TELETYPE CORPORATION
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35 "CARDATA"* READER (LEXD)

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

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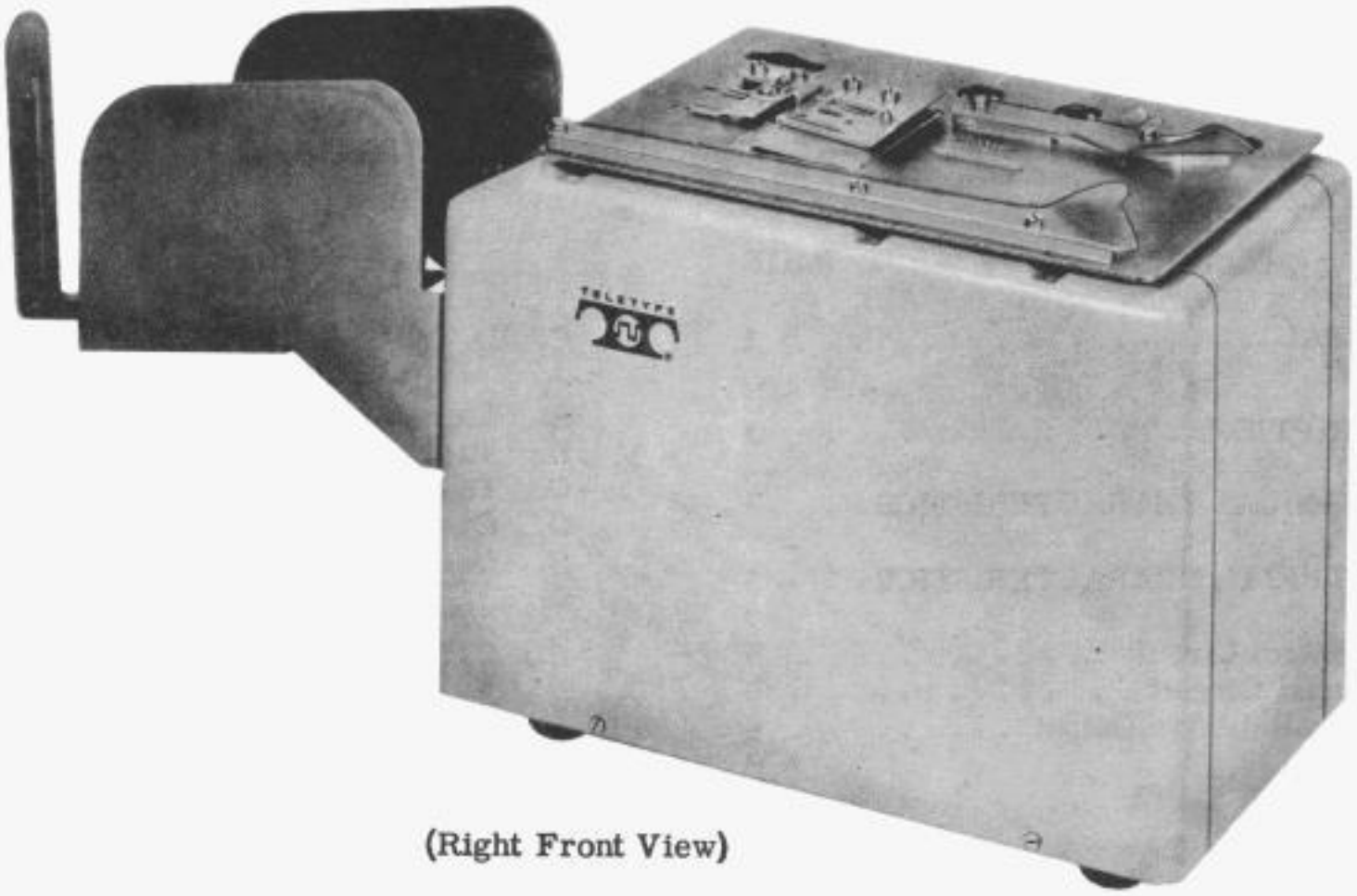
1. GENERAL

1.01 This section provides description and principles of operation for the 35 "CARDATA" reader (edge punched card reader) (Figure 1).

1.02 The reader provides the means for translating code combinations perforated in a paper tape, or from edge punched cards, into electrical pulses and transmitting these pulses. They are transmitted in the form of an eight level, start-stop permutation code, to one or more receiving stations. The reader recognizes and distributes an 8 level, 11 unit code sequentially at 110 bits per second, from either one inch tape or edge punched cards, at a speed of



(Right Front View)

Figure 1 - 35 Edge Punched Card Reader

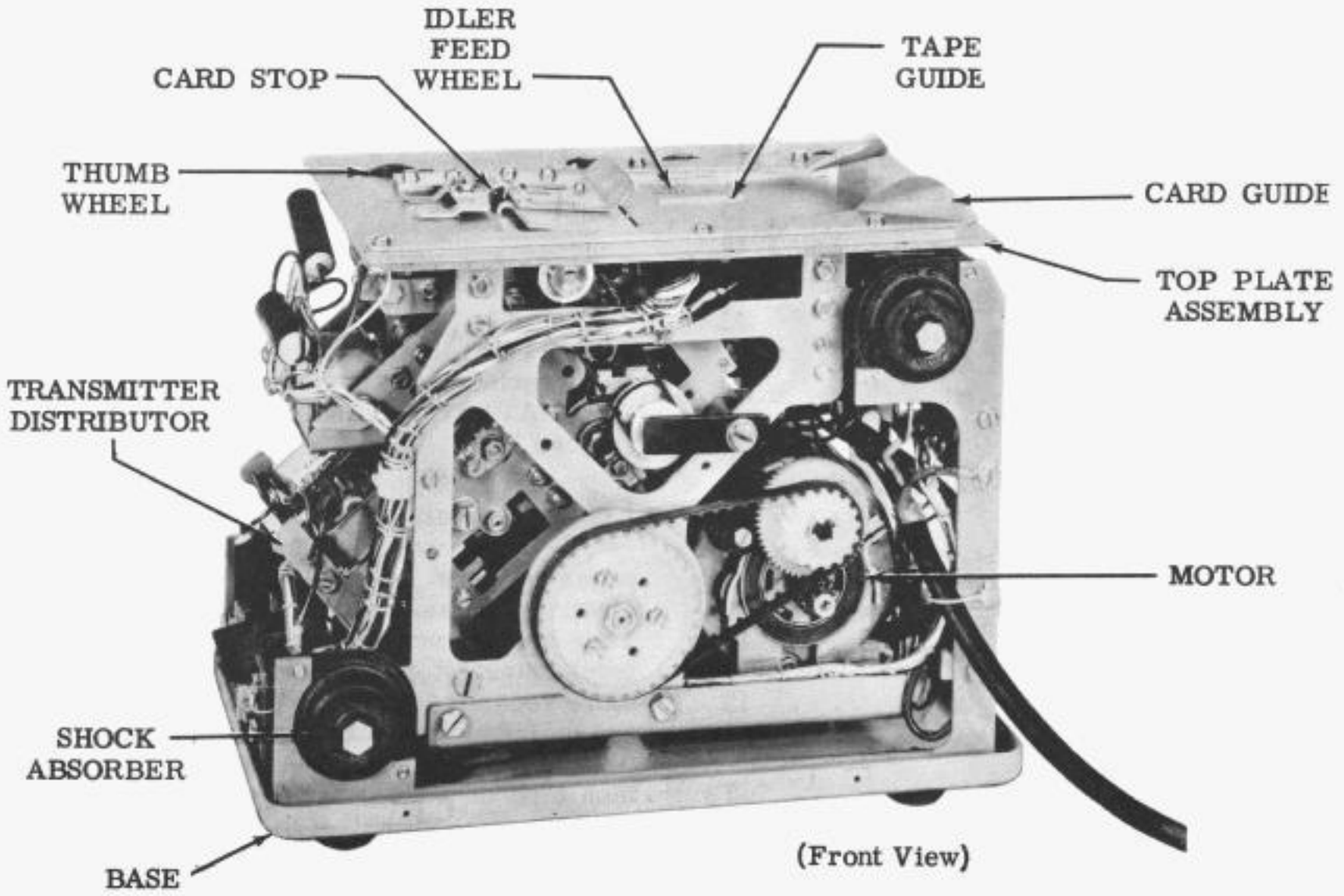


Figure 2 - 35 Edge Punched Card Reader Without Cover

100 words per minute. The signal generator contact is linked to certain mechanisms to translate the intelligence sensed into pulses of current (marking) and no current (spacing).

1.03 A parallel wire output signal is provided for control purposes or as an input into associated apparatus. When parallel wire signal output is used as an input into associated equipment, the control codes must be recognized externally.

1.04 References in the text to the left, right, front, or rear apply to the unit in its normal upright position as viewed from the front or operator's position. Pivot points are shown in the drawings by circles or elipses which are solid black to indicate fixed points and cross-hatched to indicate floating points.

1.05 If necessary, refer to the appropriate disassembly and reassembly section for removal of cover and any internal mechanisms associated with the reader. For further information regarding location of parts, refer to the exploded views in the appropriate parts section.

2. DESCRIPTION

2.01 The reader, including a card collector, (Figure 1), can be used as a table mounted unit, or it can be mounted on Automatic Send-Receive (ASR) or Keyboard Send-Receive (KSR) Sets by means of a bracket provided as a modification kit.

2.02 When the reader is used as a table top model, the cards may be fed into the unit either manually or by an automatic feeder. The unit may be wired for manual or for automatic feed operation. The feeding of the cards can be controlled from within the reader or an outside source. A thumb wheel (Figure 2) is provided to facilitate the insertion or repositioning of tape or card.

2.03 The card tray collects the processed cards from the reader. The capacity of the card collector is 150 single cards.

2.04 The unit is able to operate under normally encountered environmental conditions when supplied with 115 volts ac, ±10%, 60 hertz.

MECHANICAL CHARACTERISTICS

2.05 The edge punched card reader includes a modified transmitter distributor which is tipped up 40 degrees from the horizontal and mounted between two parallel plates. The parallel plates also hold the frames for the electric motor which are included with the unit. Two outside frames support the two parallel plates by means of four shock absorbers. The mechanisms of the unit are enclosed by a base, a cover, and a top plate (Figures 1 and 2).

2.06 The top plate (Figure 2) is the working surface of the reader. The cards are transported over the top plate as they are being read, guided by the card guides which are mounted to the top plate. Various holes and slots in the surface of the top plate expose manual control switches and other mechanisms (Figure 3) which control the reading and movement of the cards.

2.07 The mechanisms which protrude through the top plate (Figure 4) are: a card-in sensing switch lever, a card-out sensing switch lever, a card-eject control switch lever, retractable tape guides, two feed wheels, and an idler wheel (Figure 2). The two feed wheels (Figure 4) are controlled in their motion and synchronized by an idler gear. The idler feed wheel (Figure 2) rotates freely and serves as an additional card and tape guide.

2.08 A lid (Figure 3) in the reading area of the top plate allows the card to be inserted over the feed pins, feed wheel, and card-out actuator pin. After the card has been inserted in its proper position, the lid is pulled down to be flush with the top plate. This is done by a lid solenoid (Figure 5).

2.09 The eject solenoid (Figure 5), which controls the eject mechanism through a series of levers, mounts on the same bracket as the lid solenoid. The card-eject mechanism consists of a belt driven shaft and a ratchet clutch connecting the shaft to the driven center feed wheel.

2.10 The reader contains other electrical components directly responsible for the operation of the unit. Three switches (Figure 4) are controlled directly by the card, the card-in switch, the card-out switch, and the eject switch. Two relays provide additional contacts for the two solenoids and for the reader clutch magnet. Arc suppressors are used across all inductances.

