RECORDER-REPRODUCERS

KS-12068 L3, L4, L5, L6, L7,

AND L3 CONVERTED PER X-4174

PIECE-PART DATA AND REPLACEMENT PROCEDURES

1. GENERAL

1.01 This section provides information for ordering replacement parts to be used in maintenance of KS-12068 L3, L4, L5, L6, L7, and L3 converted in accordance with X-4174 recorder-reproducers. This section also describes approved procedures for replacing these parts.

1.02 This section is reissued to

(a) Change paragraph 1.01 to give general purpose of BSP

(b) Add R-2485 wrench to list of tools (3.01) and delete 68B gauge and all test apparatus described in 3.01 of previous issue

(c) Add ***Caution*** regarding overheating of magnetic heads when soldering leads to the terminals of head units (3.15)

(d) Omit information describing the checking and adjusting procedure for positioning the record heads [3.16(c) through (h) and 3.18(c) through (h) in previous issue], which is now covered in Section 034-351-701.

1.03 Part 2 of this section covers the piece-part numbers and the corresponding names of the parts which it is practicable to replace in the field in the maintenance of KS-12068 L3, L4, L5, L6, L7, and L3 converted in accordance with X-4174 recorder-reproducers (after this referred to as the ***machines***). No attempt should be made to replace parts not designated. Part 2 also contains explanatory illustrations showing the different parts.

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2.

1.05 ***List 7 Machines:*** The KS-12068 L7 machine is the same as the L6 machine except for the Micro Switch cam arrangement. Where the L6 machine has a single cam mounted on the drum, the L7 machine has two cams: one is mounted in a fixed position on the drum and the other is mounted on the first cam and is adjustable with relation to the first. The complete drum and cam assembly with the adjustable cam positioned during manufacture can be ordered as the B-554721 cam and drum assembly (2.02). If drum or cams are ordered separately, the adjustable cam must be positioned in accordance with local instructions. Piece-part data for the parts of the drum and cam assembly are as follows:

Drum	B-188807, Det 1 Drum
Fixed Cam	B-554719 Cam
Mounting Screws	P-290756 Screw
Spacer	B-554720, Det 2 Spacer
Adjustable Cam	B-554716 Cam
Mounting Screws	P-290747 Screw
Washers	P-284148 Washer
Spacer	B-554720, Det 1 Spacer

1.06 ***Make-Busy Information***

(a) ***KS-12068 L3, L5, L6, and L3 Converted Per X-4174 Machines:*** Before performing any work on the machine, notify the traffic department that it is necessary to remove the machine from service.

(b) ***KS-12068 L4 Machine:*** Before performing any work on the machine, remove the equipment from service in accordance with local instructions.

1.07 ***One drop of KS-16326 L1 oil*** for the purpose of this section is the amount of oil discharged from the nozzle of a 486A oil can when the sides are depressed until a drop is released.

2. PIECE-PART DATA

2.01 The illustrations in this part show the various piece parts in their proper relation to other parts of the machine. The piece-part

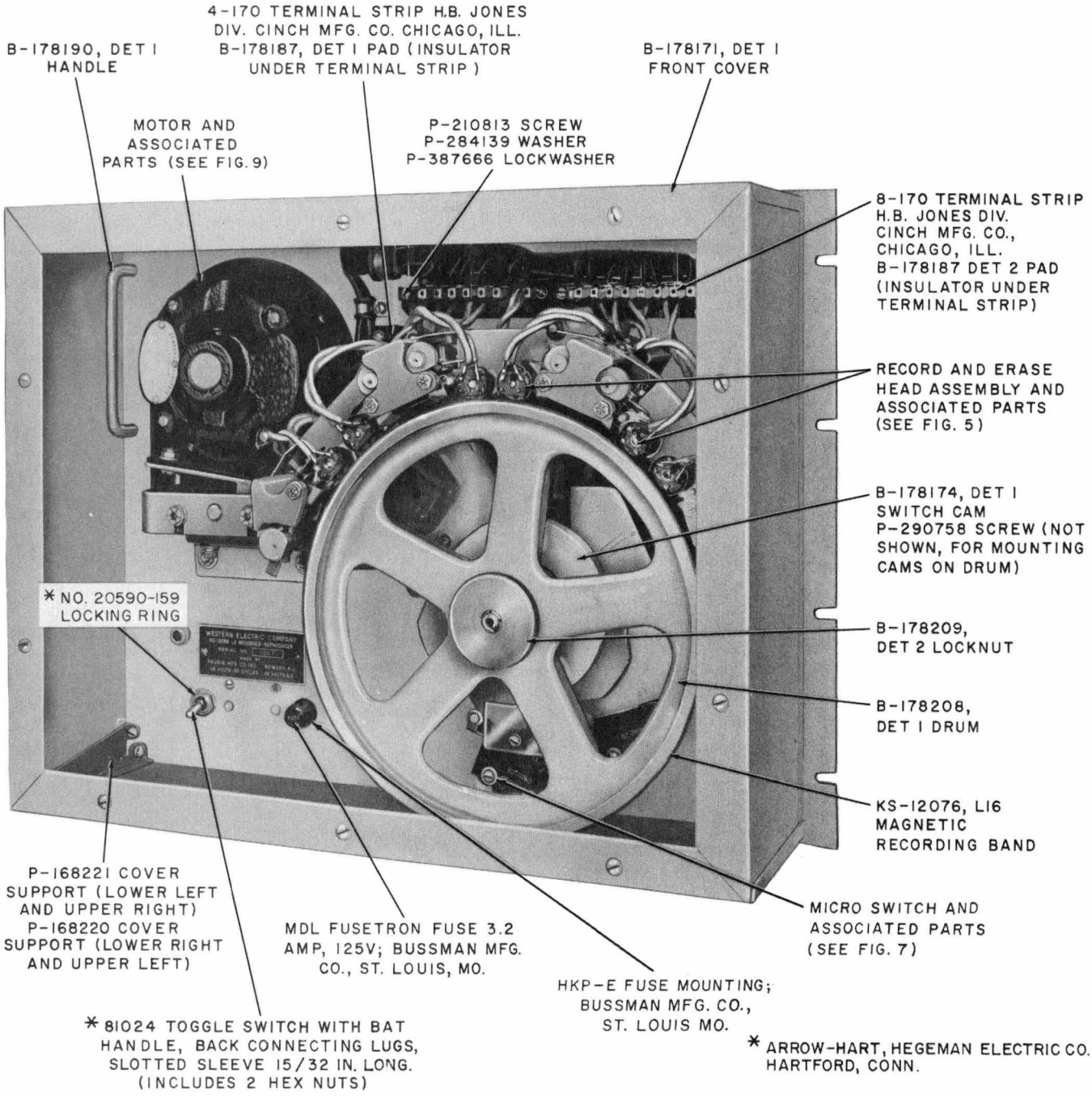


Fig. 1 — KS-12068 L3 and L3 Converted per X-4174 Recorder-Reproducers — Front View

numbers are given with the names of the parts as listed by the Western Electric Company Merchandise Department. When these names differ from those in general use in the field, the latter names, in some cases, are shown in parentheses.

2.02 When ordering parts for replacement purposes, give both the piece-part number and the name of the piece part — for example, ***P-297395 Screw.*** If a part identified by other than a piece-part number is required, order the

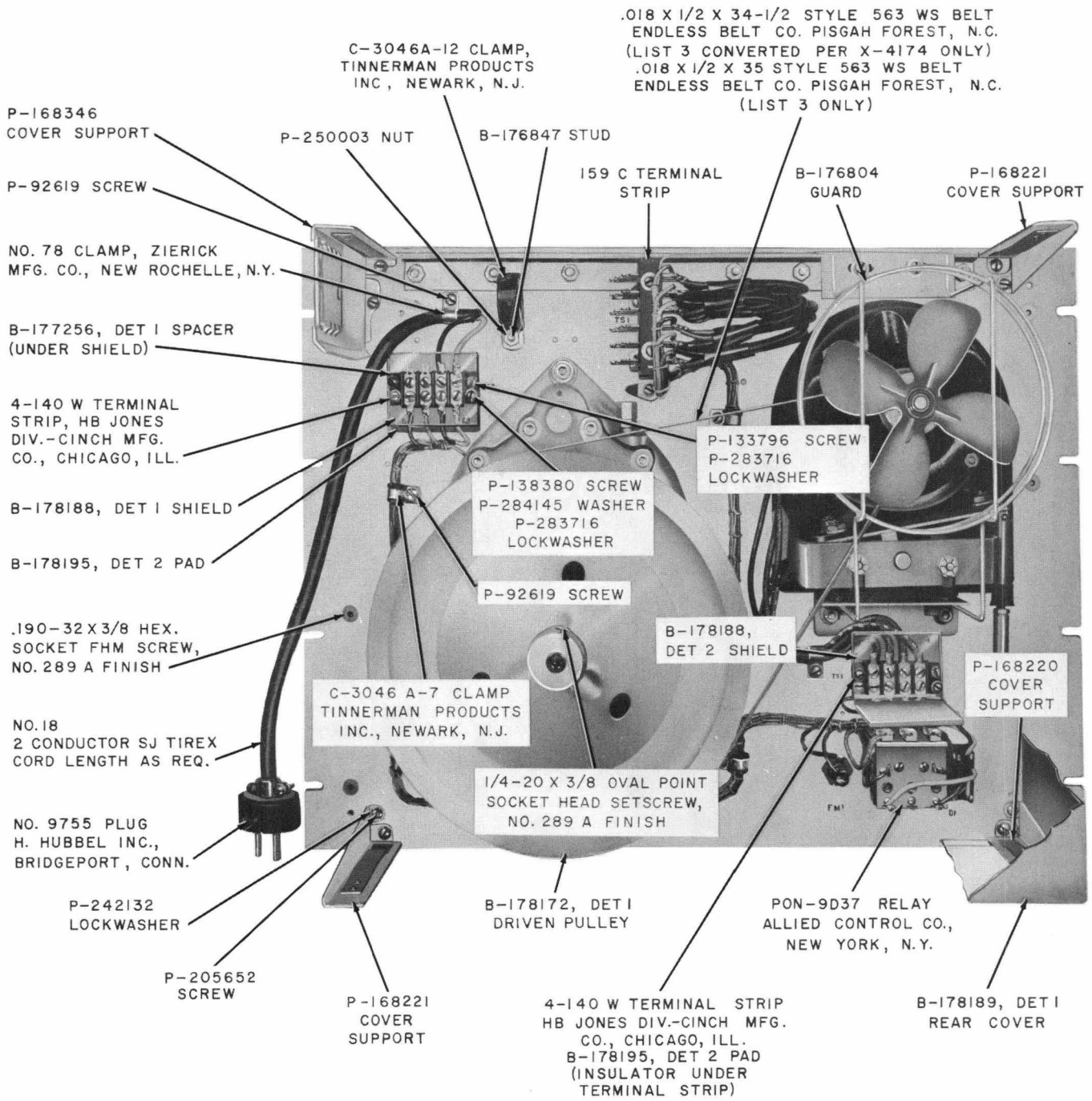


Fig. 2 — KS-12068 L3 and L3 Converted per X-4174 Recorder-Reproducers — Rear View

part by the drawing and detail number and the part name; also specify for KS-12068 L3, L4, L5, L6, or L3 converted per X-4174 recorder-reproducer — for example, ***B-178172, Det 2 Pad for KS-12068 L5 Recorder-Reproducer or BZ-2RW2 Micro Switch for KS-12068 L3 Recorder-Reproducer.*** Do not refer to the BSP number nor to any information shown in parentheses following the piece-part number.

