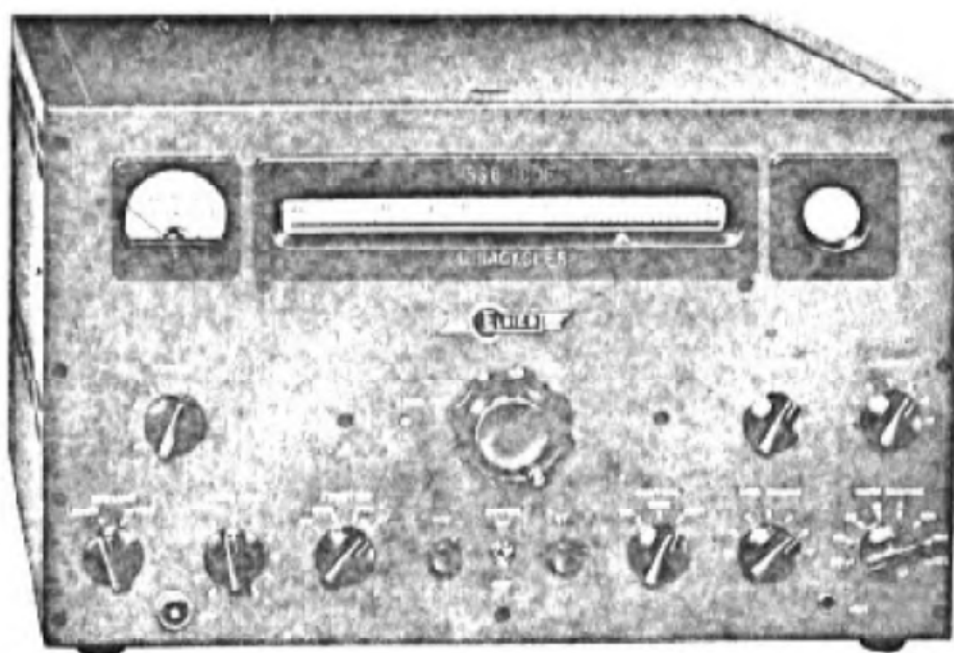




SSB-100F

EXCITER TRANSMITTER

WARRANTY

Eldico Amateur Equipment

Eldico Electronics warrants this amateur product, manufactured by Eldico, to be free from defective material and workmanship, and agrees to remedy any defect or to furnish a new part in exchange for any part of any unit of its manufacture, which under normal installation, use and service, discloses such defect, provided:

1. Promptly following his purchase, the buyer completes and returns to Eldico the registration card included in the Instruction Manual furnished with the equipment.
2. Notice of the claimed defect is submitted to Eldico in writing within 90 days from the date of the original purchase.
3. Upon receipt of shipping instructions from Eldico, the unit is delivered by the owner to Eldico intact, for examination, with all transportation charges prepaid to our factory.
4. The examination discloses, in our judgment, that the product is thus defective.

This warranty does not extend to any Eldico product which has been subjected to misuse, neglect, accident, excessive moisture or exposure, incorrect wiring not our own, improper installation, or use in violation of instructions furnished by us, nor to units which have been repaired, rewired, 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 manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by Eldico 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. In no event shall Eldico have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

IMPORTANT! It is necessary that the Registration Card included herewith be filled out and mailed to the company promptly in order for this guarantee to be effective.

SSB-100F

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SECTION I

DESCRIPTION

1. INTRODUCTION

The SSB-100F is a medium power, single sideband suppressed carrier transmitter designed for simplex telephone or telegraph operation. It may also be operated with carrier to make it compatible with existing amplitude modulated systems. The SSB-100F covers all amateur frequencies between 3.5 and 29.5 megacycles in 8 bands, selected by a front panel switch. The Peak Envelope Power output is 100 watts. The occupied bandwidth is 3 Kc as opposed to 6 Kc with a conventional AM or DSB transmitter, and either sideband is selectable by a switch on the front panel.

2. FEATURES

The SSB-100F has been designed to provide the utmost in flexibility without compromising the performance characteristics which up to now were available only in highly specialized equipment. Among the features that contribute to the high grade performance of this transmitter are the following:

- A. Highly stable filter type exciter section providing a minimum of 50 db attenuation of the unwanted sideband and carrier.
- B. Selectable sideband operation, front panel controlled.
- C. Audio shaping for maximum intelligibility, pleasing quality and conservation of valuable spectrum space.
- D. Voice controlled break-in operation with speaker quieting circuit.
- E. Built-in highly stable variable frequency oscillator.
- F. Inverse RF feedback for low distortion.
- G. Compact design, completely self-contained including all controls, circuits for receiver muting and antenna change over (external antenna relay required).
- H. Built-in one-inch oscilloscope for continuous monitoring of the linearity of all mixers and amplifiers between exciter and power output stage.

- I. Complete ham band coverage with dial calibrated in 10 Kc increments, readable to 2 Kc.
- J. Tuning rate is constant for all bands.
- K. Carrier insertion and audio level are independently adjustable.
- L. While the output impedance is nominally 52 ohms, an adjustable loading network permits matching into lines of other impedances, even with moderate standing wave ratio.
- M. Provision is made in voice control circuits to operate external relays, etc.

3. SPECIFICATIONS

Operating Frequency:

3.5 through 29.5 band switching from front panel as follows:

<u>Band Meters</u>	<u>Frequency Range Megacycles</u>
80	3.5 - 4.0
40	7.0 - 7.5
20	14.0 - 14.5
15	21.0 - 21.5
11	26.9 - 27.4
10A	28.0 - 28.5
10B	28.5 - 29.0
10C	29.0 - 29.5

Type of Transmission:

Single sideband-suppressed carrier:
USB or LSB (selectable by front panel control); one sideband with carrier (AM); continuous wave.

Frequency Stability:

Overall frequency stability of better than 500 cycles.

Power Output:

Peak envelope RF power output, 100 watts.
CW output, 50 watts
AM output (one sideband with carrier), 20 watts.

Unwanted Sideband:

Unwanted sideband attenuation: 50 db or greater.

Carrier Attenuation:

Carrier attenuation, 50 db or greater.

Distortion:

Unwanted sideband distortion products, 35 db down or greater at 100 watts P.E.P. output.

Transmitter Bandwidth:

Bandwidth, 3.3Kc approx. at 6 db points on voice signals.

Transmitter Carrier Injection:

Front panel controlled; from 50 db down to full power output, provided for tuning purposes. AM and CW operation.

Audio Input:

High impedance crystal or dynamic microphone (-55 db).

Transmitter Output:

Nominally, 52 ohms.

Voice Controlled Operation:

Voice controlled operation and receiver muting provided and selected by front panel controls. Provision for operating external relays, etc.

CW Operation:

Break-in CW operation provided; chirpless and clickless, consistent with modern engineering practice.

Metering and Monitoring:

Plate circuit meter provided, and a one-inch 1CP1 oscilloscope, with associated circuitry is incorporated to provide for constant monitoring of the outgoing signal under all conditions of operation.

Physical Specifications:

Weight: 50 pounds
Width: 17-1/16"
Height: 11" overall
Depth: 16-3/8" overall
Cabinet: Table-top cabinet, with access through top cover.
Finish: ELDICO Gray.

SECTION II

INSTALLATION

1. UNPACKING

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

2. LOCATION AND MOUNTING

The SSB-100F is a table-top transmitter. The location chosen should be as dry and cool as possible. Adequate clearance should be allowed for the connections to the rear, and for proper ventilation of the transmitter.

3. EXTERNAL CONNECTIONS

A. Antenna: The transmitter is equipped with an 83-1R coaxial receptacle and mating connector, on the rear of the chassis, for use with 52 ohm coaxial cable output. If balanced feedlines are used, they should be connected through a balun or antenna tuner. The balun or antenna tuner is then connected to the transmitter output with 52 ohm coaxial cable. If the feedline shows an appreciable reactance at the transmitter, it may be impossible to load it properly. In that case, changing the length of the feedline a few feet at a time or using an antenna tuner will alleviate the problem. It is suggested that the operator use a 52 ohm dummy load first to familiarize himself with the equipment. In the event that a proper dummy load is not readily available, a 60 or 100 watt, 110 volt light bulb will serve as a dummy load.

CAUTION: DO NOT OPERATE THIS EQUIPMENT WITHOUT PROPER EXTERNAL LOAD. EXCESSIVE RF VOLTAGES MAY DEVELOP WHICH MIGHT CAUSE COMPONENTS TO BREAK DOWN.

B. Microphone: A standard microphone connector is provided on the front panel. A high impedance crystal or dynamic microphone (-55 db) may be used.

C. Key: A standard closed circuit jack is provided on the front panel for the connection of the key. It should be unplugged except for CW operation.

D. Antenna Change-over Relay (not supplied): It is recommended that a coaxial relay be used. The coil should be 115 volts AC and be connected to terminals #4 and #5 on the terminal strip at the rear of the transmitter.

E. Receiver Silencing: Terminals 1, 2 and 3 on the terminal strip at the rear of the unit are provided for receiver silencing. 1 and 2 are normally open, whereas 2 and 3 are normally closed contacts on relay RLY-1.

F. Voice Controlled Break-in with Speaker (QT Operation): Normally, voice controlled break-in operation of the transmitter would be impossible where a speaker is used, because the loudspeaker signal would turn on the transmitter. Therefore, a cancellation circuit has been built into the SSB-100F. Part of the received signal is fed into the transmitter from the audio output transformer of the receiver to cancel out the signal picked up by the microphone. Terminals #7 and #8 are for 4 ohm output windings, and #6 and #8 are for 500 ohms.

CAUTION: OBSERVE CORRECT POLARITY OF LEADS, AS TERMINAL #8 ON THE TRANSMITTER IS GROUND-ED.

G. Power: The transmitter must be powered from a 115 volt, 50-60 cycle source.

H. Ground Connections: A 1/4-inch ground bolt is provided at the rear of the transmitter. It should be connected to a good electrical ground with as short a lead as possible.

I. A 600 ohm unbalanced audio input terminal is provided through a closed circuit jack at the rear of the unit. It may be used when the transmitter is connected to telephone lines or other low impedance sources such as recording equipment.

J. Calibrate: A receptacle for calibration is provided on the rear of the transmitter. If there is insufficient signal to the receiver in the calibrate position, a shielded lead should be run from the calibrate output receptacle to the receiver input.

SECTION III

OPERATION

1. CONTROLS

A. ON-OFF Switch: This switch connects the primary power to all circuits.

WARNING: HIGH, MEDIUM AND BIAS VOLTAGES ARE PRESENT IN ALL CIRCUITS AS SOON AS THIS SWITCH IS IN THE "ON" POSITION, REGARDLESS OF WHETHER THE CONTROL SWITCH IS IN THE "STANDBY", "TRANSMIT" OR "CALIBRATE" POSITION.

B. Control Switch: In the "STANDBY" position, the low voltage is removed from all except the oscillator stages. Blocking bias is applied to the final to provide plate current cut-off. The "CALIBRATE" position applies B+ to all except the audio stages, and also keeps the final cut off. The "TRANSMIT" position connects all the operating voltages.

C. Function Switch: This switch is used to select the desired mode of operation. In the CW position, the audio section is turned off. In the "MAN" position, the transmitter is turned on and off by the control switch ("STANDBY - TRANSMIT"). The "VOX" position makes the voice controlled break-in circuit operative, and the "QT" position connects the speaker cancellation circuit to permit voice break-in with a loudspeaker.

D. Sideband Selector Switch: This switch selects the desired sideband by changing the injection frequency in the first conversion stage to either 413 Kc below or 413 Kc above the first intermediate frequency.

E. Audio: The "AUDIO GAIN" control should be adjusted for proper scope pattern. Gain increases clockwise.

F. Carrier: This control inserts carrier voltage after the crystal filter for tuning purposes and for operation of the equipment on AM. The carrier injection increases clockwise.

G. Vox: Adjusts the gain of the voice break-in control amplifier V-5. Increases clockwise.

H. QT: Adjusts the gain of the loudspeaker cancellation circuit V-5. Increases clockwise.

I. Grid Tuning: This control tunes the grid of the final amplifier stage. The capacity of the tuning condenser increases clockwise.

J. Plate Tuning: This control resonates the final amplifier stage. The capacity of the condenser increases clockwise.

K. Loading: Adjusts the amount of loading (energy transfer from final to antenna). The capacity increases clockwise.

NOTE: CONTROLS I, J AND K SHOULD ALWAYS BE LOCATED IN THE MAXIMUM CLOCKWISE (MAXIMUM CAPACITY) POSITION WHEN TUNING UP THE TRANSMITTER IN ORDER TO AVOID TUNING TO HARMONICS AND OTHER SPURIOUS OUTPUT FREQUENCIES.

L. Band Change: The band change switch is used to select the proper coil/capacitor/crystal combination for various output frequencies. The following table will serve as a guide to the frequency coverage of each band.

Band Switch Position (meters)	Frequency Range (megacycles)
80	3.5 - 4.0
40	7.0 - 7.5
20	14.0 - 14.5
15	21.0 - 21.5
11	26.9 - 27.4
10A	28.0 - 28.5
10B	28.5 - 29.0
10C	29.0 - 29.5

M. Frequency Dial: The frequency dial permits adjustment of the transmitter output frequency through a range of 500 Kc through the band. The dial is calibrated in increments of 10 Kc and is readable to 2 Kc.

N. Zero Adjust: This control allows adjustment of the VFO over a range of approximately ± 3 Kc and is intended to compen-

sate for minor tracking errors in VFO calibration.

2. INITIAL ADJUSTMENTS

After the transmitter has been installed according to Section II, the front panel controls should be set up according to the following table:

A. Preliminary Control Settings:

<u>Control</u>	<u>Position</u>
Power Switch	OFF
Control Switch	STBY
Function Switch	MAN
Audio Gain	Fully CCW
VOX	Fully CCW
QT	Fully CCW
Carrier	Fully CCW
Band Change Switch	To Desired Band
Frequency Dial	To Desired Frequency
Grid Tuning	Fully CW
Plate Tuning	Fully CW
Loading	Fully CW
Sideband Selector	To Desired Sideband

Plug the power cord into a line outlet and place the power switch ON. Allow a minimum of three minutes for the equipment to warm up.

B. Bias Adjustment: Turn Control Switch to XMIT and adjust the bias potentiometer (Figure 9) on the rear of the unit for a static plate current of approximately 40 Ma. After this adjustment has been made, return the switch to STBY.

C. Oscilloscope Intensity Adjustment: With Control Switch in STBY position, turn scope intensity adjustment (Figure 12) to the point where the spot on the face of the oscilloscope is just extinguished.

3. TUNING PROCEDURE

After the initial adjustments have been carefully made according to the instructions in paragraph 2 of this section, the transmitter is ready for tuneup.

A. CW Operation: Turn FUNCTION switch to CW position. Turn CONTROL switch to XMIT, then advance the carrier control to about mid-range. A bright spot on the oscilloscope will be visible at this point. Now turn GRID TUNING from the maximum clockwise position slowly coun-

terclockwise until an increase in plate current is noticed. Reduce carrier control if necessary so that plate current does not exceed 100 Ma as indicated on the plate meter. Now turn PLATE TUNING condenser until the bright spot on the oscilloscope becomes a vertical line. The plate circuit is resonated where the line reaches a maximum. Now return to the GRID TUNING and adjust for maximum plate current as read on the meter. Then turn the CARRIER control fully counterclockwise. The plate current should drop down to its initial value of 40 Ma. The CARRIER control is now advanced slowly until an indication is visible on the scope. Move the PLATE TUNING control until there is no vertical deflection visible and advance the CARRIER control until the plate current rises to 150 Ma. Quickly adjust the PLATE TUNING for minimum plate current (dip). Then increase the loading by turning the LOADING control counterclockwise. Every time the loading condenser is moved, the PLATE TUNING must be readjusted for minimum plate current. Continue to do this until the plate current minimum reaches 100 Ma. Advance the CARRIER control until plate current reads 125 Ma. Plug the key into the key jack. The transmitter is now ready for use on CW.

B. SSB Operation: Tune transmitter exactly as outlined in Section A. Turn CARRIER control fully counterclockwise and switch FUNCTION switch to MAN. Adjust AUDIO GAIN control for proper scope pattern according to Figure 1. Select desired sideband. The transmitter is now ready to use on SSB. If voice controlled break-in is desired, switch FUNCTION switch to VOX. Advance VOX gain control to point where relay is easily tripped, but no further. Then turn FUNCTION switch to the QT position and advance QT gain control to the point where speaker signals do not trip the relay.

NOTE: IF THE TRANSMITTER IS PROPERLY ADJUSTED, THE PLATE CURRENT ON VOICE SIGNALS SHOULD SWING TO ABOUT 100-125 Ma BEFORE NON-LINEARITY BECOMES APPARENT ON THE SCOPE.

C. AM Operation: Follow procedure outlined under CW Operation. Then turn FUNCTION switch to MAN and readjust CARRIER control for a plate current of 100 Ma. Adjust AUDIO GAIN control until the scope pattern becomes triangular on audio peaks. The transmitter is now ready for operation on AM. Refer to Figure 1.

Oscilloscope Patterns



Unmodulated carrier or single tone.



AM pattern, about 60% modulation.



AM pattern, 100% modulation, or
SSB pattern with correct adjustment.



AM or SSB pattern with improper
adjustment; reduce drive and/or
change loading.



AM or SSB pattern with excessive
bias on 5894 stage.

Figure 1

929-

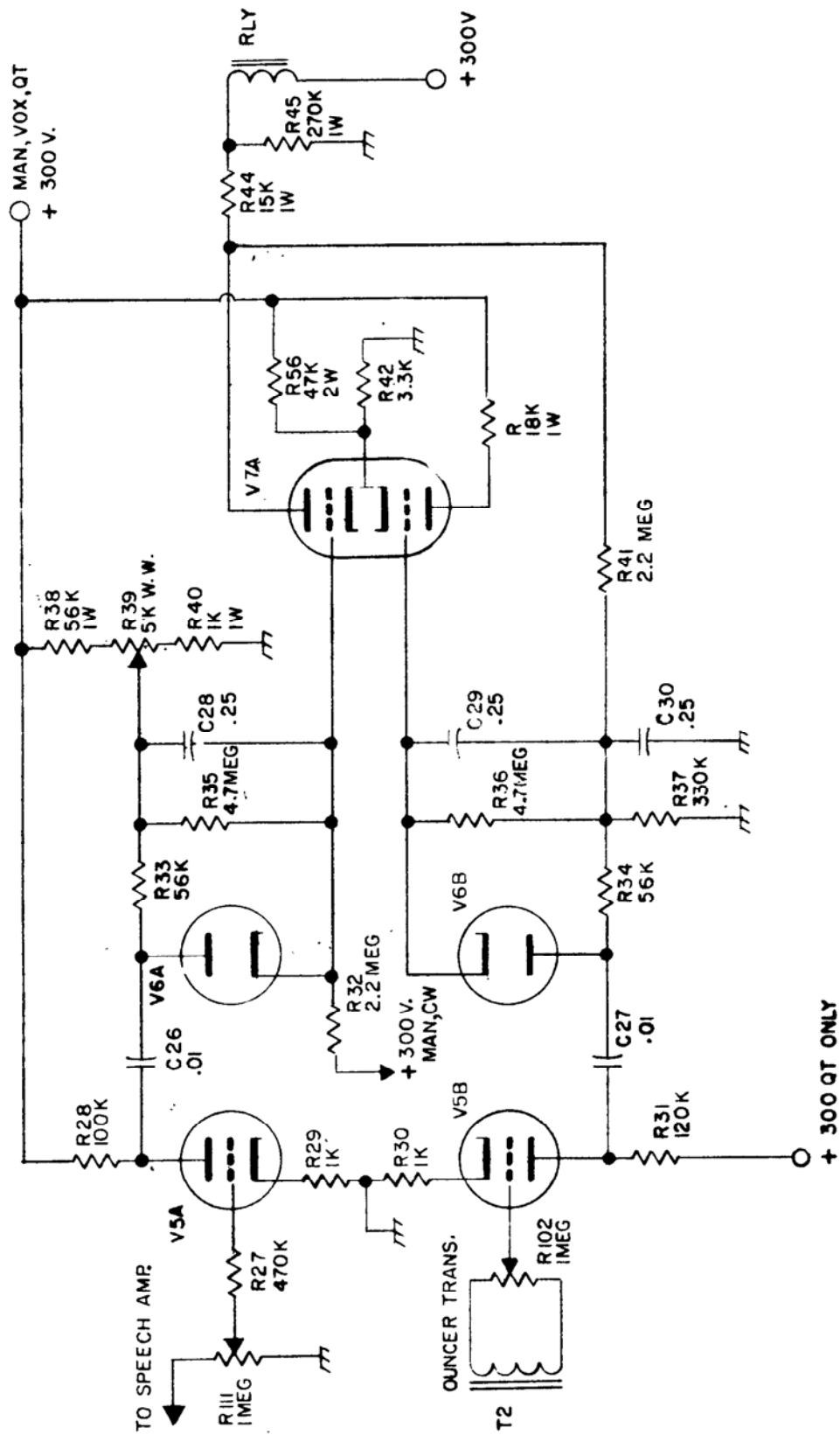


Figure 2

SECTION IV

THEORY OF OPERATION

1. GENERAL

The SSB-100F may be regarded as a triple conversion receiver in reverse. It contains all the circuits and conversion steps essential to a triple conversion receiver, only the signal path follows the circuits in the opposite direction.

