RECORDER

KS-16765 L3

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-16765 L3 recorder. This recorder with its associated KS-16765 L6 amplifier and control facilities is known as the KS-16765 L1 or L2 announcement set.

1.02 This section is reissued for the following reasons:

(a) To revise 2.02 and 3.02 to add new lubricating requirements and to emphasize the importance of regular lubrication

(b) To revise method of checking bail-stop position, 2.08.

(c) To revise List of Tools, Gauges, Materials, and Test Apparatus, 3.001

(d) To make other changes as required.

This reissue does not affect the Equipment Test List.

1.03 Two different designs of KS-16765 L3 recorders are in use in the field. The earlier- and the later-type recorders consist of a motor-belt driven drum on the surface of which is mounted a synthetic rubber recording band 1-27/32 inches wide. A single magnetic head is provided for recording a message on the recording band and reproducing it. As the drum rotates, the magnetic head is moved across the surface of the recording band by the operation of a feed screw mechanism. Announcements of up to 2 minutes duration may be recorded. Announcements are erased from the band by energizing an erase coil by means of the control circuit. On the later-type recorder, announcements of up to 3 minutes duration may be recorded by replacing the 2-minute pulley with a 3-minute pulley.

1.04 The circuit of the KS-16765 L2 announcement set is covered by SD-95283-01 and the circuit of the KS-16765 L1 announcement set is covered by SD-95286-01.

1.05 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 in this section.

1.06 The cover should be kept on the announcement set at all times except when it is necessary to remove it for maintenance reasons.

1.07 ***Number Symbol (#):*** Requirements are marked with a number symbol when they are not required to be checked before turnover.

1.08 ***Asterisk (*):*** Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of apparatus, would affect the adjustment involved, or would affect other adjustments. No check is 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.

1.09 ***Make Busy:*** Before performing any work on a recorder, the equipment is removed from service in accordance with local instructions. The equipment is not removed while running unless it runs continuously indicating a trouble condition. When it is removed, a new unit is substituted immediately.

1.10 ***Bail Assembly in 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 L1 solenoid electrically operated.

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

1.12 ***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.

1.13 ***Zero Position of Limit Switch:*** For the purpose of this section, the zero position of the limit switch is that position where the limit switch lever is in contact with the zero stop with the carriage assembly in the zero position.

1.14 ***One drop of KS-16326 L1 oil,*** for the purpose of this section, is the amount of oil discharged from the nozzle of the 486A oilcan when the sides are depressed once and held depressed until the drop is released from the nozzle.

1.15 ***A film of ▶KS-19139 L4 lubricant,◀*** for the purpose of this section, is the amount of lubricant deposited on the surface of the part after being brushed with the KS-14164 brush which has been dipped into the lubricant to a depth of 3/8 inch and scraped lightly against the side of the container as the brush is removed.

1.16 ***Rotation of Drum:*** To rotate the drum, the flat drive belt is removed and the pulley is turned in a counterclockwise direction when looking at the pulley end. If necessary, the L2 solenoid is manually operated to permit the S1 limit switch to be moved to the extreme right position.

1.17 It will be necessary to remove the recorder from the announcement set as covered in 3.003 to check the requirements.

1.18 When it is necessary to electrically operate a solenoid to make any checks or adjustments, 44- to 48-volts direct current is connected across the terminals of the solenoid. Central office 48-volt battery supply is used.

1.19 To check some requirements covered in this section, it may be necessary to change a setting to which the recorder has been adjusted. This should be done as covered in 3.005. Where a change in the announcement interval is to be made, the recorder is reset as covered in 3.005 for the interval desired.

1.20 KS-16765 L3 recorder equipped with the drive assembly, shown in Fig. 1, may be converted from a 2-minute maximum announcement recording capacity to a 3-minute maximum recording capacity by replacing the 2-minute pulley with a 3-minute pulley as covered in 3.004.

1.21 If operate tests are made on solenoid S2, it will be necessary to record a new announcement after completing tests.

1.22 ***Index:*** The following index lists the items covered in Part 2 of this section. Part 3 is not covered in the index as these items are the procedures corresponding to the individual requirements of Part 2.

INDEX

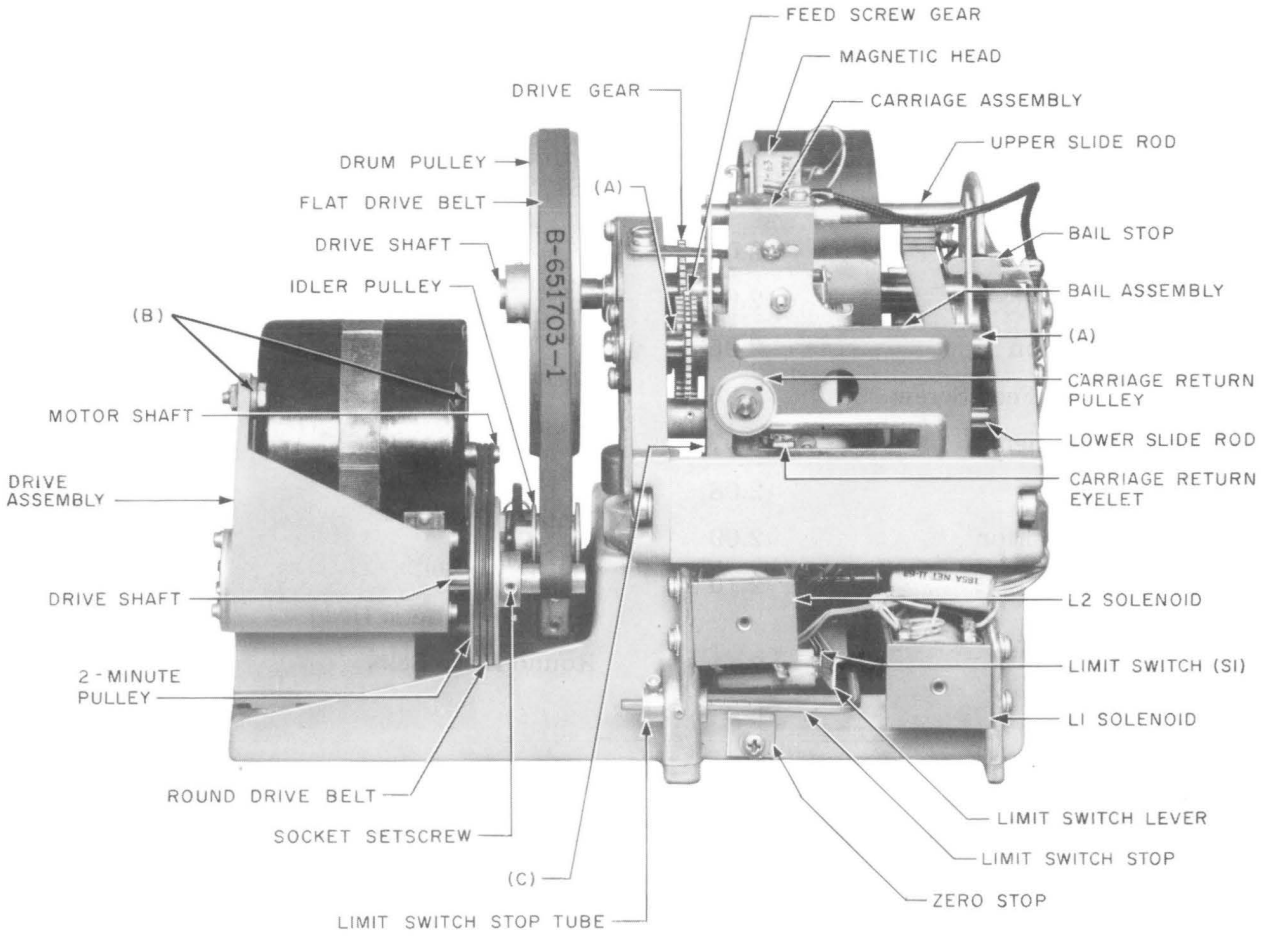

Fig. 1—▶KS-16765 L3 Recorder—Front View (Later Type Shown)◀

2. REQUIREMENTS

2.01 *Cleaning*

(a) ***Switch Contacts:*** The switch contacts (Fig. 2 and 3) shall be cleaned when necessary in acccordance with approved procedures.

