

CHASSIS MECHANICAL ASSEMBLY

NOTE: The illustrations on pages 86 and 87 may be helpful in identifying various components.

Refer to Figs. 7 Through 10

- () 1. See Fig. 7 and insert a 3/8" rubber grommet into hole A.
- () 2. Insert a 3/8" rubber grommet into hole B.
- () 3. See Fig. 8 and insert a 3/8" rubber grommet into hole D.
- () 4. From the inside of the rear apron, install an AC receptacle (P20-194) at cutout E. Use two #6-32 x 5/16" BH screws, two #6 lockwashers, and two #6-32 hex nuts.
- () 5. In the same manner as in Step 4, install the other AC receptacle (P20-194) at cutout F.
- () 6. Install the fuse holder (P20-124) in hole H. Use the 1/2" rubber washer, the 1/2" lockwasher, and the 1/2" hex nut. Do not apply excessive force to the nut. Bend the end lug as shown.
- () 7. From the outside of the rear apron, mount a 6-screw binding post strip (P20-205) over cutout J on the rear apron. From the inside of the rear apron, mount a 2-lug terminal strip (P23-178) at K. Position the two strips as shown. Use two #6-32 x 5/16" BH screws, two #6 lockwashers, and two #6-32 hex nuts.
- () 8. In the same manner as in Step 7, mount a 6-screw binding post strip (P20-205) at cutout L, and a 2-lug terminal strip (P23-178) at M.
- () 9. A triple phono jack strip (P20-203-12) is now mounted. Before mounting it, place a 3-hole Bakelite insulating plate (P20-203-22) over the sockets, between the rear apron and the phono jack strip. From the inside of the rear apron, mount the triple phono jack strip at cutout N. Position the strip as shown in Figs. 7 and 8. Use four #4-40 x 5/16" BH screws, four #4 lockwashers, and four #4-40 hex nuts. Note that when this strip is correctly positioned, the double ground lugs are on the left side of the strip when viewing the strip in Fig. 7.

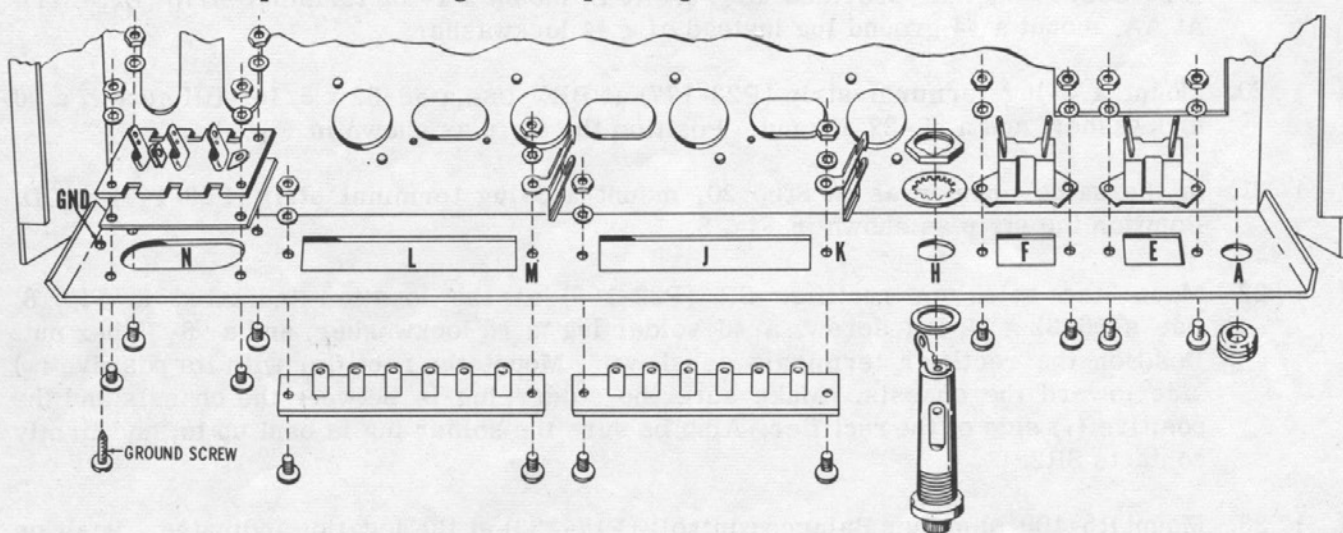


Fig. 7.

- () 10. See Fig. 8 and in the same manner as in Step 9, mount triple phono jack strip and plates (P20-203-12) at cutouts O and P on the chassis.
- () 11. In the same manner as in Step 10, mount quadruple phono jack strips (P20-204-12) at cutouts Q and U on the chassis. Use the 4-hole Bakelite insulating plates (P20-204-22) for these sockets.
- () 12. Mount a #6 x 3/8" self-tapping screw in the hole at location GND. See Figs. 7 and 10.
- () 13. From the underside of the chassis, install a 9-pin tube socket (without a shield base) (P20-192) in the hole provided for V7. Position the socket so that the blank space between pins 1 and 9 faces the front of the chassis. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts. (NOTE: If the socket has four metal tabs on the mounting flange, bend these tabs down against the chassis.)
- () 14. In the same manner as in Step 13, install three 9-pin tube sockets (without shield bases) (P20-192) in the holes provided for V6, V8 and V9. Position the sockets so that the blank space between pins 1 and 9 faces the front of the chassis. (NOTE: If the sockets have four metal tabs on the mounting flange, bend these tabs down against the chassis.)
- () 15. From the top of the chassis, install a 9-pin tube socket (with a shield base) (P20-202) in the hole provided for V4. Position the socket so that the blank space between pins 1 and 9 faces the rear of the chassis. At W, mount a 4-lug terminal strip (P23-279) from the underside of the chassis. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts.
- () 16. In the same manner as in Step 15, install a 9-pin tube socket (with a shield base) (P20-202) in the hole provided for V5, and a 4-lug terminal strip (P23-279) at X.
- () 17. From the top of the chassis, install a 9-pin tube socket (with a shield base) (P20-202) in the hole provided for V1. Position the socket so that the blank space between pins 1 and 9 faces the front of the chassis. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts.
- () 18. In the same manner as in Step 17, install a 9-pin tube socket (with a shield base) (P20-202) in the hole provided for V2. At Y, mount a #4 ground lug instead of a #4 lockwasher.
- () 19. In the same manner as in Step 17, install a 9-pin tube socket (with a shield base) (P20-202) in the hole provided for V3. At Z, mount a 1-lug terminal strip (P23-221). At AA, mount a #4 ground lug instead of a #4 lockwasher.
- () 20. Mount a 3-lug terminal strip (P23-177) at BB. Use a #6-32 x 5/16" BH screw, a #6 lockwasher, and a #6-32 hex nut. Position the strip as shown in Fig. 8.
- () 21. In the same manner as in Step 20, mount a 3-lug terminal strip (P23-177) at DD. Position the strip as shown in Fig. 8.
- () 22. Mount the selenium rectifier SR (P32-109) at the location indicated in Fig. 8. Use a #6-32 x 1" BH screw, a #6 solder lug, a #6 lockwasher, and a #6-32 hex nut. Position the rectifier terminals as shown. Mount the rectifier with its positive (+) side toward the chassis. Make sure the solder lug is between the chassis and the positive (+) side of the rectifier. Also be sure the solder lug is bent up to, and firmly contacts SR2.
- () 23. Mount R5 (100-ohm Hum Balance control) (P17-233) at the location indicated. Position terminals as shown. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts. After mounting, be sure that terminals do not touch chassis.

- () 24. Refer to Fig. 8. R6 is now mounted. Before mounting R6, carefully bend both lugs so that they will protrude down through the oval vent, as shown in Fig. 8. From the top of the chassis, mount R6 (100-ohm Bias Balance control) (P17-233) at the location indicated. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts. After mounting, be sure that terminals do not touch chassis.
- () 25. In the same manner as in Step 24, mount R7 (100-ohm Bias Balance control) (P17-233) at the location indicated. After mounting, be sure that terminals do not touch chassis.
- () 26. Mount a DPDT (6-terminal) slide switch (P14-233) at SWA. Mount a 2-lug terminal strip (P23-178) at EE as shown. Use two #4-40 x 5/16" BH screws, two #4 lockwashers, and two #4-40 hex nuts.
- () 27. Power transformer T1 (see Fig. 9) has been temporarily mounted on the chassis for shipping purposes. Remove the two nuts holding the transformer to the chassis, and remove the transformer. Then refer to Figs. 8, 9, and 10, and insert a 1/4" rubber grommet (P29-130) into each of the four oversized transformer mounting holes on the chassis.

Pull the wires of the transformer through the cutout provided for it (position it with the leads located as shown in Fig. 8). Use four #8-32 hex nuts and no lockwashers. Do not over-tighten these nuts.

- () 28. Mount C1 and C2 (100 mfd @ 200V electrolytic capacitors) (P16-257) at FF. Also mount a 3-lug terminal strip (P23-177) at FF. Position the capacitors with the positive (+) terminal of C1 toward the rear of the chassis, and the positive (+) terminal of C2 toward the front of the chassis. See Fig. 8 for the positioning of terminal strip FF. Use a #6-32 x 5/16" BH screw, a #6 lockwasher, and a #6-32 hex nut.
- () 29. From the top of the chassis, push the leads of output transformer T2 (P18-189) through the hole provided for the transformer, and mount the transformer over this hole. At HH, mount a 6-lug terminal strip (P23-261-1). Use four #8-32 x 3/8" BH screws, four #8 lockwashers, and four #8-32 hex nuts.
- () 30. In the same manner as in Step 29, mount output transformer T3 (P18-189) over the hole provided for it. At JJ, mount a 2-lug terminal strip (P23-220-1).
- () 31. From the top of the chassis, insert electrolytic capacitor C3 (P16-256) into the mounting holes provided. Position the electrolytic so that the lugs correspond to the coded markings on the chassis. Also see Fig. 8. Hold the capacitor firmly in place and twist the mounting prongs with pliers to secure, as shown in Fig. 8. Note that triangle coding symbol locates toward front of chassis.

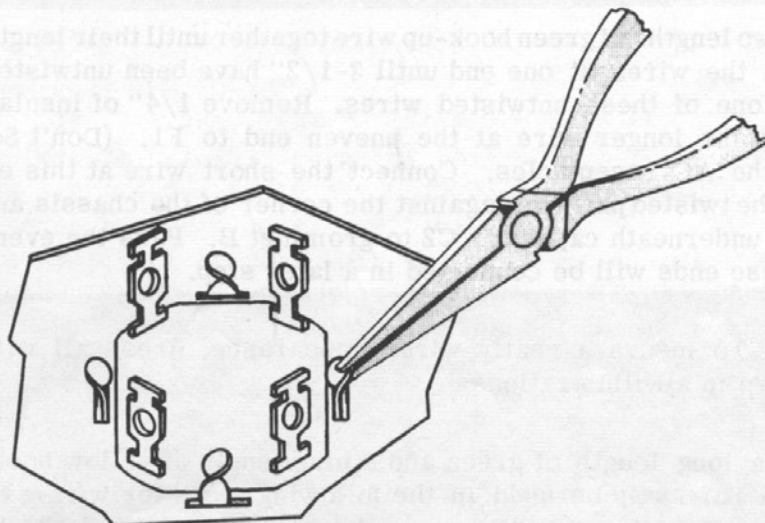


Fig. 11.

