EO 35BD-5FRT501-2

ROYAL CANADIAN AIR FORCE

DESCRIPTION & PREVENTIVE MAINTENANCE INSTRUCTIONS

GROUND TRANSMITTER COMMUNICATIONS AN/FRT-501

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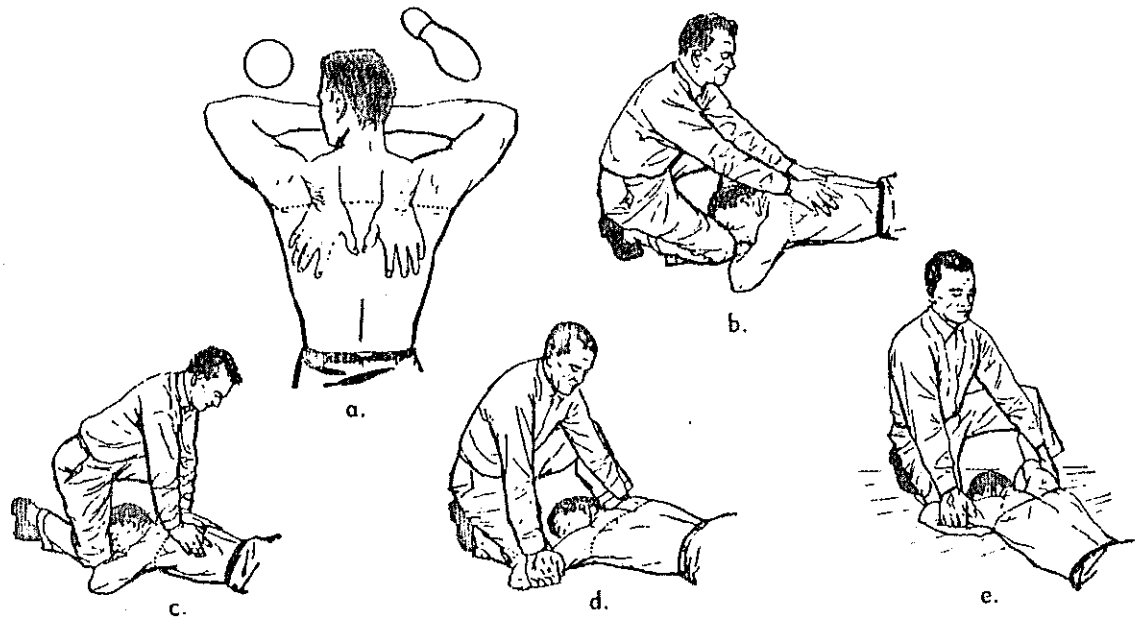
WARNING

THE VOLTAGES EMPLOYED IN THIS TRANSMITTER ARE SUFFICIENTLY HIGH TO ENDANGER HUMAN LIFE AND EVERY REASONABLE PRECAUTION HAS BEEN OBSERVED IN DESIGN TO SAFEGUARD THE OPERATING PERSONNEL. AN IMPORTANT PART OF THE PROTECTIVE SYSTEM IS THE DOOR INTERLOCK SWITCH AND ANY TAMPERING WITH THIS SWITCH SHOULD BE PROHIBITED. THE POWER SHOULD BE REMOVED COMPLETELY AND THE HIGH-VOLTAGE CAPACITORS IN POWER SUPPLIES DISCHARGED MANUALLY WITH A SHORTING BAR BEFORE CHANGING TUBES OR MAKING INTERNAL ADJUSTMENTS.

FIRST AID IN CASE OF ELECTRIC SHOCK

1. Protect yourself with dry insulating material.
2. Break the circuit by opening the power switch or by pulling the victim free of the live conductor.
3. Don't touch the victim with your bare hands until the circuit is broken.
4. Remove false teeth, tobacco or gum from the patient's mouth.
5. Start artificial respiration at once and send someone else for a doctor.



a. LAY PATIENT FACE DOWN, bend his elbows, place hands one on the other, turn face on one side and place cheek upon the hand.
b. KNEEL FACING THE SUBJECT with one knee at the side of the head.
c. PLACE PALMS OF YOUR HANDS ON PATIENT'S BACK with little fingers just touching the lower ribs.
d. ROCK FORWARD until the arms are directly vertical, keep elbows straight and pressure exerted almost directly downward on the back.
e. RELEASE THE PRESSURE, place your hands upon the patient's arms just above his elbows and commence to rock backwards drawing his arms upwards and towards you until you feel resistance of the patient's shoulders.
f. DROP THE ARMS gently which completes the full cycle.
g. The cycle should be completed twelve times per minute.
h. While artificial respiration is continued have someone else loosen the patient's clothing and keep the patient warm.
j. Four hours or more may be required.
k. Do not give liquids until patient is conscious.

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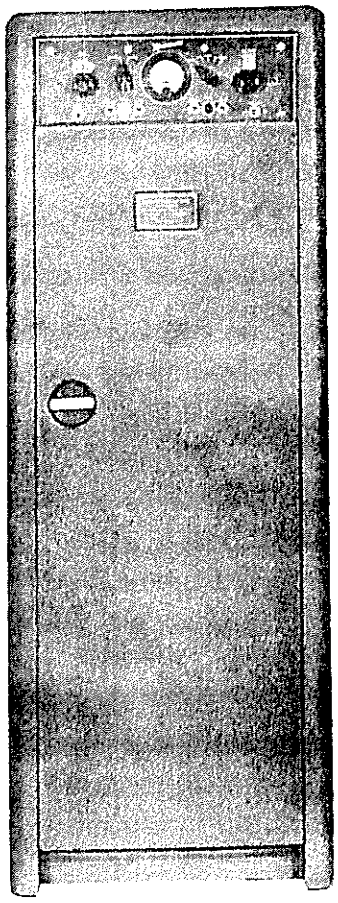

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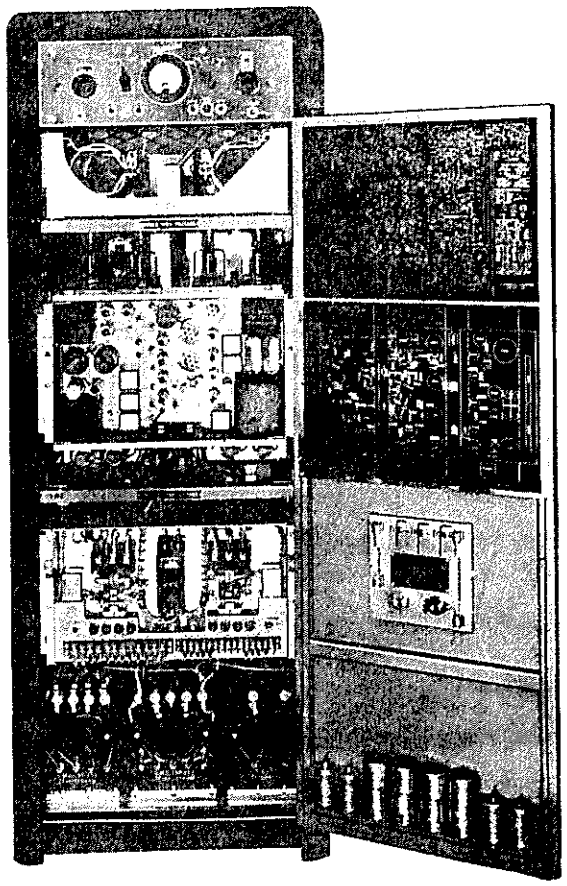

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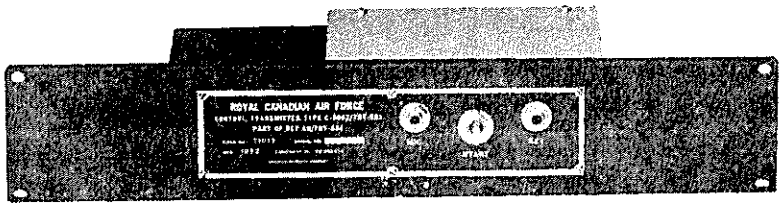
TRANSMITTER, RADIO
TYPE T-5001/FRT-501



CONTROL, TRANSMITTER
TYPE C-5002/FRT-501

FIGURE 1-1 TRANSMITTING EQUIPMENT TYPE AN/FRT-501, COMPLETE EQUIPMENT

PART 1

GENERAL DESCRIPTION

1. INTRODUCTION

a. Purpose of Manual

This Engineering Order covers the general technical description, theory of operation, preventive maintenance procedures, and supplementary technical data for Radio Transmitting Equipment, Type AN/FRT-501 (Canadian Marconi Company type TH 117, number 141-942).

b. Equipment Supplied

Radio Transmitting Equipment, Type AN/FRT-501, consists of two major units connected together by two pairs of 19-gauge telephone wires up to ten miles in length. These units are the Control, Transmitter, Type C-5002/FRT-501, and the Transmitter, Radio, Type T-5001/FRT-501, which is made up of ten major items (see Table 1-1).

c. Other Necessary Equipment

Before the transmitter can be used, it must be combined with certain other equipment to form a complete installation (see Table 1-2).

d. Purpose of Equipment

(1) This equipment is intended for general fixed station communication by morse key (A1) or by speech (A3) on a single channel in the frequency range 1.5 to 15 megacycles per second, with a nominal output power of 500 watts. Low-power operation at about one-half normal output can be obtained by changing transformer taps. With an external keyer the equipment may also be used for high-speed frequency-shift telegraphy (F1).

(2) The remote control unit is designed to give control of high voltage switching, keying, and speech modulation from a remote location. All power for this purpose is supplied over two pairs of telephone wires which connect the remote control to the transmitter. Direct control of all operating functions is also available locally from the transmitter front panel.

2. GENERAL ELECTRICAL FEATURES

a. Outline

The electrical circuits of Transmitting Equipment, Type AN/FRT-501, while mechanically distributed into various sub-assemblies as listed in Table 1-1, are best understood by ignoring the mechanical divisions and considering the electrical functions served by the various circuits (see Fig. 1-2). The transmitter consists of radio-frequency circuits (oscillator, buffer, multiplier, intermediate power amplifier, power amplifier, tuner) and audio-frequency circuits (input amplifier, driver, modulator) together with power supplies and control circuits. The r-f amplification chain magnifies the weak oscillations generated by the crystal oscillator and supplies 500 watts of r-f energy to the antenna. The a-f amplification chain magnifies the small audio signals generated by the microphone until they are large enough to control the r-f power amplifier and produce speech modulation of the transmitter output. The power supplies convert the 115v a-c input into the various a-c and d-c voltages required throughout the equipment. The control circuits ensure that the other elements work together in harmony.

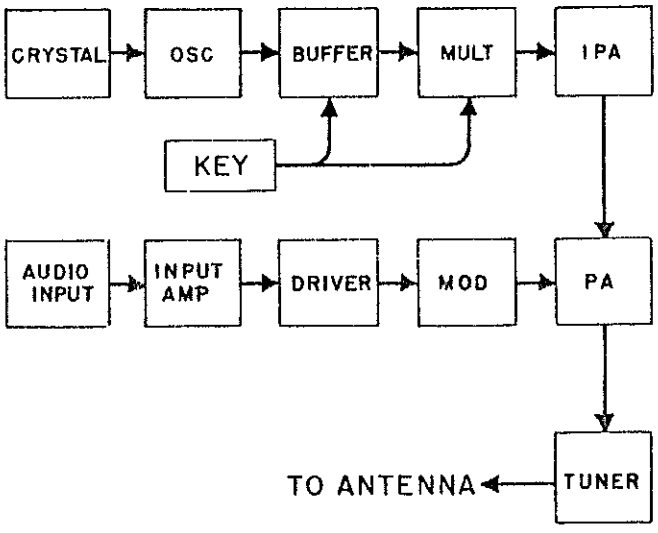


Fig. 1-2 Transmitter, Simplified Block Diagram

TABLE 1-1
EQUIPMENT SUPPLIED, TRANSMITTING EQUIPMENT, TYPE AN/FRT-501

Item	Quantity per Equipment	Name of Item	Service Type Designation	Overall Dimensions	Weight lb	Numerical Series of Circuit Reference Symbols
1	1	CONTROL, TRANSMITTER	C-5002/ FRT-501	19 in. lg 4 in. wide 3-1/2 in. high	4	301-302
2	1	TRANSMITTER, RADIO made up of Items 2a to 2k below	T-5001/ FRT-501	18 in. lg 22 in. wide 60 in. high	654	101-299
2a	1	Cabinet, Electrical Equipment	CY-5009/ FRT-501	18 in. lg 22 in. wide 60 in. high	265	181-189
2b	1	Tuner, Radio Frequency	TN-5002/ FRT-501	15-1/2 in. lg 16 in. wide 12-7/16 in. high	38	121-129
2c	1	Control, Transmitter	C-5005/ FRT-501	17-7/8 in. lg 3 in. wide 6 in. high	7¼	130-139
2d	1	Transmitter, Sub-Assembly	T-5006/ FRT-501	17 in. lg 11 in. wide 8 in. high	29	201-299
2e	1	Amplifier, Sub-Assembly	AM-5007/ FRT-501	17 in. lg 7-3/4 in. wide 8-1/2 in. high	22	101-119
2f	1	Power Supply	PP-5008/ FRT-501	17 in. lg 11 in. wide 8 in. high	34	141-159
2g	1	Power Supply, Sub-Assembly	PP-5009/ FRT-501	17 in. lg 9 in. wide 7 in. high	28	161-169
2h	1	Reactor		9-3/16 in. lg 6-11/16 in. wide 11 in. high	66	L181
2j	1	Transformer, Power, Step-Up		12-1/2 in. lg 6-11/16 in. wide 9-3/16 in. high	98	T181
2k	1	Transformer, Audio Frequency		11 in. lg 6-11/16 in. wide 9-3/16 in. high	66	T182

TABLE 1-2
EQUIPMENT REQUIRED BUT NOT SUPPLIED AS PART OF TRANSMITTING EQUIPMENT, TYPE AN/FRT-501

Item	Quantity per Equipment	Name of Item	Service Type Designation	Required Characteristics
1	1	Antenna system		Suitable for handling 500 watts at the desired frequencies.
2	1	Ground system		
3	1	Feeder system		
4	1	Power supply		Primary power source capable of supplying 2.5 kva, 115v, 60 cps, single phase.
5	2	Carbon microphone with press-to-talk switch, cord and plug		
6	2	Telegraph key, with cord and plug		One side grounded.
7	1	Quartz crystal	CR-18/U	At frequency to give desired output frequency, either directly or by doubling or tripling.
8	1	Telephone wires or cable		Two pairs, 19 gauge, for remote control.

3. ELECTRICAL SUMMARY

a. Nature. — General purpose communication radio transmitter.

b. Nominal Supply Voltage. — 115v, single phase, 60 cps.

c. Permissible Supply Voltage Variation. — Plus or minus ten per cent of nominal value.

d. Power Demand. — Approximately 2.5 kva maximum, with average power factor of 0.9 (see also Part 4, paragraph 3.b).

e. Power Output. — 450 to 500 watts in a 50-ohm or 600-ohm resistive load.

f. Antenna Impedance.

Balanced: 500 to 700 $\pm$ j 600 ohms.
Unbalanced: 30 to 75 $\pm$ j 50 ohms.

g. Number of Channels. — One only.

h. Frequency Coverage. — 1.5 to 15 megacycles.

j. Frequency Control. — Quartz crystal, type CR-18/U, or external r-f generator supplying 0.2 to 1 watt in 72 ohms.

k. Frequency Stability. — Under crystal control at temperatures between 0° C ($+32^{\circ}$ F) and $+50^{\circ}$ C ($+122^{\circ}$ F), the frequency remains within 0.005 per cent of the assigned value.

l. Frequency Change. — Requires replacement of crystal (or retuning of external r-f generator), retuning (and possible replacement) of plug-in coils, and retuning of output circuits, using coil taps, padder links and variable capacitors.

m. Power Reduction during Tuning. — A "TUNE-OPERATE" switch controls plate dissipation.

n. Final Power Amplifier. — Two 4D21 power tetrodes in parallel operating class C.

p. Neutralisation. — None required.

q. Keying. — Up to 200 words per minute, achieved by blocking the buffer and multiplier amplifiers while allowing the oscillator to run continuously.

r. Key-up Carrier Leak. — Negligible.

s. Modulation. — High-level plate modulation of the final power amplifier by two 4D21 power tetrodes operating class AB2, in push-pull. Modulation transformer carries direct current for power amplifier and modulator plate circuits.

t. Modulation Capability. — Up to 100 per cent.

u. Audio Input. – Single button carbon microphone or audio line. For 100 per cent modulation not more than - 10 db (6 mw ref) is necessary at the 500/600-ohm input terminals.

v. Carrier Control. — Telegraph key, press to-talk switch, or external switch.

w. Frequency Response. — From 300 to 3000 cps within 3 db of response at 1000 cps.

x. Harmonic Distortion. — Less than 10 per cent at 90 per cent modulation within the pass-band of 300 to 3000 cps.

y. Noise Level. — Not more than one per cent of nominal carrier amplitude.

z. Vacuum Tubes. — Number used of each type:

TUBE TYPE	NUMBER USED
3B28	6
4D21	4
6BH6	1
6X4W	1
12AT7	2
5654	3
5751	1
5933	5
6005	4
Total	27

(For vacuum tube designations and functions see Table 4-2).

4. GENERAL MECHANICAL FEATURES

a. Outline

The transmitter is enclosed within a cold-rolled sheet-steel cabinet provided with a hinged door and safety door switch (see Fig. 1-1). The meter and operating controls on the front panel remain visible when the cabinet door is closed. The heavy transformers and main filter choke are clamped to the cabinet floor. The lighter components are mounted in various sub-assemblies fitted on the cabinet walls. Two chassis in the centre of the cabinet hinge outwards to facilitate inspection and repair. A propeller-type ventilating fan draws in cooling air through an all-metal cleanable filter in the lower rear cabinet wall and blows it out through a screened opening near the top. When installed the transmitter weights 650 pounds, and is 60 in. high, 22 in. wide and 18 in. deep (for space requirements see EO 35BD-5FRT501-10, "Fitting Instructions"). The remote control mounts on a standard 19 in. rack and is 3-1/2 in. high (see Fig. 1-3).

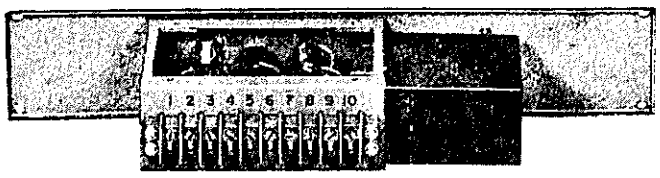


Fig. 1-3 Control, Transmitter, Type C-5002/FRT-501, Rear View (cover removed)

5. MECHANICAL DESCRIPTION OF COMPONENTS

a. Control, Transmitter

The Control, Transmitter, Type C-5002/FRT-501 (see Figs. 1-1 and 1-3) consists of a blue-grey, wrinkle-finish steel panel on which are mounted a microphone jack, a start switch and a key jack. A small metal box behind the panel supports the terminal board and microphone transformer. A removable cover held by four screws permits access to the remaining parts within the box.

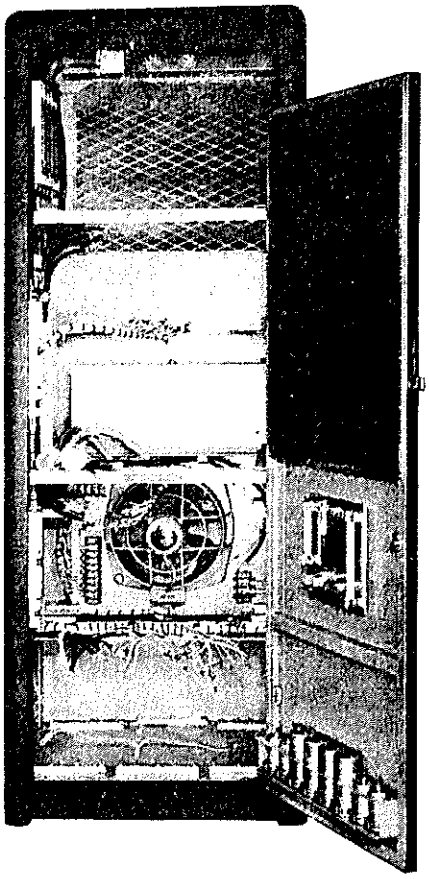
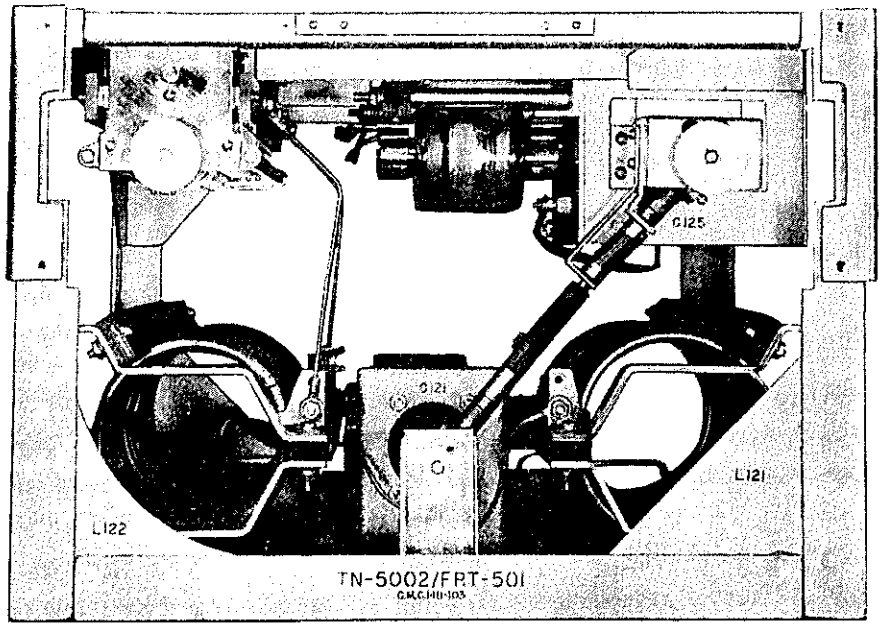


Fig. 1-4 Cabinet, Front View
(sub-assemblies removed)

b. Cabinet

The cabinet (see Figs. 1-4 and 5-28) contains all components other than the Control, Transmitter, and is welded and strengthened with angle bars; its base bracing is covered with a vermin-proof floor which is drilled to accommodate the power and control cables. The cables can be led into the holes in the transmitter floor either from below the transmitter through the building floor, or from behind the transmitter through three knock-out plugs in the back wall of the cabinet. Air is drawn by the fan through the filter into the lower part of the cabinet, distributed over the transmitter components by baffles, and expelled from the upper part of the cabinet through a screened opening in the rear wall. A small recess immediately below the cabinet roof contains the two transmitter-output terminals, to one of which is connected the r-f indicator. Five 78-watt resistors R181 to R185 are mounted vertically near the top of the left wall of the cabinet.



c. Tuner, Radio Frequency

(1) The plate tuning and antenna matching circuits are mounted inside a rigid open frame which slides on rails into the top of the cabinet and is held there by two pins and two bolts. The antenna capacitor C126 in the upper left corner (see Figs. 1-5 and 5-29) supports a terminal board for the antenna matching links. The plate tuning capacitor C121 is in the lower part of the frame between two tapped coils. The plate padding capacitor C122 is held by means of clips behind C121; when required, it is connected in the circuit by a flexible link at the rear of coil L121. The other padding capacitors, C123, C124, and C125, are mounted respectively in the centre and upper right sections of the frame. The tuner is connected to the amplifier sub-assembly by two flexible metal strips.

(2) The plate tuning capacitor is operated from the front panel through a flexible drive and bevel gears. A factory-set stop-block fixes the limits of adjustment. The control shaft ends in a flat disc which carries a pin. The pin fits into a slot in a similar disc at the rear of the control panel (see Part 4, paragraph 2. c,"Fitting Control Panel to Tuner").

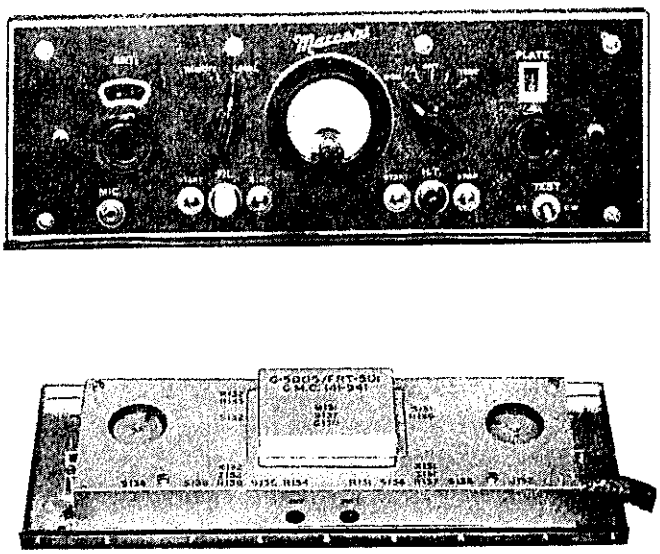


Fig. 1-6 Control, Transmitter, Type C-5005/FRT-501, Front and Rear Views

d. Control, Transmitter

The Control, Transmitter, Type C-5005/FRT-501 (see Figs. 1-6 and 5-30) is secured to the front of the tuner by six bolts. The shafts of the "PLATE" and "ANT." control knobs carry slotted discs, which engage pins on the control shafts of the plate and antenna capacitors in the tuner. To protect the settings against vibration and accidental displacement, a large disc on each control shaft is clamped at its edge by a lock-screw. The local microphone jack, meter, and operating controls are situated on the front of the panel and remain visible when the cabinet door is closed. Two screwdriver controls, marked "LINE" and "ANT.", are accessible through holes in the lower edge of the rear cover immediately beneath the thermostat.

e. Amplifier Sub-Assembly

The amplifier sub-assembly (see Fig. 1-7) is mounted immediately below the tuner. It contains four type 4D21 vacuum tubes. The plates of the modulator tubes (V103, V104 on the left) are connected to relay K101 which is mounted on the left rear wall beside the high voltage stand-off insulators 13, 14, 15. The plates of the power amplifier tubes (V101, V102 on the right) are connected to the plate-blocking capacitor C101, which is mounted on the right rear wall beside choke L101. All four vacuum tubes draw filament current from T101 situated in the centre of the unit. The amplifier sub-assembly is mounted immediately above and behind the transmitter sub-assembly and is connected to it by J101 and two spring fasteners. The power amplifier output is fed to the tuner by two flexible metal strips, the larger of which serves as an r-f ground. By-pass capacitors are mounted underneath the sockets (see Fig. 5-19).

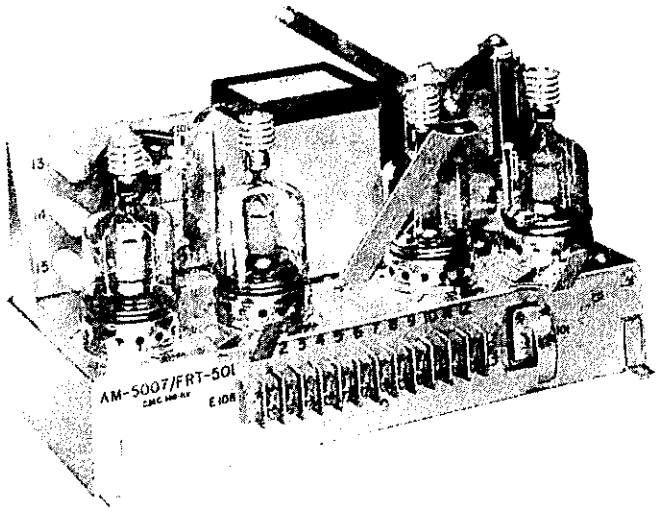


Fig. 1-7 Amplifier Sub-Assembly, Front View

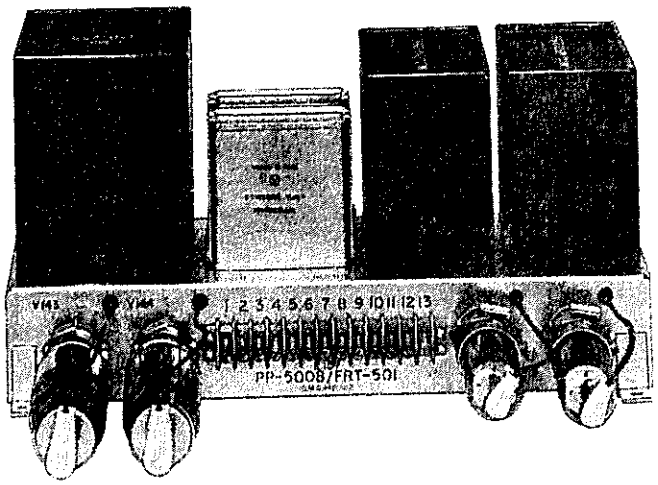


Fig. 1-8 Power Supply, Front View

f. Power Supply

The power supply (see Fig. 1-8) contains both the low voltage rectifier tubes (V143, V144 on the left) and the two clamp tubes (V141, V142 on the right). All four tubes draw heater current from transformer T141 which is mounted alongside filter choke L141, smoothing capacitors C141 and C142, and power supply transformer T142. Underneath, there is a small terminal board supporting the voltage-divider resistors (see Figs. 5-20 and 5-21). The power supply is mounted on the rear wall of the cabinet, immediately behind the transmitter sub-assembly.

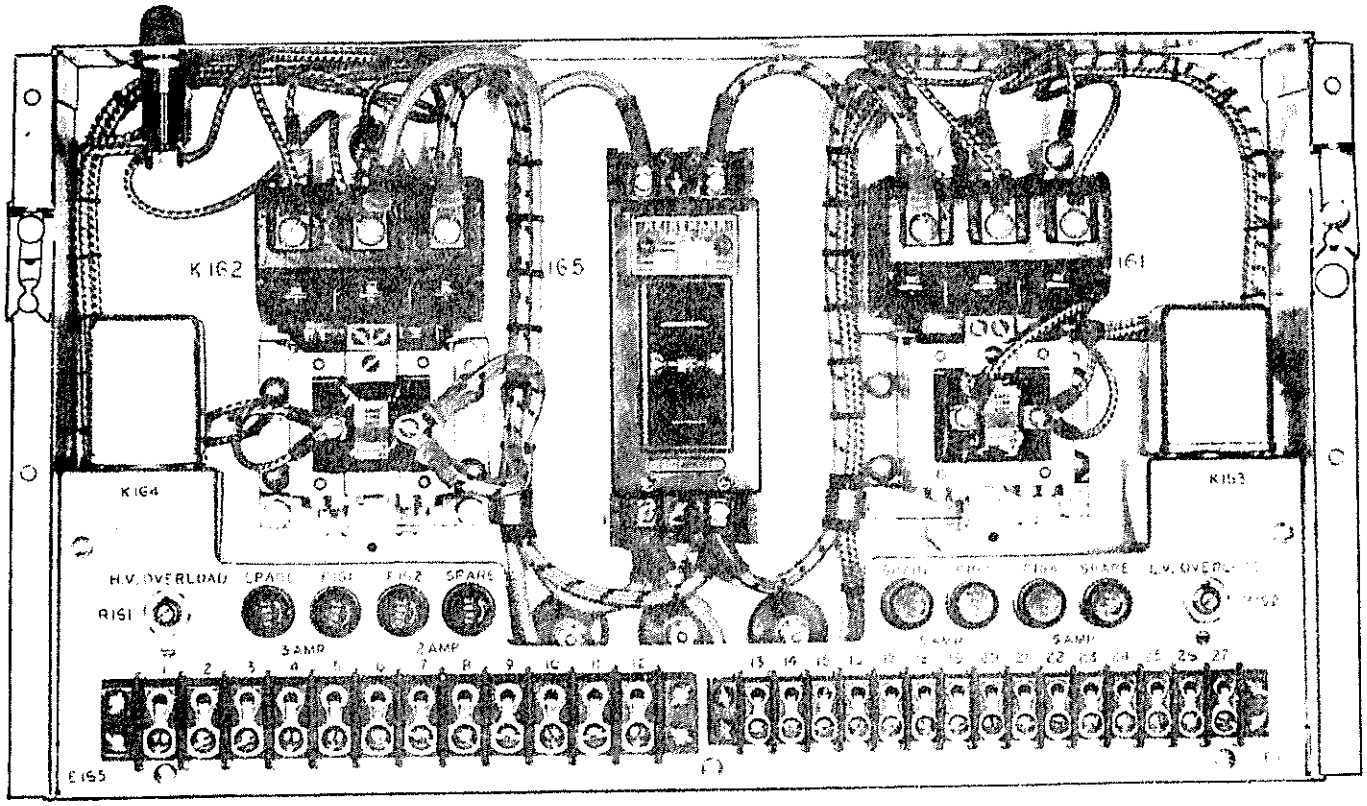


Fig. 1-9 Power Supply Sub-Assembly, Front View

g. Power Supply Sub-Assembly

The power supply sub-assembly is held on pivots in the lower section of the cabinet and has parts mounted on both front and back. On the front of the sub-assembly (see Fig. 1-9), the main circuit breaker K165 is situated between the high voltage contactor K161 and the low voltage contactor K162, which are flanked in turn by the low voltage and high voltage overload relays K163 and K164. Also situated on the front of the sub-assembly are the fuses and terminal boards. On the back of the sub-assembly, the high voltage rectifier tubes are mounted in two pairs on each side of their common filament transformer T161 (see Figs. 5-22 and 5-23).

h. Transmitter Sub-Assembly

The transmitter sub-assembly (see Fig. 1-10) is mounted on pivots in the centre of the cabinet. Normally it is held upright by four retaining screws and two slide fasteners. When released, it turns down and outwards to expose the wiring after the rear cover has been removed. Inside (see Figs. 5-25, 5-26 and 5-27) there are three sections corresponding roughly to the r-f amplifier chain, the a-f amplifier chain, and

the start, stop and time-delay circuits. Vacuum tubes, transformers, coils, relays and test jacks are mounted on the front of the sub-assembly. Many of the smaller parts are inside where there is insufficient space for labelling, so the circuit reference symbols are given in a diagram attached to the inside of the cabinet door (see Figs. 1-1 and 5-24).

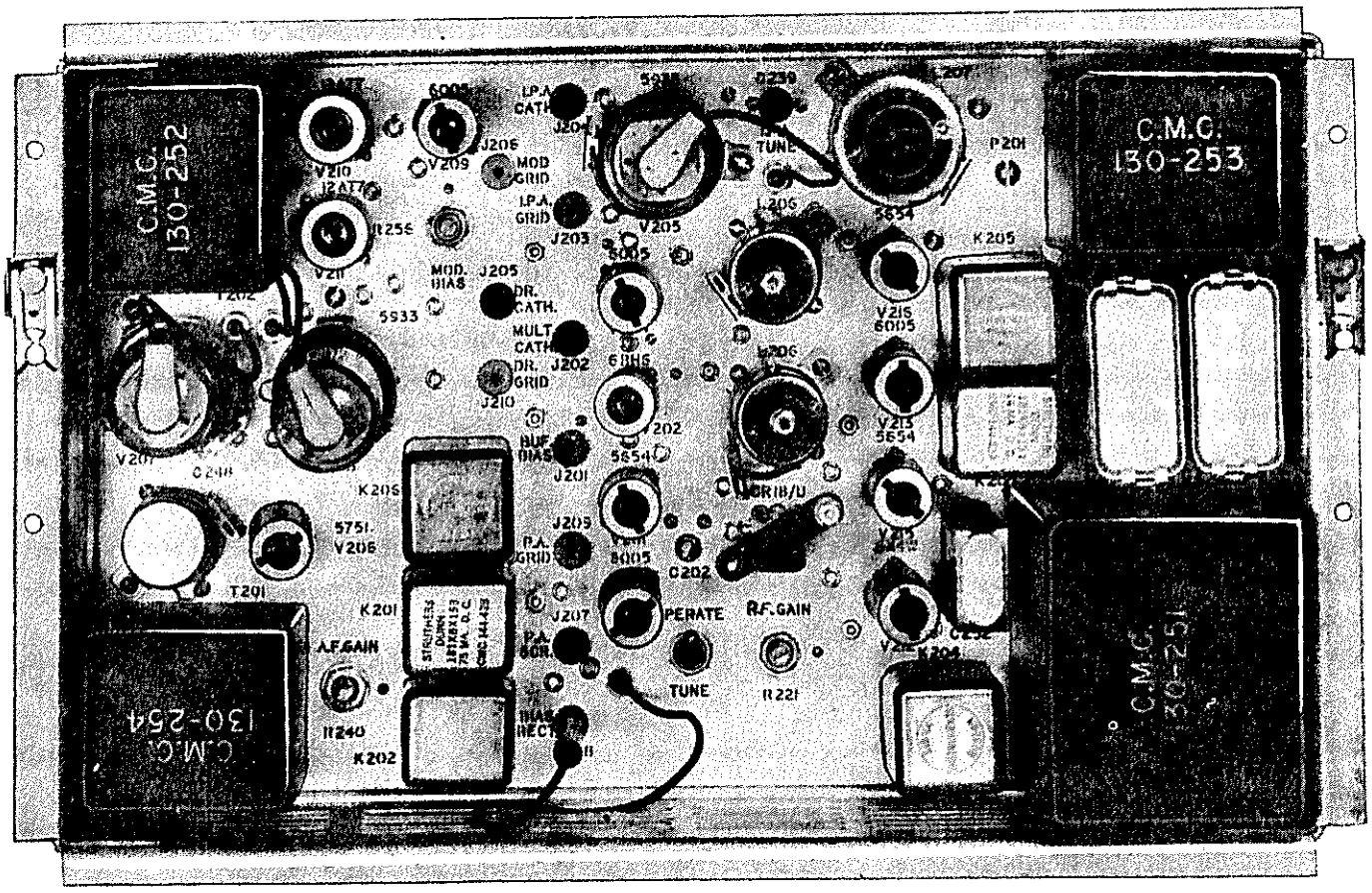


Fig. 1-10 Transmitter Sub-Assembly, Front View

PART 2

THEORY OF OPERATION

1. GENERAL

a. Master Block Diagram

A broad picture of the equipment may be obtained from the Master Block Diagram (Fig. 5-2), which outlines the functional relationships between the main circuit elements. It should be compared with the Simplified Block Diagram (Fig. 1-2), showing only the bare essentials, and with the Master Schematic Diagram (Fig. 5-1), which presents all circuits in complete detail. In studying the following paragraphs, the reader will find it helpful to first locate the part on the master block and schematic diagrams, before reading the detailed description.

2. RADIO-FREQUENCY CIRCUITS

a. Input

(1) Crystal

For crystal operation the Crystal, Type CR18/U, is mounted in socket X202 (see Fig. 5-13). It is isolated from the frequency-shift input by removal of link P206 stored in socket X201. Resistor R203 shunts the crystal, provides a d-c ground for the grid of V201, and gives the correct input impedance conditions for good operation. Capacitor C202 is factory adjusted to a value which, in conjunction with C203, C204, and the stray capacity of the circuit, results in a total capacity of 32 uuf across the crystal.

NOTE

THE SETTING OF C202 MUST NOT BE DISTURBED, SINCE CR18/U CRYSTALS DO NOT OPERATE AT THEIR MARKED FREQUENCIES UNLESS THEY ARE SHUNTED BY THE CORRECT CAPACITY.

