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**1402** Card Read-Punch

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**IBM** Customer Engineering Instruction-Reference  
**1402 Card Read-Punch**

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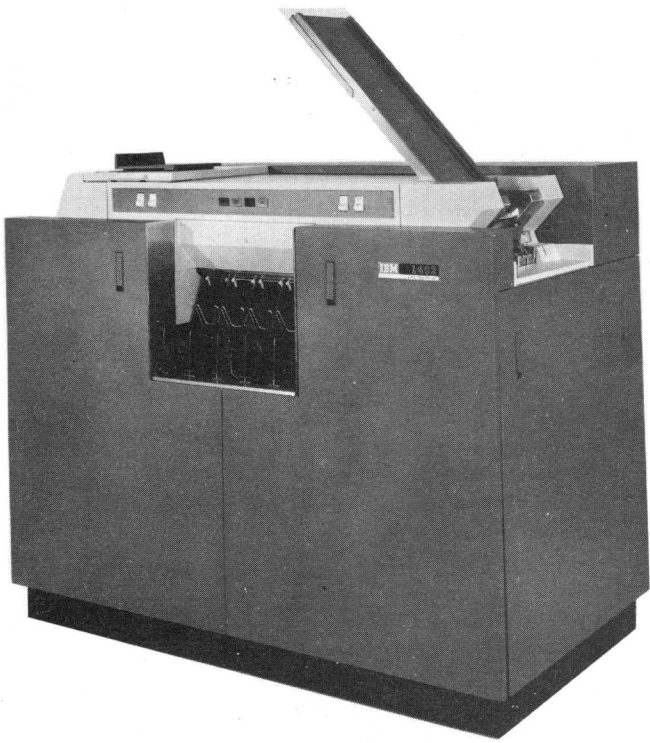
This manual, Form Number 231-0002-2, is a major revision of the preceding Form 231-0002-1. Many minor changes and additions have been made. Major revisions include new punch feed, transport, and brush timing procedures, the addition of solar cell CB instructions and adjustments, and a more complete coverage of belt replacement and retiming procedures.

This manual, Form 231-0002-2 makes obsolete Forms 231-0002-0 and 231-0002-1.

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IBM 1402 Card Read-Punch

## INTRODUCTION

The IBM 1402 Card Read-Punch provides the 1401 data processing system with a punch card input and output. The read feed is a 20 cycle-point feed equipped with a file feed which has a capacity of 3600 cards. The read feed can process cards at a speed of 800 cards per minute. The punch feed is a 16 cycle-point feed which can punch cards at 250 cards per minute. Five radial stackers are used to accomplish stacking of the cards from both feeds. The read feed and the punch feed are located at opposite ends of the machine so that cards are fed from the read feed and the punch feed into a transport assembly above the stackers. The card transport system is driven by timing belts wherever possible to reduce machine noise and maintenance. Power supplies for other machines of the system are located in the 1402.

### FUNCTIONAL PRINCIPLES

The 1402 Card Read-Punch can read cards at a maximum speed of 800 cards per minute. Actual card speed is governed by the program routing. The read feed is equipped with a 3600 card capacity file feed. The cards are fed through the read feed, 9 edge first, face down. The card path is illustrated in the feed schematic diagram (Figure 1-1). As the card passes the read check brushes, 80 columns of the card are read to condition the hole count check planes in the 1401. It is then moved past the read brushes where again 80 columns of the card are read and entered into the read area of core storage. At the same time the check planes are conditioned so that a hole count check may be completed. Next, it is transported past the stacker selection station and is directed to the appropriate stacker under control of programming. Three stackers are available to receive cards from the read feed. The NR (normal read) stacker is used unless the cards are program-directed to stacker 1 or stacker 2 (8/2).

The 1402 Card Read-Punch will punch cards and check card punching at a maximum speed of 250 cards per minute. Cards are placed in the 1200 card capacity hopper, 12 edge first, face down. Card feeding is illustrated in the feed schematic diagram (Figure 1-1). As the card passes the Punch Feed Read (optional feature), 80 columns of the card are read into the read areas of core storage of the 1401 if PFR is called for. Before the card is punched, it is aligned at the aligner station both vertically and horizontally to insure correct punching registration.

Punching is done by a high-speed punch unit. As the card passes the punch station, circuits are set up in the 1401 which allows the card to be punched with information contained in the punch area of core storage. At the same time the check plane cores are conditioned so that a hole count check may be performed. After the card is punched, it is read at the 80 column punch-check brushes to condition the check plane cores so that a hole count check may be completed. It is then moved past the stacker selection station and is directed to the appropriate stacker under program control. Three stackers are available to receive cards from the punch feed. The NP (Normal Punch) stacker is used unless the cards are program-directed to stacker 4 or stacker 8 (8/2). The 8/2 stacker cannot be used for collating between the punch and read feeds.

The card transport assembly located between the punch feed and the read feed has a set of six feed rolls along with two select magnets and chute blades for the read feed as well as two select magnets and chute blades for the punch feed. A jam bar is located in the transport assembly to provide an indication of a jam and stops the machine when a card jam occurs (Figure 1-2).

All stackers are the non-stop unloading radial type stackers with a capacity of 1000 cards each. Cards can be removed from the stackers without

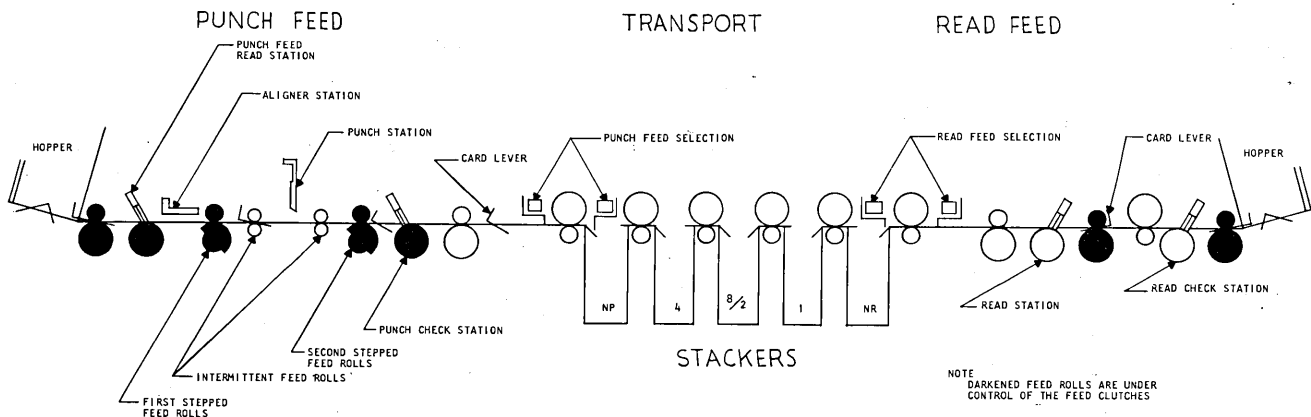


Figure 1-1. 1402 Feed Schematic

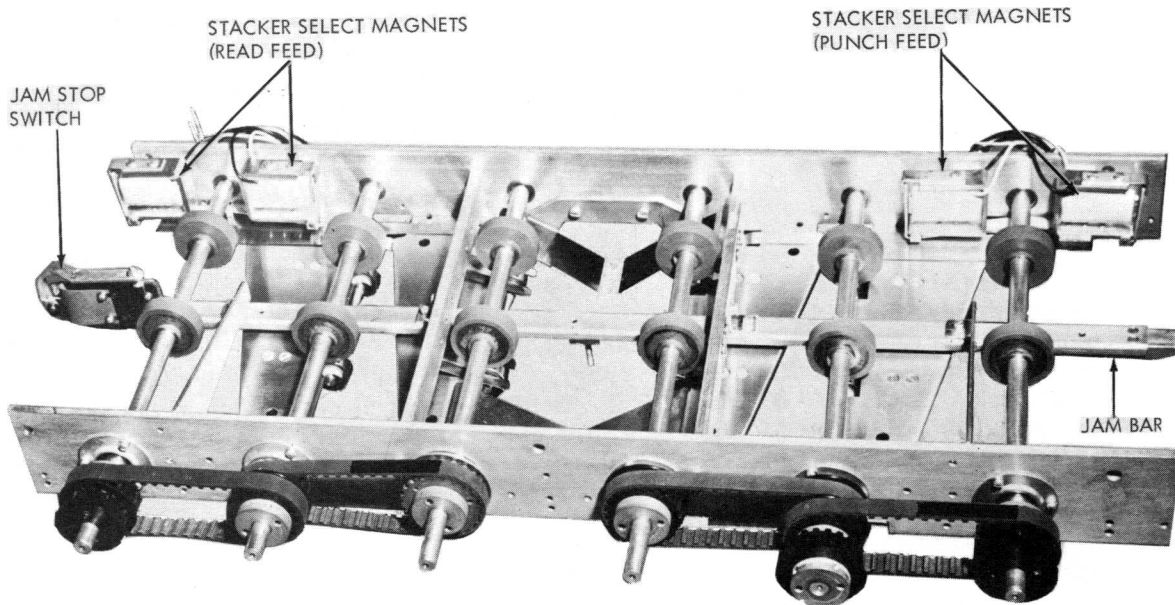


Figure 1-2. Transport Mechanism

stopping the machine. Two stackers are assigned exclusively to the punch feed. The center (8/2) stacker can be used by either unit, but it must be assigned by the program to one or the other, in any one run (Figure 1-3).

Both feeds are equipped with jam and misfeed detention devices.

#### OPERATING LIGHTS AND CONTROLS (Figure 1-4)

**Read Switch:** Controls the read section of the machine. When this switch is off, the read feed is inoperative.

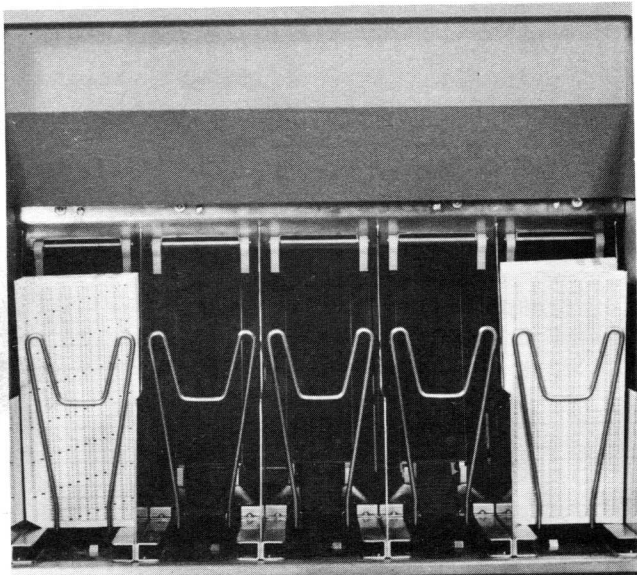


Figure 1-3. Radial Stacker

**Punch Switch:** Controls the punch section of the machine. When this switch is off, the punch feed is inoperative by program control. Cards can be run into the punch feed with the punch switch off by use of the non-process runout punch switch.

**Start Switch:** Causes the read feed motor to start when the read switch is on. Punch motor will start if punch switch is on.

**Stop Switch:** Used to stop the system. If a program instruction is in process, it is completed before the stop occurs.

**Non-Process Runout-Read Switch:** Used to run cards out of the read feed. The last two cards run out will not be processed. The read hopper must be empty to make this switch effective.

**Non-Process Runout-Punch Switch:** Used to run cards out of the punch feed. The last two cards will not be punched. When the punch switch is on, the hopper must be empty to make this switch effective.

**Load Switch:** Used to start loading instruction cards. Pressing the load key causes the read feed to operate until a card has passed the read brushes. After the card is read at the read brushes, the program can start and execute the instruction that is punched in the card. Continued operation is under control of programming. When the punch switch is on, pressing the load key causes the punch drive motor to run.

**Check Reset Switch:** Must be pressed to reset an error indication before the start key can become operative. This switch is operative only when the feed, in error, is empty of all cards.

**Power Light:** When power is supplied to the read-punch unit, this light is on.

**Reader Stop Light:** A feed failure or a card jam in the read-feed causes the machine to stop and the reader-stop light to come on.

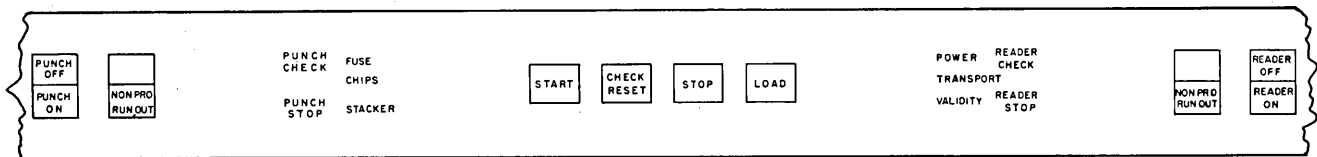


Figure 1-4. Operating Controls

**Punch Stop Light:** A feed failure or a card jam in the punch feed causes the machine to stop and the Punch Stop light to come on.

**Validity Light:** This light comes on if an invalid character is detected during read operation.

**Reader Check Light:** This light comes on under control of the data processing system when an error is detected during card reading.

**Punch Check Light:** This light comes on under control of the data processing system when an error is detected during the punching of a card.

**Stacker Light:** If any of the five stackers become full, the stacker light goes on and the machine stops. The light may come on shortly before the machine stops.

**Transport Light:** This light is turned on by the jam contact. It indicates that a card has jammed in the transport feed roll area.

#### FUNCTIONAL SWITCHES

**Cover Interlocks:** When a cover is opened, the respective interlock switch will open the circuit to the punch and reader, motor and run circuits.

**Punch Magazine Interlock:** When the magazine locking lever is opened, this switch opens the circuit to the punch motor and motor start relays.

**Die Lift Interlock:** This switch provides the same function as the magazine interlock when the lowering frame is lowered.

**Crank Interlock:** This is a manually operated switch which must be turned off to insert the hand crank. It provides the same function as the magazine

interlock while using the hand crank.

**Die Interlock:** This switch provides the same function as the magazine interlock when the die is removed or improperly located.

**Stacker Switch:** This switch operates when any of the 5 stackers are filled. When transferred, it opens the circuit to the punch and reader, start and run circuits. It also closes the circuit to the stacker indicating light when transferred.

**Jam Bar Switch:** When a jam occurs, this switch provides the same function as the stacker switch except that it completes a circuit to the transport light when transferred.

**Joggle Switch:** This switch is operated when the hinged front joggler assembly is opened. It opens the circuit to the reader motor control relay.

**Chips 1 and 2 Switches:** These switches operate when the chip box is full or removed from the machine. Operation of either switch will open the punch motor and run circuits as well as light up the "chips" indicating lamp.

#### SPECIFICATIONS

##### Dimensions:

57 1/2" wide

29 3/4" deep

45 1/4" high (plus read file feed 14 5/8")

##### Weight:

1300 lbs

##### BTU Rating:

3,500 BTU



## READ FEED

### DRIVE MECHANISM (Figure 1-1)

A 1/4 hp motor drives the input pulley on the read feed. The following are kept continuously running:

1. Timer index
2. Clutch ratchet
3. Two contact rolls
4. First feed roll after each contact roll
5. Continuously running CB/s (RC)
6. File feed drive shaft
7. Three transport feed rolls
8. Stacker jogglers for NR, 1 and 8/2 pockets.

When the read clutch engages, power is transmitted to the following:

1. Picker knife cam shaft
2. Feed knives
3. First feed roll before each contact roll
4. Clutch controlled CB's (RL) and solar cell CB (if installed)

### Speed

Adjust the motor pulley to feed cards 800+ 3-20 cards per minute.

### READ CLUTCH

#### Principles of Operation

The clutch ratchet is continuously running and makes one-half revolution each machine cycle. This ratchet is engaged by a drive dog and detent, which are controlled by the action of the drive arm and intermediate arm.

The dog and detent are spring-loaded to engage the ratchet. They pivot on studs that are part of the drive arm and are controlled by studs that are part of the intermediate arm. The intermediate arm pivots on a sleeve that is the hub of the drive arm (Figure 2-3).

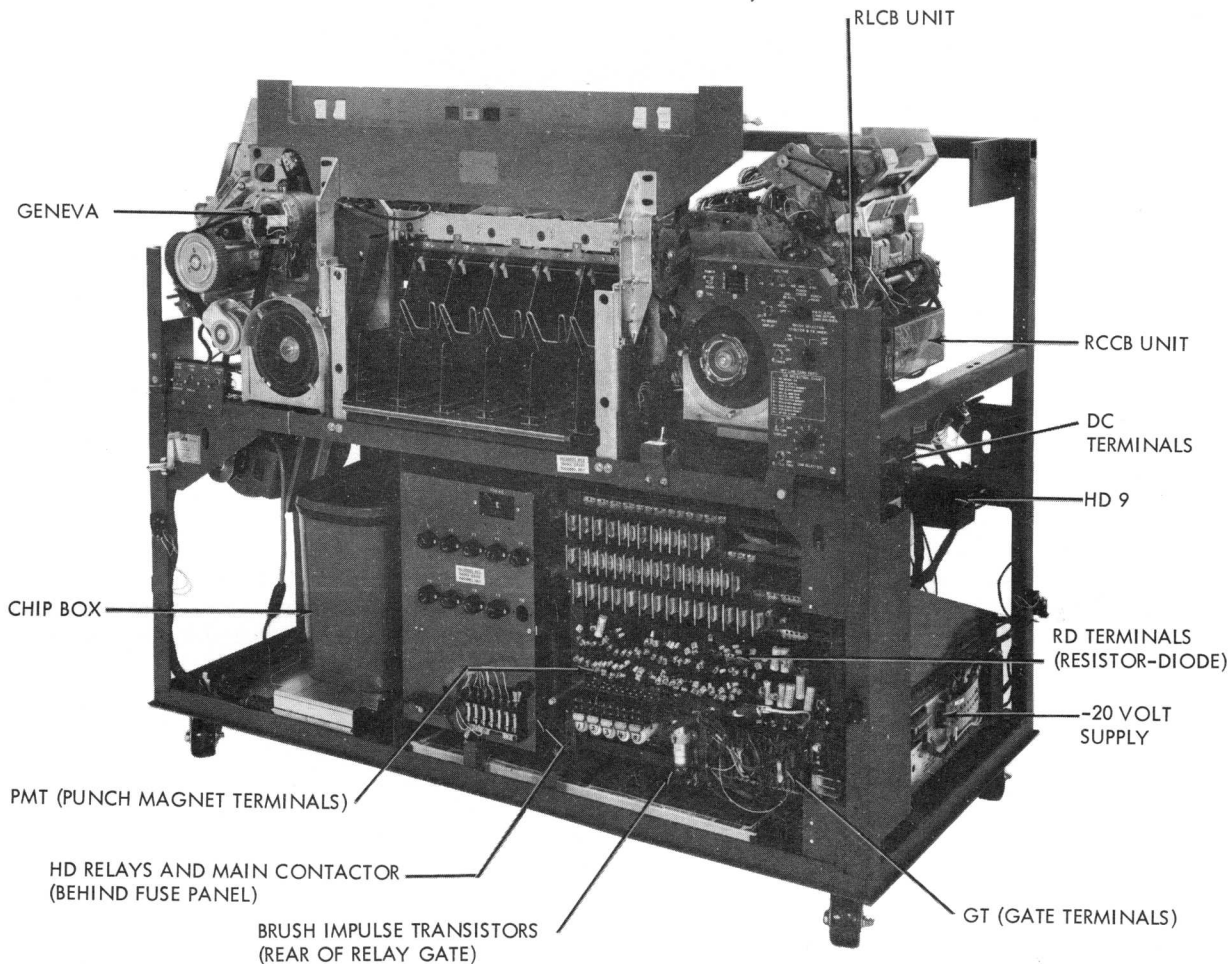


Figure 2-1. 1402 Front View

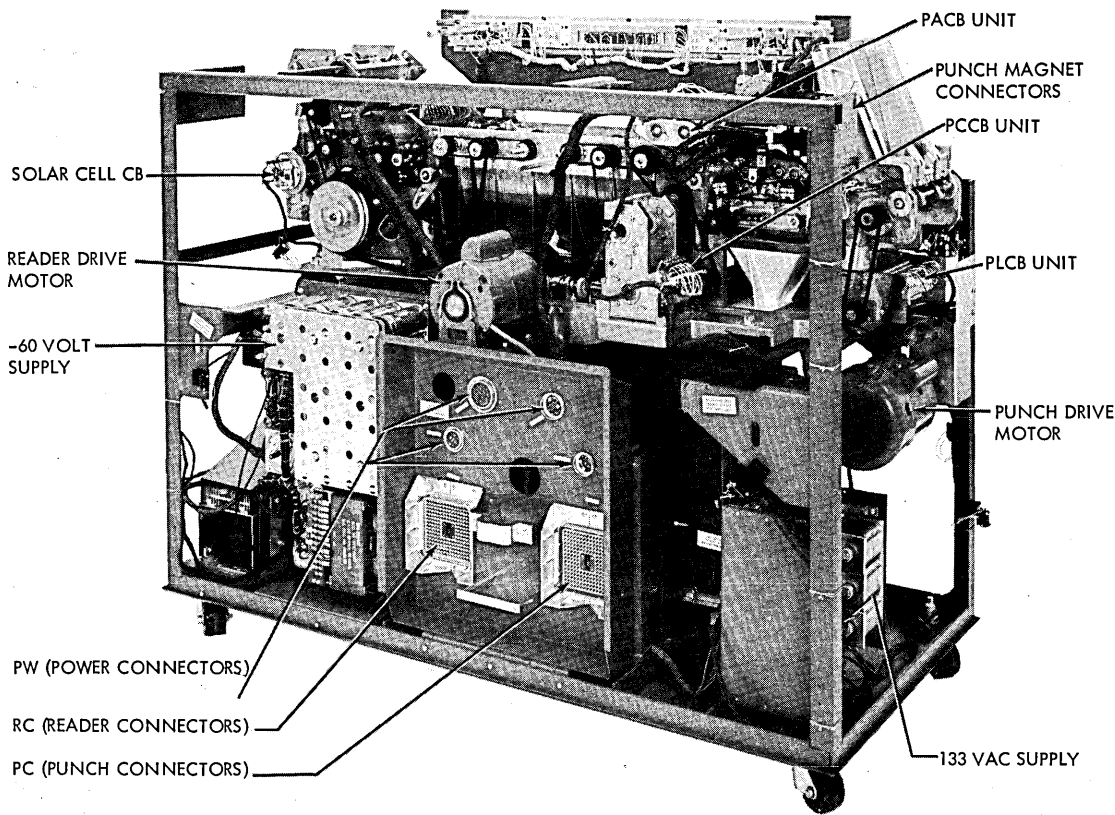


Figure 2-2. 1402 Rear View

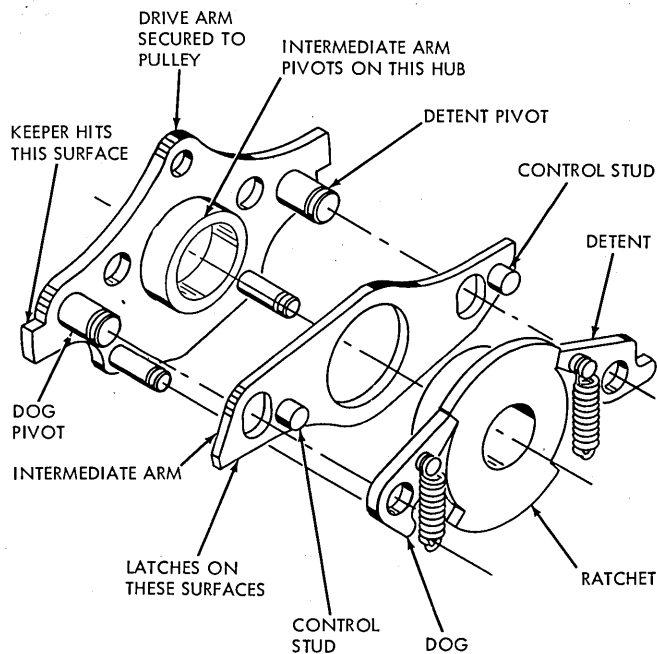


Figure 2-3. Clutch Assembly

To see the engaging action of the clutch, assume the clutch is latched as shown in Figure 2-4.

Impulsing the magnet releases the latch and allows the intermediate arm to move in relation to the drive arm. The intermediate arm moves clockwise due to the spring-loaded dog and detent exerting force on the control studs. As the intermediate arm moves, the dog and detent are allowed to engage the ratchet and rotate the mechanism that drives the feed knives and controlled feed rolls.

Unless the clutch magnet is again impulsed, the clutch will disengage when the opposite end of the arm strikes the latch. The intermediate arm, having moved clockwise in relation to the drive arm, will strike the latch first. The drive arm continues to move, and in so doing, causes the dog and detent to be cammed away from the ratchet by the motion of the pivot studs with reference to the control studs on the intermediate arm. Inertia carries the drive arm forward to strike the latch, and the keeper falls behind it to hold the clutch latched at 315°.

#### Clutch Adjustments

The read clutch may be adjusted either in the machine or with the clutch drive unit removed from the base. Steps 1 through 4 should be performed when a new

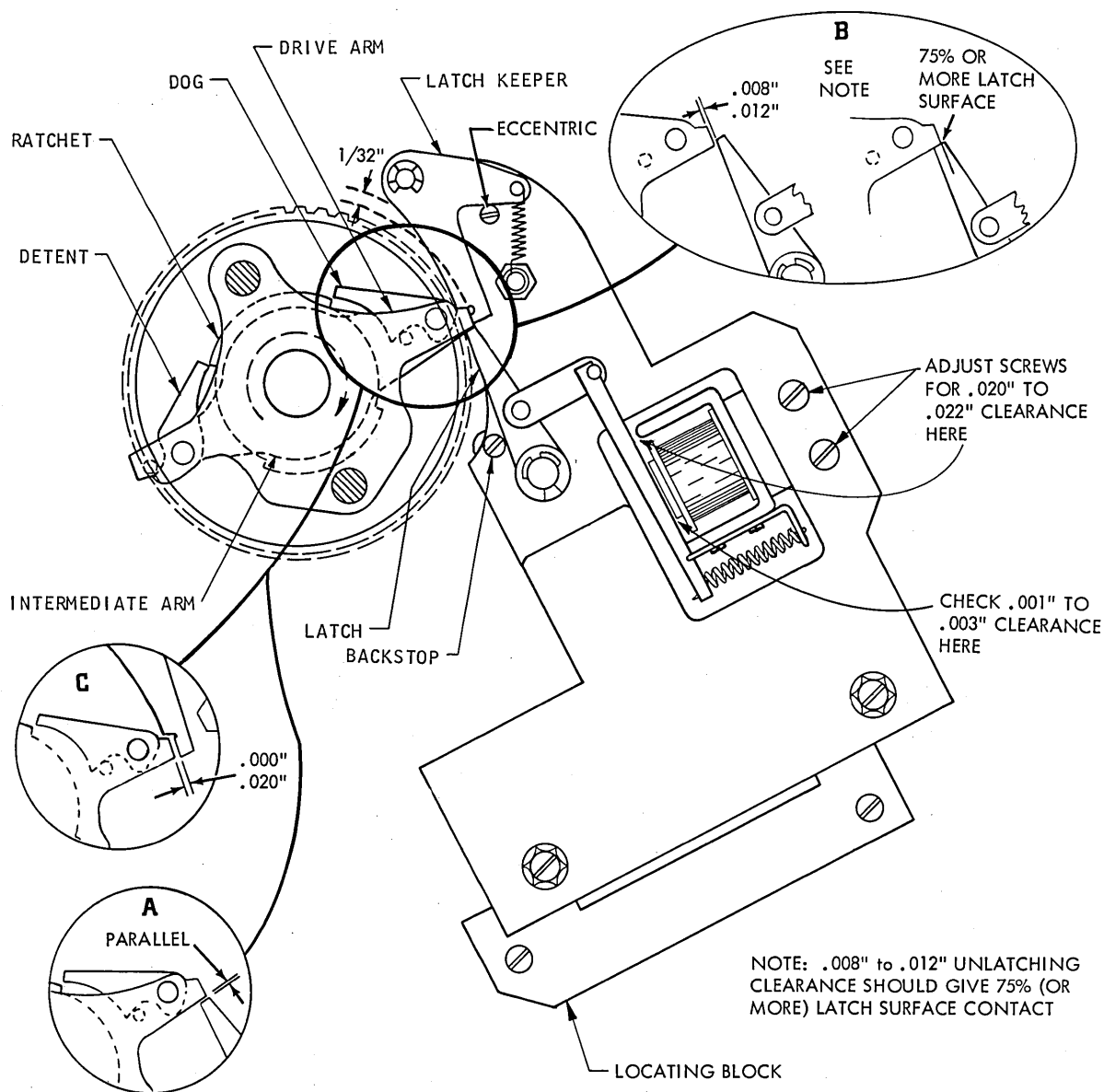


Figure 2-4. Magnet Assembly Adjustments

clutch assembly is installed or when complete adjustment is to be made of the center plate assembly and clutch magnet assembly. When this is to be made, the read clutch locating plate gage (P/N 610147) must be used.

NOTE: Use of this tool will insure a parallel condition between drive arm latch surface and the latch at latch-up time (Figure 2-4A).

Proceed to step 5 for the armature, latch, and magnet adjustments.

The following sequence is used to adjust the clutch:

1. Remove clutch pulley as described in Clutch Pulley Assembly Removal Procedure.
2. Remove latch keeper and latch from center plate assembly.
3. Position locating gage on center plate assembly studs and clutch pulley assembly shaft (Figure

2-5). Position and secure locating block with center plate assembly as far left as possible. Remove gage.

4. Reinstall latch keeper, spring, and latch. Follow Clutch Pulley Assembly Procedure for re-assembly of clutch pulley assembly.

5. Adjust armature pivot bracket to maintain .002" to .005" clearance between armature and core (Figure 2-4).

6. There should be .020" to .022" clearance between armature and yoke with latch against backstop (Figure 2-4).

7. Manually attract the armature and position the latch assembly plate for a .008" to .012" unlatching clearance between the latch and the clutch drive assembly. Tighten center plate assembly mounting screws. At this time, there should be at least 75% of the latch contacting the drive arm assembly in a



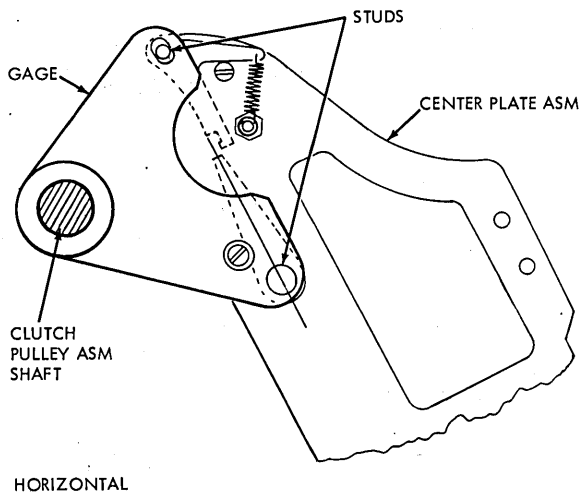


Figure 2-5. Latch Assembly Plate Alignment

latched condition (Figure 2-4B).

NOTE: Be sure to keep plate against locating block.

