COLLINS

732A

FM BROADCAST TRANSMITTER

INSTRUCTION BOOK

INSTRUCTION BOOK

for

732A FM BROADCAST TRANSMITTER

1000 WATTS

MANUFACTURED BY

COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA

520 9327 00

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GUARANTEE

This equipment is guaranteed against defects in material, workmanship or manufacture, for a period of one year from the date of delivery. Our obligation under this guarantee is limited to repairing or replacing any item which shall prove, by our examination, to be thus defective, provided the item is returned to the factory for inspection with all transportation charges paid. Before returning any item believed to be of defective material, workmanship or manufacture, a detailed report must be submitted to the company giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the company, detailed instructions as to how the equipment is to be returned will be issued. Do not return any material until instructed to do so by the company.

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REPLACEMENT OF PARTS

In case a replacement under the guarantee is desired, a full report must be submitted to the company. This report shall cover all details of the failure and must include the following information:

(A) Date of delivery of equipment.
(B) Date placed in service.
(C) Number of hours in service.
(D) Part number of item.
(E) Item number (obtain from Parts List or Schematic Diagram).
(F) Type number of unit from which part is removed.
(G) Serial number of unit.
(H) Serial number of the complete equipment.
(I) Nature of failure.
(J) Cause of failure.
(K) Remarks.

When requisitioning replacement parts, the following information must be furnished:

(A) Quantity required.
(B) Part number of item.
(C) Item number (obtain from Parts List or Schematic Diagram).
(D) Type number of unit.
(E) Serial number of unit.
(F) Serial number of equipment.

NOTE: Blank Service Report form will be found in the appendix of this instruction book.

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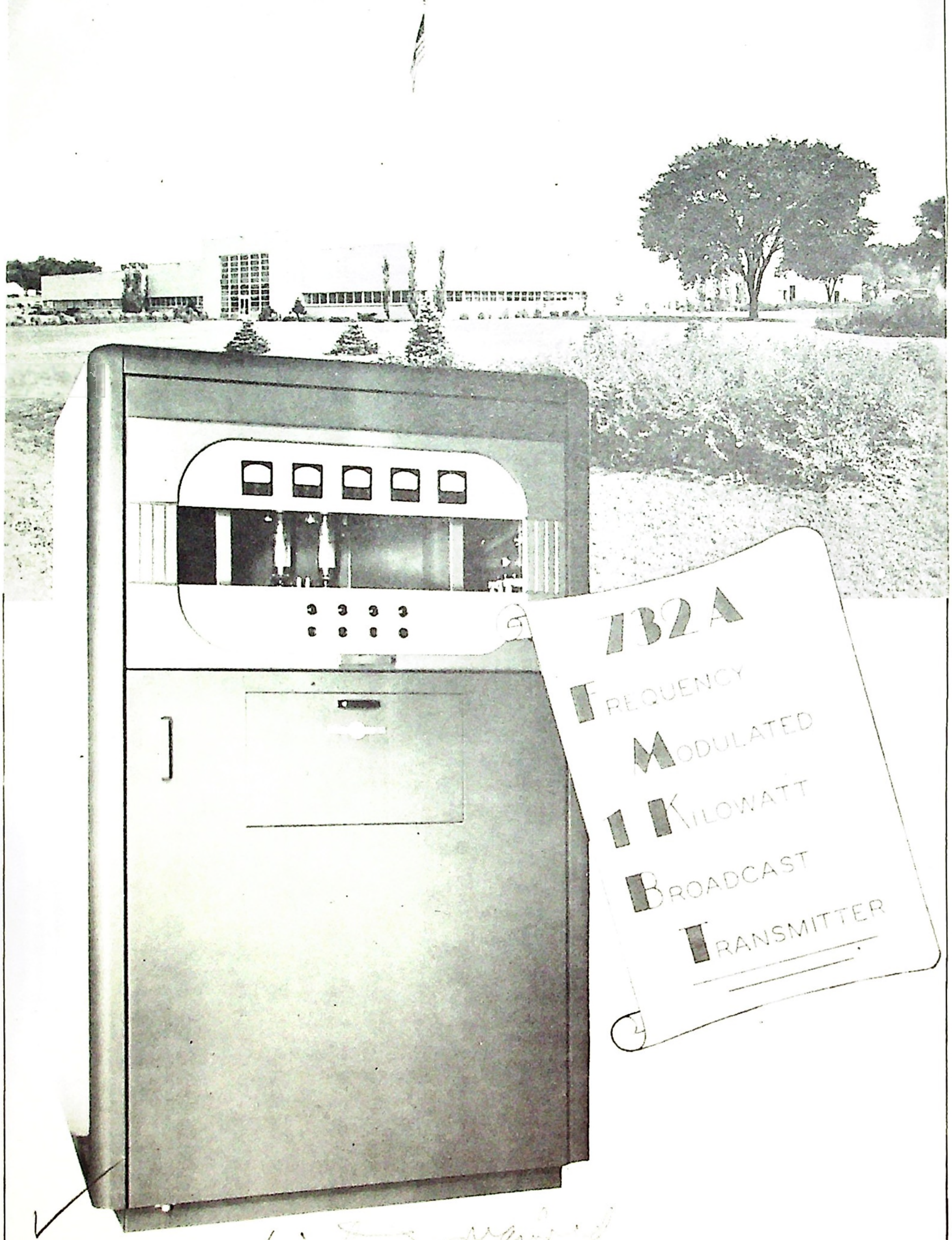

732A

FREQUENCY MODULATED 1 KILOWATT BROADCAST TRANSMITTER

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SECTION 1

GENERAL DESCRIPTION

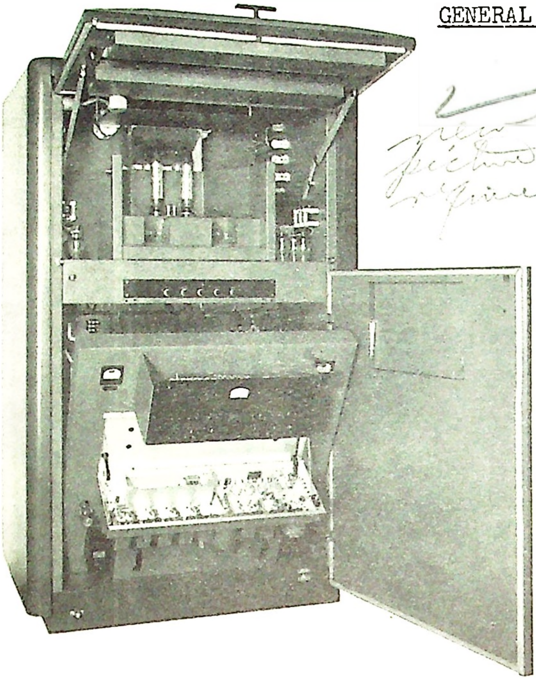

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Figure 1-1 732A Front View

1.1. GENERAL.

The Collins 732A Transmitter has been designed for FM broadcast service. The new Phasitron modulator circuit is employed, eliminating as many as ten tubes compared with former circuits, and resulting in far greater simplicity and operating reliability. Direct crystal control of the carrier frequency provides high stability without complexity of apparatus. A frequency multiplication of only 486 produces the carrier frequency. No frequency conversion or reference mechanisms are necessary. This new circuit, with fewer stages, fewer components, and greater operation simplicity assures utmost dependability with a minimum of maintenance.

1.2. MECHANICAL DESCRIPTION.

The transmitter is housed in a single cabinet of neatly styled appearance. The complete equipment occupies a space 37-1/2" deep, by 49-3/4" wide, by 79-5/16" high and weighs approximately 1900 lbs. The arrangement of the transmitter is such that all tubes are accessible from the front. Full vision of the power amplifier, intermediate amplifier and mercury-vapor rectifier tubes is provided by means of a glass window in the top door. For service and maintenance purposes, full length hinged doors are provided on the rear. Two hinged doors are provided on the front of the cabinet. The top door opens upward so as to gain access to the 4X500F power amplifier

4-400

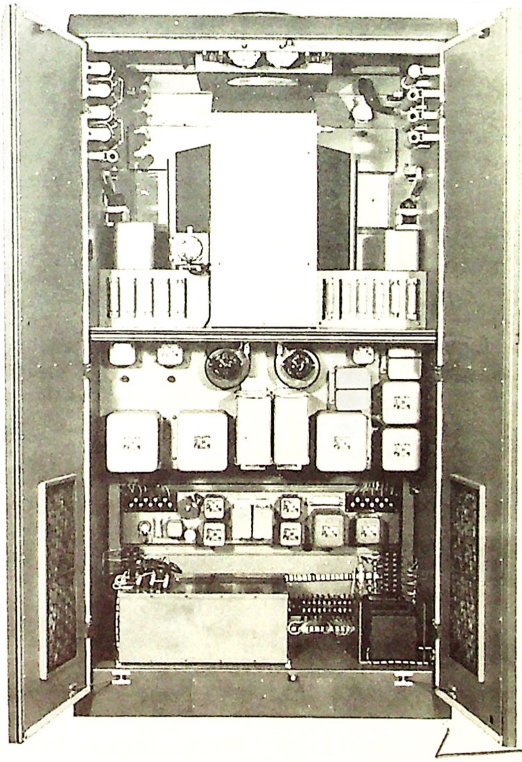


Figure 1-2 732A Rear View

tubes, the 866A rectifier tubes and the 829B multiplier tubes. The lower door allows access to the exciter and the control panel. With the lower door open, the bottom of the exciter can be viewed by loosening the two wing fasteners at the top corners of the exciter and while supporting the unit, allowing it to move forward until the bottom of the exciter is exposed. The whole vertical chassis will come forward when the two wing fasteners on the control panel are released. These features incorporated in the 732A FM transmitter, make it an outstanding unit for simplicity in servicing and maintenance. All doors, except the lower front door, are provided with high voltage shorting switches and primary interlocking switches for the protection of maintenance personnel.

The ventilating blowers are located just beneath the tuned elements of the final amplifier. This allows the circulating air to be forced thru the hollow tuned element and to be blown on the 4X500F final amplifier tubes. The air is drawn in through spun glass filters located in the rear doors of the cabinet.

Three tuning motors are provided for tuning the power amplifier and adjusting the r-f lines. One motor tunes the power amplifier by positioning the shorting bar on the parallel lines in the plate circuit. The second motor varies the degree of coupling between the amplifier output circuit and the r-f line (or transmission line). The third motor operates a variable capacitor in the antenna circuit which provides a means of resonating the r-f line.

1.3. ELECTRICAL DESCRIPTION.

1.3.1. Power Supply. - Three power supplies are employed in this transmitter to provide the necessary direct current voltages for application to the plates and screens of the transmitting tubes. The low voltage supply uses a 5R4GY rectifier tube and two VR-105 regulator tubes to supply voltage to the exciter and the audio tubes and a selenium rectifier to supply direct current for the filament of the 2H21 Phasitron tube.

The medium voltage supply uses two 866A rectifier tubes and supplies voltage to both 829B multiplier tubes and to the screens of the 4X500F power amplifier tubes.

The high voltage power supply employs a 3φ power transformer with a Y secondary and the primary delta connected. Three 866A rectifier tubes are used. The output voltage is applied to the plates of the 4X500F power amplifier tubes.

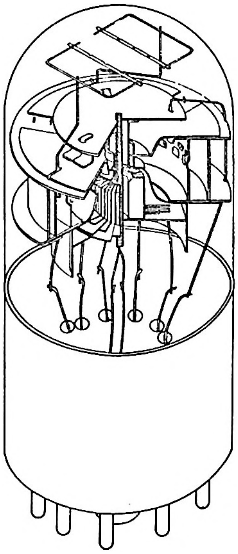


Figure 1-3 GL-2H21 Phasitron Tube

1.3.2. Audio System. - The audio system utilizes a push pull amplifier stage employing 6SJ7 triode connected tubes. The input is applied to the 6SJ7 grids through a plug-in attenuator or pre-emphasis network and an input transformer. The output of the audio system is connected to the Phasitron field coil through a transformer.

1.3.3. Modulation System. - The GL-2H21 is used as a phase-modulator in the 732A FM transmitter. As a modulator tube the GL-2H21 makes possible the introduction of comparatively wide phase excursions at audio frequency rates in a crystal controlled radio frequency carrier. The modulating circuit audio response is such that the tube has a wide-swing frequency-modulated output.

The outstanding features which this tube contributes to FM transmission are:

1. Direct crystal control using a single crystal.

2. Modulation independent of frequency control.

3. Low distortion.

4. Low noise level.

5. Simplicity of circuits and circuit alignment.

1.3.4. Exciter. - The FM exciter includes a 6SJ7 tuned plate crystal oscillator. A low temperature coefficient quartz crystal provides a high degree of frequency stability. A 6SJ7 tube is employed as a buffer following the crystal oscillator to drive the tuned circuit which supplies three-phase r-f to the Phasitron tube. The audio voltage is applied to the Phasitron tube through the field coil. The r-f stage following the Phasitron tube is a 6SJ7 tube which functions as a doubler. Following the doubler are a 6SJ7 operating as a tripler, a 6SJ7 operating as a second tripler, a 6SJ7 amplifier and a 6V6 tripler.

1.3.5. Final R-F Circuits. The final r-f circuits consists of two 829B tubes operating as triplers supplying r-f voltage to the grids of the 4X500F power amplifier tubes. The output circuit of the 4X500F's is a parallel line system. A Faraday shield is mounted between the parallel lines and the antenna coupling link.

1.4. <u>REFERENCE DATA</u>.

1.4.1. Frequency Range. - The 732A FM Transmitter is designed to operate in the 88 to 108 mc FM broadcast band. It is possible to operate this equipment on any frequency within this band.

1.4.2. Power Output. - 250 watts to 1000 watts continuous duty operation.

1.4.3. Load. - 40 to 80 ohm coaxial transmission line, power factor 0.866 to 1.0 (other arrangements are available).

1.4.4. Stability. - Better than ±250 cps.

1.4.5. Swing. - 0 to 133% modulation.

1.4.6. Frequency Response. - Flat within 1 db from 50 cps to 15,000 cps.

1.4.7. Pre-Emphasis. - Standard 75 microsecond pre-emphasis network to be supplied for mounting in transmitter, or in any convenient location where transmitter is to be fed by compression amplifier. When mounted externally, the network and its associated socket require a mounting space 3" by 2" by 5" high.

1.4.8. Distortion. - At 100% modulation, 50 cps to 15,000 cps, less than 1.5%. Measurements in accordance with FCC requirements.

1.4.9. Audio Input Level. - +12 dbm, ±2 dbm, for 100% modulation at 400 cps.

1.4.10 Audio Input Impedance. - 600 ohms and 150 ohms*, balanced to ground.

1.4.11. Noise Level. - Frequency Modulation: Better than 65 db below 100% modulation. Amplitude Modulation: Better than 50 db below a level corresponding to 100% amplitude modulation.

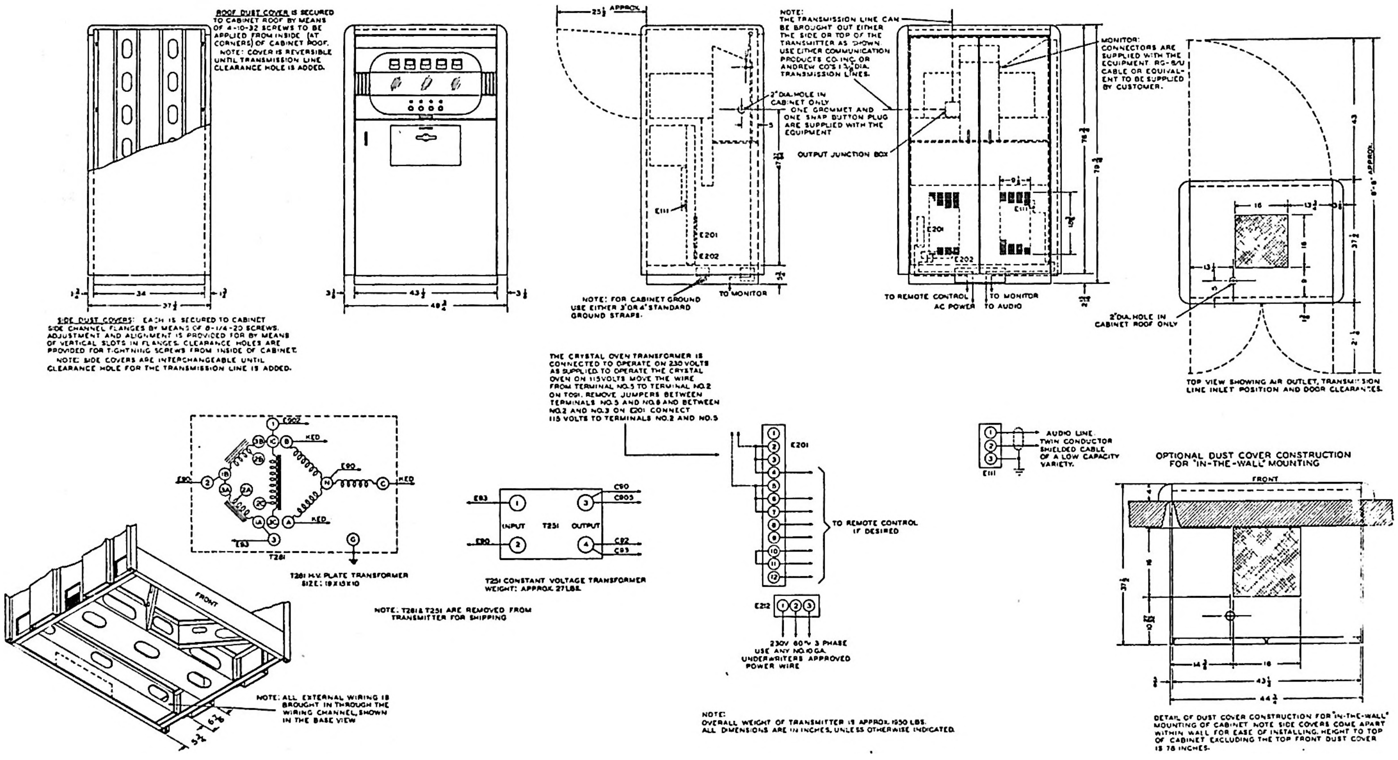
1.4.12. Line Voltage. - 208/230 volts three phase at 60 cycle normal, 50 cycles on special order. Voltage limits, 190 and 250 volts.

1.4.13. Power Demand. - 3.0 KVA, 90% P.F., at maximum rated output.

1.4.14. Vacuum Tube Complement. - The vacuum tubes employed in the 732A equipment are listed below:

QTY.	TUBE TYPE	FUNCTION
1	6SJ7	Crystal Oscillator
1	6SJ7	Buffer
1	GL-2H21	Phase Modulator
1	6SJ7	Doubler
2	6SJ7	Triplers
1	6SJ7	Amplifier
1	6V6	Tripler
2	6SJ7	Audio Amplifiers
2	829B	Triplers
2	4X500F	Power Amplifiers
1	5R4-GY	L.V. Rectifier
2	OC3/VR105	Voltage Regulator
2	866A	Int. V. Rectifiers
3	866A	H.V. Rectifiers

* A special pre-emphasis network is required if 150 ohm input is desired.



ROOF DUST COVER IS SECURED TO CABINET ROOF BY MEANS OF 4-10-32 SCREWS TO BE APPLIED FROM INSIDE (AT CORNERS) OF CABINET ROOF.
NOTE: COVER IS REVERSIBLE UNTIL TRANSMISSION LINE CLEARANCE HOLE IS ADDED.

SIDE DUST COVERS: EACH IS SECURED TO CABINET SIDE CHANNEL FLANGES BY MEANS OF 8-1/4-20 SCREWS. ADJUSTMENT AND ALIGNMENT IS PROVIDED FOR BY MEANS OF VERTICAL SLOTS IN FLANGES. CLEARANCE HOLES ARE PROVIDED FOR TIGHTNING SCREWS FROM INSIDE OF CABINET.
NOTE: SIDE COVERS ARE INTERCHANGEABLE UNTIL CLEARANCE HOLE FOR THE TRANSMISSION LINE IS ADDED.

NOTE: FOR CABINET GROUND USE EITHER 3"OR 4" STANDARD GROUND STRAPS.

NOTE:
THE TRANSMISSION LINE CAN BE BROUGHT OUT EITHER THE SIDE OR TOP OF THE TRANSMITTER AS SHOWN. USE EITHER COMMUNICATION PRODUCTS CO. INC. OR ANDREW CO'S 1 5/8" DIA. TRANSMISSION LINES.

2" DIA. HOLE IN CABINET ONLY
ONE GROMMET AND ONE SNAP BUTTON PLUG ARE SUPPLIED WITH THE EQUIPMENT

MONITOR:
CONNECTORS ARE SUPPLIED WITH THE EQUIPMENT. RG-8/U CABLE OR EQUIVALENT TO BE SUPPLIED BY CUSTOMER.

2" DIA. HOLE IN CABINET ROOF ONLY

TOP VIEW SHOWING AIR OUTLET, TRANSMISSION LINE INLET POSITION AND DOOR CLEARANCES.

THE CRYSTAL OVEN TRANSFORMER IS CONNECTED TO OPERATE ON 230 VOLTS AS SUPPLIED. TO OPERATE THE CRYSTAL OVEN ON 115VOLTS MOVE THE WIRE FROM TERMINAL NO.5 TO TERMINAL NO.2 ON T001. REMOVE JUMPERS BETWEEN TERMINALS NO.5 AND NO.8 AND BETWEEN NO.2 AND NO.3 ON E201 CONNECT 115 VOLTS TO TERMINALS NO.2 AND NO.5

AUDIO LINE
TWIN CONDUCTOR SHIELDED CABLE OF A LOW CAPACITY VARIETY.

OPTIONAL DUST COVER CONSTRUCTION FOR "IN-THE-WALL" MOUNTING

T281 H.V. PLATE TRANSFORMER
SIZE: 19X15X10

T251 CONSTANT VOLTAGE TRANSFORMER
WEIGHT: APPROX. 27LBS.

NOTE: T281 & T251 ARE REMOVED FROM TRANSMITTER FOR SHIPPING

230V 60~ 3 PHASE
USE ANY NO.10 GA. UNDERWRITERS APPROVED POWER WIRE

NOTE: ALL EXTERNAL WIRING IS BROUGHT IN THROUGH THE WIRING CHANNEL, SHOWN IN THE BASE VIEW

NOTE:
OVERALL WEIGHT OF TRANSMITTER IS APPROX. 1950 LBS.
ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE INDICATED.

DETAIL OF DUST COVER CONSTRUCTION FOR "IN-THE-WALL" MOUNTING OF CABINET. NOTE SIDE COVERS COME APART WITHIN WALL FOR EASE OF INSTALLING. HEIGHT TO TOP OF CABINET EXCLUDING THE TOP FRONT DUST COVER IS 78 INCHES.

Figure 2-1 732A Transmitter Installation

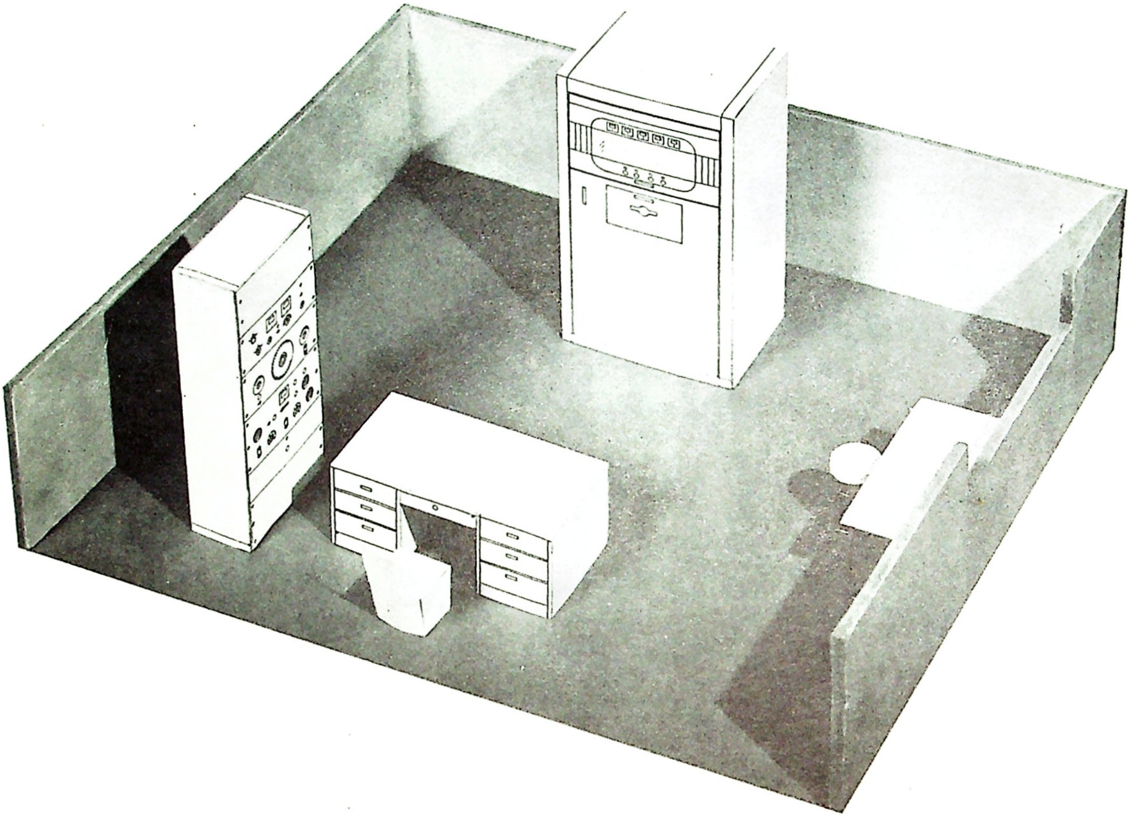


Figure 2-2 Typical Installation

2.1. PRELIMINARY.

2.1.1. Uncrating. -- Caution should be exercised when uncrating to avoid damaging the equipment. A nail puller should be used to remove the nails instead of a hammer or bar. All units should be inspected carefully. Inspect cables and wiring and make sure that all cable connections are tight. Inspect each unit for loose screws and bolts. Check all controls such as switches, dials, etc., for proper operation as far as can be determined without the application of power. All claims for damage should be filed promptly with the transportation company.

2.2. INSTALLATION PROCEDURE.

2.2.1. Location of Transmitter. - A typical station layout is shown in figure 2-2. This may be used as a pattern for your station. In any arrangement, the transmitter should be placed so that there is a minimum clearance of 30 inches at the rear of the transmitter to permit free circulation of air. A minimum clearance of 43 inches is required in front of the transmitter to allow the doors to be opened.

2.2.2. Setting Up Transmitter. - The transmitter is shipped with the heavier iron core units as well as some of the more fragile components removed from the cabinet. It is recommended that no attempt be made to place these components in position until the cabinet has been permanently placed on the transmitting room floor.

A comparatively simple arrangement to accommodate the wiring at the base of the transmitter may be constructed by assembling four two-by-fours to provide a base for the transmitter. After the two-by-fours are in place they may be painted for appearance. This kind of a base provides a mop board and prevents scuffing of the paint on the bottom of the equipment.

There are several possible ways to make connections to the transmitter. We suggest one method that is applicable to the equipment. A trench of a tee shape can be used. A 1" conduit is required for the power feed line; a 1/2" or 1" conduit is required if it is desired to remote control any of the circuits (the size of the conduit depends upon the number of control wires desired); a 1/2" conduit is required for the audio feed line and a 1/2" conduit for the monitor feed line.

All four conduits will terminate under the transmitter. The conduits must be bonded to the transmitter cabinet in one or two places with copper ribbon. Pull the wires through the conduits. Remove the plate that is located at the bottom of the transmitter. The removal of this plate gives access to the conduits and the wires. The wires can then be "snaked" into the channel and up through the bottom of the transmitter. After the wires have been brought up into the transmitter proper they can be connected to the terminals and connectors. (Refer to figure 2-1.)

(a) Power Connections. - This equipment requires a 230 volt, 60 cycle, three phase line for its operation. It is recommended that number 10 wire or larger be used for this line. Connect the a-c line to terminals 1, 2 and 3 on terminal strip E212.

