BC-654

SCHEMATIC DIAGRAMS FOR MAINTENANCE OF GROUND RADIO COMMUNICATION SETS

WAR DEPARTMENT • OCTOBER 1943

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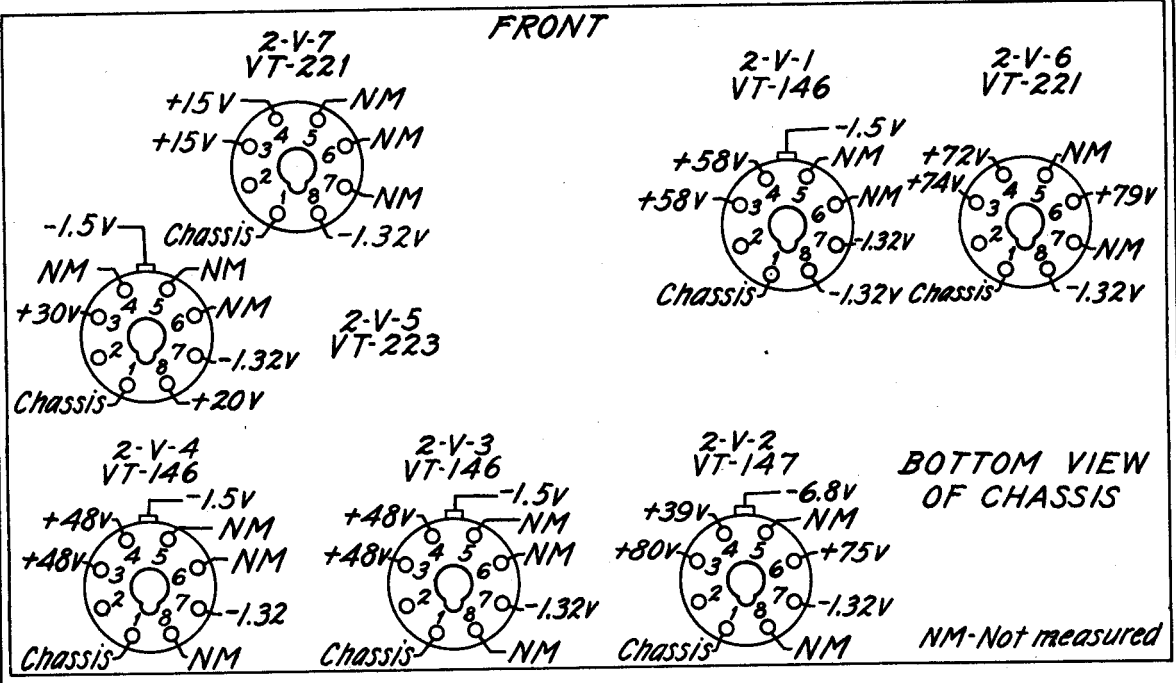
RADIO RECEIVER & TRANSMITTER BC-654-A

Part of: SCR-284-A

Reference: TM 11-275

RECEIVER RESISTANCE AND VOLTAGE MEASUREMENTS



RECEIVER VOLTAGE MEASUREMENTS

Set removed from case. Interlocks tied down.

MAIN SWITCH at CW. VOLUME control full on.

Measurements taken to No. 2 socket pins (+6v) with 1000 ohms/volt meter.

Readings may vary 15%.

RECEIVER RESISTANCE MEASUREMENTS

Chassis removed from case. Interlocks left open. Tubes and battery (or PE-104) removed.
Mic, phones, key, and power cord (CD-501) disconnected.
Controls at any position; except AVC switch (early sets) ON.
Measurements made between points indicated at tube sockets (top) and Terminal Strip 2-K-1.

Socket	Pin No.	2-K-1 Term	Resistance
2-V-1 1st I-F	Grid cap 3 & 4	2 7	1.22 meg 30000 ohms
2-V-2 Mixer	Grid cap 3 4 5 6	2 7 7 11 7	2 meg 4700 ohms 6800 ohms 220000 ohms 4400 ohms
2-V-3 1st I-F	*Grid cap Grid cap *Grid cap 3 & 4	8 2 11 7	1 meg 2 meg 1.039 meg 68000 ohms

Socket	Pin No.	2-K-1 Term	Resistance
2-V-4 2d I-F	Grid cap 3 & 4	11 7	6 ohms 68000 ohms
2-V-5 Det- 1st I-F	Grid cap 3 5	11 7 11	2.2 meg 470000 ohms 1.68 meg
2-V-6 2d A-F	5 3 4	9 7 7	2.22 meg 1000 ohms 10000 ohms
2-V-7 Osc	5 3 & 4	11 7	220000 ohms 220000 ohms

* Additional measurements for all sets over Serial #17,692.

561384 O - 43 - 3

RECEIVER ALIGNMENT

Numbers in circles refer to locations shown on figures 2 and 3.

1. Remove from case, separate receiver from transmitter. Remove receiver bottom plate. Tie down interlocks. Install new battery and check voltage (85-90). Check all tubes.
2. Connect "hot" lead of signal generator to grid cap of mixer tube (2V2) through a 0.01 - to 0.05- μf capacitor; connect "cold" lead to chassis. Set signal generator on 455 kc *, and turn to modulated signal. Plug output meter and headset into PHONES jacks. Set MAIN SWITCH to voice; AVC to on: VOLUME full on; TUNING at 5800 kc. Always work with as weak a signal from signal generator as practicable.
3. Adjust secondary (1) then primary (2) of 3d I-F transformer for maximum on output meter.
4. Adjust sec (3) then pri (4) of 2d I-F trans for max on output meter.
5. Adjust sec (5) then pri (6) of 1st I-F trans for max on output meter.
6. Turn off modulation in signal generator. Set MAIN SWITCH to CW. Tune BFO (7) to zero beat.
7. Set TUNING at 5800 kc; MAIN SWITCH to VOICE. Set signal generator on 5800 kc* and turn to modulated signal. Connect "hot" lead to antenna lead through a 50-$\mu\mu$f capacitor; connect "cold" lead to chassis.
8. Adjust osc trimmer (8) for max on output meter.
9. Adjust R-F trimmer (9) for max on output meter.
10. Adjust ant trimmer (10) for max on output meter.
11. Set TUNING at 3800 kc; set sig gen at 3800 kc.*
12. Adjust R-F coil slug (11) for max on output meter.
13. Adjust ant coil slug (12) for max on output meter.
14. Repeat steps 7 to 13 inclusive at least once.

* Check signal generator frequency (unmodulated) against SCR-211 frequency meter.

CAUTION

BEFORE REPLACING SET IN THE CASE *ALWAYS* BE SURE RECEIVER ANTENNA PLUG IS REPLACED IN JACK ON RELAY SHELF.

COMMON FAULTS AND CORRECTIVE MEASURES

ARCING IN POWER CORD CONNECTORS

On sets having the +500v lead connected to terminal No. 3 in the cording, trouble has been experienced with arc-over to ground in connectors. Late sets have the +500v connected to the No. 8 (center) terminal. On these sets the connectors are marked with a yellow arrow.

This change should be effected on all sets not already changed over. Simply interchange No. 3 and No. 8 leads in *all* connectors, viz:

Transmitter and Receiver BC-654-A
Power Unit PE-103-A
Generator GN-45-( )

Ref.: Supply Letter No. 151 (1942)

AUDIO HOWL IN RECEIVERS BELOW SERIAL NO. 3501

1. Dicsonnect blue wire from plate lug (pin 3) of 2-V-6.
2. Pull from cable. Reuse if not damaged.
3. Relocate as far as possible from cable and No. 8 terminal of AVC switch.
4. Reconnect and check receiver performance.

Ref.: Maintenance Letter No. 9 (1943)

BREAKING OF CONDUCTORS IN CORD CD-501-A

Due to insufficient clamping action of the cable connector clamps, it may be found that the cable is free to turn. Wrap a few layers of friction tape around the portion of the cable under the clamp, being sure to leave the sheath grounding tab outside the tape for grounding.

Ref.: Maintenance Letter No. 22 (1943)

SPECIAL NOTES

MOISTURE PROTECTION

A waterproof canvas cover to protect BC-654-A has been added to the parts list of SCR-284-A. Organizations having Radio Sets SCR-284-A which lack Cover, BG-154, Stock No. 2Z3400-154, should requistion them in the usual manner. This cover is not removed when the equipment is in operation.

Refer also to PE-103-A in this manual for information on a protective cover for that unit.

