

Maintenance Library



**Multi-Function Card Unit
Theory-Maintenance**

PREFACE

This manual combines the theory of operations with service information for the IBM System/3 5424 Multi-Function Card Unit.

The *IBM 5410 Central Processing Unit Field Engineering Maintenance Manual, form SY31-0244*, contains procedures for using the CPU to check the 5424.

5424 attachment circuits are explained in the *IBM 5424 Multi-Function Card Unit Attachment Field Engineering Theory of Operations, form SY31-0253*, and the *IBM 5424 Multi-Function Card Unit Attachment Field Engineering Maintenance Diagrams Manual, form SY31-0254*.

Consult your Service Aids produced by FE Technical Operations for additional service information.

For machine characteristics and installation instructions, refer to the *IBM System/3 Installation Manual - Physical Planning, form A21 - 9084*.

First Edition (March 1971)

This is a major revision of, and obsoletes both the *IBM 5424 Multi-Function Card Unit FE Theory of Operations Manual, form SY31 0213*, and the *IBM 5424 Multi-Function Card Unit FE Maintenance Manual, form SY31- 0230*.

Significant changes or additions to the specifications contained in this publication are continually being made. When using this publication in connection with the operation of IBM equipment, check the latest FE Publication System Sequence Listing for revisions or contact the local IBM branch office.

A form for reader's comments is provided at the back of this publication. If the form has been removed, comments may be addressed to IBM Corporation, Product Publications, Department 245, Rochester, Minnesota 55901.

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INTRODUCTION

The IBM 5424 Multi-Function Card Unit performs the four primary card input/output functions for the IBM System/3 Model 10:

1. Reading
2. Punching
3. Printing
4. Selective Stacking

The 5424 is under complete control of the attachment electronics and the processing unit (CPU). The 5424 combines the functions of a card reader, collator, card punch, sorter, and interpreter. All multi-function operations, except sorting, can be performed in a single pass through the machine; sorting requires multiple passes.

Cards are placed in the hoppers face down, top edge to the left, and enter the 5424 in a parallel motion. After a card is fed, it changes to a serial motion, column one edge first, moving serially through the read station, wait station, punch station, and into the cornering station. The motion then changes to parallel again to move through the print station and into the selected stacker.

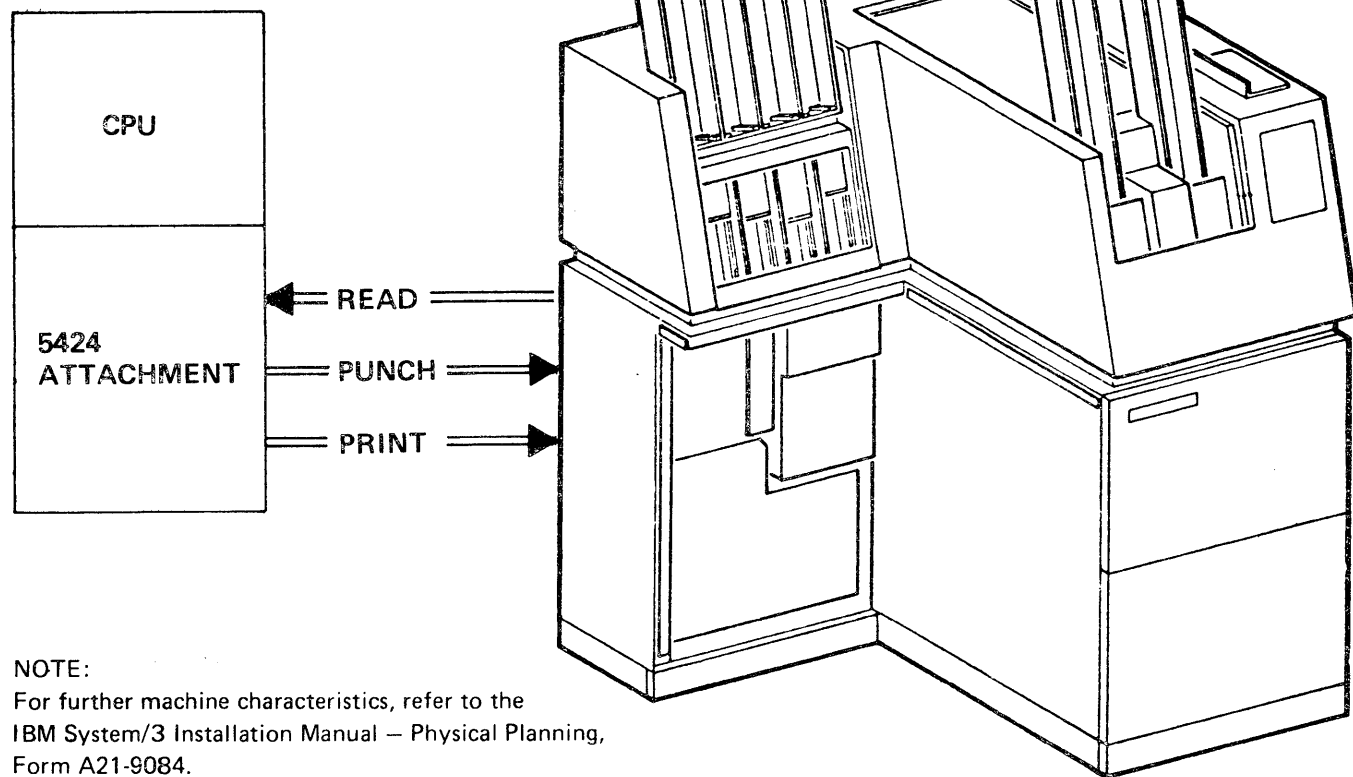
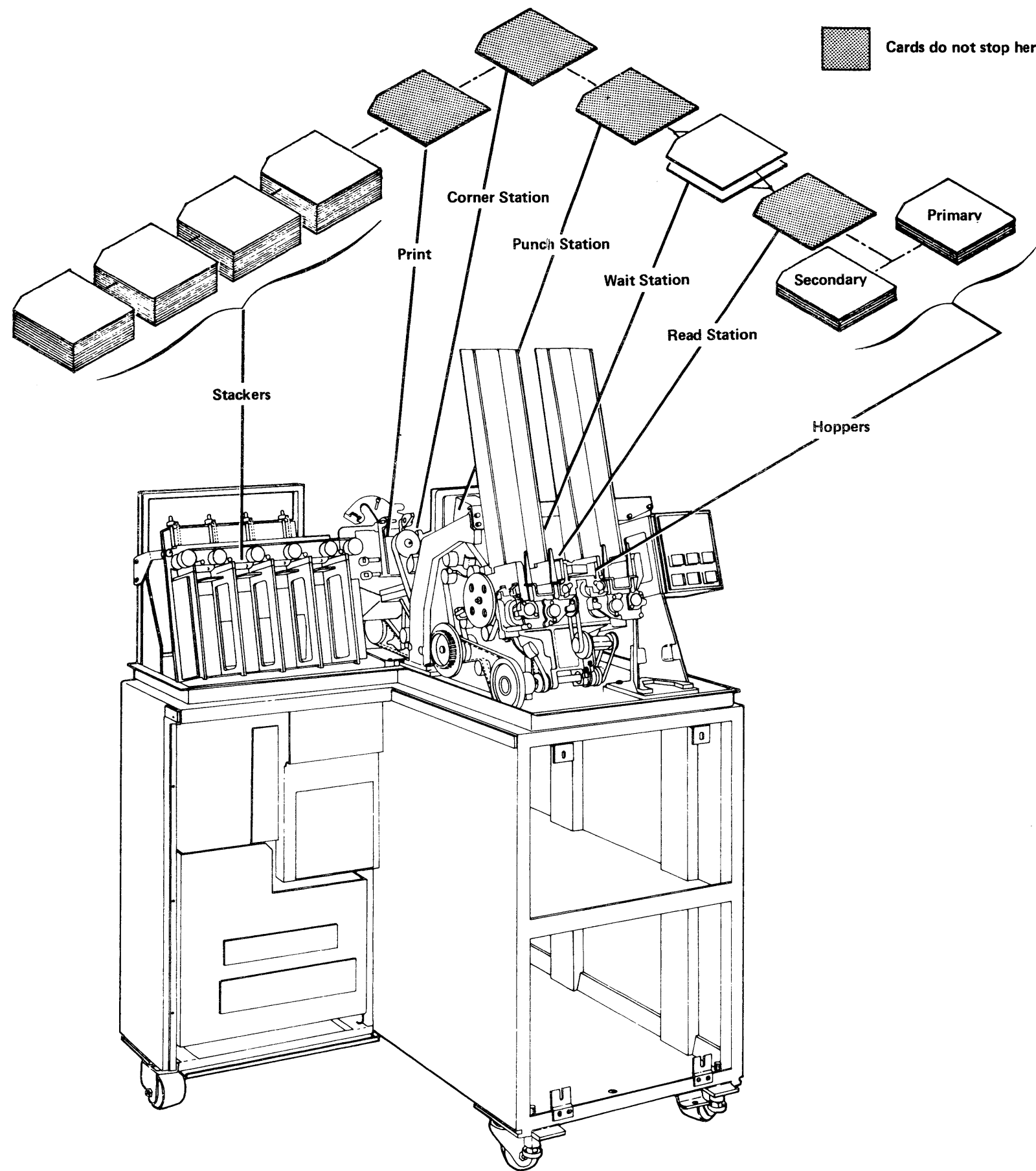
All card movement is controlled by the CPU stored program. The program designates which feed is to be used, when the cards are to be fed, and what operation is to be performed (read, punch, print).

Commands are received by the 5424 by way of signal cables from the attachment circuits. These commands, in the form of electrical pulses, activate the necessary clutches and magnets; the 5424 in turn sends signals to the attachment indicating card position, cycle timing, and read data.

Speed: Model A1
 250 cpm read
 60 cpm punch
 60 cpm print (three lines), 48 cpm print (four lines)

Model A2
 500 cpm read
 120 cpm punch
 120 cpm print (three lines), 96 cpm print (four lines)

Capacity: Hoppers – 2000 cards
 Stackers – 600 cards



NOTE:
 For further machine characteristics, refer to the IBM System/3 Installation Manual – Physical Planning, Form A21-9084.

OPERATOR PANEL

(1) – Indicates that a card covered the hopper cell late.	(9) – Indicates that a card was late uncovering the prepunch cell on a non-punch operation.	(15) – Indicates that a card was late uncovering the corner cell on a print operation.
(2) – Indicates that a card arrived at the read station late.	(10) – Indicates that a card was late uncovering the prepunch cell on a punch operation.	(16) – Indicates that a card was late covering the post-print cell on a no print operation.
(3) – Indicates that all cells were covered without a feed cycle.	(11) – Indicates that a card was late covering the corner cell on a non-punch operation.	(17) – Indicates that a card was late covering the post-print cell on a print operation.
(4) – Indicates that a card was late uncovering the read station.	(12) – Indicates that a card was late covering the corner cell on a punch operation.	(18) – Indicates that a card was late uncovering the post-print cell.
(5) – Indicates that a card covered the prepunch cell without being told to do so.	(13) – Indicates that a card was early uncovering the corner cell.	(19) – Indicates a stacker jam.
(6) – Indicates that a card was late covering the prepunch cell on a non-punch operation.	(14) – Indicates that a card was late uncovering the corner cell of a non-print operation.	(20) – Indicates that the gear emitter or fire CB is not working properly.
(7) – Indicates that a card was late covering the prepunch cell on a punch operation.		
(8) – Indicates that a card was early uncovering the prepunch cell on a punch operation.		

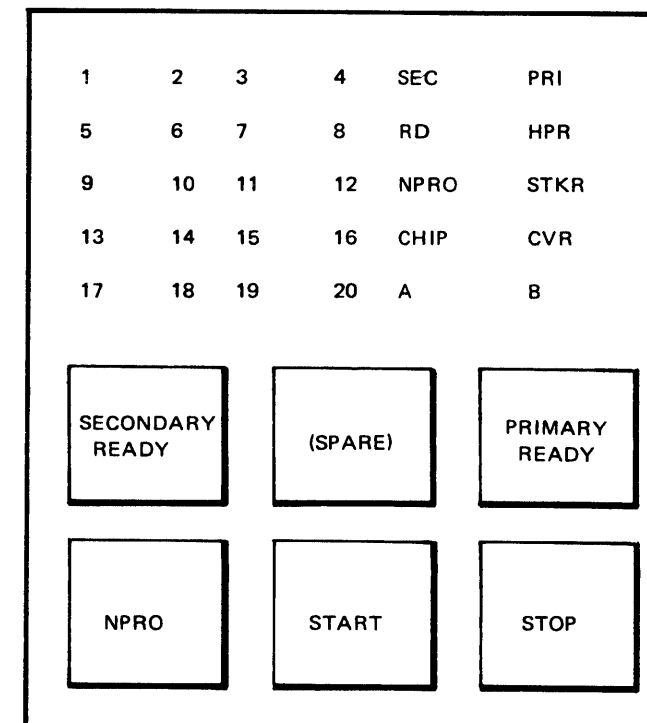
Start Key
Pressing this key places the 5424 in ready condition.

Stop Key
Pressing this key stops the 5424 after a delay to allow completion of any operation.

Non-Process Run-Out Key (NPRO)
The NPRO key is used to clear cards from the 5424 and to clear any feed check indicator. It will also clear any other error indicators that may be on. For the NPRO key to be active, both feed paths of the 5424 must be in the 'not ready' state, at least one hopper must be empty, and all cards covering photo card sensors in the card path must be removed manually.

Primary Ready – Indicates that cards are in the primary hopper, no error condition exists, and the start key has been pressed.

Secondary Ready – Indicates that cards are in the secondary hopper, no error condition exists, and the start key has been pressed.



(HPR) – Indicates that a card did not feed out of the hopper. (Hopper Check)

(PRI) – Indicates that the last feed used was the primary.

(SEC) – Indicates that the last feed used was the secondary.

(RD) – Indicates there was a read check on the last card read.

(CVR) – Indicates that the covers are open and interlock override is not activated. It will not go off until either the start or NPRO key is pressed.

(CHIP) – Indicates that the chip box is full or out of the machine. It will not go off until the start or NPRO key is pressed.

(STKR) – Indicates that one of the four stackers is full.

(NPRO) – Indicates that more run-outs are required to completely clear the machine.

(A) – This light is a spare which can be wired by the Customer Engineer for miscellaneous error conditions.

(B) – Same as (A).

FEEDING OPERATION

- Magnets along the feed path control card movement.
- Hopper CB signals the attachment that MFCU hopper mechanism is in position to have hopper magnet energized.
- Card moves from hopper through read station, and to wait station when hopper magnet is energized.
- Card moves from wait station to corner station when punch registration pressure roll magnet is energized.
- Card moves from corner station to stacker when corner kick magnet is energized.

Cards feeding is under control of:

1. continuously running feed rolls,
2. several magnet-operated pressure rolls.
3. the corner station kicker, and
4. the print stepper clutch.

One feed command moves the card from the hopper to the wait station. A second feed command moves the card from the wait station to the stacker, unless a feed check stops the machine. The card must move from one transport position to the next in a set time or a feed check will occur. A list of the twenty feed checks and the timings involved is found on page

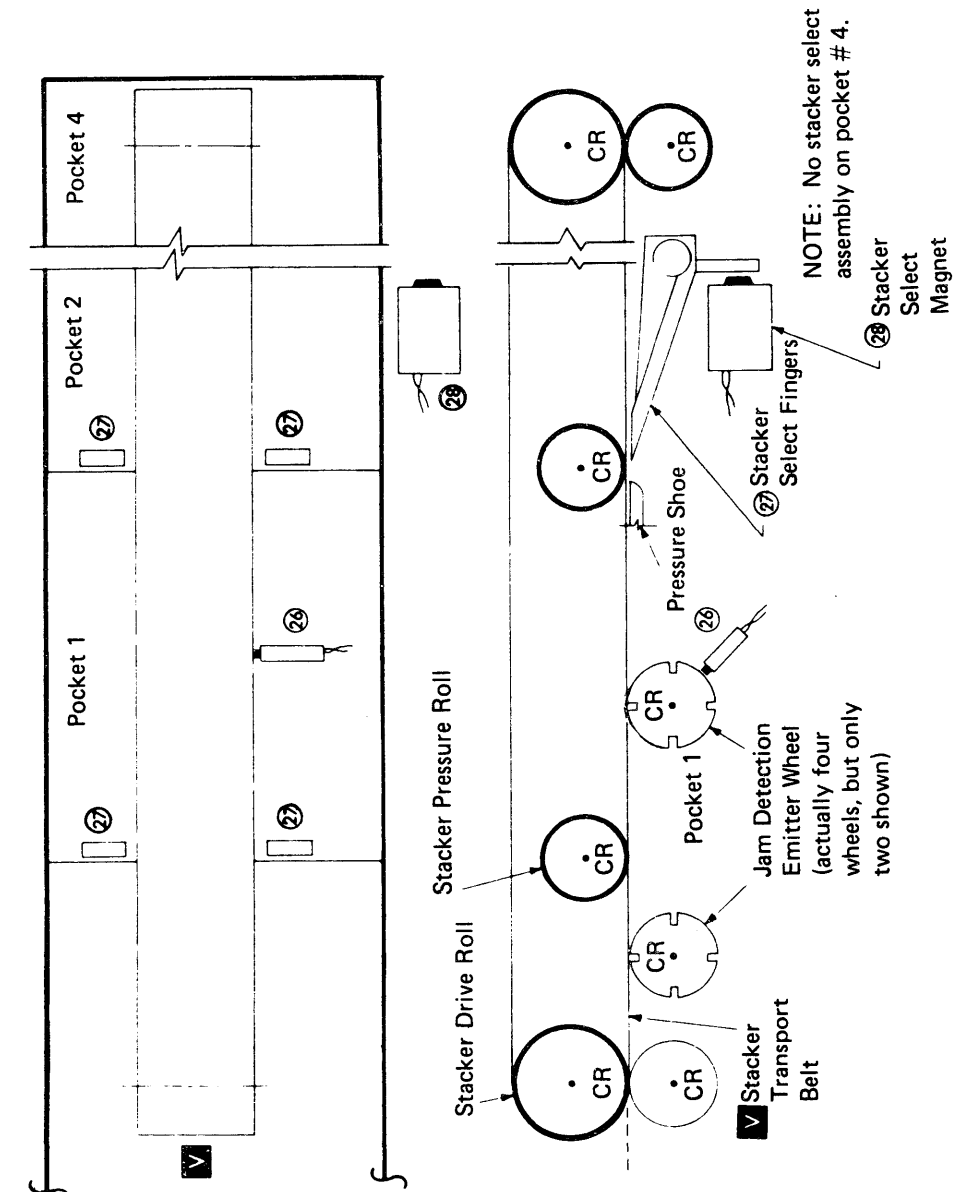
The hopper pickerknives **A** are controlled by magnetic clutches that are energized by the attachment. A card is fed into the read inject station **B** from the hopper and is stopped. The hopper cell **C** signals the attachment that the leading edge of the card has entered the inject station. Then, the (high dwell) sector of the read inject feed roll **D** moves the card into the read station feed rolls **E** and aligns the card on the registration rail. The read station feed rolls move the card through the read station. The wait inject feed rolls **F** feed the card to the wait station where the card is stopped by the inertia brake **G**. The magnet-operated path selector **H** directs the card to one of the two wait stations; the attachment picks the path selector to direct cards from the secondary hopper to the lower wait station. If the path selector is not picked, cards are directed to the upper wait station. The attachment controls the wait station card path selector and card feeding from the wait station.

If the card is to be punched, it is fed in against the punch registration gate by the punch registration feed and pressure rolls **J**. Punch registration pressure roll 1 is operated to move a card from the upper wait station. Punch registration pressure roll 2 is operated to move a card from the lower wait station. The pre-punch cell **K** detects the card while the punch registration pressure roll moves the card. The punch stepper feed roll **L** then moves the card through the punch unit stopping for each column group. If the card is not to be punched, the punch registration pressure roll feeds the card from the wait station to the punch eject rolls **M** which carry it through the punch in a smooth motion. The corner inject feed roll and pressure shoe assembly **N** moves the card into the corner station.

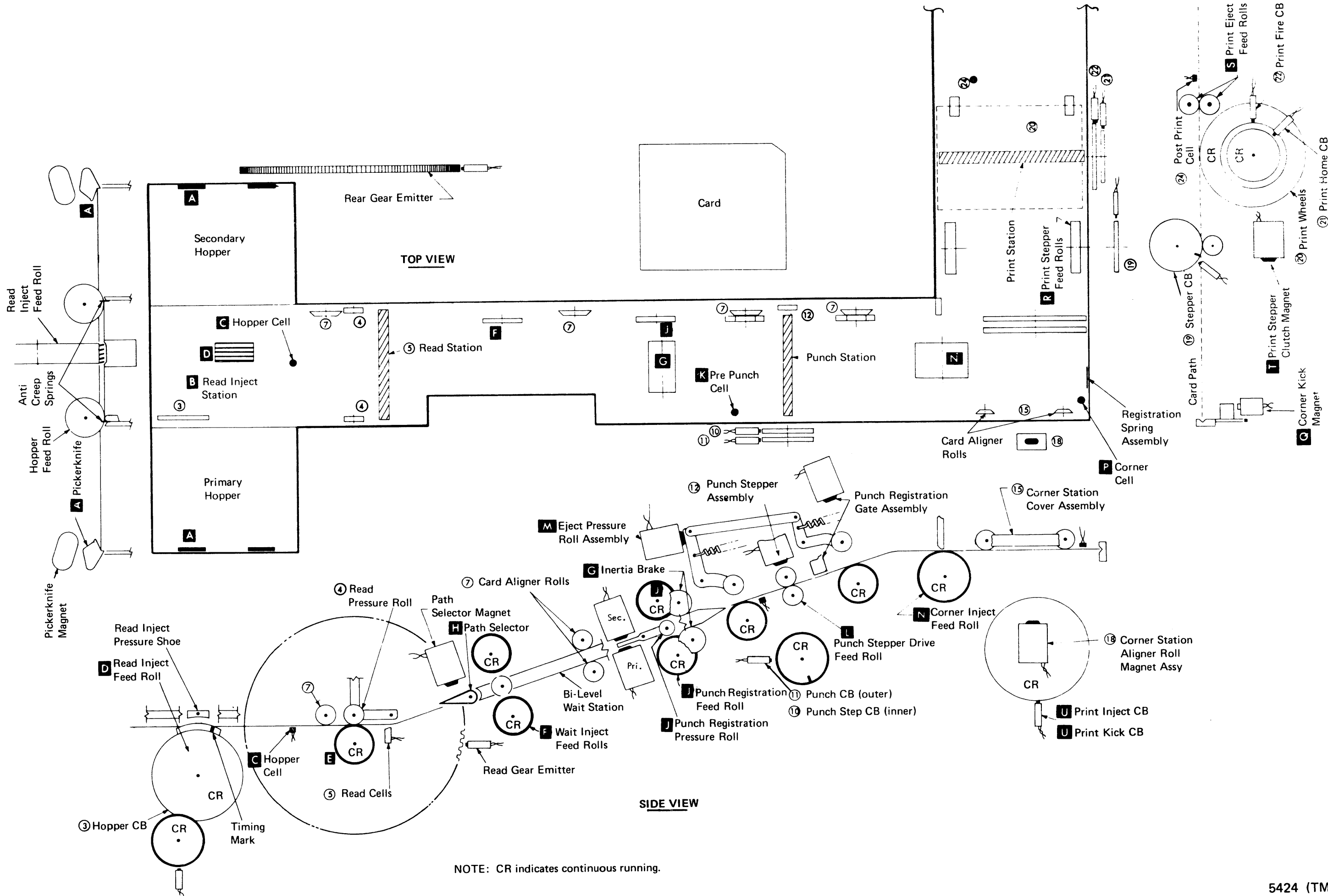
The corner cell **P** senses that the card is in the cornering station. If this is not a print operation, the corner kick magnet **Q** kicks the card into the print stepper feed rolls **R** which are turning at this time. The card moves through the print station into the print eject feed rolls **S** and into the stacker. If, however, this is a print operation, the print stepper feed rolls are stopped by the stepper clutch **T** (energized by the attachment), and the kick CB and inject CB **U** pulses provide timings to the attachment for energizing the corner kick magnet **Q**. The card is aligned in the stepper roll **R** pinch point, establishing a point of timing and print registration.

The print stepper feed rolls **R** move the card through the print unit in incremented steps, stopping for four print lines. Printing three lines is considered to be a normal print operation; a fourth line can be printed with a reduced card throughput. On a normal print operation, the card is incremented three times by the stepper rolls (printing the top three lines) and moved out under control of the stepper rolls and the eject feed rolls **S**. During each stop for a print line, the card moves three side steps (one side step for Model A2 and back to its home position. While the card is on its way back to home position, it is moved to the next line. This side motion makes it possible for the Model A1 to print the 32 positions with eight typewheels and the Model A2 to print the 32 positions with 16 typewheels. The stacker transport belt **V** moves the card from the print unit to the selected stacker.

No particular mechanical feed timing relationship is maintained between the read, punch, and print areas since each station has its own emitters providing timing pulses to the attachment. However, the slowest operation controls the throughput of the other units.



FRONT VIEW



BACK VIEW

NOTE: CR indicates continuous running.

MAINTENANCE TECHNIQUES

The maintenance techniques used on the IBM 5424 Multi-Function Card Unit (MFCU) are on-line diagnosis, maintenance and verification. Because the MFCU is an electrical-mechanical device, emphasis is placed on checking the mechanical operations and timings.

The integrated maintenance package (IMP) is to be used in diagnosing machine malfunctions about 90% of the time without using an oscilloscope. Included in the IMP are maintenance analysis procedures (MAP) charts and software diagnostic programs.

The cause of most machine stops can be determined by observing the indicators on the operator console or by a processing unit (CPU) halt or printout. If a malfunction occurs, diagnostic programs should be run to isolate the cause of error. When the type of malfunction is determined, refer to the MAP charts to aid in isolating the cause of the MFCU error. In most cases, the causes of the error can be determined without the use of an oscilloscope.

DIAGNOSTICS PROGRAMS

The diagnostic programs for the MFCU are divided into three groups:

1. **Function and diagnostic programs.**
2. **Timing analysis programs (TAPs).**
3. **Read evaluation and adjustment procedures program.**

See the program operating procedures in the Master Timing Analysis Program Users Guide part 2589737 for specific details about the programs and outlines.

Function and Diagnostic Programs

The following are general descriptions. For detailed information refer to the 5424 MFCU Diagnostic Users Guide (part 2589737).

Status Test: This program tests the sense and branch commands by checking the device status when the MFCU is placed in both the ready and the not ready status.

Commands Test: This program checks MFCU response to all possible commands as issued by the program. The test I/O and sense instructions are used to check device status before, during, and after test execution. Detected errors are logged on the system printer.

Ripple Punch Test: This program checks the punch check circuitry. A ripple pattern is punched into 64 cards so that all possible 6-bit combinations are punched in every card column. Commands are then issued in diagnostic punch mode to check for punch errors. If an error occurs, the data is stored 128 bytes beyond the location of the information that was punched in the cards.

Ripple Read: This program uses the ripple deck that was punched during the ripple punch test program. The program compares data read against the data punched into the cards. Results of the test can be printed on the system printer. Reading is done in diagnostic mode. Should a read check occur, the read check register information is stored 128 bytes beyond the read register information and is available for printout.

Stacker Selection: This program checks for correct stacker selection. Cards are selected to the four stacker pockets in a ripple or random pattern. The expected count for each stacker is printed. The cards are rerun through the MFCU for counting and compared against the expected count.

Ripple Print: This program prints all characters in the various card positions by rippling a print pattern through a deck of cards. Verification of printing must be done visually.

System Test: This program is a system checkout that exercises all I/O devices simultaneously while the CPU is executing a program.

Timing Analysis Programs (TAPs)

The timing analysis program decks are run in conjunction with the MTAP in TAP program (FF-4). These TAP programs record the status of the selected lines (+ or -) during each sense command. This information is stored in CPU core storage. The print out is either a representation of an oscilloscope trace showing the earliest and latest possible time in relation to the triggering pulse on the lines selected or the information is presented in tabular form. These scope representations and printouts are used for analyzing machine malfunctions.

Read Evaluation and Adjustment Procedures Program

The read evaluation and adjustment procedure program is a TAP type program that is used to measure the data pulse duration that is generated by the read phototransistor and also measure the relationship of the emitter pulses 1, 3, 5, 7, 9, and 11 with relation to the data pulse. Read cells 1 and 18 are prewired for this measurement and the measurement obtained also measures skew in the read station. A spare probe is available that may be plugged into any desired read cell while running this program.

SAFETY

PERSONAL SAFETY

Ensure your own safety by making it an everyday practice to use caution at all times and by being aware of potentially dangerous areas of the machine. Be sure to read and follow the safety suggestions in form 229-1264, a pocket-sized card issued to all IBM Customer Engineers.

Remember:

- Loose clothing can become entangled in moving parts of the machine.
- Drive belts, because of their internal cable construction, can cause serious injury. DO NOT crank a machine by pulling on the drive belts.
- Heat sinks are at an electrical potential. DO NOT short heat sinks to each other or to the machine side frame.
- Always unplug machine power and wait ONE FULL MINUTE before attempting repairs or adjustments in the power supply area.
- Voltages developed in the resonant circuit of regulating power supplies are apt to be much greater than the line voltages.
- Follow the specific safety precautions that accompany many of the adjustment procedures in this manual.

Be aware that the 5424 motor and/or clutches can operate unexpectedly. Conditions causing such operation are:

- Program commands.
- Loss of a dc voltage to a machine, gate, board or chassis, card, or pin.
- Removing or inserting a card or cable.
- Probing and accidentally shorting a pin.
- Component failures.
- Another person starts machine.

Ensure against these starts by placing the interlock override switch in the off (non-override) position or unplugging the voltage connector.

PREVENTIVE MAINTENANCE GUIDE

U	MACHINE SERIAL NO. _____ DATE INSTALLED _____ METER HOURS _____	QUARTER													
		1	2	3	4	5	6	7	8	9	10	11	12		
1	CLEAN MFCU WITH VACUUM CLEANER CLEAN BOTH ENDS OF LIGHT PIPES CLEAN LIGHT SENSORS INSPECT MFCU FOR WEAR, BREAKAGE OR LOOSE PARTS LUBE PRINT STEPPER CLUTCH GREASE FITTING (#23 GREASE)														
2	LUBE INCREMENTAL DRIVE ARM P/N 2591696 (#23 GREASE) LUBE INCREMENTAL DRIVE LOCKING SLIDER P/N 2591709 (#23 GREASE) LUBE PUNCH REG. PRESSURE ROLL FLAT SPRING (#23 GREASE) RUN AND ANALYZE TAP PROGRAM FF4, SECTIONS 001, 002, 003, 004, 005 - MOD I 021, 022, 023, 024, 025 - MOD II AND MAKE REQUIRED REPAIRS RUN OTHER TAP SECTIONS AS FELT NECESSARY														
3	LUBE HOPPER GEARS (#24 GREASE) CLEAN HOPPER POLE FACES LUBE SIDE MOTION GEARS AND CAM (#24 GREASE) CLEAN RIBBON DRIVE GUIDES, ROLLS, AND PATH RUN AND ANALYZE DIAGNOSTIC READ PROGRAM F03 AND MAKE REQUIRED REPAIRS														
4	LUBE MAIN COVER LATCH AND COUNTERBALANCE CAMS LUBE MAIN COVER STAYBRACE NEAR SLIDING PLATE ON LABEL SIDE ONLY REPLACE READ INJECT SECTOR P/N 2591405 INSPECT PICKER KNIFE HEADS FOR FREEDOM OF MOVEMENT AND CLEAN PIVOT SHAFTS AS NECESSARY														

DO NOT USE IBM CLEANING FLUID ON PLASTIC PARTS.

PM SCHEDULE IS BASED ON A USAGE OF 200 HOURS (MODEL A2) AND 300 HOURS (MODEL A1) PER QUARTER. ADJUST THIS SCHEDULE AS NECESSARY FOR HIGH USE MACHINES.

RECORD DATE, METER HOURS, AND INITIALS

MACHINES USING CARBON IMAGE CARDS
CLEAN READ FEED ROLLS AND PRINT STEPPER ROLLS EVERY SIX MONTHS

EQUIPMENT SAFETY

Electrical

Always replace blown fuses with fuses of the same type and rating. Using fuses of a different type or higher rating could result in damage to a card being replaced or to other cards in the net.

Mechanical

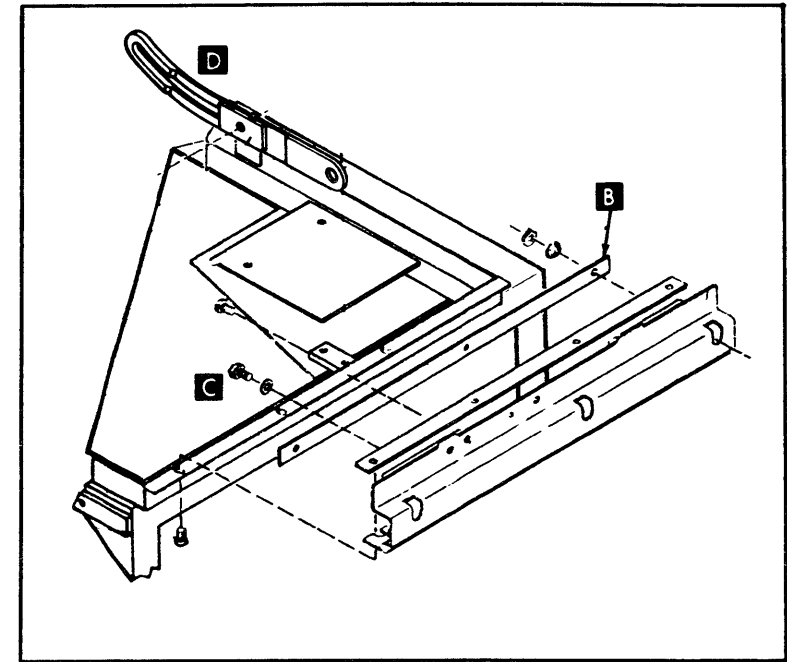
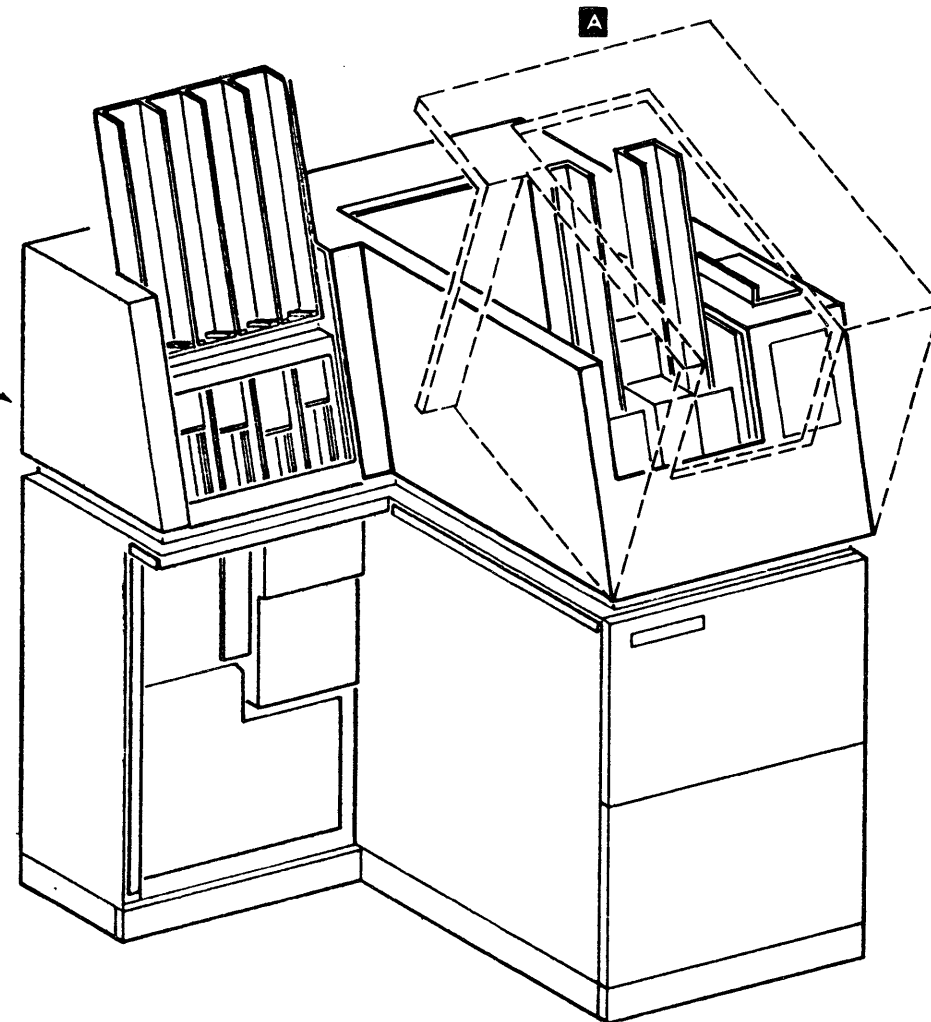
Do not operate the machine under power with units disassembled, removed, or maladjusted. Keep tools, etc clear of the mechanism when the machine is operating under power.

CAUTION: Do not use IBM cleaning fluid on plastic parts.

MACHINE COVERS

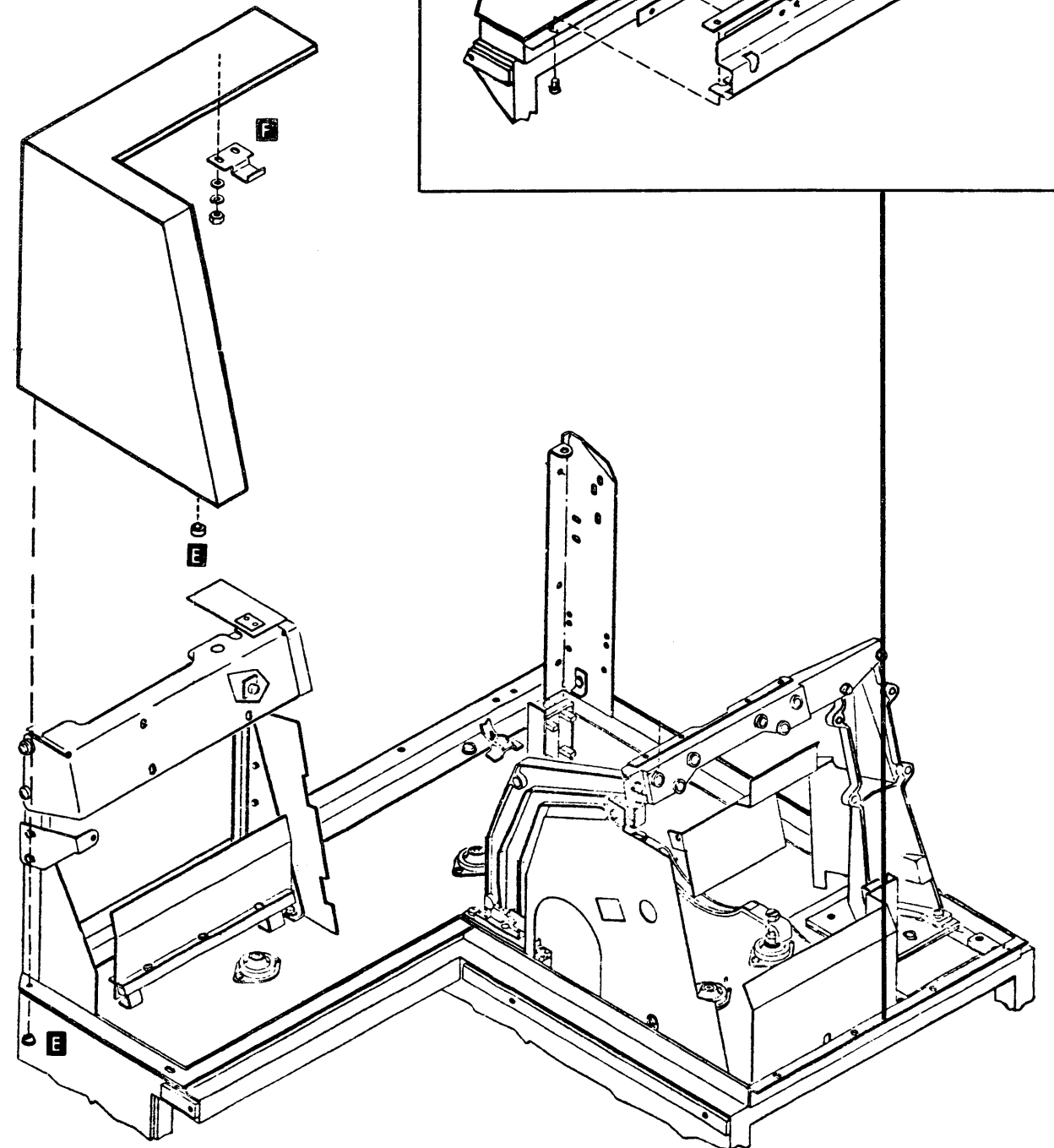
MAIN COVER REMOVAL

- 1 Open cover **A** to a full open position.
- 2 Remove the three nuts and lockwashers and take out the clamping strip. **B**
- 3 Remove screw and washer that attaches the ground strip to the cover.
- 4 Loosen the two slotted hex head screws. **C**
- 5 While supporting the cover, disconnect the cover support staybrace **D** from the pivot on the cover. The cover may now be removed by sliding it out from under the guide screws.
- 6 To reassemble, slide cover over hinge guide screws and tighten slotted hex screws. Take care to ensure that the cover is completely seated on the hinge.
- 7 Attach cover support staybrace. **D**
- 8 Assemble hinge clamping strip. **B**
- 9 Attach ground strap to cover.



STACKER COVER REMOVAL

- 1 Lower the rear cover.
- 2 Remove two knurled nuts from under the lower lip of the stacker cover. **E**
- 3 Release the slide fastener under the top surface of the cover. **F**
- 4 Lift the cover up and off the machine.
- 5 To reassemble, place the two cover studs into the holes in the cover mounting frame and at the same time make certain that the cover flange is over the stacker channel trim piece. Replace the knurled nuts, making them finger tight.
- 6 Slide the stud which is under the top surface of the cover into the opening in the stacker support bracket and relatch the slide fastener.



DRIVE MOTOR PULLEY

ADJUSTMENT

Model A1

- 1 Remove handwheel clamping screw, handwheel, hopper drive belt, two pulley clamping screws, flat belt, and flat belt pulley.
- 2 Insert one of the pulley clamping screws in tapped hole in punch drive pulley.
- 3 Tighten screw until collet and pulley separate. Remove the screw from pulley.
- 4 To keep punch drive pulley and clamping collet together replace flat belt pulley and pulley clamping screws leaving the screws loose.
- 5 Slide the pulley along the motor shaft until punch drive belt tracks properly. Tighten the clamping screws.
- 6 Replace flat belt, hopper drive belt, handwheel, and handwheel clamping screw.

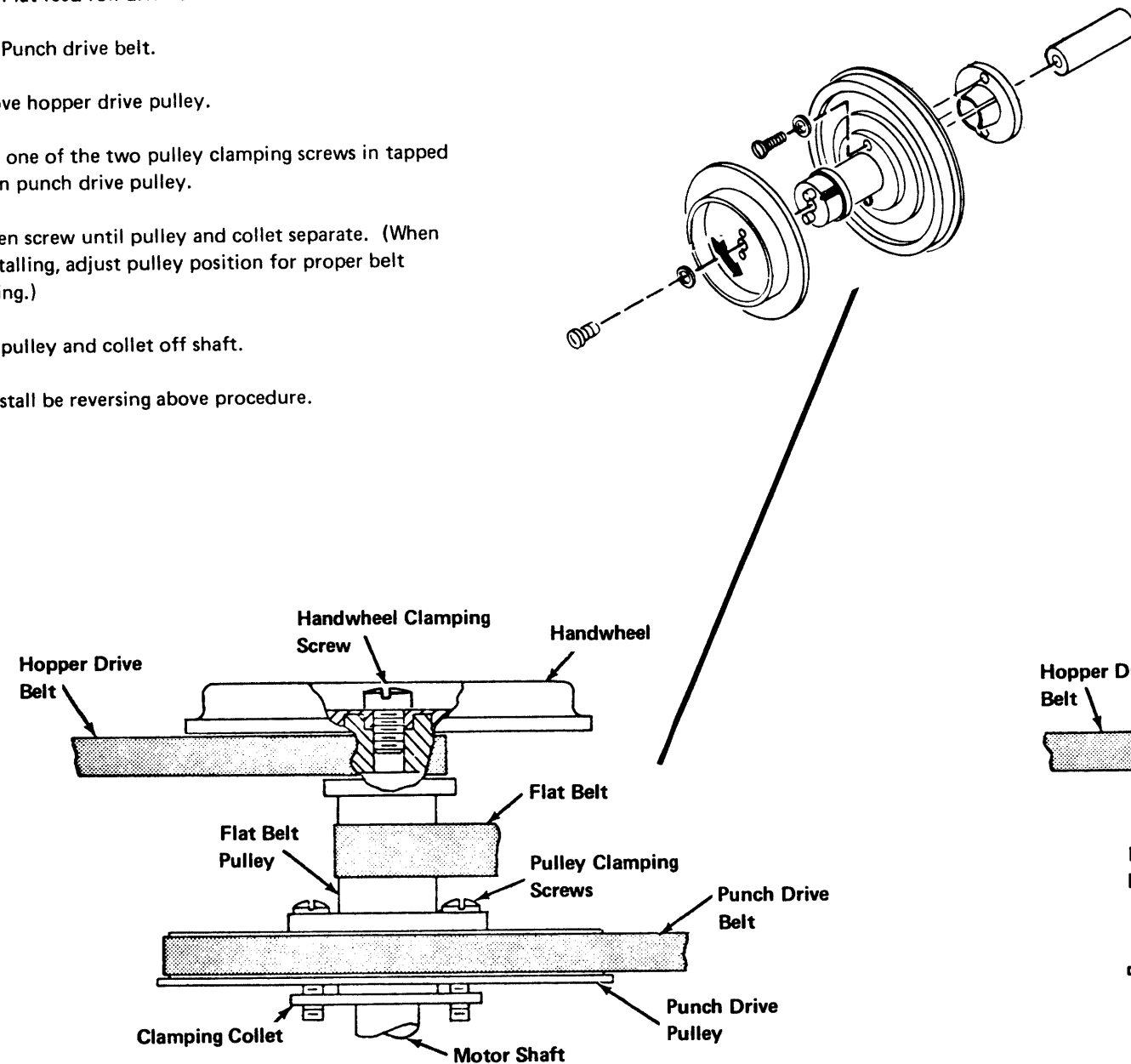
Model A2

- 1 Remove pulley clamping screws, handwheel, hopper drive belt, flat belt, and flat belt pulley.
- 2 Insert one of the pulley clamping screws in tapped hole in punch drive pulley.
- 3 Tighten screw until collet and pulley separate. Remove the screw from pulley.
- 4 To keep punch drive pulley and clamping collet together replace flat belt pulley, handwheel, and pulley clamping screws loose.
- 5 Slide the pulley along the motor shaft until punch drive belt tracks properly. Tighten the clamping screw.
- 6 Replace flat belt and hopper drive belt.

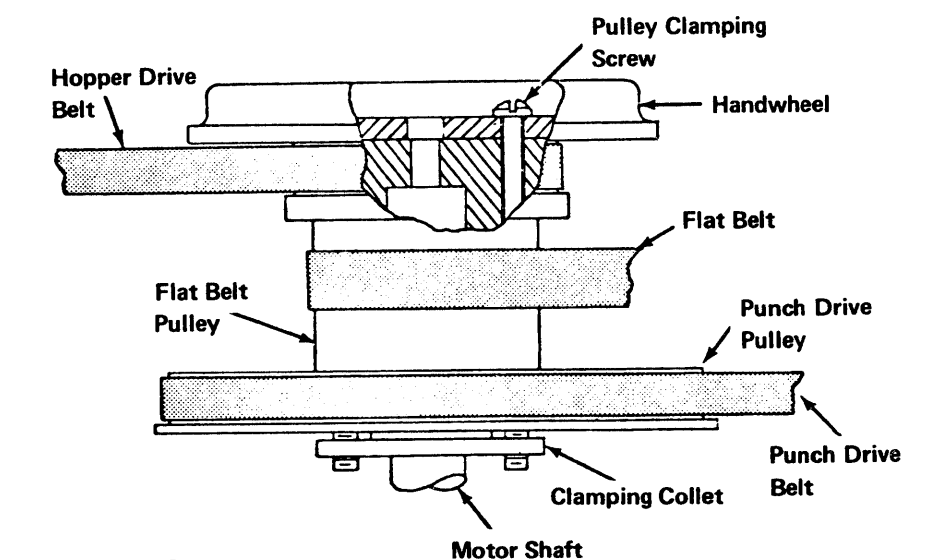
NOTE: If machine has clamped pulley on hopper jackshaft, hopper drive belt tracking can be adjusted. Care must be taken not to move hopper pulley enough to interfere with safety cover.

REMOVAL

- 1 Remove handwheel, hopper drive belt and two pulley clamping screws.
- 2 Remove:
 - a. Flat feed roll drive belt.
 - b. Punch drive belt.
- 3 Remove hopper drive pulley.
- 4 Insert one of the two pulley clamping screws in tapped hole in punch drive pulley.
- 5 Tighten screw until pulley and collet separate. (When re-installing, adjust pulley position for proper belt tracking.)
- 6 Slide pulley and collet off shaft.
- 7 Re-install by reversing above procedure.



MODEL A1



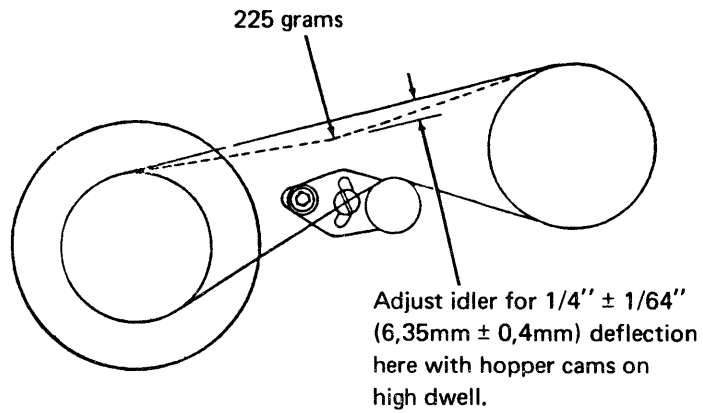
MODEL A2

DRIVE MOTOR

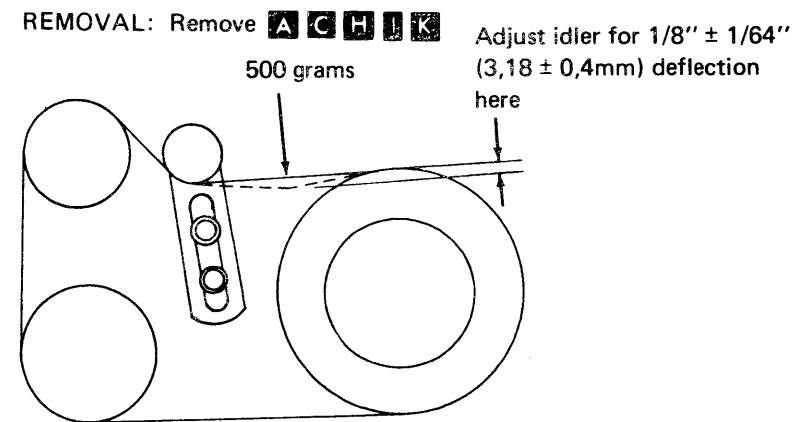
REMOVAL

- 1 Turn machine power off.
- 2 Unplug drive motor wires at quick disconnect.
- 3 Remove drive motor handwheel.
- 4 Remove:
 - a. Hopper input drive belt.
 - b. Flat feed roll drive belt.
 - c. Punch input drive belt.
- 5 Remove drive motor pulley. (When re-installing, adjust pulley for proper belt tracking.)
- 6 Remove four motor mounting bolts and remove drive motor.
- 7 Reinstall drive motor by reversing above procedure.

HOPPER INPUT DRIVE BELT A

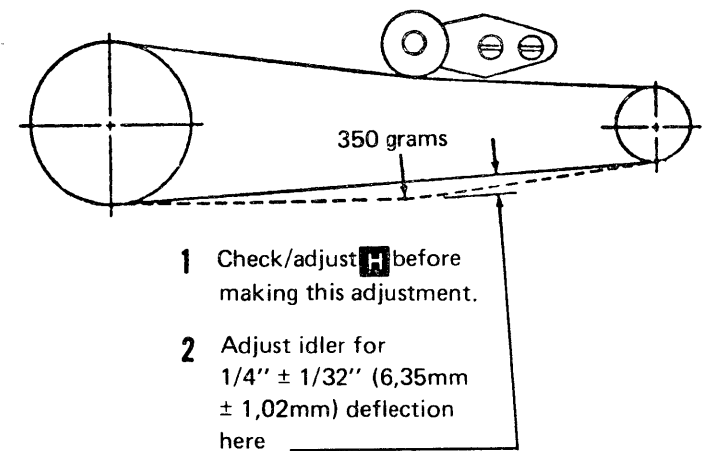


PUNCH INPUT DRIVE BELT B

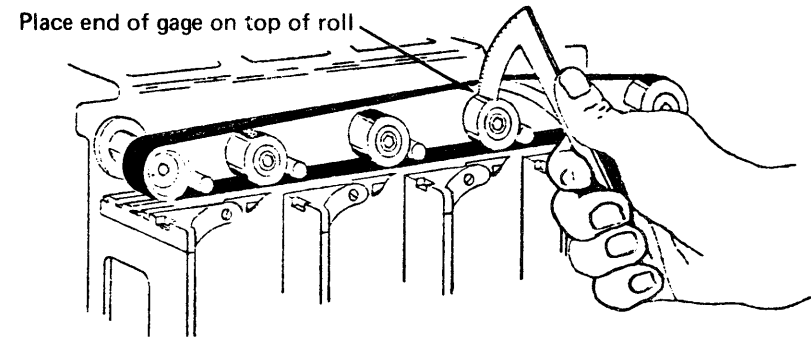


SIDE MOTION DRIVE BELT C

Removal: Remove H



STACKER BELT D



ADJUSTMENTS

- 1 Open rear machine cover and remove stacker end cover.
- 2 Loosen two end screws.
- 3 Rotate stacker roll to adjust belt tension for 550 to 600 grams. Tighten mounting screws and recheck tension.

STACKER DRIVE BELT E

Removal: Remove F

No adjustment necessary.

PRINT STEPPER CLUTCH DRIVE BELT F

- Removal:
- a. Remove stepper safety cover.
 - b. Remove hex stud from end of stepper clutch shaft.
 - c. Remove face plate.
 - d. Remove belt.
 - e. Replace by reversing above procedure.

No adjustment necessary.
Idler is spring loaded.

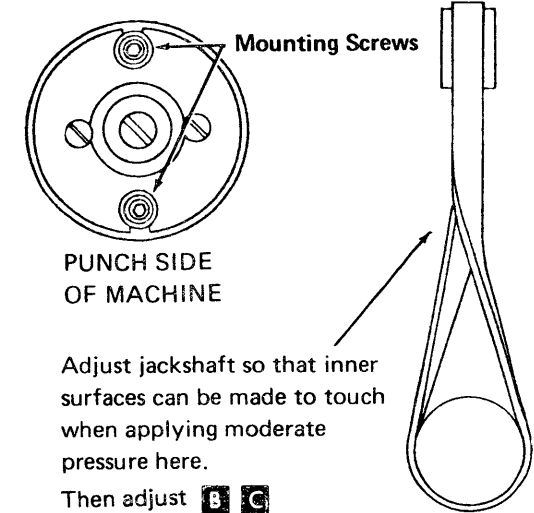
PRINT WHEEL DRIVE BELT G

Removal Remove F E and loosen stepper clutch mounting screws.

No adjustment necessary.

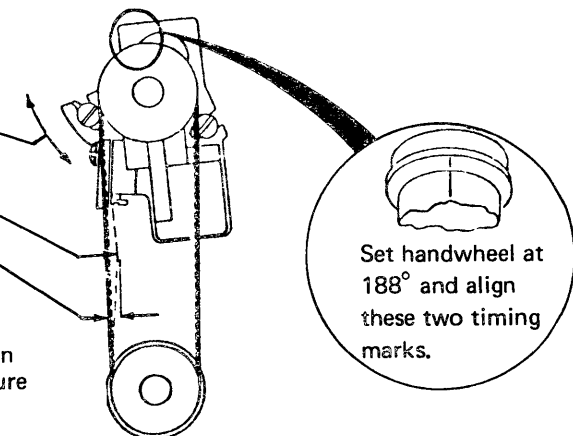
PRINT EJECT TWISTED DRIVE BELT H

NOTE: Move punch connector assembly to allow access to mounting screws.

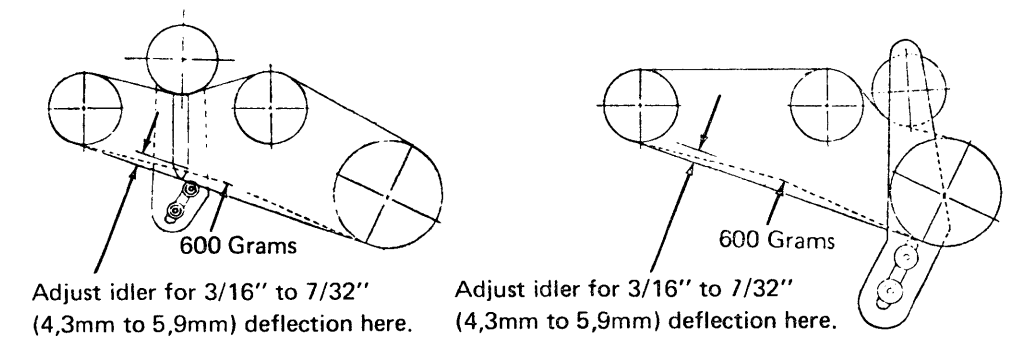


PUNCH STEPPER DRIVE BELT I

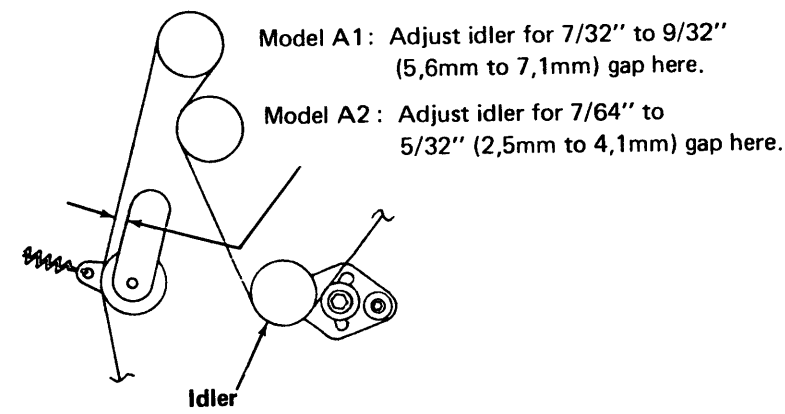
- 1 Loosen screws 1/8 turn
- 2 Rotate stepper assembly until 450 grams of pressure results in $0.125'' \pm 0.025''$ ($3.2\text{mm} \pm 0.6\text{mm}$) belt deflection.
- 3 Check timing mark at 188° .
- 4 Note: If the stepper position is changed, check the pressure roll adjustment (page 41).



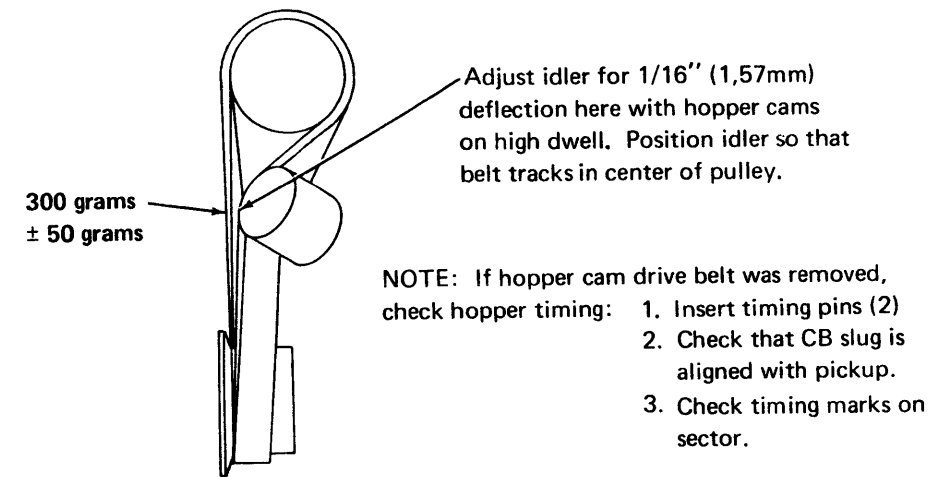
PUNCH EJECT BELT J



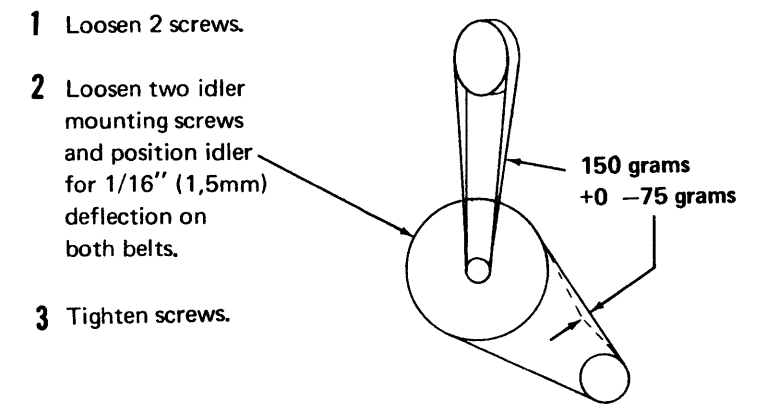
FLAT FEED ROLL DRIVE BELT K



HOPPER CAM DRIVE BELTS N



RIBBON DRIVE BELTS O

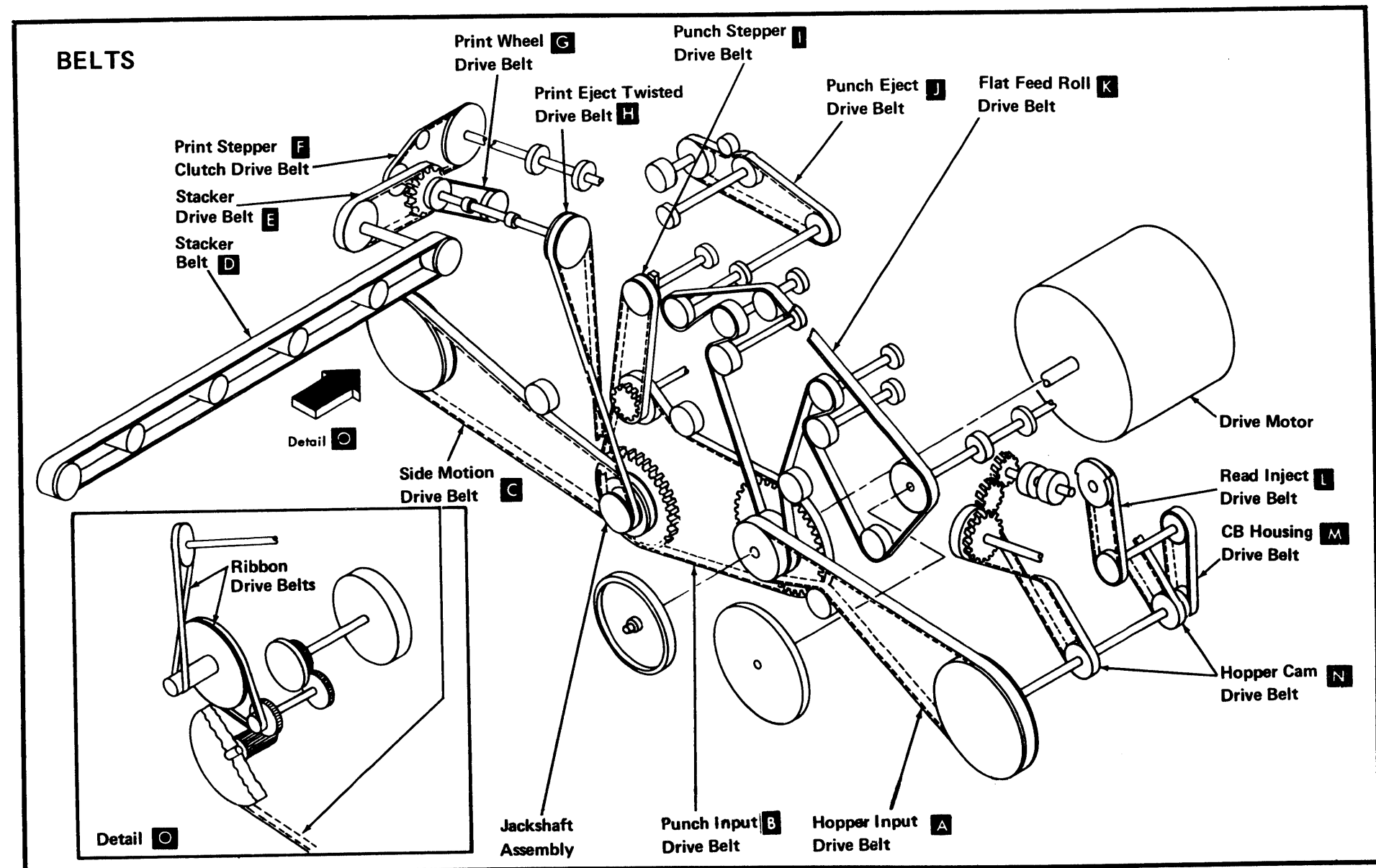
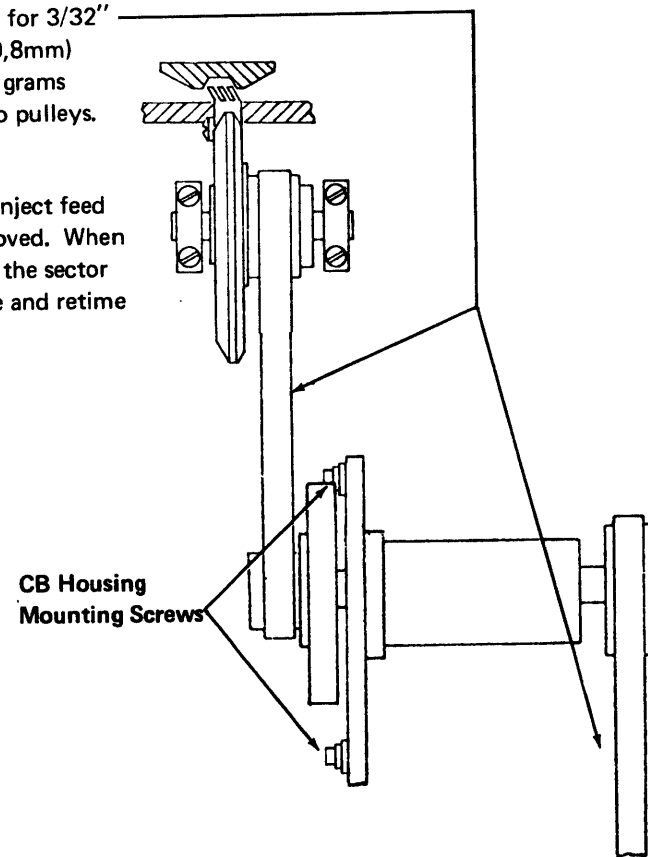


READ INJECT DRIVE BELT L CB HOUSING DRIVE BELT M

1 Loosen 3 CB housing mounting screws.

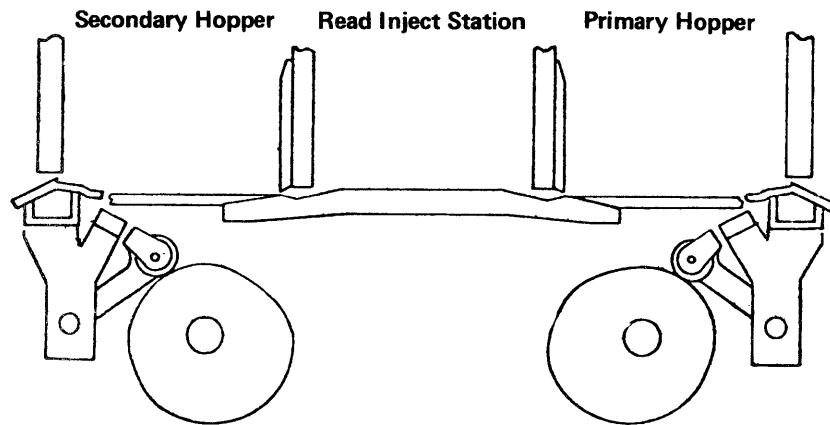
2 Position CB housing for 3/32" ± 1/32" (2,4mm ± 0,8mm) deflection with 500 grams applied between two pulleys.

3 If belt is removed, inject feed wheel must be removed. When re-installing, center the sector under pressure shoe and retime to rest of hopper.

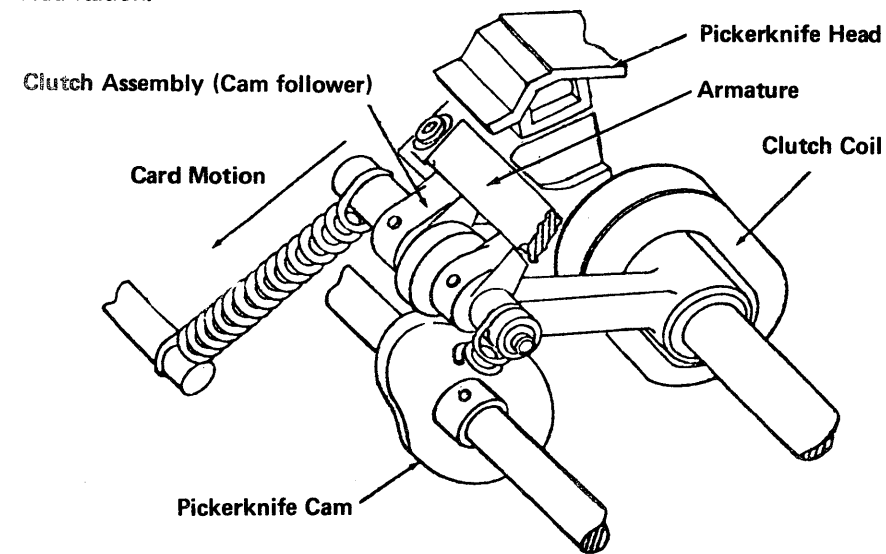


HOPPER OPERATION

The MFCU has a primary hopper and a secondary hopper. The primary hopper is located on the right side of the machine; the secondary on the left.



Cards are placed in the hoppers face down, top edge to the left, and enter the 5424 in a parallel motion. After a card is fed into the read inject station by two pickerknives, it changes to a serial motion, column one edge first, and moves into the read station.

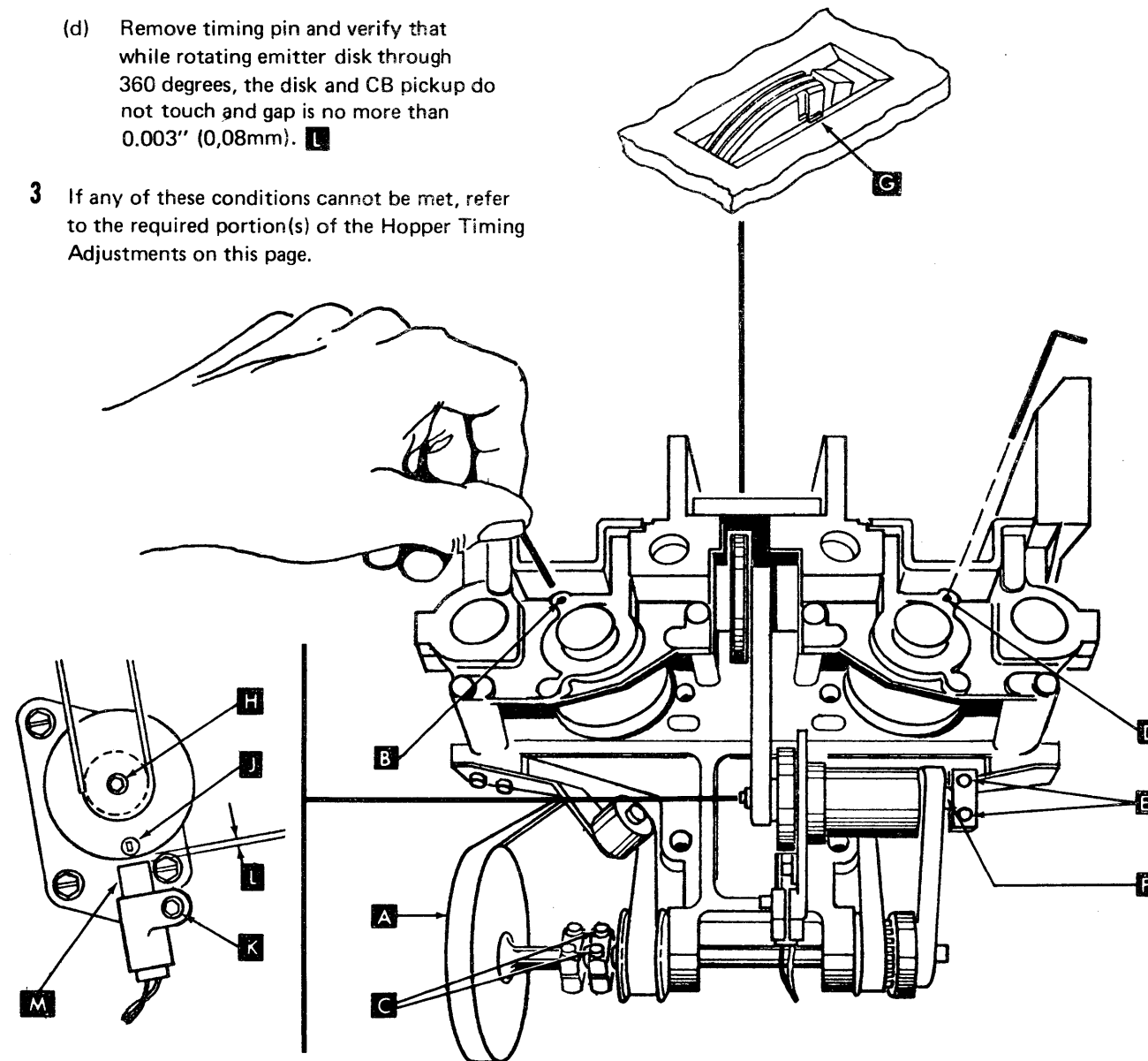


Pickerknives are operated by a continuously running cam, clutch assembly (cam follower), and clutch coil. The clutch assembly is energized at the time the clutch assembly is on the high dwell of the cam and at its closest point to the armature. Magnetic lines of force cause the clutch assembly, armature, and pickerknife head to move as one unit until the coil is de-energized at the next high dwell of the cam. Return springs hold the pickerknife heads in the returned position and keep them from following the cam until another feed command is given. The hopper CB emitter disk rotates twice for each card fed and signals the attachment when the hopper mechanism is ready for another card feed command.

HOPPER TIMING SERVICE CHECK

- 1 Rotate jackshaft pulley **A** until timing pin (part 460028) can be inserted through secondary hopper casting into pickerknife cam. **B**
- 2 With this timing pin inserted, you should be able to :
 - (a) Insert second timing pin into primary timing holes. **D**
 - (b) Observe read inject sector notch aligned with projection in card bed. **G**
 - (c) Observe hopper emitter disk slug **J** aligned with CB pickup. **M**
 - (d) Remove timing pin and verify that while rotating emitter disk through 360 degrees, the disk and CB pickup do not touch and gap is no more than 0.003" (0,08mm). **L**

- 3 If any of these conditions cannot be met, refer to the required portion(s) of the Hopper Timing Adjustments on this page.



HOPPER TIMING

HOPPER TIMING ADJUSTMENTS

WARNING: Be sure to remove timing pins after adjustment is made or extensive part damage will occur.

- 1 Rotate hopper drive jackshaft pulley **A** until timing holes **B** are aligned. Then insert timing pin (part 460028).
- 2 Loosen two clamping screws. **C** Pulley should turn freely on shaft.
- 3 Rotate hopper jackshaft pulley **A** until timing hole is aligned with timing hole in casting. **D** Then insert second timing pin. Tighten clamping screws. **C**
- 4 Loosen clamping screws. **E**
- 5 Rotate intermediate drive shaft **F** until notch on read inject sector is in line with projection on card bed. **G** Tighten clamping screws. **E**
- 6 Loosen CB emitter disk clamping screw. **H**
- 7 Rotate emitter disk until slug **J** is aligned with CB pickup. **M** Tighten clamping screw. **H**
- 8 Remove timing pins.
- 9 Loosen emitter pickup mounting screw. **N**
- 10 Adjust gap **L** so that CB pickup and disk do not touch through 360 degrees of rotation. Gap must not exceed 0.003" (0,08mm).
- 11 Tighten clamping screw **K** then recheck gap.

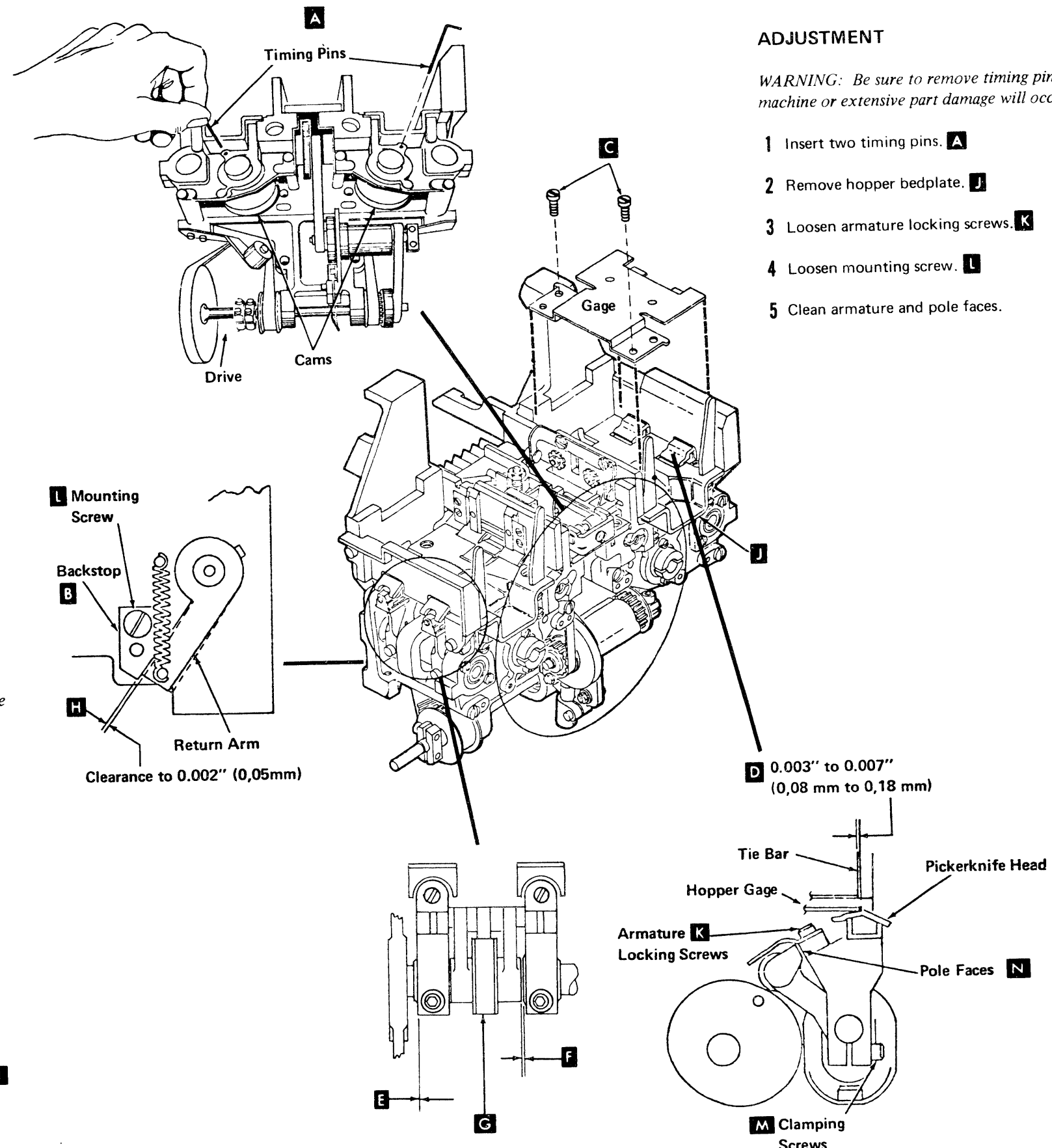
*Trademark of American Sealants Company

MAGNETIC CLUTCH

SERVICE CHECK

WARNING: Be sure to remove timing pins before running machine or extensive part damage will occur.

- 1 Insert two timing pins. **A**
 - 2 Check that return arm is flush against backstop. **B**
 - 3 Fasten hopper gage in hopper and against tie bar using bed plate mounting screws. **C**
- CAUTION:** Do not tighten rear screw or gage will be deformed.
- 4 Check that both pickerknife heads are even against gage. This places pickerknife head 0.003" to 0.007" (0,08mm to 0,18mm) **D** behind tie bar.
 - 5 Check for flush to 0.005" (0,13mm) gap here. **E**
 - 6 Check for 0.003" to 0.008" (0,08mm to 0,20mm) gap here. **F**
 - 7 Energize pickerknife magnet: **G**
 - Primary - TPB1-A to ground
 - Secondary - TPB3-A to ground
- CAUTION:** Do not remove jumpers or allow pickerknife to slip from gage while cam is off high dwell or part damage will occur.
- 8 Remove timing pins and rotate drive until cam follower just leaves cam.
- The clutch and armature should not separate under these conditions.
- 9 Rotate the cam back to its high dwell. Insert timing pins and remove gage.
 - 10 Check that there is a gap here but that the gap does not exceed 0.002" (0,05mm). **H**
 - 11 Remove jumpers and timing pins.
 - 12 Check that clutch pole faces are parallel within 0.001" (0,25mm). **N**



ADJUSTMENT

WARNING: Be sure to remove timing pins before running machine or extensive part damage will occur.

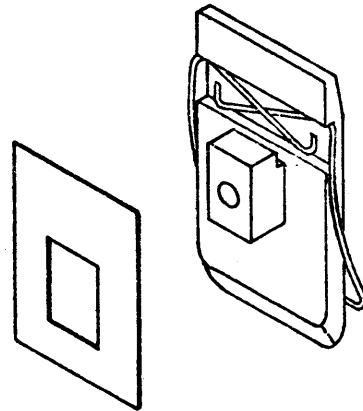
- 1 Insert two timing pins. **A**
 - 2 Remove hopper bedplate. **J**
 - 3 Loosen armature locking screws. **K**
 - 4 Loosen mounting screw. **L**
 - 5 Clean armature and pole faces.
 - 6 Position backstop flush against return arm. Then tighten mounting screw. **L**
 - 7 Adjust pickerknives:
 - a. Re-install bedplate and fasten gage in hopper against tie bar using bedplate mounting screws. **C**
- CAUTION:** Do not tighten rear screw or gage will be deformed.
- b. Loosen screws **M** and locate pickerknives on shaft for:
 - (1) flush to 0.005" (0,13mm) here. **E**
 - (2) 0.003" to 0.008" (0,08mm to 0,20mm) here.
 - c. Set each pickerknife against surface of hopper gage and tighten clamping screws. **M**
 - d. Remove hopper gage.
- 8 Adjust pickerknife armature:
 - a. Remove hopper bedplate. **J**
 - b. Place a 0.002" (0,05mm) **H** feeler gage between return arm and backstop. **B**
 - c. Energize hopper clutch magnet:
 - Primary - jumper TPB1-A to ground.
 - Secondary - jumper TPB3-A to ground.
 - d. NOTE: Do not fully tighten one armature screw and then the other, rather, alternately turn one screw half a turn and then the other. This will keep the armature block from moving out of alignment while screws are being tightened.
 - Tighten armature locking screws. **K**
 - 9 Remove feeler gage and check that there is a gap here **H** but that the gap does not exceed 0.002" (0,05mm).
 - 10 Remove jumpers.
 - 11 Re-install hopper bedplate. **J**
 - 12 Remove the two timing pins. **A**

NUDGE ROLL PRESSURE SHOE

REMOVAL

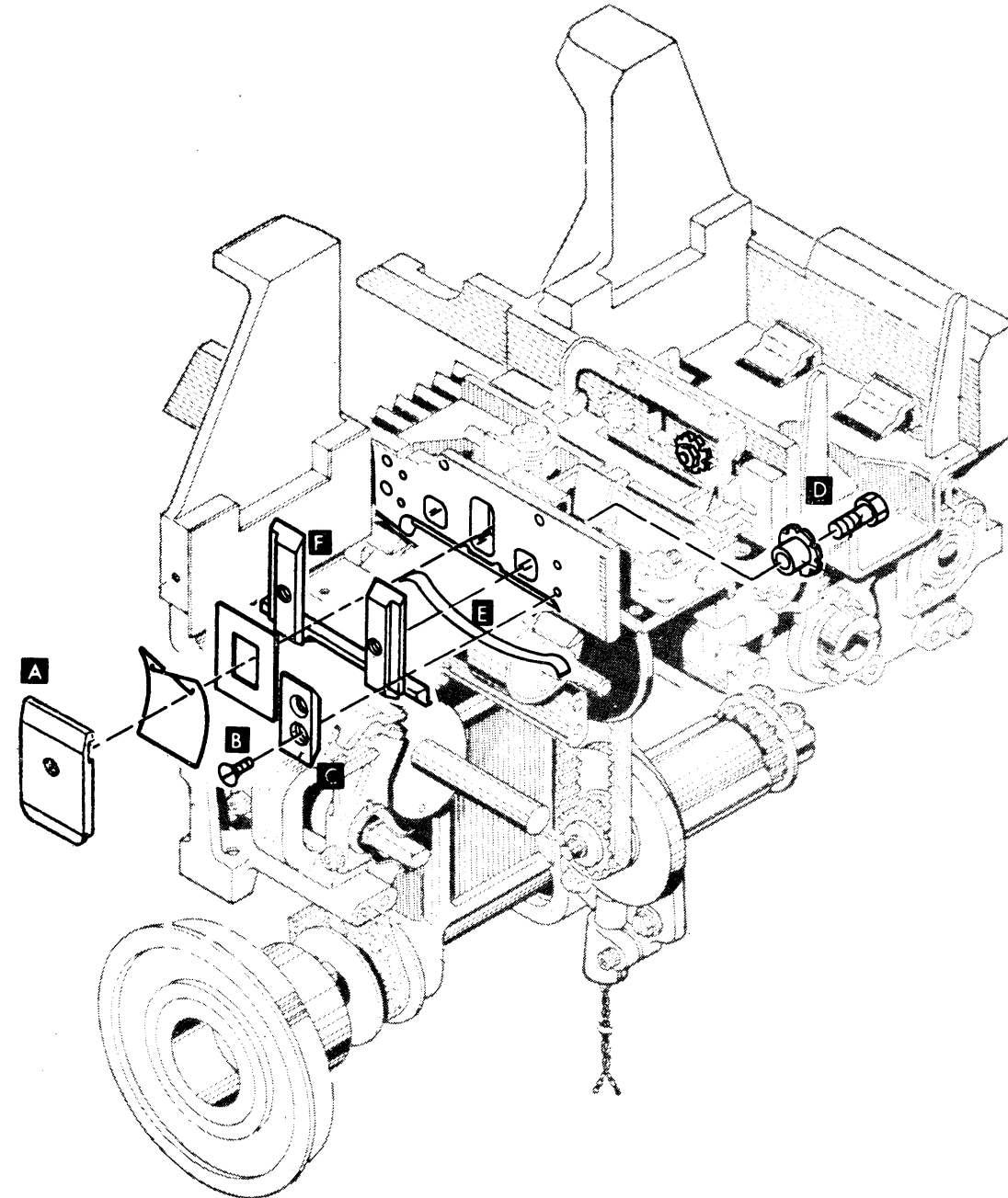
CAUTION: Be careful not to damage nudge rolls.

