# RECORDERS

# KS-19125, LIST 1 AND LIST 2

# REQUIREMENTS AND ADJUSTING PROCEDURES

## 1. GENERAL

**1.01** This section covers the KS-19125, List 1 (Fig. 1) and List 2 (Fig. 2) recorders used initially for digital recording of AMA data in the No. 1 Electronic Switching System Master Control Center.

**1.02** This section is reissued to incorporate information on the List 2 recorder and to designate the information which is not common to both the List 1 and the List 2 recorders. In this process, marginal arrows have been omitted.

**1.03** Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements described in Part 2.

**1.04** *Asterisk (*):* Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting apparatus or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

**1.05** The time during which the recorder is out of service should be as brief as possible to prevent possible loss of AMA data if the operating recorder should break down. However, the call processing equipment can store call data for a period of about 5 to 25 minutes depending upon traffic. This time will normally allow the recorder being serviced to be put back in operation without loss of AMA data.

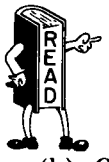
**1.06** Before any adjustment, lubrication, or cleaning operation is performed, the recorder must be in manual control condition or turned off, and any tape containing AMA information must be removed, identified, and placed in its container. (See Section 034-356-301.)

**1.07** The information in Parts 2 and 3 applies to both the List 1 and List 2 recorders except where otherwise indicated.

## 2. REQUIREMENTS

### 2.01 *Cleaning*

(a) ***Tape Path:*** The magnetic heads (Fig. 1 or 2), rotating and stationary guides, pinch roller, and capstan shall be ***free of tape oxide, dust, and all other foreign material.***

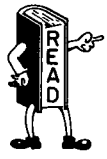



***It is important that the tape path be cleaned each time the tape is changed.***

(b) ***Cover Door:*** The cover door shall be free of finger marks and ***dust*** which may be attracted by static electricity.

(c) ***Finish:*** All painted surfaces shall be free of oil, grease, and dirt. Oil and grease should always be removed from the surface as soon as practical to prevent discoloration of the finish.

(d) ***Reel Turntable Brake Surface:*** The brake surface of the turntable (Fig. 3 or 4) and the brake material shall be kept free of all dust, oil, and grease.




***The brake surface and brake material should not be touched except with a clean cloth and approved cleaning solution.***

### 2.02 *Lubrication*

(a) ***Rotating Guides and Pinch Roller:*** The rotating guides on the tension arms (Fig. 1 or 2) and the pinch roller contain ball bearings