The audio signal, after being amplified in the speech amplifier, (V-1) is converted to a 413 Kc double sideband suppressed carrier signal in the balanced modulator (V-2), the 413 Kc carrier being supplied by the carrier oscillator (V-8). The 413 Kc double sideband suppressed carrier signal is then passed through a crystal lattice filter which passes the lower sideband and rejects the higher sideband. At the output of the crystal lattice filter the single sideband signal (at this point the lower sideband) is fed into a mixer (V-3). For amplitude modulation, some of the 413 Kc carrier which was removed by the balanced modulator is fed into the mixer at the same time. In this manner, either an SSB or an AM signal is applied to the mixer. The SSB signal is mixed with a crystal controlled signal.

For lower sideband operation, the 413 Kc signal is mixed with a 4287 Kc signal which gives a 4700 Kc lower sideband signal. To obtain an upper sideband signal, the 413 Kc signal is mixed with a 5113 Kc signal which gives a 4700 Kc upper sideband signal. A trimmer across the crystal allows the crystal resonant frequency to be adjusted so that the output carrier frequency will be the same in either sideband position.

The output of this mixer is applied to an IF transformer tuned to 4700 Kc, which suppresses any unwanted mixer products.

The signal next enters V-4, a combination cathode follower/grounded grid amplifier. The signal is taken from the common cathode of this tube and fed into the VFO chassis. This signal is also amplified in the grounded grid amplifier and applied to V-9, the envelope detector and scope intensity bias rectifier.

The signal is detected in V-9 to provide two different types of output. One of these is the envelope of the SSB signal which is taken from plate (pin 2) of V-9a and fed into the

horizontal deflection amplifier, V-19. The DC component of the signal is recovered at cathode (pin 1) of V-9b, and is applied to the grid of the scope to provide automatic beam intensification when a signal is present.

The VFO circuit is a highly stable, modified Colpitts variable frequency oscillator operating from 800 to 1300 Kc and using a 6AK6 (V-10). The output of this oscillator is fed through a low pass filter to provide suppression of the VFO harmonics.

The SSB signal (4700 Kc) is mixed with the VFO signal in a balanced mixer (V-11). This gives an SSB signal adjustable from 5.5 to 6.0 Mc. The output of this mixer is fed into an IF stage which is adjusted to track with the VFO setting. These circuits deliver their signal to V-12, an IF amplifier.

The signal enters the final chassis through an impedance matching network. The signal is delivered into V-13, a high frequency balanced mixer. The crystal oscillator, V-14, (at 5.5 to 6.0 Mc higher than the desired output frequency depending on the setting of the VFO) has its output coupled into the balanced mixer (V-13). The mixer feeds the desired signal into the driver stage (V-15) and is again amplified in the final amplifier (V-16).

2. AUDIO AND VOICE BREAK-IN CIRCUITS

The speech pre-amplifier is a resistance-coupled amplifier and is of conventional design.

The output of the audio pre-amplifier is fed into the balanced mixer. Part of the audio signal is also applied to the voice control system. (See Figure 2.)

V-5a amplifies the speech and it is then rectified by V-6a. The resultant DC voltage is applied to C-28 and to the grid of V-7a which is driven into a state of high conduction, causing the relay to close. The relay then applies the proper operating voltages to all stages. The relay will remain closed as long as a speech signal maintains V-7a in high conduction. When this applied signal stops, condenser C-28 is discharged through re-

sistor R-35 and conduction ceases. The action of V-7a is very much like that of a one-shot multivibrator.

When operating QT, the receiver audio is fed into V-5b and through the audio channel via the loudspeaker and microphone. The audio entering tubes V-5a, V-6a and V-7a (the VOX channel) tends to trip the relay. However, the audio in V-5b (from the receiver) is rectified by V-6b and applied to V-7b, causing it to conduct heavily. This causes a large voltage to appear across R-42, which in turn prevents V-7a from going into heavy conduction.

When a voice signal appears at the microphone or low impedance input, the signal levels in the two audio control channels are unbalanced, causing the relay control to operate.

When the FUNCTION control is in the MAN, VOX or QT positions, B+ is applied to V-5a, V-6a and V-7a. When the control is in QT, the B+ is also applied to V-5b.

3. LOW FREQUENCY OSCILLATOR, CATHODE FOLLOWER, BALANCED MODULATOR AND CRYSTAL FILTER

V-8 is a crystal oscillator-cathode follower combination. The crystal is connected between the plate and grid and forms a parallel resonant circuit at 413 Kc. The capacitance divider across the crystal consists of C-31 and C-32 (their mid-point is grounded) which in combination with the crystal form the oscillator circuit. Resistor R-49 provides a plate load for the tube.

The cathode follower section serves a dual purpose. One is to isolate the low frequency oscillator from the modulator circuit. This is accomplished by the inherent high input impedance of a cathode follower. Output from the plate (pin 6 of V-8) is injected into the common cathodes of the balanced modulator. In order to reinsert carrier without disturbing the crystal filter, the cathode follower-cathode resistor is a potentiometer in order to tap off the correct amount of carrier voltage and to reinject it beyond the crystal filter.

The balanced modulator is actually a balanced mixer. The carrier is fed into the cathodes, driving V-2 in push-push. The plate circuit is connected in push-pull, and is tuned to 413 Kcs. With this connection (provided tube gains, voltages, etc. are properly matched), the carrier voltage can be adjusted to be 50 db or more down. The audio is applied in a push-pull manner to the grid, heterodyning against the carrier to produce sum

and difference frequencies between audio and carrier. (The balanced modulator also performs the function of audio phase inverter.) The phase relationships are such that these mixer products appear in the proper phase to cause signal voltages to appear in the plate circuit of V-2. This results in the appearance of mixer products (sidebands) in the plate circuit, while leaving the carrier suppressed.

The crystal filter is a more elaborate version of the type found in most communications receivers. The crystals are used to provide steep skirts to the selectivity curve while maintaining a relatively flat top.

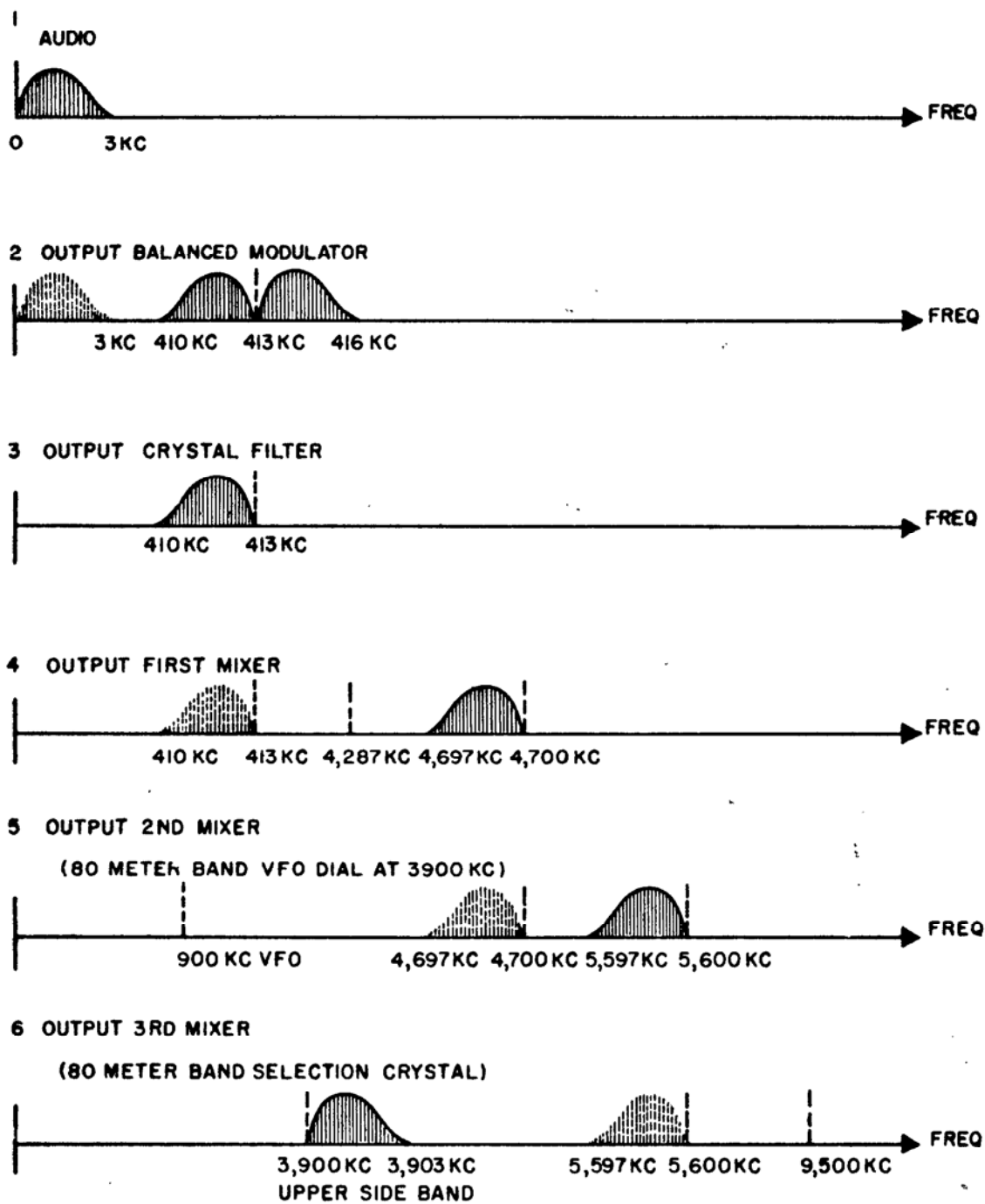
NOTE: NO READJUSTMENT OF THIS FILTER SHOULD BE ATTEMPTED. THE CRYSTALS SHOULD NOT BE REMOVED OR REPLACED. ANY ATTEMPTED ADJUSTMENTS ARE CERTAIN TO RESULT IN SERIOUSLY DEGRADED PERFORMANCE.

The crystals at the output of the filter serve as series resonant traps to increase sideband and carrier attenuation. The passband of this filter is approximately 3 Kc. The resultant single sideband signal is applied to V-3, the first conversion mixer. (See Figure 3.)

4. SIDEBAND SELECTION

The function of V-3 is to provide selection of either upper or lower sideband. This is accomplished by mixing the signal with either of two crystal controlled signals. One crystal is at 5113 Kc and the other is at 4287 Kc. These signals, when mixed with the 413 Kc signal, provide output at 4700 Kc. The output from the crystal filter is an SSB signal (lower sideband) extending from 410 Kc to 413 Kc. When added to the 4287 Kc signal, it produces a signal extending from 4697 Kc to 4700 Kc (lower sideband). This signal is later inverted to upper sideband. When the 410 to 413 Kc signal is heterodyned against the 5113 Kc signal, the output is 4700 to 4703 Kc signal (upper sideband). Later, this signal is inverted to produce a lower sideband signal at the output. See Figure 3.

The output section of the mixer (V-3) is a tuned transformer with adequate selectivity to provide sufficient rejection of unwanted mixer products, and is tuned to 4700 Kc. The transformer drives V-4, a cathode follower which supplies its output through a coaxial cable to the VFO chassis. The other half of V-4 is a grounded grid amplifier that feeds the signal into the envelope detector (V-9). The output of the detector is then applied to the horizontal scope amplifier (V-



SIGNAL PATH THRU TRANSMITTER

FIGURE 3

FIGURE 4

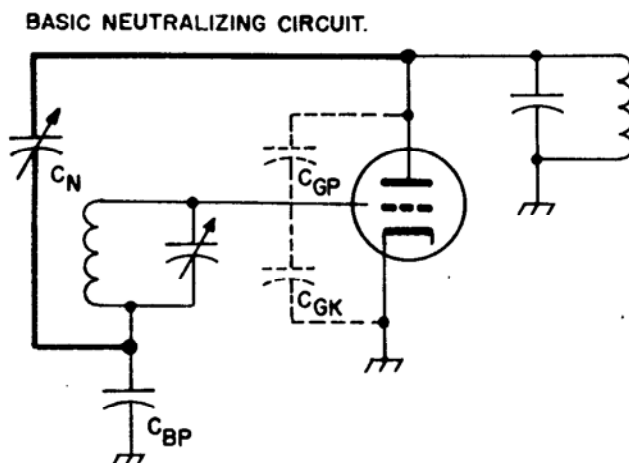
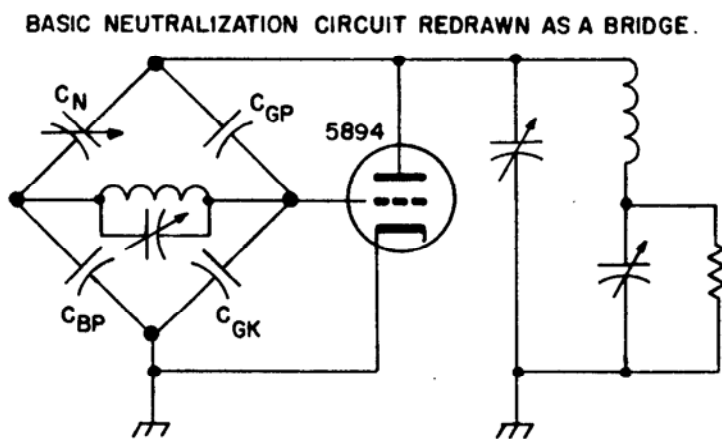
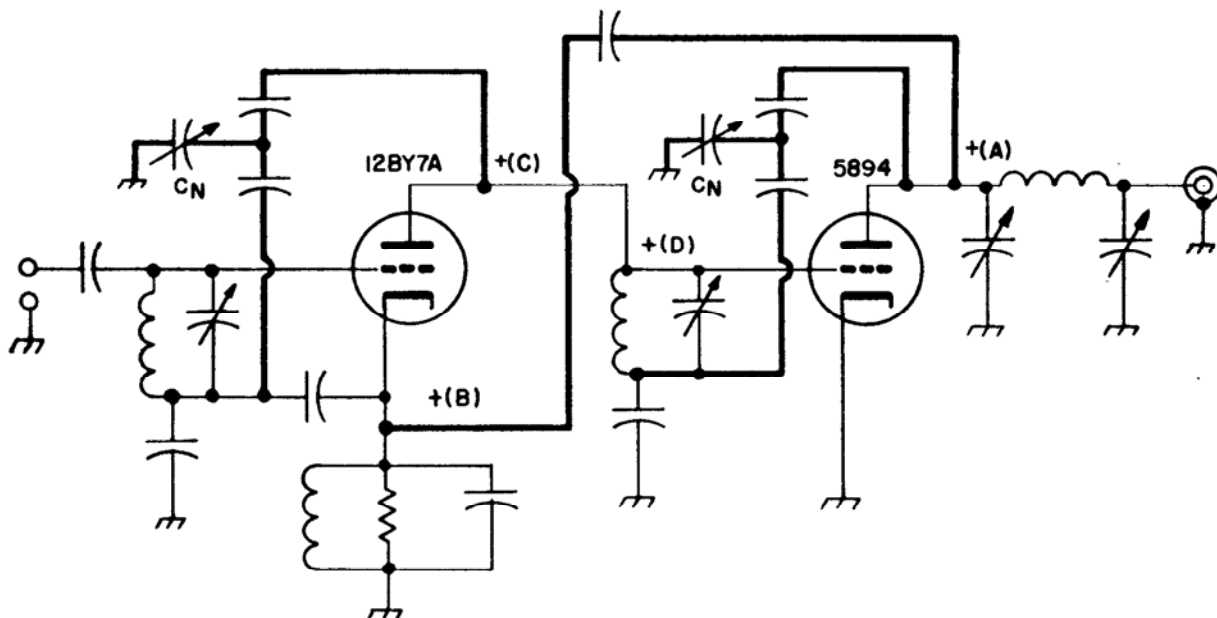


FIGURE 5



DRIVER AND P.A. SHOWING NEUTRALIZATION AND R.F. FEEDBACK PATHS.

FIGURE 6



19). The second half of V-9 provides a positive bias which is applied to the 1CP1 (V-20) oscilloscope control grid for automatic intensification of the scope pattern.

The variable frequency oscillator (V-10) is a permeability tuned, modified Colpitts oscillator. It is temperature compensated to provide high stability in excess of the usual requirements for single sideband operation. The low mass in the VFO assures adequate mechanical stability, even if the unit is used in a moving vehicle. The VFO is used as an electron coupled oscillator, and its output is inserted into a low pass filter. This filter sharply attenuates any harmonics of the VFO. The frequency range of the VFO is 800 to 1300 Kcs.

The VFO signal is taken from the low pass filter, and is applied to a balanced mixer stage (V-11), where it is mixed with the exciter signal. The output of this mixer is fed into two tuned circuits that have been adjusted to track with the oscillator.

The desired output of the mixer is applied to the variable IF amplifier (V-12) and is in turn delivered to the final chassis by means of a coaxial cable.

As a direct result of the mixing, filtering, etc., in this portion of the circuit, the transmitter is provided with an intermediate single sideband signal whose frequency is determined by the setting of the VFO and will be in the range of 5.5 to 6.0 Mc.

By heterodyning this signal once again with the band selecting crystal oscillator frequency, the signal is brought to the correct frequency of operation.

5. CW AND AM SIGNALS

CW and AM signals are produced by reinserting carrier into the signal channel. This is added to the previously formed single sideband signal, producing single sideband with carrier which can be received as conventional AM.

For CW signals (FUNCTION switch in CW position) the first speech amplifier is disabled. Carrier is injected with the carrier insertion control (R-51) to obtain the proper level. Keying is accomplished through grid-block keying applied to V-4, V-11 and V-15.

