of figure 35, the typical causes for trouble can be checked easily.

b. Tracing to a component is accomplished by starting at the power supply filter capacitors, C192 and C193. When a reading of only a few hundred ohms is found, there is probably trouble in the power supply capacitors. By switching the RECEIVE-SEND switch, S6, on and off, the location of the trouble may be verified further. With the switch in the RECEIVE position (closed), the screen grid circuits of several tubes are connected to the point of measurement. If the short indication disappears when S6 is in the SEND position (open), the short is not in the power supply but in one of the screen grid circuits.

c. Only one position of the turret is shown connected in the schematic diagrams; however, they are similar in construction except for minor differences. When a short circuit is found on only one band, the trouble probably will be traced to the turret. The coupling and bypass capacitors in the inoperative band will have to be checked using the over-all schematic diagram (fig. 43).

d. Sometimes the coupling capacitors become leaky (high resistance short) and place a positive voltage on the grid of the following tube. These capacitors should be measured with the highest resistance scale of the ohmmeter.

67. Agc Checking

A short circuit of one of the agc bypass capacitors could cause loss of agc action and poor control of the RF GAIN-AC control. Figure 30 shows a simplified circuit of the agc distribution. A shorted capacitor will prevent any change in voltage between ground (B—) and the control grid of the tube that it bypasses. This allows the tube to operate at maximum gain and could cause serious overloading.

68. Operational Test

The operational test consists of actually using the radio receiver to pick up signals. Try using all the controls. Select different bands, tune across them, and listen for noise and signals. Tune in a c-w signal and turn on the bfo to see whether an audio note is produced. Refer to the equipment performance checklist (par. 37) to check for the general location of the trouble that might be encountered.

69. Trouble-Shooting Chart

The following chart is supplied as an aid in locating trouble in the radio receiver. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. *The chart also indicates how to localize trouble quickly to the audio, i-f, or r-f stage of the receiver.* The signal substitution tests outlined in paragraphs 72, 73, 74, and 75 can then be used to supplement this procedure and to determine the defective stage. After the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defec-

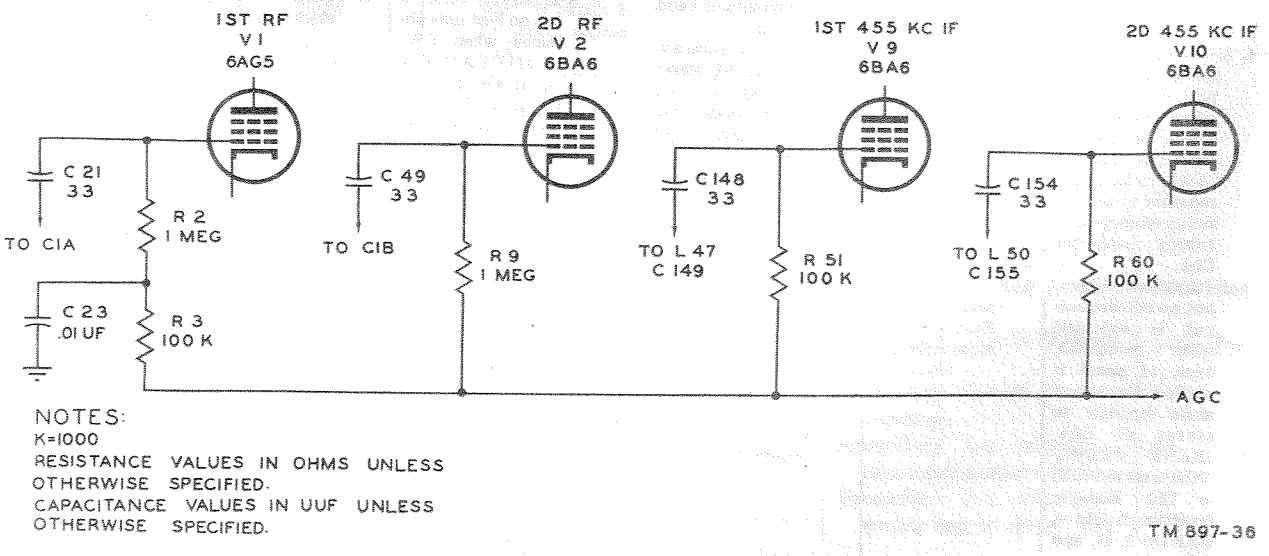

Figure 30. Radio Receiver R–274/FRR, agc and bias voltage distribution.

tive parts. Normal voltage and resistance measurements are given in figure 35.

69. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
1. RF GAIN-AC switch turned fully clockwise. Receiver fails to operate and dial lamps do not light.	1. Open fuse F1 on rear of receiver.	1. Replace fuse. If it blows again, check filter capacitors C192A, C192B, C193, and C194A.
	Connecting leads to fuseholder broken.	Repair leads.
	Power transformer T34 primary tap connection incorrect or poorly made.	Set tap to correct voltage position. Tighten tap connection.
2. No receiver output. With AGC-MANUAL switch at AGC, and RF GAIN-AC control at 10, CARRIER LEVEL meter dips and rises as TUNING dial is rotated.	2. Defect exists between detector and a-f output stages.	2. Use headphones, with .1-uf capacitor in series with one lead, across grid and plate circuits of successive audio stages to localize defective stage. Test tube in this stage, and then, if necessary, make voltage and resistance measurements to locate defective part. An alternate method is to use signal substitution in audio stages (par. 72).
3. Receiver inoperative. CARRIER LEVEL meter does not deflect as receiver is tuned. Dial lamps light.	3. Open filament regulator tube R80.	3. Replace filament regulator tube R80.
	Failure of B+ supply.	Check rectifier tube V-8. Remove bottom dust color and check voltage across capacitor C193. If voltage is low, or zero, check for leaky or shorted filter capacitors C192A, C192B, C193A, and C193B.
	Defect exists between antenna terminal and detector stage.	See symptoms 4 and 5 below.
4. A-f circuit satisfactory but no receiver output is obtained when modulated, 455-kc, i-f signal is applied through a .01-uf (microfarad) capacitor to the top stator connection of tuning capacitor C2A.	4. Faulty i-f stage.	4. Use signal substitution in i-f stages (par. 74) to locate defective stage. Test tubes and make tube socket voltage and resistance tests.
5. A-f circuit satisfactory, but no receiver output is obtained when modulated, 6-mc, i-f signal is applied through a series capacitor to stator of C2A. (BAND SELECTOR is set to IV, V, or VI.) Receiver functions all right on BANDS I, II, and III.	5. Faulty 6.455-mc oscillator V8. Faulty 2d mixer stage V7.	5. Test tube. Replace 6.455-mc crystal. Use signal substitution in i-f stages (par. 74). Test tube. Make tube socket voltage and resistance tests. Refer to chapter 5.
	Failure of i-f switch-over relay K1.	Test continuity of relay coil. If it is open, replace the relay. Check turret contacts. Clean them if necessary. Check relays for poor contacts.
6. A-f and i-f circuits satisfactory but no output is obtained when r-f modulated signal is applied to antenna terminals and receiver is tuned to this signal.	6. Faulty r-f stage.	6. Use signal substitution in r-f stages (par. 75) to locate defective stage and the faulty component.
7. A-f and i-f circuits satisfactory but no output is obtained when r-f modulated signal is applied to antenna terminals and receiver is tuned to this signal. Receiver operates normally when VFO-CRYSTAL switch is in a CRYSTAL position but not in the VFO position.	7. Faulty vfo oscillator stage V4.	7. Test tube V4. Make tube socket voltage and resistance tests.
8. A-f and i-f circuits satisfactory, but no output is obtained when r-f modulated signal is applied to antenna terminals and when receiver is tuned to this signal. Receiver operates normally when VFO CRYSTAL switch is in VFO position but not in a CRYSTAL position.	8. Faulty crystal oscillator stage V5.	8. Test tube V5. Check six crystal positions; if only one does not work, replace that crystal. Make tube socket voltage and resistance tests.
9. A-m signals received but no beat note obtained when CW-MODULATION signal switch is turned to CW. Beat note heard when i-f c-w signal is applied to terminal 1 of V11.	9. Defective bfo stage V14.	9. Test V14 and its tueb socket resistances and voltages. Check adjustment of BFO INJ. control R82.
10. Reception weak. With no signal tuned in, roaring noise is not heard when AUDIO GAIN and RF GAIN-AC controls are turned to maximum setting and SELECTIVITY switch is at NORMAL MED. With a signal tuned in, CARRIER LEVEL meter does not rise to customary peaks for reception of known stations.	10. Weak tubes.	10. Check tubes.
	Low plate or screen voltage due to shorted capacitor in plate or screen return circuit.	Check voltages and make resistance checks.
	Receiver not properly alined.	Realine receiver.

69. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
11. No control of gain	11. Shorted or leaky agc capacitor.	11. Make resistance check of each agc capacitor. Replace defective capacitor.
12. Reception distorted	12. Open grid resistor or leaky capacitor in audio circuits (especially when AUDIO GAIN control is turned past 2).	12. Use headset, with .1-uf capacitor in series with one lead to localize faulty stage. Check grid circuit for positive grid voltage.
13. Noisy and fading reception.	13. Faulty gain controls. Faulty antenna circuit	13. Check for dirty controls R83 and R94. Check antenna installations for leakage paths to ground and for loose connections.
14. Objectionable hum in output.	14. Leaky or open filter capacitors in power supply unit.	14. Check each capacitor by disconnecting positive lead from each section and charging each, then discharging by shorting to chassis with screw driver, the handle of which is insulated from the blade. Capacitors which do not seem to store sufficient charge, as indicated by size of discharge spark, may be faulty. Check by connecting new equivalent capacitor for comparison.
	Shorted turns in power supply choke. Short between winding and core in filter choke.	Check for shorted turns by measuring resistance of L61. Check for open circuit between filter choke terminal and case. If circuit is not open, replace choke.
15. Intermittent noise	15. Defective tube, resistor, or capacitor.	15. With an insulated probe, gently tap and slightly move all tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or loose connections to any component.
16. Oscillation (indicated by whistle or howl).	16. Defective tube, poor shielding, interstage coupling, or high-resistance soldered-chassis return.	16. Check tubes and shunt bypass capacitors with capacitors of equal value.
17. Selectivity not sharp in any of crystal position of SELECTIVITY switch.	17. Defective crystal or circuit component.	17. Check crystal Y8. Make voltage and resistance measurements of filter circuit.

69. Trouble-Chooting Chart—Continued

Symptom	Probable trouble	Correction
18. CARRIER LEVEL meter does not indicate properly. (No reading or off-scale readings.)	18. Wrong adjustment of METER ZERO control R87. Defective tube V13 Defective meter M1.	18. Readjust R87. Check and replace V13. Check meter M1 for open coils; replace, if necessary.

70. D-c Resistances of Transformers and Coils

The d-c resistances of the transformer windings and the coils in the receiver are listed below:

a. Coils and Transformers not in R-F Turret.

Transformer or coil	Terminals or winding	Resistance (ohms)
T25 and T26	Primary and secondary	Less than .5
T27	Primary 2 and 3	Less than .5
	Secondary 1 and 4	2
T28 and T29	Primary and secondary	2.5
	Tertiary 1 and 7	Less than .5
T30	Primary	2.5
	Secondary 7 and 8	1
	Secondary 1 and 7	3
T31	Primary and secondary	2.5
T32	Primary 1 and 2	10
	Secondary 3 and 4	Less than .5
T33	Terminal 1 and 3	.75
	Terminal 3 and 4	2
T34	Primary 0-volt terminal to 95-volt terminal.	2
	Primary 0-volt terminal to 105-volt terminal.	2.5
	Primary 0-volt terminal to 115-volt terminal.	3
	Primary 0-volt terminal to 130-volt terminal.	3.5
	Primary 0-volt terminal to 190-volt terminal.	8.5
	Primary 0-volt terminal to 210-volt terminal.	10
	Primary 0-volt terminal to 234-volt terminal.	12.5
	Primary 0-volt terminal to 260-volt terminal.	15
	Secondary 5-volt filament winding.	Less than .5
	Secondary 6.3-volt filament winding.	Less than .5
	Secondary 12-volt filament winding.	1
	Secondary h-v winding—measured across winding.	65
	Secondary h-v winding—center tap to either end.	33

a. Coils and Transformers not in R-F Turret. —Continued

Transformer or coil	Terminals or winding	Resistance (ohms)
T35	Primary 1 and 2	200
	Secondary 3 and 4	5.5
	Secondary 5 and 6	38
	Secondary 7 and 8	35
K1	Across winding	280
L39	Measured across coil	12.5
L60	Measured across coil	40
L62	Measured across coil	2
L63	Measured across coil	Less than .5
L64	Measured across coil	2.2
L65	Measured across coil	2.2
L66	Measured across coil	2
L67	Measured across coil	Less than .5

b. D-C Resistance of Turret Coils.

(1) *Antenna turret.*

Transformer	Winding	Resistance (ohms)
T1	Secondary L1	3
T1	Primary L2	1
T2	Secondary L3	4
T2	Primary L4	.5
T3	Secondary L5	1
T3	Primary L6	Less than .5
T4	Secondary L7	Less than .5
T4	Primary L8	Less than .5
T5	Secondary L9	Less than .5
T5	Primary L10	Less than .5
T6	Secondary L11	Less than .5
T6	Primary L12	Less than .5

(2) *R-f turret.*

Transformer	Winding	Resistance (ohms)
T7	Secondary L13	3.5
T7	Primary L14	11
T8	Secondary L15	6
T8	Primary L16	8
T9	Secondary L17	1
T9	Primary L18	3.5
T10	Secondary L19	Less than .5
T10	Primary L20	3.5
T11	Secondary L21	Less than .5
T11	Primary L22	Less than .5
T12	Secondary L23	Less than .5
T12	Primary L24	1

b. D-C Resistance of Turret Coils—Continued

(3) *Mixer turret.*

Transformer	Winding	Resistance (ohms)
T13	Secondary L25	3.5
T14	Secondary L26	6
T15	Secondary L27	1
T16	Secondary L28	Less than .5
T16	Primary L62	3
T17	Secondary L29	Less than .5
T17	Primary L30	2.5
T17	Primary L66	3
T18	Secondary L31	Less than .5
T18	Primary L32	1

(4) *Oscillator turret measured from grounded end to tap indicated.*

Transformer	Coil	K tap	Grid tap	Top
T19	L33	2	4.5	7
T20	L34	1	2	4
T21	L35	.5	1	2
T22	L36	Less than .5	Less than .5	Less than .5
T23	L37	Less than .5		Less than .5
T24	L38	Less than .5		Less than .5

71. Tuning Control Troubles

a. The couplings connecting the dial drive mechanism are held in place by two Allen-head screws per coupling. If these screws become loose, the dial scale may turn without turning the tuning capacitors. Sometimes slight looseness will cause a jumpy action in the dial. Make sure all coupling screws are securely tightened.

b. Coupling between the BAND SELECTOR shaft and the turret shaft is accomplished by means of a nylon coupling. If the turret should bind, the nylon coupling might crack and thereafter allow slippage between shafts. Do not overtighten the setscrews on this coupling.