(b) ***Magnetic Head:*** The pole piece of the head (Fig. 4) shall be free of dust, wax, dirt, or any other foreign matter. Lift the head to its highest position, and observe the surface of the pole piece. Gauge by eye.

(c) ***Flat Drive Belt:*** The drive belt (Fig. 3) and drive surface of pulleys shall be free of oil, dirt, or other foreign matter. Gauge by eye.

(d) ***Recording Band:*** The recording band shall be cleaned ▶and lubricated every 3◀ months. The surface of the recording band (Fig. 3) shall be free from dust and foreign material and the ▶entire surface◀ shall have a polished appearance. Gauge by eye.

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

2.02 ***Lubrication:*** ▶The life and continued proper operation of the recorder is dependent upon a well-administered and properly executed lubrication program. It is therefore critically important that the following parts be lubricated with KS-16326 L1 oil and KS-19139 L4 lubricant as specified and at the recommended intervals.◀

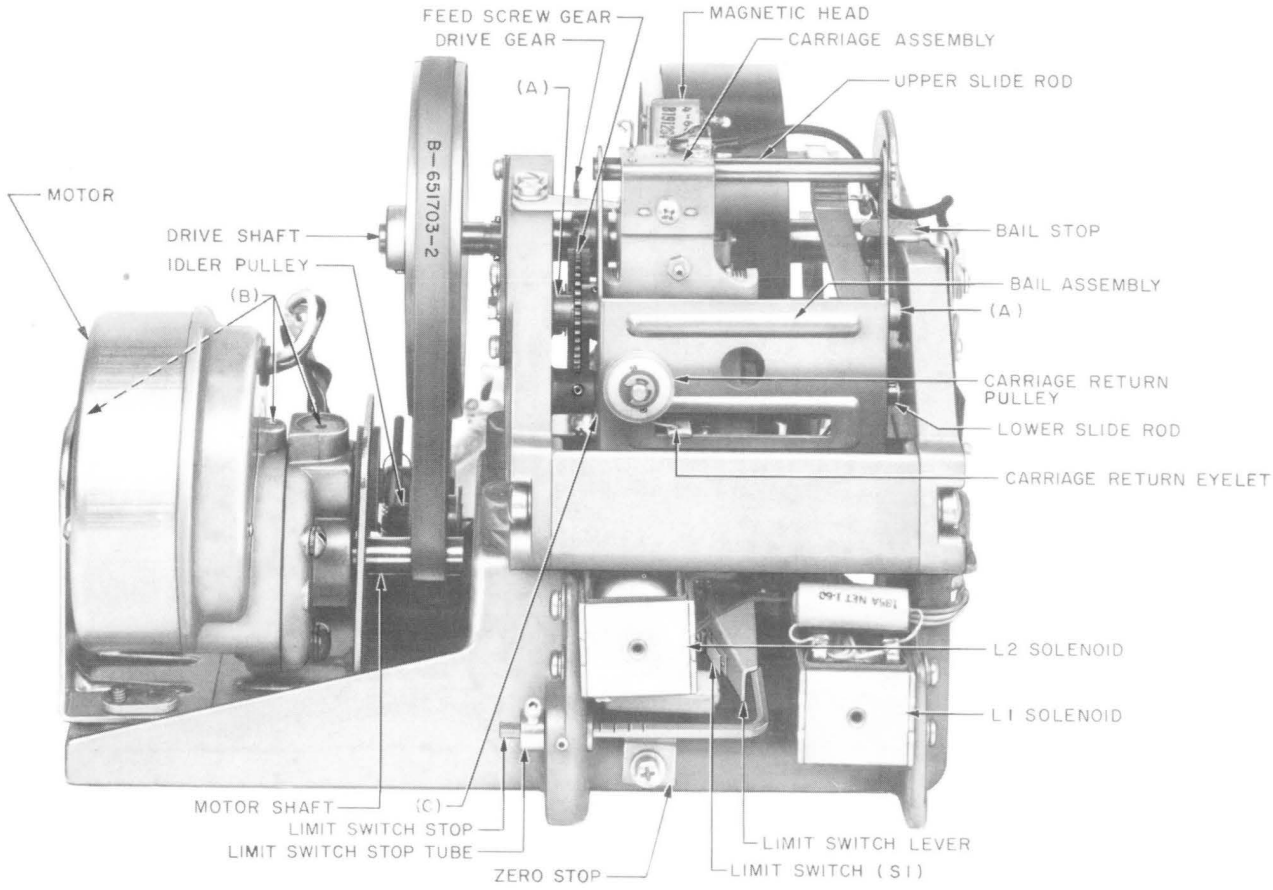

Fig. 2—KS-16765 L3 Recorder—Front View (Earlier Type Shown)

(a) ***KS-15914 L1 Motor Bearings:*** Two drops of ▶KS-16326 L1◀ oil to each of the three oil reservoirs [Fig. 2, (B)] through the three holes provided in the motor housing.

(b) ***B-650418 Motor Bearings:*** Two drops of ▶KS-16326 L1◀ oil to each of the two oil reservoirs (one at the shaft and one at the rear of the motor) [Fig. 1, (B)] as applicable. Earlier models of the motor require no lubrication.

(c) ***Feed Screw Bearings:*** Two drops of ▶KS-16326 L1◀ oil to ▶each of the two◀ feed screw bearings [Fig. 1, (A) and 2, (A)]. Apply where the feed screw enters its bearings.

(d) ***Threads of Feed Screw and Half Nut:*** A film of ▶KS-19139 L4 lubricant◀ on the feed screw [Fig. 4, (D)] and half nut ▶mounted on bracket assembly. Stir lubricant thoroughly before using.◀

(e) ***Gear Teeth:*** A film of ▶KS-19139 L4 lubricant◀ on all gear teeth [Fig. 5, (A)].

Note: It is essential that no ▶KS-16326 L1 oil or KS-19139 L4 lubricant◀ be deposited on the recording band, drive belt, pulley surfaces, or motor shaft.

(f) ***Recommended Lubrication Intervals:*** Before being placed in operation, the recorder shall have been lubricated as specified. After turnover, it is recommended that the parts listed in the requirements be lubricated ▶every 3 months. Experience may provide that sets receiving severe use may need lubricating more frequently.◀