Ref: Supply Letter No. 179 (1943)

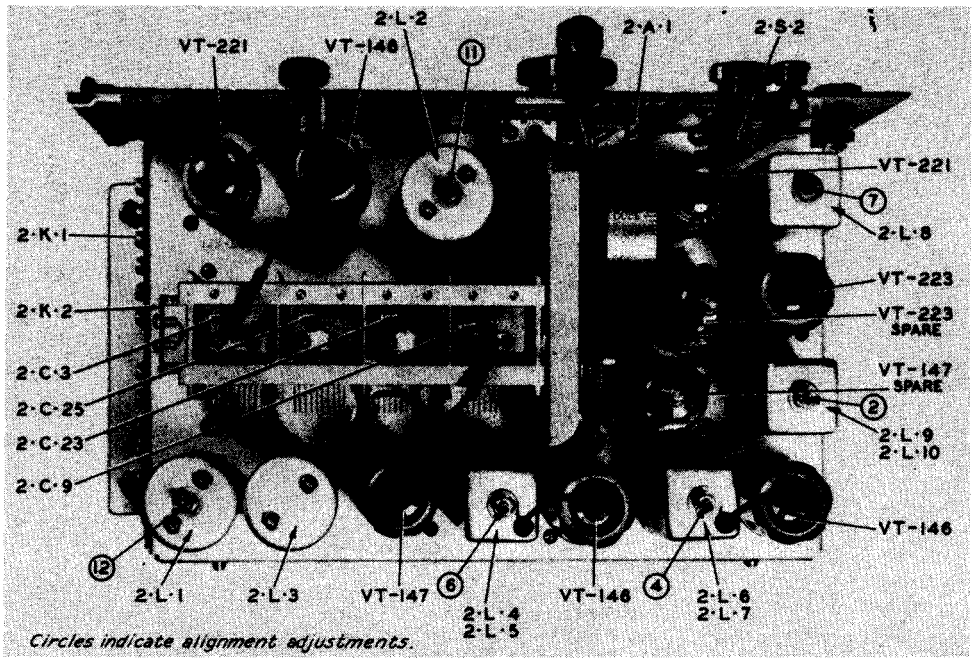


Fig. 2.—Receiver chassis, top.

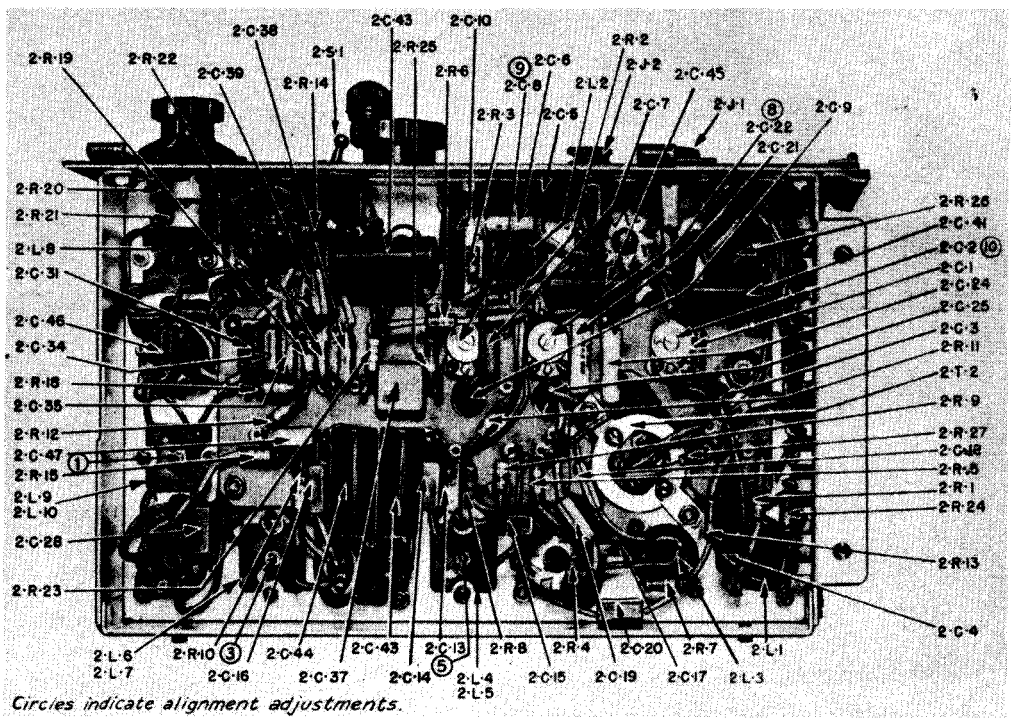
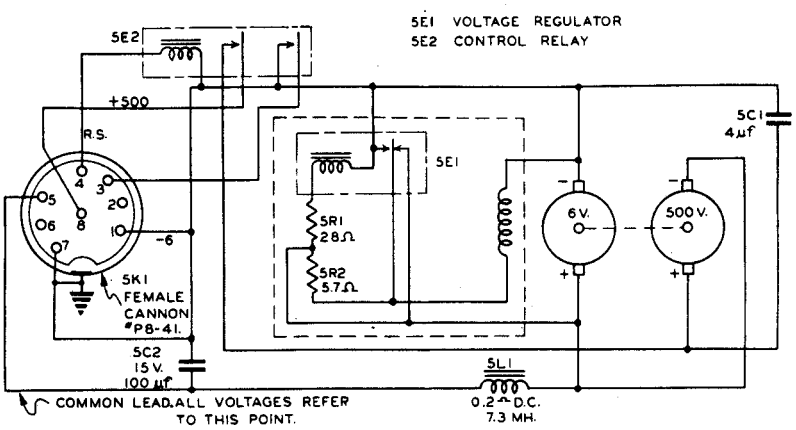


Fig. 3.—Receiver chassis, bottom.

SPECIAL NOTES

DISASSEMBLY OF TRANSMITTER AND RECEIVER

1. Remove front cover and battery (or PE-104-A).
2. Loosen the six knurled panel nuts and withdraw the set from the case.
3. Remove receiver antenna lead connector plug from jack on keying relay shelf and tilt receiver forward.
4. Disconnect bonding strap and lever arm. Disengage hinges by sliding receiver to the left.
5. Loosen wiring harness from its two supports at the side of the battery compartment.
6. Remove one screw from the left side of the receiver chassis and two from the right. Receiver may now be lifted free.



Schematic—Generator GN-45-A.

TRANSMITTER VOLTAGE MEASUREMENTS

Reference point for all voltage measurements is terminal No. 10 (+6v) of terminal strip 2-K-1.

Readings taken using fully charged 12v battery with transmitter adjusted to feed 1 amp into dummy antenna (when STANDBY sw is at HIGH).

Interlock switches behind battery door and at rear of chassis closed by temporary means.

Readings may vary 10 to 15% from those shown.

A suitable dummy antenna is a 6 foot length of Field Wire W-110-B connected to ANTENNA and GROUND posts at one end and with the other end shorted by twisting the bared conductors together. To reduce radiation it is advisable to roll the field wire into a small coil. Set ANTENNA SELECTOR at position 4 and adjust ANTENNA COUPLING until ANTENNA CURRENT meter reads 1 amp with ANTENNA TUNING at resonance and STANDBY sw at HIGH.

Grid and Plate voltages measured with 1000 ohms/volt meter

Voltage Measured		VOICE LOW	VOICE HIGH	CW LOW	CW HIGH	Where Measured
1-V-1	Plate & Screen	84	84	84	84	Center tap of Coil 1-L-1
1-V-2	Plate	115	115	115	115	Junction of 1-L-3 and 1-R-20
	Grid	-10	-10	-10	-10	Junction of 1-R-14 and 1-R-16
	Screen	Approximately 95v				Socket lug #4
1-V-3 and 1-V-4	Plate	520	510	525	515	Junction of 1-L-6 and 1-C-43
	Grid	-50	-50	-50	-50	Junction of 1-L-5 and 1-R-14
	Screen	Approximately 200v*				Socket lug #2
	Suppr.	-50	-48	0	0	Socket lug #4
1-V-5	Plate	85	80	0	0	Junction of 1-R-5 and 1-R-24
	Screen	Approx 75v		0	0	Socket lug #4
1-V-6	Plate & Screen	83	83	83	83	Junction of 1-L-2 and 1-C-22

Grid Voltages measured with VTVM (Volt-ohmyst)

1-V-1	Grid	-22	-20	-22	-20	Socket lug #5
1-V-2	Grid	-23	-20	-23	-20	Socket lug #5
1-V-3 1-V-4	Grid Grid	-53	-50	-53	-50	Socket lug #3
1-V-5	Grid	-5	-6	-6	-5	Socket lug #5
1-V-6	Grid	-1.5 -30 with CRYSTAL sw out	-1.5	-1.5	-1.5	Socket lug #5

* Subject to wide variations.

