

SEQUENCE - SELECTOR UNIT

- 77-33 - Sequence and Selector Unit Set-up Pawl Restoration: Excessive clearance between set-up magnet armature and ratchet guide plate assembly permits latching armatures in inoperative position.
- 77-34 - Item 1: Quick Test for Brush Reading and Sel. Unit Set-up.
Item 2: Care of Read Strips.
Item 3: Selector Set-up Pawl Pivot Rod: Vibration may cause armature to unlatch.
Item 4: Selector Contact Unit: Method of locating a failing contact-weak pulse may cause incorrect selection.
- 77-35 - Item 2: Oil Line Removal: Remove oil line to prevent excessive oil on armatures, core, restoring bails.
- 77-49 - Item 2: Differential Link Guide Plate: Improved guide plate (P/N 257245) increases contact rise.
Item 3: Selector Unit Restoring Bail Adj. Screws: Excessive knock-off causes wear and increases tendency for greasy armature to unlatch at "9" time.
Item 4: Residual Magnetism: More prevalent when armature touches both cores.
- 77-50 - Strip Type Selector Units (Replacement).

READING - BRUSHES - CONTACT ROLLS

- 77-1 - Service Aid (IBM 79): A control panel wire connected from low secondary to low primary will stop the machine on unequal selector unit reading.
- 77-3 - High Speed Contact Rolls.
- 77-8 - Reading of "X": CR 5 retimed to provide full brush impulse at "X" time.
- 77-16 - Brush Location (BGD).
- 77-25 - Brush Separator Rolls (Alpha 77 BGD): Diameter of ends reduced to prevent late reading or creasing of cards between "0" and "11".
- 77-34 - Item 1: Quick Test for Brush Reading and Sel. Unit Set-up.
Item 5: Card Removal - First primary reading station.
Item 6: Test Cards: Suggestions arranging cards in descending, rather than ascending order.
Item 9: Contact Rolls (BGD): Extending life of worn roll.
- 77-48 - Dust Covers, Feed Roll, and Contact Roll Wipers: Improves reading where accumulations of carbon, ink, and other foreign material cause difficulty.
- 77-49 - Item 5: Shorting at Rear of Wire Contact Relay Receptacle: Metal slivers on AZ to EZ Suffix machines.
- 77-53 - Step-cut Brushes.
- 77-56 - Item 3: Improving Brush Reading.

SAFETY

- 77-28 - Item 1: Metal Tubes: Use only glass tubes in Collators.
- 77-38 - Start and Runout Key: Announced recessed keys.
- 77-42 - Main Line Switch Terminal Shield (BGD).
- 77-43 - Impulse Circuit Breakers.
- 77-44 - Terminal Block Assembly.
- 77-46 - Top Cover Spring.
- 77-47 - Dangerous Voltage Label.
- 77-52 - Binder Post Panel Shield.
- 77-78 - Fuse Guard.

FEEDING - STACKING

- 77-26 - 51 - 80 Col. Stacker: Stacker yoke and spring hanger improvement.
- 77-30 - 51 Col. Card Guide (BGD): Five fingered card guides to improve feeding.
- 77-34 - Item 7: Lower Eject Feed Roll (BGD): Lack of lubrication causes crooked feeding (gear marked cards).
- 77-37 - Improved Stacker: Use of IBM 85 Stacker on 77.
- 77-58 - Eject Clutch Parts Identification.

TUBE

- 77-4 - Removal of Tube Control.

X SELECTORS

- 77-2 - X-Selector: Prevents overheating, arcing HS relay points.
- 77-10 - X-Selector Pick-up: HS 1 and HS 2 picked directly.
- 77-22 - X-Selector Rectifiers: Prevents contact roll burning when X selection is used when collating field over-punched by X.
- 77-24 - X-Selector Dropout: Prevents dropout caused by reverse current in pick coil.

CYCLE DELAY

- 77-7 - Control Input Timing: Improve CRZ - Cycle Delay operation.
- 77-15 - Cycle Delay Relay: Prevents overheating R-16.

FLASHING ERROR STOP LIGHT

- 77-18 - Error Stop Pickup Circuit (BGD): Prevents error light flashing on and off or machine stopping a cycle late.

BLANK COLUMN DETECTION

- 77-49 - Item 1: Blank Col. Detection: Wiring error on 85's prior to BZ Suffix.

CIRCUIT BREAKERS

- 77-8 - Reading of "X": CR5 retimed to provide full brush impulse.
- 77-19 - CR4 Timing (BGD): Timing incorrectly shown on W/D 234851A.
- 77-28 - Item 2: CB1, 2, 3, 4: Impulses should be 6 degree duration. Relocation of CB1, 2, 3, 4.

BASE - DRIVE

- 77-5 - Constant Speed Drive.
- 77-21 - Bevel Gear Identification: Soft gears prior to AW Suffix.
- 77-32 - Idler Gear Needle Bearing (BGD): Grease fitting replaces oil cup.
- 77-35 - Item 3: Top Cover Removal service aid.
- 77-49 - Item 6: Timer Dial: Numerals inscribed 266⁰ instead of 264⁰ on machines prior to CZ Suffix.
- 77-56 - Item 1: Hardened Bevel Gears.
Item 2: Bevel Gear Replacement.
Item 4: Idler Gear Stud Mounting (Bevel Drive).
- 77-67 - Grease Retainers for Bevel Gear Drive Collators.

MARK SENSE INTERFERENCE

- 77-34 - Item 8: Non Tube Collators - Lower voltage to minimize reading marks on MS cards.
- 77-36 - Mark Sense Interference Elimination (Alpha 77): Provides resistor to desensitize grids of 25L6.

77

Collator

Machine Serial

SERVICES
INDEX

IBM Customer Engineering

IBM-77 SERVICE INDEX

- 1ST CHOICE
- 2ND CHOICE
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WHAT IS SERVICE INDEX?

The Service Index is a mathematical analysis of call reports to determine the most predominant causes of a specific machine trouble. It was developed from 2458 code 01, and 14 call reports which required over 2000 hours of service time. For a particular trouble, the Customer Engineer is directed to the three most probable causes listed as choice 1, choice 2, and choice 3, which are color coded for quick identification. The numbers within each block indicate the number of times that a specific part causes a particular trouble. Since this is a mathematical analysis, it should be recognized that the causes of trouble will not always fall within the first three choices.

Service hints have been included to provide additional information, which may aid the Customer Engineer in correcting machine failure. They are listed by trouble and specific part. These hints have been developed from CEM's and Forums held at the Plant and in the Field. They contain such information as:

- a) Trouble Analysis Techniques
- b) Common Control Panel Wiring Errors
- c) Methods of Detecting a Failure
- d) Methods of Correcting a Failure
- e) Test Procedures
- f) Methods of Increasing the Frequency of Intermittent Failures

HOW TO USE SERVICE INDEX

1. DETERMINE TROUBLE
 - a) Ask operator
 - b) Observe machine indicating lights
2. LOCATE TROUBLE ON SERVICE INDEX
3. DETERMINE THE MOST LIKELY CAUSES OF FAILURE
 - a) The most probable causes of the trouble will always be identified by - RED (first choice) - GREEN (second choice) - BLUE (third choice)
4. SERVICE HINTS BY TROUBLE
 - a) * An asterisk in the trouble column indicates a service hint which will either:
 1. Provide analysis technique
 2. Provide an indication of the specific trouble.
 NOTE: Examine the titles of the listed service hints to determine their usefulness
5. SERVICE HINTS BY CAUSE OF FAILURE
 - a) A service hint listed with the cause of failure may aid in analyzing or correcting the trouble
6. TWO OR MORE TROUBLE SYMPTOMS
 - a) When a machine indicates two or more troubles, these troubles should be cross checked against each other. A cause of failure, common to both troubles is the most likely choice.

