35 EDGE PUNCHED CARD TYPING REPERFORATOR

(1A CARD REPERFORATOR)

DESCRIPTION AND PRINCIPLES OF OPERATION

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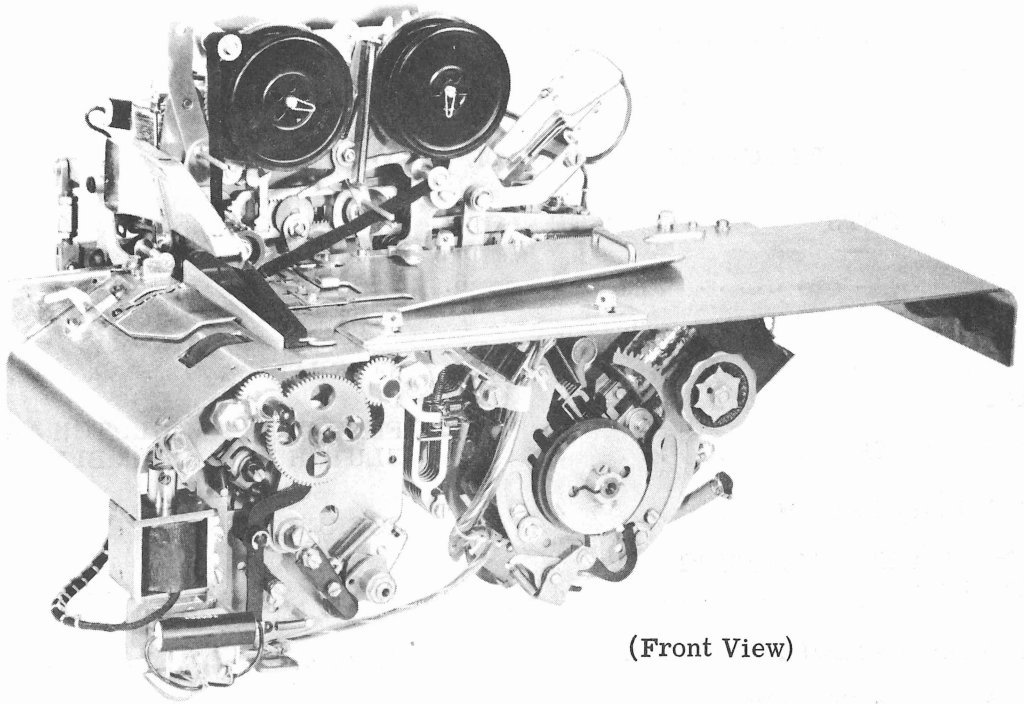
Prepared for American Telephone and Telegraph Company by Teletype Corporation



(Front View)

Figure 1 - 35 Edge Punched Card Typing Reperforator

1. GENERAL

1.01 This section contains the description and principles of operation for the 35 Edge Punched Card Typing Reperforator (1A CARD REPERFORATOR — Figure 1). The section has been reissued to incorporate engineering changes. Marginal arrows indicate the changes and additions.

1.02 The unit is capable of perforating edge punched cards (either individual cards or fanfolded stock having prepunched feed holes). The feed hole - code hole grid arrangement standardized for paper tape is maintained. Printing (interpretation) conforms to the ASCII code and occurs along the upper edge of the card above and six characters behind the corresponding code perforations. This should be considered when preparing a card for transmission. The end of the card should include all of the printed characters in the message, and the first character of the message must be preceded by at least six sets of code perforations. Sixty-four printing graphics are available.

1.03 Perforated code holes correspond to marking bits and unperforated code positions correspond to spacing bits. Reading from the rear as the card feeds from the punch block, the code positions in the card are: 1, 2, 3, feed hole, 4, 5, 6, 7, and 8 bits.

1.04 The unit is a component of a Send-Receive Set or a Receive-Only Set and is equipped to receive information in the 8-level American Standard Code for Information Interchange (ASCII). See the applicable section for a detailed explanation of this code. The signaling code is an 8-level, 11.0 unit code signal at 100 words per minute (110 baud).

1.05 A 500-milliampere selector provided in the unit plus other associated components of the set complete the circuit to the signal line. The signal line current is 0.020 ampere.

1.06 Printing is suppressed for codes not associated with the printing graphics. Print suppression may also be activated by an external signal. Return to the printing condition can be accomplished through manual operation of an externally mounted switch.