8. Loosen locating block mounting screws and position locating block as far right (ear of locating block against the plate) as possible. Lock mounting screws.

9. Adjust eccentric keeper stop stud to obtain .000" to .020" between clutch drive arm and latch keeper (Figure 2-4C) at latch time.

10. Check for .002" clearance between the step on the ratchet and detent (backlash) with clutch engaged. If there is more than .002" clearance replace with a longer detent.

NOTE: Seven new detents (P/N 609737 through 609743 are available. These detents are etched 1 through 7. Detent #1 is .002" longer than the original and #2 is .002" longer than #1, etc.

### Clutch Timing

This adjustment insures that the read feed dynamic timer is in time with the clutch at engaging time.

1. Block the clutch armature attracted.
2. Crank machine and listen or feel for latch keeper to fall behind drive arm. This should happen at  $315^{\circ} \pm 1^{\circ}$ .
3. If the index is not at  $315^{\circ} \pm 1^{\circ}$  when the latch keeper falls behind the drive arm, loosen the clamped hub on the index drive shaft and turn the index to  $315^{\circ}$ .
4. Tighten the clamped hub.
5. If the timer index is moved, the brush timing and CB timing will have to be checked.

### Clutch Pulley Assembly Removal (Figure 2-6)

The clutch pulley includes the dogs and arms that operate them. Remove the pulley as follows:

1. If the same clutch assembly is to be used, spot mark the clutch pulley and the picker knife cam shaft pulley to the belt. (This is to retain RLCB's, Solar CB, and picker knife timing.)

2. Remove file feed drive belt.
3. Loosen idler for clutch pulley belt.
4. Remove grease fitting on ends of clutch shaft.
5. Loosen retaining clamp and remove clamp and file feed drive pulley together.
6. Remove clutch pulley drive belt.
7. Remove clutch pulley assembly. It may be necessary to loosen V-belt input pulley and move it towards the end of its shaft.

### Clutch Pulley Assembly Installation

When a new clutch pulley assembly is installed, the entire procedure listed under Clutch Adjustment should be performed after the following steps have been completed:

1. Be certain that two thrust bearings (washers) are on shaft against clutch ratchet.
2. Install clutch pulley, operating the arms so that the detent and dog fit into high dwell of ratchet.
3. Place two thrust bearings against clutch pulley.
4. Install clutch retaining clamp (and file feed pulley), allowing no end play of pulley.
5. Install clutch pulley belt with spot marks lined up and adjust idler.
6. Install grease fitting and file feed drive belt.
7. Reposition V-belt input pulley, if moved.
8. Check picker knife timing, RLCB's timing, and solar CB timing.

### Clutch Drive Removal (Figure 2-6)

1. Scribe lines along one end and side of unit to maintain front to rear and side to side location.
2. Remove dynamic timer index as follows:
  - a. Remove screw from hand crank.
  - b. Remove two screws from index base.
  - c. Loosen clamped hub on index shaft.
  - d. Unplug index cable.
3. Remove four drive belts.
  - a. Contact roll drive (front).
  - b. File feed drive (rear).
  - c. Motor drive (rear).
  - d. Clutched feed roll drive. Loosen belt take-up pulley bracket (idler).
4. Remove clutch magnet leads at terminal block.
5. Remove four hex-head clutch drive assembly mounting screws.
6. Remove assembly through rear.

### Clutch Drive Installation

1. Set drive assembly in position from rear.
2. Install four drive assembly mounting screws; do not tighten.
3. Position clutch drive assembly on scribed lines. Tighten mounting screws.
4. Install dynamic timer index (leave clamped hub loose).
5. Set index to  $315^{\circ} \pm 1^{\circ}$ , block armature and turn

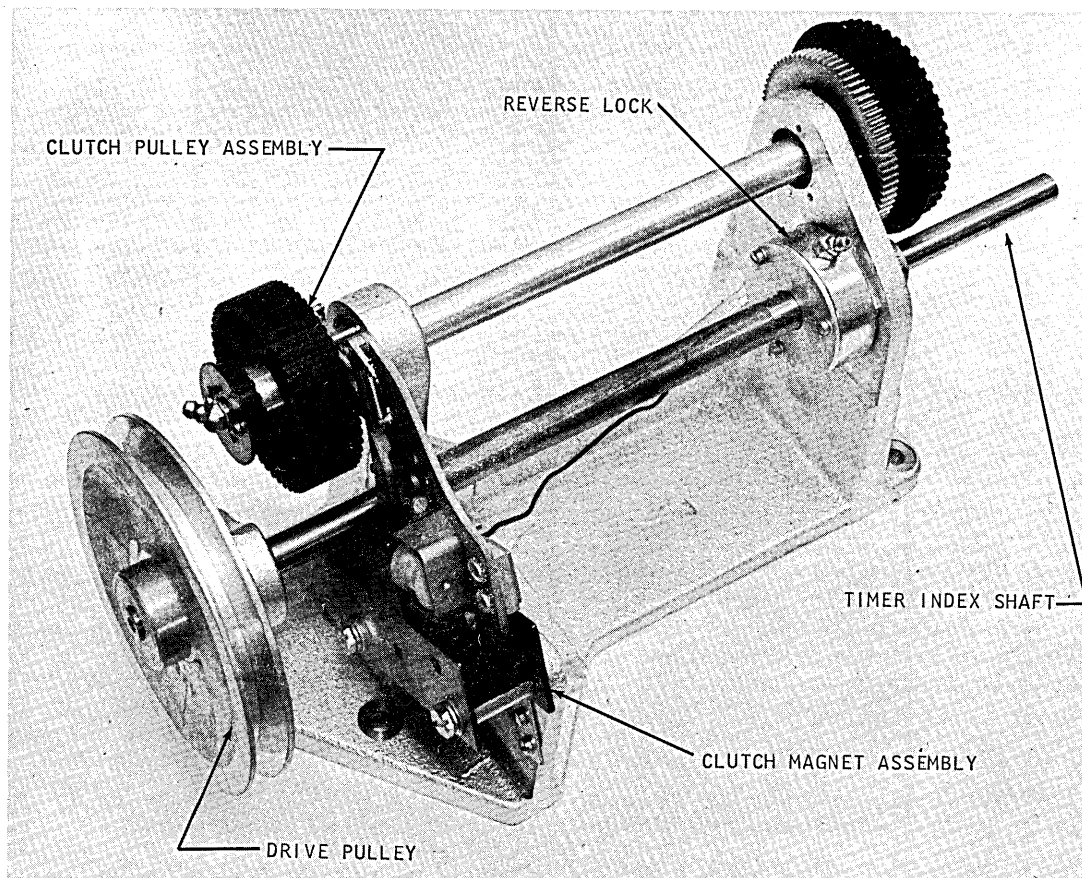


Figure 2-6. Clutch Drive Assembly

machine until detent keeper falls behind drive arm. Tighten clamping hub.

6. Install clutch drive belt and adjust idler pulley. At this time loosen the picker knife camshaft pulley locking screws.

7. Timing the picker knife camshaft can be accomplished by tripping the read clutch and setting the timer at  $216^{\circ}$  for a 2 group brush machine or  $212^{\circ}$  for a 3 group brush machine. Place a card in the hopper up against the first feed rolls. Turn the cam shaft in the normal machine direction until the feed knives touch the card. Tighten the pulley lock screws. This is a starting point for brush timing. Refer to wiring diagram for the final brush timing. Change the picker knife camshaft for the proper brush timing by slipping the drive pulley on the cam shaft.

8. Time RC CB's, using the set screw retained gear on the RC CB shaft.

9. Install the other three belts and unblock the clutch armature.

10. Check the following timings:
- a. Clutch engagement time ( $315^{\circ} \pm 1^{\circ}$ ).
  - b. Brush impulse CB timing.
  - c. RC CB timing.
  - d. RL CB timing.

## FILE FEED

### Principle of Operation (Figure 2-7)

The file feed consists of two basic units:

1. Upper magazine.
2. Lower magazine.

The upper magazine is the tray which holds up to 3600 cards to be fed into the hopper. This tray is hinged and can be locked at an angle to make the brush area of the machine more accessible.

The lower magazine contains clutch controlled feed rolls that feed the cards into the hopper. Operation of the helical spring-type feed roll clutch is controlled by the level of the cards in the hopper. Under spring tension, the front joggler applies pressure on the joggler operating lever, causing the lever to follow the contour of the front joggler cam. As the front joggler cam rotates, the front joggler oscillates, joggling the cards into position. If there are sufficient cards in the hopper to cover the sensing pads, the inward travel of the joggler is limited and the joggler control lever is not allowed to follow the low dwell of the front joggler cam. There will be no clutch action or cards fed down into the hopper at this time.

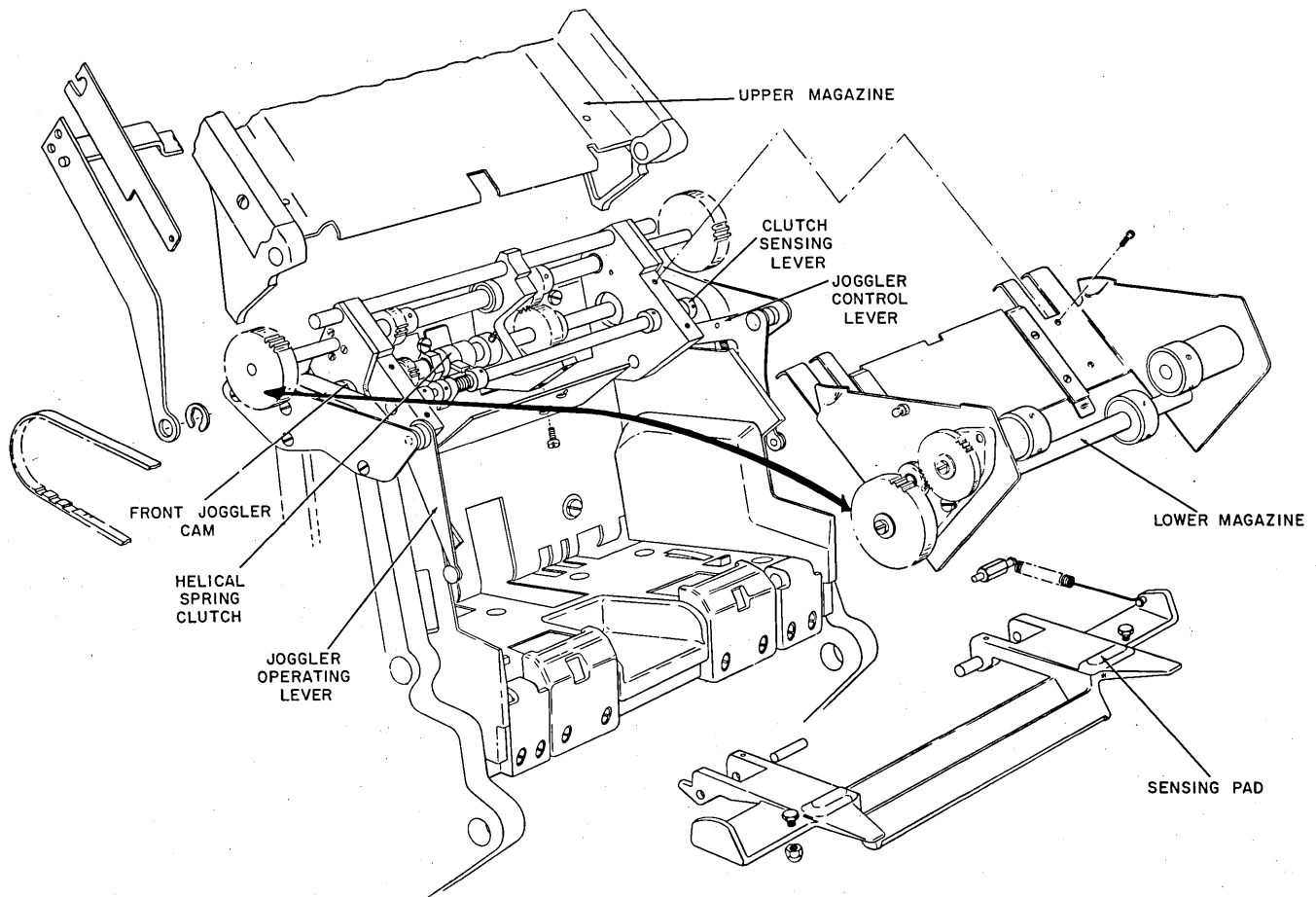


Figure 2-7. File Feed

When the card level drops below the sensing pads, the additional travel of the jogger forces the jogger operating lever to follow the low dwell of the front jogger cam. At this time, the tab on the jogger operating lever will cause the clutch operating lever to rotate counterclockwise, pivoting the clutch latch out of the step in the clutch sleeve. The helical spring grips the shaft, and the feed rolls are driven. Cards feed until card level in the hopper again reaches the sensing pads and then the clutch latches.

Cards are automatically front-and-side-joggled in the hopper. Correct operating joggler produce a deck with almost perfectly straight sides. The front jogger can be opened for insertion or removal of either cards or card weight.

The card weight is designed to pass through the lower magazine into the hopper and must be used to feed the last cards.

The front jogger interlock, mounted under the read hopper, renders the machine inoperative unless the front jogger is closed.

#### Clutch Adjustments

With the clutch latch against the latch step on the sleeve, loosen the split collar and rotate the collar

backwards (opposite normal direction) until stopped by the spring fully uncoiled inside the sleeve. While holding the split collar in this position, rotate the detent gear to  $1/16''$  past detent position. This should result in  $1/16''$  overthrow (Figure 2-8).

#### Clutch Removal

1. Remove covers and upper and lower magazines.
2. Remove drive unit from machine.
3. Remove rear pulley and front and rear jogger cams.

NOTE: Mark cams and shaft to maintain relationship.

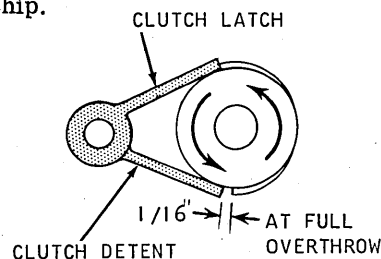


Figure 2-8. File Feed Clutch Adjustments

4. Remove rear bearing retainer plate.
5. Loosen side joggler cam, clutch hub (with grease fitting), and clutch drive gear on joggler cam shaft. These set screws are seated in undercuts on shaft and must be loosened a full turn. Slide shaft out of rear of unit.
6. Remove clutch assembly through bottom of unit. The clutch can now be dis-assembled and the spring removed.
7. Re-assemble in reverse order. Be careful to have the clutch latch and the detent in their correct positions, and the grease fittings over the slot in the shaft. The clutch drive sleeve and the side joggler cam should hold the clutch together, with the clutch in full mesh. The sleeve and the side joggler cam should hold the clutch together, with the clutch in full mesh. The sleeve and the side joggler cam should not squeeze the clutch so tightly as to cause binding when the clutch is latched. Check all drive unit adjustments after the unit is replaced in the machines.

### Service Checks

1. The front joggler interlocking arm should have approximately  $1/16''$  travel before contact makes.
2. The upper card deck support must be centered between the side frames.
3. The front joggler operating levers must be free of binds between the side plates and the lower magazine.
4. Hopper bed plate springs must be  $3/8'' \pm 1/16''$  above hopper bed plate.
5. Shims are available to shim the lower magazine if the speed nuts interfere with the helical spring clutch.
6. The lower magazine throat should be  $.020''$  to  $.040''$  above the imaginary plane determined by the tops of the feed rolls (Figure 2-9).

### Joggler Adjustments

#### Front Joggler

1. Turn the file feed drive unit until the front joggler cam followers are on the low dwells of the cams. Fill the hopper to just below the sensing pads on the front joggler and close joggler. Set the adjusting screws on the joggler to just touch the operating arms (Figure 2-10). Under these conditions there should be  $.003''$  to  $.010''$  clearance between the cards and the lower end of the joggling surfaces (the lower end of the joggling surfaces is in line with the top of the card feed knife posts). This clearance is obtained by adjusting the hopper post mounting bar with the set screw (Figure 2-10). The hopper posts will now have to be adjusted (Refer to Hopper Adjustments).

2. Turn the file feed drive until the front joggler cam followers are on the high dwell of the cams. Fill the hopper with cards to a level even with the top of the sensing pads and close the joggler. Hold the rear

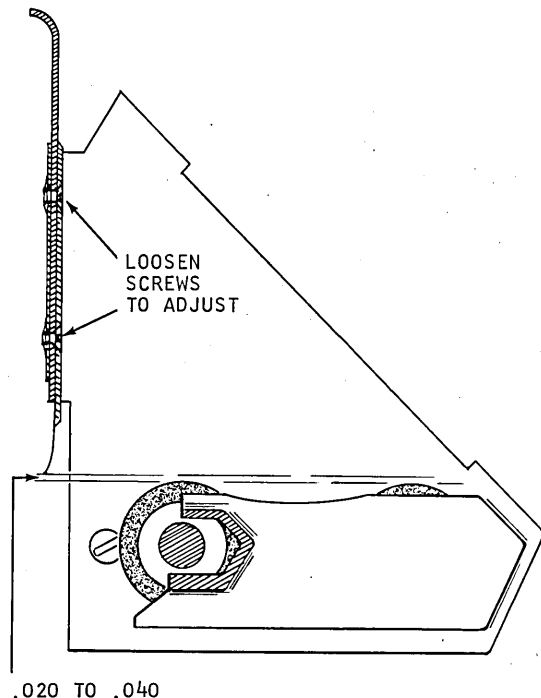


Figure 2-9. File Feed Adjustments

cam follower against the cam, and continue to operate the unit. Stop when  $.005''$  to  $.008''$  clearance appears between the cam follower arm and the adjusting screws. Loosen the clutch operating lever on its pivot shaft and fully seat the clutch latch. With the cam follower against the cam, position the clutch operating lever so that it just touches the turned over ear on the cam follower arm (Figure 2-10). Tighten the set screws in the clutch operating lever, securing it to its shaft.

#### Side Joggler

1. With a two inch column of cards in the hopper, turn the file feed drive until the hopper joggler cam follower is on the high dwell of the cam. Set the adjusting screw for  $.000''$  to  $.005''$  clearance between the top of the deck and the joggler arm (Figure 2-10A). NOTE: There is no timing relationship between the side and front joggler cams, nor between the cams and the feed knives. The front joggler cams should however, be even with each other.

### HOPPER AND PICKER KNIVES

#### Principles of Operation Figure 2-11.

After cards go from the file feed to the hopper, the picker knives provide the means of moving the cards from the hopper into the first set of feed rolls. A picker knife cam assembly is located on a shaft driven under clutch control. Two cam follower arms are clamped to an adjacent shaft that causes it to oscillate. Two picker knife arms, also clamped to this shaft, move the picker knife blocks.

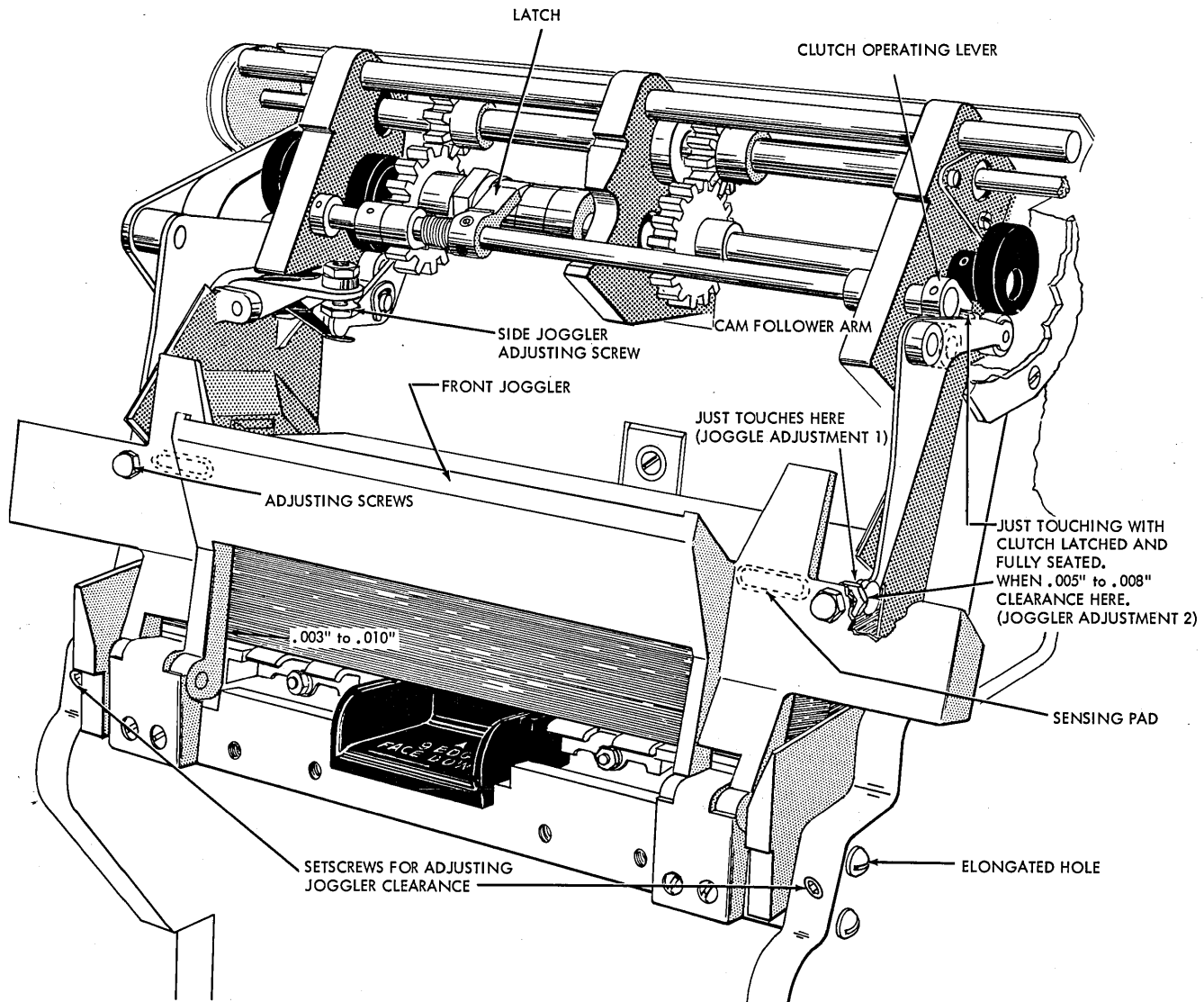


Figure 2-10. Lower Magazine Throat

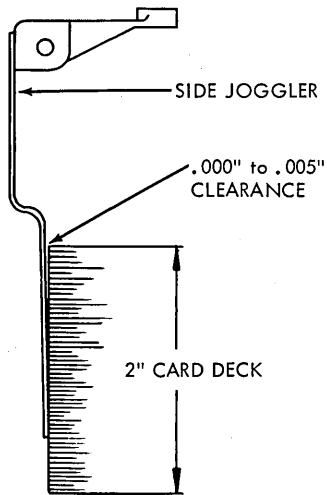


Figure 2-10A. Side Jogger Adjustments

The picker knives travel in an arc and not in a flat plane parallel to the card line. For this reason, to obtain the best possible feeding conditions, the knife blocks must travel evenly through the same arc. The knife blocks are factory adjusted and should never be changed.

Each picker knife block is fixed on its arm. Two carballoy pieces are inserted in the block surface to resist wear. The inserts are ground to specifications for knife projection and replacement of the picker block is required when the insert becomes worn.

### Adjustments

1. Position picker knife cam followers for a maximum of .004" clearance over the entire periphery of the cams, without binding.
2. Shim hopper posts on mounting bar for a clearance of .010" to .015" between hopper posts and a pack of cards resting against the throat knife. (The file feed front jogger must be adjusted first.)

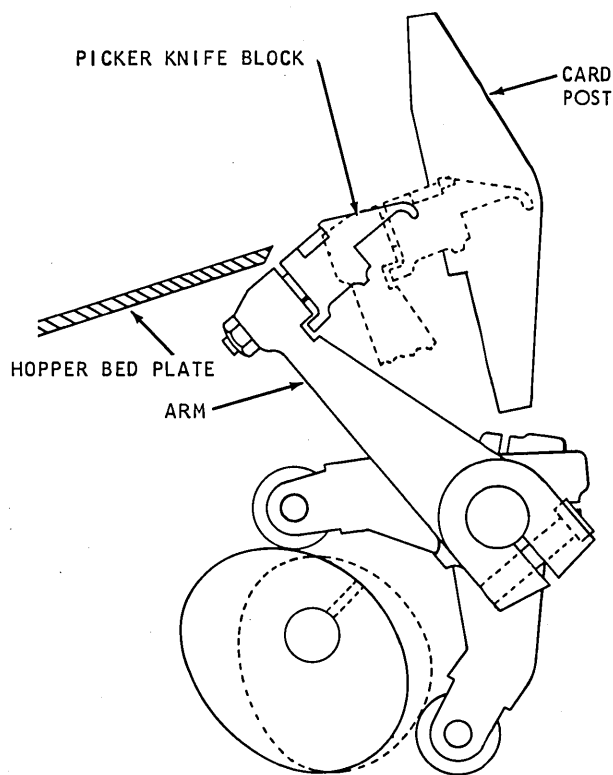


Figure 2-11. Picker Knife

3. With a clearance of  $.062'' \pm .005''$  between the rear hopper side plate and the rear side frame, adjust the front side plate for  $.016''$  to  $.021''$  over the length of the card.

NOTE: This adjustment should result in cards centered between the rails in the transport area ( $5/16'' \pm 1/32''$  from the front rail).

4. Adjust the hopper back plate card guide fingers  $.020''$  to  $.050''$  clearance to the hopper bed plate fingers (Figure 2-12).

5. Position the feed knife arms evenly on the shaft so that the feed edge of the picker knife block travels  $.020''$  to  $.030''$  beyond the trailing edge of a card, when the card is held against the hopper posts.

6. The throat roller must be positioned so that the step indicating the center line of the roller is lined up with the throat knife face.

7. The throat opening should be  $.0095''$  go and  $.0105''$  no-go. Time the picker knife cams to feed a card so that the trailing edge of a card aligns with the face of the throat knife at approximately  $72^\circ$  for 2 group brushes and  $68^\circ$  for 3 group brushes. NOTE: This is just a reference point for making brush timings. When the brushes are on the scribed line (refer to Brush Assembly Adjustment), retime the picker knife camshaft to obtain proper timing. To adjust proceed as follows:

a. Loosen clamped hub on picker knife cam shaft pulley.

b. Trip clutch by hand and turn index to  $212^\circ$  for 3 group brushes or  $216^\circ$  for 2 group brushes.

Place a card against the first feed rolls and manually turn the picker camshaft machine direction until the feed knives touch the card. Tighten pulley locking screws.

NOTE: Any change in picker knife timing will directly affect RC CB and solar CB (if on machine). Be sure to check brush timings and adjustments carefully before making these timings.

## CARD GUIDES

### Adjustments

1. Position the first lower card guide for  $.005''$  to  $.015''$  below the card line. Position the second lower card guide for  $.015''$  to  $.025''$  below the card line. Adjust by loosening the mounting screws in the side frames.

2. Position the removable upper card guide for  $.020''$  to  $.050''$  clearance to the first lower card guide assembly.

## CARD LEVERS

### Adjustments

1. Make sure all card levers are free of binds.

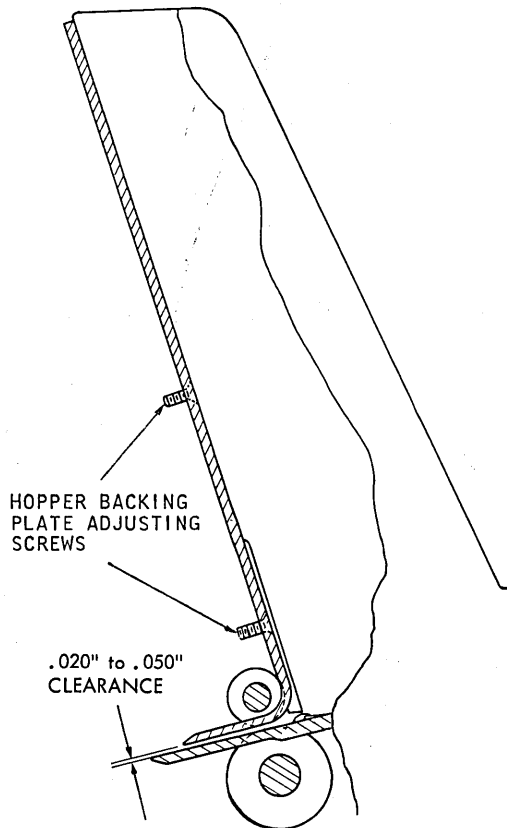


Figure 2-12. Hopper Back Plate Clearance

2. Position all card lever contacts to give a minimum contact travel of 1/16" when the card lever is being operated by a card.

3. Position card levers and contacts to provide a minimum of 1/64" rise of the N/O contact strap off its support.

4. Adjust the contacts for 1/32" minimum air gap.

5. Time according to timing charts (dynamically).

## BRUSH ASSEMBLY

### Adjustments (Figure 2-13)

1. Insert brush assembly into machine and check for .012" minimum clearance between brush separator and contact roll with an end to end variation of .015" maximum. To adjust proceed as follows:

- Loosen four separator holding screws.
- Place brush assembly on flat surface.
- Adjust separator to flat surface.
- Tighten the four screws.
- Check assembly in machine for correct clearance.

f. If clearance is incorrect, remove assembly and shift separator in proper direction.

2. Loosen locking screws at either end of brush assembly and shift block so that the heels of the brushes are .050" + .030" - .020" off the scribed line on separator toward the stacker (left in read feed) (Figure 2-14).

NOTE: This setting is for the 2 grouped brushes, if the 3 grouped brushes are used, set them on the scribed line + .030" - .020".

3. Adjust the brush assembly for correct lateral tracking of the brushes.

a. Center the brushes in the separator by use of the two Allen-head set screws in the brush assembly frames.

NOTE: Do not tighten the set screws to a point where they bind the retractable frames.

b. With the brush holder in place, adjust the screws in the machine side frames for correct brush tracking.

c. Allow .003" clearance to prevent binding, when removing or replacing the brush assembly.

