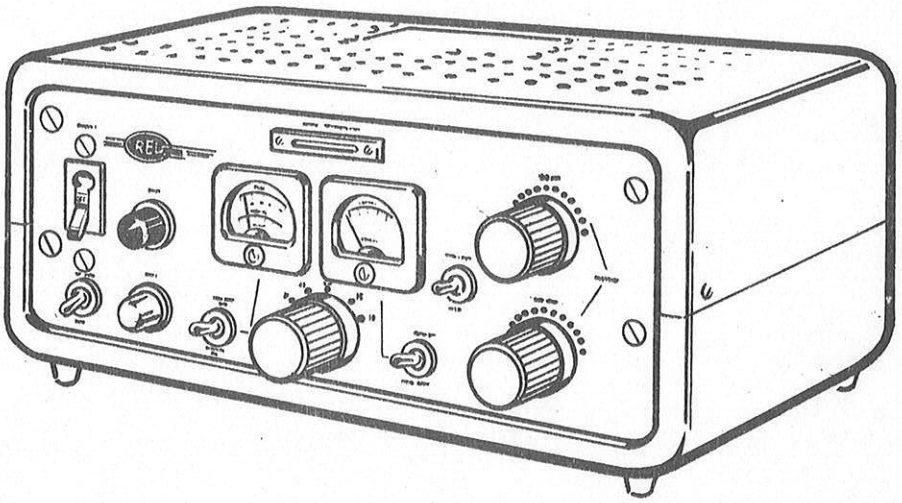
INSTRUCTION BOOK

for

L-103

LINEAR AMPLIFIER



RELIANT

RADIO ENGINEERING LABORATORIES, INC.
FARMINGDALE DIVISION
A SUBSIDIARY OF DYNAMICS CORPORATION OF AMERICA
FARMINGDALE, NEW JERSEY

SAFETY NOTICE

1. This equipment employs high voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

2. While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

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LOADING
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FIL ON
OFF
FIL
PLATE MA
SCREEN MA
80
40
20
15
10
FORWARD
REFLECTED

SECTION I

DESCRIPTION

1. INTRODUCTION. (See Figures 1-1, 1-2, 1-3, 1-4 and 1-5)

The L-103 is a one-thousand watt Linear Amplifier designed as a companion unit to the RELiant S-119 SSB Communication System. The amplifier may also be used with other exciters which are capable of meeting the drive requirements of the L-103. The modes of operation in which the L-103 may be employed are Single Sideband (SSB), Continuous Wave (CW), Amplitude Modulation (AM), Frequency Modulation (FM), and Frequency Shift Keying (FSK). The frequency range which the amplifier can accommodate is 3.4 to 30 mcs continuous. In amateur service, the L-103 is capable of running at the maximum legal SSB power input of 2 KW P.E.P.

2. FEATURES.

The L-103 has been designed to provide the utmost in flexibility in a linear amplifier. Some of the features which contribute to the high standard of performance and ease of operation are as follows:

a. Power is supplied by a companion power supply P-110.

b. The Power Amplifier employs two 4CX300A ceramic power tetrodes, parallel connected, in a grounded-grid circuit. This arrangement is advantageous in that the stability of the amplifier is considerably improved, and that the input drive is applied to the cathode and so contributes to the output power. The stability of the grounded-grid circuit also contributes to reduced distortion since the variation of loading reflected to the drive is substantially reduced.

c. To provide continuous metering of plate and screen, a multimeter indicator for plate and screen current allow integrated fool-proof tuning procedures and give the operator a clear picture of what is occurring in the amplifier at all times.

d. Safety is provided with an interlock switch which disables the high voltage power supply when the cabinet cover of the L-103 is raised. This removes all voltages from points in the unit which are exposed. Protective shields are also incorporated in the amplifier section to prevent contact with any point where high voltage DC is present in case of failure of the bleeder circuits to discharge the filter capacitors in the power supply.

e. A circuit breaker with a trip coil in the high voltage DC return for protection of the amplifier tubes is provided.

3. SPECIFICATIONS.

Frequency Range:	3.4 MC to 30 MC
Types of Operation:	Single Sideband (SSB) Frequency Modulation (FM) Amplitude Modulation (AM) Frequency Shift Keying (FSK) Continuous Wave (CW)
Power Requirements:	117 volts, 60 CPS, 15 amps maximum, single phase. ← NOTE
Power Ratings:	SSB 2000 watts P.E.P. input (2 Tone) FM 1000 watts input AM 750 watts input FSK 1000 watts input CW 1000 watts input
Distortions:	Third order distortion products better than 30 DB down.
Drive Requirements:	40 watts P.E.P. (2 Tone) SSB 20 watts average CW
Drive Impedance:	52 ohms, unbalanced.
Input Circuit:	Cathode Driven
Output Circuit:	Pi Network
Output Impedance:	52 ohms unbalanced into any load which produces no more than a 2 to 1 voltage SWR.

SECTION II

INSTALLATION

1. UNPACKING.

Open the packing carton carefully to avoid damage to the equipment. Check all the packing material carefully for small packages. Inspect the L-103 for mechanical damage and check the panel controls for bent shafts and broken couplings. Any claim for damages must be filed with the transportation company immediately, and the original packing material should be preserved.

2. LOCATION AND MOUNTING.

The L-103 is a table-top linear amplifier. The location chosen for the unit should be as dry and as cool as possible. Adequate clearance should be allowed for the connections to the rear and for proper ventilation of the linear amplifier. (See Figure 2-1)

3. EXTERNAL CONNECTIONS. (See Figure 2-2)

a. RF Output (to antenna through antenna changeover relay):

The Linear amplifier is equipped with an 83-1R coaxial receptacle and mating connector, on the rear of the chassis, for use with 52 ohm coaxial cable output. If balanced feedlines are used, they should be connected through a balun or antenna tuner. The balun or antenna tuner is then connected to the transmitter output with 52 ohm coaxial cable. If the feedline shows an appreciable reactance at the transmitter, it may be impossible to load it properly. In that case, changing the length of the feedline a few feet at a time or tuning the antenna tuner will alleviate the problem.

CAUTION

Do not operate this equipment without a proper external load. Excessive RF voltages may develop which might cause components to break down.

b. RF Input: An 83-1R coaxial receptacle and mating connector on the rear of the chassis should be connected to the output of the exciter to be used. A 52 ohm coaxial cable (RG-8/U, RG-58/U, etc.) should be used.

c. Power cable furnished with the P-110 supplied all operating power to the L-103 except for the bias voltage which is self contained in the L-103.

