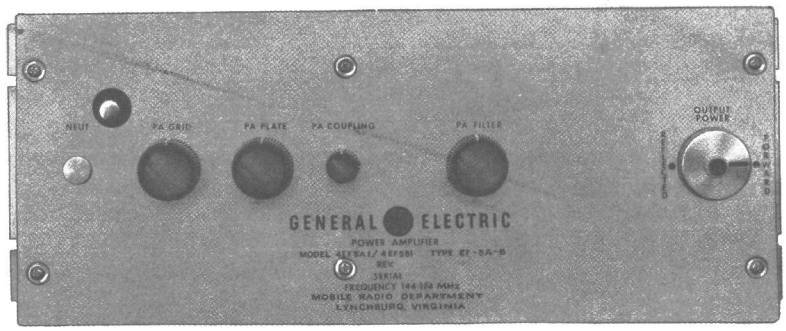
MOBILE RADIO

MASTR® II MAINTENANCE MANUAL

POWER AMPLIFIER MODEL 4EF5A1



POWER AMPLIFIER

SPECIFICATIONS *

Model Number:	EF-5-A Power Amplifier
Frequency Range:	144-174 MHz
Used With:	Driver Type KT-47-A and Power Supply 19D402530G1, G2 to provide a 250-300 Watt (KT-79-A) Transmitter
Power Input:	117 VAC, 50/60 Hz Standby: 2 amps Transmit: 8 amps
Power Output:	250-300 Watts
Tube Complement:	(1) 4CX250B or 7032/4CX250B
AM Hum and Noise Level:	Down 34 dB
Maximum Frequency Spread: (2 or more channels)	Full Specification
150.8-174 MHz	0.60 MHz
144-150.8 MHz	0.55 MHz
Rated Duty Cycle:	Continuous -- Blower recommended for cabinet ventilation under conditions of high ambient temperatures or continuous duty operation.
Ambient Temperature Range:	-30°C to +60°C (-22°F to +144°F)
Dimensions (H x W x D):	7" x 19" x 11"
Weight:	30 pounds

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

EF-5-A

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Power Amplifier Models 4EF5A1 250-300 watt) was designed for use in fixed stations operating in the 144-174 megahertz band, using an external driver and power supply. The amplifier employs a 4CX250B as a Power Amplifier tube, with forced-air cooling provided by a blower mounted on the power supply. Standard RETMA rack-mounting dimensions are used. The tuning controls most frequently used are located on the front of the unit.

All the power connections, except the high voltage connection, are made with a 6-pin plug from the front of the unit. High voltage is brought to the plate at the rear of the plate compartment.

Antenna relay keying voltage connections are made behind the Output Power Indicator, using screw connections. The RF drive connection is made by an RG-58/U cable plugged into the driver from the front of the unit.

CIRCUIT ANALYSIS

Excitation to the Power Amplifier at P482 is fed to coupling loop L482 and coupled to coil L484, which, with C481, forms the grid tank of the amplifier. By adjusting the PA GRID control (C481), the grid tank may be tuned to the operating frequency. Coil L481 isolates RF from the power cable.

In order to obtain optimum tube life the filament voltage on the Power Amplifier tube V481 is set at the factory for 6 Volts with R4, on the Power Amplifier Power Supply. The filament voltage can be set for a higher value but with a corresponding decrease in tube life. Refer to DATAFILE Bulletin 3000-5 on backheating of the cathode. C482, C483 and C484 are RF bypass capacitors and R481 is used as a screen RF de-coupling resistor. Built into the tube socket, XV481, is a ring-type capacitor which is used as a screen grid by-pass.

All input voltage connections to the Power Amplifier, except the B-plus voltage connection, are made at P481 on the front side of the panel. The 2000-volt B-plus lead is connected at terminal PO-2 located in the rear on the plate cavity cover. C485 provides by-passing for the B-plus and L485 is an RF choke. The plate tank is composed of C488 and L494. The plate tank is tuned to the operating frequency by adjusting the PA PLATE control C488.

Adjusting the PA COUPLING control varies the coupling from the plate to the output by controlling the amount of magnetic flux linking the plate line to the filter line. L483 couples energy from the PA FILTER cavity to J481. The signal from J481 is connected to the antenna through P1 and P2 on the Reflectometer and through the contacts on the antenna relay K482.

Power Reflectometer

The Power Reflectometer gives a relative voltage which indicates forward and reflected RF power output.

The Reflectometer samples the magnetic field caused by current in the transmission line and the electrical field from the voltage on the line. On a properly matched line, these two voltages are equal and cancel each other when reading REFLECTED power ("O" reflected power). When the probe is rotated 180°, these two voltages add to indicate FORWARD power.

When the load is not matched, these two voltages become unequal and provide a ratio of incident (forward) to reflected power. Any significant change in this ratio (if other than 1:1) after initial installation and check out, should be cause for examination of the antenna and feed line. Actual V.S.W.R. as measured on a calibrated bridge, should remain below 1.5:1 at all times.

Antenna Relay

K482, the antenna relay switches the antenna from the receiver to the transmitter when the transmitter is keyed.

MAINTENANCE

PREVENTIVE MAINTENANCE

To obtain optimum performance from the equipment, a program of regular preventive maintenance should be followed. This preventive maintenance should include the following:

1. A check of the operating frequency as required by the Federal Communications Commission.
2. A check of the PA PLATE current, Power Amplifier GRID current and PA PLATE voltage meter readings.
3. A check of the PA plate tuning and reflected power (if any) and realignment if improper operation is indicated.
4. A check for loose nuts, screws, cables and parts.
5. An inspection of the high- and low-voltage connections.

