ELECTRONIC SECRETARY® MODEL AO-3 MECHANICAL CHECKS

1. GENERAL

1.01 This Section supersedes Section 997-010-008 in the General System Practices.

1.02 Machines installed in answer-only service frequently encounter heavy usage. As with any device operating under such conditions, the AO-3 will perform best when given occasional service attention as described in this section.

1.03 To avoid turning the customer's premises into a workshop, the procedures outlined in this section should be performed in a shop.

1.04 For the protection of service personnel, this machine is equipped with an electrical interlock switch which will break a-c power to the machine when the cabinet front panel is removed. Proceed with caution when operating the AO-3 unenclosed.

2. DISASSEMBLY

WARNING: Disconnect power cord before proceeding with disassembly.

2.01 Remove the tape cartridge from the mechanism before disassembly is attempted.

2.02 Access to the tape heads, photocell and photocell lamp may be gained by removing the two screws from each of the two covers. Lift off the covers.

2.03 Removal of the AO-3 from its cabinet is accomplished as follows:

(1) Open the top hinged cover and remove the two screws (refer to figure 1) holding the upper edge of the front panel. Close the top cover.

(2) Tip the machine backward. Remove all visible screws on the bottom (5 screws) except those retaining the feet. Tip the cabinet forward to the normal position. Re-open the top cover.

(3) Pull the lower edge of the front panel forward until it clears the base of the cabinet. Lift the front panel upward to clear the "ON-OFF" switch and cabinet.

(4) Withdraw the tape mechanism-amplifier assembly from the front of cabinet base by sliding it forward.

2.04 To separate the tape mechanism from the amplifier assembly, refer to figure 5 and:

(1) Loosen the set screw holding the selector knob in place and remove the knob.

(2) Remove the four large screws holding the tape mechanism to the amplifier.

(3) Lift the tape mechanism and tip it forward so that the motor and head plugs may be removed from the amplifier chassis.

2.05 To further disassemble the tape mechanism:

(1) Remove the two nuts holding the fiber terminal shield on the underside of the tape mechanism (refer to figure 3).

(2) Remove the shield, and loosen the terminal screws fastening the two motor leads.

(3) With the tape mechanism in the operating position, locate and remove the four screws holding the motor frame to the tape deck (refer to figure 5).

(4) Hold the pressure roller away from the capstan shaft and lift the tape deck up off the motor frame.

(5) The flywheel may be lifted upward and tipped slightly to remove from motor frame.

NOTE: Be sure to retain the thrust bearing during this procedure.

2.06 To remove the printed circuit board from the amplifier chassis turn the chassis upside-down and remove the four printed circuit board retaining screws (refer to figure 6). Pull up on the printed circuit board in the area of the socket to disconnect the interface connector.

2.07 When reassembling, assure that all parts are replaced in proper order. Give special attention replacing flywheel thrust bearing and fiber spacer washer (refer to figure 4), motor connections, and motor terminal block shield. During assembly, clean the capstan shaft and pressure roller drive surfaces of any oil accum-

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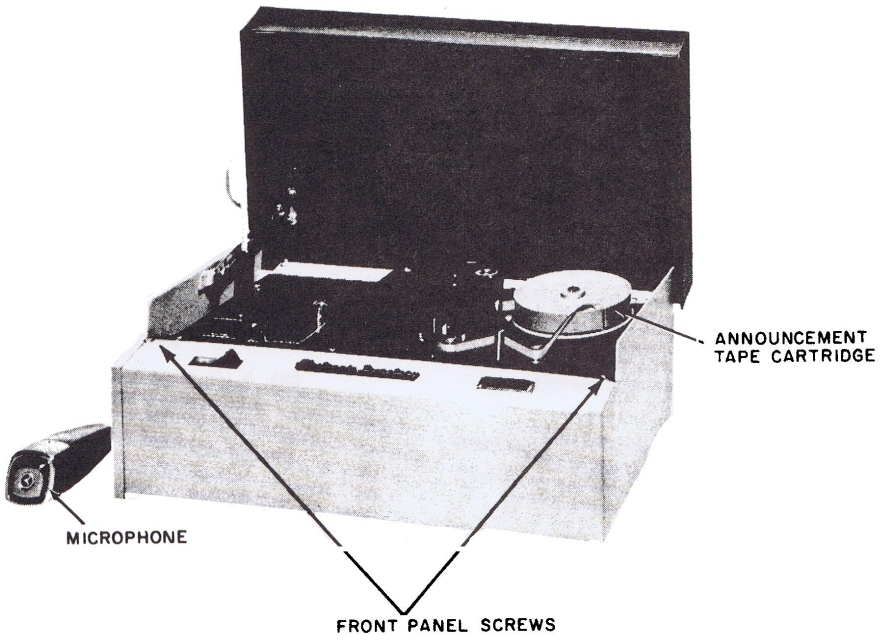