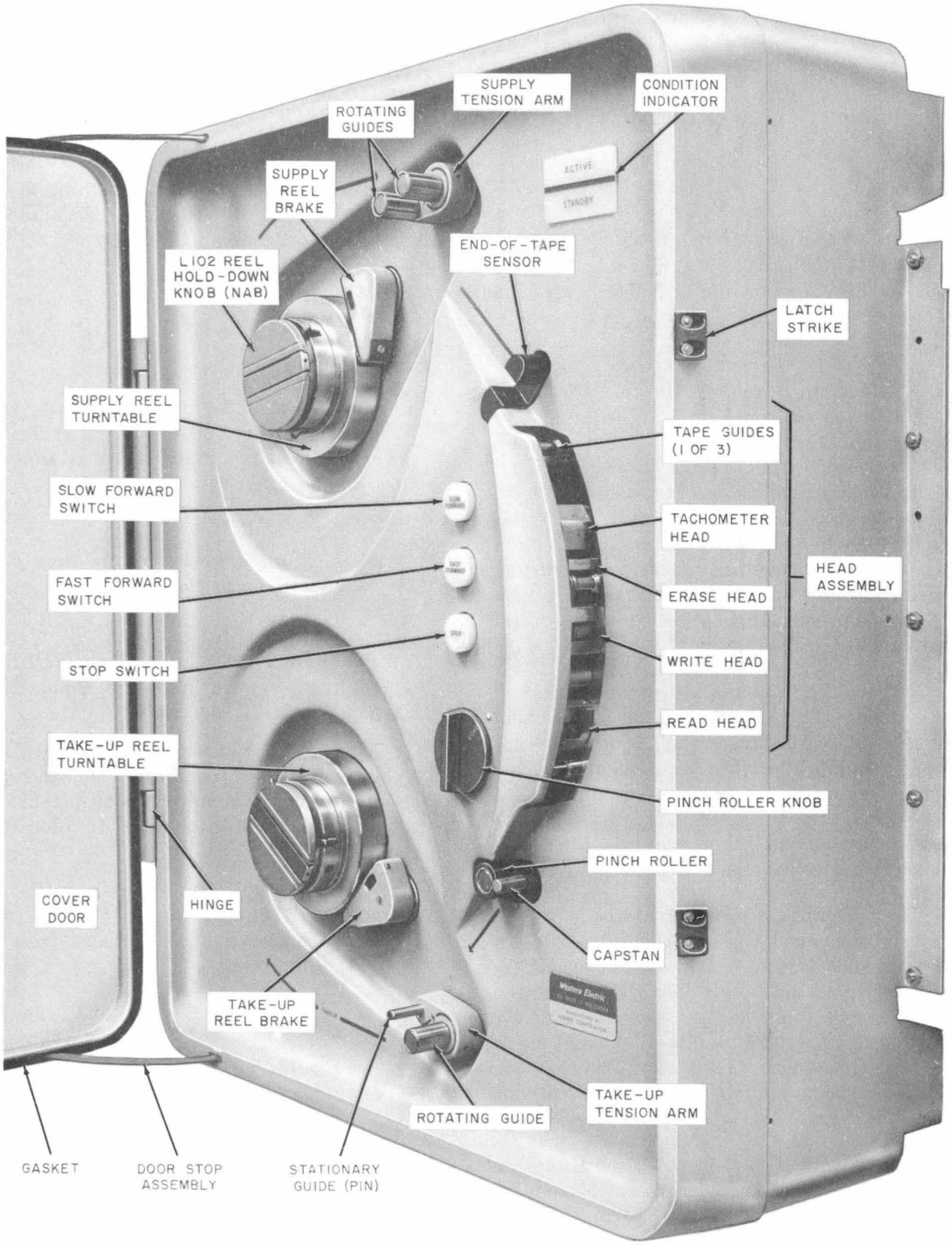



**Fig. 1 — KS-19125, List 1 Recorder — Front View**

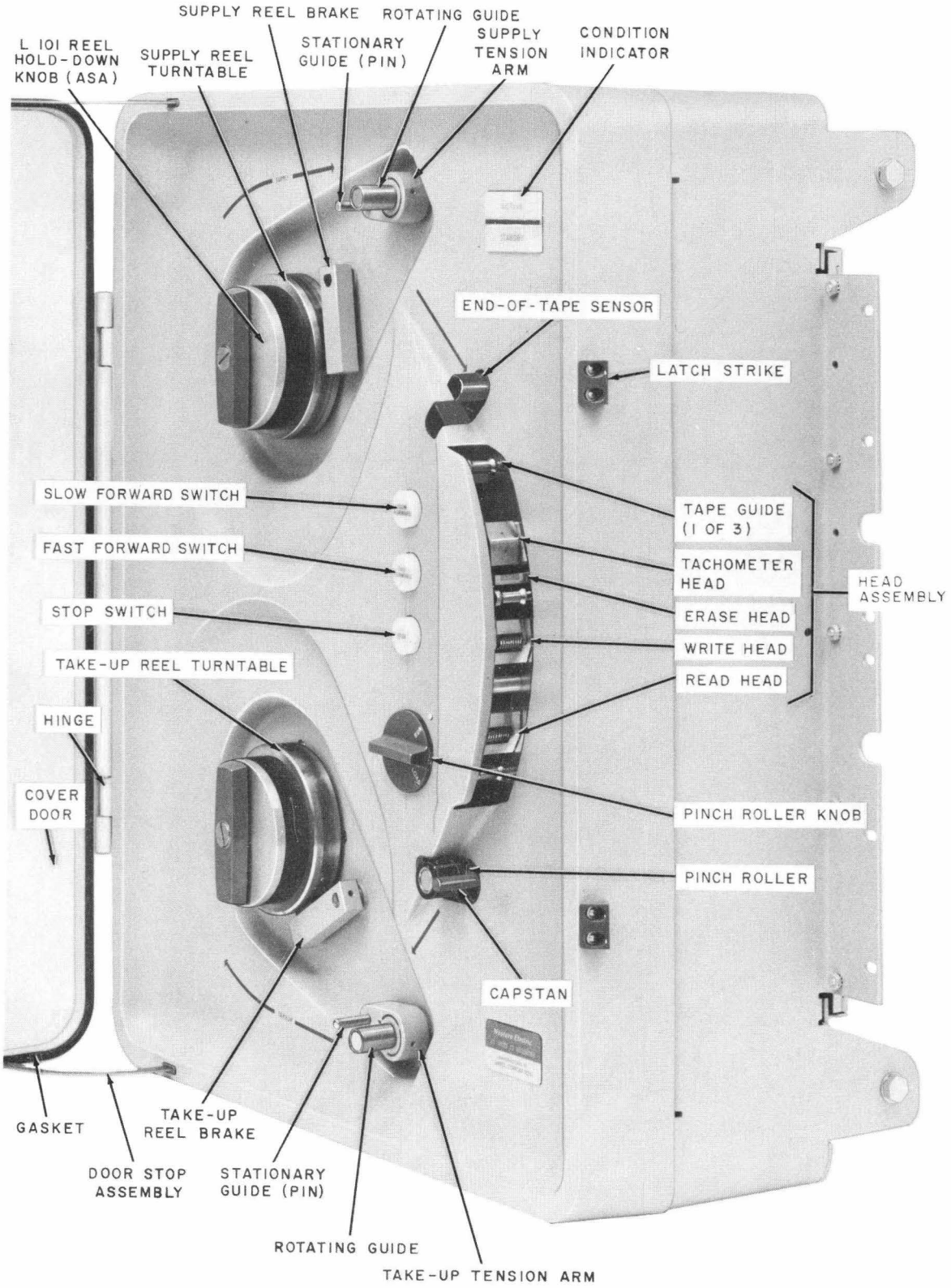



**Fig. 2 — KS-19125, List 2 Recorder — Front View**

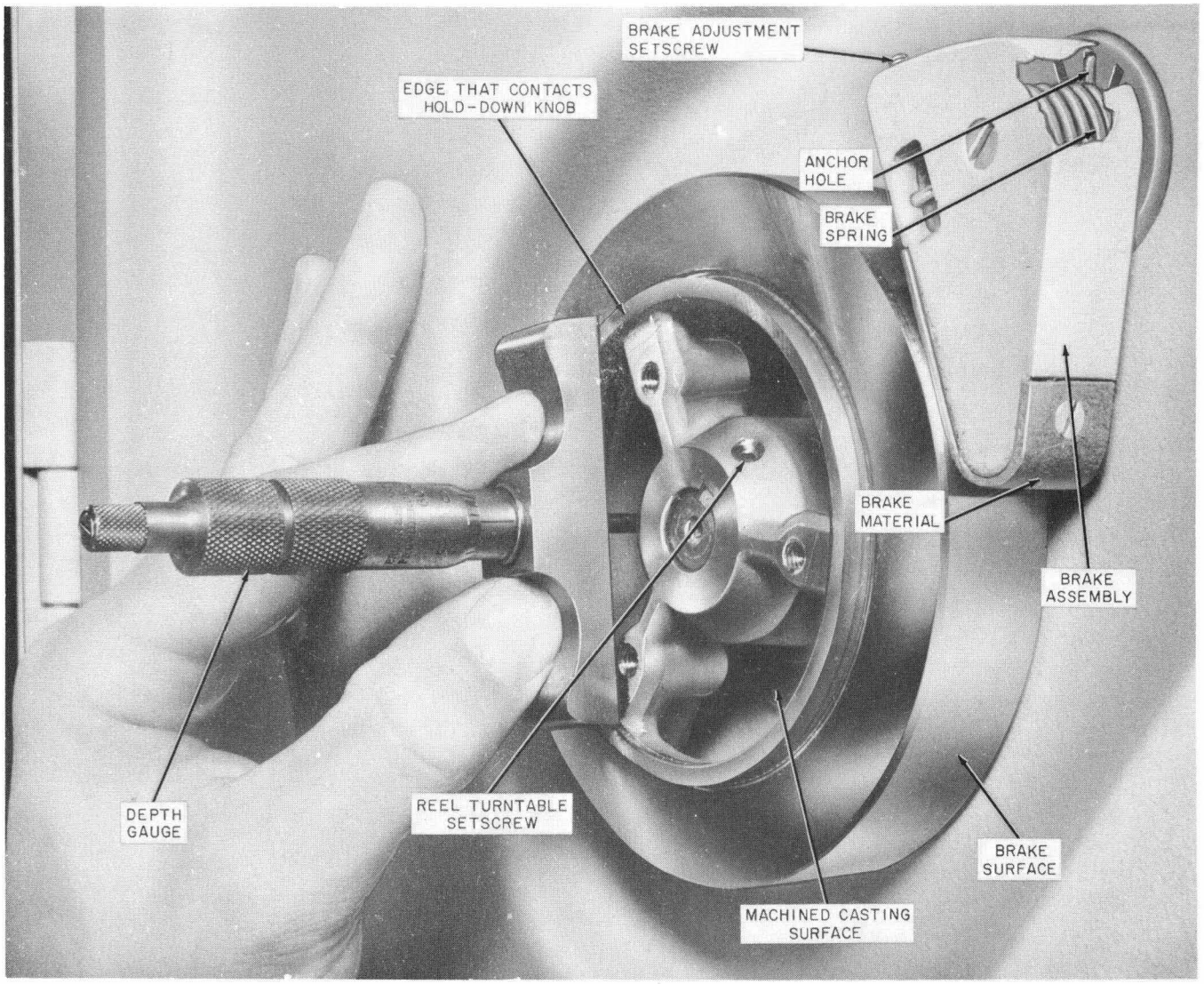



**Fig. 3 — Reel Turntable Showing Height Measurement — KS-19125, List 1 Recorder**

which require no lubrication service during their lifetime.

(b) ***Motors:*** The drive motor (Fig. 5 or 6) and the reel motor contain ball bearings which require no lubrication service.

(c) ***Pinch Roller Knob and Pinch Roller Assembly:*** The cam surface of the pinch roller knob (Fig. 5 or 6) which rubs against the pinch roller assembly requires a small amount of No. 6 Dow compound lubricant periodically.

(d) ***Hinges:*** The front cover door hinge (Fig. 1 or 2), the rear door hinges (Fig. 7), and the relay inspection panel hinge require oiling at intervals to prevent wear and squeaks. Any excess oil should be removed immediately to prevent spotting of equipment finish.

(e) ***Latches and Door Stops:*** The latch strikes (Fig. 1 or 2) and door stop assemblies use materials which require no lubrication.

(f) ***Recommended Lubrication Intervals:*** Items covered in (c) should be lubricated at 6-month intervals. Items covered in (d) should

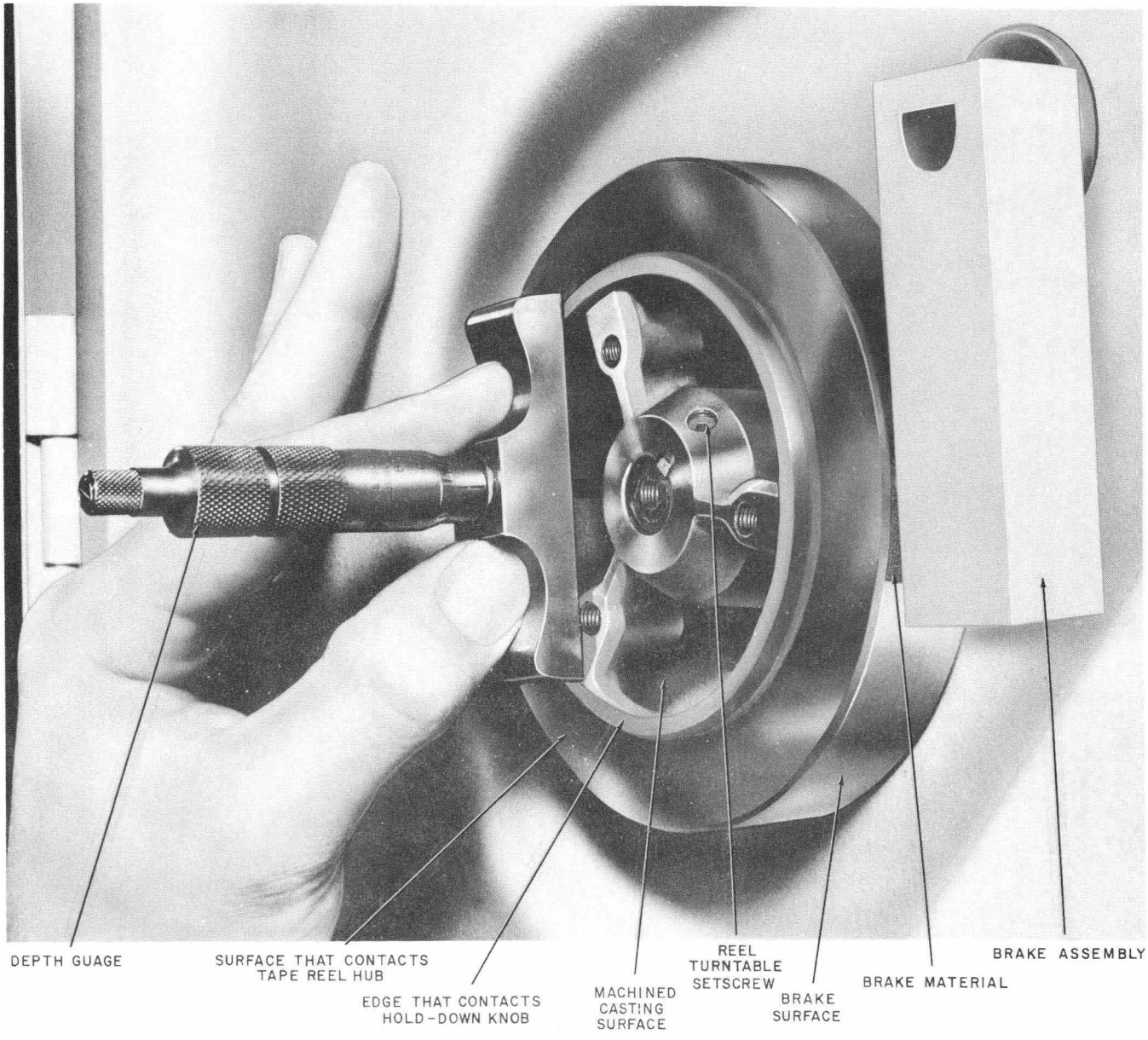



**Fig. 4 — Reel Turntable Showing Height Measurement — KS-19125, List 2 Recorder**

be lubricated at 6-month intervals or more frequently if operation indicates it is needed.

**2.03** ***Demagnetization:*** The head assembly (Fig. 1 or 2) is demagnetized by the manufacturer and should require no further attention.

**2.04** ***Reel Turntable Alignment:*** The distance between the edge of the reel turntable which contacts the hold-down knob (Fig. 3 or 4) and the machined casting surface surrounding the turntable shaft shall be 0.969 ±0.005 inch. This dimension provides alignment of tape with the tape guides of the head assembly.

**2.05** ***Brake Assembly Alignment (List 2 Only):*** The brake assembly (Fig. 4) is positioned by the manufacturer and should require no further attention.

