10A RECORDER AND ASSOCIATED APPARATUS USED IN 2AA AND MODIFIED 2A TELEPHONE ANSWERING SETS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the 10A recorder used in the 2AA and modified 2A telephone answering sets used in the 7A announcement system for machine intercept service.

1.02 This section is reissued to change the title and to refer to the 2AA instead of the 2A telephone answering set. See 1.03 and 1.04.

1.03 The 10A recorder (hereinafter referrred to as the machine) consists essentially of a motor-driven drum on the surface of which is mounted a synthetic rubber recording band 1-27/64 inches wide, impregnated with a magnetic recording material. A single magnetic recording head is provided for recording a message on the recording band and reproducing it. As the drum rotates, the recording head is moved across the surface of the recording band by the engagement of a half nut and feed-screw mechanism. Announcements up to 60 seconds can be recorded on the recording band. The maximum announcement length is predetermined and is controlled by an adjustable switch stop. Announcements are erased from the band by energizing an erase coil by means of the control circuit of the 2AA telephone answering set. The modified 2A telephone answering set was formerly the 2A telephone answering set used on subscriber premises but changes were made in the strapping options on the internal terminal strip to permit its use in the 7A announcement system.

1.04 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 listed herein. For more detailed information on the operation and maintenance of the individual equipment or apparatus, refer to the appropriate Bell System Practice.

1.05 *Asterisk (*):* Requirements are marked with an asterisk when to check for them would necessitate the dismantling or dismounting of 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.

1.06 *Make Busy:* Before performing any work on a machine, remove the equipment from service in accordance with local instructions. Do not remove the equipment if running unless it runs continuously. When it is removed, substitute a new unit immediately.

Definitions

1.07 *Bail Assembly in the Operated Position:* The bail assembly is in the operated position, for the purpose of this section, when the carriage half nut fully engages the feed screw with the L1 solenoid electrically operated.

1.08 *Bail Assembly in the Unoperated Position:* The bail assembly is in the unoperated position, for the purpose of this section, when the bail assembly contacts the bail stop and the carriage half nut is completely disengaged from the feed screw.

1.09 *Zero Position of Carriage Assembly:* For the purpose of this section, the zero position of the carriage assembly is that position where the side of the carriage nearest the motor is in contact with the adjacent side of the bail assembly with the bail assembly in the unoperated position.

1.10 *Zero Position of the Limit Switch:* For the purpose of this section, the zero position of the limit switch is that position where the limit switch button is in contact with the car-

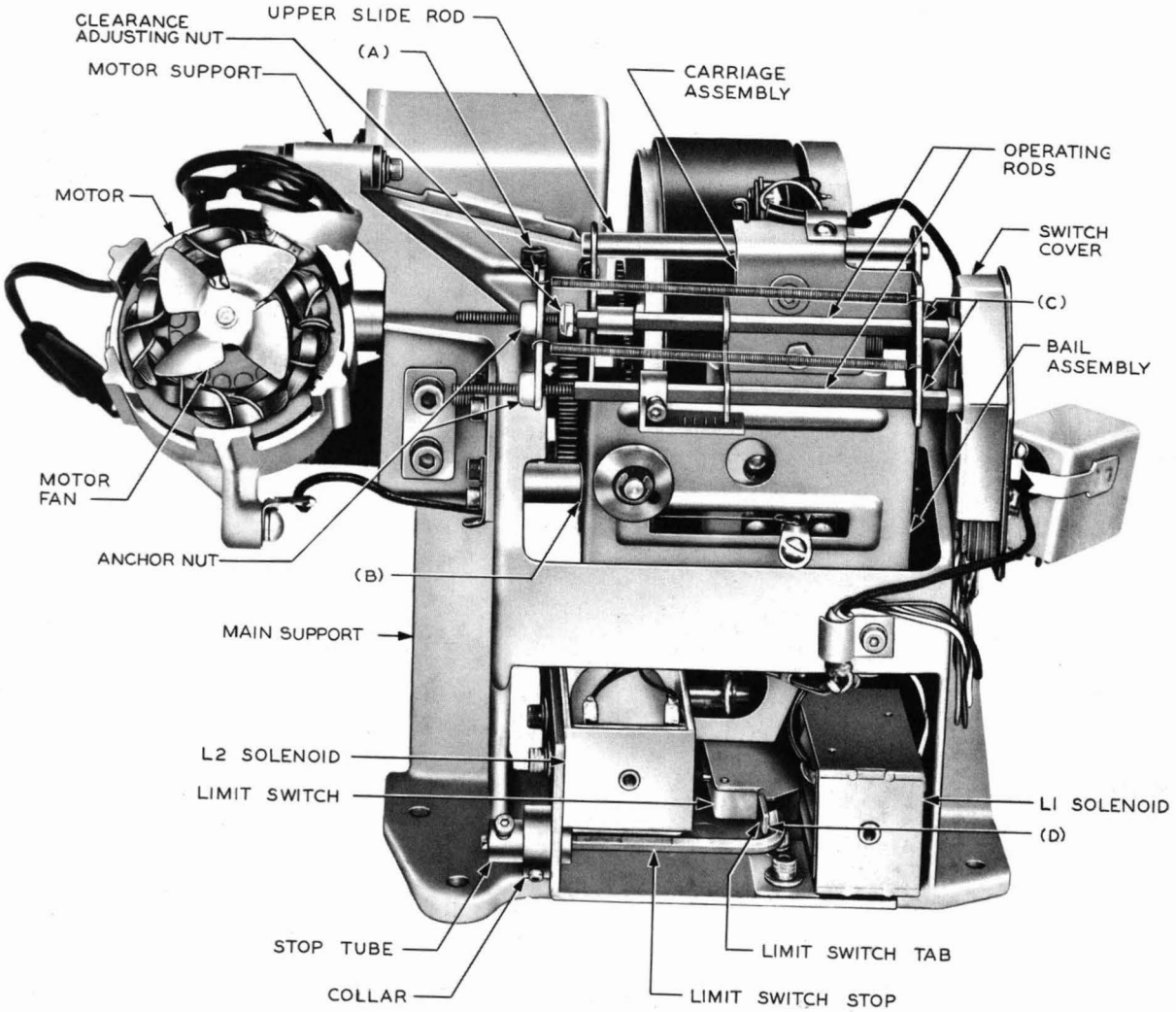

Fig. 1 — Front View of 10A Recorder (recorder shown at end of maximum announcement interval)

riage foot when the carriage assembly is in the zero position.

1.11 ***One drop of oil*** for the purpose of this section is the amount of oil discharged from the nozzle of the 486A oil can when the sides of the can are depressed once and held depressed until the drop is released from the nozzle.

1.12 ***A film of oil*** for the purpose of this section is the amount of oil deposited on the surface of a part after being brushed with the

