

SHOP PROCEDURES - MECHANICAL TESTS
ELECTRONIC SECRETARY [®] MODEL SP-2

CONTENTS	PAGE
1. GENERAL	1
2. DISASSEMBLY	1
3. ASSEMBLY	2
4. MECHANICAL ADJUSTMENTS . . .	3
Stepper Relay Stop	3
Tone Arm and Tone Arm Follower	3
Erase Coil - Announcement Message	3
Erase Coil - Incoming Message . .	4
Announcement Message - Record/Playback Head	4
Incoming Message - Record/ Playback Head	4
5. GENERAL PROBLEMS AND CAUSES	4
6. FUSE MODIFICATION	7
Reason for Modification	7
Procedure	7
1. GENERAL	
1.01 This Section contains the mechanical ad- justments required for the maintenance of the Model SP-2 mechanisms. In addition, a list of general problems and their probable causes is provided. The disassembly and assembly instructions also included will help the technician to gain access to the unit's working parts so that he can inspect, clean, lubricate, and adjust these mechanisms as required.	
1.02 The Model SP-2 telephone answering set complements regular residential telephone service, permitting completion of 100% of the telephone calls made to the residence in which it is installed. As with any device operating under such conditions, the Model SP-2 will perform best when given occasional service attention as described in this Section.	
1.03 To avoid turning the customer's pre- mises into a workshop, the procedures outlined in this Section should be performed in a shop.	

WARNING: The Model SP-2 is not equipped with an electrical interlock switch to break a-c power to the unit when the cabinet enclosure is removed. Proceed with caution when operating the Model SP-2 unenclosed.

2. DISASSEMBLY
2.01 The Model SP-2 may be broken down into the following principal assemblies: (see Figure 1).

- (a) the motorboard (turntable) assembly
- (b) the electrical switching assembly
- (c) the amplifier and control panel assembly
- (d) the cabinet

2.02 As may be seen from Figure 1, the Model SP-2 employs a unit type of construction, in which any one principal assembly can be removed from the main assembly without unwiring or using involved disassembly techniques.

2.03 Removal of the mechanical assembly (turntable) and the amplifier and control panel assembly from the cabinet is accomplished as follows:

- (1) Remove two retaining bolts in the rear of the main assembly.
- (2) Remove two lead pins fitting into a flange in the front of the cabinet enclosure.
- (3) Remove the mechanical assembly and the amplifier and control panel assembly as one piece from the cabinet enclosure.

2.04 Mechanically and electrically detach the mechanical assembly from the amplifier and control panel assembly as follows:

- (1) Unplug the connector establishing electrical connection between the mechanical assembly and the amplifier and control panel assembly.
- (2) Remove the screws that secure the mechanical assembly to the amplifier and control panel assembly.

