READERS

KS-13835 L1, L2, L3, L4, L5, L6, AND L7

PIECE-PART DATA AND REPLACEMENT PROCEDURES

1. GENERAL

1.01 This section covers the information necessary for ordering parts to be used in the maintenance of the KS-13835 L1, L2, L3, L4, L5, L6, and L7 readers. It also covers approved procedures for replacing these parts.

1.02 This section is reissued to include information for part replacement of the L7 reader.

1.03 Part 2 of this section covers the piece-parts which can be replaced in the field. These parts are identified on illustrations which show the parts together with their piece-part numbers and corresponding names.

1.04 Part 3 covers approved procedures for the replacement of the piece parts listed in Part 2. No attempt shall be made in the field to replace parts not designated.

1.05 After any part is replaced, it is necessary to check the reader on the reader and perforator test table per SD-40040-01 or SD-95497-01. To check the reader, proceed as covered in Section 034-335-501 or 034-335-502. In offices where the test table is not available, it will be necessary to ship the reader to a maintenance center for a check. In shipping the reader, use the KS-14253 carrying case in accordance with instructions in Section 034-335-701.

1.06 ***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 oil can when the sides are depressed once and held depressed until a drop is released from the nozzle.

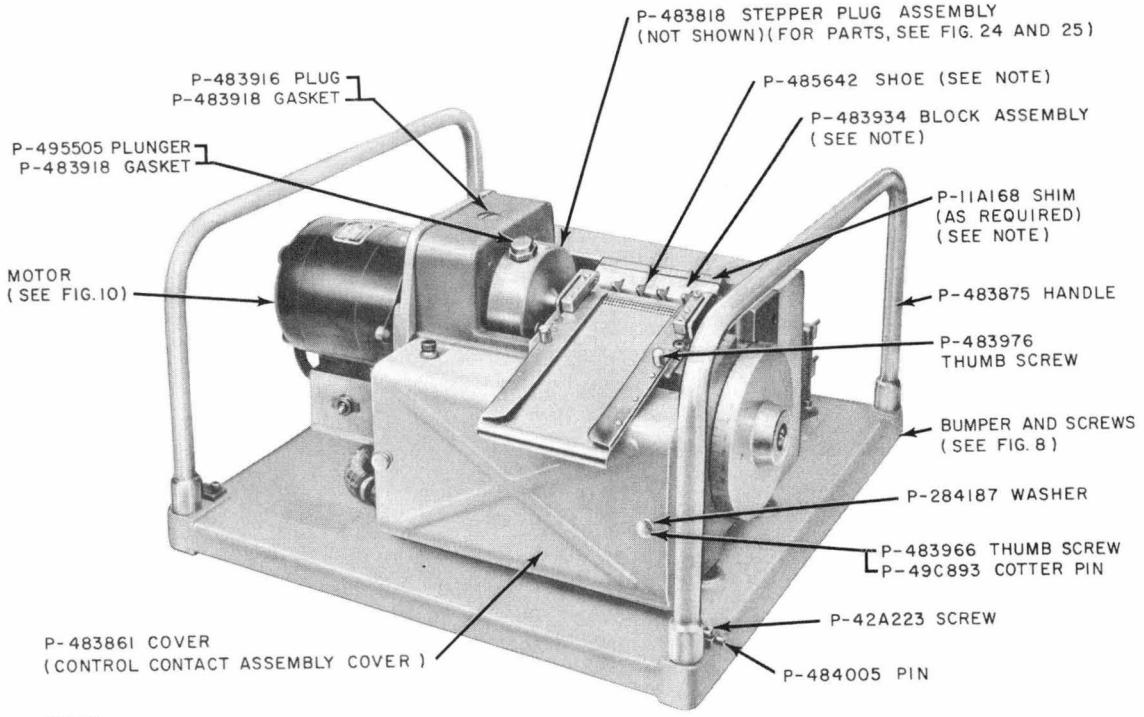
1.07 ***Preparation of KS-16832 L2 Lubricant:*** This lubricant is provided in 2-ounce and 1-pint containers. A small wide-mouth container, such as the 2-ounce jar in which the lubricant is available, should be used as a receptacle from which to dispense the lubricant. If allowed to stand more than 1 day without agitation, the lubricant ingredients tend to separate; therefore, before each day's use, shake the container of lubricant for approximately 30 seconds to ensure mixing of the ingredients. The proper method of shaking the lubricant consists of repeated, rapid turning of the container to an upside down position and back to the upright position. If the lubricant from a 1-pint container is to be used, the lubricant must be mixed as just described before it is poured into the smaller container. Under storage conditions, the cover should be tight on the container.

2. PIECE-PART DATA

2.01 The figures included in this part show the various parts in their proper relation to the other parts of the reader. The piece-part numbers of the various parts are given together with the names of the parts listed by the Western Electric Company Merchandise Department. Where these names differ from those in general use in the field, the latter names in some cases are shown in parentheses. Unless otherwise specified, the piece parts are common for all list readers.

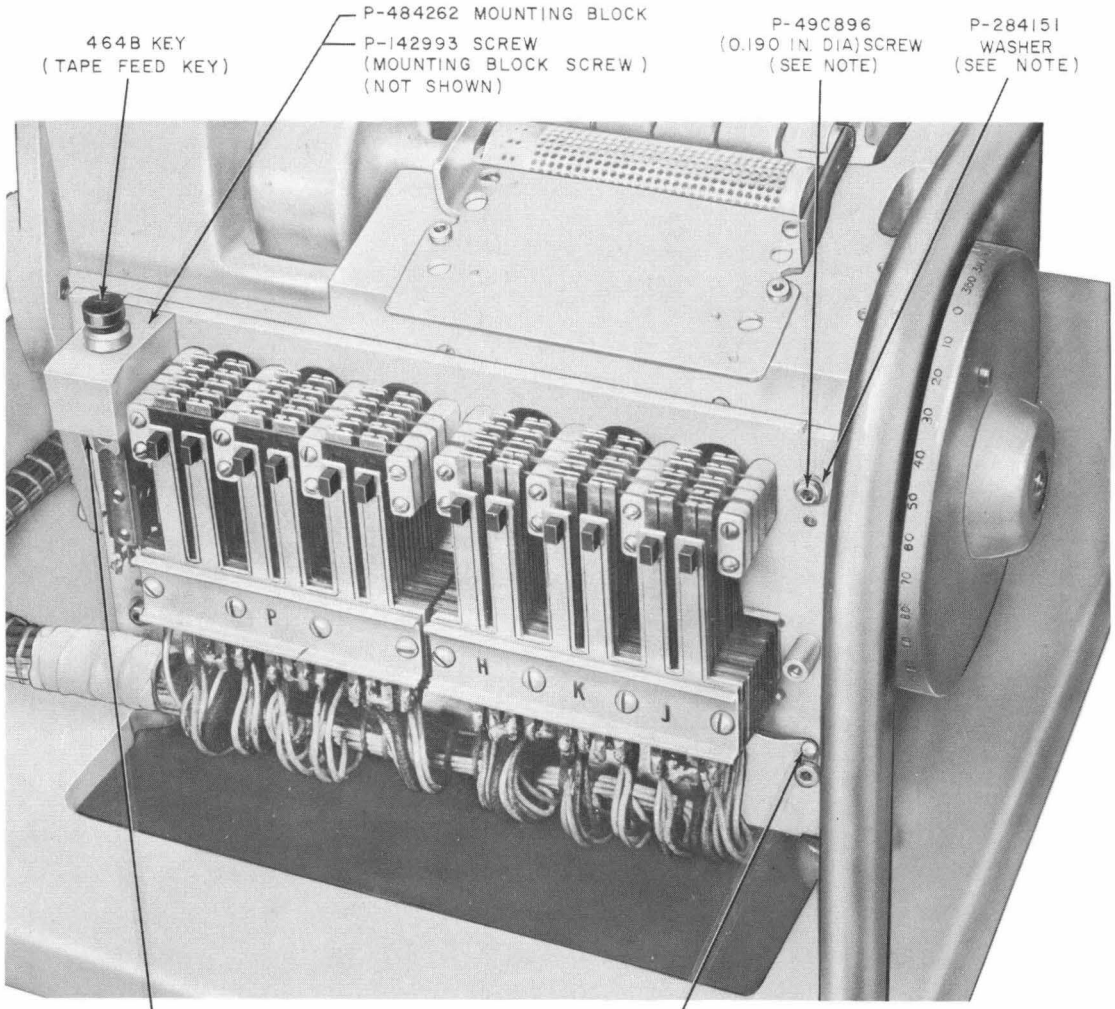
2.02 When ordering parts for replacement purposes, give both the piece-part number and the name of the part: for example, P-483850 magnet assembly. If a part is identified by other than a piece-part number, state the part number, name of the part, and the manufacturer's name: for example, No. 77R3 Bearing, New Departure Division, General Motors Corp. Do not refer to the section number or to any information in parentheses following the ordering information.

2.03 Information enclosed by parentheses is not ordering information. This information may be references to notes, parts referred to in other portions of the section and not considered replaceable, or part names in general use in the field if these names differ from those assigned by the manufacturer.



NOTE:
WHEN REPLACING SHOES, ALSO REPLACE BLOCK ASSEMBLY P-483934
IF BLOCK ASSEMBLY IS NOT MARKED WITH AN "X" WHEN REPLACING BLOCK ASSEMBLY, USE SHIMS AS REQUIRED TO OBTAIN A CLEARANCE BETWEEN THE BLOCK AND DRUM OF MINIMUM 0.012 INCH, MAXIMUM 0.020 INCH.

Fig. 1—Front View of Reader



NOTE:
WHEN 0.164 IN DIAMETER SCREW IS TO BE REPLACED, USE P-290747 SCREW AND P-284148 WASHER.

Fig. 2—Front View of Reader—Cover Removed (L1 Reader Shown)

