

Price \$1.00

Operating and Maintaining your

CONAR

Novice Receiver

Model 500

QUALITY EQUIPMENT BUILT ON A HALF CENTURY OF SERVICE IN ELECTRONICS

An antenna trimmer allows the rf circuit to be accurately peaked at any part of any band. The rf gain control allows the sensitivity of the receiver to be adjusted to accommodate both weak and strong received signals.

The receiver operates on 115V 60 Hz ac power only and draws only 18 watts of power. Any low impedance (50 to 75 ohm) antenna or transmission line may be connected to the convenient antenna terminals at the rear of the receiver.

Careful attention should be paid to the "Installation" and "Operation" sections of this manual. These sections give information for the satisfactory operation of your Model 500 receiver.

The Model 500 has a very high degree of sensitivity needed to receive weak and distant signals. Careless operation or poor installation of this high-sensitivity receiver may cause an excessive amount of noise or background hiss. Careful adjustment of the tuning, volume, and gain controls, as outlined in the previously mentioned sections, will keep these undesirable effects to a minimum.

Installation

As mentioned earlier, proper installation goes hand-in-hand with correct operating procedures to get maximum performance from your receiver. Read this section carefully to become familiar with the correct installation of your receiver.

Location. The cabinet of the Model 500 is equipped with four small feet which are suitable for placing the receiver either on a shelf, desk, or table. When you locate the receiver, try to avoid excessively warm places, such as near radiators or heaters. Warm locations may cause the receiver to drift off frequency. Be sure to allow at least one inch clearance between the rear of the cabinet and the wall to give the receiver proper ventilation.

Electrical Power. The Model 500 is transformer-operated and will operate only on 115 volt, 60 Hz ac power. It uses 18 watts of power. If you are in doubt about your power source, call your local power company before you plug the power cord into the power outlet. Connecting the receiver to the wrong power source can cause serious damage and costly repairs to the receiver.

Antennas. The antenna input of the receiver is designed to work with either a single long-wire antenna (Fig. 1) or a half-wave dipole or other resonant antenna with transmission line impedances from 50 to 75 ohms (Fig. 2). The connections to the

antenna or transmission line are made to the two screw terminals at the left rear of the receiver cabinet. The terminal on the left is *ground*, the terminal on the right is the *antenna* connection.

The long-wire antenna (Fig. 1) can be used for all three bands in locations where space is limited. The ground connection should be made to a water pipe (or other good earth ground connection) for best reception. The antenna wire should be elevated above ground as much as possible and be free of obstructions such as tree limbs and buildings.

The dipole antenna (Fig. 2) provides much better performance than the simple long-wire antenna. This antenna has an impedance of approximately 75 ohms, so it gives a good match to the 75-ohm coaxial transmission line. This type of antenna is also the basic transmitting antenna and may be used in conjunction with a novice transmitter if a switch (Fig. 3) is installed in the transmission line.

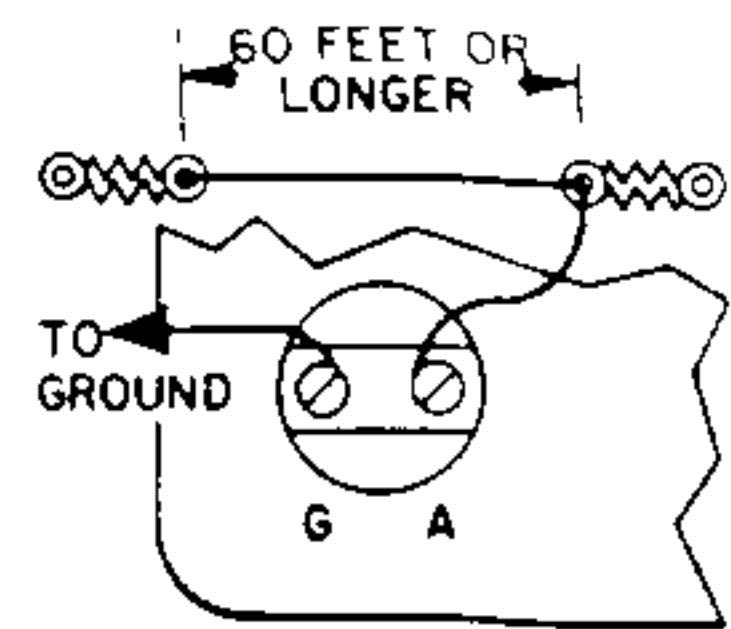


Fig. 1. Long-wire antenna.

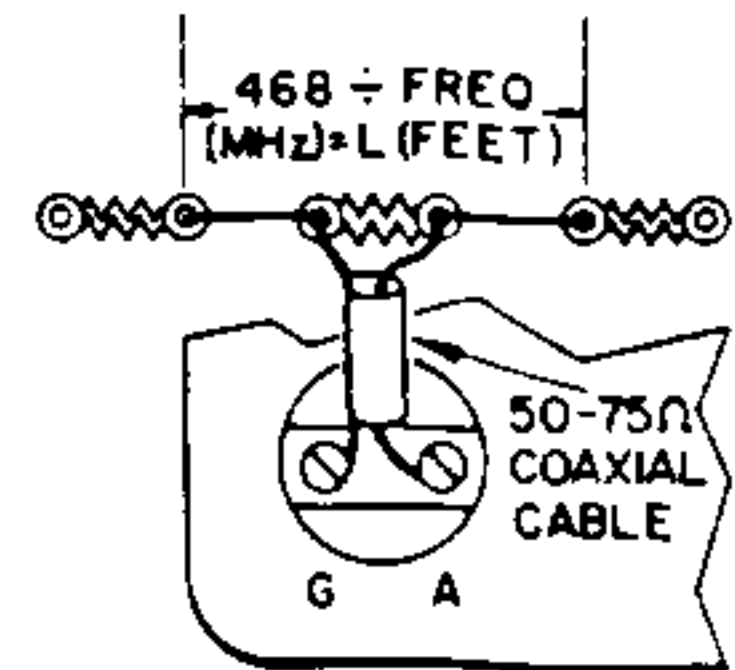


Fig. 2. Coax-fed dipole antenna.