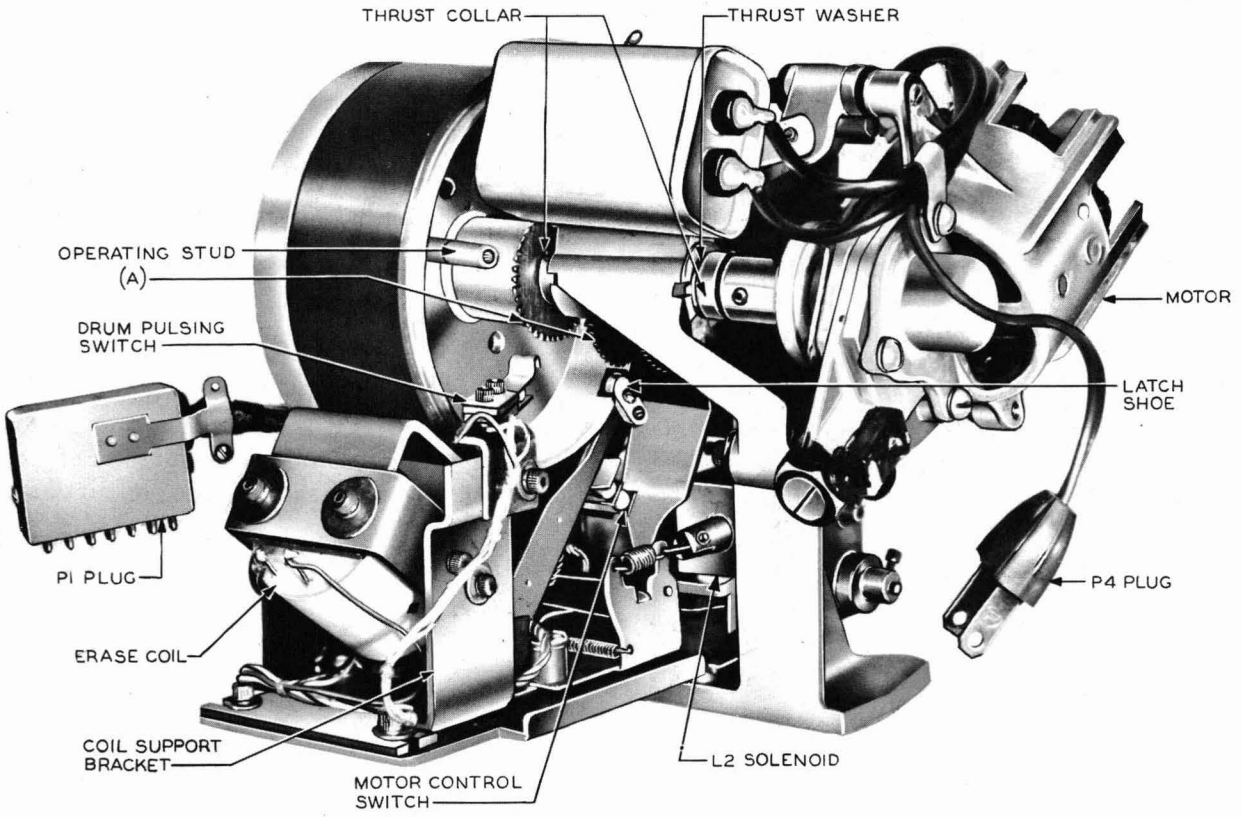

Fig. 2 — Rear View of 10A Recorder

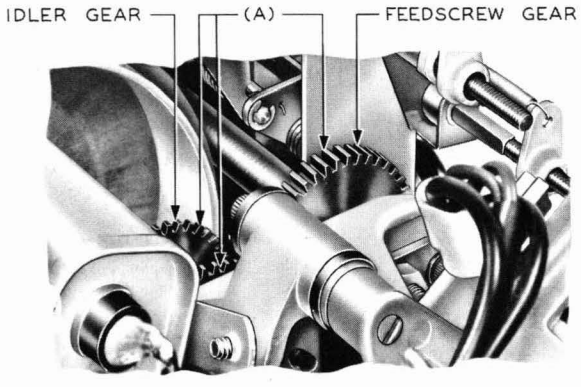

Fig. 3 — Lubrication of Gears

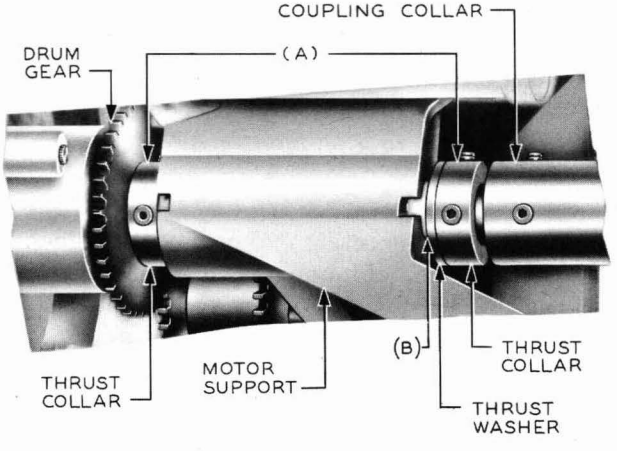

Fig. 4 — Drum Shaft and Motor Support Details

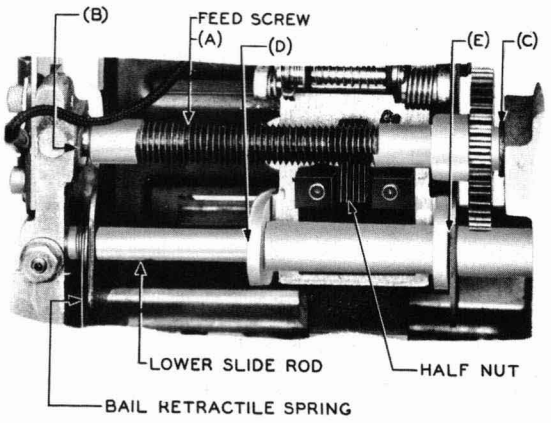

Fig. 5 — Half-Nut and Feed-Screw Details

KS-14164 brush which has been dipped into the oil to a depth of 3/8 inch and scraped lightly against the side of the container as the brush is removed.

1.13 ***A film of grease*** for the purpose of this section is the amount of grease deposited on the surface of a part after being brushed with a short, light stroke of the R-2966 brush which has been fully dipped into the grease, rotated several times, and the end of the brush scraped against the edge of the container to remove grease extending from the end of the brush.

General Information

1.14 ***Rotation of the Drum:*** To rotate the drum, release the latch and turn the motor fan blades in the counterclockwise direction with the fingers. Take care not to bend the fan blades. The latch may be released by pressing the plunger into the L1 solenoid manually or electrically operating the L1 solenoid.

Caution: Do not attempt to rotate the drum by turning the flywheel as this may result in damage to the fiber gear of the motor drive unit.

1.15 It will be necessary to remove the machine from the telephone answering set as described in 3.002 to check the requirements.

1.16 When it is necessary to electrically operate a solenoid to make any checks or adjustments, connect 48 volts dc across the terminals of the solenoid.

1.17 To check some requirements covered herein, it may be necessary to destroy a setting to which the machine has been adjusted. This should be done as covered in 3.003 and 3.004. Where a change in the announcement interval or flashing time is to be made, reset the machine as covered in 3.003 or 3.004 for the interval desired.

2. REQUIREMENTS

2.01 *Cleaning*

(a) ***Recording Head:*** The pole piece of the recording head shall be free of dirt and hard particles of wax.

Gauge by eye.

To check this requirement, lift the head to its highest position and observe the surface of the pole piece.

(b) ***Recording Band:*** The surface of the recording band shall be free of dirt or other foreign matter.

(c) Other parts shall be cleaned when necessary in accordance with approved procedures.

2.02 *Lubrication*

(a) The following parts shall be adequately lubricated with KS-16326 L1 oil. When lubrication is necessary, the oil shall be applied as follows.

(1) Fig. 1(A) — Saturate the wicking.

Note: On recent models a wicking is not provided.

(2) Fig. 2(A) and 3(A) — A film on the tooth surfaces of all gears.

(3) Fig. 4(A) — Two drops on each thrust collar.

(4) Fig. 5(A) — A film on the threads of the feed screw.

(5) Fig. 5(B) and (C) — Two drops on the exposed ends of the feed-screw bearings.

(6) Fig. 5(D) and (E) — Two drops on carriage slide rod bearings.

(7) Two drops on the idler gear spindle.

(b) ***Recommended Lubrication Intervals:*** After turnover, it is recommended that the parts listed in the requirement be lubricated annually. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that the requirements will be met during the extended interval.

(c) ***Drum Bearing:*** The drum bearing shall be lubricated with two drops of KS-16326 L1 oil whenever the drum assembly is removed for other reasons.

2.03 ***Drum Shaft Endplay:*** Fig. 4(B) — The endplay of the drum shaft in the motor support shall be perceptible.

Gauge by eye and feel.

2.04** ***Recording Head Position: With the L1 solenoid electrically operated, the recording head pole piece shall be in contact with the recording band throughout the entire announcement cycle.

Gauge by eye.

To check this requirement, electrically operate the L1 solenoid and note that the recording head pole piece rests on the recording band. Release the L1 solenoid. Adjust the limit switch stop for a 60-second announcement interval. Operate the L2 solenoid and manually slide the carriage toward the right until the limit switch tab engages the limit switch stop. Electrically operate the L1 solenoid and note that the recording head pole piece rests on the recording band. Restore the limit switch stop to its original adjustment.

2.05 ***Gear Engagement***

(a) All gears shall engage to a depth of

Min 1/32 inch
Max shall not bottom or bind

To check the minimum engagement, use the P-220366 dental mirror and gauge by eye.

To check the maximum, gauge by feel.

(b) The carriage feed-screw gear and its associated gear shall be so aligned that minimum one half the thickness of the thinner gear is in engagement with the thicker gear.

Gauge by eye.

2.06 ***Freedom of Carriage Feed Screw:*** Fig. 5(B) — The carriage feed screw shall turn freely in its bearings without perceptible endplay.

Gauge by eye and feel.

To check this requirement, insert a finger behind the bail assembly and place it on the feed screw. Attempt to rotate the feed screw and to move it axially. Note that the feed screw turns freely within the angle allowed by the backlash between the gears and that there is no perceptible endplay.

2.07 ***Bail Assembly Movement***

(a) The bail assembly shall pivot freely on the lower slide rod.

Gauge by eye and feel.

To check this requirement, pivot the bail assembly toward the drum manually and then release it. Note that the bail assembly restores to its original position without bind or hesitation.

(b) Fig. 1 (B) — The endplay of the bail assembly shall be

Min 0.002 inch
Max 0.012 inch

Use the KS-6909 gauge.

To check this requirement, take up the endplay of the bail assembly toward the right and insert the gauge into the space between the bail assembly and the spacer.

(c) The L1 solenoid shall operate electrically as specified on the circuit requirement table for the 2AA telephone answering set.

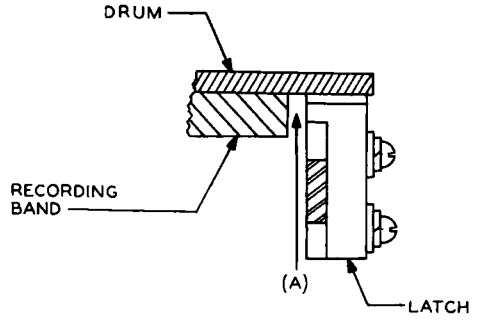

Fig. 6 — Position of Latch on Drum

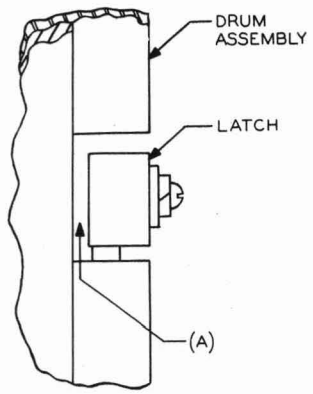

Fig. 7 — Position of Latch in Notch

2.08 ***Position of Latch***

(a) Fig. 6(A) — With the latch resting on the metal surface of the drum, there shall be clearance between the latch and the side of the band and the latch shall not extend over the edge of the drum.

Gauge by eye.

(b) Fig. 7(A) — With the latch in the notch of the drum, it shall clear the side of the band and the side of the notch adjacent to the band.

Gauge by eye.

2.09 ***Latch Operation***

(a) With the L1 solenoid electrically operated, there shall be clearance between the metal surface of the drum and the latch of

Min 0.015 inch
Max 0.045 inch

Use the KS-6909 and KS-6938 gauges.

(b) With the L1 solenoid unoperated, the latch shall rest on the metal surface of the drum, except when it is in the notch.

Gauge by eye.

(c) With the L1 solenoid unoperated, the latch shall drop into the notch in the drum when it is opposite the notch.

Gauge by eye.

To check this requirement, rotate the drum until the notch is opposite the latch and note that the latch drops into the notch.

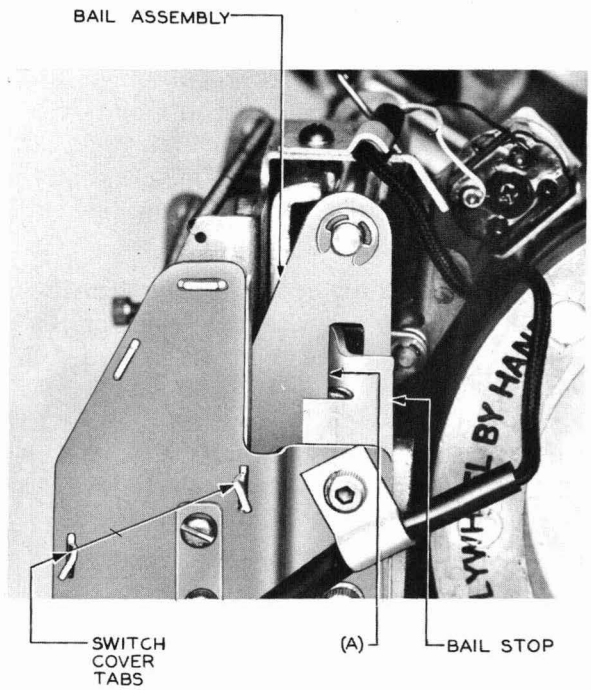

Fig. 8 — Bail Stop Clearance

2.10 ***Bail Stop Position:*** Fig. 8(A) — With the L1 solenoid electrically operated, the clearance between the bail assembly and the bail stop shall be approximately 0.015 inch.