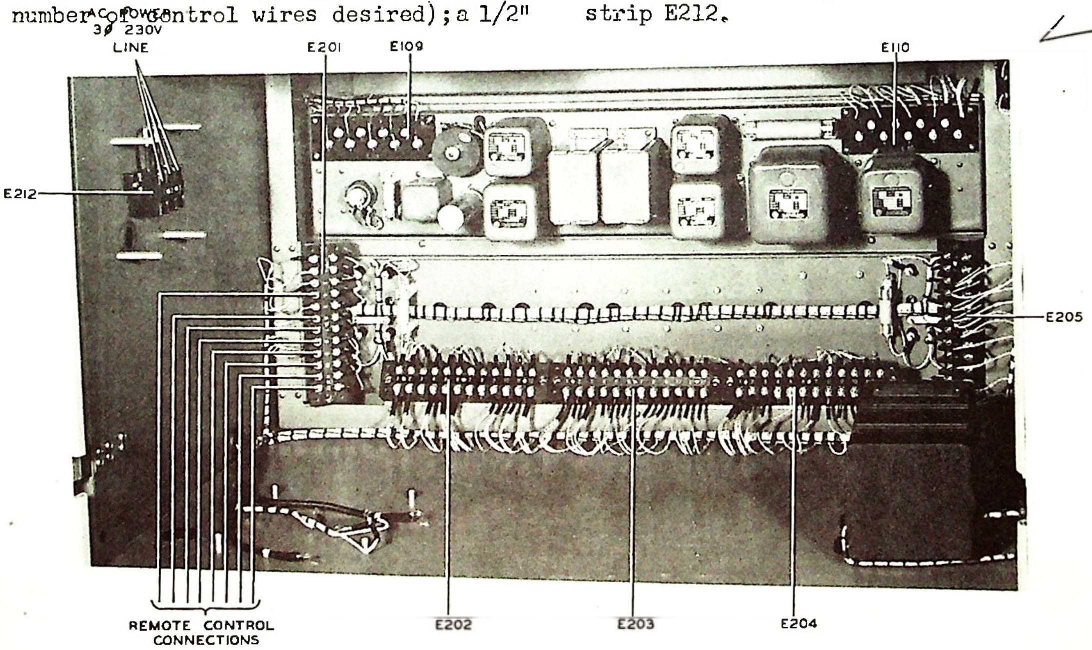


Figure 2-3 Terminal Board Assembly (Rear View)

(b) Audio Line. (Refer to figure 2-4) A two wire shielded cable of a low capacity variety is required for the audio line. The terminal strip for this line is located on the exciter chassis. To gain access to the audio terminal strip, E111, the exciter chassis must be lowered forward by releasing the wing fasteners in the upper right and left hand corners of the exciter chassis. Viewing the chassis from the bottom, the terminal strip, E111, will be found at the left rear. The audio cable is brought through the hold indicated in figure 2-1 and attached to terminals 1, 2 and 3 on E111. Terminals 1 and 2 are the audio terminals and number 3 terminal is ground. When the connections have been made the exciter can be returned to its operating position and fastened.

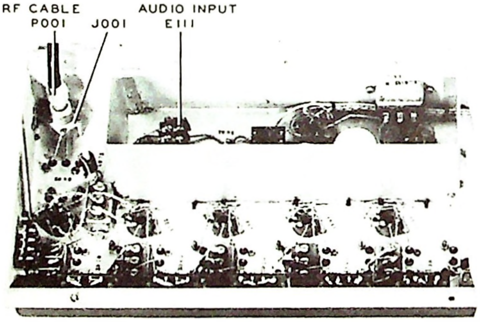


Figure 2-4 Exciter and Audio Chassis

(Bottom View)

(c) Monitor Feed. (Refer to figure 2-5). - The coaxial wall mounting connector J202 for the monitor line will be found on the right side of the r-f compartment as viewed from the rear of the transmitter. A coaxial connector or plug is supplied for use with the wall connector J202. An RG-8/U coaxial cable is recommended for the monitoring cable although most any type of HF coaxial cable can be used. From the conduit to the coaxial wall connected a coaxial cable approximately 10 feet long will be required. Refer to figure 2-1 for the routing of the cable.

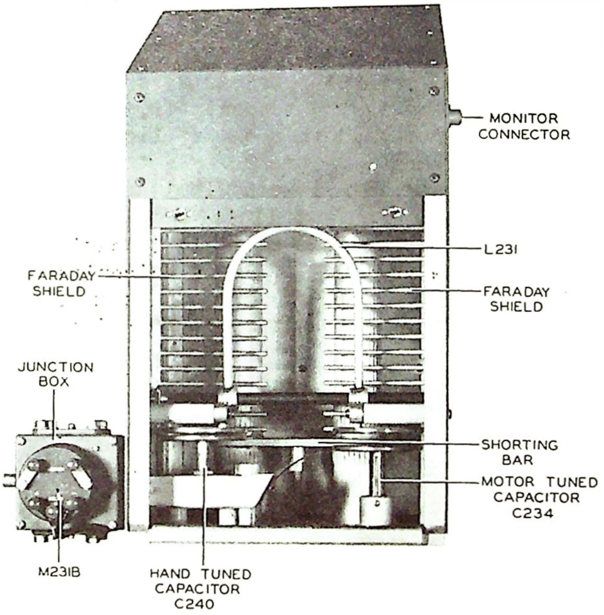


Figure 2-5 RF Output Assembly

DO NOT COUPLE THE MONITORING EQUIPMENT TO THE TRANSMITTER UNTIL ALL R-F TUNING ADJUSTMENTS HAVE BEEN COMPLETED. REFER TO PARAGRAPH 2.13.

(d) Crystal Oven. - It is usually desirable to leave the crystal oven on continuously to provide an even temperature and thus assure good frequency stability at all times. When operating the crystal oven continuously, it may be desirable to run it on a 115 volt line rather than the 230 volt line to which the oven transformer is connected as supplied. The transformer (T091) that supplies the voltage for the heater oven is equipped with a 115 volt tap. By moving the wire from terminal No. 5, which is the 230 volt tap, to terminal No. 2 on transformer T091 and removing the jumpers between terminals 5 and 6 and terminals 3 and 2 on terminal strip E201, the oven circuit will be connected for 115 volt operation. The 115 volt external connection should be made to terminals 2 and 5 on Terminal strip E201.

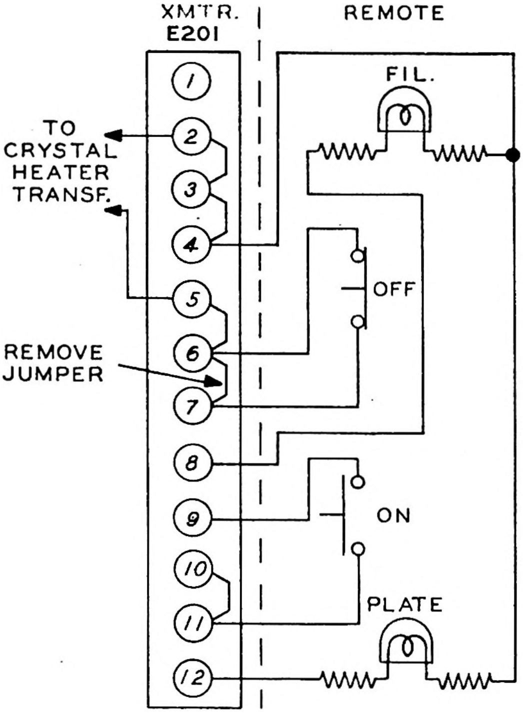


Figure 2-6 Remote Control Circuits

2.3. REMOTE CONTROL WIRES.

It may be desired to connect remote control wires from the transmitter to another operating position. The following circuits may be remotely controlled:

2.3.1. Start Button. (Refer to figure 2-6). - The start circuits may be remotely controlled by making connections to terminals 11 and 9 on terminal strip E101. The start switch should be a momentary make type, one normally open circuit, Collins Part Number 260 0355 00. When this remote switch is pressed it turns on the complete transmitter. The FILAMENT pilot light will come on immediately and the PLATE pilot light will come on as soon as the time delay relays have operated. When the PLATE pilot light comes on at the remove position, it does not mean that the transmitter is on the air. Circuit breakers S251, S266, S273, S281, S274 and S282 on the control panel must be in the ON positions. If the circuit breaker S282, PA PLATE, is turned OFF or is in the OFF position when the remote button is pressed, the PLATE pilot light on the transmitter proper will not light or will go off.

2.3.2. Stop Button. - The stop circuits may be remotely controlled by making connections to terminals 6 and 7 on terminal board E201. The stop switch should be a push button type, one normally closed circuit, Collins Part Number 260 0352 00. When the stop button is pressed it turns off the complete transmitter, including the filaments.

2.3.3. Filament Pilot Light. - The remote filament pilot light should be connected to terminals 8 and 4 on terminal strip E201.

2.3.4. Plate Pilot Light. - The remote plate pilot light should be connected

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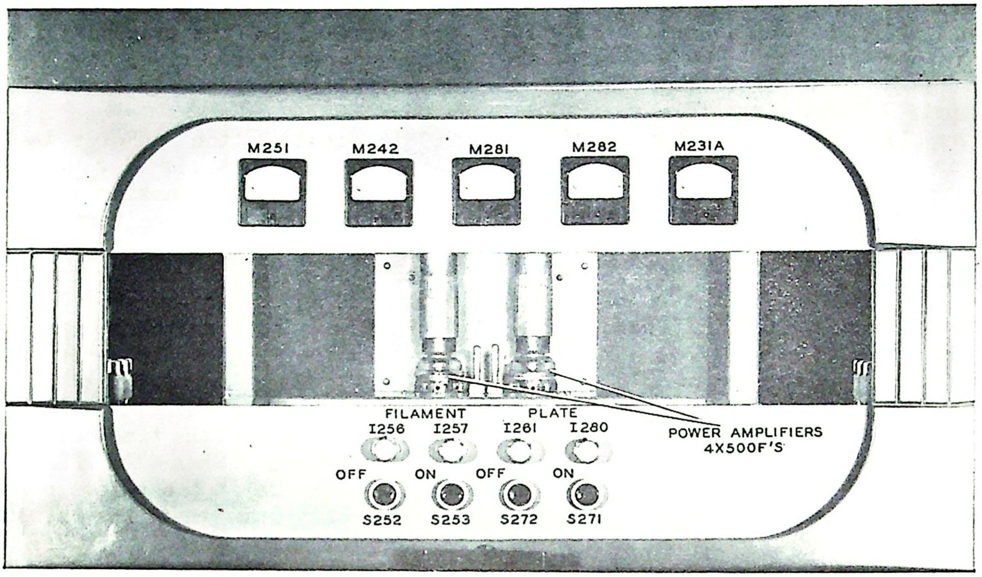

Figure 2-7 Upper Front Door

to terminals 4 and 12 on terminal strip E201.

2.4. ANTENNA TERMINATION. (Refer to figures 2-1 and 2-5.)

Connect the 732A Transmitter to the antenna by means of a concentric transmission line. The transmission line may be brought out the side or top of the cabinet. The junction box is designed to fit standard RMA 1-5/8" coaxial line. If an antenna is used that has no d-c path to ground, some means of leakage or drain to ground should be provided.

2.5. ASSEMBLY OF TRANSMITTER DUST COVERS.

After all necessary wiring has been installed, the dust covers may be fastened in place. The bolts which hold the retaining strip on the front edge of the cabinet should be loosened so that the front edge of the dust cover assembly can be slid under the strip. Holes in the cabinet walls are provided so that the screws which hold the side covers in place may be tightened from the inside of cabinet.

2.6. CONTROLS.

2.6.1. General. - The 732A Transmitter is operated and adjusted by controls located on the control panel. The control panel is located directly behind the small access door in the center of the cabinet. Four push buttons and four pilot lights are located above this control panel, on the front of the upper door.

The control panel includes the following controls:

INT. SELECTOR - switch (S242)
LINE FIL. - switch (S256)
EXCITER - meter (M241)
TUNING - switch (S291)
TUNING SELECTOR - switch (S292)
FILAMENT - circuit breaker (S251)
EXCITER - circuit breaker (S266)
INT. PLATE - circuit breaker (S273)
SELECTOR - switch (S241)
PA PLATE - circuit breaker (S281)
INT. TUNE - circuit breaker (S274)
PA TUNE - circuit breaker (S282)

2.6.2. Function of Controls.

(a) FILAMENT. - Circuit breaker (S251). This circuit breaker feeds power to the control circuits, filament constant voltage transformers, blower and crystal heater oven.

(b) EXCITER. - Circuit breaker (S266). This circuit breaker applies voltage to the exciter plate transformer T094.

(c) INT. PLATE. - Circuit breaker (S273). This circuit breaker applies primary voltage to the power transformer T171 which supplies plate and screen voltages for the 829B multipliers and screen voltage for the 4X500F final amplifier tubes.

(d) PA PLATE. - Circuit breaker (S281). This circuit breaker applies primary power to the power amplifier plate transformer T281.

(e) INT. TUNE. - Circuit breaker (S274). This circuit connects a resistance in series with the primary of power transformer T271. This resistor reduces the plate and screen voltage applied to the 829B's and screen voltage to the 4X500F's, protecting these tubes while tuning adjustments are being made.

(f) PA TUNE. - Circuit breaker (S282). This circuit breaker lowers plate voltage for tune-up and in cases where minor overloads occur, will open, dropping transmitter to tune up position. After the trouble has been cleared, S282 may be reset without interruption in broadcast service.

(g) SELECTOR (S241). - This selector switch, together with the EXCITER meter M241, makes it possible to meter all important points in the exciter unit. The steps provided include filament voltage, exciter plate voltage, audio cathode current, oscillator cathode current, modulator cathode current, modulator input, 1st tripler grid current, 2nd tripler grid current, amplifier grid current and 3rd tripler grid current.

(h) EXCITER Meter (M241). - This meter gives readings for the stages listed under SELECTOR switch S141 above. The meter readings are in arbitrary units giving relative indication.

(i) INT. SELECTOR (S242). - This selector switch, together with meter M242 on the top door, meters the grid of the first 829B, V201, in position one, the plate current of V201 in position two, the grid current of the second 829B, V211, in position three, the plate current of V211 is position four, the grid current of the 4X500F amplifier tube V221 in position five and the grid current of the 4X500F amplifier tube V222 in position six.

(j) POWER MULTIPLIERS Controls. - Five controls are located at the top of the control panel:

Control No. 1 is used to tune the grid of the first power multiplier (829B) V201.

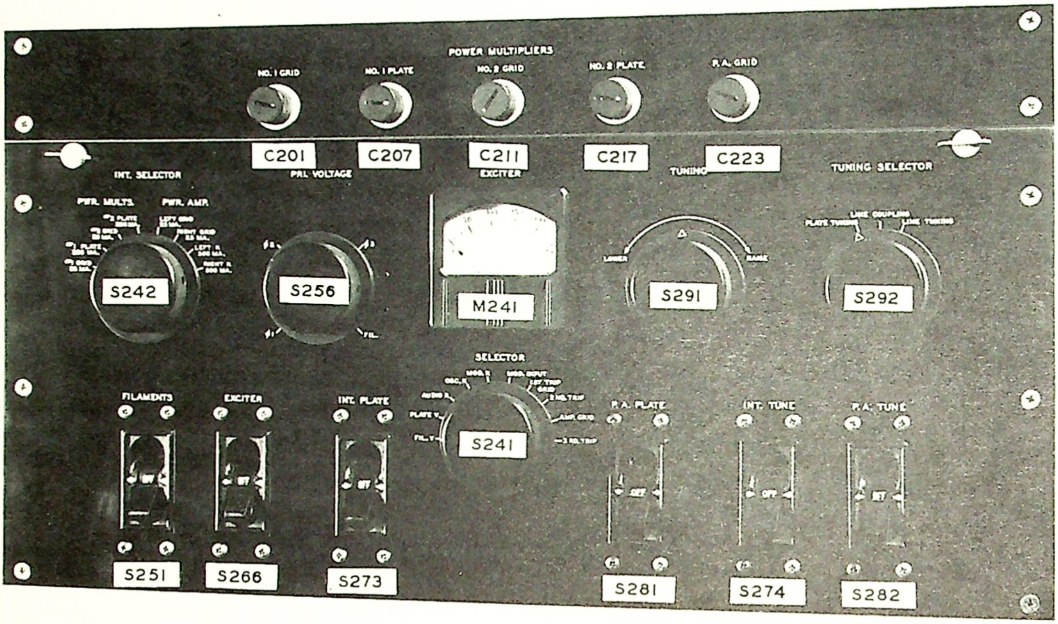

Figure 2-8 Control Panel

Control No. 2 is used to tune the plate of the first power multiplier (829B) V201.

Control No. 3 is used to tune the grid of the second power multiplier (829B) V211.

Control No. 4 is used to tune the plate of the second power multiplier (829B) V211.

Control No. 5 is used to tune the power amplifier (4X500F) grids.

(k) PRI. VOLTAGE Switch (S256). - This switch, together with the primary volt meter M251 meters the incoming a-c line when in the LINE position, and the regulated voltage applied to the primaries of all filament transformers when in the FIL. position.

(l) TUNING SELECTOR Switch (S292). - This selector switch may be used to select the PLATE TUNING, LINE COUPLING or LINE TUNING motor.

(m) TUNING SWITCH (S291). - This is a momentary contact type switch with a spring return. After the TUNING SELECTOR switch (S292) has been set to the position desired, the TUNING switch (S291) is operated either to the LOWER position or the RAISE position, as desired.

2.6.3. FILAMENT and PLATE Push Buttons. - The four pilot lights and four push buttons on the top door may be used to control and monitor the transmitter. Refer to figure 2-7. The green pilot light on the left side of the panel is across the load side of the FILAMENT circuit breaker (S251) and will light when S251 is in the ON position.

This indicates that the primary voltage is available for the control circuits. The FILAMENT ON button energizes the filaments, blower relay K252 and the first red light which is across the filament transformer primaries. At the same time, relay K261, which is a time delay type relay, is energized. Relay K261 can be set for any time delay from 0.2 seconds to 3 minutes. Normal setting is 30 seconds for warm up of rectifier cathodes. When the time is up, K261 closes relay K262, which is the exciter plate relay, and turns the exciter on. As soon as the exciter comes on, the second green light, which is across the primary of the exciter plate transformer, comes on, indicating that the excitation is present.

When the PLATE ON button is pressed, it operates the plate control relay K273 instantaneously. Following the operation of relay K273, then relay K274 operates and turns on the plate voltage for the final amplifier. The second red light comes on.

NOTE

> Pressing the PLATE ON button operates all relays in the same sequence as outlined above.

2.7. OUTLINE OF ADJUSTMENTS.

The adjustment procedure is treated in a step-by-step manner in paragraphs following this brief outline.

1. Power circuit checks.
2. Phasitron filament voltage adjustment.
3. Oscillator adjustments.
4. Buffer grid adjustment to peak Phasitron input.
5. Buffer plate adjustment to peak Phasitron input.
6. Phasitron input and coupling for 3 phase balance.
7. Phasitron output and doubler output for peak grid current of 1st tripler.
8. Adjustment of all other transformers for peak grid current of succeeding tubes.
9. 829B multiplier grid adjustment.
10. 829B multiplier plate adjustment.
11. 4X500F power amplifier grid adjustment.
12. 4X500F power amplifier plate adjustment.
13. Antenna loading adjustments.

2.8. ENERGIZING THE EQUIPMENT.

Before energizing the equipment, a thorough inspection of all connections and terminals should be made. Inspect all door interlocks, making certain that the male member is free, by pressing on the contact block until the spring is completely compressed and then releasing the pressure. If the contact block does not spring out to its initial position, check the two wires comprising the arm for parallelism, bending the wire arms until they are free of the stop pin that is located between the two wires. Before applying power to the transmitter input, be certain that all circuit breakers are in the OFF position. Do not insert the tubes into the transmitter. These precautions having been taken, the circuit to the transmitter may be energized.

2.9. POWER CIRCUIT CHECK.

1. Energize the circuit to the transmitter.

2. Close circuit breaker marked FILAMENTS (S251) on the control panel. The meter lights and the first pilot light

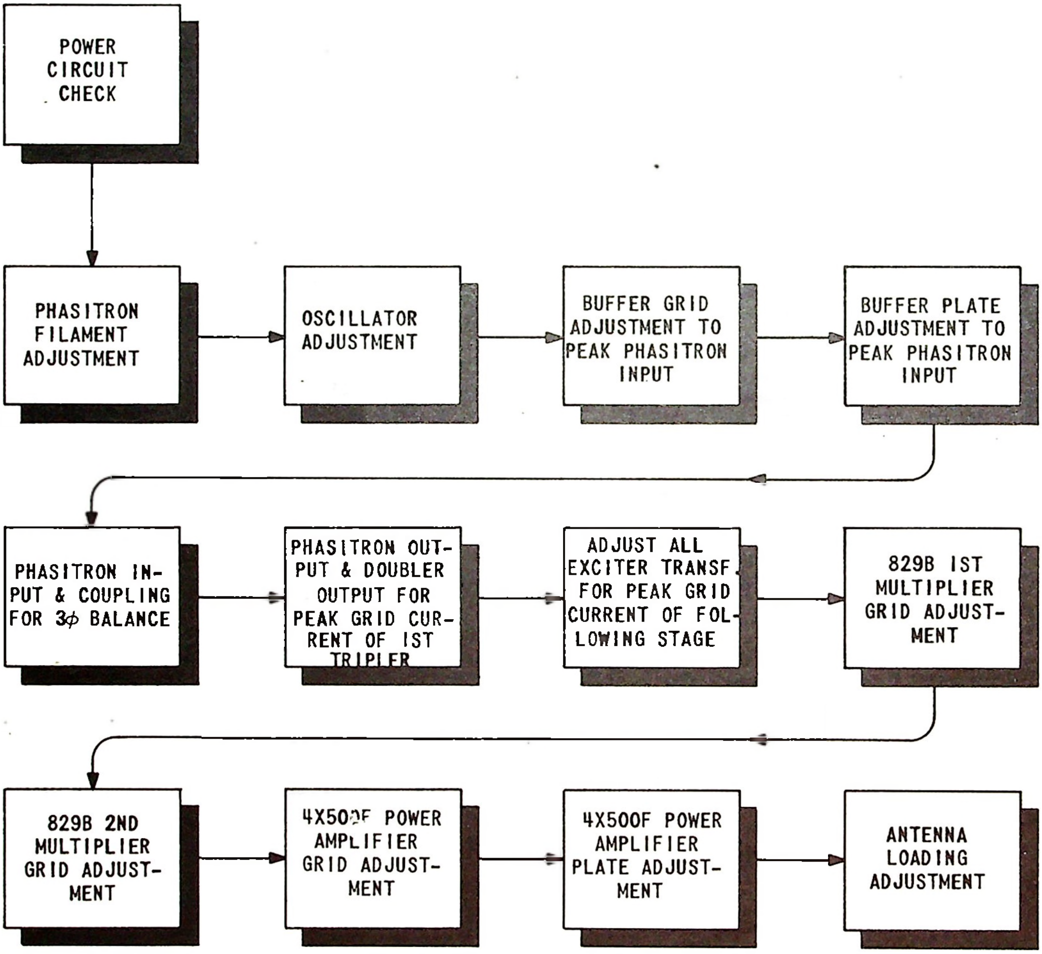

Figure 2-9 Power Circuit Check

will come on and the line voltage can be measured on the PRIMARY VOLTAGE meter with the PRI VOLTAGE switch in the ϕ1, ϕ2 and ϕ3 positions.

3. Press the FILAMENT ON button. The filament control relay (K251) will close and will be held in the operated position by the circuit through the holding contacts. The closing of this relay will light the second pilot lamp, start the ventilating blowers and energize the time delay relay (K261) and the regulator transformer (T251). The regulator secondary voltage can be measured on the PRIMARY VOLTAGE meter by placing the PRI VOLTAGE switch in the FIL. position. The remaining relays and control circuits will not operate until all interlocks are closed and the VR-105 voltage regulator tubes are in their sockets.

When the above preliminary test has been completed, press the FILAMENT OFF button to turn off the equipment.

2.10. <u>INSERTION OF TUBES</u>.

With the above power checks completed, insert the tubes into their respective sockets. Refer to figures 2-10 and 2-15.

NOTE

One of the two GL-2H21 tubes supplied with the transmitter will be marked as the one for which the transmitter is set up and should be used for the first tune up.

2.11. <u>FILAMENT CIRCUIT ADJUSTMENT</u>.

2.11.1. General. - All filament transformers are supplied through a constant voltage transformer. The following table gives the tube type, function and correct filament voltage.

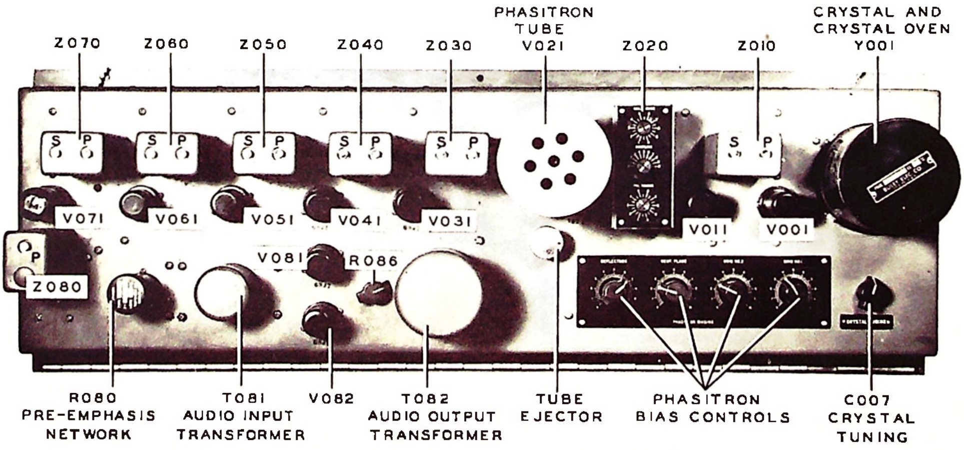

Figure 2-10 Exciter Chassis (Front View)

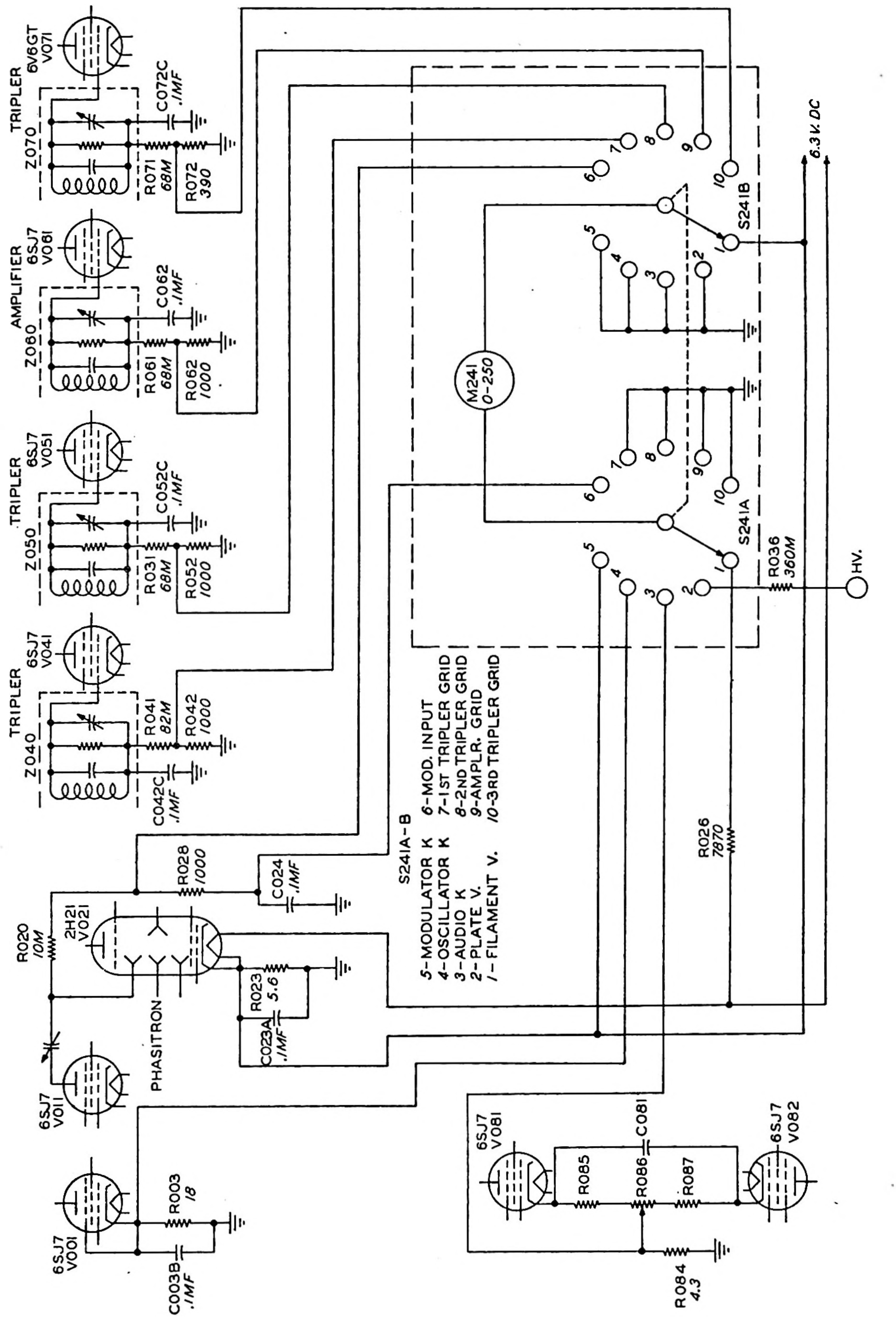

Figure 2-11 Exciter Metering Circuit

TUBE TYPE	FUNCTION	CORRECT VOLTAGE
6SJ7	Crystal oscillator	6.3
6SJ7	Buffer	6.3
2H21*	Phasitron	6.3
6SJ7	Doubler	6.3
6SJ7	1st tripler	6.3
6SJ7	2nd tripler	6.3
6SJ7	Amplifier	6.3
6V6	3rd tripler	6.3
6SJ7	AF Amplifier	6.3
6SJ7	AF Amplifier	6.3
829B	1st multiplier	12.6
829B	2nd multiplier	12.6
4X500F	Final amplifier	5.0
4X500F	Final amplifier	5.0

CAUTION

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL SHOULD AT ALL TIMES OBSERVE ALL SAFETY PRECAUTIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION, BUT ALWAYS SHUT DOWN POWER EQUIPMENT AND OPEN THE MAIN SWITCH IN SUPPLY LINE TO EQUIPMENT.

