JOHNSON VIKING FIVE HUNDRED TRANSMITTER

Model 240-500-1 (Kit Form)
240-500-2 (Assembled and Tested)

The successful operation of any radio equipment is largely dependent upon the operator's understanding of the equipment. This operating manual is made up of several parts, each with the purpose of making the operator more familiar with the Viking Five Hundred. It is strongly recommended that this manual be carefully read prior to attempting operation of the equipment.

The Viking Five Hundred should be given the good care usually accorded any other fine electronic instrument and in return will provide long trouble-free service. Periodic cleaning, dust removal, tube checking, etc., will maintain the appearance and performance of the equipment.

WARNING

The voltages encountered in this piece of equipment are high enough to cause fatal injury. Practice safety rules until they are second nature. Always turn off the high voltage before making any adjustment inside the transmitter. Never depend on a bleeder resistor to discharge filter condensers. After the power is turned off, short circuit the high voltage circuit. Never operate the transmitter with any other than the recommended fuses in the primary circuit. The fuses will protect your equipment - in the case of accidental contact with the high voltage, they may save your life. If children have access to the open transmitter, always disable the primary circuit by removing the fuses, or the high voltage circuits by removing the rectifiers. Always remove the power cord plug from the power source when working inside the transmitter.

A. INTRODUCTION

1. FUNCTION

The Viking Five Hundred is a self contained radio frequency transmitter designed for amateur service. It may be used for CW telegraphy, AM phone or, with a suitable exciter, SSB phone communication.

Approximate final amplifier ratings are:

Mode	Plate Power Input
CW	600 watts
AM	500 watts
SSB	500 watts*

The ranges of operating frequencies are:

3.5 mcs. to 4.0 mcs.
7.0 mcs. to 7.42 mcs.
14.0 mcs. to 14.85 mcs.
21.0 mcs. to 21.6 mcs.
26.9 mcs. to 27.36 mcs.
28.0 mcs. to 29.7 mcs.

Maximum output power is essentially constant throughout the operating range.

2. CONSTRUCTION

The Viking Five Hundred consists of two compact units: an RF unit small enough to place on the operating desk beside a receiver and a power supply-modulator unit which may be located remotely and controlled from the RF unit through interconnecting cables.

The RF section of the transmitter is 21 1/8" wide, 17 3/8" deep, 11 5/8" high; weighs 55 pounds net. A perforated cadmium plated steel cabinet and cadmium plated steel panel result in total shielded enclosure with adequate ventilation.

All operating controls are located on the front panel, as well as the meters, frequency determining dial and pilot lamps. Microphone input jack, keying jack, phone patch input, SSB input jack, RF output receptacle, relay jack and ground stud are located on the rear of the chassis.

The power supply-modulator unit is 10 7/8" x 20 3/8" x 15 3/4" in size, weighs 120 pounds and is totally enclosed by a perforated steel cover. The primary power input is to the power supply unit with power in turn fed to the RF section. Protective fuses are located in the power unit and are directly accessible.

To aid in eliminating spurious radiation which might result in interference to other services such as television broadcasting, the RF transmitter cabinet serves as an effective shield. Monel metal braid is used to bond the panel and seal all possible openings between the one-piece cabinet and panel. The meters are shielded at the rear and have individual RF filters in meter leads. All

* (P.E.P.) peak envelope power

external connections such as power cables, microphone input receptacle, key jack, etc. are equipped with individual RF filters to maintain cabinet shielding integrity.

Operating frequency is determined by the bandswitch and high stability, temperature compensated, integral variable frequency oscillator, both controlled from the front panel. The oscillator is calibrated directly in output frequency and the illuminated dial provides calibration points in 10KC increments throughout the frequency range.

A socket located behind a dummy knob cover on the front panel will accommodate two crystals, in type FT-243 holders, for spot frequency operation.

3. AUXILIARY EQUIPMENT

MICROPHONE - For phone operation, a crystal or high impedance dynamic microphone is required. The Viking Five Hundred is equipped with a low current DC "push-to-talk" relay requiring only a microphone with a "push-to-talk" switch to actuate it.

KEY - Any hand key, "bug" or electronic key may be used for CW operation. The DC current through the key is negligible and a keying relay is not required.

SSB EXCITER - For SSB phone operation, the transmitter requires approximately 1 watt of single sideband suppressed carrier excitation at the output frequency. This requirement is met by a number of commercially available SSB exciters. The output frequencies available and quality of the SSB signal are dependent upon the design of the accessory exciter.

ANTENNA COUPLER - Unbalanced resistive antenna loads from 15 to 200 ohms impedance or unbalanced 52 ohm systems with a standing wave ratio not exceeding 3:1 may be matched by the pi-network output tuning system. Antennas with coaxial feed are easily designed to fall within this impedance range and an antenna coupler is not required.

If it is required to work into two wire balanced antenna transmission line systems or to work into highly reactive antenna systems such as may be encountered by using one antenna for a number of different frequency bands, an antenna coupler such as the 250-30 JOHNSON "Matchbox" should be used. Alternative solutions to antenna matching problems may be found in the ARRL Handbook in the chapters "Transmission Lines" and "Antennas".

LOW PASS FILTER - While the pi-L network output circuit of the 500 provides good harmonic suppression, there are many locations where harmonic output must be reduced to an absolute minimum to avoid interference with "fringe area" television reception. In this case, a low pass filter such as the 250-20 JOHNSON is a highly desirable accessory. Since a low pass filter is a fixed impedance device (52 ohms in the case of the 250-20), antenna impedance matching flexibility must be achieved by using an antenna coupler after the low pass filter, if the SWR on the coaxial feed line is greater than 2:1.

LINE CORD - To connect the power supply to the power source, insulated flexible leads are required: two #12 for 115 volt operation or three #14 for 115-230 volt operation.

4. POWER REQUIREMENTS

The Viking Five Hundred is designed to operate from a 3 wire 115-230 volt 50-60 cycles single phase or a 2 wire 115 volt, 50-60 cycle single phase AC line voltage source. Since the screen grid voltage for the variable frequency oscillator is regulated and, for SSB operation, the amplifier screen grid voltage is regulated, the equipment is substantially independent of line voltage regulation within the limits of 105 to 125 volts.

Typical Power demands

Standby	320 watts
SSB, no signal	750
CW, 600 watts input	1200
AM, 500 watts input, no modulation	1090
AM, 500 watts input, 100% sine wave modulation	1450

B. DESCRIPTION

1. EXCITER

The Viking Five Hundred exciter section utilizes a 6AU6 (V101) variable frequency oscillator, a 6CL6 (V103) crystal oscillator/buffer, a 6CL6 (V104) frequency multiplier and a 5763 (V105) RF driver. All exciter stages are gang-tuned and are controlled by the VFO tuning knob.

The primary method used to establish frequency control is the 6AU6 high stability electron coupled oscillator. The oscillator is voltage regulated and temperature compensated. Drift and frequency shift due to temperature rise or line voltage variation are negligible. The construction of these circuits is extremely rigid to minimize the effects of shock or vibration. The 6AU6 oscillator and its associated OA2 (V102) screen voltage regulator are housed in a separate compartment, carefully shielded and isolated from all other radio frequency circuits to avoid frequency modulation of the oscillator output.

The oscillator is equipped with two separate tank circuits, one covering the range 1.75-2.0 mcs. for output on the band 3.5 - 4.0 mcs. The other tank circuit covers basically the range 7.0 - 7.42 mcs. for all other output frequencies except the 11 meter band. Here the oscillator tunes the range 6.725 mcs. to 6.84 mcs. for output in the range 26.9 - 27.36 mcs. Oscillator tank circuits are selected by SW101 actuated from the shaft of the bandswitch SW103 by the drive arm D118 and the cam D117. Oscillator frequency is determined by the capacitor C101A, B driven by the main dial and planetary drive assembly D119.

Using VFO frequency control, the 6CL6 crystal oscillator/buffer serves as a broad banded amplifier/frequency multiplier and serves to further isolate the VFO from succeeding RF stages. The plate circuit is switched by SW103A.

With switch SW102 in the "C1" or "C2" position, the VFO is disabled by removing L105 from ground thus opening the cathode circuit of V101. At the same time, one of the crystals is connected by SW102 between the grid of V103 and ground. V103 then becomes a "hot cathode" crystal oscillator.

With SW102 in the "VFO" position, the cathode of V101 is grounded thru L105, the plate of V101 is connected to the grid of V103 thru the coupling capacitor, C123, and the crystals are removed from the circuit. These same conditions exist when the operate switch, SW110, is switched to the "zero" position plus the fact that SW110 grounds pin 7 of the 12AU7 keyer (V107), thus keying the whole exciter chain.

The 6CL6 frequency multiplier employs a tuned plate circuit (L108-L112 and C138A, B) which operates at the transmitter output frequency on all bands.

The 5763 RF driver operates straight through on all bands with a tuned plate circuit consisting of inductors L113-L117 and variable capacitor C158A, B.

The inductors of both the frequency multiplier and RF driver are slug tuned to facilitate tracking. C138A, B (frequency multiplier tuning) and C158A, B (RF driver tuning) are mechanically ganged with the VFO tuning capacitor thus providing gang-tuning of the entire exciter chain.

2. RF POWER AMPLIFIER

The RF Power Amplifier (PA) uses a PL-175A pentode (or 4-400A tetrode) with a PI-L network output circuit. The PI-L network will handle unbalanced 52 ohm loads with standing wave ratios as high as 3:1 or unbalanced resistive loads from 15-200 ohms.

The pi and L networks are bandswitched by switches SW104 and SW105, respectively. Capacitor C179A,B, PA PLATE TUNING, tunes the plate circuit to resonance. Capacitor C181A, B, LOADING, is used to control the amplifier loading.

The screen voltage supply is regulated by voltage regulator tubes for SSB operation and is controlled by an 807 clamper tube in CW and AM operation. The clamper limits the screen potential and thus the plate dissipation under key-up or excitation failure conditions. The clamper also serves to reduce the screen potential in the TUNE position for tune-up purposes. The 807 also serves as a voltage control tube on SSB to improve PA screen regulation.

To operate the Viking Five Hundred on SSB, a SSB exciter capable of delivering 1 watt peak envelope power output at the desired operating frequency is required. Both the 5763 RF driver and 4-400A power amplifier function as linear amplifiers in SSB mode. It should be remembered that the transmitted signal can be no better than the exciter signal supplied and care should be taken to provide a high quality input to the Viking Five Hundred. Grounding a terminal cuts off the power amplifier and prevents diode noise during reception. This requires one normally closed contact on a voice operated relay in the SSB exciter.

3. AUDIO SECTION

The speech system consists of a 12AX7 (V109) dual triode cascade connected amplifier, a 6AL5 (V110) audio peak clipper which is followed by a low-pass filter a 6AU6 (V111) third audio amplifier and a 6B4G (V112) audio driver. These stages are located in the RF section of the transmitter.

The high level plate modulator uses a pair of 811A tubes (V305 and V306) in class B. The modulator is located in the power supply unit and is fed audio driving voltage through an interconnecting cable from the 6B4G audio driver. A safety gap, GAP301, is placed across the secondary of the modulation transformer to prevent damage to the transformer in case of accidental operation without load.

Two audio inputs are provided. J107 on the rear of the chassis is the microphone input. Terminal 1 connects the audio output of either a crystal or high impedance dynamic microphone to the grid of the first audio stage. Terminal 2 and ground of J107 connect in parallel with SW110 and if a push-to-talk microphone is used, the switch in the microphone actuates the push-to-talk relay, RY302. The phono jack, J108, also on the rear of the chassis, serves as a phone patch input. It connects between cathode and ground of the second audio stage (V109B) and is in parallel with the cathode resistor, R150. This lead should be blocked by an 8 mfd., 10 volt capacitor, in series with the phone patch input to prevent shorting of the cathode resistor by the phone patch circuit if such a capacitor is not part of the phone patch unit.

The phone patch input is substantially independent of the AUDIO gain control, thus allowing full use of the microphone input while the phone patch input is in use. The phone patch input signal feeds into the audio peak clipper which limits the modulation level to the maximum desired. About 100 millivolts RMS input is required for 100% modulation.

The audio clipper (V110) will provide more than 10DB of speech clipping, markedly improving the effectiveness of the transmitter signal. The audio filter following the clipper, consisting of C209, C210 and L141, may be considered as a part of the clipper since it is used to correct the audio wave form after clipping. The filter also helps to limit the frequency response to the range 250 to 3000 cycles. Modulation level and degree of clipping are controlled by R154, the clipping level control on the chassis rear, and by R149, the audio gain control mounted on the front panel and marked "AUDIO".

A protective shorting switch is mounted on the rear of the RF chassis such that removal of the cabinet enclosure automatically grounds the 2000 volt line. A push button interlock switch, SW112, mounted at the rear of the RF unit chassis, removes power from the coil of the primary relay, RY301, when the cabinet is removed. This de-energizes all filament circuits and power supplies.

4. POWER SUPPLIES

Three power supplies are used to power the Viking Five Hundred. A bias supply, with a 6AX5GT rectifier (V301) provides an output of -150 volts which is used for blocking, protective and/or operating bias on all RF stages and the modulator.

The bias supply is used to power the push-to-talk or control relay, RY302, and since the bias rectifier has a slow heating cathode, time delay is automatically provided which prevents the 2000 volt power supply from being energized until the filaments of the high voltage rectifiers, modulators and power amplifier have warmed up. Failure of the bias supply causes the control relay, RY302, to open and de-energize the high voltage circuits, thereby protecting modulator and PA tubes from damage.

A low voltage supply, with a 5U4G rectifier (V302) supplies +350 volts DC to the RF exciter and speech system. The bias and low voltage potentials are obtained through transformer T301 which also supplies all rectifier filaments and the modulator filaments.

The high voltage supply uses a pair of 866A mercury vapor rectifiers and delivers +2000 volts DC at approximately one-half ampere. It supplies plate voltage for the power amplifier and the 811A modulators. In addition, the screen of the power amplifier is fed from the +2000 volt source and is dropped through screen dropping resistors, R303 and R304. This screen voltage is regulated for SSB at +705 volts by means of four VR150 (V308-V311) and one VR105 (V307) voltage regulators.

A protective shorting switch is mounted in the power supply such that removal of the top cover automatically grounds the 2000 volt line.

A push button interlock switch, SW301, mounted on top of the power supply chassis, removes power from the coil of the primary power relay, RY301, when the top cover is removed. This de-energizes all filament circuits and power supplies.

5. INTERCONNECTING CABLES

Three interconnecting cables are used to connect the Viking Five Hundred RF unit and the power supply unit.

The nine conductor Power cable delivers +350 volts, bias voltage, 115 V.A.C. to the RF unit and also provides leads for push-to-talk, control and indicator functions.

A four conductor Audio cable feeds audio driving power from the RF unit to the modulator in the power supply unit and also provides keying leads for exciter control by the push-to-talk relay.

The three conductor High Voltage cable supplies +2000 volts to the RF unit (PA plate potential) and also screen potential for the power amplifier.

C. INSTALLATION

GENERAL

After removing the transmitter from the shipping containers, inspect it thoroughly for any possible damage from shipping. Claims against the carrier delivering the equipment must be made with the carrier's agent at the point of delivery. DO NOT SHIP DAMAGED EQUIPMENT BACK TO THE MANUFACTURER UNTIL AUTHORIZED TO DO SO BY THE MANUFACTURER. NOTIFY THE SERVICE DIVISION THAT A CLAIM IS BEING MADE AGAINST THE CARRIER.

CAUTION: When carried by the handles, the Power Supply will be top-heavy and should be steadied to avoid upsetting.

1. POWER SUPPLY UNPACKING AND REMOVAL OF COVERS

a. Remove sheet metal screws at the lower edge of the perforated top cover and remove the top cover.

b. Remove blocking.

c. Remove packing around tubes.

d. Remove packages containing hardware and spare fuses.

e. Remove sheet metal screws around edges of the bottom plate and remove the bottom plate

f. Remove blocking inside the chassis.

g. Search packing material for anything overlooked

h. Inspect power supply for damage from shipping.

2. RF UNIT UNPACKING AND CABINET REMOVAL

a. Unscrew the four tie bolts which are located at the top, left and right ends of the rear of the cabinet.

b. Loosen and remove the screws around the periphery of the cutout located on the rear of the cabinet.

c. Slide the chassis out of the cabinet carefully.

d. Remove the packages containing hardware, two knobs, and two keys for the POWER switch.

e. Remove the packing from around the power amplifier coils, tubes, neutralizing capacitors, and any additional packing inside the cabinet or on the chassis.

f. Remove the supports provided between the chassis bottom covers and the cabinet.

g. Untie the parasitic suppressor assembly, E104, in the PA Plate circuit (Figure 18).

h. Remove the packing from around the fan motor. The chassis bottom plates may be removed as described in paragraph C-5-k.

i. Remove any other packing inside the chassis.

j. Search the packing material for anything overlooked.

k. Inspect the RF Chassis for damage during shipment.

3. INSTALLATION OF TUBES

a. POWER SUPPLY. Refer to Figure 5. Install tubes removed for shipping and check proper location of others as shown:

(1) V301, 6AX5GT, in XV301.

(2) V302, 5U4G, in XV302.

(3) V303, V304, both 866/866A's in XV303 and XV304 (the sockets recessed below the chassis). Connect the plate caps.

(4) V305, V306, both 811A's, in XV305 and XV306. Connect the plate caps.

(5) V307, OC3/VR105, in XV307.

(6) V308, V309, V310, V311, all OD3/VR150's in XV308, XV309, XV310 and XV311.

b. R. F. UNIT. Refer to Figure 38. Install tubes removed for shipping and check proper location of others as shown (V101 and V102 are already in place inside the VFO):

(1) V101 (6AU6) in XV101, the rear socket of the VFO.

(2) V102 (OA2) in XV102, the front socket of the VFO.

(3) V103 and V104 (6CL6's) in XV103 and XV104. Install tall tube shield, E106, over V104.

(4) V105 (5763) in XV105. Do not install tube shield.

(5) V106 (PL-175A or 4-400A) in XV106. Connect plate cap E108 to V106. Replace shield cover over V106.

(6) V107 (12AU7) in XV107.

(7) V108 (807) in XV108. Connect plate cap E107 to V108.

(8) V109 (12AX7) in XV109. Install medium tube shield, E127, over V109.

(9) V110 (6AL5) in XV110.

(10) V111 (6AU6) in XV111.

(11) V112 (6B4G) in XV112.

4. INSTALLATION OF KNOBS REMOVED IN SHIPPING. Refer to Figure 9.

a. Install a 10-32 x 1/4" slotted, headless set screw in the 2 3/8" knob (no white marker peg). Place a "star" spring washer on the EXCITER TUNING planetary drive shaft with the fingers pointing away from the panel. Mount the 2 3/8" knob on the shaft of the planetary drive and apply pressure to the knob (to place the "star" washer under tension) before tightening the set screw. The tension on the "star" washer "loads" the planetary drive shaft, removing any backlash which would interfer with VFO "zeroing". The arms of the "star" washer should be deflected about 1/64" to 1/32" for proper loading.

b. Push the rectangular "push-on" knob onto the lever arm of STANDBY switch, SW110. NOTE: Rubber cement applied to the slot in the knob will secure the knob and still allow removal.

c. Insert one of the metal keys into the keyhole in the POWER switch.

5. INSTALLATION AND REMOVAL OF CHASSIS BOTTOM PLATES. Refer to Figures 20, 31 and 47.

The P.A. Bottom Plate and Exciter Bottom Plate provide electrical shielding necessary for proper operation of the transmitter. They are installed with a small bending tension to assure good electrical bonding to the chassis. These covers allow the chassis bottom to be pressurized for forced air cooling of the Power Amplifier tube. To install the chassis bottom covers, proceed as follows:

a. Turn the RF Unit upside down. Orient P.A. Bottom Plate, CH105, over the P.A. section (Figure 31), with the 4 3/4" hole over the fan blades, B102, and the corner with the deepest (1/2") notch over the rear corner of the chassis. Refer to Figure 47.

b. Insert 1/8" of the front edge of CH105 under the front lip of the chassis (not the front panel).

c. Keeping the two notched corners on the outside of the gusset plates (welded into the corners of the chassis lip), insert 1/8" of the outside edge of CH105 under the lip at the side of the chassis by pressing down on CH105 and sliding it into place.

d. Line up screw clearance holes with the holes in the lips of the chassis and shield SH102.

e. Orient the Exciter Bottom Plate, CH115, over the bottom of the exciter (Figure 20) with the deepest notch (1/2") at the rear corner of the chassis. Refer to Figure 47.

f. Insert 1/8" of the front edge of CH115 under the front lip of the chassis, (not under the front panel).

g. Keeping the two notched corners on top (outside) of the gusset plates (welded into the corners of the lip of the chassis) insert 1/8" of the outside edge of CH115 under the lip at the side of the chassis by pressing down on CH115 and sliding it into place. One edge of CH115 will overlap one edge of the P.A. Bottom Plate, CH105, from front to rear along the center of the chassis.

h. Line up screw clearance holes in CH115 to match the holes in lips of the chassis and shields.

i. Using a pointed tool, center two bottom plate spacers, HW186, near C181, (Figure 31) under the screw clearance holes in the P.A. Bottom Plate and secure them with 8-32 x 3/8" round head screws using the following sequence (from the outside): screwhead, #8 shakeproof, P.A. Bottom Plate, bottom plate spacer.

j. Secure the P.A. Bottom Plate, CH105, and the Exciter Bottom Plate, CH115, with fourteen #6 sheet metal screws.

k. To remove the bottom covers, remove the screws installed in step i and j above and slide the covers out.

NOTE: Before replacing the covers on the power supply and the cabinet on the RF Unit, it is suggested that the transmitter be given a preliminary checkout, while the circuits are readily accessible. To do this, follow the procedure given in section D2.

NOTE: To replace the covers on the power supply, reverse the process in paragraphs C1e and a.

To replace the cabinet on the RF Unit, reverse the process in paragraphs C2c, b and a. This should be done before cables are permanently connected to the RF Unit.

6. INSTALLATION OF INTERCONNECTING CABLES.

Install three eight-foot cables between units as follows:

a. AUDIO CABLE The 4 conductor audio cable, W401, is the smaller plastic-covered cable with an octal (8 pin) plug on one end and a noval (9 pin) plug on the other.

   (1) Install the female octal plug, P301, on the black male octal receptacle, J301, at the rear of the Power Supply (Figure 4).

   (2) Find the male noval plug, P109, located on the opposite end of W401, and insert it in female noval receptacle, J109, at the rear of the RF Unit (Figure 36).

b. POWER CABLE The 9 conductor power cable, W501, is the larger of the two plastic covered cables and has a 9 pin connector on each end.

   (1) Insert the male noval plug, R305, in the female noval receptacle, J305, at the rear of the Power Supply (Figure 4).

   (2) Install the female noval plug, P110, on the male noval receptacle, J110, at the rear of the RF Unit (Figure 36).

c. HIGH VOLTAGE CABLE. The 3 conductor high voltage cable, W601, is enclosed in a tinned copper shield braid. Leads have nylon tip plugs.

(1) Remove the terminal cover, from the rear of the power supply. (Figure 8).

(2) Remove the nylon cable clamp, HW362, from the rear of the power supply (Figure 4) and place it around the shield braid at one end of cable W601 next to the point where the shield tail leaves the cable.

(3) Mount the cable clamp, HW362, in its original location with W601 clamped inside it using the following sequence: clamp, #8 flatwasher, #8 shakeproof washer, 8-32 nut. Tighten hardware. The main part of the cable should extend downward.

(4) Connect the shield braid tail to ground stud, GS301, using the following sequence: shield tail, #8 shakeproof washer and 8-32 nut. Tighten securely. Keep the braid clear of the three nylon tip jacks mounted on the chassis.

(5) Connect the three tip plugs at the power supply end of W601 to the three tip jacks on the power supply. Insert the blue tip plug in the blue tip jack, red tip plug in the red jack, and the yellow tip plug in the yellow tip jack.

(6) Remove two #6 sheet metal screws from the lips of the 2" square terminal cover on the rear of the RF Unit and remove the cover.

(7) Remove the nylon cable clamp, two shakeproof washers, second nut and two flat washers from ground stud, GS102, on the RF Unit (Figure 36. The cable clamp is not shown). Place the cable clamp around the free end of the shield braid on cable W601. Connect the shield braid tail of W601 to GS102, using the following sequence: shield tail, #8 shakeproof washer and 8-32 nut. Train the tail upward and away from the tip jacks. Tighten securely. Replace the nylon cable clamp on GS102 with W601 clamped inside it using this sequence: #8 flat washer, cable clamp, #8 flat washer, #8 shakeproof washer, 8-32 nut. The main part of cable W601 should extend downward. The cable clamp should point horizontally toward the tip jacks.

(8) Connect the three tip plugs to tip jacks of matching colors.

(9) Install the 2" square terminal cover over the tip plugs with its mounting feet in a horizontal line, using two #6 sheet metal screws.

7. GROUND CONNECTIONS

CAUTION: For safety reasons, it is very important to have the Power Supply chassis and the RF chassis connected together and also to earth with a lead as large as the leads used to connect to the power source. Therefore, before making any connection to a power source, the shield braid of the high voltage cable should be connected to each chassis and a heavy lead connected from one of the chassis to a cold water pipe or other suitable connection to earth. Refer to section E-3 for means of connecting to earth.

a. DC GROUND. Connect a #12 or larger lead from ground stud, GS302, at the rear of the power supply chassis (Figure 4), to an earth ground. Refer to paragraph E-3 for means of obtaining a good dc connection to earth.

b. RF GROUND. Connect a heavy lead from the ground stud, GS101, on the rear of the RF Unit (Figure 36) to the RF ground system. Refer to section E.

8. ANTENNA CONNECTIONS

Connect an RG-8/U coaxial feed line to output connection J103 (near the high voltage terminal cover) on the rear of the RF Unit (Figure 36). Use a type PL259 plug. If a low pass filter is inserted in the feed line, use only a short length of coaxial line between the transmitter and the filter.

9. MICROPHONE CONNECTIONS

Refer to Figure 50. Use high impedance dynamic or crystal microphones connected to an Amphenol type 80-MC2M-2 circuit shielded plug (not furnished). To avoid damage to the microphone, make sure that the microphone (audio) circuit is connected to pin 1 and that the push-to-talk switch circuit is connected to pin 2. Connect the microphone plug to jack J107 on the rear of the RF Unit.

10. KEY CONNECTIONS

Connect the insulated contact of a telegraph key to the tip of a standard 1/4" dia. 2-circuit phone plug (not furnished). Connect the other terminal of the key to the sleeve. Plug the key into key jack, J101, at the rear of the chassis (Figure 36).

11. PHONE PATCH CONNECTIONS

Connect a shielded lead from the phone patch to the center terminal of a phono plug (not furnished). Connect the shield to the outside terminal. To avoid shorting the cathode resistor on V109B, the center lead of the shielded wire must be blocked for dc by an 8 mfd, 10 volt capacitor, if one is not provided in the phone patch. If an electrolytic capacitor is used, connect the positive lead to the lead going to the center terminal of the phono plug. Insert the phono plug in phono jack, J108, on the rear of the RF Unit (Figure 36). .

12. SSB INPUT CONNECTIONS

Connect a coaxial feed line from the SSB exciter to Input Connector, J102, near the microphone jack on the rear of the RF chassis (Figure 36). Use a type PL259 plug. Refer to paragraph D6.

13. RECEIVER DISABLING CONNECTIONS

Connect a pair of leads from terminals 1 and 2 on TS301 on the power supply (Figure 4) to the receiver disabling circuit. Relay RY302 will open this circuit when the transmitter is in "TRANSMIT" condition. The circuit will be closed in the "ZERO" and "STANDBY" conditions.

14. ANTENNA TRANSFER RELAY CONNECTIONS

Connect a pair of leads from terminals 4 and 5 of TS301 (Figure 4) to the coil of a 115 volt AC antenna transfer relay. Relay RY302 will energize this circuit with 115 volts AC with the transmitter in "TRANSMIT" condition only.

15. CONNECTIONS FOR 115 VOLT OR 230 VOLT POWER SOURCE

The transmitter will operate from a power source of 2 wire 115 volt 50-60 cycles single phase AC or 3 wire 115-230 volt single phase 50-60 cycles AC. The 230 volt connection will provide better voltage regulation on the power line. Refer to the schematic, Figure 46. Jumpers are provided for terminal strip TS301 on the power supply to allow connection to either source. NOTE: The "neutral", which is connected to the center tap of the secondary of the power line distribution transformer, and also to ground, must be used in the 115-230 volt connection. The Line cord is not furnished. Make connection to 115 volt supply with two number 12 wires or to 115-230 volt supply with three number 14 wires. Provide a polarized plug or switch for disconnecting power. Replace the cover over terminal strip TS301 on the power supply using four #4 sheet metal screws.

16. CONNECTIONS TO VOICE OPERATED RELAY FOR SSB OPERATION

For SSB operation, connect a pair of leads from ground stud GS101 on the rear of the RF unit and from terminal 1 of male noval plug, P109, on the audio cable, W401, to a normally closed contact on the voice operated relay in the SSB exciter. With this contact closed, the grid of the clamper, V108, will be grounded, biasing the PA tube, V106, beyond cut off and avoiding any diode noise during reception.

17. FUSES. Refer to Figure 4.

Four fuses are required. A spare set is supplied. The fuse type is stamped on the metal parts of the fuse. Fuses are installed at the locations in the following chart:

Fuse Holder	Fuse	Rating	Buss Type	Littlefuse Type	Circuit
FH301	F301	1 1/2 Amp. Slo-Blo	MDL-1 1/2	3AG	RF Fil. Primary, Fan
FH302	F302	4 Amp. Medium Lag	MTH-4	3AB	LV Primary
FH303	F303	6 Amp. Medium Lag	MTH-6	3AB	HV Primary
FH304	F304	8 Amp. Medium Lag	MTH-8	3AB	HV Primary

D. OPERATION

NOTICE: The regulations of the Federal Communications Commission requires a suitable license for operation of this equipment in the U.S.A. and possessions. Refer to publications of the F.C.C. or the American Radio Relay League for the latest rules governing station and operator licensing.

Be sure to return the enclosed warranty registration card immediately. This will register your transmitter at the factory and will insure receipt of bulletins from the factory. If it becomes necessary to write to the factory regarding your transmitter, refer to it by serial number.

1. CONTROLS

The front panel mounted controls are:

a. DRIVE control, R133, controls screen voltage on the 5763 RF driver stage thereby controlling drive to power amplifier.

b. EXCITER TUNING controls the VFO frequency and tuning of the exciter stages all stages are gang-tuned up through the power amplifier grid.

c. TUNE-OPERATE switch, SW111, reduces the power amplifier screen voltage in the TUNE position so that "tune-up" may be made with no danger of equipment damage due to mis-tuning. The switch changes bias on the clamper tube which in turn causes a drop in PA screen voltage in TUNE position.

d. The key-operated POWER switch, SW113, controls all primary input power to the equipment by means of actuating the primary power relay RY301.

e. The BAND control switches the VFO, exciter and power amplifier tuned circuits to the desired operating band.

f. The METER switch connects meter M101 to measure various transmitter currents; clamper, driver grid, driver plate, power amplifier grid and modulator cathode.

g. The AUDIO potentiometer, R149, controls the audio input level to the clipper circuit and the resultant degree of audio clipping.

h. The CRYSTALS designation refers to the dual crystal socket which is recessed behind a snap-in shielded cover. A knob is attached to the cover to facilitate removal of the cover.

i. The OSCILLATOR switch selects either of two crystals, C1 or C2, or the variable frequency oscillator, VFO, for frequency control of the transmitter.

j. The STANDBY-ZERO-TRANSMIT switch provides the basic switching functions necessary to place the transmitter "on the air". In the STANDBY position, all circuits are deactiviated (i.e. no RF signal is being generated). In the ZERO position, the RF exciter chain is activated thus providing a signal of suitable strength for zero beating against incoming signals in the station receiver. When operating CW, the switch may be left in the ZERO position instead of STANDBY when not transmitting and the key closed when a zeroing signal is desired. The TRANSMIT position activates the RF exciter chain (key must be closed in CW transmission), turns on the high voltage supply, supplies 115 VAC for control of an external antenna transfer relay or other 115 volt device and opens the contacts of the receiver disabling circuit.

k. The MODE switch selects the desired mode of operation, SSB, CW or AM. In SSB mode, only the 5763 RF driver and power amplifier are activated with the PA screen regulated by the VR tubes. In CW mode, all circuits are activated with the output windings of the audio driver transformer and modulation transformer shorted to prevent modulation of the carrier. In AM mode, the driver and the modulation transformer shorts are removed and all circuits are activated. Actual activation of the circuits occurs only when the control switch is in the TRANSMIT position or when the microphone push-to-talk switch is closed. The MODE switch selects the correct bias, screen voltage and plate voltage feed for the desired mode.

l. The PA PLATE TUNING control tunes the power amplifier plate circuit to resonance. This control is a variable capacitor, C179A,B, with both sections in the circuit on 80 and 40 meters and only the smaller section in the circuit on 20, 15, 11 and 10 meters. The two sections provide uniform loaded tank circuit Q on all bands.

m. The RESET control is used to mechanically reset the PA overload relay, RY101, which will trip when there is excessive cathode current flowing in the PA tube, thereby deenergizing relay RY303, which then removes the primary power from the 2000 volt supply.

n. The LOADING control is adjusted to obtain proper loading of the power amplifier.