Gauge by eye.

2.11 ***Carriage Half-Nut Position***

(a) With the bail assembly in the operated position, there shall be no perceptible end-play of the carriage assembly.

Gauge by feel.

To check this requirement, move the carriage toward the right and operate the L1 solenoid. Grasp the carriage at the point where the pulley cord is attached and attempt to move the carriage assembly. Take care not to force the carriage assembly when making this check.

(b) There shall be clearance between the carriage half nut and the feed screw throughout the return of the carriage to the zero position.

Gauge by ear.

To check this requirement, proceed as follows. Adjust the limit switch for a 60-second announcement interval. Operate the L2 sole-

noid to release the limit switch and slide the switch to the right until contact is made between the limit switch tab and stop. Release the L2 solenoid. Manually slide the carriage assembly to the right until the carriage foot contacts the limit switch button. Press the bail assembly forward to its operated position. Release the bail assembly and note any scraping noise during the return of the carriage.

2.12 ***Relation Between Latch and Motor Control Switch***

(a) With the L1 solenoid operated, the latch shall bear against the top of the stud of the motor control switch without slipping off.

Gauge by eye.

(b) Fig. 9 — With the latch in the notch, the normally open contacts shall be open and the normally closed contacts shall be closed.

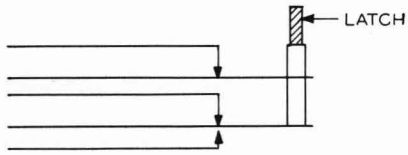

Fig. 9 — Normal Position (motor control switch)

(c) Fig. 10 — With the latch resting on the drum, or with the L1 solenoid operated, the normally open contacts shall be closed and the normally closed contacts shall be open.

(d) Fig. 10(A) — There shall be clearance between the latch and the motor control switch upper contact spring of

Min 1/32 inch

Use the P-220366 dental mirror and gauge by eye.

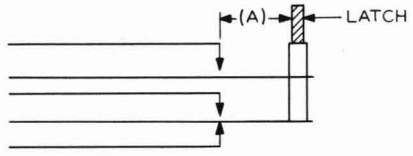

Fig. 10 — Operated Position (motor control switch)

2.13 ***Contact Alignment*** (motor control switch): Fig. 11(A) — The contacts shall be so aligned that the point of contact falls wholly within the circumference of the opposing contact disc.

Gauge by eye.

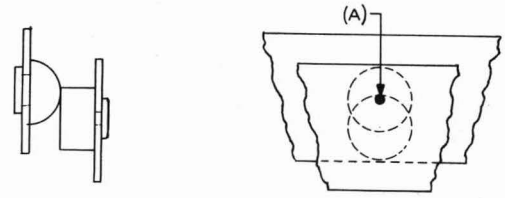

Fig. 11 — Contact Alignment

2.14 ***Contact Separation*** (motor control switch): The separation between all normally closed contacts with the switch operated, and between all normally open contacts with the switch unoperated shall be

Min 0.006 inch

Gauge by eye.

2.15 ***Contact Follow*** (motor control switch): There shall be follow of all springs of

Min 0.010 inch

Gauge by eye.

2.16 ***Contact Spring Clearance*** (motor control switch): The clearance between adjacent contact springs not intended to make contact and between contact springs and other parts shall be

Min 0.015 inch

Gauge by eye.

2.17 ***Freedom of Carriage Assembly***

(a) Fig. 12(A) — With the carriage assembly pressed toward the upper slide rod, the clearance between the carriage assembly upper tab and the slide rod shall be perceptible.

Gauge by eye and feel.

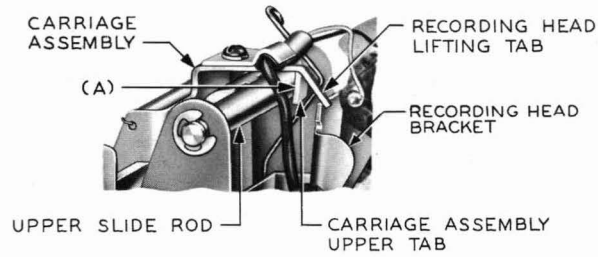

Fig. 12 — Upper Slide Rod Details

(b) The carriage assembly shall slide freely on the upper slide rod.

Gauge by eye and feel.

(c) When the bail assembly is released from the operated position, the carriage assembly shall return rapidly and without hesitation to its zero position.

Gauge by eye.

To check this requirement, manually slide the carriage assembly toward the flasher switch. Press the bail assembly forward to its operated position. Release the bail assembly and note that the carriage assembly restores rapidly to the zero position. Check this requirement in several positions, one of which is close to the zero position of the carriage.

2.18 ***Freedom of Movement of Operating Rods:*** Fig. 1(C) — The operating rods of the carriage assembly shall slide freely in the bracket.

Gauge by eye and feel.

To check this requirement, slide the rods within the range permitted by the stops and the nylon tips.

2.19 ***Operating Rod Spring Tension***

(a) ***Timing Switch:*** With the carriage in the zero position, the tension required to start the operating rod moving shall be

Min 30 grams
Max 40 grams

Use the 70D gauge.

To check this requirement, apply the 70D gauge to the anchor nut and note where the rod starts to move.

(b) ***Flasher Switch:*** With the carriage in the zero position and the flasher indicator set to operate at 25 seconds (5-second warning on a 30-second announcement), the tension required to start the operating rod moving shall be

Min 55 grams
Max 75 grams

Use the 70J gange.

To check this requirement, apply the 70J gauge to the anchor nut and note where the rod starts to move.

2.20 ***Clearance Between Operating Rod and Timing Switch:*** Fig. 13(A) — With the carriage assembly in the zero position, there shall be a separation of approximately 0.010 inch between the operating spring of the timing switch (S2) and the nylon tip of its associated operating rod.

Gauge by eye.

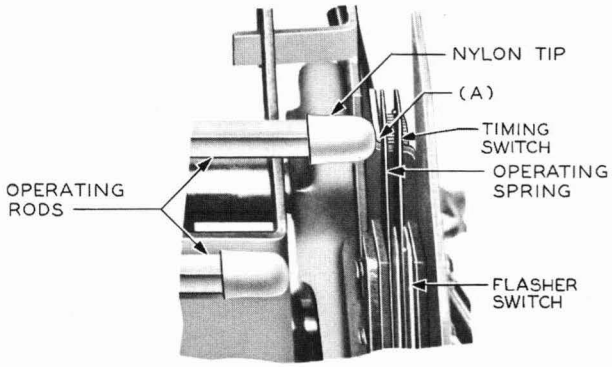

Fig. 13 — Operating Rod Clearance

*__2.21__ ***Engagement of Operating Rod and Associated Switch:*** With the bail assembly in the operated position, the operating rod shall engage the operating spring below the contacts and midway between the center of the spring and the edge nearer to the drum.

Gauge by eye.

To check this requirement, remove the switch cover as follows. Straighten the tabs with the 485A pliers so that the tabs will pass through the slots, taking care not to break the tabs. Slide the operating rods back toward the motor and remove the switch cover. Manually slide the carriage toward the switch until the operating rod contacts the contact spring. Operate the L1 solenoid and note that the requirement is met.

*__2.22__ ***Contact Alignment*** (timing and flasher switch): Fig. 14(A) — The point of contact shall fall wholly within the boundary of the opposing contact disc.

Gauge by eye.

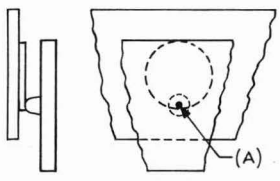

Fig. 14 — Contact Alignment

*2.23 ***Contact Separation*** (timing and flasher switch): The separation between contacts with the switch unoperated shall be

Min 0.006 inch
Max 0.020 inch

Gauge by eye.

2.24 ***Operation Sequence of Timing and Drum Pulsing Switches:*** The timing switch shall operate approximately one half of a revolution after the first operation of the drum pulsing switch. Use the 81A test set. To check the operation sequence of the switches, start with the latch engaged in the drum notch. Operate the L1 solenoid and connect the 81A test set across the terminals of the timing switch. Rotate the drum manually and note that the timing switch contacts are closed approximately midway between the first and second operation of the drum pulsing switch.

2.25 ***Carriage Foot Position***

(a) Fig. 15(A) — With the L1 solenoid operated, there shall be a clearance between the carriage foot and the frame of the L2 solenoid of minimum 1/32 inch.

Gauge by eye.

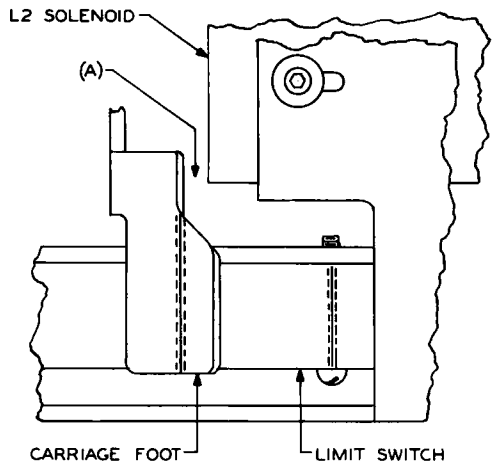

Fig. 15 — Clearance Between Carriage Foot and Solenoid

(b) Fig. 16(A) — With the carriage and the limit switch assembly in the zero position, the carriage foot shall approximately coincide with the periphery of the limit switch button.

Use the P-220366 dental mirror and gauge by eye.

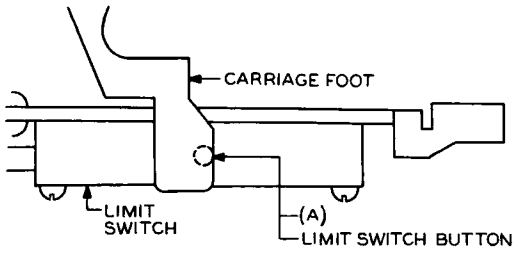

Fig. 16 — Carriage Foot Position

To check this requirement, allow the limit switch assembly to assume the zero position by operating the L2 solenoid. Note that the edge of the carriage foot just covers the periphery of the limit switch button.

2.26 ***Limit Switch Clamp Operation***

(a) With the L2 solenoid electrically operated as specified on the circuit requirement table for the 2AA telephone answering set and with the plunger bottomed in the solenoid, the clearance between the switch clamp and the limit switch assembly shall be

Min 1/32 inch

Gauge by eye.

(b) When the L2 solenoid is released from its operated position, the limit switch clamp shall securely clamp the limit switch assembly in place.