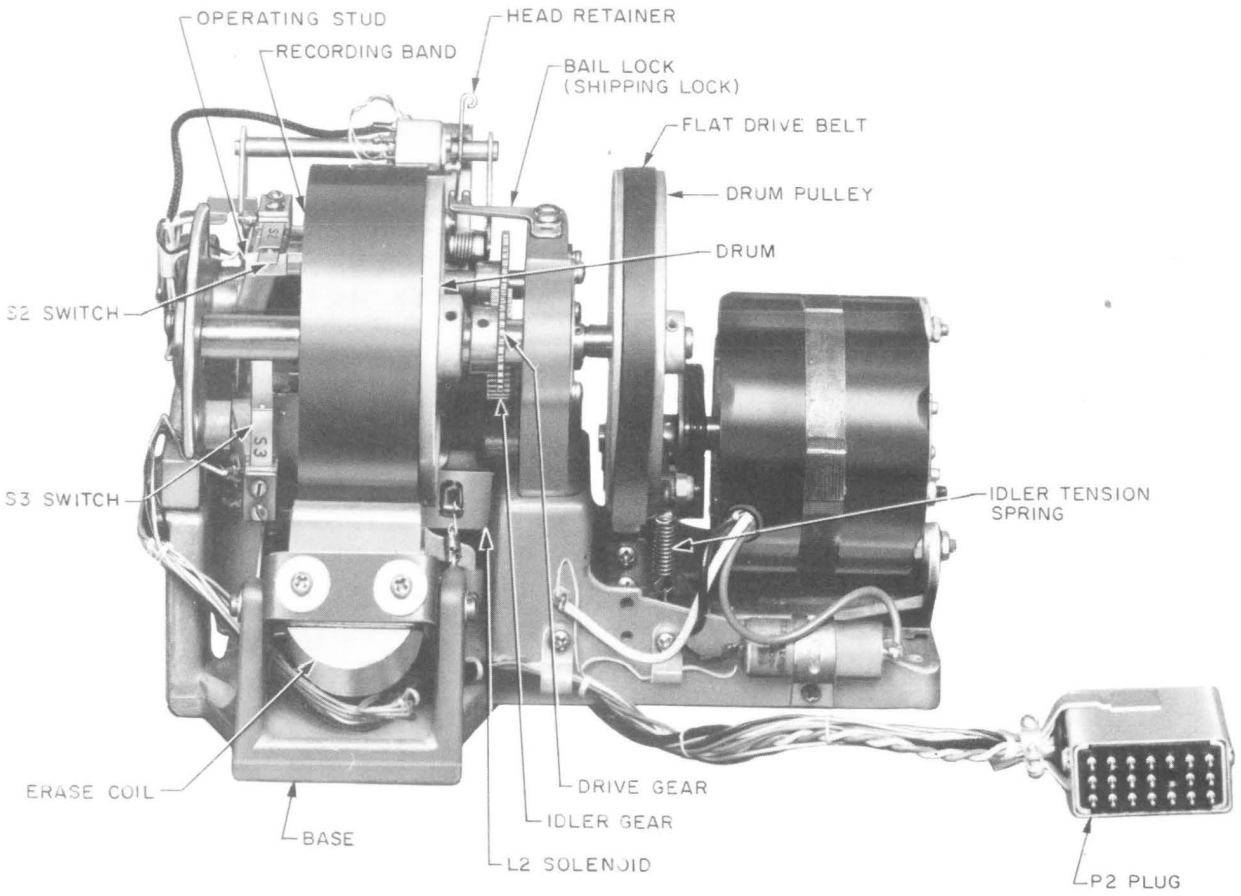

Fig. 3—KS-16765 L3 Recorder—Rear View (Later Type Shown)

2.03 ***Record of Lubrication:*** During the period of installation, a record shall be kept by date of the lubrication of the recorder mechanism and this record shall be turned over to the telephone company with the equipment.

2.04 ***Drum Shaft Endplay:*** The endplay of the drum shaft shall not be perceptible. Gauge by eye and feel.

2.05** ***Magnetic Head Position: With the L1 solenoid electrically operated, the magnetic head pole piece shall be in contact with the recording band throughout the entire announcement cycle. Gauge by eye. Check as follows.

(1) Electrically operate the L1 solenoid in accordance with 1.18, and note that the magnetic head pole piece rests on the recording band.

(2) Release the L1 solenoid.

(3) Adjust the limit switch stop for maximum capacity announcement record (3.005).

(4) Operate the L2 solenoid.

Caution: Do not move the limit switch lever unless the L2 solenoid is operated. Engage feed screw and half nut manually, and then operate the L1 solenoid.

(5) Manually slide the carriage assembly to the right, and engage the limit switch stop with the limit switch.

(6) Electrically operate the L1 solenoid (1.18).

(7) With the half nut and feed screw fully engaged, note that the magnetic head pole

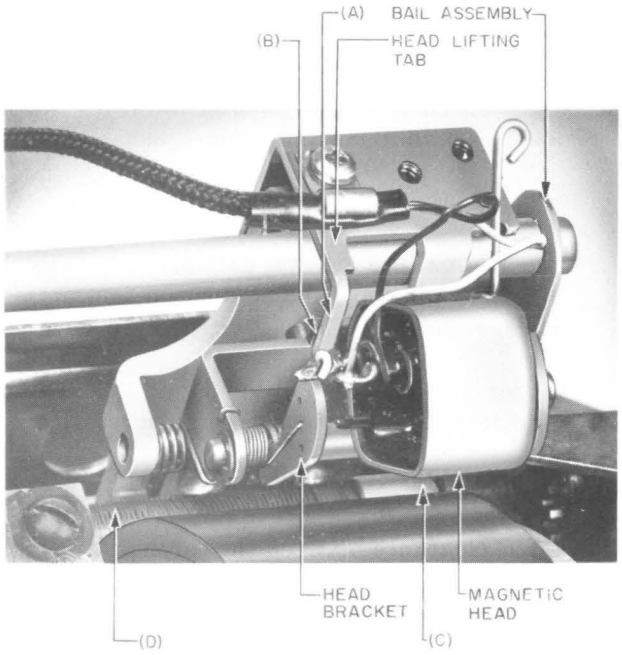

Fig. 4—Magnetic Head Lifting Tab Position (Shown in Unoperated Position

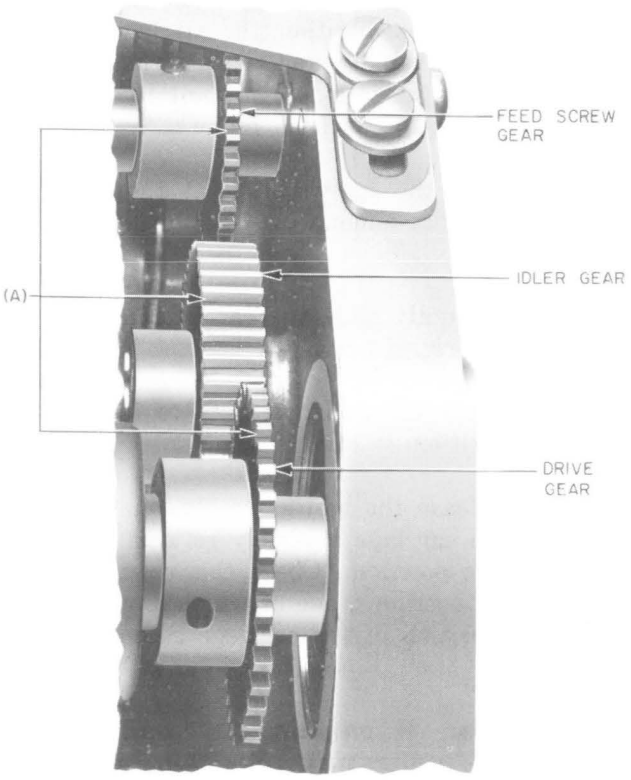

Fig. 5—Lubrication of Gears

piece rests on the recording band. Check this condition at several points of the carriage travel.

(8) Restore the limit switch stop to its original position.

2.06 ***Freedom of Carriage Feed Screw:*** The carriage feed screw shall turn freely in its bearing. Attempt to rotate the feed screw by means of a finger on the threads. Note that the feed screw turns freely within the backlash allowance between the gears. Gauge by feel.

2.07 ***Bail Assembly Movement***

(a) The bail assembly shall pivot freely on the lower slide rod. Pivot the bail assembly toward the drum manually, and then release it. The bail assembly should restore to its original position without bind or hesitation. Gauge by eye and feel.

(b) The endplay of the bail assembly [Fig. 1, (C) and 2, (C)] shall be

Min 0.002 inch
Max 0.008 inch

Take up the endplay of the bail assembly toward the right, and insert the proper gauge of the KS-6909 gauge nest into the space between the bail assembly and the boss on the support.

(c) The L1 solenoid shall operate electrically as specified in 1.18.

2.08 ***Bail Stop Position:*** With the L1 solenoid electrically operated, the clearance between the side of the slot in the bail assembly and the side of the bail stop [Fig. 6, (A)] farthest from the drum shall be minimum 1/32 inch throughout the entire carriage travel. ◗Check using the 92K gauge. This requirement should be checked each time the recorder is lubricated.◖

2.09 ***Carriage Half-Nut Position***

(a) With the bail assembly in the operated position, there shall be no perceptible endplay between the feed screw and half nut of the carriage assembly throughout the entire carriage travel. Gauge by feel. Check as follows.

(1) Move the carriage assembly to the right away from the bail.

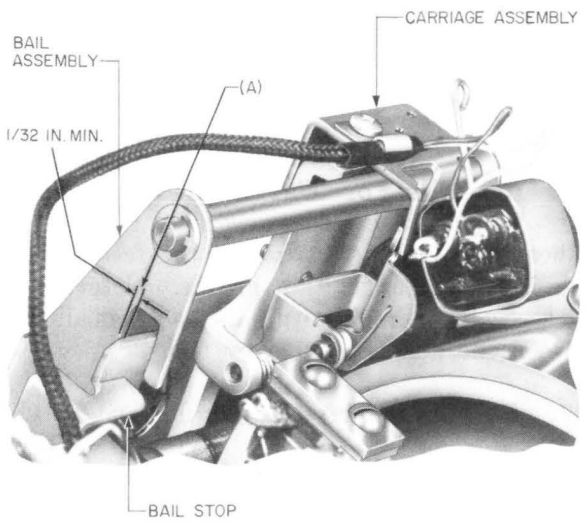

Fig. 6—Bail Stop Clearance (Shown in Unoperated Position)

(2) Manually engage the half nut and feed screw.