EXAMPLE: Cause B is most likely failure

	CAUSE A	CAUSE B	CAUSE C	CAUSE D	CAUSE E
TROUBLE #1	21	5	3		
TROUBLE #2	6	37		7	

NOTE: Cause A is the most likely failure for trouble #1 alone.

Cause C is the most likely failure for trouble #2 alone

MATCH-MERGE AND SELECTION		
MIS - MERGE	*	S.H. 17,21,26,27
MIS - MATCH	*	S.H. 17,21,26,27
SELECT EXTRA	*	S.H. 14,19
FAIL TO SELECT	*	S.H. 14,19
FAIL TO SELECT "X"	*	S.H. 19
SEQUENCE CHECKING		
FALSE ERROR LIGHTS	*	S.H. 21,26,27
FAILS TO DETECT ERROR	*	S.H. 10,15,26,27
FALSE ERROR ON R.I.		
FALSE ERROR ON R.O.		

SERVICE HINT INDEX

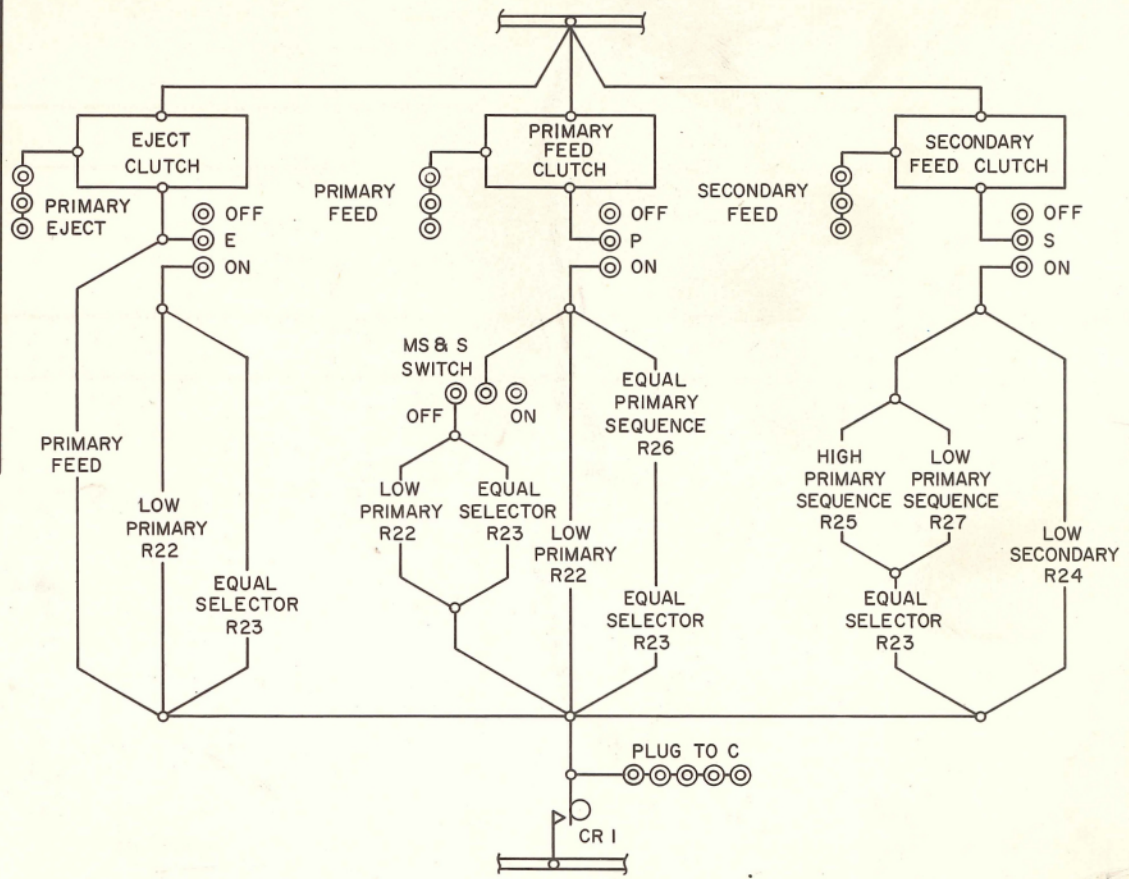
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|--------|--|--------|---|
| No. 1 | Idling Failures | No. 17 | Double Output from Unit |
| No. 2 | Individual Contact Adjustment | No. 18 | Mark Sense Interference |
| No. 3 | Reading Failures | No. 19 | Pocket Selection Magnets |
| No. 4 | Setup High Readings | No. 20 | Tracking Adjustment - Alpha Machines |
| No. 5 | Replacement of Differential Links | No. 21 | Idler Gear Stud - Bevel Gear Machine |
| No. 6 | Knockoff and Restore Bail Adjustments | No. 22 | Card Count Mechanical Trouble Analysis |
| No. 7 | Binding Differential Links and Ratchets | No. 23 | Card Count Operation |
| No. 8 | Armature Wear and Residual Magnetism | No. 24 | Alphabetic Collating Device Operation |
| No. 9 | Clutch Failures | No. 25 | Bevel Gear Replacement |
| No. 10 | Fail To Detect Sequence Errors | No. 26 | Seq. and Sel. Unit Location and Outputs |
| No. 11 | Bad Stacking - Bevel Gear Drive and/or Gear Marked Cards | No. 27 | Quick Tests #1 and #2 |
| No. 12 | Contact Rolls - Bevel Gear Drive | | |
| No. 13 | Excessive Oil in Unit | | |
| No. 14 | Extraneous Selection - (Weak Output Shot) | | |
| No. 15 | No Output Sequence Unit | | |
| No. 16 | No Output Selector Unit (Intermittently Idling) | | |

GENERAL INSTRUCTIONS

MISC.		
CARD COUNT	*	SH 22,23
ALPHA COLLATING DEVICE	*	SH 20,24
START AND RUN		
FAIL TO START		
FAIL TO STOP		
IDLES (HANGS UP)	*	SH 1,26
FAILS TO RUN CONT.	*	SEE IDLES
FAIL TO RUN OUT		
RUNS SLOW		
LOCKS UP		
NOISY		
FEEDING		
NICKING		
JAMMING		
MIS - FEED		
PRI. FAIL TO FEED		
SEC. FAIL TO FEED		
BAD STACKING	*	SH 11
TOTAL		

* AN ASTERISK IN THE TROUBLE COLUMN INDICATES A SERVICE HINT OR REFERENCE. EXAMINE THE TITLE TO DETERMINE IF THE SERVICE HINT WILL BE OF ASSISTANCE IN LOCATING THE PARTICULAR TROUBLE.
NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.