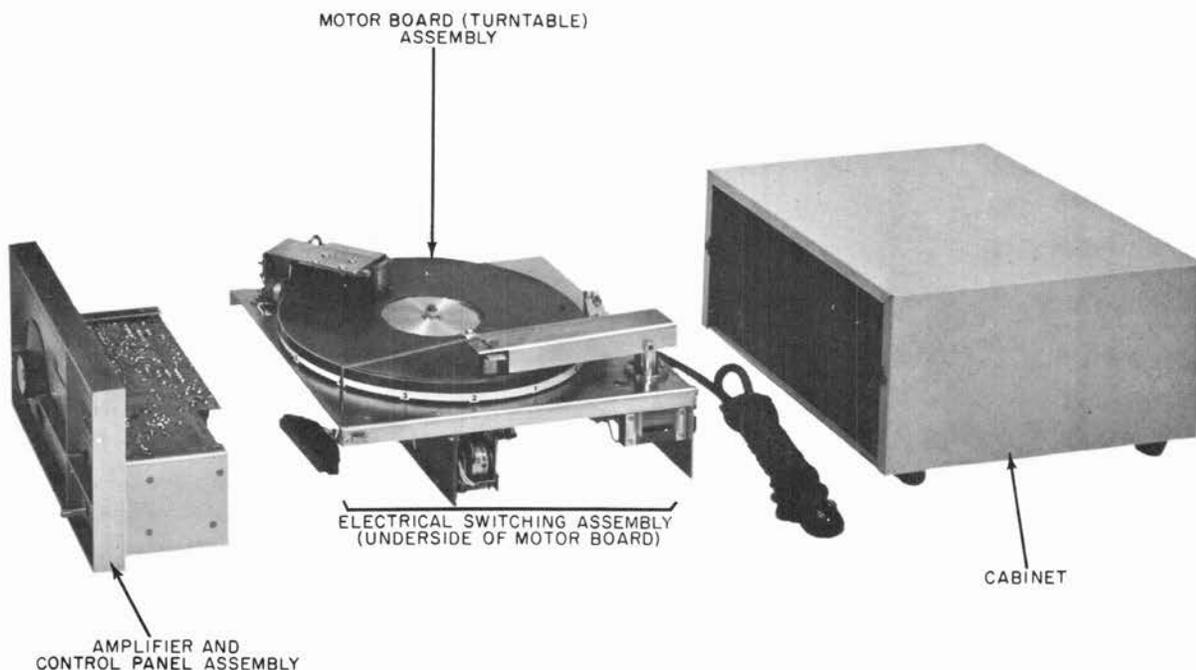


Figure 1. Principal Assemblies.

3. ASSEMBLY

3.01 The amplifier and control panel assembly can be electrically and mechanically attached to the mechanical assembly (turntable) by re-inserting the plug and re-installing the screws.

3.02 The entire combination can then be returned to the cabinet enclosure and retained therein by two lead pins. The lead pins fit into a flange on the front of the cabinet enclosure and are secured by two retaining bolts at the back of the assembly.

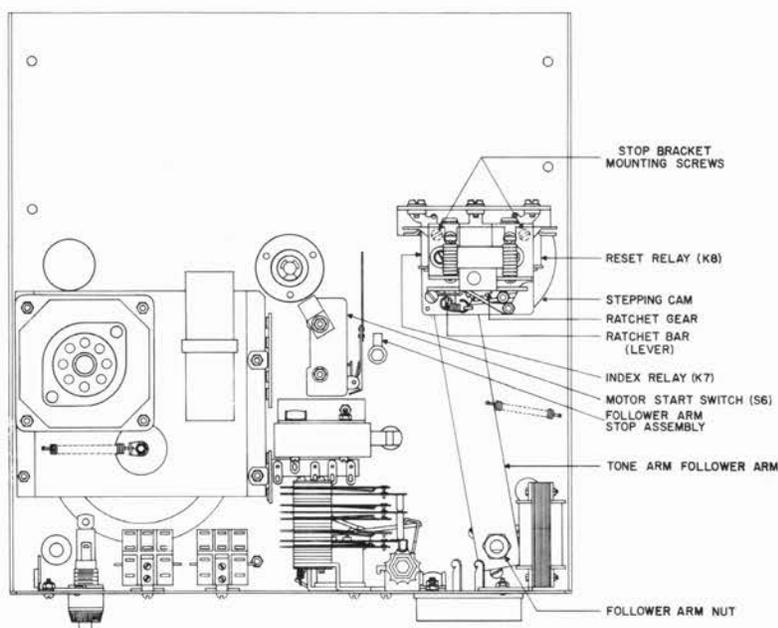


Figure 2. Motorboard, Bottom View.

4. MECHANICAL ADJUSTMENTS

4.01 Make no adjustments to the unit unless it fails to operate properly. If the unit does not operate properly, the following adjustments may have to be made.

Stepper Relay Stop

4.02 Manually operate reset relay K8 (Figure 2). This will return the stepping cam to its reset, or call number one, position. Loosen the stop bracket mounting screws on the stepper assembly and position them so that the ratchet bar (lever) will move the ratchet gear one full step when index relay K7 is manually operated.

Tone Arm and Tone Arm Follower

4.03 Manually operate reset relay K8 (Figure 2). Loosen the nut holding the follower arm. Move the tone arm assembly until the outside edge of the record/playback head pole face (edge facing toward the outside of turntable) is $\frac{3}{8}$ inch from the edge of the turntable (Figure 3). Tighten the nut.