4. Adjust brush assembly card guide for a minimum of .025" clearance to the lower card guide.

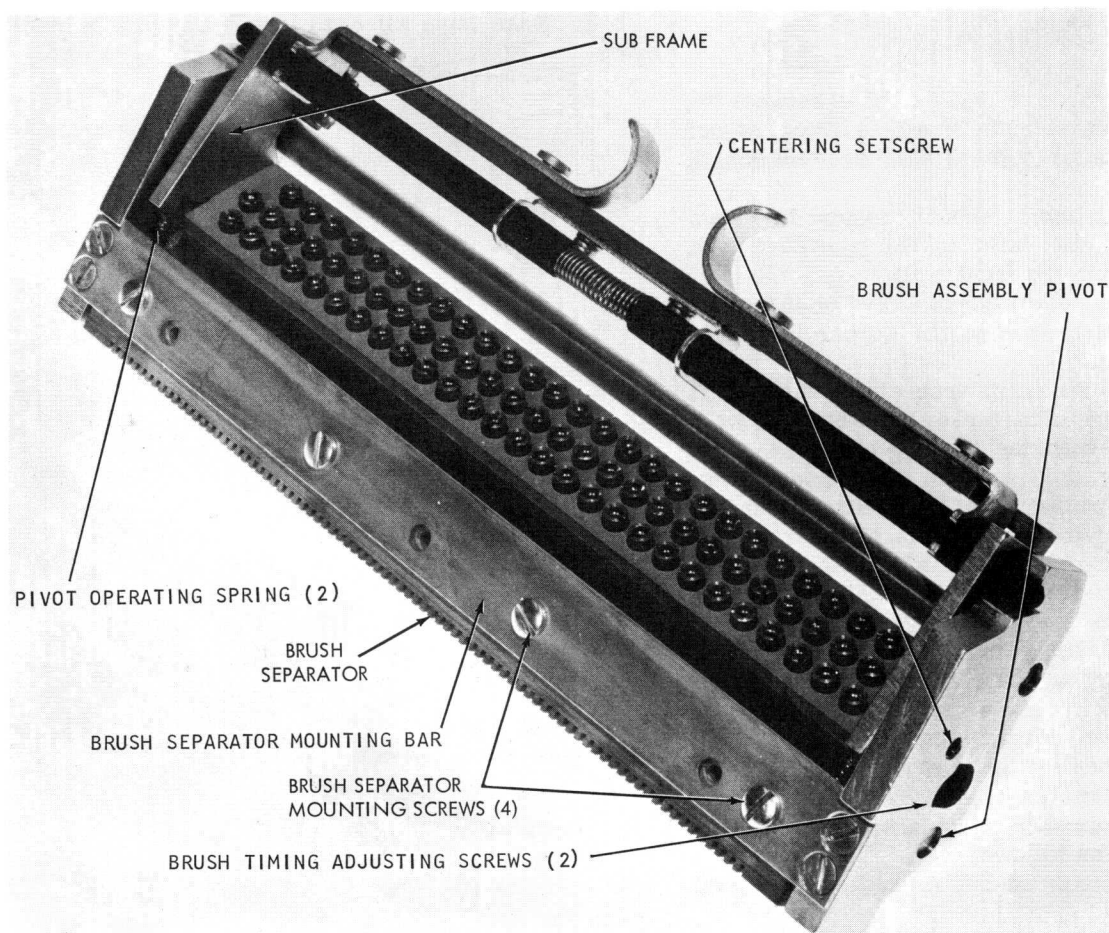


Figure 2-13. Brush Assembly



2. Position all card lever contacts to give a minimum contact travel of  $1/16''$  when the card lever is being operated by a card.

3. Position card levers and contacts to provide a minimum of  $1/64''$  rise of the N/O contact strap off its support.

4. Adjust the contacts for  $1/32''$  minimum air gap.

5. Time according to timing charts (dynamically).

## BRUSH ASSEMBLY

### Adjustments (Figure 2-13)

1. Insert brush assembly into machine and check for  $.012''$  minimum clearance between brush separator and contact roll with an end to end variation of  $.015''$  maximum. To adjust proceed as follows:

- Loosen four separator holding screws.
- Place brush assembly on flat surface.
- Adjust separator to flat surface.
- Tighten the four screws.
- Check assembly in machine for correct clearance.

f. If clearance is incorrect, remove assembly and shift separator in proper direction.

2. Loosen locking screws at either end of brush assembly and shift block so that the heels of the brushes are  $.050'' + .030'' - .020''$  off the scribed line on separator toward the stacker (left in read feed) (Figure 2-14).

NOTE: This setting is for the 2 grouped brushes, if the 3 grouped brushes are used, set them on the scribed line  $+ .030'' - .020''$ .

3. Adjust the brush assembly for correct lateral tracking of the brushes.

a. Center the brushes in the separator by use of the two Allen-head set screws in the brush assembly frames.

NOTE: Do not tighten the set screws to a point where they bind the retractable frames.

b. With the brush holder in place, adjust the screws in the machine side frames for correct brush tracking.

c. Allow  $.003''$  clearance to prevent binding, when removing or replacing the brush assembly.

4. Adjust brush assembly card guide for a minimum of  $.025''$  clearance to the lower card guide.

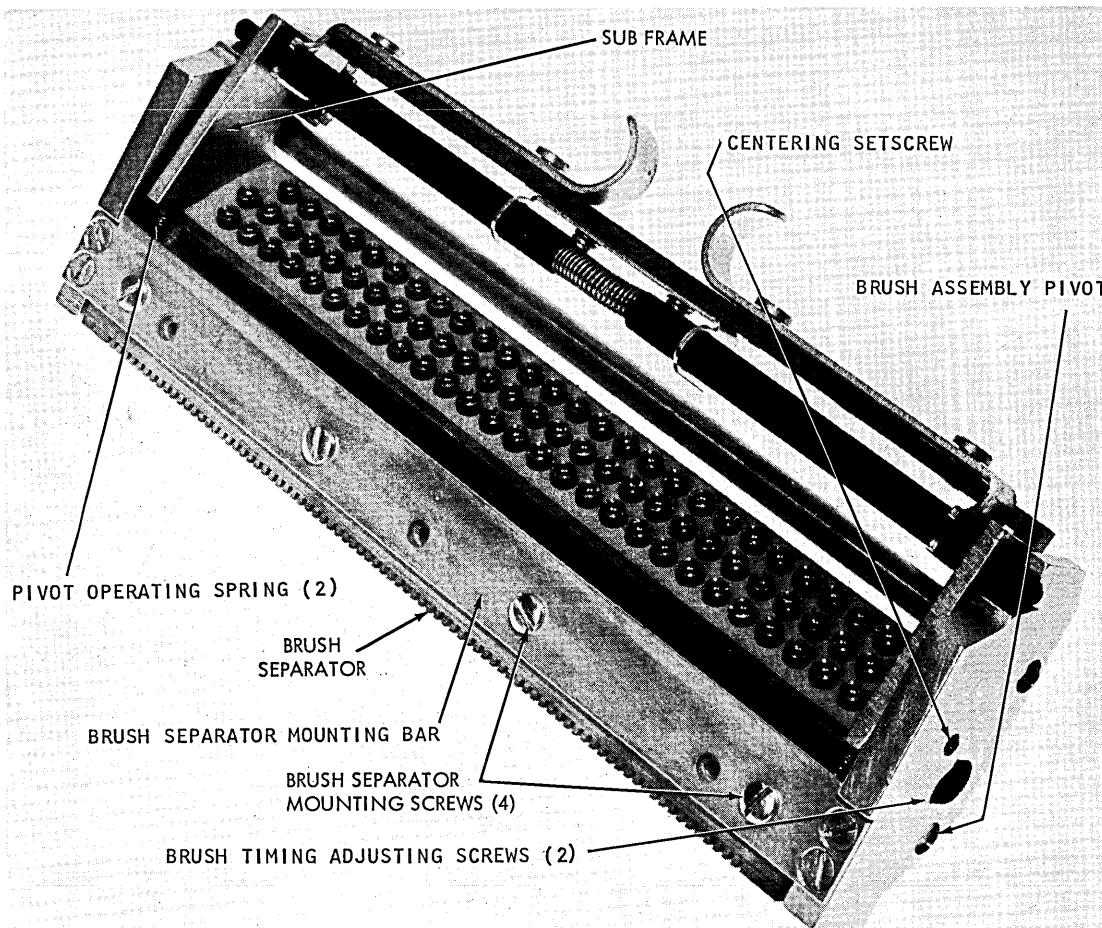


Figure 2-13. Brush Assembly



## Timing

1. Dynamically check brush to be sure that the first and second read stations are a complete machine cycle apart ( $360^{\circ}$ ) and within the scribed line settings listed above.

2. Dynamically time the brushes as per wiring diagram by shifting the picker knife timing. Do not accomplish brush timings by shifting brushes off scribed line.

NOTE: The RL CB's and Solar CB (if used) will have to be retimed after this adjustment.

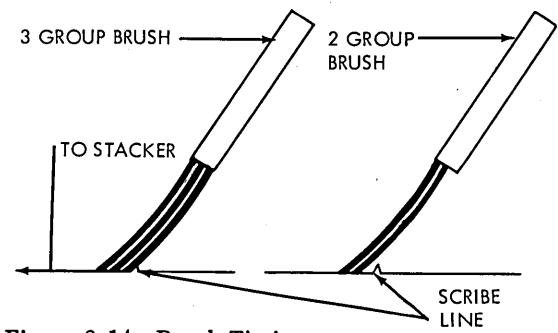


Figure 2-14. Brush Timing



## TRANSPORT AND STACKERS

### SELECTION MECHANISM

#### Principles of Operation

The transport mechanism consists of six continuously running feed rolls that move cards from the feeds to the stacker selected by chute blades. Three of the feed rolls are under control of the read feed, and three are under control of the punchfeed. Cards can go into only three of the five stackers from either feed. The stacker into which the card enters is determined by the selection mechanism at each end of the transport mechanism (Figure 3-1).

The selection mechanism consists of two chute blades and two control magnets for each of the read and punch feeds. With the select magnets de-energized, the cards enter the stacker nearest the feed; stacker NR for the read and stacker NP for the punch. If the magnet that depresses the lower of the two chute blades is energized, the cards go into 1 or 4. If the magnet that depresses both chute blades is energized, the cards from either feed can go into stacker 8/2.

A jam bar is installed over the length of the transport mechanism. The bar consists of a spring steel

strip located just above the normal card line. Any card that is bent enough to flex the metal strip causes a switch to operate. The switch causes the machine to stop and turns on the stoplight. A card jam in the feed portion of the machine is detected by other circuits.

#### Chute Blade and Selector Magnet Adjustment (Figure 3-2)

1. Lower control key and indicator light panel by loosening four holding screws and pivoting.
2. With pocket selector magnet armatures attracted, adjust each armature for  $.035'' \pm .003''$  clearance between upper part of stop and armature.
3. Adjust selector magnet assembly (by use of the mounting screws) to position the chute blades  $1/32'' + 1/64'' - 0$  above card line when the magnets are not energized, and  $1/32'' + 1/64'' - 0$  below the card line when the magnets are energized.
4. Adjust chute blades (use the chute blade mounting screw) for  $1/32'' \pm 1/64''$  clearance between end of lower chute blade and lower card guide plate (Figure 3-3).
5. Chute blade tension should be such that a force

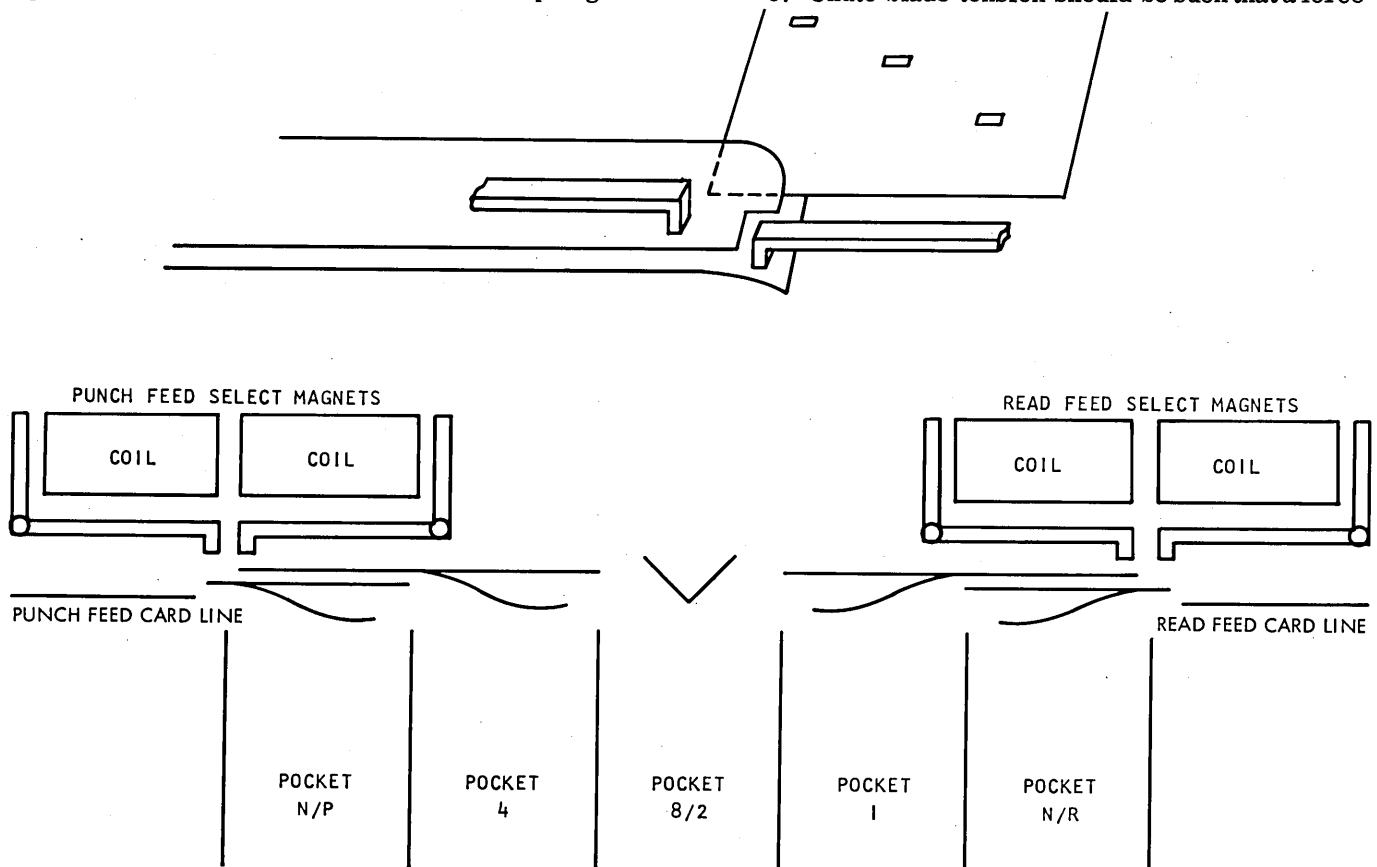


Figure 3-1. Card Selection Schematic

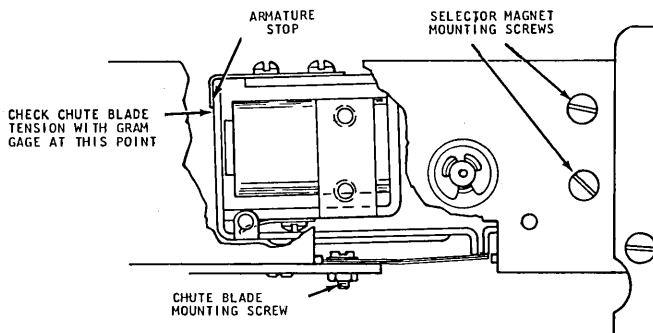


Figure 3-2. Chute Blade and Select Magnet Adjustments

of 280 to 400 grams applied to the 2 or 8 selector magnet armature (at a point just under armature backstop) should hold the armature fully attracted. A force of 110 to 230 grams should be required to hold select magnet 1 or magnet 4 armatures fully attracted.

6. With a chute blade removed and held on a flat surface, the tab containing the chute blade mounting screw hole should project  $1/8'' \pm 1/64''$  above the flat surface.

#### TRANSPORT ROLL ADJUSTMENTS

1. The lower pressure rolls should be centered directly below the upper rolls. This can be accomplished by inserting a .010" feeler gage leaf between the upper and lower rolls and adjusting the lower roll mounting brackets until the feeler gage leaf is parallel to the card line.

2. Tension on the pressure rolls is adjusted by the lower feed roll shaft mounting screws so that pull of 1.5 lb to 2.5 lb is required to pull a card strip from between the rolls (upper roll not turning). Tension on the front and rear rolls should be within 1/4 lb of each other. The card must be pulled in the same direction as it is fed. After adjusting, be sure locknuts on the mounting screws are tight.

NOTE: Push-pull scale, P/N 9900012, may be used.

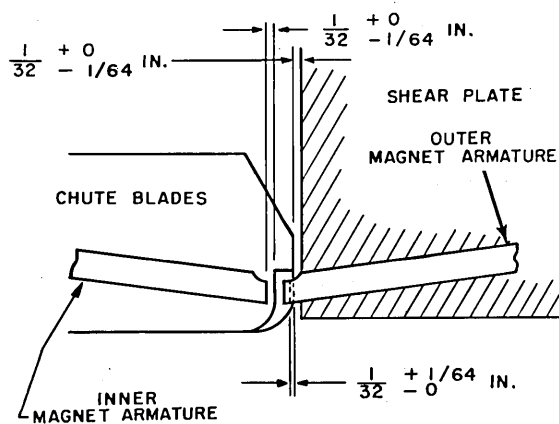


Figure 3-3. Chute Blade (Top View)

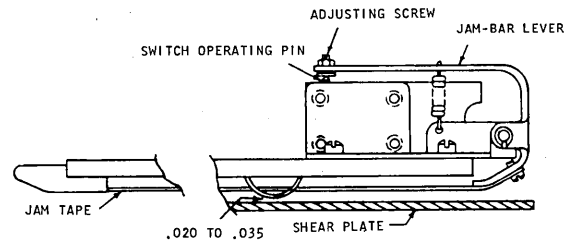


Figure 3-4. Jam Bar

#### JAM BAR ADJUSTMENTS

1. A jam bar must be positioned for .020" to .035" clearance between the formed points and the shear plates over the entire length of the card transport and at the junction of the jam bar and jam bar lever (Figure 3-4).

2. The tape must be adjusted so that the switch will be operated with a tape deflection of  $1/16''$ .

#### STACKERS

##### Principles of Operation (Figure 3-5)

The stackers used on the 1402 are the radial type. The stacker receives the card from the transport mechanism with the card horizontal. The distance from the top of the guide assembly to the lip of the pivot and lever assembly is less than the length of the card. As a result, the front of the card is held by the card restraining lever, and the rear of the card falls, guided by the guide assembly. The radius of the guide assembly is such that as the rear of the card approaches the bottom, the front falls from the card restraining lever that has been supporting it.

The card stops with the back edge on the card alignment lever and the front edge on the card deck support or card previously stacked. Spring tension supports the card alignment lever until 4 to 6 cards accumulate. Their weight overcomes the spring tension supporting the card alignment lever, and lowers the group of cards into the card pusher slide. The pusher slide oscillating front to back works the bottom of the card deck support. This can continue until the card deck support moves out enough to operate the stacker stop microswitch operating arm, which stops the machine. The card jogger mechanism is driven from either or both the punch and read feeds.

The N/R and 1 stacker joggler are operated by the read feed and the N/P and 4 stacker joggler are operated by the punch feed. The 8/2 stacker jogger is connected to both the read and punch feeds by means of two helical springs and collars so that it can be operated by either feed.

The card levers on the pivot and lever assembly keep the cards from going back into the stacker where they might jam the machine.

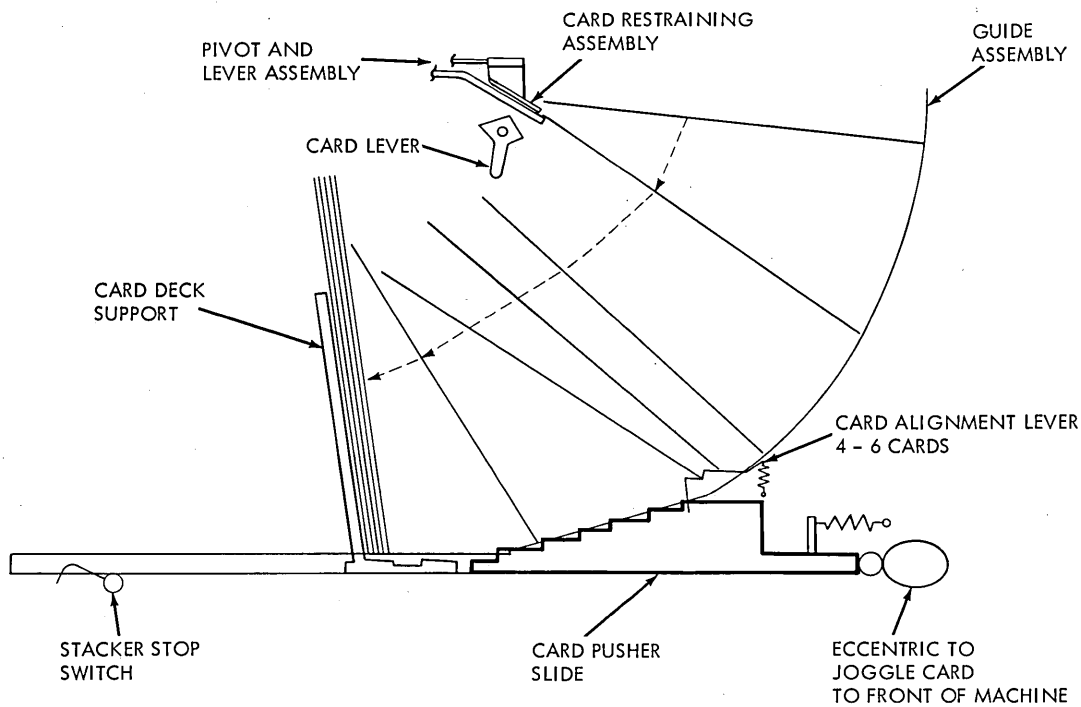


Figure 3-5. Stacker Schematic

Stacker Joggler Adjustments

1. The three shaft must be free of binds (align the four bearing bracket assemblies).
2. Maintain  $4.000'' \pm .005''$  between the bases of the two inside bearing brackets (Figure 3-7).
3. With the center shaft assembly shifted toward the reader feed and the clutch hubs flush with the spring sleeve, adjust the clutch hub (identified by a red dot) for  $.003''$  to  $.005''$  clearance while its spring sleeve is flush against the mating hub.

Stacker Adjustments

1. Make sure all sliding and pivoting parts move freely with no binds.
2. The space between the pocket separators should be  $3 \frac{5}{16}'' \pm 1/64''$ .
3. The pocket separators should be square with transport rails within  $.015''$ .
4. Form the radial guide as shown in Figure 3-6.

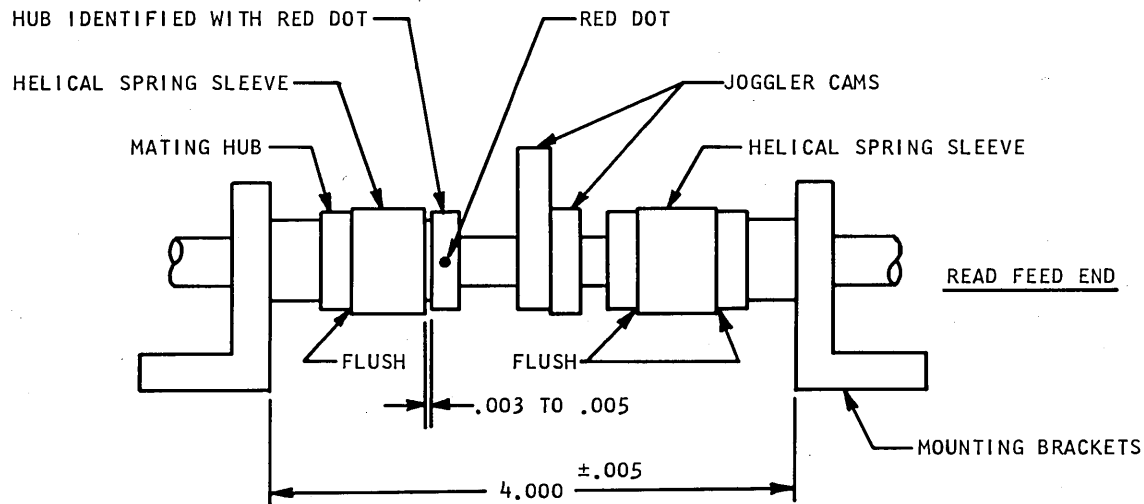
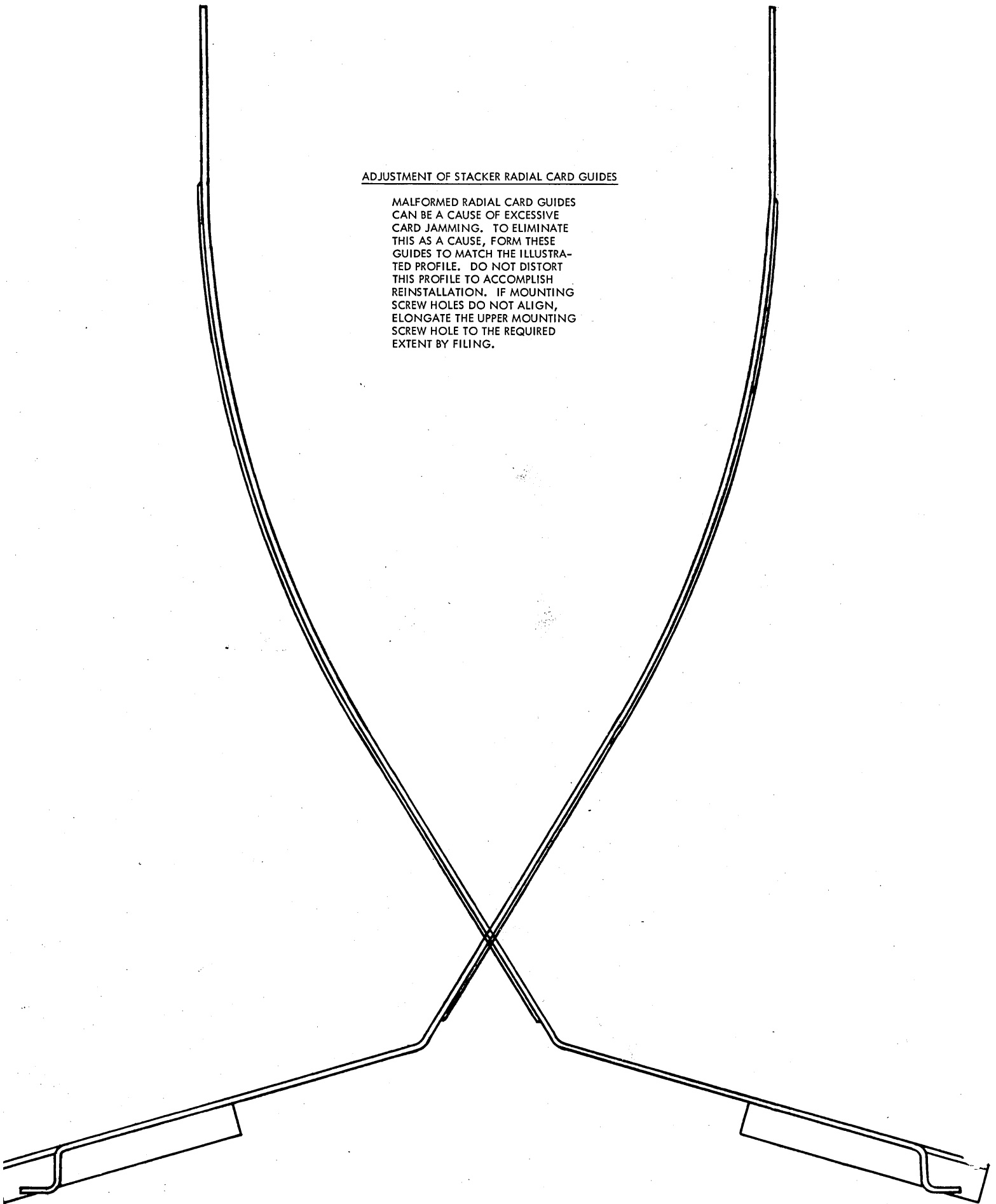


Figure 3-7. Center Stacker Joggler Assembly

ADJUSTMENT OF STACKER RADIAL CARD GUIDES

MALFORMED RADIAL CARD GUIDES CAN BE A CAUSE OF EXCESSIVE CARD JAMMING. TO ELIMINATE THIS AS A CAUSE, FORM THESE GUIDES TO MATCH THE ILLUSTRATED PROFILE. DO NOT DISTORT THIS PROFILE TO ACCOMPLISH REINSTALLATION. IF MOUNTING SCREW HOLES DO NOT ALIGN, ELONGATE THE UPPER MOUNTING SCREW HOLE TO THE REQUIRED EXTENT BY FILING.



3-4 . Figure 3-6. Radial Card Guide Outline

## PUNCH FEED

### DRIVE MECHANISM (Figure 1-1)

A 1/3 hp motor is used to drive the input idler pulley. Through gears and timing belts, the following are kept continuously running:

1. Timer index
2. Clutch ratchet
3. Geneva assembly
4. Intermittent feed rolls
5. Punch unit drive shaft
6. PACB's
7. PCCB's
8. First feed roll after the punch check brushes
9. Three transport feed rolls
10. Stacker jogglers

When the punch clutch engages, power is transmitted to the following:

1. Picker knife cam shaft
2. Feed knives
3. First feed rolls
4. First stepped roll assembly
5. Card aligners
6. Second stepped roll assembly
7. Punch check brush contact roll
8. PLCB's
9. Punch feed read brush contact roll (optional feature)

When the punch clutch latches, the intermittent feed rolls are cammed open and though they continue to turn, they cannot feed a card.

### PUNCH FEED CLUTCH

#### Principles of Operation

The punch clutch used on this machine is a 4-tooth ratchet type. The clutch pawl can engage at  $315^{\circ}$ ,  $45^{\circ}$ ,  $135^{\circ}$ , or  $225^{\circ}$ . In order to keep the PCCB's (continuously running) in time with the card and the PLCB's (under control of punch clutch), the PCCB's make and break four times for each machine cycle. Therefore, no matter which tooth the pawl engages in, the PCCB's will give the same timings in relation to the card being fed. The PACB's (high speed continuously running) make and break for each cycle point. The impulses that are required only need to be filtered out by PLCB's.

NOTE: The synchronous tooth ( $315^{\circ}$ ) of the clutch must be used when checking card transport timings using gage number 608183, otherwise all timings will be  $90^{\circ}$ ,  $180^{\circ}$ , or  $270^{\circ}$  off from timings specified. All machines after serial number 20600 use one particular tooth as synchronous tooth. This will be the tooth with its driving face opposite the center line of one of the three tapped holes located in the outside collar.

### Clutch Adjustments

The clutch assembly is pinned at the factory and should not have to be changed. Step 1 would only be performed if a new clutch assembly is installed.

1. Set clutch so that latch arm is on the horizontal centerline of picker camshaft within .005" (Figure 4-1).

a. At the same time position the unit sideways so that the keeper is flush with the edge of the dog carrier within .010".

b. Form the cam follower arm so that the cam follower is on the middle of the cam surface.

2. Turn machine to low dwell on clutch cam. Trip the clutch and set the adjusting screw for .018" to .030" unlatching clearance (Figure 4-2A).

3. Turn the machine to the high dwell on the clutch cam. Check for a minimum of 1/16" overlap of clutch latch arm on the dog and dog carrier (Figure 4-2B).

a. Reposition latch arm if necessary (Check item 2).

4. Check for .003" to .005" clearance between dog carrier and keeper. Peen or stone keeper to adjust (Figure 4-2B).

5. With cam follower on high dwell, position armature backstop plate vertically for .020" to .025" overlap of armature and latch; position horizontally for .010" to .015" relatching clearance (Figure 4-2C).