BASIC SETUP SWITCHES



ALL BASIC SETUP SWITCHES WIRED ON

OUTPUT FROM SELECTOR UNIT	OUTPUT FROM SEQUENCE UNIT	CLUTCHES OPERATED		
		EJECT	PRIMARY	SECONDARY
LOW PRIMARY	DOES NOT MATTER	X	X	
LOW SECONDARY	DOES NOT MATTER			X
EQUAL	HIGH OR LOW PRIMARY SEQUENCE	X		X
EQUAL	EQUAL PRIMARY SEQUENCE	X	X	

MS & S WIRED OFF - ALL OTHER SWITCHES WIRED ON

OUTPUT FROM SELECTOR UNIT	OUTPUT FROM SEQUENCE UNIT	CLUTCHES OPERATED		
		EJECT	PRIMARY	SECONDARY
LOW PRIMARY	DOES NOT MATTER	X	X	
LOW SECONDARY	DOES NOT MATTER			X
EQUAL	HIGH OR LOW PRIMARY SEQUENCE	X	X	X
EQUAL	EQUAL PRIMARY SEQUENCE	X	X	

NOTE: (OR MS & S NOT WIRED)

SERVICE HINT 27 (QUICK TESTS)

SERVICE HINTS

23-26

SERVICE HINTS

10-16

SERVICE HINTS

1-4

UNITS

CB'S

RELAYS

FEEDS-BASE

CTL. PANEL

CLUTCHES

STACKER

BASIC

SETUP

SWITCHES

IBM-77 SERVICE INDEX

- 1ST CHOICE
- 2ND CHOICE
- 3RD CHOICE

MIS.	START AND RUN	FEEDING	SEQUENCE CHECKING	MATCH-MERGE AND SELECTION	SEQ. SEL. UNITS			CIRCUIT BREAKERS										RELAYS																																				
					S.H. 2,14	S.H. 8,13	S.H. 6	S.H. 5,7	S.H. 7	CIRCUIT BREAKERS										RELAYS																																		
MIS - MERGE					1																																																	
MIS - MATCH					2																																																	
SELECT EXTRA					3																																																	
FAIL TO SELECT					4																																																	
FAIL TO SELECT "X"					5																																																	
FALSE ERROR LIGHTS					6																																																	
FAILS TO DETECT ERROR					7																																																	
FALSE ERROR ON R.I.					8																																																	
FALSE ERROR ON R.O.					9																																																	
TOTAL					10																																																	

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NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.

SERVICE HINT INDEX			
No. 1 Idling Failures	No. 7 Binding Differential Links and Ratchets	No. 12 Contact Rolls - Bevel Gear Drive	No. 17 Double Output from Unit
No. 2 Individual Contact Adjustment	No. 8 Armature Wear and Residual Magnetism	No. 13 Excessive Oil in Unit	No. 18 Mark Sense Interference
No. 3 Reading Failures	No. 9 Clutch Failures	No. 14 Extraneous Selection (Weak Output Shot)	No. 19 Pocket Selection Magnets
No. 4 Setup High Readings	No. 10 Fail to Detect Seq. Errors	No. 15 No Output Sequence Unit	No. 20 Tracking Adjustment Alpha Machines
No. 5 Replacement of Differential Links	No. 11 Bad Stacking - Bevel Gear Drive and/or Gear Marked Cards	No. 16 No Output Selector Unit (Intermittently Idling)	No. 21 Idler Gear Stud - Bevel Gear Machine
No. 6 Knockoff and Restore Bail Adjustments			No. 22 Card Count Mechanical Trouble Analysis
			No. 23 Card Count Operation
			No. 24 Alphabetic Collating Device Operation
			No. 25 Bevel Gear Replacement
			No. 26 Seq. and Sel. Unit Location and Outputs
			No. 27 Quick Tests #1 and #2

SEQ. SEL. UNITS	CIRCUIT BREAKERS	RELAYS
CONTACT OR STRIP	IMPULSE CB'S	
SETUP MAG. COIL, PAWL, ARM	CR-1 (FUNCT. CTL. IMP.)	
REST. MAG. BAIL, SPRINGS	CR-2 (UNIT CTL. IMP.)	
DIFF. LINK AND GUIDE PLATE	CR-3 (BRUSH RD. CTL.)	
TIMING	CR-5 (CARD LEVER CONTROL)	
BINDING RATCHET	CR-6,7 (RUN CONTROL)	
	CR-8 (FEED INTERLOCK)	
	P-1 (9 RUNOUT IMPULSE)	
	P-2 (CD LEVER, "X" HOLD)	
	P-3 ("X" PICK UP)	
	S-1 (9 RUNOUT IMPULSE)	
	S-2 (CD LEVER, "X" HOLD)	
		R-1,2 (PRI. HOPPER)
		R-3,4 (SEC. HOPPER)
		R-5 (SEC. CLC)
		R-6 (PRI. CLC)
		R-7 (SEQ. CLC)
		R-8,9 (SEC. CLC HOLD)
		R-10,11 (X SELECTORS)
		R-12,13 (PRI. CLC HOLD)
		R-14,15 (SEQ. CLC HOLD)
		R-16,33,49 (CYCLE DELAY)
		R-17,50 (START)
		R-18,19 (UNIT CLEARING)
		R-20 (FEED INTERLOCK)
		R-21 (RESTORING INTERLOCK)
		R-22 thru 27 (CTL. RELAYS)
		R-28 thru R-32 (SELECTOR)
		R-34,35 and H.S. 4 (ERROR)
		R-51,52,53 (MOTOR CONTROL)

FEEDS-BASE
CTL. PANEL
CLUTCHES
STACKER

UNITS
CB'S
RELAYS

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GENERAL
INSTRUC-
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SERVICE
HINT 27
(QUICK)
TESTS

SERVICE HINTS
23-26

SERVICE
HINTS
10-16

SERVICE
HINTS
1-4

UNITS
CB'S
RELAYS

SERVICE HINT INDEX			
No. 1 Idling Failures	No. 7 Binding Differential Links and Ratchets	No. 12 Contact Rolls - Bevel Gear Drive	No. 17 Double Output from Unit
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			No. 23 Card Count Operation
			No. 24 Alphabetic Collating Device Operation
			No. 25 Bevel Gear Replacement
			No. 26 Seq. and Sel. Unit Location and Outputs
			No. 27 Quick Tests #1 and #2

