IBM Field Engineering

Manual of Instruction

548 552 Alphabetic Interpreters

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Manual of Instruction

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548 552 Alphabetic Interpreters

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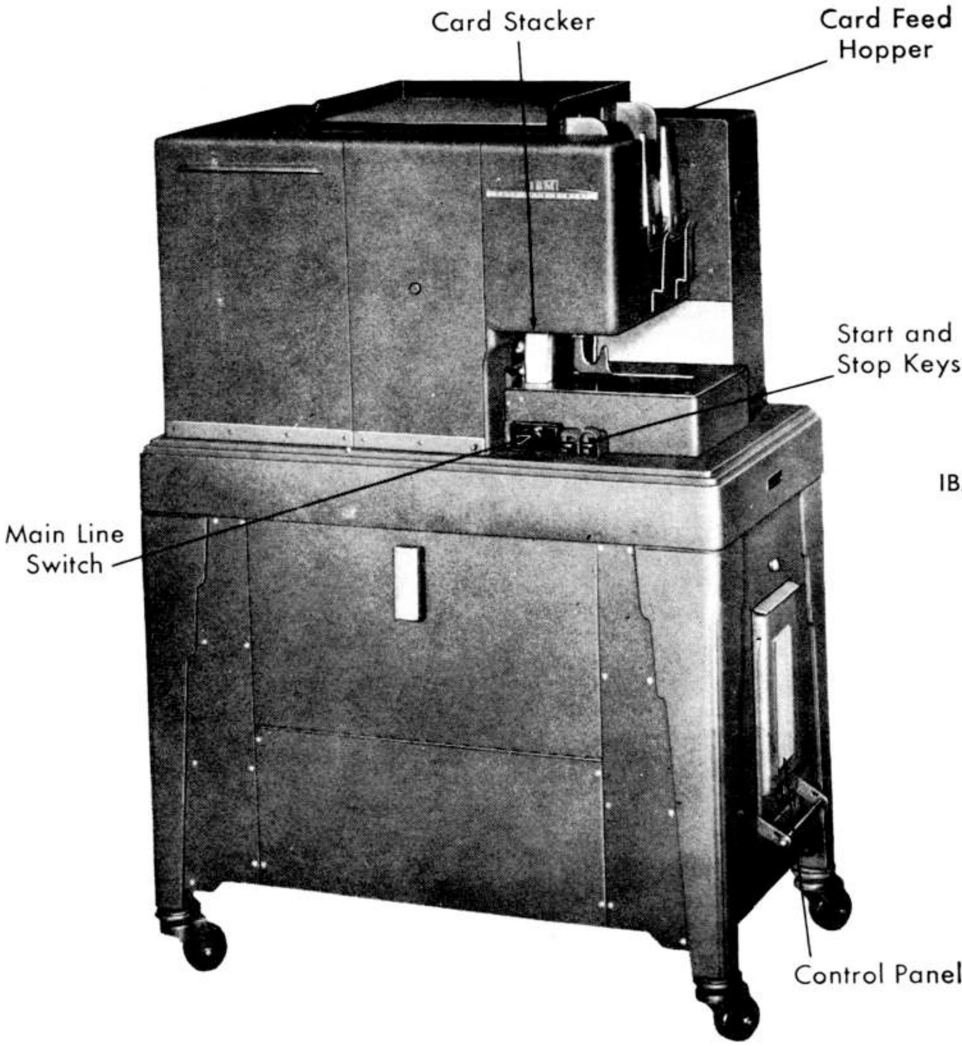
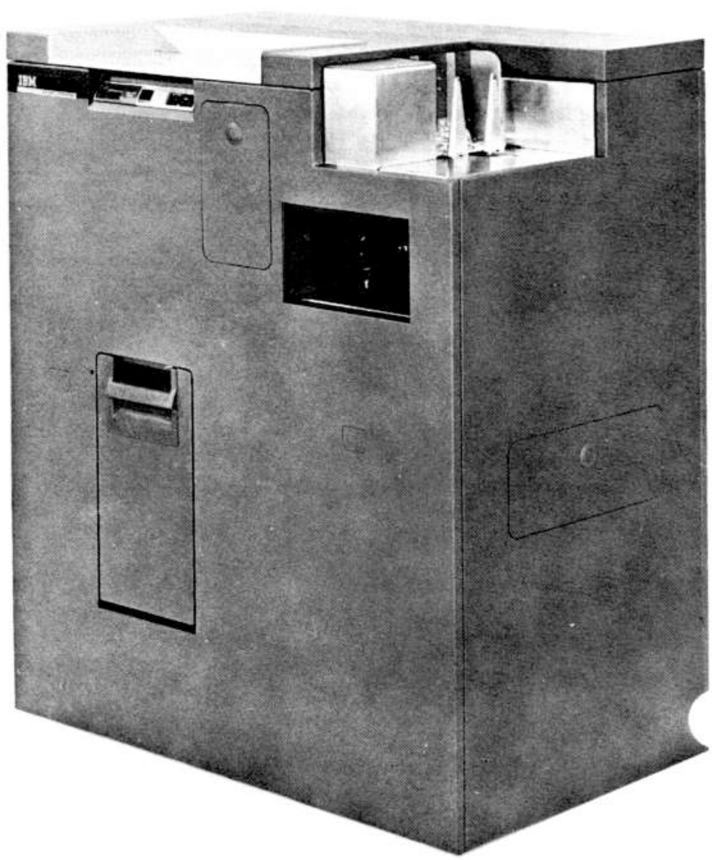


IBM 552 ALPHABETICAL INTERPRETER



IBM 548 ALPHABETICAL INTERPRETER

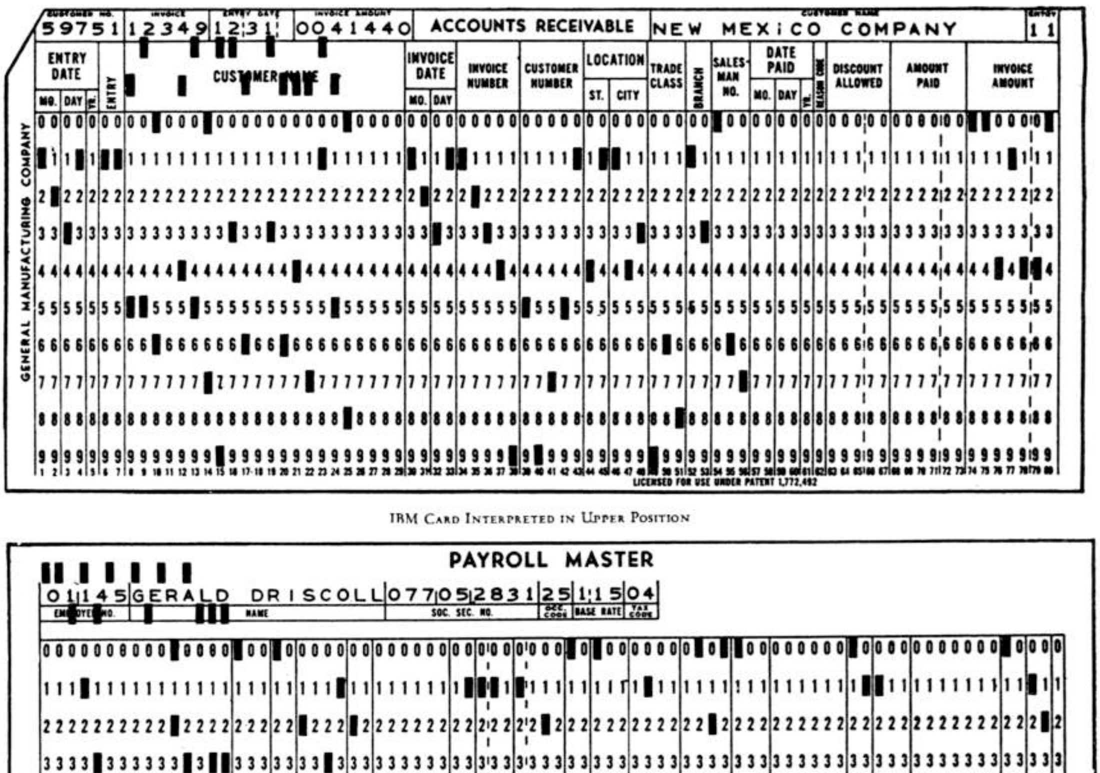
The IBM card, which is the operating unit of the IBM accounting method, is widely and variously used in the business world. Many applications of the card require that trained and untrained personnel rapidly read the punched-hole information. The IBM 548, 552 Alphabetic Interpreters are capable of translating the IBM alphabetical and numerical punched-hole code into printed characters on the face of the card. Punched and interpreted cards provide a source document that can be used by untrained personnel without affecting the intended use of the cards in the automatic accounting machines.

A few good examples of punched and interpreted cards used as source documents are insurance premium-notice cards, special payroll deduction cards, attendance time cards, and inventory cards.

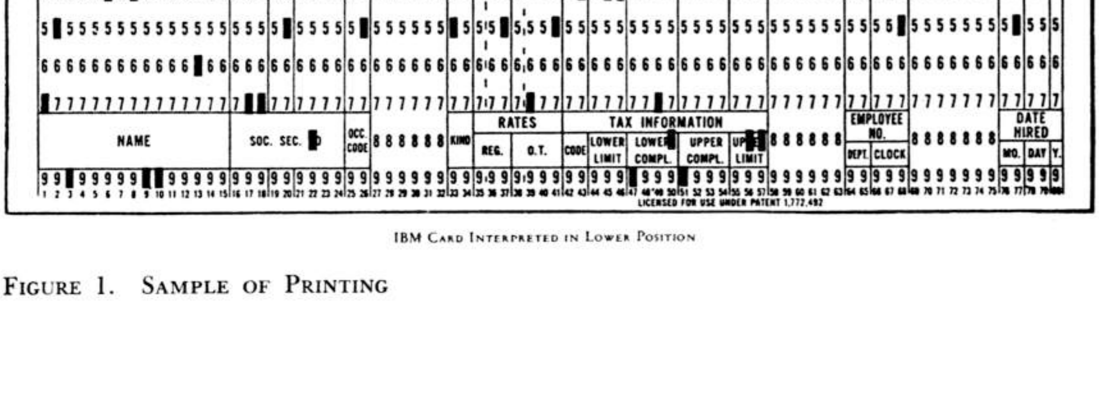
Features

The IBM 548, 552 Alphabetic Interpreters are capable of printing up to sixty columns of information at the rate of sixty cards per minute. The operator may select either one of two lines on the card where the printing will be placed. The upper line prints between the top edge and the 12-hole, and the lower line prints between the 12- and X-holes in the card (Figure 1).

The print unit consists of sixty typebars, each capable of printing the twenty-six alphabetical characters, the ten numerical characters, and two optional special characters. Various optional special characters such as the diagonal /, ampersand &, asterisk *, dollar sign $, etc., may be installed in combinations to satisfy special types of applications.



IBM Card Interpreted in Upper Position



IBM Card Interpreted in Lower Position

Figure 1. Sample of Printing

To print two lines of information from one card, or to print more than sixty columns of information from one card, two passes of the cards through the machine and two control panel wirings are required.

The IBM 548, 552 Alphabetic Interpreters contain a single set of 80 reading brushes, capable of reading alphabetical and numerical information from all 80 columns of the card. The contact roll, operating with the single set of brushes, performs a threefold function: it acts as a contact roll, a feed roll, and a platen.

The IBM 548, 552 Alphabetic Interpreters are available for operation from any standard source of electrical power. The machines are equipped with a drive motor plus either a transformer and rectifier or a motor generator set; either supplies 40 volts dc for relay and magnet operation. The following table shows the running current of the machines for the standard supply voltage with their weights and outside dimensions.

Current Requirements

	60 cy.	50 cy.	25 cy.	DC
115 volts 1-phase	8.0 amp.	9.6 amp.	7.3 amp.	
115 volts 3-phase	5.0	6.0		
208 volts 1-phase	4.4	5.3		
208 volts 3-phase	2.8	3.3		
230 volts 1-phase	4.0	4.8		
230 volts 3-phase	2.3	3.0		
115 volts				4.8
230 volts				2.6

552 Weight	552 Dimensions
Unpacked – 770 pounds	Length – 34 inches
	Width – 20 inches
	Height – 51 inches

548 Weight	548 Dimensions
Unpacked – 682 pounds	Length – 40 inches
	Width – 25 inches
	Height – 50 inches

Operating Keys, Lights, and Switches

Main-Line Switch

The 552 main-line switch is in the center on the front of the machine and controls all of the input supply line power to the drive motor and the motor generator or rectifier. This switch is of the thermal-overload type and automatically opens the circuit if the internal machine circuits become overloaded. When the switch has been opened by an overload, remove the line plug and move the switch handle to the OFF position. Check the machine to find the cause for the overload before attempting to restart.

The 548 main-line switch is a standard switch in the front upper left of the machine.

Signal Light

When the machine is functioning normally and the main-line switch is ON, a signal light will glow signifying that the internal 40-volt dc power is available for machine operation.

Start and Stop Keys

The start and stop keys are located on the front of the machine to the right of the main-line switch. The two keys start and stop the feeding of cards. The 552 start key is shielded and is only accessible from the front, while the stop key is readily accessible from all positions. It is necessary to hold the start key depressed for four cycles (until the first card has reached the stacker) before the automatic card-feeding operation takes place.

Card feeding may be stopped at any time by depressing the stop key. It is not necessary to hold the stop key depressed to stop the machine. After the stop key has been depressed, the power to the machine drive motor is cut off after the next printing operation has been completed, and the machine coasts to approximately 275°.

Stacker Stop Switch

The machine is equipped with a stacker contact switch which prevents the machine from operating with a full stacker. The start key is inoperative if the stacker is full of cards.

Printing Line Selection Control (Figure 2)

Printing line selection is controlled by a small knob projecting out of the back of the machine. By pulling out and turning the control knob, one of two scribed lines (labeled *U* and *L*) may be lined up with a third scribed line on the shaft. When the scribed line labeled *U* lines up with the scribed line on the shaft, printing will take place on the upper line. When the scribed line labeled *L* lines up with the scribed line on the shaft, printing will take place on the lower line.

Card Feed

The alphabetical interpreters are equipped with a horizontal feed. Cards are placed in the feed hopper, face up, with the 12-edge toward the throat. The machine operates at 60 cards per minute.

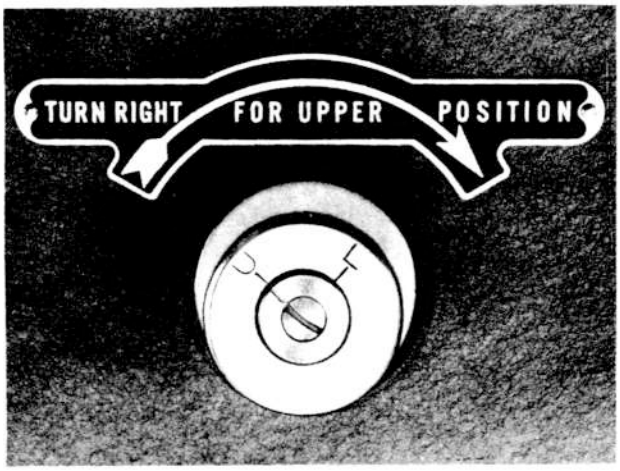


FIGURE 2. PRINTING LINE SELECTION CONTROL

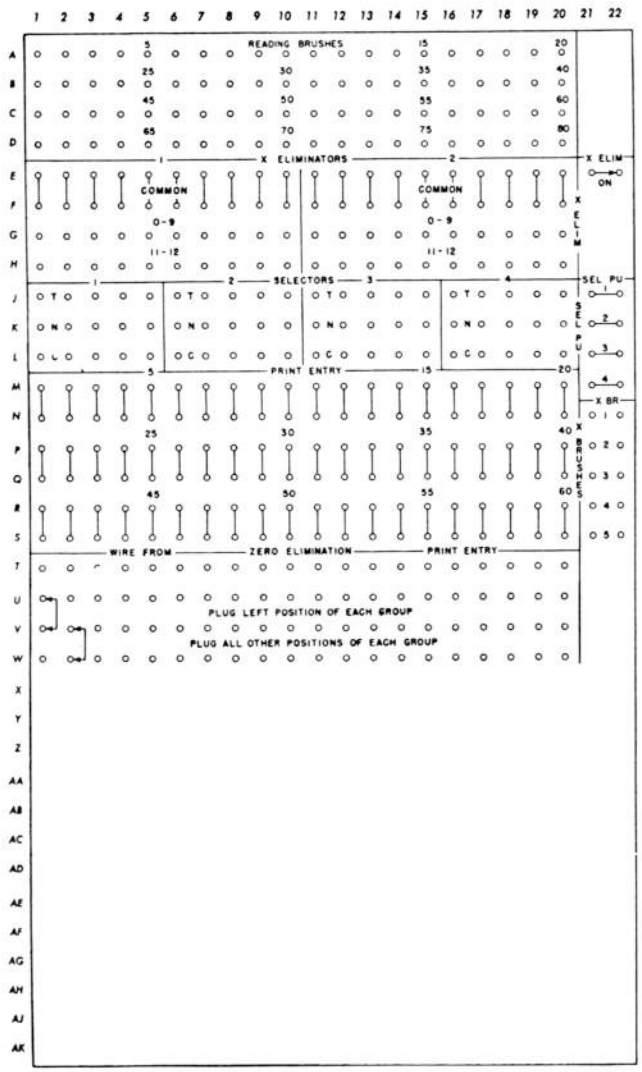


FIGURE 3A. IBM 548 CONTROL PANEL

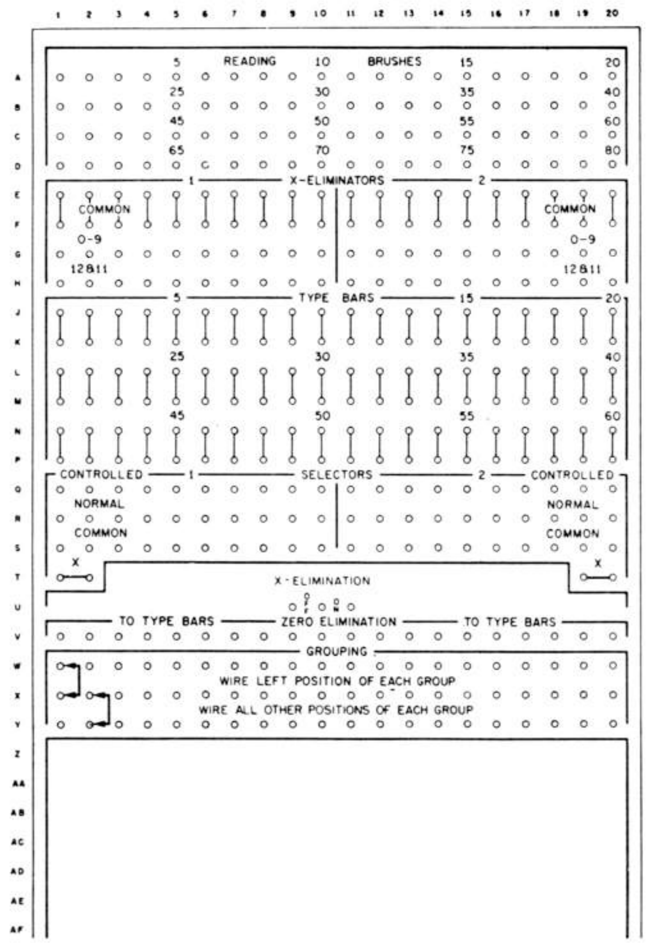


FIGURE 3B. IBM 552 CONTROL PANEL

Control Panel (Figure 3)

The IBM 552 control panel is the automatic, single-panel type and is located on the right end of the machine. The IBM 548 control panel is located in the front of the machine and uses the self-contacting wires. Both control panels contain the following groupings:

1. Eighty reading brush hubs
2. Sixty double sets of typebar hubs
3. Four 5-position class selectors — 548 only (two selector standard equipment; two optional)
4. Two 10-position selectors — 552 only (optional)
5. Two 10-position X-eliminators (optional)
6. Zero elimination (optional)
7. Five X-brushes — 548 only

When interpreting either alphabetic or numeric information, wire from the reading brush hubs to the typebar entry hubs.

To eliminate alphabetic printing caused by an X- or 12-punch above a numerical field, wire from the reading brush hub to the common of the X-eliminator and from the corresponding 0-9 hub to the typebar entry hub. The X-elimination switch must be wired ON to perform this operation.

Machine Operation

The IBM 548, 552 Alphabetic Interpreters employ a unique method of positioning the typebars, which eliminate the need for any auxiliary units for the storage of zone information. The codes for the twenty-six alphabetic characters are shown in Figure 4. Each alphabetic code consists of one zone (12, 11, 0) punch and one numeric (1-9) punch. The numeric and special characters each consist of a single punch. All these characters can be divided into four classes:

1. Those with a 12-zone punch
2. Those with an 11- (or X) zone punch
3. Those with a zero-zone punch
4. Those with no zone punch

The printing types are consequently grouped into four zone groups on the typebars. These typebars are latched in their highest position at the start of a printing cycle.

The cards are fed so that the zone punches are read first. As the zone punches are read, the typebars are unlatched and moved rapidly downward. During the zoning portion of the cycle, the card moves slowly and the typebars move rapidly. At the end of the zoning portion of the cycle, the typebars have moved varying distances to bring the proper group of types opposite the selecting pawls.

The card now moves forward at a faster rate and the typebars are lowered more slowly, while the numeric punches cause the selecting pawls to stop the typebars at the proper point within the zone group of type.

After the card has passed the brushes, it is positioned in line with the row of selected type. The card now stops, while the type makes an impression through the inked ribbon to print on the card.

Character		Punching Code	Character		Punching Code
A	—	12-1	Blank or		
B	—	12-2	Special	—	0-1
C	—	12-3	S	—	0-2
D	—	12-4	T	—	0-3
E	—	12-5	U	—	0-4
F	—	12-6	V	—	0-5
G	—	12-7	W	—	0-6
H	—	12-8	X	—	0-7
I	—	12-9	Y	—	0-8
Optional	—	12	Z	—	0-9
J	—	X-1	1	—	1
K	—	X-2	2	—	2
L	—	X-3	3	—	3
M	—	X-4	4	—	4
N	—	X-5	5	—	5
O	—	X-6	6	—	6
P	—	X-7	7	—	7
Q	—	X-8	8	—	8
R	—	X-9	9	—	9
Optional	—	X	0	—	0

FIGURE 4. TABLE OF CHARACTERS AND PUNCHING

Mechanical Principles

The locations of the principal units of the IBM 552 are shown in Figures 5 and 6; the location of the principal units of the 548, in Figures 7 and 8. Figure 9 schematically illustrates how the mechanical power is transmitted from the drive pulley to all of the units on the machine. Use this schematic illustration with Figures 5, 6, 7, and 8.

Mechanical Power Supply

The transmitting of the mechanical power from the 1/4 hp drive motor (Figures 5, 6, 7, and 8) to the various units should be studied first. Starting at the drive motor, a V-belt, with a speed-reduction step pulley on some machines, turn the drive pulley and the horizontal drive shaft (Figure 9). Some machines use a speed-reduction step pulley.