1.07 A thumb wheel is provided for manually advancing the card through the punch area.

1.08 A rapid card advance is provided which responds to a preselected code or external signal.

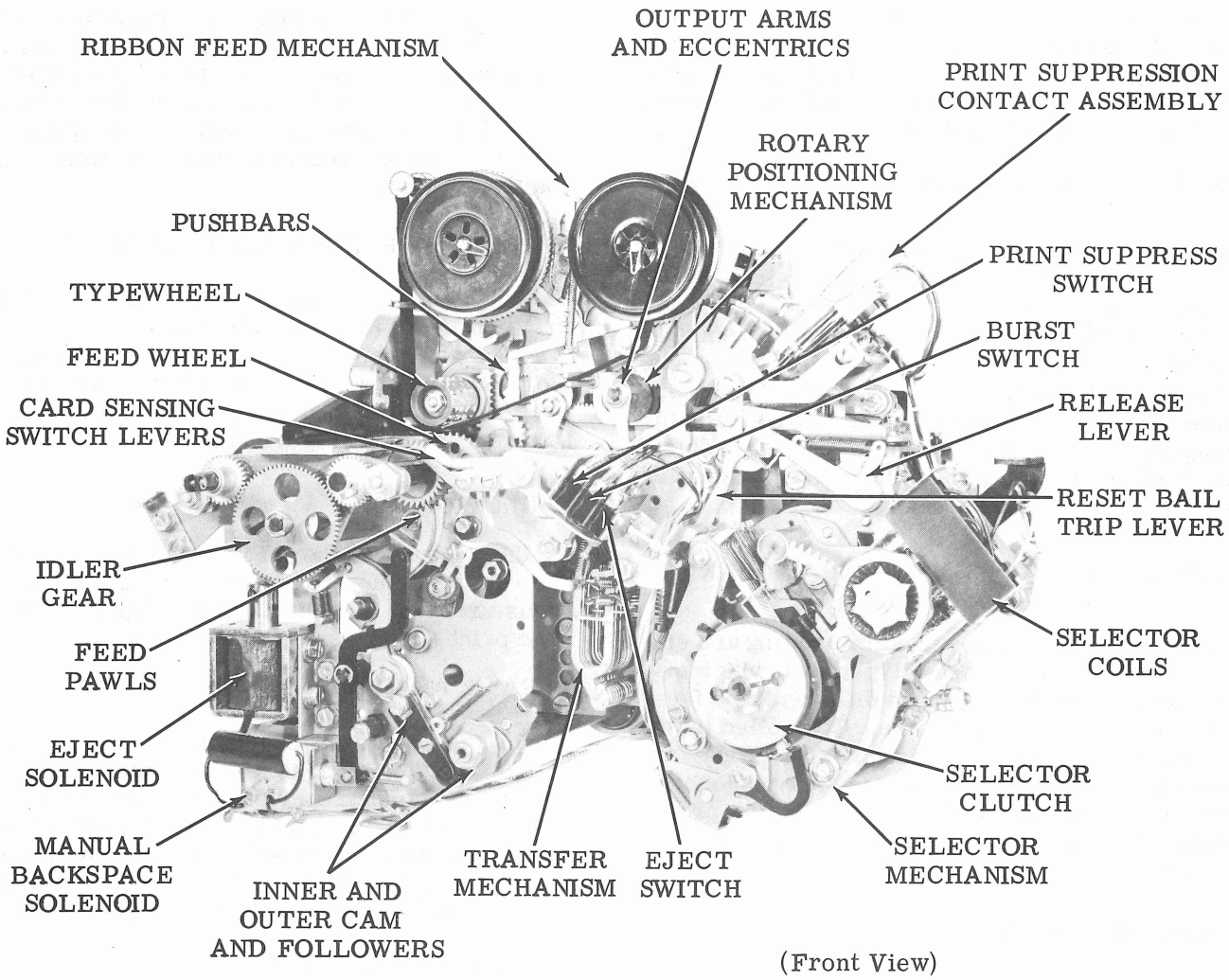


Figure 2 - 35 Edge Punched Card Typing Reperforator (Without Top Plates)

1.09 A sensing mechanism is provided which detects the reference hole in the continuous card stock to align the subsequent card in the punching position. The sensing mechanism also causes separation of the completed card from the continuous stock.

1.10 A null generator contact assembly, where provided, assures synchronization of the rapid card advance operation.

1.11 The unit is able to operate under environmental conditions of 40 degrees to 110 degrees Fahrenheit when supplied with 115 volts ac, ±10%, 60 hertz.

1.12 Unless stated otherwise, references in this section to "left" or "right" indicate the operator's right or left, facing the front of the unit (selector mechanism at the right, punch mechanism at the left). In illustrations, unless noted otherwise, the views show the equipment as viewed from the front. Pivot points are shown by circles or elipses and are drawn solid black to indicate fixed points and crosshatched to indicate floating points.

2. DESCRIPTION

GENERAL

2.01 The following paragraphs describe the mechanisms that comprise the edge punched card typing reperforator and discuss the differences between the several variations of the unit. Refer to Figures 2, 3, 4, and 5.

DRIVE MECHANISM

2.02 Rotary motion from an external source is received by the function and selector shaft assemblies (Figure 4) and distributed by

three cam-clutch assemblies. External gears permit operation at a signaling speed of 100 words per minute. A rocker bail further distributes the motion to the mechanisms involved in printing and perforation.

SELECTING MECHANISM

2.03 A selecting mechanism (Figure 2), which includes a two-coil magnet wired to the signal line, converts the electrical signaling code combinations into mechanical arrangements which govern the printing and perforation operations. The magnets are wired for 0.500 ampere line current furnished by an external selector magnet driver. A rangefinder permits adjustment of the selector in relation to the signaling code.

TYPEWHEEL AND POSITIONING MECHANISMS

2.04 The characters used in printing are embossed on a metal typewheel which may be easily replaced to obtain different type faces and character arrangements. Controlled by the selecting and transfer mechanisms, axial and rotary positioning mechanisms in conjunction with a correcting mechanism select the proper characters by moving the typewheel (Figures 2 and 3).

PRINTING MECHANISM

2.05 A printing mechanism utilizes a hammer to drive the card and inked ribbon against the typewheel and imprint the selected character (Figures 2 and 5). Printing and perforating occur simultaneously at the punch block, but the characters are printed six positions to the right of the corresponding code combinations.

RIBBON FEED MECHANISM

2.06 The ribbon feed mechanism (Figure 2) has two circular ratchets on which the ribbon spools are mounted. A feed pawl which receives its motion from the rocker bail advances the ribbon by rotating a ratchet once each cycle of operation. The direction of ribbon travel is automatically reversed when the supply spool is nearly depleted.

PERFORATING MECHANISM

2.07 The perforating mechanism (Figure 5) contains a punch block, punch pins, and drive parts. The punch pins, contained within the punch block, punch fully perforated code holes in the card in response to mechanical arrangements received from the selector mechanism via punch slides and punch slide latches. A feed hole is perforated each cycle of operation. The mechanism receives its drive from a main bail assembly.

PRINT SUPPRESSION MECHANISM

2.08 The print suppression mechanism (Figure 4) is actuated by contacts in the function box. When the signal code combinations for control functions are received, the contacts will actuate the print suppression mechanism to prevent printing (Figure 22).

FUNCTION BOX

2.09 A function box (Figures 3 and 4) enables the typing reperforator to perform various auxiliary functions, such as the actuation of the print suppression and eject contacts.

FRAME ASSEMBLY

2.10 A cast frame provides mounting facilities for the various mechanisms which comprise the typing reperforator. The frame is in turn mounted on associated equipment through which the necessary electrical and motive power connections are made. A connector for all electrical input requirements is provided.

VARIABLE FEATURES

2.11 A number of variable features are available with the typing reperforator. These features, some of which are described below, enable the unit to perform special operations and may be installed either at the factory or in the field.

(a) Contact Mechanisms: These mechanisms furnish electrical pulses for external use.

(b) Backspace Mechanism: A manual backspace mechanism is used to retract the card in order to erase (obliterate) an error.

(c) Universal Function Blade: This blade contains removable tines so that it may be coded to accommodate a desired function box requirement.

(d) Null Generator Contact: This assembly provides rapid card advance synchronization.