(2) External Generator

For operation with an external frequency-shift r-f generator, the crystal is removed and link P206 is placed between X201 and X202 in the position marked "EXT." In this case the external signal passes straight to the grid of V201, which works then as an ordinary amplifier.

b. Oscillator

(1) In the basic Colpitt's oscillator circuit (see Fig. 2-1 A and B) oscillations are obtained by connecting the grid and plate of a vacuum tube to opposite ends of a resonant circuit. The cathode is connected to an intermediate point by using two capacitors in series. When positive feedback occurs in suitable phase, the tube gain balances the resonant circuit losses and continuous oscillations result. Energy to maintain the r-f oscillations is supplied by the flow of d-c power from the plate supply.

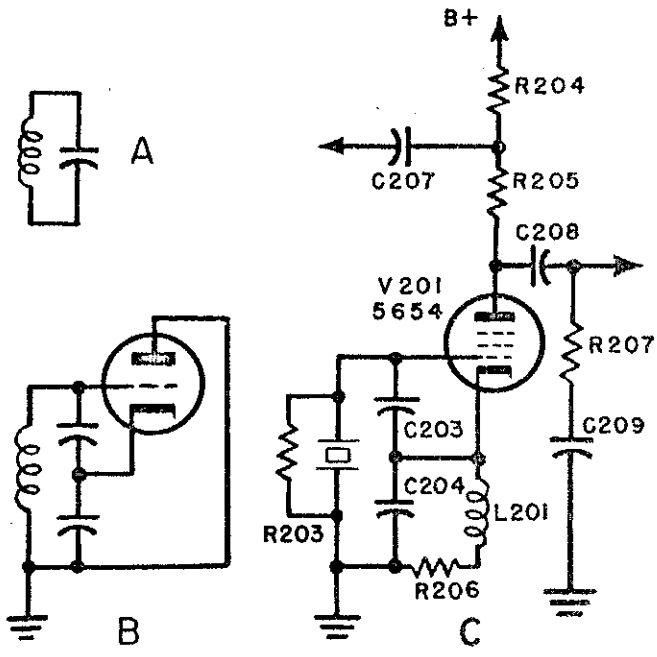


Fig. 2-1 Oscillator, Basic and Simplified Schematic Circuits

(2) In the actual oscillator circuit of the transmitter other parts are necessary. For greater frequency stability a quartz crystal is used as the fundamental resonant element (see Fig. 2-1 C), but the principle of operation re-

mains the same. Bias for the oscillator tube (type 5654) is provided by cathode resistor R206, and grid leak R203. Choke L201 prevents the cathode resistor R206 from short-circuiting r-f voltages appearing across C204. Blocking capacitor C208 keeps the d-c plate potential away from the grid of the next stage. The plate decoupling capacitor C207 completes the r-f plate circuit to ground through resistor R211 (see Fig. 5-13). The r-f voltage developed across R211 permits monitoring of the oscillator frequency at J212. The operating potential for the screen grid of the pentode oscillator tube is supplied through screen dropping resistor R202 and by-passed by capacitor C206.

c. Buffer

(1) The oscillator output voltage at the junction of C208 and R207 is applied to the grid of the buffer tube V202 (type 6BH6), which is a pentode amplifier (see Fig. 5-13). When no frequency multiplication is required, the plate load is R220 and socket X220 is empty. When frequency multiplication is required in the next stage, a resonant circuit L206 is inserted into X220 and tuned to the crystal frequency in order that the multiplier tube V204 may have enough input to produce harmonics (see paragraph 2. d, "Buffer and Multiplier Coils"). The cathode of V202 is connected through R215 to the "R. F. GAIN" control R221. Its setting determines the bias on V202 and hence also the stage gain. One end of R221 is held slightly negative with respect to ground by connection to a voltage divider (R252, R238, and R222) across the -180v output of the bias supply (see Fig. 5-1). The other end of R221 is held positive by connection through R219 to a voltage divider (R152, R151, R153, and R154) across the output of the low voltage power supply (see Fig. 5-11). This voltage divider also supplies the screen grids of the buffer and multiplier tubes through R213 and R224. Capacitors C212, C227, and C220 by-pass the screen r-f voltages to ground.

(2) When the press-to-talk switch is depressed, the grid of V202 is connected to ground through R207, R208, and the contacts 4, 3 of relay K201 (see paragraph 5. b . Thus the grid-cathode potential difference of V202, which is determined chiefly by the setting of the "R. F. Gain" control R221, allows the tube to conduct. However, when the press-to talk switch is released, relay K201 also releases, removing the ground from R208. Capacitors C219 and C210 are no longer short-circuited but charge rapidly from the bias supply (-180v) to a potential (about -37v) determined by the voltage divider R209 and R210. The large negative bias at the control grid of V202 cuts off the plate current and silences the transmitter. To prevent any carrier leak, the blocking bias is also applied to the control grid of the multiplier V204, disabling it as well. The buffer bias can be measured at J201. Plate and cathode by-passing are accomplished by C223 and C214 respectively. The functions of CR201, C209, and R208 are discussed in paragraph 5. a, "Keying".

d. Buffer and Multiplier Coils

Four coils (L206A, L206B, L206C, L206D) to cover the range 1.5 to 15 mc (see Tables 3 and 4) are available for the buffer and multiplier stages. Each coil is mechanically sealed with two fixed capacitors inside an aluminum can. One capacitor is directly in parallel with the coil. The other capacitor is connected to a pin on the coil plug, and can be brought into or out of the circuit by plugging the coil into its socket in either of two possible positions. When inserting a coil, make sure that the lettering corresponding to the desired frequency range is right-side-up. The coil is tuned by moving its screwdriver-adjustable iron core. When the best setting has been found, the core should be locked in position by tightening the nut on the adjusting screw against the threaded bushing in the end of the shield can. The special tuning wrench provided for this purpose is mounted on the inside of the cabinet door.

e. Multiplier

The output of the buffer tube V202 is applied through C225 to the grid of the multiplier tube V204 (see Fig. 5-13). The multiplier tube (type 6005) is a pentode amplifier with a tuned plate circuit consisting of the elements of the plug-in coil L206. This plate circuit operates at the output frequency of the transmitter, which can be one, two, or three times the crystal frequency (see Table 2-2 and paragraph 2. d, "Buffer and Multiplier Coils"). When the press-to-talk switch is depressed, V204 conducts, since its grid is grounded through R225 and contacts 4,3 of relay K201 (see paragraph 5. b, "Press-to-Talk Switch"). When the press-to-talk switch is released, V204 is cut off by the blocking bias across R210. During carrier-on periods the tube develops normal self-bias across cathode resistor R229 and grid leak R225. The multiplier cathode current can be measured at J202, marked "MULT. CATH." and shunted across R226.

TABLE 2-1

COIL MARKINGS AND FUNCTIONS			
Symbol	Markings	Frequencies as Marked	Function
L206A	Marconi 145-728	1.5 - 2.1 2.1 - 3.0	Multiplier Coil 1.5 - 2.5 mcs
L206B	Marconi 145-730	2.5 - 3.5 3.5 - 5.1	Multiplier Coil 2.5 - 5.0 mcs
L206C	Marconi 145-732	4.8 — 7.0 7.0 - 11.1	Multiplier Coil 5.0 - 10.0 mcs
L206D	Marconi 145-734	9.8 - 12.0 12.0 - 15.0	Multiplier Coil 10.0 - 15.0 mcs
L207A	Marconi 129-879	1.4 - 1.9 1.9 - 2.8	IPA Coil 1.5 - 2.5 mcs
L207B	Marconi 129-885	2.3 - 3.5 3.5 - 5.2	IPA Coil 2.5 - 5.0 mcs
L207C	Marconi 129-883	4.8 - 6.5 6.5 - 11.0	IPA Coil 5.0 - 10.0 mcs
L207D	Marconi 129-881	9.6 - 12.5 12.5 - 16.0	IPA Coil 10.0 - 15.0 mcs

TABLE 2-2

COILS USED FOR EACH FREQUENCY RANGE				
Frequency Ranges		Buffer	Multiplier	IPA
Output	Crystal	X220	X206	X208
1.5 - 2.5 mcs	1.5 - 2.5 mcs	No Coil	L206A	L207A
2.5 - 5.0 mcs	2.5 - 5.0 mcs	No Coil	L206B	L207B
5.0 - 10.0 mcs	2.5 - 5.0 mcs	L206B	L206C	L207C
10.0 - 15.0 mcs	3.33 - 5.0 mcs	L206B	L206D	L207D

f. Intermediate Power Amplifier

The intermediate power amplifier tube V205 supplies 5 to 10 watts of r-f energy to the grids of the final power amplifier. Four tapped coils L207A, L207B, L207C, and L207D cover the range 1.5 to 15 mc (see Table 2-2 and paragraph 2. d, "Buffer and Multifier Coils"). Each coil is an autotransformer, the primary of which serves as the plate load of V205. The secondary of the autotransformer is tuned to the carrier frequency by C239, marked "I. P. A. TUNE". The output voltage of the intermediate power amplifier is applied to the grids of the power amplifier tubes V101 and V102 through the coupling capacitor C240. Changing the distributed capacities of the wiring of the intermediate power amplifier can lead to the generation of unwanted frequencies. Consequently, the wiring should not be disturbed during repairs

or maintenance. A parasitic suppressor R235 in series with the plate of V205 helps suppress spurious oscillations. The grid and cathode resistors R230 and R236 are in series respectively with metering resistors R231 and R237, and are connected respectively to jack J203 marked "I. P. A. GRID", and jack J204 marked "I. P. A. CATH." The cathode is decoupled by capacitor C238. Capacitor C237 across the heater helps to prevent r-f voltages from appearing in other heater circuits connected to the same power supply.

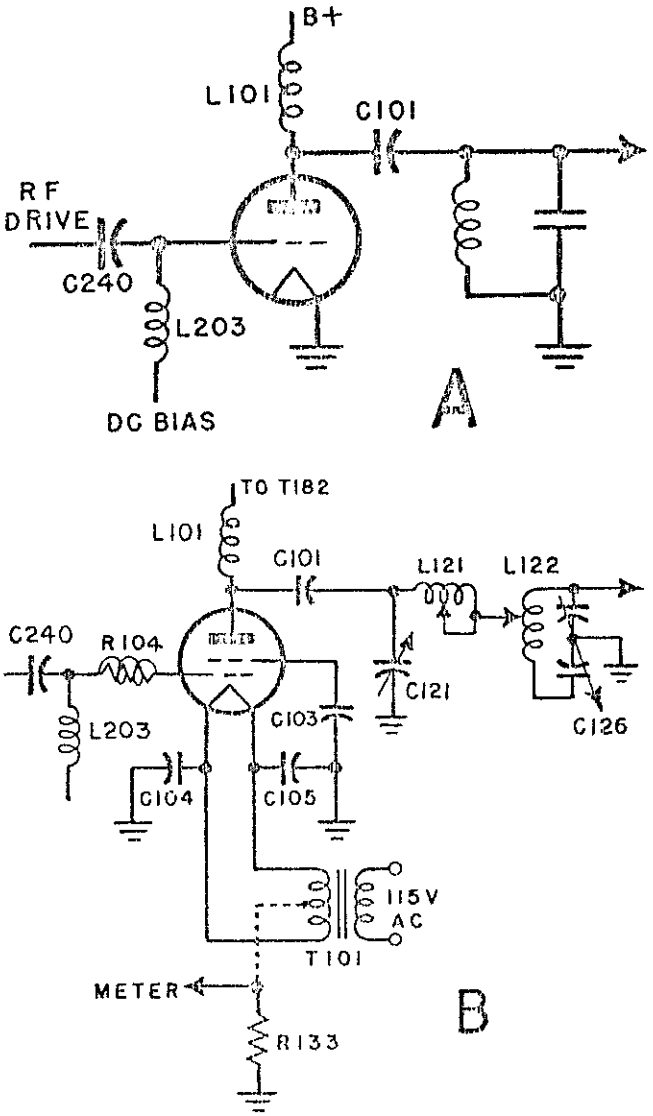


Fig. 2-2 Power Amplifier, Basic and Simplified Schematic Circuits

g. Power Amplifier

The final power amplifier tubes V101 and V102 (type 4D21 power tetrodes) are connected in parallel and operate class C. The basic circuit for one tube is shown in Fig. 2-2 A. The 2400v d-c output of the high voltage power supply is fed to the tubes through r-f choke L101. Capacitor C101 couples the r-f output energy of the power amplifier to the tuner, but isolates the tuner from the d-c plate potential of the power amplifier tubes. The tuner and antenna system can be regarded as a resonant circuit in which oscillations are maintained by short bursts of power amplifier plate current, which flow in the tube during only part of the cycle, each time the input r-f waveform drives the control grid above cut-off bias. During the remainder of the cycle, the tube is cut off by a large negative d-c bias, supplied from the bias supply through the bias isolator and r-f choke L203 (see paragraph 7. a, "Bias Isolator"). In the actual transmitter there is an L-section network (C121, L121) between the tube and the antenna circuit (see Fig. 2-2 B). This section acts as an impedance transformer; by converting the antenna impedance into the correct load impedance for the tube, it ensures that energy is transferred to the antenna circuit efficiently. The tubes used are power tetrodes with electronic control of the screen-grid potential. This control protects the tubes during carrier-off periods by reducing the screen-grid potential in the absence of r-f drive (see paragraphs 7. a and 7. b). Parasitic suppressors R103 and R104 prevent spurious oscillation. The heaters and screen grids are bypassed to ground by C104, C105, C108, C109, C103 and C110. The centre tap of the heater transformer secondary (T101) is connected to ground through the coil of relay K202 and a metering resistance R133. When S132 is in

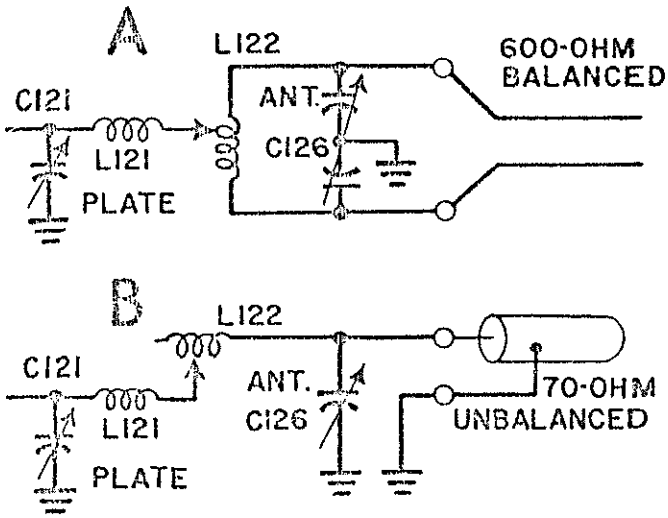


Fig. 2-3 Tuner, Radio Frequency, Basic Circuits

the position marked "P. A. ", the meter reading is proportional to the voltage drop across R133, and thus indicates the total cathode current of V101 and V102. Relay K202, with K201, controls the functioning of the bias regulator and stop circuits.

h. Tuner, Radio Frequency

(1) The transmitter is designed to operate into the following types and ranges of load impedances:

Balanced	500 to 700 ± j 600 ohms.
Unbalanced	30 to 75 ± j 50 ohms.

Thus either a balanced open-wire transmission line or an unbalanced co-axial cable may be used to feed the antenna. The tuner, when correctly adjusted, acts as an impedance transformer between the load and the power amplifier, so that energy can be efficiently transferred from the tubes to the antenna feeder. Fig. 2-3 A and Fig. 2-3 B show basic circuits used for balanced or unbalanced loads, respectively. The change from one kind of load to the other is made by moving the antenna links which connect the tuner output to the transmitter antenna terminals (see Fig. 2-4). When adjusting the tuner, the operator should bear in mind that to obtain a given reactance at a higher frequency requires fewer coil turns but a larger capacity (see Fig. 3-2 of EO 35BD-5FRT501-1, "Operating Instructions, Transmitter AN/FRT-501"). However, when the frequency changes, the load impedance may also change. The best adjustment for each case can be found only by trial.

(2) To allow the transmitter output to be metered, a small amount of r-f energy is taken from one side of the antenna circuit through C183 and rectified in the r-f indicator (see paragraph 10. a, "Metering").

3. AUDIO-FREQUENCY CIRCUITS

a. Input

The normal audio input to the transmitter is provided by a carbon-button microphone plugged into jack J302 on the Control, Transmitter, Type C-5002/FRT-501 (see Fig. 5-1, Master Schematic Circuit Diagram). Transformer T301 matches the microphone to the 500/600 ohm telephone line between control and transmitter, and T201 matches the line to the relatively high input

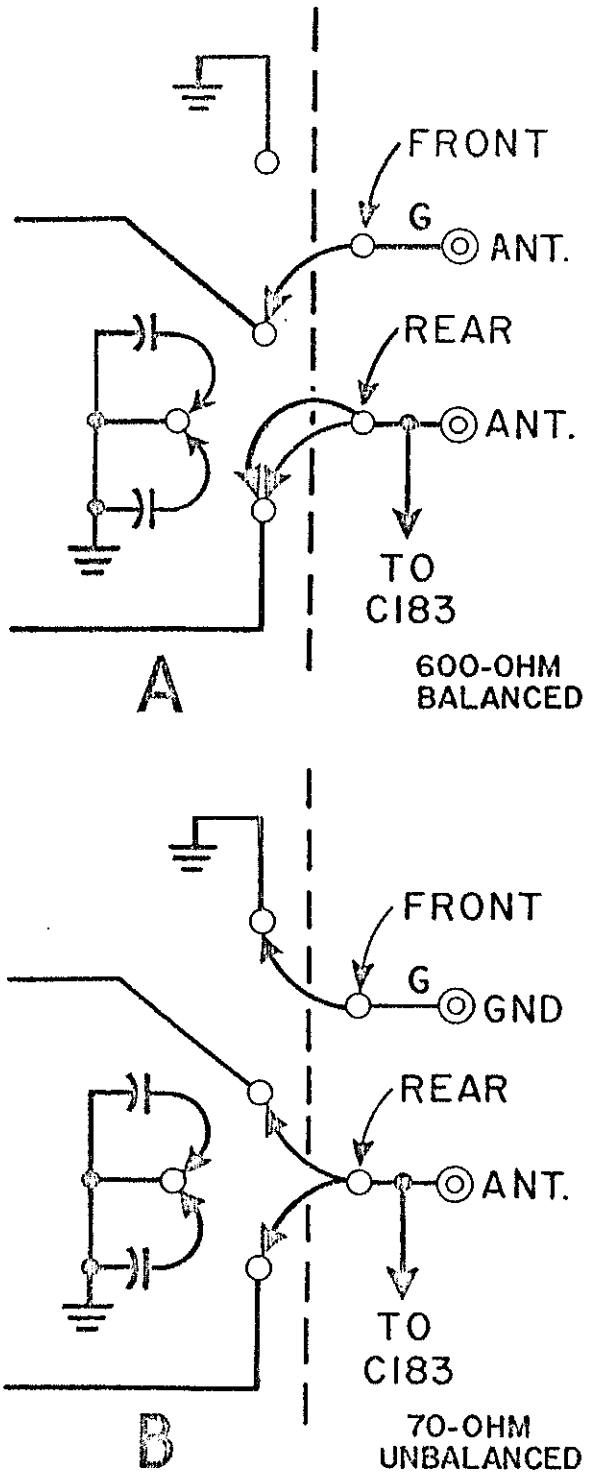


Fig. 2-4 Antenna Links, Schematic Circuits

impedance of the "A. F. GAIN" control R240, connected to the grids of the input amplifier V206. When a local microphone is used at jack J132, a separate winding on T201 provides the correct step-up from the microphone impedance, through the "REMOTE-LOCAL" switch S131.

b. Input Amplifier

The audio signals across the "A. F. GAIN" control R240 are amplified by the push-pull input amplifier V206, (type 5751 double triode) (see Fig. 5-14). The triodes of this tube obtain their plate potentials from voltage dividers (R242, R243 and R245, R244) directly across the plates of the next stage. The push-pull triodes of V206 have a common cathode resistor R241, which is not capacitively by-passed, and thus provides some negative feedback for the input amplifier.

c. Driver Amplifier

(1) The driver amplifier tubes V207 and V208 (type 5933) operate in push-pull with their cathodes and screen grids connected together. Plate potential is obtained through transformer T202 from the low voltage power supply; the potential of the screen grids is obtained from the same source through resistor R251. Audio output transformer T202 serves as a plate load and matches the driver amplifier to the modulator grids. To reduce distortion and improve stability, two negative feedback networks (R242, R243, R246, R248 and R245, R244, R247, R248) feed back part of the plate signal to the driver grids. The output transformer is shunted by C255 and C256 to reduce the high-frequency gain and prevent high-frequency parasitic oscillations.

(2) The driver amplifier cathode current flows through relay K201, and resistors R227 and R239. In the carrier-off condition, the driver amplifier tubes V207 and V208 are cut off by a blocking bias from the bias supply (-180v), through R252 and (not-operated) relay K206. Thus relay K201 also remains unoperated. When the blocking bias is removed by operation of K206, the driver amplifier cathode current operates K201 also. The voltage developed across R239 by the driver amplifier cathode current is used to energize the local microphone through transformer T201 and the "REMOTE-LOCAL" switch S131.

d. Modulator

The modulator tubes V103 and V104 (type 4D21) operate class AB2 in push-pull. The control grids are driven directly from the secondary winding of transformer T202 (see Fig. 5-1). The centre tap of this winding is connected to the bias regulator to provide the correct d-c grid condition (see paragraph 7. c, "Bias Regulator"). The screen-grid potentials of V103 and V104 come directly from the low voltage power supply. Filter capacitors C141 and C142 in the power supply provide a-f by-passing of the modulator screen grids. The plate potentials of V103 and V104 are obtained from the high voltage power supply (2400v) through the primary centre tap of the modulation transformer T182. This transformer serves to transform the d-c plate resistances of V101 and V102 into the correct plate load for the modulator tubes, in order that the a-f signal voltages can be impressed upon the r-f carrier. The modulator is disabled during morse transmission by cut-off bias applied to the tube grids; at the same time the contacts of relay K101 short-circuit the primary winding of the modulation transformer. Removing the transformer reactance from the power amplifier plate circuit improves the keying characteristics.

4. MODULATION CIRCUITS

a. Modulation Process

High-level plate modulation of the r-f power amplifier tubes V101 and V102 is produced by so varying their d-c plate voltage in proportion to the varying input speech voltage that the amplitude of the r-f output corresponds to the signal at the microphone. To accomplish this, the secondary winding of the modulation transformer T182 is inserted between the high voltage supply and the plates of V101 and V102. For cw operation, relay K101 short-circuits the primary winding of T182. In this condition the transformer has negligible effect on the power amplifier performance. For speech modulation, the contacts of K101 are open. The audio voltages developed between the plates of V103 and V104 pass through T182 and are applied to the plates of V101 and V102. However, to modulate tetrode power amplifier tubes efficiently, it is desirable to modulate the screen-grid voltage also. The necessary variations in screen-grid potential are produced by the action of resistors R181, R182, R183, R184, and R185. The voltage drop across these resistors is proportional to the fluctuating screen-grid current, which in turn follows the variations of the plate current. Thus, as the plate current increases during modulation, the screen-grid current also tends to increase, and the increased voltage drop across the resistor chain lowers the screen-grid potential. The high-resistance screen-grid supply has the disadvantage that without further control the screen-grid potential would become excessive

whenever the r-f drive was absent. The clamping circuit eliminates this disadvantage by electronically controlling the screen-grid potential according to the power amplifier grid current (see paragraph 7. b, "Clamps").

b. Modulation Transformer By-Passing

Choke L101 and r-f by-pass capacitor C102 keep r-f voltages away from the modulation transformer T182 and the high voltage power supply. However, C102 is sufficiently reactive at audio frequencies to have negligible by-passing effect on the modulation voltages at the plates of V101 and V102. Similarly, d-c plate blocking capacitor C101 allows an easy r-f path to the tuner, but offers high a-f reactance to modulation voltages. Otherwise, these voltages would be short-circuited to ground by the tuner inductors. Finally, C181 and C182 provide a low impedance from terminal 5 of T182 to ground through R161, reducing audio voltages across the high voltage power supply.

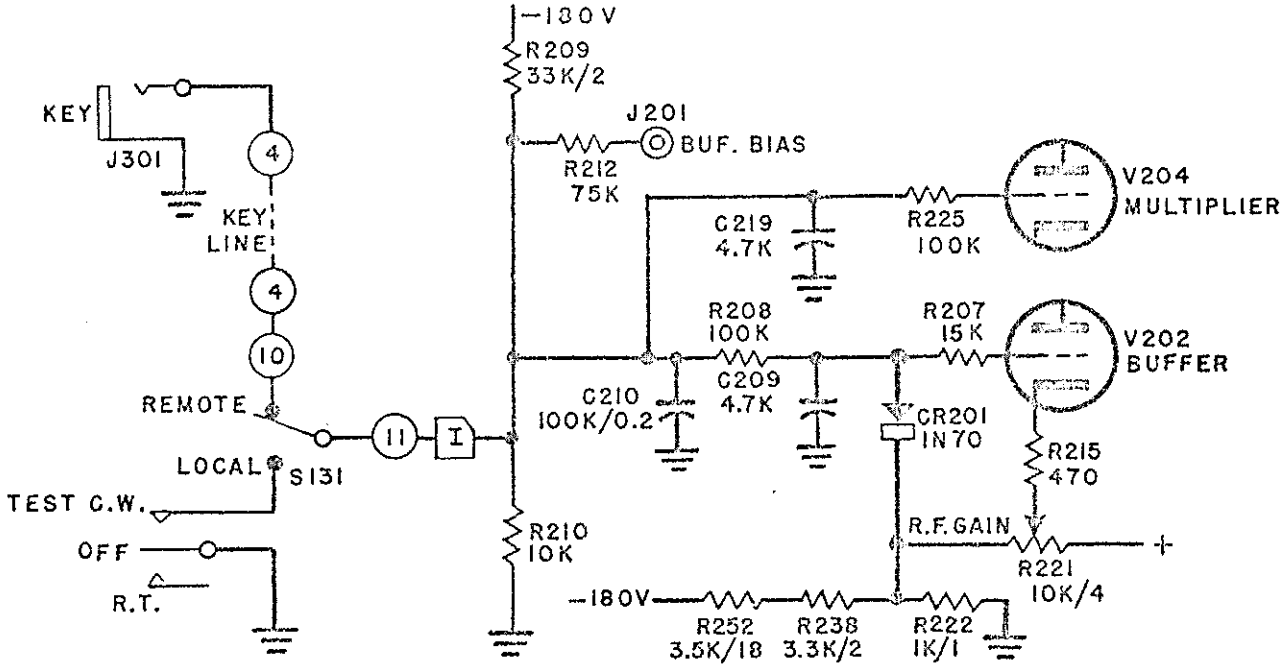


Fig. 2-5 Keying, Simplified Schematic Circuit

5. CARRIER CONTROL

a. Keying

(1) Keying of the transmitter is accomplished by disabling the buffer and multiplier stages and thus interrupting the r-f drive to the power amplifier. The key-line (see Fig. 2-5) comes from the remote control through "REMOTE-LOCAL" switch S131 to the junction of R209 and R210, which are connected between the -180v bias supply and ground. When the key is up, this junction is at a negative potential of about 37 volts, which is sufficient to cut off V202 and V204 through R208, R207 and R225. Thus, even though the oscillator continues working, no r-f signal can reach the power amplifier. When the key is down, R210 and C210 are short-circuited and the control grids are grounded through R207, R208 and R225, allowing V202 and V204 to conduct and develop cathode-resistor bias. The resistance-capacity network R208 and C210 acts as a low-pass filter which, by rounding off the sharp corners of the keying signals, reduces sideband radiation and key clicks.

(2) To prevent line transients from ever driving the control grid of V202 positive with respect to ground, a crystal rectifier CR201 is connected from the control grid (through R207) to a point (the junction of R238 and R222) which is always slightly negative. When the key is up, the high-impedance of the crystal has little effect on the circuit, since the junction of R207 and R208 is held negative by the blocking voltage developed across R210. When the junction of R207 and R208 is driven near ground potential by positive keying

transients, CR201 conducts and holds the control grid of V202 at a fixed negative potential. Bypass capacitors C209 and C219 reduce r-f voltages in the keying network, and also prevent undesirable r-f feedback between V204 and V202. Jack J201, marked "BUF. BIAS", permits observation of the keying voltage.

(3) If a local key is fitted, it is connected to terminal 9 on E183 and is brought into the circuit when switch S131 is moved from "REMOTE" to "LOCAL". Thus, either the remote or the local key has control at a given time, but never both at once. Putting the "REMOTE-LOCAL" switch S131 at "LOCAL" and pressing the "TEST" switch to "C. W." short-circuits R210 and produces a key-down condition for local test purposes.

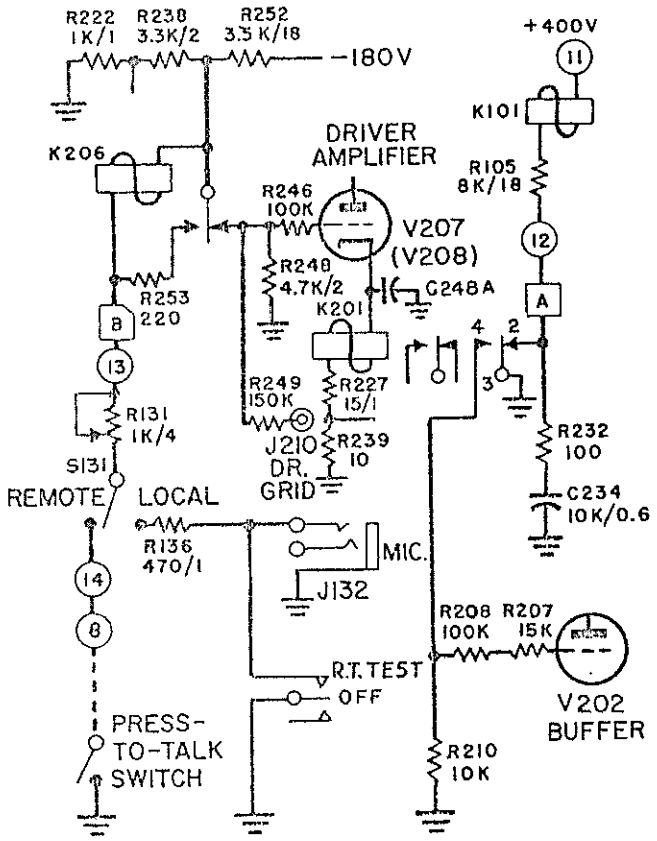


Fig. 2-6 Press-to-Talk, Simplified Schematic Circuit

b. Press-to-Talk Switch

To bring on the carrier, the press-to-talk switch of the remote microphone plugged into "MIC." jack J302 is closed (see Figs. 2-6 and 5-1). Relay K206 then operates from the bias supply through R252, R131, S131, T201, the audio line, and both windings of T301. This removes the cut-off bias from the driver amplifier, applied to the grids of V207 and V208 from the bias supply through voltage divider R252, R248. It also pulses the start circuit (see paragraph 8. d) and provides microphone d-c feed (see paragraph 6. e). When the driver amplifier starts to conduct, its cathode current, after rapidly charging C248A, operates relay K201 through R227 and R239. The movement of the grounded contact of K201 releases K101 (in the modulator) and brings on the carrier by short-circuiting R210 in the keying network (see paragraph 5. a, "Keying"). When the r-f drive causes power amplifier cathode current to flow, relay K202 closes (see Fig. 5-1) through T101 and metering resistor R133. Simultaneous operation of relays K201 and K202 short-circuits R258 (see Fig. 2-16) and establishes correct modulator bias conditions (see paragraph 7. c, "Bias Regulator", and Fig. 5-1).

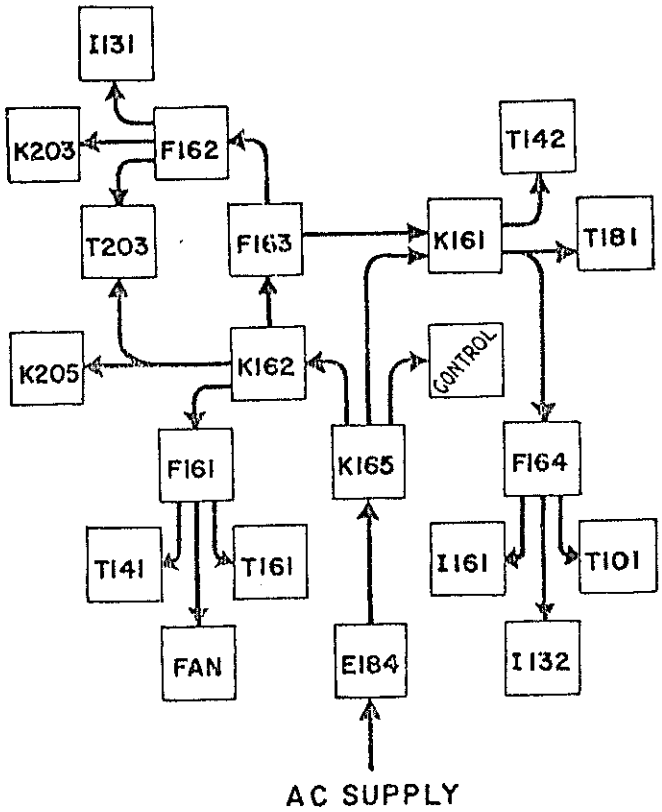


Fig. 2-7 A-C Supply Distribution, Block Diagram

6. POWER SUPPLIES

a. Distribution of a-c Supply

The a-c supply comes into the equipment on terminals 1 and 2 of terminal board E184 (see Fig. 5-1). Input power of approximately 2.5 kva

at 115v, 60 cps, is required. Only that side of the power supply which is connected to terminal 1 is protected by fuses, so the polarity of the input leads is important. The neutral (three-wire system) or side of the external supply closer to ground (two-wire system) should be connected to terminal 2. The a-c input runs from E184 to terminals 1 and 2 on the power supply sub-assembly and from there to the main circuit breaker K165. The main circuit breaker supplies the entire equipment through the low voltage contactor K162, the high voltage contactor K161, and four fuses (see Table 2-3, Fig. 2-7, and Fig. 5-3).

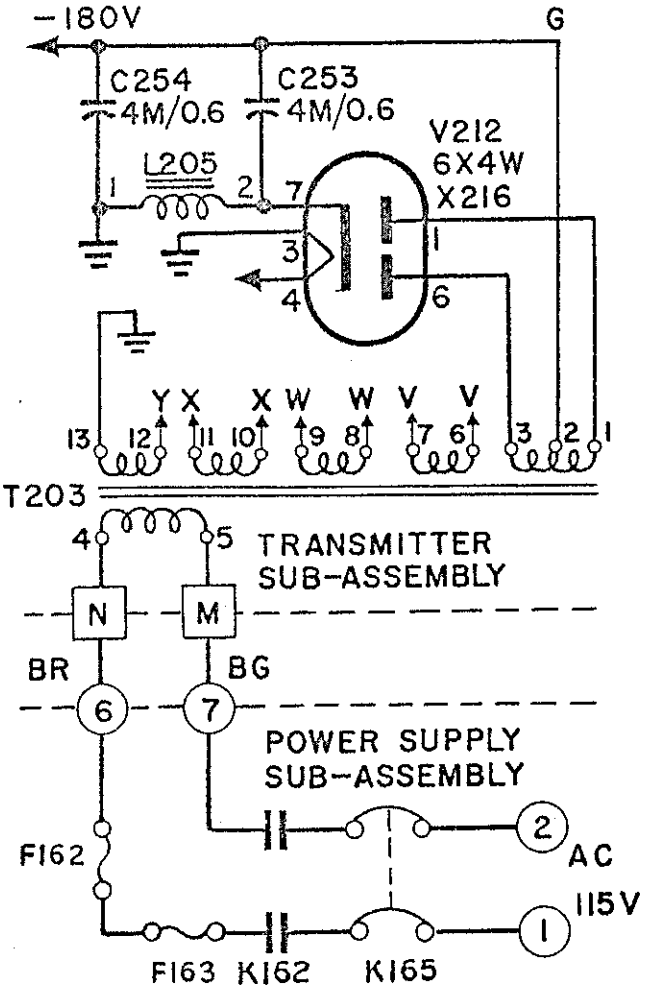


Fig. 2-8 Bias Supply, Simplified Schematic Circuit

b. Bias Supply and Distribution

In order to maintain the control grids of the power amplifier and modulator tubes at suitable negative potentials, they are connected through the bias isolator and bias regulator to the bias supply. The output of the bias supply (approximately -180v) also provides d-c energy for the start, stop, time-delay, microphone, relay, and keying circuits. The schematic diagram of the bias supply is shown in Fig. 2-8. The primary of transformer T203 is fed from the a-c supply through the main circuit breaker K165, the low voltage contactor K162, and fuses F162 and F163. The four low-voltage secondary windings of T203 supply the heaters of all tubes of the transmitter sub-assembly. The high-voltage secondary winding of T203 is connected to the plates of V212, which acts as a full-wave rectifier. The a-c ripple in the output of the rectifier is reduced by a capacity-input pi-section filter made up of C253, L205, and C254. The distribution of the bias supply voltage (-180v) is given in Fig. 5-4.