6. THIRD MIXER AND CRYSTAL OSCILLATOR

The SSB signal leaves the IF amplifier on

the VFO chassis and, traveling via coaxial cable, it enters the power supply and power amplifier chassis. C-80 and L-6 provide an impedance match to the signal grid of the dual triode balanced mixer (V-13). This circuit is in effect a reversed pi-network and actually steps up the incoming signal voltage. This circuit also helps suppress spurious signals (unwanted mixer products, harmonics, etc.). The oscillator signal is injected through C-82 into the oscillator injection grid of V-13. The plates and cathodes of V-13 are tied in parallel to provide mixer action. The tuned plate circuit of the mixer forms the grid circuit of the driver (V-15).

V-14 is a crystal oscillator operating at 5.5 to 6.0 Mcs higher than the desired output frequency, depending on the setting of the VFO. (This makes the final inversion of the sideband to produce correct upper and lower sideband output.) The operation of the oscillator in band switch positions 80 and 40 is similar to that of the carrier oscillator. When operating as an overtone oscillator (band switch positions 20, 15, 11, 10A, 10B and 10C), the circuit is that of a tuned grid, tuned plate oscillator. The coils, L-7 to L-12, are adjusted to be self-resonant at the desired overtone to insure operation of the crystal at the correct frequency.

7. DRIVER AND POWER AMPLIFIER

The driver and power amplifier consist of V-15 and V-16 respectively. V-15 operates Class A and V-16 operates in Class AB-1. This permits linear operation without distortion. The function of these stages is the generation of a high-level signal. Prior to this point, neutralization was not required because the output of the various preceding stages was not tuned to the same frequency, the gain of a particular stage was low, or the stage was inherently stable. The final stage (V-16), however, does require neutralization because the gain is high and the input and output circuits are always tuned to the same frequency. Since the type of operation is Class AB-1 (as opposed to Class C), the high power gain makes the stage far more sensitive to feed-back through the grid-plate capacity.

Figure 4 illustrates the basic configuration of the neutralization circuit. Tube capacitances (C_{gp} - grid-plate capacity) and (C_{gk} - grid-cathode capacity) are indicated by dotted lines. While these capacities are not illustrated on the schematic diagram, they are a function of the tube and are, therefore, unavoidable. When the plate circuit is tuned to a higher frequency and the tube is unneutralized, the tube will no longer be an amplifier, but will oscillate. Neutralization is

employed to avoid this undesirable condition. The heavy line in Figure 4 shows how an extra capacitance has been added from the plate to the opposite end of the grid coil to balance out the voltage coupled into the grid tank through the grid-plate capacitance.

Figure 5 illustrates the circuit of V-16 redrawn as a bridge. Assuming that the plate is going positive and the grid voltage is positive (through C_{gp}), the voltage through C_n tends to make the other end of the grid tank positive. This voltage in turn becomes negative at the other end of the grid tank, cancelling out the feed-back voltages.

To assure adequate linearity, inverse RF feed-back is employed to reduce as far as possible the amplitude distortion of the emitted wave. This inverse feed-back is required to minimize unwanted distortion products. Some of the RF is coupled through a small capacitor from the plate of V-16 back to the cathode of the driver. Figure 6 illustrates the feed-back path. Assume the voltage at point (A), which is the cathode of V-15, is going positive. This in turn drives the grid of V-16 positive, which tends to drive the plate of V-16 negative. As it was originally assumed that the plate was going positive, the feed-back can be assumed to be negative in character because it tends to reduce the output slightly. The degree of feed-back depends on the values of the feed-back capacitor and associated components.

8. OSCILLOSCOPE

The oscilloscope provides comparison with the envelope of the low level single sideband signal and the RF voltage present at the final stage. This is accomplished by first detecting the signal coming from V-4, pin 6, and obtaining the detected signal from the junction of R-23 and R-24. From there, the signal progresses to the grid of V-19. It is amplified in this tube and coupled into the horizontal deflection plates of V-20. The RF signal at the plate is picked up via a coupling capacitor (C-124) from the plate of the final amplifier to the vertical deflection plates of V-20. To provide automatic beam intensification, the DC component of the signal is rectified in V-9 and the resulting positive voltage is taken from the junction of R-25 and R-26 and applied to the control grid of the oscilloscope. The scope intensity potentiometer (R-114) should be adjusted so the beam is blanked out when the carrier and audio level controls are at zero, and the Function switch is in the manual position and control switch on XMIT.

9. POWER SUPPLY

The power supply is designed to give three basic voltages: A high voltage for the final stage and oscilloscope, a medium voltage supply for the required voltage for all low level stages and the screen of the power stage, and a negative supply for bias voltage (keyed by a relay to give operating and blocking bias) to the power amplifier. When operated CW, there is a negative voltage applied to the mixer on the VFO chassis (V-11). This voltage is keyed at the key jack providing grid-block keying. The voltages at the output of the various output filters are: 750 volts for the high voltage supply; 320 volts for the medium voltage supply, and -75 volts for the bias supply. The ignition voltage for the VR tubes is derived from the medium voltage supply. The regulated voltage (+150 volts) is supplied to the plate of the 413 Kc oscillator (V-8), the screen grid of the first conversion mixer (V-3), and the plate of the final crystal oscillator (V-12). The regulated voltage (+105 volts) is supplied to the screen grid of the VFO (V-10).

10. CONTROL CIRCUITS

The control circuits provide four basic types of operation: CW, MAN, VOX and QT. These types of operation are obtainable by switching to the appropriate position on the FUNCTION switch. When in the CW position (CONTROL switch in XMIT position) B+ is removed from the first audio stage (V-1) and operating bias is applied to all stages except V-4, V-11 and V-15. When the key is depressed, this bias is removed, allowing the carrier to come through (when the CARRIER control knob is set to the proper level). The screen voltage to V-16 is reduced through R-109 to prevent excessive screen dissipation. The vox relay is held in by a positive bias supplied to the grid of the relay tube (pin 7, V-7). The transmitter is keyed by grid-block keying V-4, V-11 and V-15.

When in the MAN position (and control switch is in XMIT), all voltages are applied. The unit can then be used for AM and SSB. The vox relay is held in by positive bias applied to pin 7 of V-7.

When in the VOX position (control switch in XMIT) all voltages are applied. When the operator's voice signal enters the grid of V-5a, it is amplified, then rectified at the cathode of V-6a (see Figure 2). This rectified positive voltage is applied to the grid of V-7a and causes an increase in the plate current which makes the relay trip. This removes the blocking bias from the grid of V-16.

The final position of the control switch is QT which allows voice controlled operation with the receiver loudspeaker on. An audio signal from the loudspeaker is applied to terminals 6 or 7 and 8 on the rear terminal strip, and fed into the grid of V-5b where it is amplified. The signal is rectified at the plate of V-6b, and the resultant positive signal is applied to the grid of V-7b, causing the cathode of V-7b to go positive. This positive voltage prevents the plate of V-7a from drawing very much current, even when the grid of V-7a is being driven positive by the signal from the loudspeaker which is picked up by the microphone. When an external signal (the operator's voice) is picked up, the additional signal will unbalance this circuit and the plate of V-7a will draw more current, tripping the relay. This balancing

circuit only works in this position, because B+ is applied to the plate of V-5b only in this control position.

The control switch has three positions. When in STANDBY position, voltage is applied to the various oscillators, assuring their stability. When in the TRANSMIT position, the voltages are distributed according to the position of the control switch as outlined previously. In the CALIBRATE position, voltages are applied to all stages except the first speech stage and the power amplifier is biased beyond cut off. When the CARRIER knob is used to provide carrier reinsertion in this position, the carrier becomes audible to any nearby receiver, enabling the operator to adjust his transmitter to the desired frequency.

SECTION V

MAINTENANCE

Generally, little maintenance should be required, provided the equipment is kept clean and dry. It should be placed in such a position that cool air is free to circulate through the equipment.

1. SERVICE ADJUSTMENTS

A. Exciter Chassis:

CAUTION: NO ATTEMPT SHOULD BE MADE TO ADJUST THE CRYSTAL FILTER. (Subchassis between V-2 and V-3). ANY ATTEMPT TO DO SO WILL SERIOUSLY DEGRADE THE PERFORMANCE OF THE UNIT. It has been factory adjusted with special equipment to give the optimum compromise between insertion loss, flatness in the pass-band, skirt slope, and spurious response in the filter. It is strongly advised that the unit be returned to the factory for service if the crystal filter is out of alignment. The component parts have been matched and completely tested to keep the RF losses at the minimum value. It is, therefore, inadvisable to attempt repairs.

The performance of the filter can be checked with an audio generator that puts out a pure, undistorted audio tone. Connect this to the audio input of the transmitter. Set the control to XMIT and MAN. Set the audio frequency to about 1000 cps. Adjust audio level until the plate current is about 85 Ma. With the carrier suppressed, the scope pattern should be a thin, clean vertical line (provided the rest of the unit is in good operating condition).

A further check is to tune in this signal with a good receiver set in its sharpest position. When tuning slowly across the signal, only one signal should be noted. Extreme care should be taken to avoid overloading the receiver, as a strong signal will cause spurious signals to be generated in the receiver. The simple reduction of RF gain is insufficient to prevent this from occurring. Keep receiver RF gain at normal levels and adjust receiver pick-up by using a short receiver antenna (12 inches or so). In some extreme

cases, it may prove necessary to disconnect the antenna lead from the input to the receiver and put a short, heavy lead from the antenna terminal to a ground on the receiver cabinet.

To check the linearity of the amplifiers, use the audio tone and carrier reinsertion. When adjusted properly, a perfect triangle should be seen. If the amplifier linearity is poor, the preceding tests for filter performance will not be valid.

To check carrier balance, set up the receiver as in the previous test and tune in the carrier. RF and AF gains should be set to normal level without overloading the receiver. With the proper adjustment, the receiver should not be overloaded. Turn AVC off and BFO on. Now turn the transmitter CARRIER control knob completely counterclockwise. Do not readjust receiver. The remaining carrier should be almost inaudible. If the carrier is completely audible, the carrier balance potentiometer will have to be readjusted. If the balanced modulator tube is replaced, the carrier will have to be rebalanced. If a satisfactory balance cannot be obtained, then a tube will have to be selected to give optimum balance. To adjust the control, the following procedure is recommended: Tune up the exciter and apply it to a dummy load. Tune the receiver to the output frequency. With the transmitter set to MAN and XMIT, and the AUDIO GAIN and CARRIER knobs set to the maximum counterclockwise position, the carrier balance control should be adjusted for minimum carrier.

To adjust the Vox threshold control, set the transmitter to VOX and XMIT. Turn the Vox threshold fully clockwise. The relay should be energized and held in. Back off the control until the relay de-energizes. Now turn Vox control clockwise while speaking into the microphone. The relay should be energized at the beginning of a word and hold in for about one-half second. If the relay holds in longer than this, turn the Vox threshold control slightly counterclockwise to reduce the hold-in time to a suitable value.

To adjust the transmitter sideband frequency, tune in the signal on a receiver. Insert a slight amount of carrier and adjust the fre-

quency until it is precisely zero beat with the BFO in the receiver. Next, switch the sideband selector switch. The carrier frequency should remain at exact zero beat. If not, put the transmitter in the LSB position and adjust transmitter frequency for exact zero beat. Switch to USB and adjust trimmer adjacent to Xtal 1 for exact zero beat.

B. VFO Chassis

There are NO service adjustments on the VFO chassis.

C. RF Chassis

There are three adjustments on the RF chassis. They are the bias adjust, the final amplifier neutralization and the inverse feed-back loop neutralization.

The bias adjustment is set by switching the transmitter to XMIT and MAN. The AUDIO and CARRIER controls are fully counterclockwise. Check the plate milliammeter. It should read 40 Ma. If it does not, adjust the bias control on the back of the unit.

Neutralization: First tune up the transmitter for maximum performance with just the carrier operating at the rated level into a dummy load. Switch to STBY. Next attach an RF voltmeter to the ungrounded side of C-112 (plate tuning). (A circuit of a suitable RF probe for use with a microammeter is included at the end of this manual.) Turn the CARRIER control to minimum. Turn the CONTROL switch to CAL., and adjust the carrier level until the RF voltmeter gives an indication. Then adjust C-105 for a dip on the RF voltmeter. This adjustment should be made only if the power amplifier (V-16) is changed.

It may be necessary to make the neutralization twice: First on the 20 meter band, and again on the 10C band. Lack of neutralization is indicated when maximum power output as indicated on the oscilloscope does not occur at the plate current minimum.

NOTE: IF, WHEN THE TRANSMITTER IS PROPERLY TUNED INTO A DUMMY LOAD, A SLIGHT LACK OF NEUTRALIZATION IS NOTED (INDICATED BY A 5 Ma OR LESS DIFFERENCE IN PLATE CURRENT BETWEEN THE MAXIMUM OUTPUT POINT AND THE POINT WHERE THE PLATE CURRENT IS MINIMUM) READJUSTMENT OF THE NEUTRALIZATION IS NOT NECESSARY.

Inverse Feed-back Neutralization: Tune up the transmitter for normal performance. Unload the final amplifier until a very pronounced plate current dip occurs. Reduce the carrier insertion so that plate current with the plate tuning condenser off resonance is 100 Ma. Lack of neutralization is indicated by a sharp rise in plate current just before the plate tuning condenser reaches resonance. The neutralizing capacitor (C-79) should be adjusted to minimize the rise in plate current on either side of resonance. Note that for satisfactory performance of the transmitter, it is not necessary to completely eliminate the plate current rise.

D. Oscilloscope chassis

There is one adjustment on the oscilloscope chassis to control the intensity of the oscilloscope pattern. With the FUNCTION switch in MAN position, the CONTROL switch XMIT, AUDIO GAIN and CARRIER insertion fully counterclockwise, the screwdriver adjusted potentiometer on the oscilloscope chassis should be adjusted to the level where the spot on the face of the oscilloscope is just extinguished.

2. TROUBLE SHOOTING

The following tables will assist the user in locating troubles. Defects in many stages will produce similar symptoms. Therefore, the signal path should be carefully followed to determine the actual trouble source before any attempt to repair the equipment is made.

TRUBLE SHOOTING CHART

SYMPTOMS	DEFECTS IN TUBE OR ASSOCIATED CIRCUITRY	CHECK TO VERIFY LOCATION OF TROUBLE	CORRECTIVE STEPS
Tubes do not light. No response at all.			Replace fuse.
Operates on CW, no output on phone. VOX and QT do not operate. Scope operates on CW.	V-1	Insert audio signal to wiper of audio gain control. Transmitter should now operate normally.	Replace tubes. Make voltage and resistance checks.
Carrier cannot be balanced out. Low output may be present. Scope operates.	V-2		Replace tubes. Make voltage and resistance checks.
Low output on phone. Reports of poor quality and inadequate sideband suppression. Operates on VOX, CW and QT. Scope indicates good linearity.	Xtal Filter	Perform tests specified in service adjustments.	If Xtal filter is defective, return to factory.
Sideband selector, scope works in one position and not in the other. On CW, works only in one sideband position, OR no output at all. No indication on scope.	V-3	Remove tube shield from V-3. Bring antenna lead from receiver near tube. Turn up carrier knob. Signal at 4700 Kc should be audible in both sideband positions if V-3 is operating properly.	Make voltage and resistance checks. Replace tubes. <u>Check crystals.</u>
VOX and QT circuits operate. No output. No indication on scope (remains dark).	V-4	Pull out cable from VFO (marked input). Bring free end to receiver tuned to 4700 Kc. If stage operates, signal will be audible.	Replace tubes. Make voltage and resistance checks.
Automatic scope intensification does not work and/or no horizontal sweep. Distorted pattern. Transmitter operates normally; VOX and QT operate.	V-9	Carrier oscillator defective. Insert signal generator to pin 8 of V-8. Set generator to 413 Kc. If transmitter operates, trouble in V-8 is indicated.	Make voltage and resistance checks. Replace V-8. If crystal is defective, obtain replacement from manufacturer.

TROUBLE SHOOTING CHART (Cont'd)

No output, no vertical deflection. Horizontal sweep present. VOX and QT operate.	V-10	Remove tube shield of V-10. Set VFO to frequency. Couple antenna to V-10. Signal should be present if oscillator is functioning.	Replace V-10. Make voltage and resistance checks.
No output, no vertical deflection. Horizontal sweep present. VOX and QT operate.	V-11	Remove key from key jack. An unclosed key will prevent operation. Remove tube shield. Couple antenna of receiver near tube. Insert carrier. Set VFO to frequency. Signal should be heard between 5.5 and 6.0 Mc if mixer is functioning.	Replace V-11. If transmitter functions normally, make service adjustment previously described. Make voltage and resistance checks.
No output, no vertical deflection. Horizontal sweep present. VOX and QT operate.	V-12	Remove cable from jack labeled input, adjacent to bleeder. Place 500 ohm resistor across inner and outer conductors. Couple receiver antenna near center conductor. Insert carrier. Set VFO to frequency. If V-12 is operating, signal will be heard at 5.5 to 6.0 Mc.	Replace V-12. Make voltage and resistance checks.
No output, no vertical deflection. Horizontal sweep present. VOX and QT operate. This may occur on only one band.	V-14	On the 20 meter band and all higher bands, retuning of the proper coil (L-7 to L-12) may be required.	Replace V-14. Make voltage and resistance checks.
No output, no vertical deflection. Horizontal sweep present. VOX and QT operate. This may occur on only one band.	V-13	Use RF probe to see if RF drive is being applied to control grid of 12BY7a. If not, V-13 or previous stage is at fault.	Replace V-13. Make voltage and resistance checks.
No output, no vertical deflection. Horizontal sweep present. VOX and QT operate. This may occur on only one band.	V-15	Use RF probe to see if RF drive is being supplied to control grid of V-16. If not, V-15 or previous stage is at fault.	Replace V-15. Make voltage and resistance checks.

TRUBLE SHOOTING CHART (Cont'd)

No output, no vertical deflection. Horizontal sweep present. VOX and QT operate. This may occur on only one band.	V-16	Check to see if RF drive is being applied to control grid of V-16. If not, check previous stages.	Replace V-16. Make voltage and resistance checks.
No horizontal deflection. Transmitter functions normally otherwise.	V-19	Connect audio generator to pin 1 of V-19 through .05 or .1 mfd condenser. If horizontal deflection does not occur, trouble is indicated in V-19.	Replace V-19. Make voltage and resistance checks.
No scope pattern even with intensity control fully clockwise.	V-20		Replace V-20. Make voltage and resistance checks.
VOX and/or QT does not operate. Possibly no output on SSB or AM.	V-5, V-6, V-7		Replace tubes. Make voltage and resistance checks.

NOTE: WHERE A TUBE IS SUSPECTED OF BEING BAD, MAKE SURE ALL THE PINS ON THE TUBE ARE MAKING GOOD CONTACT IN THE TUBE SOCKET BEFORE REPLACING THE TUBE.