Figure 1. Orientation View of AO-3.

NOTES:
1. ALLOW APPROX. 1 $\frac{29}{32}$ INCHES PER SECOND OF RECORDING TIME PLUS 5" FOR SPLICE & WINDOW; I.E. 60 SEC. TAPE = 114 $\frac{3}{8}$ IN. PLUS ANY NECESSARY CORRECTION FOR "A" FACTOR.
2. CLEAR AREA OF TAPE TO BE FREE FROM OXIDE, LUBRICANT, OR SOLVENT RESIDUE. NO SOLVENT DAMAGE PERMITTED TO OXIDE OR LUBRICANT ON UNTREATED AREAS OF TAPE.
3. ENTIRE AREA UNDER SPLICE TO BE SIMILARLY CLEANED.
4. LINES OF DEMARKATION TO BE SHARP.
5. SPLICING TAPE TO BE APPLIED TO BOTH SIDES OF JOINT IN AREA SHOWN.
6. SHORTEST SINGLE "WINDOW" TAPE TO BE 30 SEC. RUNNING TIME.
7. TAPE EDGES TO BE PARALLEL WITHIN $\frac{1}{2}$ DEGREE ON OPPOSITE SIDES OF SPLICE JOINT. MAXIMUM PERMISSIBLE OFFSET AT JOINT = .005"
8. "A" FACTOR LENGTHS

	RUNNING TIME
6 $\frac{1}{2}$" ± $\frac{1}{4}$"	30 SEC.
7" ± $\frac{1}{4}$"	45 SEC.
7 $\frac{1}{2}$" ± $\frac{1}{4}$"	60 SEC.
8"	120 SEC.
10"	180 SEC.
12"	240 SEC.
15"	300 SEC.

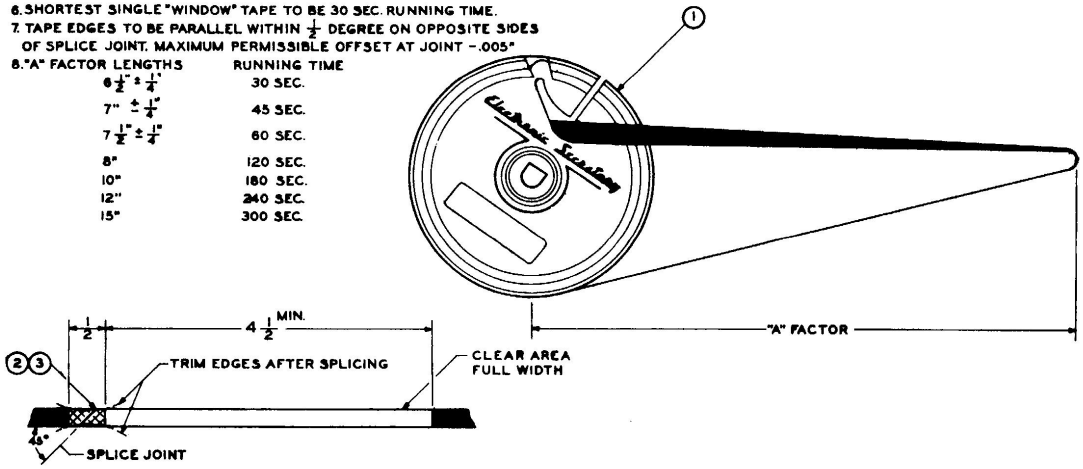

Figure 2. Tape Slack.

ulation using a soft lintless cloth and denatured alcohol. Assure that motor leads do not interfere with tension arm freedom.

