Johnson

electronic equipment

OPERATING MANUAL

VIKING COURIER AMPLIFIER

E. F. Johnson Company

WASECA MINNESOTA

PRINTED IN U.S.A.

FORM 206Q084-A

JOHNSON VIKING COURIER TRANSMITTER

Model 240-352-1 (Kit Form)
240-352-2 (Assembled and Tested)

The sucessful 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 Courier. It is strongly recommended that this manual be carefully read prior to attempting operation of the equipment.

The Viking Courier 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.

W A R N I N G

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.

STANDARD WARRANTY

Adopted and Recommended by the

Radio - Electronics - Television Manufacturers Association

The E. F. Johnson Company warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part, except for electron tubes, in exchange for any part of any unit of its manufacture which under normal installation, use and service disclosed such defect, provided the unit is delivered by the owner to us or to our authorized radio dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to original purchaser and provided that such examination disclosed, in our judgement, that it is thus defective.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture, nor to electron tubes.

Defective electron tubes should be returned directly to the tube manufacturer for adjustment at the following addresses:

(a) For RCA tubes to : Adjustment Service RCA at the nearest of the following addresses:

34 Exchange Place
Jersey City 2, New Jersey

3601 South Adams Street
Marion, Indiana

6355 East Washington Blvd.
Los Angeles 22, California

(b) For General Electric tubes to:

Adjustment Service
Owensboro Tube Works
General Electric Company
Owensboro, Kentucky

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

OPERATING MANUAL

CONTENTS

OPERATING MANUAL

CONTENTS

A. INTRODUCTION

1. Function

The Johnson Viking Courier is a self contained continous coverage radio frequency power amplifier designed for amateur service. It may be used for CW telegraphy, AM linear phone and SSB or DSB phone communication

The maximum amplifier ratings are:

MODE	PLATE POWER INPUT
CW - Class C or Class B	500 Watts
AM - LINEAR (Double sideband with carrier)	200 Watts
SSB-DSB	500 Watts PEP

(PEP) peak envelope power

The Courier provides continous frequency coverage between 3.5 and 30 megacycles. The bandswitch selects the following overlapping ranges:

3.5 mcs to 7 mcs.
7 mcs to 14. mcs.
14 mcs. to 21 mcs.
21 mcs. to 30 mcs.

Power output is essentially constant through the operating range.

Class C output is slightly greater than Class B output.

2. Construction

The transmitter is 15" wide, 11 5/16" deep, 9" high and weighs 58 pounds. A perforated cadmium plated steel cabinet and panel result in a totally shielded enclosure with adequate ventilation.

All operating controls, as well as the dial, meter and jeweled indicator are located on the front panel. The RF input receptacle, RF output receptacle, ground stud, line cord, antenna relay jack and control terminal strip are located on the rear of the chassis.

To aid in eliminating spurious radiation which might result in interference to other services such as television broadcasting, the transmitter cabinet serves as an effective shield. Monel metal braid is used to bond and seal all possible openings between the one-piece cabinet and panel. The meter is shielded at the rear and has individual RF filters in each of the meter leads. All external connections such as the line cord, antenna relay jack and control cables are equipped with individual RF filters to maintain cabinet shielding integrity.

A. 2. A fan is used to assure adequate air flow around the 811A's, 866A's and tank circuit components.

3. Auxiliary Equipment

Antenna Coupler - Unbalanced resistive antenna loads from 18 to 600 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 on 3.5 mc. On high bands a wider range of matching is possible. 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-output circuit of the Courier 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 JOHNSON 250-20, 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.

4. Power Requirements

The Viking Courier is designed to operate from a 105-125 volt 50-60 cycle single phase AC voltage source.

Typical power demands are:

Plate switch - Off		100 watts
Plate switch - On - No drive - Class B		230 watts
On - No drive - Class C		200 watts
On - full drive - full load		675 watts

B. DESCRIPTION

1. RF Power Amplifier

The RF Power Amplifier (PA) uses two type 811A high-mu power triodes together with a pi-network plate circuit.

B. 1. The pi-network consists of the variable inductor L4, as the series element; the final tuning capacitor C14, as the input shunt element; and the output shunt capacitance made up of a variable capacitor C15 (Fine Coupling) and a group of switched fixed mica capacitors, C16 thru C21 (AUX Coupling). This combination provides a continous output capacity range of 20 to 4400 mmfd. The pi net-work will match the 811A's into antenna resistances of nominally 20 to 600 ohms and tune out several hundred ohms of antenna reactance over the frequency range of the Courier. The range of antenna impedance matching extends roughly from 20 to 2000 ohms at frequencies higher than 7.0 mc.

The grid circuit is balanced to allow all band neutralization. Band-switching is accomplished by SW3, which shorts out the unused turns of the grid coil. The grid link is a four turn, resistively loaded coil.

The Meter switch (SW5) is really a combination mode-meter switch in that it has four positions, Grid-Plate on Class B and Grid-Plate on Class C. This switch switches the meter to read the appropriate current and also changes the bias on the 811A's from zero bias operation (Class B) to a combination fixed and resistive bias on Class C.

2. Power Supplies

Two power supplies are used to power the Courier. A bias supply using a selenium rectifier (SR) provides about 95 volts bias. This is used as ~~idling~~ bias (~~8~~ to ~~8~~ volts) in Class C and as cutoff bias for standby operation. Cut off 10-14

The high voltage supply uses a pair of 866A mercury vapor rectifiers and delivers approximately +1500 DC at 350 milliamperes. The HV filter consists of a 10 henry choke, 20 mfd 1800 volt capacitor and 40K ohm bleeder resistor. Remote control of the high voltage primary, blocking bias and antenna relay connections are provided by a terminal strip on the back of the chassis. Fusing is provided in the AC line cord plug.

C. INSTALLATION

General

After removing the transmitter from the shipping container, inspect it thoroughly for any possible damage from shipping. Claims against the carrier delivering the equipment must be made with the carriers 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.

1. Unpacking

In order to attach the knobs, install tubes and remove packing material, remove the transmitter from the cabinet as follows:

C. 1. a. Loosen and remove the three tie bolts which are located at the rear of the cabinet, topcenter, right and left side center.

b. Loosen and remove the eight screws around the periphery of the cutouts (four at each cutout) for the line cord and the cable connectors.

c. Slide the chassis out of the cabinet, carefully training the line cord through the opening provided.

d. Remove the packages containing knobs and plugs.

e. Remove any additional packing or supports.

f. Search the packing material for anything overlooked.

g. Inspect the unit for damage during shipment.

2. Installation of Knobs

These knobs may be already installed in wired and tested Couriers.

Meter

Turn the meter switch full clockwise. Using a 3/16" 8-32 setscrew install the single marker skirted knob with the index on Plate "C" side.

Coupling

(Top Control) Turn the variable capacitor (C15) full mesh (max. capacity) and install a 0-100 dial knob (using a 3/16" 8-32 set screw) with the green dot at "0".

Coupling

(Middle Control) Turn the switch full counter-clockwise and install the 1-7 knob (use a 3/16" 8-32 setscrew) with the green dot at "1".

Grid Tuning

Turn the capacitor (C1) to full mesh and install a 0-100 dial knob (use a 3/16" 8-32 setscrew) with the green dot at "0".

Band

Turn the band switch full counter-clockwise and install the metal knob with the handle pointed away from the 3.5 - 7 position.

Final

Install the 2 1/4" knob on the remaining shaft (use a 10-32 setscrew). Tighten all setscrews securely.

C. 3. Connections

a. Ground Connections

Caution: For safety reasons, it is very important that all equipments be grounded to earth with heavy conductors

1. DC - Connect a #12 or larger lead from the ground stud (on rear of the Courier) to an earth ground. Be sure to ground all other equipment also to prevent possible serious AC shock. Refer to section E2.

2. RF Ground - Connect a heavy lead from the ground stud to the RF ground. Refer to section E3.

b. Antenna Connections

Connect an RG-8/U coaxial feed line to the output receptacle J2 (receptacle toward center of chassis) on the rear of the unit (Figure 2). Use a type PL259 plug. If a low pass filter is inserted in the feedline, use only a short length of coaxial line between the transmitter and filter.

c. Exciter Connection

The connection between the exciter and the Courier should be either a very short length of RG-8/U (3 feet or less) or a length which is approximately 1/2 wavelength on 10 meters (11 feet of RG-8/U is approximately equivalent to 1/2 wavelength on 10 meters).

d. Antenna Relay

The antenna relay may be controlled at the exciter or it may be controled by the 115 volts AC which is available thru J3 (two terminal jack). The voltage is available when the Plate switch is closed or when terminals 3 and 4 of TS7 are connected together. Caution: Terminals 3 and 4 are connected to the 115 volt line.

e. External Control

External control of the plate voltage (and antenna relay voltage thru J3) is available at terminals 3 and 4 of TS7. When terminals 3 and 4 are connected together the plate voltage is applied to the Courier. This connection is in parallel with SW1. Therefore SW1 must be off when external control is desired. The external contactor (switch or relay) must be capable of handling 5 amperes at 115 volts AC. Caution: Terminals 3 and 4 are connected to the 115 volt line.

f. Cutoff Bias (Important)

Cutoff bias is available thru terminals 1 and 2 of TS7 (See Figure 2). In order to operate the Courier, a connection must be made between terminals 1 and 2 by means of a jumber or by a external relay. This voltage is 95 volts with no connection (terminal 1 to chassis) and 7 to 8 volts connected.

g. Power Cord

The transmitter will operate from power source of 2 wire 105-125 volt 50-60 cycle single phase AC. Two fuses are contained in the plug itself.

C. 3. g. Removal of these fuses is facilitated by poking a scribe or nail thru the small holes on the cord end of the plug and pushing the fuses out. Insert the fuses merely by pushing them back into the plug.

h. Fuses

The fuses are 7 ampere slow blow fuses (MDX 7) and should be replaced with similar fuses. During initial tune-up out of resonance condition should be allowed only for 2 to 3 seconds. If you do not find resonance within 3 seconds turn off the plate switch (allow the fuses and the 811A's to cool and repeat).

D. OPERATION

Notice: The regulations of the Federal Communications Commission require a 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 the factory regarding your transmitter, refer to it by serial number and parts by part number.

1. Controls

The front panel controls are:

a. METER Switch, SW5, is a combination meter-mode switch in that it connects the meter to the appropriate circuit and it also changes the bias when going from Class B to Class C operation. The meter reads grid and plate currents.

b. PLATE switch, SW1, controls the High Voltage by turning on and off the plate transformer primary and also controls an external 115 volt AC relay thru the antenna relay jack (J3). The red jeweled light indicates this switch is "ON".

c. FILAMENT switch, SW2, turns on the filaments, fan motor and bias supply. Visual indication of this switch being "ON" is provided by the meter light and the dial escutcheon light.

d. METER, M, reads grid current (0 to 200 ma full scale) and plate current (0-500 ma full scale). A red dot on the 0-500 scale indicates the 500 watt plate input point for a line voltage of 115 volts.

e. DIAL ESCUTCHEON, D30, is calibrated 0-100 and indicates the FINAL plate tuning. Refer to table 1 for approximate frequency settings.

D. 1. f. FINAL tuning, tunes the power amplifier plate circuit to resonance as indicated by a dip on the plate meter. Ganging of the rotary inductor L4 and the plate tuning capacitor C14 provides a uniform loaded tank circuit Q on all bands.

g. The BAND control selects the proper frequency band in the grid circuit by shorting out the unused turns.

h. GRID tuning tunes the grid circuit to resonance. This control is a dual section variable capacitor (C1).

i. "AUX" COUPLING is a switch which selects the proper value of fixed capacity to adjust the amplifier loading.

j. FINE coupling is a variable capacitor which allows fine adjustment of the amplifier loading.

2. Rear Connectors

The rear of the chassis has the following terminals and receptacles.

a. J1 is the coaxial input receptacle. (See Figure 5).

b. J2 is the coaxial output receptacle.

c. J3 provides 115 volts AC to control an antenna relay or other accessory when the Plate switch is On.

d. GD is a stud for connection of RF ground and also to provide for grounding the various other equipments together for safety reasons.

e. A four terminal strip on the rear chassis apron provides for external control of the amplifier. (TS7)

Terminals #1 and #2 (numbered from left to right when facing the strip) provides a method of connecting cutoff bias to the Final Amplifier tubes (811A's) during receiving. This would be of advantage when a T-R box is used and also allows the 811A's to run cooler during standby. It is not, however, necessary from a stability standpoint to use this cutoff bias, as the 811A's are stable even without a load such as is the case when an antenna relay is used. If the cutoff bias is not used, however, careful attention to the time constant of the antenna relay would be in order. Make certain the Final Amplifier is not delivering power before the relay closes. Therefore, it is recommended that the cutoff bias be used.

Normal operation of the Courier requires that terminals 1 and 2 be connected together. To apply cutoff bias this connection (between terminals 1 and 2) should be opened.

D. 2. e. Caution: Terminals 3 and 4 are connected to the AC line and the AC line voltage appears between one of these terminals and the earth ground. Also approximately 60-90 volts AC appears between the chassis and terminals 3 and 4 of TS7. This is the voltage drop across the .005 mfd disc capacitors. This voltage is normally of low current, however, if one of the disc capacitors should fail this is dangerous. Therefore, extreme caution is advised in regard to connection to the terminal strip, always keep the shield on and always pull out the line plug before making a connection. Also always ground the chassis of the Courier and all other equipment to a good earth ground as a protection feature. The ground should also be a good RF ground for other reasons. See Section E3.

Terminals 3 and 4 allow the primary of the high voltage transformer to be controlled externally. In other words, the Plate switch, in effect, can be moved to an external location thru terminals 3 and 4. This is the 115 volt AC line so use caution and good construction practice.

f. J3, a two terminal jack, provides 115 volts AC to an external device such as an antenna relay when the Plate switch is On.

3. Preliminary Checkout and Test

Before replacing the cabinet during the installation of the Courier transmitter, the transmitter should be given a preliminary checkout, while the circuits are readily accessible, as follows:

a. Check to see if terminals 1 and 2 of TS7 are connected together with a jumper or external relay (as in the Pacemaker).

b. Make certain the tubes are seated properly and the plate caps connected. Ground the chassis.

c. Turn the Plate switch "Off", plug the line cord in to 115 volts AC, and turn the Filament switch "On" (Important: See paragraph D4e). The meter and dial lamps should light and the fan motor should turn.

d. Check the fan blade for balance. It may have been bent during insertion or removal of the cabinet.

e. Connect a dummy antenna (50 ohms 200-300 watts, refer to paragraph E7) to output jack J2; and connect the exciter to J1 using either a very short length of 52 ohm coaxial cable (3 feet or less) or a length approximately 1/2 wavelength on ten meters (11 feet).

f. Following the tuning procedure in paragraph D4:

1. Tune and load the amplifier for Class C operation on the 10 meter band (28-30 mc.)

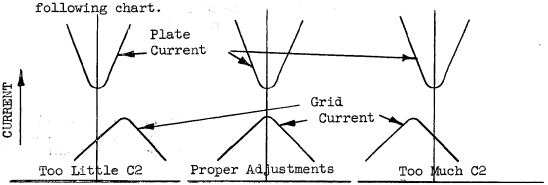
D. 3. f. 2. Check the neutralization as follows:

a. Dip Plate current exactly to resonance (full load (335 ma) class C position).

b. Switch Meter switch to Grid. (Grid current should be 70-75 ma.)

c. Detune the Final tuning slightly in the clockwise direction from resonance and note whether the Grid current increases or decreases, then return the Final to resonance.

d. Turn off the Plate switch, short the plates of the 811A's to ground using a insulated screw driver (this is a safety precaution to remove any B+ still in the filter capacitors), and adjust the position of the neutralizing capacitor, C2, as indicated in the following chart.



If the grid current increases, increase the capacity of C2.
If the grid current decreases, decrease the value of C2.
Properly neutralized, it will be possible to detune either direction from resonance and have the grid current decrease each side from plate resonance (ie - you should be able to tune for peak grid current and be at the dip (resonance) of the plate current.)

Always redip the Final tuning last. When properly neutralized on 10 meters, no further adjustment is necessary. (C2 normally will be about 2/3's open.)