Voltage Chart

Tube	Control Switch Position	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-1 12AT7	STANDBY	0	-.64	0			0	-6.2	0	-
	TRANSMIT	61	-.05	.75	6.3 AC	6.3 AC	180	0	3.5	-
V-2 12AT7	STANDBY	0	-.45	0			0	-.5	0	-
	TRANSMIT	280	+3	10.6	6.3 AC	6.3 AC	278	+4	10.6	-
V-3 6BA7	STANDBY	68	-.05	.67	-		-	-	-	0
	TRANSMIT	82	0	.75	-	6.3 AC	-	-	-	290
V-4 12AT7	STANDBY	0	-.4	.15			0	-	.15	-
	TRANSMIT	280	0	4.6	6.3 AC	6.3 AC	290	-	4.6	-
V-5 12AT7	STANDBY	0	-.35	0			0	-	0	-
	TRANSMIT	110	0	1.72			0	-	0	-
	XMIT/QT (no sig.)	111	0	1.82	6.3 AC	6.3 AC	112	-	1.65	-
	(with sig.)	116	0	1.75			108	-	1.6	-
V-6 6AL5	STANDBY	0	0	-		0	-	0	-	-
	TRANSMIT	13	10	-		37	-	13	-	-
	XMIT/QT (no sig.)	31	10	-	6.3 AC	10	-	31	-	-
	(with sig.)	18	9	-		33	-	19	-	-
V-7 12AT7	STANDBY	0	-.3	0			0	0	0	-
	TRANSMIT	270	2.32	38			125	37	38	-
	XMIT/QT (no sig.)	172	22.4	36	6.3 AC	6.3 AC	275	10	36	-
	(with sig.)	270	15	34			137	32	34	-

V-8	STANDBY	54	-2.3	-	6.3 AC	0	-2.8	.01	-
12AT7	TRANSMIT	54	-2.7	-	6.3 AC	250	0	5	-
V-9	STANDBY	.03	-.025	-	-	-	-	-	-
6AL5	TRANSMIT	.03	-.025	-	6.3 AC	-	-	-	-
V-10	STANDBY	-	-	6.3 AC	330	105	3.6	-	-
6AK6	TRANSMIT	-	-	-	285	105	3.6	-	-
V-11	STANDBY	330	-	5.5	6.3 AC	330	-	5.5	-
12AT7	TRANSMIT	285	-	4.95	6.3 AC	285	-	4.95	-
V-12	STANDBY	-	-	6.3 AC	330	105	-	-	-
6AU6	TRANSMIT	-	-	-	285	105	-	-	-
V-13	STANDBY	0	.3	3.2	6.3 AC	0	1.3	0	-
12AT7	TRANSMIT	275	-1.95	0	6.3 AC	275	0	3.4	-
V-14	STANDBY	145	-	2.3	-	145	-	2.3	6.3 AC
12AT7	TRANSMIT	145	-	2.3	-	145	-	2.3	6.3 AC
V-15	STANDBY	0	-5	-	6.3 AC	1	0	0	-
12BY7A	TRANSMIT	.55	-2.73	-	6.3 AC	-	294	185	-
V-16	STANDBY	6.3 AC	-70	0	-	-70	6.3 AC	(plate cap = 770)	-
5894	TRANSMIT	136	-33	294	-	-33	-	(plate cap = 715)	-
V-17	STANDBY	150	-	-	150	-	-	-	-
OA2	TRANSMIT	-	-	-	-	-	-	-	-

Control Switch

Tube	Position	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-18	STANDBY									
OB2	TRANSMIT	105	-	-	-	105	-	-	-	-
V-19	STANDBY	-	-	-	6.3 AC	138	84	1.87	-	-
6AU6	TRANSMIT	-	-	-		120	75	1.67	-	-
V-20	STANDBY	6.3 AC	740	682	682	.25	682	25	-	-
1CP1	TRANSMIT		680	615	615	.25	615	22	-	-
V-21	STANDBY	-	780	-	890 AC	-	890 AC	-	780	-
5R4	TRANSMIT	-	720	-	830 AC	-	830 AC	-	720	-
V-22	STANDBY	-	360	-	325 AC	-	325 AC	-	360	-
5U4	TRANSMIT	-	310	-	297 AC	-	297 AC	-	310	-
Xtal Filter Unit (V-2 to filter input)	STANDBY	0	0	0	-	-	-	-	-	-
	TRANSMIT	275	275	275	-	-	-	-	-	-
IF Trans. #1	STANDBY	0	-.37	-	-.37	0	-	-	-	-
	TRANSMIT	285	0	-	0	285	-	-	-	-
SO-2 (VFO power jack)	STANDBY	6.3 AC	-	105	330	-	-	-	-	-
	TRANSMIT		-		285	-	-	-	-	-

All DC and AC voltage measurements made with 20,000 ohms per volt meter.

Place FUNCTION switch in "MAN", and CONTROL switch in "XMIT". Set BIAS control to draw 40 Ma. All other controls to be set at minimum condition except for tuning controls which are set at maximum clockwise position.

AC line voltage in "XMIT" position is 115 volts.

Make measurements with CONTROL switch in positions indicated. All voltages indicated are relative and subject to variation in individual units.

Two additional sets of measurements are made on tubes V-5, V-6 and V-7. To make these measurements, set FUNCTION switch in "QT" position. Apply an audio signal to the unit. (60 cycle stray pickup from an 18-inch long wire clipped to the microphone input will be satisfactory if an audio generator is not available). With AUDIO GAIN at minimum, advance the "VOX" control until the relay closes, as indicated by 40 Ma idling current drawn by the final amplifier.

For "NO SIGNAL" test condition, remove the audio source.

Resistance Chart

Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-1 12AT7	235K	1 Meg	680	.05	.05	70K	1 Meg	680	0
V-2 12AT7	Inf	120K	2.7K	.05	.05	Inf	120K	2.7K	0
V-3 6BA7	37K	47K	37	0	.05	0	18K	0	Inf
V-4 12AT7	Inf	120K	470	.05	.05	Inf	0	470	0
V-5 12AT7	120K	470K	1K	.05	.05	160K	0	1K	0
V-6 6AL5	5 Meg	57K	0	.05	Inf	0	370K	-	-
V-7 12AT7	42K	5 Meg	3.3K	.05	.05	47K	Inf	3.3K	0
V-8 12AT7	180K	470K	0	.05	.05	Inf	100K	1K	0
V-9 6AL5	1 Meg	60K	0	.05	0	0	0	-	-
V-10 6AK6	220K	0	.05	0	Inf	Inf	320	-	-
V-11 12AT7	Inf	120K	390	.05	.05	Inf	Inf	390	0
V-12 6AU6	100	0	.05	0	Inf	Inf	150	-	-
V-13 12AT7	110K	120K	460	.05	.05	110K	5.6K	460	0
V-14 12AT7	33K	22K	270	0	0	33K	22K	270	.05
V-15 12BY7A	40	40K	0	.05	.05	0	110K	80K	0

V-16	5894	.05	8K	25K	.2	0	8K	.05	-
V-17	O A 2	34K	0	Inf	0	34K	Inf	0	-
V-18	O B 2	32K	0	Inf	0	32K	Inf	0	-
V-19	6AU6	475K	0	0	.05	175K	480K	1.1K	-
V-20	1CP1	.05	1 Meg	3.2 Meg	3.2 Meg	1 Meg	3.2 Meg	80K	0
V-21	5R4	Inf	24K	Inf	110	Inf	110	Inf	24K
V-22	5U4	Inf	28K	Inf	30	Inf	30	Inf	28K

UNIT

PL-2

Inf

Inf

Inf

Inf

SO-2

28K

0

32K

Inf

TS-1

Inf

Inf

Inf

Inf

Jacks (J-)

1.2M

-

-

-

Inf

Inf

-

Inf

IFT-1

Inf

130K

Inf

130K

Inf

Inf

Xtal Filter - V-2 to input
output to V-3

Inf

Inf

Inf

0

Inf

Inf

T-2-Pin 1 to ground

1.4K

QT Input Transformer

900

Pin	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PL-1	0	0	0	0	1 Meg	40	Inf	55	380K	.05	Inf	Inf	Inf	350K	Inf	33K	350K	Inf	Inf	0
SO-1	0	0	0	0	1 Meg	Inf	Inf	Inf	270K	.2	Inf	Inf	Inf	Inf	Inf	25K	1 Meg	4.9K	Inf	Inf

All resistance measurements taken with a 20,000 ohms per volt V.O.M.

NOTE: Disconnect unit from power source before making any resistance measurements.

Set all panel controls as follows:

CARRIER	-	Fully CCW	VOX	-	Fully CCW	BAND CHANGE	-	80 Meters
LSB-USB	-	LSB	POWER	-	Fully CCW	CARRIER BAL.	(Set for proper	
AUDIO GAIN	-	Fully CCW	QT	-	Fully CCW	VOX THRESHOLD	operation at factory)	
FUNCTION	-	Man.	CONTROL	-	Standby	(will be approximately mid range)		

SECTION VI

ALIGNMENT PROCEDURES

CAUTION #1: DO NOT ATTEMPT ALIGNMENT OR ADJUSTMENT ON THE CRYSTAL FILTER UNIT OR COIL L-3. THESE UNITS ARE EXTREMELY CRITICAL AND SET AT THE FACTORY FOR PROPER OPERATION. ANY ATTEMPT TO VARY THESE UNITS OR REMOVE CRYSTALS WILL UNDOUBTEDLY RESULT IN SERIOUSLY DEGRADED PERFORMANCE OF THE UNIT.

CAUTION #2: DO NOT APPLY UNDUE PRESSURES TO COIL SLUGS TO AVOID THE POSSIBILITY OF DAMAGE TO THE SLUG, THREADS, OR COIL FORMS.

1. ADJUSTMENT OF CRYSTAL OSCILLATOR

NOTE: ON 40 AND 80 METER BANDS, CRYSTALS ARE OF THE FUNDAMENTAL TYPE AND NO ADJUSTMENT IS NECESSARY. ON ALL BANDS ABOVE 40 METERS, CRYSTALS ARE OF THE OVERTONE TYPE AND THE ASSOCIATED CIRCUITS MUST BE ADJUSTED TO ASSURE PROPER OPERATION.

A. To adjust one of the crystal oscillators, it must first be understood that there are two modes of operation possible with an overtone type crystal. In one of the modes, the crystal oscillates on its fundamental frequency which is actually one-third of the frequency marked on the crystal. This is the wrong mode of operation. The other mode in which the crystal oscillator can operate is in an overtone fashion, where the frequency of operation is three times the fundamental frequency of the crystal. This overtone frequency is the frequency marked on the case of the crystal. To insure that the crystal is operating in its proper mode, adjustment of the appropriate crystal oscillator coil is necessary.

NOTE: THE 11 METER BAND IS GIVEN IN THE FOLLOWING TEXT AS AN EXAMPLE ONLY. IT IN NO WAY INDICATES THAT THE 11 METER BAND MUST BE ADJUSTED FIRST.

B. To adjust the overtone crystals, proceed as follows:

- 1) Place the BAND SWITCH at the proper band. (To adjust 11 meter crystal, place BAND SWITCH at 11 meter position.)
- 2) Connect an RF indicating device, such as a vacuum tube voltmeter with an RF probe or an RF indicator, as shown at the rear of this manual (see Figure 18) between pin 1 or 6 of V-13 (12AT7) and ground. Be sure the CARRIER control is set to minimum (fully counterclockwise) and that the CONTROL switch is in the TRANSMIT position.
- 3) Rotate the 11 meter crystal oscillator coil (marked on chassis, see Figure 10) counterclockwise until the slug has reached the end of its travel. (See CAUTION #2, this section!)
- 4) Set the RF indicating device on its lowest range and rotate the 11 meter crystal oscillator slug in a clockwise direction until an indication is observed on the RF meter. Continue to rotate the slug in this direction until the indicated RF reaches a peak and then suddenly drops. At this point, turn the slug back (counterclockwise) until the output is again indicated and adjust for maximum output.

The correct mode of operation of an overtone crystal is indicated by the output dropping suddenly as the slug is turned in. If the output drops slowly instead of suddenly as the slug is turned in, then the crystal is operating on its fundamental frequency. This is an indication that too much inductance is present. To find the proper mode, turn the slug out while observing the RF meter. The output will drop until the oscillator ceases operation. Continue rotation in this direction until the output suddenly reappears. Tune slug for maximum output at this point.

- 5) Disconnect the RF meter and tune the SSB-100F for normal CW operation. Make a fine adjustment on the crystal oscillator coil to peak the output as indicated by either the plate current or the oscilloscope pattern.
- 6) Repeat alignment operation for other bands (except 40 and 80 meters) as required.

2. STEP BY STEP ALIGNMENT PROCEDURE

A. (Refer to CAUTION #1, this section!)

Equipment required is a vacuum tube voltmeter with an RF probe or an RF indicating device, as illustrated in Figure 18.

- 1) Turn SSB-100F "ON" and tune into a dummy load for normal CW operation on 80 meter band.
- 2) Allow SSB-100F to operate for approximately two hours to allow thorough warm-up. (Alignment is always done best with the equipment hot. This eliminates the possibility of misalignment due to minor drifts in various tuned circuits.)
- 3) Alignment Procedure: (All adjustments to be made with SSB-100F operating as a CW transmitter with CONTROL switch in XMIT position.) Disconnect cable from exciter chassis to VFO chassis.
 - (a) Connect RF indicating device to output of exciter chassis and insert enough carrier to get an indication on RF indicator.

(b) Peak IF transformer slugs at top and bottom of IF transformer. (See Figure 14A for location.) To insure that IFT-1 is tuned to the proper frequency, turn carrier insertion to minimum and note whether the output drops as this is done.

(c) Switch the SIDEBAND SELECTOR switch and repeat the above step. If the tuning of the IF transformer remains peaked in both sideband positions, IFT-1 is properly tuned.

(d) Reconnect cable between exciter chassis and VFO.

(e) Disconnect cable between the VFO chassis and the Power Supply/Final Amplifier chassis. Connect RF indicating device to J-6.

(f) Set VFO to 3.5 Mc and adjust CARRIER control for an indication on RF indicator. Adjust L-4 and L-5 for maximum indication of RF.

(g) Set VFO at top end of band (4.0 Mc) and note whether output goes up, down or remains steady. If output remains constant or increases slightly, reset VFO to 3.5 Mc and follow next step. If VFO output drops at 4.0 Mc, readjust L-4 and L-5 for maximum output.

(h) Set VFO at 3.5 Mc and observe whether the output has gone up, down or remained constant. If the output has remained constant, make no adjustments. If the output has gone down, adjust C-62 and C-68 for maximum indication of RF.

(i) Reset VFO to 4.0 Mc and note whether the output has increased, decreased or remained constant. If decrease is noted, repeat adjustment of L-4 and L-5. (Step (g) preceding.)

(j) Repeat preceding steps until the output remains essentially constant or slightly higher at high and low ends of the band, and slightly lower at the center of the band.

(k) Reconnect cable between VFO chassis and Power Supply/Final Amplifier chassis.

3. ALIGNMENT OF POWER SUPPLY: FINAL AMPLIFIER CHASSIS

- A. Set BANDSWITCH to 15 meter position and tune up for normal CW operation. (VFO should be set at 21.25 Mc. Refer to Figure 10 for location of coil groups.)
- B. Insert enough carrier to get an indication of plate current and adjust L-6 for maximum plate current indication. Reduce CARRIER control to minimum. Reset BANDSWITCH to 80 meters, set VFO to 3.75 Mc and plate tuning and loading controls to maximum clockwise position. Insert enough carrier to get an indication on plate current meter and carefully peak up grid tuning control for maximum plate current. (If necessary, reduce carrier to limit plate current to 75 Ma to 80 Ma.)
- C. Set VFO dial to 3.5 Mc and readjust GRID TUNING for maximum plate current. If plate current peaks with the GRID TUNING control exactly at maximum (fully clockwise) adjust driver plate coil for 80 meter band clockwise a small amount at a time until plate current maximum occurs with GRID TUNING control set slightly before the maximum position.
- D. Set VFO dial at 4.0 Mc and retune the grid, noting that the GRID TUNING control should not quite reach minimum (counterclockwise). Set the VFO to 3.5 Mc and adjust the 80 meter mixer plate coil for maximum plate current. (Adjust with the GRID TUNING fully peaked.)
- E. Set the VFO dial to 4.0 Mc and adjust GRID TUNING for maximum. Note the plate current.
- F. Set the VFO dial to 3.5 Mc and set plate tuning and loading controls to maximum counterclockwise position. Peak up grid tuning.

NOTE: DO NOT READJUST CARRIER CONTROL.

Note plate current. If plate current is lower at 3.5 Mc than at 4.0 Mc, then turn 80 meter mixer plate coil in until the plate current increases to approximate mid-point between where it was at 4.0 Mc and at 3.5 Mc. (For example: If at 4.0 Mc, plate current was 80 Ma and at 3.5 Mc, plate current was 60 Ma, then set mixer plate coil so that plate current reads 70 Ma.)

- G. Set VFO dial to 4.0 Mc and note plate current reading. After setting plate tuning and loading controls in the maximum clockwise position and peaking the grid control. The plate current at 4.0 Mc and at 3.5 Mc should be the same. Repeat the above step if results are not the same, adjusting the mixer plate coil each time, until plate current at 3.5 and at 4.0 Mc is the same.
- H. Set the BANDSWITCH at 40 meters and set plate tuning and loading controls in the maximum clockwise position. Set VFO to 7.15 Mc and peak grid tuning for maximum plate current (control should be approximately at the middle of its range). If the control is not at its mid-range point, adjust the 40 meter driver plate coil a little at a time while readjusting the GRID TUNING control, until the GRID TUNING control peak occurs with the control set at approximately mid-range.
- I. Set VFO dial at 7.3 Mc and peak the GRID TUNING control and note plate current. Set VFO dial to 7.0 Mc. Repeat grid tuning and note plate current. If it is not the same as at 7.3, adjust 40 meter plate coil until plate current is the same at 7.0 and at 7.3 Mc.
- J. Set BANDSWITCH at 20 meter position, set VFO dial to 14.175 Mc and peak GRID TUNING control. (Control should be at approximately mid-range. If not, adjust 20 meter driver plate coil a little at a time until GRID TUNING peaks at mid-range.)
- K. Set VFO dial to 14.35 Mc. Peak GRID TUNING and note plate current. Set VFO dial to 14.0 Mc, peak GRID TUNING, and adjust 20 meter mixer plate coil if necessary so that plate current with VFO set at 14.0 and at 14.35 is the same.
- L. Set BANDSWITCH in 15 meter position and VFO dial to 21.225 Mc. Peak GRID TUNING control and adjust 15 meter driver plate coil if necessary until GRID TUNING control is approximately mid-range.
- M. Set VFO to 21.45 Mc and then to 21.0 Mc peaking GRID TUNING control each time and adjust 15 meter mixer plate coil until plate current is the same at both VFO settings.
- N. Set BANDSWITCH in the 11 meter position

and VFO dial to 27.23 Mc. Peak GRID TUNING and note plate current. Set VFO to 26.96 Mc and repeat GRID TUNING, noting plate current. Adjust 11 meter mixer plate coil until plate current is the same at both settings of the VFO.

NOTE: DO NOT ADJUST DRIVER PLATE COIL FOR 11, 10A, 10B OR 10C AT THIS TIME.

O. Set BANDSWITCH to 10A position. Set VFO dial at 28.5 Mc and peak up grid, noting plate current. Set VFO to 28.0 Mc, peak grid and adjust 10A mixer plate coil until plate current is the same at both settings of the VFO.

P. Set the BANDSWITCH to the 10B position and the VFO dial to 29.0 Mc. Peak the GRID TUNING and note the plate current. Set the VFO to 28.5 Mc and adjust 10B mixer plate coil if necessary until plate current reading is the same for both VFO settings.

Q. Set BANDSWITCH to 10C position and the VFO dial to 29.5 Mc. Peak the GRID TUNING and note that the control should fall almost at the minimum (counterclockwise) position. If it does not, adjust 11, 10A, 10B, and 10C driver plate coils until GRID TUNING peaks near the minimum. Run CARRIER INSERTION up and down to assure that GRID TUNING is tuned to the operating frequency and not to the band 10C overtone crystal frequency, which is approximately 5.5 Mc higher.