72. Signal Substitution Notes

a. Signal substitution requires a source of audio, i-f, and r-f signals. Use a signal generator which will produce each of the desired signals required in any specific signal substitution test.

b. In addition, a headset or permanent-magnet speaker is necessary. Plug the headset into

PHONES jack J3, or connect the speaker (with a matching transformer, if necessary) to terminals of AUDIO OUTPUT terminal strip E4.

c. An analyzer and tube tester are also needed to isolate the defective part after the faulty stage has been indicated by signal substitution.

d. In the tests indicated in paragraphs 73, 74, and 75, ground one side of the signal generator output to the receiver chassis, and connect the other side through a capacitor (about .01 μf) to the receiver point as directed.

e. Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare with a receiver known to be in good condition.

f. Check the wiring and soldering in each stage during the procedure.

Caution: Do not remove the shield can of the tuned unit until the trouble has been traced to that particular unit. Do not damage the wiring by pushing it back and forth during inspection. Be careful to prevent damage to the receiver in any other way.

g. Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the vfo may prevent any output.

h. When trouble is localized in a given stage, first test the tube if such a test is indicated; then measure the voltage; and finally, measure the resistance at the tube socket of the stage.

i. Trouble in a circuit or stage may not cause changes in voltage and resistance measurements at the tube socket. The instructions in this paragraph are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

j. Remove only *one* tube at a time when testing. Check the number of the tube, test the tube, and, if it is not defective, return it to its proper socket before another tube is removed.

k. At each step, it is assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble located before proceeding with any succeeding steps.

73. A-F Tests

a. Terminal 3 of V17 (Plate of A-F Output). Apply an audio signal through a series capacitor (approximately .05μf) to terminal 3 of V17. Listen for the signal in the headset which is connected to jack J3. The volume will be very low. If a speaker is connected to the AUDIO OUTPUT terminal strip, E4, a low volume signal should be heard. If no signal is heard, inspect the leads to transformer T35 and PHONES jack J3 and terminal strip connections.

b. Terminal 5 of V17 (Grid of A-F Output). Place the audio signal on terminal 5 of V17. Listen for an increased output in the headset (or the speaker, if used). If the volume does not show an increase, test tube V17. If no signal is heard, check resistor R98 and capacitor C4. Also check the plate and screen grid voltages.

c. Terminal 7 of V16 (Plate of 1st A-F Amplifier). Introduce the signal at terminal 7 of V16 and listen for the signal. If there is no signal, coupling capacitor C203 may be open. Check for an open circuit by paralleling C203 with another .01-μf capacitor.

d. Terminal 1 of V16 (Grid of 1st A-F Amplifier). Place the audio signal on terminal 1 of V16 with AUDIO GAIN control R94 set at 3 or higher. The volume of the audio output should be increased. If the volume does not show an increase, test tube V16. If no signal is heard, check resistors R96, R117, and R97 and capacitors C196 and C194B. Also check the plate voltage.

e. Terminal 3 on 4th 455-KC, I-F Transformer T31. Introduce the audio signal at terminal 3 on the 4th 455-kc, i-f transformer, T31. If no signal is heard, capacitor C176 or C200 may be open. Check for an open circuit by paralleling with another .01-μf capacitor. If a signal is heard with ANL-OFF switch S3 in the OFF position, but no signal is heard in the ANL position, check tube V12.

74. I-F Tests

a. 455-KC I-F Tests.

(*1*) *Control settings.* Set the controls as follows:

Control	Setting
CW-MODULATION	MODULATION
AGC-MANUAL	MANUAL
ANL-OFF	OFF
AUDIO GAIN	MAXIMUM
CRYSTAL PHASING	0
SELECTIVITY	NORMAL BROAD

222926 O—52——5

(2) *Terminal 5 of V11 (3d 455-kc i-f plate).* Apply a modulated 455-kc signal to pin 5 of V11. The audio modulation note should be heard in the phones or speaker. If no sound is heard, check tube V12. If the test shows the tube to be satisfactory, return it to its socket. There may be an open circuit in inductor L55 or L56, resistor R72 or R70, or a shorted capacitor, C169, C170, C172, C173, or C174. If an audio output can be heard with the ANL-OFF switch, S3, in the OFF position, but no output can be heard with switch S3 in the ANL position, resistor R71 or R73 may be open, or capacitor C175 may be shorted.

(3) *Terminal 1 of V11 (grid of 3d 455-kc i. f.).* Inject the modulated signal at the grid of V11 (terminal 1). The volume of audio output should increase. If the volume does not increase, remove tube V11 and test it. If the test shows the tube to be satisfactory, replace the tube in the socket. Resistor R66 might be open. Check voltage and resistance at the tube socket.

(4) *Bfo (V14).* Turn off the modulation in the signal generator, and apply the unmodulated 455-kc signal to terminal 1 of V11. Set the CW-MODULATION switch, S5, at CW. An audio beat note should be heard at the speaker or phones. Vary the BFO PITCH control, C183, and note the change of af. If no audio note is heard, remove tube V14 and test it. If the tube is satisfactory, return it to its socket and check the voltage and resistance measurements. Capacitor C181 may be open. Parallel it with another 5-$\mu\mu$f capacitor to check for an open circuit.

Note. Return switch S5 to the MODULATION position after the bfo has been checked. Turn on the modulation in the signal generator again.

(5) *Terminal 5 of V10 (plate of 2d 455-kc i. f.).* Inject the modulated 455-kc signal at the plate (terminal 5) of V10 and listen for an audio output. If no audio is heard, check for continuity across transformer T30 (terminals 2 to 7 and 5 to 6).

(6) *Terminal 1 of V10 (grid of 2d 455-kc i. f.).* Inject the modulated 455-kc signal at terminal 1 of V10. Set RF GAIN-AC control R83 to 10. The audio output volume should be increased. If there is no audio output, test tube V10. If the tube is satisfactory, replace it in its socket. Resistor R60 may be open. Check the socket terminals for voltage and resistance.

(7) *Terminal 5 of V9 (plate of 1st 455-kc i. f.).* Connect the modulated 455-kc signal to terminal 5 of V9. An audio output should be heard. If no sound is heard, check transformer T29 for continuity (terminals 2 to 7). Capacitor C154 may be open. Parallel it with another 33-$\mu\mu$f capacitor to check it.

(8) *Terminal 1 of V9 (grid of 1st 455-kc i. f.).* Inject the modulated 455-kc signal at terminal 1 of V9. The audio output volume should be increased. If it is not, test tube V9. If tube V9 proves satisfactory, replace it in the socket. Check resistor R51 to be sure it is not open. Check tube socket voltages and resistances. Be sure that the SEND-RECEIVE switch, S6, is in the RECEIVE position.

(9) *Terminal 2 of transformer T28 (input to 1st 455-kc i-f transformer).* Inject the modulated 455-kc signal at terminal 2 of the 1st 455-kc i-f transformer, T28. The audio signal should be heard in the speaker or phones. If no signal is heard, there may be an open primary or secondary coil in transformer T28 or in capacitor C148. Capacitor C147 or C149 may be shorted, or the coaxial lead from the i-f switchover relay, K1, may have been damaged and shorted.

(10) *Terminal 5 of V3 (plate of 1st mixer).* With the BAND SELECTOR in the BAND I, II, or III position, inject the modulated 455-kc signal at the plate of the 1st mixer. The audio signal should be heard in the phones or speaker. If no signal is heard, check for continuity from terminal 5 of V3 through the contacts of realy K1 to terminal 2 of transformer T28.

b. 6-MC I-F Tests.

(1) *Control settings.* Set the controls as follows:

Control	Setting
RECEIVE-SEND	RECEIVE
CW-MODULATION	MODULATION
AGC-MANUAL	MANUAL
ANL-OFF	OFF
RF GAIN-AC	5
AUDIO GAIN	5
SELECTIVITY	NORMAL BROAD
BAND SELECTOR	BAND IV, V, or VI

(2) *Terminal 5 of V7 (plate of 2d mixer).* Inject a modulated 455-kc signal into terminal 5 of tube V7. An audio output should be heard in the phones or speaker. If no audio output is heard, check to see that relay K1 is actuated. Capacitor C140 may be shorted out. The coaxial lead from the plate of V7 to the relay contacts may be damaged and shorted.

