IBM Customer Engineering

Reference Manual

1622 Card Read-Punch

IBM **Machine Record**

MACH TYPE	SERIAL NUMBER	DATE INSTALLED	

SPECIAL FEATURES – ENG CHANGES

			INSTALLED		REMOVED
B/M NO.	CEM NO.	DESCRIPTION	FIELD PLANT F P	DATE	DATE

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Customer Engineering Reference Manual

1622 Card Read–Punch

This manual, Form 227-5715-1, is a minor revision of Form 227-5715-0. Incorporated in this revision is a new installation procedure formerly contained in Supplement S27-5831-0.

This 1620 Reference Manual and the 1623 Reference Manual are a result of "fractionalizing" the 1620 Additional Features Reference Manual, Form 227-5540-1, which is now obsolete.

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IBM, Product Publications Department, Rochester, Minn., 55901.

CONTENTS

SAFETY

Personal safety cannot be overemphasized. To ensure your own safety, make it an every day practice to follow safety precautions at all times. Become familiar with and use the safety practices outlined in IBM Form 124-0002, a pocket sized card issued to all Customer Engineers.

Exercise caution when working around moving parts of the machine. Parts of the body or clothing near the machine can cause accidents if the machine starts unexpectedly. These accidents can be prevented.

Remember, although the cog-type timing belts look like large rubber bands, they have an internal cable construction that can cause injuries as severe as those caused by gears. Do not place fingers near them when guards are off and power is on.

Do not crank machine by pulling on drive belts. Do not trip the feed clutches with your finger; use the manual clutch trip knobs and turn the mechanisms using the hand wheel on the read mechanism or the hand crank on the punch mechanism.

CAUTION: Even though the voltage range on the 1622 is low, extreme caution should be exercised in the power supply area. Each heat sink is at an electrical potential. Do not short heat sinks to each other or to the machine frame.

Remove the power plug (1620) and wait for at least one full minute after power is off before attempting any repair or adjustment within the power supplies.

CAUTION: The IBM 1622 receives primary power (208/230 v) from the 1620. When working around power terminals, disconnect the 1620 power plug from the receptacle.

CONTENTS

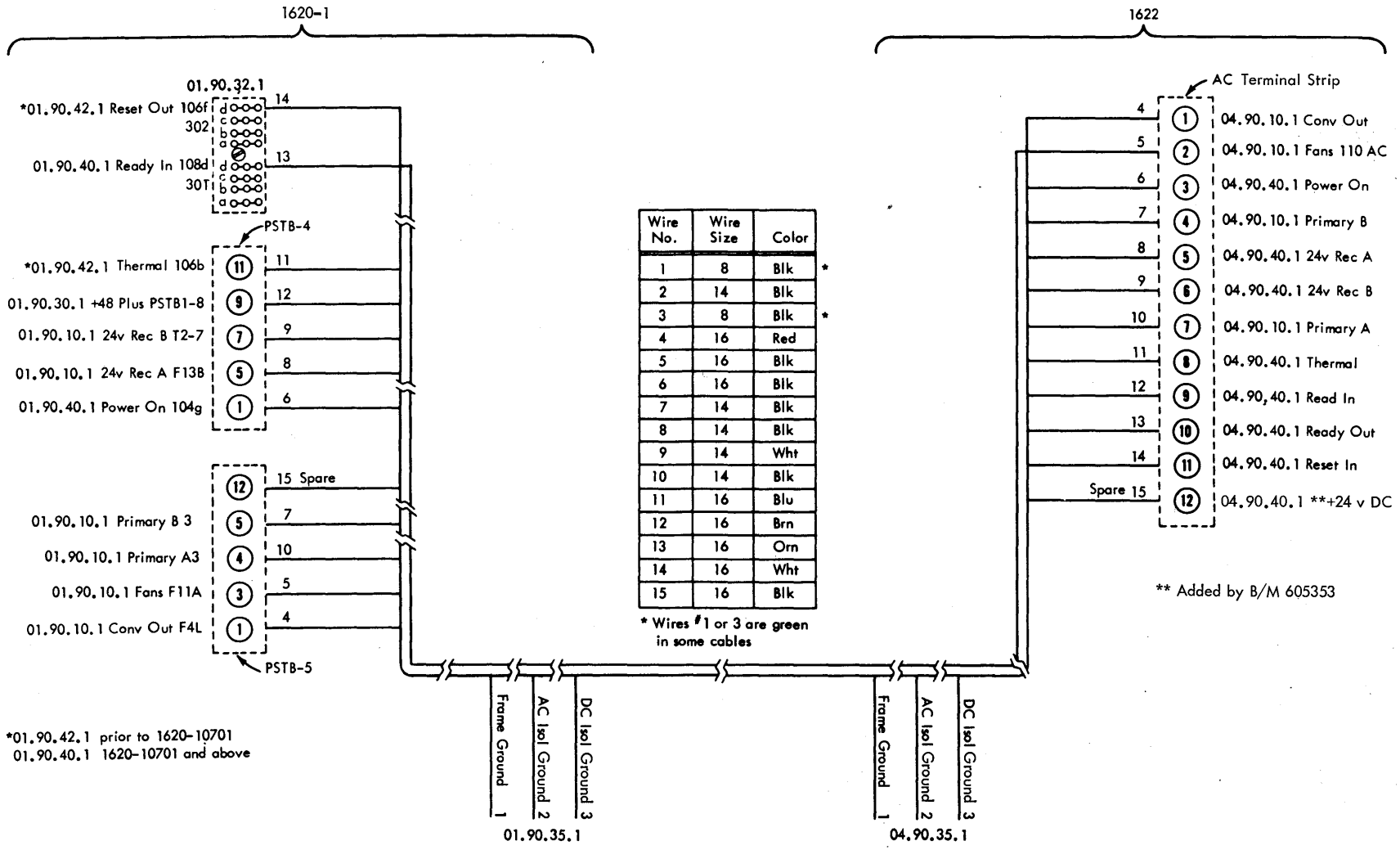
1.1 IBM 1622 INSTALLATION PROCEDURE

NOTE: Before installing a 1622 on a 1620 Model 2 ensure that Factory E.C. 805771 or F.B.M. 605353 is installed in the 1622. If there is a wire on AC 12-12 in the 1622, other than the wire from the interconnecting power cable, this change is installed.

AC 12 is located behind the 1622 fuse panel.

Verify that the jumper in the 1622, from A1A02L to A1E14P, is removed. This jumper may have been removed by prior installation of either the compatibility change described above or by the addition of process metering.

1. Open or remove all machine covers as necessary. Remove all shipping braces and blocks. Remove the chip box.
2. Inspect both feeds and card transport areas for shipping damage or loose parts.
3. Inspect all gears, shafts, and bearings.
4. Trip the clutches and crank the machine by hand. Check all operating units for freedom from binds and proper operation. Check armature of K2 for binds.
5. 1620-1: Two identical inter-machine signal cables P/N615036 and one power-sequence cable P/N615037 are used to connect the 1622 used with the 1620-1. Route the two signal cables through the hole in the 1622 base before routing the power sequence cable through the hole. Connect one signal cable between 1620 SCB (front) and 1622 connector AYA. Connect the other signal cable between 1620 connector (SCC rear) and the 1622 connector AZA. Shoe connectors SCB and SCC are located next to the lower gate-A and gate-B hinges.
   1620-2: Two machine signal cables P/N 2158840 and one power-sequence cable P/N 2158845 are used to connect the 1622 used with the 1620-2. Route the two signal cables through the hole in the base before routing the power-sequence cable through the hole. Connect the first signal cable between 1622 connector AYA and 1620-2 connectors 11DS31 and 11DS32. Connect the other labeled signal cable between 1622 connector AZA and 1620-2 connectors 11DS29 and 11DS30. The 1620-2 DS are located behind the hinge end of the "AA" and "B" gates of the 1620-2 as viewed from the rear.
6. 1620-1: Connect the 1620 end of the power sequence cable to EC302, EC301, PSTB-4, PSTB-5, frame ground, AC isolation, and DC isolation using cable diagram 615037 and Figure 1-1 or Systems Diagram 01.90.32.1 for reference. Wire No. 15 between TBAC-12 in the 1622 and PSTB5-12 in the 1620 is not used and may be taped back.
   1620-2: Connect the 1622 power sequence cable cannon connector to the cannon connector in the 1620-II labeled 1622. The cannon connector is located behind the 1620-2 power sequence panel as viewed from the front of the machine.
7. 1620-1: Connect the 1622 end of the power sequence cable as shown in Figure 1-1. The location of the AC terminal strip is shown in Figure 6-12. Ground connection locations are shown in Figure 6-5.
   1620-2: Connect the 1622 end of the power sequence cable to AC 12 using Figure 1-2 as a guide (also see logic page 10.04.38.1).
8. 1620-1: Arrange jumpers as required for various machine combinations shown by jumper chart on Systems Diagram 01.90.32.1.
9. Verify that the regulating transformer terminal -4 or -5 is wired for the correct AC input voltage (04.90.20.1).
10. Turn power on and check all power supply voltages at the marginal check voltage panel. Check that all cooling fans are operating.
11. Test the machine with Diagnostic Test I/O02 and I/O03 (see Section 2) to ensure that all units are operating correctly.



● Figure 1-1. 1620 Model 1 - 1622 Power Cable

1.2 PREPARATION FOR SHIPMENT

If needed, order the following B/M's from Rochester, Minnesota. Use these B/M's to prepare the system for shipment by padded van, air, truck, or rail.

Machine Type	Packaging Instruction Number	Carrier Type
1622	7360085	Truck, Rail, Air
	7360086	Padded Van

1.3 MACHINE SPECIFICATIONS

The following material is for information only. Any unique problems involving machine location, air conditioning, or power requirements should be referred to District Physical Planning through the customer's salesman. Detailed information on physical planning can be found in the IBM 1622 and 1623 Physical Planning Bulletin.

1.3.1 Weights

Unit	Total
1622 Card Read-Punch	1226 lb.

1.3.2 Unit Dimensions with Covers

Unit	Length	Depth	Height
1622 Card Read-Punch	57.5"	30"	45.5"

1.3.3 Unit Dimensions without Covers

Unit	Length	Depth	Height
1622 Card Read-Punch	54.8"	27"	42.8"

1.3.4 Service Clearances

Unit	Front	Rear	L-Side	R-Side
1622	36"	42"	36"	36"

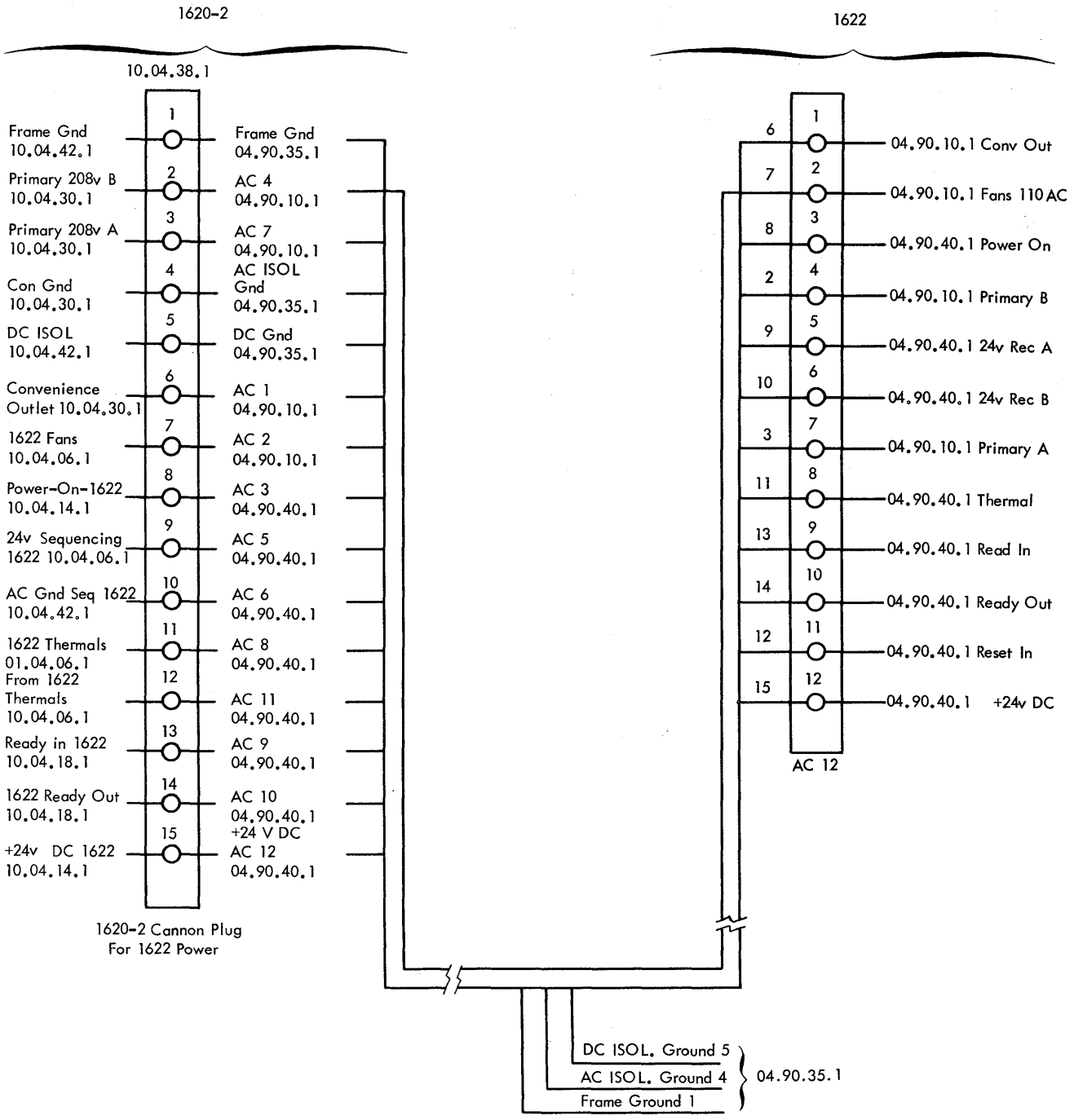
1.3.5 Temperature Requirement

The air entering the 1620 System must be between 60° and 90° F whenever the system is operating.

Normal heat dissipation for the 1622 is 5500 Btu/hour.

1.3.6 Air Filtration Requirement

Normal filtration of the area for dust control can be met with filters that have an efficiency rating of 20% by the National Bureau of Standards Discoloration Test method. Special air filtration is necessary in only those installations which will be subject to corrosive gases, salt air, or unusual dirt or dust conditions.



● Figure 1-2. 1620 Model 2 - 1622 Power Cable

CONTENTS

2.1 APPROACH TO SCHEDULED MAINTENANCE

The prime objective of any maintenance activity is to provide maximum machine availability to the customer. Every scheduled maintenance operation should assist in realizing this objective. Unless a scheduled maintenance operation reduces machine downtime, it is unnecessary.

Do not adjust or disassemble a unit that is working properly.

2.1.1 Visual Inspection

Visual inspection is the first step in every scheduled maintenance operation. Always look for corrosion, dirt, wear, cracks, binds, burned contacts, and loose connections and hardware. Alertness in noticing these items may save later machine downtime.

2.1.2 Electronic Circuits

Diagnostic programs, marginal checking, and pulse checking are the three basic tools used in scheduled maintenance of electronic circuits. All of these are effective in locating potential and intermittent troubles. These items are also excellent troubleshooting tools.

Do not adjust pulses unless the condition of the machine warrants it.

2.1.3 Mechanical Units

The three basic scheduled maintenance steps performed on every mechanical or electromechanical machine are: clean, lubricate, and inspect. Remember, do not do more than recommended scheduled maintenance on equipment that is operating satisfactorily.

1622 Scheduled Maintenance Routine

Code	Unit	Freq	Lubricate --- Clean	Observe
4	Punch Unit	6	Felt wicks for punches ---------- No. 9 Punch bail cam follower bearings ---------- No. 20	Check cam followers for wear and proper adjustments (Section 4.4.15).
4	Punch Transport	13	Clean feed path Contact and feed roll hanger pivots stacker pusher pivots, latch cam follower and clutch and all other pivots ---------- No. 9 Gears, aligner cams, roll opening and offset cams, punch clutch latch cam, extension spring ends, stacker joggler cams ---------- No. 17	Check brushes for wear and damage Check brush timing (Section 4.4.14). Check punch registration (Section 4.4.15).
4	Punch Unit		Felt wicks for latches ---------- No. 9 Latch spring hooks ---------- No. 17 Punch cam follower pivots and bearing links (4 grease fittings) ---------- No. 20	Check for excess internal backlash in the geneva mechanism on at least two intermittent motion cycles. Check throughout the movement portion by holding input pulley and rocking intermittent rolls back and forth (Section 4.4.7).
1	Read Clutch		Armature, latch and keeper pivots, load and detent pawl pivots ---------- No. 6 Clutch intermediate arm pivot ---------- No. 9 Continuously running clutch drive wheel, clutch needle bearing grease fitting, keeper and latch working surfaces ---------- No. 17 Reverse lock grease fitting ---------- No. 20	Check for excess motion between drive pawl and detent when clutch is engaged (Section 4.2.7).
0	Filter			Replace if dirt is visible from inside.
1	Read Feed	26	Clean feed path Ball bearing hanger and all other pivots ---------- No. 6 All gears, P.K. cams, spring ends ---------- No. 17	Check brush wear and for damaged strands. Check brush timing (Section 4.2.4).
3	CB's		CB drive gears ---------- No. 17 NOTE: Circuit breakers and cam surfaces must be completely free of oil and grease.	Check clearance and condition of contacts (Section 4.4.16) Check timing of CB's connected to CE Aid Panel (Section 5.4.1).
4	Punch Clutch		Latch cam follower, all other clutch pivots and dog stud ---------- No. 9 Latch cam, armature at latch pivot ---------- No. 17	Section 4.4.5.
5	DRIVE Read and Punch		Fill geneva housing to line, drive motors oil cups ---------- No. 9 Geneva gears ---------- No. 17	Check geneva gears for wear and for loose pins (Section 4.4.7)
9	Misc			Check line cords for safe condition and proper grounding (Section 1.1)
0	Base	52	Lubricate cover latches and latch operating surfaces ---------- No. 17	Check for loose cover screws.
5	Drive		Change geneva housing oil ---------- No. 9	

Chart for Scheduled Maintenance Required for the Ball Bearing Type Punch Unit

4	Punch Unit	26	Remove felt wick at top of punch unit and lubricate six oil lines ---------- No. 9 Lubricate latch wick, link pivots ---------- No. 9 Lubricate stripper cavity, latch spring hooks, armature pivots, set-up bail channel, cam surfaces ---------- No. 17 Lubricate six punch unit grease fittings, die locating studs ---------- No. 20	Check cam follower adjustments (Section 4.4.15). Check punch bail and set up bail for excessive wink. (Should not exceed .010" in any direction when cam followers are held tight against cam Section 4.4.15.)