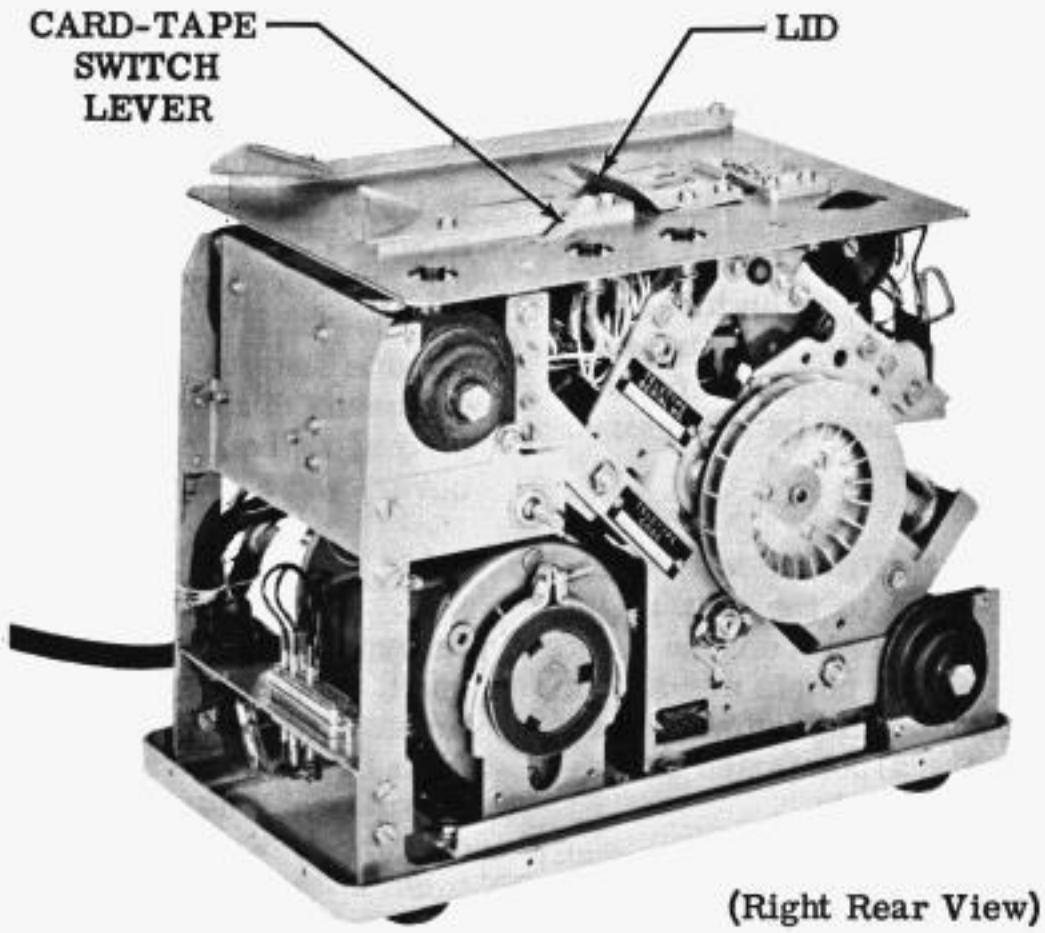


Figure 3 - 35 Edge Punched Card Reader Without Cover

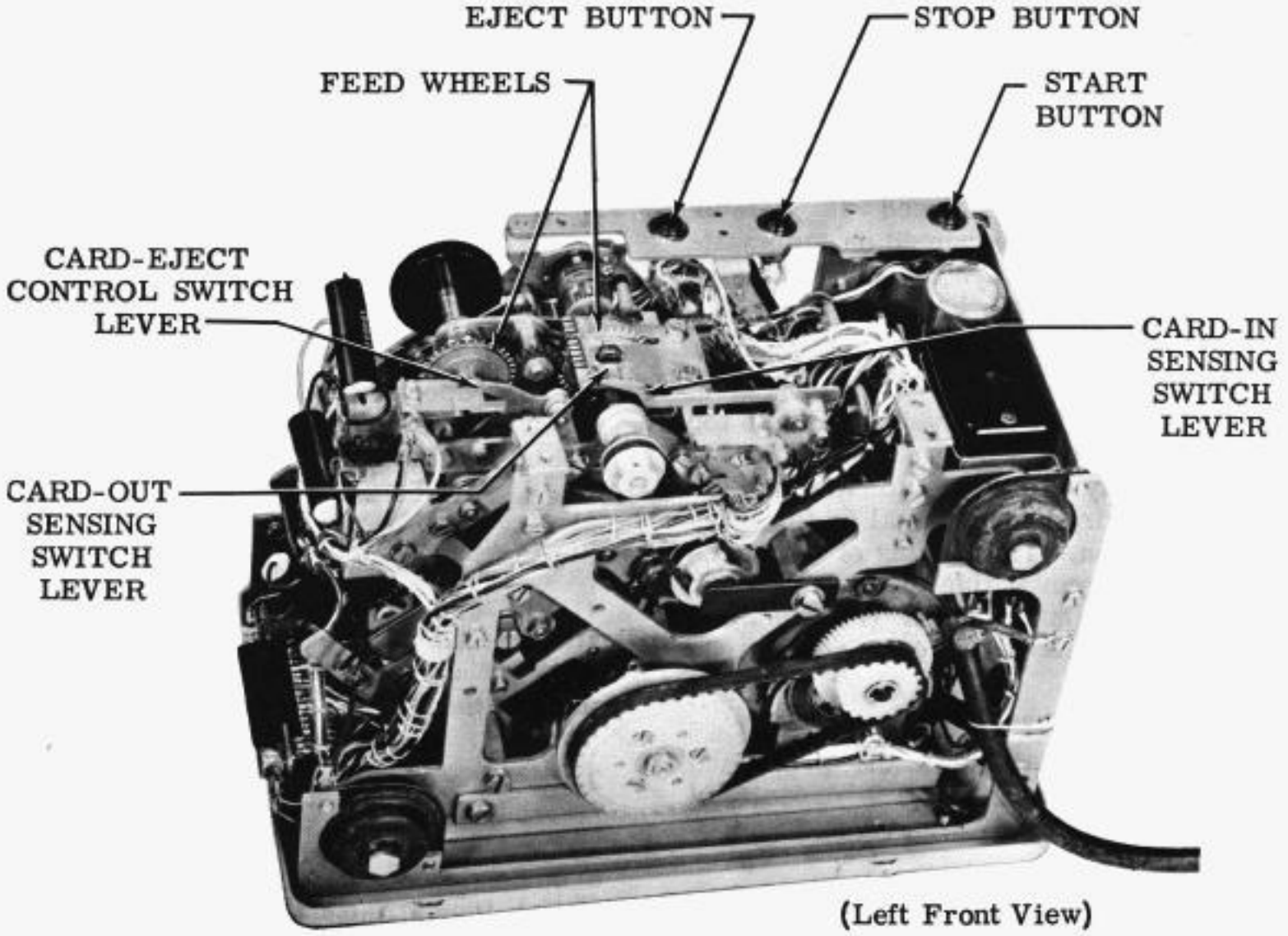


Figure 4 - 35 Edge Punched Card Reader Without Top Plate and Cover

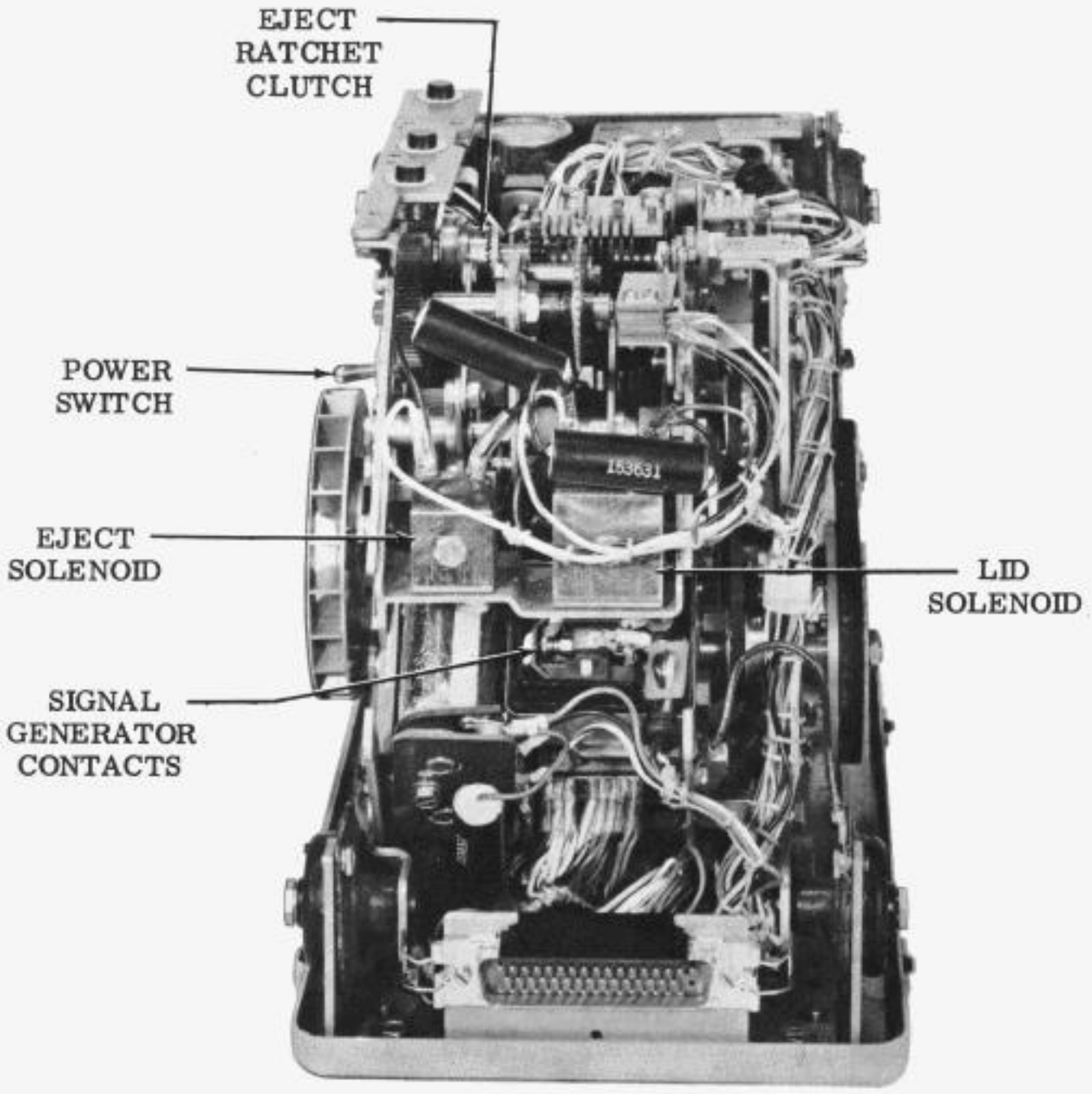


Figure 5 - 35 Edge Punched Card Feeder Without Top Plate and Cover

ELECTRICAL CHARACTERISTICS

A. Control Circuit

2.11 The reader is controlled manually by the main power switch (Figure 5), three push-button switches, and a card-tape mode selector lever. Additional controls are activated by the position of a card or tape in the unit or by certain codes in the card or tape.

2.12 The three pushbutton switches are marked START, STOP, and EJECT (Figure 4). The START button, when pressed, will start the reading operation when a card or tape is inserted in the reader. The STOP button, when pressed, will stop the operation. A card can be cleared from the reader at a fast rate (many times faster than the reading speed) after the reading process has been stopped by pushing the STOP button and then the EJECT button.

2.13 A card-/tape-out contact actuator will sense the end of a card or tape and stop the operation of the reader after the last code position has been read. A card can also be ejected automatically when a preselected code is read by the reader, or it can be ejected after the last code position in the card has been read.

2.14 The reader may be wired for manual or for automatic feed operation when coupled to the feeder. The feeding of cards can be controlled from within the reader or an outside source.