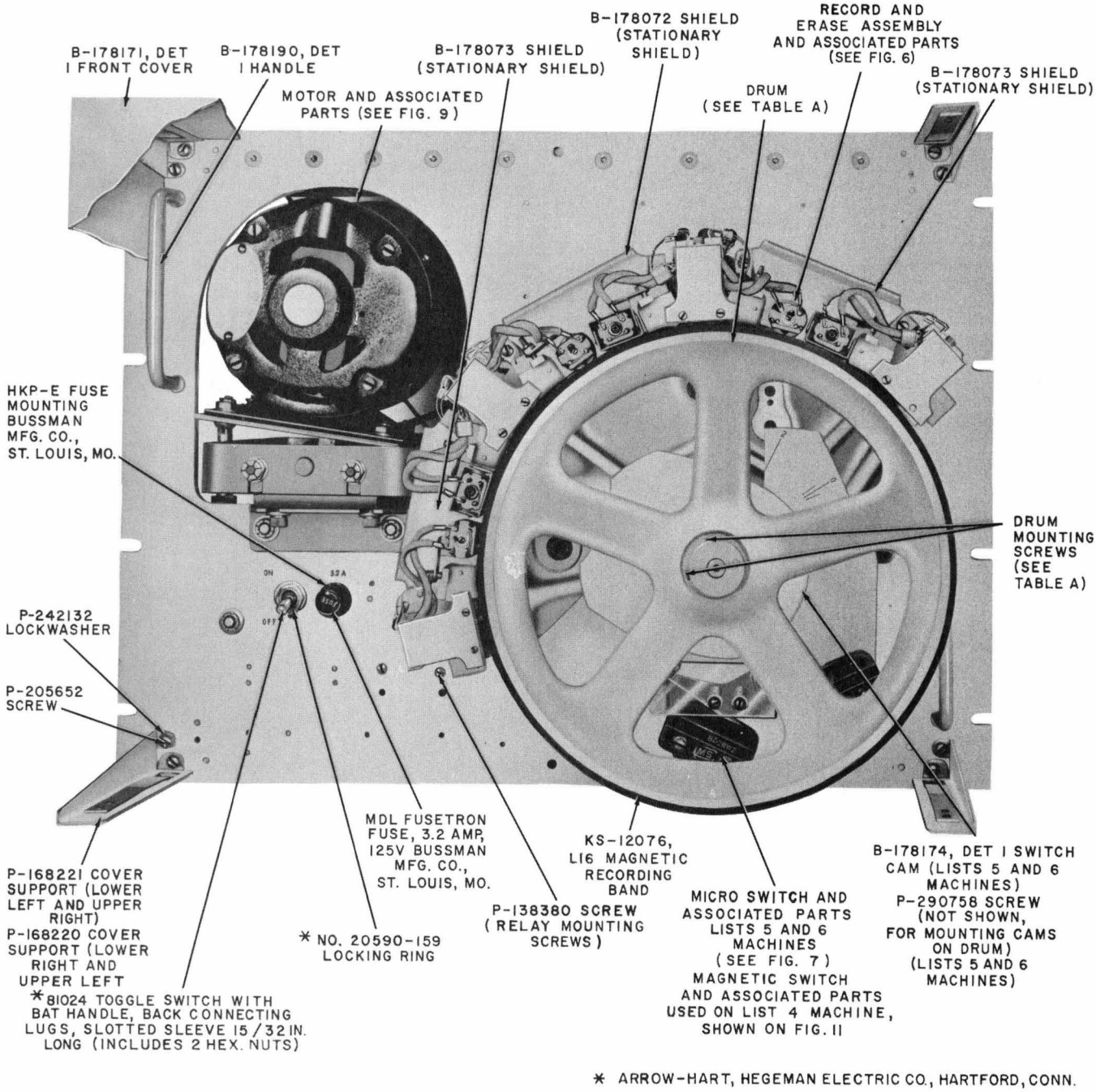


Fig. 3 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Front View (L5 machine shown)

TABLE A — DRUM — KS-12068 L4, L5, AND L6 RECORDER-REPRODUCERS (REFER TO FIG. 3)

LIST NO.	SERIAL NO.	DRUM	DRUM MOUNTING SCREWS
4	Through 1045	B-177188 Det 3	.190-24 x 3/8 FP HEX SOC HD SETSCREW
4	1046 and up	B-188807 Det 2	.190-32 x 1/4 FP HEX SOC HD SETSCREW
5	Through 1699	B-177188 Det 2	.190-24 x 3/8 FP HEX SOC HD SETSCREW
5	1700 and up	B-188807 Det 1	.190-32 x 1/4 FP HEX SOC HD SETSCREW
6	Through 1112	B-177188 Det 2	.190-24 x 3/8 FP HEX SOC HD SETSCREW
6	1113 and up	B-188807 Det 1	.190-32 x 1/4 FP HEX SOC HD SETSCREW

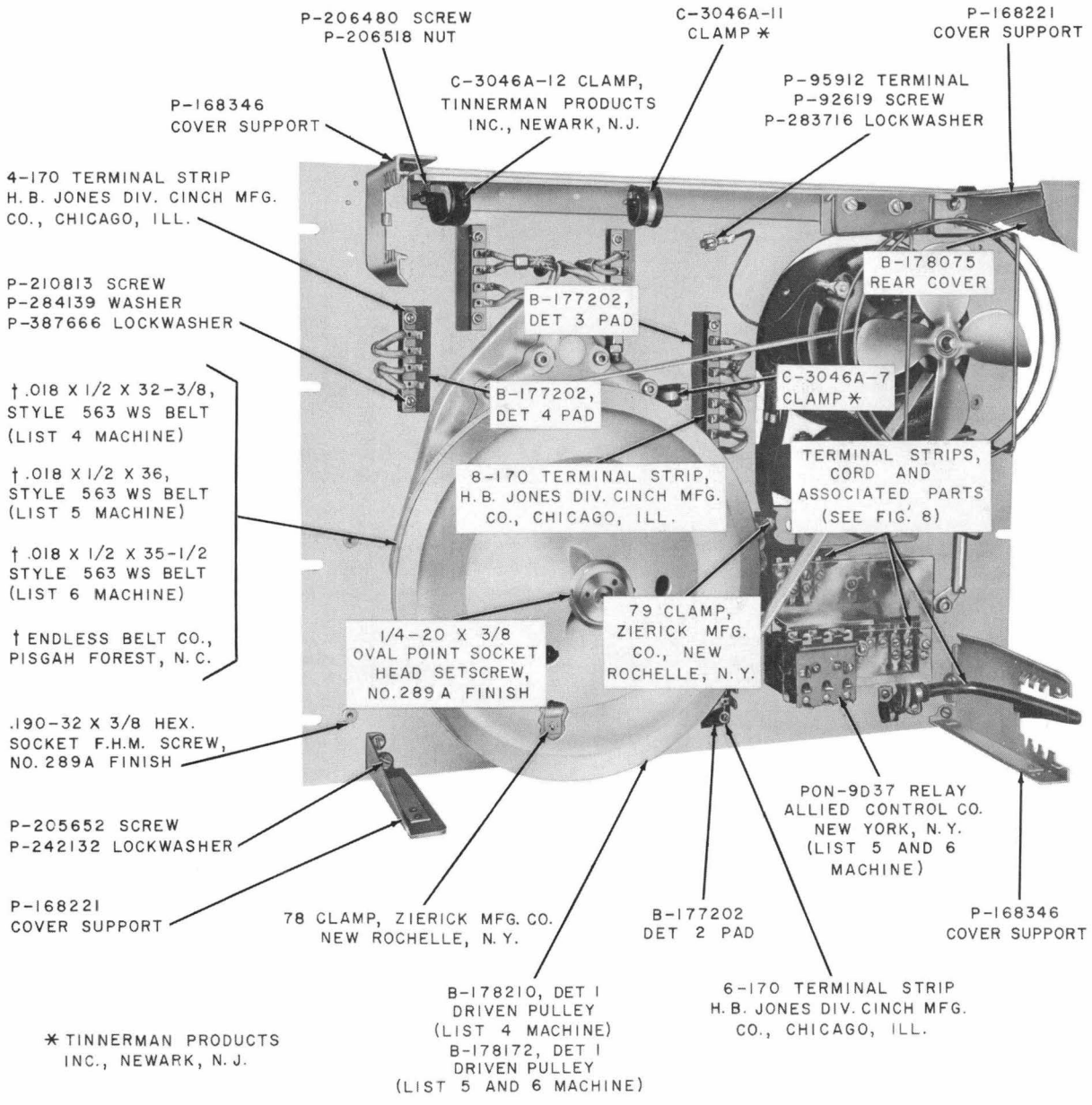


Fig. 4 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Rear View (L5 machine shown)