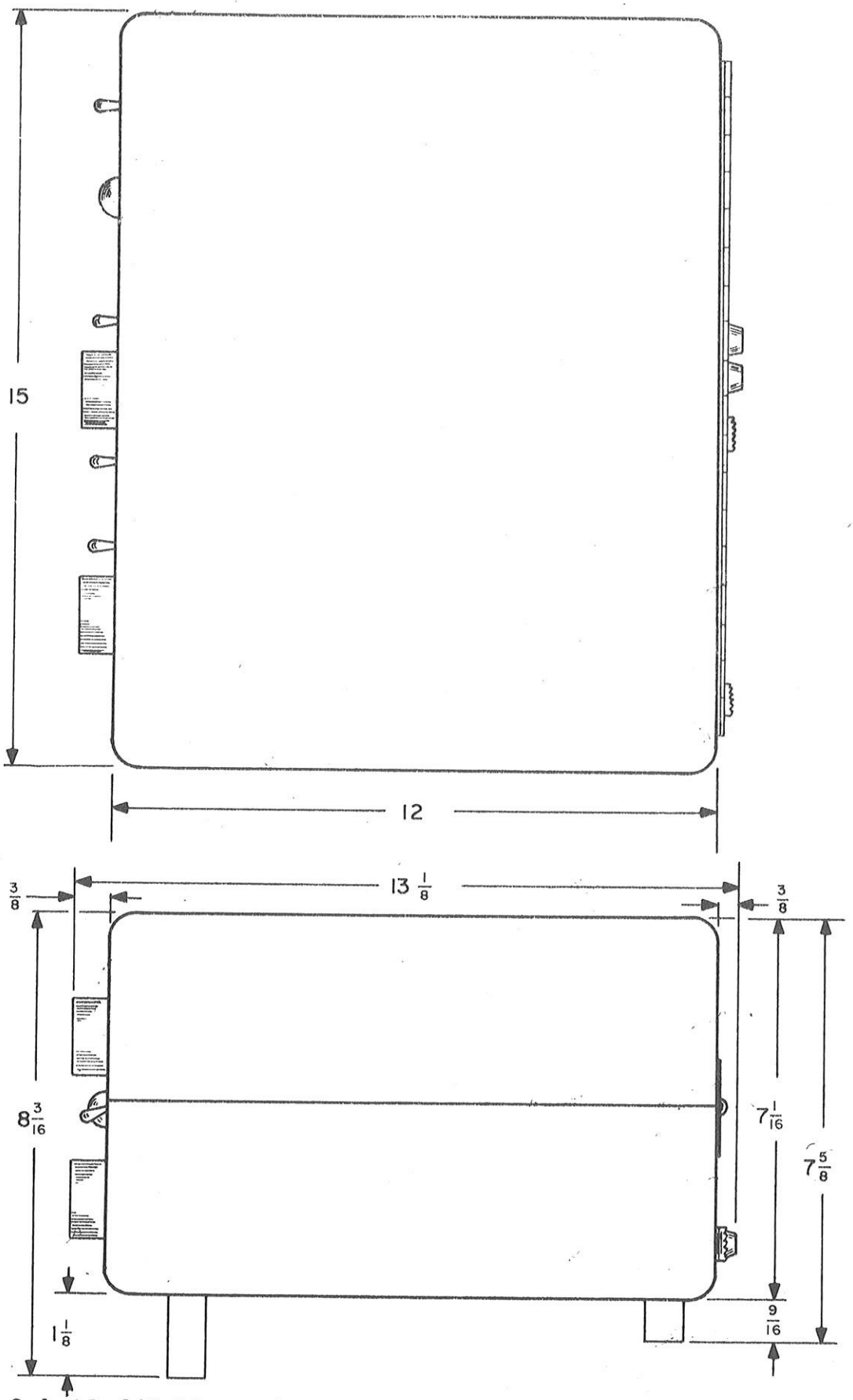

FIG. 2-1. L-103 Linear Amplifier - Dimensional Outline Drawing

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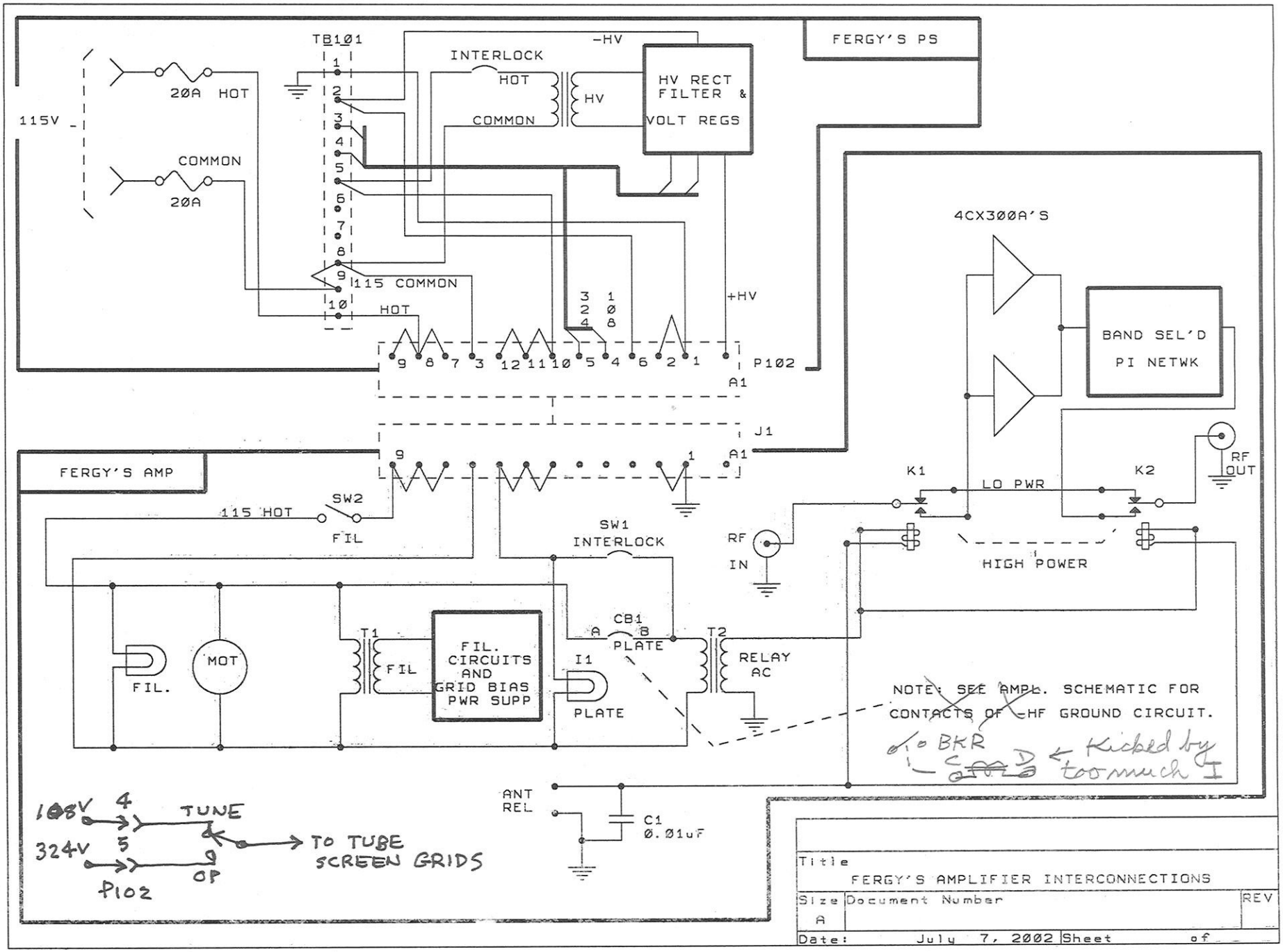
FERGY'S PS
TB101
INTERLOCK
HOT
COMMON
-HV
HV
HV RECT FILTER & VOLT REGS
115V
20A HOT
COMMON
20A
115 COMMON
HOT
+HV
P102
A1
J1
4CX300A'S
BAND SEL'D PI NETWK
RF OUT
K1
LO PWR
K2
HIGH POWER
RF IN
FERGY'S AMP
115 HOT
SW2
FIL
SW1 INTERLOCK
CB1
A
B
PLATE
T1
FIL
FIL. CIRCUITS AND GRID BIAS PWR SUPP
T2
RELAY AC
I1
PLATE
FIL.
MOT
NOTE: SEE AMPL. SCHEMATIC FOR CONTACTS OF HF GROUND CIRCUIT.
to BKR
Kicked by too much I
108V
4
TUNE
324V
5
OP
P102
TO TUBE SCREEN GRIDS
ANT REL
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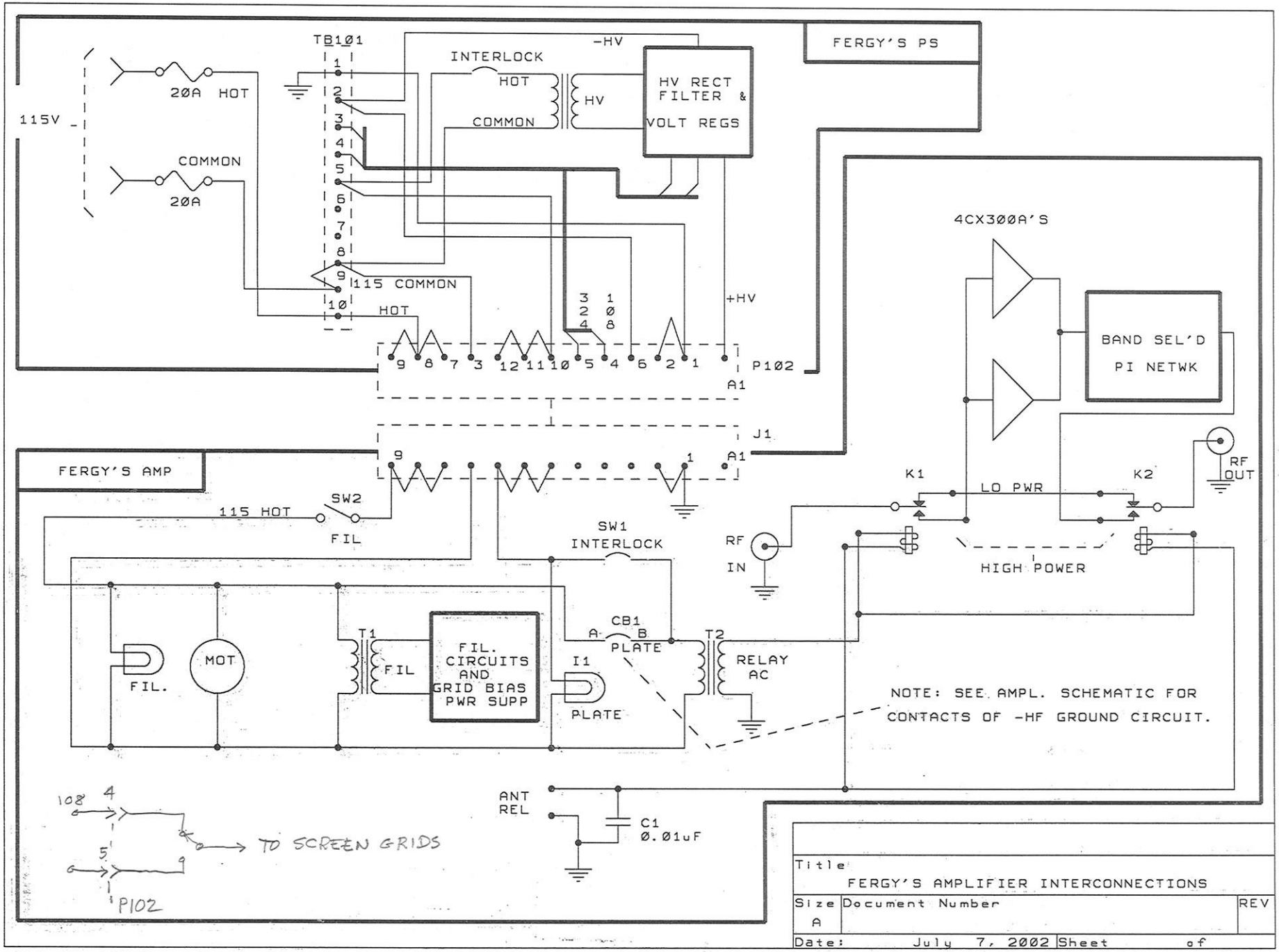
FERGY'S PS
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INTERLOCK
-HV
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COMMON
HV
HV RECT FILTER & VOLT REGS
115V
20A HOT
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115 COMMON
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P102
A1
J1
4CX300A'S
BAND SEL'D PI NETWK
RF OUT
K1
K2
LO PWR
HIGH POWER
RF IN
FERGY'S AMP
115 HOT
SW2
FIL
SW1 INTERLOCK
CB1
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B
PLATE
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FIL. CIRCUITS AND GRID BIAS PWR SUPP
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NOTE: SEE AMPL. SCHEMATIC FOR CONTACTS OF -HF GROUND CIRCUIT.
ANT REL
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TO SCREEN GRIDS
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Title
FERGY'S AMPLIFIER INTERCONNECTIONS
Size A
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SECTION III

