

*Reference/Instruction
& Diagrams Manual*

**CONTROL DATA[®]
167-2-A CARD READER**

CONTROL DATA
CORPORATION

Record of Revisions

REVISION	NOTES
B	Complete revision. Replaces publication 60022000 (220a) and 60022100 (221b). CE Diagrams in publication 60022100.
C	Change Order 9001; Pub. Nos. 60022100 and 60076600 made obsolete, material incorporated as Appendixes C and D of this manual. Pages ii, iii, iv, 3-1, 4-1, 4-10 revised.
D	Pages ii, iii, iv, 4-1, 4-10, 4-25 and 4-36 revised. Attached Appendixes A, B, and C replace previous Appendixes A, B, C, and D. CE Diagrams: pages 2, 3, and 4 revised per Change Order 9779. New Product Designation 167-2-A-15.

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CHAPTER 1
DESCRIPTION

The CONTROL DATA* 167-2 Card Reader reads data from standard punched cards and transfers it to a computer, magnetic tape unit, or line printer. Data is read column by column and sent to associated equipment in a 12-bit per word parallel mode. The operator has a choice of reading data just as it appears on a card, or first translating it from Hollerith into BCD format for special purpose usage. After translation, two Hollerith columns are automatically packed into one column consisting of two 6-bit BCD words.

TABLE 1-1. SPECIFICATIONS

MECHANICAL		
	Card Reader	Pedestal
Height	13 1/2 inches	27 inches
Width	29 3/4 inches	30 inches
Depth	18 inches	18 1/2 inches
Weight	120 pounds	90 pounds
Cooling Requirements	670 BTU/hour	
Hopper Capacity	500 cards	
Stacker Capacity	500 cards	
Reading Speed	250 cards/minute maximum	
ELECTRICAL		
Power Requirements	115 vac, 1 phase, 60 cps, 1.7 amp	
Reading Method	Photo-electric: 12 card-row cells 2 card-detect cells	
Timing Source	Magnetic Reluctance Pickup	

* Registered trademark of Control Data Corporation

TABLE 1-2. EF CODES

Code	Function
4500	EF clear
4501	Free run read
4502	Single cycle read
4505	FRR, H → BCD and Pack
4506	SCR, H → BCD and Pack
4540	Check status

Table 1-3 lists possible responses to a status request. Multiple faults are indicated as the sum of individual faults.

TABLE 1-3. STATUS RESPONSES

Code	Meaning
0000	167-2 ready
0001	Hopper empty
0002	Stacker full
0004	Feed failure
0010	Program error
0020	Amplifier failure
0040	Motor power off

Chapter 2, Operation and Programming, discusses in detail the use of the EF codes and explains the meaning of each status response.

The 167-2 reads data from cards photoelectrically. As each card-column passes the read station, light passes through each hole present in that column and strikes a solar cell. The 167-2 amplifies any signals present at the solar cells to standard logic voltage levels, translates and packs them if requested, and gates them to the computer or other interrogating device. Off-line, the card reader is directed by pseudo select codes.

CHAPTER 2
 OPERATION AND PROGRAMMING
 MANUAL CONTROLS AND INDICATORS

TABLE 2-1. SWITCHES AND INDICATORS

Name		Function
Main Power (2S01)	S*	Connects 167-2 to power lines
Motor Power (6S04)	S	Applies power to drive motor and exciters
	I**	Motor is running
Row 12 "0" Check Disable (6S05)	S	Disables amplifier "0" check of 12th row when cut-corner cards are used
	I	Disabled condition
Load (6S06)	S	Initiates a Free Run Read (FRR) operation
Stop (6S07)	S	Disables Clutch
	I	Indicates stop
Margin (6S02)	S	Used during routine maintenance reliability tests
H → BCD and Pack (6S08)	S	Selects translate mode off-line
	I	Translate mode

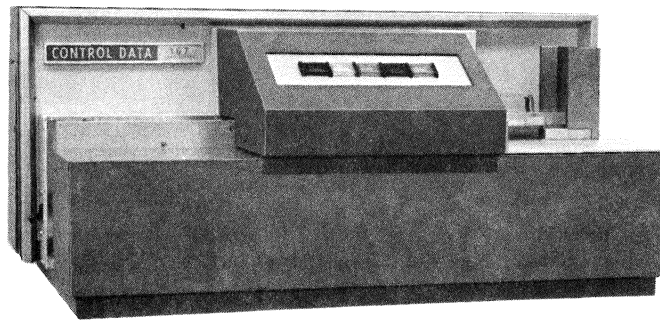


Figure 2-1. Card Reader Controls

* Switch
 ** Indicator

CARD READER PREPARATION

To prepare the 167-2 for control by interrogating equipment:

- 1) Place cards in hopper, face down, column one in direction of feed
- 2) Turn on Row 12 "0" Check Disable switch if cut-corner cards are used
- 3) Off-line, press H → BCD and Pack switch for translation of Hollerith format into packed BCD format
- 4) Turn on Main Power switch
- 5) Turn on Motor Power switch
- 6) Issue master clear
- 7) Card reader now ready for external control

EXTERNAL FUNCTION CODES

SELECT CODES

Operation of the 167-2 card reader is initiated by coded EF instructions from an interrogating device (table 2-2). 12-bit function codes transmitted by the EXC (7500) or EXF (75XX) instruction from the 160/160-A, or pseudo codes from a line printer direct operations through controls in the card reader. The upper 6 bits (octal 45XX) select the card reader; the lower 6 bits (octal XX00 through XX40) specify the card reader operation. Specially punched cards must be used for untranslated card to printer operation. See Control Data 166-2 Printer manual, volume 1.

TABLE 2-2. EF SELECT CODES

Code	Name	Description
4500	EF Clear	<p>Clears EF Select FFs and Start Counter FF. Issue an EF clear to terminate:</p> <ol style="list-style-type: none"> 1) a FRR (4501) operation. If card reader is to stop immediately after reading a card, the clear must be received within 1.5 ms after reading of the 80th column. 2) A SCR (4502) operation at any time during the cycle.
4501	Free Run Read (on-line only)	<p>Actuates clutch and starts card movement. Cards move continually without need for reselection between cards. Operation terminates when card reader receives an EF clear (4500) or generates an input disconnect. An input disconnect results from:</p> <ol style="list-style-type: none"> 1) a feed failure, 2) a late input request (program error), or 3) an amplifier failure. <p>Check status immediately after receiving the disconnect. The operator must master clear the card reader before reading can resume.</p>
4502	Single Cycle Read	<p>Actuates clutch and starts card movement. Each 4502 select causes one card to move. The operator may terminate a read operation anytime during a cycle by issuing an EF clear (4500). To read the next card, status must be checked (4540), and another 4502 issued. Full speed operation is possible if 4502 is reselected within 4 ms after the 80th column is read.</p>
4505	FRR, H → BCD and Pack	
4506	SCR, H → BCD and Pack	
4540	Check Status (on-line only)	<p>A 4540 status request directed to the card reader and followed by an input to A (76 instruction) provides the computer with information (a coded response) relative to card reader status. This code is issued anytime previous to a 4501, 02, 05, or 06 code, or after the last word desired from a card in the 4502 mode. A status request should follow each input disconnect.</p>

STATUS RESPONSES

Table 2-3 is a list of status responses the card reader may send to the computer. Multiple faults appear in coded form as the sum of individual faults. For example, 0005 (0001 + 0004) means there was a feed failure and the hopper is empty.

TABLE 2-3. STATUS RESPONSES

Code	Name	Description
0000	167-2 Ready	
0001	Hopper Empty	All cards have been read
0002	Stacker Full	To prevent a card jam, remove accumulated cards from stacker
0004	Feed Failure	If accompanied by hopper empty, cards are all read; if not, a feed problem exists
0010	Program Error	Input requested too late by interrogating device
0020	Amplifier Failure	At least one of the 12 row amplifiers is not functioning properly
0040	Motor Power Off	6S04 is off

PROGRAM TIMING

Each card requires 240 ms to pass through the read station. The card reader may send up to 40 translated or 80 untranslated 12-bit words to the interrogating device from each card. Program timing is identical for single cycle and free run read. Figure 2-2 shows the program timing for one card cycle. On-line, this chart enables a programmer to make full use of the computer between card columns and to reselect the card reader at a time that assures full speed operation.

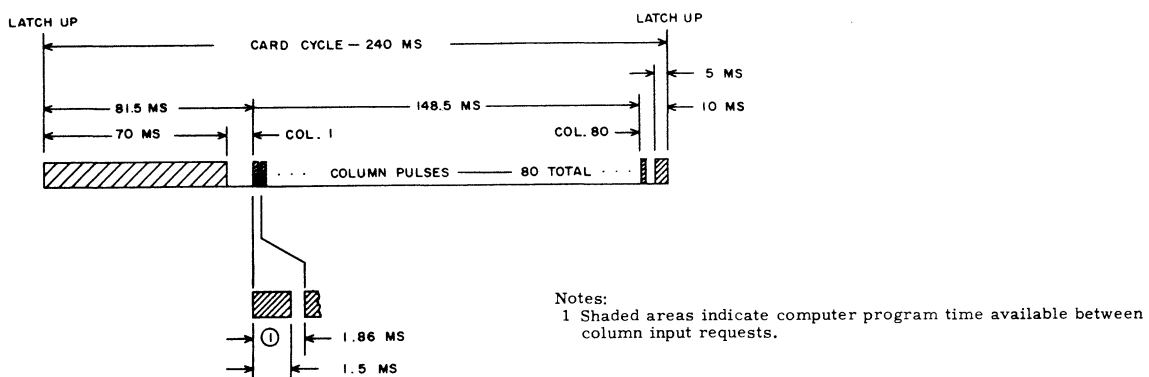
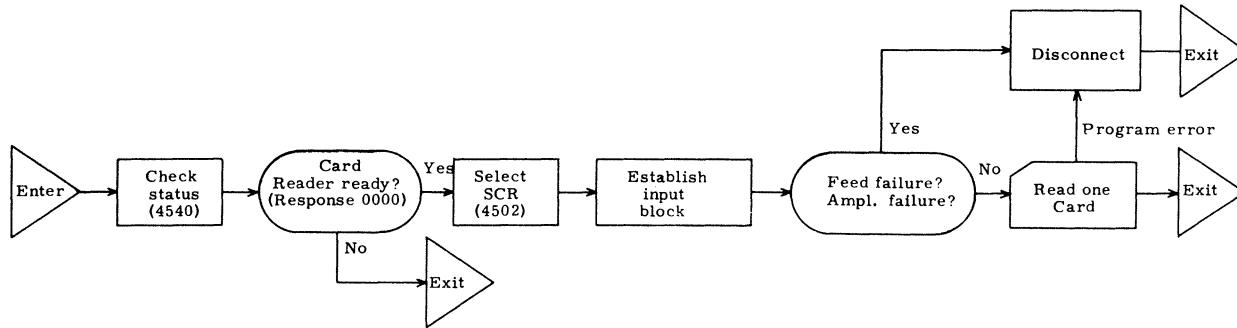


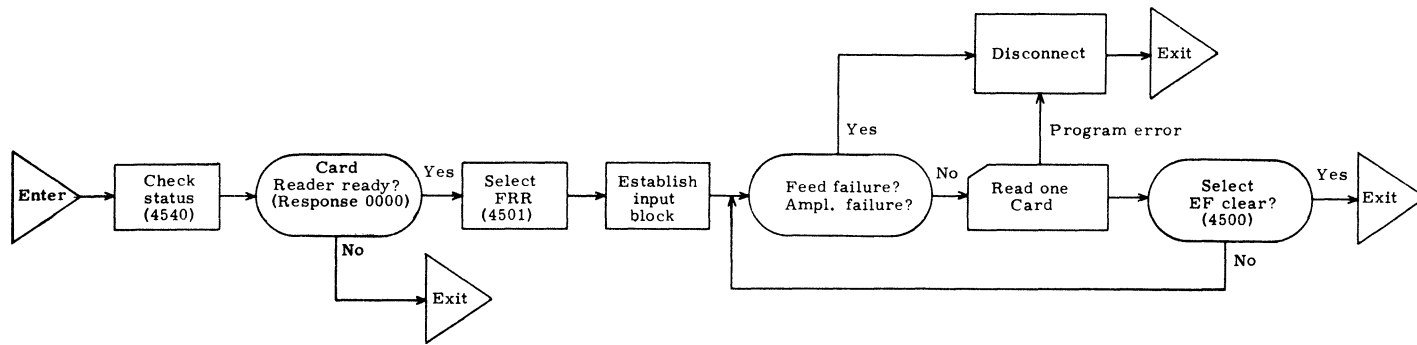
Figure 2-2. Program Timing

Figure 2-3. Flow Charts of Sample Programs

2-5



SINGLE CYCLE READ



FREE RUN READ

TRANSLATOR CODES

Table 2-4 lists the Hollerith (and Hollerith-type) codes required to produce BCD codes 00-77₈ for use by the 166 series of line printers. The table includes a list of the characters that will be printed by these codes.

TABLE 2-4. BCD VS HOLLERITH CODES

BCD Code	Character	Hollerith Code	BCD Code	Character	Hollerith Code
00	:	illegal	40	-	11
01	1	1	41	J	11 1
02	2	2	42	K	11 2
03	3	3	43	L	11 3
04	4	4	44	M	11 4
05	5	5	45	N	11 5
06	6	6	46	O	11 6
07	7	7	47	P	11 7
10	8	8	50	Q	11 8
11	9	9	51	R	11 9
12	0	0	52	%	11 0
13	=	3 8	53	\$	11 3 8
14	≠	4 8	54	*	11 4 8
15	≤	5 8	55	↑	11 5 8
16	'	6 8	56	↓	11 6 8
17	[7 8	57	>	11 7 8
20	blank	unpunched	60	+	12
21	/	0 1	61	A	12 1
22	S	0 2	62	B	12 2
23	T	0 3	63	C	12 3
24	U	0 4	64	D	12 4
25	V	0 5	65	E	12 5
26	W	0 6	66	F	12 6
27	X	0 7	67	G	12 7
30	Y	0 8	70	H	12 8
31	Z	0 9	71	I	12 9
32]	0 2 8	72	<	12 0
33	,	0 3 8	73	.	12 3 8
34	(0 4 8	74)	12 4 8
35	→	0 5 8	75	≥	12 5 8
36	≡	0 6 8	76	?	12 6 8
37	~	0 7 8	77	;	12 7 8

CHAPTER 3
PRINCIPLES OF OPERATION

This chapter discusses the principles of operation for each section of the card reader logic. The accompanying diagrams are simplified. For more details, refer to the unabridged logic diagrams in appendix D of this manual.

EF CODE TRANSLATOR

Many peripheral equipments may be connected to the computer. The EF code translator (figure 3-1) recognizes selection of the 167-2 and determines the function it is to perform. EF select codes from the computer, or pseudo codes from other interrogating equipment, are received on the output lines. The accompanying function ready signal enables the 167-2 to translate the codes and set the function select FFs. EF bits 6-11 (octal 45XX) select the card reader; bits 00, 01, 02, or 05 select the function. Previous to an EF selection, a $0.8\mu\text{sec}$ pulse from A209 clears the function select FFs. An output resume, which is directed back to the interrogator after $5\mu\text{sec}$, turns off the function ready and clears the output lines. The interrogating equipment may request status (4540), free run read (4501), or single cycle read (4502). On-line, H \rightarrow BCD and Pack is selected along with FRR or SCR if the card data must be translated.

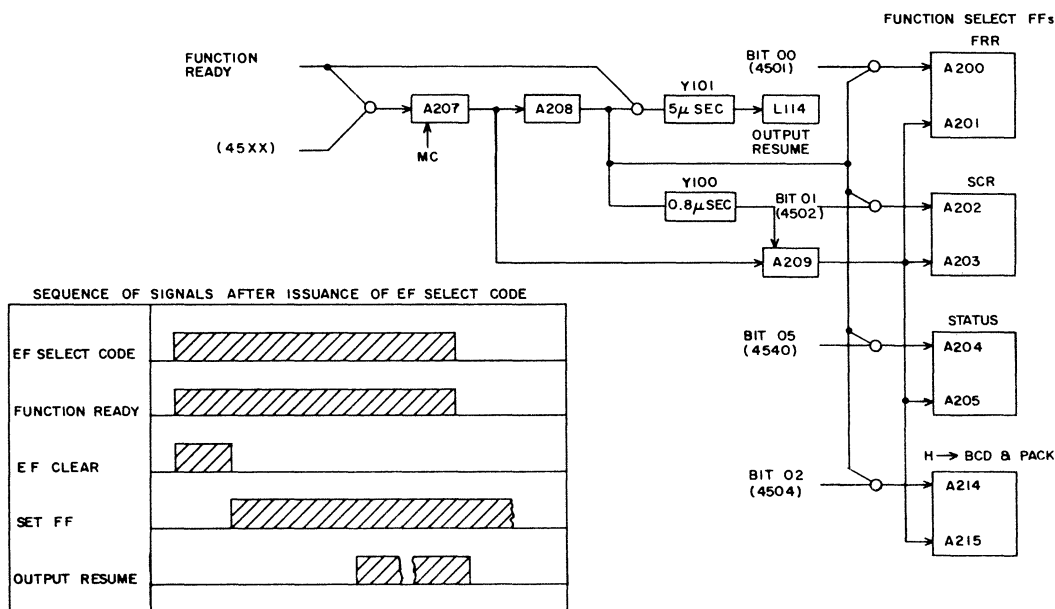


Figure 3-1. EF Code Translator

CHECK STATUS

Before selecting or reselecting a 167-2 read operation, the computer must sense card reader conditions by executing a status request (4540) followed by an input to A (76) instruction. Coded status information* is transferred to the computer on its input lines. Execution of a status request (4540), accompanied by a function ready signal, sets the Status FF. An input request, which may appear any time thereafter, generates an input ready signal and simultaneously gates status information to the computer. The input ready causes the input request to drop; a 0.8 μ sec pulse clears the Status FF. Figure 3-2 shows the circuits and timing associated with a status operation.

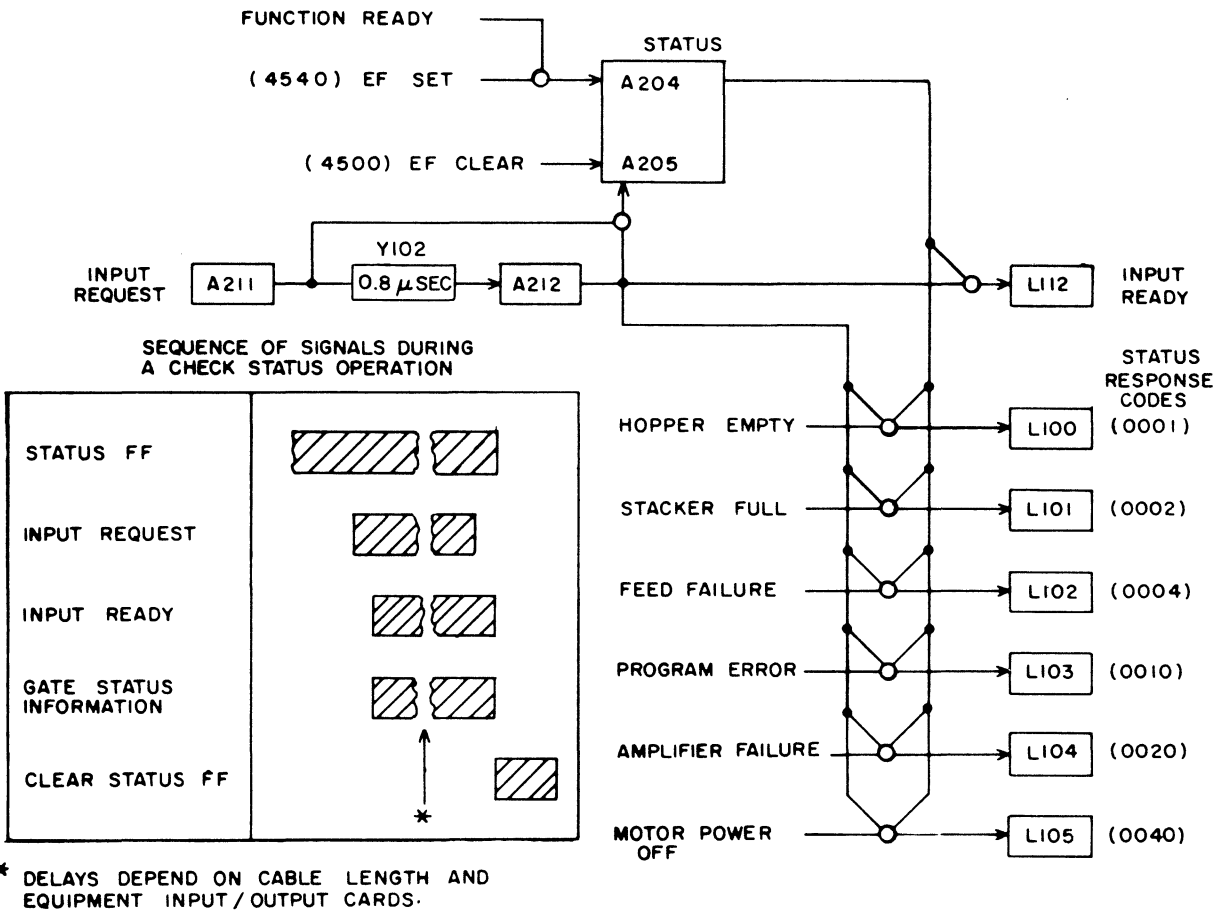
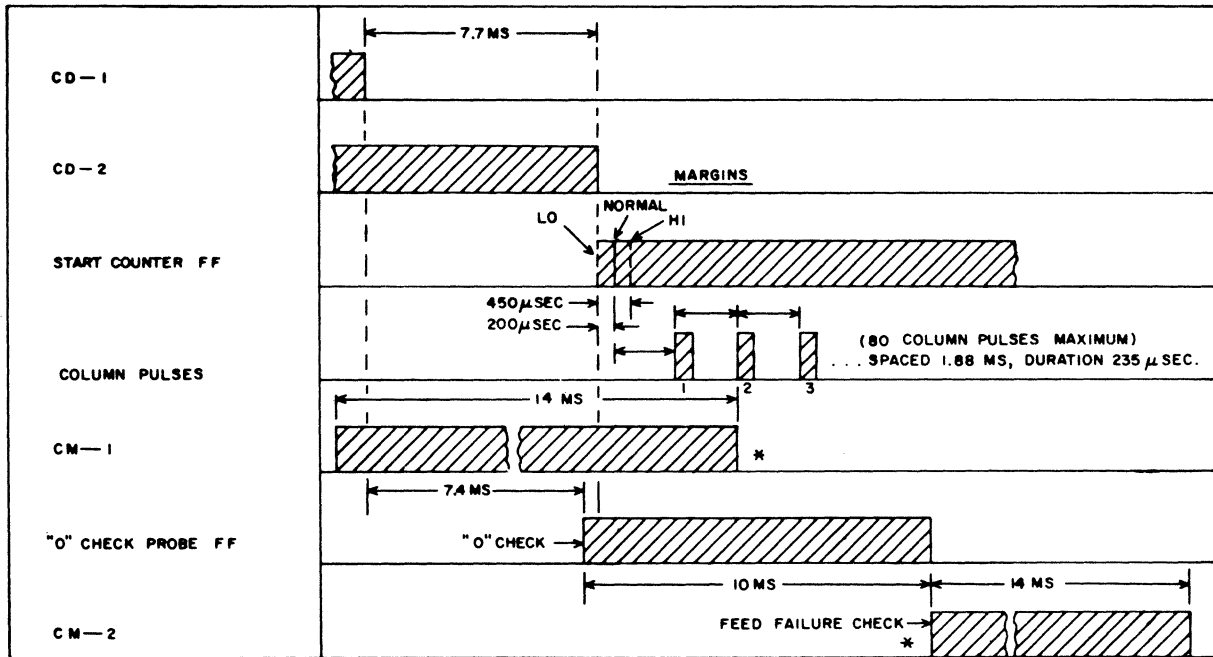


Figure 3-2. Status

* See Operation and Programming, chapter 2.

READING CARDS

The 167-2 reads a card one column at a time and sends data to the interrogator in a 12-bit per word parallel mode. The card reader includes a Hollerith to BCD translator and packer for special applications. Fourteen exciter lamp/solar cell pairs are located in the read station. Twelve of these are for reading data from the 12 card rows; one (CD-2) starts the counter and one (CD-1) stops the counter. A magnetic reluctance pickup emits pulses continuously at the rate of eight per card column. Two cams generate signals during each card cycle. The timing relationship between signals is shown in figure 3-3.



* SET CAM AT THIS EDGE.

Figure 3-3. Timing Chart - 167-2

FREE RUN READ

The Free Run Read FF (figure 3-4) is set by either an EF code 4501 from the computer or by a signal from Load switch S06 on the card reader control panel. On-line it can be cleared only by an EF clear. The FRR FF output gates the input to clutch puller P120. The Load switch permits local starting of the card reader. Stop switch S07, used for local stopping of a FRR operation, must be returned to the normal (light off) position before operation may resume. An input to L120 from the Start Counter FF locks out the clutch puller during the time that the counter is running.

SINGLE CYCLE READ

The Single Cycle Read FF (figure 3-4) is set by EF code 4502 and is cleared by the first column pulse during a read cycle or by an EF clear (4500). Its main functions are to gate the input to R114 and to pull the clutch for one read cycle.