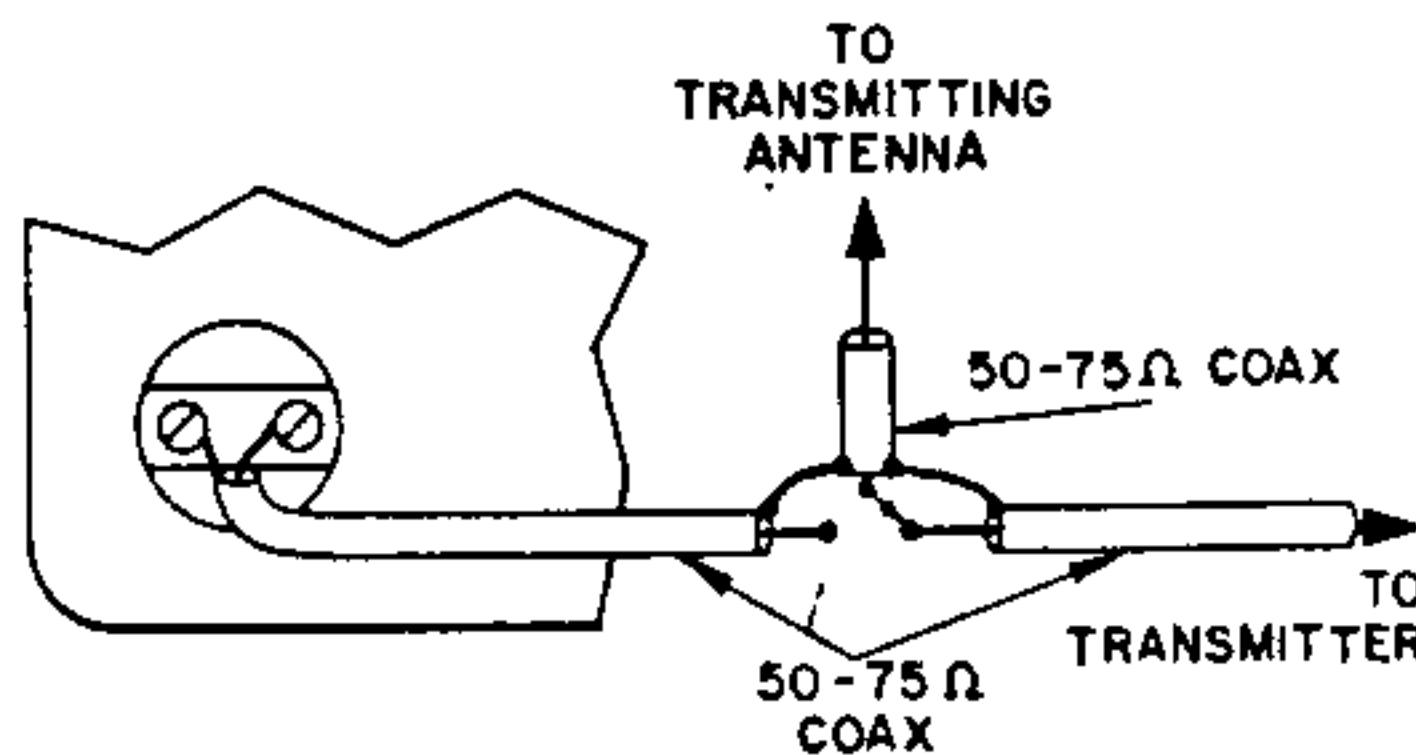


Fig. 3. Using switch with transmitter.

Output Connections. The Model 500 receiver has a built-in loudspeaker so no other output connections are needed for operation. To use headphones, a PHONES jack is provided on the front panel. This jack is wired to disable the loudspeaker automatically when headphones are plugged in. The headphone impedance is not critical; however, for maximum output, low-impedance magnetic phones (50-500 ohms) should be used. Since no direct current flows in the headphone circuit, even high impedance crystal headphones may be used.

Location and Function of Controls

Each control of the Model 500 receiver performs a definite job which contributes to the overall performance capabilities of the receiver. To fully appreciate the capabilities of the receiver, you must first become familiar with each of its controls and the effect these controls have on receiver performance.

This section gives a brief description of the various controls as shown in Fig. 4. The next section takes up the use of these controls in more detail.

Volume/Off Control. The volume control, a variable resistor, controls the gain of the audio signal in the receiver. In the full counterclockwise position this control turns off the ac power to the receiver. With power on, the pilot lamp lights. Clockwise rotation of the volume control turns the power on and increases the audio volume.

BFO Switch. The BFO switch turns the beat frequency oscillator (BFO) on and off. In the CW position, the BFO is turned on for reception of CW (telegraph) and SSB (single sideband) signals. For receiving AM (amplitude modulation) signals, the switch is placed in the AM position and the BFO is turned off. A third position of this switch (STBY) mutes the receiver for standby.