SEQ. & SEL. UNITS	CIRCUIT BREAKERS	RELAYS
S.H. 2,14	IMPULSE CB'S	
S.H. 8,13	CR-1 (FUNCT. CTL. IMP.)	
S.H. 6	CR-2 (UNIT CTL. IMP.)	
S.H. 5,7	CR-3 (BRUSH RD. CTL.)	
S.H. 7	CR-5 (CARD LEVER CONTROL)	
	CR-6,7 (RUN CONTROL)	
	CR-8 (FEED INTERLOCK)	
	P-1 (9 RUNOUT IMPULSE)	
	P-2 (CD LEVER, "X" HOLD)	
	P-3 ("X" PICK UP)	
	S-1 (9 RUNOUT IMPULSE)	
	S-2 (CD LEVER, "X" HOLD)	
		R-1,2 (PRI. HOPPER)
		R-3,4 (SEC. HOPPER)
		R-5 (SEC. CLC)
		R-6 (PRI. CLC)
		R-7 (SEQ. CLC)
		R-8,9 (SEC. CLC HOLD)
		R-10,11 (X SELECTORS)
		R-12,13 (PRI. CLC HOLD)
		R-14,15 (SEQ. CLC HOLD)
		R-16,33,49 (CYCLE DELAY)
		R-17,50 (START)
		R-18,19 (UNIT CLEARING)
		R-20 (FEED INTERLOCK)
		R-21 (RESTORING INTERLOCK)
		R-22 thru 27 (CTL. RELAYS)
		R-28 thru R-32 (SELECTOR)
		R-34,35 and H.S. 4 (ERROR)
		R-51,52,53 (MOTOR CONTROL)

SERVICE HINT INDEX			
No. 1 Idling Failures	No. 7 Binding Differential Links and Ratchets	No. 12 Contact Rolls - Bevel Gear Drive	No. 17 Double Output from Unit
No. 2 Individual Contact Adjustment	No. 8 Armature Wear and Residual Magnetism	No. 13 Excessive Oil in Unit	No. 18 Mark Sense Interference
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			No. 25 Bevel Gear Replacement
			No. 26 Seq. and Sel. Unit Location and Outputs
			No. 27 Quick Tests #1 and #2

IBM-77 SERVICE INDEX

■ 1ST CHOICE

■ 2ND CHOICE

■ 3RD CHOICE

MATCH-MERGE AND SELECTION	MIS - MERGE	*
	MIS - MATCH	*
	SELECT EXTRA	*
	FAIL TO SELECT	*
	FAIL TO SELECT "X"	*
SEQUENCE CHECKING	FALSE ERROR LIGHTS	*
	FAILS TO DETECT ERROR	*
	FALSE ERROR ON R.I.	
	FALSE ERROR ON R.O.	

MISC.	CARD COUNT	*
	ALPHA COLLATING DEVICE	*
START AND RUN	FAIL TO START	
	FAIL TO STOP	
	IDLES (HANGS UP)	*
	FAILS TO RUN CONT.	*
	FAIL TO RUN OUT	
	RUNS SLOW	
	LOCKS UP	
	NOISY	
FEEDING	NICKING	
	JAMMING	
	MIS-FEED	
	PRI. FAIL TO FEED	
	SEC. FAIL TO FEED	
	BAD STACKING	*
TOTAL		

* AN ASTERISK IN THE TROUBLE COLUMN INDICATES A SERVICE HINT OR REFERENCE. EXAMINE THE TITLE TO DETERMINE IF THE SERVICE HINT WILL BE OF ASSISTANCE IN LOCATING THE PARTICULAR TROUBLE.

NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.

GENERAL INFORMATION

Machine Serial _____

Special Features _____

Customer personnel most familiar with this machine:

Mr./Mrs. _____

Mr./Mrs. _____

Mr./Mrs. _____

OPERATIONS

Card Selection is the operation by which a particular card may be selected from a file of cards. The type of card to be selected may be an X-card, an NX-card, the first card of a group, the last card of a group, a single-card group, a zero card, a card with a particular number, or a card out of sequence.

Checking Sequence is an operation by which the collator checks a file of cards to determine whether or not they are in order. As the cards are fed through the machine, each card is compared with the one ahead; if it is out of sequence, the machine stops and an error light turns on.

Merging is the operation by which the collator combines two files of cards, already in sequence, into a single file. The cards in one file are compared with those in the other, and feeding from the two files is thereby controlled so that the combined file is in numerical sequence.

Merging with Selection is the operation by which cards in one file that do not have corresponding cards in the other file are selected as the two files are merged. Cards can be selected from either or both files and, when the operation is completed, there may be three groups of cards: one merged file and two groups of selected cards.

Matching is the operation by which the collator compares two files of cards to determine that there is a card or group of cards in one file to match each card or group of cards in the other file. Unmatched cards in either or both files are selected. When the operation is completed, there may be four groups of cards: two groups that match and two groups of selected cards.

NOTES

If this machine has a common failure due to customer application, it should be listed in the "Notes". Other items that should be listed are location of test panel, lubricants, tools, etc.

FEEDS-BASE

CTL. PANEL
CLUTCHES
STACKER

UNITS

CB'S

RELAYS

OPERATIONS

NOTES

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GENERAL

INSTRUC-
TIONS

SERVICE

HINT 27
(QUICK)
(TESTS)

SERVICE HINTS

23-26

SERVICE

HINTS

10-16

SERVICE

HINTS

1-4

SERVICE HINTS

No. 1 IDLING FAILURES

- Remove primary and secondary basic entry jackplugs to prevent a feed cycle while removing covers. If the control panel is covered, isolate R17b N/O point.
- Examine Relays 22-27.
 - No output from the selector unit (Relays 22-23-24 not picking).
 - Use the meter to locate the failing contact.
 - Check contact adjustment. (See Service Hint #2)
 - No output from the sequence unit. Relays 25-26-27 not picking.
 - Use the meter to locate the failing contact.
 - Check contact adjustment. (See Service Hint #2.)
 - No output from either unit. (Relays 22-23-24-25-26-27 not picking.)
 - Check CR-2
 - Relays 22-27 picking properly.
 - Check clutch circuit
 - CR-1 and HS-4 are the most likely failures.

No. 2 INDIVIDUAL CONTACT ADJUSTMENTS

- Check N/O contact rise with 0-1 combination setup in unit.
 - Adjust with N/O contact support strap.
- With the unit restored to equal, check to see that the operating strap opens the N/C contact before the N/O contact makes.
 - Adjust with N/C contact support strap.
- The tension of the operating strap should cause a slight flexing action of the N/C strap.
 - Adjust operating strap tension, if necessary.
- If, as a result of adjustments a and b above, the operating strap tends to rest firmly against the cam, the differential link and guide plate may be excessively worn.

No. 3 READING FAILURES

Suggestions for improving reading conditions and preventing burning of contact roll or brushes.

Circuit Breakers. The main impulse CB's 3 and 4 should be checked for accurate timing at all digit points. They must not break later than the specified time. Particular attention should be given CB's with respect to bounce and the presence of worn or binding sintered iron rollers.

Brushes. The brushes should be in good condition and set for proper tracking with the heel strands on the scribed line.

Brush Timing Variation. Considerable variation in timing may be observed, particularly at the primary reading station. If variation in timing is observed, the following should be checked:

- Wear at first continuously running feed roll bevel gears.
- Insufficient tension of primary eject feed roll shaft pressure springs.
- Binding and adequate lubrication of feed roll bearings.
- Excessive clearance between brush separator plates and contact roll. This clearance should not be greater than .018".

Power Supply. Low voltage will cause intermittent failure to setup in the sequence and selector units.

- Weak rectifier.
- Open capacitor.

Foreign Material. Cards with excess of foreign material, such as dirt, ink, carbon, can contribute towards reading difficulties.

Step Cut Brushes. When using the brush gage to check alignment of step cut brushes, care must be exercised to see that the heel of the brush does not catch on the scribed line and give false indication of alignment.