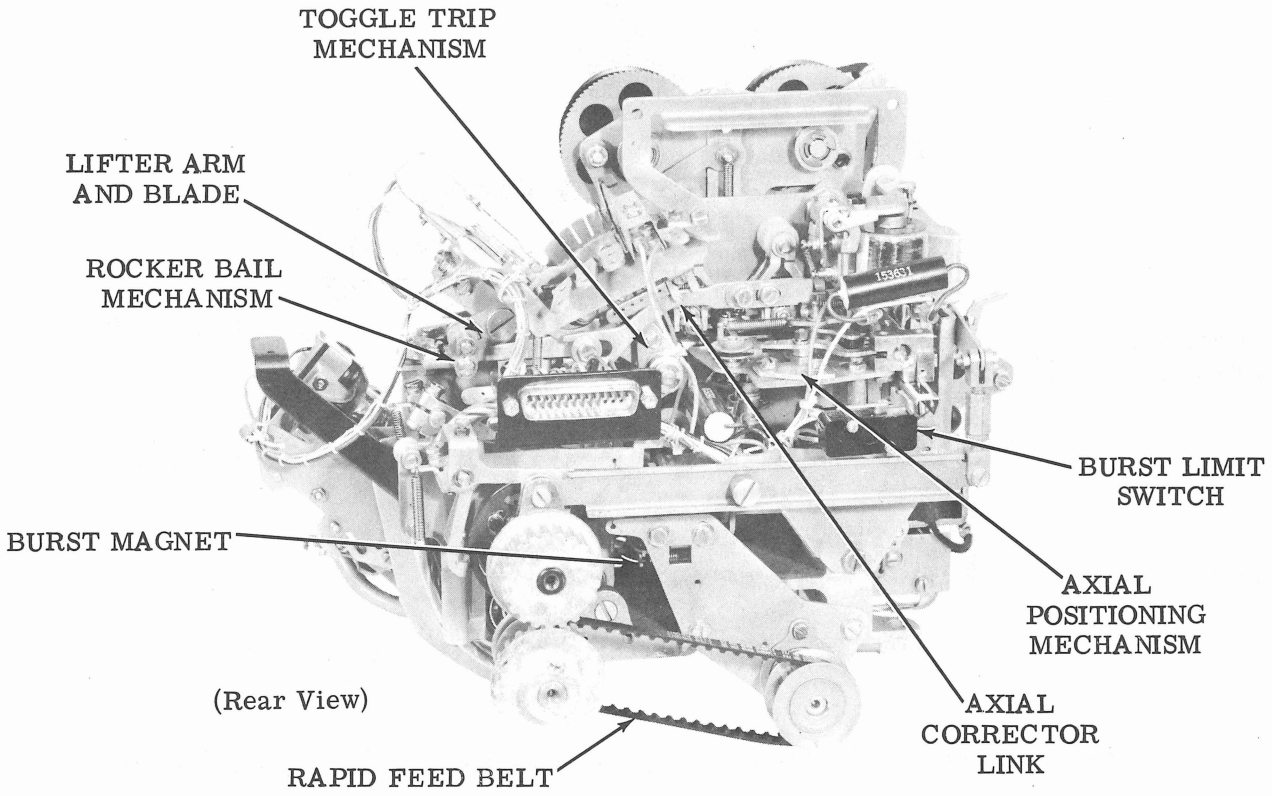


Figure 3 - 35 Edge Punched Card Typing Reperforator (Without Top Plates)

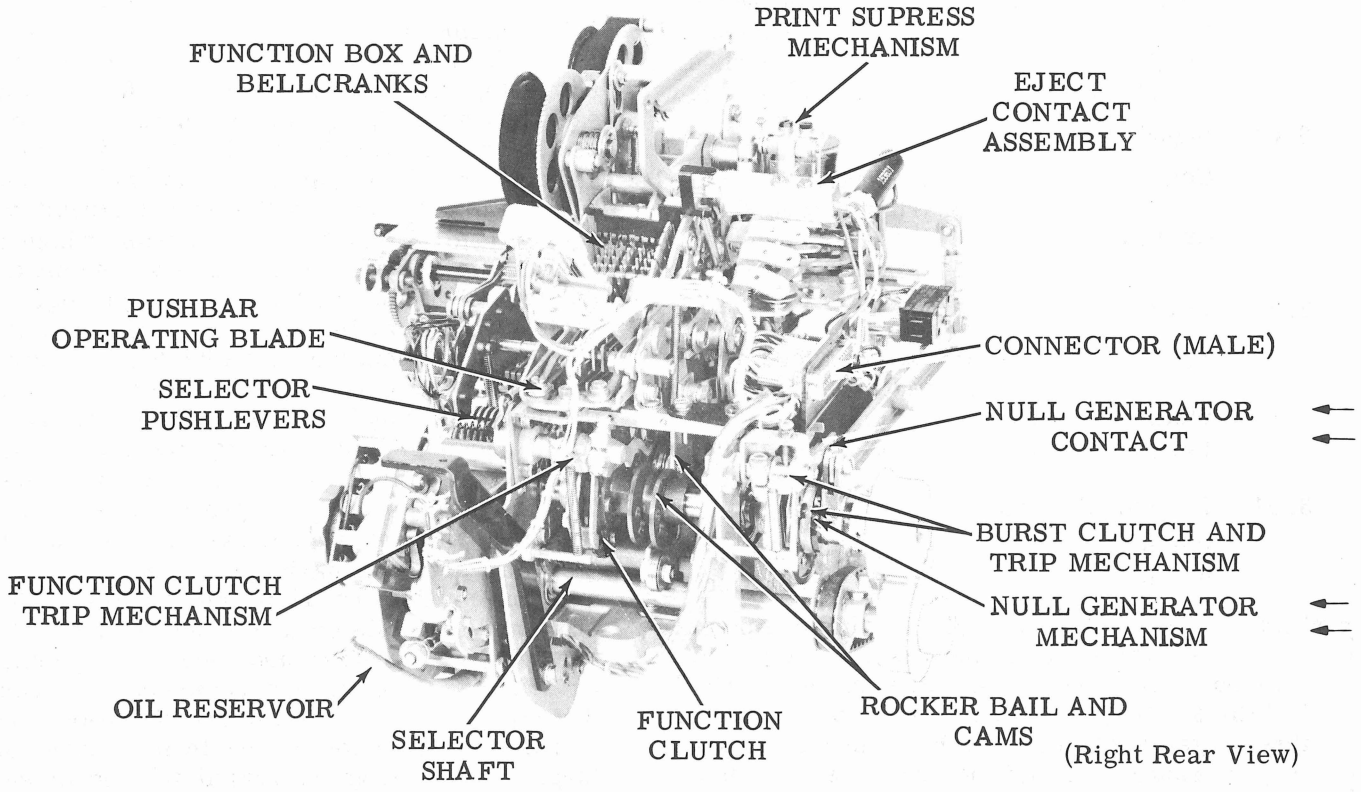


Figure 4 - 35 Edge Punched Card Typing Reperforator (Without Top Plates)