POWER AMPLIFIER TUBE REPLACEMENT

To remove the Power Amplifier tube, proceed as follows:

1. Remove the high-voltage lead from PO-2, located on the rear of the Power Amplifier.

2. Loosen the winged screws holding the rear cover plate to the assembly.

3. Slide off the rear cover plate.

4. Insert the prongs of the tube extractor (included with the station equipment) between the cooling fins of the PA tube plate.

5. Pull the tube straight out from the socket.

To reinsert the Power Amplifier tube, proceed as follows:

1. Insert the prongs of the tube extractor between the cooling fins of the PA tube plate.

2. Push the PA tube all the way into the socket while observing the key on the tube and socket. The tube extractor may be left on the tube cooling fins.

3. Replace the rear cover plate of the Power Amplifier.

4. Tighten the winged screws on the rear cover plate.

5. Replace the high-voltage lead to PO-2 on the rear of the Power Amplifier.

NEUTRALIZING ASSEMBLY REPLACEMENT

If it should become necessary to replace any part of the neutralizing assembly, it is recommended that the entire assembly be replaced.

To replace the assembly, proceed as follows:

1. Remove all four knobs on the front of the power amplifier.

2. Remove the 6 screws holding the outer front plate, and remove plate.

3. Remove the 14 hex-head screws holding the inner front plate (left side), and remove the plate.

4. Unsolder the wire from the solder terminal of the neutralizing assembly.

5. Remove the back cover and remove the nut holding the neutralizing assembly in place.

6. Install the new assembly.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

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ALIGNMENT PROCEDURE

This Alignment Procedure is provided for completely re-aligning and loading Power Amplifier Model 4EF5A1, B1, (using KT-47-A as a Driver Unit) in a KT-78-A or KT-79-A transmitter.

Before tuning the Power Amplifier, the Driver must be aligned according to the ALIGNMENT PROCEDURE.

1.0 Connect the antenna or some other suitable 50-ohm load to the top jack on the Power Amplifier antenna relay.

2.0 Turn the PLATE switch OFF on the PA Power Supply.

3.0 Turn the SCREEN adjust on the PA Power Supply fully counterclockwise.

NOTE

Make sure the PLATE switch on the PA Power Supply is in the OFF position.

4.0 Place the power switches located on the Power Panel and Driver Power Supply to the ON position. Turn the PA Power Supply CONTROL switch to the ON position. Allow 15-minutes for warmup.

5.0 Connect a microphone to the MIKE jack (J1215) on the back of the station control shelf mother board.

6.0 Pull the PA COUPLING control out to its limit. Turn control clockwise until it engages with the coupling window. Push control in all the way to its back limit. Withdraw control approximately 1/2-inch from the back limit.

7.0 Rotate the meter switch on the Power Panel to TX Driver and the meter switch on Receiver/Exciter door to position 10.

8.0 Key the driver and adjust the Power Control potentiometer on the driver PA for approximately 2 amperes of driver PA collector current (0.6 V on 3 V scale of tune-up meter). Rotate meter switch on power panel to PA GRID. Tune the PA GRID for maximum voltage on the tuning meter and then readjust the power control potentiometer for 2.5 VDC on the meter.

9.0 NEUTRALIZING

9.1 Turn the PLATE switch OFF on the PA Power Supply.

9.2 Repeat step 8 of this procedure.

9.3 Turn the Power switch OFF on the Driver Power Supply.

9.4 Block the contacts closed on the PA antenna relay (Use a piece of tape to hold the contacts).

9.5 Disconnect the antenna cable from the ANT jack on the PA antenna relay.

9.6 Disconnect the PA input cable from the output of the attenuator pad.

9.7 Connect a short coaxial cable from the jack on the attenuator pad to the Antenna jack on the PA antenna relay.

CAUTION

Failure to have the PLATE switch in the OFF position when performing step 9.8 through 9.15 below, can result in damage to the equipment.

9.8 The Driver output will now be feeding into the Power Amplifier output for neutralizing the PA.

9.9 Turn the Driver Power switch ON. Do not turn on the PLATE switch on the PA Power Supply.

9.10 Rotate the meter switch on the Power Panel to PA GRID.

9.11 Adjust the PA Grid, PA Filter and the Driver output for maximum PA Grid current.

9.12 Using an insulated tuning tool, adjust the NEUTRALIZER adjustment (located under the plug button in the front of the Power Amplifier unit), for minimum PA Grid current.

9.13 Turn the Power switch OFF on the Driver Power Supply.

9.14 Open the rear door on the Station cabinet, remove the block from the relay contacts, disconnect the coaxial cable, replace the PA antenna cable and replace the Driver output cable.

9.15 Close the rear door. This is the end of the Neutralizing procedure.

10.0 Turn the PLATE switch on the PA Power Supply to the ON position.

11.0 While keying the Driver adjust the PA PLATE control for a minimum reading at the PA PLATE current meter. Do not exceed 275 mA of plate current. Retune the PA GRID per step 8.

NOTE

The current readings on the meter includes approximately 25 mA of screen current.

12.0 Rotate the meter switch on the Power Panel to Forward/Reverse position. Rotate the REFLECTOMETER to the FORWARD position.

13.0 While keying the driver adjust the PA FILTER for maximum meter reading.

14.0 While keying the driver adjust the scree control for a reading of 250 mA on the Plate current meter.

15.0 While the driver is being keyed, pull the PA COUPLING a small amount, to a maximum of 275 mA at the PA PLATE current meter.

16.0 While keying the driver, readjust the PA PLATE control for minimum reading at the PA PLATE current meter.

17.0 Repeat steps 13, 15 and 16 above until the licensed power output or power input is reached. Do not exceed 275 mA at the PA PLATE current meter.

18.0 Carefully turn the PA COUPLING control counterclockwise to disengage it from the internal coupling window. Push the PA COUPLING control in to its back limit.

