2( ) Cut a 2½" green wire. Connect one end to lug Q6C.

3( ) Cut a 2" black wire. Connect one end to lug Q6C. Solder all three wires to lug Q6C.

4( ) Cut a 4" green wire. Form a loop at one end and crimp it onto lead Q5B. (S).

5( ) Cut a 2¾" green wire. Form a loop at one end and crimp it onto lead Q6B. (S).

6( ) Cut a 3" black wire. Form a loop at one end and crimp it onto lead Q6E. Do not solder this yet.

7( ) Cut a 5½" black wire. Form a loop at one end and crimp it onto lead Q6E. Keep both of these wires close to the end of the transistor lead. Now solder both wires to lead Q6E. This requires some care to make sure that both wires are properly soldered.

8( ) Cut an 8¼" red wire. Connect one end to lug Q5C.

9( ) Cut a 2¾" red wire. Connect one end to lug Q5C.

10( ) Cut a 3½" red wire. Connect one end to lug Q5C. Solder all three wires to lug Q5C.

When soldering to the etched circuit boards, connections will always be made to eyelets which have solder in them. However, it will probably be necessary to use additional solder to assure a good connection from the wire to the eyelet, and to the circuit on the back of the board. The job will be easier if the tip of the iron is kept clean, and a small drop of solder on the tip will aid heat transfer. The wire will be easier to connect to the eyelet if the wire is first "tinned" (see soldering instructions).

Now is the easiest time to tin all of the wires connected to the heat sink assembly. As additional wires are called for, a convenient holder for them while tinning one end is the edge of one of the smaller corrugated cartons in which parts were packaged. This tinning will not be specified in each step.

When soldering to the eyelets on the board, all connections will be made to the back of the board (the circuit side, on which only the two large resistors are mounted on the PC-14s), unless the instructions specify a connection to the front. Touch the soldering iron to the opposite side of the eyelet as you insert the wire. Be sure the wire penetrates the eyelet as you move the iron aside. *Do not push the bared end of the wire all the way into the eyelet until the insulation touches the board.* If you do, you cannot be certain that you have a good solder connection from the wire to the eyelet to the circuitry on the board.

The large resistors on the back of each PC-14 have been deliberately mounted away from the surface for proper air circulation. Check to see that they are not touching the board.

Be particularly careful not to drop or flick solder onto the back of the circuit boards, as it might cause a short circuit between two conductors, causing damage when the amplifier is turned on.

11( ) Cut a 4½" red wire. Insert one end into eyelet #4 of one of the PC-14 circuit boards. (S). Insert the other end into eyelet #14. (S). Position this wire below the row of eyelets, and clear of the board.

12( ) Insert one of the #6 x 1½" long screws in the hole in the heat sink above Q6 from the transistor side (outside). Slide a 1" tubular spacer onto the screw. Then place the PC-14 circuit board, with the etched circuit side (back) toward the heat sink and the numbered eyelets on top, on the screw and fasten loosely with a #6 lockwasher and nut. Use care in handling so you do not catch the finned radiators on the board and twist the transistor leads. Repeat the operation with the long #6 screws, nuts and lockwashers and 1" spacers at each corner of the board. Tighten all 4 nuts, but do not use excessive pressure.

13( ) Remove the rubber foot and hardware from the right front corner of the chassis, and set it aside.

14( ) Bring the right channel sub-assembly near its location on the chassis and connect the longer of the two black wires from Q6E (this is the longest black wire from the module) to the lug of the right black binding post. If you are not able to thread this wire through the hole in the binding post lug, it may be wrapped around the lug or around the bare resistor lead at this point. Solder all three wires to the lug.

15( ) Mount the right channel sub-assembly on the chassis, using the rubber foot and its hardware in the corner mounting hole, and a #6 screw, lockwasher and nut in the other mounting hole. Tighten both mounting bolts, but do not deform the rubber foot.

16( ) Insert the remaining short black wire from Q6E into eyelet #1. (S).

17( ) Insert the black wire from Q6C into eyelet #2. (S).

18( ) Insert the green wire from Q6B into eyelet #3. (S).

19( ) Insert the 3½" (middle length) red wire from Q5C into eyelet #5. (S).

20( ) Insert the green wire from Q5B into eyelet #6. (S).

21( ) Insert the green wire from Q6C into eyelet #7. (S).