The controls mounted on the rear of the chassis are:

o. The overload control, R165, which shunts the overload relay, is adjusted to set the overload trip current to the specified value of 425 ma. PA cathode current.

p. The clipping level control, R154, sets the audio clipping level or maximum modulation level.

q. The regulator control, R142, controls the bias on the 807 clamper tube in SSB and establishes the correct 807 current so that the 807 operates as a regulator to improve further the screen voltage regulation.

Controls located inside the cabinet are:

r. Bias adjustments - made by means of taps on resistor R168 which is mounted under the chassis.

s. The keyer control potentiometer, R109 - used to adjust the bias on the VFO and set the operating point of the time-sequence keying system.

2. PRELIMINARY CHECKOUT AND TEST

Before replacing the cabinets during the installation of a factory wired transmitter, it is suggested that the transmitter be given a preliminary checkout, while the circuits are readily available, as follows:

a. Check spacing of arc gaps, G301 and G101, per paragraph F-1.

b. Temporarily mount the bottom plate on the power supply using four 4-40 sheet metal screws.

c. Mount the top cover over the top of the power supply with the interlock switch bracket (inside of cover) positioned above the pushbutton interlock switch, SW301. As the cover is being lowered into position, check that the interlock switch, SW301, operates as indicated by a click. If any adjustment is needed, refer to paragraph F-12. Secure the top cover temporarily with four 4-40 sheet metal screws; two at the rear adjacent to high voltage shorting switch SW302 and fuseholder FH301, and two on one end near choke L303 and pushbutton switch SW301.

d. Connect a dummy antenna (52 ohms 500 watts - refer to paragraph F-13) to output jack J103, near the three tip jacks on the RF unit.

e. Continue with the installation as described in Section C. Make connections described in paragraphs C-6 and C-7; and C-9 thru C-15. Install "U" bracket over interlock switch, SW112 (see section F, Adjustments, general). Open the high voltage shorting switch, SW106, located near choke L122, at the rear center of the RF chassis. Tip up the long end of the switch blade till the long end passes "dead center" of the retaining spring. The switch will then hold open.

f. Follow tuning procedure in paragraph D3.

    (1) Tune and load the transmitter for CW operation at both ends of each band.

    (2) When the VFO has warmed up, check the VFO calibration at band edges according to paragraph F-2a.

    (3) Check overload adjustment per paragraph F-5 to see that RY101 trips out

at approximately 425 ma. Do not change the adjustment unless necessary.

(4) Check Clipping Level adjustment per paragraph F-8. Do not change the adjustment unless necessary.

(5) Check Keyer adjustment per paragraph F-9.

(6) Check Regulator adjustment per paragraph F-10. Do not change the adjustment unless necessary.

(7) Check SSB operation with external SSB exciter. Refer to Notes on SSB operation in paragraph D-6 and SSB Tests in paragraph D-7.

(8) Check operation of crystal oscillator per paragraph F-11.

(9) Check operation of all front panel controls.

g. After becoming familiar enough with the transmitter to feel that it is operating properly, disconnect the power source, close the high voltage shorting switch, SW106, on the RF Unit, remove the U bracket from the interlock switch, SW112, and disconnect the cables from the rear of the RF chassis so that the cabinet may be installed.

h. Insert the missing #4 sheet metal screws in the power supply top cover and bottom cover.

i. Install the terminal cover over the terminal strip, TS301, in the power supply using four #4 sheet metal screws.

j. Install the cabinet on the RF Unit by reversing the process in paragraphs C-2c, b and a. If the rear panel bulges unduly, check to see if the "U" bracket has been removed and the high voltage shorting switch closed.

k. Re-connect the cables just disconnected from the RF chassis per paragraphs C-6, 7, 8, 9, 10, 11 and 12. Replace the dummy antenna with a coaxial line to an antenna system suitable for the desired operating frequency.

l. To go "on the air", follow the tuning procedure given in paragraph D-3.

3. TUNING PROCEDURE

The tuning procedure for the Viking Five Hundred is identical on all bands of operation, 80 thru 10 meters. Therefore, the discussion of tuning on one band will apply to all bands. Only the front panel control settings will be changed in going from one band to another.

a. CW TUNING

(1) Check that the desired connections described in paragraphs C-6 thru C-16 have been made.

(2) Set Viking Five Hundred controls:

CONTROL	POSITION
Microphone push-to-talk switch	Open
Telegraph Key	Closed

CONTROL	POSITION
DRIVE	5
TUNE-OPERATE	TUNE
POWER	OFF
RESET	IN
METER	PA GRID (M101 reads 0-20 ma.)
AUDIO	0
OSCILLATOR	VFO
STANDBY-ZERO-OPERATE	ZERO
MODE	CW
BANDSWITCH	Desired band
EXCITER TUNING	Desired frequency
PA PLATE TUNING	5
LOADING	0

(3) Connect Power source.

(4) Turn POWER switch ON.

(5) Allow ten minutes warm up before placing the transmitter in "TRANSMIT" condition the first time the transmitter is used or after new 866A rectifier tubes (V303 and V304) are installed. This allows mercury to evaporate from the rectifier elements. At other times, allow 2 minutes.

(6) Adjust Drive control to give about 12 ma PA GRID current. (M101 reads 0-20 ma.)

(7) Move STANDBY switch to TRANSMIT.

(8) Adjust PA PLATE TUNING to resonance as indicated by a dip (minimum) in the PA CATHODE current on meter M102.

(9) Increase the power to the antenna by successively advancing the LOADING control clockwise in small steps, retuning the PA PLATE TUNING for minimum PA CATHODE current after each adjustment of the LOADING control. The minimum current will become progressively greater. Adjust the minimum PA CATHODE current to about 120 ma. NOTE: With the LOADING control advanced too far no "dip" (minimum) will be seen.

(10) Turn TUNE-OPERATE switch to OPERATE. The PA CATHODE current will increase to about 300 ma.

(11) Quickly tune PA PLATE TUNING for minimum PA CATHODE current. Adjust LOADING AND PA PLATE TUNING successively (as in the step 9) for a new minimum of 350 MA for CW operation or 300 MA for AM operation. The

transmitter is now loaded to full rated power input. The last tuning adjustment is always that of tuning the PA PLATE TUNING for minimum current.

(12) Adjust DRIVE control to give 9-10 ma PA GRID current on meter M101. The "500" may now be keyed for CW operation.

b. AM TUNING

(1)-(12) Tune the transmitter as for CW operation, paragraph 3a(1) thru (12), except set MODE switch on AM and adjust the dip in PA CATHODE current to 300 ma.

(13) Set METER switch at MOD CATHODE (meter M101 reads 0-300). The no-signal current will be about 35 ma.

(14) Advance the AUDIO control clockwise while speaking in normal tones into the microphone. Adjust AUDIO control for about 130 ma MOD. CATH. current on peaks for 100% modulation with no clipping, or to peaks of up to 200 ma if clipping is desired. Refer to section F-8 for clipping level adjustment and effects of clipping. The transmitter is ready for AM operation.

c. SSB TUNING (Using Viking Five Hundred carrier).

(1)-(12) Tune the transmitter exactly as for CW operation steps (1) thru (12), except temporarily open the circuit on the connection to the voice operated relay until step 13 is completed (refer to paragraph C-16). PA CATHODE current should be tuned for the dip at 300 ma. Then do not change EXCITER TUNING, PA PLATE TUNING and LOADING controls until a new frequency is set up.

(13) Set MODE switch at SSB. Set METER switch at CLAMPER. PA CATHODE current should be 75 ma. (Refer to paragraph F-6C if adjustment is necessary). This current will be zero when the Voice Operated relay grounds pin 1 of P109. Current should be 15 ma. on meter M101, or approximately 62 ma. when VOX grounds pin 1 of P109. (M101 reads 0-100 ma.) Refer to paragraph F-10 if adjustment is necessary.

(14) Set METER switch at DR PLATE.

(15) Adjust DRIVE control to give 30 ma DR PLATE current in meter M101 (M101 reads 0-100 ma.).

(16) Set METER switch at PA GRID.

(17) Make sure that the single sideband exciter is tuned to the exact frequency used to tune the Viking 500.

(18) With voice modulation, advance the SSB exciter audio gain until the Viking Five Hundred PA GRID current barely flicks meter M101 upward (peaks of more than 1 division will result in unnecessary distortion). Depending upon the operators voice, modulation peaks will read about 120 ma. on the PA CATHODE meter. The true value of these peaks exceeds 250 ma., but due to meter inertia and the short duration of the peaks, the meter reading is considerably less. The Viking Five Hundred is ready for SSB transmission.

d. ALTERNATE METHOD OF SSB TUNING (Using SSB exciter carrier).

If more convenient, the Viking Five Hundred may be tuned using the carrier output of the SSB exciter to drive the Viking Five Hundred driver and power amplifier. There is then no possibility of forgetting to tune these stages to the correct frequency.

(1) Check that the desired connections in paragraph C6 thru C16 have been made.

(2) The settings of controls not listed are not important. Set Viking Five Hundred controls:

CONTROLS	POSITION
Microphone push-to-talk switch	Open
DRIVE	5
POWER	OFF
RESET	IN
METER	DR PLATE
AUDIO	0
STANDBY-ZERO-OPERATE	ZERO
MODE	SSB
BANDSWITCH	Desired band
EXCITER TUNING	DESIRED FREQUENCY
LOADING	0

(3) Connect power source.

(4) Turn POWER switch on.

(5) Allow ten minutes warm up before placing the transmitter in "transmit" condition the first time the transmitter is used or after new 866A rectifier tubes (V303 and V304) have been installed. This allows mercury to evaporate from the rectifier elements. At other times allow 2 minutes.

(6) Adjust DRIVE control to give 30 ma DR PLATE current in meter M101. (M101 reads 0-100 ma.).

(7) Set METER switch at PA GRID.

(8) Set STANDBY-ZERO-TRANSMIT switch at TRANSMIT.

(9) Using the carrier control of a SSB exciter feed a CW signal to the Viking Five Hundred, increasing the amount until the PA CATHODE current is 120 ma. on M102, with the PA PLATE TUNING control detuned.

(10) Adjust PA PLATE TUNING to resonance as indicated by a dip (minimum) in PA CATHODE current on M102.

(11) Increase the power to the antenna (as in paragraph D3a(9) under CW TUNING) until the minimum PA CATHODE current at the dip is about 100 ma.

(12) Increase the SSB input signal to give 6 ma. PA GRID current on meter M101 (M101 reads 0-20 ma.). The PA CATHODE current will increase to about 300 ma.

(13) Quickly tune PA PLATE TUNING for minimum PA CATHODE current. Adjust LOADING and PA PLATE TUNING successively (as in paragraph D3a(9) under CW TUNING) for a new minimum of 300 ma. The last tuning adjustment is always that of tuning the PA PLATE TUNING for minimum current.

(14) Adjust SSB exciter for SSB operation.

(15) Using voice modulation, advance the SSB exciter audio gain until the Viking Five Hundred PA GRID current barely flicks the meter M101 upward. Refer to D3c(18).

4. NOTES ON CW OPERATION

The Power Amplifier may be loaded up to 350 ma PA CATHODE current. Deducting 10 ma. grid current and 40 ma. screen current leaves 300 ma. plate current, which at 2000 volts gives 600 watts input. PA GRID current should be 9 to 10 ma. With the STANDBY switch in the ZERO position, PA GRID current can rise a few milliamperes over the value established when the amplifier is "ON" and loaded.

An antenna changeover relay may be operated by the 115 V AC power furnished by terminals 4 and 5 of TS301 when the transmitter is in the "TRANSMIT" condition. This method does not allow the use of full break-in operation. To operate full break-in requires either the use of a separate receiving antenna or a TR box. Under these conditions, the STANDBY switch is left at "TRANSMIT".

ZEROING - To "zero beat" another station, turn STANDBY switch to the "ZERO" position, close the key and adjust EXCITER TUNING. Readjust PA PLATE TUNING for minimum PA CATHODE current after moving EXCITER TUNING any large amount. It is convenient to use the "ZERO" position for STANDBY, for the only difference is that the exciter can be keyed in the ZERO position.

Time-Sequence and grid-block keying is used in the VFO, crystal oscillator and exciter stages. To avoid unnecessary interference with signals on adjacent channels, blocking bias is applied thru a wave-shaping filter consisting of R114, R113, C131 and C136, to the grids of V103, V104 and V105. To avoid a chirpy signal when keying the VFO, the keyer tube, V107, allows the VFO to start quickly (a few microseconds) before V103, V104 and V105 start conducting and then continue to operate momentarily after V103, V104 and V105 have stopped conducting. The VFO keyer adjust control, R109, adjust the "hold" time for VFO operation after the key is opened. Refer to paragraph F9. This may be adjusted to cut off the VFO between marks of keyed characters and thus allows rapid CW break-in operation by enabling the operator to be aware of incoming signals while he is keying the transmitter.

When operating in this fashion, a slight sparking at the key may be noticed as a click in the associated receiver. It is not on the carrier and will only be noticed in the receiver used at the transmitter. The clicks can be reduced by installing a 2 1/2 millihenry RF choke (the ordinary receiver type) in each key lead making the connection as close to the key as possible, and connecting a .01 mfd. capacitor in series with a 500 ohm resistor across the key contacts. This reduces radiation of the spark energy by the key leads.

5. NOTES ON AM OPERATION

Normal input to the power amplifier is 300 ma. PA CATHODE current. Deducting 10 ma. grid current and 40 ma. screen current leaves 250 ma. plate current, which at 2000 volts gives 500 watts input. PA GRID current should be 9 to 10 ma. With 100% speech modulation, the indicated MOD CATH. current will be about 130 ma on peaks, or up to 200 ma. indicated on peaks if clipping is used. Refer to section F8 for clipping level adjustment and effects of clipping. This figure includes up to about 40 ma of modulator grid current. The static no-signal current is 30 to 35 ma.

The operator has two choices in controlling the transmitter carrier. The carrier can be switched manually using the STANDBY switch or with a microphone switch to provide push-to-talk operation. Refer to paragraph C9 and Figure 50.

Do not operate the Viking Five Hundred at reduced input in AM mode unless the audio power and clipping level are likewise reduced to prevent overmodulation.

Do not modulate while the TUNE-OPERATE switch is in TUNE, and the MODE switch is on AM or audio distortion will result.

Place the STANDBY switch at STANDBY when operating the MODE switch.

NOTE: In STANDBY condition on AM, it will be noticed that signals from the microphone give an indication on the MOD CATH. meter circuit. This is modulator grid current. This is normal since the speech amplifier (V109, V110, V111 and V112) has plate voltage applied whenever the POWER switch is ON.

ZEROING - To "zero beat" another signal, turn STANDBY switch to the "ZERO" position and adjust EXCITER TUNING. Readjust PA PLATE TUNING for minimum PA CATHODE current after moving EXCITER TUNING any large amount. To increase the level of the "ZERO" signal, connect one end of a short piece of insulated wire to the antenna terminal of the station receiver and insert an inch or two of the other end through a cabinet perforation near the exciter.

6. NOTES ON SSB PHONE OPERATION

When the MODE switch of the Viking Five Hundred is turned to the SSB position, regulated screen voltage is applied to the power amplifier and a 50 ohm loading resistor is connected between grid and ground of V105, the 5763 driver stage. The fixed grid bias to the power amplifier is increased to approximately -122 volts. (-130 volts for type PL-175A tube).

Power input to the SSB input should be limited to the maximum required (about 1 watt) or damage may occur to the 5763 driver tube (V105). Usually the SSB exciter should be operated near or at full output to obtain the maximum ratio of signal to noise, hum and the suppressed sideband. To satisfy these two requirements it may be necessary to insert a power divider between the SSB exciter and the SSB input of the Viking Five Hundred in order to dissipate the excess driving power available from the exciter.

In SSB operation it is important that the power amplifier be loaded properly.

When the loading is too light the amplifier is driven into saturation prematurely and the output is considerably reduced. If the coupling is too heavy, saturation is no problem but the output will be below that of proper coupling. To establish correct loading the transmitter may be tuned up at the anticipated operating frequency with the MODE switch in the CW position. The power amplifier should be loaded up to 300 ma. "PA CATHODE" current using the regular CW tuning routine and with normal grid current. Both EXCITER TUNING and PA TUNING and LOADING WILL BE LEFT UNCHANGED FROM THIS POINT ON. Turn STANDBY switch to STANDBY, MODE switch to the SSB position.

7. SSB TESTS

SSB performance may be tested using only a cathode ray oscilloscope having an adjustable horizontal sweep and an audio signal generator. The audio signal generator may be a simple oscillator operating at a fixed frequency between 250 and 1000 cycles.

If a SSB transmitter is modulated with a 1,000 cycle tone, the output would appear as a continuous wave signal 1000 cycles removed from the original carrier frequency. If the transmitter system for suppressing the carrier is then deliberately upset, an AM sideband will appear at the same frequency but out of phase with the SSB sideband. By adjusting the degree of imbalance in the sideband suppression system and the amount of audio applied thru the exciter audio input jack, an oscilloscope wave form (two-tone pattern) can be produced which appears as a series of positive and negative halves of sine waves, the bottoms of the waves coinciding on a common base line. This scope pattern with rounded tops and bottoms and with intersections forming an "X" are indicative of linear output of the system. The quality of the test pattern obtained from the Viking Five Hundred departs slightly from the ideal but indicates a degree of linearity far better than required for amateur communication service.

Adjust the power amplifier loading in accordance with the preceeding instructions. With the SSB exciter feeding the transmitter in the SSB mode of operation, inject carrier and at the same time introduce the audio signal to the exciter audio input.

Feed a sample of the amplifier output directly to the vertical plates of a cathode ray oscilloscope. Set the internal horizontal sweep to approximately four times the audio modulation frequency. Adjust the amplitude of the RF sample so it fits conveniently in the scope face. Vary the exciter audio control and carrier injection so that the test pattern described is produced. If the halves of sine waves do not meet in the center of the scope, too little audio is being applied. If the tops and bottoms of the wave forms are cut off, too much carrier is being injected. Increase carrier injection and audio to the point where the wave forms are beginning to be slightly distorted by flattening on tops and bottoms. "PA CATHODE" current at this point of saturation should be about 170 ma. under conditions of proper loading.

Leave the test set-up as is. Substitute the microphone for the audio oscillator previously used. Readjust the exciter to eliminate the carrier component of its output. Speak into the microphone in a normal manner and adjust the audio control while watching the scope. It will be easy to note the point where peaks start to be clipped. THIS IS THE LIMIT OF AUDIO INPUT. Note the plate current peak reading where clipping just begins with this particular transmitter and do not exceed this current. The indicated peak current will vary depending upon the operator's voice. Peaks of 120 ma. may be considered typical.

Typical Values - SSB Phone Operation

Driver Plate Current	30 ma.
PA cathode current (resting)	75 ma.
PA grid voltage	-122 volts (-130 V for PL-175A)
PA cathode current (voice peaks)	120 ma. (meter reading)
PA cathode current (saturated condition with two-tone modulation)	Approximately 170 ma.
PA grid current	Barely perceptible

8. NOTES ON POWER AMPLIFIER TUBE

a. In CW and AM operation the PA tube, V106, operates class C with approximately -165 volts on the control grid and 400 volts on the screen grid obtained from the 2000 volt supply through the resistors R303 and R304. The screen current is approximately 45 ma. The screen voltage varies as the PA plate circuit is modulated but does not rise sufficiently to "strike" the PA screen voltage regulator tubes V307-V311. Under no-signal (no drive) condition the type 807 clamper, V108, reduces the PA screen voltage sufficiently to cut off plate current in the PA tube, V106.

b. In SSB operation the PA tube, V106, operates class AB1 with approximately -122 volts (about -130 volts for type PL-175A) on the control grid and 705 volts (regulated by V307-V311) on the screen grid. The screen grid current varies from 1 ma. with no signal to 20 ma. at maximum signal. The regulator adjustment, R142, affects only SSB operation, for then the 807 clamper tube, V108, is switched to act as a voltage regulator on the PA screen circuit. Adjusting the current through V108 establishes the proper operating current range for the screen voltage regulators, V307-V311.

c. The Viking 500 will operate properly with any one of four different types of power amplifier tubes. V106 may be the Amperex type 6156/AX-4-250A or the Eimac type 4-250A. These are electrically interchangeable. Their rated maximum plate dissipation in unmodulated service is 250 watts. At this dissipation the lower half of the plate of the Amperex tube is dull red and the plate of the Eimac 4-250A is orange in color. Both tubes run somewhat cooler than this in typical operation in the Viking 500. The type 4-400A tube may also be used. It is electrically similar to the type 4-250A except that its maximum rated plate dissipation in unmodulated service is 400 watts. With this dissipation the plate is red. The plate is only a dull red when operating in the Viking 500 where the same operating conditions as for the type 4-250A apply. The type PL-175A tube is a pentode with electrical characteristics very similar to those of the type 4-400A tetrode. It fits the same socket and operates at the same voltages. Its higher efficiency provides about 10% more output with the same input. It has slightly more input capacitance, but less capacitance between control grid and plate. The maximum plate dissipation is 400 watts, with plate color similar to that of the 4-400A.

9. TELEVISION INTERFERENCE

The Viking Five Hundred is designed for maximum suppression of TVI.

Complete shielding of the RF unit is provided by a tight metal cabinet with well-bonded joints. All leads to external connections are extremely well filtered for suppression of television frequencies. These precautions reduce spurious radiation from the cabinet to a minimum. Harmonic energy in the output is unusually low. The RF driver always operates "straight thru" on the operating frequency. The Pi-L section provides excellent harmonic suppression in the lower frequencies as well as

TV frequencies, since the L section further reduces harmonic energy in the order of 12 to 15 db on the second harmonic and more on higher order harmonics.

In TV "fringe areas" it may be necessary to further attenuate signals at TV frequencies by inserting a Low Pass filter in the transmitter output. The Johnson 250-20 Low Pass filter adds 75 db or more attenuation at TV frequencies. This filter is designed for insertion in a 52 ohm coaxial line. It should be connected as close to the transmitter as possible.

On nearby TV receivers, overloading of the TV input stage can occur, resulting in generation of spurious signals in the TV receiver input. This can be avoided by inserting a high pass filter at the input terminals of the TV receiver. Make connections with short leads and bond the chassis of the high pass filter to the chassis of the TV receiver. T.V.I. may occur from rectification of the transmitter carrier by imperfect contacts between water, gas, and heating pipes, or by poor electrical connections in eave troughs, down spouting, metal flashing on roofs, TV antennas, house wiring, wire clotheslines, and other large metal pieces. Such TVI is often intermittent. It can be cured by opening the faulty connection or bonding it solidly. For additional information on TVI, refer to the chapter on BCI and TVI in the Radio Amateur's Handbook, published by the American Radio Relay League, and to current publications for amateurs.

E. PI-L NETWORK TUNING AND GROUND SYSTEMS

1. GENERAL

The Pi-L network used in the plate circuit of the Viking Five Hundred power amplifier is designed to match the PA into an unbalanced load of 52 ohms with standing wave ratios as high as 3:1 or unbalanced resistive loads of 15 to 200 ohms. Some reactance compensation of reactive loads is also obtained in the network. When the transmitter is well grounded and properly tuned, the higher harmonic suppression is excellent and is generally much better than with other conventional methods of antenna coupling. The tuning technique consists of resonating the plate circuit initially by adjusting PA PLATE TUNING (tuning for minimum PA CATHODE current). The amplifier is coupled to the load by successively advancing the LOADING control in small increments, retuning the PA PLATE TUNING for minimum current after each incremental adjustment of the LOADING control. As the antenna takes power, the minimum amplifier current is established at progressively higher values until the amplifier is loaded to full rated power input. The last tuning adjustment is always that of tuning PA PLATE TUNING for minimum current.

2. IMPORTANCE OF GROUNDING

To obtain proper tuning, coupling and harmonic suppression with any unbalanced transmitter antenna coupling system, the part of the circuit designed to operate at RF ground potential must be at RF ground potential. A "room full of RF" is evidence that a high RF potential exists on some object in or near the room. In many cases the source of RF appears to be the transmitter chassis and power cord. This condition is very undesirable for several reasons. Three objectionable factors affecting transmitter performance when poor grounds are involved are:

a. The impedance that the output terminal of the transmitter looks into includes not only the true antenna to ground impedance presented by the feed line but also the equivalent series transmitter chassis to ground impedance. This additional impedance can, in some cases, raise the apparent antenna impedance to such a high value that it cannot be loaded by the pi-network.

b. Part of the transmitter power is lost in the ground system due to radiation of the ground lead, power cord or cabinet. This power is quickly dissipated in surrounding objects and contributes nothing to effective radiated power.

c. Practical design considerations make it necessary to bypass possible sources of stray high frequency currents to the transmitter chassis. When a high impedance exists between transmitter chassis and ground these stray currents can radiate to a certain extent.

3. HOW TO OBTAIN A GOOD GROUND

For safety reasons a good dc connection between chassis and earth is required. The length of the lead is not important, provided suitable means of RF grounding is also provided. Earth grounds are described in paragraph 3a below.

What may appear to be a good ground at one frequency may prove to be a poor ground at another. A single ground lead may have "standing waves" on it due to its length. While it may seem difficult to obtain a good ground over a wide range of frequencies, it can be done and will be well worth the trouble when increased radiation efficiency, ease of antenna loading and reduced TVI and BCI result. There is also reduced danger of damaging microphones, receivers and other associated equipment with excessive RF fields.

Avoid using the power line, power line conduit or gas lines for RF grounding. Some suggestions which may help to obtain a good ground are:

a. Water pipes or metal building structural members are usually good sources of earth grounds. Several metal rods driven 6 feet deep into moist earth and spaced a few feet apart may be used.

b. Use heavy conductors (#12 or larger) between the connection at the ground point and the transmitter. Copper ribbon is excellent for this purpose.

c. The use of several ground leads, each of a different length and selected at random may be helpful in keeping the grounding impedance low at the transmitter, even though the transmitter is some distance from a true earth ground. The possibility of obtaining an effective ground at any frequency throughout the transmitter's range is quite good. If at any one frequency, one of the ground leads presents a low impedance at the chassis, the chassis is effectively grounded. By changing the length of one of the ground leads experimentally, a good ground can often be obtained at a frequency which has been troublesome. In bringing several leads to the transmitter, small closed loops near the transmitter or antenna feed line should be avoided. Induction fields will tend to raise the impedance of the ground leads.

d. In cases where it is impossible to obtain a good earth ground, connecting the transmitter chassis to some system of conductors having a very low effective impedance to ground compared to the antenna impedance may be helpful. Usually this artificial "ground" takes the form of a system of radial wires spread horizontally on the floor, a gridwork of wires, or a large metal sheet on the floor below the transmitter. To be most effective, the minimum area covered by the metal conductors should be roughly equivalent to a square, the length of one side of which approaches a quarter wavelength at the lowest operating frequency. This system of grounding should be experimented with before committing the location to any permanent installation.

e. A simple counterpoise made up of a single wire attached to the chassis may be helpful. On 10 meters, a length of 6 to 8 feet may be attached and the open end cut off 4" at a time until the chassis becomes "cold". The open end of the wire may be allowed to drop along the floor although its open end will be somewhat "hot" with RF.

f. A rough check on the effectiveness of the transmitter ground may be made by touching the chassis while watching the PA plate current and grid current with the transmitter operating into an antenna. A change in current upon touching the chassis is indicative of an ineffective ground. In cases where the transmitter is feeding a low impedance antenna, test by touching the cabinet with a neon lamp. The presence of 50 to 60 volts will ignite the neon lamp.

4. LOADING RANDOM ANTENNAS

With the transmitter chassis well grounded, correctly designed antenna systems having relatively "flat" unbalanced feeder systems can easily be loaded by following the instructions previously given. This assumes that the antenna terminal impedances fall within the range of the pi-L network. If the feedline is over a quarter wavelength long, feeding a balanced system (one transmission line lead to the center terminal of J103, the other side to transmitter ground stud) may prove surprisingly successful provided the transmitter cabinet is held at ground potential. Some standing waves will result but may not prove excessive. The Johnson Matchbox, a universal all band, bandswitched antenna coupler will permit loading of the Viking Five Hundred to any practical antenna system. In addition, it provides for the use of the Johnson 250-20 Low Pass Filter for increased harmonic suppression.

Antennas having random lengths, random feed points and various types of feed lines will exhibit widely different resistance and reactance characteristics. It is well to remember that the feedline is a very important part of the system. A common example of the random antenna is a horizontal wire fed by a single wire feed line. The feed line in this case actually becomes part of the radiating system. An antenna of this type can, in most instances, be fed by the pi-L network directly but there are critical dimensions where the antenna series reactance (inductive or capacitive) becomes too high and the antenna resistance can become either too high or too low to be matched by the pi-L network.

Antennas with high terminal resistance or reactance can be recognized while loading the output stage of the Viking Five Hundred. The power amplifier is loaded by reducing the output coupling capacity by adjusting the LOADING control. As the output coupling capacity is reduced in small steps, retuning the amplifier to resonance each time, the minimum plate current is increased. Normally this process is continued until full loading of the amplifier is achieved. If, however, a point is reached where decreasing the output coupling capacity does not result in a marked increase in PA CATHODE current and the PA is not fully loaded, the antenna can be assumed to have a high resistance or reactance at this frequency.

Antennas with low terminal impedance (resistance and reactance both low) can be recognized by a noticeable lack of coupling capacitor effect in the range of settings normally used at the operating frequency. It may prove impossible to decouple the amplifier sufficiently for normal loading.

Several methods may be used in an effort to bring the antenna system into the tuning range of the pi-network:

a. Change the length of the feeder line between the antenna and transmitter experimentally 1/8 to 1/4 wavelength.

b. Change the point of connection of the feedline to the antenna 1/8 to 1/4 wavelength.

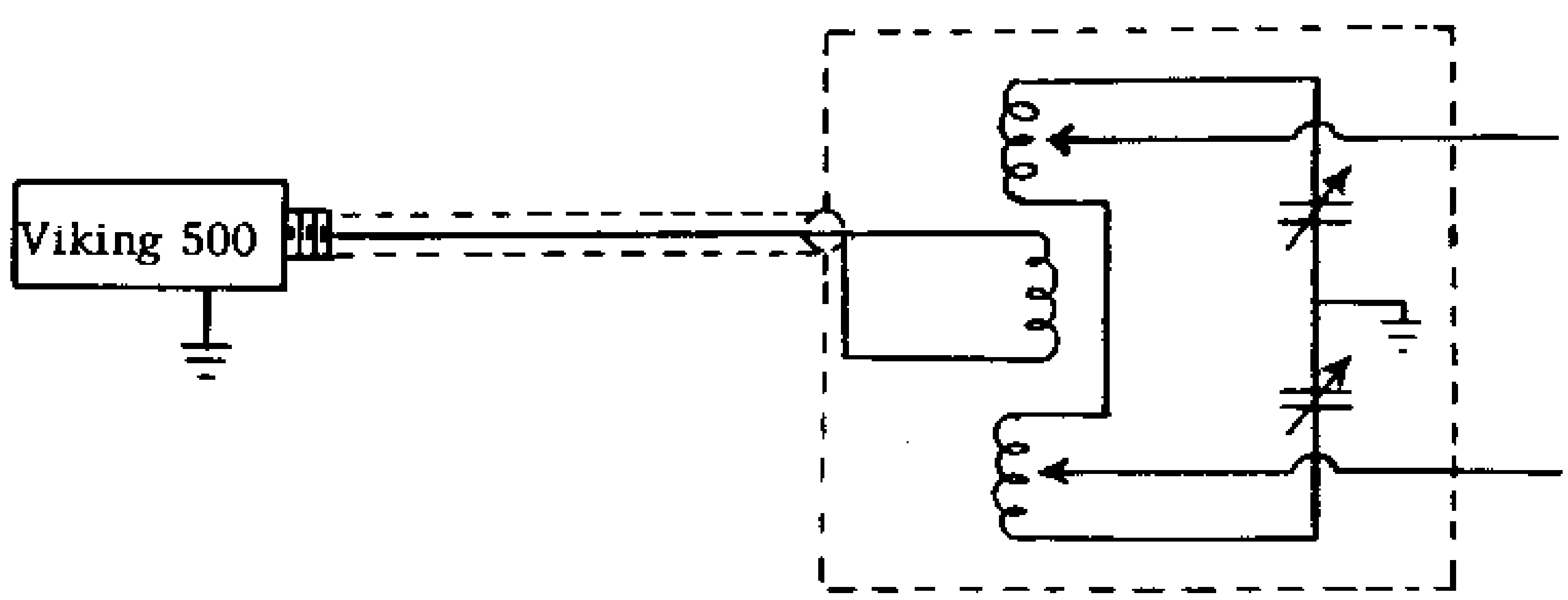
c. Change the antenna length 1/8 to 1/4 wavelength. Antennas shorter than 1/8 wavelength (antenna and feeder) may be difficult to load. They present a high capacitive reactance to the transmitter output terminals. Effective antenna lengths in the vicinity of 1/2 wavelength will have little reactance but very high resistance making them difficult to load.

d. "Load" the antenna feeder by placing an inductor or capacitor in series to cancel out the reactance of the antenna feeder. This may require considerable cut and try and will affect only the reactive component of the antenna impedance. It does prove useful in some cases.

e. L type matching networks of inductance and capacitance may be used to aid impedance matching. Much discussion of this more elaborate method of bringing the antenna impedance within the range of the pi-L network could be included, however, the few cases where it is necessary do not justify inclusion herein. Textbook and handbook discussions will be helpful if work along this line is pursued. There is danger of resonating the LOADING capacitor of the pi-L network when using an external coil. This should be watched as excessive voltage builtupacross the coupling capacitors can cause damage. Improper coupling or loading will take place under these conditions.

