IBM® Field Engineering

Maintenance Manual

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Serial Reader Punch

PREFACE

This manual contains mechanical adjustments for the serial reader punch unit contained in these machines:

- IBM 1013 Card Transmission Terminal
- IBM 1034 Card Punch
- IBM 1442 Card Read Punch

Electro-mechanical adjustments peculiar to the specific machine type are found in the maintenance manual associated with the base machine.

Fifth Edition

This is a minor revision of Y31-0026-3 incorporating changes released in the following FE Supplement:

Form Number	Pages Affected	Date
Y31-0126	Contents, 2-1, 4-8, 4-10, 4-15, 4-16, 4-21, 4-23--4-31, 4-36--4-54, 5-1	8/10/66

Significant changes or additions to the specifications contained in this publication will be reported in subsequent revisions or FE Supplements.

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This manual has been prepared by the IBM Systems Development Division, Product Publications, Department 245, Rochester, Minnesota 55901. A form has been provided at the back of this publication for reader's comments. If the form has been removed, send comments to the address above.

CONTENTS

*See base machine maintenance manual for these items.

See base machine maintenance manual.

SPECIAL TOOLS

Timing Pins-P/N 612704

This 1/8" pin is used for:

1. Timing the pickerknife camshaft with the card feed index (one pin needed).
2. Aligning the solar cell unit with lamp base (two pins needed). See Servicing Procedures, Serial Reader Punch.
3. Timing the punch unit to the incremental drive unit.

Amphenol Pin Extractor - P/N 2108398

This tool is used to remove the connector pins in the punch multi-connectors on the serial reader punch.

Feeler Gages (Incremental Drive)

The two gages used to check the clearance between the latching surface of the latch arm and the latching surface of the cam follower arm are:

1. .001" gage - P/N 626532
2. .002" gage - P/N 626533

In addition, the .002" feeler gage is used when adjusting the clearance between the punch restore lever and punches.

Feeler Gage - P/N 614688

This .005" feeler gage, used in conjunction with the .002" incremental drive feeler gage, is used to adjust the clearance between the punch restore lever and punches on the "B" Model punch unit.

Feeler Gage - P/N 626537

This Mylar* gage is used to obtain clearance between the punch magnet cores and the interposer armatures.

Lamp Positioning Gage - P/N 627700

This gage contains 12 1/8" targets on which the read station lamp beams are centered prior to final pulse duration adjustments (not used on machines with fiber optic read stations).

*Trademark of E.I. duPont de Nemours and Company.

CHAPTER 3. PREVENTIVE MAINTENANCE PROCEDURES

See base machine maintenance manual.

DRIVE MECHANISM AND REAR CASTING ASSEMBLY

NOTE: The pickerknife drive on the serial reader punch has been redesigned so that the pickerknives are driven by a barrel cam mounted on the card feed clutch shaft (Figure 4-7). Unless otherwise indicated, the following procedures apply to machines with either the belt-driven or the barrel cam-driven pickerknives.

Drive Belt Tensions

Refer to Figure 4-1 for belt tension specifications.

Pickerknife Drive Belt

Removal

The following removal procedure applies to machines with a solid CF emitter bracket and shaft support (Figure 4-2).

1. Latch and detent CF clutch.
2. Insert timing pin through timing hole in the pickerknife cam and in the hopper side casting. These holes should align when CF clutch is latched (0 degrees).
3. Remove nut and washer on front end of CF clutch output shaft. Remove keyed emitter index disk.
4. Remove pulley directly behind emitter disk on CF clutch output shaft.
5. Remove emitter disk key.
6. Engage CF clutch and cycle machine by hand until small end of tapered hub fastening pin is accessible and can be driven out. Support end of CF clutch shaft and drive pin from tapered hub. Remove hub.
7. Remove card feed emitter bracket.
8. Loosen idler bracket on hopper side casting.
9. Remove belt.

Replacement

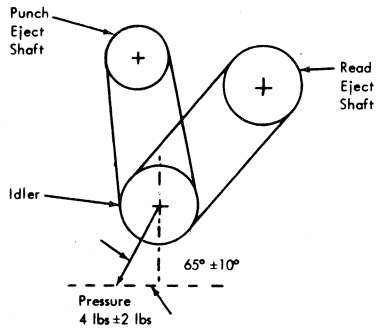
The following replacement procedure applies to machines with a solid CF emitter bracket and shaft support (Figure 4-2).

1. Slip belt over pickerknife camshaft pulley and around inner (idler) pulley on CF clutch output shaft.
2. Replace card feed emitter bracket. Make certain bracket does not bind CF clutch shaft.
3. Replace tapered hub. Be sure to support shaft when driving in pin.
4. Replace emitter disk hub key in shaft.
5. Replace pulley located directly behind emitter disk.
6. Latch up and detent CF clutch.
7. Loop belt around pulley replaced in Step 5.
8. Loop end of belt around upper idler pulley.
9. Tighten idler bracket. Make certain belt is meshed correctly on all pulleys and bracket is positioned vertically for proper belt tension.
10. Replace emitter disk. Take care not to dislodge key from shaft. When installing emitter disk, align 0° on index with pointer. This will align disk key-way with key in shaft.
11. Replace emitter disk washer and nut.
12. Remove timing pin from pickerknife cam.
13. With power on and motor plug disconnected, trip CF clutch and turn machine through a cycle by hand to make certain everything turns freely.
14. Detent CF and Read clutches before running machine under power.

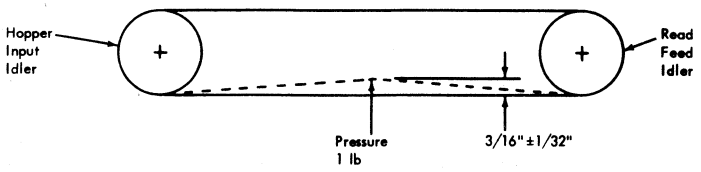
Removal

The following removal procedure applies to machines with a removable shaft support (Figure 4-2).

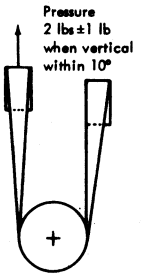
1. Latch and detent CF clutch.
2. Insert timing pin through timing hole in the pickerknife cam and in the hopper side casting. These holes should align when the CF clutch is latched (0 degrees).
3. Loosen idler bracket on hopper side casting.
4. Remove screws that attach shaft support to card feed emitter bracket.
5. Loosen card feed emitter mounting screws.
6. Remove belt.



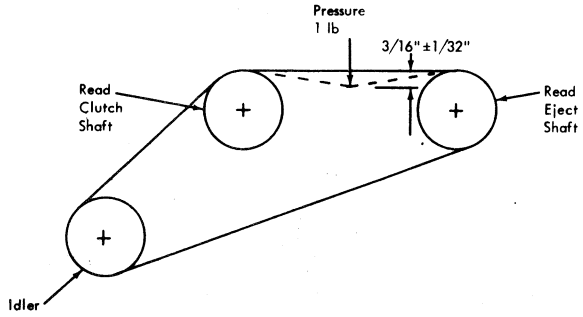
PUNCH EJECT ROLL



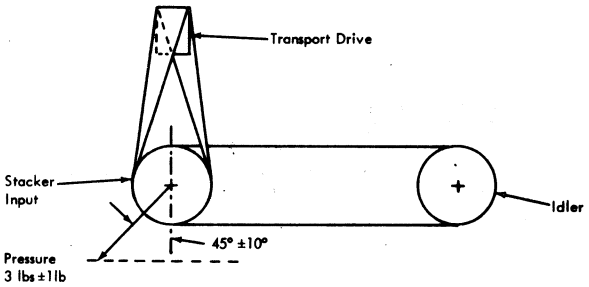
HOPPER INPUT IDLERS



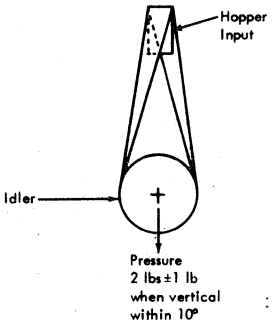
PICKER KNIFE DRIVE BELT



READ CLUTCH SHAFT



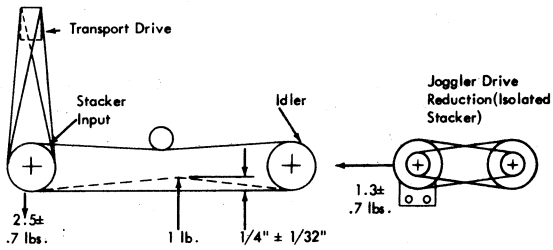
STACKER DRIVE (Non-Isolated)



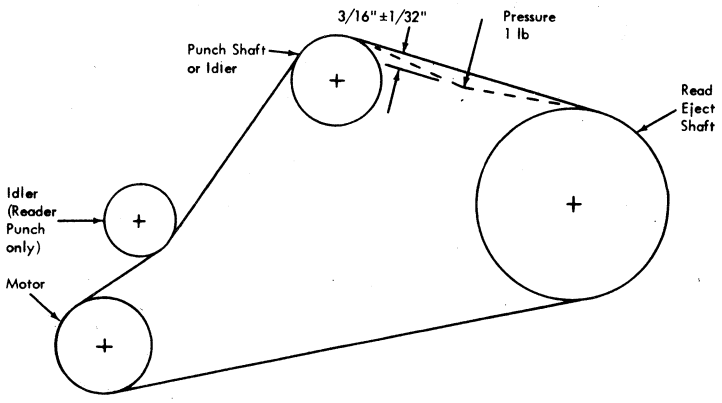
NOTE:
Belts may track off the pulley a maximum of 1/8 the belt width.

NOTE:
Check drive belts for snug fit on pulleys, proper tension, alignment and wear. Drive belt internal cables have been known to separate, causing erratic timing. Check tension throughout the entire length of the belts. If internal cables are broken, unusual vibration may be imparted to the belt because of the alternate tension and relaxation of the belt.

HOPPER INPUT



STACKER DRIVE(Isolated Stacker)



MAIN DRIVE

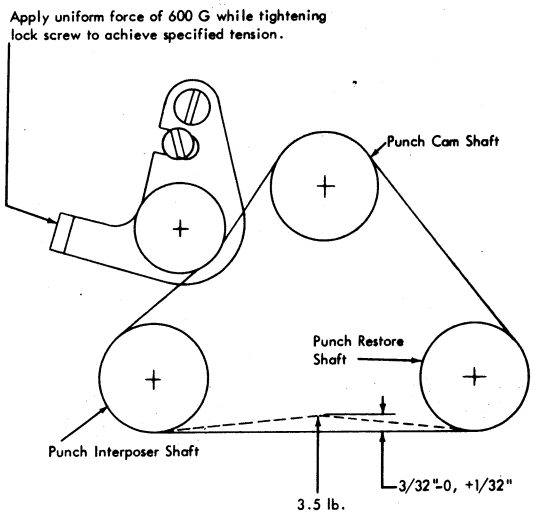


Figure 4-1. Drive Belt Adjustments

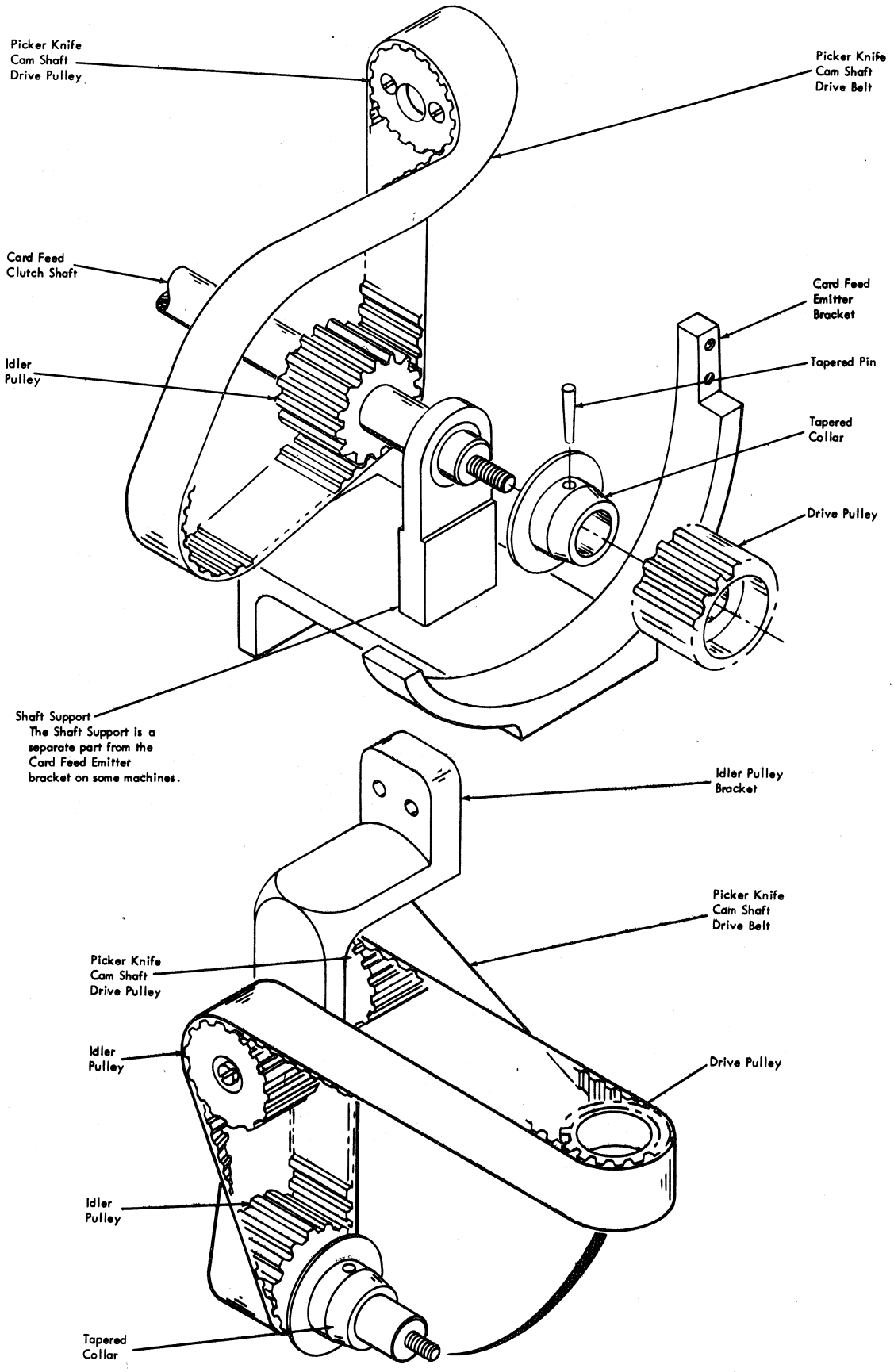


Figure 4-2. Pickerknife Camshaft Drive Belt Installation

Replacement

The following replacement procedure applies to machines with a removable shaft support (Figure 4-2).

1. Slip belt over pickerknife camshaft pulley and around both pulleys on card feed clutch shaft.
2. With shaft support bracket in place, tighten card feed emitter bracket mounting screws. Make certain card feed emitter bracket does not bind CF clutch shaft. Check for .005" to .009" clearance between coils and emitter disk.
3. Attach shaft support bracket to card feed emitter bracket. Make certain shaft support does not bind CF clutch shaft.
4. Loop end of belt around upper idler pulley.
5. Tighten idler bracket. Make certain belt is meshed correctly on all pulleys and bracket is positioned vertically for proper belt tension (Figure 4-1).
6. Remove timing pin from pickerknife cam.
7. With power on and motor plug disconnected, trip CF clutch and turn machine through a cycle by hand to make certain everything turns freely.
8. Latch and detent CF clutch.

Rear Casting Assembly

Removal

1. Remove hand-wheel pulley assembly, CF clutch drive belt, and hand-wheel pulley key (Figure 4-3).
2. Remove read clutch drive belt.
3. Remove two spacers, pulley, and pulley key on hand-wheel shaft.
4. Remove CF clutch components from CF clutch output shaft (on solar cell read stations) or casting stiffener screw (on fiber optic read station). Stiffener screw attaches casting to pre-read bed. Refer to Drive Mechanism and Rear Casting Assembly, Card Feed Clutch.
5. Remove read cell unit. Refer to Read Station, Read Cell Unit.
6. Remove holding screw and washer from front end of read feed wheel shaft. This holding screw is located between and slightly below the two read cell unit mounting screws.
7. Remove punch pusher arm spring and card patter actuator rod. (Actuator rod is clipped to stud on upper end of punch pusher arm.)
8. Unhook spring on lower end of read feed pressure roll lever.
9. Back off socket screw holding read pressure roll push rod to a point where push rod can be removed. Remove push rod.
10. Remove hopper feed roll idler drive belt.
11. Remove three nuts and washers which hold read casting to stand-off mounting studs.
12. Slide casting off mounting studs slowly and evenly. Do not apply undue force. As the casting is being removed, pivot the punch pusher arm to clear the pre-punch bed plate and clutch trip cam follower.

Replacement

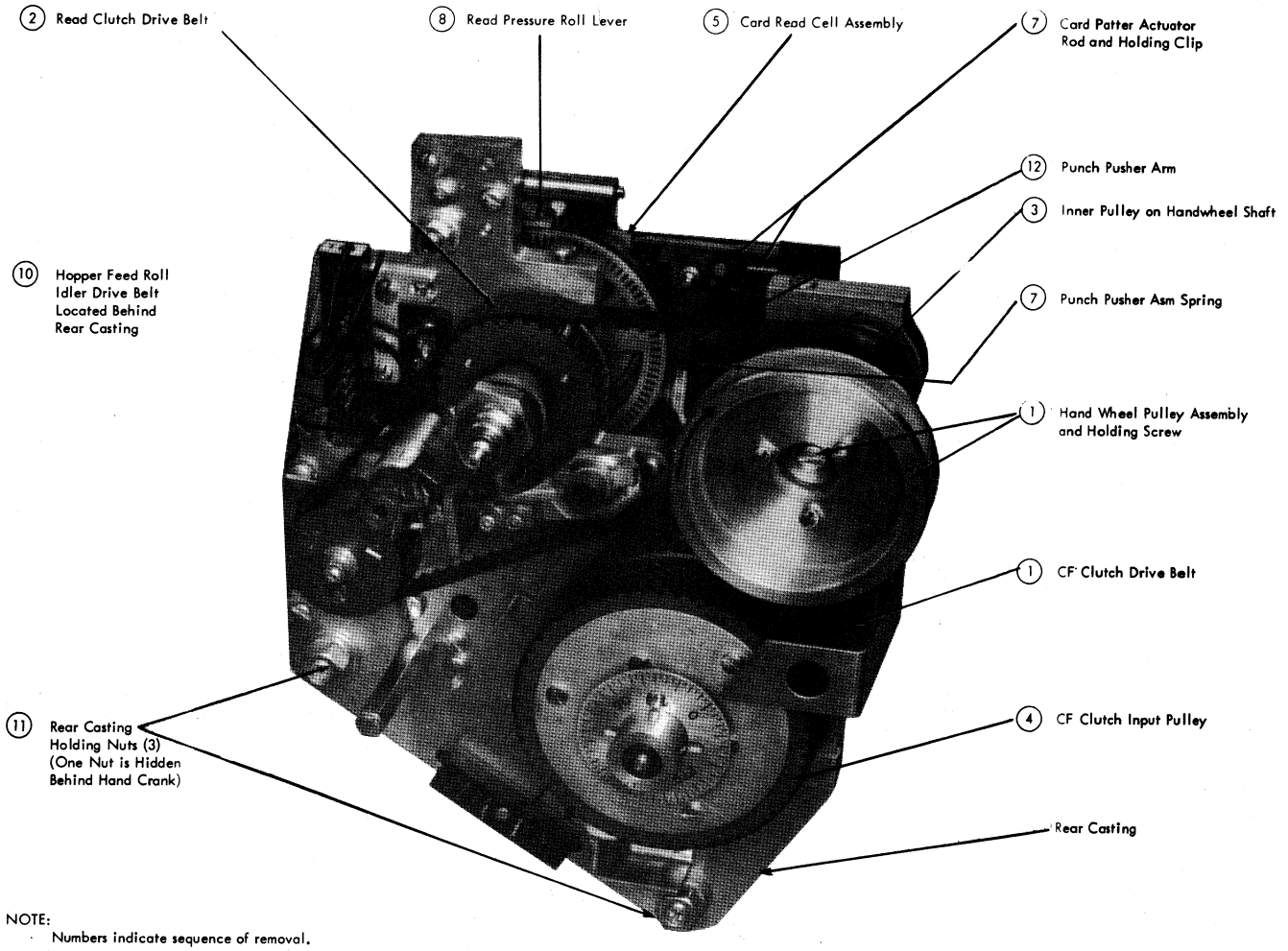
1. Perform the removal steps in reverse. However, after replacing the read feed pressure roll push rod, tighten the push rod socket screw only to the point where the push rod will not fall out.
2. Adjust read feed pressure roll push rod socket screw. Refer to Read Station, Read Pressure Roll.
3. With power on, motor plug disconnected, and CF clutch latched, cycle machine by hand. Check for binds.
4. Test machine for reading and punching under power.

Card Feed Clutch Shaft

If the CF shaft pawl breaks, or any cam is damaged, the CF shaft assembly must be replaced. The pawl, all of the cams, and the front index are factory pinned to maintain mechanical relationship.

Removal

1. Remove rear clutch safety cover.
2. Remove rear index and index pointer.
3. Remove CF clutch input pulley (3 inner screws) and CF belt.
4. Unlatch clutch and rotate CF shaft so taper pins in rear index collar and clutch pawl can be removed.



NOTE:
Numbers indicate sequence of removal.

Figure 4-3. Rear Casting Removal

5. Remove taper pins. Remove clutch as an assembly.
6. Disconnect punch eject pressure roll, punch pressure roll, and stacker pusher pull rods at the cam follower ends.
7. Disconnect read pusher pull rod at read pusher end. Do not disconnect read clutch or read pressure roll cam followers.
8. Carefully pivot disconnected cam followers and oil wicks away from camshaft.
9. Insert a screwdriver through the rear casting and under the pull rods so the loosened pull rods are held away from the CF shaft.
10. Remove punch pusher spring.
11. Steps 11, 12, and 13 apply to machines with belt driven pickerknives (see note following Drive Mechanism and Rear Casting Assembly). Remove front index and key.
12. Remove pickerknife camshaft drive pulley on CF shaft.
13. Remove tapered collar that rides against the pickerknife camshaft drive pulley.
14. Remove emitter coil bracket (2 screws).
15. Step 15 applies to machines with barrel cam pickerknife drive. Remove connecting link (Figure 4-7), loosen cam follower arm setscrew, and slide cam follower arm along its shaft to free barrel cam.
16. Remove bottom read nudge cam follower spring.
17. Remove "C" clips, at cam follower end, from read nudge pull rod and read eject pull rod. Pivot cam followers away from cams so that cams and oil wicks will clear cams.
18. Remove two front CF shaft bearing retainer screws.
19. Carefully tap shaft toward front of machine. Be sure the read pressure cam follower and oil wick and read clutch cam follower and oil wick do not catch on cams.

Replacement

1. Remove the parts on the new shaft so the new shaft compares with the old shaft. Do not intermix the new and old parts.
2. Check to see if the read feed roll push rod is properly seated. Pushing the cam follower down should activate the read feed roll and also will position the cam follower out of the way when the CF shaft is installed.
3. Insert CF shaft from front of machine. Watch for cams and oil wicks binding on the cams.
4. Tighten two front CF shaft bearing retaining screws and remove screwdriver that is holding pull rods away from CF shaft.
5. Reposition read nudge and read eject cam followers on cams.
6. Connect the read nudge and read eject pull rods. Hook read nudge pull rod spring.
7. Install emitter bracket.
8. Steps 8, 9, 10, and 11 apply to machines with belt driven pickerknives. In order to have the pickerknife camshaft drive belt in the proper position after the emitter bracket is installed, move the belt to the left to captivate the CF shaft. See Figure 4-2.
9. Install and pin the taper collar that fits against the pickerknife camshaft drive pulley.
10. Insert index key in CF shaft slot.
11. Loop pickerknife camshaft belt over CF shaft idler pulley and belt idler pulley. With the lugs engaged in the two idler pulleys, install the picker camshaft drive pulley (taper end first) and belt onto CF shaft. See Figure 4-2. Install CF index and hand-tighten retaining nut.
12. Go to rear of machine and carefully reposition the three disconnected cam followers to their cams. Hook pull rods to cam followers with C clips.
13. Connect punch pusher spring.

NOTE: Parts from the old clutch, the spring, the spring adjusting clamp, and the collar must be used on the new shaft assembly.

14. Holding the pawl assembly in one hand and the input pulley hub in the other hand, turn the pawl assembly counterclockwise and carefully pull the two apart.
15. Remove the spring from the latch assembly.
16. Remove the spring adjusting clamp and install it on the new pawl assembly.
17. Install spring on new pawl assembly.
18. Place collar on spring and pawl assembly.
19. Put input pulley hub into spring and pawl assembly. This is accomplished by twisting the collar and expanding the spring.
20. Install clutch assembly on shaft. Pin pawl assembly to shaft.
21. Pin rear index collar to shaft.

NOTE: Lubricate clutch with #23 grease. Wipe off excess.

22. Check clutch latch and keeper adjustments. See Drive Mechanism and Rear Casting Assembly, Card Feed Clutch.
23. Install CF pulley and belt.
24. Latch CF clutch. Install and adjust index and index pointer to 0°.
25. Adjust clutch spring clamp for .050" ± .010" between clutch pawl and clutch latch. This can be checked by unlatching clutch and turning it to latch-up time. The clutch control sleeve will contact the latch. The pawl should

have the specified clearance as the pulley is continuously revolved.

26. Time the pickerknives or adjust barrel cam follower. See Drive Mechanism and Rear Casting Assembly, Pickerknife Camshaft Timing or Barrel Cam Follower.
27. Time and adjust read nudge roll. See Punch Station, Read Nudge Pressure Roll.
28. Check adjustments of punch registration, read registration, drag button, read emitter-to-read cell relationship, and CF emitters-to-index disk clearance.

Card Feed Clutch

The card feed clutch on the serial reader punch has been redesigned. This redesigned clutch can be identified by the spring on the clutch latch; the old style does not have a latch spring. Adjustments for both the old and redesigned styles follow. The index plate and clutch input pulley can be removed from their hubs to facilitate adjustment. To remove clutch input pulley from hub, remove the three screws closest to the pulley hub and remove the index pointer. To facilitate reinstallation of input pulley drive belt, remove the hand wheel. When reinstalling index plate and pointer, be certain pointer aligns with 0° on index (with the CF clutch latched and detented).

Adjustment (Old Style)

1. With clutch latch arm seated against down stop, adjust down stop, by means of the mounting screws, for a .002" to .006" clearance between clutch latch and clutch control sleeve arm (Figure 4-4, Insert A). When making this adjustment, downward travel of latch armature assembly should strike the downstop; not the magnet cores.
2. With clutch latch seated against down stop, position clutch magnet assembly for .003" to .005" clearance between magnet core and clutch latch arm (Figure 4-4, Insert A).
3. With card feed clutch latched, use mounting screw to position clutch keeper for .003" to .005" clearance between keeper and clutch pawl (Figure 4-4, Insert B).
4. Adjust clutch spring clamp for .050" ± .010" clearance between clutch pawl and end of the clutch latch. The CF clutch spring clamp is fastened to the clutch pawl by two screws. When making this adjustment, the arm on the control sleeve should be in contact with the end of the clutch latch, and the clutch keeper should be pivoted out of contact with the clutch pawl. The clutch input pulley (pulley hub if pulley is removed) should also be rotated slowly by hand to unwind the clutch spring (Figure 4-4, Insert F).

Adjustment (Redesigned Style)

1. Position upstop for .060" ± .010" overlap of the clutch latch on the clutch pawl (Figure 4-4, Insert H).
2. Position the keeper for .003" to .005" clearance between the keeper and pawl when the pawl is fully seated against the clutch latch.
3. Manually activate the clutch latch and set downstop so that clutch pawl and control sleeve will pass over tip of latch with .002" to .006" clearance.
4. While holding clutch latch against downstop, position clutch magnet for .003" to .006" clearance to latch. Magnet core and latch surfaces must be parallel and in vertical alignment.
5. Adjust clutch spring clamp for .050" ± .010" clearance between clutch pawl and end of the clutch latch. The CF clutch spring clamp is fastened to the clutch pawl by two screws. When making this adjustment, the arm on the control sleeve should be in contact with the end of the clutch latch, and the clutch keeper should be pivoted out of contact with the clutch pawl. The clutch input pulley (pulley hub if pulley is removed) should also be rotated slowly by hand to unwind the clutch spring (Figure 4-4, Insert F).

Removal

1. Remove clutch drive safety shield.
2. Remove index pointer (Figure 4-5).
3. Remove hand pulley and CF clutch pulley belt. Rotate hand pulley, as it is pulled off, to facilitate drive belt removal.
4. Support end of CF clutch shaft and drive out pin that fastens index hub to CF clutch shaft. Remove index hub.

