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.

A low supply voltage when the (B) connections to the amplifiers are removed is most likely caused by a transistor which has failed, if the DC voltage across C9 is between 80 and 100 volts. All three power supply transistors should then be checked.

Trouble shooting the amplifiers

Any signs of scorched resistors or wire should be a basis for further investigation. If either R13 or R14 is burned, or smokes when the amplifier is on, then at least one of the transistors Q5 or Q6 and possibly Q3 or Q4 has been damaged, and replacement will be required. It must be emphasized that *if one of the transistors in the Class B section (Q3, Q4, Q5, Q6) is defective, the other three must be tested before proceeding further* to avoid possible repetitive breakdown. Resistors R16 and R17 on the back of each board normally get hot because of the reference bleed current. If only one of the pair is hot, Q5 or Q6 may be shorted, or D2 or D3 may be open.

The voltage at the positive terminal of C7 should be about 36 volts (one half of the supply voltage). If this voltage is far off value, this can be a sign of trouble in one or more of the Class B transistors, and all should be checked.

If the voltage at the input bases of Q3 and Q4 is significantly different (more than 1.5 volts) from the voltage at C7, the voltage at the other end of C4 should be checked to determine if something is wrong in the Class A section, Q1 and Q2. A fault in either of these transistors can change the voltage at the collector of Q2 (input of C4), and this can be reflected in an incorrect potential at the bases of Q3 and Q4, which is further reflected in the junction of Q5 and Q6 (the positive terminal of C7). Voltages at either end of C4 may be inter-related when C4 is in the circuit. If one end of C4 is lifted, the voltage deviations from normal at either end will indicate whether a fault lies before or after C4.

It is unlikely that all voltages in the audio section are correct if there is no signal. However, if this condition occurs, it is most likely an open input capacitor C1, or coupling capacitors C4 or C7, or a shorted C2.

A signal which has some distortion, or is limited in power output, is more difficult to diagnose. See the section relating to performance tests. This requires a distortion analyzer and an oscilloscope to check the signal, and then routine signal tracing should locate the fault.

A very weak signal usually indicates that the power supply is shut down as a result of an excessive input signal or an excessive load. In this case R24 will be quite hot.

Checking transistors

An ohmmeter is all that is required to locate a transistor which has failed. Small transistors must be removed from the circuit board for test. The power transistors need not be removed from the heat sinks, but the wires to their terminals must be detached for measuring. All transistors can be considered (for this test procedure) to be two diodes connected in series with common elements tied together. The junction point represents the base of the transistor. The identification of the larger power transistors is shown in the photograph of each heat sink. The smaller ones, observed from the bottom, have the collector, base and emitter arranged counter-clockwise, with the collector attached directly to the case.

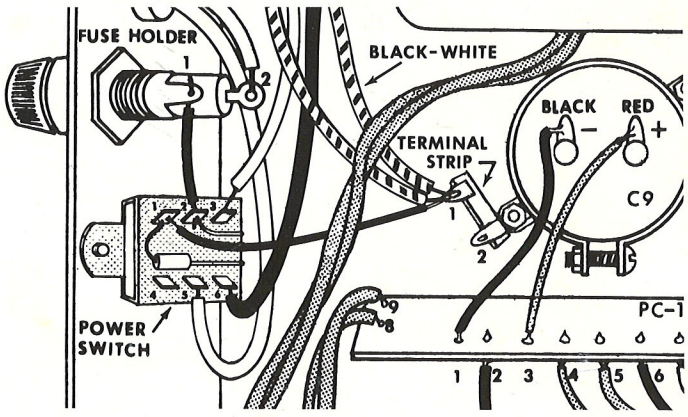
With one ohmmeter probe connected to the base, the other probe should be touched to the collector and emitter in turn. Readings from the base to the collector, and from the base to the emitter should be similar. With one orientation of the probes, there should be a high resistance reading (almost an open circuit). When the polarity of the probes is reversed, there should be a relatively low reading. The high reading will appear with one orientation of the probes for a pnp transistor, and with the opposite orientation for an npn transistor. Then the ohmmeter should be connected from collector to emitter, and a high resistance (almost open circuit) should be read, regardless of the orientation of the probes. If all of these qualifications are met, the transistor does not exhibit any gross defects. Qualitative evaluation of acceptable transistors requires equipment beyond the scope of local service facilities.

In similar fashion, diodes can be checked by verifying that they have a high resistance in one direction, and low resistance in the other.