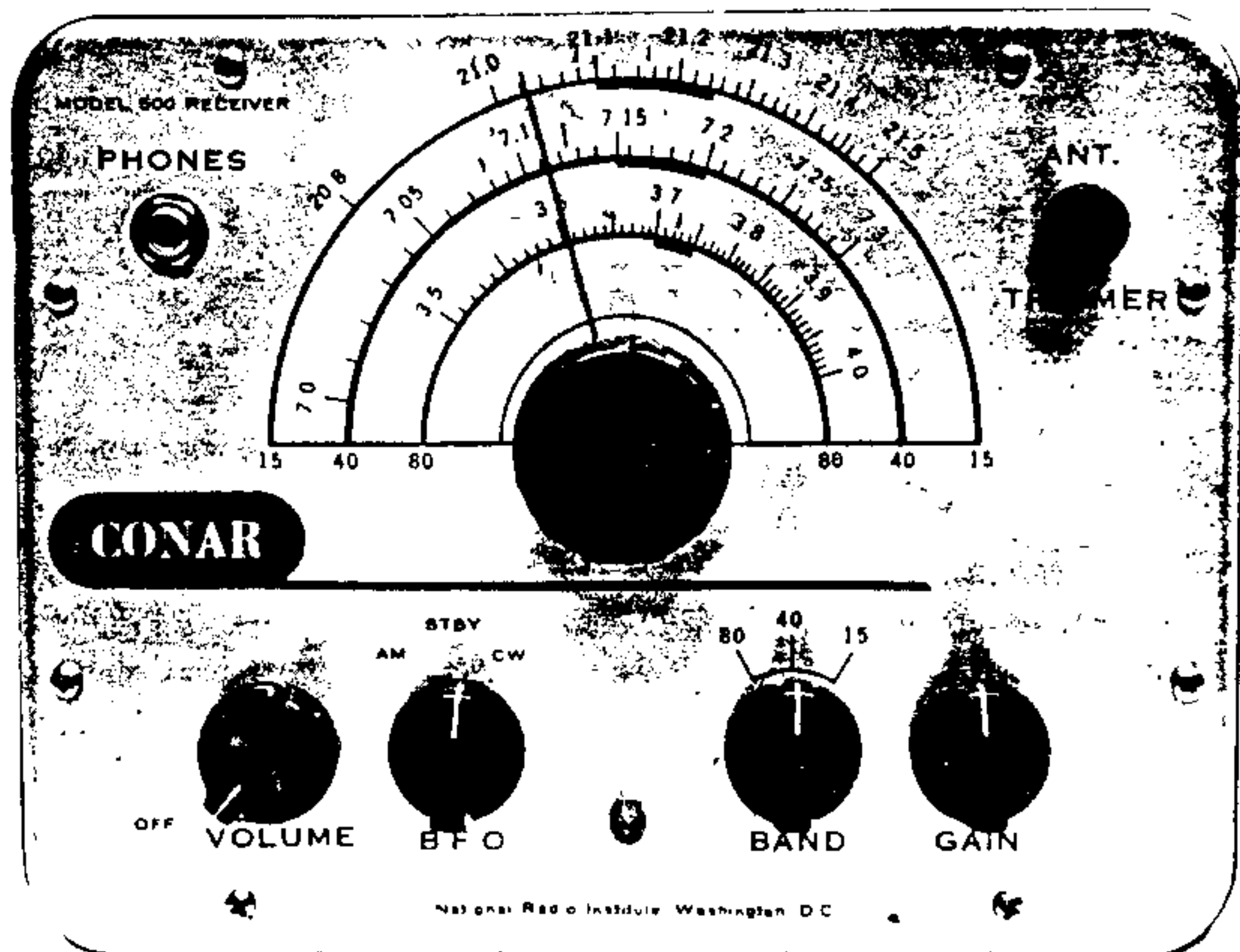


Fig. 4. Front panel controls.

Bandswitch. The band switch is a 3-position rotary switch that selects the desired amateur band. In the full counterclockwise position, the 80-meter coils are switched into the oscillator and mixer. The next two positions in a clockwise direction are 40 and 15 meters, respectively.

Gain Control. The gain control is a variable resistor used to vary the gain (amplification) of the first i-f amplifier stage. It is used primarily for CW reception, as described in the next section. Clockwise rotation of the control increases the gain of the i-f amplifier for receiving weak signals.

PHONES Jack. The PHONES jack accepts a standard 1/4" two-conductor phone plug for headphone reception. Inserting the headphone plug automatically disables the built-in loudspeaker.

Tuning Control. This control is a variable capacitor which determines the oscillator frequency for each of the three bands. It is used to tune in the various stations on each band.

Antenna Trimmer Control. The antenna trimmer is a variable capacitor connected to the secondary of the antenna coil. It is used to ensure that the antenna coil is accurately tuned to the desired incoming signal and no other.



Operation

To put the receiver into operation, first make sure the receiver is plugged in and a suitable antenna connected. There are three modes of operation of your Model 500 receiver CW, AM, and SSB. The following operating methods apply to any of the three bands. However, for practice purposes it is suggested that the 40-meter band be used since there are usually a number of CW, AM, and SSB stations on this band at all times of the day or night.

CW RECEPTION

1. To receive CW signals, set the controls as follows:

VOLUME/OFF	Fully clockwise
BAND	40 meters (or desired band)
BFO	CW
GAIN	Fully clockwise initially
ANT. TRIMMER	Peak for maximum noise

2. Starting at the low frequency end of the band, rotate the tuning control clockwise until a CW signal is heard. If necessary, reduce the gain control to lower the volume. Do not use the volume control for this purpose for CW signals. You can control the pitch (tone) of the signal by carefully adjusting the tuning control for the desired pitch.
3. Rock the antenna trimmer back and forth to produce maximum output.

SSB RECEPTION

The procedure for tuning in an SSB signal is identical to the previous procedure with one important difference. When you tune in the signal you must tune very carefully for maximum intelligibility of the speech. For very strong signals you may have to reduce the setting of the gain control considerably to produce undistorted speech. A little practice should soon make tuning in SSB signals an automatic process.

AM RECEPTION

1. For AM reception, set the receiver controls as follows:

VOLUME/OFF	Fully clockwise
BAND	40 meters or desired band
BFO	AM
GAIN	Fully clockwise
ANT. TRIMMER	Peak for maximum noise

2. Rotate the tuning control to locate an AM signal. Reduce the setting of the volume control as necessary to maintain a comfortable level. Adjust the tuning control for maximum output.
 3. For very strong stations, reduce the setting of the gain control (counterclockwise) to prevent distortion of the sound.
 4. Rock the antenna trimmer control for maximum output.
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Service Information

If your receiver is under warranty, see the special warranty information inside the front cover of this manual. If your receiver is not under warranty, you may still return the receiver to CONAR for repair and alignment for which there is a service charge of \$7.50, plus the cost of any needed parts. This charge is necessary to cover the costs of handling, inspection, and making minor repairs. If you return the receiver to CONAR for repair, write, telling us the receiver is on the way and describe fully the trouble you are having. Enclose a check or money order for the \$7.50 service charge; do not send cash. Pack the receiver carefully in a sturdy carton, filling all open spaces with wadded or shredded newspaper. Send the receiver to CONAR by prepaid express; we will return it to you express collect.

To gain access to the tubes and other components, you must remove the chassis from the cabinet. The chassis is held in place with eight screws through the front panel and one sheet metal screw through the back of the cabinet. When you have removed these screws, carefully slide the receiver out of the cabinet. Be careful not to damage the loudspeaker or any of the parts on the chassis when you slide it out of the cabinet.

Fig. 5 shows the location of various parts on top of the chassis. The part number refers to the numbers on the schematic diagram in Fig. 9 (page 14). If after checking tubes your receiver does not operate properly, check tube voltages and resistances against the measurements shown in Fig. 6 and Fig. 7. Voltage measurements are made to chassis (B— or ground) to the point indicated with the power turned on.

Measurements shown in Fig. 6 were taken with a vtvm under the conditions shown in Fig. 6.