- 1 Remove throatknife. **A**
- 2 When re-assembling, make sure creep spring and shims are in their proper place.



- 3 Remove 4 retainer screws **B** and 2 retainers. **C**
- 4 Remove pressure shoe mounting screws and bushings. **D**
- 5 Turn machine drive backwards slightly to force out spring **E** and shoe. **F**
- 6 Replace by reversing above procedure. Then check/adjust:

- a. Nudge roll pressure shoe.
- b. Throatknife (page 15).



SERVICE CHECK

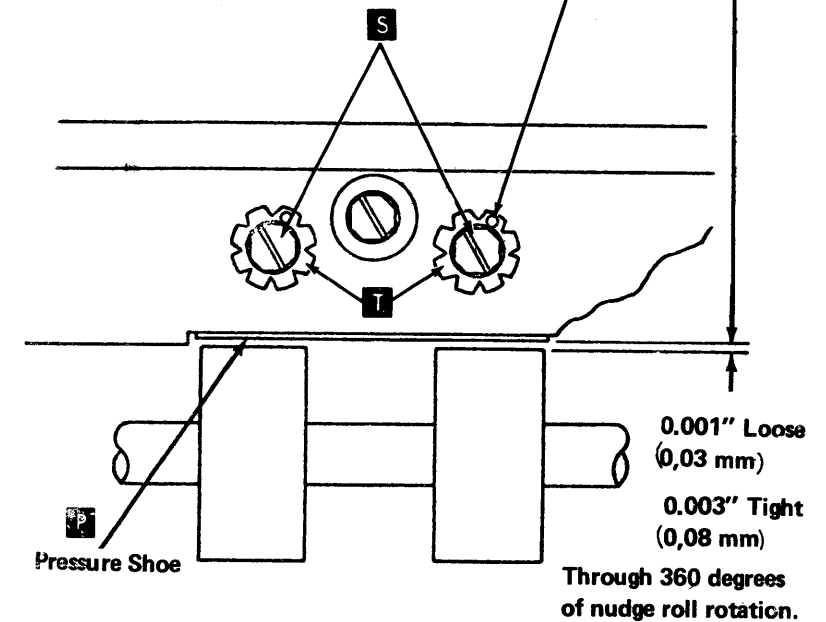
Gently lift and drop pressure shoe **P** a few times by prying under mounting screw heads **S** to check that pressure shoe is not sticking. Then recheck gap.

ADJUSTMENT

- 1 Loosen mounting screws. **S**
- 2 Turn adjusting disk **T** to adjust gap for:

NOTE: High points of eccentric discs are indicated with a punch mark. These disks must be turned in the same direction to eliminate binds.

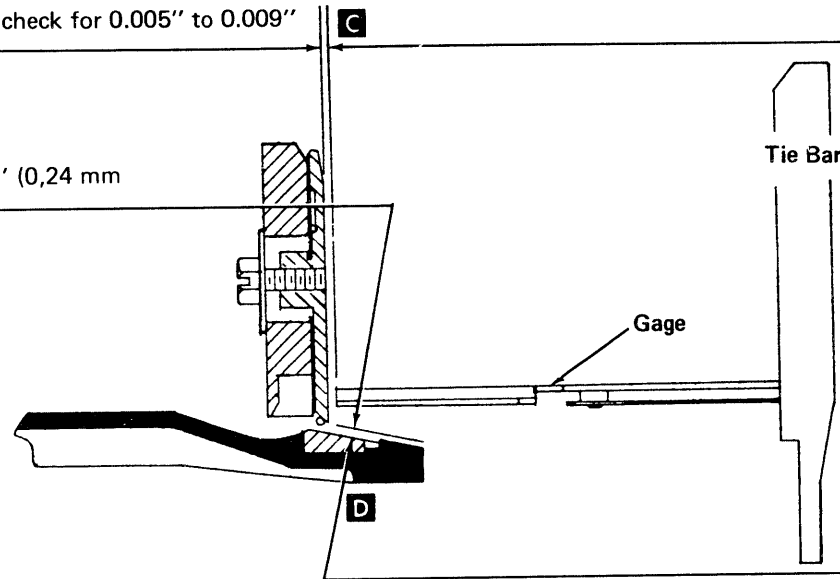
- 3 Lift and drop pressure shoe **P** a few times by gently prying under mounting screw heads **S** to check that pressure shoe is not sticking.
- 4 Recheck adjustment while rotating nudge rolls through 360 degrees.



THROATKNIVES

SERVICE CHECK

- 1 Place hopper gage (PN 2592560) in hopper.
- 2 With gage held against tie bar, check for 0.005" to 0.009" (0,13mm to 0,23mm) here.
- 3 Remove gage.
- 4 Check for 0.0095" to 0.0105" (0,24 mm to 0,27 mm) here.

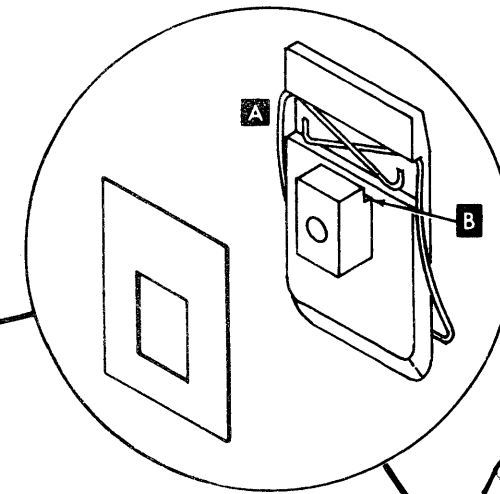


ADJUSTMENT

- 1 Place hopper gage in hopper and hold against tie bar when making this adjustment.
- 2 Insert or remove shims behind throat knife to obtain a distance of 0.005" to 0.009" (0,13mm to 0,23mm) between gage and throat knife.

NOTE: When re-installing throatknife, make sure creep spring and shims are in their proper position. Gently push creep spring behind edge of knife after it is in place

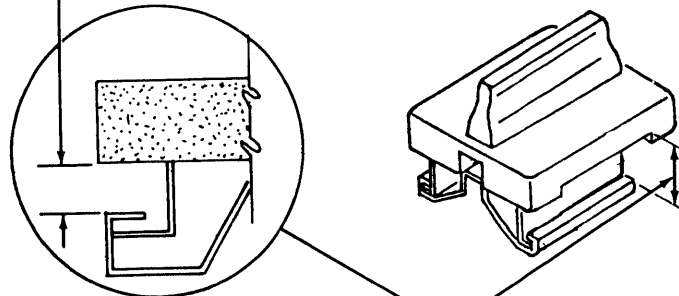
- 3 Remove gage.
- 4 CAUTION: To prevent damage to throatknife or throat ramp:
 - a. Do not pry throatknife upward with a screwdriver.
 - b. Do not tighten knife with feeler gage still in throat.
- 5 Loosen mounting screw and adjust throatknife for 0.0095" to 0.0105" (0,241mm to 0,267mm) here.



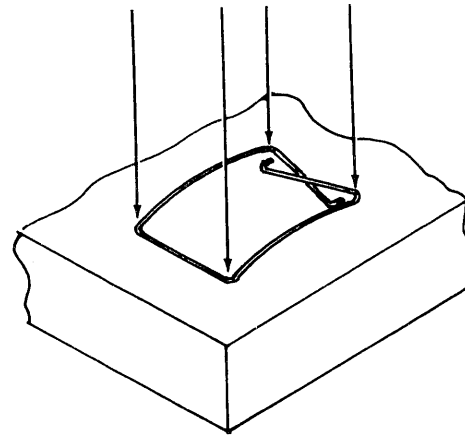
CARD WEIGHT

ADJUSTMENT

- 1 Place card weight on surface that allows full weight to be on spring.
- 2 Form spring for a gap of 0.150" ± 0.020" (3,81 mm ± 0,51 mm) here.

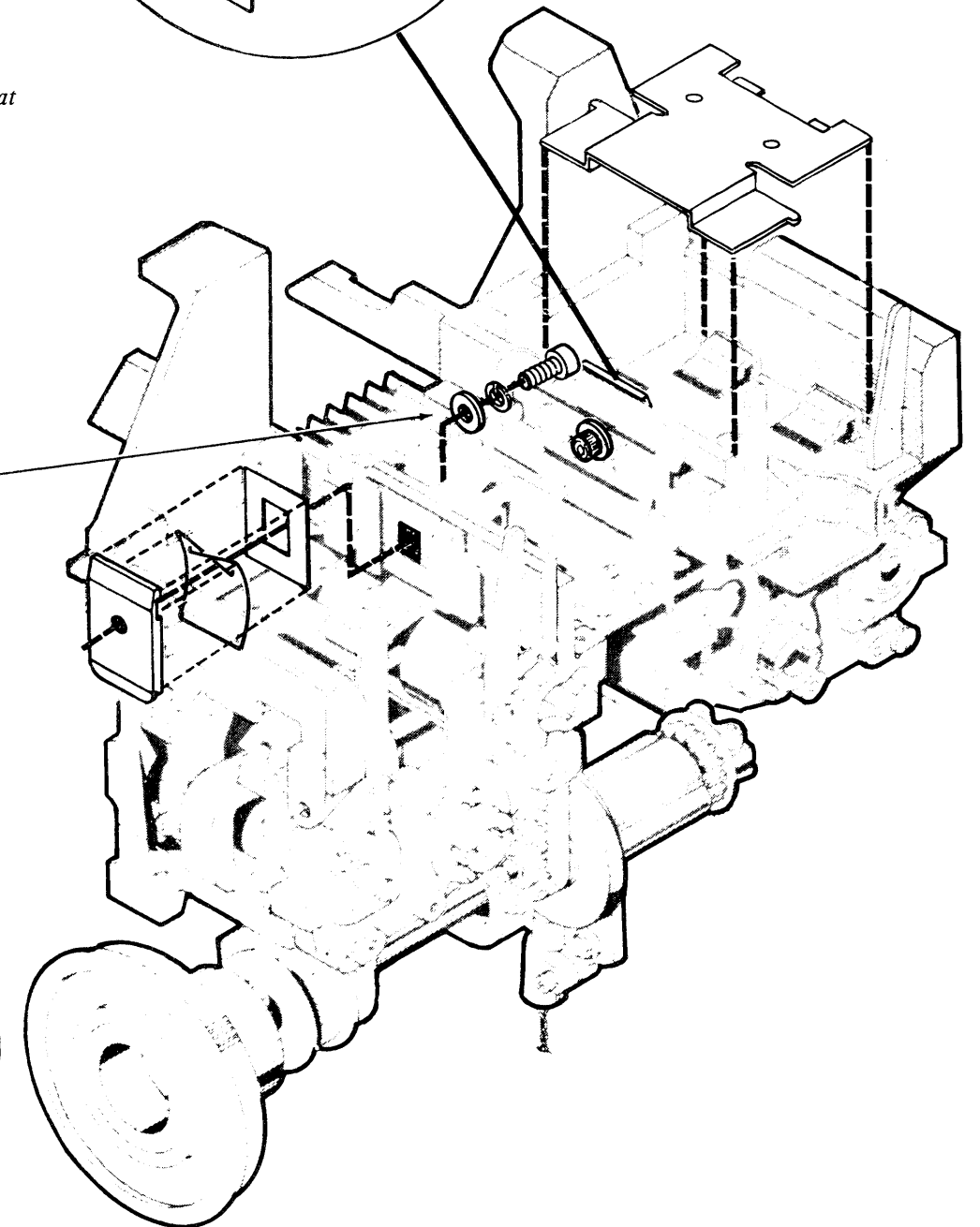


Lay creep spring on a flat surface. All four corners should touch surface within 0.020" (0,51 mm).



REMOVAL

- 1 Remove mounting screw. Check for shims and spring.
- 2 To reinstall:
 - a. Place creep spring in position. **A**
 - b. Place shims on knife and slide down into holding slot. **B**
 - c. Install knife. Leave lower end of spring on front.
 - d. Lightly tighten mounting screw.
 - e. Gently push spring under edge of knife to backside.
 - f. Place hopper gage in hopper and hold against Tie Bar. Check for 0.005" to 0.009" (0,13 mm to 0,23 mm) between gage and throat knife. **C**
 - g. Adjust throatknife for 0.0095" to 0.0105" (0,241mm to 0,267mm). **D**
 - h. Push card through throat and check that creep spring is behind knife and moves freely along back slope of knife.



HOPPER FRONT CASTING

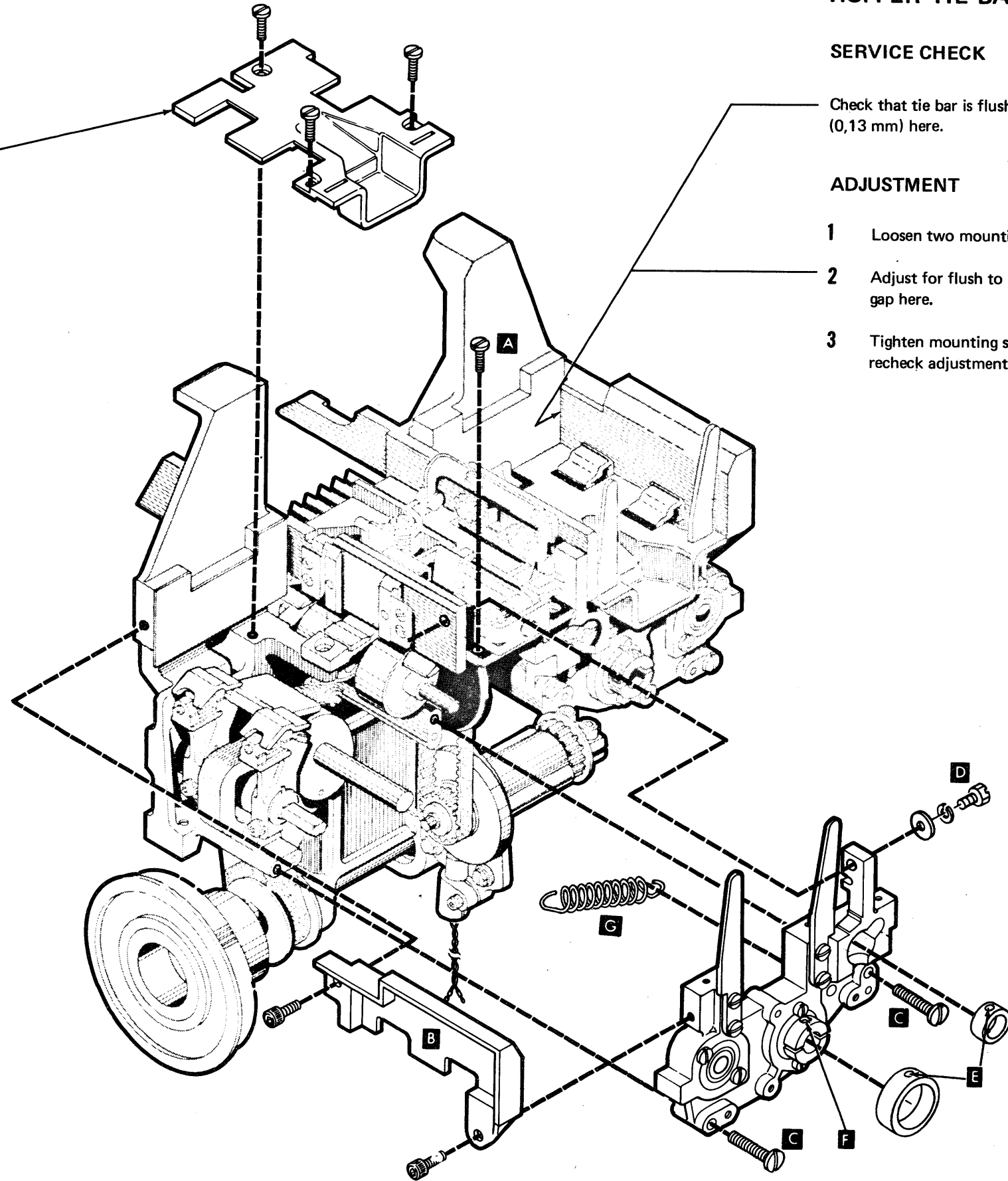
REMOVAL

- 1 Remove hopper extensions as an assembly (page 19).
- 2 Remove three screws and lift off bedplate.
- 3 Remove screw. **A**
- 4 Remove screw. **D**
- 5 Secondary hopper casting:
Remove emitter gear.
- 6 Remove two screws and remove tie bar. **B**
- 7 Loosen screws **E** Remove bearing clamps.

NOTE: When replacing front castings, make sure collar screws are in recess **F** in clamp bearing.

- 8 Unhook front clutch assembly spring. **G**
- 9 Remove two screws. **C**
- 10 Remove front casting.
- 11 Re-install and check/adjust:

- a. Tie bar (page 16).
- b. Throatknife (page 15).
- c. Nudge Roll pressure shoe (page 14).
- d. Hopper Extensions (page 19).



HOPPER TIE BAR

SERVICE CHECK

Check that tie bar is flush to within 0.005" (0,13 mm) here.

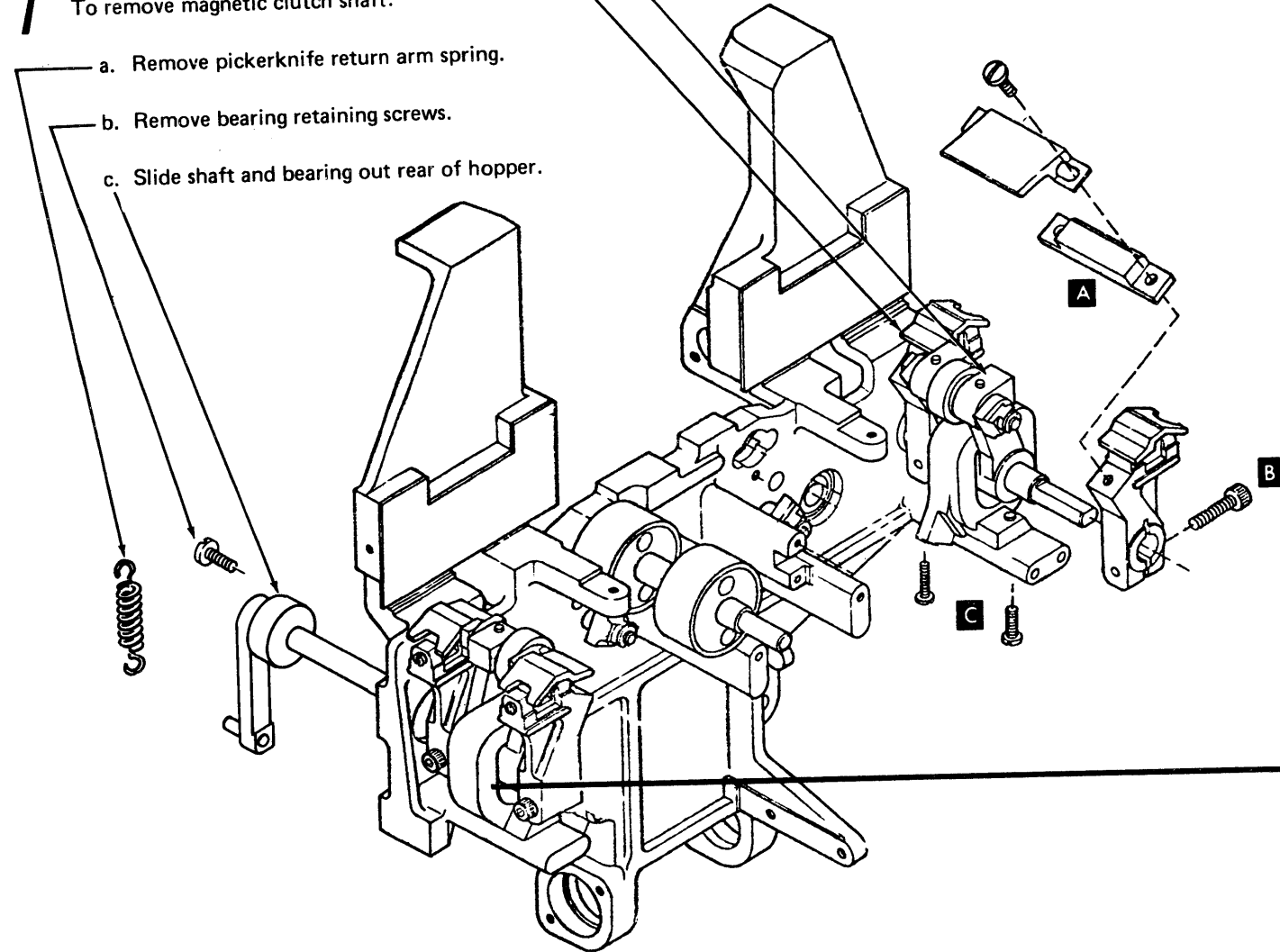
ADJUSTMENT

- 1 Loosen two mounting screws.
- 2 Adjust for flush to within 0.005" (0,13 mm) gap here.
- 3 Tighten mounting screws and recheck adjustment.

PICKERKNIFE AND CAM FOLLOWER

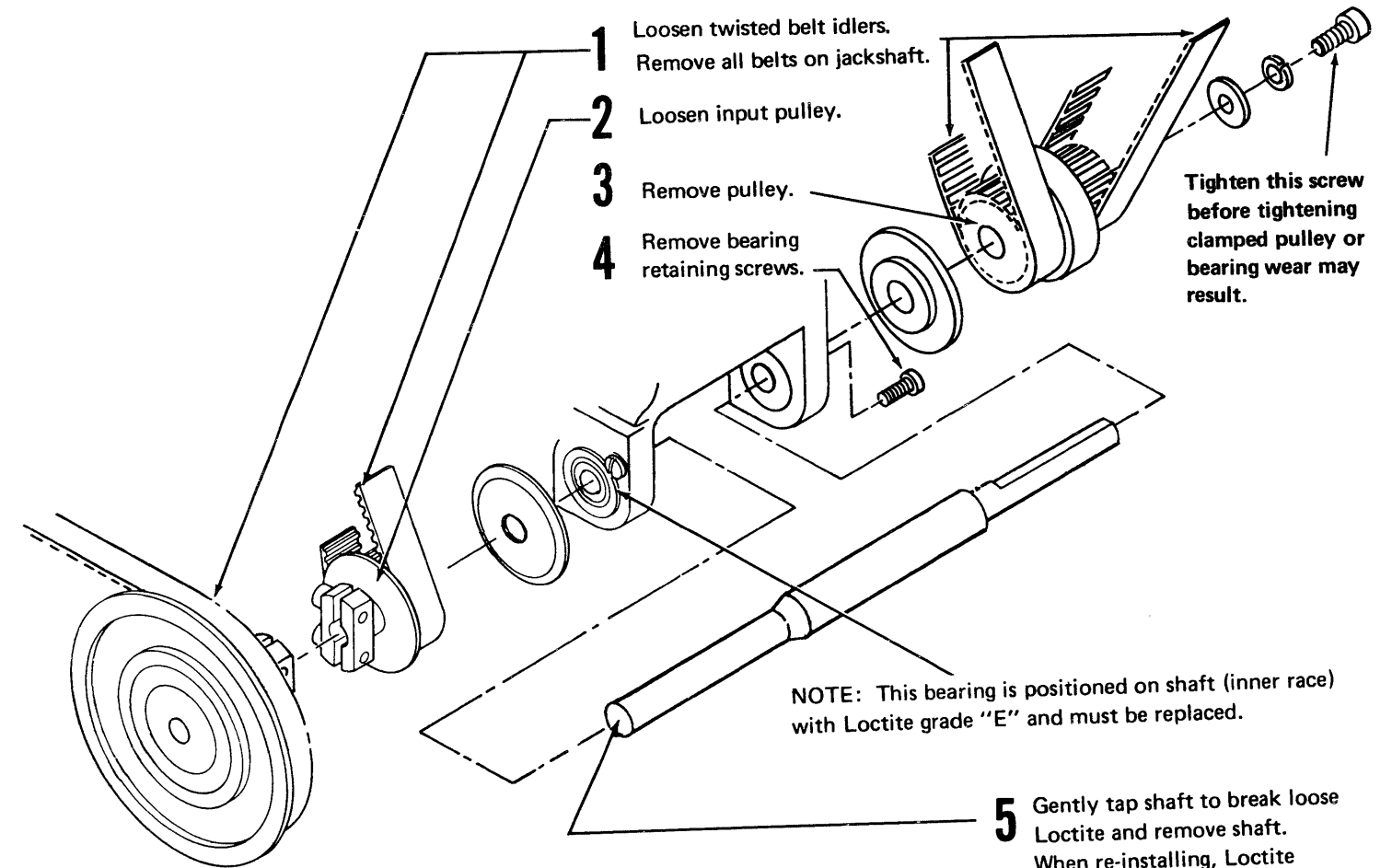
REMOVAL

- 1 Remove hopper front casting (page 16). Both clutch springs must be removed.
- 2 Remove armature. **A**
- 3 Loosen pickerknife arm clamping screws, **B** and slide front pickerknife arm assembly off shaft.
- 4 Remove two magnet coil mounting screws. **C**
- 5 Slide clutch assembly (cam follower) and coil assembly off shaft.
- 6 Slide rear pickerknife arm assembly off shaft.
- 7 To remove magnetic clutch shaft:
 - a. Remove pickerknife return arm spring.
 - b. Remove bearing retaining screws.
 - c. Slide shaft and bearing out rear of hopper.
- 8 Reinstall by reversing above procedure.
- 9 Position clutch coil so that cam and cam follower does not touch coil. Tighten screws.
- 10 Check and adjust:
 - a. Throatknife clearance (page 15).
 - b. Nudge roll pressure shoe (page 14).
 - c. Hopper tie bar (page 16).
 - d. Magnetic clutch adjustments (page 13).



HOPPER JACKSHAFT

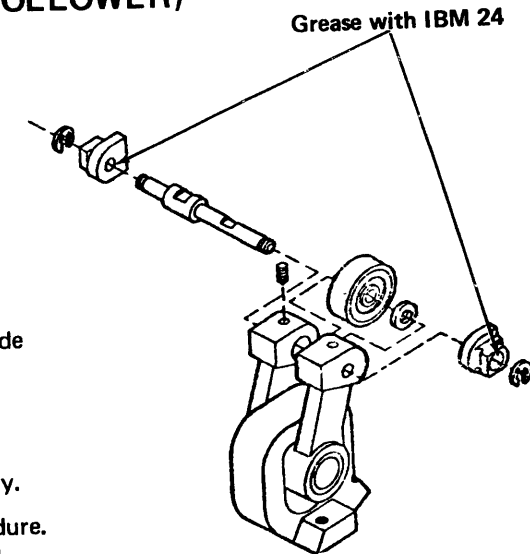
REMOVAL



CLUTCH ASSEMBLY (CAM FOLLOWER)

REMOVAL

- 1 Perform 1 through 5 of Picker knife and Cam Follower Removal.
- 2 Loosen setscrews.
- 3 Remove C clips and spring bushings.
- 4 Tap front end of shaft to break loose Loctite. When re-installing, Loctite grade "E" must be placed on inner race of follower. Be careful not to get Loctite on bearing seal.
- 5 Remove shaft from backside of assembly.
- 6 Replace shaft by reversing above procedure. Make sure shaft, bearing inner race, and spacer are clamped tight against clutch arm.



- 5 Gently tap shaft to break loose Loctite and remove shaft. When re-installing, Loctite inner race of new bearing.
- 6 Replace shaft by reversing above procedure. Then check hopper timing:
 - a. Align camshaft timing holes.
 - b. Check that read inject roll is in time.
 - c. Check that CB insert aligns with emitter pickup.
- 7 Adjust twisted belt tension.
- 8 Position hopper input pulley for good belt tracking.

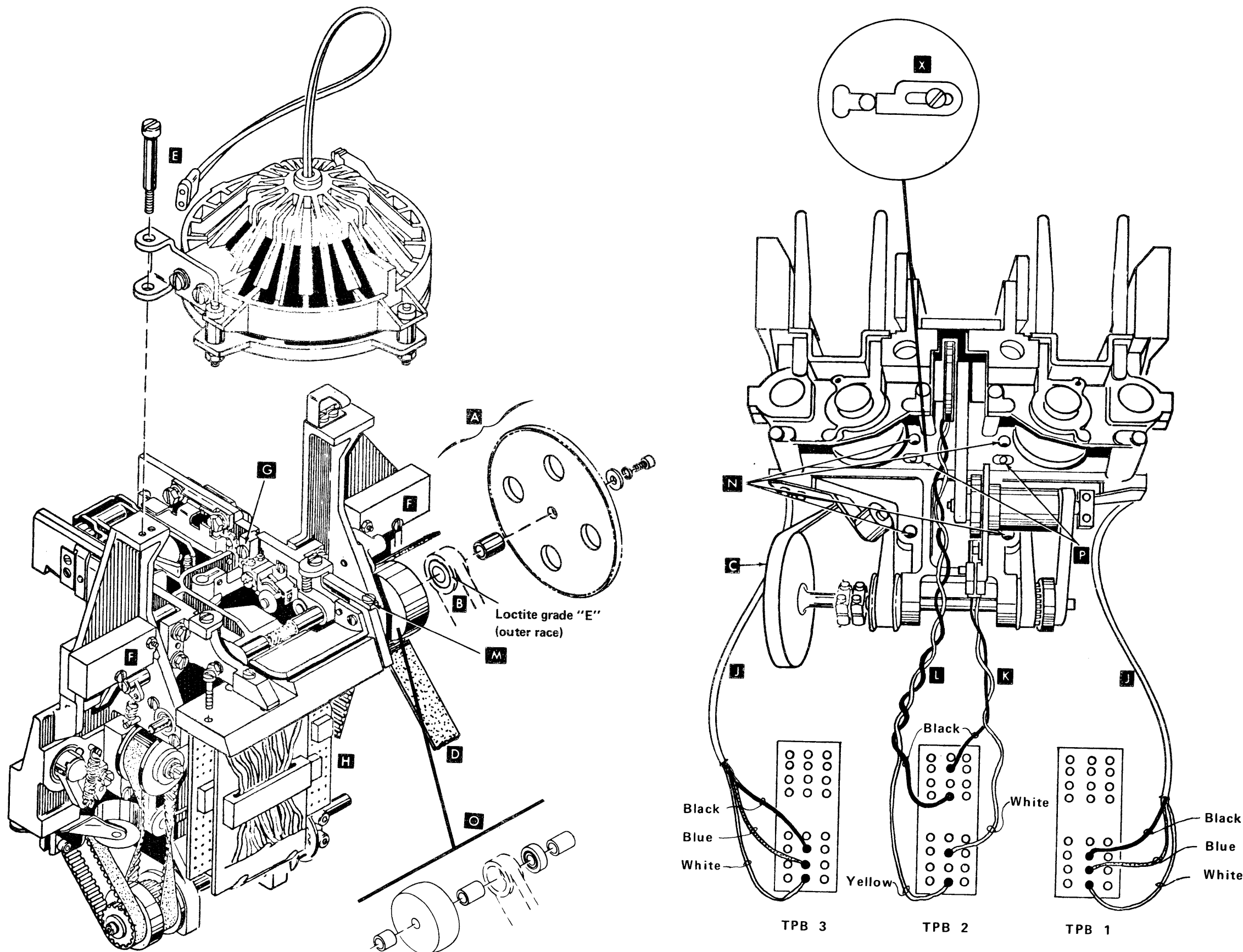
HOPPER ASSEMBLY

REMOVAL

- 1 Remove safety covers.
- 2 Remove hopper extensions and support castings as an assembly (page 19).
- 3 Remove hopper input drive belt. **C**
- 4 Remove read emitter gear and spacer. **A**
- 5 Remove read emitter pickup bracket. **B**
- 6 Remove belt **D**, pulley, and spacers. **O**
- 7 Remove lamp assembly. **E**
(Cable can remain connected.)
- 8 Remove hopper empty switches. **F**
- 9 Disconnect :
 - a. Hopper cell fiber optic bundle by removing bracket. **G**
 - b. Read station cable connector and read amplifier card. **H**
 - c. Clutch coil wires for the two clutch coils. **J**
 - d. Hopper CB emitter pickup wires. **K**
 - e. Hopper cell wire. **L**
- 10 Remove fiber bundle clamping bar. **M**
- 11 Remove bracket holding 4 light pipes to backbone.
- 12 Remove four screws **N**
- 13 **CAUTION:**
Be careful not to damage fiber bundles.

Remove hopper assembly.

CAUTION:
Do not lay hopper assembly on back or amplifier card mounting bracket may be bent.

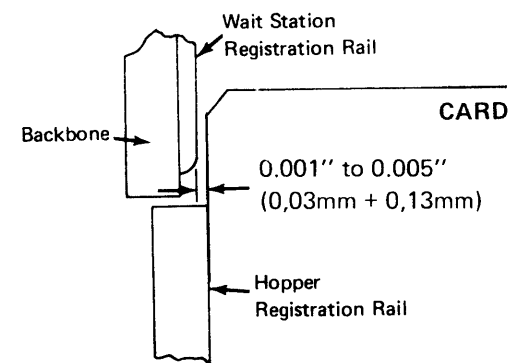


HOPPER ASSEMBLY REPLACEMENT

CAUTION

Take care when replacing hopper assembly. Check for correct cable routing. Take care that fiber optic bundles are not damaged. Also, when reinstalling assembly, be careful that the path selector and read unit are not damaged.

- 1 Place hopper assembly on hopper mounting pins. **P**
- 2 Loosely turn down the four hopper mounting screws. **N**
- 3 Align hopper and wait station registration rails by shifting hopper assembly on mounting screws.



Hint: Hopper may be moved by placing screwdriver in locating slots along side pins and gently applying pressure then tighten mounting screws and recheck adjustment.

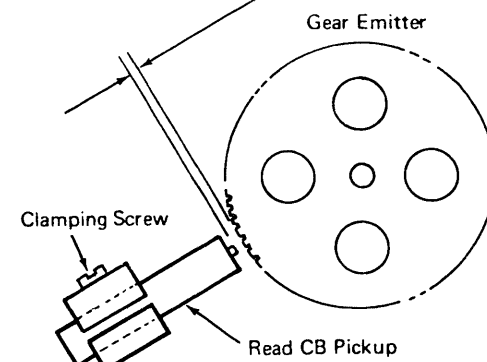
NOTE: If machine has hopper stop **X** installed, shift assembly to the left until stop contacts mounting pin. Then check registration rail alignment.

- 4 Replace hopper empty switches **F** and readjust (page 21).
- 5 Replace pulley, spacer and emitter bracket. **B** **O**
Check shaft for binds and then tighten mounting screws.

NOTE: The outer race of bearing in emitter bracket **B** is held in position with Loctite grade "E" and must be replaced with a new bearing. Prior to replacing the bracket, clean the old Loctite from bracket to allow bearing to center itself

- 6 Reinstall flat feed roll drive belt. **D**
- 7 Reinstall read emitter gear and spacer. **A**

- 8 Adjust gap for 0.001" to 0.004" (0,03mm to 0,10mm) through 360 degrees of emitter gear rotation.



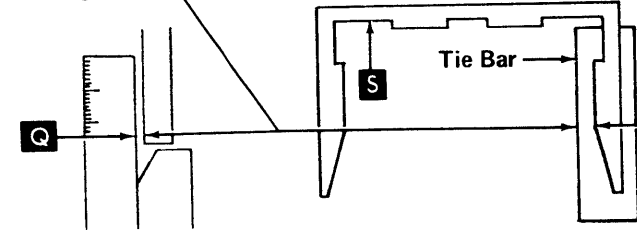
- 9 Replace:
 - a. Hopper CB emitter pickup wires. **K**
 - b. Clutch coil wires (two sets). **J**
 - c. Hopper cell wires. **L**
 - d. Read station cable connector and card. **H**
 - e. Replace fiber optic bracket **G**
 - f. Replace bracket holding the 4 light pipes to the back bone.
 - g. Replace clamping bar. **M**
 - h. Lamp assembly. **E**

- 10 Replace hopper extension assembly. **→**
- 11 Reinstall hopper input drive belt **C** and adjust belt tension (page 10).
- 12 Check hopper timing.
- 13 Replace safety cover.

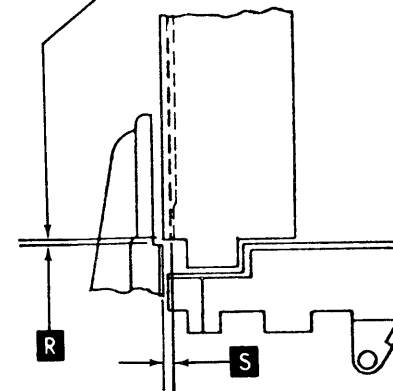
HOPPER EXTENSIONS

SERVICE CHECK

- 1 Place a straight edge vertically along the hopper tie bar and check for 0.036" ± 0.005" (0,91mm ± 0,13mm) gap here.



- 2 Use a straight edge and check that back surface is flush to 0.025" (0,64mm) in front of registration surface. **S**
- 3 Check for 3/32" + 1/32, -0.000" (2,39mm + 0,79mm -0,00mm) here.



ADJUSTMENT

- 1 Loosen three holding screws. **V**
- 2 Place a straight edge along the tie bar and locate the hopper extension laterally for 0.036 ± 0.005" (0,91mm ± 0,13mm) **Q**
- 3 Locate extension vertically for 3/32" + 1/32", -0.000" (2,39mm + 0,79mm) gap. **R**
- 4 Place a straight edge vertically on the rear of the hopper extension so that the straight edge projects down against the registration surface.
- 5 Adjust entire support frame **Z** for flush to 0.025" (0,64 mm) **S** by means of bottom screws. **Y**
- 6 Recheck all adjustments.

REMOVAL

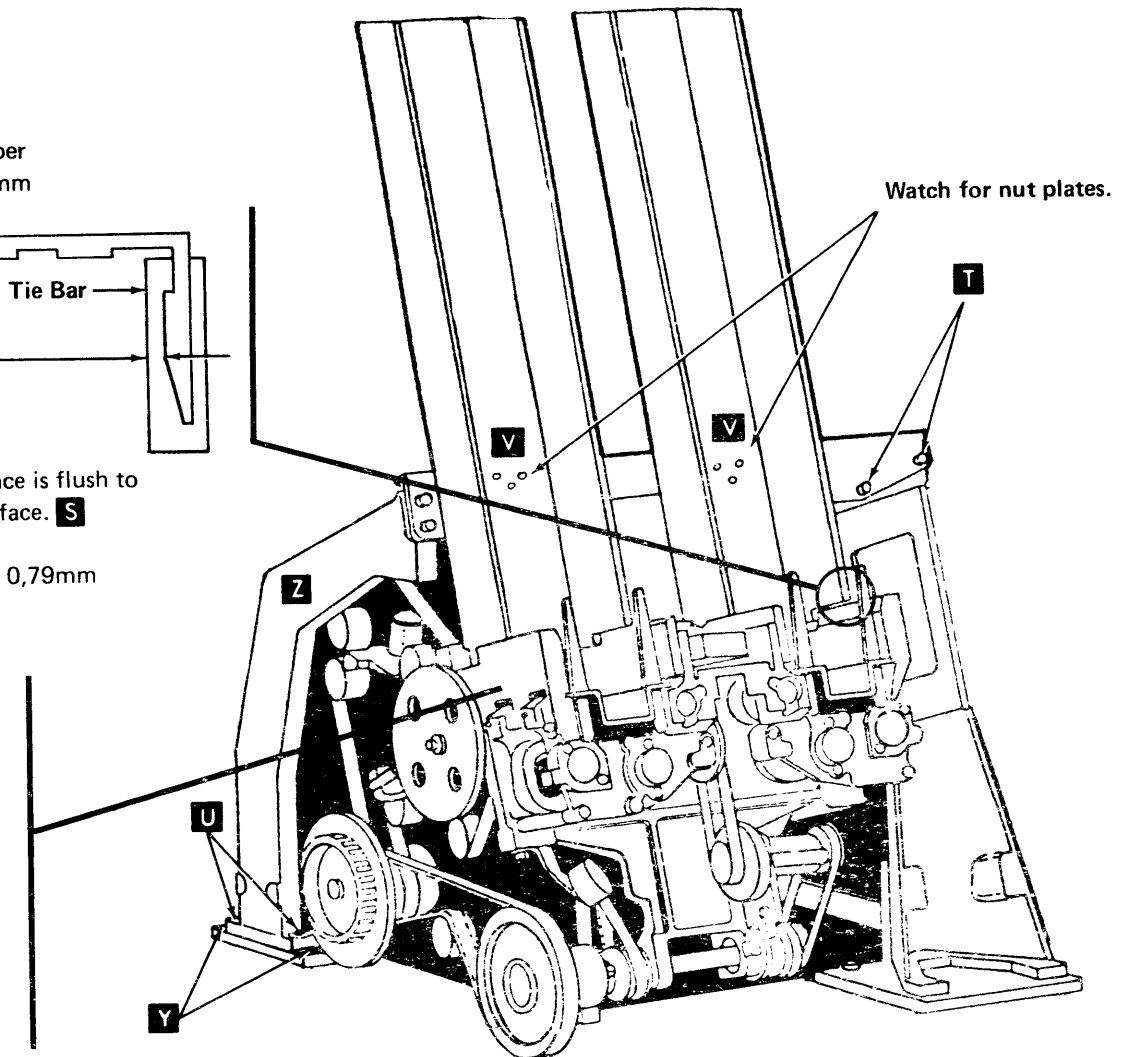
The hopper extensions may either be removed as an assembly consisting of both extensions and the two support brackets, or they may be removed individually. By removing both extensions as an assembly, easier access to parts is gained and re-assembly/adjustment is simplified.

As an assembly:

- 1 Remove two holding screws. **T**
- 2 Remove these screws. **U**
CAUTION:
Do not loosen 2 bottom screws. **Y**
- 3 Lift out assembly.
- 4 Replace by setting back on locating pin. Replace screws **T** **U** and ground strap.
- 5 Perform adjustments as given on this page.

Individual Extension:

- 1 Remove mounting screws **V** in front of hopper extension and remove hopper extension.
- 2 To replace, put hopper extension back in place and replace screws. Be sure nut plate is properly located behind extension mounting frame.
- 3 Do hopper extension adjustment shown on this page.



HOPPER NUDGE ROLL

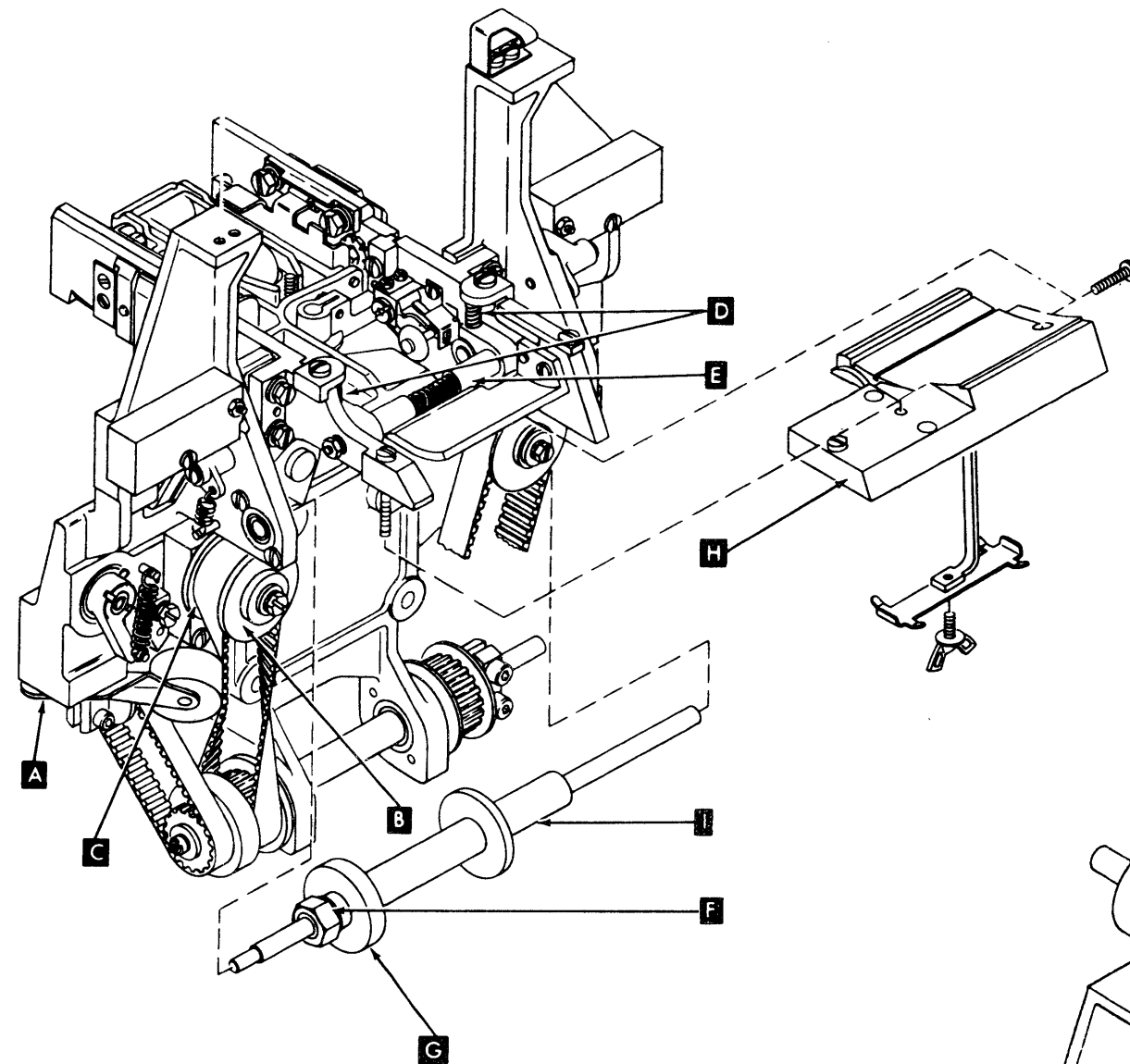
REMOVAL

CAUTION

Do not lay the hopper assembly on back or the read amplifier card mounting bracket may be bent.

- 1 Remove hopper assembly (page 18).
- 2 Loosen idler **A** and remove flange **B**, pulley and belt. **C**
- 3 Remove springs **D** and pressure roll assembly. **E**
- 4 Loosen nut **F** and shift feed wheel **G** on shaft
- 5 Remove read bed **H**
- 6 Remove read feed roll shaft. **I**

The two outer bearings are held in position with Loctite grade "E" (Loctite on inner race of right bearing, outer race of left emitter bracket bearing). Both must be replaced with new bearings.
- 7 Remove plastic gear cover **J**
- 8 Remove gears **K** **L**
- 9 Remove front casting (page 16).
- 10 Remove bearing retaining screws and drive bearing **M** out from front of hopper (note access holes in nudge rolls). **N**
- 11 Slide nudge roll out front of hopper assembly.
- 12 Replace hopper feed roll by reversing removal procedure. After hopper assembly is installed on machine, Check/adjust:
 - a. Hopper to wait station alignment (page 19).
 - b. Throatknife clearance (page 15).
 - c. Nudge roll pressure shoe (page 14).
 - d. Magnetic clutch (page 13).
 - e. Tie bar (page 16).
 - f. Belt tension (page 10).
 - g. Hopper timing (page 12).
 - h. Read inject card cover and pressure shoe (page 23).
 - i. Hopper extensions (page 19).
 - j. Hopper empty switch (page 21).
 - k. Read station lamp (page 26).
 - l. Hopper card sensor (page 27).



HOPPER DRIVE GEARS

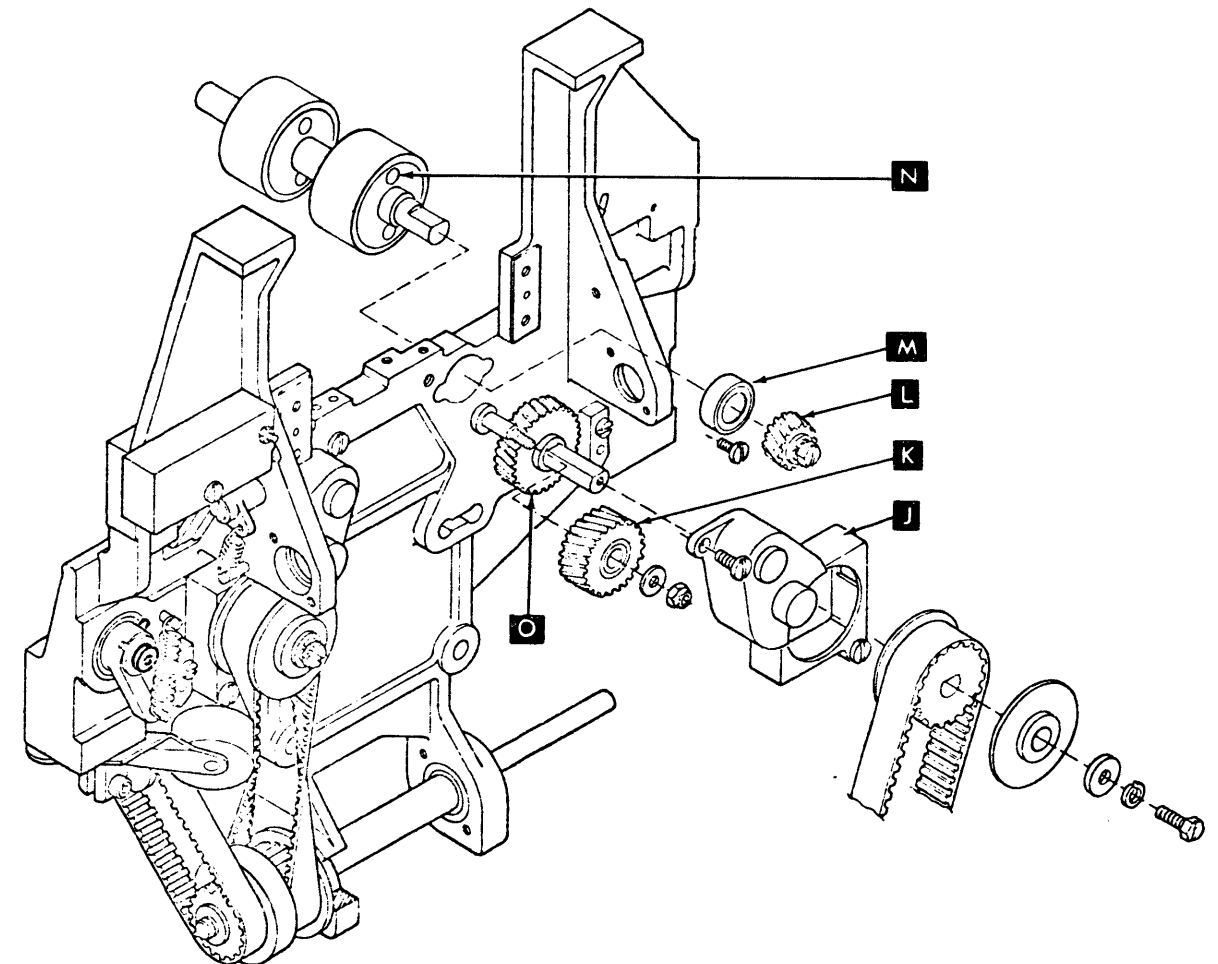
REMOVAL

Nudge Roll and Idler Gears

Perform steps 1 through 8 of Nudge Roll Removal. (on this page).

Hopper Cam Gear

- 1 Loosen idler bracket. **A**
- 2 Remove flange **B**, belt and pulley on cam shaft. **C**
- 3 Remove gear. **O**
- 4 Replace by reversing above procedure and adjust hopper twisted belt.



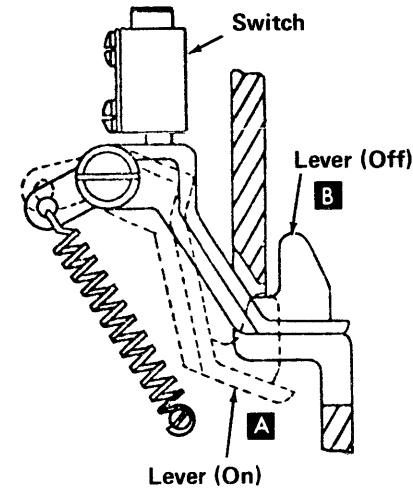
HOPPER EMPTY SWITCH

SERVICE CHECK

- 1 Check switch and lever for binds.
- 2 Place cards in hopper and check that switch lever moves down far enough so that it will not cause misfeeding. **A**
- 3 Check that switch transfers when the hopper empties. **B**

REMOVAL

- 1 Remove mounting screws, **C** cover, and switch.
- 2 Remove switch wires.
- 3 Reinstall and adjust switch.



ADJUSTMENT

- 1 Loosen two mounting screws. **C**
- 2 Adjust switch so that the contacts transfer to indicate a hopper empty or card in hopper condition. Tighten screws.
- 3 Check for binds in lever.
- 4 Check that lever moves down far enough so that it will not cause misfeeding. **A**

CARD RAIL

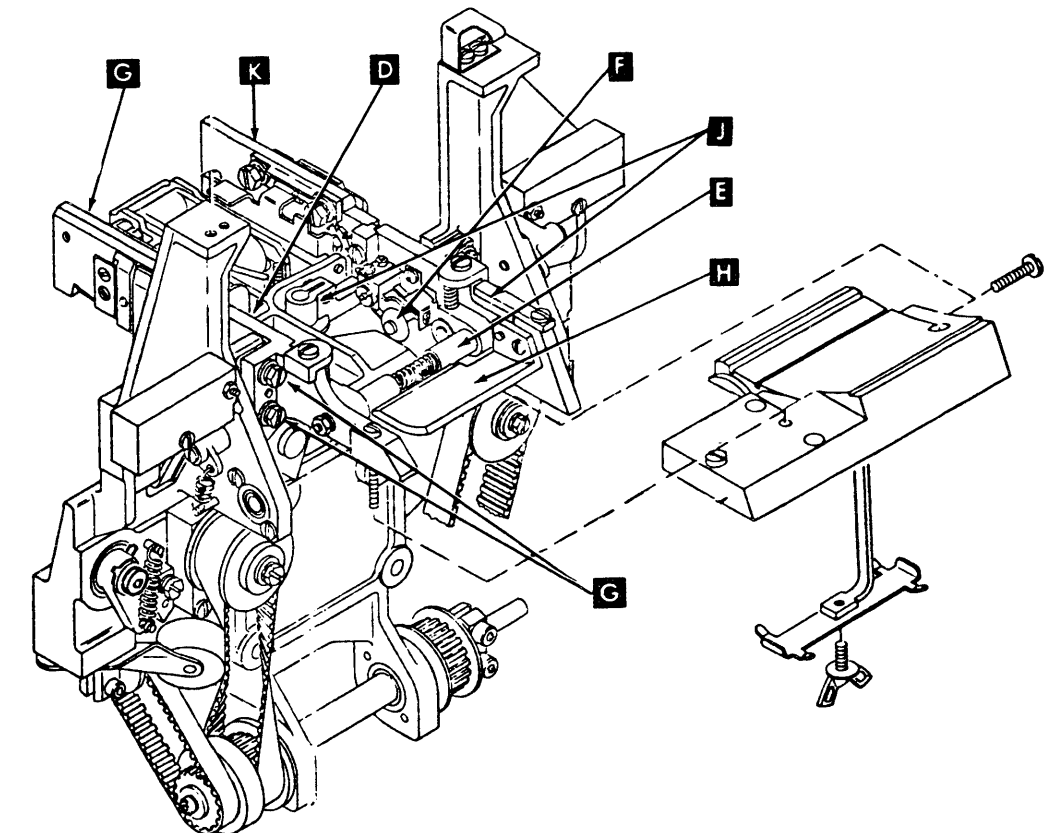
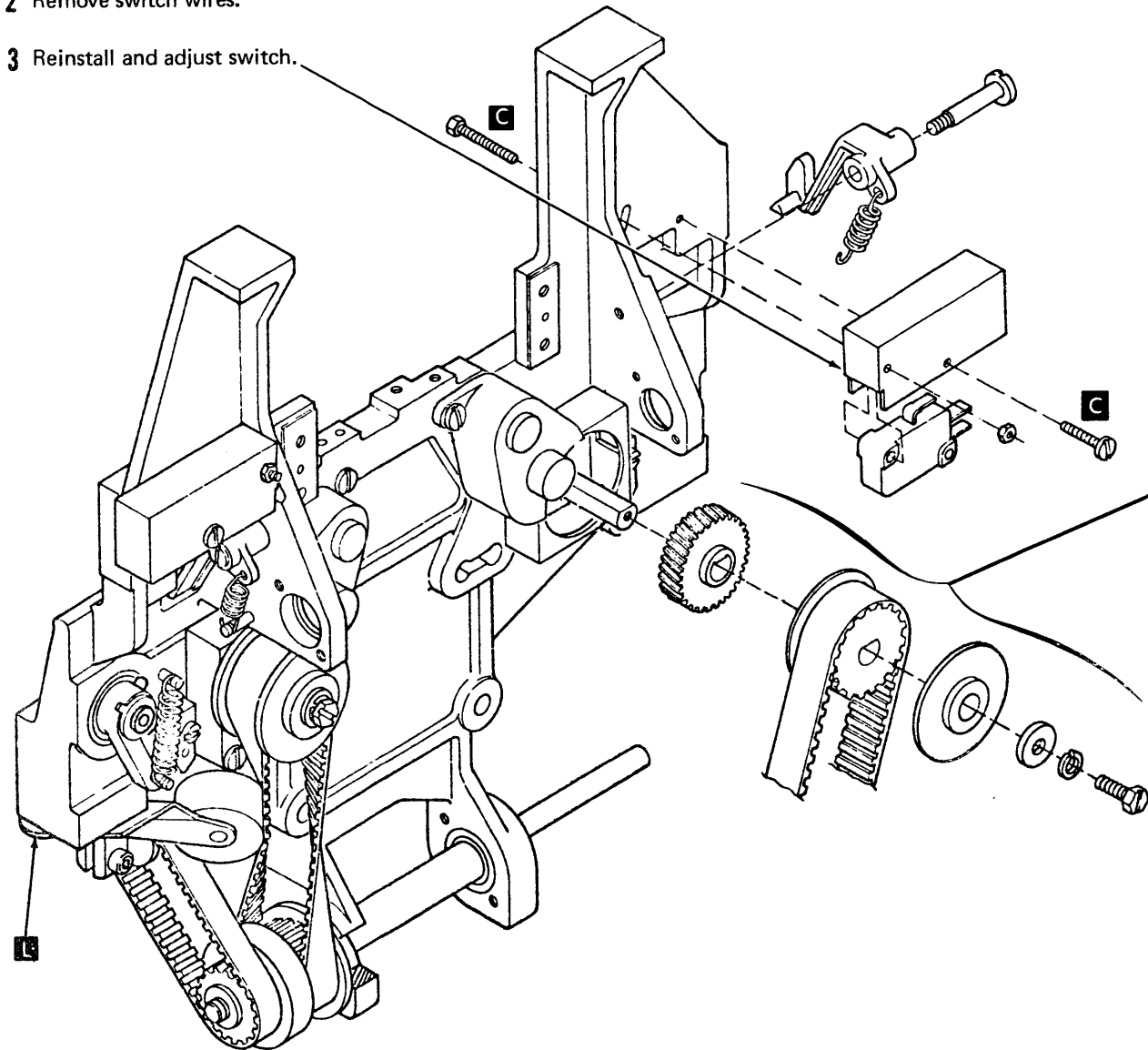
REMOVAL

CAUTION: To prevent damage or bowing of the rail while re-installing, hold front of rail in position while tightening rear screws. Then tighten front screws.

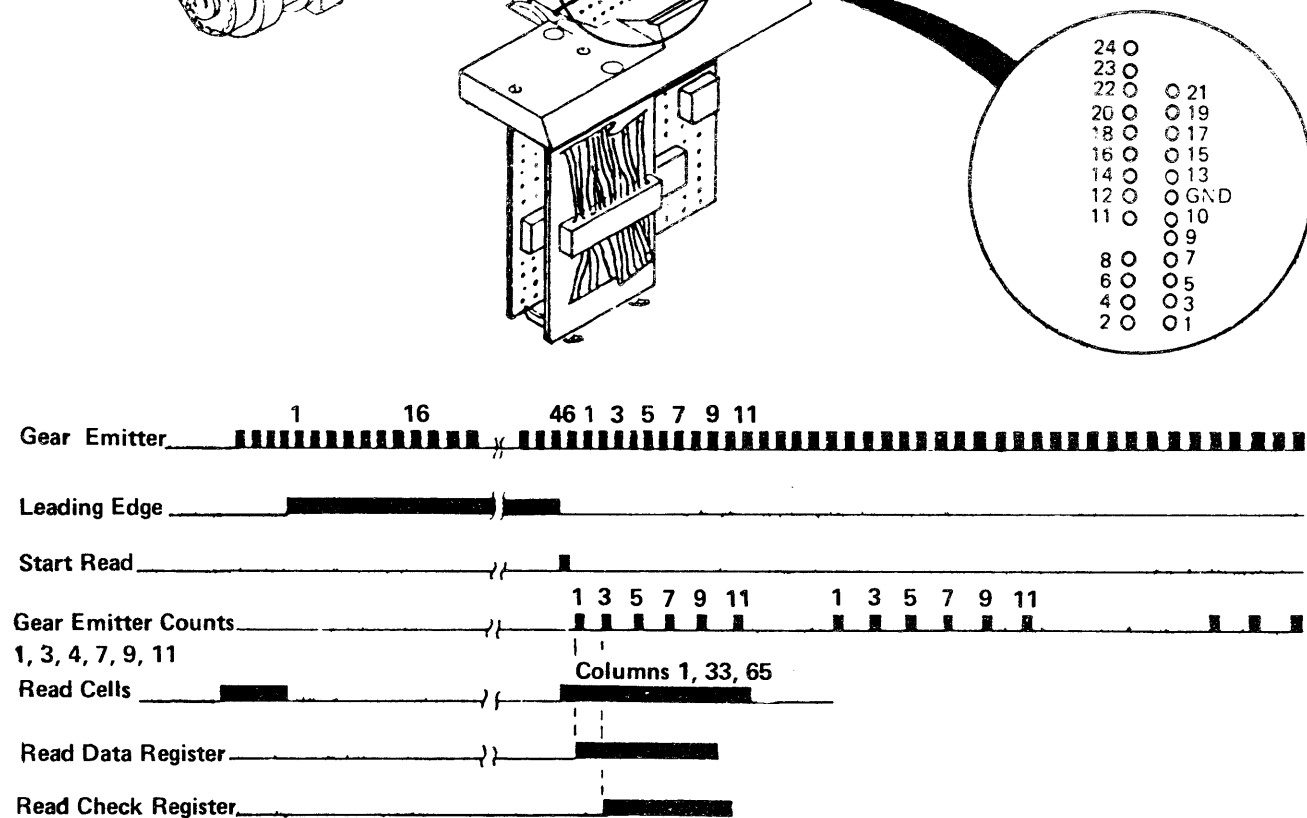
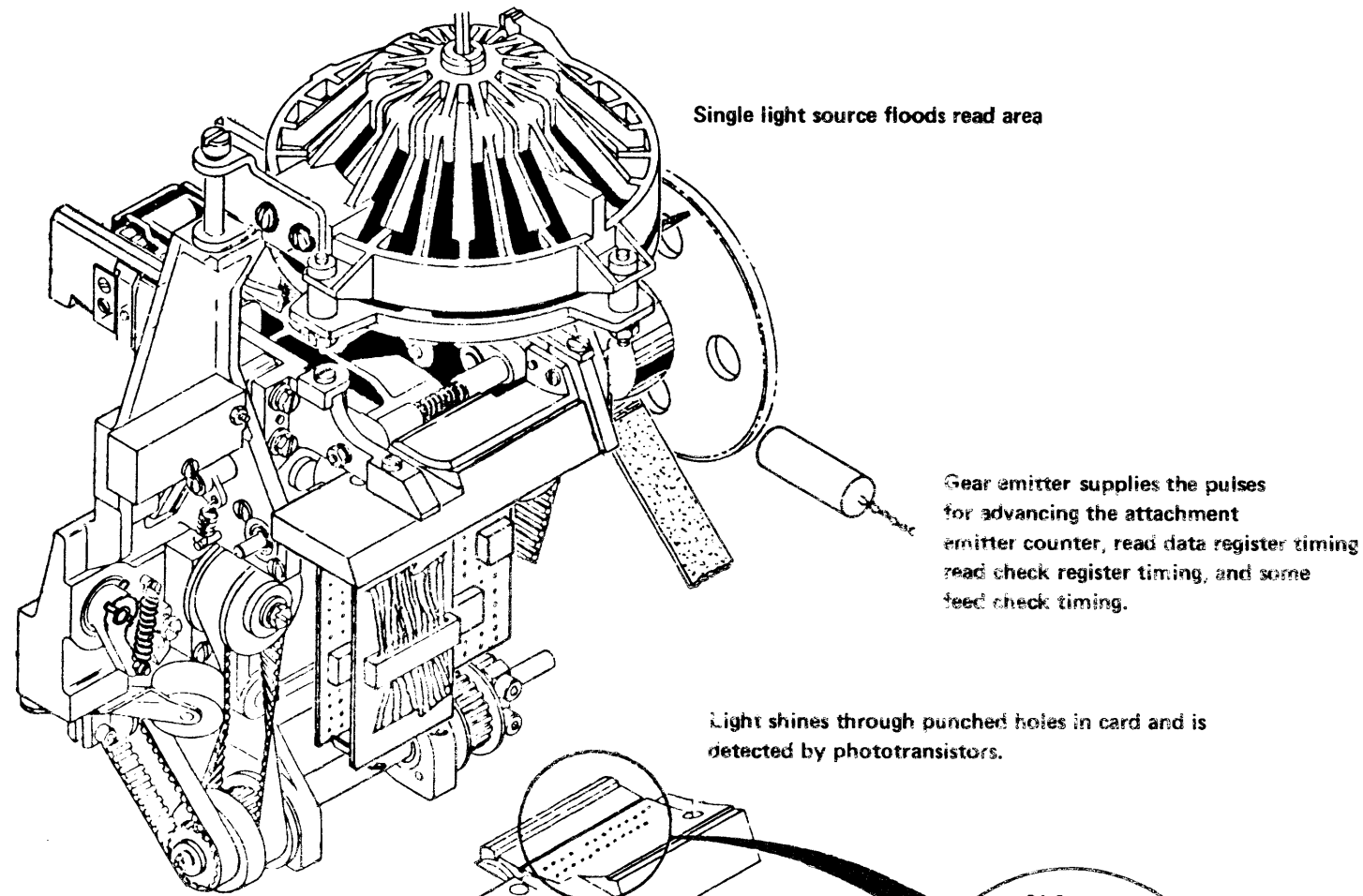
- 1 Remove hopper extensions as an assembly.
- 2 Remove Read Station.
- 3 Remove inject card cover by removing clip. **D**
- 4 Remove pre-wait card cover. **H**
- 5 When removing registration rail **K**
 - a. Remove bracket holding the 4 light pipes to the backbone.
 - b. Remove read inject light pipe bracket and clamping bar. **J**
 - c. Remove aligner roll. **F**
- 6 Remove read pressure rolls and shaft. **E**
- 7 Remove front and rear mounting screws. **G**
- 8 Remove rail.
- 9 Re-install by reversing above procedure. Check/adjust:
 - a. Nudge Roll Pressure Shoe (page 14).
 - b. Throatknife (page 15).
 - c. Read Inject cover (page 23).
 - d. Read station lamp (page 26).
 - e. Card Sensors (page 27).
 - f. Card Aligner roll (page 24).
 - g. Pre-wait card guide (page 28).
 - h. Hopper to wait station alignment (page 19).
 - i. Hopper extensions (page 19).

HOPPER CAM SHAFT REMOVAL

- 1 Remove hopper front casting. Both clutch assembly springs must be removed.
- 2 Loosen belt idler bracket. **L**
- 3 Remove end screw, flange, belt, and gear while sliding hopper cam shaft out front of machine.
- 4 Reinstall hopper cam shaft by reversing above procedure and adjust the following:
 - a. Throatknife clearance (page 15).
 - b. Nudge roll pressure shoes (page 14).
 - c. Hopper tie bar (page 16).
 - d. Magnet clutch (page 13).
 - e. Hopper timing (page 12).
 - f. Belt tension (page 10).
 - g. Read Inject Card Cover (page 23).
 - h. Read Inject Pressure Shoe (page 23).



READ OPERATION



CARD FEEDING

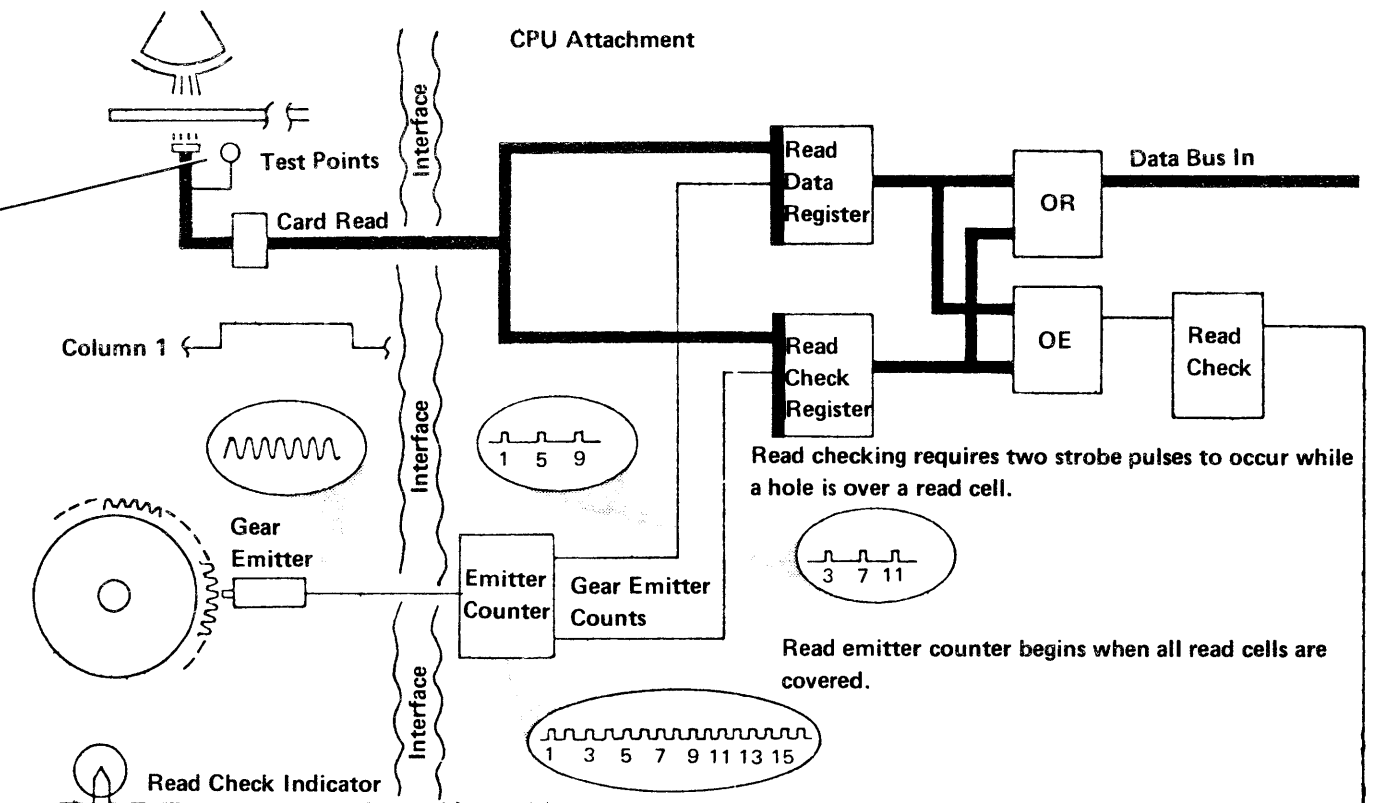
A start I/O (SIO) instruction starts the motor in the MFCU. When the CPU attachment receives a hopper CB pulse from the MFCU, the hopper clutch magnet is energized and a card is fed from the selected hopper into the read inject station. The read inject sector then moves the card into the read station (columns 1, 33 and 65 first). The card is read serially, three columns at a time, until all card columns are read. The card continues to move until it is stopped in the selected wait station. (Cards from the primary hopper move into the top wait station; cards from the secondary hopper move into the bottom wait station.) The card remains here until another SIO instruction selects that same hopper and wait station.

CARD READING

When the leading edge of the card covers all read cells, the card is considered registered at the read station and the read gear emitter counter in the CPU Attachment is started. After count 46, the counter is reset to zero and reading of columns 1, 33, and 65 begins.

The output of 18 phototransistors is gated by emitter counter pulses, into read registers in the attachment.

Six emitter counter pulses are available during the time a hole is to be read: counts 1, 3, 5, 7, 9, and 11. If a hole is over the read cell at 1, 5, or 9 time, a bit is set on in the read data register. If a hole is over the read cell at 3, 7, or 11 time, a bit is set on in the read check register. The output of these two registers is then compared. If they are not equal, a read check occurs.



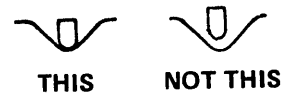
READ INJECT CARD COVER

SERVICE CHECK

- 1 Check for a uniform gap of $0.019'' \pm 0.003''$ ($0,48 \text{ mm} \pm 0,08 \text{ mm}$) here (3 cards).
- 2 Check for $0.014'' \pm 0.003''$ ($0,36 \text{ mm} \pm 0,08 \text{ mm}$) here (2 cards).

ADJUSTMENT

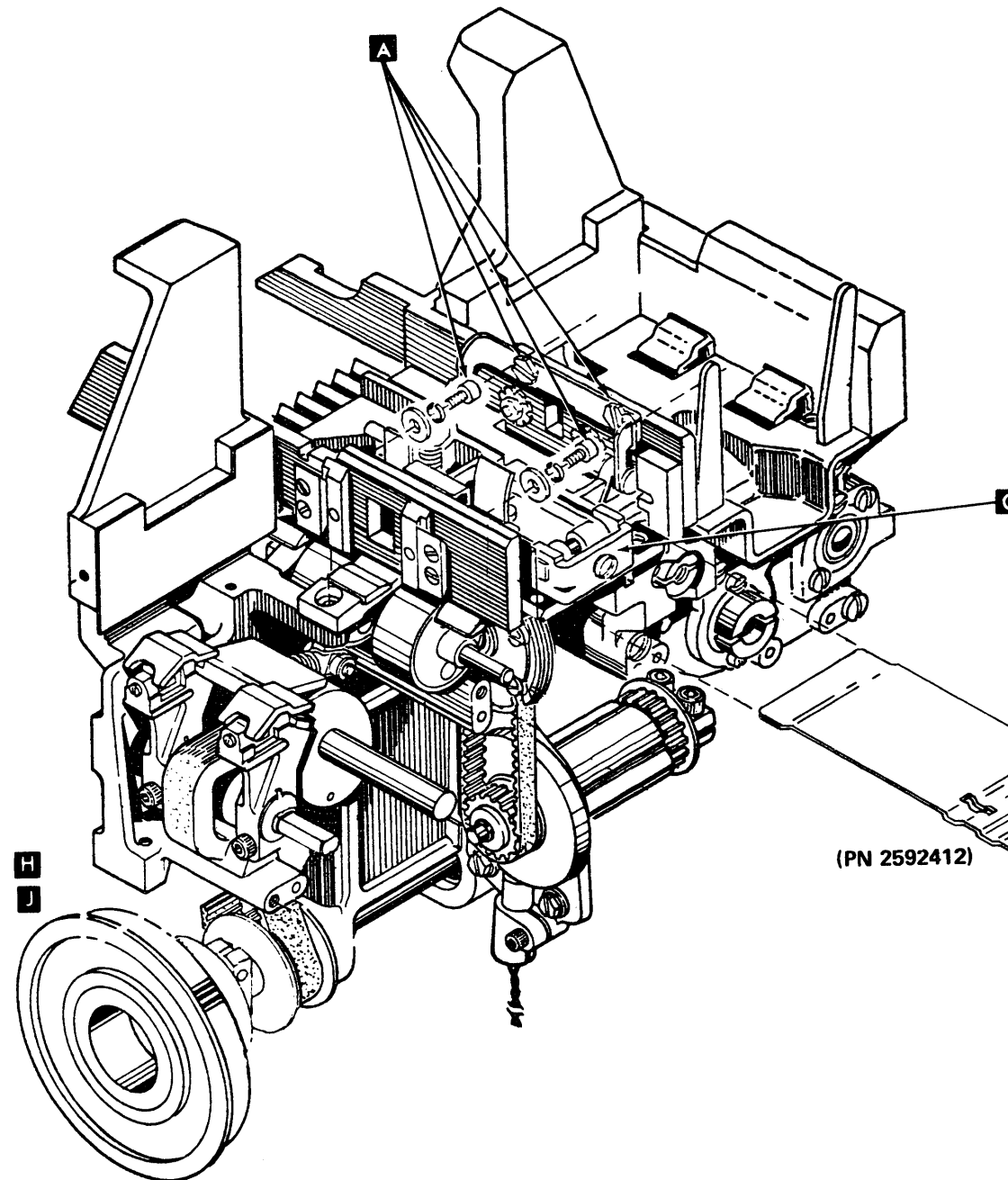
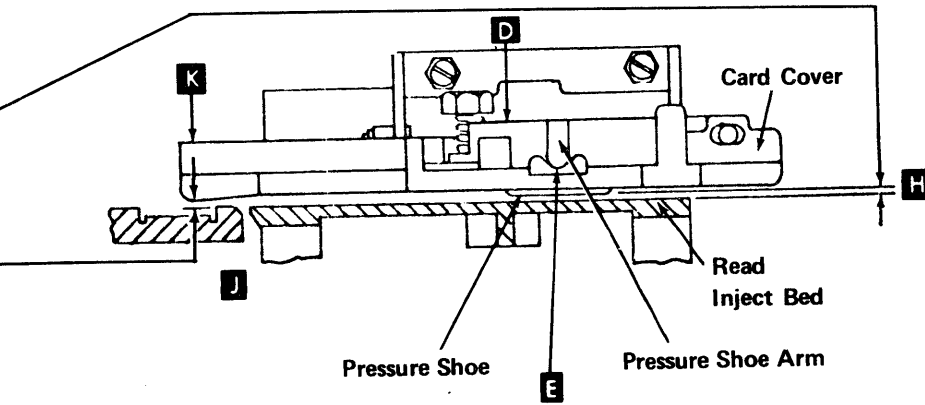
- 1 Loosen 4 screws. **A**
- 2 Place gage **B** under read inject cover. **C**
- 3 Position gage flush to primary edge of card bed.
- 4 Apply light pressure at **K** and **D**. Then tighten screws. **A**
- 5 Make sure pressure shoe arm does not move off stop. **E**



- 6 Remove gage and check adjustment.

REMOVAL

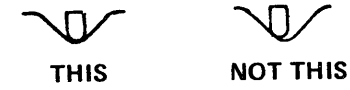
- 1 Remove static lead from top of pressure shoe.
- 2 Remove spring clip. **F**
- 3 Slide cover off mounting studs.
- 4 Replace by reversing above procedure.
- 5 Check gap between card cover and read inject bed. **H**
Also check gap between card cover and read bed. **J**



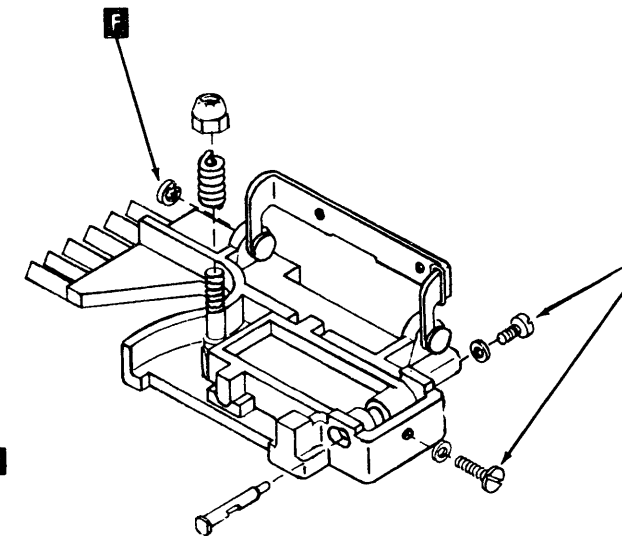
READ INJECT PRESSURE SHOE

SERVICE CHECK

- 1 Remove static lead from top of pressure shoe.
- 2 Remove read inject cover by removing spring clip. **F**
Check that pressure shoe arm is seated on both sides.
Check that it takes a force of 550 to 600 grams to just lift the pressure shoe arm from its stop. **G E**

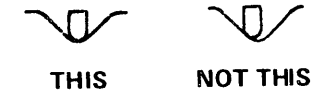


- 3 Replace cover and check gap between card cover and read inject bed. **H J**
- 4 Replace static lead.



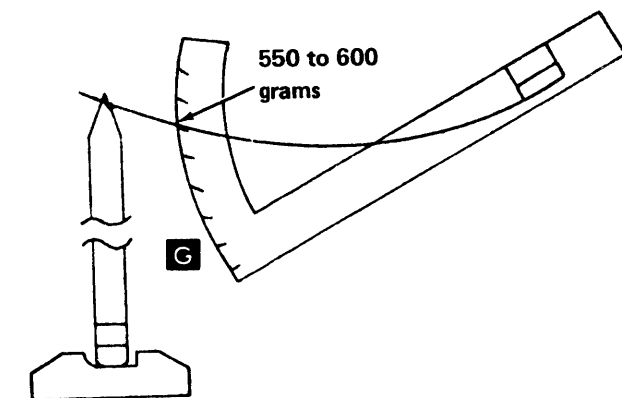
ADJUSTMENT

- 1 Remove static lead from top of pressure shoe.
- 2 Remove read inject cover by removing spring clip. **F**
- 3 If pressure shoe arm is not seated in its stop on both sides, loosen clamping screws and change pressure shoe position.

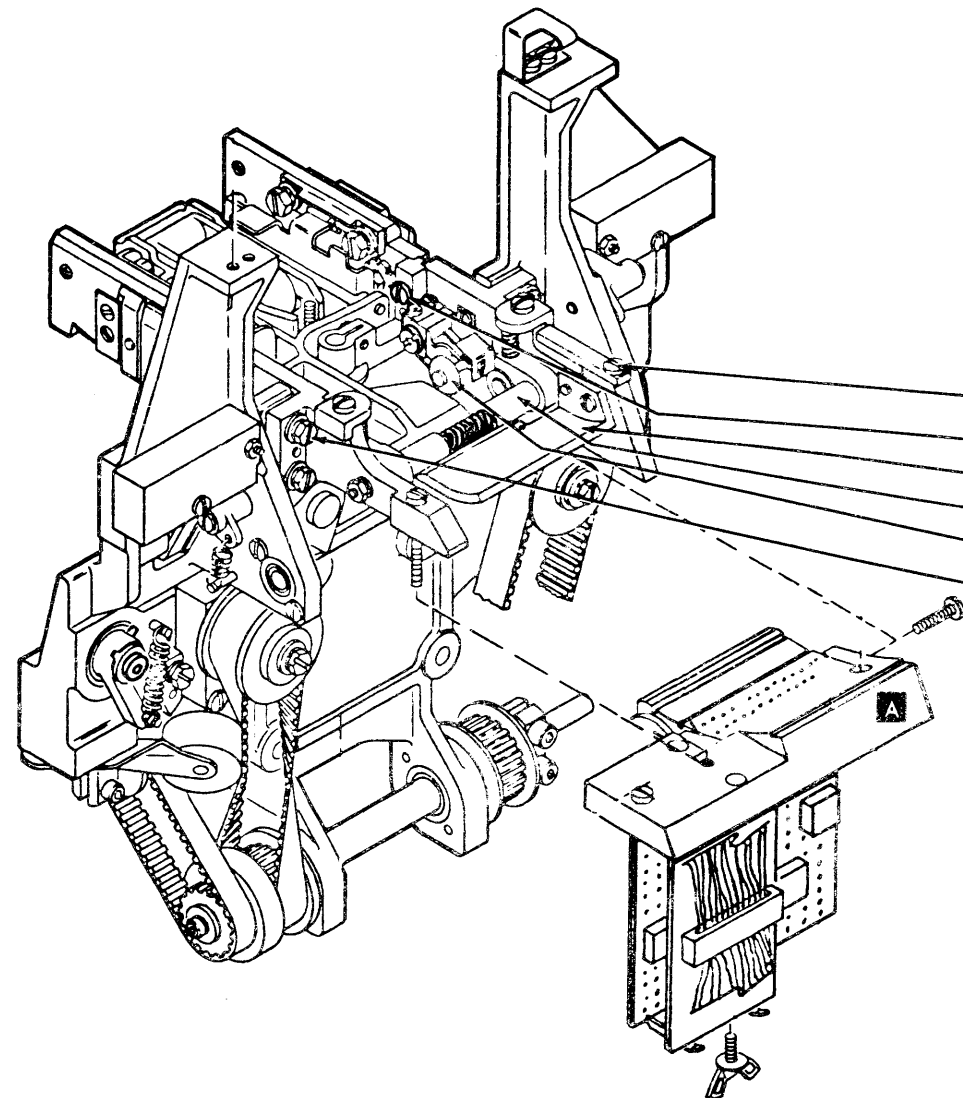


Tighten clamping screws and use Loctite grade "E" on screws. There must be no Loctite between shaft and pressure shoe arm.

- 4 Adjust pressure shoe spring until 550 to 600 grams of force is required to lift the pressure shoe arm from its stop. **G E**
- 5 Replace cover and check gap between card cover and read inject bed plate. **H J**
- 6 Replace static lead.