X Selectors. X selectors may cause contact roll burning if there is also an X in the field wired for collating. CEM #2318.

No. 4 SETUP HIGH READINGS

- Selector unit setup pawl pivot rod vibration may cause the armature of both wired and unwired setup magnets to unlatch. For example, when a considerable number of 8's are read into one side of a unit, vibration may cause one or more remaining positions to unlatch and set up a seven. This vibration can usually be eliminated by tightening the setup pawl pivot studs firmly against the ends of the pivot rod.
- Short strands in the read brushes may cause setup to be one high in the selector or sequence unit.

IBM-77 SERVICE INDEX

■ 1ST CHOICE

■ 2ND CHOICE

■ 3RD CHOICE

MATCH-MERGE AND SELECTION	MIS - MERGE	*
	MIS - MATCH	*
	SELECT EXTRA	*
	FAIL TO SELECT	*
	FAIL TO SELECT "X"	*
SEQUENCE CHECKING	FALSE ERROR LIGHTS	*
	FAILS TO DETECT ERROR	*
	FALSE ERROR ON R.I.	
	FALSE ERROR ON R.O.	

MISC.	CARD COUNT	*
	ALPHA COLLATING DEVICE	*
START AND RUN	FAIL TO START	
	FAIL TO STOP	
	IDLES (HANGS UP)	*
	FAILS TO RUN CONT.	*
	FAIL TO RUN OUT	
	RUNS SLOW	
FEEDING	LOCKS UP	
	NOISY	
	NICKING	
	JAMMING	
	MIS - FEED	*
TOTAL	PRI. FAIL TO FEED	
	SEC. FAIL TO FEED	
	BAD STACKING	*

* AN ASTERISK IN THE TROUBLE COLUMN INDICATES A SERVICE HINT OR REFERENCE. EXAMINE THE TITLE TO DETERMINE IF THE SERVICE HINT WILL BE OF ASSISTANCE IN LOCATING THE PARTICULAR TROUBLE.

NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.

No. 5 REPLACEMENT OF DIFFERENTIAL LINKS



The new style guide plates should be installed whenever it is necessary to replace the differential links. They may also be installed to increase contact rise for high readings in the upper half of the unit, if contacts fail under these conditions.

Removing differential links.

1. Remove the contact unit from the sequence or selector unit.
2. Trip the lower restoring magnet armature and restore all the lower ratchets to the zero position.
3. Trip the upper restoring magnet armature and turn the machine until the upper restoring bail is all the way to the rear of the unit. This should be about 330° on the index.
4. Remove the link guide plate support bar. The two spacers on the ends of the shaft will fall, but the link guide plates will be supported by the position of the bail.
5. Pull the lower ratchet forward and slide the link guide plate downward toward the bottom of the unit until the large opening in the link guide plate slides over the differential link stud.
6. Pull the lower ratchet forward until the large opening in the differential link slides over the stud on the lower ratchet assembly.
7. Pull the differential link forward until the differential link stud slides out of the large opening in the contact operating lever.
8. Push the differential link upward until it strikes the bail. Pull the bail forward very slightly until the large opening in the differential link slides over the stud on the upper ratchet.

To install a new differential link reverse the above procedure. When replacing the link guide plate support bar, position the link guide plates in the support bar slots, replace the center holding screws, and replace the end spacers by springing the support bar slightly.

Adjust contact. See Service Hint #2.

No. 6 KNOCKOFF AND RESTORE BAIL ADJUSTMENTS

Excessive armature knockoff, accompanied by reduced restore pawl latch clearance tends to occur with machine usage and/or wear. The knockoff bail, if forced against the armatures, not only can cause knockoff and armature wear, but can increase the tendency of greasy armatures to unlatch at "9" time.

Insufficient restore pawl latching clearance can cause intermittent failure to retain readings.

It is seldom necessary to change individual eccentric adjusting screws on the armature knockoff bails or restore bail pawl latches unless parts are replaced or repaired. Maintaining the required clearances and corresponding operating safety factor is usually best accomplished by adjusting the restoring bail adjusting screws.

NOTE: Check for loose pins and worn followers on the restoring bail cams.

No. 7 BINDING DIFFERENTIAL LINKS AND RATCHETS

Excessive cam load due to excessive contact strap movement or tension may cause binds in the differential link setup ratchets which will result in incorrect setup.

No. 8 ARMATURE WEAR AND RESIDUAL MAGNETISM

It has been observed that the tendency of magnet armatures to trip erroneously because of residual magnetism is more prevalent when armatures touch both cores. Forming armatures to the specified clearances of .003" to .005" between the armature and core nearest the pivot minimizes the effect of residual magnetism. Wear at the pivot point and latching surface can be offset by reversing the individual armatures.

No. 9 CLUTCH FAILURES

a. Possible causes of a failure to latch:

- (1) Insufficient magnet armature knockoff.
- (2) Insufficient relatching clearance.
- (3) Worn armature tip or insufficient latching overlap of the armature and latch.
- (4) Weak armature return spring.

b. Possible causes of a failure to unlatch:

- (1) Excessive magnet armature knockoff.
- (2) Insufficient unlatching clearance.
- (3) Open or shorted magnet.
- (4) Weak or short duration impulse to magnet.

No. 10 FAIL TO DETECT SEQUENCE ERROR

When it is suspected that a sequence unit position is intermittently failing to read in, causing erroneous high primary sequence conditions, the customer's cards or a test deck may be arranged in descending rather than ascending order. Wire high primary sequence output to error stop. This will stop the machine with the error set up so that the trouble may be pinpointed.

No. 11 BAD STACKING - BEVEL GEAR DRIVE AND/OR GEAR MARKED CARDS

If the lower eject feed roll bearings and the last primary feed roll bearings and pressure shoes are not lubricated sufficiently, the lower eject feed roll may be forced downward. This may cause cards to feed crooked or late from the eject station to the pockets, and may cause the cards to be gear marked.

No. 12 CONTACT ROLLS - BEVEL GEAR DRIVE

The following is suggested as a temporary measure to extend the life of contact rolls when a contact roll is badly grooved by the common brush.

Holding the removed contact roll by hand, tap the contact roll shaft with the end of a hammer handle until the shaft shifts approximately one-half of a column in relationship to the outer shell. Re-install contact roll, and the brushes should then track on an unused surface of the contact roll.

No. 13 EXCESSIVE OIL IN UNIT

It is recommended that the oil lines to IBM 77 selector and sequence units be removed to reduce failures caused by excess oil on lower magnet cores, armatures, and restoring bails. Closure Plug, P/N 190278, may be ordered for installation at point of line removal. Following removal, setup ratchet shafts should be lubricated through the oil cups during inspection, or as often as machine utilization dictates.

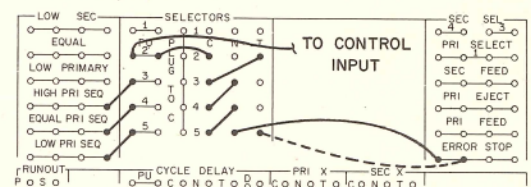
No. 14 EXTRANEOUS SELECTION (Weak Output Shot)

A weak selector unit output pulse may cause either a primary or a secondary card to be selected in error. This can occur when a weak or late pulse trips the selector unit restoring magnet but does not trip the feed clutch or does not trip it in time to engage the one-tooth ratchet. A glaze on the area directly behind the one-tooth ratchet, may indicate that the clutch is tripping late.

