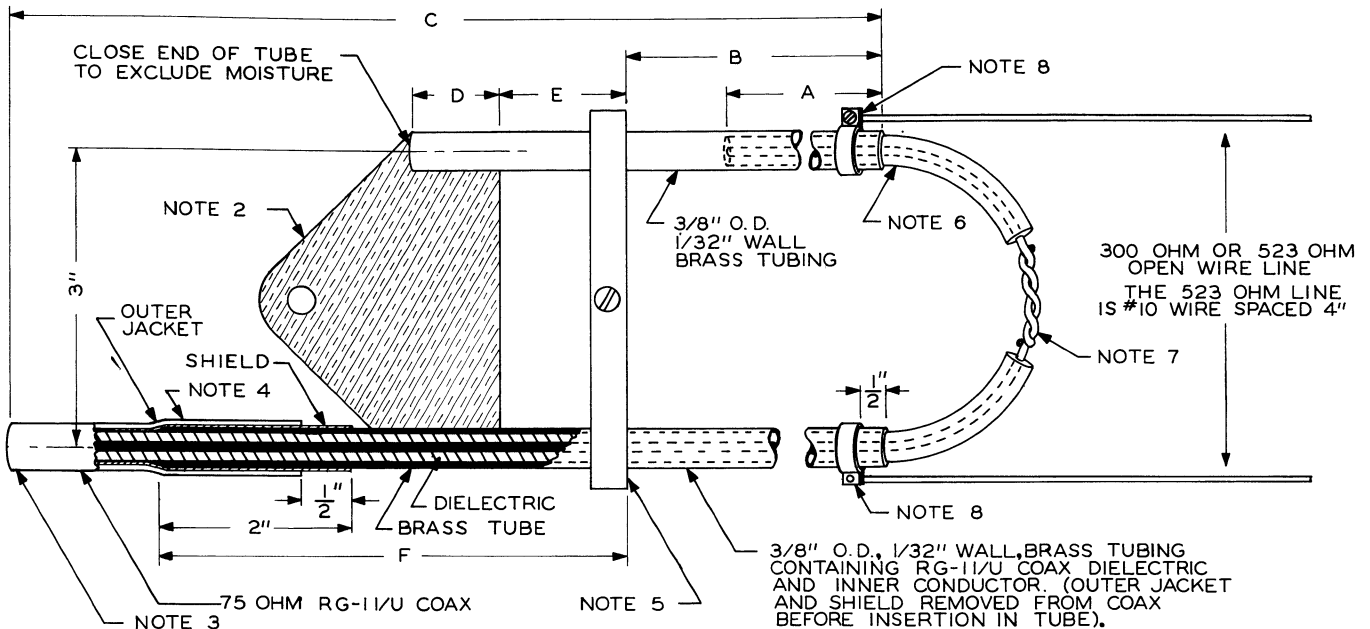


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Second Edition



THIS SYSTEM PERMITS USE OF A BALANCED OPEN WIRE LINE TO REDUCE LOSSES ON LONG TRANSMISSION LINES. CONSTRUCTION DETAILS OF THE UNBALANCED TO BALANCED IMPEDANCE MATCHING TRANSFORMER (BALUN) USED BETWEEN THE OPEN WIRE LINE AND THE 52 OHM RG-8/U COAXIAL CABLE ARE SHOWN BELOW.



NOTES:

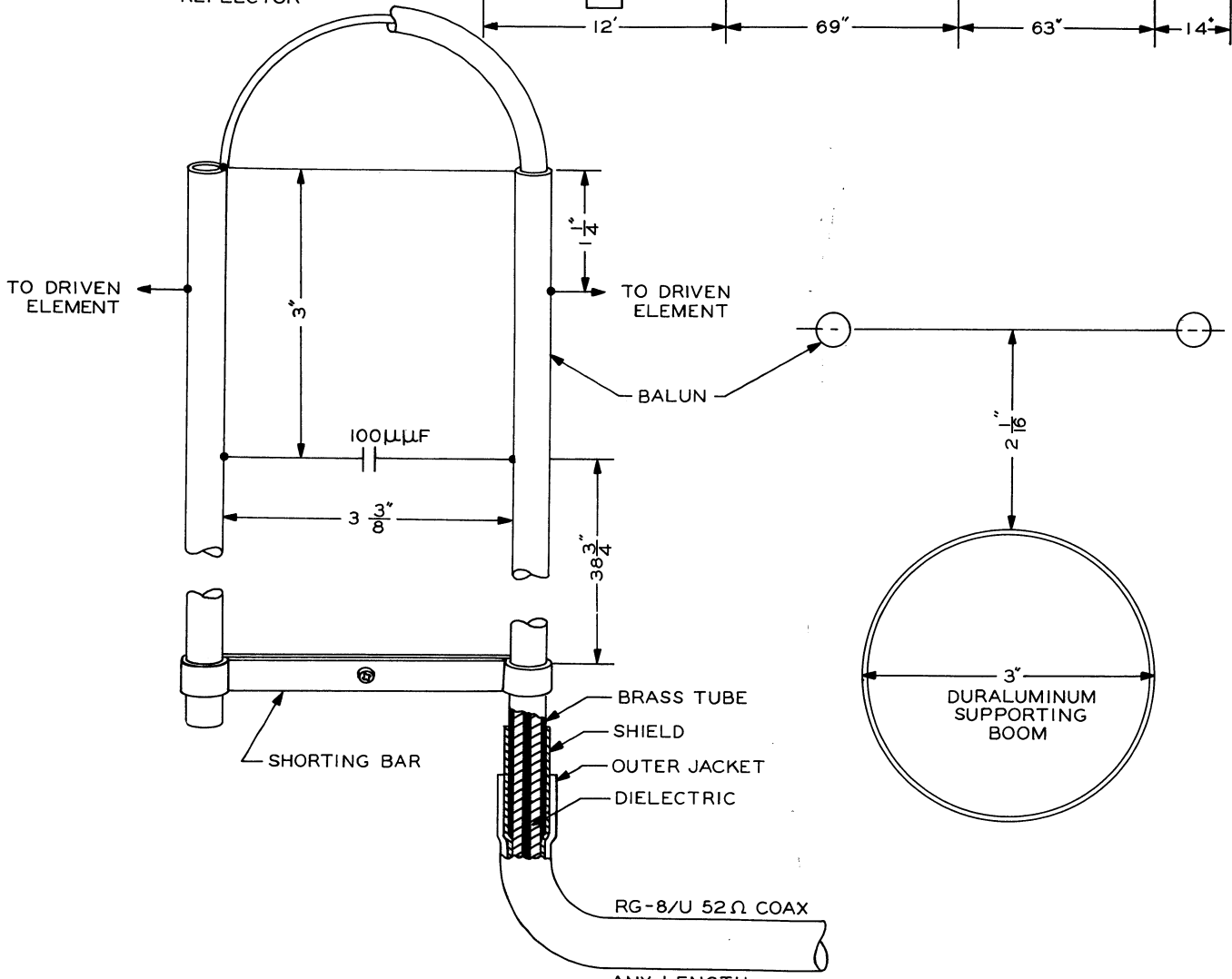