READ INJECT BEDPLATE



REMOVAL

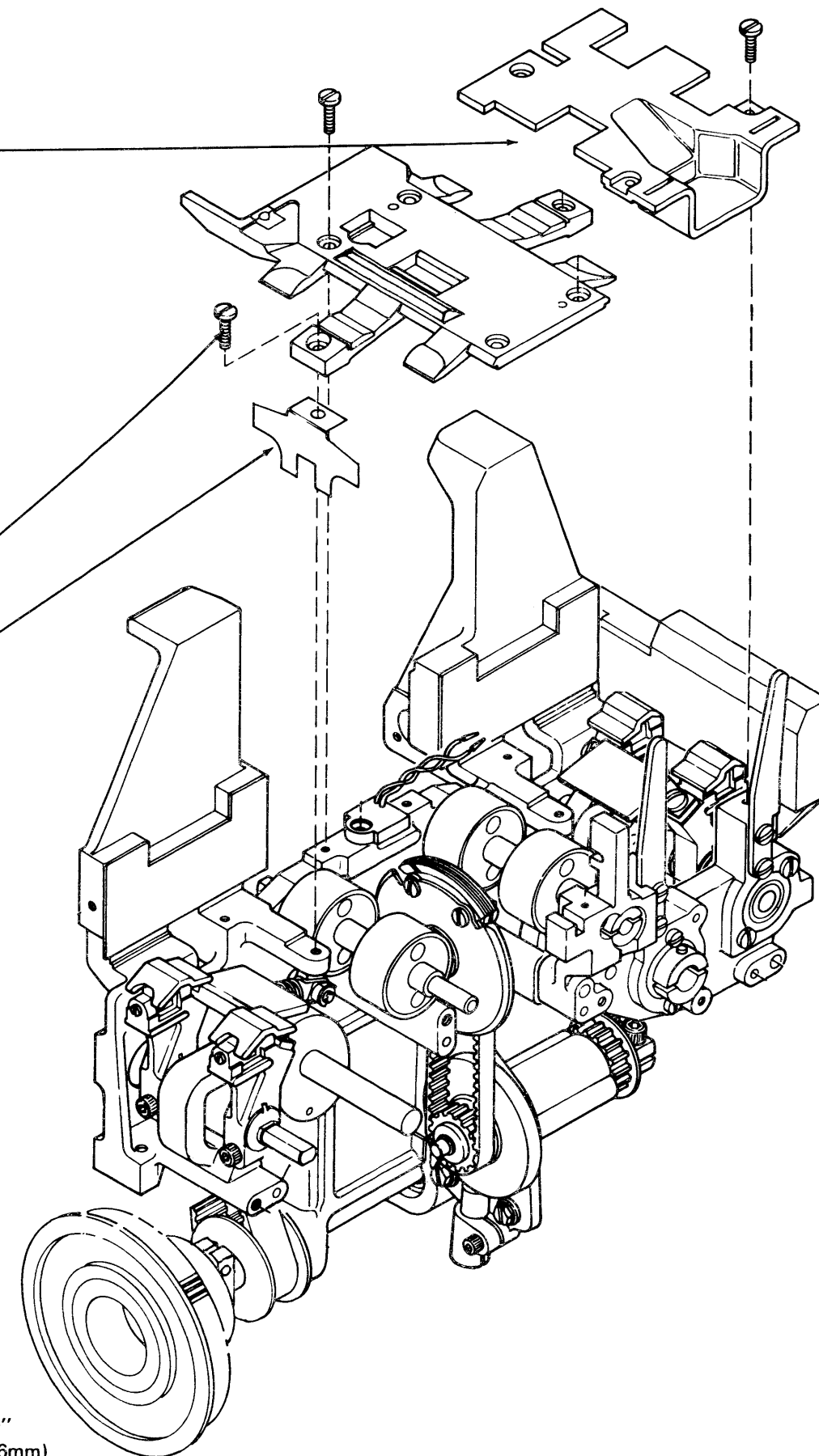
- 1** Remove hopper extensions as an assembly (page 19).
- 2** Remove read station assembly **A** (page 29).
- 3** Remove both hopper bedplates.
- 4** Remove both rails:

CAUTION: To prevent damage or bowing of the rail while re-installing, hold front of rail in position while tightening rear screws. Then tighten front screws.

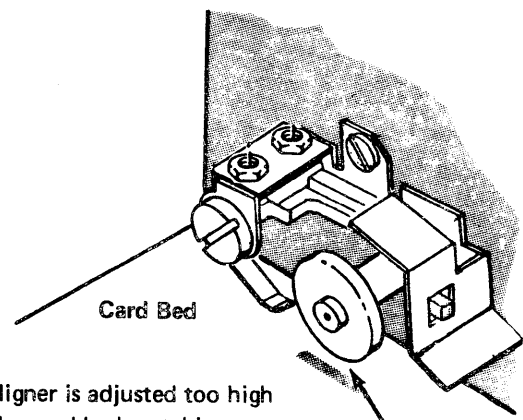
- a. Remove inject card cover by removing clip.
- b. Remove bracket holding the 4 light pipes to the backbone.
- c. Remove clamping bar on registration rail.
- d. Remove read inject light pipe bracket.
- e. Remove pre-wait card guide.
- f. Remove read pressure rolls and shaft.
- g. Remove aligner roll assembly.
- h. Remove front and rear mounting screws.
- i. Remove rail.

- 5** Remove read inject bedplate mounting screws.
- 6** Remove bedplate. Two hopper dust deflectors will fall free when bed is removed.

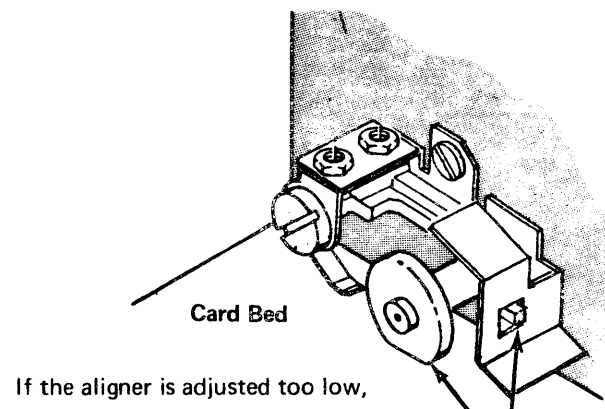
- 7** Re-install by reversing above procedure. Check/adjust:
 - a. Nudge Roll Pressure Shoe (page 14).
 - b. Throatknives (page 15).
 - c. Read Inject cover (page 23).
 - d. Card Aligner Rolls
 - e. Read Station lamp and card sensors (pages 26, 27).
 - f. Pre-wait card guide (page 28).



CARD ALIGNER ADJUSTMENT



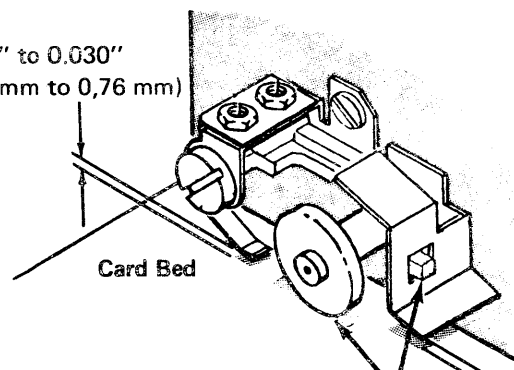
If the aligner is adjusted too high above the card bed metal insert, the aligner will have no effect. The result is usually an off registration condition.



If the aligner is adjusted too low, card marking or feed checks will result.

WRONG
(Arm lifted off stop)

0.010" to 0.030"
(0,25 mm to 0,76 mm)



Rotate the roll with a small screw driver. A very slight drag should be felt.

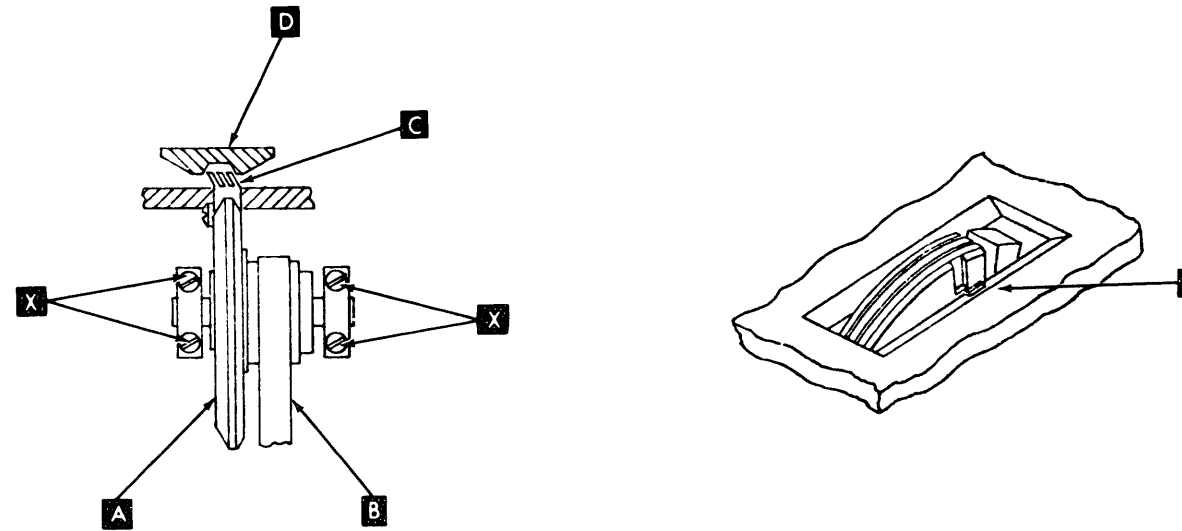
0.010" to 0.030"
(0,25mm to 0,76mm)

READ INJECT FEED ROLL

SERVICE CHECK

CAUTION: Remove timing pins before running the machine or extensive part damage will occur.

- 1 Check sector for damage or wear. **C**
- 2 Remove feed roll drive belt **B** and rotate roll; Sector **C** should pass under pressure shoe **D** with little or no drag.
- 3 Replace drive belt and check timing:
 - a. Place timing pins in both hopper cams.
 - b. Check that sector timing slot aligns with projection on card bed. **E**
 - c. Check that hopper CB slug is aligned with CB pickup. **F**
 - d. Remove timing pins.



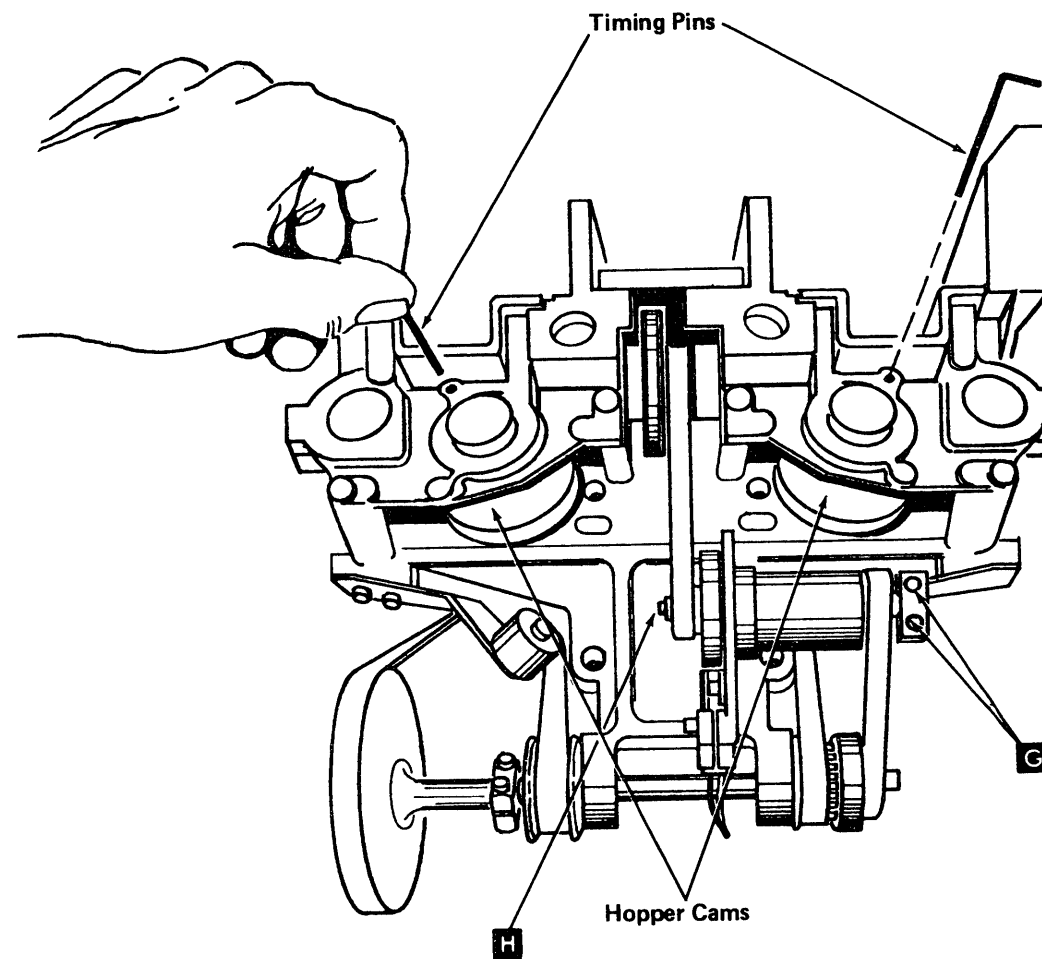
ADJUSTMENTS

TIMING

- 1 Insert timing pins in both hopper cams.
- 2 Make sure emitter disk slug is in line with CB pickup. **F**
- 3 Loosen screw. **H**
- 4 Rotate read inject roll until notch on sector is in line with projection on card bed. **E**
- 5 Tighten screw. **H**
- 6 Remove timing pins.

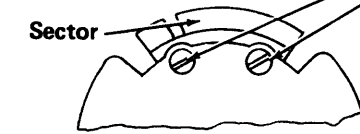
POSITION

- 1 Remove feed roll drive belt. **B**
- 2 Loosen four screws. **X**
- 3 Position feed roll **A** so that sector **C** is centered under pressure pad **D** with little or no drag when feed roll is rotated.
- 4 Tighten four screws and replace drive belt.



REMOVAL

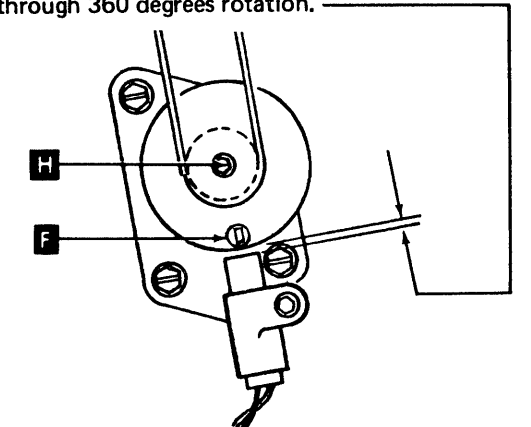
- 1 Remove aligner wheel by removing screws **X** and belt **B**
- 2 Sector is held to flywheel by two screws.
- 3 When replacing, be sure sector is seated firmly on mounting bosses.
- 4 Replace and perform service check.



HOPPER CB ADJUSTMENT

CAUTION: Remove timing pins before running the machine or extensive part damage will occur.

- 1 With both timing pins inserted, loosen screws **G** and align sector timing slot with projection in bed. **E**
- 2 Tighten screws.
- 3 Loosen screw **H** and adjust CB disk so that slug is aligned with CB pickup. **F** Tighten screw.
- 4 Remove timing pins.
- 5 Adjust CB pickup so that it does not touch disk, but gap must not exceed 0.003" (0.08mm) through 360 degrees rotation.



READ STATION LAMP

SERVICE CHECK

Note: When checking for correct cell output, your decision must be based on knowing the room temperature and the length of time the 5424 has had power on. The ideal time is with the room temperature between 67° and 77° F and when the machine has been on for less than 10 minutes. However, a chart is given in case these conditions do not exist.

- 1 Turn machine power off.
- 2 Remove pre-wait card guide. **A**
(Some card guides have holes that allow probing test points without removing card guide.)
- 3 Remove read amplifier card **X**, but do not remove cable card. **B**
- 4 Turn machine power back on.
- 5 Connect positive lead of milliammeter to ground pin on read station and negative lead to pin for read cell 3. (A paper clip can be used to probe test points.) **C**
- 6 Grasp lamp shock mount closest to punch unit and move lamp up and down. As lamp is moved either way, cell current should not rise. Return lamp to normal position.
- 7 Probe all cells to find the one with the highest output. When machine has been on for 10 minutes or less, and the room temperature is 67 to 77° F, cell output should be 3.5 mA. If cell output is more than 3.5 mA, reduce lamp voltage. If cell output is less than 3.5 mA, but still in range shown on chart **D**, leave it at that setting. For other room temperatures or machine power on time, see chart.
- 8 Check that voltage across lamp terminals does not exceed 13.0 volts.
- 9 Turn machine power off.
- 10 Reinstall read amplifier card. **X**
- 11 If pre-wait card guide was removed, re-install and adjust for a gap of 0.028" ± 0.005" (0,71mm ± 0,13mm).

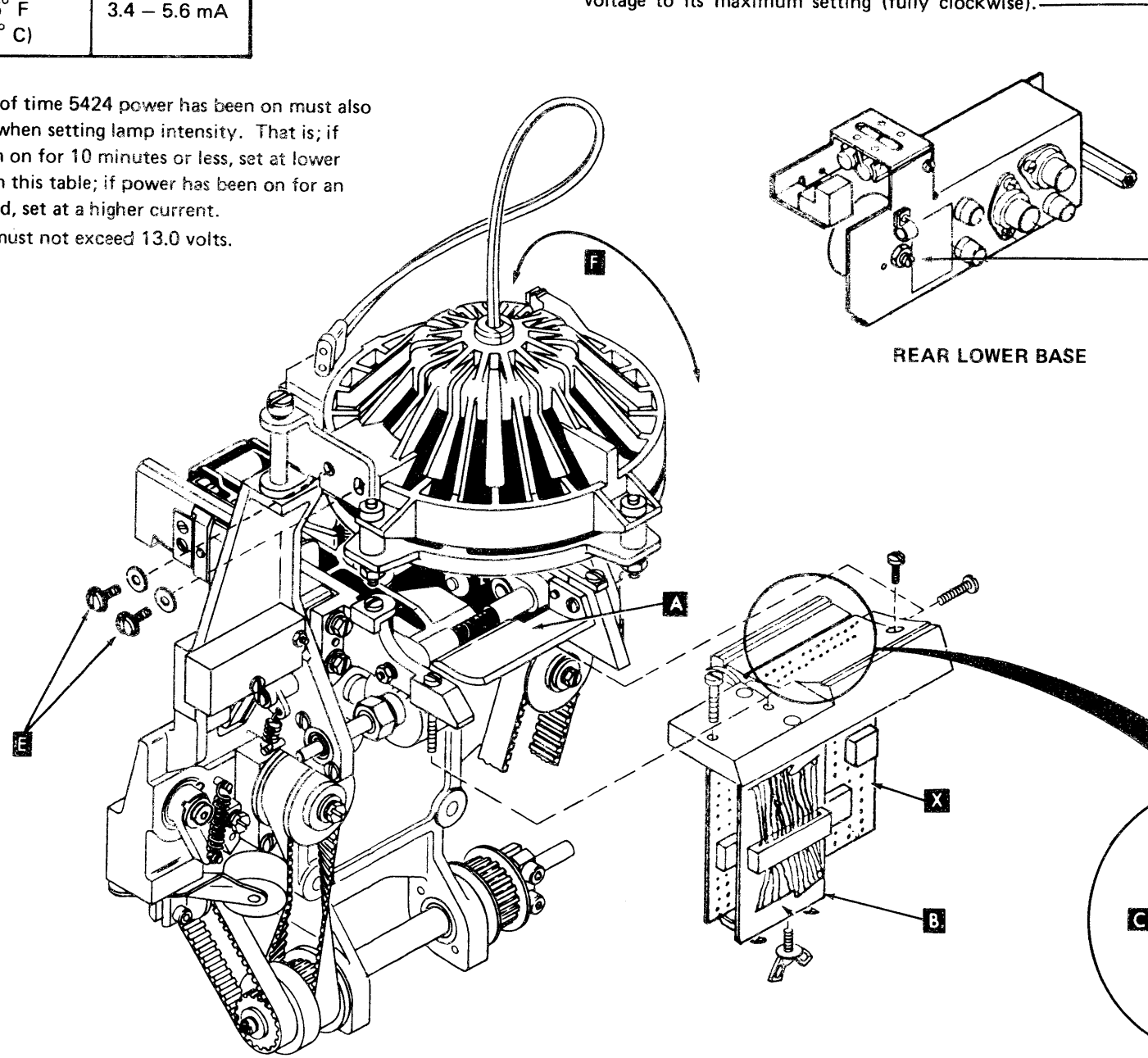
D Read Cell Current Setting

Room Temperature	Current
55° – 67° F (13° – 19° C)	2.5 – 3.9 mA
67° – 77° F (19° – 25° C)	3.0 – 4.3 mA
77° – 105° F (25° – 41° C)	3.4 – 5.6 mA

Note: Length of time 5424 power has been on must also be considered when setting lamp intensity. That is; if power has been on for 10 minutes or less, set at lower current given in this table; if power has been on for an extended period, set at a higher current. Lamp voltage must not exceed 13.0 volts.

ADJUSTMENT

- 1 Turn machine power off.
- 2 Remove pre-wait card guide. **A**
(some card guides have holes that allow probing test points without removing card guide).
- 3 Remove read amplifier card **X**, but do not remove the cable card. **B**
- 4 Turn machine power back on and adjust lamp voltage to its maximum setting (fully clockwise).



- 5 Connect positive lead of milliammeter to ground pin on read station, and negative lead to pin for read cell 3. **C**
- 6 Loosen mounting screws for lamp. **E**
- 7 Rotate lamp for maximum output from cell 3. **F** Tighten screws. **E**
- 8 Measure voltage across lamp terminals. Voltage must not exceed 13.0 volts.
- 9 Probe all cells to find the one with the highest output. When machine has been on for 10 minutes or less, and the room temperature is 67 to 77 degrees F, cell output should be 3.5 ma. If cell output is more than 3.5 ma, reduce lamp voltage. If cell output is less than 3.5 ma, but still in range shown on chart **D**, leave it at that setting. For other room temperatures or machine power on time, see chart **D**
- 10 Turn machine power off.
- 11 Reinstall read amplifier card. **X**
- 12 Re-install pre-wait card guide **A** and adjust for a gap of 0.028" ± 0.005" (0,71 mm ± 0,13 mm).
- 13 Perform card sensor service checks for all stations as shown on facing page.
 - a. Hopper, facing page.
 - b. Pre-punch, facing page.
 - c. Corner station, facing page.
 - d. Post-print, facing page.

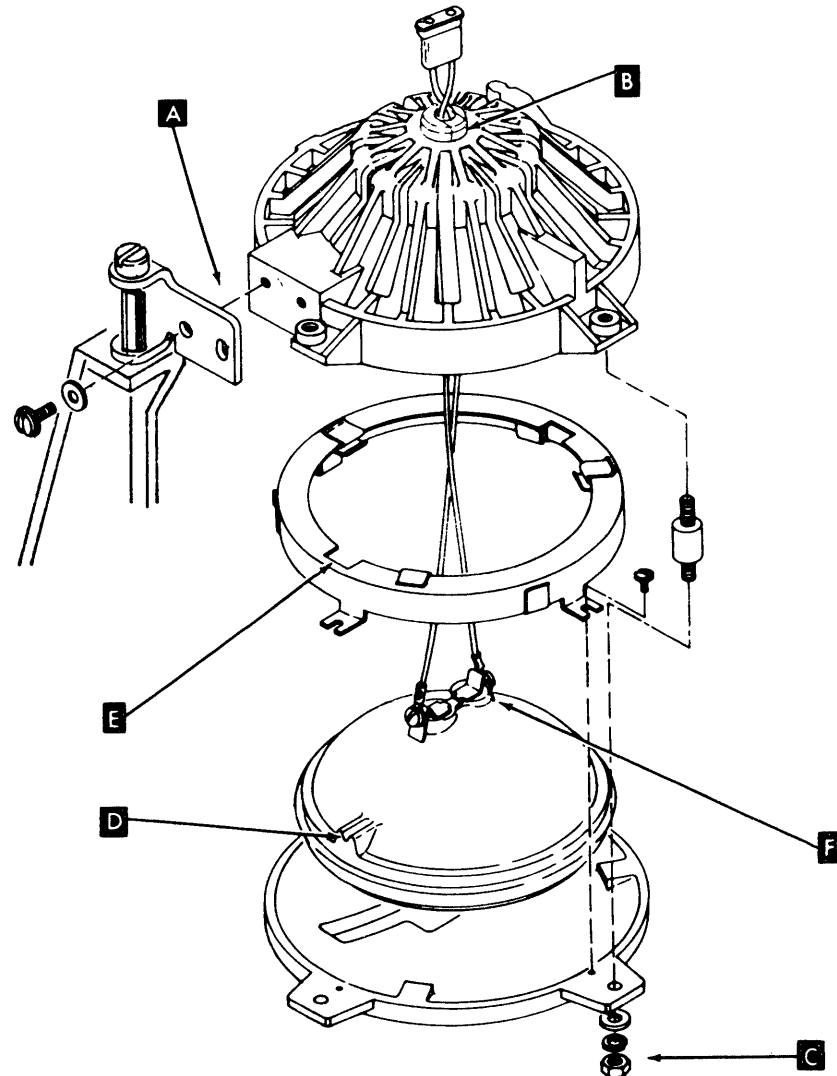
NOTE: A straightened paper clip is acceptable for probing test points.

READ LAMP REMOVAL

- 1 Remove read lamp assembly. **A**
- 2 Remove strain relief. **B**
- 3 Remove lamp shield nuts. When re-installing, keep shock mount from twisting or damage may occur. **C**

Note: When replacing lamp, be sure the alignment "V" **D** on the lamp seats within the relief in the retaining ring. **E**

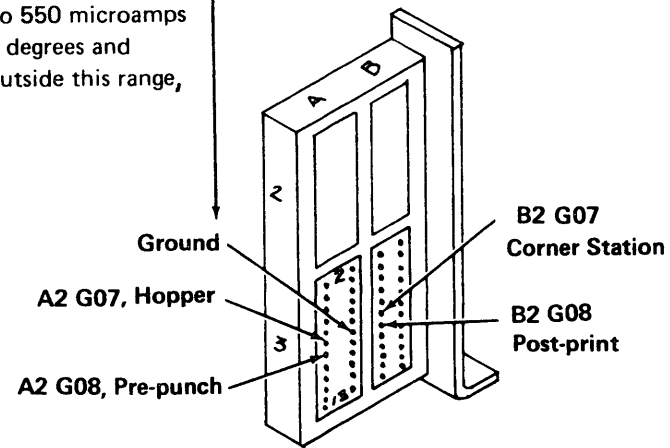
- 4 Disconnect the cable from the lamp. **F**
- 5 Reinstall by reversing the above procedure and perform the read station lamp adjustment.



CARD SENSOR

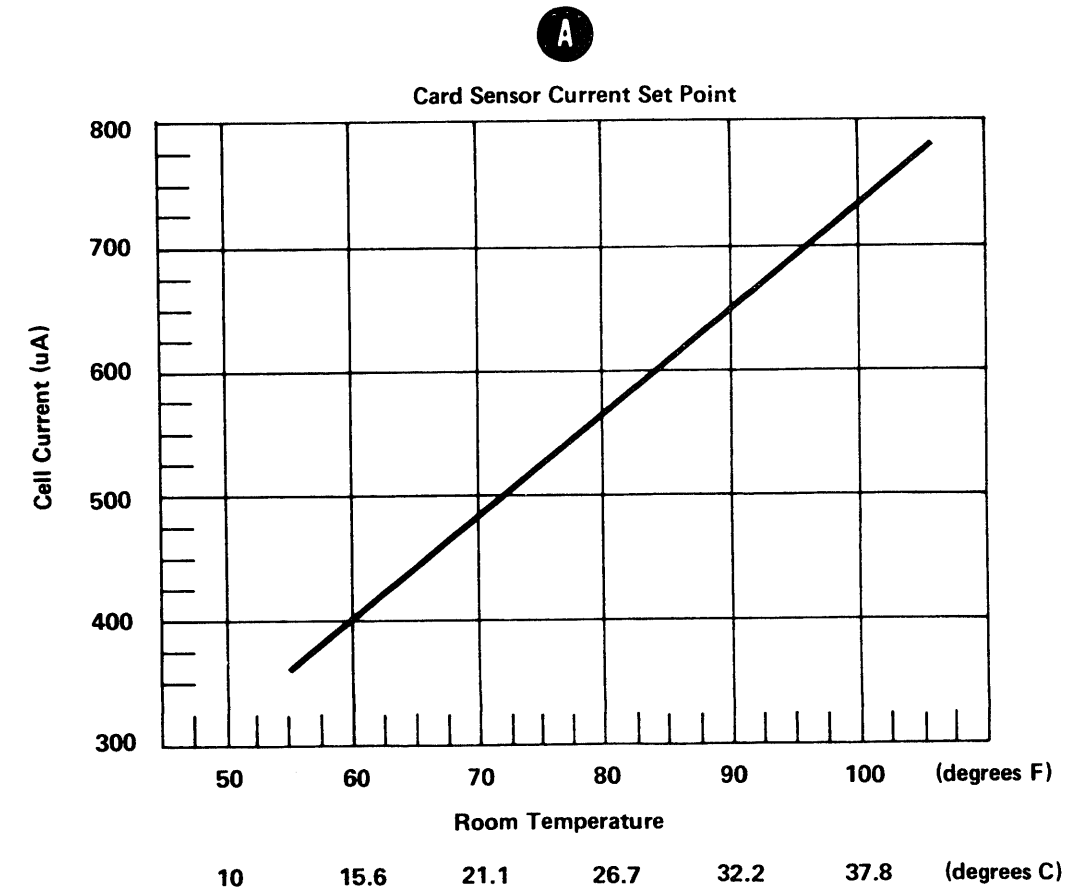
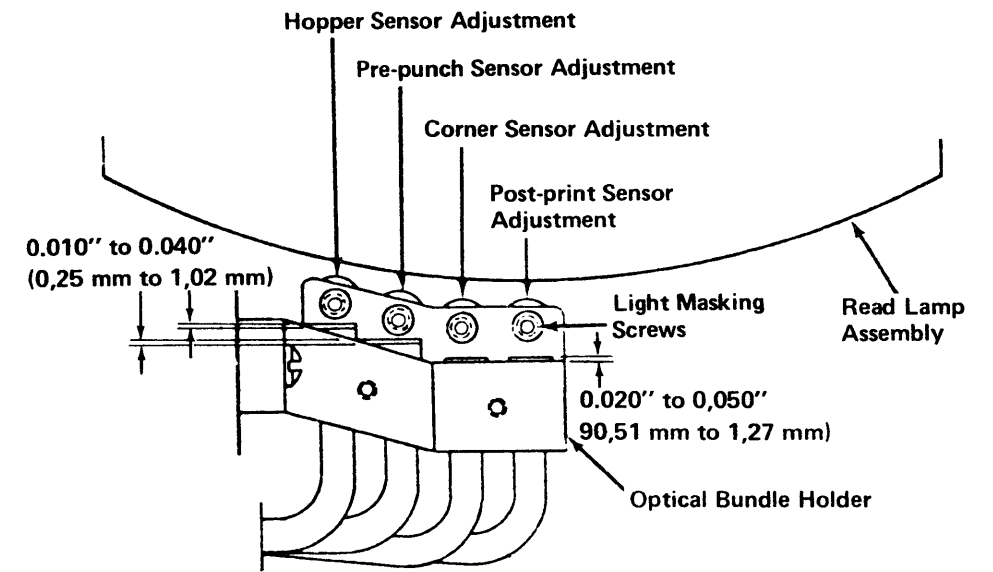
SERVICE CHECK

- 1 Turn off machine power and remove two punch check/ card sensor amplifier cards (located behind chip box).
- 2 Make sure cells and input ends of fiber bundles are clean.
- 3 Turn on machine power.
- 4 Connect positive lead of milliammeter to pin D08 (ground) and negative lead to one of the four pins shown.
- 5 Check for a meter reading of 450 to 550 microamps if room temperature is between 67 degrees and 77 degrees F. (If temperature is outside this range, refer to chart. **A**)



ADJUSTMENT

- 1 Turn off machine power and remove two punch check/ card sensor amplifier cards (located behind chip box).
- 2 Adjust fiber bundles for clearance shown.
- 3 Make sure cells and light pipe ends are clean.
- 4 The hopper cell light pipe and pre-punch cell light pipe should be adjusted flush to the surface of their holder. The corner cell light pipe and post print cell light pipe should be adjusted flush to the surface of the card bed.
- 5 Turn on machine power.
- 6 Connect positive lead of milliammeter to pin D08 (ground) and the negative lead to one of the four pins shown.
- 7 Adjust light masking screw for a meter reading of 500 microamps if room temperature is between 67 degrees and 77 degrees F. (If temperature is outside this range, refer to chart **A**)



READ PRESSURE ROLL

REMOVAL

- 1 Remove read pressure roll springs. **A**
- 2 Remove nut and washers. **B**
- 3 Use care when removing these parts. Spring tension could cause them to fly out of the machine. To remove shaft, push it toward the backbone and then lift from machine. **C**

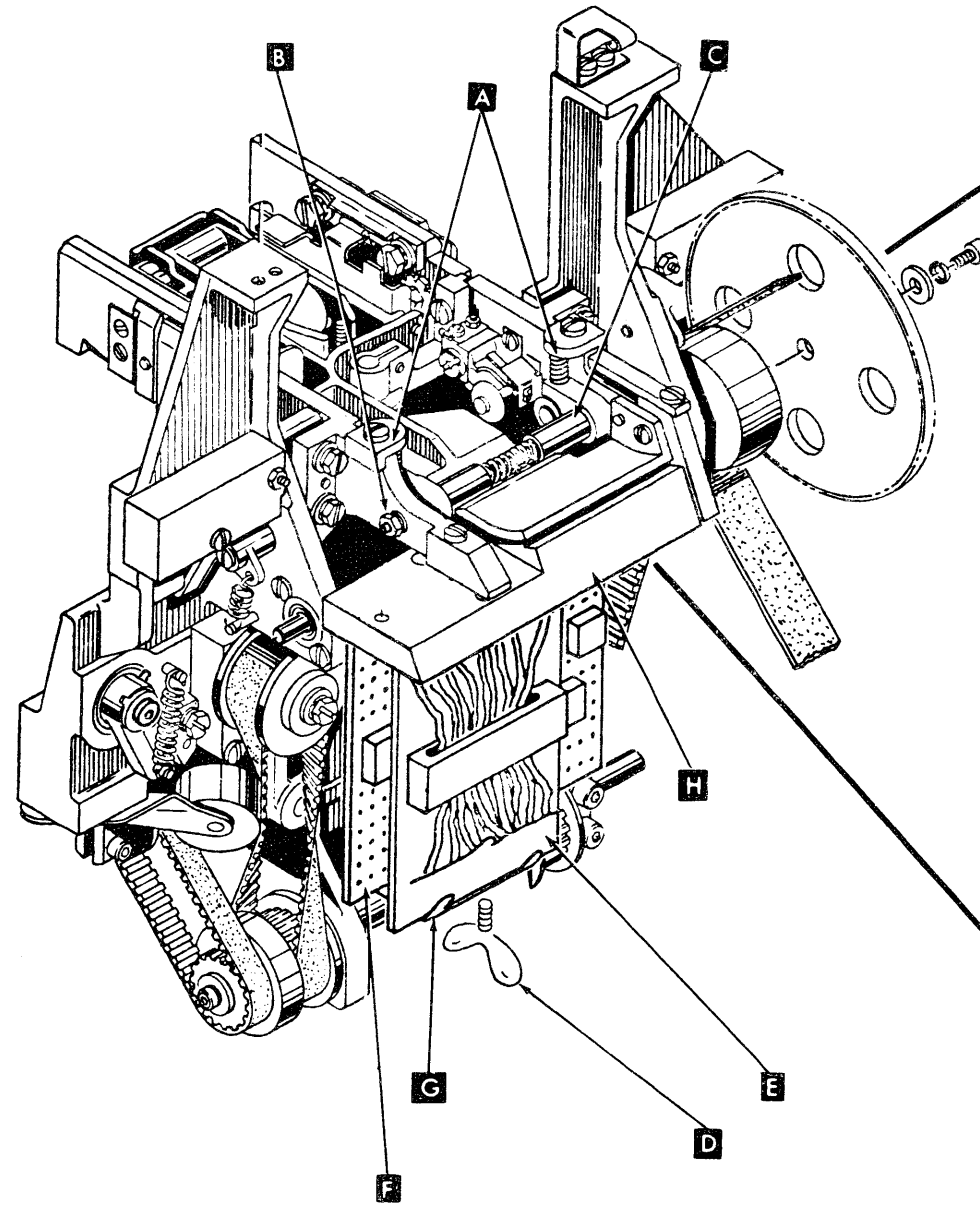
READ AMPLIFIER CARD

REMOVAL

- 1 Turn machine power off.
- 2 Loosen retaining spring screw. **D**

NOTE: Do not remove cable card unless necessary. **E**

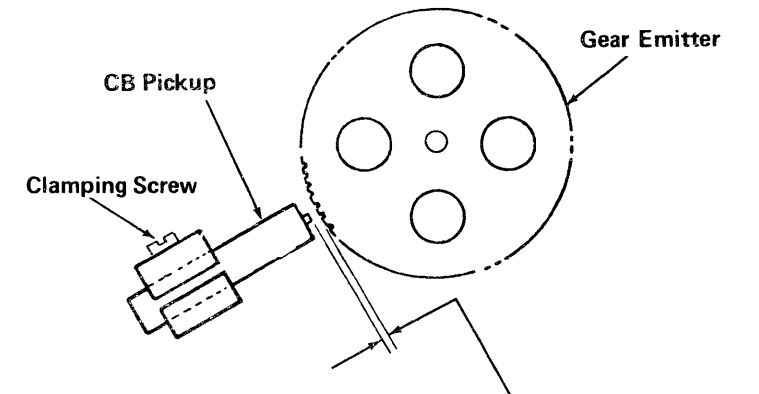
- 3 Remove amplifier card **F** by pulling it past the retaining spring **G** at an angle to the read bed. **H** Use care in removing the card to avoid bending the pins.
- 4 Re-install read amplifier card by reversing the above procedure.



READ GEAR EMITTER

SERVICE CHECK

Check for 0.001" to 0.004" (0,03mm to 0,10mm) gap through one gear emitter revolution.



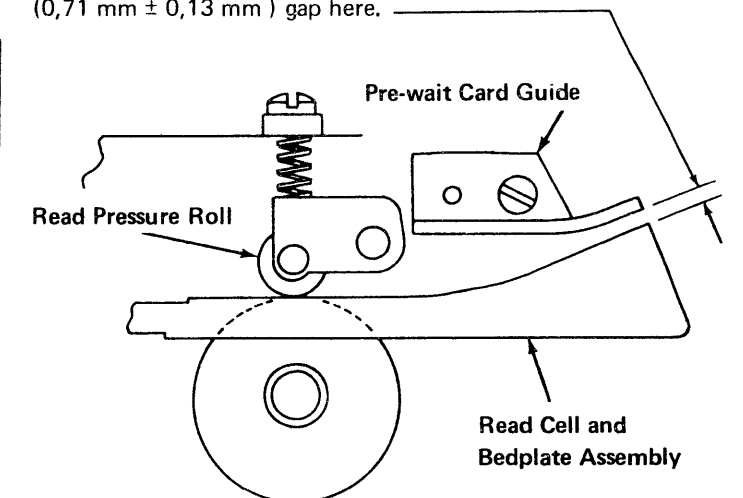
ADJUSTMENT

- 1 Loosen clamping screw.
- 2 Adjust pickup for a gap of 0.001" to 0.004" (0,03mm to 0,10mm).
- 3 Check for correct gap through one complete gear emitter revolution.

PRE-WAIT CARD GUIDE

ADJUSTMENT

Position card guide for $0.028'' \pm 0.005''$
(0,71 mm \pm 0,13 mm) gap here.

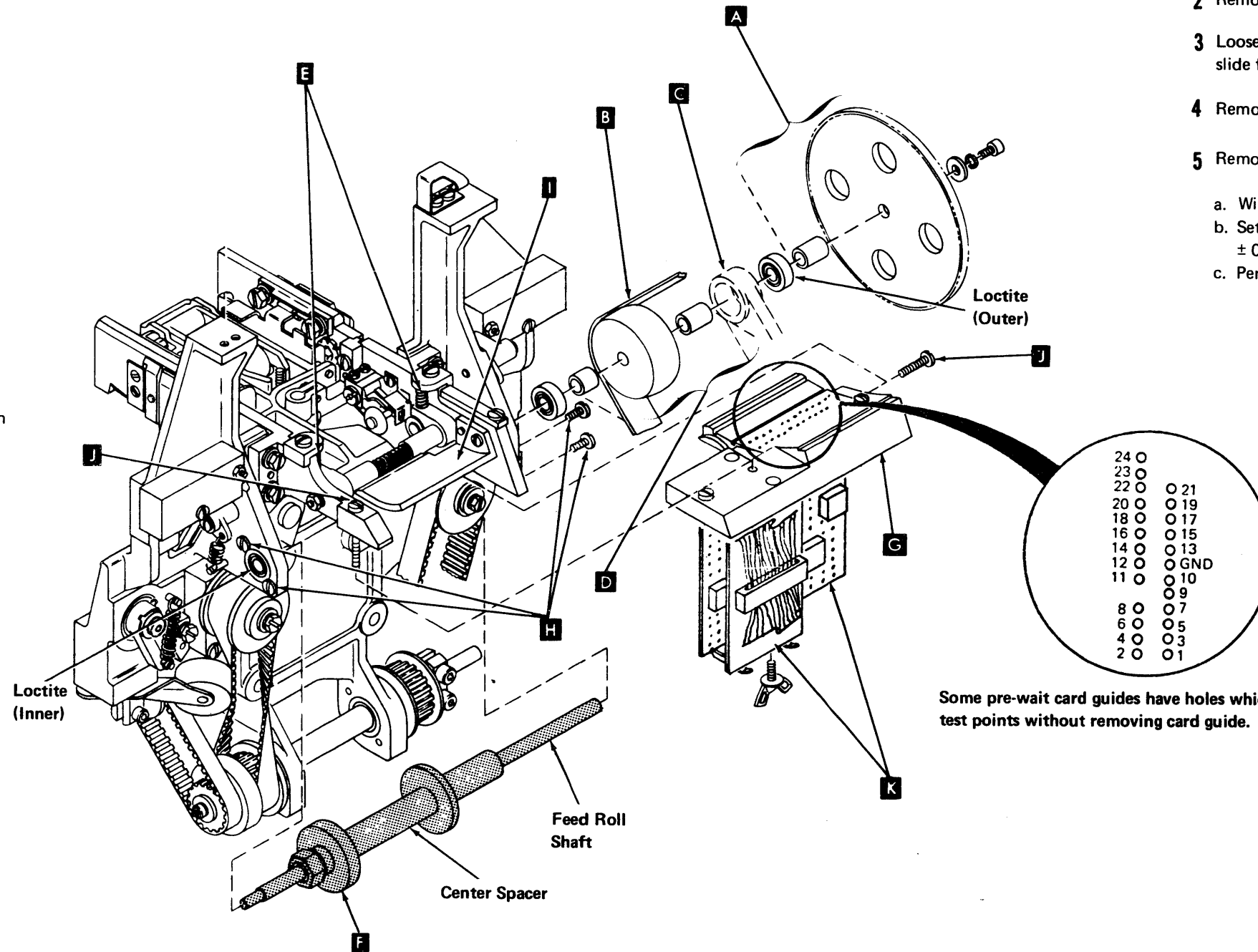


READ FEED ROLL

REMOVAL

NOTE: Two bearings on this shaft are sealed in position with Loctite. Before starting this removal, have two new bearings and Loctite grade "E" on hand.

- 1 Remove read emitter gear and spacer. When re-installing, check shaft for binds. **A**
- 2 Remove drive belt. **B**
- 3 Remove read emitter bracket. **C**
- 4 Remove spacers and pulley. **D**
- 5 Remove pressure roll springs **E** and card guide. **I**
- 6 Loosen nut on feed roll shaft and slide right feed roll away from read station. **F**
- 7 Remove read station assembly. **G** When re-installing;
 - a. Wipe dirt from back side of read assembly.
 - b. Set pre-wait card guide gap at $0.028'' \pm 0.005''$ ($0,71\text{mm} \pm 0,13\text{mm}$).
 - c. Perform read lamp adjustment (page 26).
- 8 Remove 4 bearing retaining screws. **H**
- 9 Pull shaft out the left side of hopper casting. Two feed rolls and center spacer will slip off the shaft. The bearing on each end of shaft is sealed in position with Loctite* and must be replaced with new bearings.
- 10 Use Loctite grade "E" on outer race of left bearing (emitter support bracket) **C** and inner race of right bearing. (Center bearing is clamped in position.)
- 11 Re-install by reversing above procedure.



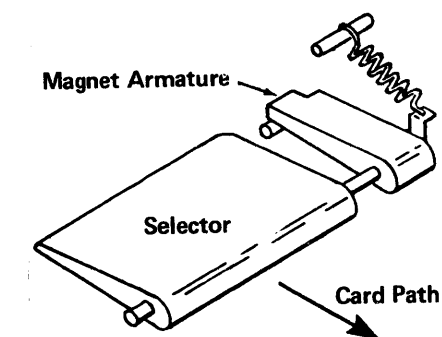
Some pre-wait card guides have holes which allow probing test points without removing card guide.

READ STATION ASSEMBLY

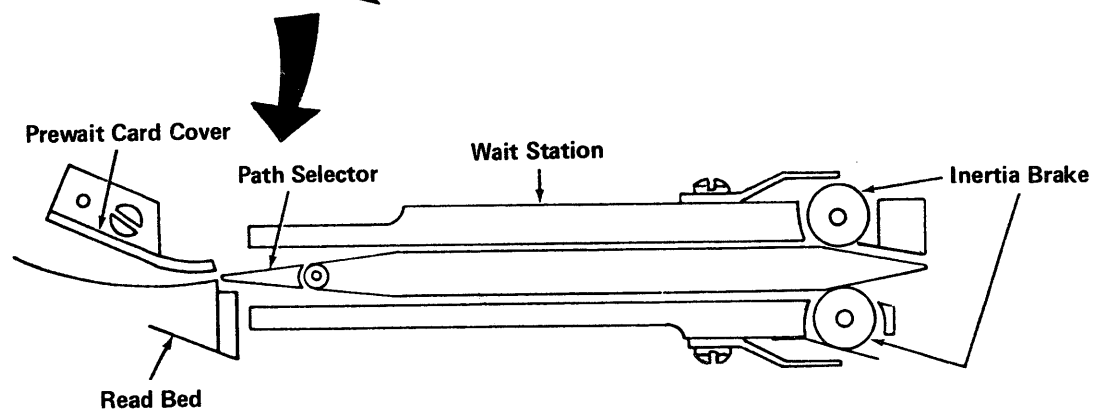
REMOVAL

- 1 Carefully remove read amplifier and cable cards. **K**
- 2 Remove pressure roll springs **E** and card guide. **I**
- 3 Loosen nut on feed roll shaft and slide front feed roll **F** away from read station. **G**
- 4 Remove two mounting screws. **J**
- 5 Remove read station. When re-installing;
 - a. Wipe dirt from back side of read assembly.
 - b. Set pre-wait card guide gap for $0.028'' \pm 0.005''$ ($0,71\text{mm} \pm 0,13\text{mm}$).
 - c. Perform read lamp adjustment (page 26).

WAIT STATION OPERATION

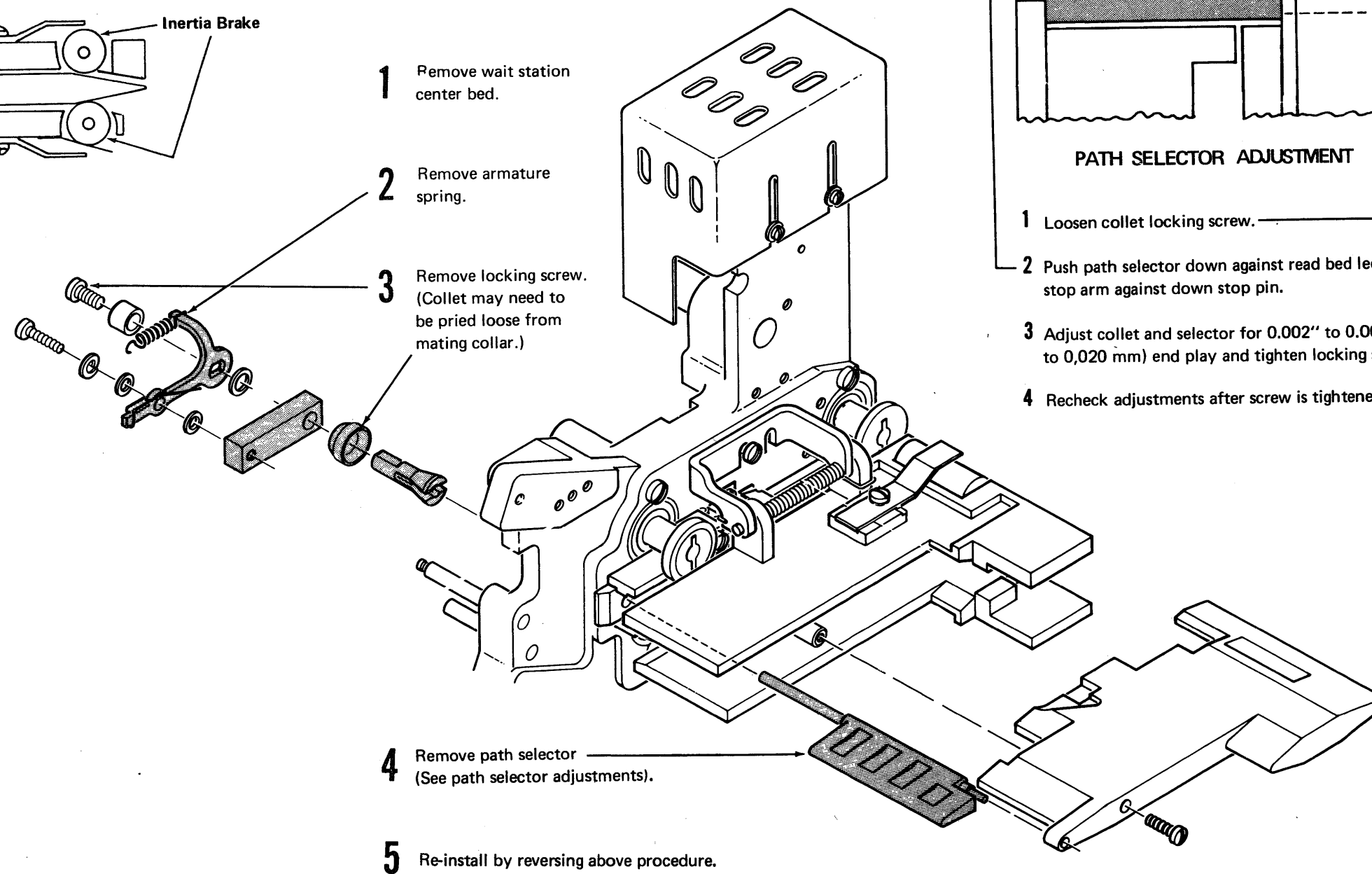


Once a hopper has been selected and card feeding started, a card feeds from the hopper to the wait station with one feed command. The path selector and wait inject feed rolls move the card into the wait station. Here it is stopped by the inertia brake. Cards from the primary hopper are fed into the top wait station, and cards from the secondary hopper are fed into the lower wait station.



PATH SELECTOR REMOVAL

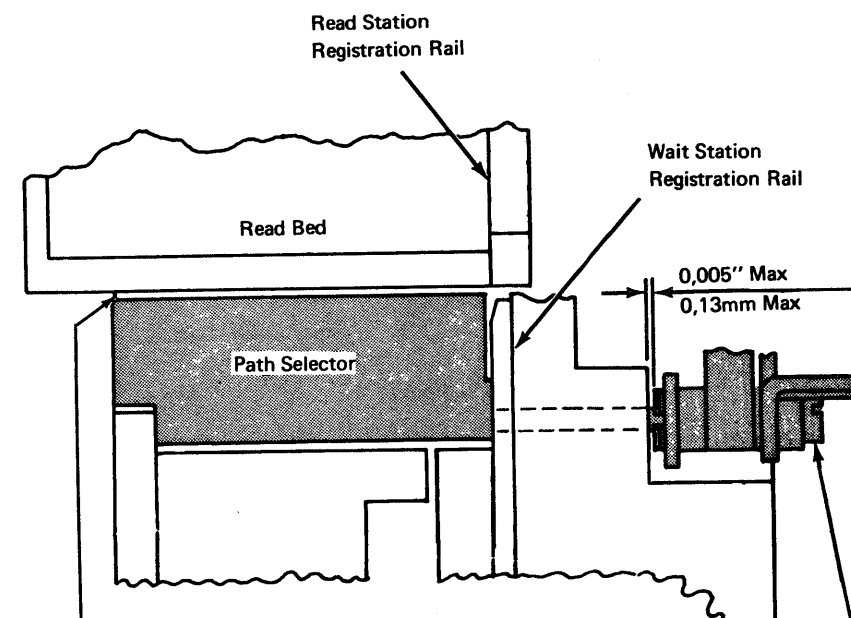
- 1 Remove wait station center bed.
- 2 Remove armature spring.
- 3 Remove locking screw. (Collet may need to be pried loose from mating collar.)



- 4 Remove path selector (See path selector adjustments).
- 5 Re-install by reversing above procedure.

PATH SELECTOR SERVICE CHECK

Check for 0.002" to 0.008" (0,05 mm to 0,20 mm) end play on the wait station path selector.



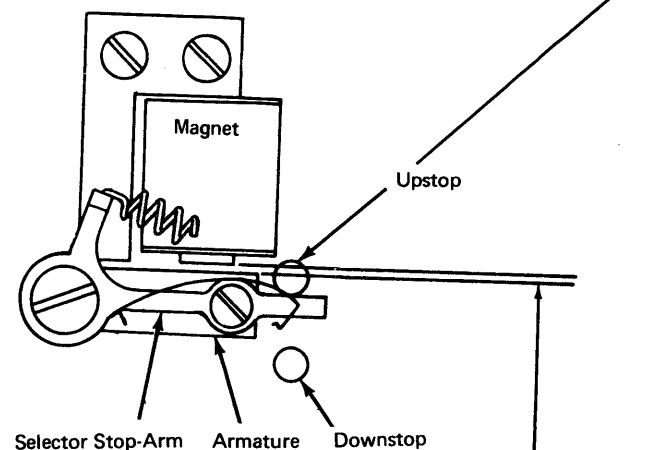
PATH SELECTOR ADJUSTMENT

- 1 Loosen collet locking screw.
- 2 Push path selector down against read bed ledge and selector stop arm against down stop pin.
- 3 Adjust collet and selector for 0.002" to 0.008" (0,05 mm to 0,20 mm) end play and tighten locking screw.
- 4 Recheck adjustments after screw is tightened.

PATH SELECTOR

PATH SELECTOR MAGNET ADJUSTMENT

- 1 Hold armature against armature upstop.

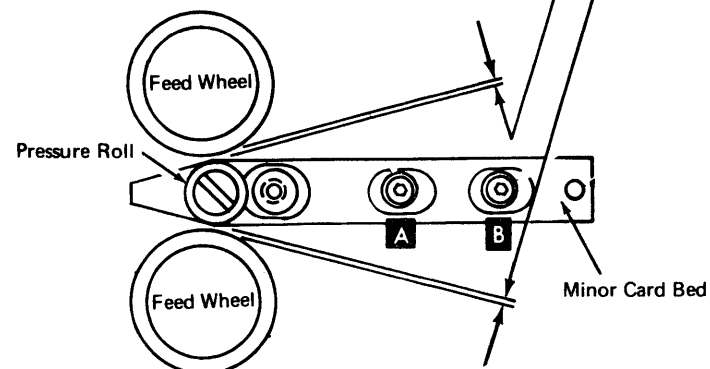


- 2 Adjust armature to core clearance for 0.006" to 0.010" (0,15 mm to 0,25 mm).

WAIT INJECT PRESSURE ROLL

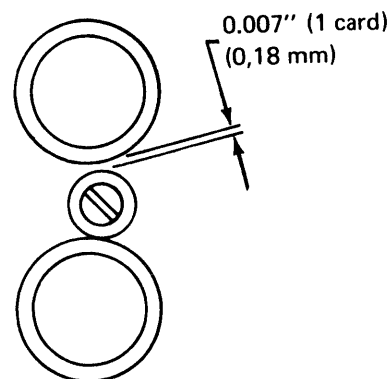
SERVICE CHECK:

Check for 0.001" to 0.004" (0,03mm to 0,10mm) gap between pressure roll and both feed rolls.

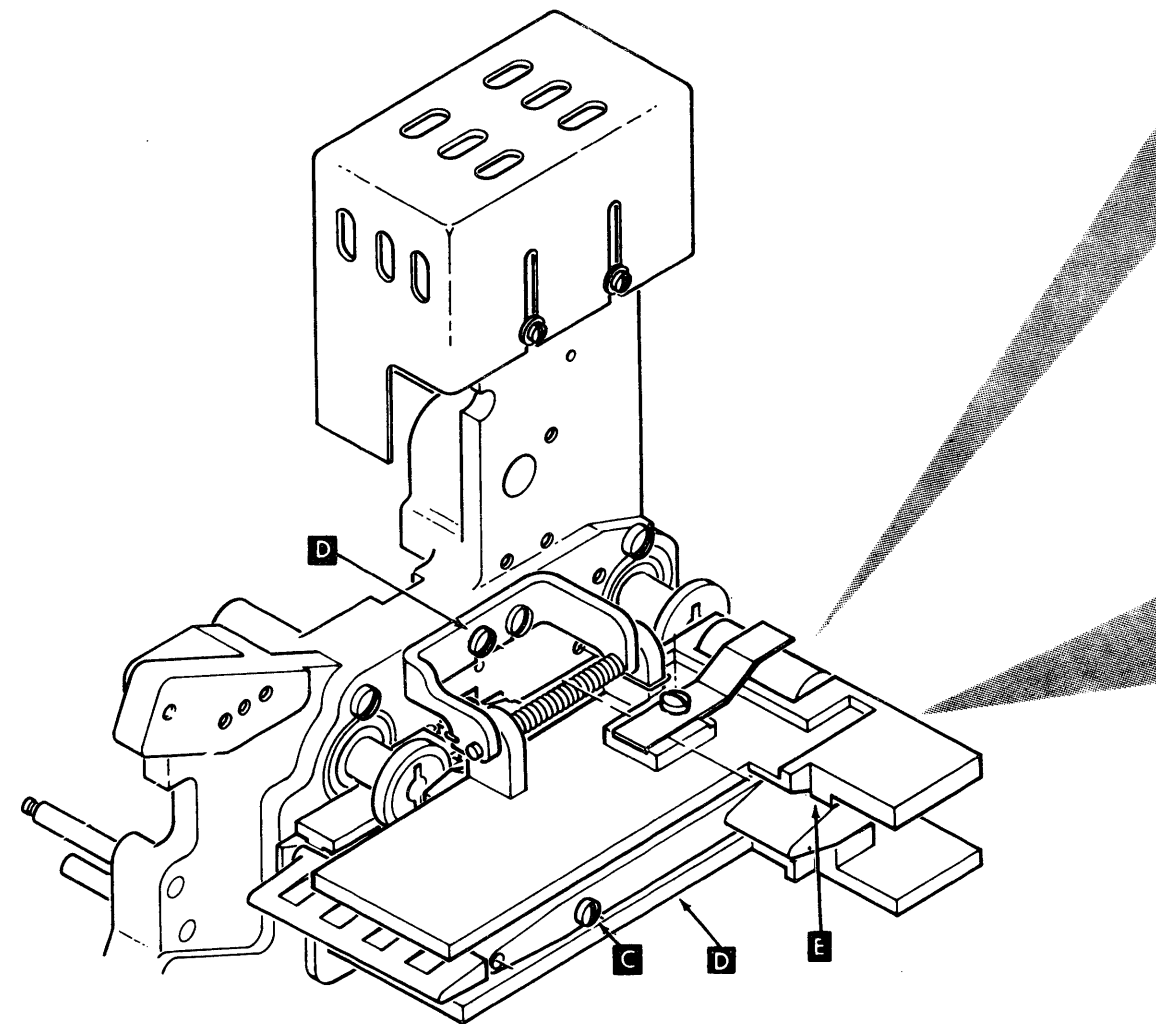


ADJUSTMENT:

- 1 Remove wait station center card bed. **C**
- 2 Remove wait station card covers. **D**
- 3 Loosen screws **A** **B**
- 4 Insert a card between pressure roll and upper feed roll.



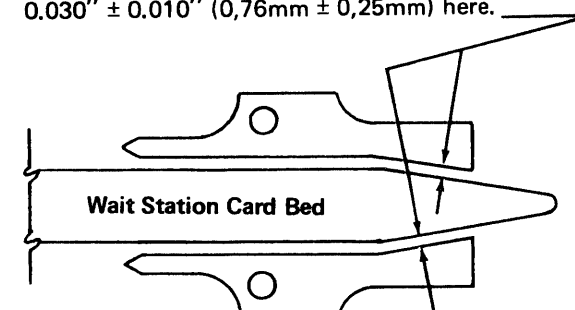
- 5 Slide minor card bed against card and tighten screw **B**
- 6 Center pressure roll between upper and lower feed rolls. Tighten screw **A**. This should result in a 0.001" to 0.004" (0,03mm to 0,10mm) gap between feed rolls and pressure roll.
- 7 Replace center card bed.
- 8 Replace card covers.
See card cover adjustment on this page.



WAIT STATION EXIT CARD GUIDES

NOTE: Card rail determines position of guides in a vertical direction.

Adjust exit card guides horizontally for 0.030" ± 0.010" (0,76mm ± 0,25mm) here.



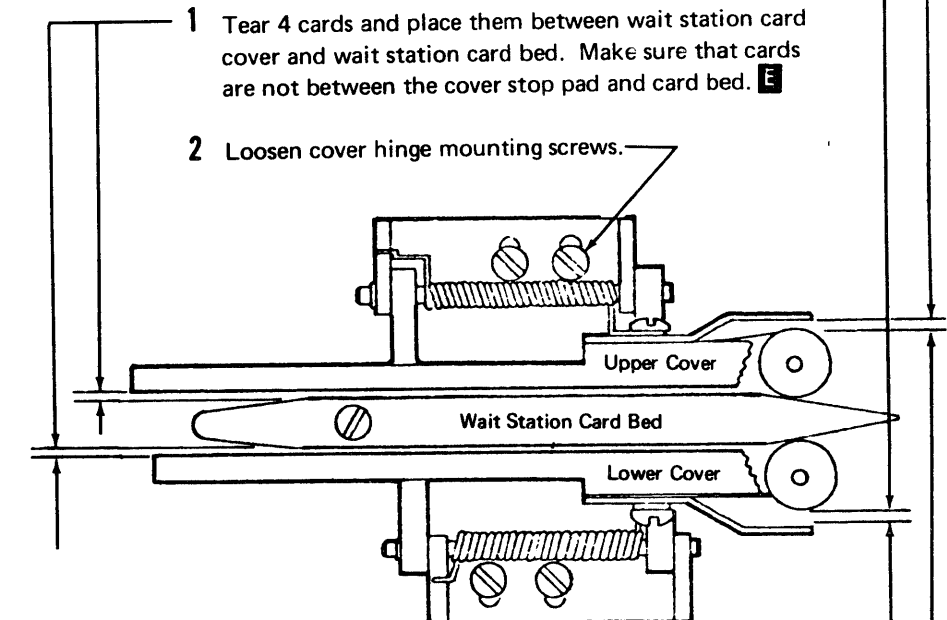
INERTIA BRAKE ADJUSTMENT

NOTE: Check wait station card cover adjustment of 0.028" ± 0.005" (0,71 mm ± 0,13 mm) gap between cover and center bed before adjusting brake.

Form brake upstop to obtain 0.014" to 0.034" (0,36mm to 0,86mm) clearance here.

CARD COVER ADJUSTMENT

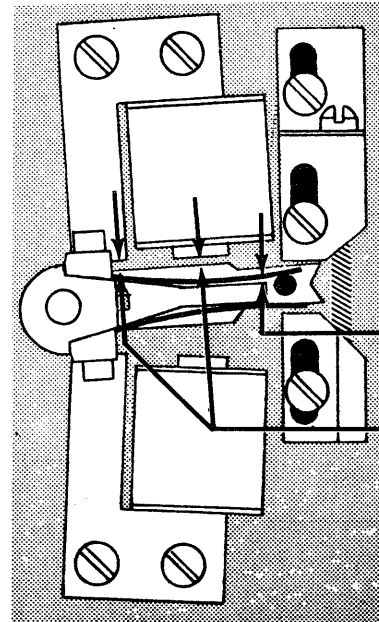
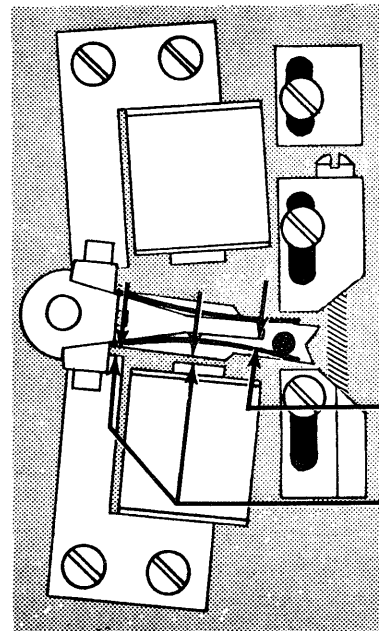
- 1 Tear 4 cards and place them between wait station card cover and wait station card bed. Make sure that cards are not between the cover stop pad and card bed. **E**
- 2 Loosen cover hinge mounting screws.



- 3 Push cover toward backbone to maintain hinge to backbone surface contact and press cover against the four cards. Tighten cover mounting screws. Then remove cards.
- 4 Check that covers open freely and check for a uniform gap between cover and bed over the length of the center bed.
- 5 Check for 0.014" to 0.034" (0,36 mm to 0,86 mm) gap at inertia brake.

PUNCH REGISTRATION PRESSURE ROLL

When the 5424 receives a start I/O command and there is a card in the wait station, one of the two punch registration pressure roll magnets is energized. There is a separate magnet for each wait station level. The combined action of the continuously running feed roll and the magnetically selected pressure roll moves the selected card into the punch station.



SERVICE CHECK

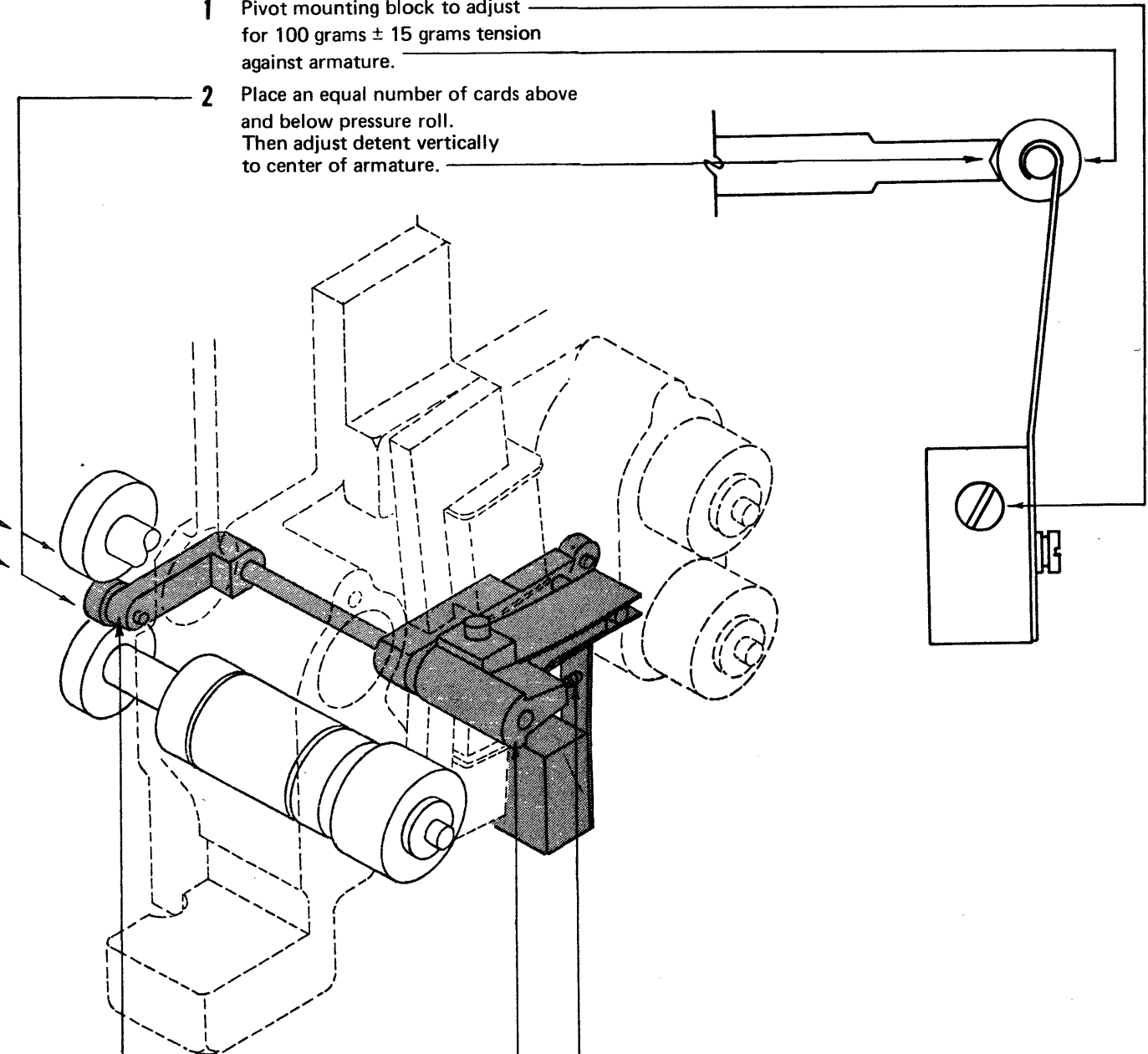
- 1 Insert a card between primary feed roll and the pressure roll.
- 2 Disable motor circuit with cover interlock.
- 3 Turn on machine power.
- 4 Pick primary punch registration magnet with a jumper from * TPB6-F to ground.
- 5 Check primary adjustments:
 - a. Check for 0.008" to 0.014" (0,20mm to 0,36mm) gap between leaf spring and lever arm.
 - b. Check for a gap 0.008" to 0.012" (0,20mm to 0,30mm) between armature and both magnet faces.
- 6 Remove card from primary station and insert card between secondary feed roll and pressure roll.
- 7 Energize secondary magnet by moving jumper from *TPB6-F to TPB6-H.
- 8 Check secondary adjustments:
 - a. Check for 0.008" to 0.014" (0,20mm to 0,36mm) gap between leaf spring and lever arm.
 - b. Check for a gap of 0.008" to 0.012" (0,20mm to 0,30mm) between armature and both magnet faces.
- 9 Remove jumper.
- 10 Check detent spring tension for 100 grams \pm 15 grams.
- 11 Remove card.
- 12 Check that detent assembly is positioned to center pressure roll vertically between the two feed rolls.

* If TPB-6 is not in machine:

Primary Registration Magnet is TPB5-C to GRD
Secondary Registration Magnet is TPB5-D to GRD

ARMATURE DETENT ADJUSTMENT

- 1 Pivot mounting block to adjust for 100 grams \pm 15 grams tension against armature.
- 2 Place an equal number of cards above and below pressure roll. Then adjust detent vertically to center of armature.

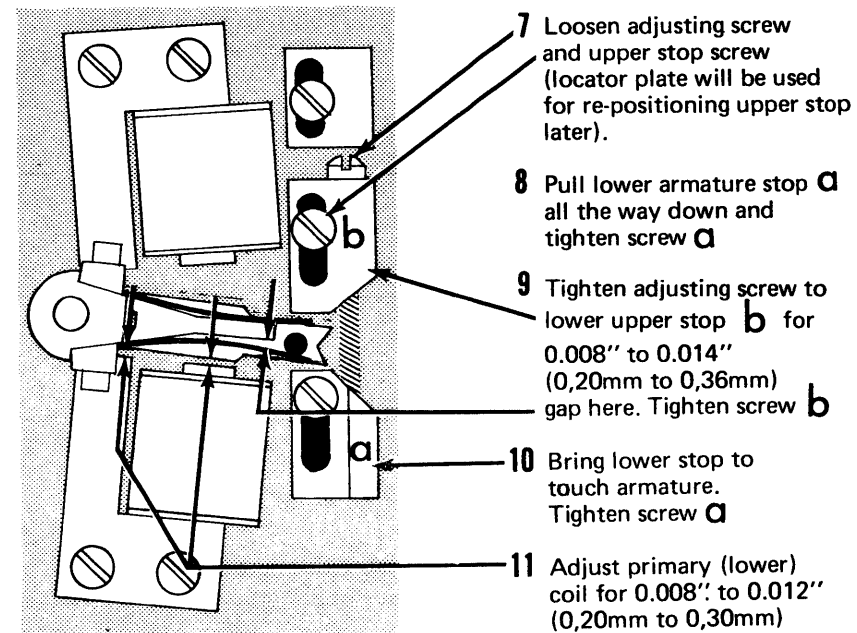
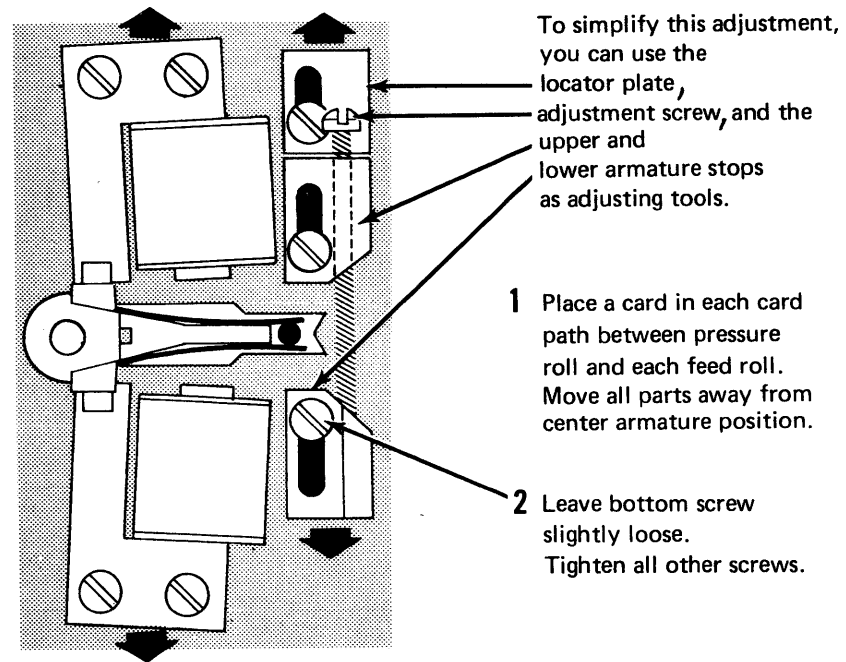


PRESSURE ROLL REMOVAL

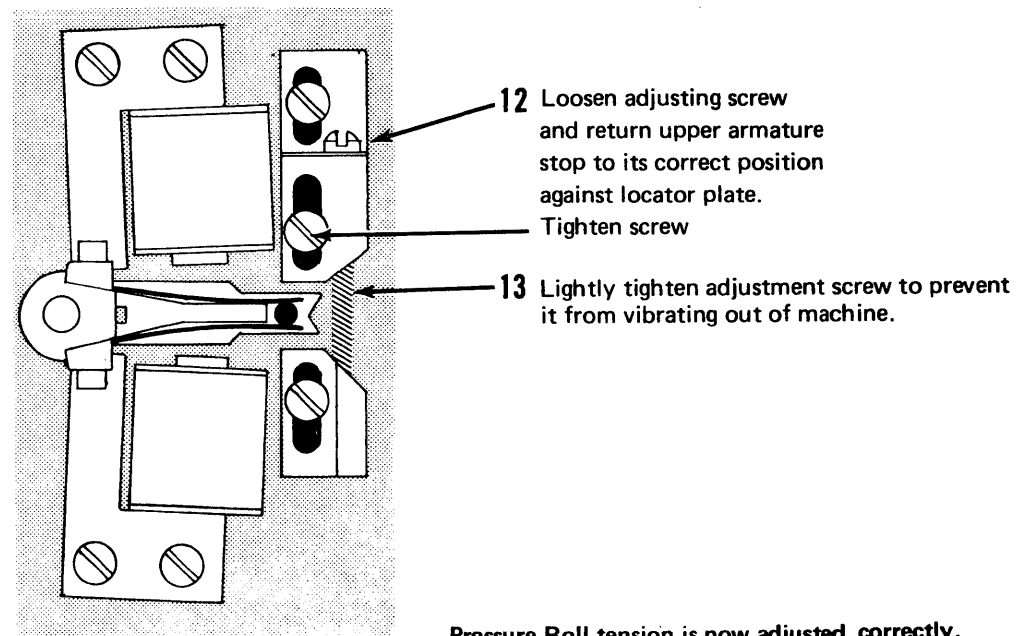
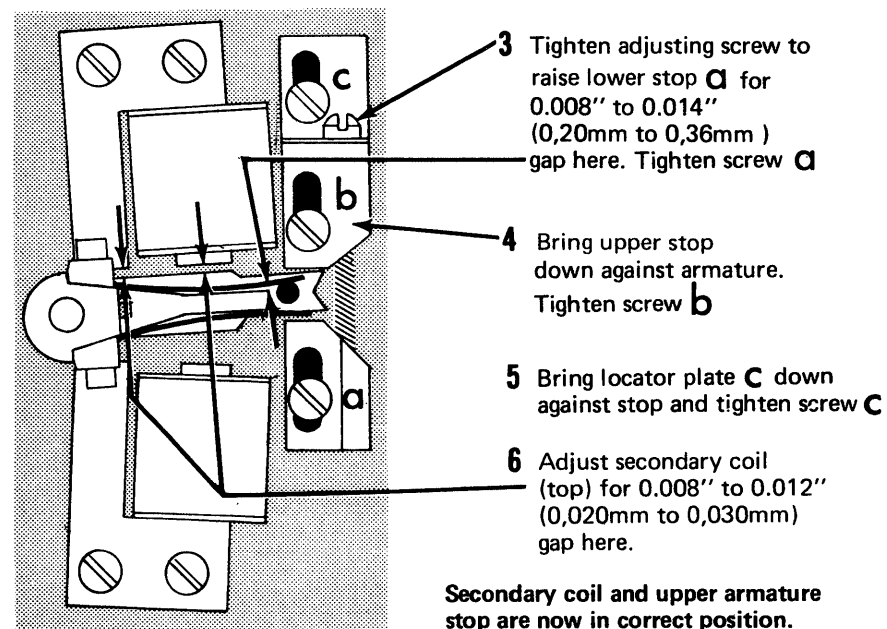
- 1 Remove threaded taper pin.
- 2 Remove armature assembly.
- 3 Remove wait station center bed.
- 4 Remove Pressure Roll assembly from bed side of machine.
- 5 Re-install roll by reversing above procedure.

ARMATURE STOPS AND MAGNET ADJUSTMENTS

This adjustment provides the correct punch registration feed pressure roll tension and the correct magnet position.

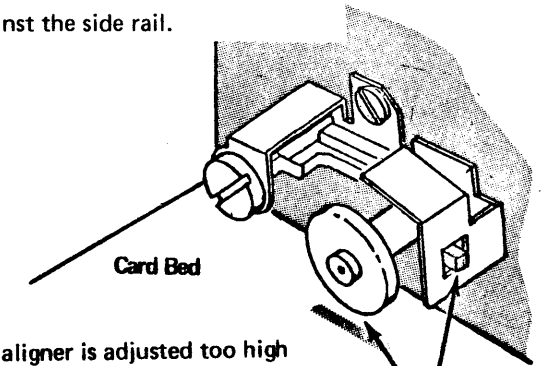


Primary coil and lower armature are now correctly adjusted.

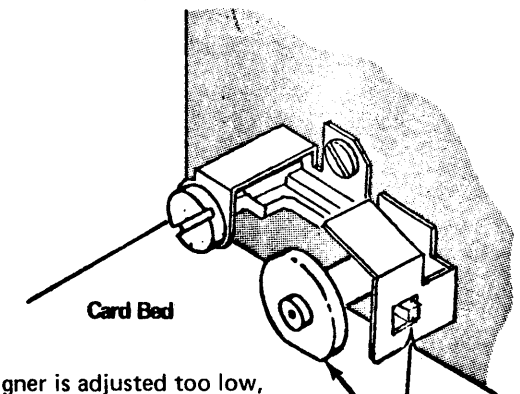


ALIGNER ROLL ADJUSTMENT

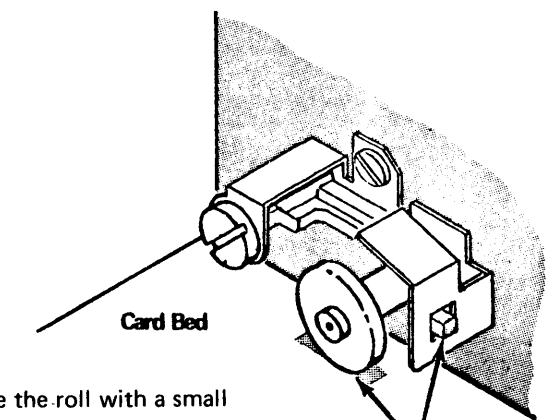
The flexing action of the card aligner rolls applies a slight pressure on the card toward the registration rail. This pressure makes sure the card is against the side rail.



If the aligner is adjusted too high above the card bed metal insert, the aligner will have no effect. The result is usually an off registration condition.



If the aligner is adjusted too low, card marking or feed checks will result.

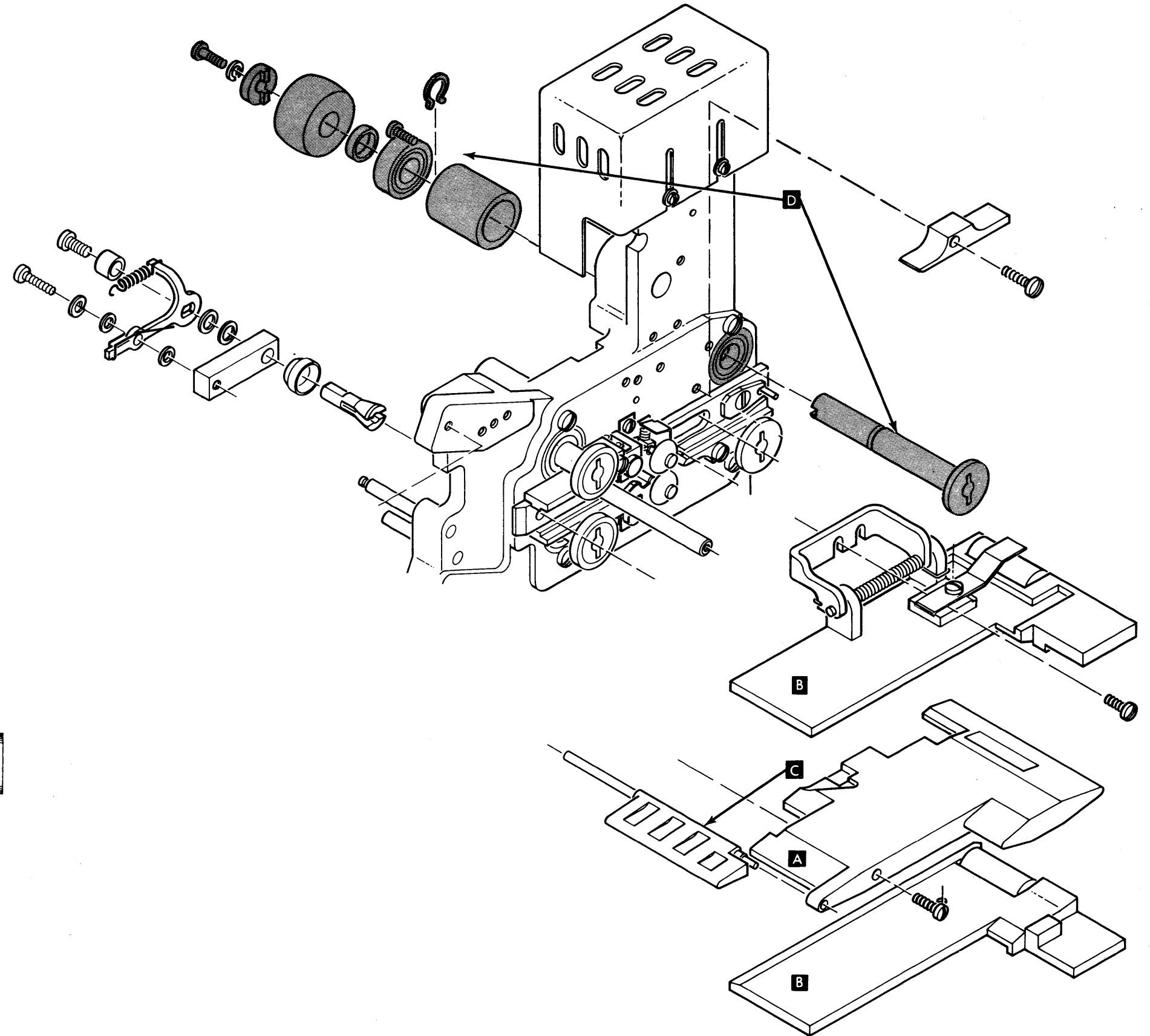
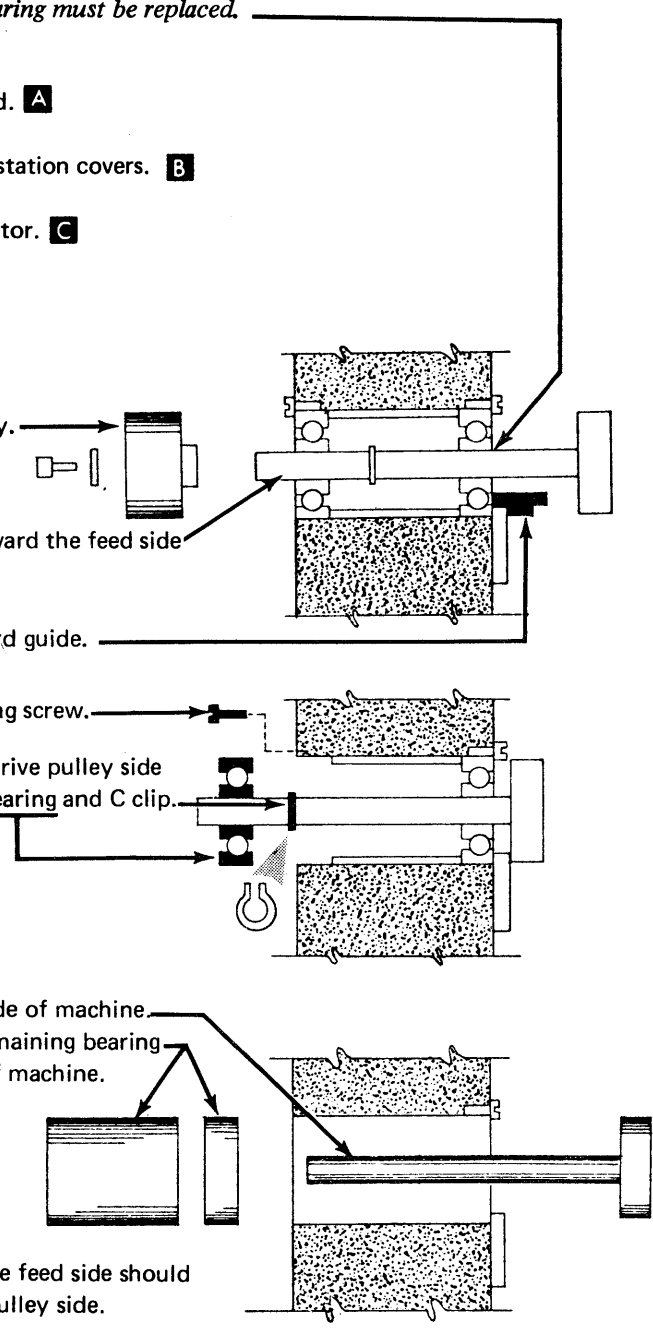


Rotate the roll with a small screw driver. A very slight drag should be felt.