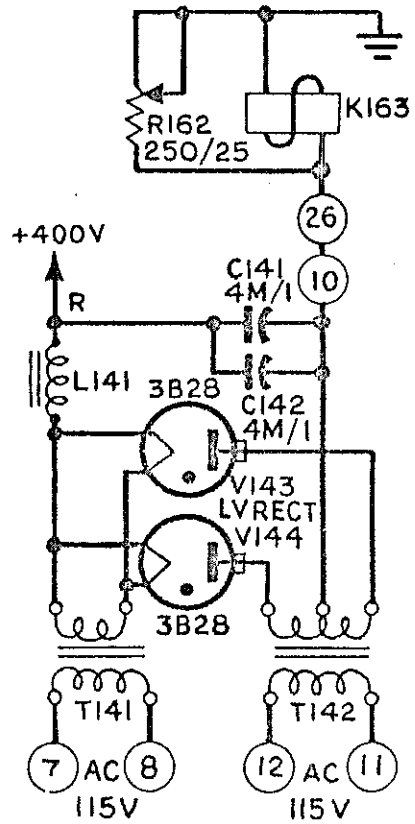


Fig. 2-9 Low Voltage Power Supply, Simplified Schematic Circuit

c. Low Voltage Power Supply and Distribution

The low voltage power supply (see Fig. 2-9) forms part of the Power Supply, Type PP-5008/FRT-501. It provides operating potentials for the plate and screen circuits of the low-level amplifier stages (see Fig. 5-5). The primary winding of transformer T142 is connected to the a-c supply through high voltage contactor K161, fuse F163, low voltage contactor K162, and the main circuit breaker K165 (see

Fig. 5-3). The secondary winding of T142 is connected to the plates of V143 and V144, which act together as a full-wave rectifier. The pulsing d-c output is smoothed by choke L141 and capacitors C141 and C142. Resistors R152, R151, R153 and R154, which are connected in series between the 400v output of the power supply and ground, serve as a bleeder (see Fig. 5-11) and provide a reduced voltage (about 100 to 150 volts) for the screens of V141, V142, V202 and V204, and for the "R. F. GAIN" network (see Fig. 5-13). The low voltage rectifier tubes V143 and V144 are directly heated. Their filaments, connected in parallel, are supplied by transformer T141 from fuse F161 and the low voltage contactor K162. Relay K163 in the power supply sub-assembly provides overload protection (see paragraph 9. b). All the d-c output of the low voltage power supply flows through the coil of K163, which is connected between the centre tap of transformer T142 and ground. Resistance R162, in parallel with the coil of relay K163, is adjusted to prevent the relay from operating under normal conditions. When an overload occurs, relay K163 operates, interrupts the coil current of the high voltage contactor K161, and disconnects the a-c supply from the primary of T142 (see paragraph 8. b (4)). This primary is also protected by fuse F163, which supplies F162 and the coil of K161. The gas-filled tubes V143 and V144 are protected against premature application of plate voltage by the same time delay circuit which protects the high voltage rectifier tubes. The distribution of the low voltage supply is given in Fig. 5-5.

d. High Voltage Power Supply and Distribution

(1) The elements of the high voltage power supply are spread about the lower section of the transmitter. The main high voltage transformer T181 is clamped in the centre of the cabinet floor. It draws its power through the high voltage contactor K161 and the main circuit breaker K165 (see Fig. 2-10). The transformer secondary develops 2770 volts between terminals 1 and 3 for full-power operation, and 1935 volts between terminals 1 and 2 for low-power operation. This alternating voltage is rectified by tubes V161, V162, V163 and V164 (type 3B28) acting together as a bridge rectifier. These gas-filled tubes, mounted in the power supply sub-assembly, are directly-heated by filament power drawn through transformer T161, fuse F161, and the low voltage contactor K162. Smoothing is provided by a single L-section filter, consisting of choke L181 mounted on the cabinet floor to the right of T181, and capacitors C181 and C182 mounted on the cabinet

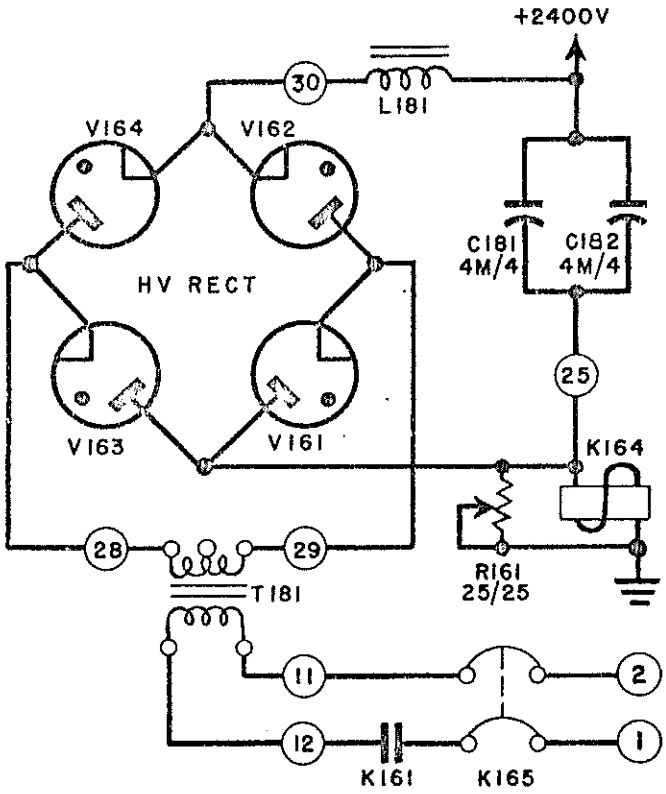


Fig. 2-10 High Voltage Power Supply, Simplified Schematic Circuit

walls. Relay K164 provides overload protection. It is connected between the bridge rectifier circuit and ground. The trip point is controlled by the setting of R161, in parallel with the coil of K164.

(2) The 2400v d-c output of the high voltage power supply is fed through the secondary of the modulation transformer T182 and the r-f choke L101 to the plates of the power amplifier tubes V101 and V102 (see Fig. 5-6). It also is fed through the primary of the modulation transformer T182 to the plates of the modulator tubes V103 and V104. The power amplifier screen grids, which require a lower voltage than the plates, are connected to the high voltage power supply through R185, R184, R183, R182, and R181, which are connected in series and mounted vertically on the upper left-hand wall of the transmitter cabinet. The voltage at the low-potential end of these resistors is controlled by direct connection to the plates of the clamp tubes V141 and V142. These resistors, in combination with R148, R149, R142, and R141 in the power supply, also act as a bleeder across the output of the high voltage power supply and ensure discharge of the filter capacitors (see also paragraph 4. a, "Modulation Process").

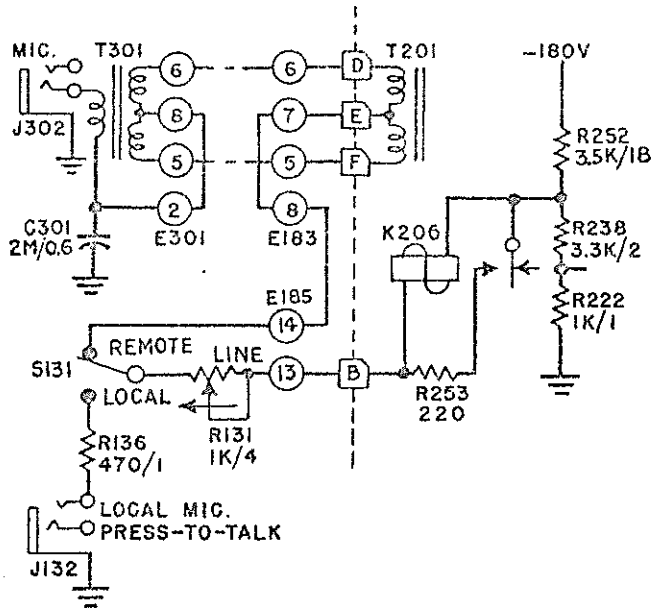


Fig. 2-11 Remote Microphone d-c Feed, Simplified Schematic Circuit

e. Microphone d-c Feed

(1) Direct current for the microphone at the remote control unit is fed from the transmitter over the audio pair of telephone wires (see Fig. 2-11). When the press-to-talk switch is depressed, relay K206 closes and turns on the driver amplifier. After the relay has closed, R253 is connected in parallel with its coil. This arrangement allows K206 to be operated initially by a large current and then to be held by means of a relatively small current. It also allows the correct operating current for the microphone to flow from the bias supply and voltage divider R252, R238, R222, through the "REMOTE-LOCAL" switch S131, transformer T201, the telephone lines in parallel, and both sides of T301. The current fed to the remote microphone may be adjusted by altering the setting of R131, marked "LINE" and situated just below the meter at the bottom of the transmitter control panel. The microphone audio circuit is completed through the primary of T201 and capacitor C301.

(2) The local microphone is energized by direct current from a different source (see Fig. 2-12). The cathode current of driver amplifier tubes V207 and V208 reaches ground through relay K201 and voltage divider R227, R239. The voltage drop across R239 is applied through T201 and the "REMOTE-LOCAL" switch S131 to the local "MIC." jack J132. No current adjustment is provided. Capacitor C248A serves as an a-f by-pass for the driver amplifier cathode.

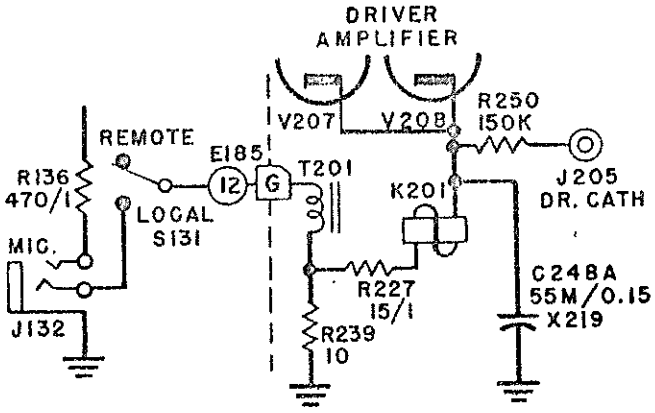


Fig. 2-12 Local Microphone d-c Feed, Simplified Schematic Circuit

7. BIAS AND CLAMPING CIRCUITS

a. Bias Isolator

(1) The power amplifier tubes operate under class C conditions, with cut-off bias preventing plate current flow during most of the r-f cycle. Near the crest of the r-f input wave, the power amplifier control grid is driven positive and grid current flows. It is the function of the bias isolator to provide a path for the d-c component of grid current during key-down periods (grid leak bias) while maintaining the minimum fixed bias to cut off the power amplifier tubes in the absence of r-f drive (key-up periods). The operation of the bias isolator is easily understood from Figs. 2-13A and 2-13B.

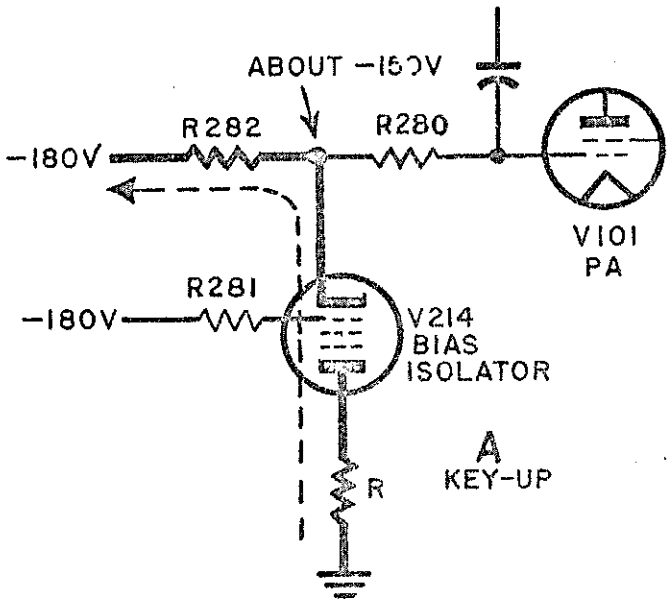


Fig. 2-13A Bias Isolator, Basic Circuit, Key-up

(2) When there is no r-f drive (key-up conditions), no grid current flows in the power amplifier. A very small current (about one ma) flows through "R", the bias isolator tube V214, and R282. The resultant voltage drop across R282 (about 30 volts) causes the cathode of V214 to take on a potential of about -150 volts. However, the grid of V214 is held at a constant potential of -180 volts through R281. The cathode-to-grid voltage of 30 volts almost cuts off the tube, holding the plate current to about one ma. Thus, the power amplifier grid bias is held at about -150 volts in the absence of r-f drive.

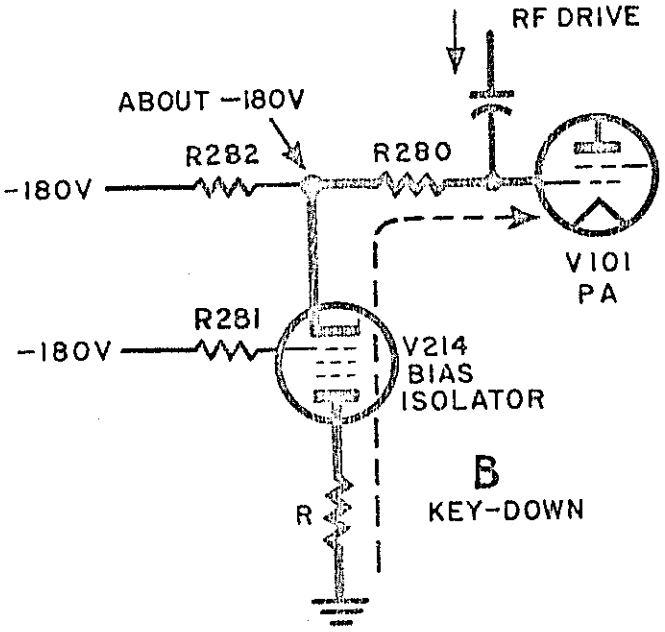


Fig. 2-13B Bias Isolator, Basic Circuit, Key-Down

(3) When r-f drive is applied to the power amplifier (key-down), grid current flows through "R", the bias isolator tube V214 and R280. This current does not flow through R282 and so does not increase the voltage drop across R282. On the contrary, the drop across "R" and V214 causes the cathode of V214 to become more negative, and reduces the drop across R282. The reduced control-grid bias of V214 causes its plate resistance to decrease. The increased current through V214 tends to make its cathode more negative still, until a balance is reached. The circuit values are chosen to give rated bias when rated power amplifier grid current is flowing. In the actual transmitter (see Fig. 5-15) R280 is in parallel with R279, r-f choke L203 and C241 keep r-f drive out of the bias isolator, and "R" of Fig. 2-13 actually consists of R277, R278 and R283.

b. Clamps

(1) Screen-grid potential for the power amplifier tubes V101 and V102 is obtained from the high voltage power supply through the resistor chain R181, R182, R183, R184, and R185. This arrangement leads to voltage modulation of the screen grids under the influence of the changing plate and screen-grid currents, and is necessary for good plate modulation (see paragraph 4. a, "Modulation Process"). However, without further control there would be the disadvantage that, when the r-f drive was removed, the power amplifier tube screen-grid voltage would become excessive. This disadvantage is eliminated by the use of a clamping circuit to provide electronic control of the screen grid potential. The circuit also provides "TUNE-OPERATE" switching to protect the power amplifier tubes during tuning adjustments.

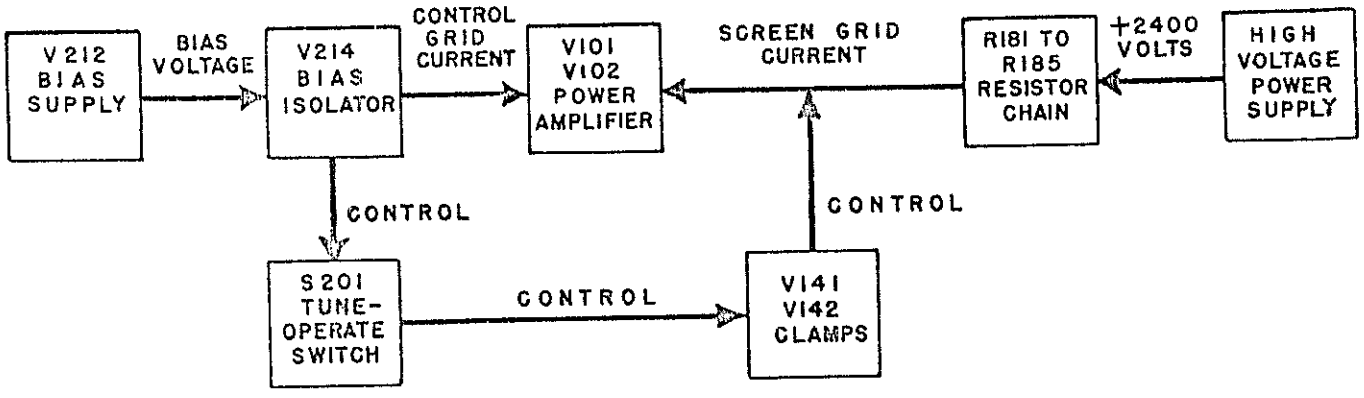


Fig. 2-14 Clamps, Block Diagram

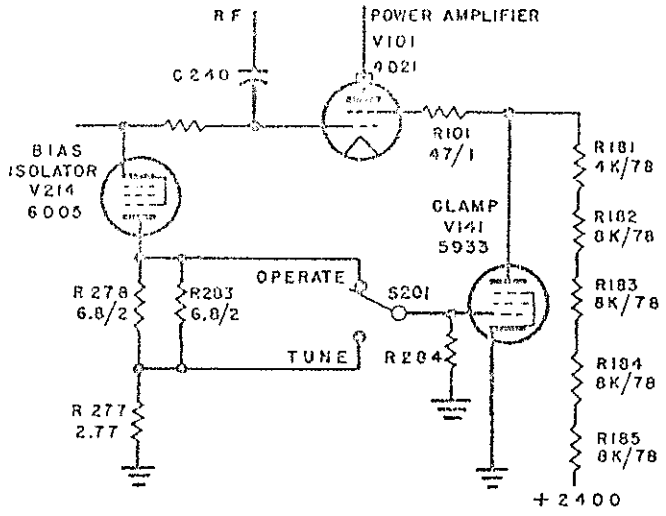


Fig. 2-15 Clamps, Basic Circuit

(2) The principal of operation may be seen from Fig. 2-14 and Fig. 2-15. When the key is up, there is no r-f drive and no power amplifier grid current flows through the bias isolator tube. Since the plate of V214 is near ground potential, the control grids of the clamps V141 and V142 in the power supply are also near ground potential. The low plate resistance of the clamps permits a large current to flow from the high voltage power supply through the resistor chain R181 to R185. The resultant voltage drop across the resistor chain during key-up periods holds the power amplifier screen potential at a safe value of about 50 volts. When the "TUNE-OPERATE" switch S201 is set at "TUNE", the control grids of the clamps are grounded through metering resistor R277 (2.27 ohms); the clamps conduct heavily, independently of the power amplifier control-grid current, and the power amplifier screen-grid voltage remains low. However, when the "TUNE-OPERATE" switch S201 is set at "OPERATE", the control grids of the clamps are connected to the plate of the bias isolator V214. As soon as power amplifier control-grid current starts to flow (key-down conditions), the plate of V214 becomes more negative by the voltage drop across R278, R283. This drives the control grids of the clamps negative, reduces their plate current, and causes the voltage drop across R181 to R185 to decrease. As a result, the screen-grid voltage applied to V101 and V102 rises to a value (about 375 volts) which is determined principally by the screen-grid current and which allows full power output from the amplifier. If the r-f drive fails, V214 returns to a high impedance condition, the clamps draw heavy plate currents, and the power amplifier screen-grid voltage is reduced to a safe value. At the instant when the "TUNE-OPERATE" switch S201 is between contacts, R284 provides a d-c ground for the control grids of the clamps. To allow the power amplifier grid current to be measured, a metering resistor R277 (2.27 ohms) is connected in the plate circuit of the bias isolator V214. When plug P205 is inserted into test jack J209, marked "P.A. GRID", the power amplifier grid current can be read on the meter (see Fig. 5-15). The power amplifier screen-grid voltage may be read at jack J207, marked "P.A. SCR." (see Fig. 5-6). Resistors R148 and R149, in parallel with the clamps V141 and V142, provide a small continuous drain on the resistor chain R181 to R185. These prevent excessive voltage rise if, for example, the clamp filament circuit should fail, and provide a discharge path for the high voltage filter capacitors.

c. Bias Regulator

(1) The modulator tubes V103 and V104 operate under class AB2 conditions. When peak modulation voltages drive the grids positive, grid current flows in the bias circuit. Unless a low-impedance path exists across the bias supply, the bias voltage will vary when grid current flows, and distortion will be produced. The main functions of the bias regulator are to provide correct modulator bias throughout the complete audio cycle and to cut off the modulator completely unless the power amplifier and driver currents are normal. In addition, it provides operating voltages for the stop circuit (see paragraph 8. e, "Stop" and Fig. 2-21). The basic bias regulator circuit is given in Fig. 2-16. Only one triode section is shown, although actually there are four in parallel (V210 and V211, type 12AT7 double triodes) with grid resistors R260, R266, R268, and R269 to stop parasitic oscillations (see Fig. 5-16). In principle the action is similar to that of the bias isolator.

(2) When relays K201 and K202 are both closed, resistor R258 is short-circuited and the grids of V210 and V211 are connected to the junction of R257 and R259. This junction is at a potential of about -60 volts, depending upon the setting of R256. If the modulator tubes V103 and V104 are not drawing grid current, a small current will flow from the -180v bias supply to ground through R263, V210 and V211, and R265. If for the present the effects of V209 are ignored,

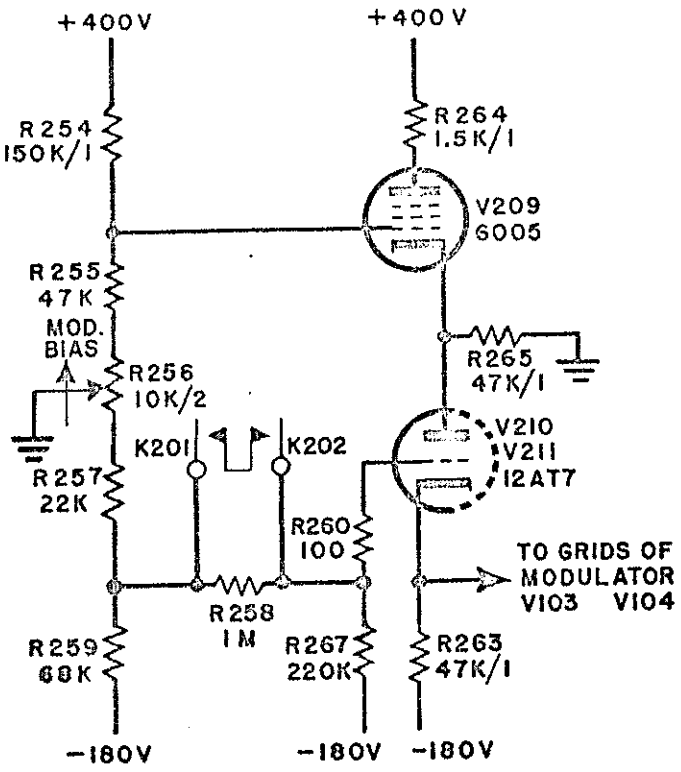


Fig. 2-16 Bias Regulator, Basic Circuit

the voltage drop developed across R263 by the plate currents of V210 and V211 will establish the cathodes of these tubes at about -45 volts when equilibrium conditions are reached. The grids of modulator tubes V103 and V104 will also be at -45 volts since they are connected to the cathodes of V210 and V211 through the secondary winding of T202. When the modulator tubes draw grid current, (from ground through R265, V210 and V211), the bias regulator cathodes tend to become more negative, reducing their own cathode-to-grid voltage. The reduced bias immediately lowers the tube internal impedance, preventing the cathode from going more negative. As the grid current drawn by the modulator increases, V210 and V211 become more conductive and offer a lower impedance to the modulator grid current. Thus, while K201 and K202 are both closed, the cathodes of V210 and V211 remain at an almost constant potential of -45 volts, the modulator bias remains fixed, and distortion is prevented.

(3) If relays K201 and K202 are not both closed, then resistor K258 (one megohm) effectively disconnects the grids of V210 and V211 from the junction of R257 and R259 (see Fig. 2-16). Instead, the grids are connected to the -180 volt bias supply through R267. The cathodes are connected to the same supply by R263. The plate currents of V210 and V211 flowing in R263 are just sufficient to maintain the cathodes of V210 and V211 at about -130 volts. This bias cuts off the modulator tubes V103 and V104. Thus the modulator cannot work unless both the driver (to close K201) and the power amplifier (to close K202) are drawing normal cathode currents. Resistor R258 is placed across the contacts of K201 and K202 to reduce sparking at the contacts. In its other effects upon the bias regulator it is equivalent to an open-circuit.

(4) Up to this time the function of the bias regulator supply tube V209 has been ignored. Its action is the same as that of the bias regulator tubes V210 and V211. Its purpose is to hold the plates of V210 and V211 at about +100 volts, instead of near ground potential as assumed for explanation purposes in the two preceding paragraphs. The grid of V209 is held at about +100 volts, by voltage divider R254, R255 and R256 across the low voltage power supply. As a result, the cathode of V209 strives to reach nearly the same potential due to plate current flowing through R264, V209 and R265. When the plate potential of V210 and V211 deviates from +100 volts, the cathode potential of V209 deviates also. The change in grid-to-cathode voltage in V209 causes the current through V209 to alter in a direction which tends to oppose any change in the cathode potential. Thus the plates of the bias regulator tubes are maintained at about +100 volts, improving their regulating action.

(5) The exact voltage at which the modulator grids are fixed is determined by the setting of R256, marked "MOD. BIAS". Adjustment of R256 alters the currents drawn by the voltage dividers R254, R255, R256 and R259, R257, R256. Thus the grid potentials of V210 and V211 and that of V209 can be set at any values within two small ranges. These grid potentials determine the equilibrium potential of the cathodes of V210 and V211, which in turn fixes the modulator bias. The modulator grid voltage may be read on the meter by plugging test prod P205 into jack J206, marked "MOD. GRID".

8. CONTROL CIRCUITS

a. Operation of Low Voltage Contactor

The low voltage contactor (or filament relay) K162 controls the a-c supply for fuses

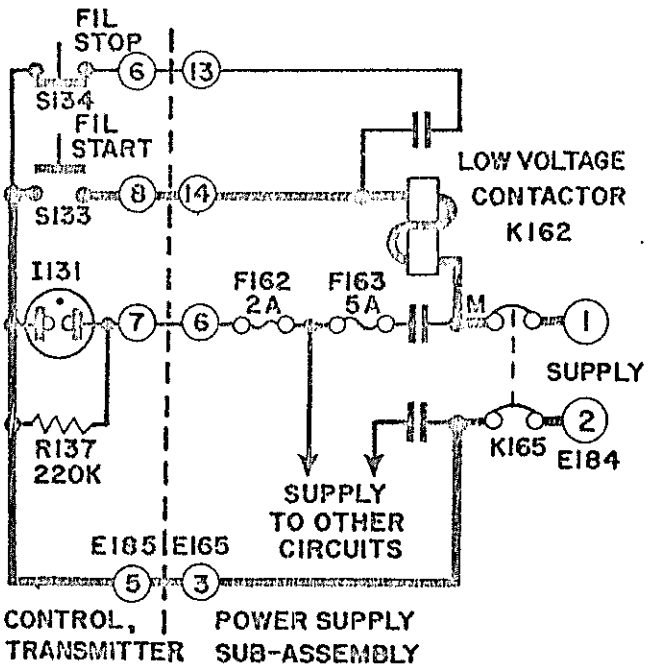


Fig. 2-17 Operation of Low Voltage Contactor, Simplified Schematic Circuit

F161, F162 and F163, after the main circuit breaker K165 has been closed. It is operated by the "FIL. START" and "FIL. STOP" switches on the front panel (see Fig. 2-17). When the "FIL. START" switch S133 is momentarily depressed, the coil of K162 is energized from the a-c supply over the circuit shown by the heavy line. As soon as K162 operates, one pair of contacts completes a holding circuit, through the normally-closed contacts of the "FIL. STOP" switch S134. Thus the coil remains energized after the "FIL. START" switch S133 is released. Other contacts of K162 switch on the a-c supply for the load circuits. A white indicator lamp I131 on the front panel, marked "FIL.", is energized through fuses F162 and F163. If this lamp fails to light, it shows that K162 has not operated, that the lamp is faulty, or that fuse F162 or F163 has blown. When the "FIL. STOP" switch S134 is depressed, it opens the holding circuit and releases K162.

b. Operation of High Voltage Contactor

(1) The circuit of the high voltage contactor (or HT relay) K161 employs the same kind of holding circuit as the low voltage contactor (see Fig. 2-18). After the main circuit breaker K165, the low voltage contactor K162 and the time delay relay K203 have been closed, the coil of K161 can be energized by momentarily depressing the "H. T. START" switch S135. As soon as K161 operates, its contacts immediately complete a holding circuit through the thermostat S137 and the normally-closed contacts of the "H. T. STOP" switch S136. Thus K161 remains energized through S136 after the "H. T. START" switch S135 is released. When the thermostat S137 opens or the "H. T. STOP" switch S136 is depressed, the holding circuit is broken and K161 releases, disconnecting the high voltage supplies.

(2) For operation from the remote control, the "START" switch S301 on the control, transmitter, is depressed (see paragraph 8. d, "Start"). If the transmitter is in the standby condition, with both main circuit breaker K165 and low voltage contactor K162 operated, depressing the "START" switch S301 causes the start relay K205 to close for an instant. The contacts of K205 (see Fig. 2-18) are effectively in parallel with the "H. T. START" switch S135 and energize the high voltage contactor K161 through the protection switches. A moment later K205 releases, but K161 remains energized due to the action of its holding circuit.

(3) When K161 closes, the red lamp I132 situated on the front panel and marked "H. T." is energized through fuse F164. To warn the operator, the high voltage warning lamp I161 (not shown in Fig. 2-18, but shown in Fig. 5-10 and Fig. 5-1) is connected in parallel with I132 and is mounted on top of the power supply subassembly inside the cabinet (see paragraph 9. f). When either of these lamps (I161, I132) is lighted, the high voltage circuits are alive. However, even though the lamps are not lighted, the high voltage circuits may still remain alive and dangerous if fuse F164 has blown or the lamps themselves have been damaged.

WARNING

WHEN CHECKING THAT THE HIGH VOLTAGE CIRCUITS ARE SAFE, DO NOT RELY ON THE WARNING LAMPS, BUT MAKE SURE ALSO THAT THE MAIN CIRCUIT BREAKER IS OFF. TAKE CARE AND STAY ALIVE!

(4) In series with the coil of relay K161 (see Fig. 2-18) there are several protective devices, which serve to prevent premature application of plate voltage and to interrupt the coil current under fault conditions. Examination of Fig. 2-18 will show that the high voltage contactor K161 cannot remain closed unless

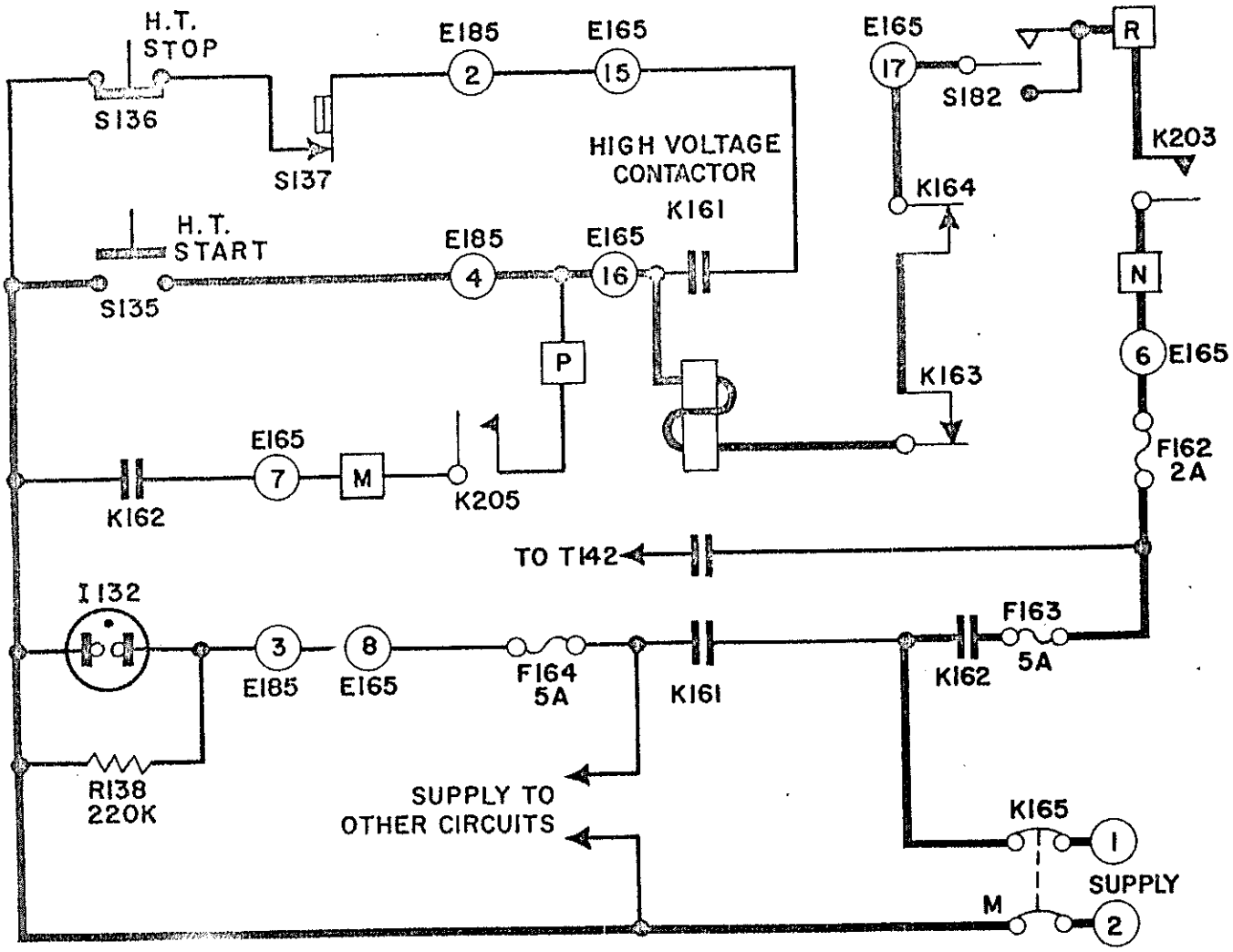


Fig. 2-18 Operation of High Voltage Contactor, Simplified Schematic Circuit

(1) the main circuit breaker K165 is closed
(2) the low voltage contactor K162 is closed
(3) fuse F163 is intact
(4) fuse F162 is intact
(5) the time delay relay K203 is energized
(6) the door switch S182 is closed (or disabled)
(7) the high voltage overload relay K164 is not energized
(8) the low voltage overload relay K163 is not energized
(9) the thermostat S137 is normal
(10) the "H.T. STOP" switch S136 is normal.

c. Time Delay

(1) The time delay circuit has three functions: it prevents premature application of plate voltage; it removes the plate voltage if the bias supply fails; with the stop circuit it

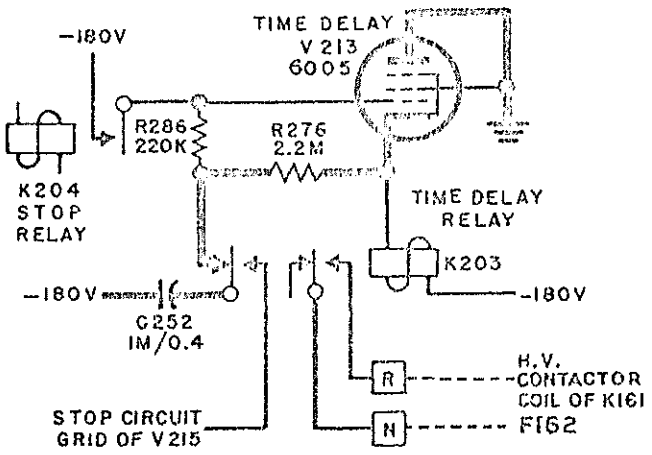


Fig. 2-19 Time Delay, Simplified Schematic Circuit

switches the transmitter to stand-by about one minute after use.

(2) To protect the tubes, the coil of the high voltage contactor K161 cannot be energised until the filaments have been on for at least 20 seconds (see paragraphs 8. b (1) and 8. b (4)). Closing the low voltage contactor K162 by pressing the "FIL. START" switch applies power to the bias supply. However, several seconds elapse before the bias supply rectifier warms up and develops the full bias voltage. The remainder of the 20-second delay is provided by the time delay circuit (see Fig. 2-19). When the bias supply comes on, C252 slowly charges through V213 and R276 (2.2 megohms). The charging current through R276 maintains the grid of V213 negative with respect to its cathode. The resulting current through V213 is too small to cause K203 to operate. As C252 approaches full charge, the voltage drop across R276 decreases, reducing the grid bias of V213 and allowing it to conduct sufficiently to operate K203.

(3) If the bias supply fails, the time delay relay K203 opens (see Fig. 2-19) and disconnects the high voltage supplies by releasing K161 (see Fig. 2-18).

(4) When the time delay relay K203 closes, C252 is transferred to the stop circuit (see Fig. 2-19, and Fig. 2-21) ready for use later in switching the transmitter to stand-by one minute after use (see paragraph 8. e).

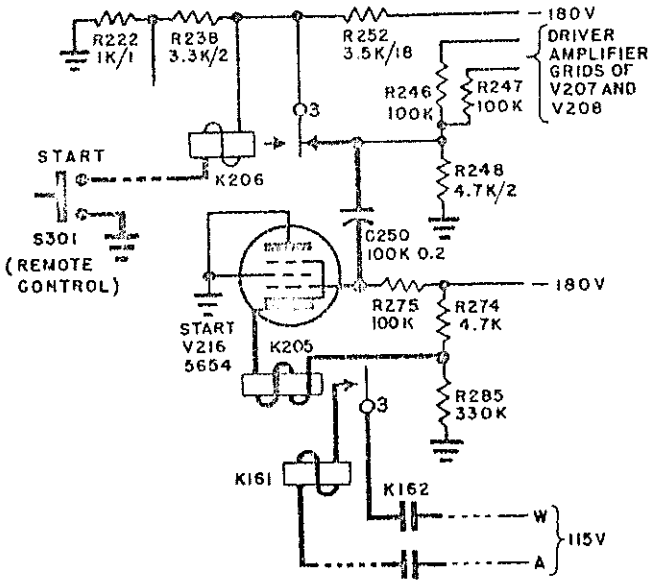


Fig. 2-20 Start, Simplified Schematic Circuit

d. Start

The transmitter high voltage supplies can be switched on locally by pressing the "H. T. START" switch S135, closing high voltage contactor K161. However, K161 can also be operated from the remote control unit (see Fig. 2-20 and Fig. 5-1). Pressing either the "START" switch S301 or the microphone press-to-talk switch grounds terminal 8 on terminal board E301. This grounds the centre of the audio pair and terminals 7 and 8 on terminal board E183. If the "REMOTE-LOCAL" switch S131 is at "REMOTE" and the transmitter has been switched on, K206 is energised from voltage divider R252, R238, R222 across the -180v bias supply. Closure of K206 removes the blocking bias from the driver amplifier tubes V207 and V208. When K206 closes, the ungrounded end of R248 suddenly undergoes a change in potential from about -90 volts to a value near ground. The positive change in potential passes through C250 to the grid of V216, driving it positive for a short time. As a result, V216 draws current from voltage divider R274, R285 across the bias supply, energizing K205, which in turn energizes K161. After K161 has operated, the charge on C250 leakes off through R275 and the bias supply. This restores the high bias on the grid of V216, cuts off its plate current, and releases K205. However, K161 remains closed through the action of its holding circuit.

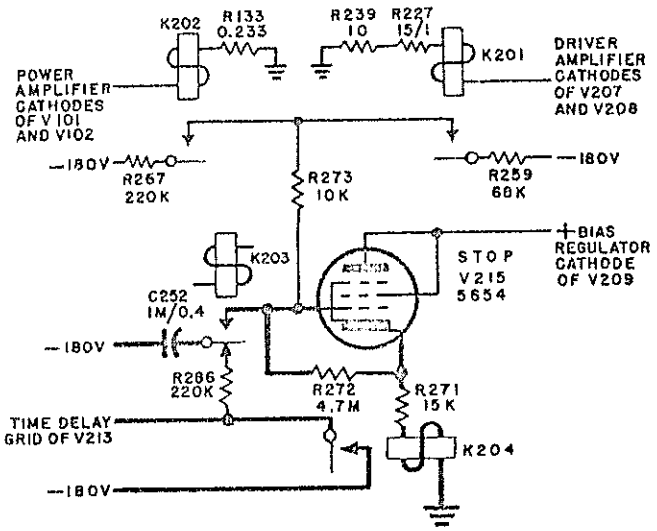


Fig. 2-21 Stop, Simplified Schematic Circuit

e. Stop

If left idle for about one minute, the transmitter automatically reverts to the stand-by condition with the plate supplies switched off by the automatic stop circuit (see Fig. 2-21). During the time the press-to-talk switch is depressed, relays K201 and K202 remain closed. The stop tube V215 is cut-off by the large negative voltage on its control grid, applied from the bias supply through R259, R267 and R273. Since K203 is energised, both sides of C252 are connected to -180v and it is uncharged. As soon as the press-to-talk switch is released, the buffer, multiplier, and driver amplifiers are cut-off, the power amplifier drive stops, and relays K201 and K202 open. This allows C252 to charge from ground through K204, R271, and R272 (4.7 megohms). As the voltage across C252 rises, the negative bias on tube V215 decreases until eventually its plate current is sufficient to energise K204. Operation of K204 connects -180v to the grid of V213, causing immediate release of K203 (see Fig. 2-19). This opens K161, disconnecting the high voltage supplies. Release of K203 also connects R286 directly across C252 (through K204 contacts), discharging C252 in preparation for the next time-delay cycle (see Figs. 2-21 and 5-17). Finally, as the plate voltage on V209 drops, K204 reopens.