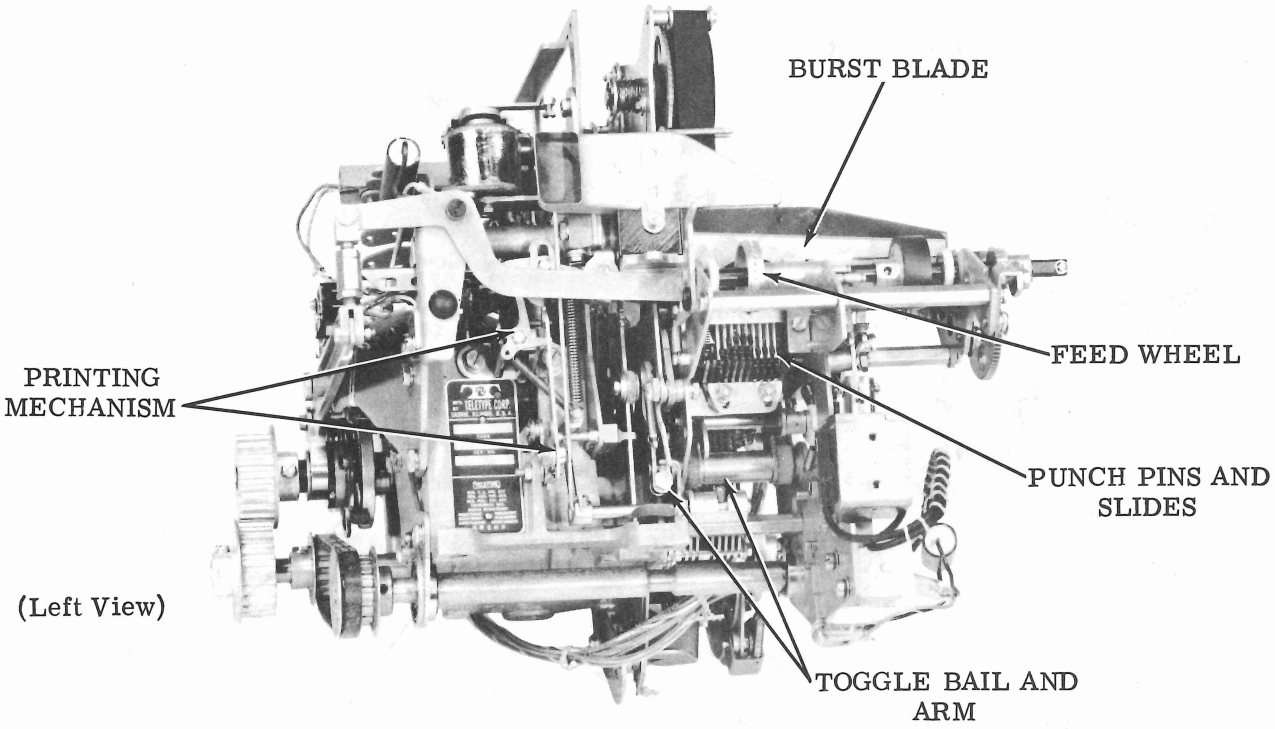


Figure 5 - 35 Edge Punched Card Typing Reperforator (Without Top Plates)

3. TECHNICAL DATA

3.01 Approximate Dimensions

Width	14 inches
Depth	11 inches
Height	8-1/2 inches
Weight	15 pounds

3.02 Signal

Code	Sequential, 11-unit start-stop (See 3.06)
Current	0.500 ampere with selector magnet driver

3.03 Cards

Type	Prepunched feed hole, individual or fanfolded
Width	3 to 3-1/2 inches
Length	7 to 8-1/2 inches

3.04 Printed Characters

Height	0.120 inch
Width	0.069 inch

3.05 Temperature Ranges — This equipment is intended to be operated in a room environment within the temperature range of 40° F to 110° F. Serious damage to it could result if this range is exceeded. In this connection, particular caution should be exercised in using acoustical or other enclosures.

Type style and character arrangement variable.

SIGNALING CODE

3.06 Information is received by the reperforator in the form of an eleven bit, start-stop signaling code (Figure 6) in which each character (graphic) or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking and during which no current flows as spacing. Every combination includes eight bits that carry the intelligence, each of which may be either marking or spacing. In present applications, the eighth bit is always marking. For even parity code transmission, the eighth bit may be either marking or spacing, so that the number of marking bits in the transmitted code is always an even number (Figure 6). The intelligence bits are preceded by a start bit (always spacing) and are followed by two stop bits (always marking). Thus each combination consists of 11.0 units of time. The start and stop bits ensure synchronization between the transmitting and receiving equipment by bringing the receiving equipment to a complete stop at the end of each combination. The marking condition of the eighth bit further enlarges the marking interval at the end of each code combination transmitted.