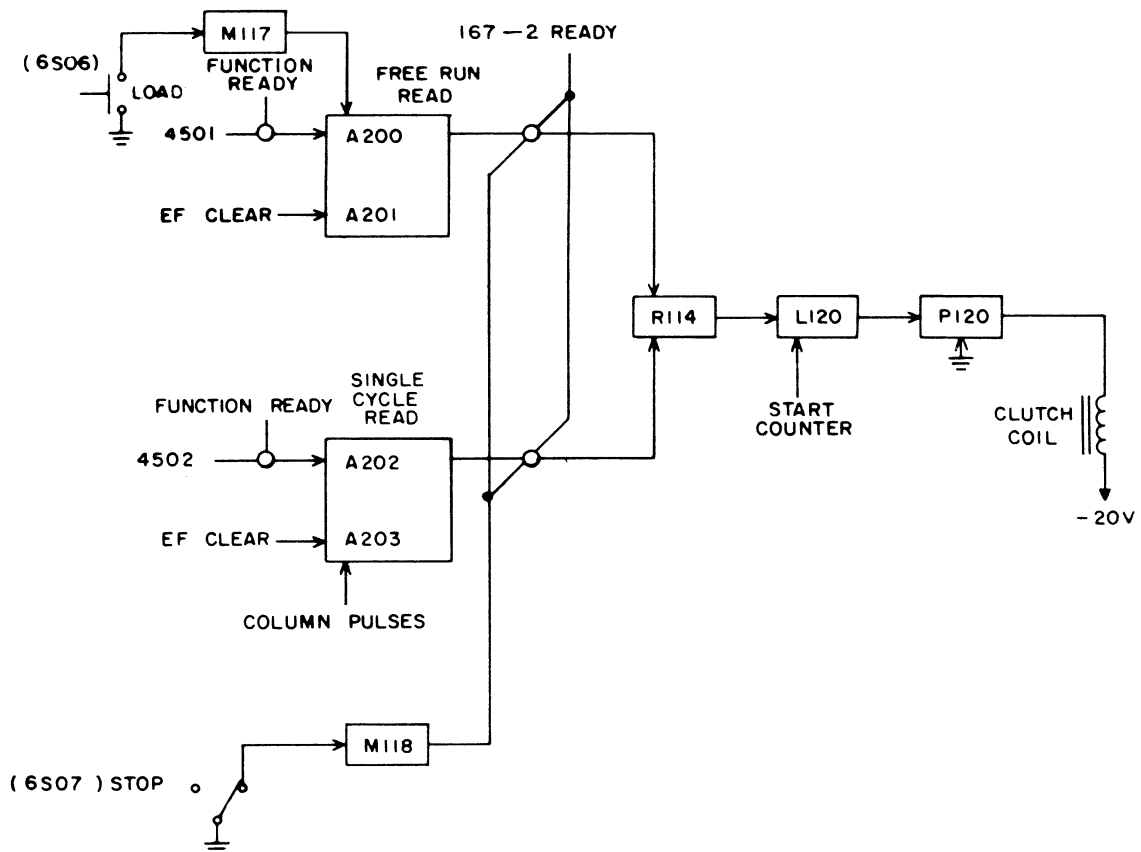


Figure 3-4. Free Run and Single Cycle Read

CUMULATIVE-8 COUNTER

Selecting the free run or single cycle read mode pulls the clutch and advances a card through the read station (figure 3-4). When no card is in the read station, a "1" from CD-1 holds a forced clear on the Start Counter FF (figure 3-5). As a card enters, the clear drops. Selection of the read operation removes a lockout "1" from B112 so that CD-2 can set the Start Counter FF. The setting of this FF reapplies a lockout to B112 via R119 and removes a forced clear from the cumulative-8 counter. This allows pulses from the magnetic reluctance pickup to advance the counter.

The counter emits one signal for every eight it receives from the pickup. A pulse generator (K115 and Y106) shapes these output signals into $0.8\mu\text{sec}$ pulses. Delays Y103 and Y104 prevent short extraneous pulses from advancing the counter. During maintenance tests, an adjustable delay (Y105 + Y111 + no delay) allows the operator to vary the position of the column pulses with respect to the card columns. Signal CM-1 drops to "0" after the first column of a card has been read. This prevents the Start Counter FF from being reset until the next card enters the read station. Delay Y112 ensures that B112 remains locked out until CM-1 drops in case an EF clear (4500) immediately follows the reading of the first column.

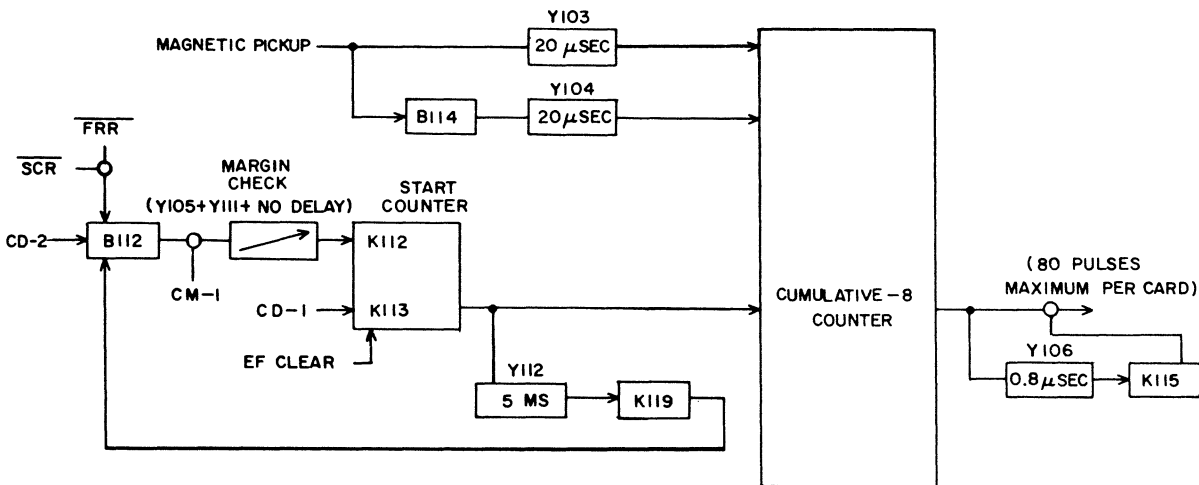


Figure 3-5. Cumulative - 8 Counter

PERMIT INPUT

Direct Input (figure 3-6)

The column pulses emitted by the counter coincide with the data from each card column. If an input request is present, the pulses set the Permit Input FF and gate data to the interrogator. If the input request is not present, an input disconnect occurs. An input ready is sent to the interrogator $5\mu\text{sec}$ after an input request is received. This turns off the input request and clears the input lines.

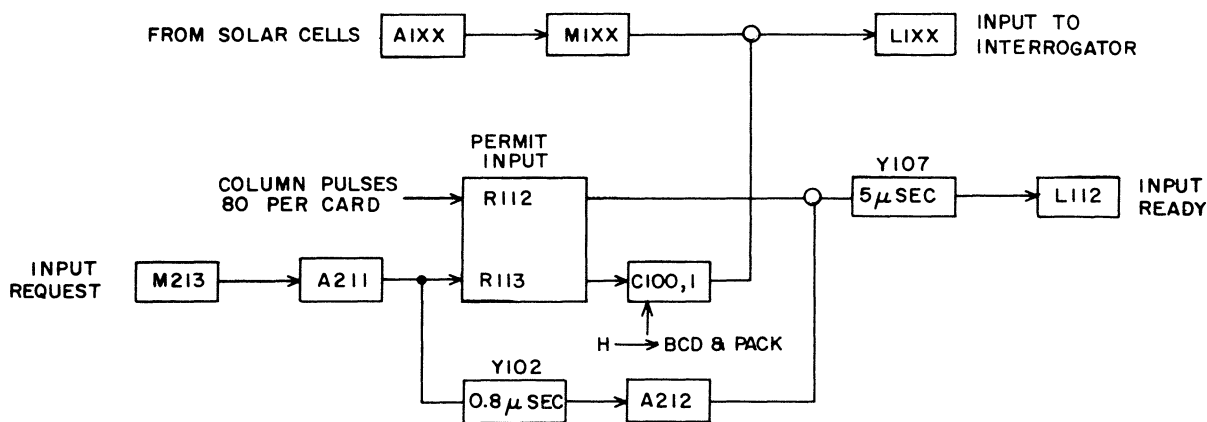


Figure 3-6. Direct Input

Translated and Packed Input (figure 3-7)

In this mode, data from cards punched in Hollerith code format is translated by a series of inverters into 6-bit BCD format. After translation, the card reader packs two 6-bit words into one column, then sends the resulting 12-bit word to the interrogator. The 80 column pulses emitted by the counter coincide with the data from each card column. Figure 3-8 shows the timing during an input from one card. Initially, the Packer and Permit Input FFs are in the cleared state. The first input request must arrive between the EF select and the generation of the first column pulse. Column pulse No. 1 sets the Packer FF and gates the translated word from card column No. 1 into the H register; after $450\mu\text{sec}$, column pulse No. 2 is enabled to set the Permit Input FF. This gates one 12-bit word to the interrogator and generates an input ready. Data (column

No. 1) from the H register goes into the upper six bits; column No. 2 into the lower six bits. As soon as the input request drops, the H register, and the Packer and Permit Input FFs are cleared. Reading continues, with the remaining odd numbered column pulses (3-79) loading the H register, and even numbered pulses (4-80) causing an input. When no more cards are available, CD-1 reappears and locks out the Packer FF via inverters R118 and R119. On-line, the H \rightarrow BCD and Pack FF is set by including bit 02 with the regular FRR and SCR codes. Off-line, the FF is set by a switch on the console.

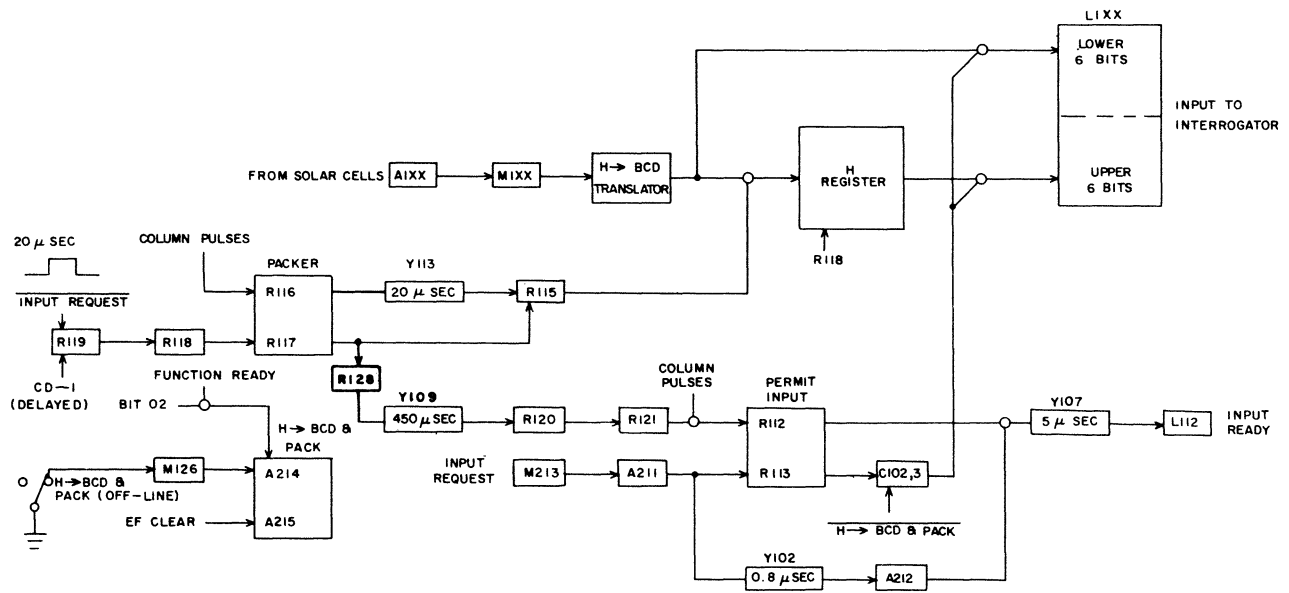


Figure 3-7. Translated and Packed Input

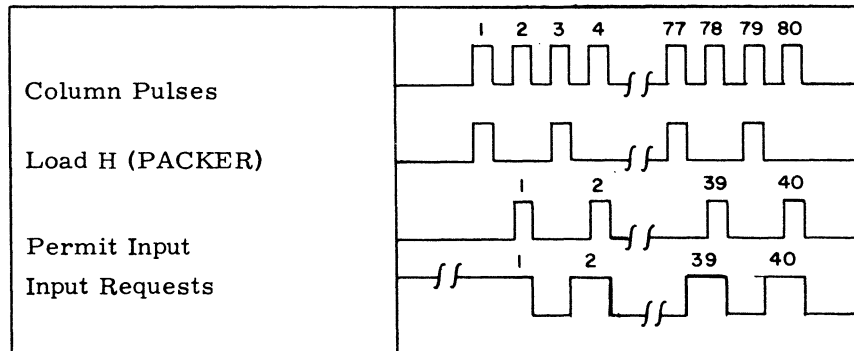


Figure 3-8. Translate and Pack Timing

INPUT DISCONNECT

On-line, the input instruction may establish a storage field block of greater capacity than the anticipated input block. The input disconnect indicates to the computer that the card reader has no more data to deliver, so the computer may return to its main program with no further delay. Three sets of conditions will cause a disconnect: feed failure, program error, or amplifier failure (figure 3-9).

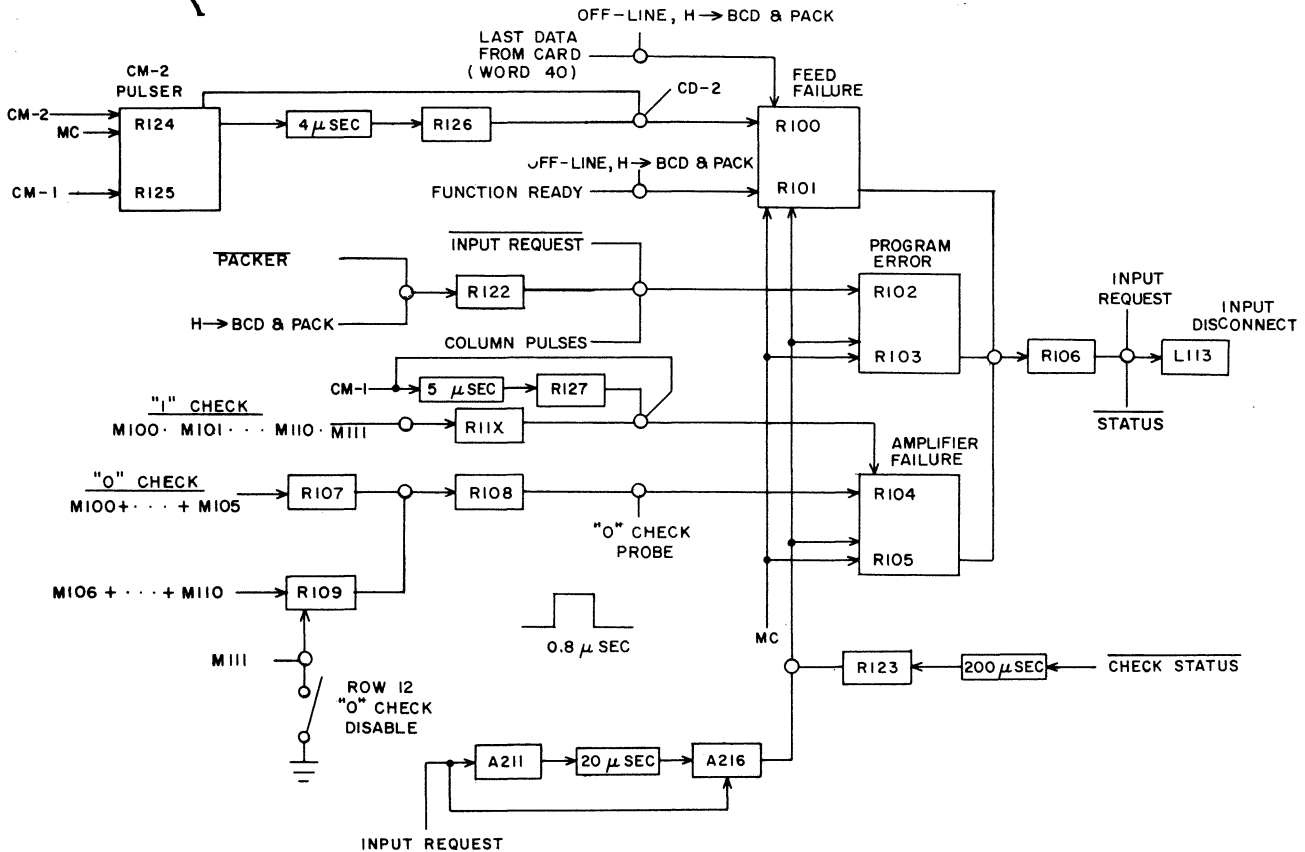


Figure 3-9. Input Disconnect

FEED FAILURE

On-Line

The Feed Failure FF sets if the Start Counter FF has not been set by a card before the signal from CM-2 appears.

Off-Line

When translated data is sent to the line printer, the input disconnect follows the 40th word to the printer. In the printer, this starts a free run operation during which

blanks (2020_g) are loaded into the last 40 memory locations. Either a master clear, a status request, or a function ready clears the Feed Failure FF.

PROGRAM ERROR

Direct Input

The Program Error FF sets if an input request is not present as each column pulse rises. Either a master clear or a status request clears the Program Error FF.

Translated and Packed Input

The Program Error FF sets if an input request is not present as each even numbered column pulse rises. Cleared as noted above.

AMPLIFIER FAILURE

The light amplifiers are checked automatically as each card enters the read station.

"1" Check

Before the card covers CD-1, the light amplifiers are checked for output. If any amplifier is not supplying a "1", the Amplifier Failure FF is set. Failure of an amplifier to supply a "1" may be caused by insufficient exciter lamp brilliancy, dirt in the solar cell aperture, or a defective amplifier.

"0" Check

After the "1" check, a "0" check is made to ensure that none of the amplifiers emit a "1" when the solar cell apertures are all covered by the leading edge of a card. The presence of a "1" usually indicates that the brilliance of an exciter lamp is set too high, causing light to penetrate the card and switch the light amplifier. An input disconnect may occur any time that corner-cut cards are used unless the Row 12 "0" Check Disable switch (S05) is on.

Either a master clear or a status request clears the Amplifier Failure FF.

After a Status Response has been sent to the computer (normally, status is requested at the end of each card) the input request will drop, thereby clearing the Status FF (figure 3-2). The 20 usec pulse produced by A216 and R123 clears the Error FFs at the same time.

CHAPTER 4 MAINTENANCE

GENERAL INFORMATION

MAINTENANCE EQUIPMENT

Logic Circuits

Equipment used in servicing the computer logic circuits is also used for maintenance of the 167-2. The following items are necessary:

- Oscilloscope
- VOM (Triplett 630 or equivalent)
- Printed circuit card extender
- Crimping tool
- Taper pin insertion tool
- Miscellaneous hand tools

An additional aid for checking printed circuit card performance is a Control Data 150 or 151 Card Tester. Manuals for these testers include test procedures and oscilloscope waveforms for each card type.

Principles of the card reader logic are described in chapter 3 of this manual, the Customer Engineering diagrams are in appendix C, and the chassis maps and file of equations are in the 167-2 Card Placement and Equation Summary manual, Pub. No. 60022200.

Card Mechanism

A number of items are required for making mechanical adjustments and repairs on the card mechanism. They include:

- Set of Allen-type wrenches
- Feeler gauges
- Phillips-type screwdrivers
- A pound gauge
- Set of small open-end wrenches
- A soft lens brush
- Specified oils and greases
- Specified shims

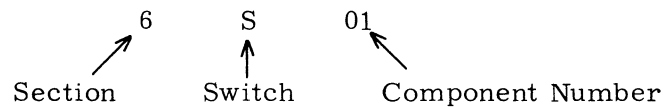
Drift punch
Brass drift rod
Plastic-head hammer
Tru-arc pliers

COMPONENT LOCATION SYSTEM

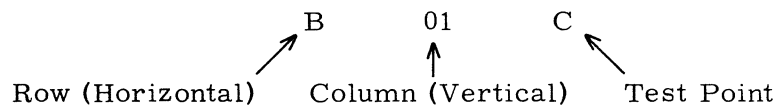
A special coordinate convention designates component locations within the card reader. The 167-2 cabinet is number 170000; the major sections of the card reader are identified as follows:

170200 card mechanism
170400 power supply
170500 logic chassis
170600 control and fuse panel

Standard symbols identify component types (J = mounted connector, P = end of cable connector, S = switch, etc.). For example symbol 6S01 would mean:



The part represented is switch number 1 which is mounted on section 6, the control panel. The location of printed circuit cards on the logic chassis is specified by the following coordinate convention:



Test point locations are A, B, C, and D (from top to bottom of a card, observed from the printed wiring side with the pin connectors to the left).

MOUNTED CONNECTORS

The 167-2 uses four types of mounted connectors. Figure 4-1 shows the pin arrangement for each type.

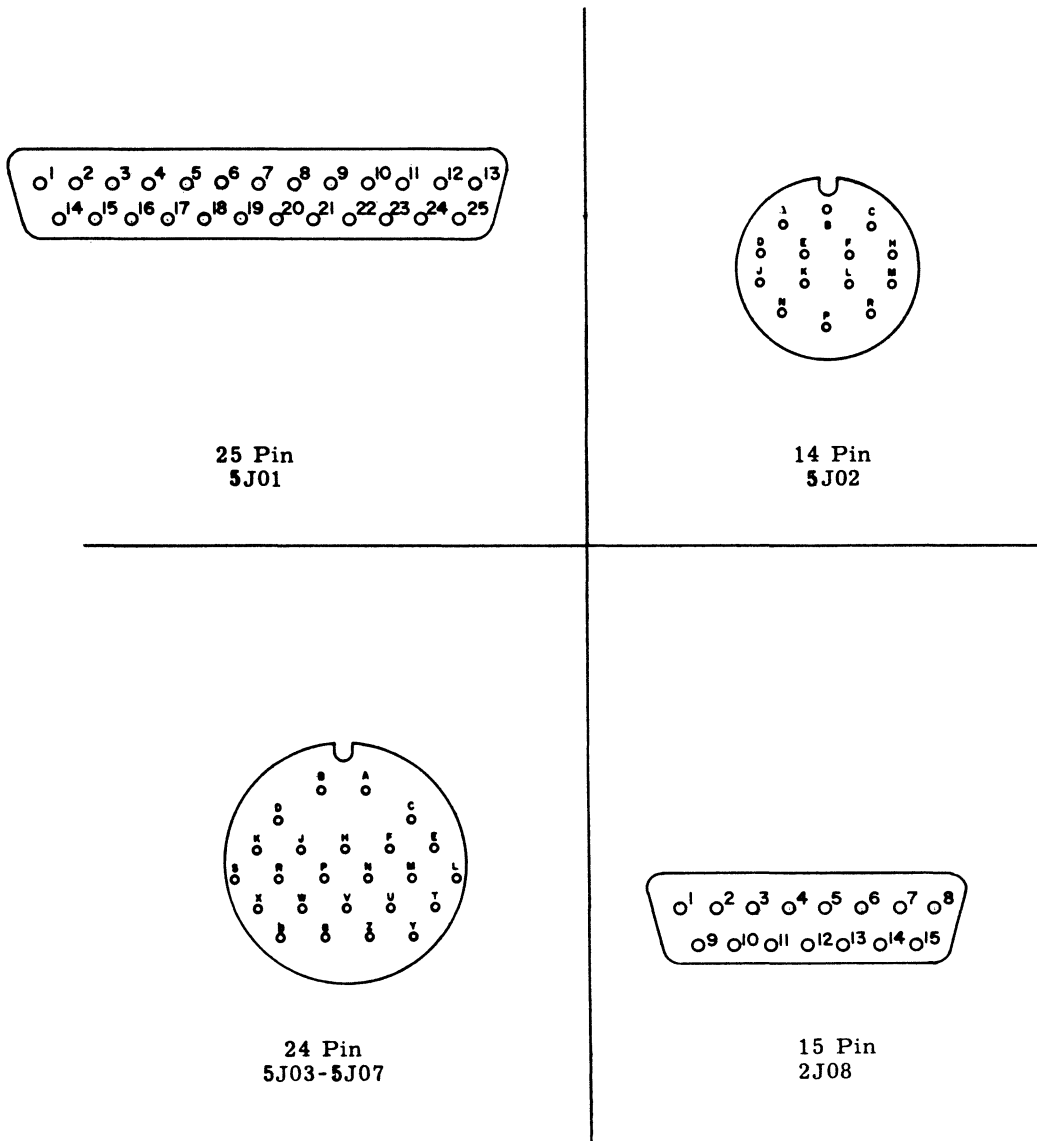


Figure 4-1. Mounted Connectors, Pin Arrangement, Front View

TABLE 4-1. PIN ASSIGNMENTS, MOUNTED CONNECTORS,
CHASSIS 170500






5J01		5J02	
PIN	FUNCTION	PIN	FUNCTION
1	Card Row 12	A	-20 vdc
2	 Info From Solar Cells 	11	Ground
3		0	+20 vdc
4		1	-2.5 vdc
5		2	Load Switch
6		3	Stop Switch
7		4	Motor Power
8		5	Margin (Y111)
9		6	 (Y105)
10		7	Margin (K112)
11		8	Clutch Coil
12	Card Row 9	N	Row 12 "0" Check
13	Magnetic Pickup	P	-4.5 vdc
14	Ground	R	H → BCD and Pack
15	 Ground 		
16			
17			
18			
19			
20			
21	Ground		
22	Not Used		
23	Ground		
24	CD-1		
25	CD-2		

TABLE 4-1. (CONT'D)

FUNCTIONS			
PIN	5J03	5J04	5J06
A	Card Row 9	Bit 00	Bit 00
B	Adjustable Voltage to Lamps ↑ 8 7 6 5 4 3 2 1 0 ↓ 11	01	01
C		02	Not Used
D		03	Not Used
E		04	Not Used
F		05	05
H		06	06
J		07	07
K		08	08
L		09	09
M		10	10
N		Card Row 12	Bit 11
P	CD-1	Not Used	Not Used
R	CD-2	Input Ready	Not Used
S	Hopper Switch-2	Input Request	Output Resume
T	Stacker Switch-NO	Not Used	Function Ready
U	CM1-B	Not Used	Master Clear
V	CM2-B	Input Disconnect	Not Used
W	Stacker Switch-NC	Not Used	↑ Not Used ↓
X	Not Used	↑ Not Used ↓	
Y	↑ Not Used ↓	Not Used	Not Used
Z		Not Used	Not Used
a	Not Used	Not Used	Not Used
b	Ground	Ground	Ground

- Notes: 1. 5J04 is paralleled with 5J05
 2. 5J06 is paralleled with 5J07

TABLE 4-2. PIN ASSIGNMENTS, CONNECTOR 2J08,
EXCITER LAMP ASSEMBLY, CARD MECHANISM 170200

PIN	J150208 (J08)	
1	Card Row 9	
2	Adjustable Voltage to Lamps ↑ ↓	7
3		5
4		3
5		2
6		1
7		11
8		12
9	8	
10	6	
11	Card Row 4	
12	CD-1	
13	CD-2	
14	Card Row 0	
15	Ground	

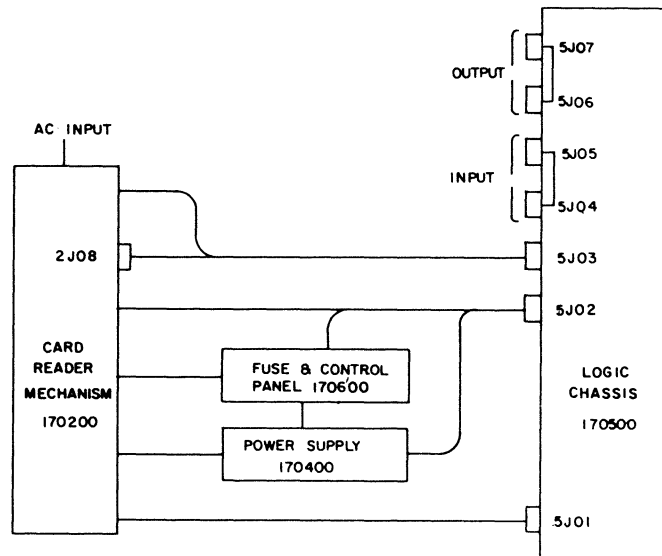


Figure 4-2. Intra-Unit Cable Diagram

PREVENTIVE MAINTENANCE

Following a preventive maintenance schedule reduces down-time. Preventive maintenance of the 167-2 card reader consists of the following:

1. Maintaining the cleanliness of components
2. Lubricating components as required
3. Assuring proper operation using test routines
4. Maintaining tolerances set forth in the section on adjustment specifications.