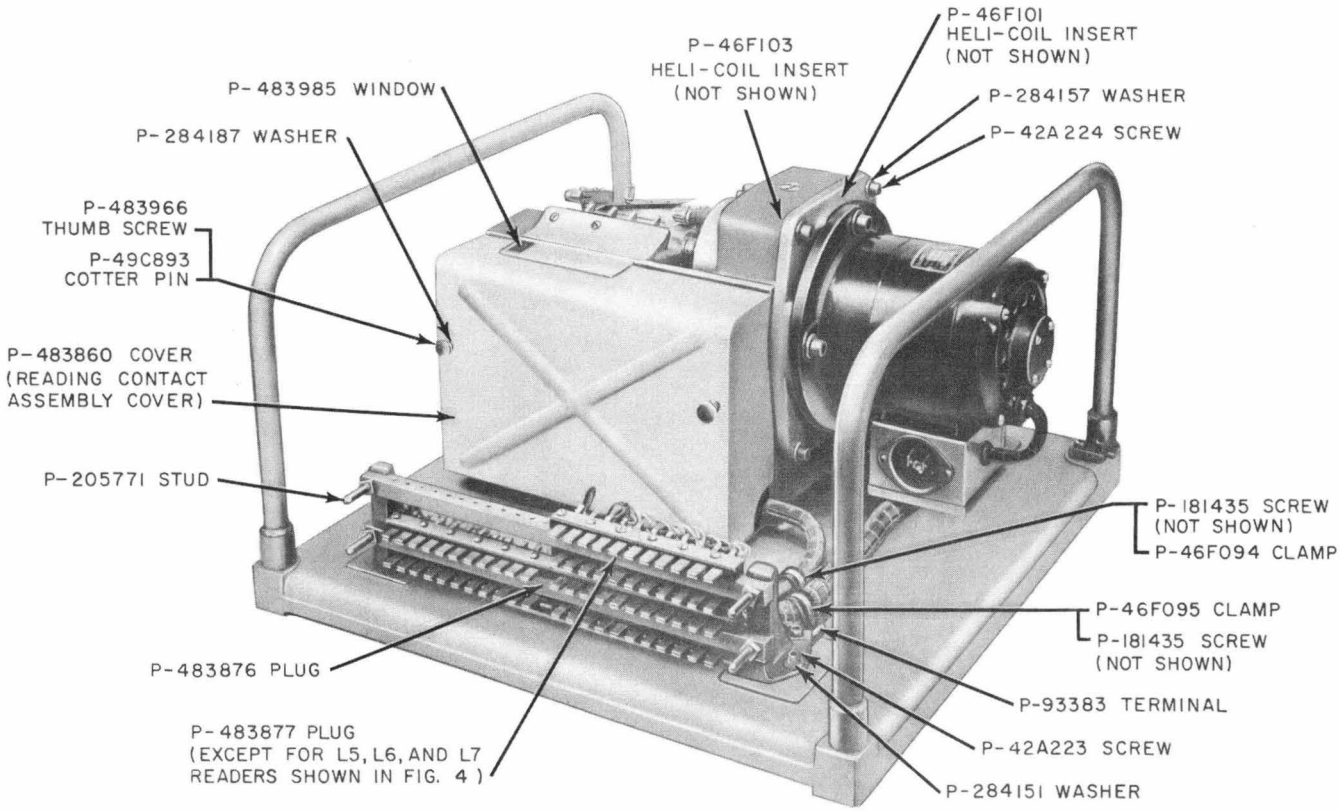


Fig. 3—Rear View of Reader

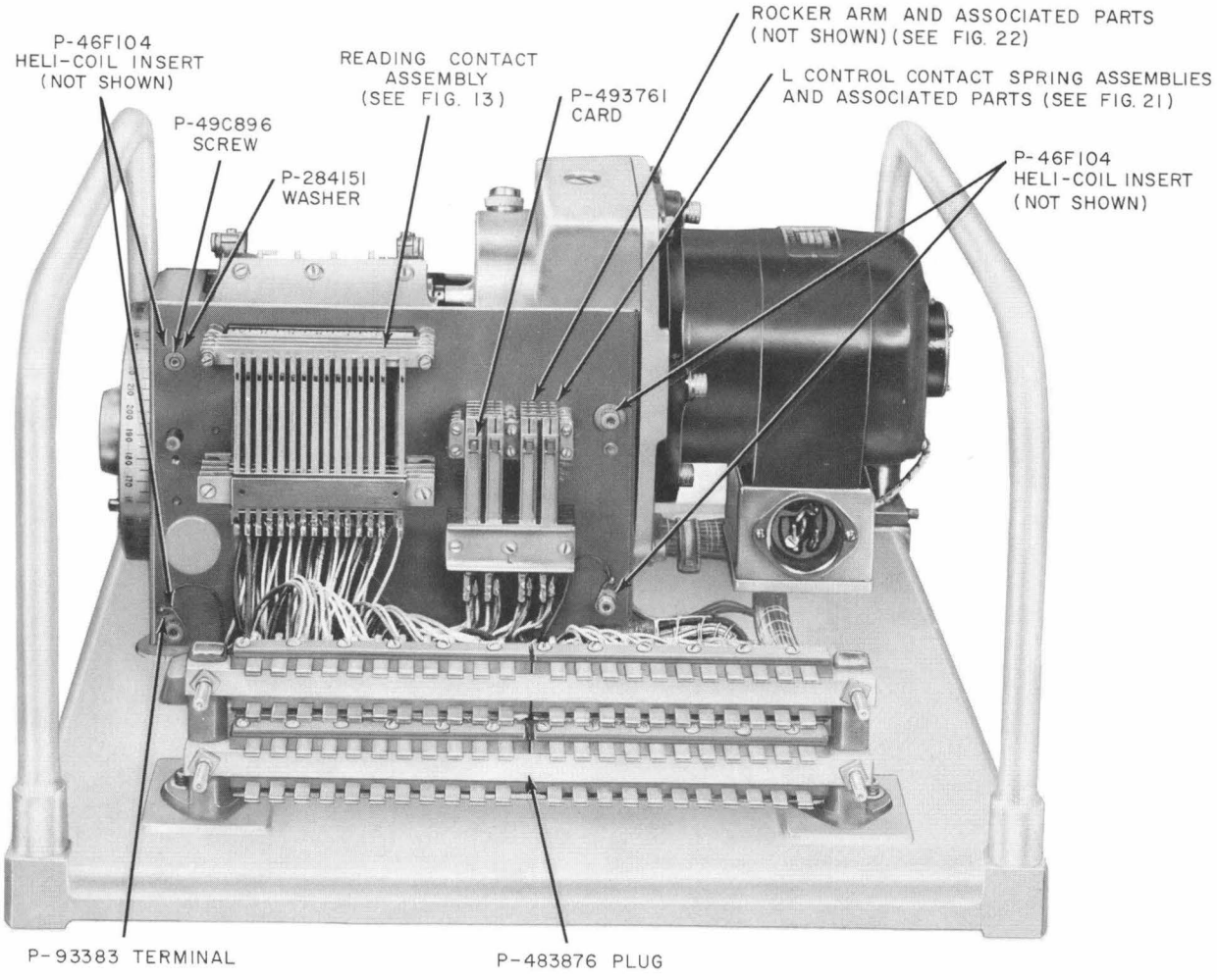


Fig. 4—KS-13835 L5, L6, and L7 Readers—Rear View with Cover Removed

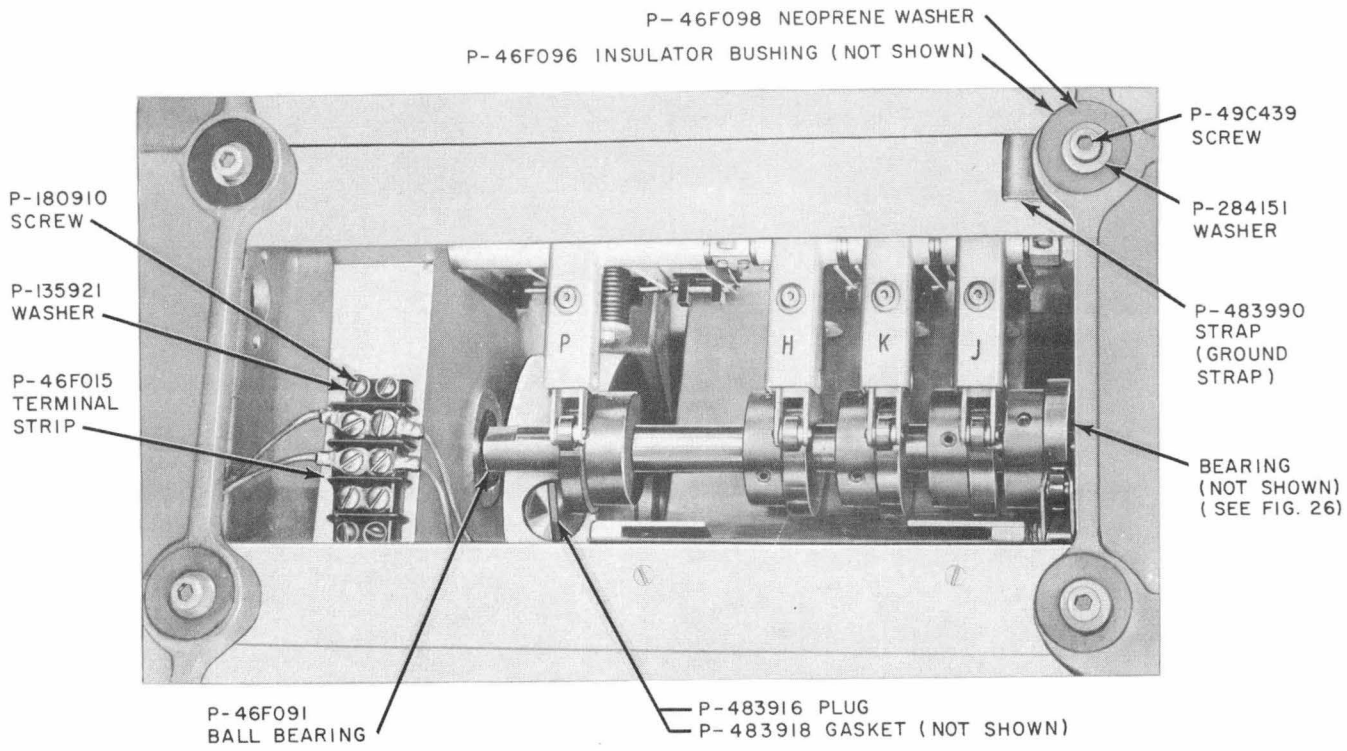


Fig. 5—Bottom of Reader

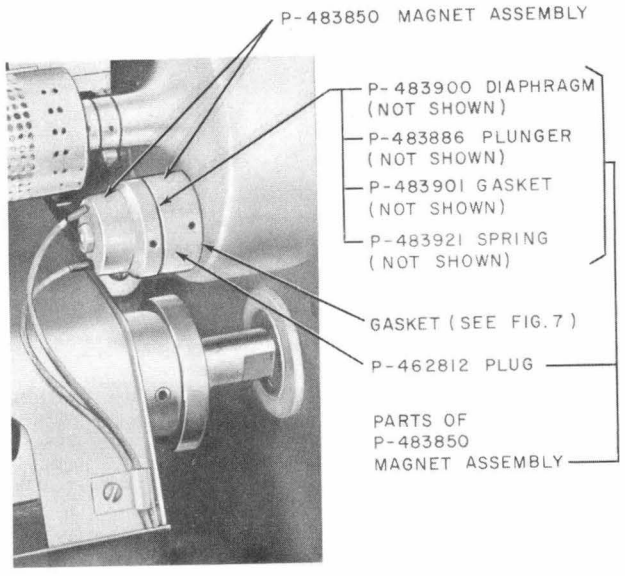


Fig. 6—Interposer Magnet Assembly

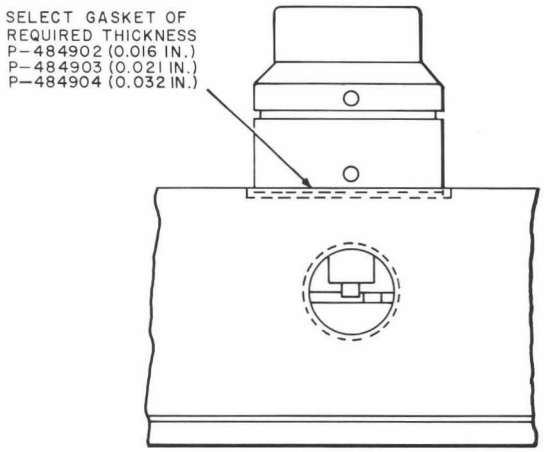


Fig. 7—Gaskets Used Under Interposer Magnet Assembly

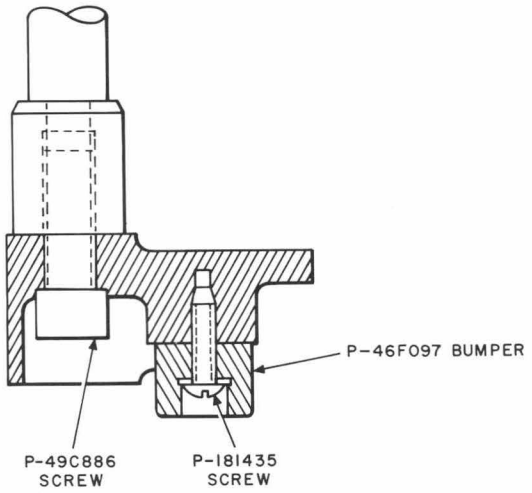
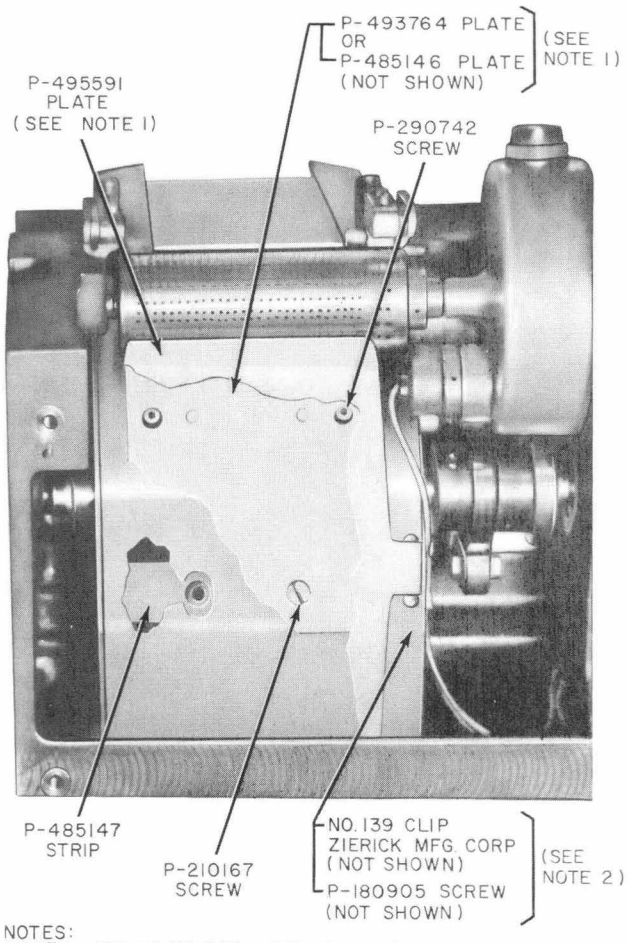


Fig. 8—Bumper and Screws at Corners on Underside of Base



NOTES:
1. IF PLATE TO BE REPLACED IS CHROMIUM PLATED, USE P-485146; OTHERWISE USE P-493764 PLATE. P-495591 IS USED ONLY WITH P-493764.
2. USE ONLY WHEN P-485146 PLATE IS USED.

Fig. 9—Output Tape Plate

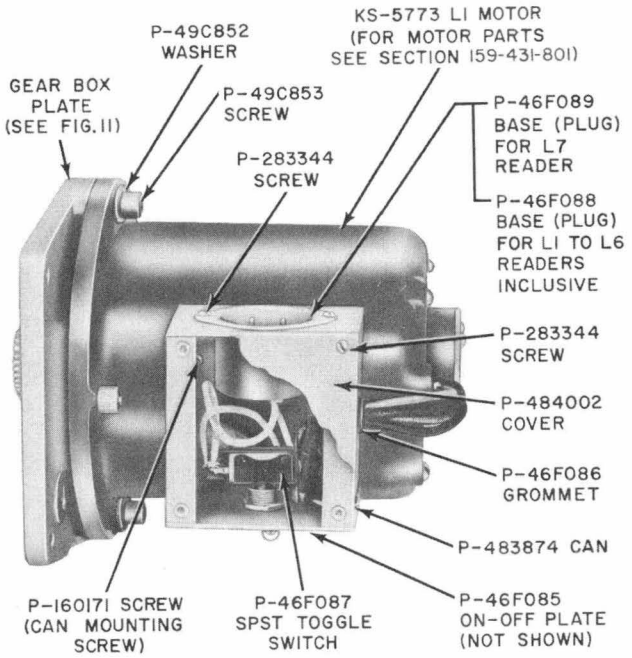


Fig. 10—Motor Assembly

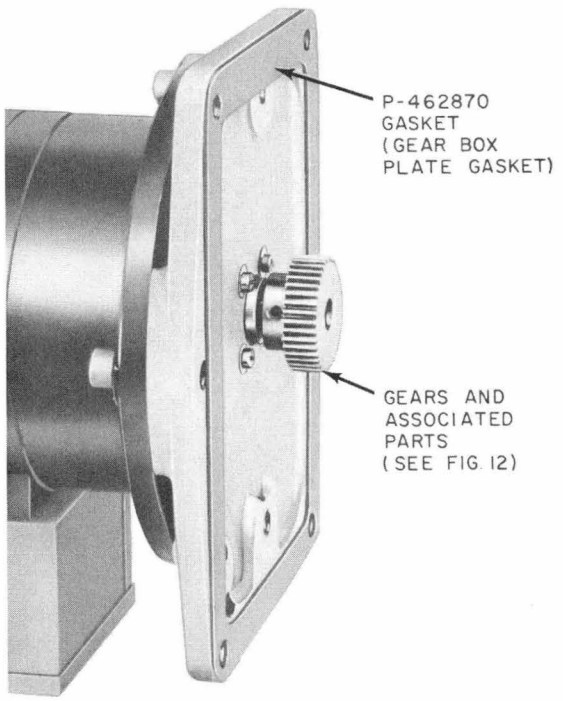
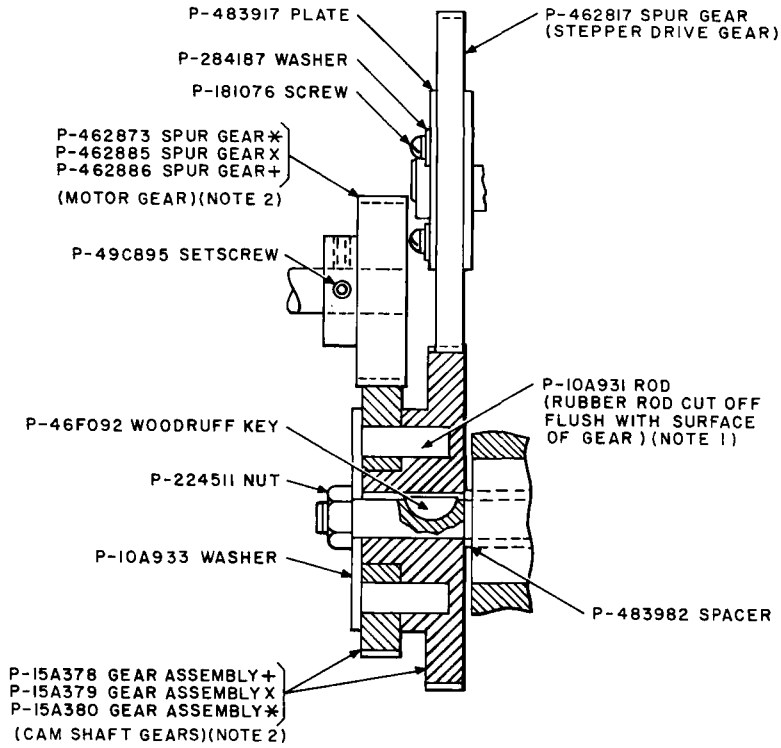


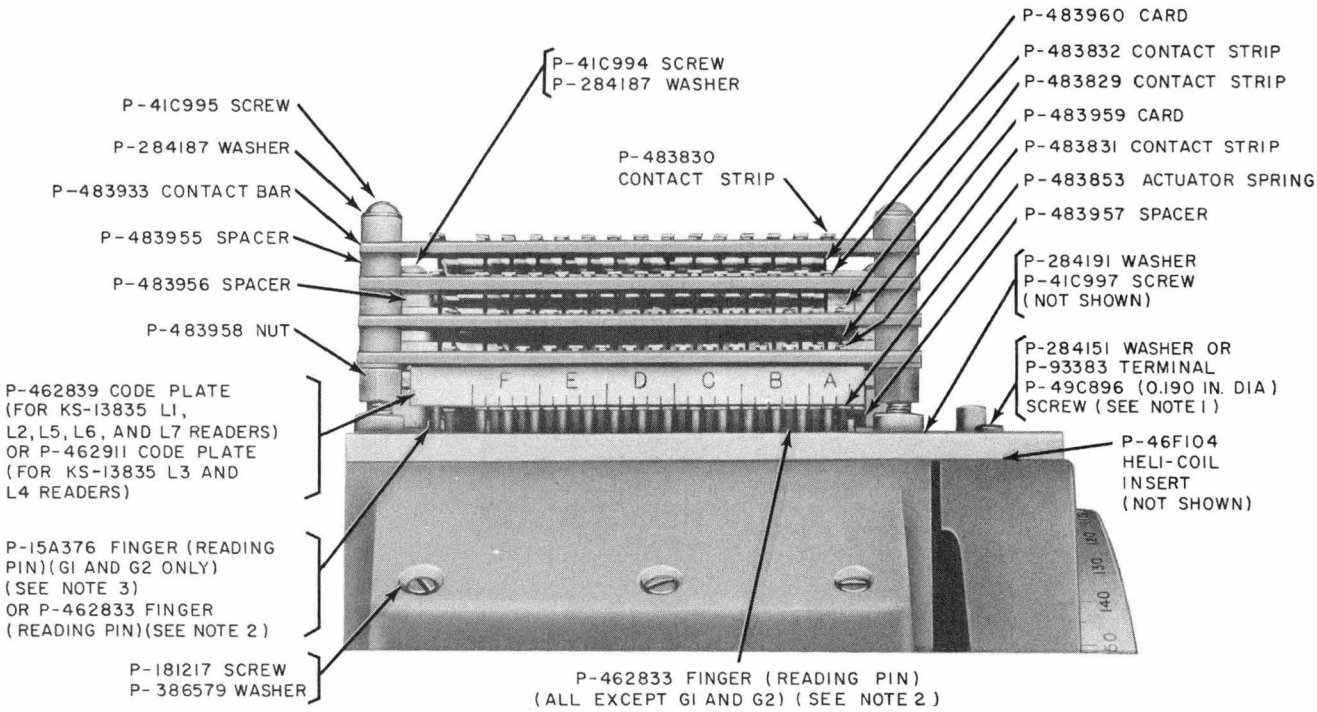
Fig. 11—Gear Box Plate



NOTES:

1. SERIAL NUMBERS ON PAIRS OF GEARS SHALL BE IN RADIAL ALIGNMENT BEFORE INSERTING RODS IN GEARS.
2. * FOR L1 AND L4 READERS ONLY.
   X FOR L2 AND L3 READERS ONLY.
   + FOR L5, L6 AND L7 READERS ONLY.

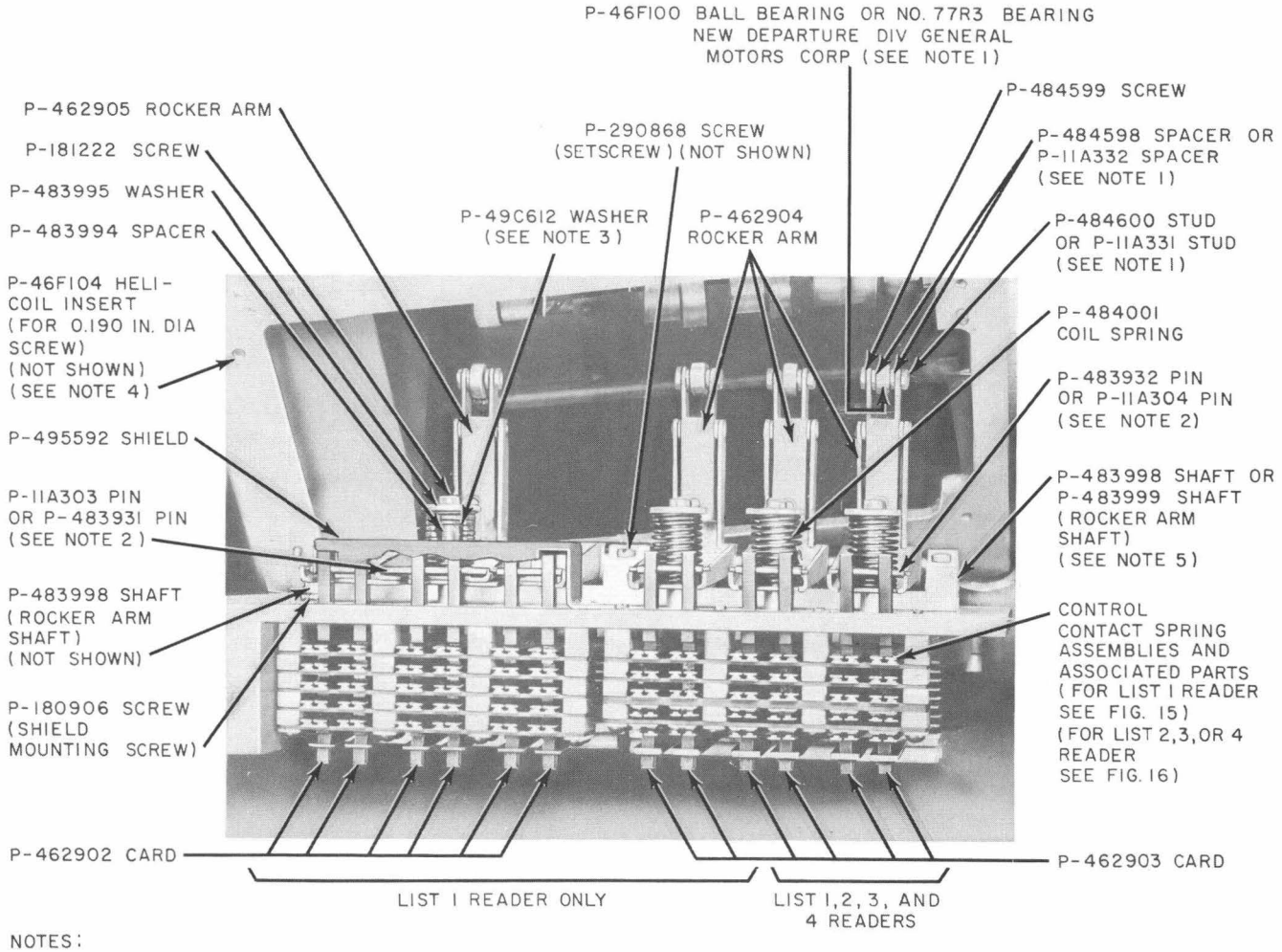
Fig. 12—Gears and Associated Parts



NOTES:

1. WHEN 0.164 IN. DIA SCREW IS TO BE REPLACED, USE P-290747 SCREW, P-284191 WASHER, AND P-46F099 HELI-COIL INSERT.
2. WHEN THE G1 AND G2 FINGER TO BE REPLACED IS LARGER THAN THE OTHER FINGERS, USE P-15A376. OTHERWISE USE P-462833. (SEE NOTE 3.)
3. USE P-15A376 OR P-462833 FINGER EQUIPPED WITH BLACK RUBBER STUD ONLY.

Fig. 13—Reading Contact Assembly



NOTES:

1. WHEN REPLACING 3/4 IN. DIAMETER BEARING, USE P-46F100 BEARING; WHEN REPLACING 1/2 IN. DIAMETER BEARING, USE 77R3 BEARING. USE P-11A331 STUD AND P-11A332 SPACER WITH 77R3 BEARING. USE P-484600 STUD AND P-484598 SPACER WITH P-46F100 BEARING.
2. USE P-483931 OR P-483932 AS SPECIFIED WHEN PIN BEING REPLACED IS SAME DIAMETER THROUGHOUT ITS LENGTH; OTHERWISE, USE P-11A303 OR P-11A304 AS SPECIFIED.
3. P-49C612 WASHER OMITTED ON OTHER THREE SPRING ASSEMBLIES.
4. IF 0.164 IN. DIAMETER SCREW IS USED, USE P-46F099 HELI-COIL INSERT.
5. FOR H, J, AND K CONTACTS OF L1 READER, USE P-483998 SHAFT. FOR H AND J CONTACTS OF L2, 3, AND 4 READERS, USE P-483999 SHAFT.