3. Tune and load the transmitter for CW (Class C) operation on each band. Check the operation of all front panel controls.

g. After becoming familiar enough with the transmitter to feel that it is operating properly, disconnect the power cord and install the transmitter in its cabinet as follows:

1. Slip a lockwasher over each tie rod and insert the three 12" long tie bolts thru the three holes in the rear of the cabinet and then thru the brackets inside the cabinet (soap or grease the threads on these rods.)

D. 3. g. 2. Pull the line cord thru the opening in the cabinet and gradually slide the transmitter into place on the rails. Be certain the fan blade doesn't become bent during installation:

3. Carefully engage the cabinet into the front panel (be sure the line cord is pulled clear).

4. Start the three tie rods into the front panel.

5. Install the eight self tapping screws around the periphery of the cutouts. Soap or grease the threads before starting them. Gradually tighten the eight screws securely while checking for proper engagement of the front panel and cabinet. Use a lockwasher under the head of each screw.

6. Tighten the three tie rods securely. Be sure to use a screw driver of proper size so as not to burr the screw driver slots in the tie rods.

4. Tuning Procedure

The tuning procedure for the Viking Courier is identical on all bands of operation 3.5 thru 30 megacycles. 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.

Class "C" Tuning (CW)

a. Check that the desired connections described in paragraph C have been made.

b. Set the Viking Courier controls:

Control	Position
Meter Switch	Grid, Side "C"
Plate Switch	Off
Filament Switch	Off
Band Switch	Desired frequency (See table 1 on page 29)
Grid tuning	Desired frequency (See page 29)
Final tuning	Desired frequency (See page 29)
Aux coupling	1 (Set at 6 above 20 megacycles)
Fine coupling	0

c. Plug the power plug into a 115 volt 50-60 cycle AC source. Be sure the proper fuses are in the plug.

D. 4. d. Turn the Filament switch On. The meter lights, dial lights and tubes should light up and the fan should turn.

e. Allow 30 minutes warm up before switching the Plate switch On the first time the transmitter is used or after new 866A rectifier tubes (V3 and V4) are installed. This allows the mercury to evaporate from the rectifier elements. At other times, allow 30 seconds warmup.

f. Turn ON the Exciter. When a Johnson Viking Ranger, Navigator, or Pacemaker is used as the exciter, the Operate switch should be turned to the Tune or Standby position.

g. Tune and load the exciter until approximately 130 to 150 ma of grid current is shown on the Courier Grid meter (Class C position only). Alternately tune the Grid tuning on the Courier and the Plate tuning and loading on the exciter for max grid drive to the Courier with minimum plate current on the exciter.

h. Switch the Meter switch to Plate (Class C.)

i. Turn the Plate switch On and quickly rock the Final tuning control until resonance is found (dip in plate current). Turn the Final tuning exactly to minimum plate current. Plate tuning is quite broad on 80 meters and becomes less broad as the frequency is raised. Always tune for the middle of the dip (resonance.)

j. Adjust the Grid tuning and exciter tuning for 60 ma grid drive. Redip the Final (big knob) if necessary.

k. Increase the power to the antenna (or load) by successively advancing the Coupling controls "clockwise" (toward 7 and 100) one step at a time and then retuning the Final tuning for minimum Plate current after each adjustment of the Coupling controls. The minimum current will become progressively greater. Adjust the Coupling and Final tuning until the Plate current is about 335 ma (red dot). The Plate input is approximately 500 watts at this setting. Normal plate color of the 811A's at full rated ICAS plate dissapation is "a barely perceptible trace of color".

l. Readjust the exciter and Courier Coupling and Final tuning as necessary to adjust the Plate Current to 335 ma with the grid current at 60 to 80 ma.

5. Notes On CW Operation

The Courier may be used as a CW telegraphy amplifier in either the Class C or Class B position. The Class C position requires more drive than Class B. The efficiency is slightly better in Class C. However, a Class B amplifier produces lower harmonic output than Class C. This might be of value for TVI prevention. It is recommended that the Class C position be used for CW when the necessary drive power is available.

D. 5. The Johnson Ranger will drive the Courier to full ratings on all bands on Class C or Class B. The Johnson Navigator or Adventurer will drive the Courier to full ratings on all bands on Class B. The Johnson Pacemaker will drive the Courier Class C or Class B on all bands..

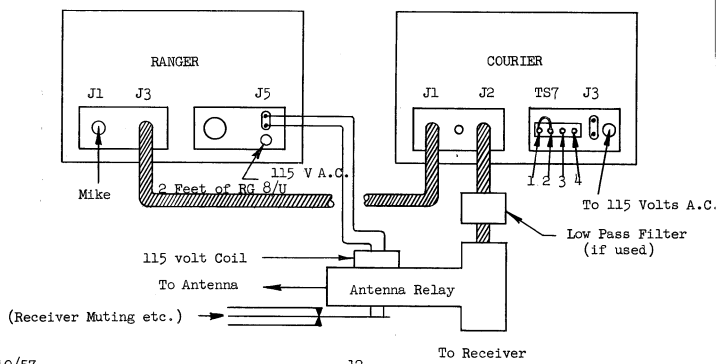
An antenna changeover relay may be operated by the 115 VAC power furnished by J3 on the rear of the chassis when the Plate switch is On. This method does not allow the use of full break-in operation. To operate full break-in requires the use of a separate receiving antenna, antenna relay controlled by the exciter or a TR box. Under these conditions, the Plate switch is left on. Blocking cutoff bias is available by opening the connection between terminals 1 and 2 of the terminal strip on the rear of the chassis. This could be performed by a set of external normally open contacts on the antenna relay.

6. Notes On AM Linear Operation

A worthwhile boost in power can be obtained with the Courier in AM linear operation. The Courier is tuned and loaded to full input on Class B (ie. 50 ma grid current at 335 ma plate current).

The grid drive to the Courier is then reduced (by the use of a power reducer, reducing the exciter input, or as is done with the Ranger, with the Drive control) until the Courier plate current is 130 ma. (Carrier level of 200 watts.) The exciter is then modulated. A scope should be used for initial modulation checking.

7. Notes On Use With The Ranger



D. 7. The Johnson Viking Ranger will drive the Courier to full output on all bands 80 thru 10 in the Class C position as well as the Class B position. It is recommended that the coaxial cable between the Ranger and Courier be kept short (less than 3 feet) in order that the input impedance of the Courier be seen by the Ranger. This precauation is necessary as a 1/4 wavelength of coax may transform the Courier input impedance to an undesirable value. If the coaxial cable cannot be kept shorter than three feet, use an eleven foot length. If the antenna relay has DPDT external contacts the receiver muting or standby and blocking bias application to the Courier may be performed with these contacts. If only SPDT external contacts are present, either an additional relay for one of these functions can be used (operated by the 115 volts AC out of the Ranger) or the Courier cutoff bias application can be jumpered with a wire. However, if the Courier is used in this fashion, a careful check of operation should be made. If any rectifier hash, diode noise, or instability should be present, it will be necessary to apply cutoff bias.

The Grid tuning is quite broad and may be peaked during initial tuneup and the Ranger Final tuning and Coupling adjusted for proper grid drive. However, a very convenient method of tune-up when the exciter has a pi-section output such as the Ranger is to turn the Ranger Coupling controls to 7 and 10 (minimum capacity) and then use the Grid tuning on the Courier as a coupling control. The position of the Grid tuning is adjusted, Ranger Final Tuning dipped, and then the procedure repeated until proper drive is obtained.

Typical Ranger-Courier Tune-Up

Ranger

(1) Operate - Tune

(2) Drive - 5

(3) Crystal-VFO - VFO or Zero

(4) Band - as desired

(5) Auxiliary Coupling - 7

(6) Coupling - 10

(7) Audio - 0

(8) Meter - Grid

(9) Buffer - tune for peak grid current

(10) Drive - adjust to 2 ma grid current

Courier

(11) Fil - On (allow 30 seconds warmup after initial warmup)

(12) Band - as desired

D. 7. (13) Final Tuning (big knob) - see chart page 29.

(14) Coupling controls - see chart page 29. Top control at "0" - Middle control as in chart.

(15) Grid - see approximate setting on chart page 29.

(16) Courier Meter - Grid "C" side

(17) Ranger Meter - to Plate

(18) Turn the Operate switch to CW and immediately tune the Final for dip in Ranger plate current (if no dip appears, change the setting of the Courier Grid Tuning until the Ranger Plate current dips.)

(19) Adjust the Courier Grid Tuning and or Ranger Coupling and the Ranger Final until the Courier Grid current is about 130 to 150 ma. (130 on 10 meters.) Be sure the Ranger Final is dipped and is not tuning at "100". (If the Ranger Final tunes at "100" (minimum capacity) it will be necessary to change the Ranger Coupling controls.)

(20) Turn the Drive to "0".

(21) Courier Meter to Plate "C" side.

(22) Turn the Courier Plate On.

(23) Advance the Drive control until about 200 ma Plate current is shown on the Courier.

(24) Quickly tune the Courier Final (big knob) to resonance (dip in plate current.)

(25) Turn the Ranger Meter to Grid. Adjust Drive until 2 ma grid current is shown on Ranger meter. Redip Courier Final if necessary.

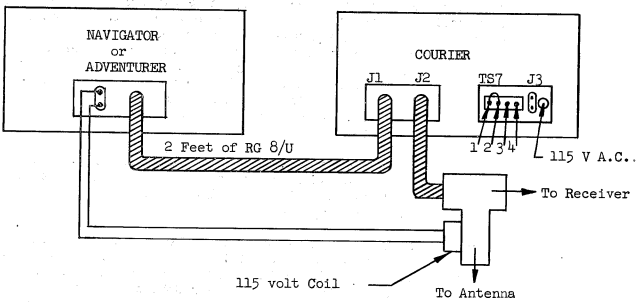
(26) Adjust the Courier loading by making a small change in the coupling control (top control) and then quickly dipping the Final. Repeat until the Courier is loaded to about 335 ma.

(27) Turn the Courier Meter to Grid "C" side. Grid current should be about 60-80 ~~70~~ - ~~75~~ ma. If it is not, readjust the Courier Grid and Ranger Final (ie. change the Ranger loading) until the grid current is 70 ma. Always dip the Final last.

(28) Recheck Courier Final tuning and loading. Always be sure to dip the Final tuning of both the Ranger and Courier last.

Required grid drive is much less in Class B position. The Ranger Drive control may be used to reduce output if the coupling controls do not reduce the output sufficiently. AM linear operation with the Ranger gives about a three fold boost to the Ranger output. This amounts to 200 watts input to the Courier.

D. 8. Notes For Use With the Navigator and Adventurer



The Navigator will drive the Courier to full ratings Class B on all bands and to full ratings on 80 and 40 meters on Class C.

The Navigator tune-up is the same as the preceding Ranger procedure with the following exceptions:

(1) The Courier is run Class B and the Courier Plate "Off" grid current is about 160 ma. The desired Plate "On" value of Grid current is 50-55 ma at 335 ma. Plate current.

(2) The Navigator does not have a Drive control and therefore when the Courier Plate switch is turned "On", it is necessary to very quickly tune the Courier Final (big knob) to resonance (dip in plate current) as the out-of-resonance plate current is high and the plate dissapation in the 811A's is very large.

(3) The Navigator Coupling controls are turned to 4 and 10 respectively (minimum capacity.)

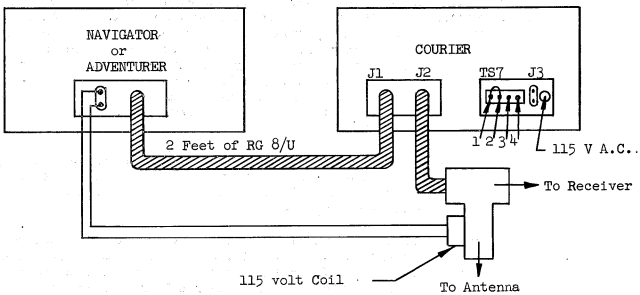
Class B position produces approximately the same output as Class C but also doesn't generate as much harmonic energy as Class C.

Operation is similar to Ranger Operation, except that reduced input must be run with the Adventurer on 10 meters.

9. Notes on SSB Phone Operation

When the Courier is used with equipments other than Johnson exciters, the correct adjustment of the exciter is best done with a scope. Several of the existing SSB exciters have insufficient output to drive the Courier to full rated output and the Courier must be run at reduced input.

D. 8. Notes For Use With the Navigator and Adventurer



The Navigator will drive the Courier to full ratings Class B on all bands and to full ratings on 80 and 40 meters on Class C.

The Navigator tune-up is the same as the preceding Ranger procedure with the following exceptions:

(1) The Courier is run Class B and the Courier Plate "Off" grid current is about 160 ma. The desired Plate "On" value of Grid current is 50-55 ma at 335 ma. Plate current.

(2) The Navigator does not have a Drive control and therefore when the Courier Plate switch is turned "On", it is necessary to very quickly tune the Courier Final (big knob) to resonance (dip in plate current) as the out-of-resonance plate current is high and the plate dissapation in the 811A's is very large.

(3) The Navigator Coupling controls are turned to 4 and 10 respectively (minimum capacity.)

Class B position produces approximately the same output as Class C but also doesn't generate as much harmonic energy as Class C.

Operation is similar to Ranger Operation, except that reduced input must be run with the Adventurer on 10 meters.

9. Notes on SSB Phone Operation

When the Courier is used with equipments other than Johnson exciters, the correct adjustment of the exciter is best done with a scope. Several of the existing SSB exciters have insufficient output to drive the Courier to full rated output and the Courier must be run at reduced input.

D. 9. 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 to 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 Meter switch in the "B" position. The power amplifier should be loaded up to 335 ma. Plate current using the regular CW tuning routine and with normal grid current of 50 ma. Both Grid tuning and Plate will be left unchanged from this point on. Turn Meter switch to "B", Plate.

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 1,000 cycles.

If a SSB transmitter is modulated with 1,000 cycle tone, the output would appear as a continuous wave signal 1,000 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 waveform (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 Courier 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, to 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 the tops and bottoms. Plate current at this point of saturation should be about 215 ma. under conditions of proper loading.

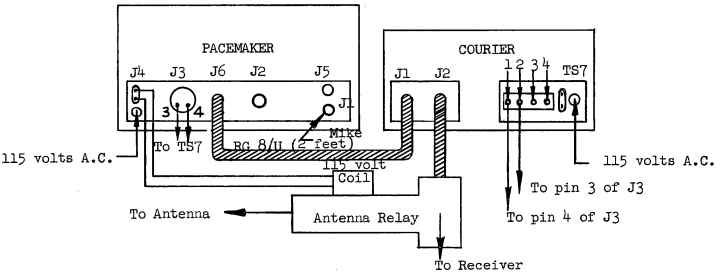
Leave the test set-up as is. Substitute the microphone for the audio oscillator previously used. Readjust the exciter to eliminate the carrier

D. 9. 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 250 ma. may be considered typical. Recommended reading; Power and Meter Facts in SSB, QST, August 1955.

10. Notes On DSB Suppressed Carrier Operation

The same ratings and loading conditions apply to DSB (double side-band) as to SSB.

11. Pacemaker



The Johnson Viking Pacemaker has excess power output available. The excess drive could be dissipated in a loading resistor, however, the resistor would have to be variable. A variable resistor of sufficient power capability, range and RF characteristic is difficult to make. However, the following method of tune-up allows the use of the Pacemaker - Courier with no loading resistors. This is accomplished by reducing the output of the Pacemaker by detuning the Exciter control. This results in less output without degrading the signal to noise ratio or carrier suppression. The Courier input loads the Pacemaker considerably by itself.

The following SSB procedure should be followed carefully.

The Courier is tuned and loading in the Class C position and the Pacemaker is loaded to 115 ma. plate current at .2 ma. grid current. (This is with the Courier approximately loaded to 300-335 ma. with greater than

D. 11. 50 ma. grid current. Then the Exciter control on the Pacemaker is reduced to set the Courier grid current to the proper value (50 ma.) and the Courier loading is adjusted properly (335 ma.). The mode switch is switched to SSB and the carrier balance controls adjusted for minimum Courier Class B plate current.

The following is a detailed tune-up procedure.

(1) Preliminary Check

a. Make sure all knobs are correctly installed.

b. Check to see that both fuses are in each of the line cord plugs.

c. Make certain terminals 1 and 2 of the terminal strip on the back of the Courier are connected together when the Courier is to be tuned up. See Section D2.

d. Set Pacemaker controls as follows:

1. Operate switch to Off.

2. Carrier Insert to "3".

3. "Balance Mod" to "5".