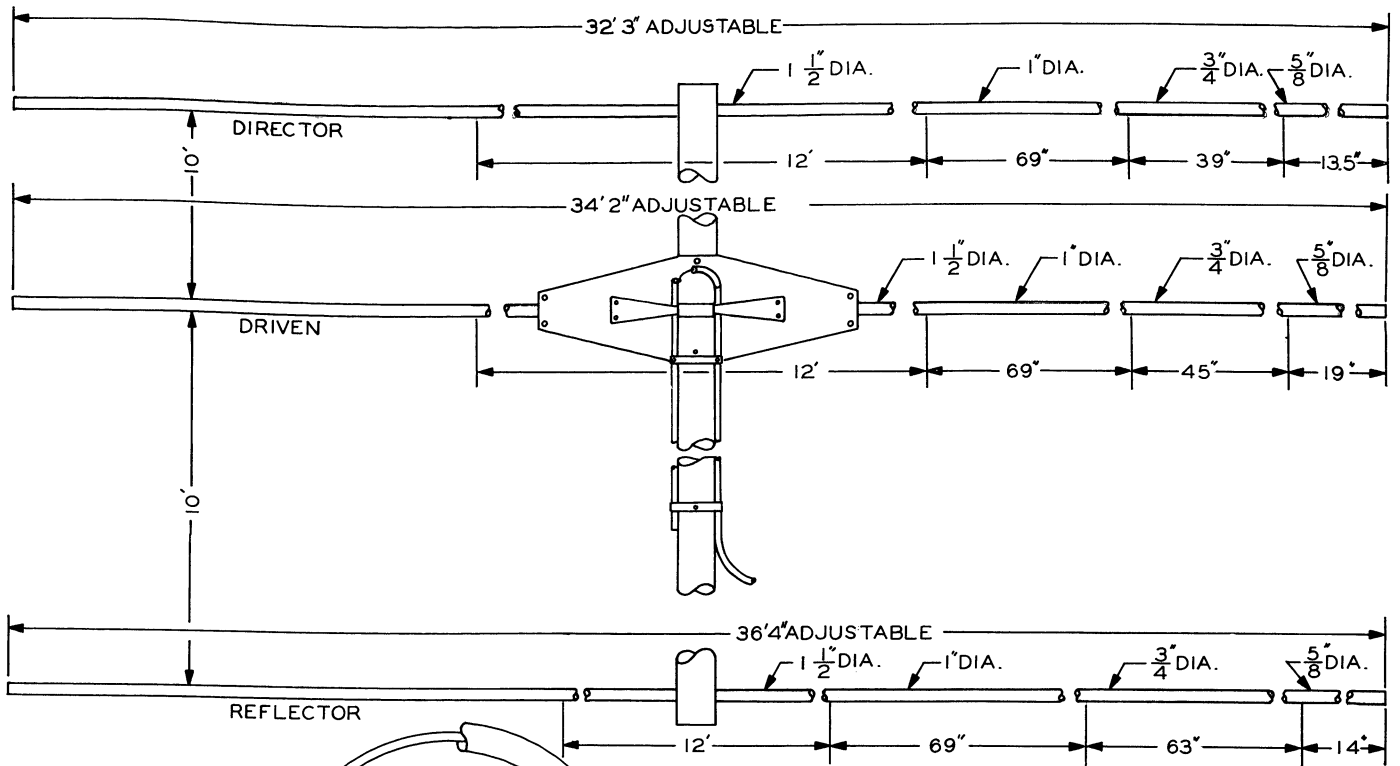
1.