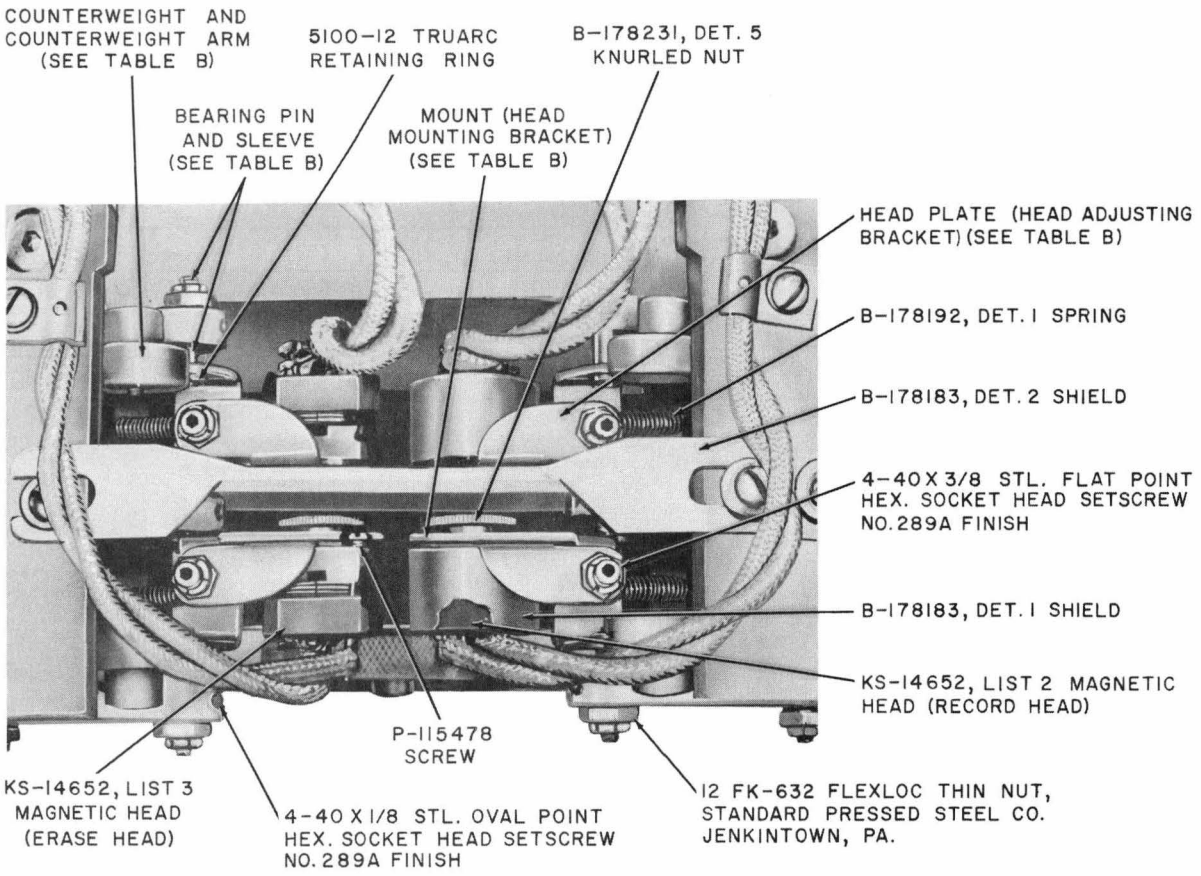


Fig. 5 — KS-12068 L3 and L3 Converted per X-4174 Recorder-Reproducers — Record and Erase Head Assemblies and Associated Parts

TABLE B — PARTS ASSOCIATED WITH RECORD AND ERASE HEADS KS-12068 L3 RECORDER-REPRODUCER (SEE FIG. 5)

CHANNEL NUMBER	RECORD OR ERASE HEAD	B178230 MOUNT (HEAD MOUNTING BRACKET) (SEE NOTE)	B178230 HEAD PLATE (HEAD ADJUSTING BRACKET) (SEE NOTE)	B178177 COUNTER-WEIGHT ARM	B178178 COUNTER-WEIGHT	B178170 PIN (BEARING PIN)	B178170 SLEEVE (BEARING SLEEVE)
1	Erase	Det 1	Det 3	Det 4	Det 2	Det 1	Det 3
	Record	Det 2	Det 4	Det 3	Det 1	Det 1	Det 3
2	Erase	Det 2	Det 4	Det 5	Det 2	Det 2	Det 4
	Record	Det 1	Det 3	Det 2	Det 1	Det 2	Det 4
3	Erase	Det 1	Det 3	Det 2	Det 1	Det 2	Det 4
	Record	Det 2	Det 4	Det 3	Det 1	Det 1	Det 3
4	Erase	Det 2	Det 4	Det 3	Det 1	Det 1	Det 3
	Record	Det 1	Det 3	Det 2	Det 1	Det 2	Det 4
5	Erase	Det 1	Det 3	Det 2	Det 1	Det 2	Det 4
	Record	Det 2	Det 4	Det 5	Det 2	Det 2	Det 4
6	Erase	Det 2	Det 4	Det 3	Det 1	Det 1	Det 3
	Record	Det 1	Det 3	Det 4	Det 2	Det 1	Det 3

Note: When replacing either the head adjusting bracket or the head mounting bracket, order both parts as indicated above and replace both parts.

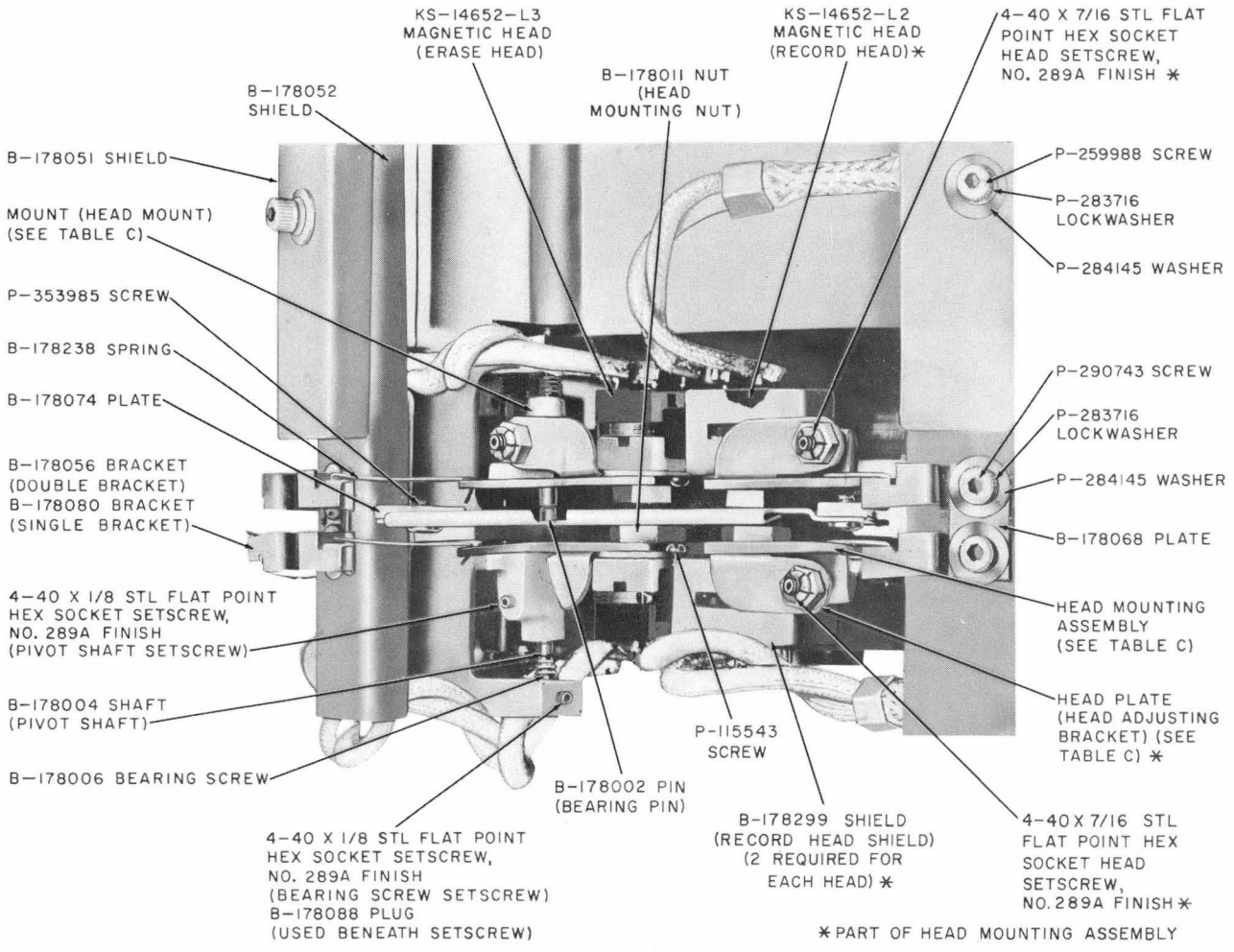


Fig. 6 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Record and Erase Head Assemblies and Associated Parts

TABLE C — HEAD MOUNT ASSEMBLY AND HEAD ADJUSTING BRACKETS KS-12068 L4, L5, AND L6 RECORDER-REPRODUCERS (SEE FIG. 6)

CHANNEL NUMBER	RECORD OR ERASE HEAD	MOUNT (HEAD MOUNT) (SEE NOTE)	HEAD MOUNTING ASSEMBLY	B-178230 HEAD PLATE (HEAD ADJUSTING BRACKET)
1	Erase Record	B-178067 B-178066	B-178182, Det 3 B-178363	Det 3 Det 4
2	Erase Record	B-178066 B-178067	B-178182, Det 4 B-178362	Det 4 Det 3
3	Erase Record	B-178067 B-178066	B-178182, Det 3 B-178363	Det 3 Det 4
4	Erase Record	B-178066 B-178067	B-178182, Det 4 B-178362	Det 4 Det 3
5	Erase Record	B-178067 B-178066	B-178182, Det 3 B-178363	Det 3 Det 4
6	Erase Record	B-178066 B-178067	B-178182, Det 4 B-178362	Det 4 Det 3

Note: When ordering the head mount, also order a No. 4-40 by 1/8-inch steel, flat point hex socket head setscrew and a B-178088 plug.

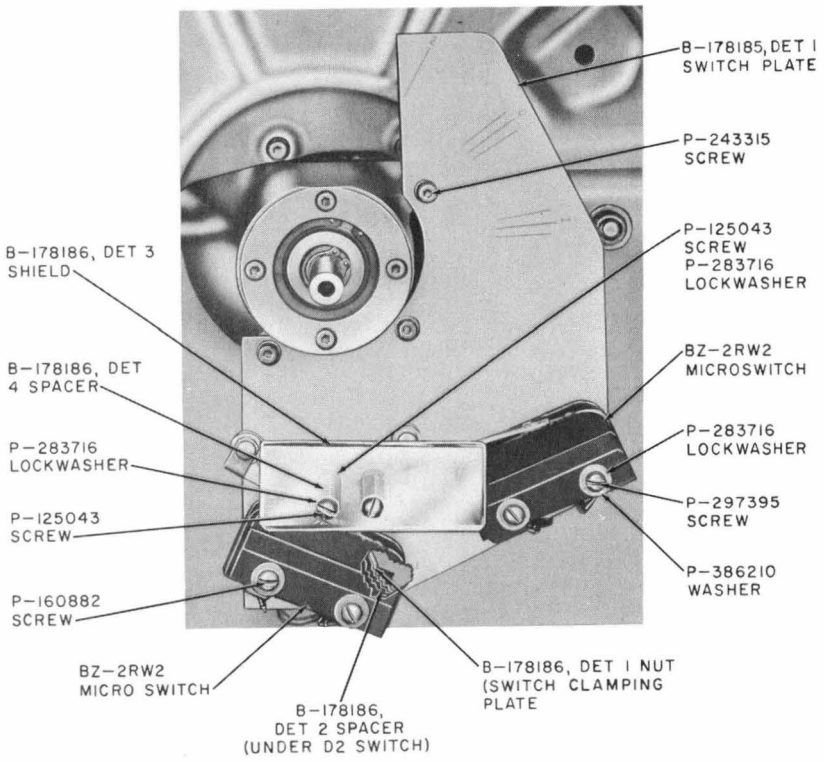


Fig. 7 — KS-12068 L3, L5, L6, and L3 Converted per X-4174 Recorder-Reproducers — Switch Plate, Micro Switch, and Associated Parts