NOTE: Do not score, deform, or stretch helical spring.

5. Individually slip the clutch pulley, the control sleeve and helical spring from the shaft. Remove the pulley from its hub. (Three screws. Do not use longer screws when replacing.) This will facilitate later adjustments.

Replacement

1. Work formed end of helical spring into slot in clutch spring clamp.

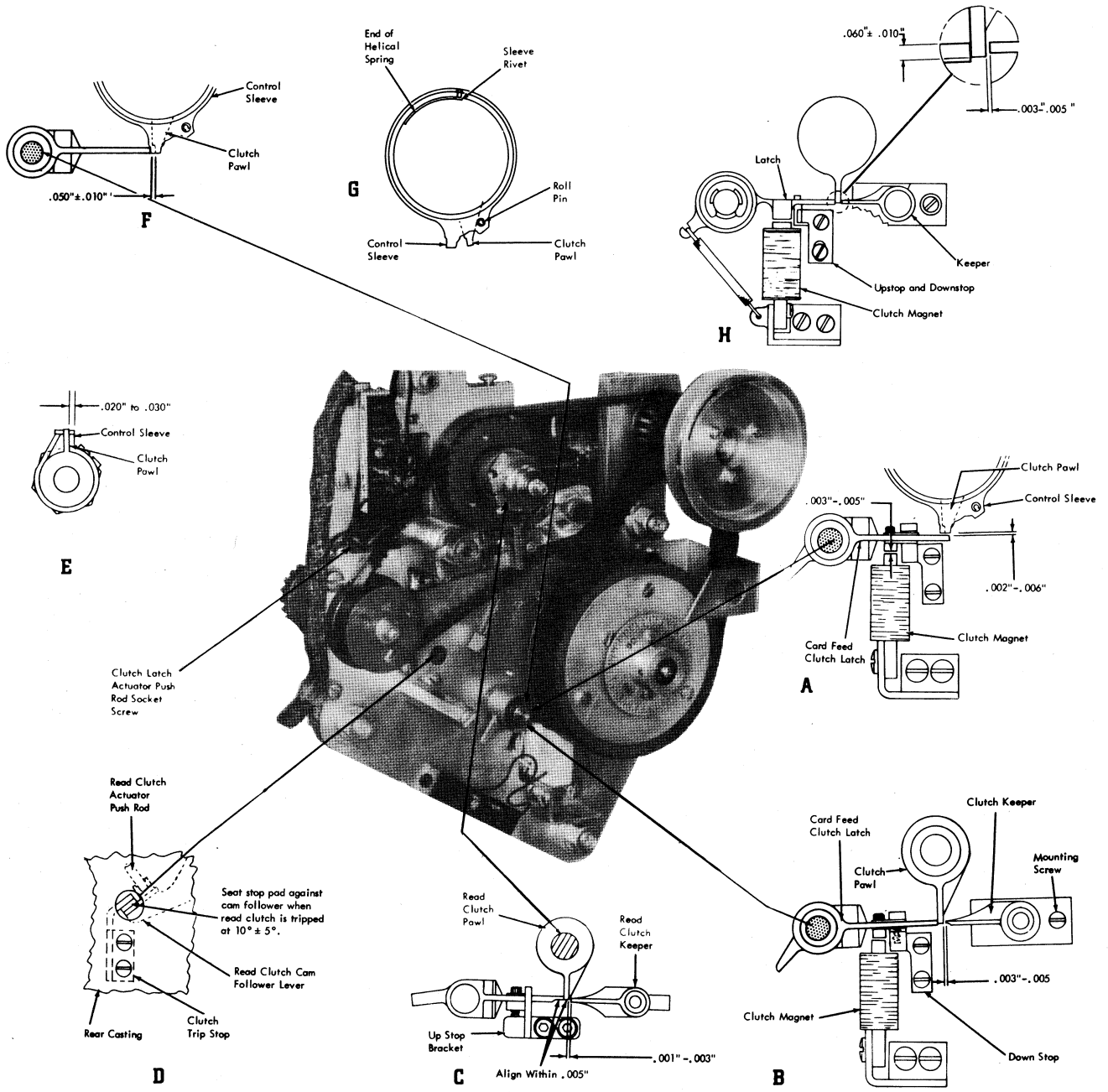


Figure 4-4. Card Feed Clutch and Read Clutch Adjustments

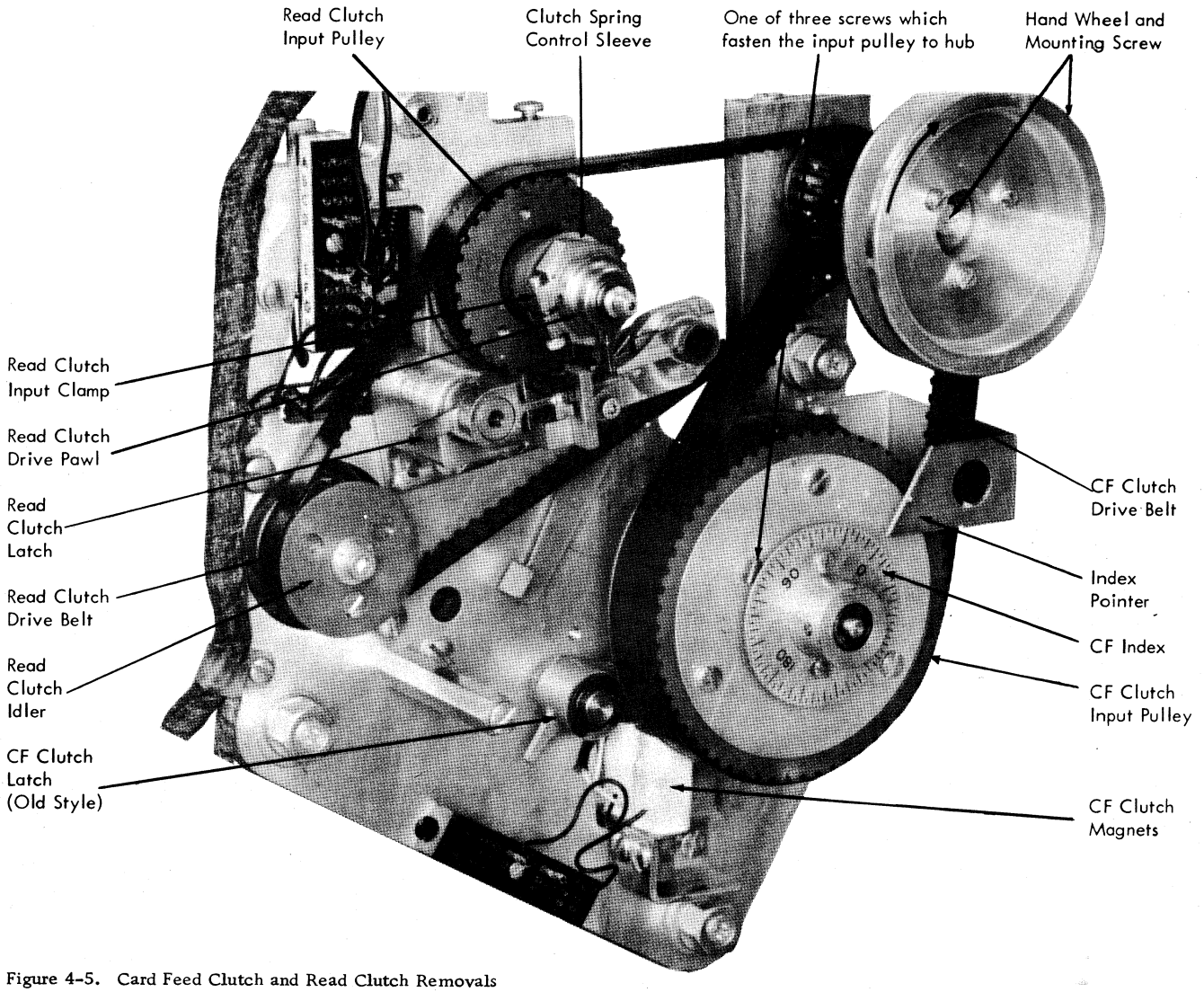


Figure 4-5. Card Feed Clutch and Read Clutch Removals

2. Slip control sleeve over helical spring and position sleeve so that roll pin follows and is in contact with clutch pawl (Figure 4-4, Insert G).
3. Use a small screwdriver to reach inside the control sleeve and push the end of the helical spring in a counterclockwise direction to unwind the spring until the spring end is caught behind the rivet inside of the sleeve.
4. Push control sleeve in to the limit of its travel, and rotate the sleeve counterclockwise to expand the spring. Hold sleeve in this position and slip clutch pulley hub onto shaft and into spring.
5. Replace index hub and its taper pin.
6. Check clutch adjustments.
7. Lubricate clutch with #23 grease (wipe off excess).
8. Replace pulley on its hub.
9. Replace clutch index pointer timing belt, and hand pulley.
10. Run machine for about five minutes, then check the .050" clearance between clutch pawl and clutch latch (Figure 4-4, Insert F). Readjust if necessary.
11. Replace clutch drive safety shield.

Read Clutch

Adjustment

1. With CF and read clutches latched, position read clutch up-stop bracket so end of the shock mounted section of the latch is aligned within .005" to bottom surface of clutch pawl (Figure 4-4, Insert C).
2. With CF and read clutches latched, adjust the read clutch keeper, by means of its

mounting nut, to obtain a .001" to .003" clearance between keeper and clutch pawl (Figure 4-4, Insert C).

3. With CF and read clutches latched, turn read clutch latch actuator push rod socket screw until read clutch latch just starts to move, then back off screw 1/2 turn. Trip CF clutch and turn CF clutch shaft by hand. Observe time on CF index when read clutch engages. It should be 10° ± 5°. If it is not, recheck adjustment No. 1. If adjustment No. 1 checks remake clutch push rod socket screw adjustment (Figure 4-4, Insert D).
4. Adjust the read clutch cam follower stop pad to seat against read clutch cam follower lever when read clutch is tripped at 10° ± 5°. The lever should clear the stop pad at 60° ± 5° (Figure 4-4, Insert D).
5. Trip feed clutch and crank until clutch pawl is in an upward position (Figure 4-4, Insert E).
6. Adjust clutch spring clamp so distance between edge of control sleeve and clutch pawl is .020" to .030" (Figure 4-4, Insert E).

Removal

1. Remove safety shield and read clutch drive belt. See Figure 4-5.
2. Trip read clutch.
3. Support end of read clutch shaft and drive out pin that fastens clutch pawl to read clutch pawl to read clutch shaft; remove clutch pawl.
4. Loosen spring clamp. Hold control sleeve, and rotate spring clamp to expand helical spring against inside diameter of sleeve. Maintain this relationship and slide the sleeve and, as a unit, the helical spring and spring clamp off read clutch shaft.

Replacement

1. Place formed end of helical spring into slot in spring clamp. Slide sleeve over spring. There is a step on the inside surface of the sleeve. Latch end of helical spring on step and, while holding the spring clamp, rotate sleeve to expand spring against inside diameter of sleeve. Maintain this relationship, and slide the sleeve and, as a unit, the spring and spring clamp into position on read clutch shaft.
2. Complete the replacement by performing Steps 1 and 3 of removal procedure in reverse order.
3. Check read clutch adjustments.
4. Lubricate clutch with #23 grease (wipe off excess).
5. Run machine for about five minutes, then check step 5 of read clutch adjustments.

Read Clutch Shaft Assembly

This assembly includes the following parts: read clutch pawl, read clutch input pulley, rear bearing, read emitter disk, read feed wheel, read nudge idler drive gear, front end bearing, and shaft. With the exception of the front end bearing, it is recommended that the entire shaft assembly be replaced if any of its parts need replacement.

Removal

1. Remove screw and washer holding read clutch shaft to front bearing.
2. Remove read cell unit or light input unit.
3. Remove read clutch latch and keeper unit.
4. Remove pressure roll spring.
5. Remove drive belt.
6. Remove screws from read nudge roll idler gear mounting bracket and remove idler gear.
7. Drive taper pins from feed wheel and pawl on read clutch shaft. (Support shaft while driving pin.)
8. Loosen read emitter disk clamping hub screws.
9. Slip shaft to the rear through gear and feed wheel emitter disk.
10. Replace in reverse order and check adjustments.

HOPPER

Hopper Removal

1. Remove electrical leads from hopper card lever switch.
2. Step 2 is for machines with belt driven pickerknives (see note following Drive Mechanism and Rear Casting Assembly). Remove pickerknife idler bracket from left hopper side frame. (See Figure 4-6.)
3. Step 3 is for machines with barrel cam pickerknife drive. Remove connecting link (Figure 4-7), loosen follower arm setscrew and slide cam follower free of cam.
4. Remove hopper feed roll drive belt.

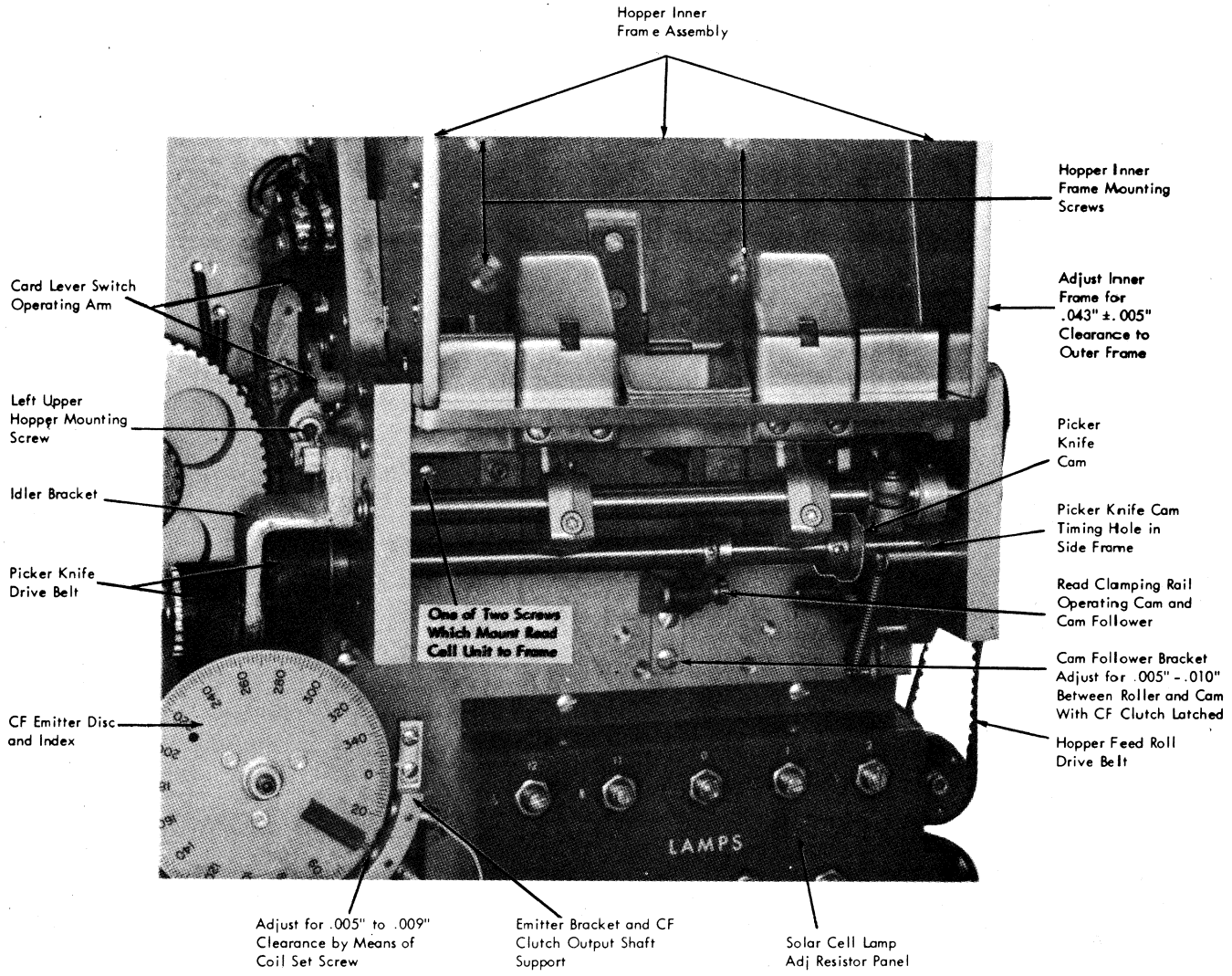


Figure 4-6. Hopper and Pickerknife Camshaft

5. Remove two screws, on left front of hopper, that hold left hopper side casting to main casting. It may be necessary to remove pulley on end of pickerknife camshaft to gain access to the lower of the two holding screws. Take care not to bend shaft when driving pulley taper pin.

6. Remove two screws, on right rear of hopper, that hold right hopper side casting to main casting. Remove hopper.

7. To replace, follow steps 1 through 6 in reverse order; then, time the pickerknife camshaft.

Pickerknife Camshaft Timing

Adjustment

This procedure applies only to machines with belt driven pickerknives.

1. Latch clutch. Loosen CF clutch index disk on front of CF clutch output shaft. Rotate pickerknife camshaft until pickerknife cam timing hole is aligned to timing hole in hopper side casting (Figure 4-6). Place timing pin through aligned holes.
2. Tighten CF index disk. Adjust CF index pointers on both sides of machine to read 0°.

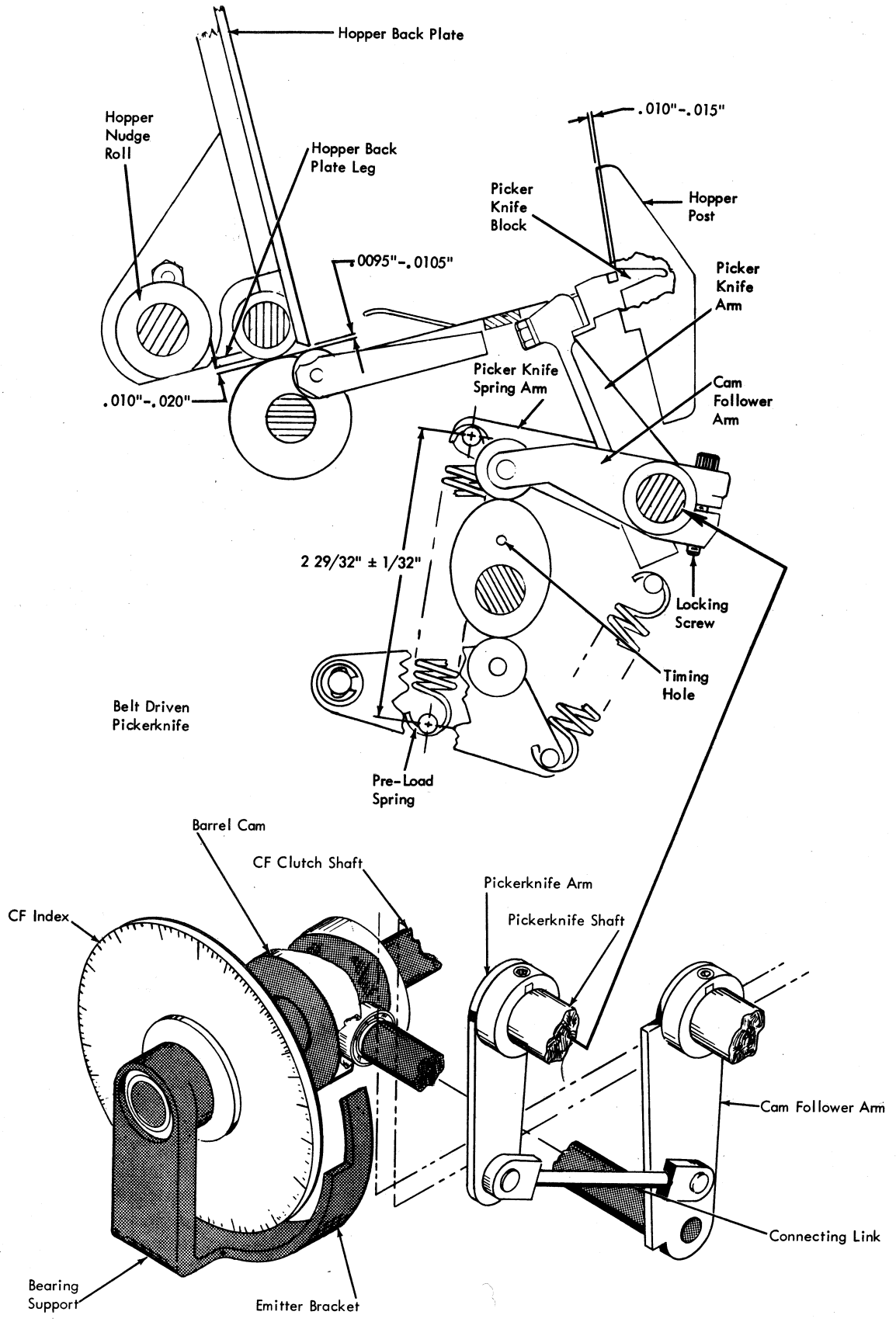


Figure 4-7. Pickerknife and Throat Adjustments

3. Remove timing pin and feed a card by hand. Leading edge of card should just touch read clamping rail at 260° ± 5°.

Barrel Cam Follower

Adjustment

Check that cam follower contacts both walls of barrel cam. To adjust:

1. Latch CF clutch.
2. Remove connecting link (Figure 4-7).
3. Loosen cam follower arm setscrew and slide cam follower arm along its shaft until cam follower contacts both walls of barrel cam.
4. Tighten cam follower arm setscrew.
5. Loosen pickerknife arm setscrew and align pickerknife arm with cam follower arm.
6. Tighten pickerknife arm setscrew.
7. Install connecting link.
8. Check pickerknife travel (see Feed Knives).

Hopper Card Lever

Adjustment

Position hopper card lever switch operating arm so a minimum travel of 1/16" is available at the switch when operated by a card. Position switch to operate at midpoint of this travel. The card lever must activate the switch when the last card leaves the hopper.

Throat Opening

Adjustment

1. Position throat roller so the high point is located under the tip of the throat knife. See Figure 4-7. This can be checked by: (1) loosening the throat knife, (2) lowering it on a .010" gage, and (3) positioning the throat roller so the gage is parallel to the card path.
2. Adjust throat opening for .0095" to .0105".

Hopper Inner Frame Assembly and Hopper Posts

Adjustments

1. Adjust hopper inner frame assembly, by means of its four mounting screws, to obtain the following:
   a. .043" ± .005" lateral spacing between hopper inner frame and outer frame. See Figure 4-6.
   b. .010" to .020" clearance between top of feed rolls and bottom of hopper back plate leg. See Figure 4-7.
2. The rear card posts are positioned to provide a clearance of .010" to .015" between the guide posts and a stack of cards in the hopper.

Feed Knives

Adjustment

This procedure is for machines with belt driven pickerknives.

1. Place feed knife cam follower on high dwell (Figure 4-7). Insert timing pin.
2. Check for 2 29/32" ± 1/32" between centers of preload spring studs. If this distance is incorrect, perform the following:
   a. Disconnect preload spring.
   b. Loosen lock screw on cam follower arm.
   c. Rotate pickerknife spring arm to obtain 2 29/32" ± 1/32" between centers of spring studs.
   d. Press cam follower to high dwell of cam. Tighten lock screw on cam follower arm.
   e. Install preload spring.
   d. Press cam follower to high dwell of cam. Tighten lock screw on cam follower arm.
   e. Install pre-load spring.
3. Adjust position of pickerknife operating arms so each feed knife is .010" to .015" behind the inner face of the rear guide posts, and in line with each other (Figure 4-7). Remove timing pin. Each pickerknife block is fixed on its arm. Two Carboloy* pieces, ground to specification for proper knife projection, are inserted in the block surface to resist wear. Knife projection is not adjustable; therefore, the pickerknife block must be replaced when the inserts become worn.

Adjustment

This procedure is for machines with barrel cam driven pickerknives.

1. Latch card feed clutch.

*Tradename of Carboloy Department of General Electric Co.

2. Adjust position of pickerknife operating arms so each feed knife is .010" to .015" behind the inner face of the rear guide posts, and in line with each other (Figure 4-7). Two Carbaloy* pieces, ground to specification for proper knife projection, are inserted in the block surface, to resist wear. Knife projection is not adjustable; therefore, the pickerknife block must be replaced when the inserts become worn.

PRE-READ STATION

Hopper Nudge Roll Shoe Bracket

Adjustment

Adjust hopper nudge roll shoe brackets for .001" to .003" gap between the shoes and the hopper nudge roll (Figure 4-8). Check for a minimum of 2.5 pound pull-out force from each roll.

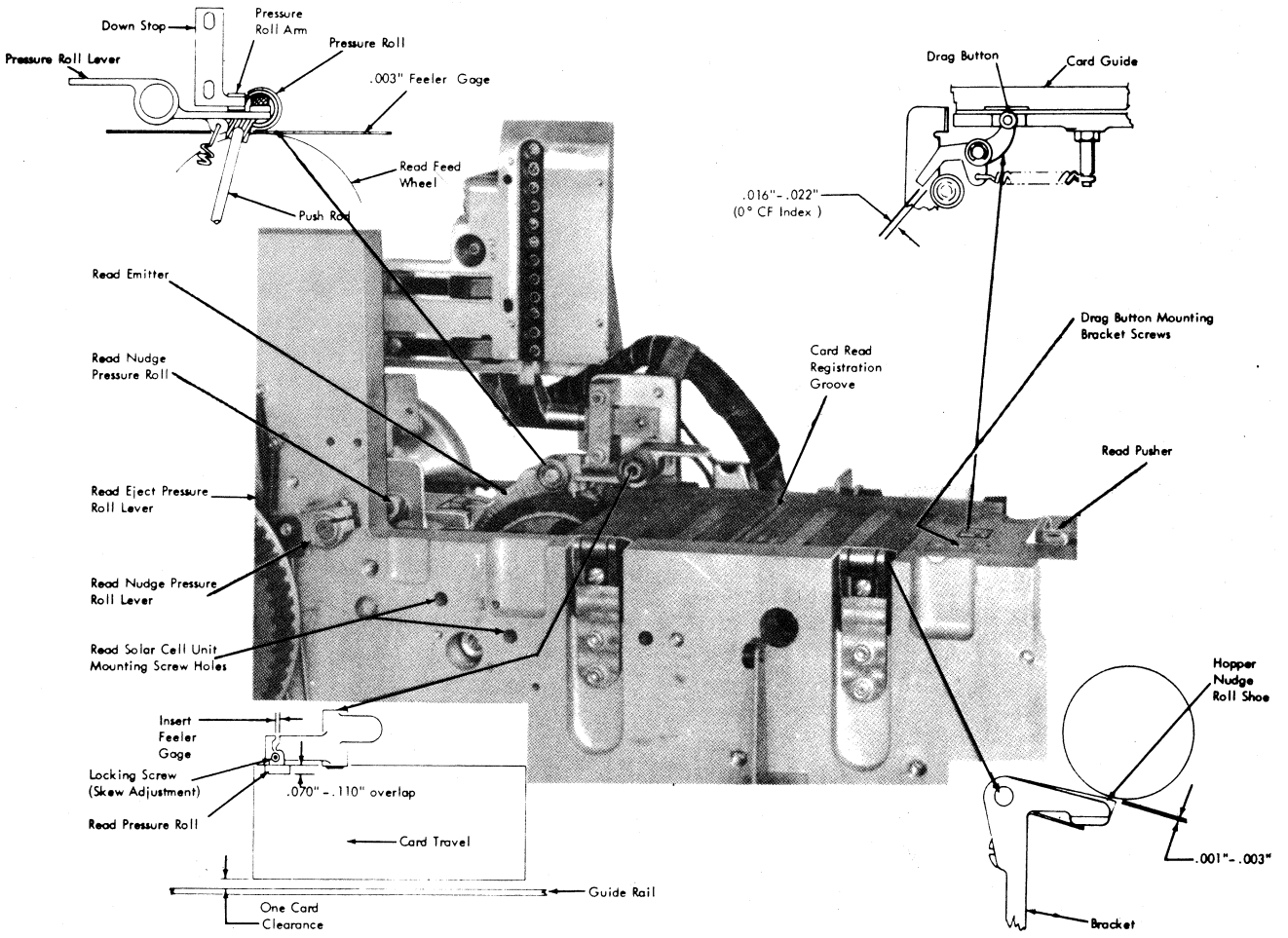


Figure 4-8. Preread and Read Station Adjustments

Removal

1. Remove hopper back plate.
2. Remove hopper nudge roll gear guard.
3. Remove hopper nudge roll bearing retaining screw.
4. Slide hopper nudge roll to the right (it is not necessary to remove the roll).
5. Hopper nudge roll shoes can now be removed through top.

Read Card Cover

Adjustment

Adjust the magnet latch and the sliding pivot for .018" to .038" (four IBM cards) between card bed and cover.