9. PROTECTION

a. Primary Supply Protection

The main circuit breaker K165, which also functions as an on-off switch for the a-c supply, is of the magnetic-trip, magnetic-blowout arc-quenching type with a contact rating of 50 amperes at 250 volts. The breaker remains closed at 125 per cent overload. It trips after 1.5 sec at 200 per cent overload and in 0.25 sec at 400 per cent overload. Operation of the toggle handle after an overload resets the breaker. However, it is of the "trip-free" type and cannot be held closed during an overload.

b. Overload Relays

The power supplies are protected by two overload relays K163 and K164. The contacts of these relays are in series with the door-switch and the high voltage contactor coil (see Fig. 2-18) and their coils are connected in the ground-return leads of the low voltage and high voltage rectifier circuits respectively (see Fig. 5-10 and Fig. 5-1). They are shunted by variable wirewound 25w resistors R162 and R161, the settings of which control the exact trip currents. If these currents are exceeded, the relays operate, release K161, and remove the high voltage supplies from the equipment. The overload relays are automatically reset when the equipment is switched off. It should be noticed that the overload relays are not in circuit with the filter capacitors C141, C142 and C181, C182. In the unlikely event that one of these should fail, the resultant short-circuit would trip the main circuit breaker K165.

c. Thermostat

The thermostat S137 opens the high voltage contactor K161 whenever the air temperature at the top of the cabinet exceeds 65°C (149°F).

d. Fuses

Four instantaneous type fuses are mounted on the front of the power supply sub-assembly. A receptacle for the storage of a spare fuse of the same rating is provided next to each active fuse. The fuse ratings and the circuits supplied by each fuse are listed in Table 2-3 (see also Fig. 2-7). Current for fuse F162 is drawn from fuse F163. Failure of either of these fuses releases relay K161 and disconnects the high voltage supplies.

TABLE 2-3

FUSE RATINGS AND CIRCUITS SUPPLIED
Fuse F161: Rating 3AG 250v, 3 amp T161 Filaments of high voltage rectifier B181 Fan T141 Filaments of low voltage rectifier and clamps
Fuse F162: Rating 3AG 250v, 2 amp I131 "FIL." lamp T203 Bias supply and transmitter sub-assembly heaters K203 Time delay relay
Fuse F163: Rating 3AG 250v, 5 amp T142 Plates of low voltage rectifiers F162 See above
Fuse F164: Rating 3AG 250v, 5 amp I132 "H.T." lamp I161 High voltage warning lamp T101 Filaments of modulator and power amplifier

e. Door Switch

A safety door switch S182 is connected in series with the coil of the high voltage contactor K161 in the power supply sub-assembly (see Fig. 2-18). When the cabinet door is shut, the switch remains closed, but opens automatically and removes the high voltage supplies whenever the door is opened. When the door is open, the safety switch can be disabled by pulling it forward; it is automatically reset when the door is closed.

WARNING

LETHAL VOLTAGES EXIST AT VARIOUS POINTS IN THE TRANSMITTER. WHEN MAKING TESTS WITH THE DOOR SWITCH DISABLED, TAKE CARE AND STAY ALIVE!

f. High Voltage Warning Lamp

A high voltage warning lamp I161, shunted by R163, is mounted on the power supply sub-assembly and is supplied from fuse F164 (see Figs. 1-9 and 5-10). When the lamp is on, the high voltage circuits are alive. However, due either to failure of the lamp itself or to blowing of fuse F164, dangerous voltages may continue to exist inside the transmitter cabinet even though the warning lamp is not lighted.

WARNING

WHEN CHECKING THAT THE HIGH VOLTAGE CIRCUITS ARE SAFE, DO NOT RELY ON THE WARNING LAMP, BUT MAKE SURE ALSO THAT THE MAIN CIRCUIT BREAKER IS OFF. TAKE CARE AND STAY ALIVE!

10. METERING CIRCUITS

a. Metering

A single meter M131 on the front panel at the top of the transmitter provides metering at essential points within the equipment (see Fig. 5-1). The meter, shunted by r-f by-pass capacitor C130, is connected to the two moving arms of meter switch S132. The cathode currents of the modulator and power amplifiers pass through the secondary windings of filament transformer T101 and then through metering resistors R132 and R133 respectively. An indication of antenna voltage is obtained through the use of the crystal CR181, which is situated in the r-f indicator unit at the top rear left side of the cabinet. The antenna voltage causes a small r-f current to flow into the crystal through capacitor C183. The resultant direct current is fed by RG-59/U coaxial cable through resistor R134 and S132 (in the "ANT." position) to the meter. To give a convenient meter deflection resistor R134, marked "ANT.", can be adjusted to suit the antenna loading and the power output. All other metering is accomplished by switching S132 to "TEST+" (red jacks) or "TEST-" (green jacks) and inserting test prod P205 into the appropriate jack on the transmitter sub-assembly. Typical meter readings are given in Tables 7 and 8 of EO 35BD-5FRT501-10, "Fitting Instructions", and also on the inside of the cabinet door.

PART 3

PREVENTIVE MAINTENANCE PROCEDURES

GENERAL

To ensure continuous good service the transmitter should be regularly cleaned, inspected, and adjusted in accordance with this order and EO 35BD-5FRT501-7, "Preventive Maintenance Schedule".

ITEM NO. 1, METER READINGS

Check and record all the meter readings, in accordance with the table on the inside of the cabinet door. A gradual change in a meter reading is often an indication of impending trouble. Most meter readings will vary slightly with the supply voltage and with tuning adjustments, but significant changes should be investigated promptly.

ITEM NO. 2, TUNING

The tuning should be checked each time the frequency of operation of the transmitter is altered. If the frequency is not often altered, it is advisable to recheck the tuning daily, following the procedure recommended in EO 35BD-5FRT501-1, "Operating Instructions".

ITEM NO. 3, FAN

Open the cabinet door and switch on the ventilating fan by pressing the "FIL. START" switch on the transmitter front panel. Listen to the fan for signs of vibration or wear. It should run silently. It does not require lubrication.

ITEM NO. 4, RELAYS AND CONTACTORS

The small relays are sealed and should not require maintenance. Inspect the contactors and clean them if necessary. Do not use carbon tetrachloride for this purpose since a film will be left on the contacts and this may lead to pitting. If the contacts are badly pitted, clean them first with fine sandpaper, then with crocus cloth, and finally with a burnishing tool. With the MAIN CIRCUIT BREAKER OFF, check relay K101 in the power amplifier sub-assembly, operating it by hand. Inspect its contacts; if they are badly blackened or pitted, clean them. Inspect and tighten all contactor terminals.

ITEM NO. 5, GENERAL MECHANICAL INSPECTION

Without removing anything from the cabinet, examine the equipment carefully for dust and signs of arcing, overheating or discolouration. For this purpose, loosen the slide fasteners on the transmitter and power supply sub-assemblies and tilt them forward on their pivots. Examine and tighten all screw-type terminals. Remove the cover from the back of the transmitter sub-assembly and examine all the parts underneath. Replace the cover and secure the two sub-assemblies in their normal positions. Go behind the transmitter and examine the air intake and outlet grills, and the antenna studs and connections. Clean and tighten as necessary.

ITEM NO. 6, DUST FILTER

The air filter may need cleaning every few weeks or once in many months, depending upon the amount of dirt in the air. When inspection discloses dirt, the filter should be removed and replaced by the spare. Loosen the locking screw just above the power supply on the inside of the cabinet rear wall. Then reach behind the transmitter and lift the filter upwards and outwards. Clean the filter opening and check the fan. Then fit the spare filter. DO NOT try to clean the filter by brushing off the dirt - this mats the dirt and makes the filter more difficult to wash. The dirty filter can be cleaned with a hose, using hot water, or it can be held under a faucet. The direction of water flow should be from the clean side (which normally faces inside the cabinet). Then soak the filter for two minutes in hot water (80°C or 176°F) mixed with ordinary washing soda (1-1/2 lb to 10 gallons water) or with Reed Cleaning Compound (1 lb to 10 gallons water). Move the filter up and down vigorously to force the water through the filter. When removing the filter from the washing tank, drive floating dirt to one side and slide out the filter edgeways through the water surface. After cleaning, dry completely and spray (or dip) with Viscosine

(Grade DBA, American Air Filter of Canada Ltd.). Allow to drain 12 hours or longer. Place in storage as the new spare.

ITEM NO. 7, DETAILED MECHANICAL INSPECTION

Examine the entire equipment as in the general mechanical inspection described above. Remove the major sub-assemblies from the cabinet and check and clean them on the work bench. Inspect and tighten all terminal connections and interconnecting cables and plugs. Confirm that all fuses (active and spare) are of the correct ratings. Check all tube plate cap connections. Before separating the tuner and control panel from one another note the dial and capacitor positions so that they can be restored to the same settings (see Part 4, paragraph 2. c, "Fitting Control Panel to Tuner").

ITEM NO. 8, SWITCH ALIGNMENT

During the detailed mechanical inspection remove the control panel from the tuner and check the rotary switches. It is important that the contacts remain aligned and secure on their shaft; otherwise the wipers may bridge two contacts and damage the meter. While the cover is off the control panel, examine the thermostat and all the screw-type connections. Clean and tighten where necessary.

ITEM NO. 9, TUNER

Examine the tuner for signs of arcing or pitting. Verify that all taps and links make good contact. Oil lightly the tuning mechanism and bearings of capacitor C126 using any thin machine oil. One drop in each bearing is enough. Spread a very small quantity of light grease on the tuning mechanism gears. When replacing the control panel on the front of the tuner verify that the dials and tuning mechanism mesh properly and that the readings give the same calibration as before (see Part 4, paragraph 2. c). This will be easier if the tuning controls are set to the end of their travel (0 and 000) BEFORE the unit is taken apart.

ITEM NO. 10, OVERLOAD RELAY ADJUSTMENT

The setting of the overload protection relays K163 and K164 is best checked during the detailed mechanical inspection when the power supply sub-assembly is on the bench. A test circuit consisting of a 0-1000 ma d-c milliammeter in series with a variable low-voltage d-c source is necessary. Stand the power supply upright on the bench in the same position that it would occupy in service. Connect an ohmmeter, or dry cell in series with a telephone headset, between terminals 16 and 17 on E166 in order to observe when the relays operate. Connect the d-c source in series with the meter successively across the coils of relays K163 and K164, and so adjust the associated shunt resistances that the relays close when the milliameter indicates the currents listed in Table 3-1.

TABLE 3-1

OVERLOAD RELAY OPERATING CURRENTS			
Relay	Connect Voltage Source Between Terminals	Adjust Resistance	Operating Current
K163	26 and 24 (ground)	R162	250± 10 ma
K164	25 and 24 (ground)	R161	640± 15 ma

PART 4
SUPPLEMENTARY DATA

1. FAULT LOCATION

a. General

The cause of a fault is frequently obvious. Where it is not, symptoms should be examined in conjunction with the master schematic and block diagrams. To avoid repeated failures, the actual source of any damage must be found. A burned resistor, for example, may really be due to overload by a seemingly good, but actually leaky, capacitor.

b. Fuse Ratings

Four active, instantaneous type fuses are situated on the front of the power supply sub-assembly near the main circuit breaker. Next to each fuse there should be a spare fuse of the same rating, according to Table 4-1.

TABLE 4-1

FUSE RATINGS	
Fuse	Rating
F161	3AG, 250v, 3 amp
F162	3AG, 250v, 2 amp
F163	3AG, 250v, 5 amp
F164	3AG, 250v, 5 amp

c. Tube Testing

The smaller vacuum tubes can be tested on a tube checker. The easiest way to prove the condition of a suspected tube is to substitute for it a tube known to be good. If this fails to clear the fault and leaves the meter readings almost unchanged, the original tube should be replaced. Tube types are given in Table 4-2 and pin connections in Fig. 4-1.

d. Current Measurements

The meter and switch situated on the control panel allow many currents to be checked while the transmitter is in operation. Any meter reading which differs by more than 20 per cent

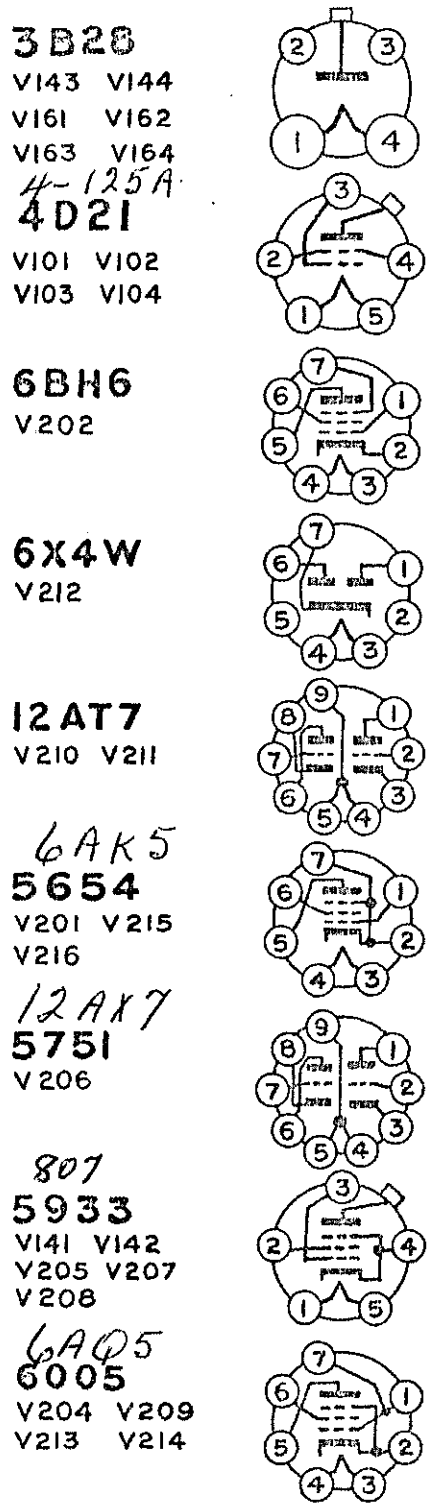


Fig. 4-1 Tube Pin Connections

from that given in Fig. 5-1 should be investigated. The procedure for checking the current overload settings is given under "Preventive Maintenance Procedures" in Part 3, Item No. 10.

e. Voltage Measurements

(1) When the transmitter is in operation, most terminals at which voltage checks might be desired cannot be reached safely. Thus the voltage tables contain only those values which are of use in fault-tracing.

WARNING

LETHAL VOLTAGES (UP TO 2500 VOLTS) EXIST AT MANY POINTS WHEN THE TRANSMITTER IS IN OPERATION. TAKE CARE AND STAY ALIVE!

(2) To check the supply distribution voltages, use an a-c voltmeter or 115v lamp equipped with test prods. With the transmitter switched on and normal, measure the voltages between the following pairs of terminals on terminal boards E165, E166 of the power supply sub-assembly:
1-2, 1-4, 1-7, 1-11, 1-14 and
2-5, 2-6, 2-8, 2-10, 2-12.
They should all be equal to the supply voltage (115v ac).

(3) Many circuits in the transmitter sub-assembly can be checked by voltage measurements between the tube pins and ground.

CAUTION

WHEN THE TRANSMITTER SUB-ASSEMBLY IS HINGED DOWN, THE BIAS CONNECTION P201-J101 IS BROKEN: APPLICATION OF PLATE VOLTAGE IN THIS CONDITION WILL DESTROY THE POWER AMPLIFIER TUBES.

Before making tube-pin voltage measurements first disable the high-voltage plate supply by disconnecting the leads to terminals 11 and 12 of E165 on the power supply sub-assembly. Also, to protect the modulator screen grids, disconnect lead 11 from E108 on the amplifier sub-assembly. Connect a short piece of wire between terminal 6 of E165 and terminal 17 of E166 to keep the low voltage power supply working. Release the fasteners holding the transmitter sub-assembly and turn it face downwards. Remove the rear cover plate. Cover P201 with a piece of paper.

NOTE

A SEVERE SHOCK (-180 VOLTS) CAN BE OBTAINED FROM THE EXPOSED TOP OF PLUG P201 WHEN MEASUREMENTS ARE MADE WITH THE TRANSMITTER SUB-ASSEMBLY HINGED DOWN.

(4) Tables 4-3 and 4-4 give the voltages between each tube pin and ground for all tubes in the transmitter sub-assembly. The values were measured under the following conditions: coils in X206 and X208, no coil in X220, the "REMOTE-LOCAL" switch at "LOCAL", the crystal removed, the "R. F. GAIN" and "A. F. GAIN" controls turned fully clockwise, the meter switch at "TEST-", and the test prod in jack J208, marked "BIAS RECT. "The "Tune Operate" switch shall be in "Tune" position.

f. Resistance Measurements

(1) Table 4-5 gives the resistance in ohms between each tube pin and ground for all tubes in the transmitter sub-assembly. The values were measured under the following conditions: no coils in place, all tubes in place, the "R. F. GAIN" and "A. F. GAIN" fully clockwise, P202, P203, J211, J212 disconnected (transmitter sub-assembly on bench). Values too high to be measured are denoted by "I" (Infinite). Values too low to be measured are marked "0". The "Tune Operate" switch shall be in "Tune" position and the test prod in jack J208.

(2) The resistance in ohms between each terminal and ground is given in Table 4-6 under two conditions: "In Cabinet", with the unit completely connected to the transmitter (switched off); "On Bench", with all external connections removed. "In Cabinet" values were measured under the following conditions: key up, the main circuit breaker "OFF", the "REMOTE-LOCAL" switch at "LOCAL", the meter switch at "P. A. " The letter "C" next to a value indicates that the meter reading rises slowly to the value given, due to the charging of a capacitor. The letter "C" alone indicates that the meter rises slowly to a very high value. A dash indicates a spare terminal.

g. Circuit and Component Tests

After all other methods have failed to show the source of a fault, a circuit and component check should be made. Remove the sub-assembly from the cabinet and check each part against the master schematic circuit diagram, and against EO 35BD-5FRT501-4, "Part List Transmitter AN/FRT-501". Resistors should

TABLE 4-2

VACUUM TUBES, DESIGNATIONS AND FUNCTIONS

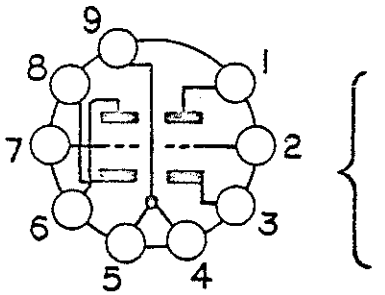
Location	Circuit Ref Symbol	Function	Type
Amplifier Sub-Assembly	V101	Power Amplifier	4D21
	V102	Power Amplifier	4D21
	V103	Modulator	4D21
	V104	Modulator	4D21
Power Supply	V141	Clamp	5933
	V142	Clamp	5933
	V143	Low-Voltage Rectifier	3B28
	V144	Low-Voltage Rectifier	3B28
Power Supply Sub-Assembly	V161	High-Voltage Rectifier	3B28
	V162	High-Voltage Rectifier	3B28
	V163	High-Voltage Rectifier	3B28
	V164	High-Voltage Rectifier	3B28
Transmitter Sub-Assembly	V201	Oscillator	5654
	V202	Buffer	6BH6
	V204	Multiplier	6005
	V205	Intermediate Power Amplifier	5933
	V206	Input Amplifier	5751
	V207	Driver Amplifier	5933
	V208	Driver Amplifier	5933
	V209	Bias Regulator Supply	6005
	V210	Bias Regulator	12AT7
	V211	Bias Regulator	12AT7
	V212	Bias Rectifier	6X4W
	V213	Time Delay	6005
	V214	Bias Isolator	6005
	V215	Stop	5654
	V216	Start	5654

TABLE 4-3

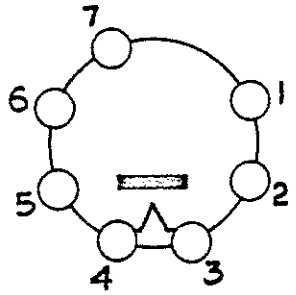
TUBE SOCKET VOLTAGES (20,000 ohms-per-volt voltmeter)

Circuit Ref Symbol	Volts from Pin to Ground								
	1	2	3	4	5	6	7	8	9
V206	150	0	1.2	6.3ac	6.3ac	140	0	1.2	0
V210	115	-150	-135	-135	-135	115	-150	-135	-135
V211	115	-150	-135	-135	-135	115	-150	-135	-135
V201	0	2.2	0	6.3ac	230	110	2.2		
V202	-35	-16	0	6.3ac	345	55	-16		
V204	-38	0	0	6.3ac	350	55	-38		
V209	90	115	115	115	370	370	90		
V212	-180	0	0	6.3ac	0	-180	18		
V213	-180	-160	-160	-160	0	0	-180		
V214	-175	-160	-160	-160	-2.2	-2.2	-175		
V215	0.05r	65	0	6.2ac	115	115	65		
V216	-178r	-175	-160	-160	0	0	-175		
V205	0	310	0	25	6.2ac	Plate Cap = 400			
V207	0	400	-65	0	6.2ac	Plate Cap = 400			
V208	0	400	-65	0	6.2ac	Plate Cap = 400			

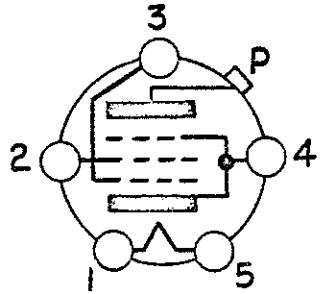
Values marked ac are alternating current; all others are dc. Relay closes (listen for click) when meter is connected to pins marked "r".



9-PINS



7-PINS



5-PINS

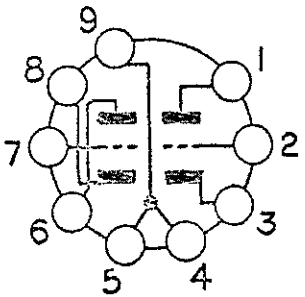
CAUTION

Before Using This Table Read Paragraph (3) of Section 1, e, "VOLTAGE MEASUREMENTS."

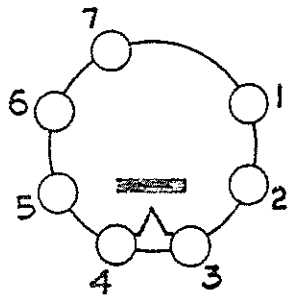
TABLE 4-4

TUBE SOCKET VOLTAGES (1,000 ohms-per-volt voltmeter)

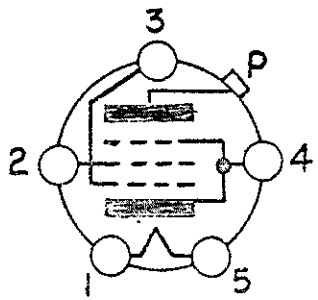
Circuit Ref Symbol	Volts from Pin to Ground								
	1	2	3	4	5	6	7	8	9
V206	135	0	1.2	6.2ac	6.2ac	125	0	1.2	0
V210	115	-95	-120	-120	-120	115	-95	-120	-120
V211	115	-95	-120	-120	-120	115	-95	-120	-120
V201	υ	2	0	6.3ac	220	105	2		
V202	-8.2	-16	0	6.3ac	320	55	-16		
V204	-30	0	0	6.3ac	355	55	-30		
V209	75	115	115	115	370	370	75		
V212	-180	0	0	6.3ac	0	-180	18		
V213	-180	-160	-160	-160	0	0	-180		
V214	-125	-160	-160	-160	-2	-2	-125		
V215	Or	65	0	6.2ac	115	115	65		
V216	-125r	-180	-160	-160	0	0	-180		
V205	0	310	0	25	6.2ac	Plate Cap = 385			
V207	0	380	-50	0	6.1ac	Plate Cap = 385			
V208	0	380	-50	0	6.1ac	Plate Cap = 385			



9-PINS



7-PINS



5-PINS

CAUTION

Before Using This Table Read Paragraph (3) of Section 1.e, "VOLTAGE MEASUREMENTS."

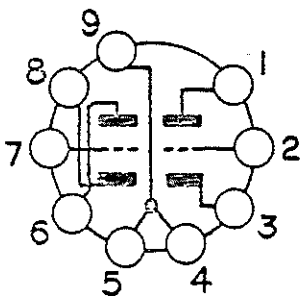
TABLE 4-5

TUBE SOCKET RESISTANCES TO GROUND

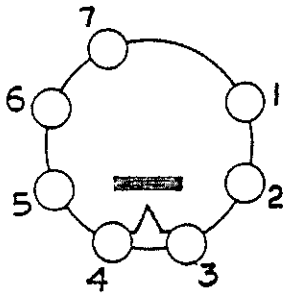
Circuit Ref Symbol	Ohms from Pin to Ground								
	1	2	3	4	5	6	7	8	9
V206	90K	2.6K	500	0	0	80K	2.6K	500	0
V210	47K	180K	40K	40K	40K	47K	180K	40K	40K
V211	47K	180K	40K	40K	40K	47K	180K	40K	40K
V201	47K	250	0	0	85K	150K	250		
V202	15K*	1.5K	0	0	130K	150K	1.5K		
V204	110K	470	0	0	I	120K	110K		
V209	40K	47K	47K	47K	80K	80K	40K		
V212	5K	I	0	0	I	5K	350		
V213	2.5M	12K	35K	35K	0	0	2.5M		
V214	110K	35K	35K	35K	3K	3K	110K		
V215	4.7M	16K	0	0	45K	45K	12K		
V216	100K	8K	35K	35K	0	0	8K		
V205	0	90K	15K	400	0	Plate Cap = I			
V207	0	100K	100K	200	0	Plate Cap = 75K			
V208	0	100K	100K	200	0	Plate Cap = 75K			

Multiplying Factors: K = 1,000, M = 1,000,000. I = Infinite

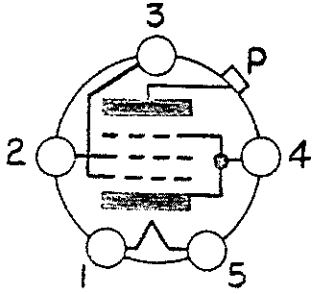
*Reverse meter leads when reading too high.



9-PINS



7-PINS



5-PINS

be within the indicated tolerances, taking into account possible error in the ohmmeter. Capacitors should be tested for open and short circuits. The d-c resistances of chokes and transformers should be within 15 per cent of the values listed in Tables 4-7 and 4-8. When test equipment is available, inductance values measured at 1000 cps may be compared with Table 4-7. All defective parts should be replaced.

TABLE 4-6

TERMINAL RESISTANCES

Condition	Ohms From Terminals to Ground	Ohms Between Terminals
E108	Amplifier Sub-Assembly	In Cabinet 2-13: 36K; 2-14: 36K
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	On Bench 5-6: 1.5; 11-12: 14K; 13-14 (with K101 open): I; 13-14 (with K101 closed): 0
In Cabinet	- 85K - 20 I I 0 40K 40K 0.223 8K 0 120K 120K 120K	
On Bench	- I - I I I 0 ——— Infinite ———	
E157	Power Supply	In Cabinet 7-8: 1.2; 11-12: 1.2
	1 2 3 4 5 0 7 8 9 10 11 12	On Bench 7-8: 6; 11-12: 1; 2-10: C; 1-5: 100K; 2-3: 20K
In Cabinet	85K 8K 10K - 20K 0 I I 3K 0.3 I I	
On Bench	85K 40K 20K - 22K 0 I I I C I I	
E165 E166	Power Supply Sub-Assembly 1 2 3 to 17 23 24 25 26 27 28 29 30	In Cabinet 3-13: 0; 3-6: 220K; 3-7: 220K; 3-8: .1; 3-9: 0; 4-5: 1.2; 11-12: 0; 25-30: 120K; 28-29: 18
In Cabinet	Alive! Do Not Measure Infinite 0 0 Do not disturb settings of R161, R162 - I I 120K	On Bench 3-8: 220K; 3-12: 220K; 4-5: 3; 5-6: 0; 8-10: I; 16-17: 35
On Bench	Infinite 0 0 - I I I	
E185	Control Transmitter	On Bench 2-3: 220K; 2-4: I; 6-7: 220K; 6-8: I
	1 2 to 8 9 10 11 12 13 14 15 16 17 18 19 20	On Bench 13-14 (S131 at "REMOTE"): Varies with R131
In Cabinet	- I 8K I 8K 18 3K I 2.5K* 0.223 0.223 - 300K 0	
On Bench	- ——— Infinite ——— 0.223 0.223 - I 0	
	Transmitter Sub-Assembly	On Bench P201-to-ground: 40K
	A B C D E F G H I J K L M N P R	P202: B-I: 10K; D-E: 30; E-F: 32
On Bench Plug P202	- 3K - I - - 18 - 9K 300K I - - 0 None	P203: E-F: 120; K-L: 16; M-N: 3.5; M-P: I; N-R: I
Plug P203	0 80K 0 - 40K 40K 110K - None 3 300K* C 300K* C I Infinite	

* Reverse meter leads when reading to high.

TABLE 4-7

CHOKES, RESISTANCES AND INDUCTANCES				
Location	Circuit Ref Symbol	Resistance Ohms (d-c)	Inductance (Without dc)	Measuring Voltage (1000 cps)
Amp Sub-Assembly	L101	2	135uH	-
Tuner	L123	12	135uH	-
Power Supply	L141	125	12H	2.6v
Cabinet	L181	50	16H	3.2v
Transmitter Sub-Assembly	L201	20	500uH	-
	L203	12	135uH	-
	L205	400	13.5H	2.6v

TABLE 4-8

TRANSFORMERS, WINDING RESISTANCES					
Location	Circuit Ref Symbol	Primary Winding		Secondary Winding	
		Terminals	Ohms	Terminals	Ohms
Amplifier Sub-Assembly	T101	1 - 2	1.1	3,4 - 6,7	0.008
				8,9 - 11,12	0.009
Power Supply	T141	1 - 2	7.3	3 - 4	0.09
				5,6 - 7,8	0.008
	T142	4 - 5	1.7	1 - 3	103
Power Supply Sub-Assembly	T161	7 - 8	3.5	1 - 2	0.7
				3 - 4	0.02
				5 - 6	0.02

TABLE 4-8 (Continued)

TRANSFORMERS, WINDING RESISTANCES					
Location	Circuit Ref Symbol	Primary Winding		Secondary Winding	
		Terminals	Ohms	Terminals	Ohms
Cabinet	T181	4,5 - 6,7	0.04	1 - 3	16
	T182	4 - 5	40	1 - 3	80
Transmitter Sub-Assembly	T201	4 - 5	7.6	1 - 3	5,200
		6 - 7	35		
		8 - 9	35		
	T202	1 - 3	125	4 - 6	125
	T203	4 - 5	4.2	1 - 3	200
				6 - 7	0.2
				8 - 9	0.2
				10 - 11	
				12 - 13	
Control, Transmitter	T301	4 - 5	7.6	1 - 3	5,200
		6 - 7	35		
		8 - 9	35		

2. SPECIAL PROCEDURES

a. General

(1) The "PLATE" tuning capacitor C121 is operated from the front panel by a system of flexible couplings and bevel gears. When the transmitter is assembled in the factory, this drive is adjusted so that the ranges of travel of the tuning mechanism and the capacitor correspond with each other and with the dial calibration. These adjustments should not be disturbed unless it is necessary to replace a damaged part.

(2) Capacitor C202 is adjusted in the factory and then marked to give the exact stray capacitance for correct operation of the crystal. Its setting should not be upset unnecessarily, since special test equipment is required for its correct adjustment.

(3) The procedure for adjusting the settings of the overload relays K163, K164 is given under "Preventive Maintenance Procedures" in Part 3, Item No. 10.

b. Removing Tuner, Radio Frequency, and Control, Transmitter, Together.

(1) Disconnect the three antenna links

from the tuner output terminal board inside the top of the cabinet.

(2) Disconnect the upper ends of the metal strips connecting the tuner to the amplifier sub-assembly and to ground.

(3) Remove all wires from the upper terminals of terminal board E185.

(4) Remove the two bolts holding the lower front corners of the tuner and slide it forward about one inch.

(5) Thread the cable above E185 up the cabinet left wall, at the same time sliding the tuner forward and out of the cabinet.

c. Fitting Control Panel to Tuner

(1) To obtain access to the rear of the control panel, the control panel must be separated from the tuner by removing the six control panel bolts. Before re-assembly, the tuning mechanism and dial should be adjusted for alignment as follows:

i Set C126 in the tuner at minimum capacitance (plates fully out), so that the slot in its tuning disc is pointing straight down.

ii Turn C121 clockwise to the limit of its travel; then turn it back exactly one-half turn, so that the slot in its tuning disc is also pointing straight down.

iii Set the "ANT." control knob at 0 and the "PLATE" control knob at 000.

iv Examine the rear of the control panel. The pins on both tuning discs should be exactly below their shafts.

v Place the control panel on the front of the tuner, making sure that the pins enter their slots.

vi Secure the six panel bolts.

vii Verify that the "ANT." and "PLATE" controls operate their respective capacitors and that the tuning drive turns freely.

d. Replacing "PLATE" Tuning Capacitor C121

(1) Remove the tuner and control panel from the cabinet without separating them.

(2) Set the "PLATE" tuning control at 000 and tighten its lock.

(3) Working from the back of the tuner, remove padding capacitor C122 and put it aside.

(4) Remove the four bolts holding C121 and slide it out.

(5) Unpack the new C121 and by hand turn its shaft clockwise to the limit of its travel.

(6) Then turn the shaft back exactly one-half turn anti-clockwise.

(7) Without altering this setting, slide the new C121 into its mount so that its tuning spindle engages the tuning mechanism coupling. Examine the bolt holes. They should be close to correct alignment. If not, withdraw the capacitor, advance the "PLATE" tuning control suitably (not beyond 003) and re-insert the capacitor. Correct bolt-hole alignment should be obtained with the capacitor exactly one-half turn from the end of its travel and the "PLATE" tuning control set between 000 and 003.

(8) Secure the capacitor mounting bolts and check that the tuning mechanism works freely over its full range.

(9) Replace padding capacitor C122 and secure it by binding wire across its clips.

(10) Replace the tuner in the cabinet and reconnect all its leads.

e. Removing Fan Bearings

CAUTION

WHILE REMOVING THE FAN MOTOR END-HOUSINGS, TAKE CARE NOT TO DAMAGE THE MOTOR WINDINGS, WHICH LIE IMMEDIATELY BELOW THE INNER EDGES OF THE END-HOUSINGS.

The bearings of the ventilating fan are a press fit on the fan shaft and a special extractor tool (Canadian Marconi Company, type 308-248) is necessary for their removal. The dismantling procedure is as follows:

i Slide the outer loose collar back from the two jaws.

ii Fit the jaws over the bearing with the tip of each jaw locked behind the outer race of the bearing (loosen the centre set-screw if necessary).

iii Replace the outer loose collar over the jaws.

iv Tighten the centre set-screw into the shaft until the bearing is removed from its seating.

3. ADDITIONAL DATA

a. General

Detailed characteristics of the transmitter are given in Part 1, section 3, "Electrical Summary", and Part 1, section 4, "General Mechanical Features". Colour codes are given in Part 1, sections 5 and 6, of EO35BD-5FRT-501-4, "Part List Transmitter AN/FRT-501".

b. Power Demand under Various Conditions

The volt-ampere input needed by the equipment changes with the supply voltage and the operating conditions. Values measured on a typical transmitter are given in Table 4-9. Some variations are to be expected, depending upon the tuning and antenna loading.

c. Electrical Characteristics of Recommended Antennas

Almost any standard antenna suitable for the transmitter frequency range may be used. However, for best output the transmitter and antenna feeder should be matched. The tuner is designed to match balanced loads from 500 ±j600 ohm to 700 ±j600 ohm and unbalanced loads from 30 ±j50 ohm to 70 ±j50 ohm in the frequency range 2.5 to 10.0 mc. Outside these frequency limits a slight mismatch can occur, depending on the line impedance. As a result, slightly reduced power output is to be expected with high-impedance lines at frequencies below 2.5 mc and with low-impedance lines above 10 mc.

TABLE 4-9

VOLT-AMPERE DEMAND, TYPICAL VALUES FOR NORMAL OPERATION					
Input Voltage	Stand-by	"C. W."		"R. T."	
		Key-up	Key-down	Carrier	90 per cent Mod
103.5v	223va	715va	1357va	1553va	2030va
115.0v	282va	943va	1598va	1840va	2233va
126.5v	348va	1303va	1923va	2202va	2530va
Low power operation on "R. T." at 90 per cent modulation required 1472va in a typical transmitter.					