CONTENTS

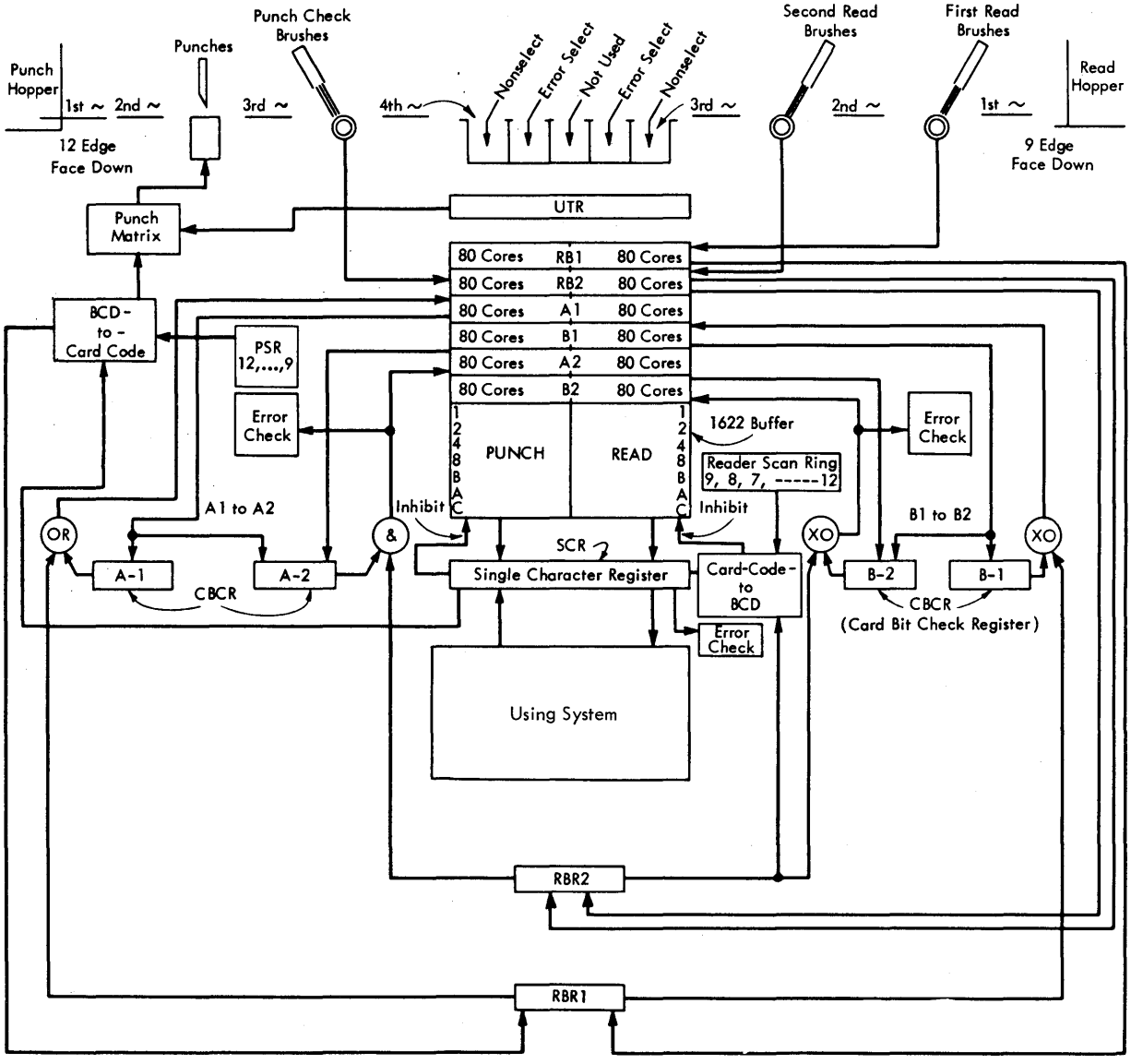


Figure 3-1. IBM 1622 Data Flow

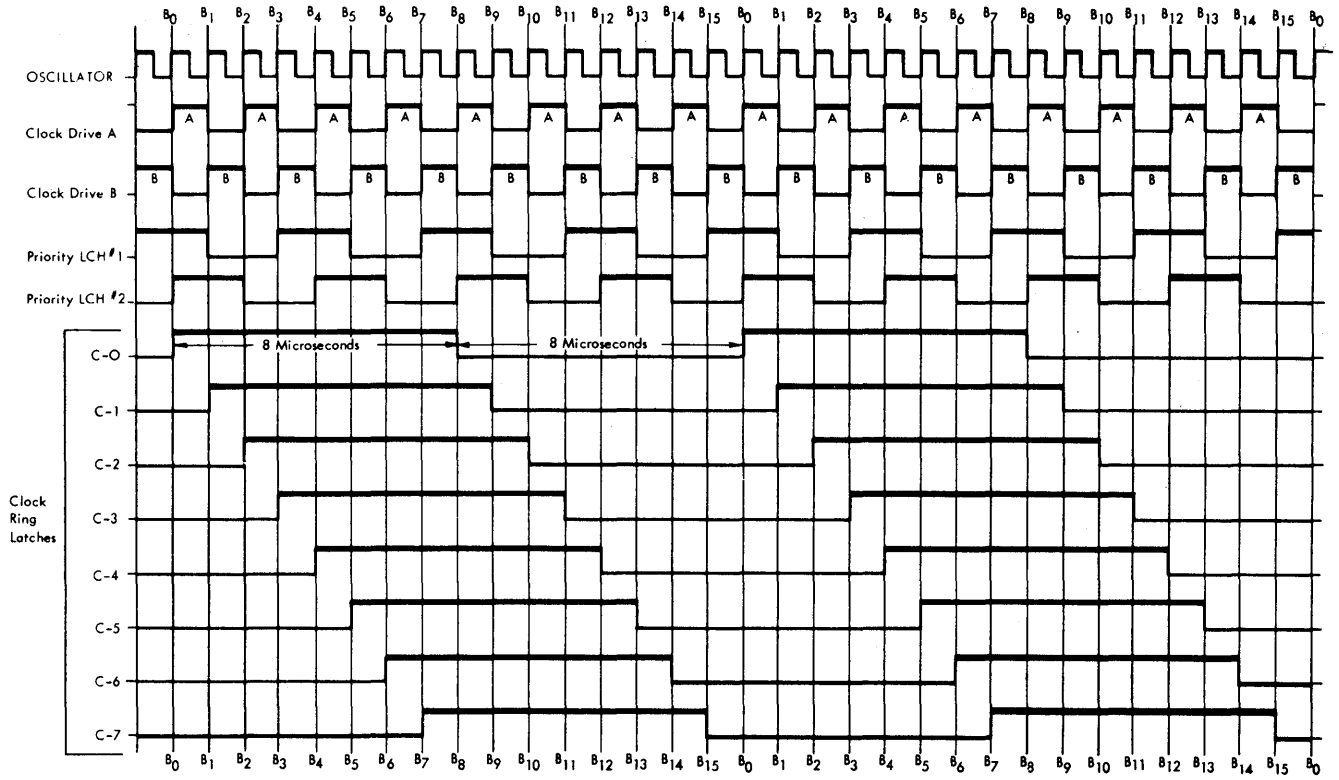


Figure 3-2. Oscillator, Priority Ring, and Clock Ring Timing

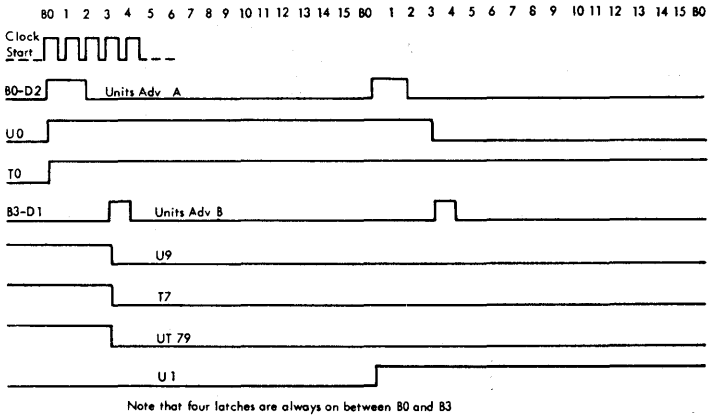


Figure 3-3. UTR Start Sequence

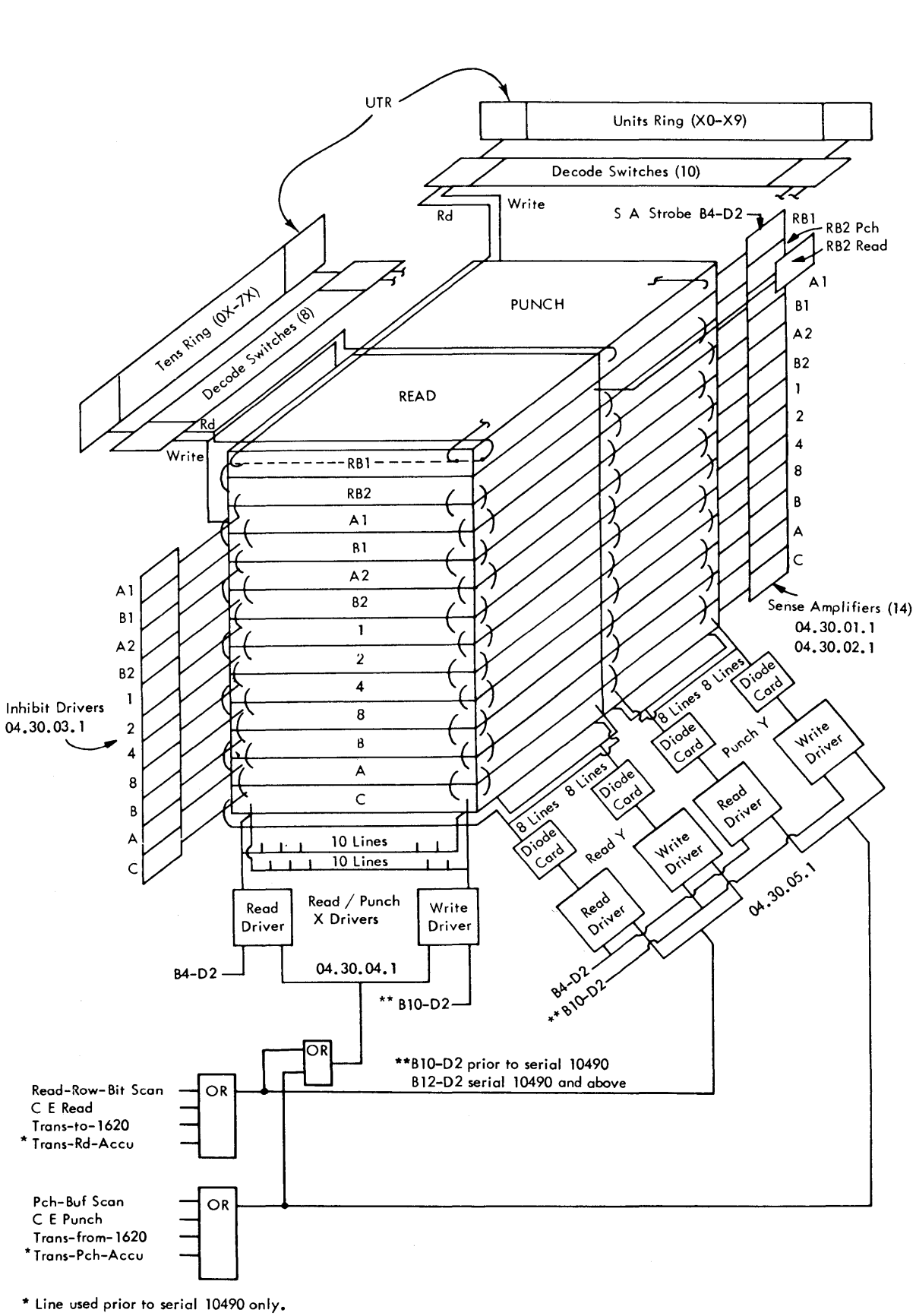


Figure 3-4. 1622 Buffer Logic

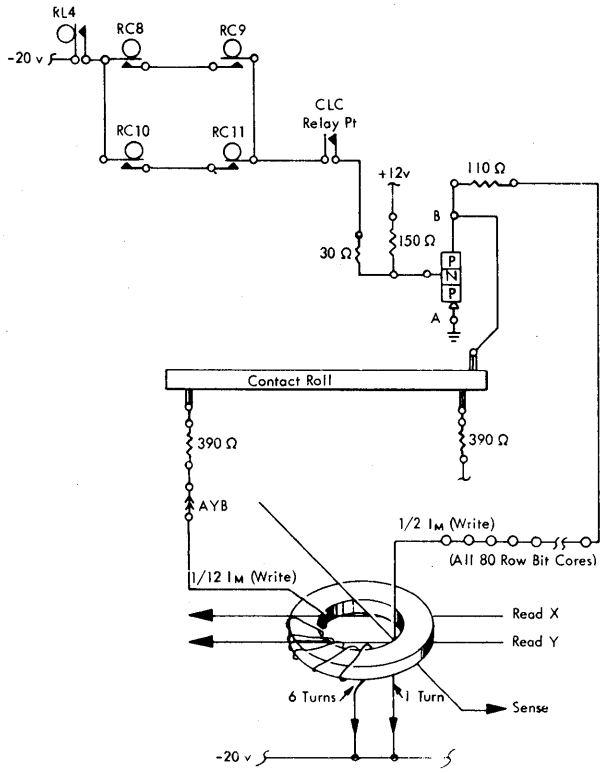


Figure 3-5. Writing into a Row Bit Core

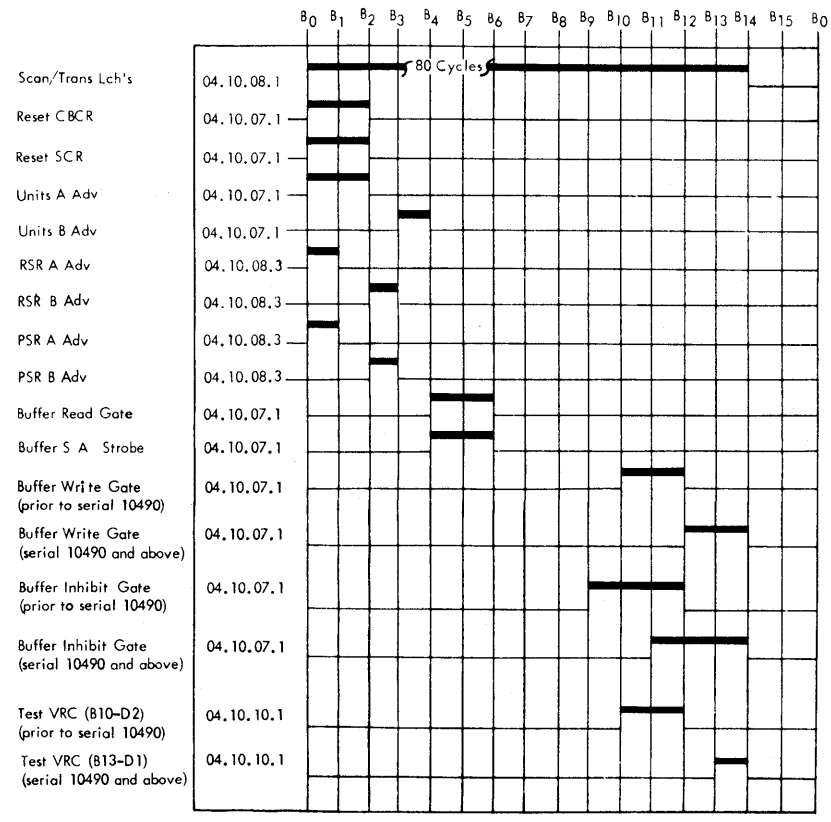


Figure 3-6. A-B Timing Chart

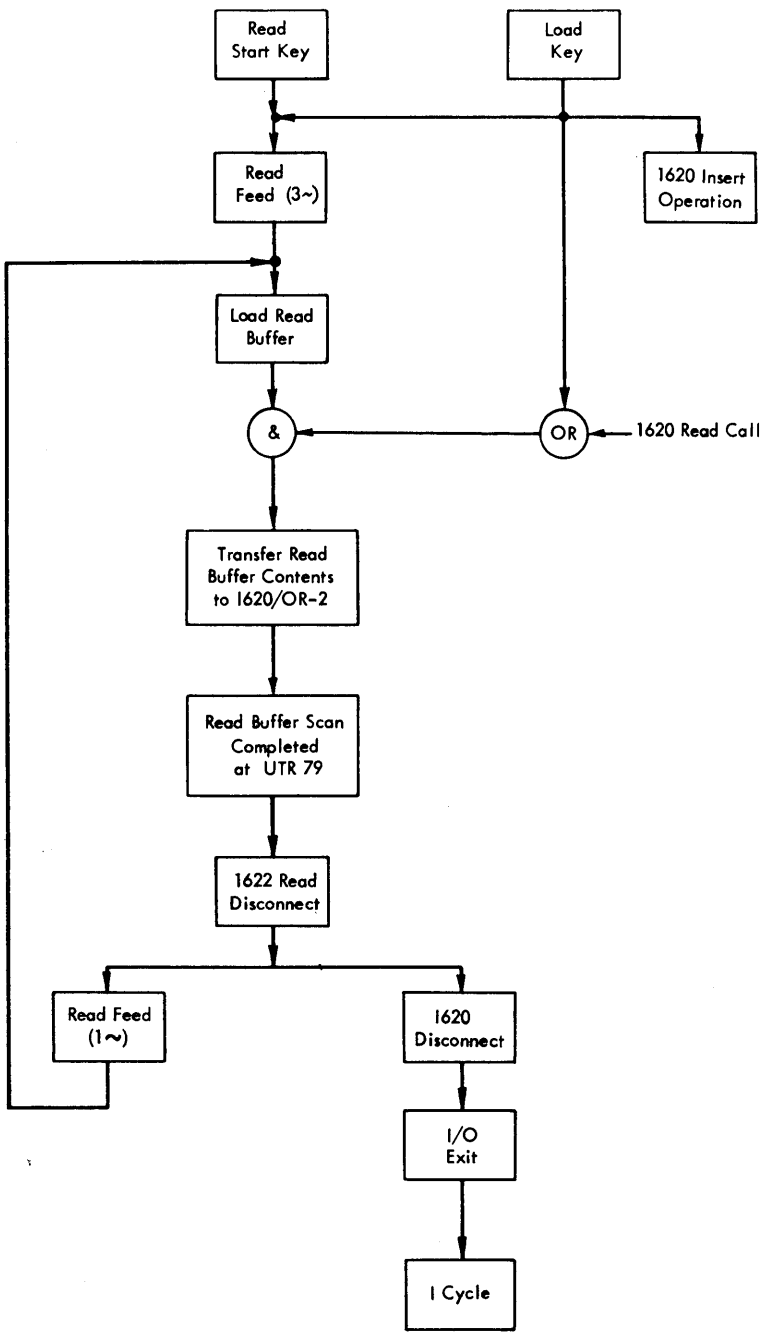


Figure 3-7. Read Operation Functional Objectives

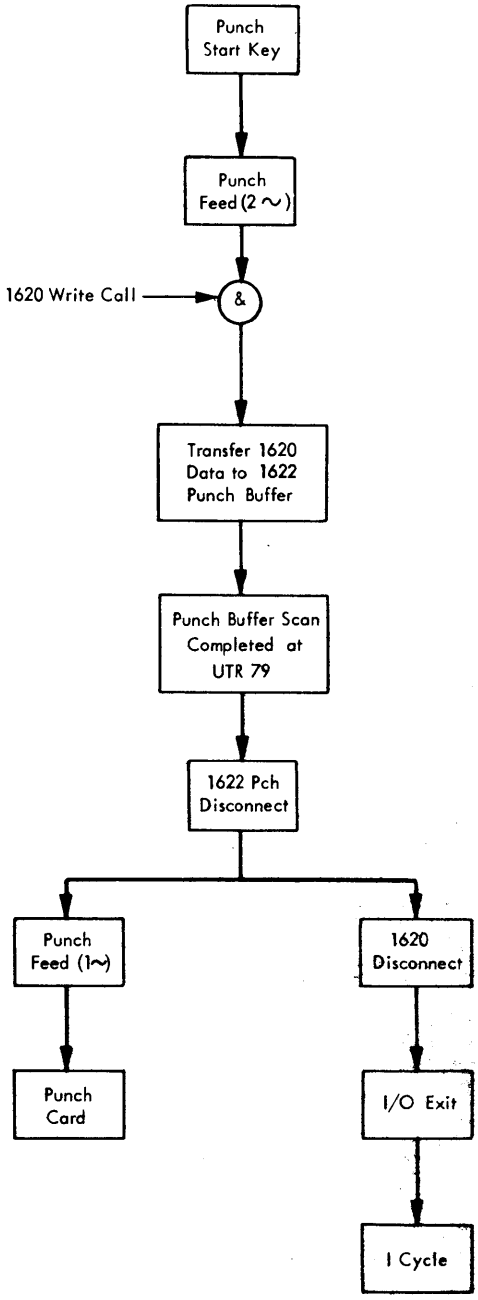


Figure 3-8. Write (Punch) Operation Functional Objectives

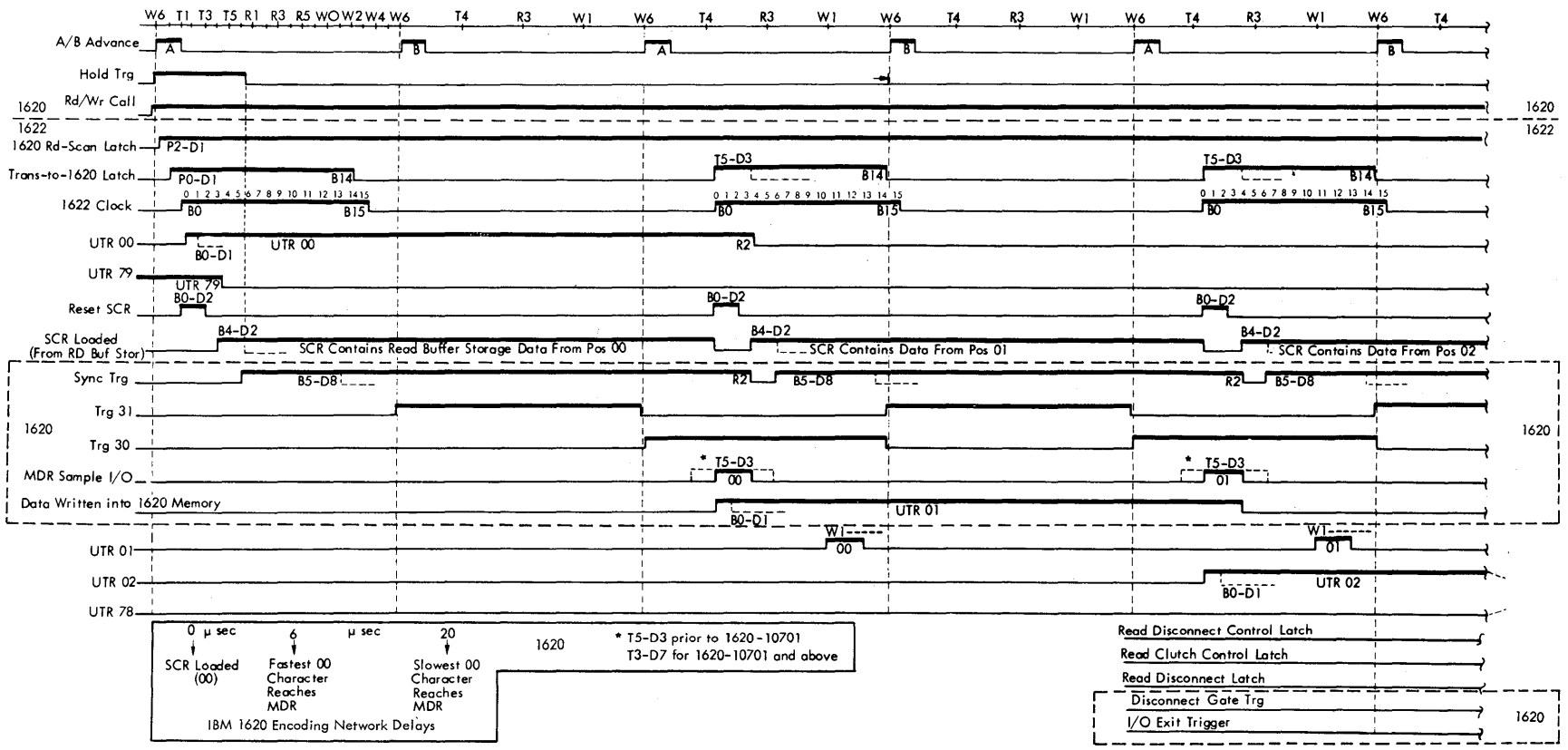


Figure 3-9a. Sequence of Read Numerically 1620-1622

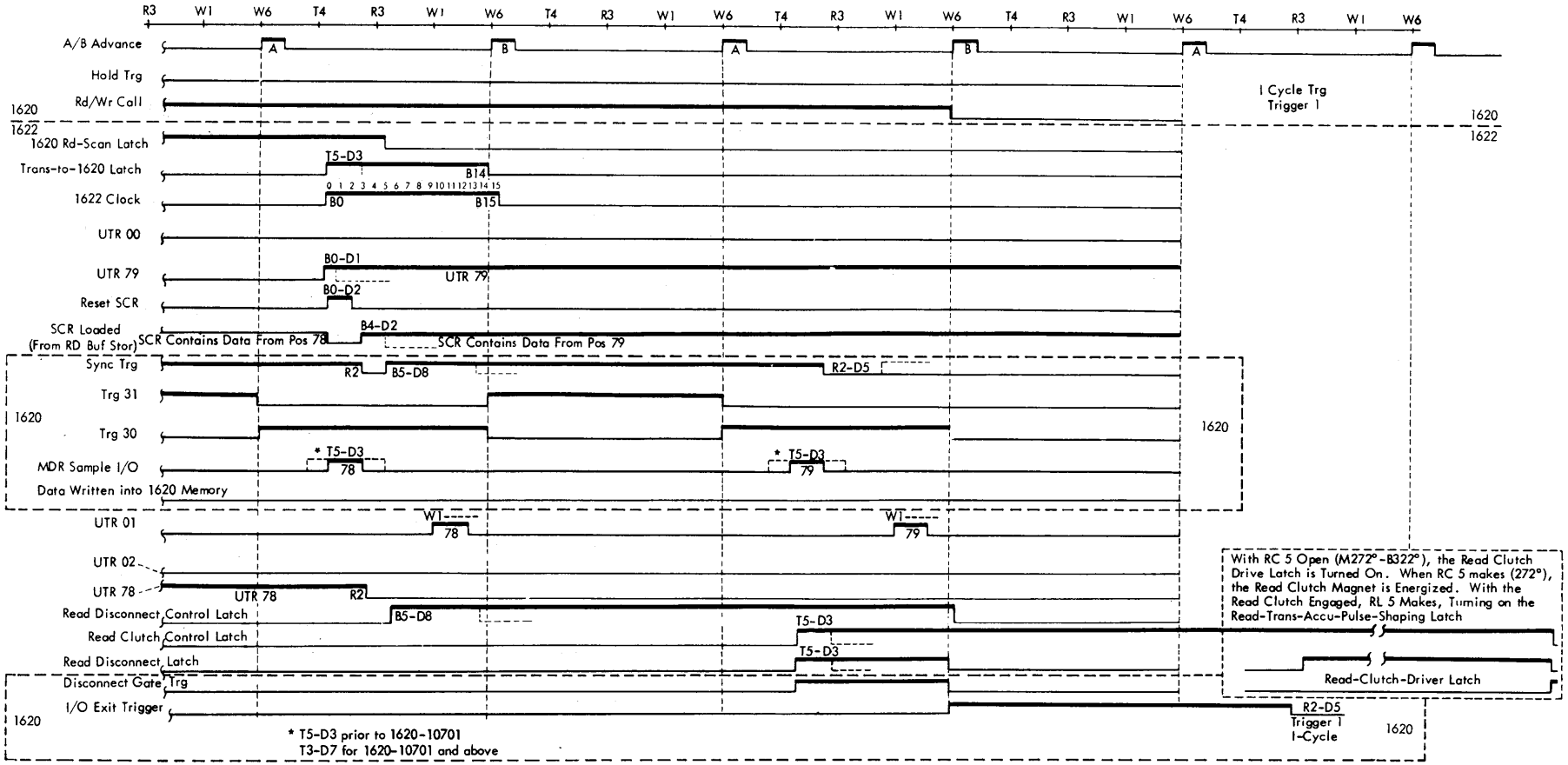
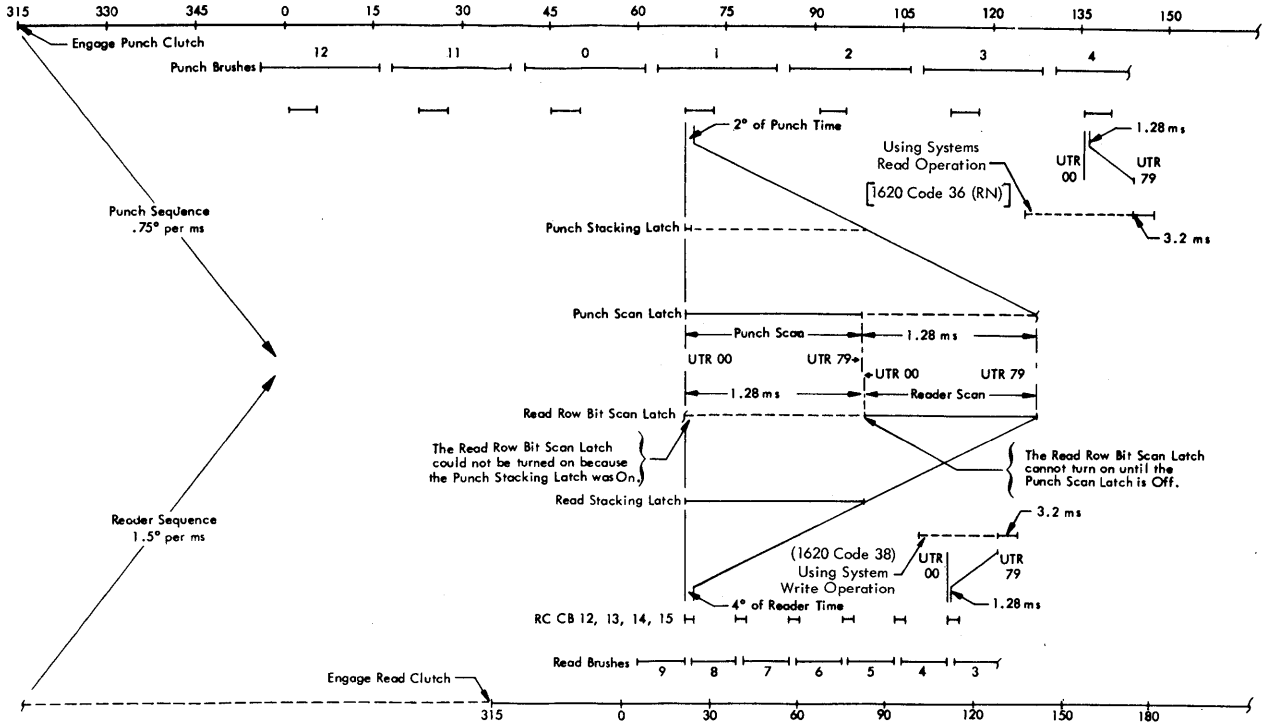


Figure 3-9b. Sequence of Read Numerically 1620-1622



Note: New timings for 1622-10490 and above are included with the machine diagrams (ILD 237)

Figure 3-10. Priority Sequence

Input

Read Alphamerically

CHAR	TAPE	CARD	RD BUF
Blank	C	Blank	C
.	0X821	12,3,8	AB821
)	C0X84	12,4,8	CAB84
-	X	11	B
$	CX821	11,3,8	CB821
*	X84	11,4,8	B84
,	C0821	0,3,8	CA821
(	084	0,4,8	A84
+	X,0,C	12	BAC
=	821	3,8	821
@	C84	4,8	C84
A-I	X0(1-9)	12,(1-9)	BA,(1-9)
J-R	X(1-9)	11,(1-9)	B,(1-9)
/	C01	0,1	CA1
S-Z	0(2-9)	0,(2-9)	A,(2-9)
0-9 (+)	(0-9)	(0-9)	(0-9)
$\overline{1}$-$\overline{9}$ (-)	X(1-9)	11,(1-9)	B(1-9)
$\overline{0}$ (-0)	—	11,0	CB841
0 (+0)	—	12,0	A
‡	028	0,2,8	A28
$\overline{‡}$	XOC28	11,2,8	B28

Read Numerically

CHAR	TAPE	CARD	RD BUF
Blank	C	Blank	C
J-R	X(1-9)	11, (1-9)	B(1-9)
$\underline{0}$-9	(0-9)	(0-9)	(0-9)
$\overline{0}$ (-0)	X or X0	11,0	CB841
+	X0	—	
0 (+0)	—	12,0	A
‡	082	0,2,8	A82
Num. Blank	C,84	4,8	C,8,4
$\overline{‡}$	XOC82	11,8,2	B,8,2

1620 Core Storage

ALPHA	NUM
C	C
C	3
C	4
2	C
1	3
1	4
2	3
2	4
1	C
3	3
3	4
4	1-9
5	1-9
2	1
6	2-9
7	C-9
5	1-9
5	C
7	C
C	C,2,8
C or 5	F,2,8

ALPHA	NUM
	C
	$\overline{1}$-$\overline{9}$
	C-9
	flag
	flag
	C
	C,8,2
	C,8,4
	F,8,2

Output

Write Alphamerically

PCH BUF	CARD	TAPE	TW
C	Blank	C	Space
AB821	12,3,8	0X821	.
CAB84	12,4,8	C0X84	)
B	11	X	-
CB821	11,3,8	CX821	$
B84	11,4,8	X84	*
CA821	0,3,8	C0821	,
A84	0,4,8	084	(
BAC	12	X0C	+
821	3,8	821	=
C84	4,8	C84	@
BA(1-9)	12,(1-9)	X0(1-9)	A-I
B,(1-9)	11,(1-9)	X(1-9)	J-R
CA1	0,1	C01	/
A,(2-9)	0,(2-9)	0,(2-9)	S-Z
(0-9)	(0-9)	(0-9)	0-9
B(1-9)	11(1-9)	X(1-9)	J-R
CB841	11,0	X	-
A	0	0	0
A28	0,2,8	EOL	Stop
B28	11,2,8	EOL	Nothing

Write Numerically

PCH BUF	CARD	TAPE	TW
A	0	0	0
B(1-9)	11,(1-9)	X(1-9)	$\overline{1}$-$\overline{9}$
(0-9)	(0-9)	(0-9)	0-9
CB841	11,0	X	$\overline{0}$
CB841	11,0	X	$\overline{0}$
A	0	0	0
A82	0,2,8	WN EOL DN 0,2,8	WN STOPS DN ‡
8,4,2	Blank	C,84	NUM @ Shift
8,8,2	11,8,2	EOL	Blank

Figure 3-11. Character Coding Chart

CONTENTS

4.1 POWER SUPPLIES

4.1.1 Primary Power Supply

Primary power is supplied to the 1622 from the 1620 CPU. The IBM 1620 System operates from either a 208-v or a 230-v, 60-cycle *, single-phase, 3-wire service line.

To change from 208 v to 230 v move the wire on terminal 4 to terminal 5 on the 1250-watt regulator (04.90.20.1).

CAUTION: Remove the 1620 line cord from outlet before changing voltage taps. Allowable voltage and frequency variation is the same as for the 1620 System.

*The 50-cycle version of the 1620 requires an input voltage of 195, 220 or 235 v AC. The 195 v AC supply can vary between the limits of 175 and 215 v AC. The 230 v AC supply can vary between the limits of 198 and 242 v AC, and the 235 v AC supply can vary between 211 and 259 v AC.

4.1.2 Individual Power Supplies

For normal operation the DC power supplies must be maintained within the specified levels as follows:

+12 from +11.52 to 12.48
-12 from -11.52 to 12.48
-20 from -19.20 to 20.80
+48** from +43.20 to 52.80

All machine functions must operate correctly when the +12M DC supply is varied between +10.2 and +13.8.

Line noise and ripple must not exceed 1.0 v peak-to-peak measured between a gate voltage bus and an adjacent ground pin. Measurement must be made with a fully shielded probe, with the shield supplying the only oscilloscope ground.

Removal

1. Turn off the main line switch, remove the 1620 line cord, and bleed the capacitors.

**Supplied by 1620

To discharge (bleed) capacitors:

a. Short posts 6 and 7 on SMS power supplies.
b. Short posts 6 and 8 on AC regulators.

2. Disconnect the leads to the particular supply to be removed.
3. Lift the two catches on the power supply rails. Slide the supply forward and out of the machine.

Replacement

Reverse Steps 2 and 3 of the removal procedure.

Voltage Check

The output of the regulator should be 133 v AC ±4%. All DC voltages should be within ±4% of their labeled values.

If an MC switch fails to make contact when transferred, voltages will not be supplied to the gate controlled by the switch. If an MC switch fails on the n/c side, the +12 v will not reach the gate. However, the marginal check voltmeter will indicate that everything is operating correctly.

Loose wires at voltage distribution connectors can cause loss of voltage to the gates while the voltmeter indicates correctly.

For installation and PM routine, measure all DC voltages at the card gates.

Servicing Hints

The following service hints should be helpful when troubleshooting 1622 power supply failures and may eliminate a costly and time consuming power supply replacement. These procedures can generally be accomplished with the power supply out of the machine. If one or more circuit breakers trip to the OFF position when power is applied, check their outputs for shorts to other voltage levels as well as to ground.

NOTE: A good ohmmeter that can peg to zero resistance on the R x 1 scale must be used, because of the very low total resistance of the circuits. Look for dead shorts. The minimum resistance to be expected can be found by dividing the supply voltage by the maximum output current.

If trouble is in an individual power supply, some of the following points may be useful:

1. On the logic diagrams, those parts enclosed within dotted or broken lines are located on the SMS cards or in the overvoltage device.
2. Series power supply transistors are those other than the ones on the power supply SMS cards.
3. With the power supply removed, you can wire 110 v AC into TB1 pins 1 and 2. Output may not reach full value, but should be close and adjustable (remove overvoltage device or overvoltage SMS card).
4. Visually inspect the unit for crimped wires or cable chafing (unit may work in opened position, but not in closed).
5. If the voltage is too high and cannot be varied by the adjusting control, check for shorted series power supply transistors (located on the large power supply heat sink), or for a bad power supply SMS card.
6. If the output voltage is high and CB1 did not trip, replace the overvoltage protective device or overvoltage SMS card (if supply is so equipped).
7. An open diode in the rectifier circuit shows up as low voltage under load. This can be detected by feeling the diodes; they are quite warm when operating normally. If one is cold, it is probably open.
8. A shorted diode in the rectifier circuit will probably trip the circuit breaker in the primary of the input transformer. It may also trip the overcurrent CB due to overvoltage spikes on the output. With the overvoltage device removed, the spikes can be scoped at the output terminals.
9. Shorted or open series power supply transistors can be detected by scoping or by checking the resistors in the emitter circuit for heat.
10. Check voltages after the machine has been on for 15 minutes. Voltage may drift slightly between cold and warm states.
11. Do not ground the meter or scope to the heat sink. Instead, ground to the holding screws at the corners of the unit.
12. If the system powers-down immediately after a power-up and the voltages of the various power supplies are correct, remove the overvoltage device from the power supplies one at a time and repeat the power-up sequence. If power-up is successful, the overvoltage device is faulty for that power supply.

4.2 READ FEED

4.2.1 Service Checks

1. Excessive timing variations in clutched CB's or brush pulses may be caused by one of the following:
   a. Loose clutch feed roll belt
   b. Loose screws in clutch pulley assembly
   c. Excessive flexibility of the clutch pulley shock mount because of defective bonding
   d. Excessive backlash in clutch (engaged) because of wear.
2. Contact roll is to be free of all rotational and axial play.
3. The dynamic timer dial must be concentric with the timer shaft to ensure reading accuracy. For adjustment see 4.2.8.

4.2.2 Speed

Adjust the motor pulley to feed 250 ± 3 cards per minute. Run the machine with cards for one minute and count the cards in the stacker and feed.

4.2.3 Hopper, Throat, and Picker Knives

1. Position the picker knife cam follower arms so that clearance (not to exceed .004") exists over the entire cam periphery (Figure 4-1). See 5.12 in Section 5 for picker knife cam shaft alignment procedure.

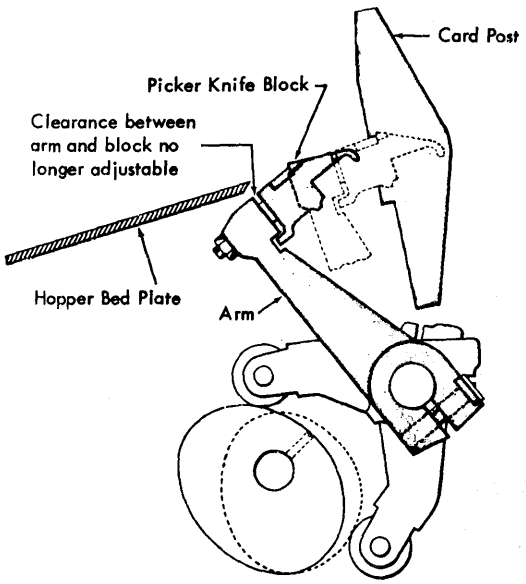


Figure 4-1. Picker Knives

2. The face of the throat knife must be .004" to .011" ahead of the periphery of the first upper feed rolls.
3. The inside faces of the card posts must be 3.265 + .000" -.005" from the face of the throat knife. Place a deck of cards in the hopper. Adjust the post mounting bar for a clearance of .010" to .015" (2 IBM cards) between the hopper posts and the deck of cards resting against the throat knife.
4. Position the feed knife arms for two conditions:
   a. The picker knives must travel .030" to .035" beyond the trailing edge of a card held against the hopper posts (3.28" +.005"-.000" from the face of the throat knife at the maximum point of backward travel).
   b. The picker knives must be parallel to the first set of lower feed rolls and aligned to within .003" of each other.
5. The trailing edge of the card should be even with the throat knife at approximately 76^{o}. This is a preliminary adjustment.
6. The throat roller must be positioned so that the step indicating the center line of the roller is lined up with the throat knife face. It must also be positioned so that the plane described by the surface of the roller and the two picker knives is in the same plane as the card line described by the first set of feed rolls.

WARNING: Using a feeler gage in the reader throat with power up can blow the fuses on the top of the SMS gate.

7. Position the throat knife vertically to obtain an opening of .0095" Go and .0105" No-Go.
8. There must be .020" to .050" clearance between the fingers of the hopper back plate and the hopper bed plate (Figure 4-2).
9. The inside surface of the right hopper end plate should be .308" ± .003" from the inside surface of the machine side frame.
10. The hopper side plates must be set so that the opening between them is 7.381" + .005" — .000". Fill the hopper half full of cards. Adjust the left hopper side plate for .006" to .011" clearance over the length of the cards.

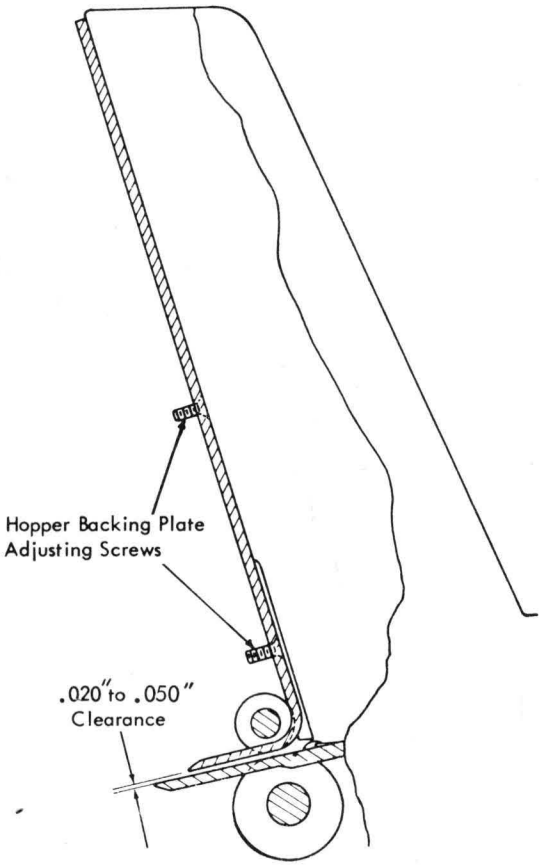


Figure 4-2. Hopper Backing Plate Clearance

4.2.4 Read Brushes

1. With brush unit down and locked, check for .015" to .040" between brush separator bar and contact roll (Figure 4-3).
2. Brushes must be centered in the separator bar.
3. Brush block should be centered within the holder assembly. (Use two Allen head set screws in holder assembly.)
4. Brush tracking is set by adjusting screws in the machine side frame. These screws are located in the holder assembly guides in the side frame and should be adjusted to give a maximum of .005" clearance to the brush holder assembly to allow brushes to be removed from machine.

Read Brush Timing

Time the first and second read brushes by shifting them off the scribe line. Brushes must make $+2^{o}$ (-0^{o}) before the line of index, and all brushes must make within $1\text{-}1/2^{o}$ of each other (dynamically timed). The brushes should break $\pm 4^{o}$ past line of index.

For Machines Prior to 1622-10490. Dynamic timing of the read brushes on the 1622 is made difficult by possible back circuits that can exist. If any brush at either read station is reading a punched hole at the same index time (9, 8, etc.) as the particular brush being checked, the worst timing condition between the two (or more) columns will be indicated by the dynamic timer. For this reason, it is necessary to lift the brush block at the station not being checked and to use a test card with different punches (9, 8, etc.) at each end.

For 1622-10490 and Above. The single read brush display switch used on earlier machines has been changed to an individual switch for each read brush

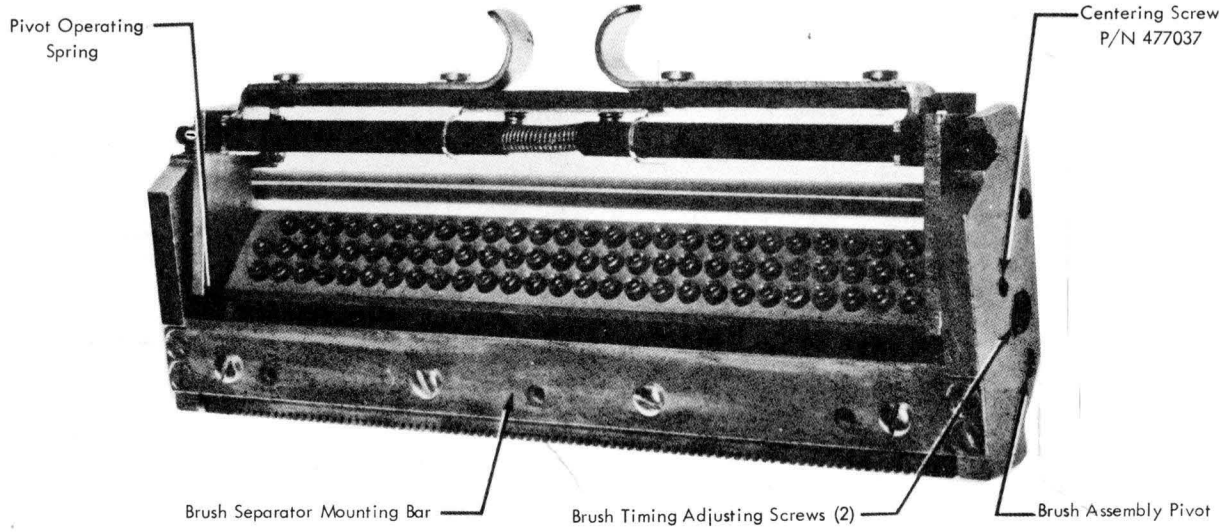


Figure 4-3. Read Brushes

station. This prevents the back circuit that previously existed between the two read brush stations when brush timing was dynamically checked with the brush selection switch. The additional switch does not prevent back circuits that exist between brushes of the same brush station. The read error bypass switch should be transferred to prevent false error indicators when read brush timings are checked in an on-line condition.

4.2.5 Read Card Levers

1. Position all card lever contacts to give a minimum contact travel of 1/16".
2. Position card levers to provide 1/64" rise of the n/o contact strap off its support bar.
3. Adjust the contact for 1/32" minimum air gap.
4. All card levers must be timed according to the timing chart in System Diagrams.

4.2.6 Card Guides

1. Position the first lower card guide .005" to .015" below the card line.
2. Position the second lower card guide .015" to .025" below the card line.
3. Allow .003" to .010" clearance between phenolic guides and contact rolls.
4. Position the hopper bed plate finger for a minimum of .010" clearance from the contact rolls.
5. Position the upper card guide assembly for .020" to .050" to the first lower card guide.

4.2.7 Read Clutch

Adjustments to the read clutch may be made with the clutch in or out of the machine.

Read Clutch Adjustments (250 CPM)

1. Adjust the clearance between armature and upper yoke to .020" to .022" with latch against backstop (Figure 4-4a).

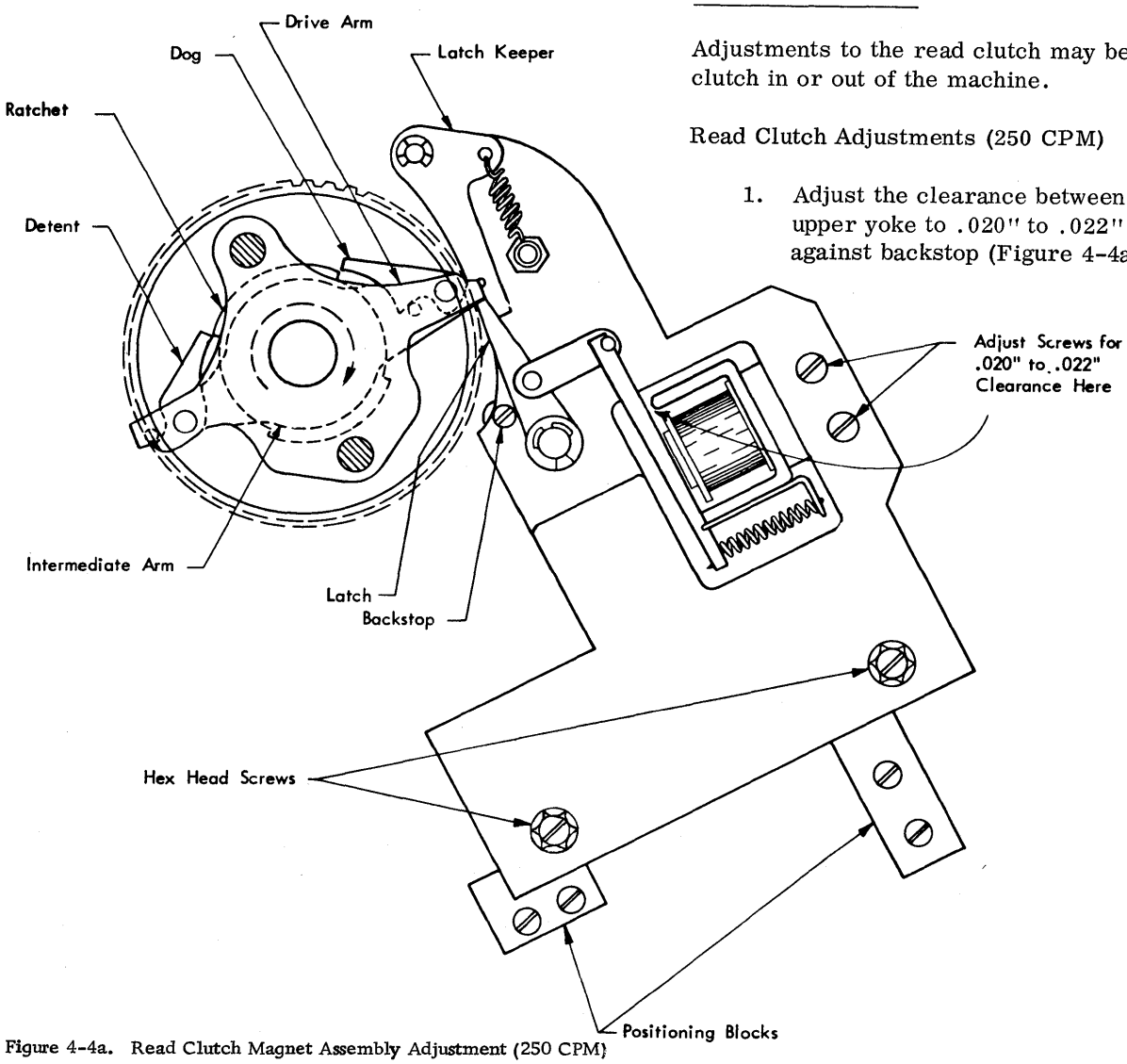


Figure 4-4a. Read Clutch Magnet Assembly Adjustment (250 CPM)

2. Position the complete clutch assembly (Figure 4-4a) so the following two conditions will be met.
   a. The drive arm should clear the keeper at the point opposite the keeper pivot by 1/32".
   b. With the armature fully attracted (Figure 4-4b), there should be an unlatching clearance of .008" to .012".

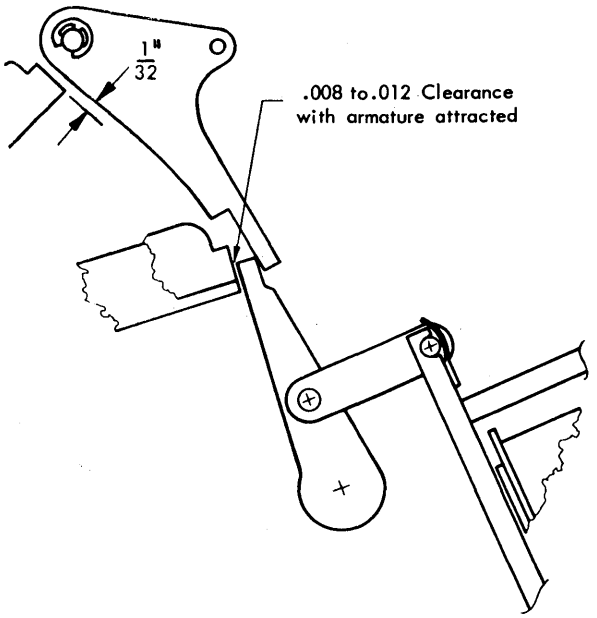


Figure 4-4b. Read Clutch Unlatching Clearance (250 CPM)

NOTE: When these conditions are met, the drive arm and intermediate arm should meet the latch squarely.

3. After tightening the clutch plate assembly mounting screws, set the two positioning blocks to maintain clutch adjustments on future removal.
4. Check for maximum of .002" clearance between the step in the ratchet wheel and the detent (backlash) with the clutch engaged. If more than .002" clearance, replace with a longer detent.

NOTE: Seven new detents are available. P/N 609737 is .002" longer than the present detent and the others are graduated in .002" increments up to P/N 609743.

Read Clutch Adjustments (500 CPM)

Steps 1 through 4 should be performed when a new clutch assembly is installed or when complete adjustment is to be made of the center plate assembly and clutch magnet assembly. When this is to be made, the read clutch locating plate gage (P/N 610147) must be used.

NOTE: Use of this tool will insure a parallel condition between drive arm latch surface and the latch at latch-up time (Figure 4-5a(A)).

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

The following sequence is used to adjust the clutch:

1. Remove clutch pulley.
2. Remove latch keeper and latch from center plate assembly.
3. Position locating gage on center plate assembly studs and clutch pulley assembly shaft (Figure 4-5b). Position and secure locating block with center plate assembly as far left as possible. Remove gage.
4. Reinstall latch keeper, spring, and latch.
5. Adjust armature pivot bracket to maintain .002" to .005" clearance between armature and core (Figure 4-5a).
6. There should be .020" to .022" clearance between armature and yoke with latch against backstop (Figure 4-5a).
7. Manually attract the armature and position the latch assembly plate for a .008" to .012" unlatching clearance between the latch and the clutch drive assembly. Tighten center plate assembly mounting screws. At this time, there should be at least 75% of the latch contacting the drive arm assembly in a latch condition (Figure 4-5a(B)).

NOTE: Be sure to keep plate against locating block.

8. Loosen locating block mounting screws and position locating block as far right (ear of locating block against the plate) as possible. Lock mounting screws.
9. Adjust eccentric keeper stop stud to obtain .000" to .020" between clutch drive arm and latch keeper (Figure 4-5a(C)) at latch time.
10. Check for .002" clearance between the step on the ratchet and detent (backlash) with clutch engaged. If there is more than .002" clearance replace with a longer detent.

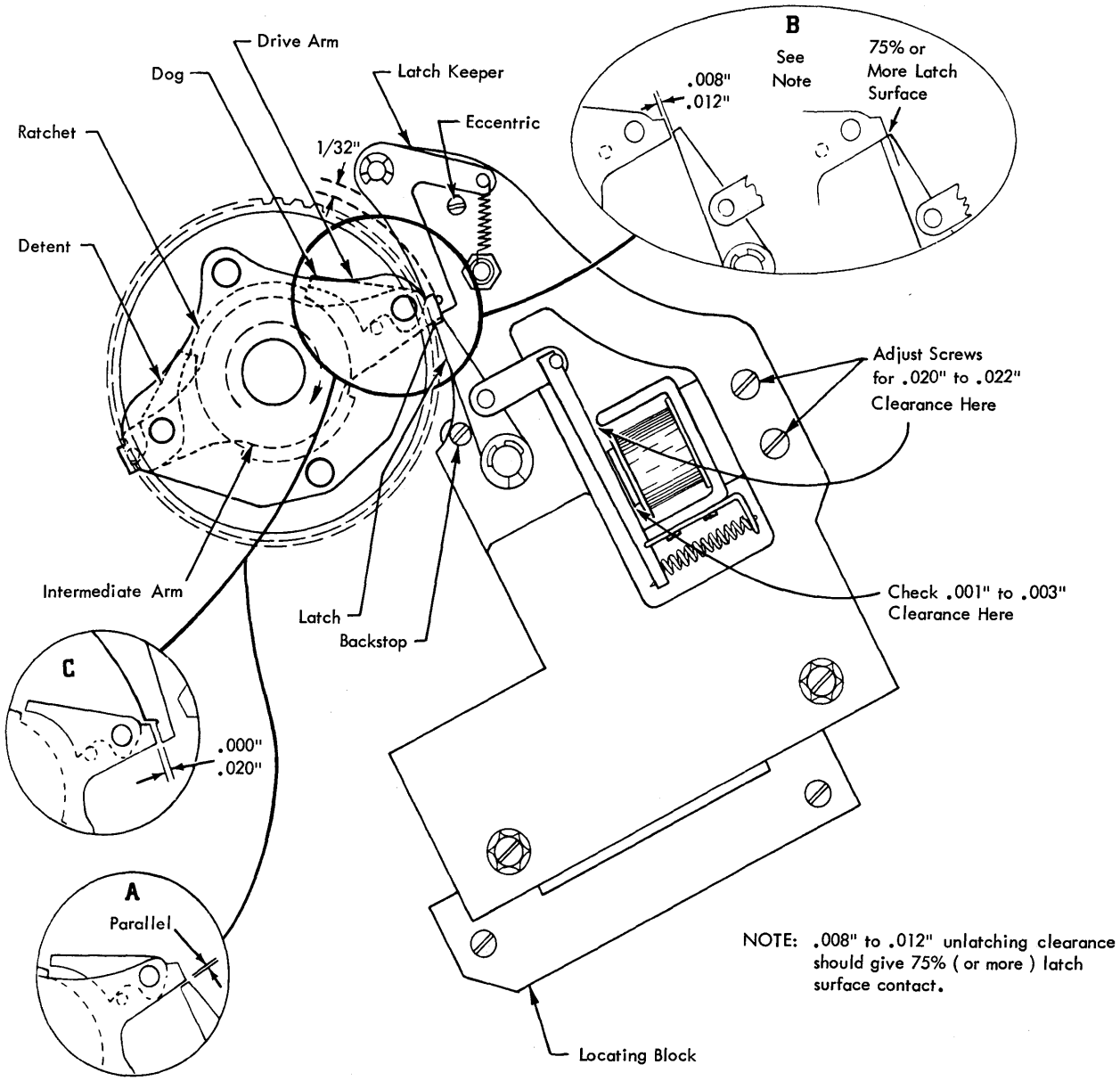


Figure 4-5a. Read Clutch Magnet Assembly Adjustment (500 CPM)

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

NOTE: Timing of the 500 CPM Read clutch and the 250 CPM Read clutch is accomplished in an indenti-cal manner.