This section contains a list of required preventive maintenance procedures scheduled on an hours-used basis. For this purpose, a running-time meter under the front cover keeps a cumulative record of operating time.

For details of each maintenance step, refer to the sections on trouble shooting, adjustment specifications, and assembly/disassembly instructions.

Every 8 hours (daily):

- A. Remove exciter lamp assembly
- B. Clean with soft bristle brush:
 1. solar cell apertures
 2. feed bed
 3. hopper area

Every 160 hours (monthly):

- A. Check:
 1. exciter lamp adjustments
 2. column pulse coincidence with read pulses
 3. EF translator validity
- B. Lubricate:
 - *1. feed slides to gibs
 - *2. feed slide to fork (serials 101-113 only; permanent dry lube on 114 and up)
 - *3. feed knife pivot

Every 1000 hours (semi-yearly):

- A. Check adjustment of:
 1. feed roller and spring pressure

* See table 4-3

2. exciter lamp assembly
3. hopper throat
4. feed knife
5. clutch coil and trip arm
6. hopper, gib, and slide
7. stacker stop actuator (stacker switch)
8. reluctance pickup
9. circuit breakers (cams 1 and 2)

B. Lubricate:

- *1. feed roll arm pivots
- *2. clutch trip arm pivot
- *3. circuit breaker contact arm pivots
- *4. stacker switch actuator shaft
- **5. feed roll shaft gears
- **6. feed cams
- **7. cams
- ***8. clutch housing and spring

Every 2000 hours (yearly):

A. Replace if necessary:

1. feed roll shaft bearings
2. cam follower roll bearings
3. pulley bearings (replace pulley assembly)
4. clutch shaft bearings
5. feed fork and follower, shaft bearings

****B. Lubricate drive motor bearings

TABLE 4-3. LUBRICANTS

Burrough's Number	Description	Vendor
* S64960-2	Oil, Lubricating, SAE 10	(Motor oil)
** S15821-39	Grease, Shell Alvania 2, #10 can	Shell Oil Company
*** S15821-32	Grease, Unitemp #MIL-G-3278	Texaco Oil Company
****S15821-26	Oil, Bodine L029, 0° - 65°C	Bodine Electric Company, Los Angeles, California

TROUBLE SHOOTING

OVERLOAD PROTECTION

One fuse and three circuit breakers protect components within the 167-2 from electrical overloads. Figure 4-3 shows the machine with the cover removed to expose the fuse and circuit breakers. Table 4-4 lists the circuits protected by each device.

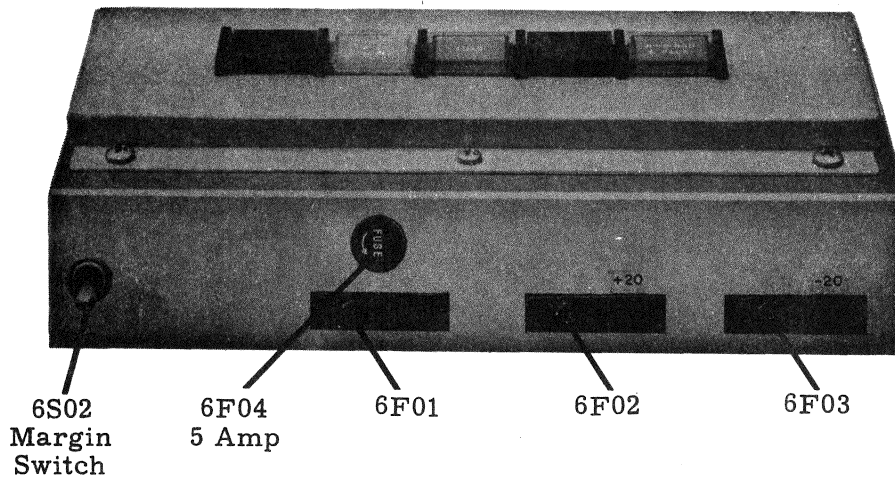


Figure 4-3. Fuse and Circuit Breakers

TABLE 4-4. FUSE AND CIRCUIT BREAKERS

Symbol	I (amp)	Circuit
6F01	5	Exciter lamps
6F02	1.5	+20 vdc logic power
6F03	4	-20 vdc logic power, and clutch coils
6F04	5	Main power line

POWER SUPPLY

The power supply has transformers that are self-regulating. With approximately correct load the ± 20 vdc output will remain constant during large fluctuations of input voltage. Only one adjustment is on the supply (resistor R02). At assembly it is set to provide -4.5 vdc output to the light amplifier cards. If this voltage drops as the parts age, re-adjust the tap on R02. Figure 4-4 shows a top view of the power supply with all of the parts called out.

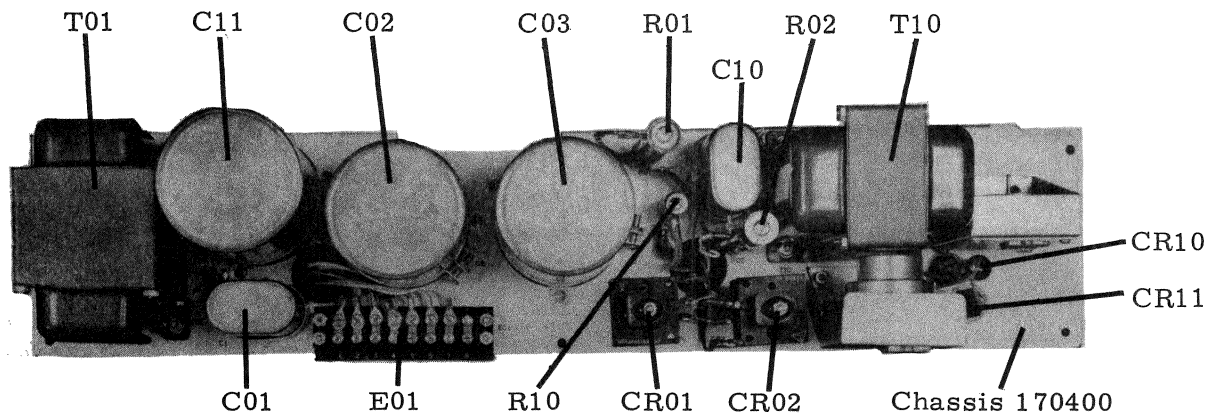


Figure 4-4. Power Supply Component Layout *

MARGIN TEST

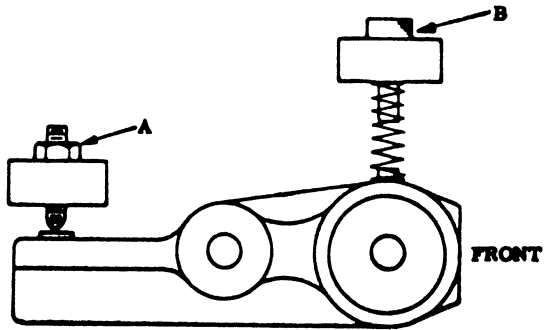
The Margin switch, figure 4-3, is used to vary the timing position of the column pulses in relation to the read strobe period. The down position is normal, the center position is the low margin, and the upper position is the high margin. If cards may be read without losing bits when the Margin switch is set to both the upper and then the center positions during a test run, maintenance personnel may assume that the column pulse falls in the middle of the strobe period. Failure during this test may mean:

1. dirt is in the solar cell apertures,
2. the lamp assembly is improperly oriented,
3. the delay capacitor has changed value, or
4. CD-2 exciter lamp brightness is too high.

Correct other failures in the logic circuits in the same way as in other Control Data equipment. Instructions for mechanical adjustments and repairs are found in the next two sections of this chapter.

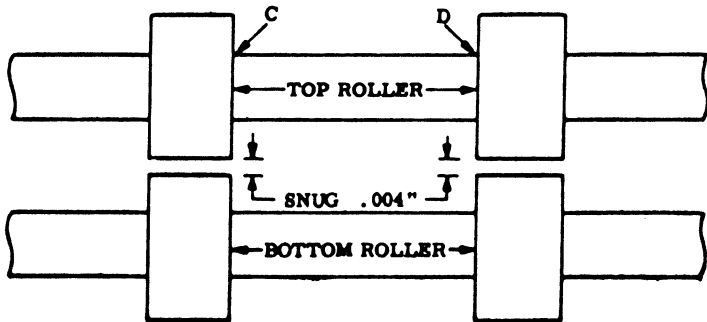
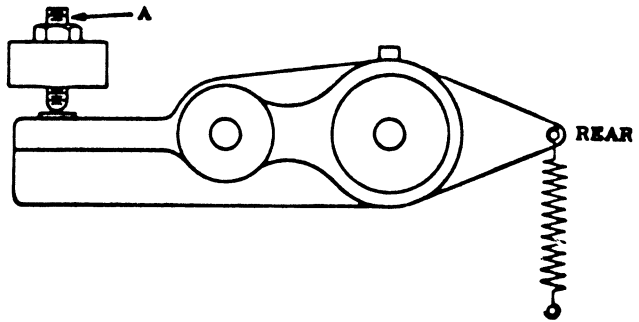
* For parts list and schematic, see appendix C, diagram 6.

ADJUSTMENTS



Left Front Pivot Arm

Right Rear Pivot Arm



Rollers

Figure 4-5. Feed Rollers

1. FEED ROLLER (figure 4-5)

CAUTION: Skew errors and card damage can result from improper feed roller openings or pressures.

OPENING

Requirement

The gap between the top and bottom feed rollers must be a snug 0.004 inch.

Adjustment

Adjust nut A to provide a snug 0.004 inch gap between both pairs of top and bottom rollers.

SPRING PRESSURE

Requirement

The tension of the springs connected to the pivot arms for both top feed rollers must be adjusted so that the rollers exert a downward force of 13.5 pounds \pm 2.

Check

Connect a pound gauge to the top feed roll shafts, first at point C and then at point D. Insure that the closest roller starts moving upward at a force of 13.5 pounds \pm 2. If it does not, perform the adjustment.

Adjustment

If the pressure exerted by the top front feed rollers is incorrect, adjust screw B for the correct pressure at both ends. If the pressure exerted by the top rear feed roller is incorrect; stretch the spring to decrease pressure or cut off turns to increase pressure.

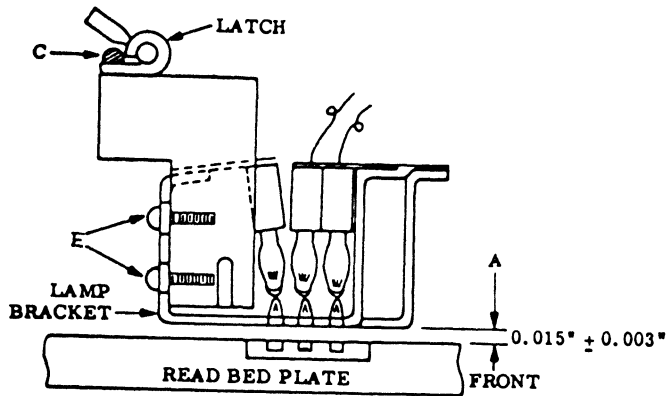
POSITIONING

Requirement

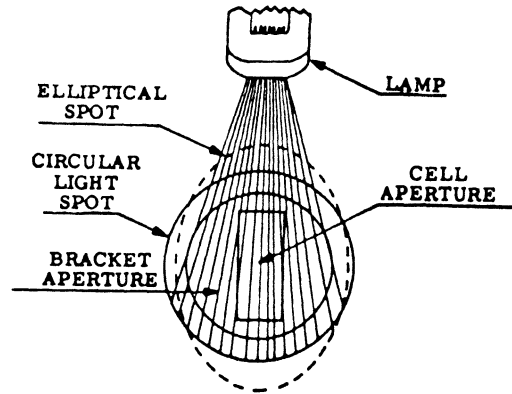
The top rollers must be aligned to within \pm 0.015 inch of the bottom rollers.

Adjustment

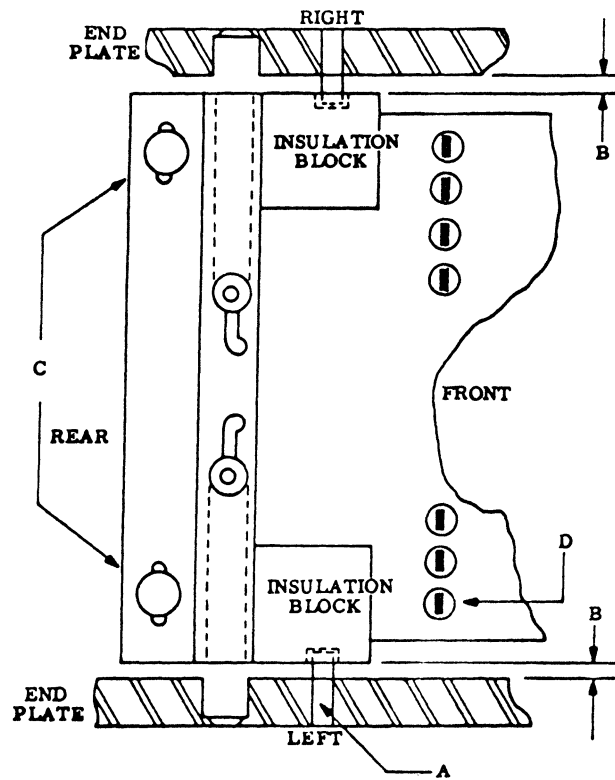
Position the bottom rollers by setting the shoulder at the right end of the feed roll shaft tight against the bearing and the pulley. Lock the pulley on the shaft with the lockscrew. Hold the feed roll shaft all the way to the left and push the gear to the right to insure minimum end play. Lock the gear on the feed roll shaft with the lockscrew. Next, align the top rollers to within \pm 0.015 inch of the bottom rollers by inserting shim washers between the retaining ring at the right end of the feed roll shaft and the bearing. Hold the feed roll shaft all the way to the left and push the gear to the right to insure minimum end play. Lock the gear on the shaft with the lockscrew.



Side View



Lamp Position



Top View

Figure 4-6. Exciter Lamp Assembly

2. EXCITER LAMP ASSEMBLY (figure 4-6)

CAUTION: Be sure that the insulation covers the wire leads and no bare strands exist.

Requirements

- a. The gap between the lamp bracket and read bed plate must be 0.015 inch \pm 0.003 (A).
- b. The individual spots cast by the lamps must be aligned to completely cover their associated bracket apertures and the solar cell apertures.
- c. There must be equal clearance between the side plates and insulation blocks (B).

Check

- a. Insert a 0.015 inch feeler gauge between the lamp assembly and the read bed plate. It should be a snug fit. Try to insert a 0.018 inch feeler gauge. It should not fit. Perform these checks at both the left and right ends of the lamp assembly.
- b. Visually inspect the light spots cast by the exciter lamps and insure that they are aligned to completely cover their associated bracket apertures and solar cell apertures.
- c. Grasp the lamp assembly and try to move it to the left and right. There should be practically no movement.

If any of these conditions do not exist, perform the appropriate adjustment.

Adjustments

- a. Loosen the lamp bracket holding screws (E). Raise or lower the lamp bracket to obtain a clearance of 0.015 inch \pm 0.003 (A) between the lamp bracket and read bed plate. Tighten the screws.
- b. Loosen the latch holding screws (C) and adjust the insulating blocks for equal clearance between the side plates and the insulation blocks (B). Tighten the screws.
- c. The figure shows the relationship between the cell aperture, bracket aperture, and lamp spot. The individual spots must be aligned to completely cover their associated bracket apertures.
- d. The front to rear alignment of the solar cells and apertures (D) is controlled by manufacturing tolerances and no adjustment can be made.
- e. Visually check the left to right alignment to assure that the lamp bracket is in alignment with its associated apertures. If the alignment is incorrect, adjustment step b must be performed again.

3. HOPPER THROAT (figure 4-7)

Requirement

The opening between the top and bottom throat blades should be 0.010 inch.

Check

Insert a 0.010 inch feeler gauge in the hopper throat opening in a horizontal plane. It should be a tight fit. The 0.010 inch feeler gauge should not pass through the opening when inserted at an angle above or below the horizontal. If these conditions do not exist, perform the adjustment.

Adjustment

- Loosen screw and adjust the position of the bottom throat blade until the peak of the bottom blade (at point C) is in line with the knife edge of the top blade. Tighten screw A.
- Loosen screw B and adjust the top blade to obtain a tight 0.010 inch between the two blades (feeler gauge inserted horizontally). Tighten screw B.
- Check the adjustment as outlined above.

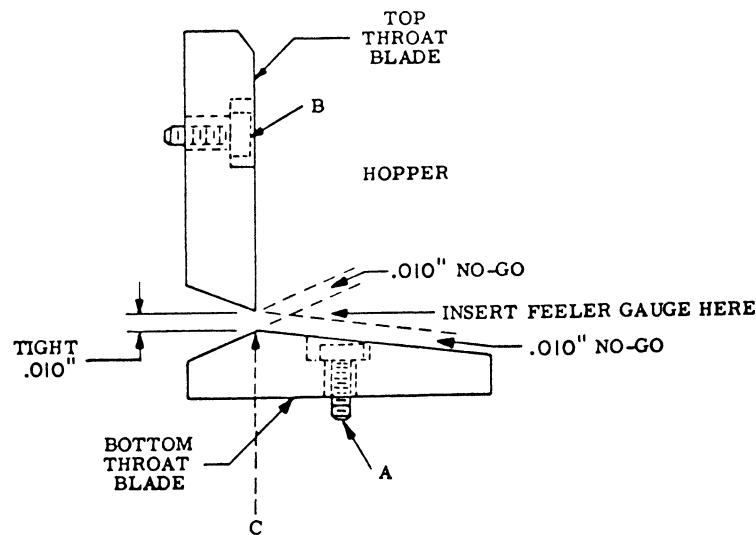


Figure 4-7. Hopper Throat

4. FEED KNIFE (figure 4-8)

CAUTION: Incorrect setting at point A will result in misfeeds and card damage.

Binding at point D will result in misfeeds and nicked cards on the column 1 and column 80 edges.

Requirement

Maintain a $0.030 \text{ inch} \pm 0.010 - 0.000$ clearance between the feed knife blade and column 80 of the card.

Adjustment

- a. Loosen setscrew at point B.
- b. Place one card in the hopper with its column 1 edge flush with the front extremity of the hopper.
- c. Rotate the knife-adjusting nut at point C to obtain $0.030 \text{ inch} \pm 0.010 - 0.000$ clearance between the feed knife blade and the column 80 edge of the card.
- d. Lock the setscrew.
- e. Rotate the knife block on the adjusting stud in the directions shown at D. The block should float freely with no binding. Travel is limited by the gib.

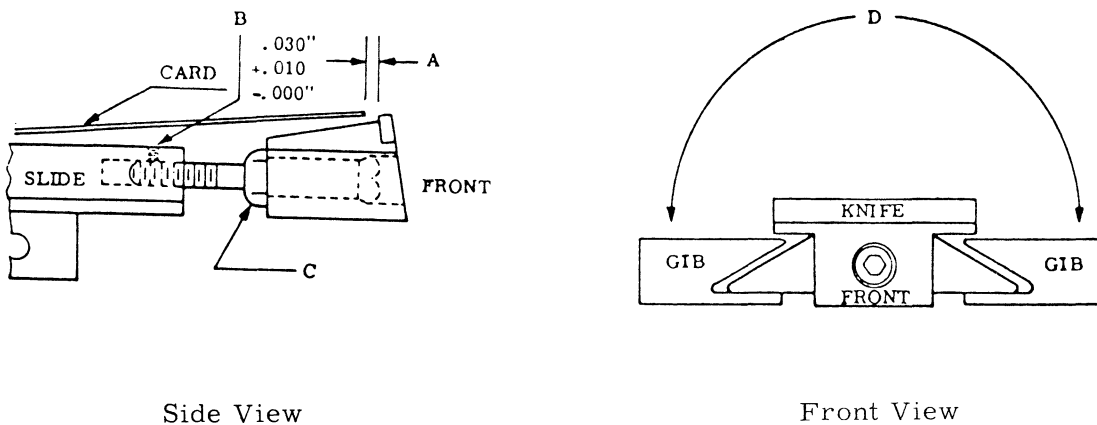


Figure 4-8. Feed Knife

5. CLUTCH COIL AND TRIP ARM (figure 4-9)

Requirements

- a. The clearance between the clutch collar and trip arm must be 0.006 to 0.008 inch when the trip arm is in the actuated position.
- b. The clearance between the trip arm and the core of the rear solenoid must be 0.001 to 0.003 inch when the trip arm is in the actuated position.
- c. The trip arm must overlap the latching ridge on the clutch collar by 0.030 inch \pm 0.005 when the trip arm is in the disengaged position.

Adjustments

- a. Loosen the solenoid mounting screws (E).
- b. Hold the trip arm so that it contacts the front core of the solenoid.
- c. Position the trip arm and solenoid so that a 0.006 to 0.008 inch gap exists at C, and a 0.001 to 0.003 inch gap at D.
- d. Tighten the solenoid mounting screws.
- e. Allow the trip arm to fall into its disengaged position.
- f. Insert a 0.040 inch feeler gauge between the trip arm and the core of the front solenoid.
- g. Adjust screw B to provide a snug 0.040 inch between the trip arm and front core. This assures a 0.030 inch \pm 0.005 latch overlap at A.
- h. With voltage applied to the clutch coils, the force required to pull the trip arm away from the cores should be a minimum of 12 pounds measured at D. If the force required is less than 12 pounds, check the clutch coils and associated circuitry.

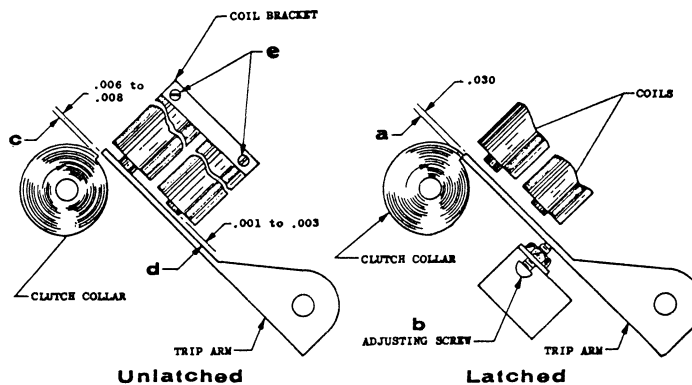


Figure 4-9. Clutch Coil and Trip Arm

6. HOPPER, GIB, AND SLIDE (figure 4-10) CAUTION: Incorrect setting of these adjustments will result in misfeeds or nicked cards.

Requirements

- The gap between a card deck and the front card guide must be 0.010 inch (A).
- There must be a minimum of 0.003 inch and not more than 0.005 inch clearance between the slide and the left gib (C).

Adjustments

- Place a deck of cards in the hopper. Insure that the deck is flush against the right and rear extremities of the hopper.
- Loosen the screws at D and use shims to obtain a 0.010 inch clearance at A. (Screws may be 9/64 Allen type.)
- The tolerance of the manufactured parts should allow a nominal 0.010 inch clearance between the card deck and the left side of the hopper at B. There is no adjustment for this.
- Hold the right gib flush against the right side of the hopper-bed plate.
- Hold the slide flush against the right gib. Check to insure that the clearance between the slide and left gib is between 0.003 and 0.005 inch (C).
- If the clearance is other than that stated in e, loosen the left gib and adjust it for proper displacement from the slide. Tighten the gib.
- Move the slide to its front and rear positions and check to insure that there is no binding.

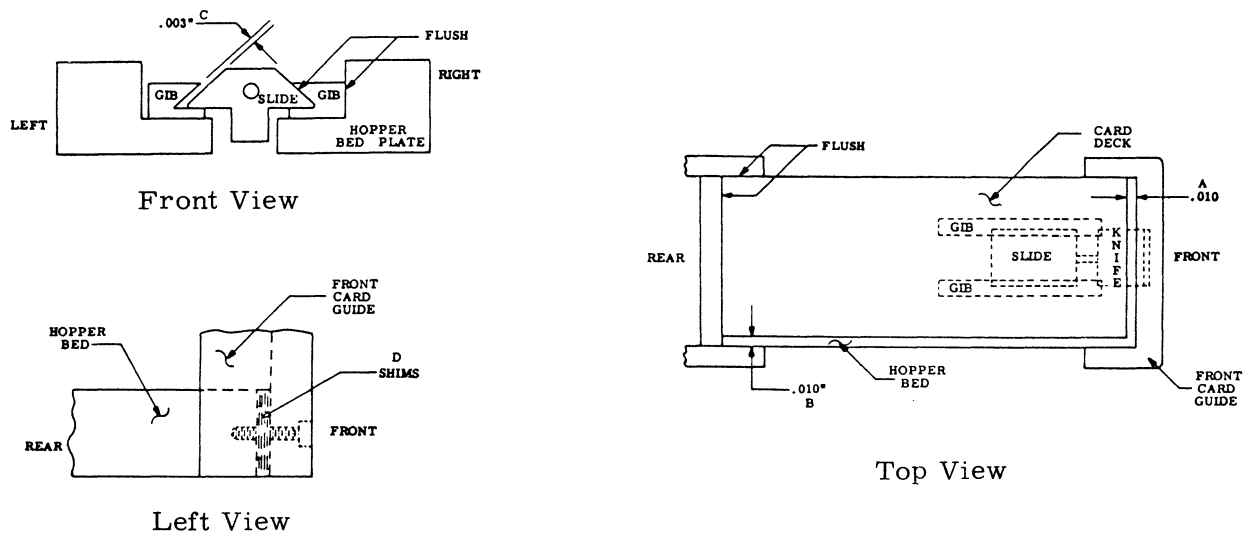


Figure 4-10. Hopper, Gib, and Slide

7. STACKER STOP ACTUATOR (figure 4-11)

CAUTION: If this adjustment is not performed correctly, the card reader will stop (1) with less than 500 cards in the stacker, or (2) with a card jam.