MULTI-FREQUENCY OPERATION

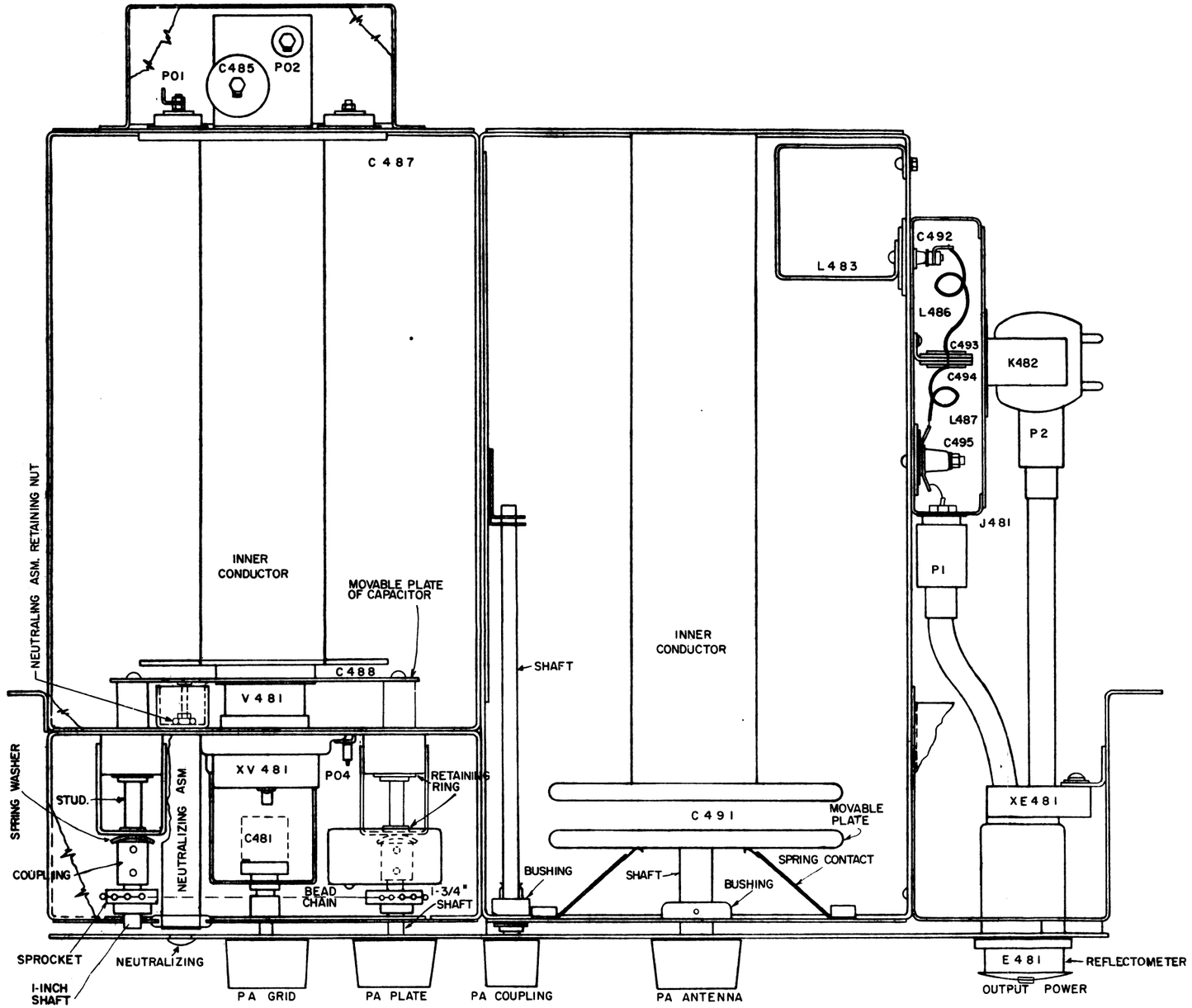
1. Tune the Power Amplifier on the lowest frequency.
2. Select the highest frequency and re-adjust the PA plate tuning toward resonance (dip), about 5-10 mA decrease.
3. Select the lowest frequency. If the difference in plate current between the lowest and the highest frequency is greater than 10 mA, repeat step 1.
4. Re-set the screen control for rated plate current. If the power output is below the rated specifications, re-adjust the PA filter to balance the power output for the low and high frequencies.
5. Re-check for the 10 mA difference and rated maximum plate current. If not within those limits then repeat steps 1 thru 3.