TRANSMITTER RESISTANCE MEASUREMENTS

From Socket	From Pin No.	To Socket or connector	To Pin No.	Resistance ohms	Remarks
1-V-1	3 & 4	1-V-4	5	32000	
	5	1-V-4	5	1 meg	
1-V-2	3	1-K-3	8*	31000	
	4	1-V-4	5	37500	
	4	1-K-3	8*	45000	
	5	1-V-4	5	1 meg	
1-V-3 or 1-V-4	2	1-K-3	8*	36500$	Relay 1-E-1 closed by hand.
	2	1-K-2	8	470000	MAIN SWITCH at CW or VOICE.
	3	1-V-4	5	44000	Check No. 3 pin of *both* sockets.
	4	1-K-2	8	2100	MAIN SWITCH at VOICE.
	4	1-K-3	5	1000	MAIN SWITCH at CW; rear interlock closed
1-V-5	3	1-K-3	8*	41000	MAIN SWITCH at CW or VOICE.
	4	1-V-5	3	5300	
	4	1-V-4	5	47000	

Cord, mic, key, headset disconnected.

Transmitter tubes and rec battery removed.

Switch positions unless otherwise noted are:
STANDBY at OFF
MAIN at OFF
CRYSTAL at OFF

$ May be 56000 or 61000 in some sets.
Values of 1-R-25 and 1-R-26 differ.

* Indicates +500 volt pin which may be No. 3 in some sets. See page 2.

TRANSMITTER ALIGNMENT AND NEUTRALIZATION

1. Calibrate the master oscillator against the crystal before aligning. To conserve battery BA-43 it is recommended that PE-104-A be installed in the battery compartment during the alignment and neutralizing operation.

2. Remove the power cord and the crystal. In order to remove the crystal from its socket it will be necessary to loosen the spare tube socket that is mounted directly above on the electrolytic capacitor and slide it around out of the way.

3. Since the crystal-oscillator circuit is to be used as a vacuum-tube voltmeter, it is necessary to light the filament of the tube without having to pull the CRYSTAL switch out. This is done by connecting a piece of wire between points 5T and 6T of the CRYSTAL switch, 1-S-2.

4. Remove the red wire 5-1-C-43 from post 1. Open the circuit between points 7 and 8 on junction block 3. These two operations remove the plate voltage from the intermediate and final power amplifiers.

5. Connect a piece of wire from pin 2 of the crystal socket 1-A-1 to the jack marked R X 100 in the lower right-hand corner of the Weston type 3-C voltohmmeter, and a piece of wire from pin 4 of the crystal socket to the jack marked R X 1000 in the lower right-hand corner of the same instrument. Place the toggle switch of the voltohmmeter in the RES position.

   NOTE: If the voltohmmeter available is the Triplett type 666-SC, a component part of the test set 1-56-C, connect the two wires to the two jacks marked V- and V+Ω in the lower left-hand corner of the instrument. Turn the selector switch to the position marked 1 Meg Ω. Any d-c vacuum-tube voltmeter, as the Voltohmyst, may be used in place of the voltohmmeter in this method of neutralization.

6. Connect a length of wire from xtal osc plate (point 6 of junction block 4) to the caps (plates) of the final power-amplifier tubes VT-225. This provides an input lead for the crystal-oscillator circuit which now serves as a vacuum-tube voltmeter.

7. Set the transmitter TUNING dial for the reading corresponding to a frequency of 5000 kilocycles. Place the ANTENNA SELECTOR switch in position 1, and the ANTENNA COUPLING control at 50. Plug the key into its jack and lock it in a closed position. Make certain that the interlock switches 1-S-5 and 1-S-6 are still closed.

8. Plug the power cord into its socket on the transmitter. Place the MAIN SWITCH in the CW position and the STANDBY SWITCH in the HIGH position.

9. Adjust the intermediate-amplifier neutralizing capacitor 1-C-17 for approximately one-third scale deflection on the meter.

10. Adjust the intermediate power-amplifier trimmer capacitor 1-C-32 for *maximum* deflection on the meter. This tunes the intermediate power amplifier tank circuit to resonance with the master-oscillator frequency.

11. Adjust the capacitor 1-C-17 for *minimum* reading on the meter. At this point the intermediate power amplifier is neutralized.

12. To tune and neutralize the final power amplifier turn the MAIN SWITCH to the OFF position and remove the power cord from the transmitter.

13. Reconnect points 7 and 8 on junction block 3 to restore plate voltage to the intermediate power amplifier.

14. Disconnect the wire that was connected to the plate caps of the final power-amplifier tubes and connect it to the antenna post.

15. Place the power cord in its socket on the transmitter. Turn the MAIN SWITCH to the CW position and adjust the ANTENNA TUNING control for *maximum* reading on the meter.

16. Adjust the final power-amplifier trimmer 1-C-40 for *maximum* reading on the meter. This tunes the final power-amplifier tank circuit to resonance.

17. Adjust the final power-amplifier neutralizing capacitor 1-C-39 for *minimum* reading on the meter.

18. Turn the MAIN SWITCH to the OFF position, the STANDBY SWITCH to the OFF position, and remove the power cord from the transmitter.

19. Replace the red wire 5-1-C-43 on post 1. Remove the wire that was connected to point 6 of junction block 4. Remove both wires that connect the meter to the crystal socket 1-A-1. Remove the connection between points 5T and 6T of the CRYSTAL SWITCH 1-S-2, and replace the crystal.

20. Mount the receiver on the transmitter and replace the brace. Replace the bonding strap.

COMMON FAULTS AND CORRECTIVE MEASURES

See page 2 — ARCING IN POWER CORD CONNECTORS and BREAKING OF CONDUCTORS IN CORD CD-501-A

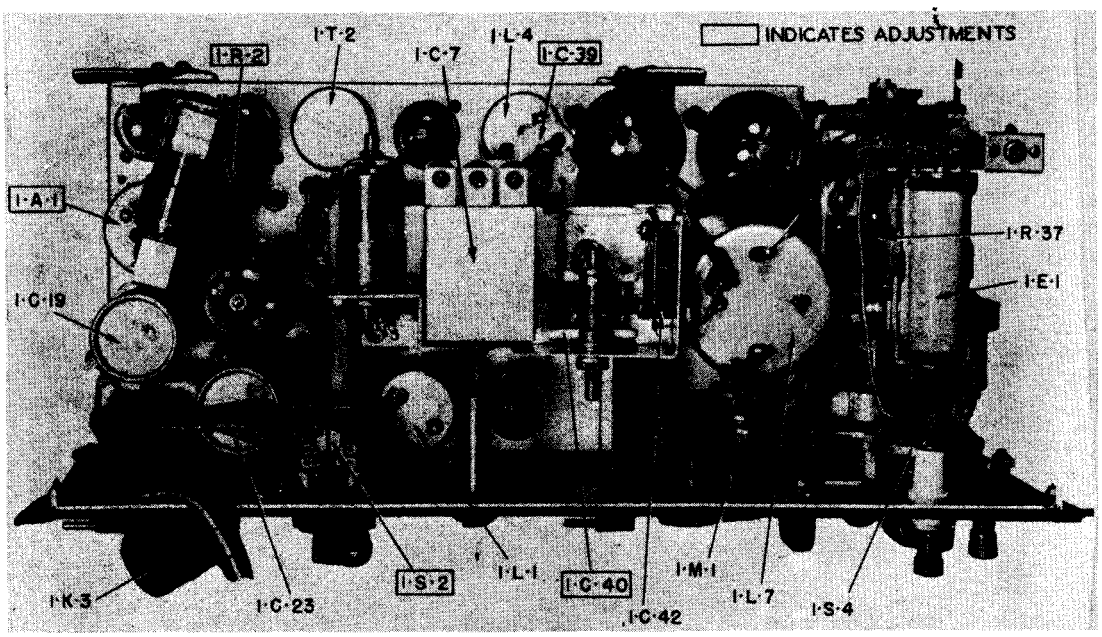


Fig. 4.—Transmitter chassis, top.