Use the KS-3008 stop watch.

To check this requirement, remount the machine in the set as covered in 3.002 without remounting the cover. Temporarily mount the knobs and button using the R-2958 wrench. Check the setting of the limit switch stop to determine the maximum announcement length. Plug the set into the ac power and turn the OFF-ON knob to its extreme clockwise position and the function knob to the extreme counterclockwise position. Depress and hold the operate button for an interval equal to approximately half of the maximum announcement length. Release the operate button and turn the OFF-ON knob to its extreme counterclockwise position. Strap terminals 1 and 10 of the TS1 terminal strip. Turn the function knob and the OFF-ON knob to their extreme clockwise positions and, using the KS-3008 stop watch, time the length of the first complete announcement. Start timing when the K6 relay

operates and stop when the bail assembly releases and the carriage starts to return. Allow the machine to recycle through nine more announcements and measure the length of the final announcement. The requirement may be considered met if the first and last announcements are equal within 1 second. Turn the OFF-ON knob to the extreme counterclockwise position and remove the strap from terminals 1 and 10 of the TS1 terminal strip. Remove the machine, the knobs, and the button from the set as covered in 3.002.

2.27 ***Limit Switch Movement***

(a) The limit switch shall return freely to the zero position when the L2 solenoid is electrically operated.

Gauge by eye.

To check, electrically operate the L2 solenoid and, with a KS-6320 orange stick, move the limit switch to the right. Release the limit switch and observe that the switch returns to the zero position without hesitation. Check this requirement in several positions, one of which is close to the zero position.

(b) Fig. 1(D) — The travel of the limit switch assembly shall be limited by engagement between the limit switch tab and the limit switch stop.

Gauge by eye.

To check, electrically operate the L2 solenoid and move the limit switch toward the right using the KS-6320 orange stick. Observe that the limit switch tab engages the limit switch stop.

2.28 ***Position of Erase Coil Assembly***

(a) The erase coil assembly shall be so positioned that the pole-piece gap is centered across the width of the recording band.

Gauge by eye.

(b) Fig. 17(A) — There shall be a clearance of

Min 0.010 inch
Max 0.040 inch

between the recording band and the surface of the erase coil pole pieces throughout one complete revolution of the drum.

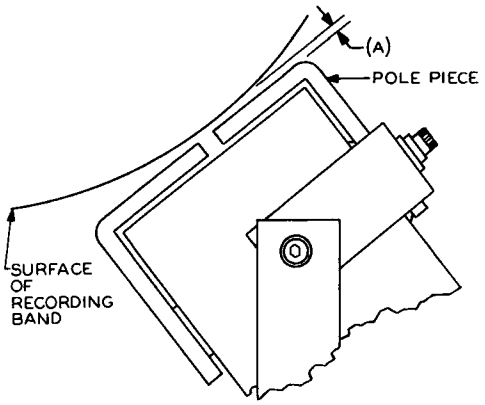

Fig. 17 — Erase Coil Clearance

Use the KS-6909 and KS-6938 gauges.

Check this requirement at four positions, each one fourth of a revolution apart.

2.29 ***Contact Alignment*** (drum pulsing switch): Fig. 11(A) — The point of contact shall fall wholly within the boundary of the opposing contact disc.

Gauge by eye.

2.30 ***Contact Separation*** (drum pulsing switch): The separation between contacts with the switch unoperated shall be

Min 0.006 inch

Gauge by eye.

2.31 ***Contact Follow*** (drum pulsing switch): There shall be a follow of all springs of approximately 0.015 inch.

Gauge by eye.

2.32 ***Recording Head Lifting Tab Position***

(a) With the L1 solenoid electrically operated, the clearance between the recording head bracket and the tab shall be

Min 1/32 inch

Gauge by eye.

(b) Fig. 18(A) — With the L1 solenoid unoperated, the tab shall prevent the recording head from engaging the recording band.

Gauge by eye.

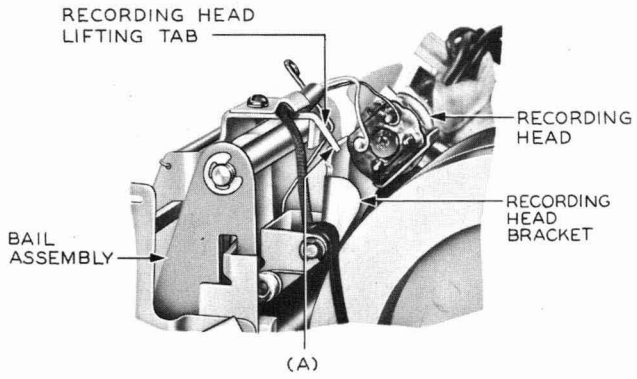

Fig. 18 — Head Lifting Tab Position

2.33 ***Recording Head Pressure:*** With the L1 solenoid electrically operated, the pressure of the recording head on the band shall be

Min	28 grams
Max	43 grams

Use the 68B gauge.

To check the requirement, electrically operate the L1 solenoid. Insert the tip of the gauge as shown in Fig. 19 under the portion of the recording head directly to one side of the pole piece and measure the pressure just as the recording head leaves the band.

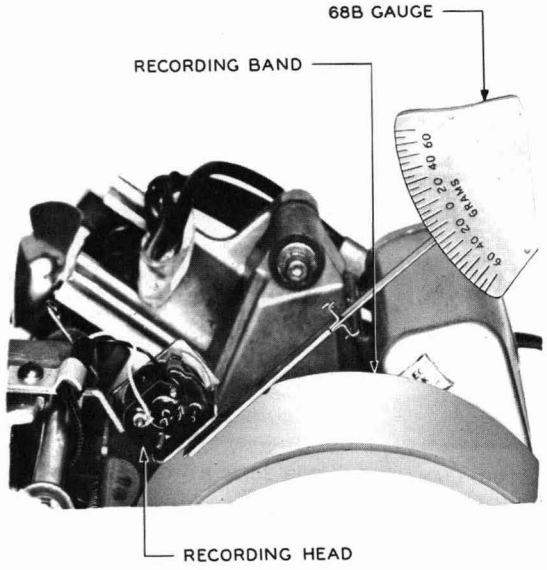

Fig. 19 — Method of Gauging Recording Head Pressure

2.34 ***Drum Clutch Pressure:*** With the drum latch disengaged and the motor running, the pressure required to prevent the drum rotating shall be

	TEST	READJUST
Min	200 grams	225 grams
Max	400 grams	325 grams

Use the 79B gauge.

To check this requirement, disengage the drum latch manually and insert a KS-6320 orange stick into the opening above the flasher and below the drum assembly as shown in Fig. 20. This opening is uncovered when the L1 solenoid is operated. Insertion of the orange stick into this opening will hold the latch in the disengaged position. Plug the motor into ac power. Insert the gauge into the drum notch with the gauge held in the horizontal position as shown in Fig. 21. Apply enough pressure to halt the rotation of the drum. Slowly decrease the pressure and note when the drum starts to rotate.

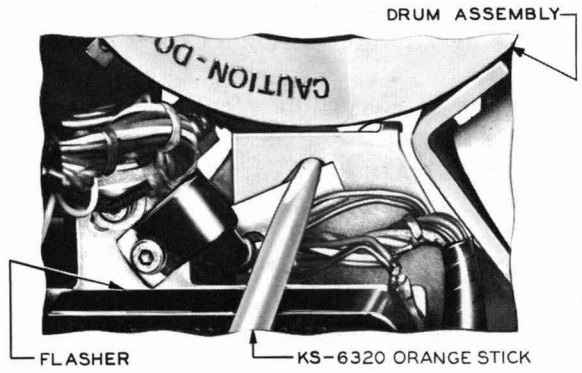

Fig. 20 — Method of Restraining Latch Engagement

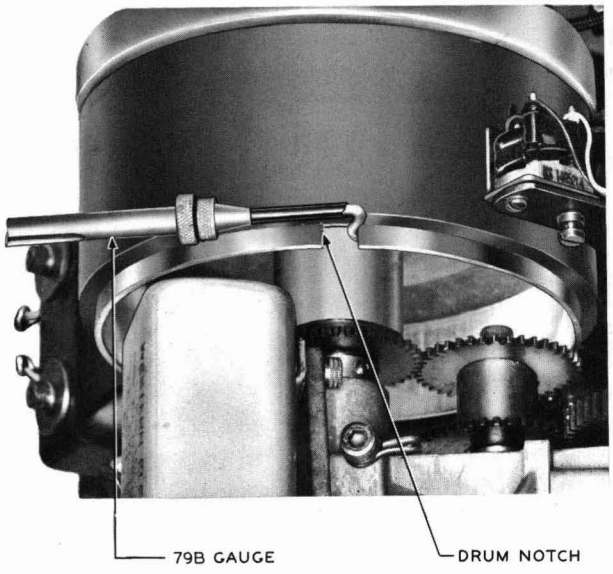

Fig. 21 — Method of Gauging Drum Clutch Pressure

2.35 ***Drum Speed:*** The speed of the drum shall be approximately 22 rpm.

Use the KS-3008 stopwatch and gauge by eye.

To check this requirement, disengage the drum latch manually and insert a KS-6320 orange stick into the opening above the flasher and below the drum assembly as shown in Fig. 20. This opening is uncovered when the L1 solenoid is operated. Insertion of the orange stick into this opening will hold the latch in the disengaged position. Plug the motor into ac power. Count the number of times that the notch passes one point during 1 minute to obtain the speed.

2.36 ***Wear of Recording Head:*** The length of the flat worn on the recording head pole piece shall be maximum 7/32 inch.

Gauge by eye.

To check this requirement, lift the recording head to its highest position and observe the contacting surface of the pole piece.