4. "Meter" to Plate

5. "Mode" to "AM HI".

6. Both "Carrier Balance" to "5".

7. "Band" switch to "80" (or band to be used.)

8. "VFO" to "3.5" ma. (or frequency desired)

9. "Aux Coupling" to "1".

10. "Fine Coupling" to "0".

11. "Exciter" to "10" (this varies with frequency.)

e. Connect the Courier input (outside coaxial receptacle) to the Pacemaker output by a short length (3 feet or less, or 11 feet) of RG - 8/U cable.

f. Connect a 200 watt (or greater) light bulb to the center of the coaxial output connector (center.) Ground the other bulb terminal to the chassis.

g. Ground all units together and to earth with short heavy leads.

D. 11. (1) h. Set the Courier controls as follows:

1. Meter to Grid on "C" side
2. Plate switch "Off".
3. Filament switch "Off"
4. Coupling (top control) to "0".
5. Coupling (middle control) to "1" (or "6" above 20 megacycles.)
6. Grid Tuning to "10".
7. Band to 3.5 - 7 (or band desired.)
8. Big knob to about "15" (or see table 1.)

i. Plug in the line cords.

j. Turn the Operate switch to zero (this position provides sufficent exciter output on any mode to zero beat to receiver frequency. Amount of output can be controlled by the "Carrier Insert".

k. Turn the Filament switch On. Allow 30 seconds warm up.

(2) CW Tune-Up

a. Make connections and adjustments as in part 1.

b. Turn the Operate switch to MAN-CW.

c. Tune Final for minimum plate current.

d. Turn Meter to Grid.

e. Tune Exciter and Bal Mod for peak grid current.

f. Reduce the Grid current to .2 ma with the carrier insert. If grid current exceeds .2 ma. with the carrier insert at zero, adjust one or both carrier bal controls to reduce grid current to zero. Adjust to .2 ma. by carrier insert.

g. Turn the Meter to Plate

h. Quickly tune Pacemaker Final for minimum plate current.

i. Adjust the Coupling controls on the Pacemaker and the Grid tuning on the Courier as necessary to obtain approximately 150 ma. grid current in the Courier. (Always keep the Pacemaker

D. 11. (2) i. Final dipped. The value of Pacemaker grid current in CW operation is not critical and should be set at about .2 ma. Likewise, the value of Pacemaker plate current is also not critical. The Pacemaker is loaded up only sufficently to drive the Courier properly.)

j. Turn the Carrier Insert to "0".

k. Tune the Carrier Bal control for minimum Courier grid current.

l. Turn Courier Meter to Plate "C".

m. Turn the Plate switch On. Plate current should be below 50 ma.

n. Advance the Carrier Insert control slowly until about 200 ma. plate current is shown on the Courier plate meter. Quickly tune the final (big knob) for dip in Plate current.

o. Advance the Carrier Insert to about "5" and redip the Courier Final.

p. Adjust the Courier Coupling and Final until the Plate current is approximately 300 ma.

q. Turn the Courier Meter to Grid "C" and adjust the Courier Grid current to 70 ma. This may be done with the Carrier Insert. If less than 70 ma. is obtainable, increase the Pacemaker loading to obtain the 70 ma. grid current. Always keep Final dipped.

r. Repeat o, p and q as necessary until the Courier is properly adjusted to 70 ma. grid current and 335 ma. plate current.

s. Turn Mode switch to CW.

t. The setup is now adjusted properly for CW.

Operate the key while watching the light bulb to see that everything is operating properly. Further check with a receiver or other monitor. Substitute an antenna transmission line and retune to a plate current of 335 ma. and grid current of 70 ma. (It should not be necessary to retune the Pacemaker.)

(3) SSB Tune-Up

a. Tune-up as in steps a thru h in part 2.

b. Adjust the Coupling control on the Pacemaker and Grid tuning on the Courier as necessary to obtain over 150 ma. grid current in the Courier.

c. Turn the Carrier Insert to "0" (Plate current will fall.)

D. 11. (3) d. Adjust both Carrier Bal controls for minimum plate current. This should be 15 to 20 ma. on the Pacemaker and about 50ma. on the Courier. Use care in this adjustment to insure that absolute minimum is obtained. The Courier Grid meter is more sensitive so use it for this adjustment. Once adjusted on a given band, no further adjustment is required until the band is changed.

e. Turn Courier Meter to Plate "B" side.

f. Turn Plate switch On.

g. Advance the Carrier Insert control slowly until about 200 ma. plate current is shown on the Courier plate meter. Quickly tune the Final (big knob) for minimum plate current.

h. Advance the Carrier Insert for .2 ma. grid current in Pacemaker and redip the Pacemaker and Courier Final.

i. Retune and load the Pacemaker for 115 ma. Plate current at .2 ma. Grid current. It may be necessary to adjust the Courier Grid Tuning to obtain the 115 ma. plate current in the Pacemaker (Keep Final dipped.)

j. Turn Courier Meter to Grid "B".

k. Set the Courier Grid current to 50 ma. by detuning the Pacemaker Exciter control.

l. Adjust the Courier Coupling and Final until the Plate current is approximately 335 ma.

m. Repeat k and l until the Courier is loaded to 335 ma. Plate current at 50 ma. Grid current.

n. Turn Mode to SB1 (upper sideband) or SB2 (lower sideband) as desired. Carefully tune the Carrier Bal for minimum Courier Grid current.

o. Turn Courier Meter to Plate "B".

p. Adjust the Audio clockwise until average voice modulation produces peak plate meter reading of about 250. Peak Grid current will be about 50 ma.

(4) AM-LO Tune-Up

a. Tune-up as in part 2, steps a thru j.

b. Set the Courier grid current to 50 ma. by turning the Carrier Insert counter-clockwise.

D. 11. (4) c. Adjust the Courier Coupling and Final until the Plate current is approximately 335 ma.

d. Repeat steps b and c until the Courier is loaded to 335 ma. plate current and at 50 ma. grid current

e. Set the Pacemaker plate current to 50 ma. with the Carrier Insert.

f. Turn the Courier Meter to Plate "B".

g. Set the Courier plate current to 130 ma. by detuning the Exciter control.

h. Mode to AM-LO.

i. Advance Audio clockwise until Courier plate meter peaks is about 150 ma. Higher average settings will degrade the signal and result in poor communication. Turn Mode to AM-HI before zero beating (changing frequency) as this turns off the Audio.

E. PI NETWORK TUNING AND GROUND SYSTEMS

1. General

The pi-network used in the plate circuit of the Viking Courier power amplifier is designed to match the PA into an unbalanced load of 52 ohms with standing wave ratios as high as 3:1 unbalanced resistive loads of 18 to 600 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 initiallyby 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.

E. 2.. 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 by-pass 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, receiver 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 into moist earth and spaced a few feet apart may be used.

b. Use heavy conductors (#14 or larger) between the connection at the ground point and the transmitter. Copper ribbon is excellent for this purpose.

E. 2. 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 of 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 inches 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-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

E. 4. may not prove excessive. The Johnson Matchbox, a universal all band, band-switched antenna coupler will permit loading of the Viking Courier 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-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-network.

Antennas with high terminal resistance or reactance can be recognized while loading the output stage of the Viking Courier. 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 noticable 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.

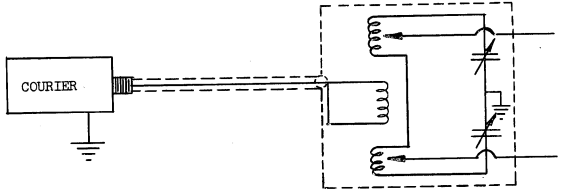
b. Change the point of connection of the feedline to the antenna 1/8 to 1/4 wavelength.

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.

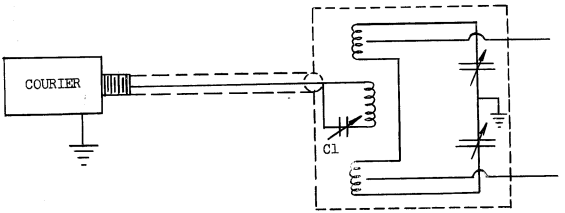
E. 5. Coupling To Balanced Loads

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 Courier is single ended, unbalanced, a coupler is required for balanced antenna systems. The Johnson Matchbox, a universal all band bandswitched antenna coupler, will permit loading of the Courier to any practical antenna system. In addition, it provides for 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.



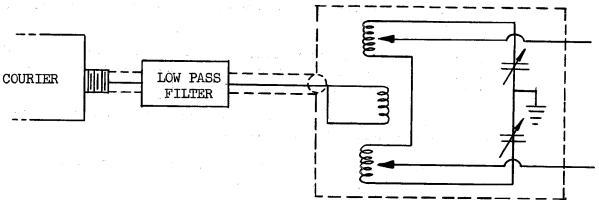
Feedpoint impedance of the coupler is adjusted by means of the inductor taps. Tap adjustment is unnecessary with the Johnson Matchbox. Final amplifier loading is adjusted with the transmitter output Loading control.

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 C_1 as shown below:



E. 6. Use of Low Pass Filters

Depending upon how it is tuned, 2nd harmonic attenuation of the Viking Courier amplifier can be greater than 30 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 Courier, but is available as an optional accessory. The filter will provide an additional 75 db or more harmonic attenuation above 54mc. with insertion loss less than .25 db. Characteristic impedance is 52 ohms, power rating 1KW. The low pass filter may be inserted in the coaxial line between the transmitter 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 Courier 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 250-26 or 250-37 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-network of the Viking Courier, or that the low output, coupling capacitance used reduced 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.

7. 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

E. 7. dummy antenna should present a resistive load of approximately 52 ohms (15 to 200 ohms can be tolerated) and be capable of dissipating 300 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.

F. TYPICAL OPERATING AND TROUBLE SHOOTING DATA

1. Trouble Shooting

   a. Schematic, 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. After turning equipment off, discharge each filter capacitor 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..

   The best procedure to follow is to attempt to isolate the trouble to a section of the equipment such as:

   1. High Voltage supply

   2. Bias Voltage supply

   3. Exciter

   4. Antennas

   5. Auxiliary circuit such as antenna transfer, relay circuit, meter circuit, etc.

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

F. 2. Typical Operating Data

Table 1 shows typical Dial readings for Class C, CW operation with a 50 ohm load.

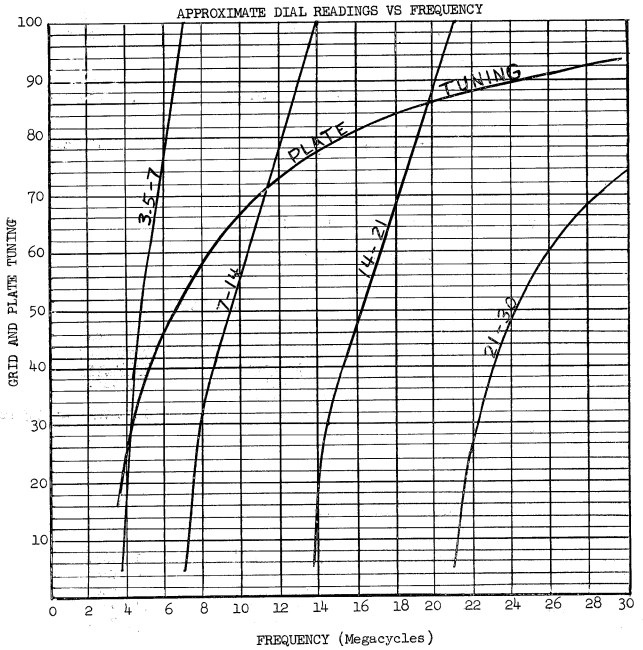


TABLE 2

TYPICAL METER READINGS

Plate Switch	Class	Mode	Grid Current	Plate Current
Off	C	CW	0	0
On	C	CW	70-75 ma.	335 ma.
Off	B	CW	0	0
On	B	CW	50 ma.	335 ma.
Off	B	SSB-DSB	0	0
On	B	SSB avg.		200 ma.
		peak (Voice)	50 ma.	250 ma.
Off	B	AM Linear	0	0
On	B	AM Linear avg.		130 ma.

TYPICAL TRANSFORMER AND CHOKE MEASUREMENTS

PLATE TRANSFORMER

T1 - 22.1388

Leads	Resistance	Voltages AC No Load	Full Load Operating Voltages
Black to Black	.44	115 volts	115 Vac.
Red to Yellow	~~165~~ 150	1800 volts	
Red to Red	~~330~~ 300	3600 volts	1500 Vdc. at 335 ma
Any lead to transformer case	Infinite	0	

FILAMENT TRANSFORMER

Ts - 22.1389

Black to Black	4.5 ohms	115 volts	115 Vac.
Brown to Brown	84 ohms	120 volts	95 Vac.
Green to Green	.04 ohms	6.5 volts	6.3 Vac.
Green to Yellow- green	.04 ohms	3.25 volts	3.15 Vac.
Blue to Blue	.02 ohms	2.6 volts	2.5 Vac.

10 HENRY CHOKE

T3 - 22.748

Black to Black	100 ohms

VIKING COURIER TRANSMITTER

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
22.1079	B1	1	Fan motor, 115 volts A.C.
22.1390	B2	1	2 1/2" 4 blade, CW fan, 1/8" bore
23.900-1	BKT. 1	1	Final tuning drive assembly
17.754-3	BKT. 2	1	Final capacitor mounting bracket
17.752-3	BKT. 3	1	Final tank support bracket
16.1001-5	BKT. 4,5,6	3	1 5/8" switch mounting brackets
16.1001-10	BKT. 7	1	1 1/8" switch mounting bracket
18.745	BKT. 8	1	Filter capacitor mounting board
16.1330	BKT. 9	1	Fan mounting bracket
16.26-1	BKT. 10	2	"E" condenser mounting brackets
16.29-3	BKT. 11	1	G capacitor mounting bracket
16.82-23	BKT. 12	1	11/16" x 37/64" L bracket
149-530-4	C1	1	Grid tuning capacitor
165-5	C2	1	23G45 neutralizing capacitor
22.856	C3	1	10mmfd. ±5% V mica. capacitor
22.827	C4,5,6,7,8, 9,10,11,26, 27,29,30,31, 32,33,34,35,36	18	.005mfd. 600 VW disc. ceramic capacitors
22.4041-5	C37,038	2	47mmfd. ±5% 500 V mica capacitor
22.1359	C12	1	500mmfd. 3 KV ceramic disc capacitor
22.~~1050~~ 1050	C13	1	1000mmfd. ~~25~~ 5 KV ceramic capacitor
154-37-2	C14	1	275E20 variable capacitor
154-40-2	C15	1	700E15 variable capacitor
22.4170-10	C16,17,18	3	620mmfd. ±10% 500 V mica capacitors
22.1446	C19,20	2	620mmfd. ±10% 600 V mica capacitors
22.1443	C21	1	300mmfd. ±10% 1200 V mica capacitor
22.1298-2	C22,23,24,25,39	5	80mfd. 450 WVDC electrolytic capacitors
22.765	C28	1	Dual 15mfd. 150 WVDC electrolytic capacitor
23.1055-2	CH1	1	Cabinet
23.1277-3	CH2	1	Panel
17.853	CH3	2	Chassis rails
17.1050	CH4	1	Chassis
22.1154-2	CH5	1	Meter shield
22.1155-2	CH6	1	Meter shield bracket
23.1475-2	CH7	4	Button, polyethylene rest
71.43-097	CH8	50"	3/16" Metaltex gasket
18.747	CH9	1	Terminal cover
23.909-2	D1,2	2	Pulley assembly
22.1272	D3,4	2	Springs
115-256-15	D5	1	Bearing and shaft assembly
104-250-54	D6	1	Insulated coupling
13.123-7	D7,8,9,10	4	3/8" panel bearings
147-310-56	D11	1	Red jewel (with nut)
13.155-102	D13	4	15/16" aluminum spacers
17.1066	CH10	1	Shield