OPERATION

1. CONTROLS.

Controls	Function
Filament	In the "ON" position, the filaments, bias supply, blower motor and control circuits are energized.
High Voltage Plates	In the "ON" position, the high voltage power supply is energized providing plate and screen voltage to the amplifier and peak limiter indicator.
Tune/Operate	In the "TUNE" position, reduced screen voltage is supplied to the linear amplifier reducing the plate current. In the "OPERATE" position, normal screen voltage is supplied to the amplifier.
Overload Reset	The high voltage plate switch is a circuit breaker which will automatically trip in the event of excessive amplifier plate current. To reset, merely return high voltage plate switch to "ON" position.
Band Change	This switch selects the desired frequency range.
Plate Tuning	Resonate the plate circuit of the amplifier. The capacity of this control increases clockwise.
Loading	This control adjusts the amount of coupling between the plate circuit of the amplifier and the antenna. The capacity of this control increases clockwise.

2. INITIAL ADJUSTMENTS.

Power plug from P-110 is plugged into L-103.

a. All switches should be placed in the "OFF" position and the tuning controls should be set at the maximum clockwise position. Connect external load to RF output.

b. Plug the P-110 unit into a source of 117 volts, 60 cycles, alternating current.

c. Place Filament Switch in the ON position. Allow the unit to warm up for at least 30 seconds (1 minute is preferable).

d. Place the Tune/Operate Switch in the Tune position and place the High Voltage Plate Switch ON. (If an exciter is connected to the L-103, it will be necessary to put it into the Transmit position so as to energize the bias switching relay). Plate current should be zero.

e. Place Tune Operate Switch in Operate position, plate current meter should indicate 200 MA. Depress SW3 in screen position, screen current should be zero.

All units are fully checked and adjusted before leaving factory. Due to aging or tube replacement it may be necessary to readjust the static tube current. To insure proper balance between both tubes, proceed as follows:

f. Remove the 4CX300A and adjust the bias potentiometer of the remaining 4CX300A for a current of 100 MA, with no excitation and Tune/Operate Switch in the Operate position.

Remove the 4XC300A for which the bias has just been adjusted and insert the other 4CX300A into the other socket. Adjust the other bias potentiometer for 100 MA plate current with no drive and the Tune/Operate Switch in the Operate Position.

Insert the tube first adjusted into its socket and read plate current of both tubes with no RF drive and the Tune/Operate Switch in the Operate Position. The meter should indicate 200 MA.

g. Place the Tune/Operate Switch in the Tune position.

h. The plate current should drop to zero.

3. TUNING PROCEDURE.

With the completion of the initial adjustments, the L-103 is ready to be tuned up and put on the air. The tune-up procedure below should be followed carefully until the operator is completely familiar with the operation of the unit.

a. Turn filaments ON and allow L-103 to warm up for 30 seconds. The exciter should also be turned ON and allowed to warm up.

b. Place Tune/Operate Switch in the Tune position.

NOTE

The following instructions refer specifically to operation with the REL T-102 Exciter. Operating with other exciters is similar.

c. Place Band Switch to desired band.

d. Leaving the High Voltage Plate Switch in the OFF position, put the exciter in the Transmit position. Tune the exciter for normal operation as into a 50 ohm dummy load.

e. When the exciter is properly tuned, reduce the Carrier Control until there is no RF drive to the L-103 (Audio Gain and Carrier should be zero). Turn the exciter Control Switch to Standby.

f. Place High Voltage Plate Switch in the ON position. Turn the exciter Control Switch to Transmit. Note that the plate meter on the L-103 should now read zero.

g. Turn the Carrier Control up only far enough to cause a line at each end of the viewer to appear on peak indicator.

h. Adjust the Plate Control until the line starts to close at the center.

i. Turn the Carrier Control back to zero and place the Tune/Operate Switch in the Operate position. Note that the plate current on the L-103 should now be approximately 200 MA.

j. Insert enough carrier to cause the plate current meter to read about 300 MA, and then dip the Plate Tuning Control.

k. Note the screen current and increase the carrier until approximately +15 to +20 MA is indicated.

l. Rotate the Loading Control counterclockwise until the screen current drops to zero to -10 MA and then adjust the Plate Tuning Control until the screen current peaks. (This will happen at the same time the plate current dips).

m. Repeat Steps k and l until the plate current is 400 MA with the Plate Control tuned to resonance and the screen current peaked at between zero and +10 MA.

n. When Step m is completed, reduce the carrier to zero and use the information below for the type of operation desired.

SSB: Increase the audio gain while talking into the microphone until the screen current meter kicks up to between zero and +10 MA on modulation peaks, and the peak indicator just closed on voice peaks.

AM: Increase the Carrier Control until 300 MA is indicated on the plate current meter. Increase the audio gain while talking into the microphone until the peak indicator closes on voice peaks.

CW: Increase the Carrier Control with the key closed until the plate current is 400 MA.

The L-103 is now tuned up and is ready for operation.

It will have been noted during the above tune-up procedure that the screen current peaks at the same point the plate current dips, when the Plate Control is tuned through resonance. This relationship between the plate and screen current makes tuning the L-103 simple even though the amplifier is heavily loaded and the plate current dip is barely noticeable. For precise tuning, the screen current peak should always be used as the indication of resonance rather than the dip of the plate current.

4. "HI-LO" POWER OPERATION.

The L-103, when used with the REL T-102 or similar exciter, may be switched in or out of operation, allowing high power (one kilowatt or low power (100 watts) to be used at the discretion of the operator. If an antenna relay is used, it should be mounted in a completely enclosed box

and care should be taken to insure that all leads in the box are as short as possible. The following tune-up procedure should be followed for this type of operation.

a. With the Plate Switch of the L-103 in the OFF position, tune the T-102 into the antenna.

NOTE

A good match is necessary between the T-102 and the antenna. Otherwise, the T-102 tuning will change when going from "LO" to "HI".

b. Refer to the normal tuning procedure (Paragraph 3 of this section), and tune-up the L-103 starting at Step f. Do not retune the exciter.

c. When the L-103 is properly tuned, leaving the Plate Switch OFF, connects the T-102 directly to the antenna. Turning the Plate Switch ON connects the T-102 to the input of the L-103 and the output of the L-103 to the antenna.

SECTION IV

THEORY OF OPERATION

1. GENERAL. (See Figure 4-1)

A linear amplifier, unlike a Class C amplifier stage where the output voltage stays almost constant over a wide range of changes in grid excitation, has to give faithful reproduction of the input signal. In other words, the output voltage must be exactly proportional to the input voltage. Three classes of operation can be used for linear amplifiers. They care Class A, Class B and Class AB1. Each class has its own advantages and disadvantages.

Class A operation gives the best linearity, but the efficiency if theoretically limited to 50% at maximum output. Therefore, in the case of high power linear amplifiers, Class A would be uneconomical.

Class B amplifiers have very good efficiency at maximum output, approaching Class C amplifiers (78.5%). However, distortion products are quite high. Also, the Class B amplifier usually reflects a varying dynamic load to the driver stage, which necessitates excellent driver regulation.

Class AB1 operation avoids all the problems of Class B operation, giving only slightly increased distortion products over Class A operation, while the efficiency approaches that of Class B.

There is also an apparent difference in efficiency of linear amplifiers depending on the type of service. It has been stated that linear amplifiers operated on AM are limited to an efficiency of 33-1/3%. This is not entirely correct. It would be more proper and less confusing to state that the efficiency of a linear amplifier at AM carrier level is 50% of the peak efficiency. In the case of AB1 operation, this is limited to about 70% and occurs at the peak of the modulation envelope. Thus, the efficiency of a linear amplifier is proportional to the amount of excitation, being at zero excitation and about 70%, in the case of the L-103, at the point where the tube is just about starting to draw grid current.

For CW operation, the efficiency will be about 70%, since the tube can be run at top level because the input is a steady signal. On AM, however, where the tube has to be capable of following the upward swing of the modulated envelope, the drive level on the carrier has to be reduced to the point where the efficiency at the unmodulated carrier level is about 50% of the peak efficiency of which the amplifier is capable.