(3) Operate the L1 solenoid.

(4) Grasp the carriage assembly at the eyelet where the pulley cord is attached, and attempt to move the carriage assembly.

Caution: Do not force the carriage assembly when making this check.

Note: Motion due to compressing the feed screw thrust ball loading spring must not be mistaken for play between the feed screw and half nut. This will show as axial movement of the feed screw in its bearings.

(b) There shall be a clearance of minimum 0.020 inch between the crests of the carriage half-nut threads and the crests of the feed-screw threads throughout the return of the carriage assembly to the zero position when the L1 solenoid is unoperated and when the bail assembly is held against the right bail stop by the bail return spring. Gauge by eye. Check as follows.

(1) Adjust the limit switch stop for a maximum capacity announcement recording interval (3.005).

(2) Operate the L2 solenoid to release the limit switch.

(3) Slide the limit switch to the right until contact is made between the limit switch lever and limit switch stop.

(4) Release the L2 solenoid.

(5) Manually slide the carriage assembly to the right until the bumper on the carriage foot contacts the limit switch lever.

(6) Press the bail assembly, and note any scraping noise as the carriage assembly returns.

2.10 *Carriage Assembly*

(a) The clearance between the carriage assembly upper tab and the upper slide rod shall be perceptible throughout full carriage travel when the L1 solenoid is unoperated. Gauge by eye and feel.

(b) The carriage assembly shall slide freely against the upper slide rod and on the lower 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 from any point in its travel. Gauge by eye. Check as follows.

(1) Lock the limit switch at the maximum capacity announcement recording interval (3.005).

(2) Manually slide the carriage assembly to the right.

(3) Press the bail assembly to its operated position.

(4) Release the bail assembly, and note that the carriage assembly returns rapidly to the zero position. Check this requirement in several positions, one of which is close to the zero position of the carriage assembly.

Caution: When placing the bail assembly in its operating position, carefully engage the threads of the half nut

and feed screw to avoid possible damage to the threads.

(d) The force required to move the carriage assembly slowly to the right throughout the entire carriage travel and with the limit switch clamped in the maximum time position and the L2 solenoid de-energized shall be

Max 275 grams

Apply the 79B gauge at the return eyelet and, holding the gauge parallel to the carriage travel, measure the force required to pull the carriage assembly to the length of its travel.

(e) The magnetic head retainer spring shall clear the upper slide rod throughout the entire carriage travel, when the spring is in its notch in the carriage bracket, by

Min 1/32 inch

Gauge by eye.

2.11 ***Contact Alignment (S1, S2, and S3 Switches):*** The contacts shall line up (Fig. 7) so that the width on the contact surface of each contact bar falls wholly within the length of its mating bar. Gauge by eye.

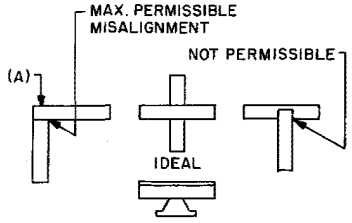

Fig. 7—Contact Alignment

2.12 ***Contact Separation and Follow (S1, S2, and S3 Switches)***

(a) In the unoperated position, S1 switch (Fig. 2) contacts shall have a separation between contacts of

Min 0.008 inch
Max 0.015 inch

Use KS-6909 gauge.

(b) In the unoperated position, S2 and S3 switch (Fig. 3) contacts shall have a separation between contacts of

Min 0.006 inch
Max 0.015 inch

Use KS-6909 gauge.

(c) When S2 and S3 switches are operated by the insulated pin on the drum, there shall be a follow of

Min 0.010 inch

Gauge by eye.

2.13 ***Carriage Foot Position:*** With the limit switch arm held in the zero position against the zero stop by the arm return spring, the clearance between the nylon bumper on the carriage foot and the adjacent limit switch contact spring shall be

Min 0.010 inch

Use KS-6909 gauge.

2.14 ***Limit Switch Clamp Operation***

(a) With the L2 solenoid electrically operated as specified in 1.18 and with the plunger bottomed in the solenoid, the clearance between the limit switch clamp and the lever assembly clip 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. Gauge by feel.

(c) With the limit switch stop set for a maximum capacity announcement recording interval (3.005) and the S1 limit switch arm clamped so that it is in contact with the stop, the time between the operation of S3 switch (which coincides with operation of L1 solenoid) and with the operation of S1 switch by the insulated pin on the carriage foot shall be

Min 2 minutes

Use the KS-3008 stopwatch.

(d) With the S1 limit switch arm clamped in any position less than the maximum time for which the limit switch stop has been set, the reproduce time of the tenth consecutive reproduce interval shall be equal to or a maximum of 2 seconds longer than the first reproduce interval.

Note: The reproduce interval is the time between the operation of S3 switch which caused engagement of the feed screw and half nut and the operation of S1 limit switch arm which de-energizes L1 solenoid.

(e) The reproduce interval shall never be less than the record interval.

Note: The record interval is the time between the operation of S3 switch (engagement of feed screw) and the clamping of the S1 limit switch arm by the de-energizing of L2 solenoid.

Check as follows.

(1) Check the setting of the limit switch stop to determine the maximum reproduce time.

(2) Remount the recorder in the announcement set as covered in 3.003 without the cover.

(3) Monitor the announcement by means of a 52-type head telephone set plugged into the J3 and J4 twin jacks.

(4) Operate S4 key located on the announcement set to CHECK which operates ST relay.

(5) Using a KS-3008 stopwatch, time the length of the first complete announcement. Start timing when the operation of S3 switch closes and operates L1 solenoid. Stop timing when the bail assembly releases and the carriage assembly starts to return (L1 solenoid de-energized by operating of S1 limit switch).

Note: The requirement is met if the last announcement is equal to or a maximum of 2 seconds greater than the first announcement.

(6) Return the S4 key to normal position.

(7) Remove the recorder from the announcement set as covered in 3.003.

2.15 ***Limit Switch Movement:*** The limit switch shall return freely from any point to the zero position when the L2 solenoid is electrically operated. The travel of the limit switch assembly shall be limited by engagement between the limit switch lever and the limit switch stop. Gauge by eye. Check as follows.

(1) Electrically operate the L2 solenoid.

(2) Using a KS-6320 orange stick, move the limit switch to the right and observe that the limit switch lever engages the limit switch stop.

(3) Release the limit switch, and observe that it returns to the zero position without hesitation. Check this requirement in several positions between the zero position and the limit switch stop, one of which is close to the zero position.

2.16 ***Position of Erase Coil Assembly***

(a) The erase coil assembly shall be positioned so that the central plane of the pole-piece gap is radial with respect to the recording band. Gauge by eye.

(b) There shall be a clearance between the recording band [Fig. 8, (A)] and the surface of the erase-coil pole pieces throughout one complete revolution of the drum of

Min 0.010 inch
Max 0.025 inch

Check this requirement at four positions, each approximately one fourth of a revolution apart. Use the KS-6909 gauge.

#2.17 ***Magnetic Head Lifting Tab Position***

(a) With the L1 solenoid electrically operated, the clearance between the magnetic head bracket and the head lifting tab [Fig. 4, (A) and 9, (A)] shall be

Min 1/32 inch

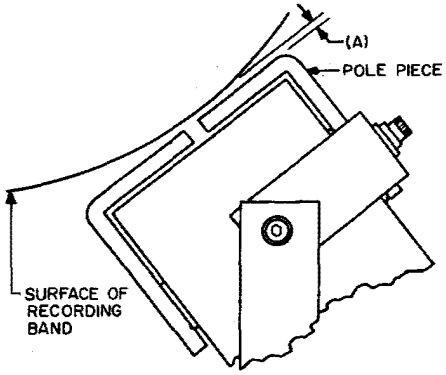

Fig. 8—Erase Coil Clearance

Gauge by eye.