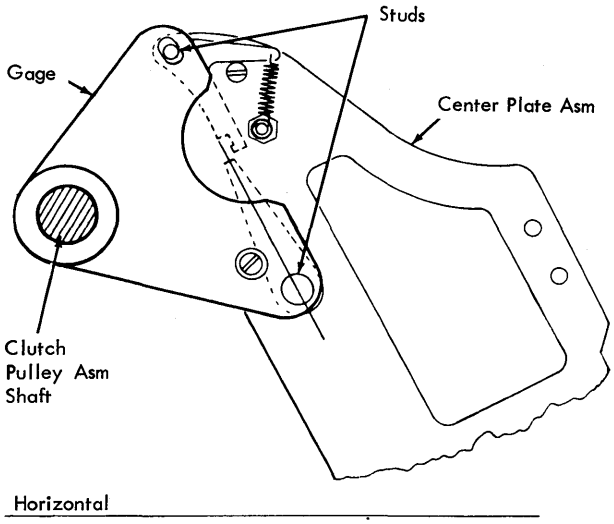


Figure 4-5b. Latch Assembly Plate Alignment (500 CPM)

Read Clutch Timing

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

1. With clutch armature blocked in the attracted position and with dog and detent engaged on ratchet, the time at which the keeper falls behind the drive arm should be $315^{o} \pm 1^{o}$ (Figures 4-4a, 4-5a and 4-6).
2. If the index is not at $315^{o} \pm 1^{o}$, loosen the clamped hub on the index drive shaft and turn the index to 315^{o}. Tighten the clamped hub.

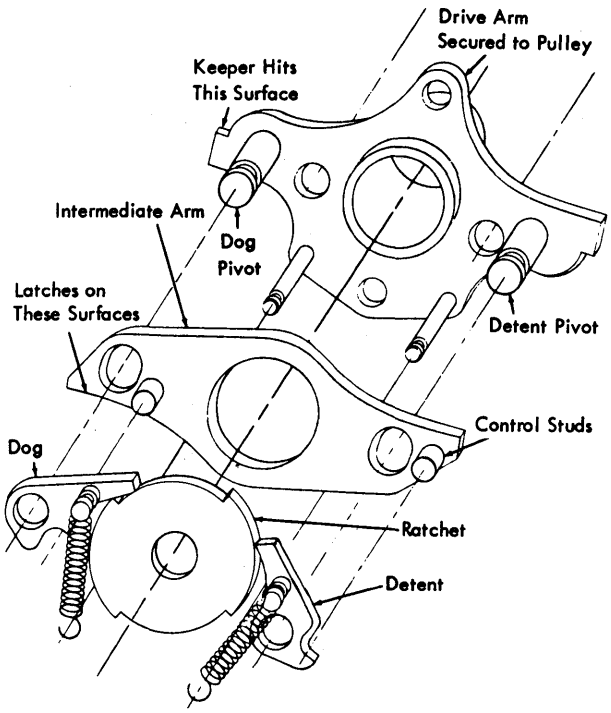


Figure 4-6. Read Clutch (Exploded View)

4.2.8 Read Feed Dynamic Timer Dial

To check the 1622 read feed for concentricity to the dynamic timer shaft:

1. Note the 12 circuit breaker pulse timings between 10^{o} and 215^{o} of 3^{o} duration.
2. Turn the timer knob until the machine is at 13^{o} and note the relationship of the bottom of the white timing mark on the inner dial to the circuit breaker pulse mark on the outer dial.

3. Repeat this procedure at 211°.
4. Shift the outer dial so that the same relationship exists at both 13° and 211° within 1/64".
5. Turn the machine to 103° and shift the dial to obtain the same relationship between the white timing mark and the circuit breaker pulse mark within 1/64".
6. Make a final check to see that the relationship of the bottom of the white line to the circuit breaker pulse mark is the same at 13°, 103°, 211° within 1/64".
7. If the outer dial requires shifting, the clutch latch timing of 315° should be checked. If the white timing mark does not indicate 315°, the inner dial should be shifted to give correct timing.

4.3 TRANSPORT AND STACKERS

4.3.1 Chute Blades and Selector Magnets

1. With selector magnet armatures attracted, adjust the armature stop for .035" ± .003" clearance between upper part of armature and stop (Figure 4-7).
2. With the selector magnet armature de-energized, adjust the selector magnet assembly (by use of mounting screws) to position the chute blades 1/32" +1/64" -0" above the card line and 1/32" +1/64 -0" below the card line when energized.
3. Adjust the chute blades (by using mounting screw) for 1/32" +1/64" -0" clearance between the end of the chute blade and the lower card guide edge (Figure 4-8).
4. With a chute blade removed and held on a flat surface, the part containing the mounting hole should project 1/8" ± 1/64" above the flat surface. Forming the chute blade in this manner should result in proper chute blade tension. A force of 150 to 200 grams should be required to just hold the armature attracted against the upper part of the yoke (Figure 4-7).
5. Position the selector magnet deflector springs for .005" to .010" clearance to the lower card guides.

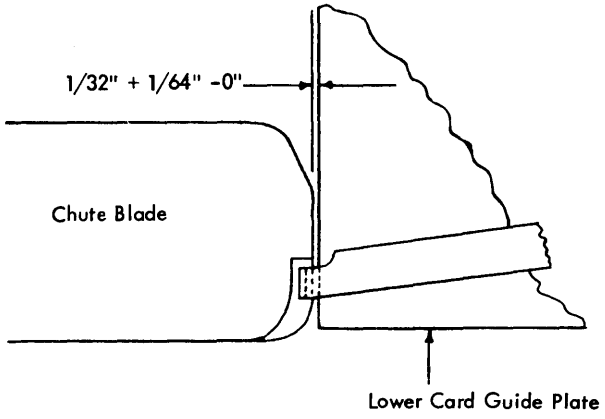


Figure 4-8. Chute Blade Adjustment

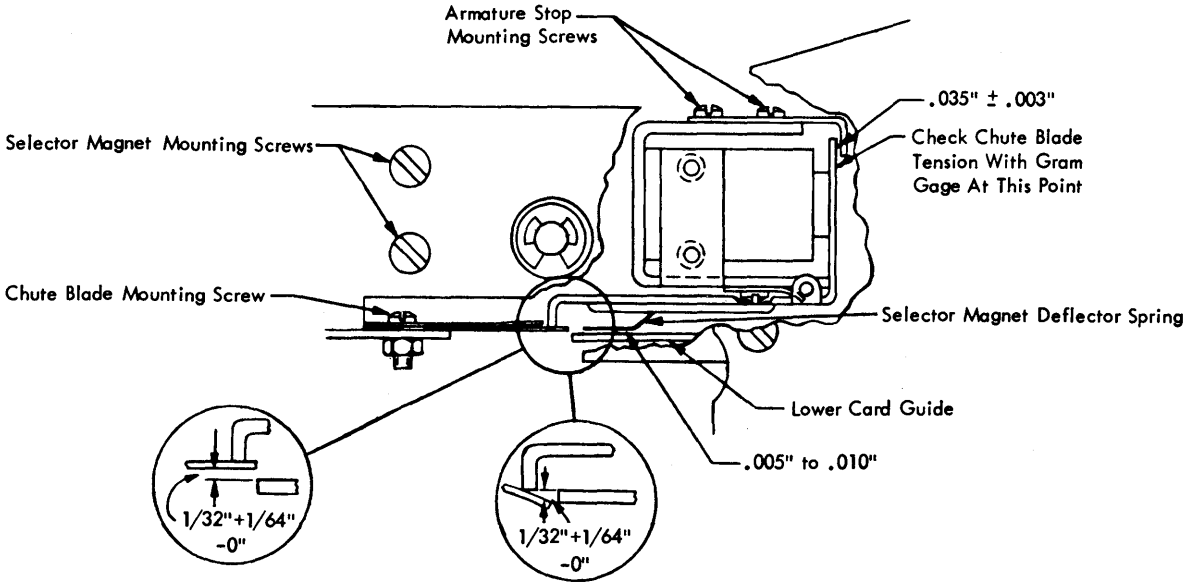


Figure 4-7. Chute Blades and Selector Magnets

4.3.2 Transport Rolls

1. The lower pressure rolls should be centered directly below the upper rolls. This can be accomplished by inserting a .010" feeler gage leaf between the upper and lower rolls and adjusting the lower roll mounting brackets until the feeler gage leaf is parallel to the card line.
2. Tension on the pressure rolls is adjusted by the lower feed roll shaft mounting screws so that a pull of 1.5 lb to 2.5 lb is required to pull a card strip from between the rolls (upper rolls not turning). Tension on the front and rear rolls should be within .25 lb of each other. The card must be pulled in the same direction as it is fed. Use card strips that are slightly wider than the width of the pressure rolls. Pushpull scale P/N 9900012 may be used.

4.3.3 Jam Bar

1. The jam bar must be positioned for .020" to .035" clearance between the formed points and the lower card guides or shear plates over the entire length of the card transport and at the junction of the jam bar and jam bar lever (Figure 4-9).
2. The tape must be adjusted so that the switch will operate with a tape deflection of 1/16".

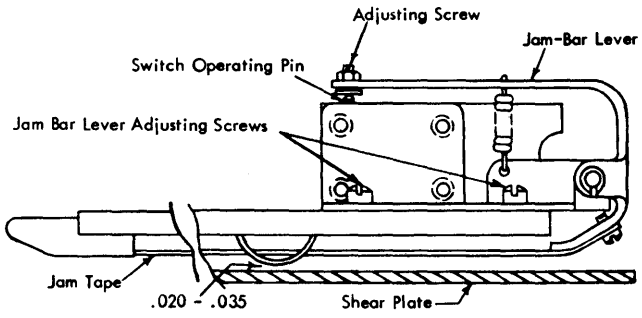


Figure 4-9. Jam Bar

4.3.4 Stackers

1. The space between pocket separators must be 3-5/16" ± 1/64".
2. The radial guides should be square with the pocket separators within .010" and should be formed as shown in the edge view in Figure 4-10.
3. All sliding and moving parts of the stacker must move freely.
4. Plastic card stacker slides (P/N 602373) used on early machines should be replaced with aluminum card stacking slides (P/N 363023) if warping or cracking of plastic slides is experienced.

Figure 4-10. Radial Card Guide Outline

Adjustment of Stacker Radial Card Guides

Malformed radial card guides can be a cause of excessive card jamming. To eliminate this as a cause, form these guides to match the illustrated profile. Do not distort this profile to accomplish reinstallation. If mounting screw holes do not align, elongate the upper mounting screw hole to the extent required by filing.

4.4 PUNCH FEED

4.4.1 Speed

Adjust the punch drive motor pulleys to feed 125 ± 3 cards per minute. Run machine with cards for one minute. Count cards in stacker and feed.

4.4.2 Hopper, Throat, and Picker Knife

Adjustments

1. The picker knife cam follower arms must be positioned so that no binding exists anywhere over the entire cam periphery (maximum clearance of .006" is allowable), and the arms are parallel to the first feed rolls within .003". With the arms in this position, the feed knives should be .020" behind the face of the hopper posts at the extreme end of the backstroke (Figure 4-1).
2. The picker knife cam is set to feed a card into the first set of feed rolls at 185° ± 1/2°. To adjust:
   a. Loosen cam on shaft
   b. Engage clutch and turn machine to 185°.
   c. Turn the cam on the shaft until the feed knives hold a card firmly against first feed rolls
   d. Tighten cam on shaft and recheck timing.
3. Position the throat roller assembly laterally so that the vertical center line of the roller is aligned with the face of the throat knife. This can be determined by observing the step on the roller block or by use of a feeler gage (Figure 4-11).
4. Position the knife vertically to obtain an opening of .0095" Go and .0105" No-Go.
5. Position the hopper posts for a clearance of .013" to .017" between the hopper posts and a deck of cards resting against the throat knife.
6. The rear hopper side plate is adjusted for two conditions:
   a. To be perpendicular to the first feed rolls within .002"
   b. To feed the card within .010" to .015" of the left-hand fixed aligner block.
7. Adjust the front hopper side plate for .010" to .015" clearance over a deck of cards placed against the rear hopper side plate.

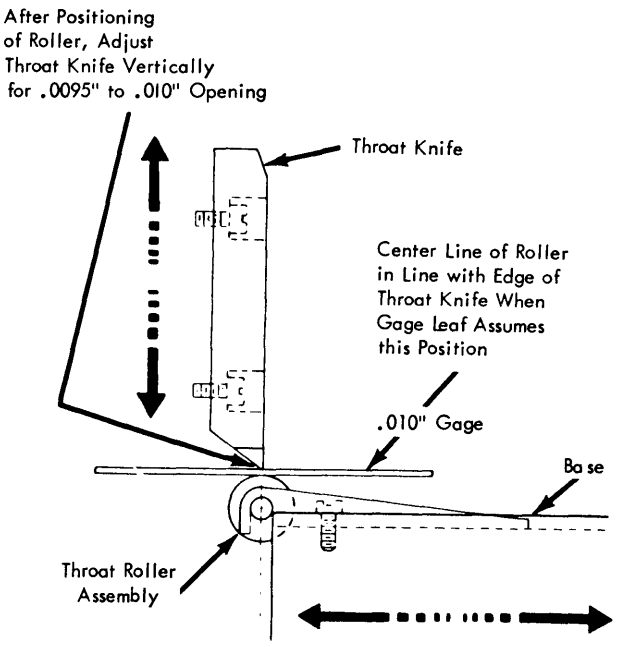


Figure 4-11. Throat Clearance

4.4.3 Punch Feed Card Guides

1. With the lowering frame in the raised position, adjust the front second lower card guide so that its top surface is in alignment flush to .012" below the rear second lower card guide top surface.
2. Adjust the clearance between the second upper and lower card guides to .012" to .025".
3. With the lowering frame in the raised position, adjust the card guides for .012" to .030" clearance at the following places:
   a. First lower card guide with respect to the hopper back plate guide. Make sure that the first lower card guide is not above the feed hopper card line. This is a line from the top of the first lower feed roll to the top leading edge of the second lower card guide.
   b. Second upper card guides over the second lower (stepped) roll.
   c. Third upper card guides over the fifth lower (stepped) roll.
4. Position the punch check brush card guide for a minimum clearance of .025".
5. The punch stacker transport lower card guide is to be positioned .015" to .025" below a line determined by the surface of

the contact roll and the sixth lower feed roll. Check for .003" to .010" clearance between the edge of the phenolic guides and the contact roll.

6. Position the punch stacker card lever bracket for .012" to .030" clearance to the lower card guide in the stacker.

4.4.4 Punch Card Levers

1. Position all card lever contacts to give a minimum contact travel of 1/16".
2. Position card levers to provide 1/64" rise of the n/o contact strap off its support bar.
3. Adjust the contact for 1/32" minimum air gap.
4. All card levers must be timed according to the timing chart in the Systems Diagrams.

NOTE: For 1622's prior to A3 suffix, a new second lower card guide (P/N 610284) and a new die card lever (P/N 610282) is available. The new components allow more travel on the die card lever and provide easier timing of the card lever. Both parts must be installed (CEM 1620-143).

4.4.5 Punch Clutch

Clutch Position

The clutch assembly is pinned at the factory and should not have to be changed. Steps 1, 2, and 3 should be performed only if a new clutch assembly is installed.

1. Set the clutch so that the latch arm face is on the vertical center line of the picker knife cam shaft within .005" (Figure 4-12).
2. Position the clutch sideways so that the keeper is flush with the edge of the dog carrier within .010" (Figure 4-13).
3. Form the cam follower arm so that the cam follower is on the middle of the cam surface.

Punch Clutch Adjustments

1. With the cam follower on the low dwell of the cam, adjust the cam follower adjusting screw (Figure 4-14) for an unlatching clearance of .018" to .030".

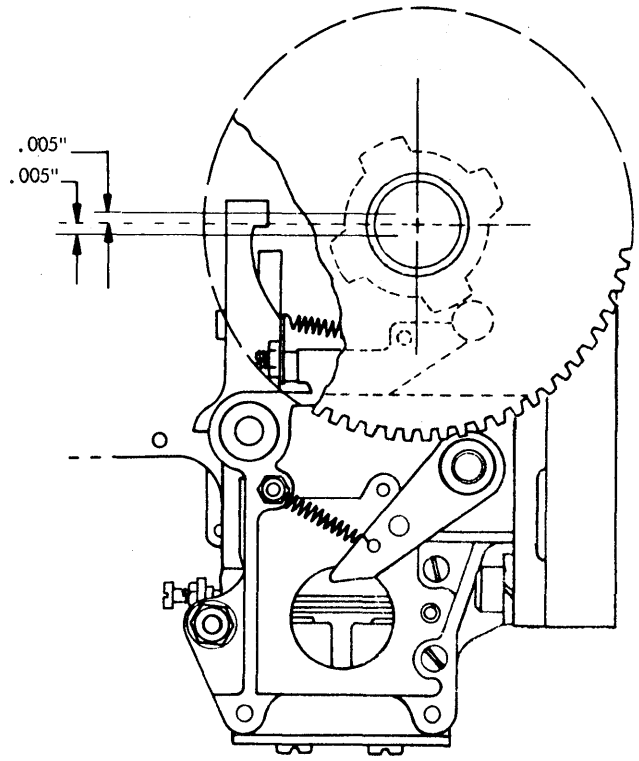


Figure 4-12. Punch Clutch Position

2. With the clutch cam follower on the high dwell of the cam, check for a minimum of 1/16" overlap of the latch on the dog and dog carrier (Figure 4-15).

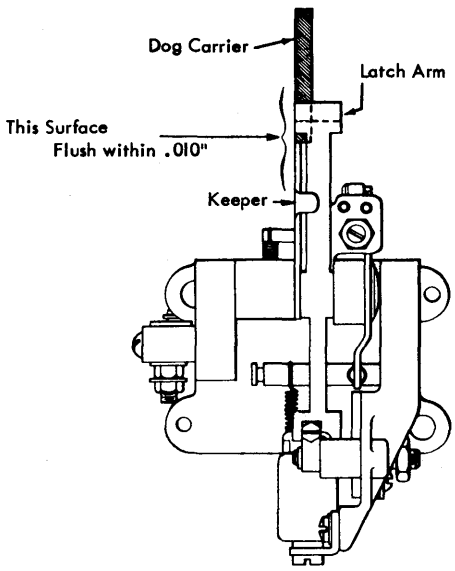


Figure 4-13. Punch Clutch Arm and Dog Carrier Relationship

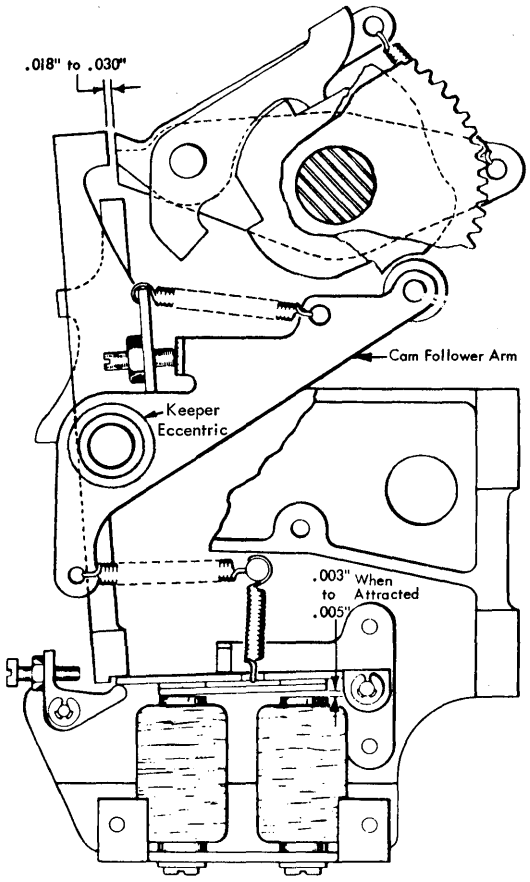


Figure 4-14. Punch Clutch Unlatching Clearance

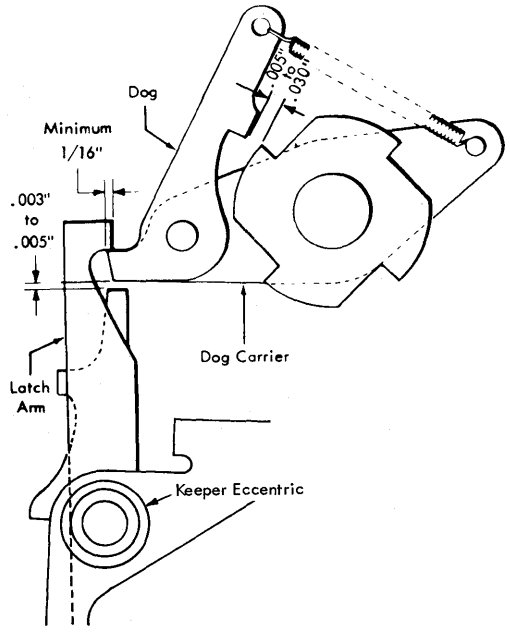


Figure 4-15. Punch Clutch Keeper to Dog Carrier Clearance

3. Adjust the keeper eccentric for .003" to .005" clearance between the dog carrier and keeper with the dog carrier against the latch arm (Figure 4-15).
4. The tooth of the dog should clear the clutch ratchet by .005" to .030" when latched. To check: latch the clutch, raise the keeper from behind the dog carrier, and watch for .005" to .030" movement of the dog to the surface of the clutch ratchet.
5. With the cam follower on the high dwell of the clutch cam, set the armature stop and pivot assembly for .020" to .025" overlap on the latch arm and for .010" to .015" relatching clearance (Figure 4-16).

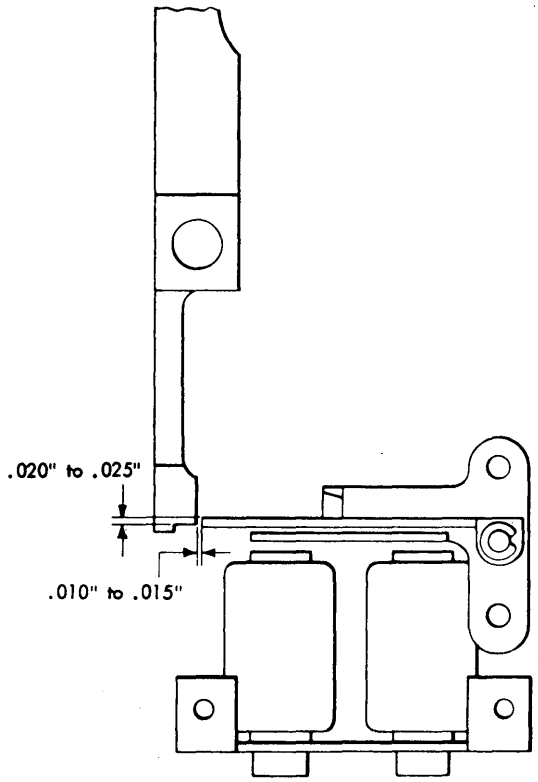


Figure 4-16. Punch Clutch Armature Relatching Clearance and Overlap

6. With the armature against its stop, adjust the magnet assembly for .023" to .027" clearance between armature and magnet core farthest from the pivot. Adjust for .003" to .005" clearance between armature and the magnet core which is nearest pivot when armature is attracted (Figure 4-17).

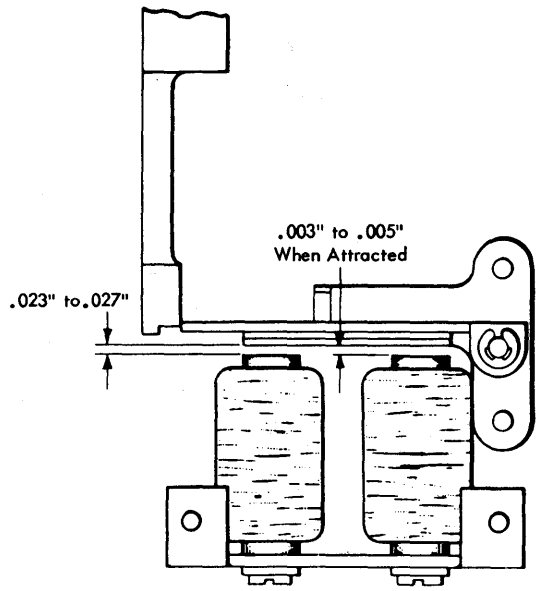


Figure 4-17. Punch Clutch Magnet Core to Armature Clearance

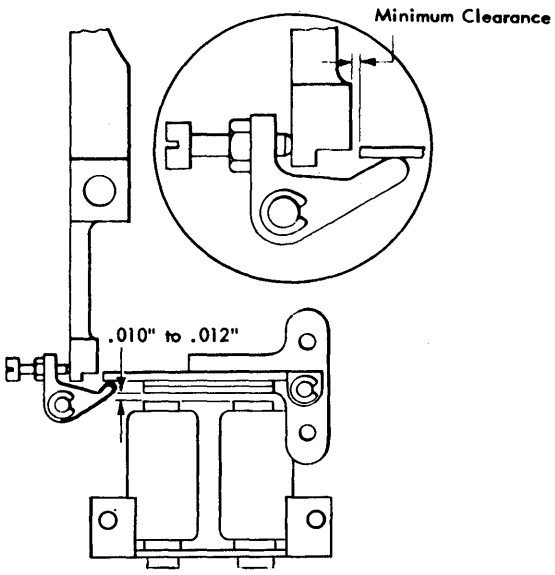


Figure 4-18. Punch Clutch Armature Knockoff

7. The clutch should unlatch with an .008" gage between armature and the core farthest from pivot, but should not unlatch with a .010" gage. Re-adjust Steps 4 or 5 to obtain this condition.
8. Set the armature knockoff to allow .010" to .012" clearance between armature and core farthest from pivot when the cam follower is on the high dwell of the clutch cam. Check that a binding condition does not exist between armature and latch as restoring takes place (Figure 4-18).

Punch Clutch Timing

In order to synchronize the 4-tooth clutch to the index, crank the machine to between 230° and 300° before tripping clutch (Figure 4-19), and:

1. While holding the clutch armature tripped, continue turning until the latching surfaces of the clutch latch arm and the dog carrier coincide.
2. With the condition in Step 1, the punch index should read 315° ± 1/2°. If index is out of time, loosen the clamping hub of the index drive pulley and turn index to 315°.

NOTE: If index timing is changed, re-check all punch-feed units for proper timing.

4.4.6 Punch Dynamic Timer

1. The dynamic timer dial must be centered so that the light will be in alignment with the index lines at 0°, 90°, 180°, and 270° within 1/2°, when the Geneva timing pin is in the lock notch.

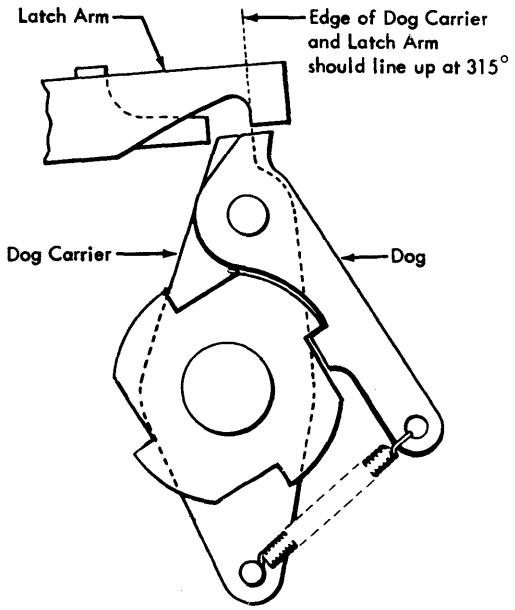


Figure 4-19. Punch Clutch Timing

2. The timer must be set at $315^{o} \pm 1/2^{o}$ which is clutch latching time. This is determined by the faces of the dog carrier and latch arm aligning with each other (Figure 4-19) when the dog is engaged and the armature attracted.
3. To synchronize the 4-tooth clutch with the dynamic timer, use one of the four slots on the 4-tooth ratchet as a reference to obtain correct timer readings. Punch clutch timing will be set up from the slot which has its driving surface in line with the center line of one of the three tapped holes located on the outside collar. To synchronize the clutch and timer, crank the machine until the timer index is between 230^{o} and 300^{o}, then operate the clutch manual trip lever. Hold the clutch tripped and crank until the clutch engages.

4.4.7 Geneva Unit

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

1. Locate the Geneva housing on the side frame to provide a minimum perceptible (.0001") to a maximum of .0045" backlash between the Geneva gears and the intermittent roll gears. Too much backlash causes punching registration problems. Gears will be damaged if no wink exists.
2. To check for Geneva gear backlash or for wear of the Geneva pins (Figure 4-20):
   a. Remove punch unit
   b. Crank machine to where intermittent rolls have completed roughly 1/4 of the total cycle point movement

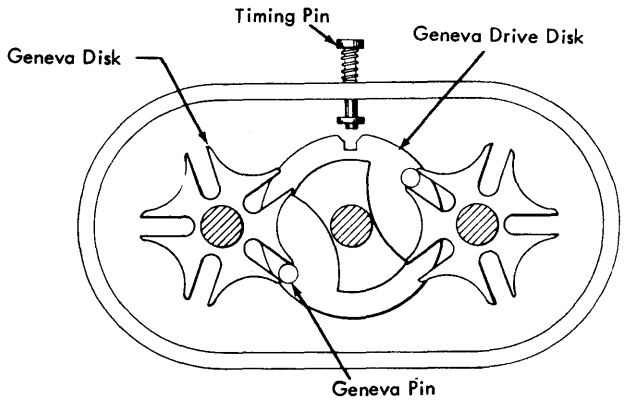


Figure 4-20. Geneva Unit

   c. Rock back and forth on the intermittent feed roll. Distinction can be made here between gear wink and wear of pins by observing what is turning.

NOTE: Gear wink should be checked at all 12 digit times on both sets of intermittent rolls.

3. The Geneva unit has locating blocks which position against the top and inside surfaces of the Geneva unit ends. They permit removal of the Geneva unit without changing gear wink or adjustment.
4. Maintain oil level 1/16" above the line.

Timing

The Geneva unit is timed so that the timing pin is in the notch of the Geneva drive disk at 0^{o} on the index (Figure 4-20). If the Geneva is out of time:

1. Turn machine to 0^{o} on the index.
2. Loosen split hub on input pulley.
3. Crank Geneva until pin seats.
4. Check timings of punch unit and PACB unit.

4.4.8 Punch Feed Station-to-Station Timing Checks

NOTE: Be sure the synchronous tooth (315^{o}) is used for these checks. It is the ratchet tooth that is opposite one of the tapped holes in its outside collar. These procedures are methods of checking the timing of the first and second stepped feed rolls, first and second intermittent feed rolls, and card aligners. They should NOT be used as final adjustment procedures. Figure 4-21 is a timing chart showing the critical machine timings.

Disconnect all power to the machine before performing any of these steps.

First Stepped and First Intermittent Feed Rolls

1. Pivot the hopper down. Remove the punch check brushes.
2. The card must enter the first feed roll at 185^{o}.
3. Trip the clutch at 300^{o} and continue turning the machine until the clutch engages (315^{o}).

NOTE: The following checks can be made with the punch unit installed but may be easier with punch unit removed.

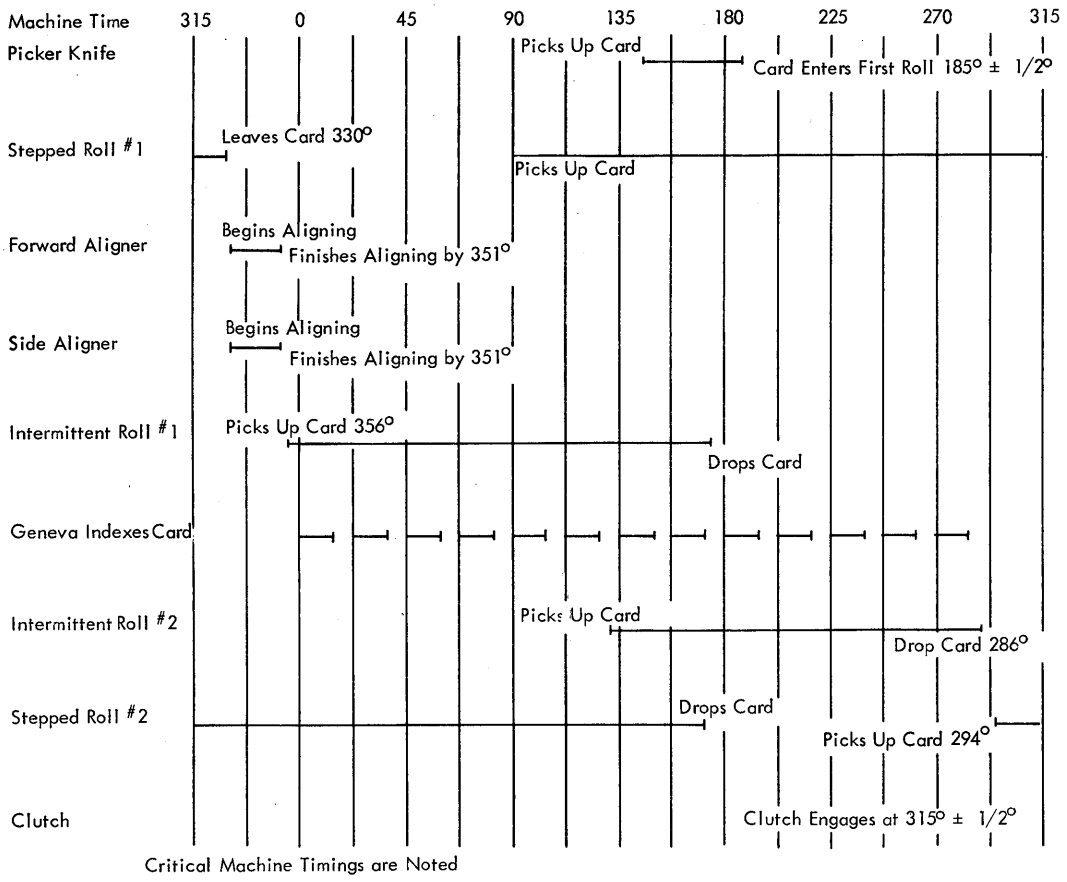


Figure 4-21. Punch Transport Timing

4. Continue turning the machine to 333°.
5. Insert a card lengthwise from the hopper end so that it is between one roll of the first stepped feed roll. Make sure that the first intermittent feed roll does not interfere with the card.
6. By turning the feed backward, check to see that the card is free at 331° and is gripped tight by the first stepped feed roll at 329°. This indicates that the first stepped roll is in time.
7. To check the first intermittent feed roll, turn the machine to 352°.
8. Insert one card lengthwise between one roll of the first intermittent feed roll. Insert another card lengthwise between the other roll of the first intermittent feed roll.
9. Check to see that each card is free at 353° and is gripped tight at 357°. This indicates that the first intermittent feed roll is in time.

Second Intermittent and Second Stepped Feed Rolls

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

Forward and Side Aligners

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

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

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

2. Insert the Punch Transport gage (P/N 608183 - Figure 4-22) as shown in Figure 4-23.
3. Pivot the hopper up and place cards in the hopper. Trip the clutch at 300° and continue turning the machine until the clutch engages (315°). Feed cards manually for two card cycles.
4. Continue turning the machine and check to see that a card finishes forward aligning to within .005" of the forward aligner timing marks on the gage at 351° (Figure 4-23).

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

5. With the machine still at 351°, check to see that the left side aligner surface is against the card and is 37/64" from the left side frame. Check to see that the right side aligner is just touching the card at 351°.

NOTE: The following steps are necessary on machines with a fixed left side aligner block.

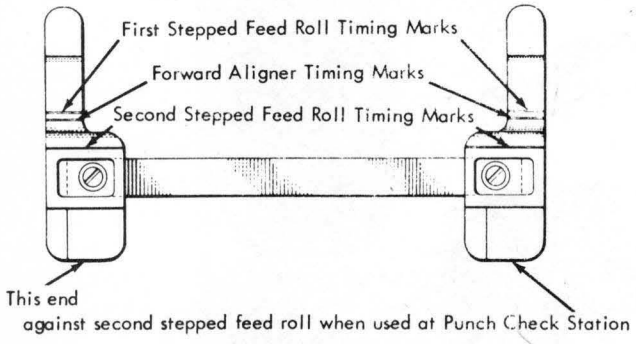


Figure 4-22. Gage P/N 608183

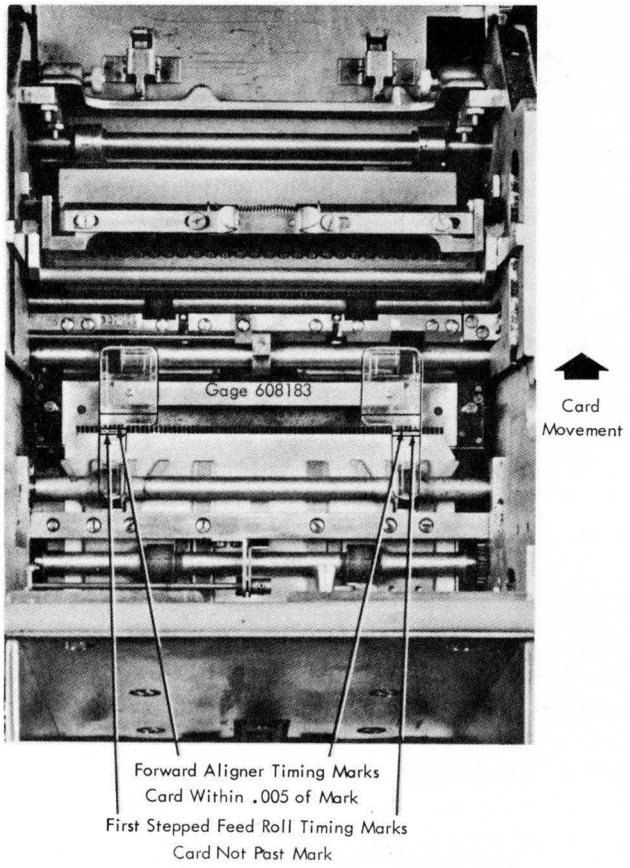


Figure 4-23. Punch Feed Station-to-Station Timings

6. When feeding cards held against the left hopper side plate, check the left side aligner block for .010" to .020" clearance to a card when the card is fed into the aligner station but prior to side aligning.
7. When feeding cards held against the right hopper side plate, check the right side aligner surface for .005" minimum clearance to a card when a card is fed into the aligner station but prior to side aligning.