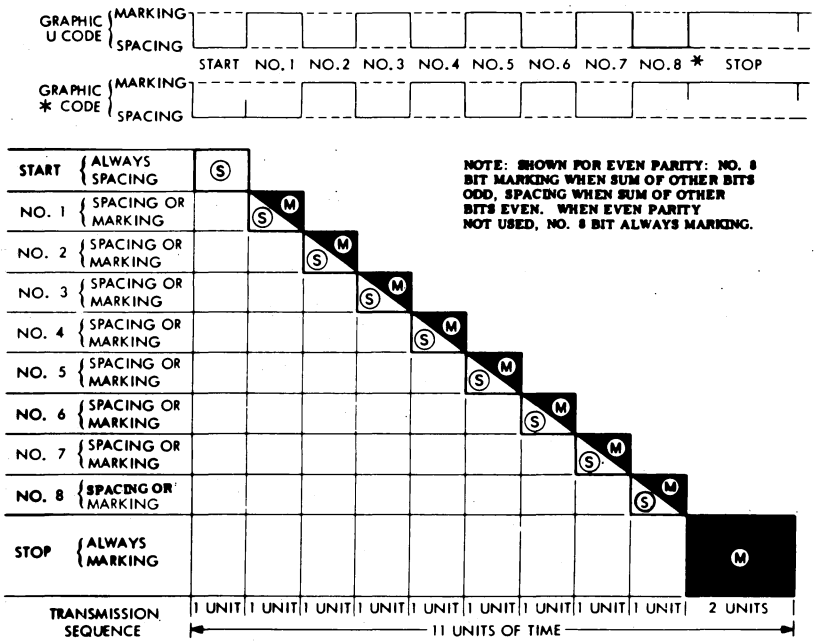


Figure 6 - Signaling Code

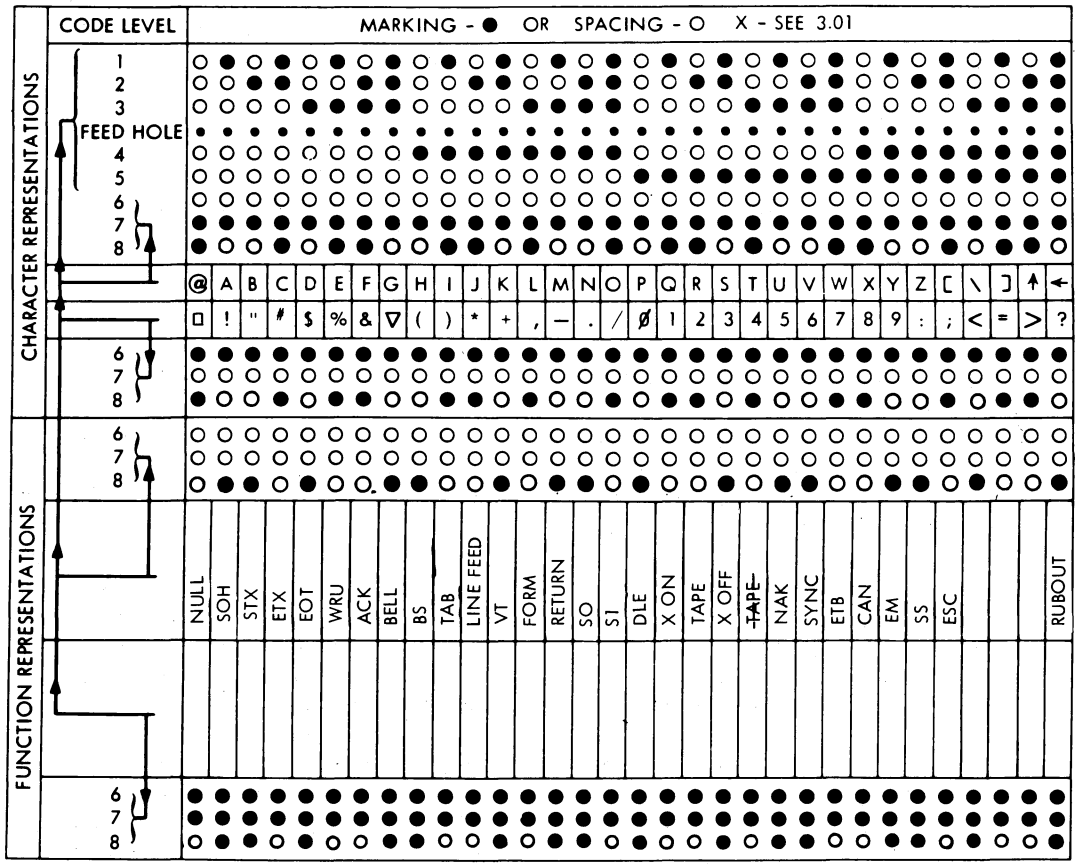


Figure 7 - Code Representations of Characters (Graphics) and Functions

3.07 The code representations for the graphics U and * are illustrated in Figure 6. In these combinations, alternate marking and spacing condition for the intelligence bits are required.

4. PRINCIPLES OF OPERATION

4.01 The relationship of the operating mechanisms of the 35 Edge Punched Card Typing Reperforator Set are illustrated in the pictorial diagram (Figure 8).

4.02 The function shaft assembly (upper) is continuously rotated by means of external power applied to its driven sprocket to provide the rotary motion for the bursting mechanism and for the function cam by means of the function clutch. This rotating shaft in turn provides predetermined controlled motions for the rocker bail of the typewheel positioning mechanism, corrector mechanism, printing mechanism, ribbon feed and corrector mechanism, ribbon feed and reverse mechanisms, and the tape perforating mechanism. Units equipped with a null character generator contact assembly have a cam segment mounted on the burst clutch which activates the generator contacts. The function clutch engagement is controlled through the selector assembly.

4.03 The selector shaft assembly (lower), continuously rotated by means of an external power applied to its driven sprockets, provides motion for the rapid feed mechanism and the selector cam with which the remainder of the selector assembly delivers signal intelligence to the punch mechanism and typewheel positioning mechanism through a transfer mechanism.

4.04 The signaling code combinations, such as the combination representing the graphic U, plotted at the right of Figure 8, are applied to the selecting mechanism. The start bit of each code combination causes the selector, through a trip assembly, to trip the selecting cam-clutch. The selector shaft then imparts motion to the cam-clutch throughout the selecting cycle. The cam-clutch mechanism, in turn, transfers timed motion to the selector, which converts the intelligence bits of the code combination into a corresponding mechanical arrangement. Near the end of the selecting cycle, the cam-clutch actuates the function trip assembly. The latter trips the function cam-clutch to operate the printing and perforating mechanisms. The selecting cam-clutch is then disengaged and remains inoperative until the next code combination is received.

4.05 The function cam-clutch, driven by the function shaft, imparts motion to the rocker bail throughout the function cycle. The rocker bail transfers the motion to the perforating mechanism, the positioning mechanisms, the card feed mechanism, and the printing mechanism.

4.06 The transfer mechanism, having received an arrangement from the selector, causes positioning of the axial and rotary positioning mechanisms, which select typewheel character to be printed.

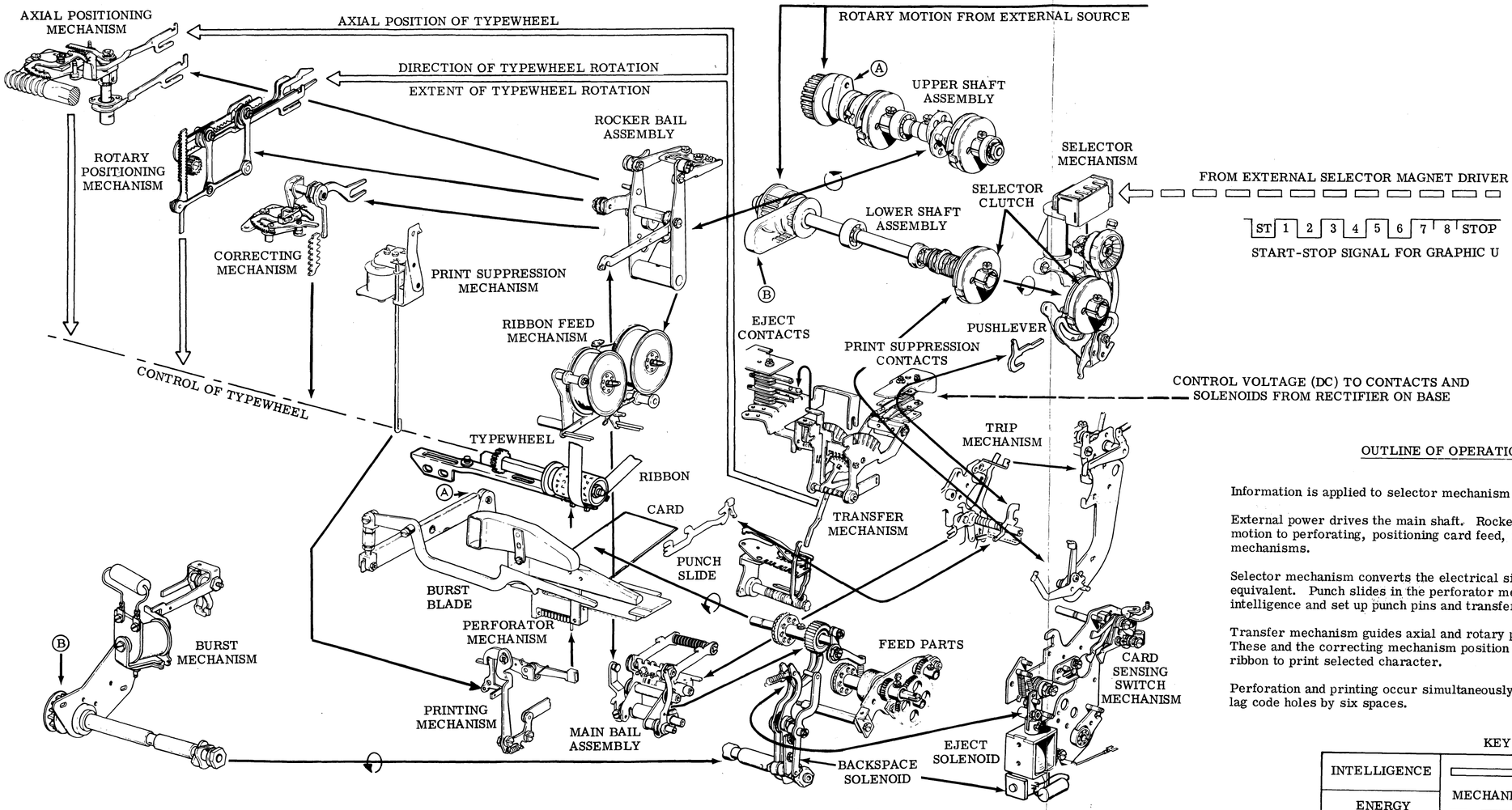
4.07 The punch slides, having received their arrangement from the selector, cause the punch pins to perforate code holes in the card corresponding to the code bits received by the selecting mechanism. Late in the function cycle, the feed parts advance the card one character space. The function cam-clutch is then disengaged and remains stationary until again tripped by the selecting cam-clutch. The operations of the reperforator may overlap if the code combinations are being received fast enough. For example, while the perforating mechanism is punching the code combination, advancing the card and the printing mechanism is printing, the selecting mechanism may be processing the next code combination.