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
13.155-70	D14	2	5/8" aluminum spacers
13.155-119	D15	12	.400 aluminum spacers
32.56-2	D29	1	Nylon feed thru bushing
32.64-3	D30	1	Dial escutcheon
22.994-2	D32	1 piece	Rubber strip for dial escutcheon
13.155-120	D31	3	3/16" aluminum spacers
22.1137-2	D34	1	Dial pointer
23.1122-2	D35	1	Dial backing plate and bracket assembly
42.49-150	D36	5 ft.	Dial cord
22.1136-2	D37,38	2	Dial cord pulleys 5/16" O.D.
31.288-2	D39	2	Dial cord pulley eyelets
23.1120-1	D41	1	Pulley assembly
23.910-2	D42	1	Spinner knob
23.907-12	D43,44	2	0-100 dial knob
23.1102	D45	1	Knob, bandswitch
23.907-14	D46	1	Single marker knob
23.907-15	D47	1	1-7 dial knob
22.997	D48	1/2 ft.	3/8" round wood doweling
42.49-140	D50	7 ft.	Lacing cord
23.1276	E1	1	Neutralizing suppressor
16.1340-2	E2,4	2	Grid parasitic suppressors
23.1280	E3,5	2	Plate parasitic suppressors
16.51-5	E6-9	4	Tube caps
22.747	E10	1	83-1R hood
22.1309	E11	1	UG177/U hood
18.36-6	E14	4	Fiber bushings
18.746	E15	1	Grid link mounting strip
22.1478	F1,2	4	7 amp. slow blow fuse type MDX
22.113-1	G1-6	6	9/16" O.D. rubber grommets
22.113-5	G7,8,9	3	5/16" O.D. rubber grommets
22.1398	I-1	3	#45 bulbs
22.21	I-2	1	#6S6 bulb
22.746	J1, 2	2	83-1R receptacles
11.951-1	HW	3	11 3/8" NPS truss head tie bolt 10-24
126-105	J3	1	Antenna relay jack
23.1274	L2	1	Grid coil assembly
23.1275	L3	1	High frequency coil
229-201	L4	1	Variable inductor
102-754	L5	1	750 ma. RF choke
22.1193	L6	1	2.4 mhy RF choke
22.939-3	M	1	0-5 ma.100 MV DC milliammeter
22.981	P1	1	Line plug
23.1031	P2	1	Antenna relay plug
22.7067-10	R1a,b,c,d	4	5600 ohm +10% 2W fixed composition resistor
22.9056-10	R2	1	100 ohm ±10% 7W WW resistor

VIKING COURIER TRANSMITTER

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
22.7073-10	R3,a,b,c,d	4	10,000 ohm ±10% 2 W fixed composition resistor
22.7001-10	R4	1	10 ohm ±10% 2 W fixed composition resistor
22.8018-5	R5	1	.51 ohm ±5% 1/2 W WW resistor
22.8877-10	R6	1	750 ohm ±10% 10 W WW resistor
23.914-1	R7	1	100 m.v. shunt for 500 ma.
22.1468	R8,9,10,11,16	5	10K ohm 25 W WW resistor
22.6049-10	R12	1	1000 ohm ±10% 1 W fixed composition resistor
22.6085-10	R13	1	33K ohm ±10% 1 W fixed composition resistor
22.9094-10	R14	1	3.9K ohm ±10% 1 W fixed composition resistor
22.6019-10	R15	1	56 ohm ±10% 1 W fixed composition resistor
22.756	SW1, 2	2	DPDT bat handle toggle switch (with nuts)
22.1392	SW3	1	Bandswitch
22.1393	SW4	1	Output coupling switch
22.1394	SW5	1	Mode switch
22.1009	SR	1	35 ma. selenium rectifier
22.1388	T1	1	1500 volt plate transformer
22.1389	T2	1	Filament transformer
22.748	T3	1	10 henry 350 ma. choke
22.740-3	TS1,6	2	3 terminal strip
22.740-4	TS2	1	4 terminal strip
22.740-6	TS3	1	6 terminal strip
22.740-8	TS4	1	8 terminal strip
22.740-5	TS5	1	5 terminal strip
22.907-4	TS7	1	4 terminal board
22.1251	V1,2	2	Type 811A electron tubes
22.212	V3,4	2	Type 866AX/A electron tubes
71.49-114	W1	7 ft.	Line cord
147-610-14	XI1	2	Lamp sockets
147-620	XI2	1	Lamp socket
23.1047	XI3	1	Pilot light assembly snap-in type
122-224-1	XV1-4	4	4 prong wafer sockets

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

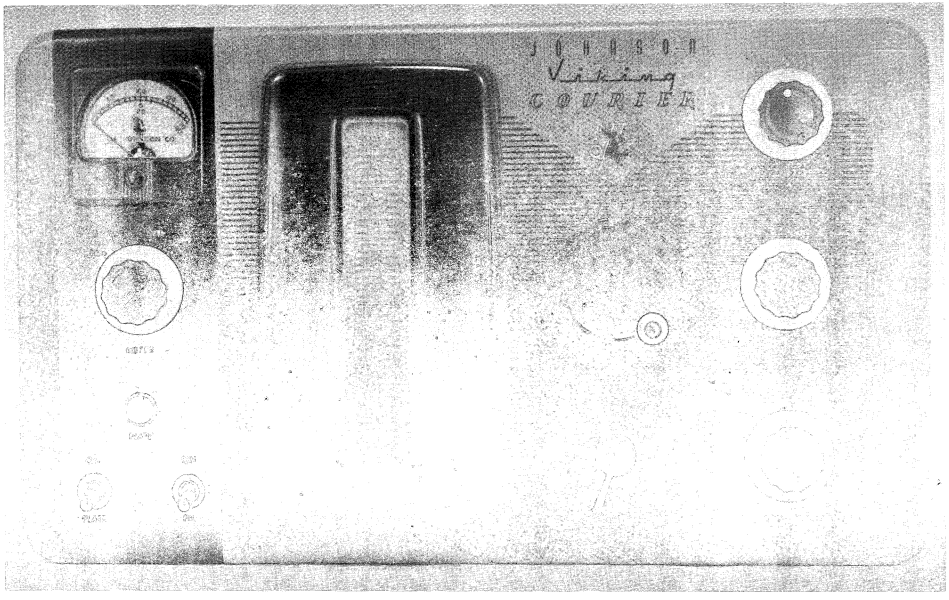


Figure 1: Front Panel

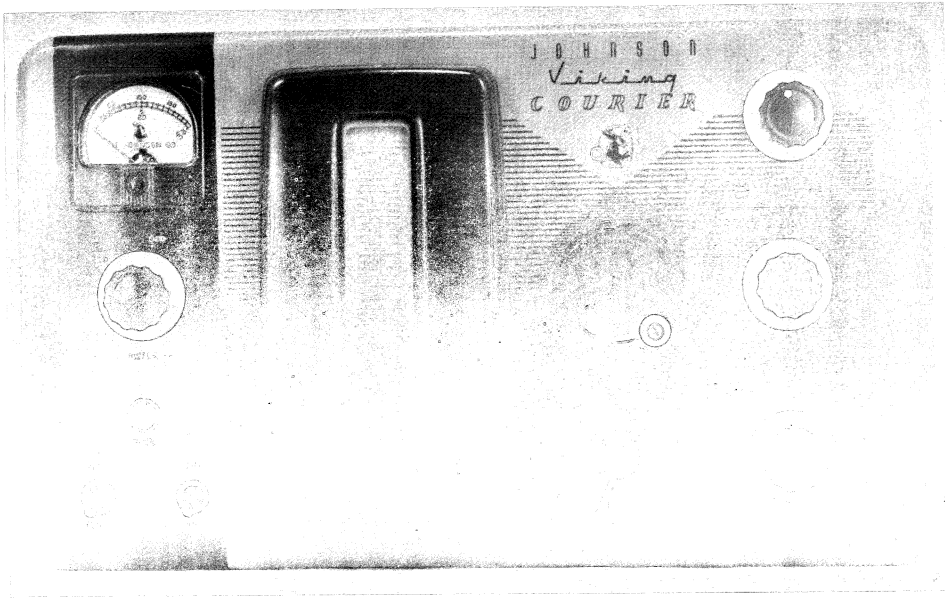


Figure 1: Front Panel

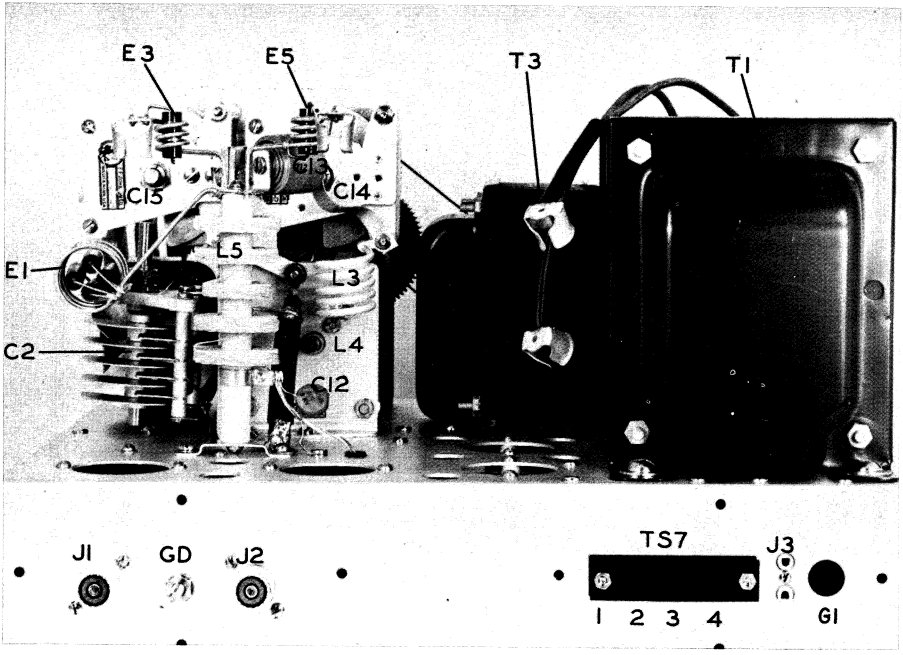
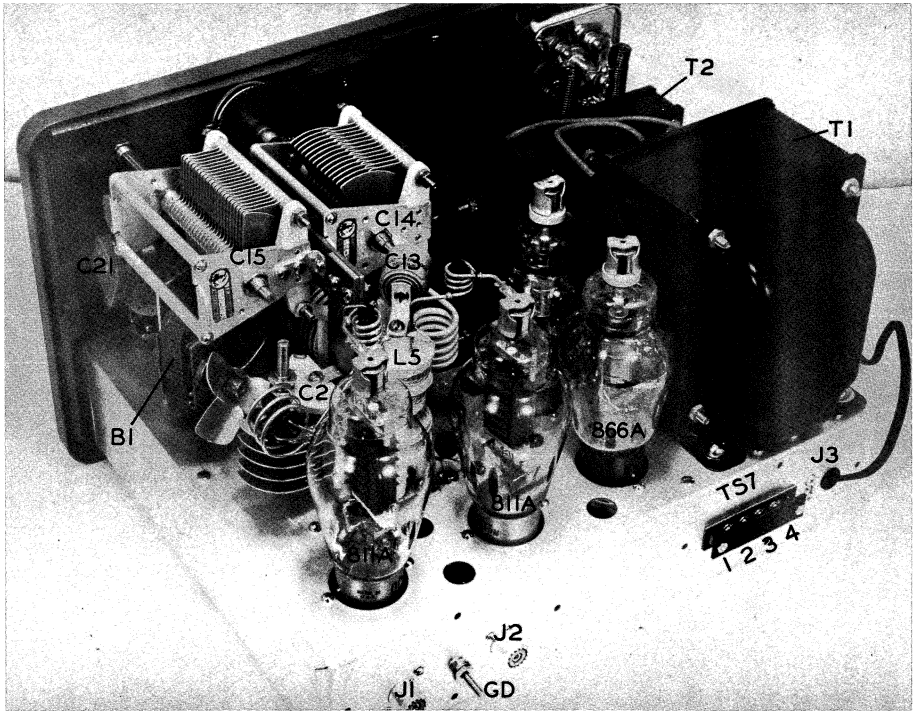


Figure 2: Back View


T2
T1
C14
C15
C13
C21
L5
C2
B1
866A
J3
TS7
1 2 3 4
811A
811A
J2
J1
GD

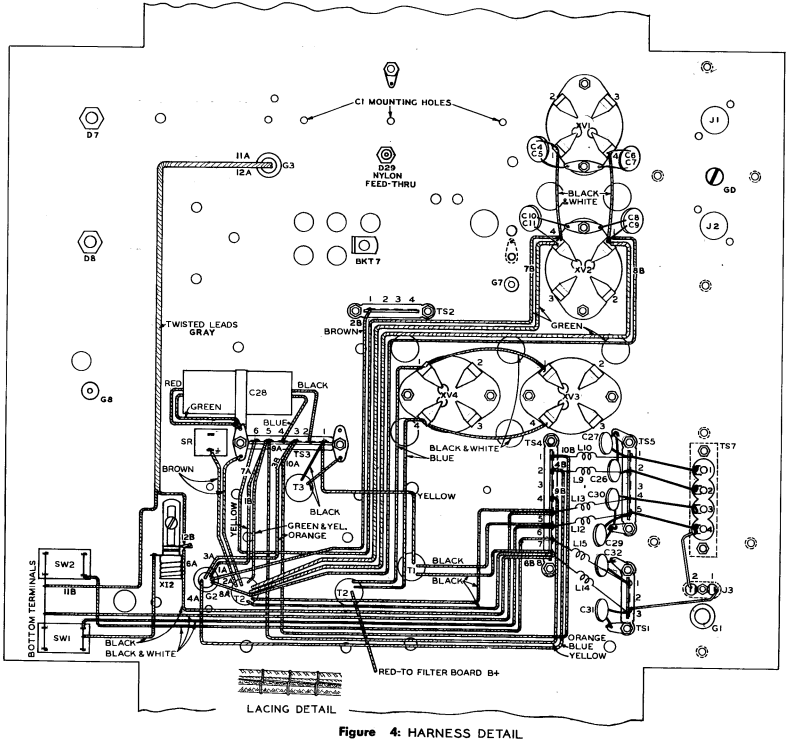


Figure 4: HARNESS DETAIL

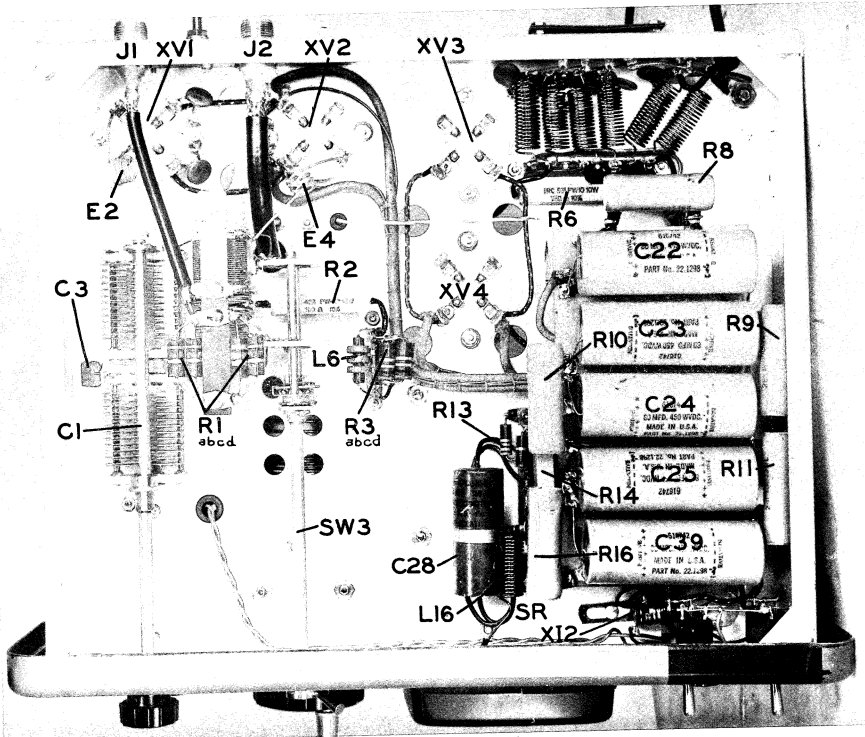
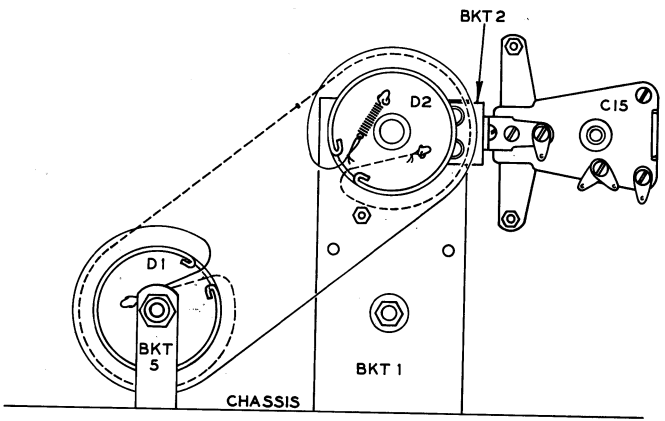