4.4.9 First Stepped Feed Roll Timing Adjustment

Complete Steps 1 through 3 of Punch Feed Station-to-Station Timing Checks (4.4.8).

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

1. Continue turning the machine to 330°.
2. Loosen the split hub of the pulley located on the front end of the first stepped feed roll.

3. While keeping the machine at 330°, turn the first stepped feed roll by hand and feed a card lengthwise through one roll of the first stepped feed roll. Make sure the card is not passing through the intermittent rolls.
4. At the point at which the first stepped feed roll stops feeding the card, rotate the roll slightly until the card experiences light drag.
5. Hold the roll at this position and tighten the pulley previously loosened in Step 2.
6. Check to see that the card is held tight by the first stepped feed roll at 329° and is free at 331°.
7. Re-time the first intermittent feed roll.
8. Check second stepped feed roll and re-time if necessary.

4.4.10 First Intermittent Feed Roll Timing Adjustment

The first stepped feed roll must be in proper time before timing the first intermittent feed roll. For a timing check, refer to First Stepped and First Intermittent Feed Rolls, Steps 1 through 6 (4.4.8).

1. Complete Steps 1 through 3 of 4.4.8.

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

2. Turn the machine to 352°.
3. Insert one card lengthwise between one roll of the first intermittent feed roll. Insert another card lengthwise between the other roll of the first intermittent feed roll.
4. Turn the machine to 356°.
5. Adjust the eccentrics at each end of the first intermittent feed roll shaft so that each card experiences light drag. Keep the high side of the eccentrics (indicated by the punch marks on the eccentrics) facing the punch marks on the intermittent feed roll opening arms (Figure 4-24).

NOTE: The eccentrics should be adjusted only if necessary.

6. Check to see that each card is free at 353° and is gripped tight at 357°.

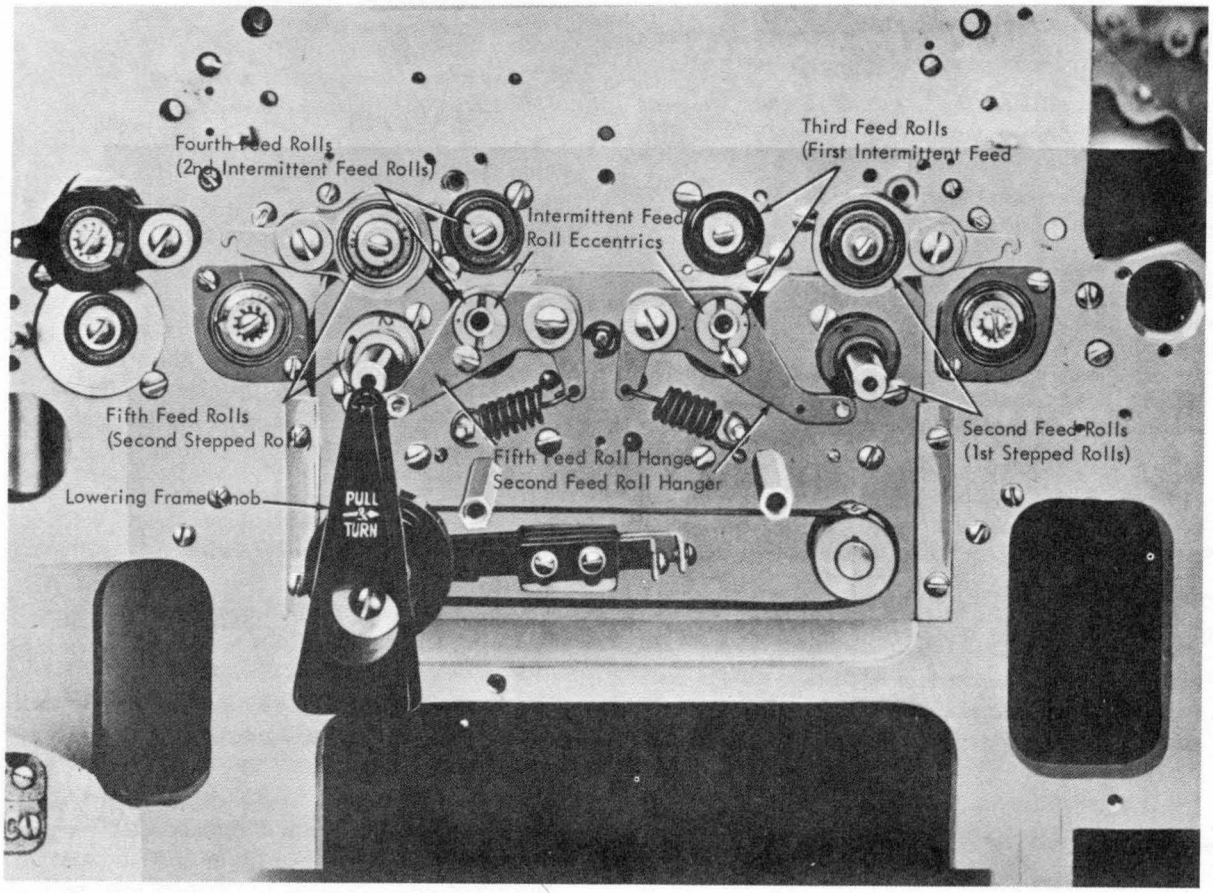


Figure 4-24. Intermittent Feed Roll Adjustments

4.4.11 Second Intermittent Feed Roll Timing Adjustment

The second stepped feed roll must be in proper time before timing the second intermittent feed roll.

1. Complete Steps 1 through 3 of 4.4.8.

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

2. Turn the machine to 290°.
3. Insert one card lengthwise between one roll of the second intermittent feed roll. Insert another card lengthwise between the other roll of the second intermittent feed roll.
4. Turn the machine backwards to 286°.
5. Adjust the eccentrics at each end of the second intermittent feed roll shaft so that each card experiences light drag. Keep the high side of the eccentrics (indicated by the punch marks on the eccentrics) facing the punch marks on the intermittent feed roll opening arms. (Figure 4-24).

   NOTE: The eccentrics should be adjusted only if necessary.

6. Check to see that each card is free at 288° and gripped tight to 284°.

4.4.12 Second Stepped Feed Roll Timing Adjustment

Complete Steps 1 through 3 of 4.4.8.

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

1. Continue turning the machine to 294°.
2. Loosen the split hub of the pulley located on the rear end of the second stepped feed roll.
3. While keeping the machine at 294°, turn the second stepped roll by hand and feed a card lengthwise through one roll of the second stepped feed roll. Make sure the card is not passing through the intermittent rolls.
4. At the point at which the second stepped feed roll begins feeding the card, rotate the roll slightly until the card experiences light drag.
5. Hold the roll at this position and tighten the pulley previously loosened in Step 2.
6. Check to see that the card is held tight by the second stepped feed roll at 295° and is free at 293°.
7. Re-time the second intermittent feed roll.

4.4.13 Forward and Side Aligner Adjustments

The first stepped feed roll must be in time prior to adjusting the aligners. Also, to basically get the forward and side aligners in time, see Steps 1 through 7 of the Forward and Side Aligner, paragraph 4.4.8.

1. Trip the clutch at 300° and continue turning the machine to 351°. Adjust the forward aligners so that the trailing edge of the card is against each aligning surface of the forward aligners and the leading edge of the card is within .005" of the forward aligner timing marks on the gage (Figure 4-23) at 351°. To adjust the forward aligners:
   a. Loosen the two screws of the locking block very slightly (Figure 4-25). The locking block serves as a support for the forward aligner adjusting screw and adjustment of the forward aligner cannot be made accurately if the block screws are loosened too much.

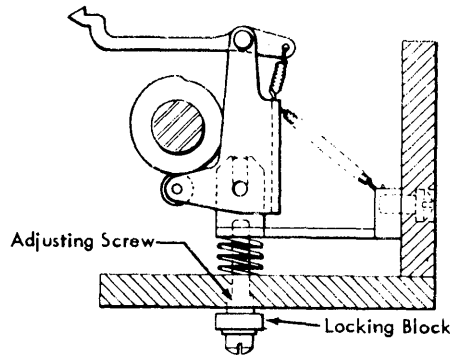


Figure 4-25. Forward Aligner

   b. Turn the forward aligner adjusting screw clockwise to move the forward aligner away from the hopper and counterclockwise to move the forward aligner toward the hopper.
   c. Re-tighten the locking block screws after properly setting the forward aligners.
2. Check the forward aligner setting by feeding cards through the machine manually to see that the leading edge of the card is within

.005" of the forward aligner timing marks at 351°.

3. The following step is necessary only on machines with an adjustable left side aligner. With the machine still at 351°, loosen the left side aligner lock nut, and turn the left side aligner adjusting screw to position the left side aligner surface 37/64" from the inside of the left side frame (Figure 4-26). Tighten the lock nut. With a card against the left side aligner, adjust the right side aligner in a similar manner so that its aligning surface just touches the card at 351°. Tighten the lock nut.
4. To obtain clearances as given in Steps 6 and 7 of Forward and Side Aligners, paragraph 4.4.8, the hopper side plates must be adjusted and the side aligner must be formed.

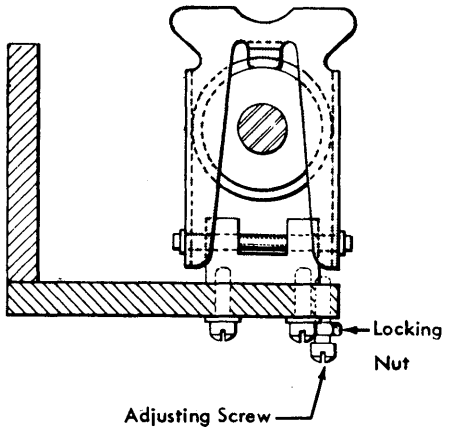


Figure 4-26. Side Aligner

4.4.14 Punch Check Brushes

Service Checks

1. Hopper side plates are not adjusted for brush tracking. Move the holder within the machine side frame.
2. Brushes are to be centered in the separator.
3. Brush strand breakage will be reduced if machine is turned over while inserting brushes.
4. Reading troubles may be caused by wax build-up between separators.

Adjustments

1. Insert the brush unit until the plunger locating pins have seated in the side frame holes. There should be .012" to .018" clearance between the brush separator and the contact roll.

NOTE: If clearance is changed, recheck centering of brushes in separator.

2. The brushes should track through the center of the holes in a properly punched, properly fed card. To adjust tracking:
   a. Center the inner brush block holder assembly by using the two Allen screws Figure 4-3). Allow clearance for inner holder assembly to pivot freely.
   b. Set adjusting screws in machine side frames for proper tracking and allow approximately .003" over the length of the holder assembly for clearance in removing and re-installing brush assembly.
3. When depressed, the heel of the brushes should be on the scribed line. This may be altered slightly to obtain best overall timing condition.

Timing

1. All brushes must make and break within ± 2° of the line of index.

NOTE: Timing is obtained by shifting brush assembly; not by changing second stepped roll timing or by shifting of the picker knife cam timing.

2. Brushes are to be paralleled within .005" of the scribed line.

4.4.15 Punch Unit (Figure 4-27)

Two types of punch units may be encountered in the field. One type has grease fittings on the cam follower assembly while the other type has sealed ball bearing cam followers. The two may be identified by the presence or absence of the grease fitting. The adjustments differ between the two units. Where there is a difference, the adjustment for the ball bearing unit will be in parentheses in the text and marked with an asterisk on the figures. Figure 4-28

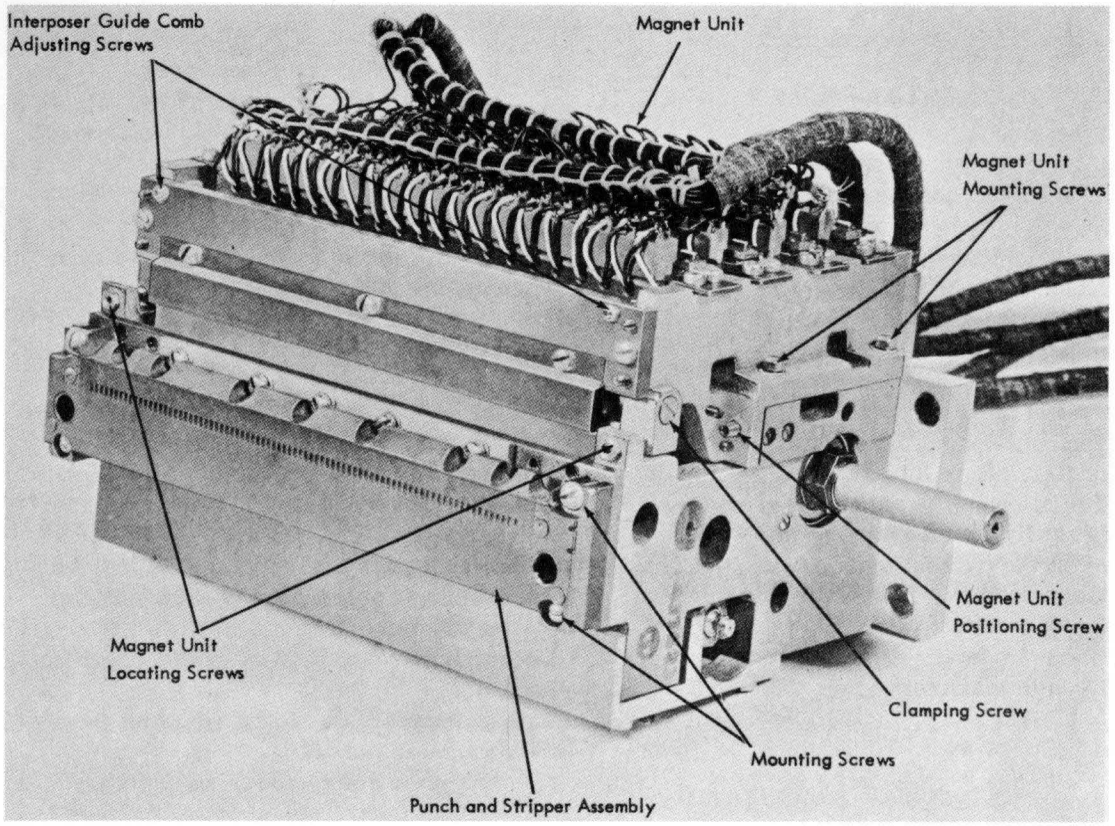


Figure 4-27. Punch Unit

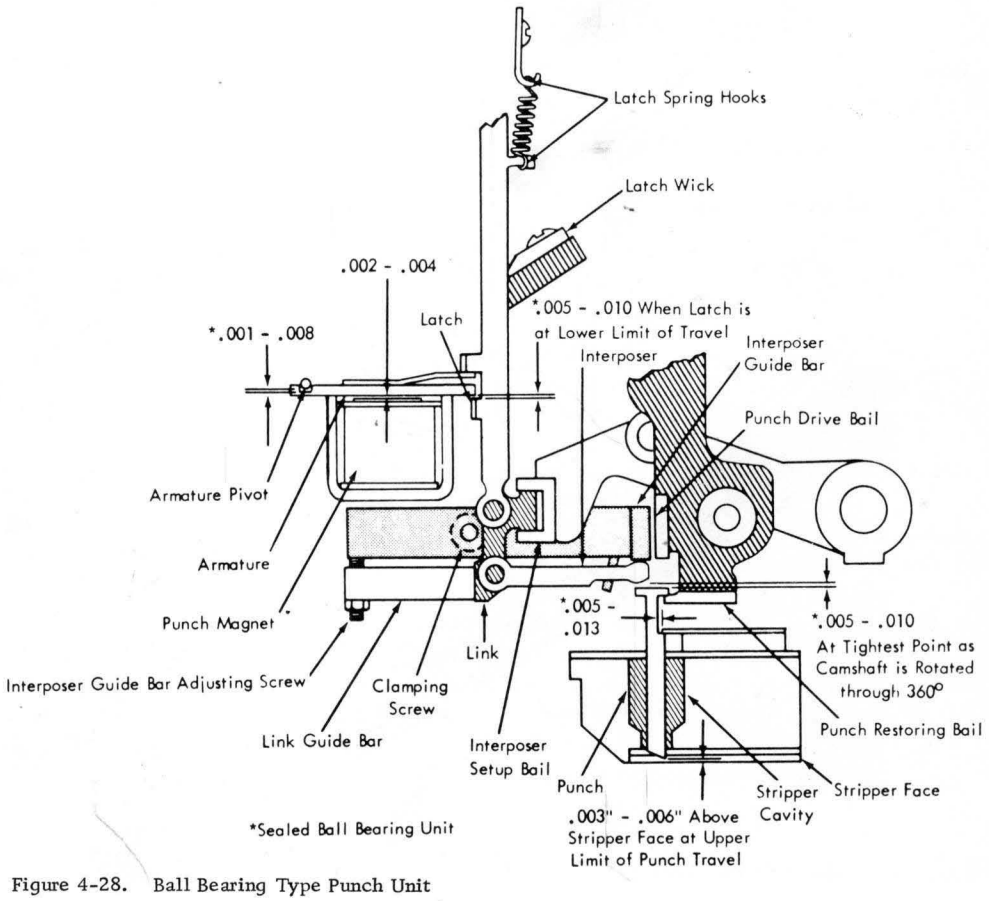


Figure 4-28. Ball Bearing Type Punch Unit

is a drawing of the ball bearing unit and may be used for reference.

The following adjustments are made with the punch unit removed from the machine. The sequence of adjustment is such that once an adjustment is made, following adjustments will not affect the preceding.

Punch Bail and Setup Bail Cam Follower Adjustments

When making the following adjustments, the punch unit should be at room temperature.

1. With a .002" feeler gage placed between the cam followers and their respective cams, adjust the roller eccentrics so that a light to moderate drag (1-1/2 lb to 3 lb as specified in a, b, and c following) is experienced (Figure 4-29). This light to moderate drag should occur only at the tightest point as the cam is rotated through 360°. This applies to the following cam followers:
   a. Punch bail complementary cam followers (top inside) — 3 lb maximum drag
   b. Punch bail active cam followers (bottom inside) — 3 lb maximum drag
   c. Setup bail complementary cam followers (top inside) — 1-1/2 lb maximum drag.

NOTE: This does not apply to the setup bail active cam followers(bottom outside) since the 80-latch springs force these cam followers to ride tight against their cams.

Cam Follower Service Checks

1. Surface of cams turning brown may indicate that a bearing is too tight at operating temperature.
2. If disassembling, keep eccentrics for right and left sides identified with proper side. If the eccentrics are reversed, it may be impossible to obtain the .002" to .005" adjustment range.
3. Eccentrics are marked by center punch on high side.
4. With the cam follower unit removed from the punch unit, check:
   a. That four collars on pivot shaft are tight against inner race of pivot bearings

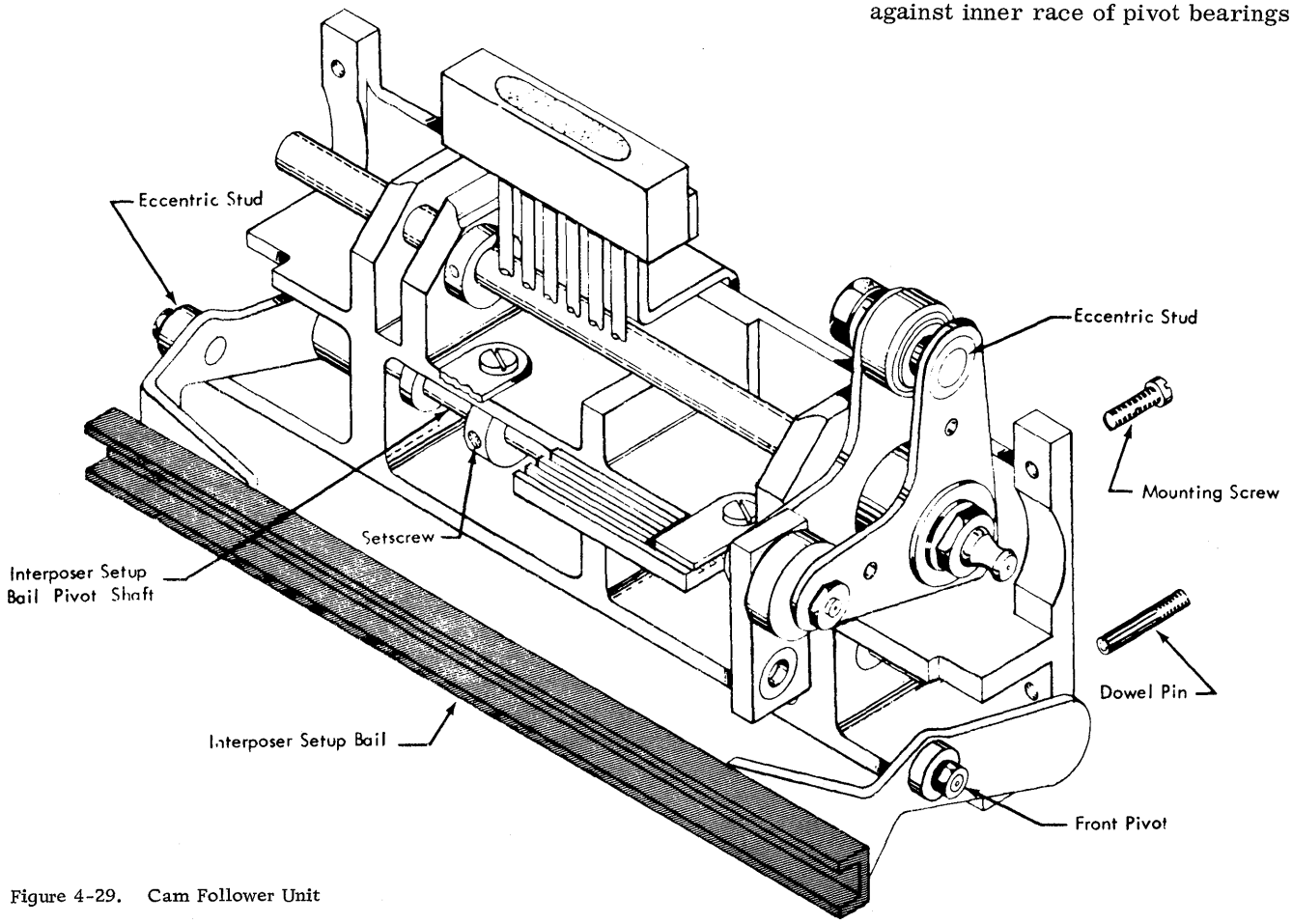


Figure 4-29. Cam Follower Unit

b. That screws holding cam follower pivot shaft, interposer bail pivot studs, and interposer bail pivot shaft are tight
c. That nuts on all cam follower shafts and interposer bail pivot studs are tight.
d. For wear, fretting corrosion, or lack of lubrication of any parts.

Interposer Setup Bail Adjustment

Check complementary cam follower adjustments before proceeding with this adjustment.

1. Remove magnet unit and stripper assembly.

NOTE: Mark or scribe line on both ends and one side of stripper assembly to maintain punch registration when replacing on punch unit.

2. Set the punch unit on a flat surface and place gage (P/N 600914) as close as possible to the right side frame (Figure 4-30).
3. Turn the punch drive unit cam shaft until the setup bail rests on top of gage. Note index setting.
4. Remove the gage without disturbing the setup bail and insert the gage at the left end of the setup bail. Place the gage as close as possible to the left side frame.
5. The setup bail should rest on top of the gage in the same manner as in Step 3. Check index setting to ensure that it has not changed since Step 3. Use the eccentric stud at this end of the setup bail to satisfy this condition.
6. Re-check the adjustments after several rotations of the punch drive unit cam shaft.

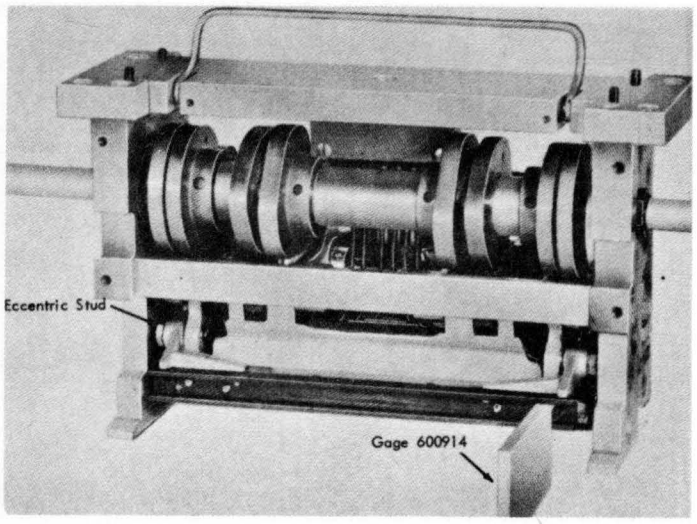


Figure 4-30. Interposer Setup Bail Adjustment

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

Punch Magnet Yoke Adjustments

With magnet yoke assemblies removed from magnet unit (Figure 4-31) check:

1. For .002" to .004" clearance between armature and cores.
2. For armature to pivot rod clearance of between wink and .008" with operating end of armature against yoke.

Punch Magnet Service Checks

With magnet yoke assemblies removed, check for:

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

Replace the punch magnet unit. (The interposer plate must be removed and may be used to hold links and interposers in place.)

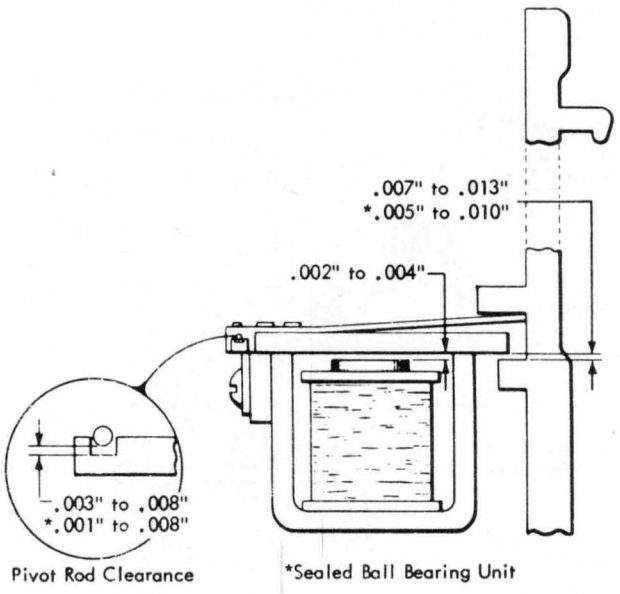


Figure 4-31. Punch Magnet Adjustments

Punch Magnet Unit Position Adjustments

1. Position the magnet unit on the punch unit by means of the magnet unit positioning screws (Figures 4-27 and 4-28) and the magnet unit locating screws. A clearance of .007" to .013" (.005" to .010" sealed ball bearing unit) between the latch and the punch magnet armature should be established while the interposer setup bail is at its lowest limit of travel.

NOTE: The mounting screws must be loosened to adjust. Avoid over-tightening the locating screws.

2. Center the interposers over their respective punches by using lateral tolerances of the magnet unit mounting holes.

NOTE: Clamping screws (Figure 4-27) hold end of interposer guide comb and thus move with magnet unit.

Interposer Entry and Guide Comb Clearance Adjustment

1. To check for .003" clearance between the interposers and the interposer guide comb, proceed as follows:
   a. With the punch magnet de-energized, insert a .003" feeler gage between the punch and the interposer (Figure 4-32).
   b. Rotate the punch cam shaft through a complete revolution making sure no binding condition exists at any point in the punch cam shaft cycle.
   c. With the interposer bail at the lower limit (23°, 143°, 263°) check that the clearance between the interposers and the punches does not exceed .015". (For the sealed ball bearing unit, rotate the cam shaft through 360° and check for .005" to .010" clearance between the interposers and the punches) See Figure 4-28. This ensures that the upper corner of the interposer does not strike the punch bail on entry between punch and punch bail.
2. To adjust the interposer guide comb:
   a. Loosen the punch unit clamping screws slightly (Figure 4-33).
   b. Loosen the lock nuts on the interposer guide comb adjusting screws (Figure 4-27).
   c. Move the interposer guide comb by means of the adjusting screws until the proper clearance is obtained.
   d. Tighten the locknut and the clamping screws.

NOTE: Lack of clearance between the interposers and the interposer guide comb at any point in the punch cycle can cause breakage of the punches.

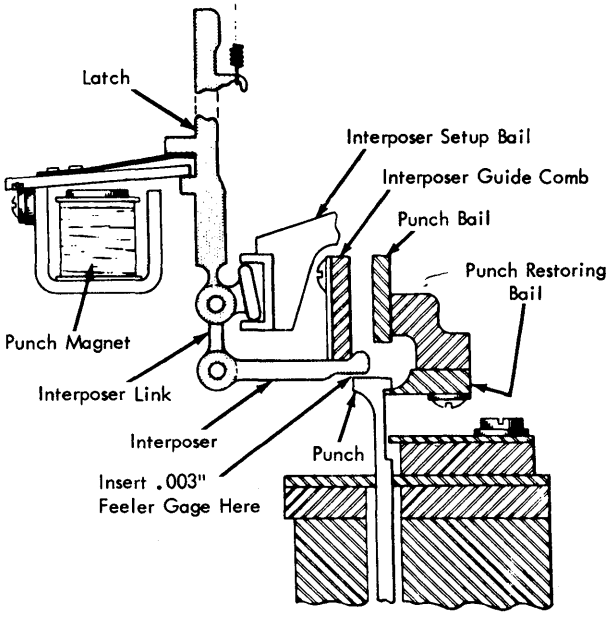


Figure 4-32. Interposer Guide Comb Clearance Adjustment

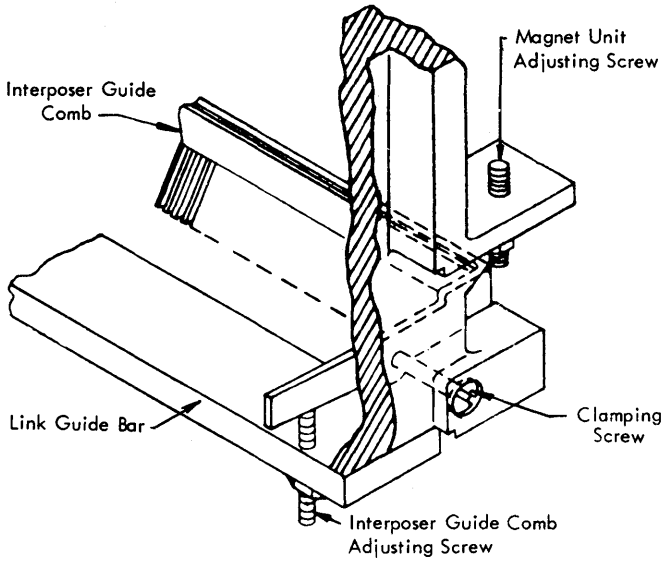
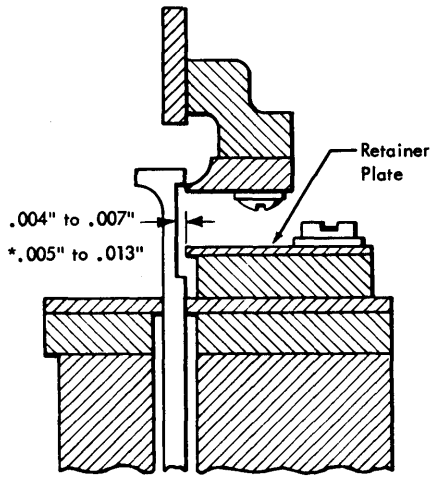


Figure 4-33. Interposer Guide Comb Adjustment

Stripper Assembly

1. Re-install the stripper assembly in its original position on the punch unit.
2. Check to see that the toe of the punch retracts .003" to .006" into the stripper. Adjust by adding or removing .003" thick shims (P/N 437964) between the stripper assembly and the punch drive frame.
3. Be sure the punches are not driven against retaining plate (Figure 4-34).
4. Adjust the retainer plate for .004 to .007" (.005" to .013" sealed ball bearing unit) clearance between the plate and the punches (Figure 4-34).

NOTE: If the toes of the punches are retracted more than .006", the heels of the punch may shear the stripper plate.



* Sealed Ball Bearing Unit

Figure 4-34. Retainer Plate Adjustment

Punch Unit Index

1. Use timing rod (P/N 219300) to line up the timing holes in the cams with the hole in the left side frame (Figure 4-27).
2. Set the punch unit index at 0^{o}.

Punch Unit Timing

At 0^{o} on the punch index, or with the Geneva pin seated, the punch unit index should read 0^{o}, 120^{o}, or 240^{o}. If the index does not read correctly:

1. Loosen the split hub of the punch unit input pulley.
2. Depress the Geneva timing pin and turn the machine manually until the pin seats in the Geneva drive disc.
3. While holding the Geneva in this position, grasp the punch unit output pulley and turn the shaft to 0^{o}, 120^{o}, or 240^{o} on the punch unit index. This timing can be observed from the right side of the machine.
4. Tighten the punch unit input pulley.
5. Check punch unit index against machine punch index. With the machine punch index at 0^{o}, the punch unit index should read 0^{o}, 120^{o}, or 240^{o}.

NOTE: If the punch unit index is at 0^{o} and the machine punch index is at 0^{o}, it will take three revolutions of the machine index before the two will be at 0^{o} again.

PACB Unit Timing

At 0^{o} on the punch unit index, the marks on the top edge of the PACB side frame and on the collar of the CB shaft should coincide. To time the PACB unit, loosen the split hub of the punch unit output pulley and turn the CB shaft until the marks line up with the punch unit index at 0^{o}.

Vertical Position of Punch Unit

Excessive wear of the die and stripper assemblies can result from improper punch adjustment. The punch unit adjusting sleeves must be set so that the die handles exhibit no wink or a very slight wink when the units are cold. This will ensure that the die lugs are tight when operating temperatures are reached. On raising the lowering frame, contact of the die lugs on the side frames should be felt on the last 15^{o} to 30^{o} rotation of the handle. This indicates that the die lugs are clamped.

NOTE: Both handles should be tested for free motion to ensure contact with die lugs on both ends of unit.

Two conditions have to be met simultaneously while making the preceding adjustments (Figure 4-35).

1. Unit must be in proper vertical position to maintain tightness between die lug and side frame.
2. The unit must be square with the side frames.

When using the squareness gage, P/N 610692, the maximum allowable deviation is .0015" gap between the punch unit and the top of the gage. In an extreme case, the top of the punch unit would be tilted toward the hopper. Adjust by:

1. Removing the four holding screws on top of the punch unit (Figure 4-36).

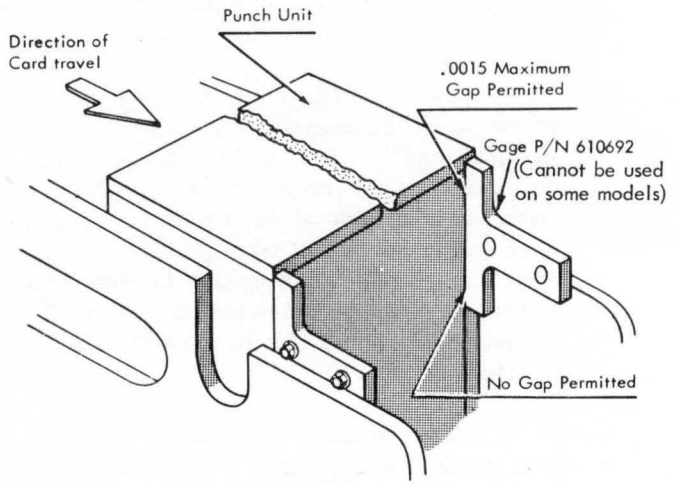


Figure 4-35. Punch Unit Position

2. Turning adjusting sleeves to obtain proper adjustment.

NOTE: The squareness gage, P/N 610692, is no longer being shipped with 1622 Systems. The punch feed side castings have been altered for the re-designed punch unit. This eliminated the machine surface which was formerly used as a reference making it impossible to use the gage. If the vertical position of the punch unit must be adjusted, feeler gages can be used between the punch unit top plate and the side castings to check for squareness.

3. Replacing holding screws and checking adjustments after holding screws are tightened.

NOTE: The punch registration is directly affected if the punch unit is not square with the side frame.

Punch Registration

1. Run the cards through the machine and check the punching registration with a card gage.
2. To shift the punching laterally on the card (horizontal registration):
   a. Loosen the four holding screws on top of the punch unit (Figure 4-36).
   b. Loosen the locknut on the horizontal adjusting screw and turn screw in proper direction to correct the horizontal registration.
   c. Move the punch unit so that it is tight against the horizontal and the two vertical adjusting screws, then tighten the holding screws. Re-check registration and repeat Step a. through c., if necessary.
3. If the vertical registration is erratic, or off more than a few thousandths of an inch, the punch may not be the cause. Check:
   a. Aligner station for correct operation and timing.
   b. Proper card feeding or timing of card to the first feed rolls.
   c. Loose feed roll belts.
   d. Punch unit not perpendicular to card line.
   e. Worn or loose Geneva studs or Geneva output gears.
4. If the vertical registration is to be corrected by moving the punch unit:
   a. Loosen the four punch unit holding screws (Figure 4-36).

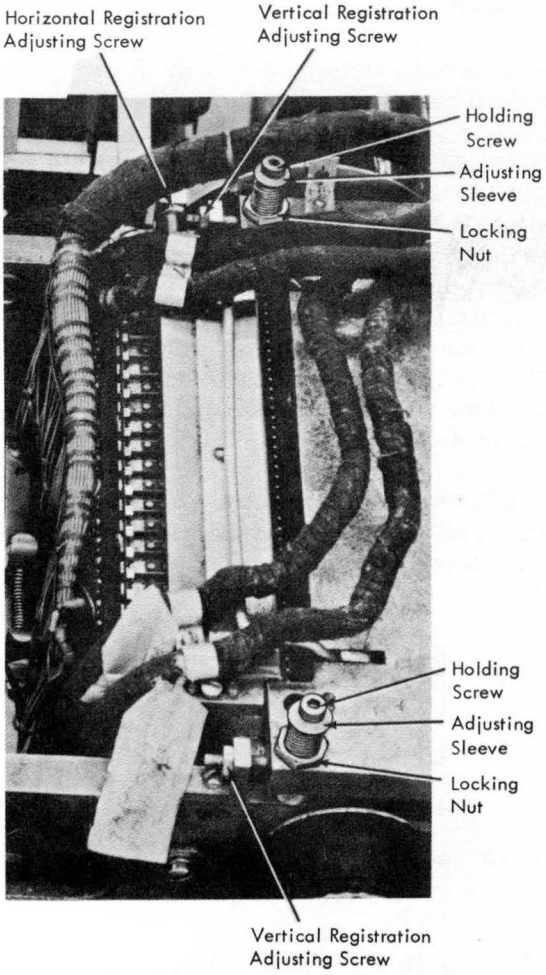


Figure 4-36. Punch Unit Registration Adjustments

b. Loosen the vertical adjusting screw locknuts and turn the adjusting screws as required.
c. Tighten locknut.
d. Move punch unit against the two vertical and one horizontal adjusting screws, tighten holding screws and re-check registration. Repeat Step a. and d. if necessary.

4.4.16 Circuit Breaker Units

Replace any cam contacts that are burned or pitted. Stoning of the cam contact surfaces is not practical because the results do not justify the time and expense involved. On the unitized CB (P/N 25590) the stationary point is replaceable. If, however, the movable point becomes pitted, the whole CB must be replaced. On the high speed plunger (P/N 615411 or 615412) or the latch type CB's if either point becomes pitted, replace the whole CB.