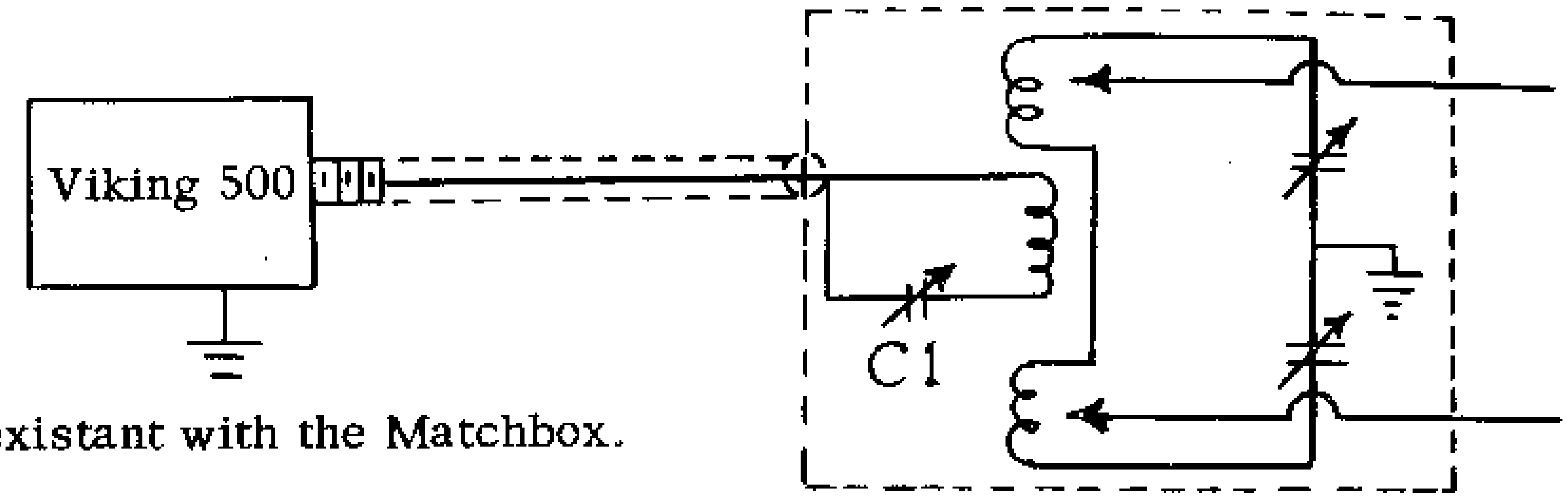
5. COUPLING TO BALANCED LOADS

Balanced antennas such as center fed "Zepps", beams and folded dipoles normally use a two wire transmission line and should have equal voltages, 180 degrees out of phase, applied to each feedline terminal. Since the output of the Viking Five Hundred is single ended, unbalanced, a coupler is required for balanced antenna systems. The JOHNSON Matchbox, a universal, all band, band-switched antenna coupler will permit loading of the 500 to any practical antenna system. In addition, it provides for the use of the JOHNSON 250-20 Low Pass Filter for increased harmonic suppression. A simple coupler for this purpose is shown below. The tank circuit is resonant at the operating frequency and can be excited by a coaxial line and coupling link. Line impedance is not critical although 52 ohm line will be most desirable if a JOHNSON Low Pass Filter is used.



Feedpoint impedance of the coupler is adjusted by means of the inductor taps. Tap adjustment is unnecessary with the JOHNSON Matchbox. Final amplifier loading is adjusted with the transmitter output LOADING control.

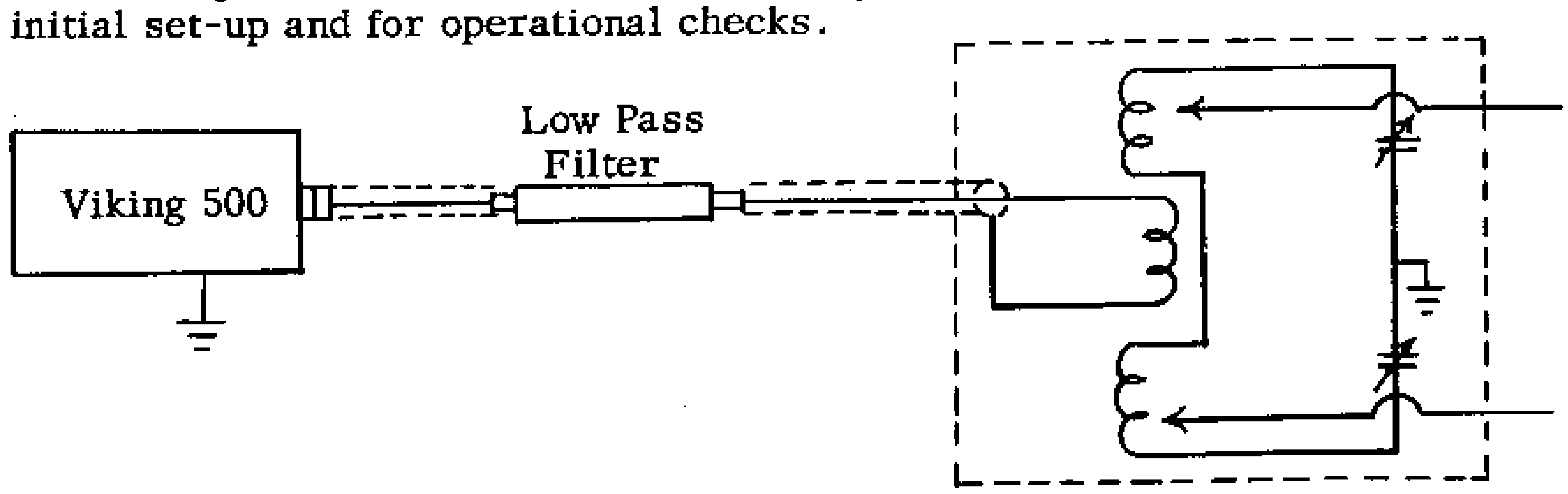
Tuning of the coupler can be made quite broad by making the L/C ratio as high as possible (low Q) while still permitting the desired loading. Inductive reactance of the coupling link may make it impossible to reduce the SWR of the coaxial line to below 1 1/2 to 1. If so, the link circuit may be made series resonant by adding capacitor C1 as shown on the next page:



This problem is non-existant with the Matchbox.

6. USE OF LOW PASS FILTERS

Depending upon how it is tuned, 2nd harmonic attenuation of the Viking Five Hundred amplifier can be greater than 45 db. Since this will permit operation in many locations without television interference, the JOHNSON 250-20 Low Pass Filter is not an integral component of the Five Hundred, but is available as an optional accessory. The filter will provide an additional 75 db or more harmonic attenuation above 54 mc. with insertion loss less than .25 db. Characteristic impedance is 52 ohms, power rating 1 KW. The low pass filter may be inserted in the coaxial line between the transmitter and the antenna (if the transmission line SWR is less than 2:1) or between transmitter and an antenna coupler. Coaxial connectors are used at the transmitter and at both ends of the low pass filter to preserve the shielding provided by the coaxial line. It is preferable that the standing wave ratio on the coaxial line between the Viking Five Hundred and the coupler be maintained at 2 to 1 or less, therefore, the impedance of the line should be the same as the characteristic impedance of the filter. (The JOHNSON 250-20 Low Pass Filter and JOHNSON Matchbox are both 52 ohms impedance.) The section of coaxial line between the transmitter and the low pass filter should be as short as possible and electrical quarter waves should be avoided. An RF bridge such as the JOHNSON 250-25, for measuring SWR will prove invaluable for both initial set-up and for operational checks.



An end fed half-wave antenna may present loading problems, both from the standpoint that its impedance is higher than can be matched by the pi-L network of the Viking Five Hundred, or that the low output coupling capacitance used reduces inherent harmonic attenuation below tolerable values. Therefore, the use of an end fed half wave antenna may create TVI problems while other antennas prove perfectly satisfactory. In these cases it is recommended that the JOHNSON Matchbox be used.

F. ADJUSTMENTS

GENERAL

Whenever power is required with the RF chassis out of its cabinet, it will be necessary to install the U bracket (supplied) on the interlock switch, SW112, to hold the interlock closed. The open side of the "U" is placed down upon SW112 from above, with the longer leg over the pushbutton and the shorter leg in front of SW112. (Figure 38).

Before applying high voltage to the power amplifier with the RF chassis out of its cabinet, open the high voltage shorting switch, SW106, at the rear center of the RF chassis. Tip the longer end of the switch blade upward and to the rear past "dead center" of the tension spring. The blade will then hold open. If the high voltage is applied with SW106 closed, fuses F303 and F304 in the primary of the high voltage supply will blow.

When testing the power amplifier with the bottom covers removed from the RF unit, apply high voltage as briefly as possible to avoid overheating the power amplifier tube. Refer to paragraph D3c. Use a dummy antenna for testing the power amplifier. Refer to paragraph F13.

1. ARC GAP ADJUSTMENTS

Modulator secondary GAP301. Refer to Figures 4 and 5. Adjust the arc gap GAP301, to .018" spacing as follows: Loosen the two 8-32 locknuts on the 8-32 x 3/4" screw supported on E306. Using the strip of aluminum supplied as a feeler gauge, turn the 8-32 x 3/4" screw until the gap just passes the feeler gauge. Tighten the two 8-32 nuts. Recheck the gap spacing. When the high voltage is turned on and off there may be a brief arc. There should be no arc with normal modulation. At high altitudes it may be necessary to increase the spacing slightly.

High voltage to chassis GAP101. Refer to Figure 36. The bracket, BKT118, mounted topside on a conical insulator inside the PA shield near RF choke, L122, serves two purposes. It is the "hot" contact which the blade of the high voltage shorting switch, SW106, (not shown) strikes to discharge the 2000 volt circuits: it also forms an adjustable arc gap, GAP101, with the PA shield, SH106 shown in Figure 38. Adjust GAP101 by bending the bracket until the clearance from the top end of the bracket to the PA shield, SH106, is 1/8".

2. VFO CALIBRATION

a. BAND-EDGE CALIBRATION CHECKS

Wired transmitters leave the factory with VFO's calibrated and there is little danger of calibration changing. However, many times the operator will depend inadvertently on oscillator calibration to insure operating within band limits and for this reason VFO calibration should be checked at band edges.

One method of checking VFO calibration is to use a communications receiver as a detector. The frequency standard such as an LM type frequency meter, 100 kc crystal calibrator, or other standard should be fed into the receiver at a level which will not block the receiver yet produce a strong enough beat with the VFO to be easily detected.

(1) The transmitter can be set up as follows:

DRIVE (R133)	5
POWER (SW113) Clockwise	ON (See F, Adjustments, General)
OSCILLATOR (SW102) Clockwise	VFO
STANDBY (SW110) Centered	ZERO
MODE (SW108) Clockwise	AM

It is not necessary to tune any of the stages other than the VFO. Run a lead from the center contact of J103 letting it lie near the receiver antenna terminals. Adjust the lead position so as to provide a signal of approximately the same level as the calibrator.

In 80 meter operation, the VFO output is on 160 meters, at the frequency indicated on the lowest scale of the EXCITER TUNING dial. This scale has been provided to facilitate calibration in case it is more convenient to calibrate at 1.75 to 2.0 mc. than at 3.5 to 4.0 mc (the actual transmitter output frequency). Signals from the exciter at twice the VFO frequency may be used, if desired, the frequency indicated on the next to lowest scale (3.5 to 4.0 mc.)

With the Viking Five Hundred bandswitch in the 80 meter position, beat the VFO signal with the calibrator signal at the calibration check points nearest 1.75 mcs. first, then nearest 2.0 mcs. These checks may be made at 3.5 mcs. and 4.0 mcs. if desired. The receiver BFO should be turned off, the beat between calibrator and VFO providing the audible check.

(2) Next turn transmitter bandswitch to the 40 meter position. Compare VFO frequency with the calibrator as follows:

VFO Actual Oscillating Freq.	VFO Dial Reading	Frequencies Thus Checked
7.0 mcs.	7.0 mcs.	7.0 mcs.
		14.0 mcs.
		21.0 mcs.
		28.0 mcs.
7.15 mcs.	21.450 mcs.	21.450 mcs.
7.175 mcs.	14.350 mcs.	14.350 mcs.
7.425 mcs.	29.7 mcs.	29.7 mcs.

If it will simplify checking frequency, the receiver and calibrator may be operated on the frequencies indicated by the VFO dial. Checks will then be made against oscillator harmonics.

If a 100 kc. standard is the frequency comparison device there is no way to check such frequencies as 14.35 mcs. or 21.45 mcs. directly using audible beats. It becomes necessary then to check against the 100 kc. standard harmonics (multiples of 100 kc.).

To check 14.35 mcs., set the VFO to the 40 meter position, the VFO dial to 14.3 mcs. and the receiver to 14.3 mcs. The second harmonic of the VFO will then beat against the 143rd harmonic of the 100 kc standard. Next tune the receiver and the VFO dial to 14.4 mcs., beating the VFO second harmonic against the 144th harmonic of the crystal calibrator. If calibration is accurate at 14.3 mcs. and 14.4 mcs., then it can be assumed that the VFO calibration at 14.35 mcs. is quite accurate. The same technique can be used to check 21.45 mcs.

(3) Turn bandswitch to 11 meter position and perform the following checks:

VFO Actual Oscillating Freq.	VFO Dial Reading	Frequencies Thus Checked
6.74 mcs.	26.960 mcs.	26.960 mcs.
6.8075 mcs.	27.230 mcs.	27.230 mcs.

If these checks disclose discrepancies in VFO calibration and if the calibrator used is known to be within .005% or better, then the VFO should be recalibrated per the instructions appearing in the next topic.

b. DEFINITIONS AND GENERAL INFORMATION

The following instructions are for calibrating the Viking Five Hundred VFO using a signal generator for the frequency standard and a receiver capable of tuning the calibration frequencies.

The accuracy of the VFO calibration will be no better than that of the signal generator used to calibrate it. To fully utilize the stability and calibration capabilities of the VFO, the frequency standard used to calibrate it should have an accuracy of .005% or better. Most crystal standards or crystal calibrated variable frequency standards are satisfactory for normal calibration purposes. A moderate signal output is required, capable of being easily detected with the receiver to be used for zero beat indication.

The frequencies F1a, F2a, F3a and F4a used in the text following are indicated output frequencies of the calibrating standard. The abbreviations F1, F2, F3 and F4 are VFO dial settings corresponding to frequencies F1a, F2a, F3a, and F4a respectively. F1a, F2a, F3a and F4a may be either fundamental frequencies or any harmonic it is desired to use.

The Viking Five Hundred VFO operates on 160 meters for 80 meter transmitter output and on 40 meters for transmitter output on 40, 20, 15 and 10 meters. For 11 meter output, the VFO operates on 6.7 to 6.85 mcs.

F1a-Any given frequency (preferably a frequency corresponding to a low frequency VFO dial calibration mark) between 1.75 and 1.78 mcs. or any of the first eight harmonics of 1.75 to 1.78 mcs. in the range of the receiver. 1.76, 3.52, 5.28, 7.04 and 8.80 mcs. are good calibrating frequencies.

F2a-Any given frequency (preferably a frequency corresponding to a low frequency VFO dial calibration mark) between 1.96 and 2.00 mcs. or any of the first eight harmonics of 1.96 to 2.00 mcs. in the range of the receiver. 1.97, 3.94, 5.91, 7.88 and 9.85 mcs. are good calibrating frequencies.

F3a-Any given frequency (preferably a frequency corresponding to a high frequency VFO dial calibration mark) between 7.00 and 7.07 mcs. or any of the first four harmonics of 7.00 to 7.07 mcs. in the range of the receiver. 7.03, 14.06, 21.09 and 28.12 mcs are good calibrating frequencies.

F4a-Any given frequency (preferably a frequency corresponding to a high frequency VFO dial calibration mark) between 7.35 and 7.425 mcs. or the first four harmonics of 7.35 to 7.425 mcs. 7.40, 14.800, 22.2 and 29.6 mcs are good calibrating frequencies.

Warm up the signal generator for at least half an hour or as long as suggested by the signal generator instructions before using it for VFO calibration.

Set up a receiver capable of detecting each of the frequencies selected. Attach antenna leads to the receiver input and the signal generator output. (Three or four foot lengths will probably be ample.) Bring the leads closer together until signal generator output can be picked up by the receiver. Separate and shorten the leads as found necessary to keep the receiver from blocking due to excessive signal input. Allow the receiver to warm up for about 1/2 hour to stabilize the local oscillator and log dial settings for frequencies F1a, F2a, F3a and F4a. The beat frequency oscillator in the receiver may be used to log and compare the signal generator and VFO frequencies but it is desirable to obtain the final zero beat indications between VFO and signal generator signals without the beat frequency oscillator. Avoid setting the receiver on or logging image frequencies.

Warm up the Viking Five Hundred in the "ZERO" position of the STANDBY switch for 1/2 hour. Turn the bandswitch to the 80 position. Turn the VFO dial pointer to the frequency F1, between 1.75 and 1.78 mcs. chosen for the low 160 meter calibrating point and find it or its harmonic (near F1a) on the receiver. Repeat the same procedure at the high 160 meter calibrating point and the 40 meter high and low points after moving the bandswitch to the 40 meter position.

c. 160, 80 METER SCALE CALIBRATION. Refer to Figure 38

Set the Viking Five Hundred bandswitch on the 80 meter position and dial at F2, the dial reading corresponding to the frequency between 1.96 and 2.00 mcs. chosen for the high 160 meter calibrating point (on 80 meters, the VFO operates on 160 meters). Set the signal generator to F2a and tune in the signal on the receiver. Adjust the "160 hi" trimmer on top of the VFO (Figure 38) until the VFO zero-beats with the signal generator.

Turn the signal generator to F1a, tune the receiver to the same frequency, turn the VFO to F1 and adjust the "160 lo" padder atop the VFO until the VFO zero-beats with the signal generator.

Repeat the "160 hi" and "160 lo" adjustments, zero beating the signal generator and VFO as accurately as possible. Since the adjustments affect each other several repeats of the adjustments may be necessary before attaining the most accurate setting possible.

d. 40, 20, 15, 10 METER SCALE CALIBRATION

Set the Viking Five Hundred bandswitch on the 40 or 20 meter position and the dial pointer at F4 on the high frequency dial scale, the frequency between 7.35 and 7.425 mcs. chosen for the high 40 meter calibration. Set the signal generator and the receiver at F4a. Adjust the "40 hi" trimmer at the top of the VFO until the VFO zero beats with the signal generator.

Turn the VFO to F3, the setting corresponding with the frequency between 7.00 and 7.07 mcs. chosen for the low 40 meter calibration, the receiver to F3A, the signal generator to F3a and adjust the "40 lo" padder until the VFO zero-beats with the signal generator.

Repeat the "40 hi" and "40 lo" adjustments, zero-beating the signal generator and VFO as accurately as possible.

e. 11 METER CALIBRATION

The 11 meter band VFO output is near 6.75 mcs. A given frequency, F5a, in the range 6.7 to 6.85 mcs. or any of the first four harmonics of the 6.7 to 6.85 mcs. range may be used to calibrate the 11 meter range. Turn the bandswitch to the 11 meter band, set the VFO dial to the position F5 corresponding to the frequency F5a or its harmonic which falls in the 11 meter band. Set the receiver to the 11 meter range or a subharmonic and detect the standard signal frequency. Adjust the "11" trimmer until the VFO zero-beats with the standard frequency.

Recheck the 40 or 20 meter calibration after the 11 meter adjustment. There is little likelihood that further readjustments are necessary unless a large change was required in the "11" setting.

f. CALIBRATION AGAINST CRYSTALS

Crystals of known frequency and accurancy in the frequency ranges F1a, F2a, F3a and F4a (designated in section F1) may be used in the transmitter crystal oscillator to provide standard frequency signals for the VFO calibration. The stability of the receiver local oscillator and beat frequency oscillator must be nominally good as the technique of beating the receiver BFO to the crystal and then beating the VFO signal to the receiver will be used. The receiver thus "remembers" the crystal frequency. Reduce the coupling of the receiver antenna to the minimum usable amount to avoid "pulling" of the local oscillator.

An example of calibrating the VFO using the actual crystal values may be helpful. Assume that the following crystals have been found as part of the amateur station equipment: 7060 kcs., 3690 kcs. and 1980 kcs. The dial calibration points then become:

$F1 = \frac{7.060}{4} = 1.765$ mcs.

F2 = 1.980 x 1 = 1.980 mcs.

F3 = 7.060 x 1 = 7.060 mcs.

F4 = 3.690 x 2 = 7.380 mcs.

The receiver setting and VFO harmonic which may be used for each respective dial calibration frequency then becomes:

F1a = 7.060 x 1 = 7.060 mcs.

F2a = 1.980 x 4 = 7.920 mcs.

F3a = 7.060 x 1 = 7.060 mcs.

F4a = 3.690 x 2 = 7.380 mcs.

Proceed as follows:

(1) Place the 1.980 mc. crystal in the C1 position of XY101 (pins 2 and 4) and the 7.070 mc. crystal in the C2 position (pins 6 and 8 of XY101).

(2) Set the bandswitch on 80 meters, the VFO dial pointer on the 1.980 mc. mark, the OSCILLATOR switch on C1 position. Place STANDBY switch in "ZERO". Tune the receiver to zero-beat the BFO with the crystal. Turn the OSCILLATOR switch to the VFO position and adjust the "160 hi" trimmer to zero beat the receiver BFO.

(3) Set the VFO pointer on the 1.765 mc. mark, and the OSCILLATOR switch to the 7.060 mc. position (C2). Tune the receiver to zero beat the BFO with the crystal. Turn the OSCILLATOR switch to VFO and adjust the "160 lo" padder to zero beat the BFO. Repeat steps 2 and 3 as necessary to cancel out interaction between the "160 lo" and "160 hi" adjustments.

(4) Remove the 1.980 mc. crystal from the C1 position and replace it with the 3.690 mc. crystal.

(5) Set the bandswitch on 40 meters, the VFO dial pointer to 7.380 mcs. and the OSCILLATOR switch to C1. Tune the receiver to zero beat the BFO with the crystal. Turn the OSCILLATOR switch to VFO and adjust the "40 hi" trimmer to zero beat the BFO.

(6) Set the VFO pointer on 7.060 mcs. and the OSCILLATOR switch to C2. Tune the receiver to zero beat the BFO with the crystal. Turn the

OSCILLATOR switch to VFO and adjust the "40 lo" padder to zero beat the BFO. Repeat steps (5) and (6) to minimize adjustment reaction.

(7) The 11 meter band setting may be made with a crystal which will place a harmonic signal in the 11 meter band. Set the bandswitch on 11 meters, the OSCILLATOR switch to the crystal (assume 1.810 mcs. is available) position. Zero beat the receiver BFO to 27.150 mcs. (the 15th harmonic of 1.810 mcs.). Turn the OSCILLATOR switch to VFO and adjust the "11" trimmer to zero beat the VFO to the receiver BFO.

(8) Recheck the "40 hi" and "40 lo" adjustments, steps (5) and (6).

The user may think of several sources of standard signals other than those mentioned. In each case the accuracy of the source should be known before using it. Many combinations of harmonics can be found and no attempt has been made to cover all of them in this discussion. Other signal sources which may be used but are not covered here are:

(a) The signal of another amateur station whose frequency has been determined by a standard.

(b) The harmonics of a signal generator the output signal of which as been zero beat with a broadcast station.

(c) Signals of WWV discussed in the next topic.

The user must adapt his techniques to the signal source he has available.

Band edge crystals or crystals near the usual operating frequencies of the amateur stations are always valuable for occasional monitoring of the VFO signals. They may be used in a separate oscillator circuit or the crystal oscillator stage of the transmitter

g. CALIBRATION AGAINST WWV

The following technique for calibration against the WWV 10 mc. signal is not recommended if other standard signal sources are available. It will be noted that most calibration points are on the ends of the bands. The receiver, the receiver BFO and the VFO should be warmed up 1/2 hour before calibrating.

(1) Zero beat the receiver BFO with the 10 mc. WWV signal.

(2) Set the VFO dial pointer to 2.00 mcs., the bandswitch on 80 meters.

(3) Adjust the "160 hi" VFO trimmer until the fifth harmonic of the VFO is zero beat with the receiver BFO.

(4) Leaving the VFO at this setting, zero beat the receiver BFO with the seventh harmonic of the VFO (14 mcs.).

(5) Turn the VFO to 1.75 mcs. and adjust the "160 lo" VFO padder to zero beat the eighth harmonic of the VFO with the receiver BFO.

(6) Adjust both ends of the 160 meter band to zero beat the eighth and seventh harmonics of the VFO with the receiver BFO as necessary to cancel adjustment interaction.

g. 40, 20, 15 and 10 meter calibration

(7) Set the VFO dial at the 1.85 mc. mark and zero beat the receiver BFO to the eighth harmonic of the VFO frequency at 14.8 mcs.

(8) Set the bandswitch to 40 meters and the dial pointer to the 7.40, 29.6 mc. mark. Zero beat the second harmonic of the VFO to the 14.8 mcs. receiver setting by adjusting the "40 hi" trimmer.

(9) Set the bandswitch and dial pointer for 1.75 mc. VFO output again and zero beat the receiver BFO at 14 mcs. Set the bandswitch and dial for 7.0 mc. VFO output. Adjust the "40 lo" padder to zero beat the VFO second harmonic with the receiver 14.0 mc. BFO setting.

11 meter calibration

(10) Set the bandswitch and VFO dial for 1.80 mc. output.

(11) Tune the receiver to 27 mcs. and zero beat the receiver BFO to the fifteenth harmonic of the VFO.

(12) Set the bandswitch on 11 and the dial pointer on 27.0 mcs. Adjust the "11" trimmer to zero beat the fourth harmonic of the VFO to the receiver BFO setting.

h. CALIBRATION TROUBLE SHOOTING

If the VFO frequency cannot be adjusted to the dial markings due to apparent lack of trimmer or padder range:

Check to make certain the frequency standard used is accurate (crystals used in amateur service are often found to differ from their marked frequency due to holder conditions, oscillator circuit loading or non-critical original calibration.

Make certain image frequencies are not being mistaken for desired frequencies in the receiver.

If, after checking the frequency standard and receiver settings, the VFO frequency cannot be adjusted to chose dial marks, adjust the trimmers to bring the VFO as close as possible to correct calibration. Remove the VFO side cover and recheck the dial location relative to the tuning capacitor shaft. The VFO tuning capacitor should be exactly meshed (not necessarily the stop position) when the dial pointer is precisely <u>horizontal</u> to the left. If the dial requires re-positioning, loosen the <u>two set screws in</u> the shaft coupler attached to C101 from beneath the chassis, <u>re-set</u> the dial, tighten <u>both</u> set screws. This should permit the VFO to be calibrated properly.

3. EXCITER ALIGNMENT

WARNING

The rotors of EXCITER TUNING capacitors, C138 and C158, are energized with +350 volts dc, as are the rotors (with screw driver slots) of all trimmer capacitors in the multiplier and driver stages. Use an <u>insulated</u> screwdriver.

Refer to Figures 10, 18 and 38 and Table 2. With the VFO properly calibrated before hand, the exciter tracking may be adjusted. For alignment with the exciter in working condition, start with step n and read only <u>PA</u> grid current while adjusting both <u>multiplier</u> and <u>driver</u> alignment controls at each frequency set up.

Following is the procedure when starting from scratch with controls completely out of alignment:

a. Disconnect power source.

b. Close the high voltage shorting switch, SW106.

c. Remove VFO side cover, SH110.

d. Turn the EXCITER TUNING control counter-clockwise until the VFO tuning capacitor, C101, is exactly at full mesh. (EXCITER TUNING pointer horizontal at counter-clockwise position.)

e. Loosen set screws on pulley, D111, on C138 and set screws on the coupler on C158 (Figure 18).

f. Set rotors of exciter tuning capacitors, C138 and C158, at exactly full mesh when C101 is at full mesh. Tighten set screws loosened in preceeding step.

g. Replace VFO side cover, SH110.

h. Remove Exciter Bottom Plate, CH115. Refer to paragraph C-5.

i. Set variable capacitor, C153, marked "NEUT" in the driver stage at 1/3 capacity (1/3 mesh). Refer to Figures 10 and 38.

j. Set remaining miniature variable capacitors marked 10C, 11C, 15C, 20C, 40C and 80C in the multiplier and driver stages at half capacity (half mesh). Refer to Figure 38.

k. Replace Exciter Bottom Plate, CH115. Refer to paragraph C-5.

l. Adjust screw on Buffer Tuning core designated BUFFER (L107) to show 3/8" of thread (Figure 38).

m. Adjust studs on tuning cores marked 10L, 15L, 20L, 40L, and 80L in multiplier and driver stages to show 1/2" of thread.

NOTE: There is no 40L in the multiplier stage. Refer to Figure 38.

n. Set Controls:

Control	Position	Dial Reading
DRIVE	Center (see paragraph CC)	5
EXCITER TUNING	See text	
TUNE-OPERATE	Counter-clockwise	TUNE
POWER	Clockwise	ON
BAND	Counter-clockwise	80
METER	2 positions from counter-clockwise	DR GRID
AUDIO	Counter-clockwise	0
OSCILLATOR	Clockwise	VFO
STANDBY	Center	ZERO
MODE	Clockwise	AM

o. Apply power.

p. Set EXCITER TUNING control at 3.9 mc. Adjust multiplier trimmer capacitor designated MULT 80C (Figure 38) for maximum driver grid current on meter M101.

q. Set EXCITER TUNING control at 3.55 mc. Adjust multiplier tuning core designated MULT 80L (Figure 38) for maximum driver grid current on meter M101.

r. The adjustments in steps p and q affect each other, so it will be necessary to repeat steps p and q, until no noticeable readjustment is needed for proper tracking. This process can be shortened by slightly "overshooting" each adjustment except the last.

s. Set BAND switch at 10.

t. Set EXCITER TUNING control at 29.5 mc. Adjust multiplier trimmer capacitor designated MULT 10C for maximum driver grid current on M101.

u. Set EXCITER TUNING control at 28.2 mc. Adjust multiplier tuning core designated MULT 10L for maximum driver grid current. NOTE: It is possible to tune this coil to the wrong harmonic (35 mc) with the core at the upper limit of its travel. Use a grid-dip oscillator to check resonance at 28 mc.

v. Set EXCITER TUNING at 29.0 mc.

w. Adjust buffer tuning core designated "BUFFER" for maximum driver grid current. Repeat steps t and u, until proper tracking is obtained. The process can be shortened by slightly "overshooting" each adjustment except the last.

x. Set BAND switch at 11. Set EXCITER TUNING at 27.1 mc. Adjust multiplier trimmer designated "MULT 11C" for maximum driver grid current.

y. Set BAND switch at 15.

z. Set EXCITER TUNING at 21.3 mc.

aa. Adjust multiplier tuning core designated MULT 15L for maximum driver grid current.

bb. Set BAND switch at 20.

cc. Set EXCITER TUNING at 14.2 mc. Adjust multiplier tuning core designated MULT 20L for maximum driver grid current.

NOTE: There is no multiplier alignment control for 40 meters.

dd. Check Driver Grid current on M101 as the EXCITER TUNING control is tuned thru the complete range of each band. There will be some difference between readings at the alignment points of any given band, but the driver grid current should be fairly constant with gradual variations. There should be no abrupt changes or evidence of instability.

ee. Set METER switch on PA GRID.

ff. Set BAND switch at 80. Set EXCITER TUNING control at 3.9 mc. Adjust driver trimmer capacitor designated "DRIVER 80C" for maximum PA grid current.

gg. Set EXCITER TUNING control at 3.55 mc. Adjust driver tuning core designated "DRIVER 80L" for maximum PA grid current on meter M101.

hh. Repeat steps ff and gg until no noticeable adjustment is needed for proper tracking.

ii. Set BAND Switch at 10. Set EXCITER TUNING control at 29.5 mc. Adjust driver trimmer capacitor designated "DRIVER 10C" for maximum PA grid current.

jj. Set EXCITER TUNING control at 28.2 mc. Adjust driver tuning core designated "DRIVER 10L" for maximum PA grid current.

kk. Repeat steps ii and jj until no noticeable adjustment is needed for proper tracking.

ll. Set BAND switch at 11.

mm. Set EXCITER TUNING at 27.1 mc. Adjust driver trimmer capacitor designated "DRIVER 11C" for maximum PA grid current.

nn. Set BAND switch at 15.

oo. Set EXCITER TUNING at 21.3 mc. Adjust driver tuning core designated "DRIVER 15L" for maximum PA grid current.

pp. Set BAND switch at 20.

qq. Set EXCITER TUNING at 14.2 mc. Adjust driver tuning core designated "DRIVER 20L" for maximum PA grid current.

rr. Set BAND switch at 40. Adjust driver tuning core designated "DRIVER 40L" for maximum PA grid current.

ss. Check PA grid current on M101 as the EXCITER TUNING control is tuned over the complete range of each band. There will be some difference between readings at alignment points, but the driver grid current should be fairly constant in any given band with gradual variations. There should be no abrupt changes or evidence of instability.

4. NEUTRALIZATION OF RF DRIVER (V105). Refer to Figure 38.

The type 5763 driver is neutralized by the capacity bridge method.