2.15 The direct current for the 48 volt dc control operations is normally provided by a diode bridge rectifier which is fed from a center tapped winding in the motor of the unit. The center tapped rectifier source can be strapped out when an external 48 volt dc power source is used to control the operation of the

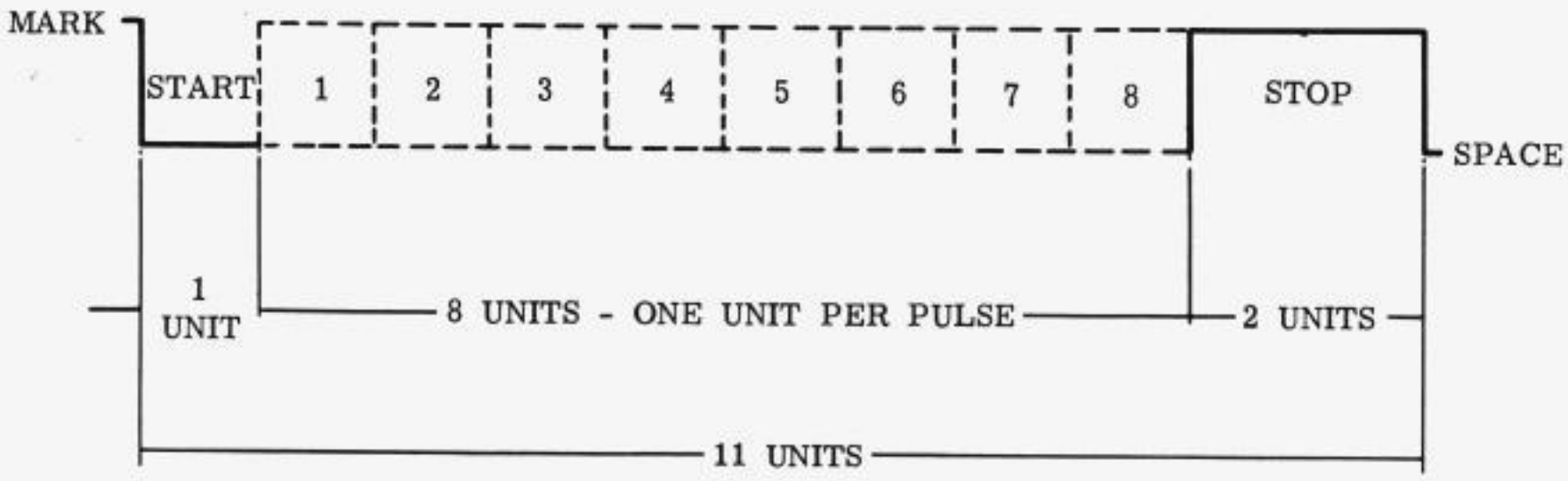


Figure 6 - Eleven Unit Transmission Pattern

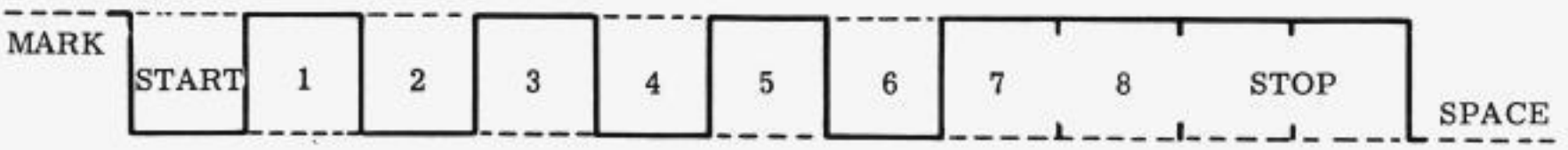


Figure 7 - Graphic Representation of the Letter "U"
(See Eight Level Data Interchange Code for Code Arrangements)

reader. Diodes are included in the circuitry where necessary. Three terminal blocks are provided for connecting the cables. The mechanical power for the unit is obtained from a 3600 revolutions per minute synchronous motor included in the reader complete with starting relay and starting capacitor.

2.16 The motion from the motor is transmitted to the reader clutch and the eject ratchet clutch (Figure 5), through the gear reduction and belt drives.

B. Signal Circuit

2.17 The signal circuit consists of gold plated signal generator contacts (Figure 5), connected in series with the signal regenerator which relays their output and insures low voltage (3 volts, dc; 70 microampere) signal circuit continuity. A timing contact is provided for use when external signal regeneration is employed.

Note: Normally for low voltage applications gold plated contacts should be used in circuits operating between 3 and 20 volts dc at a current level not to exceed 60 milliamperes. Between 20 and 70 volts dc, the current should be adjusted not to exceed a 120 milliwatt power level. The contacts are not normally intended for use on voltages above 70 volts dc. Exceeding this level for an appreciable length of time may result in damage to the gold plating and make them unfit for low voltage applications.

2.18 The signaling code transmitted is an eight unit, start-stop neutral code consisting of current and no current intervals, or pulses. See Figure 6. A marking pulse is a measured interval of time during which current flow is permitted through closure of a contact. A spacing pulse is a measured interval of time during which the flow of current is interrupted through the opening of a contact. The transmission pattern for a complete character consists of a start pulse (always spacing), eight code pulses (any one of which may be either marking or spacing) and a stop pulse (always marking) (Figure 7). The start and stop pulses are necessary to keep the receiving telegraph apparatus in synchronism with the transmitter. See eight level data interchange code section, for code arrangements.

C. Parallel Wire Output

2.19 If the parallel wire output is used as an input into associated equipment, the reader cannot use a function code to control its operation internally. The function code has to be recognized externally and a command signal has to be fed back into the reader.

TECHNICAL DATA

2.20 Operating Speed

(a) 100 words per minute

(b) 110 bits per second

(c) 110 bauds

(d) 600 operations per minute

(e) 10 characters per second

2.21 Transmission Codes

(a) 11 unit transmission pattern

(b) 8 level

2.22 Physical Characteristics

(a) Reader dimensions and weight

Height: 7-1/2 inches
Width: 10-1/2 inches
Depth: 6-3/4 inches
Weight: 16 pounds (approximate)

(b) Card collector dimensions and weight

Height: 6-5/8 inches
Width: 9-3/16 inches
Depth: 4 inches
Weight: 12 ounces (approximate)

(c) At the present time the reader will accept cards of 3 inches to 3-1/2 inches in width.

(d) Tape

8-level, 1 inch wide

2.23 Electrical Requirements

(a) AC voltage (externally supplied)

115 volts ac ±10%
60 hertz ±.45

(b) Signal line requirements

Gold plated signal generator contacts to signal regenerator - 3 volts dc; 70 microamperes

(c) Control circuits

48 volts dc ±10%

2.24 Motor Data

Motor - TP305754
Volts - 115 ac
Hertz - 60/50
Phase - Single
Winding - Synchronous (center tapped)
Millihorsepower - 15
Revolutions per minute - 3600/3000
Amperes - 1.0/1.1
Rotation - Counterclockwise (viewed from end opposite pinion end)
Temperature rating - 50° C continuous
Winding insulation - 130° C
Main winding - 23.48 ohms ±10%
Start winding - 36.50 ohms ±10%

3. PRINCIPLES OF OPERATION

3.01 The principles of operation can be divided into two groups of functions: the mechanical and the electrical. The mechanical operations will be discussed first followed by the electrical functions. The electrical functions will be touched on in the mechanical part for clarity only. There are different modes of operation; each mode will be discussed separately. The process of reading codes is common to all modes.

3.02 The reading process starts with the reader in the idle line condition, the driving motor running, and card or a tape in position to be read.

MECHANICAL OPERATING SEQUENCE

A. Clutch Trip Magnet

3.03 As the clutch trip magnet (Figure 10) receives its starting current, the magnet is energized and pulls up its armature. The armature bail extension cams the main bail latchlever about its pivot post to release the main bail.