4.04 Manually operate index relay K7, 13 times. With the follower arm in this position, switch S6 (Figure 2) should be operated. If it is not, adjust its lever arm, being certain that there is perceptible follow after the switch operates.

4.05 Loosen the follower arm stop assembly and adjust it to obtain $\frac{1}{32}$ inch spacing between the assembly and the follower arm. Tighten the stop assembly.

4.06 Manually operate relay K8. Loosen the screw (Figure 3) on the tone arm holding the channel indicator (located at the front end of the tone arm) and position the pointer to indicate channel number 1 in the countdown window. Tighten the screw.

Erase Coil - Announcement Message

4.07 Loosen the 2 screws which fasten the announcement erase coil (L3) assembly (Figure 3) to the motorboard. Position the assembly so that the pole face of the announcement erase coil (L3) is $\frac{1}{32}$ inch away from the announcement recording tape on the rim of the turntable (Figure 3). Tighten the screws.

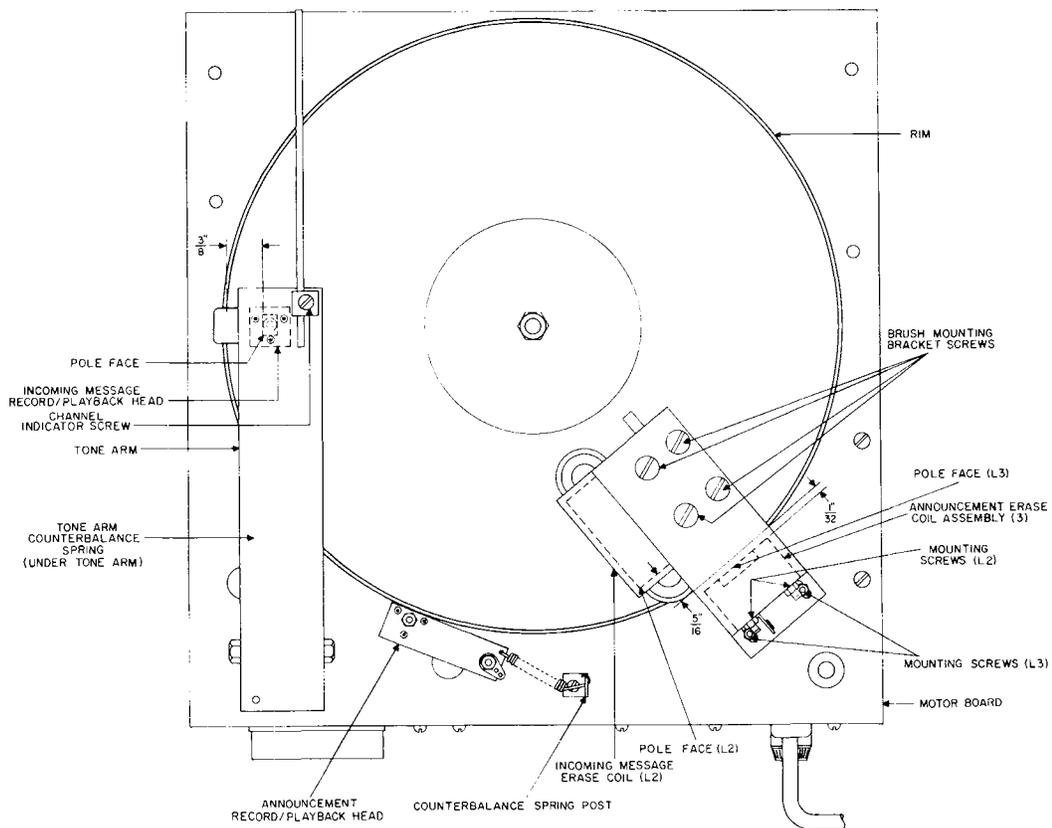


Figure 3. Motorboard, Top View.

Erase Coil - Incoming Message

4.08 Loosen the 2 screws holding the incoming message erase coil (L2) assembly (Figure 3). Position the assembly so that the pole face of the incoming message erase coil is 1/32 inch away from the recording surface and 5/16 inch from the edge of the turntable. Tighten the screws.