R. If plate current decreases to the normal idling current with the carrier at minimum, then the GRID TUNING control is tuned to the correct point. (This adjustment sets the GRID TUNING control for the 11 and all 10 meter bands.)

S. Peak the GRID TUNING with the VFO set at 29.5 and set plate current to approximately 75 Ma. Set the VFO to 29.0 Mc and adjust the 10C mixer plate coil until plate current is the same at both settings of the VFO.

T. This completes the alignment of the signal path. Set BANDSWITCH back to 80 meters and set CARRIER control to minimum position. Adjust the intensity potentiometer on the oscilloscope chassis until a spot can just be seen on the face of the oscilloscope. Back off the control until this spot is just extinguished.

Insert just enough carrier to make the spot visible. Adjust coil slug L-1 on the exciter chassis (to rear of the unit) for maximum brightness of the spot. When the CARRIER control is again set to the minimum position, the spot should not be visible. This completes the alignment of the SSB-100F. Refer to Section on SERVICE ADJUSTMENTS to check carrier balance, sideband carrier frequency zero, final amplifier idling current and other service adjustments.

SECTION VII

SPECIAL ALIGNMENT INSTRUCTIONS

1. CHANGING BAND COVERAGE

These instructions are provided in the event that it is desired to change the band coverages of the SSB-100F transmitter.

A. On each band, the output frequency is determined by the frequency of one of the eight crystals at the rear of the power amplifier chassis. The crystal sockets are marked on the chassis according to the band on which the crystal is used. Raising any of the crystal frequencies by a given amount will raise the corresponding band frequency by the same amount. As an example, consider the 80 meter band. The crystal frequency for the normal band range of 3.5 to 4.0 Mc is 9.500 Mc. Raising the crystal frequency by 25 Kc to 9.525 Mc will displace the entire band upward by 25 Kc so that the range covered will be 3.525 Mc to 4.025 Mc. If the crystal frequency is raised by 50 Kc to 9.550 Mc, the entire band will be moved upward by 50 Kc so that the range covered will be 3.550 Mc to 4.050 Mc.

B. This relationship between the crystal frequency and the band coverage holds true for all bands. It is not advisable to exceed the following limits with respect to frequency changes on the various bands:

Band	Maximum Frequency Change
80 meters	50 Kc
40 meters	50 Kc
20 meters	100 Kc
15 meters	100 Kc
11 meters	200 Kc
10A, 10B, 10C meters	200 Kc

C. The following list indicates the crystal specifications for use on the various bands. ELDICO does not supply the crystals and we recommend that crystals be obtained from the Reeves-Hoffman Corp., 145 Cherry Street, Carlisle, Pennsylvania.

When ordering crystals, specify the exact frequency desired and the appropriate

specification from the following table:

Band	Crystal Unit
80 and 40 meter	Type CR-18/U with .093 diameter pins
All other bands	Type CR-23/U with .093 diameter pins

D. It should be noted that the CR-23/U crystals as used on the 20 through 10 meter bands are overtone types and should be adjusted when installed according to the crystal oscillator alignment procedures in Section VI. The CR-18/U crystals as used on 80 and 40 meters are fundamental frequency type crystals and no adjustment is required.

E. When it is desired to change the band coverage of the unit, as outlined above, it will be necessary to realign the SSB-100F on those bands which are being changed. The step-by-step procedure for alignment of the power supply/final amplifier chassis outlined in Section VI should be followed for the particular band being changed.

NOTE: READJUSTMENT OF COIL L-6 IS NOT NECESSARY.

F. When band coverage has been changed, it is always extremely important to check the calibration of the new band coverage as any inaccuracies in the new crystal frequency will show up in the output frequency range. It should be noted that the VFO calibration is not changed when band coverage is changed. The band coverage still remains 500 Kc and the dial calibration will be accurate provided that the difference in frequency is taken into account. (See example on 80 meter band.)

G. If it is desired to change the band coverages by amounts greater than the maximum limits set by the chart above, the customer is requested to contact the factory for additional information.

Parts List

Exciter Section

All locations of parts in the Exciter Section are referred to Figure 14b unless otherwise noted. Voltage rating on all condensers 500 VDC unless otherwise noted.

PART NUMBER	DESCRIPTION	LOCATION
C-1	1 mf, 500 volt, oil condenser	C4 and Fig. 14a
C-2	330 mmf, ceramic disc condenser	B10
C-3	.01 mf, ceramic disc condenser	B10
C-4	.01 mf, ceramic disc condenser	C10
C-5	.01 mf, ceramic disc condenser	C10
C-6	.001 mf, ceramic disc condenser	E9
C-7	.005 mf, ceramic disc condenser	D10
C-8	.025 mf, ceramic disc condenser	D9
C-9	.001 mf, ceramic disc condenser	E9
C-10	.025 mf, ceramic disc condenser	E8 and Fig. 15c
C-11	10 mmf, NPO, ceramic tubular condenser	D3
C-12	200 mmf, NPO, Dur-Mica condenser	E3
C-13	.025 mf, ceramic disc condenser	D3
C-14	10 mmf, NPO, ceramic tubular condenser	C3
C-15	5-20 mmf, air variable condenser	B3
C-16	84 mmf, NPO, Dur-Mica condenser	Fig. 14a
C-17	84 mmf, NPO, Dur-Mica condenser	Fig. 14a
C-18	.01 mf, ceramic disc condenser	D2
C-19	.01 mf, ceramic disc condenser	D2
C-20	.01 mf, ceramic disc condenser	E1
C-21	50 mmf, ceramic tubular condenser	D1
C-22	.01 mf, ceramic disc condenser	D1
C-23	100 mmf, ceramic tubular condenser	D1
C-24	100 mmf, ceramic tubular condenser	C1
C-25	.025 mf, ceramic disc condenser	C2
C-26	.01 mf, ceramic disc condenser	C6
C-27	.01 mf, ceramic disc condenser	B5
C-28	.25 mf, molded paper condenser	E6 and Fig. 15c
C-29	.25 mf, molded paper condenser	E7 and Fig. 15c
C-30	.25 mf, molded paper condenser	E7 and Fig. 15c
C-31	15 mmf, NPO, ceramic tubular condenser	D10
C-32	39 mmf, NPO, Dur-Mica condenser	D10
C-33	.005 mf, ceramic disc condenser	D10
C-34	.025 mf, ceramic disc condenser	E10
C-35	Not used	
C-36	.005 mf, ceramic disc condenser	D4
C-37	.005 mf, ceramic disc condenser	C1
C-38	.005 mf, ceramic disc condenser	C10
C-39	.005 mf, ceramic disc condenser	D9
C-40	.005 mf, ceramic disc condenser	E4

PART NUMBER	DESCRIPTION	LOCATION
C-41	.005 mf, ceramic disc condenser	D2
C-42	.005 mf, ceramic disc condenser	B5
C-43	.005 mf, ceramic disc condenser	C7
C-44	.005 mf, ceramic disc condenser	C7
C-45	.005 mf, ceramic disc condenser	D10
C-46	.005 mf, ceramic disc condenser	C1
C-47	.005 mf, ceramic disc condenser	Fig: 14a
C-48	Not used	
C-49	Not used	
R-1	47K ohm, 1/2 watt, carbon resistor	C9
R-2	1 Meg ohm, 1/2 watt, carbon resistor	B10
R-3	220K ohm, 1/2 watt, carbon resistor	C9
R-4	680 ohm, 1/2 watt, carbon resistor	C9
R-5	1 Meg ohm, 1/2 watt, carbon resistor	C10
R-6	47K ohm, 1/2 watt, carbon resistor	C10
R-7	680 ohm, 1/2 watt, carbon resistor	C10
R-8	1 Meg ohm, carbon potentiometer, logtaper	C11
R-9	1K ohm, 1/2 watt, carbon resistor	C9
R-10	120K ohm, 1/2 watt, carbon resistor	C9
R-11	270 ohm, 1/2 watt, carbon resistor	C9
R-12	2.2K ohm, 1/2 watt, carbon resistor	D9
R-13	500 ohm, carbon potentiometer, lineartaper	C8
R-14	120K ohm, 1/2 watt, carbon resistor	D9
R-15	270 ohm, 1/2 watt, carbon resistor	D9
R-16	100K ohm, 1/2 watt, carbon resistor	D4
R-17	220K ohm, 1/2 watt, carbon resistor	D4
R-18	47K ohm, 1/2 watt, carbon resistor	D3
R-19	4.7K ohm, 1 watt, carbon resistor	E5 and Fig. 15c
R-20	120K ohm, 1/2 watt, carbon resistor	D3
R-21	2.2K ohm, 1/2 watt, carbon resistor	D2
R-22	470 ohm, 1/2 watt, carbon resistor	D2
R-23	56K ohm, 1/2 watt, carbon resistor	D2
R-24	4.7K ohm, 1/2 watt, carbon resistor	D2
R-25	10K ohm, 1/2 watt, carbon resistor	C2
R-26	1 Meg ohm, 1/2 watt, carbon resistor	C2
R-27	470K ohm, 1/2 watt, carbon resistor	C6
R-28	100K ohm, 1/2 watt, carbon resistor	C6
R-29	1K ohm, 1/2 watt, carbon resistor	C6
R-30	1K ohm, 1/2 watt, carbon resistor	C5
R-31	120K ohm, 1/2 watt, carbon resistor	C5
R-32	2.2 Meg ohm, 1/2 watt, carbon resistor	E7 and Fig. 15c
R-33	56K ohm, 1/2 watt, carbon resistor	C6
R-34	56K ohm, 1/2 watt, carbon resistor	E7 and Fig. 15c
R-35	4.7 Meg ohm, 1/2 watt, carbon resistor	E6 and Fig. 15c
R-36	4.7 Meg ohm, 1/2 watt, carbon resistor	E7 and Fig. 15c

PART NUMBER	DESCRIPTION	LOCATION
R-37	330K ohm, 1/2 watt, carbon resistor	E7 and Fig. 15c
R-38	56K ohm, 1 watt, carbon resistor	C6
R-39	5K ohm, wire wound potentiometer	D6
R-40	1K ohm, 1 watt, carbon resistor	C7
R-41	2.2 Meg ohm, 1/2 watt, carbon resistor	E8 and Fig. 15c
R-42	3.3K ohm, 1/2 watt, carbon resistor	E6 and Fig. 15c
R-43	47K ohm, 2 watt, carbon resistor	E6 and Fig. 15c
R-44	15K ohm, 1 watt, carbon resistor	E8 and Fig. 15c
R-45	270K ohm, 1 watt, carbon resistor	E8 and Fig. 15c
R-46	100K ohm, 1/2 watt, carbon resistor	D10
R-47	470K ohm, 1/2 watt, carbon resistor	D10
R-48	1K ohm, 1/2 watt, carbon resistor	D10
R-49	150K ohm, 1/2 watt, carbon resistor	D10
R-50	2.2K ohm, 1/2 watt, carbon resistor	D10
R-51	1K ohm, carbon potentiometer, linear taper	Fig. 14a
R-52	47 ohm, 1/2 watt, carbon resistor	D10
R-53	1K ohm, 1/2 watt, carbon resistor	E8 and Fig. 15c
R-54 to R-60	Not Used	
L-1	Coil, RF, slug tuned	D1
IF Trans-1	4.7 Mc, IF transformer	Fig. 14a
RFC-1	RF choke, 3 mh, screw mount	E9 and Fig. 15c
RFC-11	RF choke, 3 mh, lead mount	E3
V-1	Tube, 12AT7	Fig. 14a
V-2	Tube, 12AT7	Fig. 14a
V-3	Tube, 6BA7	Fig. 14a
V-4	Tube, 12AT7	Fig. 14a
V-5	Tube, 12AT7	Fig. 14a
V-6	Tube, 6AL5	Fig. 14a
V-7	Tube, 12AT7	Fig. 14a
V-8	Tube, 12AT7	Fig. 14a
V-9	Tube, 6AL5	Fig. 14a
M-1	Meter, 0-200 ma.	Front Panel
J-1	Jack, microphone input	C11
J-2	Jack, phone patch input	C1
J-3	Jack, test input	C9
J-4	Jack, exciter output	C1
SO-1	Receptacle, control and power	A9
SW-1	Switch, sideband selection	D4

PART NUMBER	DESCRIPTION	LOCATION
	Crystal, 413.0 Kc, carrier	Fig. 14a
	Crystal, 4287.00 Mc, USB conversion	Fig. 14a
	Crystal, 5113.00 Mc, LSB conversion	Fig. 14a
	Crystal, 410.0 Kc, filter	Fig. 14a
	Crystal, 410.0 Kc, filter	Fig. 14a
	Crystal, 412.5 Kc, filter	Fig. 14a
	Crystal, 412.5 Kc, filter	Fig. 14a
	Crystal, 413.4 Kc, shunt	Fig. 14a
	Crystal, 413.8 Kc, shunt	Fig. 14a
XF-1	Filter Unit The XF-1 filter unit components are listed below and all references to location are to Figure 15b unless otherwise noted.	Fig. 15a, b
C-1a	500 mmf, NPO, Dur-Mica condenser	Part of T-1a
C-2a	500 mmf, NPO, Dur-Mica condenser	Part of T-1a
C-3a	500 mmf, NPO, Dur-Mica condenser	Part of T-1a
C-4a	500 mmf, NPO, Dur-Mica condenser	Part of T-1a
C-5a	.5 to 5.0 mmf, tubular, trimmer condenser	
C-6a	1.0 mmf, NPO, tubular, ceramic condenser	
C-7a	50 mmf, NPO, tubular, ceramic condenser	
C-8a	.5 to 5.0 mmf, tubular, trimmer condenser	
C-9a	500 mmf, NPO, Dur-Mica condenser	Part of T-2a
C-10a	500 mmf, NPO, Dur-Mica condenser	Part of T-2a
C-11a	250 mmf, NPO, Dur-Mica condenser	Part of T-2a
C-12a	1.0 mmf, NPO, tubular, ceramic condenser	
L-1a	IF coil, filter coupling	
T-1a	Filter input IF transformer	
T-2a	Filter output IF transformer	

V.F.O. Section

All locations of parts in the VFO Section are referred to Figure 13 unless otherwise noted.
Voltage rating on all condensers 500 VDC unless otherwise noted.

PART NUMBER	DESCRIPTION	LOCATION
C-50	N.P.O. condenser, value selected during calibration	C9
C-51	25 mmf N750 ceramicon condenser	B9
C-52	5-20 mmf variable air condenser	B8
C-53	500 mmf, NPO Durmica condenser	C9
C-54	.0011 mf, silver mica condenser	D10
C-55	.0011 mf, silver mica condenser	C10
C-56	.025 mf, ceramic disc condenser	F10
C-57	.001 mf, ceramic disc condenser	F8
C-58	.01 mf, ceramic disc condenser	E9
C-59	.001 mf, ceramic disc condenser	F5
C-60	.005 mf, ceramic disc condenser	C4
C-61	.001 mf, ceramic disc condenser	E3
C-62	5-30 mmf, ceramic trimmer condenser	D3
C-63	200 mmf, NPO Durmica condenser	D3
C-64	.025 mf, ceramic disc condenser	D4
C-65	50 mmf, variable air condenser	C2
C-66	50 mmf, variable air condenser	E2
C-67	200 mmf, NPO Durmica condenser	E3
C-68	5-30 mmf, ceramic trimmer condenser	E3
C-69	.01 mf, ceramic disc condenser	G3
C-70	.001 mf, ceramic disc condenser	G3
C-71	.01 mf, ceramic disc condenser	G4
C-72	.01 mf, ceramic disc condenser	D8
C-73	.01 mf, ceramic disc condenser	E5
C-74	.01 mf, ceramic disc condenser	F4
C-75	.005 mf, ceramic disc condenser	F5
C-76	.005 mf, ceramic disc condenser	C4
C-77	.01 mf, ceramic disc condenser	F10
C-148	.01 mf, ceramic disc condenser	F10
C-149	.01 mf, ceramic disc condenser	F9
C-150	.025 mf, ceramic disc condenser	C6
C-151	100 mmf, N750, Tubular ceramic condenser	E5
C-152	.01 mf, ceramic disc condenser	E10
C-153	.025 mf, ceramic disc condenser	E10
R-61	220K ohm, 1/2 watt, carbon resistor	D9
R-62	270 ohm, 1 watt, carbon resistor	C10
R-63	120K ohm, 1/2 watt, carbon resistor	D5
R-64	100 ohm, 1/2 watt, carbon resistor	D4
R-65	100 ohm, 1/2 watt, carbon resistor	D4
R-66	390 ohm, 1/2 watt, carbon resistor	E4

PART NUMBER	DESCRIPTION	LOCATION
R-67	120K ohm, 1/2 watt, carbon resistor	C4
R-68	10K ohm, 1/2 watt, carbon resistor	B5
R-69	100 ohm, 1/2 watt, carbon resistor	F4
R-70	150 ohm, 1/2 watt, carbon resistor	F5
R-71	1.2K ohm, 2 watt, carbon resistor	E10
RFC-2	3 mh, RF choke	D10
RFC-3	3 mh, RF choke	F9
RFC-4	3 mh, RF choke	G4
RFC-12	3 mh, RF choke	F10
RFC-13	Special filament choke	E10
L-2	Linear VFO coil, special	E6
L-3	VFO trimming coil	D8
L-4	Variable IF input coil	D3
L-5	Variable IF output coil	E3
J-5	Signal input jack	F3
J-6	Signal output jack	F2
PL-2	Power plug, 4 prong	Not Shown
I-1	#44 pilot lamp	Figure 12
I-2	#44 pilot lamp	Figure 12
V-10	Tube, 6AK6	Figure 12
V-11	Tube, 12AT7	Figure 12
V-12	Tube, 6AU6	Figure 12
LPF	Low pass filter, 1300 Kc cutoff	Figure 12

Power Supply Section

All locations of parts in the Power Supply Section are referred to Figure 11 unless otherwise noted. Voltage rating on all condensers 500 VDC unless otherwise noted.