(b) With the L1 solenoid electrically operated, the clearance between the magnetic head and the head lifting tab [Fig. 4, (B) and 9, (B)] shall be

Min 1/32 inch

Gauge by eye.

(c) With the L1 solenoid unoperated, the clearance between the magnetic head and the recording band [Fig. 4, (C)] shall be

Min 1/32 inch

Gauge by eye.

#2.18 ***Magnetic Head Pressure:*** With the L1 solenoid electrically operated, the pressure of the magnetic head (Fig. 10) on the recording band shall be

Min 28 grams
Max 43 grams

Electrically operate the L1 solenoid. Insert the tip of the 68B gauge under the portion of the magnetic head directly to one side of the pole piece, as shown in Fig. 10, and measure the pressure just as the magnetic head leaves the band.

2.19 ***Drum Speed:*** The speed of the drum shall be

Min 19 RPM
Max 22 RPM

Set the recorder in operation and, using the roll pin securing the pulley to the shaft as a marker, count the revolutions during a 1-minute period. Use the KS-3008 stopwatch.

#2.20 ***Flat Drive Belt***

(a) The belt shall ride in the center of the drum pulley within 1/16 inch.

(b) The edges of the belt shall not ride on the flanges of the idler pulley.

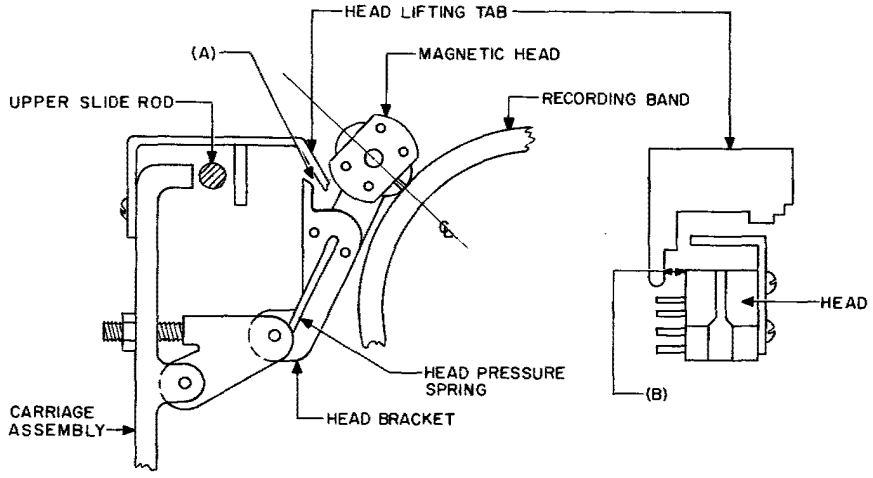

Fig. 9—Upper Slide Rod Details (Head in Recording Position)

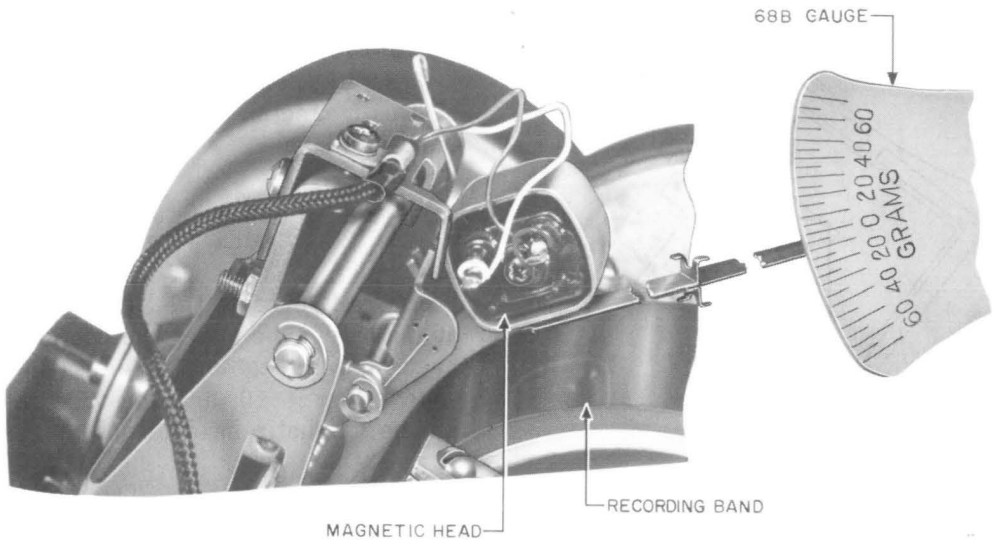

Fig. 10—Method of Gauging Magnetic Head Pressure

(c) The belt shall not slip.

(d) The belt shall not be nicked, cracked, worn, or stretched and shall be free of oil or grease.

Note: To check requirements (a) through (d), operate the recorder and gauge by eye.

#2.21 ***Wear of Magnetic Head:*** The length of the flat worn on the magnetic head pole piece shall be

Max 7/32 inch

Lift the magnetic head to its highest position, and observe the contacting surface of the pole piece.

#2.22 ***Round Drive Belts:*** The three round drive belts (Fig. 1) shall be in tact and free from cuts, cracks, or visible wear. These belts are only on recorders equipped with B-650412 drive assembly.

3. ADJUSTING PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
325B	Adjuster
485A	Smooth jaw pliers
486A	Oilcan
524A	Spring adjuster
524B	Spring adjuster
534E	Spring adjuster
KS-6320	Orange stick
KS-8511	4-1/2 inch bent tweezers
KS-14164	Brush
R-2670	3/32-inch Allen socket screw wrench
R-2958	5/64-inch Allen socket screw wrench
R-2959	1/16-inch Allen socket screw wrench

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	4-inch B screwdriver
—	6-inch B screwdriver
—	6-inch C screwdriver
GAUGES	
68B	70-0-70 gram gauge
79B	0-1000 gram push-pull tension gauge
▶92K	Feeler gauge◀
KS-3008	Stopwatch (or equivalent)
KS-6909	Thickness gauge nest
MATERIALS	
KS-2423	Twill cloth
KS-7860	Petroleum spirits
KS-16326 L1	Oil**
KS-16328 L2	Cleaner-lubricant**

**▶Available from WECo Supply Center, 650 Liberty Avenue, Union, New Jersey, 07083.◀

—	SF-1147 silicone oil, 200 centistokes, General Electric Company

▶***Note:*** When ordering SF-1147 silicone oil, be sure to specify 200 centistokes. (Available from Wilcox Electric Company, 14th and Chestnut Streets, Kansas City, Missouri, 64127, Part No. 264847-1.)◀

▶KS-19139 L4	Lubricant (Available from American Oil Company, 283 Wilson Avenue, Newark, New Jersey, 07105.)◀

TEST APPARATUS	
52-type	Head telephone set

3.002 ***Removing and Remounting Announcement Set:*** Remove the announcement set from the mounting bracket as follows.

(1) Disconnect the ac supply by removing the plug from its associated socket.

(2) Using the 6-inch C screwdriver, loosen the four captive screws on the front cover (two on each side) and remove the cover by sliding it forward.

(3) If a KS-16765 L8 power cord is provided, disconnect the P2 plug from its associated connector.

(4) If the power cord is not provided with a plug, identify each wire with its respective terminal board number and remove all connections from TB1.

(5) Using the 6-inch C screwdriver, loosen and fully disengage the screw located just below the left end of the recorder motor support.

(6) Grasp the set on the ends and bottom, lift upward, and tilt the bottom edge slightly forward.

Note: This operation disengages the small projections on the set from the holes in the top lip of the rear panel. The set is now free of the mounting bracket. Removal of the recorder is covered in 3.003.

(7) To remount the set, reverse the procedure.

Note: Information regarding terminal board connections is given in SD-95283-01 or SD-95286-01.

3.003 ***Removing and Remounting Recorder:*** Remove the recorder from the announcement set as follows.

(1) Using the 6-inch C screwdriver, loosen the four captive screws on the front cover (two on each side) and remove the cover by sliding it forward.

(2) Tilt the set back on the long rear edge.