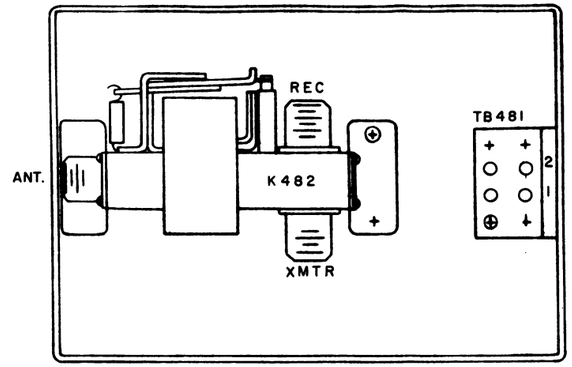
REDUCED POWER OUTPUT

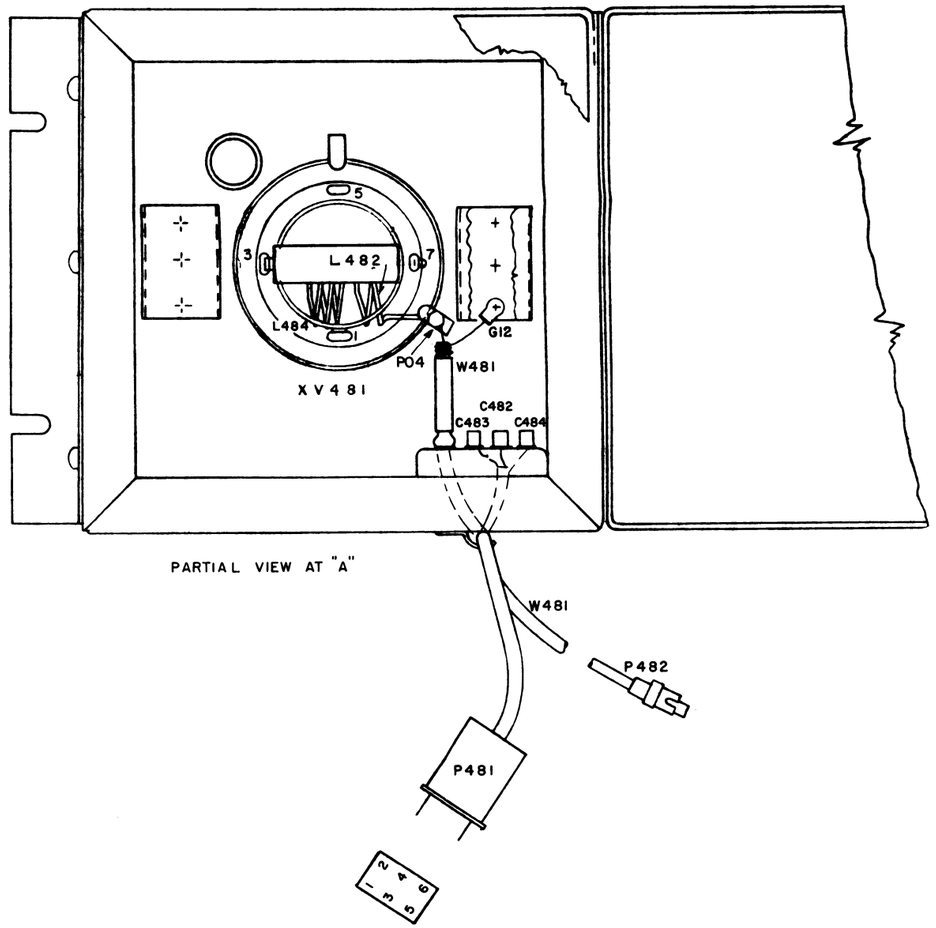
When operation at a reduced power output is desired, reduce the power output by adjusting the SCREEN control (R461) on the power supply 19D402530G1, 2. Do not use the PA COUPLING control on the 4EF5A1 to reduce power output.

To Reduce Power Output:

1. Key the transmitter.
2. Turn the SCREEN control counterclockwise until the RF output is 250 W.
3. Adjust PA PLATE for minimum reading on the plate current meter.
4. Rotate the meter switch on the power panel to FWD/REV. position. Rotate the reflectometer to FORWARD position.
5. Adjust PA FILTER for maximum reading on the tuning meter.
6. Repeat steps 1 thru 5 until output is 250 W with PLATE dipped and PA FILTER adjusted for maximum.







OUTLINE DIAGRAM

144—174 MHz, 250-300 WATT
MASTR II POWER AMPLIFIER
MODEL 4EF5A1

(D-5498034, Rev. 2)

PARTS LIST

EBI41738G

POWER AMPLIFIER 144-174 MHz
MODEL 4EF5A1
MODEL 4EF5B1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C481	7491398P1	Variable, air: approx 3.6 to 12 pf; sim to Cambion T-9476.
C482 thru C484	7485975P19	Ceramic, feed-thru: 1000 pf ±20%, 500 VDCW; sim to Erie Style 327.
C485	5490306P2	Ceramic: 500 pf +50% -20%, 20,000 VDCW; sim to Sprague 708C50.
C487		Capacitor, Feed-thru: Quantity
	4029766G1	Inner Conductor Assembly. (Plate Cavity Inner Conductor) 1
	5490189P1	Printed wiring board. 1
	4035306P20	Fibre washer: .500 inches od, .188 inches id.
	4029112P1	Ceramic bushing. 4
		Fibre washer: 0.500 inches od, 0.188 inches id. 4
	N401P8	Plain washer: No. 8. 5
	N414P16	Lockwasher: No. 8. 4
	N207P15	Nut, hex: No. 8. 5
	N83P15012	Machine screw: No. 8-32 x 3/4. 4
C488		Capacitor, PA Plate, Tuning: Quantity
	4029766G1	Inner Conductor Assembly (see C487). (Plate Cavity Inner Conductor)
	4029712G2	Movable capacitor plate. 1
	4029361P1	Bracket. 2
	4029605G1	Block. 2
	N900P50C	Retaining ring: 0.770 in. od, 0.461 in.id 2
	4029601P1	Stud. 2
	7109043P3	Retaining ring: 0.339 in. od, 0.260 in.id 2
	7160815P3	Spring washer. 2
	4029810P2	Coupling sleeves. 2
	4029870P1	Bead chain. 1
	4029856P1	Sprocket (Bead Chain Pulley) 2
	4031997P1	Set screw: No. 8 (Set Screw for Pulley) 2
	4029955P1	Plate. 1
	4029954P1	Shaft: 1.060 inches long 1
	4029954P2	Shaft: 1.760 inches long. 1
	N70P1503C13	Set screw: No. 8. 1
	7487773P6	Control knob. 1
C491		Capacitor, PA Filter, Tuning: Quantity
	4029763G1	Inner Conductor Assembly. (Plate Cavity Inner Conductor) 1
	4039772G1	Spring contact: (Finger stock to Capacitor plate).
	4029939P1	Nut plate. 2
	N414P13	Lockwasher: No. 6. 1
	N81P13005	Machine Screw: No. 6. 1
	N83P13004C13	Machine screw: No. 6, 0.500 inches long. 1
	4029422P1	Bushing for Shaft. 1
	4031104P1	Spring Plunger. 1
	N83P9004	Machine screw: No. 4. 1
	N401P41	Plain washer: 0.250 inches in dia. 1
	N70P1503C13	Set screw: No. 8. 1
	7487773P6	Control knob. 1
C492		Capacitor, Feed-thru: Quantity
	N81P13016	Machine screw: No. 6. 1
	4029692P1	Aluminum Plate. 1
	4029691P1	Teflon Plate. 1
	5495049P1	Outer Conductor. 1
	4035237P1	Nylon washer. 1
	5491426G1	Box Assembly. 1
	N401P41	Plain washer: No. 6. 1
	7479752P11	Ceramic bushing. 1
	7872492P1	Fibre washer: No. 6. 1
	7135118P2	Terminal. 1
	N207P13C6	Nut, hex: No. 6. 2
C493 and C494		Capacitor, Stand-Off: Quantity
	4029887P1	Angle. 1
	N81P9010	Machine screw: No. 4. 2
	N414P11	Lockwasher: No. 4. 4
	N401P5	Plain washer: No. 4. 4
	7135118P1	Terminal. 2
	4029886P1	Aluminum Plate. 2
	4029889P1	Teflon Plate. 2
	4035237P2	Nylon washer. 2
	N207P9	Nut: No. 4. 2