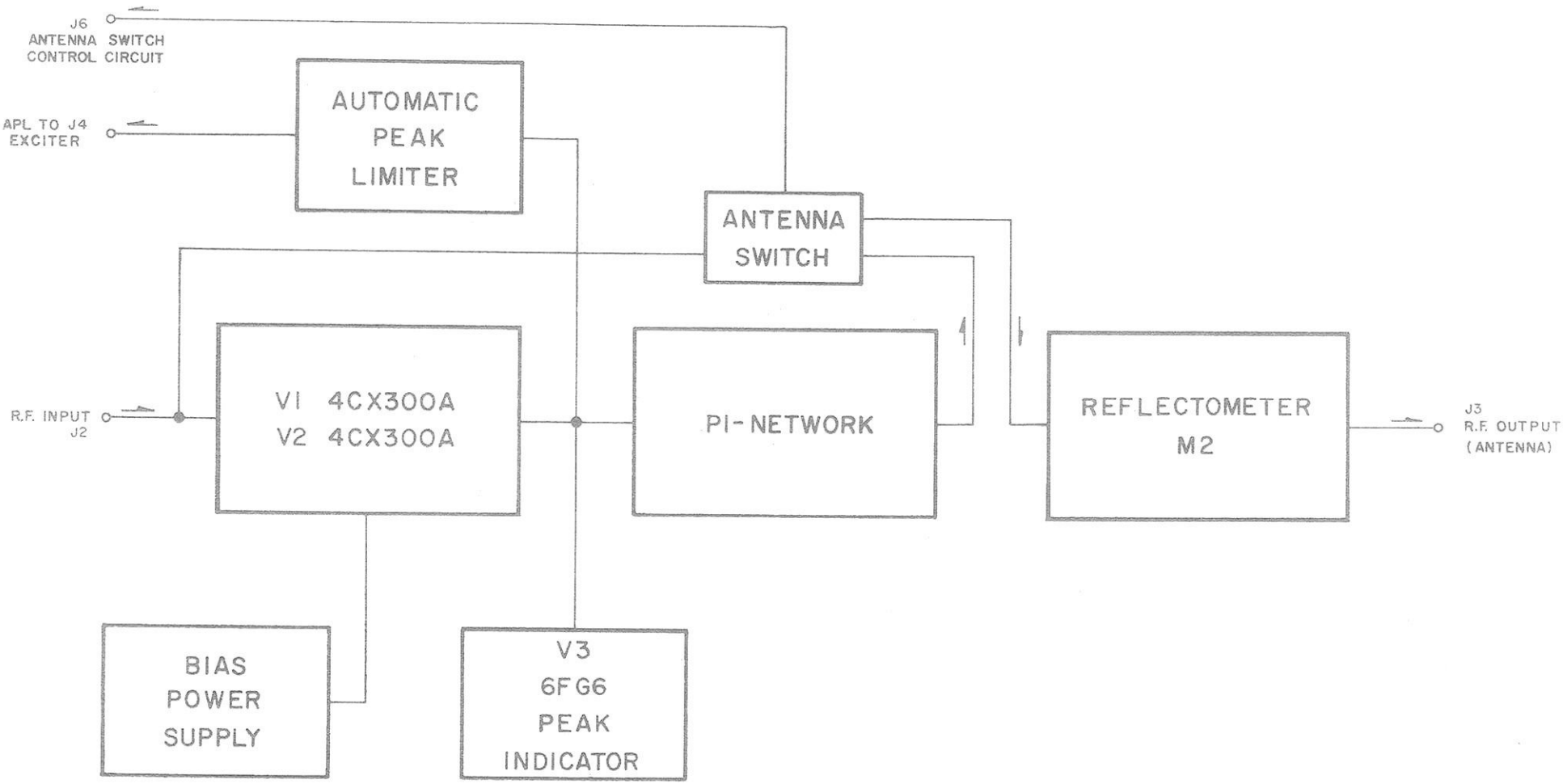


FIG. 4-1
L-103 LINEAR AMPLIFIER
BLOCK DIAGRAM

On single sideband (suppressed carrier), efficiency considerations are of little importance since the average signal level is very low. Therefore, the average plate dissipation is also very low.

2. CIRCUIT DESCRIPTION. (See Figure 4-2)

a. RF Section

Grid Box - Two 4CX300A (V1, V2) radial beam power tetrodes are connected in parallel in a conventional grounded grid configuration. The 4CX300A amplifier tubes are biased for Class AB1 operation. As a result of the excellent interelectrode shielding in the 4CX300A, neutralization is not necessary. Parasitic suppressors are incorporated in the plate lead to each tube to prevent V.H.F. parasitic oscillations. The screen grids obtain their operating voltage through an RC decoupling network, and bypass capacitors are incorporated in the tube sockets.

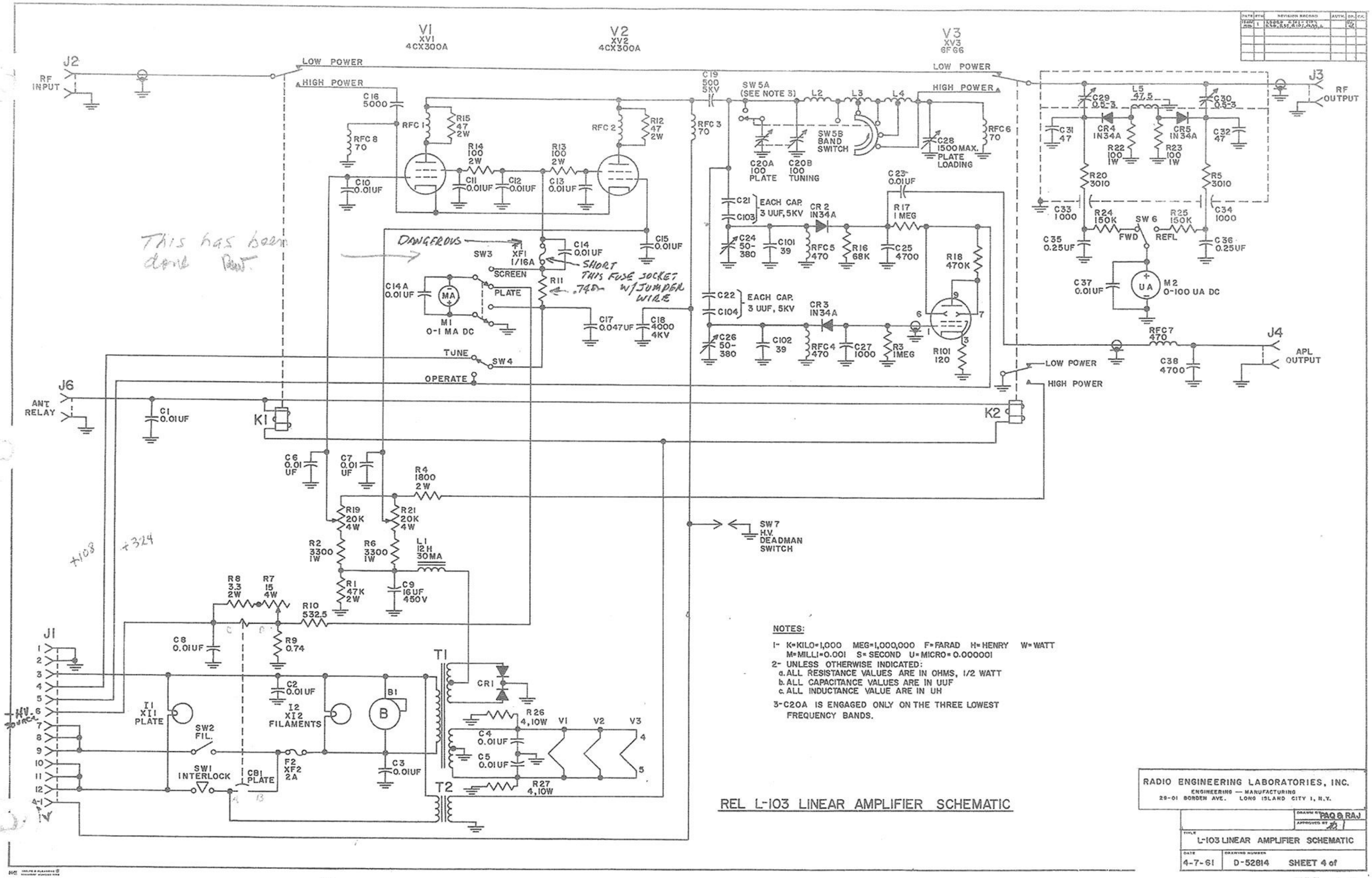
Plate Tank Circuit Assembly - A pi-network is used for the tank circuit to insure good harmonic suppression and proper loading of the amplifier. The plate tank coil is divided into three sections with taps on the mid-frequency and low frequency sections. On the 80 meter band, all sections are connected in series. As the plate tank circuit is changed to each higher band, the band switch taps the plate tank coil to provide the correct inductance for each band and the unused portions of the plate tank coils are shorted out.

The plate tuning capacitor is used to resonate the tank circuit and is controlled by a knob on the front panel. The loading capacitor is also controlled from the front panel.