(3) Using the 6-inch C screwdriver, remove the three mounting screws from the bottom of the recorder. Retain washers, screws, and lockwashers for remounting.

(4) Disconnect the P2 plug from the associated jack.

(5) Remove the recorder from the set by grasping the base and sliding forward with the left end of the recorder foremost.

(6) Remount the recorder by reversing the procedure. When remounting the cover, slide it back to properly engage the clips with the rear edges of the set chassis.

3.004 ***Conversion of KS-16765 L3 Recorder From a 2-Minute Maximum Announcement Recording Capacity to a 3-Minute Maximum Announcement Recording Capacity:*** To change the KS-16765 recorder maximum announcement recording capacity from 2 to 3 minutes, proceed as follows.

Note: Only the later-type recorder (Fig. 1) may be converted.

(1) Remove the recorder from the announcement set as covered in 3.003(1) through (5).

(2) Remove the flat drive belt.

(3) Using the 6-inch B screwdriver, remove the four screws and lockwashers which fasten the motor drive assembly to the recorder base.

(4) Remove the three round drive belts.

(5) Using the proper size Allen wrench, remove the setscrew located in the collar of the B-650416 pulley (Fig. 11).

(6) Remove the pulley.

(7) Transfer the setscrew to the B-650417 pulley.

(8) Install the B-650417 pulley, and align the grooves in the pulley with the grooves in the motor shaft. Ensure that the setscrew is against the flat of the drive shaft.

(9) Remount the round drive belts, and ensure that they are in the proper grooves.

(10) Remount the flat drive belt.

(11) Remount the recorder in the announcement set as covered in 3.003.

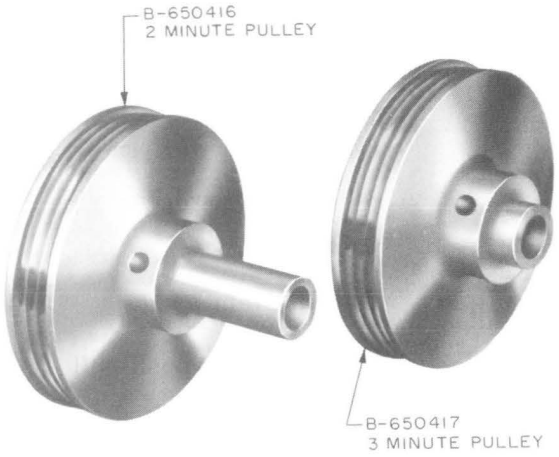

Fig. 11—Drive Pulleys

3.005 ***Announcement Recording Interval Adjustment:*** The seven marks on the limit-switch stop represent the time intervals in seconds (Table A) to which the recorder may be set for varying the length of announcements. The mark nearest the bent end of the stop is mark 1 and represents 0 second. For intervals other than those shown, it will be necessary to estimate the setting between the two appropriate marks. To change the announcement interval, proceed as follows.

TABLE A

ANNOUNCEMENT RECORDING INTERVAL

MARK	2-MINUTE CAPACITY	3-MINUTE CAPACITY
	SECOND	SECOND
1	0	0
2	15	22-1/2
3	30	45
4	45	67-1/2
5	60	90
6	90	135
7	120	180

(1) With the carriage assembly in the zero position, operate L2 solenoid so that the limit switch moves to the zero position.

(2) Using the proper size Allen wrench, loosen the screw securing the limit switch stop (Fig. 1 and 2).

(3) Position the limit switch stop (hexagonal rod with markings) so that the mark representing the desired maximum time interval is flush with the left face of the limit switch stop tube.

(4) Tighten the screw to secure the limit switch stop.

(5) If the setting has been changed for the purpose of checking a requirement, restore the setting to its previous adjustment.

3.01 ***Cleaning***

(a) ***Switch Contacts:*** Clean the switch contacts (Fig. 2 and 3) in accordance with approved procedures as covered in the appropriate sections in Division 069.

Caution: Before using the KS-16328 L2 cleaner-lubricant as covered below, thoroughly shake the container. Do not permit the cleaner-lubricant to come in contact with any part of the mechanism other than the part being cleaned.

(b) ***Magnetic Head:*** Clean the pole piece of the magnetic head as follows.

(1) Pivot the head away from the recording band, and lock it against the carriage assembly with the head locking spring.

(2) Place a clean, dry KS-2423 cloth over the top of the recording band and adjacent parts.

(3) Using a clean KS-2433 cloth moistened with KS-16328 L2 cleaner, clean the surface of the pole piece.

(4) Using a clean, dry KS-2423 cloth, immediately dry the magnetic head and other surfaces contacted by the cleaner.

Note: Both the magnetic head and the recording band shall be cleaned if either is cleaned.

(c) ***Flat Drive Belt:*** If requirements are not met, replace the belt (Section 034-354-801).

(d) ***Recording Band:*** Clean the recording band (Fig. 3) as follows.

(1) Remove the flat drive belt from the drum pulley.

(2) Using a KS-2423 cloth moistened with KS-16328 L2 cleaner, rub the recording band. Rotate the band to facilitate cleaning the entire surface.

(3) Using a clean, dry KS-2423 cloth, rub the recording band until a dry, polished surface is obtained.

(4) After cleaning the band, apply a thin film of General Electric SF-1147 200 centistokes silicone oil to the recording band using a KS-2423 cloth.

(e) Clean other parts of the mechanism with a clean, dry KS-2423 cloth.

3.02 ***Lubrication***

(1) Using the 486A oilcan and the KS-14164 brush, apply the specified quantity of ⧫KS-16326 L1 oil and KS-19139 L4 lubricant⧫ to the parts listed in the requirements.

(2) ***Gear Teeth, Feed Screw, and Half Nut:*** To gain access to all gear teeth, feed screw threads, and half nut, rotate the drum.

3.03 ***Record of Lubrication:*** ⧫The users should maintain a record showing dates lubricants were applied to the recording bands [2.01(d)] and the motor bearings, feed screw bearings, feed screw, half nut, and gear teeth [2.02(a), (b), (c), (d), and (e)].⧫

3.04 ***Drum Shaft Endplay:*** The drum shaft is mounted in ball bearings, and the endplay is negligible. If endplay is present, replace drum assembly (Section 034-354-801).

3.05 ***Magnetic Head Position:*** If the magnetic head pole piece rides off the recording band at either end of a cycle, check that the band is properly positioned. The right edge of the band should coincide with the right edge of the drum. If the requirement is not met, reposition the band. Ensure that the head is properly positioned on its supporting bracket.

3.06 ***Freedom of Carriage Feed Screw:*** Failure to meet the requirement may be due to dirt and grit on the feed screw bearings, bent retaining plate, or bent stop assembly. Clean the bearings or replace the covers as follows.

(1) Remove the retaining plate at the left end.

(2) Remove the stop assembly, cable clamp, and solder lug at the right end.

(3) Using the 4-inch B screwdriver, remove the two screws from each cover. Take care not to loose the ball at each end of the feed screw.

(4) Remove the steel balls at each end of the feed screw.

(5) Using the KS-8511 tweezers, remove the spring from the right end of the feed screw.

(6) Using a KS-2423 cloth, wipe the balls clean.

(7) Using a KS-14164 brush and KS-7860 petroleum spirits, clean the internal surface of the bearings.

(8) Using a KS-6320 orange stick and KS-2423 cloth, clean the holes in the ends of the feed screw.

(9) Using the 486A oilcan with KS-16326 L1 oil, coat the balls and apply two drops to the inside surface of each bearings and two drops in each end of the feed screw.

(10) Insert the spring and the ball in the right end of the feed screw, respectively.

(11) Remount the stop assembly being sure to replace the cable clip in proper position and the solder lug on the lower screw.

(12) Insert the ball in the left end of the feed screw, and remount the left retaining plate.

Caution: Do not excessively tighten the screws mounting the stop assembly and retaining plate.

3.07 ***Bail Assembly Movement***

(a) 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 (b). A defective retractile spring shall be replaced. Binding of the bail assembly on the lower slide rod may be due to dirt or gummy substances on the slide rod. Clean the slide rod as follows.

(1) Using a KS-14164 brush and KS-7860 petroleum spirits, clean the slide rod. Use the petroleum spirits sparingly, taking care not to get any on the wiring or on the carriage bearings.