An ohmmeter can be used to check the over-all circuit resistance of the normally closed contact points of selector and sequence units. This may be done by setting up equal readings in the unit and connecting the meter across the input and equal output terminals of the contact unit. If this combined point resistance is not close to zero, it should be brought near to zero by cleaning points, tightening terminal clip holding screws, etc.

No. 15 NO OUTPUT SEQUENCE UNIT

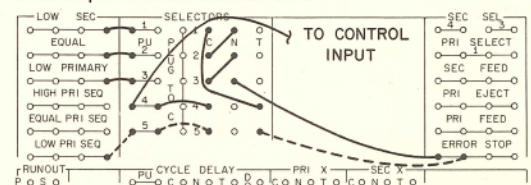
If a contact is suspected of causing failure to detect errors or intermittent idling (no output from unit), it may be detected by wiring selectors to cause an error stop if there is no output from the sequence unit.



This wiring may be added to the customer's board and he may then use his machines until the error occurs.

No. 16 NO OUTPUT SELECTOR UNIT (INTERMITTENTLY IDLING)

If a selector unit contact is suspected of causing machine to intermittently hang up (idling), it may be stopped in this idling condition by wiring selectors to cause an error stop when there is no output from the selector unit.



If the customer is not using the selectors, this wiring may be added to his board and he may then use the machine until the error occurs.

NOTE: No output from sequence unit. See Service Hint #15.

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MATCH-MERGE AND SELECTION	MIS - MERGE	*
	MIS - MATCH	*
	SELECT EXTRA	*
	FAIL TO SELECT	*
	FAIL TO SELECT "X"	*
SEQUENCE CHECKING	FALSE ERROR LIGHTS	*
	FAILS TO DETECT ERROR	*
	FALSE ERROR ON R.I.	
	FALSE ERROR ON R.O.	

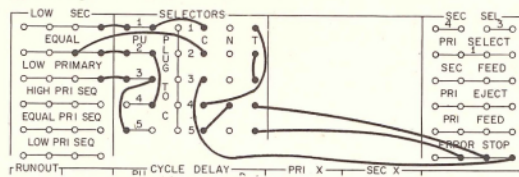
MISC.	CARD COUNT	*
	ALPHA COLLATING DEVICE	*
START AND RUN	FAIL TO START	
	FAIL TO STOP	
	IDLES (HANGS UP)	*
	FAILS TO RUN CONT.	*
	FAIL TO RUN OUT	
	RUNS SLOW	
FEEDING	LOCKS UP	
	NOISY	
	NICKING	
	JAMMING	
	MIS - FEED	
	PRI. FAIL TO FEED	
	SEC. FAIL TO FEED	
	BAD STACKING	*
TOTAL		

* AN ASTERISK IN THE TROUBLE COLUMN INDICATES A SERVICE HINT OR REFERENCE. EXAMINE THE TITLE TO DETERMINE IF THE SERVICE HINT WILL BE OF ASSISTANCE IN LOCATING THE PARTICULAR TROUBLE.

NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.

No. 17 DOUBLE OUTPUT FROM UNIT

If the selector unit is suspected of picking two output relays, the machine may be stopped in this condition by wiring selectors.



When Machine Stops:

- Pick R50 and examine output relays to determine which outputs caused this error.
- Examine contacts to determine cause of error.

NOTE: The same procedure may apply to the sequence unit.

No. 18 MARK SENSE INTERFERENCE

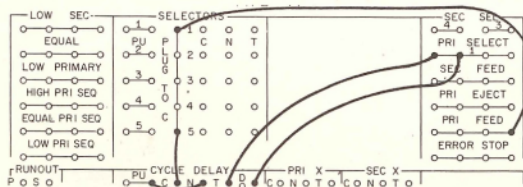
Reading errors caused from brushes sensing marks on mark sensed cards can be minimized by setting the D. C. voltage to the low limit specified on the wiring diagram.

Worn brushes may aggravate mark sense interference. Brushes should be in good condition. A heavy mark may also aggravate this condition. The proper marking technique is one line with a sharp pencil.

For mark sense interference on alphabetic 077, resistors may be added to the grid circuit of the 25L6 tubes. A 1,000 ohm 2 watt resistor, P/N 317082, should be connected in parallel with the 10,000 ohm resistor connected to pin 5 of the tube sockets. These resistors should only be used in those positions that are exposed to erroneous read-in from sense marks.

No. 19 POCKET SELECTION MAGNETS

A good operational check of the pocket selection magnets is to use blank cards and wire a control panel as below.



Alternate cards should select and can be checked for proper operation.

This board can be altered to test selection in pockets 3&4.

No. 23 CARD COUNT OPERATION

Special device to count up to 99 cards. Two different counting operations can be performed at the same time, provided each count will not exceed 9.

Runout: P, S (Primary, Secondary). Emit a control impulse on each card cycle when the opposite feed is empty. The INTERLOCK switch must be wired ON to make these hubs operative. These hubs also emit on the run-in.

Count Source: S, C, P, PS (Secondary, Common, Primary, Primary Sequence). Emit a plug to C impulse on each feed cycle that cards are in the respective feed stations. S emits on each cycle that a secondary card is controlled to stack; C on the cycle that the first card is read at primary read and on every machine cycle thereafter; P on each cycle that a primary card is controlled to stack; and PS on each cycle that a primary card is controlled to pass the primary brushes. These hubs are normally wired to COUNT IN.

Count In: U, T (Units, Tens). Accept impulses to cause the corresponding counter to add 1. If counters are coupled, only COUNT IN U is wired.

Total: 0-9, C (Common). The 0-9 hubs for the units and tens counters represent the totals accumulated in the counters. On each cycle, a path exists between the C hub and the 0-9 hub corresponding to the total count. Either hub can be used as an exit or an entry.

When the TRANSFER hubs are jackplugged, the C hub of the units counter emits, on each cycle, the total accumulated in the units counter. The C hub can be wired to a comparing entry to compare the accumulated count with another number, usually read from the card. The 0-9 hubs of the units counter become a digit emitter and emit the digits 0-9, respectively, on each cycle. In order for the C hubs of the tens counter to emit the total accumulated in that counter, the 0-9 hubs of the units counter must be wired to the corresponding hubs of the tens counter.

Carry. Jackplugged to accumulate one two-position total (up to 99); not jackplugged to accumulate two separate single position totals (up to 9 each).

Transfer. Jackplugged when a total count must be emitted from the counter for comparison with another number. Not jackplugged when a predetermined count is to control feeding and counting.

Rest: U, T (Restore: Units, Tens). Accept an impulse to reset the corresponding counter to zero. Normally impulsed by a selected PLUG to C.

No. 20 TRACKING ADJUSTMENT ON ALPHABETIC MACHINE

Punch several cards with letters E and Z in alternate columns. Mark the card with crayon or use carbon paper.