2.12. R-F TUNING ADJUSTMENTS.

The 732A is tuned up and tested on the assigned frequency before shipping and only those controls which are likely to have been disturbed in packing and unpacking should need adjustment. Although a complete tuning procedure is outlined below, perform only those operations that are required to return the transmitter controls to the proper positions for operation.

2.12.1. Exciter tuning.

(a) General. - Operate the FILAMENT and EXCITER circuit breakers on the control panel to the ON positions.

Press the FILAMENT ON button and check the filament voltage, line voltage and Phasitron filament voltage. When the time delay relay has operated the exciter is ready for tuning up.

NOTE

Adjust the bias controls of the Phasitron tubes as indicated on the data sheet enclosed with the tube. Other than the Phasitron bias control, no adjustment should be necessary in the exciter, and none should be attempted at this time unless the meter readings are more than 20% different from the typical readings given in Section 3.

(b) Crystal Oscillator Tuning. - The crystal oven should have at least a 30 min. warm up period before final adjustments are made.

The exact operating frequency may be set to the station standard by adjusting capacitor (C007) which is located directly below the crystal oven and is designated as CRYSTAL TUNING.

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* The 2H21 Phasitron tube has a rectified filament voltage supply. This rectified filament supply is provided with a potentiometer to adjust the voltage to exactly 6.3. The correct voltage is indicated by a reading of 200 on the EXCITER meter (M241) when the SELECTOR switch (S242) is in the position marked FIL. V.

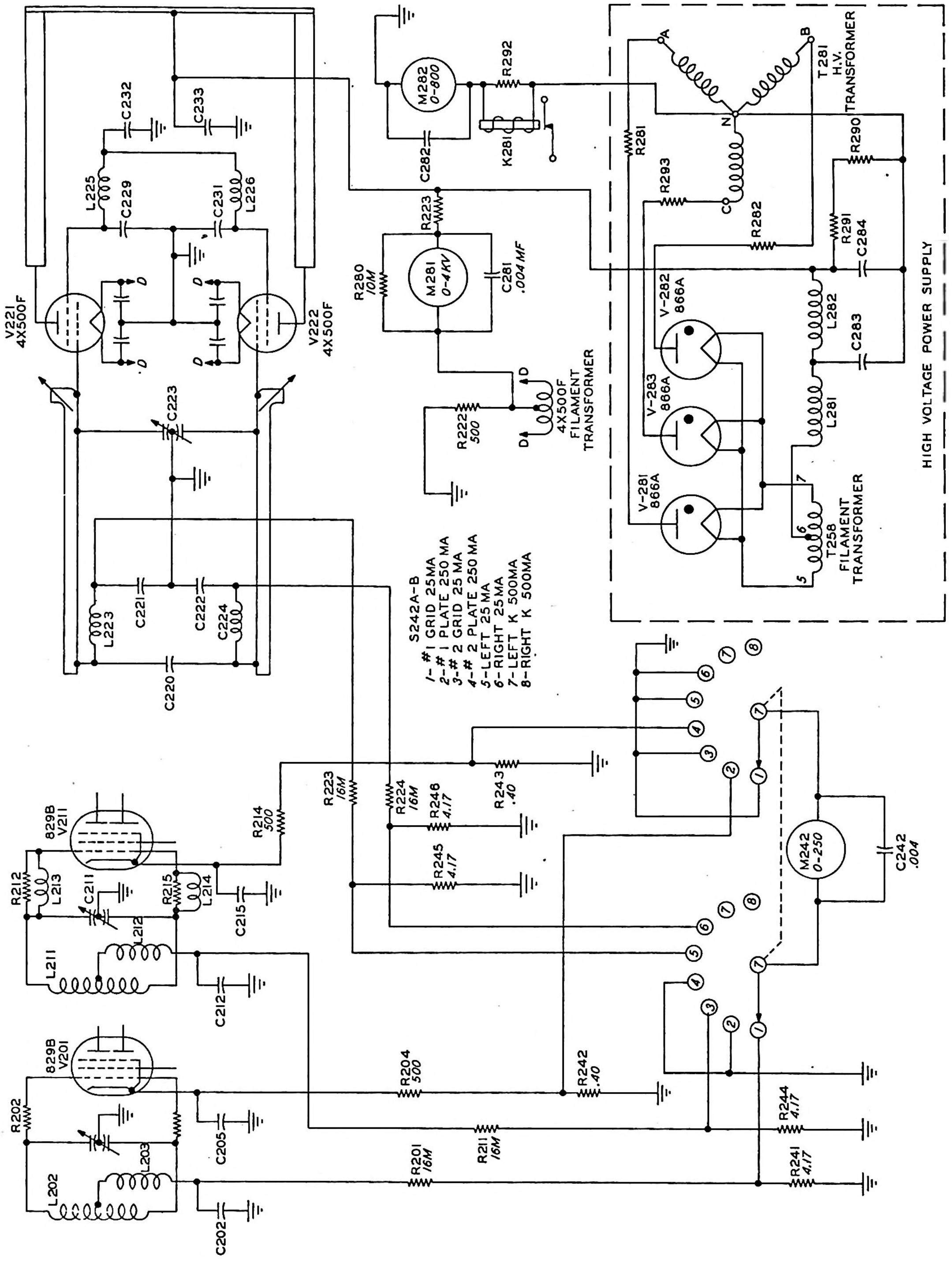

Figure 2-12 Power Multiplier and Final Amplifier
Metering Circuit

(1) Turn SELECTOR switch to OSC. K.

(2) Tune the crystal oscillator tank (Refer to figure 2-10) capacitor, "P" of Z010, for a dip in cathode current. Continue to rotate the capacitor in a counterclockwise direction, which is on the high frequency side of resonance, until a point is reached where the frequency and plate current change very slowly. This is the most stable operating point of the oscillator. Frequency adjustments should be made with C007 and not the plate tuning capacitor.

(3) Turn the SELECTOR switch to the MOD. INPUT position.

(4) Tune the secondary of Z010 (Refer to figure 2-10) for maximum indication on the meter.

(c) Modulator Tuning.

(1) Turn the SELECTOR switch to the 1ST. TRIP. GRID position.

(2) Adjust the PRI. TUNING control on the phasing network transformer for maximum indication on the meter. Further adjustment of this circuit are covered under final adjustment and need not be made here.

(d) Multiplier Tuning.

(1) Tune the primaries and secondaries of transformers Z030 and Z040 for maximum indication on the meter.

(2) Turn the SELECTOR switch to 2ND. TRIP. GRID position.

(3) Tune the primary and secondary of transformer Z050 for maximum meter indication.

(4) Turn the SELECTOR switch to AMP. GRID position,

(5) Tune the primary and secondary of transformer Z060 for maximum meter indication.

(6) Turn the SELECTOR switch to 3RD. TRIP. GRID position.

(7) Tune the primary and secondary of transformer Z070 for maximum meter indication.

(8) Turn the INT. SELECTOR switch to the #1 GRID 25 MA position.

(9) Tune the primary of transformer Z080 for maximum meter indication. This completes the tune up procedure for the EXCITER section.

2.12.2. Intermediate Amplifier Tuning.

(a) General. - Operate the INT. PLATE circuit breaker to the ON position. Press the PLATE ON button. This turns on the plate voltage for the 829B multipliers.

(1) Set the INT. SELECTOR switch to the #1 GRID position.

(2) Tune the NO. 1 GRID knob for maximum meter reading.

(3) Turn the INT. SELECTOR switch to the #1 PLATE position.

(4) Tune the NO. 1 PLATE knob for minimum plate current.

(5) Turn the INT. SELECTOR switch to the #2 GRID position.

(6) Tune the NO. 2 GRID knob for maximum grid current.

(7) Turn the INT. SELECTOR switch to #2 PLATE position.

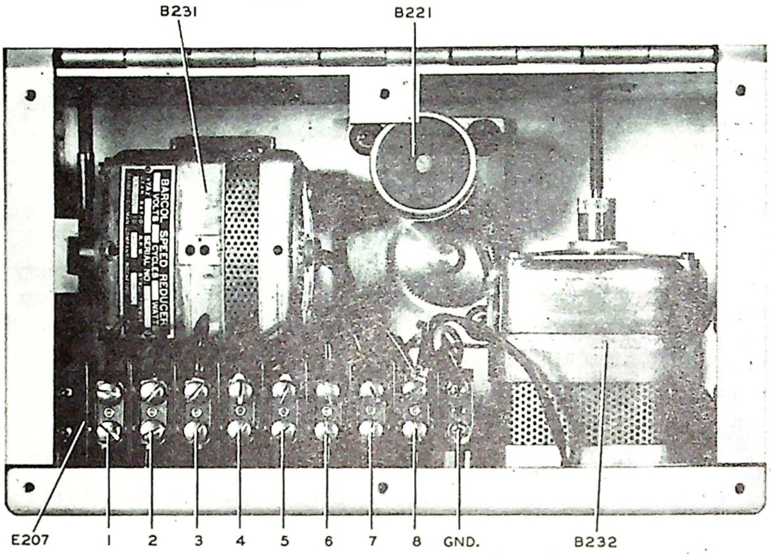

Figure 2-13 Tuning Motors

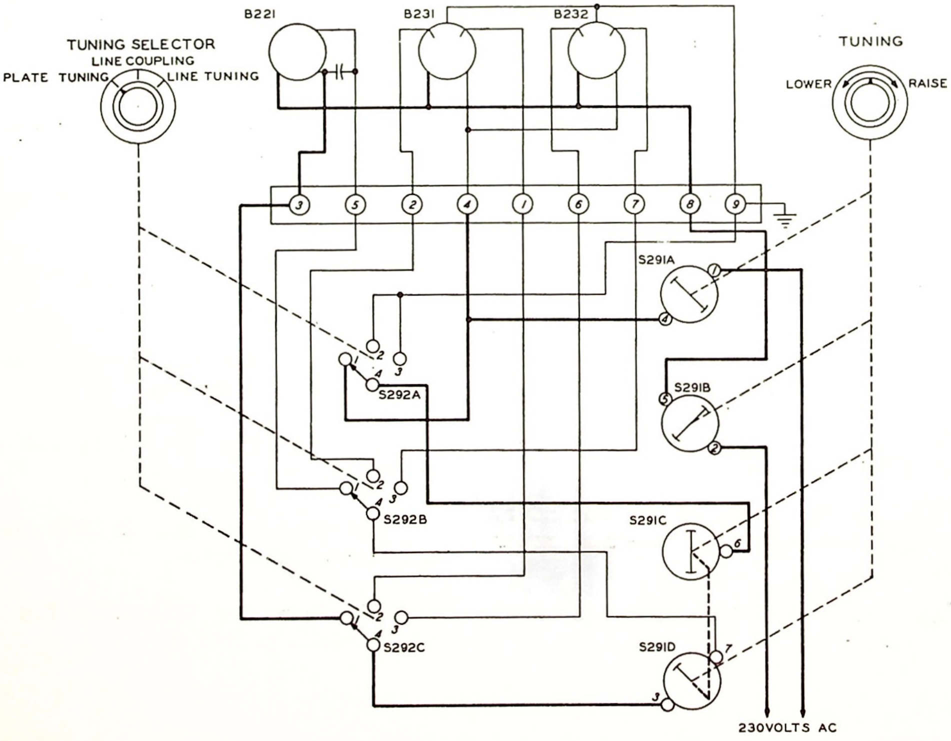

Figure 2-14 Tuning Motors Schematic

new picture required

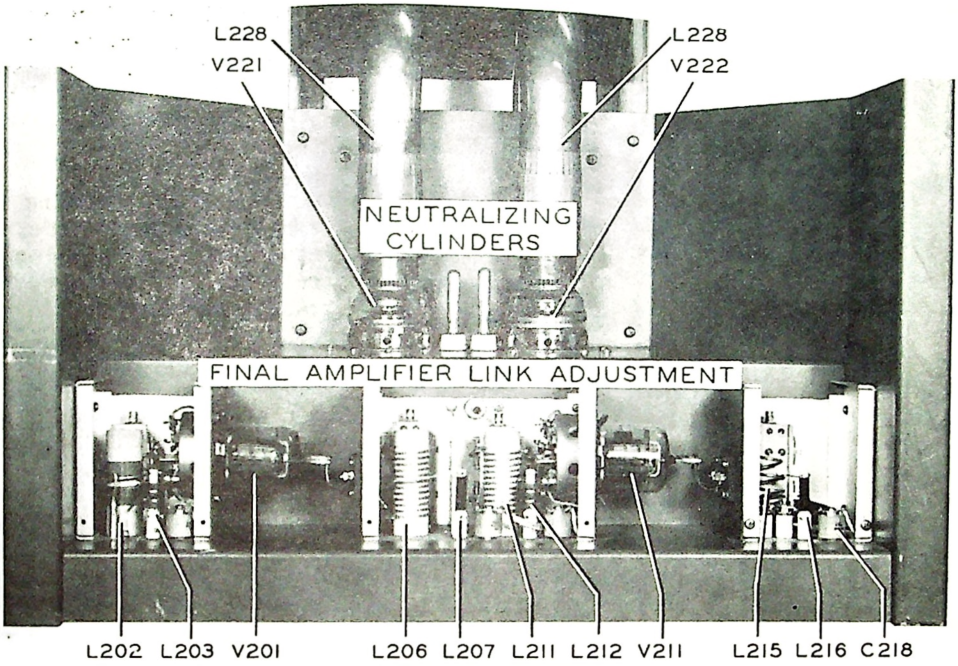

Figure 2-15 Multipliers and Final Amplifier

(8) Tune the NO. 2 PLATE knob for minimum plate current.

(9) Turn the INT. SELECTOR switch to the P.A. GRIDS LEFT position.

(10) Tune the P.A. GRID knob for maximum meter indication.

(11) Turn the INT. SELECTOR switch to the P.A. GRIDS RIGHT position.

(12) Check meter indication and touch up tuning if necessary.

(13) Turn the INT. SELECTOR switch to the LEFT K position and check meter reading.

(14) Turn the INT. SELECTOR switch to the RIGHT K position and check meter reading.

NOTE

If the meter reading for the LEFT K and the RIGHT K are not the same the 7C26 tubes are not balanced. To correct, try different tubes until a pair is found that do balance.

2.12.3. Power Amplifier Tuning.

(1) Turn on the P.A. PLATE circuit breaker.

(2) Turn the TUNING SELECTOR switch to LINE COUPLING position.

(3) Operate the TUNING knob to LOWER

so as to decouple the link from the plate lines.

CAUTION*

(4) Turn the TUNING SELECTOR switch to PLATE TUNING position.

[illegible]

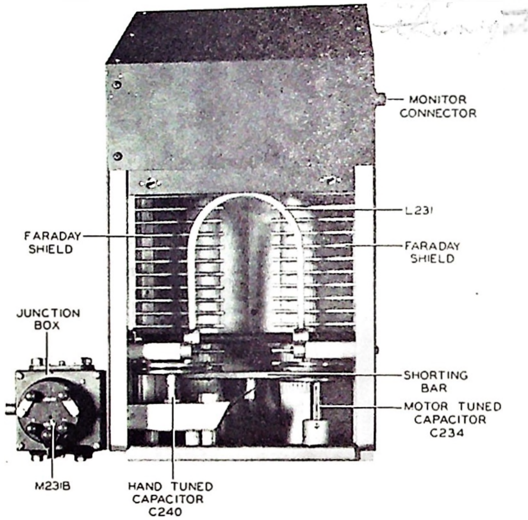

Figure 2-16 RF Output Assembly

(5) Operate the TUNING knob to resonate the final. Tune for minimum plate current.

2.12.4, Neutralization. - When tuning for resonance, watch the grid meter of the final amplifier and see if it peaks at the PLATE CURRENT dip. This is an indication that the final is neutralized.

An additional check should be made for neutralization. Turn the EXCITER circuit breaker to the OFF position. This cuts the excitation to the 829B multipliers and final amplifier tubes. Check the final for self oscillation. If it oscillates, it is not neutralized. To neutralize the final tubes, the tw6 neutralizing cylinders located between the 4X500F's should be raised or lowered. At 108 mc the cylinders are set very near the top of the post and at 88 mc the tubes are set very near the bottom of the post.

After the approximate setting of the neutralizing cylinders is made, a slight adjustment will be necessary for the final neutralizing of the stage. The final neutralizing check should be made with the INT. TUNE and PA TUNE circuit breakers in the ON position.

2.12.5. Final Amplifier Loading. - Before operating the LINE TUNING, partially decouple the antenna link.

(1) Turn the TUNING SELECTOR switch to the LINE TUNING position.

(2) Operate TUNING knob until the plate current reaches a maximum.

(3) Turn the TUNING SELECTOR switch to the PLATE TUNING position.

(4) Operate TUNING knob until the plate current dips to minimum.

Continue to operate the PLATE TUNING and LINE TUNING until the plate current at the bottom of the dip is the maximum value obtained by tuning the line. When this condition is reached, the reactance has been tuned out of the coupling circuit and the antenna presents a resistive load.

In the event the variable line tuning capacitor reaches a maximum or minimum setting, it will be necessary to adjust the semi-fixed antenna capacitor, C240, by hand, to a point where the proper tuning will fall into the middle range of the motor driven capacitor. Refer to

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* The PLATE TUNING motor is not designed for continuous duty. Maximum ON period should not be more than 2 minutes with an 8 minute OFF period.

figure 2-16. This illustration indicates the capacitor to be adjusted by hand. Once this capacitor has been adjusted and the above condition has been met, it will not be necessary to adjust it again unless the frequency of the station is changed.

(5) Turn the TUNING SELECTOR switch to the LINE COUPLING position.

(6) Operate the TUNING control until the final amplifier is loaded to the authorized power output. The plate current corresponding to this value is computed from the equation $IP = \frac{\text{Power outout}}{EP \times F}$ where EP is the final plate voltage and F is the efficiency factor supplied with the test data for the transmitter.

(7) Turn the TUNING SELECTOR switch to the PLATE TUNING position.

(8) Check to see if the plate circuit is tuned to resonance.

2.13. FINAL R-F AND AUDIO ADJUSTMENTS.

NOTE

> These last adjustments should be made with the transmitter loaded to full power.

With the transmitter coupled to the station frequency and modulation monitor as described under Installation, proceed with the following adjustments.

The slider on the monitor pick up loop (L234) should be moved back for minimum pickup and the P.A. TUNE circuit breaker placed in the ON position when first coupling the transmitter to the monitor to prevent damage to the monitor.

In this condition less than 1 volt RMS r-f voltage should be delivered to the monitor. (If a higher level is present the monitor input should be checked to be sure that the r-f line that is coupled to the monitor is terminated in a 50 ohm resistive load.)

Full power should be applied to the power amplifier plates and the sliding bar on the pickup loop adjusted for the monitor input level required. With the monitor operating normally, the xtal trimmer C007 may be adjusted for the exact assigned frequency.

NOTE

> The transmitter and/or the station frequency monitor should be checked against a secondary frequency standard calibrated with WWV to insure operation on the exact frequency.

Before feeding the program to the transmitter, the modulator should be checked. With the Phasitron bias voltages set at the recommended values, (the Phasitron Bias values are supplied with each individual tube) modulate the transmitter 100% at 50 cps and check the harmonic distortion at the monitor output with a distortion meter. When making critical adjustments of the 2H21 circuits for minimum distortion, a 15 minute warm up period should be allowed. If after the warm up the distortion is greater than indicated for the Phasitron used, the audio balance control R086 and the SEC. TUNING and COUPLING controls on the phasing transformer Z020 should be adjusted for minimum distortion. Also, it may be necessary to "trim up" the biasing controls. However, when adjusting the biasing controls, they should not reduce the 1ST. TRIP. GRID current below 100 on the meter scale as this will cause a rise in noise level. The phasing transformer and biasing controls have been supplied with dials so that spare Phasitrons can be calibrated in off the air period. And in case of tube failure, a spare tube can be inserted and the knobs set to the calibrated settings, thus insuring low distortion operation without the necessity of setting the tube up with an oscillator and distortion meter.

The biasing control calibrations supplied with each Phasitron are those settings found to give less than 1.5% distortion with 100% modulation at 50 cps and on FM, noise level of more than 65 db below 100% modulation at 400 cps. These settings are not always the same as those recommended by the tube manufacturer and better settings may be found if the station engineer cares to experiment with the tubes during off the air periods.

Since to produce frequency modulation the phase modulation varies inversely with the modulation frequency, if the Phasitron modulator is set up at 100% modulation at 50 cps the distortion will be much less at higher modulation frequencies and lower modulation levels.

The tuning of the multiplier transformers will have some affect on the response and distortion at modulating frequencies above 5000 cps.

Careful tuning for peak grid current of each stage will give satisfactory results; however, a fine tuning adjustment can be made to produce flat response and minimum distortion by going over these adjustments with 10,000 cps modulation.

It will be found that tuning of the doubler and 1st tripler input transformers affects the high frequency response and the tuning of succeeding stages affects the distortion.

SECTION 3

OPERATION

3.1. GENERAL.

After all adjustments have been made in accordance with the procedure outlined in Section 2, the equipment is ready for operation. This section contains the procedure for actual operation of the equipment. Refer to figures 2-7 and 2-8 for location of panel controls and meters.

3.2. INITIAL OPERATION.

3.2.1. Starting Equipment.

(a) Energize the circuit to the transmitter.
(b) Close all circuit breakers.
(c) Press the FILAMENT ON Button.
(d) After exciter plate comes on press the PLATE ON Button.

The transmitter is now in operation and all meters should be checked to make sure that each circuit is functioning properly. The following tables list the approximate meter readings for typical operating conditions:

METER READINGS

Position of LINE FIL. Switch (S256)	Meter Reading of (M251)
LINE	190-250 volts
FIL.	230 volts

Position of SELECTOR Switch (S241)	Meter Reading of (M241)	Current or Voltage
FIL. V	200	6.3 V-Set with R091
PLATE V	235	300 volts
AUDIO K	250	20 ma
OSC. K	200	5 ma-Set with P on Z010.
MOD. K	50-150	4-12 ma
MOD. INPUT	50-150	.2 - .6 ma
1ST. TRIP. GRID	100	.4 ma
2ND. TRIP. GRID	200	.8 ma
AMP. GRID	200	.8 ma
3RD TRIP. GRID	175	1 ma

Position INT. SELECTOR Switch (S242)	Circuit	Meter Reading of (M242)	
		Tune Up	Operating
#1 GRID 25 MA	PWR. MULTS.	5 ma	5 ma
#1 PLATE 250 MA	PWR. MULTS.	80 ma	100 ma
#2 GRID 25 MA	PWR. MULTS.	14 ma	18 ma
#2 PLATE 250 MA	PWR. MULTS.	115 ma	145 ma
LEFT 25 MA	P.A. GRIDS	8 ma	11 ma
RIGHT 25 MA	P.A. GRIDS	8 ma	11 ma
LEFT K 500 MA	P.A. CATHODE	165 ma	215 ma
RIGHT K 500 MA	P.A. CATHODE	165 ma	215 ma

Final Amp.	Meter	Plate Voltage		Plate Current	
		Tune Up	Operate	Tune Up	Operate
4X500F's	M281	2500	3500		
4X500F's	M282			320 ma	420 ma

3.2.2. Stopping Equipment.

(a) Press the FILAMENT OFF Button.

3.3. ROUTINE OPERATION.

3.3.1. Starting Equipment.

(a) Press the PLATE ON Button.

3.3.2. Stopping Equipment.

(a) Press the FILAMENT OFF Button.

Pressing the PLATE ON Button will automatically start the operation sequence that applies filament voltage to the tubes, operates the time delay relay, and applies both the low and high voltages without any further effort on the part of the operator. Pressing the FILAMENT OFF Button will automatically open the high and low voltage circuits and de-energize the filament transformers. This operation shuts off the equipment completely with the exception of the crystal heater oven. The oven will be left on continuously providing it is connected to a separate source of power as suggested in paragraph 2.2.2.(d).

Final tuning and loading is accomplished by rotating the TUNING SELECTOR switch to the desired circuit to be tuned and operating the TUNING control dial.

SECTION 4

CIRCUIT THEORY

4.1. A-C POWER CIRCUITS.

All power contactors in the equipment are of the 190 to 250 volts a-c type. All power circuits are controlled by opening or closing the transformer primary circuits. The 732A FM Transmitter uses a constant voltage transformer to supply power to the filament transformer primaries. The line voltage may vary from 190 to 250 volts without a noticeable change in filament voltage. The transmitter has been provided with a time delay relay which is energized by the constant voltage transformer. No voltage can be applied until the contacts of this relay are closed. The time required for the contacts to close can be adjusted for any interval from .2 second to 3 minutes by means of a knurled nut on the relay. Thirty second time delay is recommended to allow the oscillator tube and mercury vapor rectifiers to come up to operating temperature.

4.2. CONTROL CIRCUIT OPERATION.

4.2.1. On the upper front door of the transmitter are four push buttons and four pilot lights labeled FIL. ON-OFF, and PLATE ON-OFF. These buttons operate the relays as shown in figure 4-2 to turn the power circuits off and on automatically.

Reference to figure 4-2 will show that it is possible to turn the complete transmitter on by pushing the PLATE ON button as follows:

(a) PLATE ON button closes hold relay K273 which closes filament relay K251 and holds both relays closed.

(b) Time delay relay K261 closes exciter plate relay K262 which closes plate relay K274 through contacts on the holding and overload relays.