(2) Using a clean, dry KS-2423 cloth, wipe the slide rod dry.

(b) Adjust the endplay of the bail assembly as follows.

(1) Using the proper size Allen wrench, loosen the setscrew holding the lower rod in the boss.

(2) Shift the bail assembly to the right, and insert the proper gauge of the KS-6909 gauge nest into the space between the bail assembly and the boss.

(3) Using the KS-6320 orange stick, take up the endplay of the bail assembly by pressing firmly against the retaining ring on the right end of the rod.

(4) Using the Allen wrench, tighten setscrew securely against the rod.

(5) Remove the gauge, and check that the requirement is met.

(c) Failure of the L1 solenoid to operate may be due to improper positioning of the solenoid or to the presence of dirt or gummy substances. The plunger of an improperly positioned solenoid

will tend to pull the linkages of the bail foot to one side when operated electrically. To correct this condition, proceed as follows.

(1) Using the 4-inch B screwdriver, loosen the mounting screws securing the solenoid.

(2) Shift the solenoid as required.

(3) Tighten the mounting screws securely, and recheck the requirements. If requirements are met, omit (4) through (12). If requirements are not met, remove and clean the solenoid as follows.

(4) Carefully mark the position of the solenoid.

(5) Using the 4-inch B screwdriver, remove the mounting screws and washers securing the solenoid.

(6) Using the 4-inch B screwdriver, remove the clamp securing the wires just above the solenoid and on the right side of the recorder.

(7) Slide the solenoid out of position, taking care not to damage the connecting wires.

(8) Using the KS-14164 brush and KS-7860 petroleum spirits, clean the plunger and the interior of the solenoid.

(9) Using a clean, dry KS-2423 cloth, wipe the plunger and the solenoid dry.

(10) Remount the solenoid in its previous position, and tighten mounting screws securely.

(11) Remount the cable clamp and tighten securely.

(12) Recheck requirement. If requirement is not met, replace the solenoid (Section 034-354-801).

3.08 ***Bail Stop Position:*** If the clearance between the bail stop [Fig. 6, (A)] and bail assembly in the operated position is not satisfactory, adjust the position of the stop as required using the 325B adjuster to bend the bail stop as shown in Fig. 12.

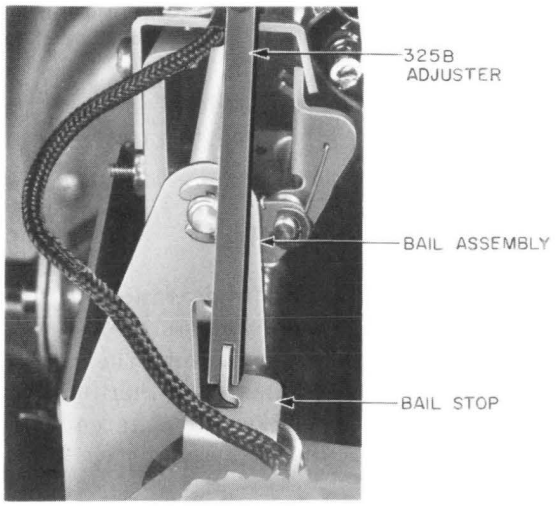

Fig. 12—Method of Adjusting Bail Stop Position

3.09 ***Carriage Half-Nut Position***

(a) Failure to meet the endplay requirements may be due to the lack of clearance between the bail and bail stop, L1 solenoid plunger not seating fully, lack of tension in spring between bail and L1 solenoid, or worn half-nut. Make adjustments as follows.

(1) Adjust clearance between bail and bail stop to meet requirement in 2.08.

(2) Clean and adjust L1 solenoid plunger in accordance with 3.07(c).

(3) Replace spring between bail and L1 solenoid (Section 034-354-801).

(4) Replace carriage assembly (Section 034-354-801).

(b) Failure to meet clearance requirements may be due to weak or broken return spring in L1 solenoid, sticking plunger of L1 solenoid, bail stop out of adjustment, or incorrect clearance between carriage tab and upper slide rod. Make adjustments as follows.

(1) Replace L1 solenoid spring.

(2) Clean the L1 solenoid as covered in 3.07(c).

(3) Adjust the bail stop to meet requirement in 2.08.

(4) Adjust clearance between carriage tab and upper slide rod to meet requirement in 2.08.

3.10 *Carriage Assembly*

(a) Failure to meet the clearance requirement or of the carriage assembly to slide freely may be corrected by adjusting the position of the upper tab. In making either adjustment, take care not to damage the adjacent wires or magnet head. Make adjustments as follows.

(1) To reduce clearance, using the 485A pliers as shown in Fig. 13, bend the tab toward the upper slide rod.

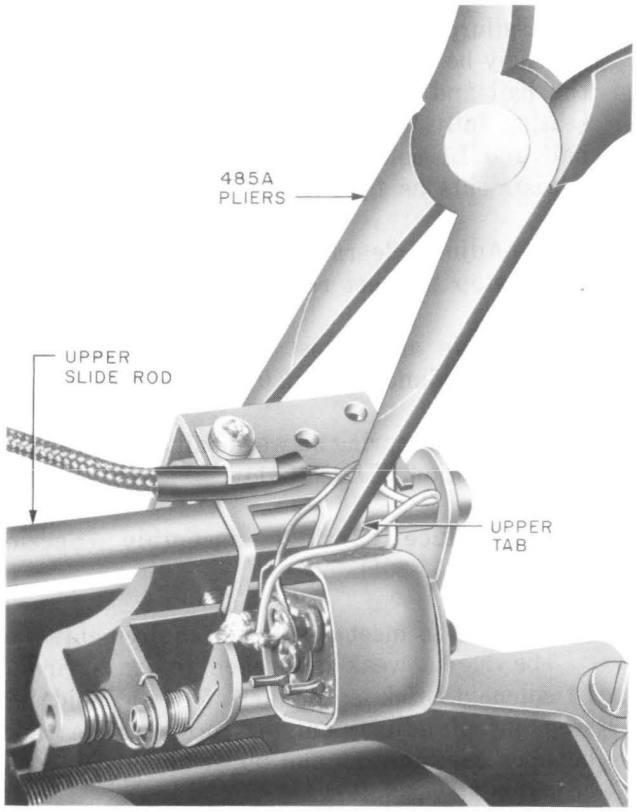

Fig. 13—Method of Adjusting Upper Tab for Minimum Clearance

(2) To increase the clearance, bend the tab away from the upper slide rod. To do this, it is necessary to remove the brass bracket.

(a) Using the 4-inch B screwdriver, remove the screw and lockwasher located in the front center of the bracket.

(b) Using the 485A pliers, bend the tab slightly and replace the bracket.

(c) Recheck the requirement.

(b) If the carriage assembly does not return properly due to improper bail assembly operation (carriage half nut does not completely disengage from the feed screw), check requirements in 2.07, 2.08, and 2.09. Readjust, if necessary, to meet the requirements.

(c) Failure of the carriage assembly to return properly, due to hesitation of the carriage, is an indication of binding between the carriage and the lower slide rod or between the tab and the upper slide rod. Make adjustments as follows.

(1) Disengage the carriage half nut from the feed screw and slide the carriage assembly back and forth to determine if there is binding.

(2) If binding is present, clean the lower slide rod with a KS-14164 brush and KS-7860 petroleum spirits.

(3) Dry with a clean, dry KS-2423 cloth.

(4) Use the petroleum spirits sparingly, taking care not to get any on the wiring.

(5) If cleaning does not remove the binding, replace defective parts (Section 034-354-801).

Caution: When the carriage assembly is moved by hand, the lever of S1 switch should always be moved to the extreme right. Operate the L2 solenoid to release the brake while the switch is moved. Damage will result to the COPRENE* brake shoe and cause slippage of the switch if this is not done.

*Registered trademark of the Maas & Waldstein Company.

(d) If failure of the carriage assembly to return properly is due to improper operation of the pulley, proceed as follows.

(1) Check that the nylon return line is not broken and is securely attached to both the pulley and the line holding eyelet in the tab of the carriage assembly. If the nylon line is defective, replace the line (Section 034-354-801).

(2) Check that the ends of the coil spring are hooked in the holes provided on the bail assembly and the pulley.