22( ) Cut a 3½" green wire. Insert one end into eyelet #8 on the *front* (component side) of PC-14. (S). Connect the other end to the red lug of the *rear* capacitor C7 (right). (S).

No connection is made to eyelet #9 at this time.

23( ) Cut a 3¼" red wire. Insert one end into eyelet #10 on the *front*. (S). Connect the other end to the red lug of capacitor C11. (S).

24( ) Cut a 3½" green wire. Insert one end into eyelet #11 on the *front*. (S). Connect the other end to the black lug of the *rear* capacitor C7 (right). Solder both wires to this lug.

No connections are made now to eyelets #12 and #13.

25( ) Insert the short red wire from Q5C into eyelet #15. (S).

LEFT CHANNEL SUB-ASSEMBLY

1( ) Place the other large black heat sink with two transistors in front of you so that the transistor leads protrude toward you and the folded edge is at the bottom. Cut a 5½" black wire, form a loop on one end, and crimp it onto transistor lead Q6E. Do not solder this yet.

2( ) Cut a 3¼" black wire, form a loop on one end and crimp it onto lead Q6E. Solder both wires to lead Q6E carefully.

3( ) Form a loop on one end of the remaining 0.47 ohm resistor (yellow-violet-silver-silver) and crimp the loop onto lead Q5E. (S). Push the other end through the hole in lug Q6C. Keep the resistor lead clear of Q5B.

4( ) Cut a 5" green wire. Form a loop on one end and crimp it onto lead Q6B. (S).

5( ) Cut a 2¼" black wire. Connect one end to lug Q6C.

6( ) Cut a 2¾" green wire. Connect one end to lug Q6C. Solder all three wires to lug Q6C.

7( ) Cut a 2¾" green wire. Form a loop on one end and crimp it onto lead Q5B. (S). Make sure the bared end cannot contact the resistor lead.

8( ) Cut a 4½" red wire. Connect one end to lug Q5C.

9( ) Cut two 2" red wires. Connect one end of each wire to lug Q5C. Solder all three wires to lug Q5C.

Now is a good time to tin all the free ends of the wires attached to the heat sink. Also remember to tin the ends of the wires following which are to be connected to eyelets on the board.

10( ) Cut a 2" red wire. Insert one end into eyelet #2 of the remaining PC-14 board. (S). Insert the other end into eyelet #4. (S). Position this wire so that it is clear of the board, and below eyelet #3.

11( ) Insert a #6 x 1½" long screw in the hole above Q5 from the transistor side of the heat sink. Slide a 1" tubular spacer onto the screw, and then place the PC-14 board, with the circuit side toward the heat sink and the eyelets on top, on the screw and fasten loosely with a #6 lockwasher and nut. Repeat this operation at each corner. Tighten all four screws, but do not use excessive force. Be careful of the transistors on the board.

12( ) Remove the rubber foot and hardware from the left front corner of the chassis, and set it aside.

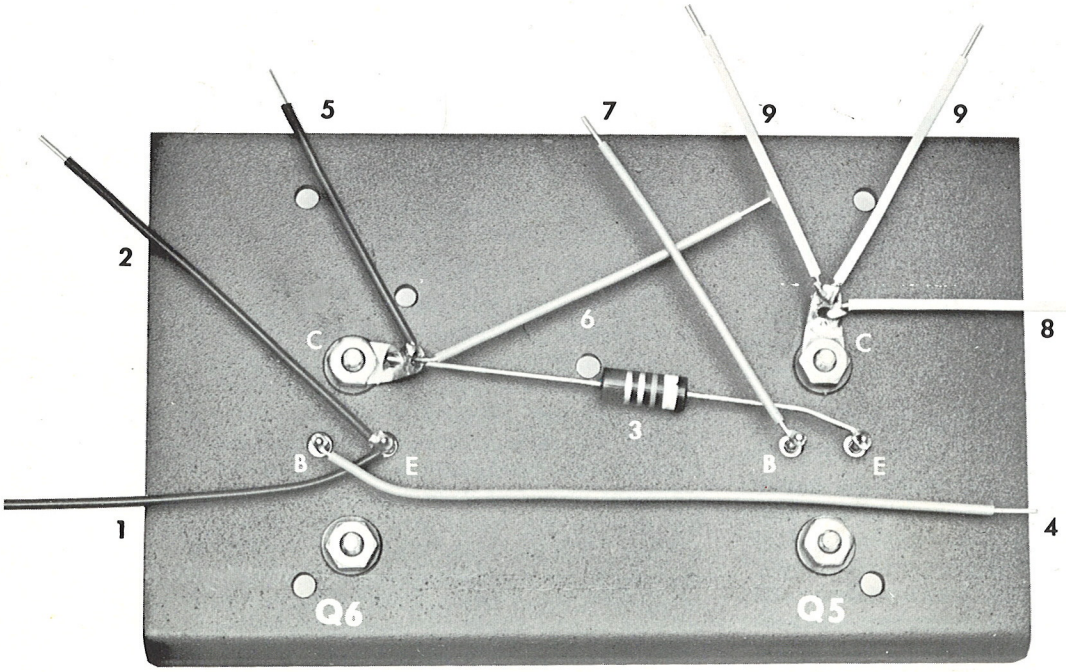
13( ) Place the left channel sub-assembly near its location on the chassis, and connect the long black wire from Q6E to the lug of the left black binding post. If you cannot thread this wire through the hole in the lug, it may be wrapped around the lug, or around the bare resistor lead. Solder all three wires to this lug.