Figure 5: Bottom View



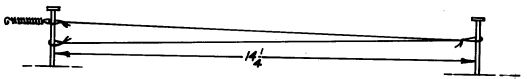


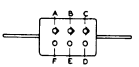
Figure 6: Dial Drive

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		1,000
SILVER	-	0.01	10	2,000
NO COLOR	-	-	20	500

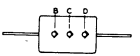
* APPLIES TO CONDENSERS ONLY

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%

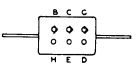


JAN FIXED CAPACITORS



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 8-DOT CODE

CONDENSER-RESISTOR COLOR CODE

Figure 7:

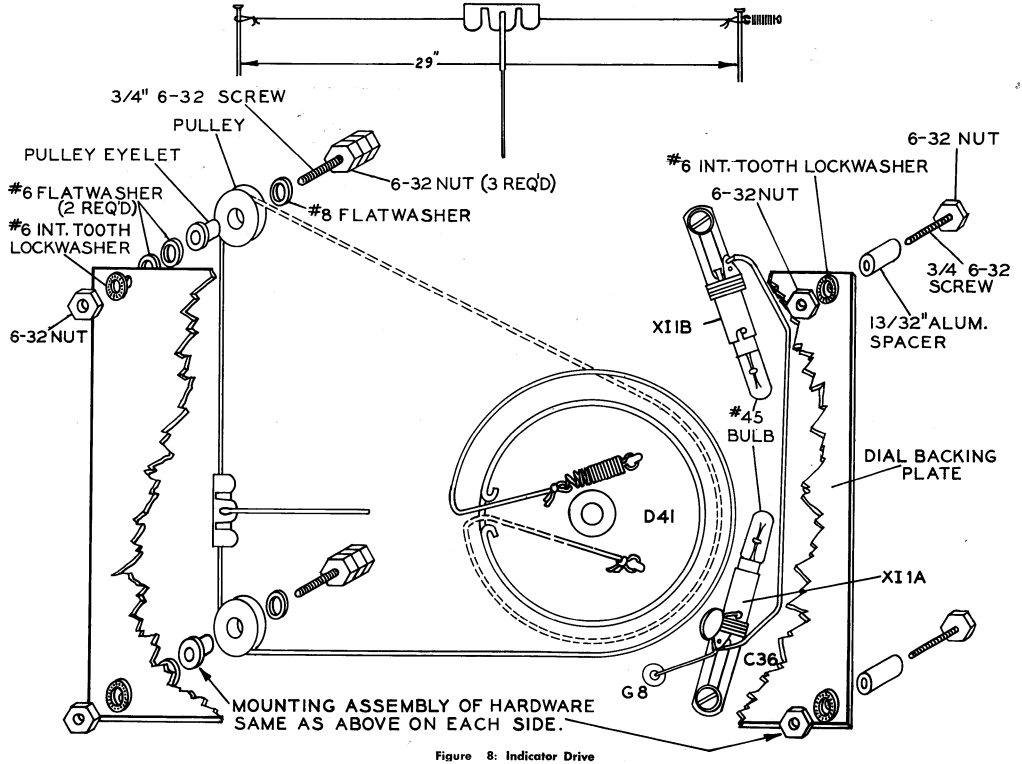
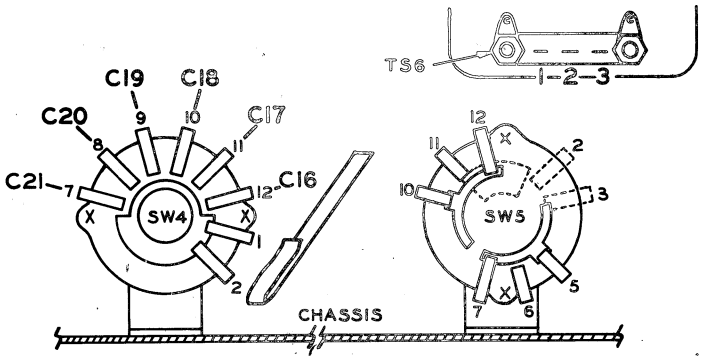
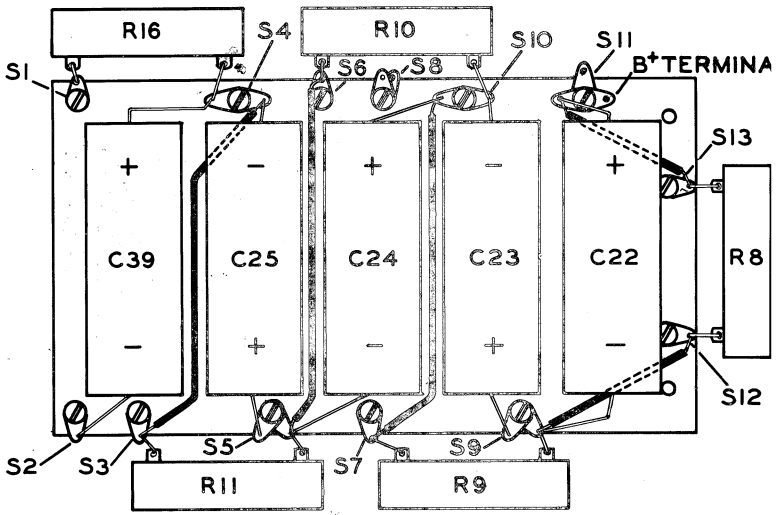


Figure 8: Indicator Drive



SWITCHES SHOWN IN CCW POSITION VIEWED FROM REAR

Figure 5:



HIGH VOLTAGE FILTER BOARD

Figure 6:

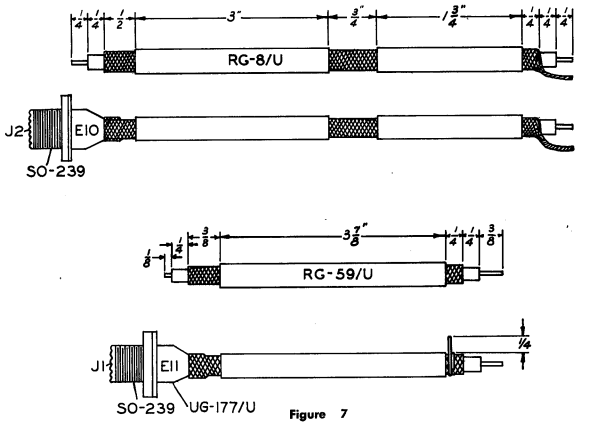


Figure 7

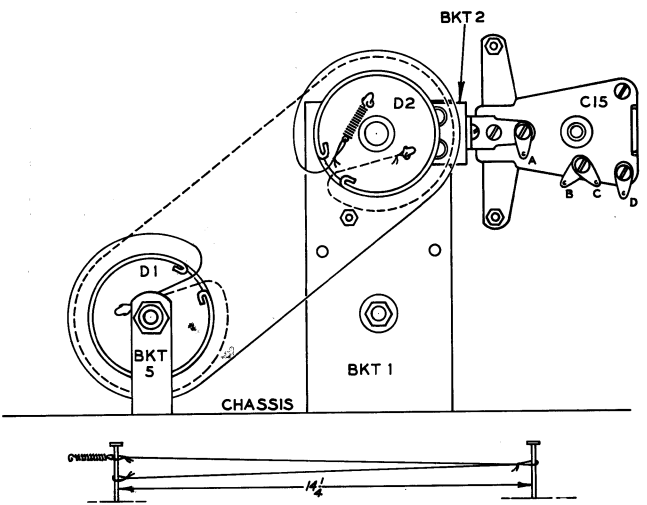
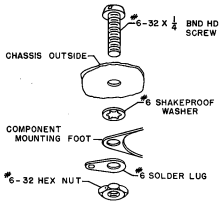
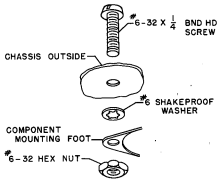


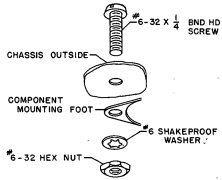
Figure 8



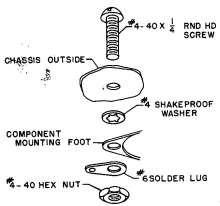
SEQUENCE "A"



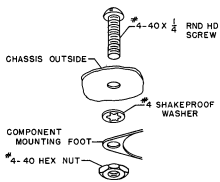
SEQUENCE "B"



SEQUENCE "C"



SEQUENCE "D"



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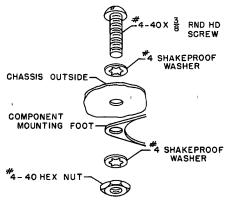
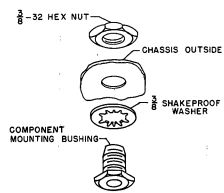
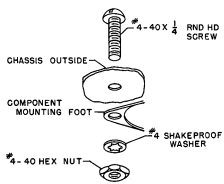


SEQUENCE "F"



SEQUENCE "G"



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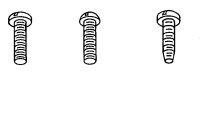


Hardware Sequence

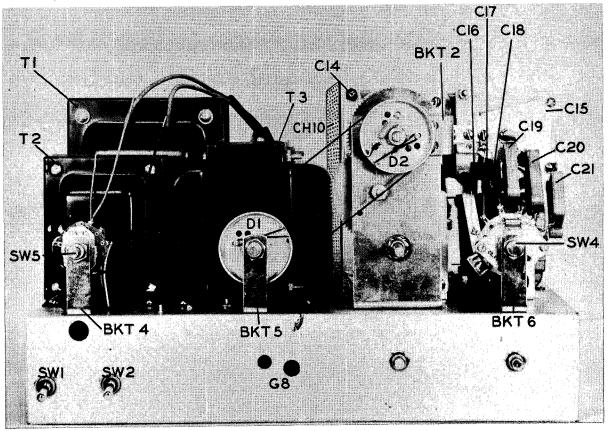


Figure 10

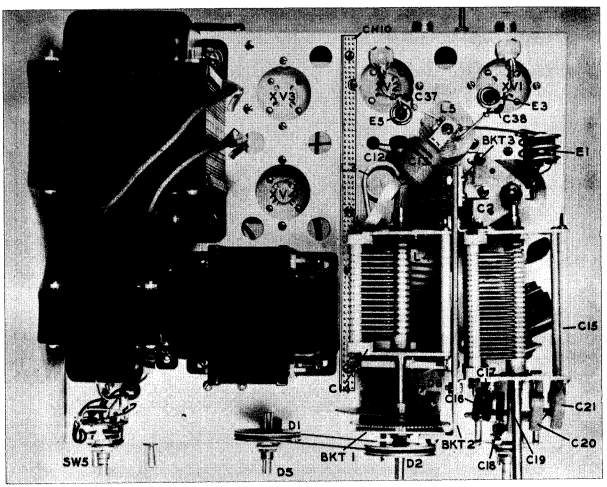
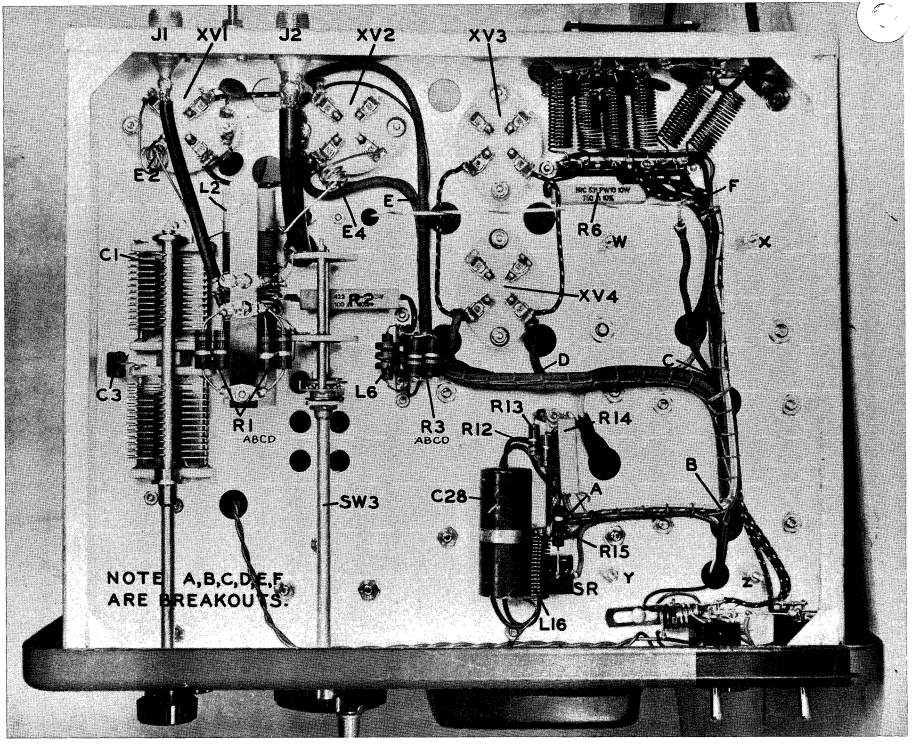


Figure 11


J1
XV1
J2
XV2
XV3
E2
L2
E
E4
F
R6
W
X
C1
R2
XV4
D
C
C3
L6
R13
R14
R1
ABCD
R3
ABCD
R12
B
A
C28
SW3
R15
SR
Y
Z
L16
NOTE A,B,C,D,E,F
ARE BREAKOUTS.

VIKING COURIER ASSEMBLY DETAILS CONTENTS

INTRODUCTION TO THE ASSEMBLY DETAILS FOR THE JOHNSON VIKING COURIER AMPLIFIER

The care with which any piece of equipment is built determines, to a large extent, the satisfaction and value which can be derived from its use. Follow each step of the assembly details carefully and completely before performing the indicated operation, rereading any step which may not be immediately clear. Use the illustrations whenever a doubt about dressing and training of leads, or positioning of a component arises.

The Viking Courier kit has been packaged for the convenience of the builder. Check the kit parts against the packing slip, consulting the listing on each envelope to identify the components and hardware. Do Not remove the hardware or components from the envelopes until they are recognized and can be kept sorted for easy access later. Check all switches carefully (against Figures 3 and 5) for correct length and position of contacts prior to mounting.

Component locations and terminal numbers are obtained from the line drawings, figures and photos of the finished chassis. Note that the hardware sequence drawings give the order of assembly and specify the size hardware to be used. Resistor and capacitor lead lengths are given. These components have been positioned so as to provide short leads and good separation between leads and components.

The letter (S) appearing in the instructions means "solder". The letters (NS) "do not solder". After completing each operation, check it off in the box ( ) provided. Do not use excess solder as it may cause shorts. This is particularly true of switches. Correct soldering procedure calls for heating the joint first and then applying solder to the hot joint, not to the soldering iron. Use good Rosin Core solder and keep the soldering iron hot and clean to assure good connections.

A nominal list of tools for kit assembly should include a good soldering iron, screwdrivers, a knife, a long nose pliers, a diagonal cutter, a 5/16" and a 1/4" Spintite type wrench, a ruler, a 1/2" and 9/16" wrench and a soldering aid probe tool.

A. COMPONENT MOUNTING

1. (✓) Make up four mounting legs as shown in Figure 1 and attach them with the eight 9/16" x 10-32 pan head screws and 10-32 nuts.

2. (✓) Mount XV3 and XV4 (4 pin ceramic tube sockets) with the large diameter holes (pins 1 and 4) toward the front of the chassis as shown in Figure 4 using the following hardware sequence: 1" x 6-32 screw head, chassis top, .400" aluminum spacer, #8 fiber washer, socket, #8 fiber washer, #6 flat-washer, #6 shakeproof washer, 6-32 nut. Center the socket and tighten securely.