PART NUMBER	DESCRIPTION	LOCATION
C-78	100 mmf, tubular ceramic condenser	D9
C-79	5-30 mmf, ceramic trimmer condenser	C7
C-80	33 mmf, NPO tubular ceramic condenser	E6
C-81	39 mmf, NPO tubular ceramic condenser	D6
C-82	100 mmf, tubular ceramic condenser	E4
C-83	.001 mf, ceramic disc condenser	C4
C-84	.005 mf, ceramic disc condenser	E3
C-85	.005 mf, ceramic disc condenser	C7
C-86	200 mmf, Durmica condenser	D6
C-87	Not used	
C-88	Not used	
C-89	100 mmf, tubular ceramic condenser	E6
C-90	.005 mf, ceramic disc condenser	F7
C-91	.001 mf, ceramic disc condenser	D8
C-92	.001 mf, ceramic feedthru condenser	D7
C-93	84 mmf, Durmica condenser	A10
C-94	100 mmf, Durmica condenser	A9
C-95	50 mmf, NPO tubular ceramic condenser	B9
C-96	33 mmf, NPO tubular ceramic condenser	B10
C-97	.01 mf, ceramic disc condenser	F9
C-98	50 mmf, NPO tubular ceramic condenser	A10
C-99	25 mmf, NPO tubular ceramic condenser	A10
C-100	18 mmf, NPO tubular ceramic condenser	B10
C-101	33 mmf, NPO tubular ceramic condenser	C10
C-102	100 mmf, APC variable condenser	D13
C-103	15 mmf, NPO tubular ceramic condenser	D13
C-104	3 mmf, NPO tubular ceramic condenser	Figure 10
C-105	5-30 mmf, ceramic trimmer condenser	D12
C-106	.025 mf, ceramic disc condenser	C8
C-107	.01 mf, ceramic disc condenser	C10
C-108	.01 mf, ceramic disc condenser	D12
C-109	.005 mf, ceramic disc condenser	F12
C-110	.003 mf, 2Kv, ceramic disc condenser	F13
C-111	500 mmf, 12.5 Kv, molded ceramic condenser	Figure 10
C-112	200 mmf, variable air condenser	Figure 10
C-113	1.0 mmf, NPO tubular ceramic condenser	Figure 10
C-114	100 mmf (2X50), NPO large ceramic button condenser	Figure 10
C-115	.025 mf, ceramic disc condenser	F9
C-116	3x450 mmf, variable air condenser	Figure 10
C-117	1 mf, 500V, oil condenser	Figure 16-A4

PART NUMBER	DESCRIPTION	LOCATION
C-118	.01 mf, ceramic disc condenser	Figure 16-F5
C-119	50 mf, 50V, electrolytic bathtub	Figure 16-C2
C-120	.01 mf, ceramic disc condenser	Figure 16-D7
C-121	.025 mf, ceramic disc condenser	Figure 16-D5
C-122	.003 mf, 2 Kv, ceramic disc condenser	Figure 16-A3
C-123	.025 mf, ceramic disc condenser	Figure 16-C6
C-124	Special ceramic coupling condenser	Figure 16-A7
C-125	.01 mf, ceramic disc condenser	Figure 16-C7
C-126	.005 mf, ceramic disc condenser	Figure 16-E7
C-127	.005 mf, ceramic disc condenser	Figure 16-B5
C-128	.003 mf, 2Kv, ceramic disc condenser	L2
C-129	.003 mf, 2Kv, ceramic disc condenser	L3
C-130	16 mf, 450V, tubular electrolytic condenser	J12
C-131	10 mf, 1000V, oil condenser	Figure 10
C-132, 133	2x40 mfd, 450V, electrolytic condenser	Figure 10
C-134	.005 mf, ceramic disc condenser	E5
C-135	.005 mf, ceramic disc condenser	E4
C-136	.005 mf, ceramic disc condenser	E8
C-137	.005 mf, ceramic disc condenser	D10
C-138	15 mf, 150V, electrolytic bathtub condenser	O10
C-139	.5 mf, 100V, tubular paper condenser	O8
C-140	.005 mf, ceramic disc condenser	D17
C-141	16 mf, 450V, tubular electrolytic condenser	H12
C-142	.025 mf, ceramic disc condenser	E13
C-143	.025 mf, ceramic disc condenser	F12
C-144	.025 mf, ceramic disc condenser	F13
C-145	.005 mf, ceramic disc condenser	D4
C-146	39 mmf, Durmica condenser	C8
C-147	200 mmf, Durmica condenser	C10
C-152	50 mmf, NPO tubular ceramic condenser	C7
C-153	.025 mf, ceramic disc condenser	E12
R-75	5.6K ohm, 1/2 watt, carbon resistor	E6
R-76	390 ohm, 1/2 watt, carbon resistor	F7
R-77	120K ohm, 1/2 watt, carbon resistor	E3
R-78	22K ohm, 1/2 watt, carbon resistor	E4
R-79	270 ohm, 1/2 watt, carbon resistor	E4
R-80	Not used	
R-81	680 ohm, 1/2 watt, carbon resistor	D7
R-82	10K ohm, 1/2 watt, carbon resistor	F7
R-83	100K ohm, 1/2 watt, carbon resistor	F7
R-84	1K ohm, 1/2 watt, carbon resistor	D7
R-85	1K ohm, 1/2 watt, carbon resistor	E9
R-86	15K ohm, 1/2 watt, carbon resistor	C10
R-87	47 ohm, 1/2 watt, carbon resistor	F11

PART NUMBER	DESCRIPTION	LOCATION
R-88	470K ohm, 1/2 watt, carbon resistor	Figure 16-D6
R-89	150K ohm, 1/2 watt, carbon resistor	Figure 16-E6
R-90	470K ohm, 1/2 watt, carbon resistor	Figure 16-F6
R-91	120 ohm, 1/2 watt, carbon resistor	Figure 16-D4
R-92	1K ohm, 1/2 watt, carbon resistor	Figure 16-C3
R-93	820K ohm, 1 watt, carbon resistor	Figure 16-D5
R-94	2.2 Meg ohm, 1/2 watt, carbon resistor	Figure 16-B3
R-95	2.2 Meg ohm, 1/2 watt, carbon resistor	Figure 16-B4
R-96	2.2 Meg ohm, 1/2 watt, carbon resistor	Figure 16-C5
R-97	1 Meg ohm, 1/2 watt, carbon resistor	Figure 16-A3
R-98	2K ohm, 5 watt, wire wound resistor	J14
R-99	470K ohm, 5 watt, carbon resistor	L3
R-100	25K ohm, 50 watt, wire wound resistor	Figure 10
R-101	33K ohm, 25 watt, wire wound resistor	J4
R-102	1 Meg ohm potentiometer, linear taper	J18
R-103	2.2 Meg ohm, 1/2 watt, carbon resistor	C11
R-104	10K ohm, wirewound potentiometer	E2
R-105	470K ohm, 1/2 watt, carbon resistor	O7
R-106	56K ohm, 1 watt, carbon resistor	O7
R-107	82K ohm, 1/2 watt, carbon resistor	O7
R-108	47K ohm, 1/2 watt, carbon resistor	O8
R-109	10K ohm, 2 watt, carbon resistor	F10
R-110	1.2K ohm, 2 watt, carbon resistor	J14
R-111	1 Meg ohm potentiometer, linear taper	L18
R-112	3K ohm, 25 watt, wire wound resistor	J2
R-113	2K ohm, 5 watt, wire wound resistor	G3
R-114	100K ohm potentiometer, linear taper	Figure 16-E4
R-115	680 ohm, 1/2 watt, carbon resistor	F6
R-116	82K ohm, 1 watt, carbon resistor	E8
R-117	33K ohm, 1/2 watt, carbon resistor	F6
R-118	18K ohm, 1 watt, carbon resistor	D8
R-119	6.8K ohm, 1/2 watt, carbon resistor	A6
R-120	15K ohm, 1/2 watt, carbon resistor	A6
R-121	6.8K ohm, 1/2 watt, carbon resistor	A7
R-122	10K ohm, 1/2 watt, carbon resistor	B6
R-123	2.2K ohm, 1/2 watt, carbon resistor	F7
R-124	56K ohm, 1/2 watt, carbon resistor	Figure 16-F6
R-125	10K ohm, 1/2 watt, carbon resistor	D9
	Crystal, 9.500 Mc, 80 meter	Figure 10
	Crystal, 13.000 Mc, 40 meter	Figure 10--
	Crystal, 20.000 Mc, 20 meter	Figure 10
	Crystal, 27.000 Mc, 15 meter	Figure 10
	Crystal, 32.900 Mc, 11 meter	Figure 10--
	Crystal, 34.000 Mc, 10A meter	Figure 10--

PART NUMBER	DESCRIPTION	LOCATION
	Crystal, 34.500 Mc, 10B meter	Figure 10
	Crystal, 35.000 Mc, 10C meter	Figure 10
L-6	Band Change Mixer Input Coil	F6
L-7	20 meter crystal oscillator coil	A4
L-8	15 meter crystal oscillator coil	A3
L-9	11 meter crystal oscillator coil	B4
L-10	10A meter crystal oscillator coil	B3
L-11	10B meter crystal oscillator coil	C4
L-12	10C meter crystal oscillator coil	C3
L-13	80 meter mixer plate coil	A7
L-14	40 meter mixer plate coil	A7
L-15	20 meter mixer plate coil	A6
L-16	15 meter mixer plate coil	B6
L-17	11 meter mixer plate coil	B6
L-18	10A meter mixer plate coil	B7
L-19	10B meter mixer plate coil	C6
L-20	10C meter mixer plate coil	C6
L-21	80 meter driver plate coil	A9
L-22	40 meter driver plate coil	A10
L-23	20 meter driver plate coil	B9
L-24	15 meter driver plate coil	B10
L-25	11, 10A, 10B, 10C meter driver plate coil	C9
L-26	Final amplifier plate tank coil	Figure 10
F-1	Fuse, 5 amp.	M2
RFC-5	3 mh RF choke, ceramic base	F4
RFC-6	3 mh RF choke, ceramic base	D6
RFC-7	3 mh RF choke, ceramic base	E9
RFC-8	3 mh RF choke, with pigtail leads	C11
RFC-9	Medium power RF choke	Figure 10
RFC-10	3 mh RF choke, with pigtail leads	Figure 10
RFC-12	3 mh RF choke, with pigtail leads	E6
V-13	Tube 12AT7	
V-14	Tube 12AT7	
V-15	Tube 12BY7A	
V-16	Tube 5894	
V-17	Tube OA2	
V-18	Tube OB2	
V-19	Tube 6AU6	
V-20	Tube 1CP1	
V-21	Tube 5R4	
V-22	Tube 5U4	

PART NUMBER	DESCRIPTION	LOCATION
J-7	Power supply chassis signal input jack	F7
J-8	Coax output jack	B2
J-9	Key jack	C17
CH-1	Choke, swinging, EC315	Figure 9
CH-2	Choke, smoothing, EC329	Figure 9
T-1	Transformer, power, ET318	Figure 10
T-2	Transformer, audio, ET328A	H16
RLY-1	Relay, 10000 ohm, 4PDT	K16
SW-2	Switch, multiple section, Band change	Figure 9
SW-3	Switch, power, DPST toggle	K17
SW-4	Switch, control, special	Figure 9
SW-5	Switch, function, special	Figure 9
SP-1	Rectifier, selenium, 65 Ma	Figure 9
SP-2	Rectifier, selenium, 65 Ma	Figure 9