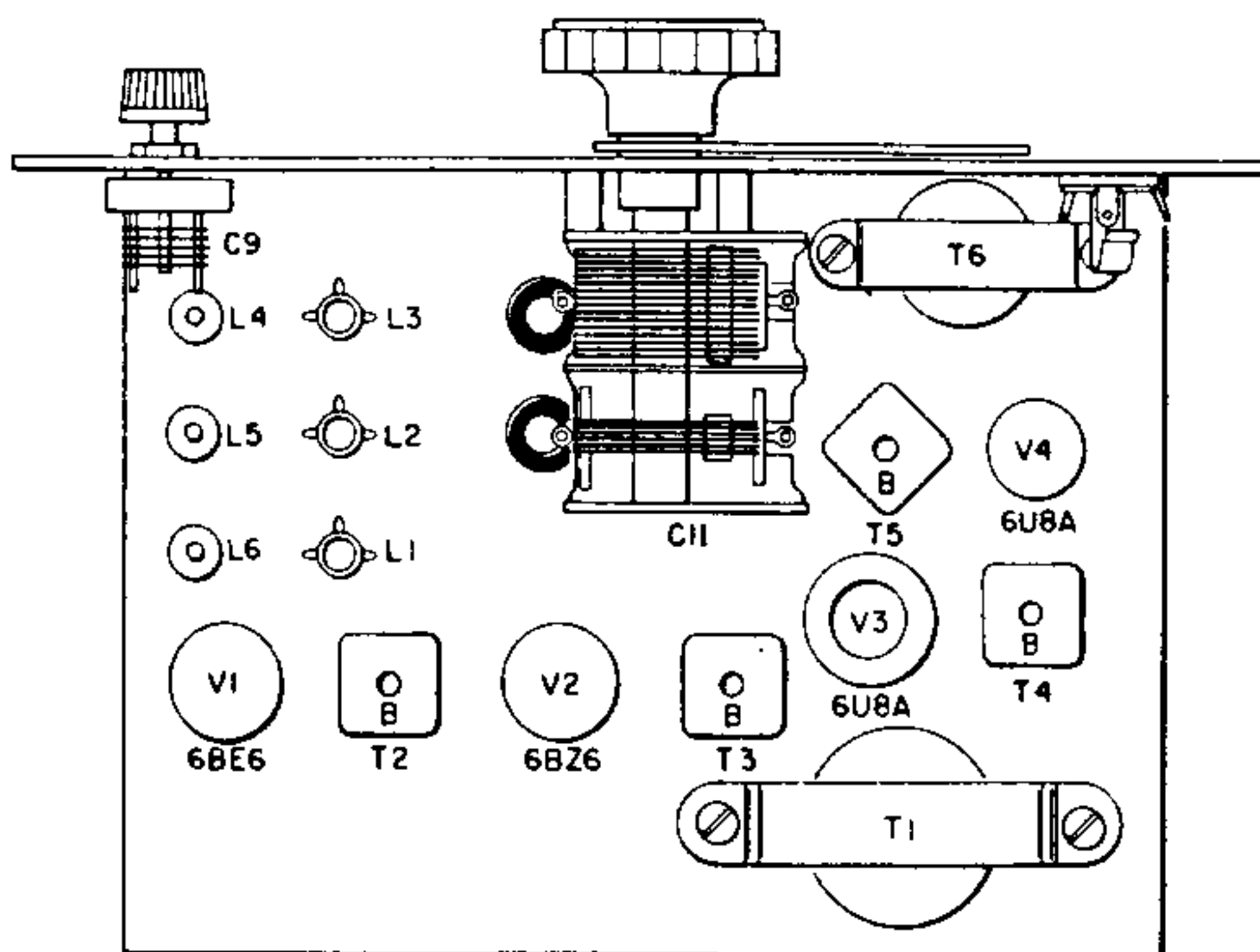


Fig. 5. Components on top of chassis.

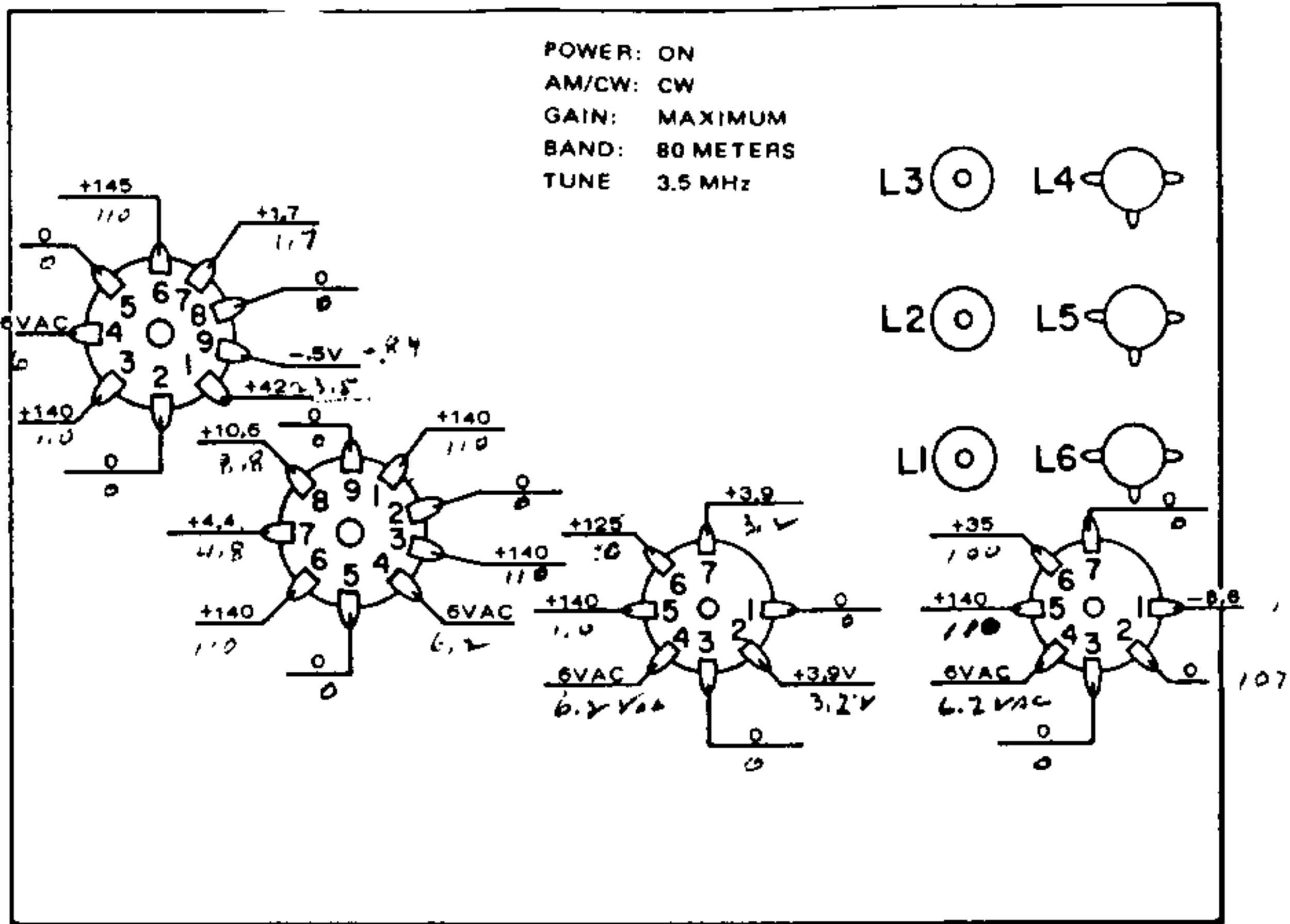


Fig. 6. Voltage measurements.