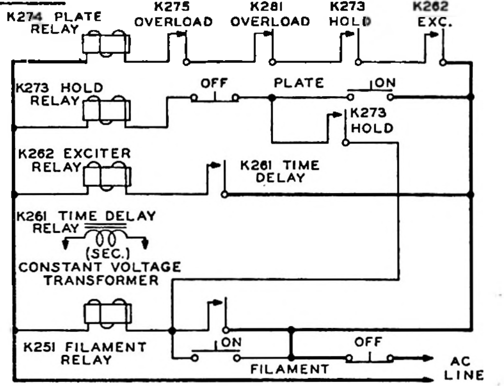


Figure 4-1 Power Control Circuit

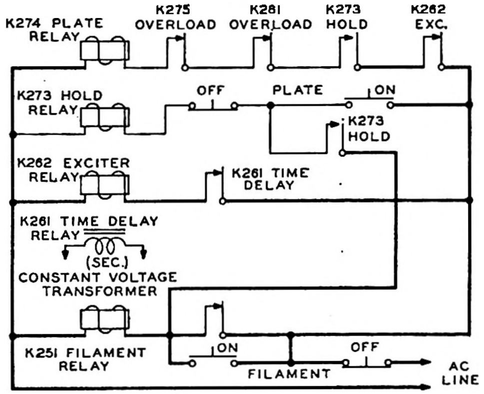


Figure 4-2 Power Control Circuit
(Filament ON Button Pressed)

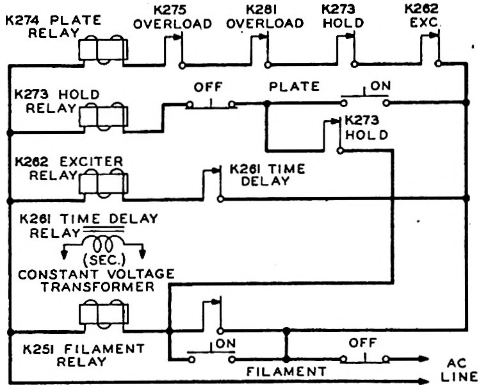


Figure 4-3 Power Control Circuit
(Plate ON Button Pressed)

The FILAMENT OFF button turns off the complete transmitter by opening all the relay circuits. The FILAMENT ON button is connected so that the filaments (and exciter plate) may be turned on without the intermediate and high voltage plate power coming on, since the PLATE ON button must be closed to close the hold relay and the hold relay must be closed to close the plate relay.

The PLATE OFF button is connected so that the intermediate and high voltage plate power may be turned off (by opening the hold relay) without turning off the filaments and time delay relay.

Also, the primary interlocks on both rear doors, the upper front door and the vertical rack are connected in series with the PLATE OFF button. These together with the mechanical shorting switches which insure discharging of the filter capacitors, prevent injury by touching high voltage circuits.

WARNING

THE VERTICAL RACK DOES NOT OPERATE A HIGH VOLTAGE SHORTING SWITCH.

The exciter chassis is interlocked to turn off all plate supplies when opened. However, since this interlock does not release the hold relay, the plate power comes on automatically when the exciter chassis is closed.

4.3. RF AND AUDIO CIRCUITS.

4.3.1. EXCITER AND PHASITRON CIRCUITS.

(Refer to figure 4-4.) The carrier frequency is generated by a crystal oscillating in the vicinity of 200 kilocycles. The crystal oscillator is a regenerative type using a type 6SJ7 tube. The output is fed to a buffer using a type 6SJ7 tube. The buffer output is used to drive a phase-splitting network to provide three-phase voltages for the input deflector grids of a Phasitron tube. (Refer to figure 4-4.) Anodes 1 and 2 are at positive d-c potential and draw electrons from the cathode radially in the form of a tapered thin-edge disc as dictated by the first and second focusing electrodes. This electron disc with the cathode as its axis, passes between a neutral plane and a three phase deflector-grid assembly. The deflector-grid assembly consists of 36 separate wires with every third wire connected together, forming three groups of twelve. (Refer to figure 4-5.) The three phase voltages are applied to these deflectors, which in turn provide a rotating electrostatic field between the deflectors and the neutral plane, and warp the electron wheel into a ruffled electron disc. (Refer to figure 4-6.)

The sinusoidal ruffle at the edge of the electron disc falls upon anode 1, which is perforated in a half-cycle arrangement to match the edge of the disc. (Refer to figure 4-7). As the disc rotates, the sinusoidal edge successively passes through the perforations, or is collected by the metallic barrier separating them. A push-pull tuned circuit placed between these two anodes is driven by the alternate collections of electrons by the two anodes, and supplies voltages at the crystal frequency for driving subsequent doublers and triplers to raise the frequency to that of the radiated carrier.

The second focus electrode, in addition to having an electrostatic influence upon the beam, is made of magnetic material and acts as a magnetic concentrator to confine the flux produced by the audio modulating coil to a narrow region at the edge of the deflector grid.

The action of this magnetic field is to

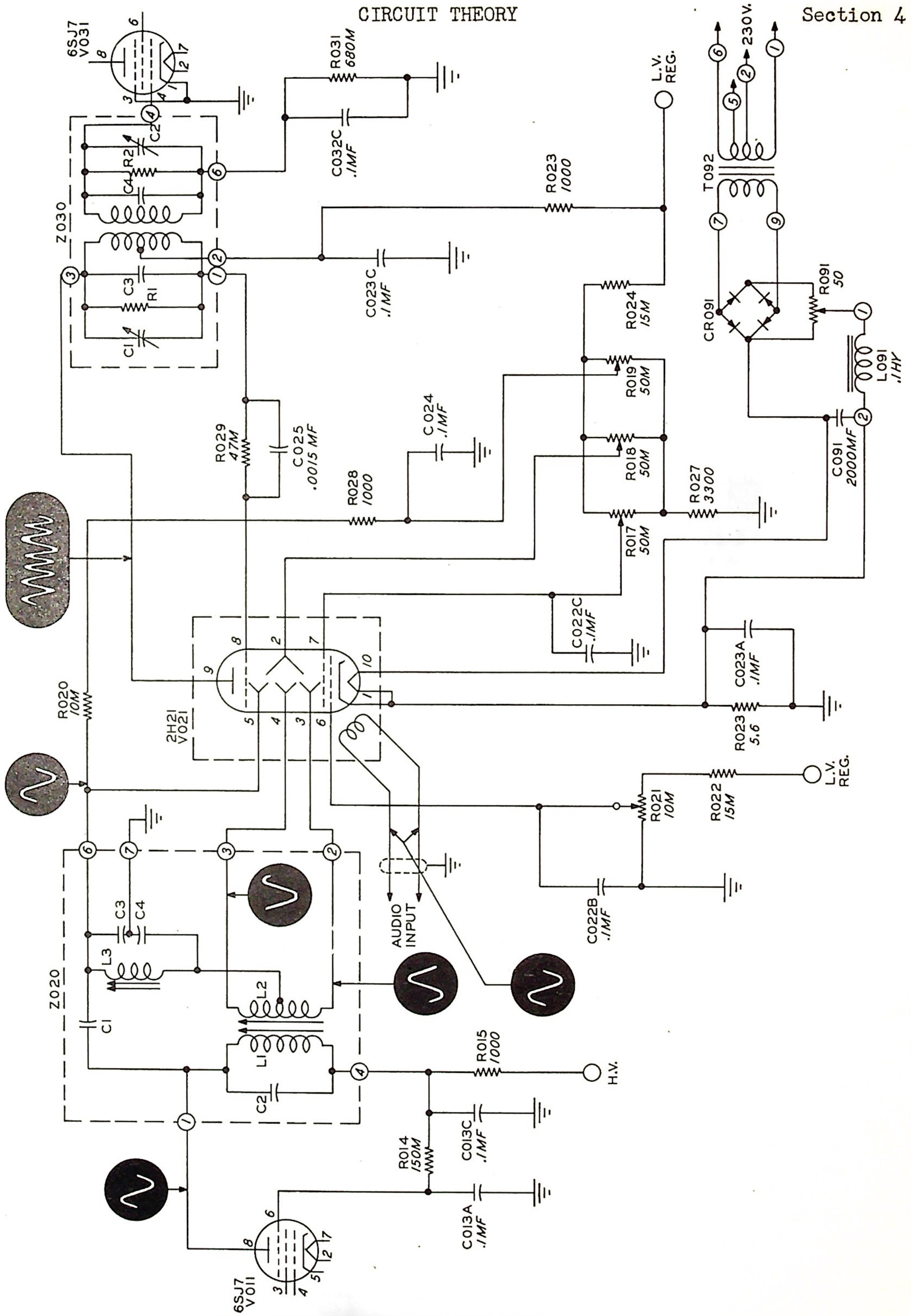


Figure 4-4   Phasitron Functional Diagram

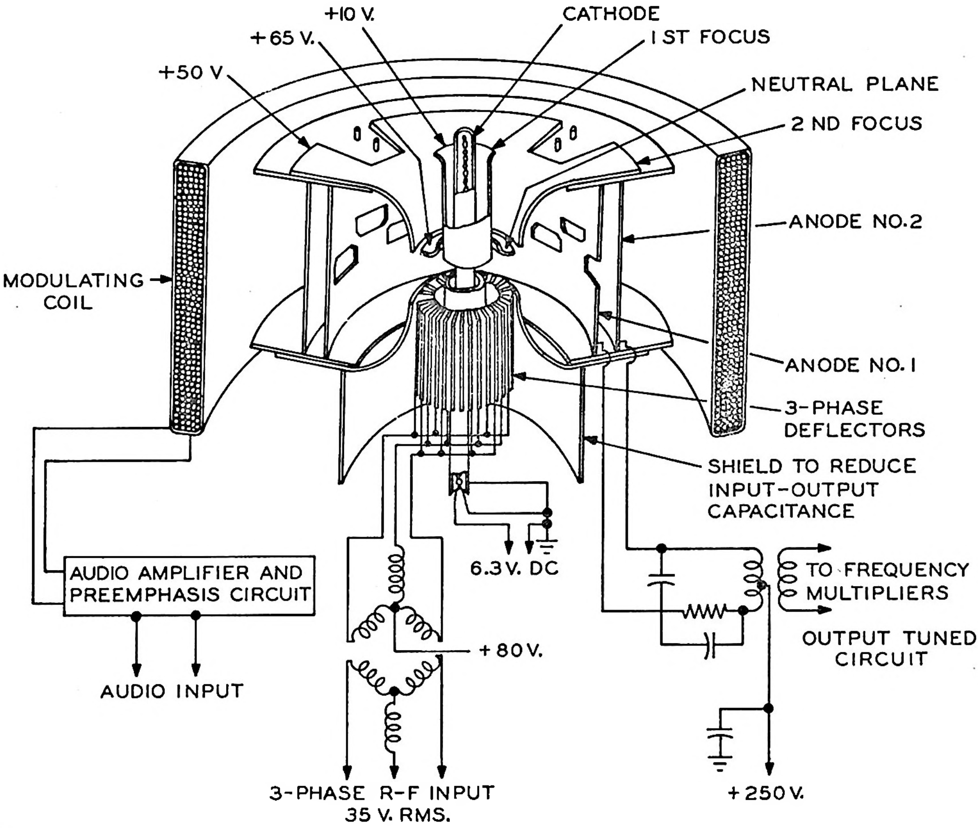


Figure 4-5 Vertical Section of the Tube and Modulator Coil. Connections to the Transmitter Circuit are Indicated.

bend the electron stream, advancing or retarding the phase of the sinusoidal ruffled edge with respect to the perforated anode, and introducing a corresponding phase shift in the tuned circuit.

The magnetic focus electrodes are mounted with the three-phase deflector grid at the bottom to keep the input leads as short as possible. In addition, the stem arrangement is oriented to place the first and second anode leads diametrically opposite the three-phase input leads so that intervening shielding can reduce the coupling to a minimum. The

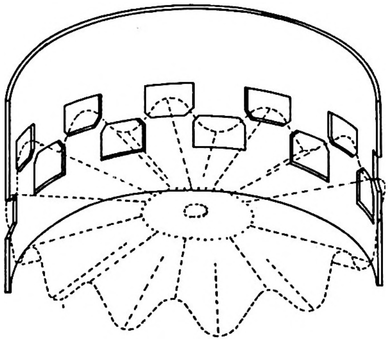


Figure 4-6 Perspective View of the Electron Disc in the Phasitron Tube. In this Position Minimum Current is Collected at Perforated Anode No. 1.

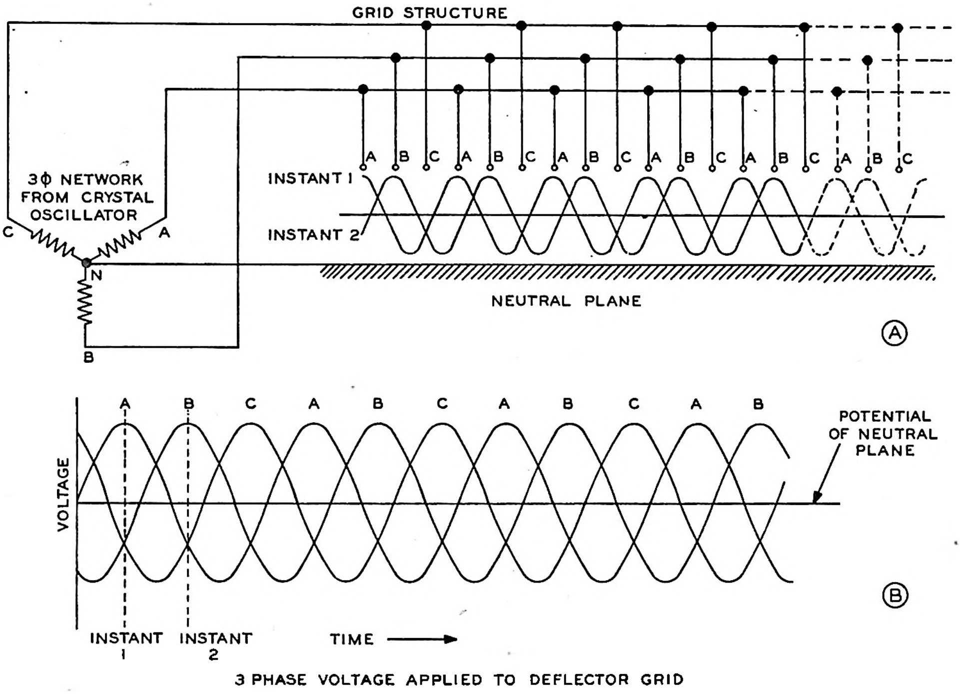


Figure 4-7 Developed View of Grid Structure and Natural Plane

flared cone-shape second focus electrodes are made of siliconnicaloi to provide low hysteresis loss. The concentration provided by these electrodes improves the magnetic sensitivity by a factor of three over that which could be obtained by action directly on the electron stream.

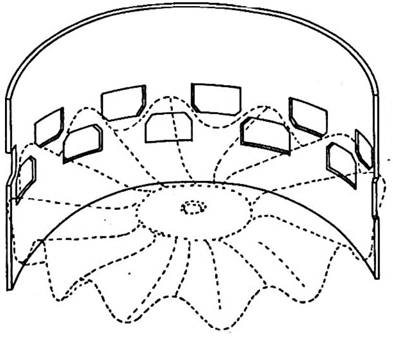


Figure 4-8 Position of the Electron Disk for Maximum Current Collected at Anode No. 1. as a Result of Modulation by the Magnetic Coil.

There are three radial slots cut in each plate to provide clearance for the anode ears and to reduce the eddy current loss at high frequencies. The anodes are made from nonmagnetic material to prevent a magnetic short circuit between the two second-focus electrodes. The neutral plane is mounted in the upper half of the tube directly opposite the three-phase deflector assembly. The cathode assembly is a standard 6J5 element coated for a quarter of an inch. The active part of the electron stream is limited by the edges of the first focus electrodes.

The bulb length is made longer than the

electrode assembly would normally require, to act as a handle for removing the tube from a permanently mounted modulating coil. The normal frequency at which the tube operates in the 732A FM broadcast transmitter is between 181 and 223 kilocycles.

The sensitivity of the tube to magnetic deflection is high and is sufficient to give a phase shift of approximately one radian per each 2.7 gauss change in field. A curve of phase deviation plotted against field strength will indicate a high degree of linearity over a plus or minus 360-degree range, with increasing sensitivity for further excursions.

The d-c potentials associated with the first and second focus, the three-phase deflectors, and the neutral plane must be adjusted for minimum signal distortion. The only test that can be performed to insure the required limits is an actual operation test in the FM transmitter, with subsequent measurement in a low-distortion detector. The radio-frequency driving voltages should be in excess of 35 rms volts, measured from phase to neutral.

The audio power required to modulate the tube to full swing is less than twenty milliwatts.

A transmitter using a phase modulation system in which the carrier is driven directly from a crystal-controlled oscillator is ideal for satisfying the carrier frequency stability requirement.

In a phase modulator, the harmonic distortion is a function of the phase swing employed, and since, for a constant frequency swing (corresponding to modulation percentage), the phase swing is inversely proportional to the modulating frequency, a phase modulator will have inherently low harmonic distortion in the middle audio frequency range.

The multiplication required is inversely proportional to the maximum phase swing that can be employed in the modulator without exceeding the permissible value of harmonic distortion. The relationship of the factors is, multiplication= $\frac{\text{Carrier swing}}{\text{Audio frequency x phase swing}}$ for a plus or minus 75 kc swing of the carrier, at a modulation frequency of 50 cycles, an angular swing of 75,000/50 or 1500 radians is required. If a total multiplication of 486 is used between the modulator and the output of the transmitter, the modulator must be capable of operating through an angle of plus or minus 1500/486 radians within the permissible distortion limits. This immediately shows the advantage of the phasitron tube, with which it is possible to use a phase swing of plus or minus 3.5 radians without exceeding 1.5 percent distortion.

The modulation circuit function is shown in figure 4-4. The crystal oscillator circuit employs a 6SJ7 tube with a tuned plate circuit. A low temperature coefficient quartz crystal provides a high degree of frequency stability. The crystal is contained in an oven thermostatically controlled and is held at a temperature of 60° C.

The oscillator is followed by a buffer amplifier that drives a phase-splitting circuit to develop the three-phase voltages for the deflector elements of the Phasitron modulator tube. It functions essentially as a single phase to two-phase conversion accomplished by the capacitor C1 and resistor R020, and a Scott-connected transformer system comprising inductance L1 and L2 with a center-tapped secondary, and the parallel tuned circuit L3, C3, C4.

Since the Phasitron is modulated by a magnetic field, fields other than those produced by the audio input will cause

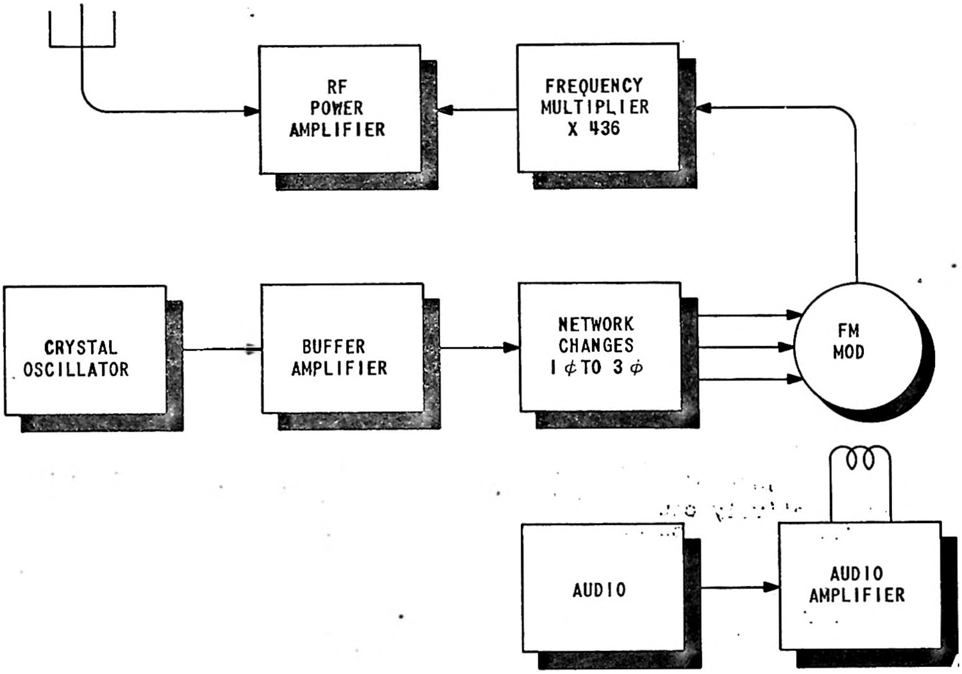


Figure 4-9 Block Diagram Showing the Use of the Phasitron Tube in the 732A

noise modulation of the carrier. These stray fields may be caused by power transformers in the transmitter unit itself or by external equipment. To avoid this source of trouble, the modulator tube and the field coil that produces the modulation are enclosed in a magnetic shield made of high permeability material. A further precaution taken to keep the carrier noise level at a low value is the use of a d-c filament supply for the Phasitron tube.

The audio system consists of a push-pull amplifier stage with two type 6SJ7 tubes connected as triodes. The input is applied to the 6SJ7 tubes through a pre-emphasis network and input transformer, and the output is connected to the phasitron field coil through an output transformer. The field coil is designed to appear as nearly as possible like a pure inductance over the entire audio-frequency range from 50 to 15,000 cycles. By holding a constant voltage across the coil at all audio frequencies, the current through the coil and consequently the magnetic field in the phasitron tube will be inversely proportional to the modulating frequency. This is exactly the correction required to convert from phase modulation to frequency modulation.

Following the Phasitron in the exciter is a doubler using a type 6SJ7, two triplers using type 6SJ7 tubes, an amplifier using a type 6SJ7 tube and a type 6V6 tripler in the output. The output of the 6V6 tripler is link coupled to the grid coil of the first 829B which is a

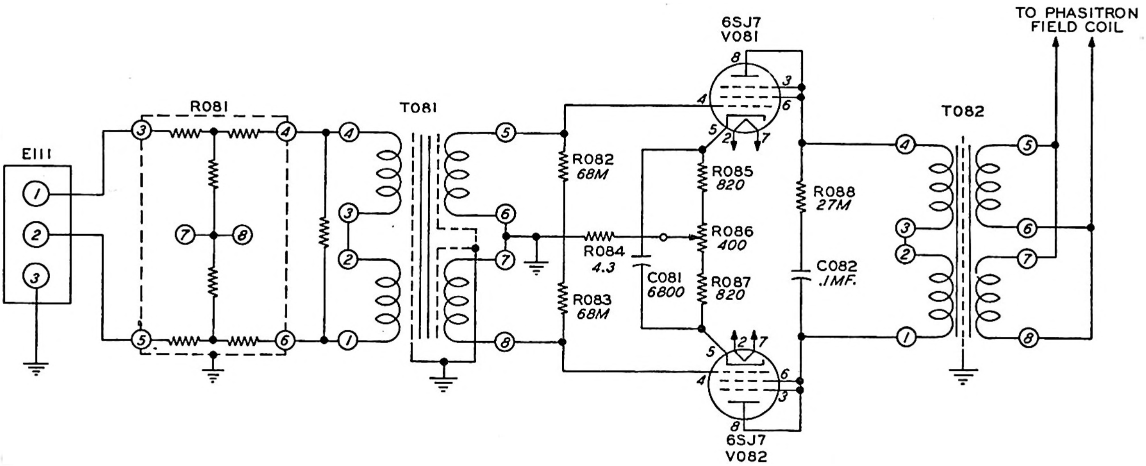


Figure 4-10 Audio Amplifier Schematic

tripler. The plate circuit of the first 829B is inductively coupled to the grid coil of the second 829B which is also a tripler. The output of the second 829B is link coupled to the grids of the 4X500F power amplifier tubes. The grid circuit of the 4X500F's uses a parallel line system and is tuned to resonance with a variable capacitor. The plate circuit of the power amplifier makes use of inductance tuning with no circuit capacity other than that of the tubes.

The variation of inductance is accomplished by moving the shorting bar up and down the parallel lines by means of a threaded screw operated by a small motor. The motor is operated from the control panel. A tank circuit of this type has a high inductance-to-capacitance ratio, thereby keeping the circulating current low and providing high circuit efficiency. The entire frequency range 88 to 108 megacycles can be covered.

The power amplifier circuit requires a small amount of neutralization. This is accomplished by using adjustable cylinders close to the power amplifier tubes.

Radio frequency output from the power amplifier is inductively coupled by an adjustable loop to a low-impedance concentric transmission line. A variable capacitor is in series with each side of the loop. One of these capacitors is semi-fixed and the other is motor tuned. In the event the line tuning capacitor reaches a maximum or minimum setting, it will be necessary to adjust the semi-fixed antenna capacitor by hand to a point where the proper tuning will fall into the middle range of the motor driven capacitor. The purpose of these capacitors is to tune out the reactance in the line.

A thermocouple for indicating r-f current to the antenna is located at the junction box of the transmission line. The antenna current meter, M231A, is located on the front panel.

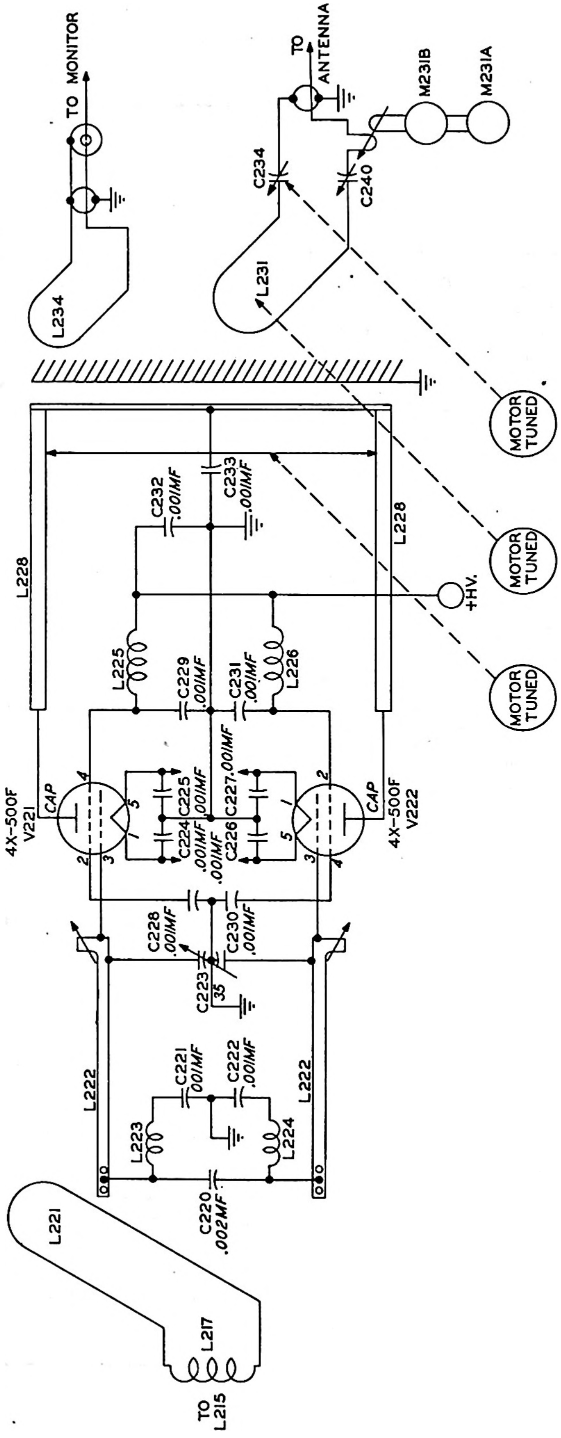


Figure 4-11 Final Amplifier Schematic

SECTION 5

OPERATORS MAINTENANCE

5.1. GENERAL.

This radio equipment has been constructed of materials considered to be the best obtainable for the purpose, and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, for best operation, routine checks of the equipment should be made and existing faults corrected immediately.

5.2. ROUTINE CHECKS.

(a) Examine all mechanical parts such as motor driven assemblies and manually operated switches for excessive wear.

(b) Examine electrical system for excessive heating of transformers, resistors, chokes, etc. The constant voltage transformer normally operates at a higher temperature than standard transformers.

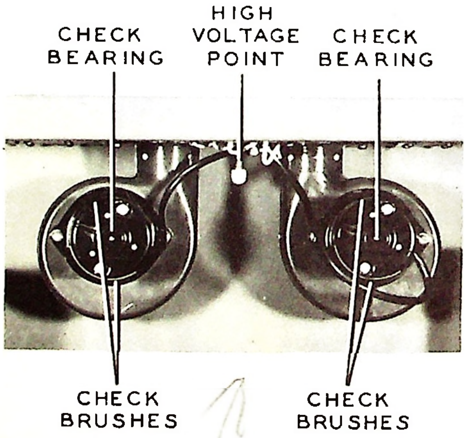


Figure 5-1 Blowers and Motor

shocks!
4-200-3040-00

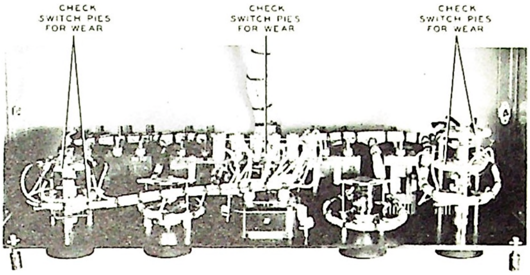


Figure 5-2 Control Panel (Rear View)

(c) A check on the emission of all vacuum tubes should be made at least every 1000 hours of service. Examine the prongs on all tubes to make certain that they are free from corrosion and make good electrical contact when in the socket.