Read Clamping Rail

Adjustment (Old Style)

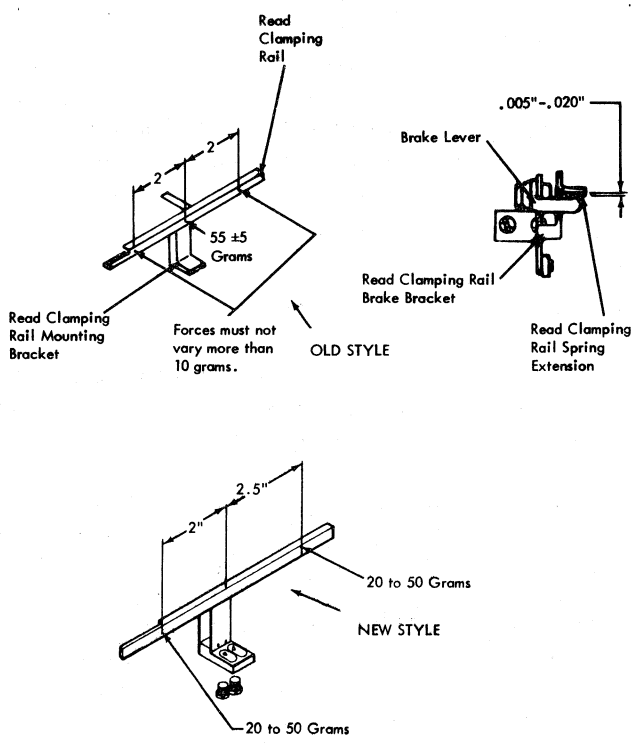
The old style clamping rail can be identified by the presence of the clamping brake (Figure 4-9).

1. With clamping brake released, position read clamping rail mounting bracket by means of its mounting screws for the following: (1) 55 grams ± 5 grams of force, measured where the spring is fastened to the clamping rail, is required to just move the rail away from card bed. (2) Rail tension must be even within 10 grams on both sides of rail as measured 2" from center of bracket (Figure 4-9). The tension at these two points will be less than 55 grams.
2. Adjust read clamping rail brake bracket for .005" to .020" clearance between brake pad and read clamping rail spring extension. To check this adjustment, pivot brake lever downward so it does not contact clamping rail spring extension.
3. With card feed clutch latched, adjust clamping rail cam follower bracket for .005" to .010" clearance between cam follower and cam (Figure 4-6).
4. Cycle machine by hand. With CF clutch engaged, the read clamping rail should be free to move between 230° ± 10° and 313° ± 10°.

Adjustment (New Style)

The new style clamping rail does not have a clamping brake.

Position clamping rail within its mounting screws so that a force of 20 to 50 grams is required to move the rail up to .010" from a card properly positioned in the pre-read station. Force measurements are to be taken at points indicated (Figure 4-9).



• Figure 4-9. Read Clamping Rail Adjustments

Read Pusher

Adjustment

Refer to Figure 4-8 for pusher location.

1. Punch digits 12 through 9 in column 40 of a card. Check punch registration.
2. Latch and detent CF clutch. Place card in preread station under read card cover. Raise read feed pressure roll to get card into position.
3. Close and latch read card cover.
4. While holding read feed pressure roll in raised position to free card, adjust the read pusher eccentric pivot stud by rotating its mounting plate. Rotate the stud so the holes in column 40 are over the red groove and show full red. Trailing edge of card must be against pusher while this adjustment is being made.
5. Check (1) read emitter-to-data pulse relationship if this adjustment has been changed (see base machine maintenance manual) and (2) read nudge pressure roll timing to ensure release of the card (285° to 290°) before punch pusher makes contact with the card.

Read Pusher Drag Button

Adjustment

At 0° on the CF index, check that drag button contacts pad on under surface of card guide, and the drag button arm has .016" to .022" clearance to the roller on the read pusher arm (Figure 4-8). Drag button must not contact sides of clearance hole. To adjust, position drag button mounting bracket.

SOLAR CELL READ STATION

To obtain optimum operation of the read station, the read station adjustments must be performed, in sequence, as presented in this section. If, for example, an adjustment appearing in the middle of this Read Station section is performed, the remaining adjustments in the section must also be performed; excluding Card Hold Down Springs and Punch Card Lever Stop.

Read Pressure Roll

Adjustment

1. With the CF clutch latched and a .003" feeler gage between pressure roll and feed wheel, adjust down stop to be in contact with pressure roll arm (Figure 4-8). There should be a .001" to .002" clearance with the feeler gage removed. The pressure roll must not contact the feed wheel at any point.
2. With CF clutch latched and detented, place card between pressure roll and feed wheel.
3. Turn read pressure roll push rod socket screw until read pressure roll just starts to lift, then back off socket screw 1/2 turn. (Socket screw is at lower end of push rod.)
4. Make sure read pressure roll grips card between 345° ± 5° and 230° ± 5°.
5. With pressure roll all the way up (between 255° and 320°), check for a minimum clearance of .030" between feed wheel and pressure roll.
6. To provide .070" to .110" overlap of pressure roll on card, loosen pressure roll pivot stud and insert the proper number of shims (P/N 627576). See Figure 4-8.

Skew Adjustment

On some machines, the pressure roll locking screw (Figure 4-8) has been factory sealed. Skew adjustment on these machines should not be necessary in the field.

Hold the read clamping rail away from the card while making following adjustments:

1. With card feed clutch latched, place a card under the read pressure roll so card is one-card thickness away from the guide rail.
2. Manually trip CF clutch. Feed card by rotating hand-wheel.
3. Adjust read pressure roll, by means of its locking screw, so the card will move against the guide rail within 4" to 6" of card travel. A feeler gage can be inserted, as indicated in Figure 4-8 to facilitate adjustment.

Read Cell Unit

Adjustment

Position cell unit over its locating pin so top of read cell lens is parallel to the card line and below periphery of read feed wheel by .002" to .006" (Figure 4-10).

A read cell stop is provided as a reference in case of future cell unit removal. With the solar cell unit adjusted, set the read cell stop against the surfaces of the cell unit as shown in Figure 4-10.

The position of the read cell unit affects the adjustment of the read lamp unit. This position also affects read cell duration and read emitter timing. If adjustment of read cell unit is changed, the read lamp unit adjustment, read cell duration, and read emitter timing should be checked and readjusted.

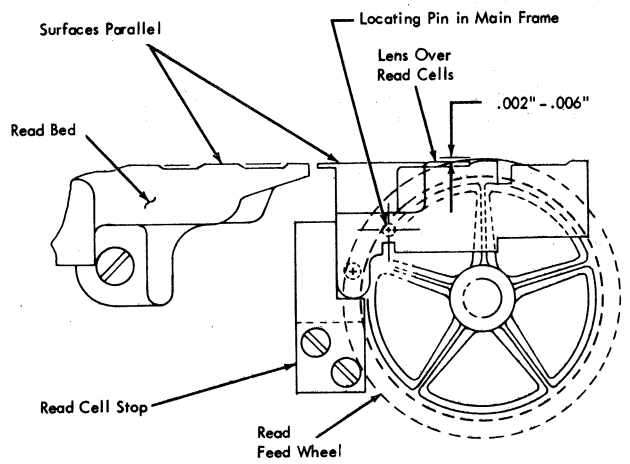


Figure 4-10. Read Cell Unit Adjustment

Removal

The read cell unit is fastened to the main machine frame by two mounting screws. These screws are located under the left end of the card hopper bed (Figure 4-11) and are accessible from the front of the machine. To remove read cell unit, loosen the mounting screws. When replacing the cell unit, be certain it is firmly against the stop (Figure 4-10) before tightening mounting screws.

Read Cell

Removal

1. Remove card read solar cell unit. See Figure 4-11.
2. Remove read cell cover. This cover is held by two screws accessible from the bottom of the cell unit.
3. Unsolder ends of cell leads on terminal card.
4. Soften (use IBM cleaning fluid) the cement which holds cell in read cell unit hole. Remove cell by pulling on cell leads. Do not push cell out from opposite end; it will dislodge the cell dust seal. Save cell lead spaghetti for use when new cell is installed.

Replacement

1. Insert cell in cell unit hole. Black (light sensitive) surface must be up and parallel to card path.
2. Cement base of cell to cell unit. Use Dupont Duco* Cement.
3. Install spaghetti on cell leads and solder leads to terminals. Observe polarity.
4. Check and adjust, if necessary, duration of replaced cell pulse.

Read Lamp Unit

Adjustment

Before making this adjustment, the read cell unit must be properly adjusted. To align card read lamp unit to read cell unit:

1. Latch lamp unit in closed position.
2. Check for .018" to .020" clearance between lamp base glass and solar cell base glass. To adjust:
   a. Loosen lamp unit hinge and latch.
   b. Place IBM card strips between the ends of the lamp and the cell unit to obtain a .018" to .022" clearance.
   c. Insert timing pins through alignment holes in lamp unit and cell unit. See Figure 4-11.
   d. If the timing pins are tight, add or remove .002" shims between hinge and machine frame, or reposition hinge and latch. See Figure 4-11.
   e. Remove IBM card strips.

   NOTE: Read lamp unit position affects the read cell duration and read emitter timing.

Read Lamp, Without Adjustable Clip

Replacement

1. Loosen lamp clamping screw and pull lamp straight out.
2. Install new lamp. Filament must be parallel to card path and end of lamp must be against lamp lens.
3. Tighten clamping screw.
4. Check duration of pulse from read cell operated by replaced lamp.
5. If the data pulse does not occur within 75 usec of all other data pulses, turn lamp 180°. If still out of limits, replace lamp.
6. If punch card lever lamp is replaced, check voltage at lamp and adjust if necessary.

*Registered trade mark of E. I. duPont de Nemours and Company

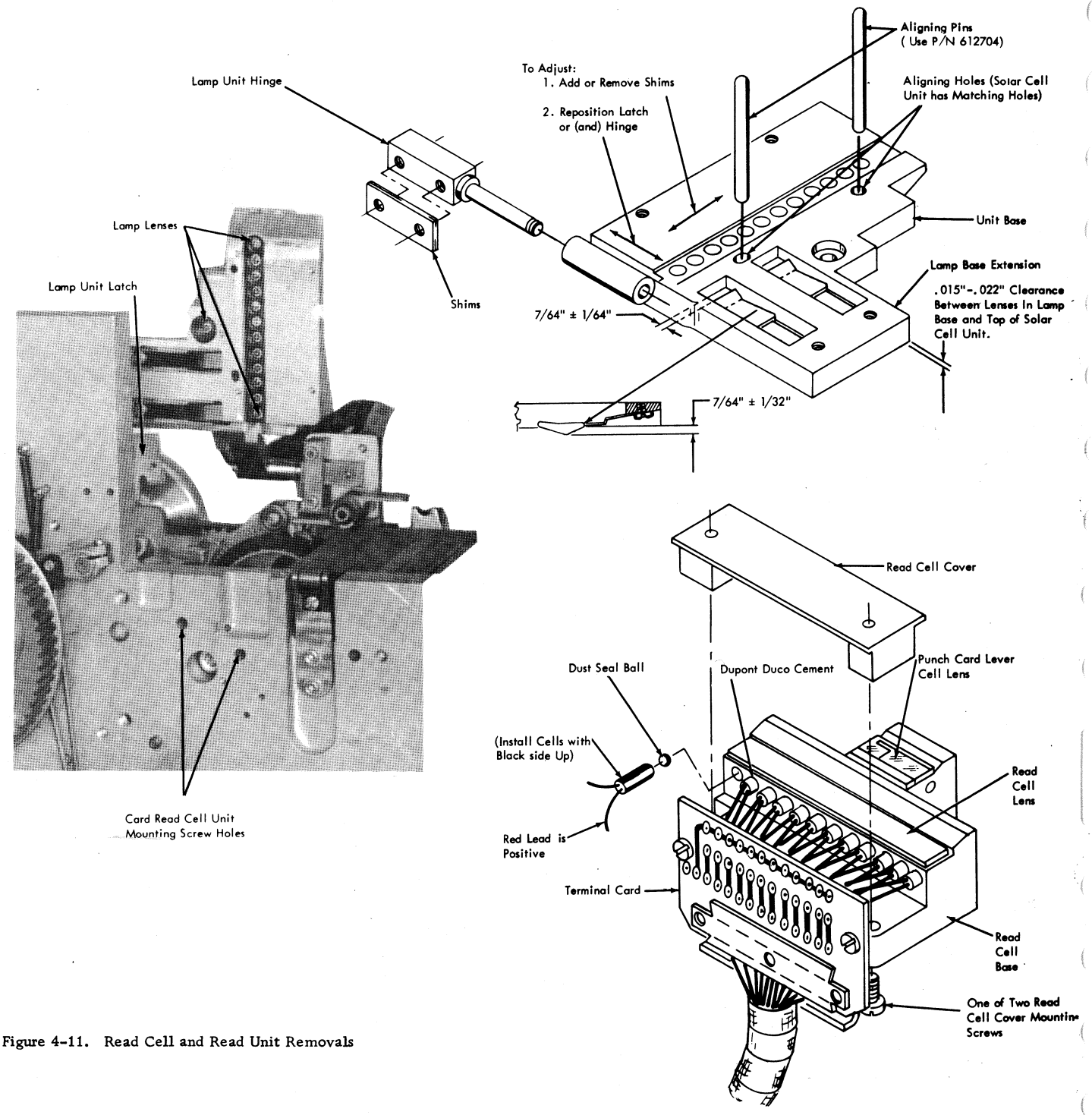


Figure 4-11. Read Cell and Read Unit Removals

Read Lamp, With Adjustable Clip

Replacement

Replace both lamp and clip. Do not use old clip; it may not properly clamp the new lamp base.

1. Remove lock screw on lamp-holding clip.
2. Remove lamp and clip (Figure 4-12).
3. Check parallelism of filament to card path.
4. Install new lamp and holding clip. Lamp lens must be properly seated in base casting of lamp assembly.
5. Center light beam on target in lamp positioning gage (P/N 627700) (Figure 4-13). (The lamp-holding clip can be moved within its slot for this adjustment.) Tighten lock screw on lamp-holding clip.
6. Check duration and timing of all data pulses. See base machine maintenance manual.

NOTE: If punch card lever is replaced, check voltage at lamp and adjust if necessary.

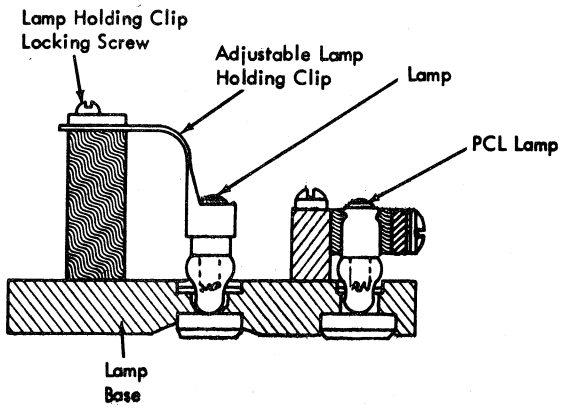


Figure 4-12. Read Station

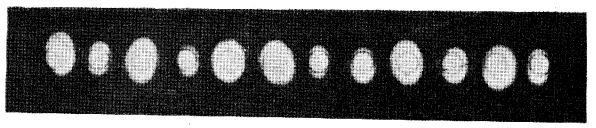


Figure 4-13. Typical Light Patterns

Read Cell Pulse Duration

See base machine maintenance manual.

Read and Punch Card Lever Lamp Adjustments

See base machine maintenance manual.

Read Emitter Lamp

Replacement

1. Remove emitter assembly.
2. Remove old lamp and insert new lamp.
3. Maintain .080" ± .010" between tip of lamp and cell mounting bracket (Figure 4-14).

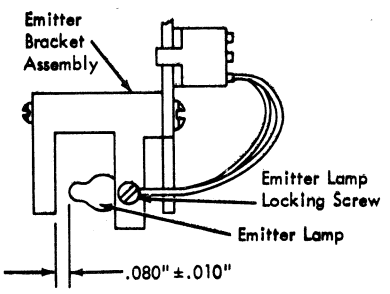


Figure 4-14. Read Emitter Lamp Adjustment

Read Emitter Timing

See base machine maintenance manual.

Card Hold-Down Springs

Adjustment

Adjust the springs so their ends will be .105 ± .010" from the end of the lamp base opening (Figure 4-11). Tilt lamp unit open and check for free spring position shown (Figure 4-11), replace or form as required. Spring must move freely within opening.

FIBER OPTIC READ STATION

The fiber optic read station consists of a single light source that transmits light through fiber glass bundles to the read station, the punch card lever, and the read emitter.

Adjustments to the fiber optic read station differ from read stations using individual lamps and solar cells as follows:

1. There is one light source adjustment instead of fourteen.
2. The relationship between the fiber bundles for each row at the read station is fixed.
3. Light enters from the bottom of the read station and is sensed by phototransistors above the read station.
4. The read emitter duration is controlled by the common light source and does not have an individual adjustment.

The light source is mounted on the right end of the machine frame. An adjusting potentiometer and an associated hi-lo range switch are mounted on the power supply and are accessible from the rear of the machine.

CAUTION: To prevent breakage, the fiber optic bundles must not be bent in a radius smaller than 2 1/2".

Every six months the following parts should be cleaned with a dry rag. Solvent should not be used.

1. Read emitter phototransistor, read emitter disk, and fiber bundle end.
2. Read head and light input unit.

The light source voltage adjustment should be checked every six months.

Read Pressure Roll

Adjustment

1. With the CF clutch latched and a .003" feeler gage between pressure roll and feed wheel, adjust down stop to be in contact with pressure roll arm (Figure 4-8). There should be a .001" to .002" clearance with the feeler gage removed. The pressure roll must not contact the feed wheel at any point.
2. With CF clutch latched and detented, place card between pressure roll and feed wheel.
3. Turn read pressure roll push rod socket screw until read pressure roll just starts to lift, then back off socket screw 1/2 turn. (Socket screw is at lower end of push rod.)
4. Make sure read pressure roll grips card between 345° ± 5° and 230° ± 5°.
5. With pressure roll all the way up (between 255° and 320°), check for a minimum clearance of .030" between feed wheel and pressure roll.
6. To provide .070" to .110" overlap of pressure roll on card, loosen pressure roll pivot stud and insert the proper number of shims (P/N 627576). See Figure 4-8.

Skew Adjustment

The pressure roll locking screw (Figure 4-8) has been factory sealed on some machines. Field adjustment of skew should not be necessary on these machines.

Hold the read clamping rail away from the card while making following adjustments:

1. With card feed clutch latched, place a card under the read pressure roll so card is one-card thickness away from the guide rail.
2. Manually trip CF clutch. Feed card by rotating hand-wheel.
3. Adjust read pressure roll, by means of its locking screw, so the card will move against the guide rail within 4" to 6" of card travel. A feeler gage can be inserted, as indicated in Figure 4-8 to facilitate adjustment.

Light Input Unit

Adjustment

Position the light input unit over its locating pin so the card bed surface is parallel to the card line and below the periphery of the read feed wheel by .002" to .006" (Figure 4-15).

A light input stop provides a reference in case of future disassembly. With the light input unit in proper position, set the light input stop against the light input unit (Figure 4-15).

If the position of the light input unit is changed, the adjustments of the read head unit, data pulse duration, and read emitter timing must be checked. See base machine maintenance manual.

Removal

CAUTION: To prevent breakage, the fiber optic bundles must not be bent in a radius smaller than 2 1/2".

The light input assembly is fastened to the machine frame by two mounting screws under the left end of the card hopper bed. The screws are accessible from the front of the machine. Because the light input unit is made of nonmetallic material, the threads are easily stripped if the mounting screws are overtightened. When replacing the light input unit, be

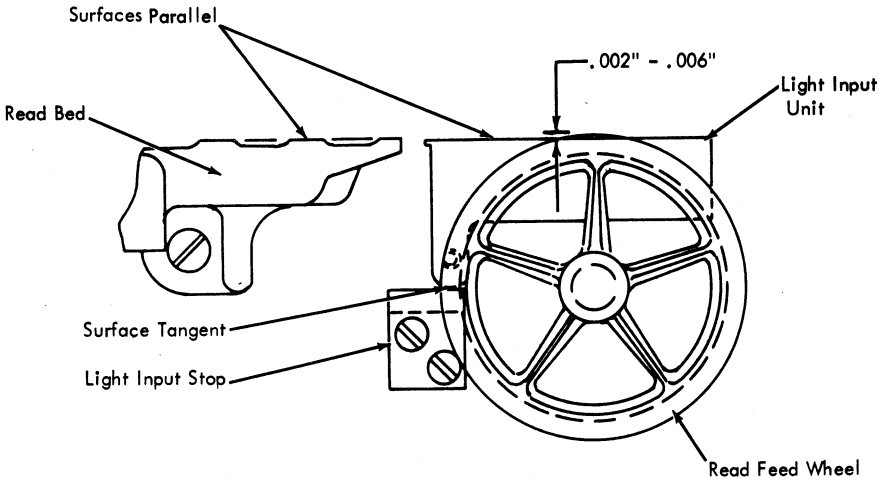


Figure 4-15. Light Input Unit Adjustment

certain it is firmly against the stop before tightening the mounting screws.

Read Head Unit

The light input unit must be in proper adjustment before making the following adjustments. Either of two types of fiber optic read head units may be encountered in serial readers. One type is mounted to the outboard casting (rear mounted), the other is mounted to the backbone (front mounted).

Adjustment (Rear Mounted)

This adjustment should result in a .017" to .025" clearance between the read head and the light input unit.

1. Latch read head unit in closed position.
2. Loosen head unit hinge and latch.
3. Place three card strips between the head unit and the light input unit to obtain .017" to .025" clearance.
4. Insert timing pins through alignment holes in head unit and light input unit (Figure 4-16).
5. If the timing pins are tight, add or remove shims between hinge and machine frame; or reposition hinge and latch.

Adjustment (Front Mounted)

This adjustment should result in .017" to .025" clearance between the light input unit and the read head unit.

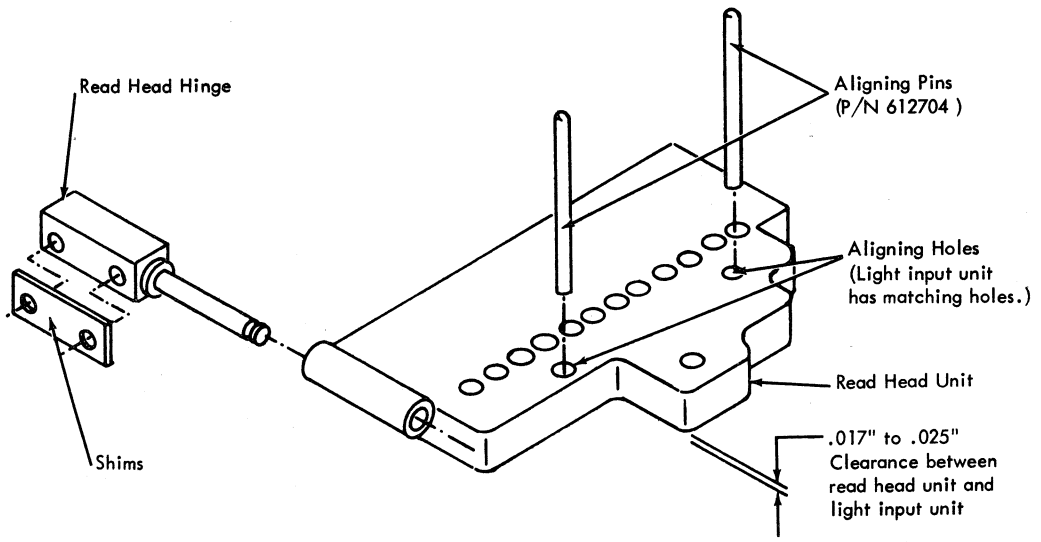
1. Loosen four mounting bracket holding screws (Figure 4-17).
2. Loosen three shield mounting screws (Figure 4-17).
3. Loosen stop and latch spring mounting screws (Figure 4-17).
4. Place three IBM cards between the read head and light input unit (allow cut-out in cards for timing pins). Be sure three-card thickness is maintained at all points between the two surfaces.
5. Insert the two timing pins to align the read head assembly to the light input unit.
6. Exert a firm finger pressure on the top surface of the shield (to ensure that upper head assembly is compressing the three-card spacer) and position read head unit so that aligning pins are loose.
7. Tighten mounting bracket holding screws.
8. Alternately snug up, then tighten, shield mounting screws. Recheck aligning pins for freeness.
9. Continue to exert finger pressure against read head shield and position stop and locator up against shield latching surface, making full contact; tighten stop mounting screws.
10. Position latch spring to hold read head firmly in place and tighten mounting screws.

NOTE: Read head unit position affects the data pulse turn on time and read emitter timing. See base machine maintenance manual.

Fiber Bundles and Light Source

Adjustment

CAUTION: Do not permit cards used for adjustments to touch the light source lamp. Contact



● Figure 4-16. Read Head Unit Adjustment

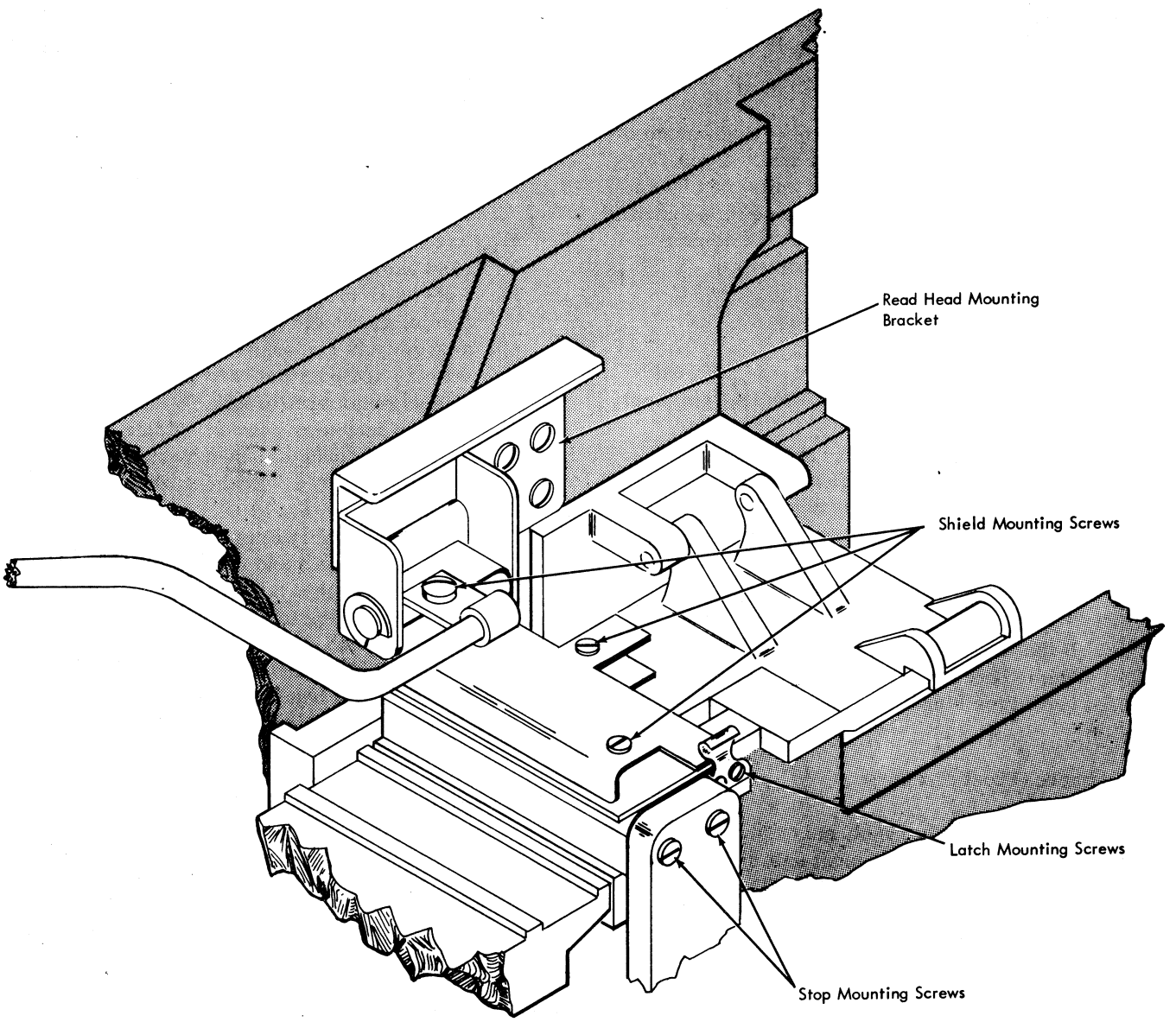


Figure 4-17. Front Mounted Read Head

with the lamp lens will darken the glass. Do not overtighten bundle setscrews. Excessive tightening of these screws may damage the bundle ferrule.

1. Center the 13-position bundle in projected light spot (Figure 4-18). The edge of a card can be placed against the outer circumference of the bundle to help determine that the light spot completely encompasses the bundle surface. Do not touch lamp with card.
   a. Loosen setscrews holding both bundles in place.
   b. Turn eccentric adjustments until 13-position bundle is centered in light spot.
2. Adjust 13-position bundle for clearance of .130" ± .010" from lamp lens, and tighten setscrew. Do not overtighten.
3. The emitter bundle position is adjusted to provide correct emitter output (see base machine maintenance manual). The emitter bundle should be no closer to the light source than the 13-position bundle and must be firmly held by setscrew.