FREQ. MC.	OPEN WIRE LINE IMPEDENCE	LENGTH - INCHES		
		A	B	C
27 TO 29.7	300 OHMS	15 3/8	38 1/4	69 5/8
27 TO 29.7	523 OHMS	10 5/8	44 1/2	69 5/8
14 TO 14.3	523 OHMS	21 1/4	92 1/4	139

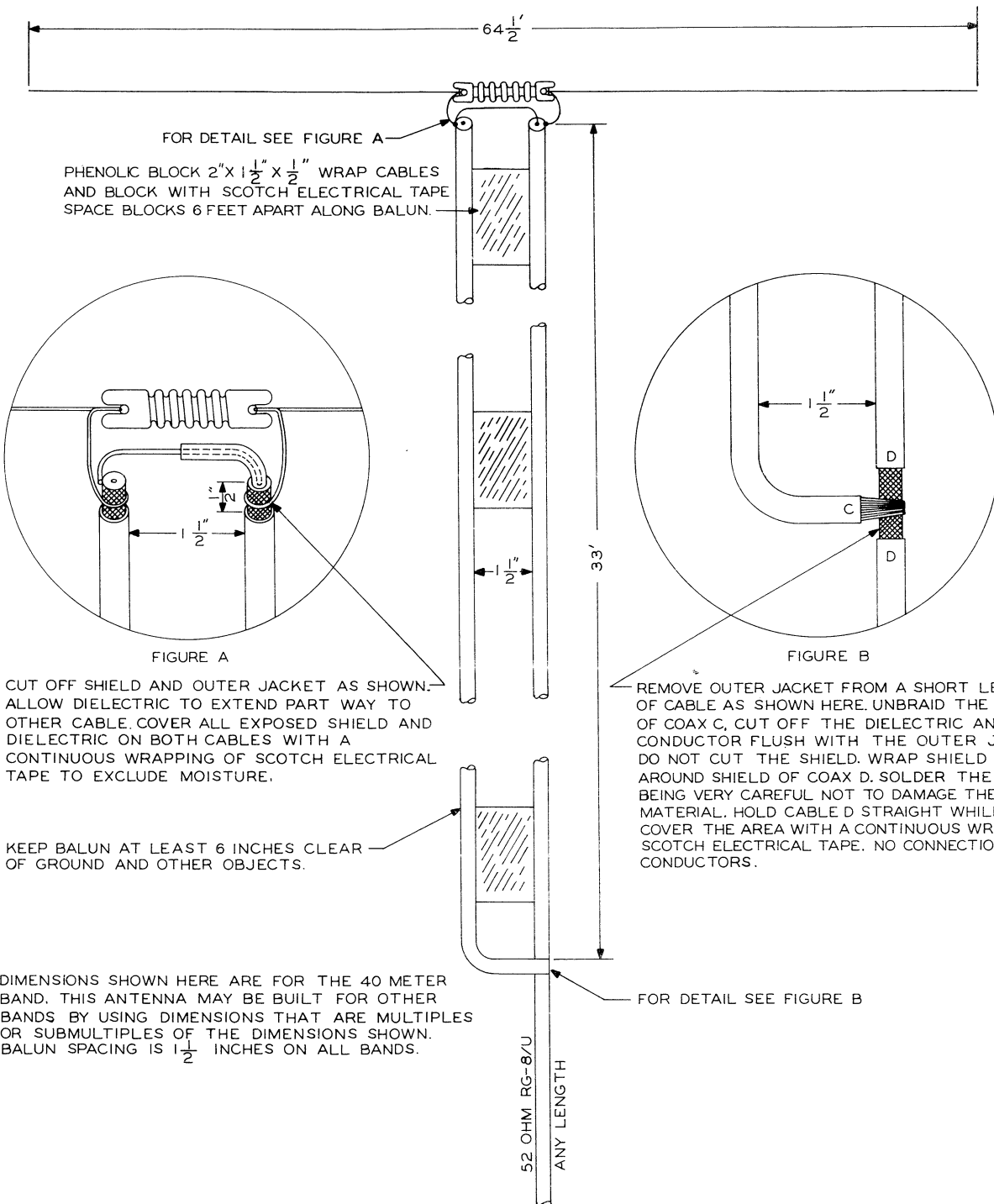
DIMENSIONS D, E, AND F ARE NOT CRITICAL AND MAY BE ADAPTED TO THE INDIVIDUAL INSTALLATION. DIMENSION D SHOULD BE LONG ENOUGH TO PERMIT SILVER SOLDERING BRASS PLATE AND TUBES TOGETHER. DIMENSION E SHOULD BE LONG ENOUGH TO PERMIT ADJUSTMENT OF THE SHORTING BAR. DIMENSION F SHOULD BE LONG ENOUGH TO PROVIDE SUFFICIENT OVERHANG FOR CONNECTING THE RG-11/U CABLE.

2. BRASS PLATE OF CONVENIENT SIZE SILVER SOLDERED TO THE TWO BRASS TUBES. PLATE MAY BE GROUNDED OR UNGROUNDED AND IS DESIGNED TO SECURE THE BALUN TO AN END SUPPORT.
3. ATTACH A COAX CONNECTOR HERE TO PERMIT ATTACHING A LENGTH OF 52 OHM RG-8/U COAX.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-11/U 75 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2 INCH SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. COVER THE AREA WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THIS SHORTING BAR SHOULD BE MOVABLE TO PERMIT ADJUSTING THE BALUN TO REDUCE THE OVERALL STANDING WAVE RATIO OF THE SYSTEM.
6. REMOVE THE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAX. INSERT THE PROPER LENGTH OF BARE DIELECTRIC INSIDE THE TUBE.
7. SOLDER INNER CONDUCTORS TOGETHER. COVER THE TUBE ENDS AND ALL OF THE CABLE BETWEEN WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
8. INSTALL A BRACKET FOR ATTACHING THE OPEN WIRE LINE. IF BRACKET IS SOLDERED, BE VERY CAREFUL TO AVOID OVERHEATING AND DAMAGING THE DIELECTRIC.

**BALUN WITH BALANCED OPEN WIRE LINE
FOR REDUCTION OF LOSSES ON LONG TRANSMISSION LINES.**



20 METER BEAM WITH SHORTENED UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM. GENERAL CONSTRUCTION IS THE SAME AS THE TEN METER BEAM.



HALF WAVE ANTENNA WITH QUARTER WAVE UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM

COLLINS RADIO COMPANY

MAIN PLANT:

855 35TH ST. N.E., CEDAR RAPIDS, IOWA

BRANCHES:

1937 IRVING BOULEVARD, DALLAS, TEXAS

11 WEST 42ND STREET, NEW YORK 18, N. Y.

2700 WEST OLIVE AVE., BURBANK, CALIF.