(d) Check all relays for proper operation and inspect relay contacts to make certain they are clean and free from pits.

(e) Check all contacts of cable receptacles and plugs to assure a clean and firm mechanical connection.

(f) Inspect all component parts for dust accumulation.

(g) Check the operation of the equipment in regard to noise and distortion.

It is important that this routine inspection be made as frequently as possible, and it should be thorough enough to include all major electrical circuits and mechanical assemblies.

5.3. VOLTAGE AND CURRENT CHECKS.

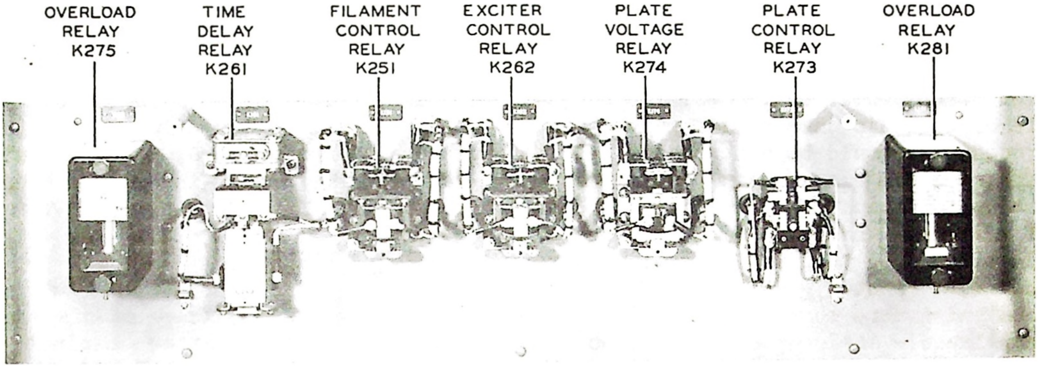


Figure 5-3 Relay Panel

During operation, meters should be under constant observation to maintain the proper operating currents and voltages. A table showing the approximate meter indications under typical operating conditions is shown in Section 3 of this Instruction Book. Some variation in the current and voltage readings may occur, but most satisfactory results are obtained from operation at rated values. The filament voltages should be within 5% of the recommended values for the type of tube used. Low voltage results in low emission which affects operation and reduces tube life. Too high a voltage causes rapid evaporation of cathode material, resulting in a short life.

5.4. CIRCUIT BREAKERS.

A check of all circuit breakers should be made immediately if the equipment becomes inoperative. This will assist in the isolation of the power circuits affected by the failure. Check all meter readings for assistance in isolating the difficulty.

5.5. TUBE REPLACEMENT.

Before removing tubes from their sockets, make certain that all high voltage circuits are shut off. Before removing high voltage tubes, make sure that the HV shorting switch is working. When replacing tubes, make certain that they are seated correctly and fully in their sockets. If the tube has a plate cap lead, be sure that the cap is in place and not lying against a metal chassis. When 866/866A rectifiers are placed in service for the first time, the filaments should be operated at normal temperature for at least 20 minutes before plate voltage is applied. Always have a good supply of spare tubes on hand for replacement in case of tube failure.

5.6. ROOM TEMPERATURE.

(a) Before turning on the equipment, the room temperature should be at least 15° centigrade or higher to protect the 866/866A rectifier tubes.

SECTION 6

PREVENTIVE MAINTENANCE

To insure peak performance and prevent failure or the impairment of the operation of the equipment, a definite schedule of periodic checks and maintenance procedures should be adhered to. It is suggested that a cleaning schedule be set up to include only a limited amount of cleaning and dusting to be done at one time. In this way it will require only a few minutes each night after shut down and a more thorough job will be accomplished. Assign a different section of the transmitter to be covered each night. Arrange the schedule so that a complete coverage of the transmitter is obtained in a week's time.

6.1. GENERAL.

The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion is accelerated by the presence of dust and moisture. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry oil-free jet of air. Although the cabinet is equipped with a dust filter which will remove most of the dust particles, there is always a slight accumulation of dust in the vicinity of circuits at a high potential above ground. Remove dust as often as a perceptible quantity accumulates at any place in the equipment. It is very important that rotating equipment such as the variable capacitors, tap switches, etc., be kept free from dust to prevent undue wear. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as the tap switches, tube prongs, and cable plug connectors are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cables, plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

6.2. AIR FILTER.

The spun glass filter elements at the rear of the transmitter cabinet will give more satisfactory life if the elements are cleaned once every two weeks. A small vacuum cleaner is a satisfactory means of removing surface dirt. The elements should be replaced whenever the spun glass appears to be appreciably clogged by dust and grease.

6.3. LUBRICATION.

6.3.1. Ventilating Blower.

(a) Lubricate the bearings of the ventilating blower motor with spindle oil of a viscosity of 190-220 Saybolt Universal Seconds at 100° F, such as Cities Service Pacemaker #2 or equal.

(b) Use a small amount at one time.

(c) Lubricate periodically.

6.3.2. Tuning Motors and Assemblies.

(a) Lubricate tuning motor assemblies with the same type spindle oil as used on the ventilating blower motors.

(b) Use a small amount at any one time.

(c) Lubricate periodically.

6.4. ROUTINE CHECKS.

6.4.1. Tube Check.

(a) A check on the emission of all vacuum tubes should be made at least every 1000 hours of service.

(b) Keep a record of the length of time the tubes are in use. Filament and plate running time meters are provided.

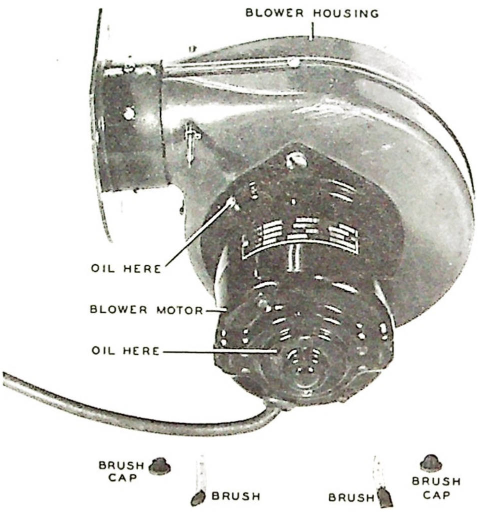


Figure 6-1 Blower and Motor Assembly

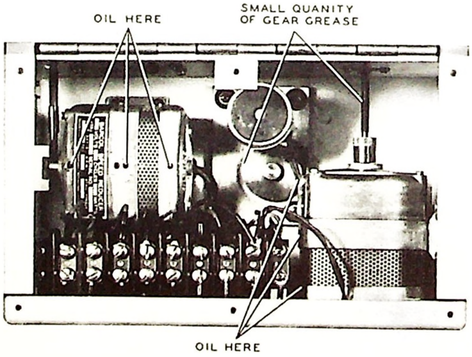


Figure 6-2 Tuning Motors

(c) Operate tubes as near their rated values of voltages and currents as possible.

(d) Replace tubes that have been in service a long time with new ones.

(e) Visually inspect the elements inside of the tubes. Elements may have become warped, increasing the probability of short-circuiting.

(f) When 866/866A mercury vapor rectifiers are put into service for the first time, the filaments should be operated at normal temperature for at least 20 minutes before plate voltage is applied.

6.4.2. Mechanical Inspection.

(a) Check all connections at least once a month. Resolder loose contacts. Tighten all nuts, bolts and screws if any loose ones are found.

(b) Check all contacts of cable receptacles and plugs to assure clean, firm mechanical and electrical connection.

(c) Inspect interlock switches in the front and rear doors for proper operation.

(d) Examine all mechanical parts of motor driven assemblies for excessive wear.

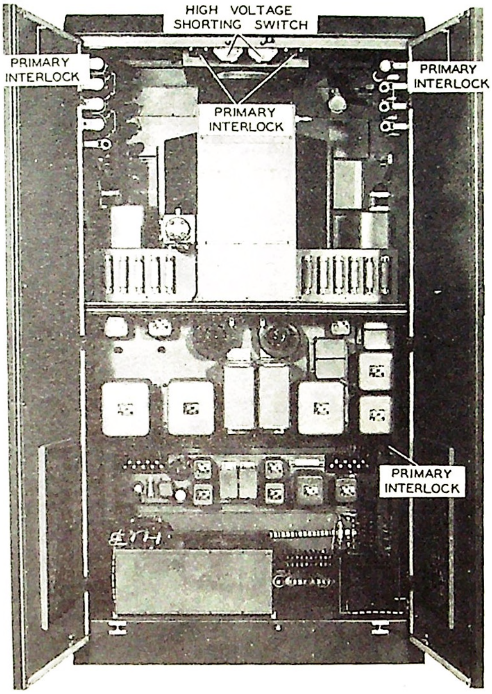


Figure 6-4 732A (Front View) Interlock and High Voltage Shorting Switch Location

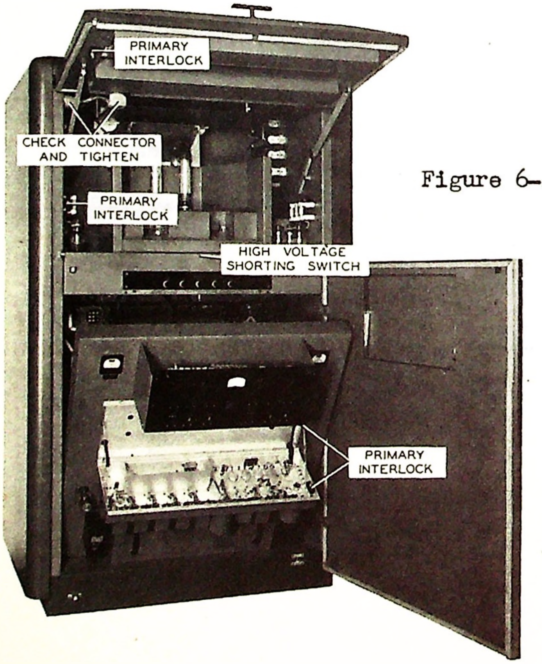


Figure 6-3 732A (Rear View) Interlock and High Voltage Shorting Switch Location

SECTION 7

CORRECTIVE MAINTENANCE

7.1. GENERAL.

If routine maintenance checks and inspection schedules, as outlined in Sections 5 and 6, are performed regularly, very little trouble is likely to occur with this equipment. However, if trouble is encountered, a systematic procedure of testing should be followed to quickly isolate the circuit at fault. Although it is impossible to foresee every case of trouble that may develop, most troubles will cause abnormal readings.

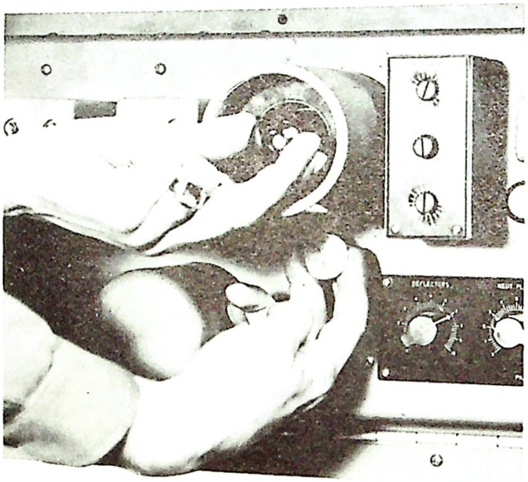


Figure 7-1 Remove Phasitron Tube

7.2. TROUBLE SHOOTING.

7.2.1. Tube Failure. - The most frequent cause of trouble in transmitting equipment is tube failure. If a fault occurs in the equipment, isolation of the circuit at fault is helpful in determining the location of the defective tube. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within vacuum tubes is a good indication of fault in the tube circuit. Low emission tubes may be the cause of erratic or poor performance of the equipment. If there is any doubt concerning the emission of any tube, it should be checked immediately and replaced if defective. Tubes with electrical noises cause excessive distortion or hum. This fault may be difficult to isolate to a particular tube, but by replacing each tube with a tube known to be in good condition, the defecitve tube can usually be located. It will be noticed that there may be one or two 866/866A mercury vapor rectifier tubes that "fire" intermittently. This does not necessarily indicate trouble or a defective tube. The demand on the power supply caused by a varying load will bring about this condition. If a set of 866/866A tubes can be found that are equally balanced, they may "fire" simultaneously.

7.2.2. Isolating the Trouble.

(a) Before starting on any extensive set of tests, examine the position of all switches and controls and make sure that they are in the correct position.

(b) A check of all circuit breakers and d-c overload relays should be made to ascertain the power circuits affected by the trouble.

(c) Check the circuits in the order they are made operative in the process of starting the transmitter.

(d) Compare the readings on all meters with those shown in the table in Section 3. This table lists the typical operating voltages and currents of the various circuits of the transmitter.

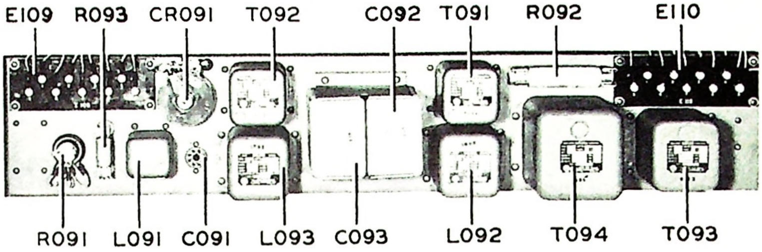


Figure 7-2 Low Voltage Power Supply (Rear View)

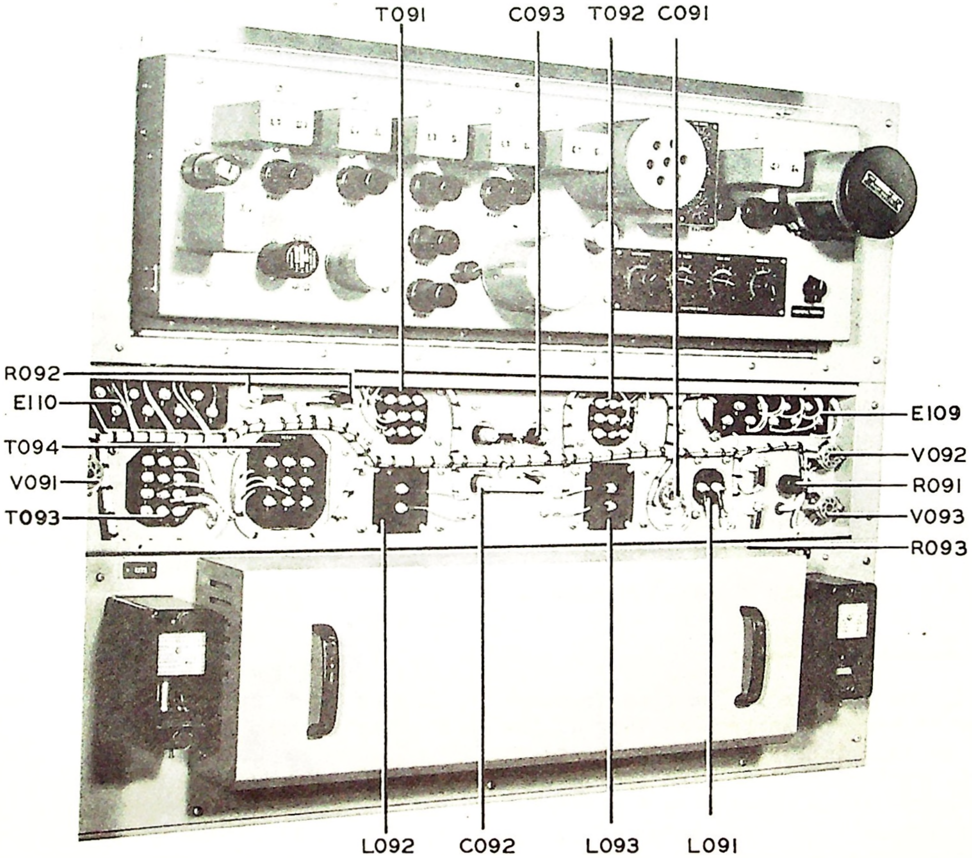


Figure 7-3 Low Voltage Power Supply (Front View)

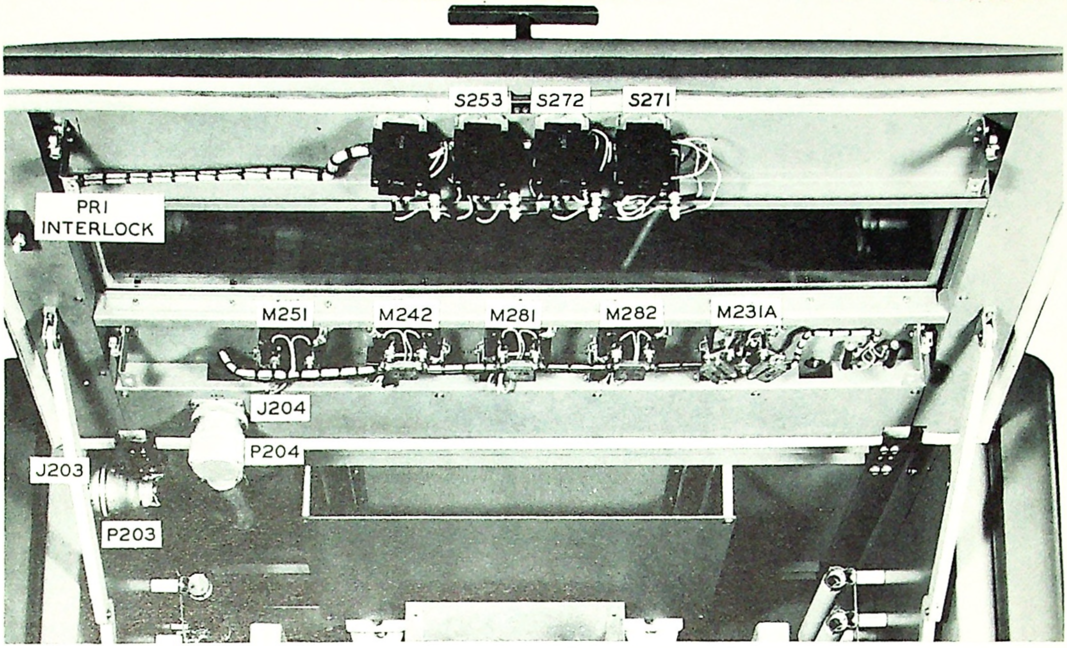


Figure 7-4 Upper Door Parts Arrangement

new figure required

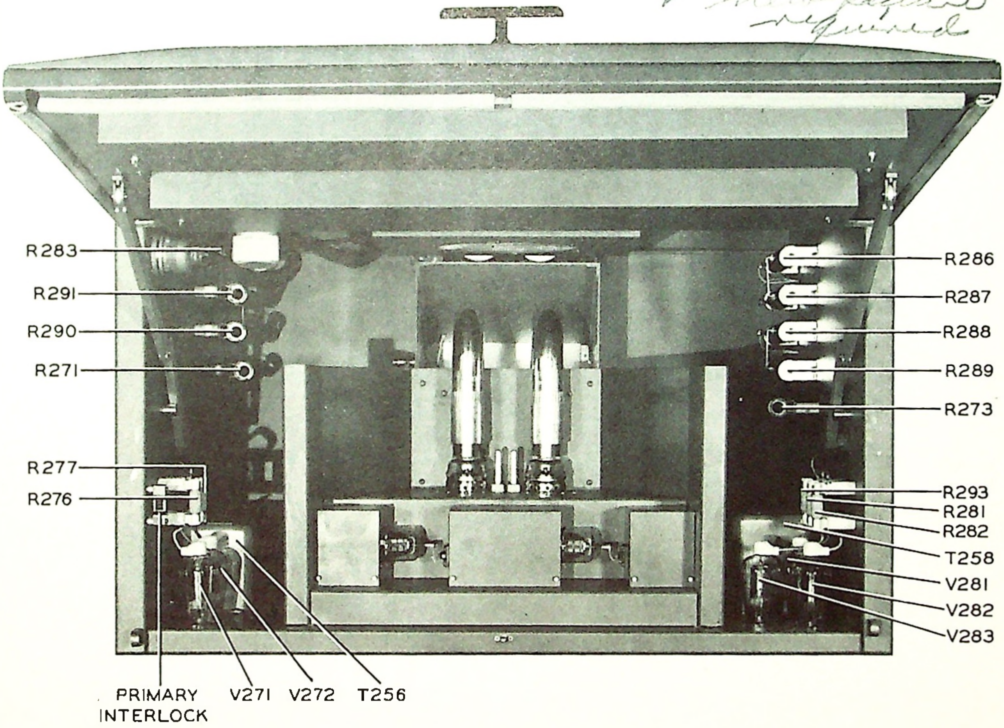


Figure 7-5 732A Front Upper Section Parts Arrangement

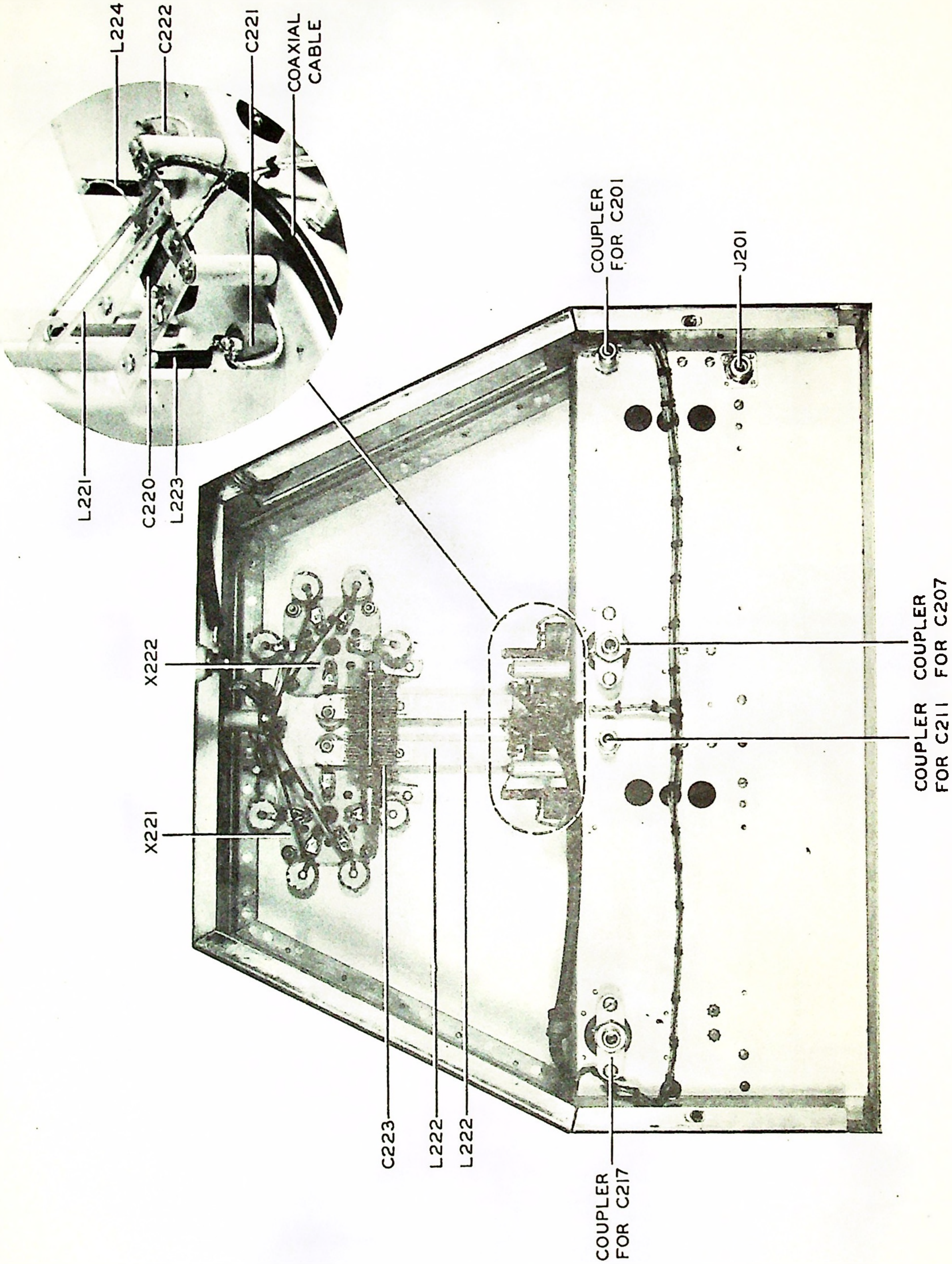


Figure 7-6 Power Amplifier Grid Circuit Parts Arrangement

all blotches on the negative

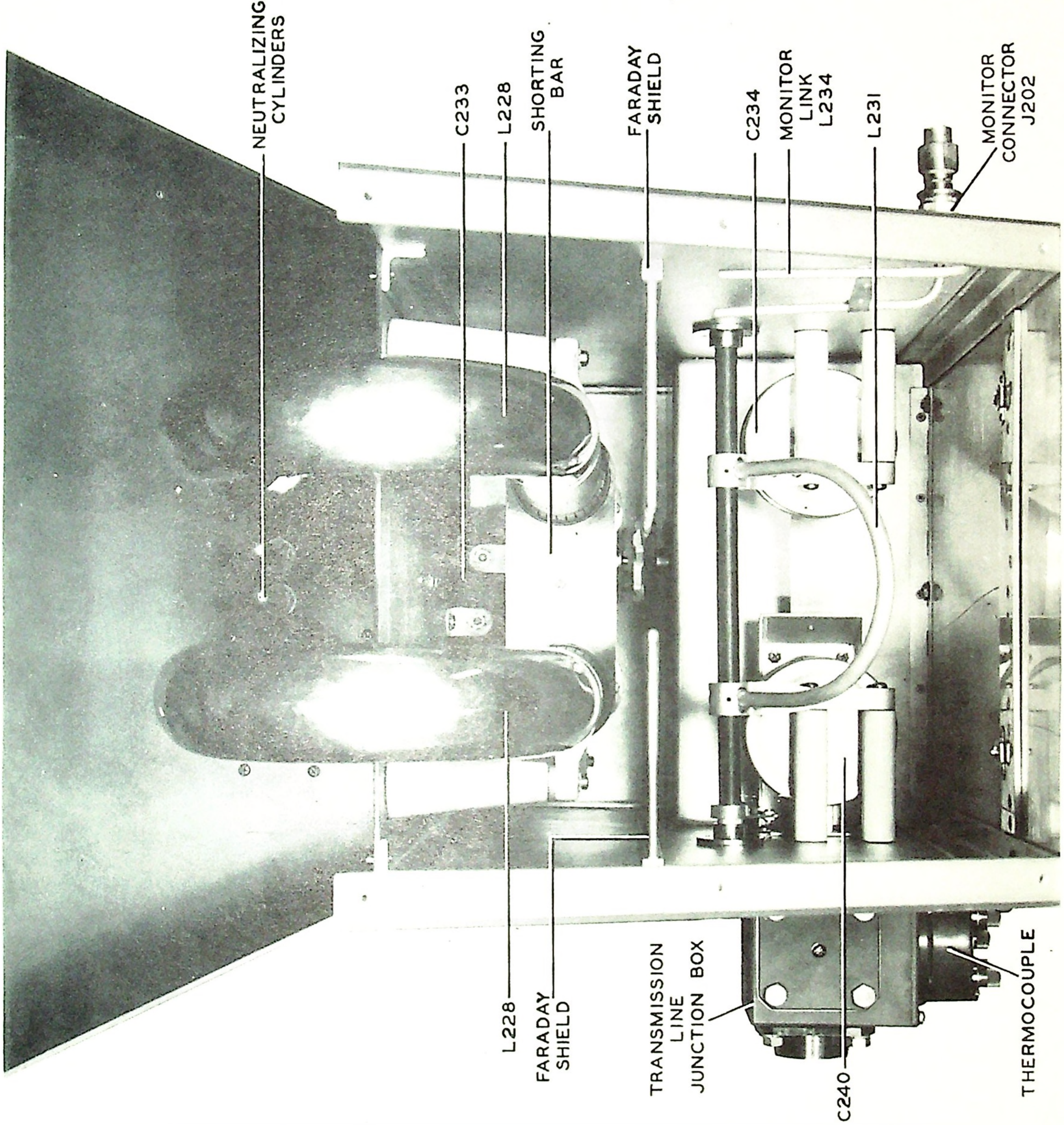


Figure 7-7 RF Output Parts Arrangement

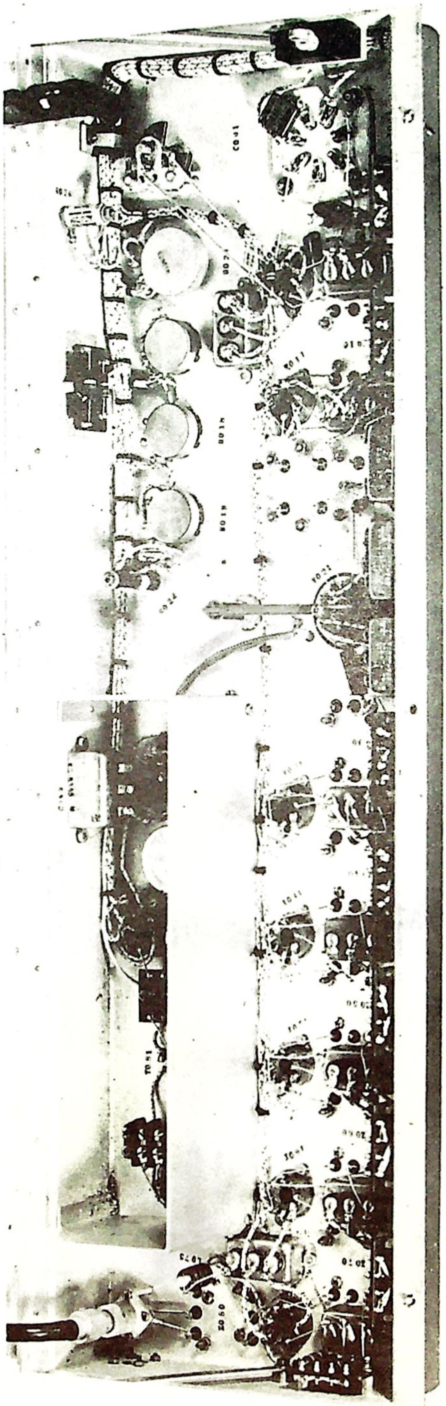


Figure 7-8 Exciter Chassis (Rear View)