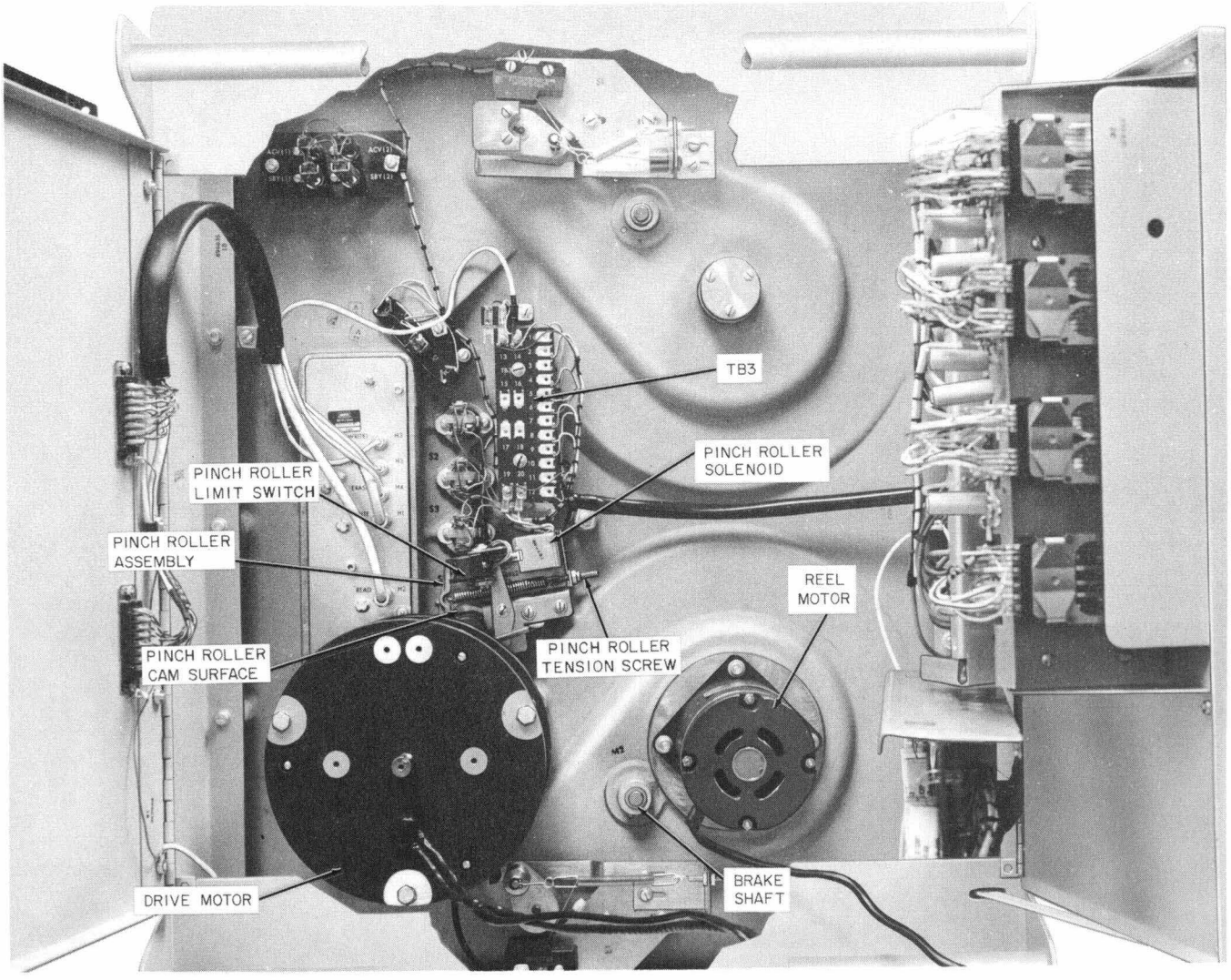



**Fig. 5 — KS-19125, List 1 Recorder — Rear View**

**2.06** ***Braking Torques for Supply and Take-Up Reel Turntables***

(a) Braking of the supply and take-up reel turntables shall be measured with turntable turning slowly clockwise and shall have the following torques:

**FOR KS-19125, LIST 1 RECORDER**

Supply — 28 to 32 inch ounces
Take-Up — 13 to 17 inch ounces

**FOR KS-19125, LIST 2 RECORDER**

Supply — 18 to 22 inch ounces
Take-Up — 10 to 14 inch ounces

(b) Correct adjustment and cleanness of brakes are essential for smooth tape motion without throwing loops and jerking tape. Readjustment to above values shall be made where necessary.

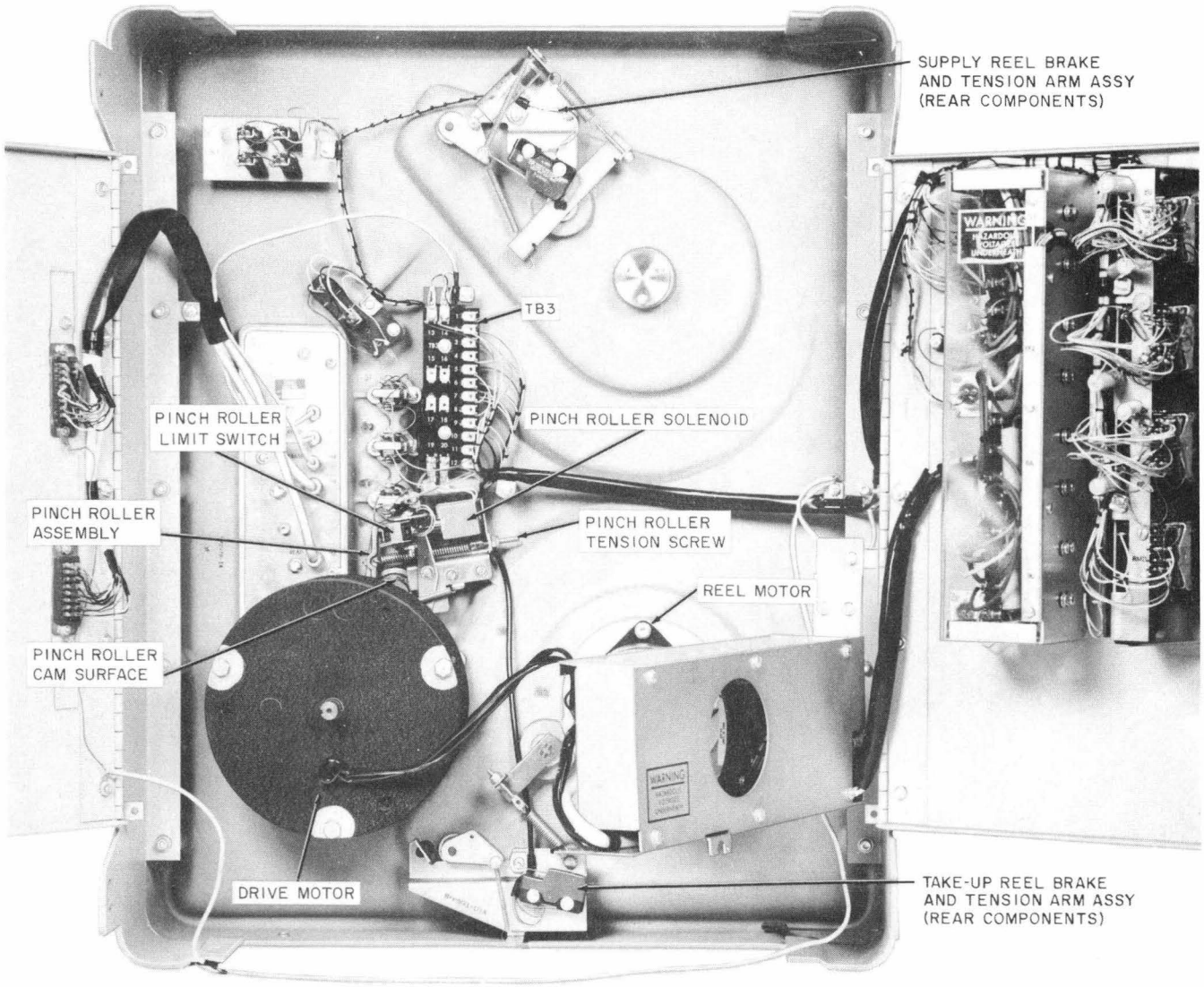



**Fig. 6 — KS-19125, List 2 Recorder — Rear View**

### 2.07 *Tape-Break Switches*

(a) ***List 1 Only:*** These switches (Fig. 8) must have a clearance of 0.025 to 0.075 inch between the switch arm and its stop at the position where the switch operates.

(b) ***List 2 Only:*** The tape-break switches (Fig. 9) and mounting brackets are assembled and positioned by the manufacturer and should require no further attention.

### 2.08 *Upper Tension Arm and Dash Pot*

(a) ***List 1 Only:*** On the upper (supply) tension arm, when the spring arm (Fig. 8) is positioned at the point at which the tape-break switch is against the stop, the spring arm (center line of the pin) shall make an angle of 25 ±2 degrees with the horizontal. When the spring arm is positioned to hold the switch arm against its stop, there shall be 1/16 ±1/64-inch clearance between the dash pot piston and the