Requirement

Actuator arm must cause the stacker stop microswitch contacts to open after approximately 500 cards have entered the stacker.

Check

Feed cards through the card reader and insure that after approximately 500 cards have entered the stacker, the stacker stop microswitch contacts open and stop the card reader.

Adjustment

- a. Loosen the lock screw which holds the actuator arm on the shaft.
- b. Position the arm so that approximately 500 cards in the stacker will cause the stacker stop microswitch contacts to open.
- c. Tighten the lock screw.
- d. Perform the check again.

Note: Do not attempt to re-form the wire spring on the microswitch.

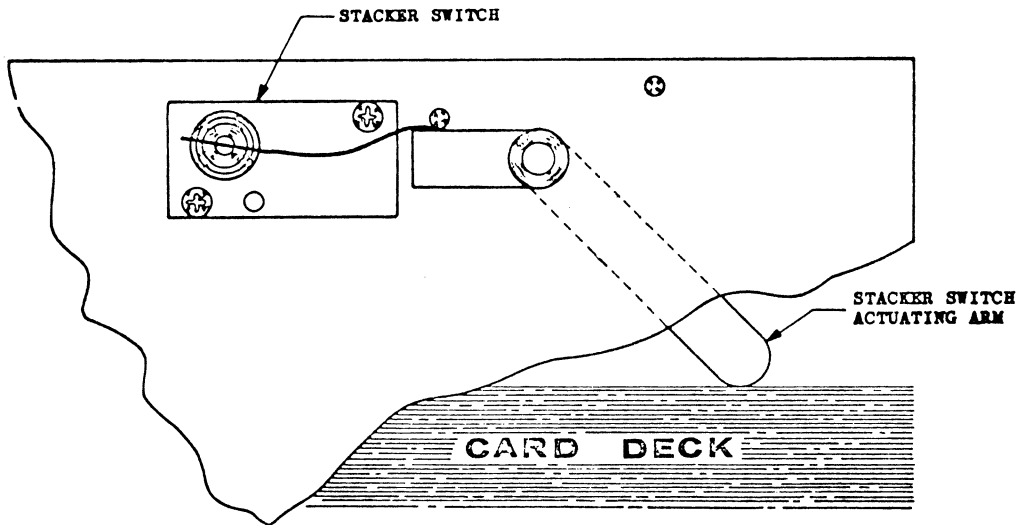


Figure 4-11. Stacker Stop Actuator

8. RELUCTANCE PICKUP (figure 4-12) CAUTION: The pickup head and the timing wheel may be damaged if these adjustments are made carelessly or inaccurately.

Requirements

- a. The gap between the timing wheel and the tip of the pickup must be 0.005 inch (B).
- b. The tip of the pickup must extend approximately 3/16 inch from the mounting bracket (C).
- c. The chisel tip of the pickup must be horizontal.

Check

- a. Switch power off.
- b. Insert a 0.005 inch feeler gauge in gap B.
- c. Manually rotate the timing wheel.
- d. The highest point of the timing wheel must be snug against the feeler gauge. (The timing wheel is concentric to ± 0.001 inch.)
- e. Check that the chisel tip of the pickup is horizontal.
- f. Check that the chisel tip of the pickup extends approximately 3/16 inch from the mounting bracket.

Adjustments

- a. Loosen locknut A.
- b. Rotate the pickup head until the chisel tip is horizontal and approximately 3/16 inch from the face of the mounting bracket (C).
- c. Tighten locknut A.
- d. Loosen the bracket mounting screws and obtain a nominal 0.005 inch clearance at B.
- e. Tighten the bracket mounting screws.
- f. Perform steps b, c, and d listed under Check.

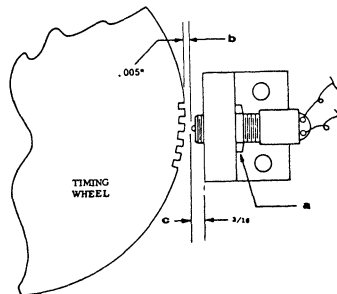


Figure 4-12. Reluctance Pickup

9. DRIVE BELT IDLER PULLEYS (figure 4-13)

Requirement

The drive belts must be tight enough to avoid slap and jumping, but they must not exert undue pressure on the pulley bearings.

Check

Using one finger and nominal pressure, the belts should deflect 1/4 inch to 1/2 inch at points A and B.

Adjustment

- a. Loosen the lock screws at C and rotate the idler pulley:
 - 1) clockwise to increase tension, or
 - 2) counterclockwise to decrease tension.
- b. Tighten the lock screws and check the belt tension.

Note: In order to make this adjustment to the motor belt idler pulley (D), the retaining ring and pulley must be removed to allow access to the lock screws with an Allen-type wrench.

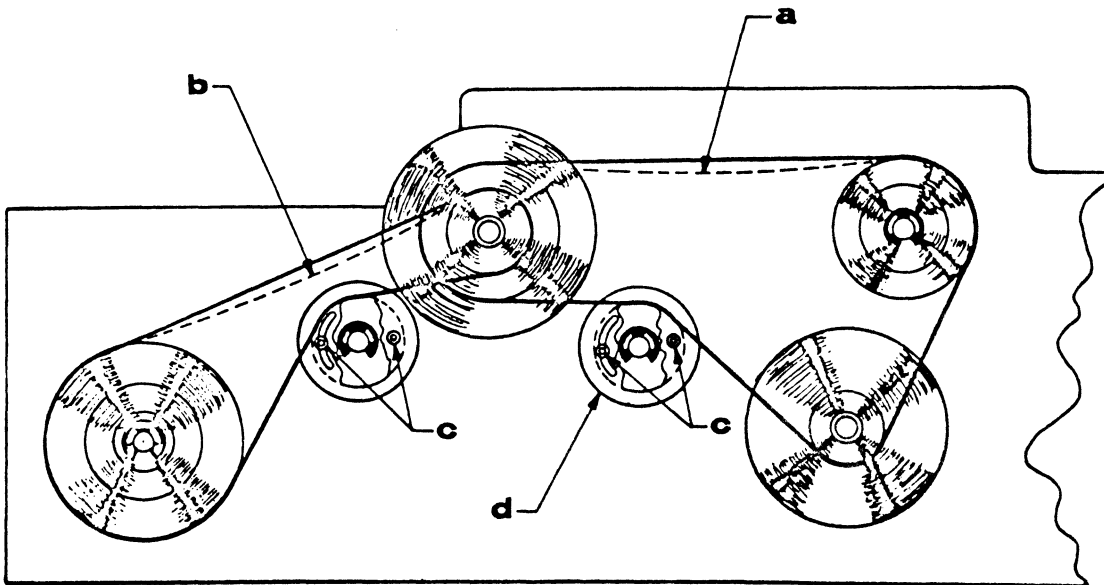


Figure 4-13. Drive Belt Idler Pulleys

10. CARD GUIDES (figure 4-14)

Requirement

The clearance between the card guide and the read bed plate must be $0.015 \text{ inch} \pm 0.005$.

Check

- a. Insert a 0.015 inch feeler gauge under each card guide and move it from end to end.
 - b. Try to insert a 0.020 inch feeler gauge under each card guide. It should not fit.
- If these conditions do not exist, perform the adjustment.

Adjustment

- a. Loosen the adjusting screws.
- b. Insert a 0.015 inch feeler gauge under the card guides and reposition them.
- c. Tighten the adjusting screws and perform the check again.

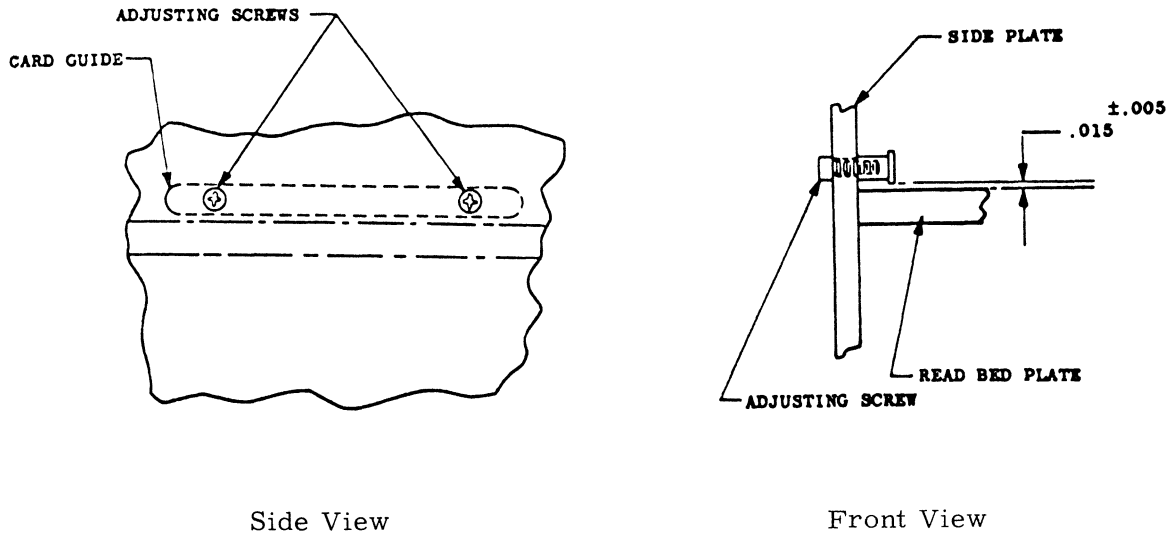


Figure 4-14. Card Guides

11. CAM OPERATED CIRCUIT BREAKERS (figure 4-15)

CONTACT GAP

Requirement

Contacts must have $0.012 \text{ inch} \pm 0.002$ gap during high dwell.

Adjustment

- a. Turn power off.
- b. Loosen the locknuts shown at A.
- c. Adjust the contact screw for $0.012 \text{ inch} \pm 0.002$ gap when the cam followers are on the rise of the cams.
- d. Tighten the locknuts.

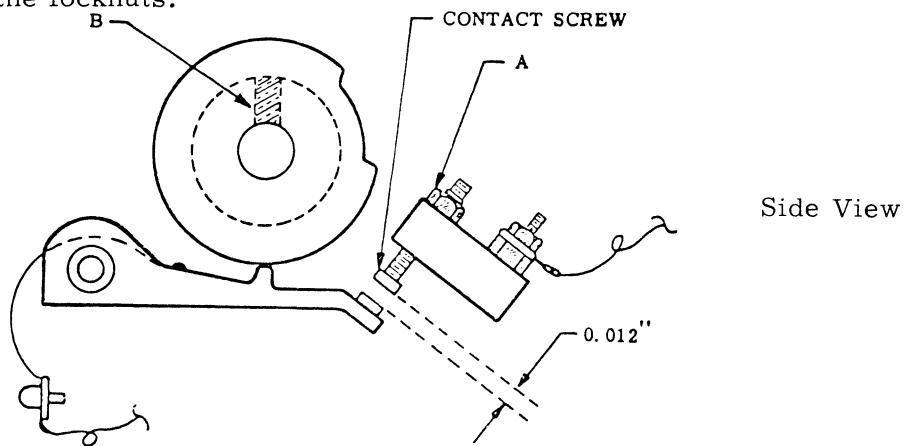


Figure 4-15. Cam Operated Circuit Breakers

12. EXCITER LAMP BRILLIANCE

- CAUTIONS:
- a. Pulse width is adversely affected by card dust in the solar cell area of the read bed.
 - b. Spurious read pulses may be emitted when the lamp for a solar cell is too bright.
 - c. Solar cell and exciter lamp life is shortened by excessive brightness.
 - d. Check lamp brilliance whenever photo-amplifier cards are changed.

Figure 4-16 shows the layout of the read station. Figure 4-17 shows the location of the variable resistors which are used to regulate the light intensity of the exciter lamps. Before adjusting, set all lamps to the point of minimum intensity.

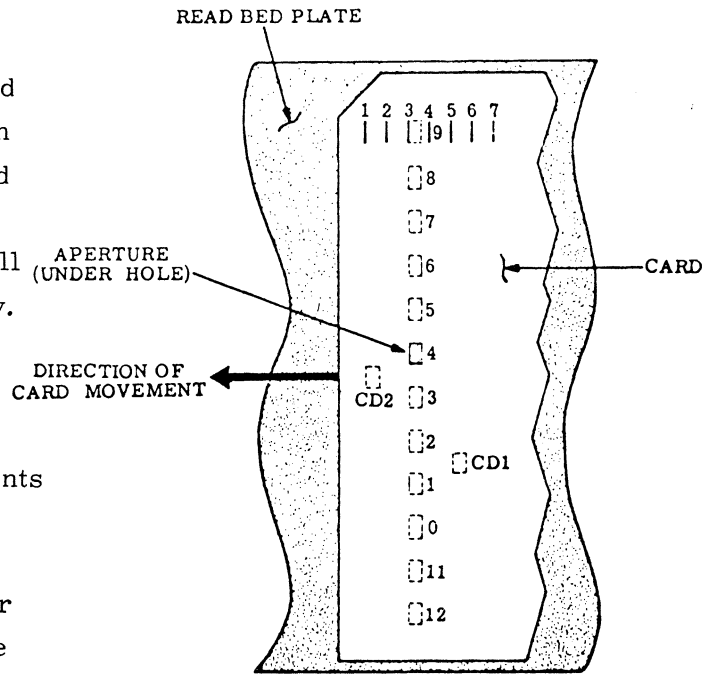


Figure 4-16. Read Station

13. TIMING

There are two types of timing adjustments on this card reader. The first type requires the adjustment of fourteen variable resistors to achieve the proper exciter lamp brilliance; the second type requires the setting of two circuit breaker cams to the proper angle on their shaft. These two cams are located on the chassis assembly (see Appendix A). The cams are mounted with CM-2 nearest the chassis assembly and CM-1 on the outside. There are five timing adjustments and they should be made in the order listed below. Refer to the timing chart in chapter 3, figure 3-3.

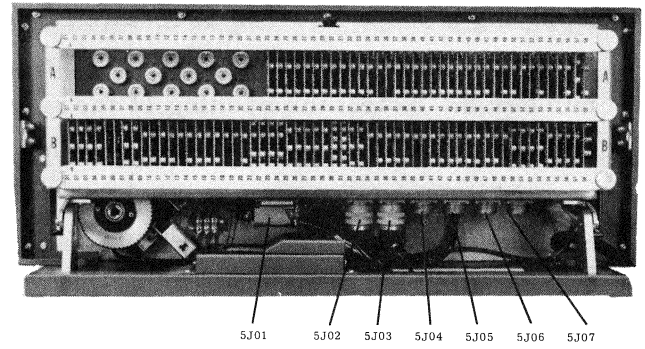


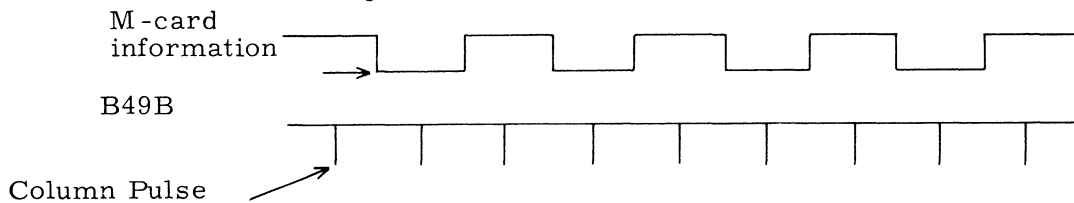
Figure 4-17. Exciter Lamp Adjustments

Information Cells

- a. Prepare a stack of cards punched in alternating columns of 5252 and 2525.
- b. Manually life clutch to advance cards through read station.
- c. Applying a scope to one M-card at time, adjust each of the controls for equal on/off periods as seen on the scope.

CD-2

- a. Press load switch (this sets Free Run Read, allowing Start Counter to be set) and set margin switch at normal.
- b. Manually lift clutch to advance cards through read station.
- c. Applying a scope to K114 (column pulse) at location B49B (sync and look at information on an M-card), adjust the control for CD-2 until the column pulse is centered on the information pulse.



CM-1 ("1" check)

- a. Press load switch (this sets Free Run Read allowing Start Counter to be set) and set margin switch at normal.
- b. Manually lift clutch to advance cards through read station.
- c. Applying a scope to M119 at location B01A (sync and look at column pulses K114 at B49B), adjust CM-1 so that the cam opens on the leading edge of column pulse number 2. Note: the opening of the cam should occur between column pulses number 1 and 2 and as close as possible to, but not past, column pulse number 2.

CD-1

- a. Manually lift clutch to advance cards through read station.
- b. Applying scope to M113 at B29B (sync and look at CD-2, M112 at B29A), adjust the control for CD-1 so that CD-1 goes to zero 7.7ms before CD-2 goes to zero.

*CM-2 (Feed Failure Check)

- a. Manually lift clutch to advance cards through read station.
- b. Applying a scope to M121 at B01C (sync and look at 0 CHECK PROBE K116/K117 at B41) adjust CM-2 so that the cam closes 10ms after 0 CHECK PROBE sets.

*The adjust of CM-2 and CD-1 does not appear to be too critical.

ASSEMBLY AND DISASSEMBLY

1. LAMP BRACKET ASSEMBLY

Disassembly

- Compress the two spring-loaded clips on the top of the lamp bracket assembly.
- Lift out the bracket.

Assembly

- Insert the assembly into the guide slots while compressing the spring-loaded clips.
- Release the clips. Insure that the tips of the clips enter the locking holes in the main casting.

2. READ HEAD ASSEMBLY (figure 4-18)

Disassembly

- Remove the lamp bracket assembly (see A/D instruction #1).
- Remove the two holding screws.
- Unplug the cable connector and remove the read head assembly and cable.

Assembly

- Insert the cable connector through the hole in the top casting (where the read head assembly rests) and connect the cable.
- Seat the read head assembly into the cutout in the top casting.
- Insert and tighten the holding screws.
- Replace the lamp bracket assembly.

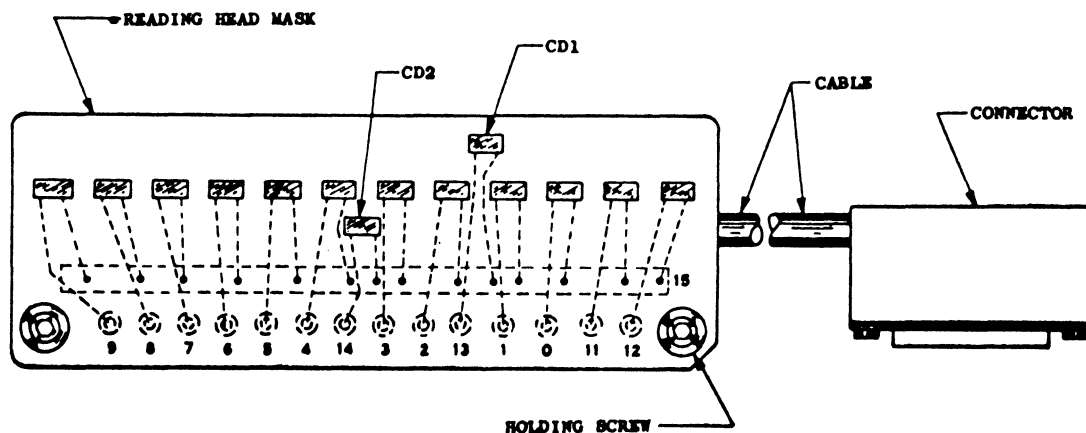
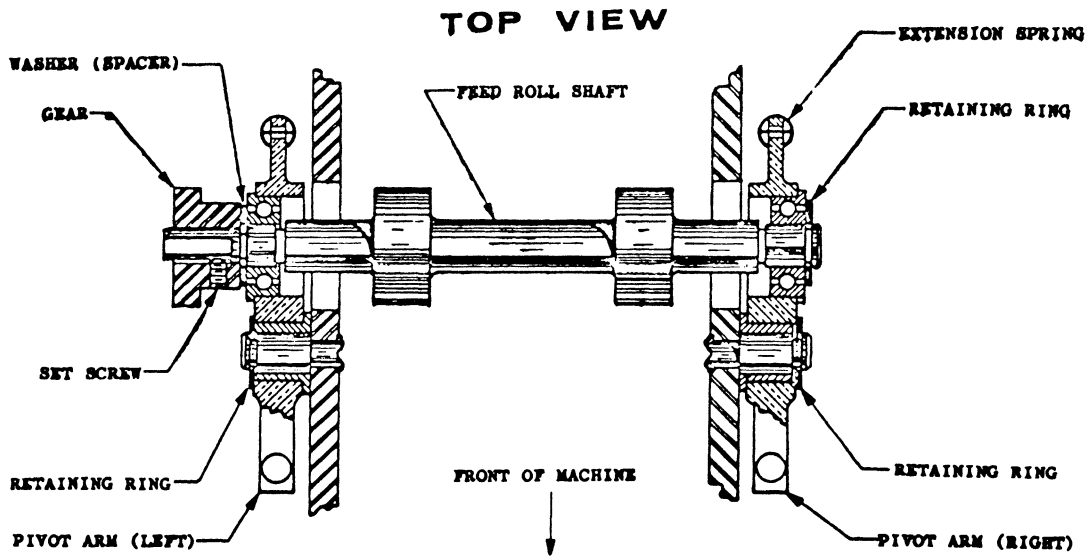
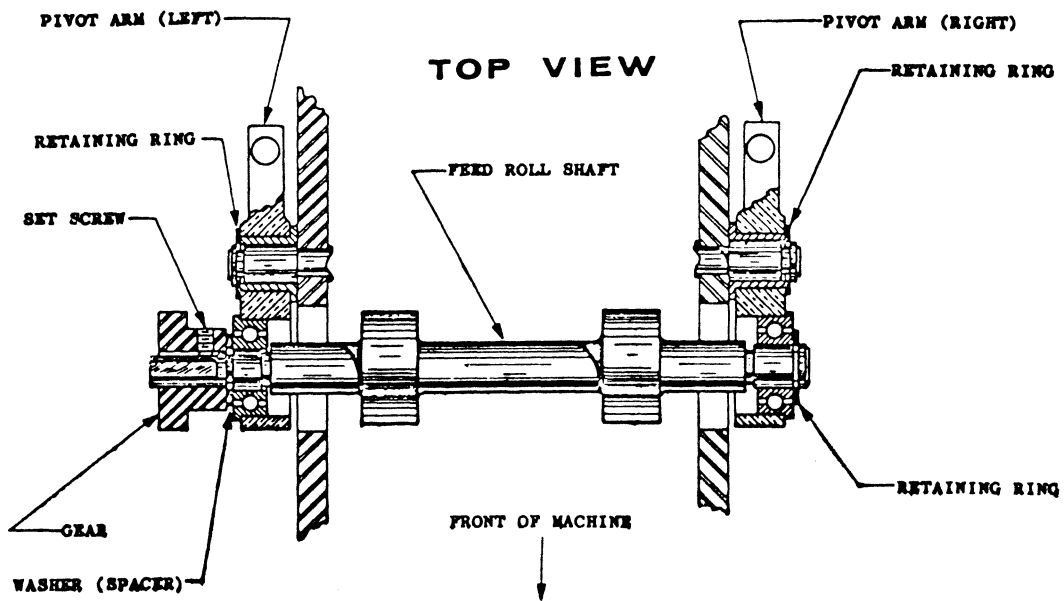


Figure 4-18. Read Head Assembly



Rear Assembly



Front Assembly

Figure 4-19. Top Feed Roll Bearings

3. FEED ROLL BEARINGS

Note: After any assembly procedure involving the feed rolls, check Adjustment section #1.

TOP FEED ROLL BEARINGS (figure 4-19)

To Remove Bearings

- a. Loosen the gear setscrew.
- b. Remove the gear.
- c. 1) Top front: unscrew the pressure-adjusting screws (B) and remove the compression springs.
2) Top rear: unhook the extension springs to remove pressure.
- d. Remove the retaining rings.
- e. Remove the pivot arm assemblies.
- f. Remove the bearings from the pivot arms.
- g. Remove the feed roll shaft through the hole in the side plate.

To Replace Top Feed Roll Assembly

- a. Replace the bearings in the pivot arms. Insure the bearing flange is flush against the face of the pivot arm.
- b. Slide the right-hand pivot arm on the pivot and replace the retaining ring.
- c. Insert the feed roll shaft through the left side plate and slide it into the right-hand pivot arm bearing.
- d. Replace any spacing washers, and replace the retaining ring.
- e. Slide the left-hand pivot arm on the feed roll shaft and the pivot. Replace the pivot-retaining ring.
- f. Replace any spacing washers on the left end of the feed roll shaft and slide the gear on the shaft.
- g. Hold the feed roll shaft to the left, press the gear to the right, and tighten the gear setscrew.
- h. Replace the pressure springs removed in step c of the removal procedure.
- i. Perform any adjustments in Adjustment section #1 that are required.