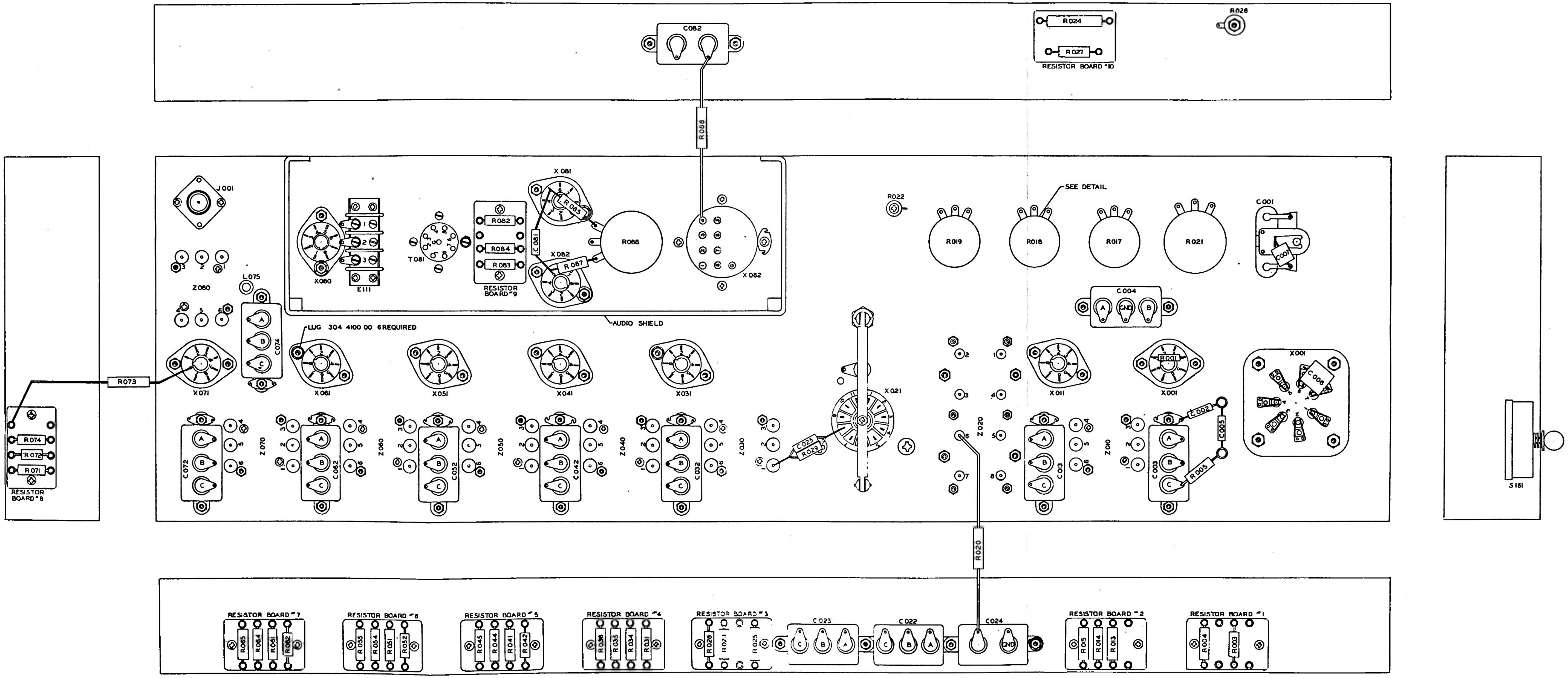


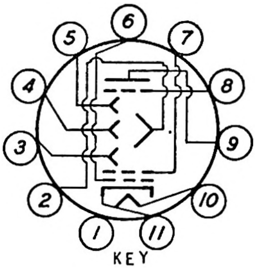
Figure 7-9 Exciter Chassis Parts Arrangement

GL-2H21 PHASITRON

Heater		
Voltage	6.3	volts d-c
Current	0.3	ampere
Direct Interelectrode Capacitances, Approximate		
Deflectors to Plate I	0.025	μμ f
Plate I to Plate 2	1.0	μμ f
Frequency for Maximum Ratings	500	kc

Pin I – No connection
Pin 2 – Deflector No. 4
Pin 3 – Deflector No. I
Pin 4 – Deflector No. 2
Pin 5 – Deflector No. 3
Pin 6 – Grid No. I
Pin 7 – Grid No. 2
Pin 8 – Plate No. I
Pin 9 – Plate No. 2
Pin I0 – Heater
Pin II – Heater and Cathode

Mounting Position Any
Base Description – Medium-Shell Magnal II-Pin



BOTTOM VIEW

Maximum Ratings and Typical Operating Conditions

PHASE MODULATOR	TYPICAL OPERATION	MAXIMUM RATING
Heater Voltage	6.3	volts d-c
Plate No. I Voltage	200	300 volts
Plate No. 2 Voltage	250	300 volts
Deflectors No. I, 2 and 3 Voltage	85	I00 volts
Deflector No. 4 Voltage	30	I00 volts
Grid No. I Voltage	I0	25 volts
Grid No. 2 Voltage	25	I50 volts
Cathode Current	4	6 milliamperes
Radio-Frequency Driving Voltage (phase to neutral)	35	volts RMS
Maximum Audio-Modulating Power for ±I80° Phase Shift	50	milliwatts
Distortion at ±I80° Phase Shift	I.2	per cent
Radio-Frequency Output Voltage	4	volts RMS

Figure 7-11 Phasitron Tube Data

(e) Make a visual inspection of all tubes, resistors and chokes. Tubes may be sputtering indicating shorts, or their plates may show excessive color, indicating a heavy current drain. Resistors and chokes may be discolored due to a short.

7.2.3. Failure of Filament Voltage Supply.

Symptoms:

(a) No filament voltage applied to any tube in the equipment.

(b) No filament voltage applied to one certain tube in the equipment.

(c) Ventilating blower not operating.

(d) Filament pilot light not lit.

Probable Causes:

(a) Constant voltage transformer defective.

(b) Filament transformers applying filament voltage to individual tubes defective.

(c) Filament relay contactor (K251) defective.

Correction:

(a) In case the constant voltage transformer has burnt out, the equipment can be operated temporarily by disconnecting the constant voltage transformer and connecting the leads that originally ran to the primary, to the secondary leads. The filament voltage may vary somewhat, but

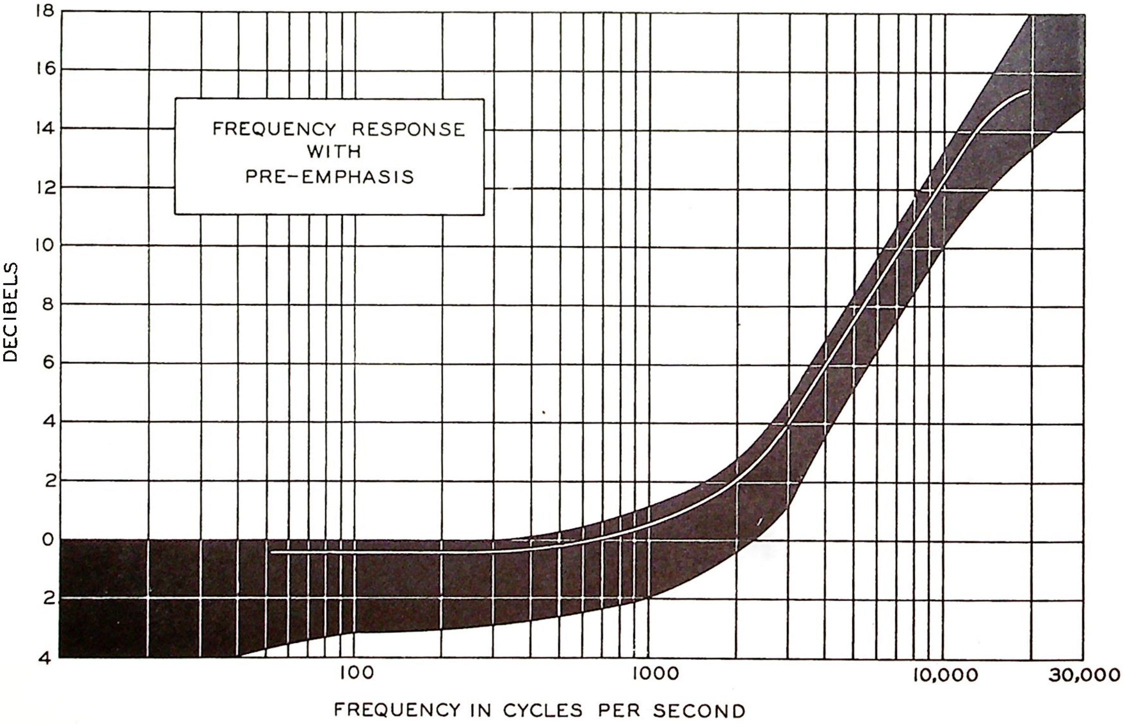


Figure 7-12 Decibels Versus Frequency Cycles Per Second, With Pre-Emphasis

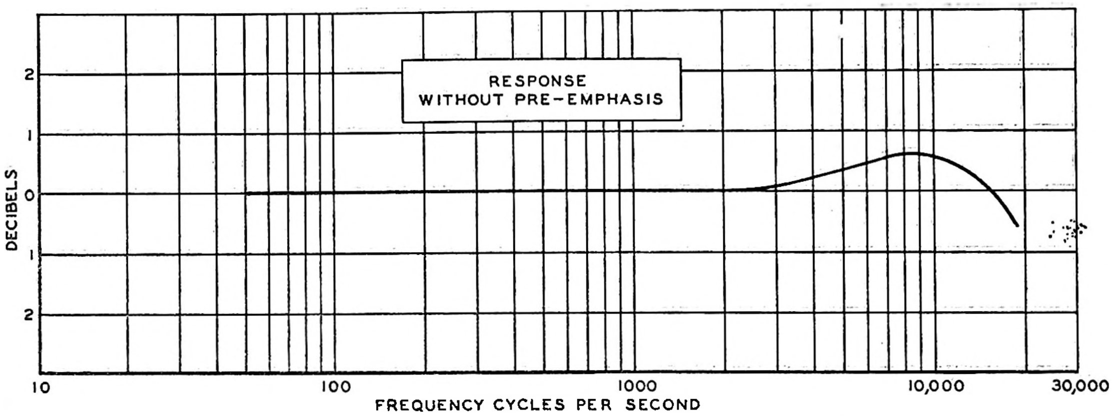


Figure 7-13 Decibels Versus Frequency Cycles Per Second, Without Pre-Emphasis

this arrangement will be satisfactory until the constant voltage transformer can be replaced.

(b) Replace individual filament transformers that are burnt out.

(c) If the filament relay contactor (K251) has become defective, it is best to replace it with a new one. Adjustments are very critical on this type of relay.

7.2.4. Exciter Plate Supply Voltage Failure.

Symptoms:

(a) 1st PLATE pilot lamp does not light.

(b) No plate voltage on M241.

Probable Causes:

(a) Door interlock open.

(b) Time delay relay has not operated.

(c) Miscroswitch in time delay relay is defective.

(d) Exciter plate relay defective.

(e) Defective component in exciter power supply.

7.2.5. Intermediate Plate Supply Voltage Failure.

Symptoms:

(a) No indication of plate current in the 829B multiplier tubes.

(b) Rectifier tubes do not glow.

Probable Cause:

(a) HV shorting switch is closed.

(b) Defective plate contactor.

(c) Defective component in intermediate voltage power supply.

7.2.6. High Voltage Does Not Come On When Plate ON Button is Pressed.

Symptoms:

(a) Plate pilot lamp does not light and

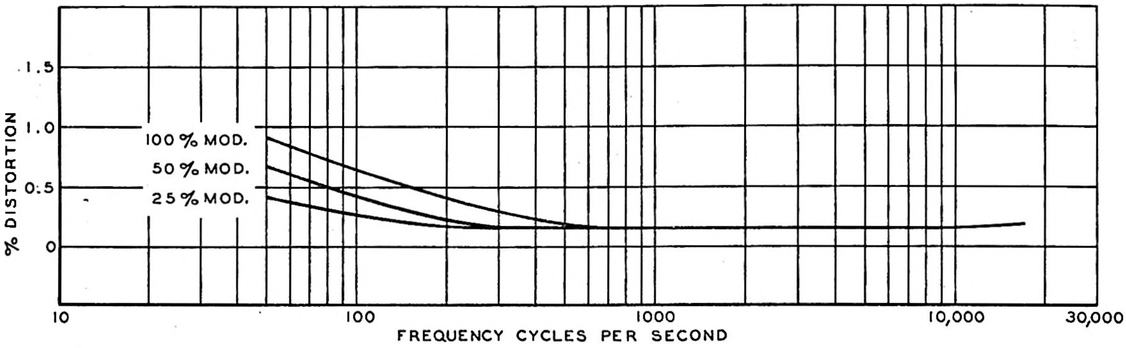


Figure 7-14 % of Distortion Versus Frequency Cycles Per Second

there is no indication of plate voltage on the power amplifiers.

(b) Plate pilot lamp lights but there is no indication of plate voltage on the power amplifiers.

Probable Causes:

(a) HV shorting switch closed.

(b) Defective part in h-v power supply.

7.2.7. Distortion. - Very little distortion is likely to occur with this equipment after it has been properly adjusted. However, if it does appear, the 3 phase transformer that is associated with the Phasitron tube should be re-adjusted for minimum distortion. Also, the audio balance and phasitron bias controls should be "trimmed-up".

7.2.8. Parasitic Oscillations. - Parasitics are guarded against in the design of this equipment. The use of parasitic suppressors dampens parasitic oscillations in the r-f driver circuits. With the final amplifier properly neutralized, there should be no trouble with parasitics.

7.2.9. Power Amplifier Stage Not Neutralized.

Symptoms:

(a) The power amplifier grid or plate current jumps when tuning the plate circuit of the power amplifier.

(b) Maximum grid current is not obtained when plate circuit is at resonance.

Probable Cause:

(a) Grid to plate capacity of power amplifier tubes has changed with aging tubes.

(b) New tubes have been installed and the grid to plate capacity of these new tubes is different than the grid to plate capacity of the old tubes.

(c) The neutralizing capacitor is out of adjustment.

Correction:

Refer to the paragraph on neutralization procedure in Section 2 of this book and re-neutralize.

7.2.10. Ventilating Blower. - It is important that the ventilating blower motor be lubricated periodically. This motor is operating continuously and consequently, should be kept well oiled. The brushes should be examined for wear periodically.

7.2.11. Tuning Motors. - To minimize the wear in these motors and their assemblies, they should be lubricated frequently with a light oil. They should be observed often for excessive wear and replaced if necessary.

7.2.12. Servicing the Equipment. - When service work or replacement of parts is necessary, it is an easy matter to gain access to all components of the transmitter. Relays are made available by removing dust cover. All wiring and components of the exciter can be exposed by opening the wing head studs and lowering the exciter chassis. The wiring and components of the exciter power supply are made available by removing the shield plate that is located beneath the exciter chassis. The wiring of the control panel can be seen when the vertical chassis is in the forward position. Also, the intermediate and h-v filter panels are accessible with the vertical forward. Power multipliers and all parts on the door may be reached by opening upper door and removing shield covers.

The constant voltage transformer, h-v voltage transformer and power amplifier and output circuits are accessible from rear.

Power amplifier grid circuit components are made available from rear by removing side plates on forward portion of PA compartment.

A phasitron tube ejector is included to assist in changing Phasitron tubes. When servicing components in the front upper door panel, remove the two dust covers.

7.2.13. Typical Voltages.

Tube	Pin	Voltage
Crystal Osc. V001 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	.05
Grid (G1) Voltage	4	-7.0
Grid (G2) Voltage	6	113
Grid (G3) Voltage	3	.05
Plate Voltage	8	180
Buffer V011 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	6.4
Grid (G1) Voltage	4	0
Grid (G2) Voltage	6	120
Grid (G3) Voltage	3	6.4
Plate Voltage	8	305
1st Doubler V031 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	0
Grid (G1) Voltage	4	-5.4
Grid (G2) Voltage	6	128
Grid (G3) Voltage	3	0
Plate Voltage	8	305
1st Tripler V041 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	0
Grid (G1) Voltage	4	-34.0
Grid (G2) Voltage	6	136
Grid (G3) Voltage	3	0
Plate Voltage	8	305
2nd Tripler V051 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	0
Grid (G1) Voltage	4	-60.0
Grid (G2) Voltage	6	144
Grid (G3) Voltage	3	0
Plate Voltage	8	305

Tube	Pin	Voltage
Amplifier V061 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	0
Grid (G1) Voltage	4	-57.0
Grid (G2) Voltage	6	133
Grid (G3) Voltage	3	0
Plate Voltage	8	305
3rd Tripler V071 6V6		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	8	21.5
Grid (G1) Voltage	5	-64.0
Grid (G2) Voltage	4	265
Plate Voltage	3	310
Audio Amplifier V081 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	11.6
Grid (G1) Voltage	4	0
Grid (G2) Voltage	6	305
Grid (G3) Voltage	3	305
Plate Voltage	8	305
Audio Amplifier V082 6SJ7		
Filament Voltage	2 & 7	6.3 v
Cathode Voltage	5	10.4
Grid (G1) Voltage	4	0
Grid (G2) Voltage	6	305
Grid (G3) Voltage	3	305
Plate Voltage	8	305

Tube	Pin	Voltage
1st Int. Amp. V201 829B		(DC) (AC)
Filament Voltage	1 & 7	94 12.6
Filament Center Tap	5	94
Cathode Voltage	4	50
Grid 1 of Unit 1	6	-105
Grid 1 of Unit 2	2	-105
Grid (G2) Voltage	3	185
Plate Voltage	P1 P2	580
2nd Int. Amp. V211 829B		(DC) (AC)
Filament Voltage	1 & 7	94 12.6
Filament Center Tap	5	94
Cathode Voltage	4	70
Grid 1 of Unit 1	6	-210
Grid 1 of Unit 2	2	-210
Grid (G2) Voltage	3	215
Plate Voltage	P1 P2	580
4X500F Power Amp. V221		(DC) (AC)
Filament Voltage	1 & 5	20 5 v
Grid (G1) Voltage	3	-180
Grid (G2) Voltage	2 & 4	350
Plate Voltage	P Cap	3500
4X500F Power Amp. V222		(DC) (AC)
Filament Voltage	1 & 5	20 5 v
Grid (G1) Voltage	3	-180
Grid (G2) Voltage	2 & 4	350
Plate Voltage	P Cap	3500

SECTION 8

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
B221	Final Amp PLATE TUNING motor	MOTOR: AC Capacitor; 230 v; single phase; 60 cps; 1/100 hp; 3000 rpm nom	230 0017 00
B231	Antenna LINE COUPLING motor	MOTOR: AC; 230 v; single phase; 60 cps; 1/5 rpm	230 0015 00
B232	Antenna LINE TUNING motor	MOTOR: AC; 230 v single phase 60 cps; 30 rpm	230 0016 00
B251	Cool the 4X500F Final Amp. Tubes	BLOWER and MOTOR ASSEM: 230 v AC; 60 cps; series wound	009 1006 00
B252	Cool the 4X500F Final Amp. tubes	BLOWER and MOTOR ASSEM: 230 v AC; 60 cps; series wound shocks	009 1005 00 200-3040-00
B253	Cooling	EXHAUST FAN: 220 v AC; 60 cps	009 1071 00
C001	Padding capacitor	CAPACITOR: 20 mmf ±1 mmf; 500 WVDC	913 0189 00
C002	RF Bypass	CAPACITOR: 2000 mmf ±10%; 500 WVDC	912 2201 20
C003		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C003A	RF Bypass		
C003B	RF Bypass		
C003C	RF Bypass		
C004		CAPACITOR: Dual section; 0.1 mf ±20% per section; 600 WVDC	956 4016 40
C004A	Filament Bypass		
C004B	Filament Bypass		
C005	Feedback	CAPACITOR: 2000 mmf ±10%; 500 WVDC	912 2201 20
C006	RF Bypass	CAPACITOR: 10,000 mmf ±10%; 300 WVDC	935 2117 00
C007	Trimmer	CAPACITOR: 6-35 mmf	922 0020 00
C013		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C013A	RF Bypass		
C013B	RF Bypass		
C013C	RF Bypass		
C022		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C022A	RF Bypass		
C022B	RF Bypass		
C022C	RF Bypass		
C023		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C023A	RF Bypass		
C023B	RF Bypass		
C023C	RF Bypass		
C024	RF Bypass	CAPACITOR: 0.1 mf ±20%; 600 WVDC	956 2016 40

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C025	RF bypass	CAPACITOR: 1500 mmf ±10%; 500 WVDC	912 2154 20
C032		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C032A	RF bypass		
C032B	RF bypass		
C032C	RF bypass		
C042		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C042A	RF bypass		
C042B	RF bypass		
C042C	RF bypass		
C052		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C052A	RF bypass		
C052B	RF bypass		
C052C	RF bypass		
C062		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C062A	RF bypass		
C062B	RF bypass		
C062C	RF bypass		
C072		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C072A	RF bypass		
C072B	RF bypass		
C072C	RF bypass		
C074		CAPACITOR: Triple section; 0.1 mf ±20% per section; 600 WVDC	956 0002 00
C074A	RF bypass		
C074B	Filament bypass		
C074C	Filament bypass		
C081	Compensating network (R085, R086, R087)	CAPACITOR: 8200 mmf ±5%; 300 WVDC	935 2113 00
C082	Compensating network (PartofR088)	CAPACITOR: 0.125 mf ±5%; 600 WVDC	932 1106 00
C091	Filter capacitor	CAPACITOR: 2000 mf; 15 WVDC	184 4000 00
C092, C093	Filter capacitor	CAPACITOR: 15 mf ±20%; 1000 WVDC	930 0051 00
C201	V201 grid tuning capacitor	CAPACITOR: Dual section; 6.5 - 100 mmf per section CAPACITOR before fabrication	503 1762 001 922 1500 00
C202	V201 grid bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C203, C204 C205	V201 filament bypass	CAPACITOR: 1000 mmf ±20%; 500 WVDC (Part of X201)	912 0286 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C206	V201 screen bypass	CAPACITOR: 1000 mmf ±20%; 500 WVDC (Part of X201)	912 0286 00
C207	V201 plate tuning capacitor	CAPACITOR: Dual section; 6.8-31 mmf per section	922 0018 00
C208	V201 plate bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C211	V211 grid tuning capacitor	CAPACITOR: Dual section; 6.8-31 mmf per section CAPACITOR before fabrication	503 1761 001 922 0018 00
C212	V211 grid bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C213, C214	V211 filament bypass	CAPACITOR: 1000 mmf ±20%; 500 WVDC (Part of X211)	912 0286 00
C215	V211 cathode bypass	CAPACITOR: 1000 mmf ±20%; 500 WVDC (Part of X211)	912 0286 00
C216	V211 screen bypass	CAPACITOR: 1000 mmf ±20%; 500 WVDC (Part of X211)	912 0286 00
C217	V211 plate tuning capacitor	CAPACITOR: Dual section; 6.8-31 mmf per section	922 0018 00
C218	V211 plate bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C220	Final amp. grid blocking capacitor	CAPACITOR: 0.002 mf ±10%; 2000 WVDC	950 2201 40
C221, C222	Final amp. grid bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C223	Final amp. grid tuning capacitor	CAPACITOR: Dual section; 6.8-31 mmf per section CAPACITOR before fabrication	503 1761 001 922 0018 00
C224, C225	V221 filament bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C226, C227	V222 filament bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C228, C229	V221 screen bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C230, C231	V222 screen bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00
C232	Screen bypass	CAPACITOR: 1000 mmf ±20%; 1500 WVDC	913 0101 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C233	Final amp. plate bypass	CAPACITOR: 1000 mmf ±5%; 5000 WVDC	938 2066 00
C234	Antenna link tuning capacitor	PLATE:Capacitor; upper; 3-1/2" diam x 1/4" thk PLATE:Capacitor; lower; 3-1/2" diam x 1/4" thk	503 1803 002 503 1866 002
C235, C236	Thermocouple bypass	CAPACITOR: 10,000 mmf ±10%; 300 WVDC	935 2117 00
C237, C238	M231A RF meter bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C239	B221 reversing capacitor	CAPACITOR: 1 mf ±10%; 600 WVDC	956 2142 00
C240	Antenna link tuning capacitor	PLATE:Capacitor; upper; 3-1/2" diam x 1/4" thk PLATE:Capacitor; lower; 3-1/2" diam x 1/4" thk	503 1803 002 503 1866 002
C241	Bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C242	M242 meter bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C243	Bypass	CAPACITOR: 10 mmf ±1 mmf; 500 WVDC	916 0006 00
C244	Bypass	CAPACITOR: 10 mmf ±1 mmf; 500 WVDC	916 0006 00
C251	Bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C271	Final amp. screen filter	CAPACITOR: 15 mf ±20%; 1000 WVDC	930 0051 00
C272, C273, C274	Filter capacitor	CAPACITOR: 15 mf ±20%; 1000 WVDC	930 0051 00
C281	M281 meter bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C282	M282 meter bypass	CAPACITOR: 0.004 mf ±20%; 1250 WVDC	925 2404 40
C283, C284	HV filter capacitor	CAPACITOR: 4 mf ±20%; 5000 WVDC	930 0053 00
C290	Bypass	CAPACITOR: 50 mmf max. to 5 mmf min; 500 WVDC	917 1007 00
CR091	Phasitron filament voltage rectifier	RECTIFIER: Dry disc; input 17 v AC rms; output 13.5 ±5% v DC at 1.2 amp.	353 0004 00
E109		BOARD ASSEM: Connector; exc. power supply; 9 term	503 1844 002
E110		BOARD ASSEM: Connector; exc. power supply; 9 term	503 1845 002
E111	Audio input	BOARD: Terminal; 3 term	367 4030 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
E201, E202, E203, E204, E205, E206		BOARD: Terminal; 12 10-32 threaded stud term	306 0030 00
E207		BOARD: Terminal; 9 term	367 0060 00
E208	Blower Motor	BOARD: Terminal; 4 term	306 0027 00
E212	Power input	BOARD: Terminal; 3 term	306 0069 00
I081		LAMP: Miniature bayonet base; 6.3 v; 0.15 amp; T-3-1/4 bulb	262 3240 00
I251, I252, I253, I254, I255, I256, I257, I261, I280		LAMP: Candelabra bayonet base; 120 v; 6 w; S-6 bulb	262 0041 00
J001, J201, J202		CONNECTOR: Wall mtg receptacle for terminating cables with AN Plug UG-21/u;	357 9003 00
J203		CONNECTOR: 30 term wall mtg receptacle	370 2026 00
J204		CONNECTOR: 30 term wall mtg receptacle	370 2025 00
K251	Filament control relay	RELAY: Power contactor; 220 v; 60 cps coil; 3 NO, 10 amp contacts	405 0033 00 *405 0421 00
K261	Time delay relay	RELAY: Timing; AC; 230 v; 60 cps coil; SPDT; 10 amp contacts	405 0115 00 *405 0403 00
K262	Exciter control relay	RELAY: Power contactor; 220 v; 60 cps coil; 3 NO, 10 amp contacts	405 0033 00 *405 0421 00
K273	Plate control relay	RELAY: Circuit control; 220 v AC, 60 cps coil; DPDT, 10 amp contacts	405 0112 00 *405 0113 00
K274	Plate voltage relay	RELAY: Power contactor; 220 v 60 cps coil; 5 NO, 10 amp contacts	405 0051 00 *405 0439 00
K275, K281	Overload relay	RELAY: AC or DC current overload; 0.5 to 2 amp coil; 2 NC contacts	405 0095 00

* Components for equipments designed for operation from 50 cps power source.