3. (✓) Mount XV1 and XV2 (4 pin ceramic sockets) with the large diameter holes toward each other as shown in Figure 4 with the following sequences: Use sequence as in step 1 for mounting on the pins 2 and 3 ends; use the following sequence on the 1 and 4 ends, 1" x 6-32 screw head, chassis, .400" spacer, #8 fiber washer, socket, #8 fiber washer, #8 double teardrop ground lug, #6 shakeproof, 6-32 nut. Center and tighten securely.

4. (✓) Mount TS1 (3 terminal strip) and two #6 teardrops using hardware sequence A. Use the two holes which are 1 3/16" and 2 3/8" from the edge of the chassis.

5. (✓) Locate the large perforated aluminum shield, CH10. Install a 5/16" O.D. rubber grommet in the large hole in CH10. Mount TS2 (4 terminal strip) under the chassis and CH10 on top of the chassis (flange of CH10 toward XV1) as follows: 1/4" x 6-32 screw, CH10 flange, chassis, TS2 foot, #6 shakeproof, 6-32 nut. Secure the ends of CH10 with 1/4" x 6-32 screws, #6 shakeproofs, and nuts.

6. (✓) Mount TS3, 6 terminal strip. At terminal 1 end use sequence A except for use of #8 double teardrop in place of #6 solder lug. At the terminal 6 end use following hardware sequence: 1/4" x 6-32 screw, chassis, #6 shake-proof washer, TS3 mounting foot, C28 (15-15 mfd 150 volt electrolytic capacitor) mounting leg (the red and green leads of C28 are toward the front of the chassis), #8 double teardrop, 6-32 nut. Tighten securely.

7. (✓) Mount TS4 (8 terminal strip) using sequence C.

8. (✓) Mount TS5 (5 terminal strip) and two #6 teardrops using sequence A.

9. (✓) Mount J3 (2 terminal ceramic jack) on the inside of the back panel of the chassis as shown using the following sequence: 3/8" x 4-40 screw, chassis, J3, #4 shakeproof, 4-40 nut. Tighten carefully.

10. (✓) Insert a 1" x 10-32 round head screw (GD) (from the inside of the chassis) through the back panel of the chassis and secure with a #10 shakeproof and nut on the outside of the chassis. Place two flatwashers and a nut on this ground stud.

11. (✓) Install G1, G2 and G3 (9/16" outside diameter rubber grommets) as shown in Figure 4.

12. (✓) Install G7 and G8 (5/16" O.D. rubber grommets) as shown in Figure 4.

A. 13. (✓) Mount BKT4, 5 and 6 (2" long and 5/8" wide "L" brackets) on the top of the chassis as shown in Figure 10 using the following sequence: 3/8" x 8-32 round head screw, bracket mounting foot, chassis, #8 shakeproof, 8-32 nut. The brackets should be flush with the front of the chassis. Center and tighten securely.

14. (✓) Mount BKT7 (1 1/2" L x 5/8" W "L" bracket) inside the chassis as shown in Figure 4 using the sequence as in step 13.

15. (✓) Mount D7 and D8 (3/8" panel bearings) from the inside of the chassis as shown in Figure 4 and secure with 3/8"-32 nuts on the outside.

16. (✓) Mount D5 (1 5/8" shaft and bearing) in BKT5 as shown in Figure 11 using a 3/8"-32 nut.

17. (✓) Mount D1 (1 3/4" pulley) on D5 using two 3/16" x 8-32 setscrews. The hub should face the front of the chassis. The pulley should be as far forward as possible.

18. ( ) Mount SW5 (mode switch, phenolic wafer) in BKT4 using sequence G. Orient as shown in Figure 5 and tighten securely. See Figure 10.

19. ( ) Mount SW4 (output coupling, single ceramic wafer, switch) in BKT6 as shown using sequence G. See Figures 10 and 5.

20. (✓) Mount SW1 and SW2 (DPDT toggle switches) as shown in Figure 3 with the ON position (Marked on switches) toward the top surface of the chassis, as follows: Remove all but one nut from each switch, position each of these nuts for 1/4" of thread in front of it, and mount with the other hex nuts. Center and tighten. Save the ring nuts.

21. (✓) Mount SR (selenium rectifier) next to TS3 using a #6 shakeproof and 6-32 nut. The (+) terminal should be away from the center of the chassis. Tighten carefully. See Figure 4.

22. (✓) Mount C1 (149-530-4 dual variable capacitor) as shown in Figure 12. Loosen D7 and insert the shaft of C1 thru it. Mount the middle, front and rear of C1, in that order, as follows: 1/2" x 6-32 screw, #6 shakeproof, chassis, 3/16" aluminum spacer, C1. Center and tighten C1 and D7 securely.

23. (✓) Mount the two grid coil supports as shown in Figures 3 and 12 as follows (starting from the chassis top): 2 1/2" x 6-32 screw, chassis, #6 shakeproof, 5/8" aluminum spacer, 6-32 nut. Tighten securely.

24. (✓) Mount the four filter board supports (W, X, Y and Z) as shown in Figure 12 as follows: Front outside support (Z); 1 3/8" x 6-32 screw, #6 teardrop (pointed toward SW5), #6 shakeproof, top of chassis, 15/16" aluminum spacer, 6-32 nut. Mount the remaining three supports as above but omit the teardrop.

25. ( ) Mount D29 (nylon feed thru) as shown in Figure 4 using a 1/4" -32 nut.

26. (✓) Mount TS7 (4 terminal board) on the back of the chassis as shown in Figure 4 using the following sequence starting from the inside of the chassis: 1/2" x 6-32 screw, #6 shakeproof, chassis, TS7, 6-32 nut, 6-32 nut, 6-32 nut, CH9 (terminal cover), 6-32 nut. Tighten each nut securely.

A. 27. (✓) Screw the 6S6 (120 volt lamp) into XI2 and mount the socket (XI2) under the chassis as shown in Figure 4 and secure with a #6 self-tapping screw and a #6 shakeproof, from under the chassis.

28. (✓) Mount a #6 teardrop (HW) on top of the chassis near G7 as follows: 1/4" x 6-32 screw, #6 teardrop, #6 shakeproof, chassis, #6 shakeproof, 6-32 nut. See Figure 4.

29. (✓) Tighten all the nuts on BKT1 (final tuning gear drive assembly), lubricate the moving parts lightly with oil or grease, and mount as shown in Figure 11 using the following sequence: 3/8" x 10-32 screw, bracket foot, chassis, #10 shakeproof, 10-32 nut.

30. (✓) Insert the long end of the small gear shaft supplied with BKT1 thru the panel bearing, nearest the chassis, from the rear of BKT1.

31. (✓) Start four 6-32 setscrews in D6 (insulated coupler).

32. (✓) Slip D6 over the shaft of BKT1.

33. (✓) Connect a 2" length of #14 bare wire between the two front terminals of L4 (rotary inductor). The front terminals are on the close wound end of the inductor. Solder one end to the flat spring terminal and wrap the other end around the screw stud (between the flatwashers) and secure with the shakeproof and nut.

34. (✓) Mount L4 (rotary inductor) as shown in Figure 11 (roller toward the outside of the chassis) using the following sequence: 3/8" x 8-32 screw, inductor mounting foot, chassis, #8 shakeproof, 8-32 nut.

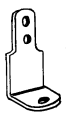
35. (✓) Center D6 and tighten the setscrews carefully.

36. (✓) Mount BKT3 (5" long "L" bracket) as shown in Figure 11 using the following sequence: 3/8" x 10-32 screw, bracket foot (toward chassis center), chassis, #10 shakeproof, 10-32 nut.

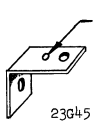
37. (✓) Mount the short end of BKT2 (6 3/4" long "L" bracket) as follows: 1/4" x 10-32 screw, #10 shakeproof, BKT2, BKT1. Do not tighten. See Figure 10.

38. (✓) Hold the gear (part of BKT1) in position (meshed with the small gear) with the setscrews toward the rear of the chassis and insert the shaft of C14 (275E20 variable capacitor, 154-37-2) thru the gear and thru the bearing in BKT1.

39. (✓) Mount C14 as follows: Front: 1/2" x 6-32 screw, depressed side of BKT2, C14 mounting foot, #6 shakeproof, 6-32 nut. Rear: 1/2" x 6-32 screw, 1" long "L" bracket, depressed side of BKT2, C14 mounting foot, #6 shakeproof, 6-32 nut. Tighten securely.



1" L Bracket



23G45 L Bracket

A. 40. (✓) Attach BKT2 to BKT3 using 1/2" x 10-32 screws, #10 shakeproofs, and 10-32 nuts.

41. (✓) Tighten the screws attaching BKT1 and BKT2.

42. (✓) Attach the 23G45 "L" mounting bracket (see above figure) to the outside of BKT3 as follows: 3/8" x 3-32 screw, L bracket, BKT3, #10 solder lug with ears (pointed toward upper terminal of L4), #8 shakeproof, 8-32 nut. (Be sure the index part is up). (See Figure 3 of the Operating Manual.)

43. (✓) Mount C2 (23G45 variable capacitor) on this bracket as follows: 1/4" x 6-32 screw, #6 shakeproof, bracket, C2. Make certain the index is properly seated and tighten carefully.

44. (✓) Attach a 1" "L" bracket to BKT2 using a 1/4" x 6-32 screw. Attach C15 (700E15 variable capacitor) to the two 1" brackets using four 1/4" x 6-32 screws. Mount four teardrops on the front end frame of C15 oriented as shown in Figure 8. Use #6 shakeproof washers under the teardrops. Tighten securely.

45. (✓) Mount L5 (5 pi RF plate choke) as follows: Sequence on screw nearest the center of the chassis, 3/8" x 8-32 screw, #8 shakeproof, #10 long flat solder lug (pointed into the 5/8" hole), L5 mounting foot, chassis, #8 shakeproof, 8-32 nut. The other side is mounted with the same sequence except that the #10 solder lug is omitted. See Figure 2 of the Operating Manual.

46. (✓) Carefully remove the screw and shakeproof from the top of L5 and install a #8 double teardrop and the 11/16" x 37/64" "L" bracket on top of L5. Orient as shown in Figure 11 with the 11/16" side of the bracket mounted on L5.

47. (✓) Mount a #6 teardrop near C1 as shown in Figure 4 using a 1/4" x 6-32 screw, chassis, #6 shakeproof, #6 teardrop, 6-32 nut.

48. (✓) Bend all teardrops up away from the chassis.

49. (✓) Install a 9/16" O.D. rubber grommet in each hole of BKT9 (fan mounting bracket).

50. (✓) Mount BKT9, under C15 with the mounting foot toward the rear of the chassis, as shown as follows: 1/4" x 6-32 screw, bracket foot, chassis, #6 shakeproof, 6-32 nut. Center carefully and tighten.

51. (✓) Mount T3 (10 henry choke) as shown using the following sequence: 3/8" x 10-32 screws, choke mounting feet, chassis, #10 shakeproof, 10-32 nuts. Center and tighten securely. See Figure 10.

52. (✓) Mount T1 (Plate transformer) as follows: Lay T1 on its side and place the chassis against it and secure with the following sequence: 3/8" x 1/4"20 screws, 1/4"flatwasher, T1 mounting foot, chassis, 1/4" lock-washers, 1/4"-20 nuts. Position T1 so it is flush with the rear of the chassis and tighten securely.

53. (✓) Mount T2 (filament transformer) with the green leads toward the front of the chassis using the same sequence as with T3.

A. 54. (1) Mount SW3 (bandswitch) in BKT7 as shown in Figures 3, 4 and 12 using sequence G.

B. TRANSFORMER AND FILAMENT WIRING. Refer to Figure 4 and 12 for training of leads. Strip 7/16" insulation off leads before connection.

1. (1) Connect one black lead from T1 to terminal 6 of TS4 (NS).
2. (1) Connect the other black lead from T1 to terminal 8 of TS4 (NS).
3. (1) Connect the shorter black lead from T2 to terminal 8 of TS4 (NS).
4. (1) Connect the longer black lead from T2 to terminal 5 of TS4 (NS).
5. (1) Connect one brown lead from T2 to the ground lug under TS3 (S).
6. (1) Connect the other brown lead from T2 to the (+) terminal of SR (S).
7. (1) Connect the green-yellow lead from T2 to terminal 5 of TS3 (NS).
8. (1) Connect the longer of the blue leads from T2 to pin 1 of XV4 (NS).
9. (1) Connect the shorter blue lead from T2 to pin 4 of XV4 (NS).
10. (1) Connect a 3 1/2" length of black-white cloth covered wire between pin 1 of XV4 (S) and pin 1 of XV3 (S).
11. (1) Connect a 3 1/2" length of black-white cloth covered wire between pin 4 of XV4 (S) and pin 4 of XV3 (S).
12. (1) Connect the shorter of the two green leads from T2 thru the large diameter hole in terminal 4 of XV2 (NS).
13. (1) Connect the longer green lead from T2 to pin 1 of XV2 (NS) (thru larger hole).
14. (1) Connect a 2 7/8" length of black-white cloth covered wire between pin 1 of XV2 (NS) and pin 4 of XV1 (NS).
15. (1) Connect a 2 7/8" length of black-white cloth covered wire between pin 4 of XV2 (NS) and pin 1 of XV1 (NS).
16. (1) Make up four filament bypass capacitors (C4-C5, C6-C7, C8-C9, C10-C11) as follows: Twist the leads of two .005 mfd disc capacitors together, thereby making a .01 mfd capacitor with heavy twisted leads. Cut these leads to 1/2".
17. (1) Connect one of the above capacitors between each of the filament pins of XV2 (NS) and XV1 (S) (pin 1 and 4 of each socket) and the adjacent ground terminals (S). See Figure 4.
18. (1) Connect a 2 1/4" length of #20 bare wire thru the four bottom terminals of SW1 and SW2 (S). See Figure 4.
19. (1) Connect an 11" length of black-white cloth covered wire between the two top terminals of SW1 (S) and terminal 6 of TS4 (NS).

B. 20. (✓) Connect a 12" length of black-white cloth covered wire between the lead thru the bottom terminals of SW1 and SW2 (S) and terminal 5 of TS4 (NS).

21. (✓) Connect an 11" length of black-white cloth covered wire between the two terminals of SW2 (S) and terminal 7 of TS4 (NS).

22. (✓) Cut the two black leads of T3 to 2 1/2" in length.

23. (✓) Connect one of the black leads from T3 to the teardrop near the terminal 1 end of TS3 (S).

24. ( ) Cut the blue and black leads of C28 (dual 15 mfd. capacitor) to 2", strip and connect as follows: Blue lead to terminal 4 (NS) and black lead to terminal 2 (NS) of TS3.

25. (✓) Cut the red and green leads of C28 to 3" and connect to the teardrop adjacent to terminal 6 of TS3 (S).

C. CAPACITOR AND RESISTOR CONNECTIONS

1. ( ) Cut the leads of C3 (10 mmfd mica capacitor) to 1/2" and connect between the front outside stator terminal of C1 (S) and the adjacent teardrop (S). See Figure 12.

2. (✓) Cut the leads of R15 (56 ohm 1 watt resistor) to 3/4" and connect between the remaining (-) terminal of SR (S) and terminal 4 of TS3 (NS).

3. (✓) Cut the leads of R14 (3,900 ohm 7 watt resistor) to 7/8" and connect between terminal 4 of TS3 (S) and terminal 2 of TS3 (NS).

4. (✓) Cut the leads of R12 (1000 ohm 1 watt resistor) to 5/8" and connect between terminal 3 and terminal 2 of TS3 (NS).

5. (✓) Cut the leads of R13 (33,000 ohm 1 watt resistor) to 5/8" and connect between terminal 2 of TS3 (S) and the adjacent teardrop (S).

6. (✓) Cut the leads of R5 (.51 ohm resistor) to 5/8" and connect between terminals 11 and 6 of SW5 (NS). See Figures 5 and 11.

7. (✓) Connect R7 (500 ma nichrome meter shunt) between terminals 3 and 5 of SW5 (NS).

8. (✓) Connect a 2" length of black plastic covered wire to terminal 5 of SW5 (S).

9. (✓) Connect the other end of the black lead (step #8) to the #6 teardrop directly to the rear of SW5 (S).