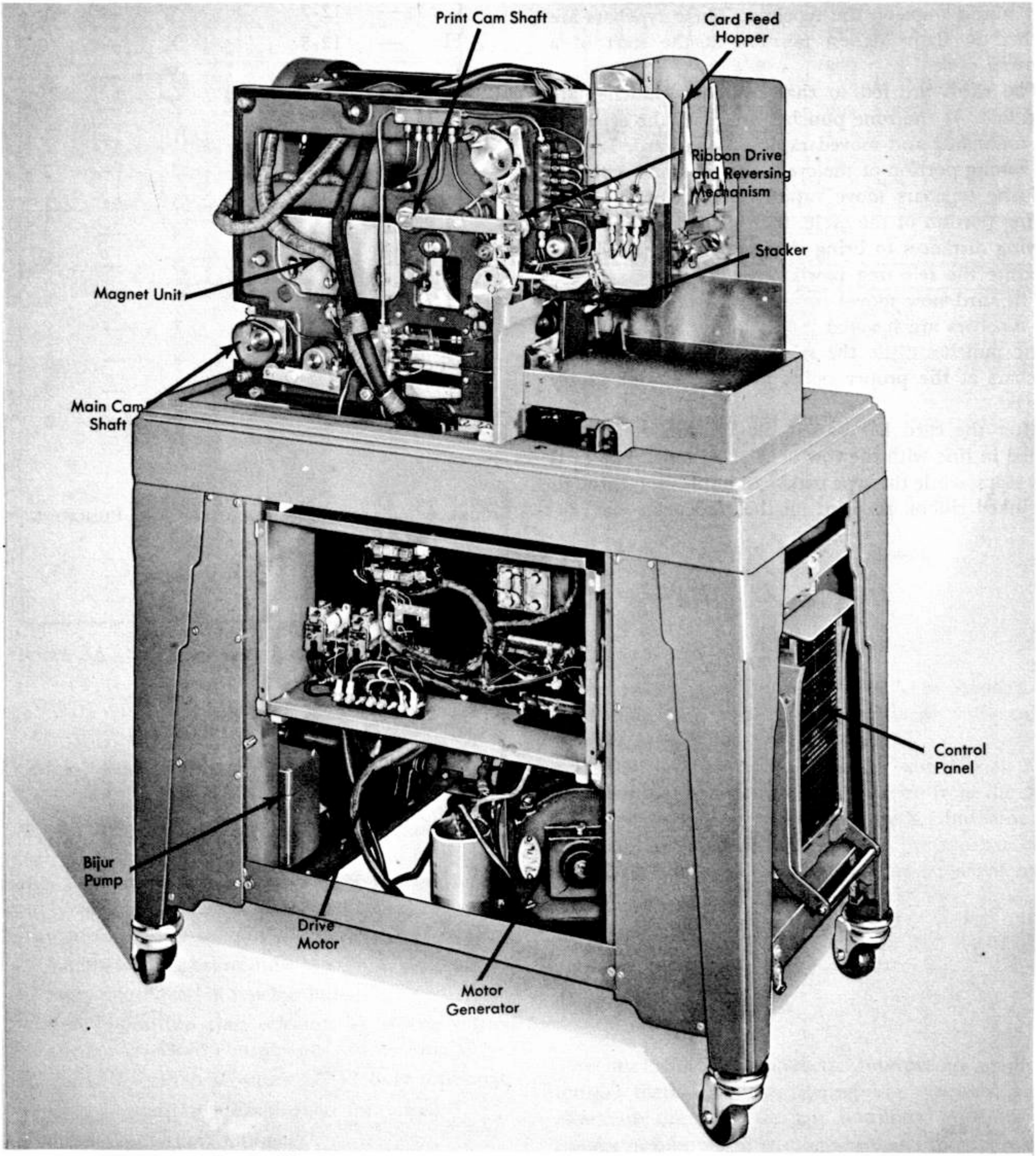


FIGURE 5. IBM 552 FRONT VIEW

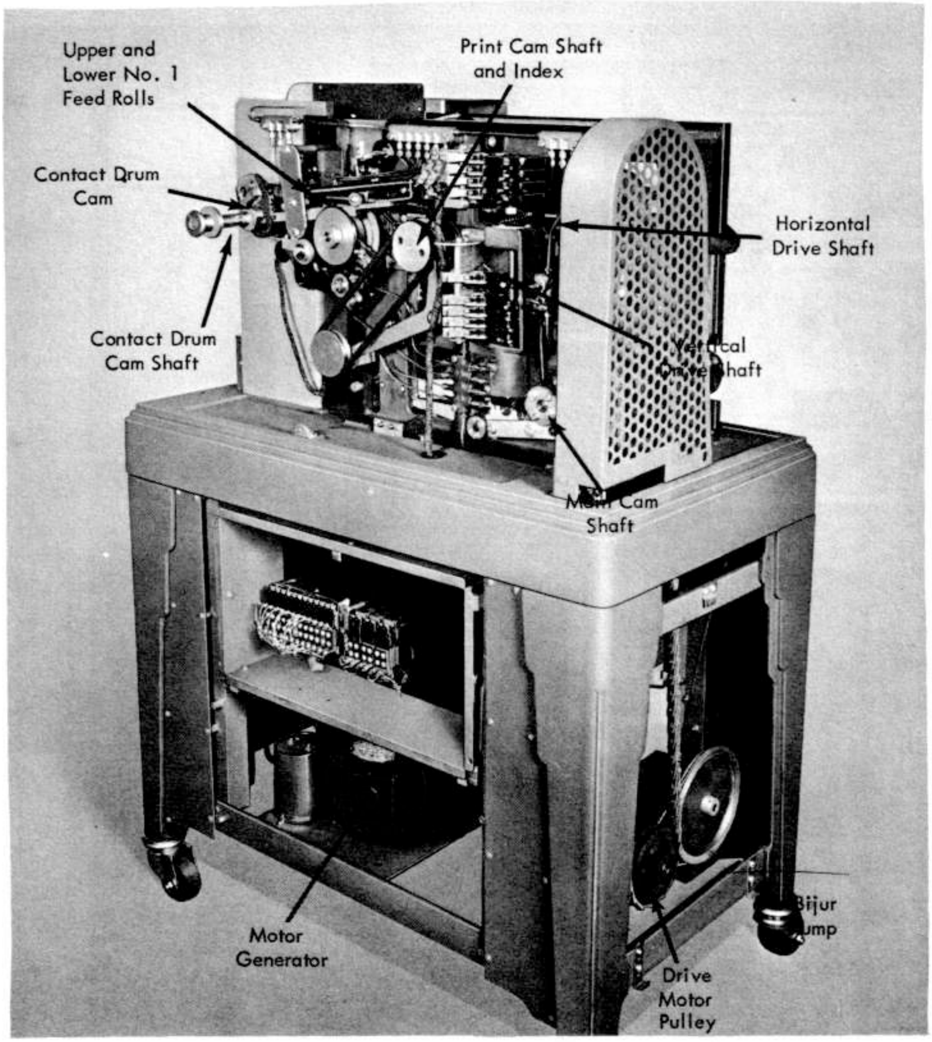


FIGURE 6. IBM 552 REAR VIEW

Looking at the back of the machine from right to left (Figures 6, 8, and 9), the first mechanical power take-off from the horizontal drive shaft is the vertical drive shaft which carries the circuit-breaker cams. The vertical drive shaft rotates once for each machine cycle, while the horizontal drive shaft makes six revolutions per machine cycle. The electrical cams on the vertical drive shaft provide timed electrical impulses for machine operation. Two additional cams are mounted on the circuit breaker unit but operate from cams located on the horizontal drive shaft. These cams provide short impulses needed for stopping the typebars at the proper position.

Keyed to the lower end of the vertical drive shaft is the main cam shaft drive gear. The main cam shaft receives its mechanical energy through the vertical circuit-breaker cam shaft.

Attached to the main cam shaft are ten cams which impart mechanical motion to the typebar unit and the print magnet unit. Figure 9 illustrates and identifies each cam. The functions of the ten cams will be studied with the mechanical principles of the print unit and the magnet unit.

Refer to the horizontal drive shaft in Figures 6, 8, and 9. The second mechanical power take-off (counting right to left) is the print cam shaft. This shaft is equipped with five cams whose principal function is to operate the printing-pressure bar and the zoning-pawl restoring-lever in the print unit. The machine index is located on the rear surface of the print cam shaft spiral gear, and is visible from the rear of the machine. Mechanical energy to operate the stacker mechanism is taken from the print cam shaft. Figure 9 does not show the stacker mechanism, but it will be discussed later in the mechanical principles section.

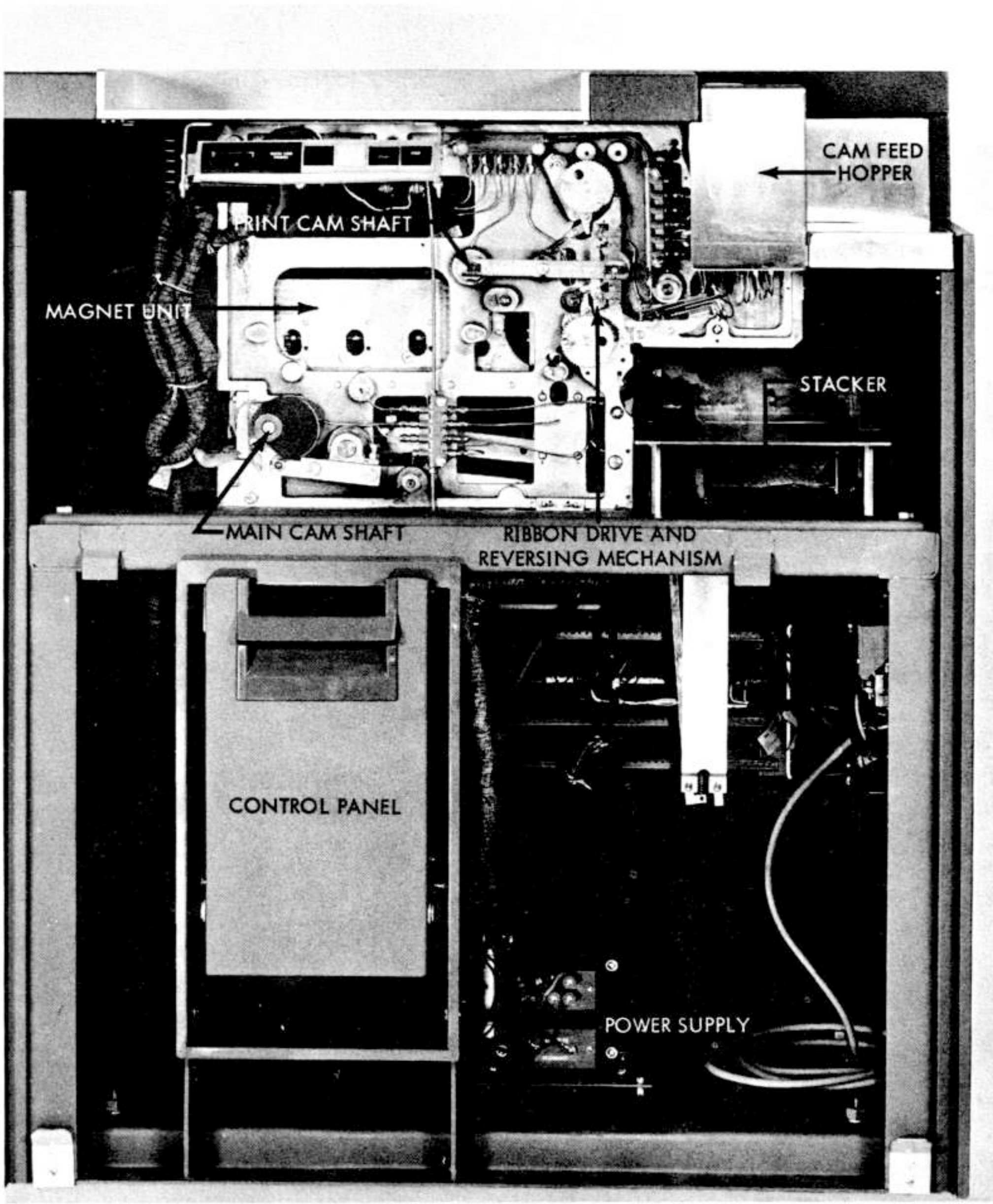


FIGURE 7. IBM 548 FRONT VIEW

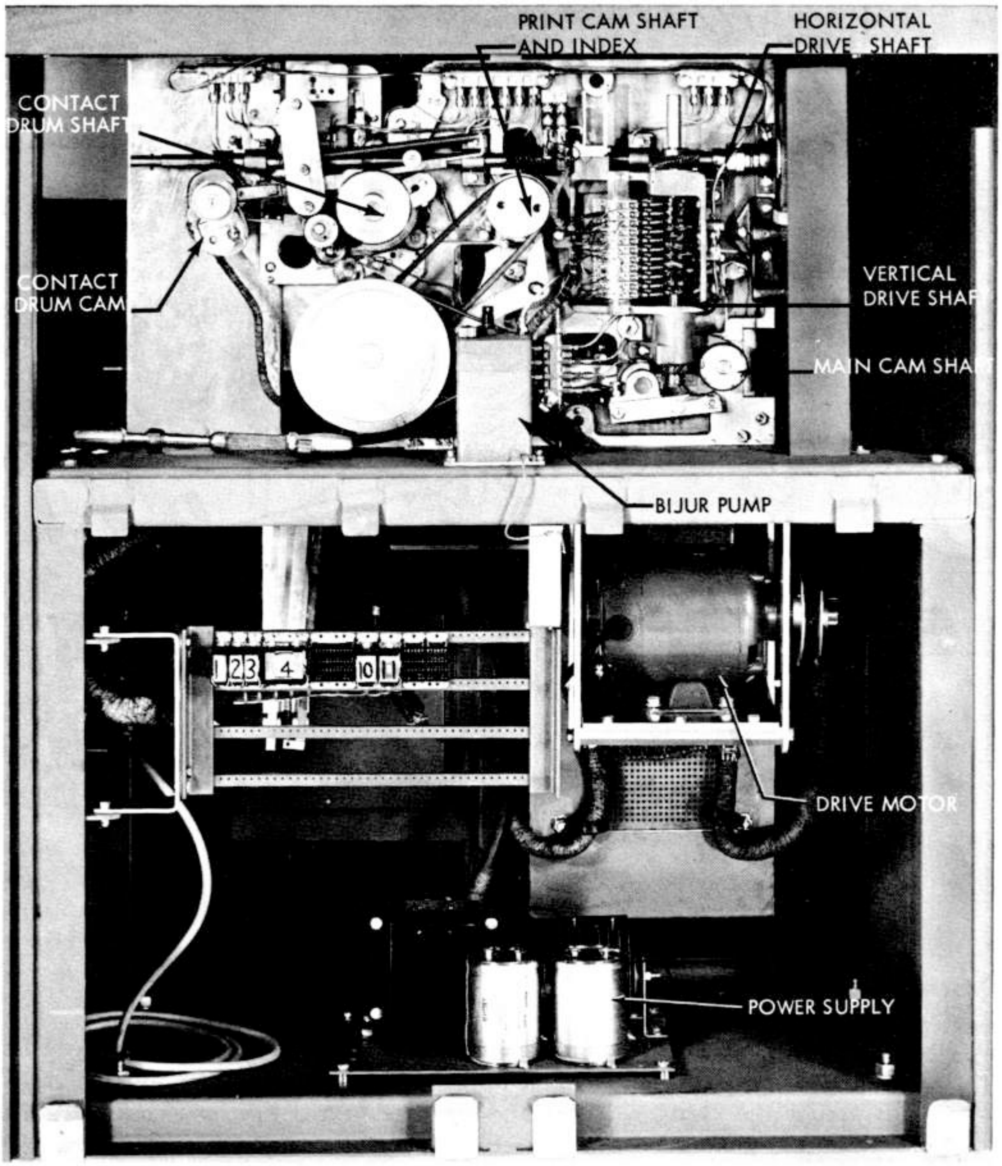


FIGURE 8. IBM 548 REAR VIEW

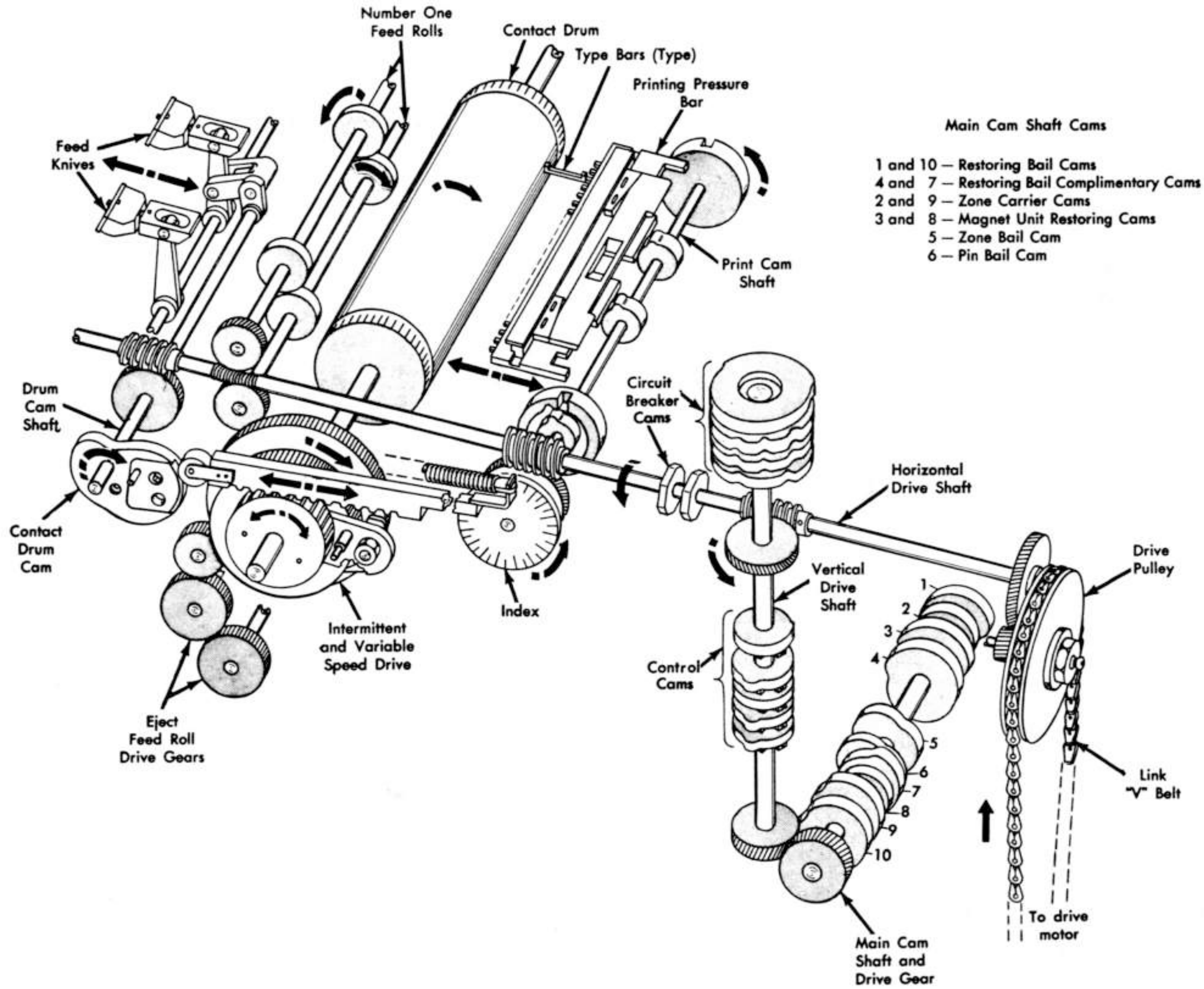


FIGURE 9. SCHEMATIC OF MECHANICAL POWER

The upper and lower number one feed rolls are the third mechanical power take-off from the horizontal drive shaft. These feed rolls accept the card from the feed knives and deliver it to the contact drum.

The fourth and last mechanical power take-off from the horizontal drive shaft is the drum cam shaft. This drum shaft provides mechanical energy to perform two distinct machine functions: furnishing the reciprocating motion of the card-feed knives, and rotating the contact-drum cam. Rotating the contact-drum cam results in intermittent and variable speeds of the contact drum.

Feed Unit (Figure 10)

The IBM 548, 552 feed unit mechanically resembles the feed unit of the IBM 80 Sorter. Cards are placed in the feed hopper, face up, and 12-edge toward the throat; they feed at the rate of 60 cards per minute.

Figure 10 is a cut-away front view of the feed hopper, first upper and lower feed-rolls, and the contact drum. The card-feed crank shaft is a continuation of the contact-drum cam shaft and is mechanically driven from the horizontal drive shaft. The rotating motion of the card-feed crank shaft is converted into reciprocating motion of the card-feed knife.

At a fixed time in each card cycle, a pair of feed knives comes into contact with the edge of the card and moves it through the throat to the first set of feed rolls. The throat is adjusted to prevent more than one card feeding during any one card-feed cycle. The first set of feed rolls, under spring tension, moves the card to the brush guide roll and contact-drum station.

The card-lever contact mounted under the hopper bed is operated mechanically by a card moving from the first pair of feed rolls to the contact drum. This contact recognizes that a card is approaching the brush reading station and is used to establish circuits to the reading brushes. As long as cards are feeding, the card-lever contact will be closed, and the card-reading brush circuit will be established.

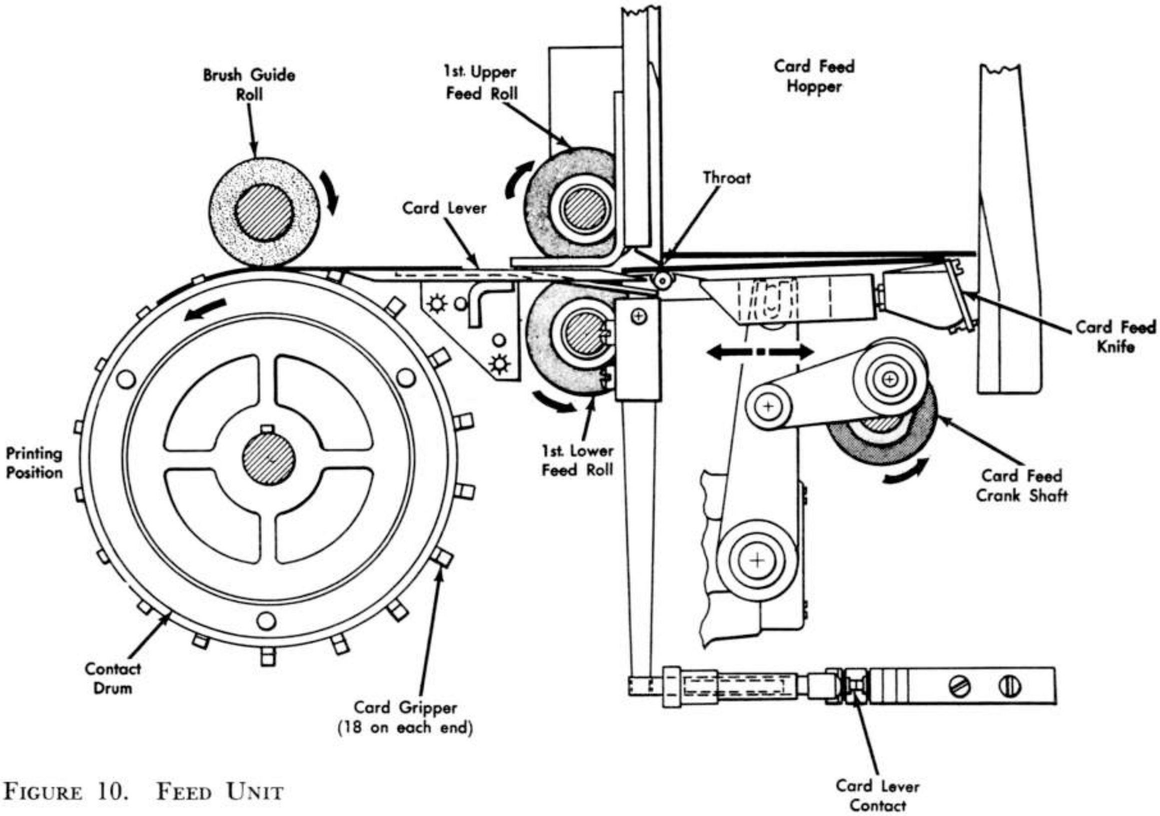


FIGURE 10. FEED UNIT

The card moves from the hopper bed through the first pair of feed rolls to the contact drum at a constant rate of speed, because both the card-feed crank shaft and the first pair of feed rolls are directly geared to the constant speed horizontal drive shaft.

Contact Drum (Figures 11 and 12)

The contact drum is a steel cylinder with plastic ends, approximately 4 inches in diameter and approximately ½ inch longer than the width of the card. Equally positioned around both ends of the outside circumference of the contact drum are eighteen spring operated, cam-controlled, gripper fingers (Figure 11). These fingers firmly grip the card to the contact drum and carry it to the printing position.

The contact drum in the IBM 548, 552 performs three basic functions:

1. It operates with the brush-guide roll as a card-feed roll.
2. It operates with the 80 reading brushes to read, electrically, the punched holes in the card (contact roll).
3. It operates with the typebars and the ribbon as a platen.

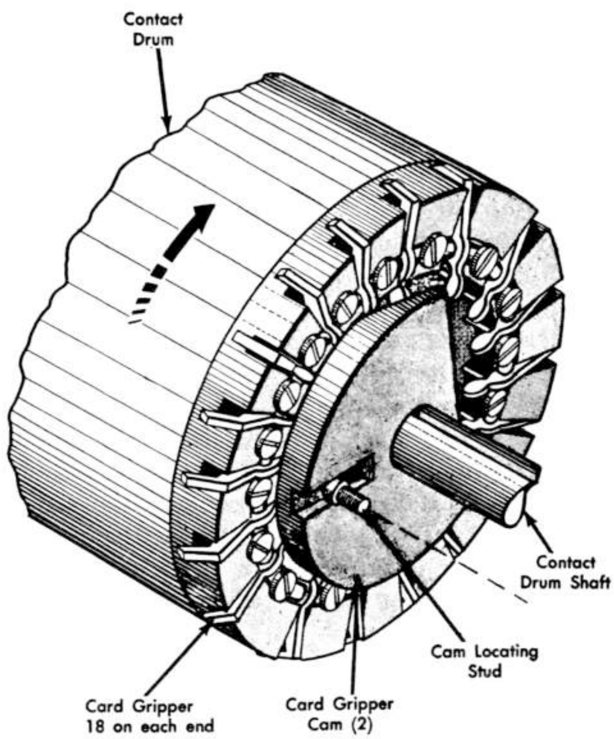


FIGURE 11. CONTACT DRUM AND GRIPPER FINGERS

As previously mentioned, the 548, 552 is capable of reading the two-hole IBM card punching code with one set of 80 reading brushes. The contact drum is required to turn at one speed during zoning time and at a faster rate of speed during selection time. The contact drum also functions as a platen; therefore, during printing time, the drum must be stationary.

Two stationary card-gripper cams (Figure 11), located on either end of the contact drum, open and close the gripper fingers at the correct time. As the contact drum revolves, the indvidual gripper fingers operate against the cams. The fingers are open to accept the card from the first feed rolls; then close to carry the card to the printing position and the stacker rolls.

Contact-Drum Drive Mechanism (Figure 12)

The contact-drum cam is located on the rear of the contact-drum cam shaft and revolves at a constant speed. Look at the exploded view of the machine (Figure 12). The revolving contact-drum cam drives the operating rack to the right and turns the contact-drum driving gear and the ratchet pawl in a clockwise direction. The revolving ratchet pawl will turn the ratchet, contact-drum gear, and contact drum in a clockwise direction. The speed at which the contact drum turns depends upon the cut of the contact-drum cam.

When the contact-drum cam has driven the operating arm to the completion of its travel, the contact drum stops. Spring tension holds the operating-rack cam roller against the contact-drum cam, causing the operating rack to move to the left, the contact-drum driving gear and the ratchet pawl to revolve in a counterclockwise direction. The contact-drum driving gear is free on its shaft, and the ratchet pawl slides over the teeth of its ratchet.

A double friction-plunger device is mounted on the contact-drum drive arm. The two spring-loaded friction plungers operate against the contact-drum brake disc and the contact-drum gear. When the contact drum is turning, the contact-drum arm and its friction-plunger device and ratchet pawl turn in the same direction and at the same speed. As the contact-drum cam slows down its driving effort, the contact-drum drive arm also slows down, but the contact drum has a tendency to run ahead, sometimes allowing the ratchet to engage in the next tooth. The friction plungers tend to stabilize this action in keeping the drum with the arm and ratchet pawl.

Contact-Drum Brake (Figure 12)

The contact-drum brake is a cam-operated mechanism that prevents overthrow of the contact drum before printing, thus insuring correct travel of the card. The brake also firmly holds the contact drum during printing time. The contact-drum brake operates with the brake disc which is pinned on the contact-drum shaft.

The brake cam is located on the contact-drum cam shaft, and, as the brake cam revolves, the brakeshoe assembly pivots on the eccentric bushing, thus delivering a brake action to the brake disc. The eccentric bushing is adjustable and provides a means to secure correct brake action. The mechanical timing chart graphically illustrates the contact-drum brake action in relation to the contact drum and card movement and printing time.

Contact-Drum Sliding Cam (Figure 13)

The IBM 548, 552 are capable of printing on either of two lines, determined by the printing-position control knob. The manual operation of the control knob positions the contact-drum sliding cam within the contact-drum cam. When the control knob is set for the lower line, the sliding cam changes the contour of the contact-drum cam, resulting in increased rotation of the contact drum just before printing occurs. This action causes printing to take place on the lower line of the card.