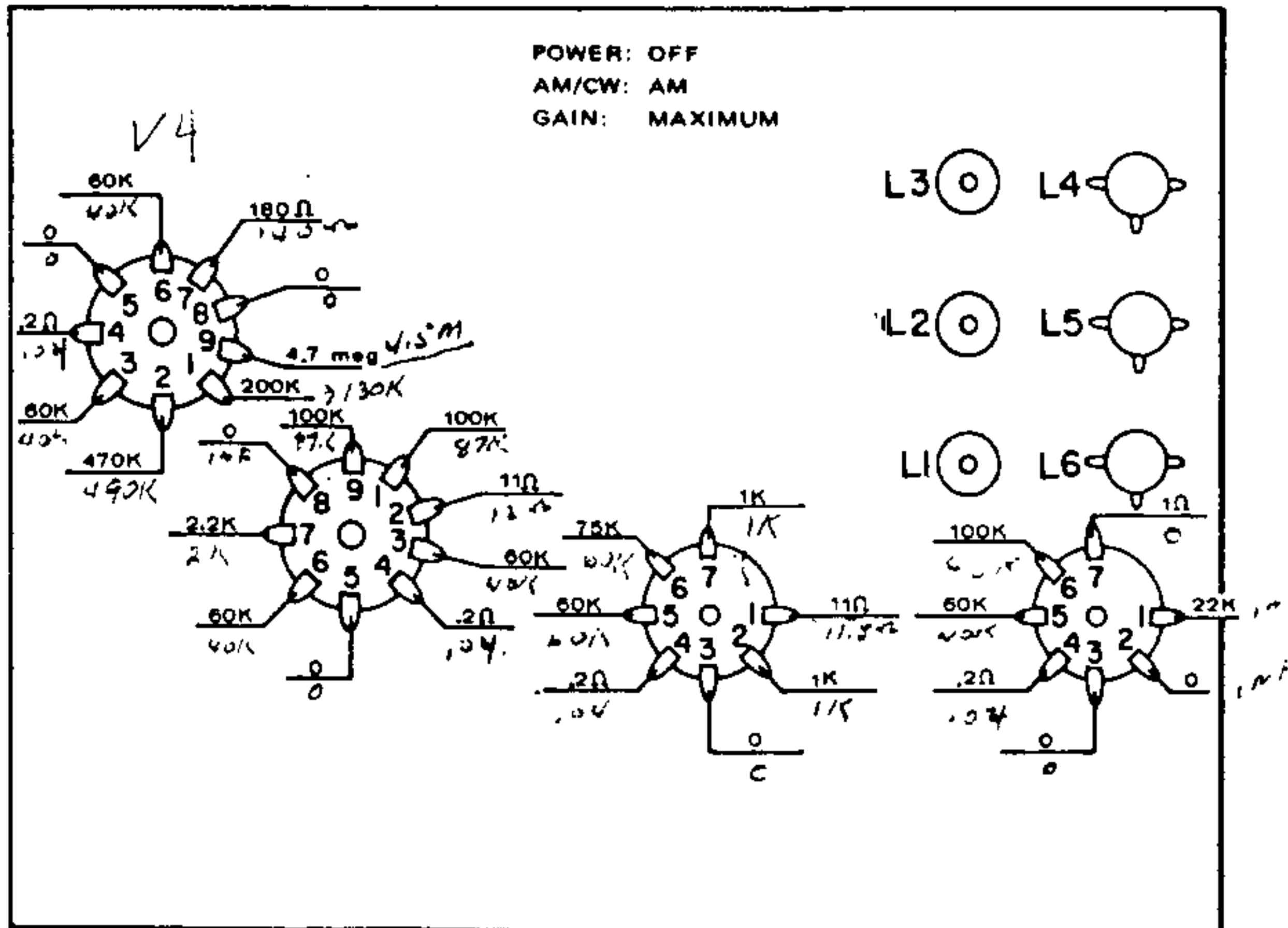


Fig. 7. Resistance measurements.

Resistance readings are shown in Fig. 7. Unplug the receiver before taking resistance readings. When writing CONAR for service consultation, be sure to include the voltage and resistance readings from your receiver to help us locate your trouble.

SYMPTOM	PROBABLE CAUSES
Receiver dead, tubes light	<ol style="list-style-type: none"> 1. V1, V2, V3 or V4 defective. 2. T6 open. 3. T1 defective. 4. D1 defective. 5. R3 open. 6. C14, C16 shorted. 7. D2 defective.
AM reception O.K., no CW reception	<ol style="list-style-type: none"> 1. V3 defective. 2. T5 open. 3. S3 set to AM. 4. T5 misadjusted.
No reception on one particular band	<ol style="list-style-type: none"> 1. Antenna coils L1, L2, and L3 open or shorted. 2. Oscillator coils L4, L5, or L6 open or shorted. 3. Open or shorted capacitors (C1, C2, C3, C4, C5, C6) associated with antenna and oscillator coils.
Weak signals on all bands	<ol style="list-style-type: none"> 1. V1, V2, V3, V4 defective. 2. Gain control open. 3. I-F transformers misaligned. 4. C9 shorted. 5. Antenna not connected.
Oscillations as receiver is tuned.	<ol style="list-style-type: none"> 1. I-F transformers misaligned. 2. Interference from nearby TV receivers.

Table I. Troubleshooting chart.

Table I is a troubleshooting chart which should help you locate a defective or inoperative part. If you are unable to locate the difficulty, write us, describing your difficulty. Be sure to include voltage and resistance measurements. We will try to give you the information needed to get your receiver into operation.

Alignment

All of the coils and transformers used in the Model 500 receiver have been preadjusted at the factory to their correct settings. However, if you have assembled your receiver from a kit, you may possibly find it necessary to readjust one or more of the i-f transformers or oscillator coils for peak performance. This is due to individual differences in wiring from one kit to another and amounts to very small adjustments. Factory assembled receivers should not require alignment unless the receiver has been tampered with or component parts have been replaced in the i-f or oscillator stages.

To align the Model 500 receiver you will need a small screwdriver, the alignment tool supplied with this receiver and a signal generator covering the following frequencies: 455 kHz, 3500 kHz, 7000 kHz, 21,000 kHz. In addition, a vtvm would prove useful, although it is not absolutely necessary if a modulated signal source is used.