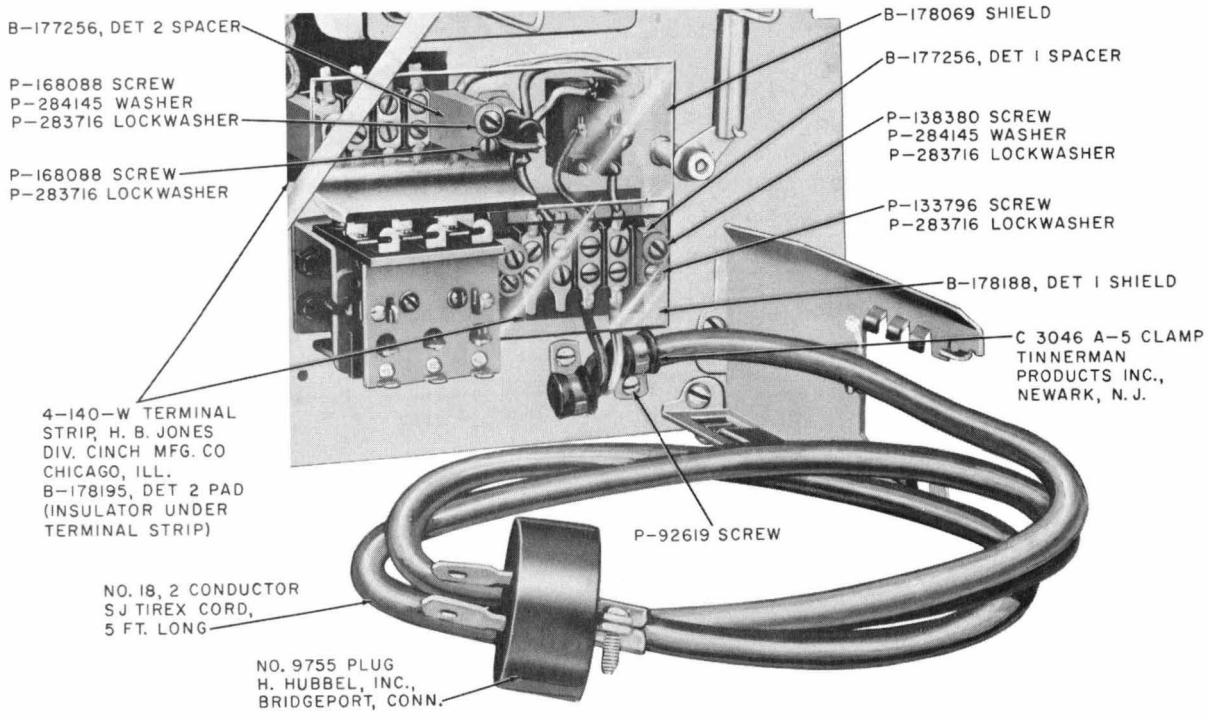
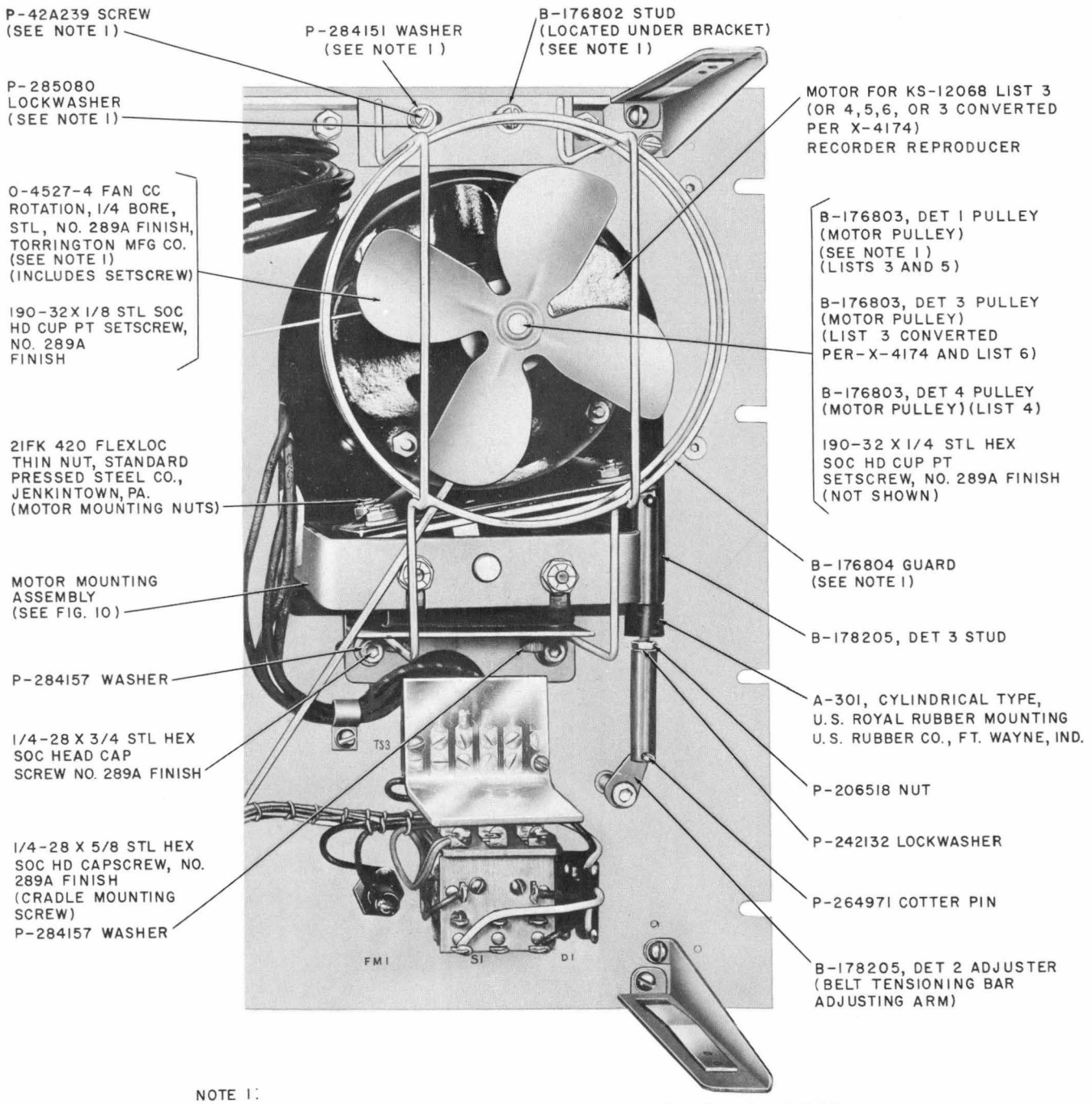


Fig. 8 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Rear View Showing Parts Located Below the Motor (L5 machine shown)



NOTE 1:
WHEN REPLACING A PULLEY ON A RECORDER-REPRODUCER NOT EQUIPPED WITH A FAN, BY A PULLEY AND FAN, ORDER
B-176803, DET 1 PULLEY
0-4527-4 FAN, CC ROTATION, ZINC PLATE
B-178804 GUARD
B-176802 STUD (2 REQUIRED)
P-42A239 SCREW (2 REQUIRED)
P-284151 WASHER (2 REQUIRED)
P-285080 LOCKWASHER
B-178171, DET 1 FRONT COVER
B-178189, DET 1 REAR COVER

Fig. 9 — Motor and Associated Parts — Rear View (KS-12068 L3 machine shown)