(3) *Terminal 7 of V7 (signal grid of 2d mixer).* Reset the signal generator to produce a 6-mc r-f output modulated with an audio frequency. Inject this modulated 6-mc signal (still through a series .05-μf capacitor) into terminal 7 of tube V7. An audio output should be heard. If it is not, test tubes V7 and V8 (one at a time to prevent accidentally interchanging the types). Return each tube to its socket if it proves satisfactory. Check that the 6.455-mc crystal fits snugly in its socket. Check for an open resistor, R104, R43, R45, R46, or R106, or open capacitor C144. Check for a shorted capacitor, C134, C139, C141, C145, or C207. Check the voltages and resistances at the tube sockets for V7 and V8.

(4) *Terminal 5 of V6 (plate of 6-mc i-f).* Inject the modulated 6-mc signal into terminal 5 of tube V6. The audio signal should be heard in the phones or speaker. If no signal is heard, check capacitor. C133 for a short circuit and the primary and secondary coils of transformer T26 for open circuits.

(5) *Terminal 1 of V6 (grid of 6-mc i. f.).* Inject the modulated 6-mc signal to the grid of V6. An increase in the audio output volume should be noticed. If no audio output is heard, remove and test tube V6. If tube V6 is satisfactory replace it in the socket. Check for an open resistor, R114 or R39, or a shorted capacitor, C132 or C212. Check voltages and resistances at the tube socket of V6.

(6) *Terminal 1 of T25 (input of 1st 6-mc i-f transformer).* Inject the modulated 6-mc signal at terminal 1 of transformer T25. If no audio signal is heard in the phones or speaker, check for an open coil, L40 or L41, in transformer T25 or a shorted capacitor, C128 or C129. Capacitor C113 may be open. The coaxial lead from the plate of the 1st mixer, V3 to the contacts of relay K1 may be damaged and shorted.

(7) *Terminal 5 of V3 (plate of 1st mixer).* Inject the modulated 6-mc signal at the plate of the 1st mixer. An audio signal should be heard in the phones or speaker. If no audio signal is heard, see whether there is continuity through the contacts of relay K1.

75. R-f Tests

a. Terminal 7 of V3 (Signal Grid of 1st Mixer).

(1) *Vfo operation.* Set up the signal generator to produce a modulated r-f signal within the range of the receiver (540 kc to 54 mc). Using the BAND SELECTOR and the TUNING control, tune the receiver to the selected signal. Set the VFO CRYSTAL switch, S2, in the VFO position. An audio output should be heard in the phones or speaker. If no audio output is heard, test tubes V3 and V4. Remove, test, and replace one tube at a time to prevent interchanging the tubes during replacement. If the tubes are satisfactory, replace them in their sockets. Check for an open circuit in resistor R18, R19, R21, or R22, or in capacitor C80, C81, or C118. Check tube socket voltages and resistances for tubes V3 and V4. If the vfo does not appear to be functioning, test by applying to terminal 1 of V3 the unmodulated output of a second signal generator tuned to the incoming rf from the first signal generator plus the i. f. in use (455-kc i. f. used below 7 mc, or 6-mc i. f. used above 7 mc). If an audio output is now heard, the vfo stage, V4 is not functioning. To check the vfo further, tune the receiver and signal

generator to one of the six frequencies specified for crystal operation; set the VFO CRYSTAL switch, S2, in the corresponding crystal position; an audio output now identifies a nonfunctioning vfo.

(2) *Crystal operation.* Select a modulated r-f signal with the signal generator to match the frequency for which any crystal channel has been assigned. Set the VFO CRYSTAL switch, S2, in the position corresponding to the channel selected. An audio output should be heard in the phones or speaker. if no audio output is heard, check the operation of the crystal oscillator, V5, by setting the VFO CRYSTAL switch, S2, in the VFO position; an audio output now indicates malfunctioning of the crystal oscillator, V5. Remove and test tube V5. If it proves satisfactory, replace it in the socket. Check the crystal socket for loose connections. Check for shorted capacitor C125, open resistor R32, open choke coil L64, or open capacitor C119. Check tube socket voltages and resistances.

b. Terminal 5 of V2 (Plate of 2d R-F). Use either the VFO position or a CRYSTAL position for switch S2. Set the modulated r-f output of the signal generator at the frequency to which the receiver is tuned. Set the RF. GAIN-AC and AUDIO GAIN controls both at 3. Inject the output of the signal generator at terminal 5 of V2. The audio modulation should be heard in the phones or speaker. If no output is heard, check for an open coupling capacitor in the mixer transformer in use or a shorted capacitor, C52.

c. Terminal 1 of V2 (Grid of 2d R-F). Inject the modulated r-f signal into terminal 1 of V2. The audio volume should be increased noticeably in the phones or speaker. If there is no audio output, remove tube V2 and test it. If the tube is satisfactory, return it to the socket and check the tube socket voltages and resistances. Retune the signal generator and the receiver to a signal in another band if the mixer transformer appears to be defective.

d. Terminal 5 of V1 (Plate of 1st R-F). Inject the signal at the plate of V1. The audio modulation should be heard in the phones or speaker. If no audio is heard, check for a shorted capacitor, C25 or C1B, or for poor contact at the turret connections. Other checks will suggest themselves according to which r-f transformer is in use.

e. Terminal 1 of V1 (Grid of 1st R-F). Inject the modulated r-f signal at the grid of the 1st r-f tube, V1. The audio modulation should appear with an increased volume in the phones or speaker If there is no audio output, remove and test tube V1. If the tube is satisfactory, return it to the socket. Check voltages and resistances at the tube socket. If the tests show the receiver to be satisfactory at this point, but the receiver still will not operate with the normal antenna input, check the antenna and lead-in cable. Check the turret contacts and transformer coils in use.

76. Stage Gain Charts

a. General. Stage gain measurements allow a check on how much amplification is occurring in each amplifier of the receiver. In trouble shooting, the measurements serve to locate the defective stage. The signal voltages injected by the signal generator will provide a voltage across the detector diode load resistor, R107, for the output measurement. The voltage across resistor R107 is kept constant by varying the signal generator output to establish this condition. As the signal generator is moved from each test point toward the antenna terminals, the input signal becomes smaller in amplitude, thereby indicating more amplification and providing a means of gain measurement. The a-f stage gains are measured by the amount of power developed in a 600-ohm load placed across the 600-ohm AUDIO OUTPUT terminals 1 and 5 (2 and 4 tied together). The front panel controls are in the following positions for stage gain measurement unless otherwise specified:

Control	Position
BAND SELECTOR	BAND I.
TUNING	Low frequency end of dial.
ANT ADJ	Peaked for measurement through antenna terminals.
ANL-OFF	OFF.
AGC-MANUAL	MANUAL.
CW-MODULATION	MODULATION.
RECEIVE-SEND	RECEIVE.
RF GAIN-AC	MAXIMUM.
BFO PITCH	0.
CRYSTAL PHASING	0.
SELECTIVITY	NORMAL MED.
VFO CRYSTAL	VFO.
CRYSTAL VERNIER	Mid-position.
AUDIO GAIN	Maximum.

b. Audio Gain Chart.

Signal generator	Input connection	Input voltage	Output watts (secondary of T35)	Stage gain
400 cps	Pin 5 V17	7	1	3.5
400 cps	Pin 1 V16	.3	1	23.3

c. Detector sensitivity.

Signal generator	Input connection	Input voltage	Output watts (secondary of T35)
455 kc modulated 30% at 400 cps.	Pin 2 of V12 through .1-μf capacitor.	2	.6

d. 3d 455-KC I-F Stage Gain Chart (Audio Gain Maximum).