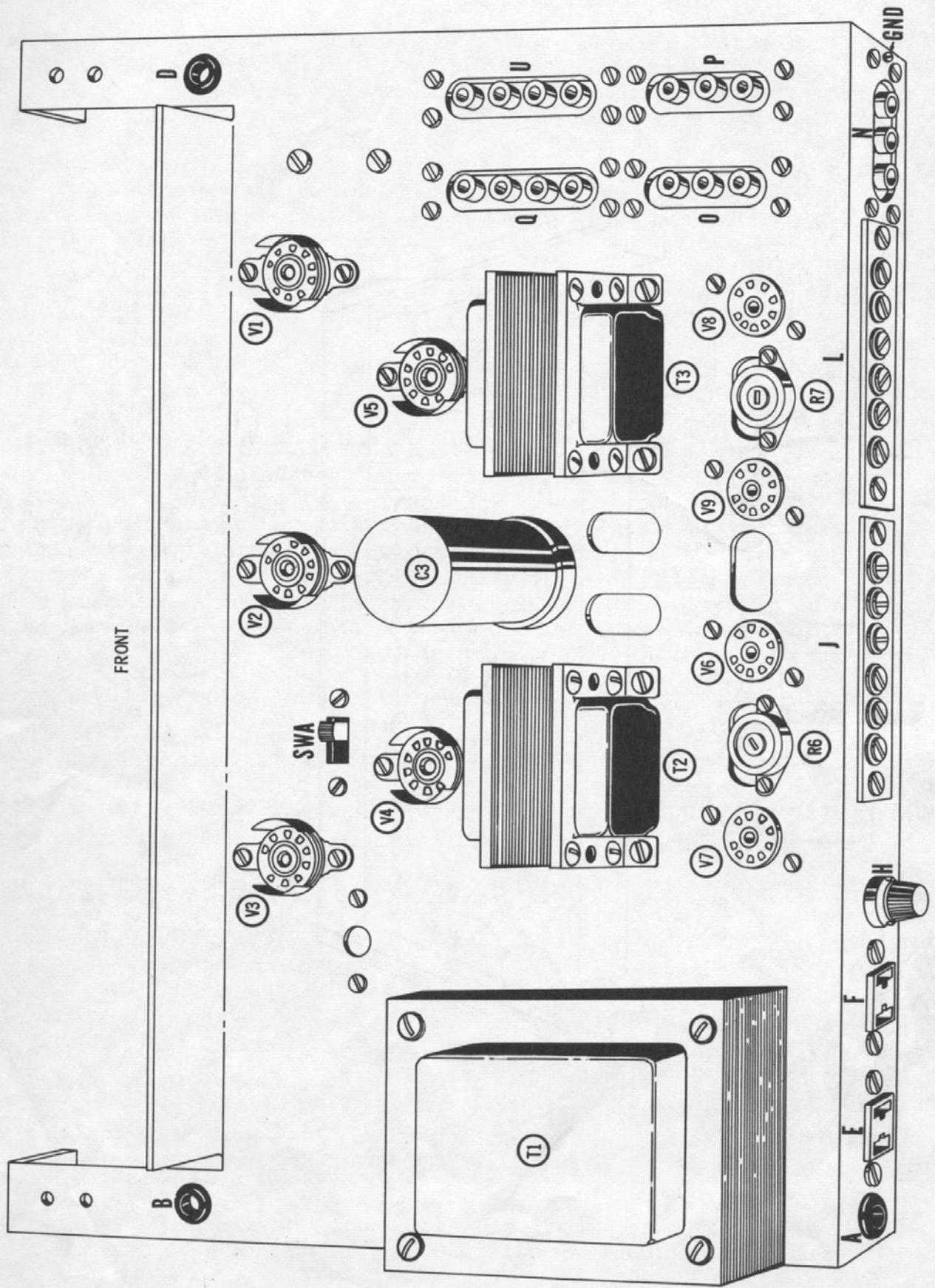


Fig. 9.

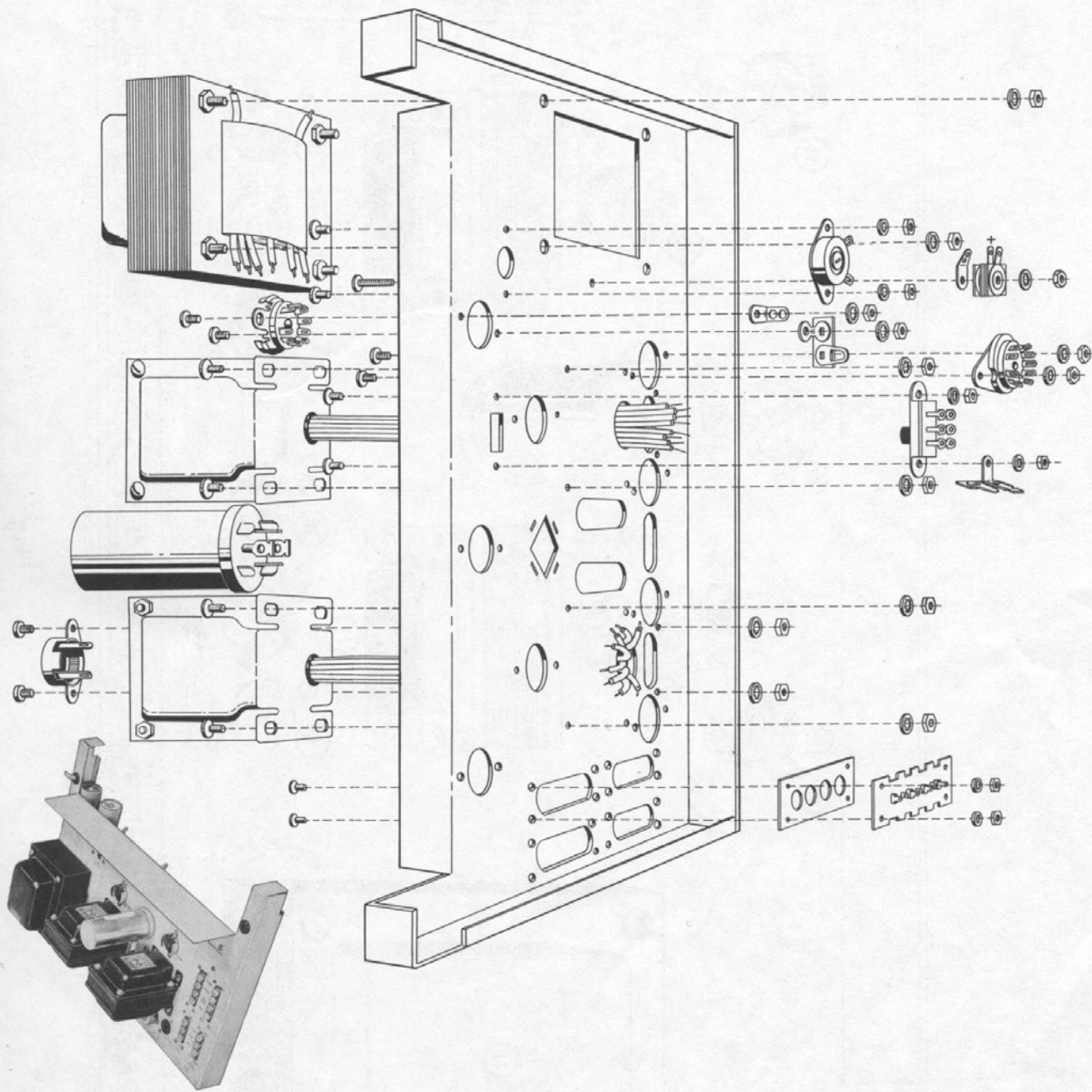


Fig. 10. Exploded View Showing Method of Mounting Various Types of Components. Refer to Figs. 8 and 9 for Proper Placement of All Components Mounted On Chassis.

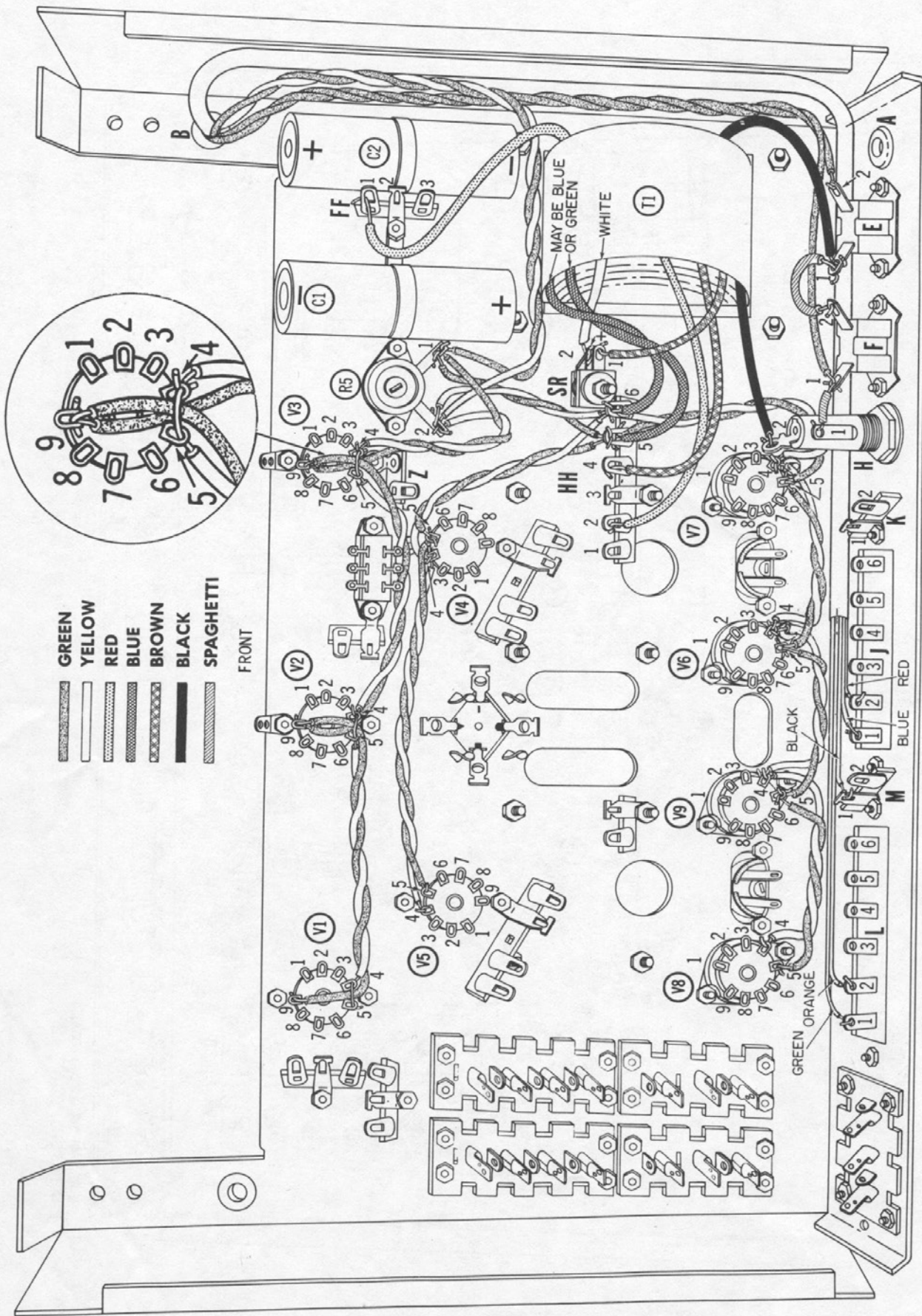


Fig. 12.