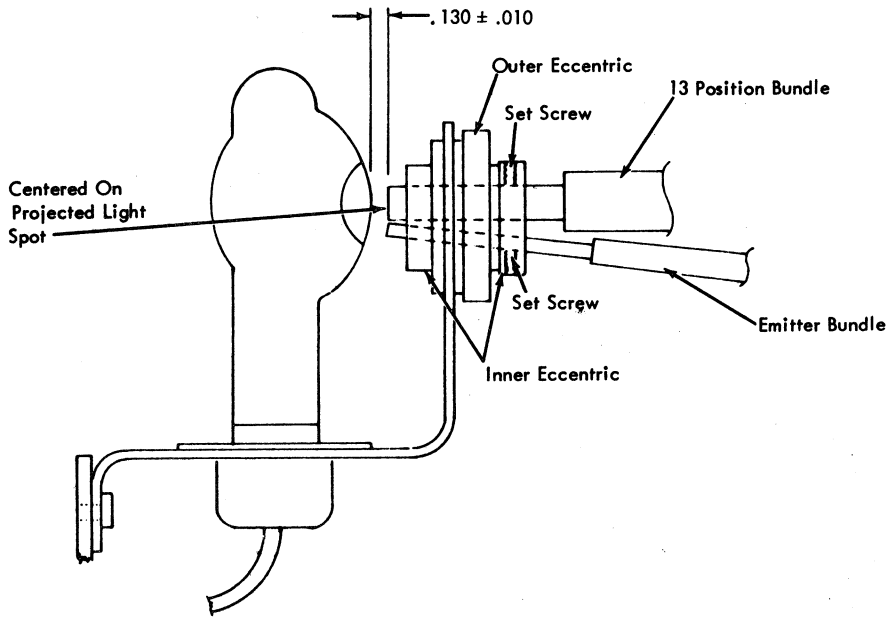


Figure 4-18. Fiber Optic Bundles and Light Source Adjustment

Read Emitter Bundle and Phototransistor

Adjustment

CAUTION: Emitter bundle must be positioned in emitter housing so bundle does not rub against read feed wheel.

1. Position bundle so bundle surface is recessed in emitter housing .040" ± .020" (Figure 4-19). The surface of the bundle must not protrude against the emitter disk.
2. Position phototransistor so it extends .080" ± .010" beyond emitter housing on the side away from the emitter.

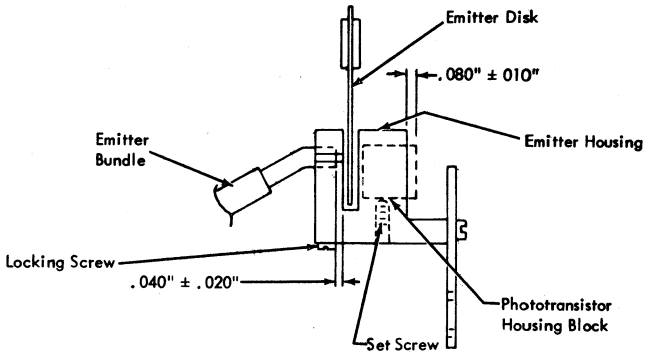


Figure 4-19. Emitter Bundle and Phototransistor Adjustment

Lamp Voltage Adjustment

See base machine maintenance manual.

Read Emitter Timing

See base machine maintenance manual.

PUNCH STATION

Read Nudge Roll

Removal

1. Remove nudge roll idler assembly.
2. Remove nudge roll mounting screw (access at front of machine) by loosening screw while holding read nudge roll bearing screw (access at rear of machine). If screw at front of machine is not slotted, it might be necessary to remove idler pickerknife pulley bracket.
3. Remove nudge roll. If read nudge roll does not come out, disconnect spring to punch pusher, loosen screw in pre-punch card bed (located between two dowels) and slide card bed out 1/8". Replace in reverse order; readjust nudge roll idler assembly and re-time pickerknife camshaft if idler pulley bracket was removed.

Read Nudge Roll Backlash

There must be a minimum backlash of the read nudge roll while the read feed wheel is held stationary. Adjust the read nudge roll idler assembly to obtain

this condition (Figure 4-20). Be sure the read nudge roll idler assembly does not bind the read feed shaft assembly or read nudge roll.

Read Nudge Pressure Roll

Adjustment

Refer to Figure 4-8 for location of pressure roll.

1. With read nudge pressure roll cam on high dwell, adjust read nudge pressure roll lever clamping hub for .015" to .025" clearance between pressure roll and feed wheel.
2. Feed a card by hand and adjust read nudge pressure roll actuator, cam-clamped hub so pressure roll releases card at 285° to 290°. Card should be gripped at approximately 200°. Card must be released before being contacted by punch pusher.

Read Eject Pressure Roll

Adjustment

1. Engage CF clutch and rotate machine until read eject pressure roll cam follower is on high dwell.
2. Adjust pressure roll lever clamped hub for .015" to .028" clearance between read eject pressure roll and read eject feed wheel.
3. Read eject roll should grip card between 20° + 5° - 0°, and 103° ± 5°.

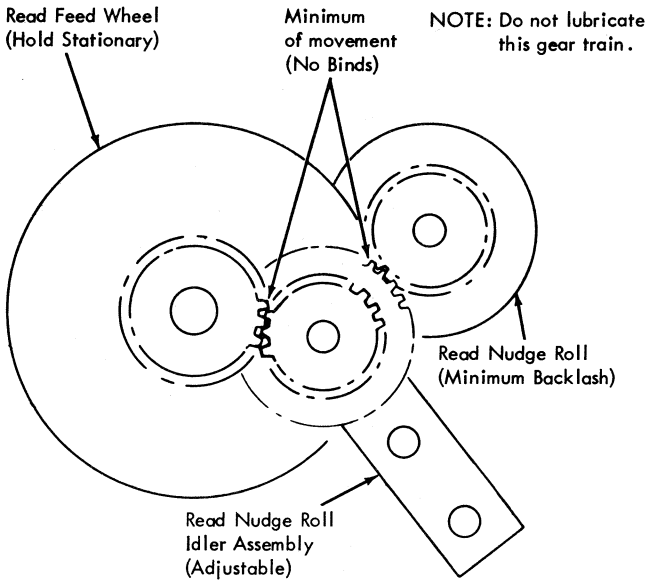


Figure 4-20. Read Nudge Roll Backlash

Punch Pusher

Adjustment

1. With the punch pusher in the center of its travel (290° ± 5°), adjust pusher holding screw so top of pusher is .035" to .045" above adjacent card bed surface (Figure 4-21, Insert A).
2. For initial adjustment of punch pusher pivot eccentric stud, set machine between 340° and 342° with CF clutch engaged.

   For machines with solar cell read station, adjust punch pusher eccentric to position trailing edge of card within .005" to .015" of edge of punch card lever solar cell slot (Figure 4-21, Insert B).

   For machines with fiber optic read station, adjust punch pusher eccentric to position trailing edge of card to within .070" to .080" of edge of punch card lever fiber bundle slot (Figure 4-21, Insert C).

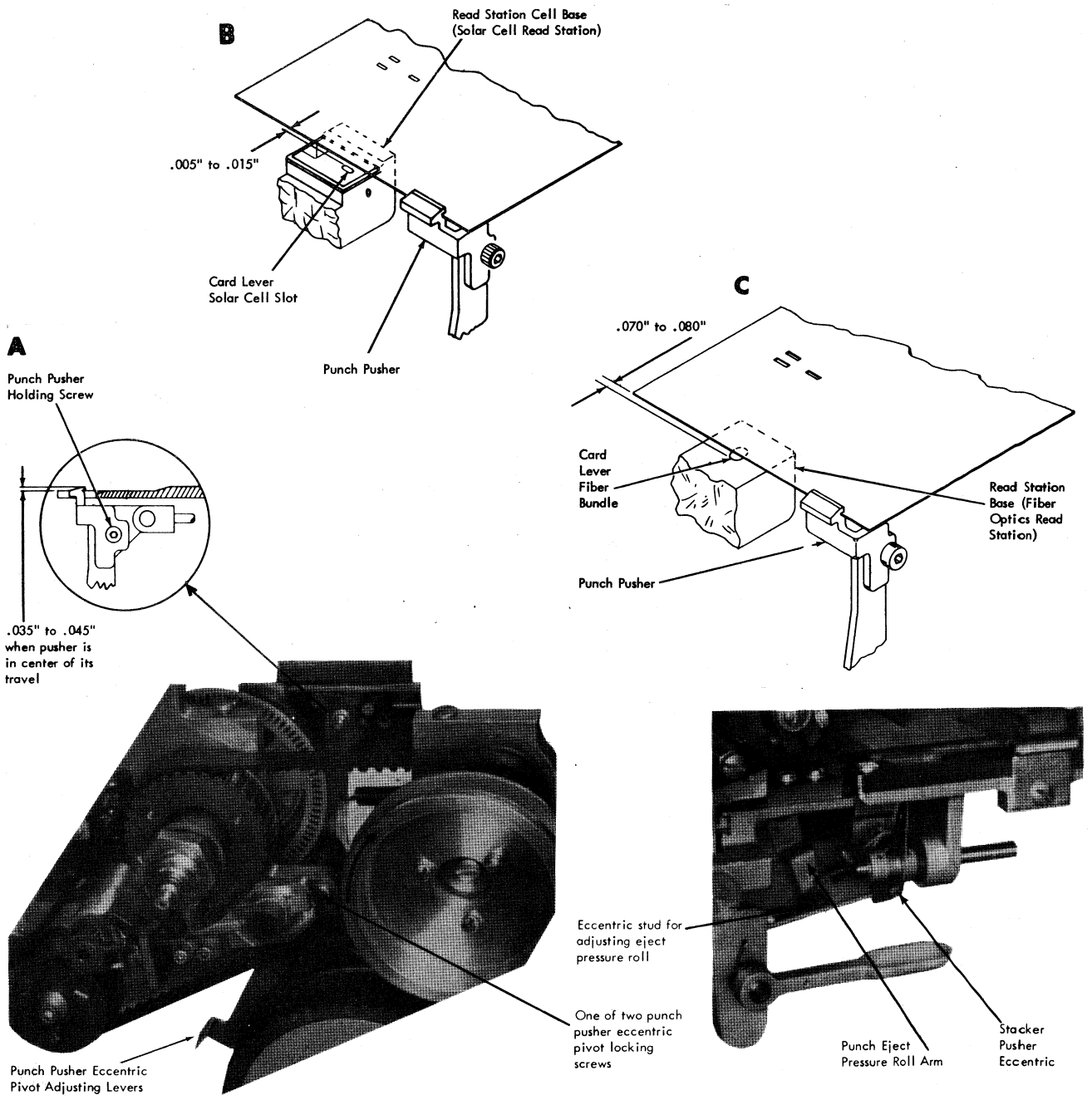
CAUTION: After adjusting pivot stud, and before running machine under power, slowly cycle machine by hand to be sure trailing edge of pusher does not jam against read cell mounting block.

3. Check punch unit jack screw adjustment. See Punch Unit, Punch Jack Screws (early production serial reader punches do not have jack screws).
4. Adjust punch pusher pivot eccentric stud until punched cards are in proper horizontal registration for card column 1 only. (The eccentric pivot stud is locked by two screws and has an adjusting lever.)
5. Check punch drag button and pattern adjustments.

Punch Drag Button and Patter

Adjustment

1. Trip CF clutch and rotate hand pulley until index reads 280° to 285°.
2. Slide card strip between drag button and pad on under surface of card guide.
3. Position drag button adjusting plate until step 2 provides a slight but perceptible drag on the card strip. Drag button must not contact sides of clearance hole (Figure 4-22).
4. Rotate hand pulley until index reads between 60° and 240°.
5. Position card patter within its bracket for 3.275" (one IBM card width plus two to three IBM card thicknesses) between patter surface and card guide rail.



● Figure 4-21. Punch Station Transport Adjustments

Pre-Punch Bed Card Cover

Adjustment

1. Adjust the pre-punch bed card cover, by means of its mounting bracket and magnetic latch, for .018" to .023" between card bed and drag button plate; clearance for remainder of cover may be .018" to .037".

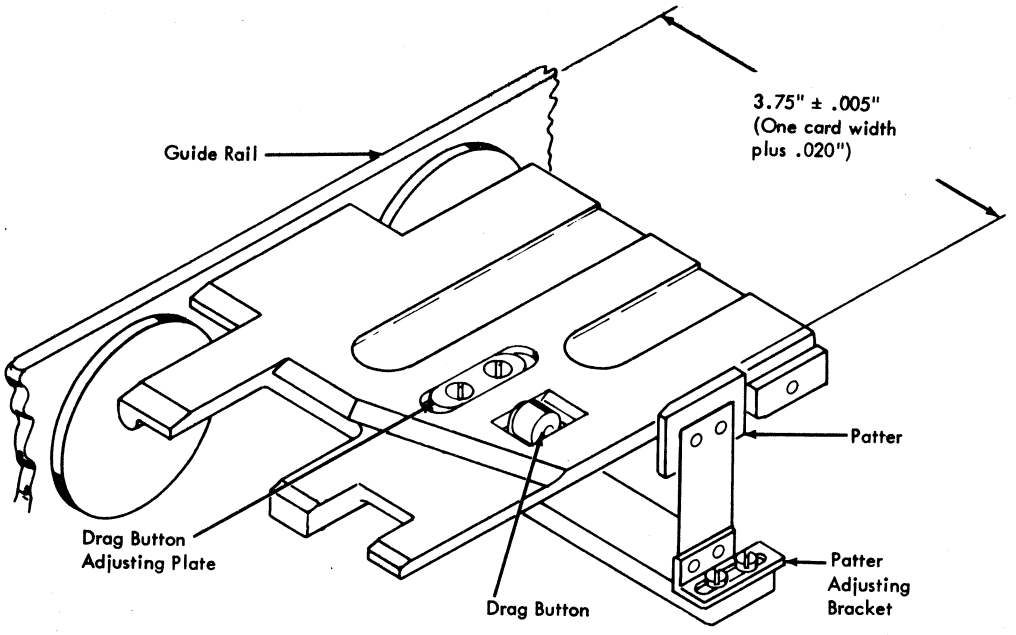


Figure 4-22. Punch Drag Button and Card Patter Adjustment

2. Steps 2 and 3 are for machines with fiber optic read stations. Adjust the two card hold-down springs so their ends will be a minimum of 5/64" from the end of the read head unit (Figure 4-23).
3. Check tension of card hold-down spring. Pads on springs should extend 7/64" ± 1/32" below the bottom of the pre-punch bed cover.

Card Guide Rail

Removal

1. Remove punch unit.
2. Remove pre-punch plastic cover.
3. Loosen read eject roll clamped hub and remove roll and shaft assembly.
4. Remove pre-punch bed assembly.
5. Remove lower read nudge roll and gear assembly.
6. Remove read pusher arm assembly and read bed assembly.
7. Remove upper and lower read units and lower unit stop.
8. Remove two bevel head screws, holding read nudge roll card bed, from old card guide rail and install on new card guide rail.
9. Remove old card guide rail.
10. Reassembly in reverse order and check all adjustments of parts removed.

Punch Station Bed Card Cover (No Punch Unit)

Adjustment

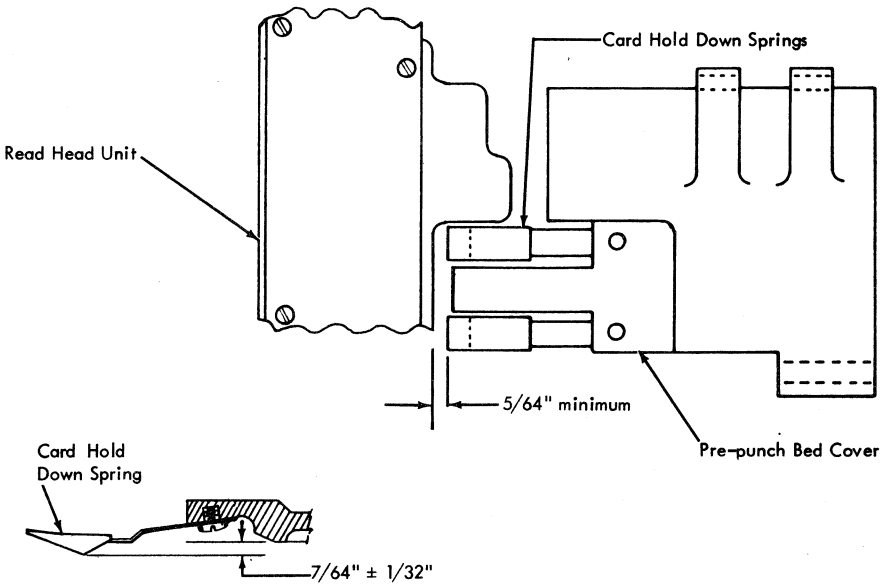
Adjust bed cover, by means of mounting bracket and magnet latch, for .012" - .037" (four IBM cards) between card bed and cover.

Punch Feed Pressure Rolls

The following adjustments are made when the punch unit is in the machine. See Punch Unit, Punch Feed Pressure Roll Downstop, for downstop adjustment.

Adjustment

1. Remove punch bed plate.
2. At 345° to 350°, insert 1/2 of a card (cut lengthwise) under front punch pressure roll and adjust eccentric link pivot until front pressure roll just tightens on card (Figure 4-24).



● Figure 4-23. Hold Down Springs Adjustment (Fiber Optic Read Station)

3. Remove card used in Step 1, and place it under the rear punch pressure roll. Adjust rear push rod socket screw until rear pressure roll just tightens on card.

When the pressure rolls are fully raised (between 40° and 320°), there should be a .015" minimum clearance between pressure rolls and feed wheels. The punch pressure rolls should grip a card at 345° to 350°, and release the card no later than 18°. At CF clutch, latch time (0°), both punch pressure roll push rods must have at least .003" vertical clearance.

Punch Feed Wheels

Removal

1. Remove incremental drive unit (See Incremental Drive).
2. Remove incremental drive ratchet from end of feed wheel shaft.
3. If machine has model B punch unit (see note following Punch Unit, for identification of model B punch unit) proceed to step 4; otherwise, remove drive wheel bearing retainer blocks (early production machines) or bearing retainer rings (later production machines).
4. Remove feed wheel assembly.

Replacement

1. Replace feed wheel assembly. Be sure that bearing retainer blocks hold bearing outer races in firm contact with upper bearing retainer surfaces.

   CAUTION: Improper alignment of feed wheel shaft bearings, particularly the duplex bearings on the rear of the feed wheel shaft, can cause binds which can shorten bearing life and contribute to poor punching registration. Rotate the feed wheels by hand and check for binds.

CAUTION: On model B punch units care must be used not to damage "O" ring bearing retainer. If necessary, dampen "O" ring with soapy water.

2. Replace incremental drive ratchet.
3. Check pressure roll downstop and skew adjustments. (See Incremental Drive.)
4. Replace incremental drive unit.
5. Replace chip chute.
6. After replacing punch unit, check adjustment of pressure roll raising link.

Punch Eject Pressure Roll Timing

Adjustment

1. Latch and detent CF clutch.
2. Adjust eccentric stud, which links punch eject pressure roll arm to operating rod, for .020" - .028" clearance between pressure roll and feed wheel (Figure 4-21).
3. Check previous adjustment to be sure card is gripped by punch eject pressure roll at 54° ± 10° and released at 335° ± 10°.

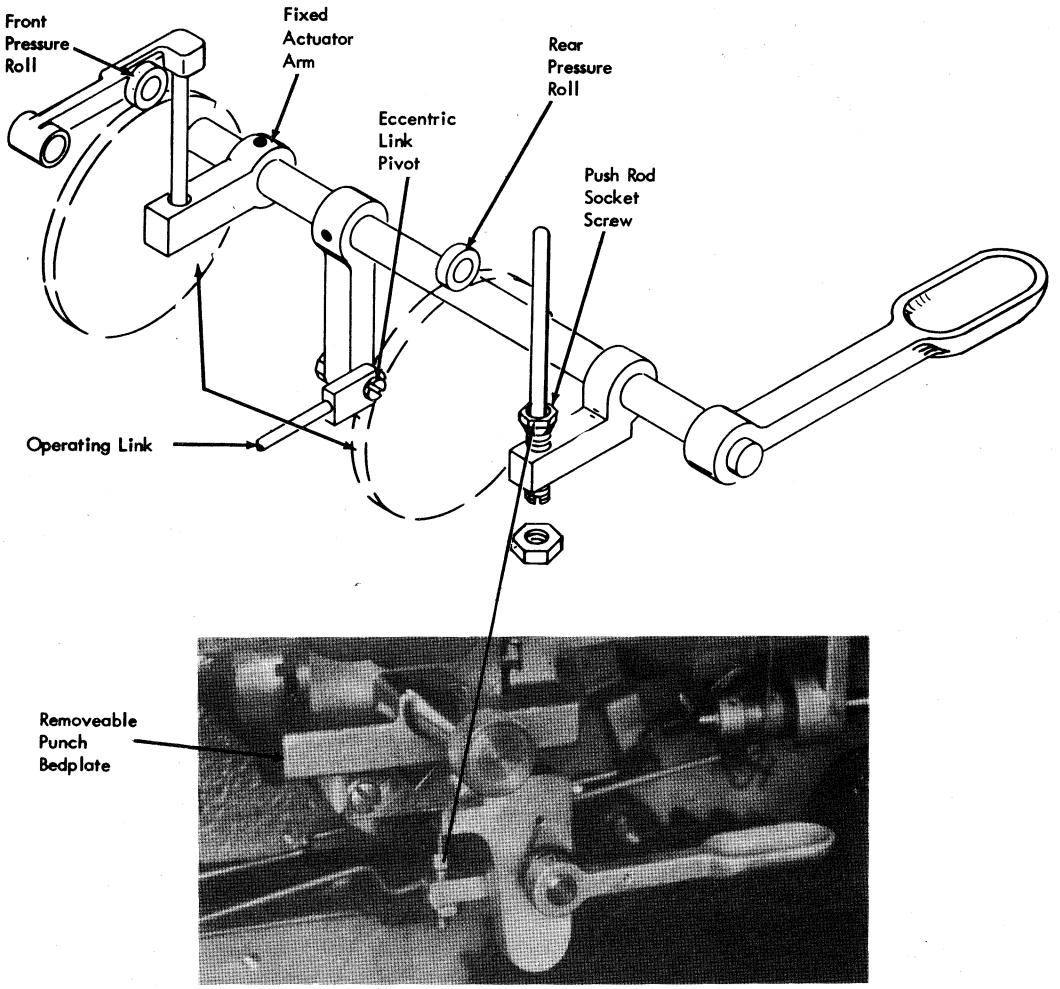


Figure 4-24. Punch Feed Pressure Roll Adjustment

Skew Adjustment (Primary Method)

1. Pull motor plug out and leave mainline switch on to prevent punching of card during this adjustment.
2. Manually trip CF clutch and turn machine to 60° ± 5°.
3. By pushing down on lower end of punch eject pressure roll arm, insert a card under punch eject pressure roll so the pressure roll rests on column 40. Also position the card for a space of .019" to .023" between the card and the cornering station guide rail.
4. Manually feed the card and adjust pressure roll adjusting screw (Figure 4-25). Card should travel parallel to cornering station guide rail. Before card has traveled 3", it should move against the cornering station guide rail.

NOTE: Card may creep up guide rail and force open cornering station cover if card is forced against rail too hard.

Skew Adjustment (Alternate Method)

1. Loosen locking screw on pressure roll adjusting screw bracket.
2. Set machine to read or punch cards continuously.
3. While watching the cards in the cornering station, adjust pressure roll adjusting screw so that:
   a. On an isolated stacker assembly, the cards are flush to .045" from the card guide rail.
   b. On a non-isolated stacker assembly, the cards are flush to .030" from the card guide rail.

NOTE: Card may creep up guide rail and force open cornering station cover if card is forced against rail too hard.

4. Tighten locking screw.

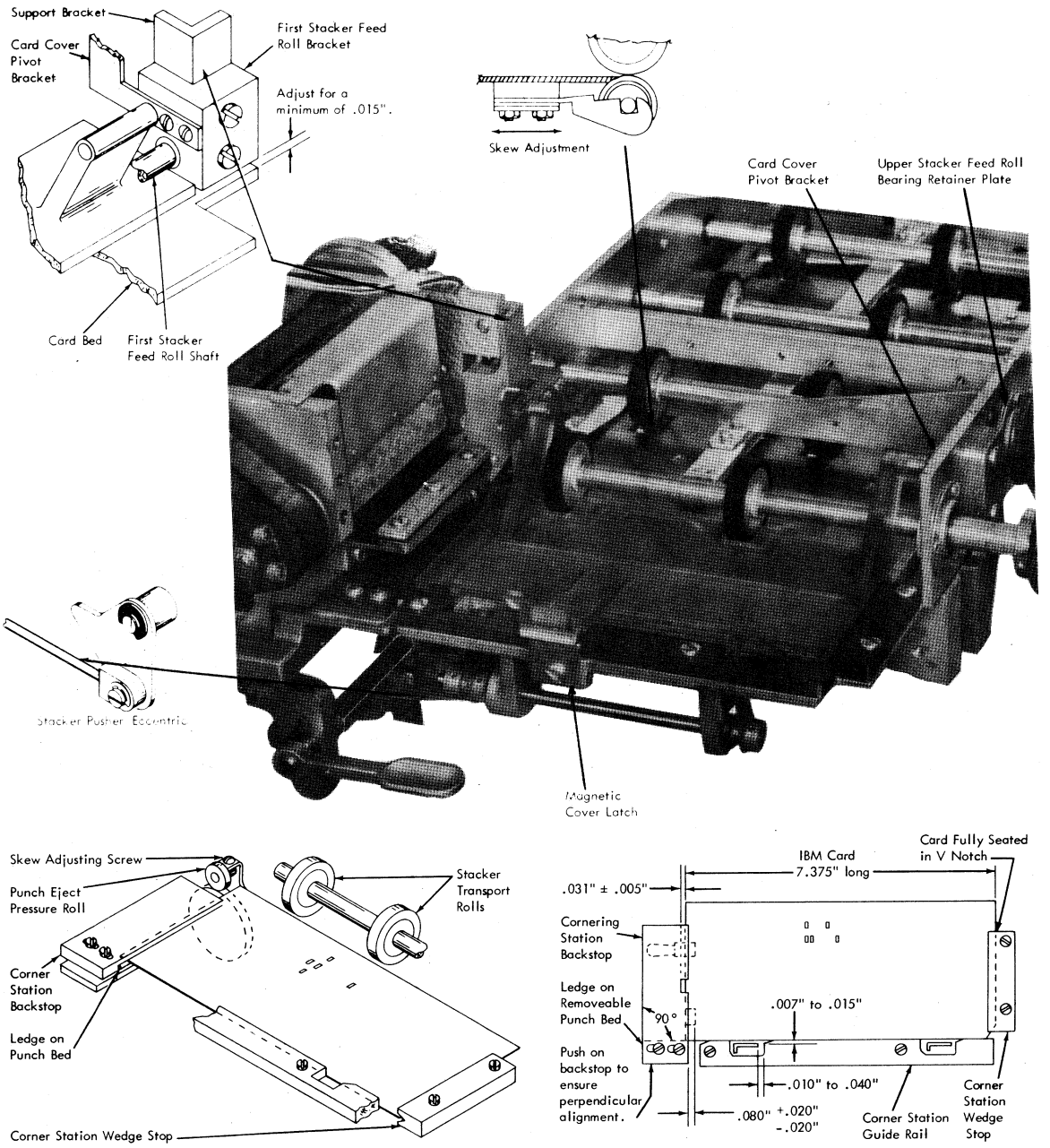
STACKER

Two types of stacker assemblies can be encountered in the serial reader punch, the isolated and the non-isolated. The isolated stacker can be readily identified because the stacker assembly is not attached to the serial reader punch backbone (center frame assembly). Unless otherwise indicated, the following adjustments apply to both the isolated and the non-isolated stacker units.

Cornering Station Backstop

Adjustment

Fully seat an IBM card in cornering station wedge stop. Adjust cornering station backstop for .031" ± .005" clearance between card and backstop (Figure 4-25), as viewed through notch.



● Figure 4-25. Stacker Cornering Station

Cornering Station Backstop Springs

Adjustment

Position backstop springs within holding screws to project .080" + .020" - .000" beyond edge of cornering station backstop (Figure 4-25). Springs must not bind on sides of openings.

First Stacker Feed Roll Bracket (Non-Isolated)

Adjustment

Position bracket to obtain a minimum of .015" between bottom of bracket and cornering station card bed (Figure 4-25).

Cornering Station Card Cover

Adjustment

Adjust the card cover magnetic latch and pivot brackets for .020" to .035" clearance (four IBM cards) between card cover and card bed (Figure 4-25).

Stacker Pushers

Adjustment

At 0°, (CF clutch latched) adjust stacker pusher eccentric stud to position the foremost of the two stacker pusher surfaces .007" to .015" behind surface of cornering station guide rail (Figure 4-25).