4.09 Loosen the 4 screws holding the brush mounting bracket (Figure 3). Position the brush so that its edge aligns with the edge of the incoming message disc. Tighten the screws.

Announcement Message Record/
Playback Head

4.10 Rotate the selector switch to its "CHECK" position. Polarize the a-c plug and listen at the microphone for minimum noise. Adjust the announcement record/playback head counterbalance spring (by bending spring post) so that the announcement head will produce 30-grams of pressure against the recording tape. (Figure 3). Visually pre-align the announcement head, and make the electrical adjustment for this head as indicated in Section 997-402-501.

Incoming Message Record/Playback
Head

4.11 Adjust the tone arm counterbalance spring assembly (Figure 3) so that the record/playback head produces 30-grams pressure against the recording disc. Visually pre-align the incoming message record/playback head, and make the electrical adjustment for this head as indicated in Section 997-402-501.

5. GENERAL PROBLEMS AND CAUSES

5.01 The following Part contains descriptions of possible cases of trouble and their causes. When clearing trouble described herein, refer to the following drawings in Section 997-402-501 and in Section 997-402-800: Model SP-2 schematic, WW-4729-54 (for the SP-2 Models above serial number 39600); motorboard wiring diagram, WW-4705-1; assembly chassis wiring diagram, WW-5044-1D; and printed circuit board assembly, WW-4697-1 (for SP-2 Models above serial number 39600).

5.02 The Model SP-2 appears to have no a-c power. (START-ON-OFF switch in "ON" position; DS1 not illuminated.) Check for the following possible trouble:

- (a) Depress INDEX button to check for presence of line voltage in the amplifier and control panel assembly.
- (b) Power source disconnected at P4; switch S2 defective; lamp DS1 inoperative.
- (c) Line fuse F1 (3-amp) blown. Determine cause if fuse blows a second time.
- (d) Pin 9 of plug P1-J1 is not making contact.

5.03 Motor will not start turntable rotating when START-ON-OFF switch is operate to "START" position (DS1 is illuminated). Check for the following possible trouble:

- (a) Contacts 2B and 3B of switch S2 are not closing a-c feed path to the motor.
- (b) Contacts 4 and 9 of relay K2 are open.
- (c) Motor B1 is defective, or mechanical drive system from motor shaft to turntable is malfunctioning.

5.04 Motor drives turntable when START-ON-OFF switch is operated to its "START" position, but stops when switch is returned to its "ON" position. Check for the following possible trouble:

- (a) Homing cam switch (S1), contacts 1 and 2 are not making contact.
- (b) Coil of relay K2 is open. K2 is not operating.
- (c) Contacts 5 and 9 of relay K2 are not closing.

5.05 Motor drives turntable continuously with switch S2 "ON." Check for the following possible trouble:

- (a) Defective homing cam switch (S1).
- (b) Contacts 5 and 9 of relay K2 shorted.
- (c) Contacts 2B and 3B of switch S2 are shorted.

5.06 Tone arm does not shift to the next channel after recording incoming message. Check for the following possible trouble:

- (a) Pulsing circuit to index relay K7 open at one of the following points: Contacts 1 and 3 of S1, or 1 and 2 of S3; contacts 5 and 6 of relay K4, or 9 and 5 of K3; disconnect at pin 8 or 10 of J1-P1.
 - (b) Coil of index relay K7 is open.
 - (c) Stepping mechanism driven by index relay K7 is malfunctioning.
- 5.07 Message indicator shows that tone arm is not stepping fully between channels. Check for the following possible trouble:
- (a) Stepping mechanism driven by index relay K7 is malfunctioning.
 - (b) Stepper relay stop adjustment needs to be performed. See Paragraph 4.02.
- 5.08 Model SP-2 does not shut itself off after all channels have been recorded. Check for the following possible trouble:
- (a) Contacts of switch S6 are fouled.
 - (b) Tone arm and tone arm follower needs adjustment. Refer to Paragraphs 4.03, 4.04, 4.05, and 4.06.
- 5.09 Model SP-2 will not reset message indicator and tone arm when RESET button is depressed. Check for the following possible trouble:
- (a) Switch S7 contacts are fouled.
 - (b) Coil of reset relay (K8) is open, or disconnect at pin 2 of P1-J1.
 - (c) Reset mechanism is malfunctioning.
- 5.10 Model SP-2 will not shift tone arm when INDEX button is depressed. Check for the following possible trouble:
- (a) Contacts of switch S3 are fouled.
 - (b) Coil of index relay K7 is open.
 - (c) Disconnect at pin 8 of P1-J1.
 - (d) Index mechanism is malfunctioning.
- 5.11 Ringing current does not initiate "Automatic answer function". Lamp DS1 illuminated. Check for the following possible trouble:
- (a) Contacts 1 and 3 of line seizing relay K3, or contacts 1 and 2 of switch S6 are fouled.
 - (b) Disconnect at pins 5 and 7 of P1-J1.
 - (c) Defective ringing bridge rectifier CR2, thermistor, or capacitor C23.
 - (d) Coil of ringing relay (K1) is open.
 - (e) Contacts 1 and 2 of relay K1 are not closing to start the motor, or switch contacts 2 and 3 of S8-B are fouled.
 - (f) Contacts 1B and 2B of switch S2 are open.
 - (g) Contacts 4 and 9 of relay K2 are open.
 - (h) Motor B1 is faulty.
 - (i) Drive mechanism from motor to turntable is faulty.
- 5.12 Model SP-2 delivers weak, distorted, or no announcement message in "Check" function. Look for the following possible trouble:
- (a) Defective microphone, or poor microphone jack and plug connection.
 - (b) Insufficient, or no high frequency bias to record head PU1. Check the following bias circuit components: transistor Q5; transformer T3; capacitors C13, C14, C15 and C16; resistors R12, R14, R19, R22 and R24.
 - (c) Low voltage power supply to bias oscillator open at contacts 9 and 5 of relay K6, or 2 and 4 of K5.
 - (d) Circuit from bias oscillator to record head PU1 open at contacts 1 and 5 of switch S8-D, or at connector P2-J2.
 - (e) Check condition of audio amplifier transistors Q1, Q2, and Q3.
 - (f) Low voltage power to audio amplifiers is absent or unsatisfactory. Check condition of the following components: rectifier CR1; capacitors C10, C24, and C25; resistors R30, R17, R7, R6, R3, R9 and R21; line transformer windings (grey and green leads).

- (g) Discontinuity in audio amplifier circuit from microphone to record head PU1 during "Dictate" function (turntable rotating). Check the condition of the following circuit components: microphone, or microphone terminal P5-J5; contacts 7 and 11 of S8-C; capacitors C8, C2, or C12; resistor R15; connector P2-J2. Check for continuity through contacts 7-8 and 1-3 of K6; also contacts 1 and 3 of K5.
- (h) The announcement message record/playback head needs adjustment. Refer to Paragraph 4.10.
- (i) Previous announcement message was not properly erased. Erase coil may need adjusting. Refer to Paragraph 4.07.
- (j) Announcement level needs adjusting. Refer to Section 997-402-501.
- (k) Weak recording. Check dictating technique.
- (l) Audio path from announcement record head (PU1) to microphone may be malfunctioning during "Check" function. Check the following circuit components for discontinuity or malfunction: contacts 7 and 10 of S8-D, 1 and 4 of S1-C, and 7 and 10 of S8-C; relay K6 and K5 should be unoperated during "Check" function; contacts 6 and 8, 1 and 3 of K6 are open; contacts 1 and 3, 6 and 8 of relay K5 are open; capacitors C7, C8, C2, C9, or C18; resistors R11, R13 and R16; connectors P2-J2 and P5-J5.

5.13 Model SP-2 delivers weak, distorted, or no message during "Playback." Check for the following possible trouble:

- (a) No message was recorded.
- (b) Previously recorded messages were not properly erased. Refer to adjustments in Paragraphs 4.08 and 4.09.
- (c) Record head PU2 needs adjustment. Refer to adjustment procedure in Paragraph 4.11.
- (d) Insufficient or no low voltage power to audio amplifiers Q1, Q2, Q3. Check rectifier CR1.