WAIT STATION FEED ROLL REMOVAL

*NOTE: If shaft is removed, Bearing must be replaced.
Use Loctite grade "E".*

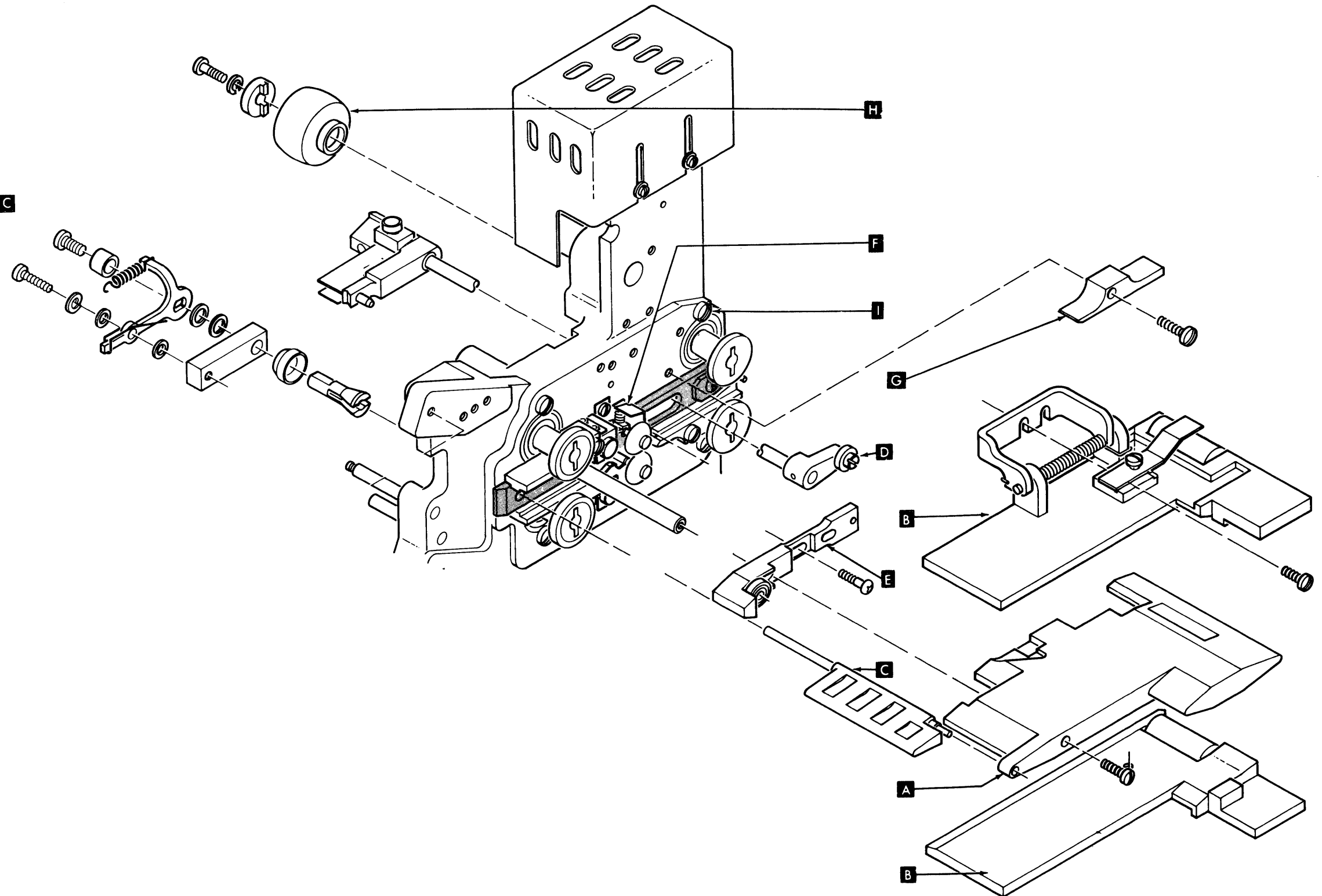
- 1** Remove wait station center bed. **A**
 - 2** Remove upper and lower wait station covers. **B**
 - 3** Remove wait station path selector. **C**
 - 4** Remove flat drive roll belt.
 - 5** Remove shaft: **D**
 - a. Remove drive roll pulley.
 - b. Drive feed roll shaft toward the feed side to break loose Loctite.
 - c. Remove wait station card guide.
 - d. Remove bearing retaining screw.
 - e. Drive feed roll toward drive pulley side of machine. Remove bearing and C clip.
 - f. Drive shaft out feed side of machine. Remove spacer and remaining bearing from the pulley side of machine.
- The new bearing for the feed side should be installed from the pulley side.
- 6** Reinstall feed roll by reversing above procedure. Bond new bearing to shaft using Loctite grade "E" taking care not to allow Loctite to enter bearing.
If one of the wait inject feed rolls is removed, check inject pressure roll adjustment.
 - 7** Replace center bed. **A** Replace and adjust upper and lower covers **B**, and path selector **C**



WAIT STATION REGISTRATION RAIL

REMOVAL

- 1 Remove wait station center bed. **A**
- 2 Remove upper and lower wait station covers (Refer to page 31 for adjustment). **B**
- 3 Remove punch unit (page 38).
- 4 Remove wait station path selector (page 30). **C**
- 5 Remove punch registration pressure roll arm (page 32). **D**
- 6 Remove minor card bed assembly. **E**
- 7 Remove wait station aligner rolls. (Refer to page 33 for adjustment). **F**
- 8 Remove four wait station card guides (Refer to page 31 for adjustment). **G**
- 9 Remove flat drive belt pulleys on 4 wait station feed rolls. **H**
- 10 Remove the 4 bearing retaining screws on card path side of feed rolls and pull the rail outward with all 4 feed roll shafts. **I**
- 11 Reinstall registration rail by reversing above procedure.
- 12 Adjust: (a) wait station inject feed rolls (page 31).
(b) aligner rolls (page 33).
(c) upper and lower wait station covers (page 31).



PUNCHING OPERATION

- Cards are punched column-group-by-column-group starting with column group one (card columns 1, 33, 65).
- Attachment energizes punch magnets.
- Punch unit sends punch check pulses to attachment.
- Punch emitters provide punch unit timing for attachment.

Card feeding through the punch unit is mechanically independent of card feeding elsewhere in the 5424.

Two magnetic emitters (Punch CB and Step CB) generate timing pulses that are sent to the attachment to be used in controlling punching and feeding in the punch unit.

When a punch command is received from the CPU with a card at the specified wait station and the unit in a ready status, the next step CB pulse starts the punch step counter in the attachment. The step counter controls the motion of the card through the punch station. Count 1 (CB pulse) picks the registration pressure roll, lowers the registration gate, and raises the eject pressure rolls. During the first four counts (four CB pulses), the card moves from the wait station to the punch registration gate. At the fourth count, the card is registered at column group 1 and is ready to be punched. At count five, as the first column group is punched, the stepper pressure roll is dropped onto the card and the registration gate is raised. The punch stepper roll drives the card, column-group-by-column-group, through the punch station. During count 36, column group 32 is punched and checked. At count 37, the eject pressure rolls drop to move the card out of the punch station.

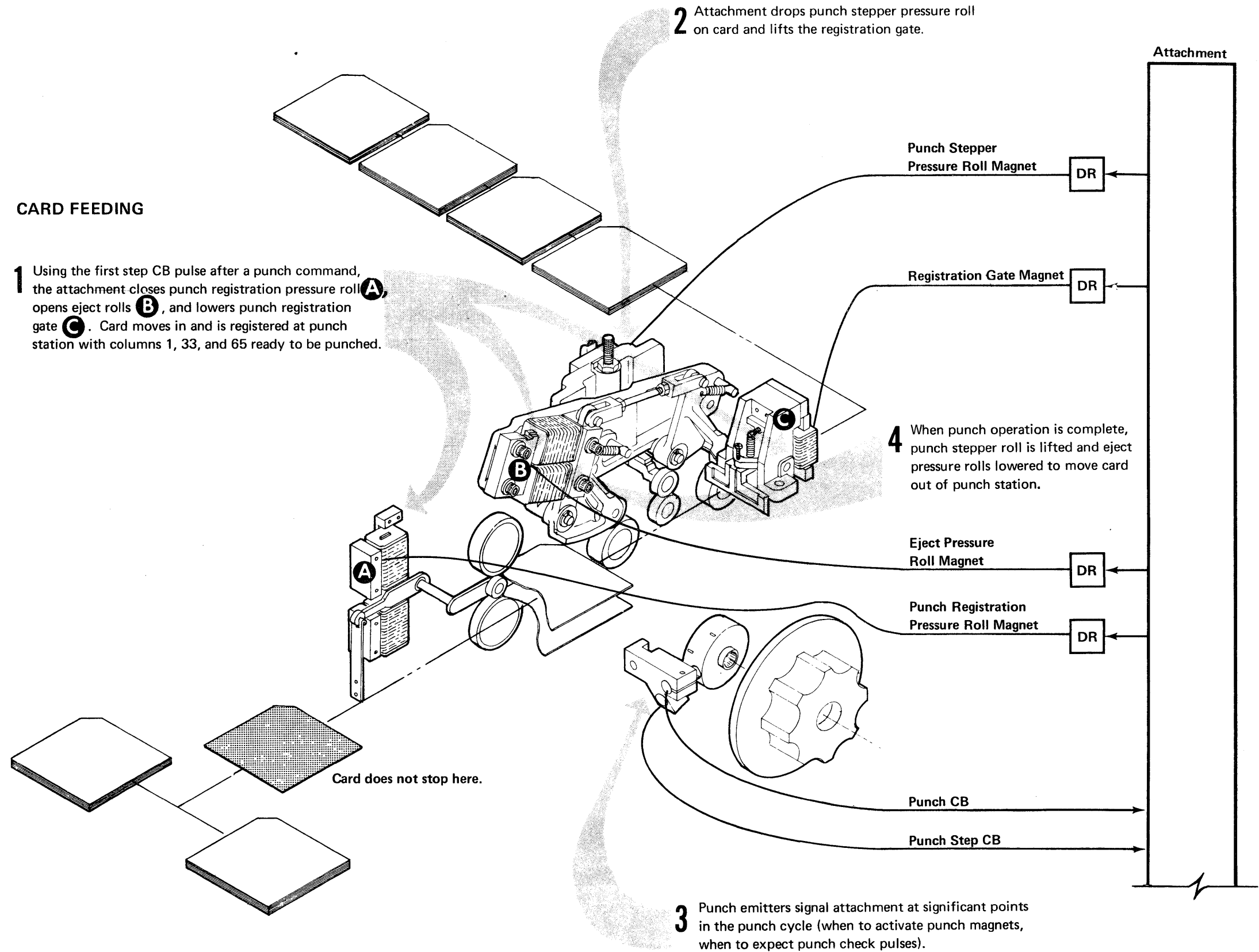
When a card is fed from the wait station, a card is also fed from the corresponding hopper after punch step count 4. That is, a punch command feeding a card from the upper wait station would initiate a card feed from the primary hopper.

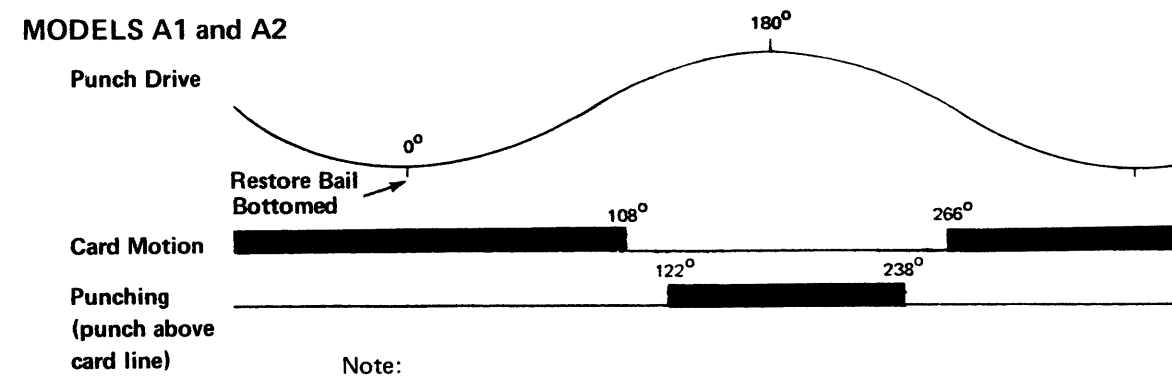
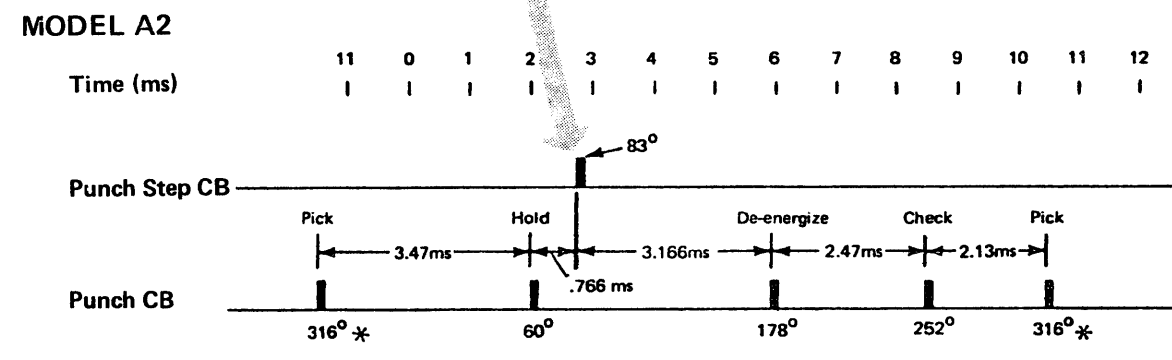
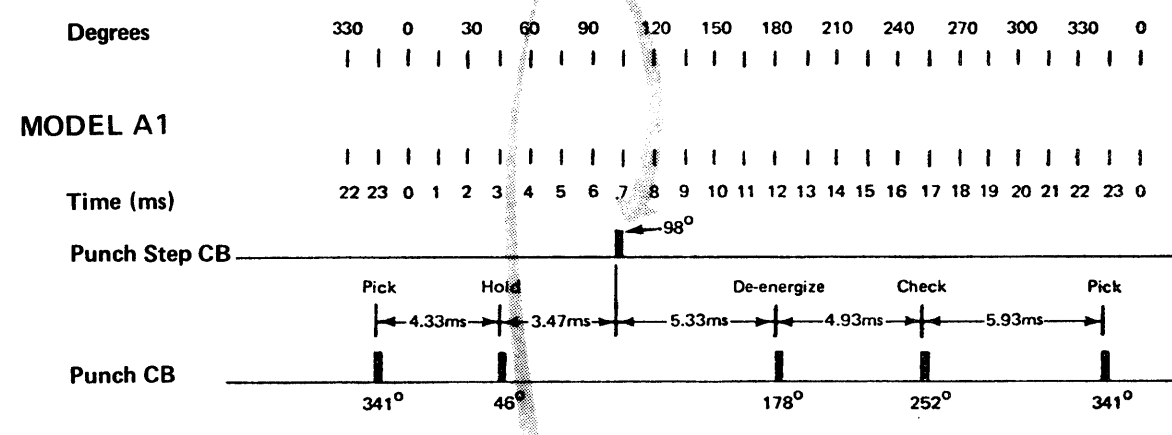
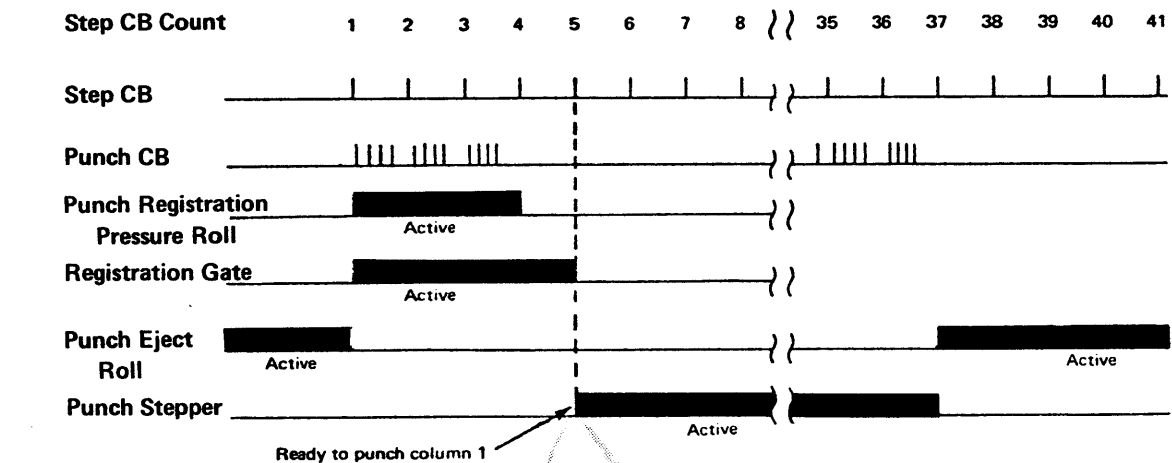
CARD FEEDING

1 Using the first step CB pulse after a punch command, the attachment closes punch registration pressure roll **A**, opens eject rolls **B**, and lowers punch registration gate **C**. Card moves in and is registered at punch station with columns 1, 33, and 65 ready to be punched.

2 Attachment drops punch stepper pressure roll on card and lifts the registration gate.

4 When punch operation is complete, punch stepper roll is lifted and eject pressure rolls lowered to move card out of punch station.





Note: See 5424 Attachment documentation for further details of a punch operation.

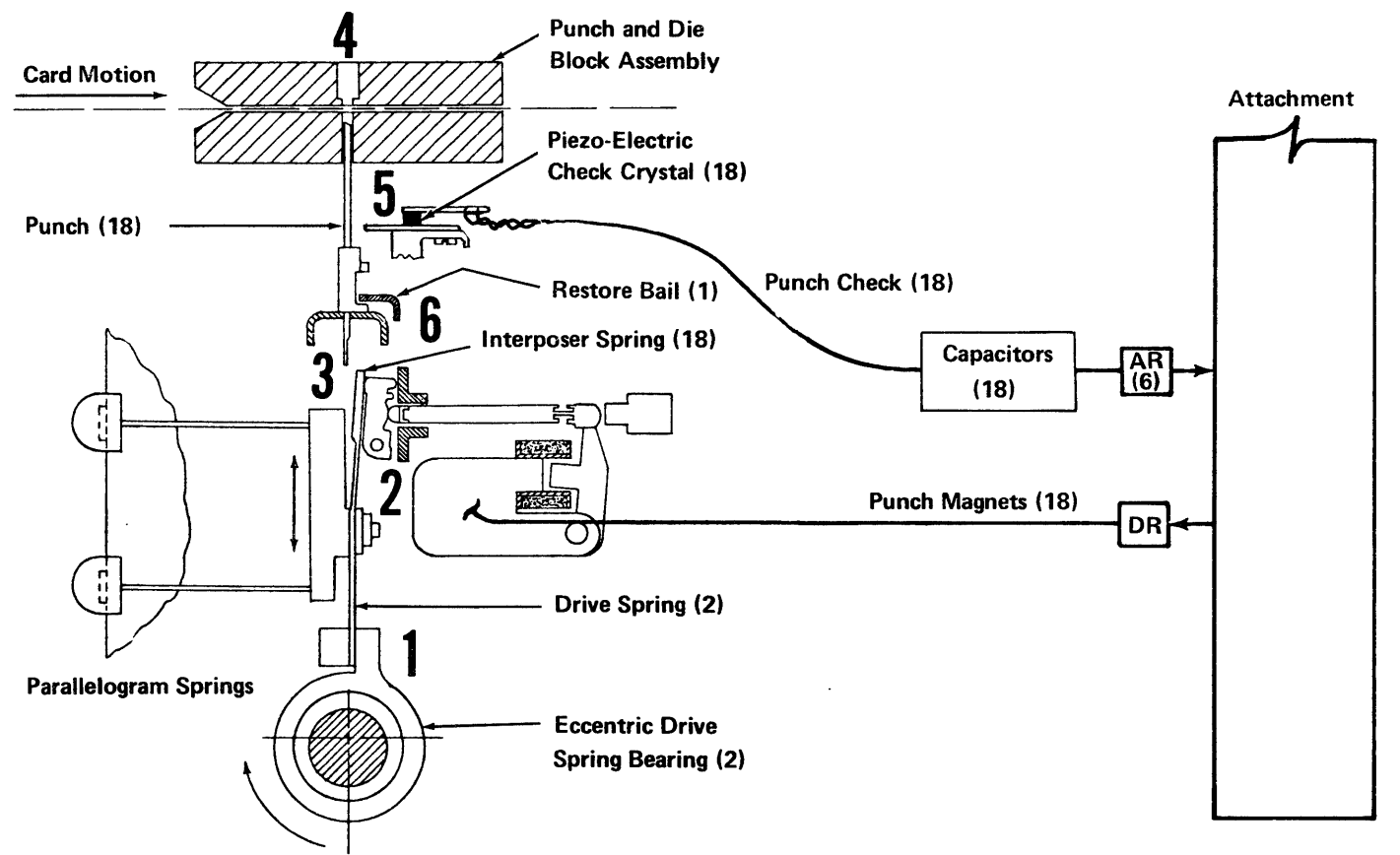
* Pick time is 300° on machines built after EC 818322.

CARD PUNCHING

The punch unit contains eighteen punches. Each punch is mechanically selected by a corresponding punch magnet. The punch magnets are energized by the attachment. A set of eighteen piezo-electric crystals checks the punch unit operation. As each selected punch is pulled out of the card, its associated crystal generates a pulse that is sampled later by the CPU. The CPU compares the check pulses with the punch data in storage, six bits at a time, to test for punching

errors. If the data does not compare, punching stops and the punch check status indicator is turned on in the attachment.

When the 5424 drive motor starts, regardless of what operation is to be performed, the attachment operates all punch positions several times before feeding the first card. This prevents sticking armatures (caused by dust or oil) during the following punch operation.



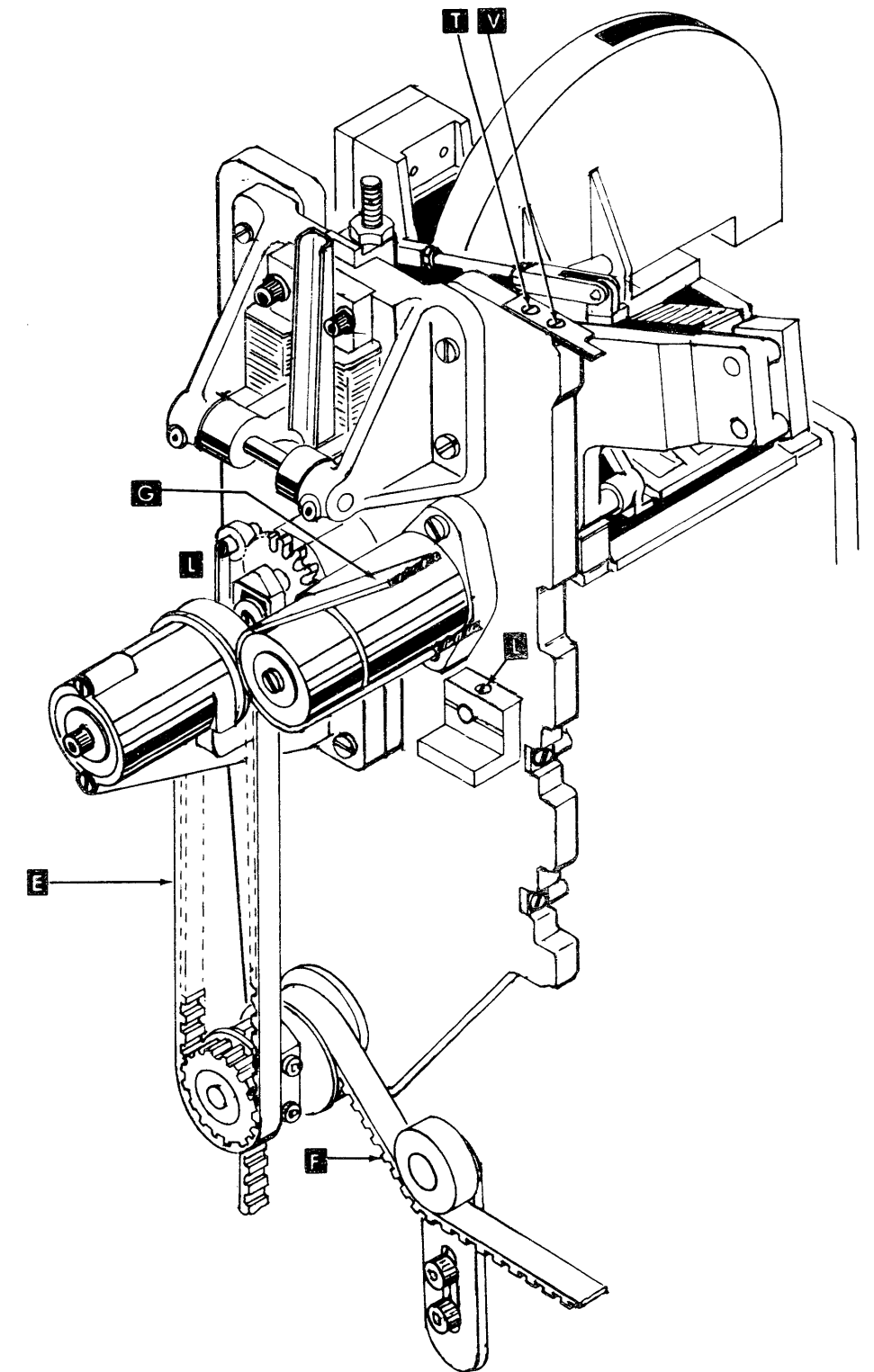
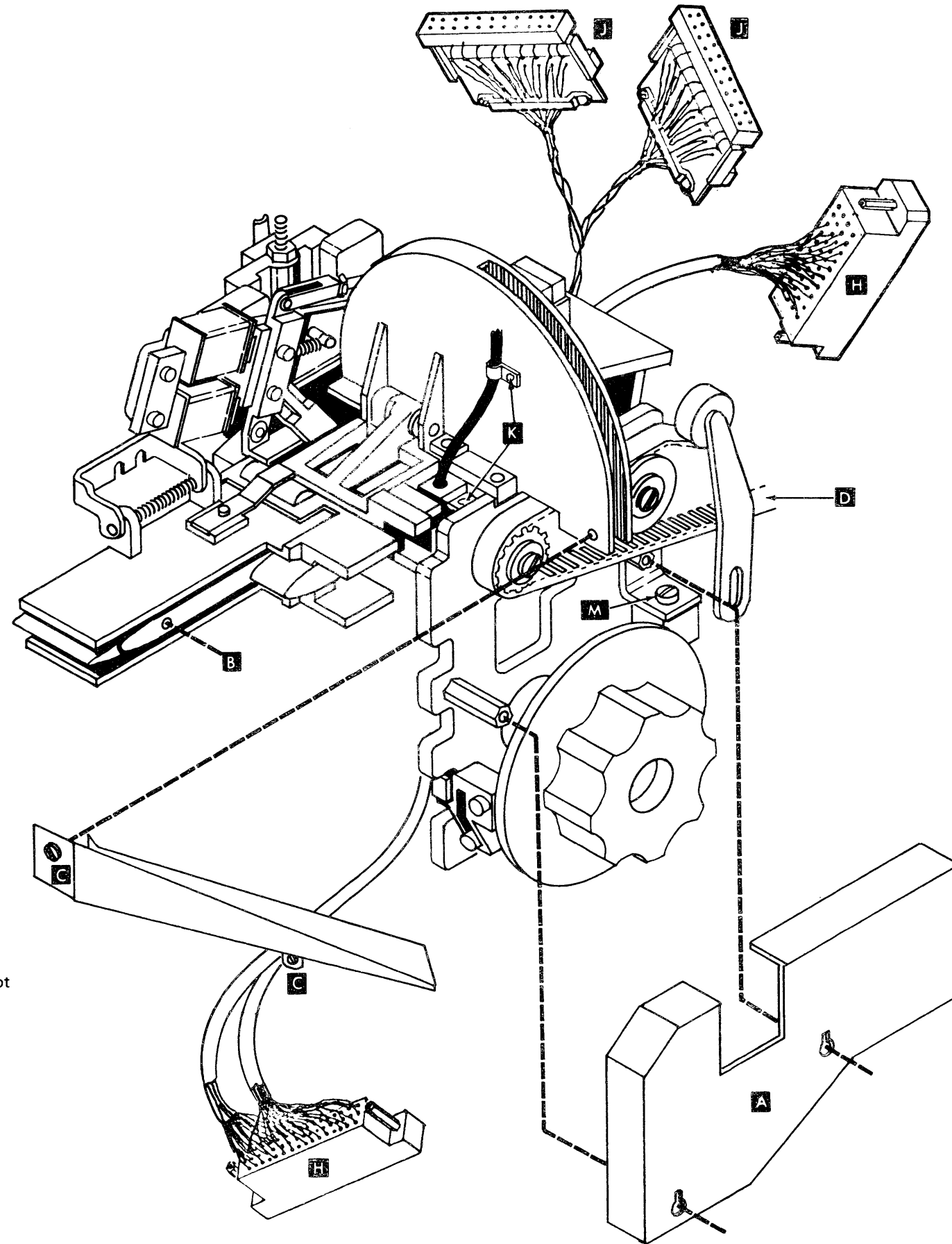
- 1 The eccentric punch drive shaft is connected to the drive spring assembly through two bearings.
- 2 The attachment under control of the punch CB energizes the required interposer magnets and the interposer spring is pushed under the waiting punch.
- 3 As the drive shaft turns, the drive spring, interposer spring fingers, and restore bail are positively driven up. The punch is pushed up by the interposer spring.
- 4 The card is punched.

- 5 A piezo-electric crystal is compressed for each hole punched. When the crystal is released, the capacitor is charged. This signal is compared at sample time, six bits at a time with CPU data for punch checking.
- 6 The downward motion of the restore bail pulls the punches out of the card. The interposer springs are under tension toward the magnets. This tension forces the magnet armature and interposers to return to the right, and the interposer spring moves out from under the punch.

PUNCH UNIT REMOVAL

The complete punch station including chip housing, pressure roll assemblies, registration gate, and stepper assembly, is removed as one physical unit.

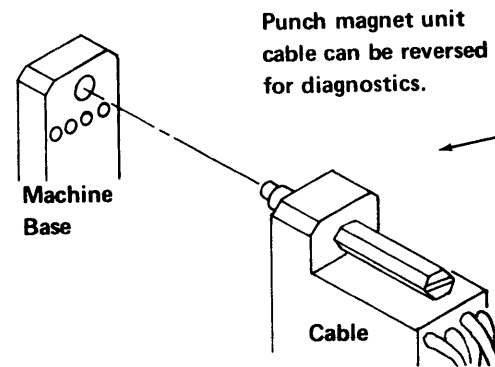
- 1 Remove safety covers. **A**
- 2 Remove wait station center bed. **B**
- 3 Remove chip chute mounting screws. **C**
- 4 Remove:
 - a. Eject drive belt. **D**
 - b. Stepper drive belt. **E**
 - c. Punch drive belt. **F**
 - d. Flat feed roll drive belt. **G**
- 5 Disconnect:
 - a. Two punch connectors. **H**
 - b. Punch check connector paddle cards. **J**
 - c. Pre-punch fiber optic bundle **K** mounting block assembly (re-adjustment is not necessary if whole assembly is removed).
- 6 To simplify reinstallation, check for correct position of the punch unit **P** **Q** Facing page
- 7 Loosen the two punch unit pin clamping screws. **L** Do not loosen the other four screws. Remove screw **T**. Loosen and pivot holding clamp on center screw **V**.
- 8 Remove punch unit mounting screw. **M**
- 9 With pre- and post-punch card covers held open, pull punch unit out to clear mounting pins, and then lift unit from machine.



PUNCH UNIT RE-INSTALLATION

Note: Installation may be simplified by tying pre-punch and post punch covers open.

- 1 Lower punch unit into machine.
- 2 Slide punch unit pins into clamps. **R**
- 3 Re-install punch unit mounting screw. **M**
Do not tighten this screw.
- 4 Hold punch unit firmly against locating tabs **R** and tighten the three punch unit mounting screws. **L M**
Replace holding screw **T** and, while holding top of punch unit firmly in place, tighten both screws. **T V**
(Facing page)
- 5 Connect:
 - a. Fiber optic bundle assembly. **K**
 - b. Punch check connectors. **J**
 - c. Two punch connectors. **H**

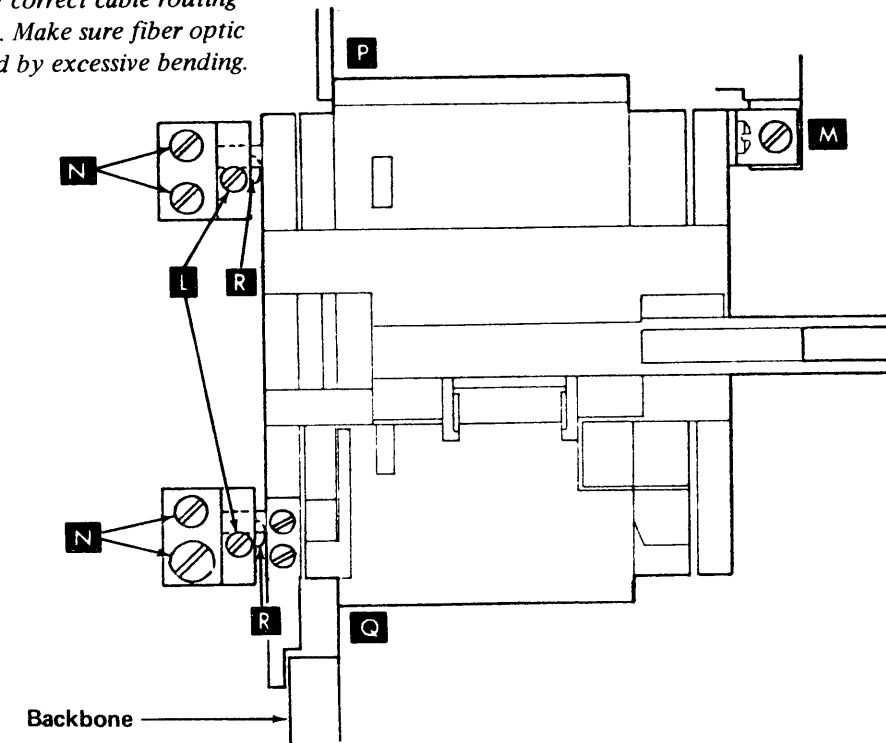


- 6 Re-install:
 - a. Flat feed roll drive belt. **G**
 - b. Punch input drive belt. **F**
 - c. Punch stepper drive belt. **E** Be sure that pulley and housing timing marks align at 188 degrees.
 - d. Punch eject drive belt. **D**
 Belt adjustments can be found on page
- 7 Re-install chip chute. **C**
- 8 Re-install wait station center bed. **B**
- 9 Check punch unit under dynamic conditions.
- 10 Re-install safety covers.

NEW PUNCH UNIT INSTALLATION

- 1 Loosen the rear mounting bracket screws. **N**
(This loosens the brackets so that the punch unit can be aligned with the wait station and corner station guide rails.)
- 2 Install the new punch unit.
- 3 Hold punch entrance card bed against wait station rail **Q** and punch exit card bed against corner station rail **P** while re-installing and tighten mounting screw. **M**
- 4 Push rear mounting brackets against punch unit and tighten 4 mounting bracket screws. **N**
- 5 Hold punch unit firmly against locating tabs **R** and tighten the two punch unit mounting screws. **L**
- 6 Connect:
 - a. Fiber optic bundle assembly. **K** (Facing page)
 - b. Punch check connectors. **J**
 - c. Two punch connectors. **H**
- 7 Re-install:
 - a. Flat feed roll drive belt. **G**
 - b. Punch input drive belt. **F**
 - c. Punch stepper drive belt. **E** Be sure that pulley and housing timing marks align at 188 degrees.
 - d. Punch eject drive belt. **D**
 Belt adjustments can be found on page
- 8 Re-install chip chute. **C**
- 9 Re-install wait station center bed. **B**
- 10 Check post punch cover adjustment.
- 11 Perform Card Sensor Adjustment.
- 12 Check punch unit under dynamic conditions (Refer to page 57).
- 13 Re-install safety covers.

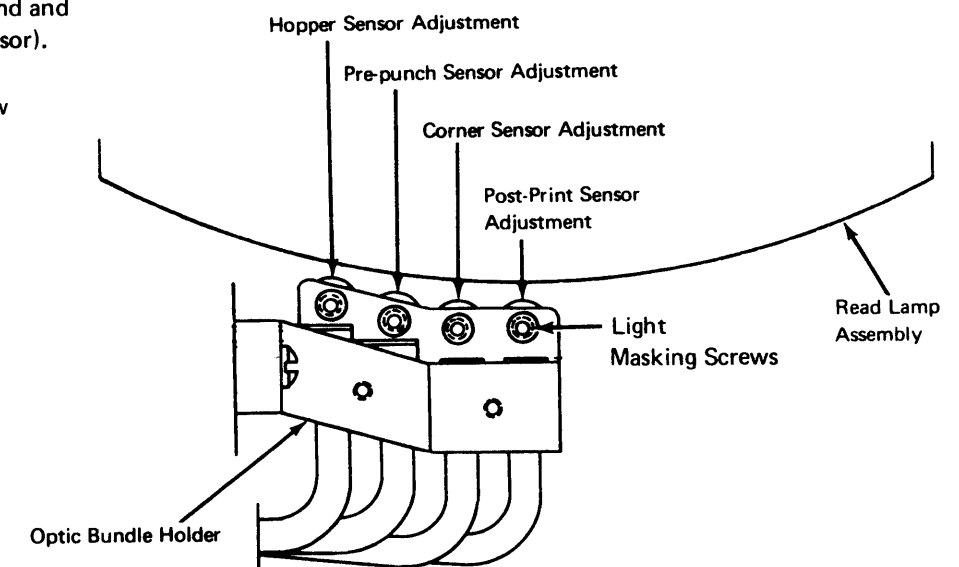
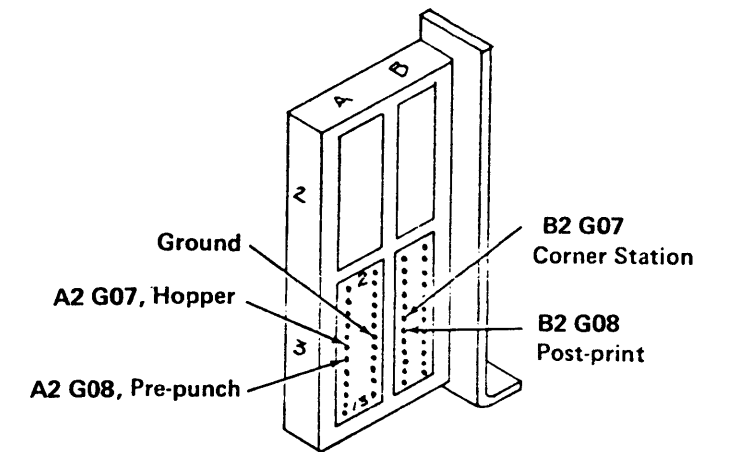
CAUTION: Check for correct cable routing and for pinched wires. Make sure fiber optic bundle is not damaged by excessive bending.



CARD SENSOR

ADJUSTMENT

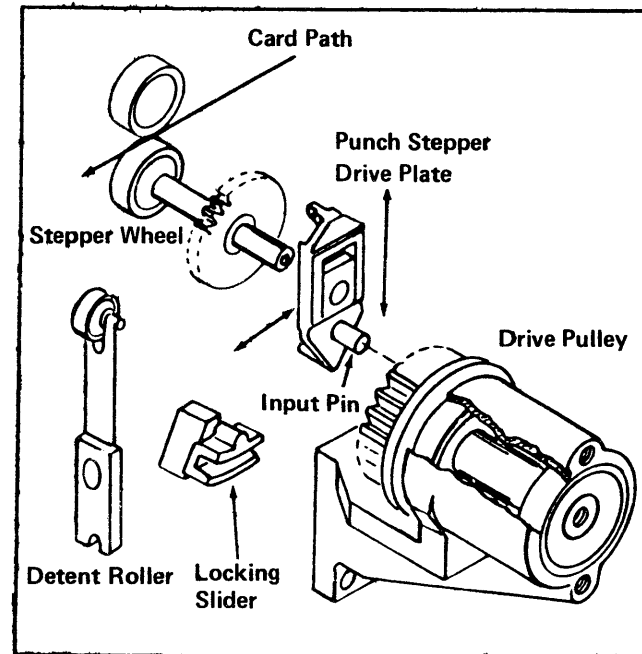
- 1 Turn off machine power and remove two punch check/card sensor amplifier cards (located behind chip box).
- 2 Make sure input ends of light pipes are clean.
- 3 Turn on machine power.
- 4 Connect milliammeter positive lead to ground and negative lead to A3B08 (pre-punch card sensor).
- 5 Adjust pre-punch sensor light masking screw for a milliammeter reading of 450 to 550 microamps if room temperature is between 67 degrees and 77 degrees F. (If temperature is outside this range, refer to chart on page 27).



PUNCH STEPPER ASSEMBLY

PUNCH STEPPER OPERATION

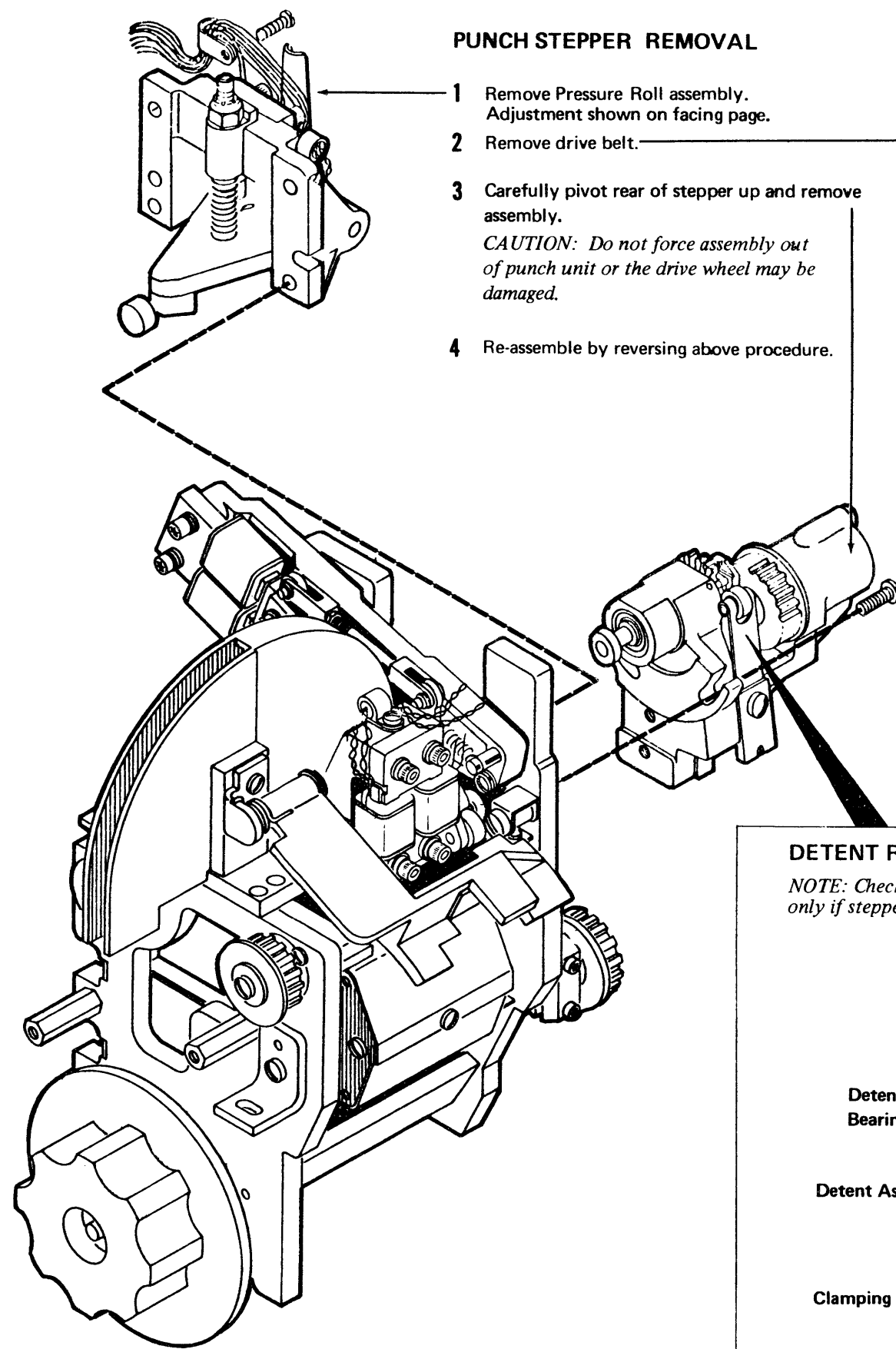
The stepper drive assembly is used to furnish incremented motion to the card during a punch operation. After the card is registered at the punch station, the punch stepper pressure roll is lowered against the card. The stepper drive pulley is driven by a timing belt from the punch shaft and is timed so that the punches are below the card line before the card is moved. The input pin fits into an off-center bearing in the back of the drive pulley. When the pulley rotates, it applies a circular motion to the ends of the drive plate. The top drive pin moves the stepper wheel one tooth per revolution of the drive pulley. The bottom stud moves the Locking Slider in a vertical motion.



While the drive pin is engaged with the stepper wheel the Locking Slider is down. The drive pin then moves out of the wheel and the Locking Slider moves in between two teeth. This prevents stepper damage if machine trouble causes the eject pressure rolls to drop, or if a card jam occurs. The detent roller is used to hold the card in an accurate position for punching.

PUNCH STEPPER REMOVAL

- 1 Remove Pressure Roll assembly. Adjustment shown on facing page.
- 2 Remove drive belt.
- 3 Carefully pivot rear of stepper up and remove assembly.
CAUTION: Do not force assembly out of punch unit or the drive wheel may be damaged.
- 4 Re-assemble by reversing above procedure.



CARD STEPPER TO PUNCH SHAFT TIMING

Set handwheel at 188° and align these two timing marks.

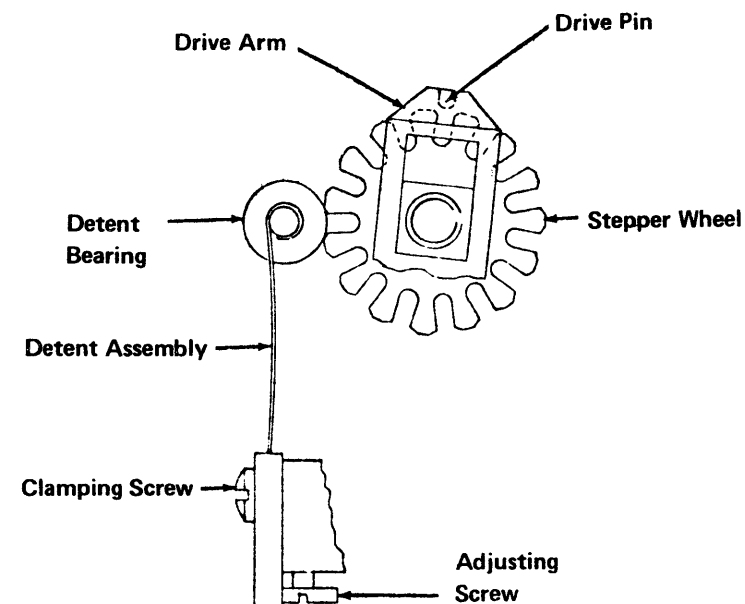
STEPPER BELT TENSION

- 1 Loosen screws 1/8 turn.
- 2 Rotate stepper assembly until 450 Grams of pressure results in 0.125" ± 0.025" (3,2mm ± 0,6mm) belt deflection.
- 3 Check timing marks at 188°.

Note: If the stepper position is changed, check the pressure roll adjustment.

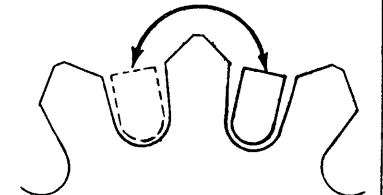
DETENT ROLL ADJUSTMENT

NOTE: Check and adjust detent roll only if stepper parts are replaced.



- 1 Turn stepper pulley in both directions while observing stepper drive pin.
- 2 Adjust detent roll so that drive pin enters adjacent stepper wheel slots the same depth before stepper wheel motion begins.

Drive Pin Motion



- 3 Re-check adjustment after clamping screw has been tightened.

STEPPER PRESSURE ROLL ASSEMBLY

The punch stepper pressure roll is located at the punch station and controls incremental card feeding on a punch operation. After the card is registered at the punch station, the pressure roll magnet is de-energized, and spring tension causes the pressure roll to drop onto the card. The feed roll below the card provides the incremented motion necessary to stop the card for punching each column. After the last column is punched, the pressure roll is raised by picking the magnet, and the eject pressure rolls are dropped to feed the card out of the punch station.

CAUTION: Do not force oversized feeler gage between die and stripper.

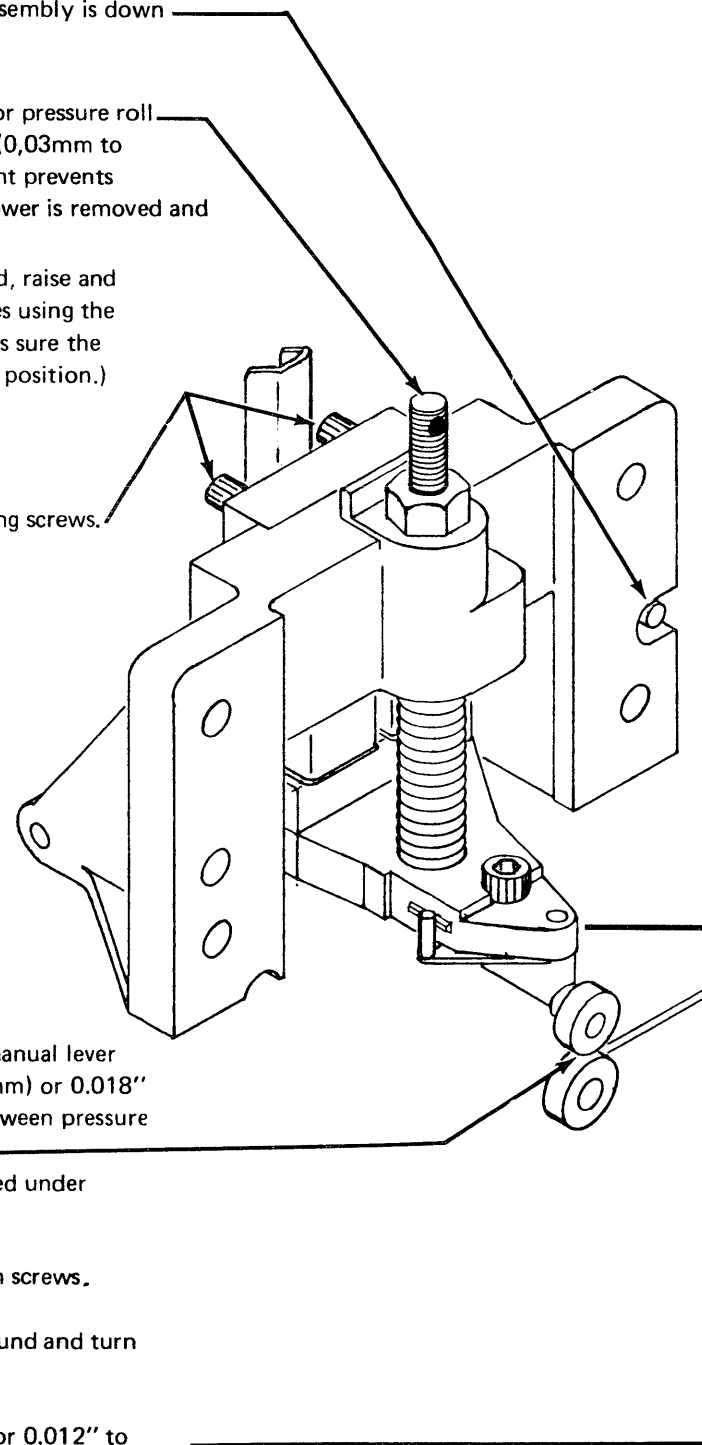
SERVICE CHECK:

- 1 With magnet de-energized, check pressure roll gap for 0.001" to 0.003" (0,03 mm to 0,08 mm).
- 2 Jumper TPB26-G to ground (Picks magnet) and check pressure roll gap for 0.012" to 0.018" (0,30 mm to 0,46 mm).
- 3 Remove jumper and check dynamic punch registration. (Refer to page 57).

STEPPER PRESSURE ROLL ADJUSTMENT:

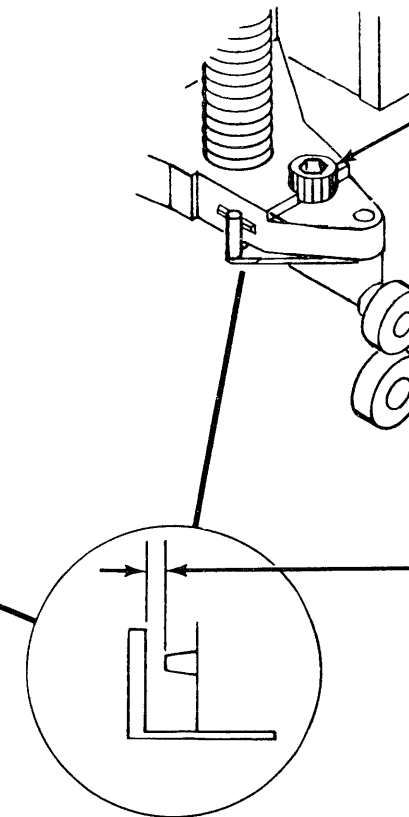
- 1 Make sure pressure roll assembly is down against locating pin.
- 2 Adjust downstop screw for pressure roll gap of 0.001" to 0.003" (0,03mm to 0,08mm). This adjustment prevents feed roll damage when power is removed and the pressure roll drops.
If adjustment was changed, raise and lower the roll several times using the manual lever. (This makes sure the holding nut is in its home position.) Then re-check the gap.
- 3 Loosen 2 magnet mounting screws.

- 4 Raise pressure roll with manual lever and insert 0.016" (0,41 mm) or 0.018" (0,46 mm) feeler gage between pressure roll and feed roll (Feeler gage can be inserted under pre-punch card cover.)
- 5 Lower magnet and tighten screws.
- 6 Jumper TPB26-G to ground and turn on machine power.
- 7 Check pressure roll gap for 0.012" to 0.018" (0,30 mm to 0,46 mm).



STEPPER PRESSURE ROLL SKEW ADJUSTMENT

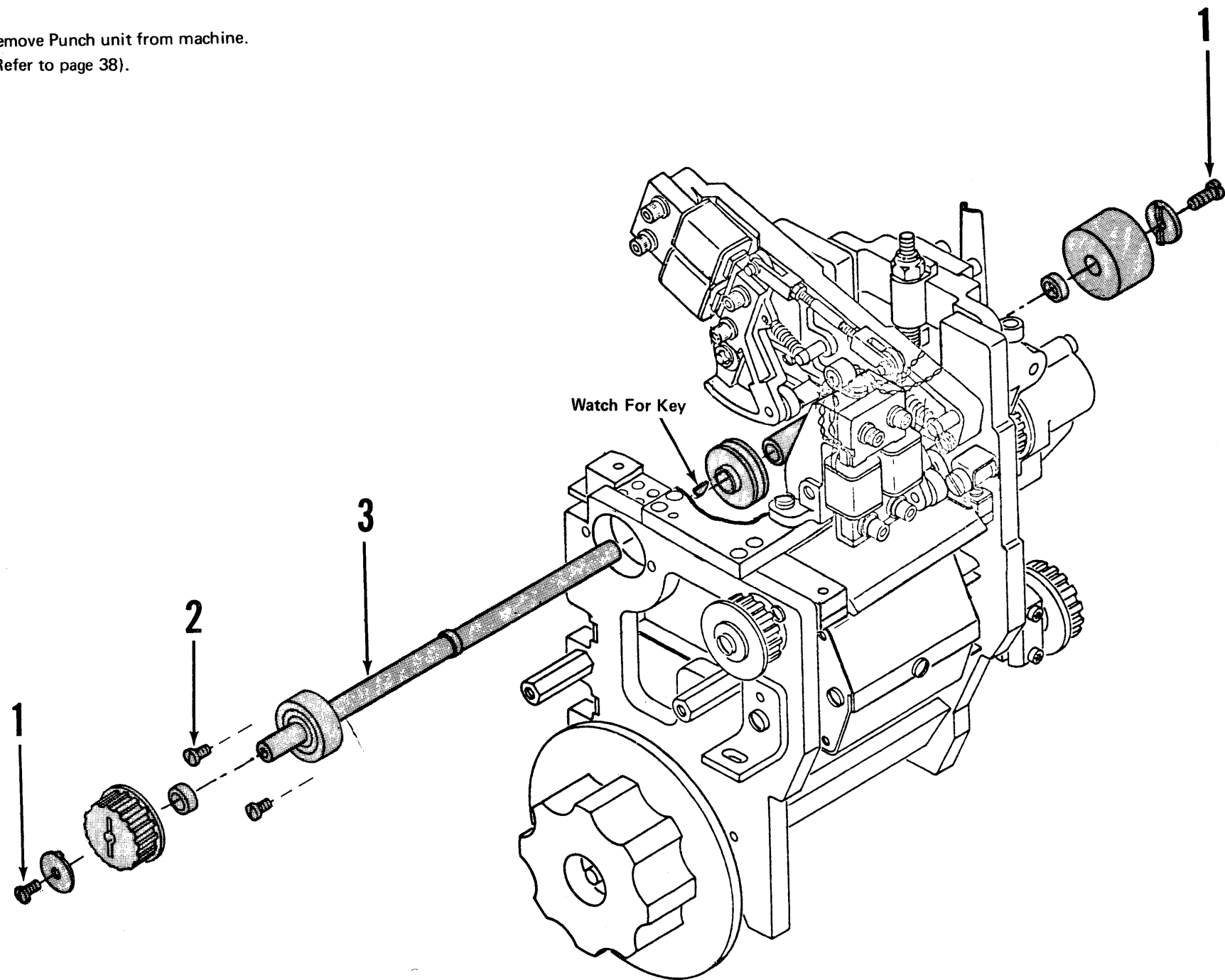
- Initial:**
- 1 Loosen pressure roll skew adjusting screw.
 - 2 Set 0.009" (0,23mm) gap here.
- Final:**
- 3 Check dynamic punch registration. (Refer to page 57).



FIRST EJECT FEED ROLL SHAFT

REMOVAL

Remove Punch unit from machine.
(Refer to page 38).

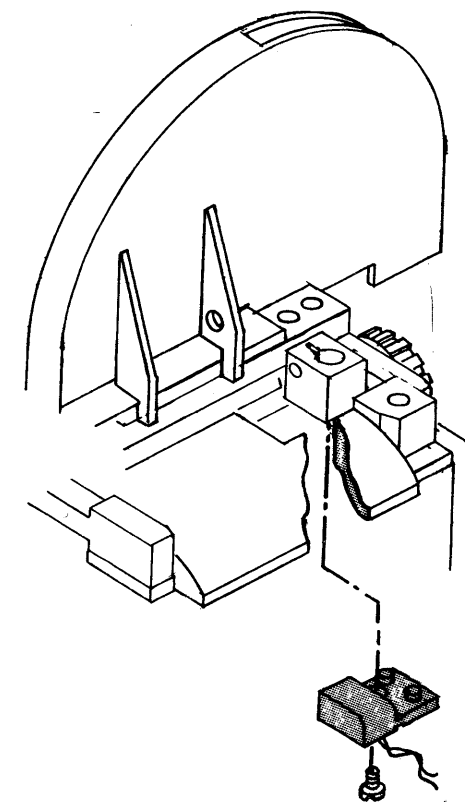


PRE-PUNCH CELL

REMOVAL

- 1 Remove first eject feed roll shaft.
- 2 Remove cell.

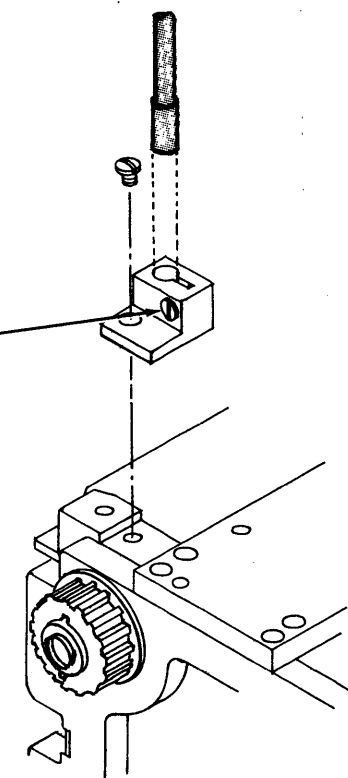
Note: If new pre-punch cell is installed, perform Card Sensor adjustment (Page 39).



PRE-PUNCH CELL LIGHT PIPE

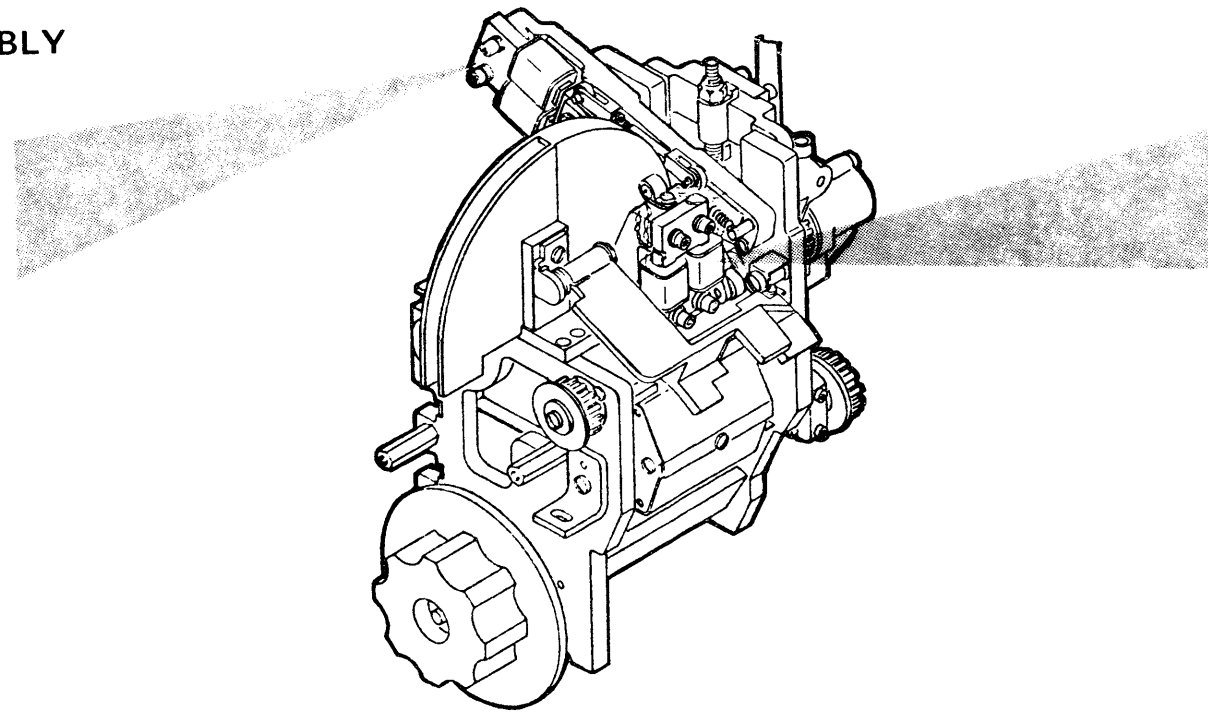
ADJUSTMENT

Push light pipe through holder until it is flush with bottom and tighten holding screw



PUNCH EJECT PRESSURE ROLL ASSEMBLY

The first and second punch eject pressure rolls are on either side of the punch stepper roll and control card feeding on a non-punch operation. The second roll is used also to eject the card after a punch operation. Spring tension pulls the rolls down against the card and the eject pressure roll magnet is used to raise them.



SERVICE CHECK

Hold magnet attracted or jumper TPB27-H to ground and check adjustments.

ADJUSTMENT

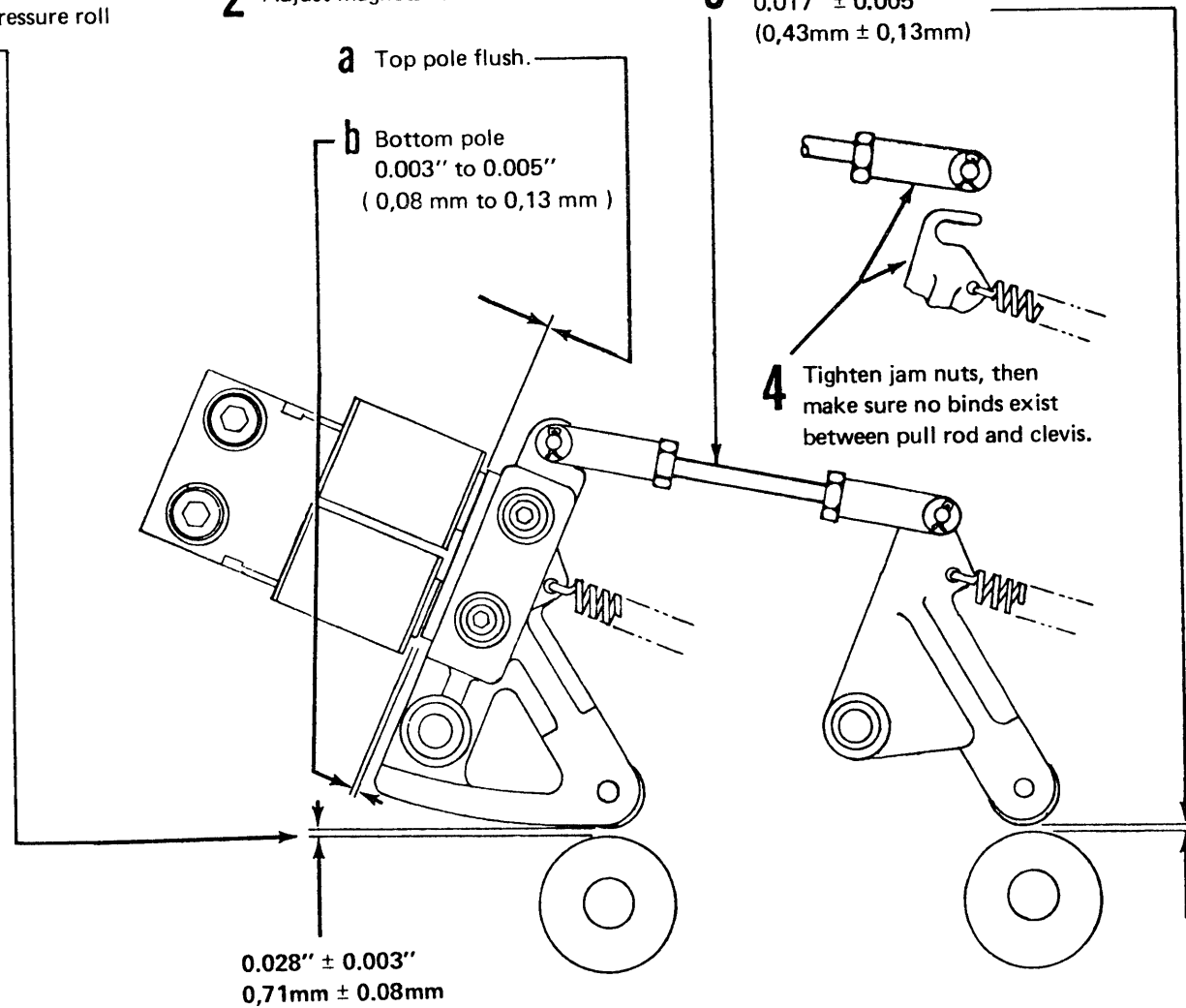
1 Place 0.28" (0,71 mm) feeler gage between pressure roll and feed roll.

2 Adjust magnets for:

- a Top pole flush.
- b Bottom pole 0.003" to 0.005" (0,08 mm to 0,13 mm)

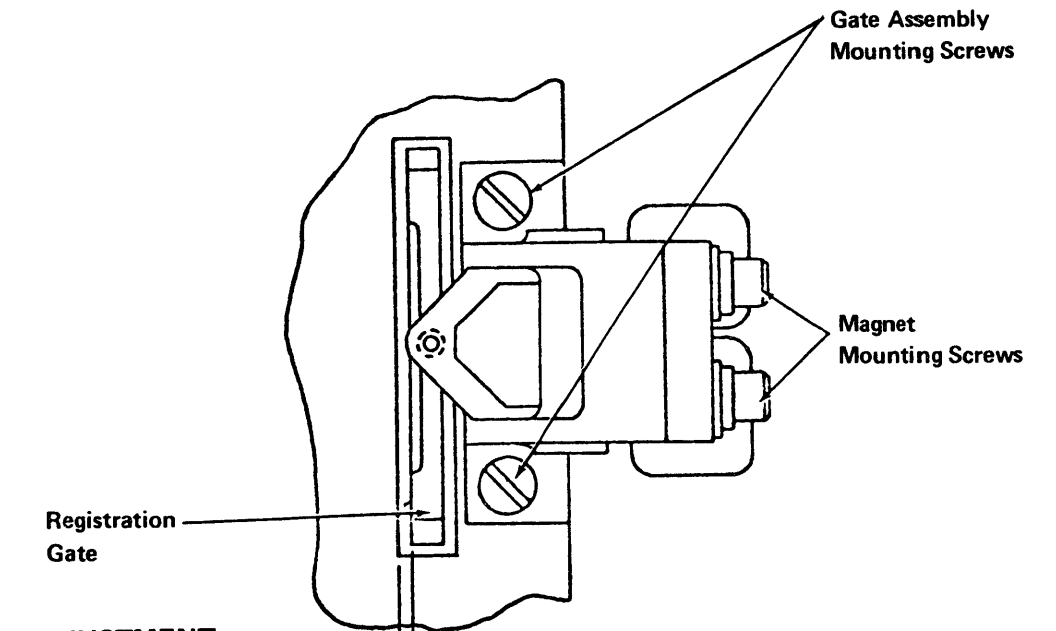
3 Adjust pull rod for 0.017" ± 0.005" (0,43mm ± 0,13mm)

4 Tighten jam nuts, then make sure no binds exist between pull rod and clevis.



PUNCH REGISTRATION GATE

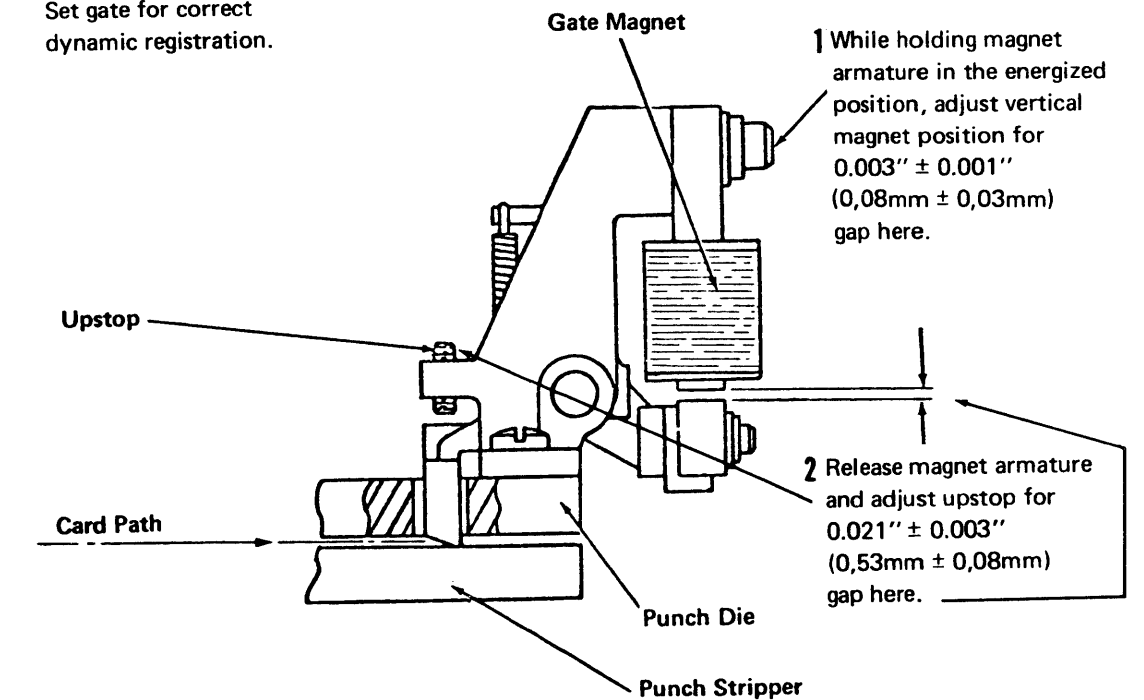
The punch registration gate is used to establish serial punch registration on column 1. When the punch registration gate magnet is energized, the punch registration feed roll moves the card in against the gate.



ADJUSTMENT

1 Initial Adjustment: 0.093" ± 0.003" (2,36mm ± 0,08mm) at both ends of gate.

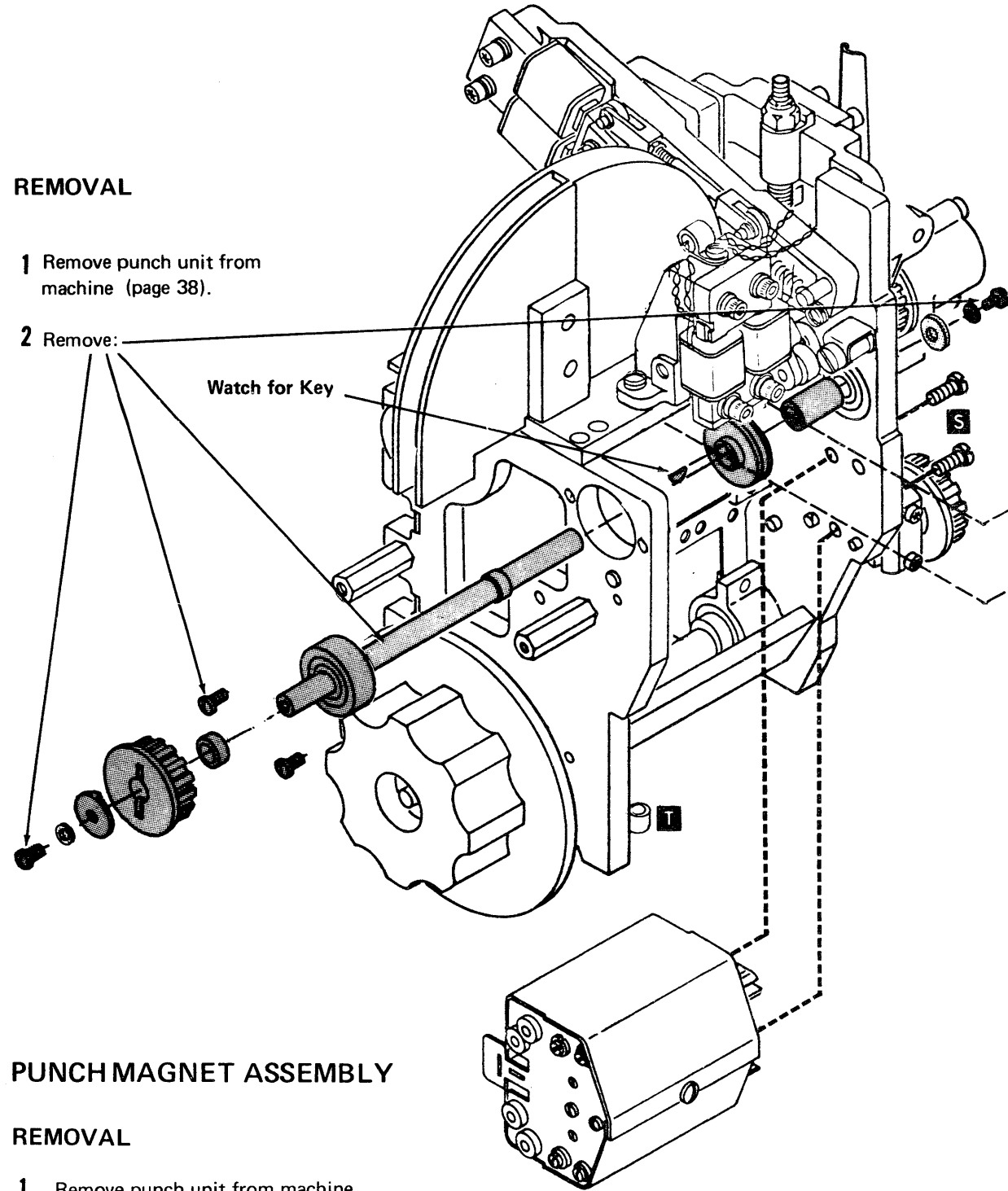
2 Final Adjustment: Set gate for correct dynamic registration.



SECOND EJECT FEED ROLL SHAFT

REMOVAL

- 1 Remove punch unit from machine (page 38).
- 2 Remove:



PUNCH MAGNET ASSEMBLY

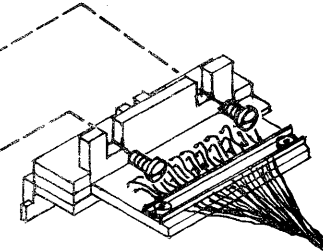
REMOVAL

- 1 Remove punch unit from machine (Refer to page 38).
- 2 Remove 2 holding screws. **S**
- 3 Carefully remove magnet assembly and cable clamp. **T**
- 4 When re-installing magnet assembly, refer to DETAIL **A** on facing page.

PUNCH CHECK ASSEMBLY

REMOVAL

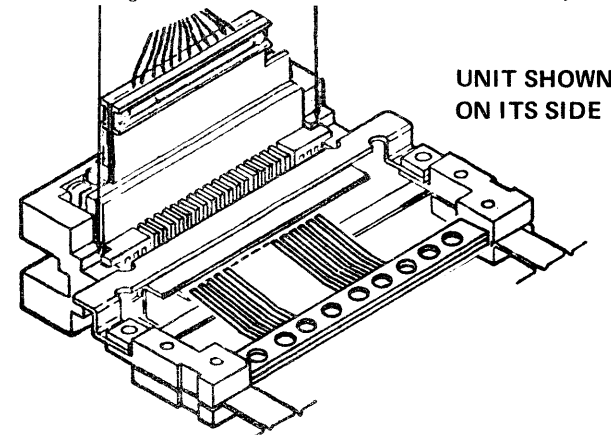
- 1 Remove punch unit from machine. (Refer to page 38)
- 2 Remove punch magnet assembly and cable clamp. **T** (For re-assembly, see DETAIL **A** on facing page.)
- 3 Remove second eject feed roll shaft.
- 4 Remove punch check assembly. (For re-assembly, see DETAIL **C**)
- 5 Re-assemble by reversing above procedure.



DETAIL C CHECK ASM' LOCATION

With a 0.002" (0,05 mm) feeler gage behind each locating ear, hold the assembly in place with light finger pressure. Alternately loosen and tighten the two mounting screws several times to work the assembly into its proper location.

There must be a gap between the assembly locating ears and the locating surface but it *cannot* exceed 0.002" (0,05 mm).



CAUTION: As the punch check assembly mounting screws are tightened, the assembly position may change. If this assembly is not in the correct position, one of two problems will occur:

- 1) If the check assembly locating ears are too far away from the locating surface, punches will flex the spring fingers too far and the spring will break.
- 2) If the assembly is positioned tightly against the locating surfaces the locating ears may be bent. The result will be weak crystal output and false punch checks.

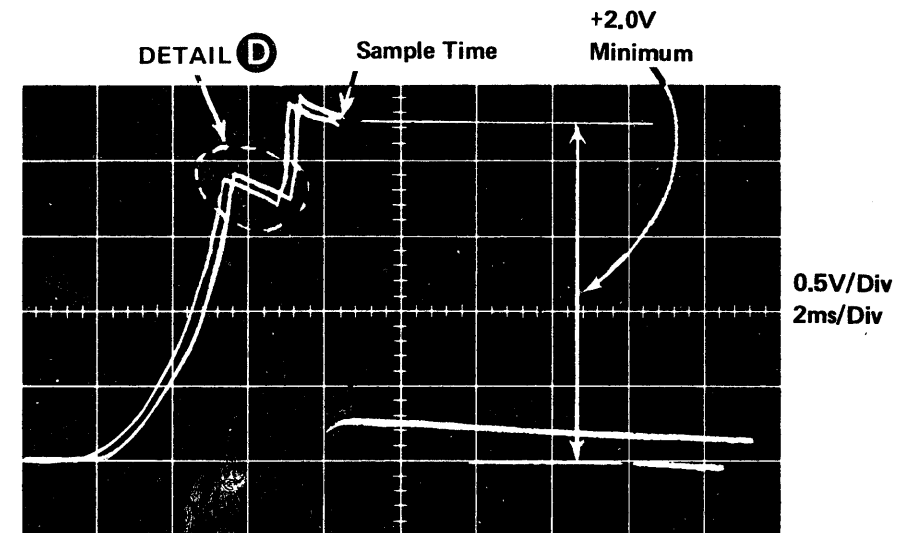
PUNCH CHECK SIGNAL

Due to the high impedance of the piezoelectric crystals used for punch checking, you cannot scope the crystal output with the cables loose. Leave check assembly cables plugged and plug applicable amplifier card into a card extender. Normal circuit shunt capacity will now minimize the scope loading effects and the desired crystal output can be checked at the input to the amplifier.

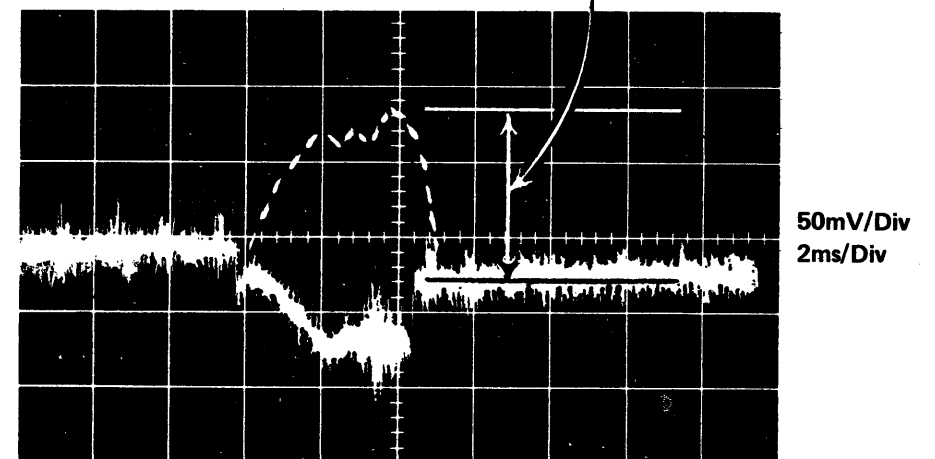
Use an oscilloscope with input capacity of 14 to 21 pf (Tektronix type 453 or 454) and a Tektronix type P6010 probe (X10).

Begin punching cards and check the desired crystal output for a minimum of 2.0V. (Because of scope loading, this reading actually indicates an output of 2.3V.)

DETAIL D shows the effect punch restore motion can have on the crystal output. This effect will not necessarily be so large on every signal checked.



This waveform shows the effect of crosstalk between check crystals that may be seen while scoping a position that is not punching. Crosstalk may be either positive or negative. Negative crosstalk will not cause problems. Positive crosstalk must be less than 0.4 V.



INDIVIDUAL PUNCH

REMOVAL

- 1 Remove punch unit
(Refer to page 38).
- 2 Remove punch magnet unit and cable clamp.
(For re-assembly see **DETAIL A**)

CAUTION: To prevent damage to the punch unit magnet assembly and interposer spring, make sure no magnet links snag between interposer spring fingers.