On 80 & 40 meter bands, an additional 100 mfd section capacitor is switched into the tuning circuit to supply the extra capacity necessary to insure proper tuning from 3.4 to 14.0 MC.

b. Power Meter

The power monitor used in the L-103 amplifier is a reflectometer type monitor. It has a forward and reflected switch incorporated in the monitor circuit so that the meter can be switched in the forward position to monitor the amplifier output power or to the reflected position to indicate power reflected from a mismatched load. The detector circuit in this meter has been designed to give a constant output reading at any frequency between 3.4 and 30 MC. Also the band between the capacitive and inductive pickup does not change so that a lower reflected reading will be obtained over the entire frequency range when this equipment is



NOTES:

1- K=KILO=1,000 MEG=1,000,000 F=FARAD H=HENRY W=WATT
M=MILLI=0.001 S=SECOND U=MICRO=0.000001

2- UNLESS OTHERWISE INDICATED:
a. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT
b. ALL CAPACITANCE VALUES ARE IN UUF
c. ALL INDUCTANCE VALUE ARE IN UH

3- C20A IS ENGAGED ONLY ON THE THREE LOWEST FREQUENCY BANDS.

REL L-103 LINEAR AMPLIFIER SCHEMATIC

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ENGINEERING — MANUFACTURING
29-01 BORDEN AVE. LONG ISLAND CITY 1, N.Y.

DRAWN BY	PAQ & RAJ
TITLE	L-103 LINEAR AMPLIFIER SCHEMATIC
DATE	4-7-61
DRAWING NUMBER	D-52814
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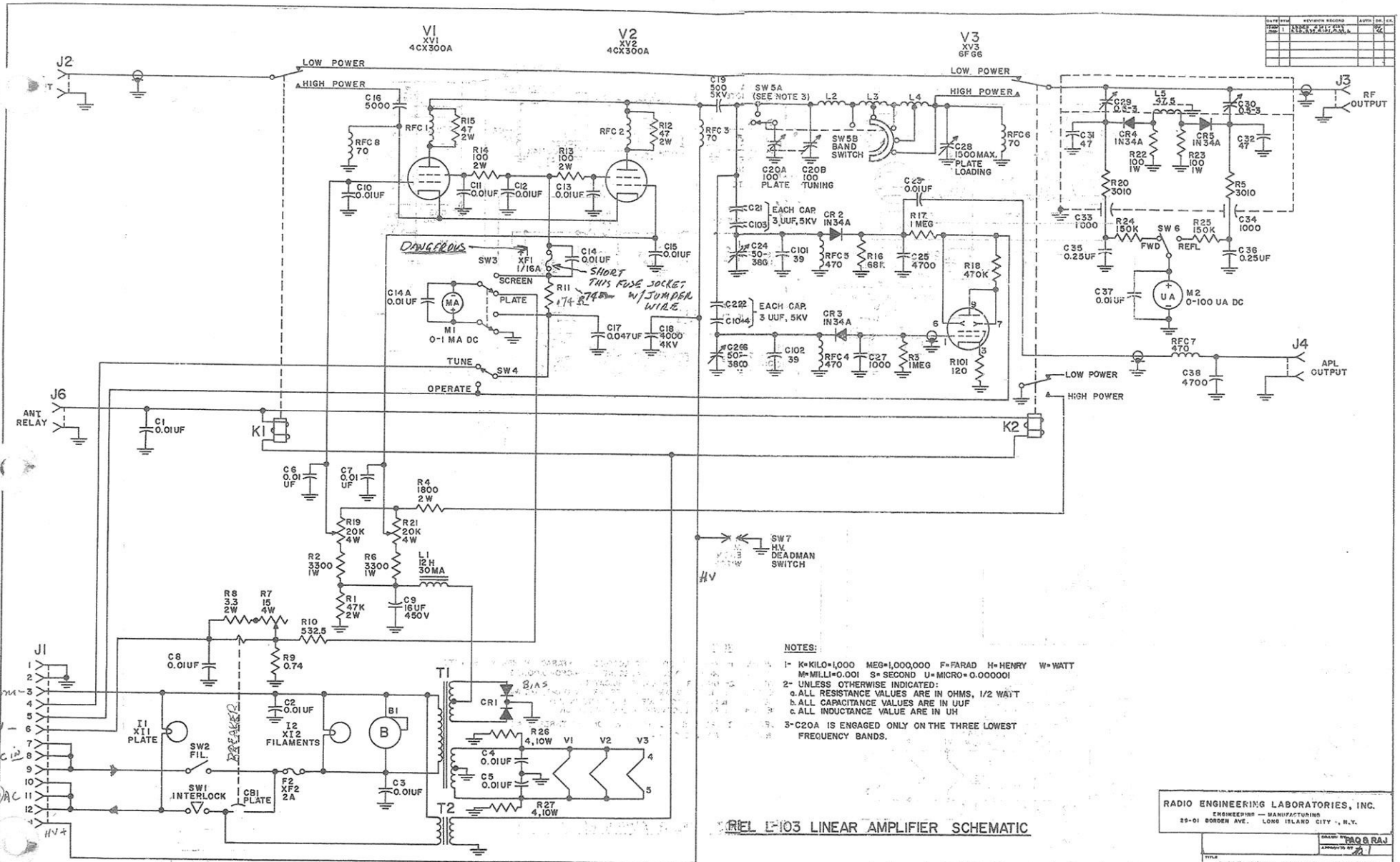
FIG. 4-2



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REL L-103 LINEAR AMPLIFIER SCHEMATIC

RADIO ENGINEERING LABORATORIES, INC.
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29-01 BORDEN AVE. LONG ISLAND CITY 1, N.Y.

DRAWN BY: RAG & RAJ
APPROVED BY:

TITLE: L-103 LINEAR AMPLIFIER SCHEMATIC

DATE: 4-7-61 DRAWING NUMBER: D-52814 SHEET 4 of

FIG. 4-2

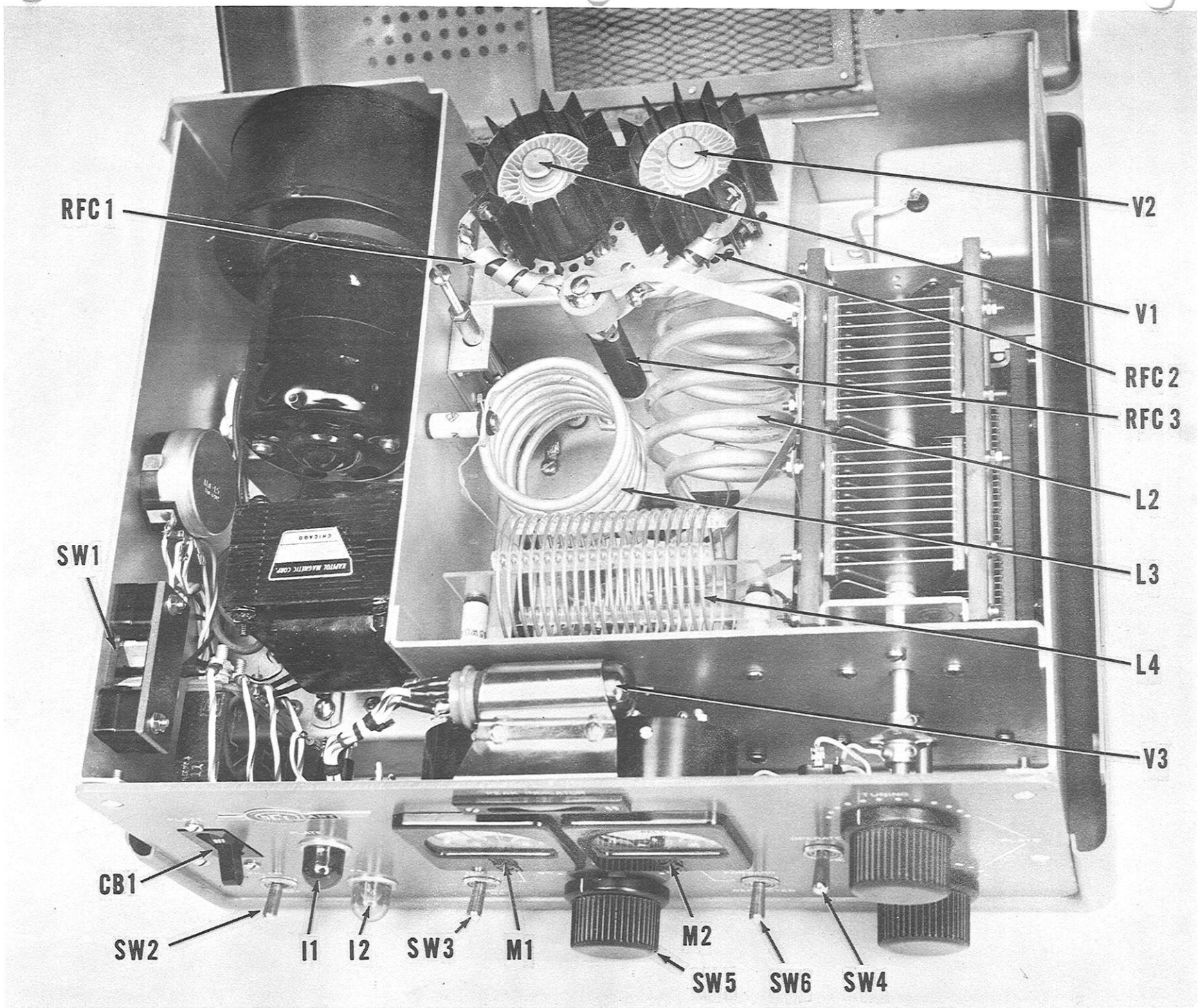
RFC 1
V2
V1
RFC 2
RFC 3
L2
L3
L4
V3
SW1
CB1
SW2
I1
I2
SW3
M1
M2
SW5
SW6
SW4

FIG. 5-1

operating into a 50 ohm resistive load. The time constants of the metering circuits have been chosen so that the meter indicates average RF power.

$$SWR = \frac{1 + \sqrt{\frac{P_R}{P_F}}}{1 - \sqrt{\frac{P_R}{P_F}}}$$

WHEN: P_R = power in watts REFLECTED.