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L020	Modulating coil	COIL ASSEM: Phasitron; 6000 turns #28 AWG duo enameled copper wire	503 1935 003
L075	RF choke	COIL: RF; 2.5 mh ±10%	240 5300 00
L091	Phasitron filament supply filter choke	REACTOR: Filter; 0.1 hy	678 0104 00
L092, L093	LV filter choke	REACTOR: Filter; 6 hy	678 2220 00
L201	Link to L202 of V201 multiplier tube	COIL: Pick-up; 2 turns #10 AWG tinned copper wire	503 1826 002
L202	Grid tank of V201	COIL ASSEM: 20 turns #20 enameled copper wire; CT	503 1822 002
L203	RF choke in grid of V201	COIL: RF; 0.5 mh ±10%	240 0004 00
L206	Plate tank of V201	COIL ASSEM: 12 turns #12 tinned copper wire;CT	503 1823 002
L207	Plate RF choke of V201	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001
L211	Grid tank of V211	COIL ASSEM: 11 turns #12 tinned copper wire groove wound	503 1824 002
L212	RF choke in grid of V211	COIL: RF; 0.5 mh ±10%	240 0004 00
L213, L214	Parasitic coil	COIL: RF; 8-1/2 turns #21 AWG wire	240 0041 00
L215	Plate tank of V211	COIL ASSEM: 3 turns	503 1827 002
L216	Plate RF choke of V211	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001
L217	Coil link on L215	COIL ASSEM: 1 turn	503 1618 001
L221	Adjustable loop to the grid lines of final amp.	LOOP ASSEM: Grid coupling	503 1708 001
L222	Grid lines of final amplifier	GRID LINE: Left hand GRID LINE: Right hand	503 1837 002 503 1836 002
L223	Grid choke of V221	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L224	Grid choke of V222	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001
L225	Screen choke of V221	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001
L226	Screen choke of V222	COIL ASSEM: 35 turns close wound #22 AWG wire	503 1616 001
L228	Final amp. plate lines	TANK ASSEM: PA; adjustable shorting bar	503 2040 004
	Plate line shorting bar	SLEEVE ASSEM: Mtg lug soldered to sleeve BEND: Return; for PA line	503 1798 002 503 1838 002
L231	Line coupling coil	COUPLING ASSEM: Antenna	503 1955 003
L232	Thermocouple link	LEAD ASSEM: Output	503 1901 002
L233	Thermocouple link	LINK ASSEM: Coupling	503 1746 001
L234	Monitor link	LINK ASSEM: Monitor	503 3071 001 503 3070 001 503 3067 001
L271, L272	Filter choke	REACTOR: Filter; 1.65 hy, 0.52 amp DC min; 7 hy, 0.030 amp DC max	678 0103 00
L281, L282	HV filter choke	REACTOR: Filter; 3.5 hy min at .520 amp DC; 15 hy min at .050 amp DC	678 0135 00
M231		METER: Remote RF thermoammeter; 0-8 amp, meter range; 0-50 ma, thermocouple range	459 0028 00
M231A	RF amp meter		
M231B	Thermocouple		
M231C	Cable connecting amp meter to thermocouple	Shielded two-wire cable connecting M231A meter and M231B thermocouple	425 0270 00
M241	Exciter meter	METER: DC 0-1 ma, 1000 ohms; 0-250 scale	458 0021 00
M242	Intermediate current meter	METER: DC 0-1 ma, 1000 ohms; 0-250 scale	458 0021 00
M251	Primary voltage meter	METER: AC voltmeter; 0-250 v scale	452 0016 00
M252	Filament time meter	INDICATOR: Elapsed time; 0-9999.9 hours	458 0933 50 *458 0923 00
M281	PA plate voltage meter	METER: DC voltmeter; 0-4.0 kv scale	458 0036 00

* Components for equipments designed to operate from 50 cps power source.

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
M282	PA plate current	METER: DC Milliammeter; 0-800 ma	450 0043 00
M283	Plate time meter	INDICATOR: Elapsed time; 0-9999.9 hours	458 0933 50 *458 0923 00
P001, P201, P202		CONNECTOR: Plug for use with AN coaxial cable #RG-8/u and RG-10/u	357 9001 00
P203		CONNECTOR: 30 term straight plug	370 2024 00
P204		CONNECTOR: 30 term right angle socket	370 2023 00
R001	V001 grid resistor	RESISTOR: 0.10 meg ±10%; 1 w	745 3170 00
R003	V001 cathode bias resistor	RESISTOR: 18 ohm ±10%; 1/2 w	745 1013 00
R004	V001 screen dropping resistor	RESISTOR: 0.10 meg ±10%; 1 w	745 3170 00
R005	V001 plate decoupling resistor	RESISTOR: 10,000 ohm ±10%; 1 w	745 3128 00
R013	V011 cathode bias resistor	RESISTOR: 1200 ohm ±10%; 1 w	745 3090 00
R014	V011 screen dropping resistor	RESISTOR: 0.15 meg ±10%; 1 w	745 3177 00
R015	V011 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R017, R018, R019	V021 bias potentiometer	RESISTOR: 50,000 ohm ±20%; 1/2 w	376 3774 00
R020	Part of phase shift network	RESISTOR: 10,000 ohm ±10%; 1 w	745 3128 00
R021	V021 grid bias potentiometer	RESISTOR: 10,000 ohm; .020 amp.	377 0010 00
R022	V021 grid bias resistor	RESISTOR: 15,000 ohm ±20%; 10 w	710 1154 40
R023	V021 cathode bias resistor	RESISTOR: 5.6 ohm ±5%; 1/2 w	707 0101 00
R024	Voltage divider	RESISTOR: 15,000 ohm ±10%; 2 w	745 5135 00

* Components for equipments designed to operate from 50 cps power source

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R025	V021 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R026	M241 multiplier resistor	RESISTOR: 7870 ohm ±1%; 1 w	722 0032 00
R027	Voltage divider	RESISTOR: 3300 ohm ±10%; 1 w	745 3107 00
R028	M241 multiplier resistor	RESISTOR: 1000 ohm ±10%; 1/2 w	745 1086 00
R029	V021 plate No.1 dropping resistor	RESISTOR: 47,000 ohm ±10%; 1 w	745 3156 00
R031	V031 grid bias resistor	RESISTOR: 0.68 meg ±10%; 1 w	745 3205 00
R034	V031 screen dropping resistor	RESISTOR: 0.15 meg ±10%; 1 w	745 3177 00
R035	V031 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R036	M241 multiplier resistor	RESISTOR: 0.36 meg ±5%; 1 w	745 3193 00
R041	V041 grid bias resistor	RESISTOR: 82,000 ohm ±10%; 1 w	745 3167 00
R042	M241 shuntresistor	RESISTOR: 1000 ohm ±10%; 1/2 w	745 1086 00
R044	V041 screen dropping resistor	RESISTOR: 0.12 meg ±10%; 1 w	745 3174 00
R045	V041 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R051	V051 grid bias resistor	RESISTOR: 68,000 ohm ±10%; 1 w	745 3163 00
R052	M241 shuntresistor	RESISTOR: 1000 ohm ±10%; 1/2 w	745 1086 00
R054	V051 screen dropping resistor	RESISTOR: 0.10 meg ±10%; 1 w	745 3170 00
R055	V055 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R061	V061 grid bias resistor	RESISTOR: 68,000 ohm ±10%; 1 w	745 3163 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R062	M241 shuntresistor	RESISTOR: 1,000 ohm ±10%; 1/2 w	745 1086 00
R064	V061 screen dropping resistor	RESISTOR: 0.10 meg ±10%; 1 w	745 3170 00
R065	V061 plate decoupling resistor	RESISTOR: 1000 ohm ±10%; 1 w	745 3086 00
R071	V071 grid bias resistor	RESISTOR: 68,000 ohm ±10%; 1 w	745 3163 00
R072	M241 shuntresistor	RESISTOR: 390 ohm ±10%; 1/2 w	745 1069 00
R073	V071 cathode bias resistor	RESISTOR: 470 ohm ±10%; 2 w	745 5072 00
R074	V071 screen dropping resistor	RESISTOR: 15,000 ohm ±10%; 1 w	745 3135 00
R080	Attenuator	RESISTOR: 600 ohm; 1 w	379 0012 00
R080A	Pre-emphasis network	RESISTOR: Pre-emphasis network; 600 ohm; 50-15,000 cps	379 0026 00
R081	Load resistor	RESISTOR: 1200 ohm ±10%; 1 w	745 3090 00
R082, R083	Load resistor	RESISTOR: 68,000 ohm ±10%; 1 w	745 3163 00
R084	M241 meter shunt	RESISTOR: 4.3 ohm ±5%; 1/2 w	707 0092 00
R085	Bias resistor	RESISTOR: 820 ohm ±5%; 1 w	745 3082 00
R086	Balance control	RESISTOR: 400 ohm; .10 amp	377 0006 00
R087	Bias resistor	RESISTOR: 820 ohm ±5%; 1 w	745 3082 00
R088	Compensating network	RESISTOR: 27,000 ohm ±5%; 2 w	745 5145 00
R091	V021 filament voltage var.resistor	RHEOSTAT: 50 ohm ±10%; 25 w	735 5020 00
R092	LV power supply bleeder	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R093	VR 105 voltage dropping resistor	RESISTOR: 1600 ohm ±20%; 15 w	733 1966 00
R094	Bleeder	RESISTOR: 0.22 meg ±10%; 2 w	745 5184 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R201	V201 grid bias resistor	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R202, R203	Parasitic resistor	CHOKE, RF: 18 turns #21 AWG wire; 1 ohm ±20%	240 0040 00
R204	V201 cathode bias resistor	RESISTOR: 500 ohm ±20%; 40 w	733 1323 00
R205	V201 screen dropping resistor	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R211	V211 grid bias resistor	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R212, R213	Parasitic resistor	RESISTOR: 10 ohm ±10%; 1 w (Part of L113)	745 3002 00
R214	V211 cathode bias resistor	RESISTOR: 500 ohm ±20%; 40 w	733 1323 00
R215	V211 screen dropping resistor	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R221	Screen dropping resistor for final amplifier	RESISTOR: 6300 ohm ±10%; 40 w	733 1388 00
R222	Bias resistor for final amplifier	RESISTOR: 80 ohm ±20%; 40 w	733 1274 00
R223, R224	V221 grid bias resistor	RESISTOR: 16,000 ohm ±20%; 40 w	733 1416 00
R225, R227	Final amplifier filament center tap resistor	RHEOSTAT: W.W.; 50 ohm ±10%; 25 w	735 5020 00
R228	Bias resistor for final amplifier	RESISTOR: 80 ohm ±20%; 40 w	733 1274 00
R241	M242 meter shunt	RESISTOR: 4.17 ohm ±1%; 1 w	722 0026 00
R242, R243	M242 meter shunt	RESISTOR: 0.40 ohm ±1%; 1 w	722 0025 00
R244, R245, R246	M242 meter shunt	RESISTOR: 4.17 ohm ±1%; 1 w	722 0026 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R247, R248	M242 meter shunt	RESISTOR: .2 ohm ±1%; 1 w	722 0033 00
R251, R252, R253, R254, R256, R257, R269, R270	Pilot light resistor	RESISTOR: 1250 ohm ±10%; 10 w	710 0024 00
R271	Bleeder for LV supply	RESISTOR: 31,500 ohm ±20%; 90 w	733 0693 00
R273	LV supply dropping resistor for tune up	RESISTOR: 80 ohm ±5%; 140 w	746 0017 00
R275, R276, R277	Suppressor	RESISTOR: 10 ohm ±20%; 15 w	733 1828 00
R280	M181 meter shunt	RESISTOR: 10,000 ohm ±10%; 1 w	745 3128 00
R281, R282	Suppressor	RESISTOR: 10 ohm ±20%; 15 w	733 1828 00
R283	M181 meter multiplier resistor	RESISTOR: 4 meg ±0.5% at 25° C; 1 ma	732 0008 00
R284, R285	Pilot light resistor	RESISTOR: 1250 ohm ±10%; 10 w	710 0024 00
R286, R287, R288, R289	HV supply dropping resistor for tune up	RESISTOR: 6.3 ohm ±20%; 300 w	710 0988 00
R290 R291	Bleeder for HV supply	RESISTOR: 63,000 ohm ±20%; 90 w	746 0046 00
R292, R293	Suppressor	RESISTOR: 10 ohm ±20%; 15 w	733 1828 00
S241 S241A S241B	Selector switch Selector switch Selector switch	SWITCH: DP, double deck, non-shorting; 10 position	259 0159 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S242 S242A S242B	INT.selector switch INT.selector switch INT.selector switch	SWITCH: DP, double deck, non-shorting; 8 position	259 0157 00
S251	Filament switch	CIRCUIT BREAKER: Magnetic; 2 overload coils; 5 amp AC; 50 amp cont	260 0239 00
S252	Filament OFF button	SWITCH: Push button stop; red; 1 NC circuit	260 0352 00
S253	Filament ON button	SWITCH: Push button start; black; 1 NO circuit	260 0355 00
S254	Air interlock	SWITCH: Mercury; magnetic type; SPNO; 1 amp 115 v AC; .5 amp 230 v AC	260 0519 00
		MAGNET: Alnico	260 0518 00
		CLIP: Nickel silver	260 0517 00
S255	Air interlock	SWITCH: Mercury; magnetic type; SPNO; 1 amp 115 v AC .5 amp 230 v AC	260 0519 00
		MAGNET: Alnico	260 0518 00
		CLIP: Nickel silver	260 0519 00
S256	PRI. voltage switch	SWITCH: Rotary; 4P ST; double break; 5 amp 250 v	260 0351 00
S261, S262, S263, S264, S265	Primary interlock switch	CONTACT ASSEM: Male section of door interlock switch	260 4040 00
		CONTACT ASSEM: Female section of door interlock switch	260 4050 00
S266	Exciter switch	CIRCUIT BREAKER: Magnetic; 2 overload coils; 1 amp AC; 50 amp cont	260 0231 00
S271	Plate ON button	SWITCH: Push button start; black; 1 NO circuit	260 0355 00
S272	Plate OFF button	SWITCH: Push button stop; red; 1 NC circuit	260 0352 00
S273	INT.plate switch	CIRCUIT BREAKER: Magnetic; 2 overload coils; 2.5 amp AC; 50 amp cont; 230 v AC/250 v DC	260 0235 00
S274	INT. tune switch	CIRCUIT BREAKER: Magnetic; 1 overload coil; 2 amp AC: 50 amp cont; 230 v AC/250 v DC	260 0094 00
S275, S276	HV shorting switch	SWITCH ASSEM: Shorting	503 1938 003
S277	HV shorting switch	SWITCH ASSEM: Shorting	503 1939 003

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S281	PA plate switch	CIRCUIT BREAKER: Magnetic; 3 overload coils; 10 amp AC; 50 amp cont; 230 v AC/250 v DC	260 0407 00
S282	PA tune switch	CIRCUIT BREAKER: Magnetic; 2 overload coils; 8 amp AC; 50 amp cont; 230 v AC/250 v DC	260 0261 00
S291	Tuning switch	SWITCH: Rotary; open neutral momentary contact; 5 amp 250 v AC	260 0523 00
S292 S292A S292B S292C	TUNING selector Selector switch Selector switch Selector switch	SWITCH: 3 P, 1 deck, 3 position, non-shorting	259 0127 00
S293	B221 overload	THERMOSTAT: shall open at 70° ±5°C	292 0022 00
T081	Audio input transformer	TRANSFORMER: Pri: 600 ohm CT, sec: 50,000 ohm CT	677 0114 00
T082	Audio output transformer	TRANSFORMER: Pri: 20,000 ohm CT, sec: 600 ohm CT	677 0113 00
T091	Voltage for crystal heater oven	TRANSFORMER: Pri: 115, 210, 220, 230, 240 v, 50/60 cps, sec: 12.6 v CT, 2.5 amp	672 0086 00
T092	Voltage for phasitron V021 filament	TRANSFORMER: Pri: 115, 210, 220, 230, 240 v, 50/60 cps, sec: 12.6 v CT 2.5 amp	672 0086 00
T093	Filament voltage for exciter supply rectifier	TRANSFORMER: Pri: 210, 220, 230, 240, 250 v, 50/60 cps, sec #1: 6.3 v CT, 5 amp sec #2: 5 v CT, 7 amp	672 0088 00
T094	Plate transformer for exciter supply	TRANSFORMER: Pri: 210, 220, 230, 240, 250 v, 50/60 cps, sec: 880 v CT, 0.142 amp	672 0101 00
T251	Constant voltage transformer	TRANSFORMER: Pri: 190-250 v single phase 60 cps; sec: 230 v at 93% power factor 500VA	664 0026 00 *664 0042 00
T252	Filament transformer for 829B tubes	TRANSFORMER: Pri: 115, 210, 220, 230, 240 v 50/60 cps, sec: 12.6 v CT, 2.5 amp	672 0086 00
T256	Filament voltage for LV supply rectifiers	TRANSFORMER: Pri: 200, 230, 240 v sec: 2.5 v CT, 10 amp	672 0102 00
T257	Filament voltage for 4X500F	TRANSFORMER: Pri: 220, 230, 240 v 50/60 cps, sec: 5 v CT, 14.5 amp	672 0098 00

* Components for equipments designed for operation from 50 cps power source.

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
T258	Filament voltage for HV supply rectifiers	TRANSFORMER: Pri: 220, 230, 240 v, 50/60 cps, 25 VA; sec: 2.5 v CT, 15 amp	672 0134 00
T259	Filament voltage for 4X500F tubes	TRANSFORMER: Pri: 220, 230, 240 v, 50/60 cps, sec: 5 v CT, 14.5 amp	672 0098 00
T271	Plate transformer for LV supply	TRANSFORMER: Pri: 208, 230 v, 50/60 cps, 1410 v CT	672 0097 00
T281	Plate transformer for HV supply	TRANSFORMER: Pri: 208, 230v, 50/60 cps, VA sec: 3600 v CT, 0.52 amp	674 0149 00
V001	Crystal oscillator	TUBE: 6SJ7; triple-grid	255 0030 00
V011	Buffer	TUBE: 6SJ7; triple-grid	255 0030 00
V021	Phase modulator tube	TUBE: 2H21; phasitron	257 0047 00
V031	Doubler	TUBE: 6SJ7; triple-grid	255 0030 00
V041, V051	Tripler	TUBE: 6SJ7; triple-grid	255 0030 00
V061	Amplifier	TUBE: 6SJ7; triple-grid	255 0030 00
V071	Tripler	TUBE: 6V6-GT; beam power	255 0031 00
V081, V082	Audio amplifier	TUBE: 6SJ7; triple-grid	255 0030 00
V091	Exciter supply rectifier	TUBE: 5R4GY; full-wave high-vacuum	257 0020 00
V092, V093	Voltage regulator	TUBE: VR105-30	257 0002 00
V201, V211	Tripler	TUBE: 829B; push-pull RF beam power	254 0402 00
V221, V222	Final amplifier	TUBE: 4X500F; VHF power tetrode	256 0081 00
V271, V272	LV supply rectifier	TUBE: 866-A/866; half-wave mercury-vapor	256 0049 00
V281 V282	HV supply rectifier	TUBE: 866-A/866; half-wave mercury-vapor	256 0049 00

PARTS LIST

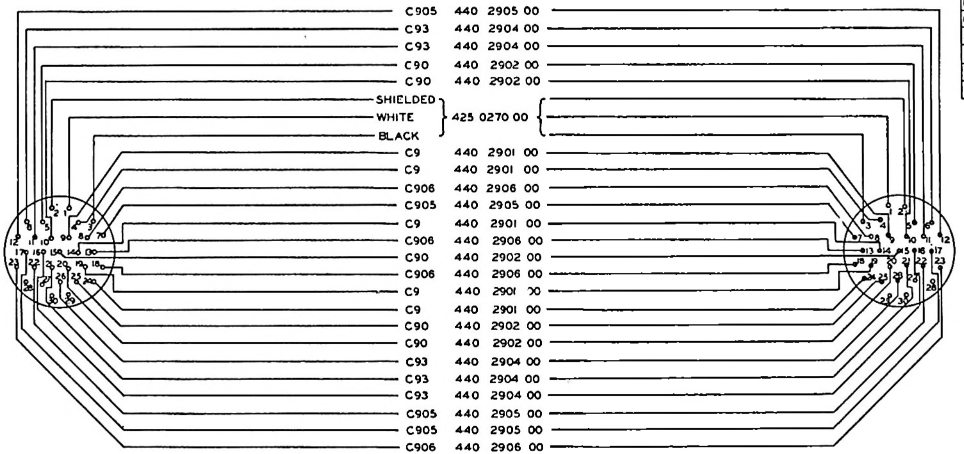
ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
V283	HV supply rectifier	TUBE: 866A/866; half-wave mercury-vapor	256 0049 00
XC091	Socket for C091	SOCKET: 8 prong; octal	220 1005 00
XI096	Socket for I081	SOCKET: Pilot light; min. bayonet base	262 0026 00
XI251, XI252, XI253, XI254, XI255	Socket for I251, I252, I253, I254, I255	SOCKET: Pilot light; double contact candelabra bayonet base	262 0042 00
XI256	Socket for I256	SOCKET: Pilot light assem for 2 contact candelabra bayonet base bulb DISC: Pilot light; green	262 0035 00 262 0037 00
XI257	Socket for I257	SOCKET: Pilot light assem for 2 contact candelabra bayonet base bulb DISC: Pilot light; red	262 0035 00 262 0036 00
XI261	Socket for I261	SOCKET: Pilot light assem for 2 contact candelabra bayonet base bulb DISC: Pilot light; green	262 0035 00 262 0037 00
XI280	Socket for I280	SOCKET: For candelabra bayonet base bulb DISC: Pilot light; red	262 0035 00 262 0036 00
XR080	Socket for R080 or R080A	SOCKET: 8 prong; octal	220 1005 00
XR080A	Socket for R080A	SOCKET: Industrial type; octal	220 1031 00
XV001, XV011	Socket for V001, V011	SOCKET: 8 prong; octal	220 1005 00
XV021	Socket for V021	SOCKET: 11 prong; ceramic	220 1019 00
XV031, XV041, XV051, XV061, XV071, XV081, XV082, XV091, XV092, XV093	Socket for V031, V041, V051, V061, V071, V081, V082, V091, V092, V093	SOCKET: 8 prong; octal	220 1005 00
XV201, XV211	Socket for V201, V211	SOCKET: 7 prong; 4 capacitors	220 1017 00

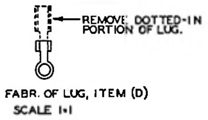
PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XV221, XV222	Socket for V221, V222	SOCKET: 5 prong; ceramic	220 1016 00
XV271, XV272, XV281, XV282, XV283	Socket for V271, V272, V281, V282, V283	SOCKET: 4 prong; UX base	220 1018 00
XY001	Socket for Y001	SOCKET: Crystal; 7 contact "JUMBO"	220 5711 00
Z010	RF transformer	TRANSFORMER ASSEM: Oscillator tank; 180-225kc	503 1943 003
Z020	RF transformer	TRANSFORMER ASSEM: Phasing network; 180-225kc	503 1949 003
Z030	RF transformer	TRANSFORMER ASSEM: Amplifier tank; 180-225kc	503 1944 003
Z040	RF transformer	TRANSFORMER ASSEM: Doubler tank; 360-450 kc	503 1945 003
Z050	RF transformer	TRANSFORMER ASSEM: Tripler tank; 1080-1350kc	503 1946 003
Z060	RF transformer	TRANSFORMER ASSEM: Amplifier tank; 3.2-4.0 mc	503 1947 003
Z070	RF transformer	TRANSFORMER ASSEM: Amplifier tank; 3.2-4.0 mc	503 1947 003
Z080	RF transformer	TRANSFORMER ASSEM: Tripler tank; 9.6-12.0 mc	503 1948 003

NOTE: DO NOT TIE OR TWIST CABLE
BETWEEN PLUG SHELLS.
ITEM (K) MUST BE GROUNDED
TO SHELLS OF CONNECTORS
ITEMS (A) & (B). SEE DWG. DETAIL.