B. Main Bail

3.04 The main bail swings upward due to the tension of the main bail spring and initiates the following actions.

3.05 The feed pawl is raised one tooth on the feed wheel ratchet (Figure 11).

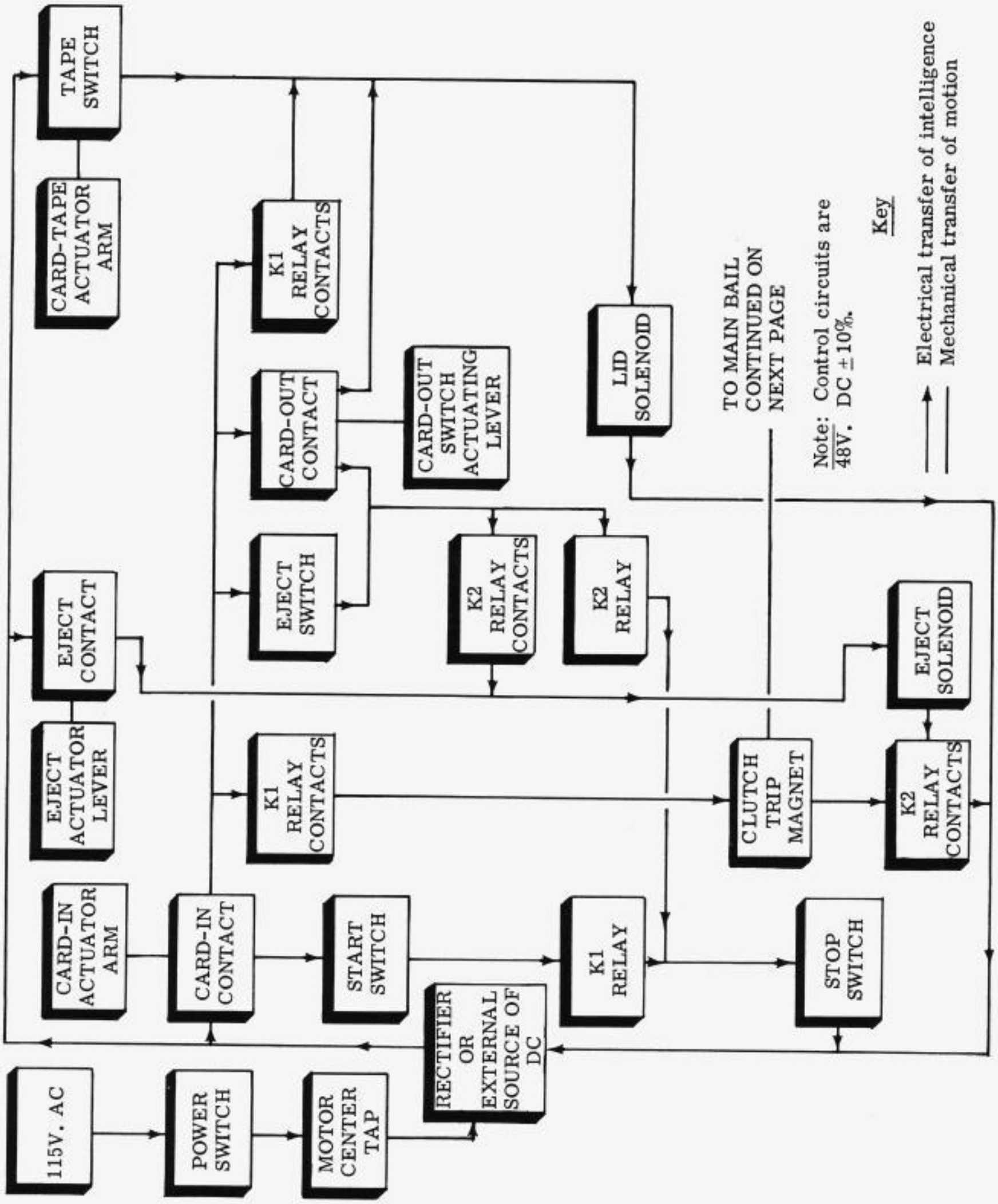


Figure 8 - Functional Block Diagram of Edge Punched Card Reader

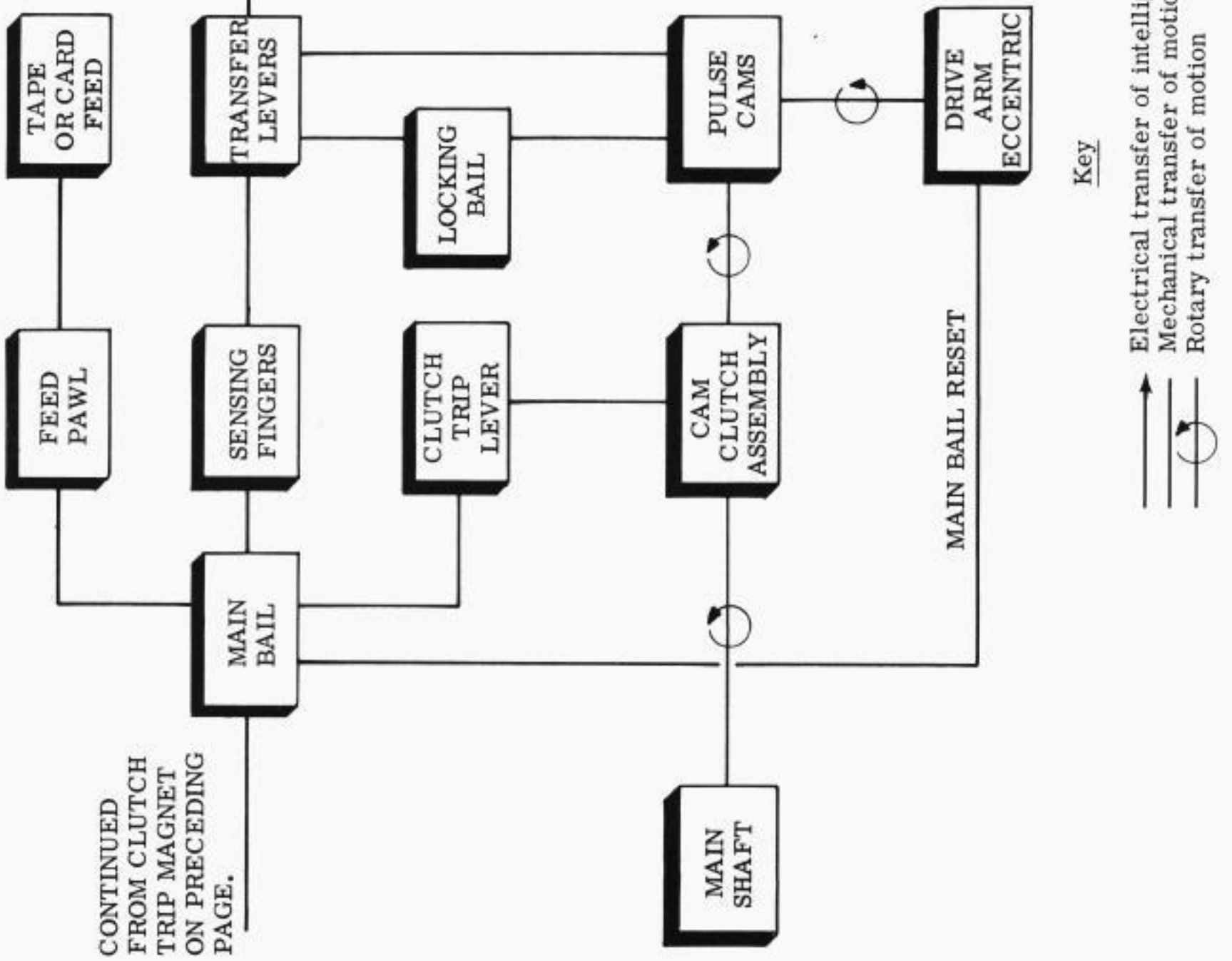


Figure 9 - Functional Block Diagram of Edge Punched Card Reader

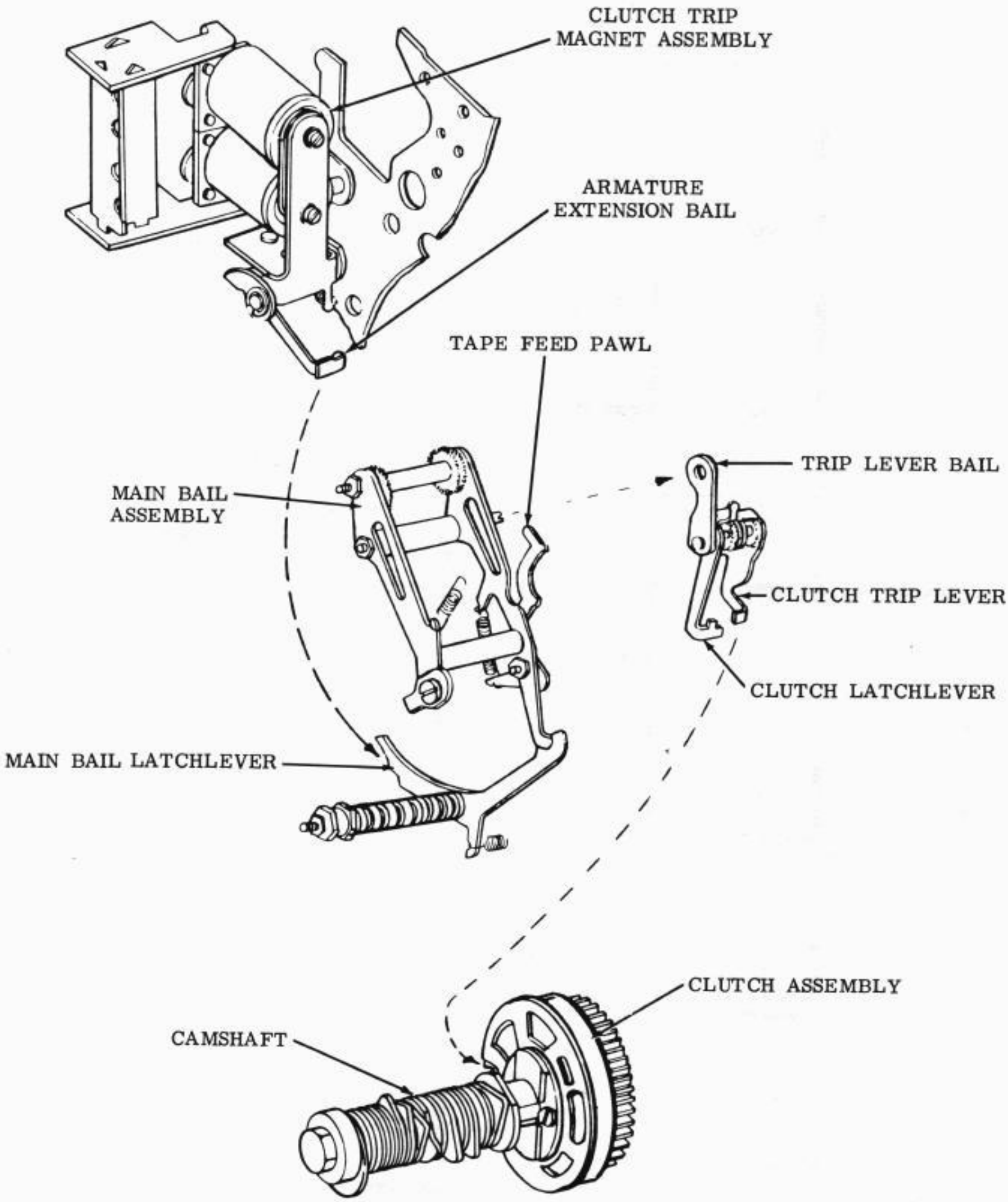


Figure 10 - Function Control Mechanism

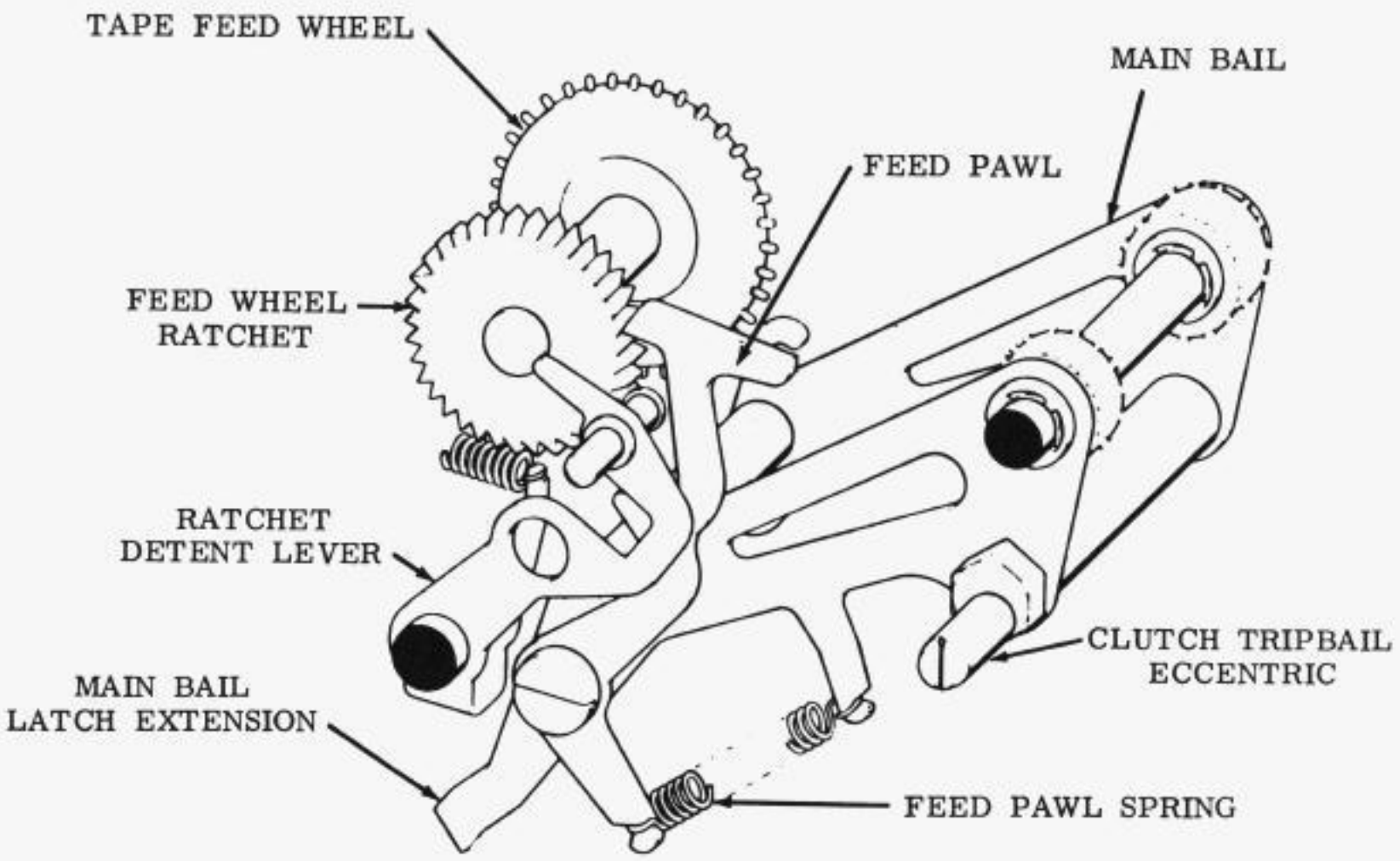


Figure 11 - Tape Feed Mechanism (Rear View)

3.06 The clutch trip lever moves away from its latch when the eccentric post on the spring biased main bail cams the clutch tripbail; the tripbail in turn moves the clutch trip lever. The eccentric post on the main bail rides in the slot of the clutch tripbail so that when the main bail is released the clutch tripbail is also released by the interconnection (Figure 10).

3.07 The sensing fingers, responding to the action of their springs, follow the main bail in its upward travel to sense the card or tape in the guideplate. If one or more of the sensing fingers encounter a perforation, the fingers will extend through the perforations until the projections on the sensing fingers strike the bottom of the main bail spacer post. The sensing fingers that extend through the perforations move their associated transfer levers upward so that they are brought above the line of action of the blade on the locking bail. If any of the sensing fingers do not sense a perforation, their upward movement is stopped by the card or tape, and the associated transfer levers remain stationary. Their extensions remain below the line of action of the locking blade on the locking bail (Figure 13).

C. Clutch Trip Lever

3.08 During the movement of the main bail, the clutch tripbail pivots on its axis and pushes the clutch trip lever away from the shoe release lever to engage the clutch and start the main shaft rotating (Figure 10).

D. Locking Bail

3.09 As the cam sleeve (Figure 12) continues its rotation, the high part of the locking bail cam moves away from the locking bail and permits the locking bail to be pulled upward by its spring. In its upward travel, the locking blade of the bail is positioned between the lower extensions of the selected transfer levers and locks them in position (Figure 13).