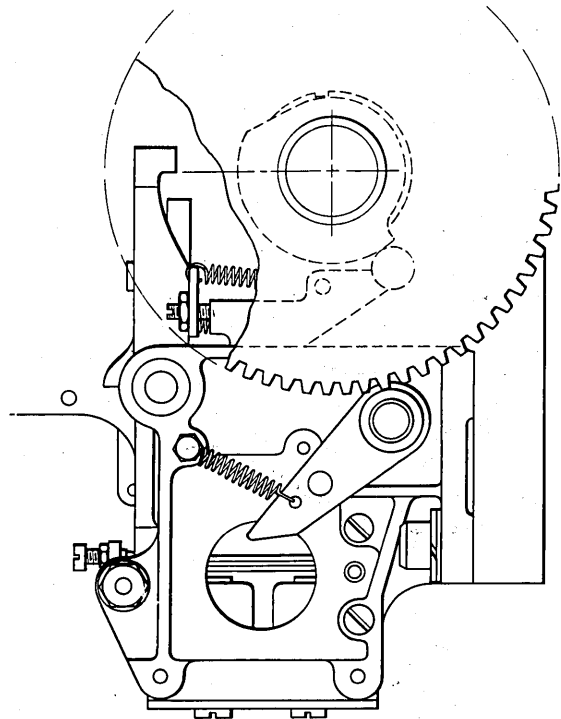


Figure 4-1. Punch Clutch Position

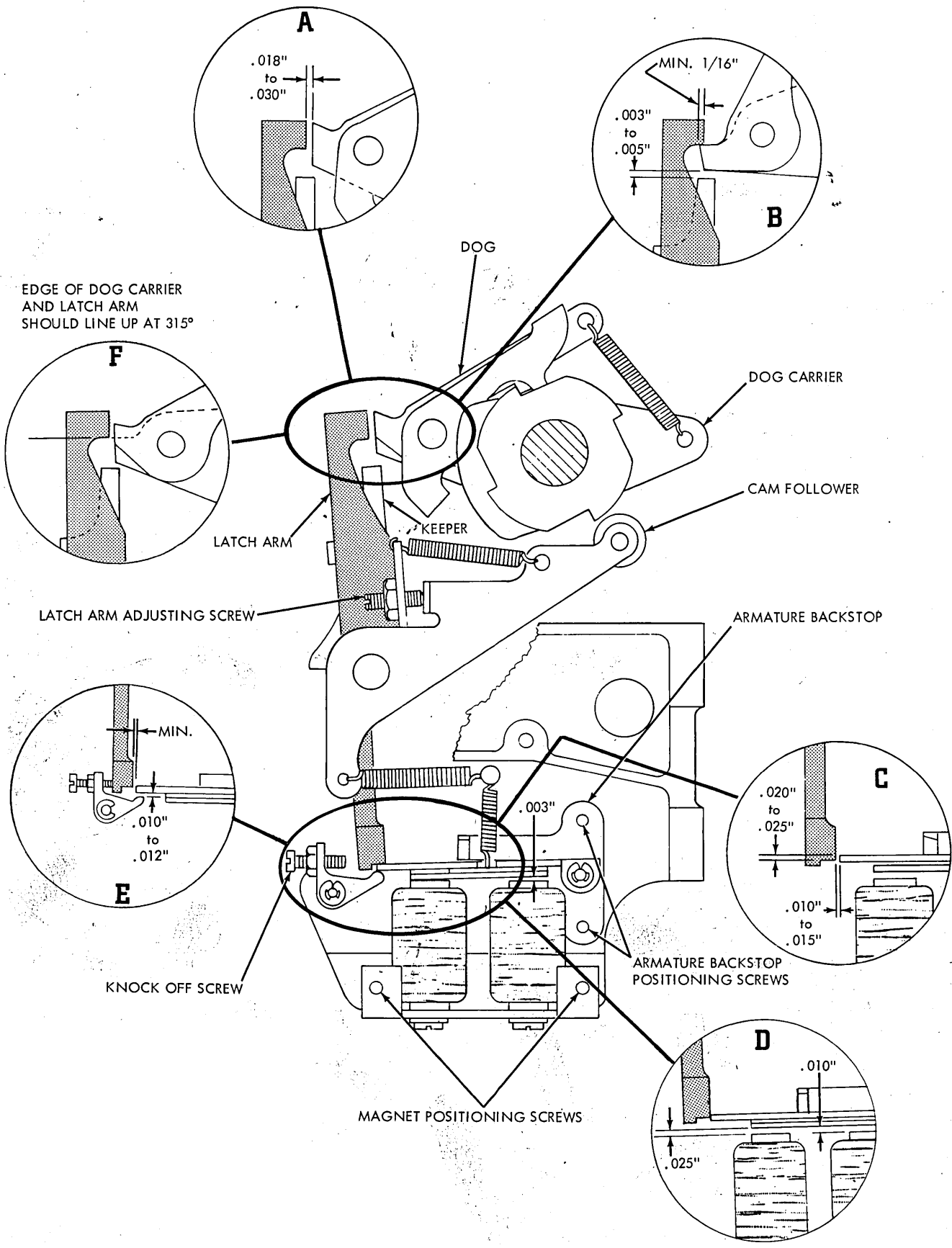


Figure 4-2. Punch Clutch Clearances



6. Adjust magnet assembly for .010" clearance between armature and core nearest pivot and .025" between the armature and core farthest from the pivot when the armature is latched (Figure 4-2D). This adjustment should give .003" to .005" clearance between armature and core nearest the pivot when armature is attracted.

7. The clutch should unlatch with an .008" gage between armature and core farthest from pivot point. It should not unlatch with a .010" gage. Readjust step 5, overlap, if necessary.

8. With the cam follower on high dwell, set the armature knockoff for .010" to .012" clearance between armature and knockoff (Figure 4-2E).

### Clutch Timing

This adjustment insures that the punch feed index is in time with the punch clutch dog engaging time.

1. Trip clutch between  $230^{\circ}$  and  $300^{\circ}$  and turn machine manually until dog engages in clutch ratchet that lines up with set screw in outside collar.

2. While holding armature in tripped position, continue turning machine until latching surfaces of the clutch latch arm and dog carrier coincide (Figure 4-2F).

3. At this time the punch feed index should be at  $315^{\circ} \pm 1/2^{\circ}$ .

a. If punch feed index is not at  $315^{\circ}$ , loosen clamping hub of index drive pulley and turn index to  $315^{\circ}$ .

b. Tighten clamping hub.

NOTE: If any change is made in the clutch timing, check the timing of all other punch feed units.

### Clutch Ratchet Removal

1. Remove main drive belt.
2. Remove large input idler pulley.
  - a. Remove nut in center of idler pulley stud.
  - b. Pull stud and input idler pulley.
3. Remove screw in end of picker knife cam shaft and pull gear and disc assembly off shaft.
4. Loosen three set screws and pull ratchet off the assembly. Do not lose spacer between the two inside bearings.
5. Install in reverse order.
6. Re-time clutch, geneva, and PLCB's.

## GENEVA

### Principles of Operation (Figure 4-3)

The geneva operates on the same principle as the genevas in other high speed punches. This geneva, however, is comparatively simple. It consists of a drive disc with two pins to drive two geneva discs. There is one set of feed rolls geared to each geneva disc. These are the only feed rolls that have intermittent action. A feed roll opening device cams these

two sets of feed rolls open at clutch latching time so that they will not feed the card when the clutch latches even though they are continuously running.

When the geneva pins ride into the deep cuts in the geneva discs, the feed rolls are driven by the gears attached to the geneva discs. The cam surface on the geneva drive disc contacts the shallow cuts on the geneva drive discs. When the cam surface is in the shallow cuts of the geneva discs, the intermittent feed rolls are held stationary. The geneva action is repeated every cycle point causing the intermittent movement of the card through the punching station.

### Adjustments

NOTE: Do not repair the geneva housing in the field.

1. Locate geneva housing on side frame to produce .002" to .0045" backlash in gears. This setting is very important. If there is too much backlash, punching registration will be off. If there is no backlash, the gears will be damaged.

2. To check for geneva gear backlash:

a. Remove punch unit.

b. Crank machine to a point where intermittent rolls are held stationary for punching (approximately  $4^{\circ}$  before line of index).

c. Grip an intermittent roll and turn in both directions, checking for slight wobble. Check both sets of rolls at all 12 digit times.

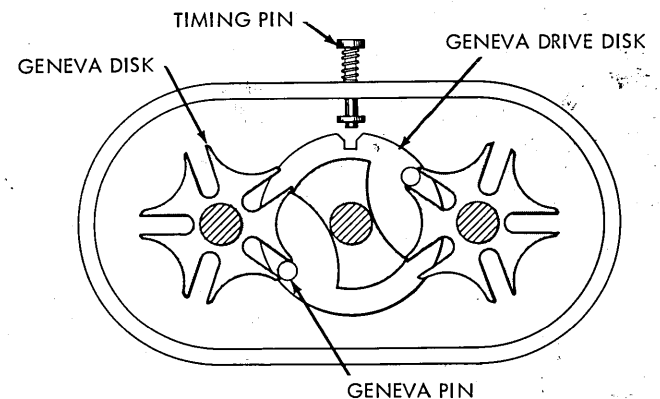


Figure 4-3. Geneva

### Timing

Check the clutch timing before proceeding with this adjustment.

1. The geneva timing pin should seat at  $0^{\circ}$  and at alternate cycle points throughout a machine cycle.
2. If geneva is out of time:
  - a. Turn machine to  $0^{\circ}$  on timer index.
  - b. Loosen split hub of geneva input pulley.
  - c. Crank machine until pin seats and tightens pulley.
  - d. Check timing of punch unit and PACB unit.

## HOPPER AND PICKER KNIVES

### Principles of Operation

Refer to hopper and picker knives in Read Feed section.

### Adjustments

1. On machines with adjustable left side aligner, locate left hopper side plate so that there is .057" to .067" clearance to hopper sub frame.
2. On machines with the stationary left side aligner locate left hopper side plate so that a card will clear left side aligner by .010".
3. The right hopper side plate is adjusted for .008" to .012" clearance over length of the cards.
  - a. Check this clearance by placing approximately a one inch pack of cards in the hopper and insert one or two cards vertically between pack and side plates. One card should be loose; two cards tight.
  - b. Make sure hopper side plates are at right angles to the first set of feed rolls.
  - c. On machines with the adjustable left side aligner, check that the card clears the left side aligner by 1/32" to 1/16" with aligners in re-stored position.
4. Position hopper posts for a clearance of .015" ± .002" between hopper posts and a pack of cards resting against throat knife.
  - a. Check for a two-card clearance between hopper posts and the pack of cards.
  - b. Adjust by loosening screws in either end of hopper posts mounting bar and shifting bar the desired amount.
5. Position throat roller assembly laterally so that vertical center line of roller is aligned with edge of throat knife. Determine this by the step in the block that indicates the center line of the roller.
6. Position cam follower arms for no binding condition over entire periphery of the cams with a maximum clearance of .008" between either cam and follower at any point.
7. Position feed knife arms evenly on shaft so that the edge of the picker knife block travels .020" to .030" beyond the trailing edge of the card when the card is held against the hopper posts.
8. Throat opening should be .0095" go, .0105" no-go.
9. The picker knife cam is set to deliver a card to the first feed rolls at  $185^{\circ} \pm 1/2^{\circ}$ . To adjust proceed as follows:
  - a. Loosen cam on shaft.
  - b. Engage clutch and turn to  $185^{\circ}$ .
  - c. Turn cam on shaft until feed knives hold card snug against first feed rolls.
  - d. Tighten cam on shaft.

## CARD GUIDES

There are four card guides that must be kept in proper relationship to the card line. They are located as follows:

1. First card guide is located just past the first feed rolls. The first upper card guide is removable and is replaced by a brush assembly if the punch feed read feature is on the machine. The first lower card guide is then altered to accommodate a contact roll.
2. Second card guide is located at the first stepped roll.
3. Third card guide is located at the second stepped roll.
4. Punch stacker transport card guide is located between the punch check brushes and the stackers at the sixth feed roll.

### Adjustments

1. Hopper back plate guide should be .008" above card line.
2. Loosen first lower card guide tie bar holding screws and shift tie bar to obtain .012" to .030" clearance between lower card guide and hopper back plate guide.
3. Trailing edge of first lower card guide should be not more than .005" above or .010" below second lower card guide leading edge.
4. Position first upper card guide for .012" to .030" clearance to lower card guide. Adjust by loosening screws in mounting bar and shifting guide to desired position.
5. Position second upper card guide for .012" to .030" clearance to lower guide.
  - a. Adjust by loosening tie bar holding screws through side frames.
  - b. Check to make certain the tip of the forward aligner is below the top surface of lower guide. Adjust by positioning the upper guide because aligners travel in a slot in the upper guide. NOTE: Screws mounting this guide to the bar are 8-36, P/N 607694.
6. Position third upper card guide for .012" to .030" clearance to lower guide. Adjust by loosening mounting bar holding screws and shift guide to desired position.
7. Position punch stacker transport lower card guide for .015" to .025" below card line level, determined by contact roll and sixth feed roll.

## FEED ROLLS AND ALIGNER STATIONS

### Principles of Operation (Figure 4-5)

As the card passes the first upper card guide, it is picked up by the first stepped roll assembly. The lower roll of the assembly is called a stepped roll,

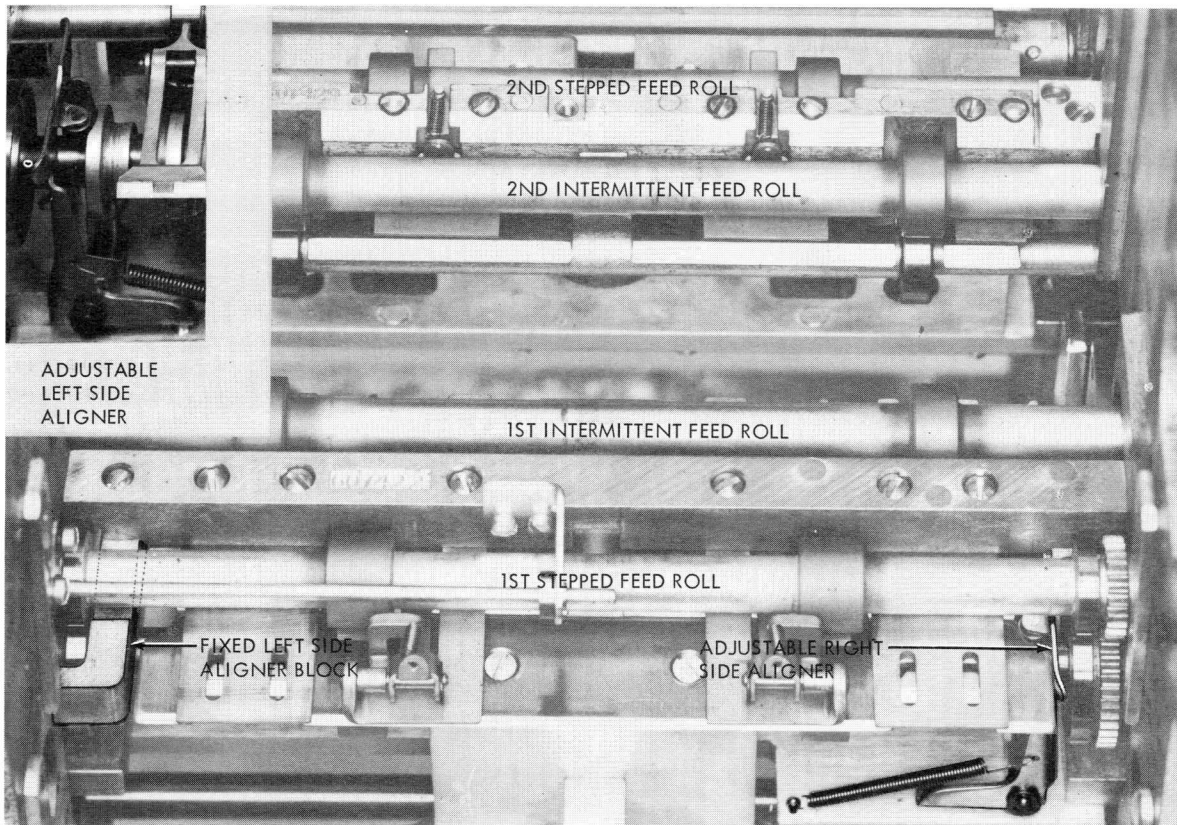


Figure 4-5. Feed Rolls and Aligner Stations

because it has a portion of its circumference cut away. When the high dwell of the stepped roll is opposite the upper roll, the card is fed through the rolls into the first intermittent rolls which are cammed open at this time. When the lowdwell of the stepped roll is opposite the upper roll, collars on the end of the stepped roll assembly shaft prevent the stepped roll from contacting the card.

During the time that the card is free from the stepped feed roll and intermittent feed roll, it is aligned to insure correct punching registration. The forward aligners contact the trailing edge of the card and move the card up to the centerline of the punches. At the same time, the card is aligned toward the column 1 end by the side aligners. Card pressure fingers are used at the aligner station to hold the card so it does not snap or buckle.

After aligning is completed, the first intermittent feed roll closes and the card is fed through the punching station. The second intermittent feed rolls are cammed open as the card is fed into them. They then close, just before the card leaves the first intermittent feed rolls. After the second intermittent feed rolls close, the first intermittent feed rolls are cammed open. When the first intermitted feed rolls open, the feeding of the card through the punch station is under control of the second intermittent feed rolls. The opening and closing of the intermittent feed rolls

prevent buckling or snapping of the card at the punch station.

While punching is being completed, the card is fed into the second stepped roll assembly which does not contact the card at this time. The second stepped roll assembly is like the first stepped roll assembly ahead of the aligner station. The second stepped roll contacts the card after the second intermittent feed roll releases the card and feeds it past the punch check brushes into the sixth feed roll. The sixth feed roll will take over control of card feeding when the second stepped roll comes to the low dwell on its circumference. After card reading the card is under control of the transport and selection mechanism. Refer to Read Feed for the transport and stacker operation.

#### Timing Check of Punch Transport

NOTE: Be sure the synchronous tooth (315<sup>o</sup>) is used for these checks. It is the ratchet tooth that is opposite one of the tapped holes in the outside collar. These procedures are methods of checking the timing of the first and second stepped feed rolls, first and second intermittent feed rolls, and card aligners. They should NOT be used as final adjustment procedures. Before performing any of these steps, be sure the machine power is off.

First Stepped Feed Roll and  
First Intermittent Feed Roll

1. Pivot hopper down.
  2. Remove punch feed brushes and PFR brushes or card guide.
  3. Trip clutch at  $300^{\circ}$  and continue turning machine until clutch engages ( $315^{\circ}$ ).
- NOTE: The following checks can be made with the punch unit installed but may be easier with punch unit removed.
4. Continue turning machine to  $333^{\circ}$ .
  5. Insert a card lengthwise from hopper end so that it is between one roll of the first stepped feed roll. Make sure that the first intermittent feed roll does not interfere with the card.
  6. By turning the feed backward, check to see that the card is free at  $331^{\circ}$  and is gripped tight by the first stepped feed roll at  $329^{\circ}$ . This indicates first stepped roll is in time.
  7. To check the first intermittent feed roll, turn machine to  $352^{\circ}$ .
  8. Insert one card lengthwise between one roll of the first intermittent feed roll. Insert another card

lengthwise between the other roll of the first intermittent feed roll.

9. Check to see that each card is free at  $353^{\circ}$  and is gripped tight at  $357^{\circ}$ . This indicates that the first intermittent feed roll is in time.

Second Intermittent Feed Roll  
and Second Stepped Feed Roll

1. Trip clutch at  $300^{\circ}$  and continue turning machine until clutch engages ( $315^{\circ}$ ).
2. Crank machine to  $290^{\circ}$ .
3. Insert card between each of the rolls on the second intermittent feed roll. This card can be inserted from the punch check brush station.
4. While turning feed backward, the card should still be free at  $288^{\circ}$  and gripped tight at  $284^{\circ}$ . This indicates that second intermittent roll is in time.
5. At  $285^{\circ}$  a strip of card will pass between the second stepped roll and its upper pressure rolls.
6. Crank the machine to  $293^{\circ}$  and the card should be free. Card should be gripped tight by  $295^{\circ}$ . This assures that the second stepped roll is in time.

PUNCH TRANSPORT TIMING

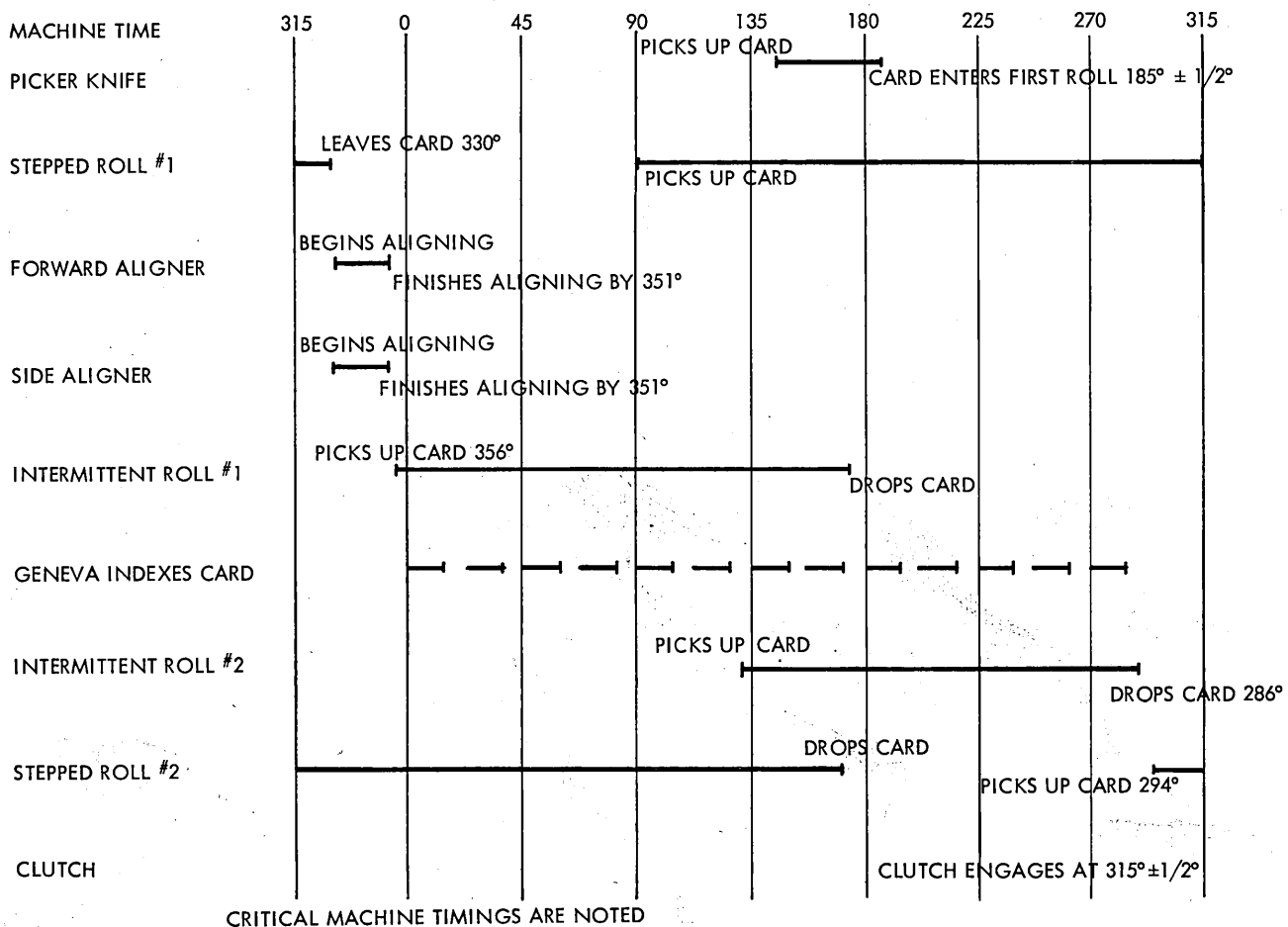


Figure 4-4.

## Forward and Side Aligners

For checking these timings, the punch unit must be removed. The first stepped feed roll must be in time before checking the aligners.

1. Latch the die into position to serve as a card guide.

NOTE: Die card guide gage 610094 will be furnished with machines containing the redesigned die and stripper 601981 to use in place of die.

2. Insert gage 608183 (Figure 4-6).

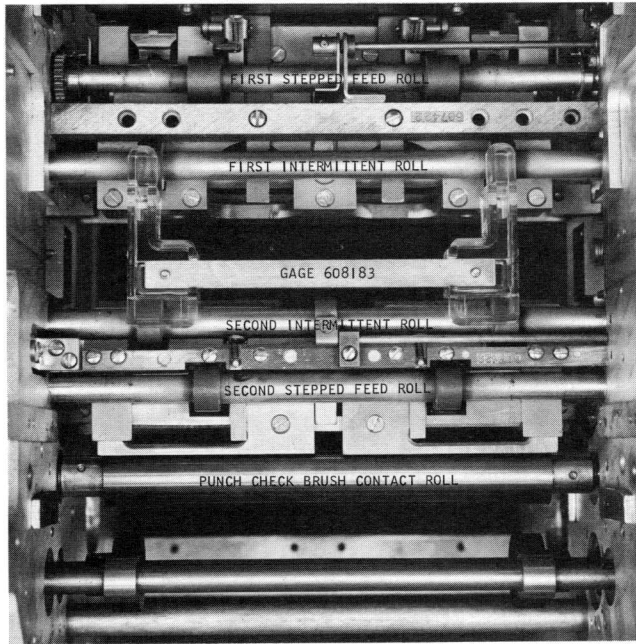


Figure 4-6. Gage Position in Punch Station

3. Pivot the hopper up and place cards in the hopper. Trip the clutch at  $300^{\circ}$  and continue turning the machine until the clutch engages ( $315^{\circ}$ ). Feed cards manually for two card cycles.

4. Continue turning the machine and check to see that a card finishes forward aligning to within  $.005''$  of the "forward aligner timing marks" on the gage at  $351^{\circ}$  (Figure 4-7). This determines that the forward aligner is timed correctly.

NOTE: The following step is necessary on machines with an adjustable left side aligner.

5. With the machine still at  $351^{\circ}$ , check to see that the left side aligner surface is against the card and is  $37/64''$  from the inside of the left side frame. Check to see that the right side aligner is just touching the card at  $351^{\circ}$ .

NOTE: The following step is necessary on machines with a fixed left side aligner block.

6. Check for  $.010''$  to  $.020''$  gap between card and left side aligner block under the following conditions.

a. The card must be fed while being held against the left side plate.

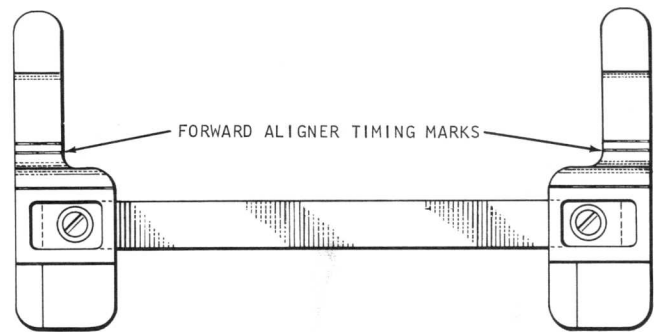


Figure 4-7. Gage 608183 Timing Mark

b. The check must be made prior to alignment.

7. When feeding cards held against the right hopper side plate, check the right side aligner surface for  $.005''$  minimum clearance to a card when a card is fed into the aligner station but prior to side aligning.

## Adjustments of Punch Transport

NOTE: Be sure all power has been removed from the machine.

### First Stepped Feed Roll

NOTE: The first stepped feed roll can be timed with the punch unit in the machine, however it is easier with the punch unit removed.

1. Pivot hopper down and remove punch feed brushes and the PFR brushes or the removable card guide.

2. Trip clutch at  $300^{\circ}$  and manually turn machine to  $330^{\circ}$ .

3. Loosen split hub of pulley located on front end of first stepped feed roll.

4. While keeping machine at  $330^{\circ}$ , turn first stepped feed roll by hand and feed a card lengthwise through one roll of the first stepped feed roll. Make sure card is not passing through intermittent rolls.

5. At the point at which the first stepped feed roll stops feeding the card, rotate roll slightly until card experiences light drag.

6. Hold roll at this position and tighten the pulley previously loosened in step 3.

7. Check to see that the card is held tight by the first stepped feed roll at  $329^{\circ}$  and is free at  $331^{\circ}$ .

8. Retime the first intermittent feed roll.

9. Check second stepped feed roll and retime if necessary.

### First Intermittent Feed Roll

The first stepped feed roll must be in proper time before timing the first intermittent feed roll. For a timing check, refer to Timing Check, First Stepped Feed Roll and First Intermittent Feed Roll. Steps 1 thru 6.

NOTE: The first intermittent feed roll can be timed with the punch unit in the machine, however it is



easier with the punch unit removed.

1. Pivot hopper down and remove punch feed brushes and the PFR brushes or removable card guide.

2. Trip clutch at  $300^{\circ}$  and turn machine to  $352^{\circ}$ .

3. Insert one card lengthwise between one roll of the first intermittent feed roll. Insert another card lengthwise between the other roll of the first intermittent feed roll.

4. Turn machine to  $356^{\circ}$ .

5. Adjust eccentrics\* at each end of first intermittent feed roll shaft so that each card experiences light drag. Keep high side of eccentrics (indicated by the punch marks on the eccentrics) facing punch marks on intermittent feed roll opening arms (Figure 4-8).

6. Check to see that each card is free at  $353^{\circ}$  and is gripped tight at  $357^{\circ}$ .

### Second Intermittent Feed Roll

The second stepped feed roll must be in proper time before timing the second intermittent feed roll. For a timing check, refer to Timing Check, Second Intermittent Feed Roll and Second Stepped Feed Roll, steps 1, 5, and 6.

NOTE: The second intermittent feed roll can be timed with the punch unit in the machine, however it is easier with the punch unit removed.

1. Remove punch feed brushes and PFR brushes or removable card guide.

2. Trip clutch at  $300^{\circ}$  and turn machine to  $290^{\circ}$ .

3. Insert one card lengthwise between one roll of the second intermittent feed roll. Insert another card lengthwise between the other roll of the second intermittent feed roll.

4. Turn machine backward to  $286^{\circ}$ .

5. Adjust the eccentrics\* at each end of the second intermittent feed roll shaft so that each card experiences light drag. Keep high side of eccentrics (indicated by the punch marks on the eccentrics) facing punch marks on intermittent feed roll opening arms (Figure 4-8).

6. Check to see that each card is free at  $288^{\circ}$  and gripped tight at  $284^{\circ}$ .

### Second Stepped Feed Roll

1. Remove punch feed brushes and PFR brushes or removable card guide.

2. Trip clutch at  $300^{\circ}$  and turn machine to  $294^{\circ}$ .

3. Loosen split hub of pulley located on rear end of second stepped feed roll.

4. While keeping machine at  $294^{\circ}$ , turn second stepped roll by hand and feed a card lengthwise through one roll of second stepped feed roll. Make sure the card is not passing through intermittent rolls.

\*The eccentrics on the first and second intermittent feed rolls should be adjusted only if necessary.