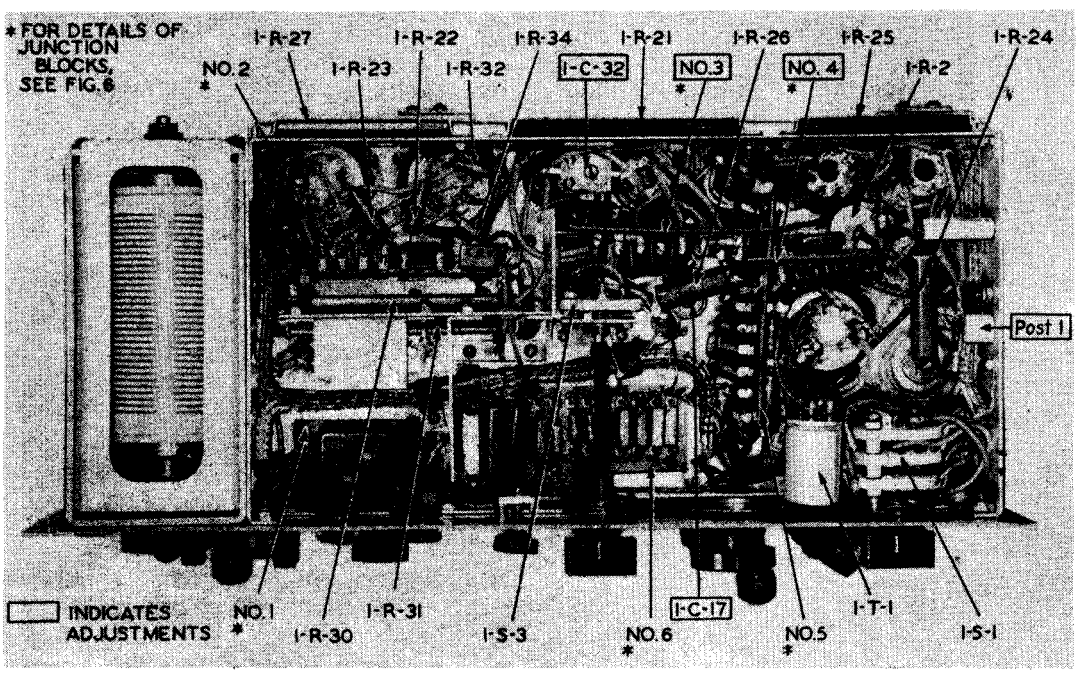


Fig. 5.—Transmitter chassis, bottom.

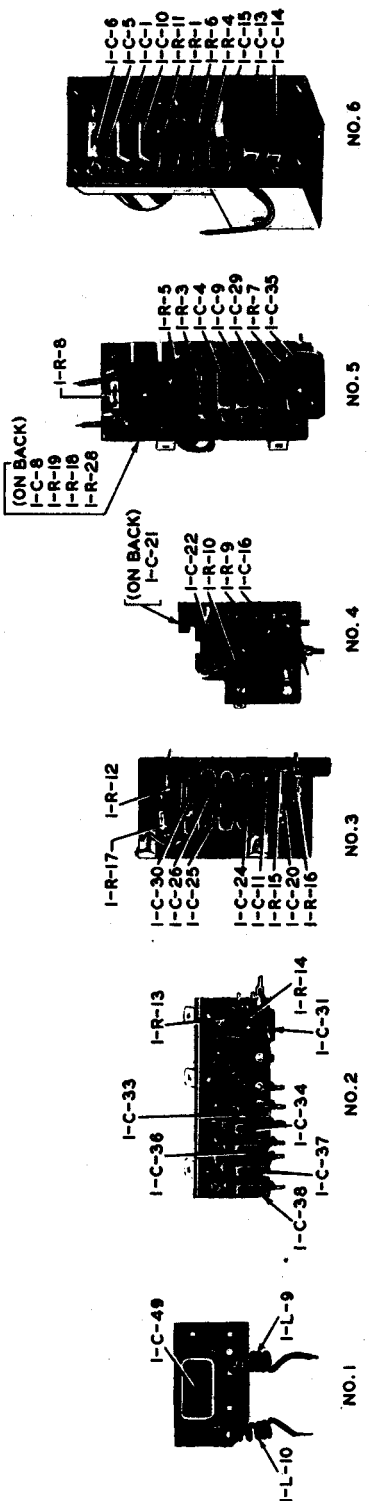


Fig. 6.—Transmitter junction blocks.

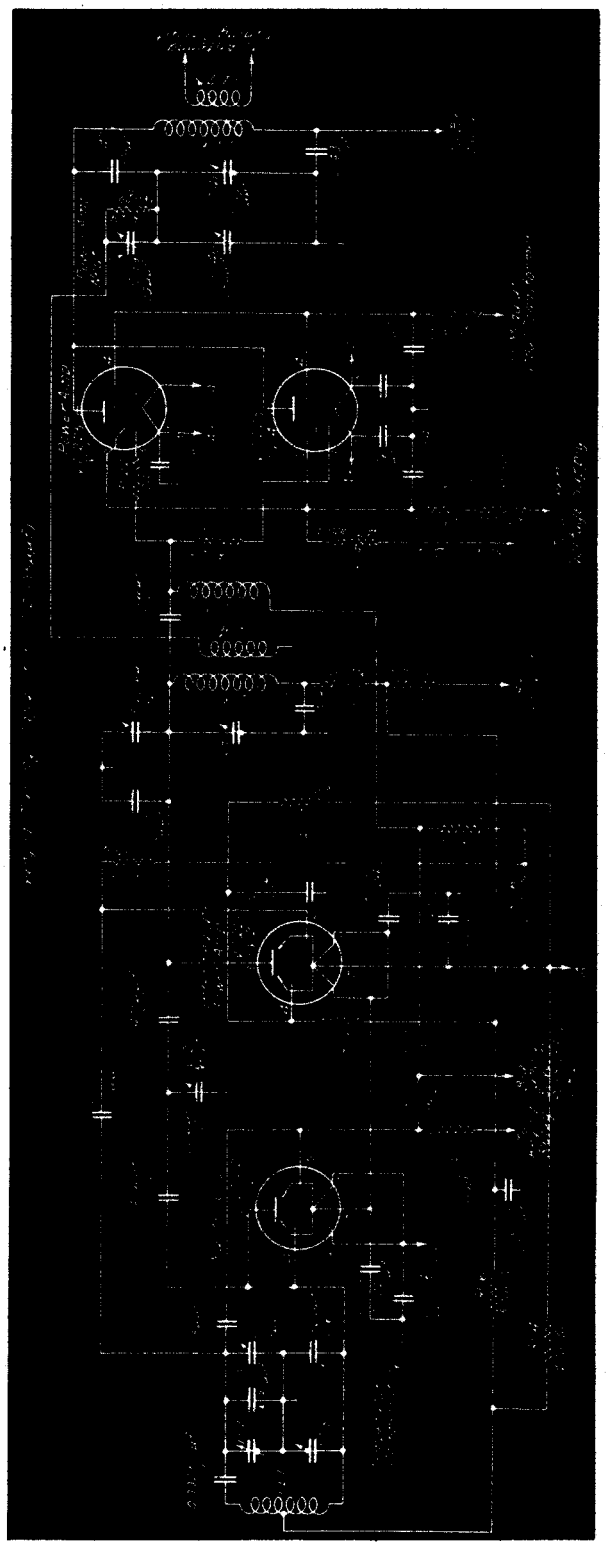
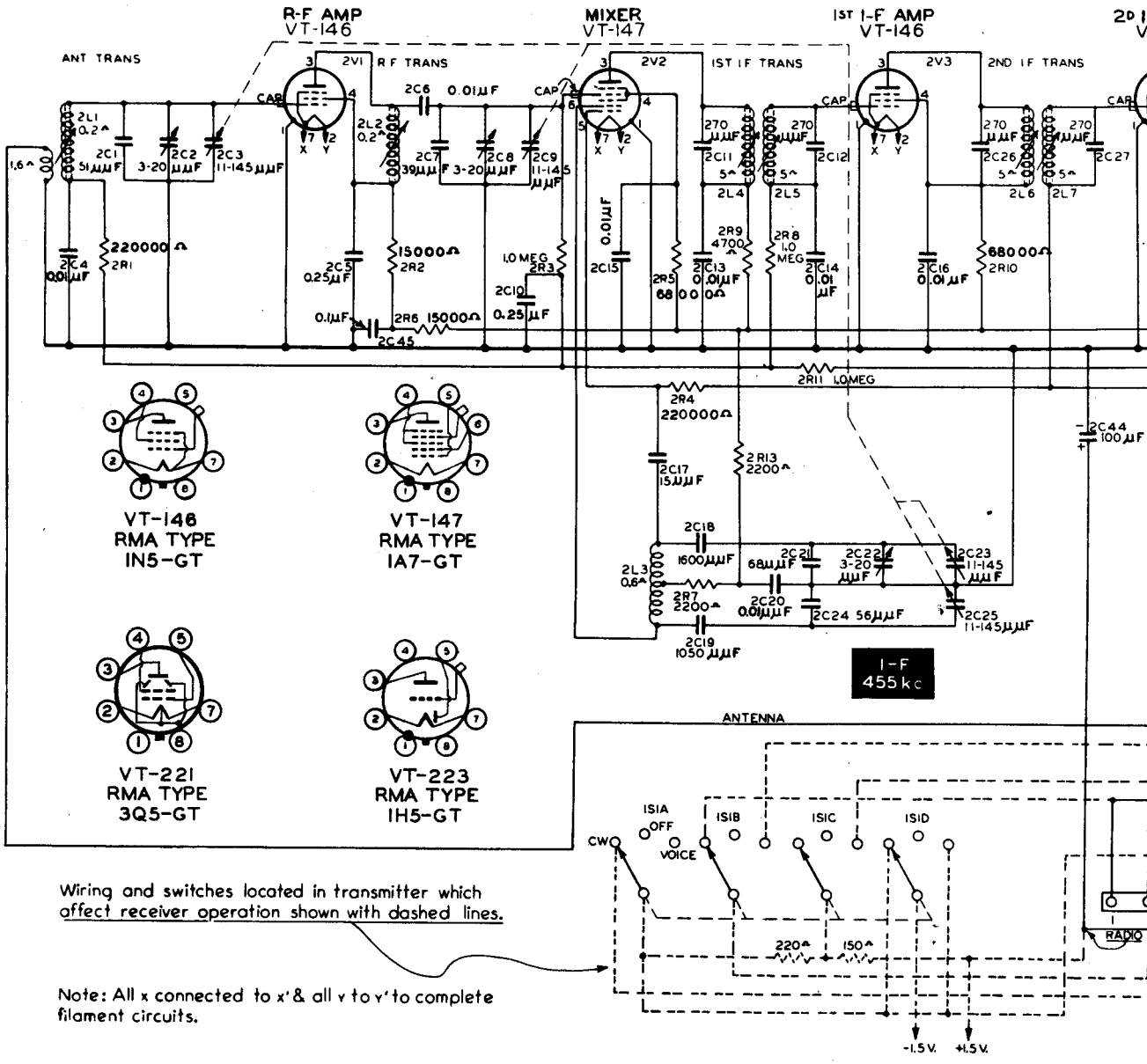