3. TAPE DRIVE SYSTEM CLEANING AND INSPECTION

3.01 Inspect the tape to assure that it is not kinked or scratched, and that the spliced joint is secure. No foreign material should be present on the tape surface except for the lubricant applied at the time of manufacture. The clear area on the tape should be reasonably clean. Should tape condition be otherwise, replacement is indicated.

3.02 Assure that the capstan, pressure roller surface, pillars and heads are clean. If cleaning is required, remove the tape cartridge from the mechanism. Use a soft lintless cloth moistened with denatured alcohol to clean the surfaces.

3.03 When in the mechanism, the tape should move freely around the pillars and heads. Assure that the tape does not bind in the cartridge and that there is sufficient tape slack consistent with running time (refer to figure 2). Tape tension arm (refer to figure 5) should move freely.

3.04 Assure that motor shafts, drive idler and flywheel surfaces are clean. If not clean, clean as in 3.02. USE ONLY DENATURED ALCOHOL ON RUBBER SURFACES.

4. LUBRICATION

4.01 Initial lubrication of the AO-3 should be sufficient for a long period of service. Generally, the drive system components should be lubricated when the mechanism is disassembled for adjusting or cleaning or is otherwise disassembled for service.

4.02 Ball bearings on the motor are grease lubricated and sealed when manufactured, and will last the life of the motor under normal service. Should the motor operate with excessive noise or the shaft not rotate freely, the entire motor should be replaced. In no case should lubrication of these bearings be attempted.

4.03 After disassembling the shafts from the respective bearings, accumulated gum and foreign material may be removed from the shafts with a lintless cloth moistened with trichlorethylene.

4.04 Any accumulations in the bronze bearings should be cleaned with a dry cloth. (Avoid using solvents on the sintered surfaces as this tends to remove the impregnated lubricant.)

4.05 One drop of Automatic Electric Company H-78819-25 oil applied to the internal surface of the drive idler bearing and both flywheel bearings is sufficient. If the idler and pressure roller pivots have been disassembled, these points may be similarly lubricated. Avoid over-lubrication.

4.06 After reassembly, remove any excess oil forced out of the ends of the bearings. • All drive surfaces should be cleaned after lubrication.

5. MECHANISM ADJUSTMENTS

Capstan Shaft

5.01 Assure that the capstan shaft is perpendicular to motorboard surface. Should this require adjustment, refer to figures 3 and 4 and proceed as follows:

(1) Remove the two 6-32 hex nuts holding the thrust bearing plate at the lower end of the flywheel shaft. Carefully remove the bearing plate, the two standoff support spacers below it, and the ball thrust bearing.

(2) Loosen slightly the two 6-32 hex nuts holding the bearing retainers. Shift the lower bearing retainer assembly to bring the shaft perpendicular to the motorboard surface. Re-tighten the bearing retainer nuts when properly located.

(3) Replace the parts removed in steps (1) and (2) in the proper order. Avoid tightening the nuts holding the thrust bearing plate to a point which would deform the spacers.

(4) Should clearances in the lower bearing mounting be insufficient to bring the flywheel shaft to proper alignment, the upper bearing may be similarly loosened and adjusted.

Pressure Roller

5.02 Assure that the pressure roller contacts the capstan shaft surface evenly. See figure 5. Move roller slightly away from capstan surface to check this alignment. Form pressure roller sup-