BOTTOM FEED ROLL BEARINGS (figure 4-20)

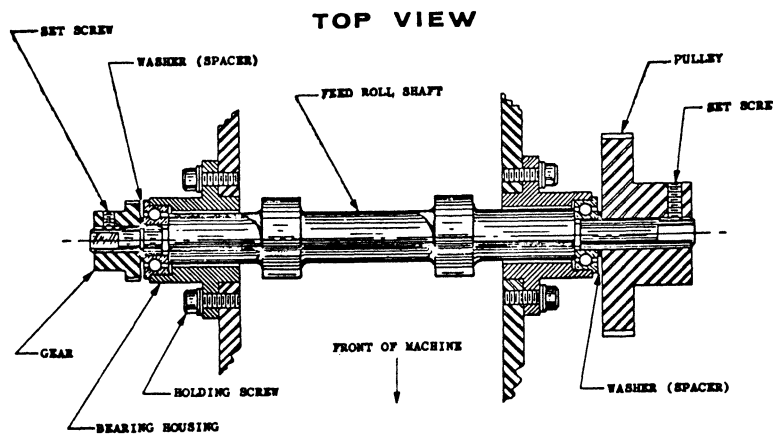
To Remove Bearings

- a. Loosen the gear setscrew.
- b. Remove the gear.
- c. 1) Bottom front: unscrew the pressure-adjusting screws (B) for the top front pivot arms and remove the compression springs.
2) Bottom rear: unhook the extension springs to remove pressure from the top rear pivot arms.
- d. 1) Bottom front: loosen the pickup head locknut (A) and unscrew the pickup head far enough to avoid damaging the chisel tip. Loosen the setscrew for the timing-wheel pulley assembly and slide the assembly off the feed roll shaft.
2) Bottom rear: loosen the setscrew for the pulley assembly and slide the assembly off the feed roll shaft.
- e. Remove the holding screws from the left-hand bearing housing.
- f. Slide the bearing housing off the feed roll shaft.
- g. Remove the holding screws for the right-hand bearing housing and slide the bearing housing off the feed roll shaft.
- h. Remove the feed roll shaft through the hole in the left side plate.
- i. Remove the bearings from the bearing housings.

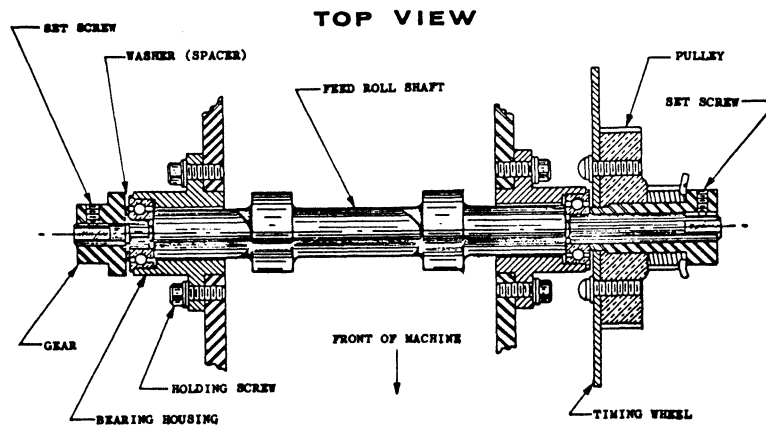
To Replace Bottom Feed Roll Assembly

- a. Replace both bearings in the bearing housings. Insure that the bearing flange is flush against the face of the housing.
- b. Insert the right-hand bearing housing in the right side plate. Replace and tighten the two holding screws.
- c. Insert the feed roll shaft through the hole in the left side plate and slide the shaft into the right-hand bearing.
- d. Slide the left-hand bearing housing on the feed roll shaft and insert the housing in the left side plate. Replace and tighten the two holding screws.
- e. 1) Bottom front: slide the timing-wheel pulley assembly on the right end of the feed roll shaft, taking care to avoid damaging the pickup head and the teeth on the timing wheel. Insure that the right-hand shoulder on the feed roll shaft and the timing-wheel pulley assembly are both flush against the bearing, and tighten the pulley setscrew.

- 2) Bottom rear: replace the spacing washer and the pulley assembly on the feed roll shaft. Insure that the right-hand shoulder of the feed roll shaft is flush against the bearing, at the same time pressing the pulley to the left, and tightening the setscrew.
- f. Replace any spacing washers and the gear on the left-hand end of the feed roll shaft.
- g. Hold the feed roll shaft to the left, press the gear to the right and tighten the set-screw.
- h. Replace the pressure springs removed in step c of the removal procedure.
- i. Perform any adjustments in Adjustment section #1 that are required.



Rear Assembly



Front Assembly

Figure 4-20. Bottom Feed Roll Bearings

4. CIRCUIT BREAKER CAMS AND CONTACTS (figure 4-21)

Disassembly

- a. Remove the two holding screws in the base of the card feed meter.
- b. Compress the coupling spring between the clutch drive shaft and the meter drive shaft and remove it, together with the meter, to the left.
- c. Remove the holding screws from the circuit breakers.
- d. Remove the retaining ring from the circuit breaker pivot.
- e. Remove the two spring-loaded contact arms.

Note: The contact arm, the spring, and the insulating hub (inside the contact arm) form a single assembly.

- f. Loosen the locknut on the stationary contacts and unscrew the contacts from the mounting block.
- g. Loosen the setscrews in the two cams, and slide the cams off the clutch drive shaft.

Assembly

- a. Slide the two cams on the clutch drive shaft and tighten the setscrews.
- b. Screw the stationary contacts into the mounting block far enough so that they just protrude below the block.
- c. Slide the two contact arm assemblies on the pivot.
- d. Replace the retaining ring.
- e. Replace and tighten the contact spring holding screws.
- f. Perform the adjustment in Adjustment section #9.
- g. Position the card feed meter and slide the coupling spring on the clutch drive shaft.
- h. Replace and tighten the card feed meter holding screws.

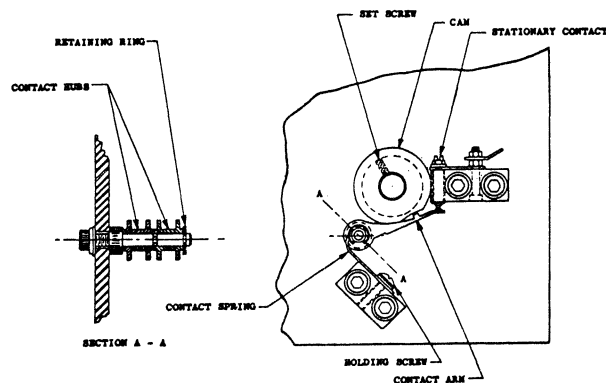


Figure 4-21. Circuit Breaker Cams and Contacts

5. CLUTCH ASSEMBLY (figure 4-22)

Disassembly

- | | |
|---|---|
| a. Remove the clutch pulley drive belt. | f. Remove clutch collar. |
| b. Remove the two holding screws. | g. Loosen clutch hub setscrew. |
| c. Remove retaining ring. | h. Remove the clutch hub. |
| d. Remove pulley hub. | i. Remove the clutch spring from the hub. |
| e. Remove pulley. | j. Remove clutch hub key. |

Assembly

- a. Replace the clutch hub key in the clutch drive shaft.
- b. Replace the clutch spring on the hub, insuring that the tip of the spring is fully engaged in the hole in the hub.
- c. Replace the hub on the shaft.
- d. Insure the hub is flush against the shaft bearing and tighten the setscrew.
- e. Smear the clutch spring with grease (P/N 15821-32)
- f. Replace the clutch collar over the spring.
- g. Put the pulley on the shaft and hold it approximately in position.
- h. Smear grease (P/N 15821-32) on the small end of the pulley hub and slide it through the pulley and inside the clutch spring.
- i. Replace the retaining ring on the shaft.
- j. Replace and tighten the pulley hub holding screws.
- k. Replace the drive belt.

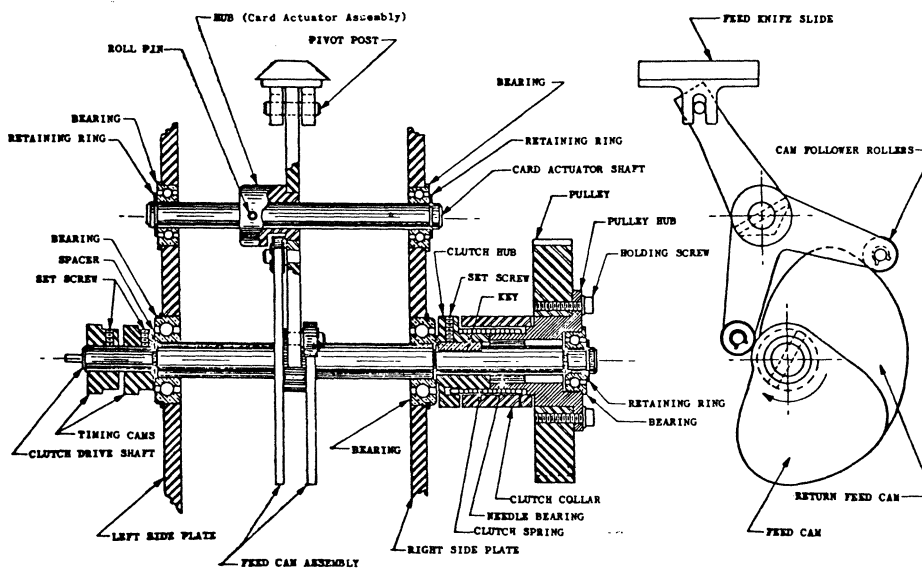


Figure 4-22. Clutch Assembly

6. CLUTCH DRIVE SHAFT, BEARINGS, AND CARD FEED CAMS

Disassembly

- a. Remove the clutch assembly (see A/D section #5).
- b. Remove the circuit breaker contact arms, the stationary contact mounting block, and two circuit breaker cams (see A/D section #4).
- c. Rotate the clutch drive shaft until the roll pin, which pins the cam assembly to the clutch drive shaft, is visible and accessible (see A/D section #5).
- d. Using the correct size drift punch (an undersized punch will damage the roll pin and the hole through the assembly) and the plastic-head hammer, drive out the roll pin.
- e. Rotate the cam assembly until the return feed cam (the large one on the left) is clear of the slot in the hub of the card actuator, and move the cam assembly all the way to the left.
- f. Withdraw the clutch drive shaft to the right, at the same time holding the cam assembly to prevent it dropping on the base plate.
- g. As soon as there is sufficient clearance, remove the cam assembly from the clutch drive shaft and put it aside.
- h. Completely withdraw the clutch drive shaft.
- i. Using the plastic-head hammer if necessary, remove the clutch drive shaft bearings.

Assembly

- a. Insert the clutch drive shaft bearings in the side plates. Insure that the bearing flanges are flush with, and on the outside of, the side plates.
- b. Insert the clutch drive shaft from the right, through the right-hand bearing.
- c. Hold the cam assembly near the left-hand bearing with the smaller cam to the right.
- d. Insert the clutch drive shaft through the cam assembly and through the left-hand bearing.
- e. Replace the parts of the clutch assembly on the clutch drive shaft in the following order:
 - 1) The clutch hub key in the clutch drive shaft.
 - 2) The clutch spring on the hub, insuring that the tip of the spring is fully engaged in the hole in the hub.
 - 3) The clutch hub on the shaft.
 - 4) The clutch collar over the spring.
 - 5) The pulley on the shaft.
 - 6) The pulley hub on the shaft.

- 7) The pulley hub holding screws.
 - 8) The retaining ring.
- f. Insert a 0.005 inch feeler gauge between the retaining ring and the pulley hub. Push the clutch drive shaft to the left to insure that there is minimum endplay between the retaining ring and the side plate. Tighten the clutch hub setscrew and remove the feeler gauge.
 - g. Replace one of the two cams, together with any spacing washer previously removed.
 - h. Insure that the clutch assembly is flush with the right bearing and the cam (and washer) is flush with the left bearing, and then tighten the cam setscrew.
 - i. Rotate the clutch pulley in the normally driven direction until the clutch trip arm is latched.
 - j. Slide the cam assembly on the clutch drive shaft to the center of the shaft.
 - k. Rotate the cam assembly and position the card actuator assembly to the position shown in the figure.
 - l. Align the hole in the shaft with the hole through the hub of the card actuator.
 - m. Insert the roll pin with pliers until it enters the hole in the shaft.
 - n. Using a brass drift rod and plastic-head hammer, completely insert the roll pin.
 - o. Manually unlatch the clutch trip arm and rotate the clutch pulley in the normally driven direction to insure that there is no binding during a complete cycle of the card feed mechanism.
 - p. Replace the drive belt on the clutch pulley.
 - q. Referring to A/D section #4, reassemble the circuit breaker cams, the stationary contact mounting block, and the circuit breaker contact arms.
 - r. Perform the adjustment in Adjustment section #9.

7. CARD ACTUATOR ASSEMBLY AND BEARINGS (figure 4-23)

Disassembly

- a. Using the correct size drift punch (an undersized punch will damage the roll pin and the hole through the assembly) and the plastic-head hammer, drive out the roll pin in the card actuator.
- b. Remove the retaining rings from the ends of the actuator shaft.
- c. Remove the actuator shaft to the right while holding the actuator assembly.
- d. Remove the actuator shaft bearings from the side plates.
- e. Remove the cam follower rollers from the card actuator.

Assembly

- a. Replace the cam follower rollers and their retaining rings.
- b. Insert the actuator shaft bearings in the side plates. Insure that the bearing flanges are flush with, and on the outside of, the side plates.
- c. Hold the actuator assembly approximately in position by engaging the pivot post in the slot of the knife slide and the cam follower rollers on the feed cams.
- d. Insert the actuator shaft through the right bearing, through the hub of the actuator assembly, and through the left bearing.
- e. Replace the retaining rings.
- f. Align the holes in the actuator assembly and shaft by rotating the shaft.
- g. Insert the roll pin with pliers until it enters the hole in the shaft.
- h. Using a brass drift rod and plastic-head hammer, completely insert the roll pin.
- i. Manually unlatch the clutch trip arm, rotate the clutch pulley in the normally driven direction, and insure that there is no binding in the movement of the card actuator assembly.

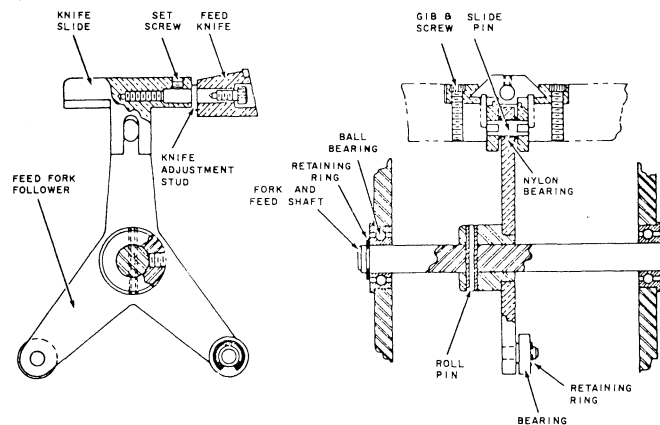


Figure 4-23. Card Actuator Assembly and Bearings

APPENDIX A
MECHANICAL PARTS LIST

APPENDIX A
MECHANICAL PARTS LIST

The following lists include parts for the chassis assembly and the mechanical assembly. The mechanical assembly includes the six sub-assemblies, each with its own detailed parts list.

Chassis Assembly	Page A-1
Mechanical Assembly	A-2
Clutch Drive Assembly	A-4
Roll Assembly - Bottom Rear	A-5
Roll Assembly - Bottom Front	A-6
Roll Assembly - Top Rear	A-7
Roll Assembly - Top Front	A-8
Actuator Card Assembly	A-9
Circuit Breaker Assembly	A-10
Exciter Lamp Assembly	A-11

CHASSIS ASSEMBLY - MECHANICAL
(Items not illustrated)

Part No.	Description	Qty. Per Unit
81734	Hopper - Front	1
1182169	Hopper-Rear	1
59720-7	Pin - Dowel, 1/8 x 5/16	2
22628-34	Pin - Spring, 3/16 x 1/2	8
81738	Plate - Head Bed	1
81693	Plate - Motor Mount	1
15966-302	Screw, 8-32 x 3/8	2
15966-303	Screw, 8-32 x 1/2	12
15966-304	Screw, 8-32 x 5/8	2
15966-453	Screw, 10-32 x 1/2	4
15966-454	Screw, 10-32 x 5/8	12
1182481	Shim - Front Hopper .003	A/R
11853264	Shim - Front Hopper .020	A/R
76556	Spacer - Chassis Support, 10-32 x 3.32	2
81715	Spacer - Side Plate, 8-32 x 3.32	3
1182166	Stud - Adjustment	4
1182165	Stud - Roller, Pressure Spring	2
6902-46	Washer - No. 8, Lock	4
6902-56	Washer - No. 10, Lock	12
9245	Washer - No. 10, Flat	12

PARTS LIST
MECHANICAL ASSEMBLY

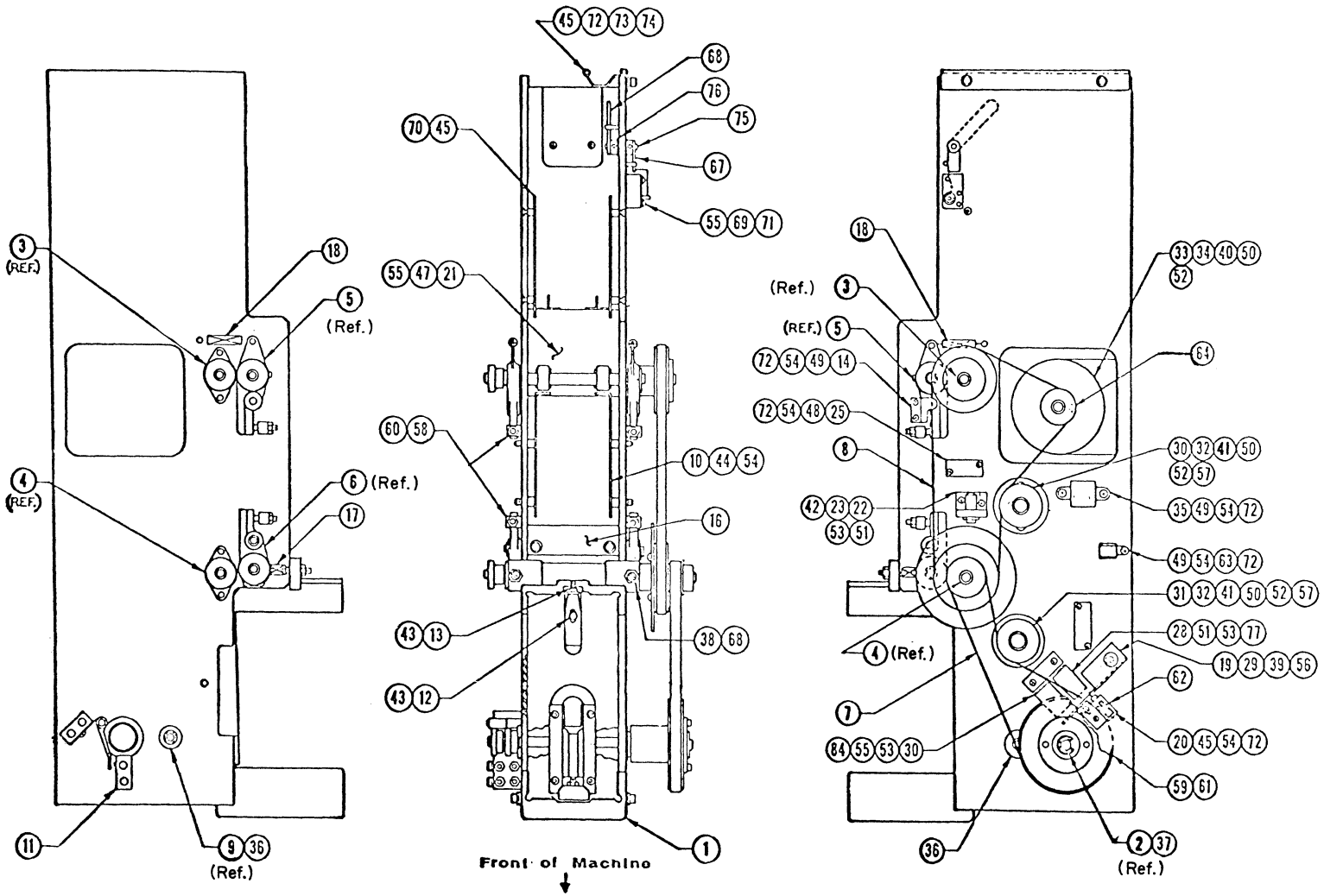
DESCRIPTION	PART NO.	ITEM NO.
SCREW - NO. 10-32 x 7/8 SOCK. HD.	15966-456	40
SCREW - NO. 10-32 x 1/2 SOCK. HD.	15966-453	41
SCREW - NO. 8-32 x 5/8 SOCK. HD.	15966-304	42
SCREW - NO. 8-32 x 3/8 BIND. HD.	78155-301	43
SCREW - NO. 6-32 x 1/2 SOCK. HD.	15966-203	44
SCREW - NO. 6-32 x 3/8 SOCK. HD.	15966-202	45
SCREW - NO. 4-40 x 3/4 SOCK. HD.	15966-105	46
SCREW - NO. 4-40 x 3/8 PAN HD.	11828175-14	47
SCREW - NO. 6-32 x 1/2 PAN HD.	11828175-43	48
SCREW - NO. 6-32 x 3/8 PAN HD.	11828175-41	49
WASHER - NO. 10 FLAT	71512-112	50
WASHER - NO. 8 FLAT	71512-109	51
WASHER - NO. 10 SPLIT LOCK	6902-56	52
WASHER - NO. 8 SPLIT LOCK	6902-46	53
WASHER - NO. 6 INT. LOCK	7058-50	54
WASHER - NO. 4 INT. LOCK	7058-46	55
SCREW - NO. 10-32 x 3/8 SOCK. HD.	15966-452	56
RING - RETAINING	69531-14	57
SCREW - SET NO. 10-32 x 7/8	63735-6	58
SCREW - SET NO. 8-32 x 1/2	70374-4	59
NUT - HEX NO. 10-32 STOP	7158-44	60
NUT - HEX NO. 8-32 STOP	7158-32	61
SPRING - EXTENSION	69009	62
CLIP - TUBE 3/8	18860-6	63
PULLEY - GEAR BELT 60 Cycles	20XL037	64
PULLEY - GEAR BELT 50 Cycles	24XL037	65
NUT - HEX 5/16 x 24 JAM	62286-2	66
ARM ASSEMBLY - SWITCH ACTIVATING	11866548	67
ARM ASSEMBLY - STACKER SWITCH	11860145	68
SWITCH - MOD. STACKER	11866555	69
DEFLECTOR ASSEMBLY - CARD	11866654	70
SCREW - NO. 4-40 x 3/4 PAN HD	11828175-18	71
WASHER - NO. 6 PLAIN	71512-107	72
WASHER - NO. 6 LOCK	6902-32	73
HINGE - STACKER	11859170	74
SHAFT - STACKER SWITCH	11862281	75
RING - RETAINING	24189-7	76
SCREW - NO. 8-32 x 3/8 SOCK. HD.	15966-302	77

DESCRIPTION	PART NO.	ITEM NO.
CHASSIS ASSEMBLY - MECHANICAL	81232	1
CLUTCH ASSEMBLY - DRIVE	81238	2
ROLL ASSEMBLY - REAR BOTTOM	81595	3
ROLL ASSEMBLY - FRONT BOTTOM	81596	4
ROLL ASSEMBLY - TOP REAR	81593	5
ROLL ASSEMBLY - TOP FRONT	81594	6
BELT - TIMING - DRIVE	79045-2	7
BELT - TIMING - FEED	79045-5	8
ACTUATOR ASSEMBLY - CARD	81582	9
GUIDE ASSEMBLY - CARD	1182159	10
CIRCUIT BREAKER ASSEMBLY	81583	11
BLADE - BOTTOM THROAT	1182184	12
BLADE - TOP THROAT	1182183	13
SHIELD - PULLEY	11828514	14
		15
HEAD ASSEMBLY - READING	80616	16
SPRING - COMPRESSION	70382-10	17
SPRING - EXTENSION	11856812	18
ARM ASSEMBLY - CLUTCH TRIP	81712	19
BRACKET - TRIP ARM ADJUST.	1182175	20
WELDMENT ASSEMBLY - STACKER	81741	21
BRACKET - PICK UP	1182160	22
PICKUP - ELECTROMAGNET	66083	23
BLOCK - TERMINAL	27025-3	24
BLOCK - TERMINAL	27025-2	25
		26
		27
COIL ASSEMBLY - CLUTCH	11836418	28
PIVOT - CLUTCH TRIP ARM	1182174	29
STUD - DRIVE BELT TENSION	1182483	30
STUD - FEED BELT TENSION	1182482	31
ROLL ASSEMBLY - BELT TENSION	81230	32
BASE ASSEMBLY - MOTOR MOUNTING	11843885	33
MOTOR - 35 MILLI H.P. 120 vac	79035-2 *	34
RELAY - MOTOR START	79038	35
BEARING - BALL - RADIAL	80046	36
BEARING - BALL	77374-2	37
SCREW - SPRING ADJUST.	79735	38
RING - RETAINING	69531-13	39

* Use with 120 vac operation voltage (USA)

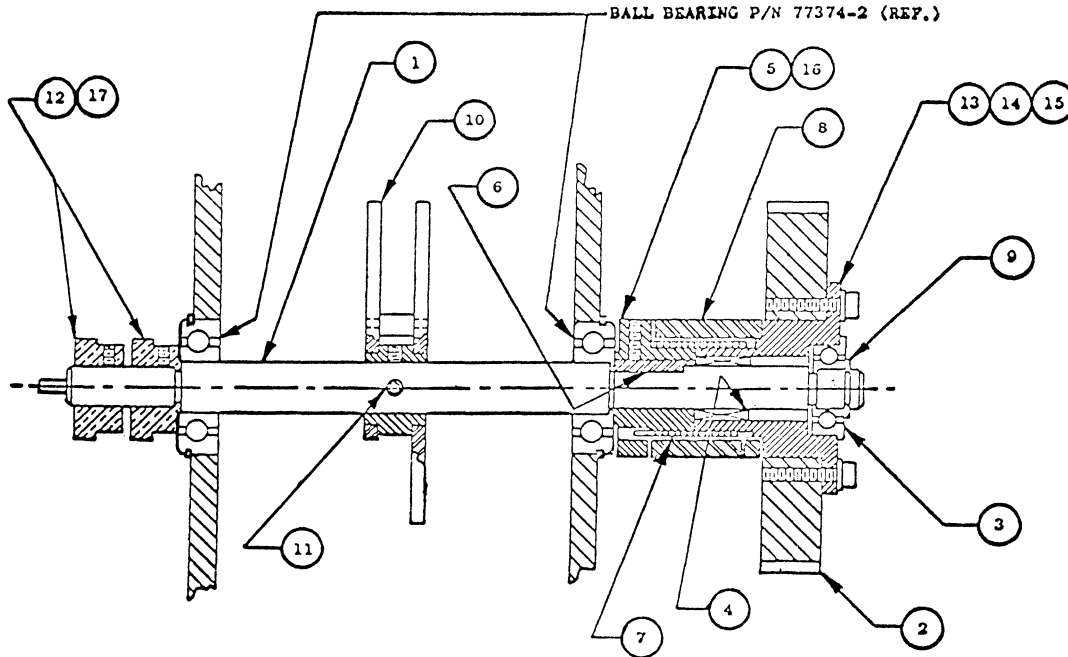
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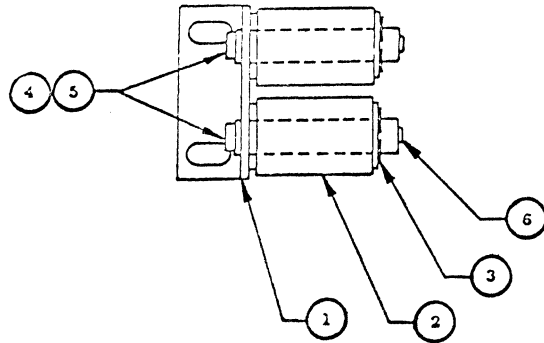