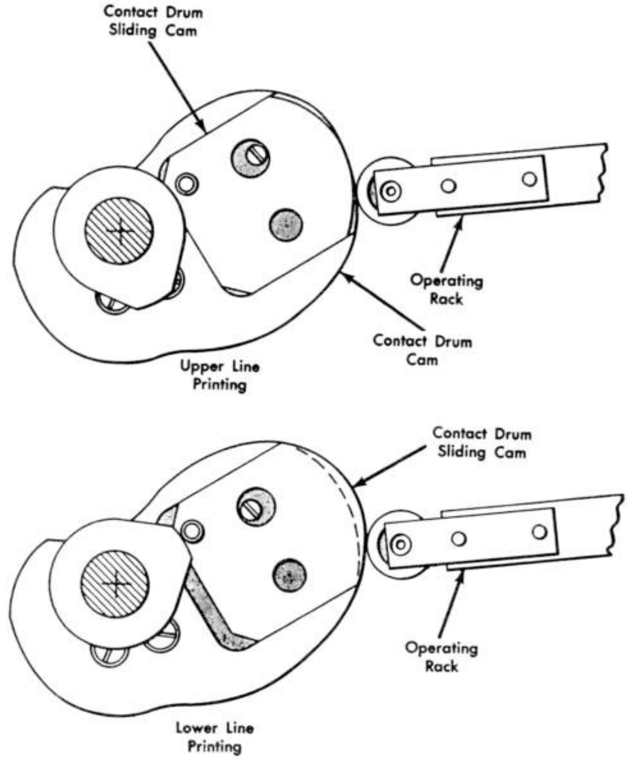


FIGURE 13. CONTACT DRUM SLIDING CAM

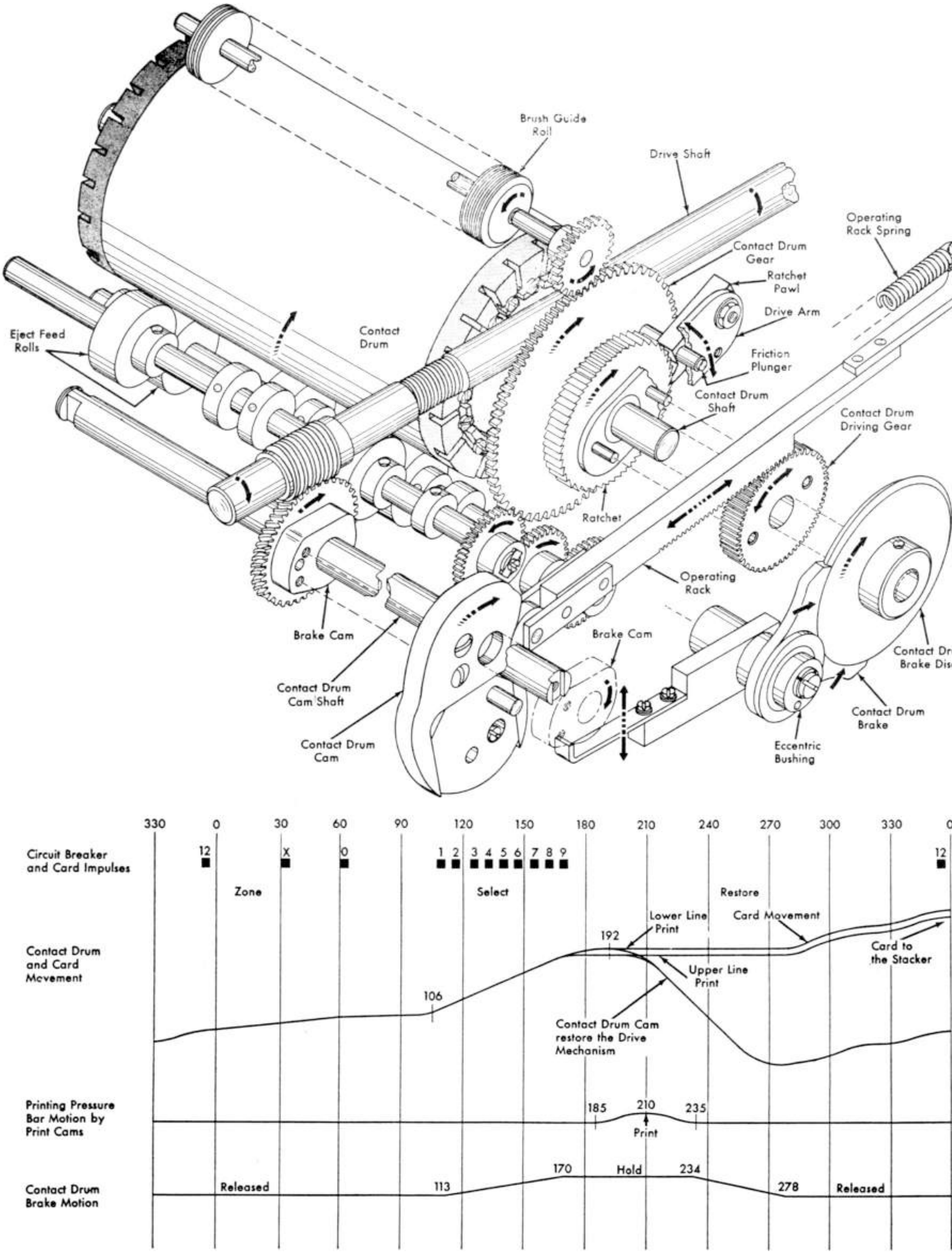


FIGURE 12. CONTACT DRUM AND DRIVE MECHANISM

NOTE: Figure 12 shows how the contact drum and card will be moved the additional distance when the printing-position control knob is set for the lower line printing. Also note the mechanical timing relation between the zone and selection impulses, contact drum movement, printing time, and contact-drum brake action.

Figure 12 contains a schematic mechanical timing chart illustrating the various speeds that the contact-drum cam will turn the contact drum. This chart also shows card movement, because at 340° the contact drum picks up the card and controls it until delivered to the stacker rolls.

Starting at approximately zero degrees, the upward pitch of the line represents a constant speed of the contact drum to 60°. Between 60° and 106° the straight line represents a stationary contact drum. The increased slope of the line from 106° to 192° represents an increased speed of the contact drum. The two horizontal lines from 192° to 284° represent the stationary contact drum, while the rack assembly and ratchet pawl is being restored for another cycle. Note that the print cam operates the printing-pressure bar at 210°, during the period of time that the contact drum and card are stationary. The brake cam also operates the contact-drum brake, firmly holding the contact drum while printing is taking place.

Brush Unit (Figures 14, 15, and 16)

The IBM 548, 552 brush unit is made up of the following basic parts:

1. Front and rear side frames
2. Brush-holder block holding 80 reading brushes
3. Brush-guide roll and bearings
4. Card-feed guide plate
5. Brush-unit locking bar

This unit is located between the two machine side frames and in a position so that the brush-guide roll is directly above the contact drum. This roll, operating with the contact drum, receives the card from the first pair of feed rolls and holds it in position to be gripped by the gripper fingers. The brush-guide roll also separates all of the 80 reading brushes. Adjustments have been provided so the reading brushes may be correctly positioned in relation to the contact drum.

The complete brush unit is locked in operating position with the brush-unit locking bar.

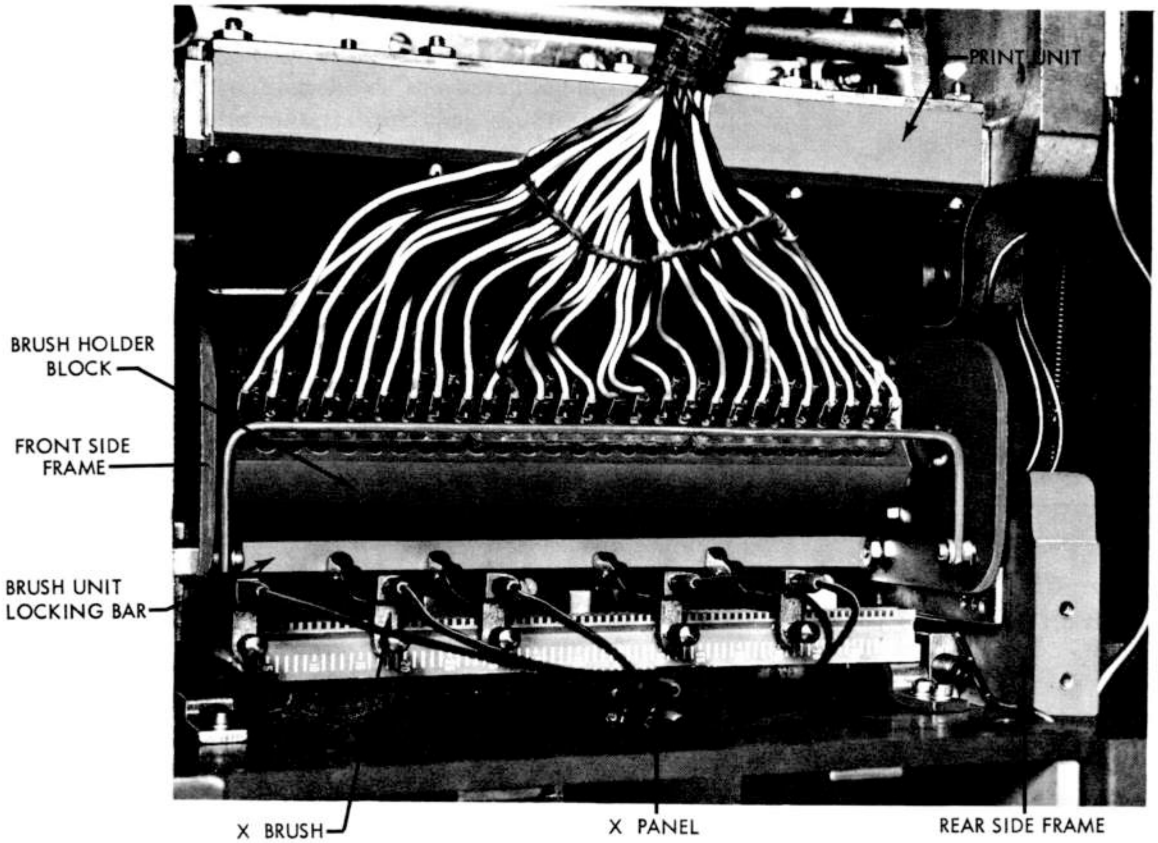


FIGURE 14. IBM 548 BRUSH UNIT — OPERATIVE POSITION

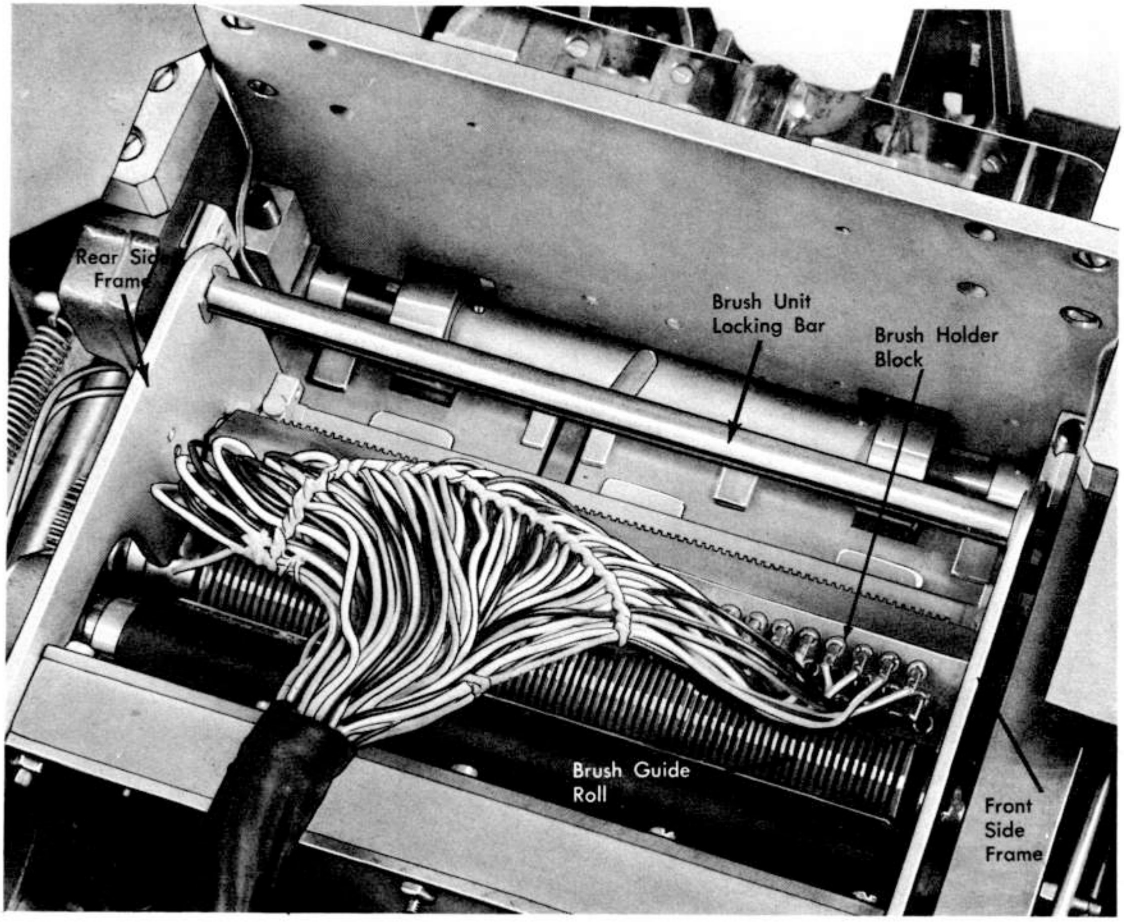


FIGURE 15. IBM 552 BRUSH UNIT — OPERATIVE POSITION

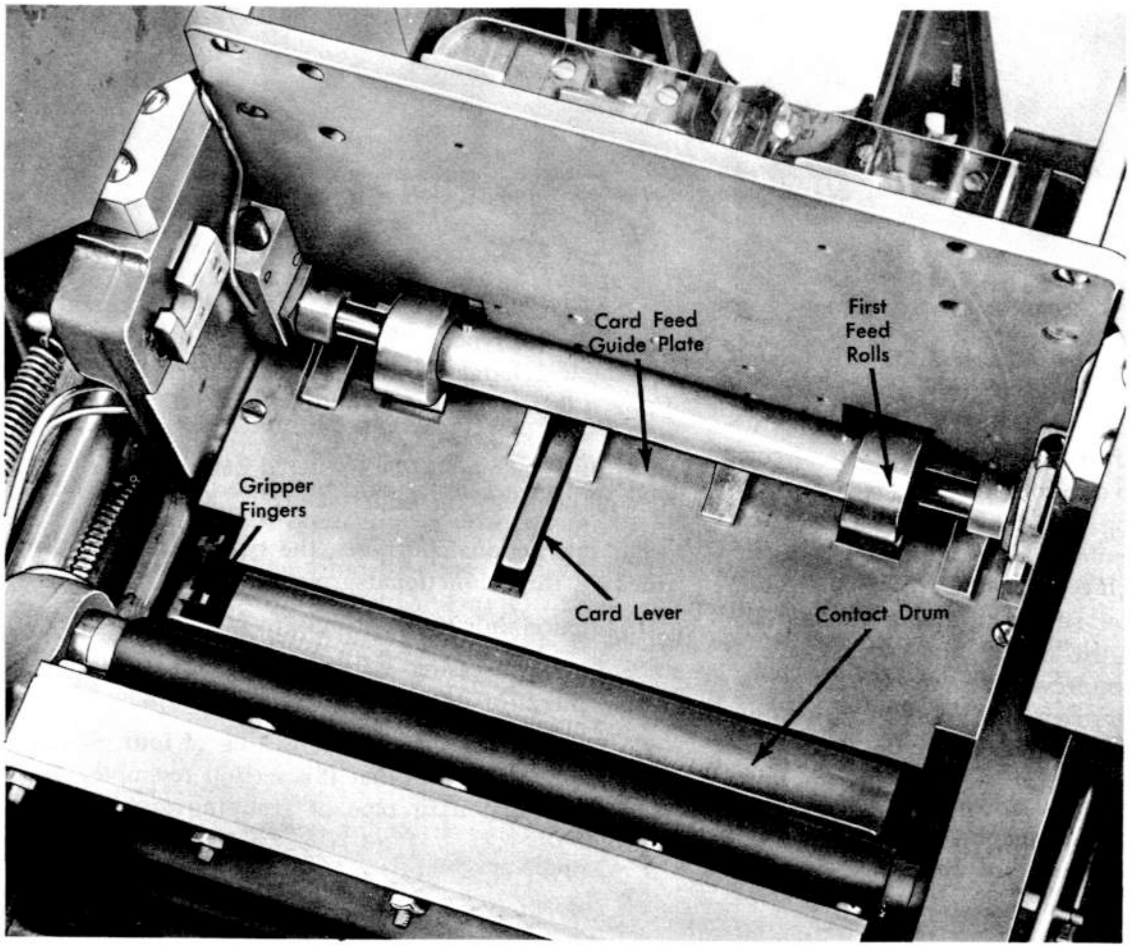


FIGURE 16. IBM 552 BRUSH UNIT RAISED OUT OF OPERATIVE POSITION

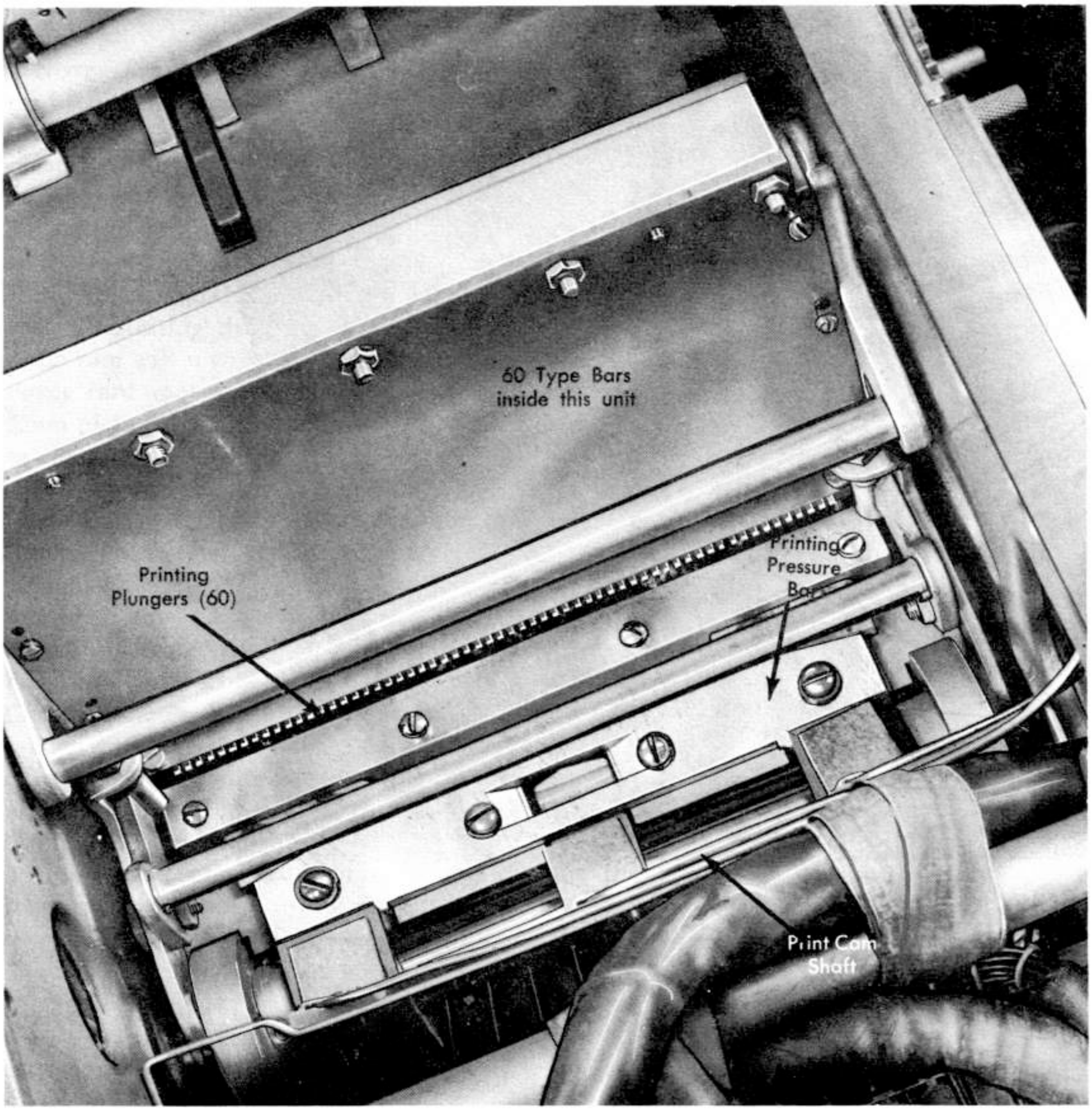


FIGURE 17. PRINT UNIT

Print Unit (Figures 17 and 18)

The print unit consists basically of 60 typebar assemblies, their individual zone and select pawls, and the zone-pawl restoring mechanism. The 60 typebar assemblies are driven up and down by two sets of complementary cams, two cam followers, two restoring bail levers and a restoring bail. Working with the print unit is a printing-pressure bar consisting of 60 printing plungers, one for each typebar. The printing-pressure bar is cam driven toward the print unit so that the 60 printing plungers will depress the selected type to create the printing impression on the card.

When the cam-operated restoring bail is driven upward, all of the typebars are restored to their home position. During the typebar zone and selection setup portion of the machine cycle, the restoring bail is cam driven in a downward direction.

Typebar (Figure 18)

The 548, 552 typebar is capable of printing the 26 alphabetical characters, numerical characters 1 through 9 plus a 0 (zero), and two optional special characters. A thorough knowledge of the typebar, its construction and principles, should be mastered before the principles of printing are undertaken.

For instructional purposes, the typebar may be divided in three functional groups:

1. Friction slide (split springs).

2. The type casing section consisting of 38 individual pieces of type, divided into 4 groups.

3. The tooth-rack section consisting of four groups of typebar teeth. Note that this section resembles the type-casing section in type of grouping and dimensions.

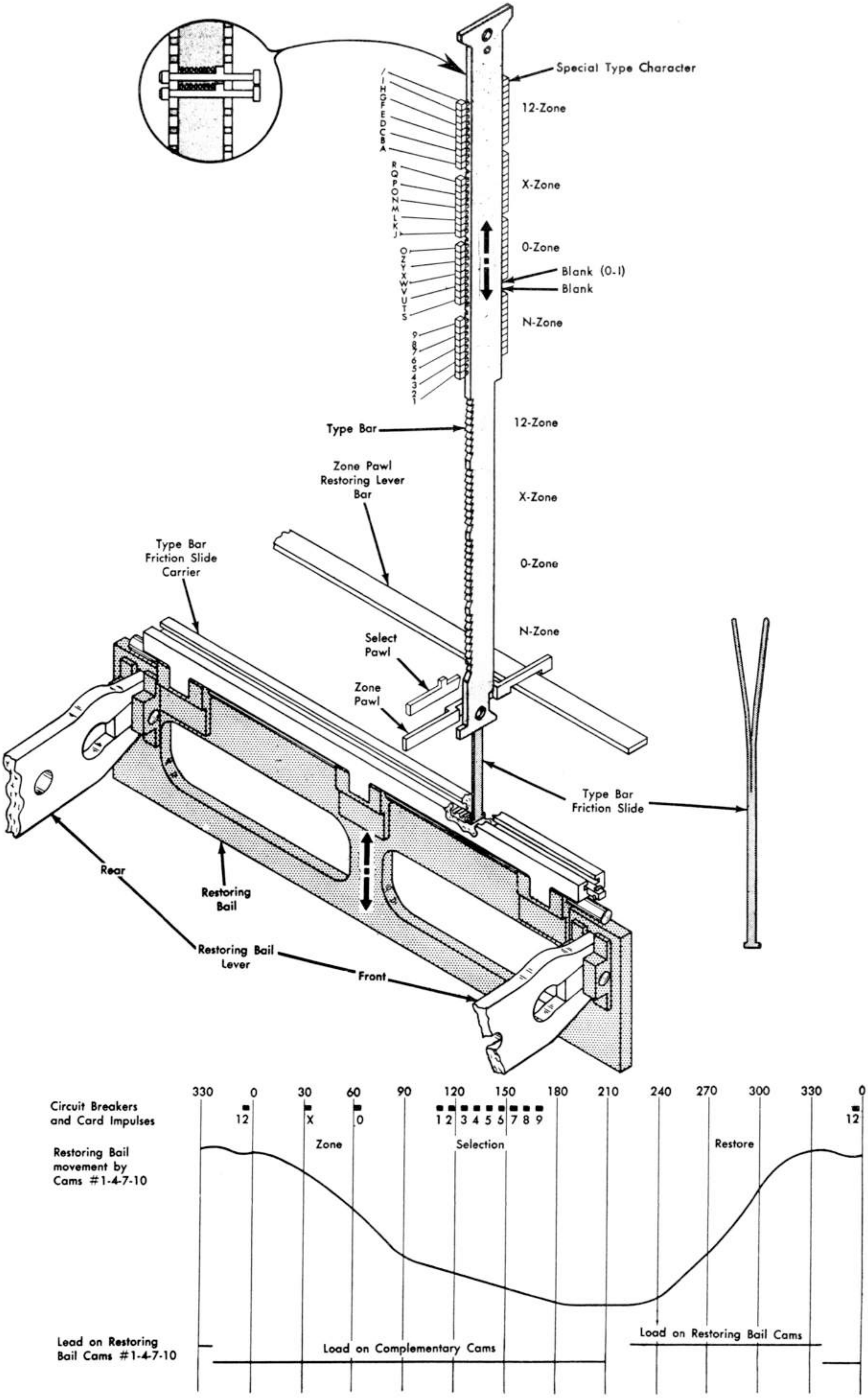


FIGURE 18. TYPEBAR AND RESTORING BAIL

Friction Slide (Figure 18)

The friction slide is a flat piece of spring steel, split about one-half its over-all distance with the two split ends spread outward (see insert, Figure 18). The lower end of the friction slide is attached to the friction-slide carrier, and in turn to the restoring bail. The split ends of the friction slide are pinched together and fit inside a grooved slot in the lower portion of the typebar. The friction slide provides sufficient friction to operate an unobstructed typebar in an upward and downward direction. During a typebar setup operation, the select pawl will stop the moving typebar. When this occurs, the typebar will become stationary, and the friction slide will slip in its typebar groove.