PRELIMINARY CHASSIS WIRING

Refer to Figs. 12 Through 14 and Page 61

IMPORTANT: Carefully position (dress) all leads and wires against the chassis. All power-transformer leads of T1 have been trimmed to proper length, and have been tinned for easier connection into the circuit. Let us pause momentarily and identify them. Note the six leads on the side facing selenium rectifier SR. Starting from the end nearest the rear apron of the chassis and moving toward capacitor C1, you will see one black, two brown, one red, and two blue leads. On the opposite side of T1 (the side nearest the right-hand apron of the chassis), there are two leads -- one black (nearest the rear apron) and one red (nearest capacitor C2). Remember the identity of these leads -- they must be correctly connected into the circuit.

- () 32. Twist the two blue leads (or green leads) of transformer T1 together. Connect one of these leads to HH5 (Don't Solder). Connect the other lead to HH6 (Don't Solder).
- () 33. Select the red lead that comes out of T1 on the same side as the two blue leads. Connect this red lead to HH2 (Don't Solder).
- () 34. Connect the longer of the two brown leads to HH4 (Don't Solder).

IMPORTANT REMINDER: Solder designations in the instructions will be followed by a number, such as (Solder: 1) or (Solder: 4). This number refers to the number of wires or component leads that should be attached to the particular lug or terminal to be soldered. Before soldering, always make sure the specified number of leads have been connected. If the number of leads you have been instructed to solder differs from the number of leads actually attached to a lug, go back over the preceding steps thoroughly in order to locate and remedy the error. Don't overlook soldering instruction at the bottom of page 14 and on pages 16 and 17!

- () 35. Connect the white wire from transformer T1 to SR2 and ground lug underneath SR2, then solder.
- () 36. Connect the short brown lead of T1 to SR1 (Solder: 1).
- () 37. Select the black lead that comes out of T1 next to the short brown lead in Step 36. Connect this black lead to H2 (Solder: 1).
- () 38. Connect the other black lead, on the opposite side of T1, to E1 (Don't Solder).
- () 39. Connect the other red lead of T1, near capacitor C2, to FF1 (Don't Solder).

PAGE 28, STEP 39: ADD THE FOLLOWING: A SHORT PIECE OF BARE BRAIDED WIRE IS SUPPLIED IN AN ENVELOPE ALONG WITH THE FOUR GROMMETS FOR MOUNTING TRANSFORMER T-1. SOLDER ONE END OF THIS BARE WIRE TO THE COPPER SHEETING ON THE BOTTOM OF TRANSFORMER T-1 (SEE FIG. 15) AT ANY POINT CLOSEST TO THE REAR OF THE CHASSIS. SOLDER THE OTHER END OF THIS WIRE TO ANY POINT ON THE CHASSIS. HOLD YOUR SOLDERING IRON ONTO THE COPPER LONG ENOUGH TO PERMIT THE SOLDER TO FLOW. THE SAME APPLIES TO SOLDERING ONTO THE CHASSIS.

NOTE: To insure a neatly wired appearance, dress all wires against the chassis, as shown in all illustrations.

- () 41. Twist a long length of green and a long length of yellow hookup wire together. This twisted pair will be used in the following steps for wiring the heater and pilot light circuits. Cut off the lengths as required. Twist additional lengths of green and yellow hookup wire if this one length is not sufficient.

- () 42. Cut off a 3-1/2" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to HH6 (Don't Solder). Connect the green wire, at the same end, to HH5 (Don't Solder). Connect the other end of the yellow wire to terminal #4 on V7 (Don't Solder). Connect the other end of the green wire to terminal #5 on V7 (Don't Solder). Dress the twisted pair neatly against the chassis above the wires of transformer T1, and underneath the fuse post.
- () 43. Cut off a 3-1/2" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to terminal #4 on V7 (Solder: 2). Connect the green wire, at the same end, to terminal #5 on V7 (Solder: 2). Connect the other end of the yellow wire to terminal #4 on V6 (Don't Solder). Connect the other end of the green wire to terminal #5 on V6 (Don't Solder). Dress the wires neatly against the chassis, between the tube sockets and the rear apron.
- () 44. Cut off a 3-1/2" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to terminal #4 on V6 (Solder: 2). Connect the green wire, at the same end, to terminal #5 on V6 (Solder: 2). Connect the other end of the yellow wire to terminal #4 on V9 (Don't Solder). Connect the other end of the green wire to terminal #5 on V9 (Don't Solder). Dress the wires neatly against the chassis, between the tube sockets and the rear apron.
- () 45. Cut off a 3-1/2" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to terminal #4 on V9 (Solder: 2). Connect the green wire, at the same end, to terminal #5 on V9 (Solder: 2). Connect the other end of the yellow wire to terminal #4 on V8 (Solder: 1). Connect the other end of the green wire to terminal #5 on V8 (Solder: 1). Dress the wires neatly against the chassis, between the tube sockets and the rear apron.
- () 46. Cut off a 5" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to HH6 (Don't Solder). Connect the green wire, at the same end, to HH5 (Don't Solder). Connect the other end of the yellow wire to terminal #4 on V4 (Don't Solder). Connect the other end of the green wire to terminal #5 on V4 (Don't Solder). Dress the wires neatly against the chassis.
- () 47. Cut off a 5-1/2" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to terminal #4 on V4 (Solder: 2). Connect the green wire, at the same end, to terminal #5 on V4 (Solder: 2). Connect the other end of the yellow wire to terminal #4 on V5 (Solder: 1). Connect the other end of the green wire to terminal #5 on V5 (Solder: 1). Dress the wires neatly against the chassis.
- () 48. Cut off a 4" length of green-yellow twisted pair, and remove 1/4 inch of insulation from the ends of the four leads. Connect one end of the yellow wire to HH6 (Solder: 4).

NOTE: Whenever a terminal lug has several wires attached, be extra careful that they are well soldered. It is very easy to make what looks like a well-soldered joint, only to find that one or two wires are not covered with enough solder to make a good connection.

Connect the green wire, at the same end, to HH5 (Solder: 4). Connect the other end of the yellow wire to terminal #2 on R5 (Don't Solder). (Bend both terminals of R5 away from the chassis slightly.) Connect the other end of the green wire to terminal #1 on R5 (Don't Solder). Dress the wires neatly against the chassis. Bend electrolytic capacitor C1 slightly away from R5 to clear the lug for soldering.

- () 49. Cut off a 4-1/2" length of green-yellow twisted pair. Cut 1/2 inch off one end of the yellow wire. Remove 1/4 inch of insulation from the ends of all four leads. Connect the yellow wire, at the even end, to terminal #2 on R5 (Don't Solder). Connect the green wire, at the same end, to terminal #1 on R5 (Don't Solder). Connect the yellow wire, at the uneven end, to terminal #4 on V3 (Don't Solder). The green wire at this end will be connected in the next step. Dress the pair neatly against the chassis, and route them between R5 and terminal strip Z.
- () 50. Cut off a 6" length of green-yellow twisted pair. Cut 1/2 inch off both ends of the yellow wire. Remove 1/2 inch of insulation from both ends of the yellow wire. Remove 1/4 inch of insulation from both ends of the green wire. Pass the yellow wire, at one end of this twisted pair, through terminal #5 on V3 (Don't Solder). Connect this wire to terminal #4 on V3 (Solder: 2). Now solder terminal #5 on V3 (Solder: 1). Be sure the wires are connected to the end of the terminal, as illustrated. Pass the green wire at this end, and the green wire from R5 (Step 49), underneath the jumper between terminals #4 and #5 on V3. Connect these wires to terminal #9 on V3 (Solder: 2). Connect the other end of the yellow wire to terminal #4 on V2 (Don't Solder). Cut off 1/4 inch of excess wire. The green wire at this end will be connected in the next step. Dress the pair neatly against the chassis, and route them between V4 and SWA.
- () 51. Cut off a 6" length of green-yellow twisted pair. Cut 1/2 inch off both ends of the yellow wire. Remove 1/2 inch of insulation from both ends of the yellow wire. Remove 1/4 inch of insulation from both ends of the green wire. Pass the yellow wire, at one end of this twisted pair, through terminal #5 on V2 (Don't Solder). Connect this wire to terminal #4 on V2 (Solder: 2). Now solder terminal #5 on V2 (Solder: 1). Pass the green wire at this end, and the green wire from V3 (Step 50), underneath the jumper between terminals #4 and #5 on V2. Connect these wires to terminal #9 on V2 (Solder: 2). Pass the other end of the yellow wire through terminal #4 on V1 (Don't Solder) to terminal #5 on V1 (Solder: 1). Now solder terminal #4 on V1 (Solder: 1). Pass the green wire, at this end, underneath the jumper between terminals #4 and #5 on V1. Connect this wire to terminal #9 on V1 (Solder: 1). Dress the wires neatly against the chassis.
- () 52. Remove 1/4 inch of insulation from the ends of the four leads of the remaining 23" length of green-yellow twisted pair. Connect one end of the yellow wire to terminal #2 on R5 (Solder: 3). Connect the green wire, at the same end, to terminal #1 on R5 (Solder: 3). Dress the pair neatly against the chassis. Route them over to the right-hand apron between T1 and capacitors C1 and C2, then underneath C2, and pass the ends through grommet B. These ends will be connected later.
- () 53. Refer to Fig. 13. Prepare one end of the 5-wire unshielded cable as follows:
- With a sharp knife or a razor blade, cut a slit lengthwise in one end of the plastic outer jacket. See Fig. 13A.
 - Grasp the outer jacket in one hand and the five inner wires in the other hand, and peel the outer jacket back 6 inches. See Fig. 13B.
 - Trim off the peeled-back outer jacket with a small pair of scissors or diagonal cutting pliers. See Fig. 13C.
 - Cut each of the exposed inner wires (except the green wire) to the following sizes. See Fig. 14.