Fig. 14—KS-13835 L1, L2, L3, and L4 Readers—Control Contact Assembly and Associated Parts (L1 Reader Shown)

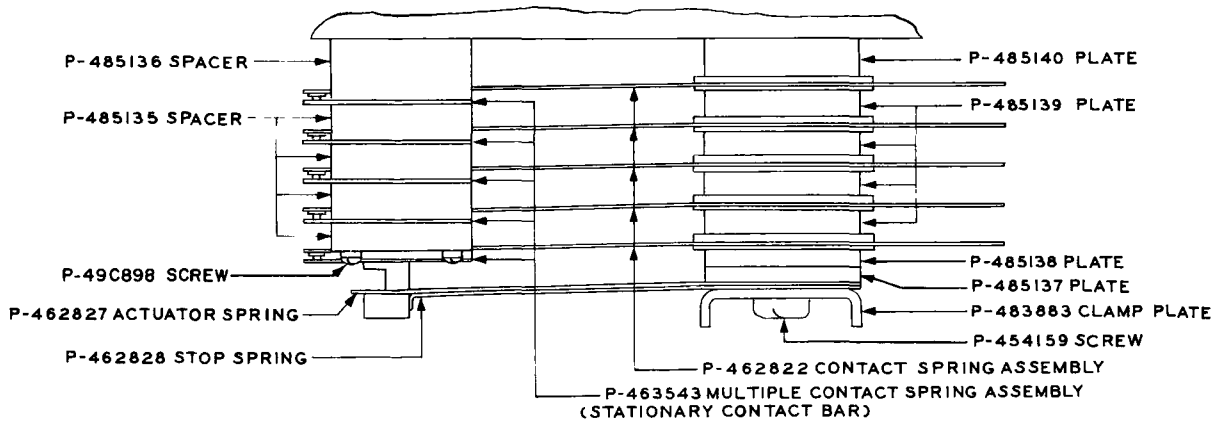


FIG. 15A - P CONTACTS

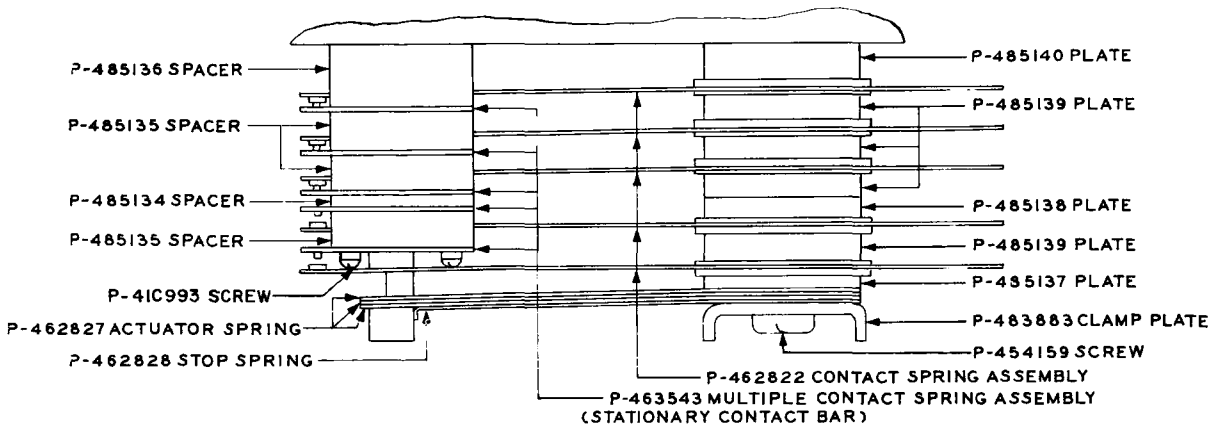


FIG. 15B - H, K AND J CONTACTS

Fig. 15—KS-13835 L1 Reader—Control Contact Assembly—Contact Spring Assemblies and Associated Parts—P Contacts and H, K, and J Contacts

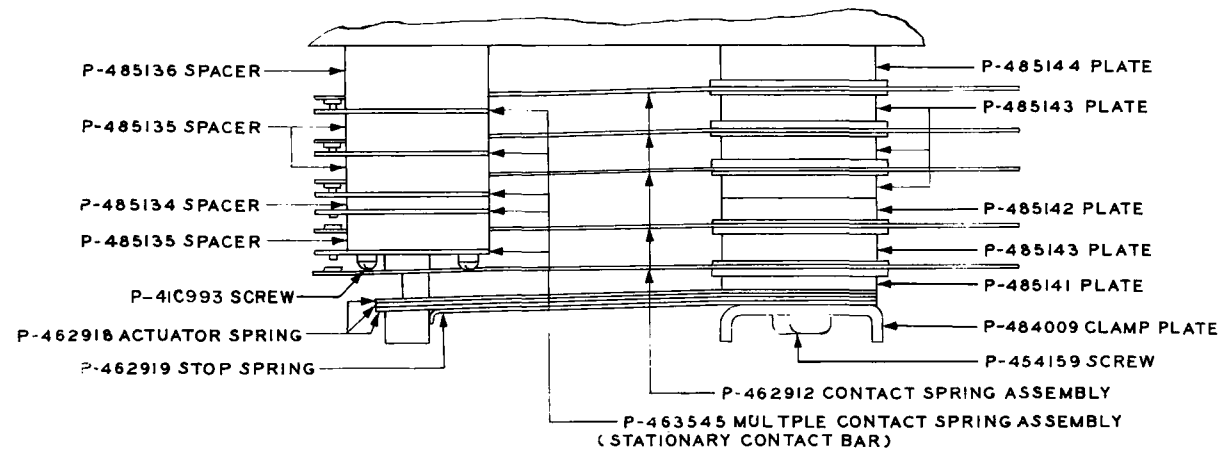
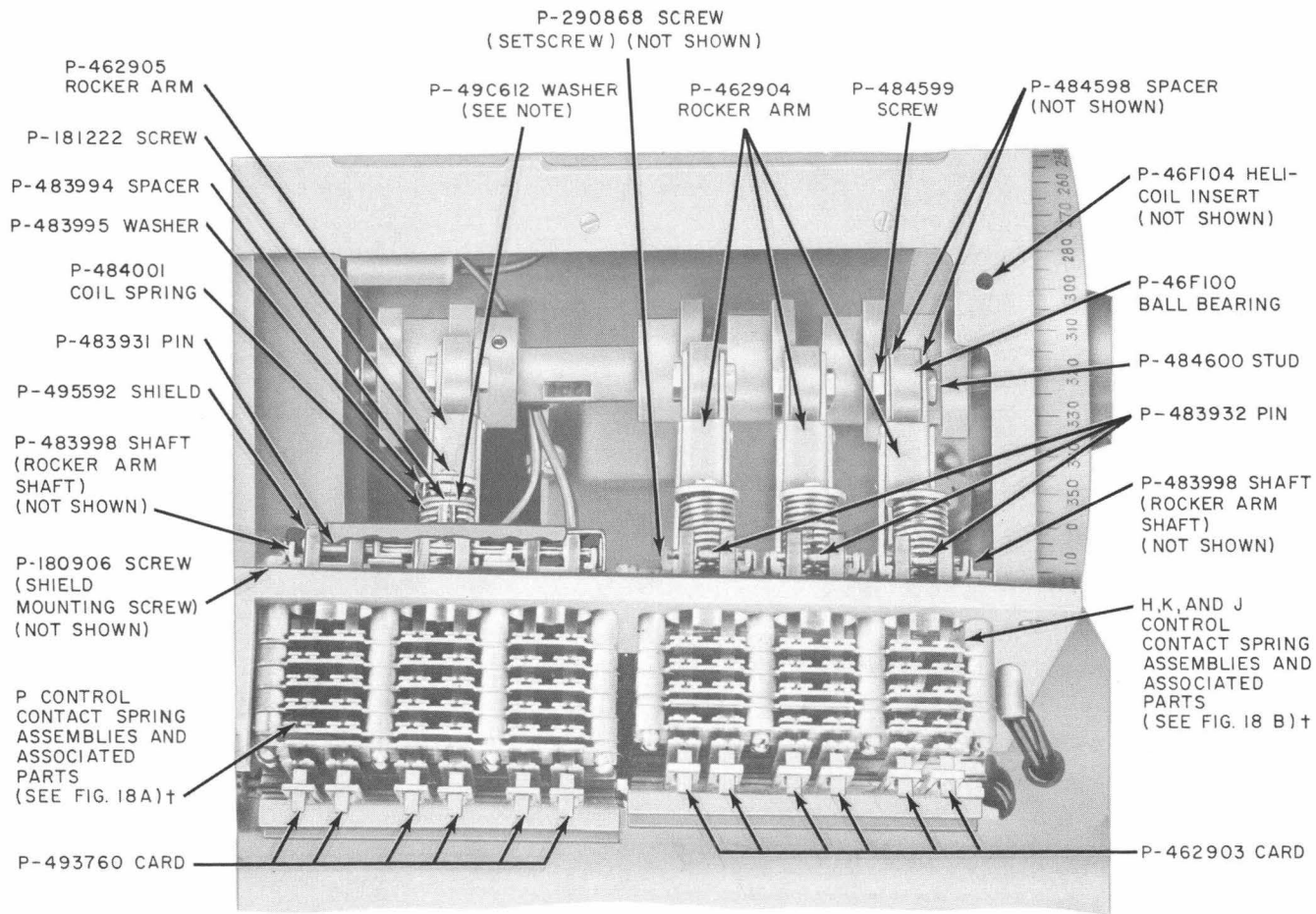


Fig. 16—KS-13835 L2, L3, and L4 Readers—Control Contact Assembly—Contact Spring Assemblies and Associated Parts—H and J Contacts



NOTE:
P-49C612 WASHER OMITTED ON OTHER THREE SPRING ASSEMBLIES.

† FOR L CONTROL CONTACT SPRING ASSEMBLIES AND ASSOCIATED PARTS, SEE FIG. 4 AND 21.

Fig. 17—KS-13835 L5 and L7 Readers—Control Contact Assembly and Associated Parts

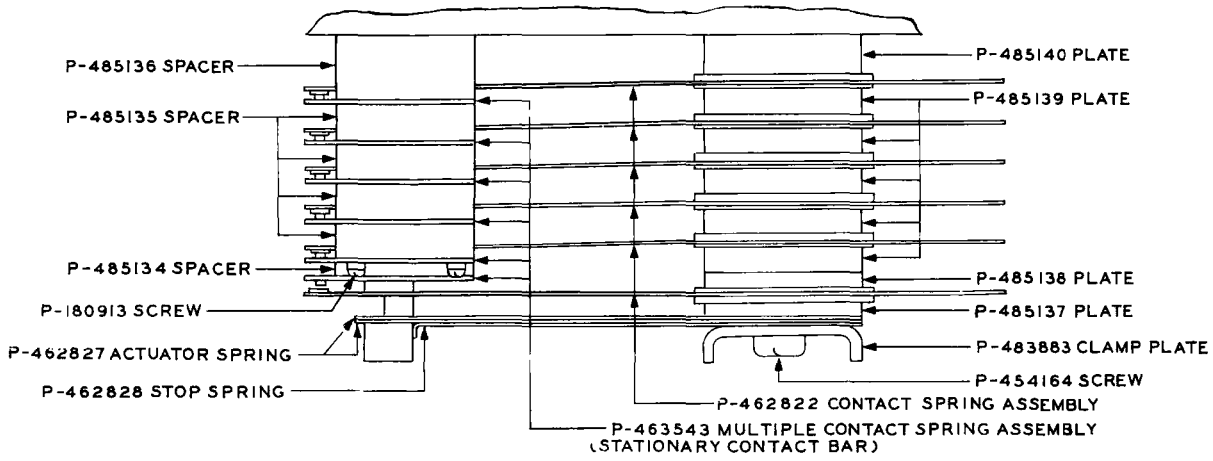


FIG. 18A - P CONTACTS

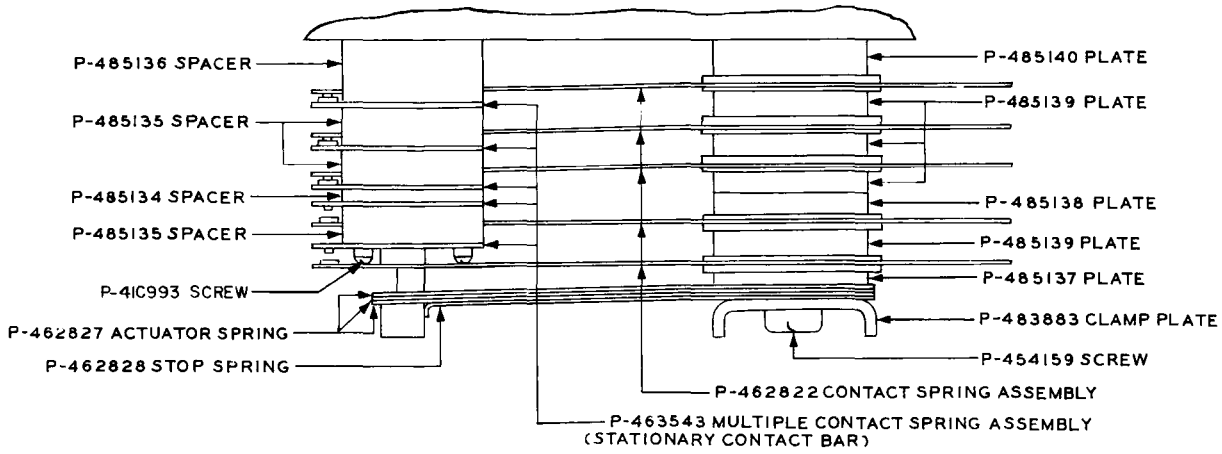
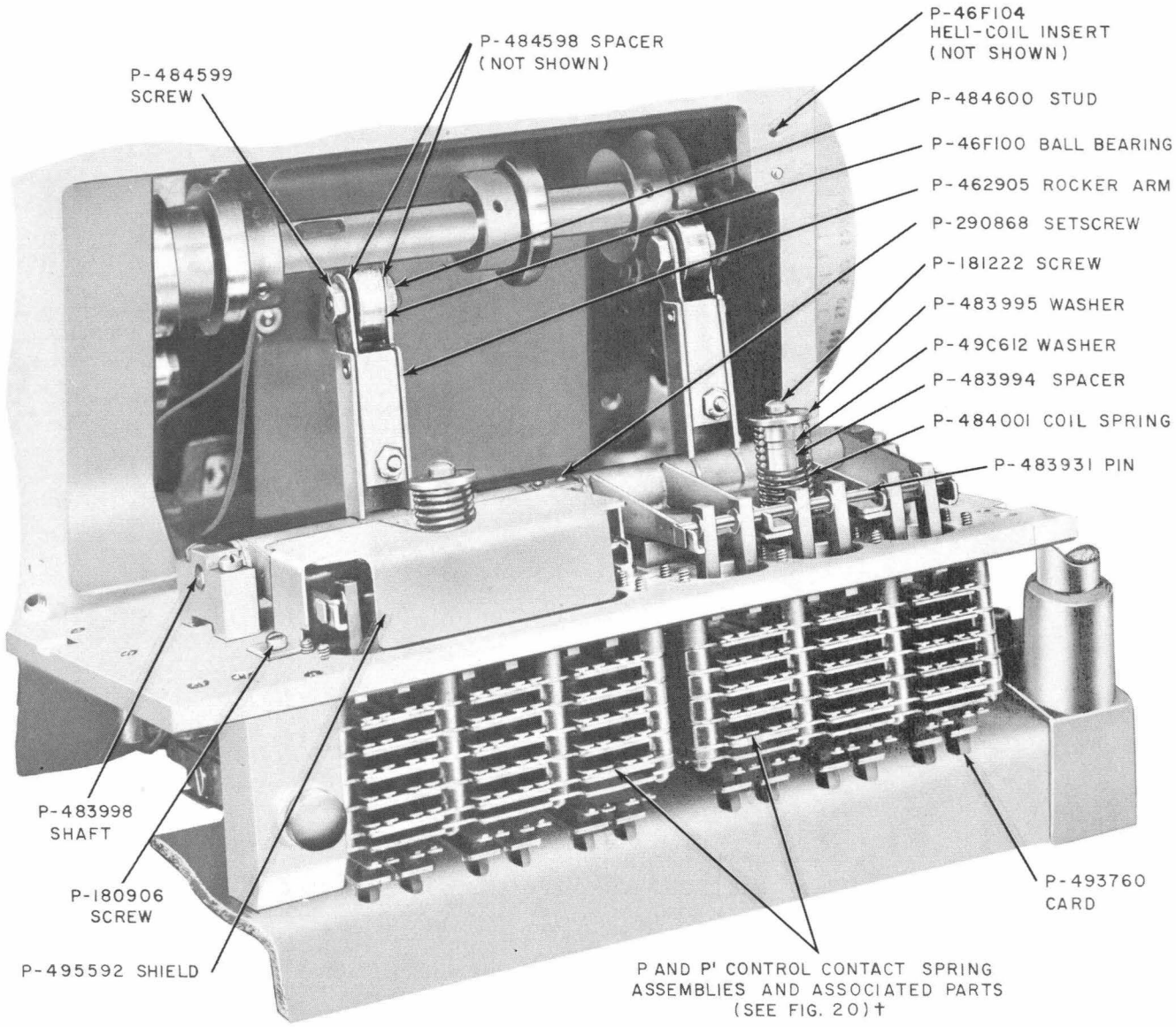


FIG. 18B - H,K AND J CONTACTS

Fig. 18—KS-13835 L5 and L7 Readers—Control Contact Assembly—Contact Spring Assemblies and Associated Parts—P Contacts and H, K, and J Contacts



†FOR L CONTROL CONTACT SPRING ASSEMBLIES
AND ASSOCIATED PARTS, SEE FIG. 4 AND 21.

Fig. 19—KS-13835 L6 Reader—Control Contact Assembly and Associated Parts

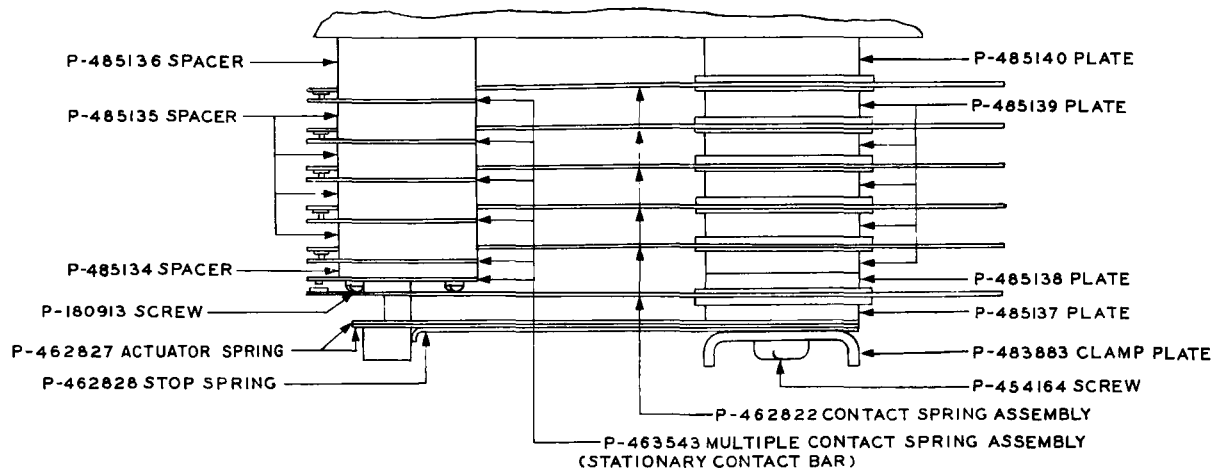


Fig. 20—KS-13835 L6 Reader—Control Contact Assembly—Contact Spring Assemblies and Associated Parts—P and P' Contacts

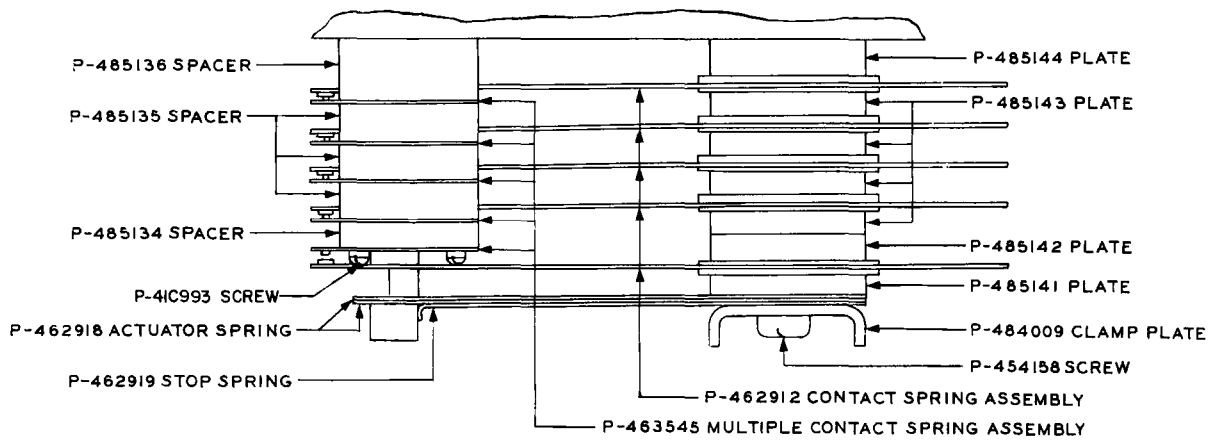


Fig. 21—KS-13835 L5, L6, and L7 Readers—Control Contact Assembly—Contact Spring Assemblies and Associated Parts—L Contacts

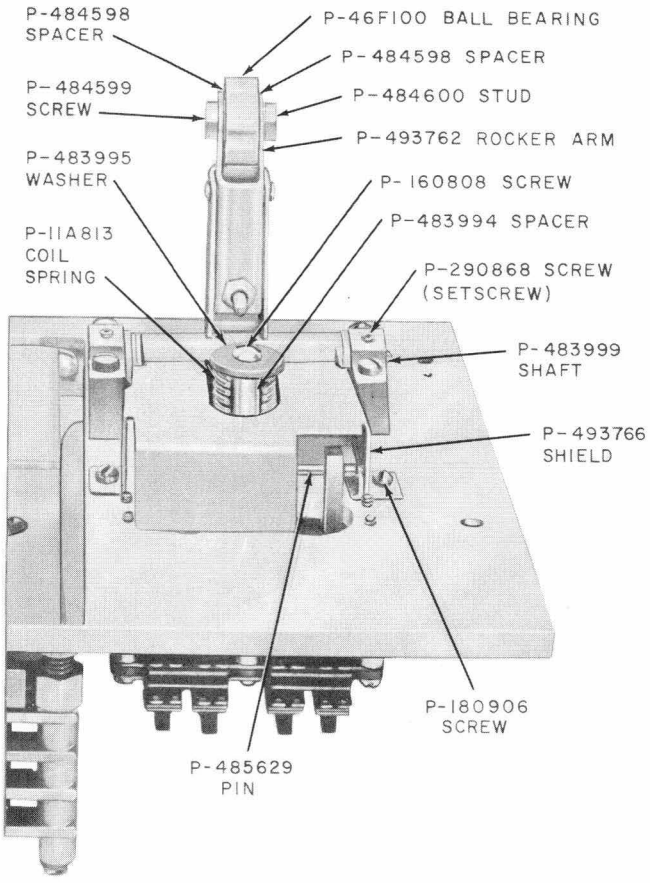
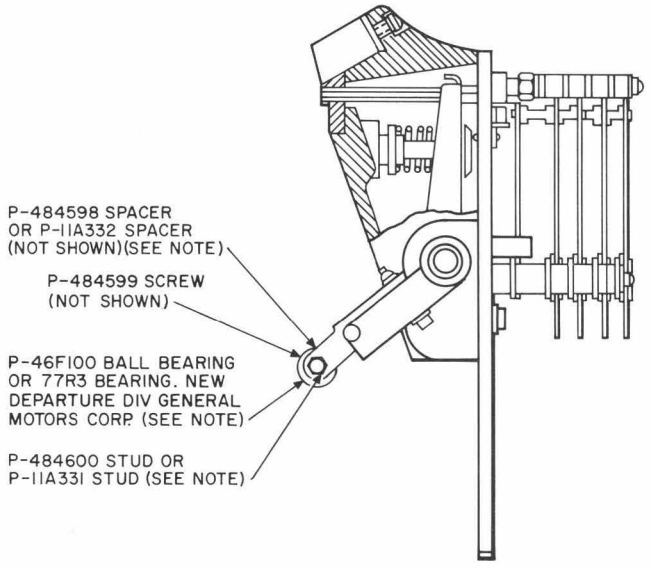


Fig. 22—KS-13835 L5, L6, and L7 Readers—Rocker Arm Associated With L Control Contacts (Mounting Plate Removed From Reader)



NOTE:

WHEN REPLACING 3/4 IN. DIAMETER BEARING, USE P-46F100 BEARING. WHEN REPLACING 1/2 IN. DIAMETER BEARING, USE 77R3. USE P-484600 STUD AND P-484598 SPACER WITH P-46F100 BEARING. USE P-11A331 STUD AND P-11A332 SPACER WITH 77R3 BEARING.