Signal generator	Input connection	Input voltage	Output volate across R107	Stage gain
455 kc modulated.	Pin 1 of V11.	30,000 microvolts.	------	(*)
30% at 400 cps.	----------	300,000 microvolts.	------	33

*30,000 μv input produces .6 watt at output. 300,000 μv (produces more than required output (2 watts)). Therefore, AUDIO GAIN must be reduced to give 2 watts (undistorted power).

e. 2d and 1st 455-KC I-F Stage Gain Chart. The output voltage is measured across detector load resistor R107. The SELECTIVITY control has an effect on the gain of the 1st and 2d 455-kc i-f stages; therefore, gains are listed for all six positions.

Position of SELECTIVITY control	Signal generator output connection		
	455 kc unmodulated to pin 1 of V10 through a .01μf.	455 kc unmodulated to pin 1 of V9 through a .01μf.	455 kc unmodulated to pin 7 of V3 through a .01μf.
	Microvolts input	Microvolts input	Microvolts input
CRYSTAL SHARP	18,000	720	100
CRYSTAL MED	21,000	800	240
CRYSTAL BROAD	32,000	1200	130
NORMAL SHARP	22,000	3200	930
NORMAL MED	20,000	4300	750
NORMAL BROAD	30,000	3200	700

Note. The above input voltages are those needed to maintain 10 volts d-c across the detector.

f. 2d Mixer Stage Gain. The gain of the 6-mc i-f and the 2d mixer, V7, is measured on BAND IV with NORMAL MED selectivity. TUNING is set to 7 mc.

Signal generator	Input connection	Microvolts input	Output voltages across R107
455 kc unmodulated	Terminal No. 7 on T26 through a .01μf.	1000	10
6 mc unmodulated	Terminal No. 7 on T26 through a .01μf.	1500	10
6 mc unmodulated	Pin 1 of V6 through a .01μf.	170	10
6 mc unmodulated	Pin 7 of V3 through a .01μf.	120	10

g. 1st Mixer and R-F Stage Gains. The BAND SELECTOR is set to the desired band. Measurements made at antenna terminals require the ANT ADJ control to be peaked. Apply signals to the antenna terminals on A and G (ground) with the other A terminal connected to G.

Band	Freq. (mc)	Signal generator connection				
		Antenna terminals through a 100-ohm dummy load	1st rf. Pin 1 of V1 through .01 μf.	2d rf. Pin 1 of V2 through .01 μf.	1st mixer Pin 7 of V3 through .01 μf.	
		Microvolts input				Voltage across R107
I	.57	3	15	170	920	10
	1.24	3	40	180	1300	10
	.9	3	*NM	*NM	*NM	10
II	1.35	1.5	12	310	750	10
	2.9	2	25	250	1000	10
	2.1	3	*NM	*NM	*NM	10
III	3.2	3	15	250	700	10
	6.8	3	20	160	900	10
	5	5	*NM	*NM	*NM	10
IV	7.3	4	16	80	135	10
	13.3	3	13	45	120	10
	10.8	3	*NM	*NM	*NM	10
V	14.5	4	13	60	140	10
	28	2.5	9	35	115	10
VI	*NM	*NM	*NM	*NM	*NM	*NM

*No measurements taken.

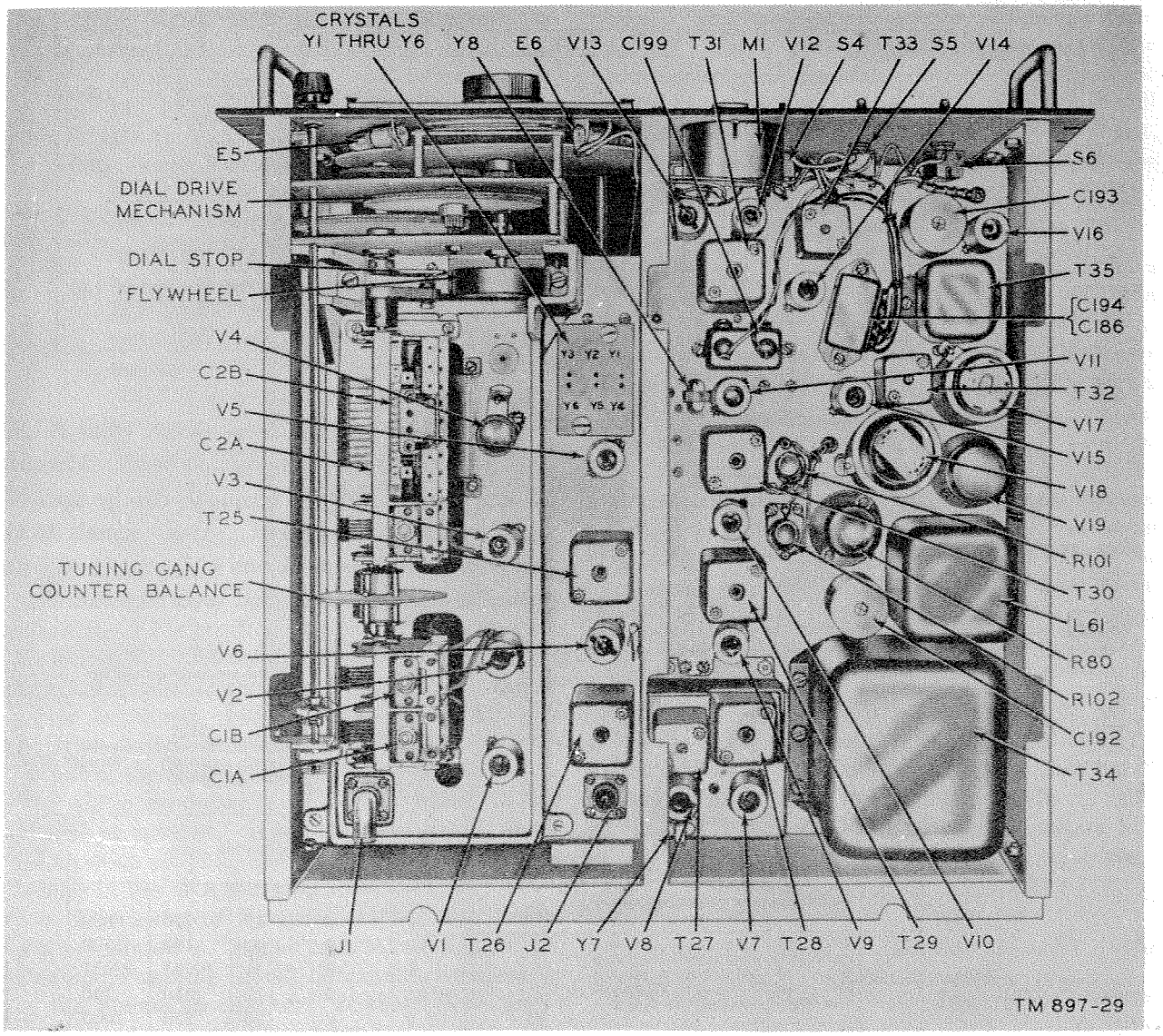

Figure 31. Radio Receiver R–274/FRR, chassis, top view.