WARNING

The rotor of the "NEUT" capacitor, C153, carries +350 volts d.c. Use a screwdriver with an insulated handle.

a. Set Controls as in Exciter alignment except as noted.

b. Set DRIVE control clockwise to 10.

c. Set METER on PA GRID.

d. Set OSCILLATOR switch on C1 or C2 with no crystals in the crystal socket, XY101. This removes the oscillator signal and leaves the exciter with key closed and only protective bias from cathode resistors.

e. Tune the EXCITER TUNING control completely across each band. Any current in the meter indicates a free-running tuned-plate-tuned-grid oscillation near the indicated operating frequency.

f. Adjust the "DRIVER NEUT" trimmer capacity, C153, slightly to reduce the meter reading to zero. Try both directions. NOTE: The "NEUT" trimmer capacitor is effectively in parallel with the "DRIVER 10C" trimmer capacitor which will now need readjustment, since the driver plate circuit now is detuned somewhat. This detuning may stop the unwanted oscillation, but the driver is not necessarily neutralized, so continue with the remaining steps.

g. Set OSCILLATOR switch clockwise to "VFO".

h. Realign driver trimmer capacitor designated "DRIVER 10C" for maximum PA grid current (see step F.3, ii). Repeat steps d and e. A position will be found for the "DRIVER NEUT" control which will allow proper alignment without oscillation when no signal is applied. Some compromise is usually necessary to satisfy the requirements of all bands.

5. OVERLOAD ADJUSTMENT. Refer to Figure 36.

a. Tune and load the transmitter for 80 meter CW operation. Note setting of PA PLATE-TUNING control.

b. Set OVERLOAD ADJUST control (R165 on the rear) counter-clockwise. By the trial-and-error method set R165 so that overload relay, RY101, trips at 425 ma on the PA CATHODE meter, M102, when the PA TUNING CONTROL is detuned briefly.

c. Restore the PA TUNING control to the normal operating position before pressing the overload RESET button. To avoid damage to the Power Amplifier tube, do not prolong this overloading.

6. BIAS ADJUSTMENTS

WARNING

Bias adjustments are made by moving three sliders on the bias bleeder resistor, R168 (Figure 31). R168 is close to the MODE switch, SW108, which carries 2000 volts when the high voltage power supply is energized.

The relay circuit which controls the high voltage is also close by on the STANDBY switch, SW110. Never make any adjustments until the power source is disconnected and the high voltage shorting switch, SW106, is closed. Avoid damage to the relatively fine resistance wire on R168 by being careful when loosening and tightening the sliders. Always make sure that sliders are completely free before moving them.

a. "Tune" bias adjustment. This provides a fixed bias for the clamp tube, V108, which in turn reduces the screen voltage of the Power Amplifier, V106, thereby limiting the maximum input to V106 to a value which will not exceed the rated plate dissipation. Set MODE SWITCH to CW. Plug key in J101 (key must be closed). Set TUNE-OPERATE switch, SW111, to "TUNE". Adjust terminal 4 of R168 so that the maximum PA CATHODE current with normal drive and the PA PLATE TUNING control off resonance, does not exceed 130 ma. Voltage at terminal 4 will be about -19 volts.

b. CW-AM Bias Adjustment. Set MODE switch, SW108, on CW. Plug key in J101 (key must be closed). Set STANDBY switch, SW110, at "ZERO". Set terminal 3 of R168 to -50 volts with exciter only operating.

c. SSB Bias Adjustment. Set MODE switch, SW108, to SSB. Set terminal 2 of R168 to adjust the no-signal PA CATHODE current to 75 MA. This will require about -122 volts (about -130 volts for type PL-175A) when the STANDBY switch, SW110, is in the "TRANSMIT" position.

7. NEUTRALIZATION OF POWER AMPLIFIER. Refer to Figure 38.

WARNING

The adjustment screw of the PA Neutralizing capacitor, C168, carries the full RF voltage found on the PA plate circuit. Do not make adjustments when the high voltage circuits are energized. Some RF voltage is also present from the exciter with the STANDBY switch at ZERO. The bottom cylinder carries +350 volts dc. Use a screwdriver with an insulated handle. Make adjustments with transmitter in STANDBY condition.

The Power Amplifier tube, V106, is neutralized by the capacity bridge method.

a. Set the small cylinder of the PA neutralizing capacitor, C168, to mesh 1/4" with the larger cylinder. (With a type PL-175A tube at V106, start with the small cylinder of C168 completely out of the larger cylinder for minimum capacity.)

b. Tune the transmitter for 15 meter CW with 250 ma PA CATHODE current. Briefly detune the PA PLATE TUNING in both directions until the PA CATHODE current is 300 ma. If the PA GRID current increases when the PA PLATE TUNING capacity is increased (lower dial numbers) than the capacity of C168 is too large. Turn C168 counter-clockwise 1/2 turn at a time and repeat this test.

If the PA GRID current increases when the PA PLATE TUNING capacity is decreased (higher dial numbers), then C168 is too small. Tune C168 clockwise 1/2 turn at a time and repeat this test.

With proper neutralization the PA GRID current will show the least reaction when the PA PLATE TUNING control is tuned through resonance. The PA grid current will decrease in a "symmetrical" manner when the PA PLATE TUNING control is detuned in both directions from resonance. When the high voltage is applied the "drive", as indicated by the PA grid current, will drop about 20% from the value obtained in the "ZERO" condition.

8. CLIPPING LEVEL ADJUSTMENT AND CLIPPING EFFECTS

The desired speech clipping level can best be established by a cathode ray oscilloscope. Use a well-insulated pickup coil near the PA Plate coils or couple from the dummy antenna directly to the vertical plates of an oscilloscope set up to check for 100% modulation using envelope pattern (see ARRL handbook). Set the AUDIO control, R149, at "0". Set the CLIPPING LEVEL control, R154 (at the rear), full clockwise (Figure 36).

Tune and load the transmitter for 80 meter AM operation. While talking in the normal tone of voice used in communication, with the microphone in its normal position, advance the audio control, R149, until 100% modulation is achieved on modulation peaks. While continuing to talk into the microphone, turn the clipping level control, R154, counter-clockwise until it is observed that modulation peaks are being slightly clipped and that over-modulation does not occur. This serves to establish the threshold of clipping at 100% modulation. The setting of R154 should not be changed from this position.

Now refer to the curve "audio gain control position", Figure 51. Find the point on the curve corresponding to the present setting of R149. Refer to the left side of the chart and determine the "relative gain DB" at this point on the curve. If 10 db of clipping is desired, add 10 to the relative gain figure just obtained. Project this new figure over to intersect the curve and read the audio gain position indicated. Turn R149 to this new gain control position. This setting will give 10 db of clipping.

As an example, let us suppose that the setting of the AUDIO control, R149, which provides 100% modulation is 5. This point is 82 db on the relative gain scale. Ten db added to this is 92 db which corresponds to a new audio gain setting of 7 for 10 db of clipping.

It may be noticed that the oscilloscope will indicate some overmodulation under these conditions. This results from phase shift as clipped wave forms pass thru the filter and modulation transformer. In well designed transmitters, this slight effect will not be detrimental. If desired, this effect can be eliminated by adjusting R154, the clipping level control. Turn R154 slightly in a counter-clockwise direction and check modulation. Repeat as necessary until overmodulation is eliminated.

Notice that the clipping level control, R154, in effect sets the maximum modulation level, while the AUDIO control, R149, in effect determines to what degree audio peaks are clipped. Clipping increases the average audio power transmitted.

Once the clipping level is set for 100% modulation, always operate with the rated PA cathode current. A reduction in input to the PA without a corresponding reduction in the clipping level adjustment will result in overmodulation.

Clipping is useful in overcoming interference but the recognizability of the operators' voice decreases as more clipping is used. Generally 10 or 12 db of clipping is the maximum desirable. The background noise present at the microphone limits the amount of clipping which can be effectively used. A condition of high background noise together with excessive clipping will result in nearly 100% modulation of the carrier by the noise thus obscuring the operator's voice and reducing intelligibility.

The following tabulation of the effects of speech clipping should aid in selecting the clipping level to be used.

6 db peak clipping - clipping is barely detectable.

12 db peak clipping - not at all objectionable, on the contrary, speech sounds as though the speaker is enunciating with special care.

15 db peak clipping - begins to interfere somewhat with the recognizability of the speaker.

18 db peak clipping - speech sounds somewhat sharp and rasping but less unnatural than speech over a throat microphone.

24 db peak clipping - speech quite intelligible but sounds unnatural and grating.

9. KEYER ADJUSTMENT. REFER TO FIGURE 38.

The slotted shaft of the KEYER control, R109, is located on top of the chassis near the right side of the VFO shield. Rotate R109 to full counter-clockwise position. Plug a key into key jack, J101. Tune and load the transmitter for CW operation. Close the key and find the VFO signal in a receiver having a short antenna close to the VFO. For 80 meter operation, the VFO will be on 160 meters, and the VFO frequency will be indicated on the lowest scale of the EXCITER TUNING dial. For 40, 20, 15 and 10 meter operation the VFO is on 40 meters. The VFO frequency will be indicated on the 7 MC scale of the EXCITER TUNING dial.

Open the key. Now turn R109 clockwise until the VFO drops out of oscillation. Turn R109 about 3 degrees beyond this point. Make final adjustment with transmitter tuned and loaded for CW operation in "TRANSMIT" condition.

10. REGULATOR ADJUSTMENT. Refer to Figure 36.

The regulator adjustment, R142, affects only SSB operation, for then the type 807 clamper tube, V108, is switched to act as a voltage regulator on the PA screen circuit. Adjusting the current thru V108 establishes the proper operating current range for the screen voltage regulators, V307-V311.

The slotted shaft of the REGULATOR adjust control, R142, is located on the rear near the key jack, J101.

Set MODE switch to "SSB".

Set METER switch to "CLAMPER".

Set STANDBY switch to "TRANSMIT".

The PA screen voltage regulator tubes, V307 thru V311 inclusive, in the power supply should show a violet glow.

Adjust R142 to obtain 15 ma CLAMPER current on meter M101.

11. CRYSTAL OSCILLATOR CHECK. Refer to Figures 9 and 20.

Insert two crystals (FT243 type holder) into CRYSTAL socket XY101. Crystal C1 plugs into socket terminals 2 and 4, crystal C2 into socket terminals 6 and 8. The long dimension of the crystal holder as viewed from the front will be vertical. Tune the transmitter to an appropriate frequency. Listen to the transmitter signal in a receiver. Turn OSCILLATOR switch to "C1" and check that the crystal oscillator follows keying at 30 words per minute. Check for normal PA Grid current. Likewise check crystal C2.

12. INTERLOCK SWITCH ADJUSTMENTS

a. Power Supply interlock switch, SW301, is located on top of the chassis near power transformer T301. As the power supply top cover is being lowered into position, check that the interlock switch (SW301) operates, as indicated by a click. The construction of this switch allows 1/8" overtravel. Additional adjustment can be obtained by moving the interlock switch bracket in the slotted mounting holes in the top cover.

b. RF Unit interlock switch, SW112, is located on the exciter side of the PA Front Shield, SH106. Adjust the inside spacing nut so the outside surface of the overtravel push button is flush with the rear of the chassis when completely depressed.

13. DUMMY ANTENNA

When testing the transmitter, use a dummy antenna on the output to avoid unnecessary interference. A dummy is a big help in testing, since it eliminates the need for connecting to and adjusting various antenna feed systems. With a dummy, band changing is simple and swift. The dummy antenna should present a resistive load of approximately 52 ohms (15 to 200 ohms can be tolerated) and be capable of dissipating 500 watts. A suitable dummy can be constructed of two 200-watt light bulbs connected in parallel. Run RG-8/U coaxial cable to the dummy and make connections with short leads. Copper strap is excellent for leads. The light bulbs provide useful indication of output power. The dc resistance of the paralleled light bulbs is about 2 ohms cold and 33 ohms hot. Carbon resistors at moderate temperatures would provide a more constant load, which is desirable for keying and SSB tests.

G. TYPICAL OPERATING DATA AND TROUBLE SHOOTING

1. TROUBLE SHOOTING

a. Schematics, photographs and charts aid greatly in trouble shooting and are furnished in this section for reference. Particularly useful are the typical operating voltages, current readings and resistance measurements. Use these charts and listings to save time in locating trouble.

b. Some precautions to be observed are:

(1) Be careful while making High Voltage Measurements. DO NOT TAKE CHANCES.

(2) Never depend on bleeder resistors to discharge capacitors. When turning equipment off, discharge each filter condenser with a screw driver which has a well insulated handle.

(3) All power supplies must be off and discharged when making ohmmeter measurements with the ohmmeter.

c. The best procedure to follow is to attempt to isolate the trouble to one of the main sections of the equipment such as:

(1) High Voltage Supply

(2) Low Voltage Supply

(3) Bias Voltage Supply

(4) Audio Circuits

(5) Keyer and Clamper Circuits

(6) VFO Circuits

(7) Crystal Oscillator

(8) RF Exciter Circuits

(9) Power Amplifier Circuits

(10) Control Circuits

(11) Auxiliary Circuits such as antenna transfer relay circuit, SSB Input circuit, meter circuits, etc.

A thorough understanding of the Viking Five Hundred block diagram and circuitry will prove an invaluable aid in localizing any trouble. Once the trouble is localized, the primary offenders would be the tubes. They should be checked or a good tube substituted in the equipment. Frequent reference to the voltage and resistance charts will also aid toward a swift and accurate analysis of the trouble.

d. Shorts in the high voltage circuits can be isolated to one chassis or the other (or in the high voltage cable) by disconnecting the 3 tip jacks on the high voltage cable (at the power end first). Do not disconnect the braid.

e. Bleeders for the -150 volt and +350V supplies are in the RF unit. Do not operate these supplies without the RF unit (with tubes) for a load unless bleeders for at least 75 MA drain are provided.

f. INTERLOCKS AND RELAYS

An understanding of the power interlocks and relay sequencing is essential for locating trouble in control circuits.

(1) To apply any power to the Viking Five Hundred requires 115 volts AC and a circuit through fuse, F301, two pushbutton interlocks switches, SW301 and SW112, and the POWER switch, SW113. This circuit energizes the fan, RF unit filaments and AC powered relay, RY301.

(2) Relay RY301 must operate and fuse F302 must conduct to energize the power supply filaments and the -150 volt and +350 volt power supplies.

(3) To apply high voltage requires -150 volts DC and a circuit thru the jumpers in five voltage regulator tubes (V307-V311), the contacts of overload relay RY101 (press RESET in) and a connection to the chassis thru either the STANDBY switch, SW110, (in TRANSMIT position) or thru the push-to-talk switch on the microphone. This circuit operates slow-release relay, RY302, closing a -150 volt circuit thru the coil of HV Relay, RY303, which operates to apply line voltage to the primary of the high voltage supply thru fuses F303 and F304.

(4) Slow-release relay RY302 also keys the exciter, opens the receiver standby circuit and supplies 115 VAC to operate an antenna transfer relay. Upon going from TRANSMIT to STANDBY condition, HV relay RY303 opens quickly, while slow-release relay RY302 holds longer, allowing the antenna transfer relay to open and the receiver to be made operative after RF power has been removed.

(5) Overload relay, RY101, is set to trip and latch open at 425 ma. PA CATHODE current. Since its contact is in series with the push-to-talk circuit, it will deenergize slow-release relay, RY302, which in turn deenergizes high voltage relay, RY303, thereby removing the high voltage.

(6) In the ZERO position, the STANDBY switch, SW110, grounds the key line without operating the slow-release relay.

g. HIGH VOLTAGE CIRCUITS

A fault in the high voltage circuits will blow fuses F303 or F304. Make sure that high voltage shorting switches, SW106 and SW302, are open. The high voltage may arc even though an ohmmeter check does not indicate anything wrong. In this case, the trouble may be isolated by power tests, as shown below.

If there is arcing at GAP101 in the RF unit, reduce the spacing on GAP301 in the Power Supply so that the transient voltage from switching surges arcs across GAP301 where it will do no harm rather than at GAP101 where DC current will flow to ground and blow fuses F303 and F304. GAP301 can usually be set as close as .018" without arcing under normal modulation. Use a feeler gauge. The spacing can be set approximately by noting that one revolution of the adjusting screw changes the spacing by .031". At high altitudes more spacing will be required. Leave spacing of GAP101 at 1/8".

If there is no arcing to ground in the RF unit, disconnect the 3 high voltage leads from the tip jacks at the Power Supply. Do not disconnect the shield braid. Apply power many times. If F303 or F304 blow, the trouble is in the Power Supply rather than in the RF unit. To determine which of the high voltages supply components is faulty, isolate it by disconnecting one thing at a time and applying primary power to the HV transformer many times as follows:

(1) Disconnect plate leads of 866A rectifiers, V303, V304. Keep plate connectors clear of metal parts. Keep high voltage shorting switch, SW301, open. Apply power many times. If fuses F303 or F304 blow, the HV plate transformer, T302, is defective.

(2) If nothing happens in step 1, reconnect plate leads to the 866A's and disconnect choke L303 from the center tap of T301. The junction is on the conical ceramic insulator under the chassis. Try power many times. Blown fuses in this condition indicate a defective LV transformer, T301, or possibly one of the 866A rectifiers is defective.

(3) If fuses do not blow in step 2, the trouble is beyond T301. Reconnect the input lead of L303 at the conical insulator and disconnect the output lead of L303. The junction is on the red tip jack, J303. Try power many times. Blown fuses in this condition indicate a short to ground in L303.

(4) If no failure occurred in step 3, reconnect the output lead of L303. Reconnect the 3 leads of the high voltage cable. Apply power and measure the voltage at the blue tip jack, J304. With normal line voltage, this should measure about 2000 volts in AM operation. If it is extremely high, it indicates shorted turns in HV choke, L303. The abnormal voltage could cause failure of filter capacitors C303 thru C307, and C315.

(5) If voltage is normal in step 4, open the red lead and the black lead from the modulation transformer, T303 (the junction is on the capacitor mounting board near C315), leaving only the VR tubes, filter capacitors, and bleeder resistor string connected. (The VR tubes are needed to keep a minimum load on the Power Supply). Apply power many times. Blown fuses here indicate shorted filter capacitor (C303 thru C307 and C315).

(6) If fuses hold in step 5, the trouble is probably in the insulation of the modulation transformer, T303.

2. TYPICAL OPERATING DATA

Table 1 shows typical Dial Readings for AM operation with a 50 ohm load. Table 2 shows typical Meter Readings. Table 3 shows the Frequency Scheme. Table 4 shows typical Socket Voltage and Resistances.

Table 5 shows typical Power Supply terminal resistance. Table 6 shows typical Transformer and Choke Voltages and Resistances. Table 7 shows typical RF Unit Terminal Resistances. Table 8 shows typical Grid Current during exciter alignment. Table 9 shows Crystal Frequencies.

TABLE 1

TYPICAL DIAL READINGS

50 Ohm Resistive Load, AM Operation

BAND	EXCITER TUNING	DRIVE	PA PLATE TUNING	LOADING
80 Meters	3.5 MC	5.7	2.6	2.0
	4.0	6.8	5.0	4.8
40	7.0	4.8	4.2	3.8
	7.3	5.8	7.3	5.2
20	14.0	5.7	4.8	4.9
	14.35	4.8	5.5	5.2
15	21.0	7.5	6.9	5.9
	21.45	7.5	7.4	6.1
10	28.0	9.0	6.7	6.9
	29.7	8.7	8.2	7.2
11	26.96	9.9	3.8	8.0
	27.32	9.0	4.2	8.0

TABLE 2

TYPICAL METER READINGS

			METER READINGS			
			CW		AM	SSB
METER	METER SWITCH POSITION	SCALE	Key Closed	Key Open		No Signal
M101	Counter-clockwise	OFF	-	-	-	-
	CLAMPER	0-100 MA	2 MA	60 MA	2 MA	15 MA
	DR GRID	0-10	0.5-3	0	0.5-3	-
	DR PLATE	0-100	15-40	0	15-40	30
	PA GRID	0-20	10	0	10	0
	MOD CATH	0-300	25	35	25	35
	No switch - permanently connected					
M102	PA CATHODE	0-500	355	0	305	75

TABLE 3
VIKING 500 FREQUENCY SCHEME

Frequency at output of each RF stage

BAND	V101 VFO	V103 BUFFER	V104 MULT	V105 DRIVER	V106 POWER AMPLIFIER
80 Meters	1.75 MC	1.75 MC	3.5 MC	3.5 MC	3.5 Mc
40	7.0	7	7	7	7
20	7	7	14	14	14
15	7	7	21	21	21
10	7	14	28	28	28
11	6.75	13.5	27	27	27

TABLE 4

TYPICAL SOCKET VOLTAGES AND RESISTANCES

DC voltages measured with 20,000 ohms-per-volt meter between chassis and indicated test points. Filament voltages measured with 5000 ohms-per-volt AC voltmeter. Line voltage 115 volts. F303 and F304 removed except for HV measurements. SW112 closed. SW106 open. Voltages shown are "positive" DC unless otherwise indicated. Transmitter controls:

POWER	ON	AUDIO	0
TUNE-OPERATE	OPERATE	BAND	80
STANDBY	TRANSMIT	OSCILLATOR	VFO
DRIVE	7	MODE	CW

Resistance measurements taken with all interconnecting cables in place and all power removed. Resistance values may vary ± 20%. "NC" means no connection. "CT" means centertap. "K" means "thousand".

TUBE SOCKET	PIN	VOLTS	OHMS
XV101 (6AU6)	1 grid(-11)	-4*	122K
	2 suppressor	0	0
	3 heater	0	0
	4 heater	6.1 ac	0.6
	5 plate	295	22K
	6 screen	150	39K
	7 cathode	0.2	33

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV103 (6CL6)	1 cathode	4	0.1	480
	2 grid(-16)	-2.6*	-45	140K
	3 screen	180	280	90K
	4 heater	0	0	0
	5 heater	6.3ac	6.3ac	note 1
	6 plate	320	370	26K
	7 suppressor	0	0	0
	8 screen	72	92	90K
	9 grid(-16)	-2.6*	-25	140K

TUBE SOCKET	PIN	VOLTS	OHMS
XV102 (OA2)	1 plate	150	39K
	2 cathode	0	0
	3 N.C.	-	-
	4 cathode	0	0
	5 plate	150	39K
	6 N.C.	-	-
	7 cathode	0	0

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV104 (6CL6)	1 cathode	4	0	470
	2 grid(-29)	-11*	-48	70K
	3 screen	255	325	50K
	4 heater	0	0	0
	5 heater	6.3ac	6.3ac	note 1
	6 plate	340	380	24K
	7 suppressor	4	0	470
	8 screen	255	325	50K
	9 grid(-29)	-11*	-48	70K

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV105 (5763)	1 plate	365	380	21K
	2 N.C.	-	-	-
	3 suppressor	7.5	0	220
See note 2	4 heater	0	0	0
	5 heater	6.3ac	6.3ac	note 1
	6 screen	175	205	15K
	7 cathode	7.5	0	220
	8 grid(-34)	-8*	-48	23K
	9 grid(-34)	-8*	-48	23K

TUBE SOCKET	PIN	VOLTS	OHMS
XV109 (12AX7)	1 plate "A"	60	700K
	2 grid "A"	-0.5	1 meg.
	3 cath. "A"	0	0
See note 6	4 heater	0	0
	5 heater	0	0
	6 plate "B"	130	170K
	7 grid "B"	0	0
	8 cath. "B"	0.75	680
	9 heater	6.3ac	note 1

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV106	1 filament	2.5ac		0.2-10
(4-400A)	2 screen	440	120	Infinite
	3 grid	-165*	-45	13K
See	4 screen	440	120	Infinite
notes	5 filament	2.5ac		0.2-10
3	Cap Plate	2000	2150	Infinite
4				

TUBE SOCKET	PIN	VOLTS	OHMS
XV110	1 cath. "A"	3	220K
(6AL5)	2 plate "B"	3	370K
	3 heater	0	0
	4 heater	6.3ac	note 1
	5 cath. "B"	3	270K
	6 N.C.	-	-
	7 plate "A"	3	370K

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV107	1 plate "A"	-0.8	-7	21K
(12AU7)	2 grid "A"	-18	-18	1 meg.
	3 cath. "A"	14	-18	20K
See	4 heater	0	0	0
note	5 heater	0	0	0
5	6 plate "B"	305	320	21K
	7 grid "B"	0	-45	19K
	8 cath. "B"	14	-18	20K
	9 heater	6.2ac	6.2ac	note 1

TUBE SOCKET	PIN	VOLTS	OHMS
XV111	1 grid	0	100K
(6AU6)	2 suppressor	1.7	1800
	3 heater	0	0
	4 heater	6.3ac	note 1
	5 plate	67	280K
	6 screen	67	280K
	7 cathode	1.7	1800

TUBE SOCKET	PIN	"Key Down" VOLTS	"Key Up" VOLTS	OHMS
XV108	1 heater	6.3ac	6.3ac	note 1
(807)	2 screen	300	185	31K
See	3 grid	-65	-13	100K
notes	4 cathode	0	0	1
4	5 heater	0	0	0
8	Cap Plate	440	120	Infinite

TUBE SOCKET	PIN	VOLTS	OHMS
XV112	1 grid	0	470K
(6B4G)	2 filament	note 7	750
	3 plate	290	21K
	4 B+	300	21K
	5 grid	0	470K
	6 fil. C.T.	45	750
	7 filament	note 7	750
	8 mod. grid C.T.	-9	68

Note 1 - Less than 0.1 ohms
Note 2 - Resistance at pin 6 and voltage at pins 1, 3,6,7,8, and 9 vary with "DRIVE" control setting.
Note 3 - Resistance on pins 1 and 5 of XV106 vary with setting of "Overload" adjustment.
Note 4 - No voltage will appear on pins 2 and 4 of XV106 (nor on the plates of XV106 and XV108) unless High Voltage is applied to the RF unit. Operating voltages for XV108 and XV106 (with 10 ma. PA GRID and 305 ma. PA CATHODE) are shown.
Note 5 - Voltages on pins 1 and 2 of XV107 obtained with V.T.V.M. and vary with setting of "Keyer" Adjustment.
Note 6 - Resistance at pin 7 of XV109 varies with "AUDIO" control setting.
Note 7 - 6.4 v.ac between pins 2 and 7 (45v.dc to gnd)
Note 8 - Voltages on pins 2, 3 and 4 measured with no plate voltage: ie, High Voltage off.
* Use 2 1/2 millihenry RF choke on probe to avoid detuning. Voltages shown in ( ) are for 14200 KC operation with circuits peaked with voltmeter connected.

POWER SUPPLY

TUBE SOCKET	PINS	VOLTS	OHMS
XV301	1 N.C.	-	-
6AX5GT	2 heater	3.1 ac	0.5
	3 plate	-195	1300
	4 bias C.T.	-190	1200
	5 plate	-195	1300
	6 bias output	-160	1000
	7 heater	3.1 ac	0.5
	8 cathode	0	0

TUBE SOCKET	PINS	VOLTS	OHMS
XV302	1 N.C.	-	-
5U4G	2 heater	400	22K
	3 N.C.	-	-
	4 plate	480 ac	50
	5 N.C.	-	-
	6 plate	480 ac	50
	7 N.C.	-	-
	8 heater	400	22K

TUBE SOCKET	PINS	VOLTS	OHMS
XV303	1 heater	*2.5 ac	115K
XV304	2 N.C.	-	-
866	3 N.C.	-	-
866A's	4 heater	*2.5 ac	115K

TUBE SOCKET	PINS	VOLTS	OHMS
XV305	1 heater	3.15 ac	0.5
XV306	2 N.C.	-	-
811A's	3 grid	-9	115
	4 heater	3.15 ac	0.5

TUBE SOCKET	PINS	VOLTS	OHMS
XV307	1 N.C.	-	-
OC3/VR105	2 cathode	0	0
	3 jumper	-160	0.3
	4 N.C.	-	-
	5 plate	0	Infinite
	6 N.C.	-	-
	7 jumper	-160	0.3
	8 N.C.	-	-

TUBE SOCKET	PINS	VOLTS	OHMS
XV308	1 N.C.	-	-
OD3/VR150	2 cathode	0	Infinite
	3 jumper	-160	0.3
	4 N.C.	-	-
	5 plate	0	Infinite
	6 N.C.	-	-
	7 jumper	-160	0.3
	8 N.C.	-	-

TUBE SOCKET	PINS	VOLTS	OHMS
XV309	1 N.C.	-	-
OD3/VR150	2 cathode	0	Infinite
	3 jumper	-160	1100
	4 N.C.	-	-
	5 plate	0	Infinite
	6 N.C.	-	-
	7 jumper	-160	1100
	8 N.C	-	-

TUBE SOCKET	PINS	VOLTS	OHMS
XV310	1 N.C.	-	-
OD3/VR150	2 cathode	0	Infinite
	3 jumper	-160	1100
	4 N.C.	-	-
	5 plate	0	Infinite
	6 N.C.	-	-
	7 jumper	-160	1100
	8 N.C.	-	-

TUBE SOCKET	PINS	VOLTS	OHMS
XV311	1 N.C.	-	-
OD3/VR150	2 cathode	0	Infinite
	3 jumper	-160	1100
	4 fil. C.T.	0	0.5
	5 plate	-8	130K
	6 N.C.	-	-
	7 jumper	-160	1100
	8 N.C	-	-

Measured between pins 1 and 4. Leave high voltage off.

TABLE 5

VIKING 500 POWER SUPPLY

TYPICAL TERMINAL RESISTANCE MEASUREMENTS

Disconnect power source and all cables. Resistance values should be within plus or minus 20% of the stated values. Measure from the prescribed terminals to the chassis. These terminals are available from outside the chassis. Refer to Figure 4.

Terminal	Resistance
NOTE: Press armature of the AC relay, RY301, to close its contacts while checking terminals 7 and 8 of TS301.	
All terminals of TS301	Infinite
NOTE: J301 is numbered clockwise when viewed from outside of the chassis.	
Pins 1, 2, 3, 4, 5, 6, 7 of J301	Infinite
Pin 8 of J301	0
NOTE: J305 is numbered counter-clockwise when viewed from outside of the chassis.	
Pin 1 of J305	Infinite
Pin 2 of J305	Infinite
Pin 3 of J305	Infinite
Pin 4 of J305	Infinite
Pin 5 of J305 (with VR tubes installed)	More than 50,000 ohms (capacitor charges)
Pin 6 of J305	More than 50,000 ohms (capacitor charges)
Pin 7 of J305	Infinite
Pin 8 of J305	More than 300,000 ohms (capacitor charges)
Pin 9 of J305	0

	With SW302 Open	With SW302 Closed
J302 (yellow)	158,000 ohms	38,000 ohms
J303 (red)	120,000 ohms	0 ohms
J304 (blue)	120,000 ohms	125 ohms

Check circuits of 4 pole relay, RY302. Resistance values should be within ± 20% of the stated values. To put RY302 in the "operated" position, press on its armature being very careful not to touch the contacts. "NC" means normally closed. "NO" means normally open.

To Check RY302 Contacts	Measure Between	Resistance With RY302 Normal	Resistance With RY302 "Operated"
9-10 NC	Term 1 and 2 of TS301	0	Infinite
7-8 NO	Term 3 and 4 of TS301	Infinite	0
5-6 NO	Term 5 and 6 of male Connector, J301	Infinite	0
3-4 NO	Term 6 of female connector J305 and Term 7 of socket, XV311	10,000 ohms	5,000 ohms

TABLE 6

VIKING 500 RF UNIT

TYPICAL TERMINAL RESISTANCE MEASUREMENTS

Measured with 20,000-ohms-per-volt meter from the prescribed terminal to chassis. All cables disconnected. Resistances value should be within plus or minus 20%.

Set controls:

DRIVE	0	OSCILLATOR	VFO
TUNE-OPERATE	TUNE	STANDBY	ZERO
POWER	ON	MODE	AM
METER	COUNTER-CLOCK-WISE	RESET	PRESSED IN
		Regulator adj	clockwise

Terminal	Resistance (ohms)
a. J104 (Yellow Tip Jack)	Infinite
J105 (Red Tip Jack)	Infinite
J106 (Blue Tip Jack)	Infinite

b. NOTE: Terminals of J110 (noval male) are numbered clockwise viewed from outside.

Pin 1 of J110	Infinite
Pin 2 of J110	Infinite
Pin 3 of J110	Infinite
Pin 4 of J110	Infinite
Pin 5 of J110	Infinite
Pin 6 of J110	1260
Pin 7 of J110	0.33
Pin 8 of J110	25,000 (capacitor charges)
Pin 9 of J110	0

c. NOTE: Terminals of J109 (noval female) are numbered counter-clockwise viewed from outside.