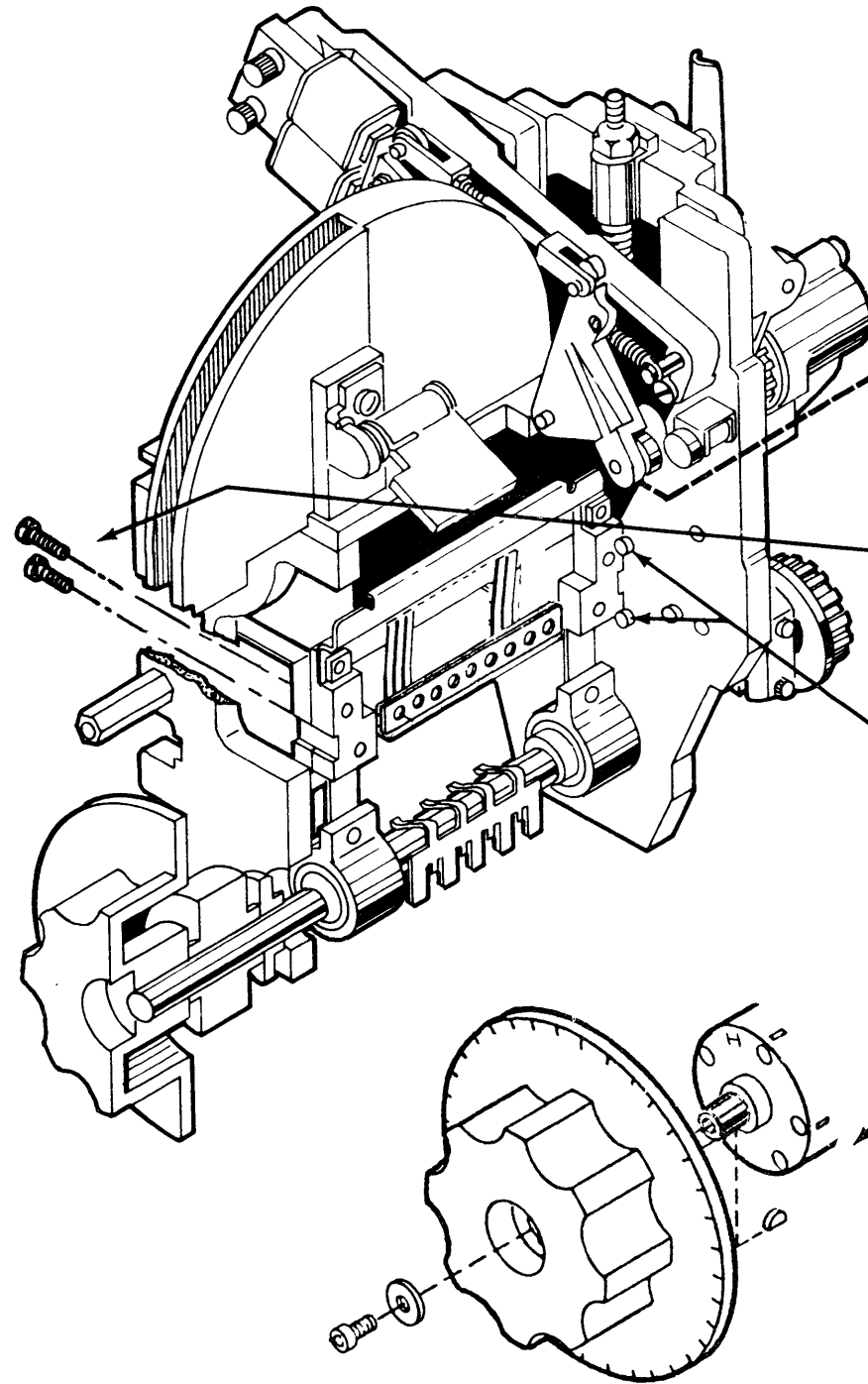
DETAIL A

While applying pressure at mounting end only, make sure locating surfaces touch before tightening screws.

Magnet unit does not touch here.

DETAIL B

Center interposer spring under punches and tighten 4 screws removed in step 3.



- 3 Remove 4 socket head screws
(For re-assembly, see **DETAIL B**)

- 4 Pivot drive spring assembly from under punches

4a OLD STYLE UNIT;

drive these pins from the outside in and throw away.
(2 on each side)

Remove handwheel to drive front pins.

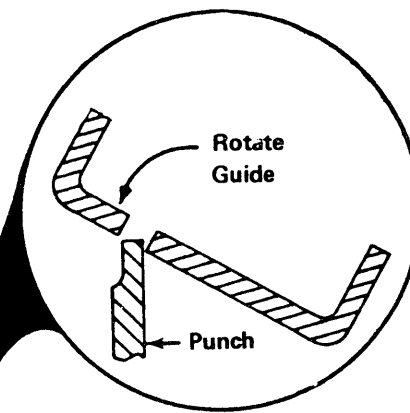
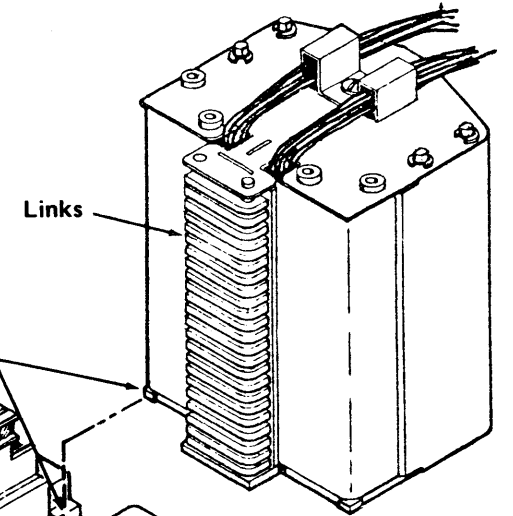
- 5 Turn punch unit upside-down and remove guide mounting screws

- 6 Replace desired punch

- 7 Replace punch guide:

7a Push punches into Die and Stripper

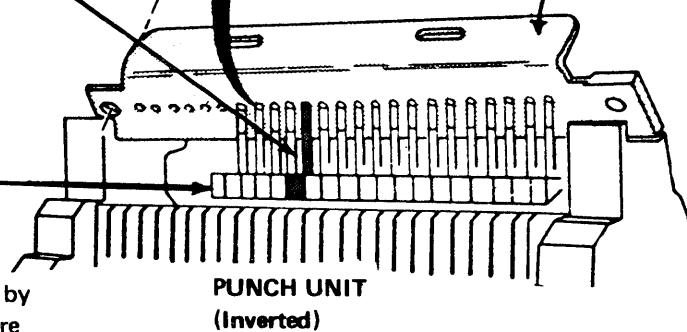
- 8 Re-assemble punch unit by reversing above procedure



7b Engage punch tips in guide holes

7c Rotate guide forward and down.

7d Install mounting screws



PUNCH UNIT (Inverted)

DIE AND STRIPPER (PUNCH DIE ASSEMBLY)

The die and stripper is replaced as an assembly that includes the guide rails, a support casting, grease wicks and their attaching hardware, punch check assembly, card sensor, punches and card beds.

REMOVAL

1 Remove Punch Unit From Machine.
(page 38)

2 Remove Chip Housing Adjustment shown on facing page DETAIL **A**

5 Remove Eject Pressure Roll Asm.

6 Remove CB block assembly to relieve cables.

7 Remove Cable Clamp

3 Remove Stepper Pressure Roll Asm. Adjustment shown on facing page DETAIL **E**

4 Carefully pivot stepper up and remove from punch unit.

CAUTION
When re-installing, do not force stepper assembly into punch unit or the drive wheel may be damaged.
Adjustment shown on facing page DETAIL **F**

8 Remove Magnet Asm. Re-assembly shown on facing page DETAIL **D**

CAUTION

Do not loosen the four socket head screws that secure the die and stripper to the card guide rail and outer card bed mounting rail. These four screws have their heads filled. Loosening these screws would destroy the die and stripper to rail alignment.

Note: If new cell is installed, perform Card Sensor adjustment

12 Remove Die and Stripper Block:

- (a) Remove mounting screws. Lift assembly up and pivot out from under restore bail.
- (b) Remove pre-punch cell.

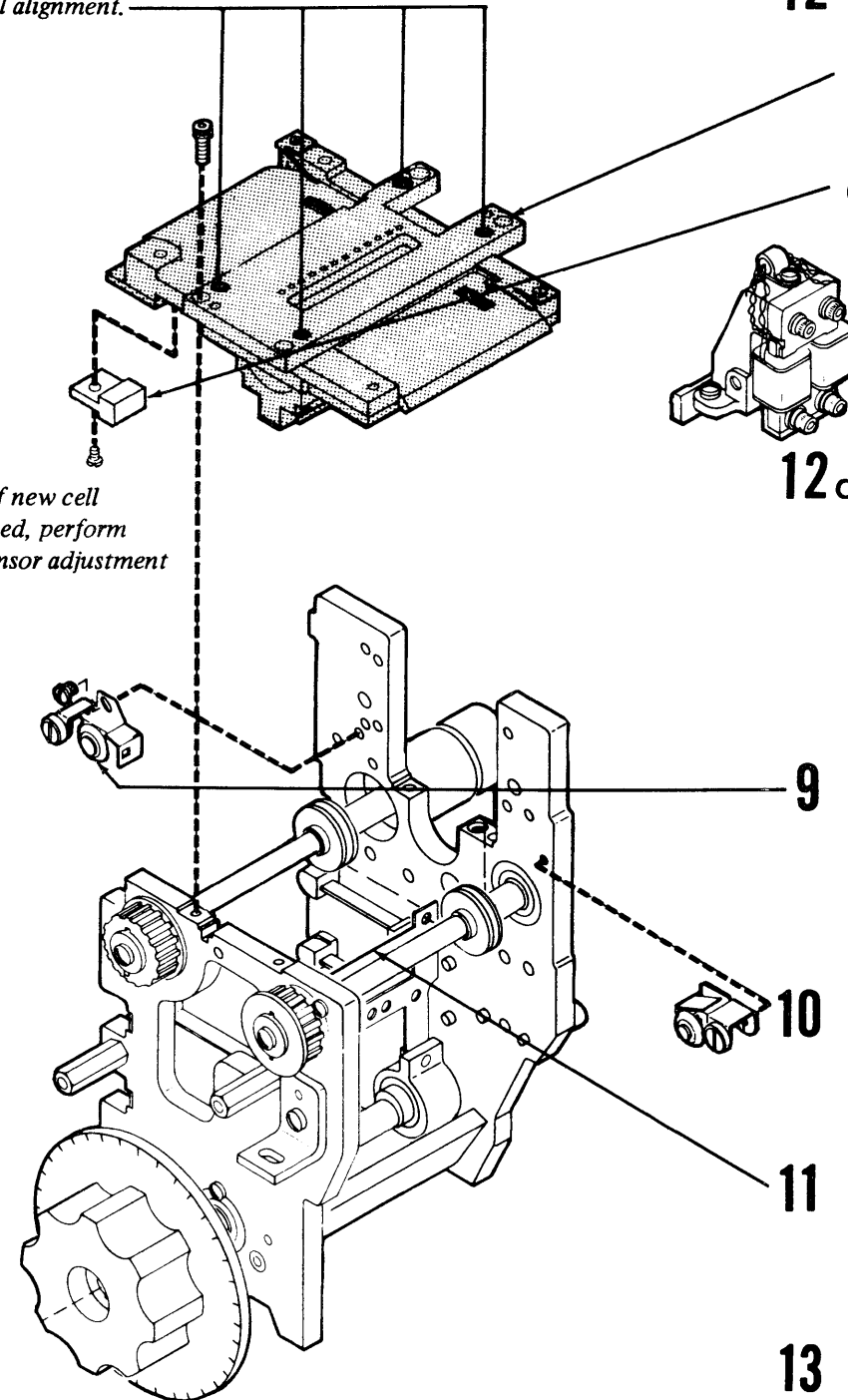
12a If new block is to be installed, remove Registration Gate Assembly. Adjustment shown on facing page DETAIL **B**

9 Remove Pre-Punch Aligner. Adjustment shown on facing page DETAIL **C**

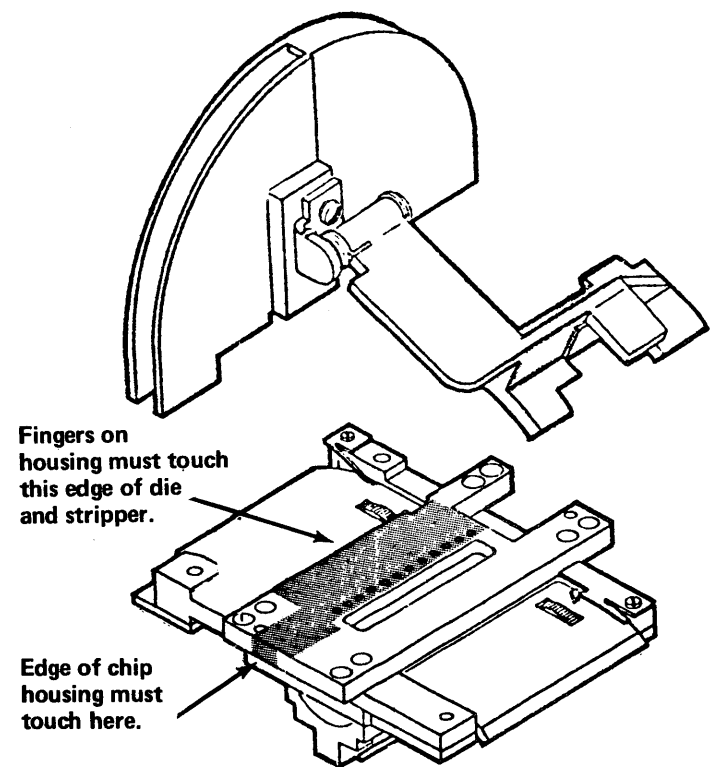
10 Remove Post-Punch Aligner. Adjustment shown on facing page DETAIL **C**

11 Rotate Handwheel So That Punch Bail Is All The Way Up (180°).

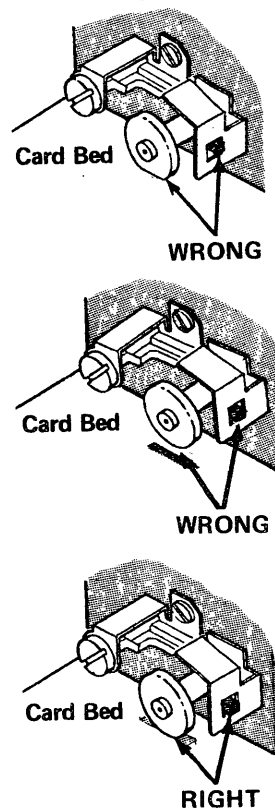
13 Re-assemble by reversing above procedure. Punches must be fully retracted before die and stripper will fit into place.



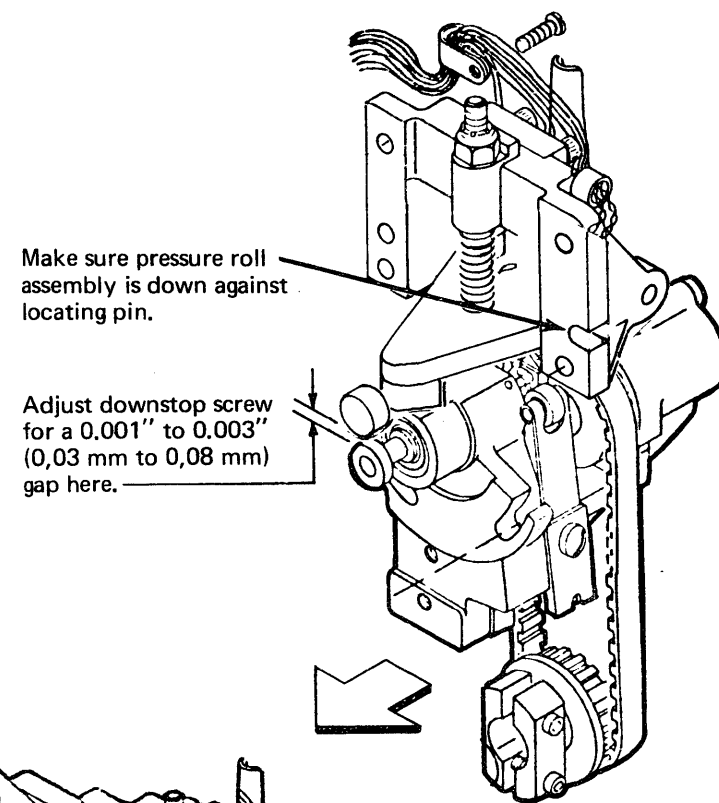
DETAIL A CHIP HOUSING LOCATION



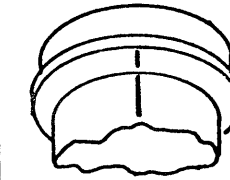
DETAIL C CARD ALIGNER ADJUSTMENT



DETAIL E PRESSURE ROLL ADJUSTMENT



CARD STEPPER TO PUNCH SHAFT TIMING

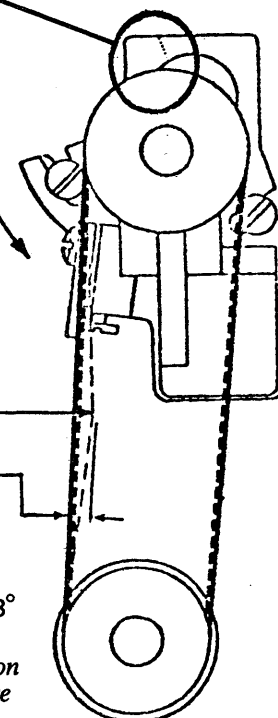


Set handwheel at 188° and align these two timing marks.

DETAIL F STEPPER BELT TENSION

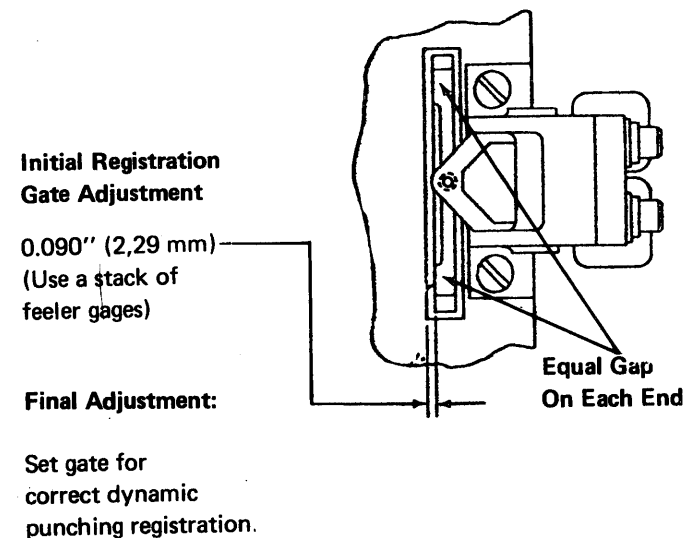
- 1 Loosen screws 1/8 turn.
- 2 Rotate stepper assembly until 450 grams of pressure results in 0.125" ± 0.025" (3,2 mm ± 0,6 mm) belt deflection.
- 3 Check timing marks at 188°

NOTE: If the stepper position is changed, check the pressure roll adjustment.



DETAIL B PUNCH REGISTRATION GATE ADJUSTMENT

(See page for complete adjustment)

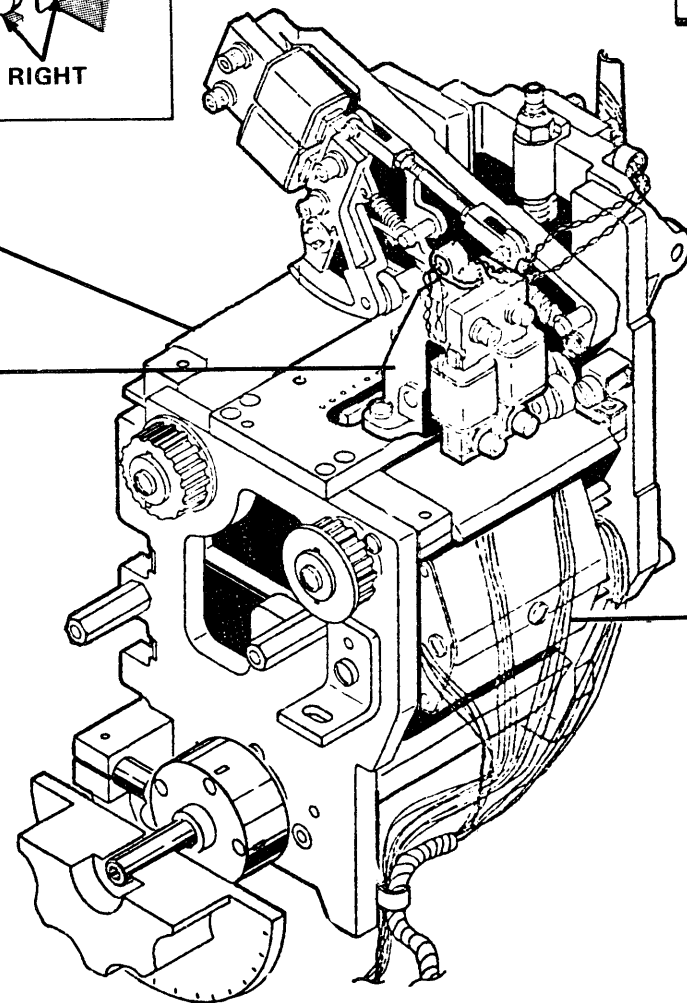
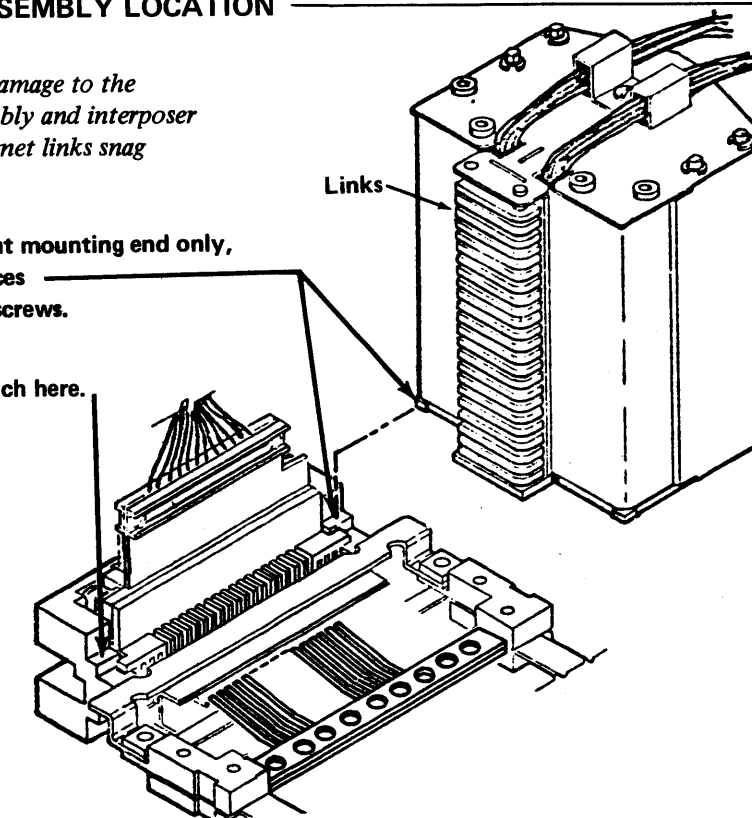


DETAIL D MAGNET ASSEMBLY LOCATION

CAUTION: To prevent damage to the punch unit magnet assembly and interposer spring, make sure no magnet links snag between spring fingers.

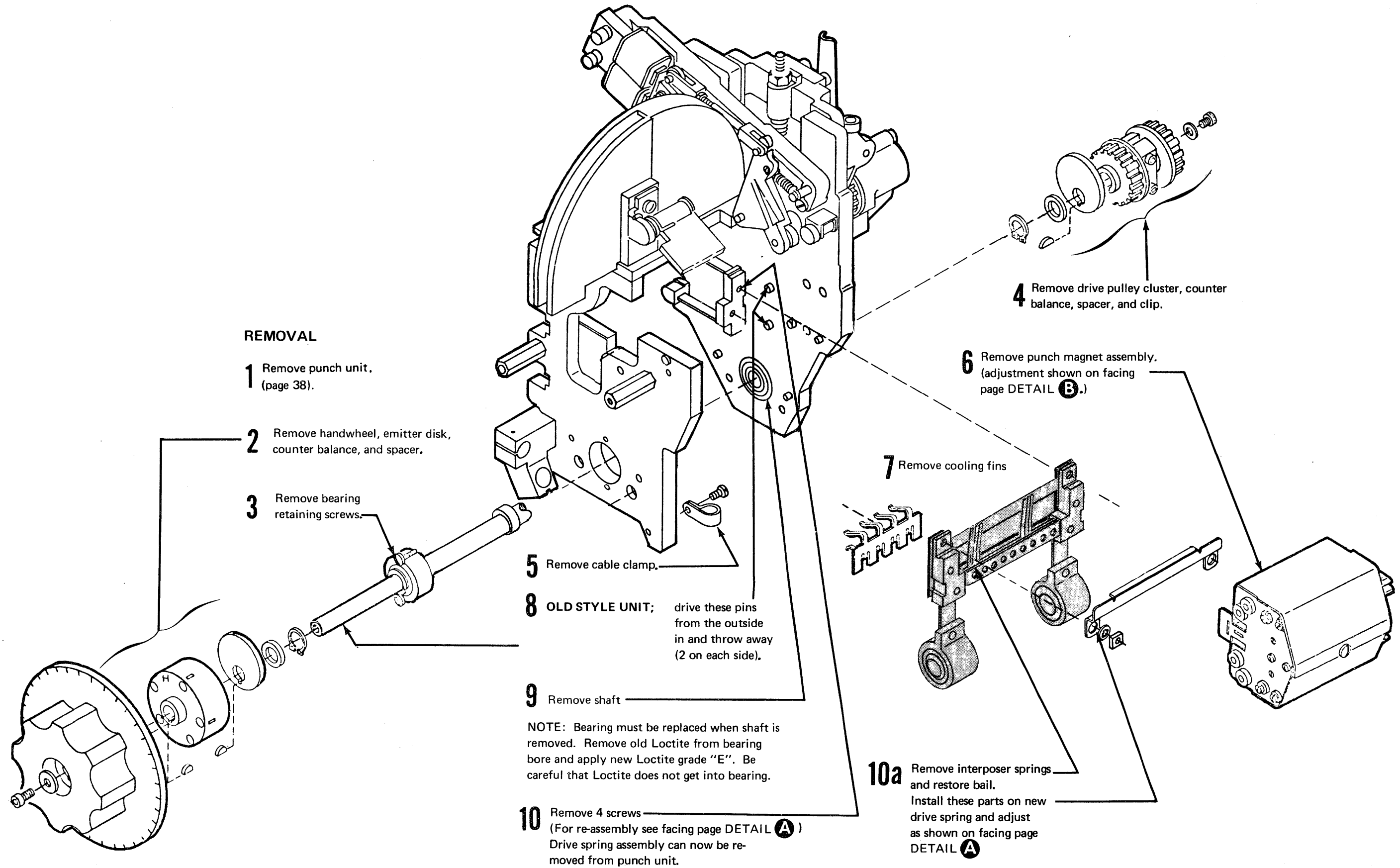
While applying pressure at mounting end only, make sure locating surfaces touch before tightening screws.

Magnet unit does not touch here.



PUNCH DRIVE SPRING

REMOVAL



DETAIL A RESTORE BAIL AND INTERPOSER SPRING ADJUSTMENT

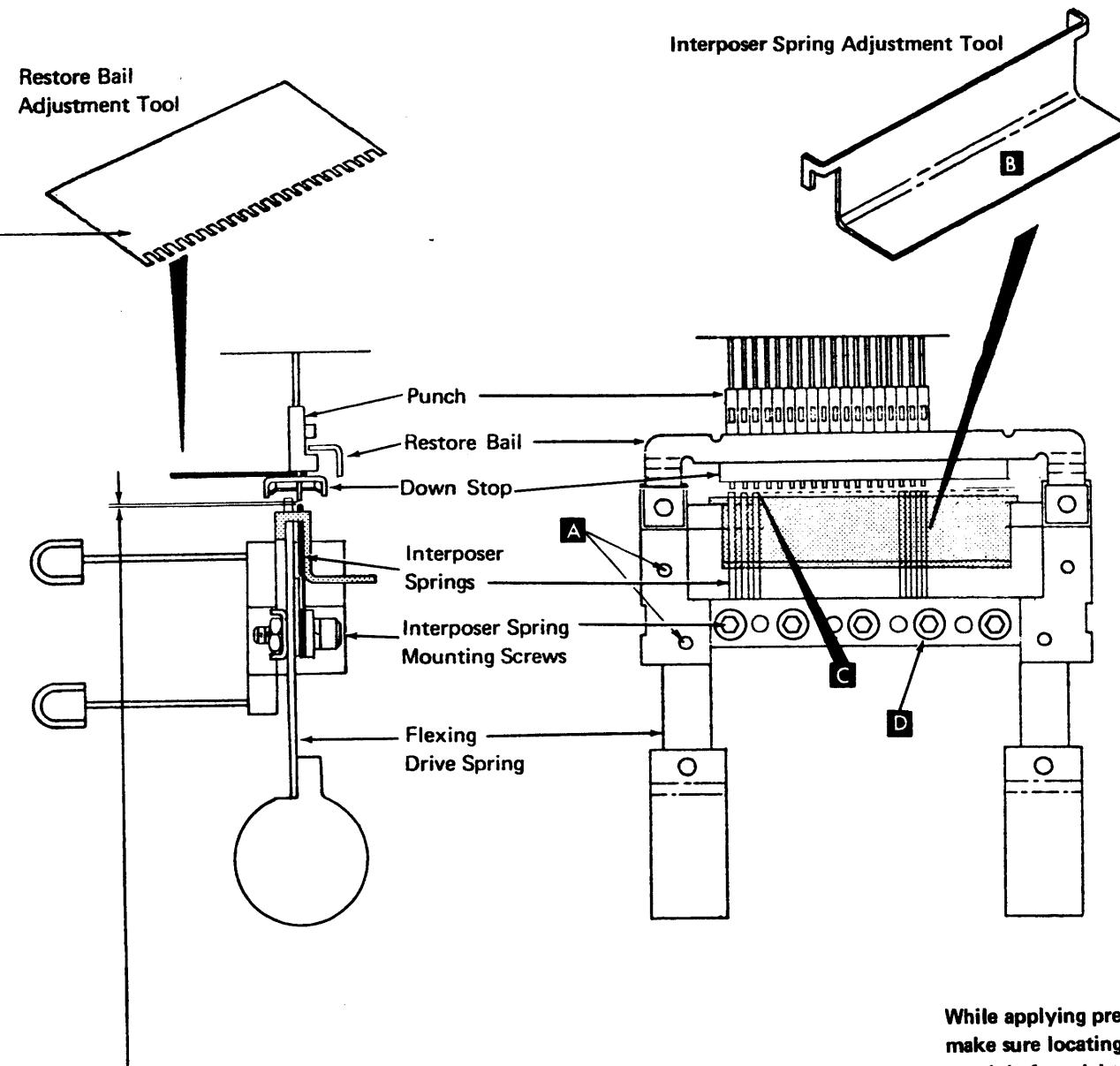
1 Center drive spring assembly between punch side frame castings. Tighten 4 parallelogram screws. **A**

2 Make restore bail adjustment:

- place special tool (Part 3591581) between punches and downstop
- with handwheel at 0 degrees, bring restore bail down against punches and tighten screws.
- Check for a very slight amount of punch movement at both ends of bail.
- Remove tool and check for a slight movement of all punches (handwheel at 0 degrees).

3. Make interposer spring adjustment:

- Tighten 5 holding screws slightly so lock washers will hold spring in place.
- with handwheel at 0 degrees, center interposer spring fingers under punches (use interposer spring adjusting tool Part 2595659) **B**
- place 0.014" (0,36mm) feeler gage between punch and interposer spring. **C** Use a small allen wrench in interposer spring bracket to shift springs up against feeler gage. Tighten screws. **D**
- With handwheel at 0 degrees, pull punches against downstop and check for 0.0095" to 0.0125" (0,24mm to 0,32mm) gap between interposer spring fingers and all punches. If readjustment is required, use a different gage in step b.

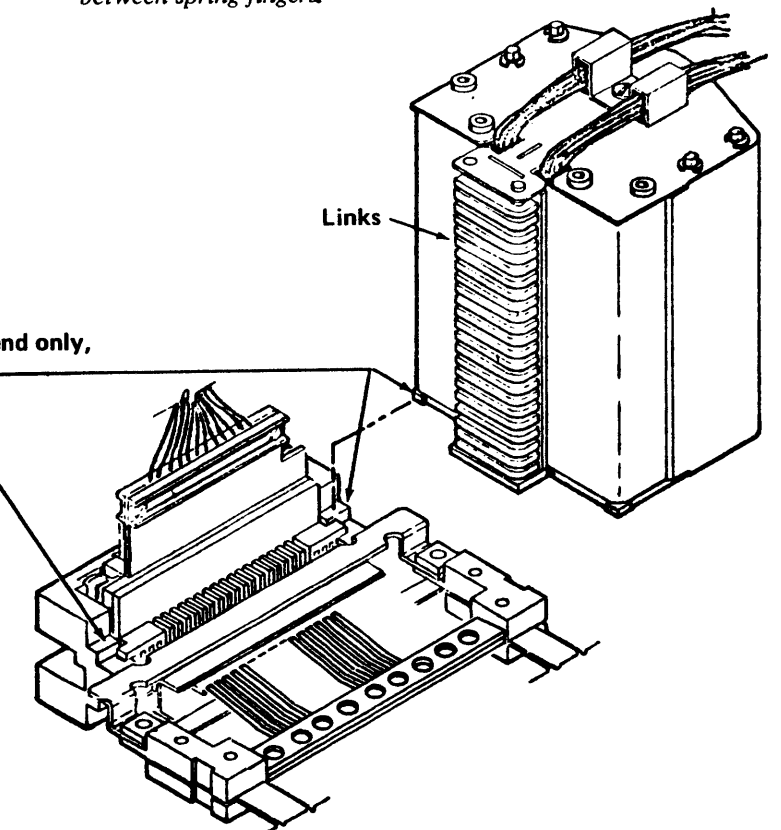


DETAIL B MAGNET ASSEMBLY LOCATION

CAUTION: To prevent damage to the punch unit magnet assembly and interposer spring, make sure no magnet links snag between spring fingers.

While applying pressure at mounting end only, make sure locating surfaces touch before tightening screws.

Magnet unit does not touch here.



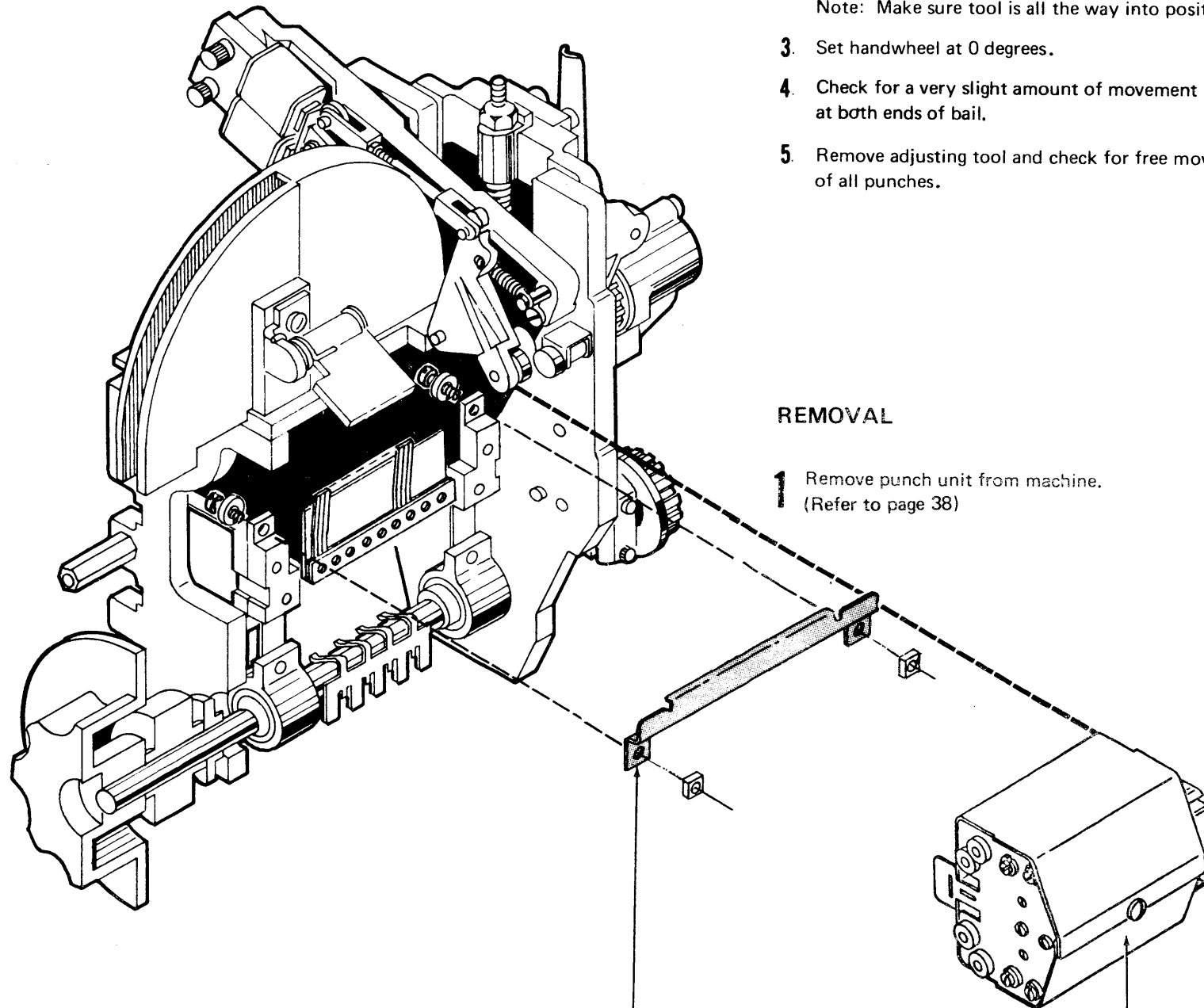
RESTORE BAIL

SERVICE CHECK

- 1 Remove punch unit from machine. (Refer to page 38)
- 2 Place restore bail adjusting tool (part 2591581) **A** between downstop and punches.
 Note: Make sure tool is all the way into position.
- 3 Set handwheel at 0 degrees.
- 4 Check for a very slight amount of movement at both ends of bail.
- 5 Remove adjusting tool and check for free movement of all punches.

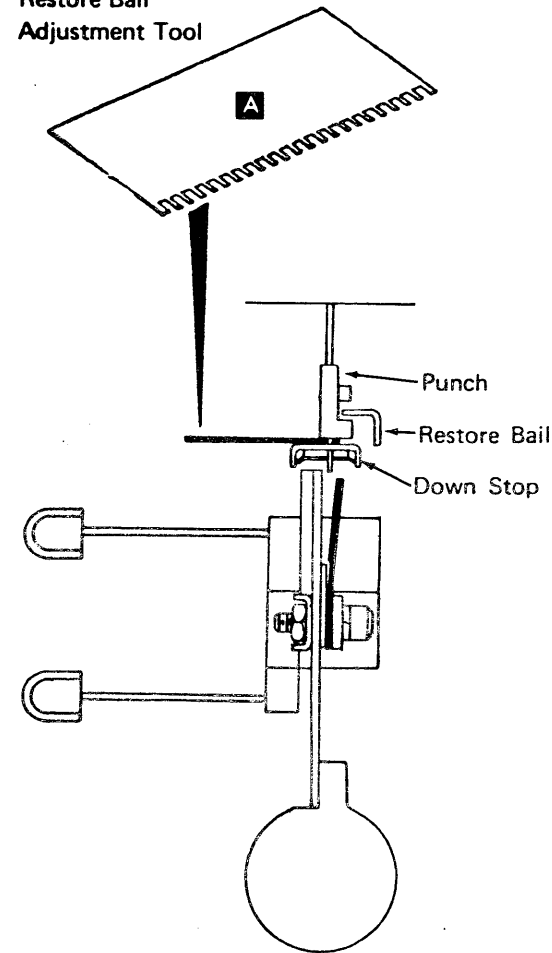
REMOVAL

- 1 Remove punch unit from machine. (Refer to page 38)



- 2 Remove magnet assembly and cable clamp. To re-assemble:
- 3 Remove 2 screws and remove bail from punch unit. See adjustment on this page.
- 4 Re-assemble by reversing above procedure.

Restore Bail Adjustment Tool



DETAIL A

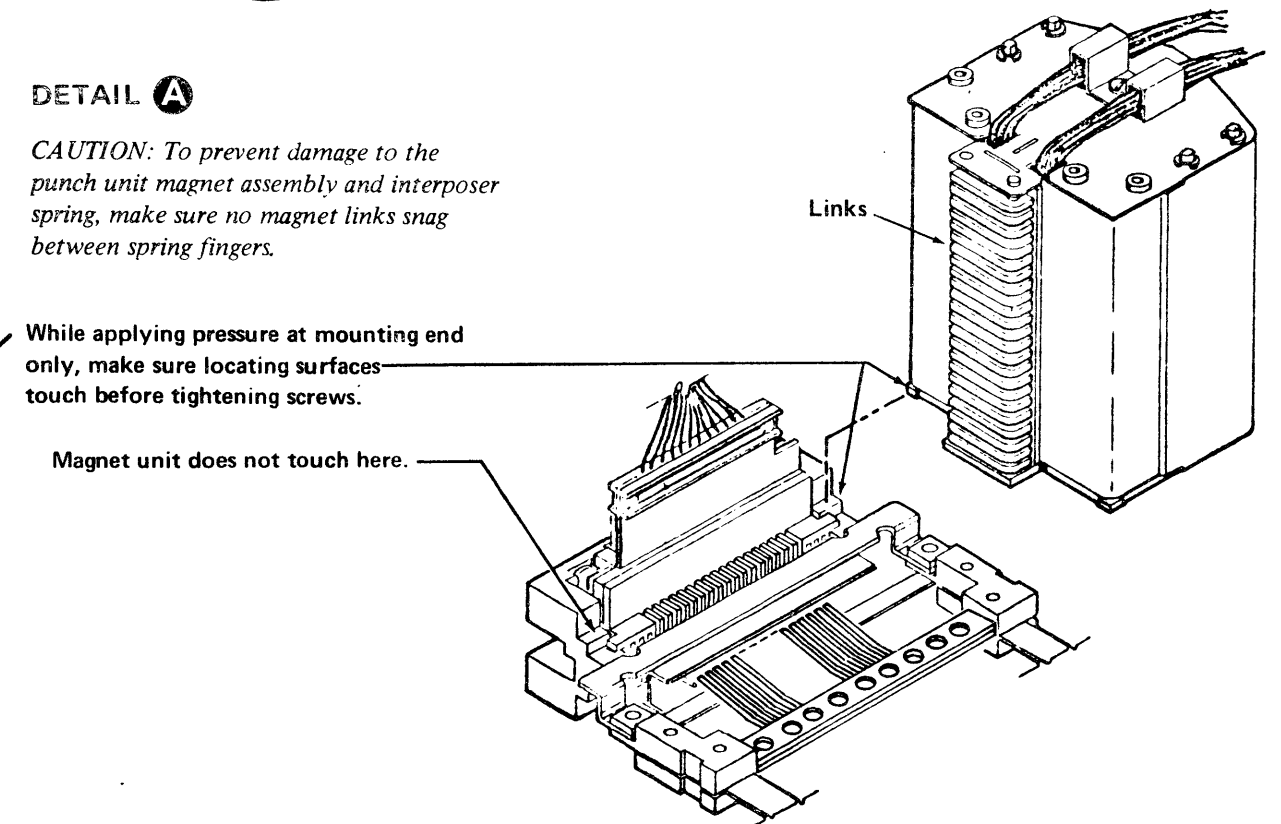
CAUTION: To prevent damage to the punch unit magnet assembly and interposer spring, make sure no magnet links snag between spring fingers.

While applying pressure at mounting end only, make sure locating surfaces touch before tightening screws.

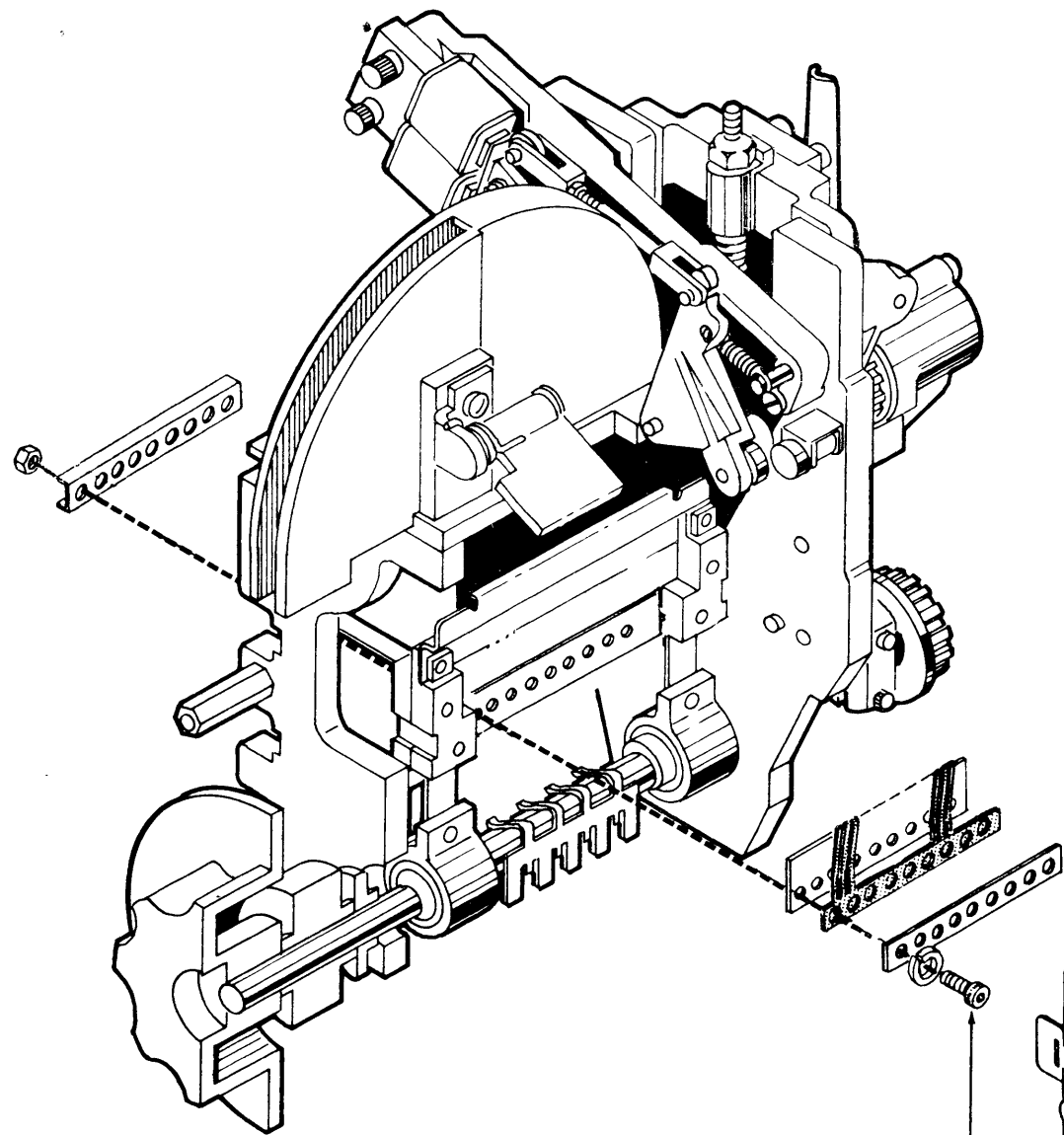
Magnet unit does not touch here.

ADJUSTMENT

1. Remove punch unit from machine. (Refer to page 38)
- 2 Remove magnet assembly.
- 3 Loosen 2 restore bail screws.
- 4 Insert restore bail tool (part 2591581). **A**
 Note: Make sure tool is all the way into position.
- 5 Turn handwheel to 0 degrees.
- 6 Pull the restore bail down evenly against punches and tighten restore bail screws.
- 7 Check for a very slight amount of punch movement at both ends of bail.
- 8 Remove tool and check for free movement of all punches
- 9 Replace magnet assembly. (See Detail A).
- 10 Replace punch unit in machine.



INTERPOSER SPRING



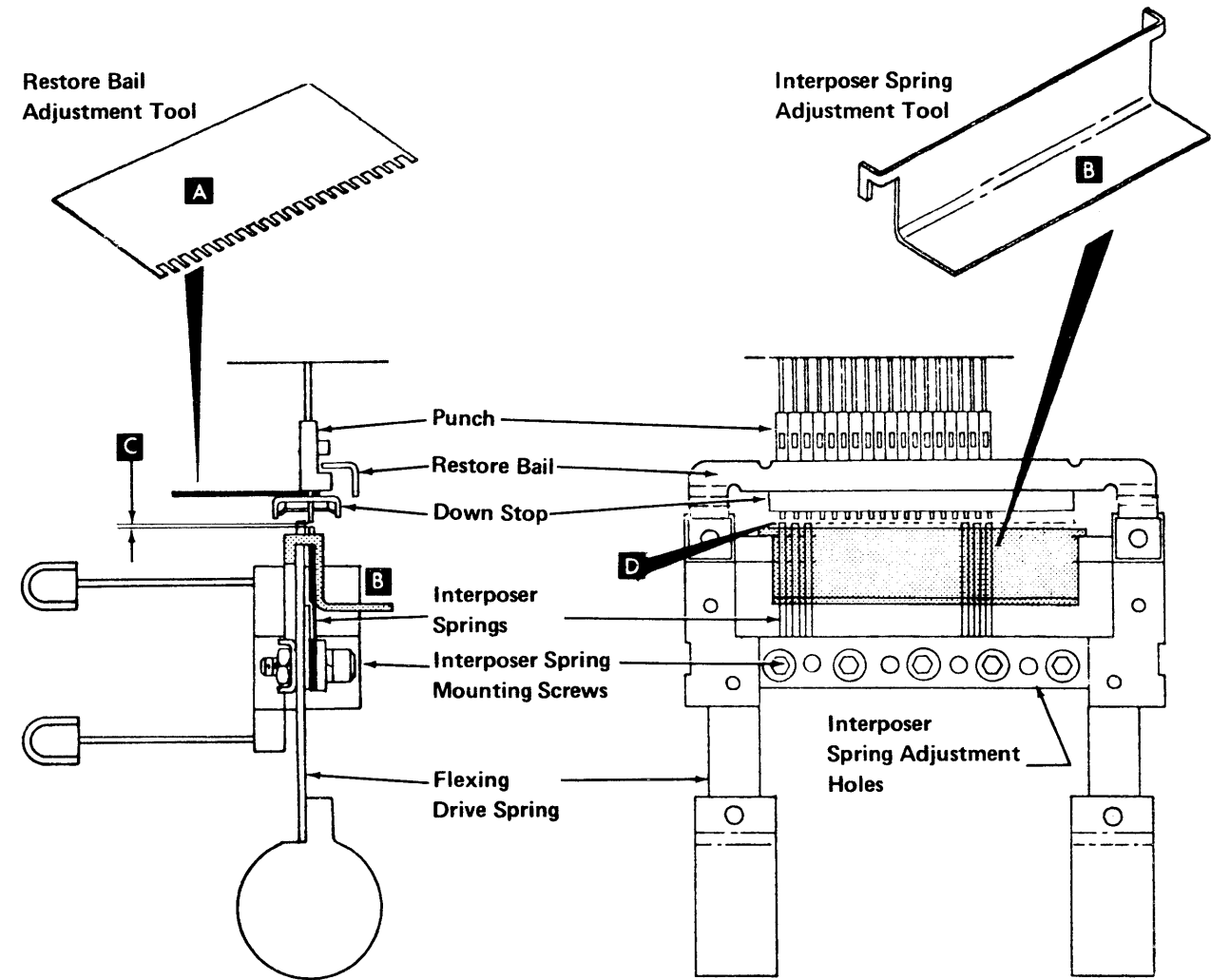
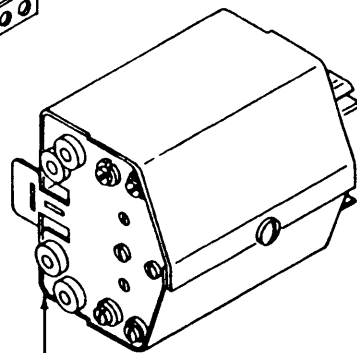
REMOVAL

1 Remove punch unit and cable clamp from machine (Refer to page 38).

2 Remove magnet unit and cable clamp. (For re-assembly, see DETAIL A on facing page)

3 Remove 5 mounting screws and remove Interposer spring. (See adjustment on this page)

4 Replace by reversing above procedure



ADJUSTMENT

1 Remove punch unit from machine. (Refer to page 38)

2 Remove magnet assembly and cable clamp. (For re-assembly see DETAIL A on facing page)

3 Make sure restore bail is adjusted correctly:

- (a) place special tool (Part 3591581) (A) between punches and downstop.
- (b) with handwheel at 0 degrees, check for a very slight amount of punch movement at both ends of bail.
- (c) Remove tool and check for a slight movement of all punches.

4 With handwheel at 0 degrees, hold interposer springs under punches (use interposer spring adjusting tool (B) Part 2595659).

5 Place 0.014" (0,36mm) feeler gage between punch and interposer spring. (D) Use a small allen wrench in interposer spring adjustment holes to shift springs up against feeler gage (spring pushes punches against restore bail). Tighten screws.

6 With handwheel set at 0 degrees, pull punches against downstop and check gap for 0.0095" to 0.0125" (C) (0,24mm to 0,32mm). If readjustment is required, use a different gage in step 5.

7 Remove adjusting tool, replace magnet unit, and re-install punch unit in machine.

PUNCH DRIVE SHAFT

REMOVAL

1 Remove Punch Unit.
(Refer to page 38)

2 Remove handwheel, emitter disk,
counter balance, and spacer.

3 Remove bearing
retaining screws.

4 Remove drive pulley, counter
balance, and spacer.

5 Remove punch
magnet assembly and cable clamp.
(Re-assembly shown in detail)

6 Remove cooling fins.

7 Remove shaft.

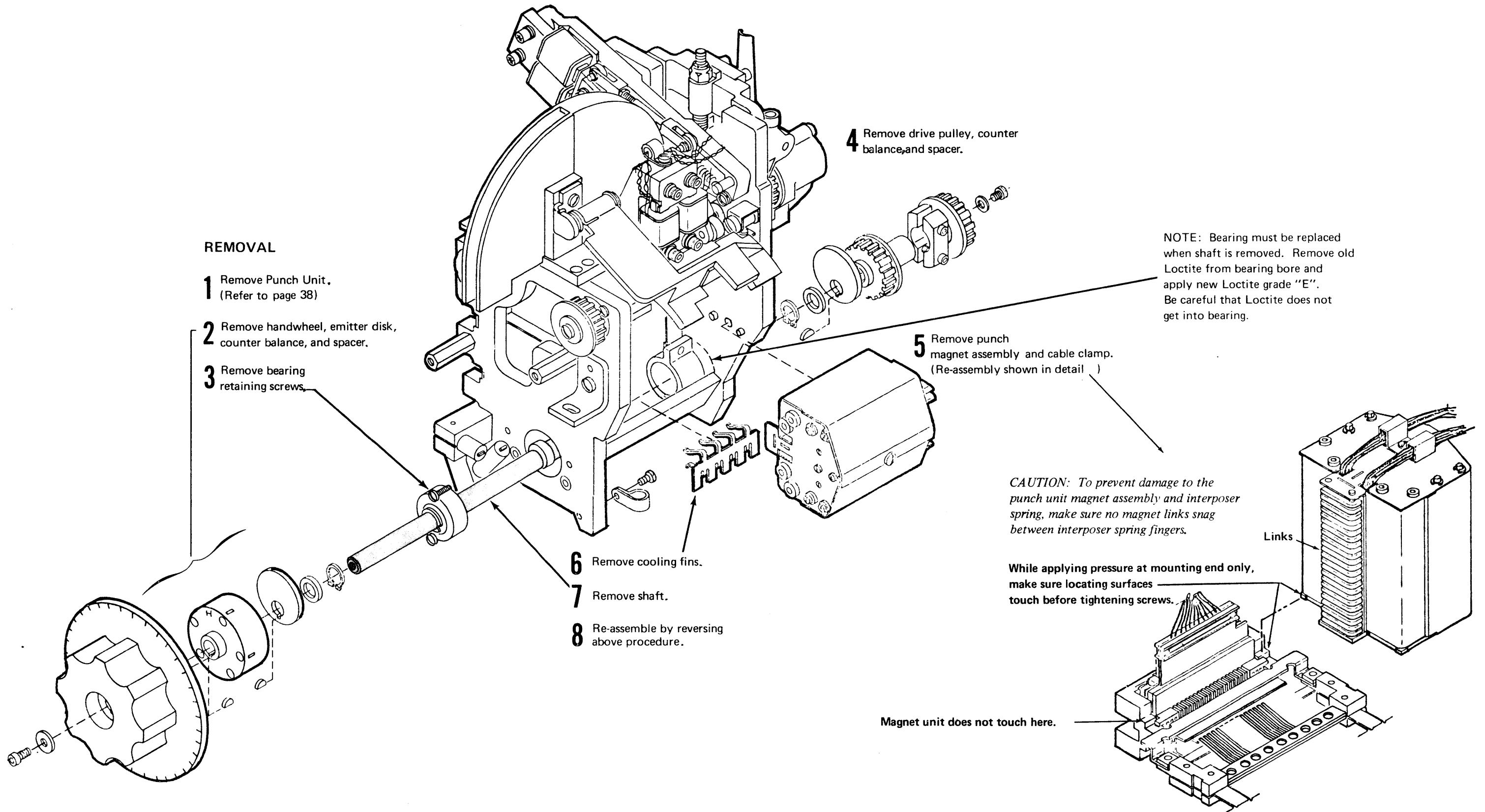
8 Re-assemble by reversing
above procedure.

NOTE: Bearing must be replaced
when shaft is removed. Remove old
Loctite from bearing bore and
apply new Loctite grade "E".
Be careful that Loctite does not
get into bearing.

CAUTION: To prevent damage to the
punch unit magnet assembly and interposer
spring, make sure no magnet links snag
between interposer spring fingers.

While applying pressure at mounting end only,
make sure locating surfaces
touch before tightening screws.

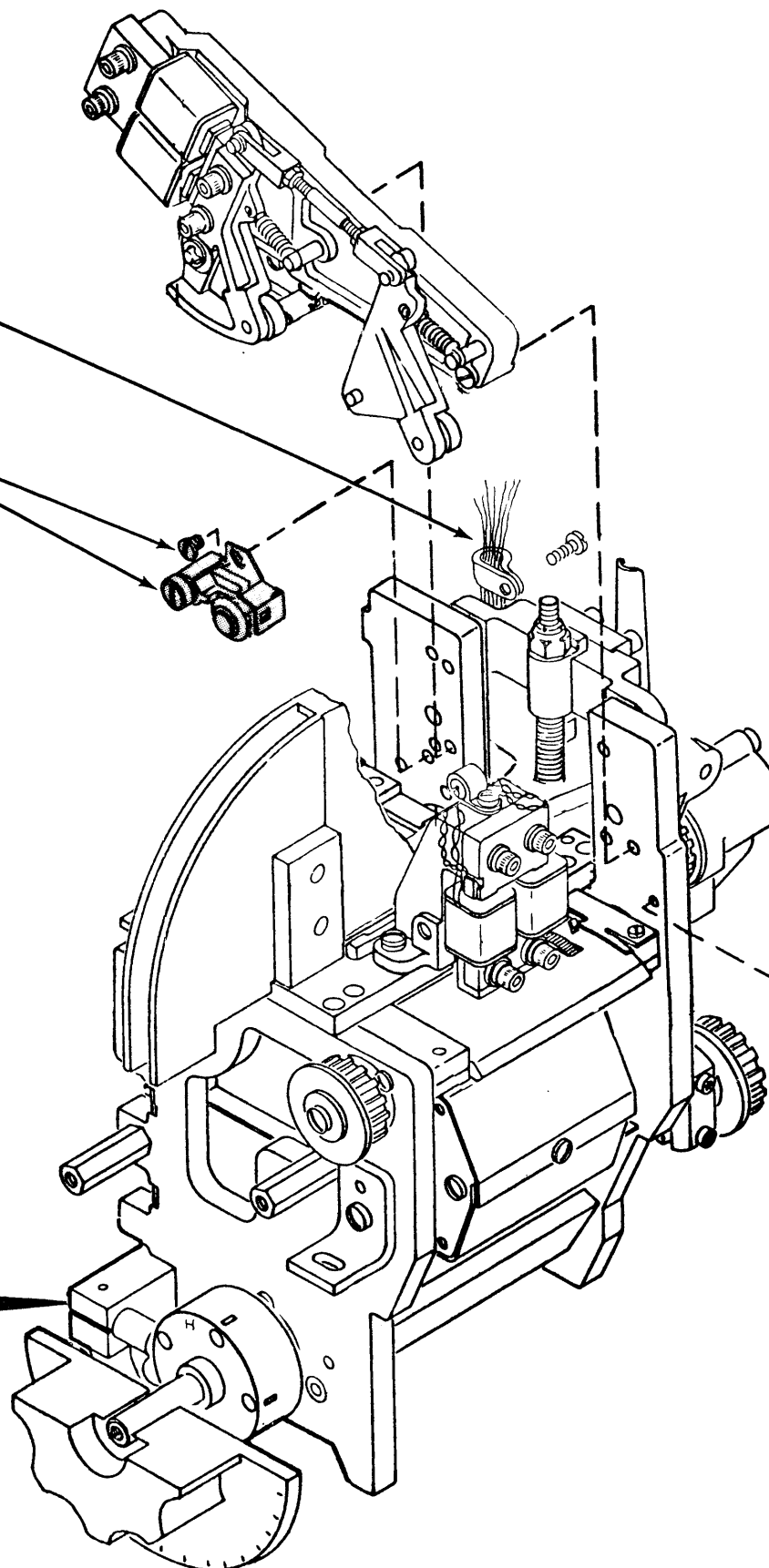
Magnet unit does not touch here.



PUNCH ALIGNER ROLLS

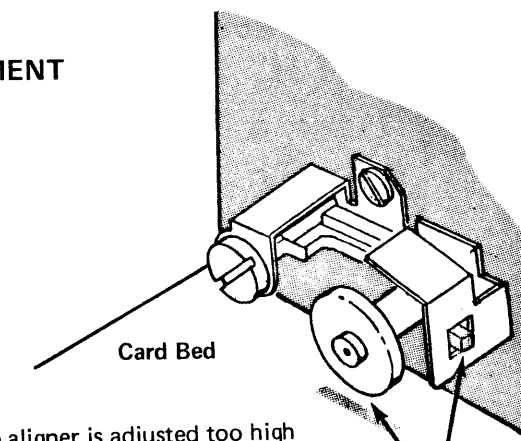
REMOVAL

- 1 Remove cable clamp.
- 2 Remove Punch eject pressure roll assembly.
- 3 Remove 2 screws.

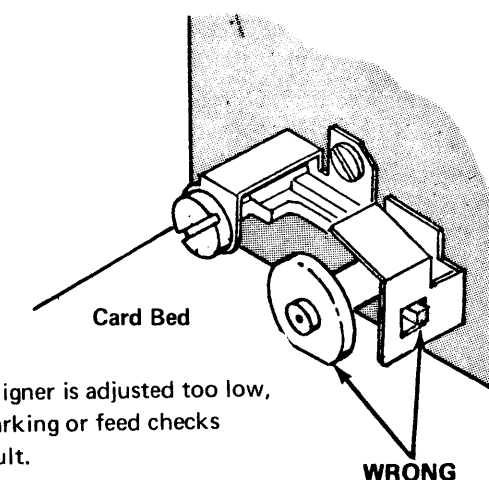


The flexing action of the card aligner rolls applies a slight pressure on the card toward the registration rail. This pressure makes sure the card is against the side rail.

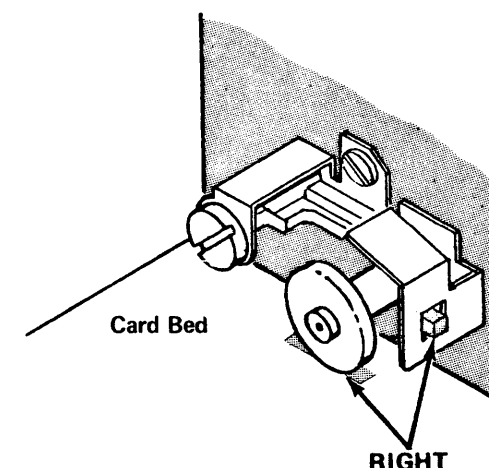
ADJUSTMENT



If the aligner is adjusted too high above the card bed metal insert, the aligner will have no effect. The result is usually an off registration condition.



If the aligner is adjusted too low, card marking or feed checks will result.



Rotate the roll with a small screw driver. A very slight drag should be felt.

PUNCH EMITTERS

Punch Step CB

The punch step CB is one of two CB's which operate off the punch shaft. The pulse generated by this CB comes one time for each revolution of the punch shaft and is used for card feed control and feed checking.

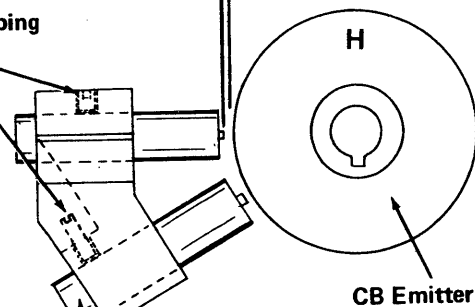
Punch CB

The punch CB has four output pulses for each revolution of the punch shaft and is used in punch magnet and punch check circuits.

H (high speed)
or
L (low speed)
indicates front
of emitter wheel.

0.010" ± 0.005"
0,25mm ± 0,13mm

Pickup Clamping
Screws



CB Pickup

Post Punch Aligner Removal

Remove pivot screw

Note: Post - Punch aligner adjustment depends entirely on pivot screw. Over-adjust in counter-clockwise direction since assembly will move when pivot screw is tightened.

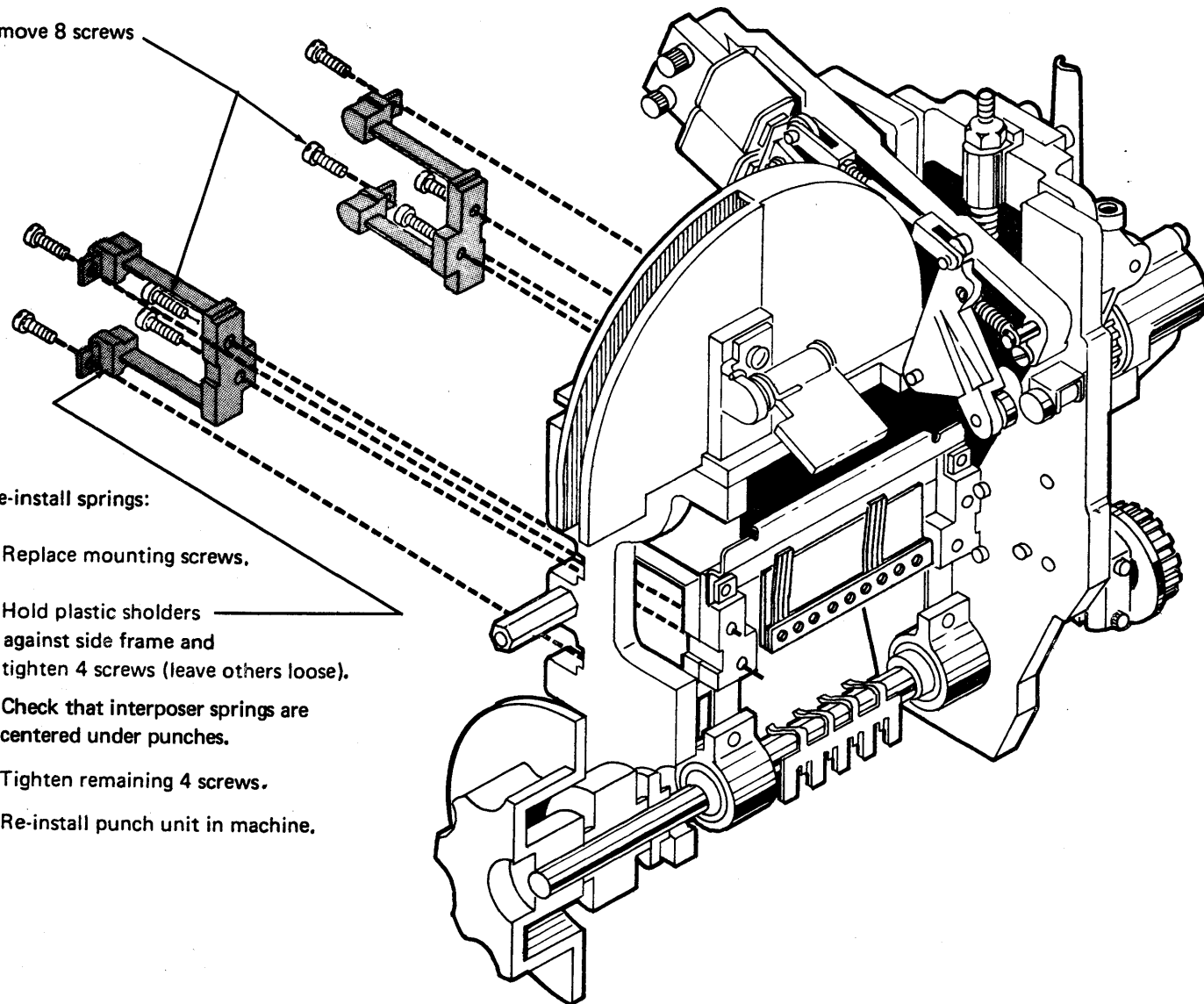
PARALLELOGRAM SPRINGS

REMOVAL

NOTE: If only one spring is removed at a time, drive spring adjustment will not be needed.

- 1 Remove punch unit from machine
(Refer to page 38)

- 2 Remove 8 screws



- 3 To re-install springs:

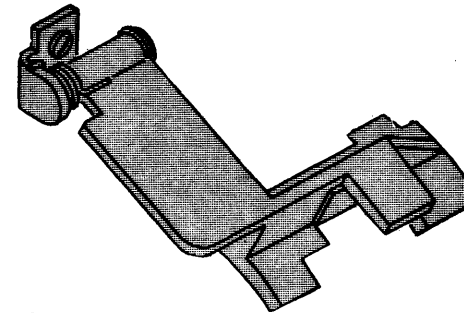
- a Replace mounting screws.
- b Hold plastic sholders against side frame and tighten 4 screws (leave others loose).
- c Check that interposer springs are centered under punches.
- d Tighten remaining 4 screws.
- e Re-install punch unit in machine.

CARD COVERS

PRE-PUNCH CARD COVER

The pre-punch card cover does not require adjustment.

POST PUNCH CARD COVER



SERVICE CHECK

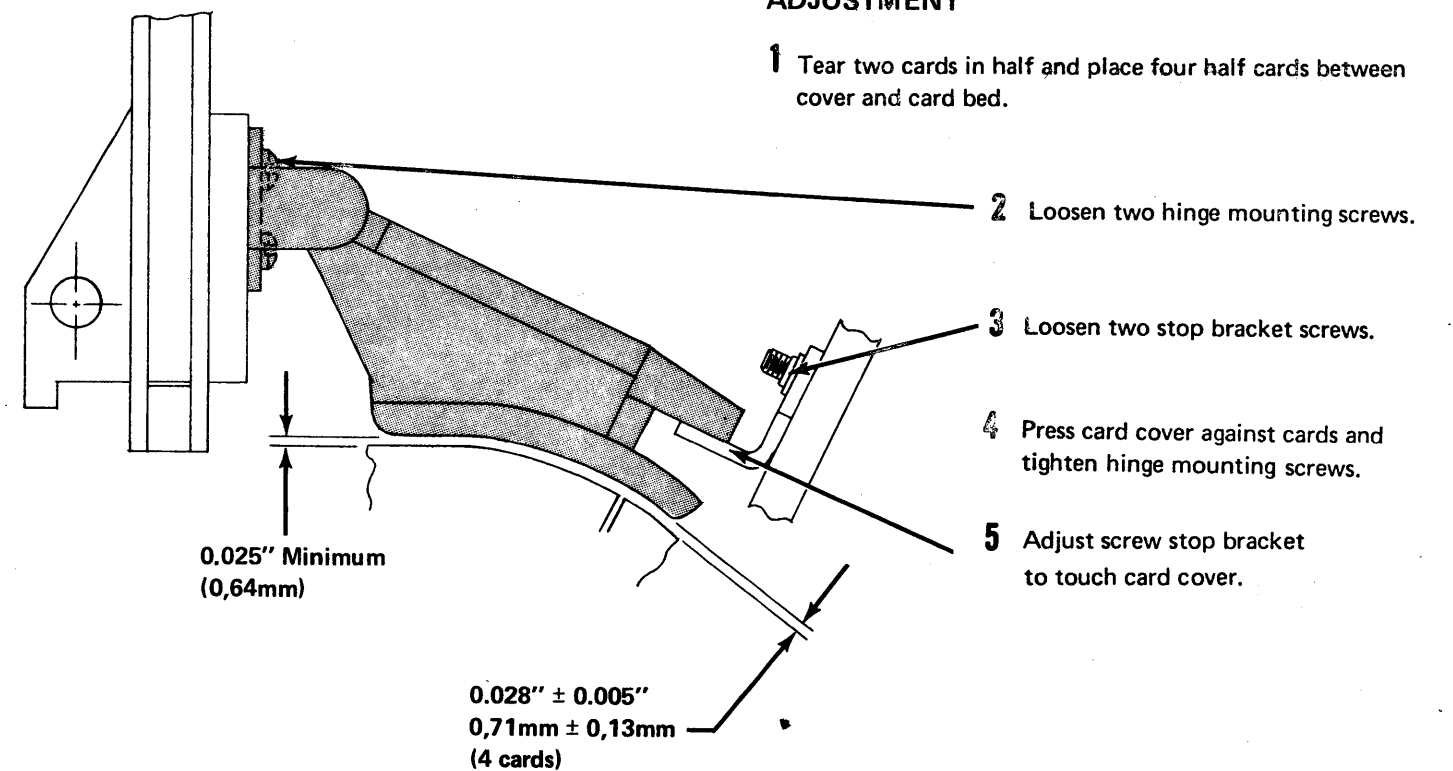
Post-Punch card cover gap should be $0.028'' \pm 0.005''$ ($0,71\text{mm} \pm 0,13\text{mm}$).

To check:

1. Tear two cards in half and place four half cards between card cover and card bed.
2. Make sure card cover can be closed and that cover makes contact with the four cards (light drag on cards).

ADJUSTMENT

- 1 Tear two cards in half and place four half cards between cover and card bed.



PUNCH GREASE WICK

REMOVAL

- 1 Remove punch unit.
(Refer to page 38)
- 2 Remove punch magnet unit and cable clamp.
(For re-assembly, see **DETAIL A**.)

CAUTION: To prevent damage to the punch unit magnet assembly and interposer spring, make sure no magnet links snag between spring fingers.

DETAIL A

While applying pressure at mounting end only, make sure locating surfaces touch before tightening screws.

Magnet unit does not touch here.

DETAIL B

Center interposer spring under punches and tighten four screws removed in step 3.

- 3 Remove 4 socket head screws
(For re-assembly see **DETAIL B**.)

- 4 Pivot drive spring assembly from under punches

- 4a **OLD STYLE UNIT;**

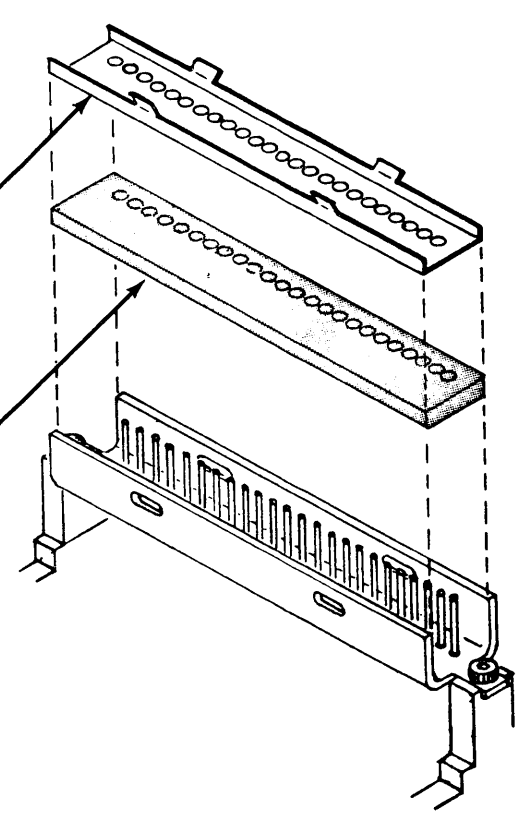
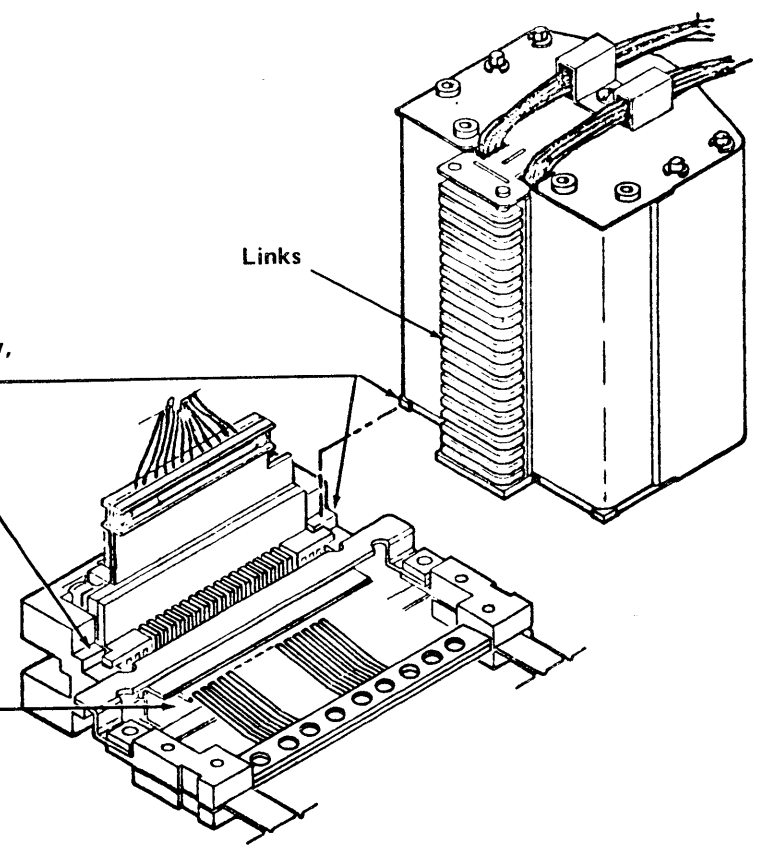
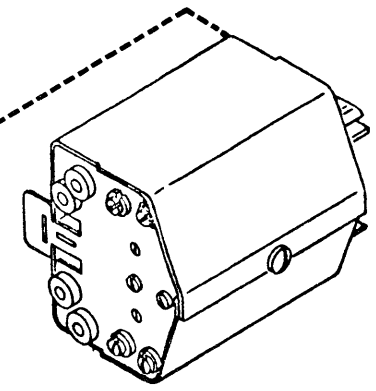
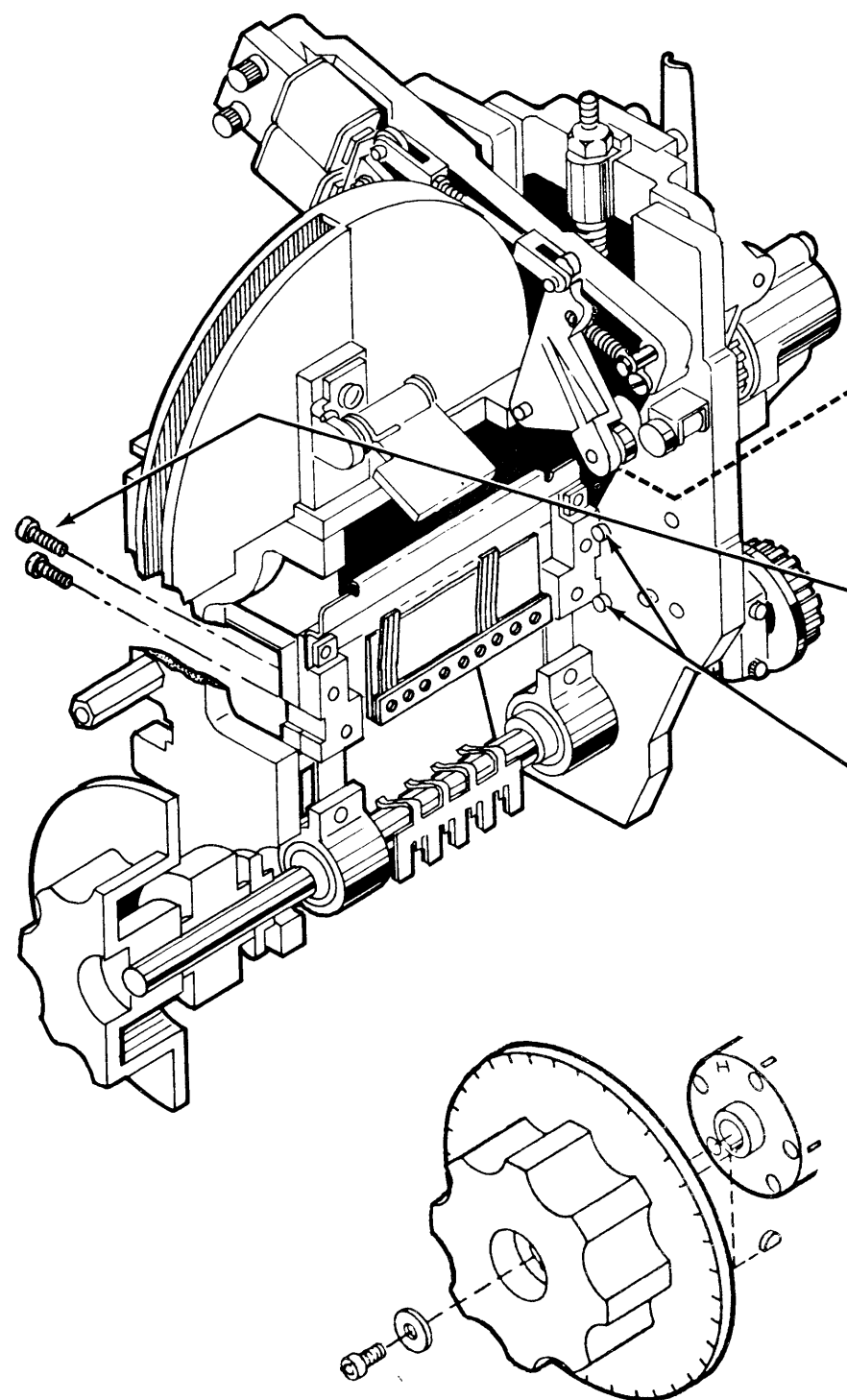
drive these pins out and throw away (2 on each side).

Remove handwheel to simplify driving front pins.

- 5 Turn punch unit upside-down and remove grease wick holder.

- 6 Replace grease wick.

- 7 Re-assemble by reversing above procedure.



CHIP HOUSING

Note: Clean out all chips from housing with a vacuum cleaner before removing housing.

REMOVAL

1 Remove chip chute screw.

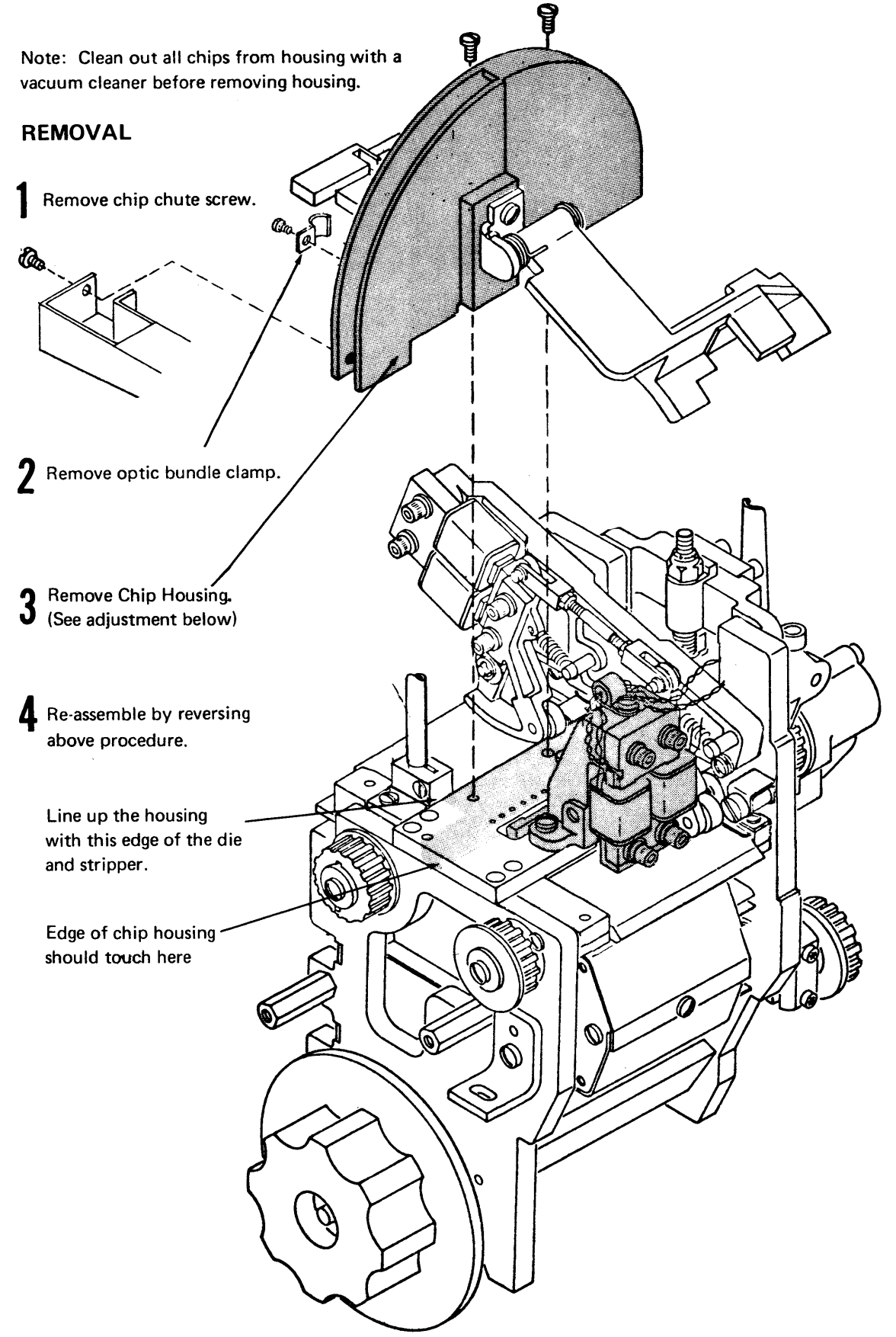
2 Remove optic bundle clamp.

3 Remove Chip Housing.
(See adjustment below)

4 Re-assemble by reversing above procedure.

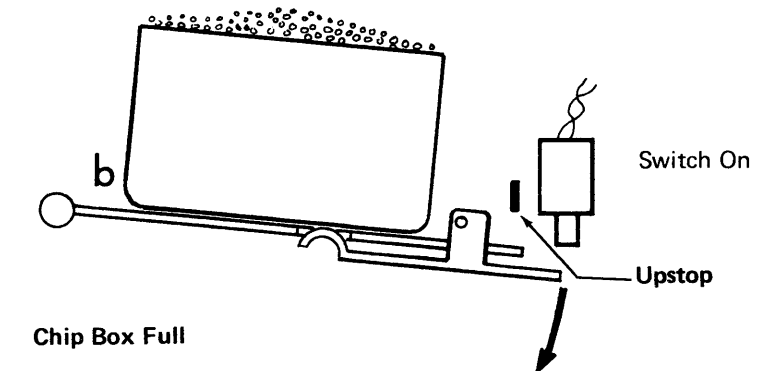
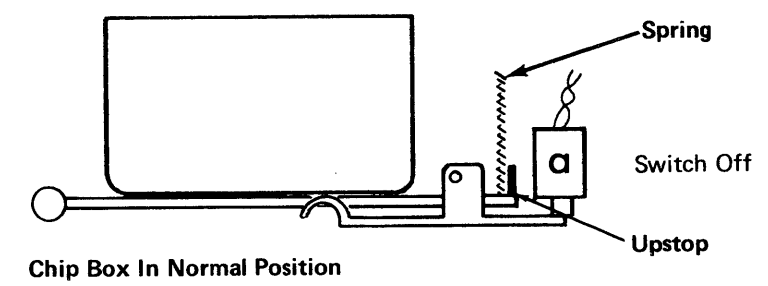
Line up the housing with this edge of the die and stripper.