QUANTITIES LISTED ARE FOR ONE ASSEMBLY					
500	500	503 1937 003	ITEM NO.	PART NUMBER	PART NAME
		1	A	370 2023 00	CONNECTOR
		1	B	370 2024 00	CONNECTOR
		1.3	C	425 0270 00	CABLE (FT.)
		4	D	304 1300 00	SOLDER LUG
		6.5	E	440 2901 00	WIRE (FT.)
		6.5	F	440 2902 00	WIRE (FT.)
		6.5	G	440 2904 00	WIRE (FT.)
		5.2	H	440 2905 00	WIRE (FT.)
		5.2	J	440 2906 00	WIRE (FT.)
		1.5	K	425 0030 00	SHIELD BRAID (FT.)
		2	L	201 1140 00	GROMMET





FABR. OF LUG, ITEM (D)
SCALE 1:1

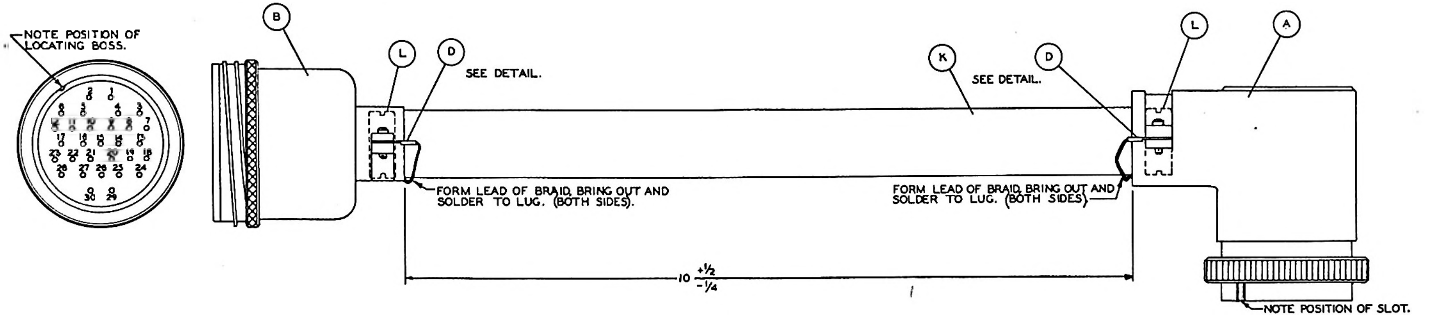


Figure 8-1 Connector Cable Assembly

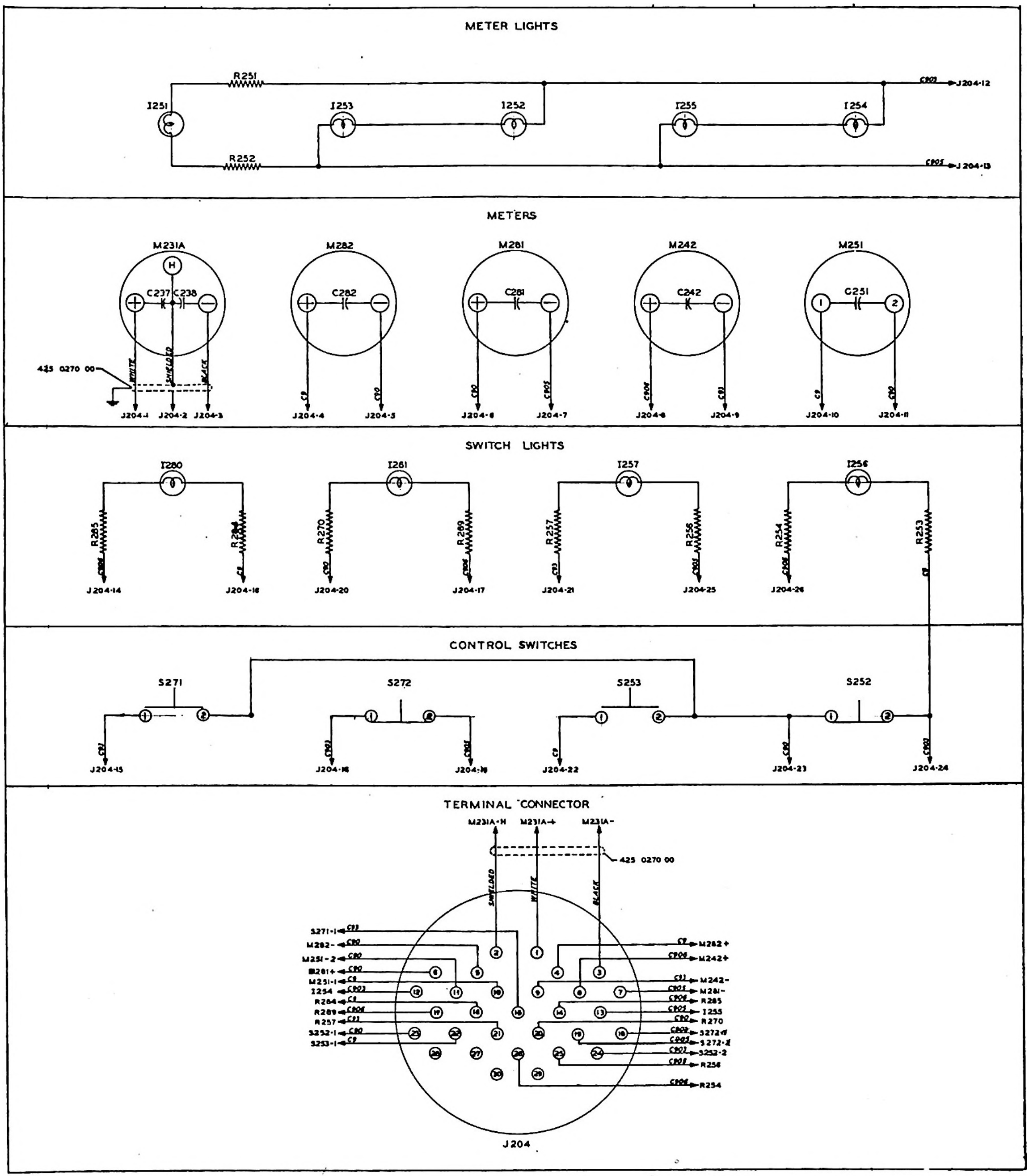


Figure 8-2 Front Door Cabling Schematic

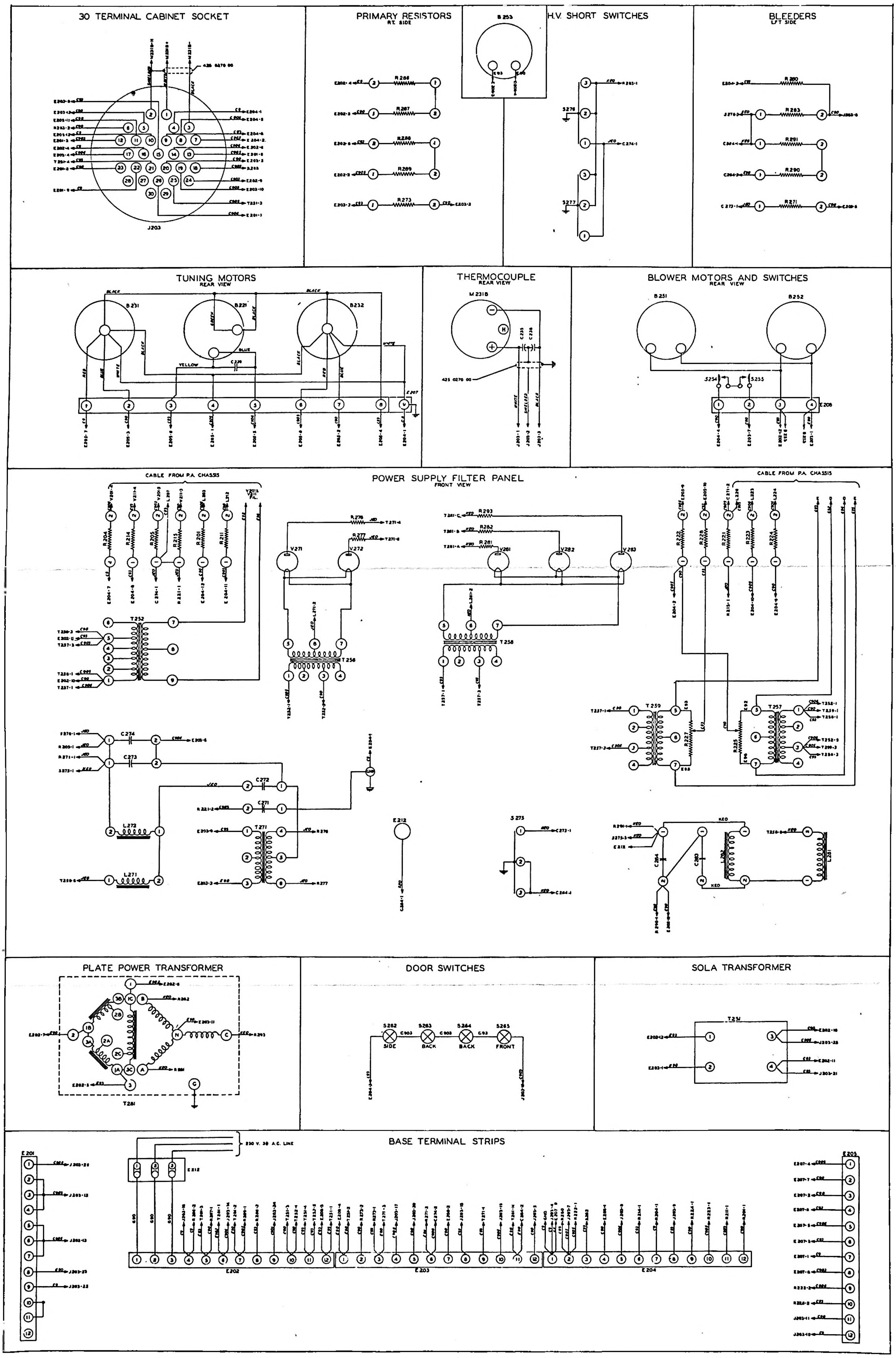


Figure 8-3 Cabinet Cabling Schematic

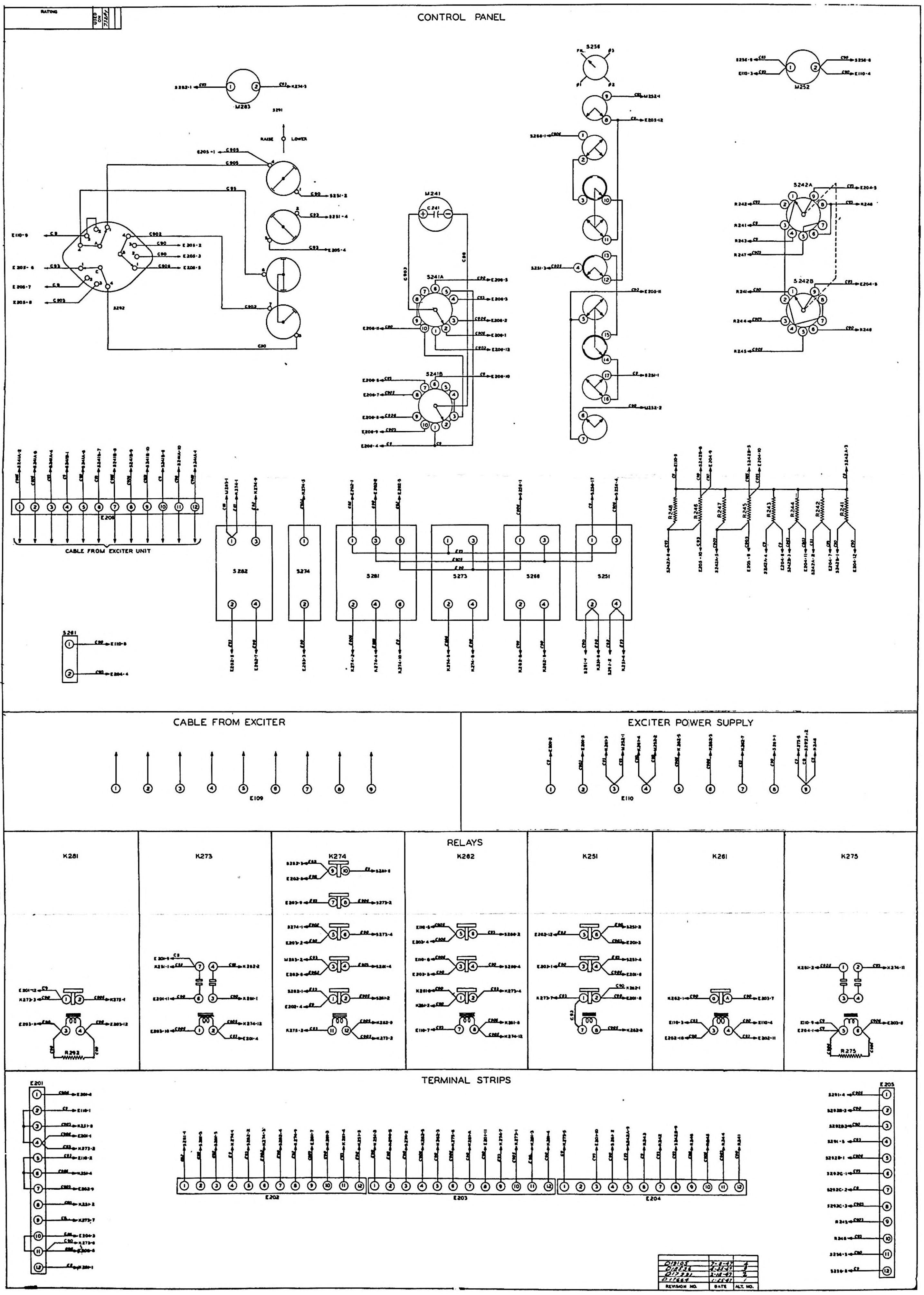
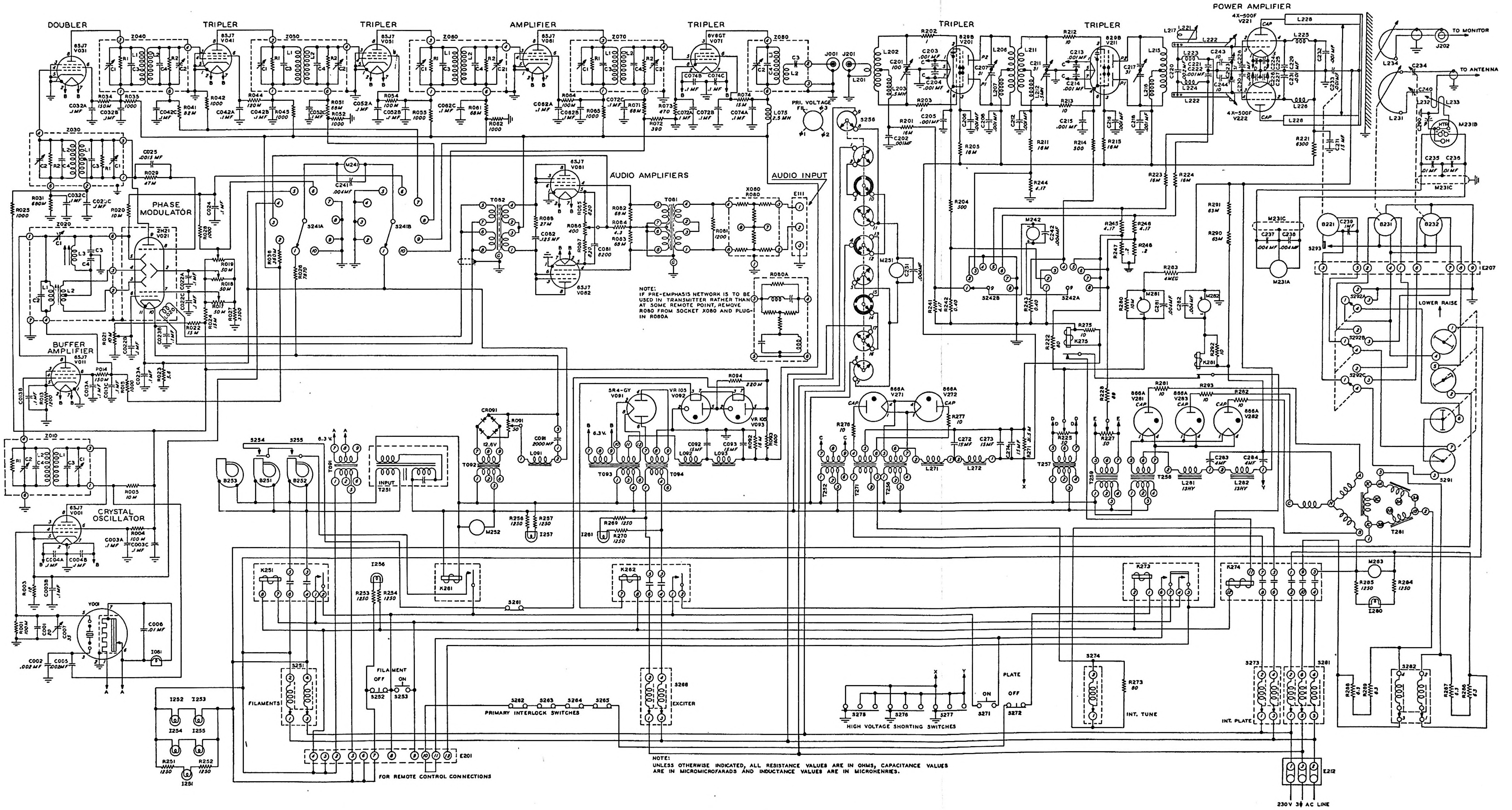


Figure 8-4 Vertical Chassis Cabling Layout (Rear View)



NOTE:
IF PRE-EMPHASIS NETWORK IS TO BE USED IN TRANSMITTER RATHER THAN AT SOME REMOTE POINT, REMOVE R080 FROM SOCKET X080 AND PLUG-IN R080A

NOTE:
UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRIES.

Figure 8-5 Main Schematic

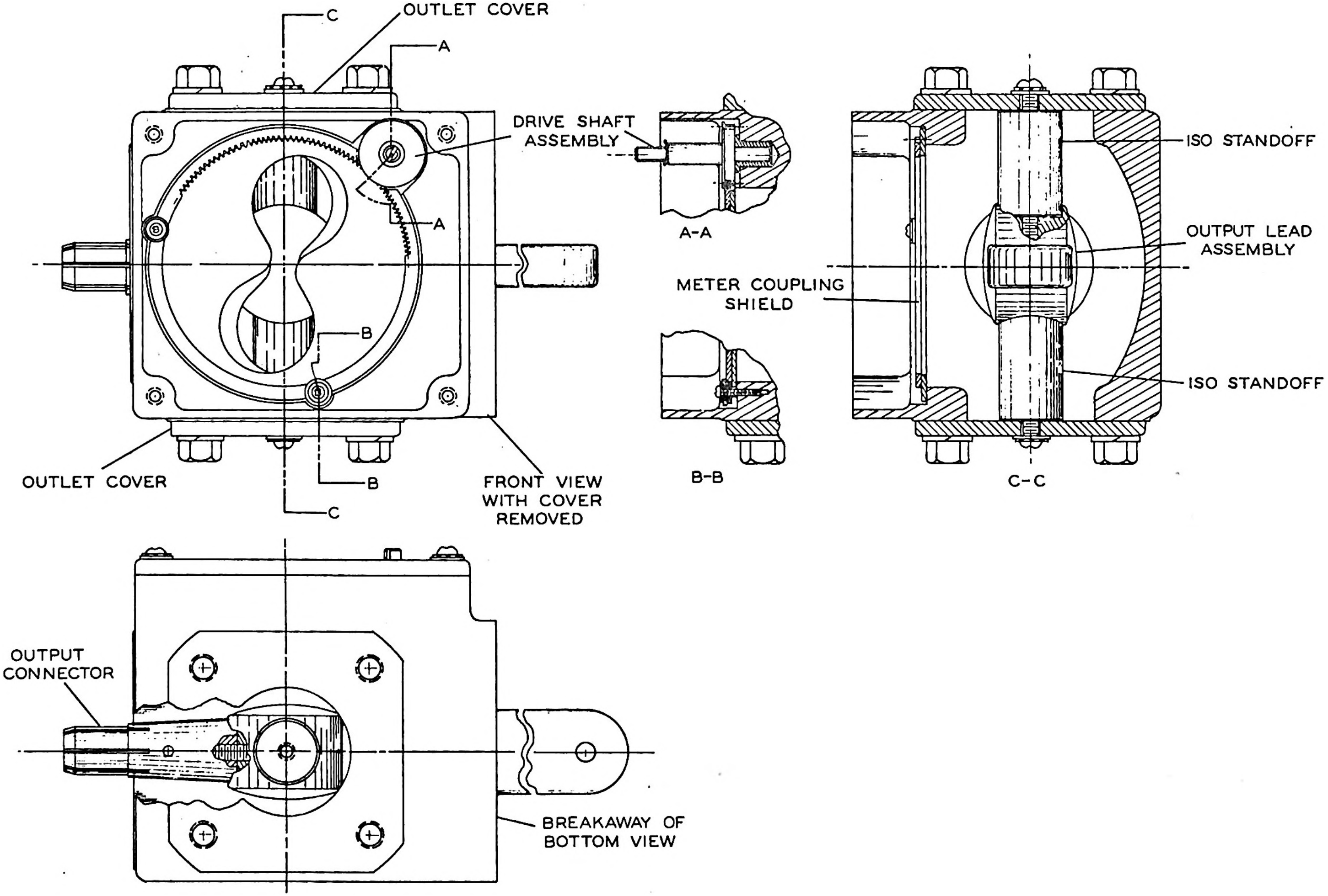


Figure 8-6 RF Junction Box

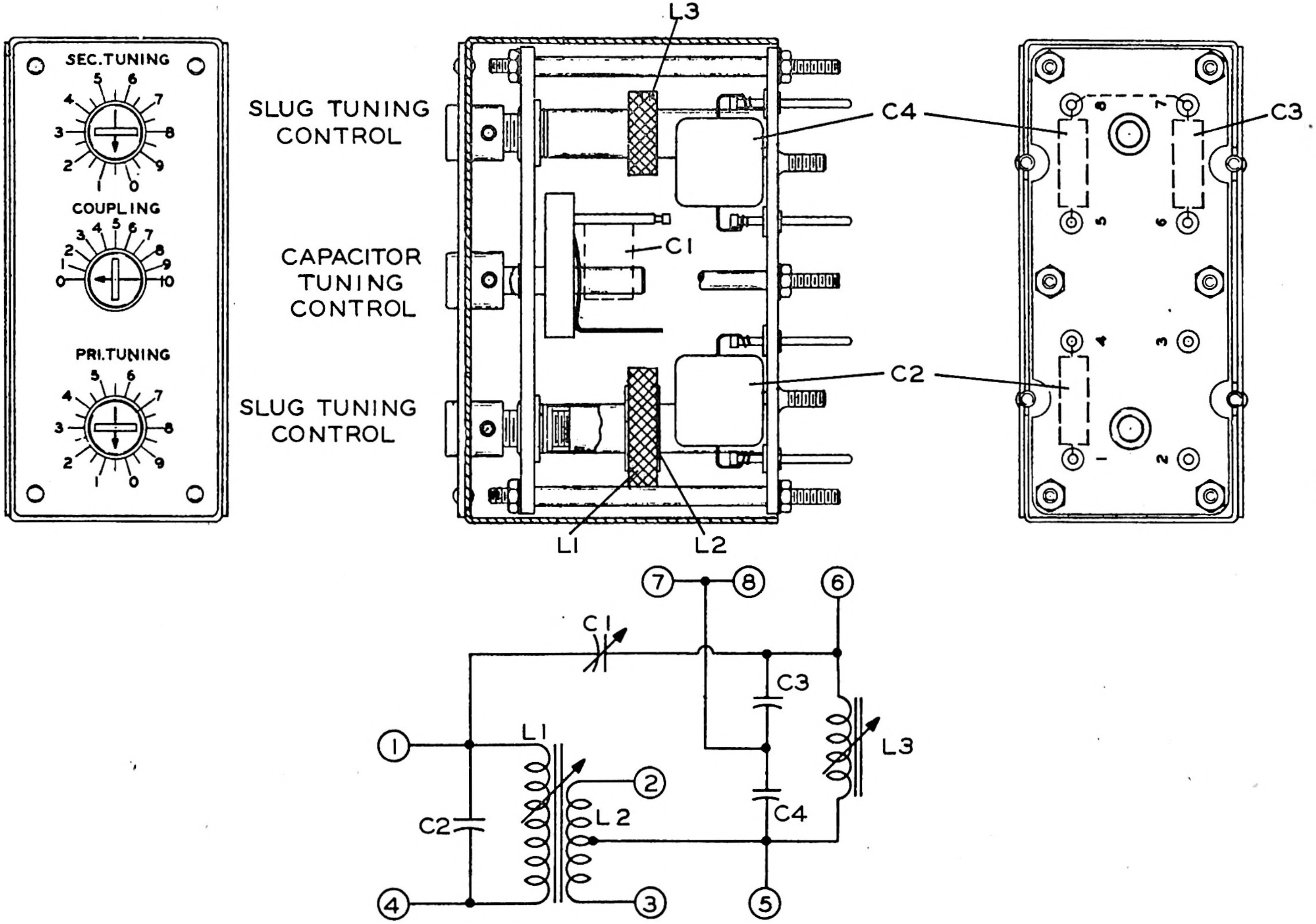


Figure 8-7 Phasing Network Transformer

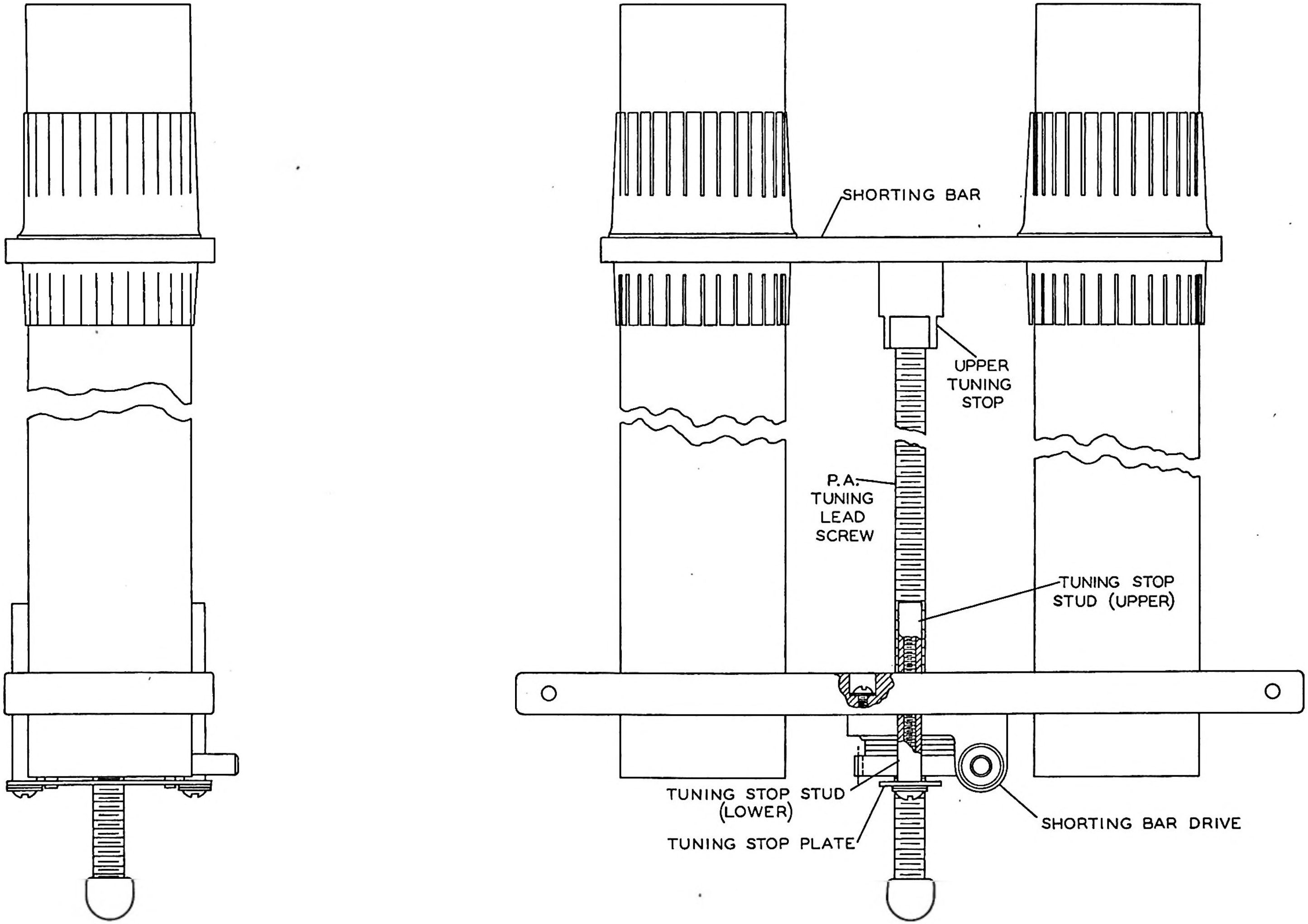


Figure 8-8 Line Tank Assembly

SERVICE REPORT
REPLACEABLE COMPONENTS

Please fill out this form and submit it by mail to the COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA, USA, when reporting failure of component parts. A properly completed report must be submitted for each part before any accounts will be adjusted. An accurate report will assure the correct replacement part.

IDENTIFICATION OF COMPONENT

Owner ______________________________

Equipment Type No. ______________ Serial No. ______________

Unit Type No. ______________ Serial No. ______________

Component Item No. ______________ Stock No. ______________

Description of Component ______________________________

____

____

SERVICE DATA

Date Equipment Received ______________ Date in Service ______________

Date of Failure ______________ Hours of Service ______________

NATURE OF FAILURE ______________________________

____

____

____

____

OPERATING DATA AND CONDITIONS (At time of failure)

Line Voltage ______________ Abnormal Meter Readings ______________

Ambient Temperature ______________ °F., Electrical Storm? ______________

Associated Fuse Failure ______________________________

Additional Comments ______________________________

____

____

____

____

PRESENT STATUS OF EQUIPMENT

Out of Service ______________ Component Replaced ______________

Temporary Repair (state nature) ______________________________

____

Date of Report ______________ Signed ______________

-o-

THESE ENTRIES TO BE MADE BY THE COLLINS RADIO COMPANY

Received ______________ R.T. No. ______________ Replacement Order No. ______________

Results of Factory Test: ______________________________

____

Disposition: ______________________________

____