Typebar Type Casing (Figure 18)

The type casing is divided into four zone groupings of type that correspond to the four zone groupings of the punched card: 12- or R-zone, a 11- or X-zone, 0-zone, and the numerical zone. The groupings are:

Zone Groups	Letters
12-zone	letters A through I
X-zone	letters J through R
0-zone	letters S through Z
Numerical zone	figures 1 through 9

Note that the 0 (zero) type is located immediately above the Z in the 0-zone group, and the two special-character pieces of type are located immediately above the I and R type in the 12- and X-zone groups, respectively.

Toothed-Rack Section (Figure 18)

Directly below, and part of the typebar, is the toothed-rack section. The teeth are grouped in the four zone groups, just like the zone groupings of the type just explained. Note that there is a typebar tooth for every piece of type plus a tooth for the blank position just below the *S* type (0-1). This tooth and blank type position will be used with the zero-elimination device, and its use will be described later.

During the typebar setup portion of the cycle, the typebars will be traveling in a downward direction. When a selection punch hole (1-9) is read by the reading brushes, the print magnet will be energized, thus releasing a drive rod that will push the select pawl into the typebar tooth. The typebar will be stopped, and the friction slide will slip downward within the bar. At printing time (approximately 210°) the printing-pressure bar and its printing plungers will be cammed toward the typebar to depress the selected piece of type.

The notch cut in the lower right-hand corner of the typebar operates with the zone pawl. The foot on the typebar, just below the notch, operates with the zone bails. The notch and foot in the typebar will be completely explained under *Zoning.*

Magnet Unit (Figure 19)

The magnet unit is located to the left of the print unit and between the front and rear vertical side castings. The unit is made up of the following parts:

a. 60 pairs of magnet coils, one for each typebar position and grouped in four rows of 15 coils each.

b. 60 magnet-coil armatures, their drive-rod levers and drive rods.

c. A drive-rod lever restoring and an armature knock-off mechanism.

d. A pin bail and pin-bail operating arm.

The individual magnet energizes and attracts its armature when it receives an impulse from the reading brush. When the armature is attracted (Figure 19), the drive-rod lever will be rotated by an individual spring, resulting in the drive rod moving to the right and operating the zone pawl or the selection pawl.

Pin Bail (Figure 19)

The pin bail is the unit that makes it possible to operate the zone pawl and the select pawl from the same magnet. During zoning time (354° to 64°) the pin bail will direct the drive rods toward the zone pawl, and during selection time (106° to 173°) the pin bail will direct the drive rods toward the selection pawls. The pin bail is lifted from the zone-pawl level to the selection-pawl level by cam 6. Spring tension holds the pin-bail cam follower on the surface of the cam. Refer to the sequence chart in Figure 19 and associate the pin-bail action with that of the zone and selection card impulses.

Magnet Unit Relatch Mechanism (Figure 19)

The magnet unit is equipped with a drive-rod lever relatch, and an armature knock-off mechanism. This mechanism operates twice during the cycle; once after zoning (90° to 93°) and a second time after selection (204° to 264°) by cams 3 and 8.

Note: The drive-rod levers are relatched during the time the pin bail is changing the drive rods from the zone pawl to the select pawl. This is accomplished by a linkage and cam 6 on the main cam shaft.

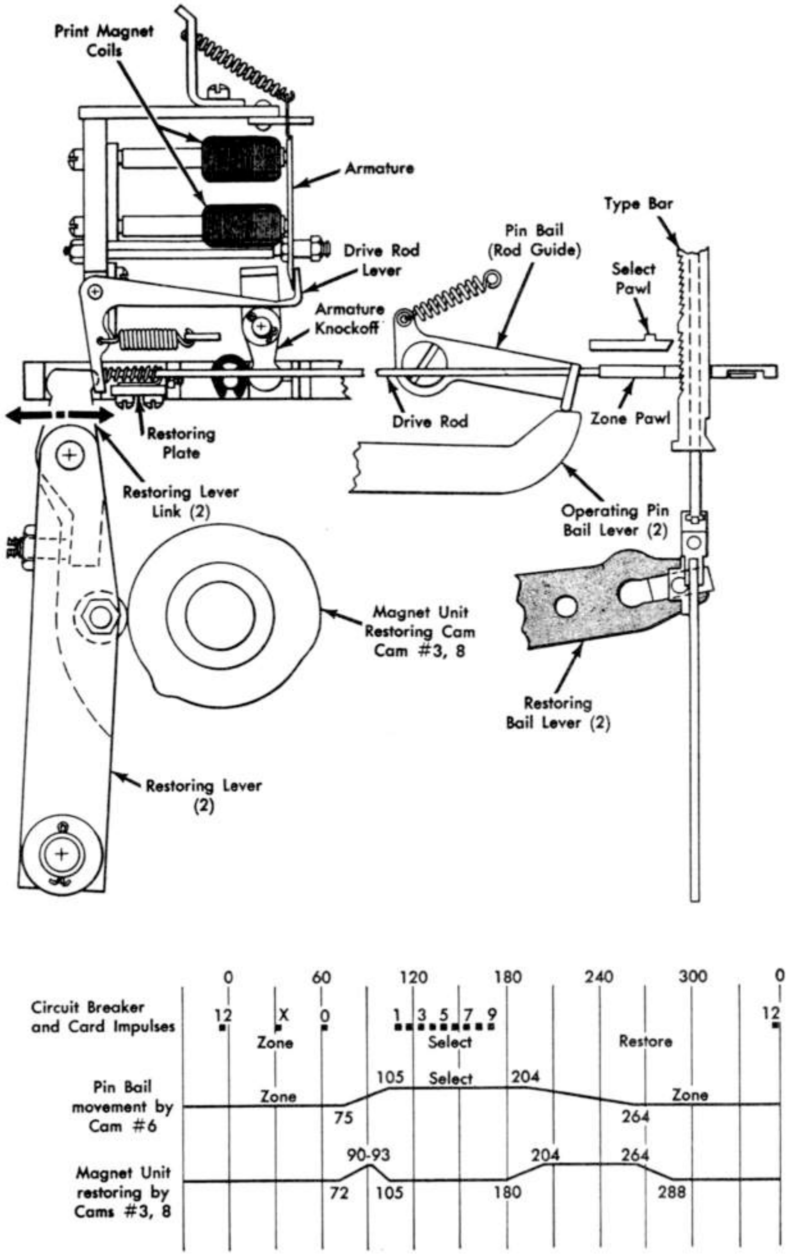


FIGURE 19. MAGNET UNIT AND PIN BAIL

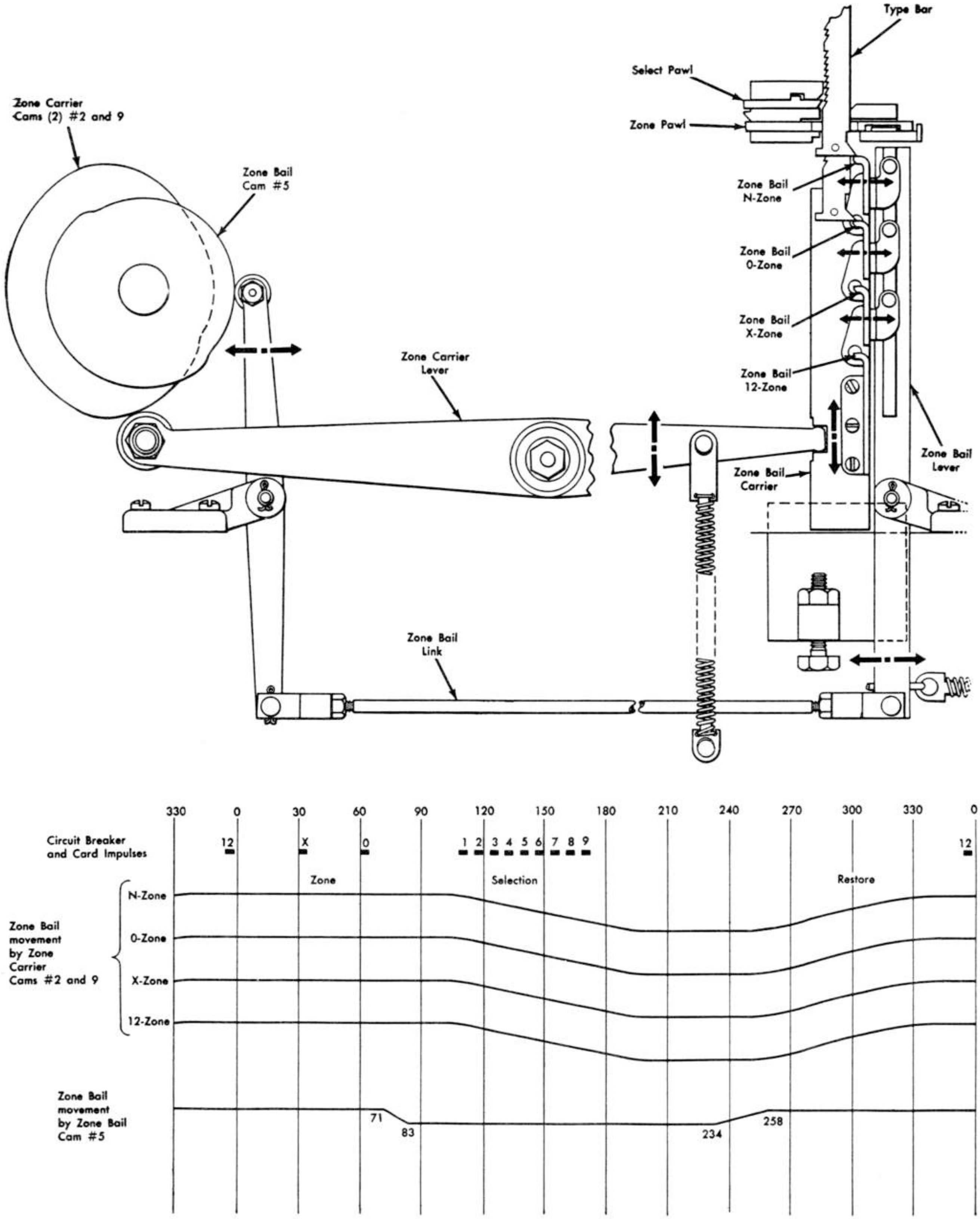


FIGURE 20. ZONE BAILS

Zone Bails (Figure 20)

The zone bails and the zone-bail carrier are located under the contact drum and to the right of the lower end of the typebars. This unit consists of four bails titled 12, X, 0, and numeric zone bail. These individual bails are mounted on the zone-bail carrier which is cam operated in an up-and-down direction.

The numeric, X, and 0 zone bails are movable on the zone carrier, and will pivot in an arc to the left to a position to catch the toe of a numeric, X, or 0-zoned typebar. The 12-zone bail is fastened solidly to the zone carrier in such a position that a 12-zoned typebar will always rest on the bail.

The sequence chart associated with Figure 20 shows that the zone-bail carrier is stationary during zoning time, and the movable zone bails are cammed in at 71° to 83°. The zone-bail carrier will move downward during selection time with the typebars resting on the zone bails. The restoring bail moves faster than the zone-bail carrier.

Printing Operations

Zoning (Figures 21, 22, 23)

To zone the typebar, several units must function in synchronism. To explain this operation, consider the following conditions on the machine:

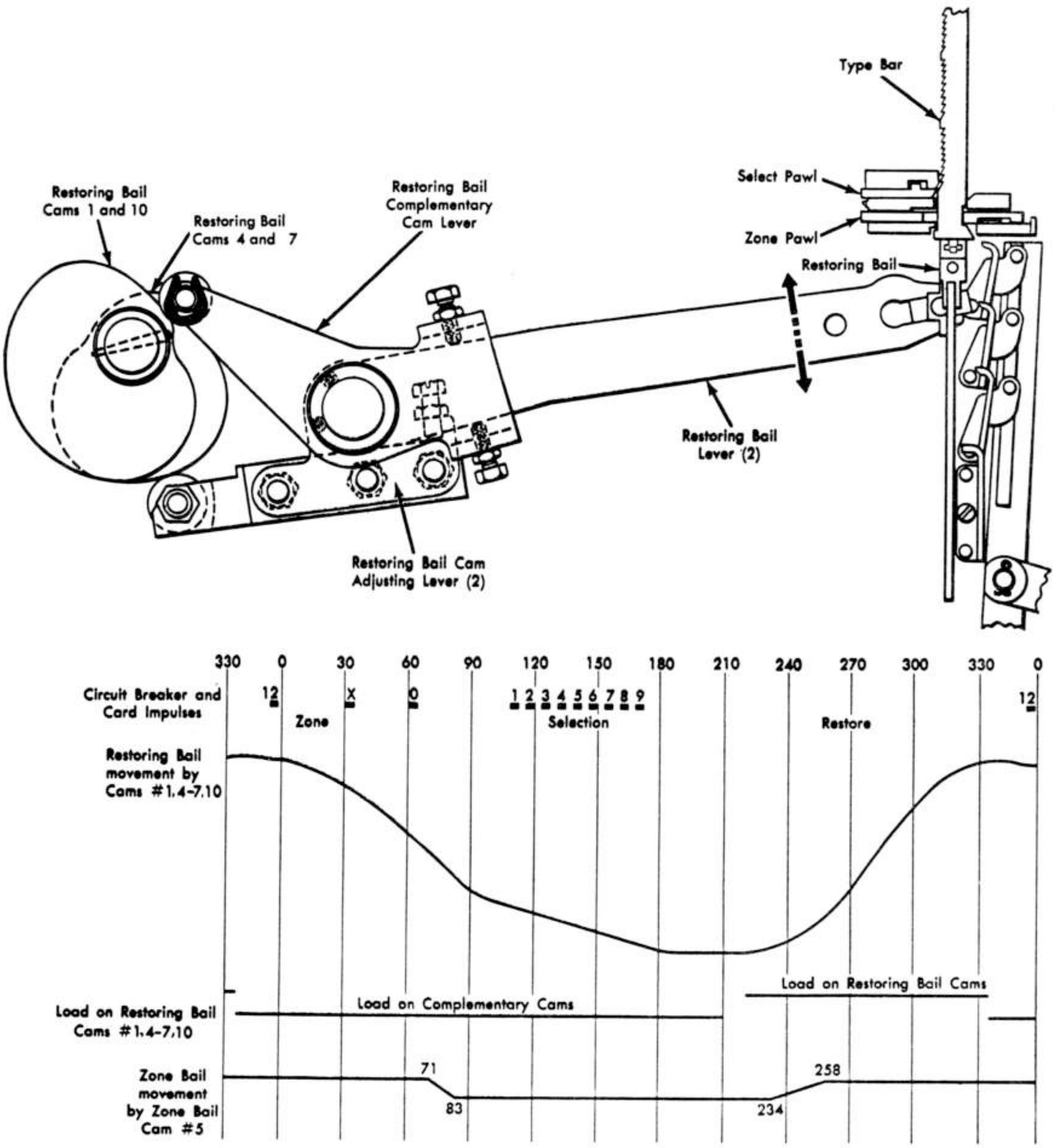


FIGURE 21. RESTORING BAIL AND CAM

1. The machine index starts at approximately 320°.

2. Cards are placed face up, 12-edge first, in the hopper with a card under the control of the contact drum and the brush-guide roll.

When the machine turns to 343°, two conditions exist:

1. The restoring-bail cams 1 and 10 and their restoring-bail levers have raised the restoring bail and typebars to their extreme upward limit (Figure 21).

2. The zoning-pawl restoring-lever cams on the print-cam shaft have driven the restoring-lever bail to the left (Figure 22), resulting in the zone pawls moving to the left and latching the typebars. By 353° the restoring-lever bail will have moved to the right, still leaving the typebars latched on the zone pawls.

At approximately 0°, the restoring bail starts downward, but because the zone pawls have latched the typebars, the typebar friction slides will slide within the bar. Recall that the pin bail has positioned the drive rods in front of the zone pawls during zoning time. When a zone impulse energizes a print magnet, its drive rod strikes the zone pawl, thus releasing the typebar to allow the bar to move downward under the control of the restoring bail.

Consider four typebars operating in a machine, each bar to be positioned in a different zone: 12, X, 9, and numeric (Figure 23). At 354° the 12-zone impulse will energize the print magnet, and its drive rod will release the zone pawl from the typebar. When the restoring bail starts down at 0°, this typebar moves with the bail. The remaining three bars are still latched by their zone pawls and their friction slides will slip.

As the restoring bail continues to move downward, at 30° the X-zone impulse will energize the second print magnet, and its drive rod will release the zone pawl from the second typebar. At this time the second bar will start downward following the restoring bail. At 60° the 0-zone impulse will energize the third print magnet, and its drive rod will cause the zone pawl to release the third typebar. The 12, X, and 0-zoned typebars are now moving downward and are positioned at different levels, and the fourth typebar is held by its zone pawl.

At 77° the movable zone bails will pivot to the left to a position to catch the toe of the X, 0, and numeric-zoned typebars. The 12-zone bail is stationary and will always catch the toe of a 12-zoned typebar. The restoring bail will continue its downward travel and the 12, X, and 0-zoned typebars will rest on their respective zone bails.

Between 84° and 105°, the zone-pawl restoring-lever bail will operate and release all of the zone pawls not previously released by their drive rods. All of the typebars released in this manner must be considered

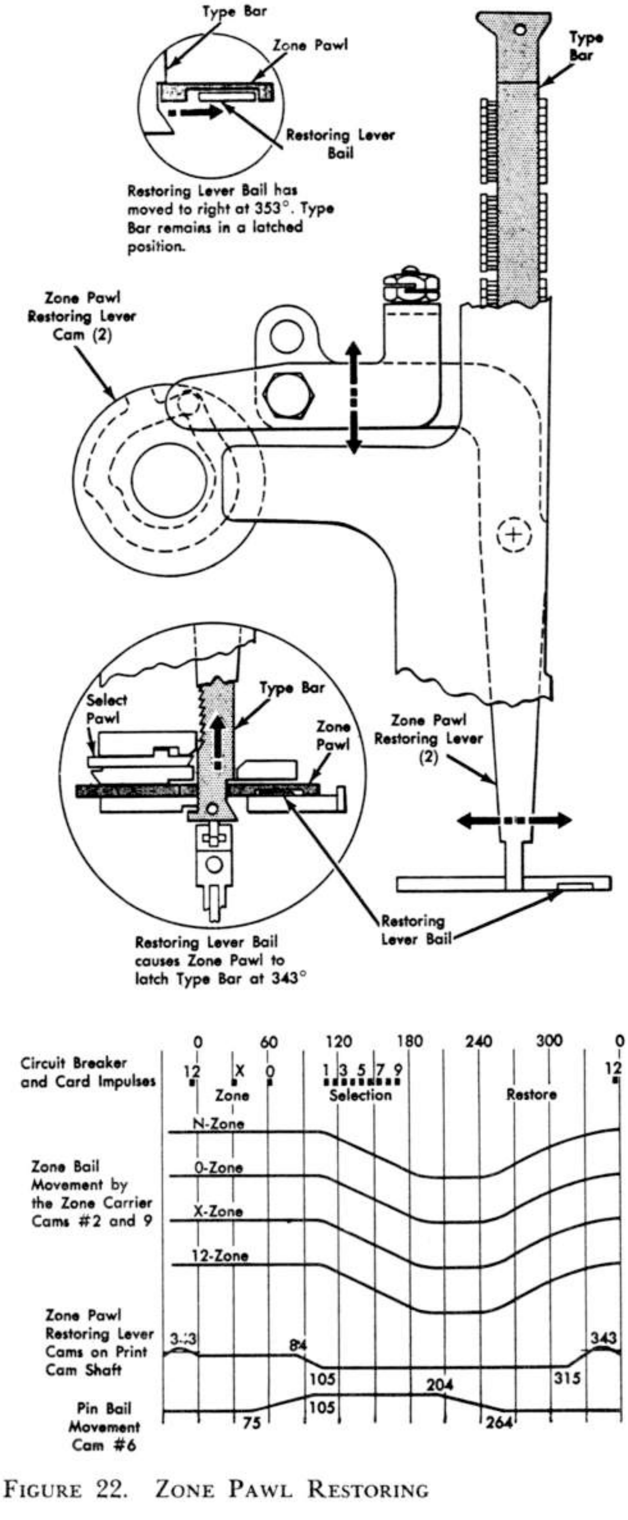


FIGURE 22. ZONE PAWL RESTORING

as being in the numerical group, and the toe of these bars will rest on the numeric zone bail. The fourth bar (Figure 23) can be included in this group.

Note that the zoning operation started at approximately 343° and was completed by 105°. At this point the typebars are zoned and resting on their respective zone bails.

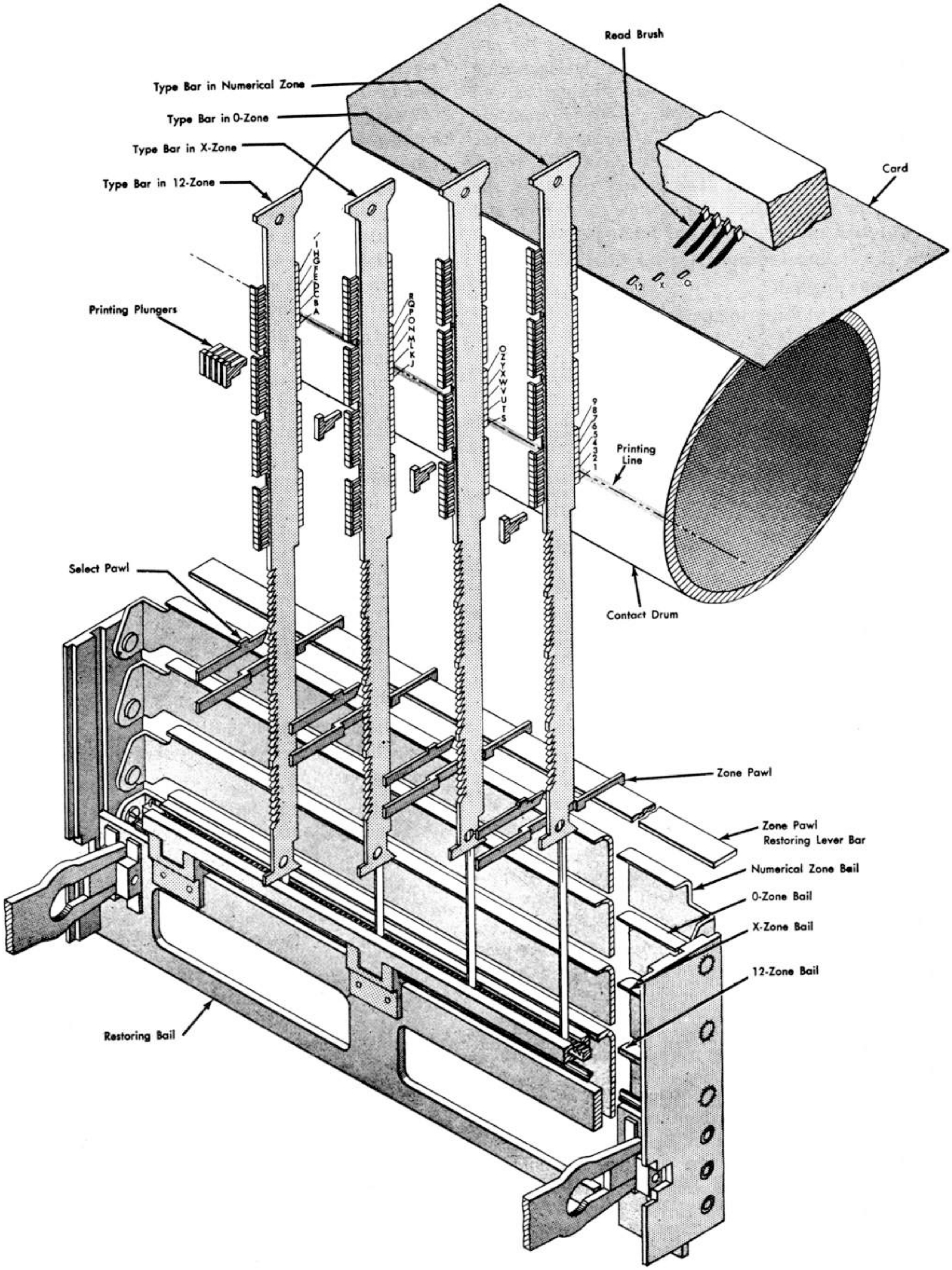


FIGURE 23. SCHEMATIC OF INTERPRETER TYPEBARS

In Figures 19 through 21 the schematic mechanical sequence charts are to be used to tie together the mechanical motions of the various units during zoning time. These charts will indicate basic timings, as well as speed relations. Note that a straight horizontal line represents a stationary object, and the slope of a line represents speed. A change in the slope of a line represents a change in speed. The greater the slope, the greater the speed. These charts show the timing and speed relationships between the following units:

1. Circuit Breaker and Card Impulses
2. Restoring Bail
3. Zone-Pawl Restoring Lever
4. Zone-Bail and Zone-Bail Carrier
5. Pin Bail
6. Print-Magnet Restoring

Selection

Selection is the process whereby the downward movement of a typebar is stopped by the energization of a print magnet with a numerical impulse (1-9). The term *selection time* may be explained as the period of time, in degrees (106° to 173°), when the numeric impulses (1-9) occur. The majority of units and parts that perform the zoning of the typebar will continue to function and perform the selection of the typebar. An individual typebar being zoned and selected will result in the typebar being set up to print an alphabetical character.

Figure 23 illustrates the position of four-zoned typebars at the completion of the zoning operation and can be considered as the position of the bars at the beginning of the selection operation. Figures 19 through 22 contain schematic sequence charts that can be used to tie together the mechanical operation of the various units during *selection time,* as well as *zoning time.*

CB's 1, 2, and 5 (548) or 4, 5 and 6 (552) provide the machine with 9 three-degree impulses that are used to read the 1 through 9 digit holes punched in the card. The *1* impulse will occur between 108° and 112°, and the *9* impulse will occur between 168° and 172°. All 9-digit impulse timings can be determined from the sequence charts.

The restoring bail and the zone-carrier bail (Figures 20 and 21) work with each other to move the typebars in a downward direction. By comparing the slope of the lines representing the restoring bail and the zone-carrier bail, it can be seen that the restoring bail moves faster than the zone-carrier bail. This action keeps the toe of the typebar resting firmly on the zone-carrier bail. Note that the slope of the line representing the downward speed of the restoring bail is less during selection time than it was during zoning time. This signifies that the downward speed of the typebars is less during selection time than during zoning time.