4.08 The backspace mechanism is operated by depressing the BACKSPACE button and manually rotating the feed wheel clockwise by means of the knob mounted on the left feed wheel shaft extension.

5. SELECTION

GENERAL

5.01 The selecting mechanism, made up of a selector (5.07), a clutch trip assembly (Figure 10), and a cam-clutch (Figure 9), translates the signaling code combinations into mechanical arrangements which govern card printing and perforation. The electrical pulses comprising each code combination are applied to a magnet of the selector. The magnet, through an armature, controls the clutch trip assembly and the parts associated with translation. The cam-clutch transfers timed motion to the selector and also trips the function cam-clutch. Using a rangefinder assembly (Figure 10), the selecting mechanism can be adjusted to sample the code bits at the most favorable time for optimum operation. The mechanical arrangements produced by the selecting mechanism are passed



OUTLINE OF OPERATION

Information is applied to selector mechanism electrically.

External power drives the main shaft. Rocker bail distributes this motion to perforating, positioning card feed, ribbon feed, and printing mechanisms.

Selector mechanism converts the electrical signal into its mechanical equivalent. Punch slides in the perforator mechanism receive the intelligence and set up punch pins and transfer mechanism.

Transfer mechanism guides axial and rotary positioning mechanisms. These and the correcting mechanism position typewheel above inked ribbon to print selected character.

Perforation and printing occur simultaneously, but printed characters lag code holes by six spaces.

Figure 8 - Pictorial Diagram of Typical 35 Edge Punched Card Typing Reperforator

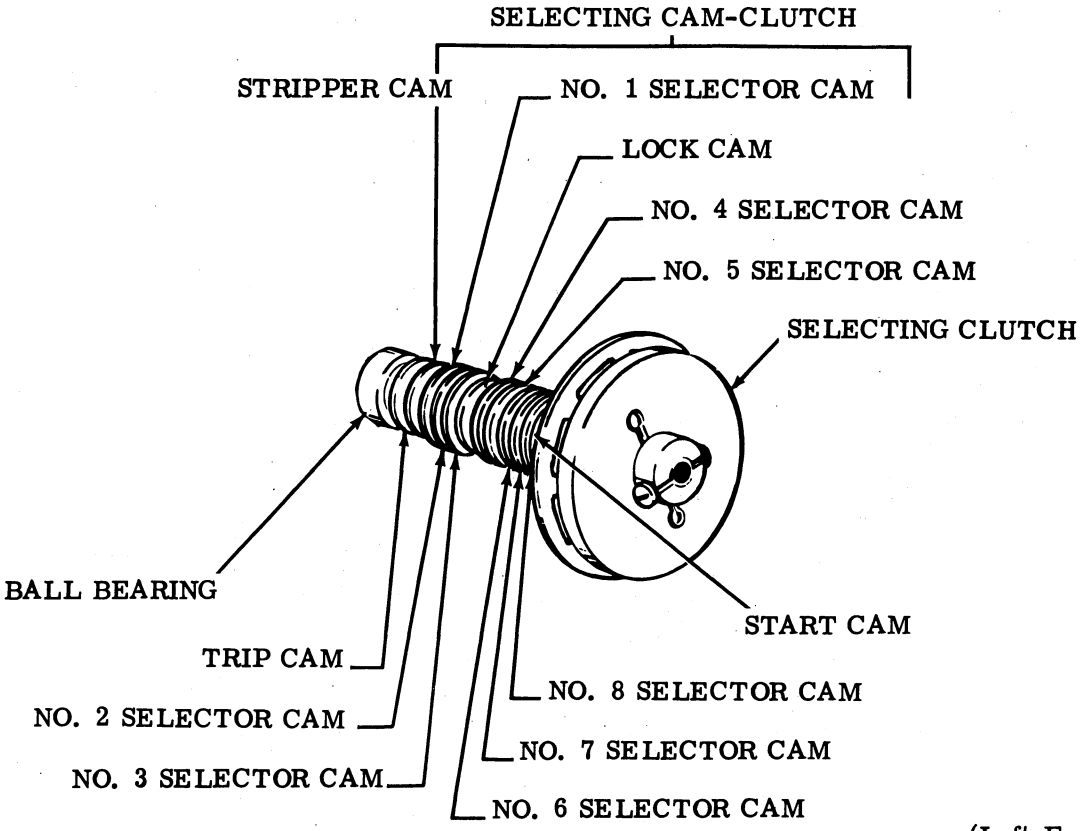


Figure 9 - Lower Shaft

through the transfer mechanism to control the positioning and printing mechanisms (5. 13) and through the punch slides to control the perforating mechanism (5. 09).

RECEPTION AND TRANSLATION

A. Selecting Cam-Clutch and Trip Assembly

5. 02 The selecting cam-clutch includes (from right to left in Figure 9) the clutch, the start cam, the eighth, seventh, sixth, fifth and fourth pulse cams, the lock cam, the third, second and first pulse cams, the stripper cam, and the trip cam. During the time in which the signal line current is closed (marking), the selector magnet coils are energized and hold the selector armature up against the magnet pole pieces (Figure 10). In this position, the armature blocks the start lever, and the cam-clutch is held stationary between the stop arm and latchlever.

5. 03 When a code combination is received, the start bit (spacing) de-energizes the magnet, and the selector armature under tension of its spring moves down out of the way of the start lever. The start lever turns clockwise under spring pressure and moves the stop arm bail into the indent of the start cam (Figure 10). As the stop arm bail rotates about its pivot point, the attached stop arm is moved out of engagement with the clutch shoe lever. The selecting cam-clutch engages and begins to rotate counterclockwise. The stop arm bail immediately rides to the high part of the cam, where it remains to hold the start lever away from the armature while the intelligence bits of the code are received and processed by the selector (5. 07 to 5. 09).