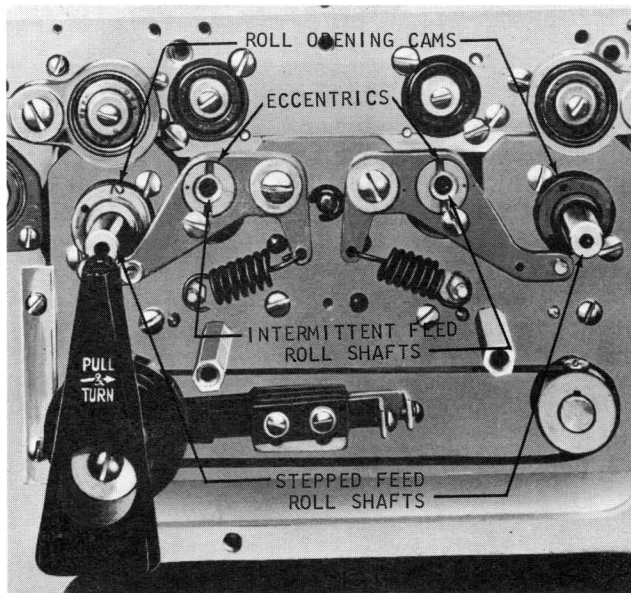


Figure 4-8. Roll Opening Device

5. At the point at which the second stepped feed roll begins feeding the card, rotate the roll slightly until the card experiences light drag.

6. Hold roll at this position and tighten the pulley previously loosened in step 3.

7. Check to see that the card is held tight by the second stepped feed roll at  $295^{\circ}$  and is free at  $293^{\circ}$ .

8. Retime the second intermittent feed roll.

### Forward and Side Aligner Adjustments

Before performing these adjustments, be sure the first stepped feed roll is in time. Refer to Timing Checks, First Stepped Feed Roll and First Intermittent Feed Roll, steps 1 thru 6. Also, to basically get the forward and side aligners in time, refer to Timing Checks, Forward and Side Aligners, steps 1 thru 7.

1. Trip clutch at  $300^{\circ}$  and continue turning machine to  $351^{\circ}$ . Adjust forward aligners so that the trailing edge of the card is against each aligning surface of the forward aligners and leading edge of the card is within .005" of the forward aligner timing marks on the gage (Figure 4-7) at  $351^{\circ}$ . To adjust the forward aligners:

a. Loosen two screws of locking block very slightly. The locking block serves as a support for the forward aligner adjusting screw. Adjustment of the forward aligner cannot be made accurately if the block screws are loosened too much.

b. Turn the forward aligner adjusting screw clockwise to move the forward aligner away from the hopper and counterclockwise to move the forward aligner toward the hopper (Figure 4-9).

c. Retighten locking block screws after properly setting forward aligners.

2. Check the forward aligner setting by feeding cards through the machine manually to see that the

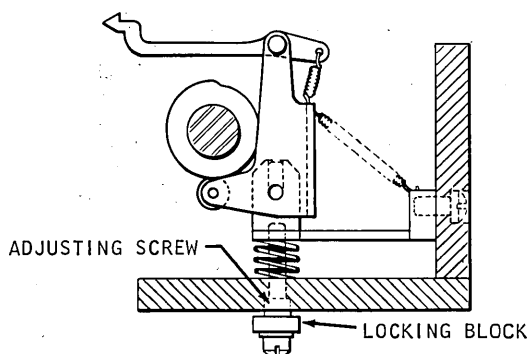


Figure 4-9. Forward Aligner Adjustments

leading edge of the card is within .005" of the forward aligner timing marks at 351°.

3. The following step is necessary only on machines with an adjustable left side aligner. With the machine still at 351°, loosen the left side aligner lock nut, and turn the left side aligner adjusting screw to position the left side aligner surface 37/64" from the inside of the left side frame. Tighten the lock nut. With a card against the left side aligner, adjust the right side aligner in similar manner so that its aligning surface just touches the card at 351°. Tighten the lock nut.

4. To obtain clearances as outlined in steps 6 and 7 of Forward and Side Aligner Check, the hopper side plates must be adjusted and the side aligner must be formed.

#### Side Aligner Removal

1. Remove punch unit from machine.
2. Remove die card lever.
3. Remove upper card guides and card guide mounting bar in aligning station.
  - a. Remove six screws holding card guides to mounting bar and slide guides toward front of the machine.
  - b. Remove two screws from each end of card guide mounting bar and lift bar out.
4. Unhook second upper feed roll tension springs and remove lower card guides in aligner station.
5. Remove side aligner.
  - a. Disconnect spring from aligner to be removed.
  - b. Pull pivot pin and lift aligner out.
6. Replace in reverse order.

#### Forward Aligner Removal

1-4. Follow first four steps of Side Aligner Removal.

5. Remove first intermittent feed roll shaft.
  - a. Remove first intermittent feed roll hangers.
  - b. Work intermittent feed roll shaft out rear

of machine.

6. Remove forward aligner adjusting screw lock plates and adjusting screws for both aligners.
7. Remove third upright card guide support.
  - a. Remove four screws up through bottom of bed plate.
  - b. Forward aligners are mounted to this upright and will come out with it.

#### First Stepped Feed Roll Removal

1. Remove side aligners.
2. Remove four screws (two at each end) that hold support to side frames. The support is a thick metal plate approximately 3/8" thick that will be in the way for removal of the card guide support bracket. It is located below the card guide support bracket.
3. Remove two screws from small bracket that is located between support and card guide support bracket (one end of the small bracket is slotted).
4. Remove four screws (two at each end) that hold card guide support bracket in place. These screws come up from the bottom through the card guide support bracket.
5. Drop card guide supports and forward aligners out bottom of roll opening assembly.
6. Remove first stepped feed roll pulley, the gear on the second stepped feed roll, and cam follower arms from front of machine.
7. Remove two screws from card bed plate. These are on the front end under the second intermittent roll.
8. Remove front side frame from roll opening device.
9. Remove pulley and bearing retaining screws from rear end of stepped roll. If roll is being replaced, bearings are furnished with a new shaft.

#### Fourth Upper Feed Roll Removal

1. Remove punch unit from machine.
2. Remove geneva (do not remove locator blocks).
3. Remove bearing retainer screw from rear of fourth upper feed roll.
4. Remove the upper card guides and card lever in second intermittent station.
5. Remove screws from "L" shaped bracket.
6. Remove screws from card guide mounting bar.
7. Lift out card guide and "L" shaped bracket.
8. Tap the shaft to front and out of the rear bearing for removal.

#### Fifth Upper Feed Roll Removal

1. Remove punch unit from machine.
2. Remove belt and pulley from rear of second stepped feed roll.
3. Remove bearing retainer screw from rear of fourth upper feed roll.
4. Remove the upper card guides and card lever

in second intermittent station.

5. Remove screws from "L" shaped bracket.
6. Remove screws from card guide mounting bar.
7. Lift out card guide and "L" shaped bracket.
8. To remove, take out front bearing screw and tap shaft to rear.

#### Second Stepped Feed Roll Removal

1. Remove fifth upper feed roll. (Refer to Fifth Upper Feed Roll removal procedure.)
2. Remove lower card guide between second intermittent and second stepped feed roll.
3. Remove four screws in bed plate.
4. Remove the two rear screws and dowel from bed plate mounting block located under first stepped roll and roll opening device.
5. Remove rear side frame on roll opening device.
6. Remove cam and gear from front of stepped roll shaft.
7. Pull stepped roll through rear.
8. Re-assemble in reverse order.
  - a. When replacing the card guides between the fourth and fifth upper rolls, the guides must be laid in place; then the mounting bar is put in place and screwed to the guides.
  - b. Check for .012" to .030" card clearance between upper and lower guides.

#### ROLL OPENING DEVICE

##### Principles of Operation (Figure 4-8)

The two stepped rolls, the two lower intermittent rolls, and the die assembly are mounted on one assembly called the roll opening device. This assembly may be lowered to facilitate removal of card jams. The roll opening device should also be lowered when removing or inserting the die assembly. The locating blocks for the die are in this frame which makes die removal and insertion much easier.

The handle on the left side of the machine is pulled out and turned clockwise to lower the device and counter-clockwise to raise the device. An electrical contact interlocks the roll opening device so that the device must be in its UP position before the machine will run.

#### BRUSH ASSEMBLIES

Refer to Brush Assemblies of READ FEED Section.

#### PUNCH UNIT

##### Principles of Operation

The entire punch unit (Figure 4-10) can be easily removed from the machine for servicing. It can be

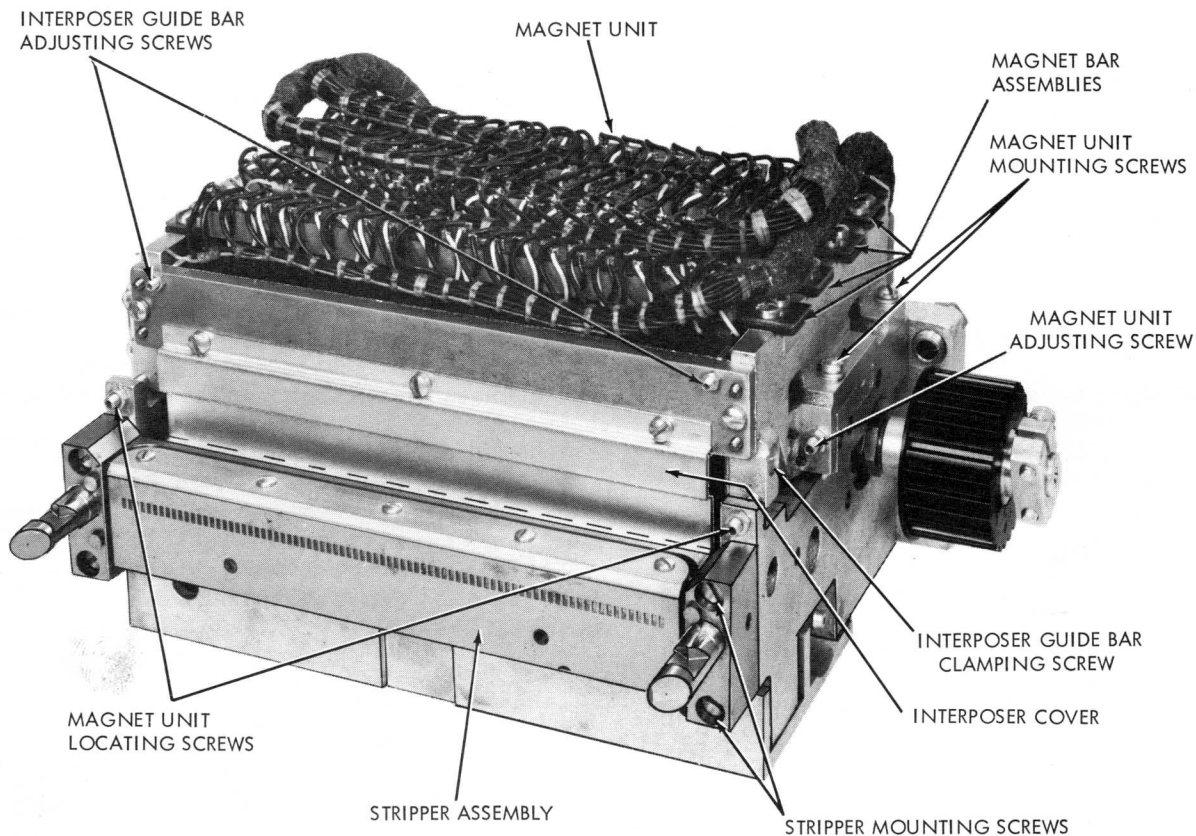


Figure 4-10. Punch Unit



separated into two main assemblies as follows:

1. The drive unit (Figure 4-11).
2. The magnet unit (Figure 4-13).

The drive unit can be further divided into the following units:

1. Cam shaft unit.
2. Punch bail and setup bail cam follower assembly.
3. Die and stripper assembly.

The cam shaft unit consists of a cam shaft and four sets of complementary cams.

The punch bail and setup bail cam follower assembly consist of:

1. A punch bail and two sets of cam follower arms.
2. An interposer setup bail and two sets of cam follower arms.

The punch magnet unit consists of 80 magnets, latches, interposer links, and interposers. The magnets are connected through miniature multi-terminal connectors to the machine circuits.

The camshaft in the punch drive unit operates continuously when the motor is running. The three-lobed cams operate the interposer setup bail and

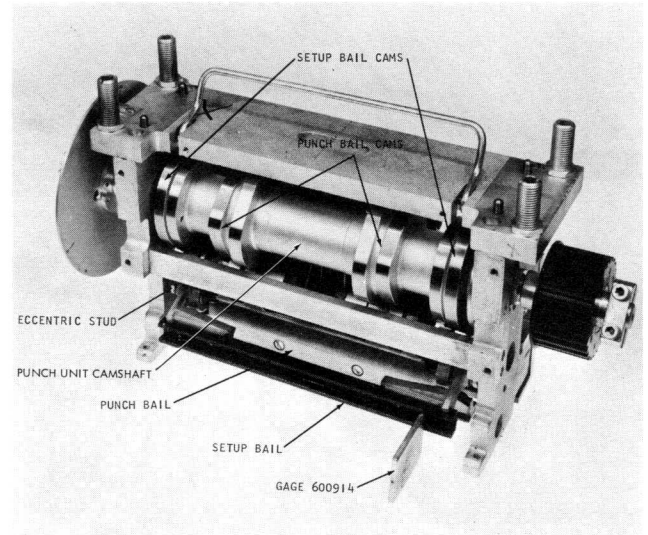


Figure 4-11. Drive Unit

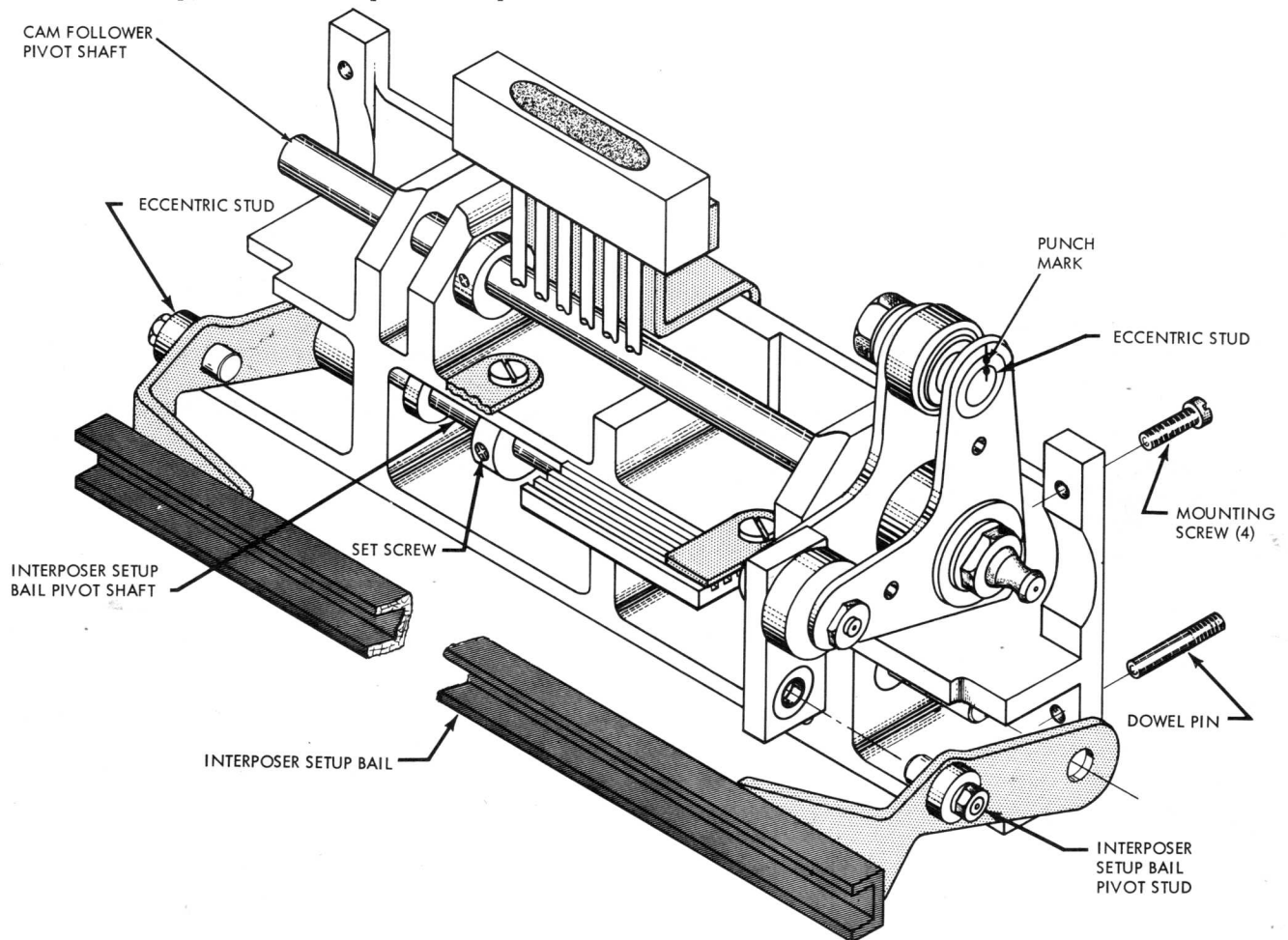


Figure 4-12. Cam Follower Assembly

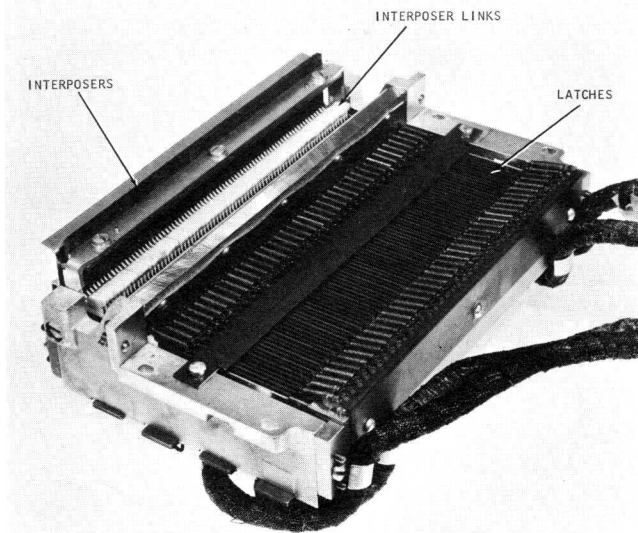


Figure 4-13. Magnet Unit

punch bail three times on each revolution of the punch camshaft. The punch camshaft makes 1333 1/3 revolutions per minute.

The interposer setup bail is a U-shaped channel. A projection on each of the 80 interposer links rides in the channel (Figure 4-15). As the interposer setup bail moves down, all the interposer links move down, carrying with them the 80 latches. This pulls each armature against its yoke. If punching is to take place, the magnet is energized at this time. Because the armature did not have to be attracted electrically, very low current is required to keep the armature sealed against its yoke. For this reason, the unit is sometimes referred to as a "no-work" punch unit.

When the interposer setup bail moves up, the magnet just energized keeps its latch in the down position. Because the latch is stationary, the upward movement of the interposer setup bail causes the interposer link to pivot, extending the interposer between the punch drive bail and the punch.

The movement of the punch unit camshaft then causes the punch bail to move down. Only those columns are punched that have the interposer between the punch drive bail and the punch. When the punch drive bail pushes the interposer down, the interposer is clamped between the punch and the punch drive bail. With this arrangement, the magnet can be de-energized while the punch is going down rather than waiting until the completion of the punching operation.

1402 PUNCH MAGNETS  
VIEWED FROM HOPPER

Cable	A	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4
	B	79	75	71	67	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3
		78	74	70	66	62	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2
		77	73	69	65	61	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1

C } Cable  
D }

Figure 4-14. Magnet Position Locating Chart

As the punch bail returns, the interposer is free to be restored by spring tension. On the return stroke of the punch bail, the punch is positively restored by the punch bail.

#### Punch Unit Removal

1. Remove the die.
2. Remove brush block assembly.
3. Remove both belts from punch unit shaft.
4. Remove four holding screws from top of unit.
5. Disconnect four multi-terminal connectors.
6. Lift punch unit from machine.

#### Punch Unit Installation

1. With die removed from the machine, place unit in machine tight against vertical and horizontal adjusting screws.
2. Replace four top holding screws.
3. Connect the multi-terminal connectors.
4. Insert the die.
5. Install the belts.
6. Time punch unit to machine.
7. Time PACB's to punch unit index.
8. Check registration and correct as necessary.

#### Cam Follower Bearing Adjustments

1. Remove punch unit from machine.
2. With punch unit at room temperature, adjust so that a .002" feeler gage, when placed between the cam follower bearings listed below and their respective cam surfaces, experiences moderate drag at the tightest point as the cam shaft is rotated through one revolution.
  - a. Punch bail complementary (top-inside) cam follower bearings.
  - b. Setup bail complementary (top-outside) cam follower bearings.
  - c. Punch bail active (bottom-inside) cam follower bearing.

This adjustment does not apply to the setup bail active (bottom-outside) cam follower bearings because the 80 latch springs force these cam follower bearings to ride tight against their cam surfaces.

3. With the cam follower bearings adjusted to the .002" feeler gage, check to see that a .005" feeler gage will not pass freely between any cam follower bearing and its respective cam surface at any point around the cam circumference. If this .005" adjustment cannot be met, check to see if the punch marks on the eccentric studs are up (these studs can be interchanged by mistake, in which case the punch marks would be down, making it impossible to adjust the follower bearings properly) (Figure 4-12).

#### Cam Follower Assembly Removal

1. Remove punch unit from machine.
2. Remove stripper assembly.

3. Remove two dowel pins in cam follower mounting plate (Figure 4-12).
4. Remove four mounting screws (Figure 4-12).
5. Separate cam follower assembly from punch unit.
6. Assemble in reverse order.

#### Service Checks

With the cam follower unit removed from the punch unit check:

1. That the four collars on the pivot shaft are tight against inner race of the pivot bearings.
2. That set screws holding cam follower pivot shaft, interposer bail pivot studs, and interposer setup bail pivot shaft are tight.
3. That nuts on all cam follower bearing shafts and interposer setup bail pivot studs are tight.
4. For wear, fretting corrosion, or lack of lubrication of all parts.

#### Cam Follower Assembly Timing

1. Use the timing rod to line up the timing holes in the cams with the hole in the punch unit left side frame.
2. Set the punch index at  $0^{\circ}$ .

#### Interposer Setup Bail Adjustment (Figure 4-11)

1. Remove punch unit from machine.
  2. Remove punch magnet unit from punch unit.
  3. Remove stripper assembly.
- NOTE: Mark or scribe a line on both ends and one side of stripper assembly to maintain punch registration when replacing on punch unit.
4. Set the drive unit on a flat surface and place gage (P/N 600914) as close as possible to the right side frame.
  5. Turn punch unit camshaft until setup bail rests on top of the gage (P/N 600914) (Figure 4-11). Make a note of the index setting.

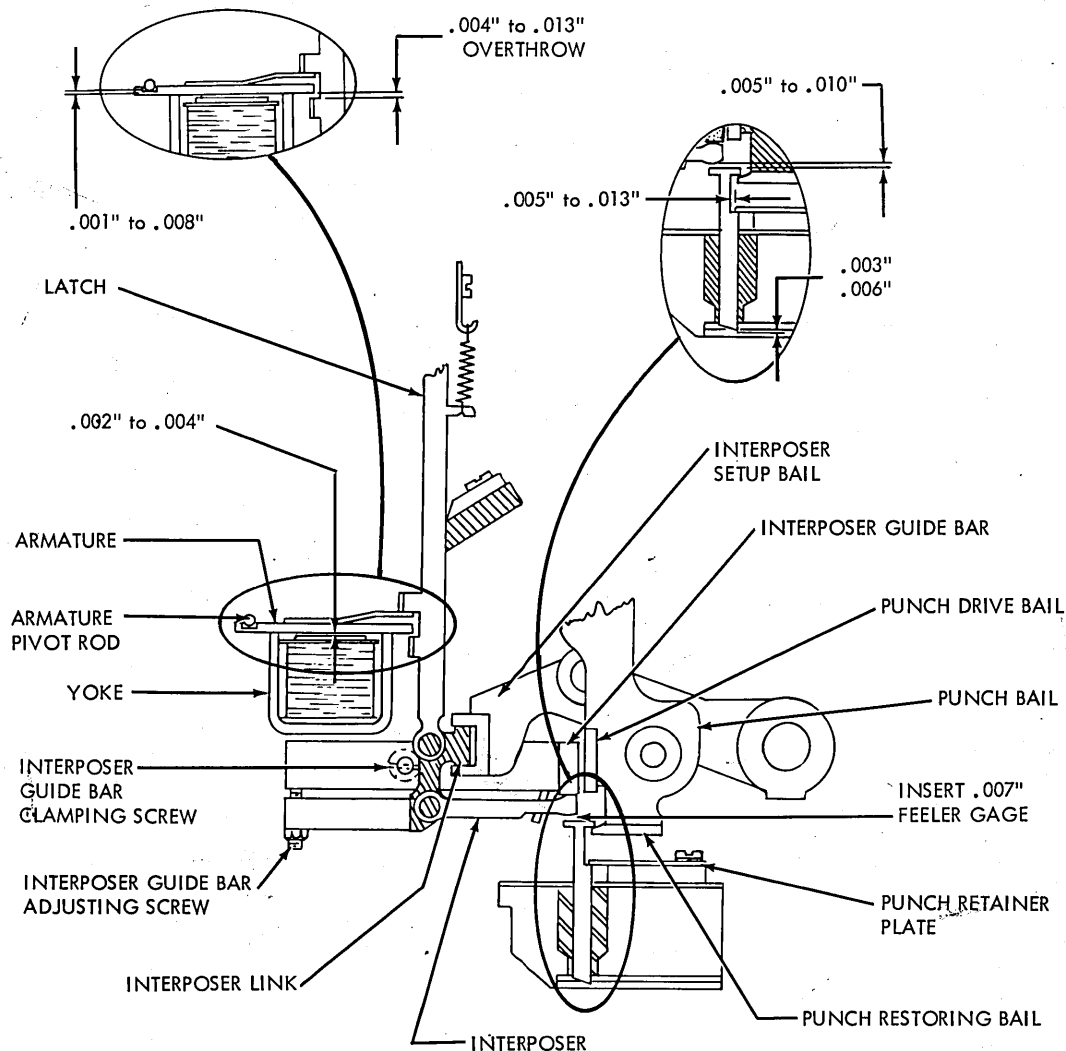


Figure 4-15. Punch Unit Adjustments

6. Remove gage without disturbing the setup bail, and insert gage at left side of setup bail. Place gage as close as possible to left side frame.

7. The setup bail should rest on top of gage in the same manner as in step 5. Check the index setting to insure it has not changed since step 5. Use the eccentric stud at the left end of the bail to satisfy this condition (Figure 4-11).

8. Recheck the adjustments after several rotations of the punch unit camshaft.

NOTE: The setup bail height must be gaged as close as possible to the drive unit side frame. The side frames must be in contact with the surface on which the gage is resting. Careful adherence to these precautions and to the procedure just outlined will result in a bail parallelism of within .003".

#### Interposer Setup Bail Removal

1. Remove punch unit from machine.
2. Remove cam follower assembly from drive unit.
3. Loosen set screws in collars on interposer setup bail pivot shaft, and on interposer setup bail.
4. Remove interposer setup bail pivot shaft.
5. Remove interposer setup bail pivot stud (column 1 end).
6. Remove interposer setup bail.
7. Assemble in reverse order.

NOTE: Check the interposer setup bail adjustments.

#### Magnet Bar Assembly Adjustment (Figure 4-15)

1. Remove punch unit from machine.
2. Remove punch magnet unit from punch unit (not always necessary).
3. With magnet bar assemblies removed from magnet unit check:
  - a. For .002" to .004" clearance between armatures and cores.
  - b. For armature to pivot rod clearance. Set clearance to somewhere between a wink of movement to a maximum of .008" with the operating end of armature held against the yoke.

#### Service Checks

With a magnet bar assembly removed check for:

1. Armatures for wear or for striking core and for loose springs or rivets.
2. Excess grease or contamination between armatures and yokes.
3. Binding between latches and latch guides.

#### Magnet Bar Assembly Removal

1. Remove magnet bar assemblies 2, 3, and 4 (counting from top to bottom).

**CAUTION:** Do not remove top bar with other three bars removed.

2. After inspection, replace bar assembly 4 and then 3.

3. Remove magnet bar assembly 1.

4. Replace magnet bar assembly 2 and then 1.

NOTE: The four magnet bar assemblies should be installed tight against the upper edge of the mounting slots. Bar assemblies go in easier with latches in lowest position. Center the magnet bar assembly so that the nylon armature guide comb does not interfere with the ears on the latches.

#### Magnet Unit Adjustments

The following steps will insure armature sealing:

1. Remove punch unit from machine.
2. Turn punch camshaft until interposer setup bail is at its lowest limit of travel.
3. Check for .004" to .013" clearance between the lower side of the armature and the latch at both the column 1 and column 80 ends of the unit (Figure 4-15).
4. Adjust the magnet unit on the punch unit to obtain this clearance.
  - a. Loosen magnet unit mounting screws (Figure 4-10).
  - b. Loosen magnet unit adjusting lock nuts and adjust screws for .004" to .013" clearance between armature and latch (Figure 4-15). The magnet unit locating screws hold the magnet unit against the adjusting screws.
  - c. With the interposers centered over their respective punches, tighten mounting screws and recheck clearance between the armature and its latch.

#### Magnet Unit Removal

1. Remove the punch unit.
2. Remove the stripper assembly.
3. Remove the interposer cover (Figure 4-10).
4. Loosen the magnet unit locating screws at each end of the punch unit.
5. Remove the four magnet unit mounting screws. Do not disturb the magnet unit adjusting screws (Figure 4-10).
6. Lift magnet unit off punch unit.
7. Use a rubber band to keep interposers from falling out.

#### Magnet Unit Installation

1. Position magnet unit as shown in Figure 4-13.
2. The 80 interposers should all be lined up.
3. Carefully place drive unit on magnet unit so that all 80 interposer links fit into the interposer setup bail (Figure 4-15).
4. Holding the assemblies together, turn them over and insert four magnet unit mounting screws. Do not tighten these screws.
5. Tighten magnet unit locating screws and lock nuts.

6. Tighten magnet unit mounting screws.
7. Replace stripper assembly.
  - a. Check for .004" to .013" latch overthrow (Figure 4-15).
  - b. Check for .005" to .010" interposer to punch clearance (Figure 4-15).
8. Replace the interposer cover.

#### Interposer Guide Bar Adjustment

1. Remove punch unit from machine.
  2. Check for .005" to .010" clearance between interposers and punch head. To check, proceed as follows:
    - a. With the punch magnet de-energized, insert a .007" feeler gage between punch and interposer (Figure 4-15).
    - b. Rotate punch unit camshaft through a complete revolution and check to see that the feeler gage experiences light drag at the tightest point.
  3. To adjust the interposer guide bar, proceed as follows:
    - a. Loosen interposer guide bar clamping screws slightly (Figure 4-15).
    - b. Loosen lock nuts on interposer guide bar adjusting screws.
    - c. Move interposer guide bar by means of adjusting screws, until the proper clearance is obtained. (Use a .007" feeler gage inserted between punch and interposer while adjusting.)
    - d. Tighten lock nuts and clamping screws.
    - e. Recheck clearance as outlined in step 2.
- NOTE: Lack of clearance between the interposers and the interposer guide bar at any point of the punch cycle can cause breaking of punches or excessive noise.