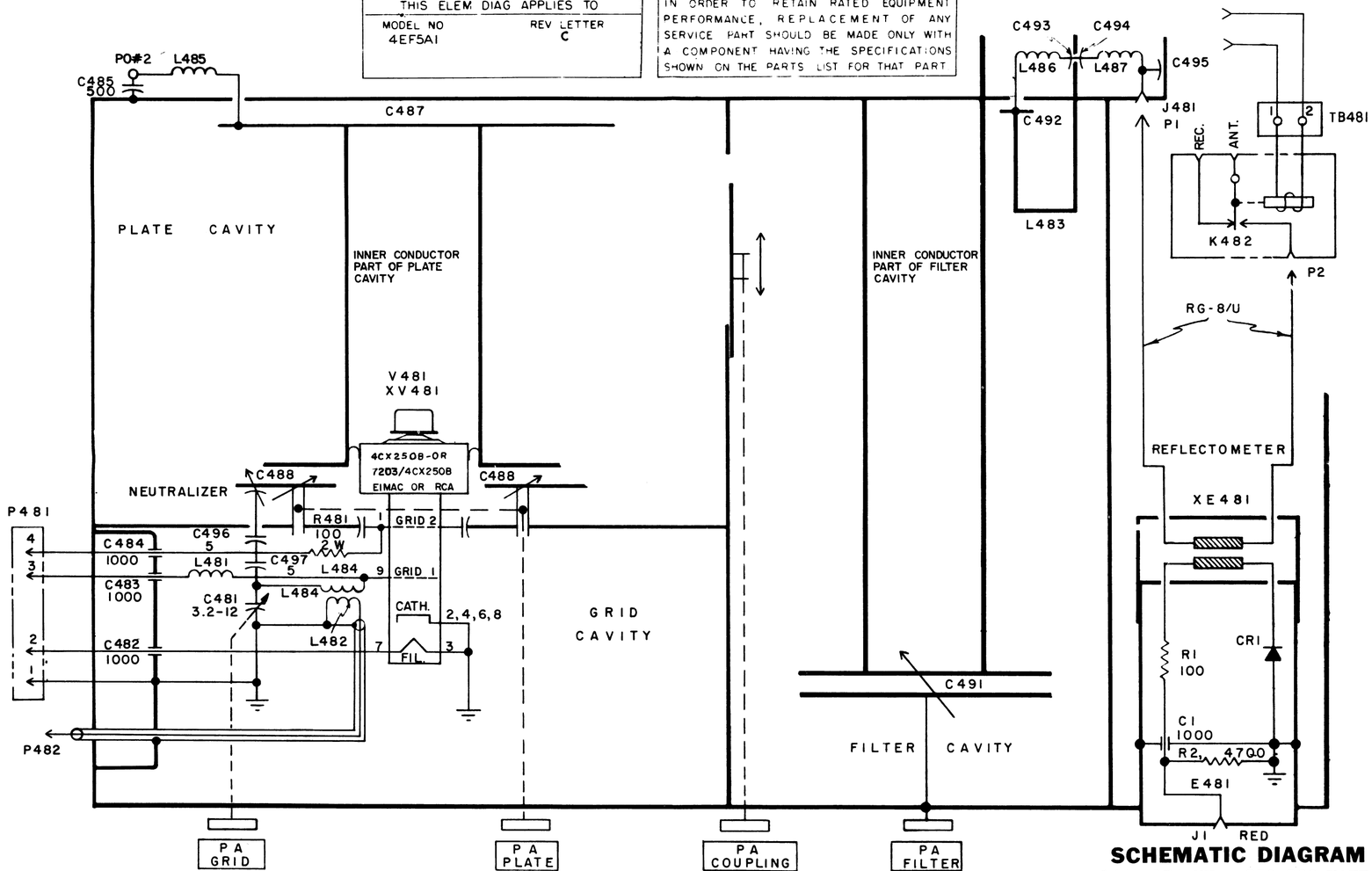
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM. DIAG. APPLIES TO

MODEL NO	REV LETTER
4EF5A1	C

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



(C-5494558, Rev. 12)