MECHANICAL ASSEMBLY

CLUTCH DRIVE ASSEMBLY - P/N 81238

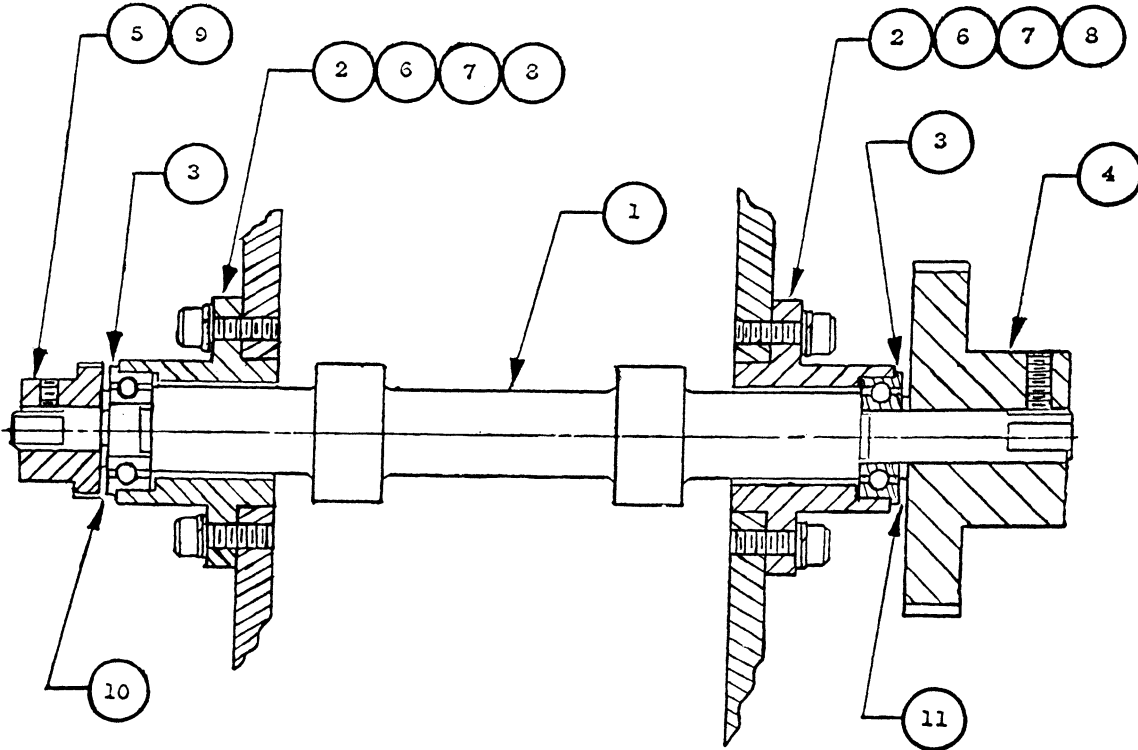


DESCRIPTION	PART NO.	ITEM NO.
SHAFT - CLUTCH	1182578	1
PULLEY - DRIVE CLUTCH	81603	2
BEARING - BALL RADIAL	80046	3
BEARING - NEEDLE	79464-1	4
HUB - CLUTCH	1182467	5
KEY - CLUTCH	1182577	6
SPRING - DRIVE CLUTCH	76544	7
COLLAR & PIN ASSEMBLY	1182485	8
RING - RETAINING	69531-15	9
CAM ASSEMBLY - FEED	81584	10
PIN - ROLL	69308-1	11
CAM - TIMING CB1 & 2	1182157	12
HUB - CLUTCH PULLEY	1182488	13
SCREW - NO.6-32 x 5/8 S.H.	15966-204	14
WASHER - NO.6 SPLIT LOCK	6902-32	15
SCREW - SET NO.8-32 x 3/8	19544-305	16
SCREW - SET NO.8-32 x 3/16	70374-1	17



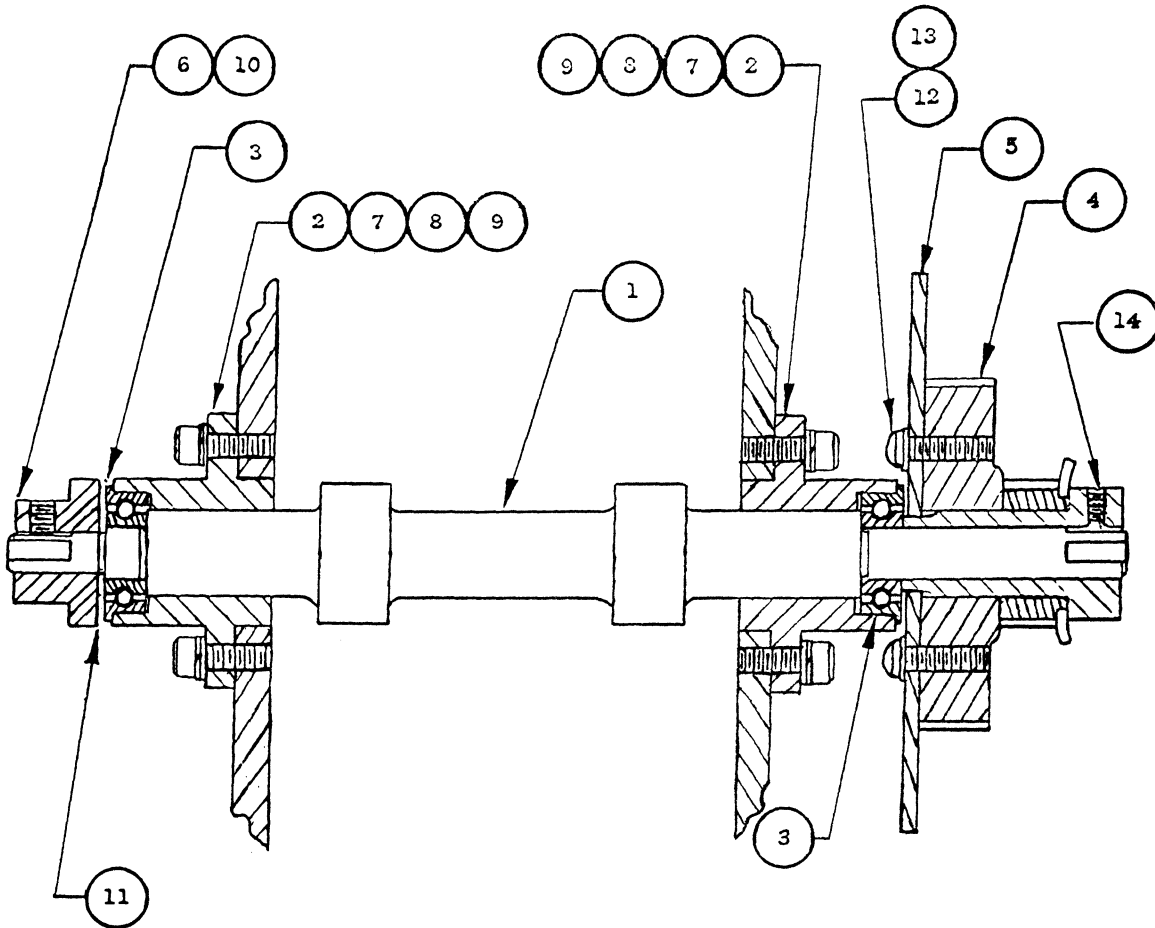
DESCRIPTION	PART NO.	ITEM NO.
BRACKET - COIL	1182185	1
COIL - TRIP ARM	80614	2
CORE ASSEMBLY - COIL	1182480	3
SCREW - NO.6-32 x 1/2 P.H.	11828175-43	4
WASHER - NO.6 INT. LOCK	7058-50	5
RING - RETAINING - EXT.	11833613-8	6

ROLL ASSEMBLY - BOTTOM REAR - P/N 81595



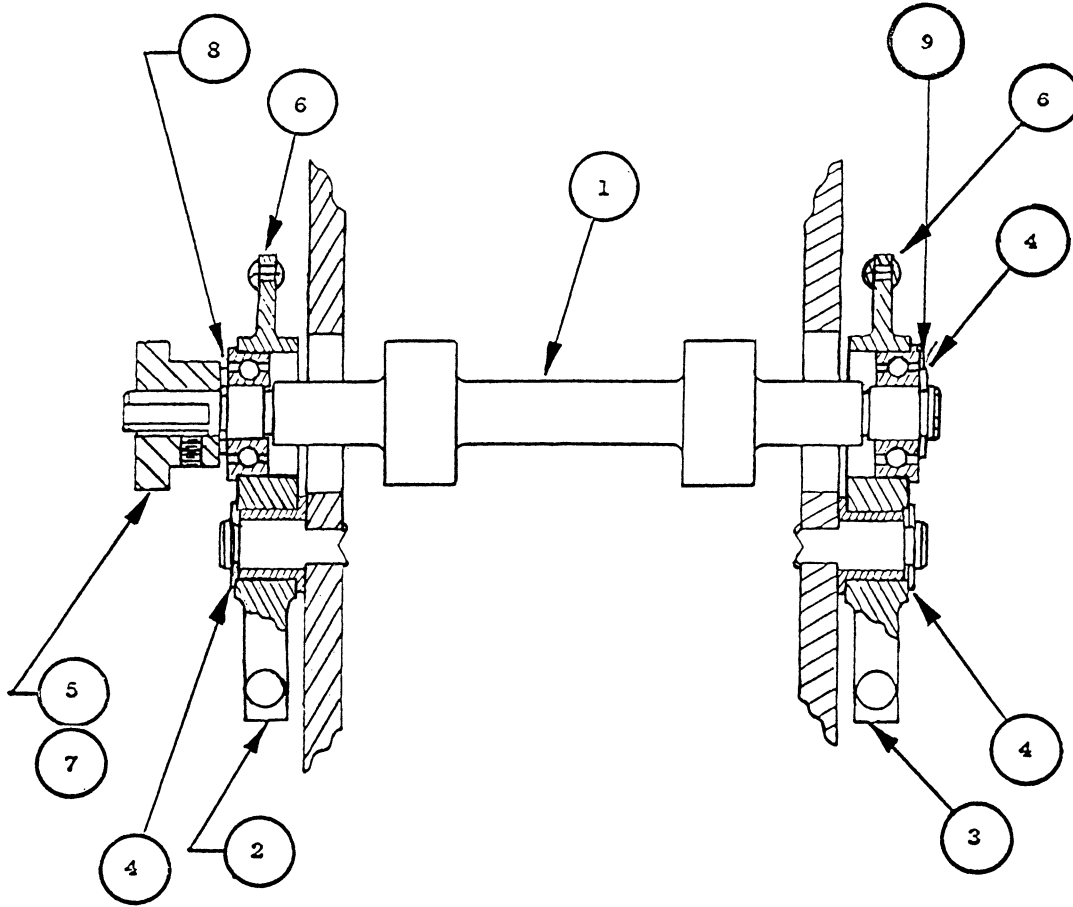
DESCRIPTION	PART NO.	ITEM NO.
SHAFT - BOTTOM REAR ROLL	81731	1
HOUSING - BEARING	81587	2
BEARING - FLANGE BALL	80046	3
PULLEY	79492-9	4
GEAR - MODIFIED	76600	5
SCREW - NO.8-32 x 1/2	15966-303	6
WASHER - NO.8 SPLIT LOCK	6902-46	7
WASHER - NO.8 FLAT	71512-109	8
SCREW - SET NO.10-32 x 3/16	19544-452	9
WASHER - SPACER	1182576	10
SPACER - PULLEY	11834314	11

ROLL ASSEMBLY - BOTTOM FRONT - P/N 81596



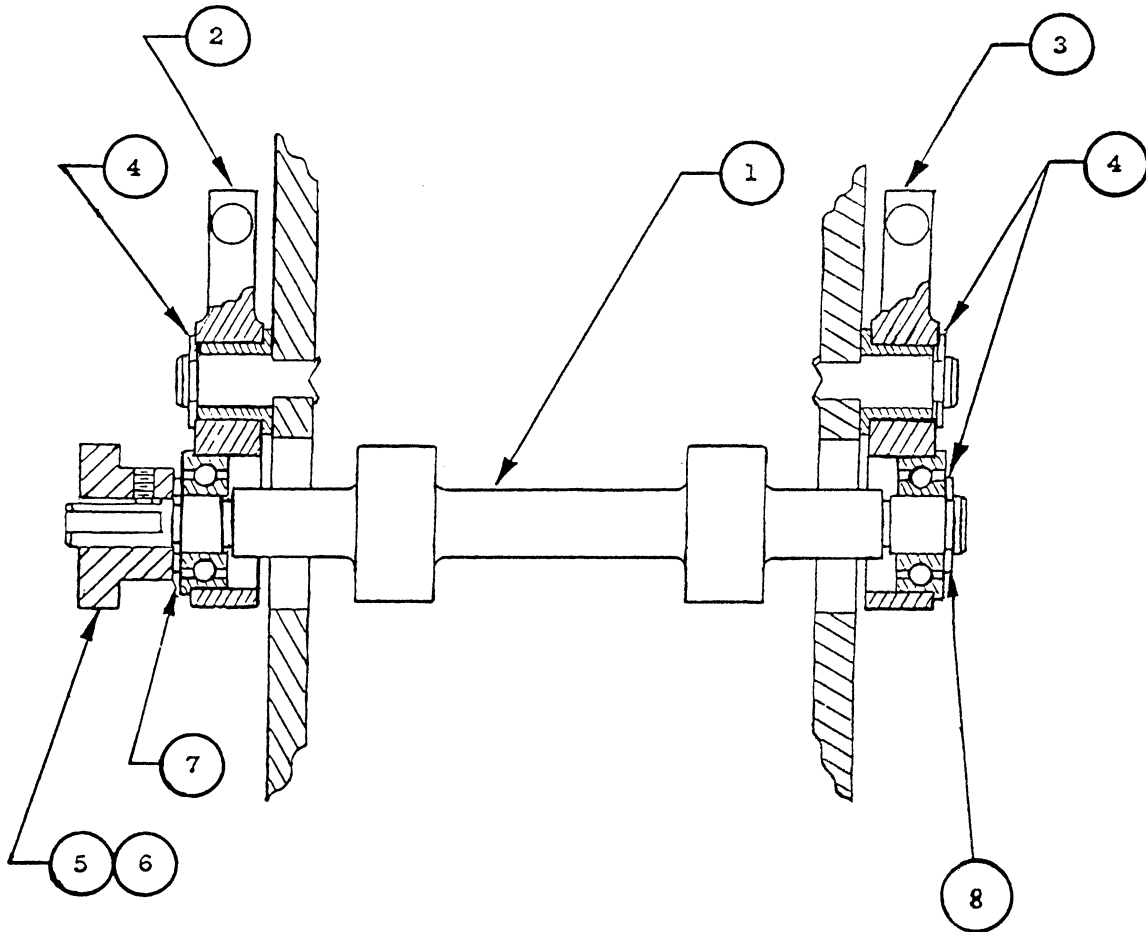
DESCRIPTION	PART NO.	ITEM NO.
SHAFT - BOTTOM REAR ROLL	81602	1
HOUSING - BEARING	81587	2
BEARING - FLANGE BALL	80046	3
PULLEY - ASSEMBLY	1182456	4
WHEEL - TIMING	81694	5
GEAR - MODIFIED	76600	6
SCREW - NO.8-32 x 1/2 S.H.	15966-303	7
WASHER - NO.8 SPLIT LOCK	6902-46	8
WASHER - NO.8 PLAIN	71512-109	9
SCREW - SET NO.10-32	19544-452	10
WASHER - SPACER	1182576	11
SCREW - NO.8-32 x 1/2 P.H.	11828175-60	12
WASHER - NO.8 INT. LOCK	7058-52	13
SCREW - SET NO.10-32 x 3/8	19544-455	14

ROLL ASSEMBLY - TOP REAR - P/N 81593



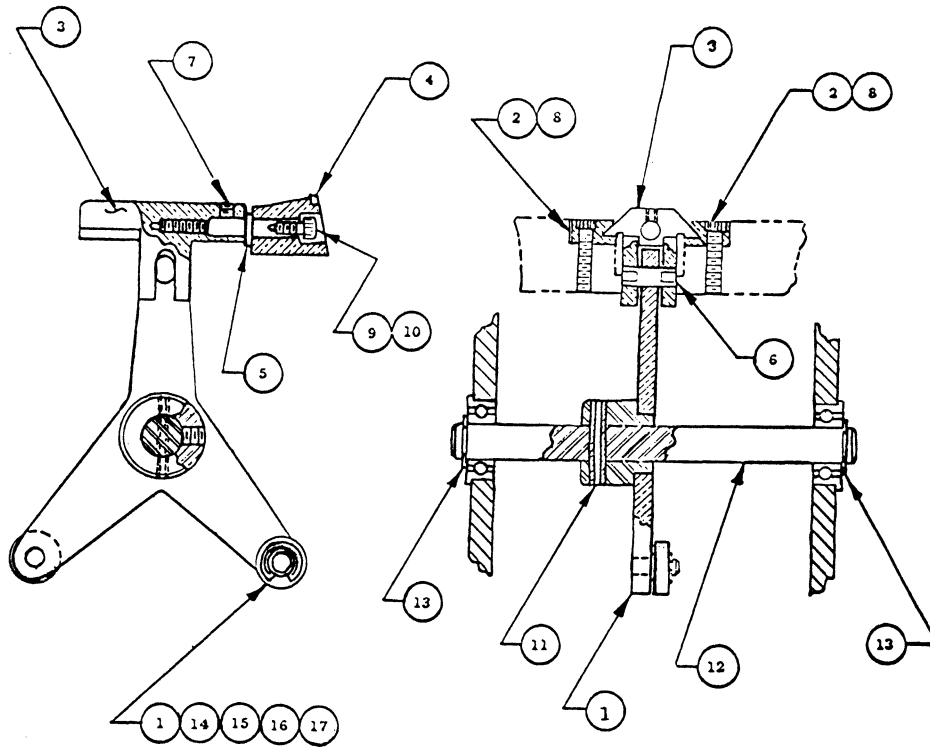
DESCRIPTION	PART NO.	ITEM NO.
SHAFT - TOP ROLL	81601	1
ARM ASSEMBLY - LEFT REAR PIVOT	81591	2
ARM ASSEMBLY - RIGHT REAR PIVOT	81721	3
RING - RETAINING	69531-15	4
GEAR - MODIFIED	76600	5
SPRING - EXTENSION	71492-4	6
SCREW - SET 10-32 x 3/16	19544-452	7
WASHER - SPACER	1182576	8
WASHER - FLAT	11863743-1	9

ROLL ASSEMBLY - TOP FRONT - P/N 81594



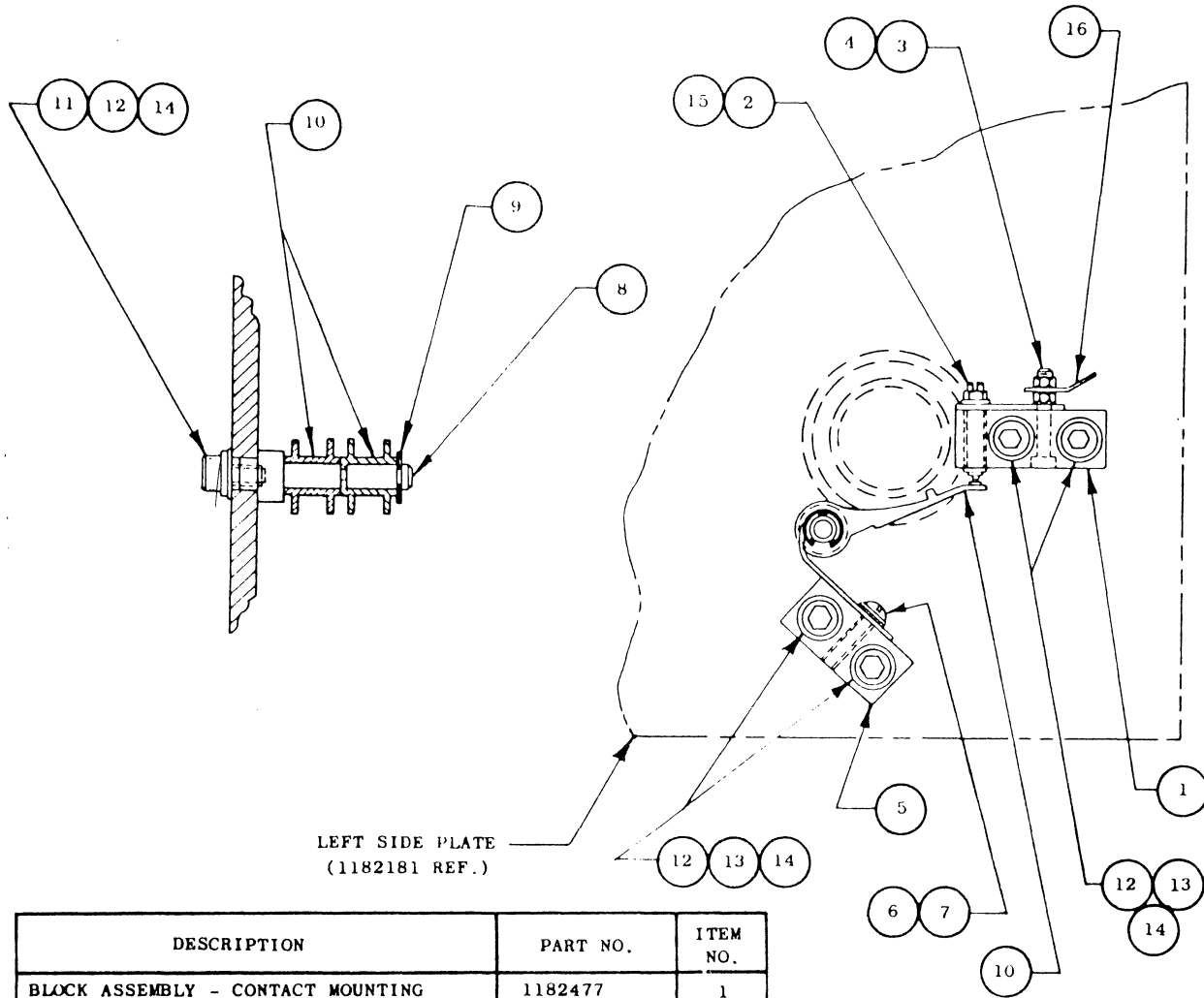
DESCRIPTION	PART NO.	ITEM NO.
SHAFT - TOP ROLL	81601	1
ARM ASSEMBLY - LEFT FRONT PIVOT	81590	2
ARM ASSEMBLY - RIGHT FRONT PIVOT	81720	3
RING - RETAINING	69531-15	4
SCREW - SET 10-32 x 3/16	19544-452	5
GEAR - MODIFIED	76600	6
WASHER - SPACER	1182576	7
WASHER - FLAT	11863743-1	8

ACTUATOR CARD ASSEMBLY - P/N 81582



DESCRIPTION	PART NO.	NO.
FEED FORK - FOLLOWER	81709	1
GIB	77483	2
SLIDE - KNIFE	1182177	3
KNIFE - FEED	81714	4
STUD - KNIFE ADJUST.	76537	5
PIN - FORK & SLIDE	1182176	6
SCREW - SET	11897964	7
SCREW - NO. 6-32 x 1/2 SOCK. HD.	15966-203	8
SCREW - NO. 6-32 x 1/4 SOCK. HD.	15966-201	9
WASHER - NO. 6 FLAT	71512-106	10
PIN - ROLL	69308-1	11
SHAFT - FORK & FEED	1182161	12
RING - RETAINING	69531-15	13
BEARING - BALL	55436	14
RING - RETAINING	69531-10	15
SCREW - SET NO. 8-32 x 3/16	70374-1	16
BEARING - NYLON	81410-6	17