- (e) Insufficient or no high frequency bias to record head PU2; check transistor Q5, bias oscillator.
- (f) Check condition of transistors Q1, Q2, and Q3, audio amplifiers.
- (g) Check for malfunctions or discontinuity at the following points in the audio recording path from the telephone line terminals (TB1) to the incoming-message record head PU2. (Make this check during the second revolution of the turntable with the SP-2 in "Automatic answer" function.) Discontinuity possibilities or malfunctions may exist at: contacts 2 and 3 or relay K3; 2 and 3 of K5; 1 and 3 of K6; 7 and 8 of K5; 1 and 2 of S8-D; pins 16 and 17 of J1-P1; connector P3-J3; capacitors C2, C11 and C15; resistor R18; line transformer T2; and loading coil L4.
- (h) Check for malfunctions at the following points in the audio path from record head PU2 to the microphone (make this check with SP-2 in "Playback"). Discontinuity possibilities or malfunctions may exist at: contact 7 and 9 of S8-D; contacts 6 and 8 of relay K6; 1 and 3 of K5; 1 and 3 of K6; 6 and 8 of K5; 1 and 3 of S8-C; 7 and 9 of S8-C; connector P2-J2; connector P5-J5; capacitors C7, C8, C2, C9 and C18; and resistor R13.

5.14 Midcycle and termination tones (1,400 cps) are not delivered to telephone line. Check for the following possible trouble:

- (a) Check condition of transistor Q4, 1,400 cps oscillator.
- (b) Check condition of these oscillator components: coil L1; capacitors C20, C21, and C22; resistors R25, R26, R27, R28 and R29.
- (c) Check ground return path of Q4 for disconnects at contacts 6 and 8 of relay K2, contacts 8 and 12 of switch S8-B, and pins 11 and 14 of P1-J1.

5.15 Model SP-2 responds to ringing current turntable starts rotating, but unit will not "seize" telephone line or perform midcycle shift. Motor stops after one revolution. Check for the following possible trouble:

- (a) Contacts 2 and 3 of switch S8-B are open.
- (b) Pin 6 of P1-J1 is disconnected.
- (c) Contacts 2 and 3 of K2 are open.
- (d) Diode CR3 is open.
- (e) Contacts 2 and 3 of K3 are fouled.
- (f) Components C27 and R34 are faulty.

6. FUSE MODIFICATION

Reason for Modification

6.01 A high incidence of power transformer failure has occurred in those Model SP-2 telephone answering sets with chassis serial numbers below 41300. It is theorized that this difficulty is due to an inferior lot of rectifier stacks or filter capacitors.

6.02 This difficulty has been reduced to minimum by adding a fuse in the transformer secondary circuit. (All units with chassis serial number 41300 or higher now contain this fuse.) Addition of this fuse to the units in the field can be accomplished with a simple modification. Parts for this modification are contained in a conversion kit, available upon request and furnished on a no-charge basis.