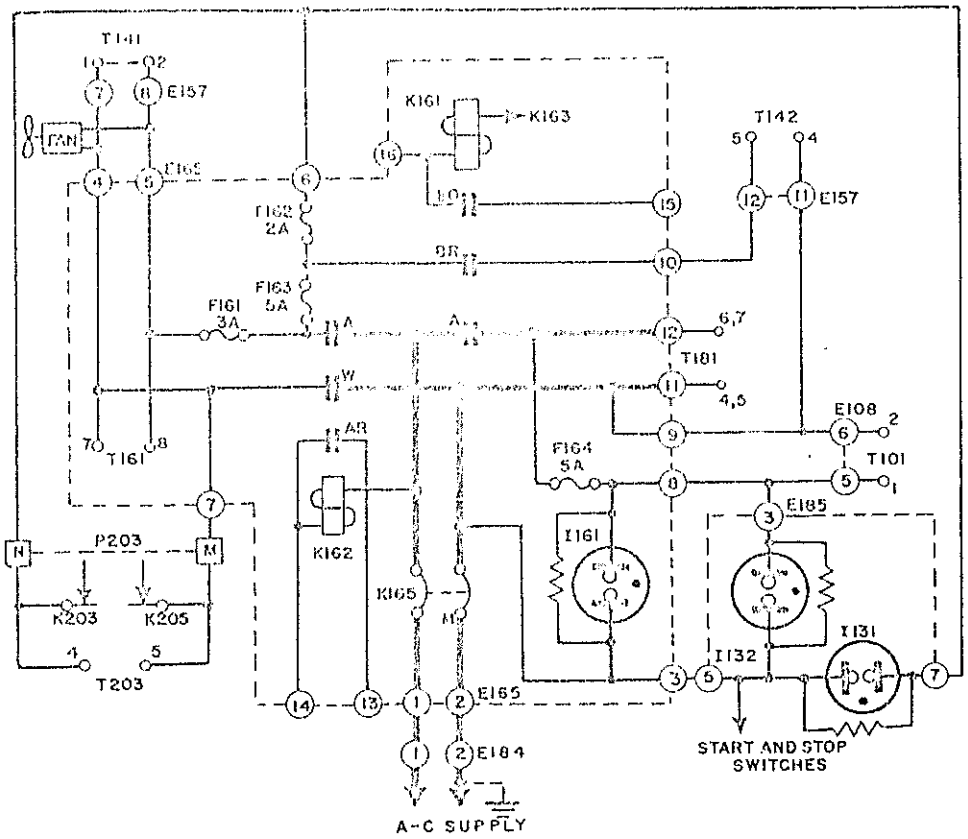


Fig. 5-3 A-C Supply Distribution, Simplified Schematic Circuit

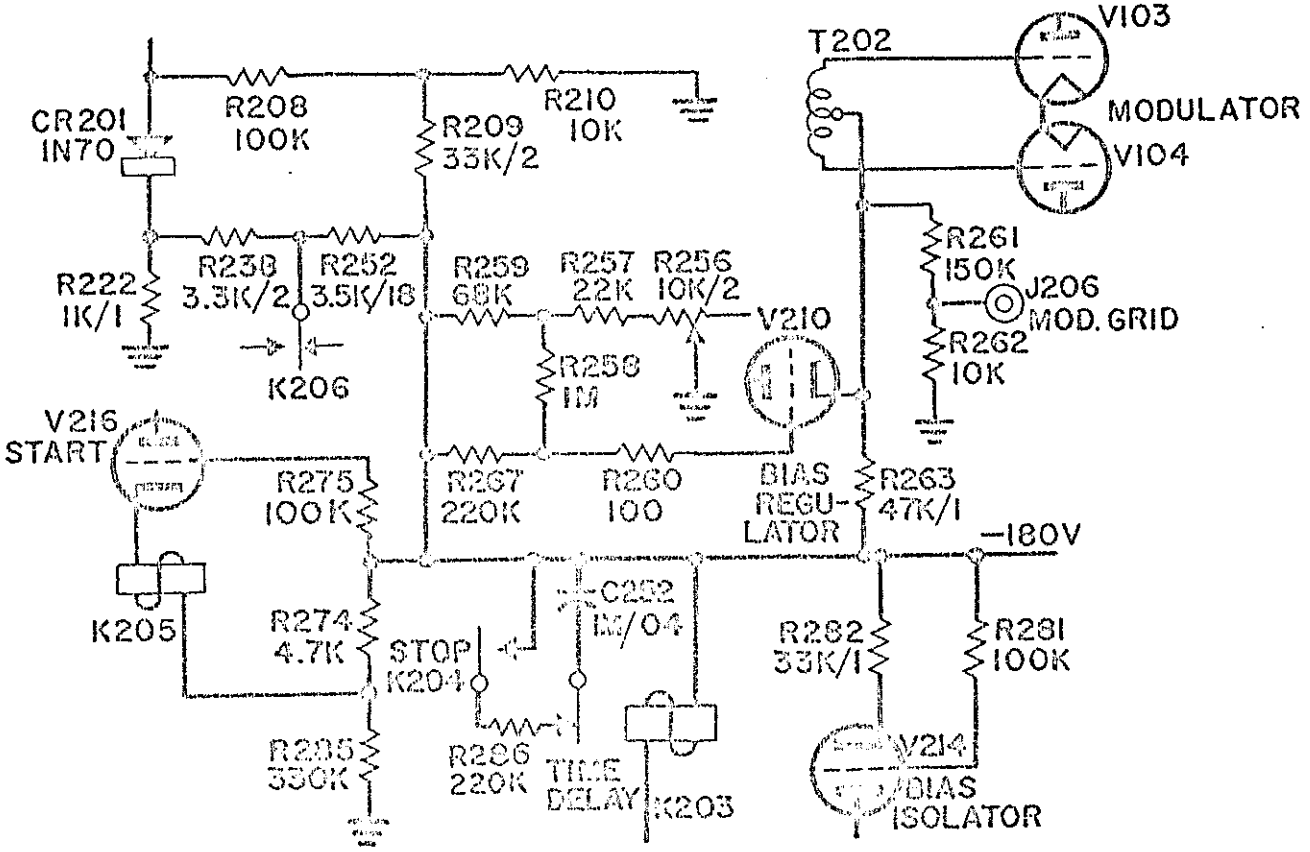


Fig. 5-4 Bias Supply Distribution, Simplified Schematic Circuit

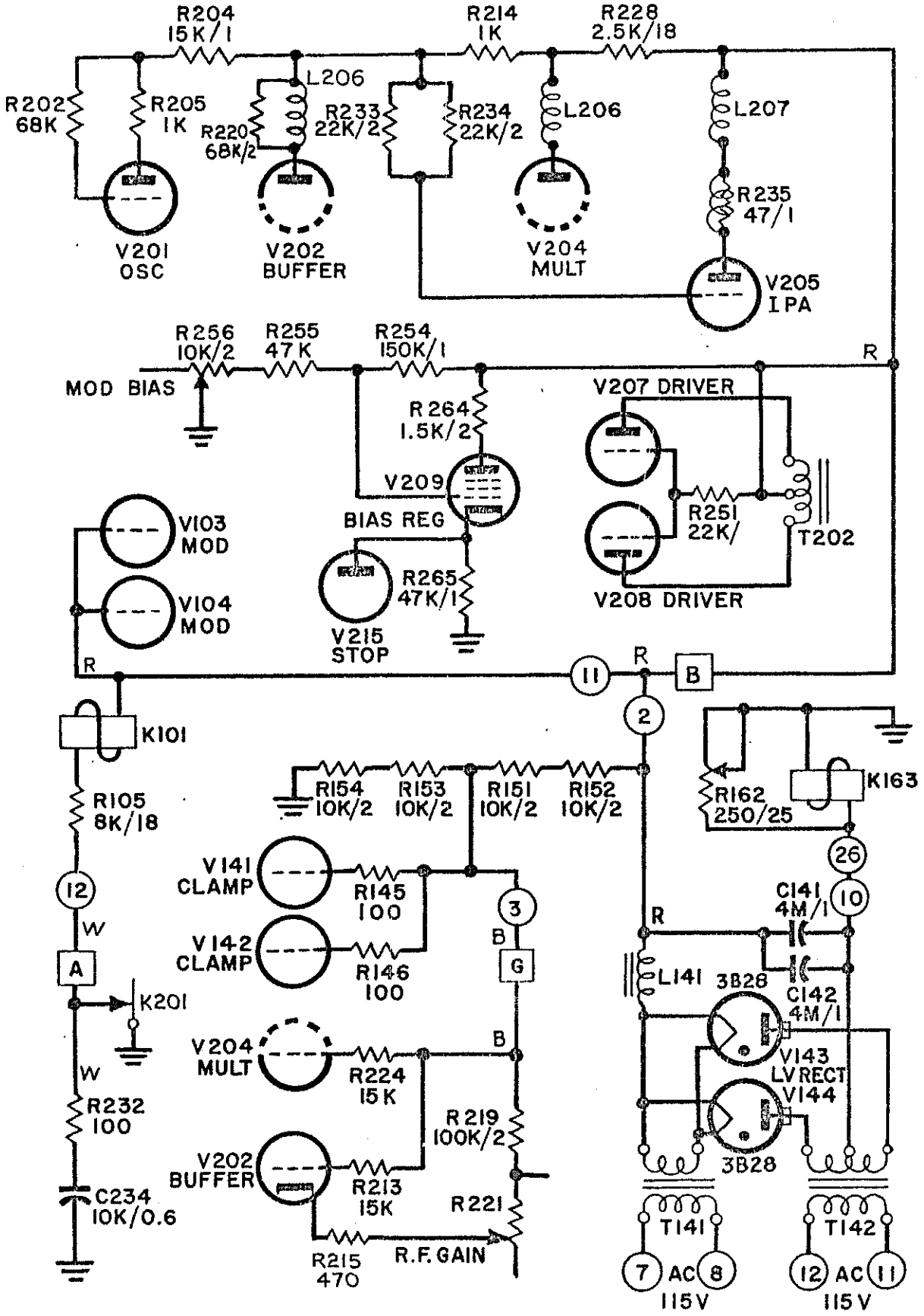


Fig. 5-5 Low Voltage Supply Distribution, Simplified Schematic Circuit

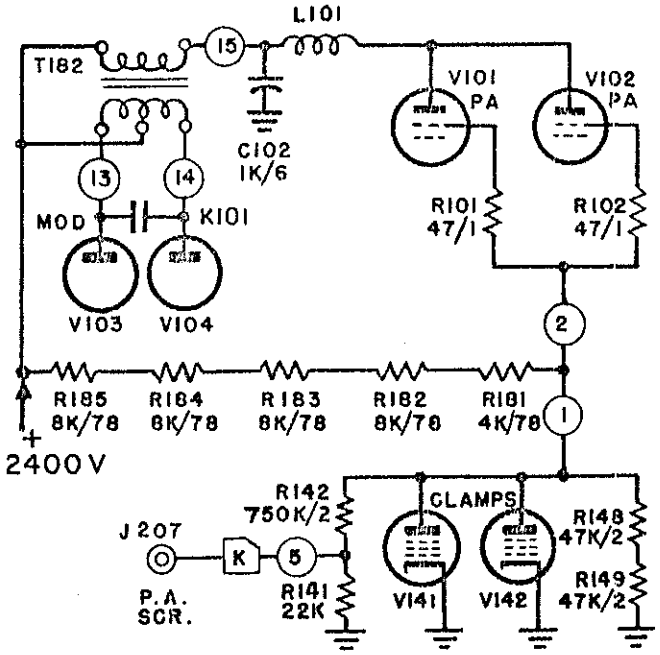


Fig. 5-6 High Voltage Supply Distribution, Simplified Schematic Circuit

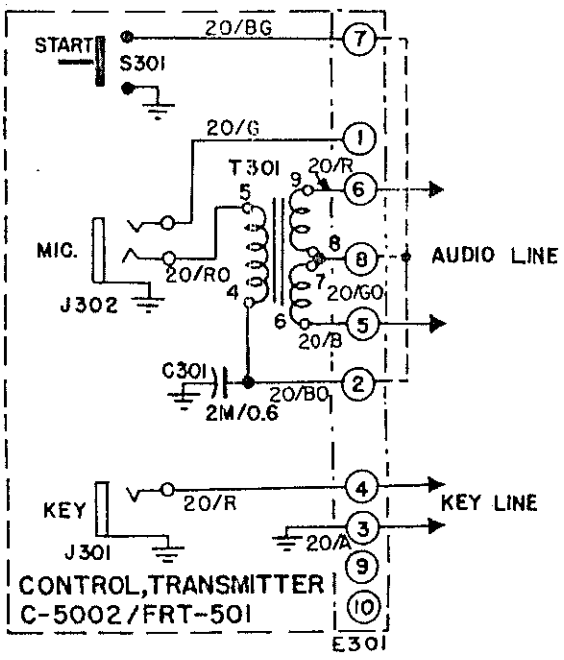


Fig. 5-7 Control Transmitter, Type C-5002/FRT-501, Schematic Circuit

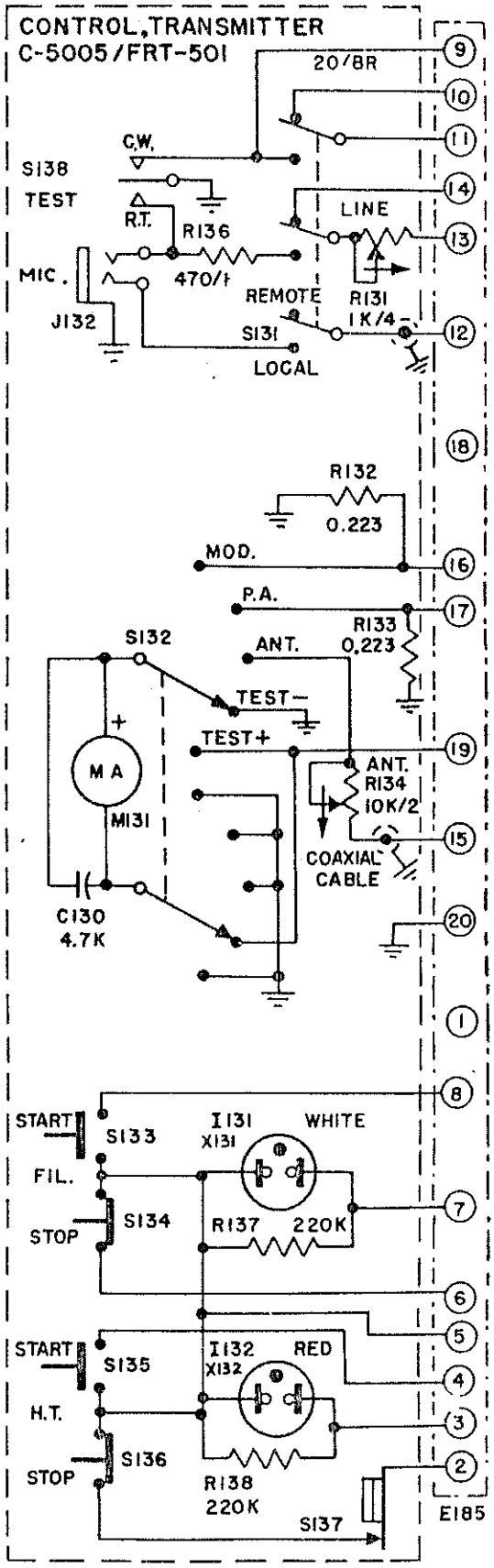


Fig. 5-8 Control Transmitter, Type C-5005/FRT-501, Schematic Circuit

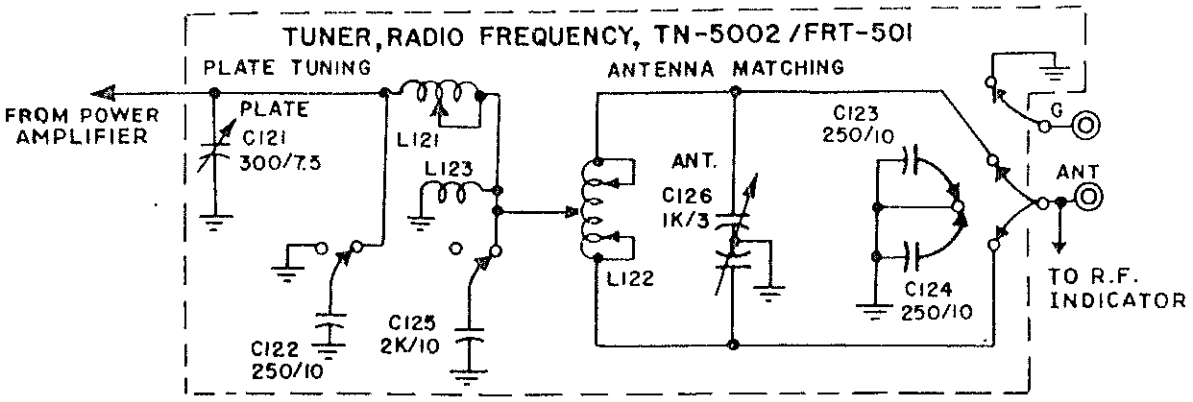


Fig. 5-9 Tuner, Radio Frequency, Schematic Circuit

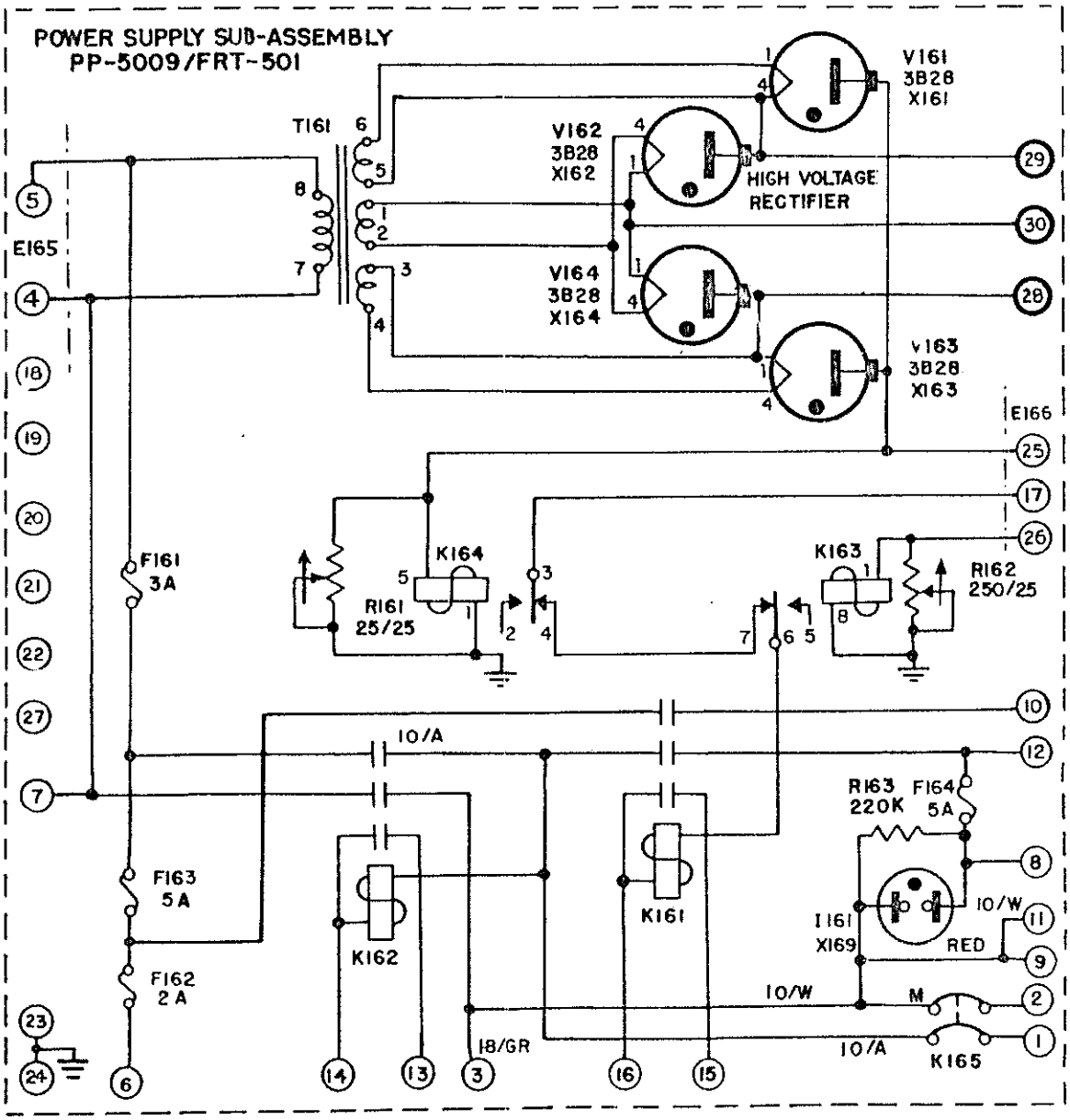


Fig. 5-10 Power Supply Sub-Assembly, Schematic Circuit

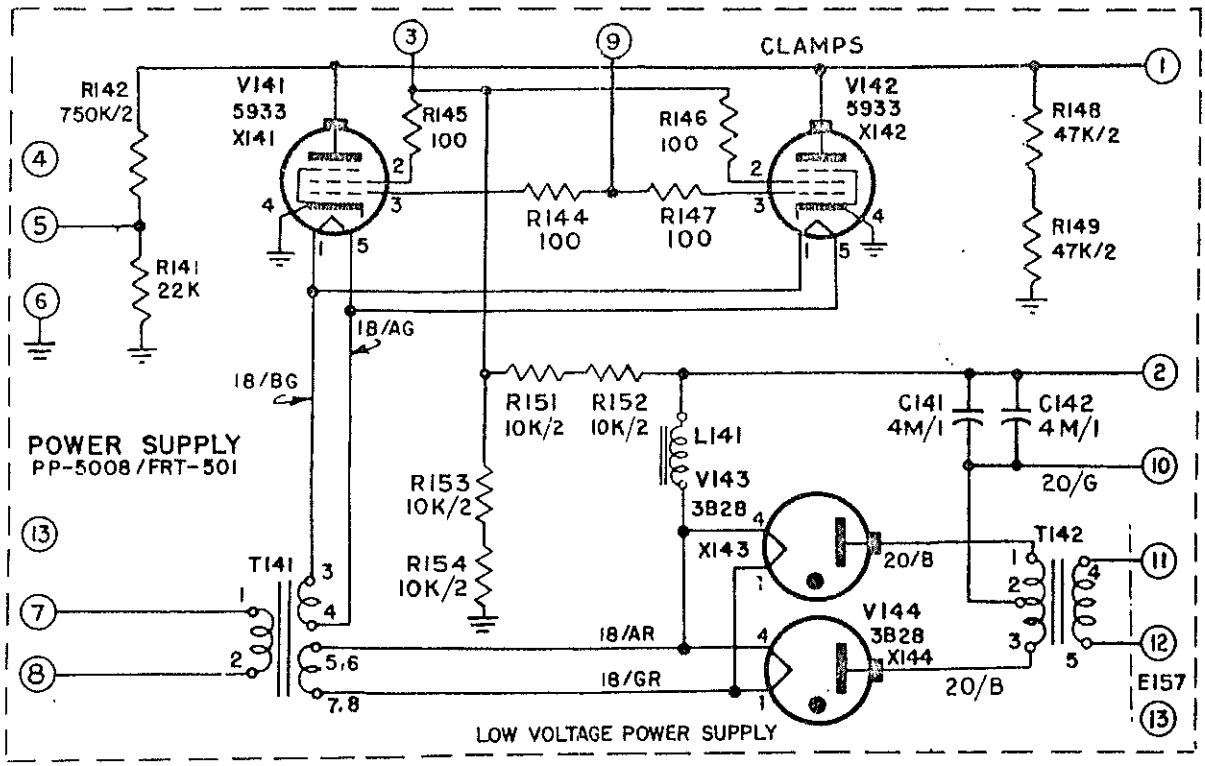


Fig. 5-11 Power Supply, Schematic Circuit

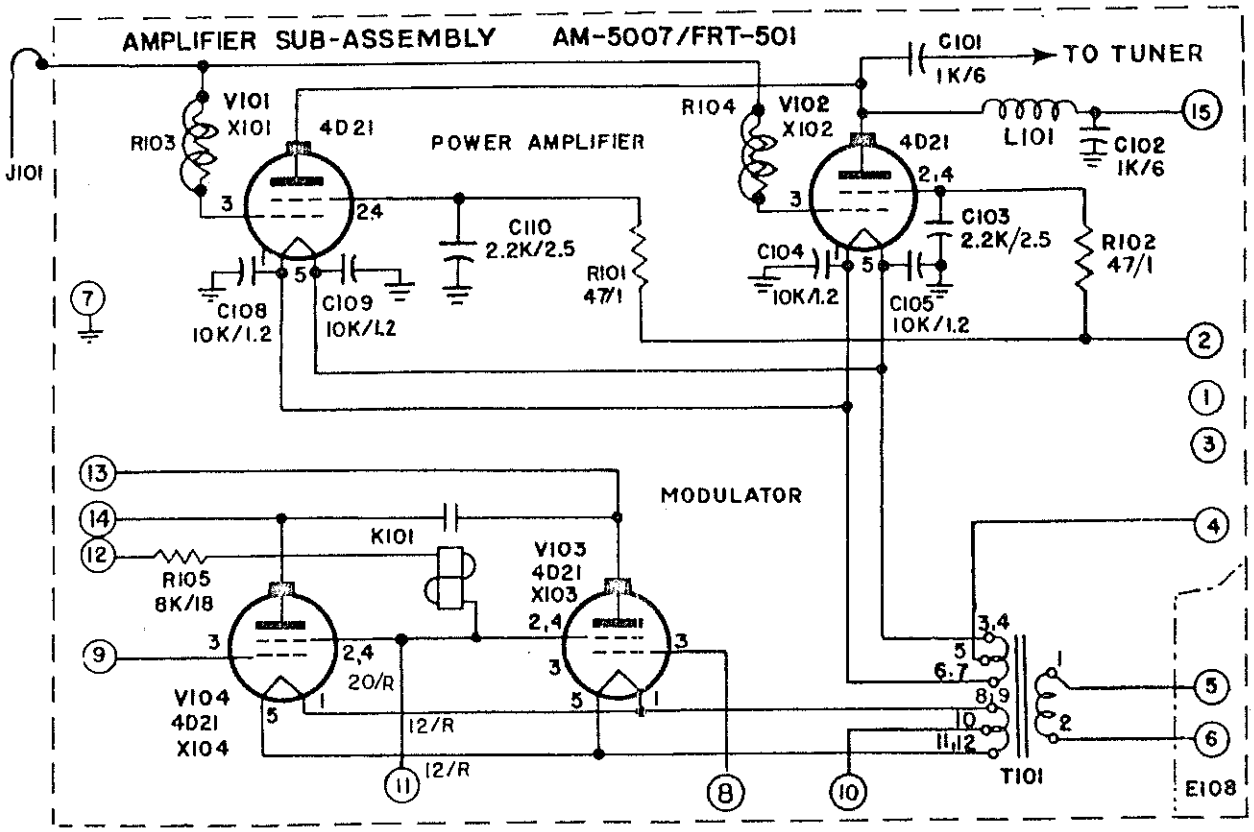


Fig. 5-12 Amplifier Sub-Assembly, Schematic Circuit

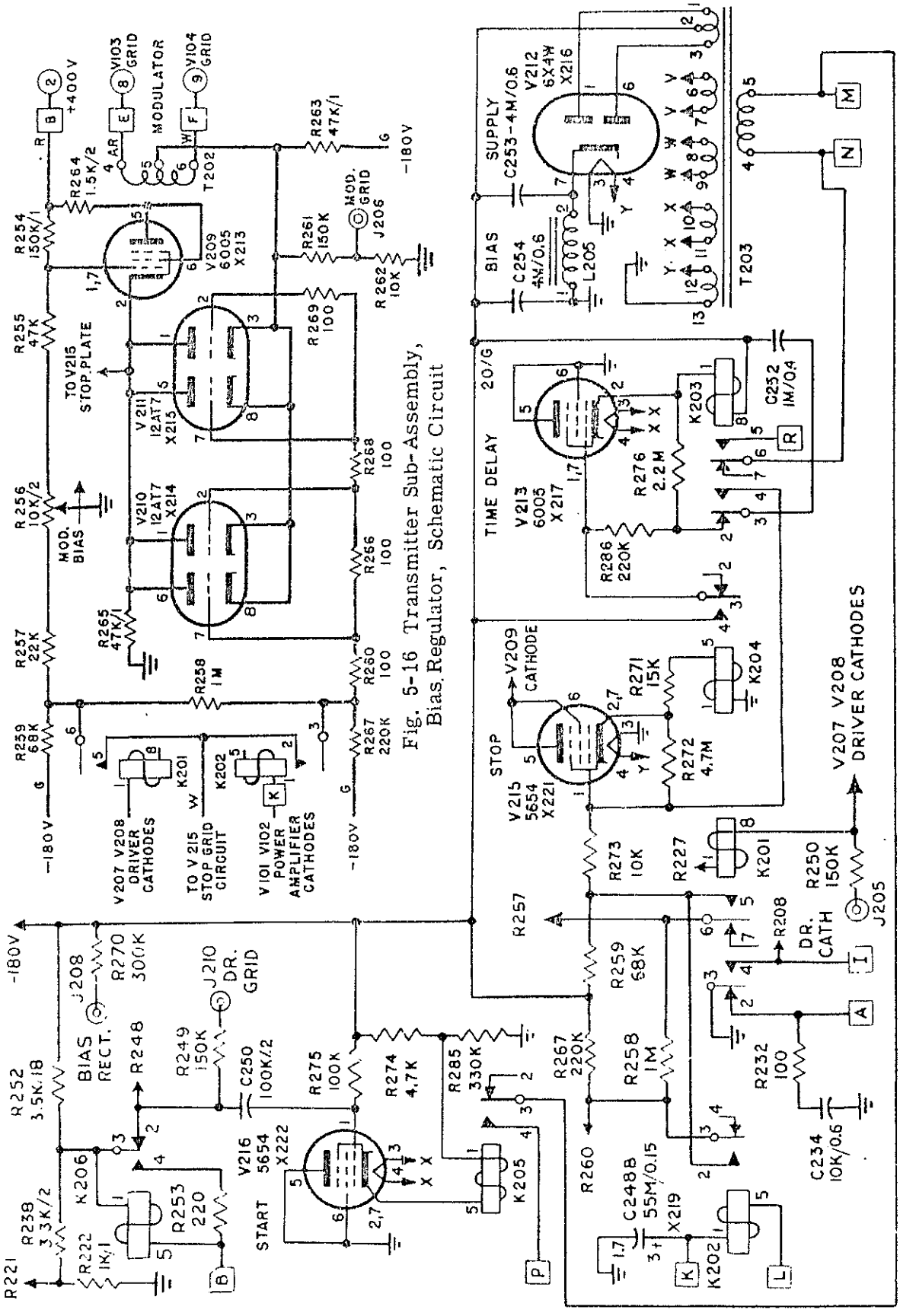


Fig. 5-16 Transmitter Sub-Assembly, Bias Regulator, Schematic Circuit

Fig. 5-17 Transmitter Sub-Assembly, Control Circuits, Schematic Circuit

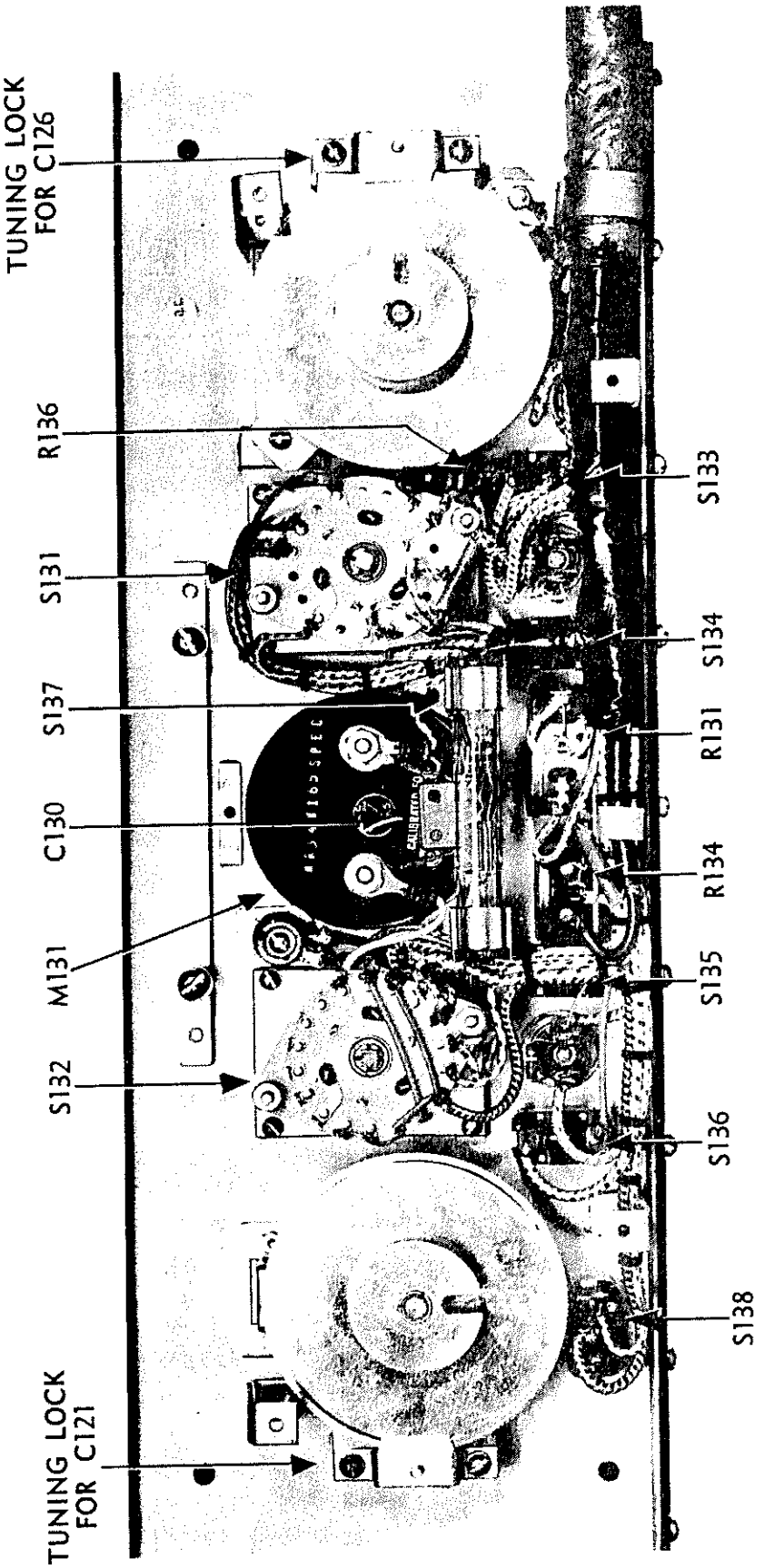


Fig. 5-18 Control Transmitter, Type C-5005/FRT-501, Rear View (Cover Removed), Showing Wiring