Fig. 7.—Transmitter functional diagram.

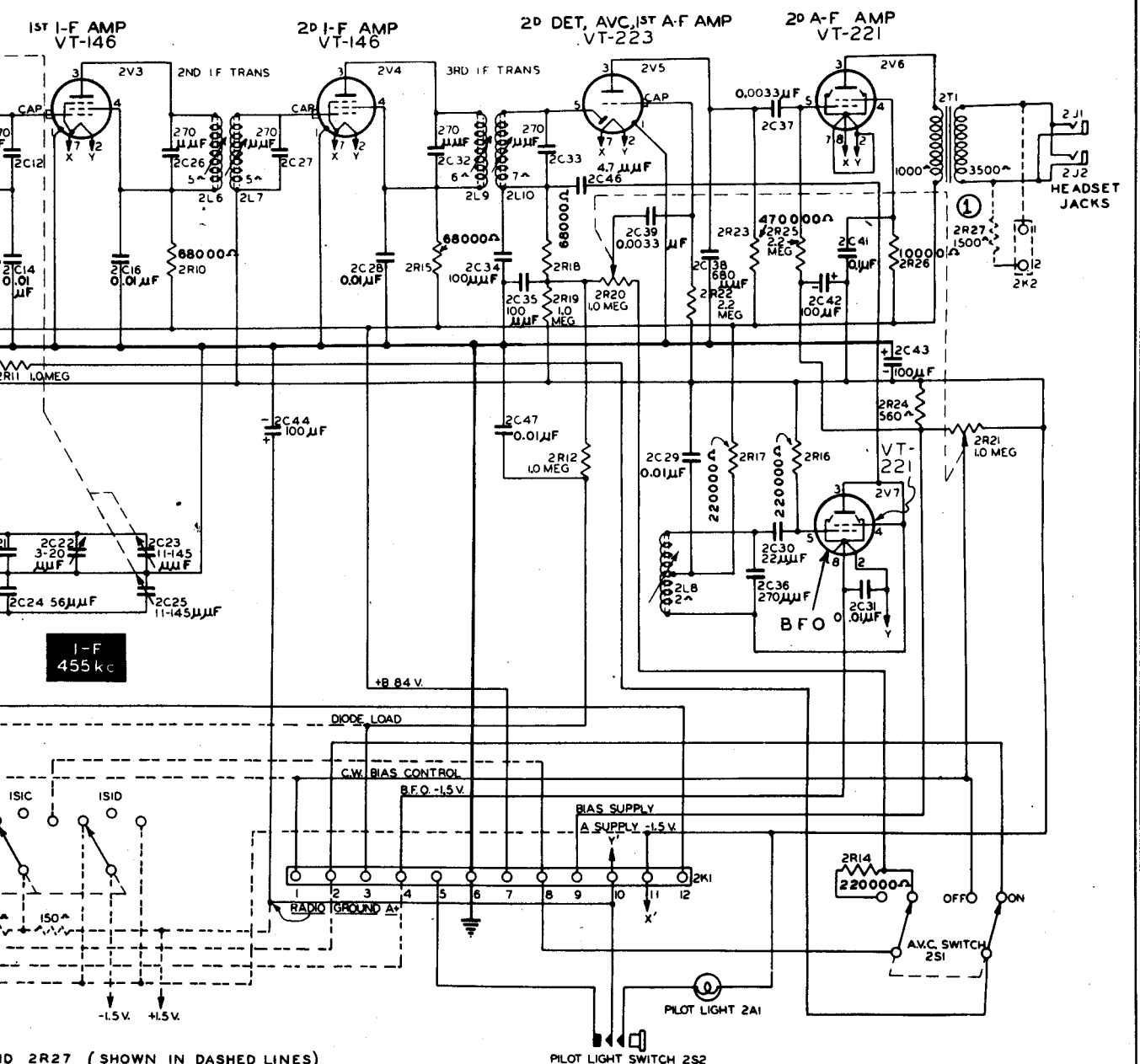


Wiring and switches located in transmitter which affect receiver operation shown with dashed lines.

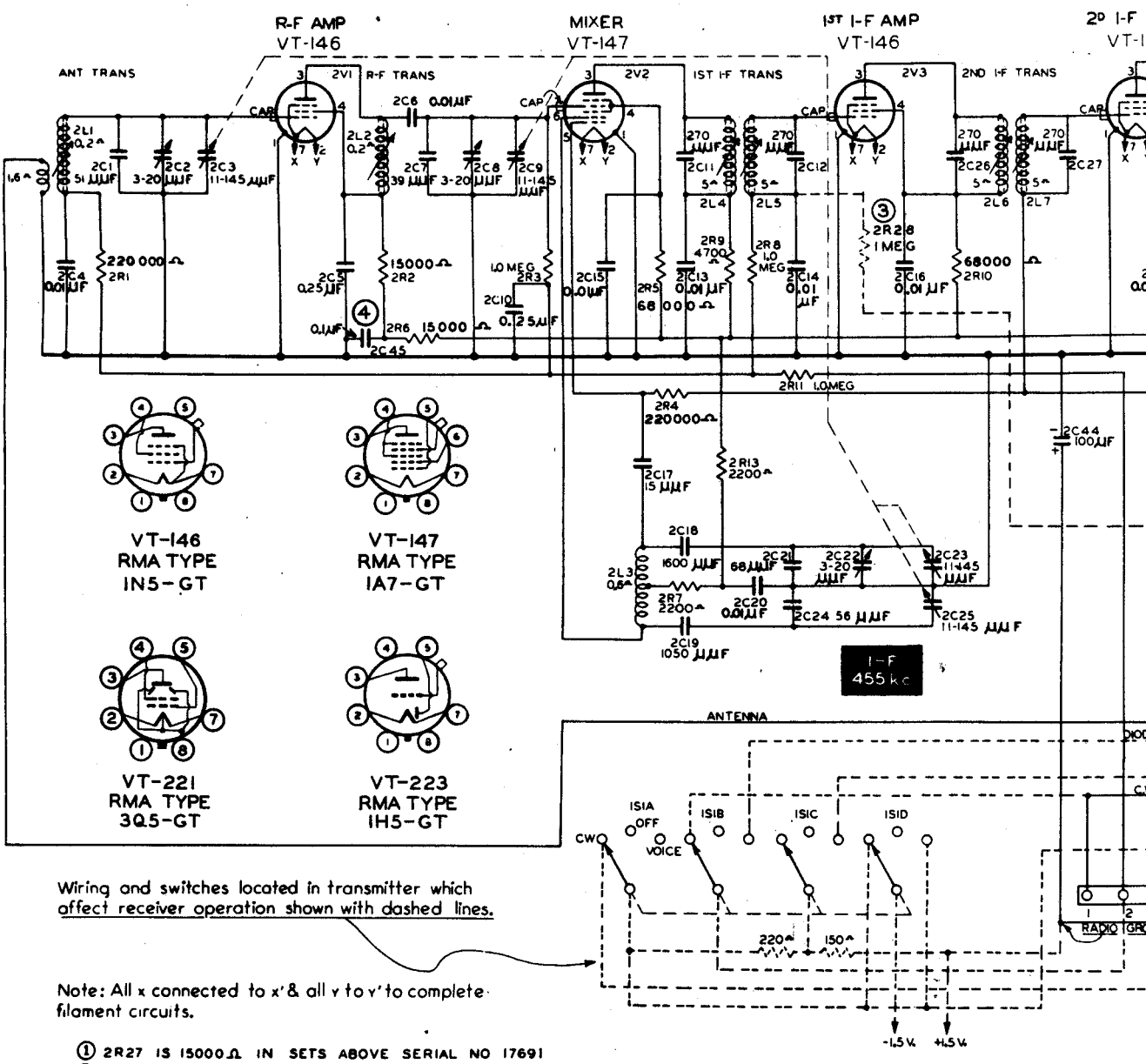
Note: All x connected to x' & all y to y' to complete filament circuits.