Procedure

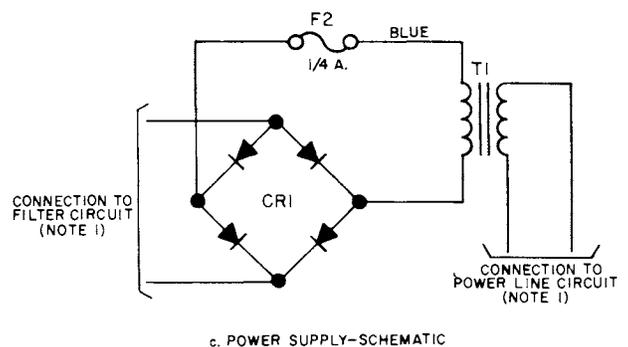
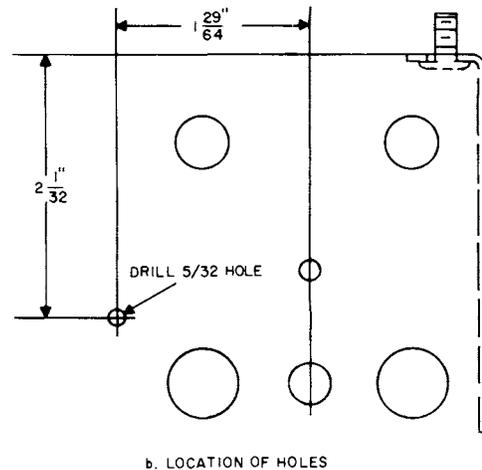
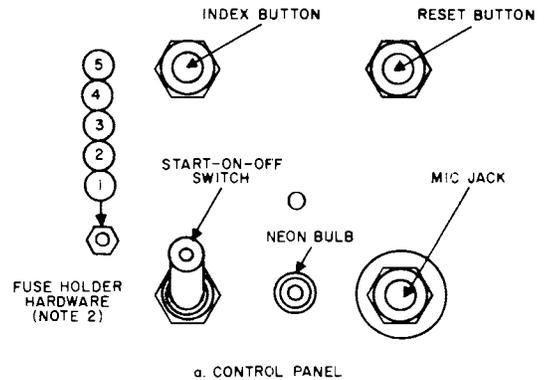
6.03 To perform this modification, a fuse holder modification kit (WW-6660-63) and a few simple tools are required. The modification kit consists of the following items:

Amount	Piece Number	Description
1	WW-3407-9	Holder, fuse
1	WW-1371-4	Washer, No.6 external star
1	WW-3600-3	Screw, 6-32 x 5/16"
1	WW-3579-46	Fuse, 1/4A
1	WW-1492-2	Nut, 6/32 KEPS

6.04 It is recommended that this modification be performed in the shop and not on the customer's premises as a hole must be drilled in the chassis.

6.05 Use the following procedure to disassemble the Model SP-2, drill the hole required, and mount the fuse holder onto the chassis assembly:

1	WW-3407-9	1	HOLDER FUSE
2	WW-1371-4	1	WASHER #6 EX. STAR
3	WW-3600-3	1	SCREW 6-32 X 5/16
4	WW-3579-46	1	FUSE 1/4 A
5	WW-1492-2	1	NUT 1/32 KEPS



NOTES:

- 1. FOR ADDITIONAL DETAIL, REFER TO MODEL SP-2 SCHEMATIC, SECTION 997-402-501.
- 2. FOR ADDITIONAL DETAIL, REFER TO CHASSIS ASSEMBLY, SECTION 997-402-800.

Figure 4. Fuse Modification.

- (1) Remove the SP-2 power cord from the 120VAC receptacle.
 - (2) Remove the Phillips-head screws from the rear of the cabinet; then slide the amplifier control and motor board assemblies forward out of the cabinet.
 - (3) For protection purposes, place packing material or cardboard under the incoming record head located on the tone arm.
 - (4) Remove the message indicator arm by loosening the set screw securing the arm to the bracket mounted on the tone arm.
 - (5) Unfasten the motorboard assembly from the amplifier and control assembly by removing four 10-32 nuts.
 - (6) To disconnect interconnecting cabling, temporarily tilt the amplifier and control assembly and the motorboard assembly on the same side; then remove the shielded cable from the cable clamp and unplug the 25-pin plug and two phono plugs from their sockets.
 - (7) Separate the amplifier and control assembly from the motorboard assembly by first tilting the motorboard forward from the rear and then raising it off of the four stud-mounted screws.
 - (8) Separate the control assembly (front panel) from the amplifier assembly by removing three 6-32 nuts; then disengage control assembly (front panel) from the amplifier assembly.
 - (9) On the amplifier chassis, locate, mark, and drill a hole $5/32''$ in diameter for the fuseholder at the position shown in Figure 4. Install fuseholder and mounting hardware.
 - (10) Connect the fuseholder as shown in the schematic portion of Figure 4. Install $1/4$ amp fuse.
 - (11) Reassemble the Model SP-2.
- NOTE: Prior to reinstalling the message indicator arm, manually depress the armature of the reset magnet and ensure that the tone arm returns to its starting or number 1 position. Then, reinstall the message indicator arm and check that it does not rub against its slot in the cabinet.

NOTE: Mark both phono plugs for proper replacement during assembly.