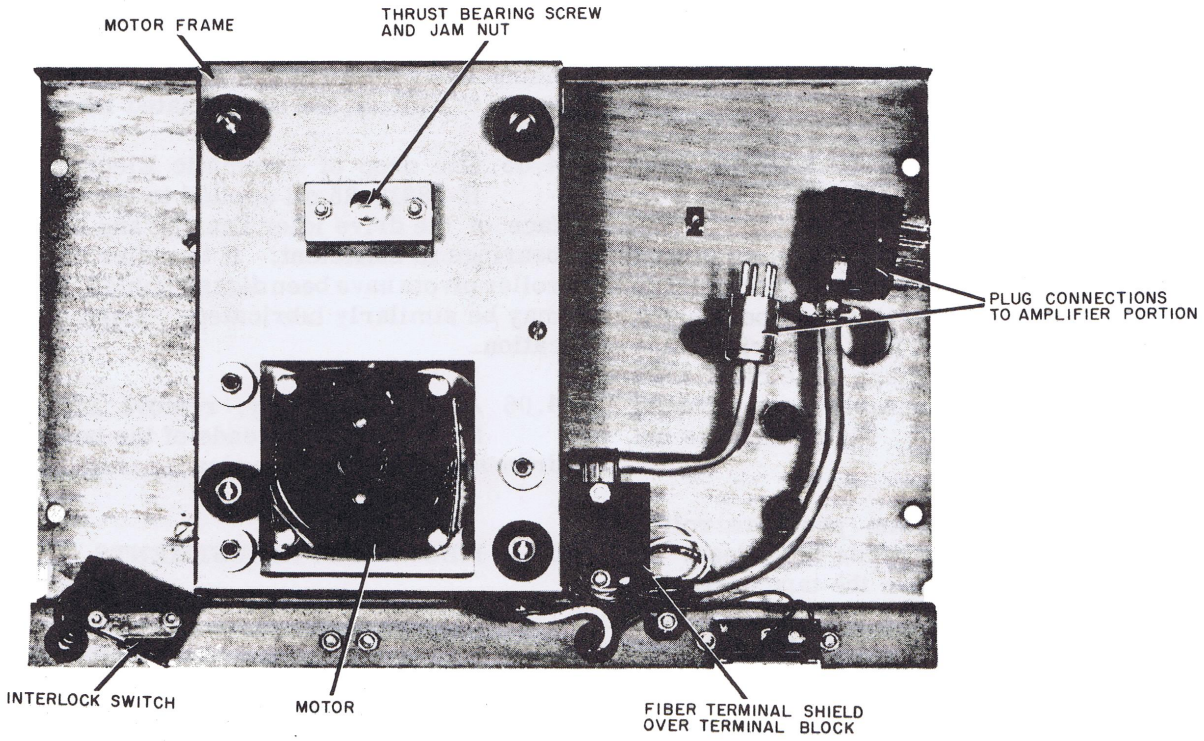

Figure 3. Bottom of Tape Mechanism.