(1) SETS ABOVE SERIAL NO 3500 HAVE ADDITIONAL CIRCUIT ELEMENTS 2K2 AND 2R27 (SHOWN IN DASHED LINES)

Fig. 8.—Receiver schematic—Sets serial Nos. 1



eceiver schematic—Sets serial Nos. 1 to 9500 incl.

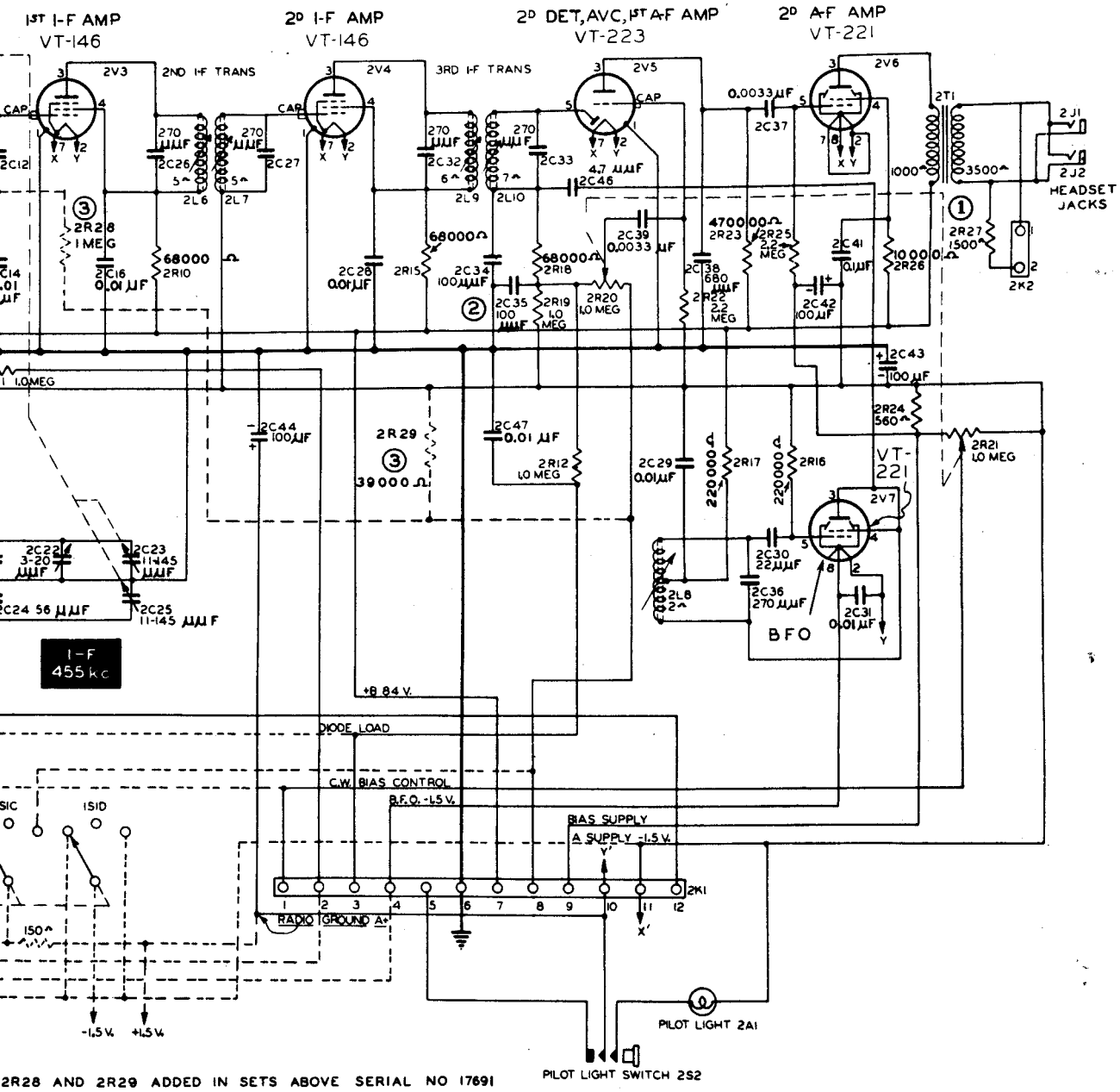


Wiring and switches located in transmitter which affect receiver operation shown with dashed lines.

Note: All x connected to x' & all y to y' to complete filament circuits.

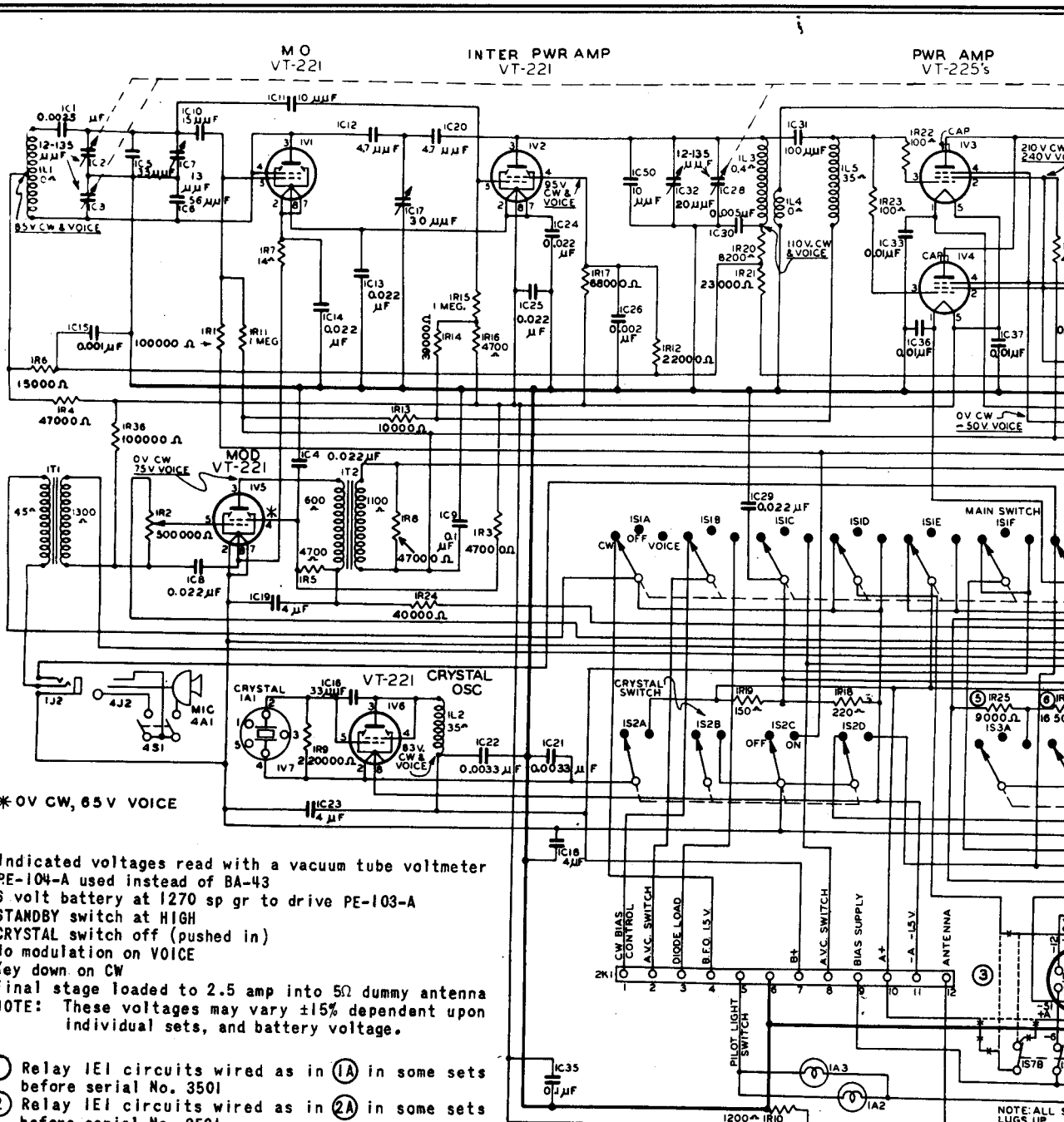
① 2R27 IS 15000Ω IN SETS ABOVE SERIAL NO 17691
② 2C35 IS 680 μμF IN SETS ABOVE SERIAL NO 17691
③ AVC CIRCUIT MODIFIED AS SHOWN BY DASHED LINES AND ADDITIONAL PARTS 2R28 AND 2R29 ADDED IN SETS ABOVE
④ 2C45 IS 12μf IN SETS ABOVE SERIAL NO. 24733