The movable pin bail (Figure 19) makes it possible for one print magnet to receive a zone impulse and a selection impulse, and to operate the zone pawl and the select pawl, respectively. The illustration and sequence chart (Figure 19) shows the position of the pin bail and drive rods during zoning time. Note that the pin-bail cam raises the pin bail and drive rods between 75° and 105°, this time being between the 0-zone impulse and the 1-selection impulse.

Figure 19 also illustrates the print-magnet restoring mechanism which latches the drive-rod lever on its armature. The sequence chart shows that this mechanism operates twice in one cycle: after zoning (90° to 93°) and after selection (204°-294°).

The downward movement of the typebars during selection time is under the control of zone-carrier cams 2 and 9 (Figure 20). The zone-carrier cam followers, on either side of the unit, pivot on adjustable, eccentric bearings. These eccentric bearings provide a means whereby the correct vertical relationship between the tooth of the typebar, and the toe of the select pawl can be established at brush-reading time.

As the typebars start downward at the beginning of selection time, the following machine conditions will exist (Figure 23):

1. Previously zoned typebars will be positioned and firmly held on their respective zone bails by the faster moving restoring bail.

2. The drive-rod levers will be latched on their print-magnet armatures.

3. The pin bail will have the drive rods aimed at the select pawls.

4. The contact drum and the card will move in synchronism with the typebars.

The selection circuit breakers provide a timed impulse for every one of the selection digits (1-9). When the brush reads a selection hole in the card, the print magnet is energized, its armature is attracted, and its drive rod strikes and depresses the select pawl. Note in Figure 23 that the construction of the select pawl is such that, when depressed, it engages the tooth of the typebar and stops its downward movement. When the typebar has been stopped and the restoring bail and zone-carrier bail continues its downward travel, the friction slide will slide within the typebar.

The card movement and typebar movement are synchronized; when a brush reads a 5-hole in the card, the select pawl stops the typebar in the fifth tooth of its respective zone. The combination of a zoned and selected typebar automatically positions the typebar to print the desired character.

The absence of a zone impulse and the presence of a selection impulse positions the typebar in the selected digit position of the numeric zone.

The absence of a zone and selection impulse would signify a blank column of the card, or an unwired typebar position. This condition would position the typebar on the numeric zone bail and in the blank type position above the nine type characters resulting in no printing from this bar.

Zero Printing

The typebar is set up in the zero zone only to print the zero character. Note in Figure 23 that the zero-zone group of type consists of the alphabetical characters S through Z, plus the zero; also, the (0-1) type position is blank.

When a brush reads a zero hole in the card, the typebar will be positioned on the zero-zone bail during the zoning operation. Because of the absence of a selection hole (1-9) punched in the card, the zero-zoned typebar will remain on the zero-zone bail during selection time. This operation positions the zero type in front of the printing plunger.

Special Character Printing

The IBM 548, 552 Alphabetical Interpreters are capable of printing two special characters, such as the $, *, /, #, etc. These individual pieces of type are placed in the blank position above the I, and the blank position, above the R.

When a brush reads an X-hole or a 12-hole in the card, the typebar is zoned and positioned on the X- or 12-zone bail. With the absence of a selection hole (1-9) punched in the card column, the 12- and X-zoned typebars remain on their respective zone bails during selection time. This operation positions the special type characters in front of the printing plunger.

Printing (Figure 24)

Printing is accomplished by the pressure method of printing. At a fixed and definite time in the cycle of operation, two printing cams, mounted on the print-cam shaft, operate against the camming surface of the printing-pressure bar, moving it toward the type. On the bar are 60 individual printing-type plungers, one for each of the 60 typebars. All of these plungers are backed with a thick rubber thrust strip to assure an even pressure of the plungers against the type. Effectively, the type is pressed against the inked ribbon, and the ribbon against the card to produce the printing. The large contact drum serves as a platen, as well as a feed roll.

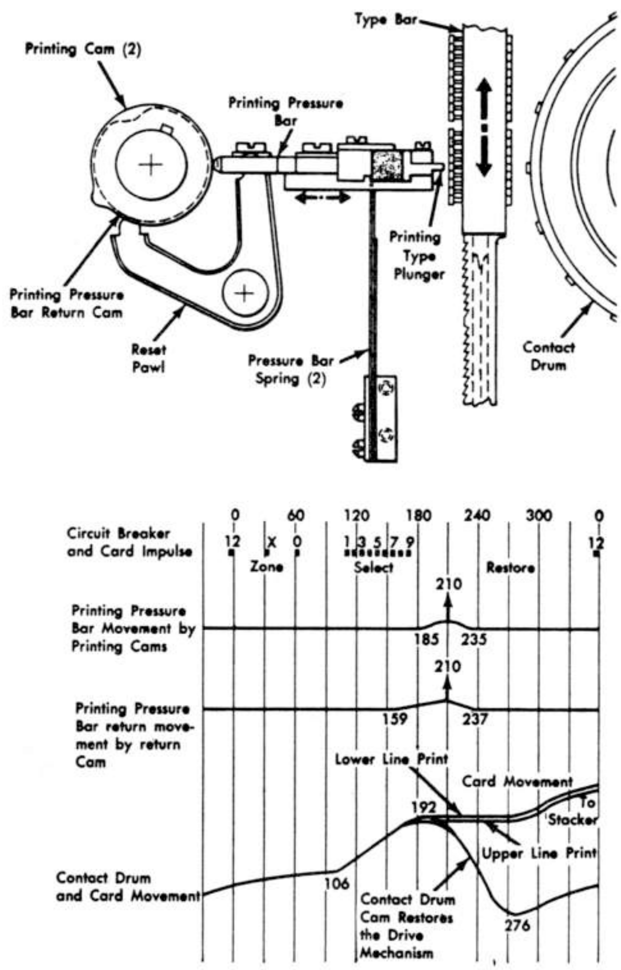


FIGURE 24. PRINTING

The printing-pressure bar is equipped with a cam-operated positive-return mechanism (Figure 24). This mechanism prevents the printing plunger from being in contact with moving typebars. There are two flat springs that assist in moving the pressure bar away from the type after printing. Note the two slots in the printing-pressure bar for the insertion of the return springs.

With the illustration of the printing-pressure bar (Figure 24), mechanical motion sequence charts are provided to show the pressure-bar action in relation with the card movement. Note that printing takes place after zoning and selection and at a time when the contact drum and card are stationary.

Ribbon Units (Figures 25 and 26)

The ribbon feeding and reversing-unit mechanism is located on the front of the vertical machine casting. The two ribbon spools and reversing controls extend horizontally between the front and rear vertical machine castings: one set above and one below the contact drum. The ribbon is as wide as the card and moves vertically between the contact drum, ribbon shields, and the type face. The ribbon rolls from one spool to the other, reverses, and rolls back.

On either end of the 552 ribbon are located two light metal bars: the ribbon-locking bar, and the reverse-trip bar. The ribbon-locking bars anchor the ends of the ribbon in the ribbon spools, and the reverse-trip bars operate the reversing mechanism. The 548 ribbon is fastened to a spool which is installed at the upper end of the ribbon-feed mechanism. The other end of the ribbon is tapered and has a connecting loop which is attached to the ribbon leader on the bottom end of the ribbon-feed mechanism (Figure 26).

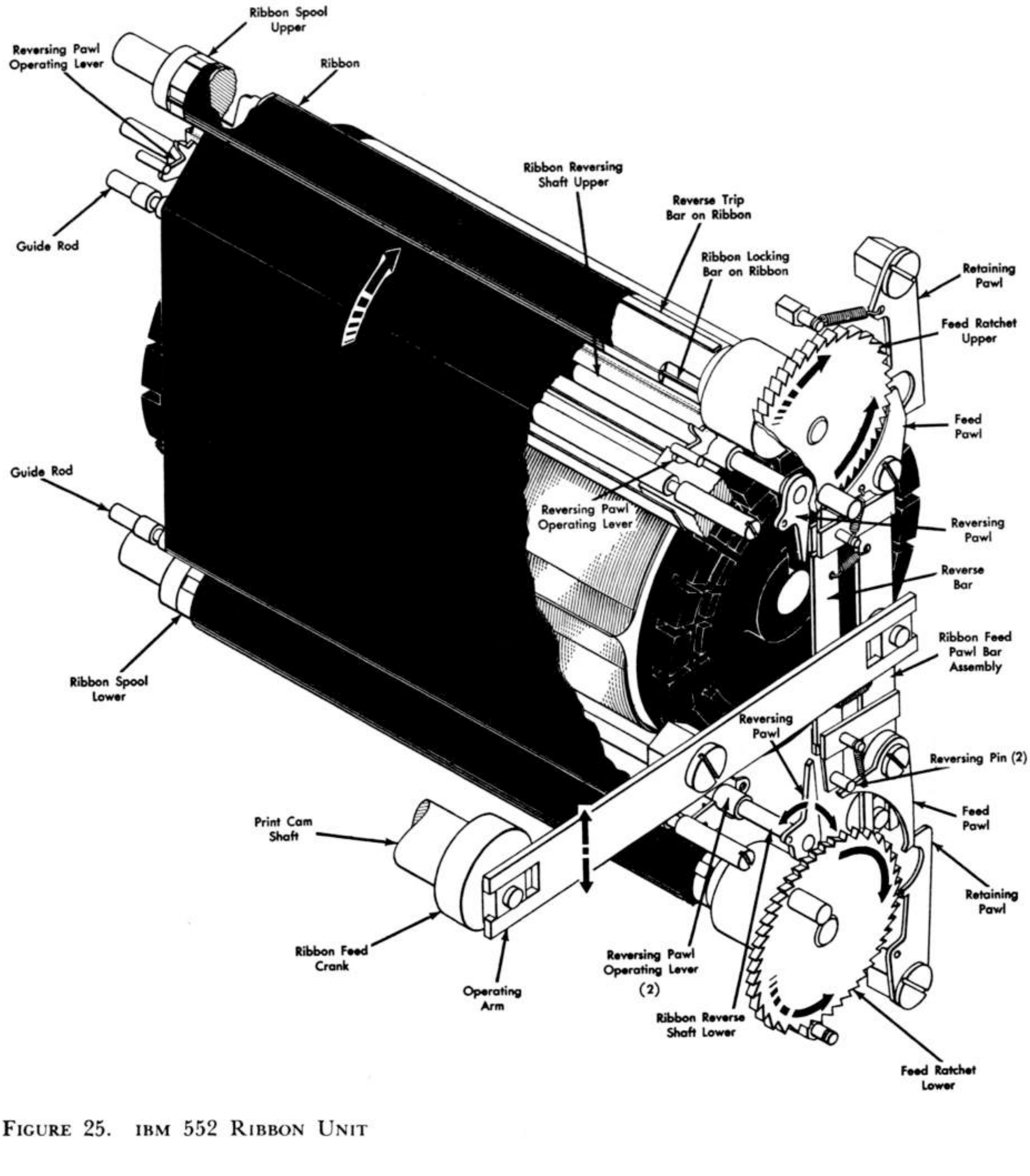


FIGURE 25. IBM 552 RIBBON UNIT

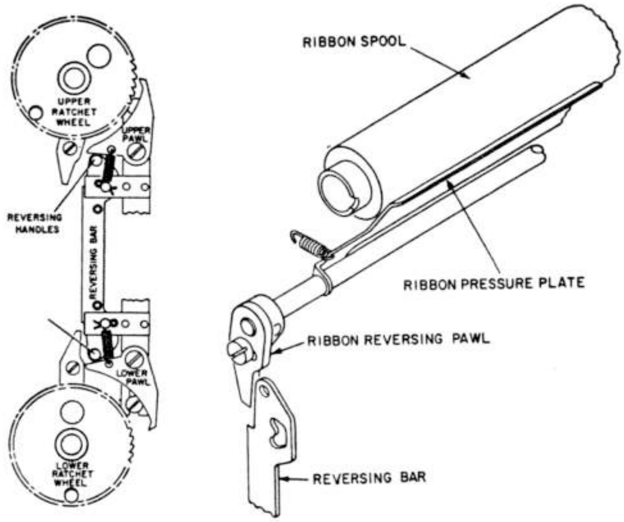


FIGURE 26. IBM 548 RIBBON REVERSE MECHANISM

All of the mechanical motion that operates the ribbon-unit mechanism originates from the ribbon-feed crank on the front end of the print-cam shaft. This cam operates the ribbon-feed operating arm which, in turn, causes a vertical up-and-down motion of the ribbon-feed-pawl bar assembly. Attached at either end of the feed-pawl bar are the two ribbon-feed pawls which operate the upper and lower ribbon-feed ratchets, respectively. These two feed ratchets are located on the front ends of the ribbon spools. One of the two feed pawls will always be engaged to operate its ribbon-feed ratchet.

When the ribbon has reached the end on one spool of the 552, the reversing-trip bar operates against the reversing-pawl operating lever, causing the ribbon-reversing pawl to position itself in line with the reversing mechanism on the ribbon-feed-pawl bar. The next up-or-down movement of the ribbon-feed-pawl bar will trip the reverse bar, which reverses the feed pawls to cause the ribbon to wind on the empty spool.

To trace the operation of the ribbon-feeding mechanism, assume that the upper feed pawl is engaged to drive the feed ratchet and feed the ribbon upward. With this condition on the unit, the reversing bar and the lower reversing pin hold the lower feed pawl and retaining pawl away from the lower feed ratchet.

Each machine cycle the print cam shaft and the ribbon-feed crank will turn one complete revolution. The ribbon-feed operating arm will pivot on its center stud and complete an up-and-down motion of the ribbon-feed-pawl bar. On the down-stroke of the ribbon-feed pawl bar, the lower feed pawl will slide past a tooth on the lower ratchet; on the upstroke, the upper feed pawl will engage in the tooth of the ratchet wheel and move the wheel and ribbon the distance of one tooth. The ribbon-feed retaining pawl holds the ratchet wheel in a fixed position until the next cycle when the operation repeats itself.

The operation of feeding the ribbon downward and winding it on the lower spool is identical except that the lower feed pawl turns the lower feed ratchet, and the ribbon is advanced on the downstroke of the ribbon-feed bar.

The ribbon-reversing mechanism on the 548 consists of a ribbon pressure plate that exerts tension on the ribbon. As the ribbon unwinds from either spool, the corresponding ribbon-reversing plate and its shaft pivot towards the center of the ribbon spool. This will pivot the ribbon-reversing pawl pinned to the shaft towards the step on the reversing bar and will overlap the step when the ribbon is almost completely unwound. The next up-or-down movement of the ribbon-feed-pawl bar will trip the reverse bar, which reverses the feed pawls to cause the ribbon to wind on the empty spool (Figure 27).

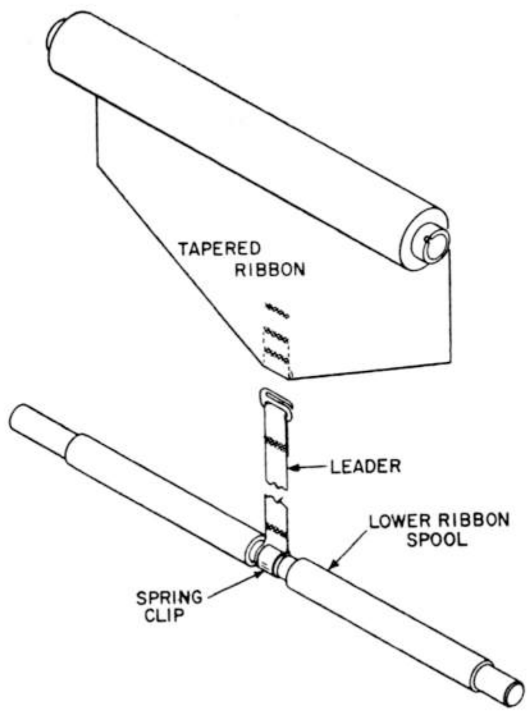
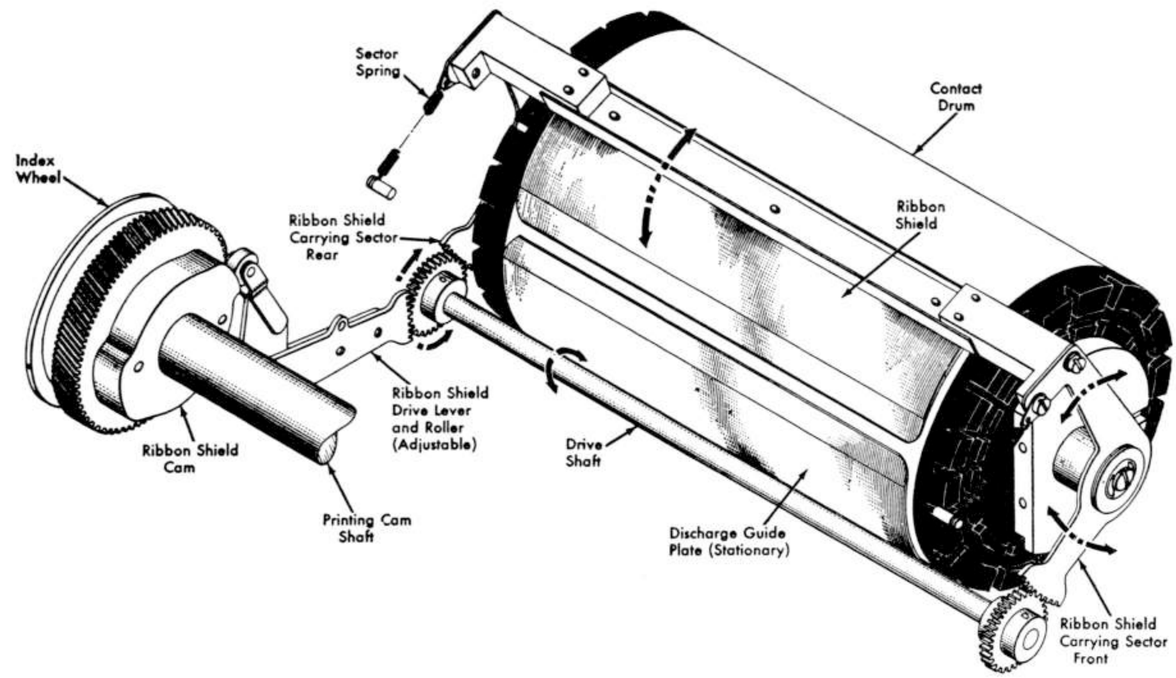


FIGURE 27. IBM 548 RIBBON AND LEADER ASSEMBLIES



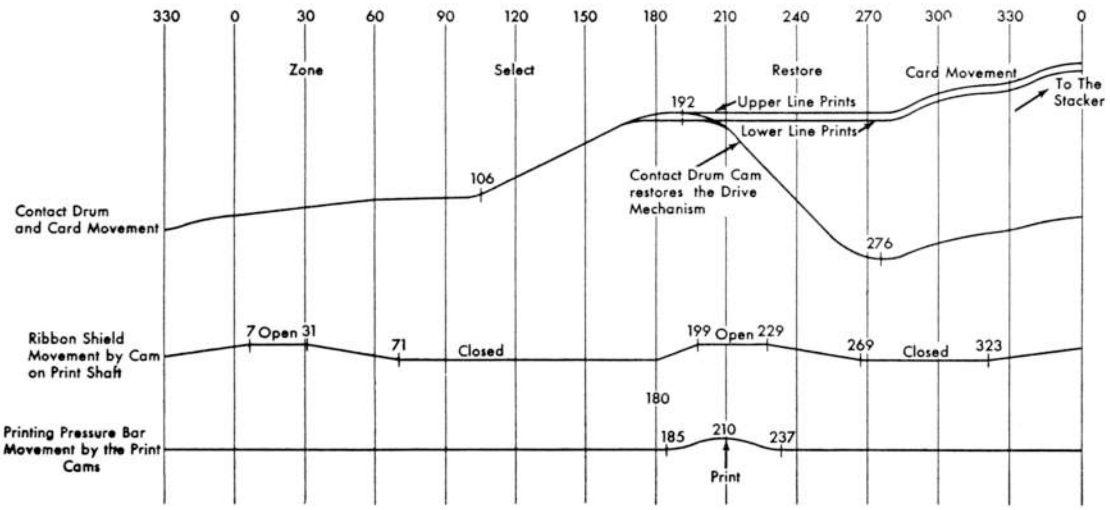


FIGURE 28. RIBBON SHIELDS

Ribbon Shields (Figure 28)

Located between the type unit and contact drum are two curved ribbon shields. These two shields serve as a card guide and also protect the card from actual contact with the inked ribbon. The lower ribbon shield or discharge guide plate is located in a fixed position so that its upper edge is below the printing line. The upper ribbon shield is movable and its action is controlled by springs and the ribbon-shield cam located on the print-cam shaft.

The two sector springs close the ribbon shields and the cam action opens them. This cam action causes the ribbon shield to open twice during each machine cycle: once during printing time (199° to 229°), and the second time when the card moves under the upper edge of the ribbon shield (7° to 31°). The opening of the ribbon shield increased the clearance between the upper edge of the shield and the contact drum at the horizontal card line.

Figure 28 illustrates the ribbon shields, their operating mechanism and a mechanical action sequence chart.

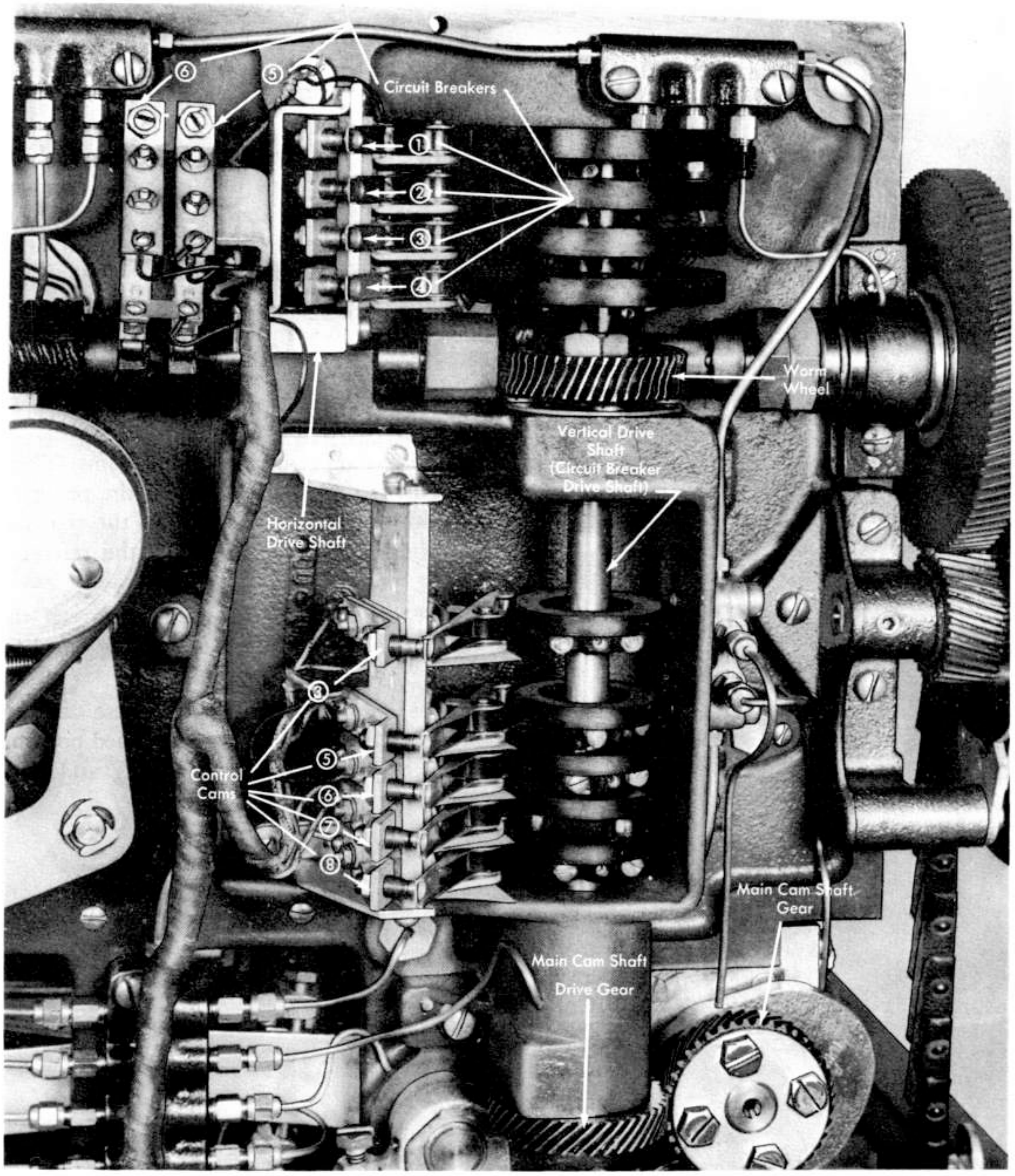


FIGURE 29A. IBM 552 CIRCUIT BREAKER UNIT

Circuit-Breaker Unit (Figure 29)

The circuit-breaker unit, located on the rear vertical machine casting, performs two machine functions:

1. The vertical shaft connects the horizontal drive shaft with the main cam shaft.
2. The vertical shaft and its individual cams and breaker points provide timed electrical impulses for machine operation.

Note that the circuit-breaker unit will run at a constant speed because it is being driven by the constant-speed horizontal drive shaft.

From the rear of the machine (Figure 29A), circuit breakers 1 through 4 of the 552 circuit-breaker unit, are located on the shaft projection above the unit casting. Circuit breakers 5 and 6 are located to the left of circuit breakers 1 through 4, and are operated by the two cams on the horizontal drive shaft. The five circuit breakers, located within the circuit-breaker unit, are called *C* cams (continuous or control). There is space provided for 8 circuit breakers in this unit. The upper two circuit-breaker positions, C1 and C2, are used when the machine is equipped with class selectors. C4 is an unused circuit-breaker position.

The older IBM 552 machines used contact fingers instead of circuit breakers for the continuous or control cams. The 548 uses the unitized circuit breakers shown in Figure 29B. Circuit breaker and C-cam impulse timings can be found in the electrical timing chart associated with the wiring diagram.