A. To check tracking of both sets of primary sequence brushes:

- Run the card in one (1) cycle under power.
- Turn off power.
- Trip the primary clutch and crank the machine to between 90° and 144° on the index.
- Drop the brush assembly and remove the card.
- Both sets of brushes will have marked the card through 5 and 9 holes. Only the zone brushes will have marked the card through 0 and 12 holes. From the marks on the card you can see which set of brushes must be moved and which way. Adjust as necessary to get proper tracking of both sets of primary sequence brushes.

B. To check tracking of primary zone brushes:

- Run a card in two (2) cycles under power.
- Turn off power.
- Trip the primary clutch and crank the machine to 342° on the index.
- Drop the brush assembly and remove the card.
- The primary zone brushes, as well as both sets of primary sequence brushes will have marked the card through the 5 and 9 holes. Only the primary sequence brushes have marked the card through the 0 and 12 holes. Adjust the primary zone brushes to track properly, if necessary.

C. To check tracking of the primary numeric brushes:

- Run the card all the way through the primary feed. Adjust primary numeric brushes as necessary.

D. To check tracking of both sets of secondary brushes:

- Repeat steps (1) through (5) of Item A for secondary brush tracking.

No. 21 IDLER GEAR STUD - BEVEL GEAR MACHINE

Intermittent mis-merging, false selection and false error lights may be caused by a loose CR circuit breaker idler gear stud.

No. 22 CARD COUNT MECHANICAL TROUBLE ANALYSIS

A mechanical operational check of the step counters is to pick R-17 (start) to cause C. R. mechanism to operate; and then pick R-45 (units) or R-46 (tens) to provide a CR-9 impulse to advance the counter. Observe counter to detect mechanical failures.

No. 24 ALPHABETIC COLLATING DEVICE OPERATION

Special device to perform collating operation using alphabetic, instead of numerical, data. For comparison, two entry-positions are required for each letter. Therefore, up to 8 positions of alphabetic data can be used in any operation that can be performed with a maximum of 16 numerical positions, and up to 16 positions in any operation performed with a maximum of 32 numerical positions.

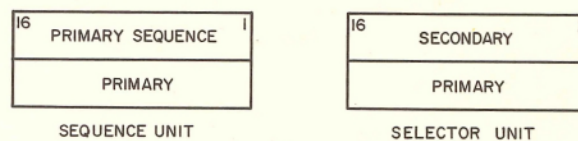
Secondary Zone Read, Primary Zone Read, Primary Sequence Zone Read. Emit impulses corresponding to the zones punched in the card passing the zone brushes. Three 16-position zone reading brush stations are installed; each zone station is associated with the corresponding standard reading station. The zones are read as numerical digits (12-zone as a 6, 11-zone as a 7, and 0-zone as an 8), and are normally wired to comparing entry immediately to the left of the corresponding numerical portion of each letter.

No. 25 BEVEL GEAR REPLACEMENT

Faster access of the No. 1 Pocket Feed Roll Drive Gear, P/N 257098, is gained by shifting the main drive shaft to the left instead of removing it from the machine. Remove taper pins and screws, as necessary, from the shaft components to permit the shaft to be moved about two inches to the left. When machine usage and gear replacement frequency warrants, install a spare No. 1 Pocket Feed Roll Drive Gear, P/N 257098, on the main drive shaft to minimize machine down time during replacement.

No. 26 SEQ. AND SEL. UNIT LOCATION AND OUTPUTS

UNITS - REAR VIEW OF MACHINE



UNIT OUTPUTS

UNIT	CONTACT TRANS	STRIP FINGER	OUTPUT HUBS ACTIVE	RELAY PICKED
SELECTOR	UPPER	UP	LOW PRI.	R-22
	NONE	CENTER	EQUAL	R-23
	LOWER	DOWN	LOW SEC.	R-24
SEQUENCE	UPPER	UP	HIGH PRI. SEQ.	R-25
	NONE	CENTER	EQUAL PRI. SEQ.	R-26
	LOWER	DOWN	LOW PRI. SEQ.	R-27

NOTE: THE FIRST TRANSFERRED CONTACT STARTING FROM THE LEFT CONTROLS THE OUTPUT.

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MATCH-MERGE AND SELECTION

MIS - MERGE	*
MIS - MATCH	*
SELECT EXTRA	*
FAIL TO SELECT	*
FAIL TO SELECT "X"	*

SEQUENCE CHECKING

FALSE ERROR LIGHTS	*
FAILS TO DETECT ERROR	*
FALSE ERROR ON R.I.	*
FALSE ERROR ON R.O.	*

MISC.

CARD COUNT	*
ALPHA COLLATING DEVICE	*

START AND RUN

FAIL TO START	
FAIL TO STOP	
IDLES (HANGS UP)	*
FAILS TO RUN CONT.	*
FAIL TO RUN OUT	
RUNS SLOW	
LOCKS UP	
NOISY	

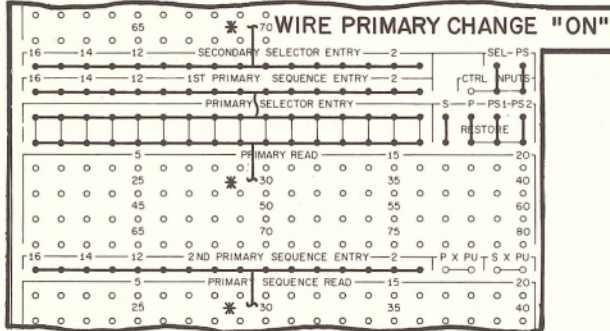
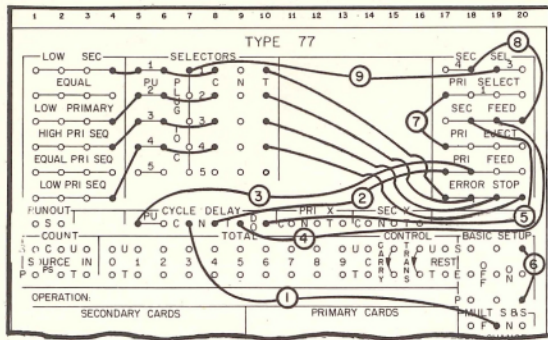
FEEDING

NICKING	
JAMMING	
MIS - FEED	
PRI. FAIL TO FEED	
SEC. FAIL TO FEED	
BAD STACKING	*

TOTAL

* AN ASTERISK IN THE TROUBLE COLUMN INDICATES A SERVICE HINT OR REFERENCE. EXAMINE THE TITLE TO DETERMINE IF THE SERVICE HINT WILL BE OF ASSISTANCE IN LOCATING THE PARTICULAR TROUBLE.

NOTE: SERVICE HINT NUMBER IS LOCATED ON GENERAL INSTRUCTION PAGE.