Fig. 9.—Receiver schematic—Sets serial Nos. 9501



2R28 AND 2R29 ADDED IN SETS ABOVE SERIAL NO 17691

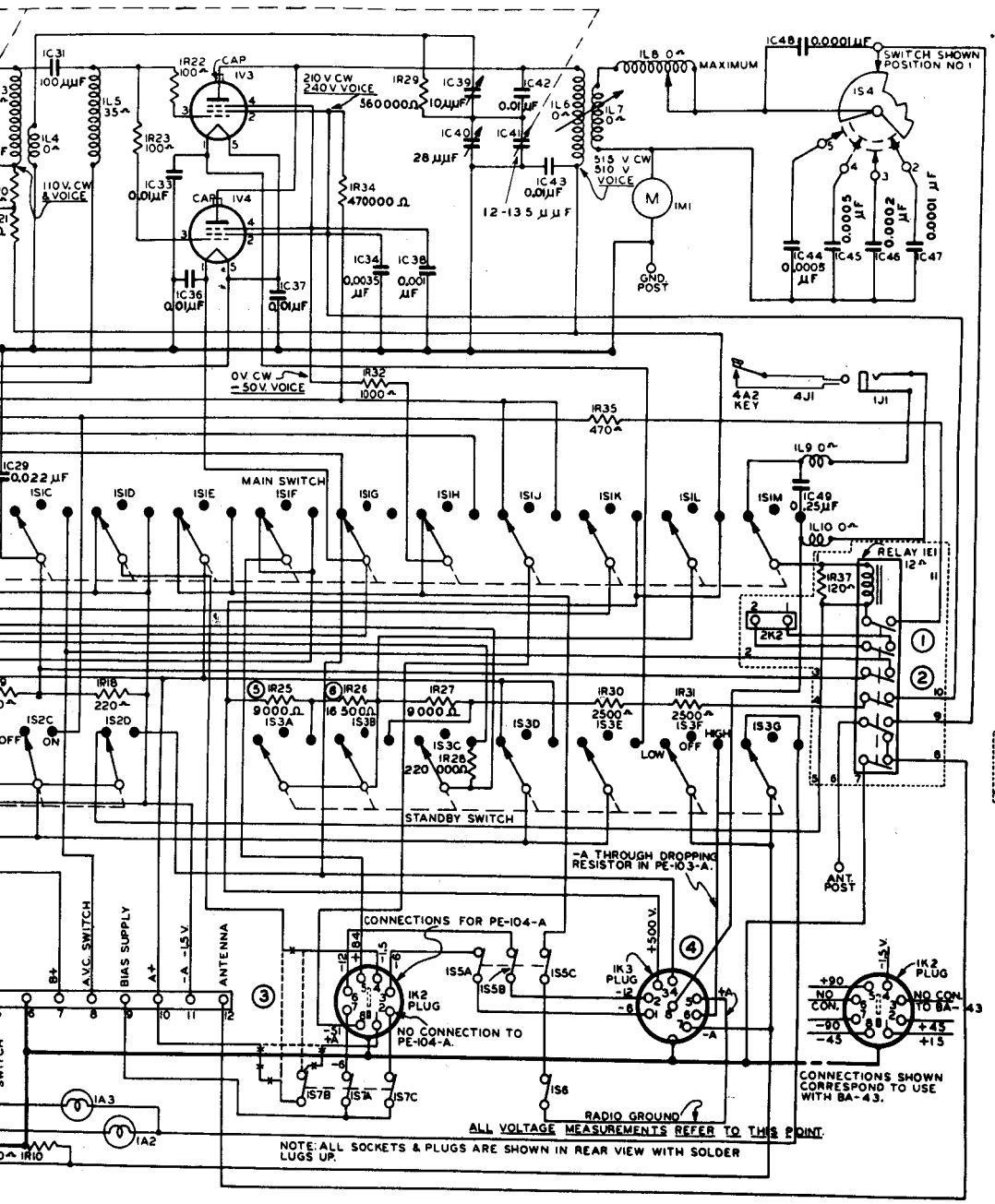
ver schematic—Sets serial Nos. 9501 and above.

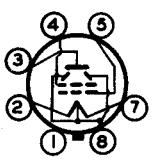


Indicated voltages read with a vacuum tube voltmeter PE-104-A used instead of BA-43
6 volt battery at 1270 sp gr to drive PE-103-A
STANDBY switch at HIGH
CRYSTAL switch off (pushed in)
No modulation on VOICE
Key down on CW
Final stage loaded to 2.5 amp into 5Ω dummy antenna
NOTE: These voltages may vary ±15% dependent upon individual sets, and battery voltage.

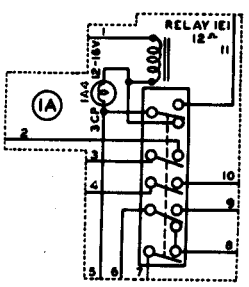
(1) Relay 1E1 circuits wired as in (1A) in some sets before serial No. 3501
(2) Relay 1E1 circuits wired as in (2A) in some sets before serial No. 3501
(3) Interlock 1S7B wiring changed in sets after serial No. 3500. (Dashed lines indicate new wiring, ~~x x x~~ indicates old wiring.)
(4) Connections to pins 3 and 8 of connector 1K3 reversed on sets after serial No. 9500. (Old circuit shown.)
(5) 1R25 is 16000Ω in some sets.
(6) 1R26 is 39000Ω in some sets.