3. ADJUSTING PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
48	7/32- and 1/4-Inch Hex. Double-End Socket Wrench and Screwdriver (includes the P-124547 wrench)
325B	Adjuster
328	Guide Adjuster
332	Adjuster
415B	Spring Adjuster
417A	1/4- and 3/8-Inch Hex. Open Double-End Flat Wrench
418A	5/16- and 7/32-Inch Hex. Open Double-End Flat Wrench
485A	Smooth Jaw Pliers
486A	Oil Can
524A	Spring Adjuster
524B	Spring Adjuster
534E	Spring Adjuster
KS-2631	Screwdriver
KS-2662	File
KS-6320	Orange Stick
KS-8511	4-1/2 Inch Bent Tweezers
KS-14164	No. 4 Artists Show Card Brush
P-220366	Dental Mirror
R-2485	5/32-Inch Allen Socket Screw Wrench
†R-2670	3/32-Inch Allen Socket Screw Wrench
†R-2671	1/8-Inch Allen Socket Screw Wrench
†R-2958	5/64-Inch Allen Socket Screw Wrench
†R-2959	1/16-Inch Allen Socket Screw Wrench
†R-2961	0.050-Inch Allen Socket Screw Wrench
R-2966	No. 5 Stiff Artists Brush
—	4-Ounce Riveting Hammer
—	6-Inch Piano Tweezers, American Supply Co, No. 56 (or equivalent)
—	3/32-Inch Pin Punch, L.S. Starrett Co, No. 565 (or equivalent)
—	Half-Nut Adjusting Wrench (made locally—see 3.005)
GAUGES	
68B	70-0-70-Gram Gauge
70D	50-0-50-Gram Gauge
70J	0-150-Gram Gauge
79B	0-1000-Gram Push-Pull Tension Gauge
KS-3008	Stopwatch
KS-6909	Thickness Gauge Nest
KS-6938	Thickness Gauge Nest
MATERIALS	
1A	Cushion
KS-2423	Cloth
KS-7860	Petroleum Spirits
KS-14774 L1	Lubricating Grease
KS-16326 L1	Oil
KS-16328 L2	Cleaner-Lubricant
—	EC-847 Adhesive (Minnesota Mining and Manufacturing Co, Inc)
TEST APPARATUS	
81A	Test Set

†***Note:*** Two new wrenches R-3415 and R-3416 may be required due to use of new and old style Allen screws. Use appropriate wrench in each case.

3.002 ***Removing and Remounting the Machine***

(1) To remove the machine from the telephone answering set, proceed as follows. Remove the knobs and button from the front panel using the R-2958 wrench. Lift the set and, with the R-2485 wrench, back off the two screws located in the underside of the base until they are disengaged from the cover. Back off the two screws located at the rear of the base about three turns each, using the R-2958 wrench. Remove the cover by lifting the rear and pivoting the cover on the front edge. If the cover snags, check that the screw on the lever is free of the cover opening. Remove the three recorder mounting screws, the bracket, and the washers, using the R-2485 wrench. Remove the P1 and P4 plugs from the associated jacks. Taking care not to damage any adjacent wiring, lift the machine out of the set.

(2) To remount the machine, proceed as follows. Place the machine in position in the set, taking care not to damage adjacent wiring. Assemble the mounting screws, bracket, and washers in position with the flat washers on the bottom. The bracket should be mounted on the left side of the machine with the upright portion toward the rear. Tighten the mounting screws securely using the R-2485 wrench. Insert the P1 and P4 plugs into the respective jacks. Grasp the cover with two hands and with the front panel nearest the body. Tilt the cover so that the bottom edge of the rear is approximately 6 inches higher than the bottom edge of the front of the cover. Maintaining this position, engage the control shafts and lever at the front of the set in the associated holes in the cover. The rear of the cover may then be lowered into position. Lift the front of the set and tighten the two screws in the underside of the base using the R-2485 wrench. Tighten the two setscrews at the rear of the base using the R-2958 wrench. Slide the button in place on the lever allowing approximately 1/64-inch clearance between the button and the panel surface. Tighten the cap screw securely using the R-2958 wrench. With the function switch in its center position, mount the larger knob on the shaft so the white dot on the knob is opposite the CHECK dot. Tentatively tighten the knob using the R-2958 wrench. Position the smaller knob so that the distance between the white dot on the knob and the ON designation when operated to the ON position will equal the distance between the dot and the OFF designation when operated to the OFF position. Adjust both knobs so that there is a clearance of approximately 1/64 inch between the knob and the panel. Tighten the setscrew in both knobs securely, using the R-2958 wrench.

3.003 ***Announcement Length Adjustment:*** The five marks (0, 15, 30, 45, and 60) on the limit switch stop represent the maximum time interval in seconds to which the machine may be set for varying length of announcements. The mark nearest the bent end of the stop represents 0 seconds. To check some requirements covered in Part 2 or to change the announcement interval, proceed as follows. With the carriage in the zero position, operate the L2 solenoid so that the limit switch moves to the zero position. Loosen the screw securing the limit switch stop with the R-2958 wrench. Position the stop so that the mark representing the desired maximum announcement interval is flush with the left face of the tube. Tighten the screw to secure the adjustment. If the setting has been changed for the purpose of checking a requirement, restore the setting to its previous adjustment.

3.004 ***Flasher Operation Adjustment:*** The purpose of the flasher switch is to warn the operator that the end of the recording interval is approaching. This is done by causing a lamp to flash upon the operation of the flasher switch. The interval of time before the lamp starts to flash is determined by the flasher indicator setting. To check some requirements covered in Part 2 or to change the flashing time, proceed as follows. Set the limit switch stop for the desired announcement interval as covered in 3.003. Operate the L2 solenoid and manually slide the carriage toward the right until the limit switch tab engages the limit switch stop. Operate the L1 solenoid to hold the carriage in this position and loosen the screw in the indicator assembly with the R-2958 wrench. Position the indicator so that the mark representing the beginning of the desired warning interval is directly below the arrow on the carriage. The six marks on the flasher indicator represent time intervals in seconds, each space representing approximately 5 seconds. The mark nearest the bent end of the indicator represents 5-second

warning. Secure the setting by tightening the screw securely. If the setting has been changed for the purpose of checking a requirement, restore the setting to its previous adjustment.

3.005 ***Half-Nut Adjusting Wrench:*** This wrench may be made as follows using 1/8-inch diameter brass tubing about 6 inches long and an R-2961 wrench. Insert the wrench in a vise and break off the shorter end of the wrench using the 485A pliers. Insert the broken end of the longer piece into the brass tubing to a depth of minimum 1/2 inch and solder it in place. Bend approximately 1-1/4 inches of the opposite end of the tubing at right angles to form a handle.

3.01 ***Cleaning*** (Reqt 2.01)

(1) ***Recording Head:*** To clean the recording head pole piece, proceed as follows. Pivot the head away from the recording band and lock it against the carriage with the head locking spring. Place a clean, dry KS-2423 cloth over the top of the band and the adjacent parts. Wrap a KS-2423 cloth around the tip of a KS-6320 orange stick and secure it in place with a 1A cushion. Moisten the cloth-covered tip of the orange stick with KS-16328 L2 cleaner and rub the surface of the pole piece clean. Dry the recording head and any other surfaces contacted by the cleaner with a clean, dry KS-2423 cloth.

(2) ***Recording Band:*** Clean the recording band by rubbing it with a KS-2423 cloth moistened with KS-16328 L2 cleaner. It will be necessary to rotate the drum in order to facilitate cleaning the entire surface of the band. Take care not to twist the flywheel while cleaning as this may result in damage to the fiber gear of the motor. Also, take care not to get any cleaner on other parts. After cleaning, rub the band with a clean, dry KS-2423 cloth until a dry, polished surface is obtained.

3.02 ***Lubrication*** (Reqt 2.02)

(1) Apply the specified quantity of oil to the parts listed in the requirements using the 486A oil can and the KS-14164 brush.

(2) ***Wicking:*** To gain access to the wicking, remove the screw using the R-2671 wrench.

(3) ***Gear Teeth:*** To gain access to all gear teeth, rotate the drum.

3.03 ***Drum Shaft Endplay*** (Reqt 2.03)

(1) Adjust the drum shaft endplay by moving the collar on the motor side of the motor support. Loosen the two setscrews in the collar using the R-2959 wrench. It may be necessary to rotate the drum manually to gain access to the setscrews. Slide the shaft toward the motor by pressing firmly on the drum end of the shaft. Insert the KS-6320 orange stick between the bushing and the adjacent surface of the washer or collar. If the bushing is nylon, use the orange stick to press the bushing in place against the support. Slide the collar toward the bushing until there is a perceptible clearance between the bushing and the adjacent surface of the collar or washer. Tighten the setscrews securely.

3.04 ***Recording Head Position*** (Reqt 2.04)

(1) If the recording head pole piece rides off the recording band at either end of a cycle, reposition the motor support on the main support. To do this, proceed as follows. Remove the rollpin securing the motor support, if provided. Drive the rollpin through by applying the 3/32-inch pin punch to the rollpin and tapping the punch lightly with the 4-ounce riveting hammer. Loosen the two mounting screws securing the motor support and drum assembly with the R-2485 wrench. With the motor support seated squarely on the step of the main support, slide the unit to the right or left as required. In doing this, attempt to position the drum so that the edge of the band is approximately 3/64 inch from the recording head pole piece with the bail assembly in the operated position and the carriage assembly in the zero position. Tighten the two mounting screws securely making sure that the motor support is still squarely seated. Check that the requirement is met. Do not replace the rollpin. If the support was not seated squarely before adjustment, check that requirements 2.09, 2.14, 2.15, 2.16, 2.28, and 2.31 are met.

3.05 ***Gear Engagement*** (Reqt 2.05)

(1) Failure to meet the depth of engagement or lateral engagement requirements may be due to improper seating of the motor support. Failure to meet the lateral engagement

requirement may also be due to a loose idler screw. If the screw is loose, proceed as covered in (2). If the motor support is improperly positioned, it may be repositioned by loosening the two mounting screws securing it to the main support using the R-2485 wrench. If the motor support is secured to the main support by a rollpin, remove the rollpin as follows. Apply the 3/32-inch pin punch to the rollpin and tap the punch lightly with the 4-ounce riveting hammer until the rollpin drops out of the opposite side of the support. Seat the motor support squarely on the step of the main support and tighten the mounting screws securely. Do not replace the rollpin. Check that requirements 2.09, 2.14, 2.15, 2.16, 2.28, and 2.31 are met.

(2) Failure to meet the requirement due to a loose idler assembly mounting screw may be corrected as follows. Mark the drum gear and the associated idler gear so that, when reassembling, the same gear teeth continue to mesh. Mark the location of the spring stop on the drum shaft to aid in reassembly. Loosen the setscrew in the spring stop with the R-2959 wrench and remove the spring and spring stop. Loosen the collar setscrew with the R-2671 wrench and remove the collar, sliding it off the shaft. Slide the flywheel and drum assembly off the shaft. Tighten the idler mounting screw securely using the R-2671 wrench. To remount the flywheel and drum assembly, proceed as covered in (3).

(3) Lock the recording head against the carriage with the head locking spring. Remount the drum and flywheel by sliding them onto the shaft making sure that the gears are meshed as previously marked. Slide the collar on the shaft with the setscrew against the flat portion of the shaft. Hold the flywheel firmly against the drum assembly and position the collar so that a clearance of approximately 0.010 inch is present between the composition face of the collar and the flywheel. Tighten the setscrew securely using the R-2671 wrench, exercising care not to exert any twisting force on the shaft. Rotate the flywheel so that the guide pin is on the opposite side from the flat of the shaft. Remount the spring and spring stop on the shaft making sure to position the stop as previously marked. Tighten the setscrew against the flat portion of the shaft using the R-2959 wrench and taking care not to twist the shaft. Unlock the recording head by disengaging the head locking spring. Check that requirement 2.34 is met.