Fig. 5-19 Amplifier Sub-Assembly, Bottom View, Showing Wiring

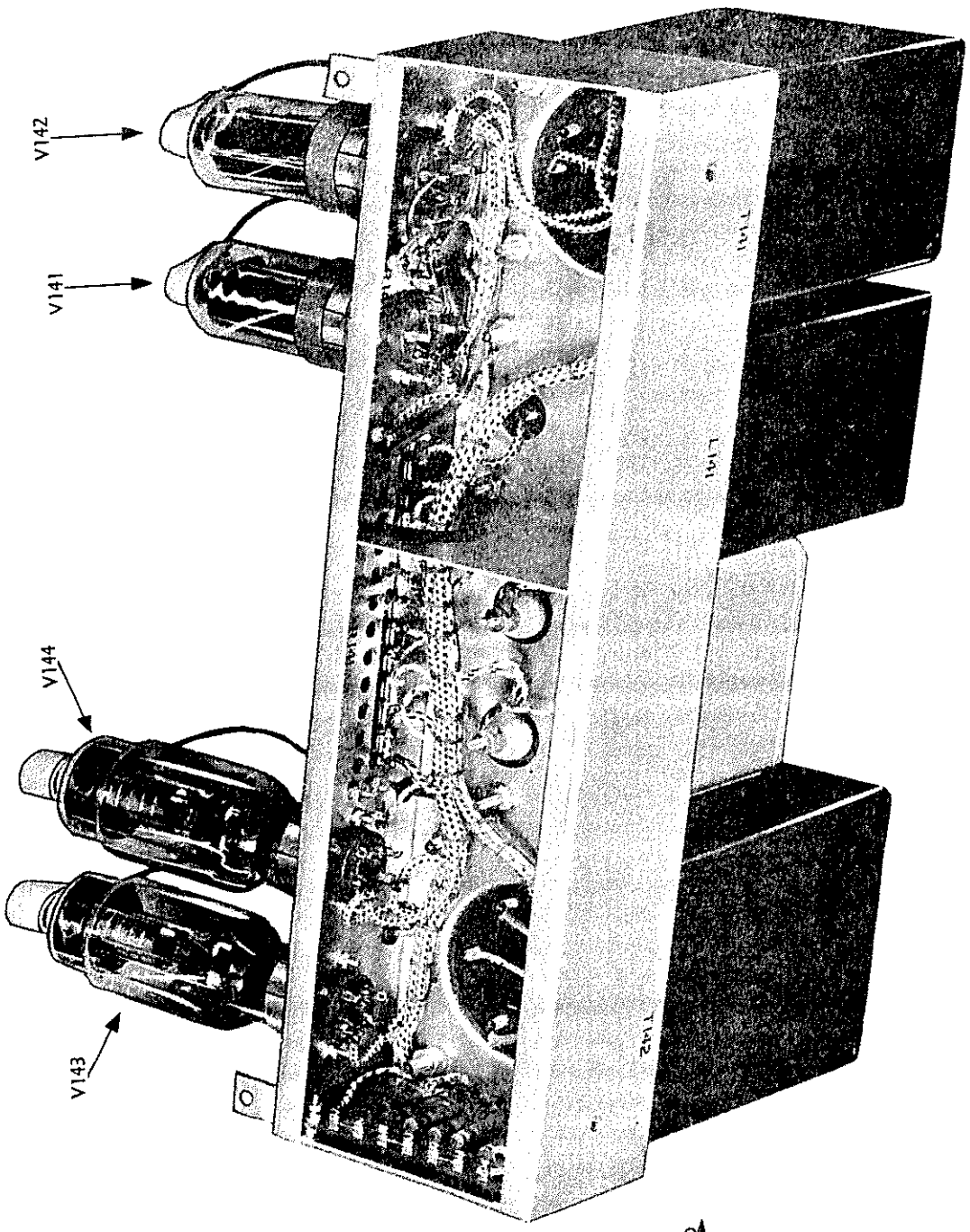


Fig. 5-20 Power Supply, Oblique Bottom View, Showing Wiring

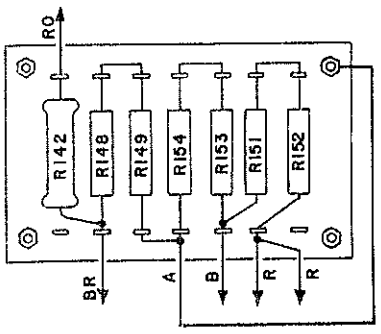


Fig. 5-21
Power Supply Terminal Board, Practical Wiring Diagram

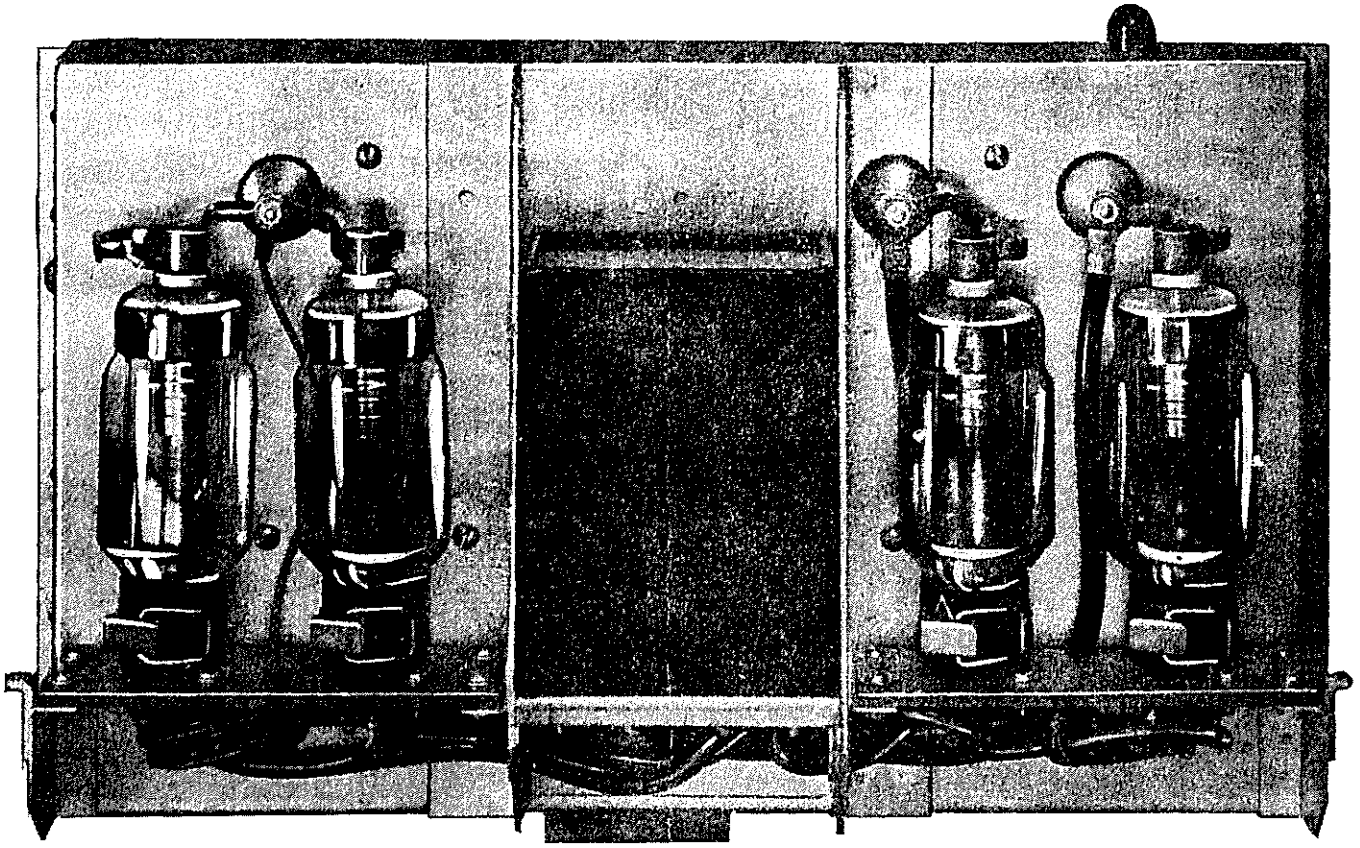


Fig. 5-22 Power Supply Sub-Assembly, Rear View, Showing Wiring

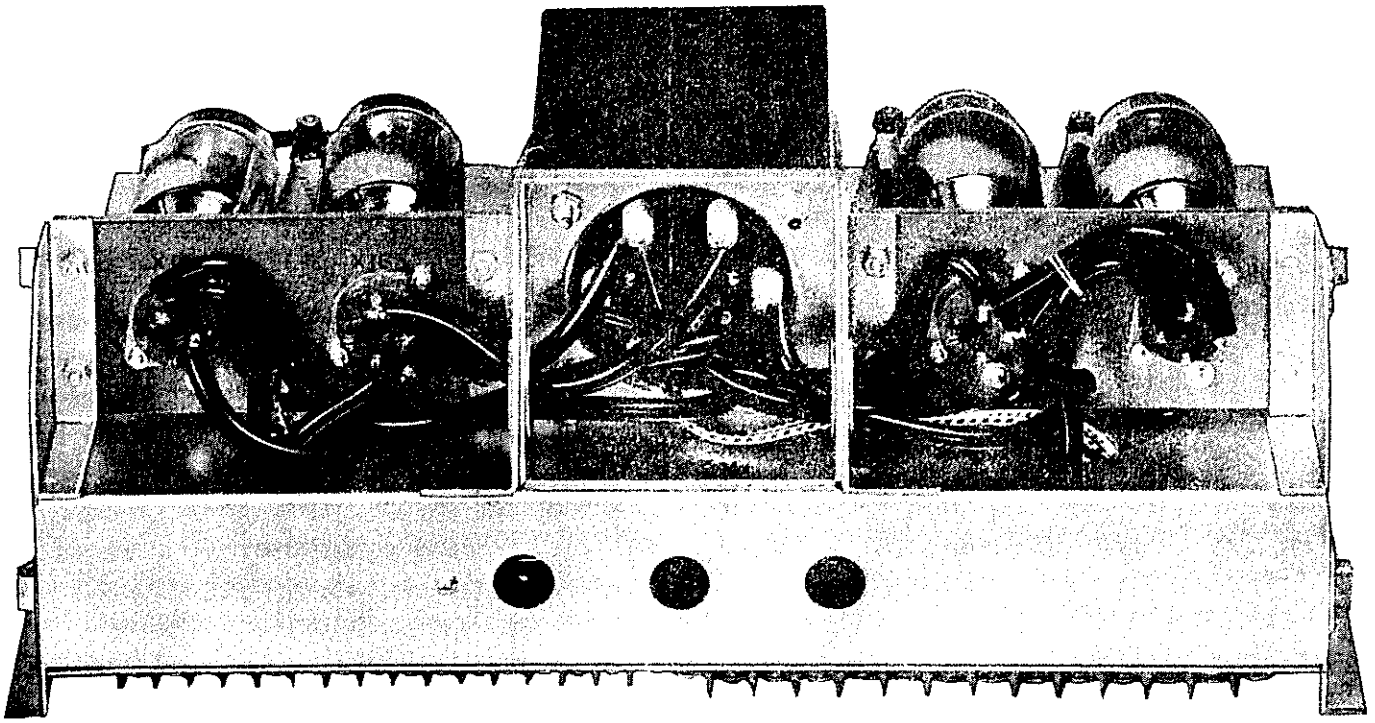


Fig. 5-23 Power Supply Sub-Assembly, Bottom View, Showing Wiring

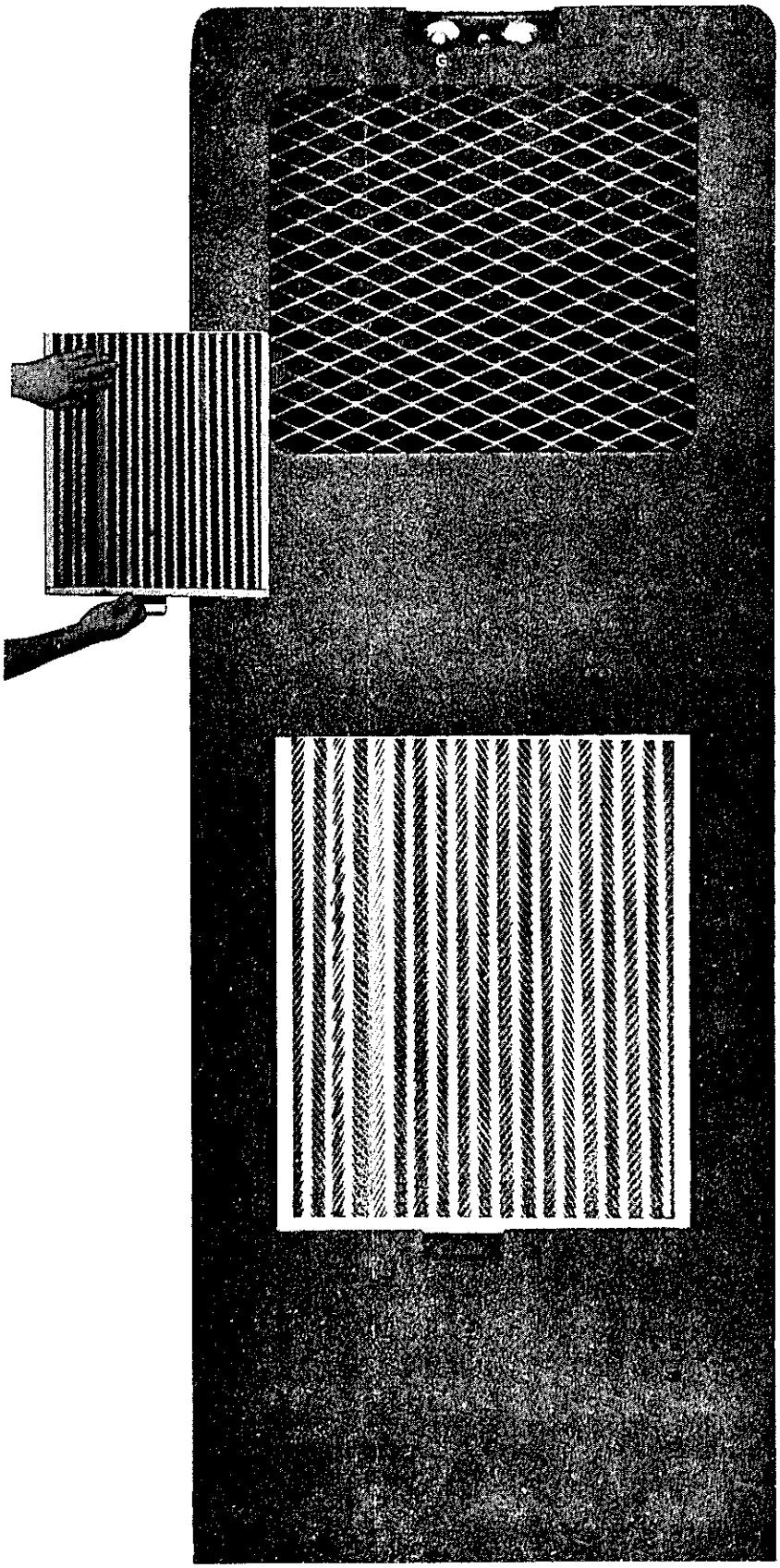


Fig. 5-28 Cabinet, Rear View (Inset: Removal of Air Filter)

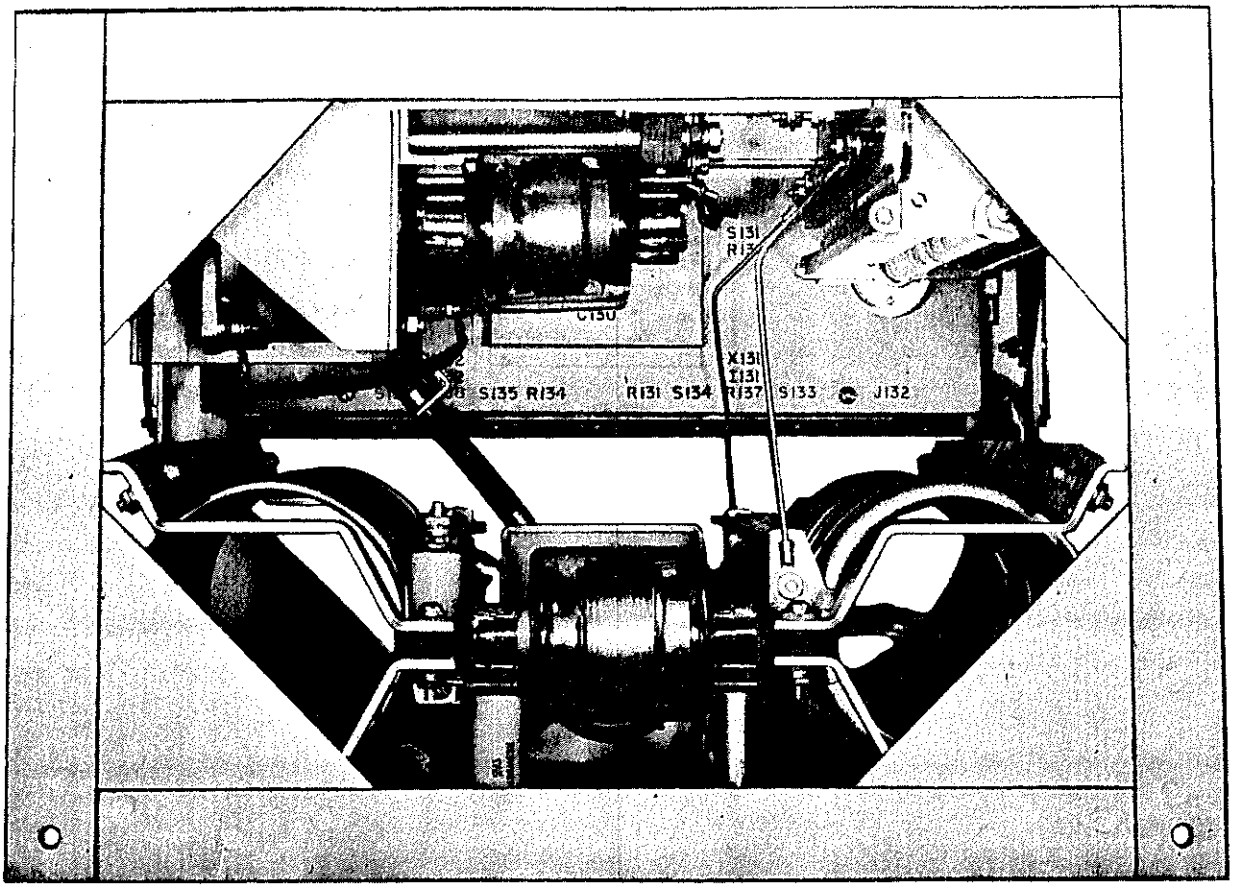


Fig. 5-29 Tuner, Radio Frequency, Rear View

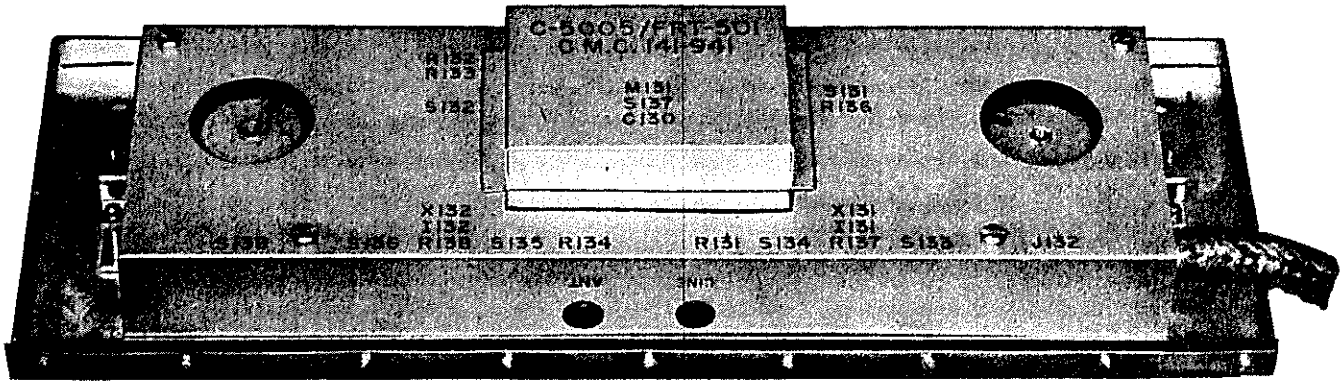


Fig. 5-30 Control, Transmitter, Type C-5005/FRT-501, Rear View

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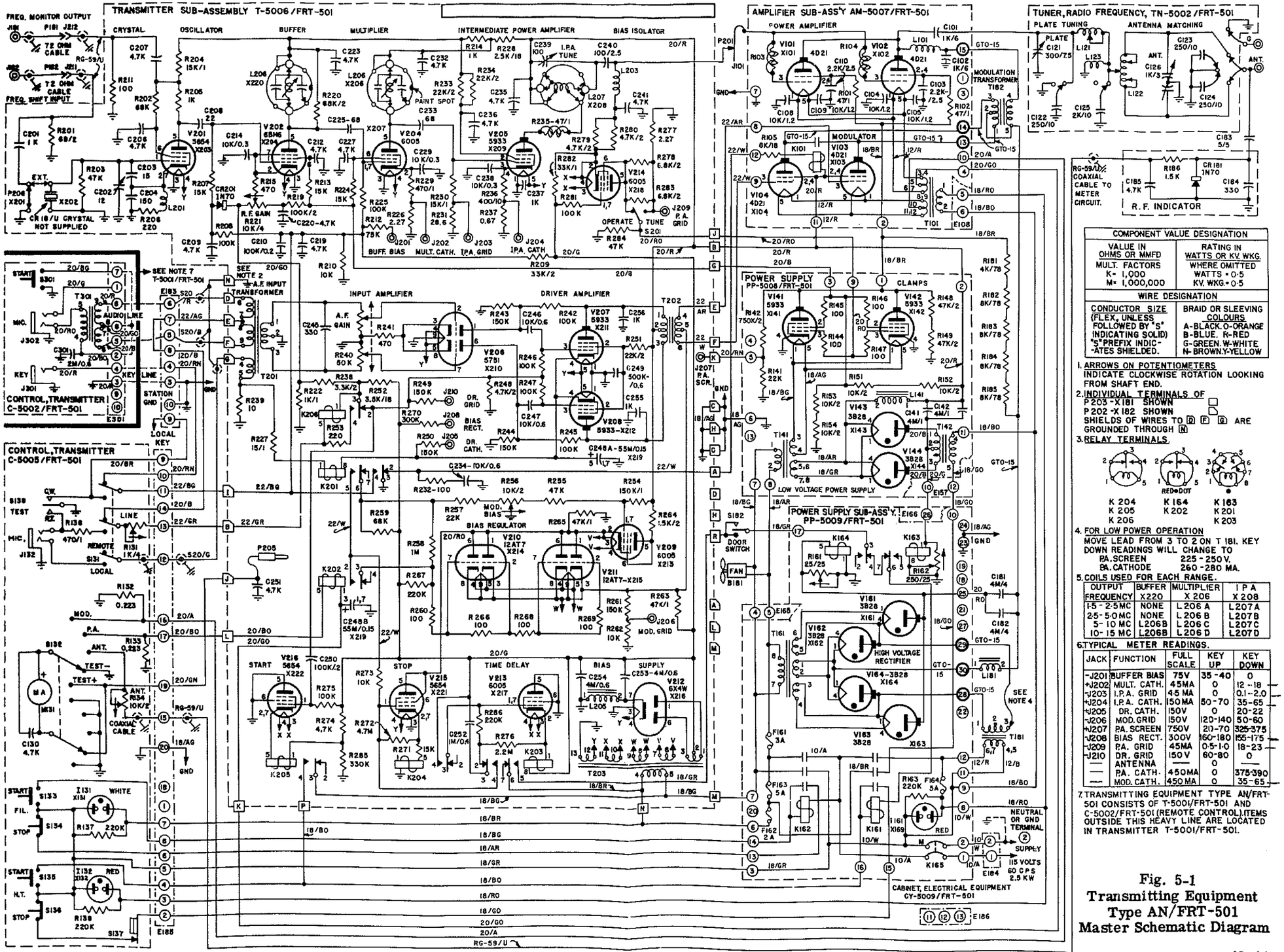

Fig. 5-1
Transmitting Equipment
Type AN/FRT-501
Master Schematic Diagram

FREQ. SHIFT INPUT
CRYSTAL INPUT
OSCILLATOR V201
FREQ. MONITOR OUTPUT
BUFFER V202
R-F GAIN CONTROL
MULTIPLIER V204
KEYING NETWORK
INTERMEDIATE POWER AMPLIFIER V205
CARRIER CONTROL
BIAS
BIAS ISOLATOR V214
CLAMPS V141-V142
POWER AMPLIFIER V101-V102
SCREEN
PLATE TUNING
ANTENNA MATCHING
ANTENNA LINKS
ANTENNA AND GROUND (OUTPUT)
P.A. CATHODES
RELAY K202
P.A.
METERING
ANT.
R-F INDICATOR
P.A. SCREEN RESISTOR CHAIN
MOD
TEST PROD.
TEST SWITCH
LOCAL KEY
KEY
KEY LINE
REMOTE
LOCAL
S131
REMOTE CONTROL
START
LOCAL MIC D-C FEED
RELAY K201
RELAY K101
MODULATION TRANSFORMER T182
B+
H.V. POWER SUPPLY V161-V162 V163-V164
AC
MIC.
AUDIO
MATCHING TRANSFORMER T301
AUDIO LINE
MIC. D-C FEED
INPUT TRANSFORMER T201
A-F GAIN CONTROL
INPUT AMPLIFIER V206
DRIVER AMPLIFIER V207-V208
SPEECH
MODULATOR V103-V104
NEGATIVE FEEDBACK
PRESS-TO-TALK
REMOTE
S131
LOCAL
LINE CONTROL
RELAY K206
START V216-K205
LOW VOLTAGE PLATE SUPPLY (+400V)
INDICATOR LAMPS
START STOP CONTROL SWITCHES
BIAS REGULATOR V210-V211
BIAS REGULATOR SUPPLY V209
L.V. POWER SUPPLY V143-V144
PROTECTION
CONTROL
D C (+100)
STOP V215
TIME DELAY V213
BIAS SUPPLY V212
DC
AC
FUSES AND POWER CONTROL RELAYS K161-2-3-4
MAIN CIRCUIT BREAKER K165
A-C INPUT
HEATERS (6·3V)
BIAS (-180V)
SAFETY DOORSWITCH
STANDBY-OPERATE
FAN
RELAY K204
RELAY K203
SPEECH
LOCAL MIC.
LOCAL D-C FEED

RELAY	COIL CURRENT
K101	K201 FROM L.V. POWER SUPPLY
K201	DRIVER AMPLIFIER CATHODES
K202	POWER AMPLIFIER CATHODES
K203	TIME DELAY CATHODE
K204	STOP CATHODE
K205	START CATHODE
K206	PRESS-TO-TALK (BIAS SUPPLY)
K161	AC FROM K162
K162	AC FROM K165
K163	L.V. POWER SUPPLY RETURN
K164	H.V. POWER SUPPLY RETURN
K165	TRIPS ON OVERLOAD

TUBE	FUNCTION
V101	POWER AMPLIFIER
V102	
V103	MODULATOR
V104	
V141	CLAMPS
V142	
V143	LOW-VOLTAGE RECTIFIERS
V144	
V161	HIGH-VOLTAGE RECTIFIERS
V162	
V163	
V164	

V201 — OSCILLATOR
V202 — BUFFER
V204 — MULTIPLIER
V205 — INTERMEDIATE POWER AMPLIFIER
V206 — INPUT AMPLIFIER
V207, V208 — DRIVER AMPLIFIER
V209 — BIAS REGULATOR SUPPLY
V210, V211 — BIAS REGULATOR
V212 — BIAS RECTIFIER
V213 — TIME DELAY
V214 — BIAS ISOLATOR
V215 — STOP
V216 — START

Fig. 5-2 Transmitting Equipment Type AN/FRT-501, Master Block Diagram

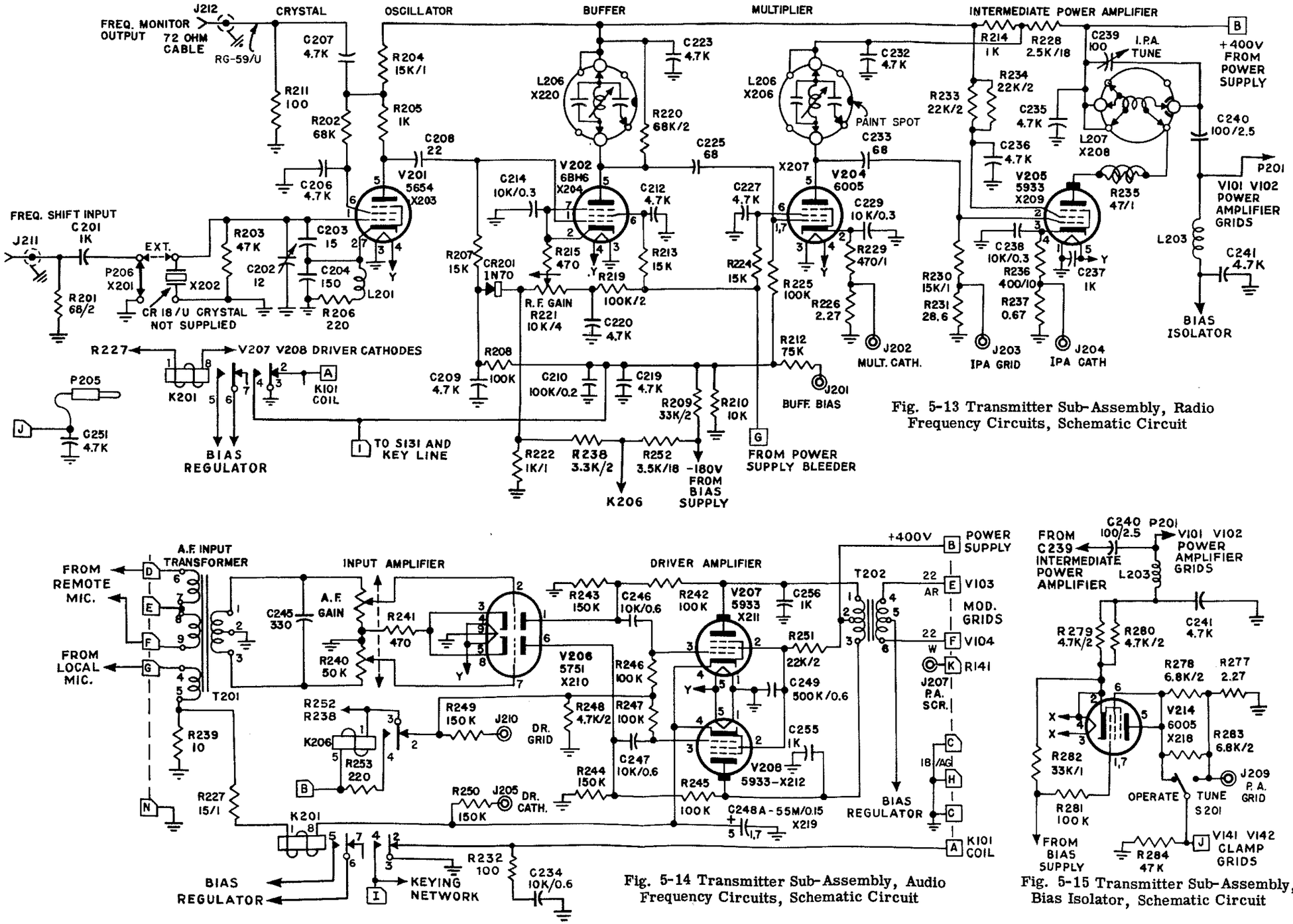

Fig. 5-13 Transmitter Sub-Assembly, Radio Frequency Circuits, Schematic Circuit

Fig. 5-14 Transmitter Sub-Assembly, Audio Frequency Circuits, Schematic Circuit

Fig. 5-15 Transmitter Sub-Assembly, Bias Isolator, Schematic Circuit

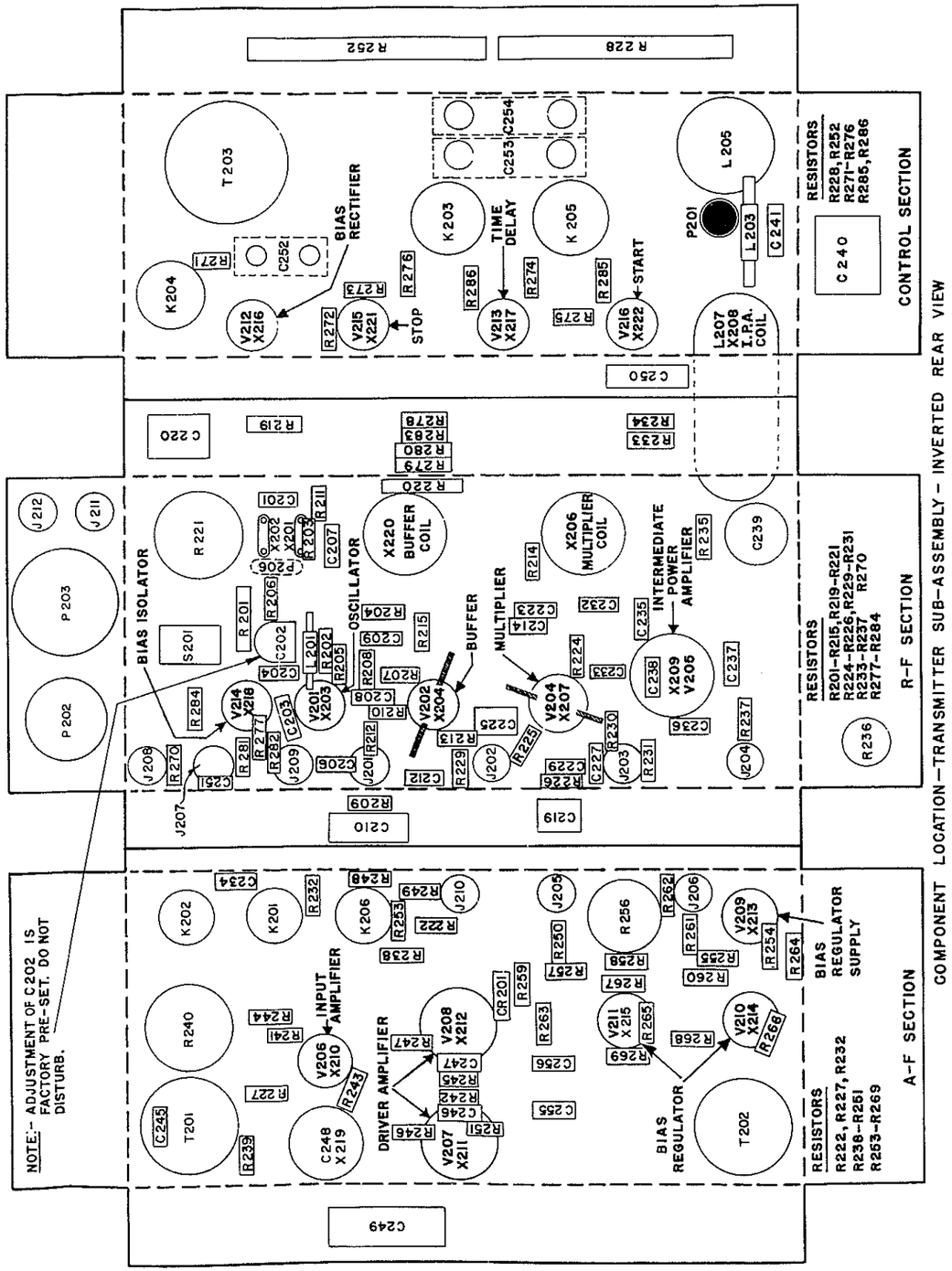

Fig. 5-24 Transmitter Sub-Assembly, Rear View, Showing Identification of Parts

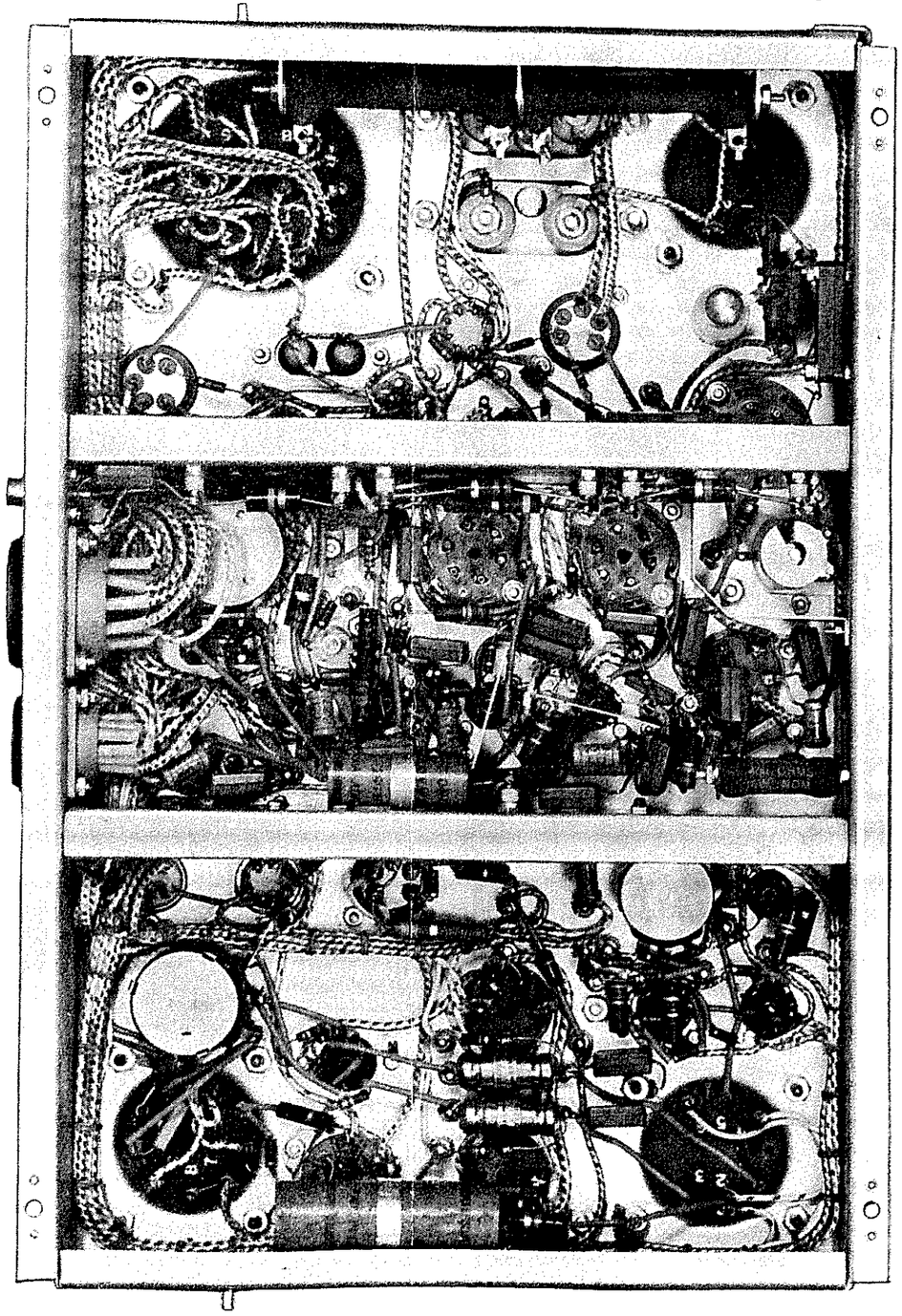

Fig. 5-25 Transmitter Sub-Assembly, Rear View, Showing Wiring

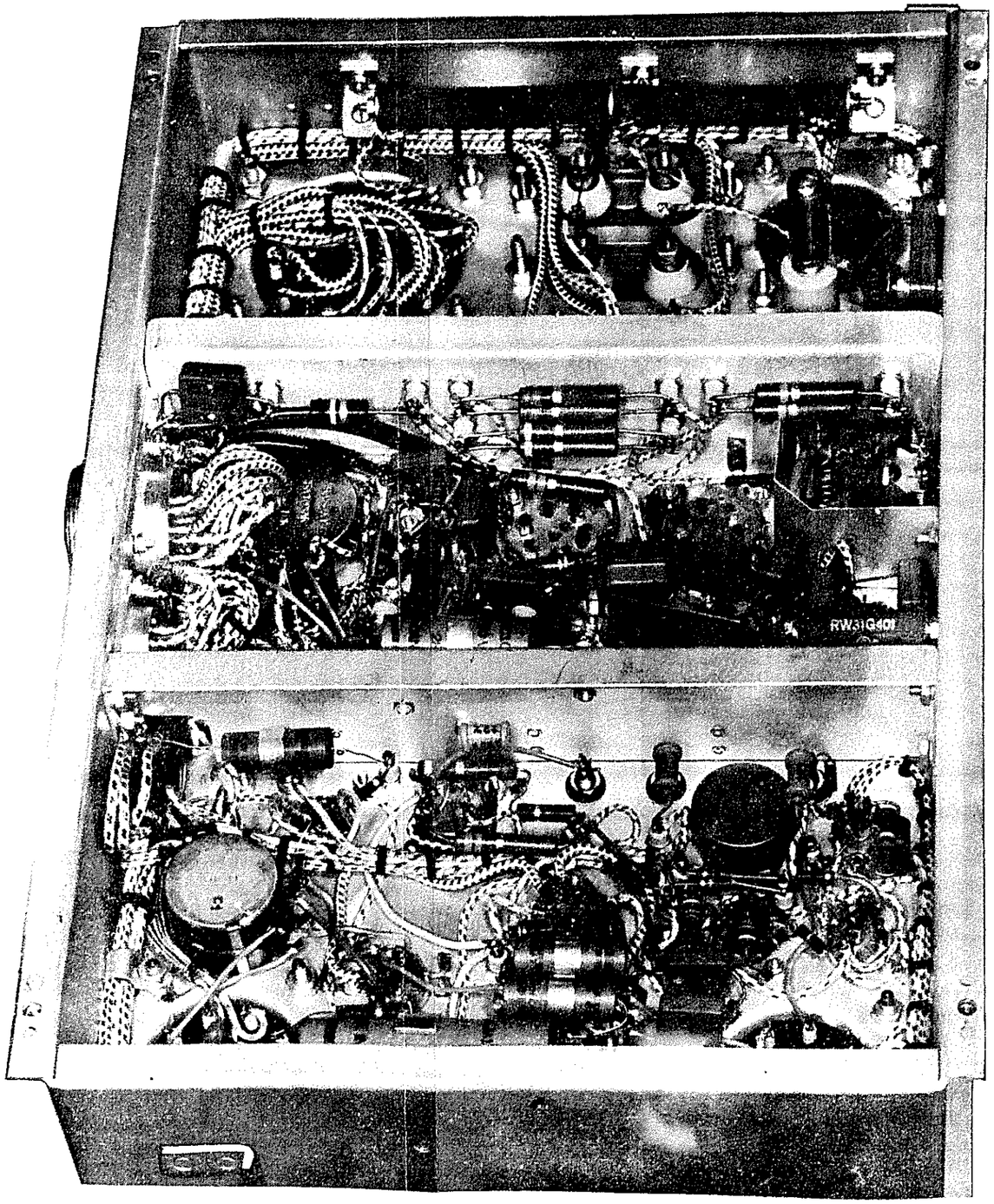

Fig. 5-26 Transmitter Sub-Assembly, Left Oblique Rear View, Showing Wiring

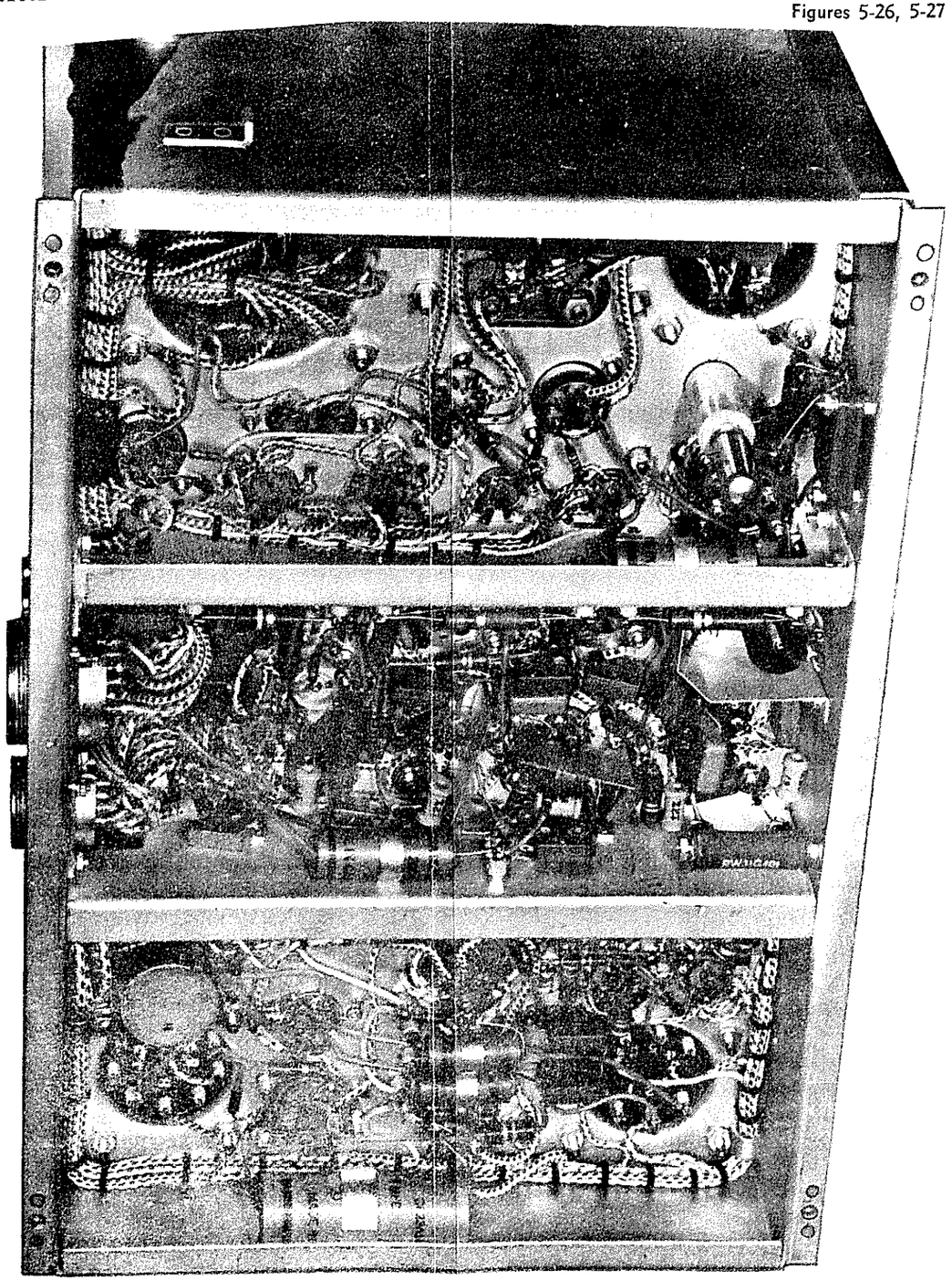

Fig. 5-27 Transmitter Sub Assembly, Right Oblique Rear View, Showing Wiring

EO 35BD-5FRT501-4

ROYAL CANADIAN AIR FORCE

PART LIST

AN/FRT-501

REVISION NOTICE

LATEST REVISED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert revised pages into basic publication.
Destroy superseded pages.