Pin 1 of J109	68,000
Pin 3 of J109	165
Pin 4 of J109	165
Pin 5 of J109	0
Pin 6 of J109 STANDBY at Zero	0
Pin 6 of J109 STANDBY at Standby	18,400
Pin 9 of J109	-0

d. Terminal 1 of J107 (Mic connector)	Infinite
Terminal 2 of J107	Infinite
Between terminals 1 and 2 of J107	Infinite (Not to chassis)
Terminal 1 of J108 (Phono jack)	680

TABLE 7

TYPICAL TRANSFORMER AND CHOKE MEASUREMENTS

T101 - 22.1269 FILAMENT TRANSFORMER

Leads	Resistance (ohms)
Yellow to Red	0.02
Yellow to Red	0.02
Yellow to Yellow	0.02
Green to Green	0.05
Black to Black-White	0.13
Black to Black-White	0.13
Black to Black (plastic)	0.23
Black to Black (cloth)	1.42

T102 - 22.1270 DRIVER TRANSFORMER

Blue to Red	170
Yellow to Black	90
Green to Black	90
Yellow to Green	180

L141 - 22.1247 AUDIO CHOKE

Black to Black	900

T301 - 22.1266 POWER TRANSFORMER

		Voltage (normal cw operation)
Blue to Blue-Yellow	60	280 ac
Blue to Blue-Yellow	60	280 ac
Blue to Blue	120	560 ac
Green to Green-Yellow	0.04	3.2 ac
Green to Green-Yellow	0.04	3.2 ac
Green to Green	0.05	6.4 ac
Red to Red-Yellow	50	480 ac
Red to Red-Yellow	50	480 ac
Red to Red	100	960 ac
Yellow to Brown-Yellow	0.05	2.5 ac
Yellow to Brown-Yellow	0.05	2.5 ac
Yellow to Yellow	0.08	5.0 ac
Black to Black-White	0.02	1.2 ac
Black to Black-White	0.02	1.2 ac
Black to Black (Large)	0.02	2.4 ac
Black to Black (Small)	0.78	115 ac

Leads		Resistance (ohms)	Voltage (normal cw operation)
T302 - 22.1267	H. V. PLATE TRANSFORMER		
Red to Red-Yellow		100	2300 ac
Red to Red-Yellow		100	2300 ac
Red to Red		200	4600 ac
Black-Red to Black		0.4	115 ac
Black-White to Black-Green		0.4	115 ac
T303 - 22.1268-1 or 2	MODULATION TRANSFORMER		
Blue to Red		85	
Yellow to Red		85	
Blue to Yellow		170	
Green to Black		120	
L301 - 22.1263	BIAS CHOKE		
Black to Black		190	
L302 - 22.1264	LOW VOLTAGE CHOKE		
Black to Black		140	
L303 - 22.1265	HIGH VOLTAGE CHOKE		
Black to Red		30	

TABLE 8

TYPICAL GRID CURRENT DURING EXCITER ALIGNMENT

OSCILLATOR switch at "VFO". STANDBY switch at "ZERO". DRIVE control at "10". MODE switch at "AM".

BAND	DR. GRID	PA. GRID
80 Meters	0.8 MA	18. MA
40	0.35	13.5
20	3.0	19.
15	3.0	17.
10	1.3	13.
11	1.0	13.

TABLE 9

CRYSTAL FREQUENCIES

BAND	OUTPUT FREQUENCY	CRYSTAL FREQUENCY
80 Meters	3500 - 4000 KC	1750 - 2000 or 3500 - 4000 KC
40	7000 - 7300	3500 - 3650 or 7000 - 7300
20	14000 - 14350	3500 - 3587.5 or 7000 - 7175 or 14000 - 1435
15	21000 - 21450	3500 - 3575 or 7000 - 7150
10	28000 - 29700	3500 - 3712.5 or 7000 - 7425 or 1400 - 14850
11	26960 - 27230	3370 - 3403.75 or 6740 - 6807.5 or 13480 - 13615

NOTE: MARS operation. With crystal control the frequency range may be extended approximately 100 KC outside each end of each amateur band.

Viking 500

R. F. Unit - part #23.1190

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
22.1079	B101	1	Motor, 115 V 60 c AC
22.1358	B102	1	Fan blade, 4 blade 4" dia.
169-26-3	C101	1	Capacitor, dualvar.. type LA 1 9/32 shaft
160-107-51	C102,105,153	3	Capacitor, var. type 15M11, right hand
160-110-50	C103,140,144,145 160,164,165	7	Capacitor, var. type 20M11
160-107-50	C104	1	Capacitor, var. type 15M11, left hand
160-130-50	C106	1	Capacitor, var. type 30M8
22.827	C107,119,120,121 122,125,108,126 128-130,109,133 134,141,146,147 149,152,154,155 161,171-175,188-192,201,202,213 215-224,226,228-241	62	Capacitor, .005 mf GMV 500 V ceramic disc
22.1014	C110	1	Capacitor, 47 mmf ± 2 1/2% N150 500 V tubular ceramic
22.954	C111	1	Capacitor, 62 mmf ± 2 1/2% NPO 500 V tubular ceramic
22.804	C112,113	2	Capacitor, 500 mmf ± 2% 500 V silvered mica
22.805	C114,115,209,210	4	Capacitor, 1000 mmf ± 2% 500 V silvered mica
22.809	C116	1	Capacitor, 91 mmf ± 2 1/2% N 080 500 V tubular ceramic
22.823	C117	1	Capacitor, 140 mmf ± 2 1/2% NPO 500 V tubular ceramic
22.807	C118,163	2	Capacitor, 43 mmf ± 2 1/2% NPO 500 V tubular ceramic
22.4061-10	C123,203,166	3	Capacitor, 330 mmf ± 10% 500 V silvered mica
22.777	C124	1	Capacitor, 25 mmf ± 5% 500 V mica
22.4053-5	C127	1	Capacitor, 150 mmf ± 5% 500 V silver mica
22.4057-5	C148,151,159	3	Capacitor, 220 mmf ± 5% 500 V silvered mica
22.1026	C131,136	2	Capacitor, .22 mf ± 20% V tubular paper
22.1361	C132,135,204	3	Capacitor, 1000 mmf ± 10% 500 V mica
22.4037-5	C137,157	2	Capacitor, 33 mmf ± 5% 500 V silvered mica
169-26-2	C138,158	2	Capacitor, dual var., type LA 27/32 shaft
22.4029-10	C139	1	Capacitor, 15 mmf ± 10% 500 V silvered mica
22.4047-5	C142,162	2	Capacitor, 82 mmf ± 5% NPO 500 V silvered mica
22.4043-5	C143	1	Capacitor, 56 mmf ± 5% NPO 500 V silvered mica
22.1097	C150,207	2	Capacitor, .01 mf +80% −20 500 V ceramic disc
22.962-1	C156	1	Capacitor, 30 mf 450 V electrolytic, with mtg. strap
159-125-2	C168	1	Capacitor, var. 1.1-11 mfd type N-125
22.828	C167	1	Capacitor, .001 mf. ± 20% 1500 V.W. ceramic disc.

R. F. Unit - part #23.1190

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
22.1359	C169,170,176 183-185	6	Capacitor, 500 mmf 3000 VW ceramic disc
22.1050	C177,178,186,187	4	Capacitor, 1000 mmf + 20% 5000 V ceramic
152-903-3	C179	1	Capacitor, var. dual 150 and 50 mmf (CD70)
22.1362	C180	1	Capacitor, 200 mmf + 5% 5000 V ceramic
154-513-4	C181	1	Capacitor, var. dual 500 mmf type 500ED20
22.768	C205,206,208,211 212	5	Capacitor, 0.1 mf 400 V tubular paper
22.1360	C214	1	Capacitor, 10 mf 50 V electrolytic with mtg. strap
16.1327	BKT124	1	"U" bracket
16.82-24	BKT123	2	Bracket, VFO stiffener
16.1190-6	CH117	1	Strap, capacitor grounding
17.970	CH101	1	Chassis, RF
17.853-2	CH102,103	2	Rails, Chassis
23.1125-3	CH104	1	Front panel
17.971-1	CH105	1	Bottom plate, PA unit
23.1128-2	CH106	1	Cabinet assembly
23.1182	FB101	1	Filter board assembly
17.1020	SH101	1	Shield, left exciter
17.1021	SH102	1	Shield, right exciter
17.1022	SH103,104	2	Shield, short exciter
17.1025	SH105	1	Shield, filter
23.1249	SH106	1	Shield, PA front assembly
22.1228-2	SH107	1	Terminal cover, 2" x 2" x 1 1/4"
16.1165-4	BKT101	1	Bracket, exciter band switch
16.1165-2	BKT102	1	Bracket, mode switch
16.1165-3	BKT103	1	Bracket, L section band switch mtg.
16.1167-1	BKT104	4	Bracket, VFO capacitor mtg.
16.1167-3	BKT105	8	Bracket, exciter capacitor mtg.
16.1001-7	BKT106	1	Bracket, Power switch mtg.
17.1024	BKT108	1	Bracket, PA band switch shaft
16.1273-1	BKT110-112	3	Bracket, pulley short
16.1273-2	BKT113	1	Bracket, pulley long
16.1165-5	BKT114	1	Bracket, PA interlock
16.1001-4	BKT115-117	3	Bracket, control mounting
16.1265	BKT118	1	Bracket, PA HV shorting switch
22.1182-2	BKT119,120	2	Bracket, meter shield
16.994	BKT121	2	Bracket, neut. capacitor mtg.
16.82-22	BKT122	2	Bracket, exciter shield
16.1188	CH107	1	Strap - PA screen
16.1321	CH110	1	Strap - PA band switch common
16.1279	CH111	1	Blade, HV shorting switch
18.699	CH112	1	VFO phenolic plate

Viking 500

R. F. Unit

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
17.855	CH113	1	VFO sub chassis
17.971-2	CH115	1	Bottom plate, exciter
17.846-3	SH108	1	VFO shield wrap-around
17.820	SH109	1	VFO top
17.819	SH110	1	VFO side cover
22.1181-2	SH111,112	2	Shield, meter
22.948-2	SH113,114	2	Shield, noval socket
17.1028	SH115	1	Shield, PA rear
17.969	SH116	1	Cover, PA shield
18.638-2	D101	5	Shaft, VFO trimmer
104-264-3	D102	2	Shaft coupler, insulated, 1/4 to 3/16, less set screws
104-262-15	D103	3	Shaft coupler, large insulated, 1/4 to 1/4, less set screws
22.950	D104	1	Coil and core holder 6-32, 3/8 dia.
22.1171	D105	4	Coil and core holder 4-40, 3/8 dia.
22.1172	D106	5	Coil and core holder 6-32, 1/2 dia.
22.1169	D107	9	Pulley, idler 1/2" S.D. x 5/8 O.D.
23.1199	D108	1	Pulley and shaft assembly (1 1/4 S.D.)
23.909-4	D109	4	Pulley assembly, 1 3/4 S.D., outside hub, 1/4 bore less set screws
23.909-5	D110	3	Pulley assembly, 1 3/4 S.D., inside hub, 1/4 bore less set screws
23.909-3	D111	1	Pulley assembly, 1 3/4 S.D., outside hub, 3/16 bore less set screws
23.1159	D112	1	Pulley assembly, 2 1/2 S.D., inside hub, 1/4 bore less set screws
22.1356	D113	1	Index 3 1/2" shaft PA band switch Pi
22.1357	D114	1	Index, 1 1/4" shaft L section band switch
22.1272	D115	10	Spring, tension, dial cord
22.1275	D116	1	Spring, tension, shorting switch
14.510	D117	1	Cam, VFO band switch
23.1059	D118	1	Drive arm, VFO band switch
23.1062	D119	1	Planetary drive assembly
17.858-4	D120	1	Dial escutcheon
22.993-2	D121	1	Dial plate
23.1064	D122	1	Dial pointer
23.564-56	D123	2	Jewel, red, black oxide finish
13.123-7	D124	1	Panel bearing, 3/8-32 x 3/8 long x .252 I.D.
13.123-12	D125	2	Panel bearing, 3/8-32 x 3/8, counterbored
42.49-148	D126	25 ft.	Dial cord, .040 nylon
16.1052	D127	5	Spring, VFO trimmer shaft coupling
23.1047	D129	2	Pilot light assembly, snap-in type
16.1062	D130	12	"C" washer
23.907-13	D131	1	Knob dial, 1 1/2" (10-0)

Part No. or Drawing No.	Item No.	Qty.	Description
23.907-14	D132	1	Knob dial 1 1/2" (Single index)
23.980-12	D133	1	Knob, 1 5/8" 2 tapped holes, nylon peg
32.46-13	D134	1	Knob, 2 3/8" tapped for 1 set screw - no nylon peg
23.1240	D135	1	Knob, 2 3/8", tapped for 2 set screws, nylon peg
23.1241	D136	1	Knob, 1 5/8" with crystal plug, nylon peg
23.1102	D137	1	Knob, pointer (meter switch)
22.600-10	D138	1	Wrench, No. 10 hex
42.49-140	D139	4 ft.	Lacing twine, No 4 waxed
22.1372	D140	1	Knob, black rectangular, for lever switch
13.883	D141	3	Control guard
23.980-11	D142	4	Knob, 1 5/8, 1 tapped hole, nylon peg
22.600-8	D143	1	Wrench, #8 hex
23.1212-1	E101,102	2	Parasitic suppressor, assembly, 1/2 W
23.912-4	E103,104	2	Parasitic suppressor, assembly, 1 W
23.1263	E105	1	Parasitic suppressor, assembly, 8 W
133-278-10	E106	1	Tube shield, medium 9 pin miniature
16.35-1	E107	1	Plate cap, .360 I.D. (807)
13.904-3	E108	1	Plate connector, finned (4-400 A)
22.1210-1	E109	4	Core, Iron, .245 x 1/2
22.1210-3	E110	5	Core, Iron, .370 x 5/8
22.747	E111	1	Hood, Coax UG-106/U for RG-8/U
18.36-7	E112	4	Bushing, fiber shoulder, 5/8 O.D. x 17/64 I.D. x 3/8 L for meter shield
32.56-2	E113	7	Bushing, nylon, red less nut
29.211-4	E114	8	Bushing, shoulder, .312/.318 Collar O.D., .250/.260 I.D., 1/2 shoulder O.D. gray fiber
10.19-1	E115	1	Insulator, 1" conical steatite, less hardware
10.19-5	E116-122,125	8	Insulator, 5/8" conical steatite, less hardware
10.19-3	E123,124	2	Insulator, 2" conical steatite, less hardware
22.1309	E126	1	Hood, coaxial, UG 177/U for RG-59/U
133-278-11	E127	1	Tube shield, tall 9 pin miniature
22.1475-2	G101	4	Foot, polyethylene
22.113-5	G102	5	Grommet, 11/32 O.D. x 1/8 I.D.
22.113-1	G103	11	Grommet, 9/16 O.D. x 5/16 I.D.
22.1170	G104	2	Grommet, 3/4 O.D. x 7/16 I.D.
22.535-1	G105	3	Grommet, 7/8 O.D. x 9/16 I.D.
71.43-097	G106	63 in.	Gasket, 3/16 rd. Metalex
22.994	G107	26 in.	Gasket, rubber
22.995	G108	4 in.	Rubber light block
23.1238	H101	1	Harness, R. F.
22.45-2	HW184	1	Cable Clamps, 1/2" steel
11.951-13 7/8	HW104	4	Screw 10-24 x 13 7/8 NPS truss head (cabinet tie bolt)

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
17.301-3	HW182	1	Cable clamp, 1/4" steel
22.1276-4	HW183	2	Cable clamp, 1/4" nylon
14.34-24	HW186	2	Spacer, aluminum, 3 5/16 L x 5/16 O.D., tapped 8-32
13.155-112	HW187	11	Spacer, .125 O.D. x .089 I.D. x .135 long (for idler pulley)
13.49-6	HW188	2	Spacer 3/8 O.D. x .195 I.D. x .551 long (for fan motor)
13.49-9	HW190	2	Spacer, aluminum 1/2" L. x 3/8 O.D. (VFO sub chassis)
13.49-19	HW191	4	Spacer, aluminum 1/4" L. x 3/8" O.D. x .195 I.D. for PA socket
14.31-64	HW192	4	Post, aluminum 2 1/8 L. x 1/4 O.D., tapped 6-32
14.31-65	HW193	4	Post, aluminum 2 15/16 L. x 1/4 O.D., tapped 6-32
14.31-62	HW194	2	Post, aluminum 1 3/8 L. x 1/4" O.D., tapped 6-32
22.1276-6	HW185	2	Cable clamp, 3/8" nylon
22.377	I101,102	2	Pilot lamp 6V, bayonet base #51
22.21	I103	1	Pilot lamp 120V, candelabra base #6S6
22.980	J101	1	Key jack, open circuit
22.746	J102,103	2	Coaxial receptacle type SO-239
105-607	J104	1	Tip jack, yellow nylon
105-602	J105	1	Tip jack, red nylon
105-610	J106	1	Tip jack, dark blue nylon
22.979	J107	1	Micreceptacle, 2 contact, chassis mtg.
22.1096	J108	1	Phono jack, single
22.977	J109	1	Socket, noval mica filled phenolic
22.1326	J110	1	Receptacle, male noval with mtg. plate
23.968-2	L101	1	Coil assembly, VFO grid
22.844-2	L102	1	Choke, RF single pi, 51 microhenries
22.951	L103,128	2	Choke, RF 4 pi, 2.5 millihenries
22.844-3	L104	1	Choke, RF, 1 pi 100 microhenries
22.844-1	L105,111	2	Choke, RF, 1 pi 200 microhenries
22.1193	L106,119,120 121	4	Choke, RF 3 pi 2.4 millihenry
22.949	L107	1	Coil Assembly, buffer plate
23.1175-2	L108	1	Coil Assembly, 28 mc multiplier plate
23.1175-3	L109	1	Coil Assembly, 21 mc multiplier plate
23.1175-5	L110	1	Coil Assembly, 14 mc multiplier plate
23.1175-9	L112	1	Coil Assembly, 3.5 mc multiplier plate
23.1175-14	L113	1	Coil Assembly, 28 mc driver plate
23.1175-13	L114	1	Coil Assembly, 21 mc driver plate
23.1175-12	L115	1	Coil Assembly, 14 mc driver plate
23.1175-11	L116	1	Coil Assembly, 7 mc driver plate

Viking 500

R.F. Unit

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
23.1175-10	L117	1	Coil Assembly, 3.5 mc driver plate
23.1085-2	L122	1	Choke Assembly PA plate
23.1235	L123	1	Coil Assembly, 28 mc PA plate
23.1236	L124	1	Coil Assembly, 14-21 mc PA plate
236-521	L125	1	Coil Assembly, 3.5-7 mc PA plate
23.1237	L126	1	Coil Assembly, L section
102-752	L127	1	Choke, RF static drain
Fabricated by Customer for Kits	L129-133,135, 137-140,142-164	REF	Choke RF, 19 turns #18 enameled copper 3/8 I.D. See W104
22.1247	L141	1	Audio reactor, 4HY ± 5%
22.1165	M101	1	Meter 5 MA DC 100 MV, scales 0-10,0-20 0-300
22.1166	M102	1	Meter 0-500 MA DC
22.5097-10	R101,115,151,157	4	Resistor, 100 K ohm ± 10% 1/2 W
22.5019-10	R102	1	Resistor, 56 ohm ± 10% 1/2 W
22.5053-10	R104	1	Resistor, 1500 ohm ± 10% 1/2 W
22.5081-10	R105,108,112	3	Resistor, 22 K ohm ± 10% 1/2 W
22.7079-10	R106	1	Resistor, 18 K ohm ± 10% 2 W
22.5041-10	R107,122,119	3	Resistor, 470 ohm ± 10% 1/2 W
22.1115	R109	1	Potentiometer, 100 K ohms ± 20% 1/2 W linear comp.
22.5121-10	R110,146	2	Resistor, 1 megohm ± 10% 1/2 W
22.5079-10	R111	1	Resistor, 18 K ohm ± 10% 1/2 W
22.5093-10	R117	1	Resistor, 68 K ohm ± 10% 1/2 W
22.5109-10	R137,153	2	Resistor, 330 K ohm ± 10% 1/2 W
22.6093-10	R140	1	Resistor, 68K ohm ± 10% 1 W
22.5065-10	R113-14	2	Resistor, 4700 ohm ± 10% 1/2 W
22.5085-10	R118	1	Resistor, 33 K ohm ± 10% 1/2 W
22.7065-10	R120	1	Resistor, 4700 ohm ± 10% 2 W
22.5089-10	R121,152,160	3	Resistor, 47 K ohm ± 10% 1/2 W
22.5083-10	R123	1	Resistor, 27 K ohm ± 10% 1/2 W
22.8056-5	R126	1	Resistor, 20 ohm ± 5% 1/2 W WW
22.7025-10	R128,129	2	Resistor, 100 ohm ± 10% 2 W
22.6033-10	R130	1	Resistor, 220 ohm ± 10% 1 W
22.7061-10	R125,132	2	Resistor, 3300 ohm ± 10% 2 W
22.732-2	R133	1	Potentiometer, 25K ohm ± 10% 4 W WW linear
22.8025-5	R134,143	2	Resistor, 1 ohm ± 5% 1/2 W WW
22.8873-10	R135	1	Resistor, 510 ohm ± 10% 10 W WW
22.8906-10	R136	1	Resistor, 12 K ohm ± 10% 10 W WW
22.5105-10	R148,155,159	3	Resistor, 220 K ohm ± 10% 1/2 W
22.5101-10	R138	1	Resistor, 150 K ohm ± 10% 1/2 W
22.8045-5	R139	1	Resistor, 6.8 ohm ± 5% 1/2 W WW
22.7117-5	R141	1	Resistor, 680 K ohm ± 5% 2 W
22.1349	R142	1	Potentiometer, 50 K ohm ± 20% 1/4 W linear composition

Viking 500

R. F. Unit

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
22.8904-10	R144	1	Resistor, 10 K ohm ± 10% 10 W WW
22.5073-10	R145	1	Resistor, 10 K ohm ± 10% 1/2 W
22.5113-10	R147,161	2	Resistor, 470 K ohm ± 10% 1/2 W
22.1195	R149	1	Potentiometer, 1 megohm ± 30% 1/4 W log taper A comp.
22.5045-10	R150	1	Resistor, 680 ohm ± 10% 1/2 W
22.1290	R154	1	Potentiometer, 100 K ohm ± 30% 2 W linear comp.
22.5107-10	R156	1	Resistor, 270 K ohm ± 10% 1/2 W
22.8877-10	R162	1	Resistor, 750 ohm ± 10% 10 W WW
22.5055-10	R163	1	Resistor, 1800 ohm ± 10% 1/2 W
22.1367	R165	1	Potentiometer, 20 ohm ± 10% 2 W linear WW
22.7021-5	R166	1	Resistor, 68 ± 5% 2 W
22.6019-10	R167	1	Resistor, 56 ohm 1 W
22.1348	R168	1	Resistor, 1200 ohm ± 10% 35 W WW 4" long, 3 adjustable contacts with mtg. bkts.
22.8013-5	R169	1	Resistor, 0.3 ohm ± 5% 1/2 W WW
22.1237	RY101	1	Relay, latching, mechanical reset, 1B contact 20 ohm coil pull-in 150 MA DC
22.988	SW101	1	Switch, VFO-band, 3 pos., 1 section
22.1350	SW102	1	Switch, XTAL-VFO, 3 pos., 1 section
22.1351	SW103	1	Switch, exciter band, 6 pos., 3 pole 3 section
23.1165	SW104A	1	Switch, PA band, Pi Sec., 6 pos., 1 section (less index)
23.1166	SW104B	1	Switch, PA band, 3 pos., 1 section (less index)
23.1164	SW105	1	Switch, PA band, L Sec., 6 pos., 1 section (less index)
22.847-2	SW107	1	Switch, meter, 6 pos. 2 pole phenolic
22.1352	SW108	1	Switch, mode, 3 pos. 8 pole 3 deck (master)
22.1353	SW109	1	Switch, mode, 3 pos. 2 pole 1 deck (slave)
22.1354	SW110	1	Switch, standby, 3 pos. 2 pole lever, less knob
22.1355	SW111	1	Switch, tune-operate, 2 pos. 1 pole 1 section
22.1273	SW112	1	Switch, interlock momentary SPST N.O. 3 amp. 250 V.
22.1066	SW113	1	Switch, power, locking SPST 3 amp. 250 VAC with keys
22.1269	T101	1	Transformer, filament
22.1270	T102	1	Transformer, driver, 4W
22.837	TS107,113,121 122,110	5	2 terminal strip
22.740-3	TS104,123,124	3	3 terminal strip
22.740-4	TS114	1	4 terminal strip
22.740-5	TS111,112	2	5 terminal strip
22.740-6	TS106,116,117	3	6 terminal strip
22.740-8	TS101-103,105, 108,109,115, 118,120	9	8 terminal strip

R. F. Unit

Parts List
(Cont'd)

Part No. or Drawing No.	Item No.	Qty.	Description
22.780	V101,111	2	Electron tube type 6AU6
22.787	V102	1	Electron tube type OA2
22.1118	V103,104	2	Electron tube type 6CL6
22.1248 or	V105	1	Electron tube type 5763
22.1751(22.1243)	V106	1	Electron tube type PL-175A (or 4-400A)
22.916	V107	1	Electron tube type 12AU7
22.783	V108	1	Electron tube type 807
22.915	V109	1	Electron tube type 12AX7
22.786	V110	1	Electron tube type 6AL5
22.1250	V112	1	Electron tube type 6B4G
71.32-170	W101	9 3/4 in.	Coaxial cable RG-8/U
71.32-178	W102	6 in.	Coaxial cable RG-59/U
22.997	W105	1 pc.	Dowel, 3/8 dia. wood
23.631	XI103	1	Socket, H.V. pilot lamp
22.975	XV101,102,110,111	4	Socket, 7 pin miniature mica filled
22.976	XV103,107	2	Socket, 9 pin miniature mica filled
122-275-1	XV106	1	Socket, giant 5 pin steatite wafer
22.1449	XV104,105,109	3	Socket, 9 pin miniature, phenolic, with shield cup
22.1363	XV108	1	Socket, 5 pin black phenolic
22.849-2	XY101,XV112	2	Socket, octal mica filled phenolic
1 envelope			#2 hardware
1 envelope			#4 hardware
1 envelope			#6 hardware
1 envelope			#8 hardware
1 envelope			#10 hardware
1 envelope			Set screws
1 envelope			Miscellaneous hardware
1 package			Miscellaneous wire and tubing

Power Supply - part #23.1191

Parts List

Part No. or Dwg. No.	Item No.	Qty.	Description
22.1252	C301	1	Capacitor, 30 mf 150 V electrolytic with mtg. strap
22.962-1	C302	1	Capacitor, 30 mf 450 V electrolytic with mtg. strap
22.1298-2	C303-307,315	6	Capacitor, 80 mf 450 VW electrolytic less mtg. strap
22.827	C308-314	7	Capacitor, .005 mf GMV 500 V disc ceramic
17.950	CH301	1	Chassis, power supply
17.953	CH302	1	Terminal strip shield
17.954	CH303	1	Bottom plate
23.1161	CH304	1	Cover assembly
23.1186	CH305	1	Barrier assembly
16.1267	CH306	1	Plate, rectifier mtg.
18.737	CH312	1	Board, capacitor mtg.
16.1197-2	CH307	1	Feeler gage .018"
16.1281	BKT301	1	Bracket, interlock switch
16.1268	BKT302	1	Bracket, shorting switch
16.1279	E312	1	Blade, shorting switch
23.1074-1	E313	1	Ball gap assembly
23.1074-2	E314	1	Ball gap assembly
16.51-5	E301-304	4	Plate clip, 9/16 dia.
10.19-1	E305-311	7	Insulator, 1" steatite conical
22.1311	F301	2	Fuse 1 1/2 amp. slow-blow 125 V Buss type MDL-1 1/2
22.1371	F302	2	Fuse 4 amp. medium lag 250V, Buss type MTH-4
22.840	F303,304	4	Fuse 8 amp. medium lag 250V, Buss type MTH-8
23.1250	H301	1	Harness, power supply
22.1275	HW349	1	Steel tension spring 1" long x 3/16 O.D.
22.113-1	HW350	4	Rubber grommet 9/16 O.D. x 5/16 I.D.
22.825	HW353	1	Foot, rubber
22.1258	HW354	2	Chest handle, bright nickel
42.49-140	HW356	30 ft.	Twine, waxed cabling #4
14.31-4	HW359	7	Post, 1 5/8" x 1/4" dia. tapped 6-32 aluminum
13.49-32	HW360	2	Spacer, 2" x 3/8 O.D. x .195 I.D. aluminum
22.1276-4	HW362	1	Cable clamp, 1/4" nylon
22.1475-2	HW357	4	Foot, polyethylene
22.850	J301	1	Receptacle male octal less cover, with ring and plate assembly, black phenolic
105-607	J302	1	Jack, yellow nylon tip
105-602	J303	1	Jack, red nylon tip
105-610	J304	1	Jack, dark blue nylon tip
22.977	J305	1	Socket, noval
22.1260	RY301	1	Relay, 2A contacts 10 amp. coil 115 VAC
22.1261	RY303	1	Relay, 2A contacts 10 amp. coil 120 VDC 10,000 ohms.

Viking 500

Power Supply

Parts List
(cont'd)

Part No. or Dwg. No.	Item No.	Qty.	Description
22.1262	RY302	1	Relay, 3A 1B contacts 1 amp., slow release, coil 120 VDC 10,000 ohms
22.1263	L301	1	Choke, 8 hy. 150 ma.
22.1264	L302	1	Choke, 10 hy. 225 ma.
22.1265	L303	1	Choke, 5-25 hy. 450 ma.
22.7051-10	R301	1	Resistor, 1200 ohm ± 10% 2 W carbon
22.1370	R303	1	Resistor, 20,000 ohm adj. 100 watt WW with mtg. brkts.
22.1271	R304	1	Resistor, 20,000 ohm ± 10% 100 watt WW with mtg. brkts.
22.833	R305-310	6	Resistor, 20,000 ohm ± 10% 20 watt WW with leads
22.1273	SW301	1	Switch, push N.O. momentary SPST 3 amp. 250 V
22.1266	T301	1	Transformer, 350 V power
22.1466-2	T302	1	Transformer, 2000 V plate
22.1268-1 or -2	T303	1	Transformer, modulation
22.1259-12	TS301	1	12 terminal strip
22.790-62	TS302	1	Marker strip, 1-12
22.1123	V301	1	Electron tube, 6AX5GT
22.1104	V302	1	Electron tube, 5U4GA
22.212	V303,304	2	Electron tube, 866/866A
22.1251	V305,306	2	Electron tube, 811A
22.1110	V307	1	Electron tube, OC3/VR105
22.1109	V308-311	4	Electron tube, OD3/VR150
22.739-2	XF301-304	4	Post, fuse extractor
22.1274	XV301,302, 307-311	7	Socket, octal mica filled phenolic
122-224-1	XV303-306	4	Socket, 4 pin steatite wafer
1 envelope			#4 hardware
1 envelope			#6 hardware
1 envelope			#8 hardware
1 envelope			#10 hardware
1 envelope			Miscellaneous hardware
1 package			Miscellaneous wire and tubing

Viking 500

Audio Cable - part #23.1188

Parts List

Part No. or Dwg. No.	Item No.	Qty.	Description
22.978	P109	1	Receptacle, male noval, mica filled, with shell
22.896	P301	1	Receptacle, female octal, phenolic, with shell
71.32-207	W401	8 ft.	Cable 4 #22 1 pair shielded, stranded copper, plastic insulation, plastic sheath

Power Cable - part #23.1187

Part No. or Dwg. No.	Item No.	Qty.	Description
22.1327-2	P110	1	Receptacle, female noval, with shell
22.978	P305	1	Receptacle, male noval, mica filled, with shell
71.32-208	W501	8 ft.	Cable, 2 #18, 7 #22 stranded copper, plastic insulation in plastic sheath

H. V. Cable Assembly - part #23.1189

Part No. or Dwg. No.	Item No.	Qty.	Description
105-307	P104,302	2	Plug, yellow nylon
105-302	P105,303	2	Plug, red nylon
105-310	P106,304	2	Plug, dark blue nylon
23.1251	W601	1	Cable assembly 3 #20, 10 kv. shielded, 8 ft. long.