10. (✓) Cut the leads of C12 (500 mmfd 3KVDC ceramic capacitor) to 3/4" and connect between the teardrop near G7 (S) and the lower terminal on L5 (NS). See Figure 2 of the Operating Manual.

D. CABLE WIRING AND LACING: In the following steps one end of each lead is designated "A" and the other end "B".

1. (✓) Cut to length and strip 7/16" insulation off each end of the following leads:

Number	Color	Length
1 #20	Yellow plastic covered wire	8 1/2"
2 #20	Brown plastic covered wire	12 3/4"
3 #20	Orange plastic covered wire	9"
4 #20	Blue plastic covered wire	15"
6 #20	Black plastic covered wire	13"
7 #20	Green plastic covered wire	19"
8 #20	Green plastic covered wire	23"
9 #20	Yellow plastic covered wire	14"
10 #20	Orange plastic covered wire	15 1/2"
11 #20	Gray plastic covered wire	17 1/2"
12 #20	Gray plastic covered wire	17 1/2"

2. (✓) Connect a 2" length of yellow plastic covered wire between terminal 10 (NS) and terminal 3 (S) of SW5.

3. (✓) Insert leads 1A, 2A, 3A, 4A and 8A up thru grommet G2 and connect as follows:

   a. (✓) Brown lead (2A) to terminal 6 of SW5 (S).

   b. (✓) Yellow lead (1A) to terminal 10 of SW5 (S).

   c. (✓) Orange lead (3A) to terminal 11 of SW5 (S).

   d. (✓) Blue lead (4A) to terminal 2 of SW5 (S).

   e. (✓) Green lead (8A) leave 6 1/2" above chassis for later connection.

4. (✓) Connect a 5" length of black wire to terminal 7 of SW5 (S). Leave other end free.

5. (✓) Connect a 4" length of red wire to terminal 12 of SW5 (S). Leave other end free.

6. (✓) Twist the two gray leads (#11 and #12) together and insert one lead thru each of the holes in the fan motor coil bobbin and carefully solder to the solder terminals.

7. (✓) Insert the twisted gray leads down thru G3 and train as shown in Figure 4.

8. (✓) Mount the fan motor (B1) on BKT9 as follows: (See Figure 3 of the Operating Manual) 3/8" x 10-32 screws, #10 flatwasher, thru the grommet on BKT9, #10 flatwasher, motor mount. Tighten carefully but do not overtighten.

9. (✓) Install a 3/16" x 8-32 setscrew in the fan blade and screw it all the way in. Unscrew and install the fan blade on the motor with the hub of the fan away from the motor and 1/4" from the end of the motor shaft. Tighten the setscrew carefully and check for clearances. The fan blade tip should not project beyond the edge of the chassis.

D. 10. (✓) Connect a 5" length of black wire between the top terminals of SW1 (S) and the nearest terminal on XI2 (S). See Figure 4.

11. (✓) Connect either 12B (gray) or 11B (gray) lead to the other terminal on XI2 (NS).

12. (✓) Connect the remaining gray lead (11B or 12B) to the bottom terminals of SW1 and SW2 (S).

13. (✓) Connect 9A (yellow) and 1B (yellow) leads to terminal 5 of TS3 (S).

14. (✓) Connect 3B (orange) and 10A (orange) leads to terminal 3 of TS3 (S).

15. (✓) Connect 6A (black) lead to the terminal on XI2 that is not soldered (S).

16. (✓) Train the yellow-green and orange leads from TS3 down along the heavy green filament leads. Train all the leads along the filament leads to point B. (See Figure 12.) Do not place the red lead from T2 in this grouping.

17. (✓) Connect 7A (green) lead to terminal 6 of TS3 (NS).

18. ( ) Lay the two green leads (7 and 8) and the brown lead (2) and yellow lead from T1 against the heavy green filament leads and lace from point A to point D on Figures 12 and 4. Observe correct lacing technique (See Figure 4).

19. (✓) Connect 2B (brown) lead to terminal 1 of TS2 (NS).

20. ( ) Connect 7B (shorter green) lead to pin 4 of XV2 (S).

21. ( ) Connect 8B (longer green) lead to pin 1 of XV2 (S).

22. ( ) Lace the cable between breakout D and E (See Figure 12).

23. ( ) Connect 6B (black) lead to terminal 8 of TS4 (NS).

24. ( ) Connect 10B (orange) lead to terminal 1 of TS4 (NS).

25. ( ) Connect 9B (yellow) lead to terminal 4 of TS4 (NS).

26. ( ) Connect 4B (blue) lead to terminal 2 of TS4 (NS).

27. ( ) Lace the cable between breakout C and F.

E. LEAD FILTERS See Figures 4 and 12.

1. ( ) Cut the leads of six .005 disc capacitors to 1/2" and connect as follows: (Keep capacitor clear of chassis.)

2. ( ) C27, between terminal 1 of TS5 (NS) and the adjacent teardrop (NS).

3. ( ) C26, between terminal 2 of TS5 (NS) and the adjacent teardrop (S).

4. ( ) C30, between terminal 4 of TS5 (NS) and the adjacent teardrop (NS).

E. 5. (✓) C29, between terminal 5 of TS5 (NS) and the adjacent teardrop (S).

6. (✓) C32, between terminal 1 of TS1 (NS) and the adjacent teardrop (S).

7. (✓) C31, between terminal 3 of TS1 (NS) and the adjacent teardrop (S).

8. (✓) Make up ten eighteen turn coils (L7 thru L16) from #18 formex-covered wire as follows:

   a. (✓) Cut ten 28 1/2" lengths of #18 wire.

   b. (✓) Scrape 5/8" of formex off the ends of each wire and tin these ends.

   c. (✓) Drill a 1/8" diameter hole 1 1/4" from the end of the 3/8" wood doweling provided.

   d. (✓) Wind the coils on the dowel with the following operations:

      1. (✓) Hook one end of the wire to a nail on a wall or post, or clamp it in a vise.

      2. (✓) Bend a right angle in the wire, 3/4" from the other end; place the bent end thru the hole in the dowel and rotate the dowel to close-wind the wire on the dowel.

      3. (✓) Straighten the hooked or clamped end of the wire (after the hooked end is reached) and make a right angle bend outward, 3/4" from the ends, to form a connecting lead on that end of the coil. Remove the other end from the dowel hole, shape the turn and bend the 3/4" end outward.

9. (✓) Connect L14 between terminal 8 of TS4 (S) and terminal 3 of TS1 (NS).

10. (✓) Connect L15 between terminal 7 of TS4 (S) and terminal 1 of TS1 (NS) X soldered

11. (✓) Connect L12 between terminal 6 of TS4 (S) and terminal 5 of TS5 (NS).

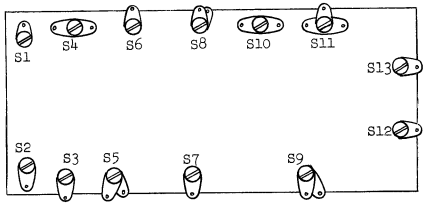
12. (✓) Connect L13 between terminal 5 of TS4 (S) and terminal 4 of TS5 (NS).

13. (✓) Connect L9 between terminal 2 of TS4 (NS) and terminal 2 of TS5 (NS).

14. (✓) Connect L10 between terminal 1 of TS4 (S) and terminal 1 of TS5 (NS).

15. (✓) Slip 1 1/8" of .053 I.D. varnished tubing over each lead of R6 and connect R6 (750 ohm 10 watt resistor) between terminals 2 and 4 of TS4 (S). Dress R2 against the chassis. See Figure 12.

F. POWER SUPPLY FILTER (See Figure 6)



1. (✓) Attach fourteen #6 teardrops and three #8 double teardrops to BKT8 (filter capacitor mounting board) as shown above using a 1/4" 6-32 screw, #6 shakeproof and 6-32 nut to fasten each. S1 and S2 should be attached temporarily only.

2. (✓) Connect three 4" lengths of black plastic covered wire between S3 and S4, S5 and S6, S7 and S10 as shown in Figure 6 (NS).

3. (✓) Connect a 2" length of black wire between S11 (NS) and S13 (NS).

4. (✓) Connect a 2 3/4" length of black wire between S9 (NS) and S12 (NS).

5. (✓) Connect C22, 23, 24, 25 and 39, 80 mfd 450 volt electrolytic capacitors, (be sure to observe correct polarity) and R8, 9, 10, 11 and 16, 10,000 ohm 25 watt resistors, (check each resistor with an ohmmeter before installing) as shown on Figure 6. The resistors should be secured by using the leads of the capacitors. Make all connections carefully so they are mechanically connected and then solder all connections carefully. Cut off any excess leads. Orient the resistors and capacitors carefully to avoid any shorts.

6. (✓) Remove the screws holding S1 and S2 and mount this filter board as shown in Figure 5 of the Operating Manual on the four supports mounted earlier using the following sequence:

   a. (✓) C39 end; filter board, (teardrop) (S1 and S2), #6 shakeproof, and 6-32 nut.

   b. (✓) R8 end; filter board, #6 shakeproof, 6-32 nut. Tighten the four nuts securely.

7a. (✓) Connect the yellow lead from T1 and the black lead from T3 to S8 (teardrops) on the filter board (S). See Figure 6.

7b. (✓) Connect a 9" length of white stranded Kel-F insulated wire between the bottom terminal of L5 (S) down thru G7 and over to the (+) terminal of the filter board (NS). See Figure 5 of the Operating Manual. Keep this lead clear of all other leads.

8. (✓) Connect the red lead from T2 to this (+) terminal and solder.

G. INPUT AND OUTPUT COAXIAL CONNECTIONS

1. ( ) Prepare the RG-59/U cable for connection to J1 as shown in Figure 7.

2. ( ) Slide the small neck coaxial hood, E11 (type UG-177/U) onto the cable with the neck (small end) toward the cable. Push the neck of the hood underneath the shield braid of the cable until it is far enough back to place a soldering iron on the center conductor of the cable.

3. ( ) Place the tinned center conductor of the cable into the center terminal of J1 (SO-239) and solder. Solder quickly to avoid overheating the coaxial cable.

4. ( ) Slide the hood back against J1 and secure E11 and J1 together temporarily with a 4-40 screw and nut.

5. ( ) Work the shield braid down tightly against the cable and hood. Using extreme care to avoid overheating the cable, solder the shield braid to the hood.

6. ( ) Cut to length and prepare the other end of the RG59/U cable as shown in Figure 7. Wrap a 1 1/2" length of bare #20 tinned wire around the shield braid and solder. Avoid excessive heat. Cut lead to 1/4" length.

7. ( ) Tack E11 and J1 together at one spot on the edge between them with solder and remove the 4-40 screw.

8. ( ) Check the cable with an ohmmeter for shorts or open.

9. ( ) Mount the assembled cable-connector on the inside of the chassis as shown in Figure 12 using sequence F, with the lead on the free end toward the center of the chassis.

10. ( ) Prepare the RG-8/U coaxial cable, W2, for connection to the RF output connector, J2, as shown in Figure 7.

11. ( ) Slide the coaxial hood, E10 onto the coaxial cable and under the shield braid as was done in step 2.

12. ( ) Tin the center conductor of the cable and insert and solder it to the center terminal of J2 (type SO-239). Avoid overheating but solder securely.

13. ( ) Slide the hood back against J2 and secure temporarily with a 4-40 screw and nut. Work shield braid down against the cable and hood.

14. ( ) Carefully solder the shield to the hood and tack (with solder) E10 and J2 together. Remove the 4-40 screw.

15. ( ) Check the coaxial cable with an ohmmeter for shorts or open.

16. ( ) Remove the extra hardware from the rear terminal of L4. Slip the 2 1/16" strap (with a hole on each end) over this stud and the other end of this strap over the stud on C15. Slip a #10 solder terminal (with ears) over the L4 stud with the terminal ears pointing downward. Replace the hardware on L4 (use only one flatwasher) and install a #6 shakeproof and nut on C15. Tighten carefully.

G. 17. (✓) Insert the unsoldered end of the RG8/U coaxial cable thru the chassis as shown in Figures 11 and 12.

18. (✓) Insert J2 into the hole in the back panel of the chassis and secure tightly using sequence F.

19. (✓) Connect the twisted shield braid to the solder lug on BKT3. Crimp the lug around the braid and solder.

20. (✓) Carefully solder the long teardrop (mounted on the mounting foot of L5) to the exposed portion of the RG8/U.

21. (✓) Connect and crimp the center conductor of the coaxial cable to the #10 solder lug mounted on L4 (S).

H. TOP OF CHASSIS CONNECTIONS

1. (✓) Slip a 2" length of .208" I.D. vinyl tubing over each of the red leads coming out of T1. Cut each red lead to 6" and strip 1/2" of insulation.

2. (✓) Connect each red lead to a tube cap. Insert thru a hole in the cap, crimp tightly and solder.

3. (✓) Slip the tubing back over each of the plate cap connections.

4. (✓) Mount C13 (1000 mmfd 5 KVDC cylindrical capacitor) on the bracket on top of L5 using the following sequence: 1/4" x 6-32 screw, #6 shakeproof, bracket, #6 shakeproof, C13. Tighten carefully. See Figure 11.

5. (✓) Connect E1 (neutralizing lead suppressor) between the rotor terminal of C2 (S) and the nearest top terminal of L5 (S). See Figure 11 and Figure 2 of the Operating Manual.

6. ( ) Mount L3 (5 turn, 1" diameter, high frequency coil) between C14 and L4 as follows:

   a. (✓) Lower rear stator terminal of C14: 3" silvered copper strap, L3 (longer leg), #6 shakeproof, 6-32 nut. Do not tighten nut.

   b. (✓) Orient L3 as shown in Figure 2 of the Operating Manual and solder the shorter end of L3 to the flat spring terminal on the rear of L4.

7. (✓) Connect the free end of the 3" strap to the unused terminal of C13 using a 1/4" x 6-32 screw with a #6 shakeproof on each side of the strap. Keep the strap clear of L3 and C13. Tighten the nut on the lower rear stator terminal of C14 securely.

8a. (✓) Connect C37 and C38 (47 mmfd mica capacitor) directly across the plate suppressors (E3 and E5) with short direct leads. Wrap each of the capacitor leads carefully around the coil-resistor junction and solder. See Figure 11.

H. 8b. (✓) Connect a plate cap to the short lead of each of the plate suppressors, E3 and E5, by crimping 1/4" of the lead tightly back on the cap (thru the hole in the lug portion of the cap). Solder both caps. See Figure 11 and Figure 2 of the Operating Manual.

9. (✓) Insert the other suppressor leads thru the unused portions of the double teardrops on top of L5 and solder. Place a right angle bend in each of the leads so that the caps are directly over the tubes and at the proper height. Temporarily install the 811A tubes to check this.

10. (✓) Place the holed end of the 4" silvered strap over the lower front stator terminal of C15 and fasten with a #6 shakeproof and 6-32 nut (finger-tight).

11. (✓) Extend the strap directly over to SW4 and wrap it around the double terminals 1 and 2 of SW4 (S). Keep the strap clear of the fan motor, SW4 tie bolt, and L4. See Figures 5 and 10. Tighten the nut on C15 stator. Refer to Figure 10 in following steps, 12 thru 16.

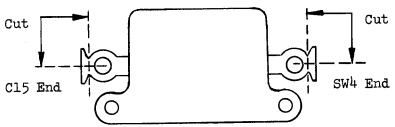
12. (✓) Connect C16, C17 and C18 (620 mmfd 500 volt mica capacitors) between C15 and SW4 as follows:

a. (✓) Cut the leads of C16 to 7/8" and 1 1/4"; connect the 7/8" lead to teardrop "A" (Figure 8) on C15 (NS) and the 1 1/4" lead to both sides of terminal 12 of SW4 (S).

b. (✓) Cut the leads of C17 to 7/8" and 1"; connect the 7/8" lead to the same teardrop used in step a (NS) and the 1" lead to both sides of terminal 11 of SW4 (S).

c. (✓) Cut the leads of C18 to 7/8" and connect between the teardrop used in steps a and b (S) and the double terminal 10 of SW4 (S).

13. ( ) Cut the terminals of C19, C20 and C21 as shown below. Note: C19 and C20 may be 600 mmfd or 620 mmfd.