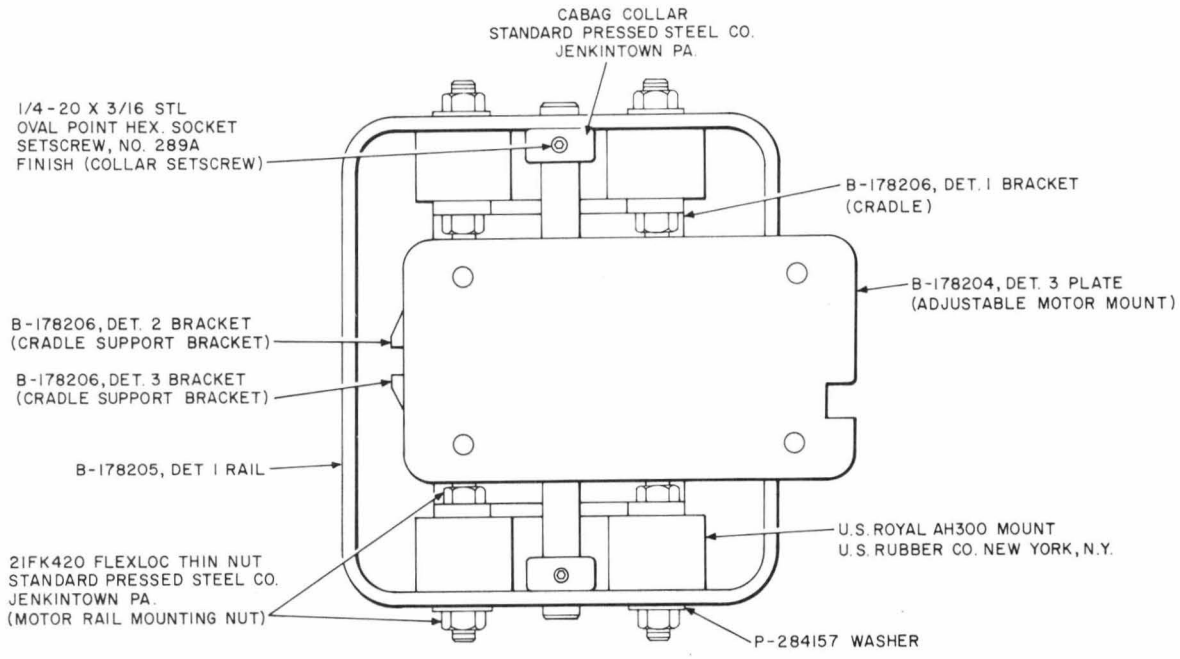


Fig. 10 — Motor Mount and Associated Parts

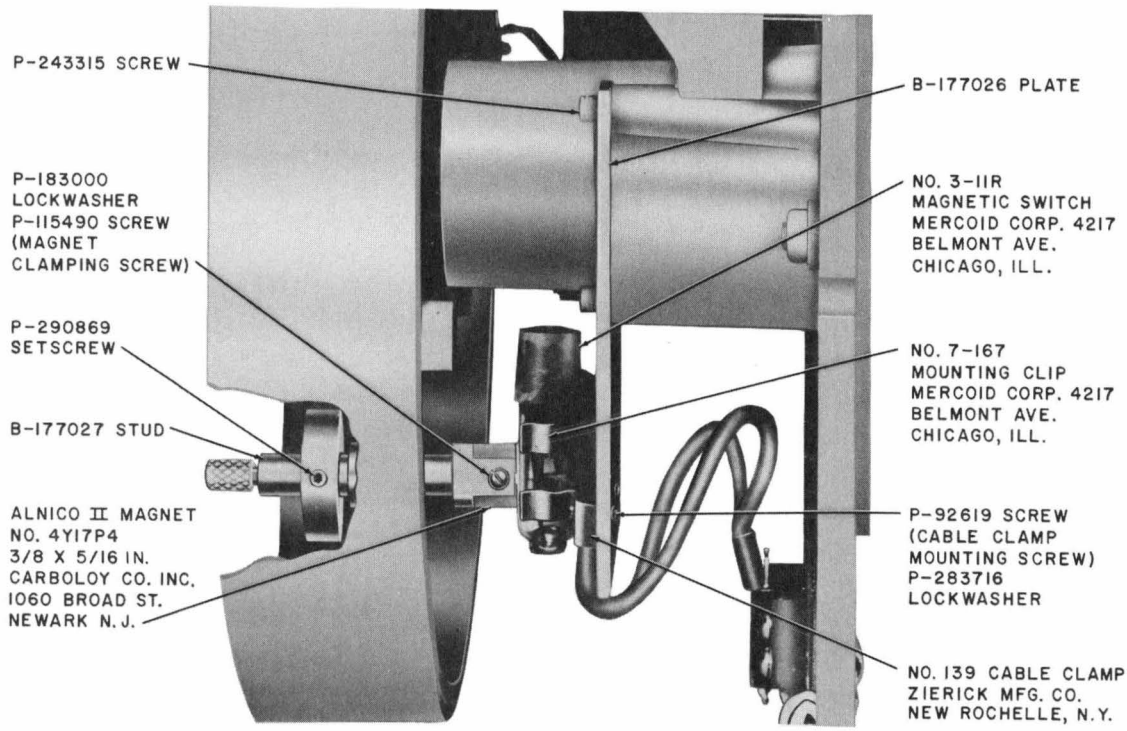


Fig. 11 — KS-12068 L4 Recorder-Reproducer — Permanent Magnet, Magnetic Switch, and Associated Parts

3. REPLACEMENT PROCEDURES

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

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
245 (2 reqd)	3/8- and 7/16-Inch Hex Open Double-End Flat Wrench
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
486A	Oil Can
507A	Spring Bender
KS-6320	Orange Stick
KS-6854	3-Inch Screwdriver
KS-8511	Tweezers
R-1051	Pillar File
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-2812	3/16-Inch Allen Socket Screw Wrench
R-2958	5/64-Inch Allen Socket Screw Wrench
R-2958 (2 reqd)	5/64-Inch Allen Socket Screw Wrench (modified per 3.05)
R-2961	0.050-Inch Allen Socket Screw Wrench
R-5850	5/8- and 3/4-Inch Hex Offset Double-End Socket Wrench
—	Long-Nose Pliers
—	No. 555E Jewelers Screwdriver, L.S. Starrett Company (or equivalent)
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
—	0012 Tru-arc Pliers for 5100-12 Retaining Ring, Waldes Kohinoor Company
GAUGES	
82B	0.016- and 0.024-Inch Double-End Thickness Gauge
131A	Thickness Gauge Nest
MATERIALS	
KS-2423	Cloth
KS-7860	Petroleum Spirits
KS-13148 L1	Abrasive Paper
KS-16326 L1	Oil
—	Duco Household Cement
—	2- by 6-Inch Cellulose Acetate Sheet, 0.005- to 0.010-Inch Thick (obtain locally)

3.02 No replacement procedures are specified for screws or other parts where the replacement consists of a simple operation.

3.03 When the front cover has ventilation holes, mount the cover so that the ventilation holes are adjacent to the nameplate. When the rear cover has ventilation holes, mount the cover so that the holes are adjacent to the ventilating fan.

3.04 After replacement of any parts, the recorder-reproducer shall meet the requirements as specified in Section 034-351-701. Re-

placement operations may affect the adjustment of related parts. Therefore such parts should be checked against the requirements and should be adjusted if necessary.

3.05 ***Special Offset Screwdriver:*** Two special offset screwdrivers for use on bearing screws located behind the stationary shield can be made as follows. File two R-2958 wrenches using an R-1051 pillar file so that screwdriver-type blades are provided on the short end of the wrenches as shown in Fig. 12.

RECORDING BAND AND DRUM

3.06 Raise the erase and record heads to their highest position. Remove the belt from the driven pulley or loosen the belt tension by adjusting the arm of the belt tension bar with the R-2812 wrench. Then, on the L3, L5, L6, and L3 converted per X-4174 machines, rotate the drum clockwise by hand until the No. 2 lobe of the cam is uppermost. On the L3 and L3 converted per X-4174 machines, loosen the drum locknut manually and on the L4, L5, and L6 machines, loosen the setscrews in the hub with the R-2670 wrench sufficiently to permit the drum to be removed from the shaft. Remove the drum and place it on a clean surface.

3.07 If the band is to be replaced, proceed as covered in 3.08 through 3.11. If the drum is to be replaced, proceed as follows. Remove the recording band from the drum as covered in 3.08. On L3, L5, L6, and L3 converted per X-4174 machines, remove the switch cam mounting screws with the R-2485 wrench and mount the cam on the new drum. On L4 machines, remove the permanent magnet and associated parts, and mount them on the new drum as covered in 3.32. Mount the band on the new drum as covered in 3.10 and 3.11.

3.08 Remove the band by inserting the end of a KS-6320 orange stick under it and gradually working the band across the surface of the drum.

3.09 Before mounting a new recording band on the drum, clean the surface of the drum carefully with a cloth moistened with KS-7860 petroleum spirits, and wipe with a clean, dry cloth.

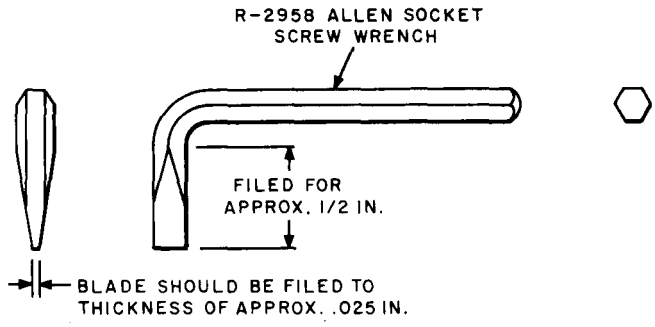


FIG. 12A – ALLEN WRENCH FILED SO BLADE IS PARALLEL TO LENGTH OF WRENCH

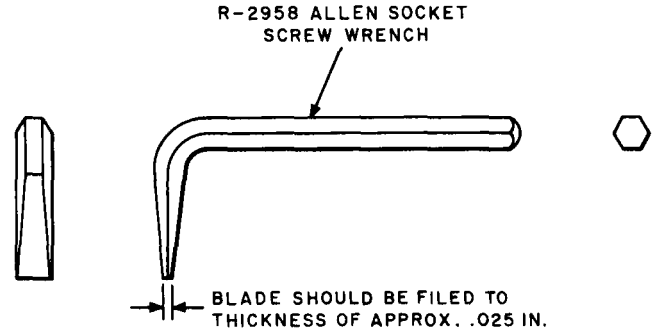


FIG. 12B – ALLEN WRENCH FILED SO BLADE IS AT RIGHT ANGLES TO LENGTH OF WRENCH.

Fig. 12 — Modified R-2958 Allen Socket Screw Wrenches

3.10 Mount the band on the drum as follows. Place the drum near the front edge of a clean table or bench with the rim of the drum vertical. Place approximately half the width of the band on the portion of the rim adjacent to the edge of the table or bench. Then draw the drum to the edge and, using the body as a support, stretch the band around the drum working simultaneously on both sides of the starting point. During this process it is advisable to use the arms to hold on the drum that part of the band which has already been mounted on it. After the entire periphery of the band has been partially mounted on the drum, insert the end of a KS-6320 orange stick under the band and gradually work the band across the surface of the drum.

Caution: During handling, exercise care to avoid bending the band sharply. Also, while mounting the band, take care not to scrape the edge or inner surface of the band against the edge of the drum.

3.11 Mount the drum as follows. Make sure the erase and record heads are in their highest position. On the L3, L5, L6, and L3 converted per X-4174 machines, hold the drum with the No. 2 lobe of the cam uppermost. In all cases, guide the drum onto the shaft carefully, rotating the shaft if necessary, so that the slot in the drum engages the pin on the shaft. After the drum has been fully seated on the shaft, rotate the drum. On the L3, L5, L6, and L3 converted per X-4174 machines, note that the cams properly engage the rollers on the Micro Switches. On the L4 machine, note that the permanent magnet clears the mercury switch. If the locknut on machines so equipped was removed from the drum, make sure in remounting it that the side of the locknut stamped ***back*** is toward the drum. Tighten the locknut securely. On the drums equipped with setscrews, tighten the setscrews securely. Clean and lubricate the surface of the recording band in accordance with Section 034-351-701 [3.01(b)(1) and (2)]. Lower the erase and record heads to the surface of the band.

Note: When a new recording band has been installed, it is recommended that, if practicable, the machine be run for approximately 1 hour before being restored to service. This will enable the record heads to form polished tracks on the band, ensuring intimate contact between the pole pieces of the heads and the band.

HEAD TENSION SPRINGS

3.12 ***L3 and L3 Converted per X-4174 Machines:*** To replace the head tension spring, remove the drum as described in 3.06. Approaching the spring from below the head, disengage the hook of the spring from the hole in the casting using the KS-8511 tweezers. Then disengage the other end of the spring from the stud in the head adjusting bracket. Hook one end of the replacing spring into the hole in the casting. Then grasp the hook at the other end of the spring with the tweezers and place it around the stud in the head adjusting bracket. Make sure that the hook engages the groove in the stud. Remount the drum on the shaft as described in 3.11.

3.13 ***L4, L5, and L6 Machines:*** To replace the head tension spring, remove the spring from the tension spring bracket with the long-nose pliers. Then remove the spring from the head mounting bracket. Mount the new spring at the head mounting bracket end and then at the tension spring bracket. Bend the ends of the spring as required to ensure that it is securely mounted.