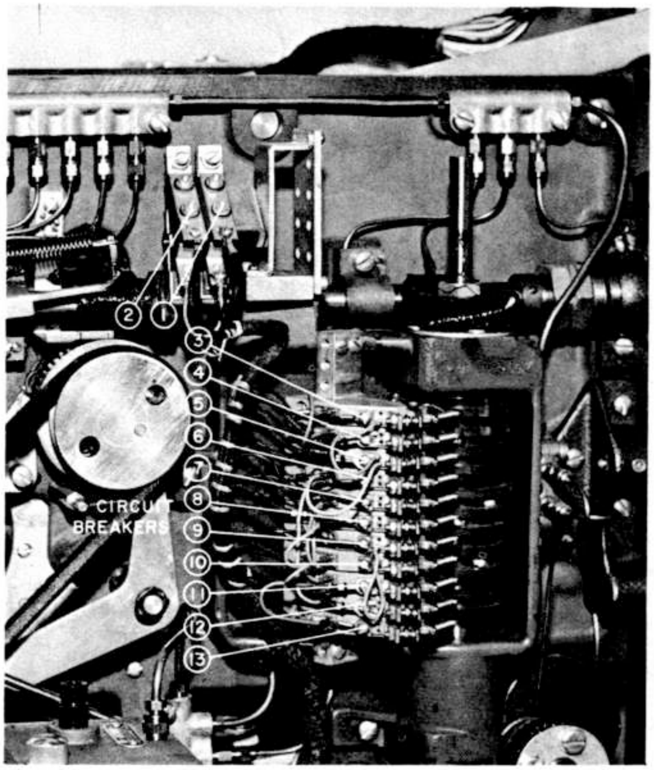


FIGURE 29B. IBM 548 CIRCUIT BREAKER UNIT

Main Cam Shaft (Figure 30)

The main cam shaft is located on the left side of the machine and extends between the front and rear vertical machine castings. This shaft is gear driven from the lower end of the circuit breaker or vertical drive shaft. Located and pinned on the main cam shaft are ten cams. Numbering the cams from the front to the rear of the machine, the ten cams and their purposes are as follows:

1 and 10 Restoring-Bail Cams. These cams restore or raise the typebars to their normal position.

4 and 7 Restoring-Bail Complementary Cams. These cams govern the downward travel of the restoring bail. The downward rate of travel of the typebars during zoning time is controlled by the restoring bail.

2 and 9 Zone-Carrier Cams. These cams govern the downward travel of the zone bails during selection time.

3 and 8 Magnet-Unit Restoring Cams. These cams restore the magnet unit to its normal latched position twice in each cycle: once after zoning and once after selection.

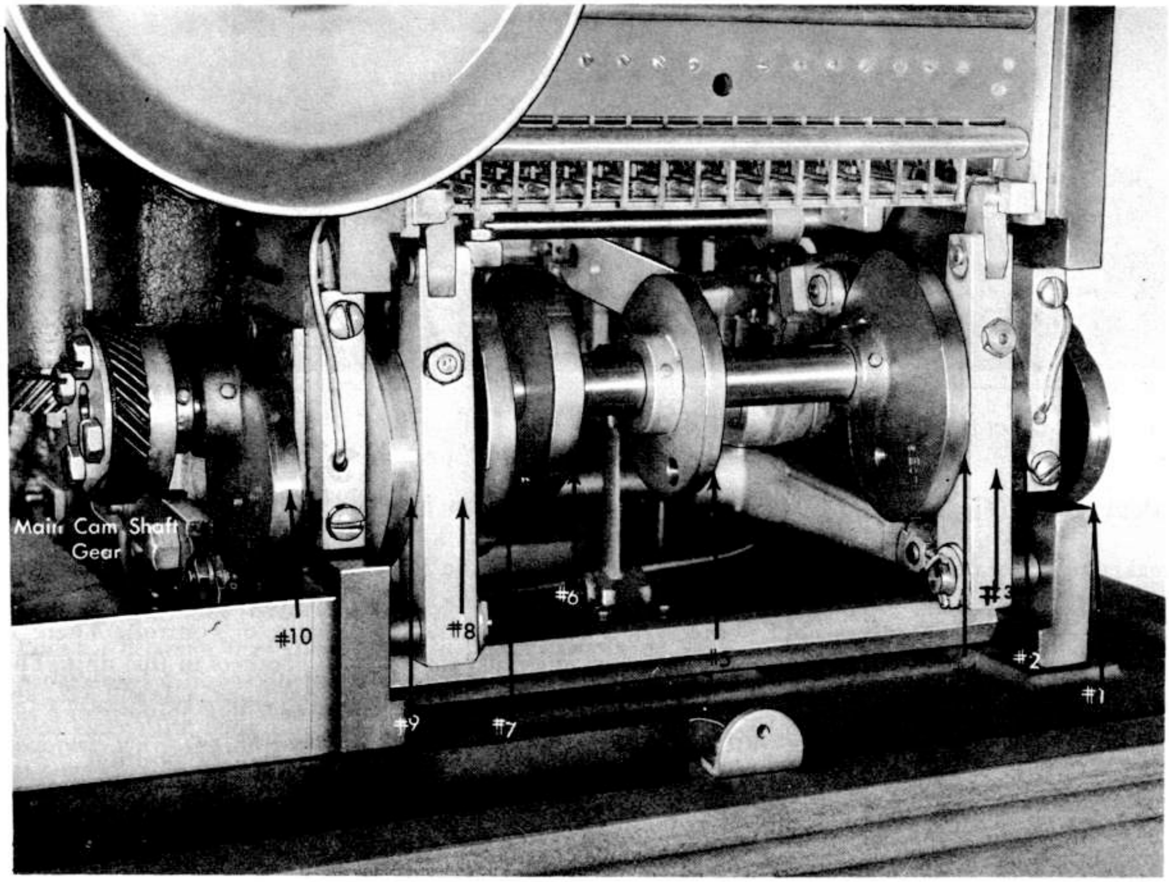


FIGURE 30. MAIN CAM SHAFT

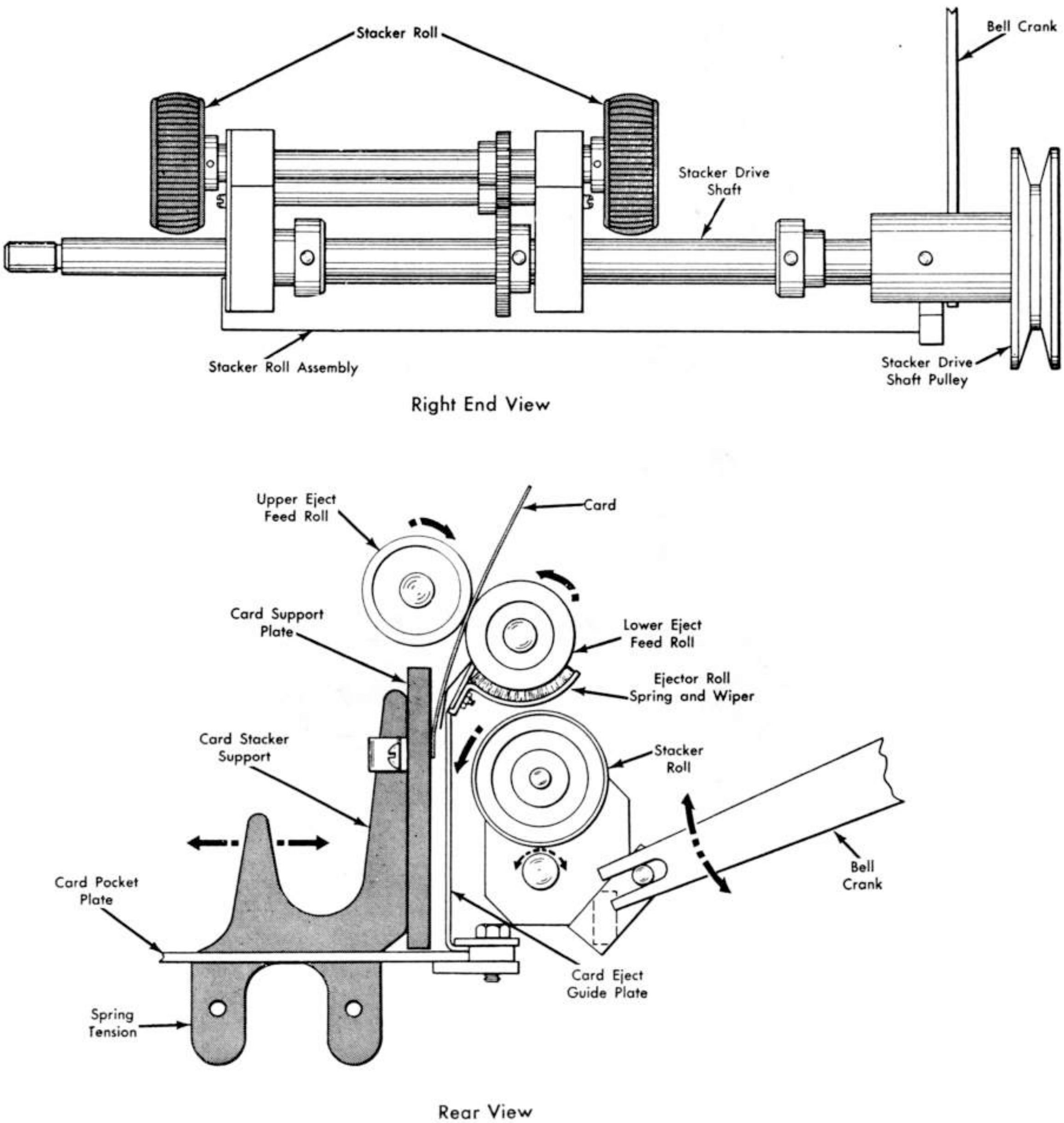


FIGURE 31. STACKER UNIT

5 Zone-Bail Cam. This cam controls the IN and OUT movement of the zone bails; IN – under the toe of the typebars; OUT – clear and free from the typebars.

6 Pin Bail Cam. This cam operates the pin bail, placing the drive rods in their UP (selection) position or DOWN (zone) position.

Note that the main cam shaft is driven from the horizontal drive shaft through the vertical drive shaft. This will result in the main cam shaft rotating at a constant speed for all machine operations.

Stacker Unit (Figures 31 and 32)

Interpreted cards are stacked in the stacker unit which is located under the card-feed hopper. The stacker unit consists of the stacker-roll assembly, card-eject-guide plate, card-pocket plate, and the card-support plate. The stacker-rolls friction feed the printed cards between the eject-guide plate and the card-support plate. As the printed cards increase in number in the stacker, the spring operated support plate moves to the left, but always holds the cards in a neat stack. The machine operation is under the control of a stacker contact that will stop the machine when the stacker is full.

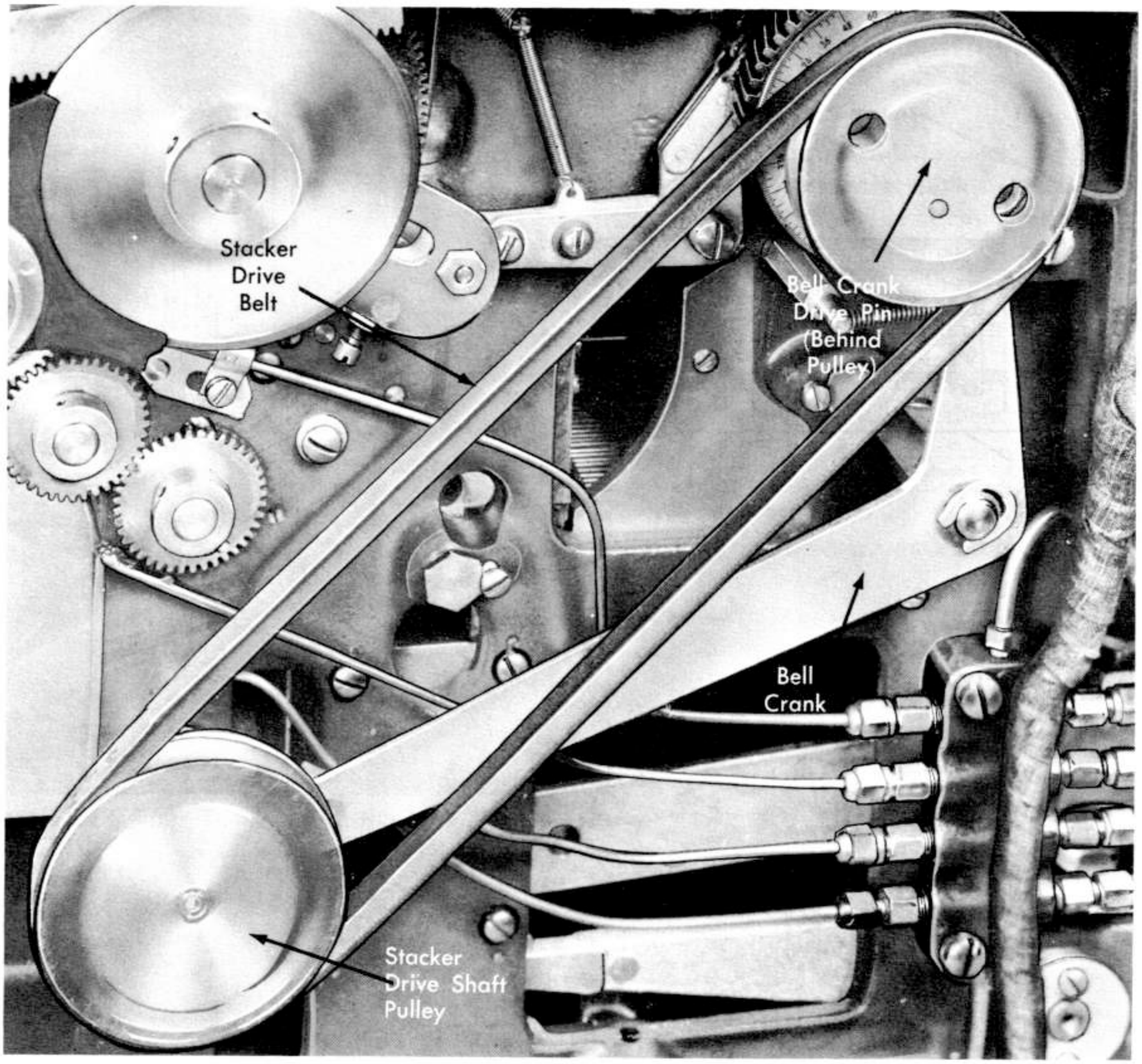


FIGURE 32. STACKER DRIVE MECHANISM

After the card has been printed and the contact drum starts to turn (approximately 282°), the gripper fingers on the contact drum release the card as it is fed into the eject feed rolls. These rolls turn with the contact drum and will continue the card movement into the stacker. The eject feed rolls do not feed the card to its final stacked position.

When the card is fed into the stacker, the stacker-feed roll assembly has been positioned to the left and away from the card (front view). The stacker rolls turn continuously because they are driven by a V-belt from the print cam shaft (Figure 32). Once each cycle, the bell-crank drive pin on the print cam shaft strikes against the bell crank, which in turn causes the stacker assembly and stacker feed rolls to pivot to the left (rear view). The revolving stacker feed rolls now strike the card, and with friction, drive the card into the stacker. The bell crank then pivots back to its normal position allowing the stacker feed rolls to pivot to the right and away from the card.

Card Jam Contact (Figure 33)

The card jam contact can be located in one of two places: under the card-feed hopper on older machines and on the front side frame to the immediate right of the ribbon-feed mechanism on later machines. This contact – a transfer contact – is mechanically operated by cards moving through the eject-roll station, i. e., the upper contact points will be closed by the presence of a card, and the lower contact points will be closed by the absence of a card. An interlock circuit functions with the jam contact to keep the machine in continuous operation as long as cards move correctly through the eject-roll station and into the stacker.

Figure 35, a combination mechanical-electrical sequence chart, illustrates the electrical function of the jam contact.

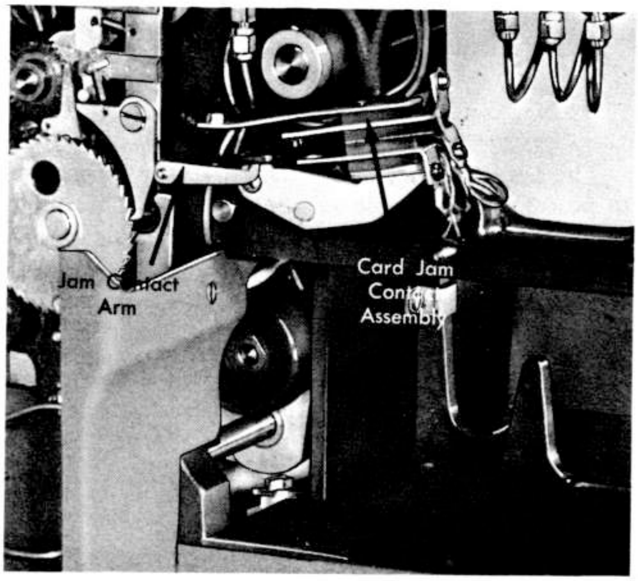


FIGURE 33. CARD JAM CONTACT

Bijur Lubrication System (Figure 34)

The IBM 552 Alphabetical Interpreter is equipped with one of two types of Bijur lubrication systems, automatic or manual. Earlier machines are equipped with a manually operated Bijur pump, while later machines and the 548 are equipped with an automatic Bijur pump. Both systems supply lubricating oil through a network of copper tubing to the majority of lubrication points on the machine. Each branch oil line in the tubing network contains a metered plug – metered to the extent that only a given quantity of oil will pass for each pump operation. Large, heavy bearings should receive more lubrication than a small, light-duty bearing; therefore the metered plug should be selected to suit the job.

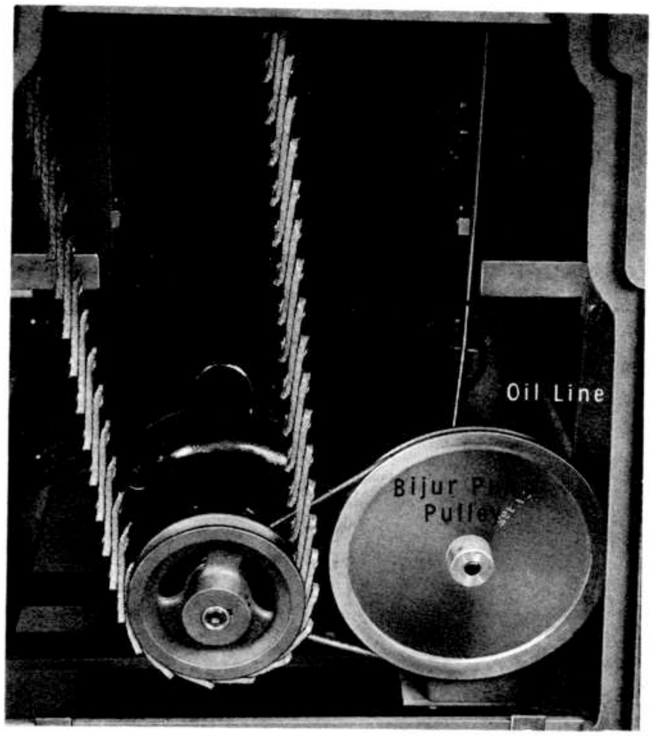


FIGURE 34. BIJUR LUBRICATION SYSTEM

The automatic Bijur pump supplies lubrication in a direct ratio to machine operation. The manual Bijur pump requires a periodic manual operation of the pump handle. The question is always asked, How often should I pull the Bijur pump plunger? Suggestion: Try pulling the plunger every time the machine ribbon is changed. Watch for over- or under-lubrication and govern accordingly. The ribbon-changing operation should be close to a direct ratio to machine operation.

Circuit Description

IBM 552 Wiring Diagram 161561T

The circuits for the IBM 552 Alphabetical Interpreter can be classified as follows:

1. Power circuits
2. Start and running circuits
3. Read and print circuits
4. X-Elimination circuits
5. Dynamic braking circuit

The wiring diagrams for these circuits are located on the last pages of this manual.

Power Circuits (Assume a 115 volt ac 60-cycle machine)

Ground (1A). The power cable contains three wires: two for power and one to ground the machine frame to the electrical system of the building. The ground wire (green) is connected to the machine frame. It is possible to remove the grounding feature for testing and service work by removing the thumb screw in the power cable. Never leave a supposedly grounded machine ungrounded as a very serious accident might result.

Transformer (2A). When the main-line switch is turned ON, a circuit is completed from power binding post 5 through the main-line switch, thermal element, power post 8, extractable rectifier fuse, power post 6, transformer primary winding, power post 7, main-line switch, power post 4, to the other side of the line.

The step-down transformer produces approximately 33 to 35 volts ac at the secondary winding, which will be changed to 46 $\pm$ 2 volts dc by a selenium rectifier and filter. The primary winding is tapped to provide the customer engineer with a means of regulating the dc output voltage of the rectifier when a small ac line voltage variation is discovered. Some transformers provide a tapped secondary instead of a tapped primary winding.

Rectifier and Filter (2A). The 552 is equipped with a full-wave selenium rectifier to convert the ac voltage supplied by the transformer to 46 $\pm$ 2 volts dc with no load on the machine. Connected across the dc output leads of the rectifier are two 8,000 mfd capacitors to provide filter action. Also connected across the dc output of the rectifier is a 100-ohm, 25-watt resistor which discharges the capacitors when the machine is turned OFF and provides a constant electrical load to improve the regulation.

The negative terminal of the dc supply is connected to post 3 of the 40-volt terminal block and through a 6-amp fuse to machine binder post 1. The positive terminal of the dc supply is connected to post 1 of the 40-volt terminal block and through a 6-amp fuse to post 6 of the machine terminal block.

A machine signal light is connected across posts 1 and 6, and when the main-line switch is on, the signal light glows. HD2 relay will also be energized – post 6, 7 to 1B as a terminal, through 3B N/C, HD2 relay coil and post 1.

Start and Running Circuits (without cards)

The completion of the drive motor circuits is dependent upon the energization of HD1 relay. When this relay is energized, the following circuit supplies line power to the drive motor: main-line switch, post 7, HD1 N/O, post 1, drive motor, post 8 and main-line switch.

When the start key is depressed, the following circuits are completed to start the machine:

1. (3A, B) Posts 6, 7, start key, R1 coil, stop key, stacker stop switch, and posts 2 and 1. No hold circuit available at this time.

2. (3A) Post 7, 1B N/O, HD1 and R3 coils, and post 1. HD1 and R3 are held through C8. NOTE: When R3 is energized, the 3B N/C points will open and HD2 will be de-energized.

Without cards in the machine, the start key must be held closed to keep the machine in operation.

Start and Running Circuits (with cards)

When R1 is energized and the R1B points have transferred, the motor relay will be energized and the drive motor will operate the machine. When the R1A points close, a second circuit is completed under certain specific conditions. This circuit is from post 1 to post 2, stacker stop contact, stop key, R1 coil, R1A N/O, C5 (M284°-B254°), C7 (M87°-B57°), post 8, post 6. The lower contact points of the card-jam contact are in parallel with C5, and the upper points are in parallel with C7. Now, if the lower contact points are closed when C5 opens and the upper points are closed when C7 opens, the hold circuit for R1 will not be interrupted.

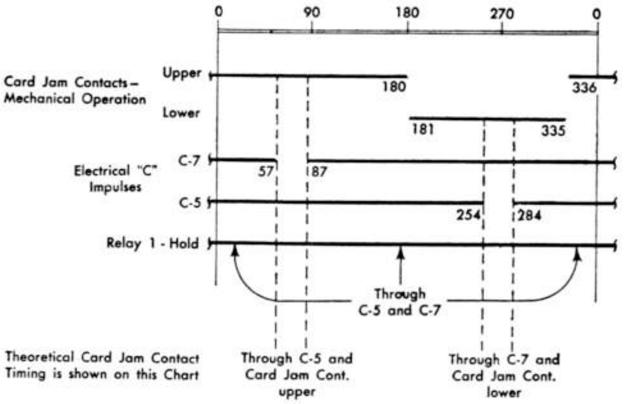


FIGURE 35. IBM 552 CONTINUOUS RUNNING OPERATION

The card-jam contact and its operating mechanism have been designed so that for a fixed period of time the lower contacts are closed and for a fixed period of time the upper contacts are closed. The sequence chart (Figure 35) shows that mechanically the upper card-jam contacts are closed between 336° and 180° of a machine cycle. The lower card-jam contacts are closed from 181° to 335°. The break in contact duration of C7 is overlapped by the upper card-jam contact and the break-in contact duration of C5 is overlapped by the lower card-jam contact. When cards are feeding correctly, R1 will be held energized and a pick circuit is provided through the R1B N/O points to pick the HD1 relay and R3.

The hold circuit for R3 and the HD1 relay comes into effective operation at this time. The circuit is as follows: post 1, HD1 relay and R3 in parallel, R3A N/O, C8 to C7, C6, post 8, post 7, and post 6. C8 with R3A points will keep R3 and the HD1 relay energized until it breaks at 140°. This circuit assures the machine will complete the reading and printing of a card, once it has been started.

The mechanical timing given in Figure 35 for the card-jam contact occurs when the machine is set to print on the upper line. When the machine is set to print on the lower line, the card will be advanced and cause the upper card-jam contact to be closed between 306° and 168°. This timing will overlap the break in C7 (57° to 87°).

Read and Print Circuits

The read circuit in the IBM 552 is made active by closing the card-lever contact. The operating lever of the card-lever contact is ahead of the contact drum and, when the cards are feeding, the points of the card-lever contact are closed. This action will close the following circuit to energize R2 (card-lever relay): post 6, post 7, post 8, C-6 (M186°-B26°), card-lever contact, R2 coil, X-eliminator relay as a terminal, posts 3, 2, and 1.

The sequence chart (Figure 36) illustrates the timing relationship between the card-lever contact, C6, (card-lever relay pick) and CB1 (card-lever relay hold). It should be noted that one card, running through the machine, will cause the card-lever contacts to close at 108° on one cycle and break at 129° of the next cycle. When cards are fed continuously, the card-lever contact break time (129°) for the first card has been overlapped by the make time (108°) of the second card. As long as cards are feeding continuously, the card-lever contact will remain closed.

R2 provides a circuit to the contact drum; this results in the contact drum being *hot* when cards are feeding. The machine being capable of reading alphabetical information must have circuits that will read the zone impulses (12-X-0), and the selection impulses (1 through 9). The circuit to read the zone impulses: posts 6, 7, 8, 9, CB1, R2A N/O, to CB4 as a terminal, through CB3 (break contact), CB2 (make contact), common brush, contact drum, through the zone hole in the card, reading brush, control-panel hub, by wire to the typebar hub, print magnet, posts 4, 3, 2, and 1. The circuit to read the selection impulses: posts 6, 7, 8, 9, CB1, R2A N/O, CB4, CB5 (make contact), CB6 (break contact), to CB2 as a terminal, common brush, contact drum, through a selection hole in the card, reading brush, control-panel hub, by wire to the typebar hub, print magnet, posts 4, 3, 2, and 1. A parallel circuit to feed the zone selection circuit breakers is available: post 8, CB6, card-lever contact, to R2 coil as a terminal, to R2A N/O as a terminal, to CB4 and CB3, etc. This circuit will be interrupted by the card-lever contact, and C6 and will not overlap the complete reading time of the card.