14( ) Mount the left channel sub-assembly on the chassis, using the rubber foot and its hardware in the corner hole, and another set of #6 hardware. Tighten the bolts but do not deform the foot.

15( ) Insert one of the 2" red wires from Q5C into eyelet #1. (S).

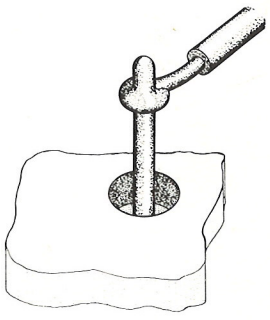
16( ) Insert the green wire from Q6B into eyelet #3. (S). This wire was earlier placed along the lower edge of the heat sink.

17( ) Insert the other 2" red wire from Q5C into eyelet #5. (S).



LEFT CHANNEL

Detail F



Detail D

18( ) Insert the green wire from Q5B into eyelet #6. (S).

19( ) Insert the green wire from lug Q6C into eyelet #7. (S).

20( ) Cut a 3¼" green wire. Insert one end into eyelet #8 on the *front*. (S). Connect the other end to the red lug of the *front* capacitor C7 (left). (S).

21( ) Cut a 6¼" red wire. Tin both ends. Insert one end into eyelet #9 on the *front*. (S). Insert the other end into the *front* of eyelet #9 on the *right channel* PC-14 board. (S).

22( ) Cut a 9" red wire. Tin both ends. Insert one end into eyelet #10. (S). The other end will be connected later.

23( ) Cut a 3¼" green wire. Insert one end into eyelet #11 from the *front*. Connect the other end to the black lug of the *front* capacitor C7 (left). Solder both wires to this lug.

No connections are made now to eyelets #12 and #13.

24( ) Insert the black wire from Q6C into eyelet #14. (S).

25( ) Insert the remaining black wire from Q6E into eyelet #15. (S).

POWER SUPPLY SUB-ASSEMBLY

The power supply module consists of the PC-15 circuit board and the remaining black heat sink with one transistor mounted.

1( ) Using the three remaining 1½" screws and 1" tubular spacers, mount the PC-15 board over the unused portion of the heat sink with #6 lockwashers and nuts. The circuit side of the board faces the heat sink. Be careful of the finned radiator on the board, and see that the mounting hardware does not touch it after it is installed.

2( ) Cut a 4" black wire. Form a loop on one end and crimp it onto lead Q9E. (S). See the pictorial diagram for identification of the leads, and for the general direction of the wire when it is being soldered.

3( ) Cut a 3¼" green wire. Form a loop on one end and crimp it onto lead Q9B. (S). See pictorial diagram.

4( ) Cut a 4" black wire. Connect one end to lug Q9C and crimp firmly in place. This is the wire from Q9C which will be connected to the circuit board eyelet later.

5( ) Remove the rubber foot and its hardware from the left rear corner of the chassis, and set them aside.

6( ) Twist together the two red leads from the power transformer. Place them in the recess at the bottom rear of the chassis, under the line cord, fuse holder, and power switch. Bring the power supply sub-assembly close to its location on the chassis, and solder either one of the red transformer leads to eyelet #8 from the *front* of the board. Heat the eyelet from the rear with the iron. Solder the other red lead to the *front* of eyelet #9. These eyelets are located on the side of PC-15. Be sure all strands of each lead are soldered to the respective eyelet. *Do not touch the black diodes, which are adjacent to the eyelets, with your soldering iron.* Be certain that sufficient solder has flowed from each lead to the eyelet and to the adjacent circuitry on the board for firm contact.