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

18 JAN 61

Revised 31 Jul 64

LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO
31 Jul 64	i		

INTRODUCTION

GENERAL

1 This Engineering Order covers the list of those electrical and mechanical parts which are subject to loss or failure, with the exception of structural and minor parts such as nuts and bolts, etc., giving circuit symbol numbers, reference numbers, descriptions and other data required to determine the exact identity of each component used.

EQUIPMENT IDENTIFICATION

5820-21-801-5788	-	Transmitting Set Radio AN/FRT501, consisting of transmitter (5820-21-801-5789) and Remote Control (5820-21-801-5797).
5820-21-801-5789	-	Transmitter, Radio, T-5001/FRT501 (does not include Remote Control) (5820-21-801-5797).
5820-21-801-5797	-	Control (Remote), Transmitter, C-5002/FRT501.

COMPONENT BREAKDOWN FOR RCAF 5820-21-801-5789

RCAF REF	NAME	SERVICE DESIGNATION	-4 SYMBOL SERIES
5820-21-801-5795	Cabinet, Electrical Equipment	CY-5009/FRT501	181-189
5820-21-801-5793	Power Supply	PP-5008/FRT501	141-159
5820-21-801-5794	Power Supply, Sub-Assembly	PP-5009/FRT501	161-169
5820-21-801-5796	Transmitter, Sub-Assembly	T-5006/FRT501	201-299
5820-21-801-5790	Amplifier, Sub-Assembly	AM5007/FRT501	101-119
5820-21-801-5791	Tuner, RF	TN-5002/FRT501	121-129
5820-21-801-5792	Control, Transmitter	C-5005/FRT501	130-139

-4 EO Alphabetic Reference Symbols

SYMBOL	PART	SYMBOL	PART
A	Structural Part	L	Inductor
B	Motor	M	Meter
C	Capacitor	P	Plug
E	Miscellaneous electrical part	R	Resistor
F	Fuse	S	Switch or Thermostat
I	Lamp	T	Transformer
J	Jack	V	Vacuum or Gaseous discharge tube
K	Contractor, Relay or Circuit Breaker	X	Socket
		CR	Crystal Rectifier

EO 35BD-5FRT501-4

ROYAL CANADIAN AIR FORCE

PART LIST

AN/FRT-501

(This EO replaces EO 35BD-5FRT501-4 dated 2 Jun 54
with the exception of Part 6 dated Sep 60)

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

18 JAN 61

LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO

INTRODUCTION

1 This Engineering Order covers the list of those electrical and mechanical parts which are subject to loss or failure with the exception of structural and minor parts such as standard bolts, screws, nuts and the like, giving reference symbols, descriptions and other data suitable for determining the exact identity of each part of electronic and related equipment (electrical and mechanical).

AN/FRT501 TRANSMITTING SET RADIO RCAF REF 10EU/5820-21-801-5789

2 EQUIPMENT BREAKDOWN INTO COMPONENTS

TABLE 1

Components and Circuit Reference Symbols

NAME	RCAF REF NUMBER	SERVICE TYPE DESIGNATION	NUMERICAL SERIES OF CIRCUIT REFERENCE SYMBOLS
Transmitter, Radio	10EU/5820-21-801-5789	T-5001/FRT501	101-299
Amplifier, Sub-Assembly	10ES/5820-21-801-5790	AM-5007/FRT501	101-119
Tuner, RF	10EA/5820-21-801-5791	TN-5002/FRT501	121-129
Control, Transmitter	10EA/5820-21-801-5792	C-5005/FRT-501	130-139
Power Supply	10EU/5820-21-801-5793	PP-5008/FRT-501	141-159
Power Supply, Sub-Assembly	10EU/5820-21-801-5794	PP-5009/FRT-501	161-169
Cabinet, Electrical Equipment	10EP/5820-21-801-5795	CY-5009/FRT-501	181-199
Transmitter, Sub-Assembly	10EU/5820-21-801-5796	T-5006/FRT-501	201-299
Control, Transmitter	10EU/5820-21-801-5797	C-5002/FRT-501	301-302

3 CIRCUIT REFERENCE SYMBOLS

TABLE 2

Alphabetic Reference Symbols

Letter	Part
A	Structural Part
B	Motor
C	Capacitor
E	Miscellaneous electrical part
F	Fuse
I	Lamp
J	Jack
K	Contactor, Relay, or Circuit Breaker
L	Inductor
M	Meter
P	Plug
R	Resistor
S	Switch or Thermostat
T	Transformer
V	Vacuum or Gaseous Discharge Tube
X	Socket
CR	Crystal Rectifier

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — AMPLIFIER SUB-ASSEMBLY, TYPE AM-5007/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-101	5910-00-108-5292	CAPACITOR, FIXED, MICA; 1,000 uuf, 6000 v ± 5%	PA plate coupling	CM75B102J	
C-102		Same as C-101	PA plate supply by-pass		
C-103	5910-00-190-8070	CAPACITOR, FIXED, MICA; 2200 uuf, 2500 v ± 5%	V-101 screen by-pass	CM50B222J	
C-104	5910-00-101-4759	CAPACITOR, FIXED, MICA; 10,000 uuf, 1200 v ± 10%	V-101 filament by-pass	CM50B103K	
C-105		Same as C-104	V-101 filament by-pass		
C-108		Same as C-104	V-102 filament by-pass		
C-109		Same as C-104	V-102 filament by-pass		
C-110		Same as C-103	V-102 screen by-pass		
E-101	5935-21-801-5846	CONNECTOR; Electron tube: heat radiating plate connections; aluminum; 1 1/16 in lg, 1 in. dia; 1 terminal, 3 5/8 in. lg, 3/8 in. wide , 0.0050 in. thick cadmium plated; dia. of mating terminal 0.360 in.	Tube plate clip		CMC 149-285

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-50A — AMPLIFIER SUB-ASSEMBLY, TYPE AM-500A/FRT-50A

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-102		Same as E-101	Tube plate clip		
E-103		Same as E-101	Tube plate clip		
E-104		Same as E-101	Tube plate clip		
E-105	5970-21-324-0052	INSULATOR, STANDOFF	HV Terminal	NS3W0312	
E-106		Same as E-105	HV terminal		
E-107		Same as E-105	HV terminal		
E-108	5940-21-801-2685	TERMINAL BOARD; molded phenolic board; 12 dual screw solder lug terminals; barrier type; 7 23/32 in. lg, 1 5/16 in. wide, 5/8 in. thick; four 0.209 in. dia mounting holes at 7 5/16 in. by 1/2 in. centers.	Unit terminal panel	BRJ 12-1/2YD	
	5960-21-801-2680	RETAINER, ELECTRON TUBE, beryllium copper wire cadmium-plated; spring action; over-all dim. 3 7/8 in. by 3 7/8 in. by 7/16 in.; mounted by four 0.189 in. dia holes at 3 5/16 in. by 3 5/16 in. centers; designed to hold material 2 5/8 in. dia.	Tube retaining clamp		CMC 131-930

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — AMPLIFIER SUB-ASSEMBLY, TYPE M-5007/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-109	5970-00-158-6823	INSULATOR, FEEDTHROUGH	L-101 Mounting	NS3W4502	
E-110		Same as E-109			
E-111	5970-00-117-5195	INSULATOR, STANDOFF	Screen Resistor tie point	NS3W0104	
J-101	5925-21-801-7714	CONTACT, ELECTRICAL; beryllium copper contact surface silver-plated; overall dim. 2 in. by 2 in. by 2 in; one solder type terminal; insulated by glass-base bakelite plate; mounted by four 0.189 in. dia. holes at 1 3/4 in. by 1 3/4 in. centers.	Rf input connector		CMC 144-691
K-101	5945-21-801-5830	RELAY, ARMATURE; non-pile-up type; SPST, normally open, double break; a-c contacts rated for 5500 v, 60 cps; 4200 ohm coil rated for 500 v max dc; operated above 100 v; 2 stud terminals for coil, 2 solder lug terminals for contacts; cont. duty; open type; overall dim. 3 1/8 in. lg, 1 7/8 in. wide, 1 5/8 in. high; mounted by two 0.196 in. dia. holes on 1 3/8 in. centers	Modulator shorting relay		CMC 147-528

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — AMPLIFIER SUB-ASSEMBLY, TYPE AM-5007/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
L-101	5950-21-801-5804	TRANSFORMER, R.F.; rated for 250 ma; for use with frequencies below 16 mc; over-all dim. 4 in. lg, 1 1/16 in. dia; two solder-lug terminals, one each end; mounted by two 1/4 in. -20 bolts, one each end	PA plate supply choke		GMC 145-904
R-101	5905-00-279-2637	RESISTOR, FIXED, COMPOSITION; 47 ohm, 1 w ± 5%	PA screen isolator	RC32GF470J	
R-102		Same as R-101	PA screen isolator		
R-103	5915-21-801-5836	SUPPRESSOR, PARASITIC; 6 turns no.18 AWG tinned copper wire; resistor 47 ohm, 2 w; 3/16 in. dia, 1 3/8 in. lg; terminal mounted; 2 pigtail terminals, one each end	PA grid suppressor		GMC 145-944
R-104		Same as R-103	PA grid suppressor		
R-105	5905-00-642-1682	RESISTOR, FIXED, WIRE WOUND; 8000 ohm, 26 w	Relay series resistor	RW33V802	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — AMPLIFIER SUB-ASSEMBLY, TYPE AM-5007/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
T-101	5950-21-501-5807	TRANSFORMER, POWER, STEP DOWN; hermetically sealed; steel case; primary 115 v, 60 cps, single phase; 2 secondary windings, each 5.05 v, 13 amp; 2.65 kv insulation test; oil filled; 3 15/16 in lg, 3 3/8 in. wide, 5 1/4 in. high; 6 solder lug terminals; four 10-32 mounting studs at 3 in. by 2 7/16 in. mounting centers.	PA and mod tube filament transformer	CTFIR01KAAAR	CMC 130-257
V-101	5960-00-188-0921	ELECTRON TUBE	PA tube	4D21	
V-102		Same as V-101	PA tube		
V-103		Same as V-101	Modulator tube		
V-104		Same as V-101	Modulator tube		
X-101	5935-00-224-0818	SOCKET, ELECTRON TUBE; 5 cadmium plated brass contacts; jumbo; overall dim. 2 7/8 in. by 2 7/8 in. by 7/8 in; ceramic body; 2 3/4 in. chassis hole required; mounted by four 3/16 in. dia holes at 2 1/4 in. by 2 1/4 in. centers	PA tube socket	Johnson 122-275	CMC 109-061T
X-102		Same as X-101	PA tube socket		
X-103		Same as X-101	Mod tube socket		

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-50L		AMPLIFIER SUB-ASSEMBLY, TYPE AM-500*/FRT-50L			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-104		Same as X-101	Mod tube socket		

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501			AMPLIFIER SUB-ASSEMBLY, TYPE TN-5007/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-121	5910-00-668-7546	CAPACITOR, VARIABLE, VACUUM; 1 section; 300 uuf max; 10 uuf min; straight line capacity tuning characteristic; 7.5 kv peak r-f voltage; 42 amp rms max; adjusted by extension shaft; counter-clockwise rotation; 22 complete turns; overall dim. 8 3/4 in. lg, 2 11/16 in. dia; glass enclosed; one ferrule type terminal located at one end; one flange type terminal located on the other end; four 0.196 in. dia mounting holes at 1 5/8 in. by 2 1/16 in. centers	PA plate tuning	Jenning: UCS-300	CMJ 147-684
C-122	5910-00-667-6542	CAPACITOR, FIXED, VACUUM; 1 section; 250 uuf; 10 kv peak r-f voltage; 42 amp max; glass enclosure; 2 ferrule terminals located one at each end; clip mounted; over-all dim. 3 5/8 in. lg, 2 5/8 in. dia	PA plate padding	Jenning: JCS-250	
C-123		Same as C-122	Ant. tank padding		
C-124		Same as C-123	Ant. tank padding		
C-125	5910-00-112-8517	CAPACITOR, FIXED, MICA; 2000 uuf ± 5%; 10,000 v	Pi network output padding	CM80B202J	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — TUNER, RADIO FREQUENCY, TYPE TN-5002/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-126	5910-21-801-5931	CAPACITOR, VARIABLE, AIR; plate meshing type; 2 identical sections, each: 1000 mmf max, 70 mmf min; straight line capacity tuning characteristic; 3000 v peak r-f voltage; over-all dim. 13 11/32 in. lg, 4 1/4 in. wide, 3 3/8 in. high; shaft 1/4 in. dia, 5/16 in. lg; shaft adjustment; 180 deg rotation; glass-base bakelite insulation between rotor and stator; 4 threaded stud terminals; mounted by three tapped holes on circle of radius 1 1/4 in., 80 deg apart, at one end, and by two mounting feet at other end	Antenna tuning		CMC 116-750
L-121	5950-21-801-5808	TRANSFORMER, RADIO FREQUENCY; single layer; 31 turns copper tubing, 3/16 in. OD by 1/32 in. wall; silver plated; space wound; 21 turns at 3 1/2 turns per in., 10 turns at 2 1/2 turns per in., glass base bakelite racks; tuning by spring contacts; overall dim. 5 in. wide, 6 in. high, 14 3/4 in. lg; 3 threaded stud terminals; four 1/4 in. dia mounting holes at 3 in. by 14 inch centers	PA plate tuning inductance		CMC 141-939

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-50L — TUNER, RADIO FREQUENCY, TYPE TN-5002/FRT-50L

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
L-122	5950-21-801-5810	TRANSFORMER, RADIO FREQUENCY; single layer; 14 turns copper tubing, 3/8 in. OD by 1/32 in. wall; silver plated; space wound; 14 turns spaced between winding centers as follows; 5/8, 1/2, 1/2, 5/8, 3/4, 7/8, 1, 1, 7/8, 3/4, 5/8, 1/2, 1/2, 5/8 in.; glass base bakelite racks; tuning by spring contacts over-all dim. and mounting dim. as in L-121.	Antenna tuning inductance		CMC 141-938
L-123	5950-21-801-5805	COIL, RADIO FREQUENCY; 2.5 mh, Hammond, 125 ma	Ant. static drain choke		1504 Hammond
	5970-00-248-8771	INSULATOR, STANDOFF (1 used per unit)	C-122 mounting	NS3V0316	
	5940-21-801-2686	CLIP, ELECTRICAL; similar to ferrule style no. 2, MBCA ref dwg group 37; phosphor-bronze, nickel-plated; 1 7/32 in. lg, 7/8 in. wide, 3/4 in. high; 600 V, 30 amp. 13/16 in. dia mating terminal (6 used per unit)	Connector for fixed vacuum capacitor	Littelfuse 600/30	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501			CONTROL, TRANSMITTER, TYPE C-5005/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-130	5910-00-101-3846	CAPACITOR, FIXED, MICA; 4700 mmf, 500 v 5%	Meter by-pass	CM35B472J	
E-131	5940-21-801-2687	CLIP, ELECTRICAL; similar to ferrule style no. 2, MBCA ref dwg group 37; phospor-bronze, nickel-plated; 13/16 in. lg, 5/8 in. wide, 19/32 in. high; 9/16 in. dia of mating terminal	Thermostat retainer	Littelfuse 250/30	
E-132		Same as E-131			
I-131	6240-00-223-9100	LAMP, GLOW; 105-125 v; 1/25 w; min bayonet base; T-3 1/4 clear bulb, MBCA ref dwg group 7; red light emitted; W-11 electrode; 1 3/16 in. max over all height; over 25 hours rated life; any burning position	Filament power indicator	CGE NE 51	
I-132		Same as I-131	HV power indicator		
J-132	5935-00-192-4729	JACK, TELEPHONE	Microphone jack	JJ033	
M-131	6625-21-801-5798	AMMETER	General purpose meter	MR34W165 SPEC	
R-131	5905-00-195-2275	RESISTOR, VARIABLE, WIRE WOUND; 1000 ohm 4 w	Remote line resistance compensation	RA30A1SA102 AK	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — CONTROL, TRANSMITTER, TYPE C-5005/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-132	5905-21-801-5945	RESISTOR, FIXED, WIRE WOUND; 0.223 ohm ± 1%; 1/3 w	Mod cathode metering shunt	RB16AER223OF	
R-133		Same as R-132	PA cathode metering shunt		
R-134	5905-00-108-6177	RESISTOR, VARIABLE, WIRE WOUND; 10,000 ohm, 2 w	Rf metering sensitivty control	RA20A1SA103. AK	
R-136	5905-00-617-7226	RESISTOR, FIXED, COMPOSITION; 470 ohm, 1 w, 5%	Local control circuit resistance make-up	RC32GF471J	
R-137	5905-00-192-0667	RESISTOR, FIXED, COMPOSITION; 220,000 ohm, 1/2 w, 5%	Neon lamp shunt	RC20GF224J	
R-138		Same as R-137	Neon lamp shunt		
S-131	5930-21-801-2689	SWITCH, ROTARY; 1 section; max no. of positions, 5; non-pile-up; adjustable stop included, set for 2 positions; 3 moving contacts; 5 fixed contacts; 3 poles ; 2 throws; contacts rated for 7.5 amp at 115 v ac; non-shorting; ceramic insulation; 2 13/16 in. high, 2 in wide, 2 3/4 in. long; two 6-32 mounting studs at 2 7/16 in. centers; flatted shaft, 1/4 in. dia; 18 solder lug terminals	Remote-local switch		CMC 145-003

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — CONTROL, TRANSMITTER, TYPE C-5008/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
S-132	5930-21-801-2691	SWITCH, ROTARY; same as S-131 except stop set for 5 positions; 5 throws	Meter function selector switch		CMC 145-002
S-133	5930-00-644-2992	SWITCH, TOGGLE	Fil. start switch	ST42G	
S-134	5930-00-050-2681	SWITCH, TOGGLE	Fil. stop switch	ST42B	
S-135		Same as S-133	HV start switch		
S-136		Same as S-134	HV stop switch		
S-137	5930-21- 801-2690	SWITCH, TOGGLE, THERMOSTATIC; normally closed; SPST; glass enclosure; overall dim. 3 in. lg, 9/16 in. dia; contacts open on temp increase; operating temp ≠ 65 deg C (≠ 149 deg F); rated for 10 w load at 220 v ac; 2 ferrule terminals, 9/16 dia., axially at each end; mounted in clips	High temperature protective thermostat		CMC 144-882
S-138	5930-00-20[illegible] 3362	SWITCH, TOGGLE	Cw/rt test switch	ST42G	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-50L			CONTROL, TRANSMITTER, TYPE C-5005/FRT-50L		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-131	6210-00-299-5157	LIGHT, INDICATOR; supplied with lens; 5/8 in. dia; 3/4 in. lg; white; smooth face; fluted back; translucent; screw-mounting lens; accommodates T-3 1/4 lamp; miniature bayonet base; no electrical rating; nickel-plated brass shell, over-all dim. 1 in. dia., 2 1/8 in. lg; mounts in one 11/16 in. dia hole; max panel thickness 3/16 in.; lamp replaceable from front of panel; 2 solder lug terminals on rear and both insulated from shell.	Holder for filament indicator	Dialco 53408-99%	
X-132	6210-00-283-9722	Same as X-131 except: red lens	Holder for HV indicator	Dialco 53408-99%	
	5970-21-324-0050	INSULATOR, STANDOFF (2 used per unit)	S-137 mounting	NS3W0212	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — POWER SUPPLY, TYPE PP-300S/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-141	5910-21-801-5932	CAPACITOR, FIXED, PAPER; 4 uf, 1000 v, 10%	LV rectifier filter	CP70E1EG405K	
C-142		Same as C-141	LV rectifier filter		
E-141	5940-00-204-9112	CLIP, ELECTRICAL; similar to style no. 9, MBCA ref dwg group 37; beryllium copper; cadmium plated; 1 1/8 in. lg, 5/8 in. high, 5/8 in. wide; ceramic insulation; 1 solder lug terminal; 5/16 in. dia of mating terminal	Tube plate clip	National SPP-3	
E-142		Same as E-141			
E-143	5940-00-501-8726	CLIP, ELECTRICAL; same description as E-141 except; 1 1/2 in. lg, 3/4 in. wide, 3/4 in. deep; mating terminal dia 9/16 in.	Tube plate clip	National SPP-9	
E-144		Same as E-143			
E-145	5910-00-666-0088	BRACKET, CAPACITOR MOUNTING		CP07S-C2	
E-146		Same as E-145			
E-147		Same as E-145			
E-148		Same as E-145			

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TRANSMITTER, TYPE AN/FRT-501			POWER SUPPLY, TYPE PP-5008/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-149	5960-00-54[illegible]-0961	RETAINER, TUBE; stainless steel; spring action; over-all dim. 2 3/4 in. by 1 5/8 in. by 7/8 in., one mounting slot 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 5/8 in. dia	Tube retaining clamp	Birtcher 926H-5	
E-150		Same as E-149			
E-153	5960-00-249-4973	RETAINER, TUBE; same as E-149, except over-all dim. 2 1/2 in. lg by 1 1/2 in. by 7/8 in., to hold material 1 1/4 in. dia.		Birtcher 926C	
E-154		Same as E-153			
E-155	5940-00-549-9552	TERMINAL STUD; insulated, swaged, similar to Style No. 60 MBCA ref dwg group 21; insulation rated for 6000 v rms; solder connection; brass, cadmium plated bushing, silver-plated lugs; over-all dim. 1 1/64 in. lg, 5/16 in. dia. mounts by plain shank, 0.187 in. dia.		CTC X1942-Y	
E-156		Same as E-155			
E-157	5940-21-801-2688	TERMINAL BOARD; molded phenolic type; 13 dual lug-screw type terminals; barrier type 6 7/16 in. lg, 1 1/8 in. wide, 1/2 in. thick; four 0.175 in. dia mounting holes at 6 1/8 in. by 27/64 in. centers		RBJ 13-141YD	

TRANSMITTER, TYPE AN/FRT-60L — POWER SUPPLY, TYPE PP-5008/FRT-60L

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-158		Same as E-155			
L-141	5950-21-801-5811	REACTOR; filter choke; 1 winding; 15H at 200 ma; d-c resistance 125 ohm; 2.65 kv insulation test; hermetically sealed metal case; 3 3/8 in. lg. 3 15/16 in. wide, 5 1/4 in. high; four 10-32 mounting studs at 3 in. by 2 7/16 in. centers; 2 solder lug terminals on front	LV rectifier filter	CTF1RO4KAAAK	CMC 130-260
R-141	5905-00-171-2004	RESISTOR, FIXED, COMPOSITION; 22,000 ohm; 1/2 w ± 5%	PA screen metering shunt	RC20GF223J	
R-142	5905-21-801-5944	RESISTOR, FIXED, COMPOSITION; 750,000 ohm; ± 2%; 2 w; body style no. 25, MECA ref dwg group 2; temp coefficient less than 0.05% per deg C; body dim. 9/32 in. dia by 1 3/4 in. lg; uninsulated; resistant to humidity changes; 2 pigtail terminals	PA screen metering multiplier	Nobleloy X-2 2/750,000/2	
R-144	5905-00-190-8889	RESISTOR, FIXED, COMPOSITION; 100 ohm 1/2 w, ± 5%	V-141 grid isolating	RC20GF101J	
R-145		Same as R-144	V-141 screen isolating		
R-146		Same as R-144	V-142 screen isolating		

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-502			POWER SUPPLY, TYPE PP-5[illegible]/FRT-502		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-147		Same as R-144.	V-142 grid isolating		
R-148	5905-00-[illegible]-6754	RESISTOR, FIXED, COMPOSITION; 47,000 ohm, 2 w ± 5%	HV rectifier filter discharge	RC42GF473J	
R-149		Same as R-148	HV rectifier filter discharge		
R-151	5905-00-185-8516	RESISTOR, FIXED, COMPOSITION; 10,000 ohm, 2 w ± 5%	LV rectifier bleeder	RC42GF103J	
R-152		Same as R-151	LV rectifier bleeder		
R-153		Same as R-151	LV rectifier bleeder		
R-154		Same as R-151	LV rectifier bleeder		
T-141	5950-21-801-5812	TRANSFORMER, STEP DOWN; hermetically sealed; 115 v a-c, 60 cps, single phase input; output 2.55 v, 10 amp, and 6.3 v at 2 amp; 2.65 kv insulation test; oil filled; 3 15/16 in. lg, 3 3/8 in. wide, 5 1/4 in. high; four 10-32 mtg. studs at 3 in. by 2 7/16 in. centers; 6 solder lug terminals	Filament transformer	CTF1R01KAAAI	CMC 130-258

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-502			POWER SUPPLY, TYPE PP-5008/FRT-502		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
T-142	5950-21-801-5813	TRANSFORMER, STEP UP; hermetically sealed 115 v a-c, 60 cps, single phase input; output 460 v each side of the center tap at 150 ma; 2.65 kv rms insulation test; oil filled; 4 11/16 in. lg, 4 in. wide, 6 in. high; 5 solder lug terminals; four 1/4 in. -20 mtg. studs at 3 11/16 in. by 3 in. mounting centres	LV rectifier plate transformer	CTF1R02MAAAF	CMC 130-255
V-141	5960-00-248-3058	ELECTRON TUBE	PA screen clamp	JAN 5933	
V-142		Same as V-141	PA screen clamp		
V-143	5960-00-108-0252	ELECTRON TUBE	LV rectifier	JAN 3B28	
V-144		Same as V-143	LV rectifier		
X-141	5935-00-201-9508	SOCKET, ELECTRON TUBE; 5 brass contacts, cadmium-plated; medium; 1 7/64 in. dia 47/64 in. thick, mounted by molded-in plate; chassis hole 1 3/16 in. dia; two 5/32 in. dia. holes on 1 1/2 in. centers; mica-filled phenolic body	Socket for PA screen clamp tube	Amphenol 78RS5T	
X-142		Same as X-141	Socket for PA screen clamp tube		

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 POWER SUPPLY, TYPE PP-5008/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-143	5935-00-501-6889	SOCKET, ELECTRON TUBE; four beryllium-copper contacts; cadmium plated; 1 27/32 in. by 1 9/32 in. by 45/64 in. high; mica-filled bakelite body; mounted by two 5/32 in. dia holes on 1 1/2 in. centers	Socket for LV rectifier tube	Amphenol MIP4T	
X-144		Same as X-143	Socket for LV rectifier tube		

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-50L — POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-50L

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-161	5940-00-501-8726	CLIP, ELECTRICAL; similar to style no. 9 MECA ref. dwg group 37; beryllium copper; cadmium plated; 1 1/2 in. lg, 3/4 in. wide, 3/4 in. deep; ceramic insulation; 1 solder lug terminal; mating terminal dia. 9/16 in.	Tube plate clip	National SPP-9	
E-162		Same as E-161			
E-163		Same as E-161			
E-164		Same as E-161			
E-165	5940-21-801-2685	TERMINAL BOARD; molded phenolic board; 12 dual screw solder lug terminals; barrier type; 7 23/32 in. lg, 1 5/16 in. wide, 5/8 in. thick; four 0.209 in. dia. mounting holes at 7 5/16 in. by 1/2 in. centers		HBJ 12-142YD	
E-166	5940-00-253-8814	TERMINAL BOARD; molded phenolic board; 15 dual screw solder lug terminals; barrier type; 7 5/16 in. lg, 1 1/8 in. wide, 1/2 in. thick; four 0.175 in. dia mounting holes at 7 in. by 27/64 in. centers		HBJ 15-141YD	
E-169	5960-00-249-4973	RETAINER, TUBE: stainless steel; spring action; over-all dim. 2 1/2 in. by 1 1/2 in. by 7/8 in.; one mounting slot, 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 1/4 in. dia		Birtcher 926C	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-170		Same as E-169			
E-171		Same as E-169			
E-172		Same as E-169			
	5970-00-156-6146	INSULATOR, STANDOFF (6 used per unit)	Rectifier plate lead tie point	NS3W2008	
F-161	5920-00-281-0209	FUSE; CARTRIDGE; 250 v, 3 amp; instantaneous; ferrules, 1/4 in. dia, 1/4 in. lg; enclosed type; glass body; one-time; non-indicating; over-all dim. 1 3/16 in. lg, 1/4 in. dia.	Primary supply protection	F02G3R00A	
F-162	5920-00-280-5062	FUSE, CARTRIDGE; 250 v, 2 amp; same physical description as F-161	Primary supply protection	F02G2R00A	
F-163	5920-00-296-1515	FUSE, CARTRIDGE; 250 v, 5 amp; same physical description as F-161	Primary supply protection	F02G5R00A	
F-164		Same as F-163	Primary supply protection		
I-161	6240-00-223-9100	LAMP, GLOW; 105-125 v; 1/25 w; min. bayonet base; T-3 1/4 clear bulb, MBCA ref dwg group 7; red light emitted; W-11 electrode; 1 3/16 in. max over-all height; over 25 hours rated life; any burning position	High voltage warning	CGE NE 51	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
K-161	5945-21-801-5831	RELAY, SOLENOID; non-pile-up type; three pole, single throw, double break; normally open; contacts rated for 25 amp, continuous, 115 v ac; 115 v a-c coil; 6 terminals on contacts, 2 on coil; cont. duty; over-all dim. 3 in. wide, 5 7/8 in. high, 3 in. lg; three mounting holes; open case	Primary supply switching		CMC 122-544
K-162		Same as K-161			
K-163	5945-21-801-5832	RELAY, ARMATURE; contact arrangement 2C, MBCA ref dwg group 4; contacts rated for for 1 amp at 28 v dc or 115 v ac; 6 solder type terminals; coil 185 ohm, operates at 75 ma dc, releases at 10 ma; cont duty; hermetically sealed; over-all dim. 2 3/8 in. high, 1 3/8 in. wide, 1 9/16 in. lg; mounted by three 6-32 studs at 1 3/16 in. by 15/16 in. centers	LV rectifier overload	Struthers-Dunn 181XBX153	CMC 144-428
K-164	5945-21-801-5833	RELAY, ARMATURE; contact arrangement 1C, MBCA ref dwg group 4; contact rated for 1 amp at 28 v dc or 115 v ac; 20 ohm coil operates at 225 ma, releases at 150 ma; physical description as for K-163	HV rectifier overload	Struthers-Dunn 181XAX112	CMC 144-427

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
K-162	5925-21-801-2692	CIRCUIT BREAKER; magnetic blowout arc quenching; DPST; contact rating 50 amp 230 v ac or dc cont; interrupting capacity 5000 amp; armature trip release; manual auxiliary trip release; holds in with 125% load; trips after 1.5 sec with 200% load, 0.25 sec with 400% load; manual closing and reset; toggle type; phenolic case; over-all dim. 5 1/4 in. high, 2 in. wide, 4 9/32 in. lg; mounted by two 10-32 bolts at 4 23/64 in. centers; 6 screw-type terminals; all metal parts cadmium plated	Primary supply protection	Heinemann 2263 [illegible],5 amp delay curve three	CMC 144-[illegible]
R-161	5905-00-173-9698	RESISTOR, VARIABLE, WIRE WOUND; 25 ohm, 25 w	HV rectifier overload adjustment	RP101SA250KK	
R-162	5905-21-801-5946	RESISTOR, VARIABLE, WIRE WOUND; 250 ohm, 25 w	LV rectifier overload adjustment	RP101SA251KK	
R-163	5905-00-192-0677	RESISTOR, FIXED, COMPOSITION; 220,000 ohm, 1/2 w ± 5%	Neon lamp shunt	RC20GF224J	
T-161	5950-21-801-5814	TRANSFORMER, POWER, STEP DOWN; hermetically sealed; 115 v a-c, 60 cps, single phase input; 2.55 v, at 10 amp, 2.55 v, at 5 amp, 2.55 v. at 5 amp output; primary insulation test 2.2 kv; secondary insulation test 7 kv; oil filled; 3 15/16 in lg, 3 3/8 in. wide, 5 1/4 in. high; four 10-32 mounting studs at 3 in. by 2 7/16 in. centers; 8 solder lug terminals	Rectifier filament transformer	CTF1R01KAAAJ	CMC 130-259

TRANSMITTER, TYPE AN/FRT-50L — POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-50L

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
V-161	5960-00-108-0252	ELECTRON TUBE	HV rectifier	JAN 3B28	
V-162		Same as V-161			
V-163		Same as V-161			
V-164		Same as V-161			
X-161	5935-00-501-6889	SOCKET, ELECTRON TUBE; four beryllium-copper contacts; cadmium plated; 1 27/32 in. by 1 9/32 in. by 45/64 in. high; mica-filled bakelite body; mounted by two 5/32 in. dia. holes on 1 1/2 In. centers	Rectifier tube socket	Amphenol MIP4T	
X-162		Same as X-161			
X-163		Same as X-161			
X-164		Same as X-161			
X-165	5920-00-280-8332	FUSE HOLDER; extractor post type; rated for 250 v, 6 amp. max; accommodates one cartridge type fuse 5/16 in. dia, 1 1/4 in. lg; phenolic body; zinc-plated brass contacts; over-all dim. 11/16 in. dia, 2 1/4 in. lg, 2 solder lug terminals; single 5/8 in. dia. mounting hole		Bussman HKP	
X-166		Same as X-165			

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 POWER SUPPLY SUB-ASSEMBLY, TYPE PP-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-167		Same as X-165			
X-168		Same as X-165			
X-169	6210-00-283-9722	LIGHT, INDICATOR; supplied with lens; 5/8 in. dia; 3/4 in. lg; red; smooth face; fluted back; translucent; screw mounting lens; accommodates T-3 1/4 lamp; miniature bayonet base; no electrical rating; nickel-plated brass shell; over-all dim. 1 in. dia; 2 1/8 in. lg; mounts in one 11/16 in. dia. hole max. panel thickness, 3/16 in. lamp replaceable from front of panel 2 solder lug terminals on rear, both insulated from shell	Holder for warning lamp	Dialco 53408-991	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501			CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
A-181	4130-21-801-5772	FILTER, AIR CONDITIONING; replaceable type; galvanized metal filtering medium; steel frame; 640 cu.ft per minute capacity; 16 in. wide; 20 in. high; 1 in. thick	Dust filter	AAFC A/C-3	
B-181	6105-21-801-2693	MOTOR-FAN ASSEMBLY; a-c motor; 115 v; 60 cps; single phase; single take-off; 1600 rpm; dustproof encl; temp. range -55 deg C (-67 deg F) ∠ 85 deg C (∠ 185 deg F); fan tip dia. 9 in. to provide 450 cu.ft per minute min. against 1/16 in. water gauge pressure; over-all dim. 11 1/2 in. high, 10 3/4 in. wide, 6 in. deep	Ventilating fan		CMC 147-525
C-181	5910-00-188-2905	CAPACITOR, FIXED, PAPER, 4 uf, 4000 v ± 10%	HV rectifier filter	CP70E1EM405K	
C-182		Same as C-181	HV rectifier filter		
C-183	5910-00-175-6418	CAPACITOR, FIXED, CERAMIC; 5 uuf ± 1 uuf; 5000 v; ceramic insulating body; 5/16 in. dia. by 3/8 in. lg; 2 pigtail term.	Rf indicator coupling	Centralab 855-5Z	
C-184	5910-00-100-8097	CAPACITOR, FIXED, MICA; 330 uuf ± 5%; 500 v.	Rf indicator divider	CM20B331J	
C-185	5910-00-101-3846	CAPACITOR, FIXED, MICA; 4700 uuf ± 5%; 500 v.	Rf indicator bypass	CM35B472J	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
CR-181	5960-00-543-1206	CRYSTAL UNIT, RECTIFYING	Rf indicator rectifier	JAN-IN38B	
E-181	5970-21-106-2125	INSULATOR, FEEDTHROUGH; double-ended conical shape, MBCA ref. dwg. no. 9; assy. of two JAN NS3W4502 bowl insulators with brass studs and washers; stud length 4.938 in.; stud thread 1/4 in. -20; mtg. hardware 6 nuts; 4 plain washers, 2 lock washers	Rf output insulator		CMC 132-200B
E-182		Same as E-181	Rf output insulator		[illegible]
E-183	5940-00-549-8879	TERMINAL BOARD; molded phenolic board; 8 double screw-type term.; barrier type; 5 15/32 in. lg, 1 5/16 in. high, 5/8 in. thick; four 0.209 in. dia mtg holes at 5 1/16 in. by 1/2 in. centers	Remote control terminal, panel	HBJ 8-142D	
E-184	5940-00-204-9410	TERMINAL BOARD; molded phenolic board; 2 double screw-type term.; barrier type; 2 1/2 in. lg, 1 13/16 in. wide, 3/4 in. thick; four 0.160 in. dia. mtg holes at 2 1/16 in. by 5/8 in. centers	Power supply mains terminal panel	HBJ 2-150D	
E-185	5940-00-038-4087	TERMINAL BOARD; molded phenolic type; 20 double screw-type term.; barrier type; 9 1/2 in. lg, 1 1/8 in. wide, 1/2 in. thick; four 0.175 in. dia. mtg holes at 9 3/16 in. by 27/64 in. centers	Local control terminal panel	HBJ 20-141D	

TABLE OF PARTS

TRANSMITTER, TYPE AN/FRT-501 — CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-186		TERMINAL BOARD; molded phenolic board; 3 double screw-type term.; barrier type; 2 11/16 in. lg, 1 5/16 in. high, 5/8 in. thick; four 0.209 in dia mtg. holes at 2 1/4 in. by 1/2 in. centers	Spare terminals	HBJ 3-42D	
E-187	5935-21-801-5911	CLAMP, ELECTRICAL		MS3057-16B	
E-188	5970-21-324-0046	INSULATOR, STANDOFF		NS3W0308	
E-189	5970-21-324-0052	INSULATOR, STANDOFF		NS3W0312	
E-190	5960-00-170-4438	CLAMP, ELECTRICAL; stainless steel; spring action; over-all dim. 2 1/2 in. by 1 1/4 in. by 17/32 in.; one mtg. slot, 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 1/4 in. dia		Birtcher 926B-2	
E-191		Same as E-190			
E-192		Same as E-190			
E-193		Same as E-190			
E-194	5960-21-801-2681	RETAINER, TUBE; stainless steel; spring action; over-all dim. 3 in. by 1 3/4 in. by 17/32 in.; one mtg slot, 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 3/4 in.dia		Birtcher 926E-5	