Position guide rail for .010" to .040" clearance between the pusher and the rail (Figure 4-25).

First Stacker Feed Roll

Pressure Adjustment

1. Adjust first lower stacker feed roll shaft support brackets (by compressing rubber spacers) so a force of 1.5 lbs to 2.5 lbs
2. Pull card strip in direction of card travel. The tension between the two rolls must not vary more than .5 lbs. The tension required to pull a card strip from between the feed rolls can be measured by a fish scale (or pushpull scale P/N 460870) hooked to the end of a card strip reinforced with cellophane tape.
3. Adjustments for the remaining stacker feed rolls are explained under Stacker Feed Rolls.

Skew Adjustment

1. Place card in cornering station.
2. Crank machine until card has traveled 1 3/4" into stacker area (Figure 4-25A).
3. Card skew in the first set of feed rolls should not exceed .030" in either direction. Reposition lower feed rolls if excessive skew exists.

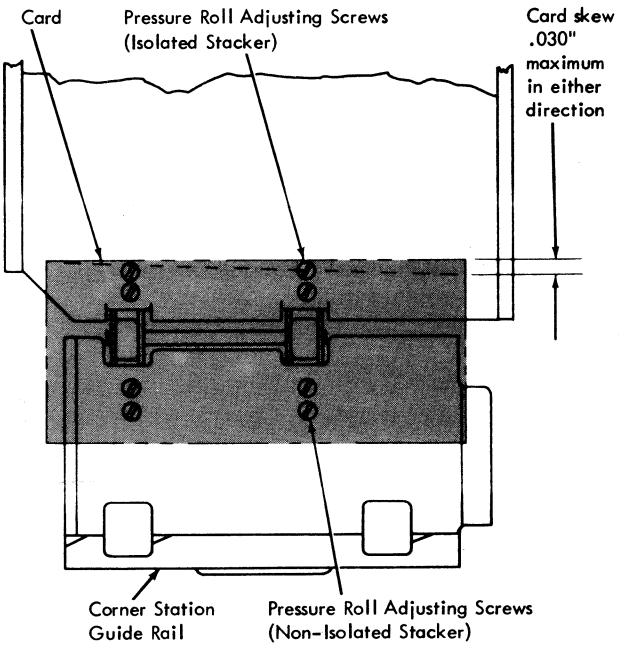


Figure 4-25A. Pressure Roll Adjusting Screw Locations

Upper Stacker Feed Rolls

Removal

1. Remove drive belt from roll.
2. Remove pulley holding nut, if present, and remove pulley(s) by loosening two setscrews per pulley.
3. Remove screw and washer on right end of feed roll shaft.
4. Remove bearing retainer plates at left end of feed roll shaft, and remove feed roll. Refer to Figure 4-25 for plate location.

Replacement

1. Perform removal steps in reverse.
2. Check lower feed roll tension adjustment.

Stacker Feed Rolls

Adjustment

Adjust all but the first lower feed roll springs, by means of adjusting nuts, for 3 to 4 1/2 lbs tension (tension must be equal within .5 lbs on each shaft). Check tension by pulling a card strip between each

pair of feed rolls (upper roll not turning). Pull card strip in direction of card travel. To measure the tension, reinforce the end of the card strip with cellophane tape and hook a fish scale (or push-pull scale P/N 460870) into the reinforced end.

Card Pivot Ledge

To check pivot ledge adjustment and to expose the two ledge mounting screws: on non-isolated stackers, remove stacker top cover hinge mounting plate; on isolated stackers, remove trim plate above pockets.

Adjustment

1. Position ledge assembly vertically so top of ledge assembly to bottom of side rail is 19/32" ± 1/64". Ledge must be parallel to stacker side rail within .010" (Figure 4-26).
2. Position ledge assembly horizontally for 1/16" to 1/8" clearance between left end of ledge assembly and card contact side of outboard pocket separator plate.

Restraining Spring

Adjustment

Rotate restraining spring mounting stud to obtain dimension shown in Figure 4-26. For optimum stacker performance, the restraining spring should conform to configuration shown (Figure 4-27).

Radial Card Guide Gate

Adjustment

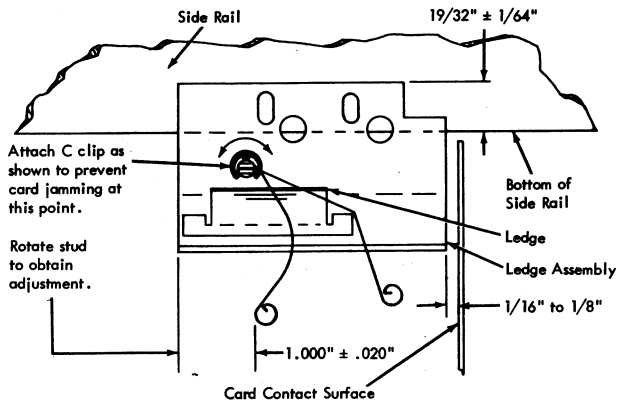


Figure 4-26. Restrainer Spring Adjustment

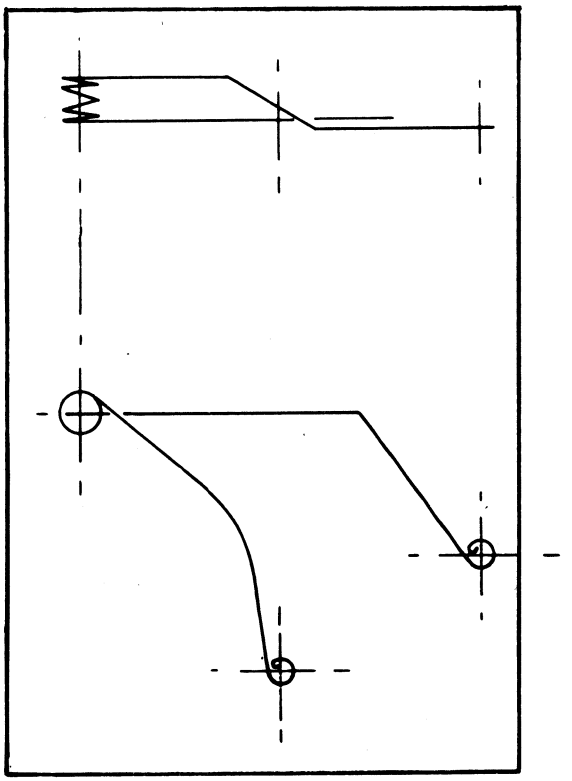


Figure 4-27. Spring Configuration (Actual Size)

1. Radial band gate should conform to configuration shown (Figure 4-28) and should be 7/16" ± 1/32" above surface of radial guide. If necessary, form radial band gate to meet these requirements.
2. Bend radial band gate spring anchor so that on the non-isolated stackers, five to ten cards are held before gate trips; on the isolated stackers, two to ten cards are held before gate trips.

Radial Card Guide

Adjustment

Form radial card guide to match profile shown (Figure 4-29 or 4-30). Do not destroy correct profile to accomplish installation. If mounting screws do not align, elongate upper mounting screw hole.

Stacker Stop Switch

Adjustment

Adjust switch to activate when card deck slide actuates operating lever. When the operating lever is fully actuated it should not bind against the switch.

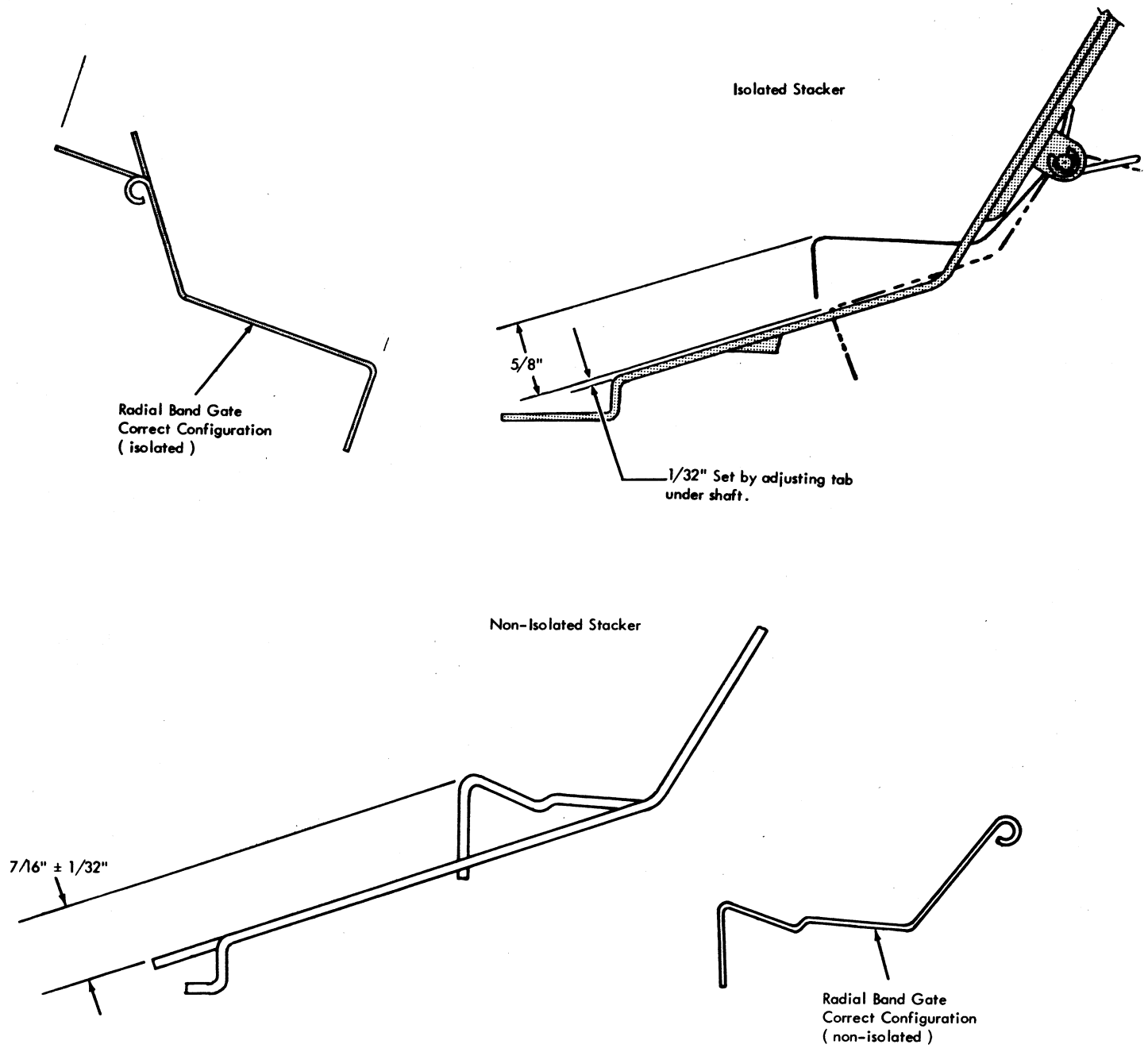


Figure 4-28. Radial Guide Gate Adjustment

ADJUSTMENT OF RADIAL STACKER CARD GUIDES

MALFORMED RADIAL CARD GUIDES CAN BE A CAUSE OF CARD JAMMING. THESE GUIDES SHOULD BE FORMED ACCORDING TO THE ILLUSTRATED PROFILE. DO NOT DISTORT THIS PROFILE TO ACCOMPLISH INSTALLATION. IF MOUNTING SCREW HOLES DO NOT ALIGN, ELONGATE THE UPPER MOUNTING SCREW HOLE.

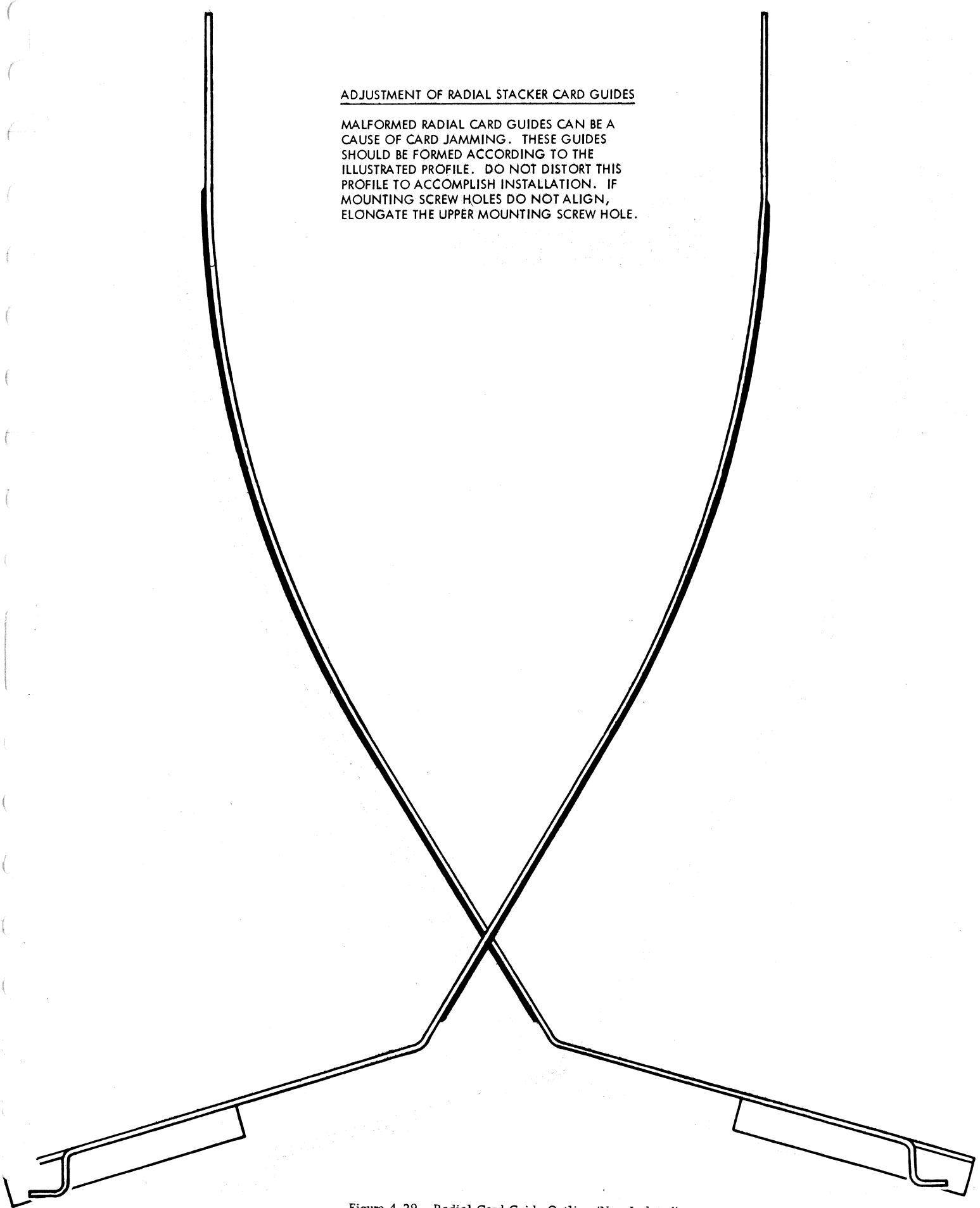


Figure 4-29. Radial Card Guide Outline (Non-Isolated)

ADJUSTMENT OF RADIAL STACKER CARD GUIDES

MALFORMED RADIAL CARD GUIDES CAN BE A CAUSE OF CARD JAMMING. THESE GUIDES SHOULD BE FORMED ACCORDING TO THE ILLUSTRATED PROFILE. DO NOT DISTORT THIS PROFILE TO ACCOMPLISH INSTALLATION.

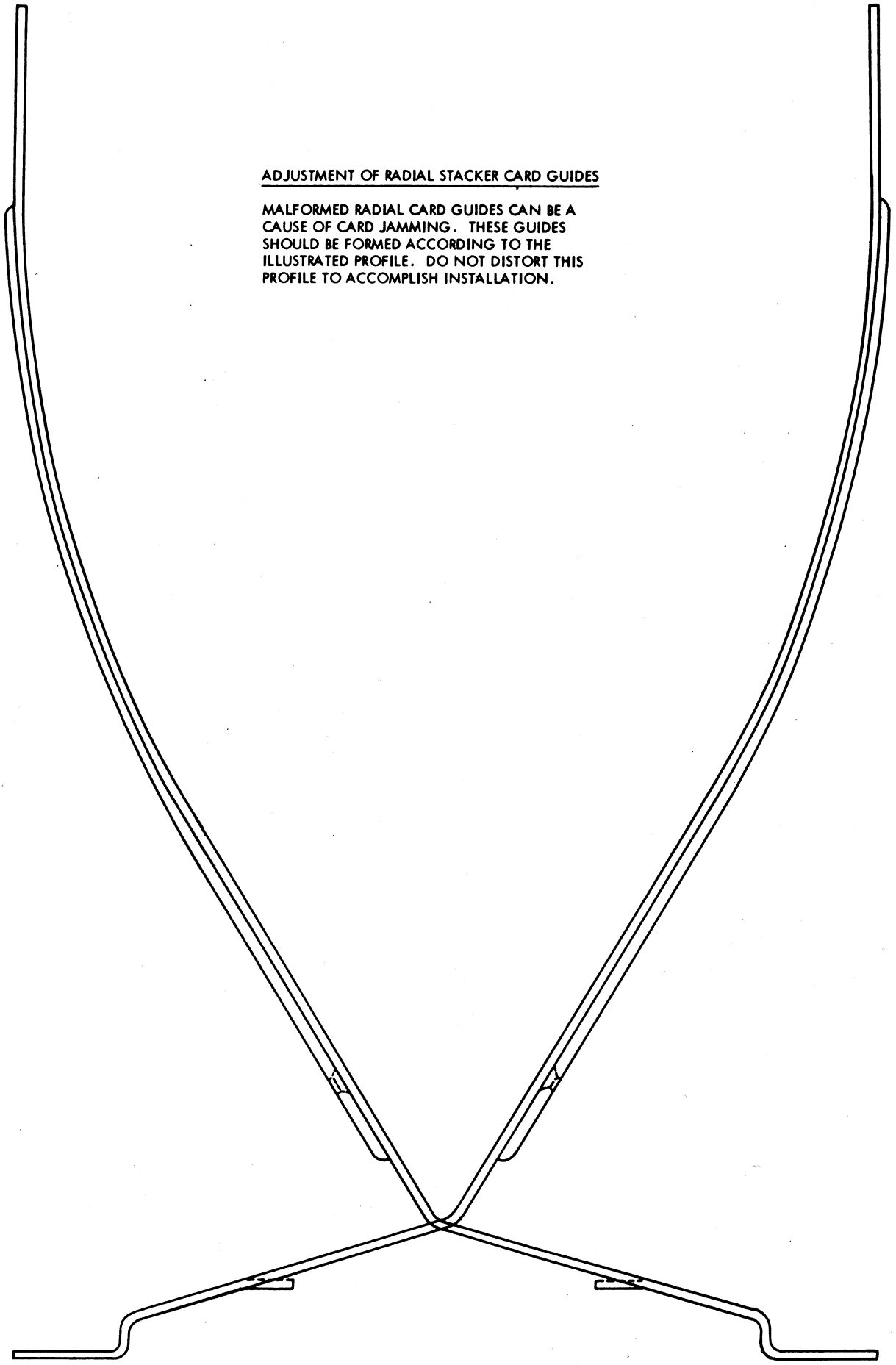


Figure 4-30. Radial Card Guide Outline (Isolated)

Selector Magnet

Adjustment

1. With armature attracted, set a clearance of .045" ± .003" between back stop. Adjust by moving armature stop (Figure 4-31).
2. With armature de-energized, position selector magnet so tip of lower chute blade is a minimum of .050" above card bed. Adjust by moving mounting bracket. Chute blade should travel at least .050" below card bed when magnet is energized.

NOTE: On isolated stacker, chute blade tip may contact plate under card bed.

3. Check that chute blade exerts 5 to 20 grams pressure on selector magnet armature (check at point indicated, Figure 4-31). Form chute blade anchor as required to obtain correct pressure.

Jam Bar

Adjustment

1. Position jam bar, by means of its mounting brackets, for .020" to .035" clearance between jam tape hangers and shear plate (Figure 4-32).

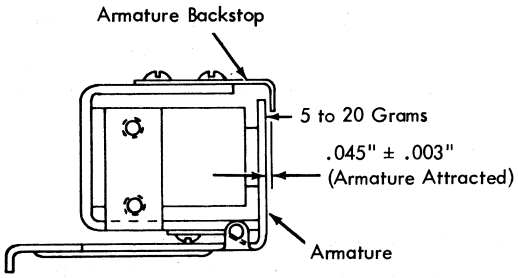


Figure 4-31. Selector Magnet

2. Adjust switch actuating screw so a jam tape deflection of approximately 1/16" actuates the switch.

Joggler Operating Arm Slide (Isolated Stacker)

Adjustment

Adjust slide (Figure 4-33) so that second step from top moves a minimum of .045" beyond corresponding card rest step when slide is in full forward and full return positions.

Stacker Alignment (Isolated Stacker)

The isolated stacker assembly mounts directly to the machine base by means of three mounting studs. Two of these mounting studs are adjustable. The serial reader punch assembly mounts to the machine base by means of three shock mounts, one of which is adjustable. If the machine location is changed, irregularities in the floor can cause a slight warp in the machine base, thus causing stacker misalignment. Misalignment may cause cornering station and/or stacker transport feeding problems.

Whenever the machine has been relocated, level machine and then check for a distance of 3 11/32" ± 1/64" between the periphery of the first stacker feed roll shaft and the card guide in the cornering station (Figure 4-34). If the distance is incorrect, adjust the serial reader punch outboard shock mount to provide the correct measurement.

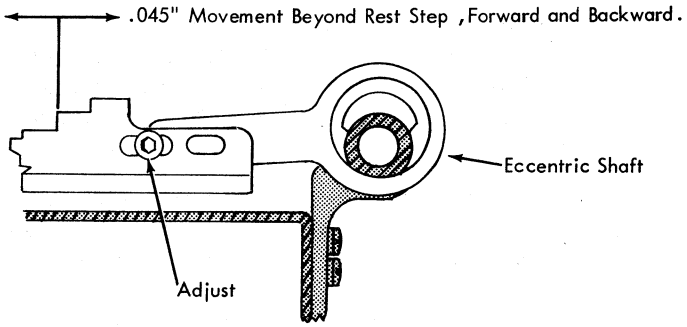


Figure 4-33. Joggler Operating Arm Slide (Isolated)

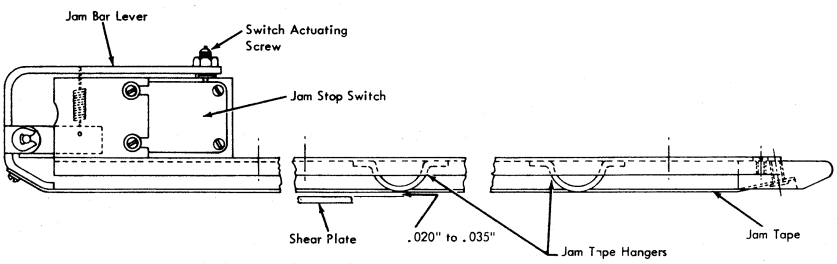


Figure 4-32. Jam Bar

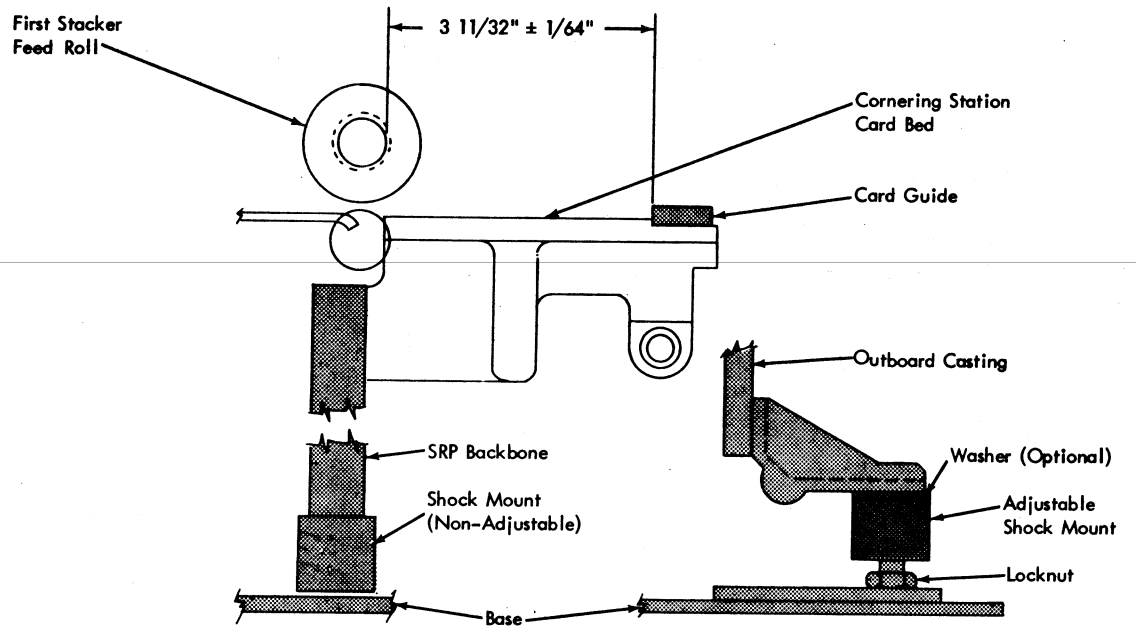


Figure 4-34. Stacker Alignment

If the stacker assembly has been loosened or removed from the machine, the following adjustments must be performed.

1. Adjust stacker transport adjustable mounting studs to obtain stacker transport plate height of ± .015" relative to cornering station card path bed (Figure 4-35).

2. Adjust serial reader punch outboard shock mount to set cornering station card path bed parallel within .010" to the first two inches of the stacker transport plate. Recheck adjustment one.

3. Loosen stacker transport mounting stud locknuts, and position stacker assembly for a distance of 3 11/32" ± 1/64" between the periphery of the first stacker feed roll shaft (not feed roll hub) and the card guide in the cornering station. First stacker rolls must be parallel to the card guide within .010".

4. Position stacker for a distance of 5/16" + 1/64" - 1/32" from edge of card fully seated in V notch of corner bumper to rear stacker side rail. Tighten stacker transport stud locknuts, and recheck adjustments 1 through 4.

5. Adjust snubber (Figure 4-35) so that pressure applied to the hopper will not reduce the measurement obtained in step 3 to less than 3 5/16". There must be a minimum 1/32" clearance to assure minimum noise level.

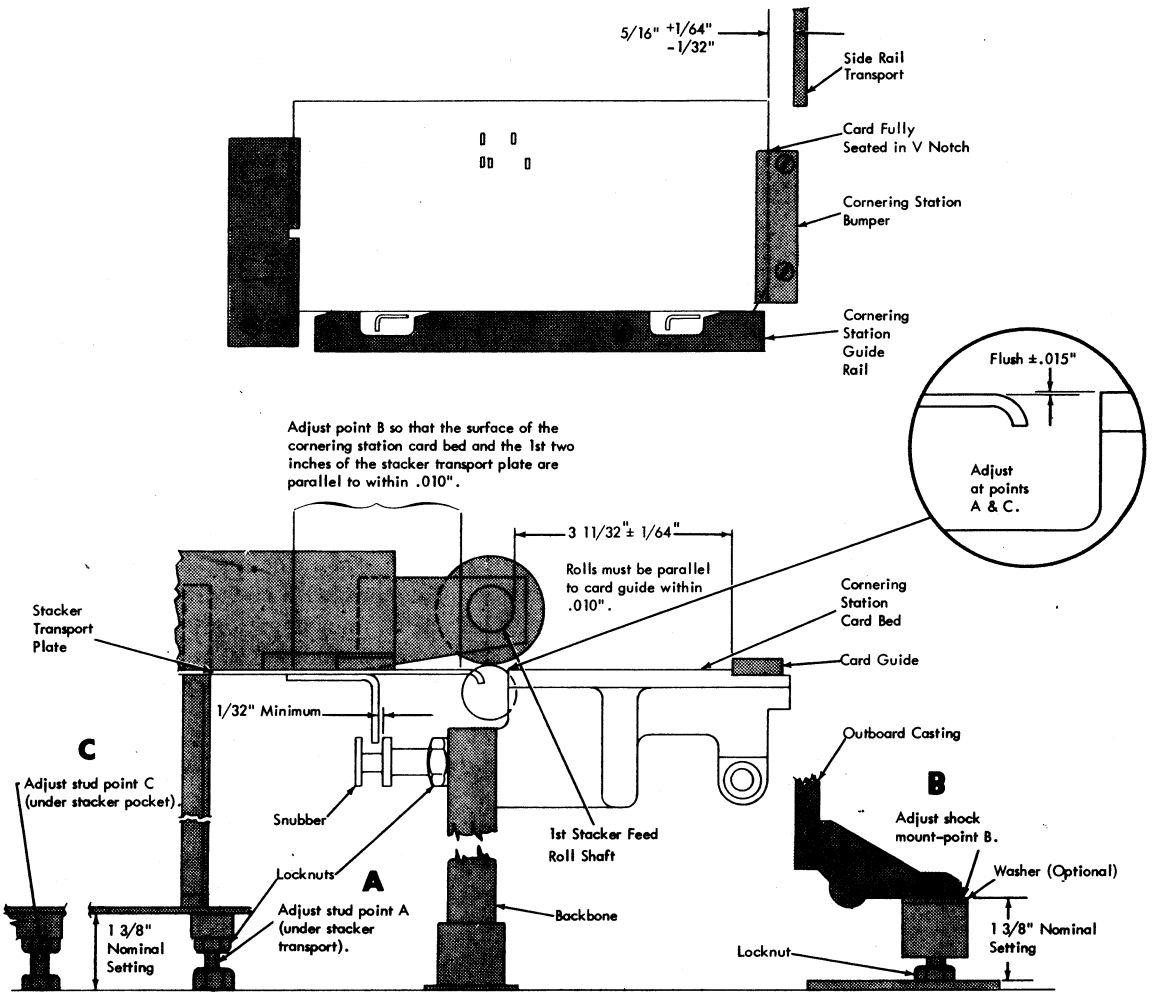
PUNCH UNIT

NOTE: Two types of punch units can be encountered in serial reader punches. The two units are interchangeable; however, many of the parts are not. The older type (Model A P/N 612940) has 24 individual punch restore levers. The newer type (Model B P/N 626415) has a single restore lever with projecting fingers. The model B can be identified by a B suffix on the punch unit serial number (stamped on bar above magnet unit). Unless otherwise indicated the following procedures apply to both types of punch unit.