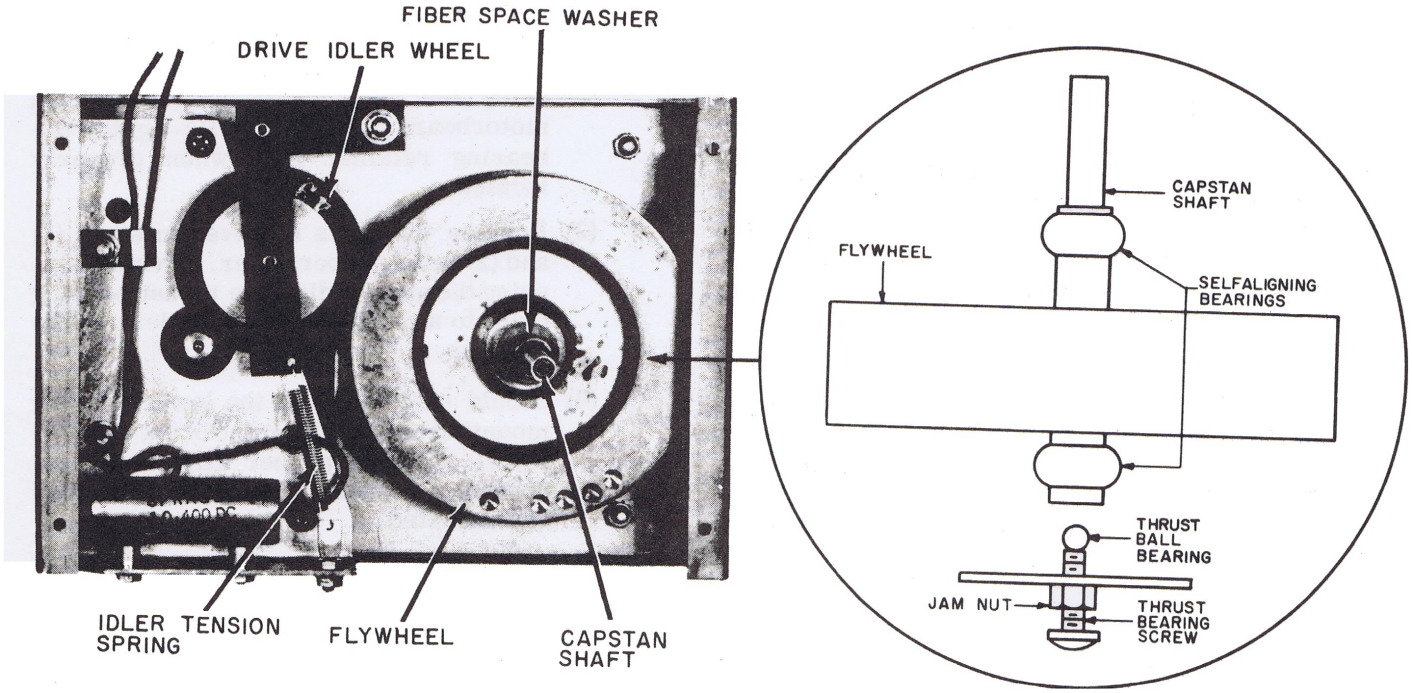

Figure 4. Top of Motor Frame.