#### Interposer and Interposer Link Removal

1. Remove punch unit from machine.
  2. Remove magnet unit from punch unit. It is not necessary to remove the magnet bar assemblies.
  3. Remove latch spring in position to be removed (Figure 4-15).
  4. Push latch to its lowest limit of travel.
- NOTE: If this travel is not sufficient, remove the magnet bar assembly containing the punch magnet controlling the position to be removed. This will increase the latch travel.
5. Unhook interposer link from its latch.
  6. Remove interposer and interposer link.
  7. Assemble in reverse order.

#### Stripper Assembly Removal (Figure 4-10)

1. Remove punch unit from machine.
2. Mark or scribe a line on both ends and on one side of the stripper assembly to maintain punch registration when replacing on the punch unit.
3. Remove four screws and remove from punch unit (Figure 4-10).

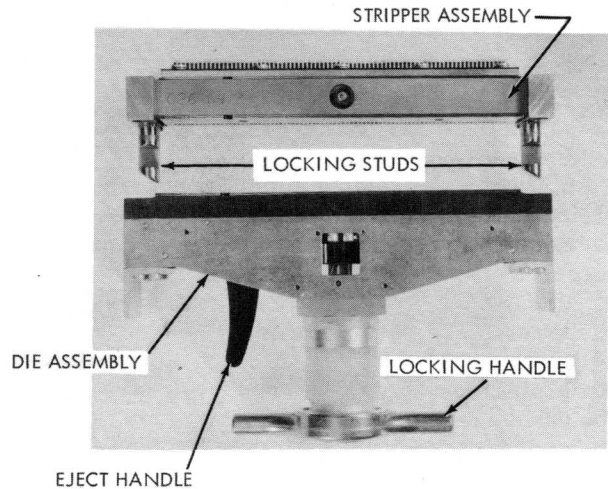


Figure 4-16. Die and Stripper

#### Stripper Assembly Installation

1. Re-install stripper assembly in its original position on punch unit.
  2. Check to see that the toes of the punches retract .003" to .006" into stripper. Adjust by adding or removing shims (P/N 437694) between the stripper assembly and the punch unit side frame. Part Number 437694 is .003" thick.
- NOTE: If the toes of the punches are retracted more than .006" within the stripper, the heels of the punches may shear the stripper plate.
3. Adjust retainer plate for .005" to .013" clearance between plate and punches (Figure 4-15).

#### Latch Removal

1. Remove punch unit from machine.
2. Remove magnet unit from punch unit.
3. Remove magnet bar assemblies from magnet unit.
4. Remove latch spring from latch to be removed.
5. Push down on latch and unhook interposer link.
6. Remove latch from magnet side of unit. The latches next to the one being removed may have to be moved slightly to obtain sufficient room for removal.
7. Assemble in reverse order using the following hints:
  - a. Replace magnet unit on punch unit before replacing magnet bar assemblies.
  - b. The latches can be pulled down to the lowest limit of travel to facilitate installation of the magnet bar assemblies by rotating the camshaft.
  - c. Position magnet bar against top of slot in magnet unit side frame.



## Punch Removal

1. Remove punch unit from machine.
2. Remove stripper assembly.
  - a. Remove the four mounting screws which hold the stripper assembly to punch unit.
  - b. Watch for shims which may be between stripper assembly and punch unit side frame.
3. Remove retainer plate from stripper assembly (Figure 4-15).
4. Remove the desired punch.
5. Assemble in reverse order.
  - a. Check for .005" to .013" punch to retainer plate clearance before reassembling stripper to the punch unit (Figure 4-15).
  - b. Check for .005" to .010" interposer to punch clearance.

## Punching Registration

1. Run cards through machine and check the punching registration with a card gage.
2. To shift punching laterally on card (horizontal registration):

- a. Loosen four holding screws on top of punch unit (Figure 4-17).

- b. Loosen locknut on horizontal adjusting screw and turn adjusting screw in proper direction to permit shifting punch unit in direction required to correct horizontal registration (Figure 4-17).

- c. Move punch unit so that it is tight against all three adjusting screws and tighten holding screws.

- d. Check registration. If necessary, repeat steps a through c.

3. To shift punching vertically on the card (vertical registration):

NOTE: See step 4 before proceeding.

- a. Loosen four holding screws on top of punch unit (Figure 4-17).

- b. Loosen vertical adjusting screw locknuts and turn adjusting screws in or out as required.

- c. Tighten locking nuts on adjusting screws.

- d. Move punch unit snug against all three adjusting screws.

- e. Tighten four top holding screws.

- f. Check registration. If necessary, repeat

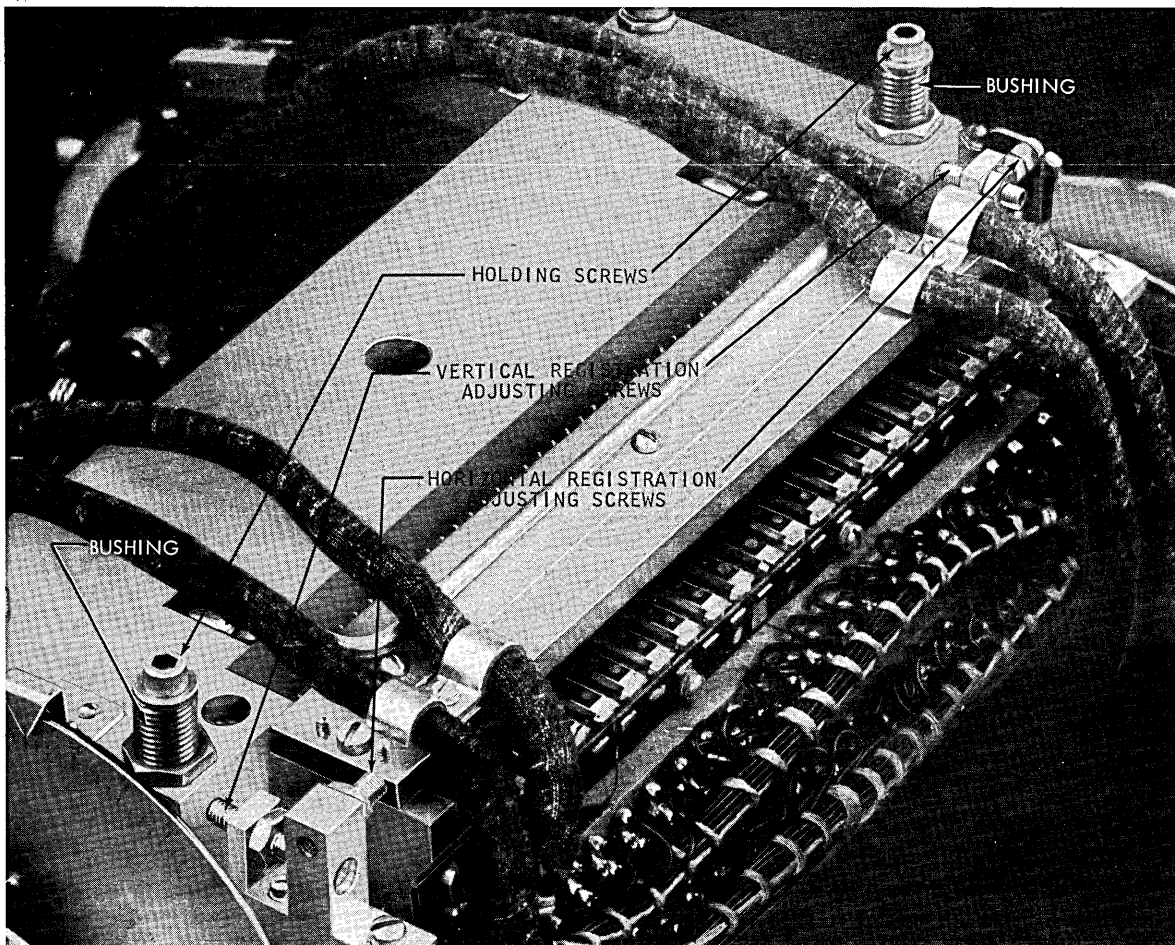


Figure 4-17. Punch Unit Adjusting Screws

steps a through e.

4. If the vertical registration is off more than a few thousandths of an inch, the punch unit adjustment is not likely to be the cause. Investigate some other possible source of trouble:

- a. Aligner station for correct operation and timing.
- b. Proper card feeding--loose feed roll belts, etc.
- c. Worn or loose geneva studs and gears.

#### Punch Unit Timing

At  $0^{\circ}$  on the dynamic timer index or with the geneva timing pin seated, the punch index should read  $0^{\circ}$ ,  $120^{\circ}$ , or  $240^{\circ}$ . If the punch index does not read  $0^{\circ}$ ,

$120^{\circ}$ , or  $240^{\circ}$ , proceed as follows:

1. Loosen split hub of punch unit input pulley.
2. Depress geneva timing pin and turn machine manually until pin seats in geneva drive disk.
3. While holding geneva in this position, grasp punch unit output pulley and turn shaft to  $0^{\circ}$ ,  $120^{\circ}$ , or  $240^{\circ}$  on punch unit index. This timing can be observed from front side of machine.
4. Tighten punch input pulley.
5. Crank machine over and check punch unit index with dynamic timer index.
  - a. At  $0^{\circ}$  on the dynamic timer index, punch unit index should read  $0^{\circ}$ ,  $120^{\circ}$ , or  $240^{\circ}$ .
  - b. If punch unit is set at  $0^{\circ}$  when the dynamic timer index is  $0^{\circ}$ , it will take three revolutions of dynamic timer index for both to be set at  $0^{\circ}$  again.





## TIMING DRIVE BELTS

### PUNCH FEED INSTALLATION PROCEDURES

Because of the large number of timed drive belts in the punch feed, special attention will be given to the replacement and retiming procedures to be performed. An important point to remember when retiming units that refer to the punch clutch is the synchronous tooth ( $315^{\circ}$ ) of the punch clutch. This tooth must be used, otherwise all timing will be  $90^{\circ}$ ,  $180^{\circ}$ ,  $270^{\circ}$  from timing specifications. All machines after serial number 20600 will use one particular tooth as the synchronous tooth. This will be the tooth with its driving face opposite the centerline of one of the three tapped holes located in the outside collar. On earlier machines, gage number 608183 must be used. Figure 5-1 will give a brief outline of the units to be removed and units to be retimed in the event of belt breakage.

#### (1) Main Drive Belt

1. Trip clutch between  $230^{\circ}$  and  $300^{\circ}$  and turn input idler pulley manually until dog engages in clutch ratchet.
2. While holding armature in tripped position, continue turning machine until latching surfaces of clutch latch arm and dog carrier coincide (Figure 4-2F).
3. At this time punch feed index should be  $315^{\circ} \pm 1/2^{\circ}$ .
4. Set timer index at  $315^{\circ}$ .
5. At this point, slip belt on geneva pulley and while keeping the relationship between lower pulley and input idler pulley ( $315^{\circ}$  at the clutch and  $315^{\circ}$  at the timer) slip belt onto two pulleys. Check timing relationship again.
6. To time the geneva, loosen geneva pulley lock screws, set timer index to  $0^{\circ}$ , and set punch index to  $0^{\circ}$ .
7. Depress geneva lock pin and tighten geneva pulley lock screws.

NOTE: At  $315^{\circ}$ , if everything is in time, the geneva pin should fall into the slot and the punch clutch will line up as described in step 2.

#### (2) Drive Motor Belt

1. Mark CR idler belt (3) and pulleys to maintain timing.
2. Loosen CR idler belt (3) and slip it off.
3. Install drive motor belt and tighten.
4. Install CR idler belt (3), line up reference marks, and tighten with idler pulley.

#### (3) CR Idler Belt

1. If there is sufficient clearance to work the belt between the index pulley and the cross-over shaft pulley, the index timer unit does not have to be removed from the base. Otherwise, the three base mounting screws on the timer index will have to be loosened.
2. Install new belt, tighten idler pulley, and if necessary, tighten timer index unit (three screws).
3. Retime index timer by loosening timer index set screws (Figure 5-2). Unlatch punch clutch between  $230^{\circ}$  and  $300^{\circ}$  and while holding the armature in the tripped position, continue turning machine until latching surface of clutch arm and dog carrier coincide (Figure 4-2F).
4. At this time, set timer index to  $315^{\circ}$  and tighten timer adjustment set screws.
5. To retime PCCB's, loosen PCCB pulley set screws. Set timer index to make time of PCCB 4 (wiring diagram). Turn PCCB unit in normal direction of rotation until PCCB 4 makes and then tighten PCCB pulley set screws.

#### (4) Timer Index Belt

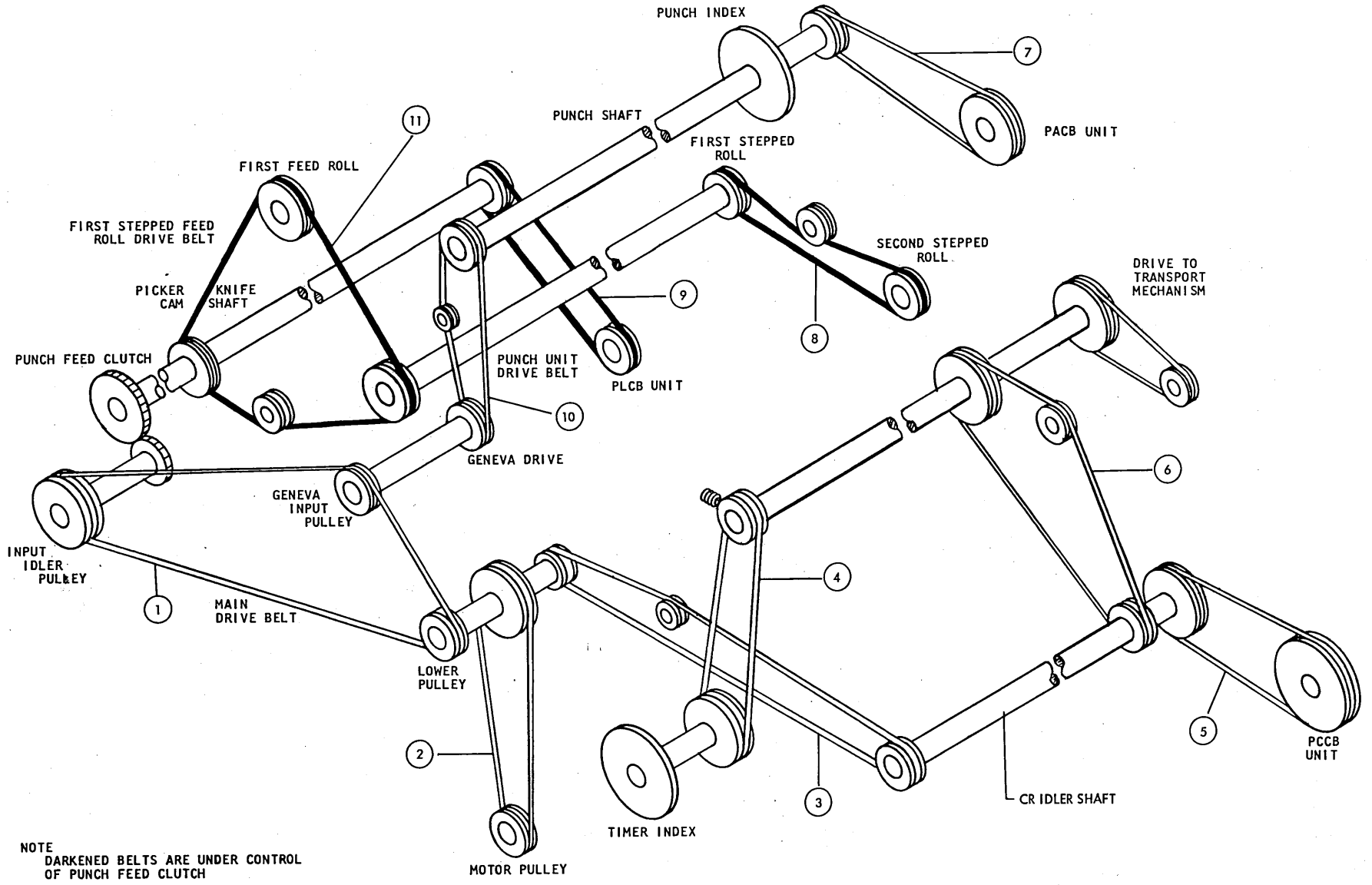
1. To get belt replacement clearance (if necessary) loosen timer index mounting screws (3).
2. Install belt. If base screws were removed, tighten by pulling timer unit to left. Tighten mounting screws.
3. To time timer index, loosen index pulley set screw (Figure 5-2). Set punch unit to  $0^{\circ}$  and depress geneva pin.
4. Set index to  $0^{\circ}$  and tighten pulley set screw.

#### (5) PCCB Drive Belt

1. Install new belt. If belt is too tight or loose, loosen PCCB unit mounting bolts and adjust belt.
2. Loosen PCCB adjusting set screws on drive pulley.
3. Set timer index to make time of PCCB 4 (wiring diagram) and turn PCCB unit in the machine operating direction until PCCB 4 makes, then tighten set screws.

#### (6) Idler Belt

1. Remove PCCB drive belt (5) and transport drive belt.
2. Install new belt and tighten with idler pulley.
3. Replace transport drive belt (no timing required) and PCCB drive belt.



NOTE  
DARKENED BELTS ARE UNDER CONTROL  
OF PUNCH FEED CLUTCH

Figure 5-2. Punch Feed Timing Belts

Belt Name and Reference Number	Belts or Units To Be Removed	Units to be Retimed After Belt Replacement
(1) Main Drive Belt		Punch Clutch, Geneva
(2) Drive Motor Belt	CR Idler Belt (3)	Timer Index, PCCB Unit
(3) CR Idler Belt	* Timer Index	Timer Index, PCCB Unit
(4) Timer Index Belt	* Timer Index	Timer Index
(5) PCCB Belt		PCCB Unit
(6) Idler Belt	PCCB Belt (5) Belt to Transport Assembly	Timer Index, PCCB Unit
(7) PACB Belt	PACB Unit	PACB Unit
(8) Second Stepped Feed Roll Belt		Second Stepped Feed Roll
(9) PLCB Belt		PLCB Unit
(10) Punch Unit Drive Belt		Punch Unit
(11) First Stepped Feed Roll Drive Belt	Main Drive Belt (1) *Punch Input Idler Pulley *Punch Drive Gear Spring (Cam Follower)	Punch Clutch, Geneva First Stepped Feed Roll

\* If there is sufficient belt replacement clearance, this unit does not have to be removed.

Figure 5-1. Punch Drive Belt Replacement Chart

- To retime the timer index refer to Drive Motor Belt Replacement, steps 4 and 5.
- To time PCCB's refer to PCCB Drive Belt Replacement, steps 2 and 3.

(7) PACB Drive Belt

- Remove PACB unit from machine (three screws).
- With unit off machine, mark two white nylon gears and remove the gear on the belt pulley shaft.
- Slip the new belt on and reinstall white nylon gear. Be sure timing marks are rematched. NOTE: On the PACB shafts there are two collars; each has a scribed line. There are also two scribed lines on the casting which will coincide with the collar lines at 0° on the punch index (Figure 5-3). Set the two CB shaft lines to line up with the scribed lines on the casting, set the punch index on 0°, then slip the PACB belt over the punch pulley. If care is taken the PACB unit can be tightened and both units will be in time.
- If the PACB unit CB's are not in time, loosen the PACB drive pulley screws. Align the two scribed marks on the PACB mounting unit with the collar scribed lines, set the punch index to 0°, depress the geneva pin, then tighten the pulley screws.

(8) Second Stepped Feed Roll Drive Belt

- Loosen idler pulley. Install new belt and tighten with idler pulley.
- Remove punch feed brushes and PFR brushes (if installed).
- For timing the second stepped feed roll, refer to Feed Rolls and Aligner Stations, Adjustments, Second Stepped Feed Roll, steps 2 thru 7.

(9) PLCB Drive Belt

- Install belt.

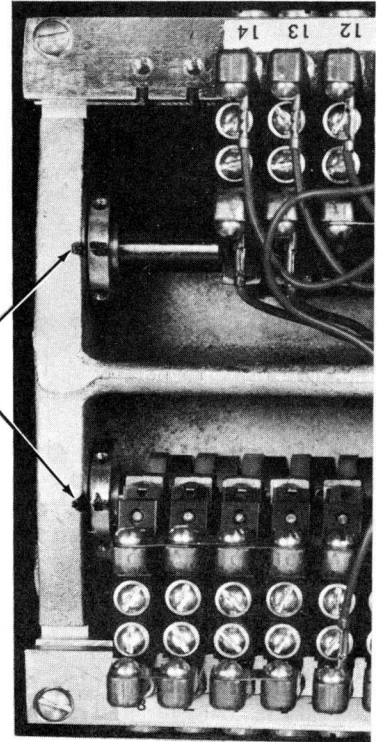


Figure 5-3. PACB Timing Marks

- Loosen PLCB shaft pulley clamping screws and retime PLCB to timer. Tighten screws.

(10) Punch Unit Drive Belt

- NOTE: Do not remove geneva unit.
- Loosen idler pulley. Install belt and tighten belt with idler pulley.
  - To retime punch, loosen locking screws on punch unit drive pulley. Set punch and timer index to 0°.
  - Depress geneva pin and tighten pulley lock screws.

(11) First Stepped Feed Roll Drive Belt

- Remove the main drive belt. NOTE: If there is sufficient clearance between the punch clutch unit and the punch drive gear to install the new belt, steps 2, 3, 8, and 9 do not have to be performed.
- After marking punch input idler pulley relationship to punch drive gear (Figure 5-4) remove hex nut that holds input idler pulley shaft onto machine casting. Remove unit. NOTE: IF this relationship is not maintained there is a possibility of getting the punch clutch back in step ±2° out of time.
- Loosen three set screws on clutch ratchet

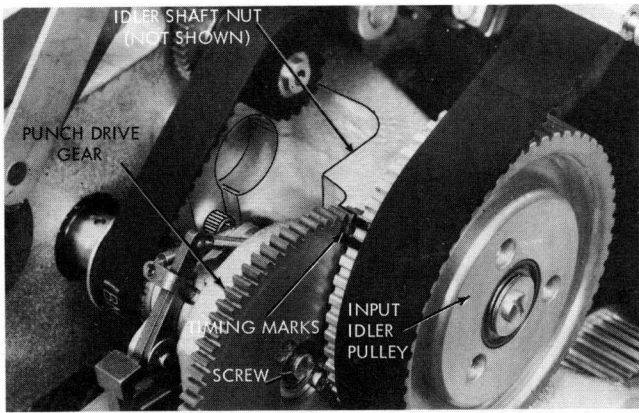


Figure 5-4. First Stepped Feed Roll Timing Belt Installation

collar, loosen punch drive gear holding screw and slide gear out on spline to obtain belt replacement clearance.

NOTE: Expose no more than 1/4" of spline.

4. Remove cam follower spring for ease of belt replacement.
  5. Unlatch clutch and manually turn punch shaft slightly.
  6. Pass belt over clutch magnet assembly and between cam follower and cam.
  7. Loosen idler pulley, install belt and adjust tension with idler pulley.
  8. Tighten punch drive gear and three set screws on clutch ratchet collar. Hook cam follower spring back on.
  9. Install punch input idler pulley. Be sure to get timing marks, made previously, into their respective positions. Tighten hex nut.
- NOTE: At this point, punch clutch, geneva unit, and first stepped feed rolls must be timed.
10. To retim punch clutch and also geneva, refer to Main Drive Belt procedures.
  11. The first stepped feed roll can be retimed by referring to Feed Roll and Aligner Stations, Adjustment, First Stepped Feed Roll.

NOTE: Once this procedure has been performed, the rest of the feed mechanism should be back in time.

The remaining drive belts in the transport unit are easily replaced and require no timing after replacement.

## READ FEED BELT INSTALLATION

### Clutched Feed Roll Drive Belt

1. Remove solar cell unit.
  - a. After removing plastic cover, remove disk mounting screw and disk.
  - b. Loosen three set screws in solar cell mounting plate. These screws retain the mounting

2. Loosen idler pulley. Install belt and tighten belt with idler pulley.

3. Loosen picker knife camshaft drive pulley.

4. Trip clutch by hand and turn index to 212° for three group brushes or 216° for two group brushes. Place a card against the first feed rolls and manually turn the picker camshaft machine direction until the feed knives touch the card. Tighten pulley locking screws. This is a reference point. Check brush timing with timer index and shift picker camshaft to get proper timing.

NOTE: Any change in picker knife timing will directly affect RCCB and solar CB (if on machine).

5. After brushes are in time, reinstall solar cell unit.
  - a. Remount solar cell mounting plate flush against the shoulder of the three studs and tighten three set screws located in mounting plate.
  - b. Reinstall disk and slightly tighten disk mounting screw. Check to see that disk is located in center of solar cell mounting block. If care has been taken to remove and reinstall the cell unit and disk, the disk will be located in the same place, in reference to cell mounting block, as it was originally installed (Figure 5-5).

6. To retim solar cell, refer to Solar Cell CB, Timing Procedure, step 2 and 3.

7. At this point, it may be advisable to time the RLCB's to make certain they are within their tolerance.

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### Read Feed Belts

The rest of the belts in the read feed are easily replaced and require no timing if they have to be removed or replaced.

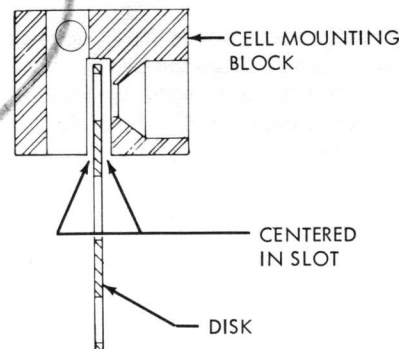


Figure 5-5. Disk Location

SOLAR CELL CB

Introduction

The solar cell CB unit is physically mounted in the read feed, on the back end of the feed knife camshaft (Figure 6-1). This unit replaces RLCB's 4, 5, 6, 7, 8, and 9. There are three major components in this unit; the solar cell, light source, and timing disk. With the aid of three transistors and necessary circuitry, the three components provide the 1402 Read Feed with the main digit impulses.

Principles of Operation (Figure 6-2)

The solar cell circuit breaker has one mechanical moving part which is the disk. This disk has twelve timed slots in it (9 through 12 time). As the disk revolves, the slots in the disk allow the light beam to strike the solar cell at digit impulse time. When the light strikes the cell, transistor T6 is conditioned by the cell output. The output of T6 is amplified by T7 and then T8. The output of T8 is used to condition 1401 and 1402 circuitry just as the digit impulse RLCB's did prior to the solar cell.

Before proceeding into the timing procedure or any of the adjustment steps, there are several points that may assist the CE in working on this unit:

1. The pulse duration of the solar cell CB varies with the light intensity while the pulse timing varies with the relationship of the slotted disk to the light beam.

2. Before any extensive analyzing of the solar cell unit is started, it may be a good idea to check the control voltages which can be measured at the solar cell terminal board (SC-TB) terminals. These terminals are numbered 1-10, left to right facing the rear of the machine. The voltages are measured from the ground hub on the CE Aid Panel to the terminals. Voltage found at SC-TB5 will be - 20 v, SC-TB6 from +1 v to + 2 v depending upon the potentiometer setting. SC-TB9 will be + 6 v, and at SC-TB10 the voltage will be - 12 volts. These are external supplies which must be present for the solar unit to work properly.

Whenever the cell unit is worked on, care should be taken not to damage the components or bend the disk.

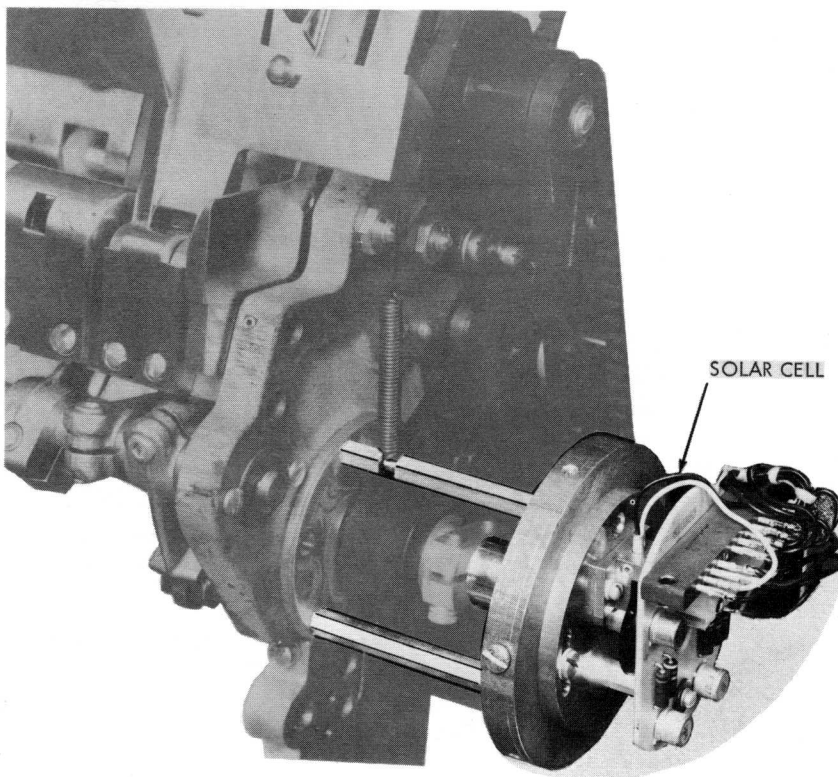


Figure 6-1. Solar Cell Position

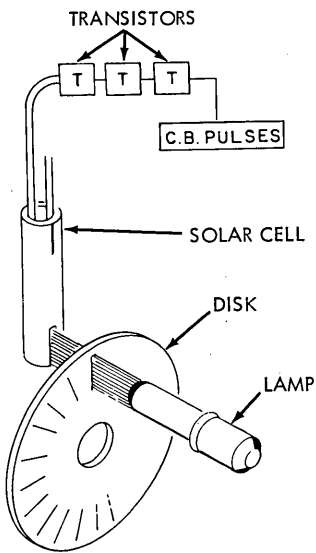


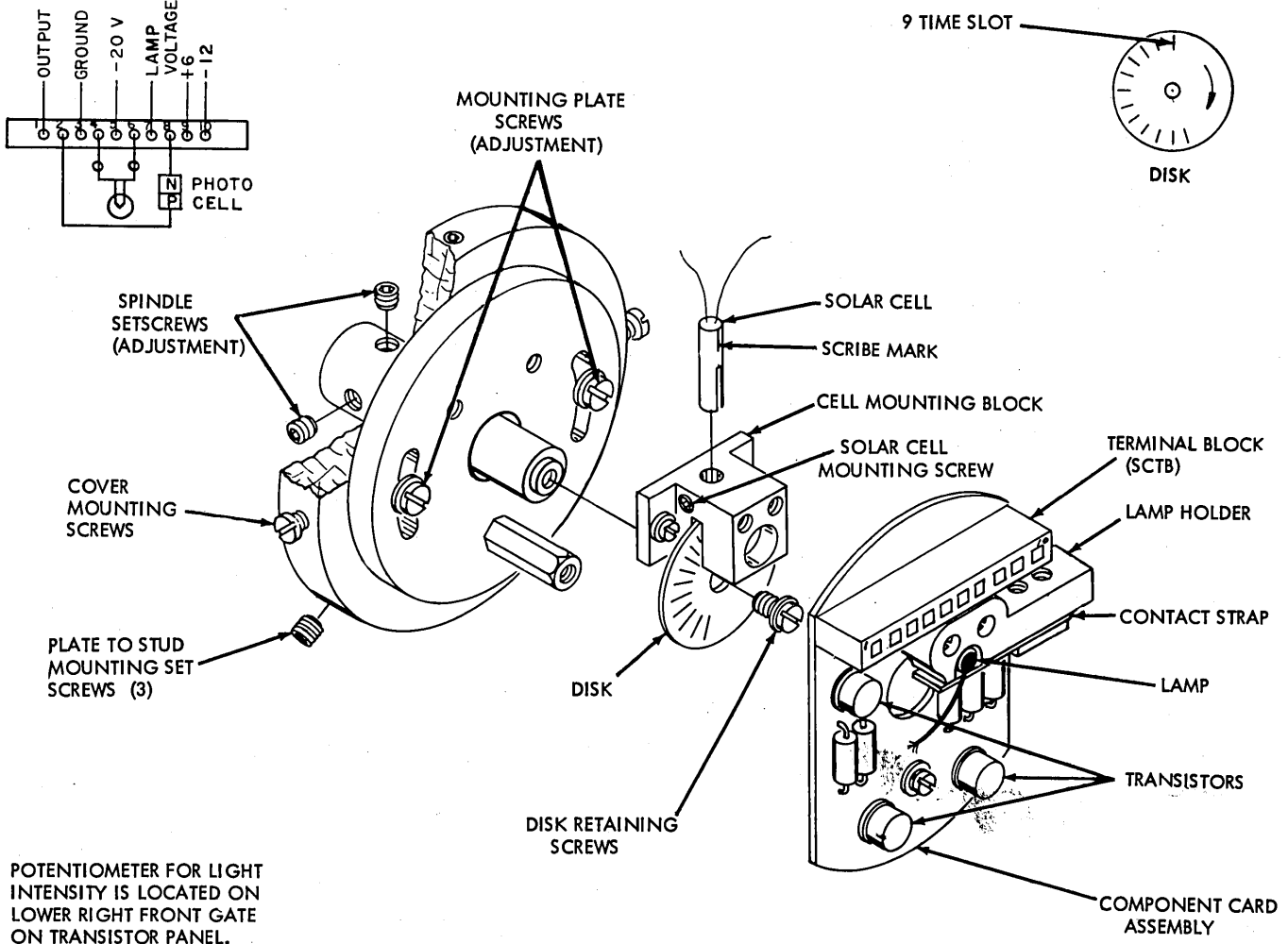
Figure 6-2. Solar Cell Schematic

### Timing Procedure

1. While depressing the non-process runout key, adjust the duration of CB pulse for  $2^0 + 1^0 - 0^0$  (415-624 micro seconds with a scope at SC-TB1) on read dynamic timer dial with potentiometer which is located on the relay gate transistor panel. Final duration adjustment should be made after one hour of power on.