7( ) The long black wire which is connected to the ground lug on the C12 bracket should now be connected to lug Q9C. Solder both wires to lug Q9C.

8( ) Mount the power supply sub-assembly on the chassis, using the rubber foot and its hardware, and another set of #6 hardware. Tighten the bolts, but do not deform the foot.

Now is a good time to tin the 3 leads on the power supply assembly, before they are connected to eyelets on the board.

9( ) Cut a 2½" black wire. Insert one end into eyelet #1 of PC-15 from the *front*. (S). Bend over the black lug of capacitor C9 and connect this black wire. (S).

10( ) Insert the black wire from Q9E into eyelet #2. (S).

11( ) Cut a 2½" red wire. Insert one end into eyelet #3 from the *front*. (S). Bend over the red lug of capacitor C9 and connect this red wire. (S).

12( ) Cut a 5" red wire. Insert one end into eyelet #4. (S). Connect the other end to the red lug of capacitor C12.

13( ) Connect the free end of the long red wire which is attached to eyelet #10 of the left amplifier board to eyelet #5 of the power supply board. (S).

14( ) Insert the black wire from Q9C into eyelet #6. (S).

15( ) Insert the green wire from Q9B into eyelet #7. (S). Cut off this wire, and the wire to eyelet #6 close to the *front* of the board so that they cannot touch the adjacent finned radiator.

FINAL ASSEMBLY

1( ) Connect the long red wire from Q5C of the right amplifier module to the red lug of capacitor C12.

2( ) Connect the red wire from Q5C of the left amplifier module to the red lug of capacitor C12. Solder all three wires to this lug.

There are now only two twisted pairs of wires remaining to be connected. These have been left to the last so that they are not likely to be burned by a hot iron being applied to nearby eyelets. This is the time you should carefully check the connection to each eyelet on the 3 circuit boards. Check both the wire color and the "source" of that wire with the pictorial diagram. Look to see that there is sufficient solder at each connection flowing smoothly from the wire to the eyelet and to the circuitry for permanent contact. Wiggle each lead, and reheat the connection if the wire is not soldered securely. Do not leave large "balls" of solder around any eyelets. Look carefully to make sure that no solder has been dropped onto the board circuitry where it may cause a short circuit.

3( ) Position the black and green twisted pair of wires from the right input socket around the edge of the right amplifier board as in the diagram and photo-

graph of the amplifier. Keep these wires clear of the board, however. Tin each lead. Insert the black wire into the *front* of eyelet #12. (S). Insert the green wire into the *front* of eyelet #13. (S).

4( ) Position the black and green twisted pair of wires from the left input socket along the front edge of the left amplifier board, but away from the board. Tin each lead. Insert the green wire into the *front* of eyelet #13. (S). Insert the black wire into the *front* of eyelet #12. (S). Now recheck these connections, and those of the preceding step for a good, neat solder connection.

Assembly of the amplifier is now completed. Check to see that there are no unattached wires and no unsoldered connections. The short terminal strip near the power switch will not have any connections to its lugs unless the amplifier has been wired for 240 volt AC line operation. With a pair of diagonal cutting pliers, clip off any excessive stubs of wires to make a neat job. Pay particular attention to the power switch, so that there will be no possibility for leads to touch any but the correct lug. Also check the lugs on the 4 binding posts carefully, to see that none of those connections come close to the chassis.

Now turn the chassis over and shake out any bits of wire or solder. Insert the fuse in the fuse holder. Check to be sure that the power transformer leads will not interfere with the lip of the cover, and then the cover can be installed. The perforated metal edge stays inside the chassis as the cover is slid down over the chassis. Turn the unit over, and use four #6 screws to secure the cover through the slotted holes in the bottom.

If you have not already done so, *read the "Operating Instructions" before turning the amplifier on.* Remember to connect input and output leads to the amplifier before the power is turned on.

IN CASE OF DIFFICULTY

Your Stereo 120 should function properly after assembly, but sometimes a wiring error, poor solder connection, or defective component may require trouble-shooting. Because 90% of the difficulties which are encountered in kit-built units can be attributed to incorrect wiring or a poor solder connection, it is strongly recommended that you ask someone else to check your wiring against the pictorial diagram, as frequently one person will make the same error twice.