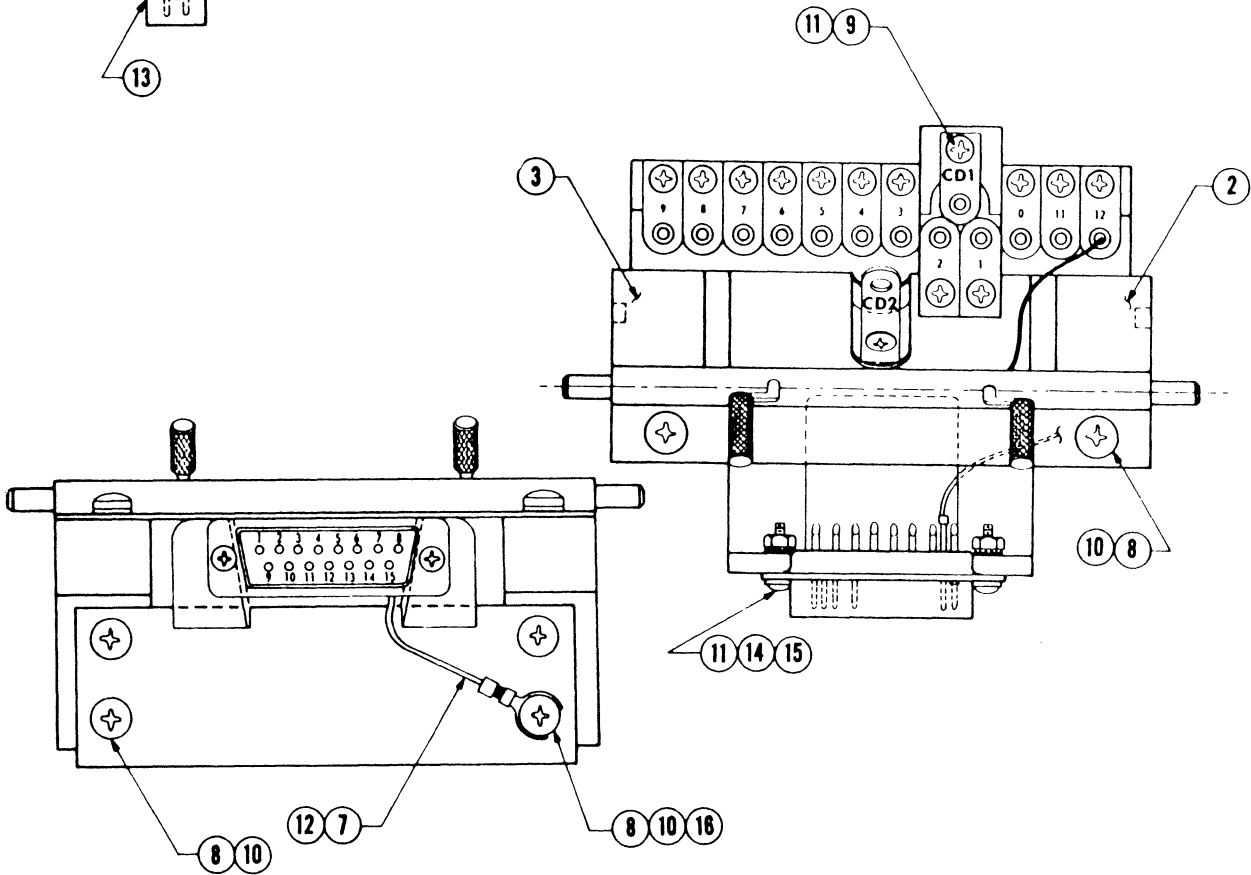
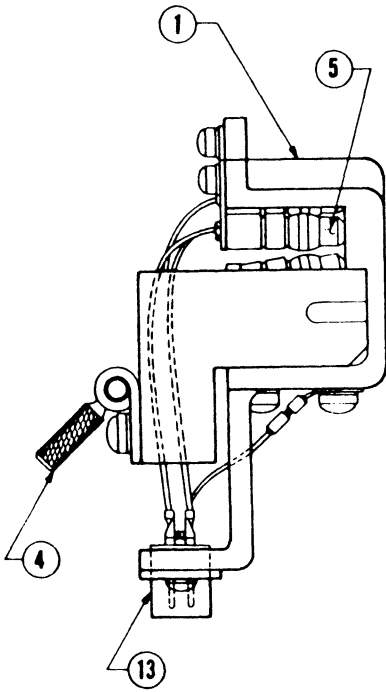
CIRCUIT BREAKER ASSEMBLY - P/N 81583



DESCRIPTION	PART NO.	ITEM NO.
BLOCK ASSEMBLY - CONTACT MOUNTING	1182477	1
SCREW - CONTACT	1182476	2
SCREW - NO. 4-40 x 3/4 FIL. HD.	11828134-44	3
NUT - HEX NO. 4-40	7074-245	4
BLOCK - SPRING	1182469	5
SCREW - NO. 6-32 x 1/2 PAN HD.	11828175-43	6
WASHER - PLAIN NO. 6	71512-107	7
STUD - BREAKER	1182472	8
RING - RETAINING	24189-7	9
CONTACT - BREAKER ARM	79054	10
SCREW - NO. 8-32 x 1/4 SOCK. HD.	15966-301	11
WASHER - PLAIN NO. 8	71512-109	12
SCREW - NO. 8-32 x 1 1/2 SOCK. HD.	15966-309	13
WASHER - NO. 8 SPLIT LOCK	6902-46	14
NUT - HEX NO. 6-32 BRASS	7074-69	15
LUG - SOLDER	7127-9	16

EXCITER LAMP ASSEMBLY - P/N 81730

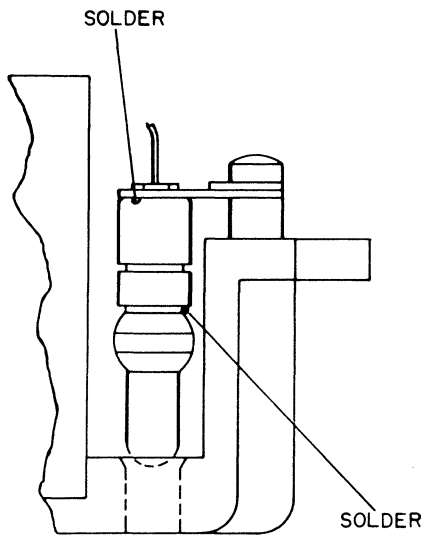
DESCRIPTION	PART NO.	ITEM NO.
BRACKET - LIGHT	11836350	1
BLOCK - INSULATION L.H.	81728	2
BLOCK - INSULATION R.H.	81729	3
LATCH - DOUBLE ACTION	81258	4
LAMP & HOLDER ASSEMBLY	11882479	5
		6
LUG - TERMINAL NO.6-32	70964-5	7
SCREW - NO.6-32 x 5/16 PAN HD.	11828175-40	8
SCREW - NO.4-40 x 3/16 PAN HD.	11828175-11	9
WASHER - INT. LOCK NO.6	7058-50	10
WASHER - INT. LOCK NO.4	7058-46	11
WIRE - STRANDED INSULATION NO.18 AWG.	11880531-7	12
CONNECTOR - MINIATURE	1181444-2	13
SCREW - NO.4-40 x 1/4 PAN HD.	11828175-12	14
NUT - HEX NO.4-40	7074-244	15
WASHER - FLAT NO.6	71512-107	16



EXCITER LAMP ASSEMBLY (CONT'D)

The lamps originally used in the exciter lamp assembly (P/N 81730) are no longer available. If it becomes necessary to order replacement lamps, a new lamp (miniature, 2.5 volt, S78852) will be supplied. The following modifications are necessary in order to use these new lamps.

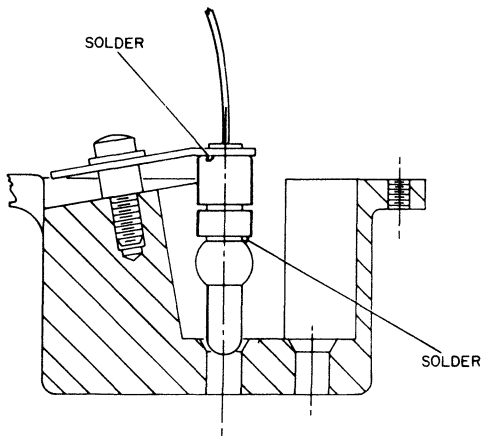
- A) To replace lamps in the CD1 position or any of the 12 row-lamp positions, a spacer (P/N S70163-11) must be ordered.



MODIFICATION INSTRUCTIONS

- 1) Remove lamp and holder assembly (P/N 11882479) from the exciter lamp assembly (P/N 81730).
- 2) Remove existing lamp and replace with new bulb (P/N S78852); solder as indicated.
- 3) Replace lamp and holder assembly, mounting it with a spacer.
- 4) Solder lamp holder to bracket.

- B) To replace the lamp in the CD2 position, a spacer (P/N S70163-11) as well as a new lamp holder assembly (P/N A11980596) must be ordered.



MODIFICATION INSTRUCTIONS

- 1) Remove the existing lamp and holder assembly for CD-2.
- 2) Replace with new lamp and holder assembly, using spacer (P/N S70163-11).
- 3) Solder lamp holder to mounting bracket.
- 4) Solder lamp to holder as shown.

APPENDIX B
PARTS LIST

TABLE OF CONTENTS

	Page
167-2 Card Reader W/Hollerith to BCD Conversion	B-1
Printed Circuit Card Assemblies (167-2)	B-5
167G-1 Modification Kit	B-6

INTRODUCTION

The parts list provides the identification and ordering data necessary for the replacement of electrical and mechanical parts for the 167-2 Card Reader with Hollerith to BCD Conversion and the 167G-1 Modification Kit.

Electrical Contents: All items are included except jumper wires and wire.

Hardware Contents: All items are included except standard hardware such as screws, nuts, bolts, washers, and raw material.

All Control Data Assemblies are listed and are broken down into individual parts (with the exception of printed circuit card assemblies) but are listed in alphabetical rather than disassembly order.

For the breakdown of printed circuit card assemblies, refer to Control Data Pub. No. 60040800, Volumes I and II.

For the breakdown of Burroughs Card Reader Model number B122, refer to Appendix A of this manual.

ORDERING OF PARTS

When ordering Control Data parts, include the following information: Item number, CDC drawing number (both if listed), description, quantity needed, equipment used on.

When ordering vendor parts, use procedure indicated by that vendor.

PARTS LIST
 167-2 Card Reader W/Hollerith to BCD Conversion P/N 232000-2
 DATE: _____

CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
101616	Bar, mounting, connector	
232014	Bar, mounting, striker	
232030	Base, table	
232027	Block, mounting, chassis	
232007	Board, mounting, potentiometer	
232011	Bracket, angle, stop, latch	
232003	Bracket, hinge, LH, chassis	
232004	Bracket, hinge, RH, chassis	
232047	Bracket, meter feed	
	Bracket, Burrough's 11828654-C Elapsed time	
245043-136	Capacitor, fixed, electrolytic, 10 uf, 25 W VDC, +20%	
245099-4	Capacitor, fixed, electrolytic, 125, 000 uf, 5 VDC Power supply (C11)	
245098-3	Capacitor, fixed, electrolytic, 25, 000 uf, 25 VDC Power supply (C02, C03)	
245099-2	Capacitor, transformer, 1.0 uf, 850 VAC, Power supply (C10)	
245203-3	Capacitor, transformer, 1.5 uf, 660 VAC, Power supply (C01)	
118005	Card reader, Burrough's B-122	
232000-2	Card reader, assembly	
241103	Card placement, chassis 170500	
232021-1	Card spacer assembly "A"	
232021-2	Card spacer assembly "B"	
225019	Card spacer assembly "AB"	
8466	Channel, rubber, "U" shaped	
232015-2	Chassis assembly, 170500	
	Circuit Breaker; 5.0 A (F01) Burrough's 11902525-5	
	Circuit Breaker; 1.5 A (F02) Burrough's 11902525-2	
	Circuit Breaker; 4.0 A (F03) Burrough's 11902415	
245316	Connector, plug, 3 wire	
245154	Connector, plug, 14 socket	
245139	Connector, plug, 24 pin	
245147	Connector, plug, 15 socket	

PARTS LIST

DATE: _____

CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
100018	Connector, receptacle, 30 socket	
245120	Connector, receptacle, 24 socket	
245155	Connector, receptacle, 14 pin	
	Connector, receptacle, 25 pin, (Cannon DB-25P)	
232058-2	Connector, receptacle, wired, 25 pin	
232059-2	Connector, receptacle, wired, 14 pin	
232060-2	Connector, receptacle, wired, 24 socket	
232061-2	Connector, receptacle, wired, 24 socket	
232061-4	Connector, receptacle, wired, 24 socket	
232061-6	Connector, receptacle, wired, 24 socket	
232061-8	Connector, receptacle, wired, 24 socket	
232051	Control panel, modification	
232032	Deflector, air	
232052	Deflector, card	
232008	Emblem, '167 Card Reader'	
8520	Fan, axial, 100 CFM	
232002-2	Frame, chassis, 170500	
245135	Fuseholder, HKP (F04)	
245362-2	Fuse, cartridge, 5 amp	
8134	Grommet, rubber, 1/4 ID	
8396-3	Grommet, rubber 1 3/8 ID	
101934	Housing, emblem	
232031	Housing, fan	
245425	Indicator, mounting, barrier	
245426-1	Indicator, screen, red	
245426-2	Indicator, screen, green	
245426-3	Indicator, screen, white	
245426-6	Indicator, screen, yellow	
245423	Indicator, switch	
232020-1	Insert, microswitch, "Motor Power"	
232020-2	Insert, microswitch, "CK Disable" "Row 12 "0"	
232020-3	Insert, microswitch, "Load"	
232020-4	Insert, microswitch, "Stop"	
232020-6	Insert, microswitch, "H→BCD and Pack"	

PARTS LIST

DATE: _____

CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
232069-1	Label, Instruction "← Open"	
232069-2	Label, Instruction. "Open→"	
245123-2	Lamp, incandescent, 327	
232009	Latch assembly, chassis	
232010	Latch chassis	
8496	Leg, Leveling, adjustable, table	
232046-1	Meter feed cycle assembly	
	Meter feed cycle, Burrough's 11837663	
	Meter elapsed time, Burrough's 11833530	
8383	Nut, "U" type, sheet spring 8-32 NC	
8491	Nut, anchor, Plain plate, 10-32	
232037	Panel, power panel	
232005	Pin, pivot, chassis	
245007-1	Pin, Taper	
245007-2	Pin, Taper	
232048	Plate, meter feed	
115550	Plate, mounting, screen, blower	
232024	Plate, serial	
232067	Plate, spacer, fan	
232026	Plate, switch	
232054-1	Power panel assembly	
245466	Power supply kit	
245099	Power supply kit, 2.5v	
8528	Pulley, flat, timing belt	
245466-2	Rectifier, silicon, power supply (CR01)	
245466-3	Rectifier, silicon, power supply, (CR02)	
245099-3	Rectifier, IN2154, power supply (CR10, CR11)	
245000-31	Resistor, fixed, composition, 47 ohm, 1/4W, $\pm 5\%$	
245366	Resistor, WW, variable, 0.5-6 ohm	
245099-4	Resistor, WW, 25 ohm, 20 W, (R10) power supply	
245098-6	Resistor, WW, adjustable, 100 ohm, 50W, power supply (R01, R02)	
115549	Screen, Blower	
232045	Sheet, rear, cover, chassis	

PARTS LIST

DATE: _____

CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
245145	Shell, connector used on 245147	
222023	Skin, inner, table	
300138-2	Spacer	
232012	Spring, latch	
232016	Stand off channel, LH chassis	
232017	Stand off channel, RH chassis	
232015	Striker, chassis catch	
100318	Strip, marker, narrow, 01-12	
101693	Strip, marker, narrow, 47-58	
101694	Strip, marker, narrow, 13-46	
232055	Strip, marker, narrow, 13-22	
232056	Strip, marker, narrow, 23-46	
101695-2	Strip, marker, wide, 47-58	
225080	Strip, marker, wide, 37-46	
232057	Strip, marker, wide, 23-36	
245012-8	Strip, terminal board, 8 contacts	
245022-8	Strip, marked, terminal board, 8 character	
245090	Switch, push, momentary, 2 PDT (S06)	
245092	Switch, push, alternate, 4 PDT (S04)	
245213	Switch, push, alternate, 2PDT (S05, S07, S08)	
245088	Switch, toggle, 3 position, DPDT (S02)	
232029	Table assembly, card reader	
2 32028	Top, table	
245099-1	Transformer, constant voltage, T10 (power supply)	
245466-1	Transformer, constant voltage, T01 (power supply)	
241101	Wire list, chassis	

PARTS LIST
Printed Circuit Card Assemblies (167-2)

DATE: _____

CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
102018	Printed circuit card assembly, type 11	
102019	Printed circuit card assembly, type 12	
102020	Printed circuit card assembly, type 13	
102025	Printed circuit card assembly, type 14	
102026	Printed circuit card assembly, type 15	
102027	Printed circuit card assembly, type 16	
102028	Printed circuit card assembly, type 21	
102034	Printed circuit card assembly, type 22	
102035	Printed circuit card assembly, type 23	
102328	Printed circuit card assembly, type 29	
103344	Printed circuit card assembly, type 30	
102037	Printed circuit card assembly, type 31	
102038	Printed circuit card assembly, type 32	
102039	Printed circuit card assembly, type 33	
103369	Printed circuit card assembly, type 60	
102060	Printed circuit card assembly, type 61	
102102	Printed circuit card assembly, type 67	
103352	Printed circuit card assembly, type 73A	
103397	Printed circuit card assembly, type 75B	
103347	Printed circuit card assembly, type 85A	
103372	Printed circuit card assembly, type 87	

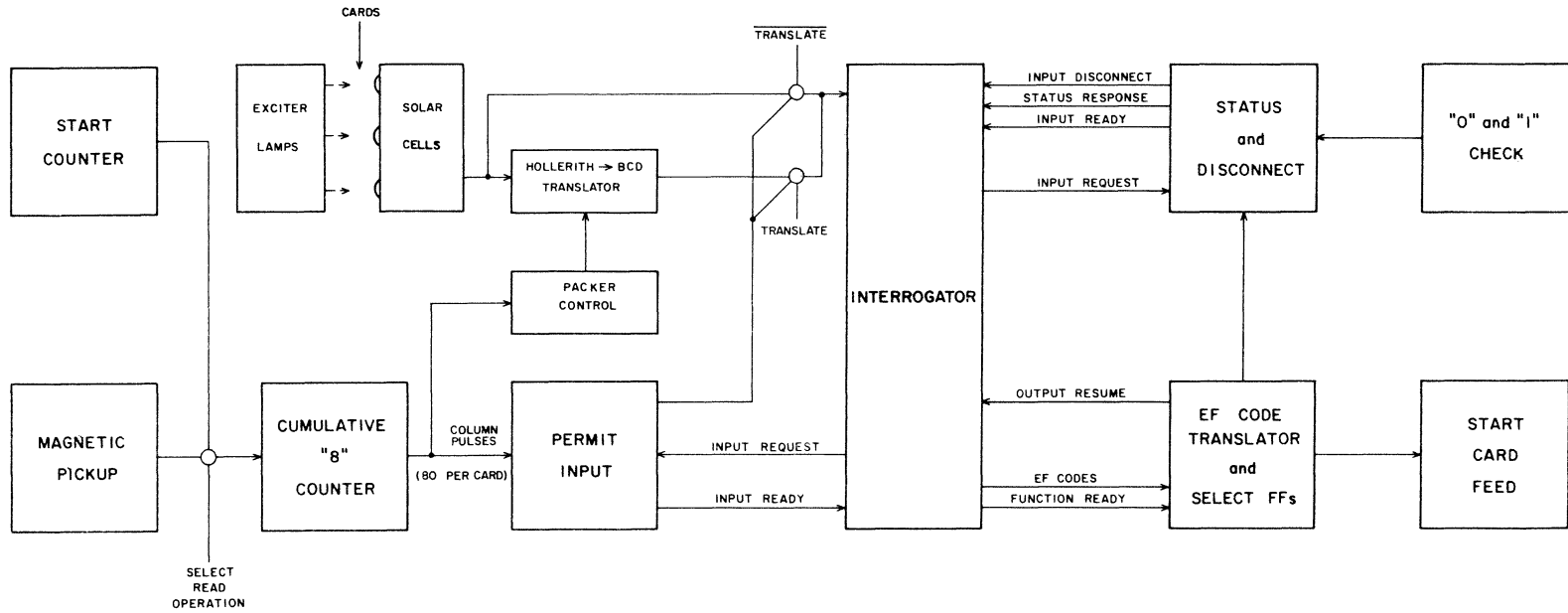
PARTS LIST


107G-1 Modification Kit P/N 232068

DATE: _____

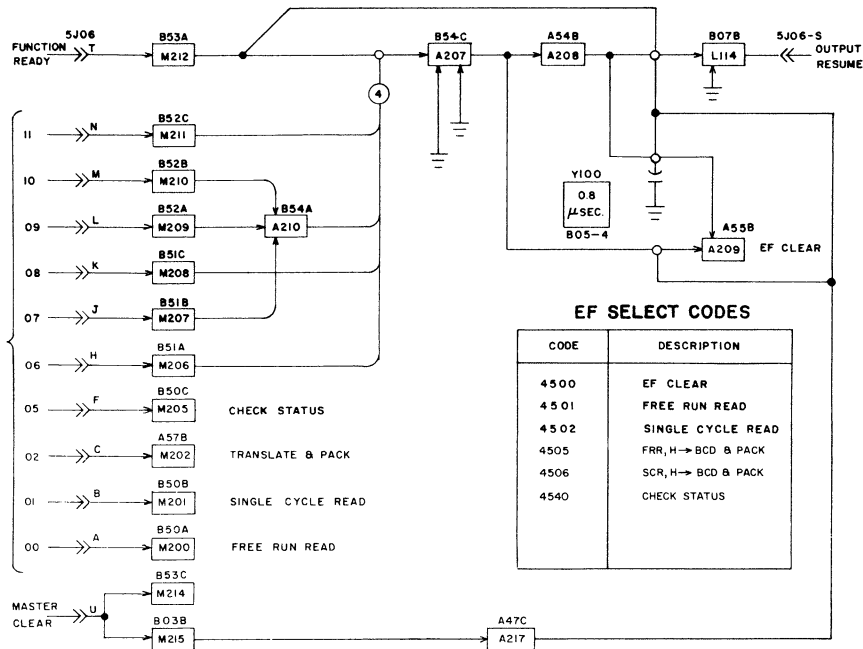
CDC - DRAWING NUMBER	DESCRIPTION	QUANTITY EACH MACHINE
100018	Connector, receptacle, 30 socket	
102325	Printed circuit card assembly; type 28	
102328	Printed circuit card assembly; type 29A	
102037	Printed circuit card assembly; type 31A	
103392	Printed circuit card assembly; type 50	
102060	Printed circuit card assembly; type 61	
102102	Printed circuit card assembly; type 67	
244156	Printed circuit card assembly; type 99	
244147	Printed circuit card assembly; type 108	
244150	Printed circuit card assembly; type 109	
110611	Serial plate G. S. D.	

APPENDIX C
CUSTOMER ENGINEERING DIAGRAMS



REV. AUTH. DATE ENG. DRWG. CHG. APPROVED REVISIONS APPROVED BY CHECKED BY DRAWN BY TOM A. WEGEL 4-17-65 DESIGNED BY	REFERENCE DRAWINGS		 CONTROL DATA CORPORATION PROJECT OR PRODUCT 167-2-A DRAWING NUMBER XCP232926 TITLE BLOCK DIAGRAM	C PAGE 1
	COMPONENTS (UNLESS OTHERWISE INDICATED)			
	RESISTORS	TOLERANCE VALUE SIZE		
	CAPACITORS	TOLERANCE VALUE SIZE		

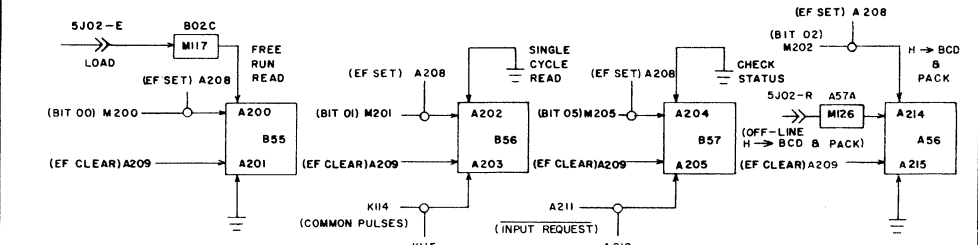
EF CODE TRANSLATOR



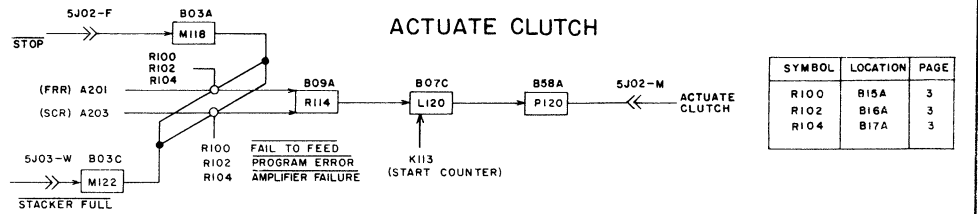
EF SELECT CODES

CODE	DESCRIPTION
4500	EF CLEAR
4501	FREE RUN READ
4502	SINGLE CYCLE READ
4505	FRR, H → BCD & PACK
4506	SCR, H → BCD & PACK
4540	CHECK STATUS