Fig. 23—Partial View of Reading Contact Spring Assembly Showing Bearing on Associated Rocker Arm

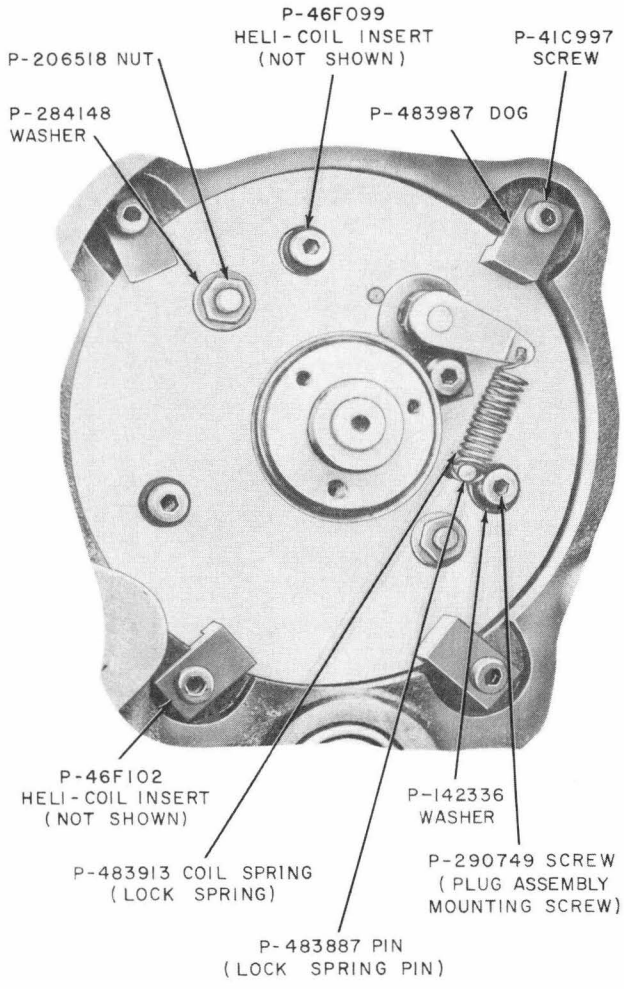


Fig. 24—KS-13835 Reader—Stepper Plug Assembly—Portion Outside of Shell

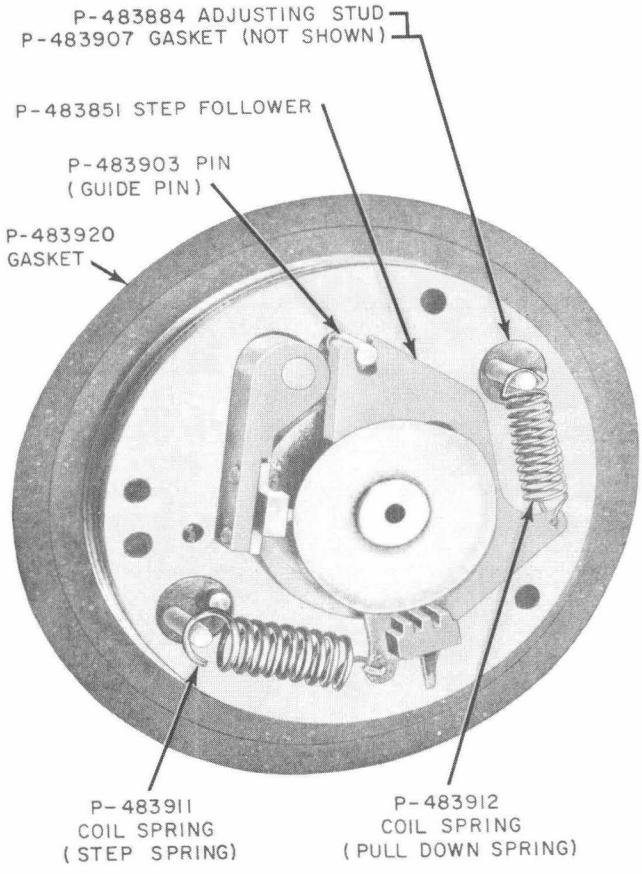


Fig. 25—KS-13835 Reader—Stepper Plug Assembly—Portion Inside of Shell (Plug Removed from Shell)

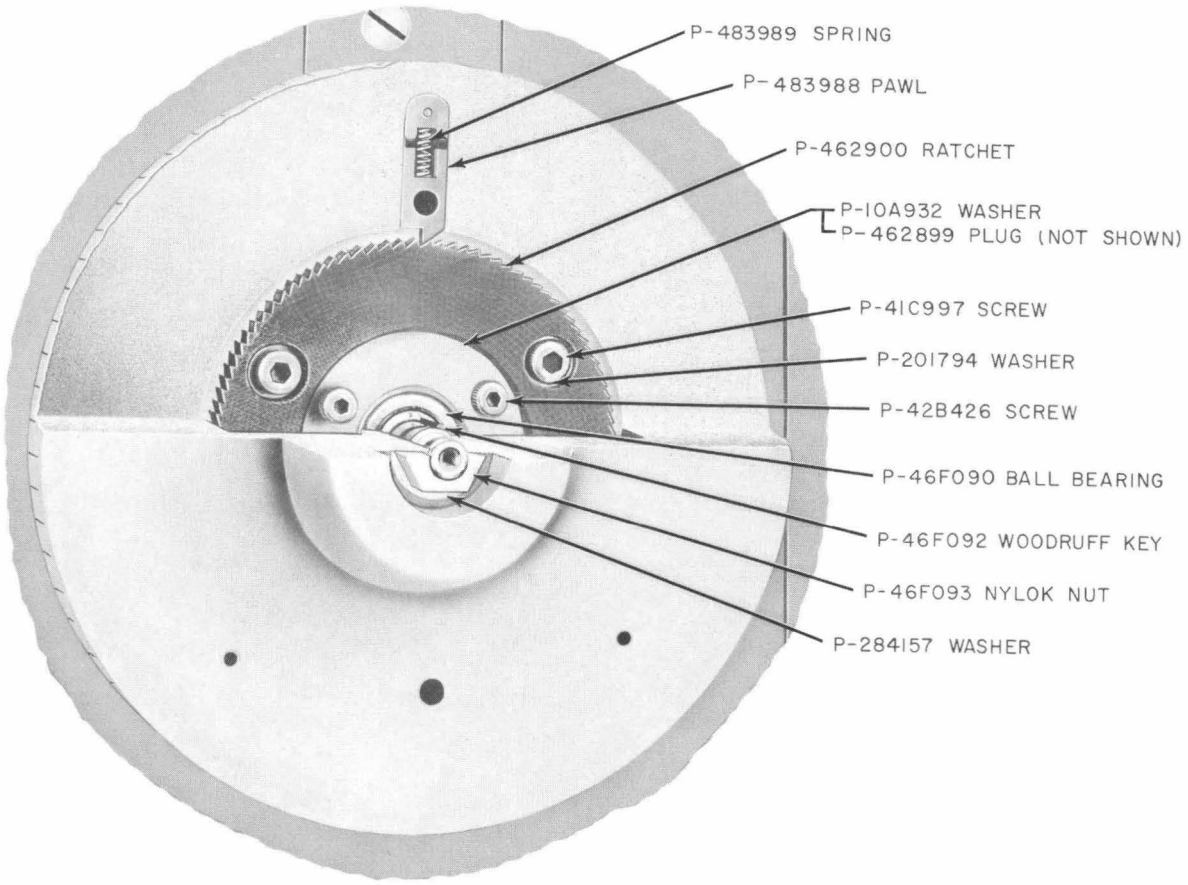


Fig. 26—KS-13835 Reader—Pawl, Ratchet, and Associated Parts

3. REPLACEMENT PROCEDURES

3.01 *List of Tools, Gauges, and Materials*

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
245	3/8- and 7/16-Inch Open Double-End Flat Wrench
417A	1/4- and 3/8-Inch Open Double-End Flat Wrench
418A	5/16- and 7/32-Inch Open Double-End Flat Wrench (2 required)
485A	Smooth-Jaw Pliers
486A	Oil Can
642A	Dial Locking Tool
646A	Ratchet Release Pin (2 required)
647A	Spanner Wrench (2 required)
KS-6320	Orange Stick
KS-14220 L1	T Handle Wrench
KS-14220 L14	Socket
R-1060	Putty Knife
R-2485	5/32-Inch Allen Socket Screw Wrench
R-2486	5/16-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-2959	1/16-Inch Allen Socket Screw Wrench
R-2964	7/32-Inch Allen Socket Screw Wrench
R-3415	7/64-Inch Allen Socket Screw Wrench
R-3416	9/64-Inch Allen Socket Screw Wrench
R-5850	5/8- and 3/4-Inch Double-End Offset Wrench
R-8550	6-Inch Steel Scale
—	Block of Wood, 4 x 1 Inches
—	4-Ounce Riveting Hammer
—	P Long Nose Pliers
—	3-Inch C Screwdriver
—	4-Inch E Screwdriver
—	5-Inch E Screwdriver
—	No. 56 Tweezers (or equivalent) Hammacher Schlemmer & Co
—	No. 565 3/32-Inch Pin Punch L. S. Starrett Co.
—	528-2N Heli-Coil Inserting Tool†
—	535-3N Heli-Coil Inserting Tool†
—	535-4N Heli-Coil Inserting Tool†
—	535-5N Heli-Coil Inserting Tool†
—	1227-06 Heli-Coil Extracting Tool†
—	1227-6 Heli-Coil Extracting Tool†
—	1196-5 Heli-Coil Tang Break-Off Tool†
	†Heli-Coil Corp
GAUGES	
70D	50-0-50 Gram Gauge
79B	0-1000 Gram Push-Pull Tension Gauge
79F	0-6000 Gram Push-Pull Tension Gauge
129A	0.007-Inch Thickness Gauge
KS-6909	Thickness Gauge Nest
MATERIALS	
KS-2423	Cloth
KS-16326 L1	Oil
KS-16832 L2	Lubricant
KS-19578 L1	Trichloroethane
—	Beacon 325 Grease, Esso Standard Division of Humble Oil and Refining Co
—	Dry Cells as Required
—	Razor Blade (single edged)
—	Hardwood Toothpicks, Flat at One End and Pointed at the Other

3.02 When a reader is to be removed from a circuit for replacement of any part, remove it in accordance with accounting center practices. The reader should rest on its base at all times except when maintenance work requires that it be in a different position, during which time it may be placed in any position convenient for performing the work.

3.03 After making any replacement of parts of a reader, the unit containing the part (for example, interposer magnet) shall meet the readjustment requirements involved as specified in Section 034-335-701. Other parts, the adjustments of which may have been disturbed by the replacing operations, shall be checked to meet the readjustment requirements and an overall operation check shall be made of the reader.

3.04 No replacement procedures are specified for screws and other small parts when the procedure consists of a simple operation.

3.05 Certain subassemblies on the readers are accurately positioned by the manufacturer and are then doweled in place. Such subassemblies may be removed to obtain access to other parts and remounted in their correct positions without disturbing the adjustments. ***However, these subassemblies are not interchangeable with corresponding subassemblies on other readers and must always be reinstalled on the readers from which they were removed.***

3.06 In some cases, in order to gain access to parts under the tape chute, it will be necessary to unscrew the two tape chute thumbscrews and swing the chute back.

> ***Caution: When the chute is not held in place by the thumbscrews, it is free to swing and may be damaged when turning the reader on its side or in any position other than normal position; therefore, always make sure that the tape chute is securely fastened while the reader is being tipped from one position to another.***

3.07 At the time of making replacement of parts, clean and lubricate the reader in accordance with Section 034-335-701.

3.08 Wiring diagrams for readers with individually insulated stationary springs in the control contact spring assemblies are shown in Fig. 32 for list 1, Fig. 33 for list 2 and Fig. 34 for lists 3 and 4 readers. Wiring diagrams for readers with bus-bar type multiple stationary springs in the control contact spring assemblies are shown in Fig. 35 for list 1, Fig. 36 for list 2, Fig. 37 for lists 3 and 4, Fig. 38 for ▶lists 5 and 7,◀ and Fig. 39 for list 6 readers. The ▶lists 5, 6, and 7◀ readers do not have individually insulated stationary springs.

MOTOR AND ASSOCIATED PARTS

3.09 ***General:*** To replace the motor or any of the associated parts, remove the motor assembly as follows. Stand the reader on end with the motor up. Remove the four mounting screws and washers which mount the gear box plate using the proper size Allen wrench. Remove the motor and gear box plate as a unit from the gear box. If the heli-coil inserts in the tapped holes for mounting the gear box are loose or damaged, replace them as covered in 3.53 through 3.57.

3.10 ***Motor***

(1) To replace the motor, loosen the gear setscrews using the proper size Allen wrench and remove the gear. Remove the motor mounting screws that secure the motor to the gear box plate using the proper size Allen wrench. Remove the motor from the plate. If the heli-coil inserts in the tapped holes are loose or damaged, replace them as covered in 3.53 through 3.57. Then break off the heli-coil insert tangs as covered in 3.58. Make sure that the tangs are removed from the holes and do not adhere to the inside of the gear box plate in order to prevent them from entering the gear box where they might damage the gears.

(2) Remove the can cover using the 3-inch C screwdriver. Loosen the toggle switch clamping ring with the P long nose pliers and remove the ring. Remove the ON-OFF plate and toggle switch. On motors with four conductors, open the splices between the motor leads and the leads to the plug and toggle switch, respectively. On motors with two conductors, unsolder the motor leads to the plug and switch. Remove the plug and the toggle switch with attached leads from the can using the 3-inch C screwdriver. Withdraw the motor leads from the can. ▶On L7 reader only, use a screwdriver to remove the screw and lockwasher which hold the ground

wire to the motor, and remove the ground wire.◀ Remove the can from the motor with a screwdriver.

(3) Mount the can on the new motor, tightening the screws securely. ***If there are four conductors from the new motor, proceed as follows.*** Connect in pairs one black and one green lead. To these pairs, connect a source of 60 Hz, 115 volts. Observe the direction of the shaft. If the leads are paired correctly, the shaft will rotate counterclockwise viewing the exposed end of the shaft. If the shaft rotates in a clockwise direction, disconnect the source of power and interchange the black leads. Insert the motor leads into the can and solder together the paired leads. Insert the toggle switch through the plughole and mount the plug in this hole, tightening the screw securely. Splice the paired motor leads to the toggle switch and plug leads, respectively, in the approved manner. ***If there are two conductors from the motor,*** it is unnecessary to check the direction of rotation of the motor. Insert the motor leads in the can and mount the plug as described above. Splice the motor leads to the toggle switch and plug leads, respectively. Remount the toggle switch in the can and the cover on the can. ▶On the L7 reader only, fasten the ground wire under the head of the nearest screw on the end of the motor housing. Take care to remove sufficient paint from the housing to provide a good ground.◀

(4) Mount the motor on the gear box plate. Tighten all screws securely. On motors having gear plates with oil seals, check that the motor shaft turns freely. If it does not, loosen the oil seal mounting screws with the screwdriver and shift the oil seal as required. Tighten the screws securely. Remount the gear so that there is a clearance of minimum 0.015 inch, maximum 0.025 inch between the hub of the gear and the oil seal as shown in Fig. 27. Use the KS-6909 gauge to check the clearance.

(5) If necessary, replace the gear box plate gasket as follows. Remove any sealing compound which may be present on the associated surfaces of the plate or gear box using the R-1060 putty knife. Clean the surface of the plate which will be in contact with the gasket with a KS-2423 cloth moistened with KS-19578 L1 trichoroethane. Put the new gasket in place and remount the motor and gear box plate on the gear box.

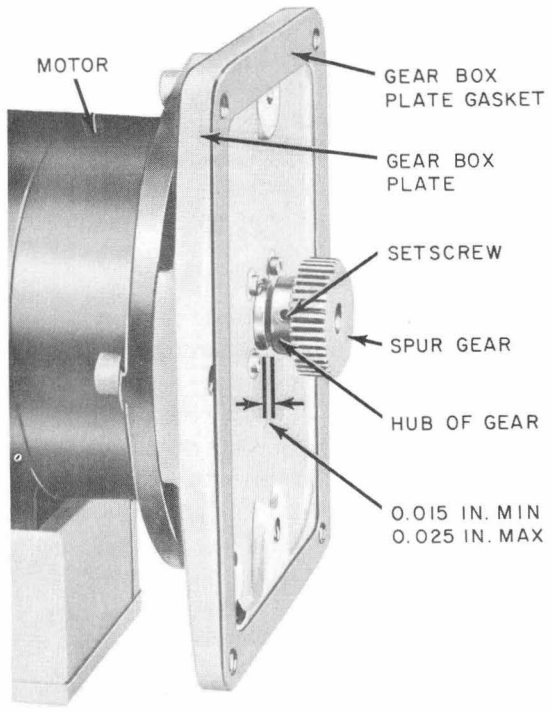


Fig. 27—Clearance Between Hub of Gear and Oil Seal

3.11 ***Gear Box Plate Gasket:*** Remove the motor assembly from the gear box as covered in 3.09. Replace the gasket as covered in 3.10.

3.12 ***Toggle Switch and Motor Plug:*** To replace either or both of these parts, remove the part or parts as covered in 3.10(2). Substitute the new part or parts, and mount them in the reverse order of removal.

GEAR AND ASSOCIATED PARTS

3.13 ***Motor Gear:*** To replace the gear attached to the motor shaft, remove the motor assembly as covered in 3.09. Loosen the gear setscrews using the proper size Allen wrench. Mount the new gear on the motor shaft. On motors having gear plates with oil seals, position the gear so that there is clearance of minimum 0.015 inch, maximum 0.025 inch between the hub of the gear and the oil seal, as shown in Fig. 27, using the KS-6909 gauge to check the clearance. On motors having gear plates without oil seals, position the gear so that the end of the hub is approximately even with the machined mounting surface of the plate. To do this, place the R-8550 scale across the machined service of the plate and position the hub approximately

even with the inner side of the scale. Tighten the setscrews securely. If necessary, replace the gear box gasket as covered in 3.10. Remount the motor assembly on the gear box.

3.14 *Camshaft Gears and Associated Rubber Rods*

(1) When either of the gears on the camshaft requires replacement, replace both gears and the six associated rubber rods as an assembly. To replace this assembly, remove the motor assembly and gear box plate as covered in 3.09. Remove the grease from the gear box using the R-1060 putty knife.