Edge of chip housing should touch here

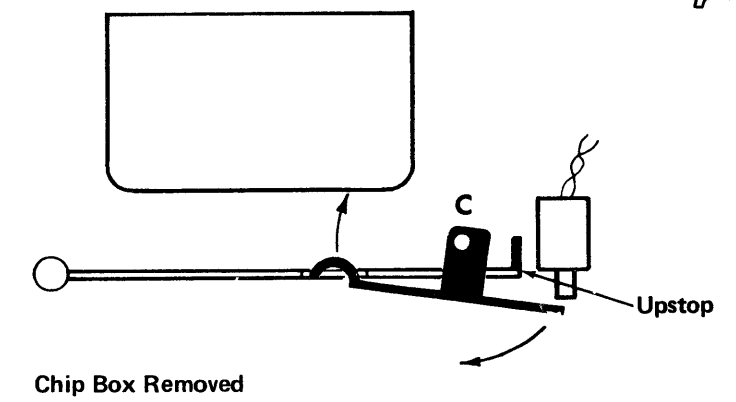


CHIP BOX

When the chip box is full or removed a light on the operator panel turns on. This light is controlled by a switch **A**



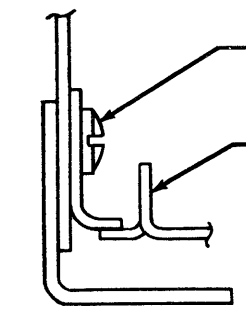
When the chip box is full the weight of the chips pivots the chip box tray **b** down thus actuating the switch.



When the chip box is removed the switch actuating arm pivots at point **C** actuates the switch.

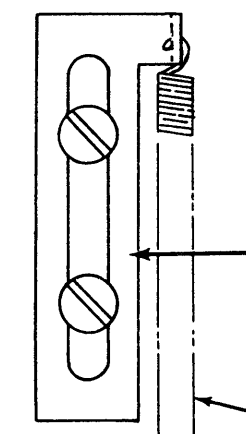
CHIP BOX TRAY ADJUSTMENT

1 Adjust upstop:

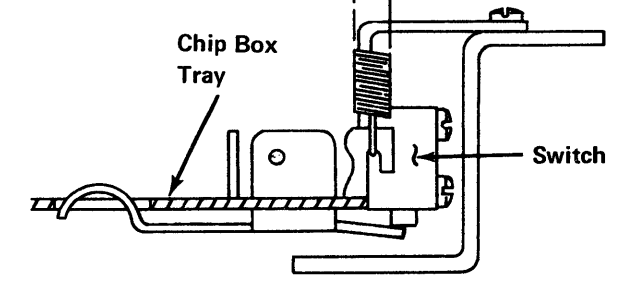


- a. Loosen upstop mounting screw
- b. Place empty chip box on chip box tray.
- c. Position upstop so that when the tray is moved 0.010" to 0.40" (0,25mm to 1,02mm) away from upstop, the switch contacts transfer.

2 Adjust chip box spring:



- a. Place a stack of unpunched cards in the center of the chip box (1/2" - 12,7mm - higher than the sides of the chip box). Then place the chip box on the chip tray.
- b. Adjust chip box spring bracket so that tray is 0.005" to 0.040" (0,13mm to 1,02mm) from the upstop.



DYNAMIC PUNCH REGISTRATION

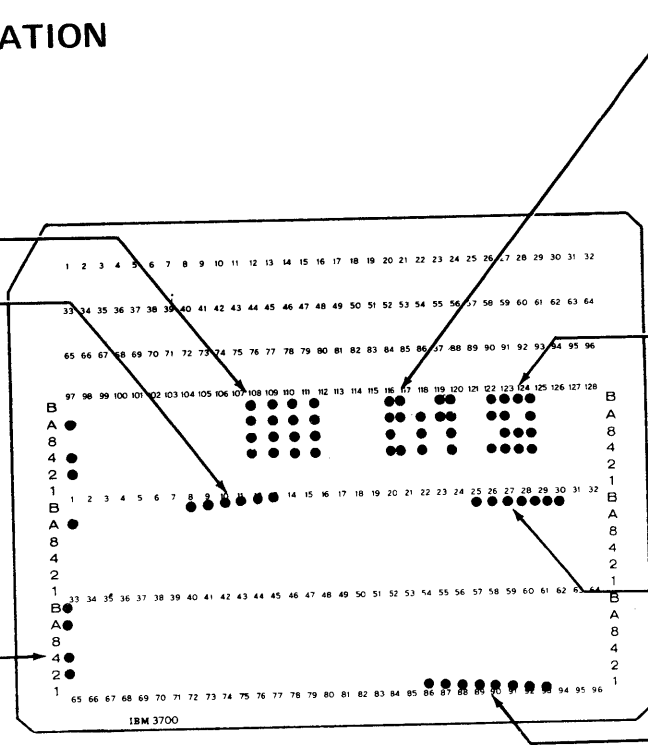
Use small card gage to check punch registration.

Punches too far apart
or
Punching high on card
(skew away from registration rail)

- Increase gap between pressure roll arm and locating pin **B**.
- Check aligner roll adjustment **D**.

Card Off Punched
in Column group 1
(columns 1, 33, and 65)

- Adjust punch registration Gate Assembly **A**.
- Check punch unit location **E**.



- Check pressure roll downstop adjustment
- Check stepper belt timing **C**

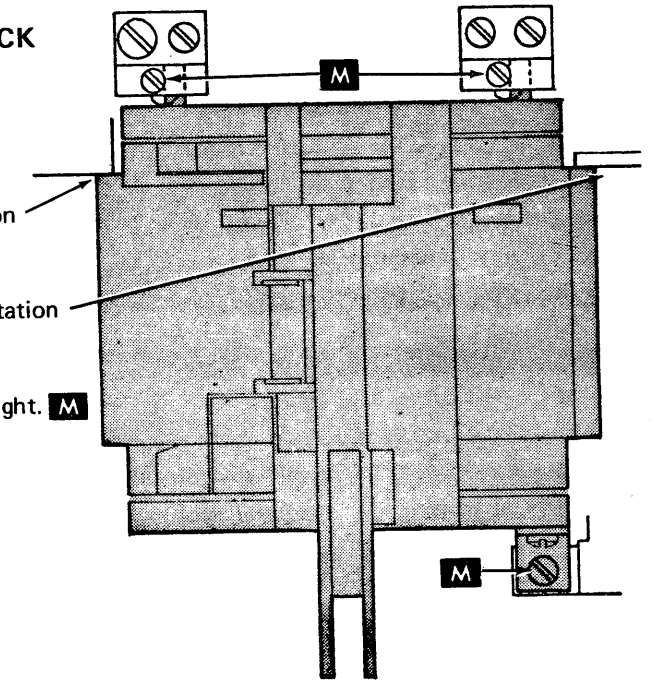
- Check card cover gap (page 54).
- Check pressure roll downstop gap **B**

Punches too close together
(Starts with column 1 registered correctly but punches gradually creep closer together.)
or
Punching low on card
(skew toward registration rail)

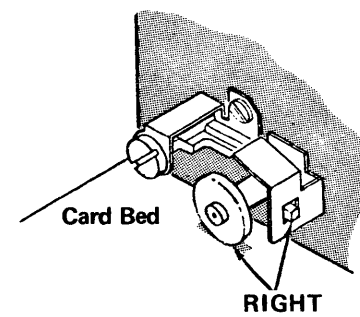
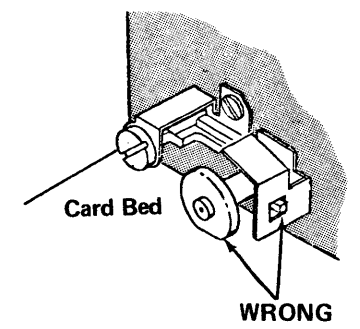
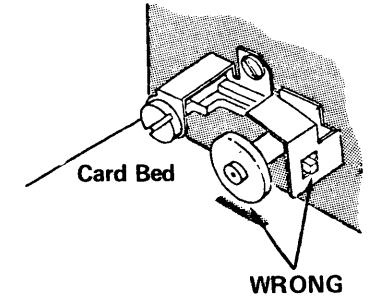
- Decrease gap between pressure roll arm and locating pin **B**.
- Check aligner roll adjustment **D**.
- Check punch stepper belt timing **C**.

E PUNCH UNIT POSITION SERVICE CHECK

- 1 Check that prepunch card bed is against wait station registration rail.
- 2 Check that post punch card bed is against corner station registration rail.
- 3 Check that the three punch mounting screws are tight. **M**
- 4 If punch registration problems exist, check that punch card beds are all the way back against punch registration rail. If punch card bed position is changed, re-adjust punch position.



D CARD ALIGNER ADJUSTMENT



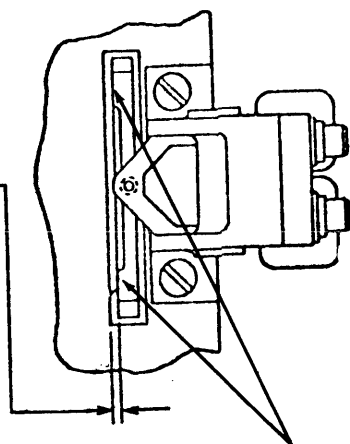
A PUNCH REGISTRATION GATE ADJUSTMENT

(See page 43 for complete adjustment.)

Initial Registration Gate Adjustment

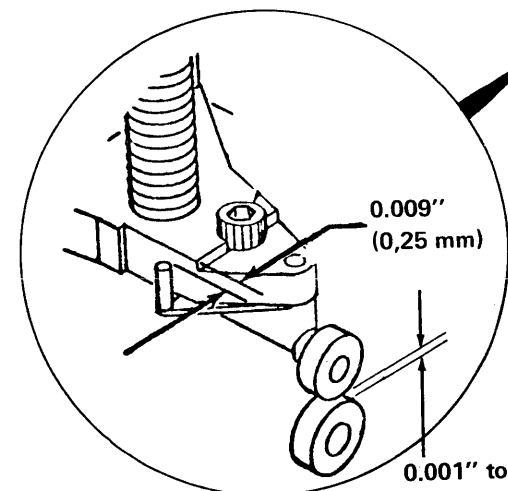
0.090" (2,29 mm)
(use a stack of feeler gages)

Final Adjustment:
set gate for correct dynamic punching registration.



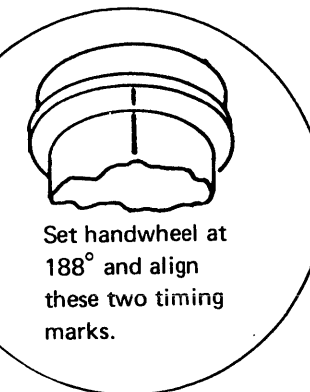
Gap should be equal at both ends.

B STEPPER PRESSURE ROLL SKEW AND DOWNSTOP ADJUSTMENT



0.001" to 0.003"
(0,03 mm to 0,08 mm)

C CARD STEPPER TO PUNCH SHAFT TIMING



Set handwheel at 188° and align these two timing marks.

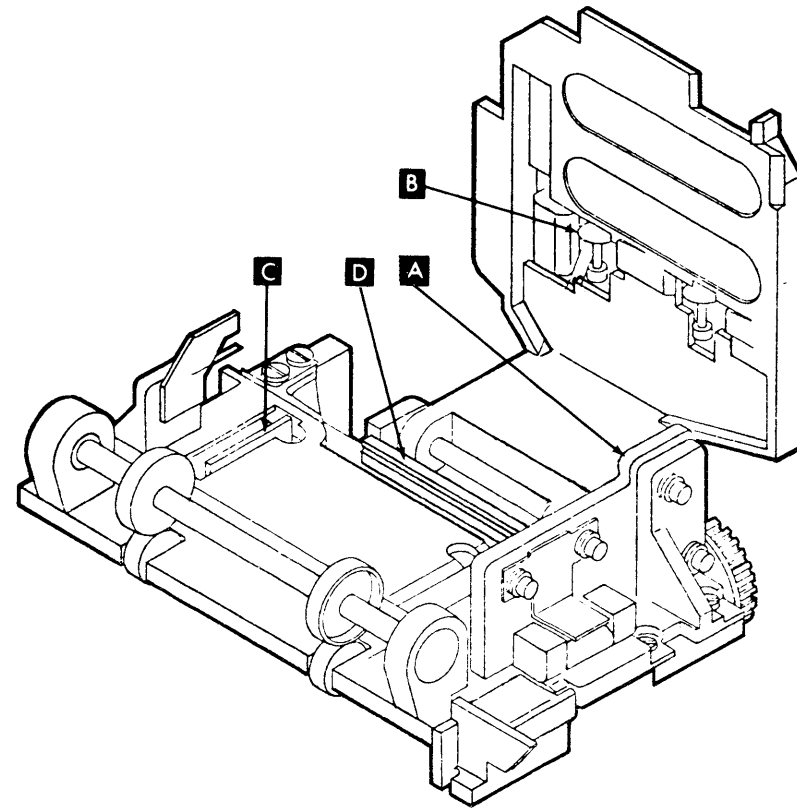
CORNER STATION OPERATION

WARNING: Do not loosen the three corner assembly mounting screws. These screws hold the assembly to the machine backbone and requires special tooling to adjust alignment.

The cornering station consists of an inject feed roll and pressure shoe assembly, **A**. Two card aligner rolls, **B**, a registration spring assembly, **C** and a card kicker assembly, **D**.

The inject feed roll and pressure shoe assembly moves the card into the cornering station. As the card enters, the aligner rolls skew the card slightly to make sure it is against the kicker rail and away from the print stepper rolls. The registration spring assembly stops the card and then registers it back against the pressure shoe base. This registers the card serially for printing.

The aligner rolls are then raised and the card kicker moves the card from the cornering station into the pinch point of the print stepper rolls. The card is now registered at the print station.



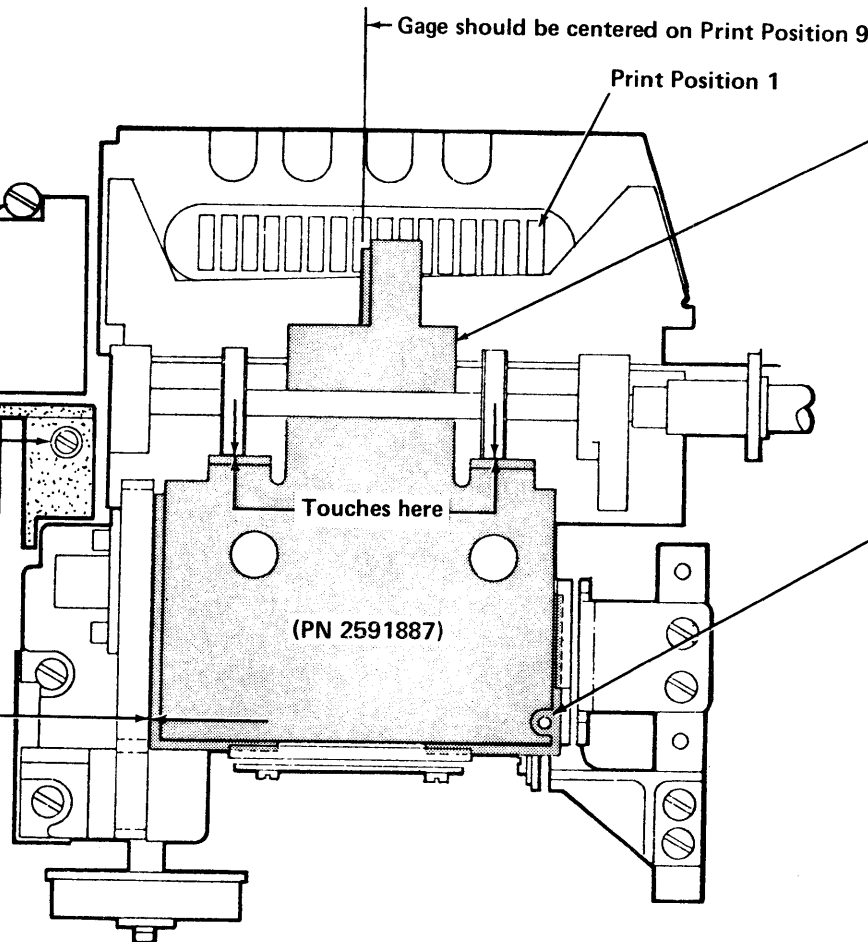
CORNER STATION GUIDE RAIL

REMOVAL

NOTE: Do not remove this guide while punch is out of machine.

- 1 Remove ribbon guide screw and slide guide out of the way. (When re-installing, see adjustment page 65).
- 2 Remove mounting screw.
- 3 Reinstall by reversing above procedure.
- 4 When re-installing, make sure guide rail is against post-punch card bed.

Flush to 0.003" (0,076 mm)
Maximum Gap

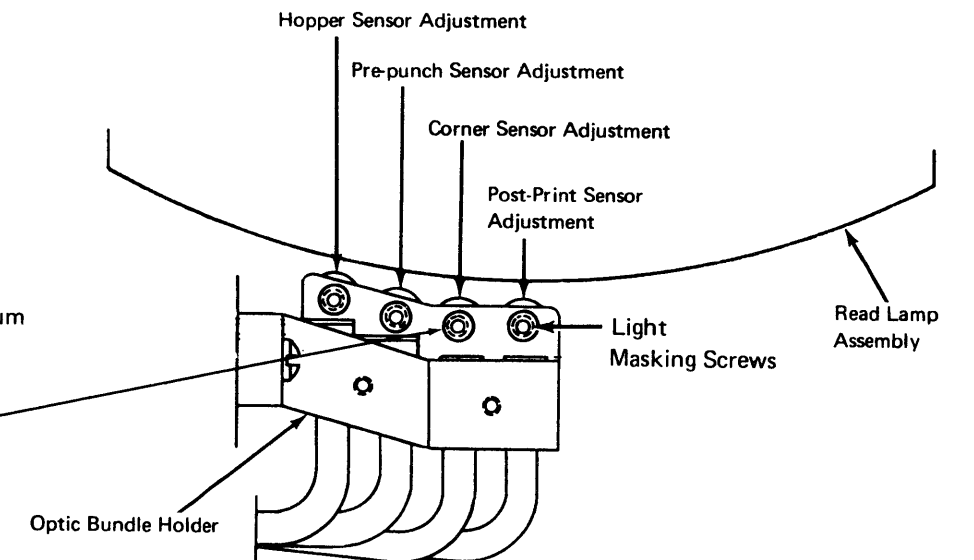
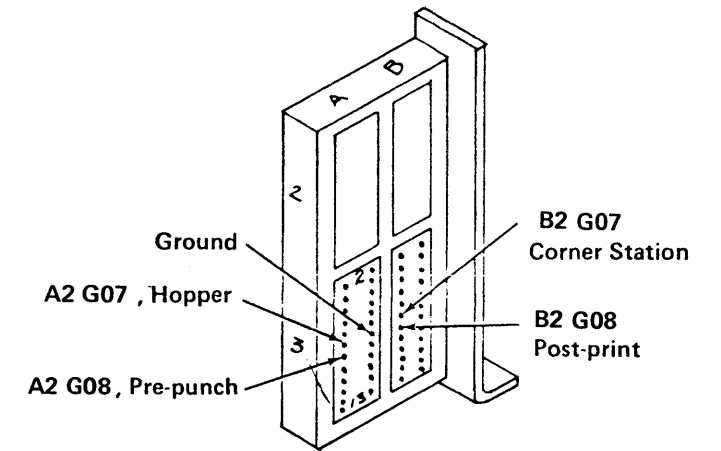


CORNER STATION CARD SENSOR

ADJUSTMENT

NOTE: Make sure corner station gage can be positioned as shown. If not, adjust pressure shoe base assembly to print station alignment.

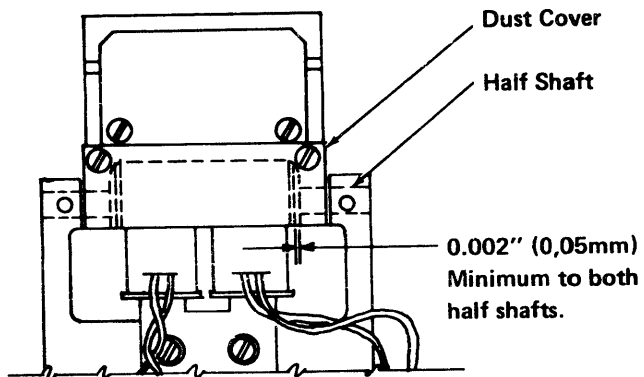
- 1 Turn off machine power and remove two punch check/card sensor amplifier card (located behind chip box). Remove necessary safety covers.
- 2 Make sure both ends of light pipe are clean.
- 3 Adjust light pipe flush to top of card bed.
- 4 Turn on machine power.
- 5 With corner station alignment gage in place, position light pipe in center of hole.
- 6 Connect milliammeter positive lead to ground and negative lead to B3B07.
- 7 Position cover mounted card sensor for a maximum output and tighten holding screw.
- 8 Adjust light masking screw for a meter reading of 450 to 550 microamps if room temperature is 67° to 70° F, (19° to 25° C). (If temperature is outside this range, refer to chart on page 27).



CORNER KICKER ASSEMBLY

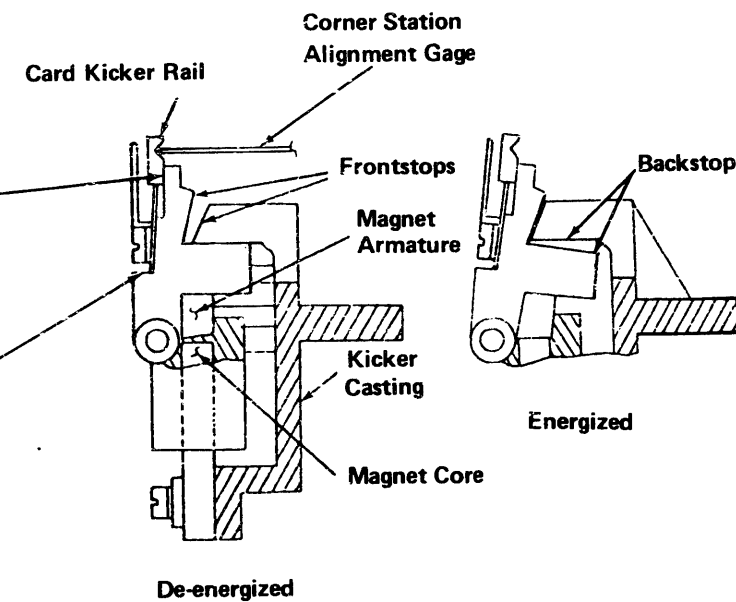
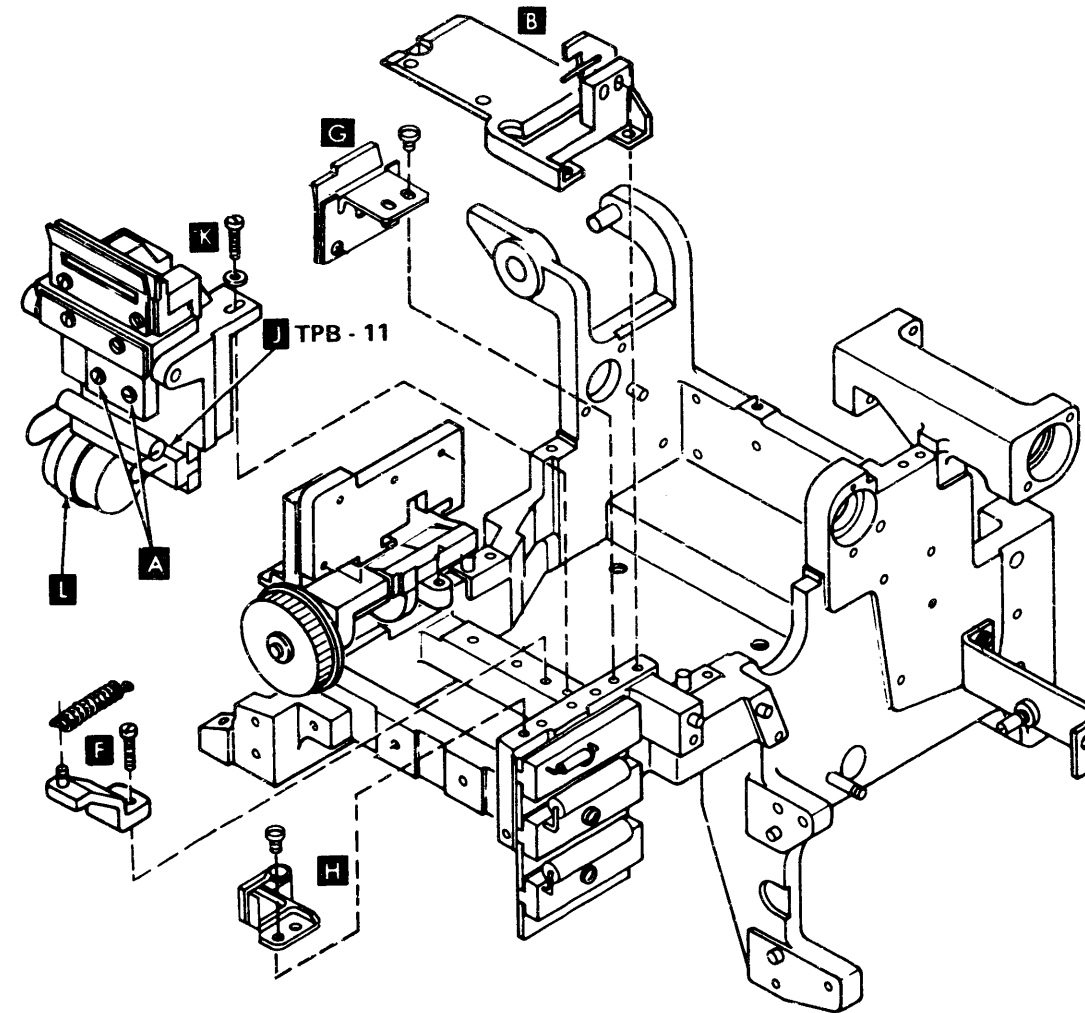
SERVICE CHECK

- 1 Energize and de-energize kick magnet several times by jumpering TPB11-B and then TPB11-C to ground. Each jumper energizes only half the magnet.
- 2 Each time magnet is energized, check that frontstops make full contact. When magnet is de-energized, check that kicker returns freely against backstops.
- 3 Machines with serial number 10,000 to 12,400, check for excessive backstop wear as indicated by:
 - a. No spring tension holding kicker arm against backstop (de-energized position).
 - b. Assembly being adjusted to its limits (slotted holes).
 - c. Kicker rail contacts bedplate when pushed forward.
- 4 If binding occurs or kicker does not return freely, check half shaft clearance to dust cover.



ADJUSTMENT

- 1 Adjust kicker magnet:
 - a. Jumper TPB11-B to ground (kicker magnet). CAUTION: Do not leave magnet energized for over 3 minutes or damage will occur.
 - b. Loosen magnet mounting screws. **A**
 - c. Move magnet assembly and force kicker arm forward until front stops make full contact. Allow both legs of magnet core to contact armature.
 - d. Tighten mounting screws.
 - e. Remove jumper.
 - f. Check that kicker moves freely.
- 2 Check adjustment by energizing only half of the magnet several times (jumper TPB11-B or TPB11C to ground). Each time, kicker frontstops should make full contact. Rail should return freely when magnet is de-energized.
- 3 Adjust kicker location:
 - a. Remove bedplate. **B**
 - b. Place corner station alignment gage in position as shown on facing page.
 - c. Loosen mounting screws.
 - d. Adjust corner kicker assembly for 0.001" to 0.005" (0,03mm to 0,13mm) gap.
 - e. Tighten mounting screws and recheck adjustment.
 - f. Remove gage.
 - g. Re-install bedplate. (See page 62).
- 4 Adjust kicker rail spring to touch bottom.



REMOVALS

KICKER ASSEMBLY REMOVAL

- 1 Remove safety cover.
- 2 Remove bedplate. **B**
When re-installing, see page 62.
- 3 Remove spring and support bracket. **F**
(When re-installing, center bracket in clearance.)
- 4 Remove registration spring assembly. **G**
- 5 Remove light pipe holder mounting screws. **H**
- 6 Remove terminal block **J** mounting screw.
- 7 Remove magnet. **A**
- 8 Remove mounting screws. **K**
- 9 Remove capacitor holding clamp **L** and screw.
- 10 Re-install by reversing above procedure and adjust assembly as shown on this page.

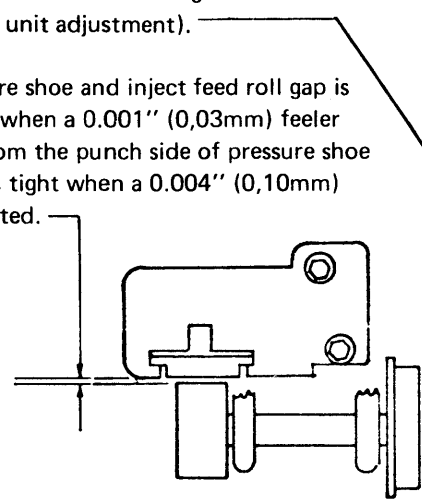
KICKER MAGNET REMOVAL

- 1 Remove safety cover.
- 2 Remove magnet leads from TPB11.
- 3 Remove taper pin block **J** mounting screw.
- 4 Remove magnet mounting screws. **A**
- 5 Remove assembly.
Re-install by reversing above procedure.

CORNER INJECT FEED ROLL AND PRESSURE SHOE BASE ASSEMBLY

SERVICE CHECK

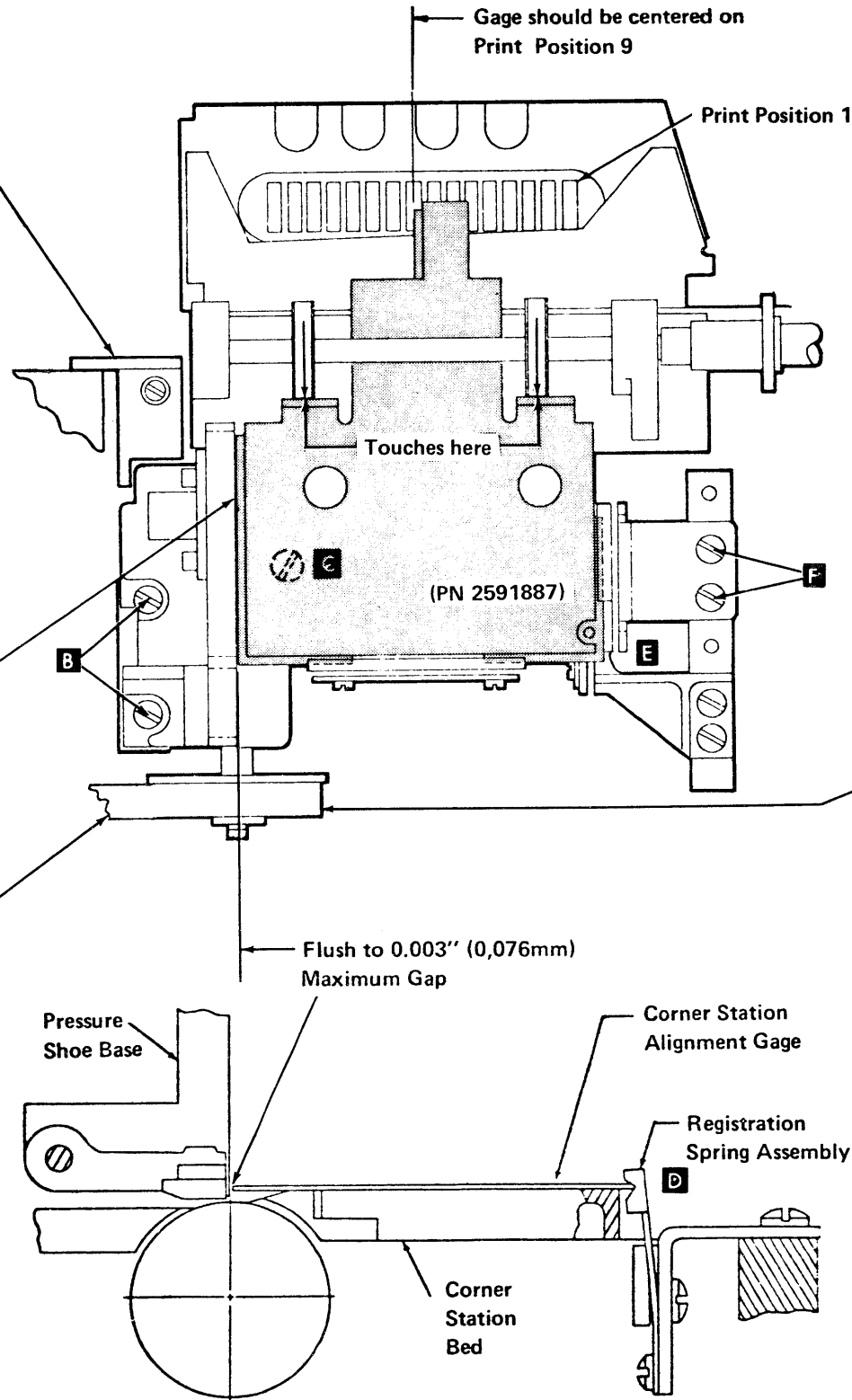
- 1 Check that post punch card bed is against corner station guide rail. (Punch unit adjustment).
- 2 Check that pressure shoe and inject feed roll gap is parallel and loose when a 0.001" (0,03mm) feeler gage is inserted from the punch side of pressure shoe and feed roll; and tight when a 0.004" (0,10mm) feeler gage is inserted.



- 3 Check adjustment through 360 degrees of feed roll rotation.
- 4 Make visual inspection of feed roll.
- 5 Check corner pressure shoe base assembly to print station alignment:
 - a. Open print magnet unit and insert corner station alignment gage. Make sure gage is down against corner station bed.
 - b. Check that gage is aligned as shown.
 - c. Remove gage.

REMOVAL

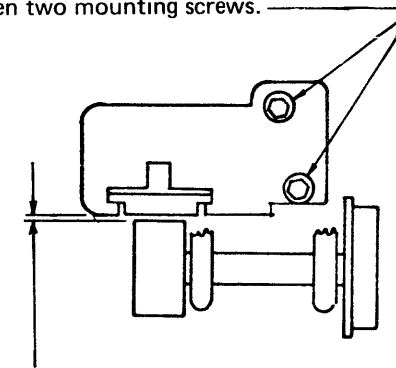
- 1 Remove drive belt.
- 2 Remove corner station bedplate.
- 3 Remove two mounting screws. **B**
- 4 Reinstall assembly by reversing above procedure and check/adjust:
 - a. Corner inject feed roll and pressure shoe assembly.
 - b. Corner registration spring (This Page)
 - c. Post-punch card cover (page 54).
 - d. Corner Station bed (page 62).



ADJUSTMENT

- 1 Adjust corner inject feed roll to pressure shoe gap:

- a. Loosen two mounting screws.
- b. Lower base assembly until a 0.004" (0,10mm) gage is tight and 0.001" (0,03mm) gage is loose between pressure shoe and inject feed roll. Insert gage from punch side of assembly. Check that pressure shoe is parallel to feed roll, then tighten mounting screws.
- c. Recheck adjustment.



- 2 Adjust pressure shoe base assembly to print station alignment:

- a. Loosen drive belt.
- b. Loosen two mounting screws. **B**
- c. Loosen corner bedplate mounting screw. **C**
Place corner station alignment gage in position and adjust for alignment as shown.
- d. Tighten mounting screws. **B**
- e. Remove gage. Tighten bedplate mounting screw. **C**
- f. Make sure that at least a clearance (0.003" 0,08 mm) exists between feed roll assembly casting and print side motion carriage through full carriage travel.
- g. Adjust drive belt tension.

- 3 Check corner station registration spring adjustment
- 4 Check post-punch cover adjustment
- 5 Check light pipe location (page 58).

CORNER STATION REGISTRATION SPRING ASSEMBLY

SERVICE CHECK

- 1 Check corner pressure shoe base to print station alignment using corner station alignment gage in position shown.
- 2 Check that registration spring assembly notch makes contact with the gage without deflecting the spring. **D**

ADJUSTMENT

- 1 Place corner station alignment gage in position and check alignment.
- 2 Check that light pipe is centered in gage hole and will not interfere with spring assembly. **E**
- 3 Loosen two registration spring adjusting screws. **F**
- 4 Locate assembly so that notch makes contact with gage without deflecting spring. **D**
- 5 Remove registration gage.

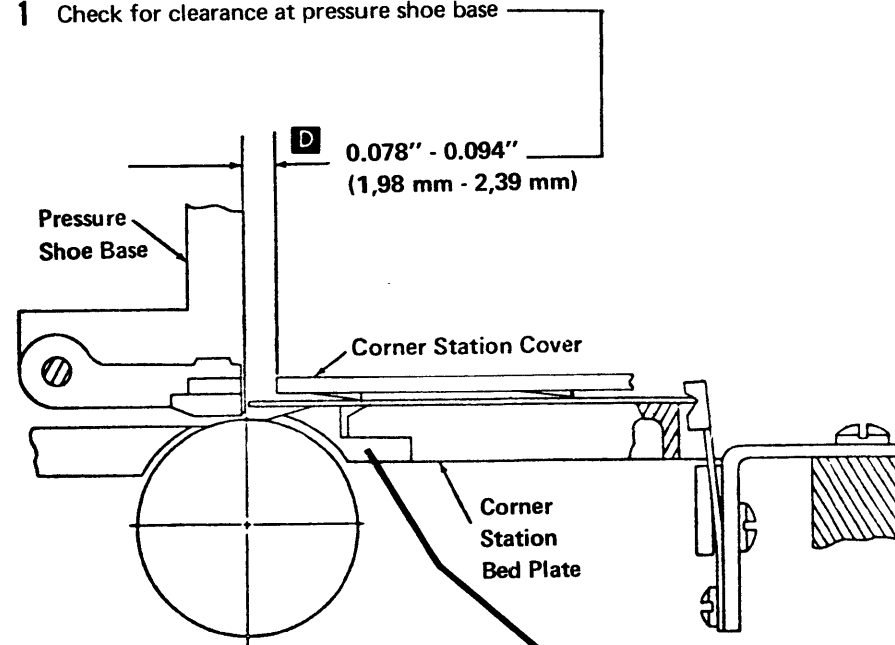
REMOVAL

- 1 Remove corner station bedplate.
When re-installing:
 - a. Check for clearance at print side motion carriage.
 - b. Check that kicker does not touch bed when magnet is energized.
 - c. Check that cover latch is flush with catch.
- 2 Remove two mounting screws. **F**
- 3 Reinstall by reversing above procedure and adjust as shown on this page.
- 4 Adjust corner station bed plate position.

CORNER STATION COVER

SERVICE CHECK

- 1 Check for clearance at pressure shoe base



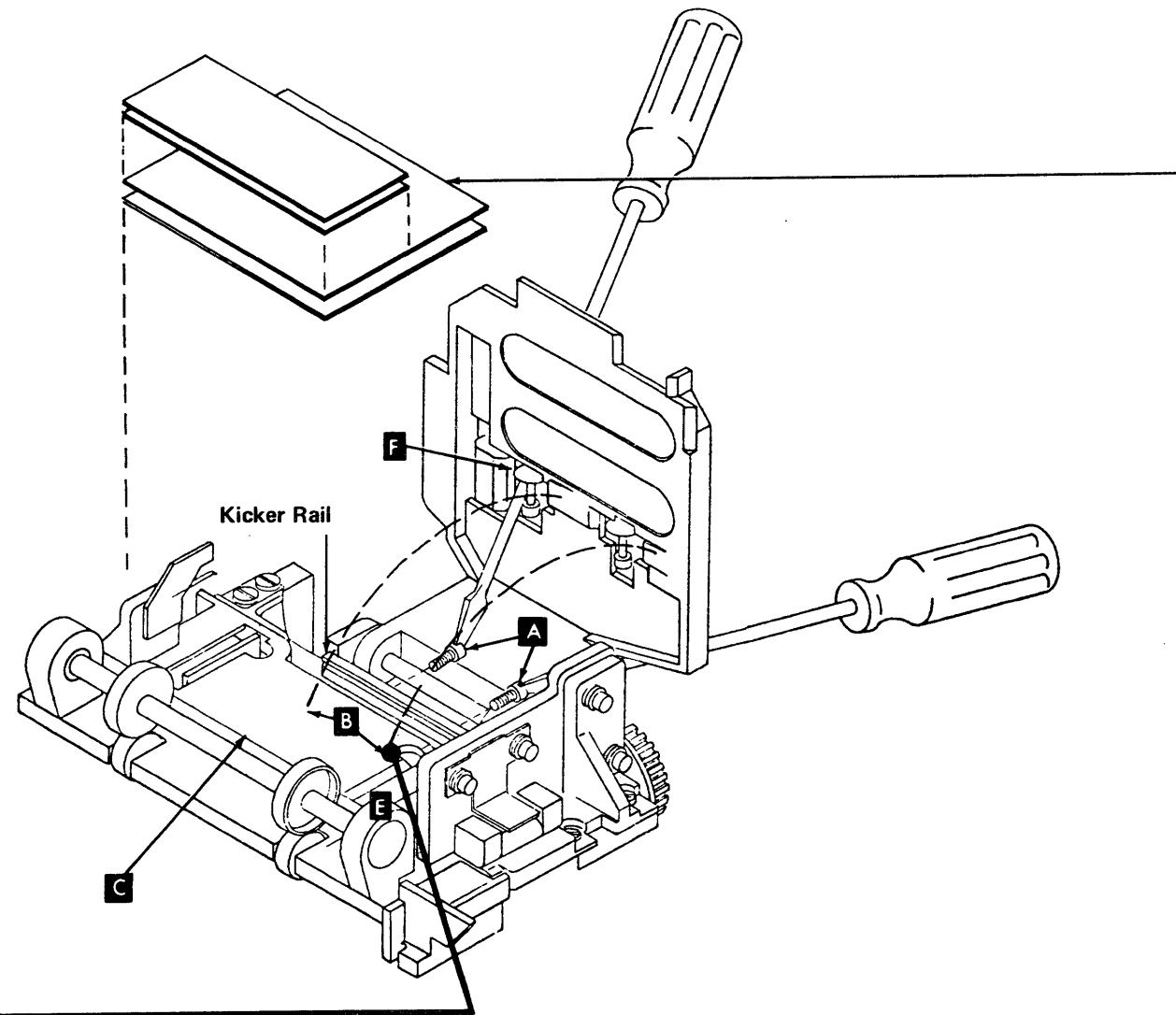
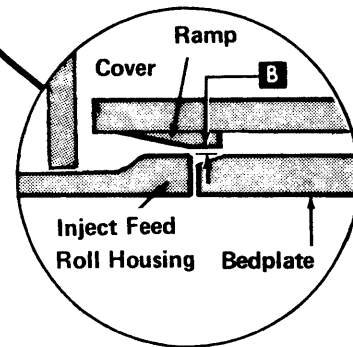
- 2 Remove kicker rail **A** and check gap between cover ramps and bedplate as shown.

$0.014'' \pm 0.005''$ (0,36 mm \pm 0,13 mm) **B**

- 3 Replace kicker rail. Rail spring should touch bottom.

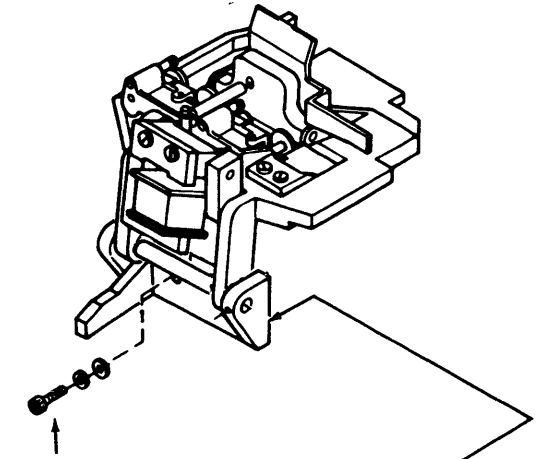
- 4 Check for minimum gap between cover and print side motion carriage bed.

$0.028'' \pm 0.005''$ (0,71 mm \pm 0,13 mm) **C**



ADJUSTMENT

- 1 Insert cards under the corner station cover (two full size and one cut in half).



- 2 Loosen mounting screws (a thin film of oil on back side will help in adjusting cover).

- 3 Loosen cover catch mounting screws.

- 4 Locate cover to clear (1) pressure shoe base (approximately 0.078" - 1,98mm), **D** and (2) print side motion carriage. **E**

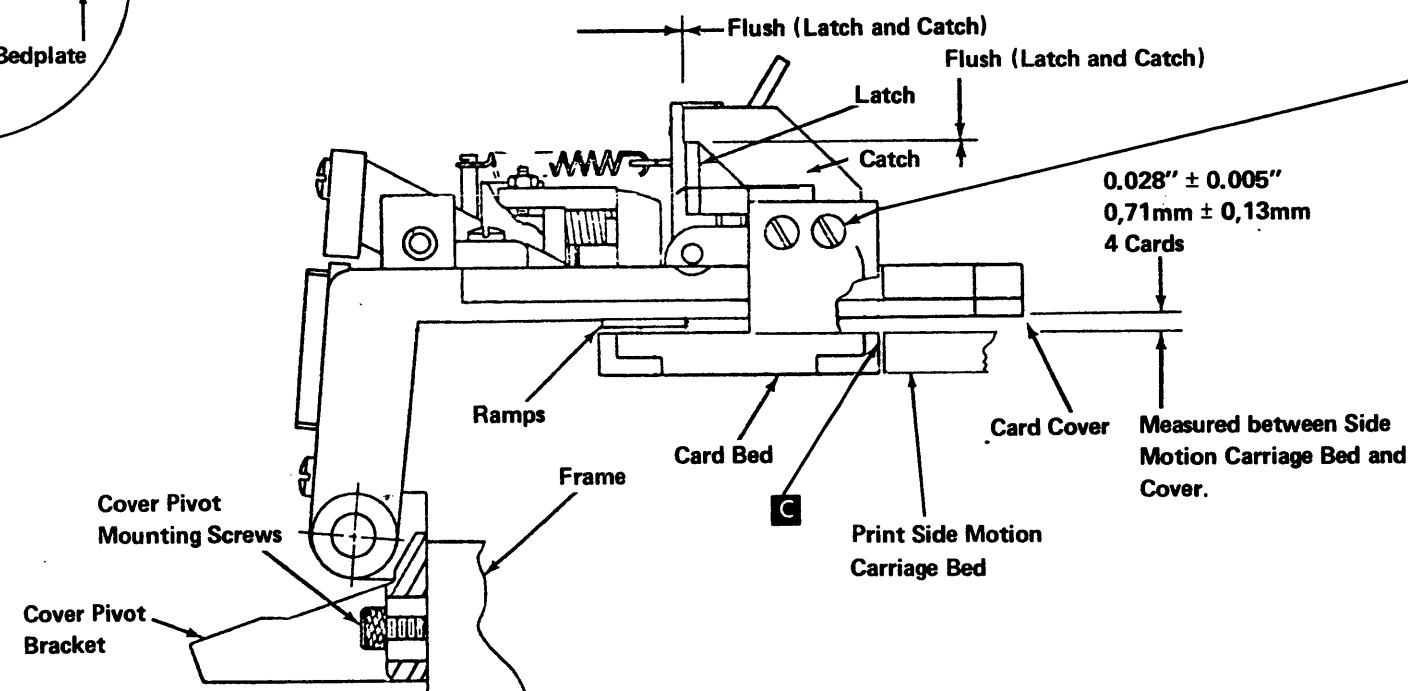
- 5 Press down on cover and tighten mounting screws.

- 6 Hold cover down and position latch flush with catch. Tighten screws.

- 7 Remove cards and make minor re-adjustments as needed to meet specified clearances. **B** **C**

- 8 With side motion cam at low dwell, move print side motion carriage to check for interference between cover and rolls.

- 9 After cover is in the correct position, make aligner roll adjustment **F** (page 62).

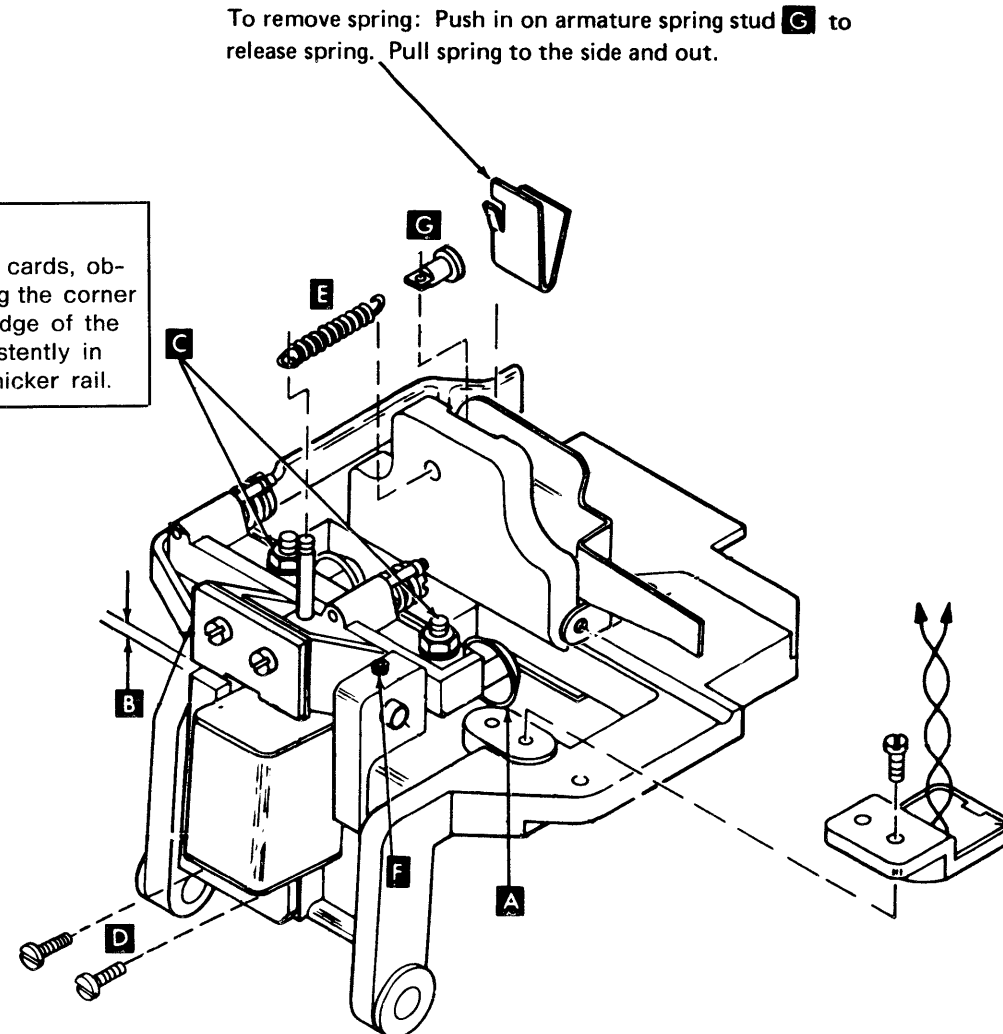


CARD ALIGNER ROLLS

SERVICE CHECK

- 1 Check that magnet core and armature are parallel with a $0.010'' \pm 0.002''$ (0,25 mm \pm 0,05 mm) gap. **B** Residual must be flush against armature.
- 2 Perform **Corner Station Cover** service check (page 61).
- 3 Insert a card in the corner station and check that setscrews **C** clear their downstop.
- 4 Remove card and energize aligner roll magnet (TPB9-A to ground). Check for 0.001'' to 0.005'' (0.03 mm to 0.13 mm) gap between aligner rolls **A** and the card bed inserts.

NOTE
While feeding cards, observe the card entering the corner station. The bottom edge of the card should be consistently in the V notch of the chicker rail.

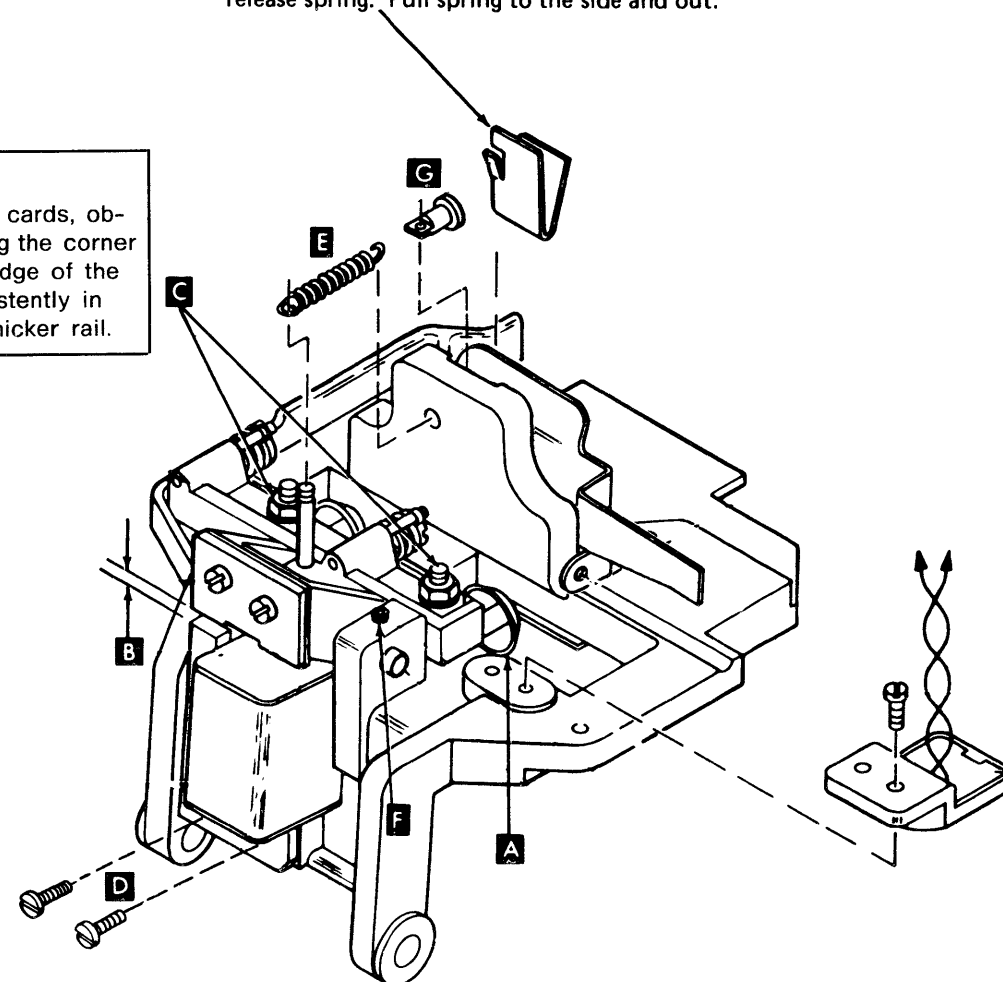


ADJUSTMENT

- 1 Perform **Corner Station Cover** service check (page 61).
- 2 Loosen magnet mounting screws. **D**
- 3 Adjust magnet (and armature if necessary) for $0.010'' \pm 0.002''$ (0,25 mm \pm 0,05 mm) gap. **B** Core and armature must be aligned and parallel. Residual must be flush against armature.
- 4 Tighten mounting screws. **D**
- 5 Place a card in the corner station and adjust setscrews **C** to just clear their downstops.
- 6 Remove the card and energize the aligner roll magnet (TPB9-A to ground).
- 7 Check for 0.001'' to 0.005'' (0.03 mm to 0.13 mm) gap between aligner rolls **A** and the card bed inserts.
- 8 If above conditions can not be achieved, re-adjust magnet to armature gap for $0.012'' + 0.000'' - 0.002''$ Then repeat step four.

LATCH SPRING REMOVAL

To remove spring: Push in on armature spring stud **G** to release spring. Pull spring to the side and out.



CARD ALIGNER ROLLS

REMOVAL

- 1 Remove armature spring. **E**
- 2 Loosen set screw **F** and slide out shaft
Some machines have set screw on bottom side of cover.
CAUTION: Housing can be cracked if screw is overtightened.
- 3 Replace aligner roll as required.
Re-install and adjust rolls **A**
- 4 Check magnet to armature gap. **B**

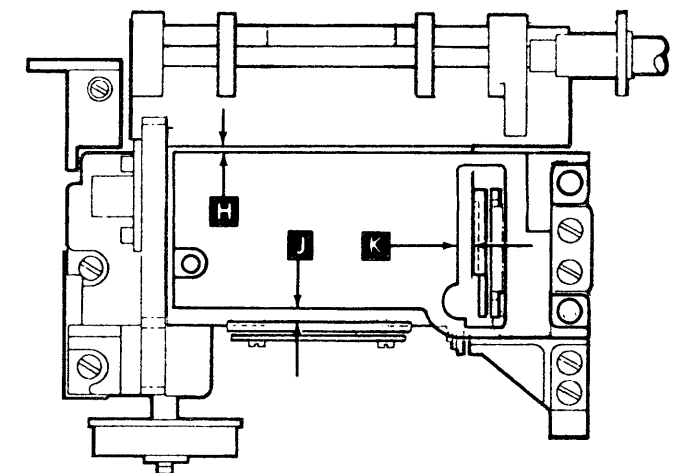
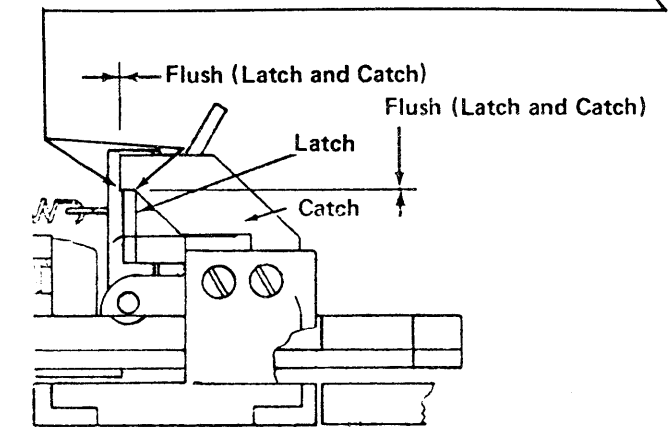
CORNER STATION BEDPLATE

POSITION ADJUSTMENT

Position bedplate for clearance to

- 1 Print side motion carriage **H**
 - 2 Corner kicker rail (with magnet energized - TPB11-B to ground), **J**
- NOTE:** Do not leave magnet energized over three minutes or coil damage will occur.
- 3 Registration spring assembly. **K**

Cover release should latch up between these two points.



PRINTING OPERATION

- The SIO instruction starts the print operation.
- Printing begins after the card is fed from the corner station and advanced to print line 1 position.
- The card is printed and fed through the print station in a parallel manner.
- A side motion carriage is shifted serially to allow printing of 32 print positions per print line.

CARD FEEDING

The SIO instruction starts the mechanical operation of the MFCU. To begin a print operation, the card is ejected from the selected wait station. The card then passes through the punch station to the corner station and at the corner station the corner kicker registers the card against the print stepper feed roll. The stepper clutch magnet is de-energized and the card moves to print line 1 position. Line 1 is now ready to be printed. When all lines of printing is completed, the card is routed to the selected stacker.

CARD PRINTING

The sixty-three possible characters are printed by a set of continuously running print wheels; the sixty-fourth place on the wheels is a blank. Individual print hammers drive the card to be printed down against an inked ribbon and print wheel at the right time to print the desired character. Printing occurs with the print wheels in motion.

The Model A2 print unit contains 16 printwheels, 16 hammers, and 16 magnets. This allows printing of alternate positions on the card for each position of the side motion carriage. The Model A1 print unit contains only eight printwheels, eight hammers, and eight magnets and therefore require four positions of the side motion carriage. The print magnets are controlled by the attachment.

It is possible to print thirty-two print positions of alpha, numeric, or special characters across four print lines at the top of the card. Three lines are printed on a normal print operation, but a fourth line may be printed at reduced throughput with a change to the instruction.

CB pulses are sent from the MFCU to the attachment unit to synchronize the electrical-mechanical operations. These CB pulses are also used to step counters in the attachment unit to control the print operation.

After the card is positioned at line 1, the print operation begins. The print wheels rotate on a common shaft, and a print character counter in the attachment is used to determine the character that is ready to be printed.

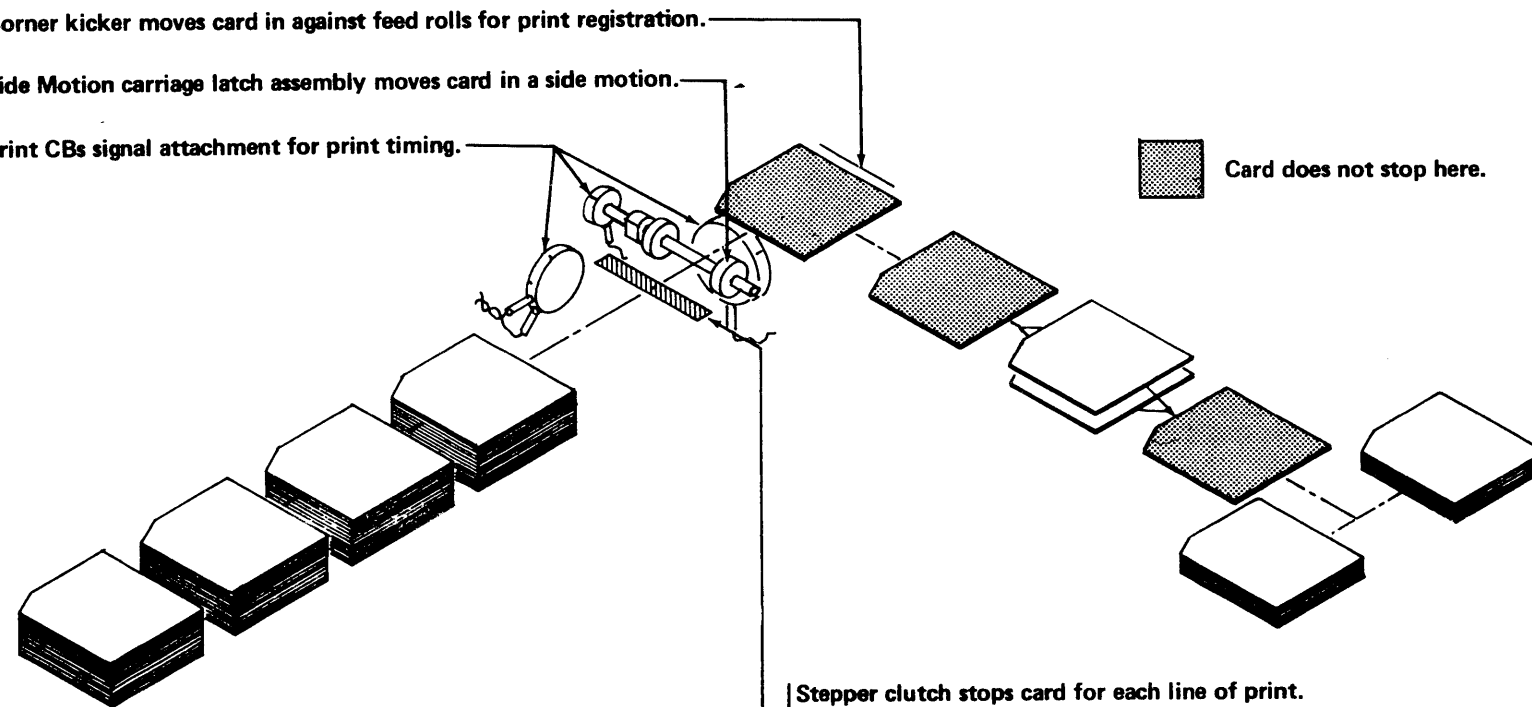
The contents of the print character counter are sent to the CPU during each print cycle steal. The print character count is then compared with the data from each addressed core storage position to determine whether or not the character is to be printed by one or more of the typewheels. As a result of each compare, a compare or no compare signal is sent to the attachment print shift register. As each compare or no compare signal is generated and sent to the print shift register, the data is shifted one shift register position. After 16 (Model A2 comparisons), the print shift register contents are gated to a print register. The print register is gated to print the positions that have been selected as the result of the comparisons. The print fire CB pulse causes the print character counter to be advanced one count. A new group of 16 comparisons (Model A2 is made for the next print character count).

There are 16 comparisons made for each print character counter value and 64 characters counted for each revolution of the typewheels. After one typewheel revolution, all characters on the 16 typewheels have been optioned for printing. At the completion of one typewheel revolution, one-half line (alternate positions) has been printed (Model A2). The side motion carriage then shifts so that 16 more characters can be printed on line 1 (B). The same comparison takes place for the second half of line 1. After the second group of characters is printed, line 1 printing is completed. (Three side motion carriage shifts are necessary for machines with eight typewheel positions.) The side motion carriage returns the card to the starting position and the print stepper clutch advances the card to print line 2 for the next group of print cycles.

Corner kicker moves card in against feed rolls for print registration.

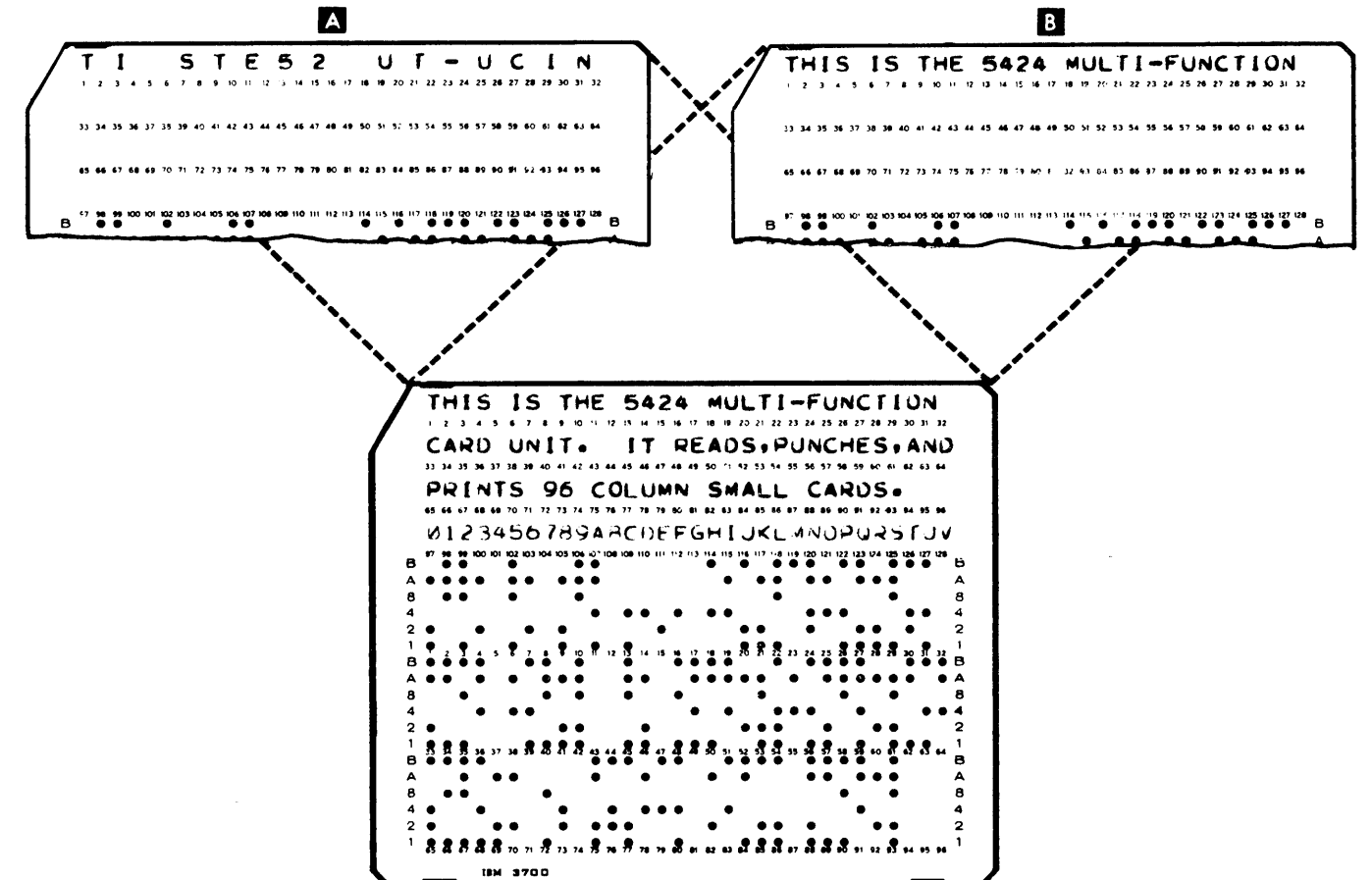
Side Motion carriage latch assembly moves card in a side motion.

Print CBs signal attachment for print timing.



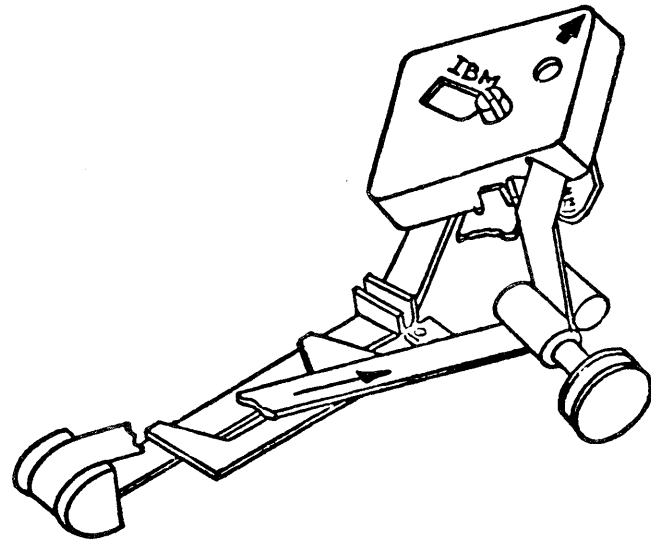
Stepper clutch stops card for each line of print.

Print positions 1, 3, 4, etc are printed by the 16 printwheels. (Model A1 prints positions 1, 5, 9, etc with eight printwheels.)



RIBBON DRIVE

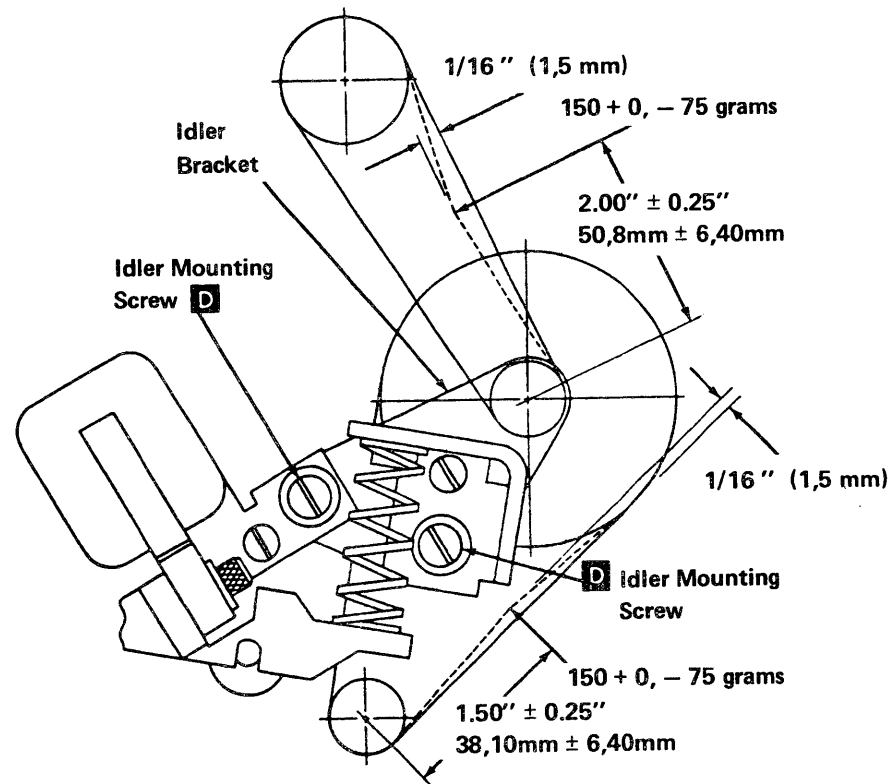
An endless loop of nylon ribbon is driven in a continuous motion across the print line, rolled up in a small cartridge and fed again from the center of the roll. Pinch rolls pull the ribbon out of the center hole of the cartridge, across the print line at an angle, around guide rolls, and feed it back around the outside of a spool inside the cartridge. A one-half turn loop in the ribbon causes both sides of the ribbon to be used in printing, and because the ribbon moves across the print line at an angle, the entire surface is used. Any initial slack in the ribbon is automatically taken up by the cartridge.



RIBBON DRIVE BELTS

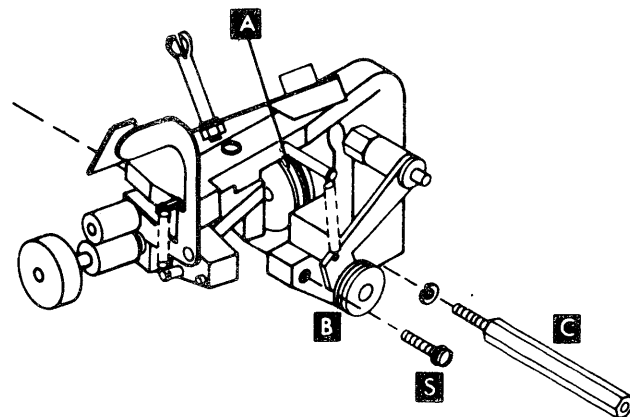
ADJUSTMENT

- 1 Loosen 2 idler mounting screws. **D**
- 2 Position idler so that $150 + 0, - 75$ grams pressure on either belt will cause $1/16''$ ($1,5 \text{ mm}$) deflection of that belt.
- 3 Tighten mounting screws. **D**



REMOVAL

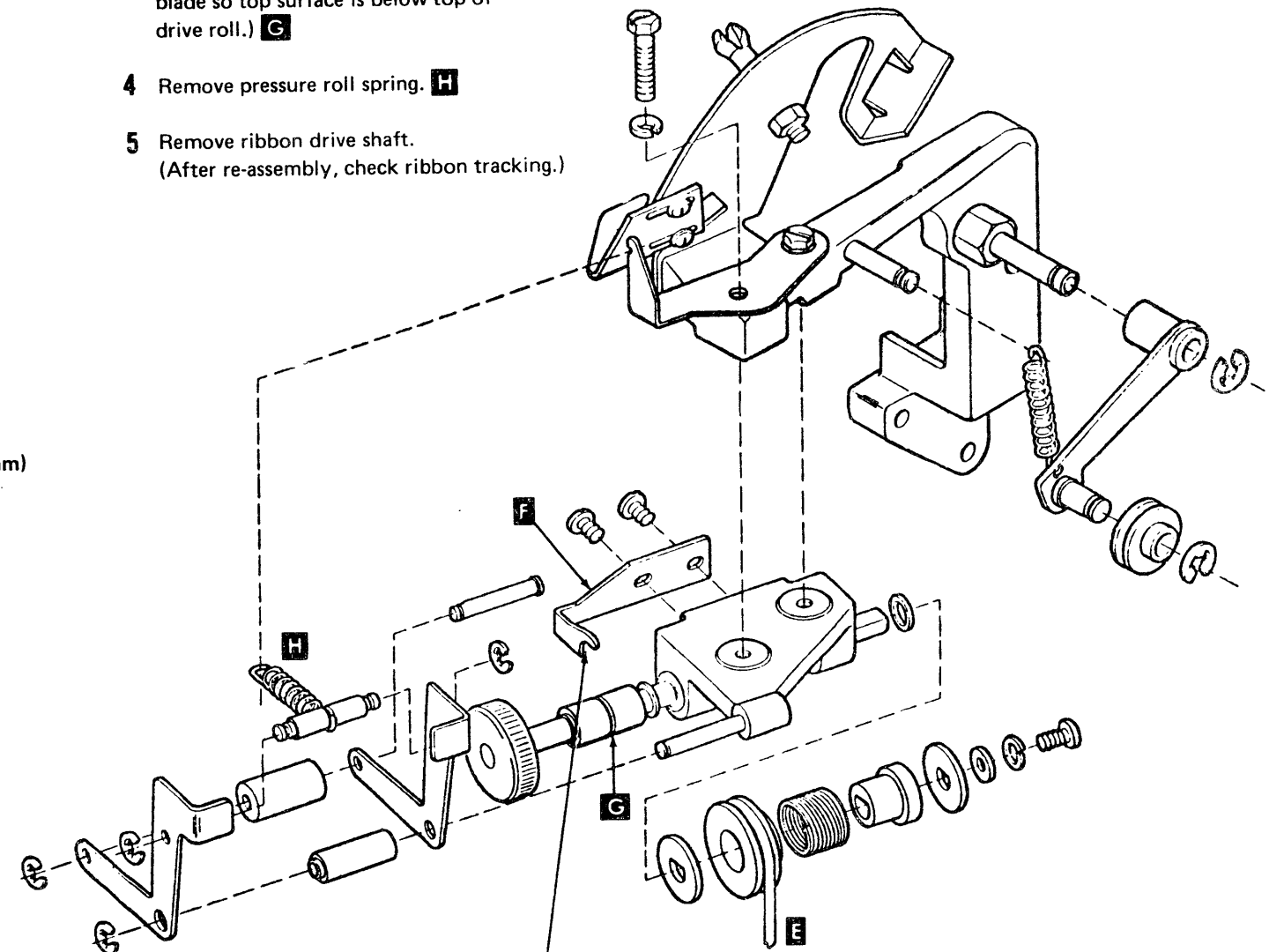
- 1 Remove ribbon.
- 2 Remove ribbon drive belt **A** by loosening idler assembly.
- 3 Unhook stepper clutch belt idler **B**
- 4 Remove ribbon drive stand-off mounting stud. **C**
- 5 Remove two screws **S** and ribbon drive assembly.
- 6 Reinstall assembly by reversing above procedure and check ribbon tracking.



RIBBON DRIVE ROLL

REMOVAL

- 1 Remove ribbon.
- 2 Remove ribbon drive belt. **E**
- 3 Remove ribbon stripper blade. **F**
(After re-assembly, position stripper blade so top surface is below top of drive roll.) **G**
- 4 Remove pressure roll spring. **H**
- 5 Remove ribbon drive shaft.
(After re-assembly, check ribbon tracking.)

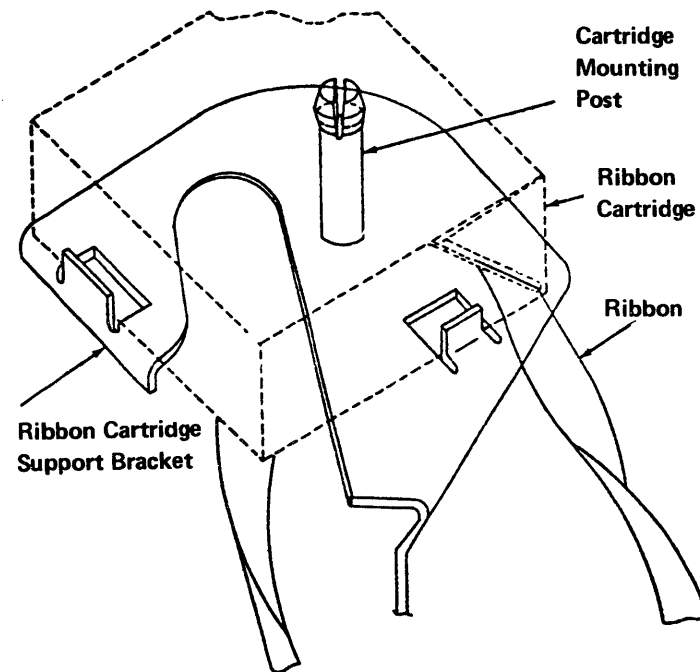


RIBBON STRIPPER BLADE SERVICE CHECK

Top edge of stripper blade must not protrude above top surface of rubber drive roll.

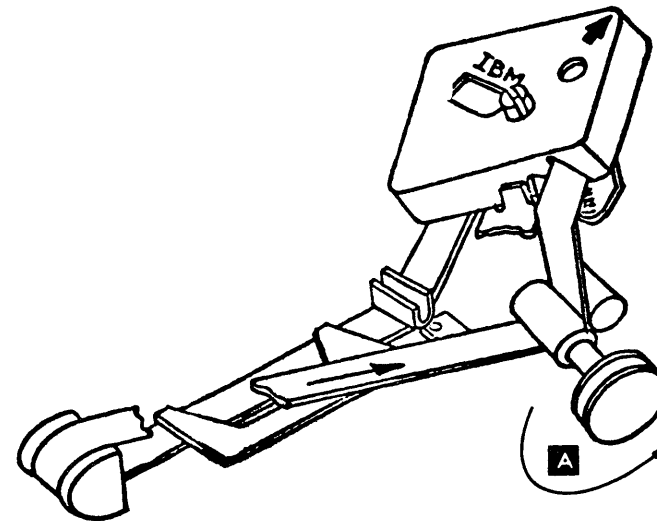
RIBBON REMOVAL

- 1 Raise print hammer unit.
- 2 Remove ribbon from guides and drive rolls.
- 3 Unsnap ribbon cartridge from mounting post and remove ribbon cartridge.



RIBBON REPLACEMENT

- 1 Pull out 18" to 20" (457,2 mm to 508,0 mm) of ribbon slowly from the center of the ribbon cartridge. (As ribbon is pulled out, prevent it from entering the slot on the side of the cartridge.)
- 2 Snap cartridge on mounting post.
- 3 Route ribbon according to decal on ribbon unit.
- 4 Turn drive roll knob counterclockwise **A** until slack has entered the cartridge.

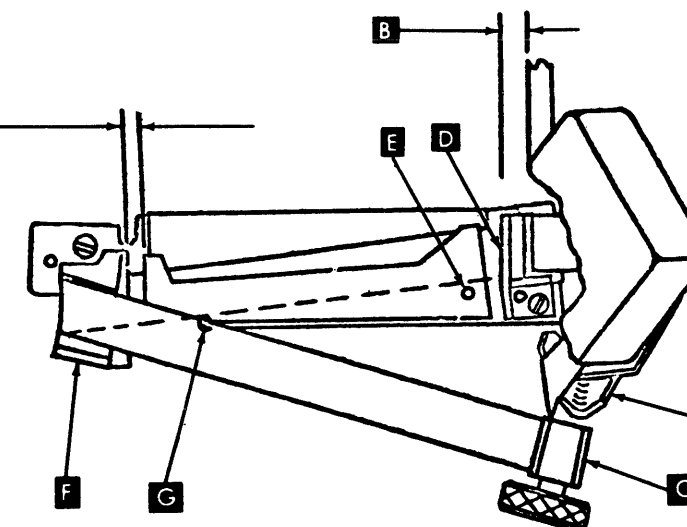


RIBBON TRACKING

ADJUSTMENT

Initial

- 1 Adjust guide roll so that its axis is parallel to edge of ribbon mask.
- 2 Adjust guide **D** so that flat face is parallel **B** with machine frame.
- 3 Adjust ribbon drive roll assembly by rotating hand knob and pivoting the drive assembly until ribbon is approximately centered on the drive roll. **C**



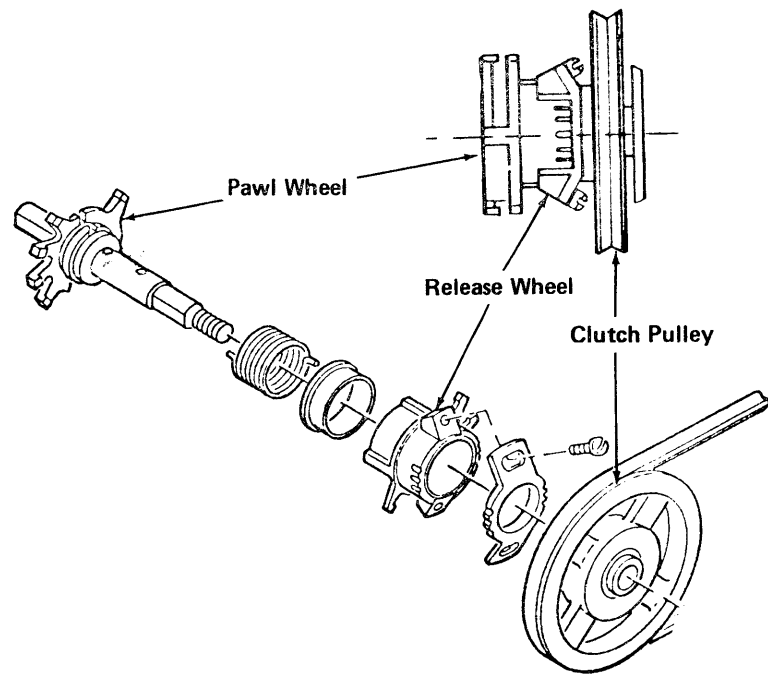
Final

- 1 Rotate the hand knob and check that the ribbon remains centered on the guide **D**; at the same time be sure that:
 - a. The ribbon is within the track in the print wheel bed.
 - b. The ribbon does not fold over or wrinkle at the guide pin. **E**
- 2 Adjust guide **F** so that ribbon stays within the track in the print wheel bed and does not wrinkle or fold over at the guide pin. **G**
- 3 Adjust guide **F** so that ribbon is as nearly centered as the previous adjustments will allow.
- 4 Adjust ribbon drive roll assembly so that ribbon is approximately centered on this roll. **C**
- 5 Adjust guide bracket so that ribbon is approximately centered on guiding surface.
- 6 Lower the print hammer unit and secure with thumbscrew. Start the machine and visually check ribbon tracking.

STEPPER CLUTCH

The helical spring stepper clutch controls the motion of the first set of feed rolls in the print feed. Under normal operation, the clutch magnet is de-energized and the feed rolls are continuously running. The clutch spring is wound around the clutch drive pulley hub and the pawl wheel, driving the print feed rolls.

When the clutch is energized, the clutch armature stops the release wheel, and the clutch spring unwinds from the drive pulley hub. The pawl wheel (which was lagging the release wheel) latches up behind the backstop flush with the release wheel. This stops the card for printing. There are five prongs (clutch latch points) on the release wheel and the pawl wheel. The separate latch point stops the feed rolls for print registration. The feed rolls stop and the card is buckled slightly against the feed rolls by the corner kicker.