Removal

1. Disconnect punch unit cable connector.
2. Remove punch unit drive belt (Figure 4-36).
3. Disconnect punch pressure roll operating link by loosening the retaining clip holding screw. Pivot clip so link can be pulled off eccentric stud.
4. Remove three mounting screws (from front of machine) that hold punch unit to base.
5. Remove punch unit by lifting straight up.

CAUTION: When lifting punch unit out, be careful not to damage eject pressure roll operating link with the punch pressure roll eccentric link. Also, care should be taken not to score drive shaft pulley with incremental drive magnet mounting plate.



• Figure 4-35. Stacker Positioning

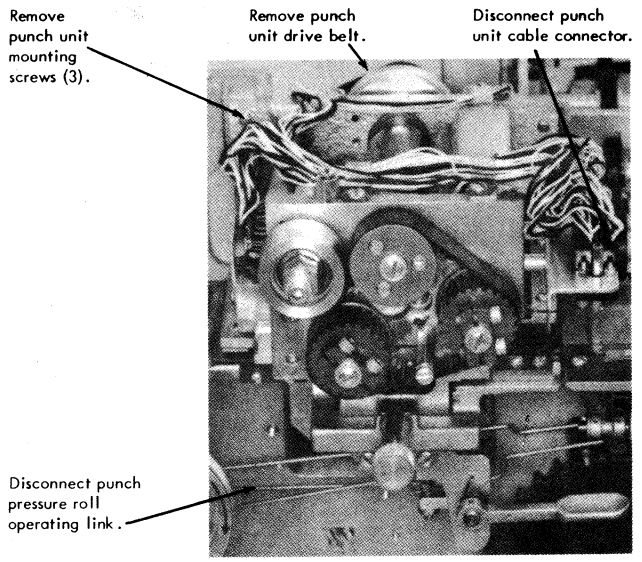


Figure 4-36. Punch Unit Removal

Replacement

NOTE: Only high speed punch units are stocked at parts centers; therefore, if a slow speed unit is being replaced, its drive pulley must be removed for use on the new unit. If P/N 640117 (2560 punch unit) is used as a replacement part on a serial reader punch, save: (1) the input drive pulley and associated parts, (2) the input card guide, (3) the pressure roll operating link eccentric stud and keeper, and (4) the chip tube from the old punch unit. It will also be necessary to remove the amp connector bracket extension, and reinstall the connector in normal position.

Removable card bed plates are not supplied with new punch units.

1. Perform removal steps in reverse order.
2. Operate punch unit by hand, and check overall operation and pressure roll timing.

3. When a new punch unit is installed, check:
   Cornering station backstop adjustment
   Pressure roll adjustments
   Jack screw adjustments
   Hold coil adjustments

Punch Jack Screws

Punch jack screw adjustments set column 1 vertical registration. Column 1 registration must be very accurate because a little skew in column 1 will be greatly exaggerated by column 80 and can appear to be pressure roll skew problems. A blue steel buckle gage, (used on the 514), P/N 158333, is used to align the punch unit to the card guide.

Adjustment

1. Rotate punch unit to zero degrees to place punches in down position.
2. Raise read head and pre-punch plastic card guide and insert gage in card bed (removable card bed may have to be loosened before gage can be inserted).
3. Raise pressure rolls and seat gage end firmly against lowered punches (some buckle gages have a feed knife slot in one end; be sure not to use this end against the punches). Hold gage against punches and move gage close to guide rail; lower pressure rolls to hold gage in place.
4. Use flashlight to check distance between guide rail and gage at points A and B (Figure 4-37). If jack screw adjustment is correct, gage will be parallel to card guide (distance from gage to card guide will be the same at both A and B). Adjust jack screws until perfect alignment is obtained. Be very critical with this adjustment as the gage must be parallel to the guide.
5. Remove buckle gage.
6. Punch cards with 12 and 9 in all 80 columns and check column 1 on a card gage. If punches are high or low, move jack screws equally to get perfect column one registration. Recheck with buckle gage to ensure parallelism has not been lost. Punch unit is now aligned to machine and any skew appearing is caused by pressure roll adjustment.

Punch Feed Skew

Punch unit jack screw adjustments, incremental drive detent and pawl adjustments, and incremental

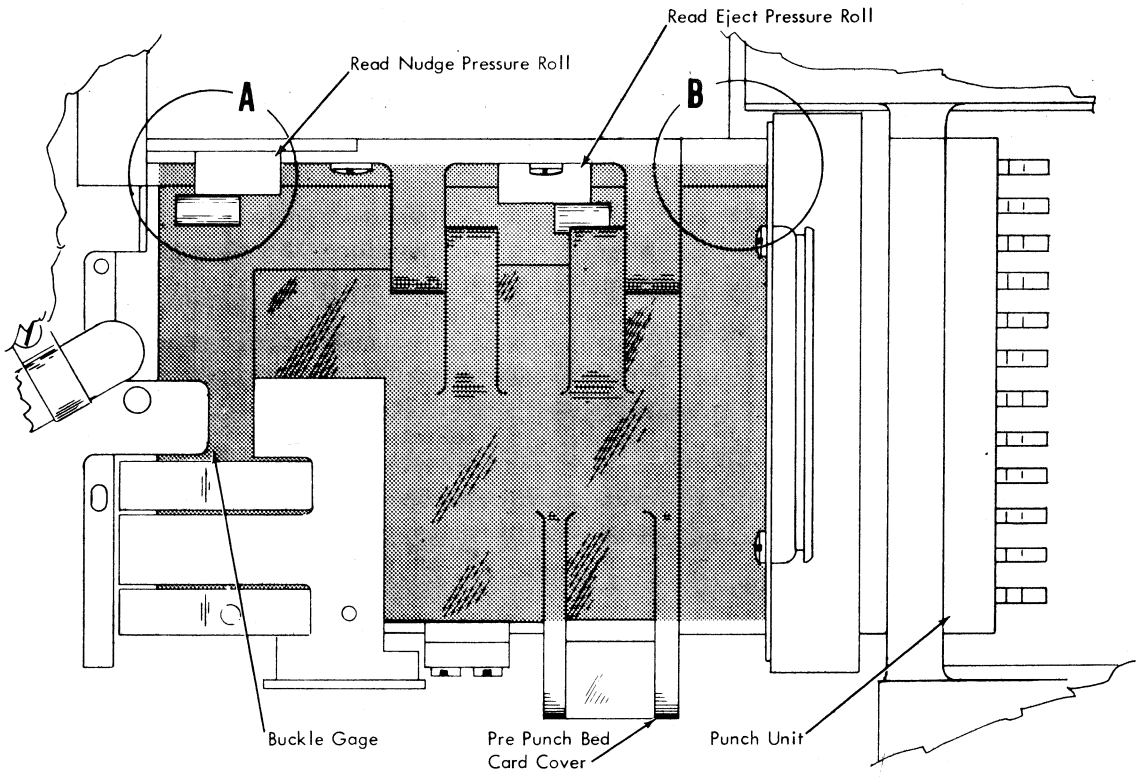
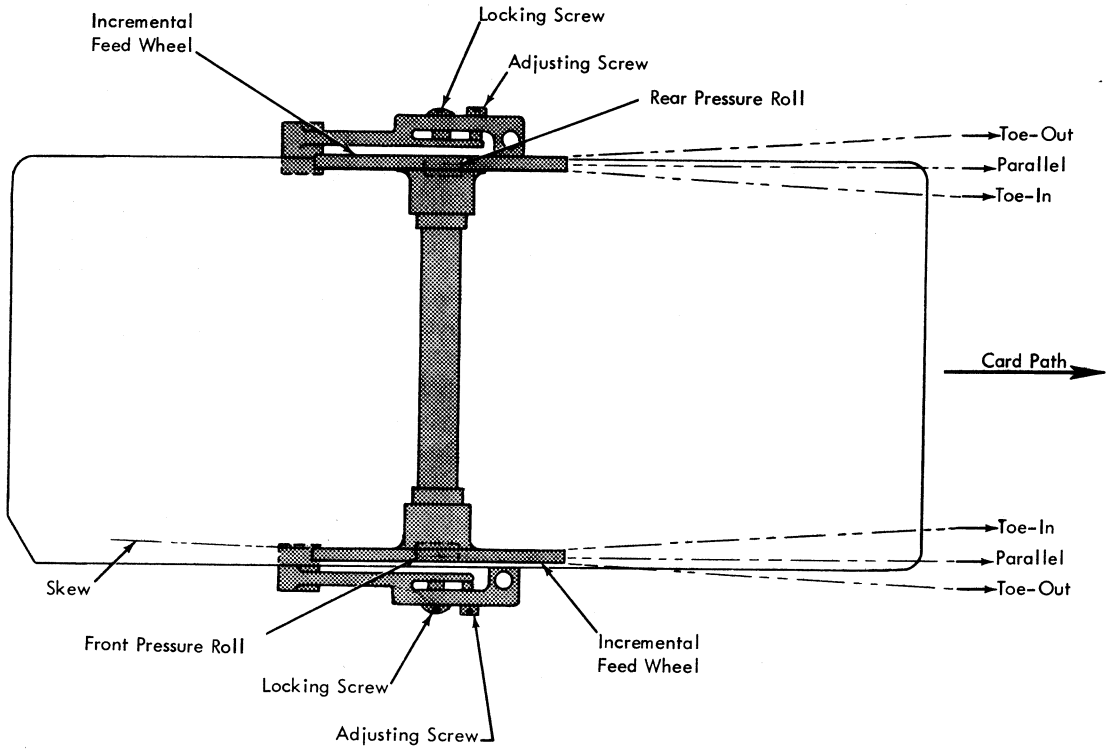


Figure 4-37. Jack Screw Adjustment

drive to punch unit timing must be correct before performing adjustments.

Adjustment

1. Check downstop adjustment on both punch pressure rolls. See Punch Feed Pressure Roll Downstop.
2. Check column 1 registration. Adjust punch pusher if necessary.
3. Loosen locknut on bottom of rear pressure roll actuator rod. Turn screw in so rod goes up and moves pressure roll away from feed wheel and allows card to be controlled by just the front pressure roll.
4. Punch cards with 12 and 9 in all columns. Set front pressure roll adjusting screw (Figure 4-38) for no vertical skew on the 12 punches. No light must show on the top or bottom of the hole when checked on the card gage. Horizontal registration will probably be off as this adjustment just sets the front pressure roll parallel to the card path.
5. Back the rear actuator rod screw down to its normal position. The adjustment is correct when both actuator rods contact the pressure roll hangers at the same time. Tighten lock nut.
6. Adjust rear pressure roll for no vertical skew; no light must show on top or bottom of 12's and 9's when checked on gage.
7. If skew is correct and card is still off-punched horizontally, pressure rolls must be toed-in or toed-out (Figure 4-38). Toe-in will correct short punching. Toe-out will correct long punching. Long punching is defined as a card which starts punching correctly in column 1, but gradually creeps off until column 80 is significantly off-punched toward column 81. Short punching is defined as a card punching correctly in column 1 and gradually slipping until column 80 is punched toward column 79. The skew is now correct and when making this adjustment, the relationship of the pressure rolls must remain the same so the skew will not be affected. If the rolls must be toed-in or out, both must be changed by the same amount. That is, if the rear adjusting screw is backed out 1/2 turn for toe-out, the front adjusting screw must also be backed out 1/2 turn. The amount of toe-in or toe-out needed, depends on the degree of long or short punching.
8. If good registration is unobtainable, the following should be checked:
   a. Jack screws.



● Figure 4-38. Skew Adjustment (Viewed from Underside of Punch Unit)

b. Position of punch unit in relation to back casting, card guides and card bed.
c. Wear at 3 back casting mounting holes making perfect jack screw adjustment impossible.
d. Clearance of upper and lower punch eject rolls.

Punch Feed Pressure Roll Downstop

Adjustment

Adjust pressure roll downstops for .001" - .003" clearance between pressure rolls and incremental drive feed wheels (Figure 4-39). See Punch Station, Punch Feed Pressure Rolls, for pressure roll adjustment.

Interposer Leaf Spring Assembly

Adjustment

1. Remove upper card guide plate that covers leaf springs.
2. Turn punch mechanism so interposer cam follower shoes are fully actuated by low dwell of interposer cam. Adjust leaf spring assembly so 450 ± 25 grams tension is required to break a leaf spring away from the point of contact with its associated interposer. Use the 11 and the 8 interposer leaf springs to check this adjustment. Figure 4-40 indicates the point on the springs at which tension measurement is made.

Punch Stop Comb

Adjustment

Adjust punch stop comb for .001" minimum clearance to sides of all punches. Cam felt wiper and restore lever assemblies must be removed to make this adjustment. See Figure 4-41.

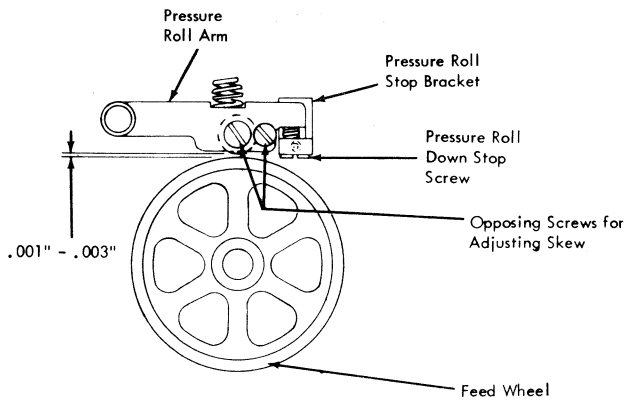


Figure 4-39. Downstop Adjustment

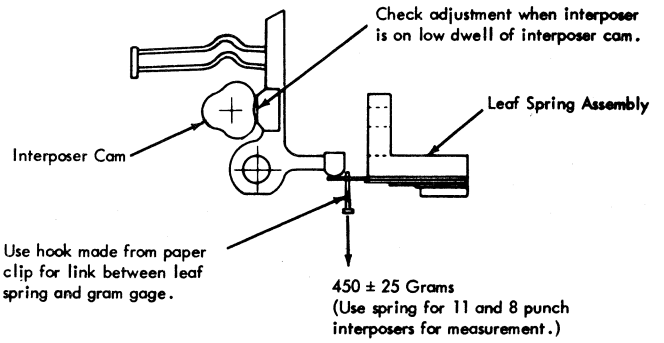


Figure 4-40. Interposer Leaf Spring Assembly Adjustment

Restore Lever Assembly (Model A Punch Unit)

See note following Punch Unit for identification of punch units.

Adjustment

1. Remove restore lever spring assembly and cam drive belt (Figure 4-41).
2. Loosen restore cam pulley clamping hub and screw.
3. With punch cam on low dwell and restore cam on high dwell, adjust restore lever assembly for .002" to .006" clearance between restore levers and cam. Make sure all punches are at their upper limit of travel.

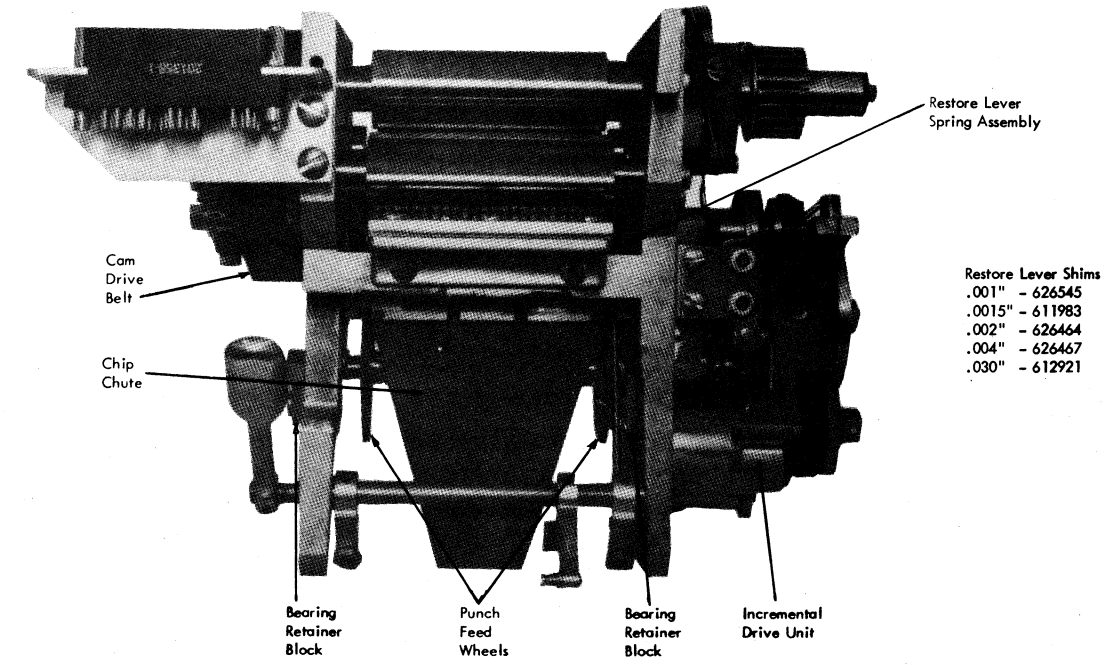
   On early production machines this adjustment is made by means of the restore lever assembly mounting screws and temporarily-inserted (size 4-40) adjustment screws. Remove the adjustment screws after adjustment is completed and mounting screws are tightened. On later production machines, this adjustment is set and maintained by shims between the lever comb and punch unit frame.
4. Adjust restore lever assembly laterally for a minimum of .002" clearance between the sides of punches and interposer levers. Check for equal clearance.

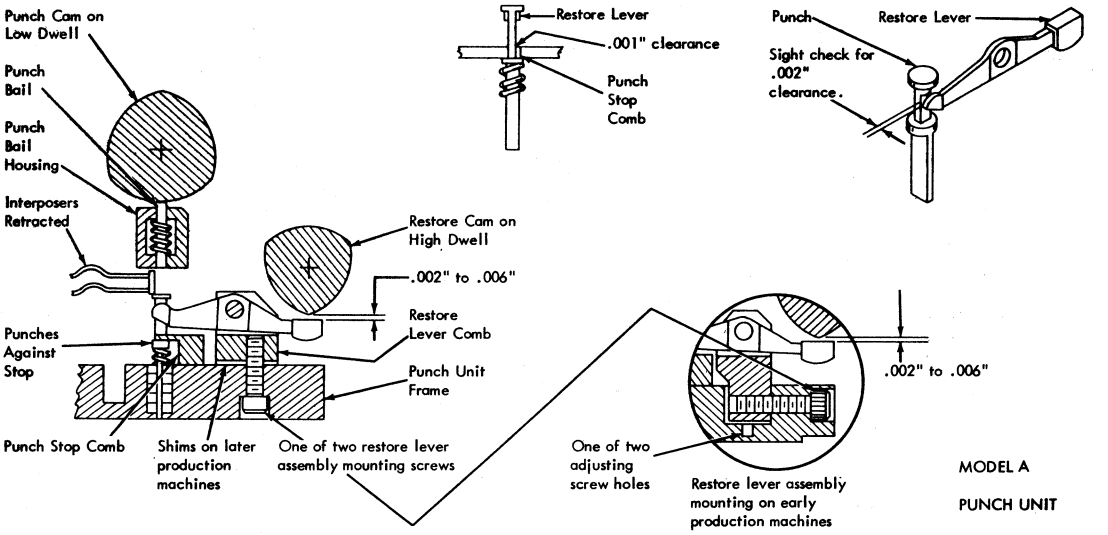
Restore Lever Assembly (Model B Punch Unit)

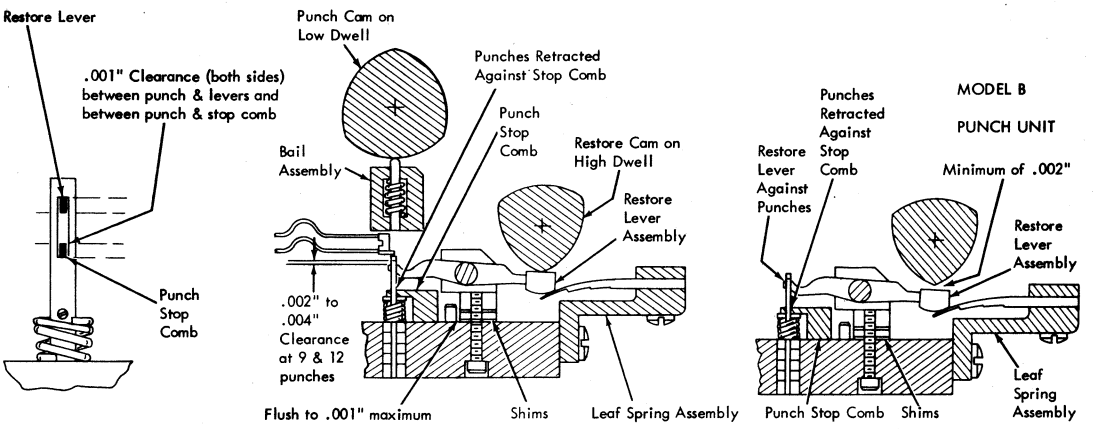
See note following Punch Unit for identification of B punch unit.

Adjustment

1. Remove restore lever spring assembly and cam drive belt (Figure 4-41). Matchmarking cams and side frame can facilitate retiming.







● Figure 4-41. Punch Stop Comb and Restore Lever Assembly Adjustments

2. Loosen restore cam pulley clamping hub and screw.
3. With punch cam on low dwell and restore cam on high dwell, push restore lever against cam surface. Check for .002" to .004" restore lever to punch clearance by inserting the incremental drive .002" gage between top of restore lever teeth and the 9- and 12-punches. The gage should clear easily. The .005" gage (same shape as incremental drive gages) should not go between punches and top of restore lever teeth. This .002" to .004" clearance should be the same on both the 9- and 12 punches. If not, add or remove shims as necessary. It might be necessary to add or remove half of a shim.
4. With restore lever held against punches, a minimum clearance of .002" must exist between restore cam and restore lever (Figure 4-41). It might be necessary to remove or add shims to obtain this clearance. If a shim is added or removed, recheck clearances of step 3.
5. Position restore lever mounting block:
   a. So that it is flush to .001" maximum from the mounting block positioning dowels.
   b. For a minimum of .001" clearance to all punches (Figure 4-41).

Interposer Pivot Rod

Each half of the interposer pivot rod should be adjusted for a clearance of .001" to .003" between the rod shoulder and the pressure roll hub arm.

Adjustment

1. Remove interposer leaf spring assembly.
2. Loosen shaft-locking setscrews.
3. Position pivot rod. Threading a 6-32 screw into the tapped hole in the outer end of each shaft will facilitate positioning the pivot rod (Figure 4-42).
4. Tighten setscrew and remove 6-32 screw.
5. Reinstall and adjust interposer leaf spring assembly.

Interposer Magnets

Adjustment

1. Remove magnet assembly. Remove any grease and dirt from armature and core surfaces. Place a clean .001" Mylar gage across face of all clean interposer armatures. Gage must cover entire face surface of all interposers and magnet cores (Figure 4-42). Replace magnet assembly, leaving mounting screws loose.
2. Rotate the punch index to 50° and insert timing pin. This places the armatures on the highest lobe of the interposer cam.
3. With power on and approximately 7.5 volts across hold coil, shift interposer magnet assembly so core and interposer surfaces are in firm contact with the gage. Apply a light downward pressure on the magnet assembly so it will seat in its lower most position. Tighten the magnet assembly holding screws evenly.
4. Turn power off. Gage should be firmly held between armatures and cores.
5. Remove timing pin.
6. Rotate punch unit by hand until gage is free, then remove gage. With power on, rotate punch unit by hand to check for binds.
7. Adjust the punch hold coil voltage. Refer to the base machine maintenance manual.

Punch Hold Coil Voltage

See base machine maintenance manual.

Index Pointer

Adjustment of the index pointer is shown in Figure 4-43.

Cam Timing

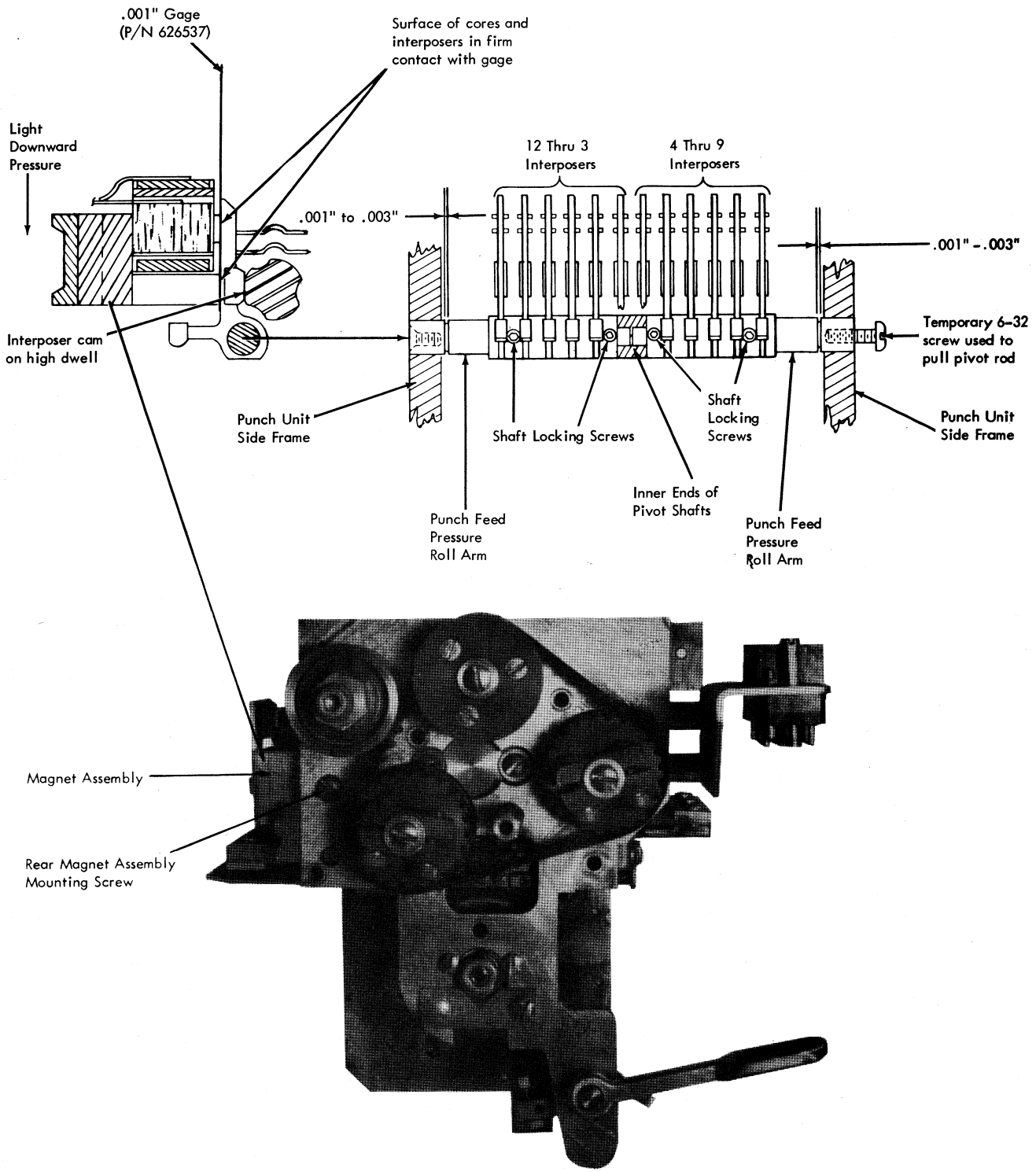
Timing of the interposer cam, restore lever cam, and punch cam can be made with the punch unit in the machine. The sequence of adjustments for the cams and emitters is shown in Figure 4-44.