3.06 *Freedom of Carriage Feed Screw* (Reqt 2.06)

(1) Failure to meet the requirement may be due to dirt and grit in the feed-screw bearing or to improper adjustment of the feed-screw bearing screw. To clean the bearings, proceed as covered in (2). To adjust the bearing screw, proceed as covered in (3).

(2) To clean the bearings, it will be necessary to remove the feed-screw plate. Remove the two plate mounting screws nearest the front using the R-2670 wrench. Temporarily remove the upper screw securing the motor drive unit to the main support to make the upper plate mounting screw accessible. Remove the plate mounting screw and reassemble the upper motor drive unit mounting screw in place, tightening it securely. Repeat this procedure to remove the lower plate mounting screw. Remove the feed-screw plate. Remove the two screws securing the bail stop and switch assembly to make the opposite feed screw bearing accessible. Clean the internal surfaces of the bearings with a KS-14164 brush and KS-7860 petroleum spirits. Remove the steel balls using the KS-8511 tweezers and wipe them clean using a KS-2423 cloth. Clean the countersunk holes in the ends of the feed screw using the cloth and the KS-6320 orange stick as required. Fill the countersunk holes with KS-14774 L1 grease. Dip the steel balls in the grease and insert them into place on the ends of the feed screw. Apply two drops of KS-16326 L1 oil to the inside surface of each bearing. Remount the bail stop, switch assembly, and cable clamp in position and tighten the two mounting screws. Holding the feed-screw plate in position, assemble the two mounting screws and the associated washers into the two holes nearest the front. The ground terminal is mounted under the lower screw. Remove the upper motor drive unit mounting screw. Assemble a plate mounting screw and its associated washer in the upper hole. Remount the motor drive unit mounting screw and tighten securely. Repeat this procedure to mount the bottom plate

mounting screw. Tighten all mounting screws securely and check that the requirement is now met. Check that requirements 2.10, 2.20, 2.21, and 2.24 are met.

(3) To adjust the feed-screw bearing screw, proceed as follows. Loosen the feed-screw bearing screw locknut using the 417A wrench. To make the locknut accessible, remove the adjacent plate mounting screw and washer with the R-2670 wrench. Adjust the feed-screw bearing screw using the R-2670 wrench. Turning the screw out will increase the freedom of rotation and turning it in will reduce the endplay. The requirements for freedom of rotation and no endplay represent a minimum and maximum adjustment. They both, therefore, should be taken into consideration when making the adjustment. When the required adjustment is obtained, hold the screw in position and tighten the locknut securely. Remount the plate mounting screw and washer.

(4) Failure to meet the lateral engagement requirement may be due to a loose idler assembly mounting screw or to improper position of the feed-screw gear on the feed screw. If the mounting screw is loose, proceed as covered in (2). If the feed-screw gear is improperly positioned, it will be necessary to reposition the gear. Rotate the drum manually, as required, to gain access to the setscrew securing the gear to the feed screw. Loosen the setscrew with the R-2959 wrench, and reposition the gear as required. In moving the gear, exercise care not to change the rotational relationship between the feed-screw gear and the idler gear or the feed screw. Tighten the setscrew securely.

3.07 ***Bail Assembly Movement*** (Reqt 2.07)

(1) If the endplay of the bail assembly is unsatisfactory, adjust as follows. Loosen the locknut on the setscrew securing the lower slide rod with the 418A wrench and turn the setscrew out with the R-2959 wrench. Shift the bail assembly to the right and insert a gauge into the space between the bail assembly and the spacer. Take up the endplay of the bail assembly toward the spacer by pressing firmly against the right end of the lower carriage slide rod with the KS-6320 orange stick. Tighten the setscrew securely against the lower slide rod with the R-2959 wrench and tighten the locknut securely. Remove the gauge and check that the requirement is met.

(2) Failure of the bail assembly to pivot freely may be due to insufficient endplay of the bail assembly, a defective retractile spring, binding of the bail assembly on the lower slide rod, or binding of the plunger in the L1 solenoid. The endplay may be corrected as covered in (1). A defective retractile spring should be replaced.

(3) Binding of the bail assembly on the lower slide rod may be due to the presence of dirt or gummy substances on the slide rod. If dirty, clean the slide rod with a KS-14164 brush and KS-7860 petroleum spirits. Use the petroleum spirits sparingly, taking care not to get any on the wiring or on the carriage bearings. After cleaning, the carriage slide rod bearings should be lubricated as covered in requirement 2.02.

(4) Binding of the plunger in the L1 solenoid may be due to the presence of dirt or gummy substances or to improper positioning of the solenoid. Examine the position of the L1 solenoid. The plunger of an improperly positioned solenoid will tend to pull the linkages and bail foot to one side when operated electrically. To correct this condition, loosen the mounting screw securing the solenoid with the R-2670 wrench and shift the solenoid as required. Tighten the mounting screw securely and check that requirements 2.09, 2.14, 2.15, and 2.16 are met. If the plunger movement is sticky or binding, it will be necessary to remove the solenoid for cleaning as follows. Mark the position of the solenoid carefully. Remove the mounting screw and washer securing the solenoid with the R-2670 wrench. Removal of the clamp securing the wire just above the solenoid will facilitate the removal of the solenoid. Slide the solenoid out of position, exercising care not to damage the connecting wires. Clean both the plunger and the interior of the solenoid with the KS-14164 brush and KS-7860 petroleum spirits and wipe dry. Reassemble the solenoid and plunger, taking care to restore the solenoid to its previous position. Tighten the mounting screw securely. Remount the cable clamp and tighten the mounting screw securely using the R-2670 wrench. Check that requirement 2.09 is met.

(5) Failure of the L1 solenoid to operate satisfactorily may be due to binding of the plunger in the solenoid or to a defective solenoid. Binding of the plunger may be corrected as covered in (4). A defective solenoid should be replaced.

3.08 ***Position of Latch*** (Reqt 2.08)
3.09 ***Latch Operation*** (Reqt 2.09)
3.10 ***Bail Stop Position*** (Reqt 2.10)
3.11 ***Carriage Half-Nut Position*** (Reqt 2.11)

(1) If any of these requirements are not met it is important that all the requirements be checked and adjustments required be made in the following order.

(2) If the position of the latch with respect to the band and the edge of the drum does not meet the requirement, adjust the latch position as follows. To gain access to the latch, loosen the limit switch stop locking screw with the R-2958 wrench. Slide the limit switch stop to the right until the extreme left-hand mark on the stop is flush with the left face of the tube. Tighten the locking screw. Slide the carriage to the right until stopped by the limit switch stop. Press the bail assembly toward the drum so that the carriage assembly is held stationary by the engagement of the half nut and feed screw. With the bail assembly held in this position, apply the straight portion of the 325B adjuster on the latch just above the motor control switch by inserting the adjuster between the L1 and L2 solenoids. Exercise care not to damage the switch. Adjust the latch as required. Check that the requirement is met. Release the bail assembly and return the carriage to the zero position. Loosen the limit switch stop locking screw and return the stop to its previous position. Tighten the locking screw securely.

(3) To adjust for clearance between the drum and the latch or if the latch does not drop into the notch properly, loosen the screw securing the L1 solenoid with the R-2670 wrench. Shift the solenoid toward the drum if the clearance is excessive and away if it is insufficient. Tighten the screw securely.

(4) Failure of the latch to rest on the metal surface of the drum or to drop into the notch may be due to binding of the parts, defective retractile spring, or improper latch position. Binding of the parts may generally be located by a careful examination of the latch and its associated linkages. Attempt to move the latch or the connecting part being checked. If necessary, the motor control switch may be dismounted to remove the pressure of its contact from the latch. If a binding part is located, examine the sliding surfaces for the presence of dirt, grit, or other sources of friction. Clean as required, using the KS-14164 brush and KS-7860 petroleum spirits. If binding is not the cause, examine the latch retractile spring. If the spring is defective, replace it. If failure to meet the requirement is not due to any of the above, check that the latch position meets requirement 2.08.

(5) If the latch shoe is excessively worn, examine the metal surface of the drum for scoremarks. Such marks will cause the nylon to wear rapidly. If this condition is present, replace the drum and latch shoe.

(6) The presence of endplay of the carriage assembly when the bail assembly is operated is an indication of improper engagement of the half nut and feed screw. Check that the bail assembly does not contact the bail stop when the bail assembly is in the operated position. If the bail stop position is satisfactory, adjust the half-nut position to obtain proper engagement as covered in (8). After adjusting the position of the half nut, check that requirement 2.10 is met.

(7) If the clearance between the bail stop and the bail assembly in the operated position is unsatisfactory, adjust the position

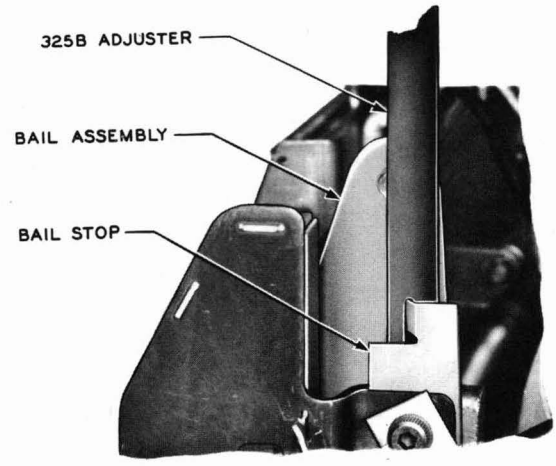

Fig. 22 — Method of Adjusting Bail Stop Position

of the stop as required, using the 325B adjuster as shown in Fig. 22.

(8) Failure of the carriage half-nut position to meet the requirement may be corrected as follows. To gain access to the half-nut positioning screw, slide the carriage toward the right until the positioning screw and locknut are centered in the hole in the bail assembly. Electrically operate the L1 solenoid to hold the carriage locked in this position. Insert the half-nut adjusting wrench through the P-124547 wrench and engage the half-nut positioning screw. Slide the P-124547 wrench forward to engage the locknut and loosen it. Using the half-nut adjusting wrench, turn the screw counterclockwise to obtain clearance, or clockwise to remove carriage endplay. Lock the adjustment by tightening the locknut securely while holding the screw from turning. Release the L1 solenoid and check that the requirement is met. Check that requirement 2.10 is still met.