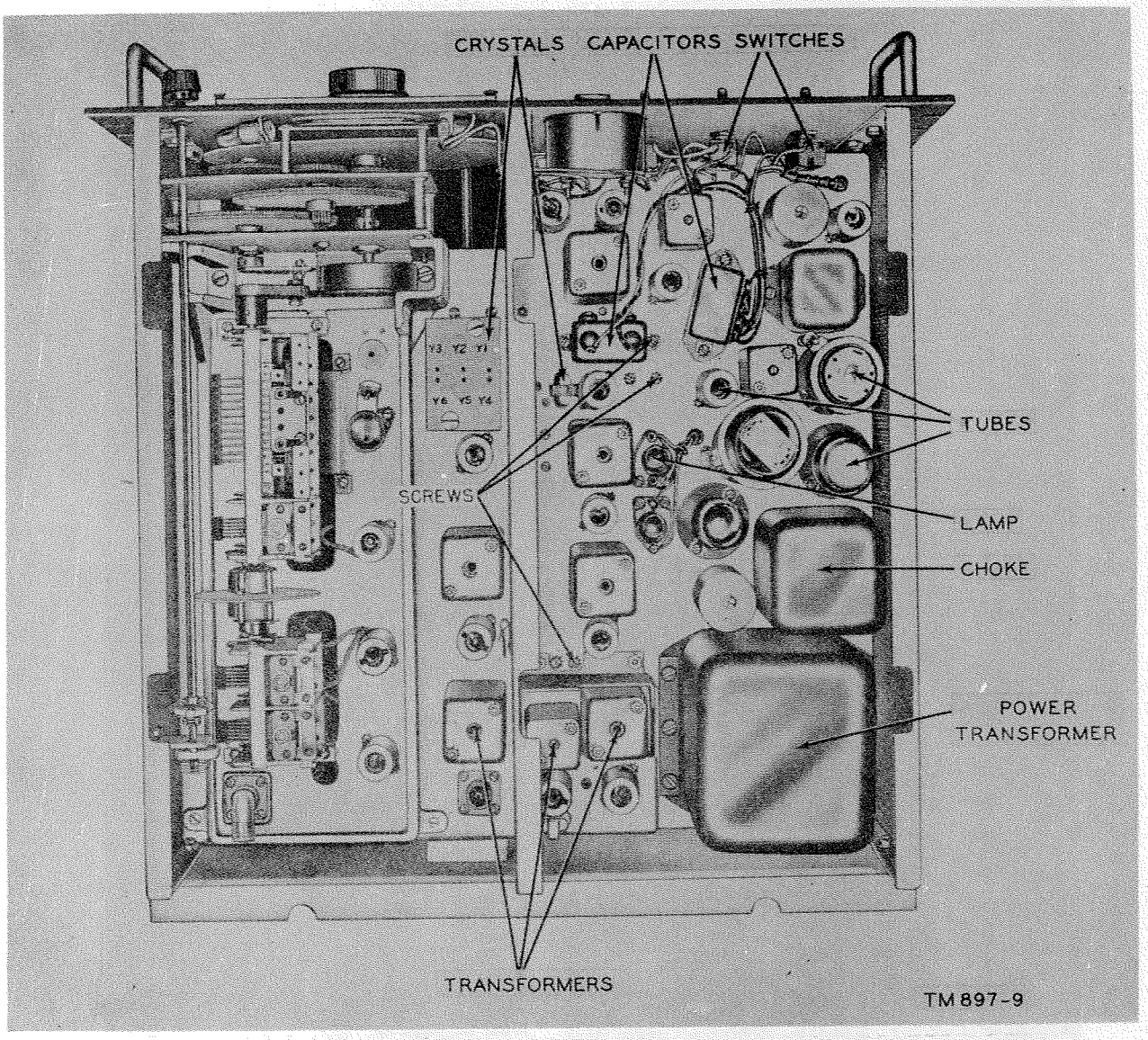

Figure 32. Radio Receiver R–274/FRR, r-f chassis, bottom view.

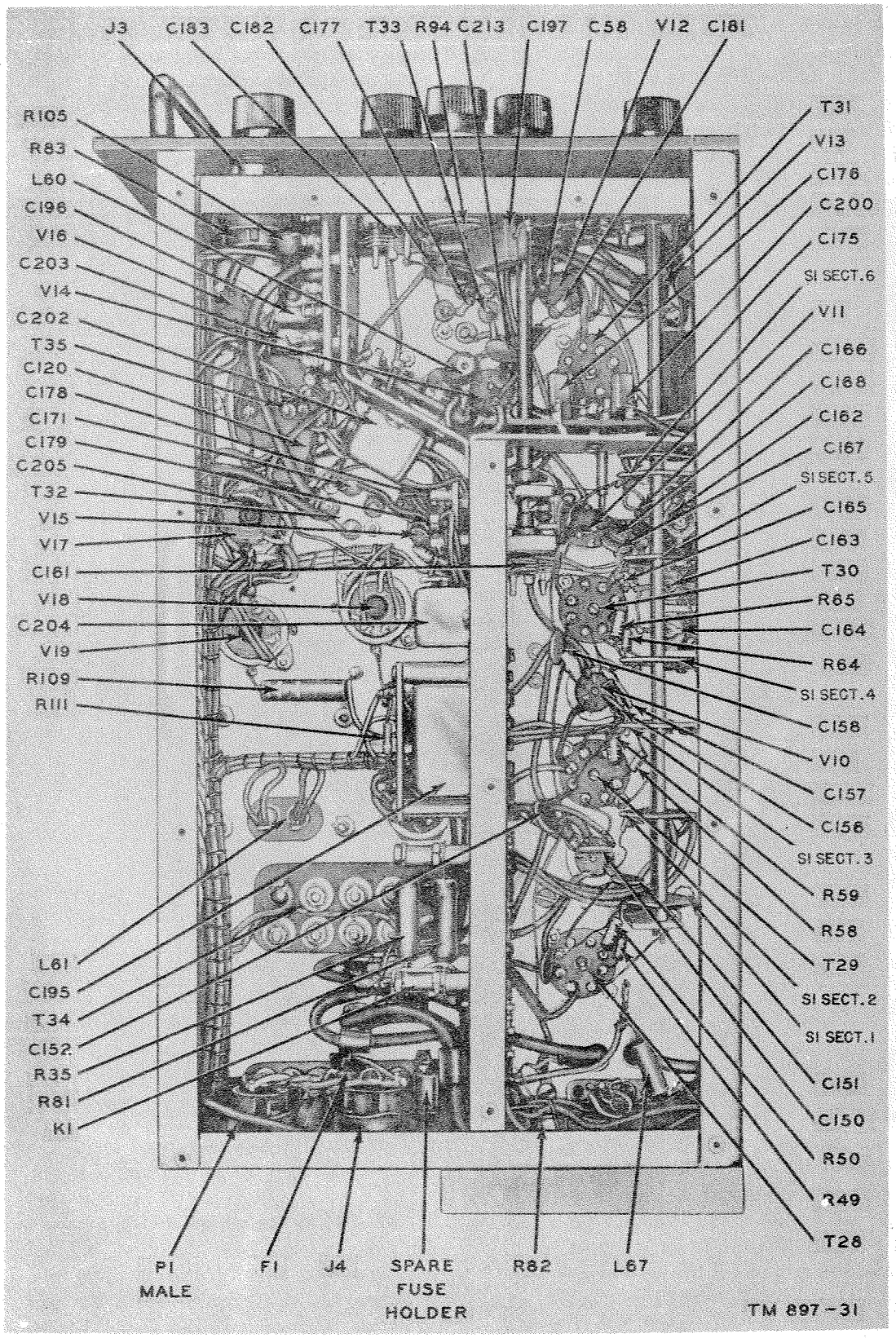

Figure 33. Radio Receiver R-274/FRR, i-f and audio chassis, bottom view.