Before timing the cams, make sure the index pointer reads 0° (within width of graduation line) with the timing pin inserted in the 0° timing hole (Figure 4-43).

Interposer Cam, High Lobe Identification

The highest lobe of the interposer cam is used when adjusting the interposer magnet armature-to-core clearance. Some punch units have the highest interposer cam lobe identified with black paint or a scribed "X". These marks are adjacent to the highest lobe at one end of the cam surface. If it is not identified, the highest lobe of the interposer cam can be identified as follows:

1. Rotate the punch unit and look for the interposer cam lobe that gives the least armature-to-core clearance; or longest contact time if no clearance exists. A strip of white paper, on the side of the armature opposite the viewer, makes this clearance (contact time) more apparent (Figure 4-45, Insert A).



● Figure 4-42. Interposer Adjustments

2. Mark the end adjacent to the highest lobe with a felt tipped pen or other marker.
3. If neither the 12, 9, nor one of the middle armatures indicates a lobe difference, mark one of the lobes to ensure using the same lobe each time an adjustment is made.

Interposer Cam Timing

1. Turn off the cover interlock switch so motor will not run. Turn machine power on. Adjust punch hold coil voltage for approximately 7.5 volts.

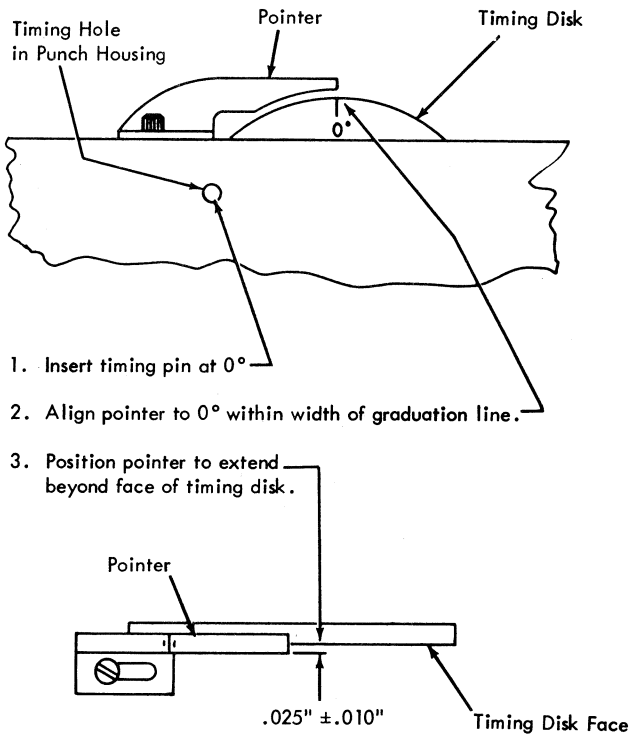


Figure 4-43. Index Pointer Adjustment

2. Loosen locking screw and clamped pulley screws on rear end of interposer camshaft. If restore cam is to be retimed, loosen its locking screw and clamped pulley screws (Figure 4-45).

CAUTION: To prevent damage to the restore levers, the punch and restore cams must not be on the high dwell at the same time.

3. Loosen interposer magnet assembly mounting screws to permit the magnet unit to follow the armatures.
4. Rotate the interposer camshaft, by means of the gear on the front, to a point where:
   a. The high (marked) lobe is up.
   b. The interposers are on a low dwell.
5. Rotate the punch camshaft to 113.5°, making sure the interposers are under the punch bail. Insert the timing pin.
6. Use an insulated screwdriver (Figure 4-45, Insert B) to facilitate the adjustment by amplifying the armature motion.
7. Rock the interposer cam about the low dwell, making sure all interposers and the magnet assembly follow the interposer cam. It may be necessary to apply finger pressure against the magnet assembly. The center of the low dwell is the midpoint between perceptible motion of the screwdriver handle.
8. Tighten the interposer cam locking screw and clamped pulley screws.
9. A check of the interposer cam center low dwell position with the timing pin removed should result in an index reading of 113.5° ± 1°. A more accurate check can be made by using both hands to grip punch cam shaft pulleys rocking the punch unit about this point.

Interposer Magnet Adjustment

1. Remove magnet assembly, and clean any grease and dirt from armature and core surfaces. Place a clean .001" Mylar gage across face of all interposer magnets. Gage must cover entire face surface of all interposers and magnet cores (Figure 4-42). Replace magnet assembly, leaving mounting screws loose.
2. Rotate the punch index to 50° and insert timing pin. This places the armatures on the highest lobe of the interposer cam.
3. With power on, shift interposer magnet assembly so core and interposer surfaces are in firm contact with the gage. Apply a light downward pressure on the magnet assembly so it will seat in its lowest position. Tighten the magnet assembly holding screws evenly.
4. Turn power off. Gage should be firmly held between armatures and cores.
5. Remove timing pin.
6. Rotate punch unit by hand until gage is free, then remove gage. With power on rotate punch unit by hand to check for binds.

Restore Lever Cam Timing

1. Rotate punch unit in normal direction of rotation to 95° and insert timing pin.
2. Loosen the lock screw and the clamped pulley screws at the rear end of the restore camshaft.
3. Rotate the restore cam until the restore levers are on a low dwell.
4. Use an insulated screwdriver (Figure 4-45, Insert C) to facilitate the adjustment by amplifying the restore lever motion.
5. Rock the restore cam about the low dwell. The center of the low dwell is the midpoint between perceptible motion of the screwdriver handle.
6. Tighten the lock screw and the clamped pulley screws.
7. Remove timing pin.
8. A check of the restore lever low dwell should result in an index reading of 95° ± 1°.

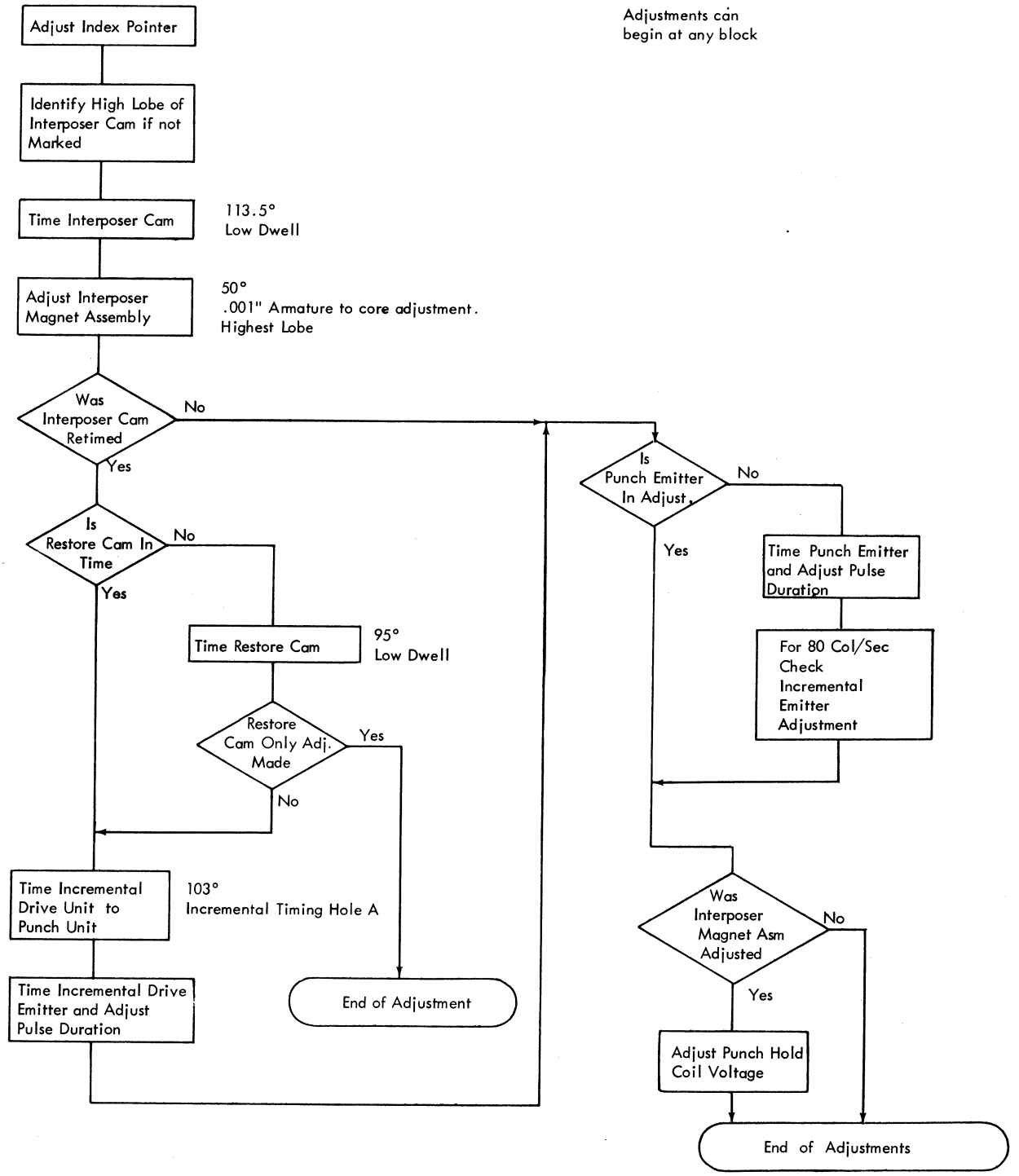


Figure 4-44. Cam and Emitter Adjustment Sequence

9. With power off, remove restore lever spring assembly, and check for .002" clearance between restore cam and followers at all points of rotation. If less than .002" clearance exists, return to restore cam low dwell and shift timing to 97° maximum to provide the necessary clearance.
10. Replace restore lever spring assembly.

Punch Emitter

See base machine maintenance manual.

Punch (Model A Punch Unit)

See note following Punch Unit for punch unit identification.

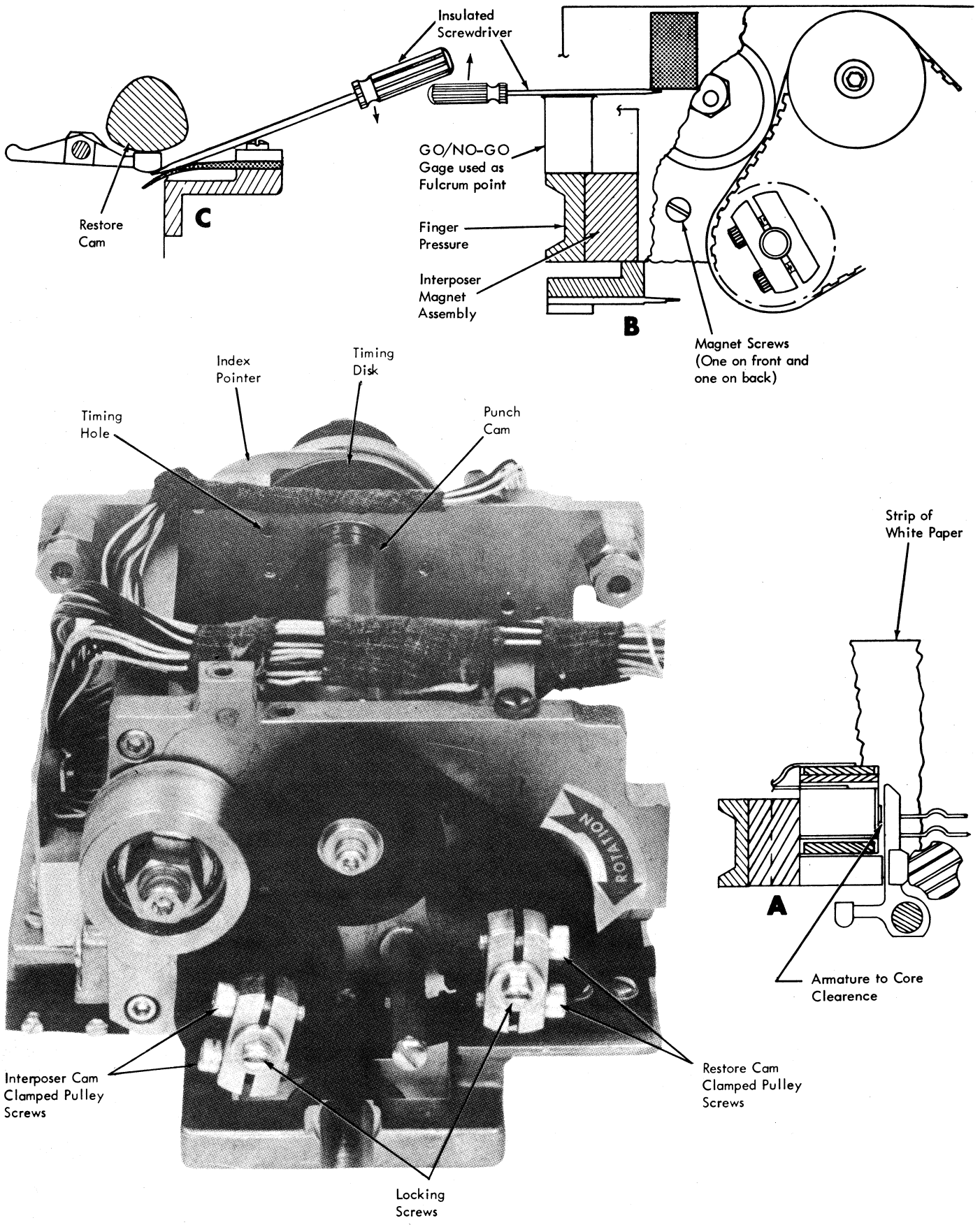


Figure 4-45. Cam Timing

Removal

1. Remove punch unit from machine.
2. Remove timing belt from three punch unit cams.
3. Remove punch and restore grease cam wiper bracket (Figure 4-46).
4. Remove restore lever leaf spring assembly.
5. Loosen screw on front end of restore camshaft. Tap head of screw with brass rod and hammer. As the shaft and rear end bearing slide out, continue to loosen the front end camshaft screw.
6. Remove restore lever assembly.
7. Remove interposer magnet assembly.
8. Remove two screws (grease fitting side) holding punch bail assembly to the punch drive bail bar. (Punch bail assembly includes: punch drive bail plate, plastic punch bail, four bail springs, and two spacers). Remove bail assembly by rocking it toward restore cam.
   DANGER: Springs are under considerable tension, and could fly out and cause injury.
9. Loosen two (2) allen screws holding punch drive bail bar to punch unit casting. Insert wrench through hole on interposer end of casting. Back the screws out two (2) full turns. Push bar assembly toward interposers as far as loosened screws will allow. This will allow punches to clear bar as they are pulled out.

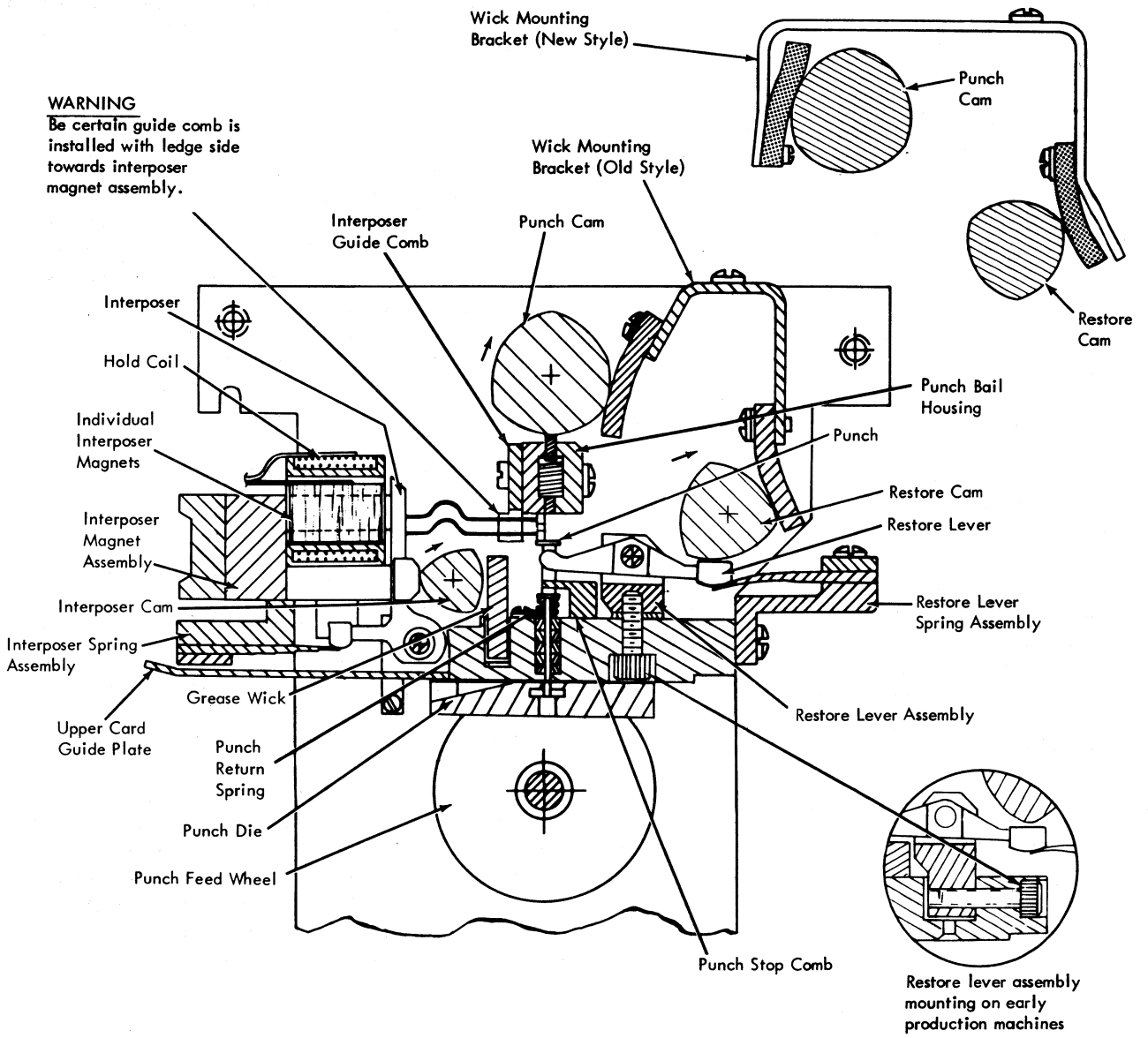


Figure 4-46. Punch Unit

10. Remove punch stop comb.
11. Move interposer out of way of damaged punch. Pull punch out of stripper. Watch for punch return spring.

Replacement

1. Perform removal steps in reverse order. Adjust punch stop comb and restore lever assembly as they are installed.
2. Move punch drive bail bar back into position and tighten two (2) allen screws.

   NOTE: While tightening screws, downward pressure must be applied to both ends of the bar to overcome punch pressure roll spring tension.

   CAUTION: Do not use cam to pry on. Use each end of shaft. Punch drive bail bar must seat firmly down on casting.
3. Place plastic bail into position on punch drive bail plate, rounded edge up. Insert four springs and seat springs firmly into slot on bail plate. Place two spacers in position. When mating bail assembly to punch drive bail bar, grease fitting up, insert with a rocking motion so that projecting bottom edge of springs contacts bottom of slot in bar. Then rock into position while rotating punch camshaft to depress bail and compress springs. (Rotate camshaft CCW facing incremental drive end of punch unit.) When bail assembly seats firmly in bar, insert screws and tighten loosely. Adjust bail assembly so that bottom of plate and bottom of bar are aligned within .003". Rotate punch cam and check for binds in bail. Bail should contact cam at all times.
4. Before installing restore camshaft, remove sealant from the rear bearing outer race and the bearing mounting hole in punch unit rear casting. Reseal outer race to frame with loctite* (P/N 216348) sparingly. If inner race becomes loose, clean and reseal. (Loctite* requires 24 hours to dry at room temperature. However, if placed under a 100 watt light bulb, it will harden in approximately 20 minutes.)
5. Retime punch unit cams.
6. Install punch unit in machine.
7. Adjust interposer magnet assembly.
8. Operate punch unit by hand and check for abnormal binds.
9. Install punch drive belt. Test machine.

Punch (Model B Punch Unit)

See note following Punch Unit for punch unit identification.

Removal

1. Remove punch unit from machine.
2. Remove punch and restore cam grease wiper assembly (Figure 4-46).
3. Remove restore lever spring assembly.
4. Remove restore lever assembly.
5. Remove interposer magnet assembly.

   NOTE: If half shims are present, observe location for proper replacement.

6. Remove interposer guide comb.
7. Remove screws (2) holding punch bail assembly to punch unit housing. Remove punch bail by rocking it toward interposer cam.
8. Remove punch stop comb.
9. Move interposer out of way of damaged punch. Pull punch out of stripper. Watch for punch return spring.

Replacement

1. Perform the removal steps in reverse order. Adjust the punch stop comb, interposer guide comb, and restore lever assembly as they are installed. The punch bail housing, which is under spring tension, must be held down against the bail mounting framework as mounting screws are tightened.
2. Install punch unit in machine.
3. Adjust interposer magnet assembly.
4. Operate punch unit by hand and check for abnormal binds.
5. Install punch unit drive belt. Test machine.

Interposer

The interposer pivot rod is divided into 2 halves. One half serves as a pivot for the digit 12 through 3 interposers; the other half serves as a pivot for the digit 4 through 9 interposers. The specific interposer to be removed determines which pivot rod half is to be pulled out. A 6-32 tapped hole is provided in the outer end of each shaft half. A 6-32 screw is temporarily threaded into this tapped hole so the shaft can be pulled out the required distance. The interposer pivot shafts also serve as a pivot for the punch pressure roll arm. Because these arms are spring loaded, they exert considerable tension on the pivot rods. This tension must be kept in mind when pulling or inserting pivot rods. Refer to Figure 4-42 for location of parts.

*Registered trademark of American Sealants Company.

Removal

1. Remove punch unit from machine.
2. Remove interposer leaf spring assembly.
3. If a digit 4 through 9 interposer is to be removed, remove cam drive belt and interposer cam clamped pulley. If a digit 12 through 3 interposer is to be removed, the belt and pulley are not removed.
4. Remove interposer magnet assembly.
5. Remove interposer guide comb.
6. Loosen locking setscrew for the particular pivot rod to be pulled.

CAUTION: Before proceeding with next step, place two thicknesses of IBM card strips between each pair of punch pressure rolls and feed wheels. This will prevent damage to the feed wheel periphery if the pressure roll should drop down on the feed wheel when the pivot rod is pulled.

7. Insert 6-32 screw in end of interposer pivot rod to be removed. Pull rod to point where interposer can be removed.

Replacement

Perform removal steps in reverse. Do not drive the Nylotron* bushing into pressure roll hanger arm. Simple hand pressure is sufficient when the components are properly aligned. Undue force will deform the bushing.

Adjust interposer leaf spring and magnet assemblies. The punch unit cams must be timed if cam drive belt and interposer cam pulley were removed.

CAUTION: On early production machines, the lower slotted portion of the interposer guide comb has a thicker ledge on one side. The comb must be installed with the ledge side towards the interposer magnet assembly. (See Figure 4-46.) If the interposer comb is not installed correctly complete restoration of the interposers will be blocked and punch unit damage will result. Repositioning or rotation of interposer pivot rod can change the clearance between the incremental drive feed wheels and pressure rolls. Before installing punch unit, pressure-roll-to-feed-wheel clearance should be checked.

Punch Die

Only on rare occasions, such as the removal of a broken punch tip, will there be a need to remove the punch die. If installation of a new punch(s) does not correct unclean punching of holes, the entire punch unit (including the incremental drive unit) should be replaced. Punch dies are not interchangeable and will function properly only with the matching stripper. If the punches and the die are not in perfect alignment, chipped die and punches will result.

Removal

1. Remove punch feed wheel assembly. Refer to Servicing Procedures, Punch Station, Punch Feed Wheels Removal.

CAUTION: Do not damage periphery of feed wheels.

2. Remove four die screws, and remove die. Do not lose spacers mounted on screws between die and stripper. (Die mounting screws are held tight by Loctite, and will not turn freely even after initial loosening.)

Replacement

1. Rotate punch unit so punches project through stripper to the limit of their downward travel.
2. Clean mounting screws and apply fresh Loctite.
3. Install die. Thread spacers on mounting screws between die and stripper. Before tightening mounting screws, all punch tips should enter die, die should be firmly against spacers, and spacers must be firmly against stripper.
4. Operate punch unit by hand to see that punches move in and out of die properly. Insert a blank card between die and stripper, and be sure that 12 thru 9 digits punch correctly.
5. Replace punch feed wheel assembly. Refer to Servicing Procedures, Punch Station, Punch Feed Wheels, Replacement.
6. Test punching under power.

INCREMENTAL DRIVE

Make the following adjustments with punch unit removed from machine unless otherwise indicated. See Figure 4-46A for sequence of adjustments.

Incremental Drive Magnets and Latch Arms

Adjustment

NOTE: Obtain optimum unlatching and relatching clearance between latches and cam followers.

1. Turn incremental drive until left-hand cam follower is on high dwell.

*Tradename of Polymer Corporation, Reading, Pa.

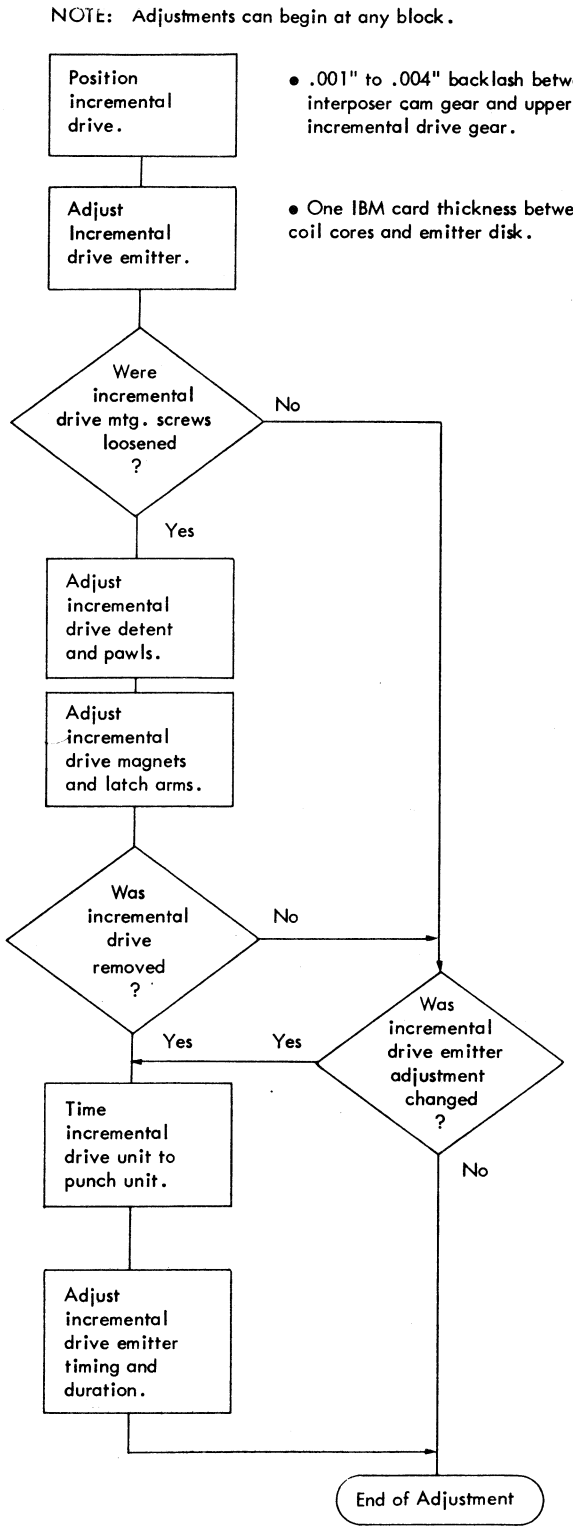


Figure 4-46A. Incremental Drive Unit Adjustment Sequence

2. Adjust upper incremental magnet assembly by means of its mounting screws, to meet the following requirements:
   a. .024" to .027" between latch and magnet core furthest from latch pivot (Figure 4-47).
   b. .001" loose and .002" tight clearance between latch latching surface and follower latching surface while maintaining finger pressure on latch (Figure 4-47). Turn drive to other high dwell on cam and recheck this clearance. Use special gages, P/N's 626532 and 626533, to check for this clearance. The accuracy of this adjustment is essential for proper incremental drive operation.
3. Repeat Steps 1 and 2 for lower incremental drive magnet assembly.

Timing Incremental Drive Unit to Punch Unit

If the incremental drive unit has been removed from the punch unit, refer to Incremental Drive Unit Replacement. These adjustments can be made with the punch unit in the machine.