E. Start Pulse

3.10 Further rotation of the main shaft moves the lobe of the start cam (Figure 12) into position and shifts its transfer lever downward. Since the start transfer lever has no sensing finger, the lever is always in the spacing position. The upper finger of the start transfer

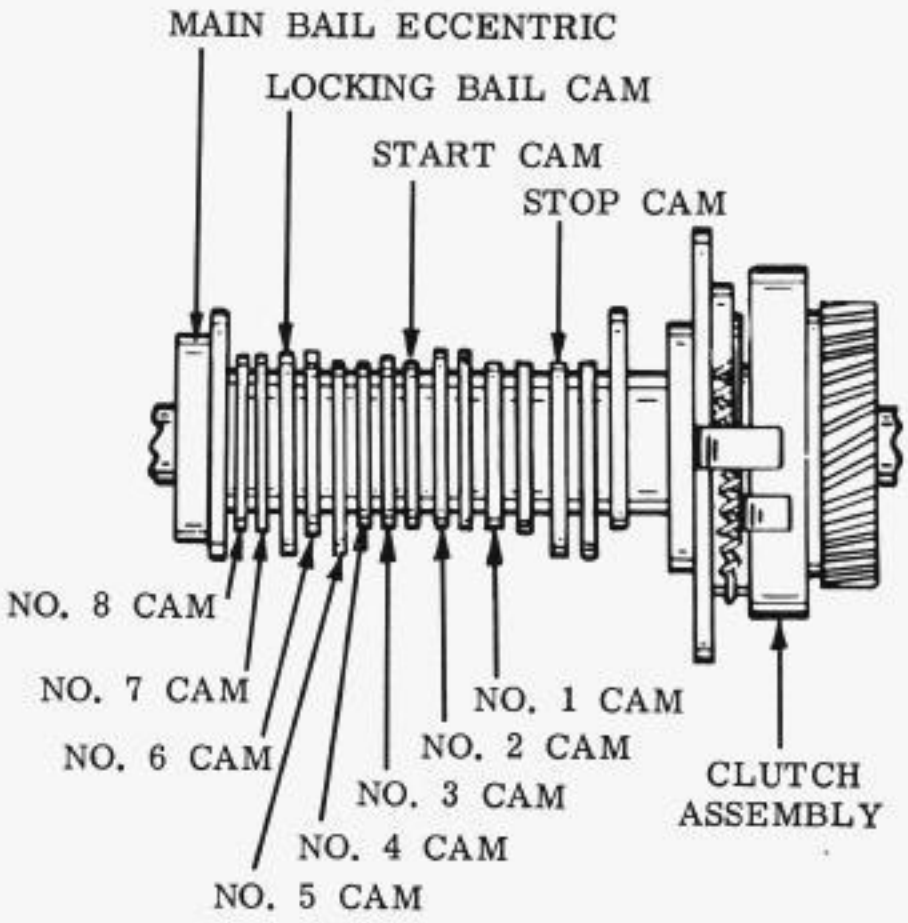


Figure 12 - Clutch Camshaft Assembly

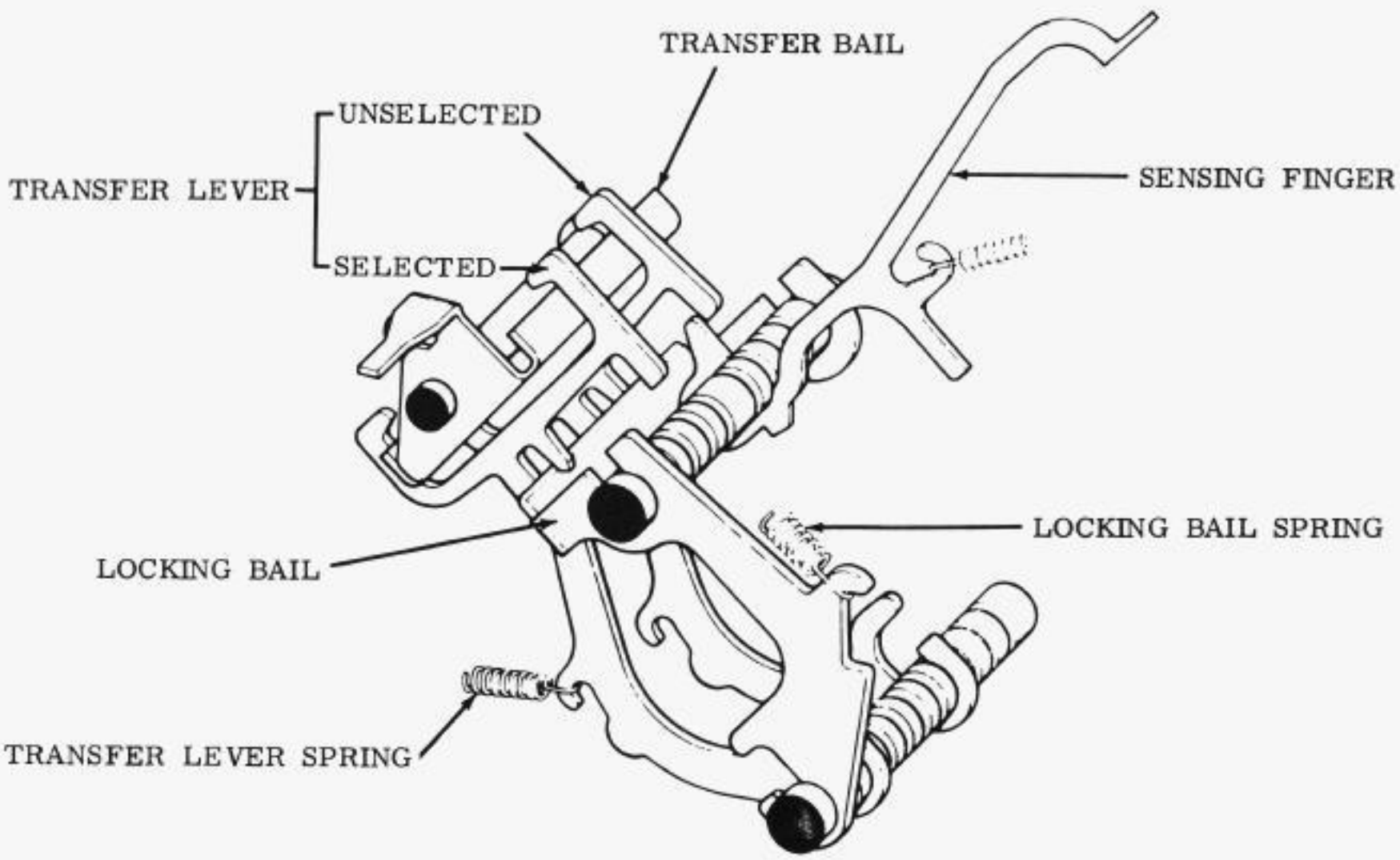


Figure 13 - Locking Bail and Transfer Lever Mechanisms

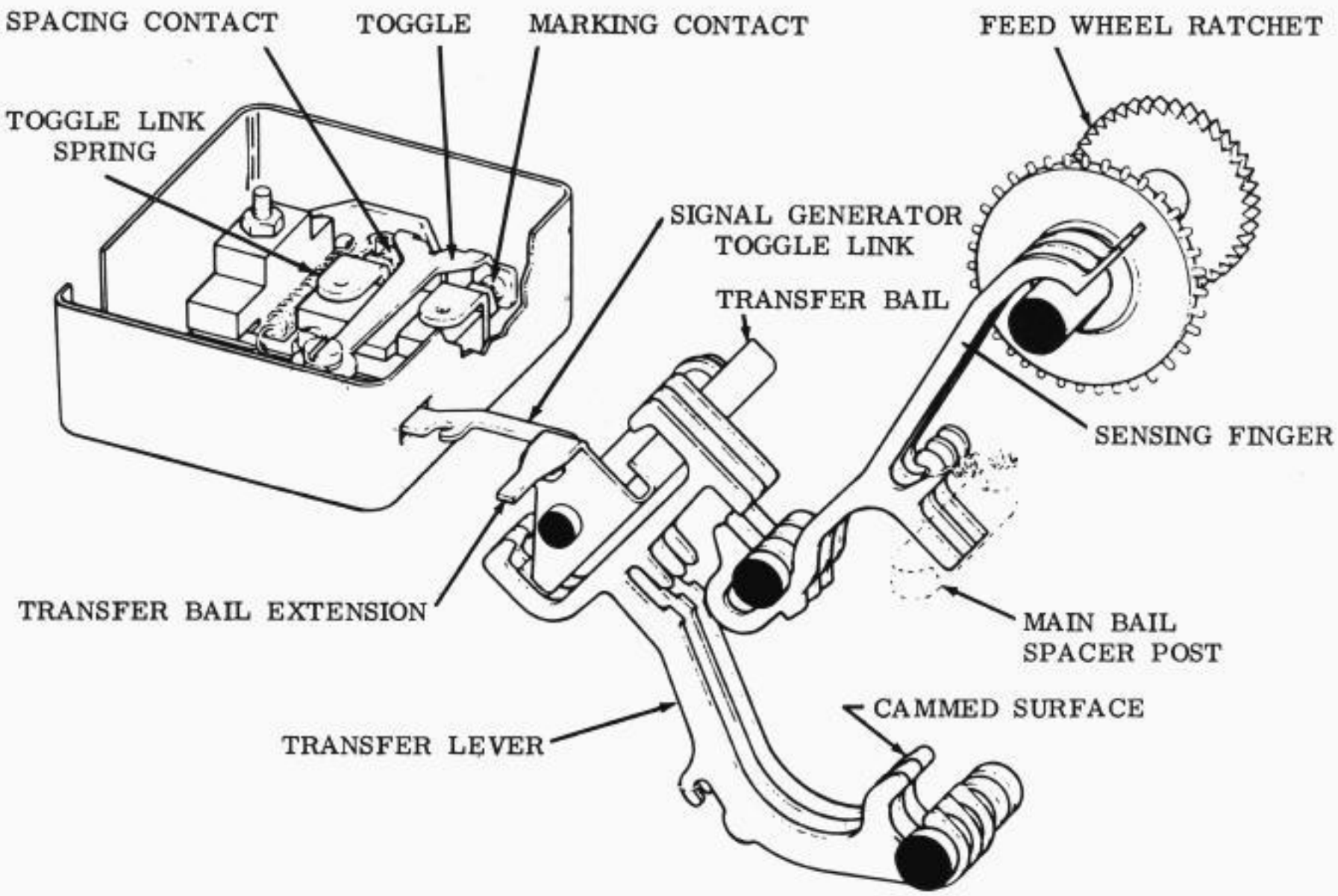


Figure 14 - Transfer Lever and Signal Generator Mechanisms

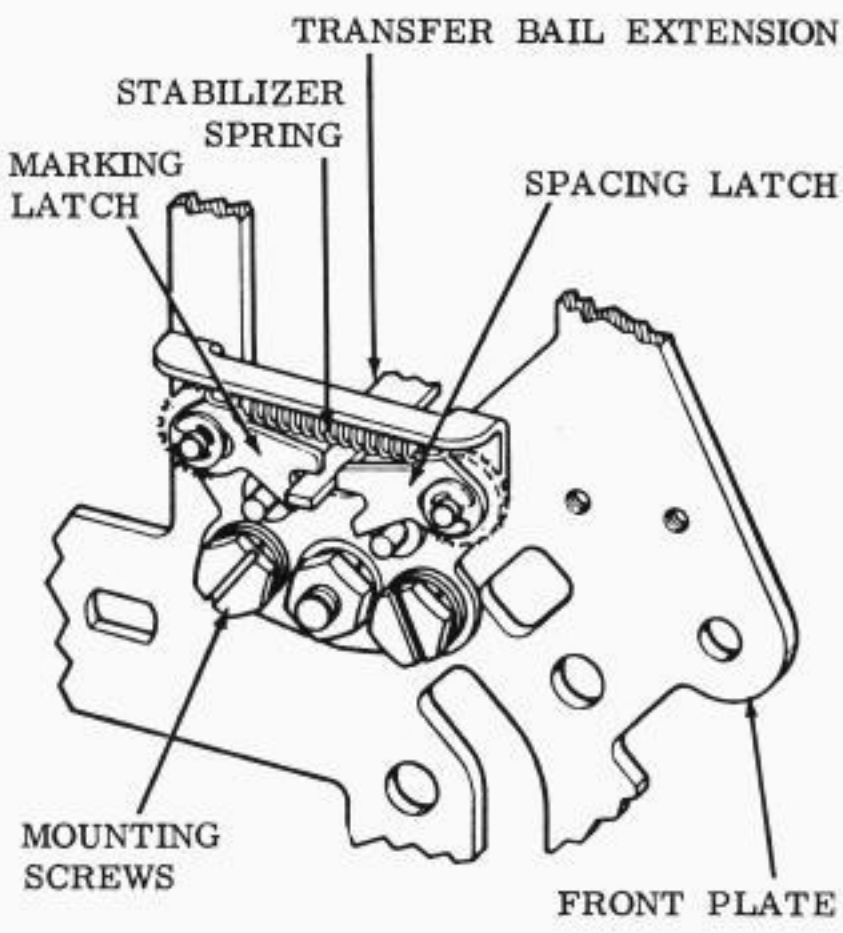


Figure 15 - Transfer Bail Stabilizer

lever hooks the upper side of the transfer bail and causes it to move clockwise. All transfer levers except the start and stop are arranged to move in two directions. The forked end of these eight levers can be moved from the spacing position to the marking position by the associated sensing levers. The transfer levers are also moved downward and to the right in a sequence that is timed to actuate the transfer bail in accordance with the 11.0 unit transmission pattern (Figure 6). The transfer bail extension moves the signal generator toggle link which causes the toggle to open the marking contact and close the spacing contact in the signal generator contact assembly (Figure 14). The extension, in moving to the spacing position, forces the marking latch on the stabilizer (Figures 14 and 15) out of its way and continues its travel far enough to let the spacing latch fall into the latching position simulating a detent action.