SCHEMATIC DIAGRAM

144—174 MHz, 250-300 WATT
MASTR II POWER AMPLIFIER
MODEL 4EF5A1

SYMBOL	GE PART NO.	DESCRIPTION
C495		Capacitor, Stand-off:
		Quantity
	N81P13016	Machine screw: No. 6. 1
	N401P67	Plain washer: No. 6. 1
	5495051P1	Box. 1
	4029691P1	Teflon Plate. 1
	4029692P1	Aluminum Plate. 1
	4035237P1	Nylon washer. 1
	7875267P1	Terminal. 2
	7479752P11	Ceramic bushing. 1
	7872492P1	Fibre washer: No. 6. 1
	N207P13	Nut: No. 6. 1
C496 and C497	3R122P27	Silver mica: 5 pf ±10%, 500 VDCW; sim to Electro Motive Mfg. CM15.
		- - - - - - MISCELLANEOUS ELECTRICAL PART - - - - -
E481	4029629G1	Reflectometer Probe: consists of the following components with E481 prefix.
E481-C1	7160807P1	Capacitor, ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW.
E481-CR1	7777146P22	Diode, germanium.
E481-J1	7150763P2	Test Point, jack, tip, stake-in: red nylon body, sim to Alden Products 110BC1.
E481-R1	3R77P101J	Resistor, composition: 100 ohms ±5%, 1/2 w.
E481-R2	3R77P472J	Resistor, composition: 4.7K ohms ±5%, 1/2 w.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J481	4029493P1	Receptacle, coaxial: sim to Amphenol 83-798.
		- - - - - - - - - - - RELAYS - - - - - - - - - -
K482	7479680P2	Coaxial: 140 VDC nominal, 7K ohms ±10% coil res, 1 form C contact; sim to Amphenol 300-11294.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L481	7772834P5	Choke, RF: 1.8 µh ±10%, 0.33 ohms ±15% DC res, freq range 80-200 MHz; sim to Ohmite Z-144.
L482	4029883P1	Coil: 2 turns, left hand wound.
L483	4029694P1	Loop, output.
L484	4031669G1	Coil assembly.
L485*	19B226007G1	Coil.
		In REV B and earlier:
	7772834P5	Choke, RF: 1.8 µh ±10%, 0.33 ohms ±15% DC res, freq range 80-200 MHz; sim to Ohmite Z-144.
L486 and L487	4029693P1	Coil.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P481	7473192P25	Plug: 6 male contacts, cable clamp in cap; sim to HB Jones 261-31-06-030.
P482		Plug: included in W481.
		- - - - - - - - - - - POST - - - - - - - - - - -
P02		Post, insulated.
		Quantity
	7133855P36	Stud: No. 6. 1
	N207P13C6	Nut: No. 6. 3
	7878455P2	Terminal, lug. 1
	4035306P10	Fibre washer: .500 in. od. .156 in. id. 2
	4035306P2	Fibre washer: .500 in. od. .266 in. id. 2
	7479752P11	Ceramic bushing. 1
	7479752P1	Ceramic bushing. 1
	7867274P1	Wing nut. 1
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R481	3R79P101K	Composition: 100 ohms ±10%, 2 w.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB481	19C301088P9	Phen: 2 terminals, 15 amps at 1200 VRMS; sim to GE CR151D75702AB.
		- - - - - - - - - - - TUBES - - - - - - - - - - -
V481	4039217P1	Tube: sim to EIMAC or RCA Type 4CX250B or 7203/4CX250B.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W481	5491689P54	Cable assembly: Includes 32.75 inches cable, short phono plug molded on one end.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XE481	5490188G2	Reflectometer housing: Includes the following with XE481 prefix:
XE481P1 and XE481P2	2R22P1	Plug, coaxial: 2 piece straight plug; sim to Signal Corps PL-259 or Amphenol 83-1SP.
		2 sections of RG-8/U Cable.
XV481	5490373P2	Tube: octal; sim to Eitel-McCullough SK610.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4029892P1	Tube extractor: steel, 4 inches long; sim to Eitel-McCullough SK601.
	19B216740G1	Neutralizing Assembly.
		MECHANICAL PARTS (SEE RC3257)
1	5490189P1	Printed board.
2	5490421P1	Cover.
3	N81P13005C6	Machine screw: No. 6-32 x 5/16.
4	N414P13	Lockwasher, internal tooth: No. 6.
5	4035306P50	Fiber washer, nonmetallic: .719 dia.
6	N401P8	Flatwasher: No. 8.
7	N83P15012C6	Machine screw: No. 8-32 x 3/4.
8	N207P15C6	Hex nut: No. 8-32.
9	N414P16	Lockwasher, internal tooth: No. 8.
10	4035306P20	Fiber washer, nonmetallic: .188 dia.
11	4029112P1	Insulator, disc.
12	19B209103P506	Tap screw, hex head: No. 10-32 x 3/8.
13	4029763G1	Inner conductor.
14	N401P7	Flatwasher: No. 6.
15	N207P13C6	Hex nut: No. 6-32.
16	5495051P1	Box.
17	5490427P1	Cover.
18	N81P13004C6	Machine screw: No. 6-32 x 1/4.
19	N84P15004C13	Machine screw: No. 2-56 x 1/4.
20	7867274P1	Wing nut.
21	4035306P10	Fiber washer, nonmetallic: .156 dia.
22	7479752P11	Bushing.
23	N107P15006C13	Tap screw: No. 8-32 x 3/8.
24	19B209401P204	Tap screw: No. 4-40 x 1/4.
25	4029784G2	Plate.
26	4029699P1	Strap.
27	19A129728P1	Strap.
28	4029887P1	Support.
29	4029889P1	Insulator, teflon.
30	4029886P1	Plate.
31	4025237P2	Washer: .156 dia.
32	N414P11	Lockwasher, internal tooth: No. 4.
33	N81P9010C6	Machine screw: No. 4-40 x 5/8.
34	N401P5	Flatwasher: No. 4.
35	7135118P1	Solderless terminal.
36	5495049P1	Outer conductor.
37	N401P41	Flatwasher, regular: No. 1/4.
38	7872492P1	Washer, fiber: 5/32 dia.
39	7135118P2	Solderless terminal.