4.4.17 Open Strap Contacts

Adjust the hopper, throat, roll opening device interlock, and stacker contacts for approximately 1/32" minimum air gap and for 1/64" minimum rise of the stationary strap off the support strap.

4.4.18 Timing Belt Tension

Belt, pulley, bearing, and shaft life can be increased with the proper belt tension. The 1-lb (450-grams) pressure indicated in Figure 4-37 can be measured by using the gram gage (P/N 450459) and the X10 blade.

When using the gram gage to measure belt tension, the pointer must be at least to the midpoint of the belt and not on the very edge.

Several belts have not been included because of no adjustable idlers, or belts which cannot be readily measured with the gram gage. In these cases, proper tension may be obtained by comparison to a belt of similar span and width.

4.5 REMOVAL AND INSTALLATION PROCEDURES

4.5.1 Read Feed

Clutch Drive Assembly Removal (Figure 4-38)

1. Locate the positioning blocks firmly against the drive assembly and tighten the positioning block locating screws.

NOTE: This is normally set at the factory and should not be changed unless belt tightness needs adjusting or a belt is running to one side of a pulley.

2. Scribe a line along one end of the drive assembly to maintain front to rear location.
3. Remove the dynamic timer and the hand wheel as an assembly.
4. Establish clutch ratchet to RCCB timing:
   a. Block clutch armature and turn until keeper falls behind drive arm ($315^{o} \pm 1^{o}$).
   b. Spot-mark RCCB shaft gear to CB side casting or to guard.
5. Remove three drive belts:
   a. Contact roll drive
   b. Motor drive
   c. Clutched feed roll drive (rear). Loosen take-up pulley bracket.
6. Remove the clutch magnet leads at the terminal block.
7. Remove the four hex-head drive assembly mounting screws.
8. Remove the clutch drive assembly to the rear.

Clutch Drive Assembly Installation

1. Set the drive assembly into position from the rear.
2. With clutch engaged and keeper behind drive arm, mesh the clutch ratchet shaft gear to the idler gear while keeping RCCB shaft gear spot marks in position.

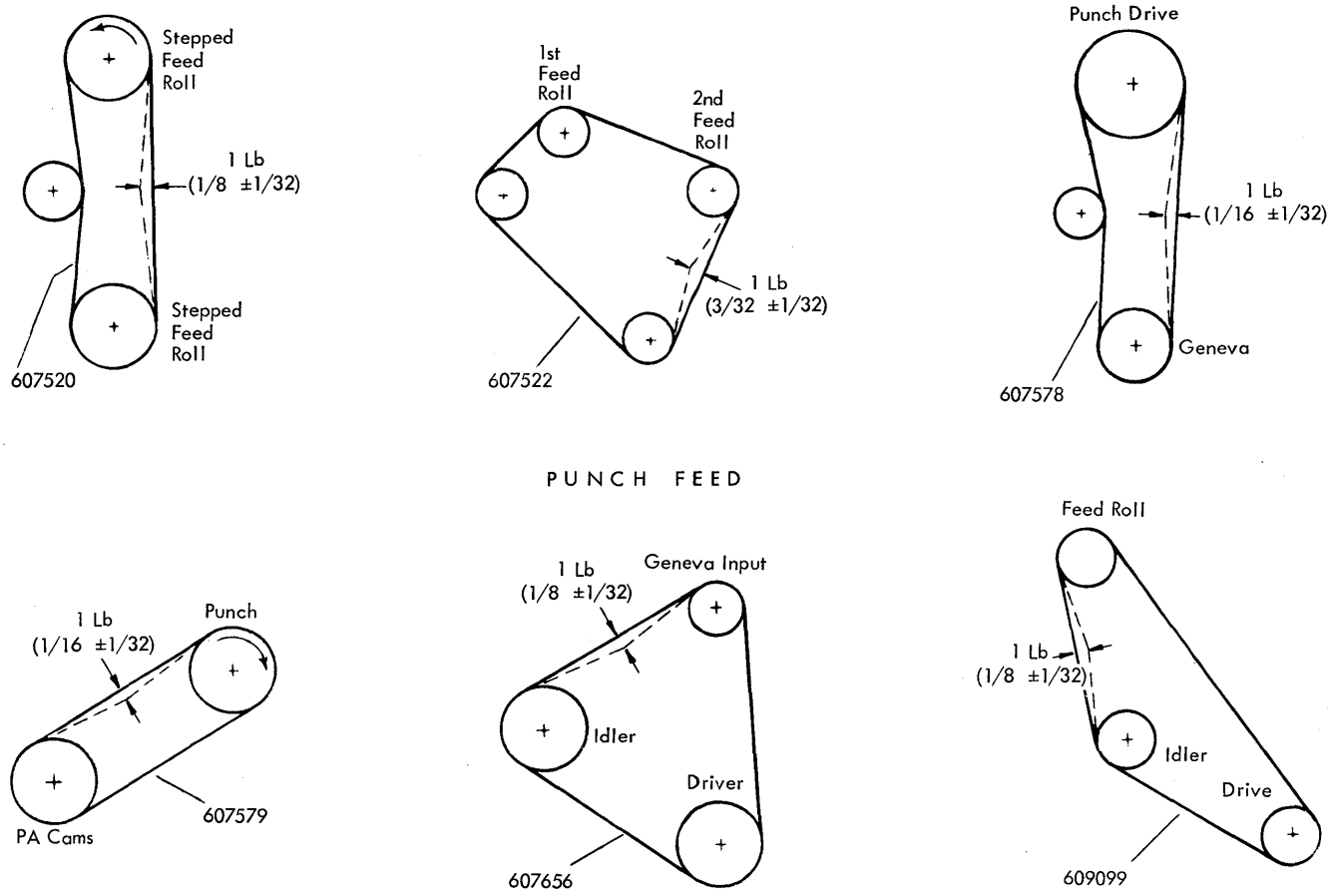


Figure 4-37. Timing Belt Tension, Punch and Read Feed

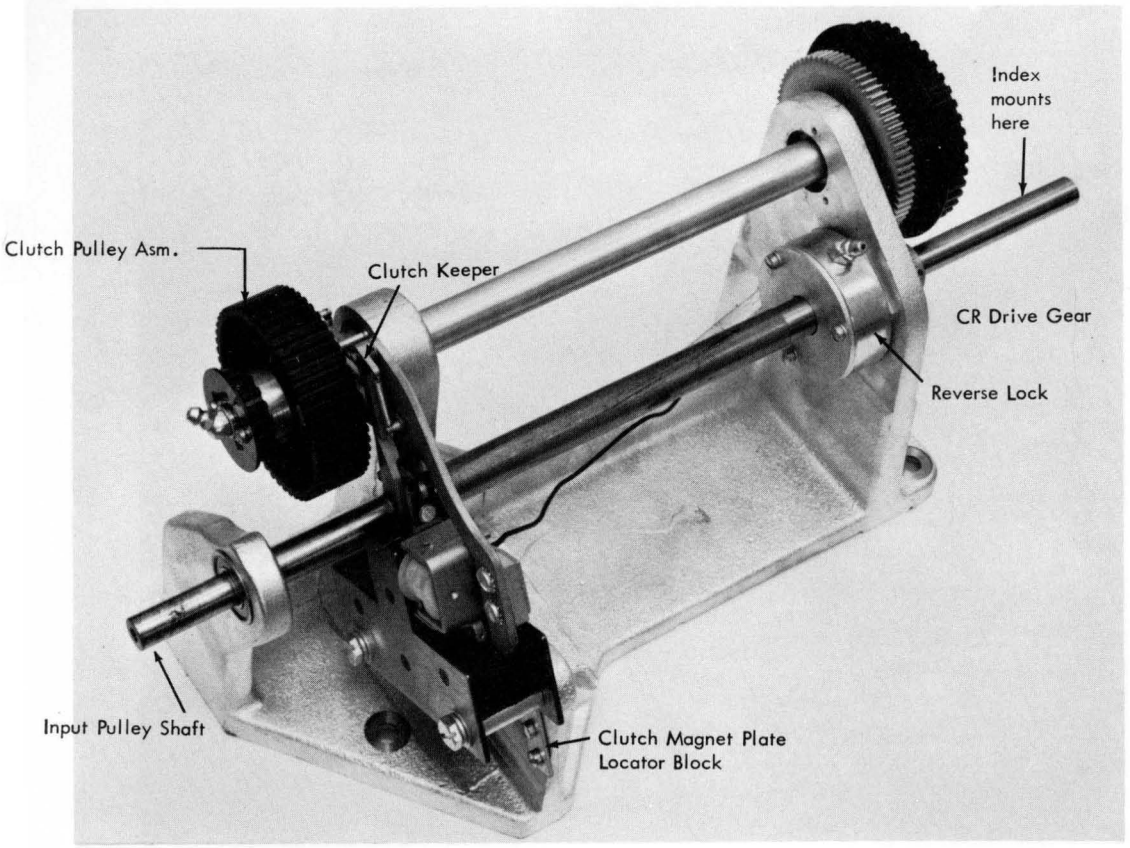


Figure 4-38. Clutch Drive Assembly

3. Install four hex-head drive assembly mounting screws. DO NOT TIGHTEN.
4. Position clutch drive assembly against locating blocks and on scribed line on end of unit. Tighten mounting screws.
5. Install dynamic timer leaving clamped hub loose.
6. With clutch engaged and with keeper behind drive arm, set the dynamic timer index to $315^{o} \pm 1^{o}$.
7. Crank a card in by turning card feed cam shaft until leading edge of card is against first set of feed rolls.
8. Turn machine to set index at 221^{o} and install clutch drive belt. Tighten idler pulley against belt and check the following:
   a. Clutch engagement time ($315^{o} \pm 1^{o}$)
   b. Brush impulse CB timings (use CE aid panel)
   c. Timing of RCCB.

Upper Feed Roll Removal

1. Lower the control key and indicator light panel (Figure 4-39).
2. Remove the necessary belts.
3. Remove the pulley(s) by loosening two set screws per pulley.
4. Remove the rear bearing retainer.
5. Move the feed roll to the rear until the front end of the shaft clears the front machine side frame. Lift the front end of the roll over the front side frame.
6. Assemble in reverse order.

Contact Roll Installation

When installing a new contact roll assembly, be certain that the flat portion of the hub (P/N 602216) is horizontal and up. If the hub is not horizontal, the brush block assembly will not seat properly (Figure 4-40).

Position the shaft collars to eliminate the contact roll shaft end play.

Chute Blade Removal

1. Lower the control key and indicator light panel.
2. Remove the covers at each end of the stacker.

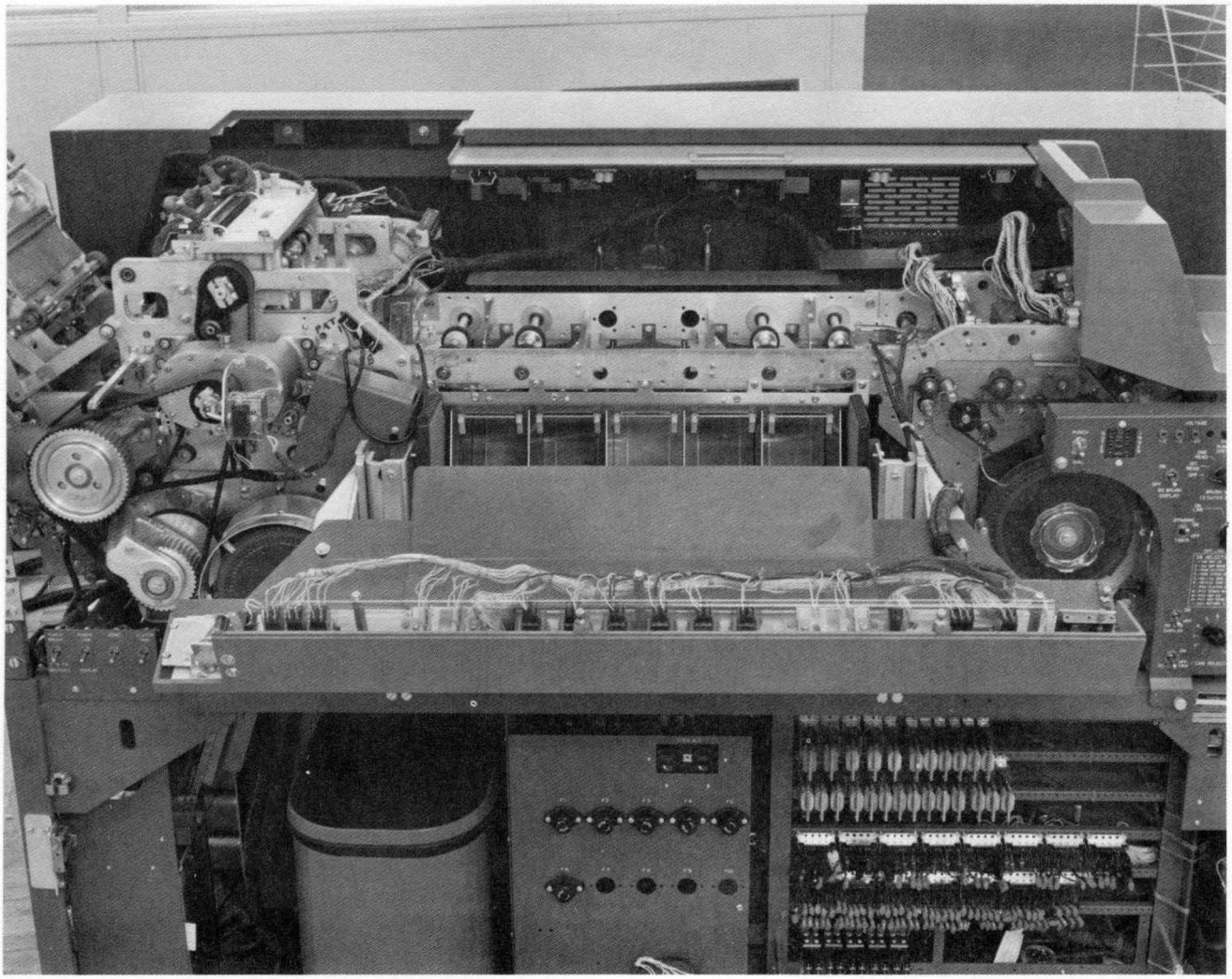


Figure 4-39. Upper Feed Roll Removal

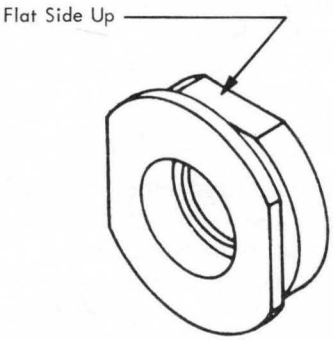


Figure 4-40. Contact Roll Hub

3. Remove the nut from the chute blade mounting screw and remove the chute blades.
4. Assemble in reverse order.

Read Feed Belt Installation

Clutched Feed Roll Drive Belt.

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

NOTE: Any change in picker knife timing will directly affect RCCB's.

4. At this point it is advisable to check (and re-time if necessary) RLCB's to make certain they are within tolerance.

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

4.5.2 Punch Feed

Timing Drive Belts

Removal of any timing belt (Figure 4-41) except the transport roll drive belt, will usually affect the timing of some unit or units. Because of the large number of timed drive belts in the punch feed, careful attention must be given to the following procedures for replacement and re-timing. An important point to remember when re-timing units that refer to the punch clutch,is the synchronous tooth (315°) of the punch clutch. This tooth must be used, otherwise all timing will be 90°, 180°, or 270° from timing specifications. The synchronous tooth is the tooth with its driving face opposite the centerline of one of the three tapped holes located in the outside collar.

Figure 4-42 is a chart showing the units to be removed and units to be re-timed in the event of belt breakage.

(1) Main Drive Belt.

1. Trip clutch between 230° and 300° and turn input idler pulley manually until dog engages in clutch ratchet.
2. While holding armature in tripped position, continue turning machine until latching surfaces of clutch latch arm and dog carrier coincide (Figure 4-19).
3. At this time punch feed index should be 315° ± 1/2°.
4. Set timer index at 315°.
5. At this point, slip belt on Geneva pulley and while keeping the relationship between lower pulley and input idler pulley (315° at the clutch and 315° at the timer) slip belt onto two pulleys. Check timing relationship again.
6. To time the Geneva, loosen Geneva pulley lock screws, set timer index to 0°, and set punch index to 0°.
7. Depress Geneva lock pin and tighten Geneva pulley lock screws.

NOTE: At 315°, if everything is in time, the Geneva pin should fall into the slot and the punch clutch will line up as described in Step 2.

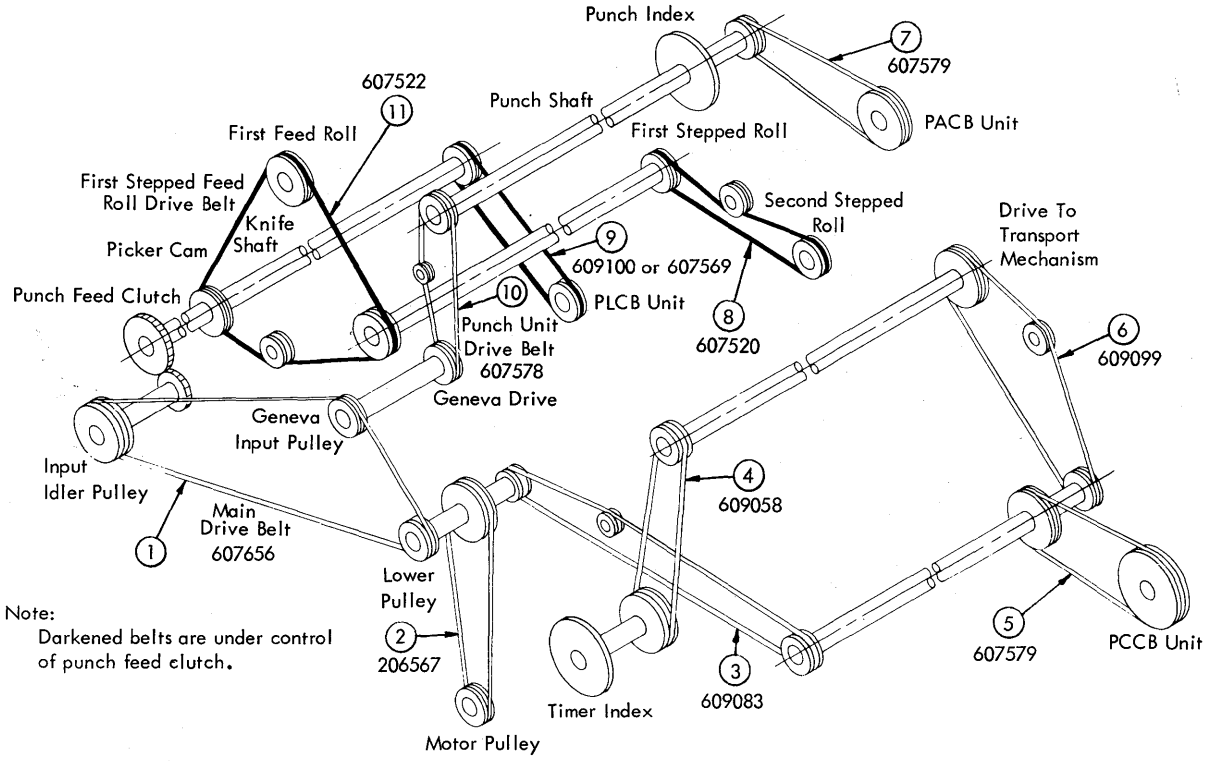


Figure 4-41. Punch Feed Timing Belts

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

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

Figure 4-42. Punch Drive Belt Replacement Chart

(2) Drive Motor Belt.

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

(3) CR Idler Belt.

1. If there is sufficient clearance to work the belt between the index pulley and the cross-over shaft pulley, the index timer unit does not have to be removed from the base. Otherwise, the three base mounting screws on the timer index will have to be loosened.
2. Install new belt, tighten idler pulley, and if necessary, tighten timer index unit (three screws).
3. Re-time index timer by loosening timer index set screws. Unlatch punch clutch between 230^{o} and 300^{o} and while holding the armature in the tripped position, continue turning machine until latching surface of clutch arm and dog carrier coincide (Figure 4-19).
4. At this time, set timer index to 315^{o} and tighten timer adjustment set screws.
5. To re-time PCCB's, loosen PCCB pulley set screws. Set timer index to make time of PCCB 4 (wiring diagram). Turn PCCB unit in normal direction of rotation until PCCB 4 makes and then tighten PCCB pulley set screws.

(4) Timer Index Belt.

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

(5) PCCB Drive Belt.

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

(6) Idler Belt.

1. Remove PCCB drive belt (5) and transport drive belt.
2. Install new belt and tighten with idler pulley.
3. Replace transport drive belt (no timing required) and PCCB drive belt.
4. To re-time the timer index refer to CR Idler Belt Replacement, Steps 3 and 4.
5. To time PCCB's refer to PCCB Drive Belt Replacement, Steps 2 and 3.

(7) PACB Drive Belt.

1. Remove PACB unit from machine (three screws).
2. Install the new belt.

NOTE: On the PACB shaft there is a collar which has a scribed line. There is also a scribed line on the casting which will coincide with the collar line at 0^{o} on the punch index. Set the scribed line on the CB shaft collar to line up with the scribed line on the casting, set the punch index on 0^{o}, then slip the PACB belt over the punch pulley. If care is taken the PACB unit can be tightened and both units will be in time.

3. If the PACB unit CB's are not in time, loosen the PACB drive pulley screws. Align the scribed mark on the PACB mounting unit with the collar scribed line, set the punch index to 0^{o}, depress the Geneva pin, then tighten the pulley screws.

(8) Second Stepped Feed Roll Drive Belt.

1. Loosen idler pulley. Install new belt and tighten with idler pulley.
2. Remove punch feed brushes and PFR brushes (if installed).
3. For timing the second stepped feed roll, refer to Section 4.4.12.

(9) PLCB Drive Belt.

1. Install belt.
2. Loosen PLCB shaft pulley clamping screws and re-time PLCB to timer. Tighten screws.

(10) Punch Unit Drive Belt.

NOTE: Do not remove Geneva unit.

1. Loosen idler pulley. Install belt and tighten belt with idler pulley.
2. To re-time punch, loosen locking screws on punch unit drive pulley. Set punch and timer index to 0^{o}.
3. Depress Geneva pin and tighten pulley lock screws.

(11) First Stepped Feed Roll Drive Belt.

1. Remove the main drive belt.

NOTE: If there is sufficient clearance between the punch clutch unit and the punch drive gear to install the new belt, Steps 2, 3, 8, and 9 do not have to be performed.

2. Mark punch input idler pulley relationship to punch drive gear (Figure 4-43). If this relationship is not maintained there is a possibility of getting the punch clutch back in step $\pm 2^{o}$ out of time.
3. Remove hex nut that holds input idler pulley shaft to machine casting. Remove unit.

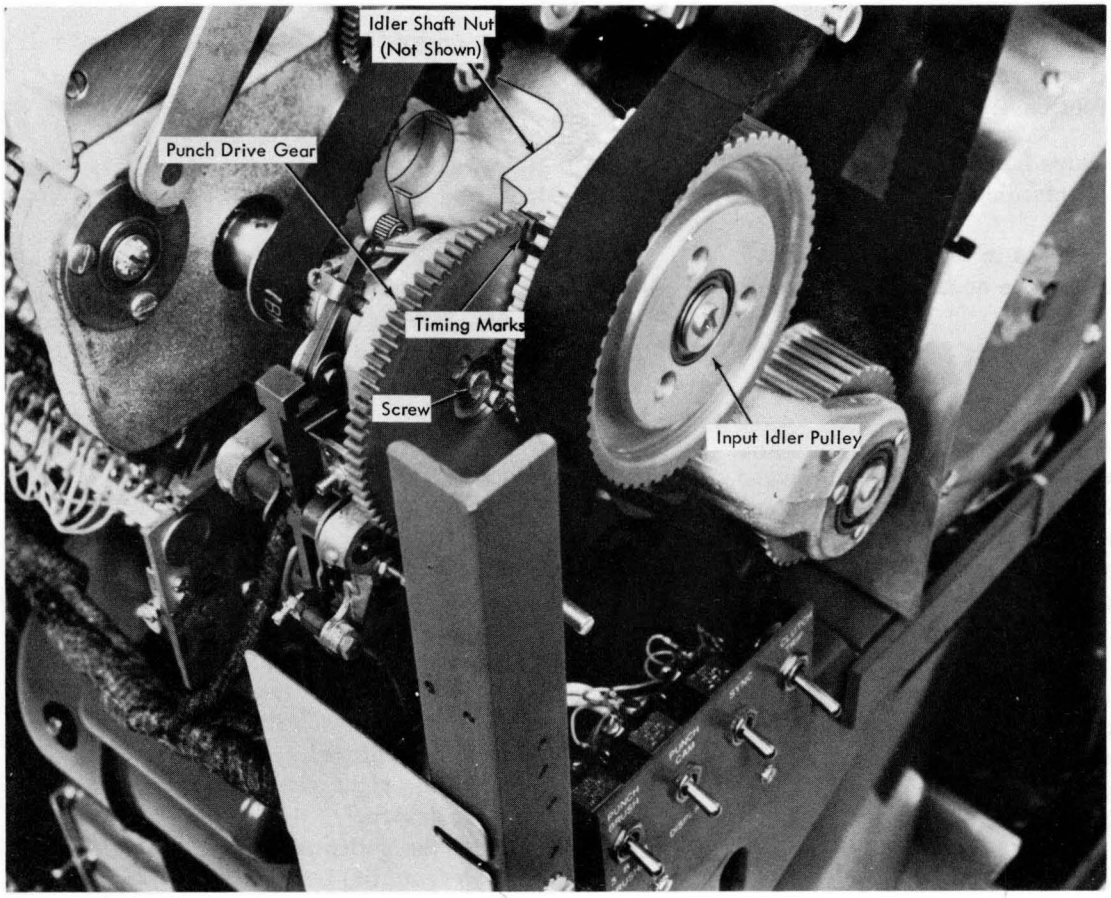


Figure 4-43. PACB Timing Marks

4. Loosen three set screws on clutch ratchet collar, loosen punch drive gear holding screw and slide gear out on spline to obtain belt replacement clearance.

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

5. Remove cam follower spring to ease belt replacement.
6. Unlatch clutch and manually turn punch shaft slightly.
7. Pass belt over clutch magnet assembly and between cam follower and cam.
8. Loosen idler pulley, install belt and adjust tension with idler pulley.
9. Tighten punch drive gear and three set screws on clutch ratchet collar. Re-install cam follower spring.
10. Install punch input idler pulley, being sure to align timing marks, made previously. Tighten hex nut.

NOTE: At this point, punch clutch, Geneva unit, and first stepped feed rolls must be timed.

11. To re-time punch clutch and also Geneva, refer to Main Drive Belt procedures.
12. The first stepped feed roll can be re-timed by referring to Section 4.4.9.

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

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

Clutch Ratchet

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

Side Aligners

1. Remove the punch unit.
2. Remove the Geneva unit.
3. Remove the die card lever assembly.
4. Remove the upper card guides and the card guide mounting bar in the aligning station:
   a. Remove six screws holding card guides to the mounting bar and slide the guides toward the feed.
   b. Remove two screws from each end of the card guide mounting bar and lift the bar out.
5. Remove the second upper feed roll.
6. Remove the lower card guides in the aligner station.
7. Remove to side aligner:
   a. Disconnect the spring from the aligner.
   b. Pull the pivot pin and lift out the aligner.
8. Replace in reverse order.

Forward Aligners

1. Follow the first six steps under Side Aligners.
2. Remove the first lower intermittent feed roll hangers.
   a. Remove the first intermittent feed roll hangers.
   b. Work the intermittent feed roll shaft out the rear side of machine.
3. Remove the forward aligner adjusting screw lock-plates and adjusting screws for both aligners.
4. Remove third upright card guide support by removing four screws through bottom of bed plate. The forward aligners are mounted to this upright and will come out with it.

First Stepped Feed Roll

1. Remove the side aligners.
2. Remove two screws and one pin from each end of the bed plate.
3. Drop the card guide supports and forward aligners out bottom of roll opening assembly.
4. Remove the pulleys and the cam follower arms from the right side of the machine.
5. Remove two screws from the card guide bed plate. These are on the right end under the second intermittent roll.
6. Remove the right side frame from the roll opening device.
7. Remove the pulley and bearing retaining screws from the left end of the stepped roll.

Tap the roll to the front through the bearing hole. If the roll is being replaced, bearings will be furnished with a new shaft.

Fourth of Fifth Upper Feed Roll

1. Remove the punch unit.
2. Remove the Geneva (do not remove locator blocks).
3. Remove the belt and pulley from the right end of the second stepped roll.
4. Remove the bearing and hanger from the left end of the fifth lower roll and the hanger from the right end.
5. Remove the upper card guides and card lever in the second intermittent station.
6. Remove the screws from the "L" bracket and the mounting bar.
7. To remove the fourth upper roll:
   a. Remove bearing retainer screw from left end of shaft.
   b. Tap shaft to the right out of the left-hand bearing — the right-hand bearing slips out of casting.
8. To remove the fifth upper roll, tap shaft out to the right.

Second Stepped Feed Roll

1. Remove the fifth upper feed roll as stated previously.
2. Remove the lower card guide between the second intermittent and the second stepped feed rolls.
3. Remove four screws in the bed plate.
4. Remove two screws and two dowels from the bed plate mounting block located under the first stepped roll in the roll opening device.
5. Remove the right side frame on the roll opening device.
6. Remove the cam and pulley from the left end of the stepped roll shaft.
7. Pull the stepped roll through the right side.
8. Re-assemble in reverse order.
   a. When replacing the card guides between the fourth and fifth upper rolls, the guides must be laid in place; then the mounting bar is put in place and screwed to the guides.
   b. Check for .012" to .030" card clearance between the upper and lower guides.

Punch Unit

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

Punch Unit Installation

1. Place the unit in the machine tight against the vertical and horizontal adjusting screws.
2. Replace the four top holding screws.
3. Connect the multi-terminal connectors.
4. Insert the die.
5. Check squareness and vertical position.
6. Install belts.
7. Time punch unit to machine.
8. Time the punch CB to the unit.

Punch Magnet Unit Removal

1. Remove the punch unit.
2. Remove the punch and stripper assembly.

NOTE: Watch for shims between the stripper and punch drive frame.

3. Remove the interposer cover.
4. Loosen the magnet unit locating screws at both ends of the punch unit side frames.

NOTE: Do not change the positioning screws unless a change of adjustment is necessary.

5. Remove four mounting screws from the
6. Lift the magnet unit off the punch unit frame.
7. Use a rubber band to keep interposers from falling out.

Punch Magnet Unit Installation

1. Place the magnet unit in position on the punch unit frame. Use the edge of the interposer cover to hold the interposer in place.
2. Tighten the magnet unit locating screws which force the magnet unit against the punch unit side frame.
3. Replace the magnet unit mounting screws.
4. Replace the punch and stripper assembly.
   a. Check for .007" to .013" latch overthrow.

b. Check for .003" clearance from interposer to punch.
c. Check that interposers are centered over punches.

Magnet Yoke Assemblies

1. Remove magnet yoke assemblies 2, 3, and 4 (counting from top to bottom).
2. After inspection of units, replace assembly 4 and then 3.
3. Remove magnet yoke assembly 1.
4. Replace magnet yoke assembly 2 and then 1.

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

Interposer and Interposer Link

1. Remove the punch unit.
2. Remove the punch magnet unit from the punch drive. It is not necessary to remove the yoke assemblies.
3. Remove the latch spring in the position to be removed.
4. Push latch to its lower limit of travel.
5. Unhook the interposer link from its latch.
6. Remove the interposer and interposer link.
7. Assemble in reverse order.

Interposer and Interposer Link (Alternate Method)

1. Remove the punch unit from the machine.
2. Remove the punch magnet unit from the punch drive unit.
3. Remove the magnet yoke assembly which contains the magnet that controls the position to be removed.
4. Remove the latch spring in the position to be removed.
5. Push the latch to the lowest limit of its travel.

NOTE: Removal of the yoke assembly in Step 3 increases the latch travel.

6. Unhook the interposer link from the interposer and the latch.
7. Remove the interposer link from the unit.
8. Assemble in reverse order.

Latch

1. Remove the punch unit from the machine.
2. Remove the punch magnet unit from the punch unit.
3. Remove the magnet yoke assemblies from the punch magnet unit.
4. Remove the latch spring from the latch to be removed.
5. Push down on the latch and unhook the interposer link.
6. Remove the latch from the magnet side of the unit.

NOTE: The latches next to the one being removed may have to be moved slightly to obtain sufficient room for removal.

7. Assemble in reverse order as follows:
   a. Replace the punch magnet unit on the punch drive unit before replacing the magnet yoke assemblies.
   b. The latches can be pulled down to the lowest limit of travel to facilitate installation of the magnet yoke assemblies.
   c. Position the magnet mounting bar against the top of the slot in the magnet unit side frame. Be sure that the nylon latch guides do not bind the latches.

Punch

1. Remove the punch unit from the machine.
2. Remove the punch and stripper assembly.
   a. Remove the four mounting screws which hold the punch and stripper assembly to the punch drive frame.
   b. Watch for shims between the stripper assembly and the drive frame.
   c. Position the punch bail at its lowest limit of travel while separating the punch and stripper assembly from the punch drive frame.
3. Remove the five holding screws and remove the retainer plate from the punch and stripper assembly.
4. Remove the desired punch.
5. Assemble in reverse order.
   a. Check for .004" to .007" clearance between punch and retainer plate before re-assembling stripper to the punch drive frame.
   b. Check for .003" clearance between interposer and punch.

Cam Follower Assembly

1. Remove the punch unit from the machine.
2. Remove the punch and stripper assembly.
3. Remove the magnet unit from the punch drive unit.
4. Remove the two dowel pins in the cam follower mounting plate.
5. Remove the four mounting screws.
6. Separate the cam follower assembly from the punch drive unit.

Interposer Setup Bail

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

NOTE: Check the interposer setup bail adjustments as outlined in paragraph 4.4.15.

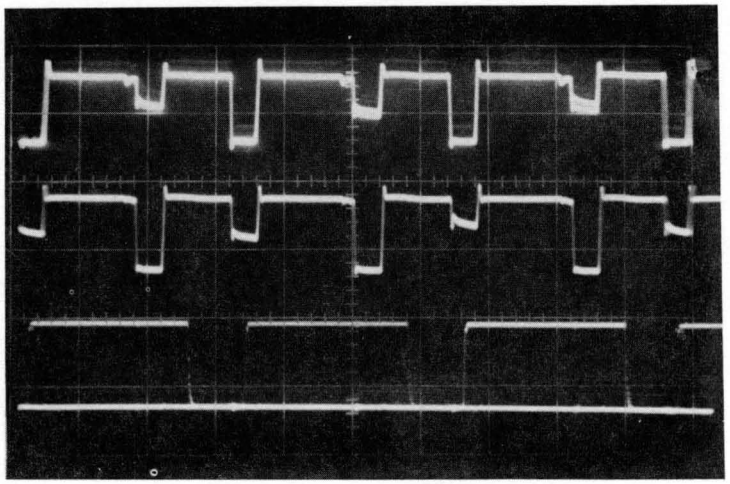
4.6 BUFFER WAVEFORMS

The waveforms in Figure 4-44a through 4-44g can be obtained as follows:

1. Place CU01 test deck in read feed with CU01 load card in front of deck.
2. Depress start key to obtain three run-in feed cycles.
3. Turn on reader select switch. (For upper three waveforms Figure 4-44c, turn on punch select switch instead.)
4. Depress CE start key.

The data from the load card is now circulating in and out of the read buffer.

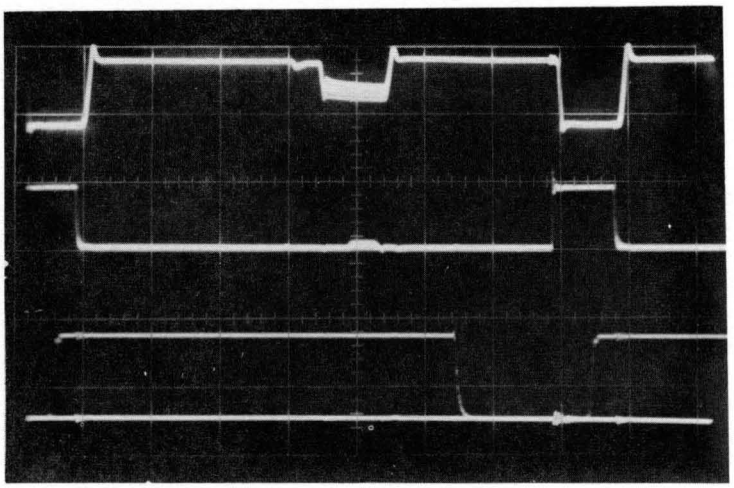
The sync point used for each figure is the No. 1 waveform test point.