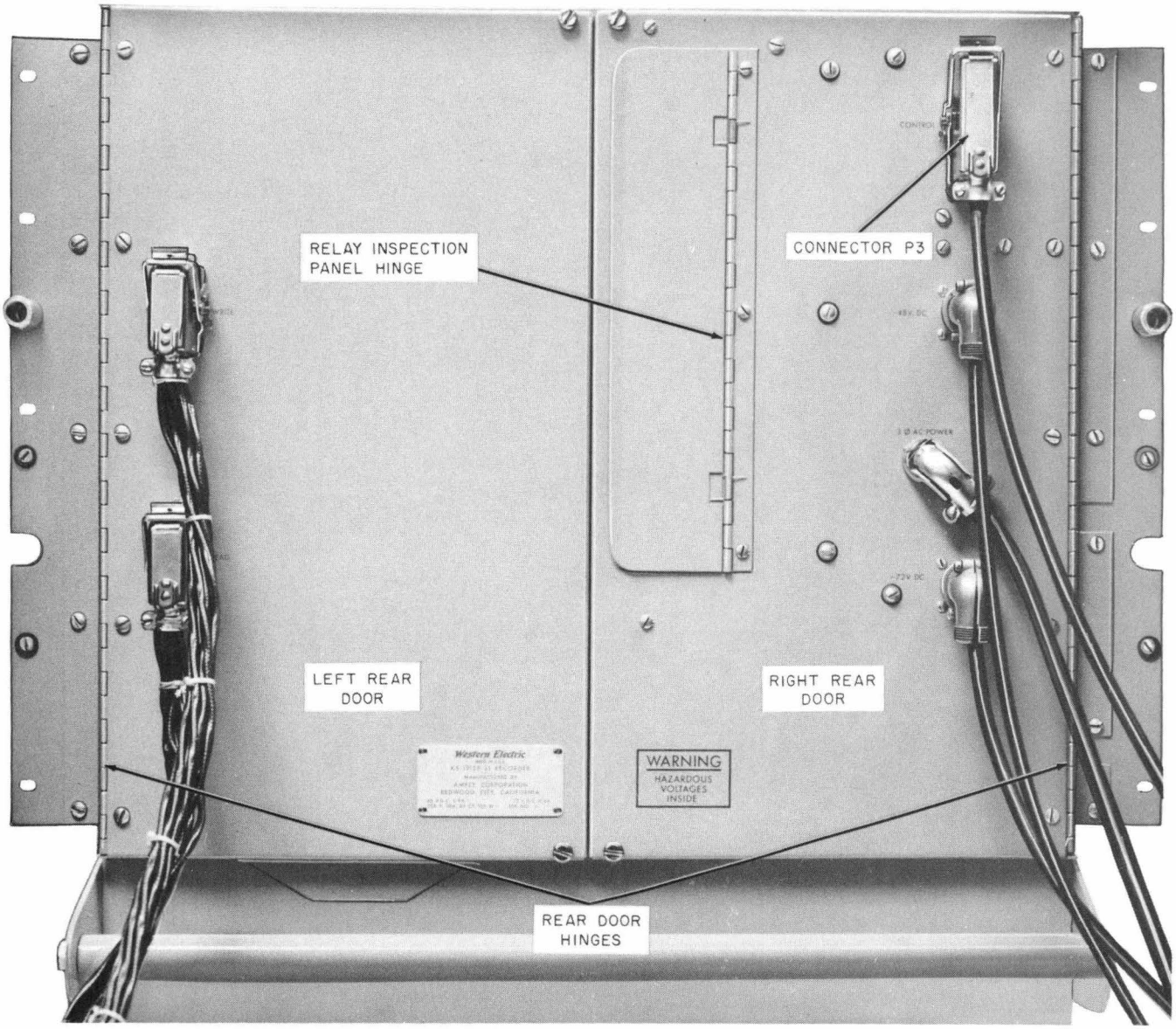
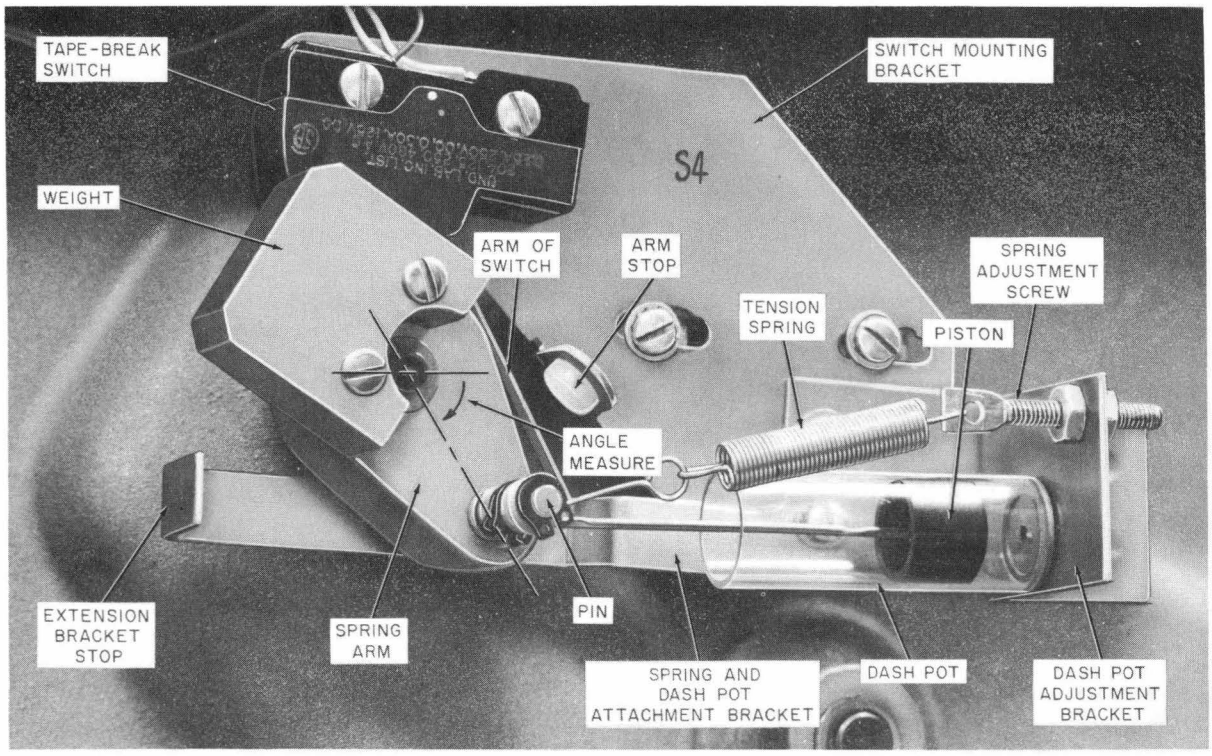


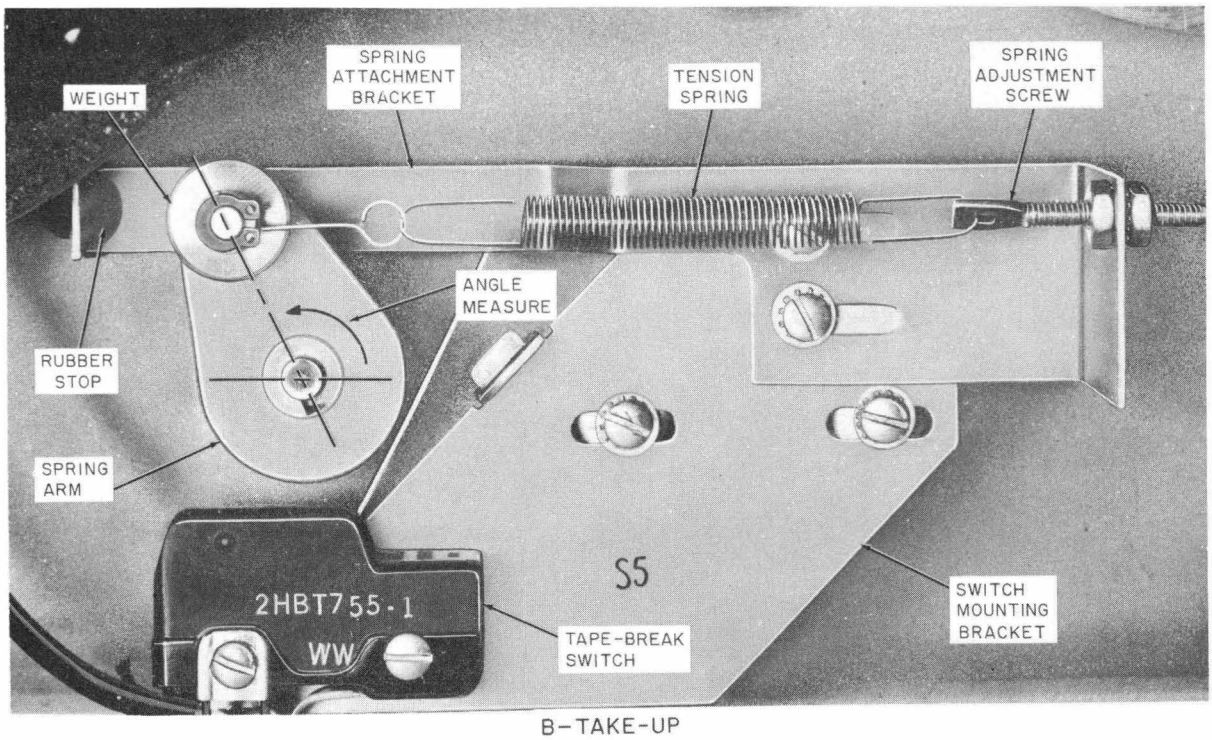

**Fig. 7 — Rear View of Recorder with Doors Closed**

end of the dash pot. When the spring arm is rotated to remove all slack from the spring and its linkage, the spring arm shall make an angle of 45 ±3 degrees with the horizontal. With the spring arm rotated to just release the switch, the arm shall cause operation of the take-break switch when released with a 1/4-ounce weight attached to the pin but must not cause operation when the spring arm is released from the vertical position with a 1/2-ounce weight attached to the pin. When the spring arm is rotated clockwise, its motion shall be limited by the extension bracket stop and the dash pot piston shall be retained in the dash pot cylinder.

(b) ***List 2 Only:*** The upper (supply) tension arm (Fig. 9) and dash pot are assembled and positioned by the manufacturer and should require no further attention.