14. (✓) Connect C19 (620 mmfd 600 volt mica capacitor) between teardrop "B" (Figure 8) on C15 and terminals 9 of SW4 (S). See Figure 10. The terminals of C19 should be inserted thru the double terminals on SW4.

15. (✓) Connect C20 (620 mmfd 600 volt mica capacitor) between the teardrop "C" on C15 and terminal 8 of SW4 (S).

16. (✓) Connect C21 (300 mmfd 1200 VDC mica capacitor) between teardrop "D" on C15 and terminal 7 of SW4 (S).

17. (✓) Temporarily install a knob on the rotary inductor shaft.

H. 18. (✓) Adjust the position of C14 such that when it is at minimum capacity, the rotary inductor (L4) is at minimum inductance (roller toward rear) and tighten the setscrews on the gear on the shaft of C14. Be certain the s" the gear hub is centered with the other gear.

19. (✓) Turn the final tank circuit to the full counterclockwise position (maximum inductance) and install D2 (1 3/4" pulley) using two 3/16" x 8-32 setscrews. Place the opening in the pulley as shown in Figure 8. Set for 1/16" clearance between D2 and the screw heads on BKT1 and tighten securely.

20. (✓) Cut a 36" length of dial cord, tie an overhand knot (with a loop) at its center, and attach the spring as shown in Figure 8.'

21. (✓) Install the dial drive as shown and check for proper operation. If the cord is to loose, shorten slightly and repeat. Check for proper operation and cut off excess cord. Be certain this cord is tight!

I. INSIDE OF CHASSIS CONNECTIONS See Figures 3 and 12 in the following steps.

1. (✓) Cut the leads of L6 (2.4 millihenry RF choke) to 5/8" and connect between terminals 1 and 4 of TS2 (NS).

2. (✓) Cut a 2 1/2" length of #14 tinned wire. Feed it up thru the nylon feed-thru (from the underside of the chassis) thru the stator teardrop of C2 (S). Connect the free end of this lead to the stator terminal on the front section of C1 (NS).

3. (✓) Connect a 1" length of #20 tinned wire to each of the outside clips on L2 (grid coil) (NS) on the side opposite to the solder terminals and extend the leads directly away from L2. Solder carefully.

4. (✓) Cut a 16" length of white stranded Kel-F insulated wire and strip 9/16" each end. Wind this wire around the center turns of L2 (same winding direction as L2) with two turns on each side of the L2 center tap. Twist the two ends together temporarily. The twisted ends should come off at the same point as the center tap of L2.

5. (✓) Install L2 (coil taps toward SW3) on the two studs installed previously and fasten using the following sequence: #8 fiber washer, L2, #8 fiber washer, .400" aluminum spacer, 6-32 nut. Very carefully tighten. Do not over-tighten as damage to the ceramic form may occur.

6. (✓) Connect the front lead from L2 to the front stator terminal of C1 (S).

7. (✓) Connect the rear lead from L2 to the rear stator terminal of C1 (NS).

8. (✓) Be very careful in making the following connections to L2. The small twisted loops on L2 are fragile and can be easily damaged. Insert a length of #20 tinned wire thru each terminal of SW3 and then extend over and thru the loops on L2. Solder both the terminal and the loops, and then cut off the excess wire. See Figure 12.

   a. (✓) Connect the front terminal of L2 to terminal 11 on the front wafer of SW3 (S).

I. 8. b. (✓) Connect the rear terminal of L2 (NS) to terminal 11 on the rear wafer of SW3 (S).

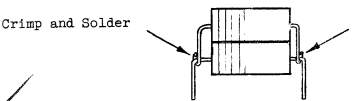
c. (✓) Connect each of the "next-to-outside" loops of L2 to the #10 terminals of the associated front or rear wafer of SW3 (S).

d. (✓) Connect the next loops of L2 to the #9 terminals of SW3 (S) in similar manner to step c.

e. (✓) Connect the terminals on each side of the center tap of L2 to the associated #8 terminal of SW3 (S).

9. (✓) Slip a 1" length of .053 I.D. varnished tubing over each end of R2 (100 ohm 7 watt resistor) and carefully connect between the center tap of L2 (S) and terminal 4 of TS2 (NS). Keep the leads of R2 clear of SW3. See Figure 12.

10. (✓) Cut the leads of R3 a, b, c, and d (10,000 ohm 2 watt resistors) to 5/8", make two assemblies per the sketch below, and connect them (as shown) between terminals 1 (S) and 4 (S) of TS2.



11. (✓) Fasten two #8 double teardrops to the center of the 4" x 1/2" phenolic strip using two 1/4" x 6-32 screws, teardrops, strip, #6 shakeproofs, and 6-32 nuts as shown in Figure 12.

12. (✓) Mount this phenolic strip above L2 using a #8 double teardrop (front screw only), #6 shakeproof and nut at each end.

13. (✓) Untwist the link leads on L2 which were temporarily twisted earlier and straighten leads taking care to avoid cutting or nicking the insulation. Connect each end of the grid link to one of the ends of the double teardrops at the center of the coil. Use the holes in the teardrops which are toward the center of the chassis. Solder only the link terminal which is toward the rear of the chassis.

14. (✓) Connect the center conductor of the RG59/U coaxial cable to the center double teardrop on the phenolic strip (NS) and the outer braid lead to the rear double teardrop on the phenolic strip (S).

15. (✓) Cut the leads of two 5600 ohm 2 watt resistors, R1b and R1c, to 5/8". Connect them, one on each side the phenolic strip, between the double teardrop to which the center conductor of the RG59/U cable is connected and the double teardrop on the forward end of the phenolic strip (NS). See Figure 12. Cut the leads of the remaining two 5600 ohm 2 watt resistors, R1a and R1d, to 7/8" and connect them alongside R1b and R1c, respectively, using the same double teardrops (S).

I. 16. (✓) Connect a 1 1/2" length of black plastic covered wire between terminal #2 of J3 (S) and terminal 4 of TS7 (NS). See Figure 4.

17. (✓) Connect a 1 1/4" length of #20 tinned wire between the terminal #1 of J3 (S) and terminal 3 of TS1 (NS).

18. (✓) Connect a short length of #20 tinned wire between each of the following terminals:

a. (✓) Terminal 1 of TS5 (S) and terminal 1 of TS7 (S).

b. (✓) Terminal 2 of TS5 (S) and terminal 2 of TS7 (S).

c. (✓) Terminal 4 of TS5 (S) and terminal 3 of TS7 (S).

d. (✓) Terminal 5 of TS5 (S) and terminal 4 of TS7 (S).

19. (✓) Connect grid suppressor E2 from the rear inside stator terminal of C1 to pin 3 of XV1 as shown in Figure 12 (S).

20. (✓) Connect grid suppressor E4 from the rear terminal of L2 to pin 3 of XV2 as shown in Figure 12. (S).

J. FRONT PANEL

1. (✓) Mount the red "PLATE" jewel as in Figure 1 of Operating Manual. Hold the jewel tightly when tightening the nut so as not to mar the paint.

2. (✓) Locate the meter shield bracket which is a shallow drawn cover with a 2 1/2" diameter pierced hole. Mount the meter and meter shield bracket as follows: Meter, panel, meter shield bracket, #4 shakeproof, 4-40 nut. Tighten carefully so as not to damage the meter case. Refer to Figure 3 of the Operating Manual for general meter shield arrangement.

3. (✓) Mount TS6, 3 terminal strip, on the meter shield (see Figure 5) using the following sequence (starting from the inside of the shield): 1/4" x 6-32 screw, shield, #6 shakeproof, TS6 mounting foot, #6 teardrop, #6 shakeproof, 6-32 nut. Bend the teardrops up.

4. (✓) Slip a fiber shoulder bushing over each meter stud with the shoulder away from the meter.

5. (✓) Slip the meter shield over the meter and into the shield bracket.

6. (✓) Install a #45 bulb in the snap-in pilot light socket assembly, XI3, and install the assembly into the center hole in the meter shield.

7. (✓) Slip another shoulder bushing over each meter stud (shoulder toward meter) and secure with a flatwasher and nut.

8. (✓) Slip a #10 teardrop over each meter stud, orient in a horizontal plane and secure with a nut.

9. (✓) Bend each teardrop away from the meter shield.

J. 10. (✓) Cut the leads of three .005 mfd disc capacitors (C33, C34 and C35) to 5/8".

11. (✓) Connect C33 and C34 between the meter terminals and the nearest teardrop under TS6 respectively, solder at teardrops only.

12a. (✓) Cut the leads of R4 (10 ohm 2 watt resistor) to 1/2" and connect between the pilot light terminal (NS) and the metal pilot light shell of XI3 (S).

12b. (✓) Connect C35 across R4 leads (S).

13. (✓) Connect an 18 turn coil (made up previously) between the (+) terminal of the meter (S) and terminal 1 of TS6 (NS). Connect another 18 turn coil between the remaining meter terminal (S) and terminal 3 of TS6 (NS).

14. (✓) Connect an 18 turn coil between the terminal of XI3 (S) and terminal 2 of TS6 (NS). Make certain these coils are not touching the transformer or meter shield after the panel is installed.

15. (✓) Insert a 3/4"x 6-32 screw thru each of the four small holes in the panel (See Figure 9) (from the rear side) and secure with a 6-32 nut. These holes form a rectangle 1 13/16" x 6 3/4".

16. (✓) Turn two additional 6-32 nuts on each of the two left side studs (nearest the meter) installed in the previous step. Tighten each nut securely.

17. (✓) Slip a 3/8" I.D. flatwasher (paint protecting washer) over each of two 3/8"-32 panel bearings.

18. (✓) Insert (from the front of the panel) these two bearings thru the top Coupling and Final Tuning holes (FINAL tuning is the large knob in Figure 1 of the Operating Manual) and secure each with a 3/8"-32 nut. Center and tighten securely.

19. (✓) Mount XIIA and XIIB (pilot light sockets) as shown using the following sequence: 1/4" 6-32 binding head screw, socket mounting foot, #6 shakeproof, panel, #6 shakeproof, 6-32 nut. Tighten temporarily.

20. (✓) Connect a 6 1/2" length of green plastic wire between pilot light sockets XIIA (NS) and XIIB (S).

21. (✓) Connect C36 (.005 mfd disc capacitor) between the terminal of XIIA (NS) and the shell (ground) of the pilot light socket (S).

22. (✓) Slip the panel into position on the chassis. Some adjustment of the bearings or switches may be necessary.

23. (✓) Fasten the panel using a 3/8" I.D. flatwasher and 3/8"-32 nut on each shaft.

24. (✓) Fasten SW1 and SW2 with the ring nuts. Tighten carefully to avoid marring the panel.

25. (✓) Mount D41 (3" diameter pulley) flush with the end of the shaft as shown in Figure 9 using two 3/16" x 8-32 setscrews. Orient the opening of D41 as shown with the Final Tuning turned fully clockwise and tighten the setscrews.

J. 26. (U) Cut a 33" length of dial cord.

27. (U) Connect this cord to a spring as shown in Figure 9.

28. (U) Slip an eyelet thru a pulley and #8 flatwasher and slip these assemblies over each of the left hand studs on the front panel.

29. (U) Install the dial pointer at approximately the middle of the cord.

30. (U) Install the dial cord as shown in Figure 9 making certain the pointer is pointing as shown in Figure 9 and also is out away from the panel.

31. (U) Check for proper operation. The pointer should be in the up position for maximum clockwise rotation of the Final Tuning. If the spring is not stretched about 1 3/16", shorten the cord slightly and reconnect.

32. (U) Install #45 pilot lamps in XI1A and XI1B.

33. (U) Loosen the screws holding XI1A and XI1B slightly and adjust the positions of the sockets so the bulbs are close to (but not touching) the pulley.

34. (U) Connect the remaining 18 turn choke between terminal 6 of TS3 (S) (see Figure 12), slip a 1" length of varnished tubing over the other end and extend this end out thru grommet G8 and connect to the terminal of XI1A (S).

35. (U) Slip a 13/32" aluminum spacer over each of the right side (dial backing plate mounting) studs and two #6 flatwashers over each of left side studs as shown in Figure 9.

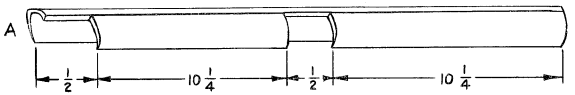
36. (U) Turn the Final Tuning until the pointer is approximately centered.

37. (U) Mount D35 (dial backing plate and bracket) on the four studs as follows: Place the pointer on D35 (unpainted area) and then install D35 on the four studs and secure with a #6 shakeproof and 6-32 nut at each stud. The painted surface of D35 should be facing outward with unpainted edge nearest the meter.

38. (U) Check operation and clearances.

39. (U) Position the dial pointer so that with the Final Tuning in maximum clockwise position, the distance between the pointer and the top stud is 7/8"

40. (U) Install the rubber light blocking strip around the periphery of D30 (dial escutcheon) as follows: Cut the notches in as shown below. Install the rubber strip on D30 as follows: Start the "A" end of the strip on the "0" end of the escutcheon. When installing the strip, make certain it is firmly in place all the way around. The notches should be on the inside of the escutcheon.



J. 41. ( ) Observe the hole at the inside "0" end of D30. Place D30 over the dial backing plate D35 such that the hole in D30 mates with the projecting screw at the bottom of D35. This is done most easily by holding the top of D30 away from the panel until the bottom edge can be slipped upward onto the mating screw. Push the top end of D30 against the panel and fasten to D35 with a 3/8" 4-40 screw.

42. ( ) The pointer should travel from about "100" to "5".

43. ( ) Connect the green lead near the meter to terminal 2 of TS6 (S). Train this lead and the following leads to TS6 to the side of T2 to avoid pinching leads between T2 and meter shield.

44. ( ) Connect the black lead from terminal 7 of SW5 to terminal 3 of TS6 (S).

45. ( ) Connect the red lead from terminal 12 of SW5 to terminal 1 of TS6 (S).

K. MISCELLANEOUS

1. ( ) Strip 1/2" of insulation off each end of the line cord.

2. ( ) Place a 7 amp slow blow fuse between each clip-and-terminal and clip-and-blade assembly. (Type MDX fuse).

3. ( ) Set the fuses in place in the plug to gain familarity with these mounting positions.

4. ( ) Tie a tight overhand knot near the end of one end of the cord (this knot must fit inside the plug shell) and connect the cord to the two screw terminals.

5. ( ) Fasten the plug with the nut and screw supplied.

6. ( ) Insert the other end of the cord thru the grommet in the back of the chassis, tie a knot in the cord and connect one lead to terminal 1 of TS1 (S) and the other to terminal 3 of TS1 (S).

7. ( ) Inspect the entire chassis carefully, looking for obvious mistakes, unsoldered connections, touching uninsulated wires or omissions.

8. ( ) Place a <u>small</u> drop of oil on each variable capacitor, switch and panel bearing.

9. ( ) Carefully install the following tubes:

   a. ( ) 866A's as shown in Figure 3 of the Operating Manual.

   b. ( ) 811A's as shown in Figure 3 of the Operating Manual.

10. ( ) Connect the tube caps to the tubes as shown. The plate connectors to the 811A's should be bent so no stress is placed on the tube caps.

11. ( ) Attach the two rails and the four rubber feet to the bottom of the cabinet as shown in Figure 2. The slanting side of each rail must be toward the outside of the cabinet.

K. 12. (✓) Push the 3/16" metaltex braid between the panel strips and flange and between the panel flange and the chassis bottom edge. Start at the middle of the top panel flange and push the braid in place with a screw driver, taking care to train the braid fully and smoothly around the corners for good electrical seal. Cut off any excess after the braid has been brought completely around and butt the end to the starting point.

13. (✓) Remove the temporary legs from the chassis.

L. TRANSMITTER TEST

1. (✓) Refer to section C-2 of the Operating Manual and install the knobs as per instructions.

2. (✓) Check the adjustments as per section C-3 of the Operating Manual.

3. ( ) Perform the operational checks listed in sections C and D of the Operating Manual.

4. ( ) Set the neutralizing capacitor C2 to 2/3 open position.

5. ( ) Perform the preliminary checkout and test as described in section D3 thru step D3f2 of the Operating Manual.

6. ( ) Tune the transmitter on all bands following the procedure described in section D4 of the Operating Manual, to verify performance and to gain familiarization.

7. ( ) After becoming familiar enough with the transmitter, install it in the cabinet as instructed in section D3g.