The BFO and i-f transformer windings are resonated with a fixed capacitor. The resonant frequency of each winding can be adjusted by turning the slugs in the windings with the special alignment tool included with your receiver.

So that you can easily observe how far you have turned the alignment tool, attach a piece of tape to the center of the alignment tool as shown in Fig. 8A. The end nearest the tape "flag" is the end to use for all transformer adjustments. It is possible to adjust both the top and bottom slugs of the transformer from either the top or the bottom hole. However, to avoid becoming confused, you will make all your adjustments from the end closest to the slug that you are adjusting. Make sure that you insert the tip of the alignment tool into the transformer only far enough to reach the first slug.

As you can see from Fig. 8B, there is one powdered iron slug associated with each of the transformer coils. When you look at the transformer from the top, turning the top slug counterclockwise will move this slug toward the top of the transformer, and since the slug is moving away from the coil, the inductance will be decreased, so the resonant frequency will rise. Looking at the trans-

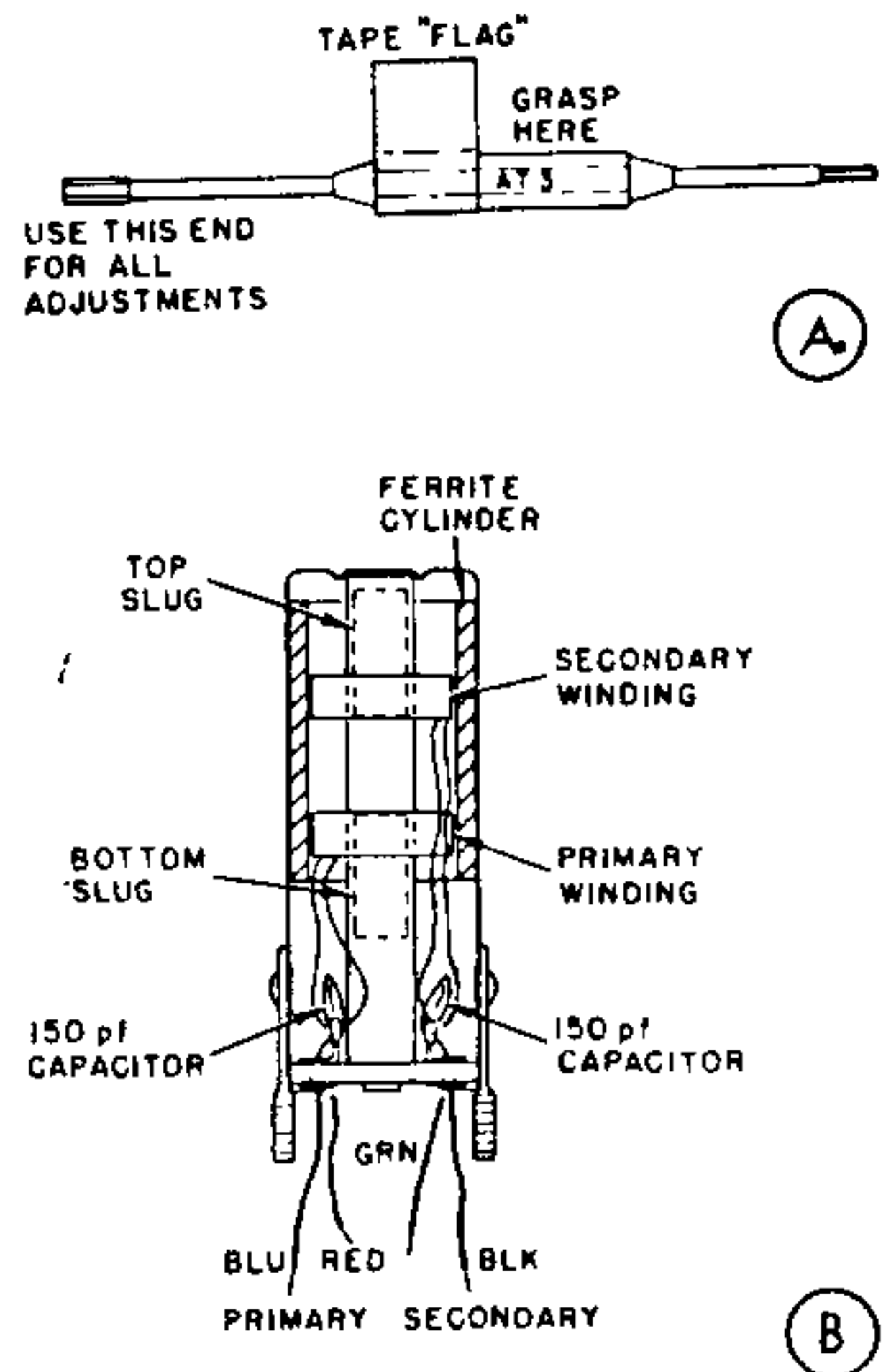


Fig. 8. Alignment tool (A) and construction of i-f transformer (B).

former from the bottom, turning the bottom slug counterclockwise will move the slug toward the bottom of the transformer, which will reduce the inductance of the bottom coil, and therefore raise the resonant frequency of this part of the transformer.

I-F ALIGNMENT—METHOD 1

1. To align the i-f's, set the controls as follows:

VOLUME/OFF	Fully clockwise
BFO	AM
BAND	15 meters
TUNING DIAL	22 MHz
GAIN	Fully clockwise
ANT. TRIMMER	Any position

2. Disconnect the antenna and connect the signal generator to pin 1 of the 6BE6 converter V1 (see Fig. 6 and Fig. 9.) Adjust the signal generator to 455 kHz, modulated with a 400 Hertz audio tone.
3. Carefully adjust the top slug of T4 (see Fig. 5) for maximum audio output. If necessary, reduce the output of the signal generator for a comfortable sound level.
4. Next adjust the bottom slug of T4 for maximum output. Continue by adjusting T3 top, T3 bottom, T2 top, and T2 bottom. Reduce the generator output as necessary to keep the audio output to a reasonable level as you proceed with the alignment.
5. Repeat Steps 3 and 4 for final peaking of the i-f transformers.

I-F ALIGNMENT—METHOD 2

1. Set the controls as for Method 1.
2. Connect the signal generator to pin 1 of V1 as before, but set the signal generator to 455 kHz unmodulated.
3. Set the vtvm to read -dc volts on a low range. Connect the probe to the high side of the volume control (junction of R15 and R16) and the ground lead to the chassis.
4. Turn the volume control down all the way and continue with Steps 3, 4, and 5 as described in Method 1, adjusting for maximum deflection of the vtvm.