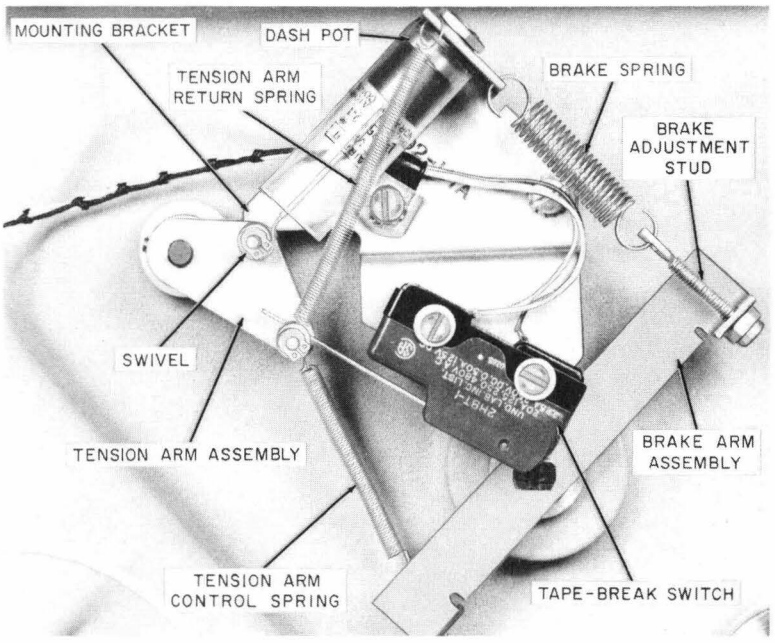



A-SUPPLY

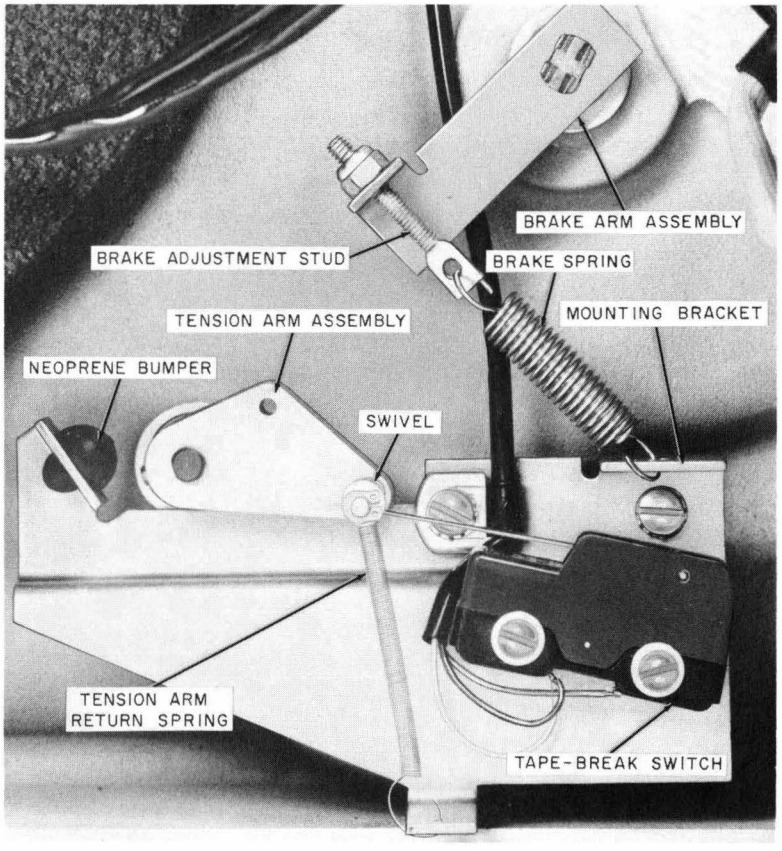



B-TAKE-UP

**Fig. 8 — Tape-Break Switches and Rear Components of Tension Arms — KS-19125, List 1 Recorder**




A-SUPPLY




B-TAKE-UP

**Fig. 9 — Tape-Break Switches and Rear Components of Tension Arms — KS-19125, List 2 Recorder**

**2.09** ***Lower Tension Arm***

(a) ***List 1 Only:*** On the lower (take-up) tension arm, when the spring arm (Fig. 8) is positioned to hold the switch arm against its stop, the spring arm shall make an angle of 25 ±2 degrees with the horizontal. When the spring arm is rotated to remove all slack from the spring and its linkage, the spring arm shall make an angle of 55 ±5 degrees with the horizontal and when the arm strikes the rubber stop, the angle shall be 125 ±5 degrees. With no tape on the recorder, the tape-break switch shall be operated.

(b) ***List 2 Only:*** The lower (take-up) tension arm (Fig. 9) is assembled and positioned by the manufacturer and should require no further attention.

**2.10** ***Head Assembly:*** The four magnetic heads of the assembly (Fig. 1 or 2) are aligned by the manufacturer and require no adjustment. Defective or excessively worn heads can cause unsatisfactory operation of the equipment. The tape guides shall keep the tape centered between the conical sections and shall not be worn so as to allow the tape to ride up on the conical sections.

**2.11** ***Pinch Roller and Limit Switch:*** The pinch roller (Fig. 1 or 2) shall produce a force of 15 pounds ±0.5 pound against the capstan with pinch roller knob in the RUN position. The pinch roller limit switch (Fig. 5 or 6) shall operate when the knob is positioned to RUN and shall release when the knob is positioned to LOAD.

**2.12** ***Pinch Roller Solenoid:*** The pinch roller solenoid (Fig. 5 or 6) shall operate smoothly and produce positive locking of the pinch roller knob in the RUN position during remote control of equipment.

**2.13** ***FAST FORWARD, SLOW FORWARD, and STOP Switches:*** The local control switches shall operate smoothly and cause the correct equipment response. The SLOW FORWARD switch (Fig. 1 or 2) shall cause the tape to be driven at 5 to 5.5 inches per second (ips). The FAST FORWARD switch shall cause the tape to be driven at 27 to 33 ips. The STOP switch shall cause the tape to stop within 0.1 second from the slow forward speed.

**2.14** ***End-of-Tape Sensor:*** The end-of-tape sensor (Fig. 1 or 2) shall produce the correct resistance values for normal tape, tape with no oxide, illuminated sensor lamp, and burned-out sensor lamp. For light hitting the photocell, resistance is 100 to 600 ohms. For no light hitting the cell, resistance is greater than 50,000 ohms.

**2.15** ***Drive Motor and Capstan:*** The drive motor (Fig. 5 or 6) with its shaft machined as the capstan has one winding which drives the tape at 5 to 5.5 ips and a second winding that drives the tape at 27 to 33 ips. When stopping the tape, the 5-ips winding is used as a dc brake that stops the tape within 0.1 second from the slow forward speed.

**2.16** ***Reel Motor:*** The reel motor (Fig. 5 or 6) drives the take-up reel turntable directly. The drive shall be such as to provide uniform take-up of the tape without delay on take-up and without breaking or unduly stretching tape on stop.

**2.17** ***Condition Indicator:*** Both lamps of the STANDBY section of the condition indicator (Fig. 1 or 2) shall illuminate during standby condition as determined by the remote equipment. Both lamps of the ACTIVE section of the condition indicator shall illuminate during active condition. In manual control for local operation, neither section shall be illuminated.

**2.18** ***Front Cover Door:*** The gasket of the front cover door (Fig. 1 or 2) shall be in contact with the recorder casting at all points when the door is fully latched.

**2.19** ***Rear Doors:*** A uniform spacing of about 1/16 inch shall exist between the edges of the two rear doors (Fig. 7) when they are closed.

**2.20** ***Relays:*** Relay contacts should be clean and in alignment. Any contacts having pits or buildups should be reconditioned. (See Section 069-306-801.) Judge by eye.

## 3. PROCEDURES

### 3.001 *List of Tools, Gauges, Test Apparatus, and Materials*

| CODE OR SPEC NO. | KS-19125 RECORDER LIST 1 | KS-19125 RECORDER LIST 2 | DESCRIPTION |
|---|---|---|---|
| **TOOLS** | | | |
| 129B | √ | √ | 1/4-Inch Open Double-End Offset Wrench |
| 418A | √ | √ | 5/16-Inch and 7/32-Inch Open Double-End Flat Wrench |
| 486A | √ | √ | Oil Can |
| AT-7825 | √ | √ | 5-Inch E Screwdriver |
| AT-7825 | √ | √ | 4-Inch E Screwdriver |
| KS-6320 | √ | √ | Orange Stick |
| KS-7507 | √ | √ | Vacuum Cleaner or equivalent |
| R-2670 | √ | √ | 3/32-Inch Allen Wrench |
| R-2958 | √ | √ | 5/64-Inch Allen Wrench |
| R-2959 | √ | √ | 1/16-Inch Allen Wrench |
| R-2961 | √ | √ | 0.050-Inch Allen Wrench |
| R-2975 | √ | √ | Snap-Ring Pliers |
| R-3193 (2 used) | √ | √ | 9/32-Inch and 11/32-Inch Double-End Flat Wrench |
| — | √ | — | 1/4-Ounce Lead Weight. (Obtain locally and trim as necessary.) |
| — | √ | — | 1/2-Ounce Lead Weight. (Obtain locally and trim as necessary.) |
| — | — | √ | APCO Mossberg Torque Screwdriver with 7/16-Inch Screwdriver Bit. (Obtain bit locally.) |
| **GAUGES** | | | |
| 79B | √ | √ | 0-1000 Gram Push-Pull Tension Gauge |
| 133A | √ | — | Thickness Gauge Nest or equivalent (for 0.025- and 0.075-inch measurements) |
| R-2481 | √ | √ | 0-30 Pound Spring Balance Scale (4-ounce steps) |
| R-8550 | √ | √ | 6-Inch Steel Scale |
| — | √ | √ | Micrometer Depth Gauge (up to 1 inch in 0.001-inch divisions) Miller Falls No. 31 or equivalent |
| — | √ | — | Protractor (small transparent) |
| **TEST APPARATUS** | | | |
| W1AB | √ | √ | Cord (1-1/2 foot with alligator clip on each end) |
| KS-14510, L1 | √ | √ | Volt-Ohm-Milliammeter or equivalent |
| **MATERIALS** | | | |
| KS-2423 | √ | √ | Twill Cloth |
| KS-6232 | √ | √ | Oil |
| KS-19094, L1 | — | √ | Antiseize Compound |
| — | √ | √ | Freon (TF Grade) |
| — | √ | √ | Isopropyl Alcohol |
| — | √ | √ | No. 6 Compound Lubricant, Dow Corning, Midland, Mich. |
| — | √ | — | Pressure Contact Tape (approximately 2 inches) |

| CODE OR SPEC NO. | KS-19125 RECORDER LIST 1 | KS-19125 RECORDER LIST 2 | DESCRIPTION |
|---|---|---|---|
| MATERIALS (Cont) | | | |
| — | √ | √ | Recording Tape, 1/2-Inch (scraps, 1 foot long and 3 inches long) |
| — | — | √ | Sealant (Loctite) Grade E |
| — | √ | √ | String (approximately 3 feet) |

**3.01** ***Cleaning***

(1) ***General Cleaning:*** When necessary, vacuum clean (KS-7507 vacuum cleaner) any loose dust inside front cover, on face of recorder, and inside rear portion of recorder. Remove any remaining residue by wiping with a clean KS-2423 twill cloth moistened with Freon. The Freon should be sprayed on the cloth rather than on the surface being cleaned. Follow by wiping with a clean, dry KS-2423 twill cloth.