Your Stereo 120 has been designed to provide exceptional accessibility for the serviceman, but the average kit-builder should confine his servicing to the basic suggestions given here, after checking to make sure the fuse is intact. Audio transistors, unlike tubes, cannot be easily checked locally for any other than gross defects, and even this should be left to the qualified technician. For this reason your Stereo 120 is considered to have "no user-serviceable parts inside".

The 3 modules (power supply and each amplifier channel) contain all of the semi-conductors (transistors and diodes). Each of the circuit boards and all 5 power transistors have been tested to assure that they meet specifications prior to shipment, so routine trouble-shooting can eliminate these as the source of the trouble, although they could have been subsequently damaged. You should, however, examine the back of each circuit board closely to make sure there are no solder splashes, and be sure that no solder has been allowed to flow into the holes around the leads of the power transistors mounted on the heat sinks.

Check the connections at each eyelet along the edge of the circuit boards. Sometimes a connection which appears solid between the eyelet and the wire will not have a smooth flow of solder from the eyelet to the circuitry on the board. If a vacuum tube voltmeter is available, you should check each eyelet against the voltage chart on the schematic diagram. A deviation greater than 10% indicates a possible error or component failure.

Little or no audio signal from both channels usually indicates that the power supply is not functioning. If the 4700 ohm, one watt resistor R24 is overheating, the power supply is not "turned on" because of an excessive load or high input signal level. In the latter case, reducing the level of the input signal before switching on the amplifier will restore normal operation. An excessive load may be the result of improper output connections, or a fault in one of the amplifier modules.

You may be able to isolate a fault in one amplifier channel by removing the wire to one of the modules from the red lug of the largest capacitor C12. *Turn off the amplifier before you make or break any connections.* If the other channel then functions normally, the disconnected module is suspect.

In the event of difficulty with one of the channels, the suspect module (circuit board and attached heat sink) can be removed easily and returned to Dynaco for test and service, while the rest of the amplifier continues to function monophonically. For safety, 6 of the 8 leads from the module should be disconnected at the "far end" so that no unattached leads will be left in the amplifier. If you wish, the leads may be unsoldered at the module and insulated with electrical tape. Note that the test points (eyelets) #9 and #10 on each amplifier board are joined on the board, and when one module is removed, it is essential that the 2 wires connected to these points be unsoldered *at the eyelets* and temporarily soldered together to complete the circuit of the remaining amplifier. This connection must be insulated. Tag each wire for easy re-installation.

Because the module is light in weight, it may be shipped by air if desired. Do not return the circuit board alone—only the complete module. Be sure the packing adequately protects the small transistors with the finned radiators located on the circuit board, so that their leads will not be crushed. In extreme cases, it is possible to return all 3 modules for factory checking to save the weight of the chassis, power transformer and capacitors, but this is not recommended unless you are certain that no fault exists in these components, because the only sure test is that of the complete amplifier.

If you have a voltmeter, the power transformer can be checked by measuring the AC voltage between eyelets #8 and #9 on PC-15. A defective rectifier or poor solder connection on the rectifier bridge may cause the power transformer to emit an audible mechanical vibration. The DC voltage measured across C9 will be between 80 and 100 volts if the bridge rectifier diodes are functioning properly.

Beyond the most rudimentary checks, servicing of transistorized equipment should be left to the qualified technician. The Stereo 120 needs no maintenance in normal use, and there are no adjustments required during the life of the amplifier. Improper servicing can impair its performance or damage it, so it is very important that the technician familiarize himself with the Circuit Description and

with the Service Information which follows, before proceeding. Unless you are confident that a local repairman has the specialized knowledge and equipment for servicing high quality solid state audio equipment, *factory service is strongly recommended.*

SERVICE INFORMATION FOR THE TECHNICIAN
(FOR QUALIFIED PERSONNEL ONLY)

Before attempting to service the Stereo 120, be sure to read the circuit description in the front of this manual, as well as the preceding section, "In Case Of Difficulty". Some of the amplifier's unique features are not immediately apparent when examining this essentially simple circuit. A systematic check of voltages and signal paths, based on an understanding of the functioning of each section, will lead to a rapid diagnosis of any malfunction.

Each of the four screws which secures the cover is located between a rubber foot and the edge of the chassis. All of the numbered test points are located along the edges of each circuit board. Each of the three modules (power transistor heat sink and the associated circuit board) are fastened with only two screws. When these are removed, the module may be tilted outwards to gain access to the components.