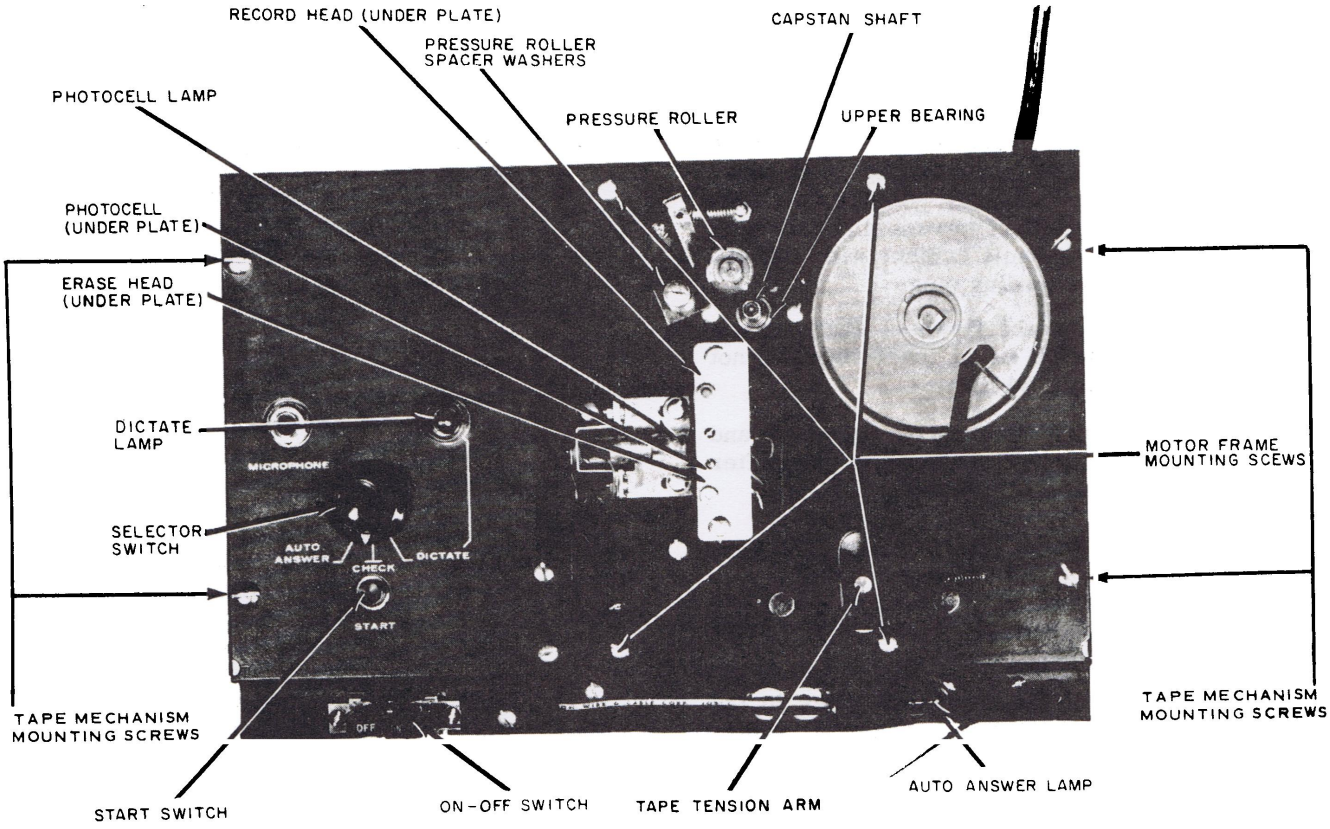

Figure 5. Top of Tape Mechanism.

port bracket to align as necessary. Correct pressure roller force against capstan is 600-800 grams.

Flywheel Thrust Bearing

5.03 Refer to figures 3, 4, and 5, and proceed as follows to adjust flywheel thrust bearing:

(1) Loosen the jam nut on the flywheel thrust bearing screw and bearing plate. During the following adjustment it will be necessary to relax pressure roller tension against capstan surface by disconnecting the pressure roller spring, or holding the roller back while adjustments are made.

(2) With the motorboard in a level, operating position, view the clearance between the upper step on the flywheel shaft, including spacer washers if present, and the upper bronze bearing.

(3) Rotate the thrust adjustment screw counterclockwise until the lower flywheel shaft step rests on the lower bearing. At this point the flywheel will not follow further motion of the adjustment screw.

(4) Noting the approximate number of turns, rotate the thrust adjusting screw clockwise until upper bearing clearance [see (2)] is eliminated.

(5) If flywheel travel from lower to upper bearing contact required more than $\frac{1}{2}$ turn but less than $1\frac{1}{4}$ turns of the thrust adjusting screw, loosen the screw $\frac{1}{4}$ turn and tighten the jam nut.

(6) If $\frac{1}{4}$ to $\frac{1}{2}$ turn of the adjusting screw was required to move the flywheel between the bearing contact points, set the adjustment screw to position the flywheel approximately halfway between these contact points; i.e. loosen the adjusting screw $\frac{1}{2}$ the total travel from lower to upper bearing.

(7) In cases where less than $\frac{1}{4}$ turn of the adjustment screw completes the travel of the flywheel between bearings remove a spacer washer from the flywheel

shaft and adjust as in (5). Where the travel required more than $1\frac{1}{4}$ turns, addition of a spacer washer is usually indicated. Assure that there will be sufficient adjustment screw thread in the bearing plate when adding spacers to the top flywheel shaft. Assure that final adjusted height of the capstan drive surface will permit contact with the full width of recording tape.

(8) End play of the flywheel shaft as adjusted should be at least .005 but not more than 1/64 inch.

(9) Assure that jam nut is tightened and pressure roller spring is in place after completing this adjustment.

Head and Photocell

5.04 The head and photocell are adjusted as follows (see figure 5):

(1) Head mounting studs should fall in the centers of the clearance holes in the head cover. Centering is accomplished by slightly loosening the two screws holding the head mounting plate to the pillars and shifting the plate to correct position. Retighten the screws.

(2) Further positioning of the heads is best accomplished on a completely assembled, operating AO-3 machine. Best head to tape contact may be approximated by loosening the hex nuts holding the head and rotating to obtain best possible contact with a tape in the running position and under light tension. Record and erase heads are adjusted by rotating for maximum tape reproduction level and maximum signal erasure respectively. Assure that heads are tight after final adjustment is reached.

(3) After heads are aligned, photocell housing may be adjusted by slightly loosening the two 2-56 screws which secure the housing to the head mounting plate. With a tape in the operating position and under light tension, postion the front of the photocell housing 1/64 inch away from the tape and parallel to it. Tighten the screws.