P_F = power in watts DIRECT.

c. Power Supply

The power supply contained in the L-103 delivers the following voltages to the various circuits:

+2500 volts at 500 MA
+ 324 volts at 30 MA
+ 108 volts at 30 MA

The high voltage plate supply (+2500 volts) is a conventional full-wave power supply using a silicon bridge rectifier. A 5 to 25 henry swinging choke and a 8 mfd, oil filled capacitor filter the output of the power supply.

Bleeder resistors are used to draw enough current from the supply to insure proper operation of the swinging choke and to drop the voltage to supply the 0B2 and 0A2's gaseous voltage regulator tubes for the +324 and +108 volt outputs.

Meters are incorporated in both the high voltage plate and screen supplies. The plate current meter is connected in the negative lead of the +2500 volt supply while the screen current meter is connected in series with the output of the screen supply. The screen voltage is dropped from +324 to +108 for tune-up purposes.

d. Control Circuits

The control circuits in the L-103 completely control all functions of the power supply. A B+ shorting switch is activated by the top cover to provide operator safety in the event the cover must be opened.

A potentiometer is connected in parallel with the DC current overload coil of the circuit breaker so that the trip current can be adjusted.

A bias switching relay is also incorporated so that when the exciter used with the L-103 is in the Standby position, cut-off bias (-225 volts) is applied to the amplifier tubes. When this relay is energized by shorting J2 to ground, normal operating bias is applied to the tubes.

SECTION V

MAINTENANCE

1. PREVENTIVE MAINTENANCE. (See Figures 5-1, 5-2, 5-3 and 5-4)

Preventive maintenance is work performed on equipment to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair. Its object is to prevent certain troubles before they occur. The list below presents a maintenance program which should be followed at least once a month.

a. Clean dirt and moisture from all exposed items.

b. Inspect controls for binding, scraping, excessive looseness and positive action.

c. Inspect cords, cables, wire and mounts for cuts, breaks, fraying, deterioration, kinks and strain.

d. Inspect equipment for looseness of accessible items such as switches, knobs, jacks, connectors, transformer, relays, capacitors and pilot lights.

e. Inspect seating of readily accessible items such as tubes, lamps, fuses, connectors and all other plug-in items.

f. Check tubes, lamps, and other plug-in items for bent or corroded pins.

g. Inspect resistors, bushings and insulators for cracks, chipping, blistering, discoloration and dust.

h. Inspect all screw-type terminals for loose connections, cracks and breaks.

i. Inspect transformer, chokes (and fixed capacitors) for overheating and oil leakage.

2. SERVICING.

If the L-103 is used according to this manual, little or no maintenance should be required to keep the unit in good operating condition at all times. Other than keeping the unit dry and free of dust, the

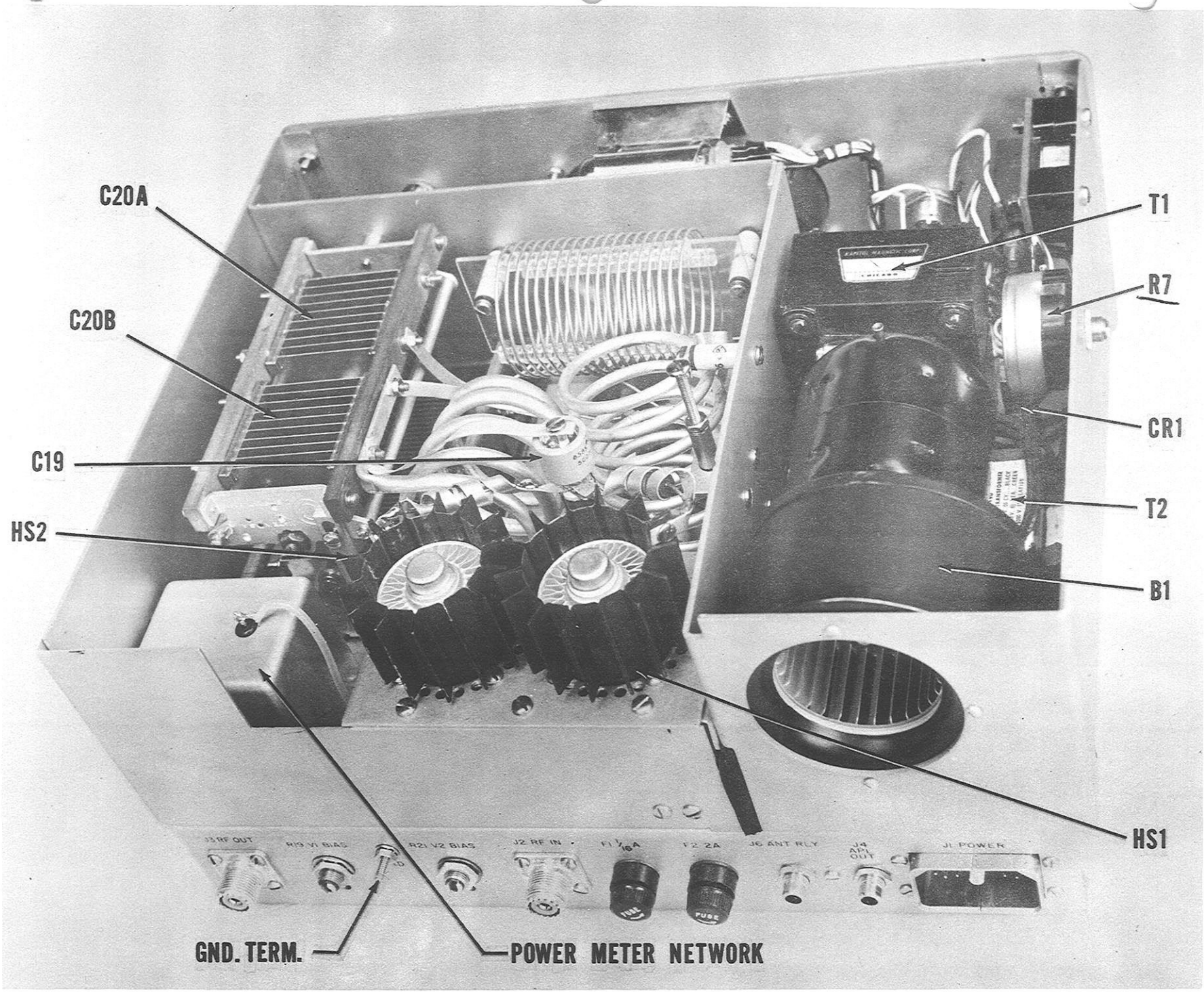
C20A
C20B
C19
HS2
T1
R7
CR1
T2
B1
HS1
GND. TERM.
POWER METER NETWORK