(2) Insert the 646A ratchet release pins in the dial. Remove the nut from the gear end of the camshaft using the 245 wrench while holding the shaft stationary with the 417A wrench applied to the flat portion of the shaft. Set the dial at zero. Lift the two camshaft gears and associated parts from the shaft, being careful not to turn the camshaft or the stepper shaft.

(3) Check that both gears of the new gear assembly have the same serial number. Arrange the gears so that these numbers are in radial alignment with each other, and insert a new rubber rod in each of the six holes in the gears until an end of each rod is in the bottom of each hole. Cut off the excess length of each rod flush with the surface of the gear using a razor blade. Substitute the new gear assembly for the gears being replaced. If it is required to replace the rubber rods without replacing the gears, the procedure is the same, except that it will be necessary to remove only the outer of the two gears. When this gear is removed, the rubber rods will be exposed. Remove them with the fingers or the P long nose pliers. Place the outer gear back on the hub so that the serial numbers are in radial alignment with each other. Insert the new rubber rods in the holes in the gears as described above. Place the washer over the gear and place the nut on the camshaft. Tighten the nut using the 245 and 417A wrenches in the same manner as they were used in removing the nut.

(4) Energize the interposer magnet by connecting 6 through 8 volts dc to the terminals on the bottom of the reader. Turn the reader on its side to make this connection and then turn it back on its base. Rotate the dial back and forth a few degrees each side of zero. The midpoint of the drum step should occur at zero as judged by eye. If the midpoint of the step does not occur at zero, rotate the dial to the point at which the drum is at the midpoint of the step. Then, loosen the screws from the clamp plate over the gear of the stepper assembly with the 4-inch E screwdriver, being careful not to turn the stepper shaft. Rotate the dial carefully to zero without turning the stepper shaft. Then tighten the clamp plate screws. Recheck to determine if the midpoint of the step occurs at zero. If not, repeat the procedure just described until the midpoint of the step occurs at zero.

(5) Fill the gear box with grease as covered in Section 034-335-701. Remount the motor and gear box plate. Remove the ratchet release pins.

3.15 ***Stepper Drive Gear:*** Remove the grease from the gear box as covered in Section 034-335-701. Remove the motor and gear box plate as covered in 3.09. Insert the 646A ratchet release pins in the dial and set the dial at zero. Remove the screws holding the clamp plate on the hub with the 4-inch E screwdriver. Remove the clamp plate. Remove the gear, being careful not to turn the stepper shaft. Place the new gear, clamp plate, and clamp plate screws in position and tighten the screws with the 4-inch E screwdriver. Check to determine if the midpoint of the drum step occurs at zero as covered in 3.14. If the midpoint of the drum step does not occur at zero, correct the condition as covered in 3.14. Fill the gear box with grease as covered in Section 034-335-701. Remount the motor and gear box plate.

READING CONTACT ASSEMBLY AND ASSOCIATED PARTS

3.16 *Reading Pins*

(1) Remove the studs supporting the plug associated with the reading contacts using the 417A wrench. Remove the cable clamp of the associated cable using the 3-inch C screwdriver. Remove the cover. Remove the reading contact assembly mounting plate screws using the proper size Allen wrench.

(2) Remove the reading contact assembly (Fig. 28) and the associated cable and plug. Place them on a workbench with the contacts up. The tape shoes and, if provided, the loose tape plate forming part of the tape chute assembly will drop out of place when the reading contact assembly is removed. Remove the screws holding the casting and arm assembly to the reading contact assembly mounting plate using the proper size Allen wrench. While holding the casting, lift the reading contact assembly mounting plate from the casting and arm assembly.

(3) Remove the reading pins to be replaced and carefully insert new pins as required. To avoid bending new pins, do not force them in place. After the pins are in the bail, it may be necessary to move them slightly from side to side and up and down to guide them into the holes in the pin guide. If difficulty is experienced in inserting the pins, check to see that adjacent pins are correctly located in the holes in the pin guide. Check that there is a pin in each hole. This may be observed by holding the assembly above eye level with the arm of the assembly down and in the operated position. Place the casting and arm assembly on a workbench with the arm down and carefully position the reading contact assembly mounting plate so that the dowels enter the corresponding holes. Insert the four mounting screws and tighten them securely using the proper size Allen wrench.

(4) If the heli-coil inserts in the tapped holes in the reader frame for mounting the reading contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(5) Mount the reading contact assembly on the reader and securely tighten the mounting plate screws. Mount the plug and cable clamp. Set the dial at 100. Any contact not made with the dial so set, except the G1 or G2 contacts (which make alternately on alternate steps of the drum), indicates that the associated pin is not in the hole in the actuator spring but is resting on the spring. Where such a condition occurs, guide the end of this pin into the hole using the tweezers.

(6) When all contacts are made, except either the G1 or G2 contacts, the pins are in the holes in the actuator springs, except where a pin is between two springs. To check for this condition, observe whether the pins are parallel to each other and at right angles to the code plate. Any pin not in this position is probably seated between two adjacent springs. To check further for this condition, press down lightly against each pin using the KS-6320 orange stick. If the pin is in the spring hole, it can be moved only slightly. More than a slight movement of the pin is an indication that it is between two springs. To correct this condition, push the associated actuator spring away from the pin with the KS-6320 orange stick and at the same time guide the pin so that it will rest on its associated spring. Guide the pin into the hole using the tweezers.

(7) To check that the pin associated with the G1 or G2 contacts (whichever contacts were not made in the preceding test) is in the hole in the actuator spring, set the dial at 0, press the drum release plunger, and move the drum one step by hand. Then, release the plunger and move the dial to 100. If the contacts do not make, guide the pin into the hole in the actuator spring using the preceding method.

(8) Remove the cover. Remount the tape shoes as covered in 3.48. Remount the loose tape plate, if provided, as covered in 3.52.

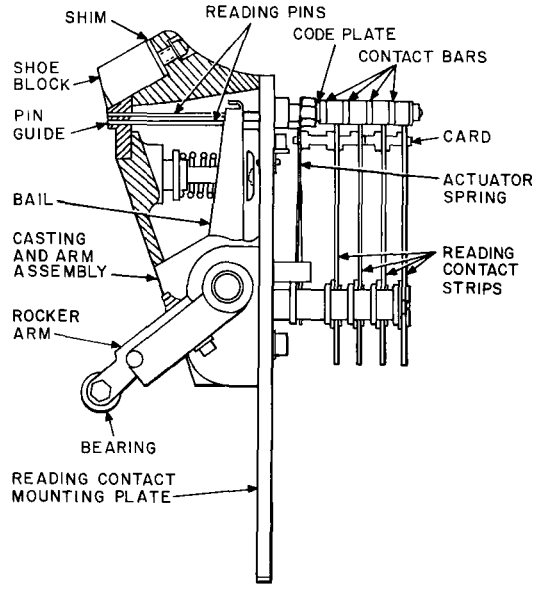


Fig. 28—Sectional View of Reading Contact Assembly and Associated Parts

3.17 ***Contact Bars and Code Plate:*** Set the dial at 0 so that the contacts on the springs will not touch the contact bars. This will avoid disturbing the position of the cards, reading pins, and the adjustment of the springs when the bars are removed and replaced. Using the 3-inch C screwdriver, loosen the screws until the threads are disengaged and then carefully lift the contact bars, code plate, and associated spacers away from the contact springs, keeping the parts together on the screws to avoid losing any of them. Substitute new parts as necessary and carefully mount the contact bars, code plate, and associated parts. Take care not to distort the springs nor disturb the cards or pins. Securely tighten the screws.

3.18 ***Cards***

(1) Remove the contact bars and code plate as covered in 3.17. Using the tweezers, lift the end of the card out of the slot in the actuator spring. Carefully slide the card between this spring and an adjacent actuator spring until the card is free from its associated springs of the contact strips. Use the KS-6320 orange stick to steady the contact strip springs while freeing the card.

(2) To insert a card, proceed as follows. Grasp the card with the tweezers and insert the actuator spring end of the card between its associated actuator spring and an adjacent spring. With the orange stick, guide the card into the slots in the springs of the contact strips. Then, with the tweezers, guide the end of the card into the slot in the actuator spring. After the card is in place, make a careful check to see that all cards are properly seated in the slots in the springs of the contact strips and in the slots in the actuator springs.

(3) Carefully mount the contact bars, code plate, and associated parts as covered in 3.17. Check that the reading pins are correctly placed in the actuator springs using the method covered in 3.16(6) and (7).

3.19 ***First (Outside) Contact Strip:*** Unsolder the connections from the first strip and remove the wires. Remove the contact strip assembly mounting screws using the 3-inch C screwdriver and remove the strip. Substitute the new strip and tighten the screws securely. Reconnect the wires in accordance with 3.23. Check that the associated cards are in place.

3.20 ***Second Contact Strip***

(1) Unsolder the connections from the first and second contact strips and remove the wires. Remove the contact bars and code plate as covered in 3.17. Remove the contact strip assembly mounting screws using the 3-inch C screwdriver, and remove the first and second strips and associated spacers. When the strips are removed, the cards will fall from the springs. Take care not to lose any of the cards.

(2) Substitute the new strip and remount the strips and spacers, making certain that the correct strips are used and that they are in correct relation to each other as shown in Fig. 13. Tighten the mounting screws securely. Reconnect the wires in accordance with 3.23. Remount the cards as covered in 3.18 and the contact bars and code plate as covered in 3.17.

(3) Check the springs for binding by slightly moving each spring away from the contact bar using the KS-6320 orange stick. If any spring binds, loosen the contact strip mounting screws and shift the position of the strip as required.

3.21 ***Third Contact Strip***

(1) Remove the contact bars and code plate as covered in 3.17. Remove the contact strip assembly mounting screws using the 3-inch C screwdriver, and move the first and second contact strips and associated spacers out of the way so that the soldered connections of the third and fourth strips are accessible. When the strips are moved, the cards will fall from the springs. Take care not to lose any of the cards.

(2) Unsolder the connections from the third strip and remove the strip. Substitute the new strip, making certain that the correct strip is used as shown in Fig. 13. Reconnect the wires in accordance with 3.23. Remount the strips and spacers and tighten the mounting screws securely. Remount the cards as covered in 3.18 and the contact bars and code plate as covered in 3.17.

(3) Check the springs for binding by slightly moving each spring away from the contact bar using the KS-6320 orange stick. If any spring binds, loosen the contact strip mounting screws and shift the position of the strip as required.

3.22 ***Fourth Contact Strip:*** Remove the third contact strip as covered in 3.21. Unsolder the wires from the fourth strip and substitute the new strip. Remount the third strip and reconnect the wires in accordance with 3.23. Reassemble the parts as covered in 3.21.

3.23 ***Wiring of Reading Contact Strips:*** Connect the wires to the reading contact strips in accordance with the figure listed below which applies to the reader on which work is being done.

(a) For readers with individually insulated stationary springs in the control contact spring assemblies—

LIST	FIG.
1	32
2	33
3 and 4	34

(b) For readers having bus-bar type multiple stationary springs in the control contact spring assemblies—

LIST	FIG.
1	35
2	36
3 and 4	37
→ 5 and 7	38
6	39

3.24 ***Actuator Spring***

(1) Remove the contact bars and code plate as covered in 3.17. Remove the contact strip mounting screws using the 3-inch C screwdriver. Remove the contact strips and associated spacers. When the contact strips are removed, the cards will fall from the springs. Take care not the lose any of the cards.

(2) Remove the actuator spring and substitute the new spring. Remount the contact strips and tighten the screws securely. Guide each pin into the hole of the associated actuator spring as covered in 3.16 and place the cards in position as covered in 3.18.

(3) Check carefully to see that all pins and all cards are properly in place in the springs. Carefully mount the contact bars, code plate, and associated spacers as covered in 3.17.

CONTROL CONTACT ASSEMBLY

3.25 ***Bearing Pins and Cards Associated With H, K, or J Springs***

(1) Remove the control contact assembly mounting plate from the reader frame by removing the four mounting screws using the proper size Allen wrench. Withdraw the assembly far enough to reach the parts at the back of the plate. Support the assembly in a manner to avoid damage to any of the parts.

(2) If the heli-coil inserts in the tapped holes in the reader frame for mounting the control contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(3) To replace the bearing pin, press back on the front ends of the associated cards and withdraw the pin, using the 485A pliers if necessary. Turning the pin will facilitate removal of the old and insertion of the new pin. Make sure that the container of KS-16832 L2 lubricant has been shaken as covered in 1.07. Using a toothpick, apply KS-16832 L2 lubricant sparingly in the rocker arm bearing pin notches and on the pin where it is in contact with the cards. Insert the new pin in the holes in the cards. Remove pressure from the front of the cards, and make sure that the pin is properly seated in the rocker arm notches.

(4) To replace a card, remove the associated bearing pin as described in (3). Pull forward the positioning spring associated with the card, move the card to the bottom of the retractile spring slot, and withdraw the card from the rear. Insert the new card from the rear into the slots in the springs until the end of the card rests against the positioning spring. Using the 3-inch C screwdriver, push the end of the retractile spring against the adjacent contact spring. Slowly push the card foward until the positioning spring falls into place under the card. After the card is in place, insert the bearing pin as described in (3), using a new pin if necessary.

(5) Remount the contact assembly mounting plate, taking care to place washers or terminals on the screws. Tighten all screws securely.

3.26 *Bearing Pins and Cards Associated With P, P', or L Springs*

(1) Remove the control contact assembly for the P or P' springs or the reading contact assembly for the L springs from the reader frame by removing the four mounting screws using the proper size Allen wrench, as required. Withdraw the assembly far enough to reach the parts at the back of the plate. Support the assembly in a manner to avoid damage to any of the parts. Remove the oil shield, if provided, using the 4-inch E screwdriver.

(2) If the heli-coil inserts in the tapped holes in the reader frame for mounting the control contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(3) To replace the bearing pin, push back on all cards simultaneously so that the retractile springs rest against the fiber strip. The use of a flat object, such as a block of wood approximately 4 by 1 by 1 inches is desirable for this purpose. Withdraw the pin using the 485A pliers. Turn the pin and slightly move the cards from time to time while withdrawing the pin. Make sure that the container of KS-16832 L2 lubricant has been shaken as covered in 1.07. Using a toothpick, apply KS-16832 L2 lubricant sparingly in the rocker arm bearing pin notches and on the pin where it is in contact with the cards. Insert the pin into the holes in the cards. If the pin binds while being inserted, move the cards slightly from time to time while inserting the pin. Remove pressure from the front of the cards and make sure that the pin is properly seated in the rocker arm notches.

(4) To replace a card, remove the bearing pin, as described in (3), from as many cards as necessary in order to free the cards to be replaced. Pull foward the positioning spring associated with the card, move the card to the bottom of the retractile spring slot, and withdraw the card from the rear. Insert the new card from the rear into the slots in the springs until the end of the card rests against the positioning spring. Using the KS-6320 orange stick, push the end of the retractile spring against the fiber strips. Slowly push the card forward until the positioning spring falls into place under the card. After all cards are in place, push all of them back simultaneously so that the retractile springs rest against the fiber strip. Insert the bearing pin as described in (3), using a new pin if necessary.

(5) Remount the oil shield if provided. Remount the contact assembly mounting plate, taking care to place washers or terminals on screws as required. Tighten all screws securely.

3.27 *Removing Contact Spring Assembly*

(1) Remove all cards associated with the spring assembly to be replaced as covered in 3.25 or 3.26.

(2) Place the reader in position so that, when the control contact assembly mounting plate is placed on its mounting, the contact assembly will be at the top. Do not fasten the plate to its mounting.

(3) Referring to Fig. 29, remove the contact spring assembly mounting screws using the 5-inch E screwdriver. Remove the clamp plate and the card positioning and actuator springs. Remove the plates above the top contact spring assembly, noting their relative positions and that of all other plates subsequently removed from the pile-up.

(4) Lift the top contact spring assembly from the pile-up and, if it is not to be replaced, swing it away from the pile-up, taking care not to damage the leads. If the assembly is to be replaced, tag and unsolder the leads to the contact springs.

(5) Successively remove the plates and swing the contact spring assemblies away from the pile-up as described below until the assembly to be replaced is accessible. To swing a contact spring assembly away from the pile-up, lift the terminal end of the assembly and carefully withdraw the contact springs from between the stationary contact bars.

(6) When the contact spring assembly to be replaced is accessible, tag and unsolder the leads to the contact springs. Remove the contact spring assembly and connect and solder the leads to the proper contact springs in the new assembly.

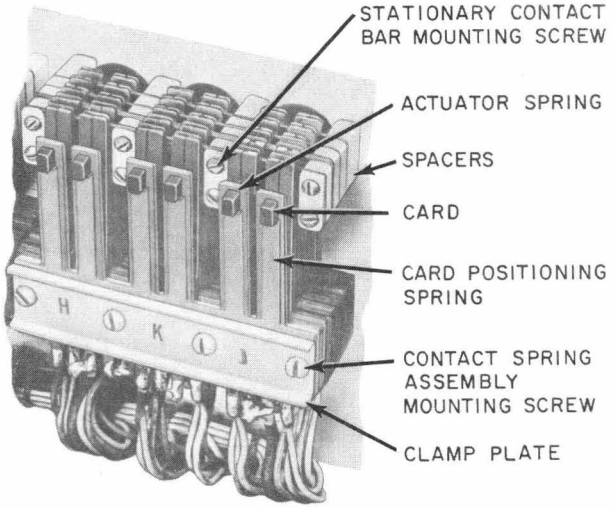


Fig. 29—Partial View of Control Contact Assembly

3.28 *Mounting Contact Spring Assembly*

(1) Place the new contact spring assembly in position on the pile-up by sliding the contact end of the springs between the proper stationary contact bars. Successively place the plates and other spring assemblies in position, making sure that the relative positions of the plates are correct.

(2) Place the actuator and card positioning springs and the clamp plate on the pile-up. Insert the contact spring assembly mounting screws in the pile-up and partially tighten them. Check that the holes through which the cards pass are in alignment and then securely tighten the screws. Dress the wiring.

(3) Remount the cards as covered in 3.25 or 3.26.

3.29 ***Stationary Contact Bars:*** To replace a stationary contact bar, proceed as follows.

(1) Remove all cards associated with the contact bar to be replaced as covered in 3.25 or 3.26.

(2) Place the reader in position so that, when the control contact assembly mounting plate is placed on its mounting, the contact assembly will be at the top. Do not fasten the plate to its mounting.

(3) Referring to Fig. 29, remove the screws mounting the stationary contact bars and associated spacers using the 4-inch E screwdriver. Note the relative position of the spacers.

(4) Slide the contact bar to be replaced and the associated spacers from the assembly. Place the new contact bar and associated spacers in position in the pile-up. Insert and partially tighten the mounting screws for the contact bars and spacers. Check that the holes through which the cards pass are in alignment and then securely tighten the screws.

(5) Remount the cards as covered in 3.25 or 3.26.

CONTROL CONTACT ROCKER ARM AND ASSOCIATED PARTS

3.30 *General*

(1) To replace a rocker arm or any of the associated parts, first remove the cover from the associated contact spring assembly. Then, remove the contact spring assembly mounting plate, using the proper size Allen wrench. Remove the screw from the associated cable clamp. Remount the cover over the control contact springs and place the assembly in a position which provides access to the part to be replaced taking care not to damage the wiring.

(2) If the heli-coil inserts in the tapped holes in the reader frame for mounting the control contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(3) On the KS-13835 L5, L6, and L7 readers, the L control contact springs are mounted on the reading contact spring assembly mounting plate. Removal of this mounting plate will cause the tape shoes and, if provided, the loose output tape plate forming part of the tape chute assembly to drop out of place. Take care not to lose the shoes and plate which must be remounted in the block, as covered in 3.48 and 3.52, after remounting the contact spring assembly mounting plate.

3.31 *Bearing on Rocker Arm*

(1) Using two 418A wrenches, remove the bearing assembly screw. Remove the stud on which the bearing is mounted using the 485A pliers if necessary. Remove the bearing and spacers at each side of the bearing.

(2) Substitute new parts as required. Assemble the stud, bearing, and spacers on the rocker arm, making sure that the spacers are in place at each side of the bearing. Insert the screw and tighten it securely. Check that the bearing turns freely.

(3) Remove the cover from the contact spring assembly and remount the assembly mounting plate on the reader. Remount the cover. If the reading contact spring assembly was removed, remount the tape shoes as covered in 3.48.

3.32 ***Rocker Arm Spring:*** Using the 3-inch C screwdriver, remove the spring mounting screw with associated washers and spacer. Remove the spring. Substitute new parts as required and mount the parts in reverse order of removal. Make sure that the small washer at the outer end of the spacer is mounted on the screw if this washer is specified in the assembly.