ERASE OR RECORD HEAD ADJUSTING BRACKET AND ASSOCIATED PARTS

3.14 To replace these parts, proceed as listed below:

MACHINE	REPLACE PARTS AS DESCRIBED IN	THEN POSITION HEAD AS DESCRIBED IN
L3 and L3 converted per X-4174	3.15	3.16
L4	3.17	3.18
L5 and L6	3.19	3.20

See Fig. 13 and 14 for location of parts and Fig. 15 for head positioning.

3.15 ***Replacement of Parts — L3 and L3 Converted per X-4174 Machines***

Caution: Avoid overheating during soldering process involving magnetic head terminals. Excessive heat can cause irreparable damage to the head unit.

(a) Loosen the stationary shield mounting screws with the 4-inch E screwdriver and remove the stationary shield. If the head is to be replaced, lift the head to its highest position and unsolder the leads. If only the associated adjusting bracket or other parts are to be replaced, it is not necessary to unsolder the leads to the head.

(b) With the head in its highest position, remove the head mounting nut with the fingers, and disengage the head and the adjust-

ing bracket from the head mounting bracket. As these parts are freed from the mounting bracket, support the head adjusting bracket so that the spring tension cannot pull it towards the casting. Grasp the head tension spring with the KS-8511 tweezers and disengage it from the stud on the head adjusting bracket.

(c) Remove the head mounting screws with the KS-6854 screwdriver.

(d) Substitute the new part of parts required.

Reassemble the parts in the reverse order of removal and securely tighten the head mounting screws. Mount the head and the adjusting bracket on the head mounting bracket so that the head adjusting screw overlaps the stop on the head mounting bracket. Tighten the head mounting nut, making sure that the head adjusting screw is in contact with the stop. Grasp the head tension spring with the tweezers and loop the spring over the stud on the head adjusting bracket. Make sure that the hook on the spring engages the groove in the stud. Reconnect the leads to the head if they were removed. Remount the stationary shield.

3.16 ***Positioning of Heads — L3 and L3 Converted per X-4174 Machines:*** After securely mounting the record or erase head, position the head so that it rests on the surface of the recording band at the magnetic gap between the pole pieces. (See Fig. 15.) On erase heads, position the head as described in (a). On record heads, position the head as described in (b).

(a) To position an erase head, slightly loosen the head mounting nut by hand; turn the head adjusting screw with the R-2958 wrench in or out, as required, until the magnetic gap between the pole pieces appears to rest directly on the recording band. Tighten the head mounting securely.

(b) To position a record head, slightly loosen the head mounting nut by hand; turn the head adjusting screw with the R-2958 wrench in or out, as required, until the magnetic gap between the pole pieces appears to rest directly on the recording band. Tighten the head mounting nut. Adjust the head to its final position as described in Section 034-351-701, and then proceed as described in (c).

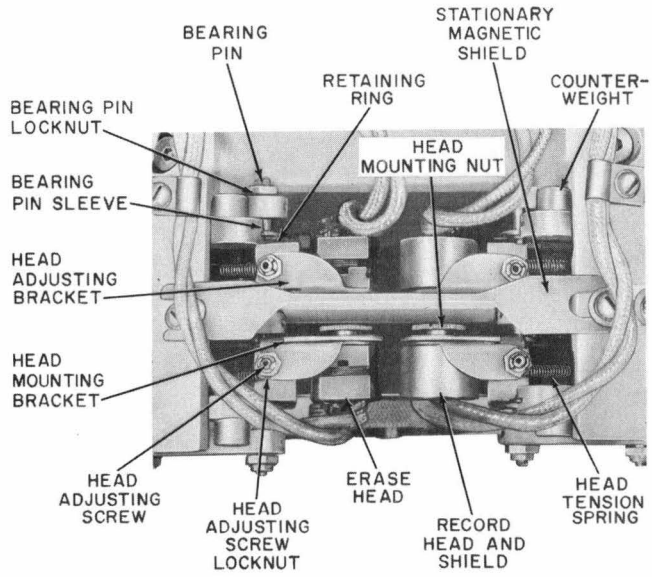


Fig. 13 — KS-12068 L3 and L3 Converted per X-4174 Recorder-Reproducers — Erase and Record Head Assembly and Associated Parts

(c) After positioning the record head, polish the pole pieces as follows. In order to protect the recording band and to provide a smooth base for the polishing operation, place the 2- by 6-inch sheet of cellulose acetate between the head and the recording band. Place the KS-13148 L1 abrasive paper, with the abrasive side up, between the head and the acetate sheet. Press the head lightly against the abrasive paper and withdraw the paper from between the head and acetate sheet, pulling it in the direction of rotation of the drum. Repeat this procedure ten times. Remove the acetate sheet.

3.17 ***Replacement of Parts — L4 Machine***

(a) Manually remove the stationary shield, noting the position of the offset so that the shield may be correctly remounted. If the head is to be replaced, lift the head to its highest position and unsolder the leads. If only the associated adjusting bracket or other parts are to be replaced, it is not necessary to unsolder the head leads.

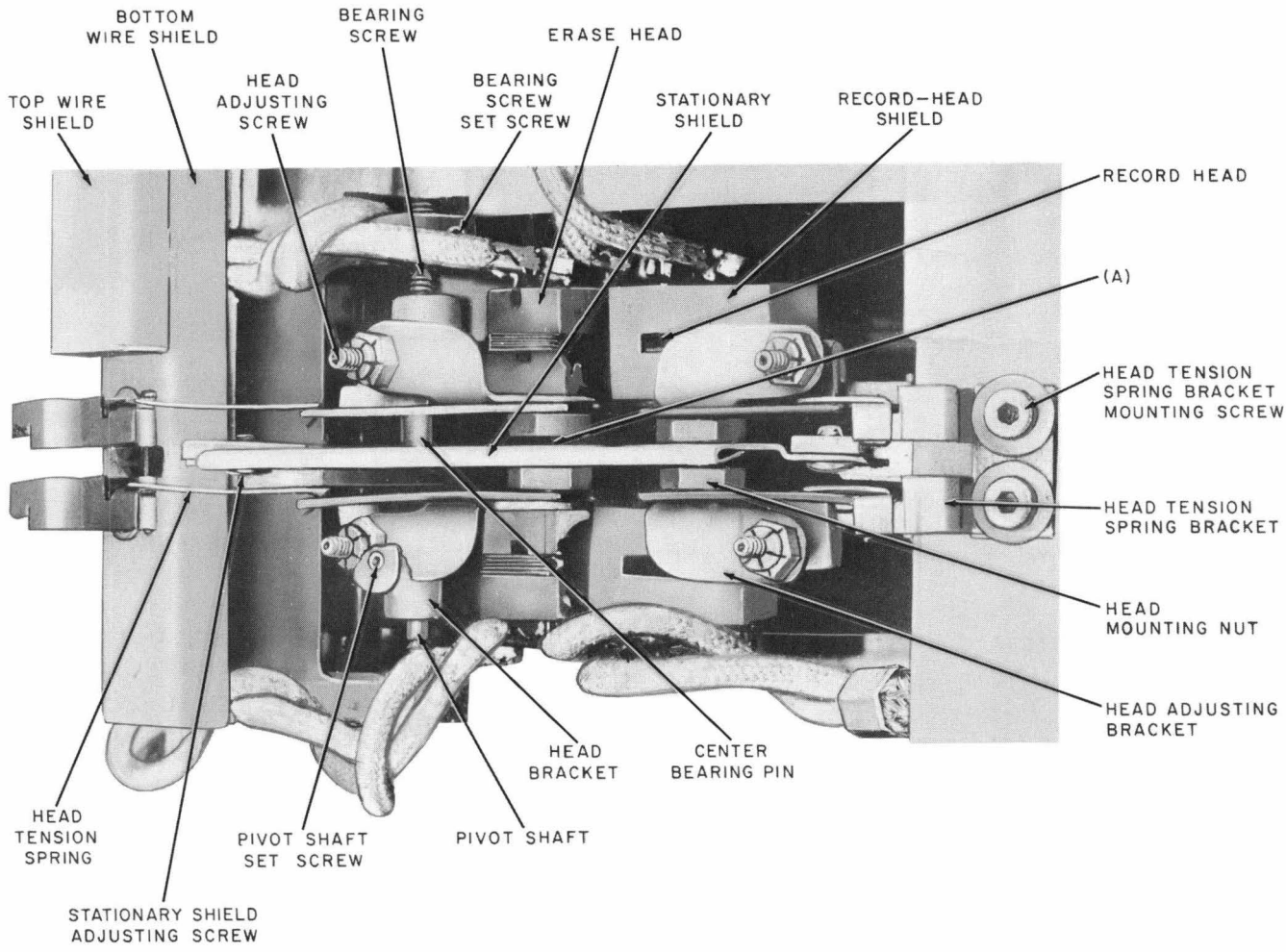


Fig. 14 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Erase and Record Head Assembly and Associated Parts

(b) With the head in its highest position, remove the head mounting nut with the 245 wrench. Disengage the head tension spring from the head adjusting bracket. Remove the head mounting screws with the KS-6854 screwdriver.

(c) Substitute the part or parts required. Reassemble the parts in the reverse order of removal and securely tighten the head mounting screws. Mount the head and head adjusting bracket on the head mounting bracket so that the head adjustment screw overlaps the stop on the head mounting bracket. Tighten the head mounting nut, making sure that the head adjusting screw is in contact with the stop. Reconnect the leads to the head if they were removed. Remount the stationary shield, taking care that it does not interfere with adjacent head mounting nuts.

3.18 ***Method of Positioning Heads — L4 Machine:*** After mounting the record or erase head, position the head so that it rests on the surface of the recording band at the magnetic gap between the pole pieces (Fig. 15). On erase heads, position the head as described in (a) and on record heads, position the head as described in (b).

(a) To position an erase head, slightly loosen the head clamping nut with the 245 wrench; turn the head adjusting screw with the R-2958 wrench in or out, as required, until the magnetic gap between the pole pieces appears to rest directly on the recording band. Then tighten the head mounting nut securely.