1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-5μsec/cm

2. A1 D24 C (04.30.04.1) Rd/Pch Write X Driver
   10 v/cm-5μsec/cm

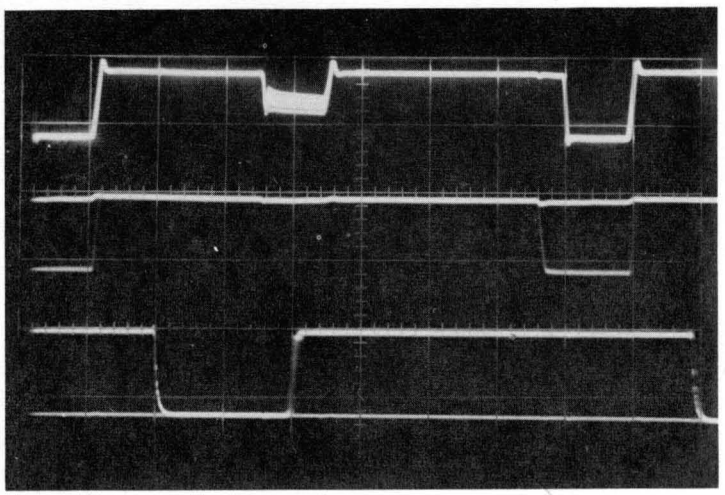
3. A1 B11 A (04.30.01.1) Sense Amp 1 Bit
   10 v/cm-5μsec/cm



1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-2μsec/cm

2. A1 A20 Q (04.30.01.1) +S B3-D2 Sense Amp Strobe
   10 v/cm-2μsec/cm

3. A1 B11 A (04.30.01.1) Sense Amp 1 Bit
   10 v/cm-2μsec/cm

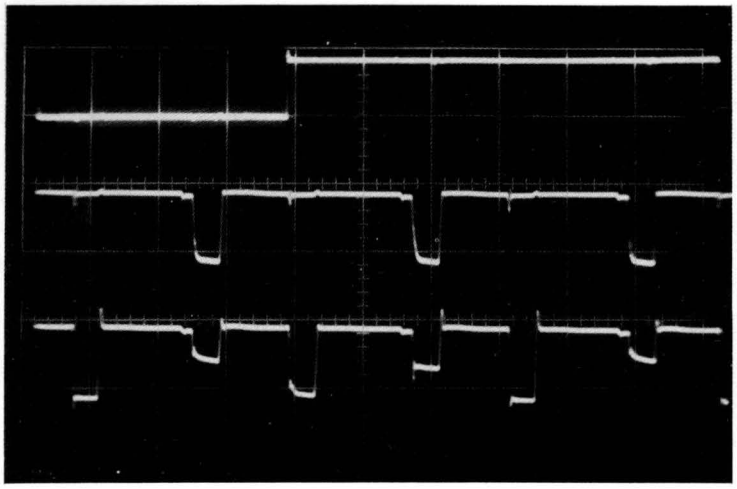


1. A1 D24 C (04.30.04.1) Rd/Pch Write X Driver
   10 v/cm-2μsec/cm

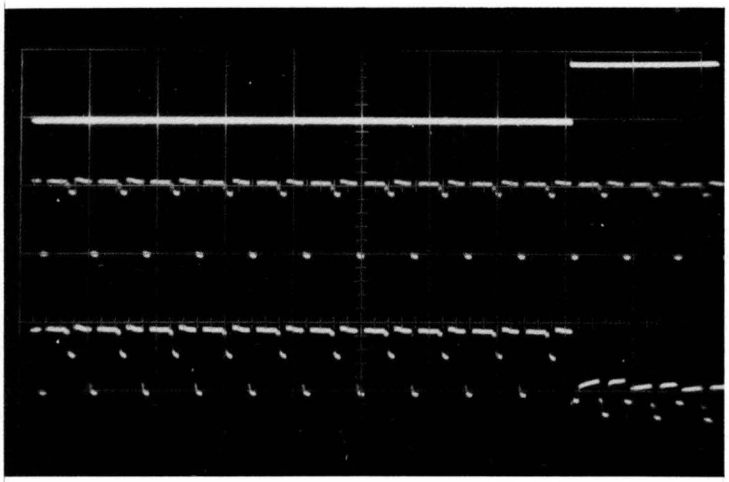
2. A1 D21 E (04.30.03.1) -R Inh 1 Bit
   10 v/cm-2μsec/cm

3. A1 B11 A (04.30.01.1) Sense Amp 1 Bit
   10 v/cm-2μsec/cm

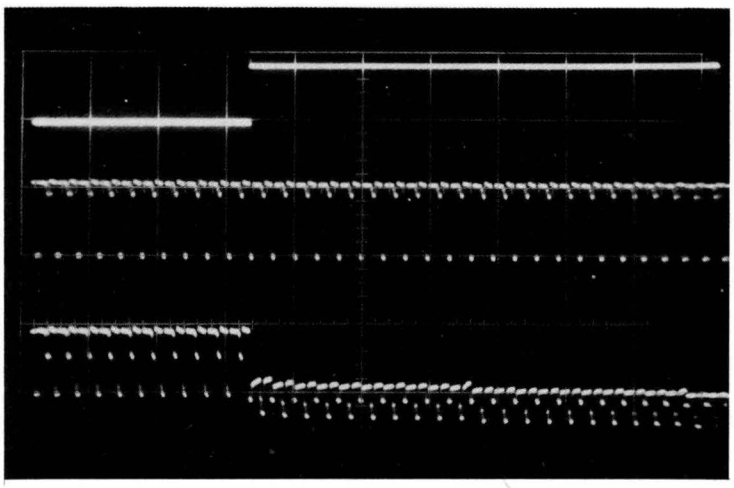
Figure 4-44a. Buffer Waveforms



1. A1 D05 A (04.30.06.1) -S Units 0
   10 v/cm-5μsec/cm
2. A1 D05 G (04.30.06.1) -R Units WR Res
   10 v/cm-5μsec/cm
3. A1 D05 D (04.30.06.1) -R Units RD Res
   10 v/cm-5μsec/cm

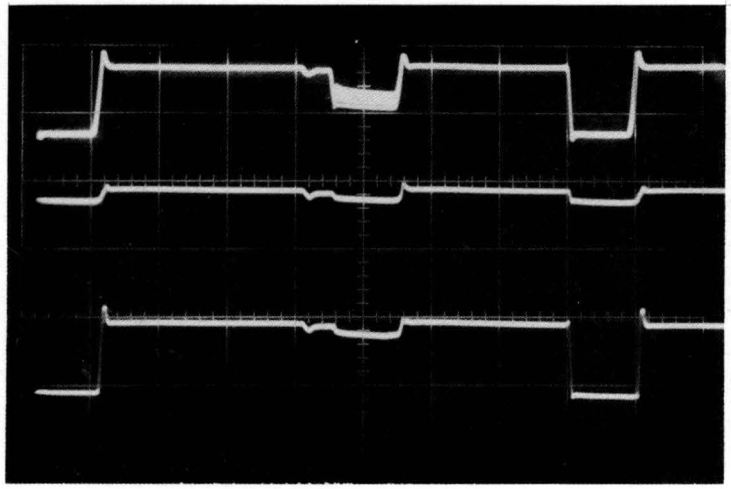


1. A1 D10 A (04.30.07.1) -S Tens 0
   10 v/cm-20μsec/cm
2. A1 D25 E (04.30.05.1) -S B3-D2 Rdr Read Y Driver
   10 v/cm-20μsec/cm
3. A1 D10 H (04.30.07.1) -R R/P RD T 0
   10 v/cm-20μsec/cm



1. A1 D10 A (04.30.07.1) -S Tens 0
   10 v/cm-50μsec/cm
2. A1 D25 E (04.30.05.1) -S B3-D2 Rdr Read Y Drive
   10 v/cm-50μsec/cm
3. A1 D10 H (04.30.07.1) -R R/P RD T 0
   10 v/cm-50μsec/cm

Figure 4-44b. Buffer Waveforms

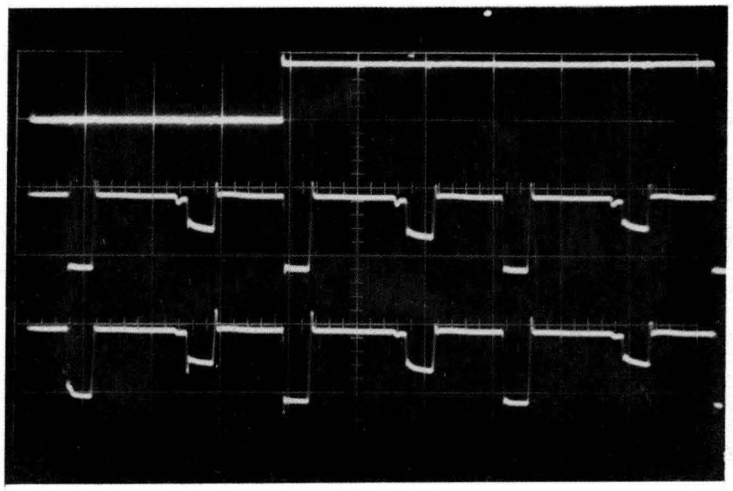


* Pch Select On

1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-2μsec/cm

2. A1 D25 E (04.30.05.1) Reader Read Y Driver
   10 v/cm-2μsec/cm

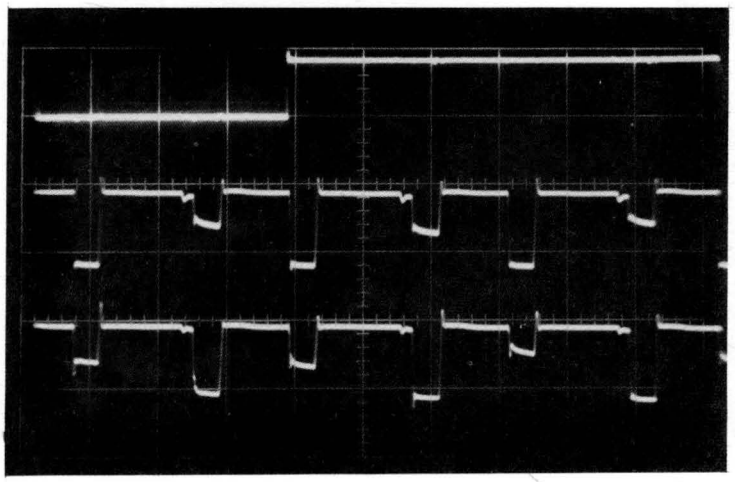
3. A1 D26 E (04.30.05.1) Punch Read Y Driver
   10 v/cm-2μsec/cm



1. A1 D05 A (04.30.06.1) -S Units 0
   10 v/cm-5μsec/cm

2. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-5μsec/cm

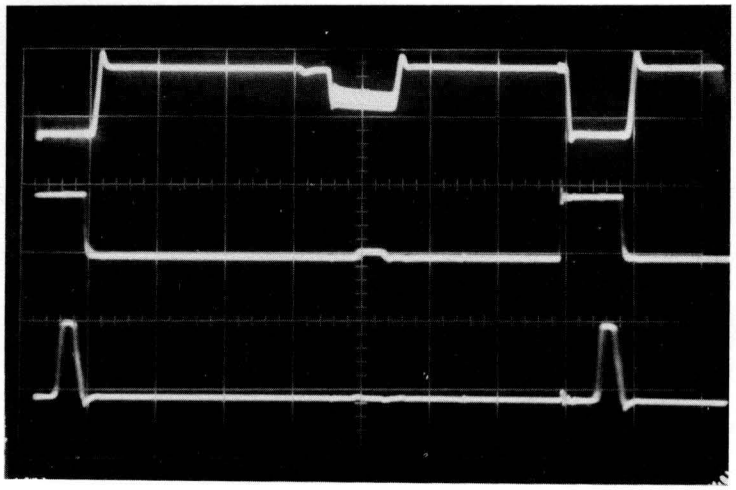
3. A1 D05 H (04.30.06.1) -R R/P RD U 0
   10 v/cm-5μsec/cm



1. A1 D05 A (04.30.06.1) -S Units 0
   10 v/cm-5μsec/cm

2. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-5μsec/cm

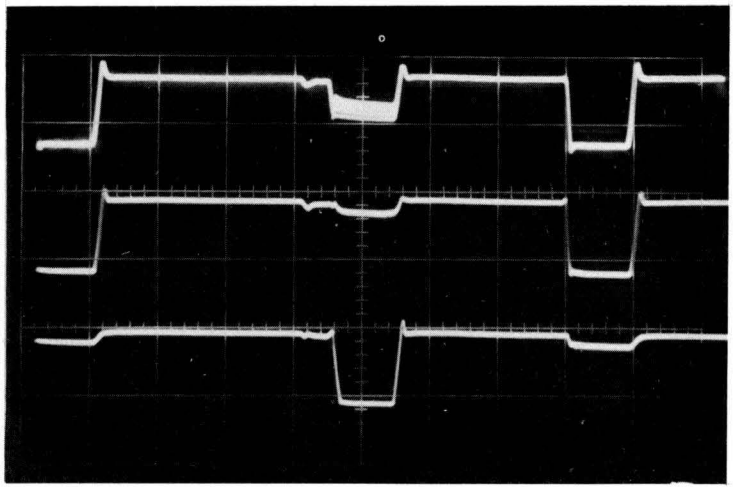
3. A1 D05 F (04.30.06.1) -R R/P WR U 0
   10 v/cm-5μsec/cm



1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-2μsec/cm

2. A1 A20 Q (04.30.01.1) +S B3-D2 Sense Amp Strobe
   10 v/cm-2μsec/cm

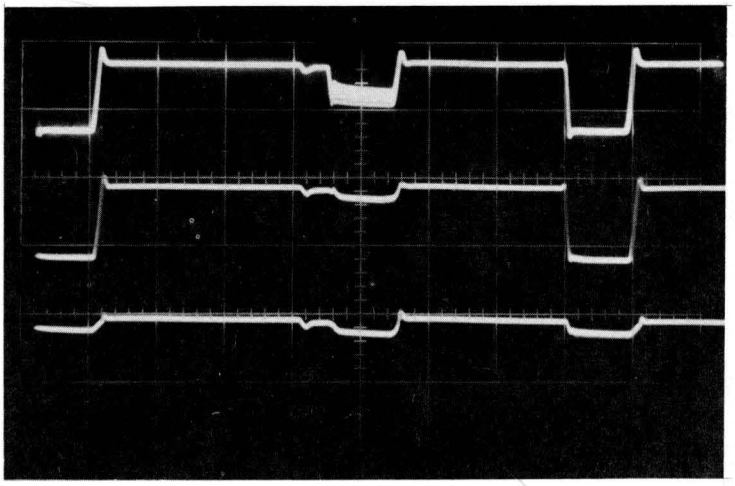
3. A1 B07 AF (04.30.02.1) Sense Amp, A1 Check Plane
   10 v/cm-2μsec/cm



1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-2μsec/cm

2. A1 D25 E (04.30.05.1) Reader Read Y Driver
   10 v/cm-2μsec/cm

3. A1 D25 C (04.30.05.1) Reader Write Y Driver
   10 v/cm-2μsec/cm

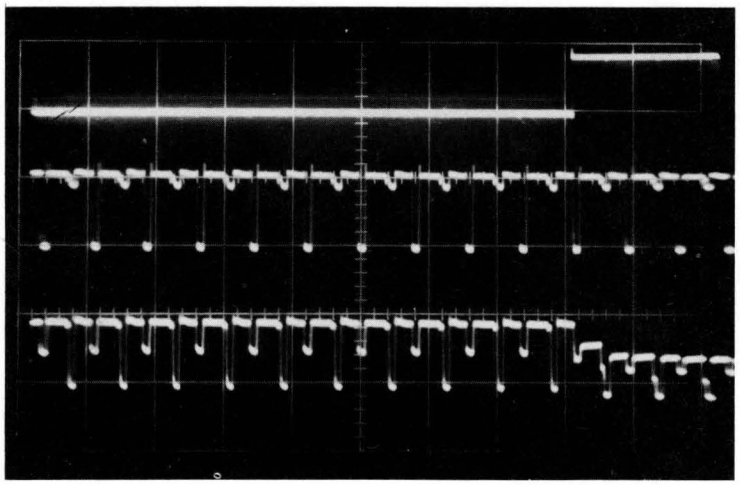


1. A1 D24 E (04.30.04.1) Rd/Pch Read X Driver
   10 v/cm-2μsec/cm

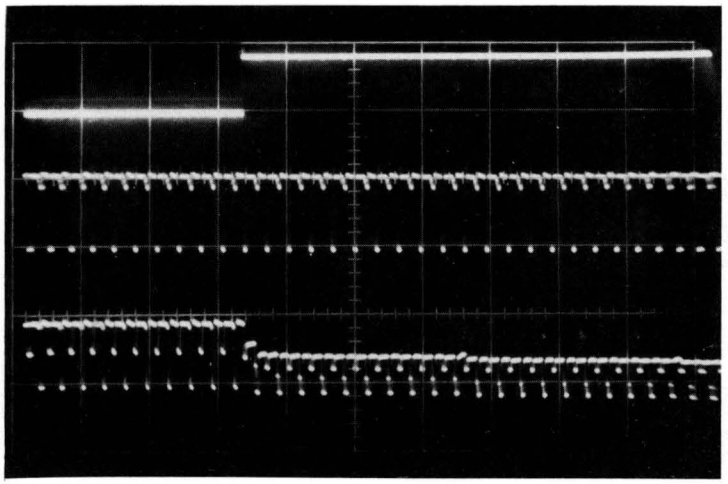
2. A1 D25 E (04.30.05.1) Reader Read Y Driver
   10 v/cm-2μsec/cm

3. A1 D26 E (04.30.05.1) Punch Read Y Driver
   10 v/cm-2μsec/cm

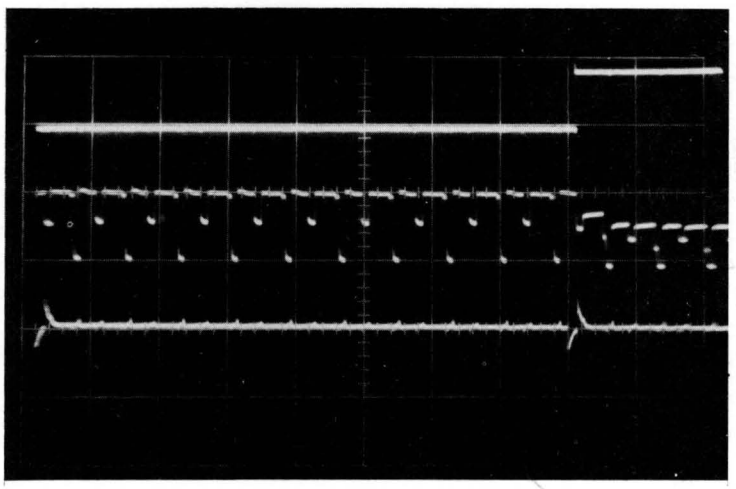
Figure 4-44d. Buffer Waveforms



1. A1 D10 A (04.30.07.1) -S Tens 0
   10 v/cm-20μsec/cm
2. A1 D05 F (04.30.06.1) -R R/P WR U0
   10 v/cm-20μsec/cm
3. A1 D10 H (04.30.07.1) -R R/P RD T 0
   10 v/cm-20μsec/cm

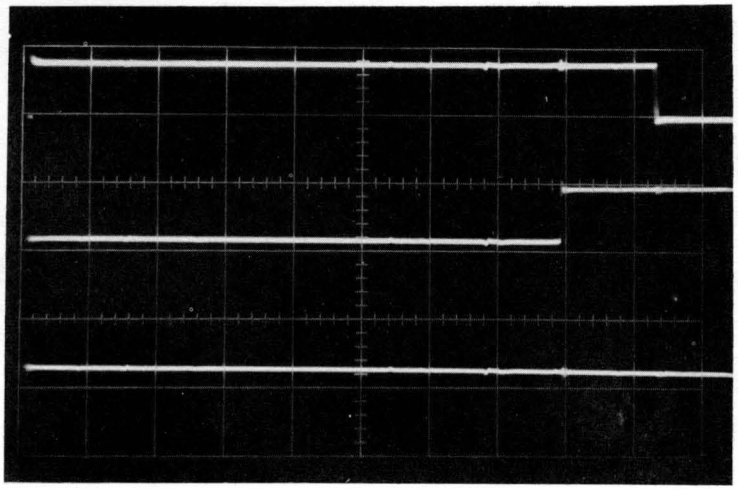


1. A1 D10 A (04.30.07.1) -S Tens 0
   10 v/cm-50μsec/cm
2. A1 D05 F (04.30.06.1) -R R/P WR U0
   10 v/cm-50μsec/cm
3. A1 D10 H (04.30.07.1) -R R/P RD T 0
   10 v/cm-50μsec/cm



1. A1 D10 A (04.30.07.1) -S Tens 0
   10 v/cm-50μsec/cm
2. A1 D10 F (04.30.07.1) -R R/P WR T 0
   10 v/cm-50μsec/cm
3. A1 D17 G (04.30.07.1) Current Source
   2 v/cm-50μsec/cm

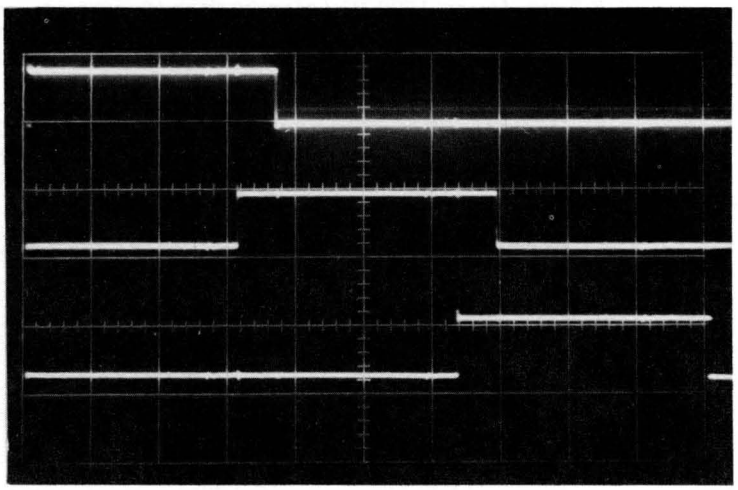
Figure 4-44e. Buffer Waveforms



1. A1 E01 B (04.15.01.1) UTR Units 0
   10 v/cm-2μsec/cm

2. A2 E01 E (04.15.01.1) UTR Units 1
   10 v/cm-2μsec/cm

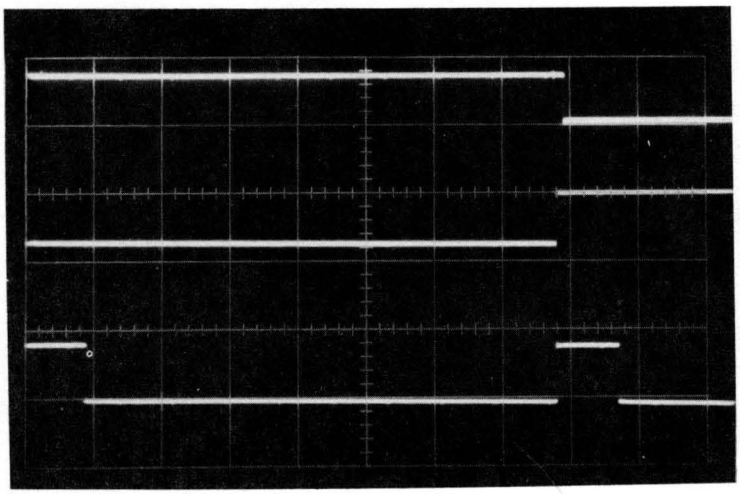
3. A2 E04 B (04.15.01.1) UTR Units 2
   10 v/cm-2μsec/cm



1. A2 E01 B (04.15.01.1) UTR Units 0
   10 v/cm-5μsec/cm

2. A2 E01 E (04.15.01.1) UTR Units 1
   10 v/cm-5μsec/cm

3. A2 E04 B (04.15.01.1) UTR Units 2
   10 v/cm-5μsec/cm

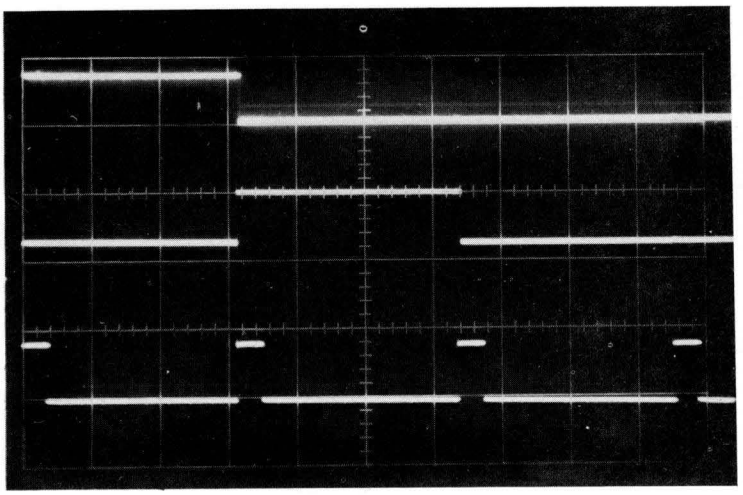


1. A2 F01 B (04.15.03.1) UTR Tens 0
   10 v/cm-20μsec/cm

2. A2 F01 E (04.15.03.1) UTR Tens 1
   10 v/cm-20μsec/cm

3. A2 E01 B (04.15.01.1) UTR Units 0
   10 v/cm-20μsec/cm

Figure 4-44f. Buffer Waveforms



1. A2 F01 B (04.15.03.1) UTR Tens 0
   10 v/cm-50μsec/cm
2. A2 F01 E (04.15.03.1) UTR Tens 1
   10 v/cm-20μsec/cm
3. A2 E01 B (04.15.01.1) UTR Units 0
   10 v/cm-50μsec/cm

Figure 4-44g. Buffer Waveforms

4.6.1 Transfer from 1620 Waveforms (Write Instruction)

The waveforms in Figure 4-45 are obtained as follows:

1. Run in blank cards in the punch.
2. Depress punch stop key to prevent Step 5 causing a punch feed clutch operation.
3. Turn on the punch buffer ready latch by grounding A2 D26 H (04.10.11.1).

NOTE: On machines with serial number 10490 and above, a switch (PCH BUF RDY) is provided for turning on the punch buffer ready latch (Figure 5-2).

4. Insert a write numerically instruction followed by a branch instruction (back to the write numerically instruction).
5. Depress release and start keys. A continuous transfer from 1620 operation is now occurring. Scope the points as indicated.

NOTE: All CE switches are to be off (normal).

4.6.2 Transfer to 1620 Waveforms (Read Instructions)

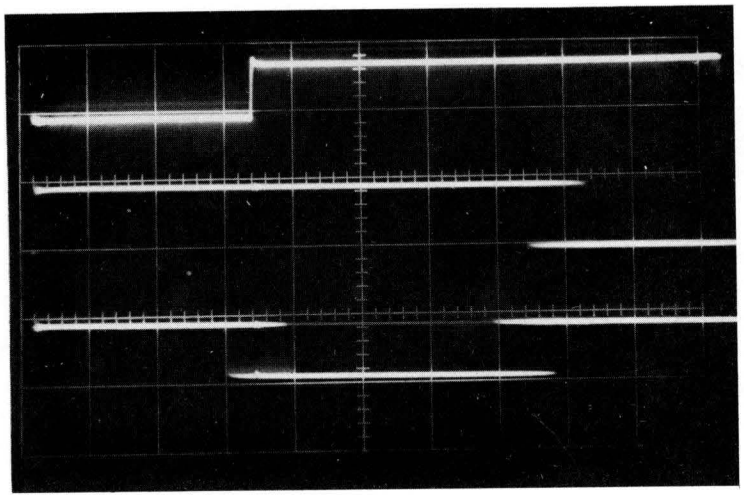
The waveforms in Figure 4-46 are obtained as follows:

1. CUO1 test deck is run in three feed cycles to load the read buffer.
2. Depress reader stop key to prevent Step 5 causing a read feed clutch operation.
3. Turn on the read buffer ready latch by grounding A2 C05 K (04.10.11.1).

NOTE: On machines with serial number 10490 and above, a switch (RD BUF RDY) is provided for turning on the read buffer ready latch (Figure 5-2).

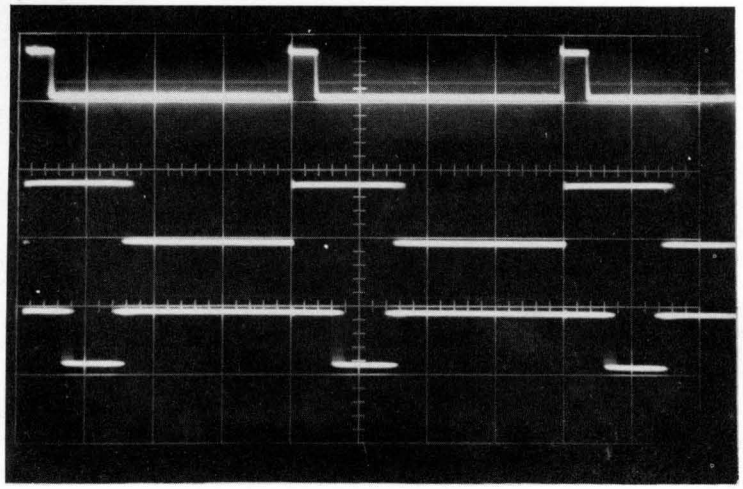
4. Insert a read numerically instruction followed by a branch instruction (to the read numerically instruction).
5. Depress release and start keys. A continuous transfer to the 1620 operation is now occurring. Scope the points as indicated.

NOTE: All CE switches are to be off (normal).

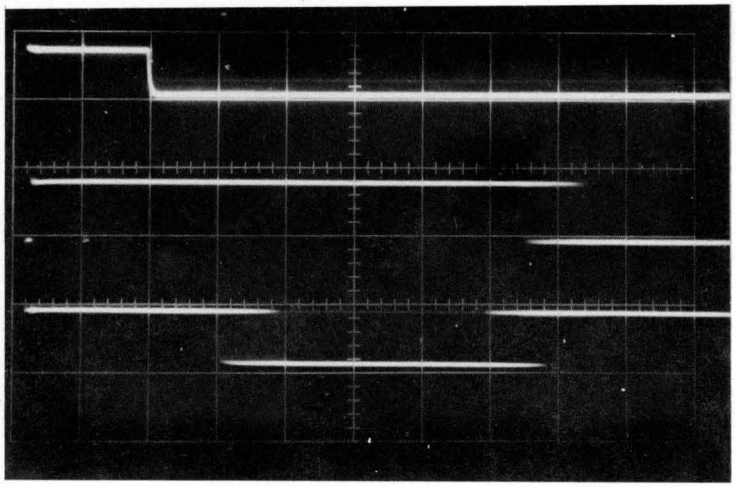


1. A2 A16 A (04.10.09.2)-S 1620 I/O Sample
   10 v/cm-2μsec/cm
2. A2 A16 E (04.10.09.2) Trans From 1620
   10 v/cm-2μsec/cm
3. A2 A15 C (04.10.09.2) -S Punch Sync
   10 v/cm-2μsec/cm

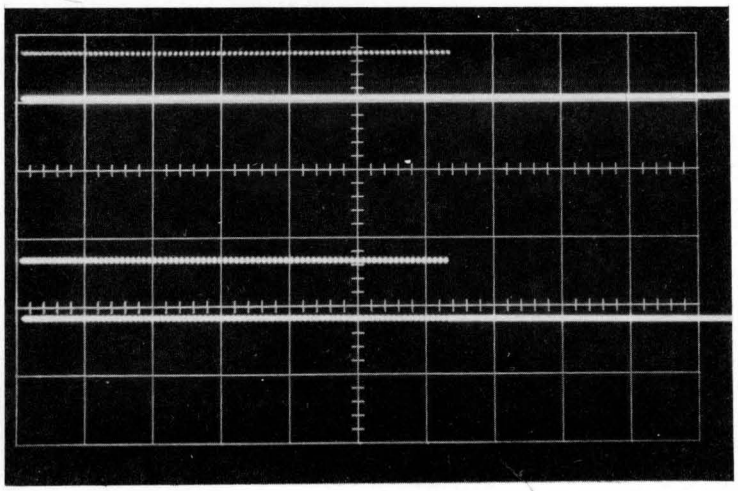
Figure 4-45. Transfer Form 1620 Waveforms (Write Instruction)



1. A2 B23 R (04.10.09.1) +S 1620 Sample I/O
   10 v/cm-10μsec/cm
2. A2 A12 B (04.10.09.1) Transfer To 1620
   10 v/cm-10μsec/cm
3. A2 A11 C (04.10.09.1) -S Card Read Sync
   10 v/cm-10μsec/cm



1. A2 B23 R (04.10.09.1) +S 1620 Sample I/O
   10 v/cm-2μsec/cm
2. A2 A12 B (04.10.09.1) Transfer To 1620
   10 v/cm-2μsec/cm
3. A2 A11 C (04.10.09.1) -S Card Read Sync
   10 v/cm-20μsec/cm



1. A2 B23 R (04.10.09.1) +S 1620 Sample I/O
   10 v/cm-0.5msec/cm
2. A2 A12 B (04.10.09.1) Transfer To 1620
   10 v/cm-0.5msec/cm

Figure 4-46. Transfer To 1620 Waveforms (Read Instruction)

CONTENTS

5.1 APPROACH TO SERVICING

Rapid and effective diagnosis depends upon thorough knowledge of the machine logic and efficient use of diagnostic tools.

Whenever a machine fails to perform an operation, the cause must be located quickly so that corrective maintenance can be performed and the machine returned to the customer with a minimum loss of time. Therefore, it is necessary that every CE develop a good diagnostic technique. This technique should include interpretation of all error indications, recognition of certain failures as being due to particular component failures, and a complete understanding of diagnostic programs, CE test and aid panels and their method of use.

When a customer reports a trouble, the CE should first collect as much information as possible from the operator concerning the customer's program, console indicator lamps, and CE panels before attempting any corrective action. Which operation was being attempted? How did the machine fail? Is the trouble intermittent or consistent? Record the contents of all registers and the status of any error indicator lamps. Check that timing rings are in the proper position for the operation being performed.

If power supply voltages are not within specified limits, correct the condition. This may cure the trouble.

Try to localize the trouble before operating the machine. It is possible that a static check, with the machine remaining in the error condition, will reveal the trouble. If it doesn't, try to reconstruct the operation using the same addresses and data. Analysis of indicators and data may point to the trouble.

Diagnostic tests and marginal voltage tests are effective aids in diagnosis.

5.2 DIAGNOSTIC TESTS

For a complete description of the diagnostic test programs see the diagnostic test manual.

Diagnostic Test IO02 is designed to check all characters in all positions of the buffers in the 1622: punch and read, last card indicator, and the read and write checks in both alphameric and numerical modes.

5.3 MARGINAL CHECKING

A pulse may experience a decrease or increase in width as it travels through successive stages. If serious enough, this may cause incomplete switching or improper timing.

Marginal checking is a preventive maintenance technique used to detect the marginal operation of circuits within a machine system.

By varying the +12M, the CE can inspect a machine system and replace circuit assemblies which are approaching a failure condition.

Transition delay time in the transistors is increased by running diagnostic tests with the +12M reduced -15% (-1.8 v). If transition time has deteriorated, this test can be used to show the area involved. Transition delays are cumulative. The most critical areas are where a number of logic blocks (transistors) are in series.

The diagnostic test manual gives test routines with associated flow charts for aiding the Customer Engineer in locating trouble. The tests can be used to check machine performance following scheduled maintenance.

5.3.1 Marginal Check Unit

The marginal check unit consists of a special power supply with a variable output voltage. This unit is placed in series with the +12 v supply and permits the Customer Engineer to change the +12 v a maximum of ± 3 v.

WARNING: The MC voltage must be at zero before any MC switches are transferred. Adjust the MC rheostat for a zero per cent meter reading.

Two switches are provided to allow the voltage to be directed to panel A1 and/or A2. Any one or both may be used at the same time. In the normal (down) position, the +12 v supply is fed directly to panels A1 and A2. With the switches transferred (up) the marginal check unit is in series with the 12 v supply and the MC rheostat can be used to vary the +12M supply to the panel selected by the switch or switches.

5.4 DIAGNOSTIC AIDS

5.4.1 CE Aid Panel (Figure 5-1)

A service panel is provided in conjunction with the dynamic timer, to aid the CE in servicing the 1622. The CE aid panel is located on the front upper right end of the machine and contains the following aids:

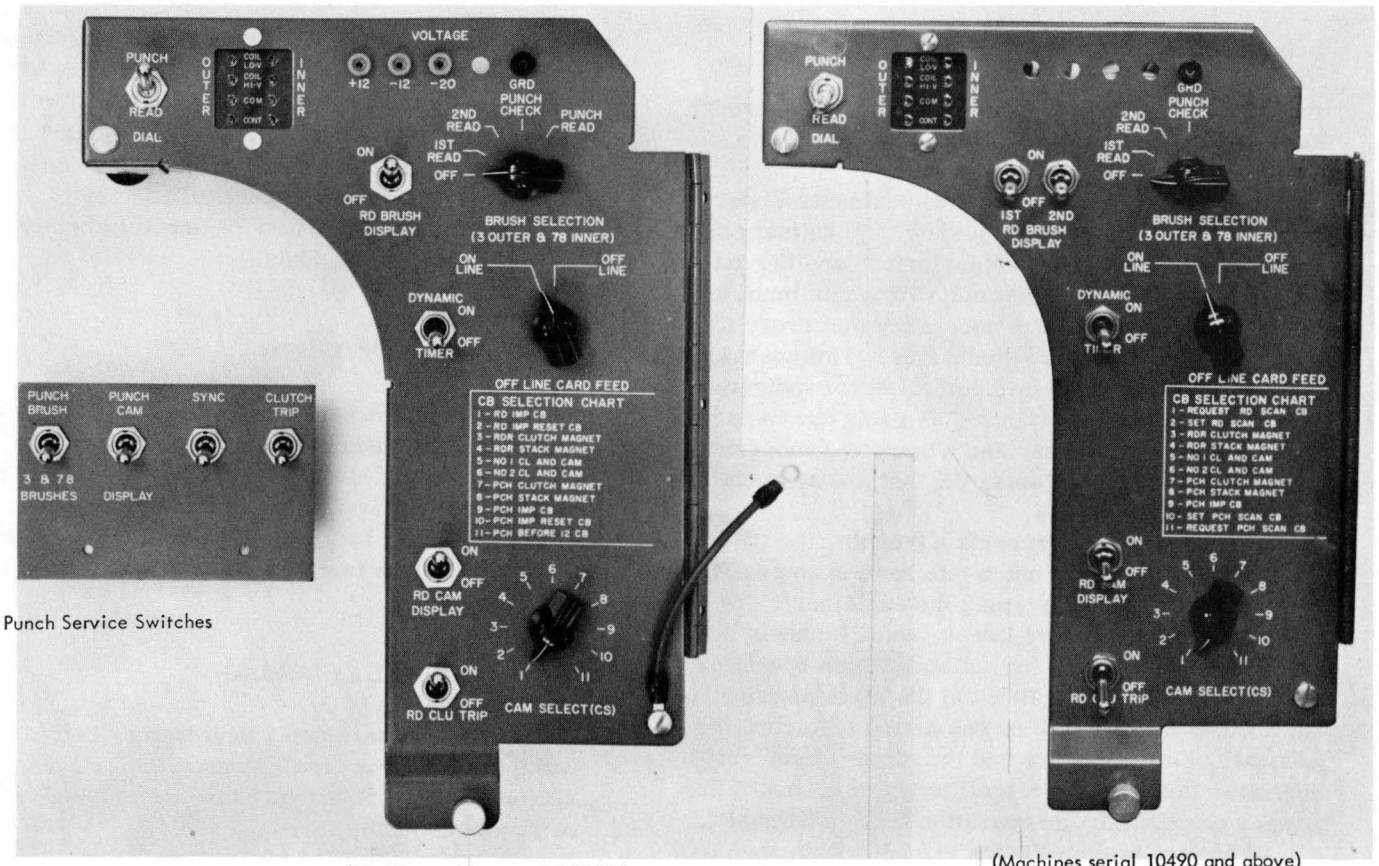


Figure 5-1. CE Aid Panel

1. Voltage test hubs: -12 v, +12 v, -20 v, and ground (on machines prior to serial 10490 only).
2. Dynamic timer control hubs.
3. Toggle switches
   a. Dial display switch to control which timer dial (read or punch) will be illuminated.
   b. Read brush display in conjunction with dynamic timer and brush selection switch allows reading of columns 3 and 78. Machines serial 10490 and above have two individual switches to eliminate back circuits between the two read brush stations. Brush timing checks must be made with the machine off-line for machines prior to serial 10490. Read brushes on machines serial 10490 and above may be checked on-line by transferring the Read Error Bypass switch to prevent false error indications.
   c. Dynamic timer On-Off switch.
   d. Read cam display, On-Off switch. This switch in conjunction with the dynamic timer and cam select switch allows the display of various cam impulses.
   e. Read clutch trip, On-Off switch. This switch allows remote control of the read clutch when the Off-Line Card Feed switch is in the Off-Line position.
4. Rotary Switches
   a. Brush selection switch, in conjunction with brush display switch, allows display of brushes 3 and 78.
   b. The Off-Line switch puts the two clutches under CB control. It blocks the read check and punch check error circuits. It allows the CE to analyze troubles in the 1622 while the customer is using the 1620.
   c. Cam select switch selects which CB is to be viewed by dynamic timer.
   d. Punch clutch trip switch allows remote control of punch clutch when the Off-Line Card Feed switch is in the Off-Line position.
6. Override interlock switch allows operation of machine with covers removed. It is located on the machine frame under the right end cover.