5. 04 When the stop bit at the end of the code combination is received, the armature is pulled up and blocks the start lever. Thus the stop arm bail is prevented from dropping into the low part of its cam, and the attached stop arm is held in position to stop the clutch stop lever. When the clutch shoe lever strikes the stop arm, the inertia of a cam disc causes it to continue to turn until its lug makes contact with the clutch shoe lever. At this point, a latchlever drops into an indent in the cam disc, and

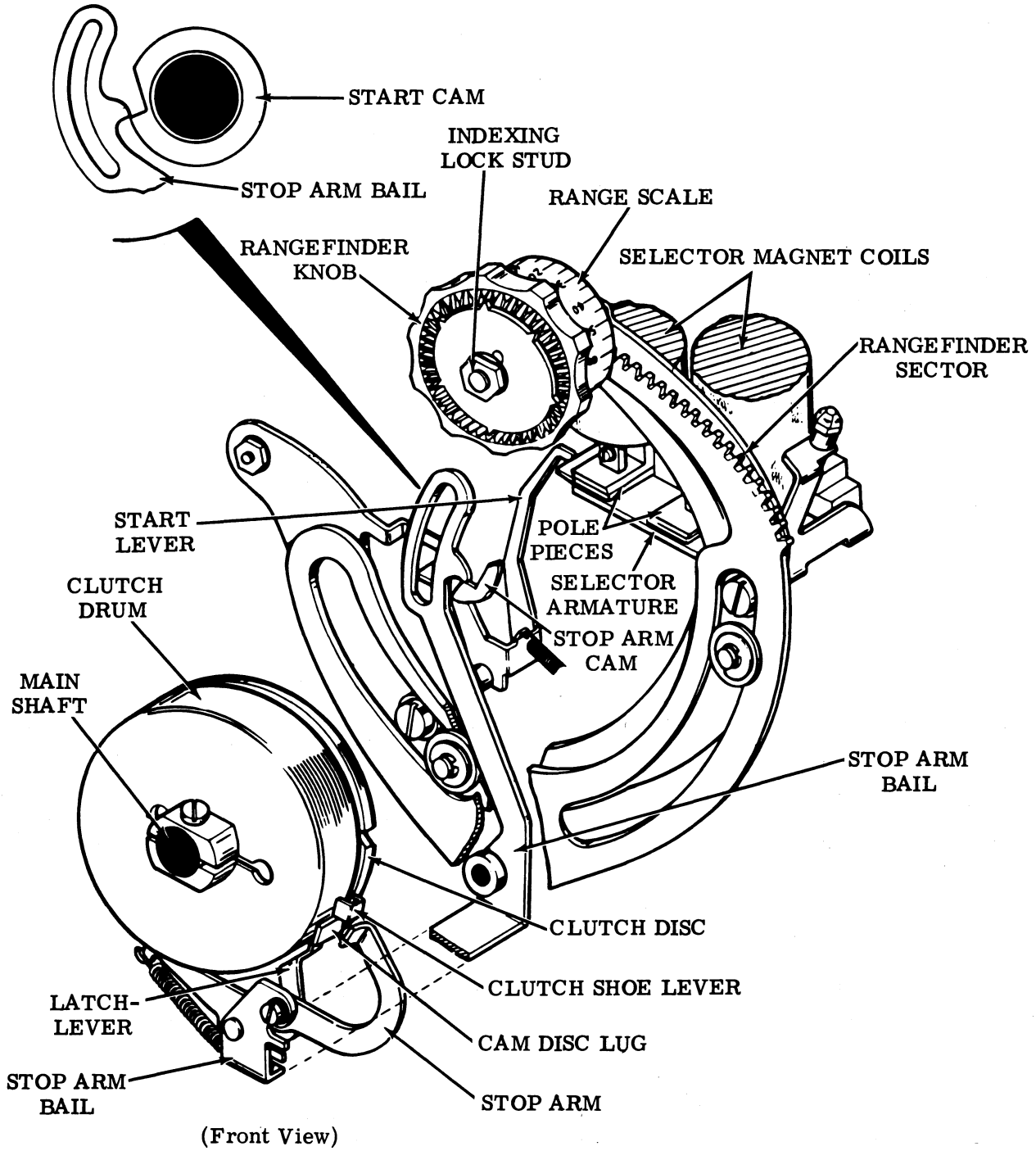


Figure 10 - Rangefinder and Selecting Cam-Clutch Assembly

the clutch is held disengaged until the next code combination is received.

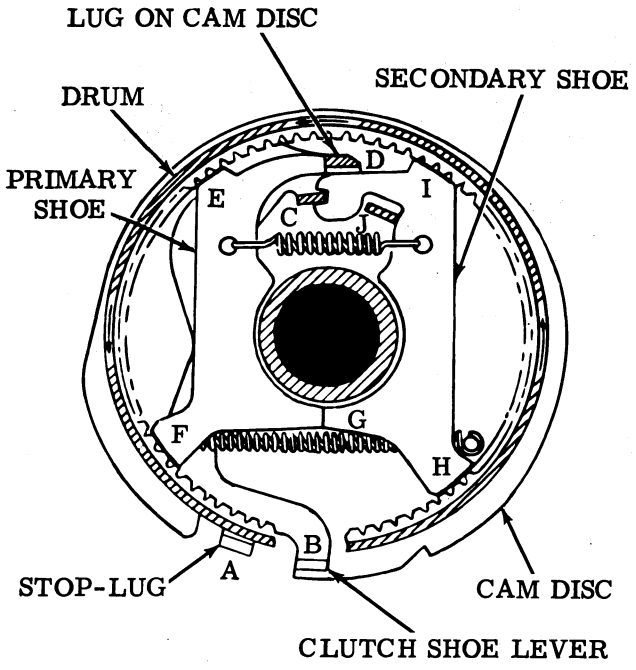
B. Clutch Operation

5.05 The clutch drum is attached to and rotates in unison with the main shaft (Figure 9). In the disengaged position, as shown in Figure 12, the clutch shoes do not contact the drum, and the shoes and cam disc are held stationary. Engagement is accomplished by moving the stop arm (Figure 10) away from the clutch and thus releasing stop-lug A and the lower end of shoe lever B (Figure 11). 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 notched inner surface of the rotating drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward so that it again makes contact with the drum at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point G. The lever end of the secondary shoe then bears against the drum at point H. The drum drives this shoe upward so that it again makes contact with the drum at point I. The forces involved are multiplied at each of the preceding steps. The aggregate force is applied through the shoes to the lug J on the clutch cam disc, and the disc and attached cam turn in unison with the drum.

5.06 Disengagement is effected when the lower end of shoe lever B strikes the stop arm (Figure 10). Lug A and the lower end of the shoe lever are brought together (Figure 11), and 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. The latchlever seats in the indent in the cam disc (5.04) and the cam is held in its stop position until the clutch is again engaged.