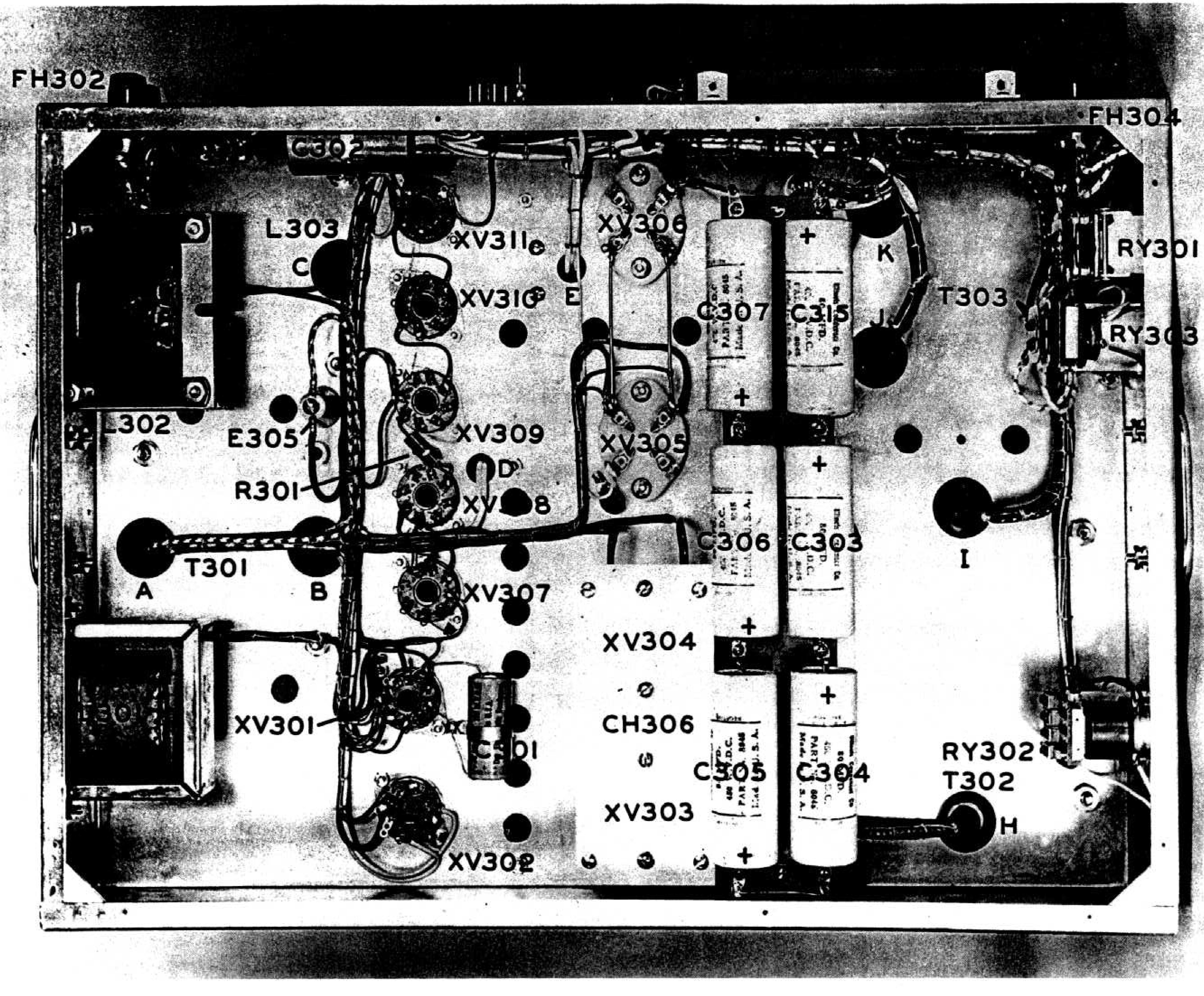


Figure 3: Bottom View of Completed Chassis

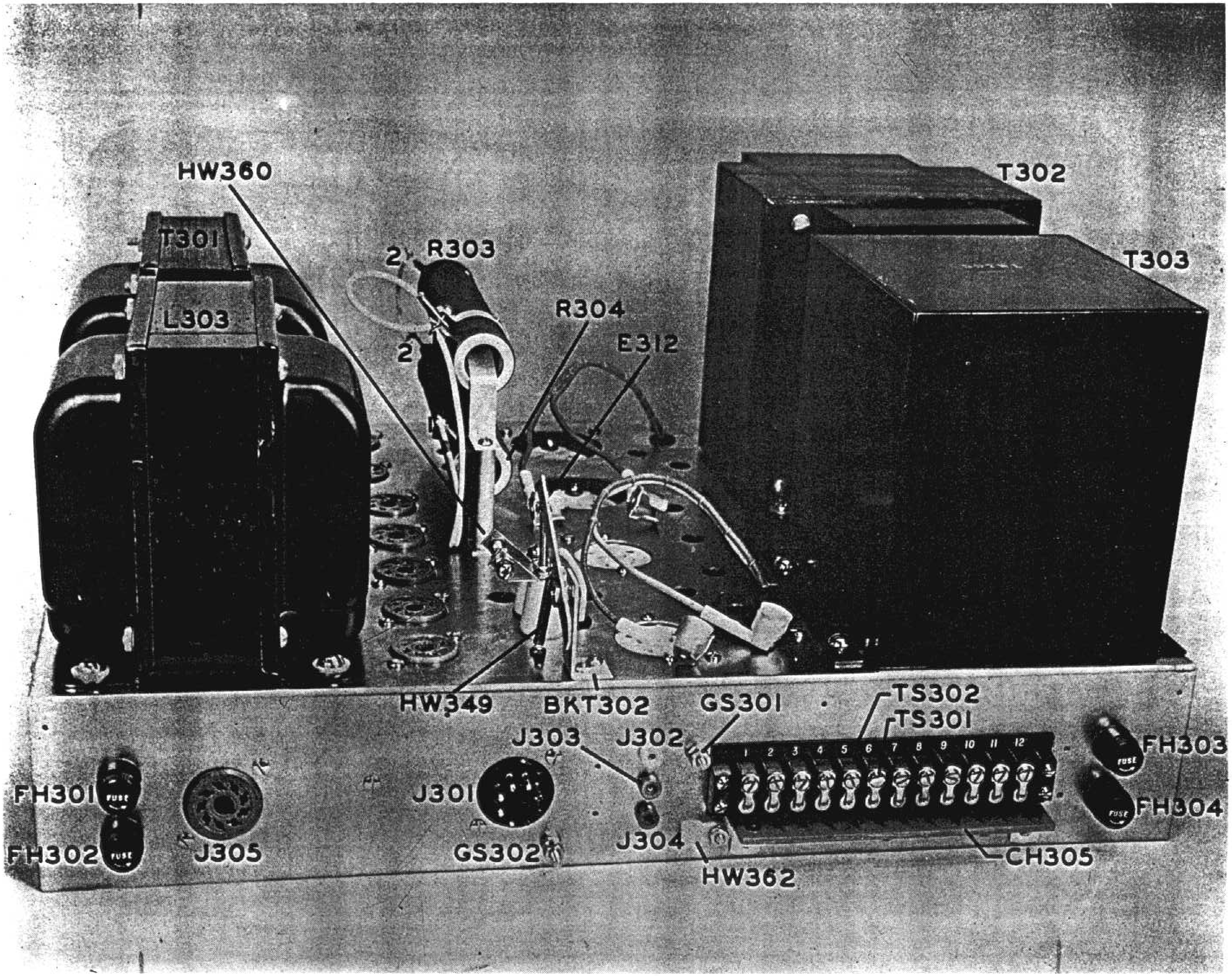


Figure 4: Rear Top Angle View of Completed Chassis

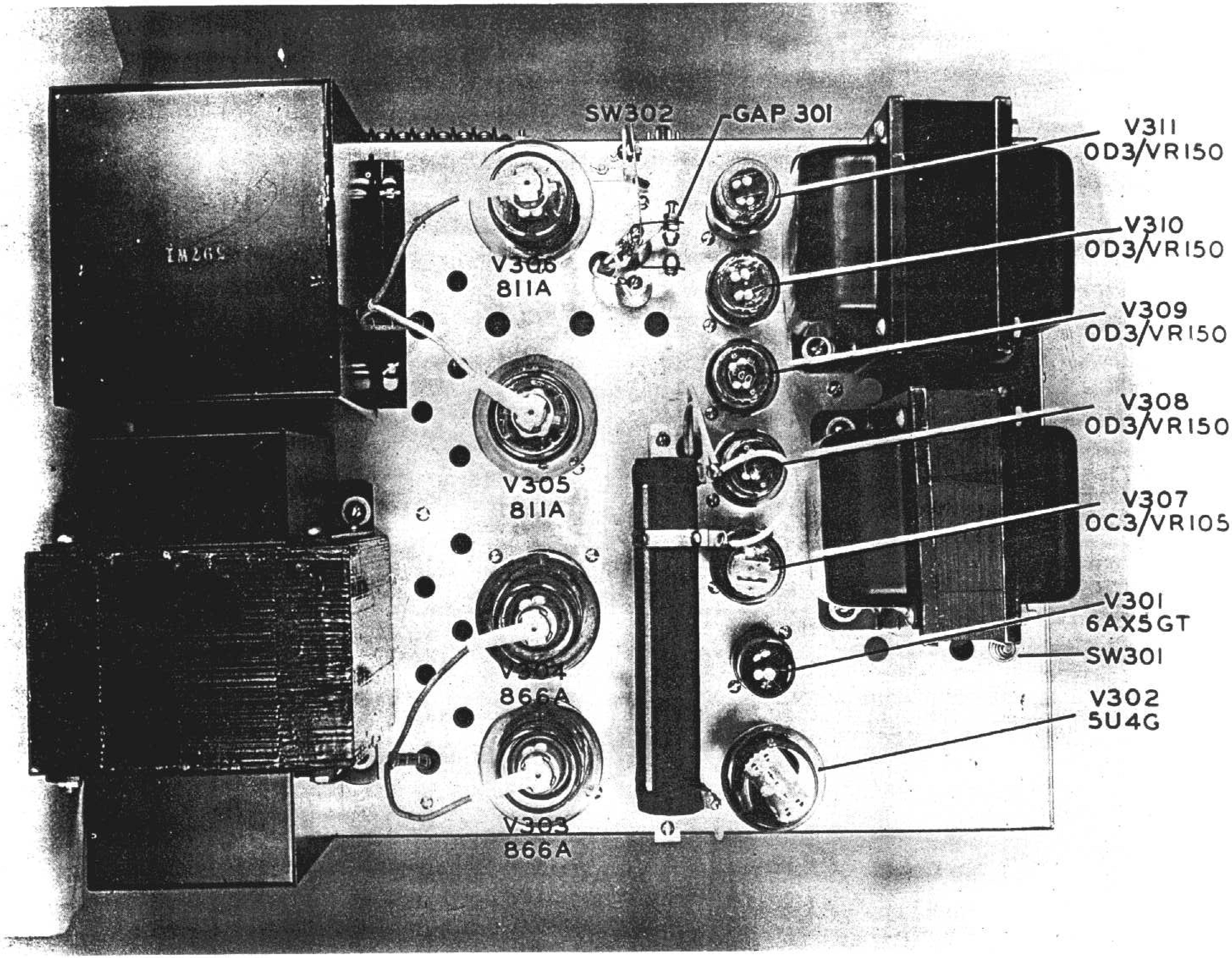


Figure 5. Top View of Completed Chassis Showing Tube Placement

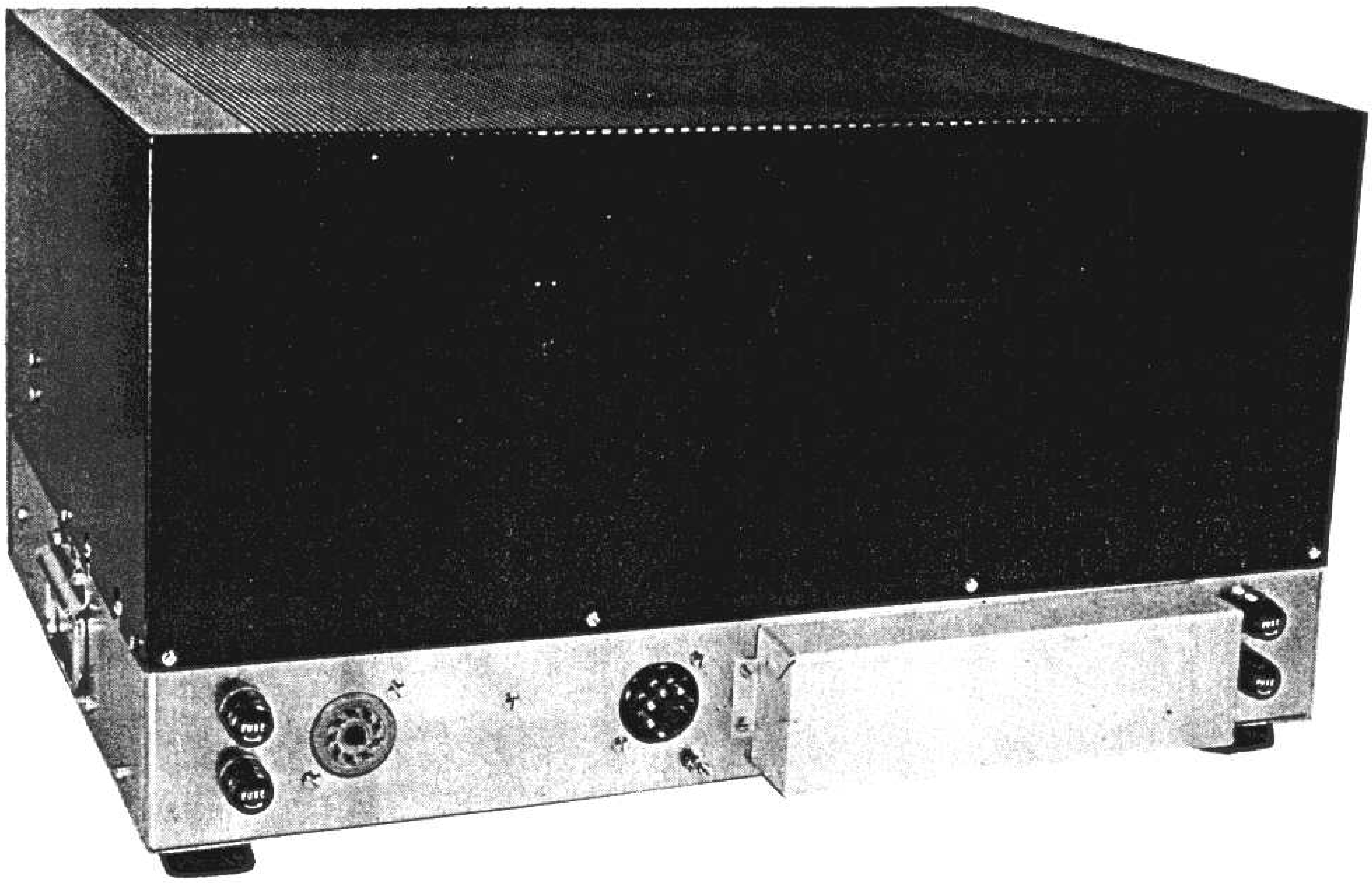


Figure 8, Rear View of Power Supply with Covers

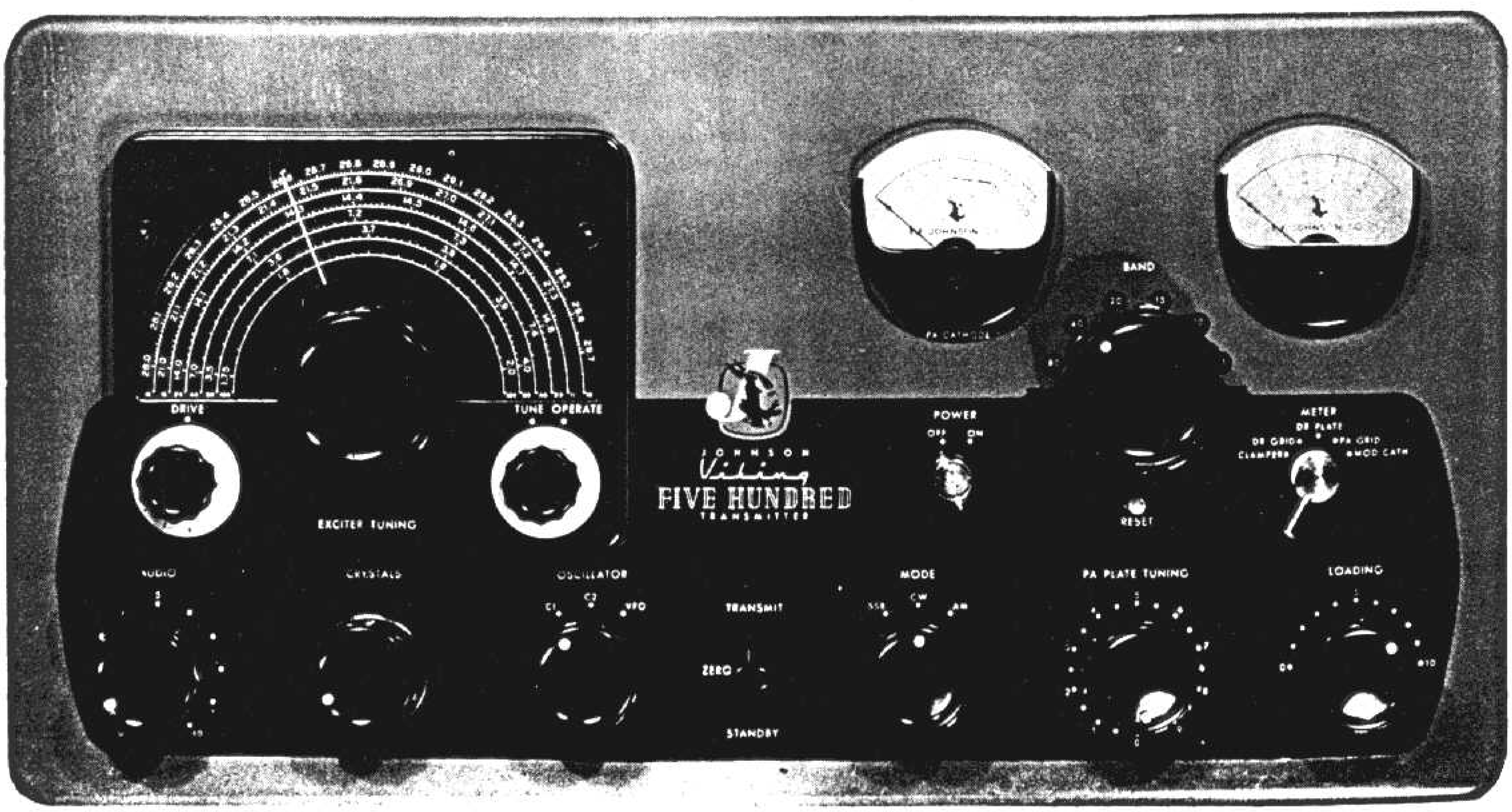


Figure 9, Front Panel of RF Unit

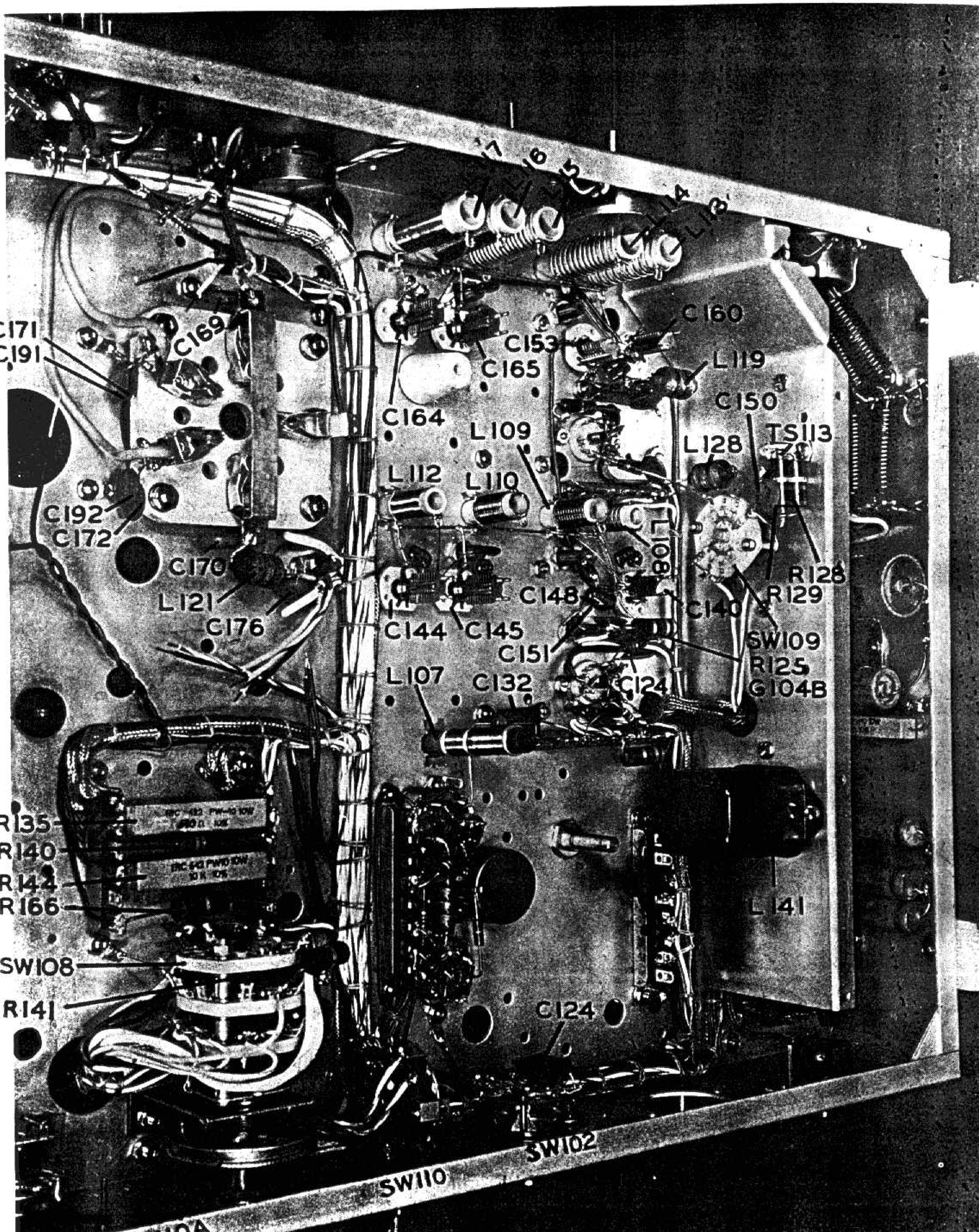


Figure 10, Exciter Wiring, Bottom Angle View.