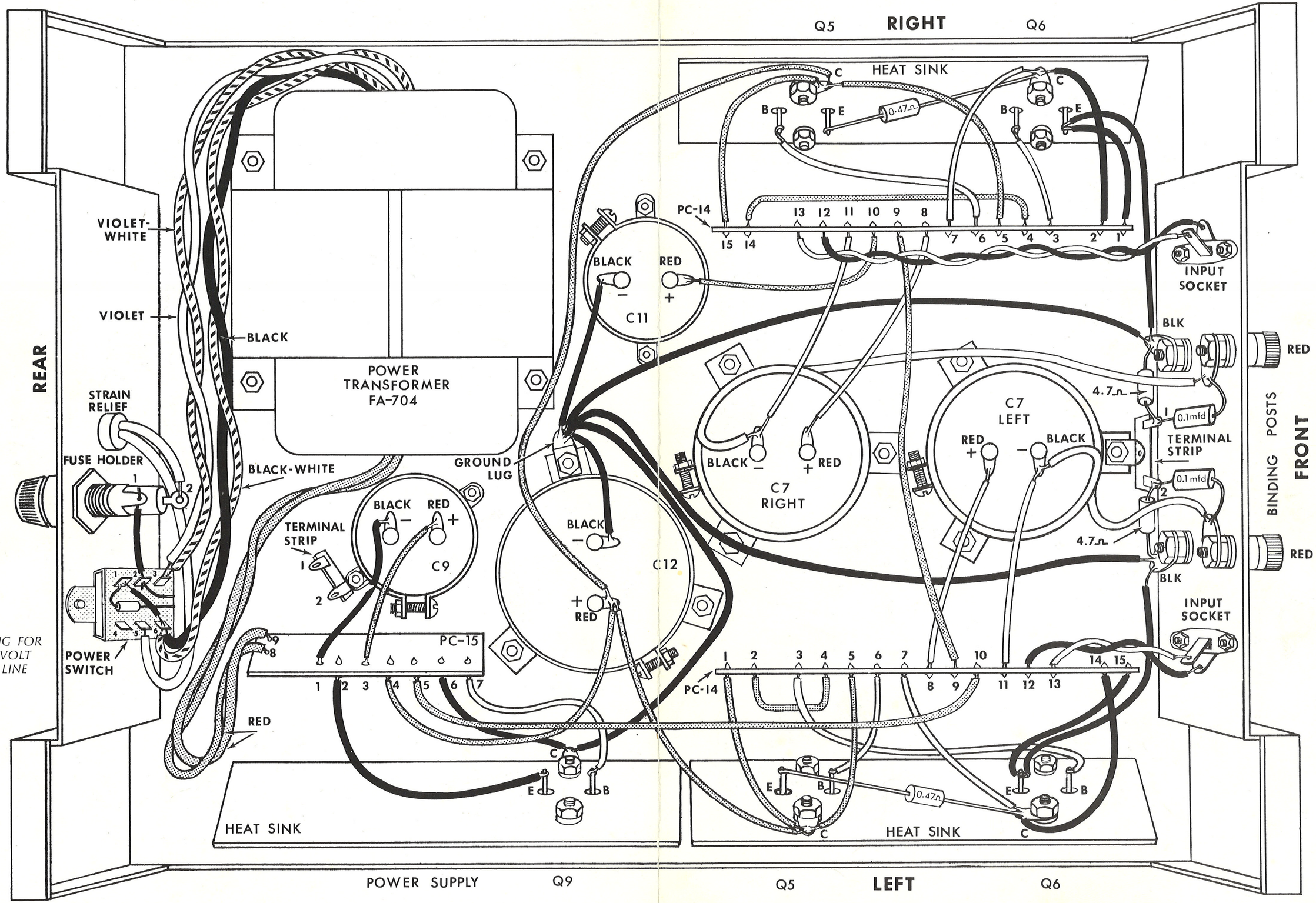
When replacing transistors, the small ones with the finned radiators should have the radiators transferred to the replacement. The silicon grease between transistor and radiator should be transferred to the new transistor. Be careful to insert the leads into the proper eyelets. Do not use excessive heat on the leads—let the heat go to the eyelet instead. When replacing the power transistors on the heat sinks, maintain the mica insulator between the transistor and the heat sink (Q9 does not use a mica insulator). Spread some of the silicon grease, which is a heat transfer compound, between the mica insulator and the transistor, as well as between the heat sink and the insulator. Be sure to use the nylon insulators around the mounting screws.

When making replacements, standard types can be used provided they are screened beyond the manufacturer's routine specifications. This is necessary because transistors of a given type vary far more widely than do tubes. The requirements for each transistor are given in the parts list with the schematic diagram. No screening will be necessary for transistors obtained from Dynaco if the application (Q-number) or the Dynaco part number is specified. If emergency needs require substitution of an unscreened transistor, the audio circuits will function but the effectiveness of the protective circuitry in the power supply may be somewhat reduced. The Dynaco audio circuit has been designed so that no matching of transistors is required.

While the parts list does not show all of the possible transistor options, under no circumstances should unlisted transistors be used unless factory-approved in advance.



WIRING FOR 240 VOLT AC LINE



PICTORIAL DIAGRAM