(b) To position a record head, slightly loosen the head mounting nut with the 245 wrench; and turn the head adjusting screw

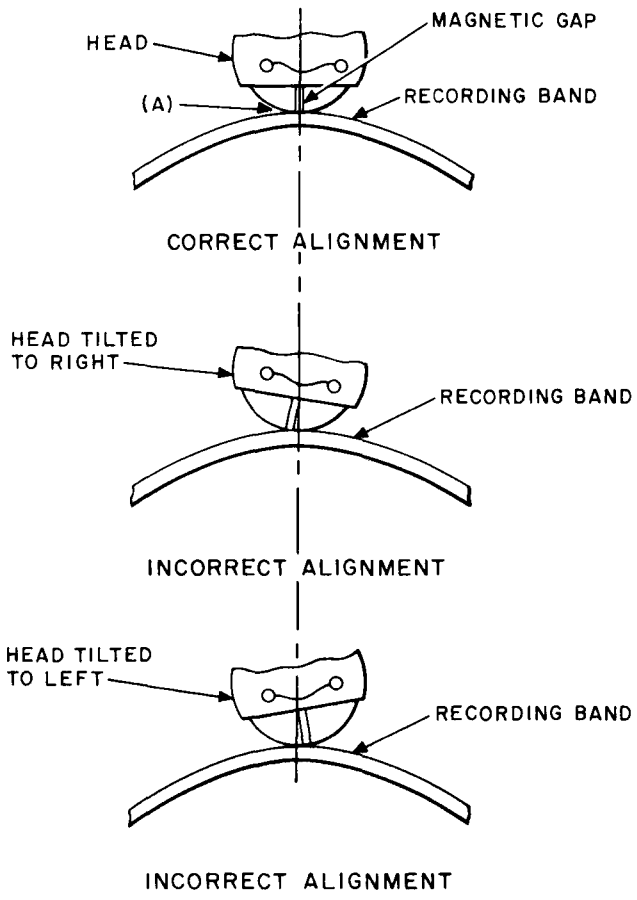


Fig. 15 — Position of Magnetic Gap of Head on Recording Band — KS-12068 Recorder-Reproducers

with the R-2958 wrench in or out, as required, until the magnetic gap between the pole pieces appears to rest directly on the recording band. Tighten the head mounting nut. Adjust the head to its final position as described in Section 034-351-701, and then proceed as described in (c).

(c) After positioning the record head, polish the pole pieces as follows. In order to protect the recording band and to provide a smooth base for the polishing operation, place the 2- by 6-inch sheet of cellulose acetate between the head and the recording band. Place the KS-13148 L1 abrasive paper, with the abrasive side up, between the head and the acetate sheet. Press the head lightly against the abrasive paper and withdraw the paper from between the head and acetate sheet, pulling it in the direction of rotation of the drum. Repeat this procedure ten times. Remove the acetate sheet.

3.19 ***Replacement of Parts — L5 and L6 Machines:*** To replace these parts, proceed as described in 3.17.

3.20 ***Positioning of Heads — L5 and L6 Machines:*** After mounting the record or erase heads, proceed as described in 3.16.

HEAD MOUNTING BRACKET, COUNTERWEIGHT BRACKET (WHERE PROVIDED), AND RECORD AND ERASE HEAD BEARING PINS

3.21 ***L3 and L3 Converted per X-4174 Machines:*** To replace any of these parts, proceed as follows.

(a) Remove the head associated with the part being replaced as described in 3.15. Remove the counterweight associated with these parts using an R-2961 wrench.

(b) Hold the outer bearing pin with a jewelers screwdriver or with the modified R-2958 wrenches. Remove the bearing pin locknut using the 418A wrench. Loosen the bearing pin sleeve setscrew with an R-2961 wrench and remove the sleeve from the casting.

(c) Push the bearing pin toward the center of the brackets and remove the retaining ring from the bearing pin. Then remove the bearing pin from the casting. Move the brackets from the center bearing pin, and remove the head mounting and counterweight brackets from the machine.

(d) Replace the head mounting bracket and counterweight bracket, as required. Before mounting these parts, place the counterweight bracket inside the head mounting bracket so that the bearing holes line up. Insert the bearing pin through the bracket bearings from the side opposite the head adjusting stop. Make sure that the slotted end of the bearing pin is on the outside of the brackets. Mount the retaining ring on the bearing pin as described in (e).

(e) Insert the tips of the Tru-arc pliers into the eyes of a retaining ring. Spread the ring by closing the pliers, taking care to spread them only enough to permit the ring to slip over the end of the bearing pin. Slip the retaining ring over the bearing pin to a point about 1/8 inch beyond the groove in the pin. Then release the pliers.

(f) Slide the bearing pin across the inside of the brackets so that the end with the retaining ring groove enters the other bearing of both the head mounting and the counterweight brackets. The bearing pin should be so placed that it is underflush with both sides of the head mounting bracket. Place the brackets in position in the machine so that the bracket bearings line up with the bearing hole in the casting. Take care that the counterweight arm is above the bearing sleeve on the opposite side of the casting.

(g) When the brackets are in proper position, move the bearing pin into the casting hole. Slowly slide the retaining ring along the bearing pin until it is seated in the bearing pin groove, being careful that it does not slip off the end of the pin. Then move the brackets onto the fixed bearing pin. Place a clean, dry KS-2423 cloth between the brackets and the recording band, and lubricate each bearing with one drop of KS-16326 L1 oil applied with a 486A oil can. Wipe off the excess lubricant with the cloth.

(h) Place the bearing pin sleeve over the bearing pin. Place the 82B gauge between the shoulder of the center bearing pin and the head mounting bracket as shown at point A in Fig. 16. Holding the sleeve in this position, tighten the associated setscrew. Mount the bearing pin locknut on the bearing pin. Hold the bearing pin with the proper screwdriver and tighten the locknut with the 418A wrench.

(i) Before remounting the head, clean the pole piece as covered in Section 034-351-701.

(j) Remount the head in position as described in 3.15(d) and position it on the magnetic band as described in 3.16.

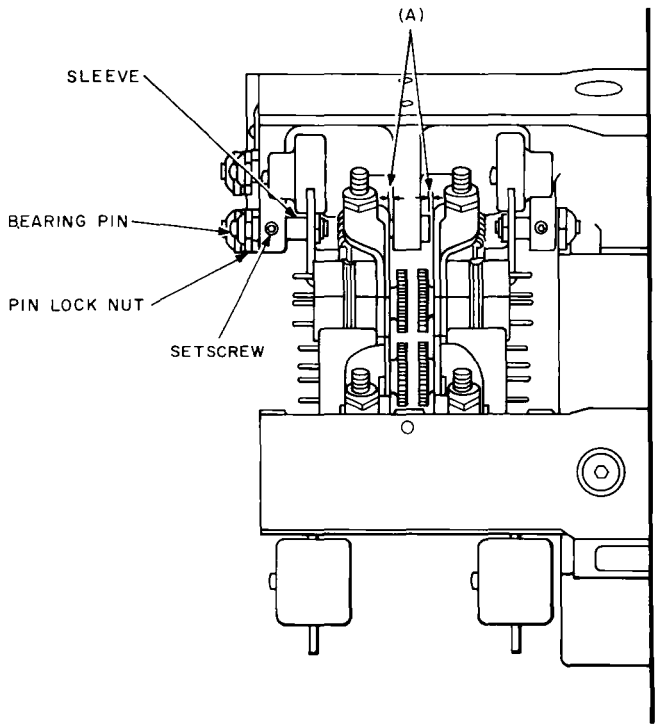


Fig. 16 — Method of Positioning Record and Erase Head Assemblies on KS-12068 L3 and L3 Converted per X-4174

3.22 ***L4, L5, and L6 Machines:*** To replace any of these parts (Fig. 17), proceed as follows.

(a) ***Bearing Screws:*** Remove the bearing screw setscrew with the R-2961 wrench. Remove the bearing screw with the R-2958 wrench or the jewelers screwdriver. On the rear bearing screws, use the R-2958 wrench or the modified R-2958 wrenches. Substitute the new bearing screw. Check for proper side play of the head mounting bracket, and securely tighten the setscrew. Place a clean, dry KS-2423 cloth between the pivot bearing and the recording band, and lubricate the bearing with one drop of KS-16326 L1 oil applied with a 486A oil can. Wipe off the excess lubricant with the cloth.

(b) ***Center Bearing Pin:*** Remove the head tension spring from the tension spring bracket with the long-nose pliers. Measure and make note of the clearance between the casting and the front and rear head mounting

brackets associated with the center bearing pin being replaced. Use the 131A gauge. Back off the front bearing screw as described in (a). Place the front head mounting bracket assembly at some convenient place on the casting, taking care not to damage the leads or the head. Then loosen the center bearing pin setscrew with the R-2961 wrench and remove the center bearing pin. Hold the rear head mounting bracket while inserting the new center bearing pin into position. Position the center bearing pin to give proper side play to the rear head mounting bracket and then tighten the center bearing pin setscrew. Mount the front head mounting bracket assembly in position and turn in the front bearing screw to give proper side play to the front bracket. Tighten the front bearing screw setscrew. Insert between the rear head mounting bracket and the casting the 131A gauge corresponding to the clearance measured between these parts before the bracket was removed. If necessary, loosen the rear pivot shaft setscrew, move the rear head mounting bracket against the gauge, and tighten the setscrew. Repeat this operation for the front head mounting bracket.

(c) ***Other Parts:*** To replace the head mounting bracket and pivot shaft, remove the head associated with the part to be replaced as described in 3.17, and then proceed as covered in (d).

Note: Unless the center bearing pin is being replaced as covered in (b), do not loosen the setscrew holding the center bearing pin in position since this affects the relation of the head with respect to the associated heads.

(d) ***Head Mounting Bracket and Pivot Shaft:*** Using the 131A gauge, measure the clearance between the casting and the head mounting bracket to be replaced. Back off the bearing screw as described in (a) and remove the head mounting bracket. If the bracket is to be replaced and the pivot shaft is satisfactory, loosen the pivot shaft setscrew with the R-2961 wrench. Remove the pivot shaft and mount it in the new bracket. Insert a new plug and setscrew in the mounting bracket. Place the bracket in position and turn in the bearing screw until there is proper side play in the pivot shaft. Between the head mounting bracket and the casting, insert the 131A gauge corresponding to the clearance measured between these parts before the bracket was removed. Move the head mounting bracket against the gauge and tighten the pivot shaft setscrew. Then tighten the bearing setscrew.

(e) ***Remounting Head:*** Before remounting the head, clean the pole piece as covered in Section 034-351-701. Then proceed as covered in (f).

(f) Remount the head in position as described in 3.17 and position it on the magnetic band as described in 3.16 for the L5 and L6 machines or 3.18 for the L4 machine.

MICRO SWITCH (L3, L5, L6, AND L3 CONVERTED PER X-4174)

3.23 ***Removing Switch:*** To replace a Micro Switch, first remove the drum as described in 3.06; then disconnect and tag the wires from the Micro Switch. Remove the switch screws with the 4-inch E screwdriver and remove the switch, switch clamping plate, and switch spacer block (on the D2 switch). Mount the new switch. On the D2 switch, insert the switch spacer block between the switch and the switch mounting plate. Hold the switch clamping plate behind the switch mounting plate; insert the screws through the associated washer and through the holes in the switch spacer block; and switch mounting plate into the switch clamping plate.