There are three parts to the circuit. One is the regulated power supply. The other two are essentially identical audio amplifiers (but with changed physical layout). Capacitors C9, C11, and C12 provide power supply filtering and decoupling; and there is an output coupling capacitor C7 for each channel.

There are certain general precautions to be observed in servicing any transistorized equipment:

1. Never make circuit changes (connections or disconnections) of any kind when the amplifier is turned on.
2. Be particularly careful not to short any transistor leads to each other or to the chassis when the power is on.
3. When using test equipment, you must avoid transient voltage peaks and excessive test voltages.
4. Exercise caution when soldering and unsoldering transistor and diode leads to avoid excessive heat.

Power supply

The power supply is designed to provide a constant 70 to 72 volts with demands up to 3 amperes and with power line voltages between 110 and 130 VAC (between 220 and 260 VAC when connected for 240 volt use). Transistor Q9 is a series regulator using servo-type action in which the impedance of Q9 is varied as the load changes to provide a constant output. This variation is accomplished by a negative feedback loop which compares the potentials at the emitter and base of Q7. Differences furnish a corrective signal which is amplified in Q8 and passed to Q9. Zener diode D10 furnishes a reference potential at the emitter of Q7, and a voltage divider at its base provides the comparison voltage. D10 is kept "alive" by the current flow in R19. However, when the current in Q7 exceeds the current in R19, D10 is "starved", and its Zener action drops out. Then, without a corrective signal, a regenerative action causes the supply to cut off by increasing the impedance of Q9 so that it cannot pass current.

Amplifiers

There is a physical change of component positions for the left and right audio channels, but they are electrically identical. Each amplifier has two basic sections. The direct-coupled pair Q1 and Q2 is the Class A amplifier-driver with a DC feedback loop from the second emitter to the input base. Audio signals at the input base of Q1 are amplified and appear at the collector of Q2 to drive the four-transistor Class B power output section.

Q3 and Q4 are a complementary-symmetry driver directly coupled to Q5 and Q6 output power transistors. The Class B section provides a power gain, but no voltage gain. The input junction of Q3 and Q4, and the output junction of Q5 and Q6 swing together through the signal cycle. The ability of the output junction to follow the input junction (and the consequent linearity of this section) depends on the feedback path from the collector of Q6 to the emitter of Q4. Variations at Q4 emitter compared to its base potential will create a corrective signal for Q6, which makes the output follow the input.

Diodes D2 and D3 are in this feedback path, in a direction which would not be conductive (breaking the feedback path) were it not for the forced current through bleeder resistors R16 and R17. When the current in Q4 reaches that in R16 and R17, the diodes D2 and D3 no longer conduct, and the feedback path is broken. Simultaneously D1 starts conducting and makes a short circuit between the input of Q3 and Q4, and the output of Q5 and Q6.

Thus when the current demand in the feedback loop exceeds the limit determined by the bleeder resistors, the ability of the circuit to drive is restricted, and excessive currents cannot be induced in Q5 and Q6. The action of D1 short circuits the drive from Q2, reducing the drive until the cause of the high current demand is corrected. Thus an excessive drive signal, or too heavy a load on the output, which would require excessive current, switches the circuit to a configuration which prevents damaging current flow through the output and driver transistors.

Trouble shooting the power supply

When the supply is performing properly, its voltage in a given amplifier remains within 1% of its nominal value over the operating range, and should be within 5% of the specified 72 volts. If the output is 80 volts or more, Q9 is probably shorted. Tests for gross transistor defects are described in a later section. An output of less than 65 volts indicates that the supply is either deficient or being overloaded. Turn off the amplifier and detach the wires to each of the amplifier modules at the positive terminal (B) of C12 so that the amplifier sections will be separated from the power supply. If normal supply voltage is obtained with these wires detached, then connect one amplifier lead at a time to see if one channel is loading the supply excessively.

Verifying the supply's performance under full load and under heavy load, as well as checking the 72 volt output, is necessary to assure normal supply operation. A suitable full load test can be made by connecting a 200 watt, 25 ohm resistor across the supply. This provides about 2.8 amperes current drain. The voltage output of the supply should not vary more than ± 1 volt. With a heavy load of 5 ohms, or even a short circuit, the current delivered should not exceed 0.5 ampere.