Red	2-1/2 inches	Orange	5-1/2 inches
Blue	3 inches	Green	Do not cut
Black	4 inches		

e. Remove 1/4 inch of insulation from the ends of the inner conductors. See Figs. 13D and E. Position the prepared end of the cable under binding post strips J and L, in the corner formed by the rear apron and the underside of the chassis. The ends of the green and orange wires should be almost underneath L1 and L2. The edge of the outer jacket should be almost underneath J5. Dress the other end of the cable under fuse post H and under AC connectors F and E, then over to the right-hand apron, up the right-hand apron under C2, and finally, through grommet B. This end will be connected later.

- () 54. Connect the green lead of the cable to L1. (Solder: 1).
- () 55. Connect the orange lead of the cable to L2 (Solder: 1).
- () 56. Connect the black lead of the cable to M1 (Don't Solder).
- () 57. Connect the blue lead of the cable to J1 (Solder: 1).
- () 58. Connect the red lead of the cable to J2 (Solder: 1). Carefully press the cable tightly into the corners of the chassis.

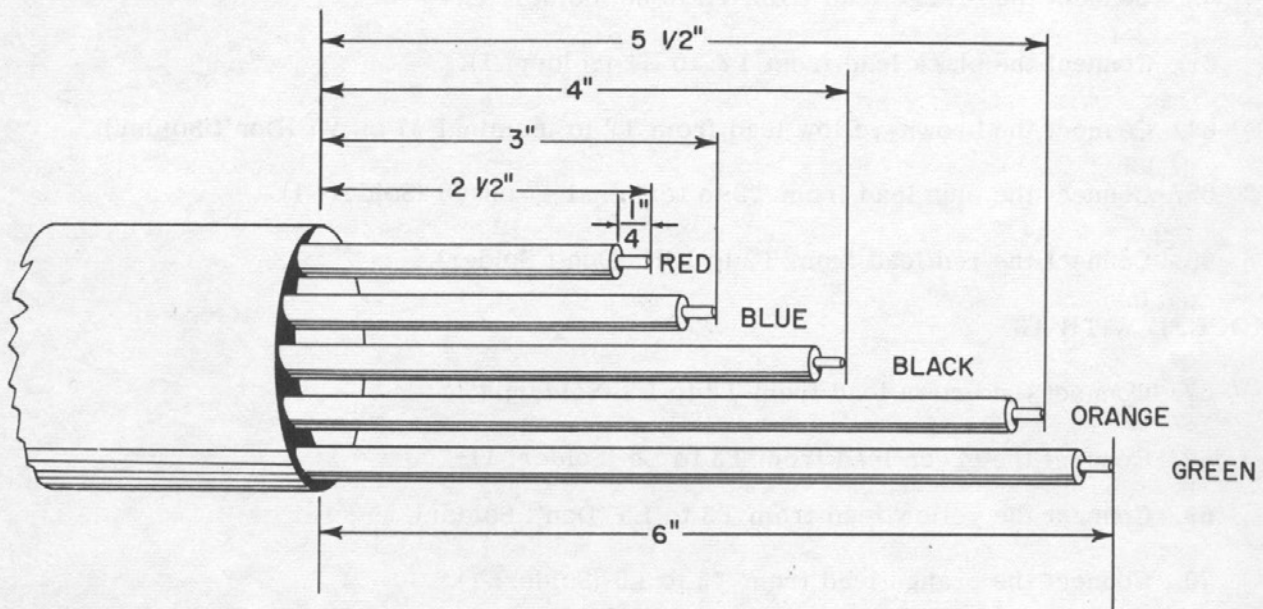
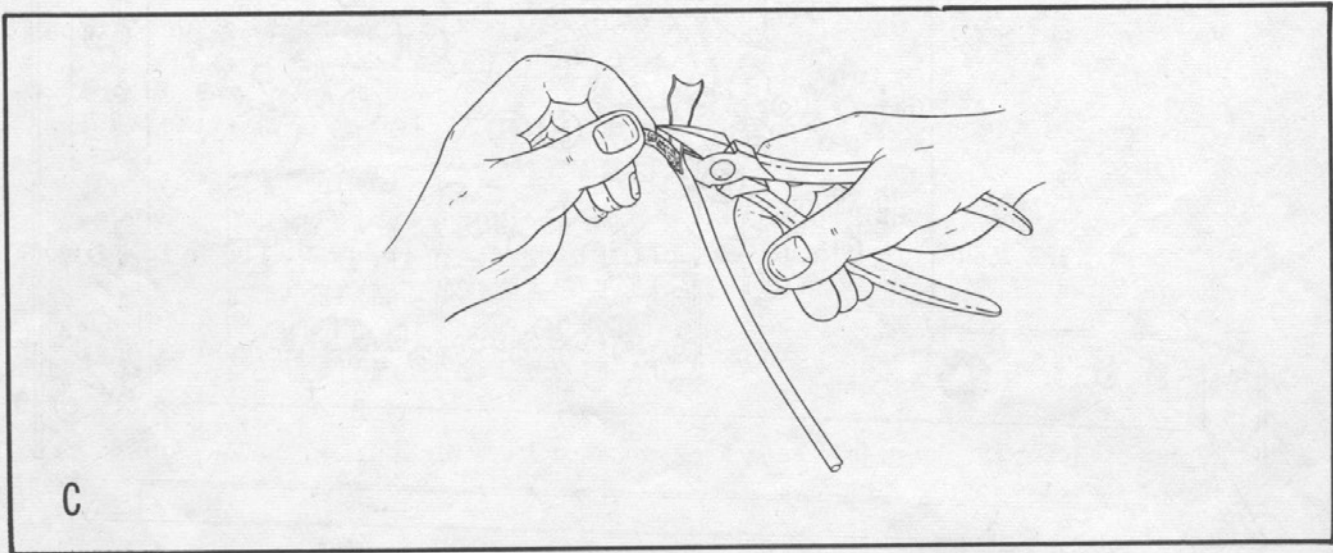
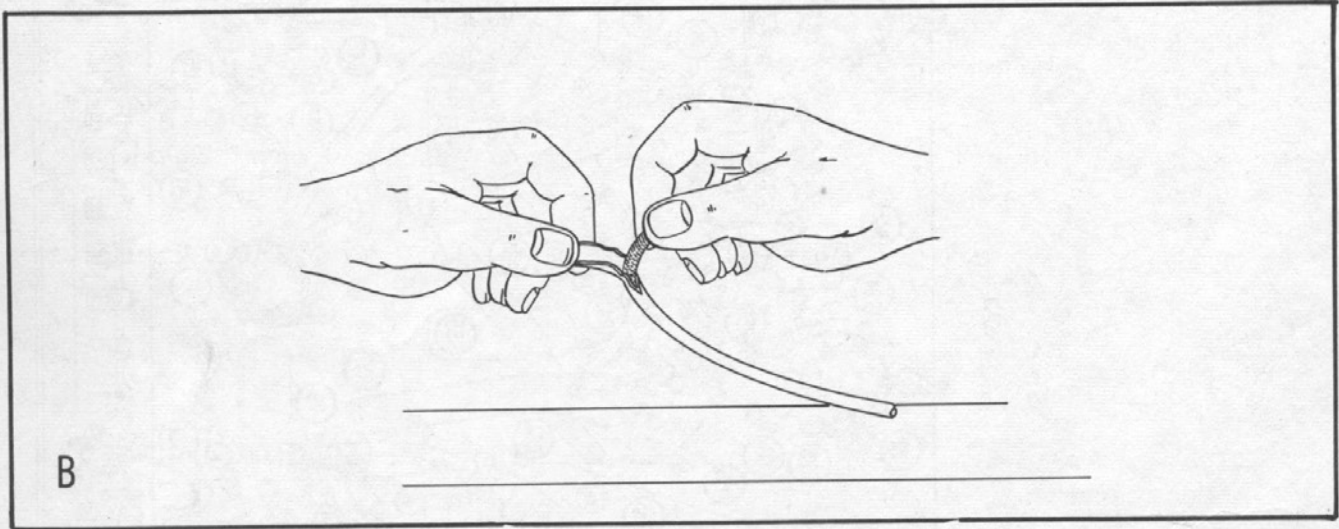
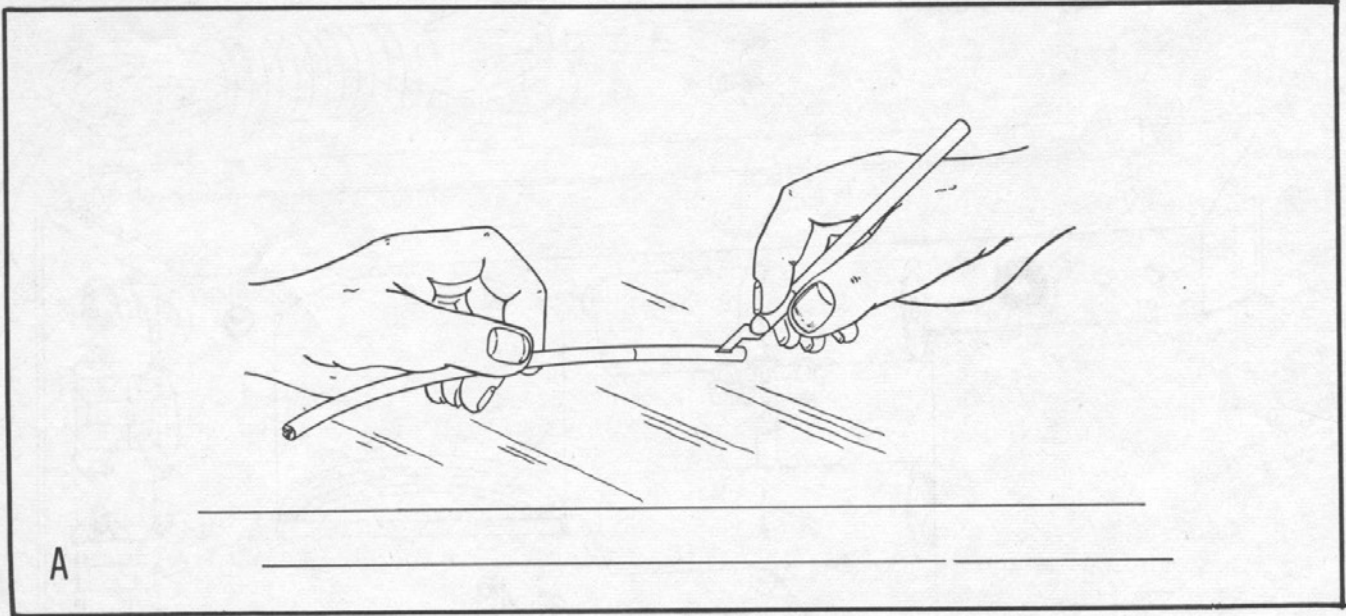
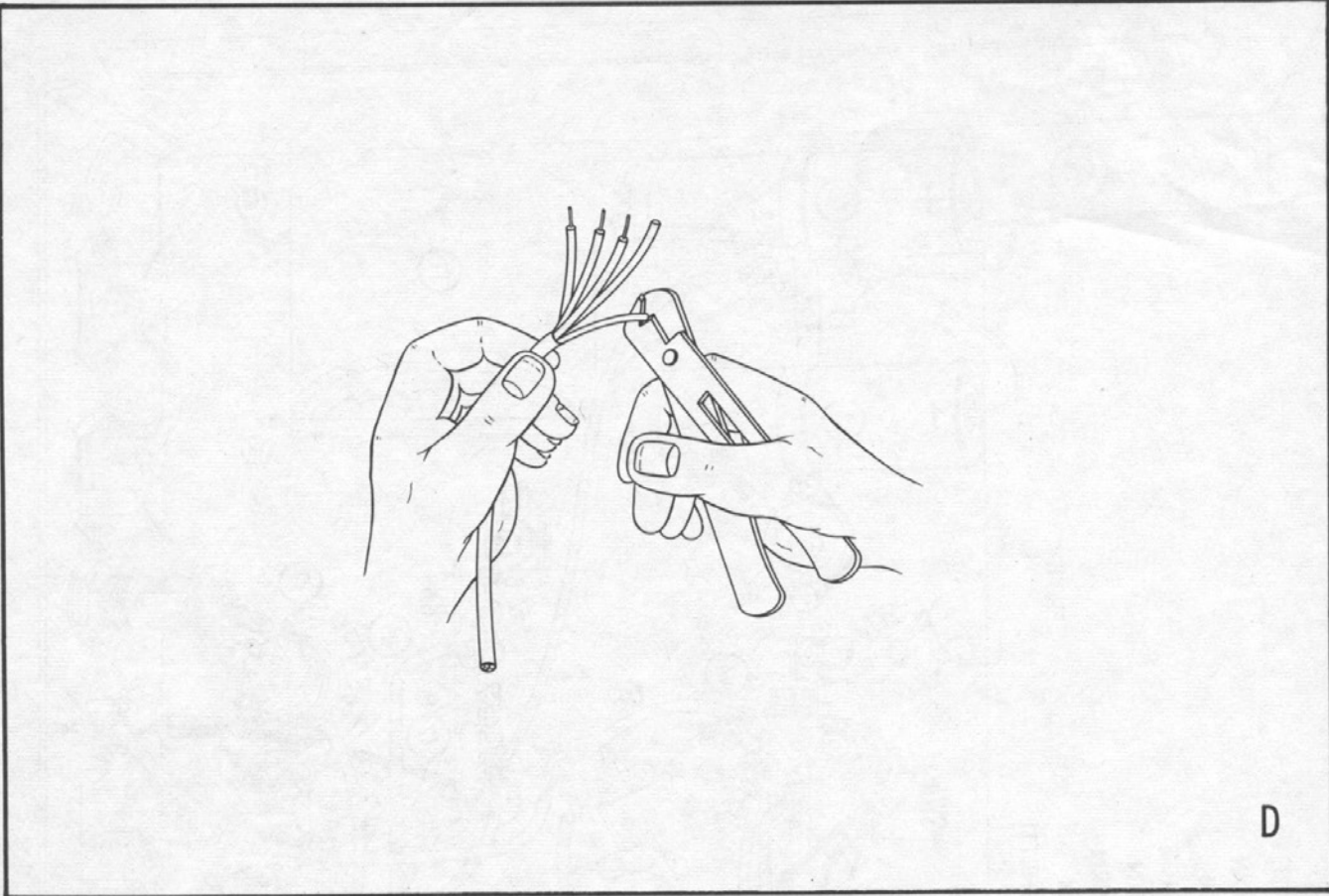
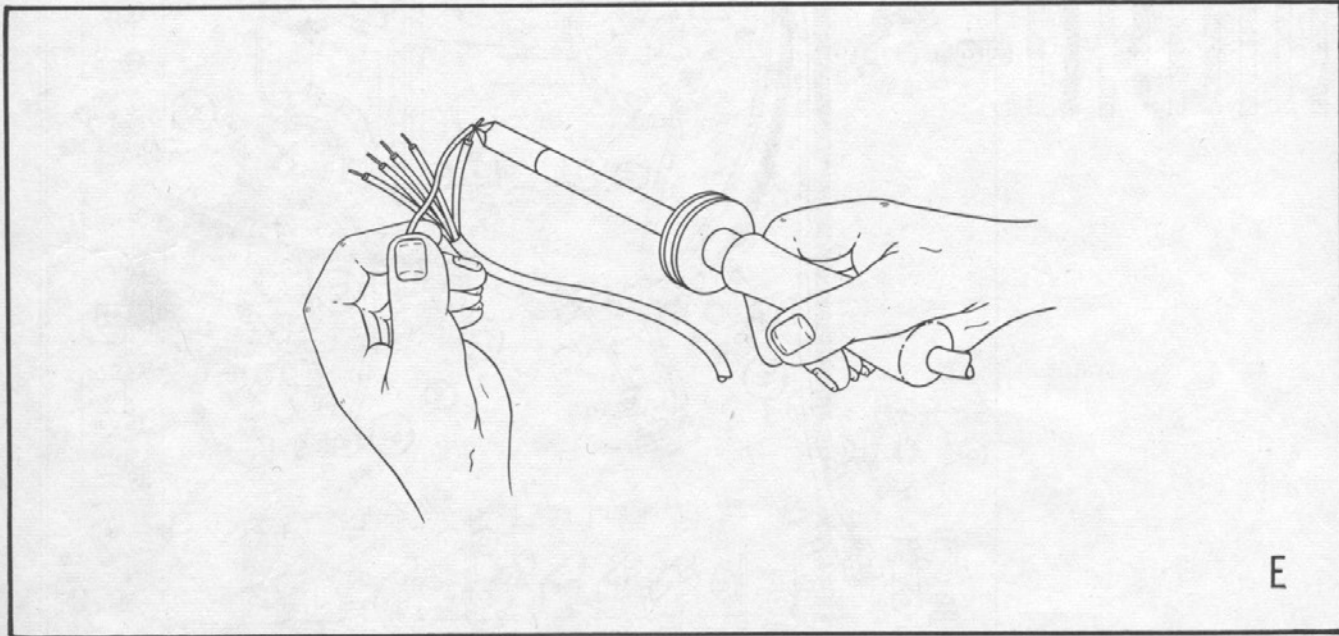