(9) ***Rechecking Other Requirements:*** If the latch position has been adjusted as covered in (2), check that requirement 2.12 is met. If the position of the L1 solenoid is changed as covered in (3), check that requirements 2.12, 2.14, 2.15, and 2.16 are met.

3.12 ***Relation of Latch and Motor Control Switch*** (Reqt 2.12)
3.13 ***Contact Alignment*** (Reqt 2.13)
3.14 ***Contact Separation*** (Reqt 2.14)
3.15 ***Contact Follow*** (Reqt 2.15)
3.16 ***Contact Spring Clearance*** (Reqt 2.16)

(1) Failure to meet the requirement on the relation between the latch and the switch may be corrected by repositioning the switch as follows. Loosen the two screws mounting the switch on the bracket using the R-2670 wrench. Shift the switch as required taking care not to shift the point of contact on the latch. Tighten the mounting screws securely and check that the switch meets the contact separation and follow requirements.

(2) If the switch fails to meet the contact alignment requirement, refer the matter to the supervisor.

(3) Do not straighten kinked springs unless the kink interferes with proper adjustment of the spring assembly. Removing kinks tends to weaken the spring and to shorten its life. Normally straight springs that have been adjusted should have no sharp bends due to adjustment. A gradual bow, however, is permissible.

(4) Contact separation and contact follow of these contact springs are interdependent. Care should be taken when adjusting to meet one requirement that the other is also met. Adjustments should be made using the 534E spring adjuster on the stationary springs, and the 524A or 524B spring adjuster on the operating springs. To adjust, place the adjuster on the spring and slide it back to where the spring leaves the insulators and adjust the spring up or down as required.

(5) If the clearance between adjacent contact springs is not satisfactory, adjust the springs, as required, using the 534E adjuster for stationary springs and the 524A or 524B adjuster for operating springs. If the clearance between a spring and any adjacent part is unsatisfactory, it may be necessary to shift the position of the switch. To do this, loosen the two mounting screws securing the switch to the bracket with the R-2670 wrench and reposition the switch as required. Tighten the screws securely. After doing this, check that requirements 2.12, 2.14, and 2.15 are met.

(6) A change of clearance due to adjustment will generally be found between the second and third springs of the switch. If this clearance is unsatisfactory, determine whether the condition can be corrected by adjusting the third spring away from the second. Use the 534E adjuster. If such adjustment produces a failure to meet the contact separation requirement when the latch rides on the drum, it will be necessary to reposition the switch and readjust the contact springs. To do this, loosen the two screws securing the switch bracket to the base plate, using the R-2670 wrench. These two screws are located on the drum side of the machine just above the flasher unit. Shift the switch away from the latch as required. Tighten the two screws securely and check that requirements 2.12, 2.14, and 2.15 are met. Readjust as required.

3.17 ***Freedom of Carriage Assembly*** (Reqt 2.17)

(1) Failure to meet the clearance requirement or of the carriage to slide freely may be corrected by adjusting the position of

the upper tab as follows. To reduce the clearance, bend the tab towards the upper slide rod using the 485A pliers as shown in Fig. 23. To increase the clearance, bend the tab away from the upper slide rod using the 328 adjuster as shown in Fig. 24. In making either adjustment, take care not to damage the adjacent wires or the recording head.

(2) If the carriage does not return properly, it may be due to improper bail assembly operation, binding between the carriage and the lower slide rod, or improper operation of the return pulley.

(3) If failure to meet the requirement is due to improper bail assembly operation, that is, the carriage half nut does not completely disengage from the feed screw, check that requirements 2.07, 2.10, and 2.11 are met and readjust if necessary.

(4) If failure of the carriage to return properly is due to hesitation of the carriage, it is an indication of binding between the carriage and the lower slide rod. Disengage the carriage half nut from the feed screw and slide the carriage back and forth to determine if there is binding. If binding is present, clean the lower slide rod with a KS-14164 brush and KS-7860 petroleum spirits. Use the petroleum spirits sparingly, taking care not to get any on the wiring. If cleaning does not remove the binding, refer the matter to the supervisor.

(5) If failure to meet the requirement is due to improper operation of the pulley, proceed as follows. Check that the return cord is securely attached to both the pulley and the cord-holding terminal and that the cord is not broken. If the cord is defective, replace it. If necessary to secure the cord to the terminal, proceed as covered in (7). Check that the ends of the coiled spring are hooked into the holes provided in the bail assembly and the pulley. If the spring is defective, replace it. If the trouble is due to insufficient spring tension, correct as follows. Loosen the cord holding terminal mounting screw with the KS-2631 screwdriver and rotate the cord holding terminal away from the pulley about one-fourth of a turn. Tighten the screw securely. If this does not correct the condition, replace the coiled spring.

(6) Binding of brass pulleys, provided on earlier machines, may be due to a worn pulley or wedging of the spring between the pulley and the bail. Replace the pulley.

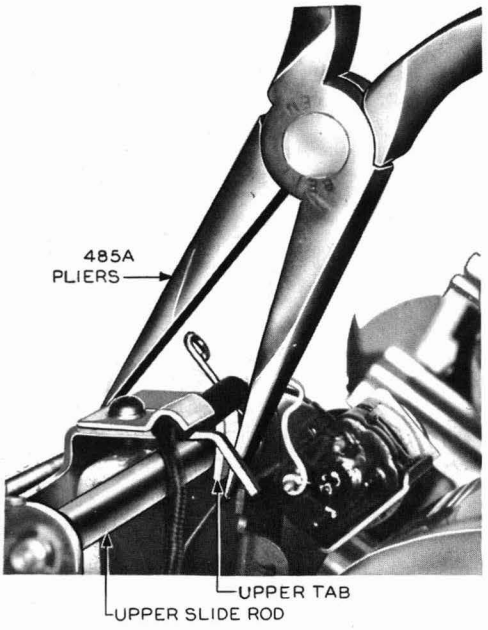

Fig. 23 — Method of Adjusting Upper Tab for Minimum Clearance

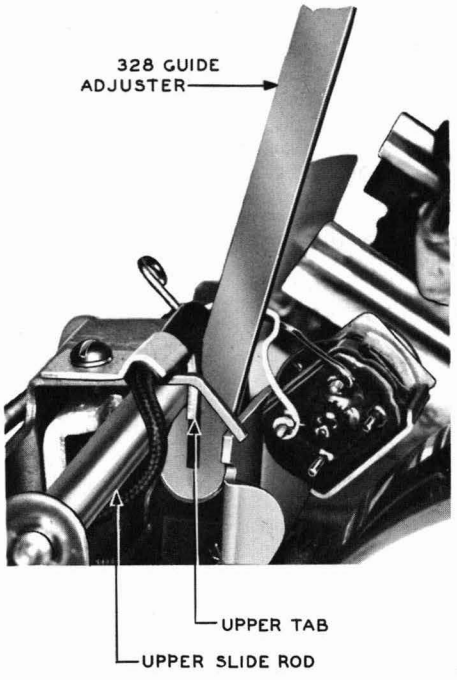

Fig. 24 — Method of Adjusting Upper Tab for Maximum Clearance

(7) To secure the cord to the cord-holding terminal, tie the cord to the terminal with two half hitches. Secure the knot at each end with a drop of EC-847 adhesive. Wrap the cord around the pulley twice and check that requirement 2.17(c) is met. If the requirement is not met, wrap the cord around the pulley an additional turn. Take care not to increase the pulley spring tension so that the carriage slams against the bail on returning.

3.18 ***Freedom of Movement of Operating Rods*** (Reqt 2.18)

(1) Examine the rod for dirt and burrs. If failure to meet the requirement is due to the presence of dirt, clean the rod with a KS-2423 cloth moistened with KS-7860 petroleum spirits. If burrs are present on the rod that interfere with the operation, remove the burrs using the KS-2662 file. If the rod still fails to meet the requirement, replace the rod.

3.19 ***Operating Rod Spring Tension*** (Reqt 2.19)

(1) To correct, proceed as follows. Unhook the end of the spring at fault from the tension adjusting nut. Turn the nut as required to obtain the specified tension. In making this adjustment, always position the adjustment nut so that the ear of the nut is uppermost and the long dimension is approximately vertical. Hook the spring back onto the nut and check that the requirement is met. If not, repeat the above procedure until the requirement is met.

3.20 ***Clearance Between Operating Rod and Timing Switch*** (Reqt 2.20)

(1) If the clearance is not satisfactory, adjust it by turning the adjusting nut adjacent to the brass spacer as required. Use the 418A wrench. Check that requirement 2.24 is met.

3.21 ***Engagement of Operating Rod and Associated Switch*** (Reqt 2.21)
3.22 ***Contact Alignment*** (Reqt 2.22)

(1) If failure to meet the engagement requirement is noted at both switches by approximately the same amount, this condition may be corrected by repositioning the switch mounting plate. Loosen the two mounting screws with the R-2670 wrench. Shift the mounting plate as required, taking care not to disturb the position of the bail stop. Tighten the mounting screws securely and check that the requirement is met. Check the position of the bail stop as covered in requirement 2.10.

(2) If failure to meet the engagement requirement is present at only one switch, correct this condition by repositioning the individual switch assembly as follows. Loosen the two switch mounting screws using the KS-2631 screwdriver. Shift the switch assembly as required, taking care not to change the relationship of the contacts. Tighten the mounting screws securely and check that the contact alignment meets requirement 2.21.

(3) Failure to meet the contact alignment requirement may be corrected by repositioning the stationary spring as follows. Loosen the two switch mounting screws with the KS-2631 screwdriver. Shift the stationary spring as required, taking care not to move the operating spring. Tighten the mounting screws securely and check that the switch position meets requirement 2.21.

(4) If a switch cover tab is broken or cracked, replace the cover.

3.23 ***Contact Separation*** (Reqt 2.23)
3.24 ***Operation Sequence of Timing and Drum Pulsing Switches*** (Reqt 2.24)

(1) To obtain the required contact separation, adjust the stationary spring with the 415B adjuster. Place the adjuster on the spring as close to the base as possible. Adjust the spring to the right or left as required.

(2) If the timing switch contacts do not close at approximately one half of a revolution after the closure of the drum pulsing switch contacts, proceed as follows. Check the separation between the contacts of the timing switch. If closure of the timing switch contacts is late, reduce the separation toward the minimum by adjusting the stationary spring using the 415B adjuster. If closure of the contacts is early, increase the separation by adjusting the stationary spring. If a satisfactory adjustment cannot be obtained within the limits of the separation requirement, an ad-

justment of the clearance between the operating rod and the operating spring will be necessary. Proceed as covered in 3.20, adjusting the position of the operating rod as required to meet the sequence requirement.