NOTE: The 1620 may be operated independently of the 1622 by turning off the 1622 power switch.

WARNING: The 110-v supply to the 1622 convenience outlets and the 24-v sequencing supply to the 1622 remain energized with the 1622 power switch off.

5.4.2 CE Analysis Panel (Figure 5-2)

A CE analysis panel is provided to aid the CE in servicing the electronic portion of the 1622 circuits. The CE analysis panel is located on the electronic gate and contains the following:

Indicator Lights

TENS. Displays position of tens part of units and tens ring (UTR).

UNITS. Displays position of units part of UTR.

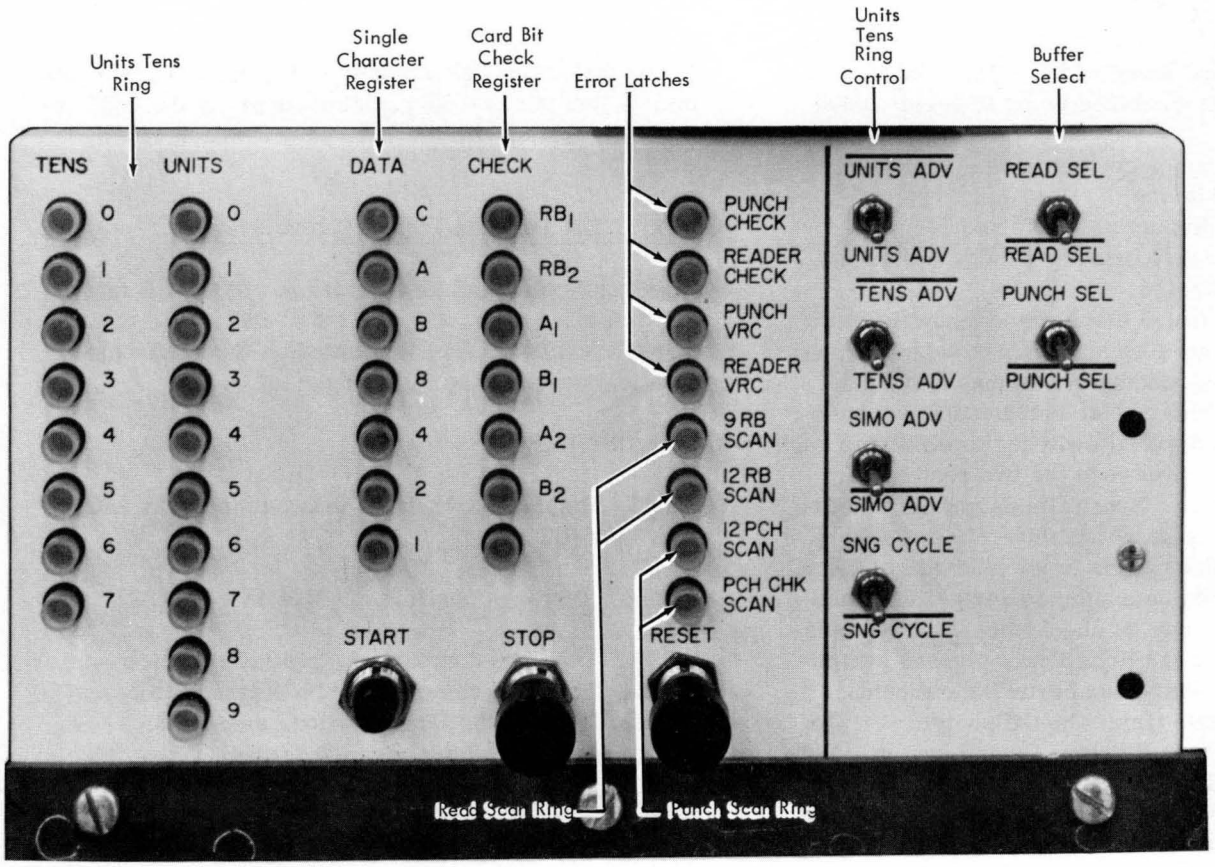
DATA. Displays contents of single character register (SCR). The read select or punch select switches in conjunction with the UTR position, select which side of the buffer and which core (00 through 79) is read into the SCR.

CHECK. Displays check data from the position of the buffer as selected by read or punch select switches and the position of the UTR. The output of the selected position of the buffer sets the associated register. The analysis panel light displays the on/off condition of the following registers:

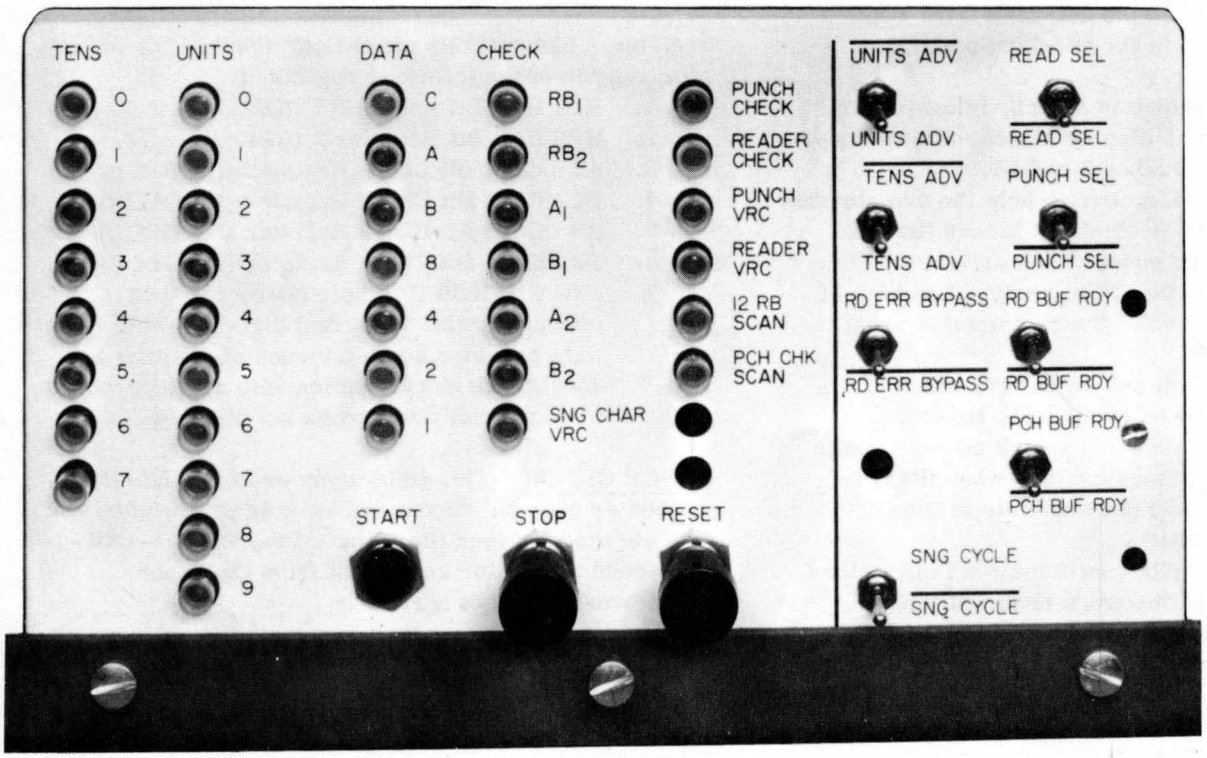
1. RB1 Row Bit Register 1 (RBR-1)
2. RB2 Row Bit Register 2 (RBR-2)
3. A1 Card Bit Check Register (A1-CBCR)
4. B1 Card Bit Check Register (B1-CBCR)
5. A2 Card Bit Check Register (A2-CBCR)
6. B2 Card Bit Check Register (B2-CBCR)
7. SNG CHAR VRC (single character VRC, machine serial 10490 and higher). This light provides a rapid means of locating a specific memory location with a VRC error when manually interrogating memory.

PUNCH CHECK. This light turns on to indicate that the odd or even hole count and/or hole or no-hole data checked between the output of the BCD-to-IBM-card-code translator and output from the punch check brushes do not agree.

READER CHECK. This light turns on to indicate that the odd or even hole count and/or hole or no-hole check from first and second read brushes do not agree.



For machines prior to serial 10490.



For machine serial 10490 and above.

Figure 5-2. CE Analysis Panel

PUNCH VRC. This light turns on to indicate incorrect parity in the SCR when the output of the SCR is transferred to the punch magnet drivers during a punch scan operation.

READER VRC. This light turns on to indicate a parity error in the SCR during a read buffer scan operation.

NOTE: Parity is not checked during RSR-9 time because the output from read buffer storage to the SCR is blocked to clear read buffer storage.

9 RB SCAN. This light turns on to indicate that the reader scan ring is at 9 time (machines prior to serial 10490 only).

12 RB SCAN. This light turns on to indicate that the reader scan ring is at 12 time (RSR-12). RSR-12 time is home position for the reader scan ring.

12 PCH SCAN. This light turns on to indicate that the punch scan ring is at 12 time (machines prior to serial 10490 only).

PCH CHK SCAN. This light turns on to indicate punch check time which is home position for the punch scan ring.

Push Button Switches

START. Depressing the start key causes the 1622 clock to run by turning on the CE run latch (04.04.05.1). The CE run latch is turned off by:

1. Depressing the stop key
2. Depressing the reset key
3. Operating the single cycle switch
4. A reset function from the 1620.

STOP. Depressing the stop key turns off the CE run latch, thereby causing the 1622 clock to stop.

RESET. Depressing the reset key turns off the CE run latch, stops the clock, and resets off all latches (except error latches) in the 1622.

Toggle Switches

UNITS ADV. Turn this switch on to prevent the advance of the units and tens ring (UTR).

TENS ADV. Turn this switch on to prevent the advance of the tens ring.

SIMO ADV. Turn this switch on to allow the units and tens ring (UTR) to be advanced simultaneously (machines prior to serial 10490 only).

SNG CYCLE. Turn this switch on with start key depressed to cause the 1622 clock to run for one cycle only. The single cycle switch maintains a -S input to the off side of the CE run latch.

READ SEL. Turn this switch on to select the read portion of the 1622 buffer which displays the data stored in cores in the associated registers. The position of the UTR determines which specific core position is displayed.

PUNCH SEL. Turn this switch on to perform the same function for the punch portion of the 1622 buffer that the read select switch performs for the read portion of the buffer.

RD BUF RDY. Turn this switch on to allow a transfer to the 1620 without having to wait for reader card cycles (machine serial 10490 and above).

PCH BUF RDY. Turn this switch on to allow a transfer from the 1620 without having to wait for punch card cycles (machine serial 10490 and above).

RD ERR BYPASS. Turn this switch on to allow read errors to be bypassed, thus permitting continuous reader operation (machine serial 10490 and above).

NOTE: All toggle switches should be off (down) when not being used to analyze problems.

To check data in read buffer storage position 58 (card column 59 data) proceed as follows (for machines prior to serial 10490):

1. Turn on read select switch to select the read side of the buffer.
2. Turn on (up) simultaneous advance switch to cause the units portion and the tens portion of the UTR to advance simultaneously. (For machines with serial 10490 and above, the CE must single cycle in increments of one to the position he wishes to check.)
3. Turn on (up) single cycle switch to allow the CE to control the UTR advance via the start key.
4. Depress the start key once with single cycle switch on. This causes the 1622 clock to cycle once, and the UTR to advance to 00. The second depression of the start key causes

the UTR to advance to 11, the third depression causes UTR to advance to 22. Continue depressing the start key until the UTR is advanced to 55.

5. Turn off simultaneous advance key. The UTR is now conditioned to step in its normal progression, that is, the units portion must take ten steps before the tens portion advances once.
6. Depress the start key again. The units ring will advance once, which will advance the UTR to 56. A second depression advances UTR to 57 and the third depression of the start key advances UTR to 58. The desired data is now displayed in the registers associated with the various planes. The read buffer data at core position 58 is now in the SCR and displayed in the lights under Data. To cause the data to circulate in and out of read buffer storage, turn on units advance key, turn off single-cycle switch, and depress the start key. The 1622 clock will now run continuously causing the data to be read out of and written back into core position 58 on every 1622 clock cycle.

5.5 TROUBLESHOOTING METHODS

If a failure occurs that stops the 1620 system, the CE must first determine which unit caused the system to stop. If it is determined that the trouble is in the 1622, the 1622 may be serviced in an Off-Line condition.

Observation of the 1622 and the 1620 indicator panel lights will show which part of the system (punch check, read check, thermal, stacker, etc.) caused the stop condition and why. After determining that the problem is in the 1622, a check of the CE analysis panel might show the problem to be a reader VRC check. A VRC check would indicate certain component failures, such as read buffer circuitry, card-code-to-BCD translator, SCR latches, or the RBR-2 latch.

The trouble analysis procedures given in this manual are designed to assist the CE in determining the general areas causing problems. The servicing procedures and checks are given to assist the CE in localizing the problem area and for testing the various mechanical and electronic units.

It is a good practice to check all power supply voltages for proper range before investigating individual components that appear to be giving trouble.

5.6 ANALYSIS OF READ MALFUNCTIONS

A single character VRC (SNG CHAR VRC) light has been added to the CE analysis panel. When manually interrogating memory, this light comes on to indicate a specific memory location that has a VRC error.

5.6.1 Reader Check Light On with No VRC

The 1622 will stop at the end of the machine cycle in which the reader check light turns on. The reader check light turns on if the A2 or B2 cores are written into at 12 reader scan ring time. To determine the area involved, use the CE analysis panel as follows:

1. Read select switch on.
2. Single-cycle switch on.
3. Using the start key, single cycle from 00 through 79 observing the A2 and B2 lights. When one or the other or both lights turn on, the tens and units lights indicate the core position or card column (core position + 1) in which the trouble occurred.

A2 Light On. This light turns on to indicate that a hole was read at the first read station but not at the second read station. The failure could be in any part of the circuitry associated with the reading stations. Check:

1. Is it a single or multiple position failure?
2. Brush condition and timing.
3. Contact roll.
4. Card lever contact and relay.
5. CB's.
6. Feed problems such as skew and picker knife timing.
7. Common brush and switch.
8. Brush transistor.
9. Half write circuit.

NOTE: Cores can function with the half write circuit open, especially with light loads (a few holes punched in the row being read).

B2 Light On. This light turns on to indicate:

1. That the second read station read a different number of holes than the first read station, that is, the total number of holes read by both reading stations in one column was odd. The failure could be in any part of the circuitry associated with the reading station.

Check SCR contents against the card in the error select pocket of the stacker.

a. If the SCR and the card contain identical data, the problem is probably in the first first read station circuitry (brushes, RB-1 cores, RB-1 sense amplifiers, RB-1 latch, etc.). Perform checks listed in section concerning A2 lights.
b. If the SCR and the card do not contain identical data, the problem is in the second read station circuitry (brushes, RB-2 cores, RB-2 sense amplifiers, RBR-2 latch, etc.). Perform the checks listed in the section concerning the A2 light.

2. A possible "read trans accu" failure, that is, a failure to transfer data from B1 to B2.

NOTE: On a complete failure to trans accu, the machine will stop with B2 cores in the "1" state representing those card columns punched with an odd number of holes.

5.6.2 Reader VRC Light On

The 1622 will stop at the end of the machine cycle in which the VRC light is turned on. An even parity condition in the SCR causes the VRC to be turned on. To determine the particular column or core position giving trouble, the CE analysis panel can be used as follows:

1. Turn on read select switch.
2. Turn on single-cycle switch.
3. Using the start key, single cycle from 00 through 79 observing the SCR (data) lights. When the data lights, or single character VRC light, indicate incorrect parity, the tens and units lights indicate the core position or column (core position +1) in which the trouble exists.

5.6.3 Read Parity Error Analysis

If a parity error (VRC) occurs, the trouble could be in the:

1. Read buffer circuitry.
2. Card-code-to-BCD translator.
3. SCR or RB-2 latch.

NOTE: It is possible to have a VRC check with no reader check if the operation is read alphamerically and adjacent second read brushes are shorted.

5.7 ANALYSIS OF PUNCH MALFUNCTIONS

5.7.1 Punch Check Lights On with No VRC

With the select N stop-select stop key in the select stop position, the machine will stop at the end of the machine cycle in which the punch check light is turned on.

It must be noted that:

1. The punch check operation occurs one machine cycle after the card being checked was punched. It is possible that the next machine cycle could occur immediately or may be minutes later depending upon the program.
2. The data in the punch buffer, at the time the punch check occurs, is for the card following the card selected into the error pocket.

To assist in locating the problem, the CE analysis panel can be used as follows:

1. Turn on punch select switch.
2. Turn on single-cycle switch.
3. Using the start key, single cycle from 00 through 79 observing the A2 and B2 lights. When one or the other or both lights turn on, the tens and units lights indicate the core position or column (core position + 1) in which the error occurred.

A2 Light. This light turns on to indicate:

1. A punched column was not read at the punch check brushes.
2. A punch operation was attempted (output of BCD-to-card code translator was correct) but the hole was not punched and therefore could not be read by the punch check brushes.

Examine the card in the error select pocket for a punch in the column indicated by the UTR (+1). If the column is punched, the problem is in the punch read station circuitry. If the column is not punched, the problem is in the punch circuitry following the BCD-to-card-code translator or in the punch mechanism.

B2 Light. This light turns on to indicate:

1. That a different number of holes was read at the punch check brushes than was punched or attempted (output of BCD-to-card-code translator hole count). In other words, the total number of holes punched, attempted, and read in a column is odd.
2. A possible punch trans accu failure, that is, a failure to transfer B1 to B2.

NOTE: A punch VRC error will force a punch check on the next 1622 machine cycle because the VRC check prevents the transfer of A1 to A2 and B1 to B2. Exception: If a VRC error occurs during punching of a card containing an even number of holes in all 80 columns (blank or alphameric), the VRC error will not force a read check until a card is punched that contains an odd number of holes in at least one column. This could possibly occur many machine cycles after the VRC error was detected in the SCR.

5.7.2 Punch VRC and Punch Check Light On

A punch VRC error does not stop the 1622 at the end of the machine cycle in which it occurs. The VRC error forces a punch check on the 1622 machine cycle following the cycle in which the VRC error occurs. Because a VRC error is detected during the cycle in which the error card is being punched, the error card cannot be selected into the error pocket until one more machine cycle takes place. When the next machine cycle takes place, the error card is fed past the punch check brushes and then into the error select pocket. For this reason the circuits were designed so that a VRC error forces a punch check by preventing the transfer of A1 to A2 and B1 to B2. Failure to transfer A1 to A2 and B1 to B2 will be detected and will cause a punch check one cycle after the VRC error occurs.

When diagnosing a VRC error, remember that it is possible for the VRC light and the punch check light to be on:

1. When the card being punched causes a VRC error and at the same time the card being checked at the punch brush station causes a punch check error.
2. When circuitry common to both stations fails.

If the NPRO or check reset key is operated, the VRC error caused by the card just punched will be lost. This card will not cause a punch check and will not be selected into the error pocket.

A check for the double error condition can be made by single cycling through the punch buffer noting the contents of the SCR. Incorrect parity will appear in some position of the SCR if condition 1, given previously, exists.

5.7.3 Punch Parity Error Analysis

If a parity error (VRC) occurs, the trouble could be in the:

1. Punch buffer circuitry.
2. SCR latches.

NOTE: When data is transferred from the 1620 to the 1622, it is not parity checked after leaving the output translator nor when entering the 1622 punch buffer. If a bit is lost (or gained) in transmission, the loss (or gain) will not be detected until the data is read out of the punch buffer for punching in a card. When the punch buffer is read out, the SCR is parity checked and the error will be detected.

Punch VRC Immediate Stop

The UTR can be stopped when a punch VRC occurs by conditioning the units advance with an output from the punch VRC latch. For machines prior to serial 10490, add jumpers as follows:

A2C04C (04.10.10.1) to A1E25A (unused circuit)
A1E25P (unused circuit) to A2C15E (04.10.07.1)

For machines serial 10490 and above, insert a VE card at unused position A2C09 and add jumpers as follows:

A2C04C (04.10.10.1) to A2C09A (unused circuit)
A2C09P (unused circuit) to A2C15E (04.10.07.1)

When a VRC occurs, the UTR will stop because the units advance has been blocked. The card will be laced in the column for which the VRC occurred and the remainder of the card columns will be blank. The punch buffer will not be reset. The stop key must be depressed before removal of the jumpers to prevent reloading the buffer. After removing the jumpers, it will be possible to interrogate the buffer circuits and locate the cause for the VRC.

5.8 READER SERVICING PROCEDURES, CHECKS, AND HINTS

The following procedures and checks are given to assist the CE in localizing specific trouble areas. Test instruments can then be used to find the failing component.

5.8.1 Reader Scan Ring (RSR)

Reader scan ring trouble will usually show up as dropped or extra bits in the SCR. To check:

1. Turn on the read row bit scan latch by grounding A2 C10 F (04.10.08.1). The RSR should now be running.
2. Scope timings and levels using marginal voltages as needed.

5.8.2 Row Bit 2 (RB-2)

If the RB-2 read sense amplifier is failing, the SCR will contain all C bits after reading in a card containing miscellaneous punches.

If a single position of RB-2 fails when displayed in the SCR, the SCR will contain C bits regardless of data in the associated card column. Also, a read check will occur (B2 light ON) for any column containing an odd number of holes.

To check:

1. Run test deck with ripple pattern if it appears that there is no output from the RB-2 sense amplifier.
2. If it is a single column failure, run a test deck with a punch in the failing column.
3. Scope sense amplifier output at A1 B05 AF (04.30.02.1) using internal sync.
   a. If there is no output using the ripple deck, the trouble could be the common brush, common brush transistor, display switch contacts, CLC and CLC relay points, or the sense amplifier.
   b. If there is no output for a single position, the trouble could be the individual reading brush and circuit, read brush resistor, or connector.
   c. Incorrect CB timing will give reading failures.

NOTE: The same testing procedure is used for RB-2 punch sense amplifier. Items a. and b. apply to the punch side also. Scope at A1 B04 AF (04.30.02.1)

5.8.3 Row Bit Register 2 (RBR-2)

This single latch is turned on by the output of either the read or punch RB-2 sense amplifier. To check:

1. Run same test decks as when checking RB-2.
2. Scope RBR-2 (on side) output at A1 B18 B (04.25.03.1).

5.8.4 Single Character Register (SCR)

Failures of the RSR, inhibit drivers, SCR latches, RB-2, and RBR-2 will show up in the SCR. If a check of the RSR, RB-2, and RBR-2 shows that they are functioning properly, a further check of the SCR and associated circuits is indicated.

SCR Failure Indications

1. Groups of ten dropped (SCR blank), for example: 0 through 9, 10 through 19, 20 through 29, etc., indicates a failure in the selection (decode) switches in the tens part of UTR.
2. Pattern in groups of eight (SCR blank), for example: 1, 11, 21, 31, ...71 or 4, 14, 24, 34, 44, ...74, indicates a failure of a selection (decode) switch in the units part of UTR.

To check:

   a. Turn on RBR-2 latch by grounding A1 B18 P (04.25.03.1).
   b. Turn on the read select key and single cycle to the failing position.
   c. Turn on the not units advance key to prevent UTR from stepping.
   d. Depress the start key.

The failing position should be reading and writing in the read buffer. Scope read and write decode switches, A1 D05 F and H (04.30.06.1). The voltage probe can be used to determine that a decode switch is selected. However, the current probe must be used to check that the decode switch and current source circuit is functioning properly.

3. Pattern of all 1 bits or all 4 bits, etc., dropped, indicates a possible failure of an inhibit driver or one of the SCR latches.

To check:

   a. Read in one card which contains punches associated with the failing bit.
   b. Turn on read select switch.
   c. Depress CE start key. The clock and UTR should now be running and circulating the character through the 80 positions of the read buffer and associated circuitry.
   d. Sync on B0.
   e. Check levels and timings of the sense amplifier strobe, sense amplifier output, read/write current or voltage, inhibit lines, and SCR latches.
   f. Vary marginal voltage as needed.

4. For particular character dropping or picking up bits (6 (4-2) drops the 2 or 6 (4-2) comes out as 4-2-8):
   a. Check RSR as given previously.
   b. The failure could be in the card-code-to-BCD translator.

5.8.5 Card-Code-to-BCD Translator

Failures in the translator will show as dropped or extra bits in the SCR. As an example, dropping or picking up of bits for a six is used here. To check:

1. Turn on read row bit scan latch by grounding A2 C10 F (04.10.08.1).
2. Turn on the RSR-6 latch by grounding A2 E15 R on 04.35.14.1.
3. Turn on RBR-2 latch by grounding A1 B18 P (04.25.03.1).
4. Turn on read select switch.
5. The output of RBR-2 is now being translated as a six and is continuously circulting through the read buffer and associated circuitry.
6. Use scope to check circuits. Sync on B0 at A1 E05 A (04.15.01.1). Vary marginal voltages as needed.

5.8.6 Read Trans Accu (Prior to Serial 10490 only)

To check operation of the read trans accu scan latch:

1. Place a deck of blank cards in the hopper.
2. Turn On-Line — Off-Line switch to Off-Line position.
3. Set up scope to observe the read trans accu scan latch. The latch will be turned on once and then off.
4. Depress CE start key to cause a three card run-in. Observe scope.

If the read trans accu scan latch fails to turn on, check circuits back to and including the CB's.

If the read trans accu scan latch turns on, the following procedure can be used to set up a continuous loop for transferring A1 to A2 and B1 to B2.

1. Set all A1 and B1 cores to the one state by initiating a three card run-in using a ripple deck.
2. Turn on the read trans accu scan latch by grounding A2 D13 F (04.10.08.1). With the read trans accu scan latch turned on, the clock and UTR will start. The one status of the A1 and B1 cores will transfer to A2 and B2 on the first UTR cycle.
3. Remove the ground from the read trans accu scan latch and single cycle 00 through 79, and observe that the A1, A2, B1, and B2 lights are on for each core position.

For a further check of A1, A2, B1, and B2 circuits, see procedure given in Section 5.10.

5.8.7 1622 to 1620 Transfer (Read) Operations

Continuous Transfer Loop

The following procedure can be used to facilitate locking the 1620-1622 in a continuous transfer to 1620 operation.

1. Insert the following program:

```
00000 36 01000 00500    RN
00012 46 00000 00600    BI
00024 49 00000          B
```

2. Turn read check error switch to the program position.
3. Place a card with the desired information, as well as an 11-12 punch combination in any column other than column 80, in the read feed. Run in card under control of the above program.

This procedure will force a 1620 read check which will prevent a read clutch cycle and also prevent resetting the buffer ready latch. Continuous transfers to 1620 will take place with a read check occurring on each. However, the 46 code will interrogate and reset the read check indicator allowing subsequent transfers to proceed.

Control lines and data lines can be scoped dynamically while this program is running.

MBR-Odd or MBR-Even VRC Error with No Read Check

An MBR-odd or MBR-even VRC error with no read check indicates a failure in the input translator or in the data lines.

For a static check:

1. Load the 1622 buffer using a card punched with the failing character.
2. Turn on CE switch No. 9 in the 1620.
3. Insert a read numerically operation (code 36) and single cycle the 1620 (SCE key) until the desired data is in the SCR. At this time the data in the SCR is being presented to (not in) the MDR triggers through the transmission line drivers, transmission line terminators, and the input translator

circuits. The scope can be used for a static check of the circuits involved.

For a dynamic check, follow the procedure given under Continuous Transfer Loop.

Alternate Procedure for Continuous Transfer Loop

This procedure does not force a read check. Therefore,if for some reason the forced read check is undesirable, this alternate procedure should be used.

1. Turn on the read buffer ready latch by grounding A2 C05 K (04.10.11.1) or by turning on the RB BUF RDY switch (on serial number 10490 and above).
2. Insert:

   00000 36 XXXXX 00500 RN
   00012 34 00000 00101 K-Space
   00024 49 00000 00000 B

   The code 34-K-space operation develops a delay between transfers to make scoping easier. The space operation has nothing to do with the transfer operation.

3. Depress release key then start key. The data and control lines may now be scoped as desired.

5.9 PUNCH SERVICING PROCEDURES, CHECKS, AND HINTS

5.9.1 Punch Scan Ring (PSR)

Punch scan ring failures are shown by incorrectly punched cards such as double punching or missed punches in an entire row. Punch check errors will also occur.

To check the PSR, turn on the punch scan latch by grounding A2 D16 F (04.10.08.2). When the punch scan latch is on, the UTR and the PSR start. Scope the PSR circuits for levels and timings. Vary marginal voltage as needed.

5.9.2 BCD-to-Card-Code Translator

Failures in the BCD-to-card-code translator show up as incorrectly punched cards, but usually will not cause punch check errors. To check:

1. Load the punch buffer from the 1620 (write code operation) using data corresponding to the failure.
2. Follow checking setup procedure given under PSR.
3. Scope the BCD-to-card-code translator for timings and levels, varying the marginal voltage as needed.

NOTE: Failing punch magnet circuitry and punch mechanics will also appear as incorrectly punched cards.

5.9.3 1620 to 1622 Transfer (Write Operation)

Continuous Transfer Loop

The following procedure can be used to facilitate locking the 1620-1622 in a continuous transfer to 1622 operation.

1. Turn on the punch buffer ready latch by grounding A2 D26 H (04.10.11.1) or by turning on the PCH BUF RDY switch (on serial number 10490 and above).
2. Insert the following program:

   00000 38 XXXXX 00400 (WN)
   00012 34 00000 00101 (K-space)
   00024 49 00000 00000 B

3. Depress release key then start key. The data and control lines may now be scoped as desired.

1620 Write Checks

If a 1620 write check occurs, it indicates a failure between MDR-MBR and the output of the output translator.

A static check can be made by setting up a write instruction in the 1620, and then, by using SCE (CE switch No. 9 must be on), single cycling the 1620 until the character giving trouble is in MDR-MBR. The output translator can now be scoped in a static condition.

5.10 READER-PUNCH CHECK CIRCUITS

5.10.1 Checking A1, B1, A1-CBCR, B1-CBCR, OR, and Exclusive OR

The objective of this procedure is to test:

1. A1-CBCR and B1-CBCR.
2. The OR associated with A1-CBCR.
3. The exclusive OR (XO) associated with B1-CBCR.
4. The inhibit drivers for A1 and B1 core planes.

5. The read drivers, write drivers, and sense amplifiers associated with the A1 and B1 core planes.

Procedure

1. Operate NPRO key to clear all check planes (reset cores to "0").
2. Turn on RBR-1 latch by grounding A1 B18 F (04.25.03.1)
   For single cycle operation:
   a. Turn on single cycle switch
   b. Turn on read select switch.
   c. Using CE start key, single cycle 00 through 79 five times. The A1 and B1 lights should show the following pattern.

First time through Reading out cleared cores ("0") and writing back 1's from RBR-1 through OR (A1) and through XO (B1).	A1 and B1 are blank
Second time through Reading out 1's set on first time through. Writing into A1 plane from A1 to RBR-1. Inhibiting writing into B1 plane because both RBR-1 and B1 are on and the XO inhibits the write back.	A1 and B1 are on for each position
Third time through Reading out A1 cores which were set on second time through. B1 blank because B1 cores were inhibited from writing on second time through. Write back into A1 cores from A1 or RBR-1. Write back into B1 from RBR-1 through XO.	A1 is on for all 80 positions —B1 is blank
Fifth time through	Same as third time

NOTE: After the first time through (all blank), the second, fourth, sixth, etc., times through will always be alike. The third, fifth, seventh, etc., times through will always be alike.

For electronic speed operation:
   a. Turn off single cycle switch.
   b. Depress CE start key and allow rings to run for a few seconds.
   c. Depress CE stop key. The A1 and B1 configuration should be like either an even (second, fourth, etc.) time through, or an odd (third, fifth, etc.) time through.
   d. Turn on single cycle switch.
   e. Using CE start key, single cycle 00 through 79 twice to observe that the A1 and B1 lights conform to the odd or even configuration.

      If A1 or B1 do not conform, run the machine at electronic speed and scope the circuits while checking timings and levels. Vary the marginal voltage as needed.

5.10.2 Checking A2, B2, A2-CBCR, B2-CBCR, Comparing AND, and Exclusive OR

The objective of this procedure is to test:
1. A2-CBCR and B2-CBCR.
2. The comparing AND associated with A2-CBCR.
3. The exclusive OR (XO) associated with B2-CBCR.
4. The inhibit drivers, read drivers, write drivers, and sense amplifiers associated with the A2 and B2 core planes.

Procedure

1. Operate NPRO to clear all check planes (reset cores to "0").
2. Turn on read select switch.
3. Turn on A2-CBCR latch by grounding A1 B20 F (04.25.03.1). The output of A2-CBCR is used to set all cores in A2 to the one status.
4. Turn on B2-CBCR latch by grounding A1 B20 P (04.25.03.1). The output of B2-CBCR is used to set all cores in B2 to the one status.
5. Using CE start key, run the machine for a few seconds.
6. Depress CE stop key. The cores in the A2 and B2 planes should all be set to the one status.
7. Remove ground wires from A2 and B2-CBCR's.

8. Using CE start key, run machine for a few seconds. The A2 cores are being read out to A2-CBCR. With A2-CBCR on and RBR-2 off, the comparing AND is satisfied and at write time the A2 cores will be set to the one status. The B2 cores are being read out to B2-CBCR. With B2-CBCR on and RBR-2 off, the XO causes a one to be written back into the B2 cores.

   Single cycle through all 80 buffer positions and check that the A2 and B2 lights come on for every position. If the check is satisfactory, the A2 and B2 sense amplifiers, read drivers, write drivers, comparing AND, and exclusive OR circuits are working properly for a no compare condition. Vary marginal voltage as needed.

To check the comparing AND and the exclusive OR for a compare condition and to check the inhibit drivers, the RBR-2 latch must be turned on. With RBR-2 on:

1. The comparing AND will not be satisfied and the one status of the A2 cores read out to A2-CBCR will be inhibited from writing back into the A2 plane.
2. The XO circuit will have like inputs to both sides on one cycle (B2 core reads out to turn on B2-CBCR) and will therefore inhibit writing back into the B2 plane.

On the next cycle, B2-CBCR will not be turned on (no cores in the one status in B2 plane) while RBR-2 is still on. The XO circuit has unlike inputs and ones will be written back into B2 plane. To check:

1. Turn on RBR-2 by grounding A1 B18 P (04.25.03.1).
2. Turn on single-cycle switch.
3. Turn on read select switch.
4. Using CE start key, single cycle 00 through 79.

First cycle through	A2 and B2 on
Second cycle through	A2 off and B2 off
Third cycle through	A2 off and B2 on
Fourth cycle through	Same as second
Fifth cycle through	Same as third

This test can be made at electronic speeds. If failures develop, scope the associated circuitry for levels and timings. Vary the marginal voltage as needed.

5.11 INTERLEAVE OPERATION

Reader or punch checks may occur with interleave troubles.

5.11.1 Indications of Interleave Problems

1. The 80th character transferred to the 1620 may be missing or incorrect if the punch trans accu scan latch is turned on while the read disconnect latch is on. The extender A1 E09 (04.10.08.2) to the AND A2 D20 is for the purpose of preventing this condition.
2. Incorrect or missing punching and reading could occur if the punch operation latch A2 A16 (04.10.09.2) fails to turn on during a punch operation and a read operation is initiated by the 1620.
3. If an attempt is made to select the read and punch buffer simultaneously, nothing will be punched and nothing will be loaded into the read buffer. (Units read and write X drivers are inoperative.) A VRC check will result because nothing will be placed in the SCR. Operating the CE read select and punch select switches at the same time will cause the condition just described.
4. If data being loaded into the read buffer is simultaneously punched in a card and this data is not in the punch buffer, the +S Punch buffer scan to A2 B08 H (04.35.01.1) is probably floating (open).

5.11.2 Interleave Trouble Diagnosis

Run reader and punch Off-Line simultaneously.

If interleave failures do not occur, the failing interlock is associated with either a transfer from or transfer to the 1620. If failures do occur, they eliminate the previously mentioned interlocks.

If the failures occur fairly frequently (every 5 or 6 cards), the failing interlock is probably the read row bit scan and punch buffer scan.

Failures between read row bit scan and punch trans accu or between punch buffer scan and read trans accu occur every 40 to 50 cards.

Failures seldom occur between read trans accu and punch trans accu or between stacking latches.

5.11.3 Checking Interleave Operations

Jumper wires may be used to force an interleave between any two of the scan latches. For example, an interleave between read row bit scan and punch buffer scan can be forced as follows:

1. Put the request punch scan latch (A2 D16) on an extender and remove the lead from pin L.
2. Jumper from the request read row bit scan latch turn-off input (A2 C10 Q on 04.10.08.1) to the request punch scan latch turn-on input which is now on the extender (A2 D16 L on 04.10.08.2).
3. Jumper from the request punch scan latch turn-off input (A2 D16 Q on 04.10.08.2) to the request read row bit scan latch turn-on input (A2 C10 L on 04.10.08.1). Pin L is not in use so an extender is not needed.
4. Depress the reader or punch start keys to start the operation.

   Once started, the read row bit scan and punch buffer scan should alternate but never overlap. If a failure occurs, alternation may stop. If it stops, run one feed and scope the interlocks involved.

5.12 MISCELLANEOUS SERVICE HINTS

1. WARNING: Feeler gages should not be inserted into reader throat with power up. This can blow the fuses on the top of the SMS Gate.
2. Cam display switches should not be used when dynamic timer is connected to anything by external leads (one or more of the signal fuses can be blown).
3. When using the dynamic timer to check any timings, blank cards should be used to prevent punch checks from occurring and to prevent wear on the sand blasted step feed rolls.
4. Punch checks can occur on the punch run-in if the brush card lever sticks.
5. If both sets of brushes are out of time, the picker knife travel should be checked.
6. If the punch starts lacing one column, first check the associated magnet driver, then the diode for that magnet.
7. On a 1 column failure with either nominal or marginal voltages, changing the associated brush will often clear up the trouble, even though there is nothing apparently wrong with the brush.
8. When failures are occurring on the first few columns, check the associated taper pins in the integrator gate. These pins are put under strain if the gate is opened too far.
9. When troubleshooting the data paths between brushes and buffer, it is often helpful to use a deck of cards with only one punch per card, and follow this one character through the circuitry.
10. Intermittent write problems that seem to have no pattern may be caused by an open fuse (8 through 14).
11. If the first card of a job is erroneously punched with the same data as was punched in the last card of the previous job, the die card lever adjustments should be checked.
12. Error stop circuits may be crippled by removing the error relay driver card A2C07. For machines prior to serial 10490, grounding the read buffer ready or punch buffer ready latch ON permits scoping of data transfer circuits without cards in the 1622. For machines with serial 10490 and above, turning on the read buffer ready or punch buffer ready switch on the CE analysis panel permits scoping of data transfer circuits.
13. The reader picker knife cam shaft may break if the RLCB unit is not positioned correctly. Misalignment of the unit causes fatigue breakage of the picker knife cam shaft due to continuous flexing. Alignment may be checked as follows:
    a. Notice the index time when the trailing edge of a card lines up with the throat knife.
    b. Remove the CB unit and check for molding ridges on the surface that mounts against the side frame. A cocked unit and unnecessary strain on the shaft will result if a molding ridge exists. Remove the ridge, if present, and re-install the unit without the bearing in the housing.
    c. Loosen the split hub on the reader picker knife cam shaft drive pulley. Move the shaft toward the CB unit about 5/16". Rotate the shaft to check that it is not bent.
    d. Replace the bearing on the shaft. The bearing should line up with the hole in the CB unit. If the bearing does not line up within .004", realign the CB unit. When aligned, the CB unit should be tight and the bearing should slip into the unit easily. Tightening the CB unit screws can cause the unit to shift.

e. Re-time the reader picker knife cam shaft to the timing noted in Step "a" and check the CB timing.