Fig. 14.





D



E

Fig. 13

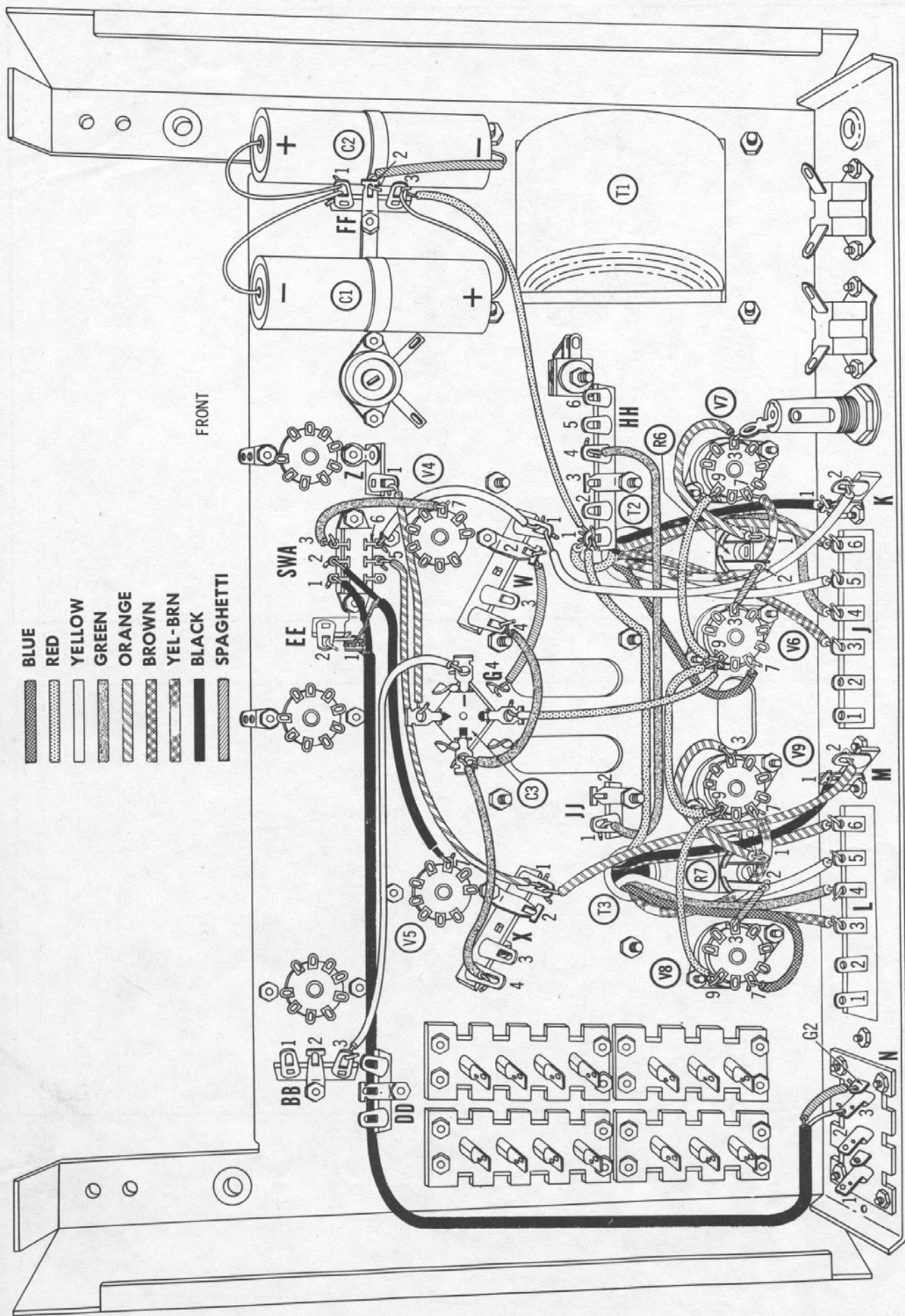


Fig. 15.