F. First Pulse

3.11 As the shaft rotates further, the cam for the first pulse moves its transfer lever downward and toward the right. Depending on

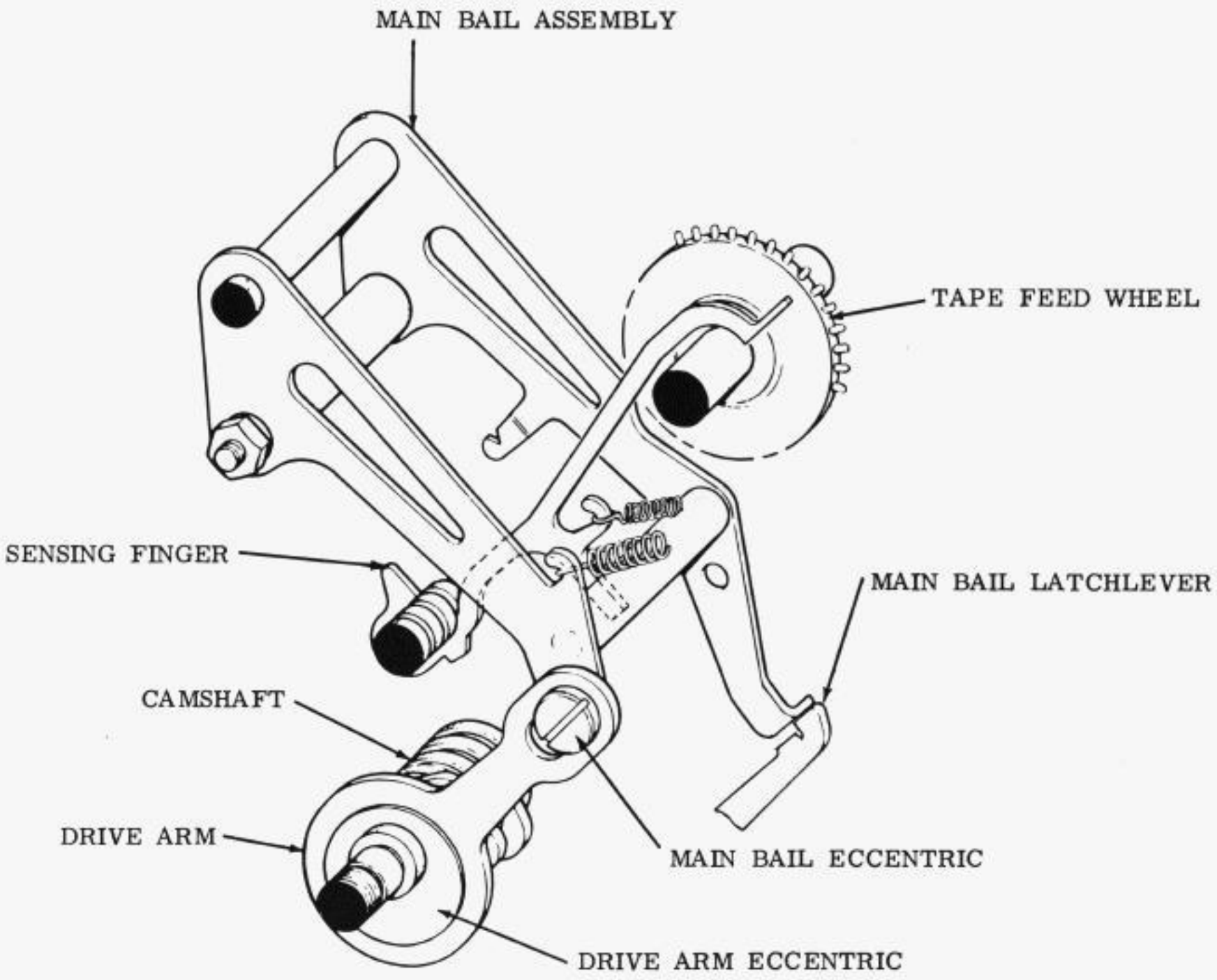


Figure 16 - Main Bail and Drive Arm Mechanism

the position of the transfer lever finger (upper fork engaging bail-marking), the transfer bail is rotated if the pulse to be transmitted is not the same as the preceding pulse. If the preceding pulse is the same, no action occurs because the bail has been previously rotated. If the preceding pulse was different, the extension on the transfer bail moves the toggle link and causes the toggle to open the closed contact and close the open contact.

G. Succeeding Pulses

3.12 The remaining pulses are generated in the same manner as the first. The action is repeated as each cam moves its associated transfer lever in sequence.

H. Stop Pulse

3.13 The stop pulse cam follows the eighth pulse cam as the main shaft is completing its cycle. Again the action is the same as that for the first pulse, except that, since the stop pulse has no sensing finger and its transfer lever is blocked, its lower finger always hooks the transfer bail resulting in a marking pulse on the completion of each character.

I. Main Bail Drive Arm

3.14 As the cam for the first pulse starts its action, the drive arm eccentric (Figure 16) starts to cam the drive arm downward. The drive arm pulls on the eccentric stud of the

main bail causing the main bail to pivot downward to complete the operations initiated when the main bail was originally released.

3.15 The main bail in pivoting downward withdraws the sensing fingers that are extended.

3.16 It pulls down on the tape feed pawl advancing the card or tape to the next set of perforations.

3.17 The main bail is moved to its latching position, however, it does not latch since the card or tape is still in the guide and the latch is held in the nonlatching position by the armature bail extension.

J. Tape Feed

3.18 The feed pawl advances the feed ratchet one tooth against the action of the ratchet detent roller. The feed ratchet is part of the center feed wheel. Therefore, the center feed wheel advances the tape or card by one character position. Since the forward feed wheel is geared to the center feed wheel, it follows through the same motion as the center wheel aiding in the movement of the card or tape.

K. Repeating the Feed Action

3.19 Since the clutch tripbail does not latch, the drive arm moves again to its upper position. In so doing, repetition occurs when the main bail swings upward and the main shaft starts to rotate, until the unit runs out of cards or tape.

L. Card-Out or Tape-Out Sensing

3.20 The code sensing fingers cannot distinguish between a perforation in the card or tape or the end of a card or tape. In order to stop the action at the end of a card or tape, the lever or pin of the card-out sensing finger, which is normally held down by the unperforated portion of the card or tape, is forced up by spring tension. The extension of the card-out sensing finger changes the position of the card-out switch and consequently the reader clutch magnet becomes de-energized and releases its armature. This permits the armature extension to pivot out of its position of blocking the main bail lever latch. The main bail lever latches the main bail (Figure 16). The latched main bail permits the clutch trip lever to block the clutch shoe lever. When the clutch is blocked, the inertia of the mechanism causes the clutch to rotate far enough to permit its latch to fall into the notch on the clutch cam disc.

CLUTCH OPERATION

A. Clutch Engagement

3.21 The clutch is engaged (Figure 17) by releasing the lower end of lever B. The upper end of lever B pivots about its ear C (which bears against the upper end of the secondary shoe) and moves its ear D, and the upper end of the primary shoe, toward the left until the shoe makes contact with the drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward, so that it again makes contact with the drum, this time at point F. There the combined forces acting on the primary shoe causes it to push against the secondary shoe at point G. The lower end of the secondary shoe then bears against the drum at point H. The revolving drum acts to drive this shoe upward so that it again makes contact with the drum at point I. Since the forces involved are multiplied at each succeeding step, the final force developed at point I is great. This force is applied to the lug J on the clutch cam disc to cause it to turn in step with the drum. The cam disc on the clutch is connected to the camshaft imparting rotary motion to the cam assembly.

B. Clutch Disengagement

3.22 The clutch is disengaged (Figure 18) by bringing together lug A on the clutch cam disc, and the lower end of the clutch shoe lever B. The upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum.

LID OPERATION

A. Opening

3.23 The hinged portion of the top plate is called the lid (Figure 3). With the tape card switch in card position and no card or tape inserted, the lid is in its spring loaded upward open position. In this position, the center feed wheel and the card-out sensing finger are below the surface of the lid and a card can be inserted into the reader. The open lid will deflect the card over the top of the feed wheel pins and the card-out pin. When the lid is open, the functional edge of the card stop (Figure 2) extends