BOARD WIRING - PANEL 1

- A. Feed control. Primary and secondary feeds are controlled to feed alternately through cycle delay.
- Wire #1 -- (Equal - equal sequence) output from the units will provide an impulse to the common of cycle delay.
 - Wire #2 -- Normal output of cycle delay to cause primary feed.
 - Wire #3 -- Cycle delay picked on primary feed cycle.
 - Wire #4 -- Transferred output of cycle delay to cause secondary feed.
 - Wire #5 -- Cycle delay dropped out on secondary feed cycle.
 - Wire #6 -- To provide impulse to cycle delay common through wire #1 on first cycle after error reset.
- B. Pocket Selections.
- Wire #7 -- To cause all primary cards that feed as a result of an impulse to the eject clutch to select into pocket #1.
 - Wire #8 -- To cause all secondary cards that feed as a result of an impulse to the secondary clutch to select into pocket #4.
 - Wire #9 -- To cause all secondary cards that feed without an impulse to the secondary clutch to select into pocket #3.
- C. Error Stop. All unequal conditions (low secondary, low primary, high primary sequence, low primary sequence) are wired to error stop. Selectors are used to prevent back circuits.
- D. Control Input. Normal wiring.
- E. Restore. Normal wiring.
- F. Sequence and Selector Unit Entry. All positions to be wired to whatever columns the customer was using on his board.

TEST NO. 1

CONTROL PANEL: Wire control panel as shown in Figure 1.

CARDS: All equal cards.
All cards are punched 4-6-4-6-4-6, or any two digits other than nine (9) and zero (0). 4 and 6 are easy to read when set up in the unit.

PURPOSE FOR SUGGESTED PUNCHING:

- Provides heavy electrical load.
- Makes it easy to recognize the setup of a wrong digit.

OPERATION: Feeds will operate alternately as controlled by cycle delay. Only equal control relays R-26 and R-23 should pick. Primary cards are selected into pocket one (1) and secondary cards are selected into pocket four (4).

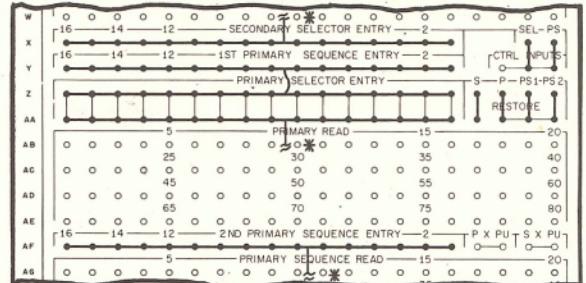
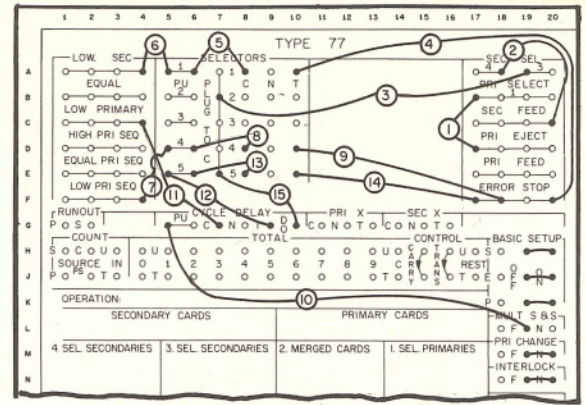
ERROR STOP: All unequal conditions are wired to error stop. (Low Pri - Low Sec - Low Pri Seq - High Pri Seq.) Selectors are used to prevent back circuits.

WHEN THE MACHINE STOPS WITH AN ERROR LIGHT:

- Pick R50 manually.
- Examine Relays 22, 24, 25, 27 to determine which unit caused the error.
- Examine the appropriate unit to determine the conditions causing the error.
- Check unit conditions and probable causes. (below)

NOTE: ERROR STOP NORMAL ON R.I. & R.O.

- UNIT CONDITIONS AND MOST PROBABLE CAUSES
- ALL ZEROS
 - Restoring bail failed to latch up.
 - Clutch failed to unlatch. Service Hint #9 and 14.
 - Reading brush circuit. (Common brush card lever, etc.)
 - ONE POSITION AT ZERO
 - Individual reading brush circuit
 - Individual setup magnet.
 - ONE POSITION AT NINE
 - Individual magnet armature failed to remain latched.
 - Setup magnet adjustments or wear (see Service Hint #8)
 - Oil between armatures and core. (See Service Hint #13)
 - Oil on knock-off bail. (See Service Hint #13)
 - Broken restore bail spring.
 - Residual magnetism (arm touching both cores). See Service Hint #8.
 - Knock-off adjustment. (See Service Hint #6)
 - Restoring bail adjustment. (See Service Hint #6)
 - Excessive operating strap tension. (See Service Hint #7)



BOARD WIRING - PANEL 2

- A. Feed Control. Feeds are controlled through basic setup switches.
- B. Pocket Selection.
- Wire #1 -- To cause all primary cards that feed as a result of an impulse to the eject clutch to select into pocket #1.
 - Wire #2 -- To cause all secondary cards that feed as a result of an impulse to the secondary clutch to select into pocket #4.
 - Wire #3 -- To cause all secondary cards that feed without an impulse to the secondary clutch to be selected into pocket #3.
- C. Error Stop.
- Wire #4, 5, 6 -- (Low secondary) output to cause error stop. (With matched decks there should be no low secondaries.)
 - Wire #7, 8, 9 -- (Low primary sequence) output should cause error stop.
 - Wire #10, 11, 12, 13, 14 -- To cause an error stop if a (low primary) output follows another (low primary) or an (equal - equal primary sequence) output.
NOTE: Wire #10 provides a pick to cycle delay on (low primary) and on (equal - equal primary sequence) conditions.
 - Wire #15 -- Drops out cycle delay.
- D. Control Input. Normal wiring.
- E. Restore. Normal wiring.
- F. Sequence and Selector Unit Entry. All positions to be wired to whatever columns the customer was using on his board.

TEST NO. 2

CONTROL PANEL: Wire as shown in Figure 2.

CARDS: Two matched decks.
1. Use the customer's cards and reproduce a second matched deck.
2. Or matched test decks.

OPERATION: Feeding is controlled by basic setup switches. Primary cards are selected into pocket 1 and secondary cards are selected into pocket 4.

ERROR STOP: (Low secondary) and (low primary sequence) conditions should never exist and are wired to error stop. A (low primary) condition should never follow another (low primary) or an (equal - equal sequence) condition and is, therefore, wired to stop through cycle delay.

WHEN THE MACHINE STOPS WITH AN ERROR LIGHT:

- Pick R50 manually.
 - Examine Relays 22-27 to determine which unit caused the error.
 - Examine the appropriate unit to determine the condition causing the error.
 - Check unit conditions and probable causes. (below)
- NOTE: When restarting the machine after an error, another error may occur. This should not be investigated

NOTE: ERROR STOP NORMAL ON R.I. & R.O.

- UNIT CONDITIONS AND MOST PROBABLE CAUSES
- SETUP ONE OR MORE DIGITS OFF
 - Read brush -- condition or timing.
 - Restoring bail timing.
 - Bind in ratchet. (See Service Hint #7)
 - Bind in differential link. (See Service Hint #7)
 - Excessive operating strap tension. (See Service Hint #7)
 - Loose pawl pivot rod. (set up in unused position.) See Service Hint #4.
 - CARD IN POCKET 3
 - Secondary clutch failed to latch up. (See Service Hint #9)
 - Pocket 4 selection failed.
 - CARD IN POCKET 2
 - Eject clutch failed to latch up. (See Service Hint #9)
 - Pocket 1 selection failed.
 - Pockets 3 and 4 selection failed (sec. card).

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(QUICK TESTS)

(TESTS)