2. With power removed and reader cranked to "9" time, a coarse timing can be obtained by loosening disk retaining screw and rotating till "9" time slot is visually opposite the light source (Figure 6-3).

3. To accurately adjust the cell for CB duration, loosen the mounting plate screws (Figure 6-3) which enable the mounting plate to be rotated within the mounting slots. Check the "make" and "break" time of the CB pulses at several digit times on the timer. If the mounting plate slotted hubs do not allow proper adjustment, repeat step 2.



POTENTIOMETER FOR LIGHT INTENSITY IS LOCATED ON LOWER RIGHT FRONT GATE ON TRANSISTOR PANEL.

Figure 6-3. Solar Cell Lamp

## Adjustment Procedure

1. Check for the disk being visually centered laterally in the slot in the solar cell mounting block. Adjust if necessary by loosening set screws and repositioning spindle on picker knife camshaft (Figure 6-3).

2. Set the potentiometer to give 1.8 volts across lamp terminals (SC-TB4 and SC-TB6). This lamp voltage is a starting point only. The final setting must produce a pulse duration of  $2^0 + 1^0 - 0^0$ .

3. Remove machine power.

4. Unplug solar cell leads from SC-TB2 and SC-TB8 and connect to an IBM meter (yellow lead plus). Set the scale to a reading capable of measuring values from 0 to 500 microamps (1/2 ma).

5. With clutch manually tripped, bring power up and hand crank the read feed to a digit CB time (disk slot opposite solar cell). Turn the machine very slowly to avoid passing index points where meter deflection occurs. A minimum of 100 microamps should be observed. Orient and/or replace lamp or solar cell assemblies to obtain the required output.

## Removal and Replacement (Figure 6-3)

### Lamp Assembly

1. Remove machine power.

2. Loosen two contact strap screws until lamp can be slid out of lamp holder. Unplug lamp lead from SC-TB6 and remove.

3. To reinstall lamp, plug lamp lead into SC-TB6 and insert lamp to its full depth through lamp holder and retighten contact strap screws.

4. The lamp holder mounting screws must be loosened to permit the plastic lamp holder to be shifted. This will permit the lamp base to seat firmly in the plastic holder with the lens end fully seated against hole in solar cell mounting block (Figure 6-4).

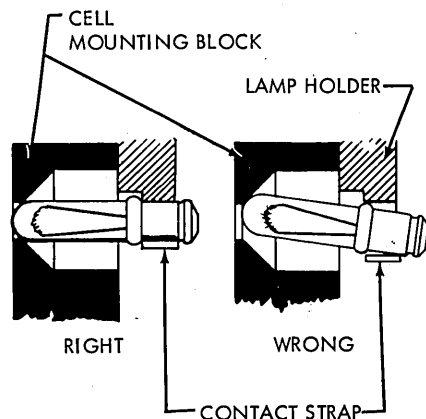


Figure 6-4. Solar Cell Adjustments

5. Check solar cell output by setting lamp terminal voltage at 1.8 and measuring a minimum of 100 microamps across cell at any index point as described in step 5 of adjustment procedures. Cell output may be peaked by rotating lamp in holder.

NOTE: Depress the end of the contact strap to relieve pressure which will permit rotating and/or reseating lamp. It may be necessary in some cases to reposition lamp holder after rotation as in step 4.

### Solar Cell Assembly (Figure 6-3)

1. Remove machine power.

2. Loosen set screw and remove solar cell assembly. Unplug solar cell leads from SC-TB2 and SC-TB8.

3. To reinstall, insert cell into cell mounting block leaving approximately 1/4" of the metal sleeve exposed above the cell mounting block. Position the scribed locating mark so that it points toward the light source (Figure 6-3).

4. Connect solar cell leads to meter. Check output by setting lamp terminal voltage at 1.8. At an index point, measure for a minimum of 100 microamps across the cell as described in step 5 in adjustment procedure. To avoid damaging cell, use care when tightening cell retaining set screw (Figure 6-3).

5. Plug the solar cell leads into SC-TB2 (yellow lead) and SC-TB8.

### Component Card Assembly (Figure 6-3)

1. Remove machine power.

2. Unplug (identify if necessary) the leads in the solar cell terminal block.

3. Remove the lamp holder mounting screws and lower component card mounting screw. Remove component card assembly.

4. To reinstall, replace the lamp holder and mounting screws. Adjust the lamp for proper position according to Lamp Assembly Removal and Replacement step 4.

5. Plug all leads into terminal block.

## PERMISSIVE MAKE RELAYS

### Principles of Operation (Figure 6-5)

All wire contact relays in the 1402 are of the permissive-make type. The difference between them and the conventional type is indicated by their names. In the permissive relay, a contact is never forced to make by armature pressure. The armature is always moved out of the way of an open contact and the spring tension of the contact wire is permitted to make the contact. This can be seen in Figure 6-6. The fact that the armature is not slamming the contact closed, gives a more closely controlled make with less bounce. The 1402 uses four- and six-position, high speed and standard permissive-make relays. All relays have 20 v coils.



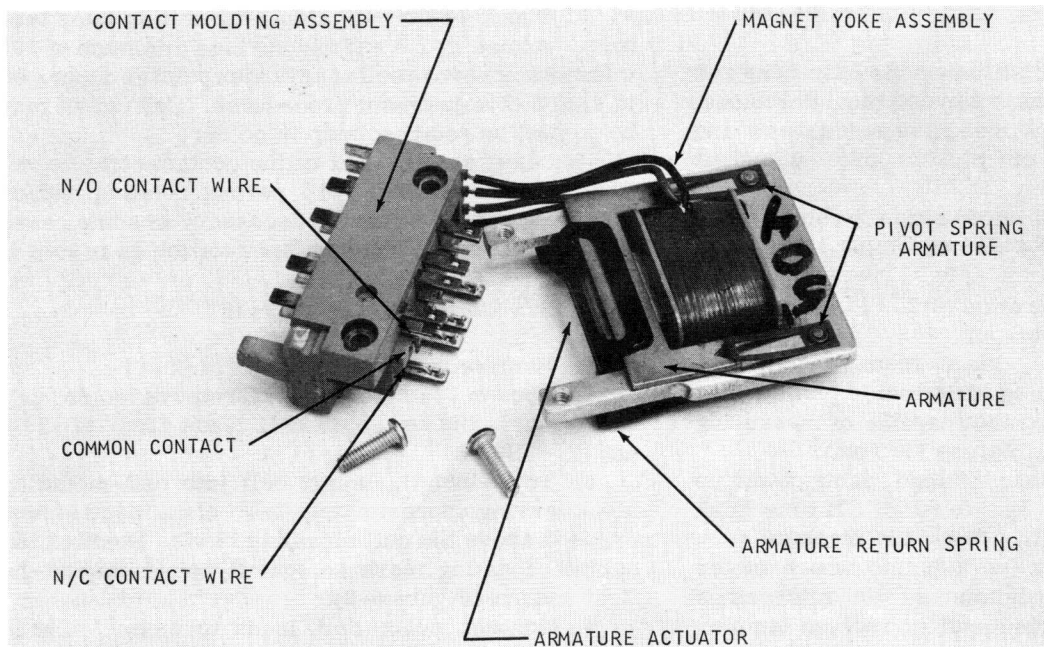


Figure 6-5. PM Relays

### Contact Replacement

When a machine malfunction is caused by PM relay contacts failing to make, it may not be necessary to replace the entire relay. The following procedure should be used to replace individual contact wires and check common contacts for dust or corroded areas.

1. Remove the two relay yoke mounting screws and separate the contact moulding assembly from the yoke assembly. This will expose the contact wires and common contacts. Use care to prevent breakage of coil wires from relay moulding.
2. Using a screwdriver, press the contacts free of the locating hole and remove them from the moulding.
3. Inspect the common contact point for dust or corrosion film. If necessary, lightly burnish the point. Do not attempt to clean the common contact if it is pitted or burned. This will result in increased air gap and loss of contact tension.
4. Check new contacts for correct configuration before installing (Figure 6-7).
5. Install new contact wires one at a time to avoid twisting.

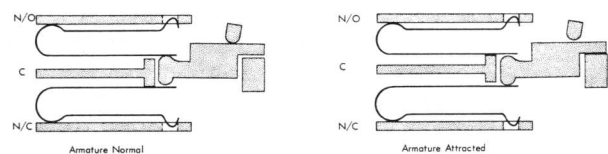


Figure 6-6. PM Schematic

6. Re-assemble yoke to contact moulding assembly. The armature must be centered on the contact wires with equal dimensions between the end contacts and the ears of the moulded armature actuator. Be certain that the yoke is held tight against the mounting pads.

7. Check all wires to see that none are crossed or misplaced from the locating hole. Check for freedom of armature and coil leads and proper seating of the armature pivot springs. Check the operation of the relay contacts with the dynamic timer or oscilloscope.

### CIRCUIT BREAKERS

The read feed has CB's that are continuously running and some that are under control of the read clutch. Both sets of circuit breakers turn at 800 rpm. The punch feed has three sets of CB's, one set is under control of the punch clutch while the other two sets are continuously running. One set of continuously running CB's turn at 250 rpm while the other set turns at 1333 1/3 rpm. Identification of these circuit breakers is as follows:

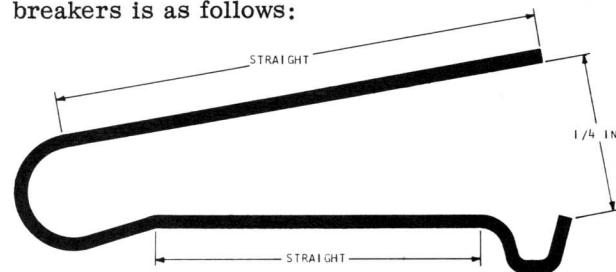


Figure 6-7. PM Relay Contact Wires



RCCB—Read feed continuously running  
RLCB—Read feed clutch controlled  
PCCB—Punch feed continuously running  
PACB—Punch feed continuously running high speed  
PLCB—Punch feed clutch controlled

For machines without the solar CB cycle points, RL5 and 6 are the make and break for odd digits while RL7 and 9 make and break for the even digits.

In the punch feed, the PACB's are used for digit impulses. They make and break three times for every punch index cycle. Because they are running at 1333 1/3 rpm, they will actually make and break 16 times every punch machine cycle.

The RCCB's, RLCB's and PLCB's are the plunger type CB, P/N 602083. The PACB's are the plunger type P/N 435701. If either point becomes burned on these assemblies, replace the entire assembly. The PCCB's are the unitized rocker type, P/N 255970. These cams have removable stationary points. However, if the movable point becomes burned, the entire contact assembly must be replaced. Stoning or cleaning of any of these cam contact surfaces is not practical as the results do not justify the time and expense involved.

Certain positions of the RLCB's and PACB's

require circuit breakers with silver contact points. For the RLCB's the positions are 1, 2, 3, 4, and 9. The P/N for this circuit breaker is 610070. For the PACB's the positions are 1, 2, 3, 4, 11, and 12 and the circuit breaker P/N is 610073. The silver points minimize "failure-to-make" problems previously encountered with tungsten points.

**CAUTION:** The silver point circuit breakers can be used only in low current circuits. Attempts to use them in other than specified positions will lead to early failure.

1402 machines equipped with a solar circuit breaker on the RL shaft will have only three RLCB's which are numbers 1, 2, and 3.

#### Open Strap Contacts

##### Adjustments

1. Position all card lever contacts to give a minimum contact travel of 1/16" when the card lever is being operated.
2. Adjust all contacts for 1/32" minimum air gap.
3. All contacts should have a minimum of 1/64" rise of the N/O contact strap off its support.



## SERVICE AIDS

### CUSTOMER ENGINEERING SERVICE PANEL

The 1402 Card Read-Punch contains a customer engineer service panel (Figure 7-1). This panel allows the Customer Engineer to check certain routine areas without going directly to the internal parts of the machine. This can save much valuable time. Following is a list of switches and their use.

**Dial Display Switch:** This toggle switch selects which one of the timer indexes is being used with the service panel.

**Off Line Card Feed:** This rotary switch when set to OFF LINE allows the feeds to be operated independently of the system. It must be set to ON LINE for the system to operate.

**Read Clutch Trip:** This momentary contact switch allows the read clutch to be electrically tripped. The off line card feed switch must be on OFF LINE to make this switch effective.

**Brush Selection:** This rotary switch, when set to a brush position, internally connects brush 3 (outer light) and 78 (inner light) of the selected set of brushes to the dynamic timer. When the corresponding feed brush display switch is held on, the brush timing is displayed on the associated feed timer index. **Example:** To check second read brush timing, set brush selection to SECOND READ and run card through the read feed with columns 3 and 78 punched. When the read brush display switch is held ON, the brush timing is displayed on the read feed index.

**Read Brush Display:** This momentary contact switch is used in conjunction with the brush selection switch to display read feed brush timing.

**Cam Selection:** This rotary switch when set to a position on the dial, selects a certain CB for a timing check.

**Read Cam Display:** This momentary contact switch is used in conjunction with cam select switch. It displays the read feed CB selected for a timing check on the read feed index.

**Voltage Hubs:** Each power supply voltage may be checked at these hubs.

**Punch Clutch Trip:** This momentary contact switch allows the punch clutch to be electrically tripped. The off line card feed switch must be set to OFF LINE to make this switch effective.

**Sync:** Because the punch feed has a four-tooth clutch ratchet, this momentary contact switch is used to sync the punch feed and the punch index at 315°.

**Punch Brush Display:** This momentary contact switch is used to display the timing of the punch check brushes when the brush selection switch is set to the PUNCH CHECK position.

**Punch Cam Display:** This momentary contact switch is used in conjunction with the cam selection switch to display the punch feed CB selected for a timing check.

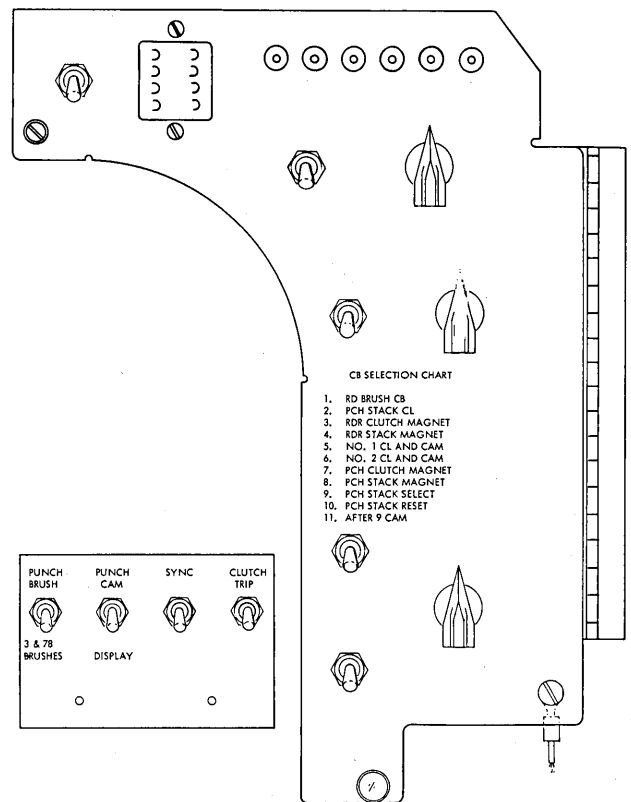


Figure 7-1. CE Service Aids



## SPECIAL FEATURES

### 51-80 COLUMN DEVICE

This feature permits reading and stacking of 51-column cards into pockets NR and 1. The operator performs several operations to convert from 80 to 51-column operation. This feature applies only to the read feed.

To convert a 51-column operation, perform the following steps:

1. Place the auxiliary hopper side plates in the hopper.
2. Interchange 80 and 51-column card weights.
3. Insert auxiliary file aligners in upper part of file feed.
4. Program the read feed to stack in pockets NR and 1 only.
5. Pull the center portions of the radial guides in pockets NR and 1, into their forward detented position.

Pull the auxiliary ledges for pockets NR and 1 down and toward the rear of the machine to a detent position. Restore cover.

When pocket N/R is set up for a 51-column operation, a micro switch is operated. This switch connects -20 v to the RC 191 connector and to logic 36.16.11.2 then to 56.80.11.2. This -20 v sets the storage address register to 014 instead of 000 before each read scan. The other operation it performs is to bring up the last address line when the storage address register reaches 065 instead of 080.

Relay 13 is used for a cycle delay in column 80 mode operation. When selecting to stacker 1, R13 is picked from the 1401 and held through 1301 N/O and RCCB 15 (M330<sup>0</sup>-B240<sup>0</sup>). At 150<sup>0</sup> of the next cycle, the select magnet is energized through 13-2 N/O and RCCB 16 (M150<sup>0</sup>-B230<sup>0</sup>). Selecting the stacker N/R requires no special circuitry.

### Mechanical Adjustments

#### Read Feed

1. The card jogger on the front auxiliary hopper side plate should just contact the card deck at its maximum travel toward the card.
2. Column 1 of the 51-column card should center on brush 15.
3. The hopper card lever contact should make when the card lever is .060" ± .003" above the surface of the feed knives. Pressure to operate the lever should be 18 to 24 grams.

#### Pocket Selectors (Figure 8-1)

1. Adjust the air gap of the selector magnets between the upper part of the armature and the armature stop for .038" ± .002".

2. With the select magnet energized, the select blade tip should be flush with the face of the lower card guide. The tip of the blade should be a minimum of .025" above the card line in its normal position. To get this adjustment, move the magnet plate assembly up or down.

### PUNCH FEED READ (PFR)

The Punch Feed Read feature adds an additional set of 80 read brushes to the blank station ahead of the punches in the punch feed (Figure 8-3). With this feature, data may read from a card and the results of a calculation may be punched into the same card. Normal operation of the 1401 is retained with PFR operating. The only restriction is that no combination operation code involving the use of the read feed may be programmed in conjunction with PFR Op code, 4R. For example, the instruction 5R will result in a read and punch (5) operation. The R will be ignored.

### Principle of Operation

The 80 PFR brushes are switched through relay points, as shown in Figure 8-4, so that data read at the punch read brushes enters the read area of main storage in the same manner as data from the second read brushes on a read operation. The punch clutch is energized in the normal manner as an ordinary punch operation. When the cam impulse picking the punch clutch breaks, Not Process punch comes on and causes a transfer read brush signal. This picks relay 59. Relay 59 holds along with 13 other 6-position relays. The points of these relays transfer common brushes and the 80-punch read brushes to the second read row bit cores. Also, the punch brush impulse CB's are transferred to feed the punch read brush common.

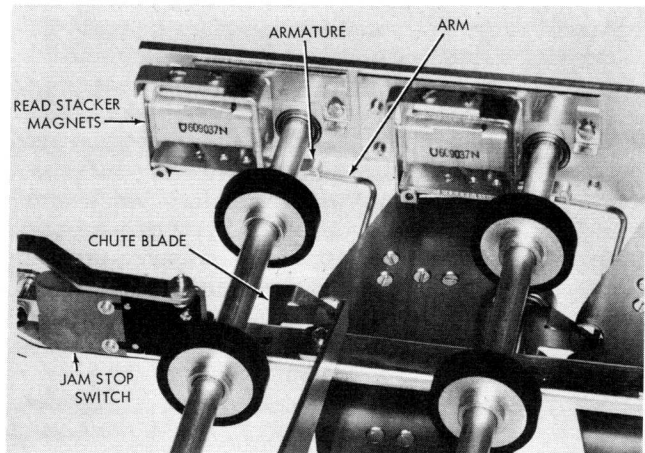


Figure 8-1. 51-80 Column Transport Selectors

ADJUSTMENT OF STACKER RADIAL CARD GUIDES

MALFORMED RADIAL CARD GUIDES CAN BE A CAUSE OF EXCESSIVE CARD JAMMING. TO ELIMINATE THIS AS A CAUSE, FORM THESE GUIDES TO MATCH THE ILLUSTRATED PROFILE. DO NOT DISTORT THIS PROFILE TO ACCOMPLISH REINSTALLATION. IF MOUNTING SCREW HOLES DO NOT ALIGN, ELONGATE THE UPPER MOUNTING SCREW HOLE TO THE REQUIRED EXTENT BY FILING.

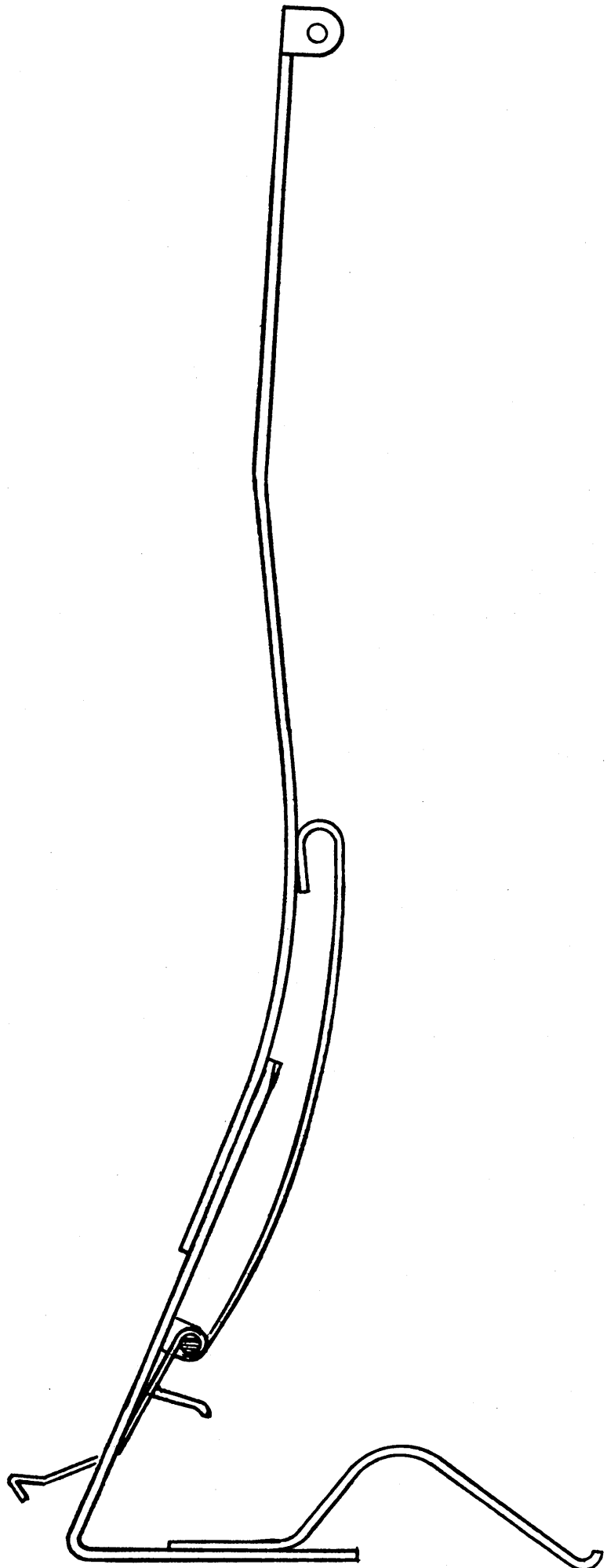


Figure 8-2. 51-80 Column Stacker Radial Card Guide Adjustment

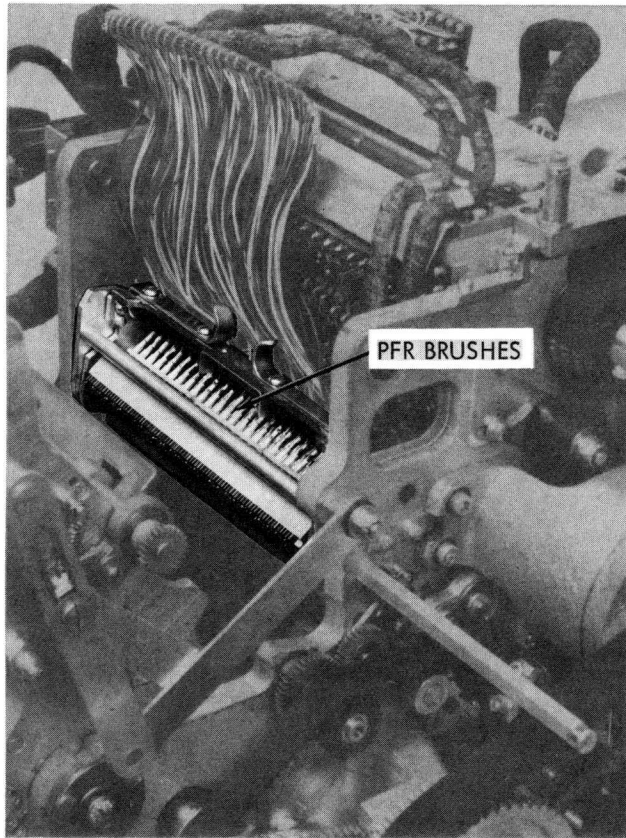


Figure 8-3. Punch Feed Read Brush Location

Card Guide Adjustments Figure 8-5.

1. Maintain .001" to .012" between the punch feed read feed roll and the card guide assembly (2nd lower).
2. Loosen card guide assembly mounting screws

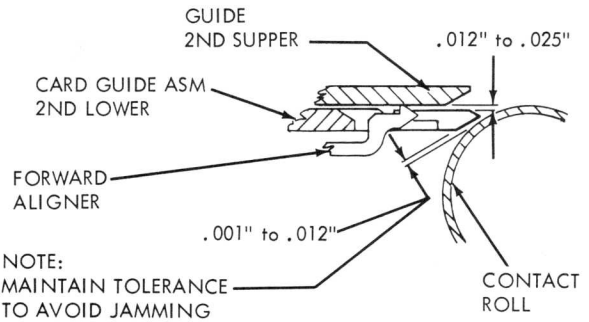


Figure 8-5. Punch Feed Read Card Guide Adjustments and shift the card guide to obtain clearance.

EARLY CARD READ

The Early Card Read feature allows the 1402 to feed cards at the same speed that the 1403 is printing on a list operation. The only requirement that is necessary to obtain a 600 card per minute read-print operation is that the print buffer feature must be installed in the printer.

In order to get a 600 card per minute feed on the 1402, a 6-tooth ratchet clutch assembly is used. With the use of this clutch, the 1401 does not have to wait for the mechanics of the normal clutch to position itself for engagement. This necessitates use of multi-lobe cams to filter clutch engage pulses and card lever pick and hold times. This is achieved by the installation of three lobe cams in position RC-6, RC-7, RC-8, and RC-12. RL-10 is a new circuit breaker used for holding relay 11.

A synchronizing switch is installed for timing the brushes or checking the feed. This switch, when thrown, will allow the read clutch to engage at  $315^{\circ}$  and only  $315^{\circ}$  every cycle thus disregarding the other possible pulses from RCCB-6.

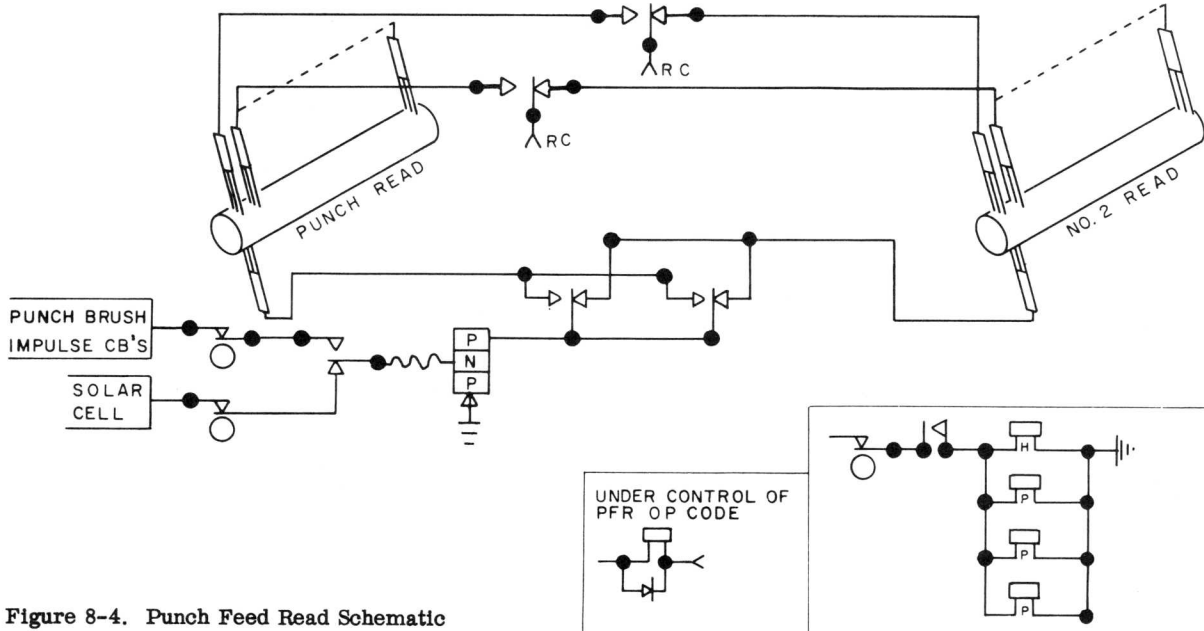


Figure 8-4. Punch Feed Read Schematic





## SERVICE HINTS

### INSTALLATION PROCEDURE

1. Remove shipping braces, tape plastic bag on relay gate, and blocks under feed shock mounts.
2. Install the upper magazine of the file feed.
  - a. Remove front and rear covers over the sides of hopper casting.
  - b. Just above the file feed drive shaft is a split shaft held by a set screw; slip both halves of the shaft to the center so they are inside the casting.
  - c. Put upper magazine in position and slip both halves of the split shaft from the center so they will hold the magazine in place. The ends of the split shaft should be flush with the end of the magazine holes.
  - d. Turn split shafts so the set screw bites both halves and tighten the set screw.
  - e. Replace the two covers.
3. Examine all relays (without removing) for displaced armatures.
4. Trip the clutches and turn machine by hand, checking for any binding conditions in the feeds or card transport.
5. Tighten the screws in all CB contact stacks.
6. After installing main line cord through the bottom of the machine, check that the cable clamp is fastened securely to bottom plate of machine.
7. Check the power supply voltages at the CE SERVICE panel.
8. Check covers for proper fit and appearance.
9. Check operation of file feed. Adjust hopper delay potentiometer so approximately 1 1/2" to 2" of cards enter the hopper before feeding begins.
10. Run test decks to verify correct machine operation.