(2) ***Tape Path:*** The tape path shall be cleaned each time the tape is changed. Clean all surfaces touched by the tape, except the pinch roller surface, using a clean KS-2423 twill cloth moistened with Freon. These surfaces are the stationary pin and rotating guide surfaces on the supply and take-up tension arms, the three tape guides and the four head faces on the head assembly, and the capstan. Remove all accumulations of tape oxide and dust. Only the surface of the heads contacted by the tape requires cleaning. Clean the pinch roller surface using a clean KS-2423 twill cloth moistened with isopropyl alcohol. Use only enough alcohol on the pinch roller to provide cleaning. Wipe all parts with a clean, dry KS-2423 twill cloth. Do not touch any surface which tape contacts with fingers as body oils can contaminate tape.

(3) ***Cover Door:*** When the tape is changed or after servicing of the recorder, any dust attracted to the inside of the cover door glass should be removed with a dampened KS-2423 twill cloth.

(4) ***Finish:*** When any oil or grease gets on a painted surface of the recorder, it shall be removed with a KS-2423 twill cloth moistened with Freon. Follow by wiping with a clean, dry KS-2423 twill cloth.

(5) ***Reel Turntable Brake Surface:*** The brake surface of the turntables and the brake pads must be completely free of all dust, oil, and grease (even the oil left by a finger print) if the torque applied by the brakes is to be uniform. Clean the brake surface and brake pads with a clean KS-2423 twill cloth moistened with Freon. Wipe brake surfaces and pads with a clean, dry KS-2423 twill cloth.

**3.02** ***Lubrication***

(1) ***Pinch Roller Knob and Pinch Roller Assembly:*** Position the pinch roller knob to LOAD position. Using a KS-6320 orange stick, apply a small amount of No. 6 Dow compound lubricant to the cam surface on the rear section of the pinch roller knob at the point where it contacts the pinch roller assembly (Fig. 5 or 6). Operate the pinch roller knob between the LOAD and RUN positions several times to spread the lubricant.

(2) ***Hinges:*** Using 486A oil can apply a drop of KS-6232 oil to each hinge joint of the cover door (Fig. 1 or 2). Remove any excess oil with KS-2423 twill cloth. Operate the door back and forth to work the oil into the hinge. Repeat the procedure for each of the rear door hinges and the relay inspection panel hinge (Fig. 7).

**3.03** ***Demagnetization:*** Requires no periodic procedure.

***3.04** ***Reel Turntable Alignment***

(a) ***List 1 Only:*** To adjust the turntable with the KS-19125, L 102 (NAB) hold-down knob (Fig. 1), proceed as follows:

(1) Loosen two setscrews in cover plate (Fig. 10), using a 0.050-inch Allen wrench, until cover plate can be removed.

(2) Loosen setscrew which holds nylon ball against threads of special captive screw under cover plate several turns using a 5/64-inch Allen wrench.

(3) Turn reel turntable until setscrew in (2) above is down.

(4) Remove semicircular flaps and Delrin cam of knob by loosening special captive screw using a 5-inch E screwdriver.

(5) Check that nylon ball is still in captive screw hole, and place a piece of pressure tape over hole of captive screw in reel clamping assembly to prevent losing nylon ball. Do not cover machine screws.

(6) Remove three screws which secure reel clamping assembly using a 4-inch E screwdriver. Support part to prevent its falling when removing last screw.

(7) Check and adjust turntable as described in (c) below.

(8) Replace hold-down knob by reversing the procedure in (1) through (6) above. Make certain that nylon ball is in place in setscrew hole inside special captive screw hole before replacing special captive screw and that any adhesive from the pressure tape is removed from the surface. The special captive screw should be tightened until about one quarter turn of hold-down knob causes full operation of clamping fingers.

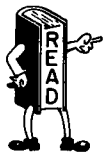
(b) ***List 2 Only:*** To adjust the turntable with the KS-19125, L 101 (ASA) reel hold-down knob (Fig. 2), proceed as follows:

(1) While holding hold-down bar (Fig. 11), use the 5-inch E screwdriver to remove special left-hand threaded screw (turn screw clockwise). Take care not to mar the slotted area of the screw.

(2) Unscrew hold-down bar by turning it counterclockwise and remove bar from stud.

(3) Remove thrust bearing, two washers, and hold-down cap from stud.

(4) Using the 4-inch E screwdriver, remove three screws and lockwashers securing hold-down base to reel turntable and remove hold-down base, ring, and stud.




***Do not disassemble hold-down base and stud unless necessary. If further disassembly is required, refer to Section 034-356-801.***

(5) Check and adjust turntable as described in (c) below.

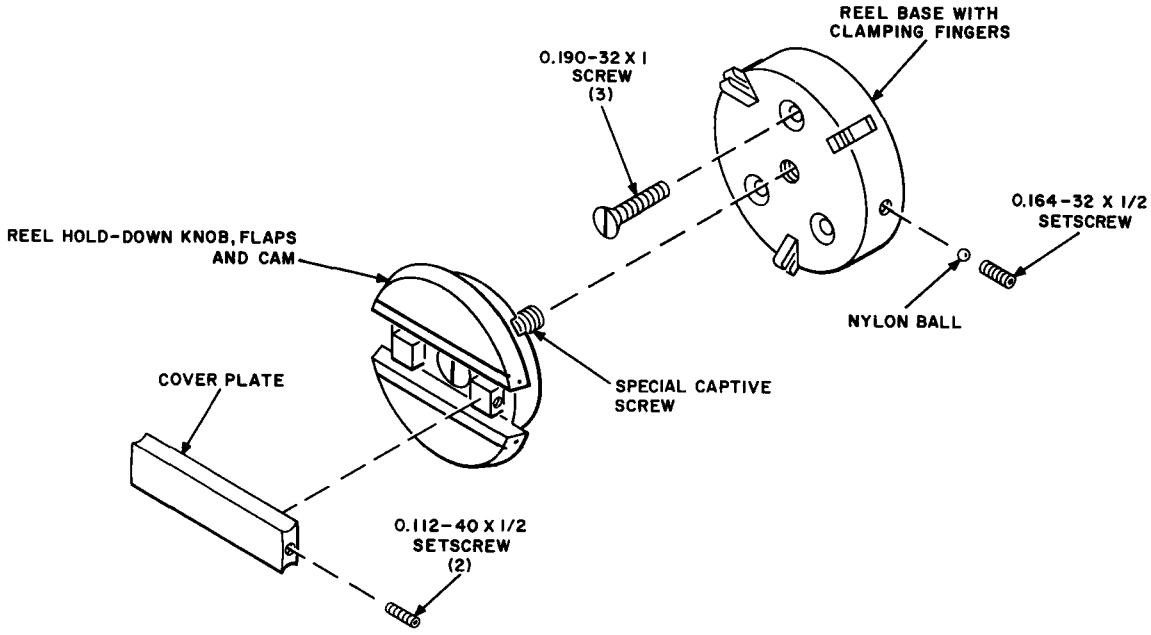



**Fig. 10 — KS-19125, L 102 Reel Hold-Down Knob — Exploded View**

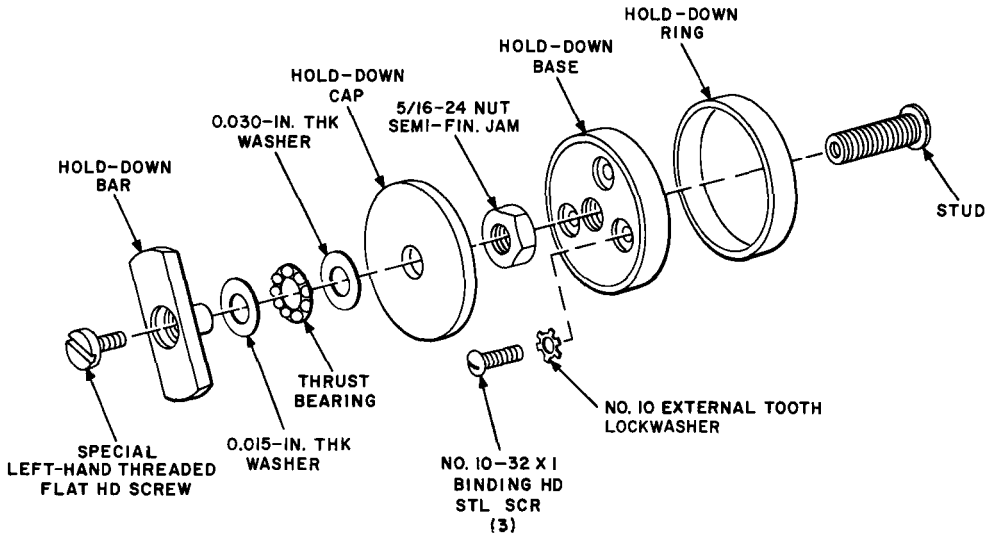



**Fig. 11 — KS-19125, L 101 Reel Hold-Down Knob — Exploded View**

(6) Replace reel hold-down assembly by reversing the procedure in (1) through (4) above, except apply Loctite E to threads of special left-hand threaded screw and tighten this screw to a torque of 18 to 20 pound inches using the APCO Mossberg torque screwdriver with a 7/16-inch bit. To measure counterclockwise torque, set screwdriver to torque desired and rotate handle counterclockwise back to zero.

(c) Using depth gauge, measure from hold-down knob edge of reel turntable to machined surface on casting (Fig. 3 or 4). If measurement is not within limits, loosen setscrew (Fig. 12) using a 5/64-inch Allen wrench. Being careful not to touch braking surface, raise or lower turntable as required and tighten setscrew. Recheck with depth gauge.

**3.05** ***Brake Assembly Alignment (List 2 Only):*** The brake assembly (Fig. 4) is positioned by the manufacturer and should require no further attention.

**3.06** ***Braking Torques for Supply and Take-Up Turntables***

(a) Remove and store any tape reels from turntables.

(b) To check braking torque, proceed as follows:

(1) Wrap one end of a 3-foot piece of string three or more turns around the drum surface of the hold-down knob and turntable in a clockwise direction as shown in Fig. 13.

(2) With the 0-1000 gram push-pull tension gauge attached to a loop in the other end of the string, hold the gauge in a horizontal position and pull in a direction in line with the wraps of string on the turntable.