3.25 ***Carriage Foot Position*** (Reqt 2.25)

(1) Failure to meet the requirement may be corrected by bending the carriage foot using the 332 adjuster. Insert the adjuster between the L1 and L2 solenoids and grasp the carriage foot just below the bend in the foot. This bend is on a level with the top of the L2 solenoid. Adjust the foot as required, taking care that both requirements are met.

3.26 ***Limit Switch Operation*** (Reqt 2.26)

(1) Failure of the L2 solenoid to operate satisfactorily may be due to binding of the plunger in the solenoid, to improper positioning of the solenoid, or to a defective solenoid.

(2) Binding of the plunger in the L2 solenoid may be due to the presence of dirt or gummy substances. If the plunger movement is sticky or binding, it will be necessary to remove the solenoid for cleaning as follows. Mark the position of the solenoid carefully. Remove the mounting screws and washers securing the solenoid with the R-2670 wrench. Removal of the clamp securing the wire above the L1 solenoid may facilitate the removal of the solenoid. Slide the solenoid out of position, exercising care not to damage the connecting wires. Clean both the plunger and the interior of the solenoid with the KS-14164 brush and KS-7860 petroleum spirits and wipe dry. Reassemble the solenoid and plunger, taking care to restore the solenoid to its previous position. Tighten the mounting screws securely. Remount the cable clamp, if removed, and tighten the mounting screws securely using the R-2670 wrench. Check that the requirement is met.

(3) Insufficient clearance between the limit switch clamp and the limit switch arm may be corrected by shifting the L2 solenoid. To do this, proceed as follows. Loosen the two screws securing the L2 solenoid with the R-2670 wrench. Taking care to keep the solenoid in the same horizontal position, shift the solenoid as required. When doing this, make sure that the plunger is bottomed in the solenoid. Tighten the two mounting screws securely and check that the requirement is met. Check that the clearance between the carriage foot and the solenoid meets requirement 2.25.

(4) A defective solenoid should be replaced.

(5) Failure of the limit switch clamp to securely clamp the limit switch assembly may be due to a defective clamp retractile spring. Replace the spring if found defective. If this does not correct the trouble, replace the limit switch assembly.

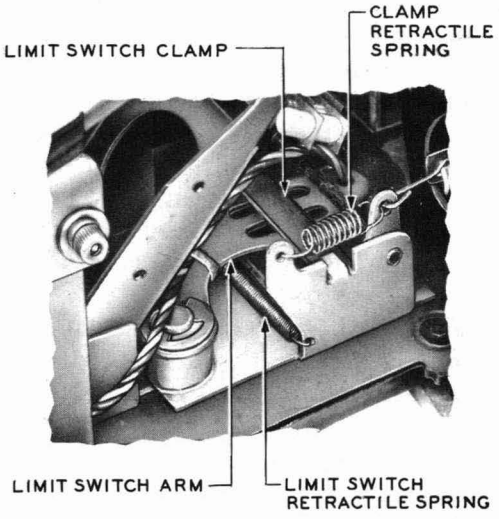

Fig. 25 — Limit Switch Assembly Details

3.27 ***Limit Switch Movement*** (Reqt 2.27)

(1) If the limit switch fails to return freely to its zero position, check that requirement 2.26 is met. If met, check the limit switch retractile spring. If defective, replace it.

(2) Failure of the limit switch tab to fully engage the stop may be corrected as follows. Loosen the screw in the tube with the R-2958 wrench. Rotate the stop in its tube, as required, to obtain proper engagement. Tighten the screw securely.

3.28 ***Position of Erase Coil Assembly*** (Reqt 2.28)

(1) To center the pole-piece gap across the width of the band, loosen the three screws securing the base of the erase coil bracket support assembly using the R-2670 wrench. Shift the bracket support assembly

sideways as required to center the width of the pole piece across the width of the recording band. Take care not to change the clearance by shifting the bracket support assembly towards or away from the drum. Tighten the three screws securely and check that the requirement is met.

(2) To adjust the clearance between the pole pieces and the recording band, proceed as follows. Loosen the three screws securing the erase coil bracket to the bracket support assembly using the R-2670 wrench. Position the erase coil bracket so that the erase coil pole pieces are tangent to the recording band with the pole-piece gap closest to the band. Tighten the three screws securely. Loosen the two screws securing the erase coil to the erase coil bracket using the R-2670 wrench. Position the erase coil and pole-piece assembly so that the clearance is uniform across the width of the recording band and meets the requirement. Tighten the two screws securely.

3.29 ***Contact Alignment*** (Reqt 2.29)
3.30 ***Contact Separation*** (Reqt 2.30)
3.31 ***Contact Follow*** (Reqt 2.31)

(1) If the switch fails to meet the contact alignment requirement, refer the matter to the supervisor.

(2) To adjust for contact separation, use the 524A spring adjuster. Place the adjuster on the upper contact spring and slide it back to the base of the spring. Adjust the spring as required.

(3) To adjust for the contact follow, loosen the mounting screw securing the switch bracket to the erase coil bracket support assembly using the R-2670 wrench. Shift the switch bracket up or down as required. Tighten the mounting screw securely and check that the requirement is met.

3.32 ***Recording Head Lifting Tab Position*** (Reqt 2.32)

(1) Failure to meet the requirement may be corrected by adjusting the lifting tab as required using the 325B adjuster. Take care not to damage the wiring.

3.33 ***Recording Head Pressure*** (Reqt 2.33)

(1) Failure to meet the requirement may be due to improper recording head lifting tab position, binding of the parts, improper spring tension, or a defective spring. Check that the position of the recording head lifting tab meets requirement 2.32. If the requirement is met, check that the recording head and bracket assembly pivot on the shaft without bind. If binding is present, clean as required using KS-7860 petroleum spirits applied with a KS-14164 brush. Thoroughly dry the parts using a KS-2423 cloth. If binding is not present, an adjustment of the spring tension will be necessary. On machines having a recording head bracket provided with holes for the repositioning of the end of the recording head pressure spring, proceed as covered in (2). On machines not provided with a recording head bracket of this type, proceed as covered in (3).

(2) To adjust the recording head pressure on a machine having a bracket with holes provided for spring pressure adjustment, proceed as follows. Using the KS-8511 tweezers, remove the end of the spring from the hole and insert it in the next hole as required. Moving the spring end to the next hole away from the drum will increase the recording head pressure, and toward the drum will decrease the pressure. If the spring end is in the last hole, bend the spring slightly toward the drum to increase the pressure or away from the drum to reduce the spring pressure. Use the 485A pliers. Reinsert the end of the spring in the hole and check the recording head pressure. If the requirement cannot be met by any of the methods outlined above, proceed as covered in (3).

(3) To adjust the recording head pressure on machines having no spring position holes in the bracket, proceed as follows. To make the spring accessible, remove the flywheel and drum assembly as covered in 3.05(2). Using the 6-inch tweezers, bend the end of the spring as required to adjust the spring pressure against the back of the recording head bracket. Reassemble the flywheel and drum assembly as covered in 3.05(3). Check that the requirement is met. If not, replace the spring.

3.34 ***Drum Clutch Pressure*** (Reqt 2.34)

(1) Failure to meet the requirement may be due to improper spring tension, wear or binding of the parts, or improper clearance. If the pressure required to halt drum rotation is below the minimum, proceed as covered in (2) and, if excessive, as covered in (4).

(2) If the pressure required to hold the drum stationary is less than the minimum, a slippage of driving parts or parts binding against the drum is indicated. Check that the drum clears all parts. If the drum does not bind, check that requirement 2.03 is met. Check that the setscrews in the collar adjacent to the motor coupling are secure. If loose, move the collar toward the motor until further movement is stopped. Back off the collar from this point a distance of approximately 1/64 inch and tighten the setscrews securely using the R-2959 wrench. If the cause of the trouble is not any of the above, wear of the clutch is indicated. Compensate for the wear as covered in (3).

(3) To compensate for wear of the clutch or to adjust clutch pressure, proceed as follows. Remove the spring stop and spring by loosening the setscrew in the stop with the R-2959 wrench and sliding the parts off the shaft. Take care not to twist the shaft. Hold the flywheel firmly against the drum assembly and check that a clearance of approximately 0.010 inch is present between the surface of the flywheel and the composition facing of the collar. If the clearance is unsatisfactory, adjust the position of the collar as follows. Loosen the setscrew in the collar with the R-2671 wrench. Take care in loosening the setscrew not to exert any twisting force on the shaft as this may damage the fiber gear in the motor drive unit. Reposition the collar, as required, to obtain the 0.010 inch clearance. Tighten the setscrew securely, taking care not to twist the shaft. Assemble the spring and spring stop on the shaft. The spring stop should be positioned on the shaft so that the setscrew is on the flat portion of the shaft and the flywheel pin enters the hole in the spring stop. Rotate the flywheel as required to obtain engagement between the pin and the stop. Tighten the setscrew in the stop with the R-2959 wrench. Check the pressure required to halt drum rotation. If the pressure is not within limits, reposition the spring stop as required. Shifting the stop towards the drum increases the pressure and away decreases the pressure. Repeat the procedure until the average pressure measured meets the requirements.

(4) If the pressure required to hold the drum stationary is excessive, proceed as follows. Loosen the setscrew securing the spring stop to the shaft and remove the spring and spring stop. Use the R-2959 wrench. Check the clearance between composition face of the collar and the flywheel with the flywheel held firmly against the drum. This clearance should be approximately 0.010 inch. If the clearance is unsatisfactory, adjust it as covered in (3). If the clearance is satisfactory, or excessive, loosen the setscrew in the collar with the R-2671 wrench and remove the collar. Take care not to twist the shaft. Remove the flywheel from the shaft, taking care not to move the drum from its position of engagement with the idler gear. Examine the clutch pad surface and the clutch plate surface for the presence of dirt, grit, or other deposits. If burrs are present on the clutch plate or the clutch pad is damaged, give consideration to replacing the plate of the flywheel. Clean the metal surfaces thoroughly with a KS-2423 cloth moistened with KS-7860 petroleum spirits. The clutch pad should feel oily to the touch. If it does not, replace the flywheel. Reassemble the parts and adjust the clutch pressure as covered in (3).

3.35 ***Drum Speed*** (Reqt 2.35)

(1) Failure to meet the requirement may be due to binding of the parts, loose or damaged coupling collar, a defective motor, or a defective capacitor. Proceed as outlined in 3.34(2). If this procedure does not correct the trouble, give consideration to replacing the motor.

3.36 ***Wear of Recording Head*** (Reqt 2.36)

(1) Recording heads failing to meet the requirement shall be replaced.