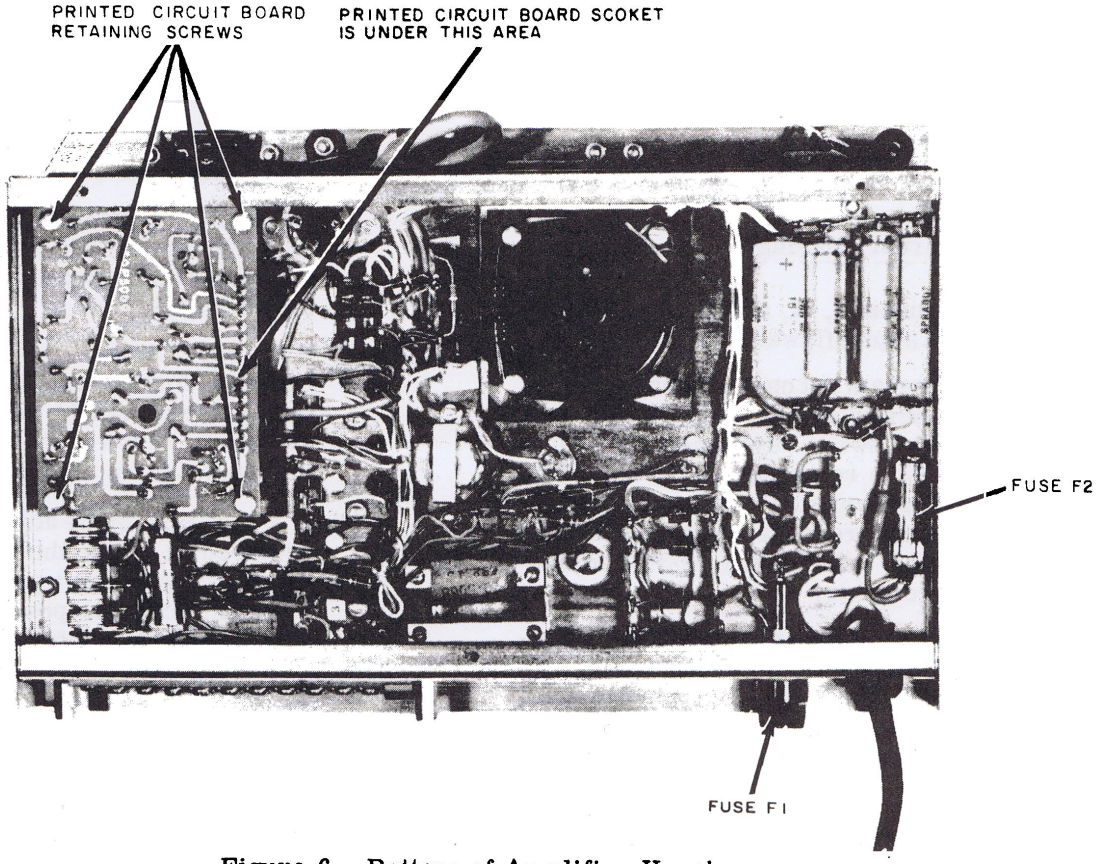

Figure 6. Bottom of Amplifier Housing.

(4) Slightly loosen the two 6-32 screws which secure the photocell lamp mounting bracket. With tape positioned as in (3), adjust the bracket so that the tip of the lamp barely makes contact with the tape, and is centered with respect to the photocell housing window. Do not position the lamp in such a manner as to force the tape into contact with the photocell housing.

(5) Assure that the tape, when properly threaded, covers the entire photocell window.

Drive System

5.05 Drive system alignment is accomplished as follows (refer to figures 4 and 5):

(1) Assure that the lower portion of the capstan drive surface and pressure roller contact entire width of the tape when properly threaded. Pressure roller height may be adjusted slightly by rearranging spacer washers on the pressure roller bracket pivot shaft as necessary.

(2) Assure that the full width of the drive idler wheel contacts both flywheel surface and motor shaft evenly and firmly. It should be parallel with the motorboard and motor bracket surfaces, and show no tendency to ride off the upper edge of the flywheel. Make certain that the drive idler has sufficient clearance from the motor bracket to prevent contact during operation. Check in operating position. Form the idler support brackets to obtain this clearance, if necessary.

(3) Pivot points on the idler support brackets and the idler bearing itself should move freely. Assure that the idler tension spring is properly anchored, does not interfere with other parts and has sufficient tension.

6. GENERAL PROBLEMS AND CAUSES

NOTE: Observe standard printed circuit board repair precautions when unsoldering or resoldering.