3.33 *Rocker Arm and Rocker Arm Shaft*

(1) If only the rocker arm shaft is to be replaced, loosen the shaft setscrew with the proper size Allen wrench. If there are two rocker arm shafts end to end, also loosen the setscrew of the second shaft. Remove the shaft to be replaced by pushing it out of the assembly with the KS-6320 orange stick. In the case of the two shafts, push against the outer end of the shaft adjacent to the one being replaced in order to remove the latter. Mount the new shaft and securely tighten the setscrews.

(2) If a rocker arm is to be replaced, remove the rocker arm spring as covered in 3.32. Remove the rocker arm shaft following the procedures covered in (1). Push the shaft back with the orange stick and remove the rocker arm. Place enough Beacon 325 grease in the bearing hole of the new rocker arm to adequately lubricate the bearing. Mount the new rocker arm and the shaft and other parts in the reverse order of removal.

INTERPOSER MAGNET ASSEMBLY

3.34 *Gasket Under the Plug*

(1) Place the reader on its side with the control contact assembly down. Remove the cover from the reading contact assembly and remove the four mounting plate screws, using the proper size Allen wrench. Remount the cover to avoid damage to the contacts. Carefully move the reading contact assembly to a position that will make the interposer magnet accessible. The tape shoes and, if provided, the loose tape plate forming part of the tape chute assembly will drop out of place when the reading contact assembly is removed.

(2) If the heli-coil inserts in the tapped holes in the reader frame for mounting the reading contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(3) Remove the output tape plate with the 3-inch C screwdriver. The screws holding the tape plate in position thread into a metal strip back of the baffle. Hold this strip while removing the screws and remove the strip when it becomes loose.

(4) Remove the two interposer magnet leads from the terminal strip with the 3-inch C screwdriver. Remove the leads from the clip. Remove the interposer magnet assembly and the associated gasket using the 647A spanner wrench applied to the plug shown in Fig. 30. Gaskets for mounting under the plug of the interposer magnet assembly are obtainable in three thicknesses: 0.016 inch (P-484902), 0.021 inch (P-484903), and 0.032 inch (P-484904). Substitute a new gasket as required. Ordinarily, the new gasket should be the same thickness as the one replaced in order to meet the conditions noted below. The gasket is used to set the relationship between the plunger and the follower so that

(a) The tip of the plunger extends into the notch in the step follower 0.020 inch minimum, as shown in Fig. 30, and

(b) The plunger clears the face of the step follower by 0.005 inch minimum, as shown in Fig. 31, when the magnet is energized on

6 through 8 volts dc and the camshaft is so rotated that the tip of the follower is opposite the end of the plunger.

(5) Check these conditions after mounting the interposer magnet assembly but before connecting the leads to the terminal strip, by proceeding as follows. Remove the plug from the bottom of the stepping mechanism housing using the 4-inch E screwdriver. To check the relationship in the preceding (4)(a), set the dial at 300 and direct a light into the opening from which the plug was removed. Check that the tip of the plunger extends 0.020 inch minimum into the notch of the step follower. This can be checked by comparing the position of the tip of the plunger with the thickness of the step follower which is 0.050 inch. To check the relationship in (4)(b), set the dial at 180 and energize the interposer magnet by connecting 6 through 8 volts dc from dry cells to the magnet leads. Rotate the index dial one complete turn and stop at 0. Operate and release the plunger several times by making and braking the battery connection. If the plunger can be seen to move, the 0.005-inch minimum clearance between the tip of the plunger and the step follower shall be considered met.

(6) If the proper relationships in (4)(a) and (b) are not met, it will be necesssary to remove the magnet assembly from the reader housing and substitute a gasket of a thickness that will enable meeting these relationships. After satisfactorily meeting these conditions, connect the interposer magnet leads to the terminal strip and securely tighten the screws. Place the leads under the clip and tighten the clip if provided.

(7) Remount the plug and associated gasket. Remount the output tape plate as covered in 3.52. Place the reading contact assembly in position for mounting and remove the cover.

(8) Remount the assembly, taking care to place washers or terminals on the screws. Tighten all screws securely. Remount the cover and turn the reader back on its base. Remount each tape shoe as follows. Lift the ball in the slot in the shoe block by means of a stiff piece of wire and then insert the shoe. Remove the wire. The shoe will be held in position by the ball. Take care in replacing the shoe not to damage the drum. Remount the loose tape plate, if provided, as covered in 3.52.

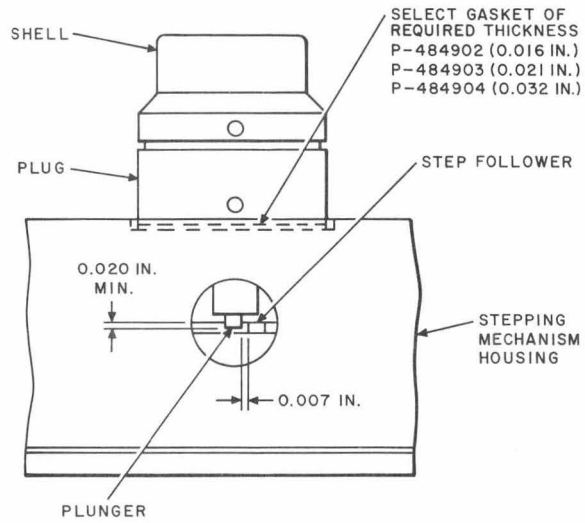


Fig. 30—Minimum Extension of Plunger in Notch of Step Follower

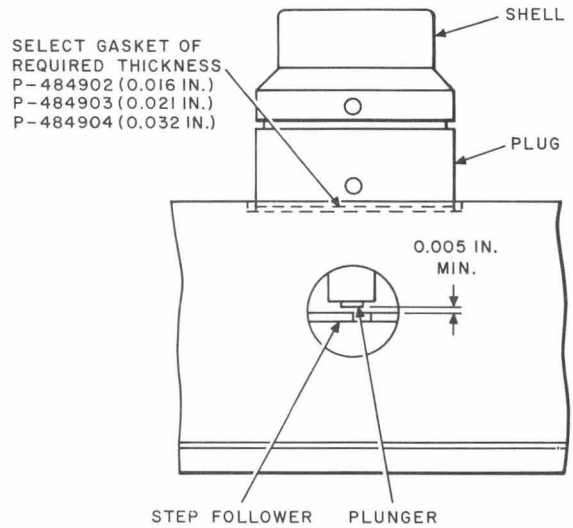


Fig. 31—Minimum Clearance Between End of Plunger and Tip of Step Follower

3.35 *Plunger, Spring, Diaphragm, and Gasket Under the Diaphragm*

(1) Remove the interposer magnet assembly as covered in 3.34. Using two 647A spanner wrenches, separate the shell from the plug. The diaphragm, gasket, spring, and plunger can then be readily removed. Replace parts as required.

(2) In replacing the plunger, insert the plunger in the bearing with the large diameter end inside the plug. Check that the plunger will fall of its own weight when the plug is held vertically. Place the smallest turn of the spring against the shoulder at the inner end of the plunger. Place the gasket in the plug and place the diaphragm on top of the gasket. Take care that no turn of the spring is clamped under the diaphragm or the associated gasket and that the edge of the diaphram is not in a thread of the plug. Reassemble the shell and plug and tighten them by hand. Any binding is an indication that the edge of the diaphram is in a thread. In this case, disassemble the shell and plug, position the diaphragm properly, and reassemble the parts. After the shell and plug have been properly assembled, tighten them securely by means of two 647A spanner wrenches.

(3) If the spring has been replaced, check that the pressure of the new spring is minimum 25 grams, maximum 40 grams when the plunger is depressed by applying the 70D gauge to the tip of the plunger. If this requirement is not met, substitute another spring. Remount the interposer magnet assembly. Check the relationship between the plunger and the follower, connect and secure the magnet leads, and mount the reading contact assembly and tape shoes as covered in 3.34.

STEPPER PLUG ASSEMBLY

3.36 *Removing Stepper Plug Assembly*

(1) Drain the oil from the stepping mechanism unless only the lock spring is to be replaced. To drain the oil, remove the drum release plunger and gasket with the R-5850 wrench. Place the receptacle in position to receive the drained oil. Turn the reader upside down by turning it toward the front. Drain the oil into the receptacle, taking care to avoid spilling oil on the reader. Remove any oil that may have spilled using the KS-2423 cloth.

(2) Stand the reader on end with the motor upward. Remove the four screws and washers which mount the gear box plate using the proper size Allen wrench. Remove the motor and gear box plate as a unit from the gear box.

(3) Using the R-1060 putty knife, remove the grease from the gear box. Using the 4-inch E screwdriver, remove the screws which secure the stepper driving gear on the hub. Remove the gear and associated plate.

(4) If only the lock spring is to be replaced, replace it as covered in 3.37.

(5) If other parts or the complete stepper plug assembly are to be replaced, remove the camshaft gears as covered in 3.14. Disconnect the two interposer magnet leads from the terminal strip. Place the reader on its base. Remove the reading contact assembly mounting plate as follows. Remove the cover from the mounting plate and remove the four mounting plate screws, using the proper size Allen wrench. Remount the cover to avoid damage to the contacts. Carefully move the reading contact assembly to a position that will make the stepper plug assembly accessible. The tape shoes will fall out of the shoe block when the reading contact assembly is removed. Take care not to lose the shoes which must be remounted in the block after remounting the reading contact assembly mounting plate. If a clip is provided for holding the interposer magnet leads, loosen the clip mounting screw with the 3-inch C screwdriver and remove the leads from under the clip.

(6) Scribe lines on the shell and gear box to accurately show their relative positions. Using the proper size Allen wrench, remove the screws securing the dogs which clamp the plug in the gear box. Remove the dogs. Remove the stepper and drum assembly through the gear box, being careful not to damage the drum. If the stepper shell sticks to the gear box, tap the shell lightly with the 4-ounce riveting hammer.

(7) Separate the plug assembly from its shell as follows. Using the proper size Allen

wrench, loosen the three assembly mounting screws two or three turns. While holding the plug assembly, lightly tap the screwheads to loosen the plug assembly from the shell. Remove the three screws and separate the plug and shell. Take care not to damage the gasket and drum.

(8) If the heli-coil inserts in tapped holes for securing the gear box plate or stepper plug assembly to the gear box or the stepper plug in the shell are loose or damaged, replace them as covered in 3.53 through 3.57.

(9) If the complete stepper plug assembly is to be replaced, mount the new assembly as covered in 3.44. Replace individual parts of the assembly, if necessary, as covered in 3.37 through 3.43.

3.37 ***Lock Spring:*** Remove the motor and gear box plate and remove the stepper driving gear as covered in 3.36(1), (2), and (3). Using the tweezers, remove the lock spring from the pin and lock arm and replace it with a new spring. Remount the stepper driving gear as covered in 3.44(5), place lubricant in the gear box as covered in Section 034-335-701, and remount the motor and gear box plate.

3.38 ***Lock Spring Pin:*** Remove the stepper plug assembly as covered in 3.36(1) through (7). Drive the lock spring pin from the plug by applying the 3/32-inch pin punch to the end of the pin at the inside of the plug and tapping it with the 4-ounce riveting hammer. Drive the new pin in the plug from the outside of the plug by gently tapping it with the 4-ounce riveting hammer. If the new pin fits loosely, replace the plug assembly. Remount the parts as covered in 3.44.

3.39 ***Guide Pin:*** Remove the stepper plug assembly and separate the plug from the shell as covered in 3.36(1) through (7). Drive the guide pin from the plug by applying the 3/32-inch pin punch to the end of the pin at the outside of the plug and by tapping it with the 4-ounce riveting hammer. The same pin may be reused once by removing it and turning it 90 degrees and then reinserting it in the guide pin hole. If the replacing pin fits loosely, replace the plug assembly. Remount the parts as covered in 3.44.

3.40 ***Pull-Down Spring***

(1) Remove the stepper plug assembly and separate the plug from the shell as covered in 3.36(1) through (7). Using the tweezers, remove the spring and mount the new spring. With the stepper camshaft set so that the spring is in extended position, the tension of the spring measured at the hook engaging the adjusting stud pin should be minimum 600 grams, maximum 700 grams. Check the tension by looping a piece of thread over the hook and applying the 79B gauge to the loop.

(2) If the spring tension is outside limits, slightly loosen the nut on the adjusting stud with the 418A wrench and turn the stud as required with the blade of the 3-inch C screwdriver applied between the two pins on the stud. The stud should be positioned after adjustment so that the pin to which the spring is attached is in half of the stud toward the center of the plug. While holding the stud in position with the screwdriver, tighten the nut on the stud. Recheck the spring tension and, if necessary, make further adjustment. Remount the stepper plug and other parts as covered in 3.44.

3.41 ***Step Spring***

(1) Remove the stepper plug assembly and separate the plug from the shell as covered in 3.36(1) through (7). Turn the shaft so that the step spring is in the nonextended position. Using the tweezers, remove the step spring and mount the new spring. With the stepper camshaft set so that the spring is in the extended position, the tension of the spring measured at the hook engaging the adjusting stud pin should be minimum 2200 grams, maximum 2400 grams. Check the tension by looping a piece of thread over the hook and applying the 79F gauge to the loop.

(2) If the spring tension is outside the limits, slightly loosen the nut on the adjusting stud with the 418A wrench and turn the stud as required with the blade of the 3-inch C screwdriver applied between the two pins on the stud. The stud should be positioned after adjustment so that the pin to which the spring is attached is in half of the stud toward the outer edge of

the plug. While holding the stud in position with the screwdriver, tighten the nut on the stud. Recheck the spring tension and, if necessary, make further adjustment. Remount the stepper plug and other parts as covered in 3.44.

3.42 *Adjusting Stud*

(1) To replace a pull-down spring or step spring adjusting stud, proceed as follows. Remove the stepper plug assembly as covered in 3.36. Using the P long nose pliers, remove the spring from the pin on the stud. Note the position of the stud pins. Remove the nut from the stud with the 418A wrench. Remove the washer under the nut and remove the stud.

(2) Mount the new adjusting stud so that the pins are in approximately the same position as the pins of the replaced stud. Make sure that the gasket is under the stud and that the washer is under the nut. Partially tighten the nut and hook the spring on the pin of the adjusting stud. Check the spring tension as covered in 3.40 or 3.41, as applicable, and adjust the tension if necessary. Remount the stepper plug and other parts as covered in 3.44.

3.43 *Step Follower*

(1) Remove the stepper plug assembly as covered in 3.36. Remove the pull-down spring and step spring from the pins on the adjusting studs with the P long nose pliers. Remove the pull-down spring adjusting stud as covered in 3.42. Remove the step follower. If the springs are in good condition, remove them and mount them on the new step follower. If they are worn at the hooks or in otherwise unsatisfactory condition, replace them. Since the springs are not alike, make sure that each spring is hooked in the proper hole in the step follower.

(2) Position the step follower in the plug assembly. Remount the pull-down spring adjusting stud as covered in 3.42. Attach the springs to the adjusting stud pins with the P long nose pliers. Check and adjust, if necessary, the tension of the springs as covered in 3.40 and 3.41. Remount the plug and other parts as covered in 3.44.

3.44 *Mounting Stepper Plug Assembly*

(1) Check the condition of the stepper plug assembly gasket. If the gasket is damaged, substitute a new gasket. Remove the plug in the shell adjacent to the interposer magnet using the 4-inch E screwdriver.

(2) Rotate the stepper plug shaft until the step follower is on the high portion of the cam. Since this position of the follower is used to properly position the stepper plug in the shell, take care to avoid moving the shaft while mounting the plug as covered below. Mount the stepper plug in the shell with the gasket in place and tighten the mounting screws friction tight. Position the stepper plug in the shell so that the clearance between the interposer magnet plunger and the side of the notch in the step follower is 0.007 inch (Fig. 30). Use the 129A gauge inserted through the hole in the shell to measure this clearance. Securely tighten the plug mounting screws and recheck the clearance. If the gasket extends beyond the plug flange, trim the gasket flush using the single-edged razor blade.

(3) Check whether the tip of the plunger extends into the notch of the step follower 0.020 inch as shown in Fig. 30 and whether the plunger clears the face of the step follower by 0.005 inch as shown in Fig. 31. Make these checks and adjust, if necessary, as covered in ▶3.34(4), (5), and (6).◀

(4) Mount the stepper and drum assembly in the gear box, taking care not to damage the drum. Mount the dogs which secure the plug in place and tighten the screws friction tight using the proper size Allen wrench. Place the interposer magnet leads under the clip and tighten the clip screw. Remount the reading contact assembly. Connect the interposer magnet leads to the terminal strip. Position the stepper plug assembly so that the marks previously made on the shell and gear box are in alignment and securely tighten the screws in the dogs. If the lines were not scribed on the shell and gear box, as covered in 3.36(6), position the shell as follows. Set the dial at 150. With the dog mounting screws friction tight, carefully rotate the shell in either direction until the edges of the holes in the drum engaging the reading pins

are against the pins. Take care not to force the drum against the pins. Mark lines on the shell and gear box to indicate their relative positions under this condition. Then, carefully rotate the shell in the opposite direction until the opposite edges of the holes in the drum are against the pins. Mark a line on the gear box in alignment with the line previously marked on the shell. Then, rotate the shell back until the mark on the shell is midway between the two lines on the gear box. In this position, the pins will be approximately centered in the holes in the drum. Securely tighten the screws in the dogs, taking care that the position of the shell does not shift. Mount the gears on the camshaft as covered in 3.14.

(5) Mount the stepper driving gear and plate on the hub and tighten the screws friction tight. Position the drum with relation to the dial as follows. Energize the interposer magnet by connecting 6 through 8 volts dc from dry cells to the magnet leads at the terminal strip. Set the dial at zero and hold the dial in this position with the 642A dial locking tool during the following procedure. Rotate the stepper shaft hub until the drum just starts to step. At this point, mark a pencil line on the stepper driving gear in line with the center of one of the stepper gear plate mounting screws which will be used as a reference point. Continue to rotate the hub until the drum completes the step and at this point mark a second line on the stepper gear in line with the center of the reference screw. Rotate the hub back and forth to make sure that the reference screw and the line on the gear indicate the beginning and end of the step. If necessary, mark new lines on the gear. Then rotate the hub so that the center of the reference screw is midway between the two lines on the gear, in which position the drum is at the midpoint of its step. Securely tighten the stepper gear plate mounting screws.

(6) Place lubricant in the gear box as covered in Section 034-335-701. Remount the motor and gear box plate. Lubricate the stepping mechanism as covered in Section 034-335-701. Mount the drum release plunger using the R-5850 wrench.

PAWLS, PAWL SPRINGS, AND RATCHET

3.45 *Pawls and Pawl Springs*

(1) To replace the pawls and pawl springs, it is necessary to remove the dial. Before removing the dial, carefully check and record the dial readings at the make and break of any control contact. This information is necessary in order to remount the dial in exactly its original position on the shaft and thereby to avoid changing make and break contact timing readings. To remove the dial, turn the reader on end with the dial upward. Insert two 646A ratchet release pins in the holes in the dial to disengage the two pawls from the ratchet. Reaching in through the bottom of the reader, apply the 417A wrench to the flat portion of the shaft to hold the shaft stationary. Then, remove the dial mounting nut with the KS-14220 L1 T handle wrench and the KS-14220 L14 socket. Remove the dial from the shaft. Removal of the dial may be facilitated by placing the tips of two screwdrivers between the edge of the dial and the frame, approximately 180 degrees apart, and gently prying the dial loose with both screwdrivers, simultaneously, in order not to bend the shaft.

(2) To replace a pawl and associated spring, release the pawl by removing the ratchet release pin from the dial. Remove the pawl and spring. Clean the pawl retaining slot. To do this, remove the plate from the inside of the dial, using the 3-inch C screwdriver to remove the plate mounting screws. Clean the slot with a KS-2423 cloth moistened with KS-19578 L1 trichoroethane. Remount the plate. Position the new pawl and spring in the dial with the pawl tip to the left of the center of the pawl as viewed facing the pawl tip. Push the pawl up in its slot and check whether it slides freely. Insert the ratchet release pin in the hole in the dial to hold the pawl in position.

(3) Remount the dial on the shaft as follows. Check that the key is seated in the shaft keyway. Place the dial on the shaft so that the key engages the dial keyway. Place the washer and nut on the shaft. While holding the shaft stationary with a 417A wrench applied to the flat portion of the shaft from the bottom of the reader, securely tighten the nut with the KS-14220 L1 T handle wrench and the KS-14220 L14 socket.