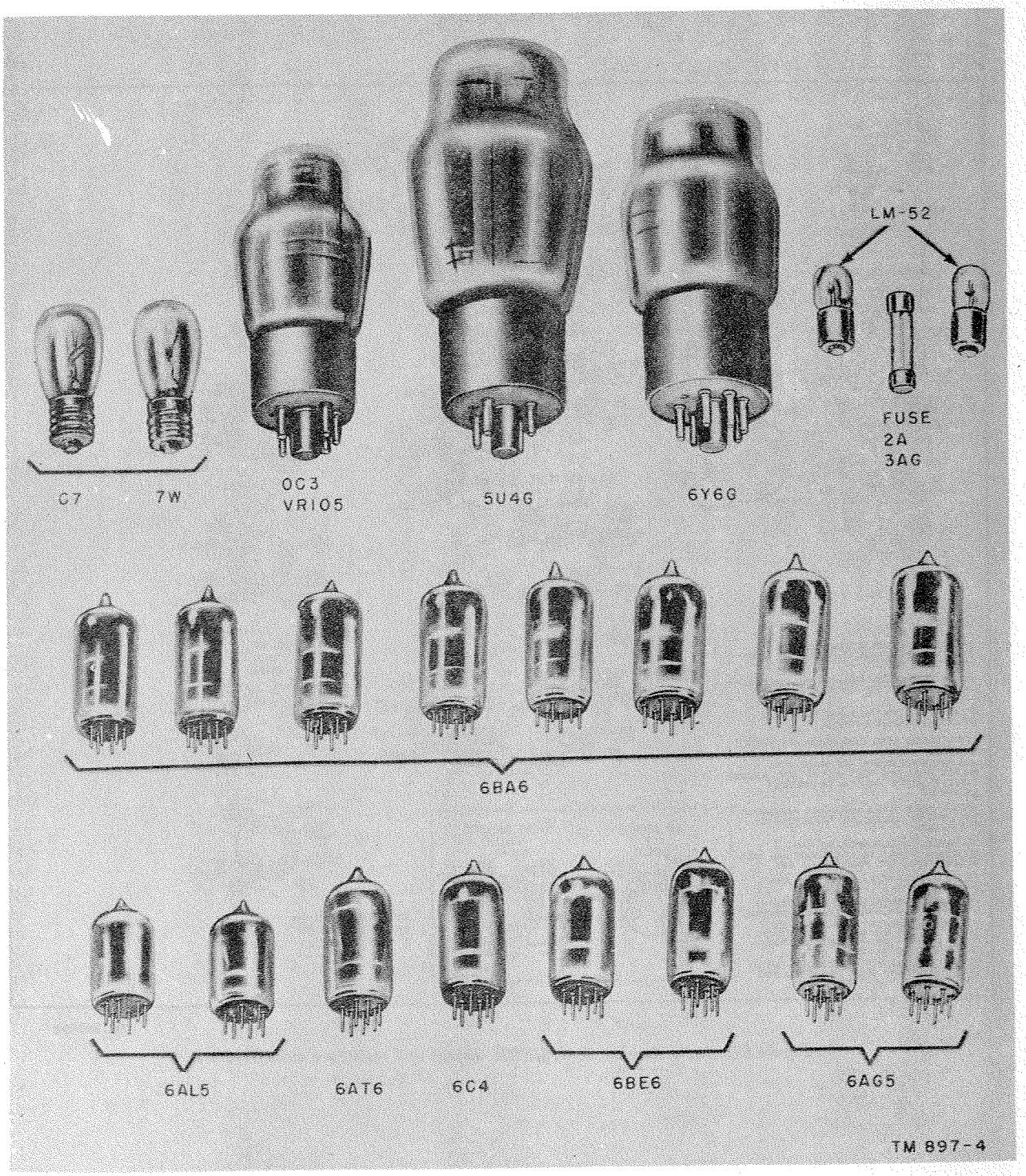

Figure 34. Radio Receiver R–274/FRR, 2d mixer and 6.455-mc oscillator, bottom view.

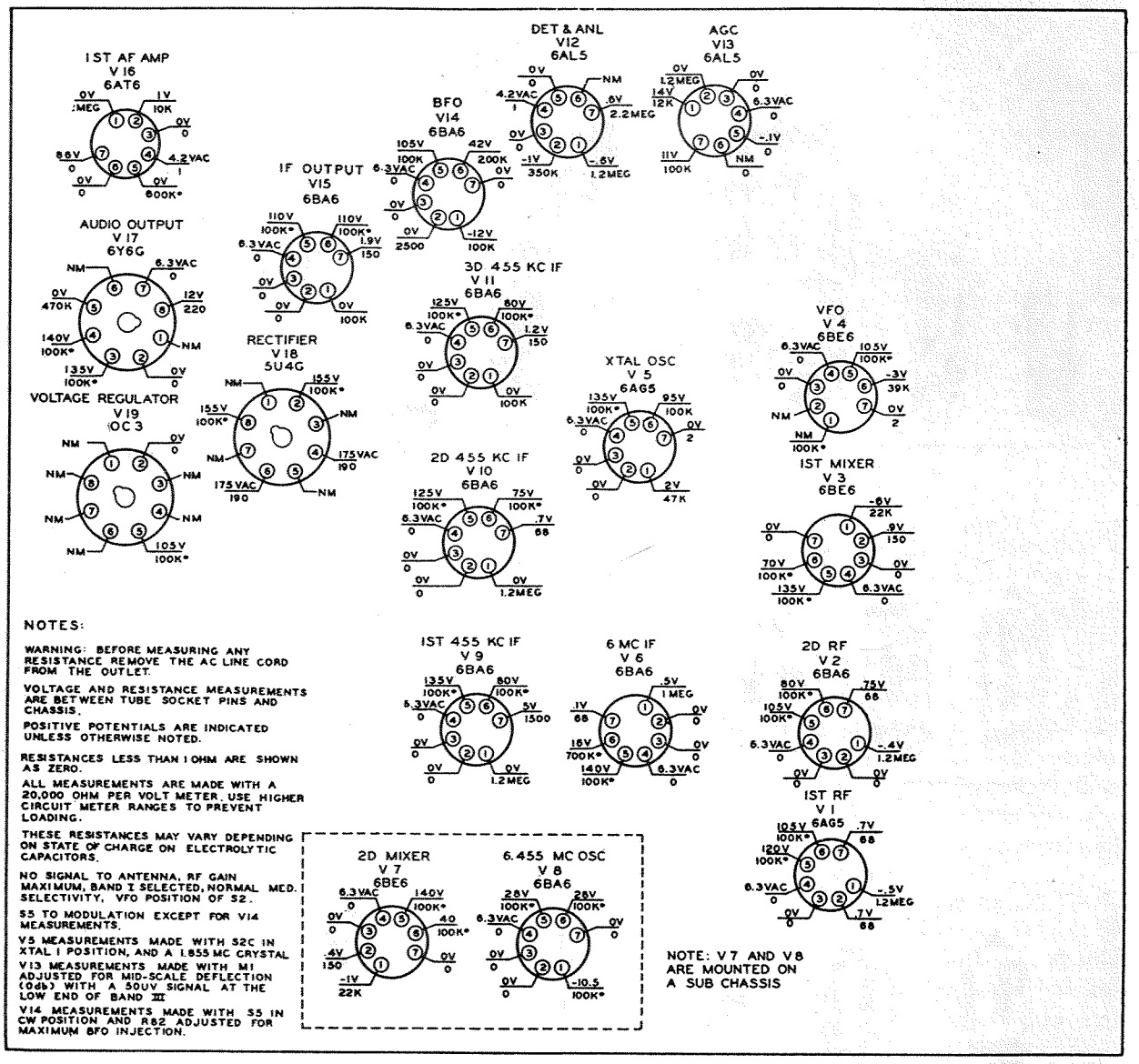

Figure 35. Radio Receiver R-274/FRR, voltage and resistance measurements.