X-Elimination Circuit

Each IBM 552 machine is equipped with one 10-position X-eliminator. This device could be termed a 10-position, switch-controlled class selector. It eliminates the X- and 12-punch readings that are sometimes placed over a numeric information field. When the X-elimination jackplug switch is ON, the following circuit becomes effective: posts 6, 7, 8, 9, CB1, R2A N/O, C3 (M45°-B247°), X-elimination jackplug switch, X-elimination relay, posts 3, 2, and 1. To eliminate a 12- or an X-punch reading and allow only numerical information to print, wire the reading brush to a common hub of the X-eliminator and out the corresponding 0-9 hub to the typebar. C3 is the controlling factor in this circuit; it is made between 45° and 247° which overlaps the impulses 0 through 9.

Dynamic Braking Circuit

Dynamic braking is a principle built around the fact that an electric motor and an electric generator are basically the same. An electric motor receives electrical energy and transforms it into mechanical energy; and an electric generator receives mechanical energy and transforms it into electrical energy.

When a motor has been driving a machine and the electrical energy to the motor is cut off, the mechanical energy stored in the moving machine drives the motor for a period of time. How long the machine drives the motor will depend on several factors. One factor to consider in the IBM 552 Interpreter is the machine temperature. When the machine is hot and the lubrication is light, the machine will coast for a longer period of time than when the machine is cold; therefore, the machine has no definite stopping point. This is undesirable because the machine may stop at one of a number of index positions; and if left for a period of time, damage to the machine may result.

Dynamic braking is basically applying an electrical load to a coasting motor. The coasting motor acts as a generator and produces electrical energy for the load resistor. The mechanical energy stored in the coasting machine is therefore converted into electrical energy by the motor and applied to a load resistor. The size of the load resistor will determine how fast the generated electricity will be consumed.

Using this principle, it is possible to apply a sharp load to the motor and machine the instant the electrical force to the motor has been cut off. This load would exceed the friction load of the machine thus causing the machine to stop.

This principle, called dynamic braking, has been applied to the IBM 552 Interpreter. HD2 relay and a 25-ohm variable resistor is used to stop the machine between 260° and 285°. When a machine stop occurs, C8 will de-energize HD1, R3, and the R3B N/C points will energize HD2. Note when the HD2 points close, the 25-ohm variable resistor will be connected across the drive motor causing a very smooth stopping action of the machine and a fairly constant stopping point on the index. The customer engineer should adjust variable resistance to cause the machine to stop between 260° and 285°.

IBM 548 Wiring Diagram 600601

The circuits for the IBM 548 Alphabetical Interpreter can be classified as follows:

1. Power circuits
2. Start and running circuits
3. Read and print circuits
4. X-elimination circuits
5. Dynamic braking circuit

Power Circuits (Assume a 115 volt ac 60-cycle machine)

Ground (1A). The power cable contains three wires: two for power and one to ground the machine frame.

Transformer (2A). When the main-line switch is turned ON, a circuit is completed from post L-2 through fuse 3, main-line switch, post L-5, post L-4, transformer primary winding, fuse 1, post L-6, main-line switch, post L-1, to the other side of the line.

The step-down transformer produces approximately 33 to 35 volts ac at the secondary winding, which will be changed to 46 ± 2 volts dc by a selenium rectifier and filter. The primary winding is tapped to provide the customer engineer with a means of regulating the dc output voltage of the rectifier when a small ac line voltage variation is discovered. Some transformers provide a tapped secondary instead of a tapped primary winding.

Rectifier and Filter (2A). The 548 is equipped with a full-wave selenium rectifier to convert the ac voltage supplied by the transformer to 46 ± 2 volts dc with no load on the machine. Connected across the dc output leads of the rectifier are two 8,000 mfd capacitors to provide filter action. Also connected across the dc output of the rectifier is a 100-ohm, 25-watt resistor which discharges the capacitors when the machine is turned OFF and provides a constant electrical load to improve the regulation.

The negative terminal of the dc supply is connected to binder post 46v-5 and through a 6-amp fuse to binder post 46v-6. The positive terminal of the dc supply is connected to binder post 46v-4 and through a 6-amp fuse to binder post 46v-1.

A ready light is connected across binder post 46v-1 and 46v-8 through R1-2 N/C point, and when the main-line switch is ON, the ready light will glow until R1 is energized to operate the machine. A HD2 relay will also be energized: binder post 46v-1, to R2-2 as a terminal, through R1-2 N/C, HD2 relay coil, to HD1 relay coil as a terminal, to binder post 46v-6.

Start and Running Circuits (without cards)

The completion of the drive-motor circuits is dependent upon the energization of HD1 relay. When this relay is energized, the following circuit supplies line power to the drive motor: post L-1, main-line switch, post L-6, fuse 2, HD1 N/O, through the connector, drive motor, back through connector, post L-5, main-line switch, fuse 3, and post L-2.

When the start key is depressed, the following circuits are completed to start the machine:

1. (3A, B) binder post 46v-3, auxiliary start key jack N/C, start key, R2 coil, stop key, stacker stop switch, and binder post 46v-7. No hold circuit available at this time.

2. (3A) binder post 46v-1, through R2-2 N/O, to R1-1 O/P as a terminal, R1 coil, to binder post 46v-7. NOTE: When R1 is energized, the R1-2 N/C points will open, and HD2 will be de-energized.

3. (3A) binder post 46v-1, R2-2 O/P as a terminal, through R1-2 N/O, HD1 coil, to binder post 46v-6.

Without cards in the machine, the start key must be held to keep the machine in operation.

Start and Running Circuits (with cards)

When R2 is energized and the R2-2 N/O points have closed, the motor-run relay will be energized, and the drive motor will operate the machine. When the R2-1 N/O points close, a second circuit is completed under certain specific conditions. This circuit is from binder post 46v-7, stacker stop contact, stop key, R2 coil, through R2-1 N/O, C9 (M284°-B254°), C10 (M87°-B57°), to C8 as a terminal, to binder post 46v-2. The lower contact points of the card-jam contact are in parallel with C9, and the upper points are in parallel with C10. Now, if the lower contact points are closed when C9 opens and the upper points are closed when C10 opens, the hold circuit for R2 will not be interrupted.

The card-jam contact and its operating mechanism have been designed so that for a fixed period of time the lower contacts are closed and for a fixed period of time the upper contacts are closed. The sequence chart (Figure 35) shows that mechanically the upper card-jam contacts are closed between 336° and 180° of a machine cycle. The lower card-jam contacts are closed from 181° to 335°. The break in contact duration of C10 is overlapped by the upper card-jam contact and the break in contact duration of C9 is overlapped by the lower card-jam contact. When cards are feeding correctly, R2 will be held energized.

If at any time during machine operation cards fail to feed, or feed incorrectly, the mechanical operation of the card-jam contact will be interrupted and the hold circuit for R2 will be opened. The R2-1 and R2-2 points will return to their normally open condition. When R2-1 opens, the R2 hold circuit is opened making it impossible for R2 to be re-energized if the card-jam contact resumes normal operation; it can be re-energized only by depressing the start key. The R2-2 points open the pick circuit to R1.

The hold circuit for R1 comes into effective operation at this time. The circuit is as follows: binder post 46v-7, R1 coil, through R1-1 N/O, C8, to binder post 46v-2, C8 with R1-1 N/O points will keep R1 energized until it breaks at 140°. This circuit assures the machine will complete the reading and printing of a card, once it has been started. When the R1-2 point transfers back to normal, it opens the pick circuit to the HD1 relay and closes the pick circuit to energize the HD2 relay.

The mechanical timing given in Figure 35 for the card-jam contact occurs when the machine is set to print on the upper line. When the machine is set to print on the lower line, the card will be advanced and cause the upper card-jam contact to be closed between 306° and 168°. This timing will overlap the break in C10 (57° to 87°).

Read and Print Circuits

The read circuit in the IBM 548 is made active by closing the card-lever contact. The operating lever of the card-lever contact is ahead of the contact drum and, when cards are feeding, the points of the card-lever contact are closed. This action will close the following circuit to energize R3 (card-lever relay): binder post 46v-7, to R1 coil as a terminal, through R3 coil, to C5 as a terminal, through the card-lever contact, through C11, to C10, C8, and binder post 46v-2. The hold circuit for R3 is as follows: binder post 46v-7, to R1 coil, through R3 coil, through R3-1 N/O and R3-2 N/O in parallel, through C7, C8, and 46v-2.

The sequence chart (Figure 36) illustrates the timing relationship between the card-lever contact, C11, and C7. Note that one card running through the machine will cause the card-lever contacts to close at 108° on one cycle and break at 129° of the next cycle. When cards are fed continuously, the card-lever contact break time (129°) for the first card has been overlapped by the make time (108°) of the second card. As long as cards are feeding continuously, the card-lever contact will remain closed.

R3 provides a circuit to the contact drum; this results in the contact drum being *hot* when cards are feeding. The machine being capable of reading alphabetical information must have circuits that will read the zone impulses (12-X-0), and the selection impulses (1 through 9).

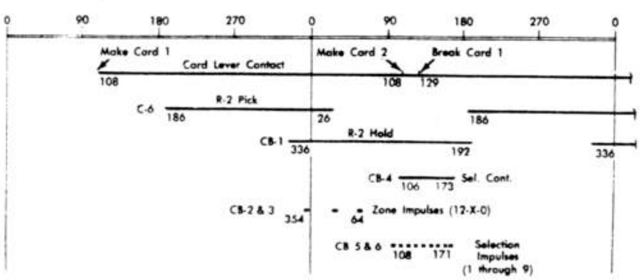


FIGURE 36A CARD READING CIRCUITS (552)

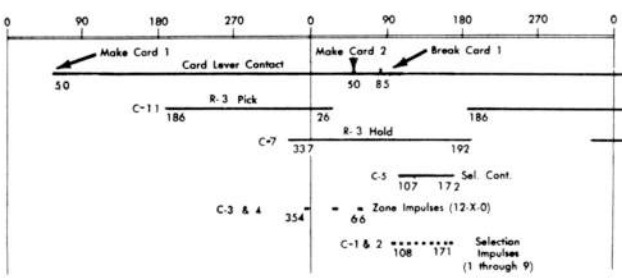


FIGURE 36B CARD READING CIRCUITS (548)

The circuit to read the zone impulses: binder post 46v-2, to C8 as a terminal, through C7, through R3-1 and 2 N/O in parallel, to C6 and C5 as terminals, through C3 (make contact), C4 (break contact), common brush, contact drum, through zone hole in the card, reading brush, control-panel hub, by wire to the typebar hub, print magnet, and binder post 46v-8. The circuit to read the selection impulses: binder post 46v-2, to C8 as a terminal, through C7, R3-1 and 2 N/O in parallel, to C6, through C5, C2 (break contact), C1 (make contact), to C4 as a terminal, through the common brush, contact drum, reading brush, control-panel hub, by wire to the typebar hub, print magnet, and binder post 46v-8.

A parallel circuit to feed the zone selection circuit breakers is available: binder post 46v-2, to C8 and C9 as terminals, through C11, card-lever contact, to C5 as a terminal, through C4 and C3, etc. This circuit will be interrupted by the card-lever contact and C11 and will not overlap the complete reading time of all cards.

X-Elimination Circuit

Each IBM 548 machine is equipped with one 10-position X-eliminator. This device could be termed a 10-position, switch-controlled class selector. It eliminates the X- and 12-punch readings that are sometimes placed over a numeric information field. When the X-elimination jackplug switch is ON, the following circuit becomes effective: binder post 46v-2, to C8 as a terminal, through C7, R3-1 and 2 N/O in parallel, through C6, X-elimination jackplug switch, R4 coil, R3 and R1 as terminals, and to 46v-7. To eliminate a 12- or an X-punch reading and allow only numerical information to print, wire the reading brush to a common hub of the X-eliminator and out the corresponding 0-9 hub to the typebar. C6 is the controlling factor in this circuit; it is made between 45° and 245° which overlaps the impulses 0 through 9.

Dynamic Braking Circuit

Dynamic braking is a principle built around the fact that an electric motor and an electric generator are basically the same. An electric motor receives electrical energy and transforms it into mechanical energy; an electric generator receives mechanical energy and transforms it into electrical energy.

When a motor has been driving a machine and the electrical energy to the motor is cut off, the mechanical energy stored in the moving machine drives the motor for a period of time. How long the machine drives the motor will depend on several factors. One factor to consider in the IBM 548 Interpreter is the machine temperature. When the machine is hot and the lubrication is light, the machine will coast for a longer period of time than when the machine is cold; therefore, the machine has no definite stopping point. This is undesirable because the machine may stop at one of a number of index positions; and if left for a period of time, damage to the machine may result.

Dynamic braking is basically applying an electrical load to a coasting motor. The coasting motor acts as a generator and produces electrical energy for the load resistor. The mechanical energy stored in the coasting machine is, therefore, converted into electrical energy by the motor and applied to a load resistor. The size of the load resistor will determine how fast the generated electricity will be consumed.

When this principle is used, it is possible to apply a sharp load to the motor and machine the instant the electrical force to the motor has been cut off. This load would exceed the friction load of the machine thus causing the machine to stop.

This principle, called dynamic braking, has been applied to the IBM 548 Interpreter. HD2 relay and a 22-ohm variable resistor stops the machine between 260° and 285°. When a machine stop occurs, C8 will de-energize R1. The R1-2 points will transfer to de-energize HD1 and energize HD2. Note when HD2 points close, the 22-ohm variable resistor will be connected across the drive motor causing a very smooth stopping action of the machine and a fairly constant stopping point on the index. The customer engineer should adjust variable resistance to cause the machine stop between 260° and 285°.

X-Reading Brushes and Class Selectors

The IBM 548 is equipped with five X-brushes which can be set to read any five columns of the card, provided they are separated by at least two columns. The X-brushes will only read an X-punch in the cards because of the timing of C12 which is in series with the X-brushes.

The IBM 548 is also equipped with two class selectors. A class selector consists of a relay with five transfer points wired to the control panel. The operating point is wired to a control-panel hub labeled *C;* the normally closed point is wired to a control-panel hub labeled *N;* and the normally open point is wired to a control-panel hub labeled *T*. When the coils of the class-selector relays are de-energized, there is a connection between C and the N hubs. When the relays are energized, there is a connection between the C and T hubs.

The class-selector relays are energized by wiring an X-brush to a class-selector pickup hub. The selector will be transferred when an X is read. The selector will pick before zone time and hold through selection time, dropping out in time for the next card to read normally.

Zero Elimination Device

Circuit Diagram. It is generally desirable for all positions in the numeric fields of the cards to be punched; if no significant digit occurs, the card column is generally filled with a zero punch. This results in the punching of zeros to the left of the first significant digit. When the cards are interpreted, it may be desirable to suppress the printing of these zeros. However, any zeros that occur to the right of the first significant digit must be printed.

The 548, 552 normally print a zero when a typebar is positioned by a zero impulse. Zeros that print to the left of the highest order significant number are at times undesirable and can be eliminated with the zero-elimination device (Figure 43).

This device cannot be used with fields punched with alphabetical information or fields where a zero and some other digit is punched in the same column.

The maximum capacity of this device is twenty positions. It can be wired in several groups, the sum of positions will not exceed twenty, or a single group of any number of positions up to twenty. All or any part of this device can be wired to be active.

Principles of Operation. The zero-elimination device does not eliminate the zero typebar setup but produces a 1 selection impulse. The zero impulse from the card, plus the 1 selection impulse from the zero-elimination device, will position the typebar at a blank position so that no printing will result. Therefore, the addition of a select 1 to the zero from the card will prevent printing in that typebar.

The conditions for the addition of this select 1 impulse are:

1. The zeros to be eliminated must be to the left of the highest order significant digit (1-9) in a field.
2. All such zeros must be punched in the card, i. e., no blank columns.
3. The zero elimination device must be correctly wired to define the field.

Control Panel Wiring.

A. Consider the three-position field in Figure 44.

1. Wire reading brushes 57-59 to typebars 35-37.
2. Wire zero elimination as shown. Any consecutive positions may be used.

B. The hubs of the zero-elimination device are used:

1. To accept impulses to pick the ZE relays.
2. To emit impulses to select 1 in the wired typebars.
3. To establish holding circuits for ZE relays.

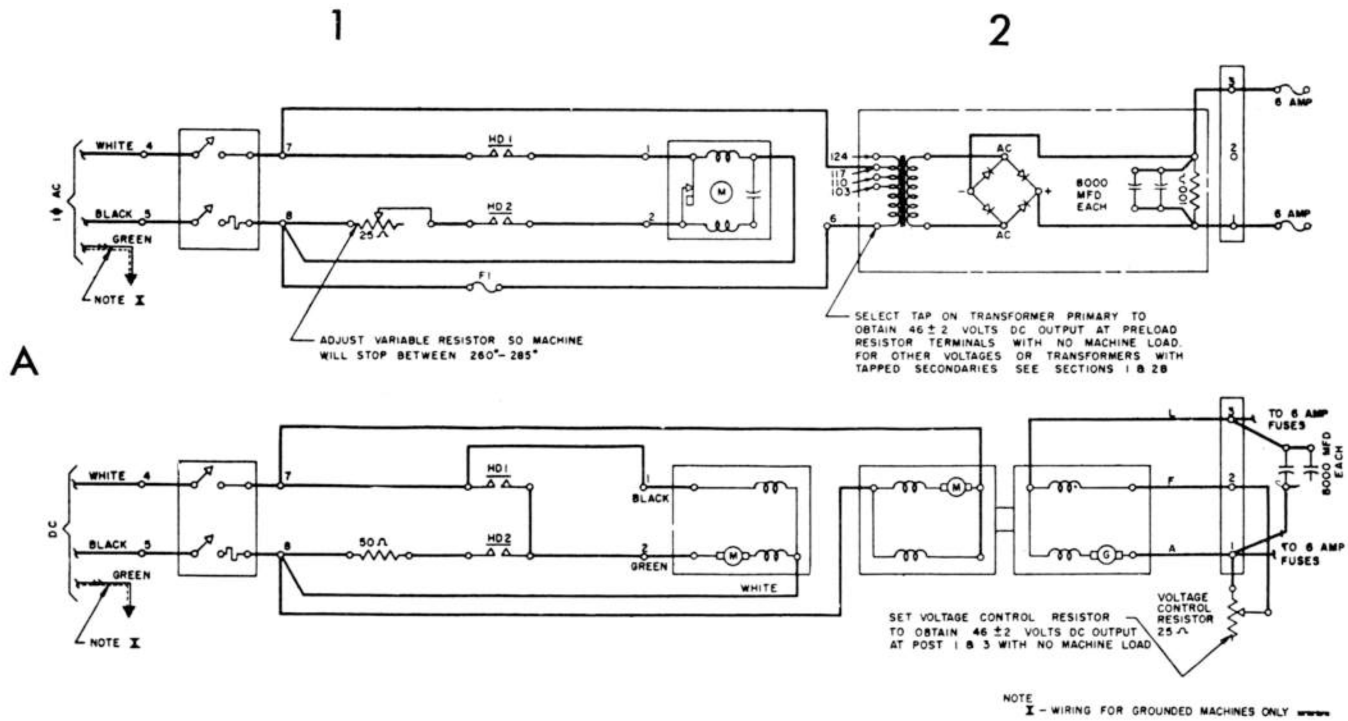
Circuits (Figures 45 and 46)

1. Consider the three-position field to be punched 040.
2. At 0-time the impulses from the card zone the typebars and also energize RZE18 and 20. RZE18 is the high order position of the field.
3. RZE18 will hold through its 2-point and X-elimination cam, but RZE20 cannot hold because RZE19 has not been picked, thus indicating a significant digit in that column.

Note that the hold of any zone-elimination relay, except the high-order position, is dependent upon the wired positions to the left. Because RZE18 is holding, the 1-9 numerical selection impulses from the selection cam through the RZE18-1 point are available to energize the typebar print magnet. However, the 1-impulse, coming first, will cause the typebar to be stopped in a blank printing position: Zone 0 — select 1.

4. The pick and hold circuits for the ZE relays will be effective when reading the 1-9 significant figures from the card. Because the typebar will be selected by the same impulse that picked the ZE relay, the added impulses through the ZE relay (1) points will have no effect on the mechanical operation of the typebar.

NOTE: The ZE relays are the wire-contact type and are located on a separate relay-gate behind the rear relay panel on the 552.



			MACHINES EQUIPPED WITH RECTIFIER POWER PACKS				MACHINES EQUIPPED WITH MOTORS AND GENERATORS	
POWER SUPPLY			SWITCH THERMAL ELEMENT		FUSE 1		SWITCH THERMAL ELEMENT	
VOLTS	CY	PH	AMP	PART NO	AMP	PART NO	AMP	PART NO
115	60	1	6.6	143366	3.0	107610	7.5	143375
115	60	3	6.6	143366	3.0	107610		
115	50	1	7.5	143375	3.0	107610		
115	50	3	7.5	143375	3.0	107610		
115	25	1	6.6	143366	3.0	107610		
115	DC						5.1	143351
150	60	1	7.5	143375	3.0	107610		
208	60	1	4.5	143345	2.0	107803		
208	60	3	4.5	143345	2.0	107803		
208	50	1	5.1	143351	3.0	107610		
208	50	3	5.1	143351	3.0	107610		
230	60	1	4.5	143345	2.0	107803	4.0	143340
230	60	3	4.5	143345	2.0	107803		
230	50	1	4.5	143345	2.0	107803		
230	50	3	4.5	143345	2.0	107803		
230	25	1	4.0	143340	2.0	107803		
230	DC						2.7	143327

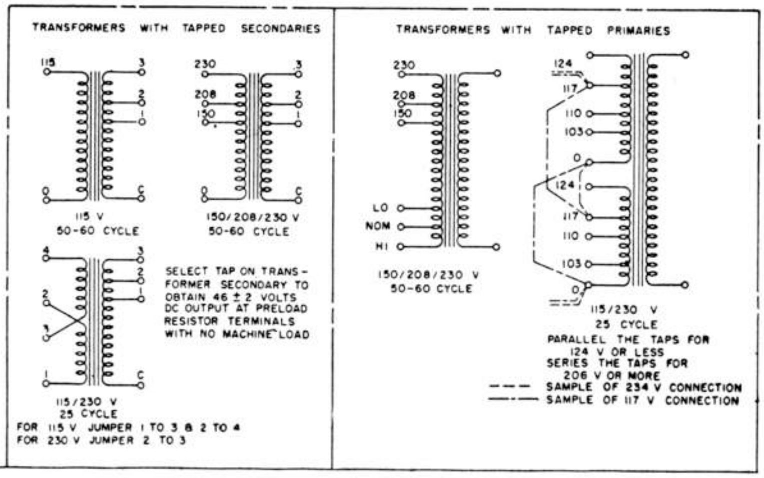


FIGURE 37. IBM 552 POWER SUPPLY (WD 161561T)