FUNCTION SELECT FFs



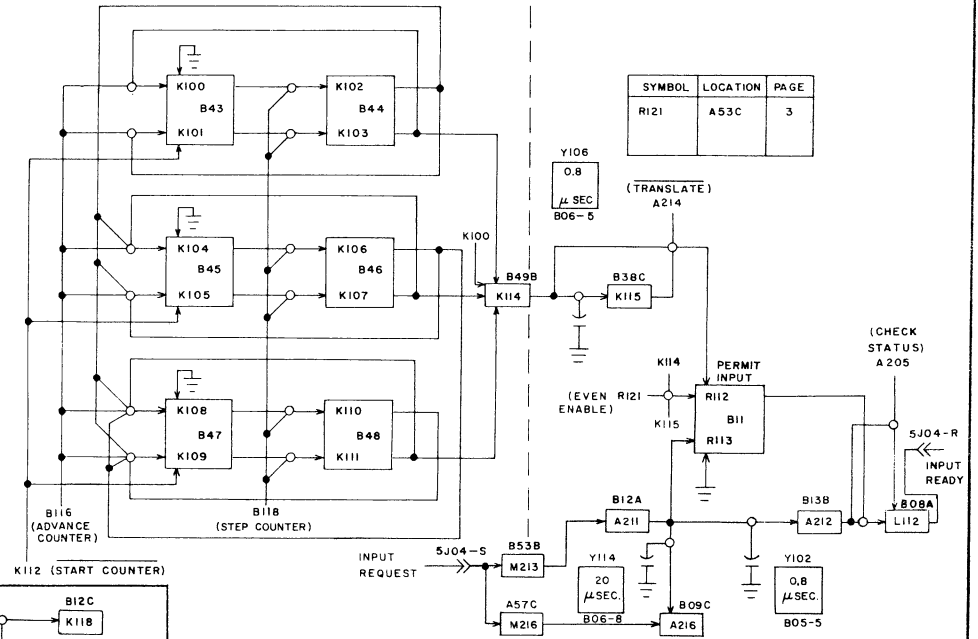
ACTUATE CLUTCH



SYMBOL	LOCATION	PAGE
R100	B15A	3
R102	B16A	3
R104	B17A	3

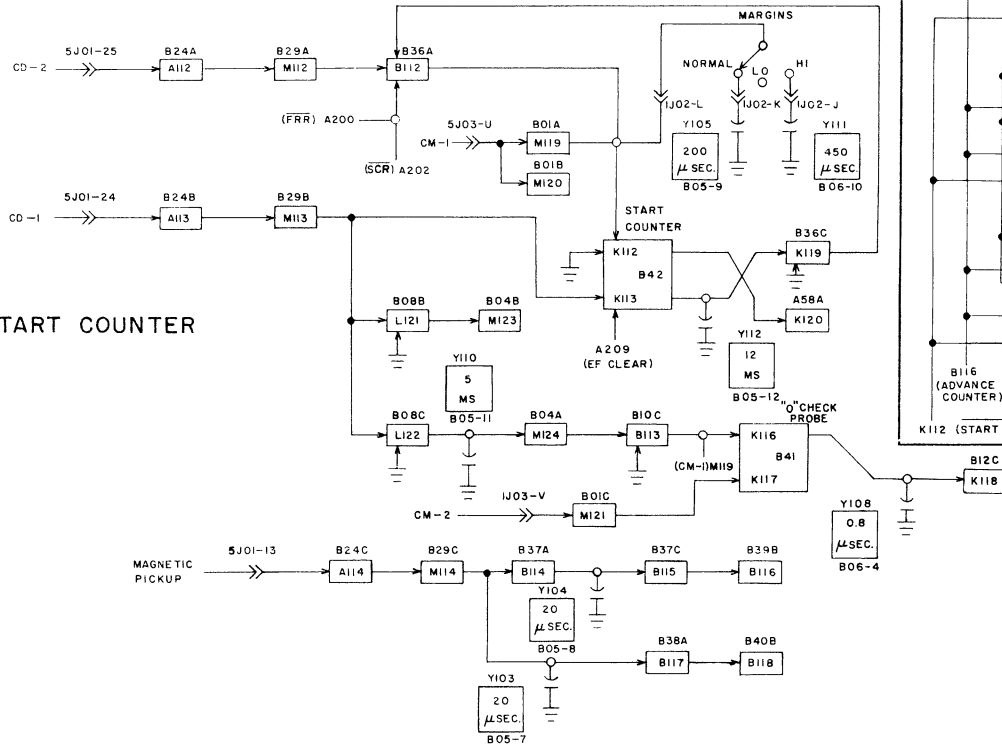
CUMULATIVE-8 COUNTER

PERMIT INPUT



SYMBOL	LOCATION	PAGE
R121	A53C	3

START COUNTER



REVISIONS		REFERENCE DRAWINGS													
APPROVED	DATE	BY	CHK.												
CHECKED	DATE	BY	CHK.												
DESIGNED	DATE	BY	CHK.												
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RESISTORS	TOLERANCE	VALUE	SIZE												
CAPACITORS															
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PROJECT OR PRODUCT															
167-2 CARD READER															
DRAWING NUMBER															
XCP232927															
PAGE															
2															



CONTROL DATA CORPORATION

PROJECT OR PRODUCT

167-2 CARD READER

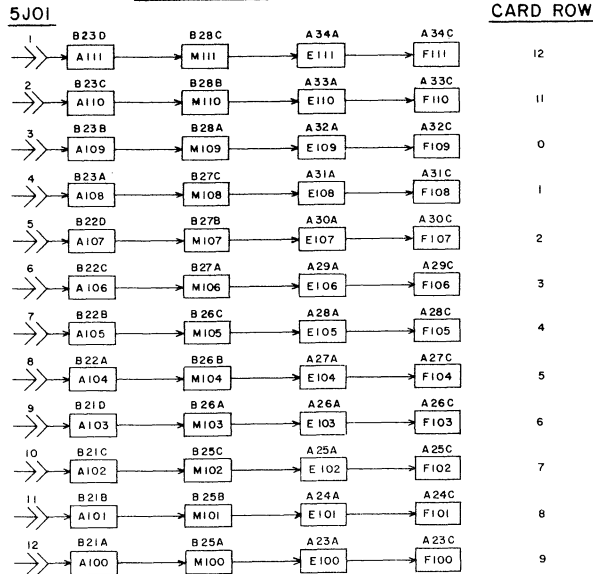
DRAWING NUMBER

XCP232927

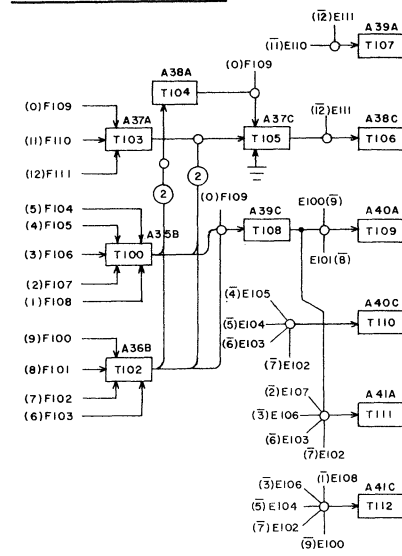
PAGE

2

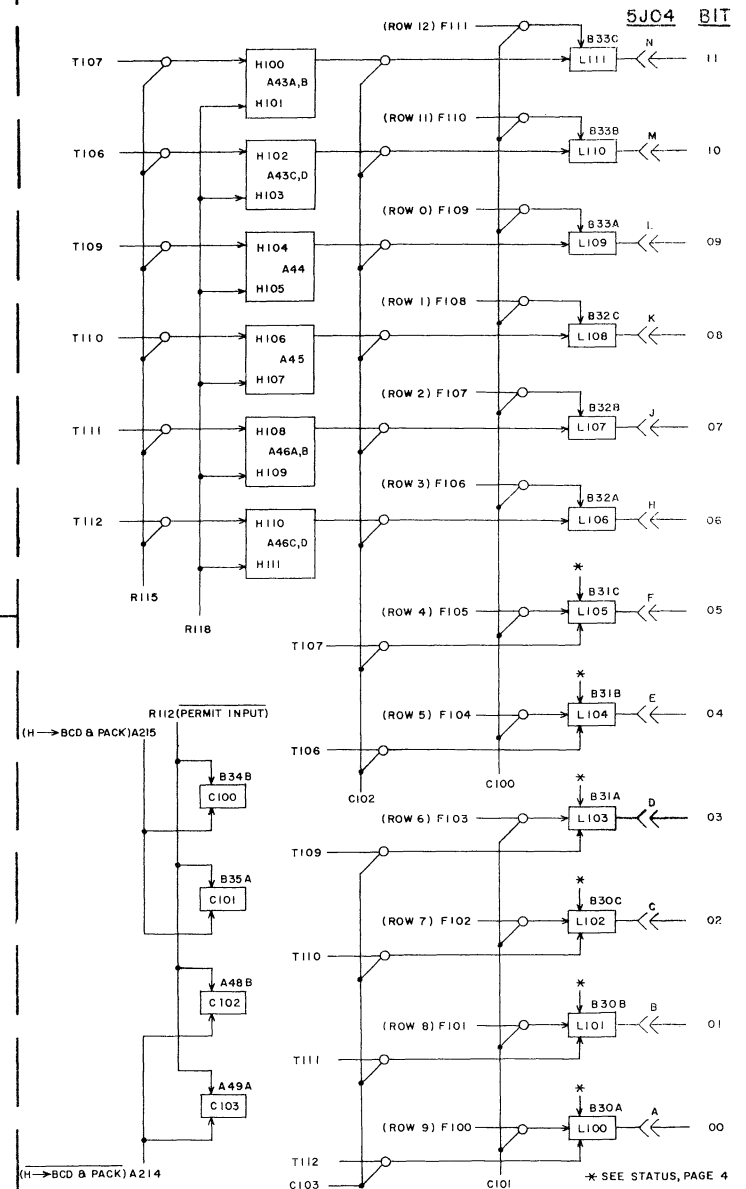
CARD DATA



HOLLERITH → BCD TRANSLATOR

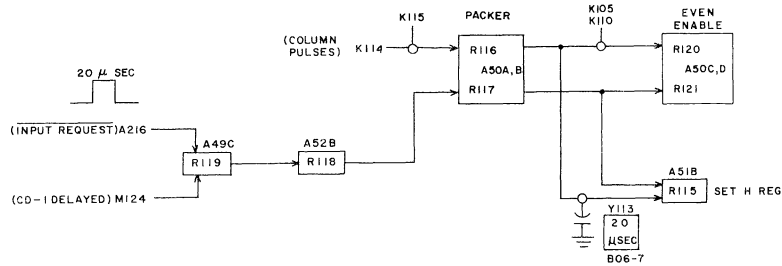


COMPUTER INPUT



PACKER

SYMBOL	LOCATION	PAGE
A214	A56A	2
A215	A56C	2
A216	B09C	2
K114	B49B	2
K115	B38C	2
M124	B04A	2
R112	B11A	2



REFERENCE DRAWINGS			
COMPONENTS (UNLESS OTHERWISE INDICATED)			
RESISTORS	TOLERANCE	VALUE	SIZE
CAPACITORS			
TITLE			

CONTROL DATA CORPORATION

PROJECT OR PRODUCT
167-2 CARD READER

DRAWING NUMBER
XCP 232928

PAGE
3

REV. AUTH. DATE IND. DRW. CHK. APPROVED

REVISIONS

APPROVED: *[Signature]* 7-17-62

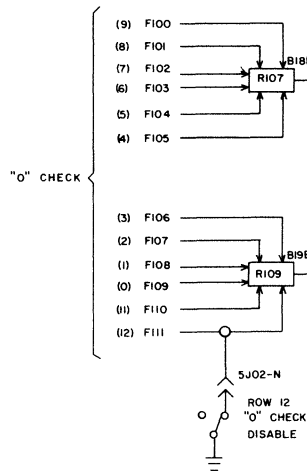
CHECKED: *[Signature]* 7-13-62

DRAWN: L. KOLLEN

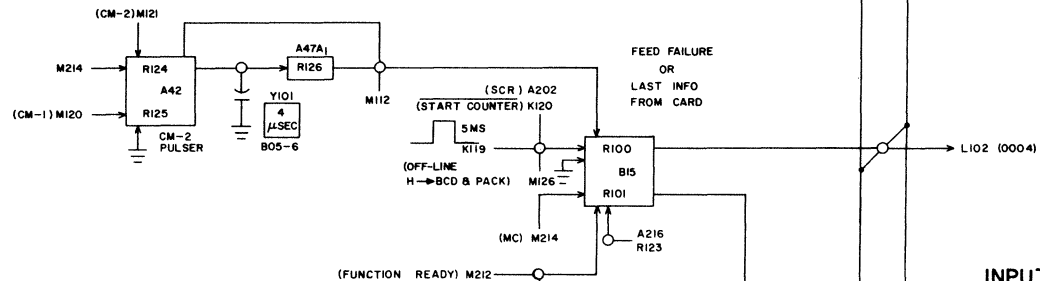
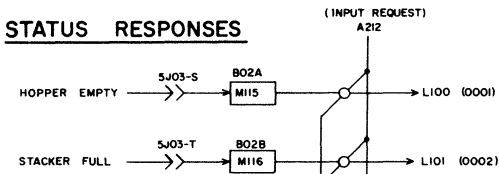
DESIGNED: *[Signature]*

**READ, TRANSLATE,
PACK, & INPUT**

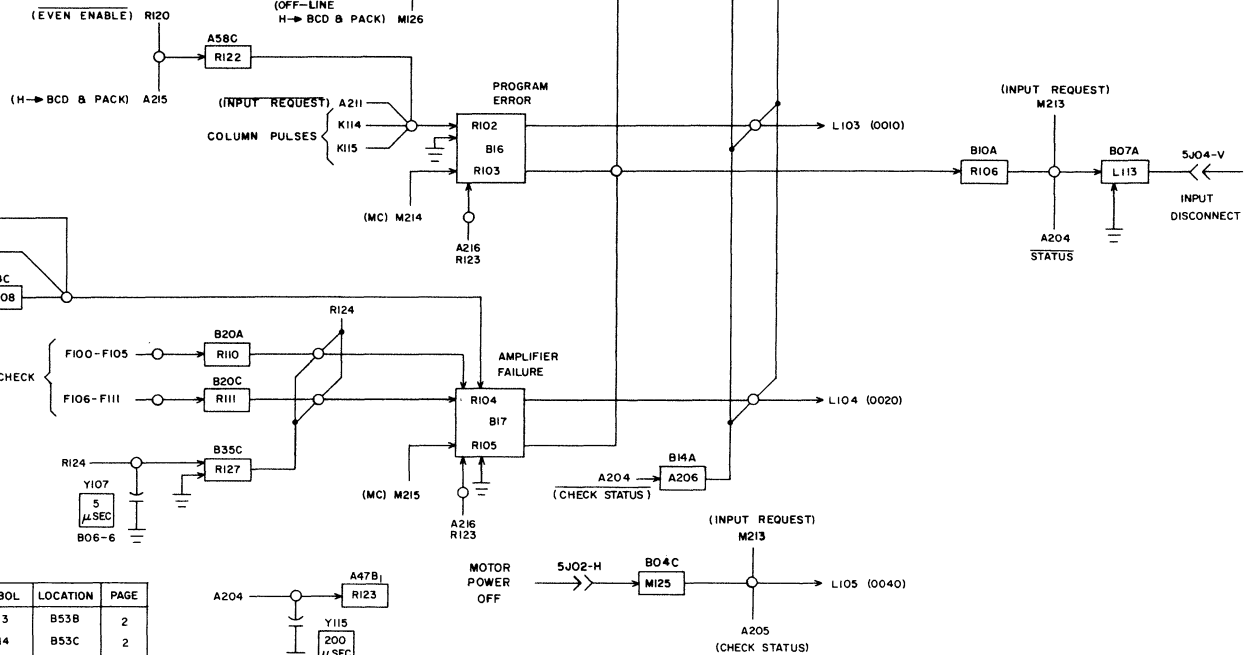
"0" AND "1" CHECK



STATUS RESPONSES



INPUT DISCONNECT

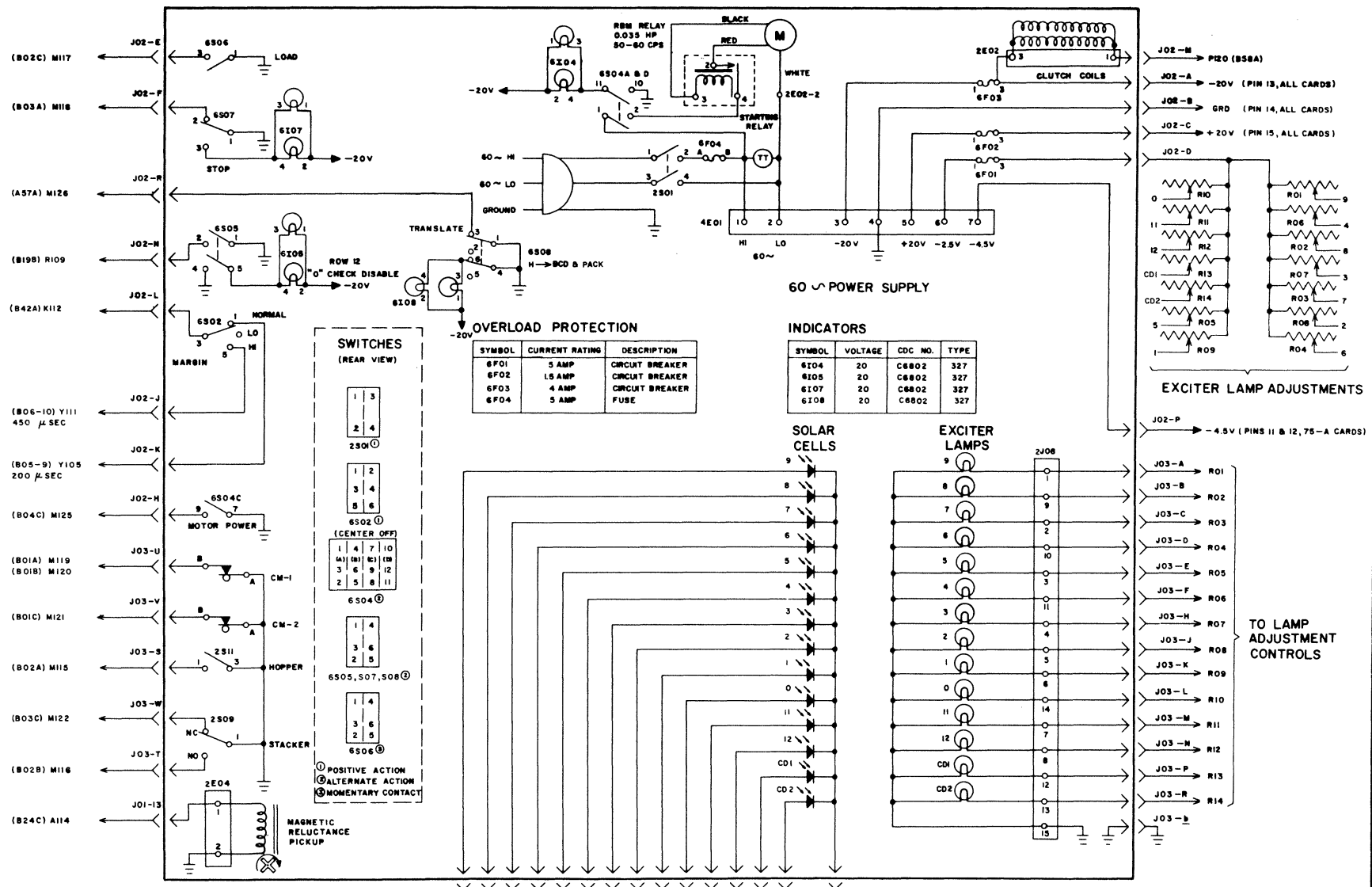


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			F108	A31C	3	L101	B30B	3	M214	B53C	2
A211	BI2A	2	F109	A32C	3	L102	B30C	3	M215	B03B	2
A212	BI3B	2	F110	A33C	3	L103	B31A	3			
A215	A56C	2	F111	A34C	3	L104	B31B	3	R120	A50C	3
						L105	B31C	3			
F100	A23C	3	K114	B49B	2	M112	B29A	2			
F101	A24C	3	K115	B38C	2	M119	BO1A	2			
F102	A25C	3	K117	B41C	2	M120	BO1B	2			
F103	A26C	3	K118	B12C	2	M121	BO1C	2			
F104	A27C	3	K119	B36C	2	M123	BO4B	2			
F105	A28C	3	K120	A58A	2	M126	A57A	2			
F106	A29C	3									

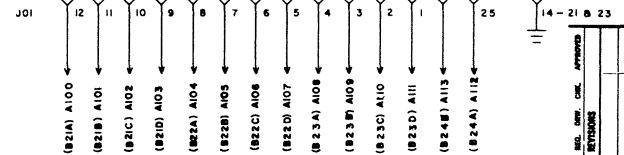
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	RESISTORS		
CAPACITORS			
TITLE			
STATUS AND DISCONNECT			
PROJECT OR PRODUCT 167-2 CARD READER			
DRAWING NUMBER XCP232929			
PAGE 4			



CONTROL DATA CORPORATION
 PROJECT OR PRODUCT
167-2 CARD READER
 DRAWING NUMBER
XCP232929



NOTE: ALL PARTS EXTERNAL TO BOX ARE LOCATED ON LOGIC CHASSIS 170500



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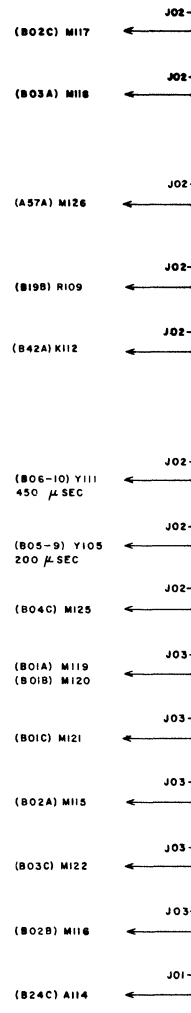
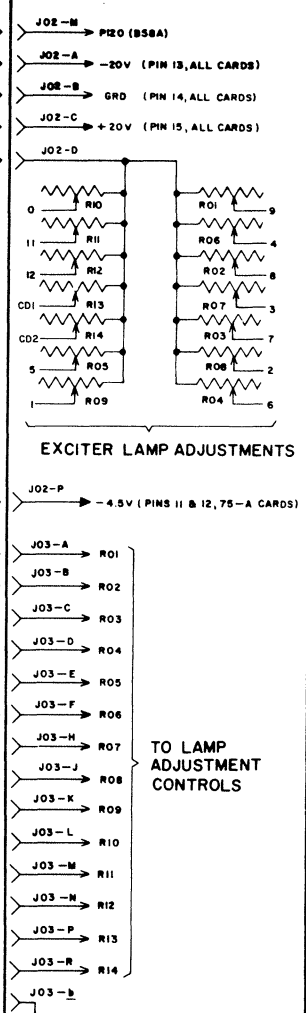
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TOLERANCE	VALUE	SIZE
RESISTORS		
CAPACITORS		
TITLE CONTROL CIRCUITS AND PHOTOELECTRIC PICKUP		

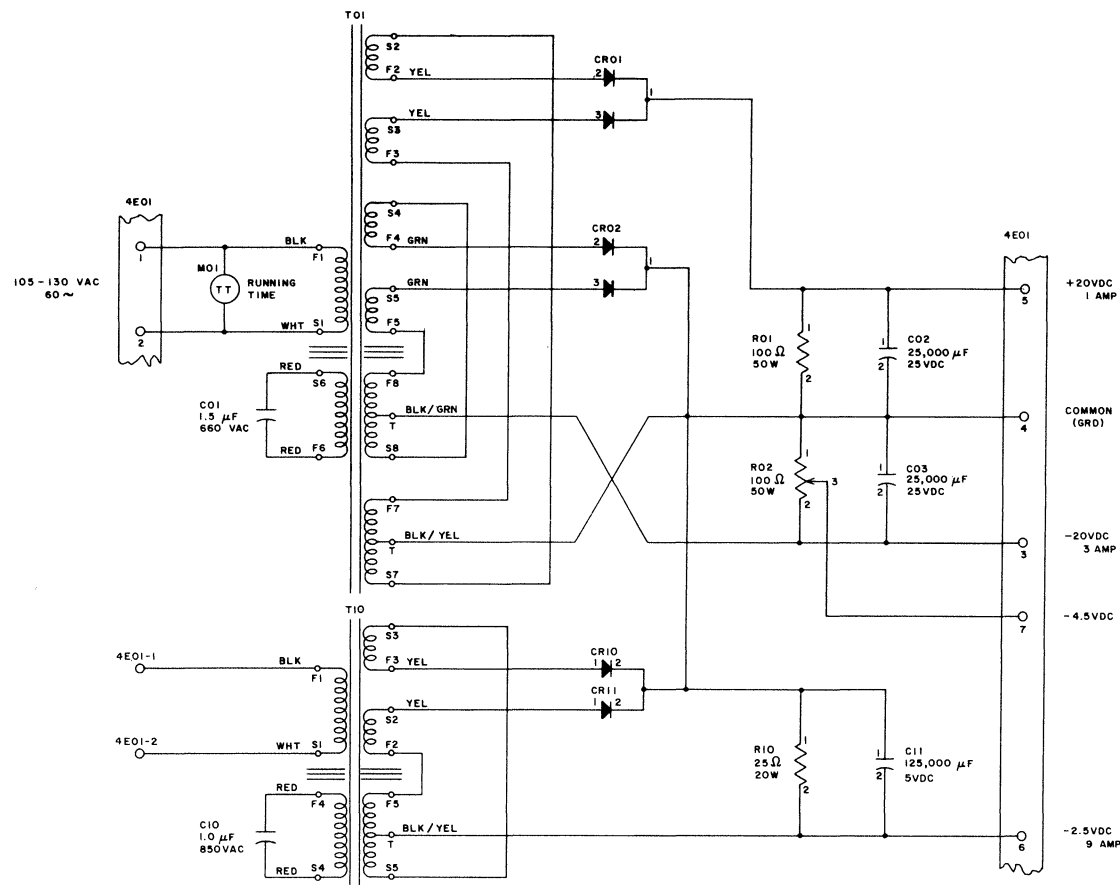
CONTROL DATA CORPORATION

PRODUCT OR PRODUCT
167-2-A

FORMING NUMBER
XCP 232930

PAGE
5





SYMBOL	DESCRIPTION	VALUE	CONTROL DATA NO.
C01	Capacitor, transformer	1.5 mfd 660 vac	631
C02, 03	Capacitor, electrolytic	25,000 mfd 25 vdc	629
C10	Capacitor, transformer	1.0 mfd 850 vac	625
C11	Capacitor, electrolytic	125,000 mfd 5 vdc	624
CR01	Rectifier, GE Series 4JA411 Mod. AC1AH1		628
CR02	Rectifier, GE Series 4JA411 Mod. AC1AH2		644
CR10, 11	Rectifier, 1N2154		633
R01, 02	Resistor, Wirewound, Adjustable	100 ohm, 50 w	630
R10	Resistor, Wirewound	25 ohm, 20 w	627
T01	Transformer, Constant Voltage	Sola #9-1833	632
T10	Transformer, Constant Voltage	Sola #9-1832	626

REV. AUTH. DATE REQ. DIM. CHG. APPROVED REVISIONS	APPROVED	REFERENCE DRAWINGS		
	CHECKED	COMPONENTS (UNLESS OTHERWISE INDICATED)		
	DESIGNED	RESISTORS TOLERANCE VALUE SIZE		
	DRAWN	CAPACITORS		
DRAWN: T. TOM, A. WEIGEL DESIGNED: L.		PROJECT OR PRODUCT SOLA 281653 & 4		
TITLE POWER SUPPLY		DRAWING NUMBER XCP224061		
		PAGE		C
		6		



CONTROL DATA CORPORATION

SOLA 281653 & 4

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6

COMMENT SHEET

MANUAL TITLE CONTROL DATA 167-2A CARD READER

Reference/Instruction Manual

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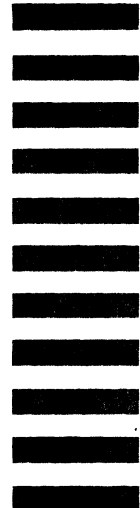
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