6.01 The following paragraphs describe possible cases of trouble and their causes. When clearing trouble described herein, refer to figures 3, 4, and 5, and applicable issues of wiring diagram 14517 and schematic 545109.

6.02 The AO-3 appears to have no a-c power. Check for the following possible trouble:

(a) Power source disconnected at P1 (power plug) defective S4.

(b) Fuse F1 blown. Determine cause before replacing with 3/8 amp 3AG or AGC size.

(c) Interlock switch S3 not operated. Readjust switch arm to assure operation when front panel is installed in cabinet.

(d) Mechanism plug is disconnected from socket J5.

(e) Discontinuity through relay K2, 1T and 2T contacts or rotary switch section S2B and lamp DS-3 open.

6.03 AO-3 photocell lamp DS-3 lights, but machine does not respond to ring signals in "Automatic" position. Check for the following:

(a) Discontinuity through relay K1, 1T and 2T contacts or rotary section switch S2B terminals 5 & 6.

(b) Defective ringing rectifier bridge CR-1 or poor connection in associated wiring.

(c) Incorrect external connection to telephone terminals.

(d) Drive system components or motor frozen.

(e) Open motor circuit. Assure that connections to motor terminal block underneath motorboard are completed.

6.04 AO-3 does not respond to closure of start switch S1 in "Check" or "Dictate". Check the following:

(a) Check (d) and (e) in Paragraph 6.03.

(b) Discontinuity through rotary switch section S2B terminals 5 & 7 (Check) terminals 5 & 8 (Dictate), start switch S1, or associated wiring.

6.05 AO-3 motor runs on ring or start signal, but delivers no message and does not complete a cycle. Check for the following:

(a) Tape improperly threaded, parted or jammed.

(b) Drive idler tension spring disconnected or broken.

(c) Insufficient force of pressure roller on capstan, roller tension spring disconnected or defective, bind in support arm or in pressure roller bearing.

(d) Oil or grease on drive system components.

(e) Relay K2 not releasing, K2 release adjustment marginal, K2, 1T and 2T contacts fouled.

(f) Defective or shorted LDR1 or associated wiring.

(g) Photocell housing, lamp, or head plate incorrectly adjusted resulting in excessive light leakage to LDR1, holding relay K2 operated.

6.06 AO-3 drives tape through cycle, but delivers no message in "Automatic" or "Check". Check the following:

(a) Headplug P3 not in socket J3.

(b) No message on tape.

(c) Record head misaligned or fouled.

(d) Announcement level control R32 fully counterclockwise.

(e) Relay K3 not operating in "Automatic". Check relay K2, 1B, and 2B contacts. S2B terminals 9 & 10, CR4, R35, C20.

(f) Defective Q1, Q2 or Q3. Substitute known good units. Assure that printed board is in place and fully seated.

(g) Discontinuity in amplifier. Check voltages, components, connections and switch S2 sections. Signal trace if necessary.

6.07 AO-3 announcement message weak, distorted, or varying in level. Check for the following:

(a) Poor contact of tape to record playback head PU-1.

(b) See (c), (d), (f) and (g) in Paragraph 6.06.

(c) Weak recording. Check dictating technique.

6.08 AO-3 announcement message previously recorded is satisfactory, but new recordings are weak and distorted or no recording at all. Check for the following:

(a) Defective microphone or poor connection in microphone circuits.

(b) Insufficient or no high frequency bias to record head PU-1 and/or erase head PU-2. Check condition of Q4, Q5, by substitution with known good transistors.

(c) Check oscillator voltages, C12, T4 and associated components.

(d) Check applicable sections in switch S2.

6.09 AO-3 does not erase cleanly or will not erase at all. Check for the following:

(a) Defective or open erase head PU-2, or poor connection to erase head.

(b) Erase head misaligned or fouled.

(c) Check applicable points under 6.08.

6.10 AO-3 cycles continuously regardless of selector switch position. Check for the following:

(a) Lamp DS-3 open or open connection in associated circuitry.

(b) Fuse F2 blown. Determine cause before replacing with 3/8 amp 3AG or AGC size. In case where F2 has opened, amplifier will also be dead.

(c) Photocell LDR1, K2 coil, or associated wiring open circuited.