14. Highly intermittent dropping of a row of punches (all 1's, 2's, etc.) may be caused by defective components or loose connections in the integrator (04.02.05.1) to the punch magnet driver transistor (T4). Look for loose connections in the terminal blocks or a defective diode (D10).

15. The 24-v power supply may be overloaded and its rectifier burned if the armature of K2 binds or fails to seat properly. Check K2 relay for freedom from binds.

16. Misfeeding from the punch hopper due to a nicked card or hopper jam may result in an undetected loss of information, which may appear to have been caused by a missing card. If a misfeed occurs, the machine will stop with a punch check; however, a blank card is in position to be punched on the next punch feed cycle and the punch buffer contains the data to be punched. The following procedure will not prevent loss caused by a jam at the punch station, but will prevent loss of punch data due to a misfeed:
    a. Remove all cards from the punch hopper.
    b. Place one good unpunched card in the punch hopper.
    c. Depress the punch start key to execute one feed cycle. Punch buffer data is punched into the card just ahead of the punch station.
    d. Depress the punch NPRO key and run out all cards.
    e. Remove the last card in the stacker (blank).
    f. Reload the punch hopper and depress the punch start key to resume operation.

17. If trouble is experienced which can be attributed to incorrect operating speed (read or punch), obtain correct speed by adjusting the adjustable pulley. If machine is not equipped with an adjustable pulley (P/N 615450), replace non-adjustable pulley (read or punch) with adjustable pulley (CEM 1620-114).

18. If read feed problems are encountered (card over-travel and brush timing), special feed rolls and feed roll tension springs are available to correct the condition. The feed rolls are for the first, third, and fourth lower, and second upper feed roll positions. The special rolls have a reduced diameter to prevent over-travel and can be recognized by a blue-black stripe on the feed roll shaft. The special springs are to be mounted on the first, third, and fourth upper, and second lower feed roll bearing hangers. The springs have reduced tension (less than 30 turns) to prevent distortion of the feed roll surface.

    NOTE: All four feed rolls must be replaced at the same time because of differences in diameter between the regular and the special feed rolls. Brushes must be re-timed for the same reason. (CEM 1620-119).

    P/N 610224 Spring, Feed Roll (8)
    P/N 610331 Feed Roll, Lower (3)
    P/N 610332 Feed Roll, Upper (1)

19. The units tens ring can be stopped immediately when a punch VRC occurs by connecting jumpers as follow:

From:	To:
A2C15E (04.10.01.1)	Output of any unused inverter circuit
A2C04C (04.10.10.1)	Input of the inverter circuit.

    NOTE: It may be necessary to add a VE card to an unused SMS location to accomplish the above. The units tens ring will stop immediately because the units advance will be blocked. The card will be laced in the specific column in which the VRC occurred and for the remainder of the card. The punch buffer will not be reset. After removal of the jumpers, it will be possible to interrogate it for the cause of the VRC. The stop key must be depressed before removal of the jumpers to prevent reloading the buffer.

20. If the die card lever contact assembly on the 1622 Reader Punch is adjusted incorrectly, the first card of a group may have the same information punched in it that was punched in the last card of the previous job. If this condition occurs, check the die card lever adjustments.

21. IR reports indicate that contact roll common brush leads are grounding at the point on the side frame castings through which they pass. On the next service call, tape the common wire at this point on the side frame casting.

22. Reader checks can be a result of variation in read brush timing caused by a loose Read Contact Roll Drive Belt. B/M 605264 provides parts and instructions to install an idler to enable adjustment of belt tension.

CONTENTS

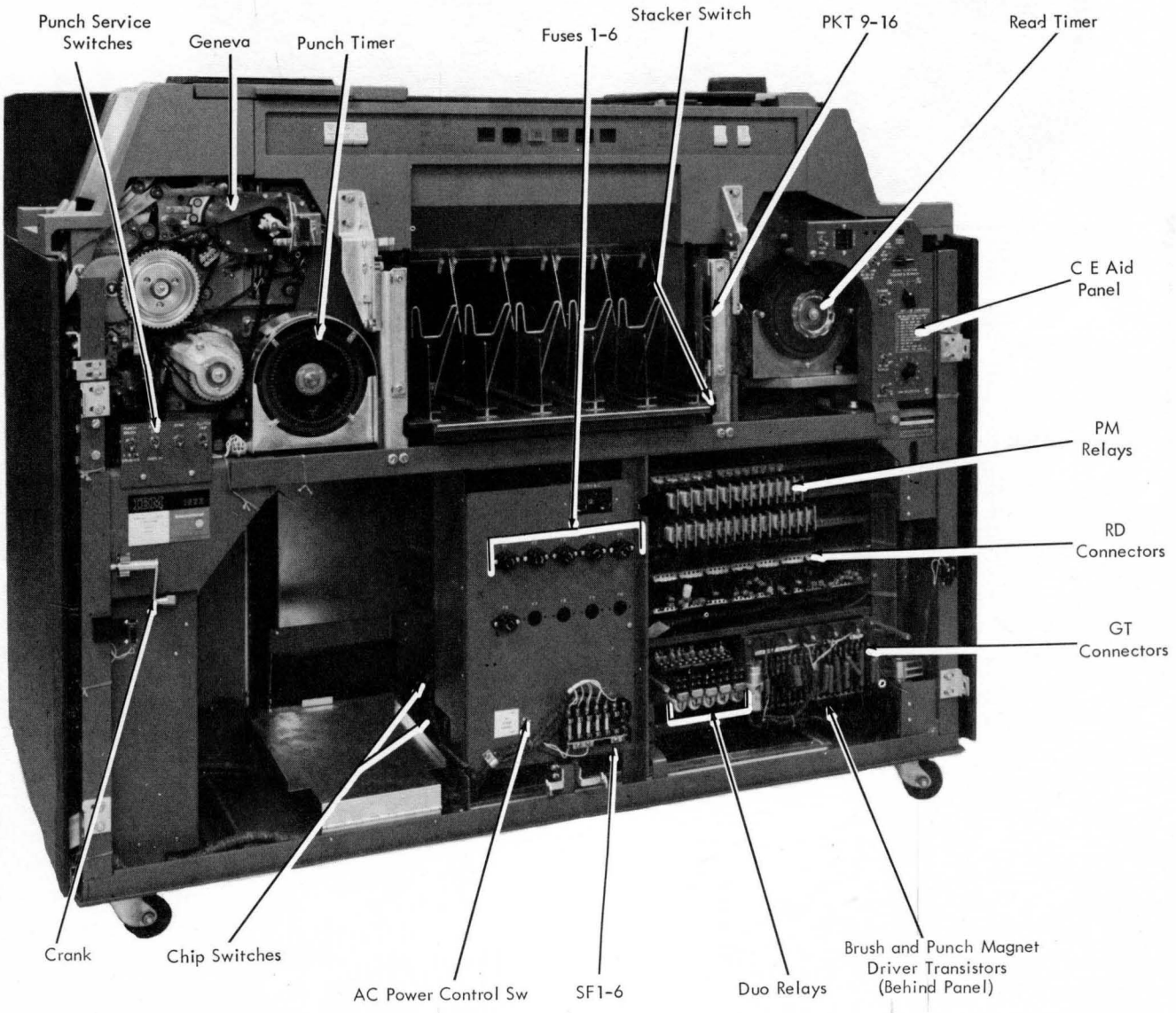


Figure 6-1. IBM 1622 Front View

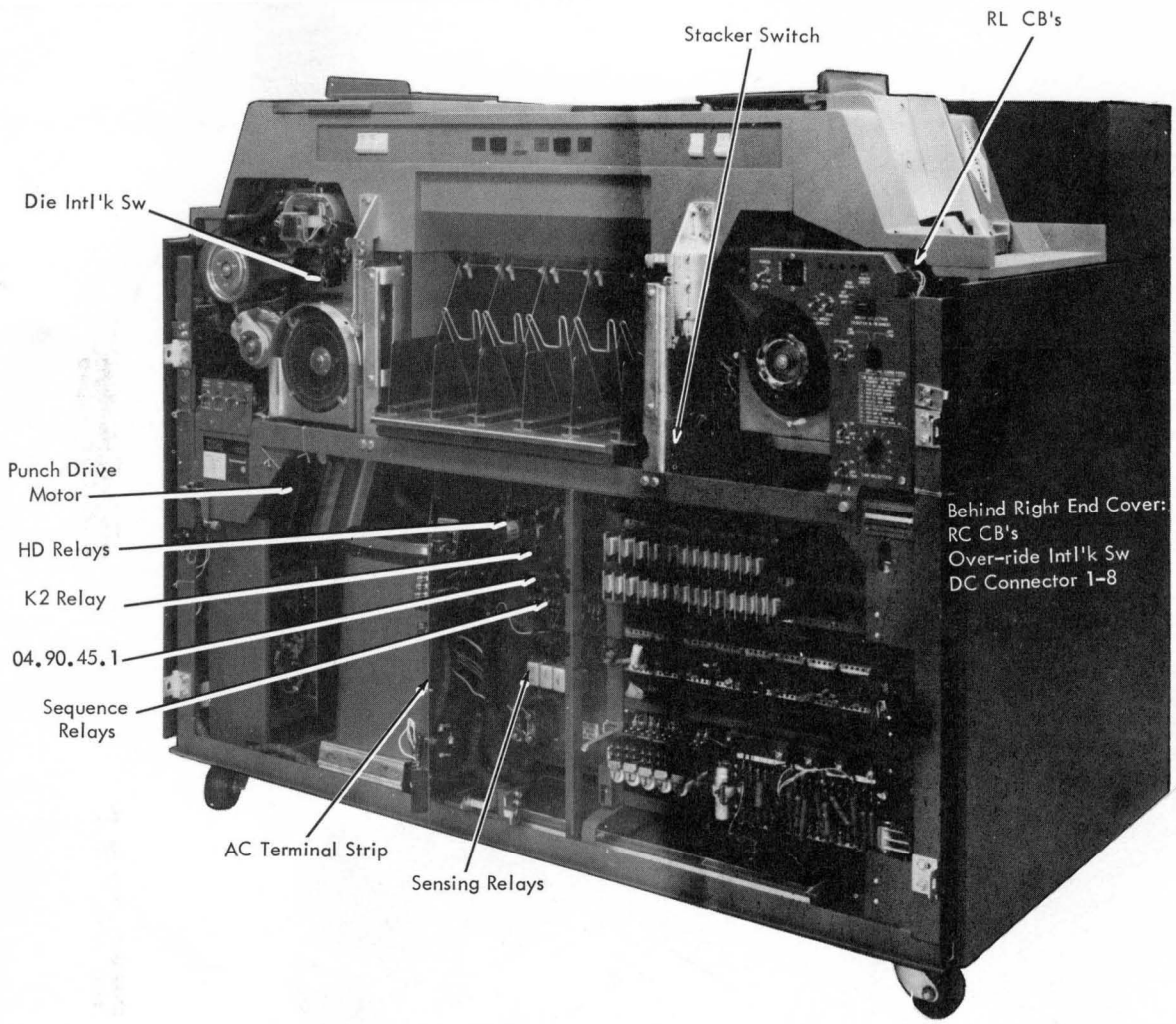


Figure 6-2. Front and Right End View

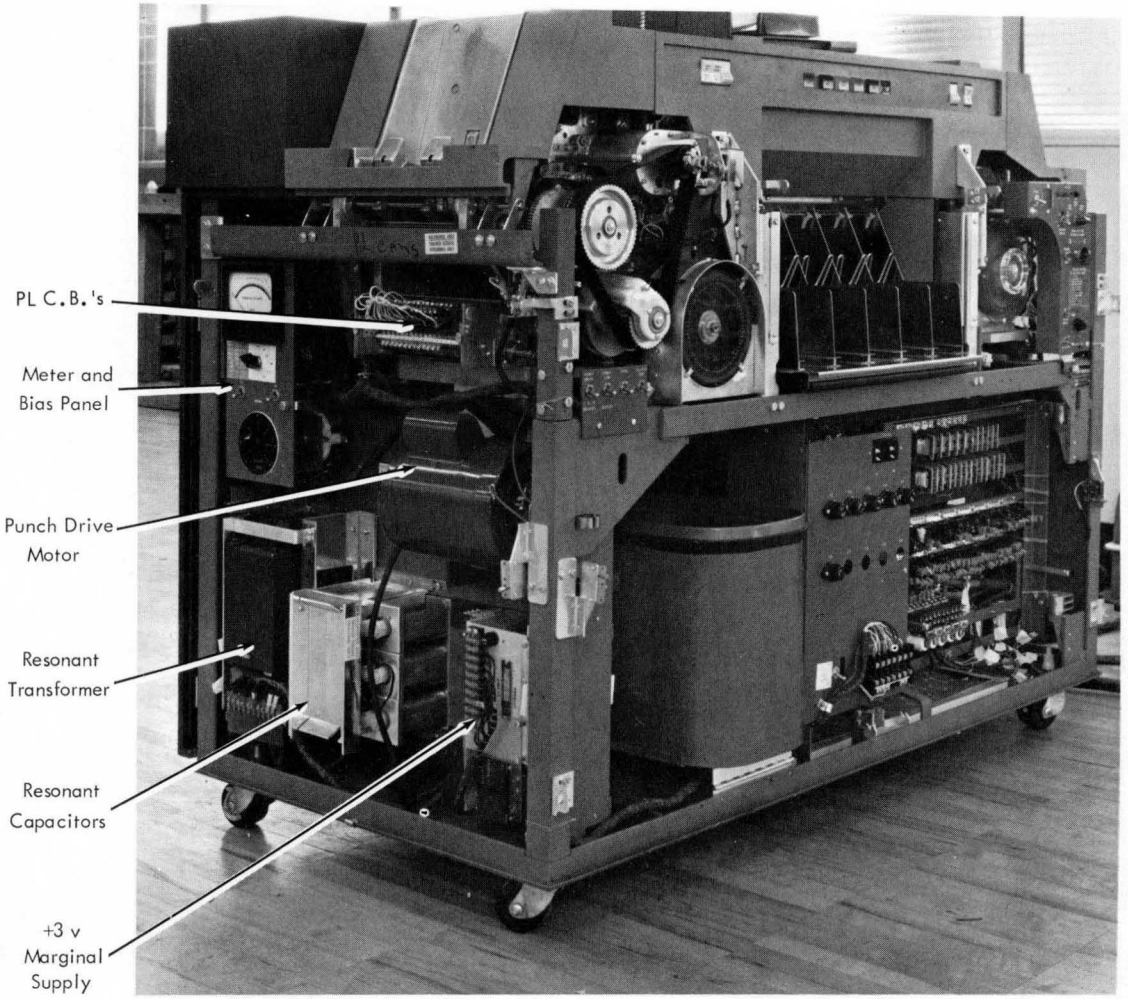


Figure 6-3. Left End and Front View

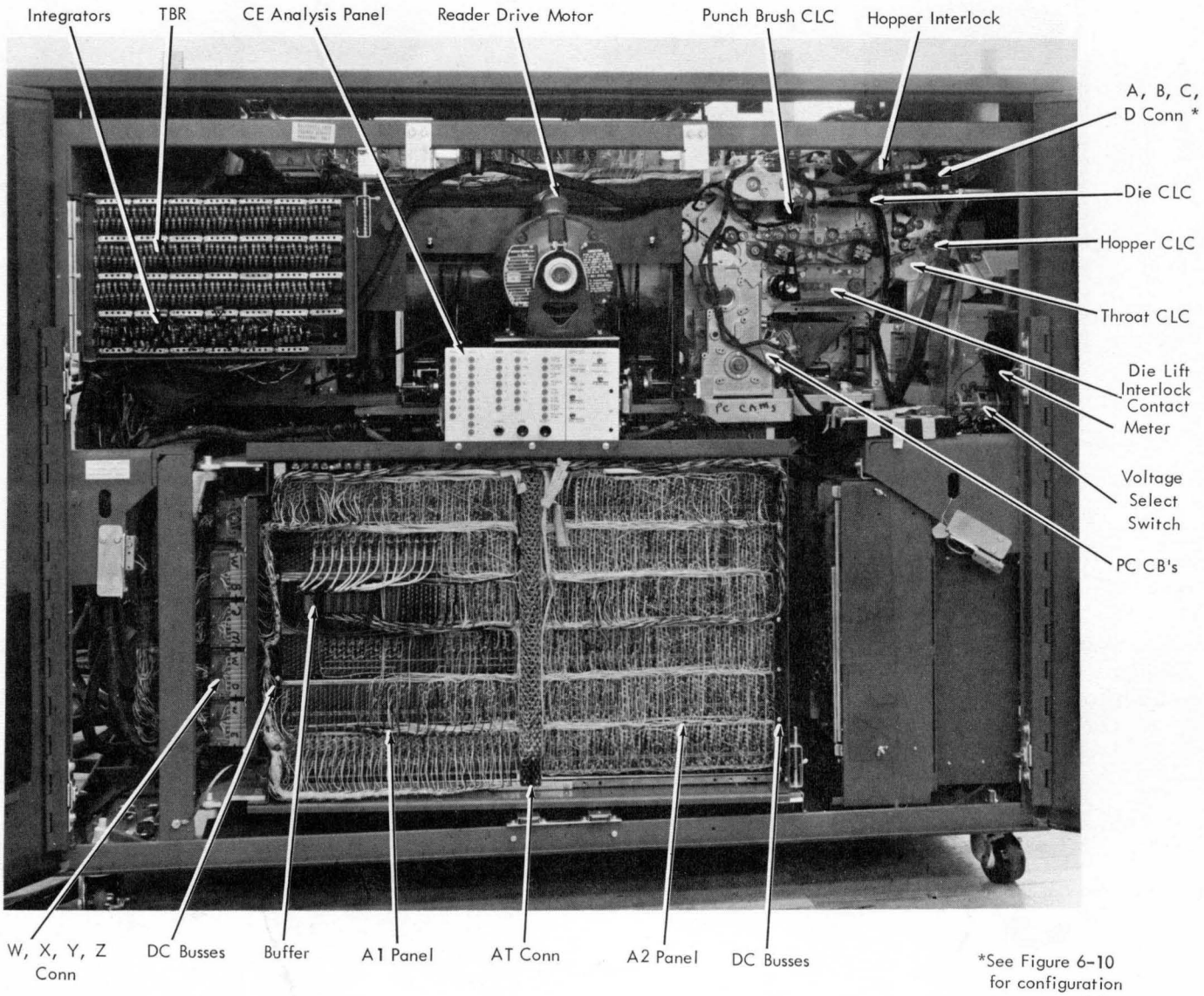


Figure 6-4. Rear View

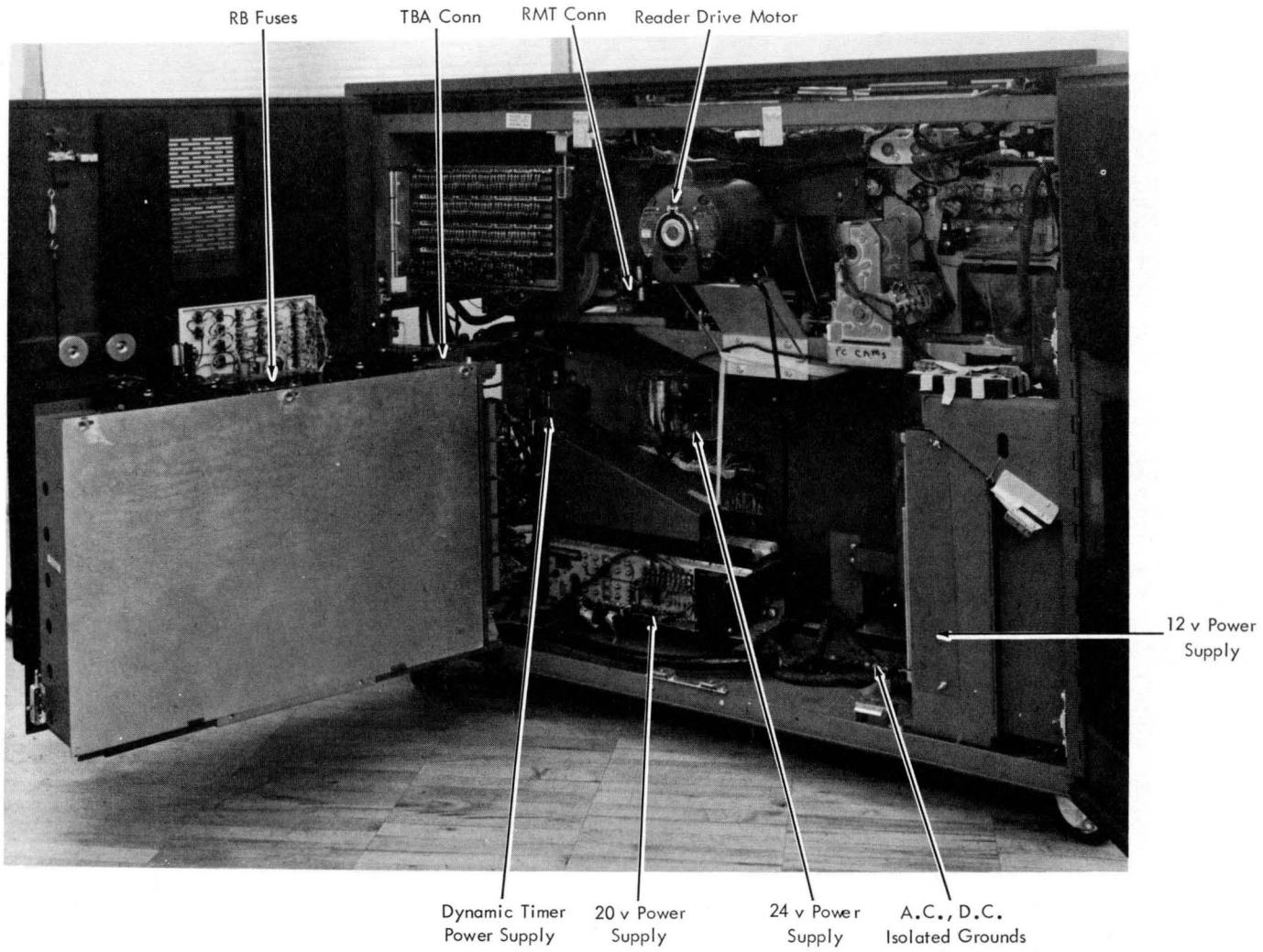


Figure 6-5. Rear View - Gate Open

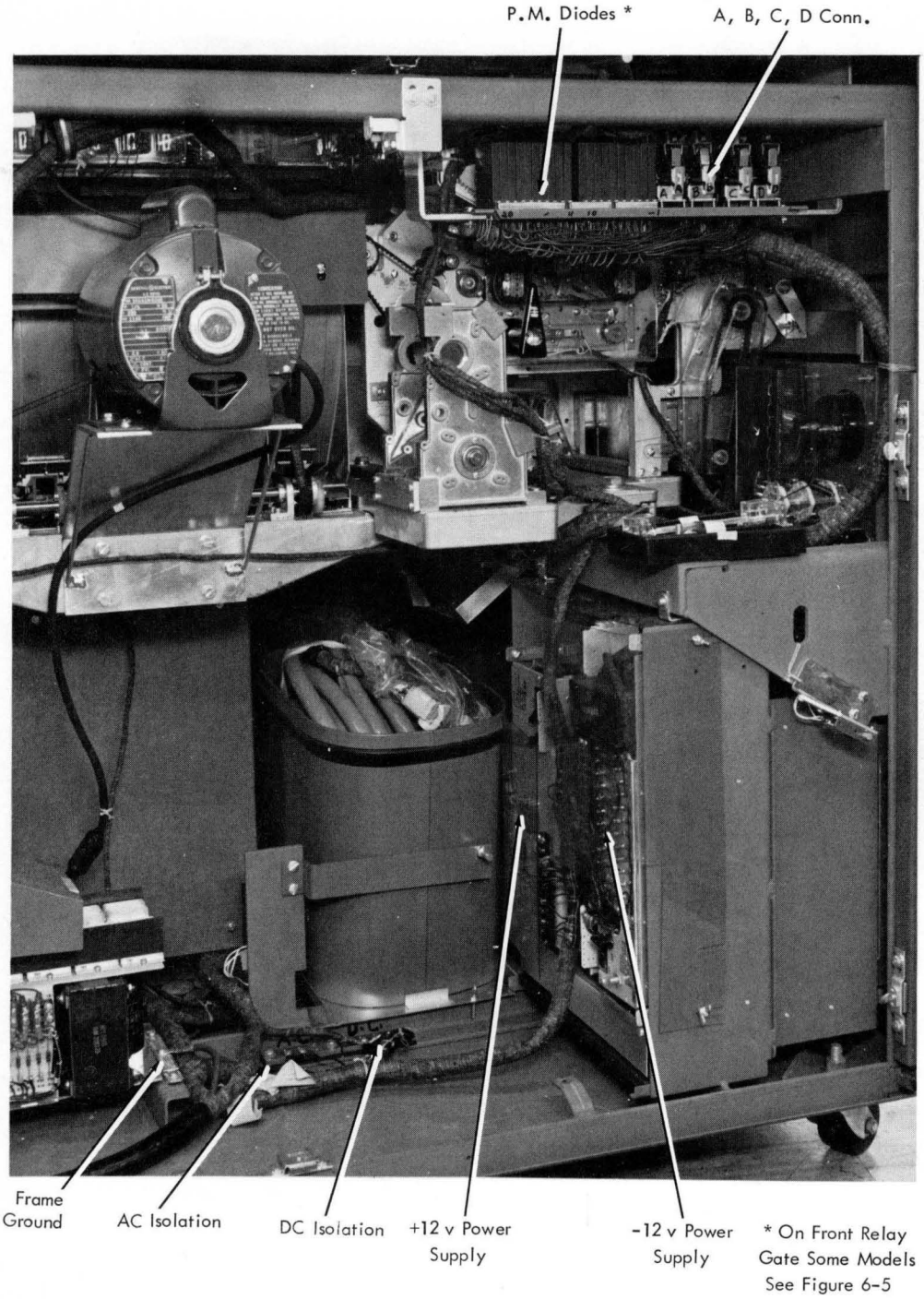


Figure 6-6. Punch End-Rear View

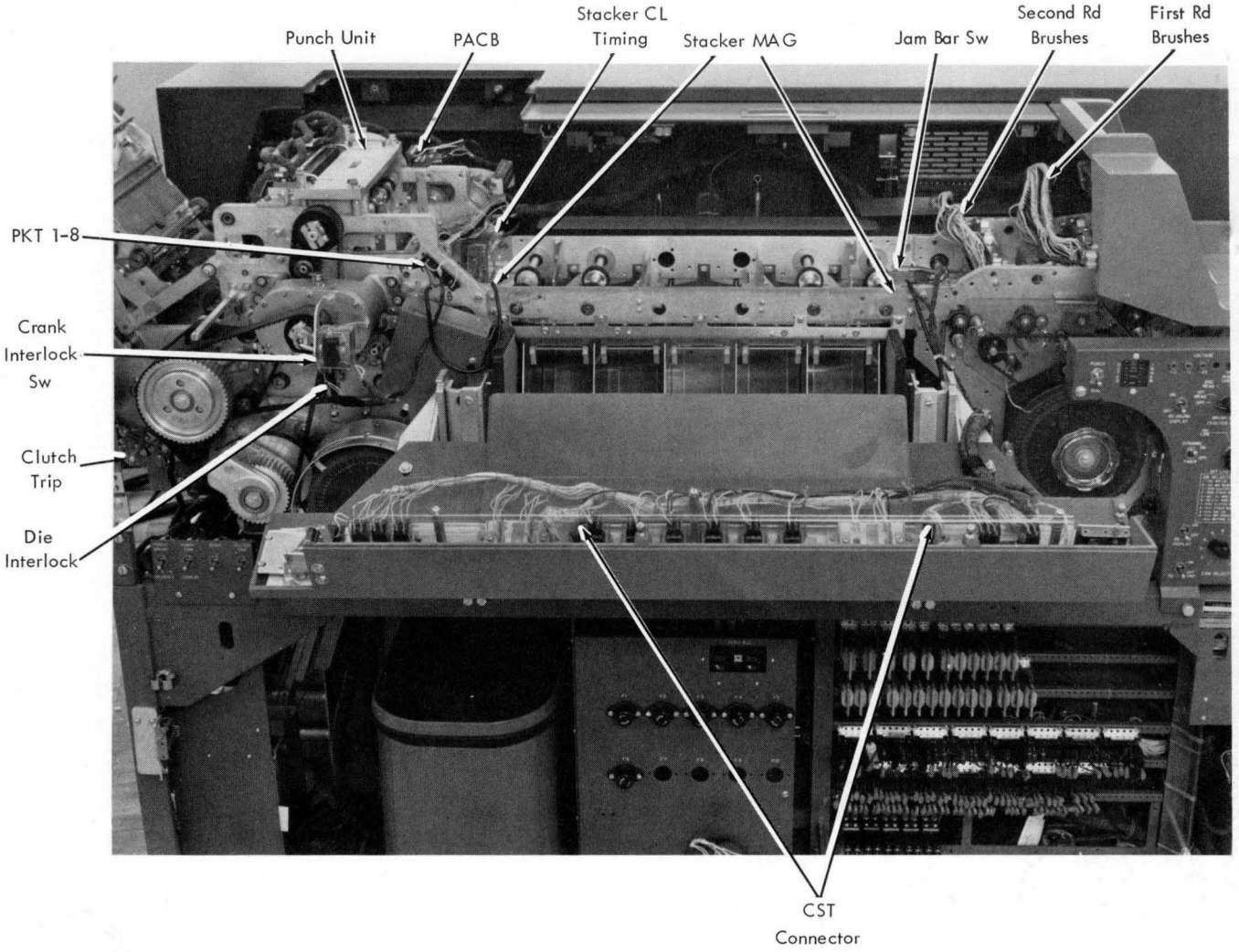


Figure 6-7. Card Transport

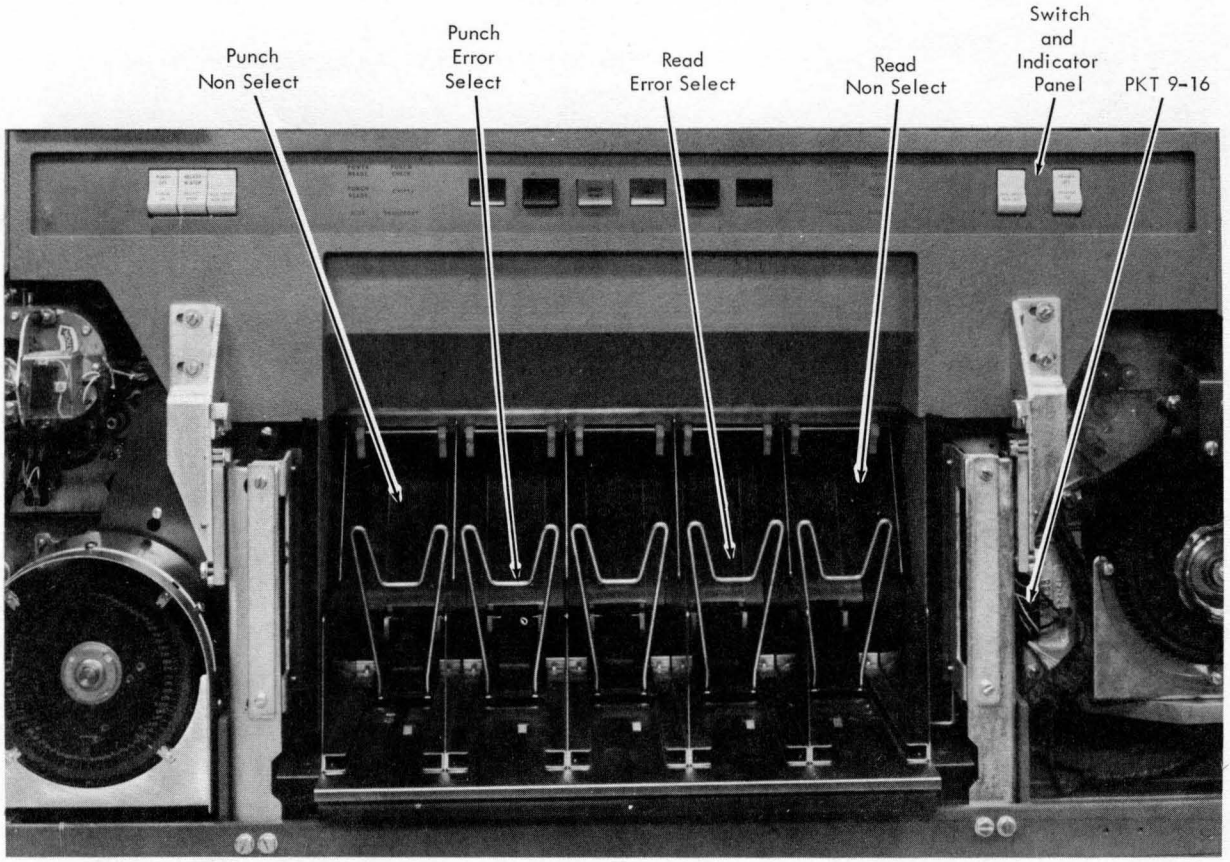


Figure 6-8. Stackers

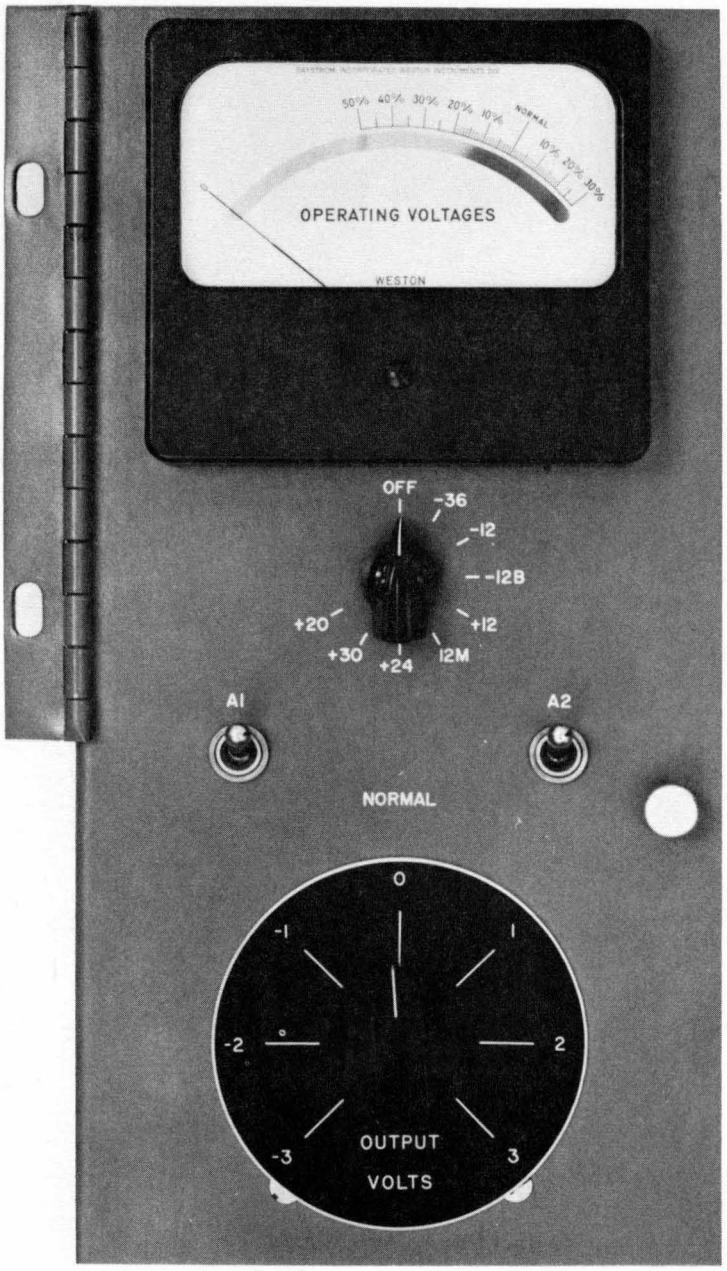


Figure 6-9. Marginal Check Panel

CONTENTS

7.1 SHIPPING GROUP

This is a list of special tools and supplies which will be sent with the machine from the factory. These tools are to be kept at the installation.

Description	Form No.	Part No.	Quantity
System Diagram Volume 5		615000	1
DFT Manual Pages		2125682	1
DFT Card Deck		2125683	1
Signal Cable		605036	2
Power Cable		615037	1
Cams Align Rod		219300	1
Set Up Bail Gage		600914	1
Card Weight Assembly		610660	2
Punch Crank		256213	1
Parts Catalog	121-0512-0		1
CE Reference Manual	227-5715-0		1
Red Test Lead		206046	2
Black Test Lead		206047	2

7.2 OFFICE TOOLS

The following tools will normally be located in the branch office and can be obtained when needed.

Description	Part No.
Meter, Simpson	450497
Meter, 901, Weston, or equivalent (iron vane meter with low range voltage scale)	460879
Scope clip assembly, black	2108156
Scope clip assembly, red	2108157
Scope dual input switch	450934
Scope, 310 Tektronix and accessories	450841
Probe attentuator	451215
Binding post adaptor	
Filter	
Instruction Manual	
Viewing hood	
Test lead, 10' black	450840
Test lead, 10' red	450839
Probe, additional attenuator scope	450857
Probe, direct coaxial scope	461019
Probe tiplet	461119
Current Probe Adaptor	2109279
Current Probe	2108282
Probe Feed through Termination	2108281
Wire Wrapping Tool, Pistol	461012
Wrapping Bit Wire Size No. 24	461009
Sleeve Wire Size No. 24	461014
No. 24 gage solid tin copper wire is used on the back panel circuits	

7.3 TOOLS FOR SMS SERVICING

This list contains the tools and supplies which are not shipped with the machine and should be ordered for each installation.

Description	Part No.
Un-Wrap Tool	451573
Card Extender — Cable Isolation Tool	451075
SMS Card Contact Lubricant	451053
SMS Card Insertion-Extraction Tool	451030

Refer to General CEM's for latest information on newly released SMS tools and supplies.

NOTE: If the tools for SMS servicing are ordered for use with the 1620, do not duplicate the order for the 1622.

7.4 WIRE WRAPPING

The wire-wrapping procedure given in the Standard Modular System, CE Reference Manual (Form 223-6900) is applicable to the IBM 1622.

7.5 APPLICABLE CUSTOMER ENGINEERING MANUALS

The following is a list of CE manuals that contain information that is of value in servicing the IBM 1622 Card Read-Punch.

Customer Engineering Manuals of Instruction:

60 Cycle SMS Power Supplies	*Form 225-6478
Tektronix Oscilloscopes	*Form 223-6725
Transistor Component Circuits	Form 223-6889
Transistor Theory Illustrated	Form 223-6794
Transistor Theory and Application	Form 223-6783

Customer Engineering Reference Manuals:

Standard Modular System	*Form 223-6900

* Recommended for each installation