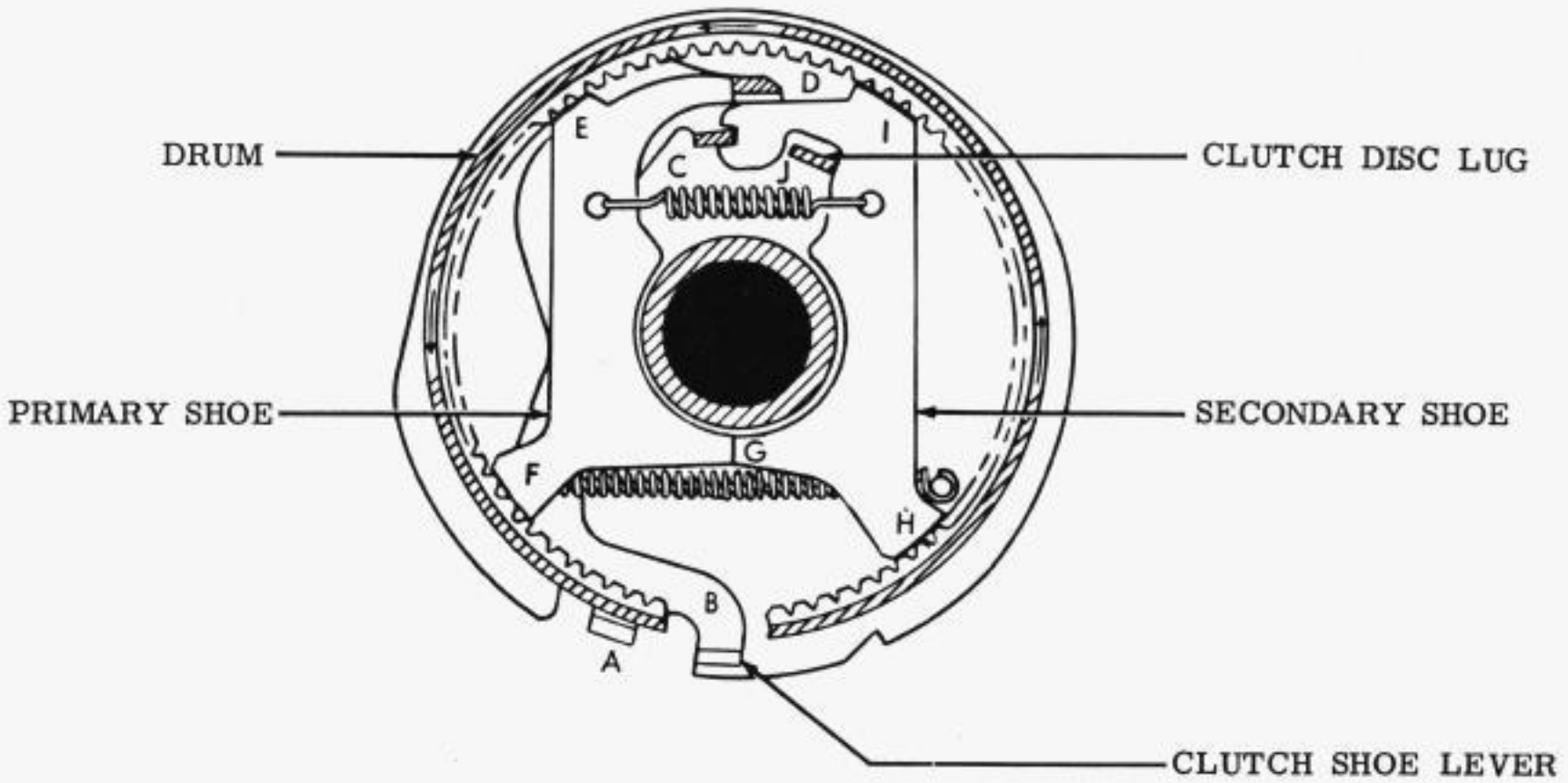


Figure 17 - Clutch — Engaged

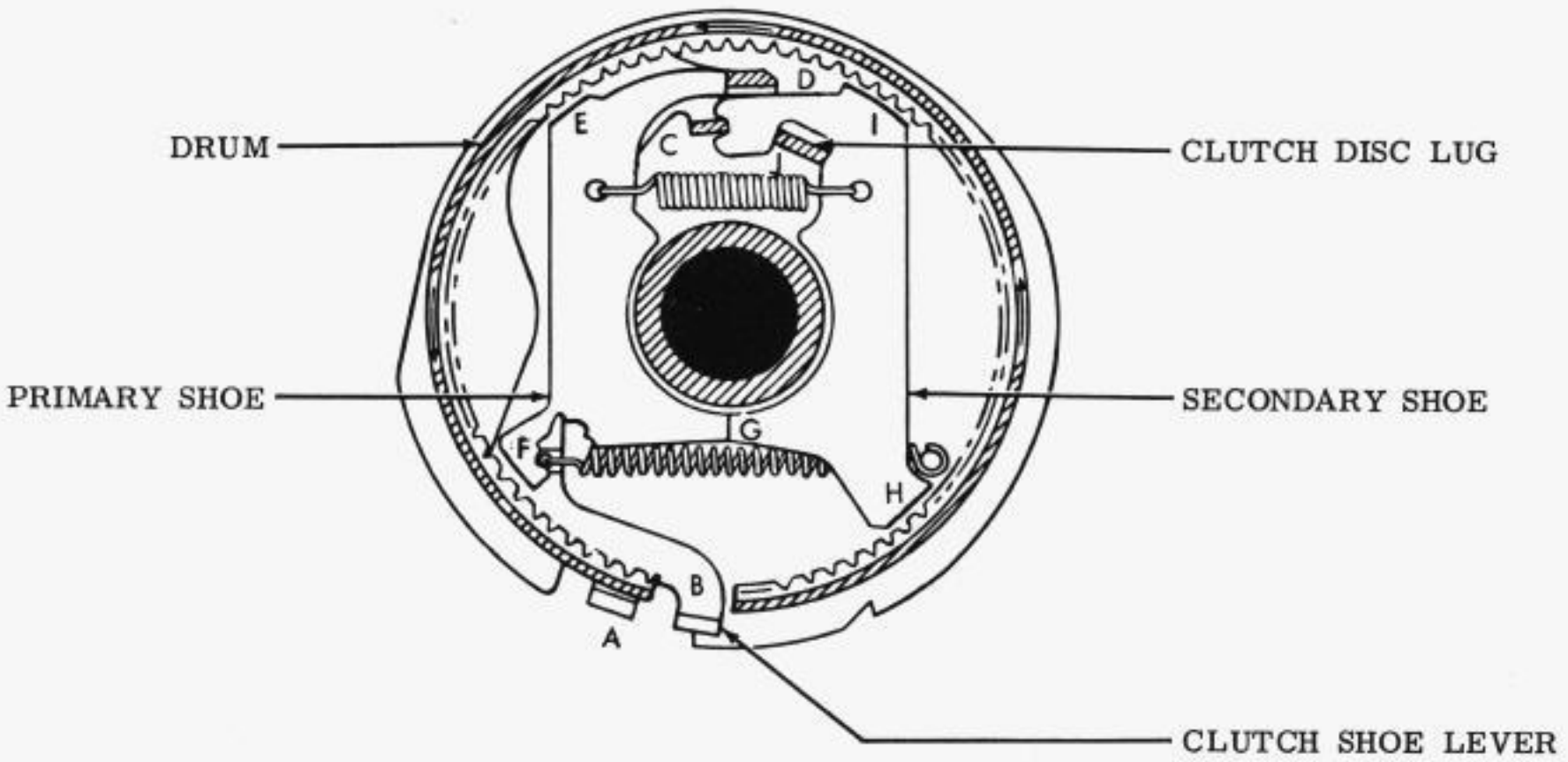


Figure 18 - Clutch — Disengaged

below the surface of the lid intersecting the path of the inserted card and stopping the card from being inserted any further. In its normally adjusted position, the card stop will have left the card in a position where, if the lid were pulled down, the sensing fingers would be lined up with the perforations of the first character in the card and the pins of the feed wheel would engage smoothly with the feed holes in the card.

B. Closing

3.24 As the lid is pulled down by the lid solenoid (Figure 5), the feed pins of the feed wheel engage with the feed holes in the card. At that time the front edge of the card is pulled down below the retaining edge of the card stop. The card is then free to be advanced by the feed wheel. With no card in the reader and the lid in its down position, the pin and the lever of the card-out sensing finger would project through openings in the lid. As the lid comes down, it pushes the card against the pin of the card-out sensing finger.

EJECTION OF CARDS

3.25 As a card advances during the reading process, it passes over the eject switch lever depressing it, which in turn closes the eject switch. When the eject switch is closed, the unit can eject a card at a signal. At the signal the eject solenoid becomes energized. The solenoid plunger pulls into the coil. The motion is transmitted from the plunger through a lever and link to the ratchet clutch bail. The ratchet clutch bail pivots. By pivoting one extension of the bail, it lifts the feed wheel detent away from the feed wheel ratchet placing the feed wheel into freewheeling. The other extension of the bail pulls away from the clutch release ratchet, which is spring loaded, and engages with the mating ratchet on the feed wheel. The clutch transmits the motion from the constantly turning feed wheel shaft directly to the main feed wheel and the card is ejected at a fast rate. As the rear edge of the card moves past the eject switch lever, the lever is forced up opening the eject switch contact causing the eject solenoid to become de-energized. The spring loaded clutch bail pivots and while one of its extensions makes contact with the camming surface of the clutch release, the other extension allows the detent to return to the feed wheel ratchet. The clutch release cam coming into contact with the extension of the clutch bail, causes the clutch release to be cammed out of engagement with the clutch ratchet on the feed wheel. With the opening of the eject switch, the lid solenoid also becomes de-energized and allows the lid to open. This conditions the reader to accept a new card.

CARD-TAPE SWITCH LEVER

A. Tape Operation

3.26 The reader can be switched into the tape mode condition by means of the card-tape switch lever. It will then be able to accept a one inch wide, 8-level tape. When the card-tape switch lever is switched to the tape position (which is identified by a T designation on the top plate) a cam which had previously held the tape guides below the surface of the top plate is pivoted out of contact with the guides. The guides are allowed to protrude above the surface of the top plate. At the same time the lower end of the card-tape switch lever operates a switch which causes the lid solenoid to be energized pulling the lid down.

B. Tape Start

3.27 Manual insertion of a tape can be accomplished when the lid is down and by using the hand wheel in the top plate to turn the feed wheels. By inserting the tape, an extension of the card-out actuator is depressed and the reader becomes conditioned to read the tape. Depressing the START pushbutton will start the reading cycle.

C. Tape Stop

3.28 As soon as the end of the tape has passed over the tape extension of the card-out actuator, the reader will stop the reading cycle. The end of the tape is still engaged in the forward feed wheel of the reader since the fast ejection of a card is not applicable to tape. The tape has to be removed from the reader by again using the hand wheel. The reader will remain in the tape oriented condition as long as the card-tape switch lever is left in the tape position.

D. Card Operation

3.29 The reader can be switched into the card mode condition (which is identified by a C designation on the top plate) by means of the card-tape switch lever. The cam connected to the lever will retract the tape guides to a position below the surface of the top plate. The switch lever at the same time causes a switch to de-energize the lid solenoid allowing the

spring loaded lid to move to its open position. This is the idle position of the reader when conditioned to read cards. When a card is inserted into the reader, the process followed is as described in previous paragraphs covering LID OPERATION.

3.30 The reader can either accept cards which are inserted manually or it can accept cards fed automatically from an automatic feed hopper (edge punched card feeder).

Manual

3.31 When a card is inserted into the reader manually, the card is pushed to the card stop. However, the lid solenoid will not be energized until the manual START button in the top plate is pushed or an external start signal is received. This serves as a precaution against a premature triggering of the reading process because of the uncontrollable speed of manual insertion of a card. At the same time, it allows the card to be in a position, ready for reading, from which the reading cycle can be started instantly either by local or external control.

Automatic

3.32 In the automatic feed mode, the card is inserted into the reader at a constant and known speed from the feeder unit. In this case the card-in actuator is used to signal that a card has been inserted. The lid solenoid will energize and the reading cycle will start immediately after complete insertion of the card. In the automatic feed mode, the reader will call for a new card as soon as the ejection of a card begins.

E. Card or Tape Stop

3.33 Any time during the reading cycle, the action may be stopped by pushing the manual STOP switch in the top plate or by an outside source. This stopping of the reading cycle applies to both cards or tapes. If the reading is stopped, the lid will remain in the down position. With a card or tape in the reader and the lid in the down position, the card or tape may be moved to any desired position by means of the feed wheel. If a card is moved backward past its starting position until the card-out actuator is allowed to come up, the lid solenoid will de-energize and the reader will assume its idle condition. If the card is moved forward with its last code hole position passing the sensing area, the card-out actuator will again be allowed to come up but now the eject solenoid will be energized and the card will be ejected from the reader at a fast rate as described in a previous paragraph EJECTION OF CARDS.

ELECTRICAL CIRCUITS

3.34 Grouping of Main Circuit Elements

(a) The manual controls consist of the START switch, the STOP switch, the EJECT switch, and the card-tape switch.

(b) The card operated contacts are comprised of the card-in contact, the card-out contact, and the eject contact.

(c) The two relays are the start relay K1 and the eject relay K2.

(d) The lid solenoid and the eject solenoid are the mechanical output devices.

(e) The signal output components include the signal generator contacts, the code reading contacts, and the timing contacts.

(f) The dc power supply consists of an unfiltered bridge rectifier and a center tap for the motor circuit.

A. Controls Located on Top Plate

3.35 The following controls extend through the top plate and are clearly identified. Once operated, they need not be held for their function to continue.

(a) START Switch - The START switch is a momentary action pushbutton switch, the make side of which is employed in this application. Its single function is to provide a path for the energizing of relay K1.

(b) STOP Switch - This switch is physically identical to the START switch. The break contact is used to de-energize relay K1 and K2.

(c) EJECT Switch - The EJECT switch is the same type as the START and STOP switches. The make side is used to energize relay K2 if the eject contact has been closed by the card.

(d) Tape-Card Switch - This switch is a two circuit switch. The make side is used to energize the lid solenoid H. With this switch operated, the lid solenoid will remain ener-

gized until the tape-card lever is returned to the card position.