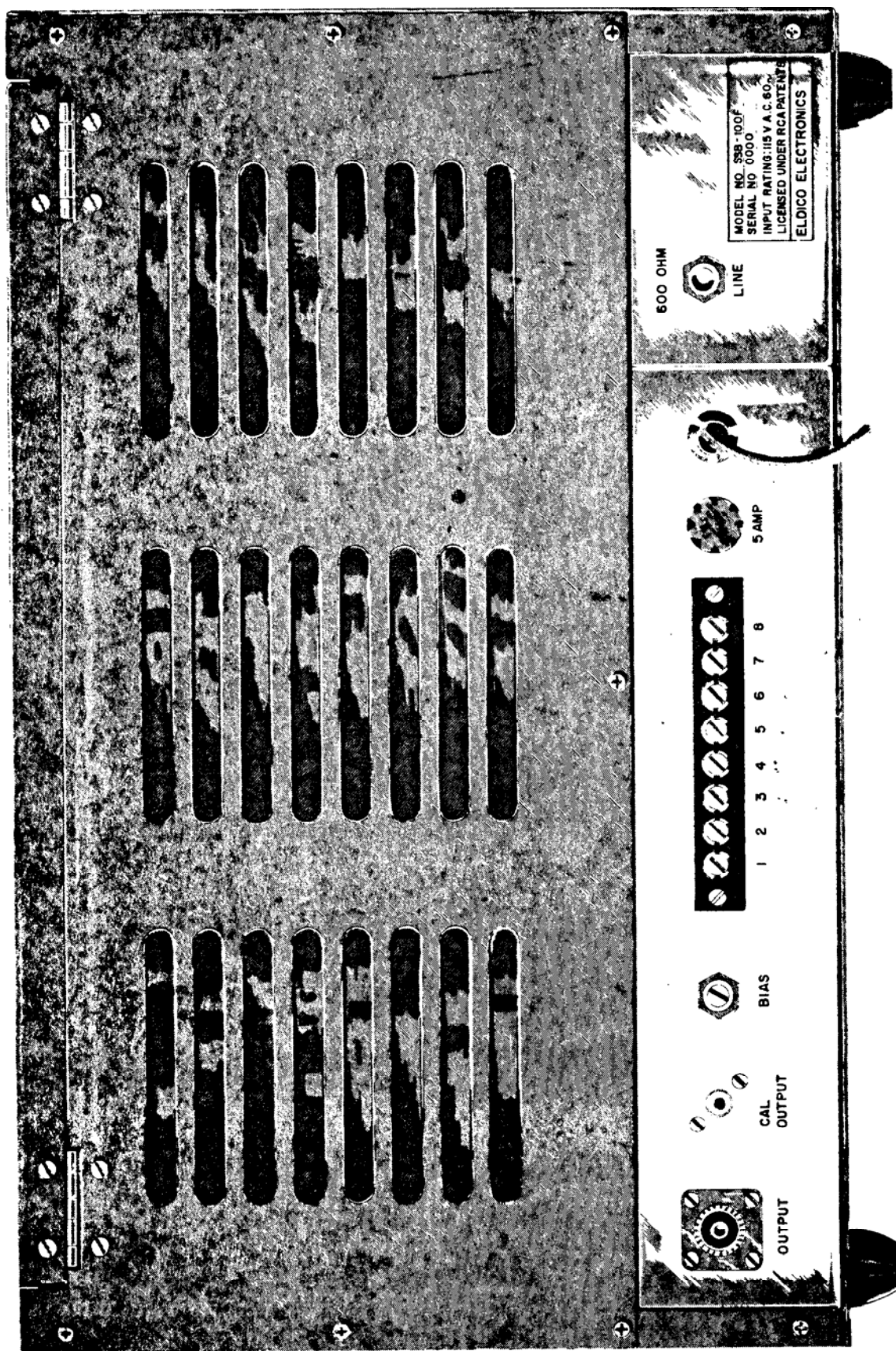


FIGURE 7 SSB-100F, BACK VIEW

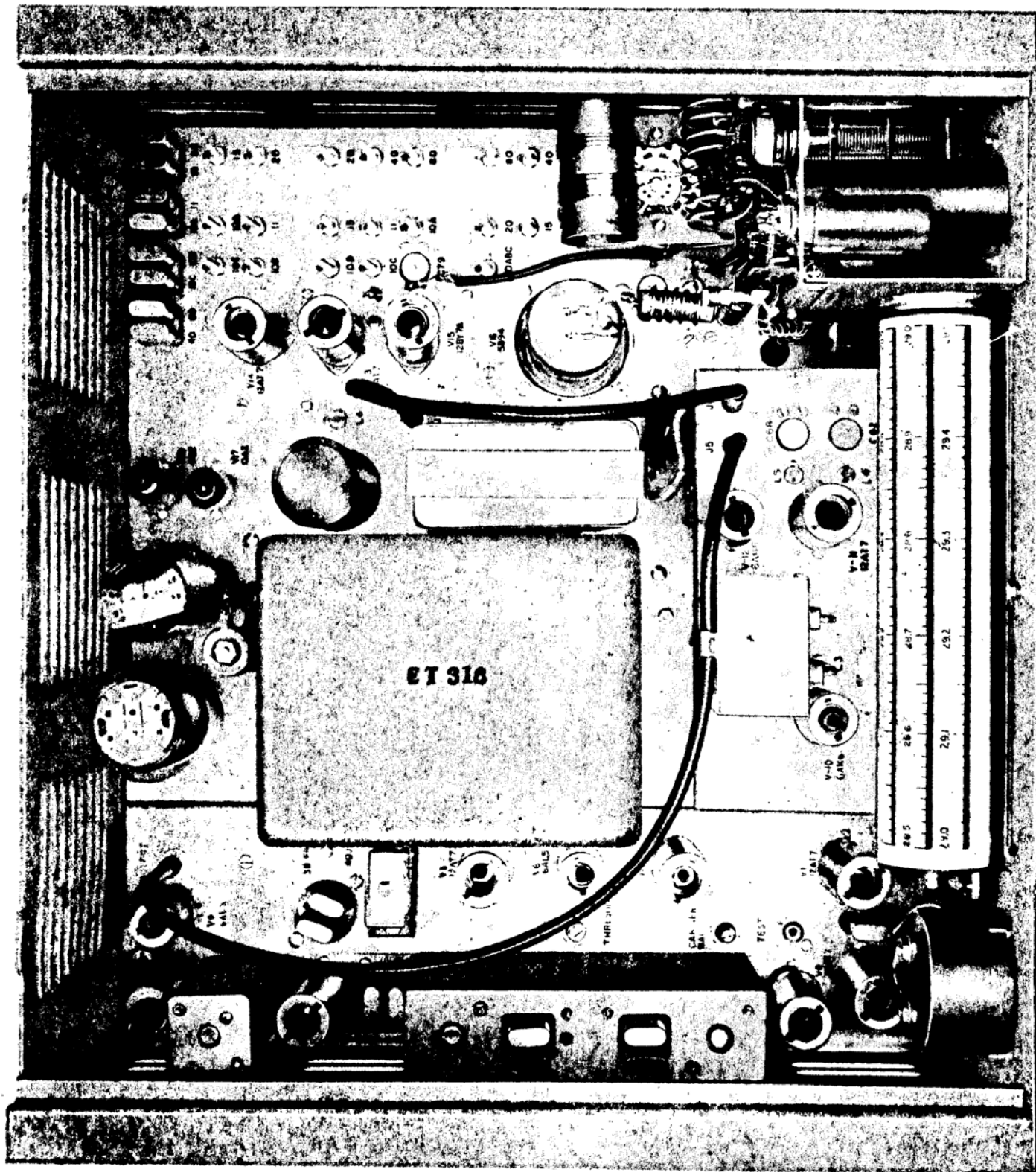


FIGURE 8, SSB-100F TOP VIEW

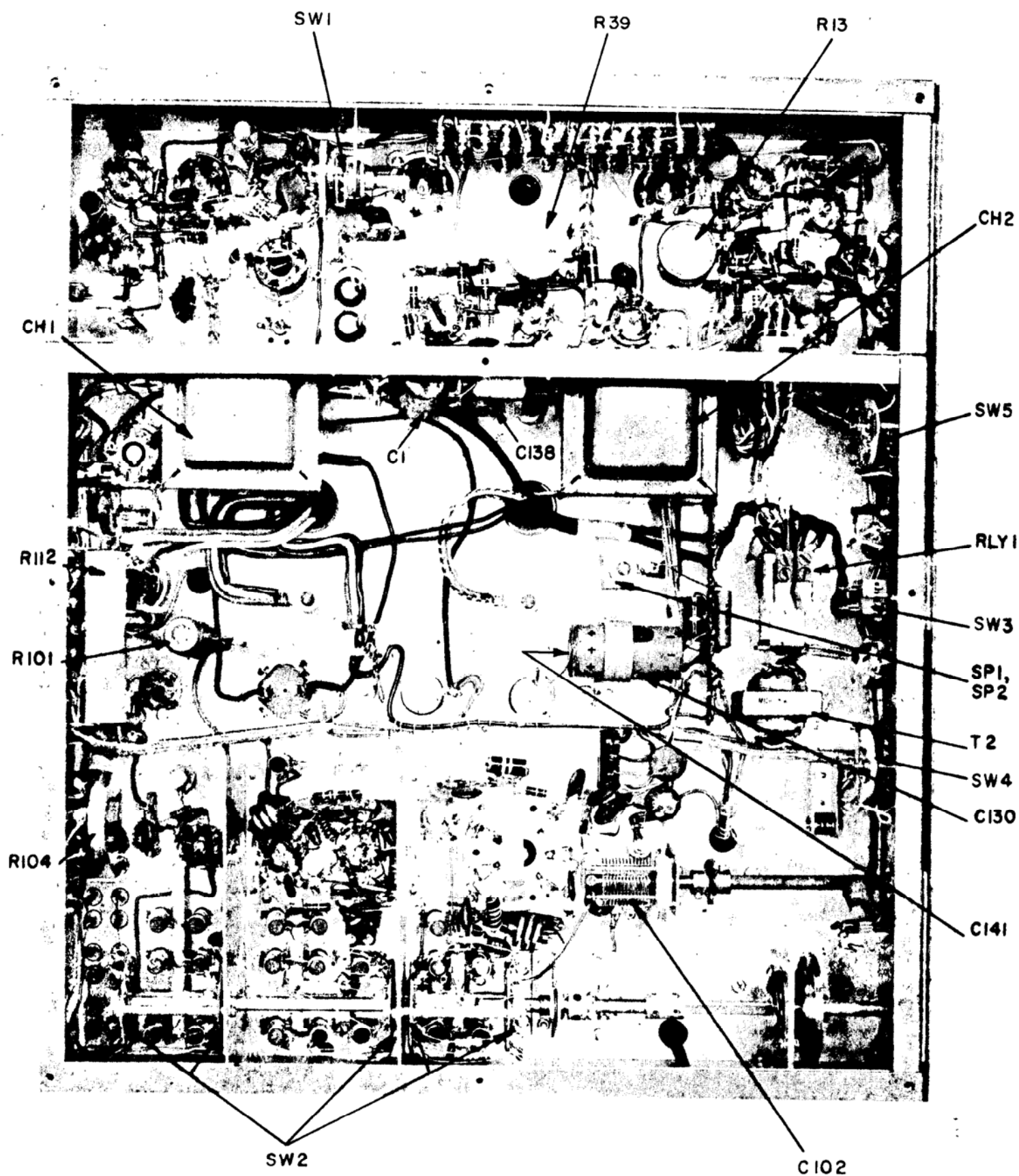


FIGURE 9 SSB-100F, BOTTOM VIEW

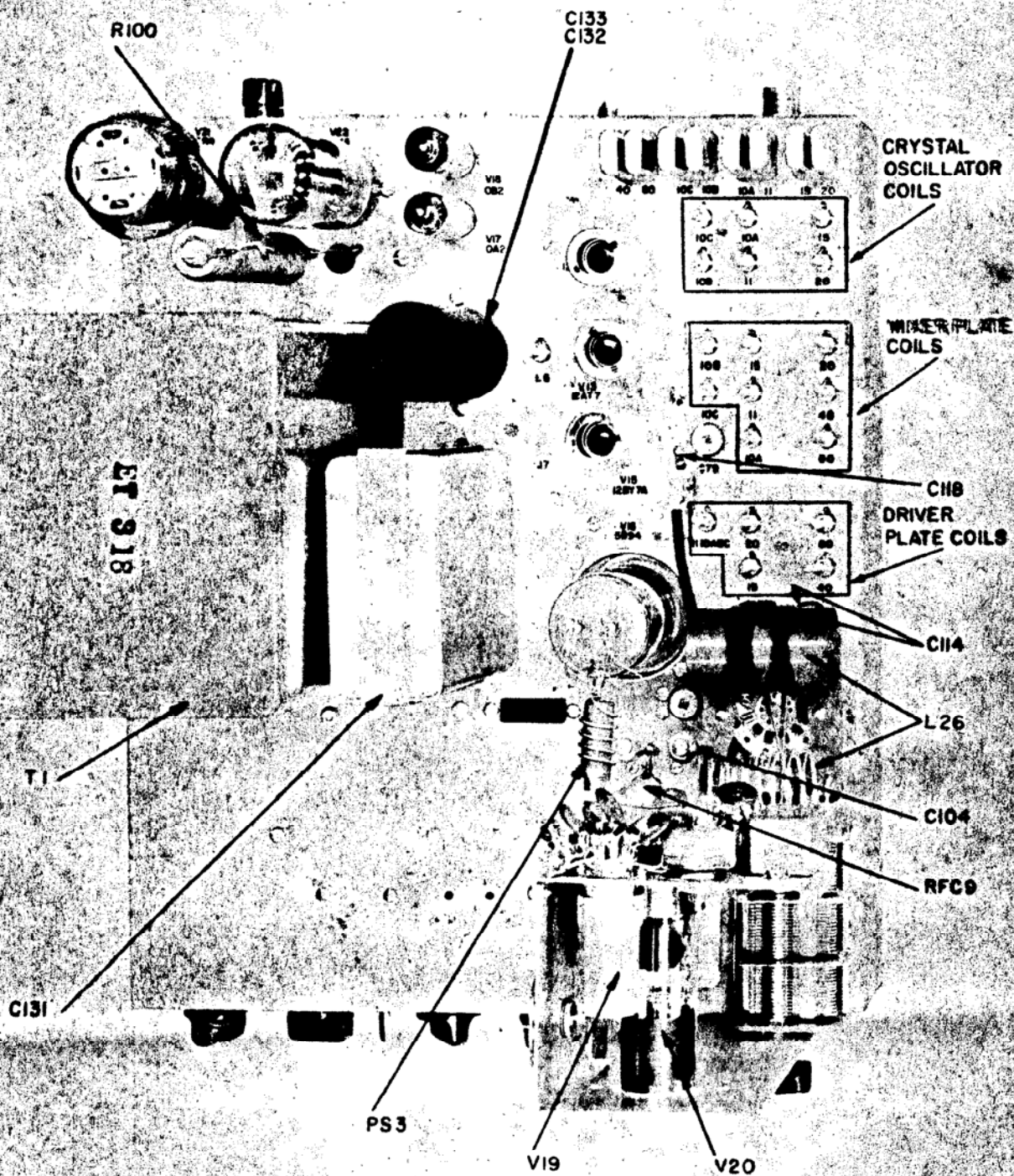


FIGURE 10 POWER SUPPLY, TOP VIEW

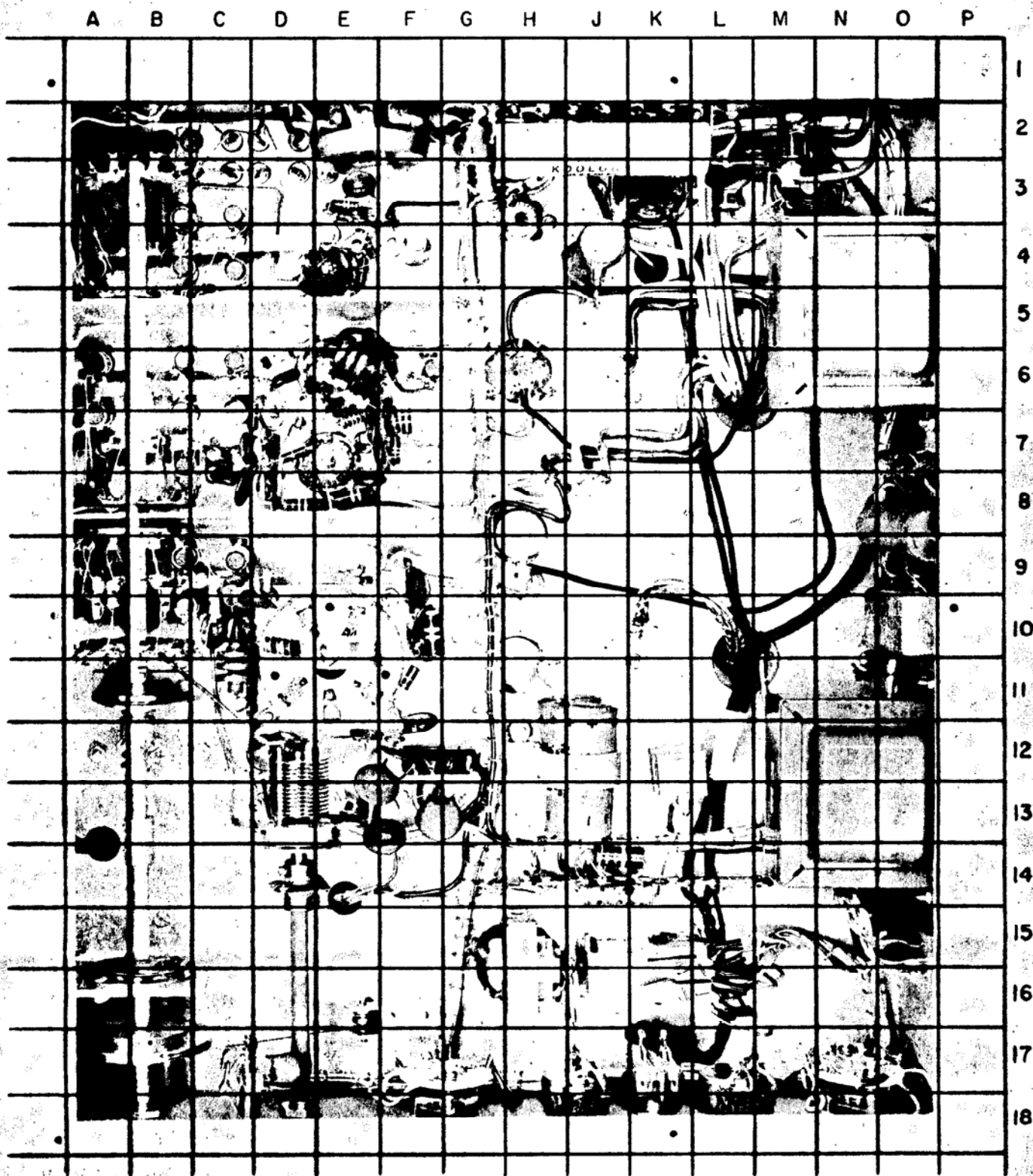


FIGURE 11 POWER SUPPLY, BOTTOM VIEW

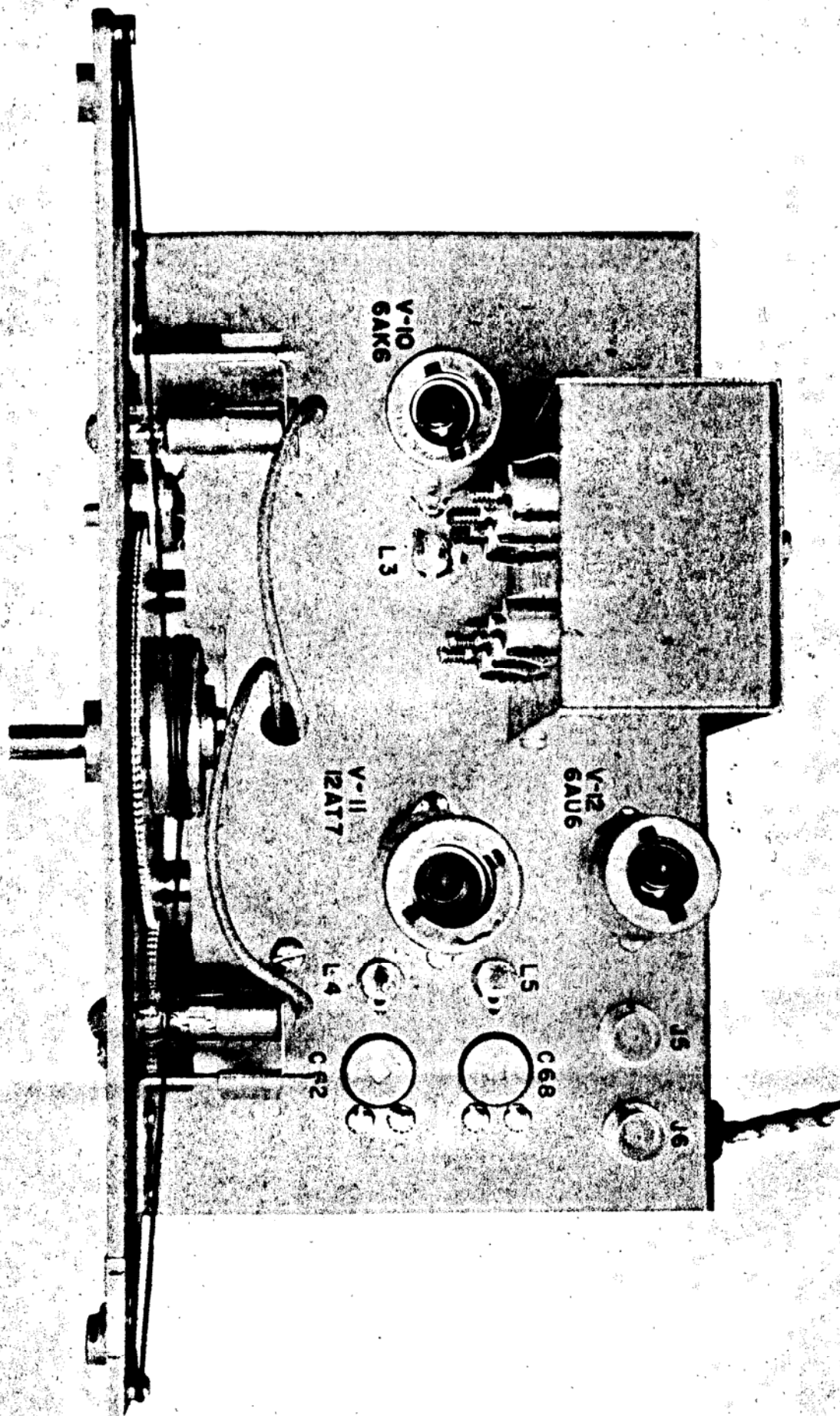


FIGURE 12 VFO CHASSIS, TOP VIEW

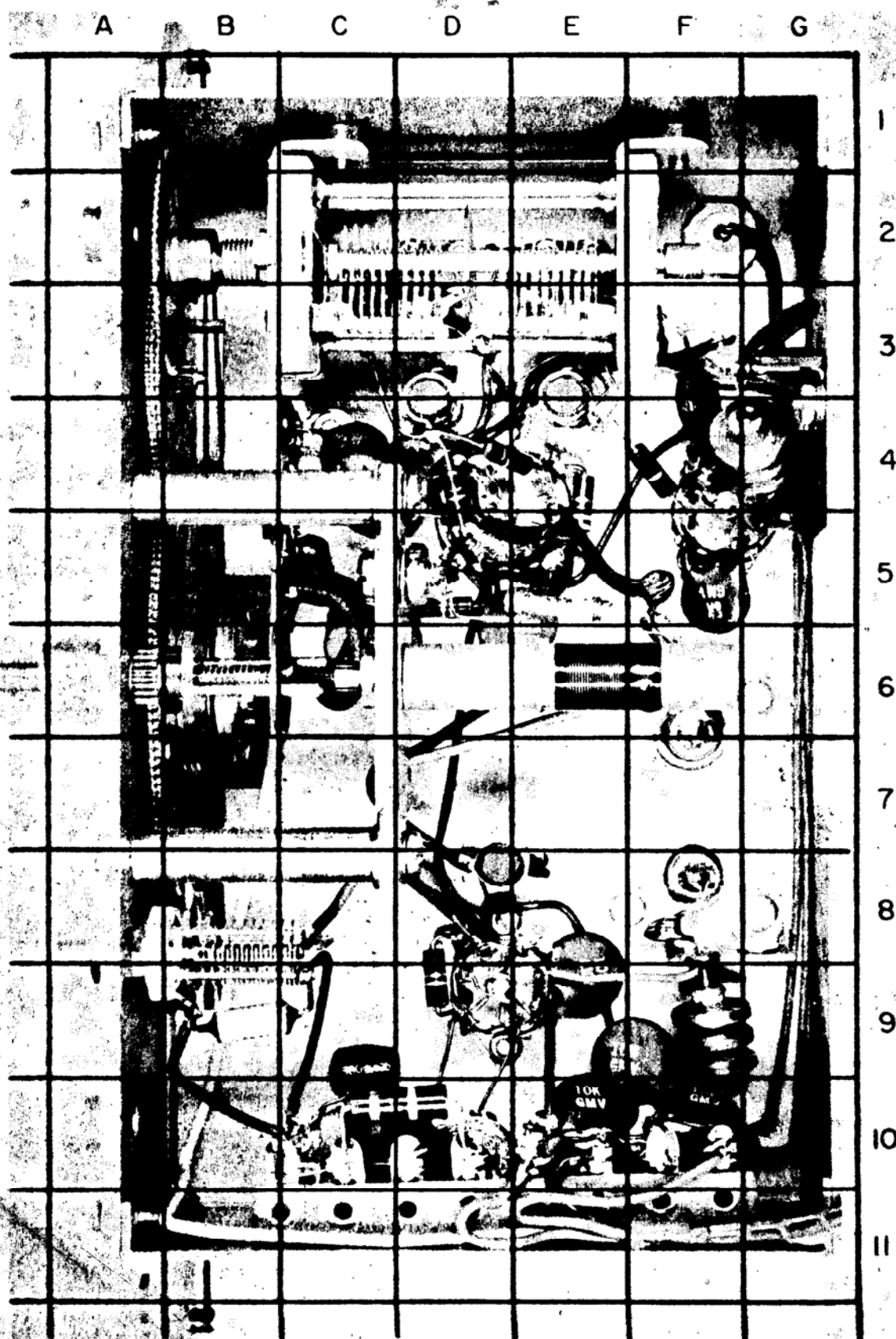


FIGURE 13 VFO CHASSIS, BOTTOM VIEW

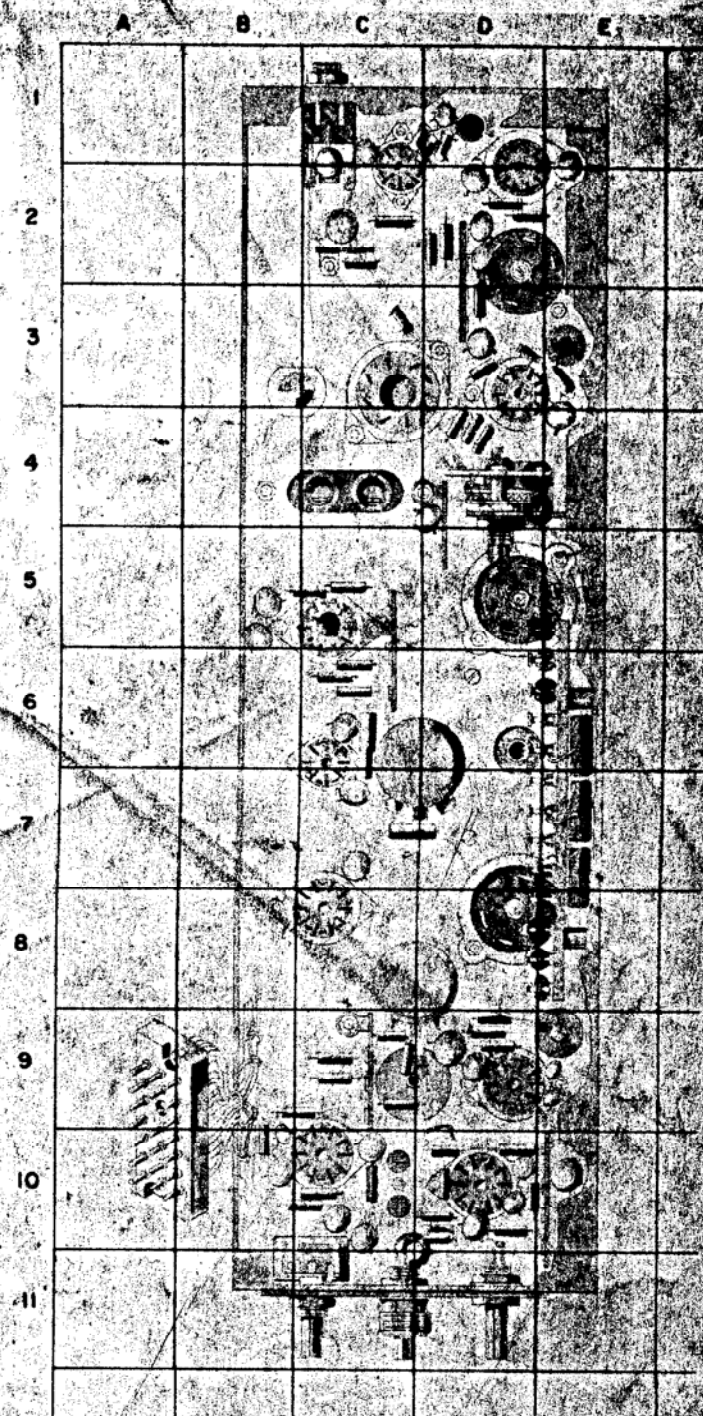