SYMBOL	GE PART NO.	DESCRIPTION
40	4029691P1	Insulator, teflon.
41	4029692P1	Plate.
42	7875267P1	Terminal.
43	N405P39	Lockwasher, spring type: No. 10.
44	4035237P1	Washer, nylon: .265 dia.
45	N81P13016C6	Machine screw: No. 6-32 x 1.
46	N401P67	Flatwasher, wide: No. 6.
47	2R53P16	Grommet, rubber.
48	4029712G2	Disc assembly.
49	4029774G3	Stud.
50	4029881P2	Insulated bushing.
51	N81P9004	Machine screw: No. 4-40 x 1/4.
52	7878455P2	Solderless terminal.
53	4037466P2	Clip, spring tension.
54	4029935P1	Tube.
55	N529P11C	Plug button.
56	4029895P2	Bushing.
57	N70P902	Set screw: No. 4-40 x 1/8.
58	4035306P8	Fiber washer, nonmetallic: .203 dia.
59	4029831P1	Can.
60	N81P1306C6	Machine screw: No. 6-32 x 3/8.
61	5490506P1	Plate.
62	5490329P3	Plate.
63	19B209103P504	Tap screw, hex head: No. 10-32 x 1/4.
64	4035306P2	Fiber washer, nonmetallic: .266 dia.
65	7479752P1	Bushing.
66	7133855P36	Stud.
67	N80P15003C6	Machine screw: No. 8-32 x 3/16.
68	N83P13008C6	Machine screw: No. 6-32 x 1/2.
69	4029768G1	Shaft.
70	4029771G1	Strap.
71	19A121748G1	Disc.
72	5490194G1	Housing.
73	N83P13016C6	Machine screw: No. 6-32 x 1.
74	5490363G2	Plate. (4EF5A1).
	5490363G4	Plate. (4EF5B1).
75	7147248P2	Marker strip.
76	N81P13010C6	Machine screw: No. 6-32 x 5/8.
77	7109043P3	Retaining ring.
78	7763541P5	Retaining strap.
79	4029710G1	Can.
80	4029695P1	Support.
81	4029939P1	Strap.
82	4029772G1	Spring contact.
83	4029422P1	Disc.
84	7487773P6	Knob.
85	N83P9004C6	Machine screw: No. 4-40 x 1/4.
86	N70P1503C13	Set screw: No. 8-32 x 3/16.
87	4031104P1	Detent plunger.
88	N83P13004C13	Machine screw: No. 6-32 x 1/4.
89	7487773P5	Knob.
90	N70P1503C13	Set screw: No. 8-32 x 3/16.
91	7165075P2	Hex nut, brass: thd. size No. 3/8.

SYMBOL	GE PART NO.	DESCRIPTION
92	7115130P9	Lockwasher, internal tooth: sim to Shakeproof 1220-2.
93	4029955P1	Plate.
94	4029954P2	Shaft.
95	4029618P1	Shaft.
96	N70P1302C6	Set screw: No. 6-32 x 1/8.
97	N81P13006C6	Machine screw: No. 6-32 x 3/8.
98	7491824P4	Solderless terminal.
99	4032463P1	Grommet, rubber.
100	4029954P1	Shaft.
101	4031987P1	Set screw, self locking: No. 6-32 x 3/16.
102	19B209103P508	Tap screw, hex head: No. 10-32 x 1/2.
103	4029870P1	Bead chain.
104	4029956P1	Sprocket.
105	4029810P2	Coupling shaft.
106	7160815P3	Washer, spring tension.
107	7190043P3	Retaining ring.
108	4029601P1	Stud.
109	4029358P1	Support.
110	N900P50C	Retaining ring.
111	4029361P1	Support.
112	4029766G1	Inner conductor.
113	5495050P1	Plate cavity.
114	4029776G1	Plate.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. C - Incorporated into initial shipment.