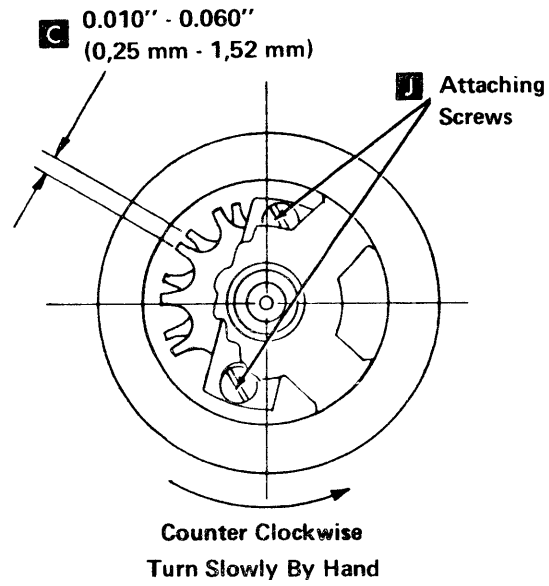
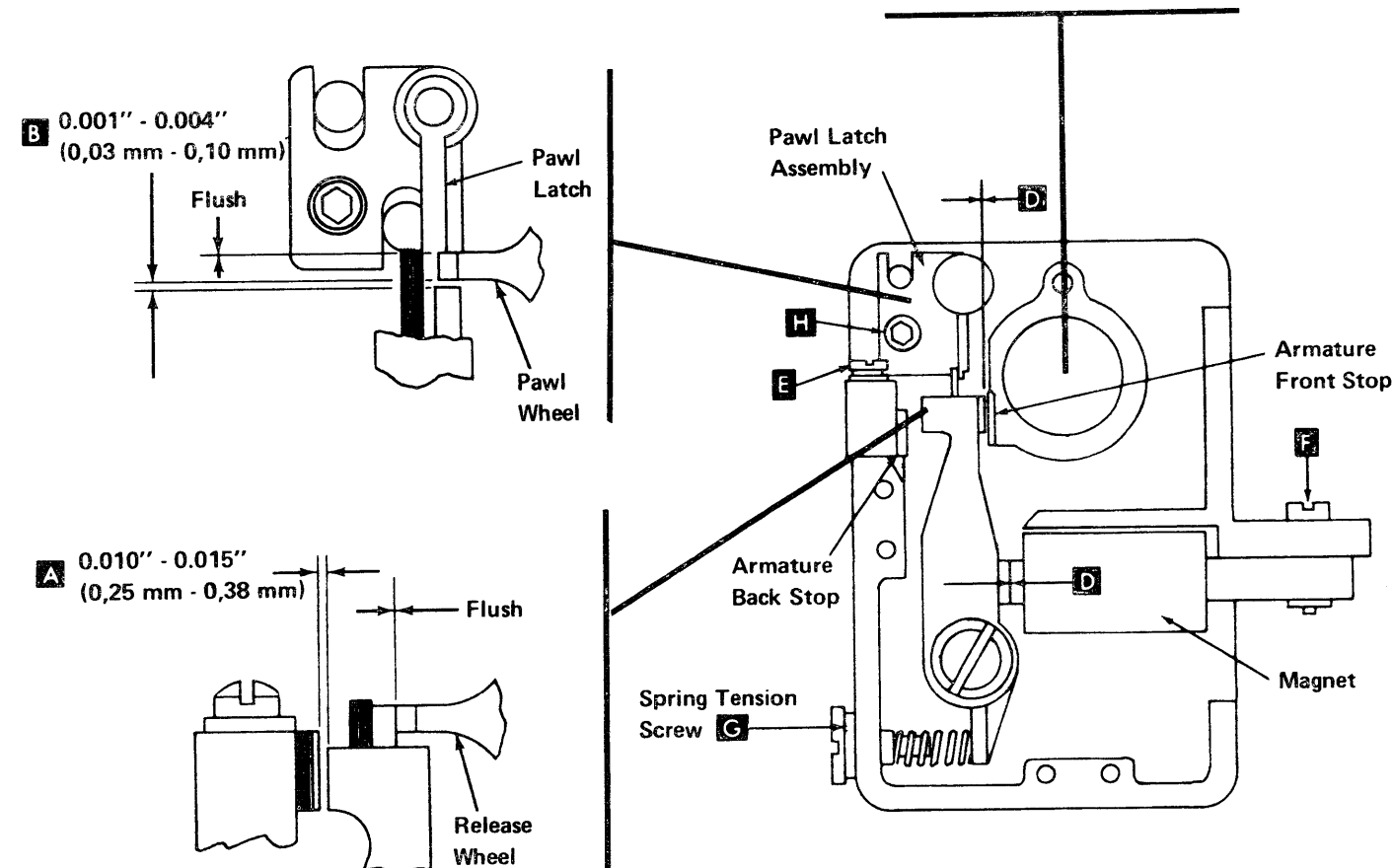


The remaining four latch points on the wheels correspond to the four print lines. When the magnet is energized, the feed rolls stop with the card in the correct position for printing a line.

Once the printing line is complete, the clutch is released and the armature returns under spring tension. The clutch spring winds around the pulley hub and the pawl wheel providing drive to the feed rolls again. This is repeated for each print line. Following the last printing line, the feed rolls move the card from the print station into the pinch point of the continuously running eject feed rolls.

SERVICE CHECK

- 1 Hold armature against tip of release wheel and check for 0.010" to 0.015" (0,25mm to 0,38mm) here. **A**
- 2 Hold pawl in the latched position and check for 0.001" to 0.004" (0,03mm to 0,10mm) here. **B**
- 3 Hold release wheel and rotate pulley counterclockwise. Check that release wheel leads pawl wheel by 0.010" to 0.060" (0,25mm to 1,52mm). **C**
- 4 Check that armature resilient is in place and armature is flush to 0.002" (0,05mm) maximum gap at either of these points. **D**



ADJUSTMENTS

- 1 Adjust armature and magnet:
 - a. Remove safety cover.
 - b. Loosen armature back stop mounting screws. **I**
 - c. Loosen magnet mounting screws. **K**
 - d. Hold armature against tip of release wheel and adjust armature back stop for a clearance of 0.010" to 0.015" (0,25mm to 0,38mm). **A**
 - e. Remove spring tension on armature by removing the spring tension screw. **G**
 - f. Jumper TPB32-H to ground clutch magnet. Hold armature against front stop. Make sure magnet core is seated on armature and tighten mounting screws. **L**
 - g. Remove jumper.
 - h. Tighten spring tension screw. **G**
- 2 Adjust pawl keeper assembly:
 - a. Loosen pawl latch screw. **M**
 - b. Adjust pawl latch position vertically so that when pawl is in the latched position there is a maximum clearance of 0.004" (0,10mm) between pawl latch and armature. **N**
- 3 Adjust lead of release wheel to pawl wheel:
 - a. Remove clutch drive belt.
 - b. Loosen two attaching screws. **J**
 - c. Adjust sleeve so release wheel leads pawl wheel by 0.010" to 0.060" (0,25 mm to 1,52 mm). **C**
 - d. Tighten attaching screws.
 - e. Hold release wheel and slowly rotate clutch pulley counterclockwise. Check that release wheel leads pawl wheel by 0.010" to 0.060" (0,25 mm to 1,52 mm).
- 4 Reinstall drive belt.
- 5 Reinstall clutch cover.

CARRIAGE STEPPER CLUTCH

REMOVALS

Clutch Assembly Removal

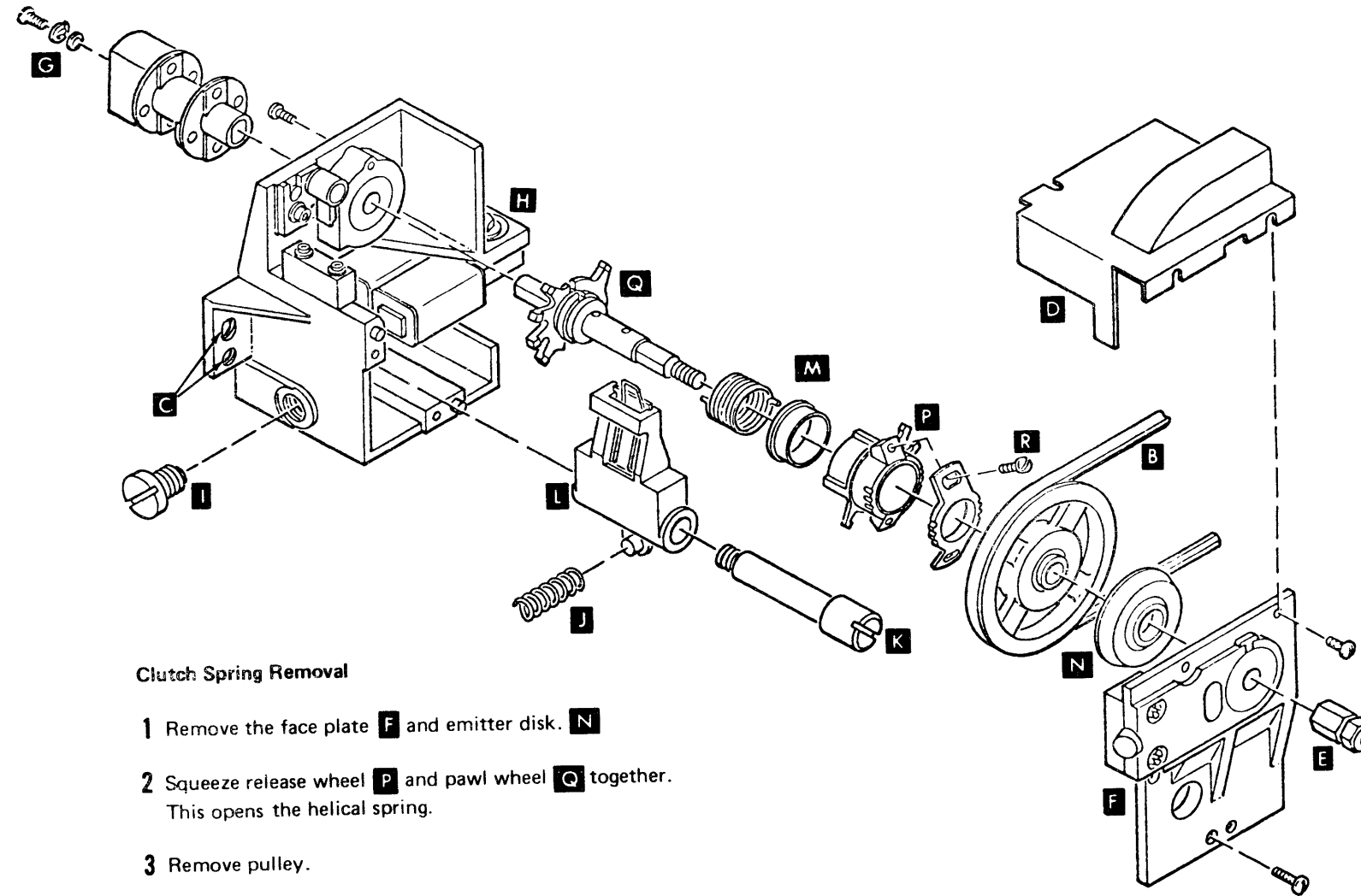
- 1 Remove drive belt. **B**
- 2 Mark and remove magnet and emitter wires.
- 3 Remove two clutch mounting screws. **C**
- 4 Remove assembly.
- 5 Reinstall by reversing above procedure.

Clutch Belt Removal

- 1 Remove safety cover. **D**
- 2 Remove hex nut from end of clutch shaft. **E**
- 3 Remove two face plate mounting screws and remove face plate. **F**
- 4 Remove belt. **B**
- 5 Reinstall belt by reversing above procedure and check stepper CB gap.

Carriage Stepper Clutch Disassembly

- 1 Remove clutch assembly from machine.
- 2 Remove coupling screw. **G**
- 3 Remove two face plate mounting screws and hex nut on end of clutch shaft and remove face plate. **F**
- 4 Remove two mounting screws and remove magnet assembly. **H**
- 5 Remove armature spring mounting screw **I** and remove spring. **J**
- 6 Remove armature pivot shaft **K** and remove armature. **L**
- 7 Remove stepper shaft assembly. **M**
- 8 Reassemble by reversing above procedure and readjust clutch.



Clutch Spring Removal

- 1 Remove the face plate **F** and emitter disk. **N**
- 2 Squeeze release wheel **P** and pawl wheel **Q** together. This opens the helical spring.
- 3 Remove pulley.
- 4 Remove release wheel, sleeve, and helical spring.
- 5 Replace the spring by reversing the above procedure and re-install the front plate. Check that the teeth of the release wheel lead the teeth of the pawl wheel by 0.010" to 0.060" (0,25 mm to 1,52 mm).
- 6 If new clutch parts are installed, adjust release wheel to lead pawl wheel by only 0.015" ± 0.010" (0,38 mm ± 0,25 mm). This allows for break in of the new parts.
- 7 If the lead is incorrect, loosen the two screws **R** that hold the adjusting collar to the release sleeve.
- 8 Rotate the release sleeve relative to the adjusting collar to make the adjustment.
- 9 Tighten screws. **R**
- 10 Lubricate the clutch with IBM #23 grease.
- 11 Check the stepper CB gap.

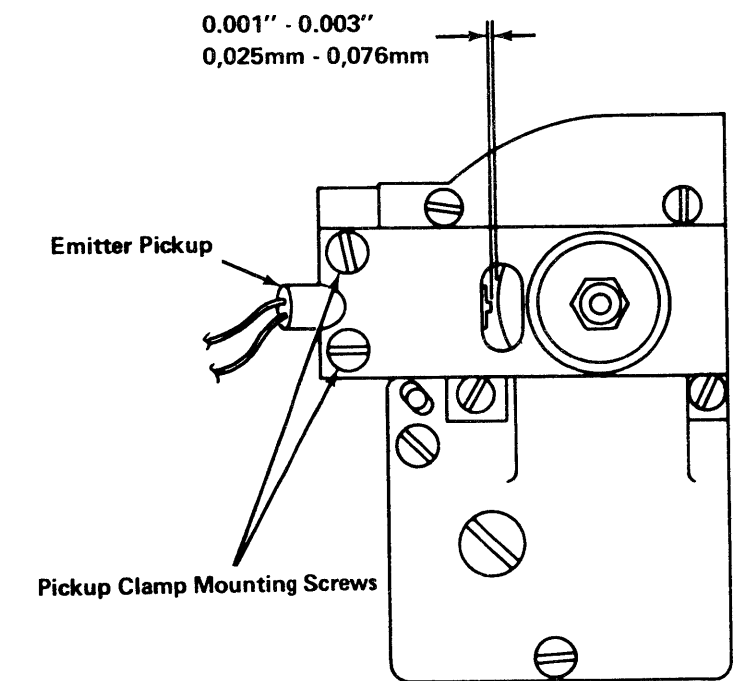
CARRIAGE STEPPER CLUTCH EMITTER

SERVICE CHECK

Check for a gap of 0.001" to 0.003" (0,03mm to 0,08mm) through 360 degrees of emitter wheel rotation.

ADJUSTMENT

- 1 Loosen pickup clamp mounting screws.
- 2 Adjust emitter pickup for a gap of 0.002" ± 0.001" (0,05mm ± 0,03mm) through 360 degrees of emitter wheel rotation.
- 3 Tighten mounting screws.
- 4 Recheck emitter gap.



SIDE MOTION CARRIAGE OPERATION

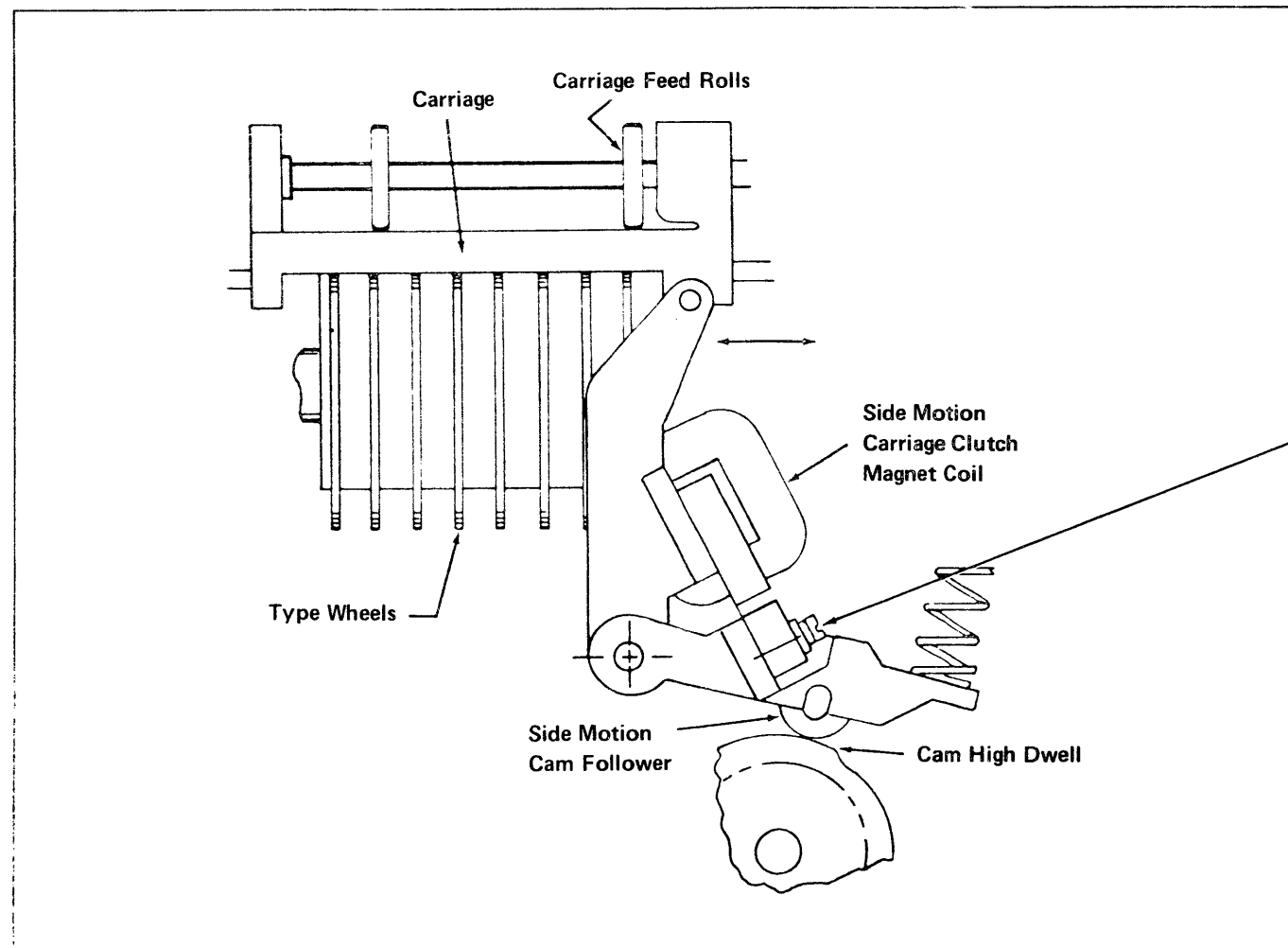
- Moves the card in parallel incremented steps for three printing lines. (Four lines can be printed under program control.)
- Moves the card serially (side motion) for each print line.
- Moves the card through in a smooth motion if the 5424 is not printing.

There are 32 print positions across the card, and the information is printed with eight printwheels (Model A1) by moving the card in a serial motion. This means that print positions 1, 5, 9, etc, are printed, then the carriage is moved one print space serially and characters 2, 6, 10, etc, are printed. With this method, all positions may be printed by moving the card serially three times for each print line. The card is moved to the next print line as it returns to its home positions. Model A2 has 16 printwheels, and requires moving the card only once in a serial motion. The odd-numbered column groups are printed, and the card is

moved serially one card column, and the even-numbered column groups are printed. This change in the number of side steps is accomplished by changing the carriage assembly cam.

The side motion magnet is energized at the time the cam follower is on the high dwell of the cam and against the magnet coil yoke. Through magnetic attraction, the side motion assembly moves with the cam follower. To ensure smooth motion of the carriage, this energizing and de-energizing occurs only when the cam follower is on its high dwell.

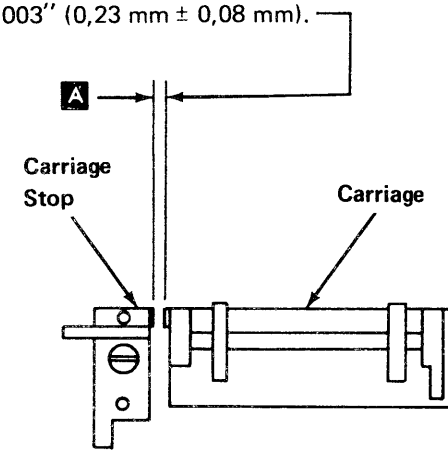
After three print lines, the card is ejected in a smooth motion. A fourth line may be printed before the card is ejected but requires a special program instruction. Printing this fourth line results in lower throughput in both Model A1 and Model A2. If the 5424 is not in a print operation, the card moves through the printer with neither stopping nor side movement.



CARRIAGE LATCH MAGNET

SERVICE CHECK

- 1 Rotate cam so that cam follower is on highest dwell.
- 2 Jumper TPB10-H to ground (carriage latch magnet).
- 3 Check that gap between carriage and carriage stop is $0.009'' \pm 0.003''$ (0,23 mm \pm 0,08 mm).



- 4 Remove jumper.
- 5 Check that magnet pole faces and armature make full contact.

ADJUSTMENT

- 1 Loosen mounting screws.
- 2 Rotate cam so that follower is on highest dwell.
- 3 Insert $0.009''$ (0,23 mm) feeler gage between carriage and carriage stop.
- 4 Jumper TPB10-H to ground (latch magnet).
- 5 Position magnet for $0.009''$ (0,23 mm) gap. **A** Pole faces and armature must make full contact. Make sure that magnet coil does not make contact with armature.
- 6 Tighten mounting screws.
- 7 Remove jumper.

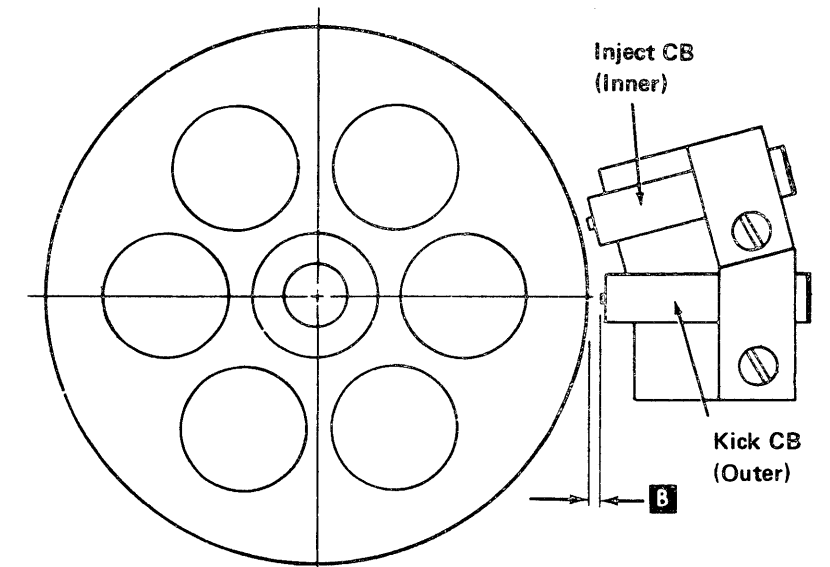
SIDE MOTION EMITTERS

SERVICE CHECK

Check the inject and kick CB pickups to emitter wheel gap for a maximum of $0.003''$ (0,08mm) **B** through 360 degrees of disk revolution.

ADJUSTMENT

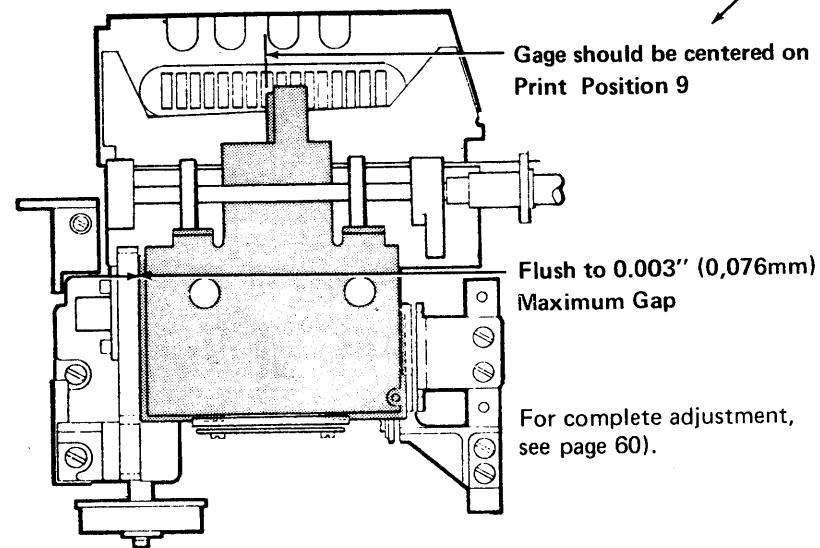
- 1 Loosen clamping screw for CB to be adjusted.
- 2 Adjust CB pickup unit for $0.002'' \pm 0.001''$ (0,05mm \pm 0,03mm) gap **B**.
- 3 Check CB pickup to emitter wheel gap for a maximum of $0.003''$ (0,08mm) through 360 degrees revolution of disk.



SIDE MOTION CARRIAGE ASSEMBLY

REMOVAL

- 1 Remove ribbon and ribbon guide nearest punch. **A**
- 2 Remove punch eject drive belt. **B**
- 3 Remove corner station bedplate. **C**
- 4 Remove corner station pressure shoe base. **D** See adjustment

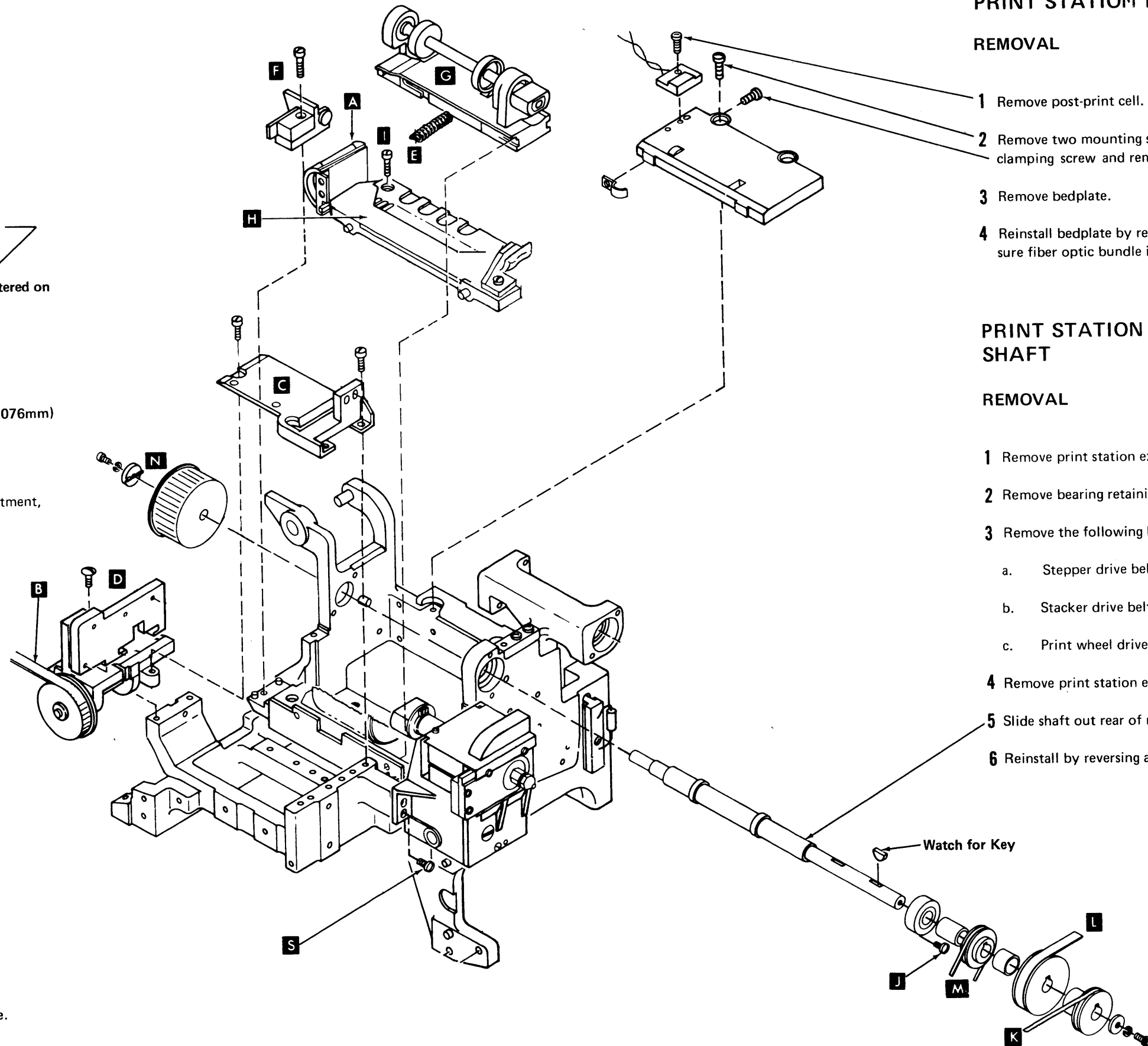


- 5 Remove side motion carriage spring. **E**
- 6 Remove registration rail. **F**
- 7 Loosen stepper clutch assembly mounting screws **S**
- 8 Push carriage **G** toward punch as far as it will go and lift out of machine.
- 9 Reinstall assembly by reversing above procedure.

PRINTWHEEL BEDPLATE

REMOVAL

- 1 Remove print side motion carriage assembly.
- 2 Remove ribbon guide plate. **H**
- 3 Remove four mounting screws, **I** and then remove bedplate.
- 4 Reinstall by reversing above procedure.



PRINT STATION EXIT BEDPLATE

REMOVAL

- 1 Remove post-print cell.
- 2 Remove two mounting screws and gently lift plate. Loosen clamping screw and remove fiber bundle.
- 3 Remove bedplate.
- 4 Reinstall bedplate by reversing above procedure, make sure fiber optic bundle is adjusted flush with card bed.

PRINT STATION EXIT FEED ROLL SHAFT

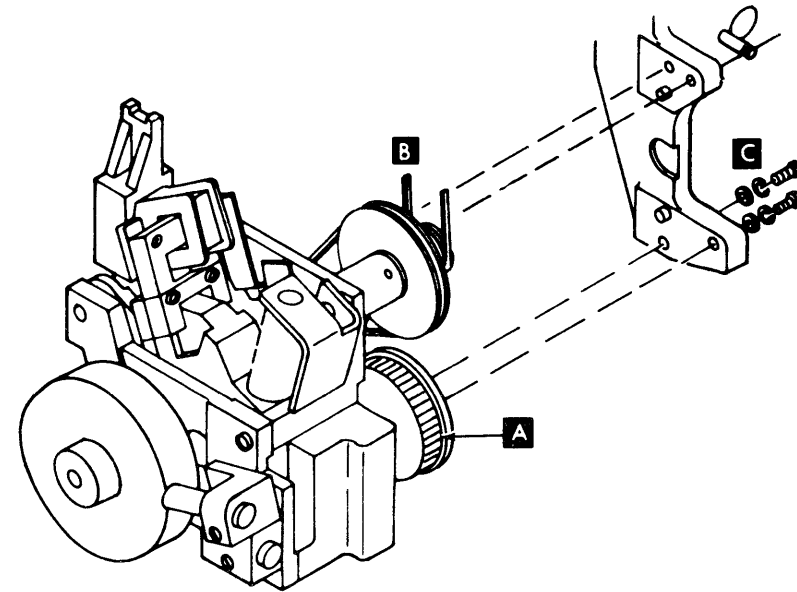
REMOVAL

- 1 Remove print station exit bedplate.
- 2 Remove bearing retaining screw **J** from rear of machine.
- 3 Remove the following belts and pulleys:
 - a. Stepper drive belt. **K**
 - b. Stacker drive belt. **L**
 - c. Print wheel drive belt. **M**
- 4 Remove print station exit drive belt and pulley. **N**
- 5 Slide shaft out rear of machine.
- 6 Reinstall by reversing above procedure.

SIDE MOTION ASSEMBLY

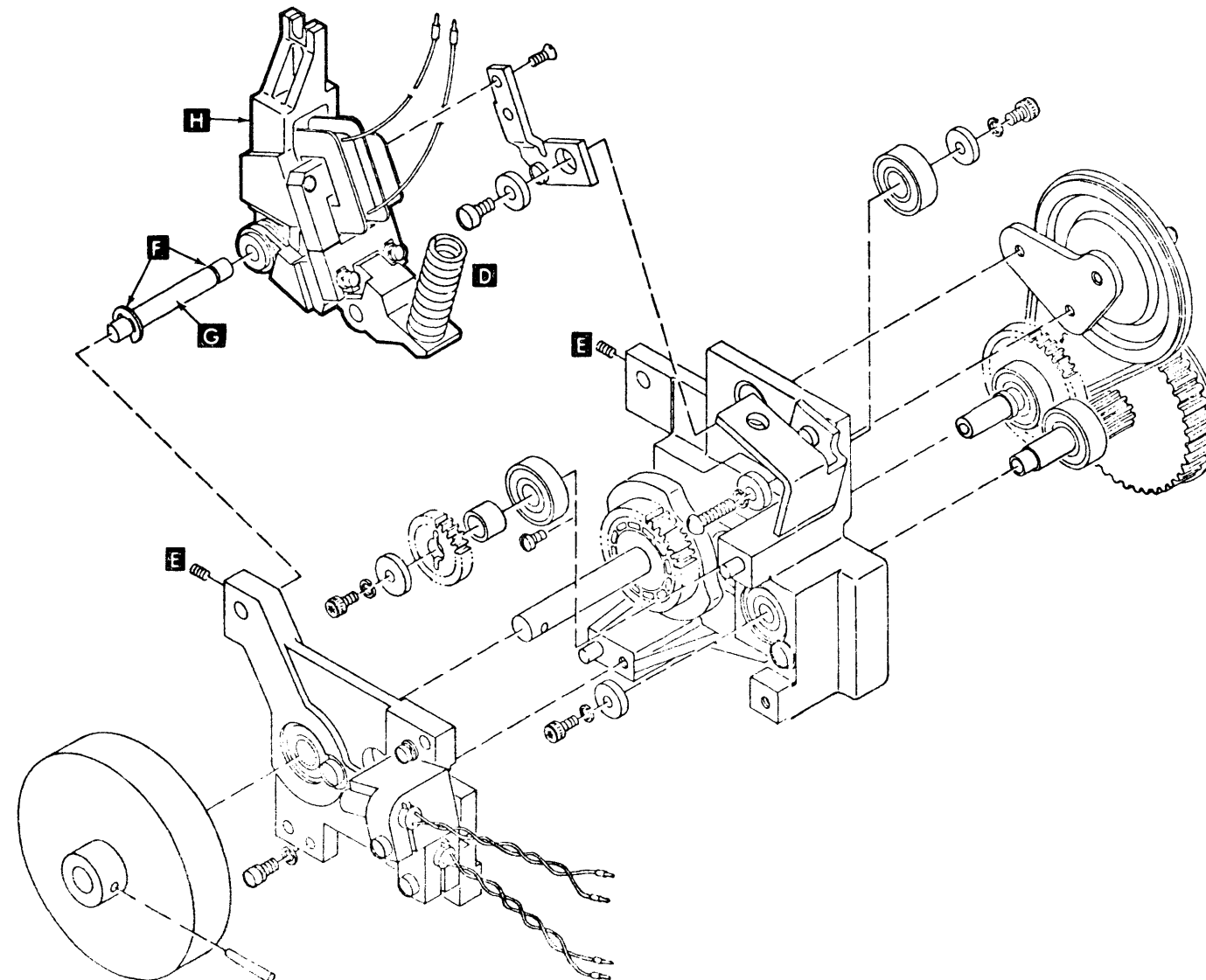
REMOVAL

- 1 Remove safety covers.
 - 2 Remove side motion cam follower drive belt. **A**
 - 3 Remove upper ribbon drive belt. **B**
 - 4 Mark and remove side motion cam follower magnet wires and emitter pickup unit wires.
 - 5 Remove four mounting screws. **C**
 - 6 Replace by reversing above procedure.
- Check/ Adjust:
- a. Carriage Latch Magnet.
 - b. Ribbon Drive Belt.
 - c. CB pickup to emitter gap.



ARMATURE AND PIVOT SHAFT DISASSEMBLY

- 1 Remove side motion assembly.
- 2 Remove cam follower spring **D** (cam should be on low dwell).
- 3 Remove two set screws. **E**
- 4 Remove two C clips. **F**
- 5 Remove shaft. **G**
- 6 Remove cam follower and armature. **H**
- 7 Reassemble by reversing the above procedure.
- 8 Check carriage latch magnet adjustment (page 68).



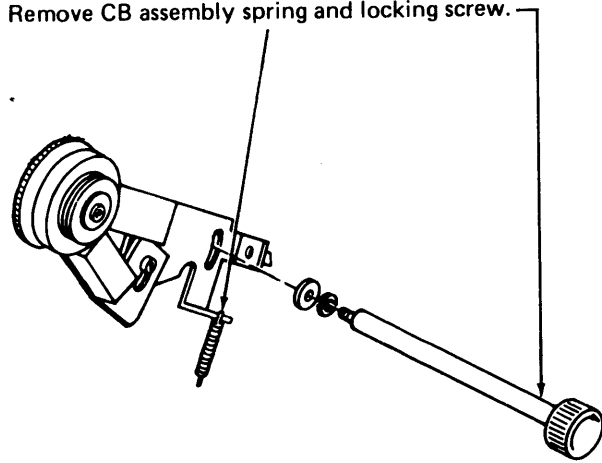
EMITTER WHEEL AND CAM SHAFT REMOVAL

The side motion assembly shafts and associated hardware are not recommended for replacement. If a failure occurs in these parts, replace the side motion assembly.

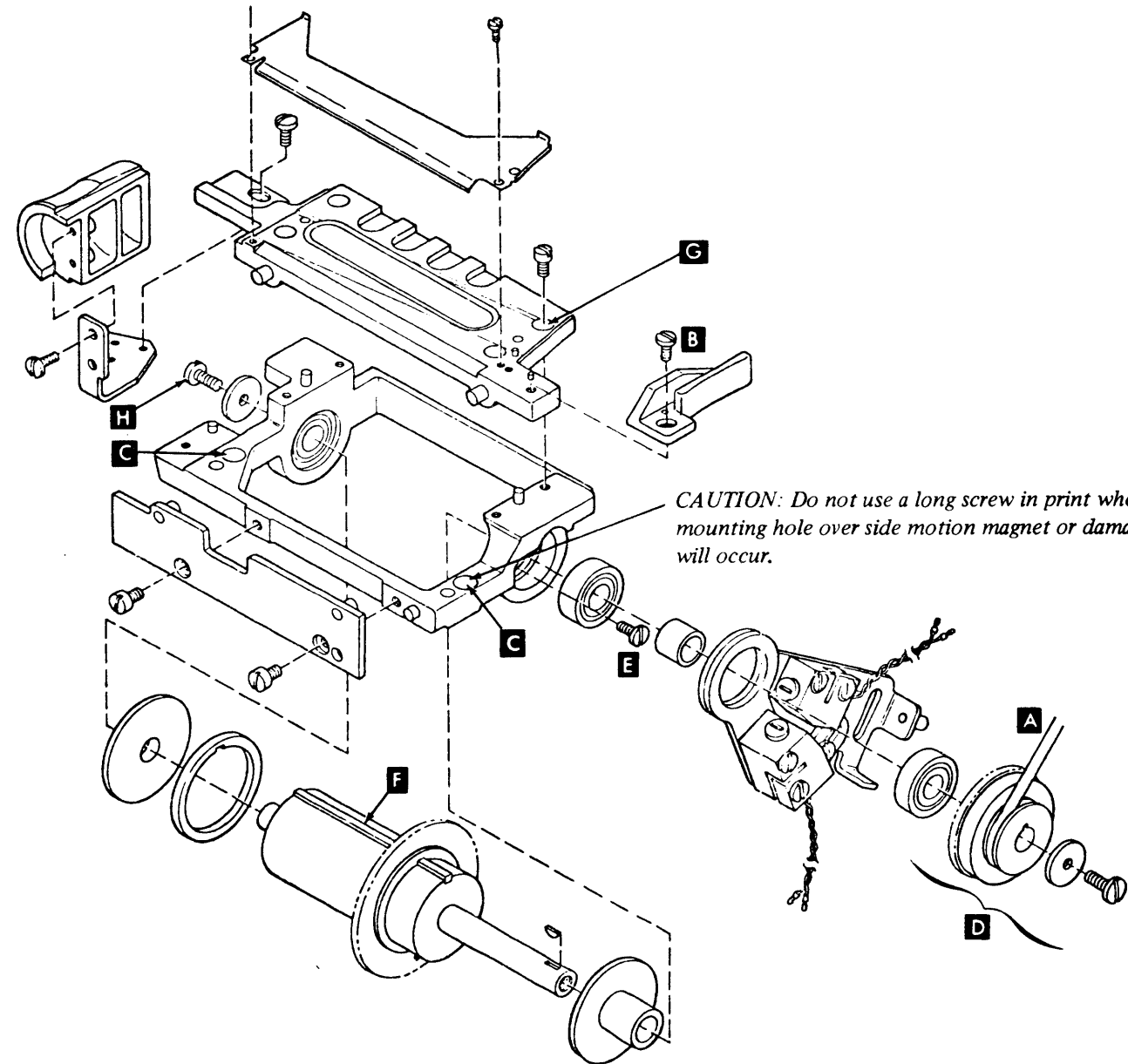
PRINTWHEEL ASSEMBLY

REMOVAL

- 1 Remove side motion carriage assembly. See removal procedure on page 69.
- 2 Remove print wheel drive belt. **A**
- 3 Loosen second ribbon guide **B** and remove four print wheel mounting screws. **C**
- 4 Remove and mark emitter pickup wires.
- 5 Remove CB assembly spring and locking screw.



- 6 Remove print wheel assembly.
- 7 Re-install by reversing above procedure and check/adjust the following:
 - a. Home CB and Fire CB (page 74).
 - b. Ribbon tracking (page 65).
 - c. Corner station guide rail (should be against post-punch card bed).
 - d. Pressure shoe base assembly (page 60).
 - e. Registration spring assembly (page 60).
 - f. Print registration (page 72).

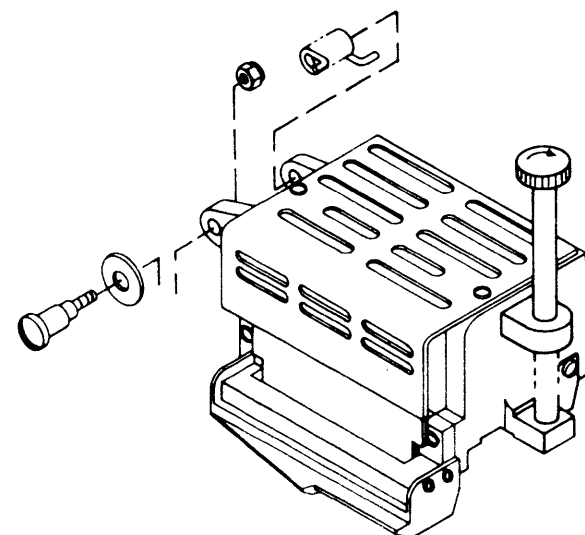
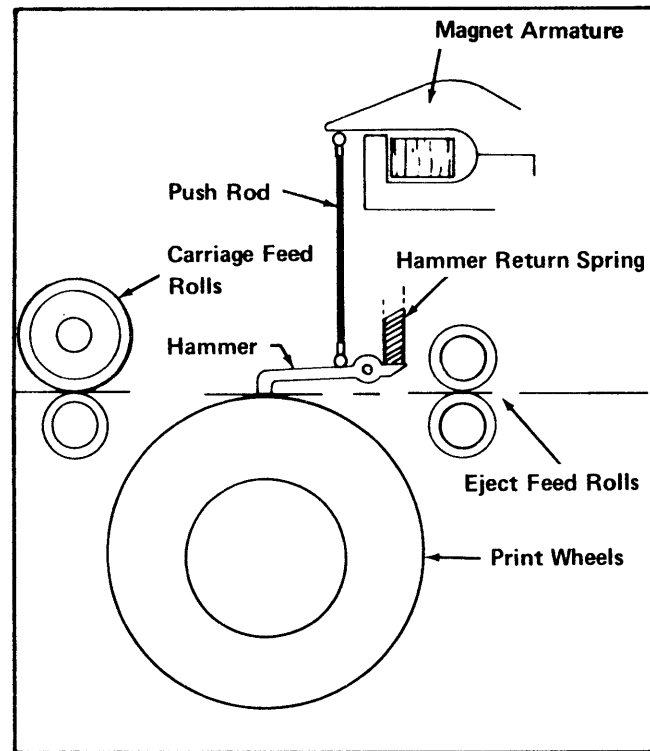


INDIVIDUAL PRINT WHEEL REMOVAL

- 1 Remove print wheel assembly as shown in previous procedure.
- 2 Remove ribbon guide and guide comb.
- 3 Remove emitter, pulley, and spacers **D** on printwheel shaft.
- 4 Remove screw. **H**
- 5 Remove bearing clamping screw. **E** Then slide assembly back and remove bearing. Tilt shaft and lift out.
- 6 Pull the print wheels off the shaft. Watch for key. **F**
- 7 Replace necessary print wheel and reassembly print wheels on shaft. Maintain same orientation that wheel originally had.
- 8 Re-install by reversing removal procedure and make the following checks/adjustments:
 - a. Home CB and Fire CB (page 74).
 - b. Ribbon tracking (page 65).
 - c. Corner station guide rail (should be against post-punch card bed).
 - d. Pressure shoe base assembly (page 60).
 - e. Registration spring assembly (page 60).
 - f. Print registration (page 72).

HAMMER ASSEMBLY

For each print wheel there is one magnet, one push rod, and one hammer. To print a character, the magnet is energized and the push rod is pushed down against the hammer. The push rod is not long enough to push the hammer all the way down to the card; however, inertia keeps the hammer moving, and it continues down and drives the card against the print wheel.



ADJUSTMENT

When printing wide characters such as an H, one side of the character may be darker than the other side. To correct for this condition, the hammer unit must be adjusted horizontally.

- 1 Loosen two hammer block mounting screws.
It may be necessary to loosen push rod assembly to allow enough horizontal movement.
- 2 Position hammer unit for uniform character density :
 - a. **If left side of character is darker than right side;**
slide push rod assembly slightly to the left.
 - b. **If right side of character is darker than left side;**
slide push rod assembly slightly to the right.
- 3 Check individual print positions for binds.
If a bind occurs;
 - a. Loosen two mounting screws.
 - b. Allow push rod assembly to relocate itself and then tighten mounting screws.
 - c. Recheck for binds.

Print some cards and check for uniform character density in horizontal direction.

VERTICAL REGISTRATION ADJUSTMENT

Vertical print registration is adjusted by raising or lowering an individual hammer magnet assembly; thereby, adjusting hammer flight time.

- 1 Loosen clamping screw for position to be adjusted.
- 2 **If character is being printed above print line;**
turn differential screw counterclockwise.
- 3 **If character is being printed below print line;**
turn differential screw clockwise.
- 4 Tighten clamping screw.
- 5 Check print registration.

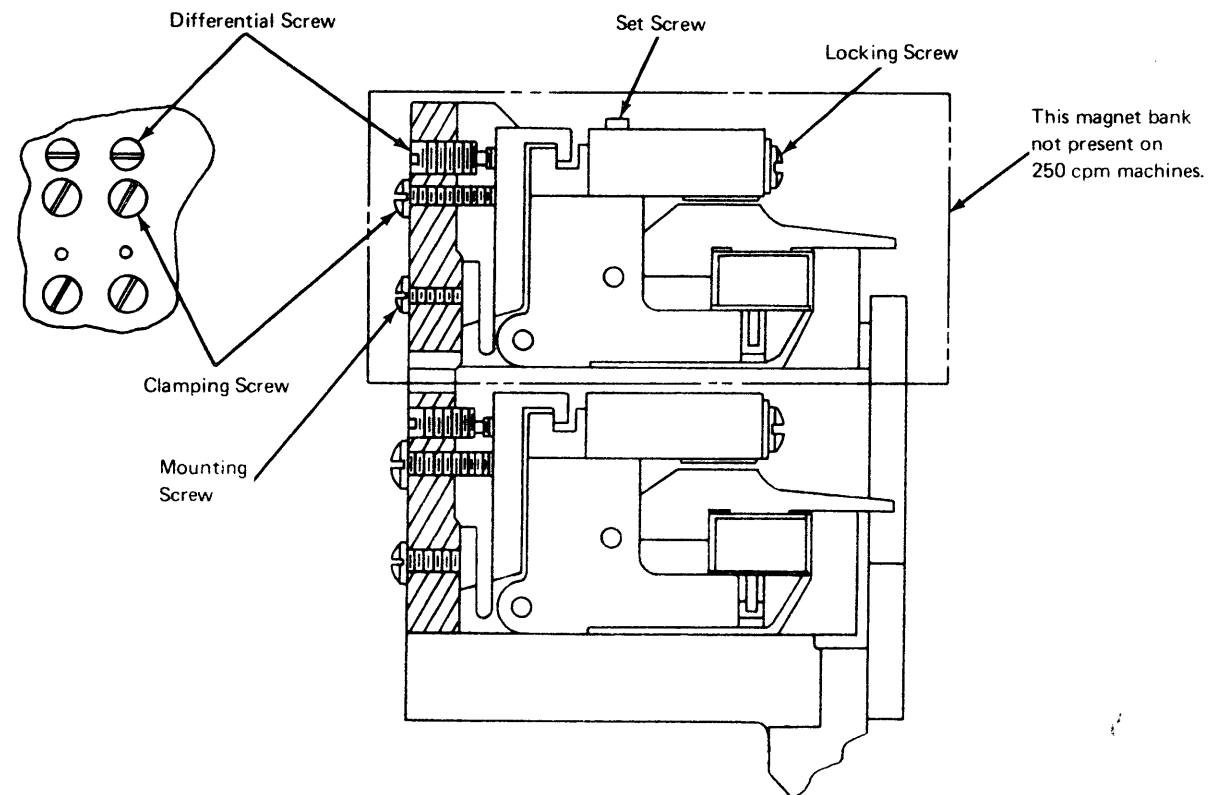
PRINT DENSITY ADJUSTMENT

Character print density can be varied slightly by increasing or decreasing the armature seal time. However, this is a factory adjustment and should not be attempted in the field.

HORIZONTAL REGISTRATION

Horizontal print registration for the entire card is accomplished in the corner station. Refer to page 60 for **CORNER INJECT PRESSURE SHOE BASE ASSEMBLY** adjustments.

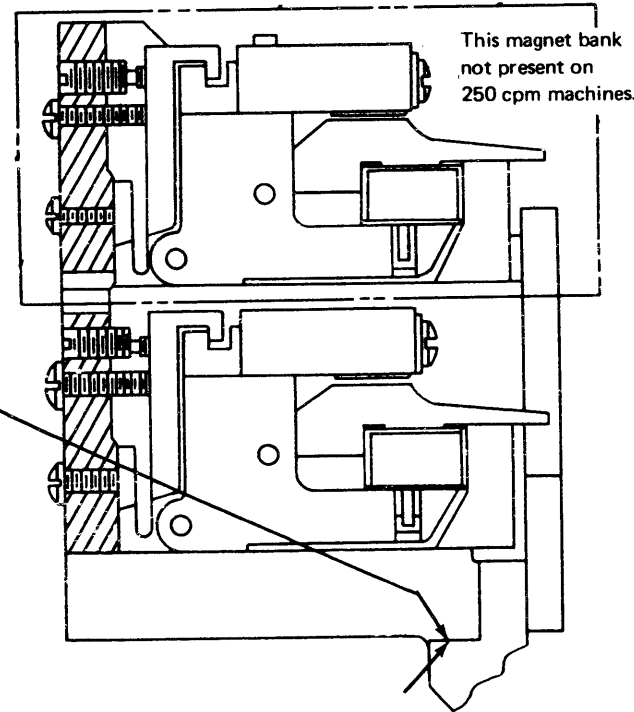
If horizontal print character position is irregular, check side motion adjustments.



HAMMER MOUNTING BLOCK

REMOVAL

- 1 Remove safety cover. **B**
- 2 Open print unit.
- 3 Remove mounting screws. **A**
- 4 Remove three mounting screws. **C**
- 5 Remove three mounting screws.
Be sure hammer mounting block butts against frame when re-installing.
- 6 Reverse above procedure and check for proper printing and horizontal density.

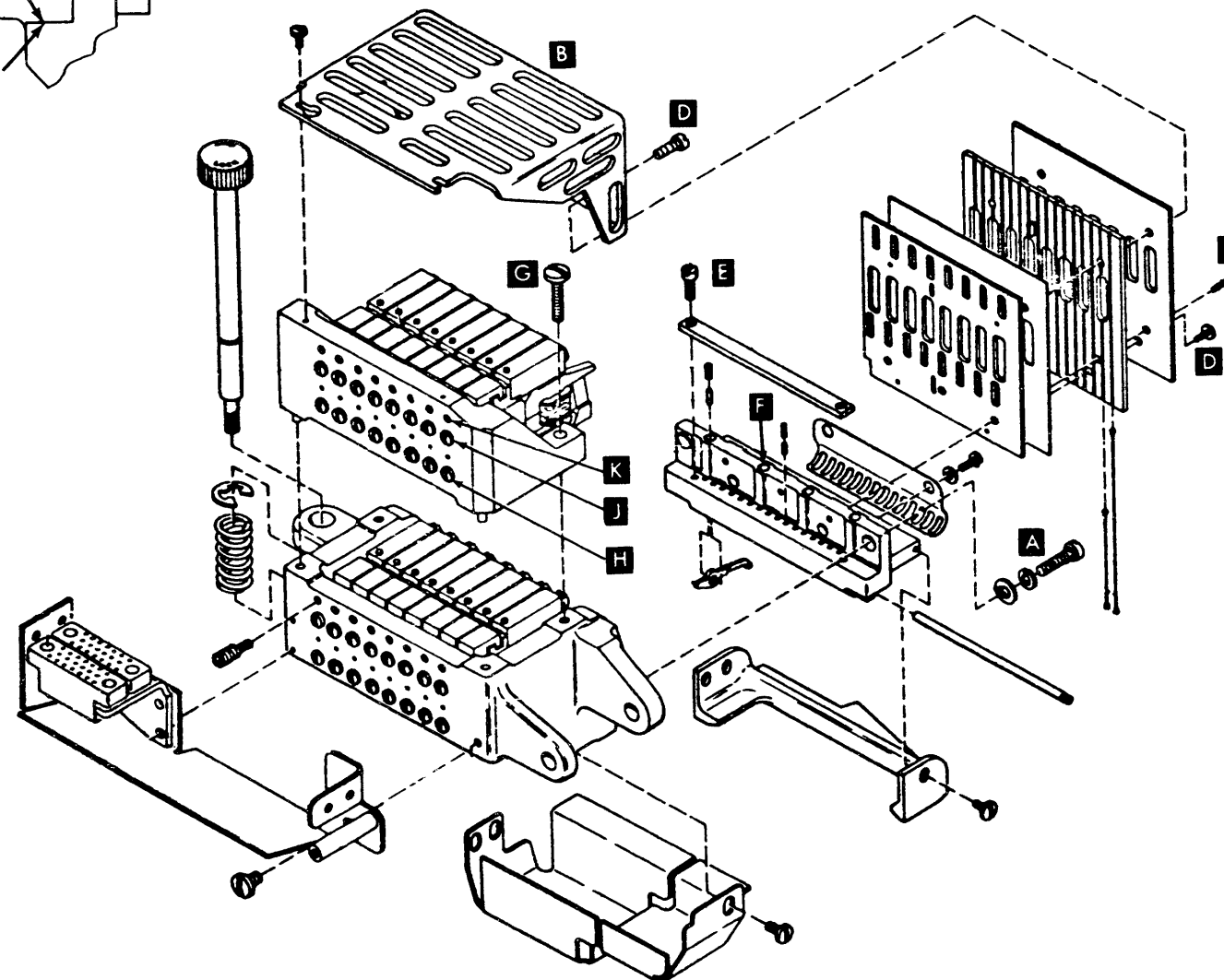


PUSH ROD REMOVAL

- 1 Remove hammer mounting block.
- 2 Remove holding screws **D** (two screws for low speed machines and four screws for high speed machines).
- 3 Remove push rod.
- 4 Re-install by reversing above procedure.
Be sure push rods are centered on armatures and hammers before tightening the three mounting screws. **C**

SINGLE HAMMER REMOVAL

- 1 Remove hammer mounting block and pushrod assembly.
- 2 Loosen two spring retaining plate screws. **E**
- 3 Loosen four retaining screws. **F**
- 4 Use a follow-up rod (key punch code plate aligning tool) and slide shaft out to free hammer that is to be replaced. If shaft binds, hammer may have dropped into groove in end of shaft. Slide out other end.
- 5 Replace by reversing above procedure and check print quality.



MAGNET REMOVAL

- 1 Remove safety cover. **B**

NOTE: This step applies to high speed machines only. Remove two magnet unit mounting screws. **C** if defective magnet is in the upper unit, skip to step 3
- 2 Remove two mounting screws **A** and remove hammer mounting block.
- 3 Remove the mounting screw **H** and clamping screw. **J** Then back out the differential adjusting screw **K** to disengage it from the magnet assembly.

4 When re-installing;

INITIAL:

- a. Turn the clamping screw **J** in until the distance between the magnet assembly and the mounting frame is about 3/16" (4,78 mm).
- b. Turn the differential screw **K** in until it engages the magnet unit bracket. It may be necessary to slightly loosen the clamping screw in order to engage the differential screw.
- c. Loosen the clamping screw two turns.
- d. Turn the differential screw in until the hammer is aligned with the other hammers.

FINAL:

Check Print registration;

- a. If character printed above print line, turn screw counterclockwise.
- b. If character printed below print line, turn screw clockwise.

Replace by reversing the above procedure and then check print quality.

FIRE AND HOME CBs

For each character on the print wheel, there is a corresponding tooth on the fire CB emitter wheel. As the emitter wheel teeth move past a magnetic pickup, pulses are generated which advance a character counter in the attachment. This character counter indicates which typewheel character is in position to be printed. This counter, when compared with the data to be printed, determines when a particular hammer will be fired in the print cycle. Two magnetic pickups are used for this character selection; fire CB and print data home CB. The fire CB advances the character counter and is ahead of the actual character on the print wheel, since there is a flight time delay between the time the print magnet is energized and the time the hammer hits the card. The home CB has a separate emitter wheel and generates one pulse per revolution of the print shaft. This pulse establishes the home position for the print wheels.

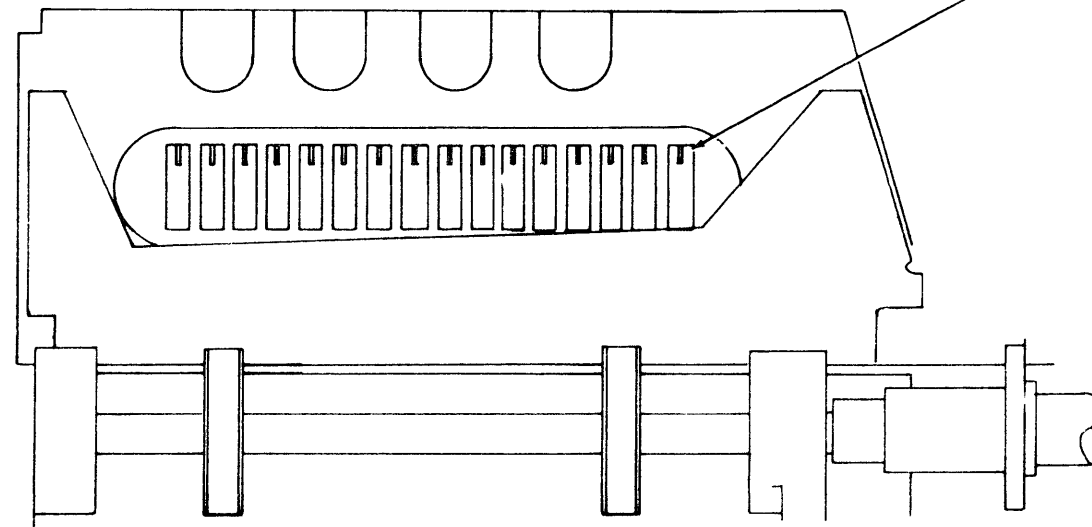
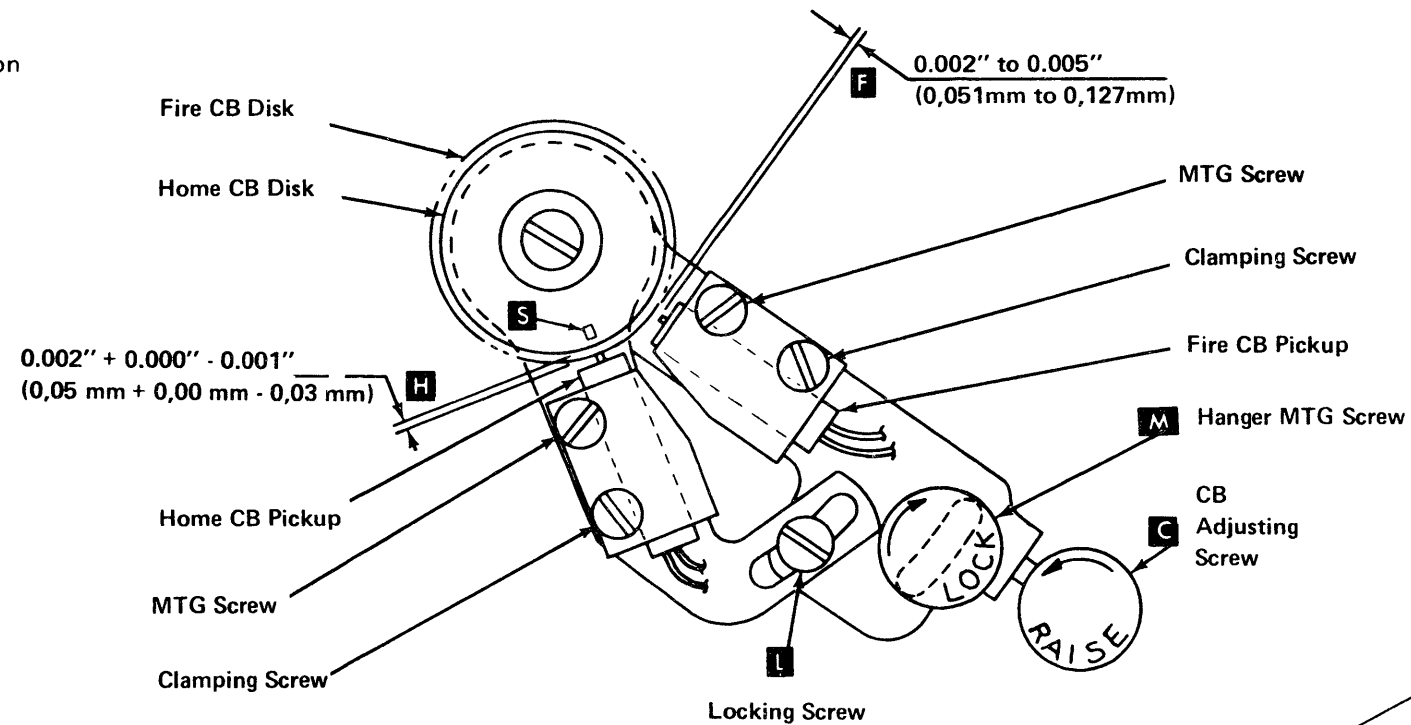
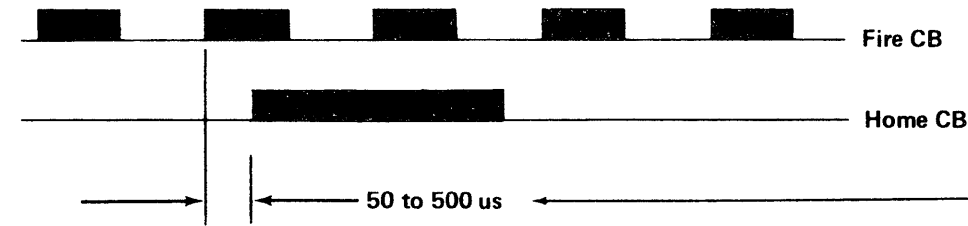
ADJUSTMENT

Adjust Fire CB for:

0.002" to 0.005"
(0,05mm to 0,127mm) **F**
through 360 degrees
rotation of emitter disk.

Adjust Home CB for:

0.002" to 0.005"
(0,05mm to 0,127mm) **H**
through 360 degrees
rotation of the emitter disk.



TIMING

The following adjustments ensure printing of the correct character with uniform density.

1 The character emitter (fire) CB must lead the home CB by 50 to 500 microseconds. Adjust home CB to fire CB timing relationship:

- Run TAP program, 011 (Model A1) or 031 (Model A2).
- Loosen home CB locking screw. **L**
- Observe CB output and adjust CB position to obtain 50 to 500 microseconds of delay between fire CB output and home CB output.
- Tighten locking screw.
- Check emitter gaps. **F H**
- Recheck home CB to fire CB timing.

2 CB to typewheel, Initial adjustment:

- Check cards for correct character printing.
- Turn off machine and rotate typewheels until vertical bar symbol is flush with stacker edge of cutout in print bed.
- Then loosen mounting screw **M** and align home CB pickup with slug in disk **S** by turning **C**
- Tighten hanger mounting screw.
- Check cards again for correct printing.

3 CB to typewheel, Final adjustment:

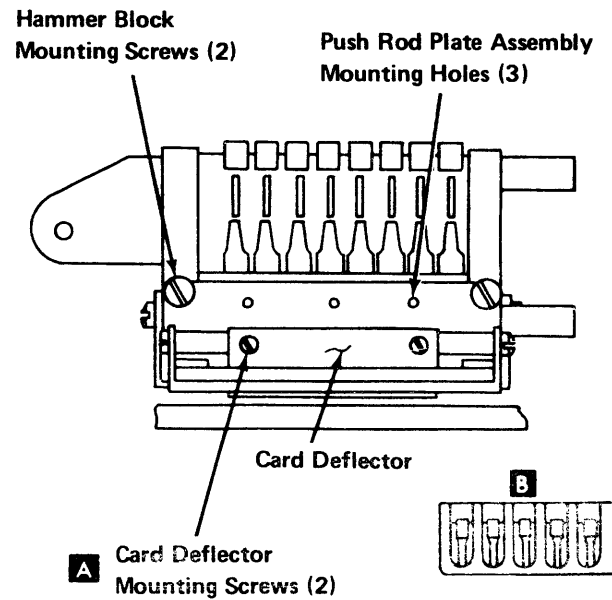
- Check printed card for vertical print registration.
- Loosen mounting screw. **M**
- Adjust fire CB position for correct registration on most characters and tighten mounting screw. Individual positions may be adjusted by changing the hammer flight time for those positions.
- Check emitter gaps. **F H**

4 Recheck print registration.

CARD DEFLECTOR

ADJUSTMENT

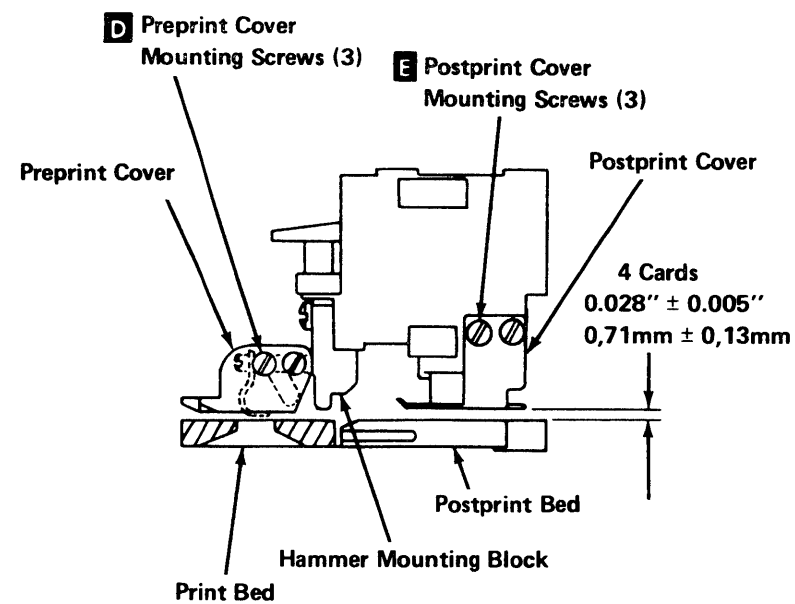
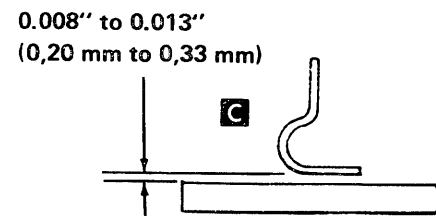
- 1 Insert one card in transport under hammers.
- 2 Loosen mounting screws. **A**
- 3 Place a 0.002" (0,05mm) feeler gage between card deflector and card.
- 4 Position card deflector laterally for even clearance with print hammers **B** and vertically to hold card lightly against print bed. **C** Then tighten mounting screws.
- 5 Check adjustment by feeding cards through transport under machine power. If extra ink marks appear on cards, repeat adjustment using a 0.003" (0,08mm) feeler gage.



PRE-PRINT CARD COVER

ADJUSTMENT

- 1 Loosen three mounting screws. **D**
- 2 Place four cards between card cover and bed.
- 3 Hold cover against card and tighten mounting screws.
- 4 Remove cards.



POST-PRINT COVER

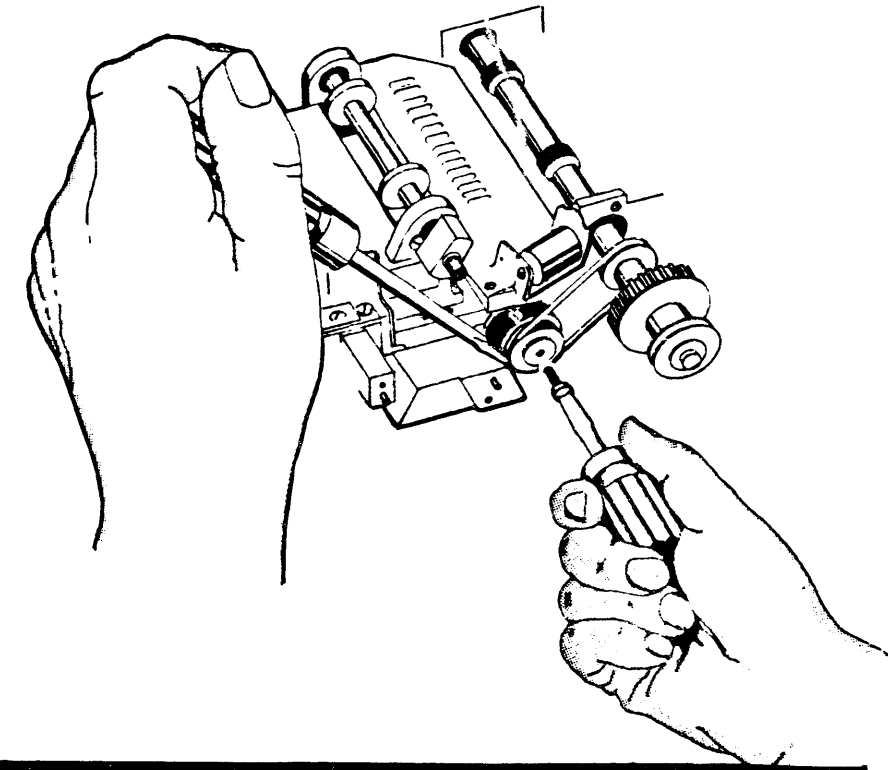
ADJUSTMENT

- 1 Loosen the three mounting screws. **E**
- 2 Place four cards between card cover and bed.
- 3 Press post-print card cover against cards and tighten mounting screws.
- 4 Remove cards.
- 5 Check to see that cover does not rub on post print eject rolls.

PRINTWHEEL EMITTER DISK AND EMITTER GEAR

REMOVAL

Wedge a screwdriver between machine casting and print wheel belt. Apply just enough pressure so that CB disk screw can be removed.

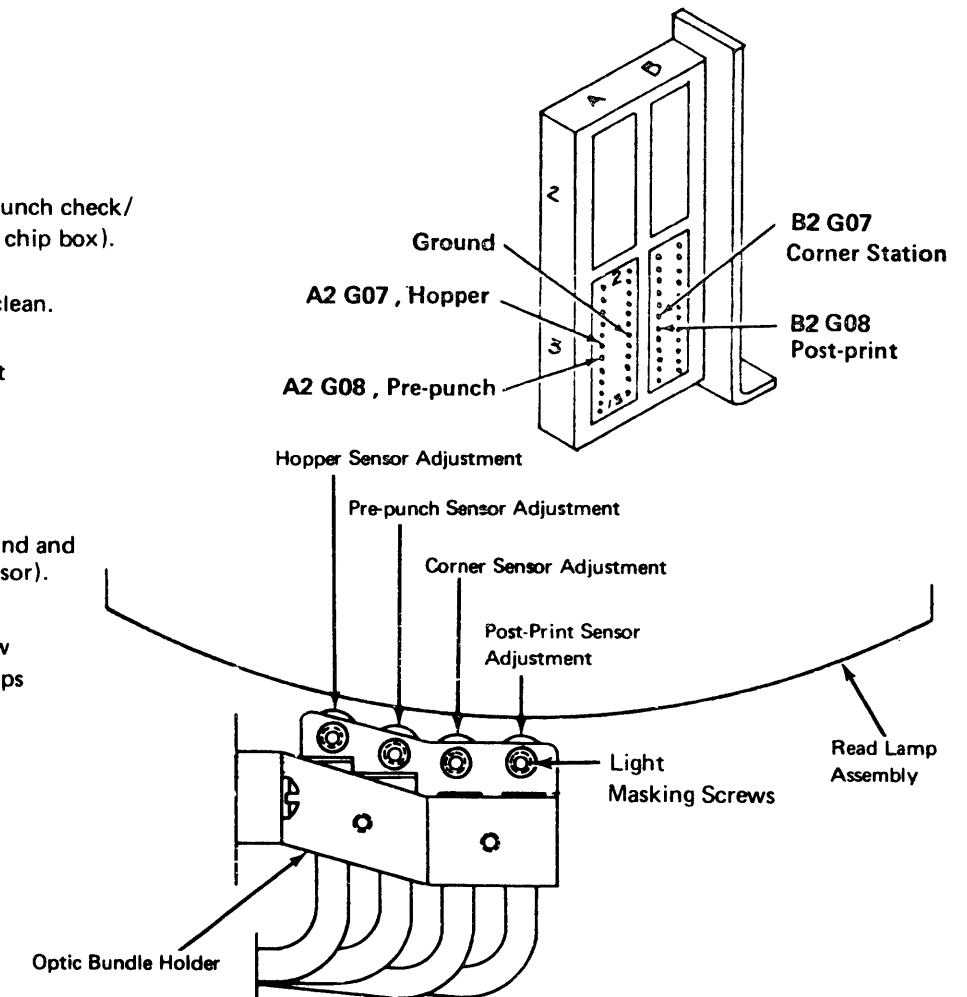


CARD SENSOR

ADJUSTMENT

- 1 Turn off machine power and remove two punch check/ card sensor amplifier cards (located behind chip box).
- 2 Make sure input ends of fiber bundles are clean.
- 3 Make sure light pipe is flush with post-print card bed.
- 4 Turn on machine power.
- 5 Connect milliammeter positive lead to ground and negative lead to B3B08 (Post-Print card sensor).

Adjust post-print sensor light masking screw for a milliammeter reading of 450 microamps to 550 microamps if room temperature is between 67 and 77 degrees F. (If temperature is outside this range, refer to chart on page 27).



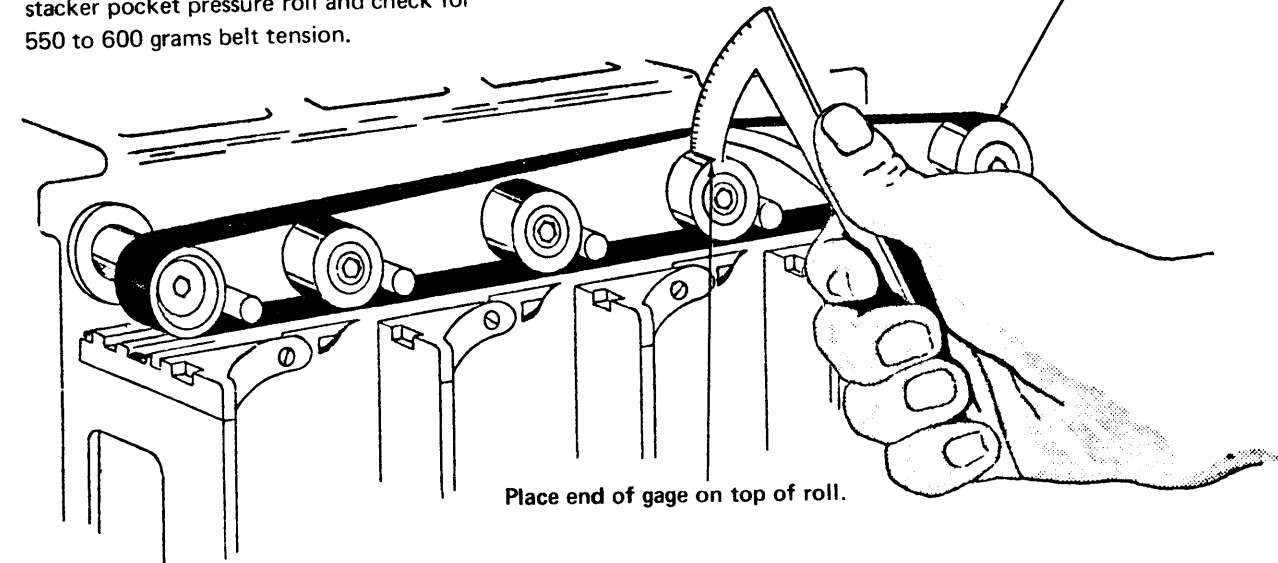
STACKER OPERATION

The continuously driven transport belt moves the card, with the help of the pressure rolls (top) and the pressure shoes (bottom), from the print unit to one of the four stackers. The first three stacker pockets contain a selector assembly, a jam detector and a feed roll. Pocket 4 does not have a selector assembly. If no selector magnet is energized, the card will go to pocket 4.

STACKER TRANSPORT BELT

SERVICE CHECK

Place end of gram gage on top of number two stacker pocket pressure roll and check for 550 to 600 grams belt tension.

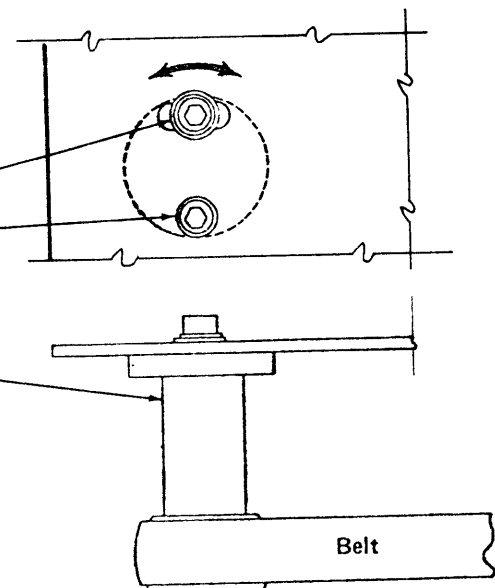


REMOVAL AND REPLACEMENT

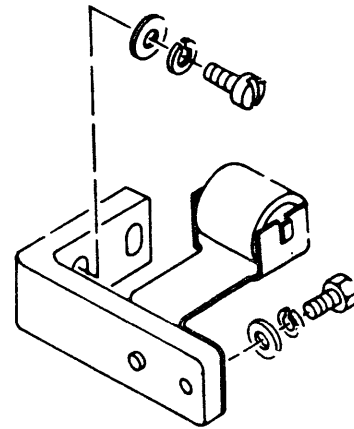
Carefully rotate belt and work it off the pulley on the pocket 1 end.

ADJUSTMENT

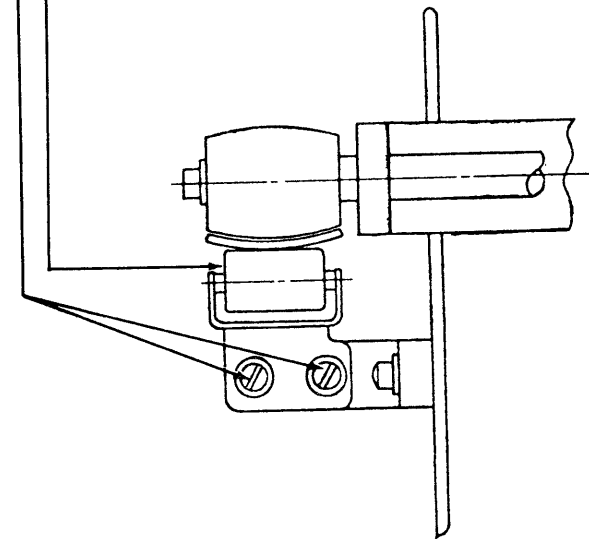
- 1 Open rear machine cover and remove stacker end cover.
- 2 Loosen two end screws.
- 3 Rotate stacker roll standoff to adjust belt tension for 550 to 600 grams. Tighten mounting screws and recheck tension.



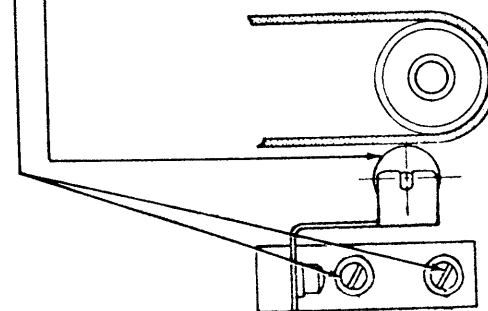
INPUT IDLER ADJUSTMENT



- 1 Loosen idler bracket adjusting screws.
- 2 Position input idler assembly parallel to the stacker input shaft and tighten adjusting screws.

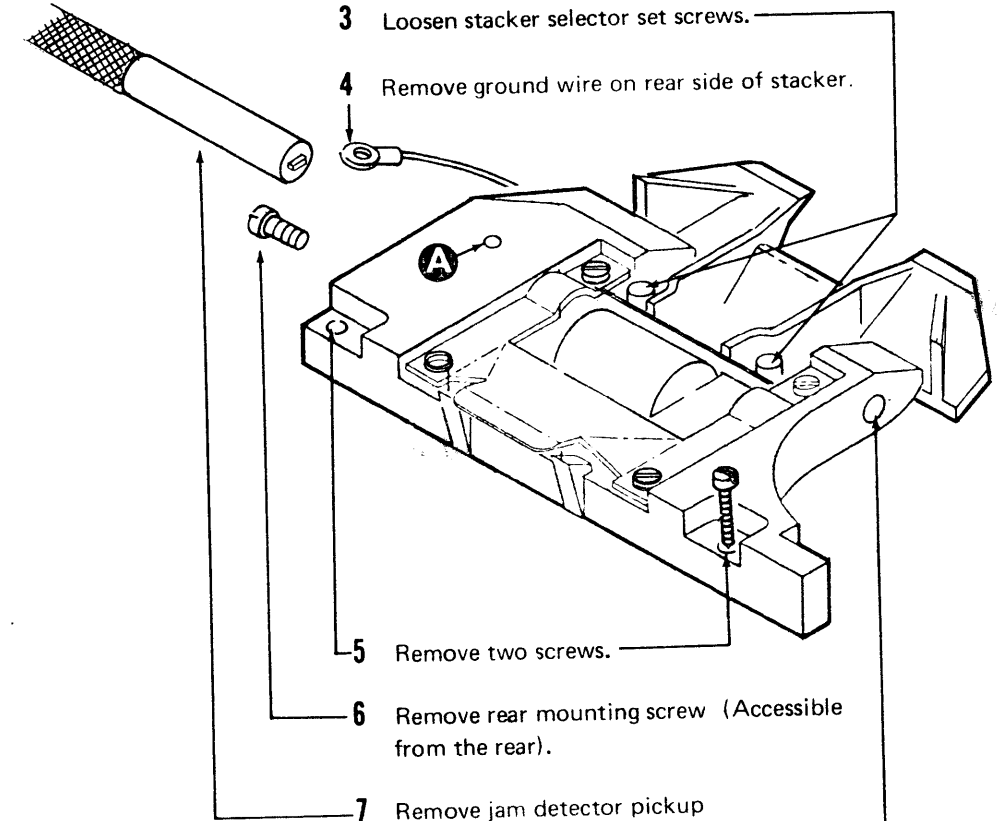


- 3 Loosen mounting screws.
- 4 Adjust bracket so that input idler touches stacker drive belt. Turn handwheel and check that idler roll turns. Then tighten idler bracket mounting screws.



STACKER GUIDE BLOCK REMOVAL

- 1 Remove stacker transport belt.
- 2 Remove pressure roll assembly.
- 3 Loosen stacker selector set screws.
- 4 Remove ground wire on rear side of stacker.
- 5 Remove two screws.
- 6 Remove rear mounting screw (Accessible from the rear).
- 7 Remove jam detector pickup by loosening set screw. **A**
- 8 Carefully slide assembly outward. (The stacker selector will separate from guide block.)



CAUTION

Be careful not to bend selector shaft when removing guide block.

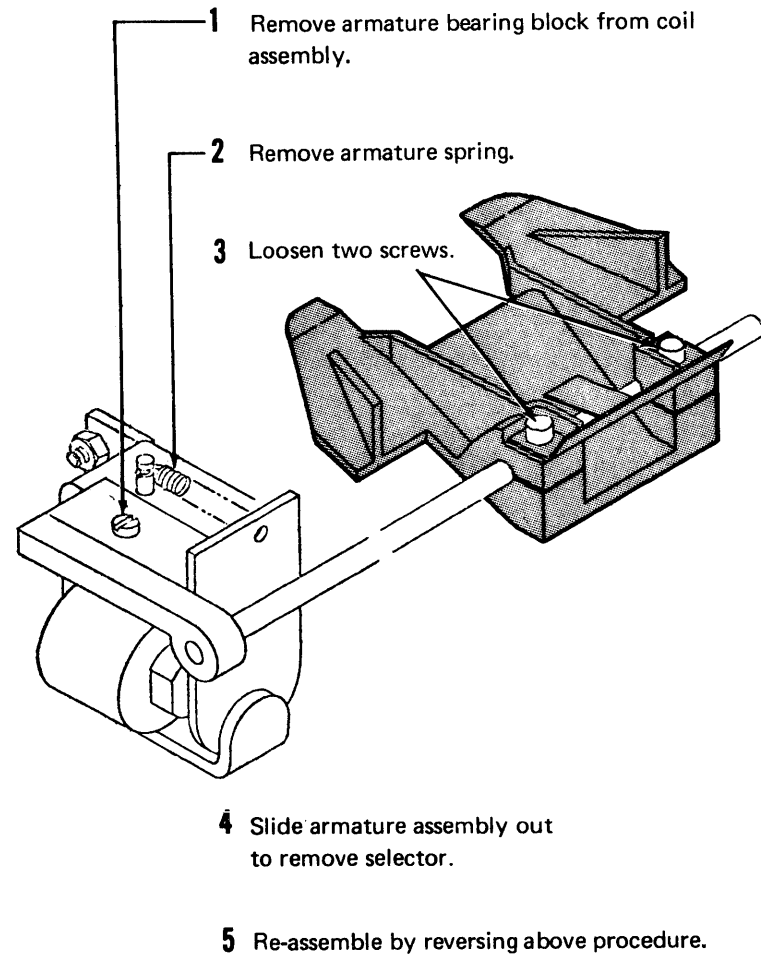
- 9 Re-install, by reversing above procedure.
- 10 Adjust:

- Stacker pressure shoe (page 78).
- Jam detector (page 80).
- Transport belt tension (This Page)
- Pocket selector (page 77).