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TRANSMITTER, TYPE AN/FRT-501			CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-195		Same as E-194			
E-196		Same as E-194			
E-197		Same as E-194			
E-198	5935-21-801-5912	RETAINER, TUBE		MS3057-12B	
	5940-00-549-9552	TERMINAL, STUD; insulated, swaged, similar to style no. 60 MBCA ref. dwg group 21; insulation rated for 6000 v rms; solder connection; brass; cadmium plated; over-all dim. 1 1/64 in. lg, 5/16 in. dia; mounts by plain shank 0.187 in. dia (1 used per unit)	C-185 tie point	CTC X1942-Y	
	5970-21-801-2682	INSULATOR, BUSHING (91 used per unit)	Antenna feedthrough	NP2W4201	
	5970-00-117-5120	INSULATOR, BUSHING (1 used per unit)	Antenna feedthrough	NP2W4101	
	5970-21-103-1679	INSULATOR, BUSHING (10 used per unit)	PA screen resistor support	NP2W4104	
J-181	5935-21-102-9800	CONNECTOR, RECEPTACLE	Ext. freq. monitor	UG-262C/U	
J-182		Same as J-181	Ext Rf input		

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TRANSMITTER, TYPE AN/FRT-501 CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
L-181	5950-21-801-5815	REACTOR; filter choke; 1 winding; 16 H at 700 ma dc; d-c resistance 50 ohms; 7 kv rms insulation test; hermetically sealed; metal case; 9 3/16 in. lg, 6 11/16 in. wide, 11 in. high; no mounting holes or studs; top and bottom case members dished inwards to form mounting flanges; 1 threaded stud and 2 solder lug terminals on bottom; fitted with carrying handle	HV Rectifier filter	CTF1MC4YYAAL	CMC 130-261
L-206A	5950-21-801-5816	TRANSFORMER, RADIO FREQUENCY; single layer; 49 1/2 turns no. 29 AWG; cotton enamel insulation; phenolic coil form; powdered iron core; adjustable tuning by screwdriver adjustment of core; aluminum case; over-all coil dim. excluding pins and mounting attachments, 2 1/2 in. lg. by 1 1/4 in. dia; 6 contact type terminals; plugs into 6-pin vibrator socket; includes shunt connected mica capacitors for tuning; markings on top: MARCONI; 145-728; 1.5 -2.1; 2.1-3.0	Multiplier Coil 1.5-3.0 mc		CMC 145-728
L-206B	5950-21-801-5817	TRANSFORMER, RADIO FREQUENCY; same description as L-206A except: 39 1/2 turns no. 27 AWG; cotton enamel insulation; markings: MARCONI; 145-730; 2.5-3.5; 3.5 to 5.1	Multiplier coil, 2.5-5.0 mc.		CMC 145-730

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TRANSMITTER, TYPE AN/FRT-50A — CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-50A

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
L-206C	5950-21-801-5818	TRANSFORMER, RADIO FREQUENCY; same description as L-206A except: 25 1/2 turns no. 24 AWG; double-cotton-covered insulation; markings: MARCONI; 145-732; 4.8-7.0; 7.0-11.2	Multiplier coil, 7.0 - 10.0 mc		CMC 145-732
L-206D	5950-21-801-5819	TRANSFORMER, RADIO FREQUENCY; same description as L-206A except: 13 1/2 turns of no. 18 AWG; double cotton enamel insulation; markings: MARCONI; 145-734; 9.8 - 12.0; 12.0 - 15.0	Multiplier coil, 10.0 - 15.0 mc		CMC 145-734
L-207A	5950-21-801-5820	TRANSFORMER, RADIO FREQUENCY; single layer; 175 turns no. 32AWG; close wound single silk (covered) enamel insulation; taps at 20, 65, and 150 turns from start; no tuning adjustment; aluminum case; over-all coil dim. excluding pins; 3 5/8 in. lg, 1 3/4 in. dia; 6 contact type terminals; plugs into a 6-pin vibrator socket; markings on top; MARCONI; 129-879; 1.4 - 1.9; 1.9 - 2.8	IPA coil, 1.5 - 2.5 mc		CMC 129-879
L-207B	5950-21-801-5821	TRANSFORMER, RADIO FREQUENCY; same description as L-207A except: 75 turns no. 22 AWG; close wound double silk covered, no enamel insulation; taps at 12 5/6, 37, and 47 turns from start; no tuning adjustment; markings: MARCONI; 129-885, 2.3-3.5; 3.5-5.2	IPA coil, 2.5 - 5.0 mc		CMC 129-885

TRANSMITTER, Type AN/FRT-501 CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
L-207C	5950-21-801-5822	TRANSFORMER, RADIO FREQUENCY; same description as coil L-207A except: 37 turns no. 20 AWG; bare copper at 18 turns per in.; taps at 7 2/3, 19 and 24 turns from the start; markings: MARCONI; 129-883; 4.8 - 6.5; 6.5 - 11.0	IPA coil, 5.0 - 10.0 mc		CMC 129-883
L-207D	5950-21-801-5823	TRANSFORMER, RADIO FREQUENCY; same as L-207A except; 19 turns no. 16 AWG; bare tinned copper at 9 turns per in.; taps at 5 2/3, 11 and 13 turns from start; markings: MARCONI; 129-881; 9.6 - 12.5; 12.5 - 16.0	IPA coil, 10.0 - 15.0 mc		CMC 129-881
P-181	5935-00-257-9019	CONNECTOR, PLUG	Freq. monitor	UG-260C/U	
P-182		Same as P-181	Ext. input		
R-181	5905-00-665-5092	RESISTOR, FIXED, WIRE WOUND; 4000 ohm; 113 w	PA screen dropping	RW37V402	
R-182	5905-21-801-5943	RESISTOR, FIXED, WIRE WOUND: 8000 ohm; 113 w	PA screen dropping	RW37V802	
R-183		Same as R-182	PA screen dropping		
R-184		Same as R-182	PA screen dropping		

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TRANSMITTER, TYPE AN/FRT-501		CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-185		Same as R-182	PA screen dropping		
R-186	5905-00-279-1757	RESISTOR, FIXED, COMPOSITION; 1500 ohms; 1/2 w ± 5%	RF indicator filter	RC20GF152J	
T-181	5950-21-801-5824	TRANSFORMER, POWER, STEP UP; primary winding 115 v, 60 cps, single phase; secondary winding 2770 v, 700 ma ac, tap at 1935 v; 3 kv insulation test; varnish impregnated, oil filled; hermetically sealed; metal case; dim. MBCA ref dwg group 12, 12 1/2 in. lg, 6 11/16 in. wide, 9 3/16 in. high; no mounting holes or studs; top and bottom case members dished inwards to form mounting flanges; 1 threaded stud and 5 solder lug terminals on end; no internal shield; fitted with carrying handle	HV Rectifier plate transformer	CTF1R02YYAAM	CMC 130-262
T-182	5950-21-801-5825	TRANSFORMER, AUDIO FREQUENCY; modulation type; single primary winding 22,000 ohms, center tapped; single secondary winding 9,000 ohms, not tapped; primary rating 260 ma dc; secondary rating 300 ma dc; max audio operating level 400 w; ratio of turns 1.56 to 1, primary to secondary; frequency response ± 1 db from 300 to 4000 cycles; not tuned; 8 kv rms insulation test; hermetically sealed; metal case; silicon steel core; dim.	PA plate modulation transformer	CTF1R14YYAAG	CMC 130-256

TRANSMITTER, TYPE AN/FRT-501 CABINET, ELECTRICAL EQUIPMENT, TYPE CY-5009/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
T-182 (Cont'd)	5950-21-801-5825	MBCA ref. dwg. group 12, 11 in. lg, 6 11/16 in. wide, 9 3/16 in. high; no mounting holes or studs; top and bottom case members dished inwards to form mounting flanges; 1 threaded stud and 5 solder lug terminals on end; no internal shield; fitted with carrying handle			
S-182	5930-00-296-6478	SWITCH, interlock	Protective door switch	Microswitch 3AC1	
X-181	5935-21-801-5907	CONNECTOR, PLUG	Audio and control plug	MS3106A28-17S or MS3106B28-17S	
X-182	5935-21-801-5897	CONNECTOR, PLUG	Power and control plug	MS3106A20-27S or MS3106B20-27S	

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TRANSMITTER, TYPE AN/FRT-501		TRANSMITTER SUB-ASSEMBLY, TYPE T-5006-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-201	5910-00-101-4023	CAPACITOR, FIXED, MICA; 1000 uuf, 500 v ± 5%	Ext. input coupling	CM30B[illegible]2J	
C-202	5910-00-126-1611	CAPACITOR, VARIABLE, CERAMIC; 12 uuf	Input capacity trimmer	CV11A120	
C-203	5910-00-101-5599	CAPACITOR, FIXED, MICA; 15 uuf, 500 v ± 10%	Crystal reaction divider	CM20B150K	
C-204	5910-00-801-5934	CAPACITOR, FIXED, MICA; 150 uuf, 500 v ± 10%	Crystal reaction divider	CM20B151K	
C-206	5910-00-101-3846	CAPACITOR, FIXED, MICA; 4700 uuf, 500v ± 5%	Osc. screen by-pass	CM35B472J	
C-207		Same as C-206	Osc. plate by-pass		
C-208	5910-21-801-5935	CAPACITOR, FIXED, MICA; 22 uuf, 500 v ± 5%	Osc. output	CM20B220J	
C-209		Same as C-206	Buffer grid by-pass		
C-210	5910-00-112-7513	CAPACITOR, FIXED, PAPER; 100,000 uuf, 200 v ± 20%	Keying waveform shaping	CP28A1EC104M	
C-212		Same as C-206	Buffer screen by-pass		
C-214	5910-00-100-8142	CAPACITOR, FIXED, MICA; 10,000 uuf, 300 v ± 5%	Buffer cathode by-pass	CM35B103J	

TRANSMITTER, TYPE AN/FRT-501		TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-219		Same as C-206	Keyline by-pass		
C-220		Same as C-206	Rf gain control by-pass		
C-223		Same as C-206	Buffer plate by-pass		
C-225	5910-00-100-8108	CAPACITOR, FIXED, MICA; 68 uuf, 500 v ± 5%	Buffer output coupling	CM20B680J	
C-227		Same as C-206	Mult. screen by-pass		
C-229		Same as C-214	Mult. cathode by-pass		
C-232		Same as C-206	Mult. plate by-pass		
C-233		Same as C-225	Mult. output coupling		
C-234	5910-00-280-6639	CAPACITOR, FIXED, PAPER; 10,000 uuf, 600 v ± 10%	Spark suppressor	CP28A1EF103K	
C-235		Same as C-206	IPA plate by-pass		
C-236		Same as C-206	IPA screen by-pass		
C-237		Same as C-201	IPA filament by-pass		

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-238		Same as C-214	IPA cathode by-pass		
C-239	5910-21-801-5936	CAPACITOR, VARIABLE, AIR; plate meshing type; 1 section; 100 uuf max, 8 uuf min; no std. tuning characteristic; 700 v a-c peak; 2 in. lg. 1 in. wide, 1 1/4 in. high; shaft beyond bushing 1/4 in. dia, 13/16 in. lg; 3/4 in. long bakelite knob secured to end of shaft with slot for screw driver adjustment; ceramic insulation between rotor and stator; 2 solder lug terminals, two 4-40 tapped holes on 21/32 in. mounting centers	IPA plate tuning		CMC 145-175
C-240	5910-00-101-4536	CAPACITOR, FIXED, MICA; 100 uuf, 2500 v ± 5%	IPA output coupling	CM45B101J	
C-241		Same as C-206	PA bias by-pass		
C-245	5910-00-100-8097	CAPACITOR, FIXED, MICA; 330 uuf, 500 v ± 5%	Af input transformer shunt	CM20B331J	
C-246		Same as C-234	Af driver grid coupling		
C-247		Same as C-234	Af driver grid coupling		

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-248	5910-00-174-9216	CAPACITOR, FIXED, ELECTROLYTIC; dual 55 uf; 150 v, 5%	Af driver and PA cathode by-pass	CE52C550J	
C-249	5910-00-112-7482	CAPACITOR, FIXED, PAPER; 500,000 uuf; 600 v, 10%	Af driver screen by-pass	CP28A1EF504K	
C-250		Same as C-210	Auto start grid coupling		
C-251		Same as C-206	Meter by-pass		
C-252	5910-21-801-5937	CAPACITOR, FIXED, PAPER; 1 uf; 400 v, 10%	Tuning circuit reservoir	CP90B1EE105K	
C-253	5910-00-120-1687	CAPACITOR, FIXED, PAPER; 4 uf; 600 v, 10%	Bias rectifier filter	CP70E1EF405K	
C-254		Same as C-253	Bias rectifier filter		
C-255		Same as C-201	Af driver plate by-pass		
C-256		Same as C-201	Af driver plate by-pass		
CR-201	5960-00-543-1206	CRYSTAL UNIT, RECTIFYING	Buffer bias clamp	JAN-1N38B	
E-201	5960-00-262-0015	SHIELD, ELECTRON TUBE		TS102 U01	

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-202	5960-00-272-9094	SHIELD, ELECTRON TUBE		TS102U02	
E-204	5960-00-170-4438	RETAINER TUBE; stainless steel; spring action; over-all dim. 2 1/2 in. by 1 1/4 in. by 17/32 in; one mounting slot 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 1/4 in. dia.	Tube retaining clamp	Birtcher 926B-2	
E-205		Same as E-204			
E-206	5960-00-272-9092	SHIELD, ELECTRON TUBE		TS102U03	
E-207	5960-21-801-2681	RETAINER TUBE; stainless steel; spring action; over-all dim., 2 1/2 in. by 1 3/4 in. by 17/32 in; one mounting slot, 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 1/4 in. dia.	Tube retaining clamp	Birtcher 926E-5	
E-208	5960-00-264-3004	SHIELD, ELECTRON TUBE		TS103U02	
E-209		Same as E-208			
E-210		Same as E-206			
E-211		Same as E-208			
E-212		Same as E-206			
E-213		Same as E-206			

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-214		Same as E-206			
E-215	5960-00-549 -0961	RETAINER ELECTRON TUBE; stainless steel spring action; over-all dim. 2 3/4 in. by 1 5/8 in. by 7/8 in; one mounting slot 5/16 in. by 3/16 in. at base of clamp; designed to hold material 1 5/8 in. dia.	Tube retaining clamp		Birtcher 926H-5
E-216		Same as E-215			
E-217		Same as E-215			
E-218		Same as E-204			
E-219	5940-00-204 -9112	CAP, ELECTRICAL; similar to style no.9 MBCA ref. dwg group 37; beryllium copper; cadmium plated; 1 1/8 in. lg, 5/8 in high, 5/8 in. wide; ceramic insulation; 1 solder lug terminal; 5/16 in. dia. of mating terminal	Tube plate clip	National SPP-3	
E-220		Same as E-219			
E-221		Same as E-219			
E-222		Same as E-201			
E-223		Same as E-201			
E-224	5910-21-801 -5938	BRACKET, CAPACITOR MOUNTING		CP090SA5	

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
E-225	5910-00-666 -0087	BRACKET, CAPACITOR MOUNTING		CP07SB4	
E-226		Same as E-225			
E-227		Same as E-225			
E-228		Same as E-225			
	5940-00-271 -5601	TERMINAL, STUD; style no. 8 MBCA ref. dwg. group 21; breakdown voltage 3800 v; solder connection; nickel-plated brass bushing, silver-plated brass lugs; over-all dim. 1 in. lg. 1/2 in. dia; mounts by threaded bushing in 1/4 in. dia hole (3 used per unit)	Tie point	CTC X1795A	
	5940-00-549 9552	TERMINAL, STUD; insulated, swaged, similar to Style no. 60 MBCA ref. dwg. group 21; insulation rated for 6000 v rms; solder connection; brass, cadmium-plated bushing, silver-plated lugs; over all dim. 1 1/64 in. lg. 5/16 in. dia. mounts by plain shank, 0.187 in. dia (35 used per unit)	Tie point	CTC X1942-Y	
J-201	10EC/35348	CONNECTOR, RECEPTACLE; one round male contact accommodated; straight type tip jack connector; green phenolic head; over-all dim. excluding terminal 5/8 in. lg, 1/2 in. dia; mounted in single 1/4 in. dia. hole	Buffer grid metering	Johnson 105-528	

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
J-202	5935-00-222 -0850	CONNECTOR, RECEPTACLE; same description as J-201 except red plastic head	Mult. cathode metering	Johnson 105-520	
J-203		Same as J-201	IPA grid metering		
J-204		Same as J-202	IPA cathode metering		
J-205		Same as J-202	Af driver cathode metering		
J-206		Same as J-201	Mod. grid metering		
J-207		Same as J-202	PA screen metering		
J-208		Same as J-201	Bias rectifier metering		
J-209		Same as J-201	PA grid metering		
J-210		Same as J-201	Af driver grid metering		
J-211	5935-00-539 -0761	CONNECTOR, RECEPTACLE	Ext. input connector	UG-290A/U	
J-212		Same as J-211	Freq. monitor connector		

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TRANSMITTER, TYPE AN/FRT-501		TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
K-201	5945-21-801 5832	RELAY, ARMATURE; contact arrangement 2C MBCA ref. dwg group 4; contacts rated for 1 amp at 28 v dc or 115 vac; 6 solder type terminals; coil 185 ohm, operated at 75 ma dc, releases at 10 ma; cont. duty; hermetically sealed; over-all dim. 2 3/8 in. high, 1 3/8 in. wide, 1 9/16 in. lg; mounted by three 6-32 studs at 1 3/16 in. by 15/16 in. centers	Cw/rt transfer		CMC 144-428
K-202	5945-21-80[illegible] -5833	RELAY, ARMATURE; contact arrangement 1C MBCA ref. dwg. group 4; 20 ohm coil operates at 225 ma dc, releases at 150 ma; otherwise same as K-201	PA interlock relay		CMC 144-427
K-203	5945-21-801 -5834	RELAY, ARMATURE; contact arrangement 2C MBCA ref. dwg. group 4; same as K-201 except: 6000 ohm coil operates at 14ma, releases at 8 ma.	Filament time delay relay		CMC 144-429
K-204	5945-21-801 -5835	RELAY, ARMATURE; contact arrangement 1C MBCA ref. dwg. group 4; contacts rated for 2 amp at 115 v ac; 1000 ohm coil operates at 3.2 ma max, releases at 1.2 ma min; cont. duty; hermetically sealed; 6 solder type terminals; over-all dim. 1 1/2 in. wide, 1 1/2 in. lg. 3 3/32 in. high; mounted by two 6-32 studs on 1 3/8 in. centers	Auto stop relay		CMC 131-927
K-205		Same as K-204	Auto start relay		

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
K-206		Same as K-204	Cw/rt control relay		
L-201	5950-00-645-3769	COIL, RADIO FREQUENCY; 150 ma current rating; self-resonant at 6.5 mc; over-all dim. excluding terminals 1/2 in. dia, 1 5/8 in. lg; 2 pigtail terminals, one at each end	Osc. cathode choke		CMC 110-097E
L-203	5950-21-801-5806	COIL, RADIO FREQUENCY; 150 ma current rating; self-resonant at 12 mc; over-all dim. excluding terminals: 13/32 in. diam, 1 5/8 in. lg; 2 pigtail terminals one each end.	PA Grid choke		CMC 110-097M
L-205	5950-21-801-5826	REACTOR; filter choke; one winding 15H at 70 ma; 400 ohm d-c resistance; 2.65 kv insulation test; hermetically sealed; metal case; 2 3/4 in. lg, 2 3/8 in. wide, 3 13/16 in. high; four 8-32 mtg. studs, at 2 1/8 in. by 1 3/4 in. centers; 2 solder-lug terminals.	Bias rectifier filter choke	CTF1RO4GAAAD	CMC 130-253
L-206		(See Cabinet, Electrical Equipment)			
P-201	10EC/35339	CONTACT, ELECTRICAL; contact surface cadmium-plated brass; over-all dim. 3/4 in. dia, 2 15/16 in. lg; 1 solder lug terminal; mounted by one 10-32 tapped hole in integral stand-off insulator	Rf output connector		CMC 144-595

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
P-202	5935-00-280-2074	CONNECTOR, RECEPTACLE	Audio and control connector	MS3102A20-27P	
P-203	5935-00-201-7868	CONNECTOR, RECEPTACLE	Power and control connector	MS3102A28-17P	
P-205	6625-21-801-5908	PROD, TEST: 1 round male contact: straight type: cylinderical, black, bakelite body: 4 1/8 in. lg, 3/8 in. dia.	Meter test probe		CMC 145-945
P-206		CONNECTOR, PLUG: 2 round male contacts connected together, 13/64 in. lg, 3/64 in. dia, 31/64 in. centers: over-all dim. 49/64 in. lg, 11/32 in. wide, 31/32 in. high	External crystal-link		CMC 146-222
R-201	5905-00-279-3525	RESISTOR, FIXED, COMPOSITION, 68 ohm, 2 w ± 5%	Rf input line termination	RC42GF680J	
R-202	5905-00-249-3661	RESISTOR, FIXED, COMPOSITION: 68,000 ohm, 1/2 w, 5%	Osc. screen dropping	RC20GF683J	
R-203	5905-00-254-9201	RESISTOR, FIXED, COMPOSITION: 47,000 ohm, 1/2 w, 5%	Osc. grid leak	RC20GF473J	
R-204	5905-00-299-2028	RESISTOR, FIXED, COMPOSITION: 15,000 ohm, 1 w, 5%	Osc. isolating	RC32GF153J	
R-205	5905-00-195-6806	RESISTOR, FIXED, COMPOSITION: 1000 ohm 1/2 w, 5%	Osc. plate load	RC20GF102J	

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-206	5905-00-279 -3513	RESISTOR, FIXED, COMPOSITION: 220 ohm, 1/2 w, 5%	Osc. cathode	RC20GF221J	
R-207	5905-00-279 -2616	RESISTOR, FIXED, COMPOSITION: 15,000 ohm, 1/2 w, 5%	Buffer grid leak	RC20GF153J	
R-208	5905-00-195 -6761	RESISTOR, FIXED, COMPOSITION: 100,000 ohm, 1/2 w, 5%	Buffer grid isolating	RC20GF104J	
R-209	5905-00-279 -2675	RESISTOR, FIXED, COMPOSITION: 33,000 ohm, 2w, 5%	Keyer bias divider	RC42GF333J	
R-210	5905-00-185 -8510	RESISTOR, FIXED, COMPOSITION: 10,000 ohm, 1/2 w, 5%	Keyer bias divider	RC20GF103J	
R-211	5905-00-190 -8889	RESISTOR, FIXED, COMPOSITION: 100 ohm, 1/2 w, 5%	Freq. monitor source	RC20GF101J	
R-212	5905-21-801 -7715	RESISTOR, FIXED, FILM: 75,000 ohm, ± 2%: 1/2 w: body style no. 25, MBCA ref. dwg. group 2: temp. coefficient less than 0.05% per deg C: body dim. 9/32 in. dia, 5/8 in. lg: uninsulated, resistant to humidity changes: 2 pigtail terminals	Mult. grid metering	Nobleloy 1/2/75000/2 Type X1/2	
R-213		Same as R-207	Buffer screen dropping		
R-214		Same as R-205	Buffer plate isolating		

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-215	5905-00-192 3973	RESISTOR, FIXED, COMPOSITION: 470 ohm, 1/2 w ± 5%	Buffer cathode	RC20GF471J	
R-219	5905-00-254 -7101	RESISTOR, FIXED, COMPOSITION: 100,000 ohm, 2 w ± 5%	Rf gain voltage divider	RC42GF104J	
R-220	5905-00-249 -3663	RESISTOR, FIXED, COMPOSITION: 68,000 ohm, 2 w, 5%	Buffer plate load	RC42GF683J	
R-221	5905-00-112 -4152	RESISTOR, VARIABLE, WIRE WOUND: 10,000 ohm, 4w, 10%	Rf gain control	RA30A1SA103AK	
R-222	5905-00-299 -2048	RESISTOR, FIXED, COMPOSITION: 1000 ohm 1 w, 5%	Bias bleeder	RC32GF102J	
R-224		Same as R-207	Mult. screen dropping		
R-225		Same as R-208	Mult. grid leak		
R-226	5905-21-801 -5947	RESISTOR, FIXED, FILM 2.27 ohm ± 2% 1/2 w: same physical description as R-212	Mult. cathode metering	Nobleloy 1/2/2R27/2T Type X1/2	
R-227	5905-21-279 -1745	RESISTOR, FIXED, COMPOSITION: 15 ohm, 1w 5%	Af driver cathode	RC32GF150J	
R-228	5905-00-270 -5799	RESISTOR, FIXED, WIRE WOUND: 2500 ohm: 26 w.	LV supply dropping	RW33G252	

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-229	5905-00-617 -7226	RESISTOR, FIXED, COMPOSITION: 470 ohm 1 w. 5%	Mult cathode	RC32GF471J	
R-230		Same as R-204	IPA grid leak		
R-231	5905-21-801 -5948	RESISTOR, FIXED, FILM: 28.6 ohm, ± 2%: 1/2 w; same physical description as R-212	IPA grid metering	1/2/28R6/2	
R-232		Same as R-211	Spark suppressor		
R-233	5905-00-239 -0568	RESISTOR, FIXED, COMPOSITION: 22,000 ohm 2 w 5%	IPA screen dropping	RC42GF223J	
R-234		Same as R-233	IPA screen dropping		
R-235	5915-00-503 -2047	SUPPRESSOR, PARASITIC: 5 turns no.20 AWG, tinned copper wire; resistor 47 ohm, 1 w; 5/16 in. dia, 3/4 in. lg; terminal mounted; 2 pigtail terminals	IPA plate suppressor		CMC 144-481
R-236	5905-00-636 -9918	RESISTOR, FIXED, WIRE WOUND: 400 ohm 14 w. ± 5%	IPA cathode	RW31V401	
R-237	5905-21-801 -5949	RESISTOR, FIXED, FILM: 0.67 ohm, ± 2%: 1/2 w; same physical description as R-212	IPA cathode metering	Nobleloy 1/2R67/2 Type X1/2	
R-238	5905-00-257 -0926	RESISTOR, FIXED, COMPOSITION: 3300 ohm, 2 w 5%	Bias bleeder	RC42GF332J	

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TRANSMITTER, TYPE AN/FRT-501		TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-239	5905-00-190 -8883	RESISTOR, FIXED, COMPOSITION: 10 ohm, 1/2 w 5%	Local microphone voltage source	RC20GF100J	
R-240	5905-21-801 -5950	RESISTOR, VARIABLE, COMPOSITION: sliding brush type: 2 identical sections each: 50,000 ohm ± 20%: 1/2 w: std. L taper, MBCA ref. dwg. group 3: 3 solder lug terminals per section: phenolic body: enclosed: 1 3/8 in. dia, 1 1/8 in. deep: slotted metal shaft, 1/4 in. dia, 7/8 in lg: normal torque: insulated contact arm: no 'off' position: mounted by 3/8 in. -32 bushing, 1/2 in. lg.	Af gain control		CMC 135-412
R-241		Same as R-215	Input amplifier cathode		
R-242		Same as R-208	Af driver feedback		
R-243	5905-00-279 -2522	RESISTOR, FIXED, COMPOSITION: 150,000 ohm, 1/2 w 5%	Input amplifier plate load	RC20GF154J	
R-244		Same as R-243	Input amplifier plate load		
R-245		Same as R-208	Af driver feedback		
R-246		Same as R-208	Af driver grid leak		

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-247		Same as R-208	Af driver grid leak		
R-248	5905-00-257 -0937	RESISTOR, FIXED, COMPOSITION: 4700 ohm 2 w ± 5%	Af driver biasing	RC42GF472J	
R-249	5905-21-801 -5951	RESISTOR, FIXED, FILM: 150,000 ohm ± 2%: 1/2 w: same physical description as R-212	Af driver grid metering	Nobleloy 1/2/150,000 /2 Type X1/2	
R-250		Same as R-249	Af driver cathode metering		
R-251		Same as R-233	Af driver screen dropping		
R-252	5905-00-642 -3771	RESISTOR, FIXED, WIRE WOUND: 3500 ohm, 26 W	Bias divider	RW33V352	
R-253		Same as R-206	K206 shunt		
R-254	5905-00-299 -1999	RESISTOR, FIXED, COMPOSITION: 150,000 ohm, 1 w ± 5%	Bias regulator divider	RC32GF154J	
R-255		Same as R-203	Bias regulator divider		
R-256	5905-00-108 -6177	RESISTOR, VARIABLE, WIRE WOUND: 10,000 ohm, 2 w	Mod. bias control	RA20A1SA103AK	

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-257	5905-00-171 -2004	RESISTOR, FIXED, COMPOSITION: 22,000 ohm, 1/2 w ± 5%	Bias regulator divider	RC20GF223J	
R-258	5905-00-192 -0390	RESISTOR, FIXED, COMPOSITION: 1 megohm, 1/2 w, ± 5%	Bias regulator divider	RC20FG105J	
R-259		Same as R-202	Bias regulator divider		
R-260		Same as R-211	Bias regulator suppressor		
R-261		Same as R-249	Mod. bias metering		
R-262		Same as R-210	Mod. bias metering shunt		
R-263	5905-00-299 -2013	RESISTOR, FIXED, COMPOSITION: 47,000, ohm, 1 w ± 5%	Bias regulator cathode	RC32GF473J	
R-264	5905-00-279 -2530	RESISTOR, FIXED, COMPOSITION: 1500 ohm, 2 w ± 5%	Bias regulator plate	RC42GF152J	
R-265		Same as R-263	Bias regulator bleeder		
R-266		Same as R-211	Bias regulator suppressor		
R-267	5905-00-192 -0667	RESISTOR, FIXED, COMPOSITION: 220,000 ohm, 1/2 w ± 5%	Bias regulator divider	RC20GF224J	

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-268		Same as R-211	Bias regulator suppressor		
R-269		Same as R-211	Bias regulator suppressor		
R-270	5905-21-801 -5952	RESISTOR, FIXED, FILM, 300,000 ohm ± 2%; 1/2 w; same physical description as R-212	Bias metering	Nobleloy 1/2/300,000/2 Type X1/2	
R-271		Same as R-207	Auto stop cathode		
R-272	5905-00-185 -8490	RESISTOR, FIXED, COMPOSITION; 4.7 megohm 1/2 w ± 5%	Auto stop delay grid	RC20GF475J	
R-273		Same as R-210	Auto stop isolating		
R-274	5905-00-279 -3504	RESISTOR, FIXED, COMPOSITION; 4700 ohm 1/2 w ± 5%	Auto start cathode	RC20GF472J	
R-275		Same as R-208	Auto start grid leak		
R-276	5905-00-190 -8885	RESISTOR, FIXED, COMPOSITION; 2.2 megohm, 1/2 w ± 5%	Fil. time delay grid	RC20GF225J	
R-277		Same as R-226	PA grid metering		
R-278	5905-00-279 -2528	RESISTOR, FIXED, COMPOSITION; 6800 ohm, 2 w ± 5%	Bias isolator plate	RC42GF682J	

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
R-279		Same as R-248	PA grid leak		
R-280		Same as R-248	PA grid leak		
R-281		Same as R-208	Bias isolator grid leak		
R-282	5905-00-299 -2018	RESISTOR, FIXED, COMPOSITION: 33,000 ohm, 1 w ±5%	Bias isolator cathode	RC32GF333J	
R-283		Same as R-278	Bias isolator plate		
R-284		Same as R-203	PA screen clamp grid		
R-285	5905-00-279 -2519	RESISTOR, FIXED, COMPOSITION: 330,000 ohm, 1/2 w ± 5%	Bias divider	RC20GF334J	
R-286		Same as R-267	Fil. time delay grid		
S-201	5930-00-050 -2681	SWITCH, TOGGLE	Tune/operate switch	ST42D	
T-201	5950-21-801 -5827	TRANSFORMER, AUDIO FREQUENCY: input type, three primary windings, 50 ohm, 125 ohm, 125 ohm: secondary 100,000 ohm, center tapped: each primary rated for 85 ma: insulation test 600 v: hermetically sealed: steel case; 3 13/16 in. high, 2 3/4 in. lg, 2 3/8 in wide: turns ratio, primary to secondary 240/	Af input transformer	CTF1R10GAAAB	CMC 130-254

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
T-201(cont'd)		380/380; 10,400; ≤ 1 db, 300 to 4000 cps; four 8-32 mounting studs at 2 1/8 in. by 1 3/4 in. centers; oil filled; 10 solder lug terminals located axially on one end.			
T-202	5950-21-801-5828	TRANSFORMER, AUDIO FREQUENCY; plate coupling type; primary 10,000 ohm; secondary 5000 ohm; both center-tapped; insulation test 2.65 kv; hermetically sealed; steel case; 2 3/4 in. lg, 2 3/8 in. wide, 3 3/16 in. high; turns ratio, secondary to primary 1350; 1740; 8 w max audio level; ≤ 1 db 300 to 4000 cps; 6 solder lug terminals located axially at one end; four 8-32 mounting studs at 2 1/8 in. by 1 3/4 in. mounting centers; oil filled	Af driver output transformer	CTF1R12GAAAC	CMC 130-252
T-203	5950-21-801-5829	TRANSFORMER, POWER, STEP DOWN AND STEP UP, hermetically sealed; metal case; primary 115 v ac, 60 cps, single phase output; 180 v each side of center tap at 50 ma, 6.3 v at 5 amp, 6.3 v at 0.9 amp, 6.3 v at 0.9 amp, 6.3 v at 0.9 amp; 2.65 kv insulation test; oil filled; 3 15/16 in. lg, 3 3/8 in. wide, 5 1/4 in. high; four 10-32 mtg. studs at 3 in. by 2 7/16 in. mounting centers; 13 solder lug terminals on small stand-off insulators	Bias rectifier and filament transformer	CTF1RC3KAAAB	CMC 130-251

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TRANSMITTER, TYPE AN/FRT-501			TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
V-201	5960-00-262-1357	ELECTRON TUBE	Oscillator tube	JAN 5654/6AK5W	
V-202	5960-00-188-3602	ELECTRON TUBE	Buffer tube	JAN 6BH6	
V-204	5960-00-669-6861	ELECTRON TUBE	Multiplier tube	JAN 6005/6AQ5W	
V-205	5960-00-248-3058	ELECTRON TUBE	IPA tube	JAN 5933	
V-206	5960-00-193-5145	ELECTRON TUBE	Af input amplifier tube	JAN 5751	
V-207		Same as V-205	Af driver tube		
V-208		Same as V-205	Af driver tube		
V-209		Same as V-204	Bias regulator supply tube		
V-210	5960-00-262-0167	ELECTRON TUBE	Bias regulator tube	JAN12AT7WA	
V-211		Same as V-210	Bias regulator tube		
V-212	5960-00-272-9182	ELECTRON TUBE	Bias rectifier tube	JAN6X4WA	
V-213		Same as V-204	Fil. time delay tube		

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TRANSMITTER, TYPE AN/FRT-501 — TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501

Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
V-214		Same as V-204	Bias isolator tube		
V-215		Same as V-201	Auto stop tube		
V-216		Same as V-201	Auto start tube		
X-201	5935-00-501 -8358	SOCKET, CRYSTAL; 2 contacts, beryllium copper, cadmium plated; miniature size overall dim. excluding terminals 1 5/8 in. lg, 3/8 in. wide, 3/8 in. deep; ceramic body; mounted by one 5/32 in. dia. hole; 2 1/4 in. holes on 1/2 in. centers required to pass terminals;	Socket for external rf input jumper	Millen 33302	
X-202		Same as X-201	Crystal socket		
X-203	5935-00- 222 -6453	SOCKET, ELECTRON TUBE	Socket for V-201	TS102P01	
X-204		Same as X-203	Socket for V-204		
X-206	5935-21-801 -5910	SOCKET, COIL; 6 cadmium plated, brass contacts; medium; over-all dim. excluding terminals; 1 7/8 in. lg, 1 1/2 in. wide, 5/16 in. thick; melamine body; two 0.144 in. mounting holes at 1 1/2 in. centers	Socket for L-206		CMC 144-690

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TRANSMITTER, TYPE AN/FRT-501		TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501			
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-207		Same as X-203	Socket for V-204		
X-208		Same as X-206	Socket for L-207		
X-209	5935-00-203 -9508	SOCKET, ELECTRON TUBE; 5 brass contacts cadmium-plated; medium; 1 7/64 in. dia; 47/64 in. thick; mounted by molded in plate; chassis hole 1 3/16 in. dia; two 5/32 in. dia holes on 1 1/2 in. centers; mica-filled phenolic body	Socket for V-205	Amphenol 78RS5T	
X-210	5935-00-160 -1365	SOCKET, ELECTRON TUBE	Socket for V-206	TS103P01	
X-211		Same as X-209	Socket for V-207		
X-212		Same as X-209	Socket for V-208		
X-213		Same as X-203	Socket for V-209		
X-214		Same as X-210	Socket for V-210		
X-215		Same as X-210	Socket for V-211		
X-216		Same as X-203	Socket for V-212		

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TRANSMITTER, TYPE AN/FRT-501 TRANSMITTER SUB-ASSEMBLY, TYPE T-5006/FRT-501					
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
X-217		Same as X-203	Socket for V-213		
X-218		Same as X-203	Socket for V-214		
X-219	5935-00-258 0217	SOCKET, ELECTRON TUBE	Socket for C-248	TS101P01	
X-220		Same as X-206	Socket for L-206		
X-221		Same as X-203	Socket for V-215		
X-222		Same as X-203	Socket for V-216		

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TRANSMITTER, TYPE AN/FRT-501			CONTROL, TRANSMITTER, TYPE C-5002/FRT-501		
Circuit Reference Number	RCAF Reference Number	Name of Part or Description	Function	Manufacturer and Designation or JAN Type	Contractor or Manufacturer Number
C-301	5910-00-112 -7402	CAPACITOR, FIXED, PAPER: 2 uf, 600 v	Audio by-pass	CP53B1EF205V	
E-301	5940-00-283 -3461	TERMINAL BOARD: molded phenolic board 10 dual screw solder lug terminals; barrier type: 6 19/32 in. lg, 1 5/16 in. wide, 5/8 in. thick: four 0.209 in. dia. mounting holes at 6 3/16 in. by 1/2 in. centers.	External connection panel	HBJ 10-142YD	
J-301	5935-00-283 -1269	JACK, TELEPHONE	Key jack	JJ034	
J-302	5935-00-192 -4729	JACK, TELEPHONE	Microphone jack	JJ033	
S-301	5930-00-644 -2992	SWITCH, TOGGLE	Start switch	ST42C	
T-301	5950-21-801 -5827	TRANSFORMER, AUDIO FREQUENCY: input type, three primary windings: 50 ohm, 125 ohm, 125 ohm: secondary 100,000 ohm center-tapped: each primary rated for 85 ma. insulation test 600 v: hermetically sealed: steel case: 3 13/16 in. high, 2 3/4 in. lg, 2 3/8 in. wide: turns ratios, ratios, primary to secondary 240/380/380: 10,400: ± 1 db, 300 to 4000 cps: four 8-32 mounting studs at 2 1/8 in. by 1 3/4 in. centers oil filled: 10 solder lug terminals located axially on one end.	Microphone to line transformer	CTF1R10GAAAE	CMC 130-254