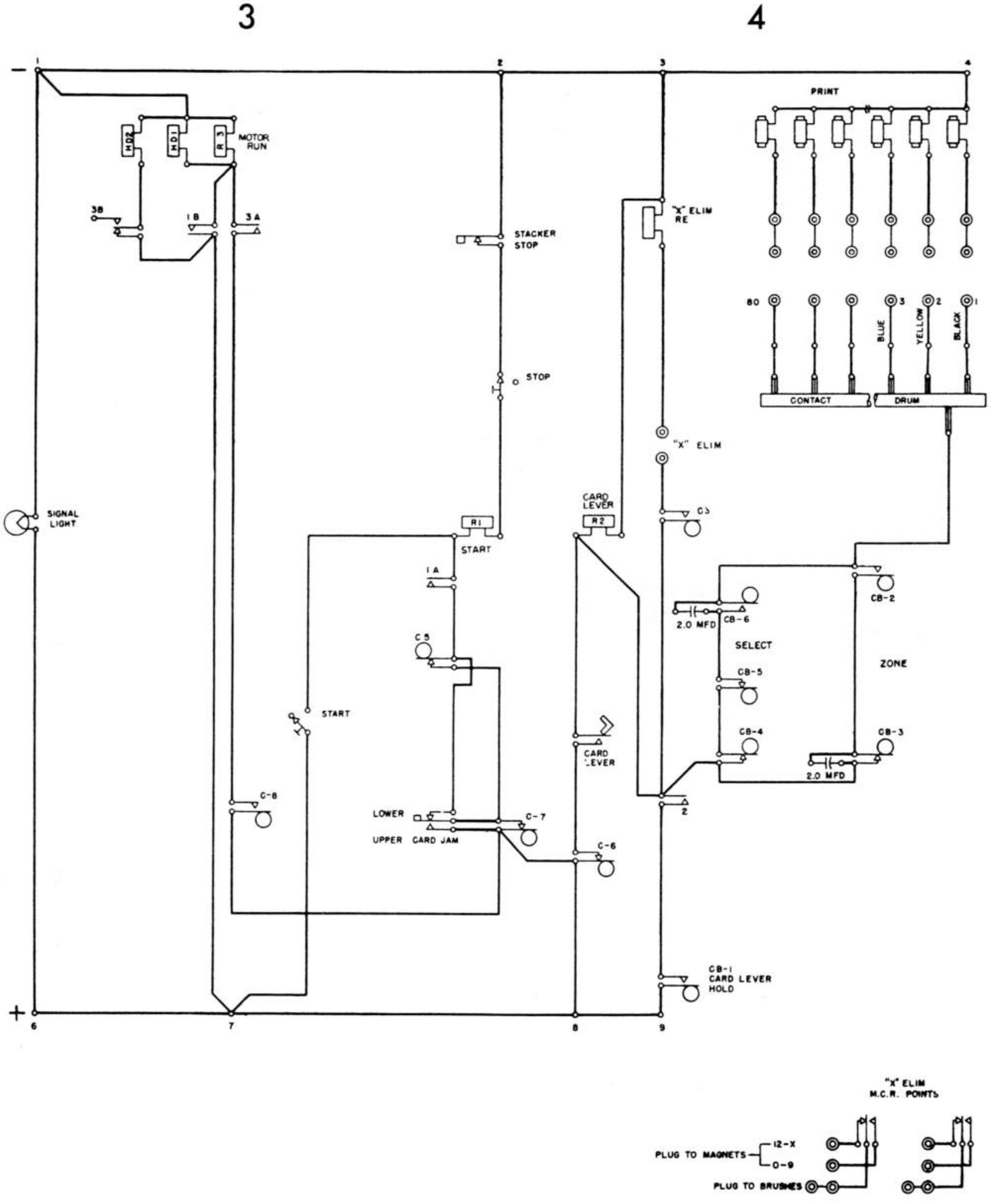
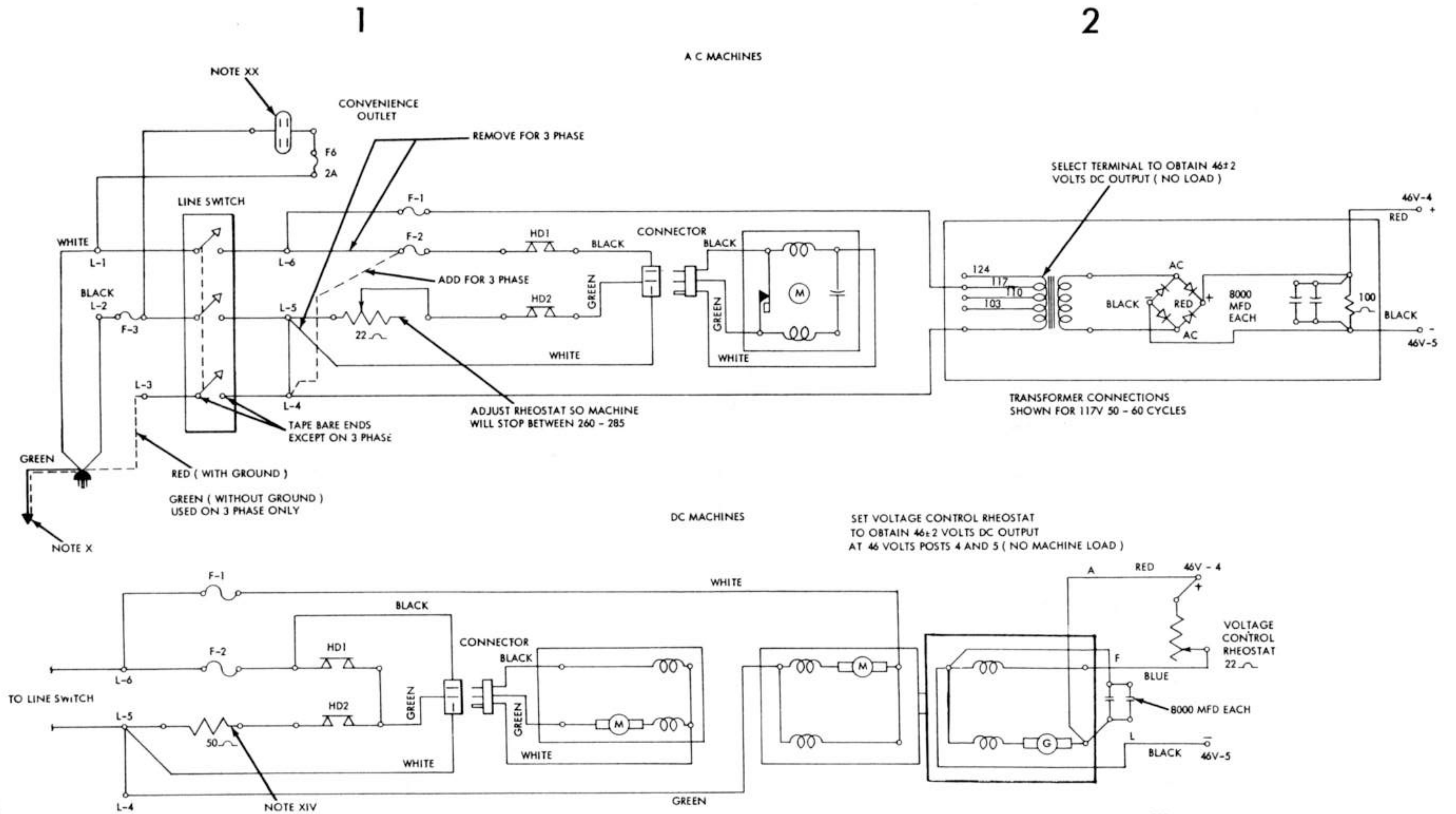


FIGURE 38. IBM 552 WIRING DIAGRAM (WD 161561T)



Power Supply			Fuse 1 BAF		Fuse 2 FNM		Fuse 3 FNM	
Volts	Cy	Ph	Amp	Part No.	Amp	Part No.	Amp	Part No.
115	60	1	3.0	107610	4	107665	8	107668
115	60	3	3.0	107610	4	107665	8	107668
115	50	1	3.0	107610	4	107665	10	107669
115	50	3	3.0	107610	4	107665	10	107669
115	25	1	3.0	107610	4	107665	8	107668
115	DC		2.5	107663 FNM	2.5	107663	5	107666
150	60	1	3.0	107610	4	107665	6.25	107667
208	60	1	2.0	107803 BAF	2.5	107663	5	107666
208	60	3	2.0	107803	2.5	107663	5	107666
208	50	1	3.0	107610	2.5	107663	6.25	107667
208	50	3	3.0	107610	2.5	107663	6.25	107667
230	60	1	2.0	107803	2.5	107663	4	107665
230	60	3	2.0	107803	2.5	107663	4	107665
230	50	1	2.0	107803	2	92734	5	107666
230	50	3	2.0	107803	2	92734	5	107666
230	25	1	2.0	107803	2	92734	4	107665
230	DC		1.6	228391 FNM	1.6	228391	4	107665

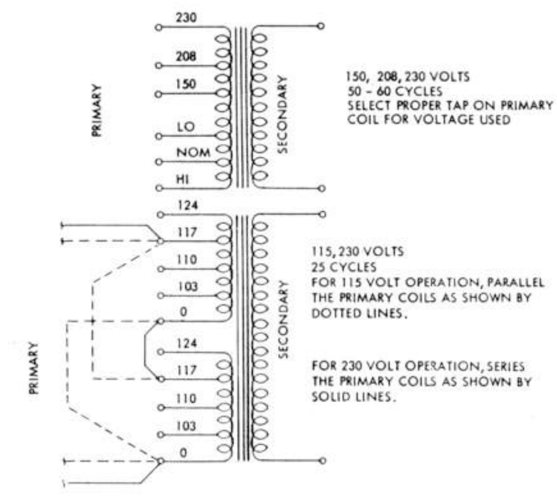


FIGURE 39. IBM 548 POWER SUPPLY (WD 600601)

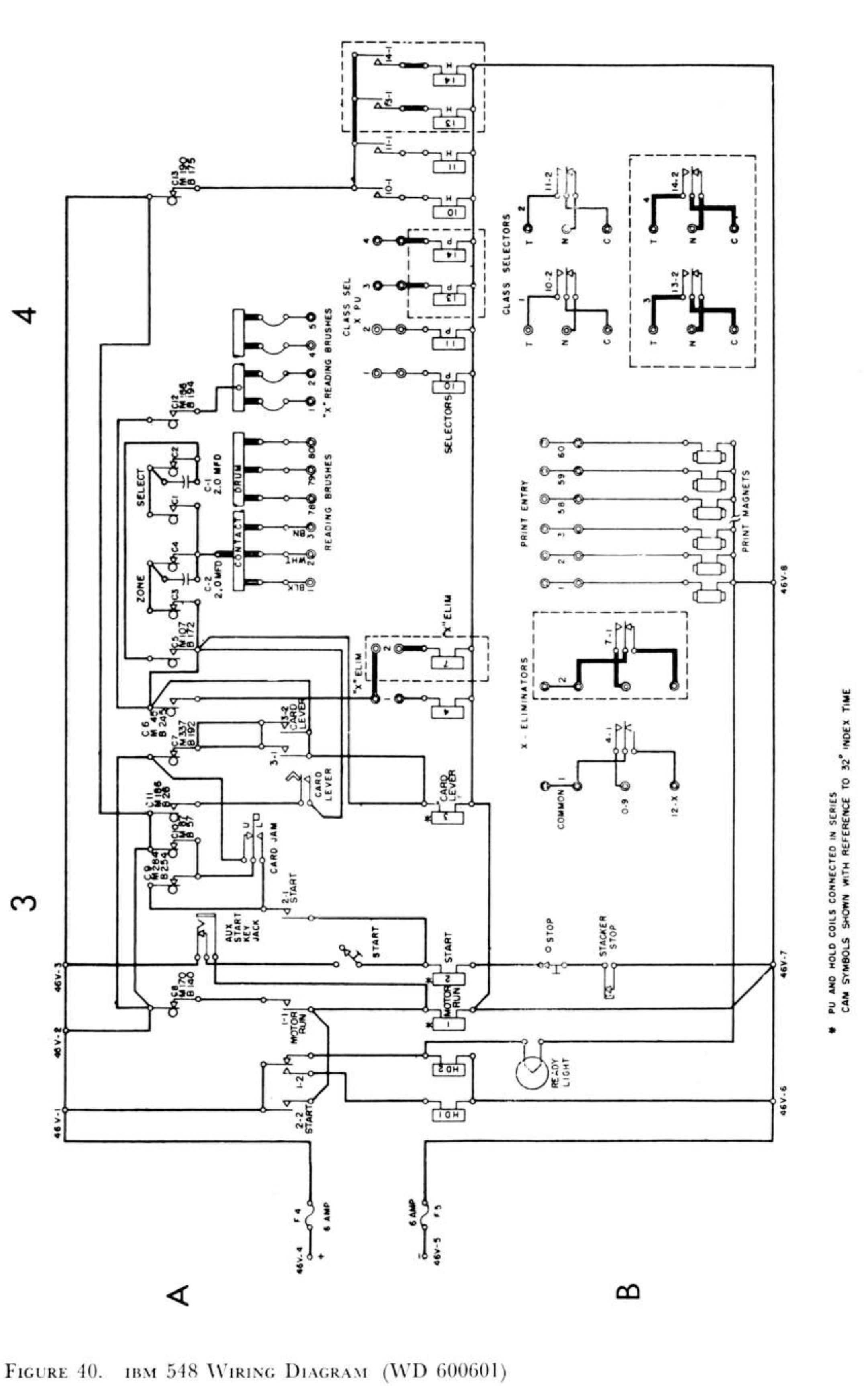
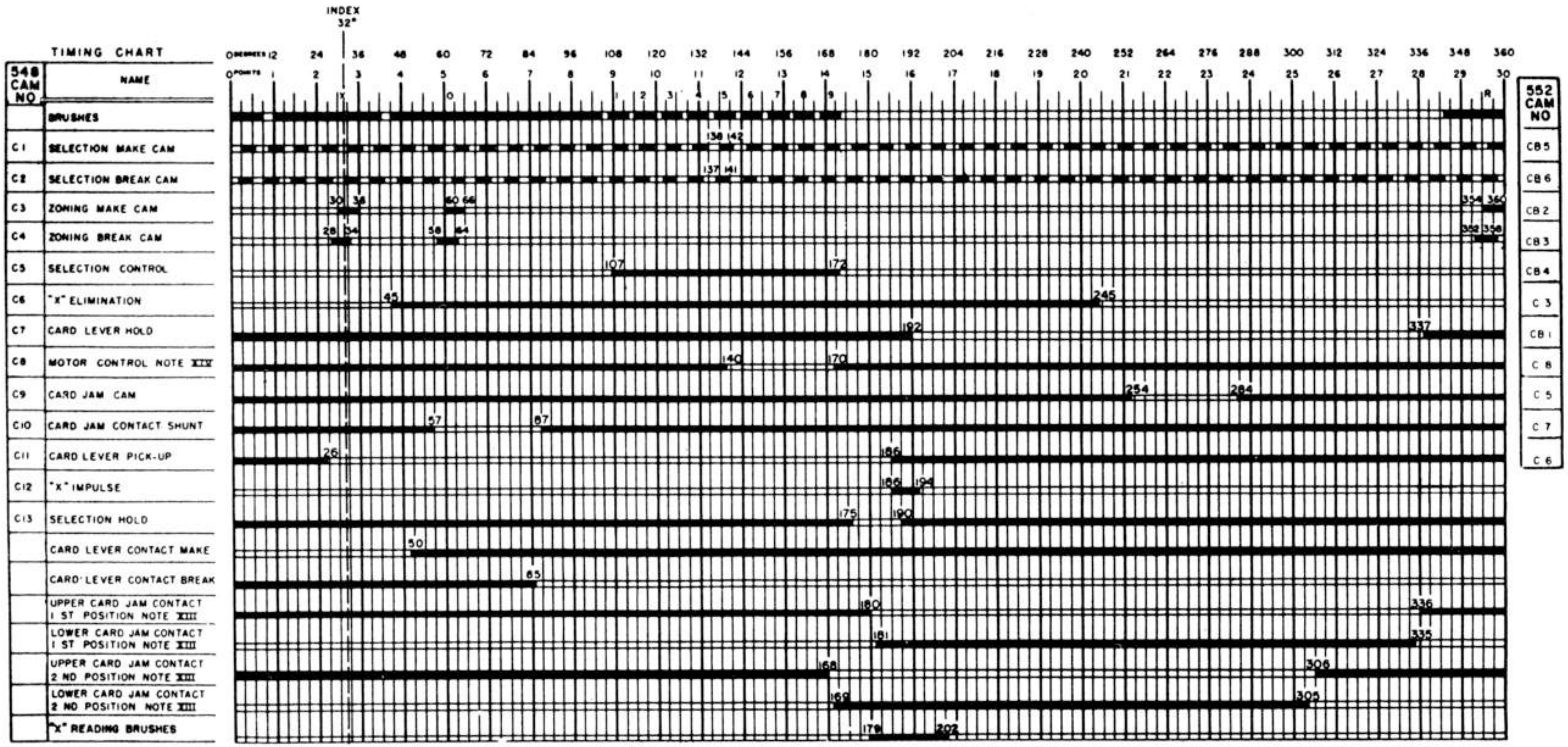


FIGURE 40. IBM 548 WIRING DIAGRAM (WD 600601)



NOTES

I WIRING FOR GROUNDED MACHINES ONLY

XI SELECTION BRUSH TIMING DURATION MINIMUM IS 6° BRUSHES SHOULD ALL BE MADE 1 1/2° BEFORE C-1 MAKES. IF BRUSH DURATION IS MORE THAN 6° THE ADDITIONAL TIME SHOULD BE ALLOWED ON THE BREAK SIDE

XII TIME "C-9" TO MAKE 21° BEFORE LOWER CARD JAM CONTACT (2 ND POSITION) BREAKS. "C-9" BREAKS 330° AFTER MAKE TIME

XIII THEORETICAL CARD JAM CONTACT TIMING IS SHOWN ON CHART. THIS MAY VARY ON EACH INDIVIDUAL MACHINE. TIMING IS NOT CRITICAL. THE DURATION OF THE LOWER CARD JAM CONTACT SHOULD NOT BE LESS THAN 120° WHEN PRINTING IN THE 2 ND POSITION (BEND OPERATING ARM IF NECESSARY)

XIV FOR D.C. MACHINES ONLY, TIME MOTOR CONTROL CAM "C-8" SO MACHINE WILL STOP BETWEEN 260°-285° TIME "C-8" APPROXIMATELY M 250°- B 220°

FIGURE 41. ELECTRICAL TIMING CHART

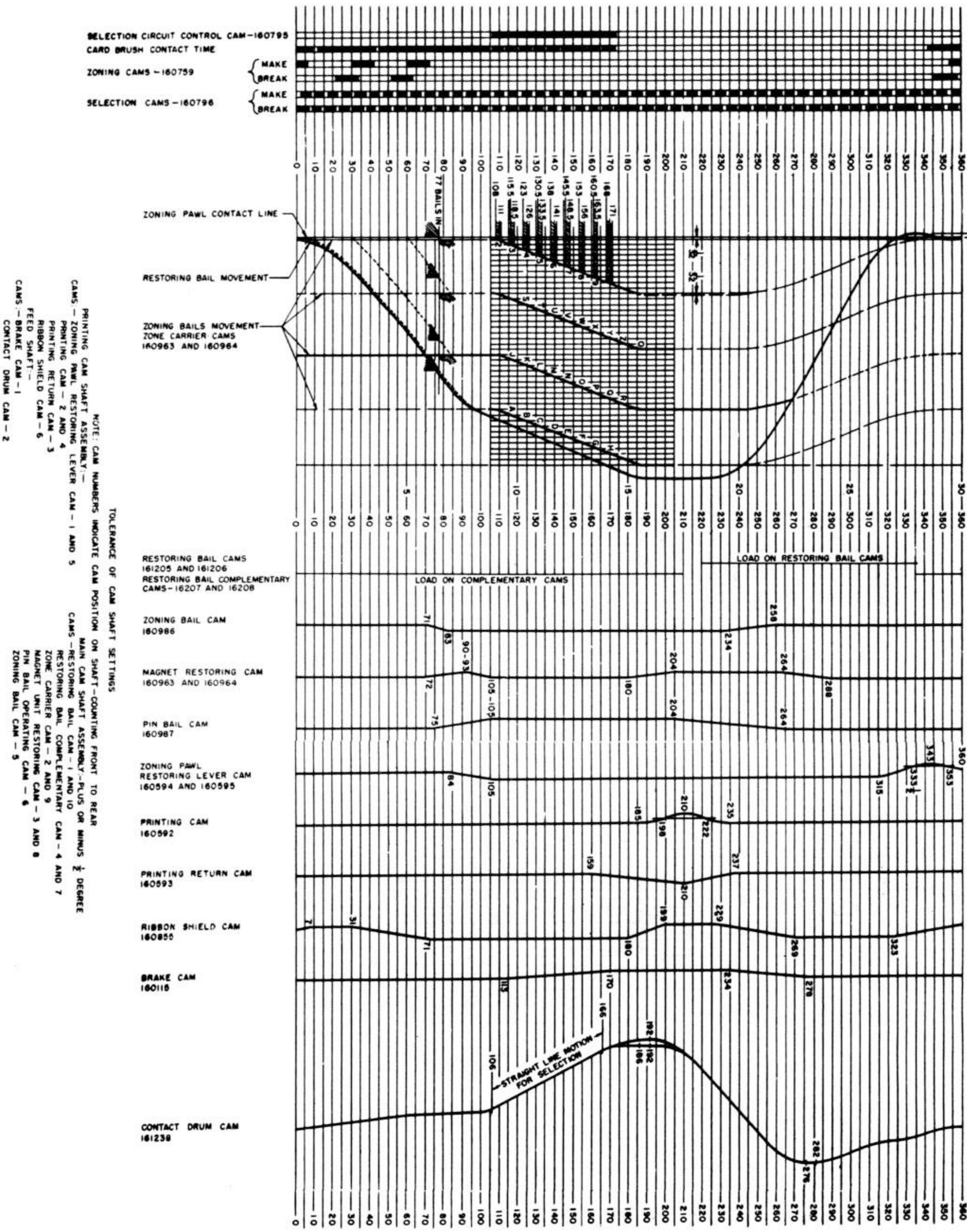


Figure 42. Mechanical Timing Chart

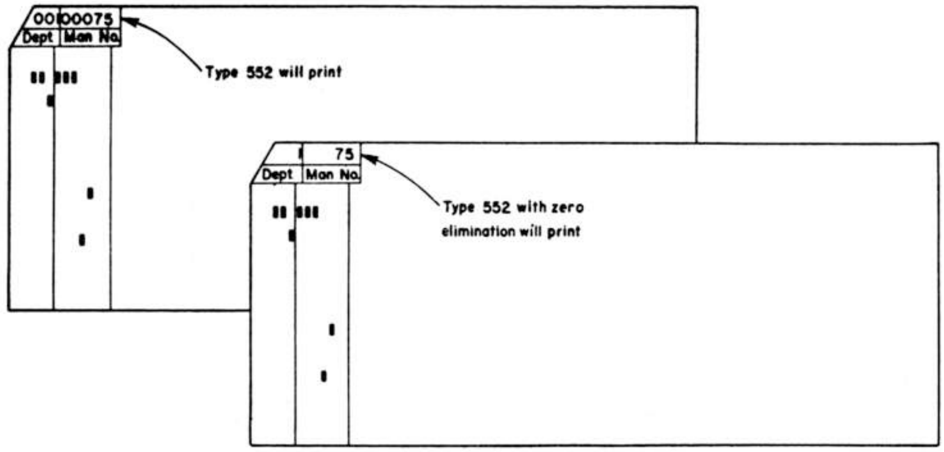


FIGURE 43. ZERO ELIMINATION

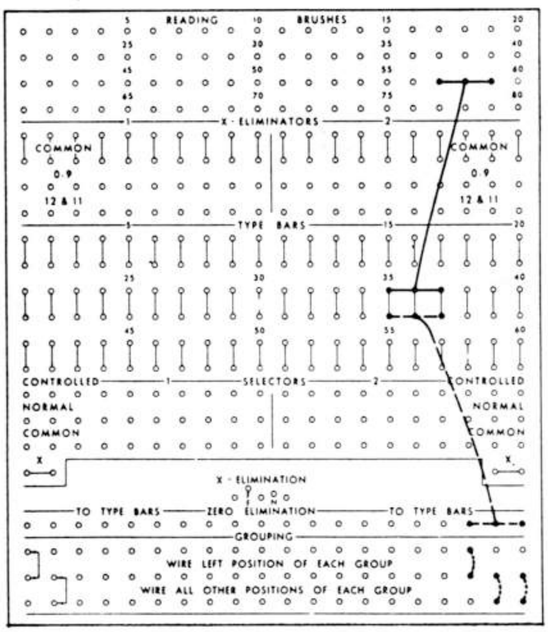


FIGURE 44. ZERO ELIMINATION CONTROL PANEL WIRING

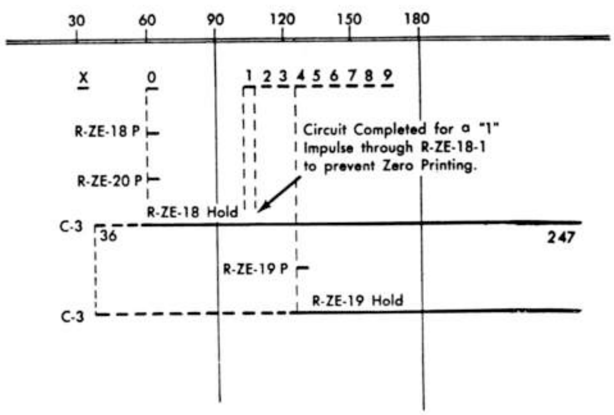


FIGURE 45. ZERO ELIMINATION SEQUENCE CHART (552)

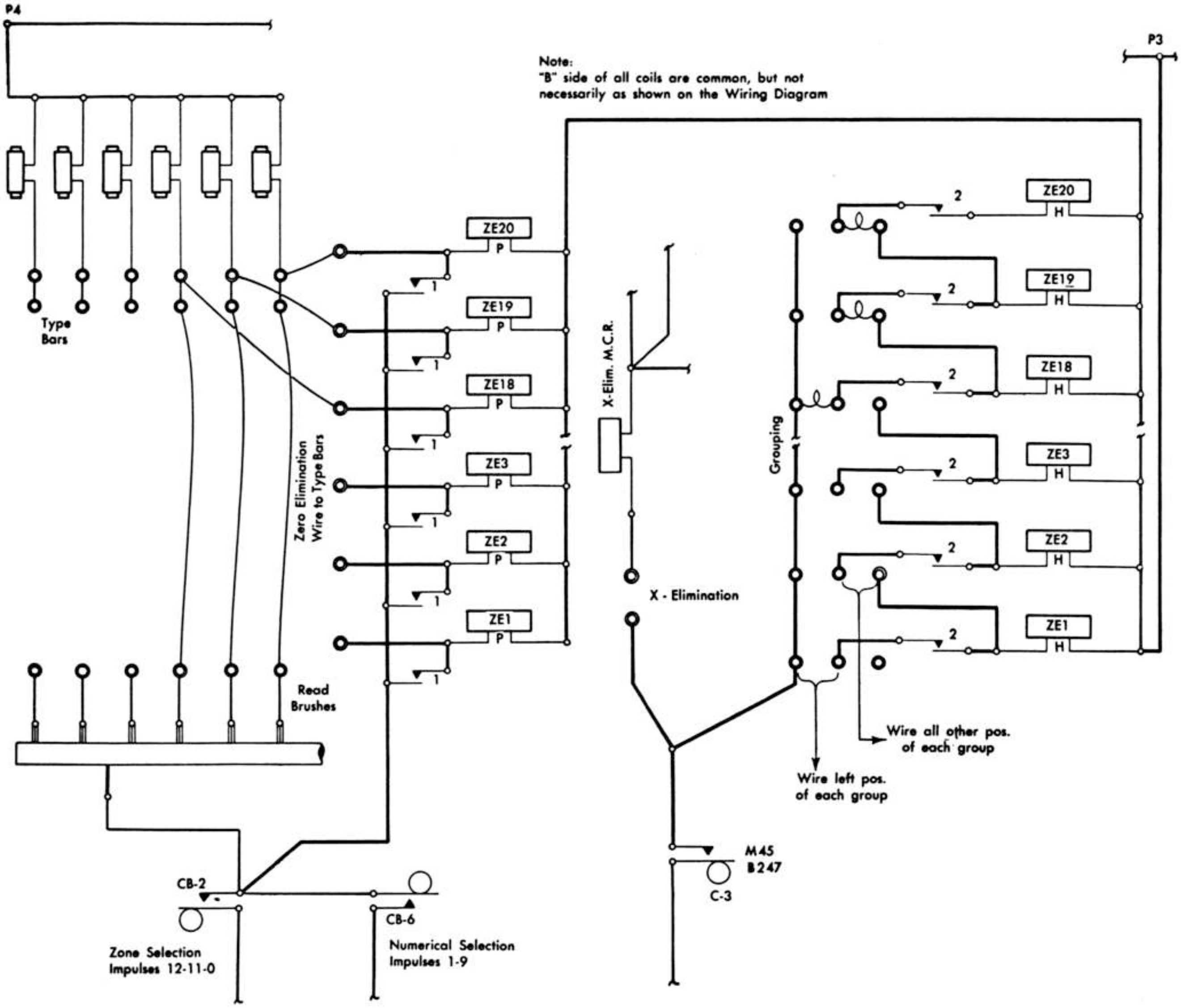


FIGURE 46. ZERO ELIMINATION CIRCUIT

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