### READ FEED

#### Reader Stop Lights

1. Frequent misfeeding of cards caused by insufficient weight of cards over the picker knives indicating the file feed requires readjustment. The time delay should be at least three seconds before the clutch operates and at least 1 1/2" of cards should be in the hopper while feeding.
2. False reader stops may be caused by number 1 or number 2 card levers bouncing. Set cam display switch to position 5 and then position 6 while observing the timer index. A bouncing card lever will show up as a spot of light between 158° and 188°. Readjust card lever contacts.

#### Reader Check Lights

1. This may occur as a result of the card skewing

between read stations. Inspect the transport area particularly for uneven feed roll pressure. Pressure should measure at least 6 pounds on a strip of IBM card when drawn through any single set of feed rolls.

2. Failure to read a certain column of the card is quite often the result of an open somewhere between the brush and the row bit core in storage. To check, raise the brush assembly from the contact roll and measure the voltage between the brush in question and ground. A normal brush should read - 20 v (an open line will be zero).

3. Brushes raised off contact roll.
4. Loose or broken common brush.
5. Bad IBM 022 transistor.

#### Validity Lights

1. Intermittent make of read two common brush.
2. Cards feeding late so that brush span time spans the make of two impulse CB's.
3. Card feeding skewed so that one brush reads two columns. This is usually confined to one end of the card depending on which way the skew occurs.

#### Picker Knife Timing Check

Feed a card until the trailing edge is aligned with the throat knife. The timer should read 72° for a two group brush and 68° for a three group brush.

#### Brush Timing

Checking brush timing or any 1402 timings may require removal of the 200-position connector to eliminate back circuits.

#### Circuit Breaker Timings

Excessive timing variations in clutched CB's or brush impulses can be caused by one of the following:

1. Loose motor drive belt.
2. Loose clutched feed roll belt.
3. Loose screws in the clutch pulley assembly.
4. Excessive flexibility of the clutch pulley shock mount because of defective bonding.
5. Excessive backlash in clutch (engaged) because of wear. Try a new sized detent (P/N 609737 to 609743).

NOTE: Check the 1401 Service Hints for other possibilities.

### PUNCH FEED

#### Punch Stop Lights

Causes are normally the same as those listed under reader stop lights.

### Punch Check Lights

Causes are normally the same as those listed under reader check lights.

### Punch Check Brushes Out of Time

1. If all digits are out of time, check the tension of the second stepped feed roll.
2. If the lower digits (5-9) are out of time, check the tension of the sixth feed roll.

### Punching Registration

1. Cards being punched off by one digit can be caused by a loose main drive belt. This usually happens when the clutch latches, causing the belt to jump one tooth on the first stepped feed roll drive pulley.
2. Variable registration (12 through 9) may be caused by intermittent rolls becoming polished. This is caused by running the machine excessively without cards. The intermittent rolls are vapor blasted and running together shortens the life of the vapor blast.
3. Variable registration (12 through 9) may be caused by insufficient roll tension. Tension trouble can be caused by cam follower bottoming or a weak spring.
4. If registration is off all the way across the card, check the mesh of the geneva gears, or for a loose pin.
5. If vertical registration varies slightly, check the pressure shoe springs for tension. Make certain they have not become polished at a point where they contact the card.
6. Varying vertical registration can be caused by intermittent roll closing too soon and moving card

slightly at the end of the previous geneva cycle.

7. Skewed punching and card marking can be caused by the trailing edge of the card not traveling past the forward aligners at least  $1/32''$ .

8. If horizontal registration is varying, check the side aligner adjustment.

### Dropping Punches

1. Check the interposer to punch clearance. It should be  $.005''$  to  $.010''$ .
2. Check the clearance between the lower side of the punch magnet armature and its latch. It should be  $.005''$  to  $.010''$ .
3. Check the punch magnet armature pivot rod clearance. It should be  $.001''$  to  $.008''$ .
4. Check for bent or loose punch magnet armature leaf springs.
5. The miniature punch magnet connector terminals can become dislocated. A poor connection can result.

### Multiple Punches

1. Check the clearance between the lower side of the punch magnet armature and the latch for at least  $.005''$ .
2. Broken latch springs or latch spring hooks.

### Damaged Cards or Jams

1. Intermittent errors and card jamming may be caused by loose or damaged timing belts.
2. If cards are being nicked on the leading edge by the punches, check the timing of the first stepped feed roll.
3. If the punch unit cuts long holes or is tearing holes, check the punch unit timing.

PREVENTIVE MAINTENANCE

APPROACH TO PREVENTIVE MAINTENANCE

1. The prime objective of any maintenance activity is to provide maximum machine availability to the customer. Unless a preventive maintenance adjustment reduces machine downtime, use caution before doing it. One adjustment often affects another with adverse results.

2. Be visually alert for trouble indications any time you service the machine. Look for corrosion, wear, cracks, burnt contacts and loose connections.

Watch for filters clogged with dirt.

PREVENTIVE MAINTENANCE PROCEDURE

1. The three basic steps of preventive maintenance are clean, lubricate, and inspect. Do not do more than scheduled preventive maintenance on equipment which is operating satisfactorily.

2. Apply lubrication only in the quantity necessary to supply the immediate area involved. Wipe off excess.

1402 PREVENTIVE MAINTENANCE ROUTINE

CODE	UNIT	FREQ.	LUBRICATE - CLEAN	OBSERVE
4	Punch Feed	13	Clean and vacuum feed. Lubricate contact and feed roll hanger pivots, all clutch pivots . . . . . # 9  Lubricate gears, aligner cams, feed roll opening cams, picker knife cams, punch clutch latch cam, extension spring ends, punch clutch armature latch pivot . . . . . #17	Brushes for wear and damage Brush timing  Punch registration Belt wear
1	Read Clutch	13	Lubricate armature pivot and link with . . . # 6 Lubricate latch, keeper, load pawl, detent pawl, and intermediate arm pivots with . . . #17 Lubricate arm, keeper, latch, and clutch ratchet working surfaces with . . . . . #17 Lubricate clutch needle bearing and reverse lock grease fittings with . . . . . #17	Detent pawl, keeper, latch, and ratchet for wear Excessive clutch backlash while engaged Clutch pulley shock mount for looseness
0	Filter	13		Replace if dirt is visible from inside
1	Read Feed	13	Clean and vacuum feed. Lubricate feed roll hanger pivots and all other pivots with . . . . . # 6 Lubricate gears, picker knife cam, extension spring ends with . . . . . #17	Brushes for wear and damage Brush timing Belt wear
1	File	13	Lubricate cam follower arm jogger pivots with . . . . . # 9 Lubricate all other pivots with . . . . . # 6 Lubricate front jogger spring ends, gear jogger, cams, adjusting screw surfaces, clutch latch cam surface, side jogger side return spring with . . . . . #17 Clutch grease fitting with . . . . . #20	Clutch overthrow Belt wear Feed rolls for glaze

3	CB's	13	Lubricate CB arm pivots and rollers with . . # 9	Contact condition and movement Check timing of CB's connected to CE Service panel
5	Geneva	13	Fill geneva housing to line if oil window is right of drive pulley. . . . . # 9 Fill geneva housing to 1/16" above line if oil window is left of drive pulley. . . . . # 9 Drive gears with . . . . . #17	Check gear wink clearance Check for excessive internal backlash in the geneva mechanism on at least two intermittent cycles. Check through-by holding the input pulley and rocking intermittent rolls back and forth. Check for loose pins.
4	Stacker Transport	13	Clean and vacuum transport. Lubricate card pusher slide cam followers with . . . . # 9 Lubricate card pusher slide spring ends and cams with . . . . . #17 Lubricate stacker jogger clutch spring grease fitting with . . . . . #20	Belt wear
4	Punch	13	Remove felt wick at top of punch unit and lubricate six oil lines with . . . . . # 9 Lubricate latchwick, link pivots with . . . . # 9 Lubricate stripper cavity, latch spring, hooks, armature pivots, setup bail channel, cam surfaces with . . . . . #17 Lubricate needle bearing grease fittings, die locating studs with . . . . . #20	Check cam follower adjustments Check punch bail and setup bail for excessive wink. (Should not exceed .010" in vertical plane when cam followers are held tight against cam). Check top of 80-magnet cores for dirt or rust. Clean if necessary.
5	Drive Motors	26	Fill drive motor oil cups with. . . . . # 9	
5	Geneva	52	Replace geneva oil . . . . . # 9	
5	Base	52	Lubricate cover latches and operating surfaces with . . . . . #17	

## 1402 CIRCUITS

### POWER SUPPLY AND INTERLOCK CIRCUITS

The 1402 Card Read-Punch is connected to a 3-phase, 208 or 230 v AC source of voltage.

It contains a - 20 v supply which is used for read-punch relay and magnet operation. This - 20 v is also distributed to the 1401 processor. A ferro-resonant bulk supply distributes 133 v AC to the 1401 processor. A - 60 v supply is distributed to the 1401 for use in printer circuits. Besides these supplies, there is a 115 v transformer which furnishes 115 v AC to the blower motors and convenience outlets for the entire system.

SMS cards control the - 20 v power supply. The detailed operation of this power supply is covered in the CE Manual of Instruction of SMS Power Supplies, Form 225-6478. For general information such as voltage rating, etc., refer to Power Supply in the 1401 Manual.

The source voltage is applied to the 115 v transformer through a set of HD8 relay points (Section 1B 1402 Wiring Diagram). HD8 (Section 1A) is energized any time the machine is connected to the source voltage. HD8 is de-energized only when the emergency stop switch is open (located on the 1401 console). This will drop all voltages, including the 115 v at the convenience outlets by de-energizing the contactor and HD8.

The source voltage is applied to all other units of the 1402 through a contactor. This contactor (Section 1A) is energized by a power-on switch, located on the 1401 console. When the contactor is closed, power is supplied to the - 20 v supply, - 60 v supply, 133 v AC supply, 208 v AC to 1401, and 115 v AC to the blower motors. HD4 (Section 2B) is picked from the processor after proper power-on sequence has been completed. (The power-on and off sequence are explained later). HD4 furnishes a hold for the power contactor (Section 1A) after the power-on key is released.

The power-off switch, when operated, will de-energize HD4. The contactor has now lost its hold circuit and will now de-energize.

#### Power On Sequence

1. (1A) The power-on key energizes the contactor.
2. (1A) The contactor points furnish power to the - 20 v and - 60 v supplies in the 1402. They also furnish power to the + 30 v, + 6 v and - 12 v supplies in the 1401.
3. HD12 in the 1401 picks when the + 6 v and + 30 v are available and supplies the rest of the relays with - 20 v (HD15 also picks with HD12 if required).
4. (2B) HD3 picks when the - 12 v is available. HD10 and HD11 in the 1401 also pick at this time (HD14 also picks with HD3 if required).

5. The - 6 v, - 20 v, and + 30 v circuits are now available in the 1401.

6. With the - 6 v circuits available, DU11 picks in the 1401 (HD13 also picks with DU11 if required).

7. The - 36 v circuit is now available in the 1401 if required.

8. With the - 36 v circuit available, DU12 picks in the 1401 if required.

9. (2B) HD4 and HD9 can now pick.

10. (1A) HD4 keeps the contactor energized after the power-on key is released. HD9 completes the - 60 v sequenced circuits.

The complete power-on sequence takes from .5 to .7 seconds. This time is hardly noticeable from the operator console.

#### Power Off Sequence

1. (2B) Pressing the power-off key drops HD4 and HD9.

2. HD9 removes the - 60 v sequenced from the 1401 circuitry immediately.

3. (1A) HD4 opens the hold circuit to the contactor.

4. Opening the contactor de-energizes the DC power supplies simultaneously.

The power-off sequence takes from .2 to .5 seconds. The power-on and off sequences are needed in order to energize the 1403 space (off) and skip (off) magnets before carriage and chain motors start running. Otherwise the 1403 could start out in a skip or continuous space operation.

### READ FEED CIRCUITS

#### Load Key Operation

The load key causes the 1402 read feed to take three run-in card-feed cycles under program control. The load key sets up a read instruction in the 1401 processor which will enable the read feed to run until a card has passed the read brushes.

1. (4B) R8 (delay) hold coil will be energized through R1-3N, R9-2N and the interlock switches.

2. (5B) The load key (No. 2) will pick DU2, the start relay.

3. (4B) DU2-AU will pick R9 through the reader switch ON and the interlock switches. R9 will hold through its own 1 point.

4. (4B) R9-2N opens the circuit to R8. R8 will now hold through its delay circuit (3K resistor and 7500 mfd capacitor). Adjust for 3 to 5 seconds delay.

5. (4B) R9-2T will pick HD1 (read motor control). HD1 will supply AC voltage to the read-feed drive motor.

6. (4A) With file feed now operating, cards enter the hopper and pick R1.

7. (4B) As soon as R8 drops, R7 picks through R9-3T, R8-1N, and RC3.

### First Card-Feed Cycle

1. (6A) The - T Process Feed line will be conditioned by RC5, R7-2T, R6-3N, R11-3N, and R11-2N. The - T Process Feed line in conjunction with the read instruction set up in the 1401 processor by the load key activates the - T Read Clutch line (6A). The - T Read Clutch line will energize the read clutch magnet and R10, the clutch check relay, through RC5.

2. (4A) R2, the No. 1 card-lever relay, will pick and hold on this card-feed cycle.

3. (4A) R6 will pick and hold on this card-feed cycle and all further read-feed cycles.

### Second Card-Feed Cycle

1. (6A) The - T Process Feed line will be conditioned through RC5, R7-2T, R6-3T, R13-2N, R2-3T, R1-6T, R3-4N, and R11-2T.

2. (6A) The read-feed clutch and R10 will be energized the same as on the previous card-feed cycle.

3. (4A) R3, the No. 2 card lever relay will pick and hold on this card-feed cycle.

4. (4A) R11 will pick on this cycle and following feed cycles. Its purpose is to detect a failure of CL2 to make.

### Third Card-Feed Cycle

A third card-feed cycle will be obtained the same as the previous card-feed cycle. After the third card-feed cycle, the 1401 processor will start processing information just read from the card at the read brushes. All further card-feed cycles will be under program control.

### Start Key Operation

The start key (No. 1) in section 5A will allow the read-feed motor to start, as described under Load Key Operation. No card-feed clutch operations are taken until a program instruction calls for one. Any card-feed clutch cycles that are taken use the same circuits described under Load Key Operation.

### Card Reading (RLCB Machines)

The first and second read brushes (7A and 8A) provide card digit impulses to the 1401. Each brush station consists of 80 brushes and is capable of reading any digit in the card.

1. The base of T2 will be conditioned for every impulse by R3-5T, RL5 and 6 (odd) or RL7 and 8 (even), and R7-3T.

2. When T2 conducts, ground potential is applied to the common brush. T2 conducting also applies 1/2 write current through all 80 row bit cores.

3. When a hole in the card is read a circuit exists from T2 conducting (0 volts), common brush, contact roll, read brush, and the respective row bit core to

- 20 v. This furnishes the other 1/2 write current to the proper core (refer to 1401 manual).

### Reader Non-Process Run-Out

The NPRO key is used to clear the read feed of cards that are not to be processed. The hopper must be empty before this key is effective.

OBJECTIVE: Start a feed cycle by using the NPRO key.

1. (4B) The read NPRO key (No. 1) will pick R9 through R1-1N, the reader switch ON, and the interlock contacts.

2. (4B) With R9 energized, the HD read motor relay is energized and the read motor started.

3. (5A) The read NPRO key (No. 2) picks R4 and turns on the reader stop light.

4. (4B) R9-3T and RC3 picks R7.

5. (5A) The - T Not Process Feed line is conditioned through R4-2T, R6-3N, R7-2T, and RC5.

6. (5A) The - T Not Process Feed line can also be conditioned through R6-3T, R13-2N, R2-3, R1-6N, R3-4N, R11-3N, and R4-2T.

7. When the NPRO key is used, the last 2 cards in the NR stacker have not been processed. The Check reset key must be used to drop out R4 (Refer to Card Jam Circuits, steps 8-11).

### Stop Key Operation

OBJECTIVE: Allow the read feed to stop when the stop key is depressed. This will also stop the complete system.

1. (3B) The stop key (No. 1) will open the circuit to the motor control relay (R9) causing the read-feed drive motor to stop.

2. (6B) Stop key (No. 2) will activate the - T Stop Key line at RC179.

3. The - T Stop Key line will condition circuitry in the 1401 which will pick DU3 (6A).

4. (3B) DU3-AU keeps the circuit to R9 open after the stop key is released.

5. The start key is used to re-start the read-feed. The start key will cause DU3 to drop out through the use of the +U Interlock Stop line (6A).

### Card Jam Circuits

A card jam is detected when the number one or number two card lever contact remains closed too long during a read-feed cycle.

OBJECTIVE: Stop the read-feed if a card feed is detected and turn on the reader stop light.

1. (3A) If either card lever remains closed till 158<sup>0</sup>, R13 (4A) is picked through RD57 or RD58 (4A).

2. (4B) R13 will hold through R13-1 N/O, and RC-1.

3. (4A) R4 is picked through RD-3 (5A), R13-2 N/O, R6-3 N/O, and RC5. R4 holds through R4-1 N/O, and DU4-AU until check reset is depressed. The reader stop light comes on with R4 hold (5A).

4. (4B) R4-5N opens the circuit to R9, causing the read drive motor to stop.
5. (5B) R4-6T activates the - T Read Jam line, which is used in the 1401.
6. (6A) The R4-2T point allows the cards remaining in the feed to be run out under control of the NPRO key by activating the - T Not Process Feed line.
7. (7A) R4-4N opens the - T Brush Impulse CB line to the 1401.
8. The check reset key must be used to drop out R4 and allow the read-feed to be re-started.
9. (6B) The check reset key picks DU4 through R28-3T and R7-3N to - 20 v.
10. (6A) The DU4-AU point opens the hold circuit to R4 and turns off the reader stop light.
11. (5A) The DU4-BU activates the + U Read Check Reset line to the 1401.

### Clutch Check Circuit

Each time the read clutch magnet is energized, R10 is also energized. If the read feed clutch magnet receives an impulse and fails to pick, or a clutch cycle is taken without the clutch receiving an impulse, R10 signals a clutch failure.

OBJECTIVE: Stop the read-feed drive motor and turn on the reader stop light under the following conditions:

1. When the clutch receives an impulse and fails to unlatch.
  - a. (5A) R10 is picked by read clutch impulse from the 1401. R10 holds through R10-1T and RC4 (4A).
  - b. (4A) R13 picks at 158<sup>o</sup> through RC7, R10-2 N/O, and R6-4 N/C.
  - c. (3A) R4 picks through R13-3 N/O and R6-4 N/C.

With R4 energized, the read-feed will stop as described under Card Jam.

2. When the clutch unlatches without receiving an impulse.
  - a. (4A) R6 picks through RL3 because of a card-feed cycle.
  - b. (4A) R13 picks through RC7, R10-2 N/C and R6-4 N/O.
  - c. (4A) R4 picks through RD3 (5A), R13-2 N/O and RC-5. With R-4 energized, the read-feed will stop as described under Card Jam.

## PUNCH FEED CIRCUITS

### Punch Motor Start and Run

When either the load key or start key is depressed the punch drive motor will start. If the start key is used the processor unit is started and normal programming will control feeding. If the load key is used, the processor unit is started and an automatic read-feed cycle is called for.

OBJECTIVE: Cause punch drive motor to start and continue to run.

1. (10B) R28 is picked when punch motor stops.
2. (10A) Cards in hopper will pick R21.
3. (6A) DU2 is picked by the load or start key.
4. (10B) R29 and HD2 are picked through interlock contacts, DU2-BU, R31-2 N/C, DU3-BU, chip switches, and punch switch ON. With these two relays picked the punch drive motor will start.
5. (10B) R29 and HD2 hold through interlock contacts, R29-1 N/O, R21-4 N/O, R31-2 N/C, DU3-BU, chip switches and punch switch ON. Motor will run until this circuit is broken.
6. (10B) R29-2 N/C drops R28.
7. (10B) R27 is picked by R29-3 N/O, R28-1, 2 N/C, PC-1, R21-4 N/O, R31-2 N/C, DU3-BU, chip switches and punch switch ON.
8. (11A) PC-3, 4 send pulse through R27-4 N/O, R31-3 N/C, and out PC178 to signal process unit of 1402's readiness to take a punch cycle.

### Punch Feed Cycles

All normal punch feed cycles are under control of the processing system. If the 1402 is running a pulse is sent out PC178 (- T PROC-PCH) through R31-3 N/C, R27-4 N/O, PC-3, 4 and PL-6. When a punch operation code is read in the operation register PC178 (- T PCH CLUTCH MAGNET) goes to ground potential and a punch cycle will occur (12A). On punch feed run-in the first punch operation code read at the operations register will cause three feed cycles unless machine is equipped with PFR (Punch Feed Read). If PFR is installed only two cycles are normal on run-in.

### Punch Feed Read

This optional feature allows cards to be read in the punch feed one cycle before punching rather than from the read-feed brushes.

OBJECTIVE: Allow cards to be read at the punch feed read station.

1. (13A-B) R59 is picked by an instruction from 1401. R59 holds through R59-3T. PL17 and R46 through R58 pick in parallel with R59 hold.
2. (14A-B) The punch read brushes will now set the row bit cores by R59-5T and R59-6T in parallel whenever T1 conducts.
3. (13A-B) The base of T1 is conditioned by R59-4T, R25-2T, R31-5N, PA10, PA9, and PL10.

### Card Punching

Any punch magnet can be energized when PA5, 6, 7, and 8 make and its respective + U Punch Magnet line is activated from the 1401.

### Punch Check Brushes

The punch check brushes are used to read the card after it has been punched. Circuits for the 80 brushes are similar to the circuits covered for the read-feed brushes.

### Punch Non-Process Run-Out

The NPRO key is used to clear the punch feed of cards. Cards must be removed from the punch hopper before this key is effective.

OBJECTIVE: Start a punch feed cycle by using the NPRO key.

1. (9B) The punch NPRO key (No. 10) will pick R29 and HD2 through the interlock contacts, R21-1N, chip switches, and the punch switch. The punch feed motor will start with the above relays energized.

2. (11A) The punch NPRO (No. 2) picks R31 hold coil through R27-2N and turns on the punch stop light.

3. (10B) R27 is picked as normal.

4. (12A) -T Not Process Punch line is conditioned by R31-3T, R27-4T, PC4, PC3, and PL6. The 1401 will then condition the -T PUNCH CLUTCH MAGNET line and energize the punch clutch.

5. The check reset key must be used to drop out R31 (Refer to Card Jam, steps 5-7).

### Stop Key Operation

OBJECTIVE: Allow the punch feed to stop when the stop key is pressed.

1. (3B) The stop key (No. 1) will open the circuit to R29 and HD2 (10B), causing the punch feed motor to stop.

2. (6B) DU3 will be picked the same as described under Read Stop Key Operation.

3. (9B) DU3-BU will keep the circuit to R29 and HD2 open after the stop key has been released.

4. (5A) The start key will drop out DU3 through the use of the +U Interlock Stop line from the 1401 (6A).

### Card Jam Circuits

A card jam or misfeed is detected by the card lever relay points (11A). When a feeding failure is detected, the punch feed will be stopped.

OBJECTIVE: Stop the punch feed if a jam or misfeed is detected.

1. (12A) R31, the punch stop relay is picked through the card lever relay points and PL7. The -T Punch Jam line is conditioned at the same time. If any delay relay picks when they should not, or any card lever relay fails to pick, then a circuit is available at PL7 time.

2. (11A) R31 will hold through R31-1T and the card lever relay points to ground. It can also hold through DU4-BL to ground. The punch stop light is turned on in parallel with R31 hold.

3. (9B) R31-2N opens the circuit to R29 and HD2. The punch feed drive motor will stop.

4. The cards must be run out of the feed by use of the NPRO key and then the check reset key must be used to restore the punch feed to an operating status.

5. (5B) The check reset key will pick DU4 through R28-3T and R7-3N.

6. (11A) The DU4-BL point opens the hold to R31

and turns off the punch stop light.

7. (11A) The DU4-AL point conditions the +U Read Check Reset line to the 1401.

### Clutch Check Circuit

Each time the punch clutch magnet is energized, R30 is also energized. If the punch feed clutch magnet receives an impulse and fails to pick, or a clutch cycle is taken without the clutch receiving an impulse, R30 signals a clutch failure.

OBJECTIVE: Stop the punch feed drive motor.

1. When the clutch receives an impulse and fails to unlatch.

a. (12A) R30 is picked by the -T Punch Clutch Magnet line from the 1401 and the CB's.

b. (10B) R10 holds through PL4.

c. (12A) R31 is picked by R30-4T, PC5, and PL6.

d. (9B) R31-2N opens the motor relay circuit, stopping the punch feed motor. The cards must be removed from the feed and the check reset key pressed to restore the punch feed to an operating status.

2. When the clutch unlatches without receiving an impulse.

a. (12A) R30 will not pick.

b. (12A) R31 is picked through R30-2N and PL7. This circuit also conditions the -T Punch Jam line which will stop the punch feed through the 1401 circuitry.

c. (9B) R31-2N opens the motor relay circuit, stopping the punch feed motor. Remove cards from the hopper and press check reset key to restore punch feed to operating status.

### Stacker Select Circuits

1. (11B) The stacker card lever picks R37 any-time a card enters the transport unit from the punch feed.

2. (12B) R35 will pick on every punch-feed cycle between times that the stacker card lever is made through R37-3N and PL15.

3. (12B) R35 pick coil has a hold after R37 picks through R35-2T, R37-3T, R35-1T, PC6, and stacker card lever.

4. (11B) R35 hold coil can energize if the +U Stacker Inhibit line becomes active.

5. (11B) The stacker control relays are picked by the +U Stacker 4 or 8 from the 1401. R33 or 34 will then hold through PL14.

6. (12B) The stacker 4 magnet is picked through R33-2T after R35 has dropped and the stacker card lever has closed by PC6 time at 35° to 75°.

7. (12B) R31 will pick through R37-2N and R32-4T if a card was at the punch check brushes but did not reach the stackers on the next punch-feed cycle.

8. (12A) R31 will pick through R35-4N and 32-4T if a punch cycle is taken after a card has been at the punch check brushes and stacker inhibit (R35) fails to pick.



DESCRIPTION

The 1402 Model 2 is a slightly revised 1402 Model 1. The Model 2 is primarily used as an input-output unit with the 1410 system. Mechanically the only differences are the addition of the punch emitter and a clutch controlling the fourth read feed roll. Electrically, the primary differences are the addition of several power supplies and the addition of several operational controls.

VARIATIONS BETWEEN THE MODEL 1 AND MODEL 2

Read Feed Roll Number 4 (Figure 1-1)

This feed roll is put under the control of the read clutch. In the Model 1 it is continually running. In the Model 2 this feed roll is belt driven whereas in the Model 1 it is gear driven. In the event of belt or feed roll replacement, there is no special timing condition.

Punch Emitter

This is a decoder unit which is located in the punch feed on the front end of the PLCB shaft. This punch emitter is actually a gating device that provides a gated pulse at each digit time during a punch operation. The information coming from the 1414 must be "anded" with the gated pulse from the decoder. The output from this "and" switch will condition the punch magnets to become energized and therefore punch the card.

Electrical Changes

There are two new power supplies in the 1402 Model 2. A -12 v, 20 amp, and a +12 v, 4 amp supply are added to the 1401 Model 1 to form the 1402 Model 2.

The -20 v power supply has been revised to 6 amp (the 1401 Model 1 had 15 amp).

The primary 208 or 230 volt "power up" sequence relays are not located in the 1402 Model 2. The voltage comes into the machine from another unit.

Instead of the master CB pulses (RLCB) going directly to the power transistor as in the 1402 Model 1, the Model 2 pulses go to the 1414 unit then return through "single shots" which condition the power transistor.

Operating Controls and Lights (Figure 11-1)

The 1402 Model 2 has the same basic control and light panel as the 1402 Model 1, with the addition of the following controls:

1. **Punch Start:** Depressing this key causes two cards to be fed into the punch feed, the computer interlock to be established, and the punch ready light to be turned on. If the punch has been stopped, depressing the punch start key will re-establish the interlock, turn on the punch ready light and card punching will resume under program control. After the cards have been removed from the punch feed, depressing the punch start key will cause the remaining three cards to be moved to the non-select pocket. The first card that enters the non-select pocket will be unchecked.
  2. **Punch Ready:** This light indicates that the computer interlock has been established. The punch is then under the control of the stored program.
  3. **Punch Stop:** Depressing this key causes the punch to stop, the computer interlock to be removed, and the punch ready light to be turned off.
  4. **Reader Ready:** This light indicates that the computer interlock has been established. The reader is then under control of the stored program.
- NOTE: Mechanical hardware differences are noted in current parts catalogs.
5. **End-of-File:** The end-of-file key controls circuits which create at last-card condition in the CPU.

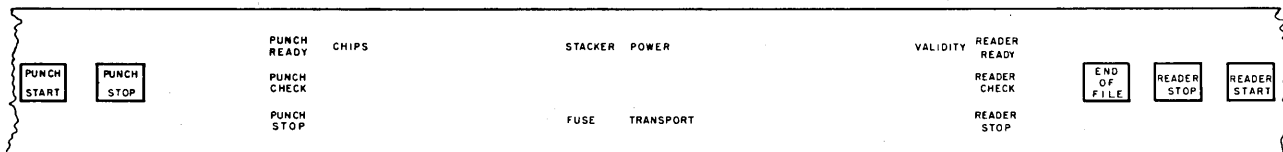


Figure 11-1. Operating Controls and Light Schematic



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