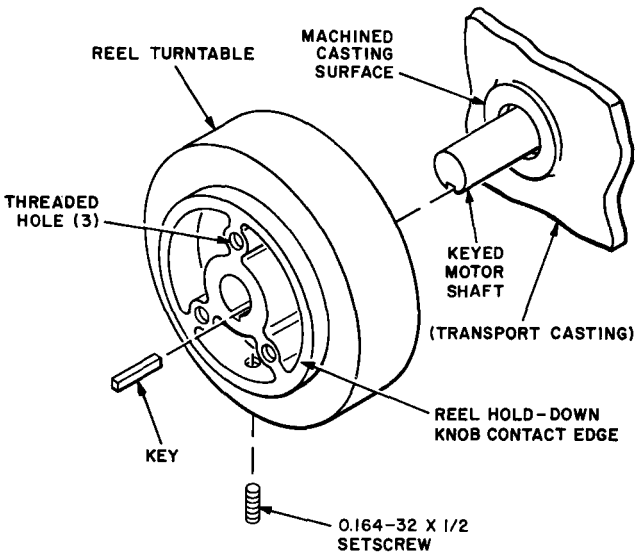



**Fig. 12 — Reel Turntable and Mounting Details — Typical**

(3) Pull smoothly and steadily with a braking surface velocity of 2 to 5 ips. With the reel turning smoothly, the tension gauge should indicate the following:

**FOR KS-19125, LIST 1 RECORDER**

Supply — 525 to 600 grams
Take-Up — 245 to 320 grams

**FOR KS-19125, LIST 2 RECORDER**

Supply — 275 to 340 grams
Take-Up — 160 to 225 grams

Readjust only if the above limits are exceeded.

(c) ***List 1 Only:*** Minor adjustment of braking torque is as follows:

(1) If the requirements are not met, use a 1/16-inch Allen wrench to adjust the setscrew on the brake assembly (Fig. 3) until the requirements are met.

(2) Rotate setscrew clockwise if indication was low and counterclockwise if indication was high. Each turn of the setscrew causes a change equivalent to about 40 grams in tension.

(d) Should the limit of major adjustment be insufficient, the anchor hole in which the end of the spring is placed must be changed as follows:

(1) Remove the reel hold-down knob. (See 3.04.)

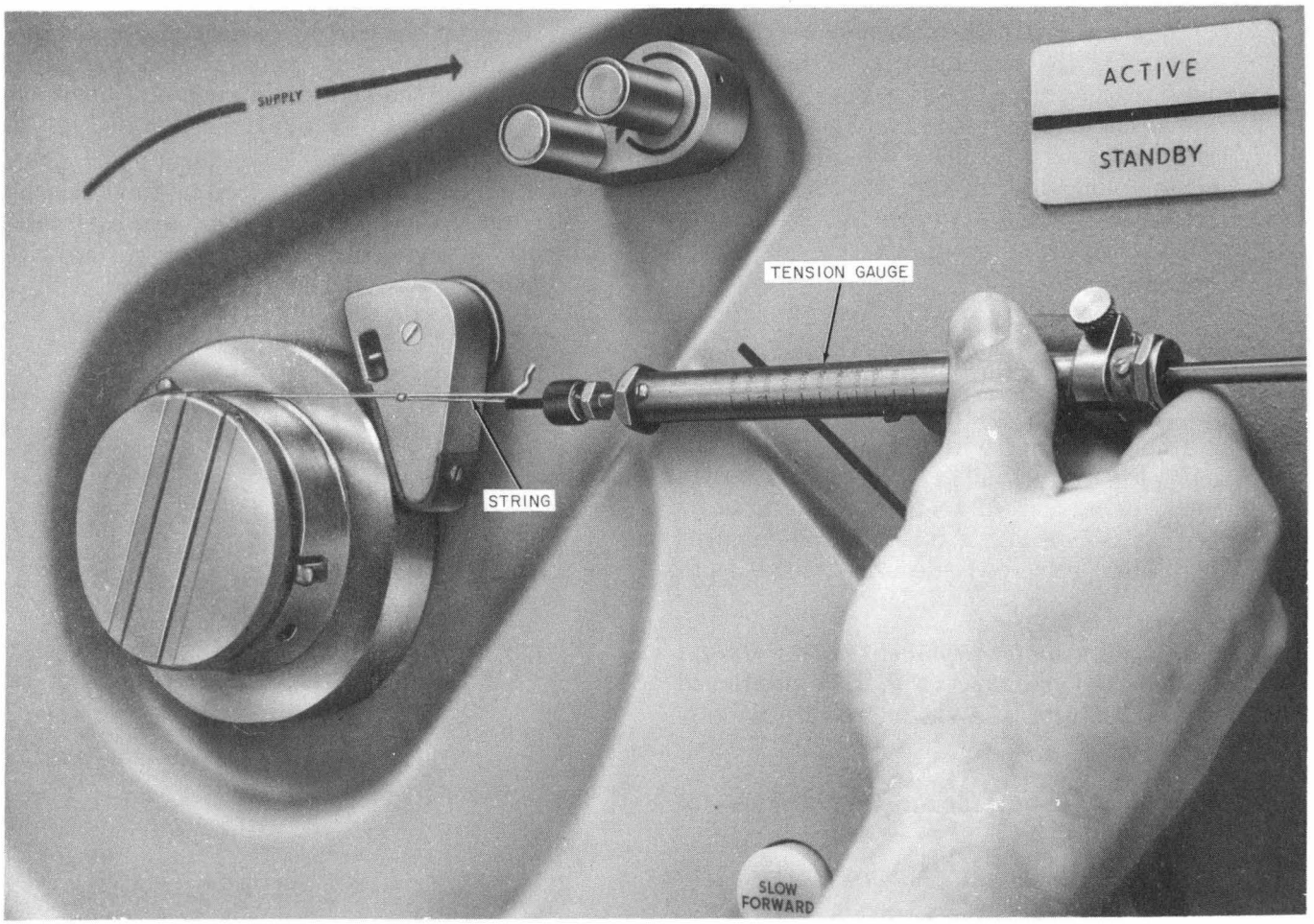



**Fig. 13 — Measurement of Braking Torque — Typical**

(2) Loosen setscrew which secures reel turntable (Fig. 3) using a 5/64-inch Allen wrench.

(3) Without touching braking surface of reel turntable or brake assembly, rotate brake assembly away from turntable and remove turntable from shaft. Retain shaft key, release brake assembly, and temporarily store turntable and key.

(4) Check that recorder is turned off.

(5) At rear of recorder, use adjustable snap-ring pliers to remove retaining ring and shim washer from shaft of brake assembly.

(6) At front of recorder, slide brake assembly forward slightly and note anchor hole in which spring end is located.

(7) If less braking is needed, move spring end counterclockwise to anchor hole closer to turntable. If more braking is needed, move spring clockwise to hole farther from turntable.

(8) Slide brake assembly back into position and replace shim washer and retaining ring.

(9) Replace reel hold-down knob assembly and turntable. (See 3.04.)

(e) Repeat torque measurement procedure using tension gauge and adjust setscrew and/or change spring in anchor hole as required.

(f) ***List 2 Only:*** Adjustment of braking torque is as follows:

(1) If requirements are not met, adjust the brake adjustment nut (Fig. 9A) using the 11/32-inch end wrench until requirements are met.

(2) Rotate brake adjustment nut clockwise if indication was low and counterclockwise if indication was high.

(3) The brake setting for the supply reel should be adjusted so that the brake arm just starts to move with a force of 2.5 pounds $\pm$0.2 pound applied vertically upwards at the hole for the tension arm control spring in the brake arm.

(4) The brake setting for the take-up reel should be adjusted so that the brake arm (Fig. 9B) just starts to move with a force of 1.7 pounds $\pm$0.2 pound applied vertically upwards at the end of the brake arm.

### 3.07 *Tape-Brake Switches*

(a) ***List 1 Only***

(1) Turn off recorder being serviced.

(2) At the rear of the recorder, with no tape on the machine, rotate the upper (supply) spring arm (Fig. 8) away from the arm stop until the switch is heard to release.

(3) Slowly rotate the spring arm until the tape-break switch operates, and with thickness gauge (133A or equivalent) measure the distance between the arm of the switch and its stop.

(4) If the requirement of 2.07 is not met, loosen the two mounting screws of the switch with a 4-inch E screwdriver.

(5) Reposition the switch for the required measurements and tighten the screws.

(6) Recheck measurements.

(7) Perform (1) through (6) above for the lower (take-up) tape-break switch.

(b) ***List 2 Only:*** The tape-break switches for both supply and take-up reels are assembled and adjusted by the manufacturer and should not require any further attention.

### 3.08 *Upper Tension Arm and Dash Pot*

(a) ***List 1 Only***

(1) Make sure the recorder is turned off and tape is removed.

(2) Rotate spring arm (Fig. 8A) to hold arm of tape-break switch against its stop. Using a protractor, measure the angle the arm makes with the horizontal.

(3) If the requirement of 2.08(a) is not met, use the 4-inch E screwdriver to loosen the two mounting screws securing switch mounting bracket. Position bracket to obtain the specified angle (25 $\pm$2 degrees) and tighten screws.

(4) Rotate spring arm to hold switch arm against its stop. Using the 6-inch steel scale, measure the clearance between the piston and the closed end of the dash pot.

(5) If requirement is not met, use the 4-inch E screwdriver to loosen the two screws securing dash pot adjustment bracket. Re-

position bracket to obtain the specified clearance (1/16 ±1/64 inch) and tighten screws.

(6) Position the spring arm to just remove all slack from the spring and its linkage. Using a protractor, measure the angle the arm makes with the horizontal.

(7) If necessary, use two 11/32-inch end wrenches to adjust the nuts on the spring adjustment screw to just remove all slack from spring and linkage when the spring arm is at the specified angle (45 ±3 degrees). Lock adjustment screw in place by tightening nuts.

(8) Attach a 1/4-ounce weight to the spring arm pin and rotate spring arm away from its stop until the tape-break switch just releases; then release spring arm. The arm should rotate and activate the tape-break switch.

(9) Remove 1/4-ounce weight and attach a 1/2-ounce weight to the pin. Rotate spring arm to position the pin directly below the spring arm shaft; then release spring arm. The arm should not rotate enough to activate the tape-break switch.