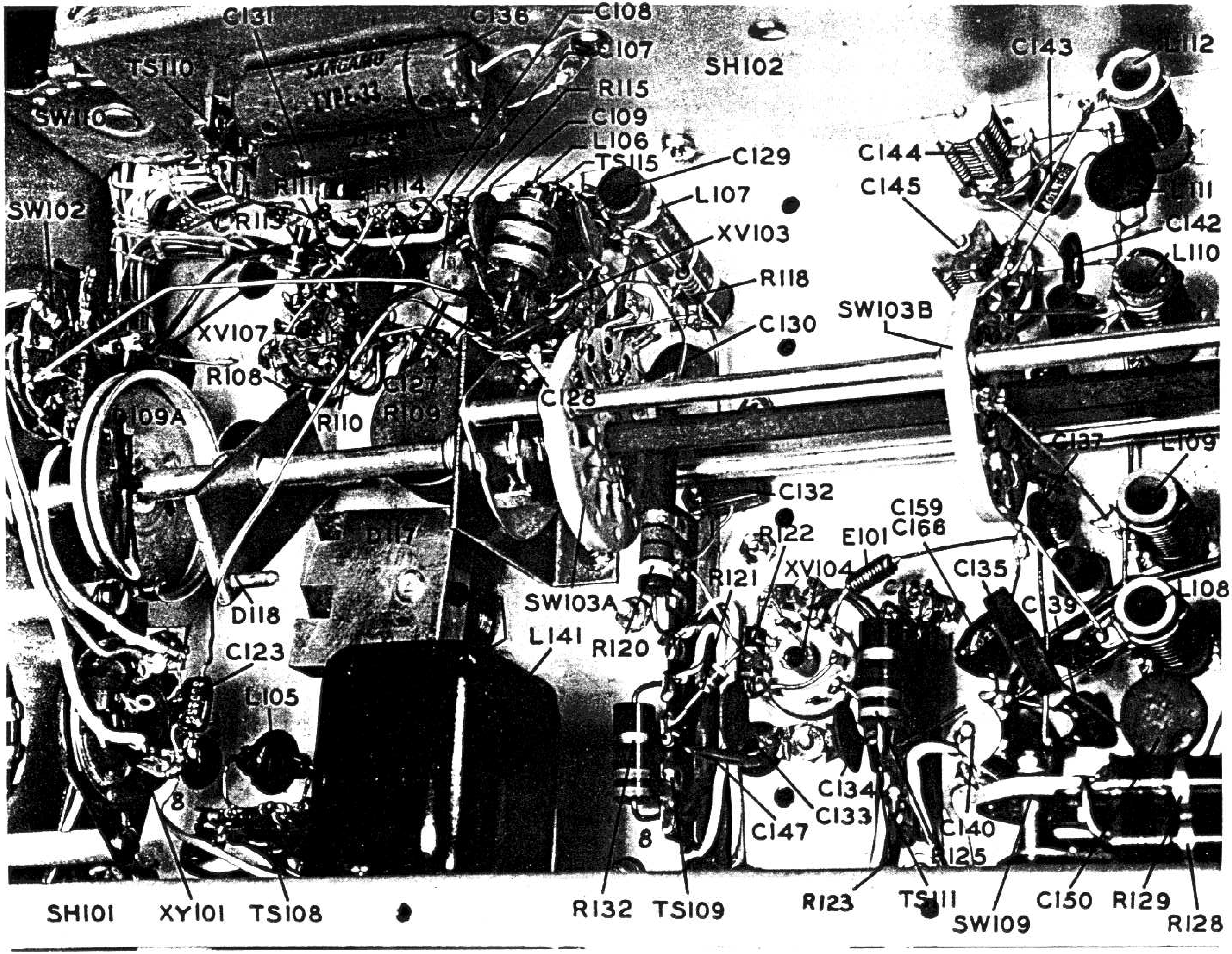


Figure 12, Keyer Wiring

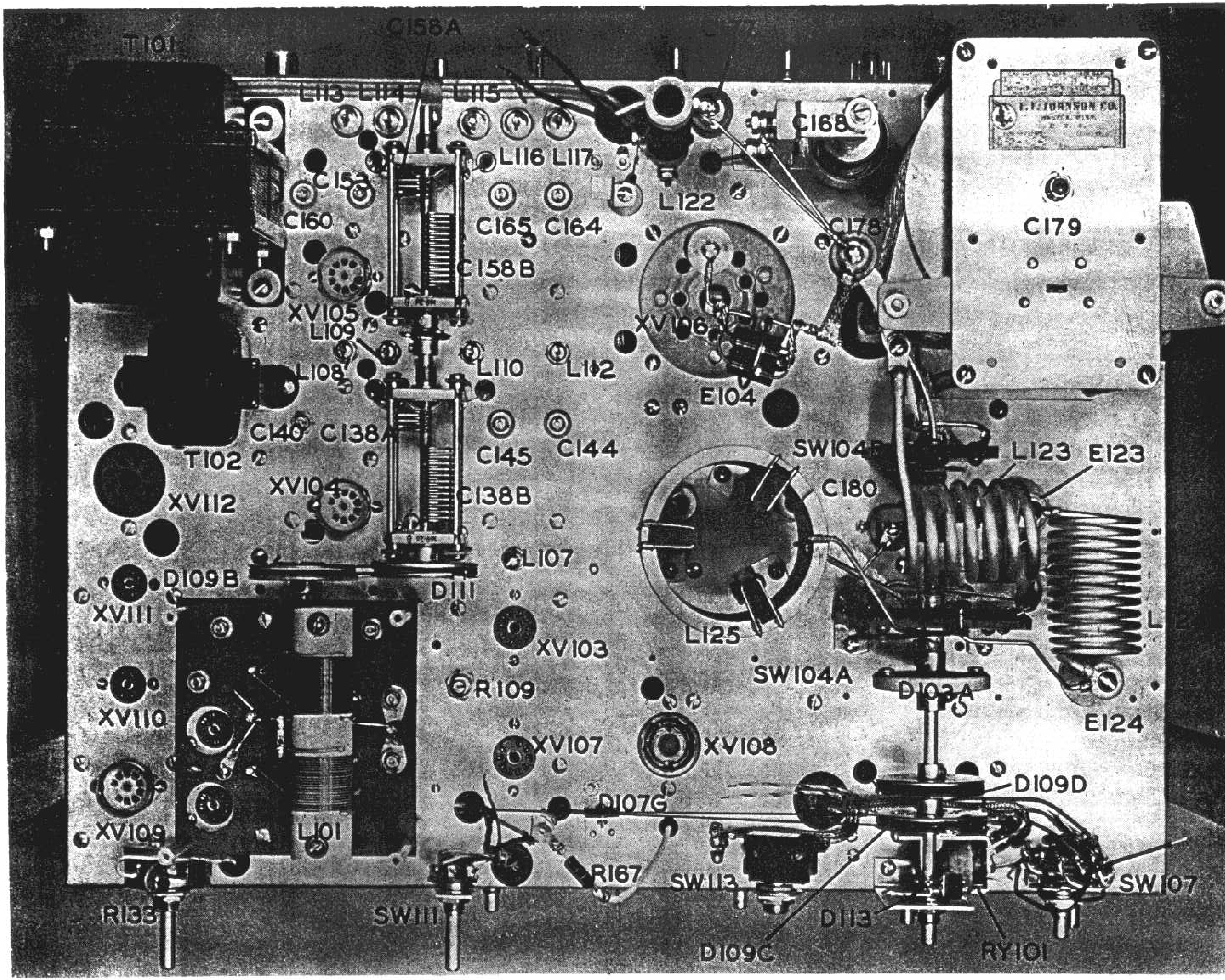


Figure 18, Top View of Chassis - No Front Panel

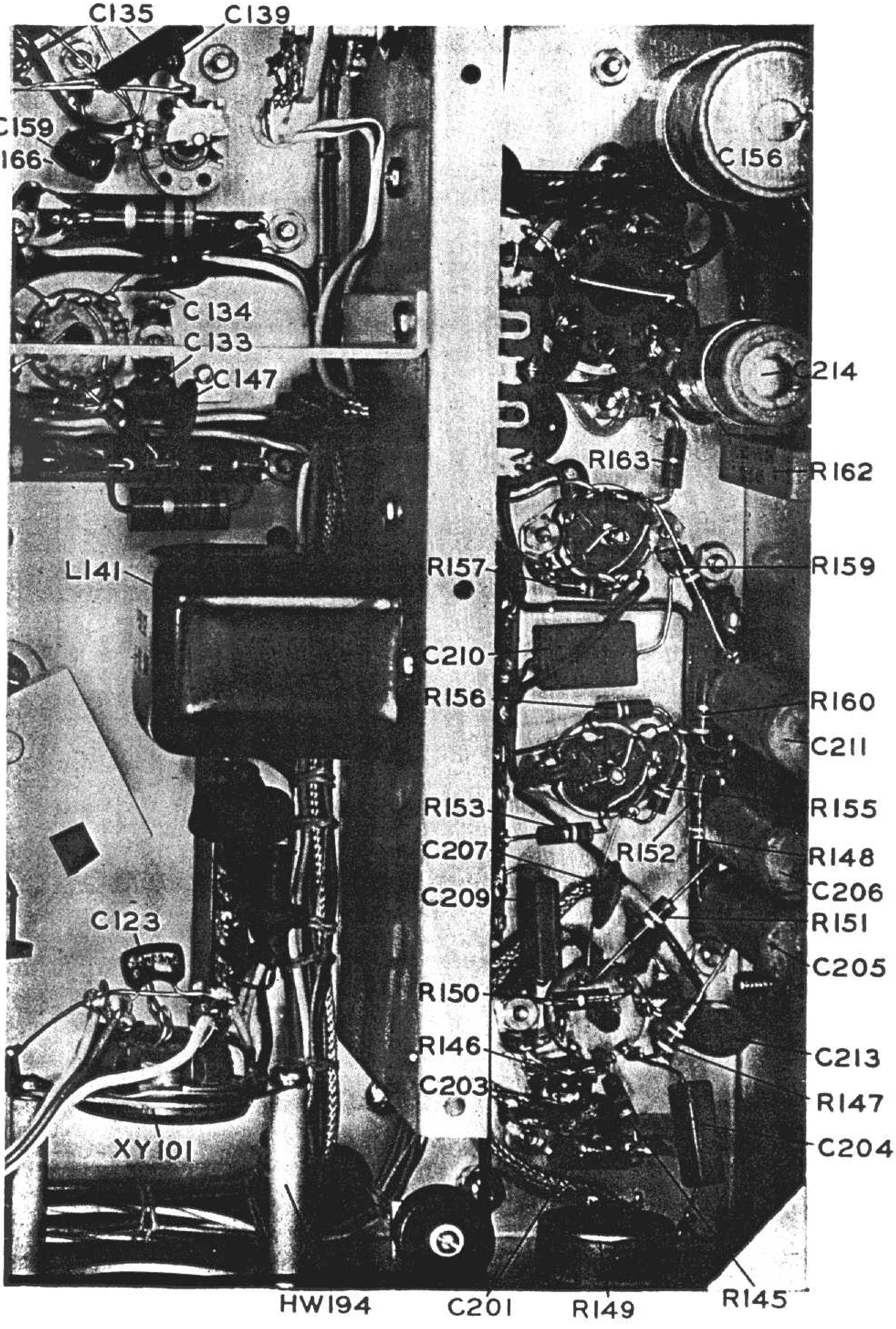


Figure 19, Bottom View of Completed Audio Section

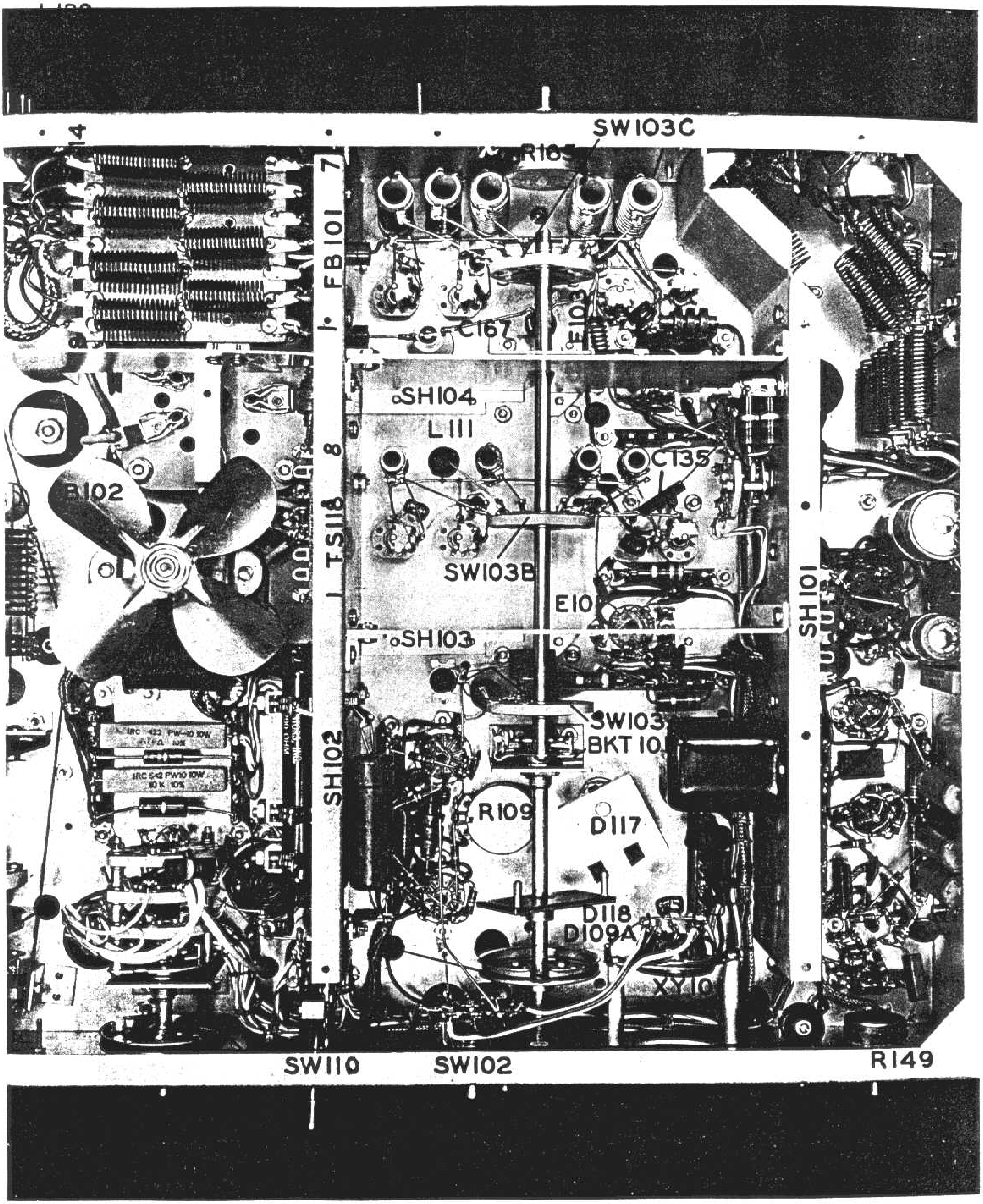


Figure 20, Bottom View of Exciter

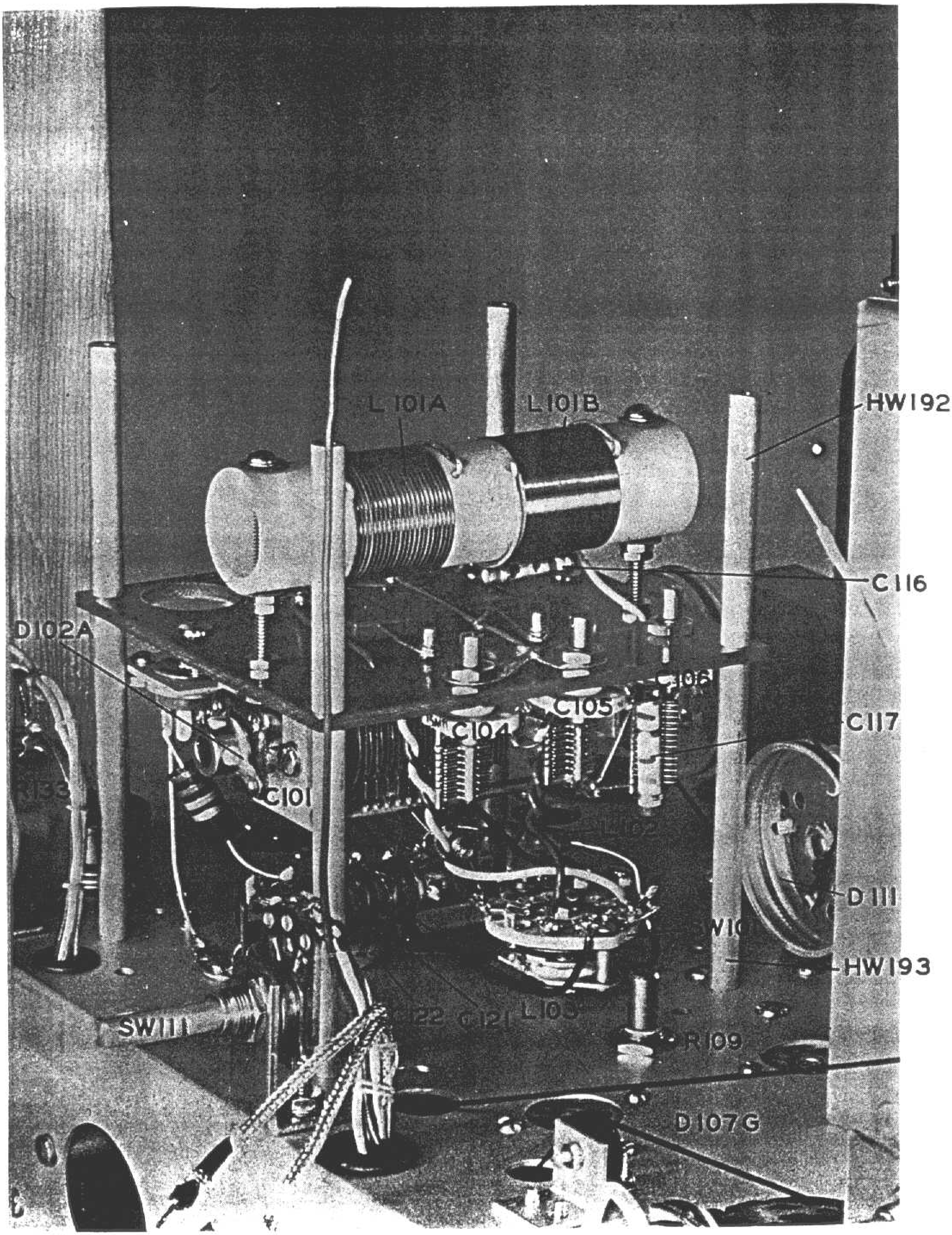


Figure 24A, Right Front View of VFO

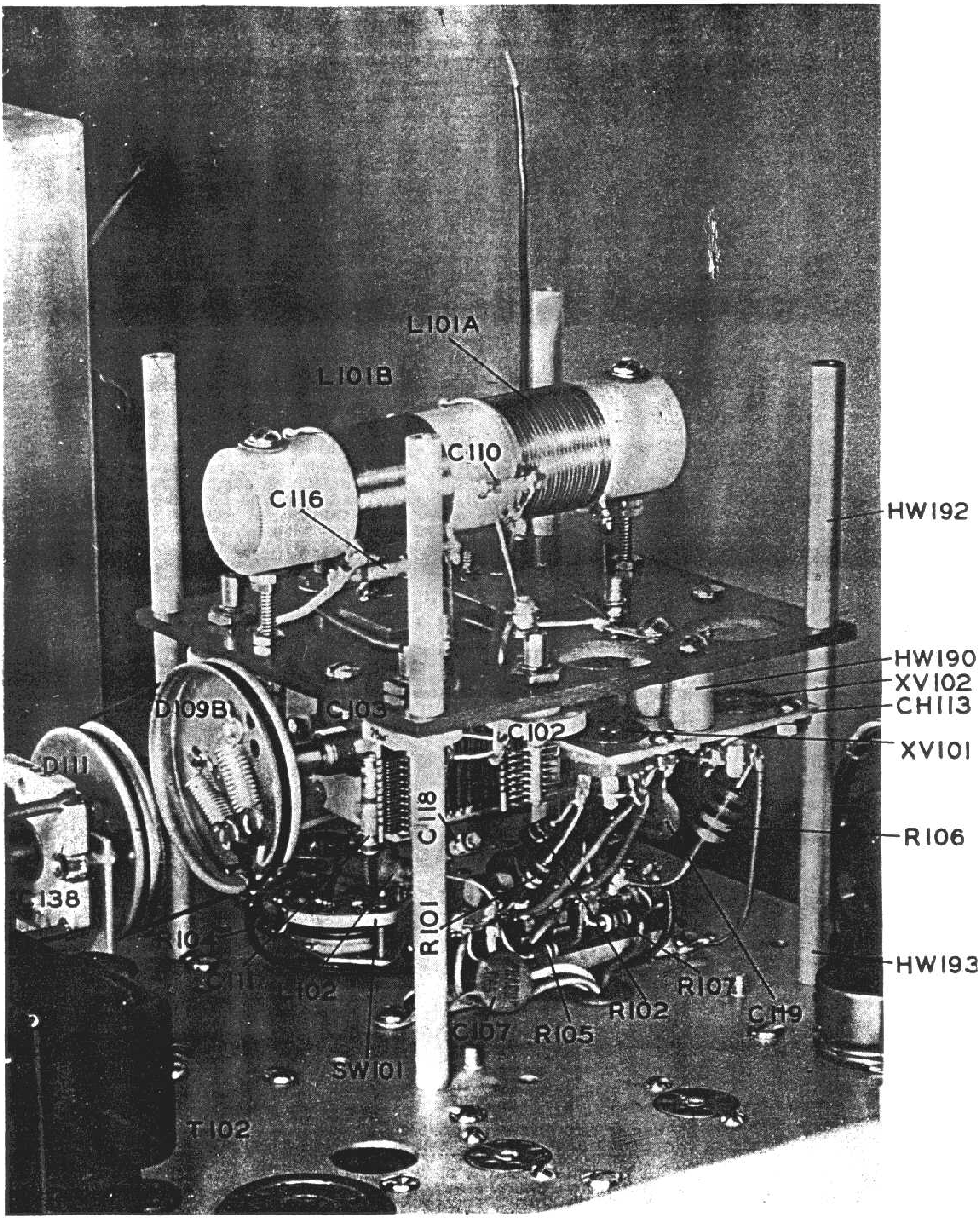
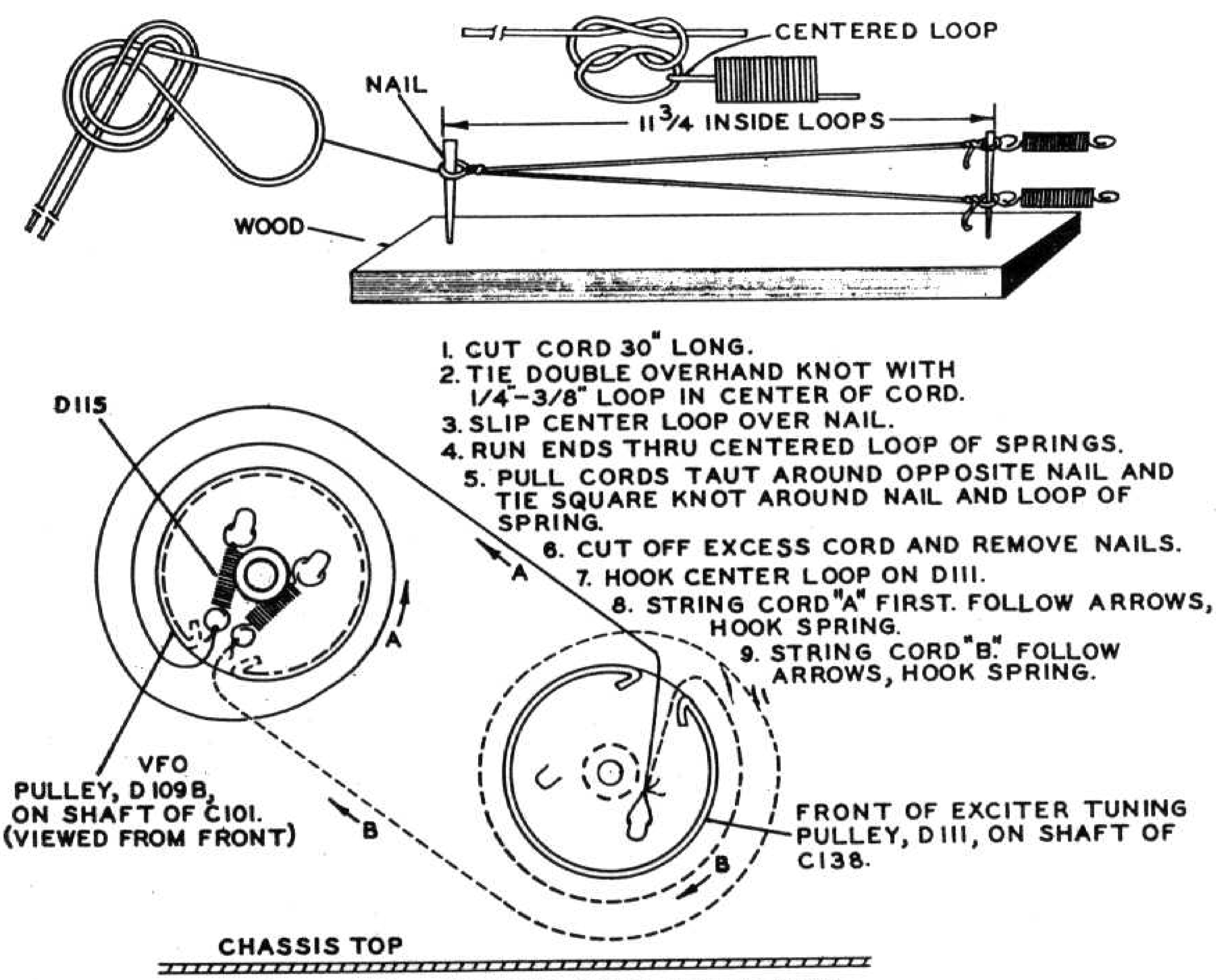
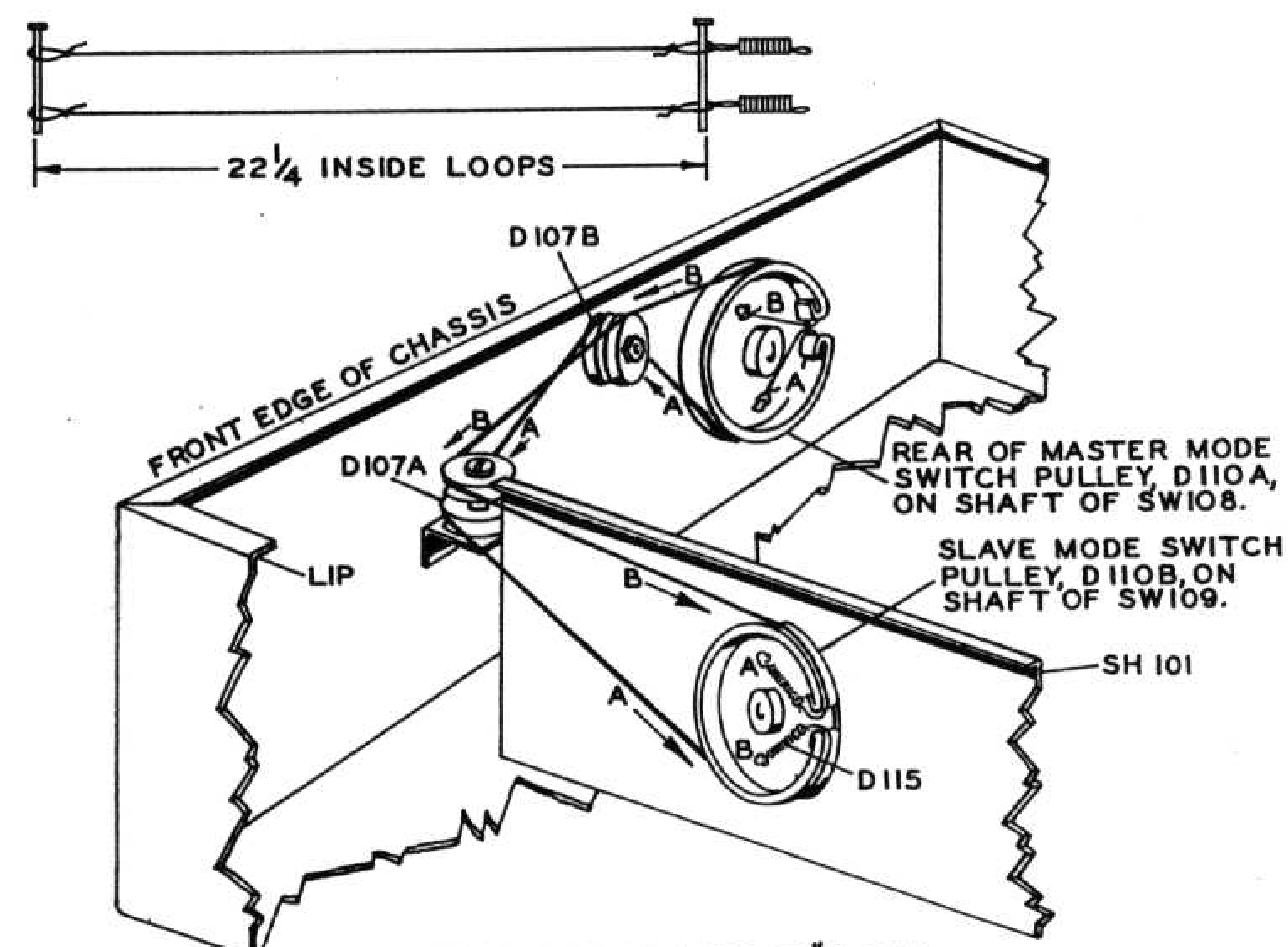


Figure 24B, Left Rear View of VFO



VFO — EXCITER DRIVE, FRONT VIEW

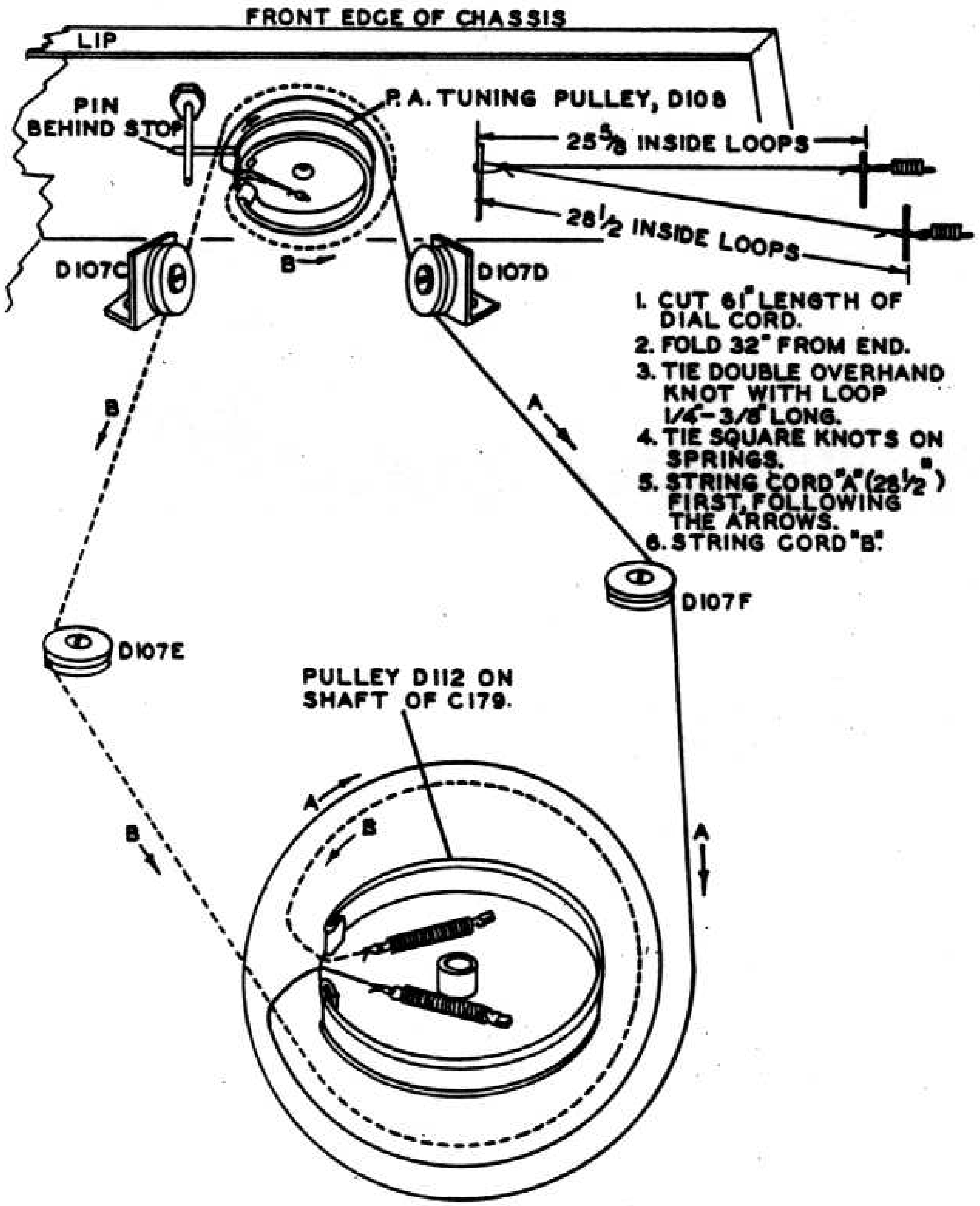
Figure 25



1. CUT TWO PIECES OF CORD 30" LONG.
2. FOLD BACK 2" AT ONE END OF CORD AND TIE DOUBLE OVERHAND KNOT WITH 1/4" TO 3/8" LOOP.
3. TIE SQUARE KNOTS ON SPRINGS.
4. STRING CORD "A" FIRST, FOLLOWING ARROWS.
5. STRING CORD "B" FOLLOWING ARROWS.

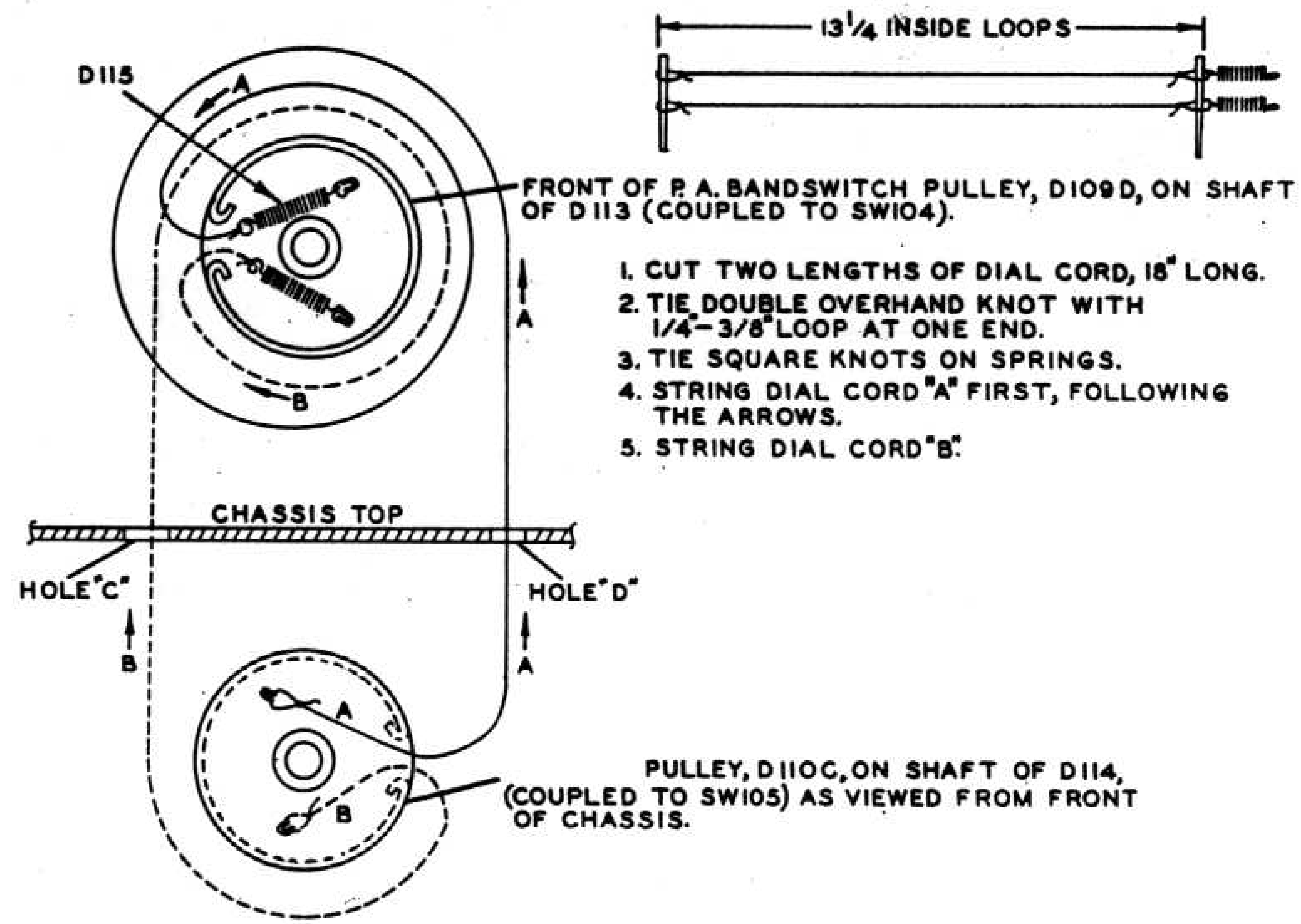
MODE SWITCH DRIVE—CUTAWAY BOTTOM VIEW.