(4) Remounting the dial may cause a slight change in the original relation between the positions of the dial and cams due to slight play at the key. This change in relative position may be sufficient to change make-contact and break-contact time readings. Check whether the make and break of the contacts observed in (1) occur at the dial settings as recorded. If the contact make and break do not occur at the dial settings observed in (1), hold the shaft stationary with the 417A wrench applied to the flat portion of the shaft, loosen the dial mounting nut, slightly shift the position of the dial on the shaft, and then tighten the nut. Make checks and adjustments in this manner until the make and break of the contacts occur at the exact dial settings as observed in (1).

3.46 ***Ratchet:*** Remove the dial as covered in 3.45(1). Using the proper size Allen wrench, remove the ratchet mounting screws. Remove the washers. Mount the new ratchet, making sure that the washers are under the screwheads and that the screws are securely tightened. Remount the dial as covered in 3.45(3) and, if necessary, adjust the position of the dial as covered in 3.45.

CAMSHAFT BALL BEARINGS

3.47 If it is necessary to replace either of the ball bearings, replace both. To replace the bearings, proceed as follows.

(1) Stand the reader on end with the motor upward. Remove the four screws and washers which mount the gear box plate using the proper size Allen wrench. Remove the motor and gear box plate as a unit from the gear box. Using the R-1060 putty knife, remove the grease from the gear box. With the dial set at zero, scribe lines on the stepper driving gear and mating camshaft gear to show the relative positions of the two gears unless they have already been marked. While holding the camshaft stationary with the 417A wrench applied to the flat part of the shaft, remove the nut from the end of the shaft with the 245 wrench. Lift the camshaft gears and associated parts from the shaft. Remove the Woodruff key from the shaft, using the 3-inch C screwdriver to pry it out if necessary.

(2) Turn the reader on end so that the dial is upward. Remove the dial from the shaft as covered in 3.45(1). Remove the Woodruff key from the dial end of the shaft. Remove the ratchet as covered in 3.46.

(3) Place the reader on its base. Remove both contact assembly mounting plates by first removing the contact covers and then removing the mounting plate screws using the proper size Allen wrench. The tape shoes will fall out when the reading contact assembly is removed. Take care not to lose the shoes. Remount the covers on the mounting plates to avoid damaging the contacts. Place the contact spring assemblies on the reader base, taking care not to damage the wiring.

(4) If the heli-coil inserts in the tapped holes in the gear box for mounting the gear box or in the reader frame for mounting the reading contact assembly mounting plate are loose or damaged, replace them as covered in 3.53 through 3.57.

(5) Remove the camshaft with the plug and bearing on the dial end of the shaft by pushing the shaft through the dial end of the frame. The bearing and spacer at the motor end of the shaft will remain on either the shaft or in the frame. If difficulty is experienced in starting the shaft, place a block of wood against the motor end of the shaft and tap the block lightly with the 4-ounce riveting hammer.

(6) Remove the plug with bearing from the shaft. If the bearing is held in the plug by staking, discard both bearing and plug and use a new plug with associated washer and screws. If the bearing is held in the plug by a washer, remove the washer using the proper size Allen wrench. Remove the bearing. Mount the new bearing in the plug and securely tighten the washer mounting screws.

(7) If the bearing and spacer have remained on the other end of the shaft, remove them from the shaft. If the bearing remained in the frame, remove it as follows. Place the end of the handle of the KS-14220 L1 wrench against the spacer at the outer end of the frame and lightly tap the handle of the wrench with the 4-ounce riveting hammer.

(8) Mount the plug with the new bearing on the dial end of the shaft so that the bearing rests against the shoulder on the shaft. Mount

the ball bearing and spacer on the motor end of the shaft. Insert the shaft through the dial end of the reader frame until the bearing at the motor end is in place in the frame. Position the plug and bearing at the dial end of the shaft in the frame, aligning the screwholes in the plug with the screwholes in the frame. Mount the ratchet and tighten the mounting screws.

(9) Remove the contact covers, mount the contact assembly mounting plates, and remount the covers. Mount the tape shoes as covered in 3.48.

(10) Place the Woodruff key in the dial end of the shaft. Mount the dial on the shaft as covered in 3.45(3) and (4).

(11) Turn the reader over so that the dial is downward. Make sure that the spacer is positioned against the bearing on the motor end of the shaft. Place the Woodruff key in the shaft. Place the camshaft gear assembly on the shaft, making sure that the lines on the camshaft and the stepper drive gears are in alignment. Place the nut on the shaft and tighten it with the 245 wrench, while holding the shaft stationary with the 417A wrench applied to the flat portion of the shaft. Check that the midpoint of the drum step occurs at zero position of the dial by connecting 6 through 8 volts dc from dry cells to the interposer magnet leads and rotating the dial back and forth a few degrees each side of zero. If the midpoint of the drum step does not occur at zero, first check that the scribed lines on the gears are in alignment and, if so, proceed as covered in 3.44(5). Place grease in the gear box in accordance with Section 043-335-701. Mount the motor and gear box plate on the gear box and securely tighten the screws. Turn the reader on its base.

TAPE SHOES

3.48 Remove the screws holding the shoe block in place using the 4-inch E screwdriver. Remove the shoe block and the tape shoes. Remount the shoe block if it is marked with an X and tighten the screws securely. If the shoe block is not marked with an X, replace it with a block so marked. Remount the tape shoes by lifting the ball in the slot by means of a stiff piece of wire and inserting the shoe. Remove the wire. The shoe will be held in place by the ball. Take care in replacing the shoe not to damage the drum. Using the 486A oil can, apply one drop of KS-16326 L1 oil to the part of each shoe in the slot.

DRUM RELEASE PLUNGER AND GASKET

3.49 Remove the plunger from the housing using the R-5850 wrench. Replace the gasket or plunger or both as necessary. Tighten the plunger securely.

TAPE FEED KEY

3.50 Unscrew the two tape chute thumbscrews and swing the chute back. Remove the cover from the control contacts. Unsolder the wires from the tape feed key and note the terminals to which each wire is connected. Remove the mounting screws with the 3-inch C screwdriver and remove the key. Substitute the new key and mount it securely in place. On the new key, solder the wires to the terminals corresponding to those to which they were connected on the key being replaced.

PLUG (CABLE TERMINATING)

3.51 To replace either or both plugs, remove the plug studs of the plug to be replaced using the 417A wrench and move the plug to a position convenient for unsoldering the wires. Unsolder the wires from the plug terminals. Substitute the new plug and solder the wires to the terminals, taking care that they are connected to the correct terminals in accordance with wiring diagrams for the respective readers shown in Fig. 32 through 39.

OUTPUT TAPE PLATE AND STRIP

3.52 Remove the reading contact assembly as covered in 3.34. The tape plate is held in place on the baffle by two screws which thread into a metal strip back of the baffle. Remove the plate by removing these screws using the 3-inch C screwdriver. Substitute the new plate and strip as follows. Hold the strip back of the baffle with the countersunk screwholes facing the baffle. Position the plate so that the holes in the plate line up with the holes in the strip. Place the screws in the holes and tighten them securely. Adjust the position of the tape plate as covered in Section 034-335-701. Replace the contact assembly and tape plate shoes as covered in 3.34. Remount the loose tape plate, if provided, as follows. Turn the reader on its

side with the reading contacts down. Hold the plate at the notched end with the projections at the sides of the place facing upward. Slide it into position in the tape chute until the projection at the notched end falls into the hole in the frame. Place the reader back on its base.

HELI-COIL INSERTS

3.53 Special tools are required for extracting and inserting heli-coil inserts, the tool used in each case depending on the diameter of the insert. Each heli-coil insert has a radial tang at one end for engagement with the slot in the insertion tool. In some cases, the tang is removed after insertion of the heli-coil insert. A notch, adjacent to the tang, facilitates breaking off the tang with a tool provided for this purpose.

3.54 The following table lists the heli-coil inserts specified in this section together with the extracting, inserting, and break-off tools required for the respective inserts. These tools are also listed in 3.01.

HELI-COIL INSERT	TOOLS		
	Extracting	Inserting	Tang Breakoff
P-46F102	1227-06	528-2N	—
P-46F099	1227-06	528-2N	—
P-46F104	1227-6	535-3N	—
P-46F103	1227-6	535-4N	—
P-46F101	1227-6	535-5N	1196-5

3.55 Heli-coil inserts which are loose or damaged should be replaced when they are made accessible by removal of the plate or other component mounted on the part containing the insert in connection with the replacement of other parts. Reference is made to replacement of heli-coil inserts in the procedures for replacing associated parts.

3.56 ***Removing Heli-Coil Insert:*** Insert the proper extracting tool, as covered in 3.54, into the heli-coil insert to be removed. While maintaining firm pressure of the tool against the insert, turn the tool counterclockwise and remove the insert from the hole.

3.57 ***Inserting Heli-Coil Insert:*** To insert a heli-coil insert, proceed as follows.

(1) Select the proper inserting tool as covered in 3.54. If the tool has a stop collar on the mandrel, position the collar so that with the collar against the body of the tool the end of the mandrel will project approximately 1/64 inch beyond the tip of the tool. Securely tighten the stop collar screw.

(2) Retract the mandrel.

(3) Place the heli-coil insert in the tool with the tang toward the tip of the tool.

(4) Push the mandrel into the tool until the slot in the mandrel fully engages the tang on the insert.

(5) Rotate the mandrel clockwise until the end of the mandrel extends about 1/32 inch beyond the tip of the tool. The first coil of the insert should not protrude beyond the tip of the tool.

(6) Place the tool squarely and firmly against the hole into which the heli-coil insert is to be inserted. Rotate the mandrel slowly and uniformly in a clockwise direction without exerting foward pressure on it. Continue rotating the mandrel until the insert is fully in the hole which will be indicated by the mandrel stop touching the body of the tool equipped with stops. Withdraw the tool. The heli-coil insert should be just underflush with the end of the hole. If the heli-coil insert is inserted too far in the tapped hole, reposition it properly with the extracting tool. Do not use the inserting tool for this purpose.

3.58 ***Removing Tang from Heli-Coil Insert:*** If required, remove the tang as follows. Insert the proper tang breakoff tool, as covered in 3.54, into the insert so that the end of the tool rests against the tang. Strike the tool a sharp blow with the 4-ounce riveting hammer.

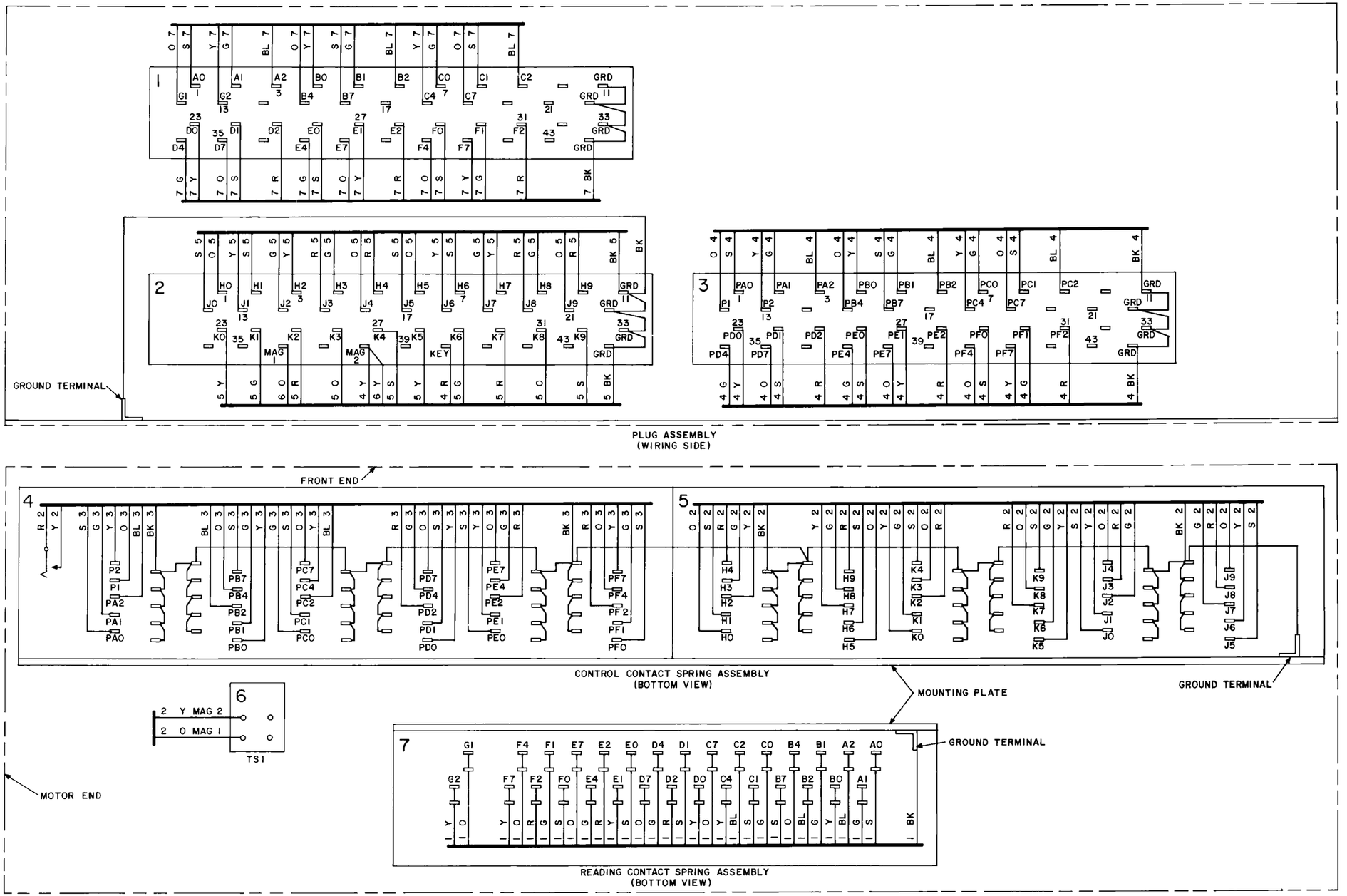


Fig. 32—Wiring Diagram—KS-13835 L1 Reader With Individually Insulated Stationary Springs in Control Spring Assemblies

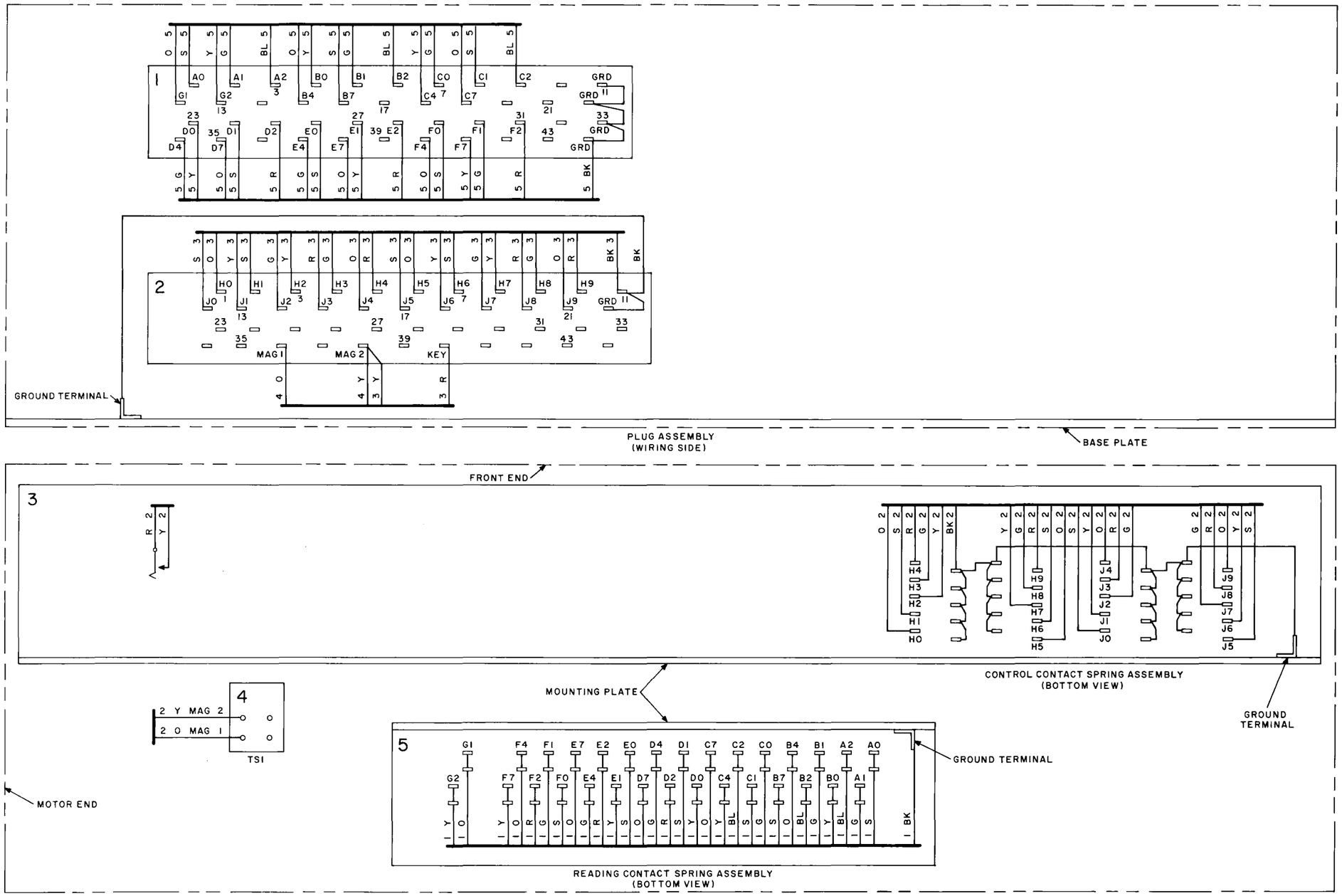


Fig. 33—Wiring Diagram—KS-13835 L2 Reader With Individually Insulated Stationary Springs in Control Spring Assemblies

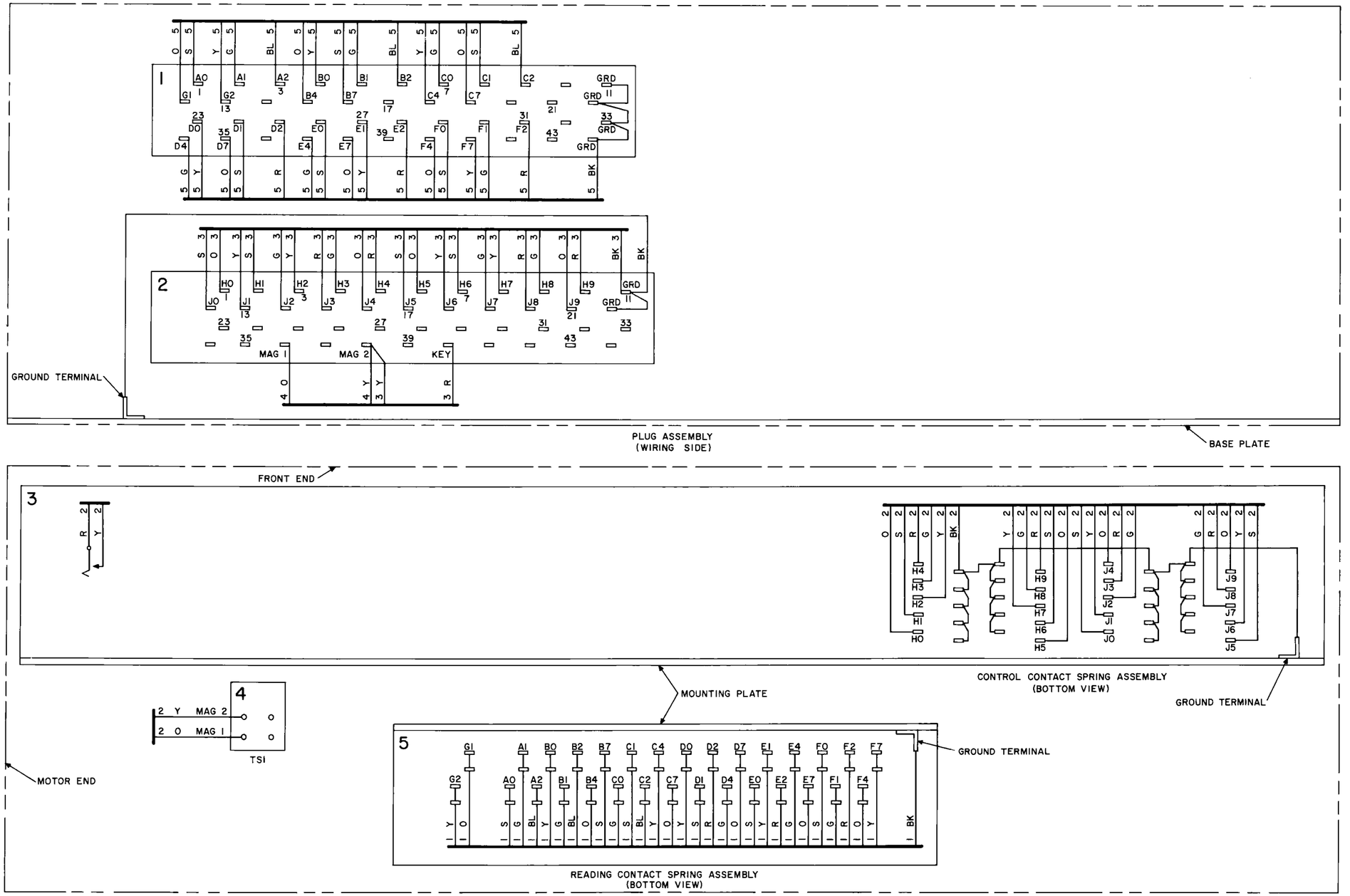


Fig. 34—Wiring Diagram—KS-13835 L3 and L4 Readers With Individually Insulated Stationary Springs in Control Spring Assemblies