1. Remove mounting bracket containing incremental drive emitter coils (Figure 4-47).
2. Loosen lock screw and clamped hub screws at the front end of the interposer camshaft.
3. Turn incremental drive gears until incremental drive timing hole A (Figure 4-47) aligns with hole in gear. Insert timing pin.
4. Turn punch unit in normal direction of rotation, to 103°.
5. Tighten lock screw and clamped hub screws on front end of interposer camshaft.
6. Remove timing pin.
7. A check of incremental drive timing should result in the incremental drive timing holes being aligned every fourth revolution of the punch index at 103° ± 2°.
8. Replace incremental drive emitter bracket. Adjust coil-to-emitter disk clearance for .005" to .009" (one card thickness). This is an initial adjustment; the final adjustment is covered under Incremental Drive Emitter.

Incremental Drive Emitter Timing and Duration

See base machine maintenance manual.

Incremental Drive Detent and Pawls

The detent and the adjustable pawl eccentric are adjusted so the drive pawls are centered in the ratchet wheel slots as they leave the slots. This condition can be seen by checking that the drive pawls are in the center of their respective slots when their cam followers are on the low dwells. Variations in the ratchet wheel and drive cams make it difficult

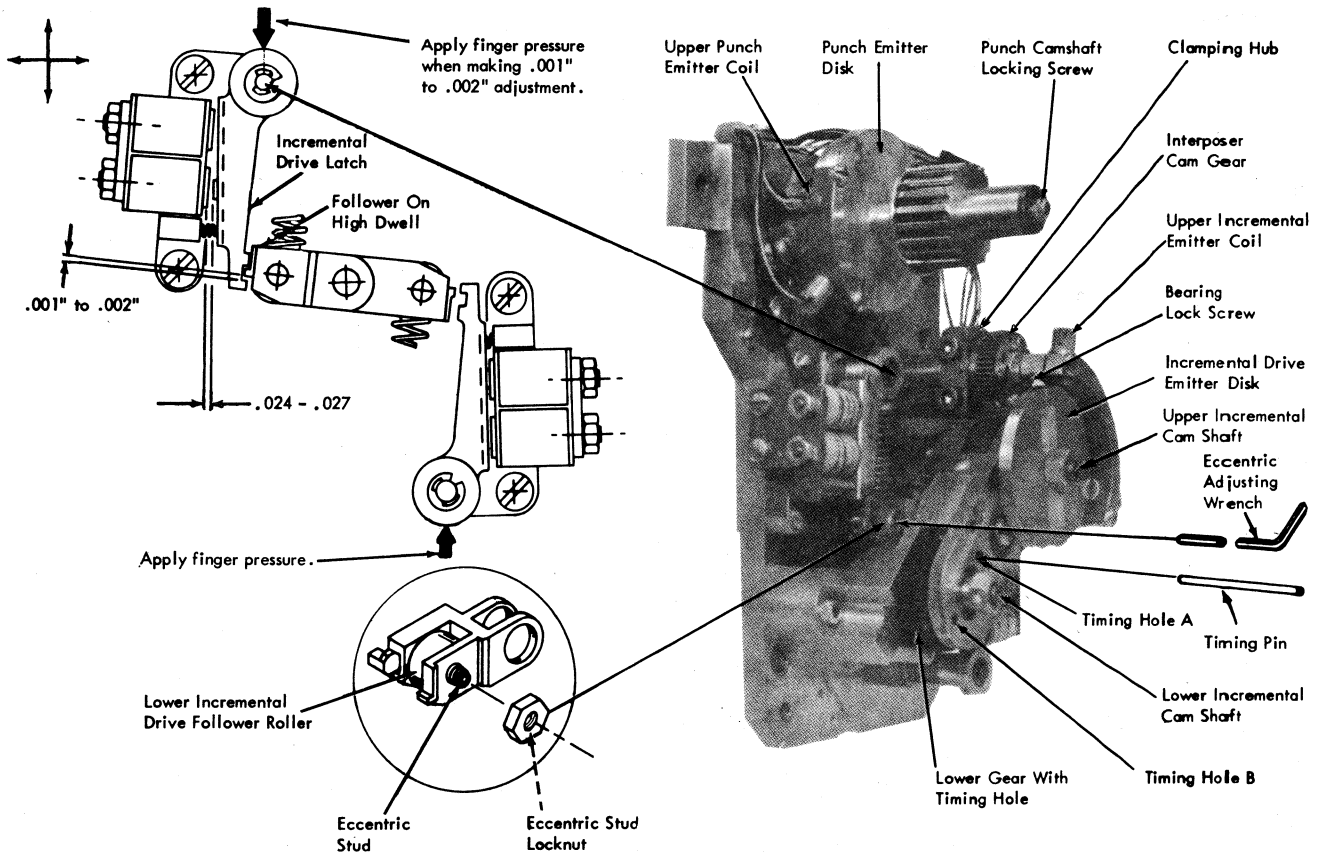


Figure 4-47. Incremental Drive Adjustments

to obtain perfect centering; therefore considerable care must be taken to arrive at the best possible adjustment.

Adjustment

1. Hold both latch arms in an unlatched position with rubber bands throughout this procedure.
2. Divide the lower nylon incremental drive gear into quarters. Starting with the tooth that has the white timing mark, mark every sixteenth tooth. White chalk provides an excellent means of marking the teeth.
3. Insert the timing pin in the upper timing hole of the incremental drive housing and into the hole in the incremental drive gear itself. Mark the incremental drive housing adjacent to one of the marked teeth on the gear. Remove the timing pin and advance the incremental drive gear to the next marked tooth.
4. At this position, the non-adjustable pawl is entered in a ratchet slot and its follower arm is on the low dwell of the cam.
5. Adjust the detent (Figure 4-48) for equal clearance between the non-adjustable pawl and each side of the ratchet slot. This can be checked by rocking the feed wheel back and forth and visually observing that the drive pawl has an equal amount of movement in both directions in the slot. After obtaining this condition, tighten the detent locking screw and recheck the adjustment. This is necessary because tightening the locking screw sometimes changes the adjustment. Readjust the detent to achieve equal movement with the locking screw tight.
6. Advance the drive gear, two marked teeth, again check for equal movement on each side of the drive pawl. Note that you are now checking the adjustment at the other low dwell of the same cam. The detent should be readjusted for the best possible setting between the two low dwells of the cam.
7. Recheck the detent adjustment at two other locations on the ratchet wheel about 20 teeth apart. Try to obtain the best possible adjustment on the two low dwells in each of the three ratchet wheel locations.
8. Now, reinsert the timing pin into the incremental drive gear. At this position, the adjustable pawl is in the ratchet slot and its cam follower is on the low dwell.

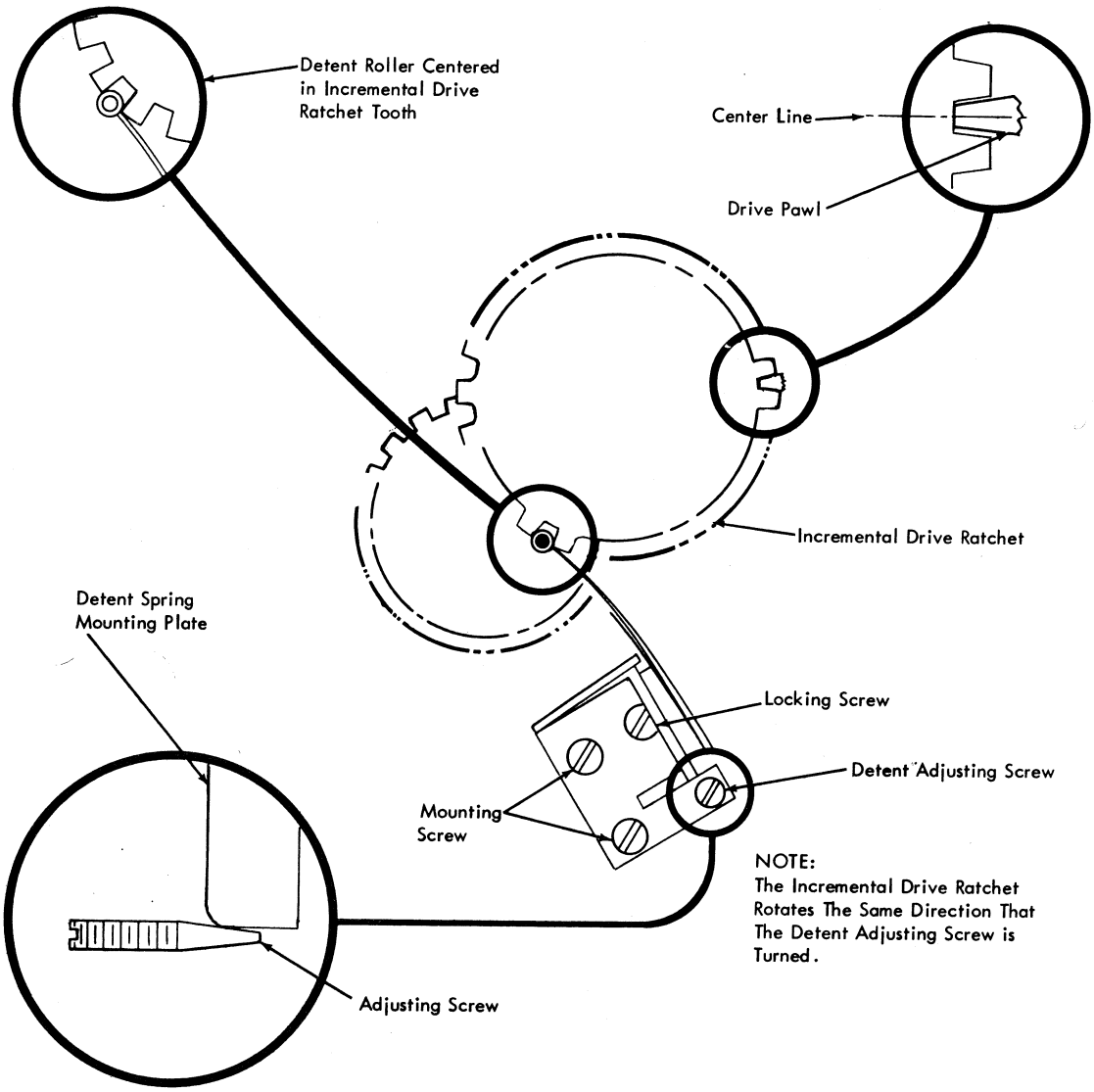


Figure 4-48. Incremental Drive Ratchet Detent Adjustment

9. Remove timing pin and adjust the pawl by means of its eccentric screw for the same drive pawl to ratchet wheel movement as before. Recheck the adjustment after tightening the locking screw.
10. Advance incremental drive gear two marked teeth and recheck and readjust as before. Also check for the best possible adjustment on the two low dwells at the three other positions on the ratchet wheel.
11. Remove the rubber bands and check for .001" - .002" latching clearance on each latch arm, adjust if required.

Incremental Drive Unit

Refer to Figure 4-49 for the following procedure.

Removal

1. Remove punch unit.
2. Remove incremental drive magnet assemblies. Take care not to lose armature return springs.
3. Remove incremental drive emitter coil bracket.
4. Remove cam follower springs.
   DANGER: This spring is under considerable tension and could fly out and cause injury. When removing springs, remove screw on end of spring bracket first, then slowly loosen the retaining bracket screw. This will permit spring tension to dissipate as bracket pivots.
5. Remove incremental drive unit by removing three mounting screws.

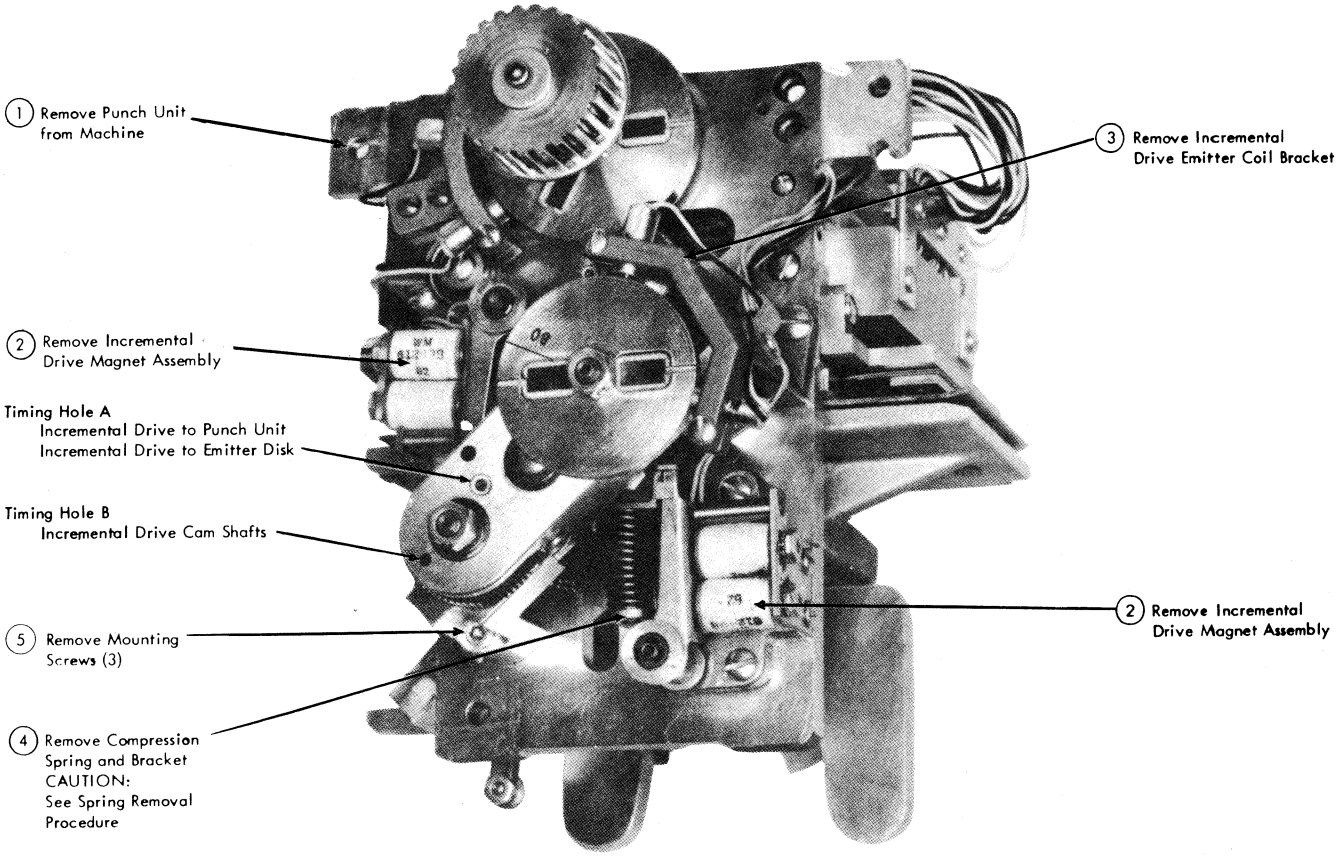


Figure 4-49. Incremental Drive Unit Removal

Replacement

1. Replace incremental drive unit. Position the incremental drive unit casting for .001" to .004" backlash between interposer cam gear and upper incremental drive gear. Adjust by pivoting the casting so ratchet wheel bearing remains in alignment with recess in ratchet wheel.
2. Replace the rest of the components in the reverse order of removal.
3. Adjust incremental drive emitter coil bracket for one IBM card thickness between coil cores and emitter disk.
4. Adjust incremental drive detent and pawls.
5. Adjust incremental drive magnets and latch arms.
6. Time incremental drive unit to punch unit.
7. Adjust incremental emitter timing and duration. See base machine maintenance manual.

Incremental Drive Eccentric Shaft

When the incremental drive cam follower arm pivot bearings require replacement, the entire follower arm assembly should be replaced. See Figure 4-50.

Removal

1. Remove incremental drive unit. Refer to Servicing Procedures, Incremental Drive, Removal.
2. Remove incremental emitter disk.
3. Rotate incremental drive until timing marks on upper camshaft gear and eccentric shaft drive gear line up. Timing holes in upper and lower camshaft drive gears must also be in alignment with timing holes B and C in drive housing. Insert timing pins in holes B and C (Figure 4-50).
4. Remove bearing retainer screw from front of eccentric drive shaft.
5. Remove two eccentric drive shaft rear bearing retainer screws.
6. Pull eccentric shaft with cam followers out of the housing as an assembly. Watch for gear key and spacer.

Replacement

1. Replace shaft assembly. Gear key must be installed in shaft and aligned with key slot in gear.

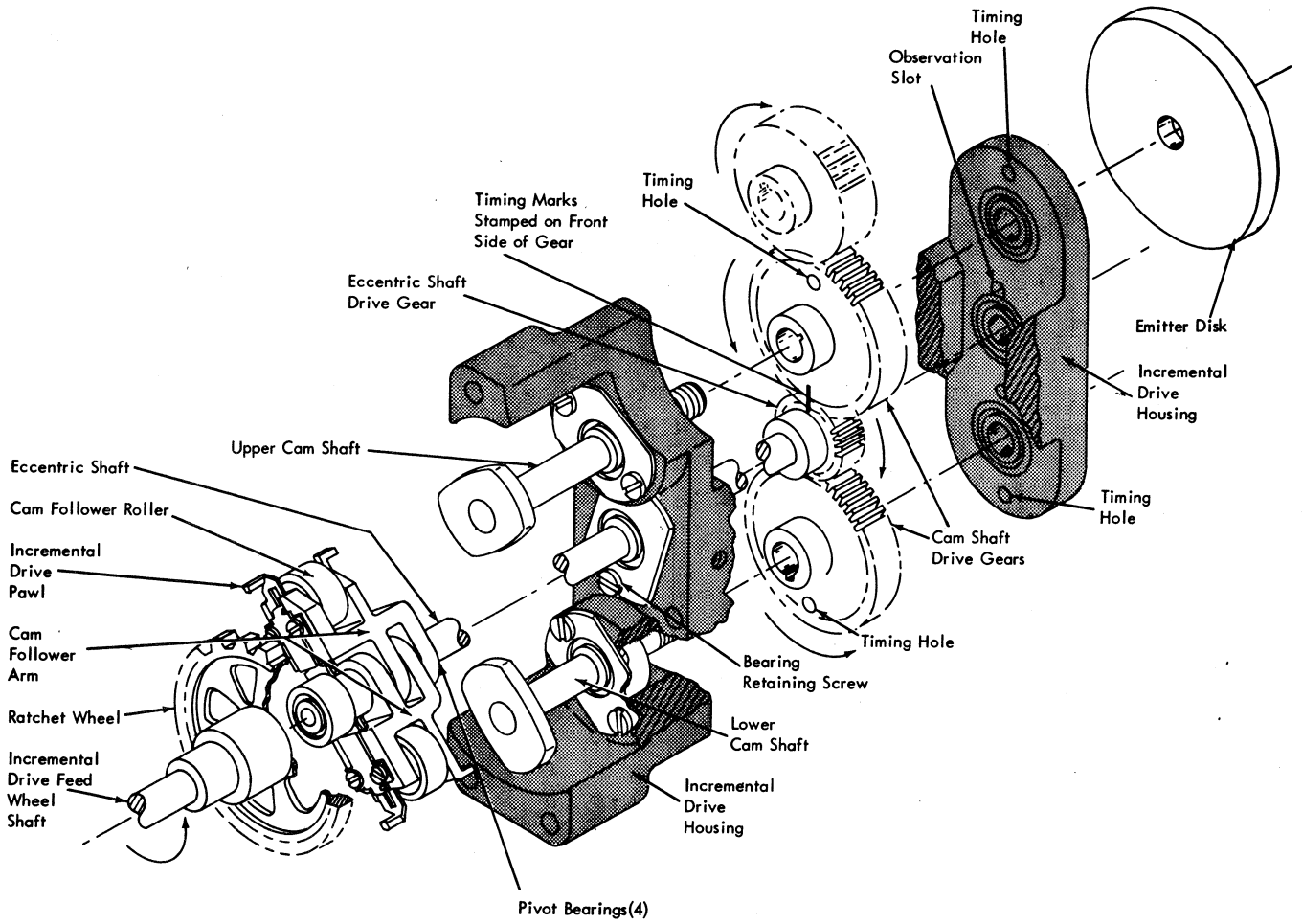


Figure 4-50. Incremental Drive

2. Check to see that upper and center gear timing marks are lined up (observe through bearing bore). Position washer above gear and install outer bearing.
3. Replace bearing retainer screw.
4. Remove timing pins.
5. Replace incremental drive unit.
6. Replace and time emitter disk.
7. Check incremental drive adjustments.
8. Install punch unit.

Incremental Drive Camshafts

Removal

The removal procedure for the upper camshaft, and the lower camshaft is the same, except for the emitter disk. Refer to Figure 4-50 for location of components.

1. Remove incremental drive unit. Refer to Servicing Procedures, Incremental Drive, Removal.
2. Align timing marks on upper and center gears. Also align timing holes in upper and lower gears with timing holes B and C in housing. Insert timing pins in holes B and C.
3. Remove upper cam wiper.
4. Remove locking nut on front end of upper camshaft.
5. Remove emitter disk and spacers.
6. Remove two rear bearing retainer screws.
7. Pull camshaft and rear bearing out of housing from rear. Watch for key and spacer.

Replacement

1. Slide camshaft into place making certain that gear key and spacer between gear and front bearing are installed properly.
2. Check upper and center gear timing marks for alignment. Remove timing pins.
3. Replace incremental drive unit.
4. Replace and time emitter disk.
5. Check incremental drive unit adjustments.
6. Install punch unit.

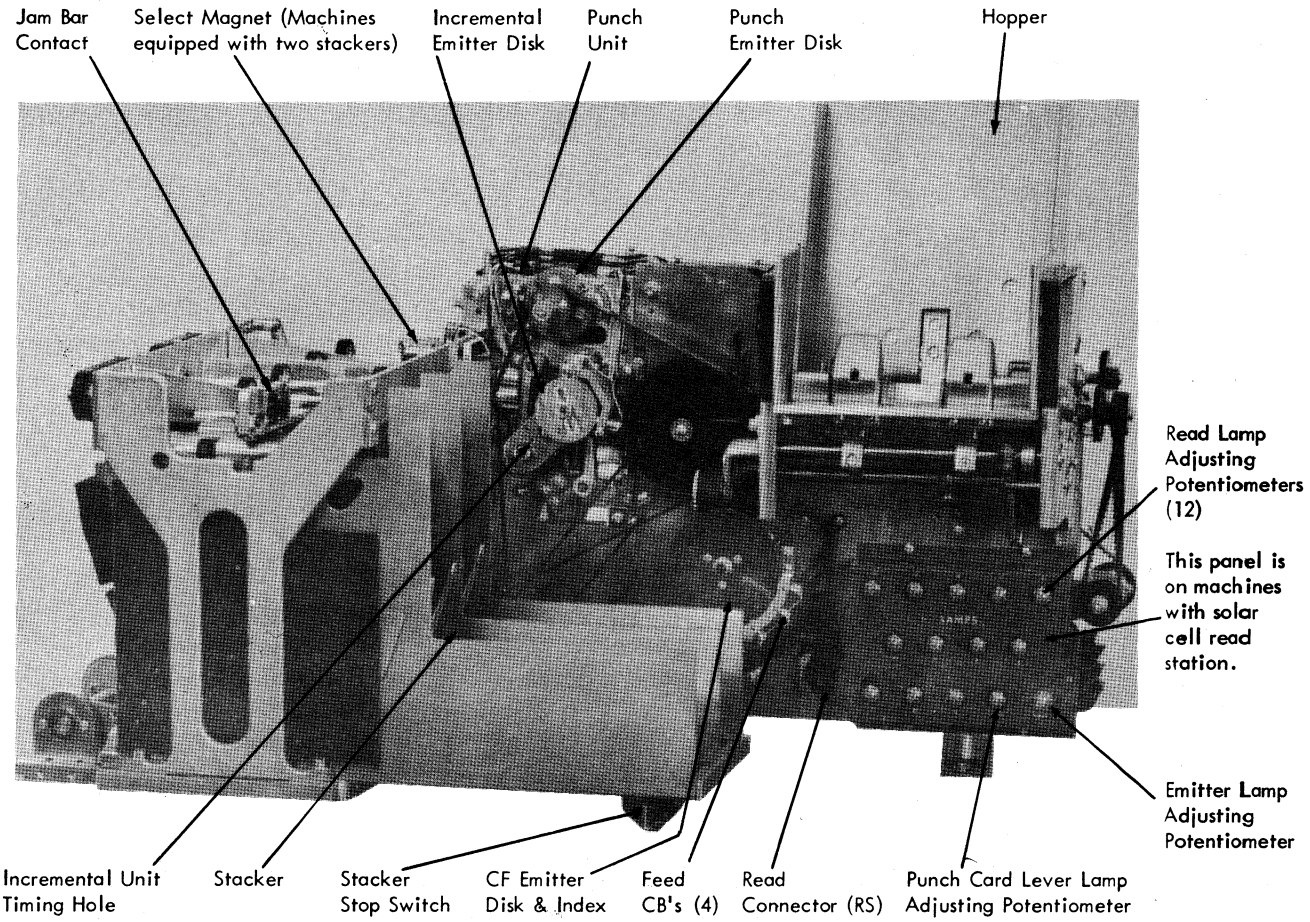


Figure 5-1. Serial Reader Punch, Front View

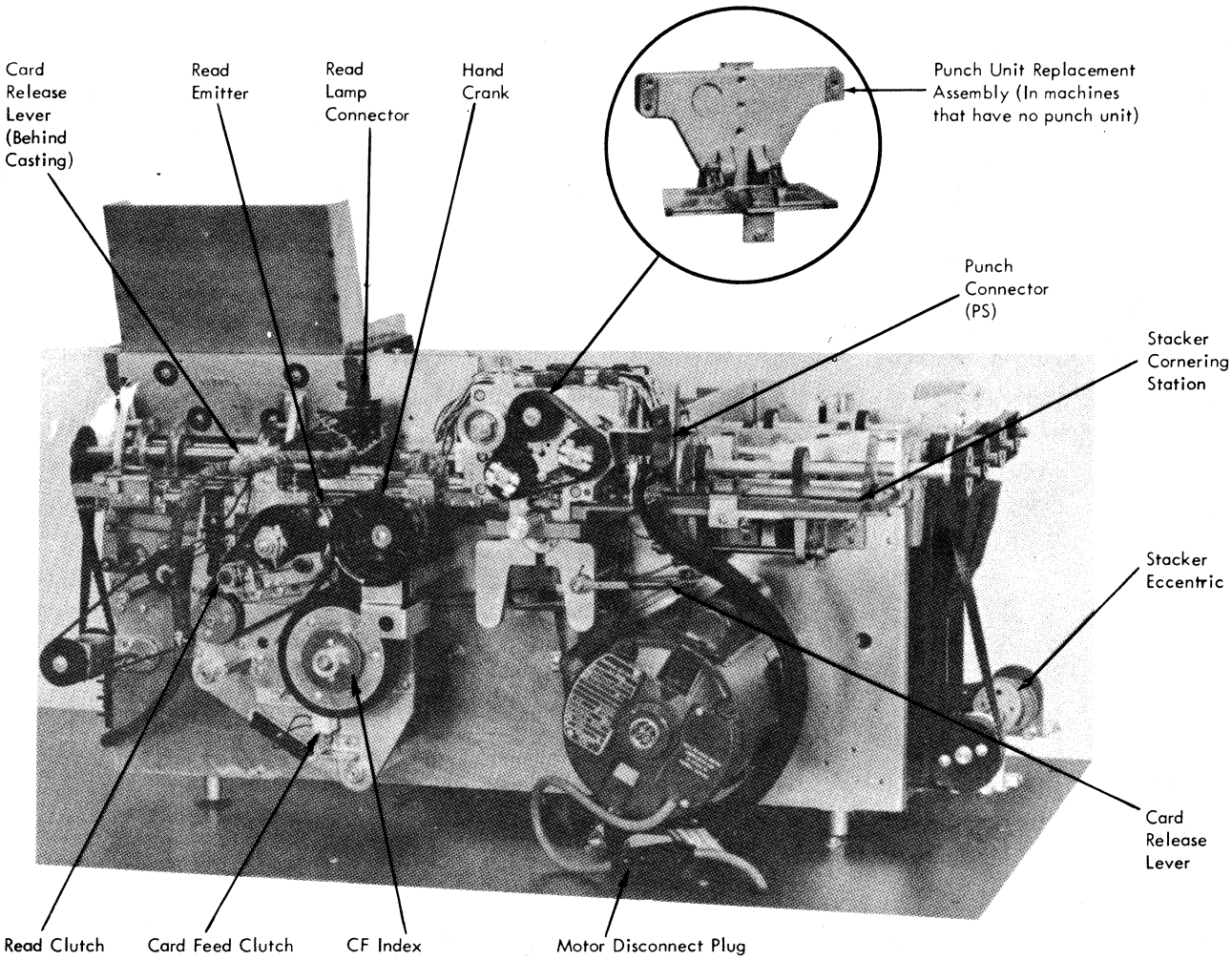


Figure 5-2. Serial Reader Punch, Rear View

*See base machine maintenance manual for these items.

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