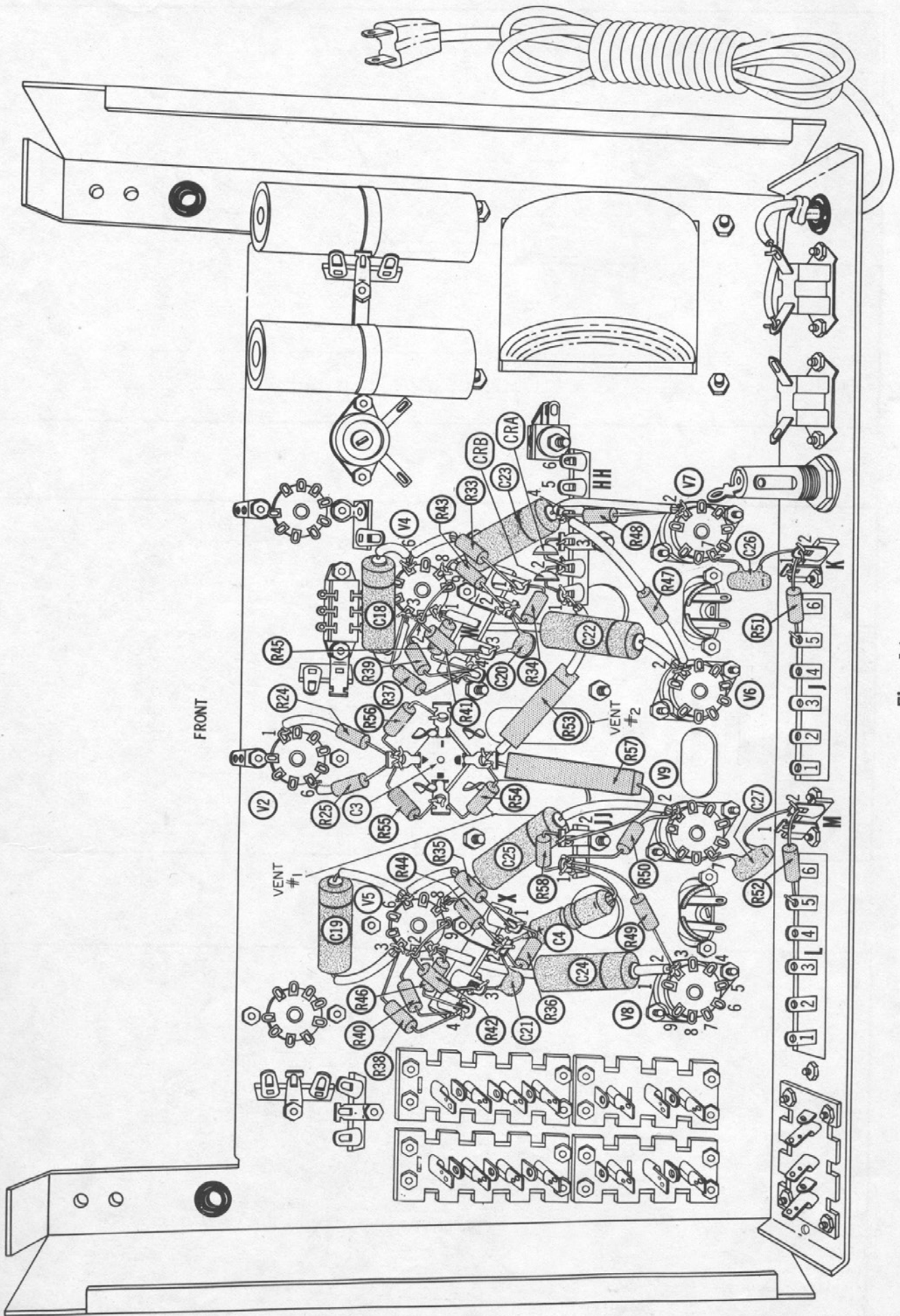


Fig. 16.

Refer to Fig. 15

NOTE: The leads of the two output transformers T2 and T3 will be connected next. All of these leads except the red leads have been trimmed to 3-1/2 inches and have been tinned. The red leads are 5-1/2 inches long. Be sure to dress all leads as shown in Fig. 15, so that some leads pass to the right and some to the left of Bias Balance controls R6 and R7. The wires connecting these controls into the circuit will be added later. These wires also hold the transformer leads in place against the chassis and away from the controls. Before connecting the leads from output transformer T2, cut the red lead on T2 to 1-1/2 inches, remove 1/4 inch of insulation, and tin the stranded end.

PROCEED WITH T2

NOTE: Dress all wires neatly against the chassis.

- () 59. Connect the brown lead from T2 to J3 (Solder: 1).
- () 60. Connect the green lead from T2 to J4 (Solder: 1).
- () 61. Connect the yellow lead from T2 to J5 (Don't Solder).
- () 62. Connect the orange lead from T2 to J6 (Solder: 1).
- () 63. Connect the black lead from T2 to K1 (Solder: 1).
- () 64. Connect the brown-yellow lead from T2 to terminal #7 on V7 (Don't Solder).
- () 65. Connect the blue lead from T2 to terminal #7 on V6 (Solder: 1).
- () 66. Connect the red lead from T2 to HH1 (Don't Solder).

PROCEED WITH T3

- () 67. Connect the brown lead from T3 to L3 (Solder: 1).
- () 68. Connect the green lead from T3 to L4 (Solder: 1).
- () 69. Connect the yellow lead from T3 to L5 (Don't Solder).
- () 70. Connect the orange lead from T3 to L6 (Solder: 1).
- () 71. Connect the black lead from T3 to M1 (Solder: 2).
- () 72. Connect the brown-yellow lead from T3 to terminal #7 on V9 (Don't Solder).
- () 73. Connect the blue lead from T3 to terminal #7 on V8 (Solder: 1).
- () 74. Connect the red lead from T3 to HH1 (Don't Solder).
- () 75. Refer to Fig. 12 and connect a 1 1/2" length of bare hook-up wire [use thin spaghetti (insulated tubing)] from E1 (Don't Solder) to F2 (Solder: 1).
- () 76. Refer to Fig. 12 and connect a 1 1/2" length of bare hook-up wire (use spaghetti) from F1 (Solder: 2) to H1 (Solder: 1).

NOTE: Dress all wires neatly against the chassis.

- () 77. Connect a 6-1/2" length of green hook-up wire from HH4 (Don't Solder) to JJ1 (Don't Solder).

- () 78. Connect a 5-1/2" length of yellow hook-up wire from K2 (Don't Solder) to W1 (Don't Solder).
- () 79. Connect a 3-1/2" length of yellow hook-up wire from W1 (Don't Solder) to SWA 6 (Solder: 1).
- () 80. Connect a 6" length of orange hook-up wire from SWA5 (Solder: 1) to X1 (Don't Solder).
- () 81. Connect a 5-1/2" length of orange hook-up wire from X1 (Don't Solder) to M2 (Don't Solder).
- () 82. Connect a 1" length of bare hook-up wire from terminal #3 on V8 (use spaghetti) (Solder: 1) to terminal #2 on R7 (Solder: 1). This wire will also keep the output transformer wires against the chassis.
- () 83. Connect a 2-1/2" length of orange hook-up wire from terminal #3 on V9 (Solder: 1) to terminal #1 on R7 (Solder: 1). This wire will also keep the output transformer wires against the chassis.
- () 84. Connect a 1" length of bare hook-up wire from terminal #3 on V6 (use spaghetti) (Solder: 1) to terminal #2 on R6 (Solder: 1).
- () 85. Connect a 2-1/2" length of orange hook-up wire from terminal #3 on V7 (Solder: 1) to terminal #1 on R6 (Solder: 1).
- () 86. Connect a 3-1/2" length of red hook-up wire from terminal #9 on V7 (Solder: 1) to terminal #9 on V6 (Don't Solder).
- () 87. Connect a 3-1/2" length of red hook-up wire from terminal #9 on V6 (Don't Solder) to terminal #9 on V9 (Don't Solder).
- () 88. Connect a 3-1/2" length of red hook-up wire from terminal #9 on V9 (Solder: 2) to terminal #9 on V8 (Solder: 1).
- () 89. Connect a 4" length of red hook-up wire from terminal #9 on V6 (Solder: 3) to C3 ▲ (Don't Solder).
- () 90. Connect a 2-1/2" length of bare hook-up wire (use spaghetti) from W2 (Don't Solder) to G4 on C3 (Solder: 1).
- () 91. Connect a 4" length of green hook-up wire from C3 ■ (Don't Solder) to X4 (Don't Solder).
- () 92. Connect a 3-1/2" length of green hook-up wire from C3 ■ (Don't Solder) to W4 (Don't Solder).
- () 93. Connect a 7" length of yellow hook-up wire from C3 — (Don't Solder) to BB3 (Don't Solder).
- () 94. Connect a 4-1/2" length of orange hook-up wire from C3 ▲ (Don't Solder) to Z1 (Don't Solder).
- () 95. Connect a 2-1/2" length of green hook-up wire from terminal #7 on V4 (Solder: 1) to SWA3 (Don't Solder).

- () 96. Prepare a 5" length of black, single-conductor shielded cable as follows:
 - a. Remove 1 inch of the outer insulation from both ends, being careful not to cut into the shield wires. (Make small slits in the ends, and peel back the insulation, as illustrated in Figs. 13A and B.)
 - b. On one end, unwind the shield wires and cut them off at the base of the outer insulation.
 - c. On the other end, unwind the shield wires, twist them into a single strand, and tin the end.
 - d. Remove 1/4 inch of insulation from both ends of the inner conductor.
 - e. Tin both ends of the stranded inner conductor.
- () 97. Using the prepared cable from step 96, connect the end with the shield trimmed off (Step 96b) to terminal #7 on V5 (Solder: 1). Connect the inner conductor, at the other end, to SWA2 (Solder: 1). At this same end, pass the shield wire through EE1 (Don't Solder) and connect it to EE2 (Don't Solder).
- () 98. Prepare a 16" length of black, single-conductor shielded cable as described in Step 96, except omit Step 96b, and prepare the shield wires on both ends, as described in Step 96c. Connect the inner conductor, at one end of this cable, to N3 (Solder: 1). At this same end, cover the shield wire with spaghetti and connect it to G2 on N (Solder: 1). Dress the cable against the chassis, over to the left-hand apron, then up along the left-hand apron in the corner formed by the apron and the underside of the chassis, to a point opposite terminal strip DD, and finally across the chassis between terminal strips DD and BB to switch SWA. Connect the inner conductor, at this end, to SWA1 (Don't Solder). Connect the shield wire, at this end, to EE1 (Solder: 2).
- () 99. Cover the negative (unmarked) lead of C2 with spaghetti. Connect this wire to FF2 (Solder: 1). Connect the positive (+) lead of C2 to FF1 (Don't Solder).
- () 100. Connect the negative (unmarked) lead of C1 to FF1 (Solder: 3). Connect the positive (+) lead to FF3 (Don't Solder).
- () 101. Connect a 7" length of red hook-up wire from FF3 (Solder: 2) to HH1 (Don't Solder).