FIG. 5-2

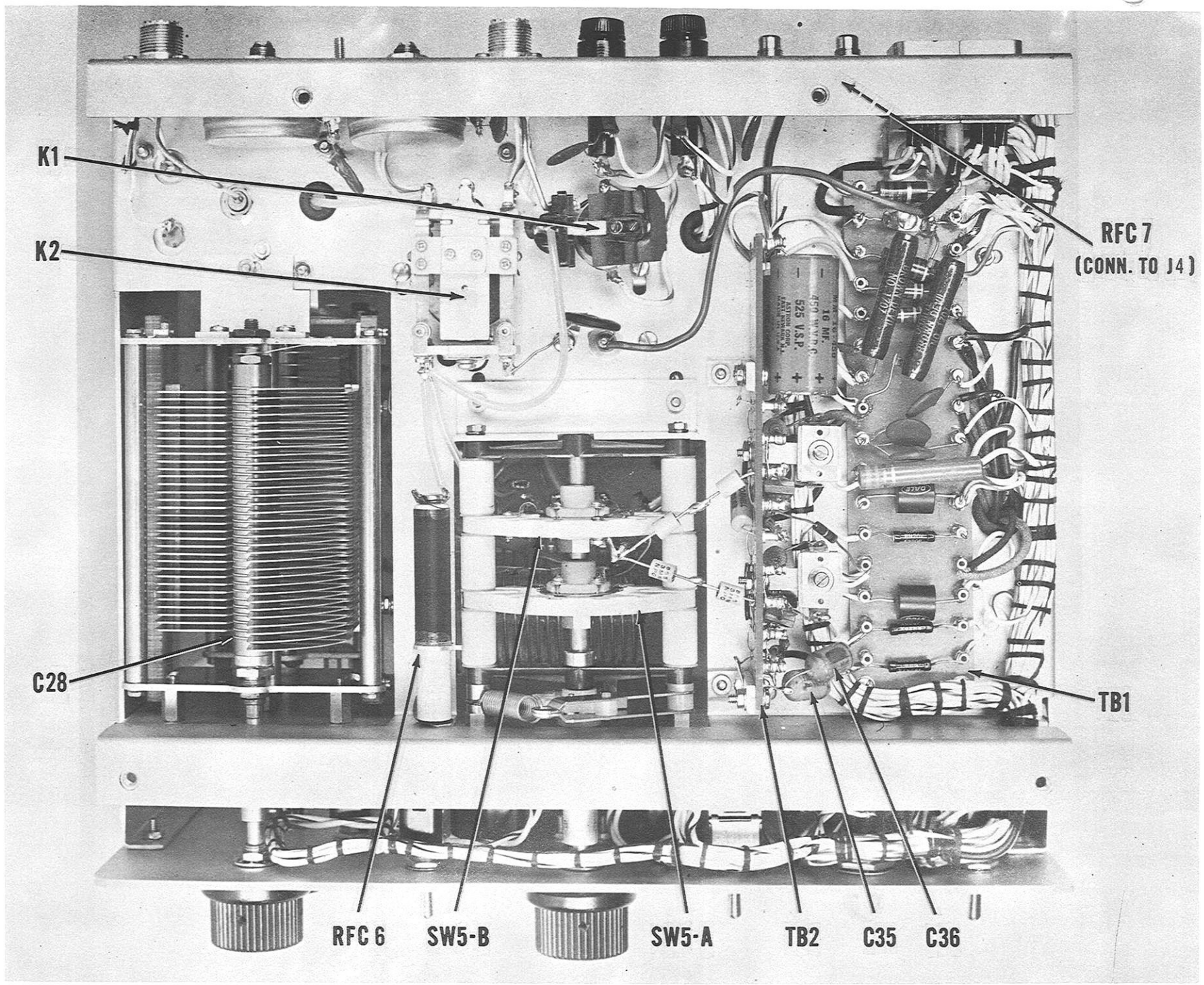

FIG. 5-3

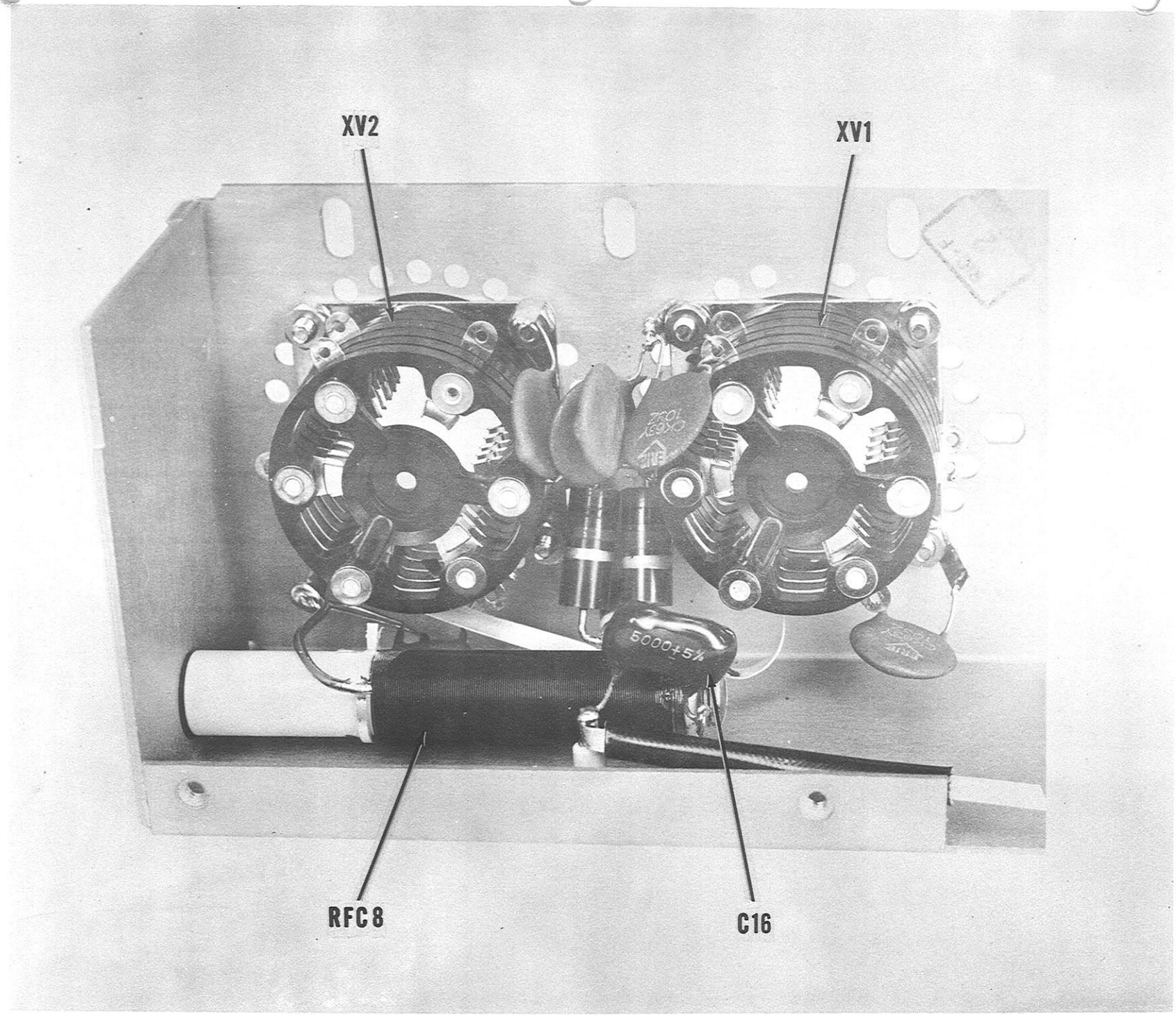

FIG. 5-4

blower bearings and the voltage regulator tubes are the only things requiring periodic check-ups. In normal use, the blower bearings should be oiled with one or two drops of oil about every six months. These bearings are made of porous bronze, so they can remain lubricated for a considerable length of time. Any good household utility oil will serve the purpose. The oilers are located left of the final plate circuit and can be reached from the top of the unit.

The voltage regulator tubes should be checked periodically for their ability to regulate voltages, since aging causes an increase in their internal resistance. The normal screen voltage is 324 volts, and if the screen voltage is found to be more than 20 volts higher, the voltage regulator tubes should be replaced. Should components failure occur, a list of voltages at various points is of great assistance in locating the source of trouble. A voltage chart for this purpose will be found at the end of this section.

3. FACTORY SERVICE.

If the trouble experienced is of a complex nature, and cannot be cured with ordinary measures, it is suggested that a letter be sent to the factory giving the following information:

a. Item, type number, and serial number of this equipment.

b. From whom the item was purchased and date of delivery.

c. Date on which equipment was placed into service and total number of hours of service.

d. Nature of trouble and cause (if known).

e. Remarks.

If necessary, authorization will be given to return the equipment to the factory for servicing. Refer to the Warranty at the front of the manual for further details in regard to returning equipment to the factory.

4. TROUBLESHOOTING PRECAUTIONS.

Great care should be exercised if and when any troubleshooting becomes necessary. While troubleshooting is being done on the L-103, remember that with the unit connected to a source of power, lethal voltages are present in the various circuits. NEVER work on the L-103 alone! Have someone on hand who can take action to remove the power from the unit and assist the person doing the servicing if this should be necessary.

5. VOLTAGE CHART

TUBE NO.	SOCKET PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	2600VDC	300VDC	-45VDC	0	6.3VAC				
V2	2600VDC	300VDC	-45VDC	0	6.3VAC				
V3	0* 22V**			6.3VAC	6.3VAC	340V	90V* 340V**		90V* 340V**

* no drive
** with drive

6. RESISTANCE CHART

TUBE NO.	SOCKET PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	0	60K	1.1 Meg*	0					
V2	0	60K	Infinite**	0					
V3	102Ω		120Ω	2Ω	2Ω	68K	1.5 Meg		1.5 Meg

* SW4 in OPERATE position
** SW4 in TUNE position

SECTION VI

PARTS LIST

PART NO.	DESCRIPTION	LOCATION FIG. NO.
B1	Blower	5-2
C1	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3
C2	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3
C3	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3
C4	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3 (TB1)
C5	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3 (TB1)
C6	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-4
C7	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-4
C8	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-3 (TB1)
C9	Capacitor, Fixed, Electrolytic; 16 µf, +50%, -10%, 450 VDCW	5-3 (TB2)
C10	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-4
C11	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-4
C12	Capacitor, Fixed, Ceramic; .01 µf, +100% -20% GMV, 600 VDCW	5-4