BFO ALIGNMENT

To properly adjust the BFO, leave the receiver connected as for i-f alignment (Method 2) with the following changes:

1. Remove the vtvm.
2. Turn the volume control fully clockwise.
3. Turn the bottom slug of T5 three full turns in a counterclockwise direction. Adjust the top slug of T5 to produce an audio tone from the receiver. Now turn the bottom slug of T5 in a clockwise direction to fine-tune the BFO frequency to produce a pleasing tone.

CONVERTER ALIGNMENT

There are two ways to align the oscillator and antenna coils of the Model 500 receiver. The first way is to use an unmodulated signal generator with a vtvm connected as for i-f alignment (Method 2). The second way is to use the output from a transmitter (crystal controlled) as the signal source rather than a signal generator. If you use your transmitter you will, of course, adjust the receiver at the frequency of the transmitter. When using a signal generator, use the frequencies listed in Table II on page 15.

1. Preset the controls as follows:

VOLUME/OFF	ON
BFO	AM
ANT. TRIMMER	Plates fully meshed
BAND	80 meters
TUNING DIAL	3.5 MHz
GAIN	Fully clockwise

2. Connect the signal generator to the antenna and ground terminals and set to 3.5 MHz unmodulated. Or: Connect a short lead to the antenna terminal, set the tuning control to the transmitter frequency and turn on the transmitter (connected to a dummy antenna.)
3. Connect the vtvm as for i-f alignment.
4. Rotate the tuning control until you get a maximum reading on the vtvm. Note whether the dial reads above or below 3.5 MHz.
5. Set the tuning control to 3.5 MHz and adjust L4 (Fig. 5) for a maximum vtvm reading. If the dial was below 3.5 MHz in Step 4, turn L4 counterclockwise to align the oscillator. If the dial was above 3.5 MHz in Step 4, turn L4 clockwise to align the oscillator.
6. Adjust L1 for maximum output on the vtvm. L1, L2, and L3 are adjusted from the bottom of the chassis.
7. Adjust the converter coils for the remaining bands as outlined in Table II.