(10) If the spring arm does not operate as described in (8) and (9) above, adjust the rate of the dash pot as follows: Using a 3/32-inch Allen wrench, turn the screw in the mounting end of the dash pot. Only slight adjustment is needed. Repeat (8) and (9) and adjust screw until both requirements are met.

(b) ***List 2 Only:*** The upper tension arm and dash pot are assembled and adjusted by the manufacturer and should require no further attention. Before assembly on the transport, the dash pot is initially set by turning its adjustment screw 90 degrees back from the maximum in position. Slight readjustment may be made to optimize start profile and/or to prevent any actuation of tape-break switch under manual fast forward-stop operation.

**3.09** ***Lower Tension Arm***

(a) ***List 1 Only***

(1) Make sure recorder is turned off and tape is removed.

(2) Rotate spring arm (Fig. 8B) to hold arm of tape-break switch against its stop. Using a protractor, measure the angle the arm makes with the horizontal.

(3) If the requirement of 2.09(a) is not met, use the 4-inch E screwdriver to loosen the two mounting screws securing switch mounting bracket. Position bracket to obtain the specified angle (25 ±2 degrees) and tighten screws.

(4) Rotate spring arm until it is in contact with the rubber stop. Using a protractor, measure the obtuse angle the arm makes with the horizontal.

(5) If requirement is not met, use the 4-inch E screwdriver to loosen the two screws securing spring attachment bracket. Position bracket to obtain the specified angle (125 ±5 degrees) and tighten screws.

(6) Rotate spring arm to just remove all slack from the spring and its linkage. Using a protractor, measure the angle the arm makes with the horizontal.

(7) If necessary, use the two 11/32-inch end wrenches to adjust the nuts on the spring adjustment screw to just remove all slack from the spring and its linkage when the spring arm is at the specified angle (55 ±5 degrees). Lock adjustment screw in place by tightening nuts.

(b) ***List 2 Only:*** The lower tension arm is assembled and adjusted by the manufacturer and should not require any further attention.

**3.10** ***Head Assembly:*** No adjustment is permitted.

**3.11** ***Pinch Roller and Limit Switch***

(a) To measure pinch roller pressure, proceed as follows:

(1) Operate the pinch roller knob to LOAD position.

(2) Form a tape loop by folding a 1-foot piece of magnetic tape lengthwise and tying the ends.

(3) Place the tape loop between the capstan and pinch roller with the loop to the left (Fig. 14).

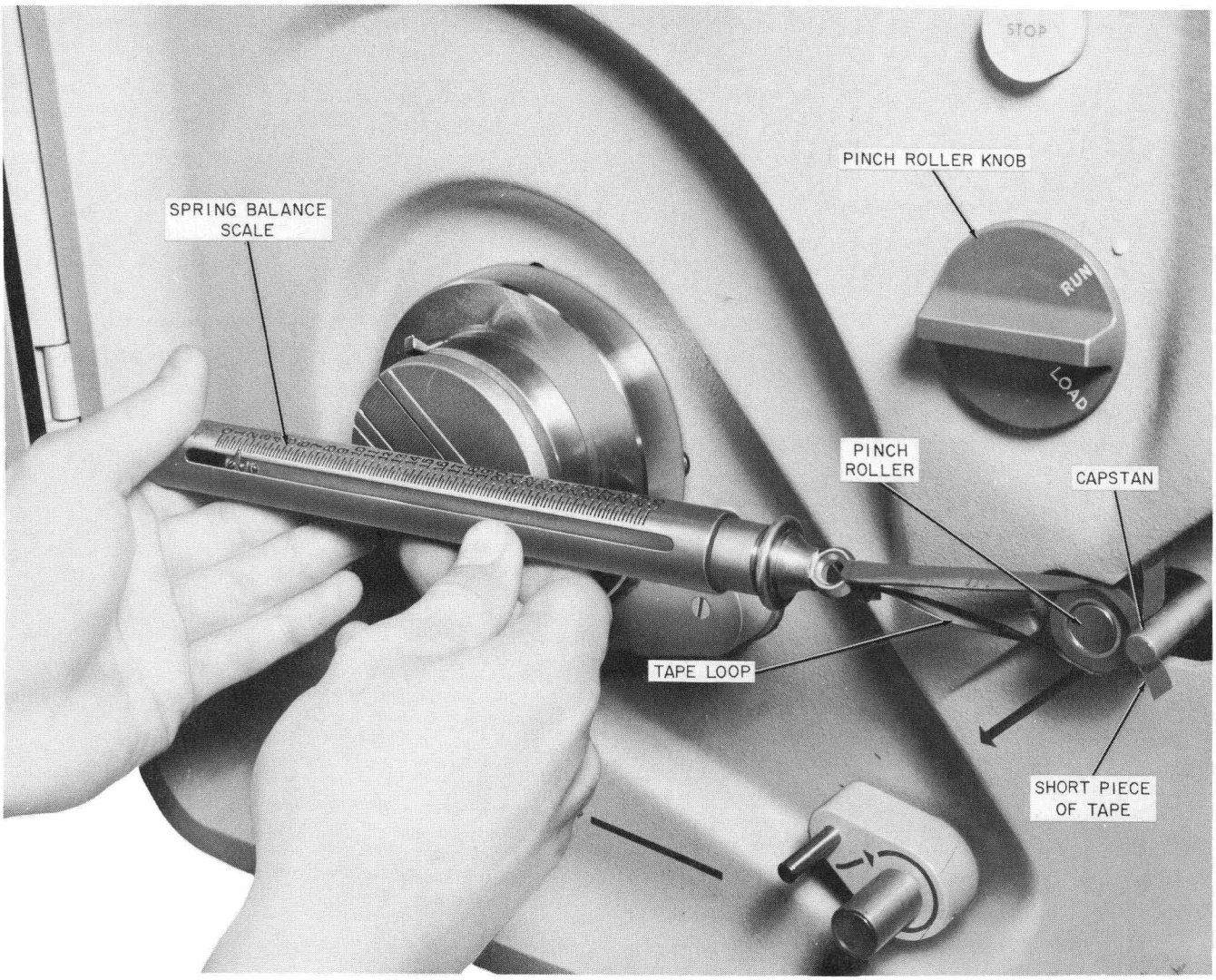



**Fig. 14 — Set-Up for Checking Pinch Roller Pressure — Typical**

(4) Place a second short piece of tape between the tape loop and the capstan.

(5) Operate the pinch roller knob to RUN position securing both tapes.

(6) Hold the 0- to 30-pound spring balance scale horizontal and note distance of indicator from zero.

(7) With the 0- to 30-pound spring balance scale attached to the tape loop, pull in a direction to pull the roller away from the capstan with a force of 14-1/2 pounds. In measurement, include allowance for initial displacement of scale indicator.

(8) The short piece of tape shall still be held by the force of the pinch roller against the capstan. Increase the force by 1 pound and the short piece of tape will be freed.

(b) To adjust pinch roller pressure, proceed as follows:

(1) If requirements of 2.11 are not met, using a 11/32-inch end wrench while holding the pinch roller tension screw (Fig. 5 or 6) so that it does not rotate, turn nut clockwise to increase pinch roller pressure or counterclockwise to reduce pressure. One turn of the nut causes approximately 0.75-pound change in pressure.

(c) To adjust limit switch, proceed as follows:

(1) If limit switch does not operate when pinch roller knob is turned to RUN position and does not release when turned to LOAD position, loosen screws which secure switch, using a 5/16-inch end wrench and a 4-inch E screwdriver, and rotate switch on mounting bracket to cause operation.

(2) Tighten screws and recheck switch operation.

**3.12** ***Pinch Roller Solenoid***

(1) Condition recorder for manual control of operation.

(2) Turn pinch roller knob to RUN position.

(3) At the rear of recorder (Fig. 5 or 6), connect W1AB cord between TB3-19 and TB3-11 (ground).

(4) The pinch roller lock solenoid shall operate and the pinch roller knob shall be locked in the RUN position.

(5) Remove the jumper cord from TB3.

**3.13** ***FAST FORWARD, SLOW FORWARD, and STOP Switches***

(1) With the recorder conditioned for manual operation and a spare tape on the recorder, turn the pinch roller knob to RUN position.

(2) Operate the SLOW FORWARD, FAST FORWARD, and STOP switches to check their smoothness of operation and the relative speed of the capstan and reel motors.

(3) The slow forward speed of the capstan is checked by the connected equipment.

(4) The fast forward speed should be roughly six times as fast.

(5) On slow forward speed, the stopping of the supply reel turntable, take-up reel turntable, and pinch roller should be smooth and appear to coincide with operation of the STOP switch.

(6) Rapid, alternate operation of the SLOW FORWARD and STOP switches should not cause operation of either tape-break switch. On fast forward speed, the stopping should be smooth. The brake adjustment or condition of the brake surface may affect braking of the turntable.

**3.14** ***End-of-Tape Sensor***

(1) With all power removed from the recorder (off condition), remove connector P3 (Fig. 7) at rear of recorder.

(2) With KS-14510, L1 volt-ohm-milliammeter, measure resistance between J3-13 and J3-14 and between J3-13 and J3-15.

(3) Condition recorder for manual control and repeat resistance measurements. All measurements must meet requirements of 2.14.

(4) Turn recorder power off and reconnect connector P3.

**3.15** ***Drive Motor and Capstan***

(1) The drive motor and capstan operation is monitored by the connected equipment during remote operation except for fast forward speed.

(2) Fast forward operation was checked in 3.13.

**3.16** ***Reel Motor:*** The reel motor was checked in 3.13 for reel motor requirement covered in 2.16.

**3.17** ***Condition Indicator:*** No procedure is needed.

**3.18** ***Front Cover Door***

(1) If the door gasket does not touch at all points, loosen screws holding cover door latch strike (Fig. 1) using a 5/64-inch Allen wrench.

(2) Position strikes to cause gasket to seal, and tighten screws.

(3) If front cover door is difficult to unlatch, loosen screws holding the door latch strikes, advance strikes still maintaining full gasket engagement, and tighten screws.

**3.19** ***Rear Doors:*** If clearance between rear doors is not correct, loosen hinge screws with a 4-inch E screwdriver and a 1/4-inch end wrench, position doors correctly, and tighten hinge screws.

**3.20** ***Relays:*** Clean and recondition relay contacts, as required, in accordance with Section 069-306-801.