FIG. 1 - PARTS BREAKDOWN: C492 THRU C495

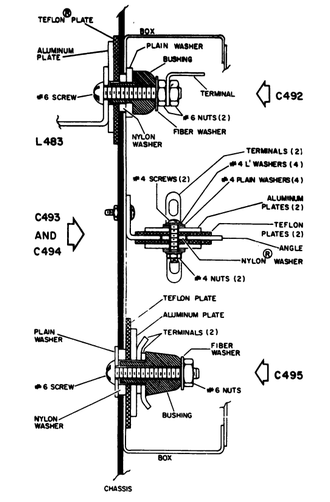
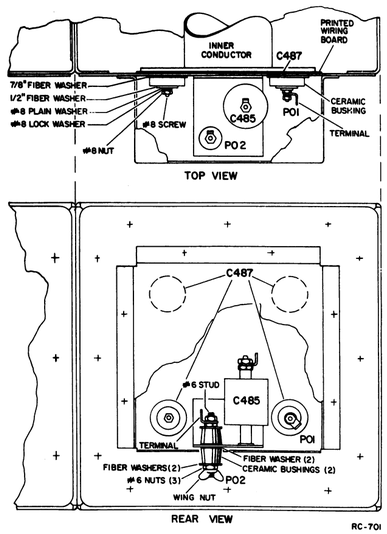
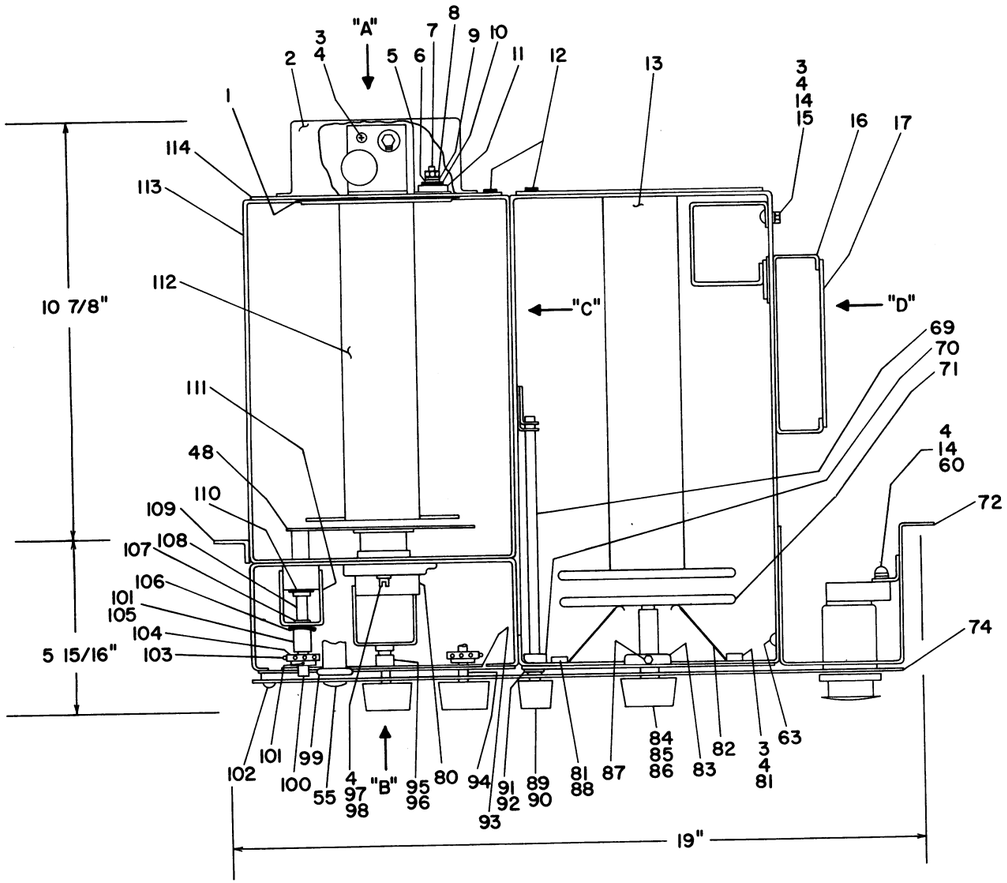
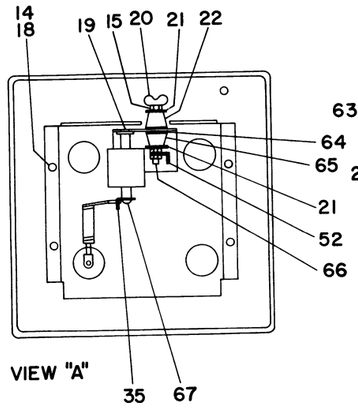
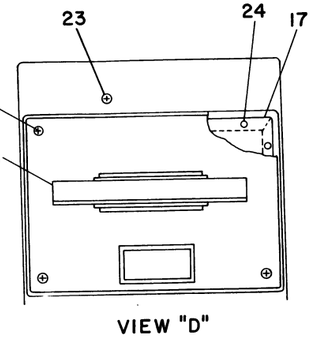


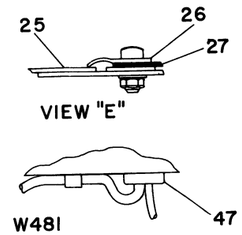
FIG. 2 - PARTS BREAKDOWN: C487, P01 & P02

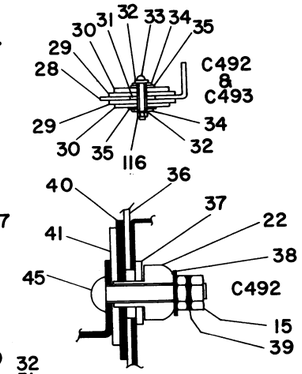


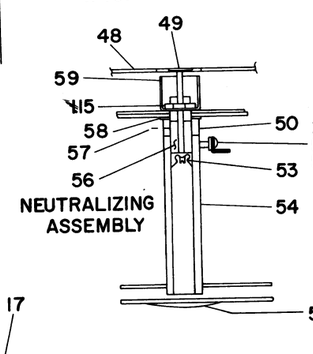


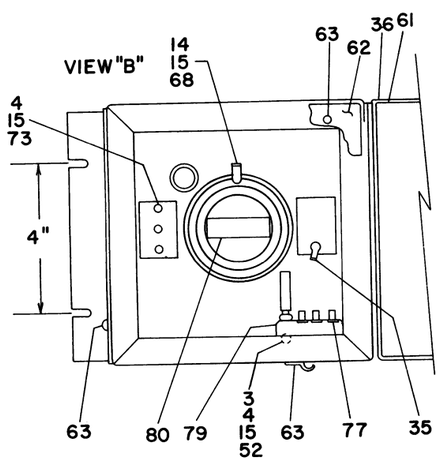


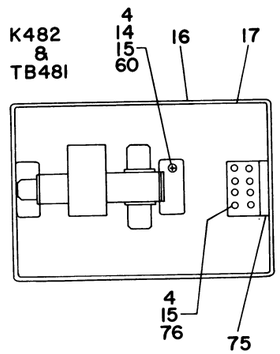


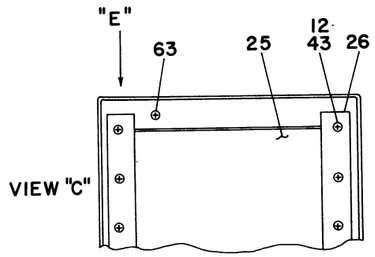












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MECHANICAL ASSEMBLY