(3) Check for sufficient spring tension. If more tension is needed, loosen the nylon line from the eyelet and pull the line so that it rotates the pulley about one-half turn. Fasten the line to the eyelet. If this does not correct the condition, replace the coil spring (Section 034-354-801).

(4) Check the molded pulley for wear or wedging of the spring between pulley and the bail. If the pulley is worn, replace the pulley (Section 034-354-801).

(e) If clearance between the magnetic head retainer spring and the upper slide rod fails to meet requirement, bend the spring using the 485A pliers to meet the requirement.

3.11 ***Contact Alignment (S1, S2, and S3 Switches):*** If any switch fails to meet the contact alignment requirement, replace switch (Section 034-354-801).

3.12 ***Contact Separation and Follow (S1, S2, and S3 Switches)***

Note: 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 not have sharp bends due to adjusting. A gradual bow is permissible.

(a) 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. Adjust using the 534E spring adjuster on the stationary springs and the 524A or B spring adjuster on the operating springs. To adjust, place the adjuster on the spring, slide it back to where the spring leaves the insulators, and adjust the spring up or down as required.

(b) 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 B adjuster for operating springs.

(c) 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 mounting screw securing the switch to the bracket with the 4-inch B screwdriver and reposition the switch as required. Tighten the screw securely.

(d) Recheck requirements in 2.11 and 2.12.

3.13 ***Carriage Foot Position:*** Adjust as follows.

(1) Using the 4-inch B screwdriver, loosen the screw securing the zero stop.

(2) Move the stop as necessary to obtain required clearance.

(3) Tighten the screw to secure the stop, and recheck the requirement.

3.14 ***Limit Switch Clamp Operation***

(a) 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.

(1) Using the 4-inch B screwdriver, loosen the two mounting screws securing the L2 solenoid.

(2) Shift the solenoid as required, taking care to keep the solenoid in the same horizontal position.

(3) Tighten the two mounting screws securely, and check that requirement in 2.13 is met.

(b) Failure of the limit switch clamp to securely clamp the limit switch assembly may be due to a defective clamp, defective retractile spring, worn brake shoe, or worn lever clip (Fig. 14). To correct this, proceed as follows.

(1) Replace the retractile spring if defective.

(2) If requirement is still not met, replace the limit switch assembly (Section 034-354-801).

(c) If requirements (a) and (b) are met, requirements (c) through (e) are also met.

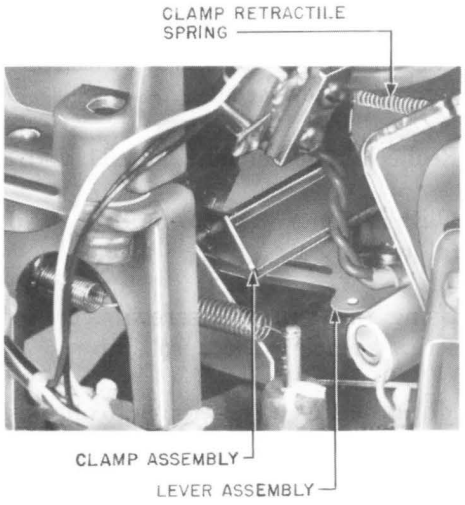

Fig. 14—Limit Switch Detail

3.15 *Limit Switch Movement*

(a) If limit switch fails to return freely to its zero postion, check requirement in 2.14.

(b) Failure of the limit switch lever to fully engage the stop may be corrected as follows.

(1) Using the proper size Allen wrench, loosen the screw in the stop tube (Fig. 1 and 2).

(2) Rotate the stop in its tube, as required, to obtain proper engagement.

(3) Tighten screw securely.

3.16 *Position of Erase Coil Assembly:*

To meet requirements (a) and (b), proceed as follows.

(1) Using the 4-inch B screwdriver, loosen the two screws securing the erase coil assembly to the U-shaped bracket.

(2) Position the erase coil on the bracket so that the erase coil pole pieces are parallel to the recording band for its entire width and with the pole piece gap closest to the band.

(3) Position the coil assembly on the bracket to meet the clearance requirement [Fig. 8, (A)]. Clearance should be uniform across the width of the recording band.

(4) Tighten the two screws securely, and check the requirements.

3.17 *Magnetic Head Lifting Tab Position:*

Adjust the lifting tab (Fig. 4 and 9), as required, using the 325B adjuster. Take care not to damage the wiring.

3.18 *Magnetic Head Pressure:*

To adjust the head pressure, proceed as follows.

(1) Check that the magnetic head lifting tab position meets requirement in 2.17.

(2) Check that the magnetic head and bracket assembly pivots on the shaft without binding. If binding is present, using KS-7860 petroleum spirits and KS-14164 brush, clean as required. Care shall be taken not to drop spirits on head or drum. Using a clean, dry KS-2423 cloth, thoroughly dry the parts.

(3) Adjust the magnetic head pressure as follows.

(a) Using the KS-8511 tweezers, remove the end of the head pressure spring (Fig. 9) from the hole in the head bracket and insert it in the next hole as required.

Note: Moving the spring end to a hole further away from the drum will increase magnetic head pressure, and moving the spring end toward the drum will decrease the pressure.

(b) If requirement is not met, replace the spring (Section 034-354-801).

3.19 ***Drum Speed:*** To adjust the drum speed, proceed as follows.

(1) Check the binding of parts by removing the flat belt and ensuring the drum clears all parts and rotates freely. If binding is present, adjust or replace associated parts (Section 034-354-801).

(2) Check for loose or damaged flat drive belt. If drive belt is loose, damaged, or worn, proceed as covered in 3.20.

(3) Check the round drive belts (recorders equipped with B-650412 drive assembly) for requirements in 2.22.

(4) Recheck requirements.

(5) If requirements are not met, replace motor starting capacitor (Fig. 15) (Section 034-354-801).

(6) If requirements are not met following the above procedure, replace the motor (Fig. 2) (Section 034-354-801).

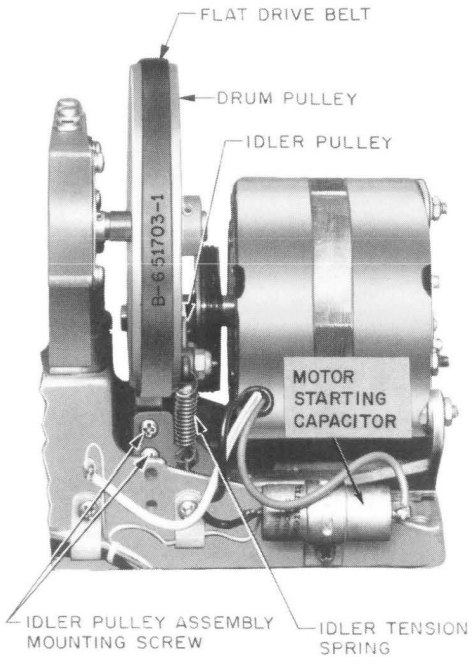

Fig. 15—Idler Pulley Detail (KS-16765 L3 Recorder Equipped With B-650412 Drive Assembly

3.20 ***Flat Drive Belt***

(a) If KS-16765 L3 recorder equipped with B-650412 drive assembly (Fig. 15) is used and the flat drive belt runs to either side of the drum pulley, proceed as follows.

(1) Using the 4-inch B screwdriver, loosen the two mounting screws which fasten the idler pulley assembly to the motor support.

(2) Shift the idler pulley as necessary to meet the requirements in (a) and (b).

(3) Securely tighten the mounting, and recheck the requirement.

(b) If belts are slipping, proceed as follows.

(1) Check for binding of parts [3.19(1)].

(2) Check for improper spring tension on the idler pulley. If adjustment is needed, reposition spring on idler pulley arm.

Note: To increase the spring tension, move the spring on the idler pulley arm toward the end of the arm. To decrease the tension, move the spring toward the idler pulley.

(c) Check the flat drive belt for nicks, cracks, wear, stretch, or presence of oil or grease. If necessary, replace the belt (Section 034-354-801).

3.21 ***Wear of Magnetic Head:*** If wear on the magnetic head exceeds the requirement, replace the head.

3.22 ***Round Drive Belts:*** Replace worn or damaged belts.