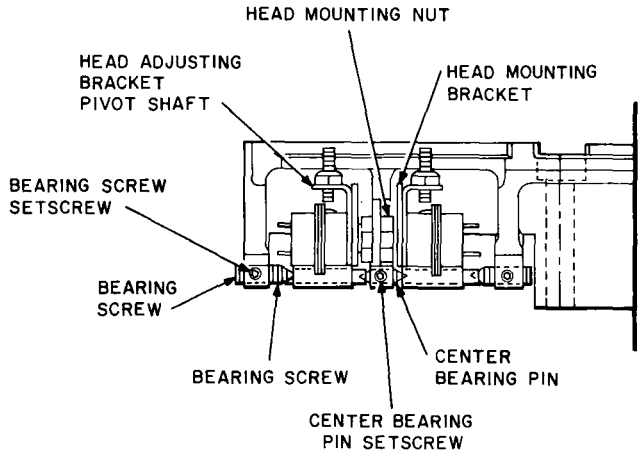


Fig. 17 — KS-12068 L4, L5, and L6 Recorder-Reproducers — Record and Erase Head Bearings and Associated Parts

3.24 ***Positioning Switch:*** Note the extreme positions of the switch as it pivots on its pivot screw (at right end of switch). Then securely tighten the pivot screw and the adjusting screw (at the left end of the switch) with the switch in the midposition. Remount the drum. Make sure in the case of the D2 switch that the operating lever clears the stud that supports the shield when the roller of the operating spring is not in contact with the cam. To check if the switch is correctly positioned, proceed as described in 3.25. See Fig. 18 for relation of cam lobes to Micro Switches.

3.25 ***Method of Checking Switch Positions***

(a) Slowly rotate the drum clockwise until lobe 1 on the cam closes switch D2. Place a pencil mark on the cam opposite line 0 on the cam.

(b) Continue to rotate the cam clockwise until lobe 1 opens switch D2. The pencil mark should now fall between the limit indicating lines on either side of line 1 on the cam.

(c) At the point where lobe 1 opens switch D2, place a second mark on the cam opposite the indicator line 2. Continue to rotate the cam clockwise until lobe 2 closes switch D2. The second pencil mark should now fall between the limit indicating lines on either side of line 0.

(d) At the point where lobe 2 closes switch D2, place a third pencil mark on the cam opposite the indicator line 2. Continue to rotate the cam clockwise until the lobe 2 opens switch D2. The third pencil mark should now fall between the limit indicating lines on either side of line 0.

(e) If the pencil marks do not fall within the limits described in (b) through (d), loosen the switch adjusting and pivot screws for switch D2 and shift the switch as required. Erase the old pencil marks. Recheck as described in (a) through (d) with a new set of pencil marks. Repeat as required until all pencil marks are within their required limits.

(f) After switch D2 has been properly positioned, erase all pencil marks. Then turn the drum clockwise until lobe 2 on the cam opens switch D2. Lobe 3 should have previously closed switch D3. Place a pencil mark on the cam opposite line 0. Continue to rotate the cam clockwise until lobe 3 opens switch D3. The pencil mark should now fall between the limit indicating lines on either side of line 1. If the pencil mark does not fall within the described limits, loosen the adjusting and pivot screws of switch D3; shift the switch as required; and tighten the screws securely. Again check as described above to make sure that switch D3 is properly positioned.

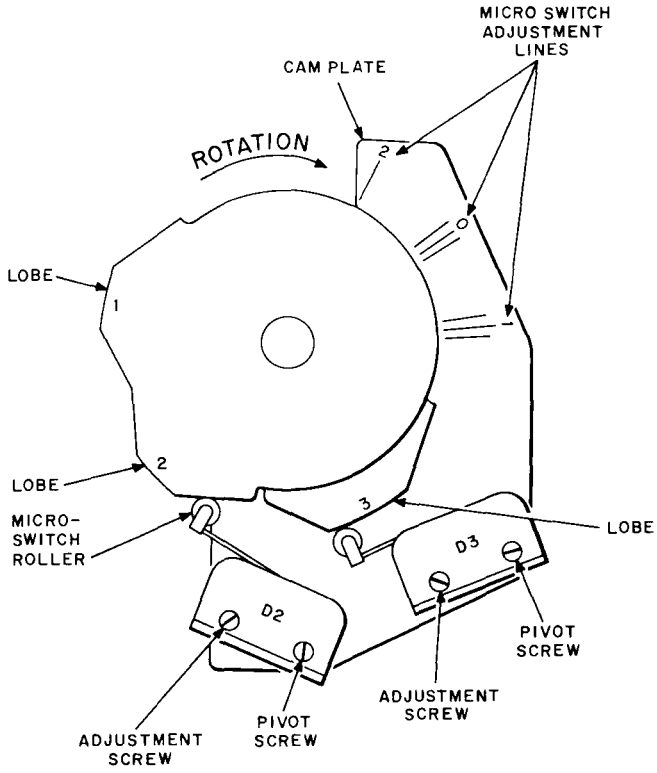


Fig. 18 — Relation of Cam Lobes to Micro Switches

MOTOR AND ASSOCIATED PARTS

3.26 ***Fan:*** To replace the fan, loosen the fan setscrew with the 3-inch C screwdriver. Remove the fan from the pulley shaft through the fan guard. Mount the new fan on the pulley shaft taking care that the setscrew of the fan engages the flat on the shaft. Securely tighten the setscrew.

3.27 ***Driving Pulley:*** To replace the driving pulley, remove the fan as covered in 3.26. Remove the belt from the driving pulley. Loosen

the driving pulley setscrew with the R-2670 wrench and remove the pulley from the motor shaft. Mount the new pulley on the shaft, making certain that it clears the motor housing and that the setscrew engages the flat on the motor shaft. Tighten the pulley setscrew securely and remount the belt. Remount the fan securely in place.

3.28 ***Fan Guard:*** Remove the screws from the upper mounting of the fan guard with the 4-inch E screwdriver. Loosen the cradle mounting screws below the fan guard by using the R-2812 wrench. Remove the guard and substitute a new one. Tighten all mounting screws securely.

3.29 ***Motor and Adjustable Motor Mount:*** To replace the motor or the adjustable motor mount, proceed as follows.

(a) Remove the fan as described in 3.26 and the fan guard as described in 3.28. Remove the motor terminal strip shield using the 3-inch C screwdriver. Unsolder and tag the motor leads. Remove the clamp holding the leads by using the 4-inch E screwdriver. Disconnect the ground wire by using the 417A wrench.

(b) Remove the belt from the driving pulley. Remove the cotter pin connecting the belt tension bar to the adjustable motor mount.

(c) Loosen the setscrews on both motor mount collars with the R-2671 wrench. Shift the motor toward the front of the machine until the motor mount pivot bearing clears the motor rail. Press down on the rail and tilt the motor upward until the pivot bearing is above the rail. Then remove the motor and motor mount from the machine.

(d) Loosen the motor mount nuts with the 245 wrench and remove the motor mount from the motor. If the mount is to be replaced, substitute the new one at this time and mount it securely in place on the motor. Transfer the motor mount collars from the motor mount being replaced to the new mount.

(e) If the motor is to be replaced, loosen the driving pulley setscrew with the R-2670 wrench and remove the pulley from the shaft of the motor being replaced. Mount the pulley securely on the shaft of the new motor, making sure that it clears the motor housing and that the setscrew engages the flat on the motor shaft. Mount the motor mount on the new motor.

(f) Mount the motor and motor mount in the machine from the rear, and at the same time depress the motor rail to permit the shaft of the adjustable mount to clear the motor rail. With the motor rail held down, shift the motor toward the front so that the shaft of the adjustable mount enters the bearing in the front of the motor rail sufficiently for the rear of the shaft of the mount to clear the inside of the rail at the rear. Then release the rear of the rail and pull the motor toward the rear until the shaft is properly seated in the rail. If the collars have slipped off the shaft of the adjustable mount, place them on the shaft before mounting the adjustable mount in the motor rail.

(g) Insert and secure the cotter pin connecting the belt tension bar to the adjustable motor mount. Mount the driving belt on the driving and driven pulleys. Then mount the fan guard and securely tighten all screws. Connect the motor leads and mount the terminal strip shield. Place the collars in position so that the driving belt is properly centered on the driving and the driven pulleys, and tighten the setscrews. Check the motor alignment and readjust it by shifting the motor base on the adjustable motor mount as required. Adjust the belt tension bar as required to give proper belt tension.

3.30 ***Motor Rail, Cradle, and Rubber Mounts:*** To replace any of these parts, remove the fan and fan guard as described in 3.26 and 3.28. Remove the motor and adjustable motor mount as described in 3.29 (a) through (c); then proceed as follows.

(a) Using the 245 wrench, remove the motor rail mounting nuts and washers on the outside of the motor rail. Lift the motor rail from the rubber mounts. If the motor rail is to be replaced, substitute a new one and then proceed as described in (c). If rubber mounts are to be replaced, remove the mounting nuts

by using the 245 wrench; substitute new parts as required; and tighten the nuts securely.

(b) If the cradle is to be replaced, remove the rubber mount mounting nuts on the inside of the cradle with the 245 wrench and remove the mounts. Remove the cradle mounting screws with the R-2812 wrench and remove the cradle. If the cradle support brackets are to be replaced, remove the mounting screws with the R-2812 wrench.

(c) Remount the parts in the reverse order of removal and tighten all screws securely. Mount the motor as described in 3.29 (f) and (g).

MISCELLANEOUS PARTS

3.31 ***Toggle Switch:*** Remove the shield over the toggle switch wiring by using the 3-inch C screwdriver. Unsolder the leads to the toggle switch. Loosen the toggle switch mounting ring using the R-5850 wrench. Remove the switch from the rear of the machine. Mount the new switch securely in position and tighten the mounting ring. Resolder the leads.

3.32 ***Permanent Magnet and Associated Parts (L4 machine):*** To replace the permanent magnet, loosen the clamping screw by using the 3-inch C screwdriver. Remove the magnet. Place the new magnet in position and securely tighten the clamping screw. To replace the magnet adjusting stud, remove the drum as described in 3.06. Loosen the setscrew in the periphery of the stud mounting bushing using the R-2958 wrench. Loosen the screw sufficiently to permit the stud to be removed from the rear of the drum. Mount the new stud through the hole in the spoke and the stud mounting bushing. Tighten the setscrew securely making sure that the screw bears against the flat surface on the stud. Mount the drum as described in 3.11.

3.33 ***Magnetically Operated Switch (L4 machine):*** To replace the magnetically operated switch, disconnect the leads to the switch from the terminal block using the 3-inch C screwdriver. Break the switch from the cement in the metal clamps. Mount the new switch in position with the convex surface of the armature facing the front of the machine and located approximately midway between the clamps which hold the switch. Apply a small amount of Duco household cement to the inner surface of the clamps to hold the switch in position.