FINAL WIRING OF POWER-AMPLIFIER SECTION

NOTE: When inserting a resistor or capacitor (or other component) into place, it is most important that you position the component as shown in the illustration. Lead lengths and physical fit have been carefully designed into the SA-40 and are accurately portrayed in all the illustrations.

Refer to Fig. 16

- () 102. Connect resistor R51 (2200 ohms, 1/2 Watt, 10% Carbon) (red-red-red-silver) from J5 (Solder: 2) to K2 (Don't Solder).
- () 103. Connect capacitor C26 (68 mmf, 1000V, Ceramic Disc or Tubular) (gray-black-blue-gray-black-black) from K2 (Solder: 3) to terminal #7 on V7 (Solder: 2).
- () 104. Connect one end of Capacitor C23 (0.1 mfd @ 400V, Molded Tubular) to terminal #2 on V7 (do not cut lead) (use spaghetti) (Don't Solder). Dress this lead between HH4 and HH5. Connect the other lead to terminal #8 on V4 (use spaghetti) (Don't Solder).
- () 105. Connect Resistor R48 (220K ohms, 1/2 Watt, 10% Carbon) (red-red-yellow-silver) from terminal #2 on V7 (Solder: 2) to HH4 (Don't Solder).

- () 106. Connect Resistor R47 (220K ohms, 1/2 Watt, 10% Carbon) (red-red-yellow-silver) (use spaghetti on both leads) from HH4 (Solder: 4) to terminal #2 on V6 (Don't Solder).
- () 107. Connect one lead of Capacitor C22 (0.1 mfd @ 400V, Molded Tubular) to terminal #2 on V6 (use spaghetti) (Solder: 2). Pass the other lead through the hole between terminals #2 and #3 on terminal strip W, and connect it to terminal #1 on V4 (use spaghetti) (Don't Solder).
- () 108. Connect Resistor R52 (2200 ohms, 1/2 Watt, 10% Carbon) (red-red-red-silver) from L5 (Solder: 2) to M2 (Don't Solder).
- () 109. Connect Capacitor C27 (68 mmf, 1000V, Ceramic Tubular) (gray-black-blue-gray-black-black) from M2 (Solder: 3) to terminal #7 on V9 (Solder: 2).
- () 110. Connect one lead of Capacitor C25 (0.1 mfd @ 400V, Molded Tubular) to terminal #2 on V9 (use spaghetti) (Don't Solder). Connect the other lead to terminal #8 on V5 (use spaghetti) (Don't Solder).
- () 111. Connect Resistor R50 (220K ohms, 1/2 Watt, 10% Carbon) (red-red-yellow-silver) from terminal #2 on V9 (Solder: 2) to JJ1 (Don't Solder).
- () 112. Connect one lead of Capacitor C24 (0.1 mfd @ 400V, Molded Tubular) to terminal #2 on V8 (use spaghetti) (Don't Solder). Pass the other lead through the hole between terminals #2 and #3 on terminal strip X, and connect it to terminal #1 on V5 (use spaghetti) (Don't Solder).
- () 113. Connect Resistor R49 (220K ohms, 1/2 Watt, 10% Carbon) (red-red-yellow-silver) from terminal #2 on V8 (Solder: 2) to JJ1 (Don't Solder).
- () 114. Connect Resistor R46 (27K ohms, 1/2 Watt, 5% Carbon) (red-violet-orange-gold) from terminal #1 on V5 (Solder: 2) to X4 (Don't Solder).
- () 115. Connect one lead of Resistor R42 (15K ohms, 1/2 Watt, 10% Carbon) (brown-green-orange-silver) to X3 (Don't Solder). Pass the other lead through terminal #2 on V5 (Don't Solder), and connect it to terminal #9 on V5 (Solder: 1). Make sure that the resistor lead, which connects from terminal #2 to terminal #9 does not short against terminal #1 on V5.
- () 116. Connect Resistor R40 (360K ohms, 1/2 Watt, 5% Carbon) (orange-blue-yellow-gold) from terminal #2 on V5 (Solder: 2) to X4 (Don't Solder).
- () 117. Connect Resistor R38 (1.5 Meg, 1/2 Watt, 5% Carbon) (brown-green-green-gold) from X4 (Solder: 4) to terminal #3 on V5 (Don't Solder).
- () 118. Connect the outside foil lead (banded end) of Capacitor C19 (.033 mfd @ 400V, Molded Tubular) to terminal #6 on V5 (use spaghetti) (Don't Solder). Connect the other lead to terminal #3 on V5 (use spaghetti) (Solder: 2).
- () 119. Connect Resistor R35 (1800 ohms, 1/2 Watt, 5% Carbon) (brown-gray-red-gold) from terminal #6 on V5 (use spaghetti) (Solder: 2) to X1 (Don't Solder).
- () 120. Connect Resistor R44 (27K ohms, 1/2 Watt, 5% Carbon) (red-violet-orange-gold) from terminal #8 on V5 (Solder: 2) to X2 (Don't Solder).
- () 121. Connect Capacitor C21 (47 mmf, Ceramic Disc) from X2 (Don't Solder) to X3 (Solder: 2).
- () 122. Connect the positive (+) lead of Capacitor C4 (100 mfd @ 12V, Electrolytic) to X2 (Don't Solder). Connect the negative (-) lead to JJ1 (Don't Solder).

- () 123. Connect Resistor R36 (56 ohms, 1/2 Watt, 10% Carbon) (green-blue-black-silver) from X1 (Solder: 4) to X2 (Solder: 4).
- () 124. Connect resistor R58 (10K ohms, 1/2 Watt, 10% Carbon) (brown-black-orange-silver) from JJ1 (Solder: 5) to JJ2 (Don't Solder).
- () 125. Connect resistor R57 (12K ohms, 10 Watt, Wirewound) (P15-967) from JJ2 (Solder: 2) to C3 ▲ (Don't Solder). Position R57 over vent 1. Press R57 firmly against the chassis.
- () 126. Connect one lead of resistor R53 (2000 ohms, 7 Watt, Wirewound) (P15-531A) to C3 ▲ (use spaghetti) (Don't Solder). Pass the other lead under C22 and connect this lead to HH1 (do not cut) (use spaghetti) (Don't Solder). Position R53 over vent 2. Press R53 firmly against the chassis.
- () 127. Connect resistor R54 (3300 ohms, 1/2 Watt, 10% Carbon) (orange-orange-red-silver) from C3 ▲ (Solder: 4) to C3 ■ (Don't Solder). Note: Make sure that solder does not run down the lug and cause a short between lug and chassis!
- () 128. Connect resistor R55 (10K ohms, 1/2 Watt, 10% Carbon) (brown-black-orange-silver) from C3 ■ (Solder: 4) to C3 ▲ (Don't Solder).
- () 129. Connect resistor R25 (82K ohms, 1/2 Watt, 10% Carbon) (gray-red-orange-silver) from C3 ▲ (Don't Solder) to terminal #6 on V2 (use spaghetti) (Don't Solder).
- () 130. Connect resistor R24 (82K ohms, 1/2 Watt, 10% Carbon) (gray-red-orange-silver) from C3 ▲ (Don't Solder) to terminal #1 on V2 (use spaghetti) (Don't Solder).
- () 131. Connect resistor R56 (22K ohms, 1/2 Watt, 10% Carbon) (red-red-orange-silver) from C3 ▲ (Solder: 5) to C3 — (Solder: 2).

NOTE: In the following steps, the wiring of socket V4 is similar to that of socket V5.

- () 132. Connect resistor R45 (27K ohms, 1/2 Watt, 5% Carbon) (red-violet-orange-gold) from terminal #1 on V4 (Solder: 2) to W4 (Don't Solder).
- () 133. Connect one lead of resistor R41 (15K ohms, 1/2 Watt, 10% Carbon) (brown-green-orange-silver) to W3 (Don't Solder). Pass the other end of R41 through terminal #2 on V4 (Don't Solder) and connect it to terminal #9 on V4 (Solder: 1).
- () 134. Connect resistor R39 (360K ohms, 1/2 Watt, 5% Carbon) (orange-blue-yellow-gold) from terminal #2 on V4 (Solder: 2) to W4 (Don't Solder).
- () 135. Connect resistor R37 (1.5 Meg, 1/2 Watt, 5% Carbon) (brown-green-green-gold) from W4 (Solder: 4) to terminal #3 on V4 (Don't Solder).
- () 136. Connect the outside foil lead (banded end) of capacitor C18 (.033 mfd @ 400V, Molded Tubular) to terminal #6 on V4 (use spaghetti) (Don't Solder). Connect the other lead to terminal #3 on V4 (use spaghetti) (Solder: 2).
- () 137. Connect resistor R33 (1800 ohms, 1/2 Watt, 5% Carbon) (brown-gray-red-gold) from terminal #6 on V4 (use spaghetti) (Solder: 2) to W1 (Don't Solder).
- () 138. Connect resistor R43 (27K ohms, 1/2 Watt, 5% Carbon) (red-violet-orange-gold) from terminal #8 on V4 (Solder: 2) to W2 (Don't Solder).
- () 139. Connect resistor R34 (56 ohms, 1/2 Watt, 10% Carbon) (green-blue-black-silver) from W1 (Solder: 4) to W2 (Don't Solder).

- () 140. Connect capacitor C20 (47 mmf, Ceramic Disc) from W2 (Solder: 4) to W3 (Solder: 2).

NOTE: The two silicon rectifiers will be connected and soldered in Steps 141 and 142. Because the heat from the soldering iron could damage these rectifiers, some means of conducting heat away from them must be provided. One method is to use a pair of long-nosed pliers. The lead is grasped, with the pliers, between the rectifier and the lug to be soldered. However, if just one person is soldering, a "third hand" -- someone else to hold the pliers -- is necessary. The need for a "third hand" is eliminated in another method, in which the jaws of an alligator clip, previously filled with solder, are clamped to the lead. (See Fig. 17). The solder-filled alligator clip does a good job of conducting away the heat. Two or three such clips are a valuable addition to any tool kit because they can also be used in solder work involving other small components, such as 1/2-watt resistors. In fact, we encourage new kit builders to use some such device on small components, at least until they have acquired more soldering experience. In the following steps, whenever a small component must be protected from heat, the term "use heat sink" will serve as a warning.