Figure 26



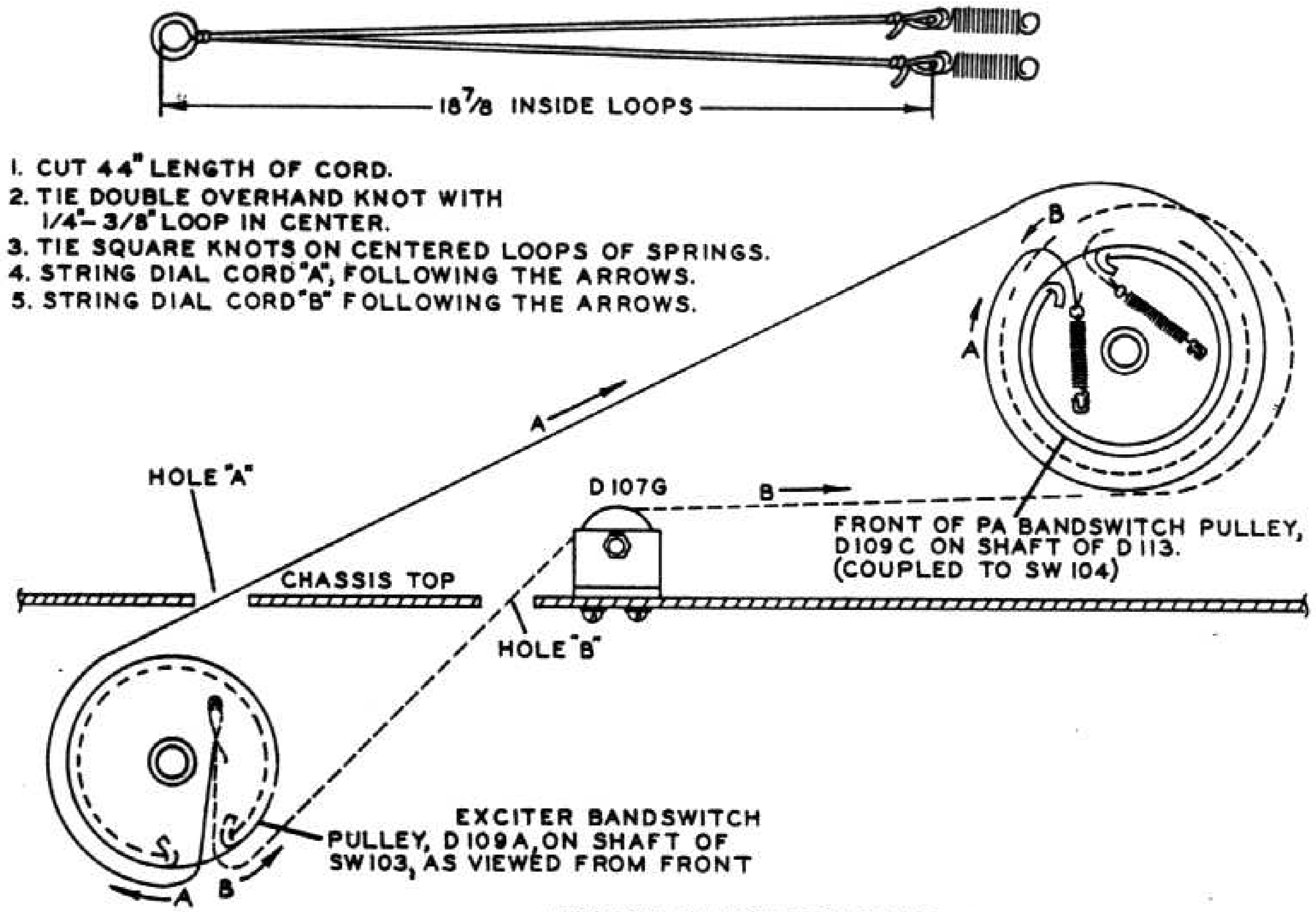
P.A. TUNING DRIVE
BOTTOM VIEW

Figure 27



P.A. "L" SECTION BANDSWITCH DRIVE
VIEWED FROM FRONT

Figure 28



EXCITER BANDSWITCH DRIVE
FRONT VIEW

Figure 29

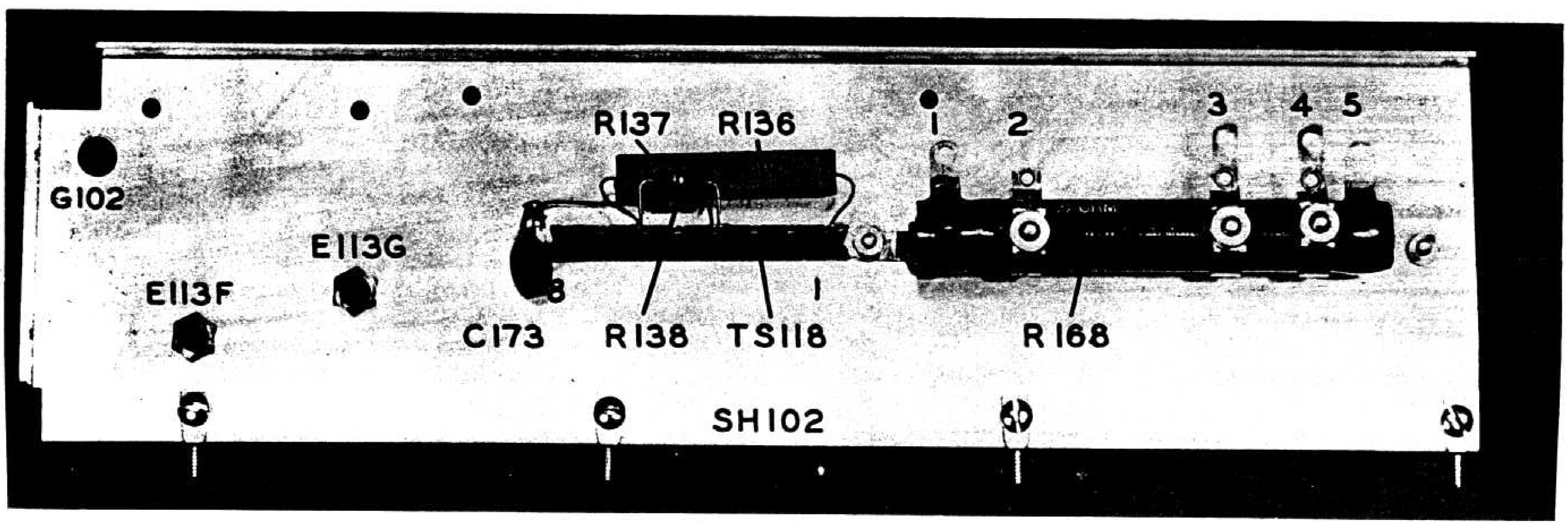


Figure 30, Parts Mounting on Right Exciter Shield

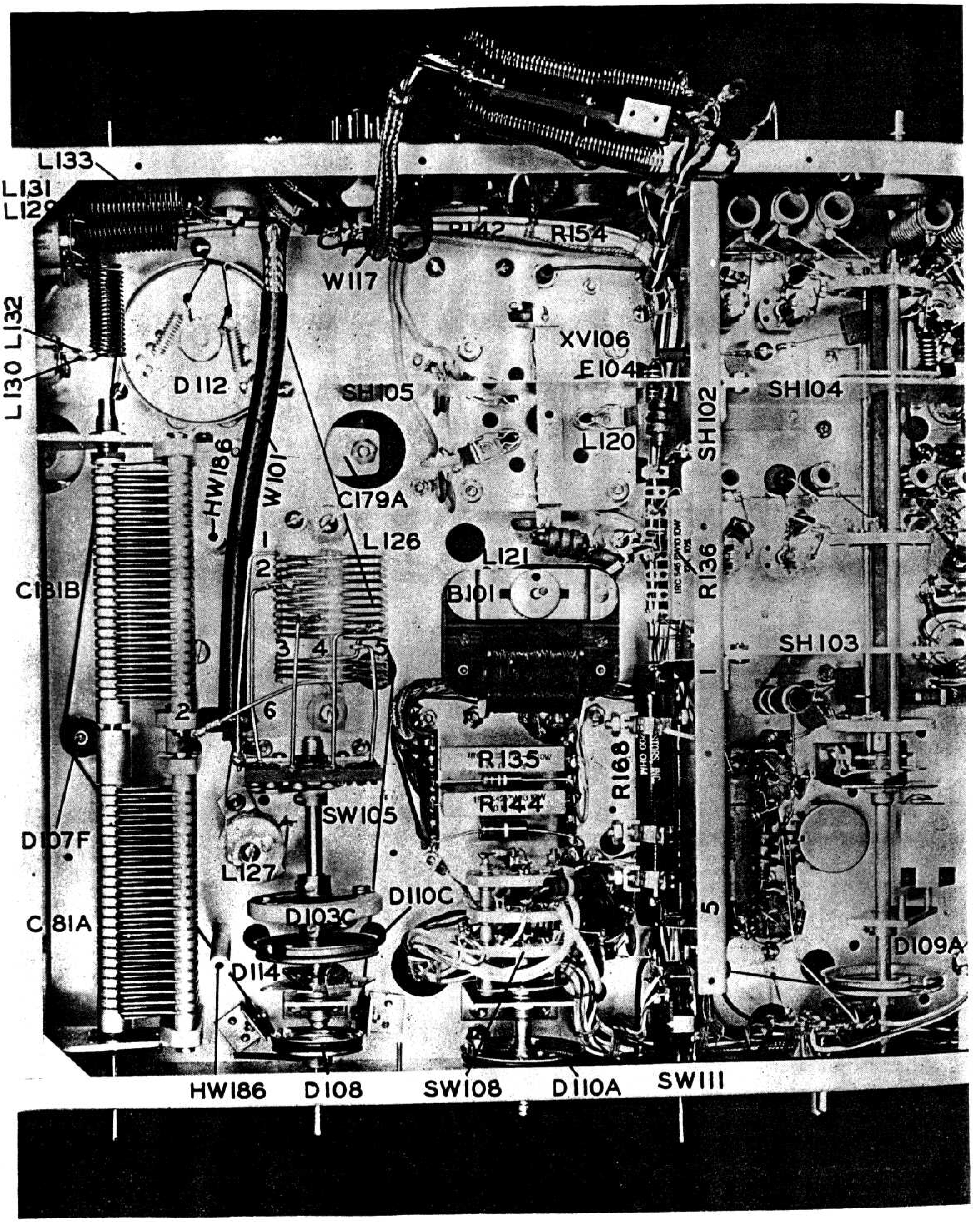


Figure 31, Bottom View of Power Amplifier - Filter Board Assembly Removed

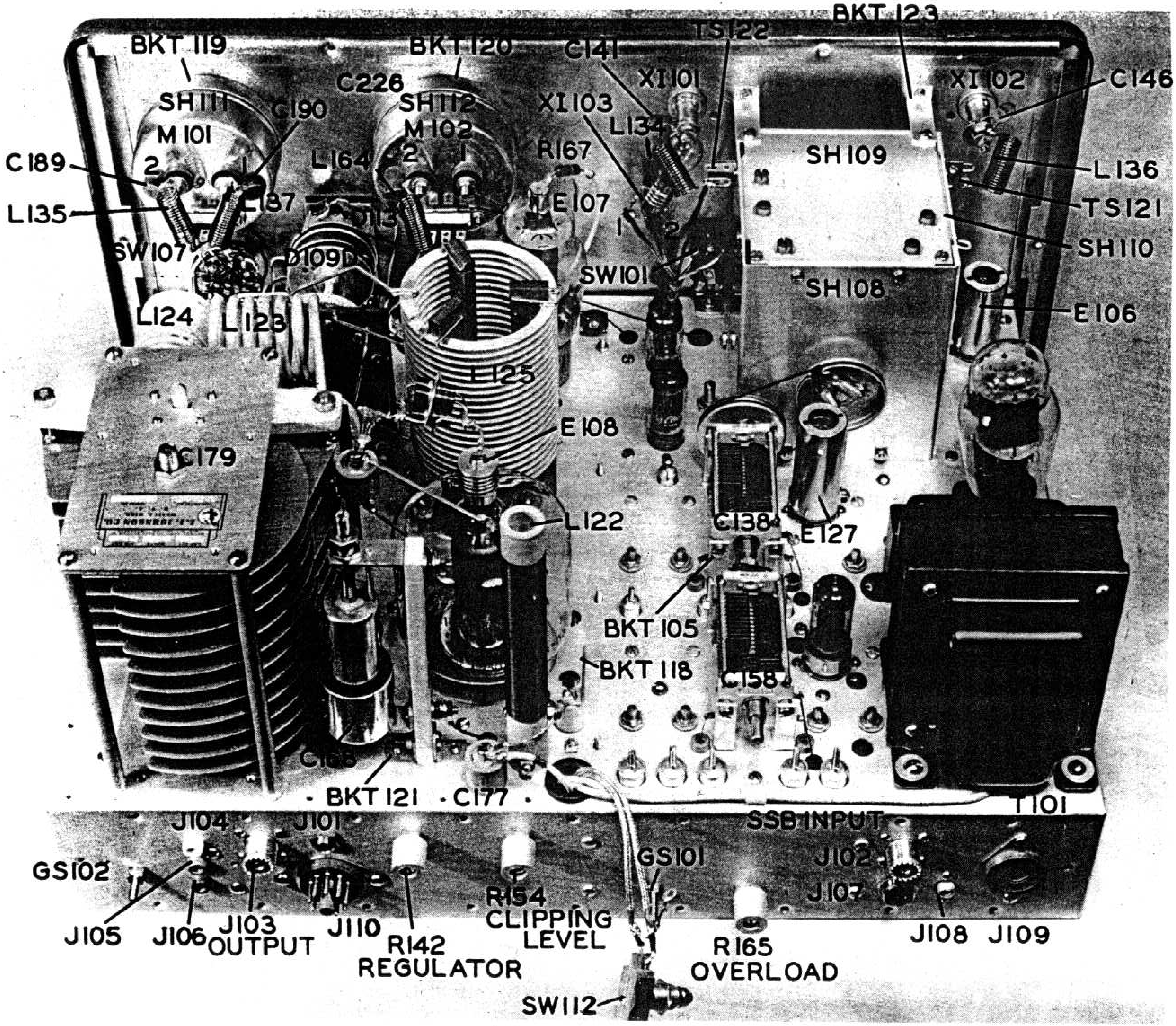


Figure 36, Rear View of RF Unit, Less P.A. Shield

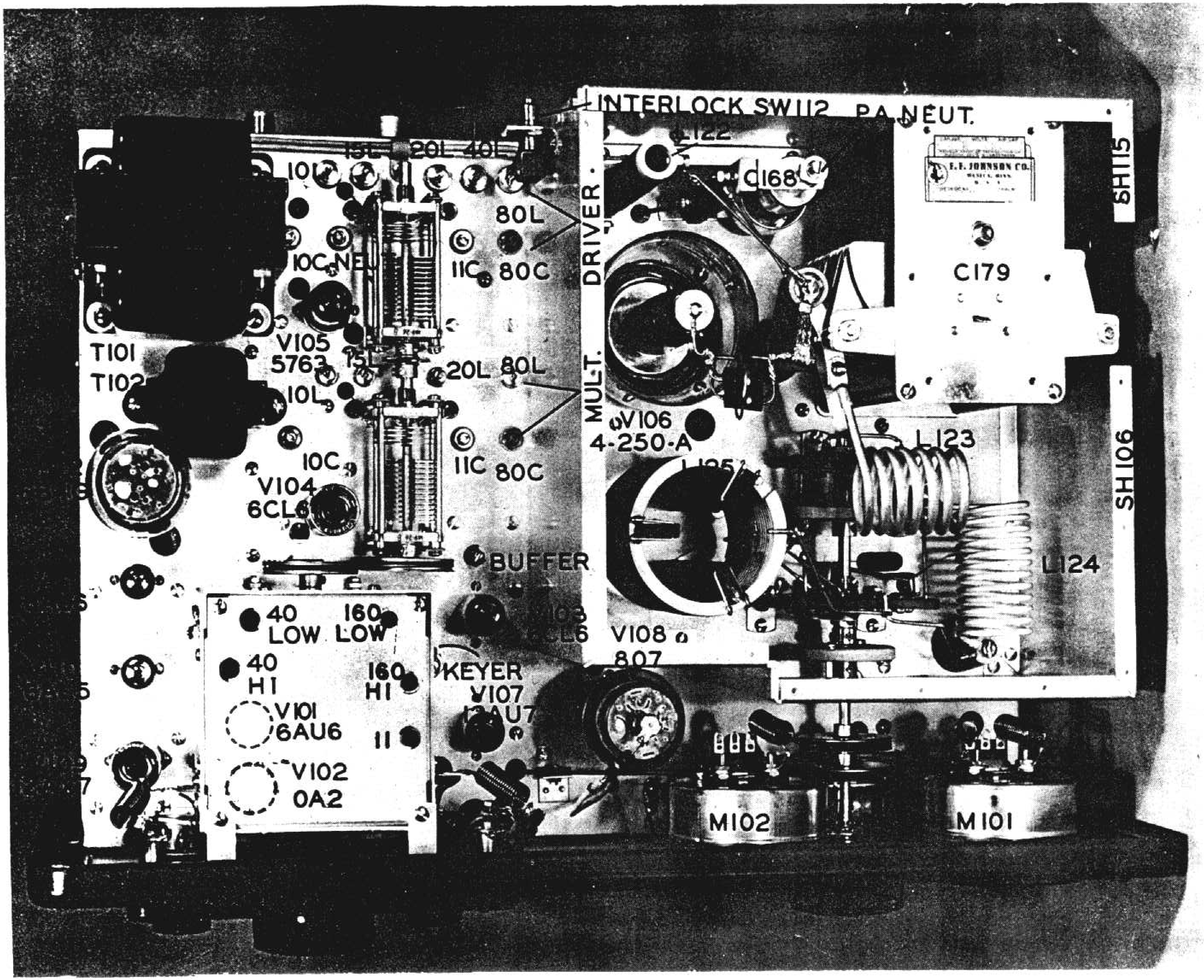
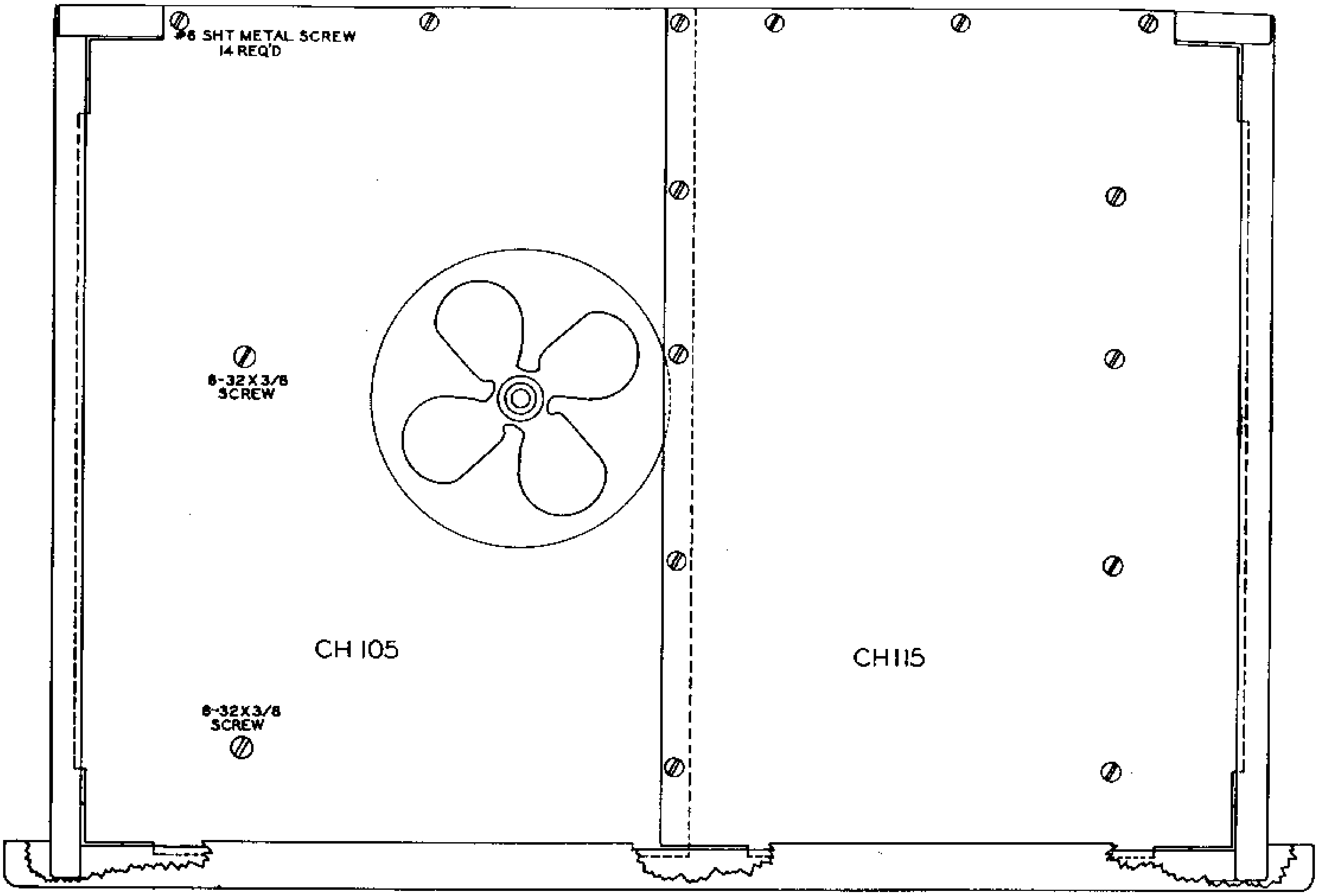


Figure 28 Top View Showing Tube Placement

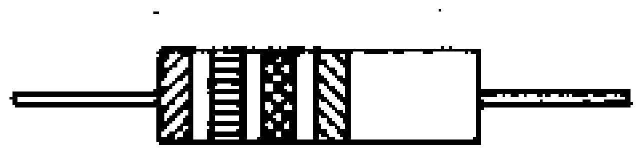


INSTALLATION OF BOTTOM PLATES, VIKING FIVE HUNDRED RF UNIT

Figure 47

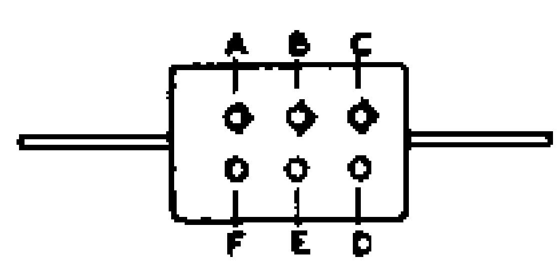
COLOR	SIGNIFICANT FIGURE	DECIMAL MULTIPLIER	TOLERANCE (%)	VOLTAGE RATING*
BLACK	0	1	-	—
BROWN	1	10	1	100
RED	2	100	2	200
ORANGE	3	1,000	3	300
YELLOW	4	10,000	4	400
GREEN	5	100,000	5	500
BLUE	6	1,000,000	6	600
VIOLET	7	10,000,000	7	700
GRAY	8	100,000,000	8	800
WHITE	9	1,000,000,000	9	900
GOLD	-	0.1	5	1,000
SILVER	-	0.01	10	2,000
NO COLOR	-	—	20	500

* APPLIES TO CONDENSERS ONLY

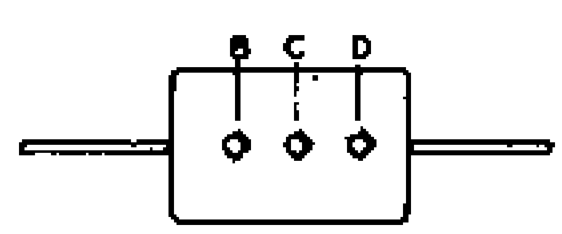


COLOR CODING OF FIXED RESISTORS

A-FIRST SIGNIFICANT FIGURE OF RESISTANCE IN OHMS
B-SECOND SIGNIFICANT FIGURE
C-DECIMAL MULTIPLIER
D-RESISTANCE TOLERANCE IN PERCENT IF NO COLOR SHOWN TOLERANCE IS ± 20%.

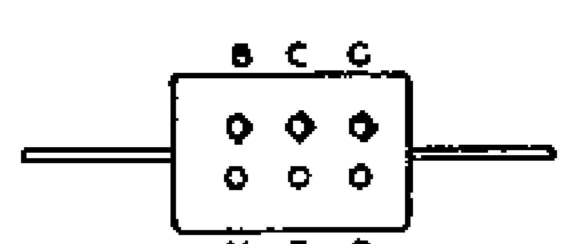


JAN FIXED CAPACITORS



RMA 3-DOT CODE 500VOLT ± 20%

COLOR CODING OF FIXED CONDENSERS
A-TYPE: MICA BLACK, PAPER SILVER
B-FIRST SIGNIFICANT FIGURE OF CAPACITY
C-SECOND SIGNIFICANT FIGURE
D-DECIMAL MULTIPLIER
E-TOLERANCE
F-CHARACTERISTIC
G-THIRD SIGNIFICANT FIGURE
H-VOLTAGE RATING



RMA 6-DOT CODE

CONDENSER-RESISTOR COLOR CODE

Figure 48

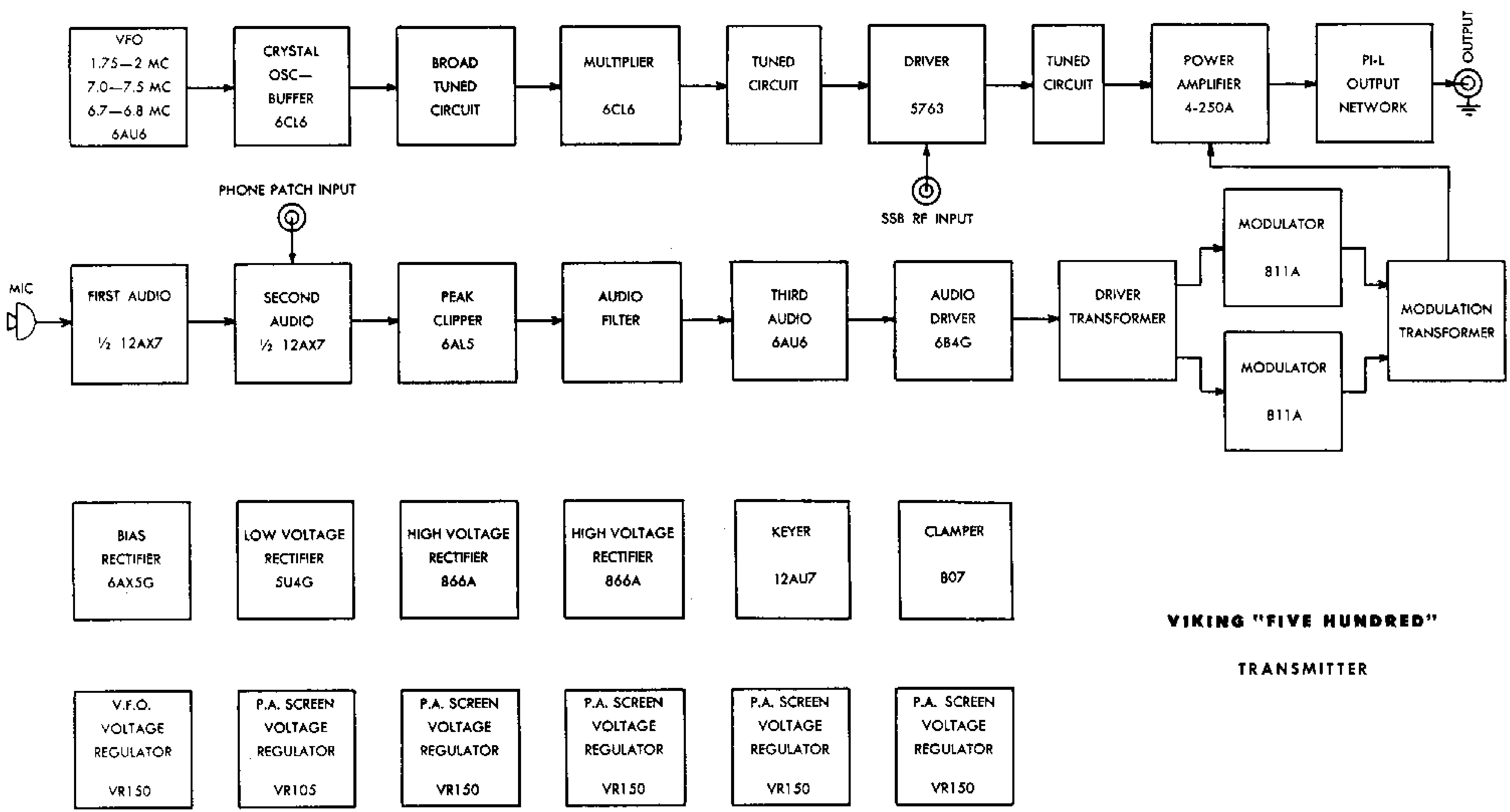


Figure 49, Block Diagram

Figure 50 Push-to-Talk, Microphone Schematic

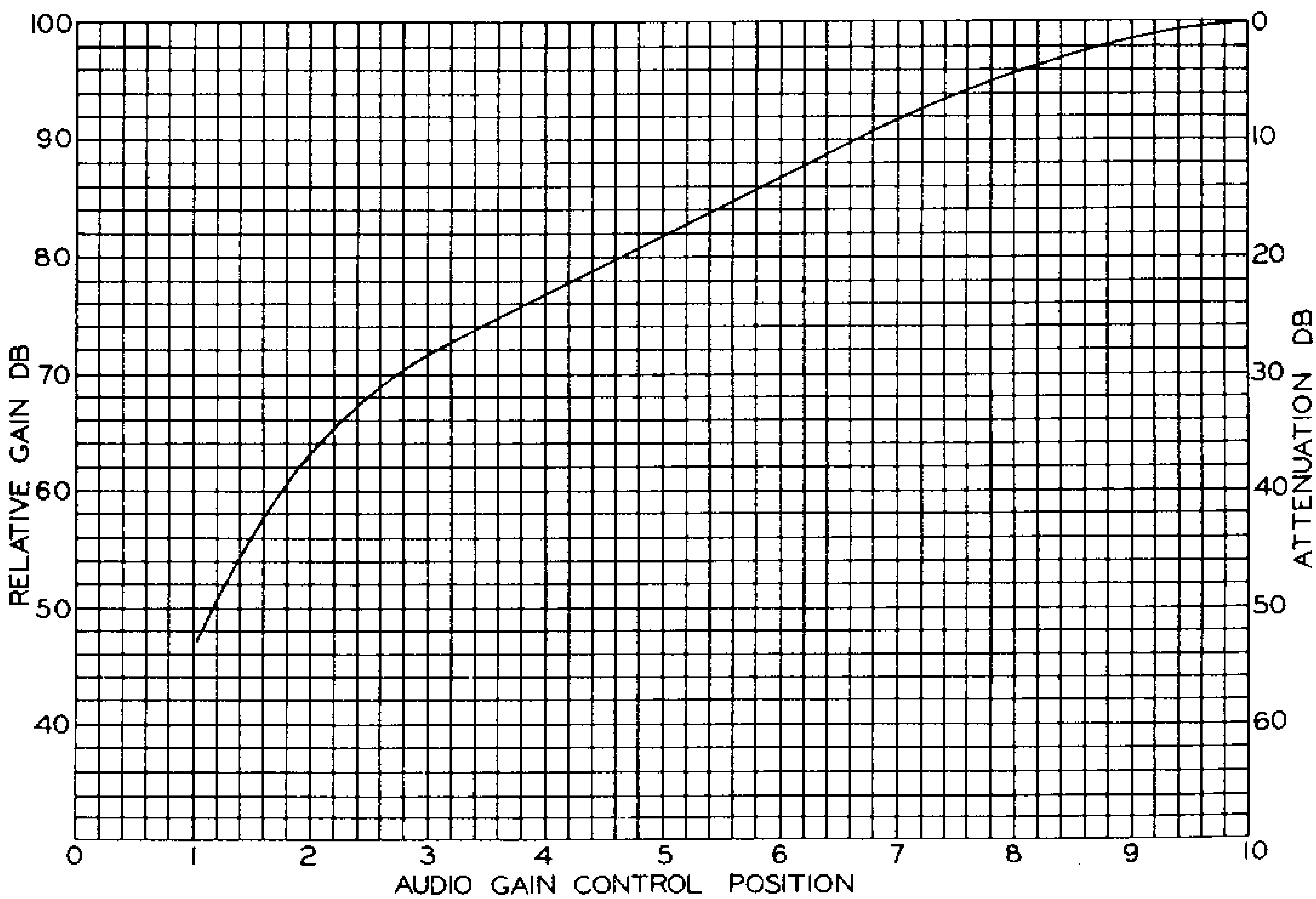
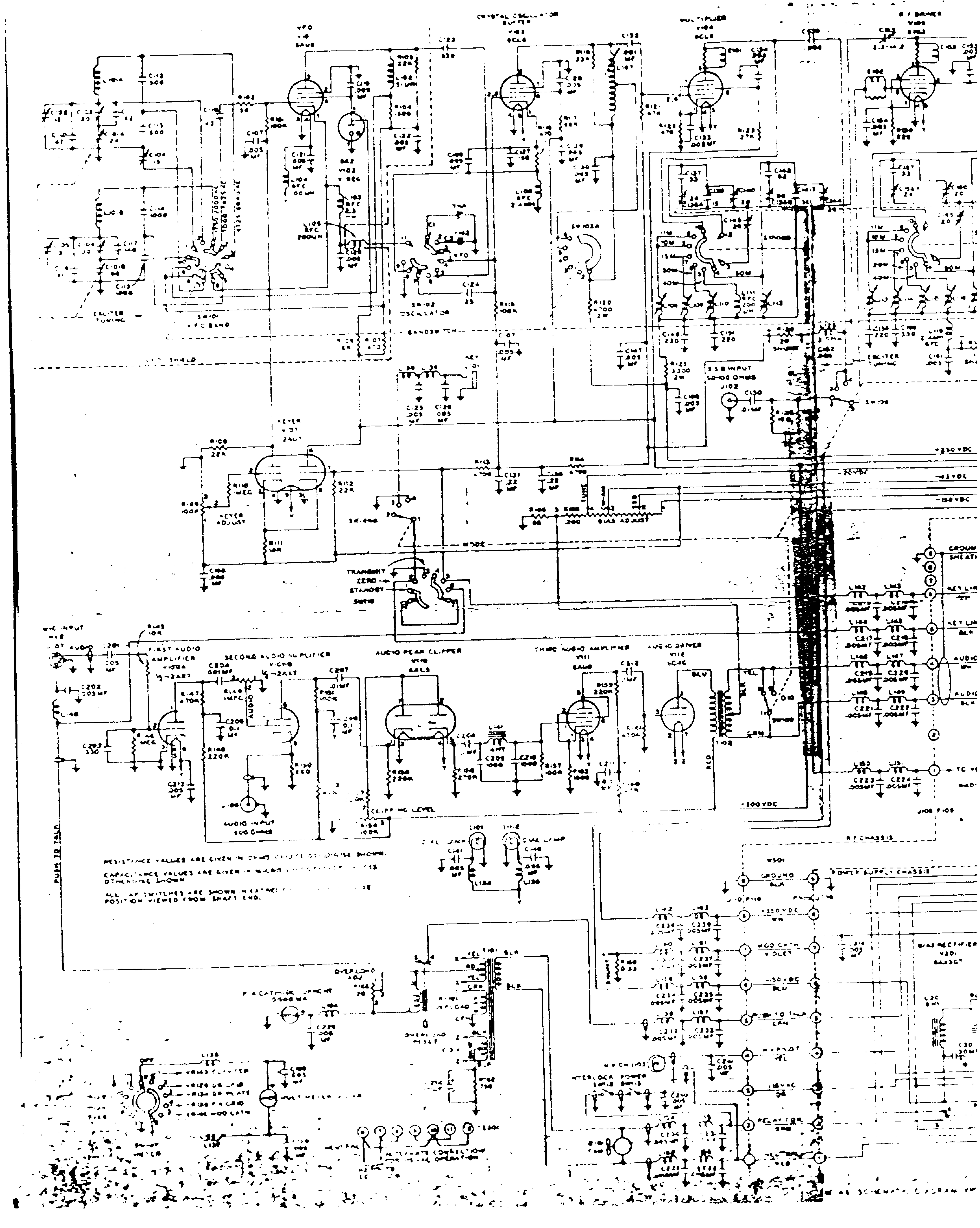
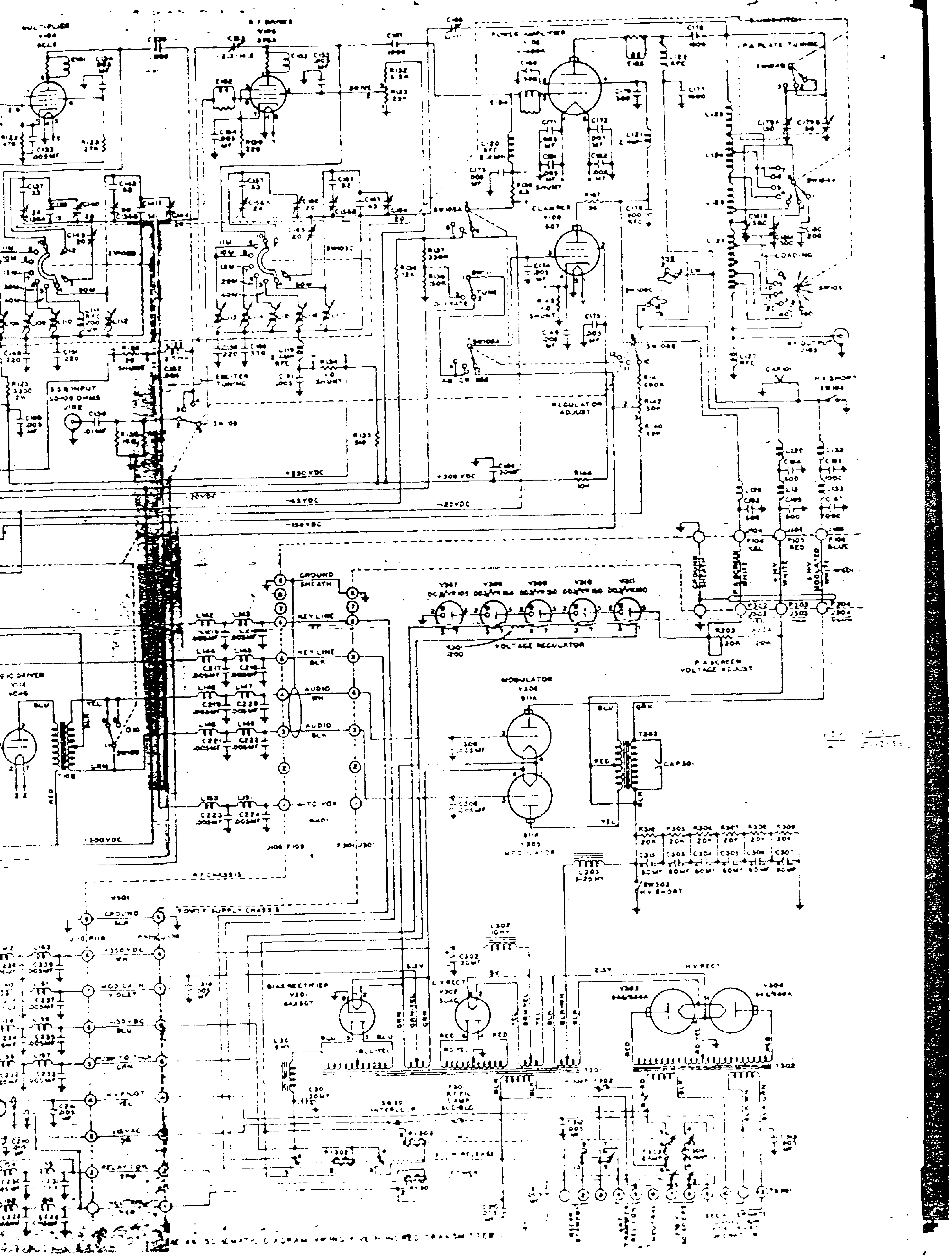


Figure 51 Audio Gain Control Curve


VFO
CRYSTAL OSCILLATOR BUFFER
MULTIPLIER
KEYER
EXCITER TUNING
BANDSWITCH
KEY
BIAS ADJUST
KEYER ADJUST
MODE
TRANSMIT
ZERO
STANDBY
MIC INPUT
FIRST AUDIO AMPLIFIER
SECOND AUDIO AMPLIFIER
AUDIO PEAK CLIPPER
THIRD AUDIO AMPLIFIER
AUDIO DRIVER
CLIPPING LEVEL
AUDIO INPUT 500 OHMS
PUSH TO TALK
DIAL LAMP
+350 VDC
-150 VDC
GROUND
OVERLOAD ADJ
OVERLOAD RESET
POWER SUPPLY CHASSIS
BIAS RECTIFIER
RF CHASSIS
PUSH TO TALK



SCHEMATIC DIAGRAM, VIKING FIVE HUNDRED TRANSMITTER

See inside back cover.