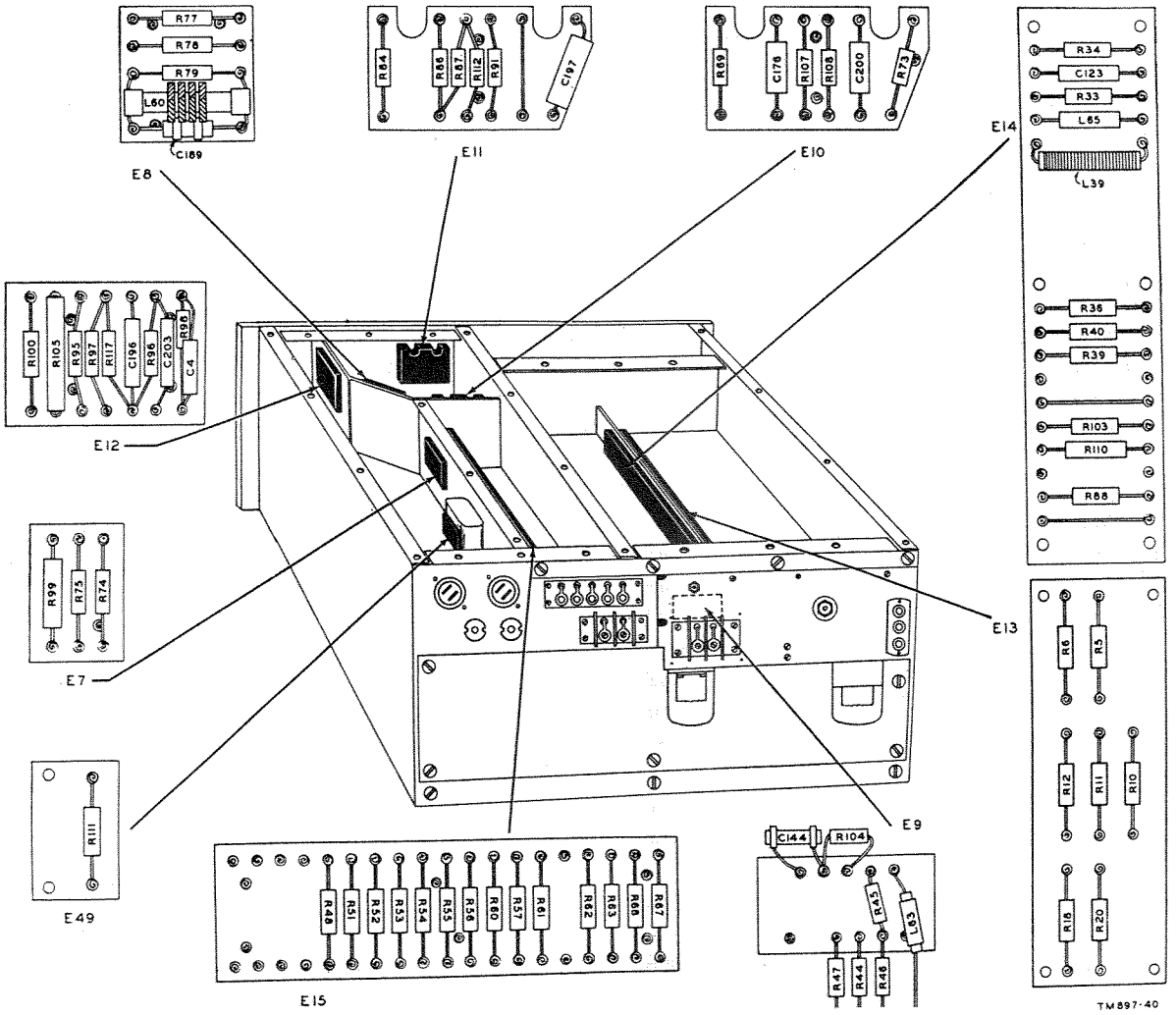

Figure 36. Radio Receiver R-274/FRR, resistor-capacitor board, location diagram.

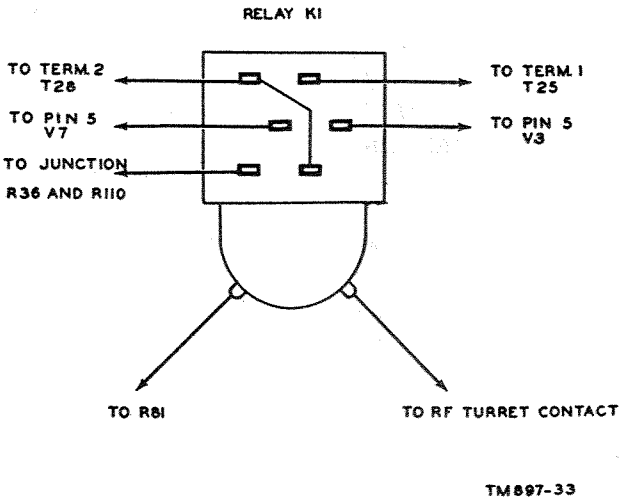

Figure 37. I-f switch-over relay connections.

77. Replacement of Parts

a. Little explanation is necessary for the removal of most parts. However, there are some parts which require a special removal and replacement procedure. Be careful in handling the miniature tubes to prevent bending the base pins. If the pins become bent and a pin straightener is available, straighten the pins before reinserting the tubes in their sockets. The crystals are held in place either by spring clips or by a spring-loaded retaining plate. Two screws hold down the retaining plate of the crystal oscillator crystals. A sliding panel on the top dust cover provides access to this retaining plate.

b. The top dust cover is held in place by flat springs. Remove the cover by pulling it to the rear about an inch to release the springs and lifting it upward to take it from the receiver. The bottom cover is fastened by 27 No. 6–32 binder head screws. All screws must be removed in order to remove the cover. The rear dust cover is removed by releasing the Dzus fasteners.

c. The front panel must be removed for some repairs. The correct removal procedure is as follows:

(1) Remove all knobs with a special Allen type wrench provided.
(2) Remove all switch nuts and also PHONES jack J3 nut.
(3) Disconnect CARRIER LEVEL meter M1 by removing the terminal nuts. Leave meter fastened to panel.
(4) Unsolder dial lamp socket leads.
(5) Loosen the dial mask gear coupling.
(6) Loosen the two setscrews on the front end of the coupling to the turret shaft.
(7) Loosen setscrews on capacitor C22 coupling to allow removal of the shaft.
(8) Remove all front panel screws.
(9) Pull the front panel away from the chassis.

d. Capacitors C183, C125, C161, and C22 are all removed in the same manner: Unsolder the connecting leads and remove the knob. Loosen the shaft coupling setscrews. Remove the mounting nut or screws. Move the capacitor away from its mounting to remove it from the chassis.

e. The crystal oscillator gang switch, S2, is removed by unsoldering the connecting wires and removing the knob, and then completely unscrewing the shaft bushing nut. Slide the switch toward the rear of the chassis.

78. Disassembly of Complex Parts

This paragraph contains the procedures to be followed for removing the tuning gang capacitors, dial-drive mechanism, r-f turret, selectivity gang switch, second mixer, and 6-mc oscillator subchassis. Follow these procedures carefully; otherwise, damage to some parts may result.

a. Tuning Gang Capacitors (fig. 31). First, remove capacitors C1A and C1B (1st and 2d r-f sections). Disconnect the leads and ground straps. Loosen the two setscrews on the rear end of the shaft coupling with the Allen wrench supplied with the receiver. Next, remove the three chassis-mounting screws and slide the gang to the rear. It may now be taken from the chassis. To replace, reverse the above procedure. The coupling remaining on the end of capacitor C2A (mixer section) shaft is also a disk mounting for counterbalance weights. Capacitors C2A and C2B are removed in the same manner as capacitors C1A and C1B.

b. Dial-Drive Mechanism (figs. 10 and 12). To remove the dial-drive mechanism, it is necessary to remove the top and bottom covers and the front panel. The dial-drive assembly is removed as follows:

(1) Remove the springs from the coupling between the tuning gang capacitor shaft and dial-drive mechanism.
(2) Remove the dial pointer and dials.
(3) Remove the three screws which hold the dial drive to the chassis. Openings in the front plate are provided to gair access to these screws.
(4) Slide the drive forward and upward, pulling away from the chassis.
(5) To replace the assembly, reverse the above steps. Do not use too much force on any of the shafts. Forcing may result in bending the component parts. The dial-drive mechanism requires special adjustment to assure alinement of the dial scale with the tuning gang. See paragraph 80*b* for the instructions.