PART NO.	DESCRIPTION	LOCATION FIG. NO.
C13	Capacitor, Fixed, Ceramic; .01 μf, +100% -20% GMV, 600 VDCW	5-4
C14A	Capacitor, Fixed, Ceramic; .01 μf, +100% -20% GMV, 600 VDCW	4-2 (M1)
C15	Capacitor, Fixed, Ceramic; .01 μf, +100% -20% GMV, 600 VDCW	5-4
C16	Capacitor, Fixed, Mica; 5000 μμf ±5%, 300 VDCW	5-4
C17	Capacitor, Fixed, Paper; .047 μf ±20%, 600 VDCW	5-3 (TB2)
C18	Capacitor, Fixed, Ceramic; .004 μf GMV, 3000 VDCW	5-3
C19	Capacitor, Fixed, Ceramic; 500 μμf ±20%, 500 VDCW	5-2
C20A	Capacitor, Variable, Air Dielectric, Split Stator 13-100 μμf each section	5-2
C20B	Capacitor, Variable, Air Dielectric, Split Stator 13-100 μμf, each section	5-2
C21	Capacitor, Ceramic, Disc; 3 μμf, ±20%, 5000 VDCW	5-3
C22	Capacitor, Ceramic, Disc; 3 μμf, ±20%, 500 VDCW	5-3
C23	Capacitor, Fixed, Dielectric Mylar; .01 μf, 400 VDCW	5-3 (TB2)
C24	Capacitor, Compression, Mica; 50-380 μμf, 175 VDCW	5-3 (TB2)
C25	Capacitor, Fixed, Ceramic; 4700 μμf GMV, 600 VDCW	5-3 (TB2)
C26	Capacitor, Compression, Mica; 50-380 μμf, 175 VDCW	5-3 (TB2)

PART NO.	DESCRIPTION	LOCATION FIG. NO.
C27	Capacitor, Ceramic, Disc; .001 μf GMV, 600 VDCW	5-3 (TB2)
C28	Capacitor, Variable, Air Dielectric; 50-1500 μμf, .03 Air Gap	5-3
C29	Capacitor, Ceramic, Adjustable; 0.5-3 μμf, 500 VDCW, Power Meter Network	5-2
C30	Capacitor, Ceramic, Adjustable; 0.5-3 μμf, 500 VDCW, Power Meter Network	5-2
C31	Capacitor, Ceramic, Fixed, Tubular; 47 μμf, ±1%, 600 VDCW, Power Meter Network	5-2
C32	Capacitor, Ceramic, Fixed, Tubular; 47 μμf, ±1%, 600 VDCW, Power Meter Network	5-2
C33	Capacitor, Ceramic, Feed-Thru; 1000 μμf, GMV, 500 VDCW, Power Meter Network	5-2
C34	Capacitor, Ceramic, Feed-Thru; 1000 μμf, GMV, 500 VDCW, Power Meter Network	5-2
C35	Capacitor, Fixed, Paper; 0.25 μf +30%, -20%, 200 VDCW	5-3 (TB1)
C36	Capacitor, Fixed, Paper; 0.25 μf +30%, -20%, 200 VDCW	5-3 (TB1)
C37	Capacitor, Fixed, Ceramic; .01 μf, +100% -20% GMV, 600 VDCW	5-3 (TB2)
C38	Capacitor, Fixed, Ceramic; 4700 μμf GMV, 600 VDCW	5-3
C39	Capacitor, Fixed, Ceramic; .01 μf +100% -20%, GMV, 600 VDCW	5-3
C101	Capacitor, Fixed, Mica; 39 μμf, ±10%, 1 KV DCW	5-3 (TB2)

PART NO.	DESCRIPTION	LOCATION FIG. NO.
C102	Capacitor, Fixed, Mica; 39 μμf, ±10%, 1 KV DCW	5-3 (TB2)
C103	Capacitor, Ceramic, Disc; 3 μμf, ±20%, 5000 VDCW	5-3
C104	Capacitor, Ceramic, Disc; 3 μμf, ±20%, 5000 VDCW	5-3
CB1	Circuit Breaker, SPST 14 ELECT. 0.3A 125VDC 60Hz "PAM 12 RSK"	5-1
CR1	Rectifier, Selenium, Full Wave	5-2
CR2	Diode, Germanium, 1N34A	5-3
CR3	Diode, Germanium, 1N34A	5-3
F1	Fuse, 3 AG Cartridge Type 1/16 Amp, 250 V	5-2
F2	Fuse, 3 AG Cartridge Type 2 Amp, 250 V	5-2
HS1 & HS2	Tube Heat Dissipater	5-2
I1	Lamp, Neon NE51, Plate	5-1
I2	Lamp, Neon NE51, Filament	5-1
K1	Relay, SPDT 6 VAC Coil	5-3
K2	Relay, DPDT 6 VAC Coil	5-3
L1	Choke, Filter, 12 HY-20 MA.DC - Top Chassis Under Blower Motor	4-2
L2	Coil, High Frequencies Plate Tank	5-1
L3	Coil, Medium Frequency Plate Tank	5-1
L4	Coil, Low Frequency Plate Tank	5-1

PART NO.	DESCRIPTION	LOCATION FIG. NO.
L5	Coil, Power Monitor	5-2 (P.M.N.)
M1	Meter, 0-1 MA DC Screen-Plate	5-1
M2	Meter, 0-100 ~~MA~~ uA DC FWD-Reflected	5-1
R1	Resistor, Fixed, Composition; 47,000 ohms ±10%, 2W	5-3 (TB1)
R2	Resistor, Fixed, Composition; 3,300 ohms ±10%, 1W	5-3 (TB1)
R3	Resistor, Fixed, Composition; 1 meg ohm ±10%, 1/2 W	5-3 (TB2)
R4	Resistor, Fixed, Composition; 1,800 ohms ±10%, 2 W	5-3 (TB1)
R5	Resistor, Fixed, Film; 3,010 ohms, ±1%, 1/2 W	5-2 (P.M.N.)
R6	Resistor, Fixed, Composition; 3,300 ohms ±10%, 1 W	5-3 (TB1)
R7	Resistor, Variable, Wirewound; 15 ohms ±10%, 4 W	5-2
R8	Resistor, Fixed, Wirewound; 3.3 ohms ±10%, 2 W	5-3 (TB1)
R9	Resistor, Fixed, Wirewound; 0.74 ohms ±1%, 1/2 W	5-3 (TB1)
R10	Resistor, Fixed, Film; 532.5 ohms ±1%, 1/2 W	5-3 (TB1)
R11	Resistor, Fixed, Wirewound; 0.74 ohms ±1%, 1/2 W	5-3 (TB1)
R12	Resistor, Fixed, Composition; 47 ohms ±10%, 2 W	5-2

PART NO.	DESCRIPTION	LOCATION FIG. NO.
R13	Resistor, Fixed, Composition; 100 ohms ±10%, 1/2 W	5-4
R14	Resistor, Fixed, Composition; 100 ohms ±10%, 2 W	5-4
R15	Resistor, Fixed, Composition; 47 ohms ±10%, 2 W	5-2
R16	Resistor, Fixed, Composition; 68,000 ohms ±10%, 1/2 W	5-3 (TB2)
R17	Resistor, Fixed, Composition; 1 meg ohm ±10%, 1/2 W	5-3 (TB2)
R18	Resistor, Fixed, Composition; 470,000 ohms ±10%, 1/2 W, Tube Base	5-1 (6FG6)
R19	Resistor, Variable, Wirewound; 20,000 ohms ±10%, 2 W	5-3
R20	Resistor, Fixed, Film; 3,010 ohms ±1%, 1/2 W	5-2 (P.M.N.)
R21	Resistor, Variable, Wirewound; 20,000 ohms ±10%, 4 W	5-3
R22	Resistor, Fixed, Film; 100 ohms ±1%, 1 W	5-2 (P.M.N.)
R23	Resistor, Fixed, Film; 150,000 ohms ±1%, 1/2 W	5-2 (P.M.N.)
R24	Resistor, Fixed, Film; 150,000 ohms ±1%, 1/2 W	5-3 (TB1)
R25	Resistor, Fixed, Film; 150,000 ohms ±1%, 1/2 W	5-3 (TB1)
R26	Resistor, Fixed, Composition; 4 ohms ±10% 10 W	5-3 (TB1)

PART NO.	DESCRIPTION	LOCATION FIG. NO.
R27	Resistor, Fixed, Composition; 4 ohms ±10%, 10 W	5-3 (TB1)
R101	Resistor, Fixed, Composition; 120 ohms, ±10%, 1/2W, Tube Base	5-1 (6FG6)
RFC1	Parasitic Suppressor Wound on R15	5-1
RFC2	Parasitic Suppressor Wound on R12	5-1
RFC3	RFC Choke 70 mh	5-1
RFC4	RFC Choke 470 mh	5-3 (TB2)
RFC5	RFC Choke 470 mh	5-3 (TB2)
RFC6	RFC Choke 70 mh	5-3
RFC7	RFC Choke 470 mh	5-2
RFC8	RFC Choke 70 mh	5-4
SW1	Switch, Interlock	5-1
SW2	Switch, Filament, Toggle SPST	5-1
SW3	Switch, Screen & Plate, Toggle DPDT	5-1
SW4	Switch, Tune & Operate Toggle SPDT	5-1
SW5	Switch, Band, Rotary	5-3
SW6	Switch, Power Monitor, Toggle SPDT	5-1
T1	Transformer, Power	5-2
T2	Transformer, Filament	5-2
V1	Tube, 4CX300A	5-1
V2	Tube, 4CX300A	5-1
V3	Tube, 6FG6/EM84	5-1