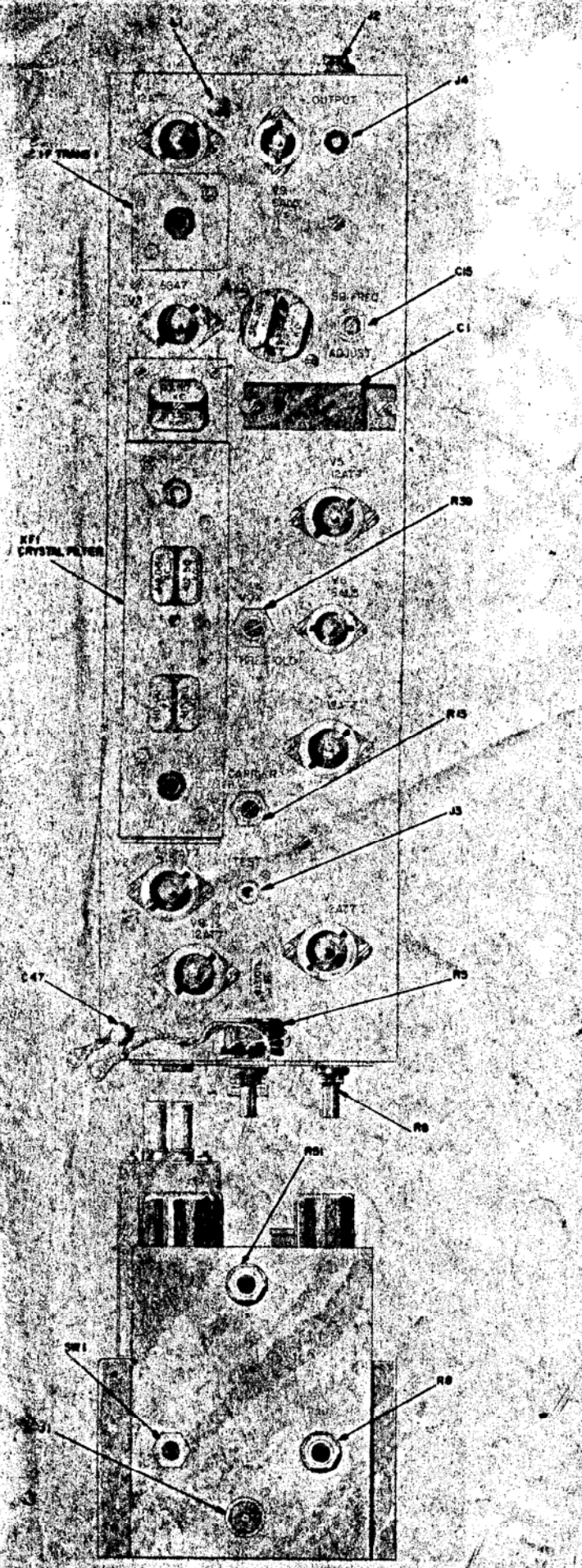


FIGURE 14-a-b-c EXCITER SECTION

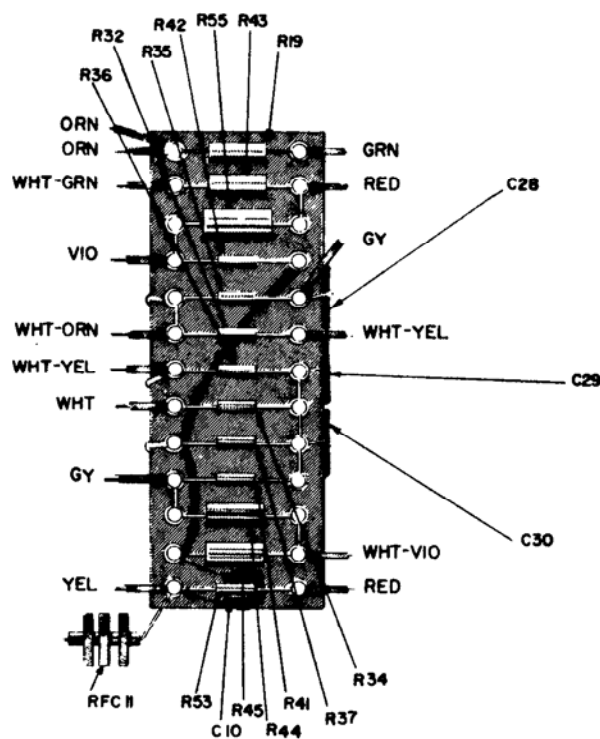
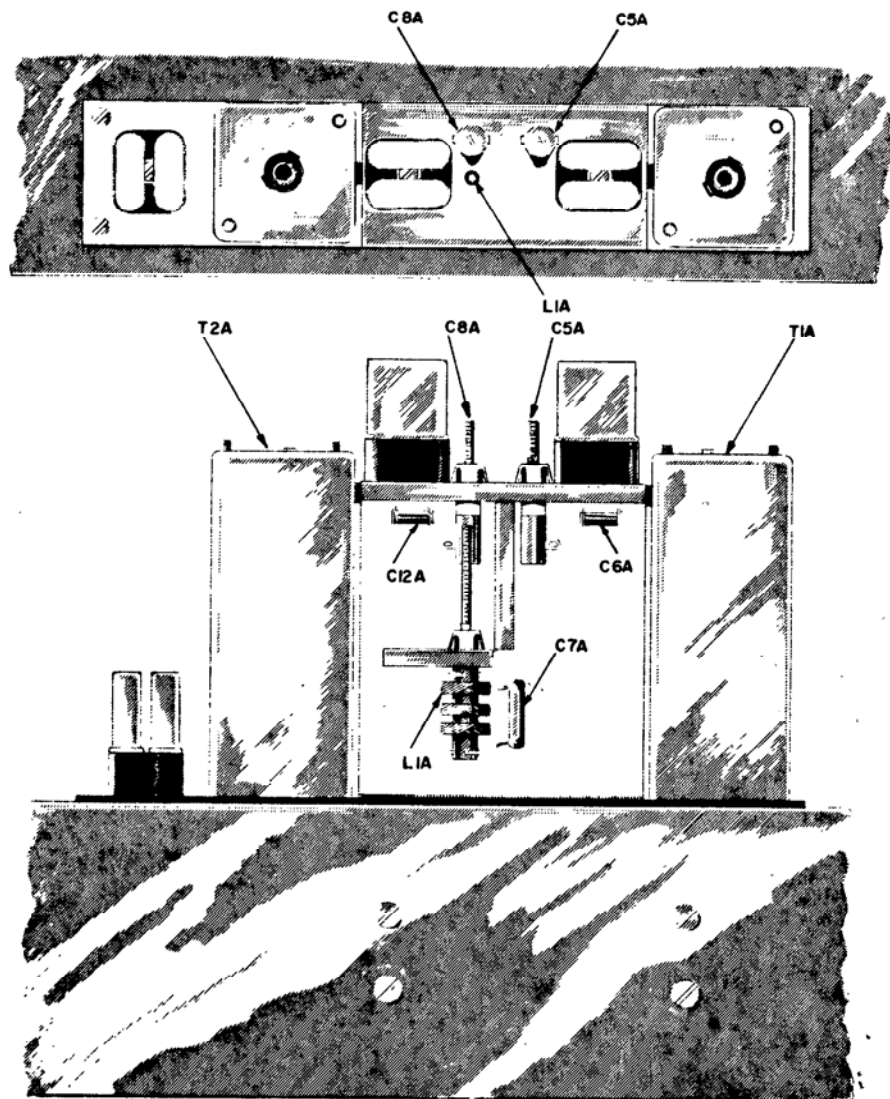


FIGURE 15-a-b-c CRYSTAL FILTER and TERMINAL BOARD

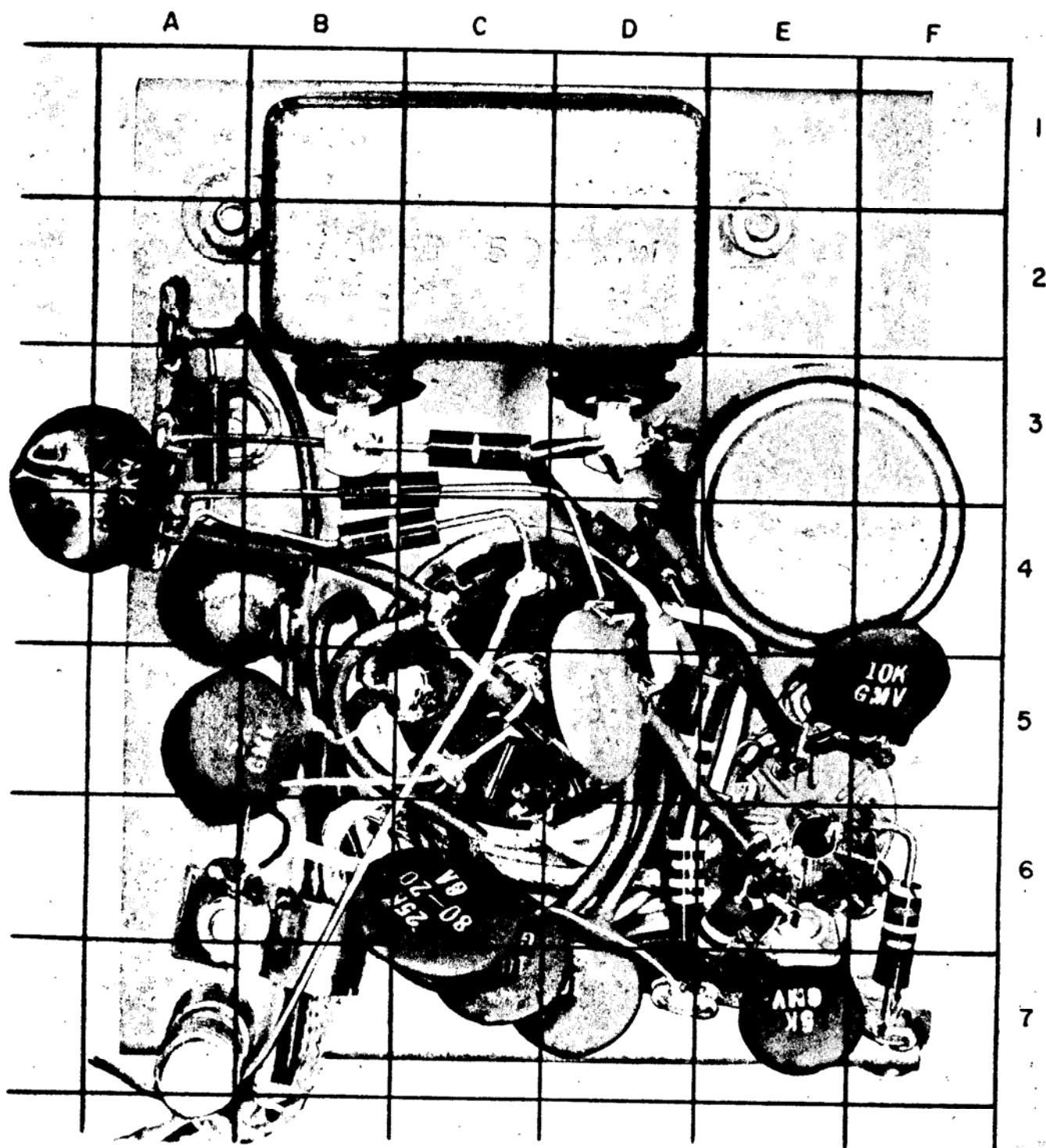
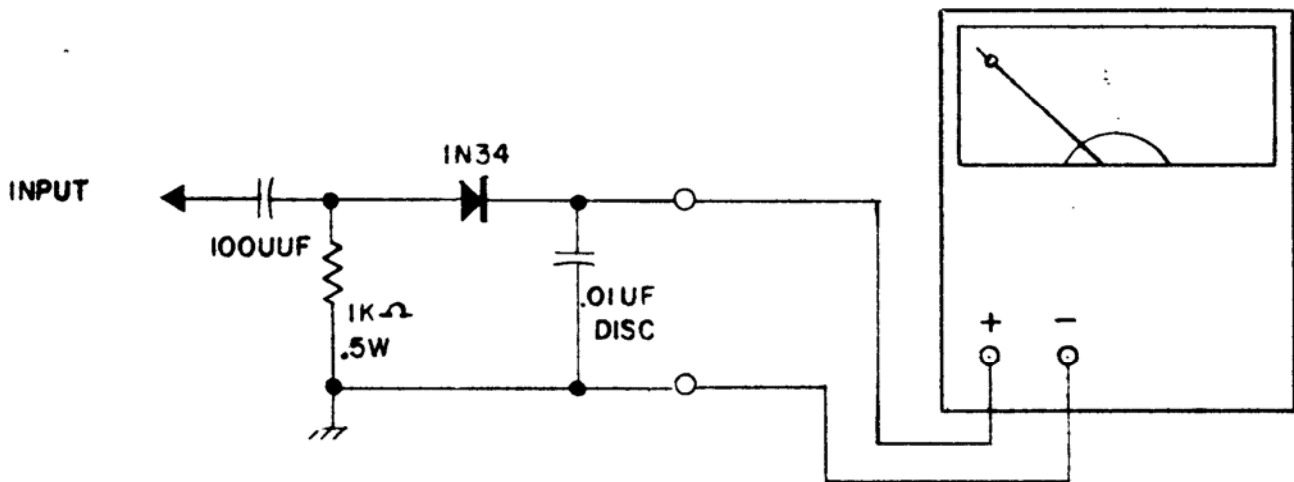
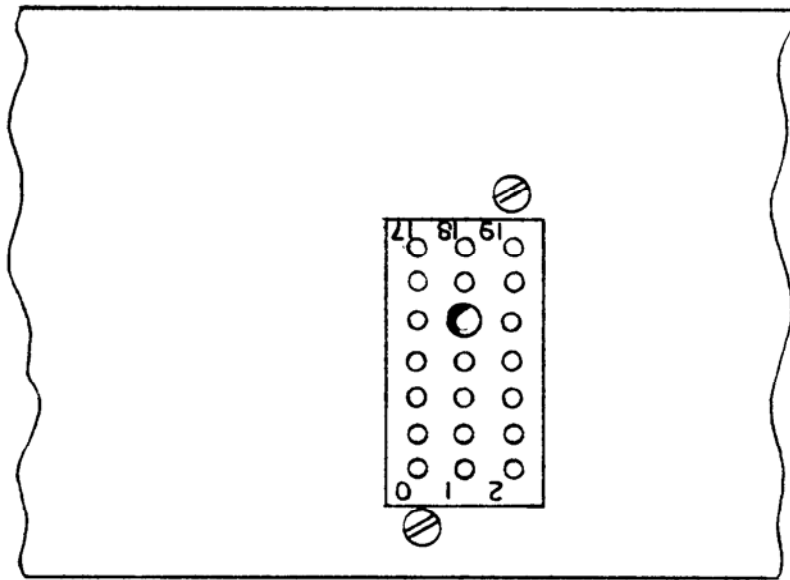


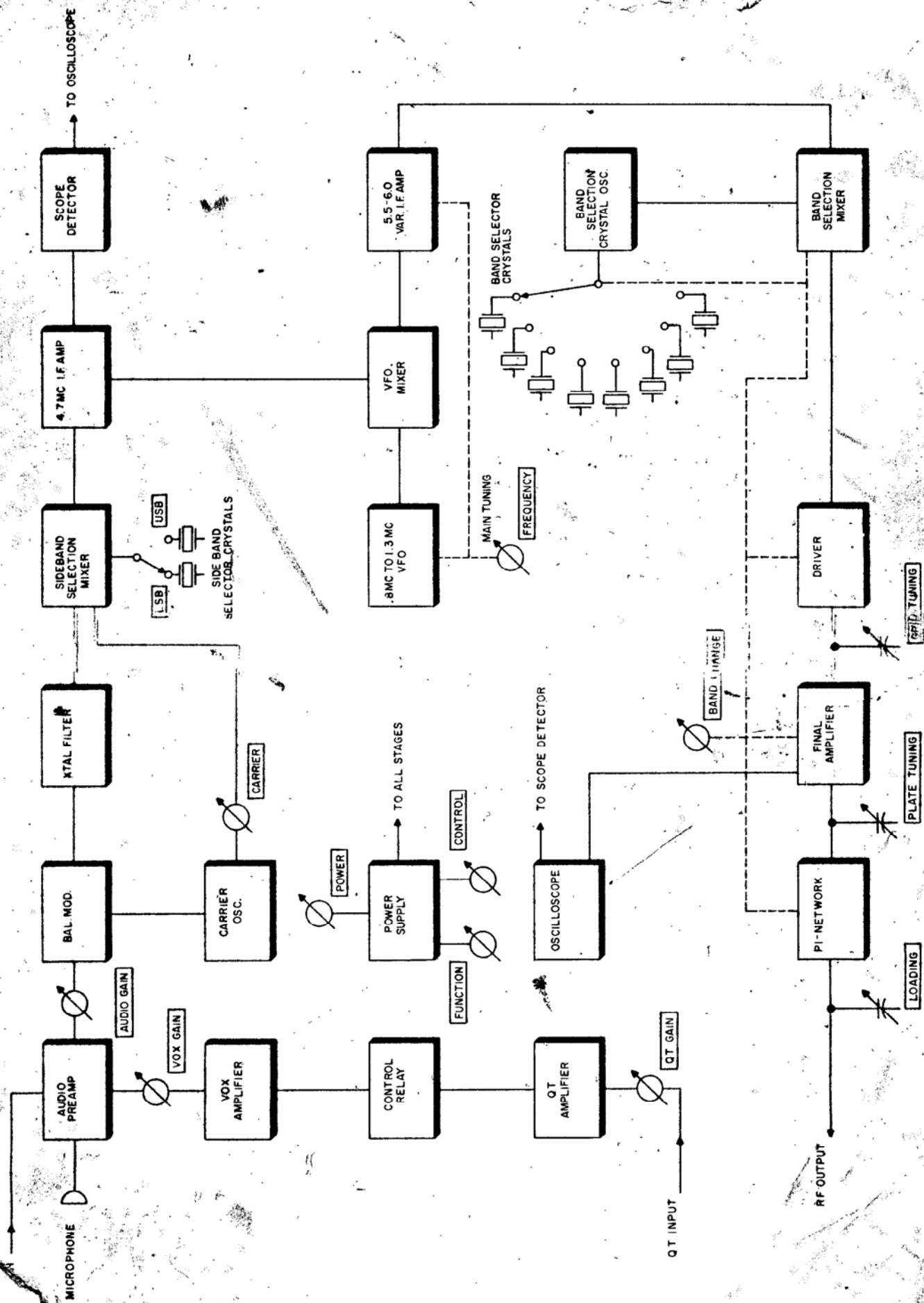
FIGURE 16 OSCILLOSCOPE CHASSIS

POWER SUPPLY CHASSIS TOP



SIMPSON MODEL 260
OR OTHER SIMILAR
VOLT-OHM-MA. METER
0-10V. RANGE

R.F. INDICATOR



SSB 100F BLOCK DIAGRAM