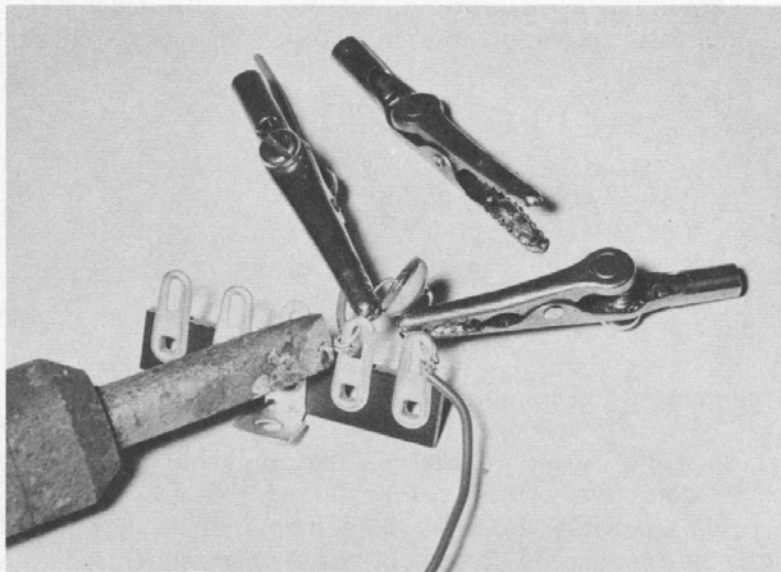


Fig. 17.

- () 141. Connect the negative (-) end of silicon rectifier CRA to HH3 (use heat sink) (Solder: 1). Connect the positive (+) end to HH2 (Don't Solder).
- () 142. Connect the negative (-) end of silicon rectifier CRB to HH2 (use heat sink) (Solder: 3). Connect the positive (+) end to HH1 (use heat sink) (Solder: 5).
- () 143. Refer to Fig. 12 and insert the line cord from the rear of the chassis through grommet A. Tie an overhand knot, approximately 2 inches from the end, for strain relief. Connect one lead of the line cord to E1 (Solder: 3). Connect the other lead of the line cord to E2 (Solder: 2).
- () 144. Install the 3-amp fuse in the fuse holder at location H.

NOTE: The construction and wiring of both the right- and left-channel power amplifiers are now completed. The remainder of the assembly and wiring of your SA-40 will be concerned mainly with the preamplifier section. At this point, it is possible to operate the power amplifier section by using a tuner or record player and a speaker. Before proceeding any further, may we suggest that you now check the amplifier section. This will allow you to correct any errors. Although it is not absolutely necessary to check the amplifier section at this point, we strongly recommend that you do so. Any future wiring troubles can thus be isolated in the preamplifier section, so that trouble-

shooting will be much easier. If you decide not to check the amplifier section before continuing, skip Steps 145 through 155, and go to Step 156 on page 45.

POWER AMPLIFIER CHECK-OUT PROCEDURE

- () 145. Temporarily twist together the bare ends of the green twisted pair coming out of grommet B. Cover the bare ends with electrical tape to prevent their accidental shorting to the chassis or other parts of the circuit. Make sure the ends of the green-yellow twisted pair coming out of grommet B are well separated. Cover each end with electrical tape.

NOTE: If a vacuum tube voltmeter such as PACO V-70, is available, the following checks outlined in Step 146 should now be performed. IF NO METER IS AVAILABLE, SKIP STEP 146 AND PROCEED TO STEP 147.

- () 146. Before installing any tubes, make a quick check of the power supply section as follows:
- a. With an ohmmeter, check the resistance to chassis ground at each of the B+ source points. The following approximate readings should be obtained:

1. 400V Source (+ lead of C1) - 13K ohms

2. 300V Source (C3 ▲) - 11K ohms

3. 270V Source (C3 ■) - 14K ohms

4. 250V Source (C3 ▲) - 24K ohms

5. 180V Source (C3 —) - 45K ohms

Be sure to allow for electrolytic capacitor charging and to wait for the meter pointer to completely stop before taking the readings. If any of the readings measure considerably more or less than indicated, check the B+ rectifier and filter circuit thoroughly for shorts or wrong connections. Any trouble should be corrected before the amplifier is connected to the AC line.

- b. Plug the line cord into an AC outlet and, with a DC voltmeter, measure the bias voltage for the 7189 output tubes. (Measure from the negative side of the 100 mfd, 12 volt electrolytic capacitor C4, to chassis.) This voltage should be negative 14 volts, ± 2 volts. If this voltage is not present, disconnect the amplifier from the AC line. Then carefully inspect the selenium bias rectifier SR to make sure the connections have not been reversed. Also inspect C4 for wrong connections.

- () 147. Insert two of the 7189 power output tubes into right-channel sockets V6 and V7. Insert a 7199 driver and phase-inverter tube into right-channel socket V4. Place a tube shield over V4.

- () 148. Connect one side of a speaker to the screw labeled "GND" (on the rear apron). Connect the other side of the speaker to the proper impedance terminal on the right-speaker binding post strip.

NOTE: When connecting the two resistors during the check-out procedure, do not cut the resistor leads. Simply connect them between the specified points by using a set

- () 149. From the remaining supply of 1/2-watt carbon resistors, select a 1-meg and a 100K-ohm resistor. Temporarily connect these two resistors in series, and connect the free end of the 100K-ohm resistor to the chassis ("ground"). See Fig. 18.

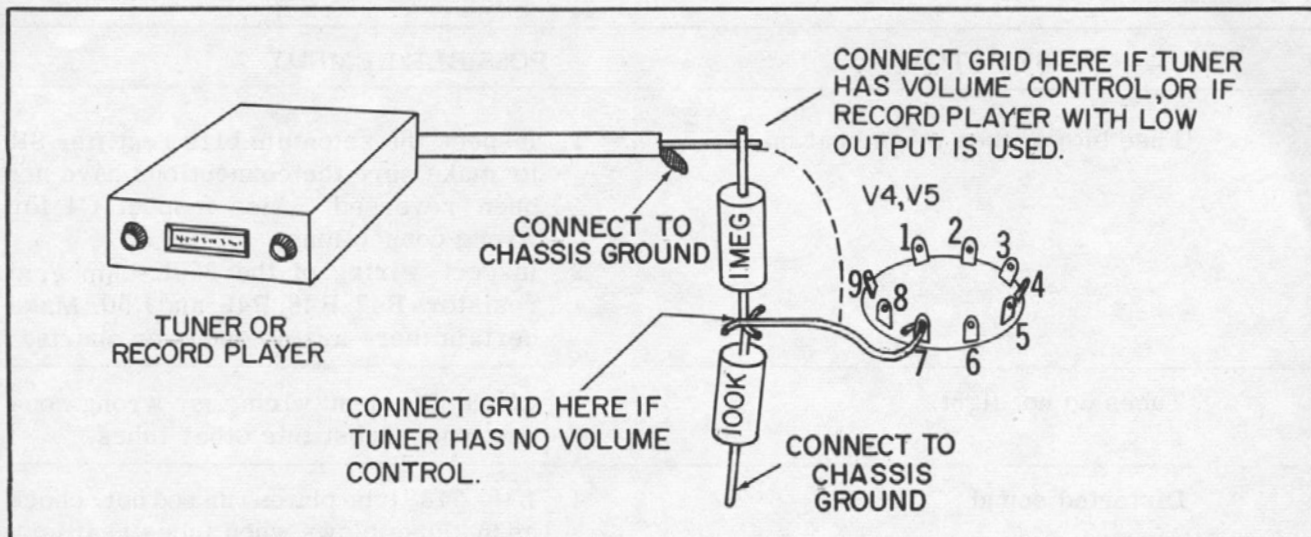


Fig. 18.

of clip leads if available, or by "tacking" them in with solder. Since the loudness control has not yet been connected, the input grid (terminal #7) of the driver stage will be "open". The resistors are therefore serving temporarily as "grid loads", in place of the Loudness control.

- () 150. Connect the output of a tuner, or the output of a record player in which a crystal or ceramic cartridge is used, between the free end of the 1-meg resistor and "ground". See Fig. 18. Connect the grid (terminal #7) of V4 to either the junction of the two resistors or the "high" end of the 1-meg resistor, depending upon the signal source.

NOTE: The reason for this type of connection is to prevent the speaker from "blasting the walls down" if a high-level signal -- for example, the signal at the output of a tuner without a volume control -- were applied to the grid of driver stage (V4 or V5).

- () 151. Plug the line cord into an AC outlet and observe whether all three tube filaments heat up properly. Tune in a station or play a record. The music should be clear, with no distortion or hum, and fairly loud. If the right-channel amplifier passes these tests, proceed to the next step. If any trouble is experienced such as hum, distortion, no signal, etc., carefully check all connections involving the right-channel amplifier. Look for poor solder connections, wrong connections, or omitted connections. If a meter is available check all voltages and resistances of the right-channel amplifier as shown on the schematic on pages 91 and 92. Check all tubes either by substitution or with a good quality tube tester.

NOTE: If a meter is not immediately available, the following chart will help you to locate and correct some of the more serious troubles:

SYMPTOM	POSSIBLE REMEDY
Fuse blows immediately when power is turned on.	<ol style="list-style-type: none"> 1. Make sure that fuse is a 3-ampere unit (as supplied). 2. Inspect silicon rectifiers CRA and CRB to make sure their connections have not been reversed. Also check the two 100 mfd @ 200 volt electrolytic capacitors (C1 and C2) for reversed connections. 3. Inspect filament and other wiring for shorts or wrong connections.

SYMPTOM	POSSIBLE REMEDY
Fuse blows when tubes heat up.	<ol style="list-style-type: none"> 1. Inspect the selenium bias rectifier SR to make sure the connections have not been reversed. Also inspect C4 for wrong connections. 2. Inspect wiring of the 220K-ohm grid resistors R47, R48, R49, and R50. Make certain there are no opens or shorts.
Tubes do not light.	<ol style="list-style-type: none"> 1. Check filament wiring for wrong connections. Substitute other tubes.
Distorted sound	<ol style="list-style-type: none"> 1. If the 7189 tube plates run red hot, check as in "Fuse blows when tubes heat up". 2. Inspect resistors for correct values in section being tested. Inspect wiring.

- () 152. Remove the line cord from the AC outlet. Disconnect the speaker lead from the right-speaker binding post strip. Connect the lead to the same impedance terminal on the left-speaker binding post strip.
- () 153. Remove the two 7189 tubes from sockets V6 and V7, and insert them into sockets V8 and V9. Remove the 7199 tube from socket V4 and insert it into socket V5.
- () 154. Disconnect the two resistors and the tuner or record player output from terminal #7 on V4, and connect them to terminal #7 on V5. See Fig. 18.
- () 155. Plug the line cord into the AC outlet. Test the left-channel power amplifier just as you tested the right-channel power amplifier in Step 151. If the performance is satisfactory, unplug the line cord from the AC outlet. Remove the two 7189 tubes from sockets V8 and V9, and substitute the other two 7189 tubes in the same sockets. Remove the 7199 tube from socket V5, and substitute the other 7199 tube in the same socket. Repeat the power amplifier check-out procedure on the untested tubes.

This completes the power amplifier check-out procedure. Now remove all tubes, speaker connections, and tuner or record player connections. Return the two resistors to your stock, and proceed with the subpanel assembly.