B. Sensing Controls

3.36 These contacts are operated by levers which protrude through slots in the top plate. These assemblies are swinger-type leaf contact pile-ups. Primarily, this group senses the position of the card on the top plate.

(a) Card-In Contact - This contact senses the presence of a card in the reading area. Depressing the START switch will initiate the reading cycle only if the card-in contact is operated.

(b) Card-Out Contact - This contact senses the end of the card as it passes out of the reading area. The relay K2 will then energize and activate the eject solenoid.

(c) Eject Contact - The eject contact has two functions: (a) It prevents the energizing of the eject solenoid while a card is being inserted into the reading area. (b) It detects the end of the card and signals the end of the eject cycle.

C. Relays

3.37 The relays serve to control the operation of the two solenoids and the clutch trip magnets. Both relays are mounted on a common circuit card located on the underside of the unit.

(a) Start Relay (K1) - The start relay provides the starting and holding path for the reader clutch magnets through its contact K1-2. Relay K1 also provides the path for energizing the lid solenoid H through contact K1-4.

(b) Eject Relay (K2) - The function of the eject relay is to open the reader clutch magnets and energize the eject solenoid through contact K2-3. The operations above occur when the end of a card is sensed or upon receipt of an eject code from the card or external device.

D. Solenoids

3.38 Solenoids are used to provide the motive force for lowering the lid and for initiating the ejection of a card.

(a) The lid solenoid, designated H on the schematic wiring diagram, is a continuous duty 48 volt dc component. Operation of the lid solenoid causes the lid to be drawn down lowering the card onto the feed wheel.

(b) The eject solenoid, identified on the schematic wiring diagram as E, is an intermittent duty component. The purpose of the solenoid is two-fold. When this solenoid is energized, the feed wheel detent becomes disengaged and allows the feed wheel to rotate freely. As this is happening, the solenoid also causes the ratchet clutch to engage and eject the card.

E. Signal Circuit

3.39 The signal circuit consists of signal generator contacts wired to provide neutral operation. A protective circuit is provided across the signal generator contacts to reduce arcing. This circuit can be easily disconnected for low voltage applications and when signal regenerator contacts are employed. However, once the unit has been used in a higher voltage application (standard 0.020 or 0.060 ampere circuits), the contacts must be replaced for low voltage applications.

3.40 In order to insure signal regeneration for the above signal regenerator, the standard signal generator contact points are gold plated. Also, the contact toggle is furnished with a flexible strap wire to electrically bridge the movable toggle and its fixed terminal post. This insures low voltage (3 volt; 70 microampere) signal circuit continuity.

Note: Normally for low voltage applications, gold plated signal generator contacts should be used in circuits operating between 3 and 20 volts dc at a current level not to exceed 60 milliamperes. Between 20 to 70 volts dc the current should be adjusted so as not to exceed a 120 milliwatt power level. The contacts are not normally intended for use on voltages above 70 volts dc. Exceeding this level for an appreciable length of time may result in damage to the gold plating and make the contacts unfit for low voltage applications.

3.41 The signal generator contacts are gold plated for low voltage applications and are connected in series to the external signal regenerator which relays their output to the receiving equipment. The signal regenerator is used to

improve the signal quality obtained from the signal generator. The main component of the circuit is the silicon controlled rectifier (SCR) which is controlled by the timing contacts. These timing contacts are opened by their respective cams in the middle of each generated pulse from the signal generator. They also switch the SCR on or off in accordance with the marking (closed) or spacing (open) condition of the signal generator. The timing contacts are open and the respective signal generator contacts are closed. The gate current is from +20 volts dc through the output load, the zenner and silicon diodes, to the gate turning the SCR on, producing a marking output. The SCR will remain on until the current drops below 8 milliamperes. Since the current can pass through either the signal generator marking contacts or the timing contacts, the SCR stays on until both the timing contacts and the respective signal generator contacts are opened simultaneously. The mark to space transition is triggered by the timing contacts and, therefore, the output of the SCR is as good as the timing of these contacts.

F. Parallel Circuits

3.42 The parallel wire circuits consist of parallel contacts, plus a make-before-break auxiliary contact. The associated cable provides a parallel signal circuit at the same time that the sequential signal is being transmitted.

G. Control Circuits

3.43 The reader electrical system was designed to operate from an internal battery supply or to accept power battery supply from associated equipment. Provisions were made so that two power options are available. A connector is supplied, designated Z on the associated schematic wiring diagram, to which straps may be added or deleted to obtain these options.

(a) A center tapped winding in the motor of the reader provides the alternating current which is rectified to 48 volts dc by a diode bridge rectifier located in the unit. To prepare the reader to operate from an internal supply, it is necessary to connect straps between Z11 and Z23, Z13 and Z25. When operating with an automatic card feeder, a strap will be required between Z7 and Z20. Refer to the associated schematic wiring diagram.

(b) To operate from an external 48 volt dc source, straps from Z11 to Z23 and Z13 to Z25 should be removed. Removal of these straps will disconnect the internal 48 volt dc supply. The external 48 volt dc supply is brought into the 50-pin connector. The negative line connects to B22 and the positive line to B23 as shown on associated schematic wiring diagram.

H. Hand Fed Operation

3.44 To operate as a self-contained hand fed card reader, the Z connector is set up as shown on the associated schematic wiring diagram.

(a) The card to be read is inserted into the reader and pushed against the card stop. As the card enters the reading area, it causes the card-in contacts to transfer. This transfer allows relay K2 to become energized. Relay K2 holds through the card-out contact W and the card-in contact V. The common relay contact K2-3 in the transmitter clutch magnet and eject solenoid circuit has now been transferred. The transmitter clutch magnet A will be prevented from energizing until relay K2 releases. Although K2-3 in the eject solenoid circuit is closed, the open eject contact AA prevents E from pulling in. This provision keeps the feed wheel from being in motion as the card is brought over the feed pins.

(b) The reader is now conditioned to be started and to read a card. At a momentary depression of the START switch, Y will energize relay K1. Relay K1 will then hold through its contact K1-2.

(c) The contact K1-4 now allows the lid solenoid H to pull in. As the lid solenoid pulls in, the lid is drawn down and forces the card against the card-out contact W. As contact W transfers, relay K2 becomes de-energized. With the release of relay K2, transfer contacts K2-3 allow the transmitter clutch magnets to energize and hold through K1-2.

(d) The edge punched card is fed and the information distributed in the normal manner. When the card has been fed about thirteen characters, the eject contact AA will close. A card may now be ejected either by code or manually.

(e) The parallel wire output can be connected in a manner which will allow rapid ejection of a card when a given code is sensed. Upon receipt of the eject code, a positive connection is made to relay K2 through B36. Relay K2 pulls in and holds through its contact K2-1 and through the eject contact AA.

(f) The card is now ejected from the unit at a rate which is approximately twenty times the normal line speed. The card continues to be ejected until its trailing edge passes the eject contact. This event causes the hold paths for relay K2 and the eject solenoid to be broken. Relay K1 and the lid solenoid also de-energize at this time. All circuits have now been returned to their unoperated condition and the unit is ready for recycling.

(g) During the reading of a card, the reader may be stopped at any time by depressing the STOP switch. With the operation of the STOP switch, relay K1 will de-energize and open its contact K1-2. Since K1-2 is the holding path for the reader clutch magnets, transmission stops.

(h) Operating the START switch restarts transmission. The START switch reenergizes relay K1. The pickup of K1 closes the hold circuit for the reader clutch magnet A.

(i) Ejection of a card may be externally initiated. If a connection to the plus side of the power supply of at least a 20 millisecond duration is supplied to B36, the relay K2 will energize. Ejection of the card will then take place in the manner described for coded ejection.

(j) If neither a code nor pulse is used to energize relay K2, ejection of the card will occur automatically when the trailing edge of the card reaches the sensing area. As the card passes beyond the card-out contact W, the relay K2 is energized through the transfer of W. Contact K2-3 stops transmission and pulls in the eject solenoid. Rapid ejection then occurs as described above.

I. Manual Ejection of a Card

3.45 Manual ejection of a card can be obtained by depressing the EJECT switch. Since the eject solenoid is held energized through the eject contact, a card cannot be ejected until the eject contact closes. It will take approximately thirteen characters to feed the card far enough to close the eject contact. Pressing the manual EJECT switch energizes relay K2. The eject solenoid will pull in and the card will eject as described above. The EJECT switch should not be depressed while the reader clutch is engaged. Activating the eject solenoid at this time may cause the sensing fingers to damage the code holes in the card.

J. Diodes

3.46 A number of diodes are included on the reader printed circuit card for the following purposes.

(a) The CR-1 diode is associated with the hopper feed relay. Its use here is to prevent the relay K2 from energizing while there is no card in the unit.

(b) The CR-2 diode prevents the hopper feed relay from remaining energized when a card is inserted into the unit.

(c) The CR-3 diode is used to protect switch Y from the heavy starting load of the reader clutch magnets. As connected, Y will energize only relay K1. The reader clutch magnets will energize only through contact K1-2.

(d) The CR-4 diode is associated with the tape feature. It allows relay K1 to drop out when the card-out contact senses the end of a tape.

(e) The CR5 causes a delayed drop out of relay K1.

(f) The CR6 is used as a blocking diode associated with a synchronization assurance modification kit.

K. Tapes

3.47 A one-inch wide tape may also be read in this unit. Operating the card-tape switch S to the tape position, will energize and hold the lid solenoid. The lid will remain down until the card-tape switch is returned to the card position.

(a) A tape is manually inserted into the unit and brought into the reading area by means of the thumb wheel. The tape passing over the card-out contact W causes it to transfer

(b) Depressing the START switch energizes relay K1 providing the hold path for the reader clutch magnets. The clutch magnets now hold through K1-2, the card-out contact, and the card-tape switch.

(c) When the card-out contact senses the end of the tape, it transfers to its unoperated condition. K1 and the reader clutch magnets de-energize.

L. Operation from an Automatic Edge Punched Card Feeder

3.48 Operation from an automatic edge punched card feed unit requires that a strap be placed on the Z connector between points 7 and 20 as shown on associated wiring diagram.

(a) Connection to the edge punched card feed relay is made in the fifty pin connector at points B37 and B38. The function of this relay is to control two solenoids which are located in the edge punched card feed unit. These solenoids operate the card feeding device.

(b) When a card is delivered to the reader from the feed unit, the card-in contact transfers. Relay K2 energizes through the card-out and card-in contacts. With contact K2-2 closed and the strap between Z7 and Z20 in place, relay K1 will energize. K1 will pull in the lid solenoid. Reading will take place as described above.

(c) The first card supplied by the feeder to the reader is inserted into the reader until the card-in contact is operated. The normally closed side of the card-in contact opens de-energizing the edge punched card feeder relay and causing the edge punched card feeder to stop feeding. A contact called the roller switch in the feeder unit prevents the reader lid from operating until the feeding has stopped. This assures the complete positioning of the card by the feeder before sensing begins.

(d) In order to save signal line time, a card is fed into the reader while the previous card is being ejected. When the eject relay K2 is energized, the feeder feed relay is picked up. On an advance feed, the path for the feeder feed relay is through CR1, K2-1 and the eject contact AA.

M. External Source

3.49 In some cases it may be desirable to control the starting, stopping, and ejection of cards from an external source such as an Automatic Send-Receive Set.

(a) To directly control the starting and stopping of the reader clutch magnets by means of an external contact, remove the strap between B6 and B35. Positive controlling voltage must then be supplied to the clutch magnets through B6.

(b) If the parallel wire output contacts are not being used to perform other functions, they may be used for recognizing a card eject code. When used in this manner, the parallel contacts should be connected between B20 and B36.

(c) In the event the parallel contacts are being used elsewhere, positive eject pulses may be fed to relay K2 at B36.

(d) A momentarily opened stunt box contact may be inserted at B19 and B18. This contact will act to stop the reader when the contact is operated by a code in the stunt box.

(e) To restart the reader by a stunt box code, insert a momentarily closed contact between B21 and B39. As this contact pulses, the relay K1 will start the reader clutch magnets.

(f) Connector termination B34 may be used as an indication of the presence or absence of a card in the reading area. Terminal B34 is connected to the positive side of the power supply through the card-in contacts when there is no card in the reader.