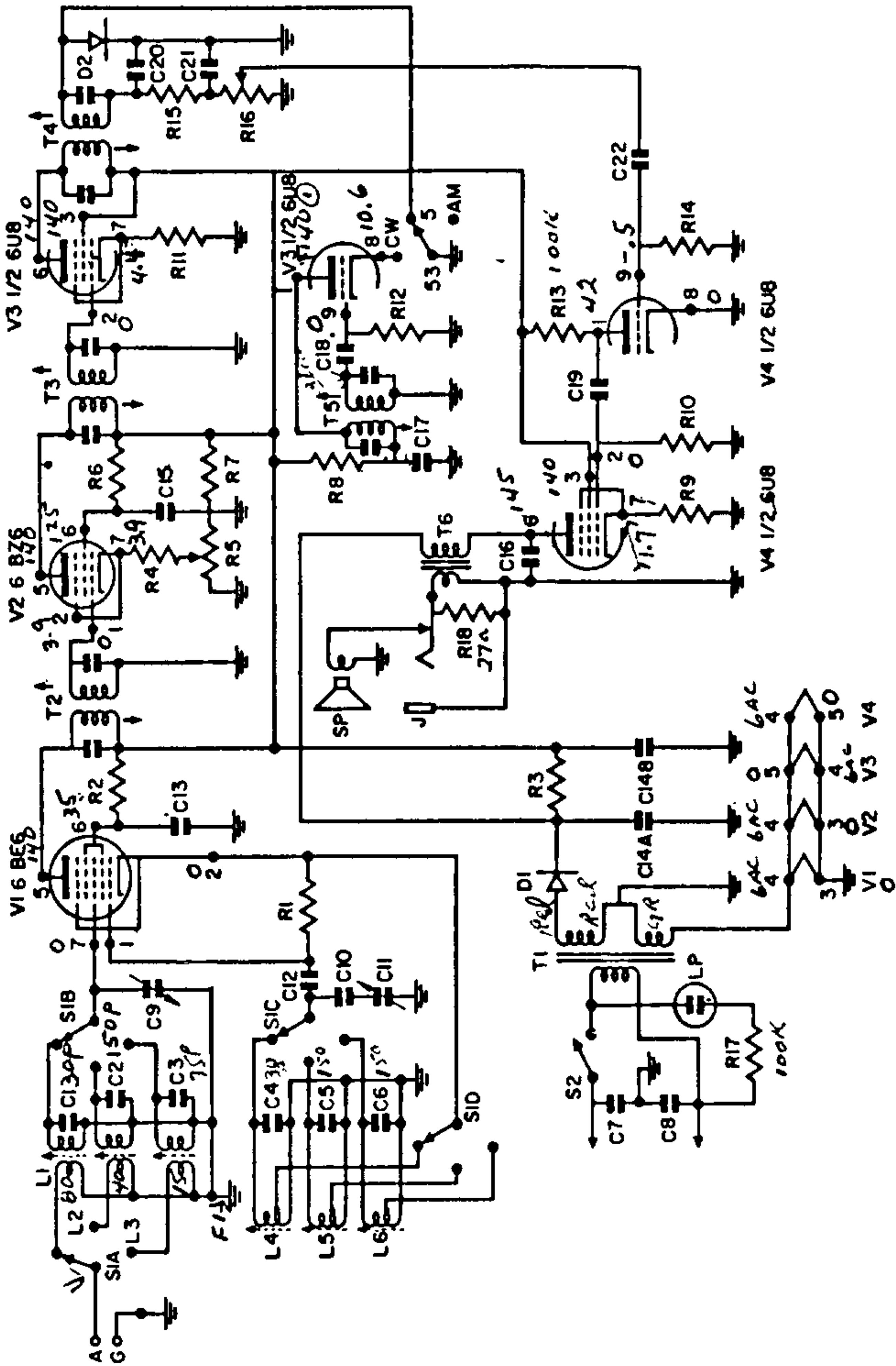


Fig. 9. Schematic diagram of the Model 500 receiver

LIST OF SCHEMATIC SYMBOLS

C1	30 pf NPO	R11	2.2k, 1/2-watt
C2	150 pf NPO	R12	100k, 1/2-watt
C3	75 pf	R13	100k, 1/2-watt
C4	30 pf NPO	R14	4.7 meg, 1/2-watt
C5	150 pf NPO	R15	47k, 1/2-watt
C6	150 pf NPO	R16	500k potentiometer
C7	.01 mfd	R17	100k, 1/2-watt
C8	.01 mfd	R18	27 ohm, 1/2-watt
C9	35 pf variable	T1	Power transformer
C10	30 pf NPO	T2	I-F transformer
C11	2-section variable	T3	I-F transformer
C12	100 pf mica	T4	I-F transformer
C13	.01 mfd	T5	BFO transformer
C14	50/30 mfd electrolytic	T6	Audio output transformer
C15	.01 mfd	D1	Selenium rectifier
C16	.001 mfd	D2	Diode detector
C17	.001 mfd	S1	4-pole, 3-position rotary switch
C18	500 pf	S2	SPST line switch (R16)
C19	.001 mfd	S3	1-pole, 3-position rotary switch
C20	500 pf	L1	80 meter antenna coil
C21	500 pf	L2	40 meter antenna coil
C22	.001 mfd	L3	15 meter antenna coil
R1	22k, 1/2-watt	L4	80 meter oscillator coil
R2	4.7k, 1/2-watt	L5	40 meter oscillator coil
R3	470 ohm, 1-watt	L6	15 meter oscillator coil
R4	1k, 1/2-watt	V1	68E6
R5	20k potentiometer	V2	6BZ6
R6	22k, 1/2-watt	V3	6UBA
R7	27k, 1/2-watt	V4	6UBA
R8	47k, 1/2-watt	J	Closed circuit phone jack
R9	180-ohm, 1/2-watt	LP	Neon pilot lamp
R10	470k, 1/2-watt	SP	Loudspeaker

BANDSWITCH CONTROL	TUNING CONTROL	GEN. FREQ.	ADJUST FOR MAXIMUM	
			FIRST	SECOND
40 meters	7.0 MHz	7.0 MHz	L5	L2
15 meters	21.0 MHz	21.0 MHz	L6	L3

Table II. Converter alignment.

Parts List

Quan.	Part No.	Symbol	Description	Price Each
COILS				
1	CO96	L1	80-meter antenna coil	1.35
1	CO97	L2	40-meter antenna coil	1.50
1	CO98	L3	15-meter antenna coil	1.50
1	CO99	L4	80-meter oscillator coil	1.25
1	CO100	L5	40-meter oscillator coil	1.30
1	CO101	L6	15-meter oscillator coil	1.30
TRANSFORMERS				
1	TR22a	T1	Power transformer	2.40
1	TR27a	T6	Audio output transformer	1.25
4	TR91	T2, T3, T4, T5	1-F and BFO transformer	1.30
SWITCHES				
1	SW14	S3	Single-pole, 3-position rotary bandswitch	1.10
1	SW44	S1	4-pole, 3-position rotary bandswitch	2.10
CAPACITORS				
1	CN4	C12	100 pf mica	.20
4	CN34	C16, C17, C19, C22	.001 mfd disc ceramic	.20
3	CN51	C18, C20, C21	500 pf tubular ceramic	.20
4	CN86	C7, C8, C13, C15	.01 mfd disc ceramic	.20
1	CN113	C3	75 pf disc ceramic	.20
1	CN115	C11	2-section variable	2.35
1	CN155	C14	50/30 mfd, 150V electrolytic	1.10
1	CN157	C9	35 pf variable	1.80
3	CN158	C1, C4, C10	30 pf NPO disc ceramic	.20
3	CN159	C2, C5, C6	150 pf NPO disc ceramic	.20
POTENTIOMETERS				
1	PO40	R5	20k potentiometer	.90
1	PO65	R16	500k potentiometer w/switch	1.05

Parts List

Quan.	Part No.	Symbol	Description	Price Each
RESISTORS				
1	RE29	R2	4.7k, 1/2-watt	.15
1	RE30	R4	1k, 1/2-watt	.15
2	RE33	R1, R6	22k, 1/2-watt	.15
1	RE34	R7	27k, 1/2-watt	.15
2	RE35	R8, R15	47k, 1/2-watt	.15
3	RE36	R12, R13, R17	100k, 1/2-watt	.15
1	RE38	R10	470k, 1/2-watt	.15
1	RE41	R14	4.7 meg, 1/2-watt	.15
1	RE58	R11	2.2k, 1/2-watt	.15
1	RE103	R18	27 ohm, 1/2-watt	.15
1	RE143	R9	180 ohm, 1/2-watt	.15
1	RS28	R3	470 ohm, 1-watt	.20
MISCELLANEOUS				
1	AT3		Alignment tool	.40
1	CB5		Metal cabinet	6.75
1	CH53		Chassis	1.75
1	CR4	D2	Diode detector	.20
1	DA13		Dial pointer	1.55
6	GRI		Rubber grommets	.05
2	HA5		3/8" X 1/4" bushings	.10
1	HA9		Speaker grille cloth	.20
2	HA31		Potentiometer grounding lug	.05
1	JAI	J	Closed circuit phone jack	.50
1	KN7		Round knob	.15
1	KN8		Round knob	.25
4	KN12		Bar knobs	.20
1	LP8	LP	Neon pilot lamp	.40
3	LU5		No. 6 ground lugs	12/.15
18	NU1		6-32 hex nuts	12/.15
2	NU3		8-32 hex nuts	12/.15
8	NUS		4-40 hex nuts	12/.15
1	PA21		Metal panel	5.20
1	PCI		Power cord	.40
10	SCI		6-32 X 1/4" screws	12/.15
8	SC6		4-40 X 1/4" screws	12/.15

Parts List

Quan.	Part No.	Symbol	Description	Price Each
2	SC43		8-32 X 1/4" screws	12/.15
1	SC45		No. 6 sheet metal screws	12/.15
8	SC46		No. 6 Phillips head screws	12/.15
2	SC47		6-32 X 9/16" screws	12/.15
2	SH4		7-pin tube shield	.30
1	SH17		9-pin tube shield	.30
1	SH18		9-pin shield base	.15
2	SO15		9-pin tube socket	.20
2	SO17		7-pin shield base socket	.20
1	SP10	SP	Loudspeaker	1.70
1	SR10	DI	Selenium rectifier	.55
1	ST11		2-lug screw terminal strip	.15
2	ST14		3-lug terminal strip	.10
3	ST15		4-lug terminal strip	.10
1	ST41		5-lug terminal strip	.10
1	TU17	V1	6BE6 tube	2.45
1	TU77	V2	6BZ6 tube	2.25
2	TU79	V3, V4	6U8A tube	2.85
4	WA14		5/8" flat control washer	.05
25	WA15		No. 6 lockwashers	12/.15
2	WA16		No. 8 lockwashers	12/.15
4	WA18		Large washers	12/.15

FOR KIT VERSION

Quan.	Part No.	Symbol	Description	Price Each
1	HA23		4' solder	.25
1	WR72		3' blue hookup wire	.25
1	WR76		3' bare wire	.25
1	WR205		4' black hookup wire	.25
1	WR219		4' twisted pair wire	.25
1	WR242		5' red hookup wire	.25