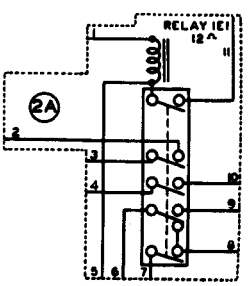
Fig. 10.—Transmitter schematic—Sets serial Nos

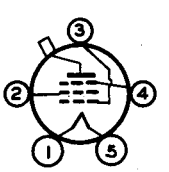




VT-221
RMA TYPE
3Q5-GT

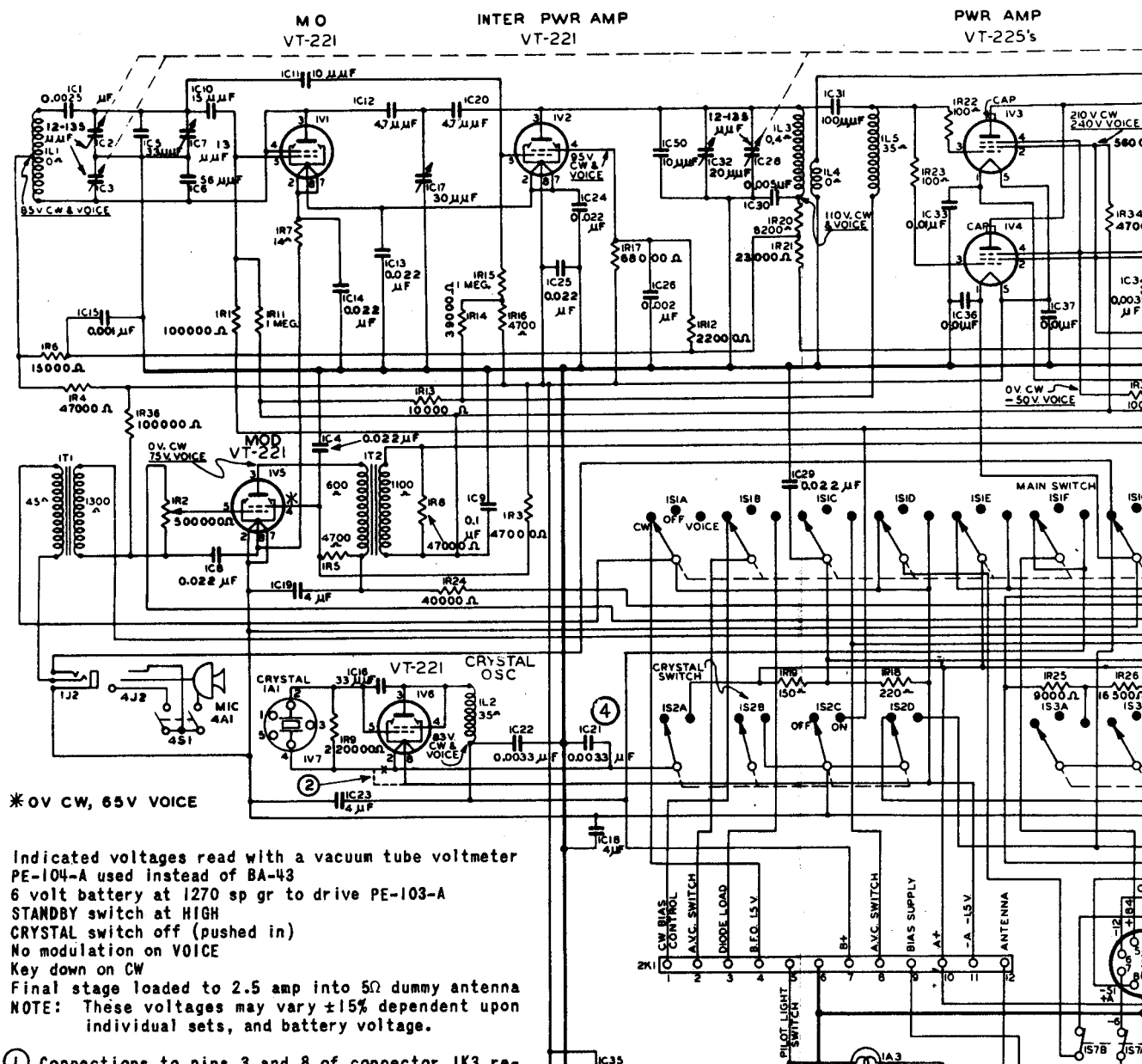






VT-225
RMA TYPE
307-A

ansmitter schematic—Sets serial Nos. 1 to 9500 incl.

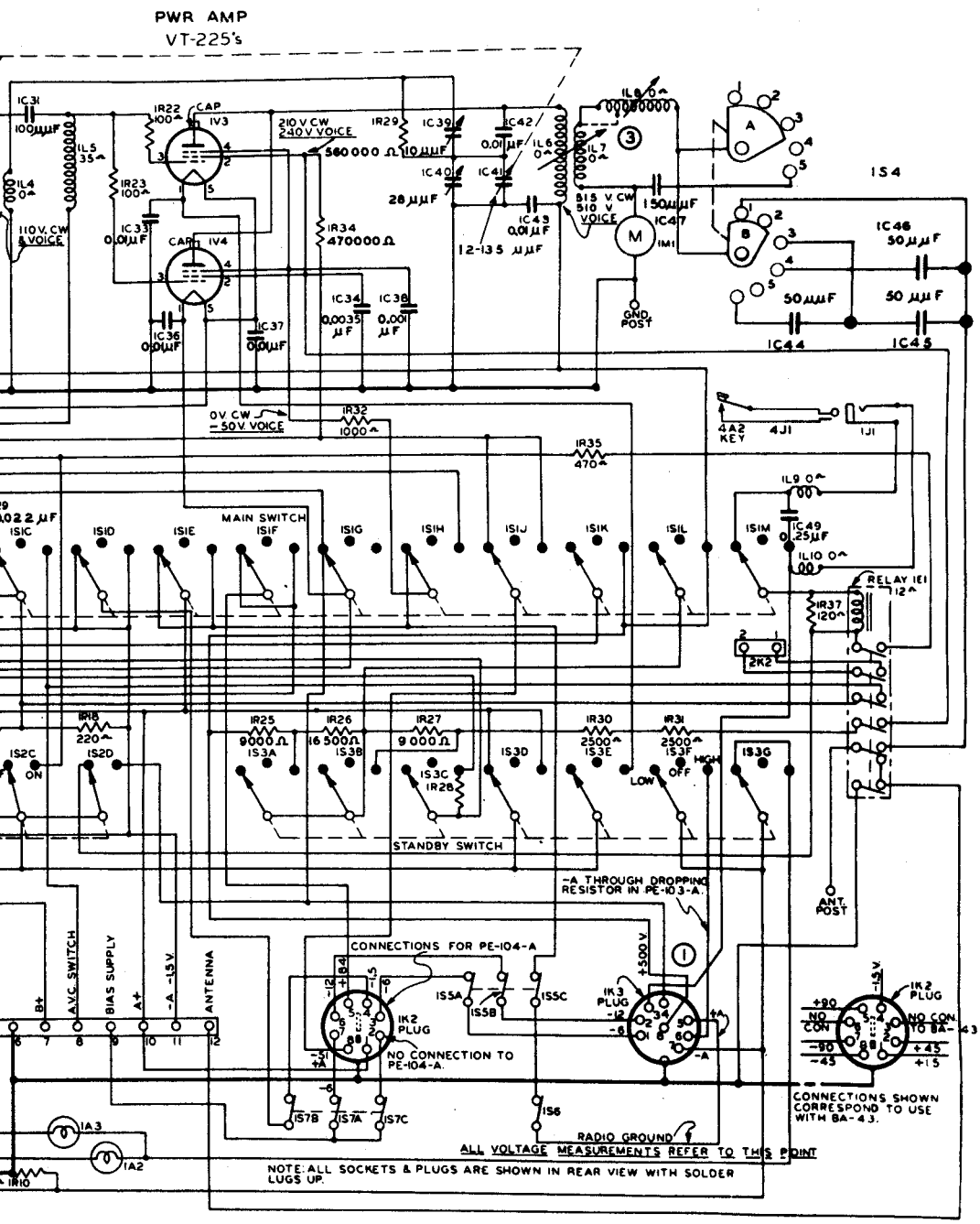


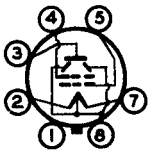
*0V CW, 65V VOICE

Indicated voltages read with a vacuum tube voltmeter PE-104-A used instead of BA-43
6 volt battery at 1270 sp gr to drive PE-103-A
STANDBY switch at HIGH
CRYSTAL switch off (pushed in)
No modulation on VOICE
Key down on CW
Final stage loaded to 2.5 amp into 5Ω dummy antenna
NOTE: These voltages may vary ±15% dependent upon individual sets, and battery voltage.

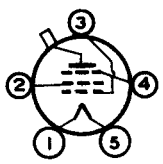
(1) Connections to pins 3 and 8 of connector 1K3 reversed on sets with serial Nos. below 9500.
(2) Crystal return changed from pin 2 to pin 8 of tube 1V6 on sets above serial No. 13000.
(3) Connections to Coil 1L8 changed as shown in dashed lines on sets above serial No. 13000.
(4) 1C21 is 0.1 μf in sets above serial No. 19819

Fig. 11.—Transmitter schematic—Sets serial Nos. 95





VT-221
RMA TYPE
3Q5-GT



VT-225
RMA TYPE
307-A

itter schematic—Sets serial Nos. 9501 and above.