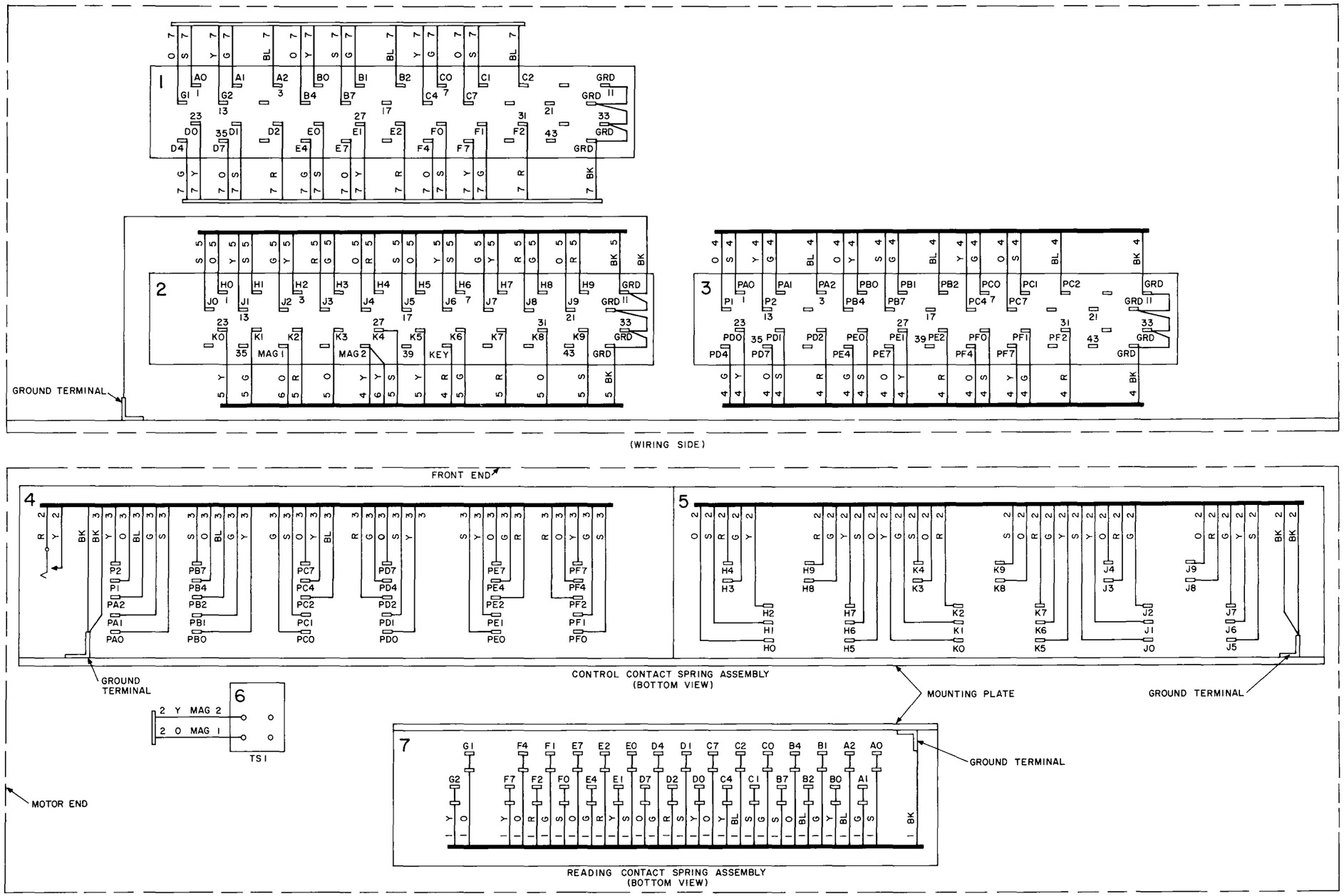


Fig. 35—Wiring Diagram—KS-13835 L1 Reader With Bus-Bar Type Stationary Springs in the Control Spring Assemblies

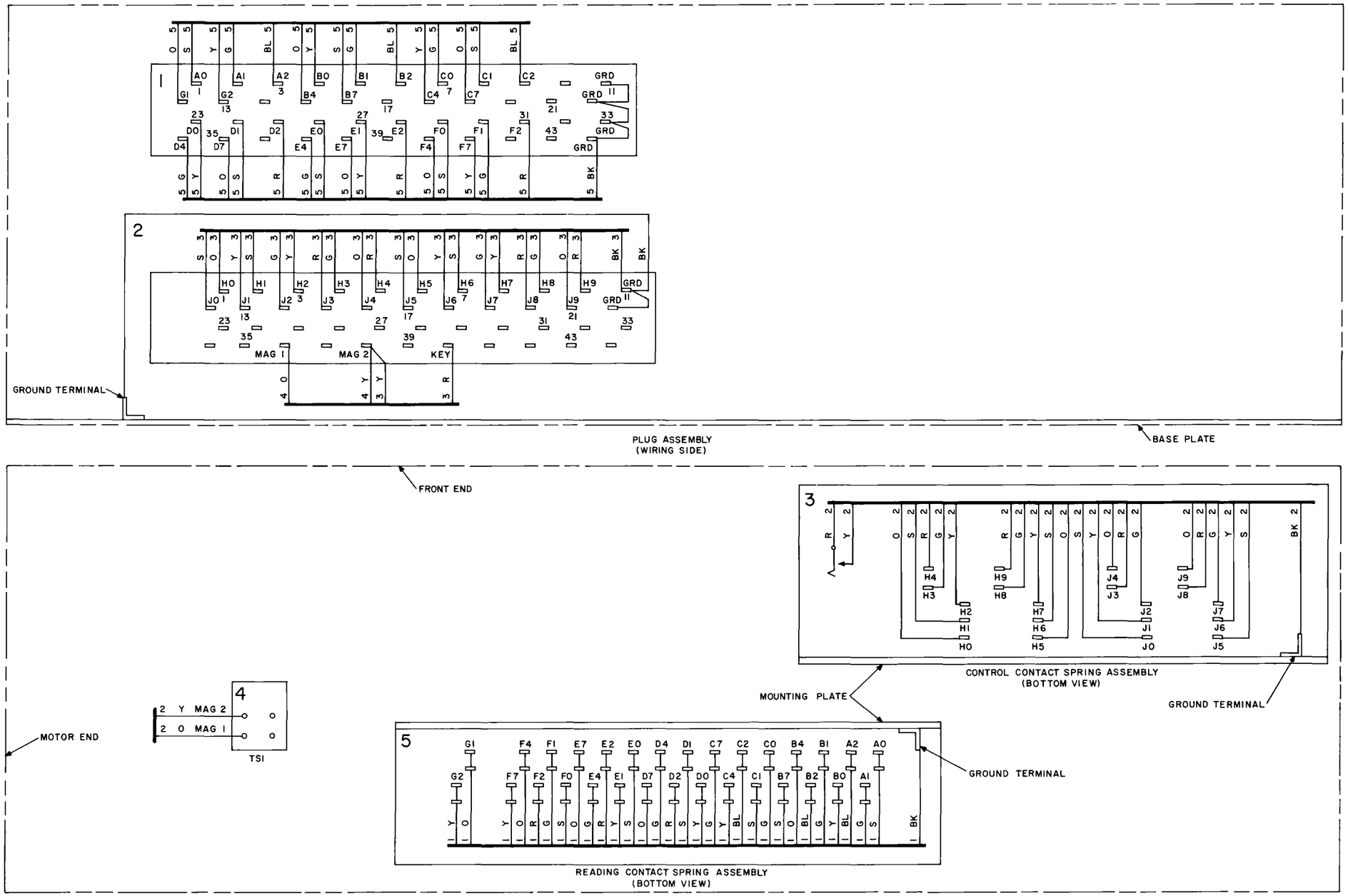


Fig. 36—Wiring Diagram—KS-13835 L2 Reader With Bus-Bar Type Stationary Springs in the Control Spring Assemblies

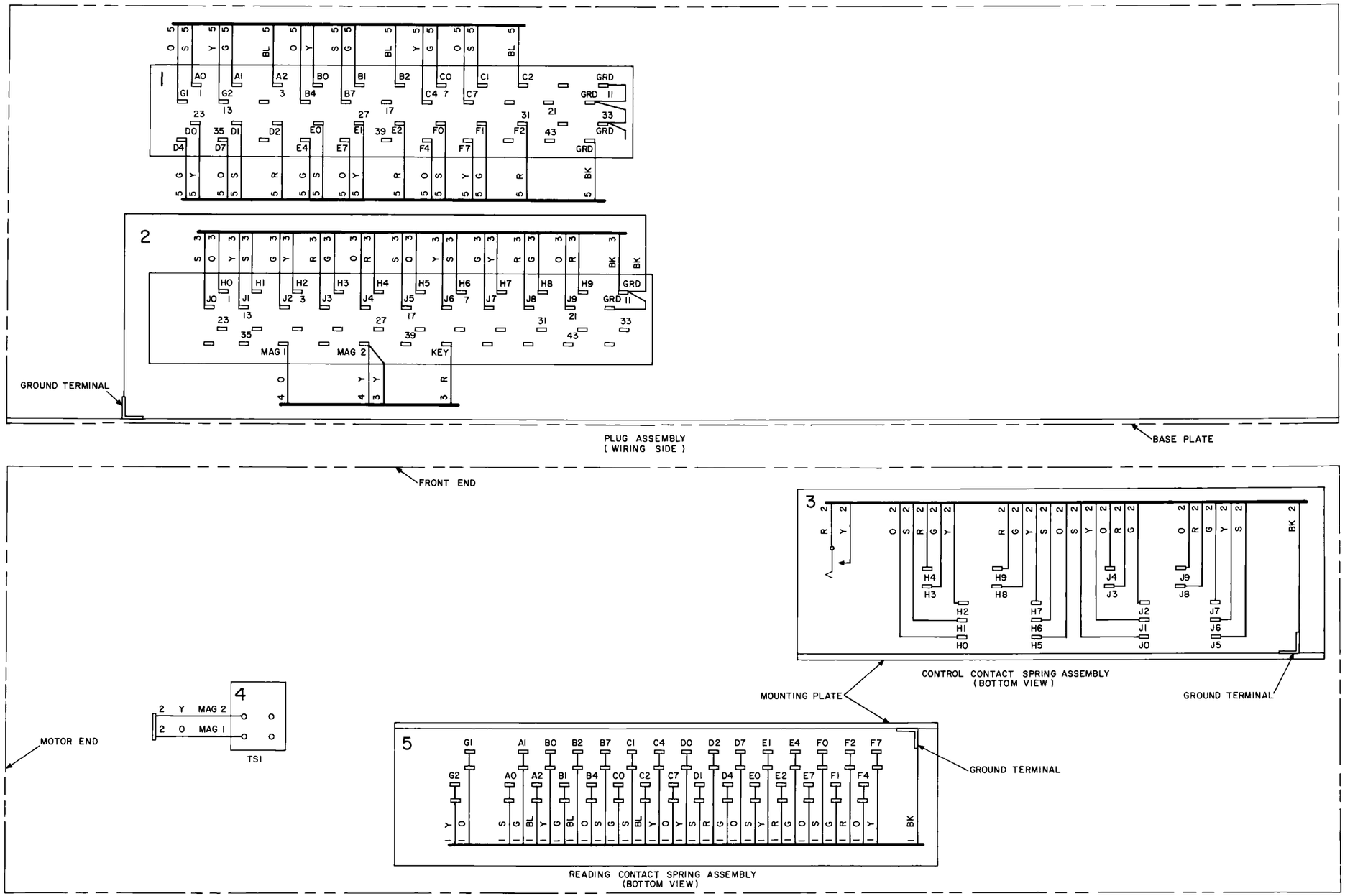


Fig. 37—Wiring Diagram—KS-13835 L3 and L4 Readers With Bus-Bar Type Stationary Springs in the Control Spring Assemblies

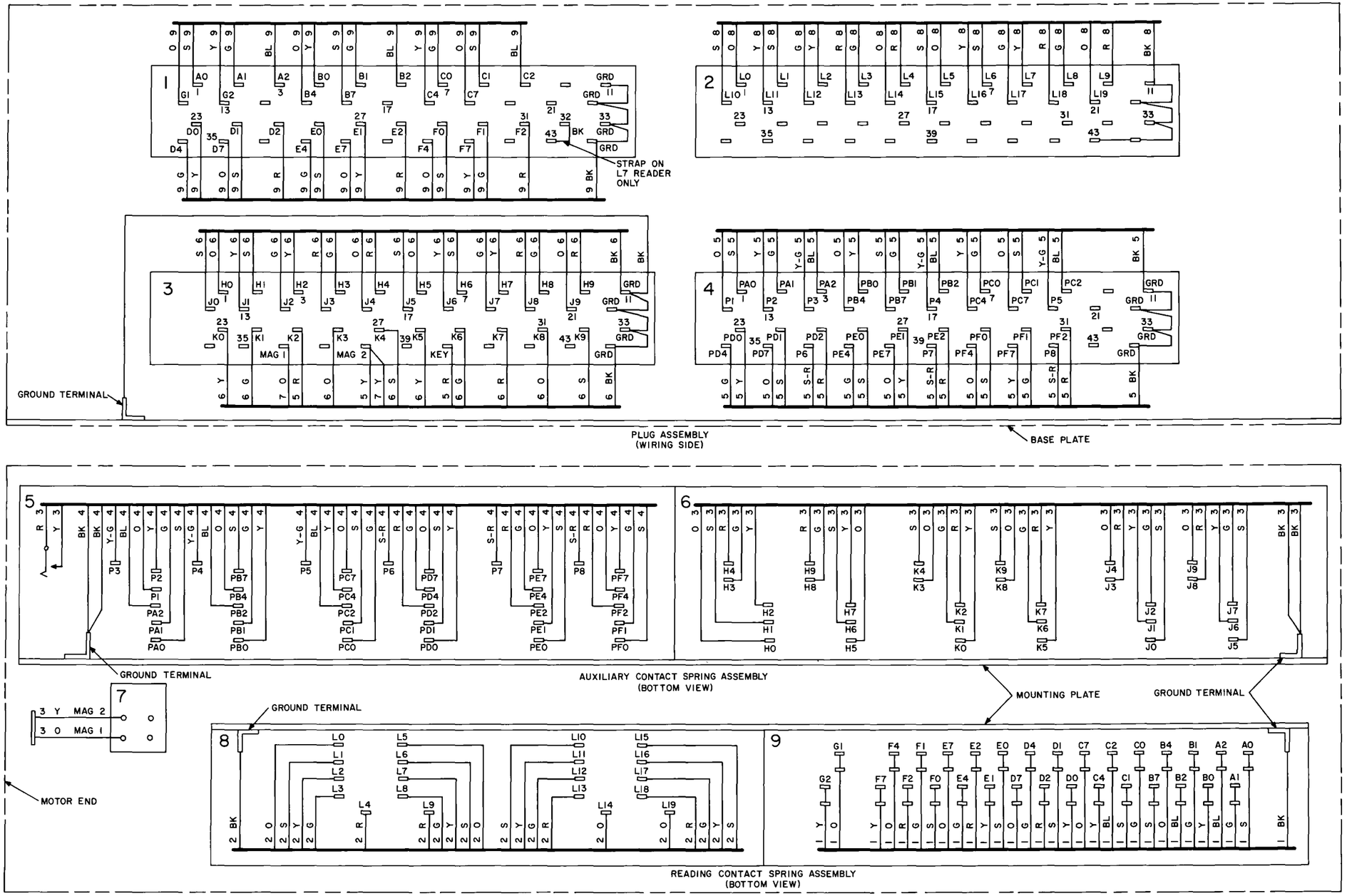


Fig. 38—Wiring Diagram—KS-13835 L5 and L7 Readers With Bus-Bar Type Stationary Springs in the Control Spring Assemblies

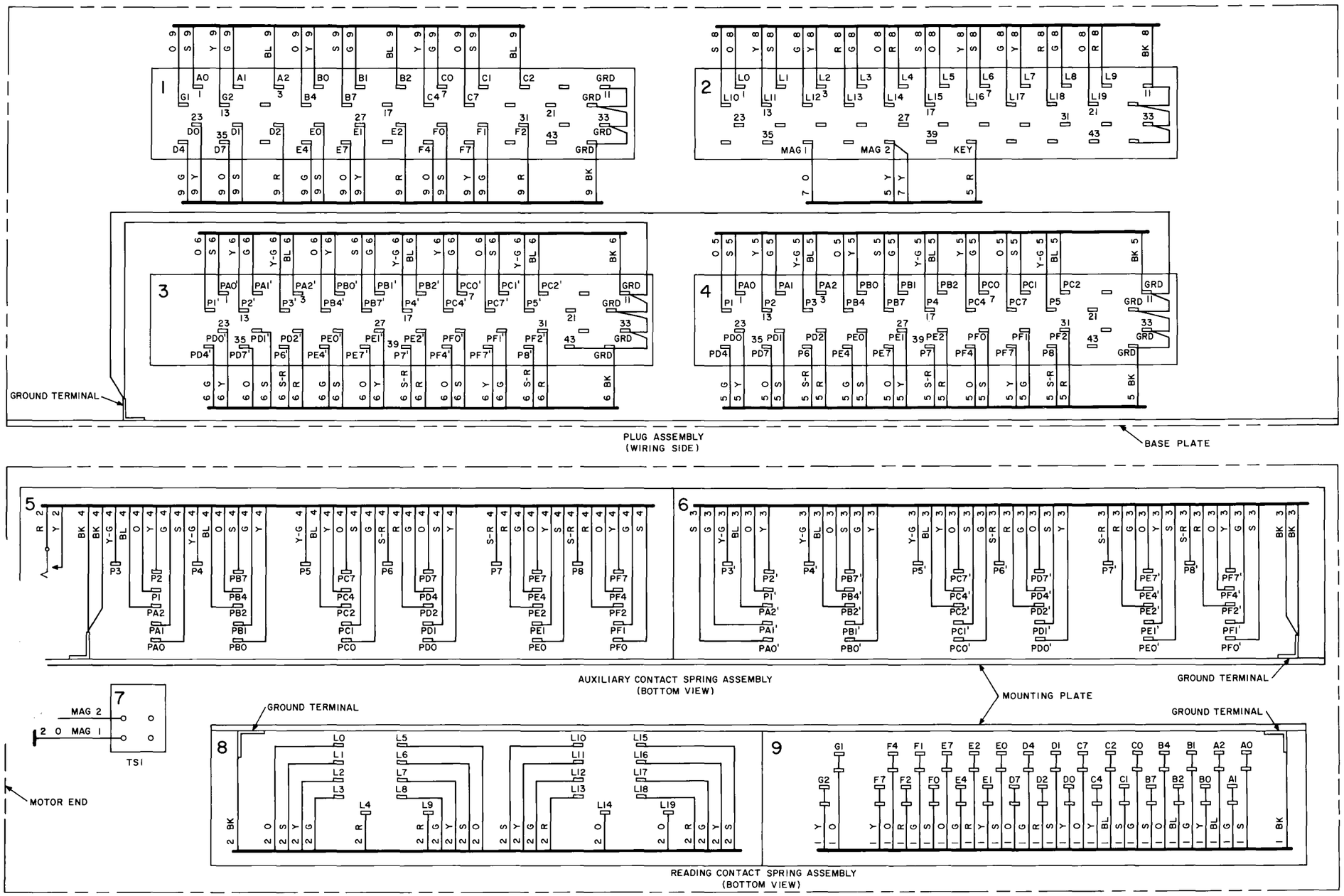


Fig. 39—Wiring Diagram—KS-13835 L5 and L7 Readers With Bus-Bar Type Stationary Springs in the Control Spring Assemblies