STACKER SELECTORS

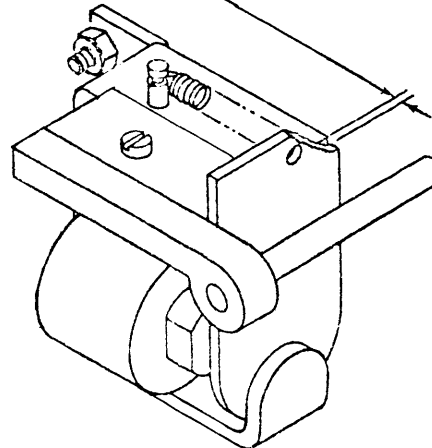
A stacker selector assembly consists of a magnet and selector fingers which are connected to the magnet armature. The selector magnet is located behind the stacker assembly and can be seen from the back of the machine. The selector fingers rest below the card line, but the tips move above the card line when the magnet is energized and create a path for the card into the selected pocket.

STACKER SELECTOR REMOVAL

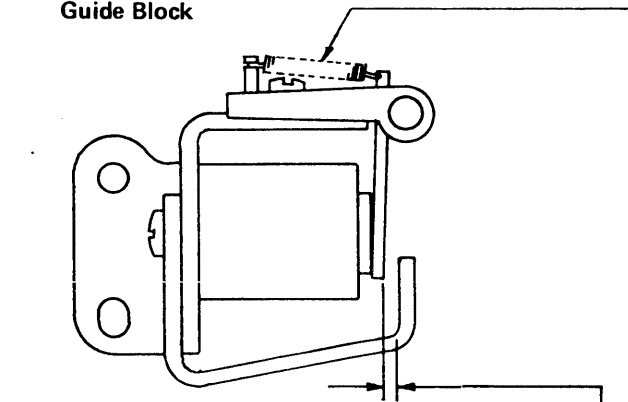
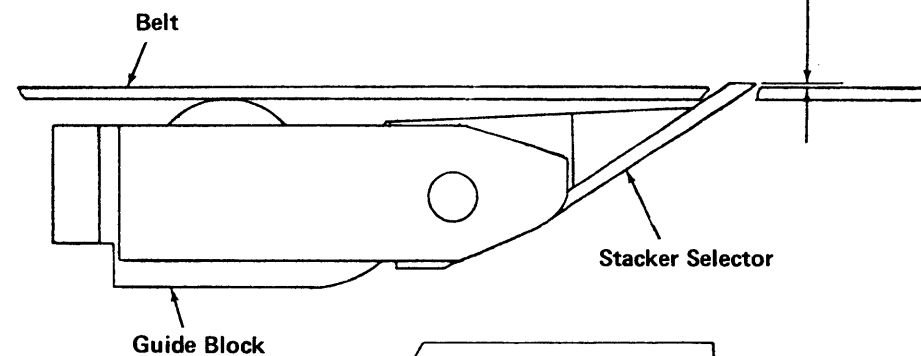


SERVICE CHECKS

- 1 Energize selector magnet.
 jumper: TPB14-H to ground (pocket 1)
 TPB15-H to ground (pocket 2)
 TPB16-H to ground (pocket 3)
 and check for : $0.003'' \pm 0.002''$
 (0,076mm \pm 0,051mm)

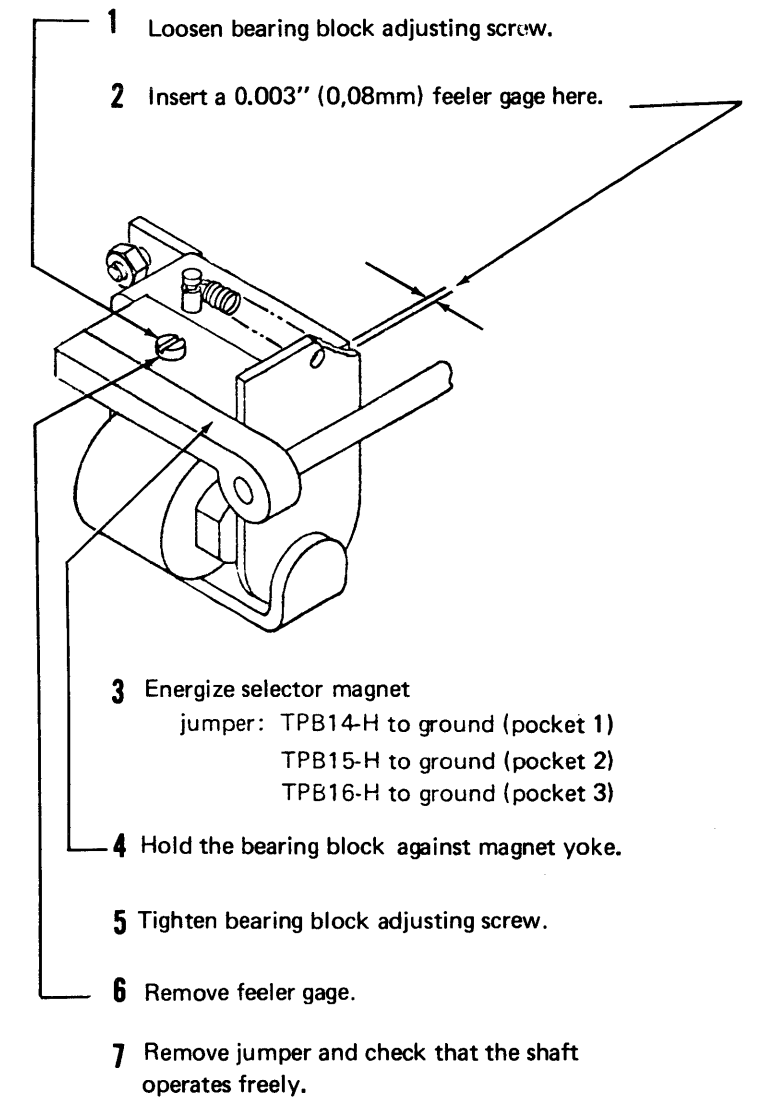


- 2 Check that stacker selector tip is flush +0.010'' (0,25mm) with top of stacker transport belt.



- 3 Check for 0.060'' to 0.067'' (1,52mm to 1,70mm). Remove jumper.
- 4 Remove armature spring and check stacker selector shafts for binds. Then reinstall spring.

STACKER SELECTOR MAGNET ADJUSTMENT



Note: If shaft binds, magnet may have to be re-positioned on mounting screws.

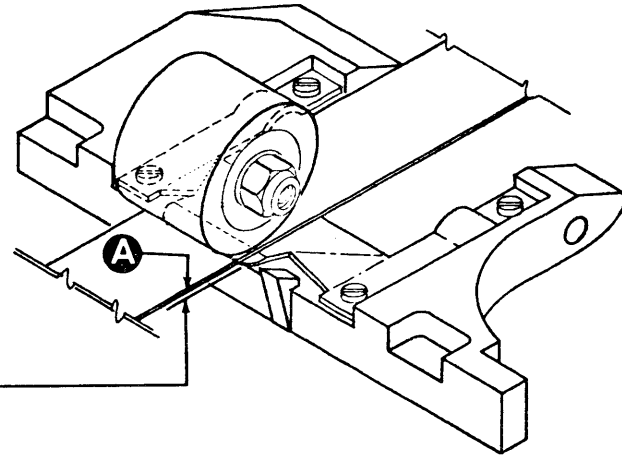
STACKER PRESSURE SHOES

For correct card feeding, the pressure shoes must be parallel to the guide block and pocket divider. Also, the top surface directly below the upper pressure roll must be parallel to the transport belt.

SERVICE CHECK

Check for 0.001" to 0.004" (0,03mm to 0,10mm) clearance.

Check that belt is parallel with pressure shoe.

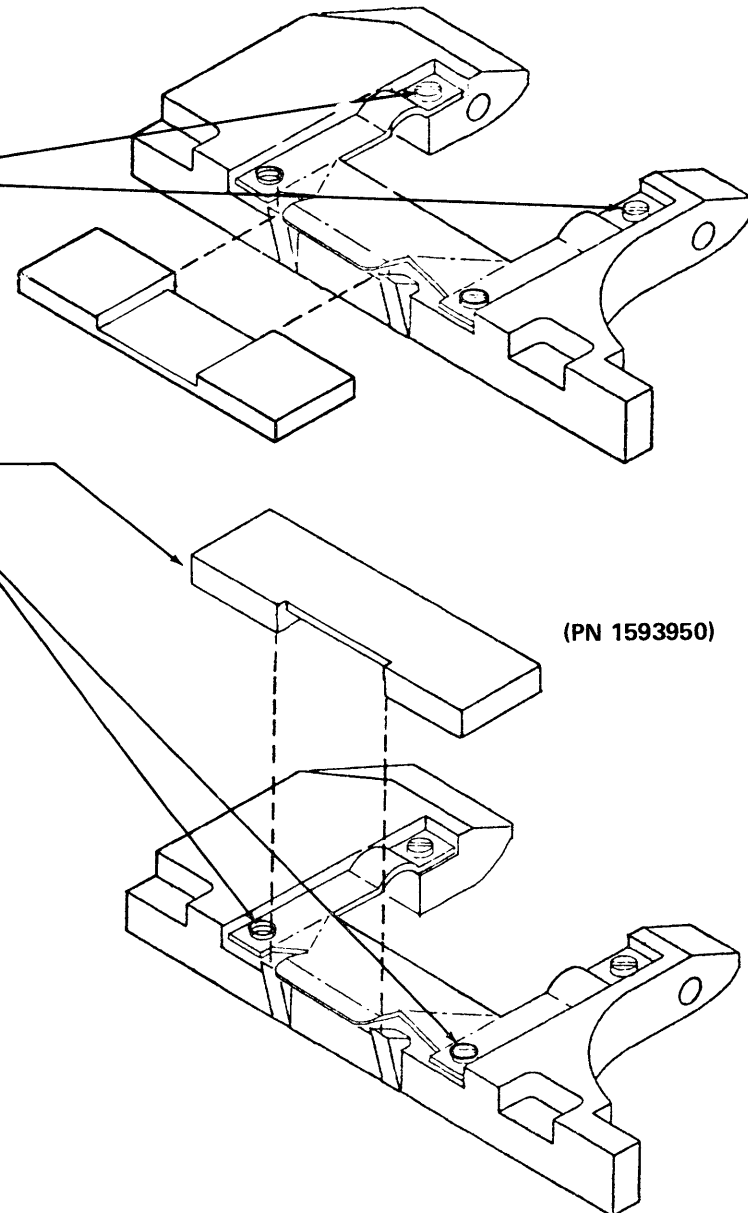


ADJUSTMENT

- 1 Remove stacker transport belt.
- 2 Remove upper pressure roll located above the pressure shoe that is to be adjusted.
- 3 Loosen the pressure shoe mounting screws.
- 4 Place pressure shoe adjusting tool against guide block ears.
- 5 Adjust pressure shoe until it contacts the full length of the indentation of the adjusting tool. Tighten mounting screws.
- 6 Place tool on top of the stacker guide block ears.
- 7 Adjust the pressure shoe adjusting screws until the pressure shoe contacts the full length of the indentation of the adjusting tool.
- 8 Reinstall upper pressure roll.
- 9 Reinstall stacker transport belt.
- 10 Check and adjust stacker transport belt tension.
- 11 Check that pressure shoe top surface is parallel to transport belt.
- 12 Adjust the pressure shoe to transport belt clearance:

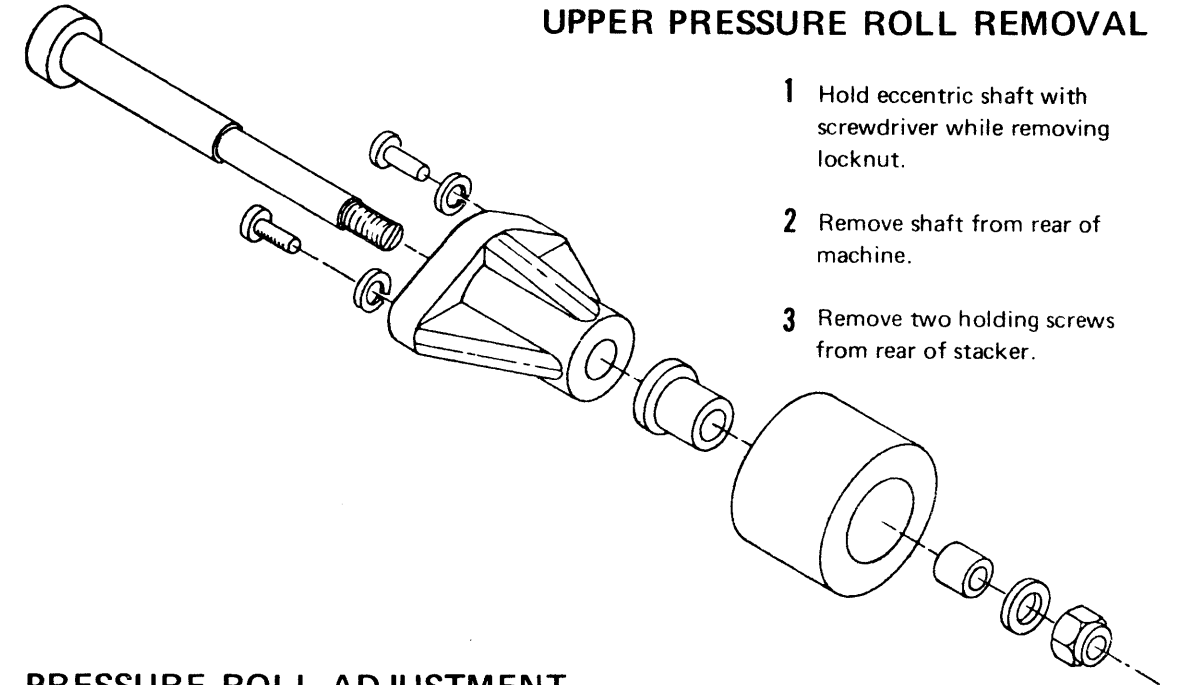
Place a 0.002" (0,05mm) feeler gage between the pressure shoe and transport belt.

Loosen eccentric locknut and turn shaft counterclockwise for a clearance of 0.001" to 0.004" **A** (0,03mm to 0,10mm). Tighten eccentric locknut and recheck adjustment.



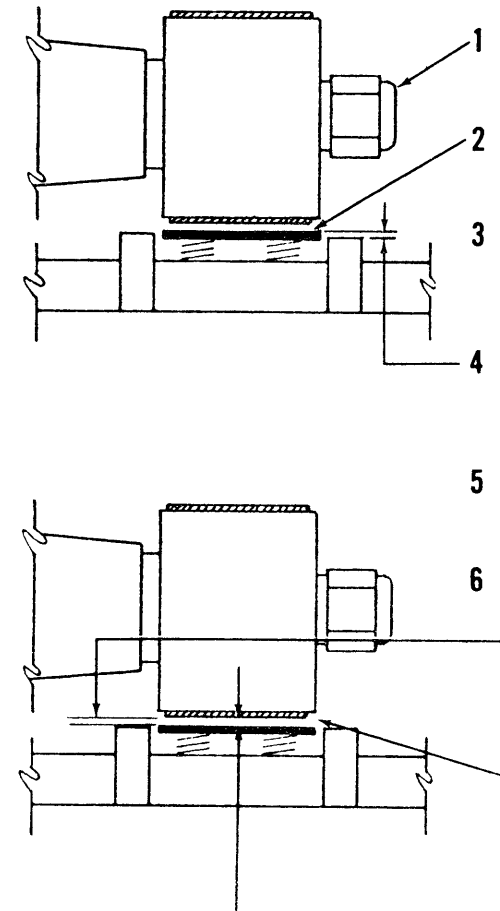
UPPER PRESSURE ROLL REMOVAL

- 1 Hold eccentric shaft with screwdriver while removing locknut.
- 2 Remove shaft from rear of machine.
- 3 Remove two holding screws from rear of stacker.

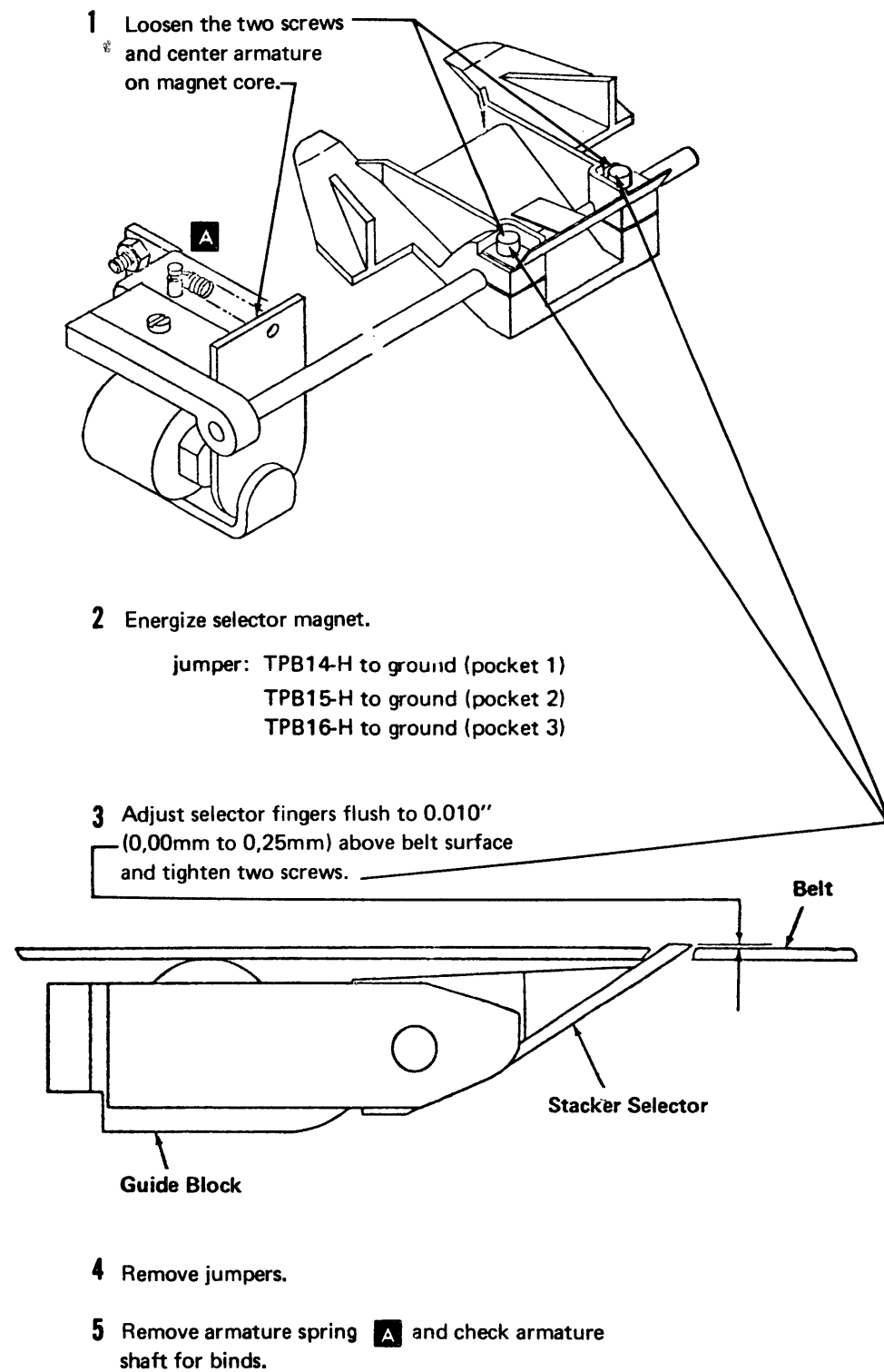


PRESSURE ROLL ADJUSTMENT

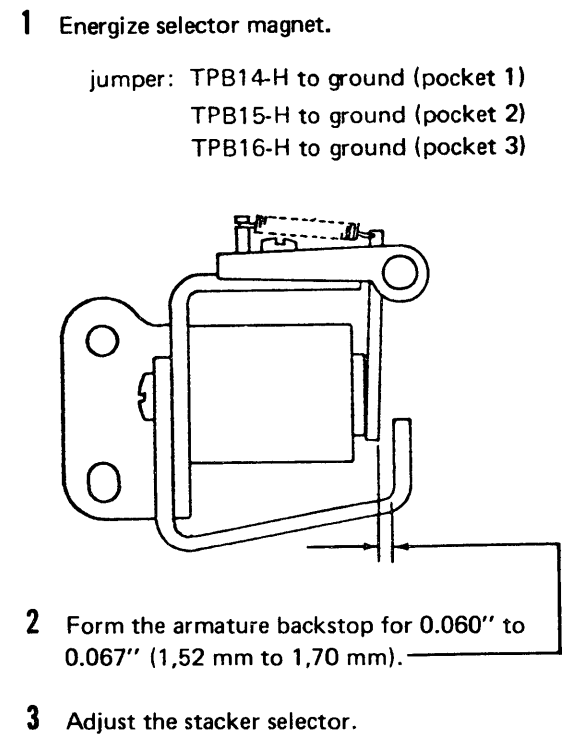
- 1 Loosen eccentric lock nut and turn shaft clockwise to open gap.
- 2 Place a six inch scale between belt and pressure shoe.
- 3 Turn eccentric shaft counterclockwise until belt holds scale in position without deflecting the pressure shoe.
- 4 Check that vertical distance between guide block ear and scale is between 0.008" and 0.015" (0,20mm and 0,38mm).
- 5 If condition is wrong, perform pressure shoe adjustment.
- 6 If condition is met:
 - Check that pressure shoe top surface is parallel to transport belt.
 - Adjust the pressure shoe to transport belt clearance: Place a 0.002" (0,05mm) feeler gage between the pressure shoe and transport belt.
 - Loosen eccentric locknut and turn shaft counterclockwise for a clearance of 0.001" to 0.004" (0,03mm to 0,10mm). Tighten eccentric locknut and recheck adjustment.



STACKER SELECTOR ADJUSTMENT



ARMATURE BACKSTOP ADJUSTMENT



STACKER FULL SWITCH

The stacker full switch consists of a small permanent magnet mounted on each tray and a reed switch for each pocket. When the pocket is full, the magnet transfers the reed switch. A stacker full condition also stops the machine and turns on the stacker full light (STKR).

SERVICE CHECK

Check that the stacker full switch turns on when the stacker tray is all the way down, and that it turns off when the tray is moved away from the bottom position.

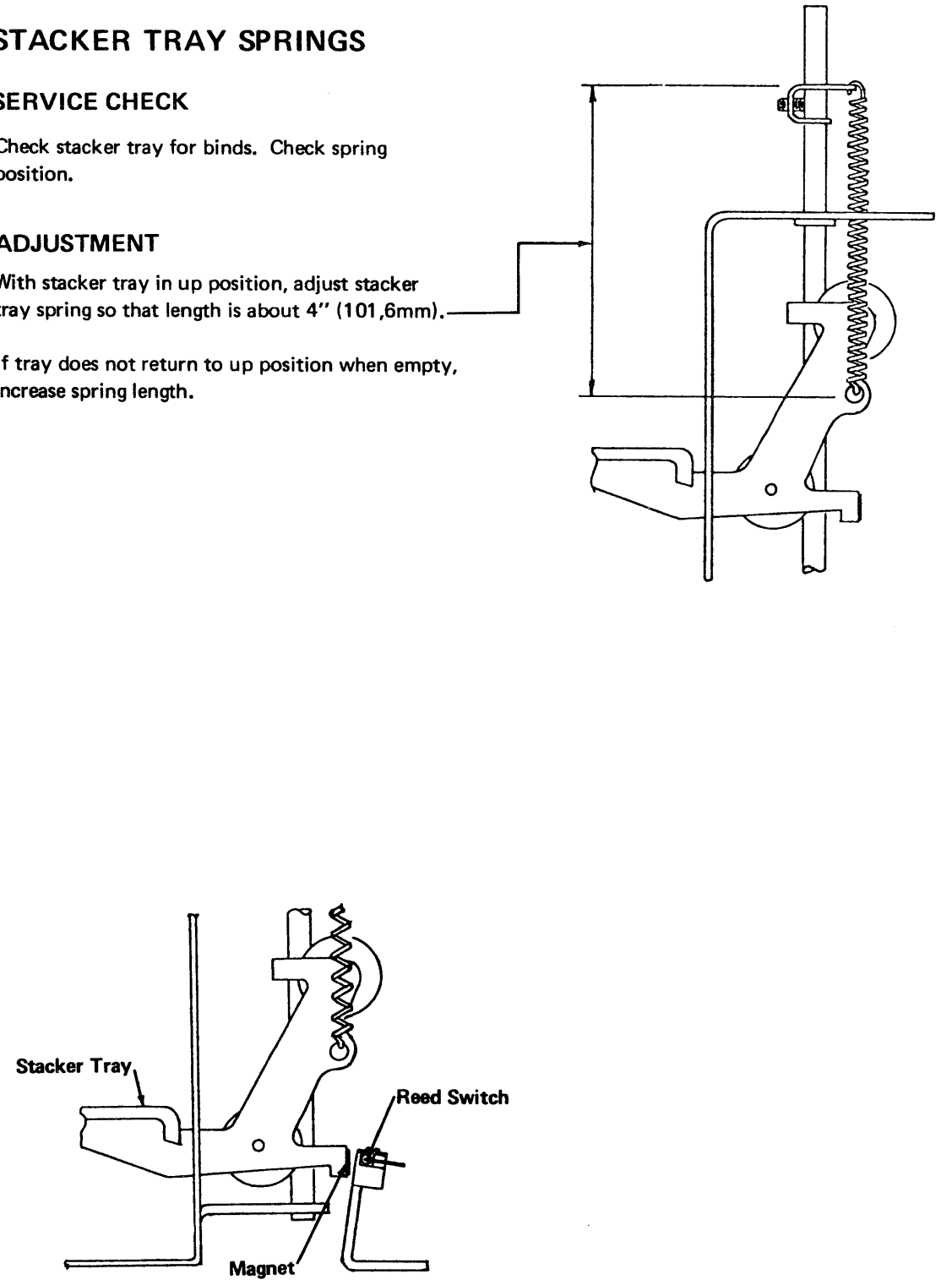
STACKER TRAY SPRINGS

SERVICE CHECK

Check stacker tray for binds. Check spring position.

ADJUSTMENT

With stacker tray in up position, adjust stacker tray spring so that length is about 4" (101,6mm).
 If tray does not return to up position when empty, increase spring length.



JAM DETECTORS

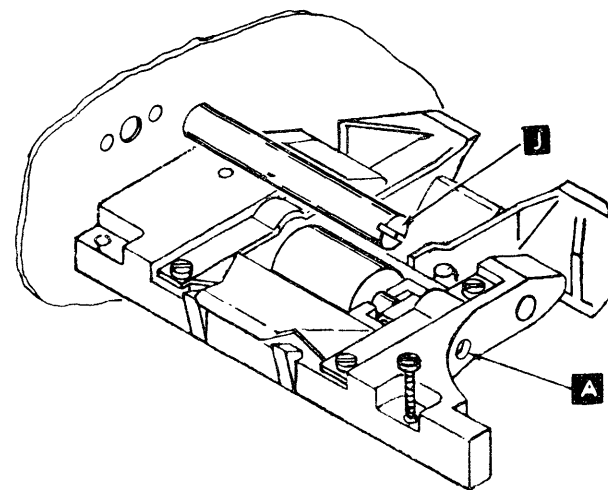
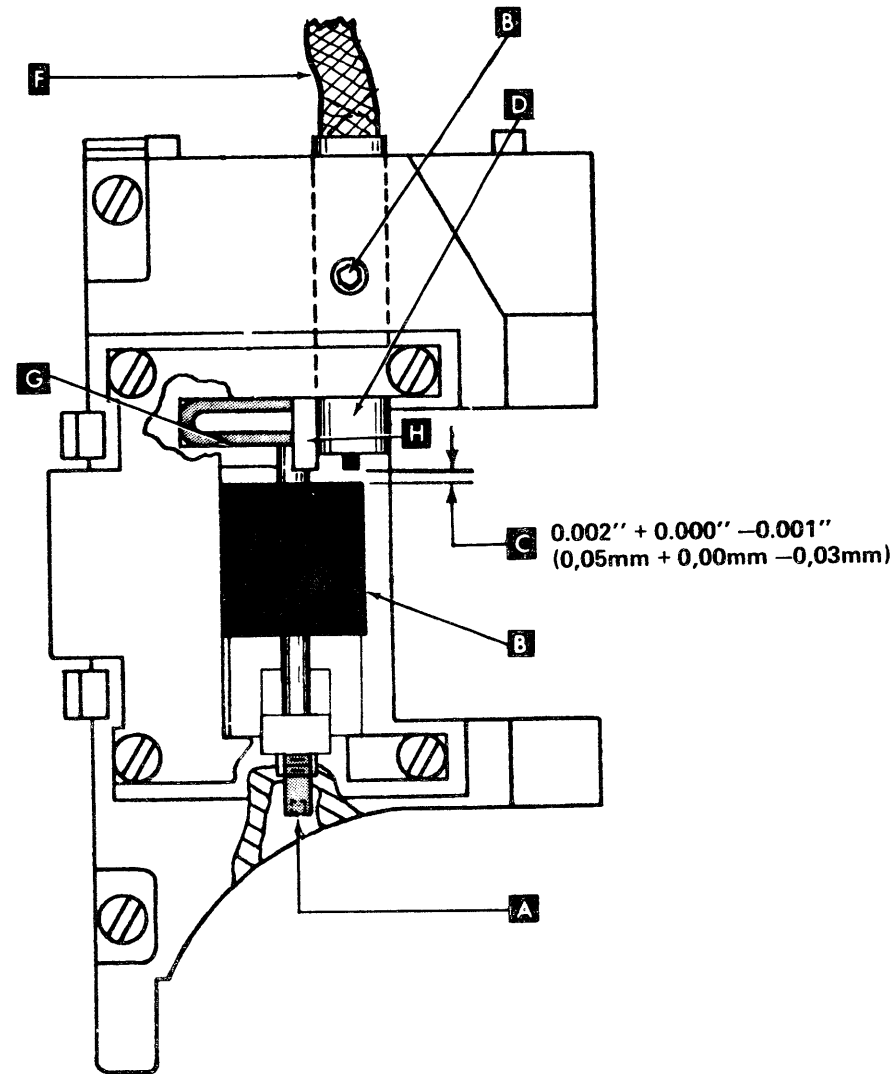
Associated with each stacker pocket is a jam detector. Each jam detector has an emitter coil and rotating disk. These disks emit pulses as they are turned continuously by either the transport feed belt or by a card in the transport. The attachment checks the timing of these pulses and turns on the stacker check light and stops the machine if a disk slows or stops.

SERVICE CHECK

- 1 Check that the four detector rolls do not touch the pickup.
- 2 Check that a 0.001" (0,03mm) feeler gage is free between detector roll and pickup magnet and a 0.002" (0,05mm) gage will not go. **C**

ADJUSTMENT

- 1 Loosen screw **E** and pull emitter pickup away from roll.
- 2 Turn adjusting screw **A** clockwise until shoulder of roll touches guideblock.
- 3 Slide pickup in to touch roll.
- 4 Turn screw **A** counterclockwise until roll does not touch pickup.
- 5 Check that 0.001" (0,03mm) feeler gage is free in gap and a 0.002" (0,05mm) gage will not go. **C**



Jam Detector Pickup Removal

- 1 Loosen holding screw **E**
- 2 Disconnect pickup wires at terminal block. **F**
- 3 Slide pickup out back of machine. **D**
- 4 To re-install jam detector pickup:
 - a. Turn jam detector adjusting screw **A** clockwise until shoulder of roll touches guideblock.
 - b. Slide pickup against jam detector roll and tighten pickup mounting screw. Connect wires at terminal block.

5 Adjust jam detector pickup:

Turn jam detector adjusting screw counterclockwise until roll does not touch pickup. **A**

Check that a 0.001" (0,03mm) feeler gage is free in gap and a 0.002" (0,05mm) gage will not go. **C**

Jam Detector Roll Removal

- 1 Remove stacker belt.
- 2 Loosen safety stud to allow access to jam roll. **J**
- 3 Loosen jam detector adjusting screw. **A**
- 4 Push jam detector roll back, then up and out of machine. **B**
- 5 Reinstall by reversing above procedure.

Note: Removal is easier if a 0.020" (0,51mm) feeler gage is used to compress the spring at point **G**

- 6 Be sure flat on rear of jam detector roll shaft is facing toward corner station. **H**
- 7 Check roll to pickup gap. **C**
- 8 Adjust stacker transport belt tension (page 76).

POWER SUPPLIES

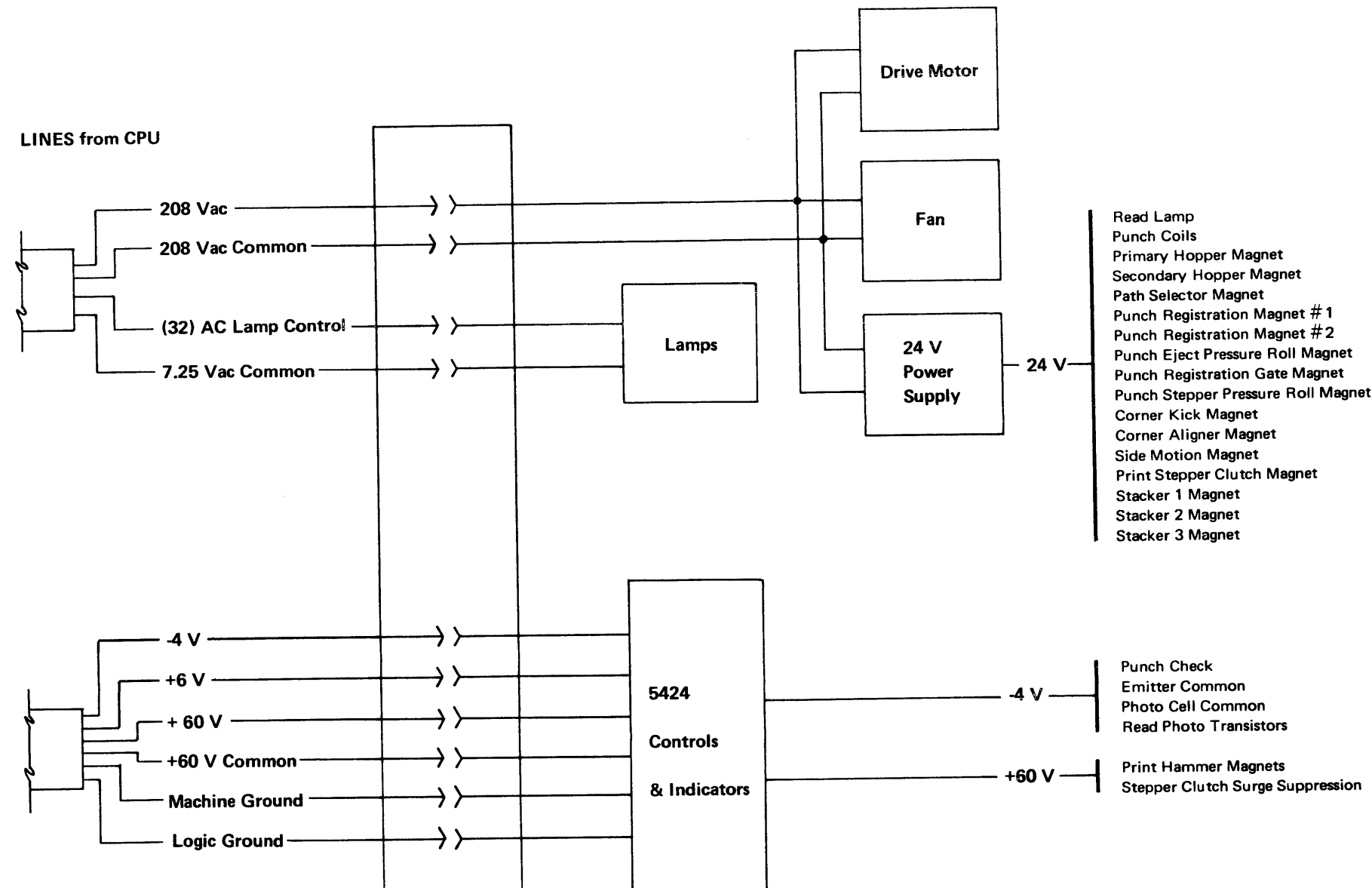
SYSTEM SUPPLIED VOLTAGES

System-supplied voltages are provided to the 5424 by two cables.

1. An ac-power cable provides 208 Vac for operation of the 5424 drive motor, fan, and the 24 volt power supply, and 7.25 Vac for indicator lamps.
2. A dc power cable provides -4 Vdc, +6 Vdc, and +60 Vdc for 5424 circuits.

A 24 volt dc power supply is located in the MFCU base. The ferro-resonant circuit consists of a winding on the power supply transformer and a capacitor operating at a frequency of 50 Hz (World Trade) or 60 Hz (domestic).

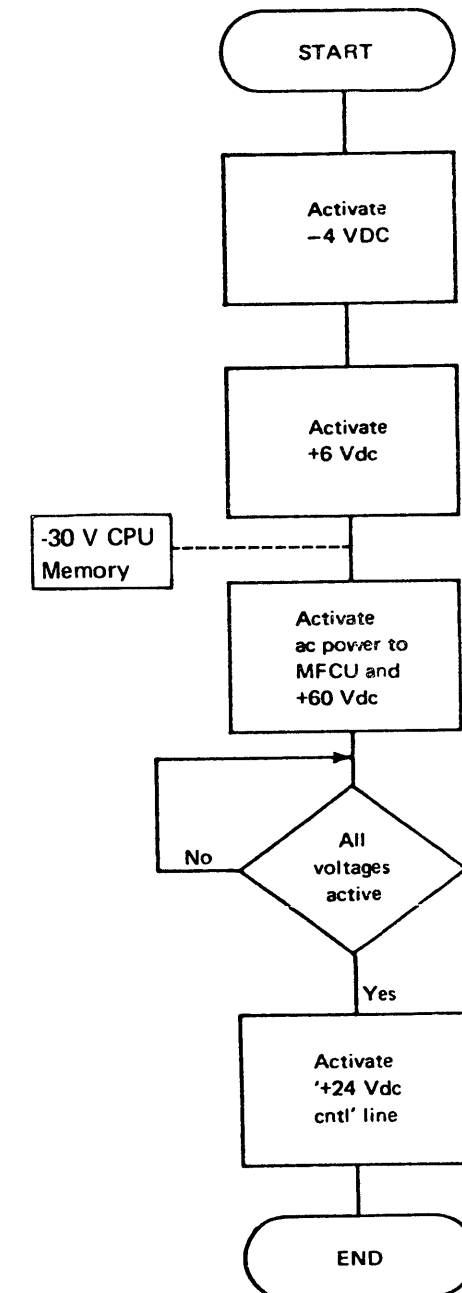
Output voltages from the power supply are not adjustable. The transformer is selected and wired according to the input frequency and the input line voltage.



POWER SEQUENCING

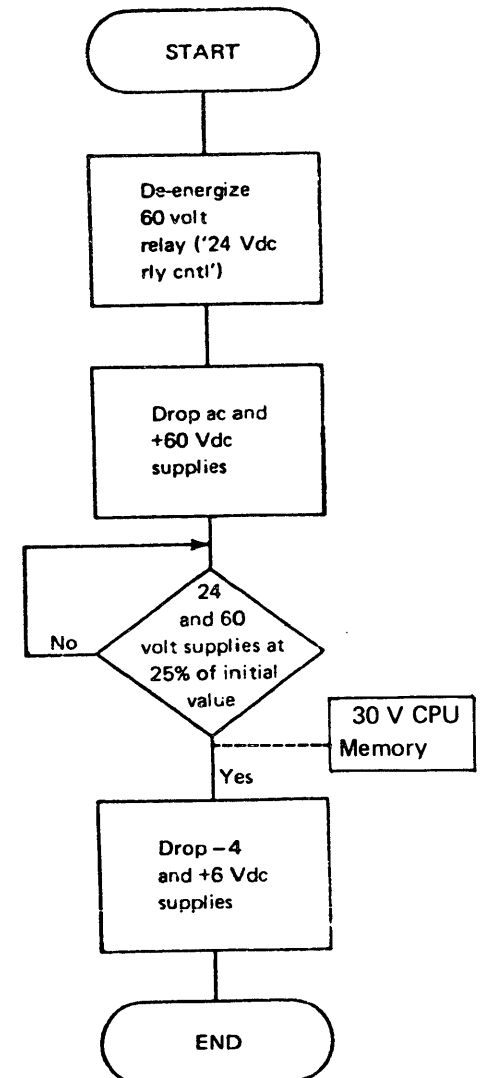
POWER ON

Power-on sequencing is controlled entirely by the CPU. Power in the 5424 is brought up when the processing unit supplies primary power.



POWER OFF

Power-off sequencing is normally controlled by the CPU. Power is dropped when the processing unit removes primary power.



POWER SUPPLIES

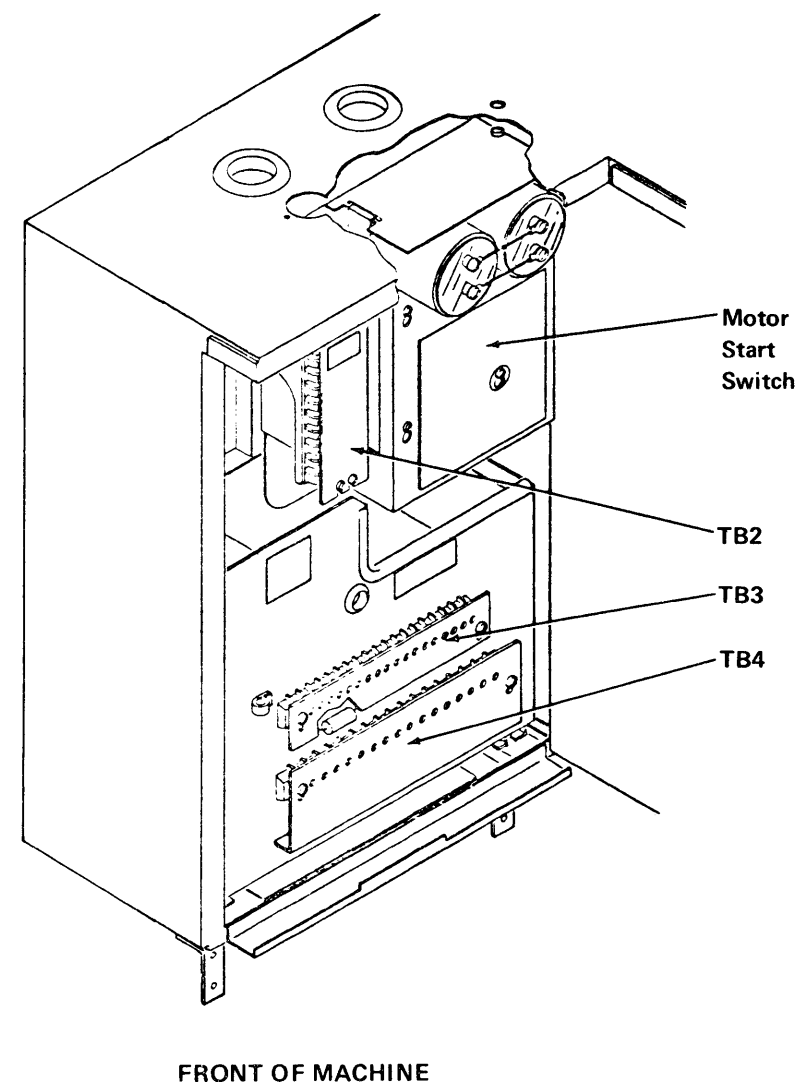
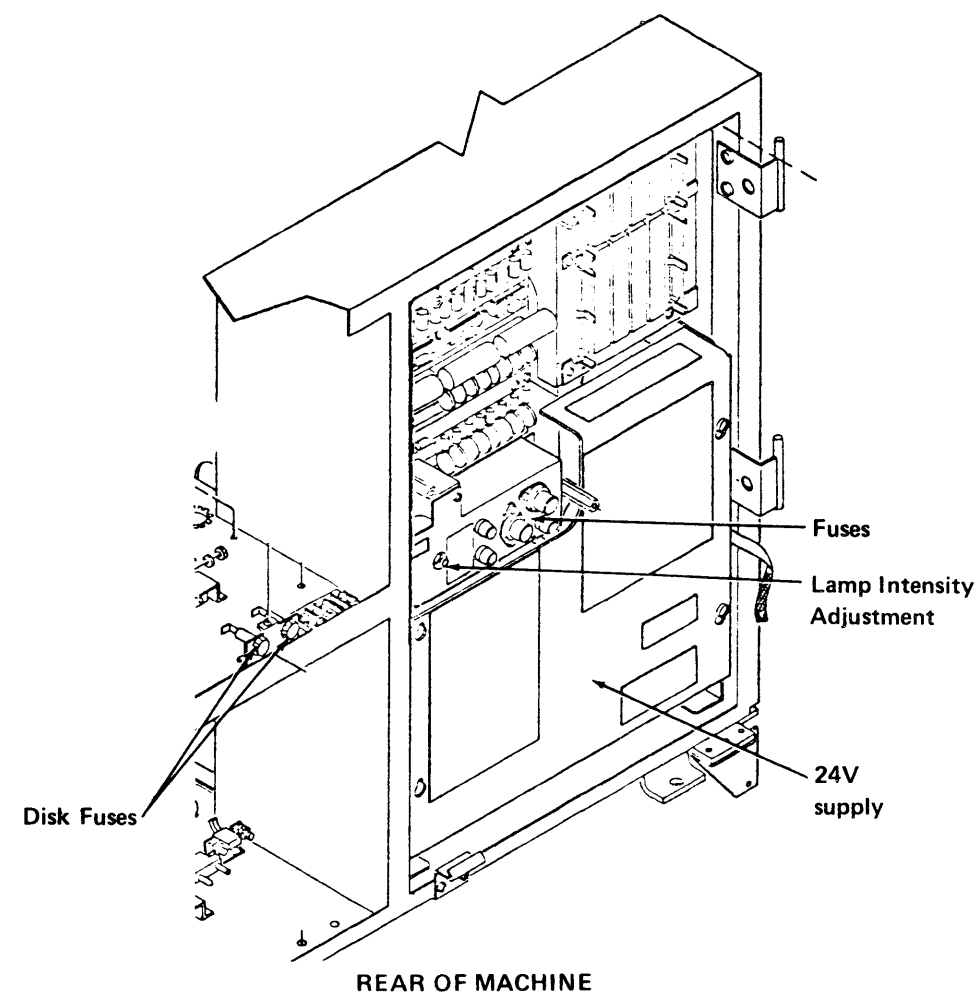
SERVICE CHECK

Check that voltages in MFCU are within limits specified:

Voltage Line	Test Points	Voltages	Tolerances
Input for 60 Hz \pm 1/2 Hz*	TB1-1 TB1-2	208 Vac	187.2 Vac – 228.8 Vac
	TB2-9 TB2-12	230 Vac	207 Vac – 253 Vac
Inputs for 50 Hz \pm 1/2 Hz*	TB1-1 TB1-2	220 Vac	198 Vac – 242 Vac
	TB2-9 TB2-12	235 Vac	211.5 Vac – 258.5 Vac
Output for 50 Hz \pm 1/2 Hz and 60 Hz \pm 1/2 Hz	TB4-1 (+) TB4-7 (-)	+24 Vdc	21.6 Vdc – 26.4 Vdc
	TB3-1 (-) TB3-8 (+)	-4 Vdc	3.6 Vdc – 4.4 Vdc
	TB3-4 (+) TB3-8 (-)	+6 Vdc	5.4 Vdc – 6.6 Vdc
	TB4-4 (+) TB4-7 (-)	+60 Vdc	55.2 Vdc – 66.0 Vdc

*Determine input voltage for machine being checked.

NOTE: To change voltage value, see ALD page YB115 and YF215.



ADJUSTMENTS

The 24 volt supply is not adjustable. Check power supplies in the CPU before making any power supply adjustments.

LOW OUTPUT VOLTAGE

Ground or shorts in a circuit can cause a low output voltage from the power supply. To diagnose low output voltage:

1. Disconnect power-supply output and measure output voltage. If voltage rises to normal or above normal, check output circuits for ground and shorts.
2. Check fuses and check that input power is being applied to the machine. Fuses are located in the CPU.
3. Check for an overload on one or more of the outputs.
4. Check for a shorted rectifier diode, shorted filter capacitor, or a shorted bleeder resistor.
5. Check resonant circuit for a shorted capacitor.
DANGER: Check with the power removed from system.
6. Check for excessive ripple. If ripple is over 1 volt peak-to-peak, check for an open rectifier diode or an open filter capacitor.

HIGH OUTPUT VOLTAGE

1. Check input voltage.
2. Check for open bleeder resistor.

FAN

One fan cools the MST logic circuits and the electrical-mechanical components. No air filters are in the MFCU.

ADJUSTMENT AIDS

READING OFF PUNCHED CARDS

To read cards that are punched either early or late, the following procedure should be used. This should only be used if the cards are punched off more than 0.020" (0,51 mm) horizontally and they must be read for customer service. It should not be used as a procedure for curing any and all read problems since it would only cause future trouble. The changes should be reversed after the bad cards have been read.

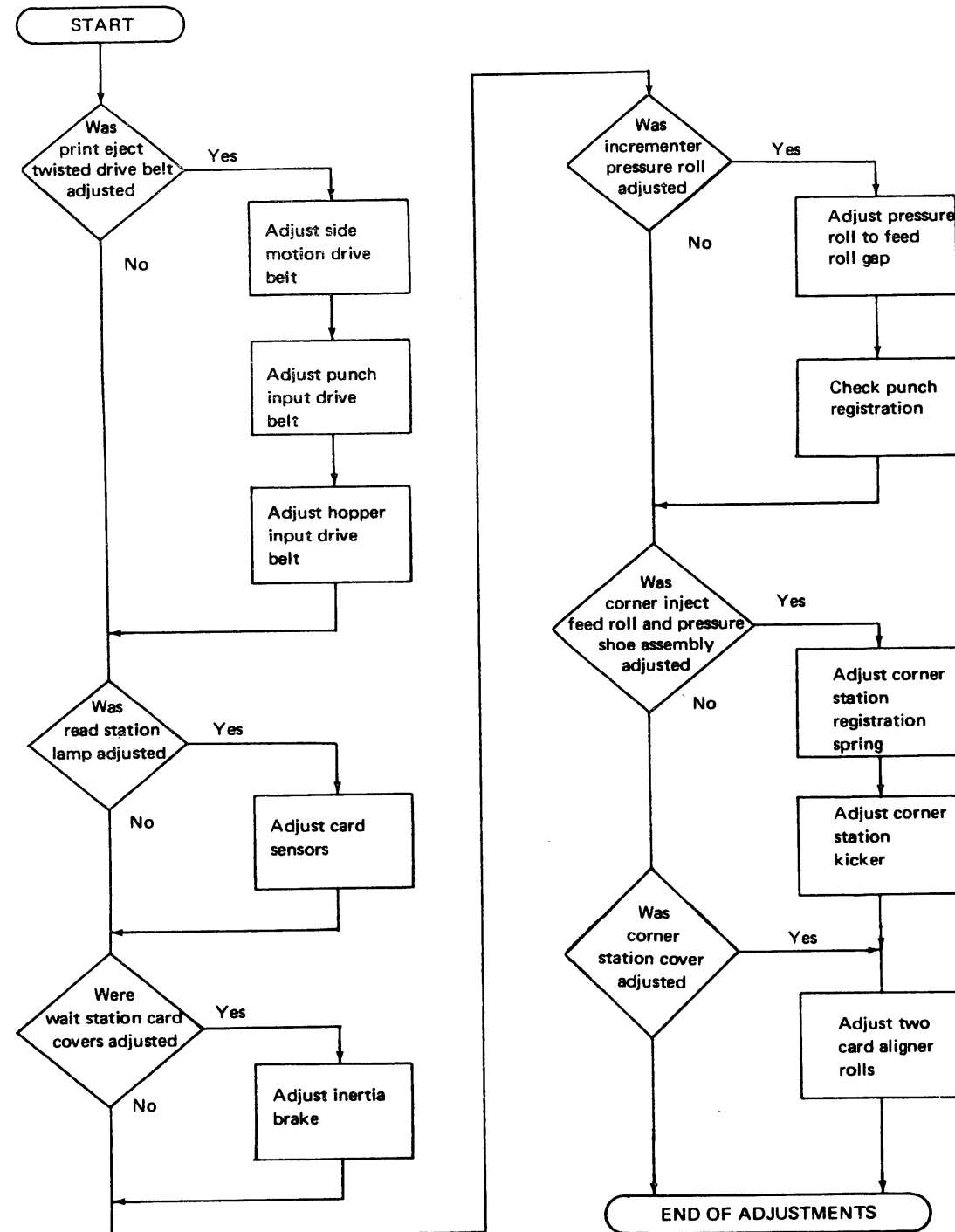
To read cards that are punched late (to the right on a card when viewed from the face up), the following changes should be made on board 01-A3 to change the gear count from 46 to 50.

- Delete jumper from 01A- A3K5D06 to 01A-A3K5D11
- Delete jumper from 01A- A3K5B13 to 01A-A3K5D11
- Add jumper from 01A-A3K5D06 to 01A-A3K3B08
- Add jumper from 01A-A3K5B13 to 01A-A3K3B08

To read cards that are punched early (to the left on a card when viewed face up), the following changes should be made to change the gear count from 46 to 42:

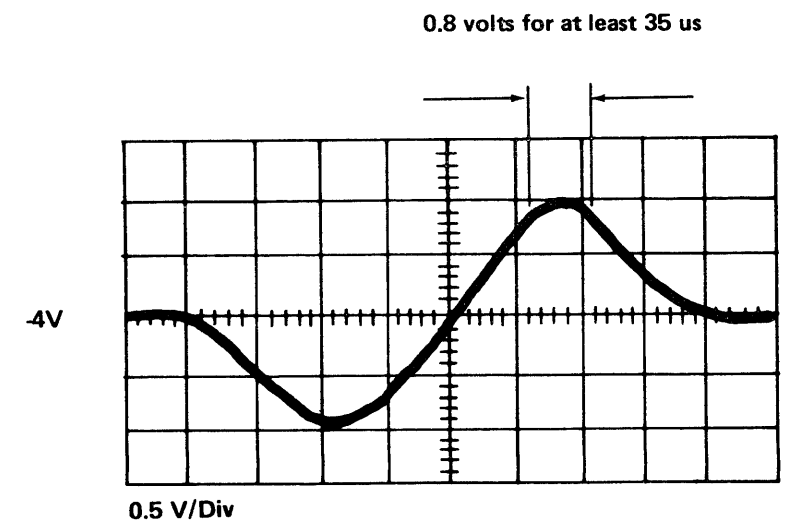
- Delete jumper from 01A-A3K5B13 to 01A-A3K5D11
- Add jumper from 01A-A3K5B13 to 01A-A3K5D12

SEQUENCE SENSITIVE ADJUSTMENTS



EMITTER PICKUP OUTPUT

All magnetic emitter pickup pulses must go negative before going positive (oscilloscope connected to signal lead shown on logic page FG180).



TYPICAL WAVEFORM

NOTE: This is a minimum voltage reading. Read gear emitter may greatly exceed this value.

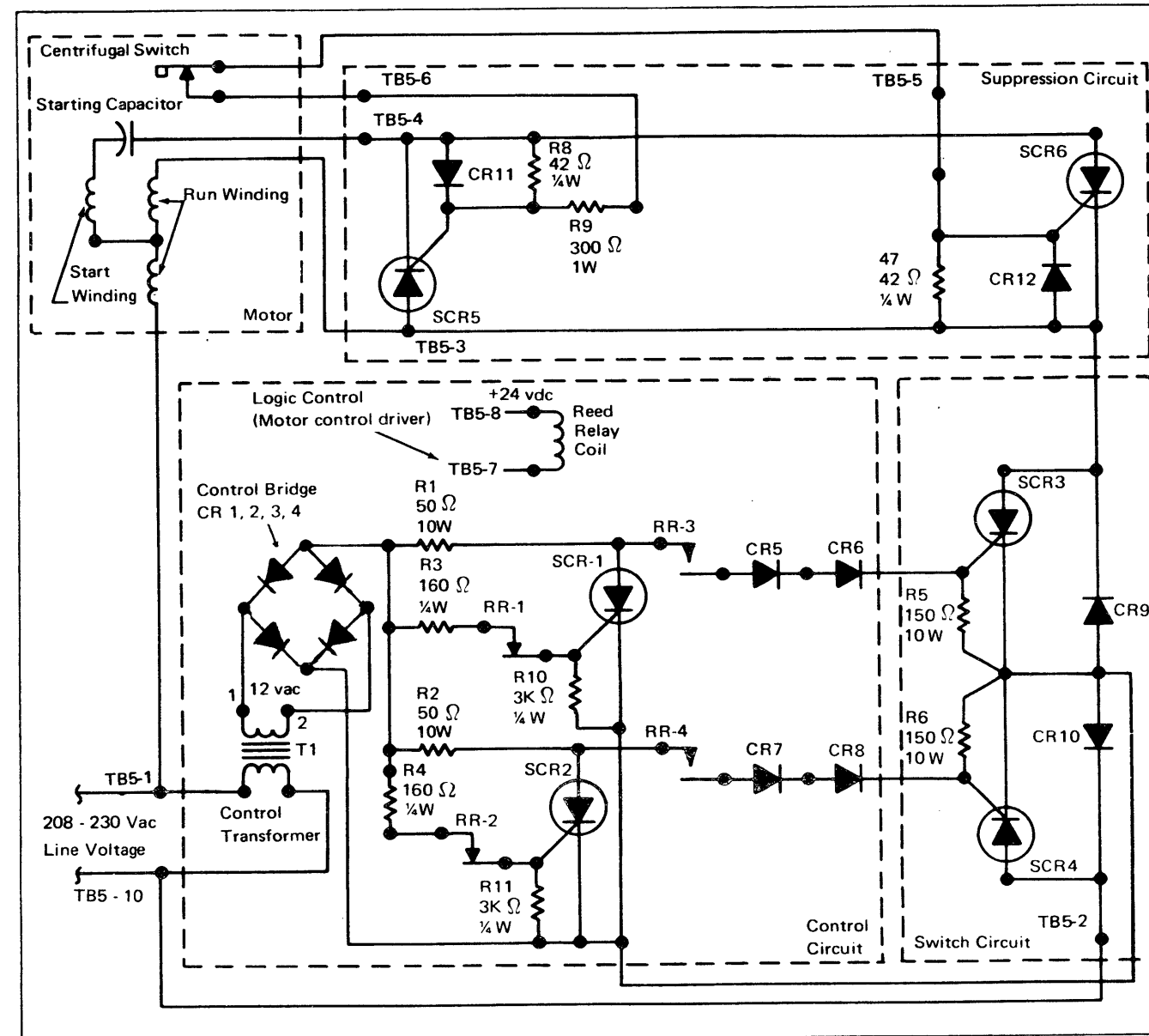
MOTOR START SWITCH

The motor start switch, on the ac distribution panel is a solid state switching device that eliminates the electrical noise normally associated with motor starting and stopping. There are three circuits in the switch: a control circuit, a switching circuit, and a suppression circuit.

The control circuit synchronizes the starting of the motor with the line voltage. The logic control signal ('motor control drive') that starts the motor can occur during any part of the ac wave that drives the motor. To ensure noiseless switching, the control circuit gates the switching circuit only when the ac wave passes through the zero point. The circuit works like this: (assume that 'motor control drive' is inactive at first). The ac voltage that appears across the motor also appears across the control transformer (T1). The control bridge, a full wave rectifier, provides gate current for SCRs 1 or 2 through R3, R4, and the normally-closed reed delay points, RR-1 and RR-2. SCRs 1 and 2 conduct thus shunting gate current from SCRs 3 and 4 and holding the motor off. When 'motor control drive' transfers the reed relay points during the non-zero part of the ac wave, the gating path to SCRs 1 and 2 is interrupted and the path to SCRs 3 and 4 is completed. However, the shunting action of SCRs 1 and 2 continues until the ac wave reaches zero and turns them off. Gate current for SCRs 3 and 4 cannot flow until SCRs 1 and 2 continue until the ac wave reaches zero and turns them off. Gate current for SCRs 3 and 4 cannot flow until SCRs 1 and 2 turn off: gate current is thus provided for SCRs 3 and 4 near the zero point. When 'motor control drive' is deactivated, the process is reversed turning the motor off at the zero point. SCRs 1 and 2 again shunt gate current from SCRs 3 and 4 thus holding the motor off.

The switching circuit, which turns on when the control circuit gates SCRs 3 and 4, provides paths for motor current. If gate current is applied when the SCR 3 anode is positive with respect to the SCR 4 anode, motor current flows from the SCR3 anode through CR 10 to the negative side of the line. On the next half cycle, SCR 4 and CR 9 conduct in the same way. When the control circuit removes gating current, the conducting SCR continues to conduct for the remainder of the half cycle. Thus the motor turns off only when the ac wave passes through zero.

The suppression circuit is also a solid state switching circuit. The normally closed points of the motor centrifugal switch control gate current for SCRs 5 or 6. When the switching circuit is turned on, gating current is provided immediately for SCRs 5 or 6. The suppression circuit conducts, thus energizing the motor start-winding



until the motor attains enough speed to open the centrifugal switch points. The electrical noise, normally generated when the centrifugal switch points open, is eliminated because the conducting SCR continues to conduct until the ac wave reaches the zero point.

MOTOR START SWITCH ASSEMBLY

VOLTAGE SERVICE CHECK

As an aid to help isolate a defective motor start switch assembly P/N 2591117, use a CE meter and the following chart for voltage checks:

Voltages on normal switch and motor

TB 5 TERMINAL	MOTOR ON	MOTOR OFF
2 to 3	Approx. 1.5 vac.	Line Voltage
3 to 4 or 5 to 6	290 to 320 vac. which drops slowly or 0 vac. depends on meter polarity	0 vac.

To check voltage between TB-5 - 3 & 4 or 5 & 6, stop machine, connect CE meter. Start and stop machine 3 to 4 times using NPRO switch (depending on phase motor switch, starts on meter may read 0 volts on one or more of the above tries). If meter reads below 50 volts AC, reverse meter leads and repeat. If meter does not read 290 to 330 VAC and slowly drops (like capacitor bleed off) with meter connected in one of the two polarities, replace motor start switch assembly P/N 2591117.

NOTE : FOR 50 HZ MACHINES MOTOR START SWITCH ASM IS P/N 2591116

TRIAC MOTOR SWITCH

The circuit is composed of three functional sections:

1. Control Corcuit
2. Main Power TRIAC
3. Start Winding TRIACs

Control Circuit

The control circuit accepts a 24 Vdc control signal and switches the main power TRIAC at the proper time to minimize the electrical noise.

The 24 Vdc signal may be random with respect to the voltage on the AC power input.

The control transformer reduces the AC voltage to a nominal 13 Vac and is connected so that the secondary voltage is in phase with the main terminal 2 voltage of the main power TRIAC. This ensures that the main power TRIAC is operated in the two switching quadrants which require the lowest gate current for turn on.

When the motor is off, the two control SCRs will be on (one for the + cycle and the other for the - cycle). When the reed relay is picked, the SCR gate circuits are opened and the circuit to the main TRIAC gate is closed. The SCR which was on continues to stay in conduction until the AC control voltage approaches zero volts, it then goes off.

The next AC wave is then fed directly to the main TRIAC gate to turn it on. The SCRs will remain off and the main TRIAC will conduct.

The current through the main TRIAC will lag the current from the control transformer due to the large motor inductance. This ensures that the main TRIAC in the normal running condition, will have a sufficient gate current to come back on each cycle before the TRIAC main terminal voltage is two volts.

The reed relay uses parallel points for both the N/O and the N/C for high reliability. Removal of the plugable reed relay will not start the motor. The reed relay must be energized with the proper polarity DC voltage to function correctly.

Main Power TRIAC

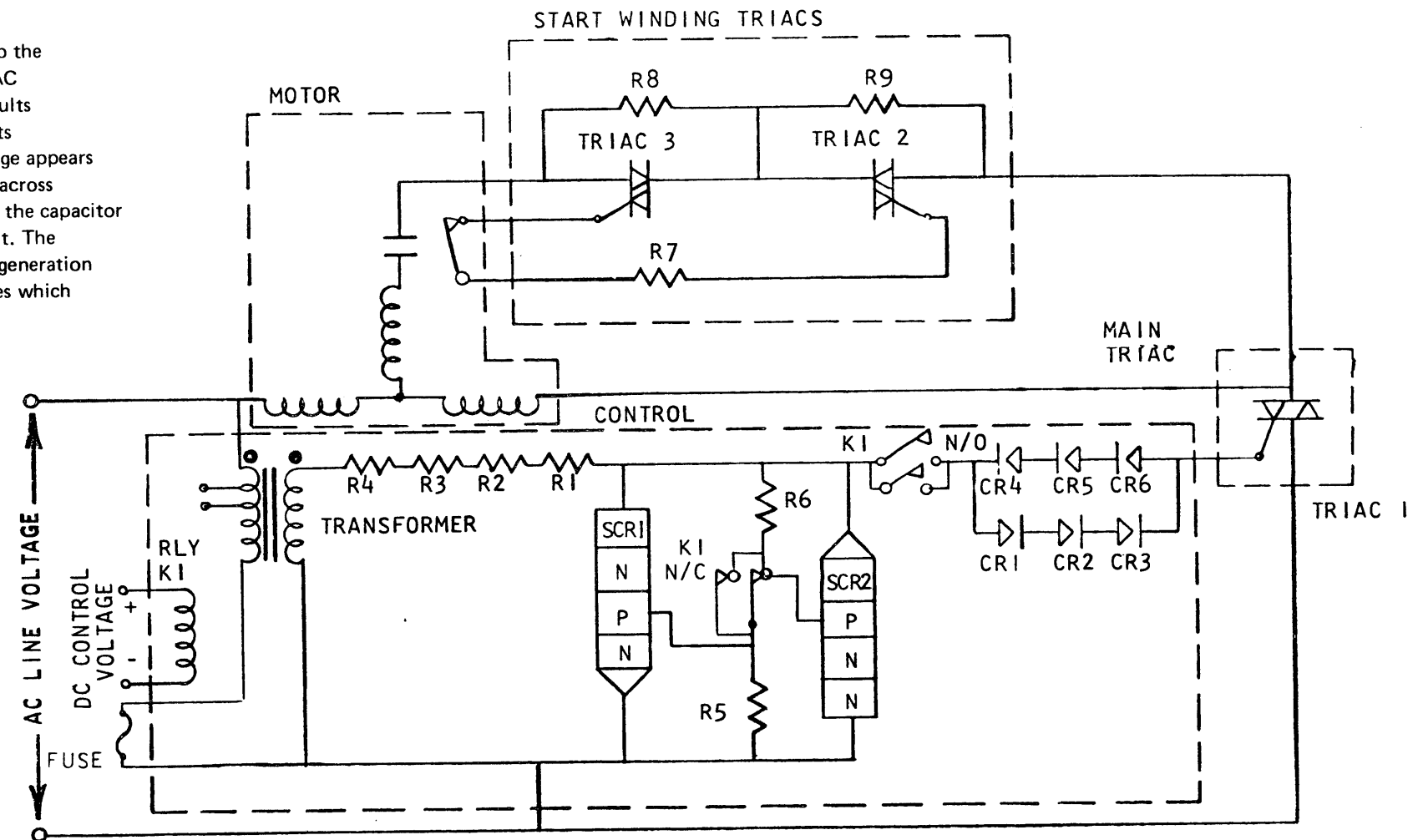
The total motor current is controlled by the main TRIAC. It will turn on each cycle and conduct until the main terminal current passes through zero. When the 24V control signal is turned off, the reed relay N/O contacts open. The TRIAC will turn off as the current approaches zero and will then stay off. This turn off at zero current prevents electrical noise from being generated.

Start Winding TRIACs

This section consists of two TRIACs, Three resistors, and the motor centrifugal switch.

The switch in the motor is closed if the motor is not up to speed. When the main TRIAC conducts the start TRIACs will conduct if the motor switch is closed. They continue to conduct until the switch opens and the start winding current approaches zero. They then stay off.

The resistors which parallel the two TRIACs keep the voltage on each TRIAC from exceeding the TRIAC breakdown voltage. This possible high voltage results from the motor capacitor voltage being close to its peak value when the TRIACs turn off. This voltage appears as a "bias" which adds to the normal AC voltage across the TRIACs. The resistors also serve to discharge the capacitor and reduce the voltage seen across the start circuit. The reduced capacitor charge results in a lower noise generation when the motor stops and the motor switch closes which then rapidly discharges the capacitor.



DISK ENCLOSURE ADJUSTMENTS AND LOCATIONS

Enclosure Air Filter, PM Procedure (Required once each year)

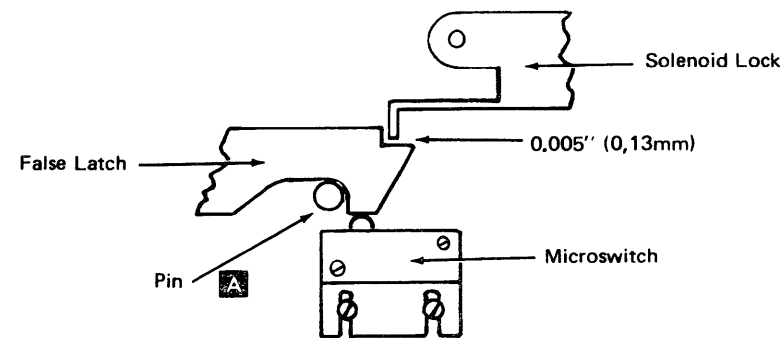
1. Turn off system power switch.
 2. Pull out on the three snap latches and swing out the blower mounting plate.
- Note: Early machines may require that the top and bottom finger stock assemblies be removed prior to filter replacement.
3. Loosen wing-nuts securing the filter retaining brackets and remove filter.
 4. Install new filter, tighten retaining wing-nuts, and close the blower mounting plate.
 5. Press in on the three snap latches to secure the blower mounting plate.

Drawer Lock Bypass Procedure

1. Insert a small tool approximately 1/2" (12,7 mm) into the lock access hole located on the left side of the enclosure. Use a prying motion to lift the lock while unlatching the drawer.

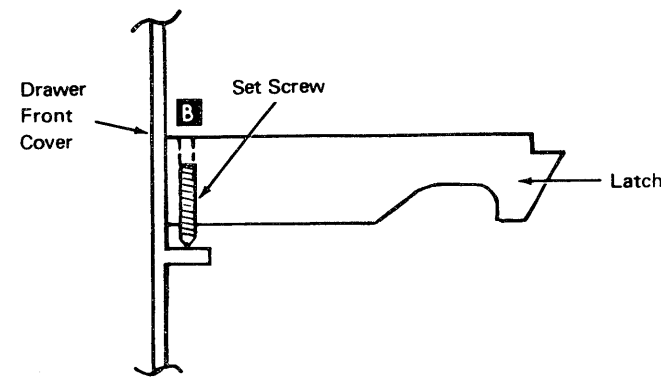
CAUTION: If cartridge is to be removed, be sure the head cleaning brushes and the read/write heads are fully retracted.

2. To power up the file with the drawer open, the drawer lock microswitch must be activated by inserting the false latch, part 2590976.



Disk Drawer Microswitch and Latch Adjustment

1. Turn off the disk drive power switch.
2. Open the drawer.
3. Turn off the systems power switch (to de-energize the drawer lock solenoid).
4. Remove the front drawer cover and open the rear blower cover.
5. Slide disk drive to the rear.
6. Insert the false latch so it rests on the latch pin. **A**
7. Insert a 0.005" (0,13 mm) feeler gage between the latching surface of the false latch and the solenoid lock. This allows the solenoid lock to operate freely with the latch in place.
8. With the feeler gauge clamped between the lock and the latch surface, position the microswitch so the operating button is fully transferred to the normally closed position.
9. Remove the feeler gauge and the false latch.
10. Slide the disk into the enclosure and close the blower cover.
11. Install front cover. Be sure that locating tabs are resting on the file tray extension.
12. Check the drawer for easy closing and latching. If the latch hits the pin and does not ride easily over it, adjust the vertical position of the latch perpendicular to the disk front cover. **B**
13. Check that the disk drive does not drop ready status when the drawer cover is closed and latched:
 - a. Close the drawer.
 - b. Turn on the system power switch and the disk drive start switch.
 - c. Try to open the drawer several times after the ready indicator turns on. If the ready indicator goes out, check for a defective microswitch and/or repeat the adjustment procedure.



Disk File Removal Procedure

1. Slide file assembly forward.
2. Disconnect cable (2588131) for top file from CF-2 connector (on rear of base) and cable (2588131) from CF-4 connector for bottom file. Disconnect cable (2588134) from CF-3 connector on top file and from CF-5 connector on bottom file.
3. Unplug cable assembly (2588298) from board W4A1 for and W4A2 for top file (on front of base under the stacker). Unplug cable (2588298) from board W4B1 and W4B2 for bottom file.
- *4. Loosen screw holding the cable clamp (2590960) and cables (2588298), (2588131), and (2588134) to the base. Slide the clamp from the retainer.
- *5. Disconnect the cable retainer from the base.
- *6. Remove four screws that hold cover to tray. Retain the hardware.
- *7. Remove two screws that hold file tray to the slides.
- *8. Slide file assembly to the rear and remove two screws that hold the file tray to slides. Retain parts.
- *9. Remove file from slides. This can be done from the front or rear of machine. CAUTION: File weighs in excess of 60 pounds.
10. For installation of the file, reverse the removal procedure. Make sure that the cables in the flexible retainer lay flat and do not buckle or overlap each other when the file is withdrawn to the rear.

Note: Steps with * to be repeated for two file installation.

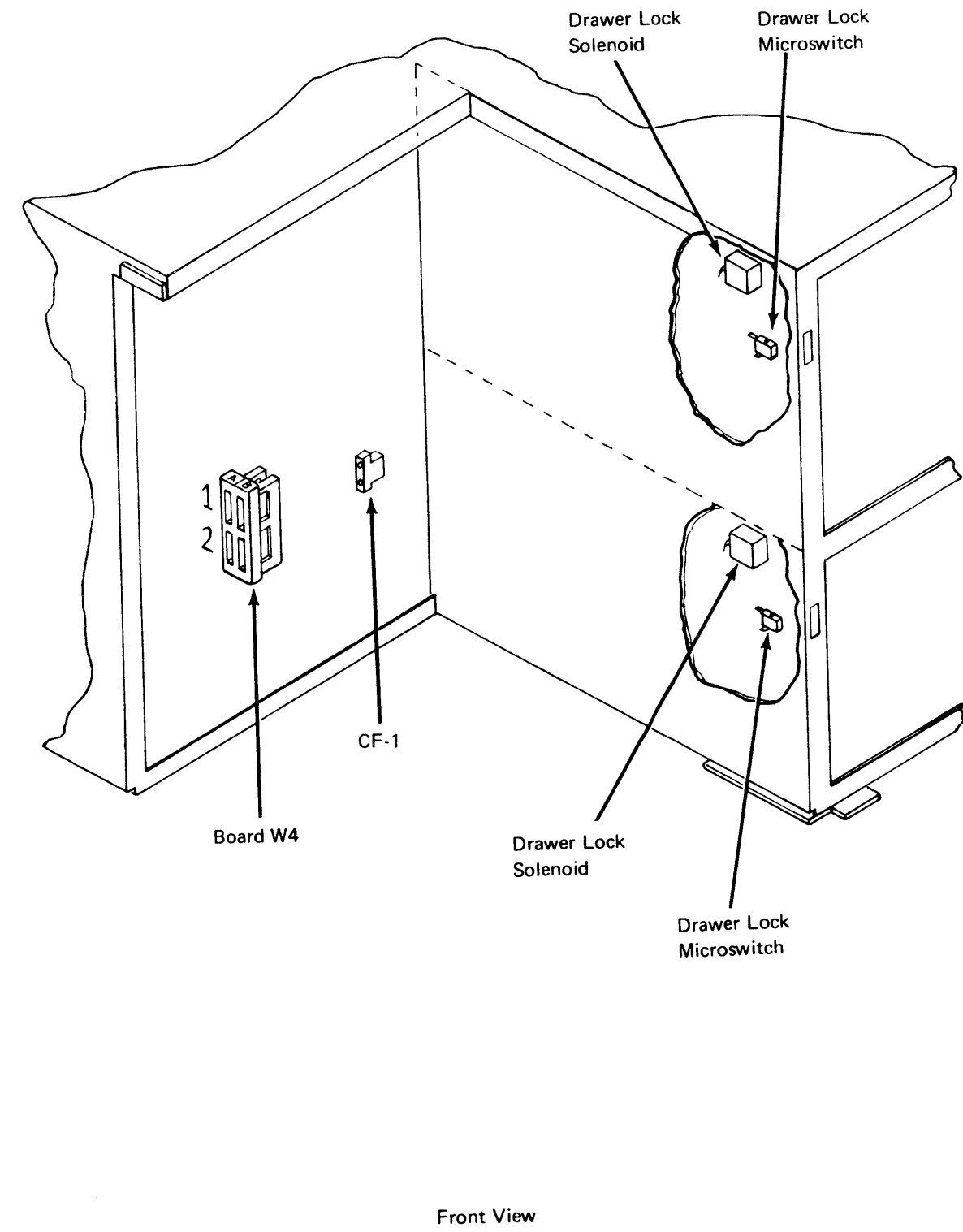
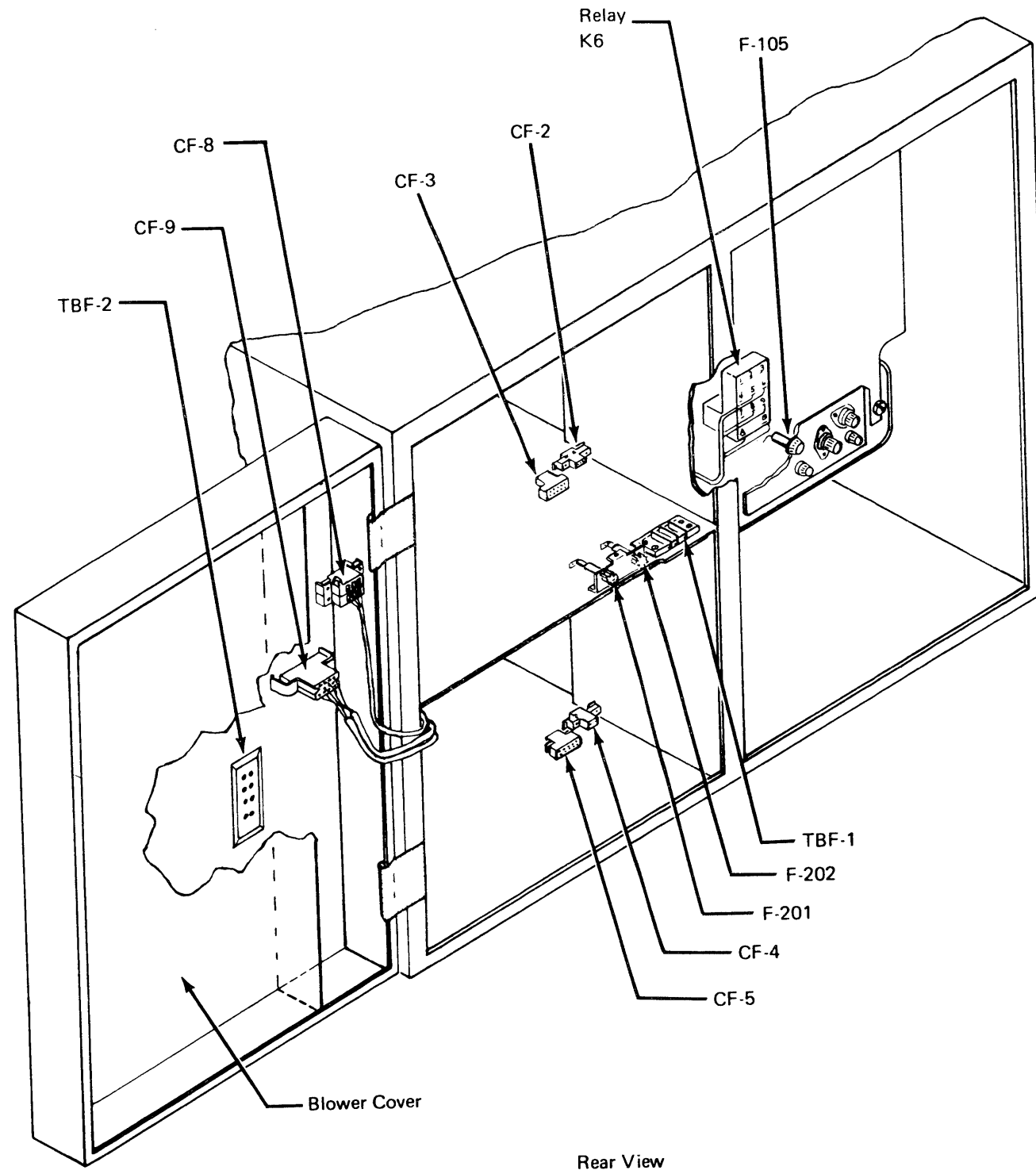
TAPS Sense Jumpers

If the jumpers normally installed between the unsafe latches and the TAPS line driver input pins are changed during diagnostics, they must be returned to the proper pins or customer programming errors may occur.

The following pin numbers show the correct jumper locations:

	Unsafe Latch	TAPS Line driver	Unsafe Condition	Sense	
				Byte	Bit
File board YWI	H6B10 to H6G04	G7B04	Select Unsafe	2	1
	H6G04 to H6G03	G7B03	Erase Unsafe	2	2
	H6G03 to	G7B05	Write Unsafe	2	3

DISK ENCLOSURE ADJUSTMENTS AND LOCATIONS

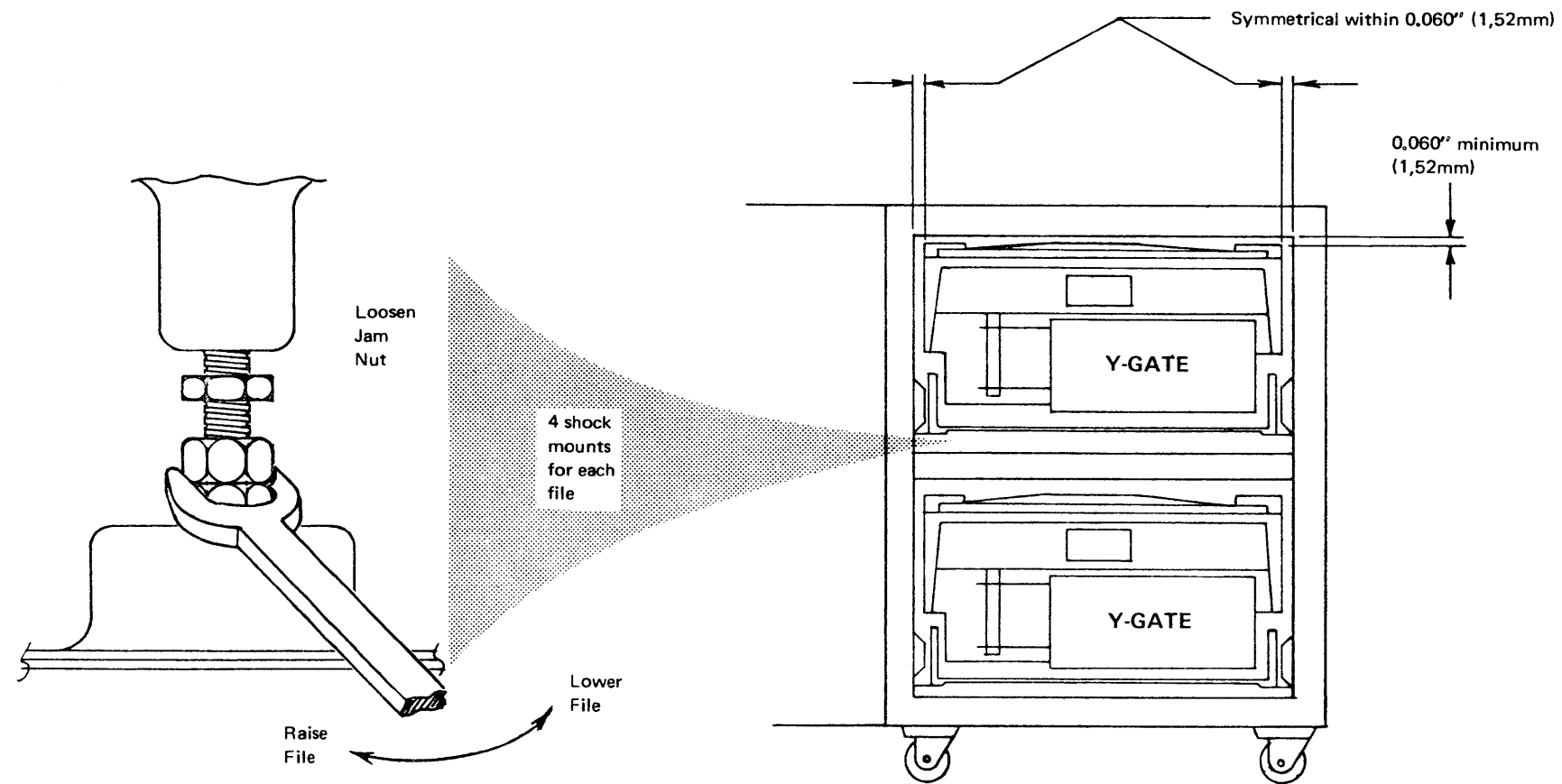


DISK ENCLOSURE ADJUSTMENTS AND LOCATIONS

Disk File Shock Mount Adjustment

Perform this adjustment if the file strikes the inside of the machine base or if there is less than .030" (0,76 mm) clearance between the "Y-GATE" and the tray (front of file) or between the DC box and the tray (rear of file).

1. Remove front cover.
2. Loosen the jam nut at each shock mount position.
3. Rotate the shock mount center core to achieve the proper clearance.
4. Tighten jam nuts and attach the front cover.



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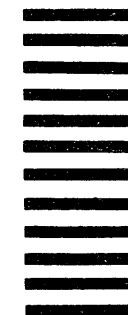
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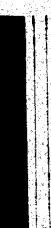
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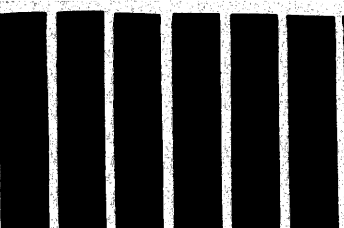


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