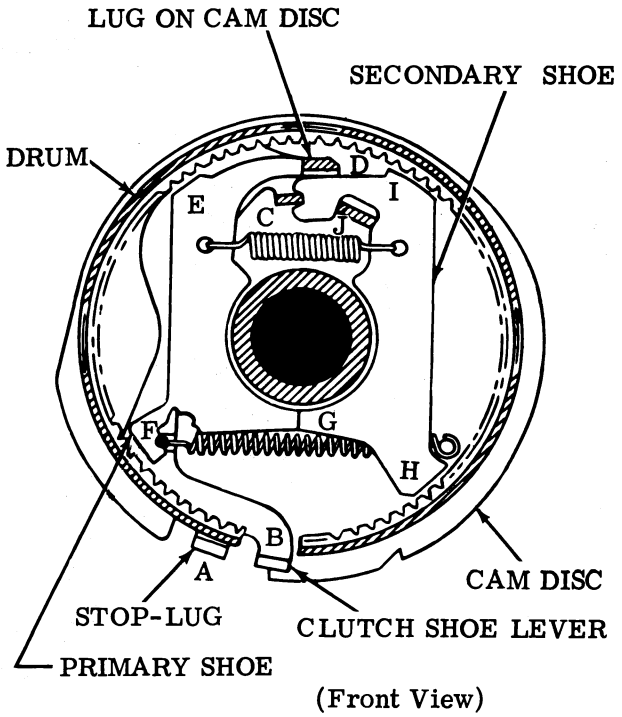
C. Selector Operation

5.07 The selector assembly consists primarily of two magnet coils (Figure 10), an armature and associated bails, levers, and latches (Figure 13). Eight linkages, each of which consists of a selecting lever, a pushlever, and a punch slide latch, link the selector cam with the punch slides. Since the linkages are identical, only the no. 4 is shown in its entirety in Figure 13. As the selecting bits of the code combination are applied to the magnet, the cam actuates the selecting levers. When a spacing bit is received, a marking locklever is blocked by the end of the armature, and a spacing locklever swings to the



(Front View)

Figure 11 - Clutch, Engaged



(Front View)

Figure 12 - Clutch, Disengaged

right above the armature and locks it in the spacing position until the next signal transition occurs. Extensions on the marking locklever prevent the selecting levers from following their cams. When a marking bit is received, the spacing locklever is blocked by the end of the armature, and the marking locklever swings to the right below the armature and locks it in the marking position until the next signal transition occurs. During this marking condition, the selecting levers are not blocked by the marking locklever extensions, but are permitted to move against their respective cams. The selecting lever that is opposite the indent in its cam, while the armature maintains a marking condition, swings to the right, or selected, position, and the end of an associated pushlever falls off a step on the selecting lever.

5.08 As the cam rotates, the selecting levers, together with any selected pushlevers, are moved to the left by the high part of their respective cams, where they remain until the next code combination is received. The unselected pushlevers remain to the right. When the next code combination is received, a selector reset bail, lifted by its cam (Figure 13), strips the selected pushlevers from selecting levers, and the pushlevers are returned to the right by their springs.

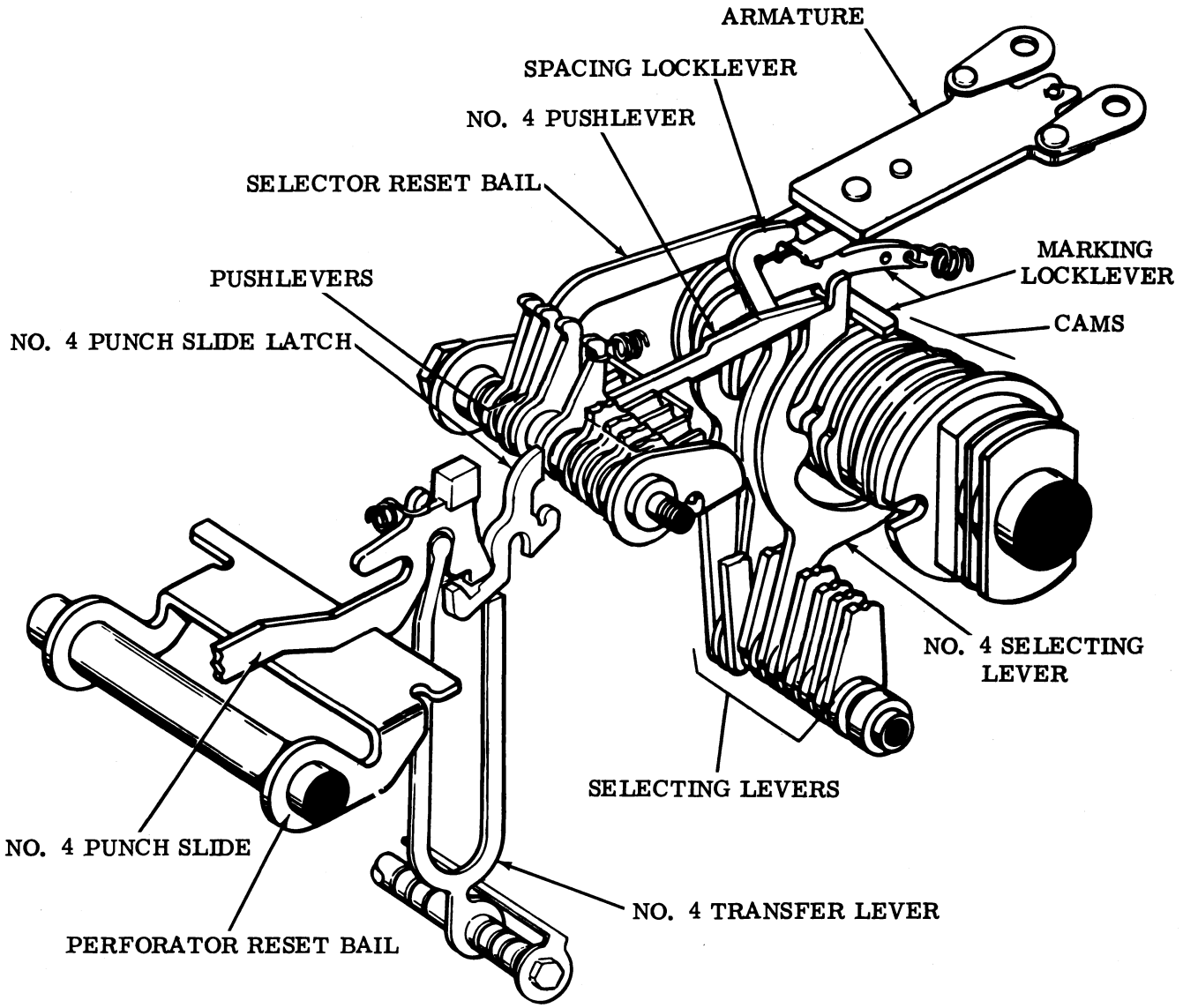


Figure 13 - Selector

5.09 The selected pushlevers, in moving to the left, rotate associated punch slide latches counterclockwise (Figure 13). Just before the eighth pushlever is selected, the selecting cam through the function trip assembly causes the perforator reset bail to release the punch slides (5.13). The unselected latches retain their associated slides to the right, while the selected latches permit their slides to move to the left under spring tension. During the latter part of the function cycle, the reset bail returns the punch slides to their unselected position. The latches under spring tension return to their unselected position when the pushlevers are repositioned at the beginning of the next selecting cycle.

ORIENTATION

5.10 For optimum performance, the selecting mechanism (Figure 10) should be adjusted to sample the signaling code bits at the most favorable time. To make this adjustment, the operating margins are established through the rangefinder, which provides a means of varying the time of sampling. The obtaining of this optimum setting is referred to as orientation.

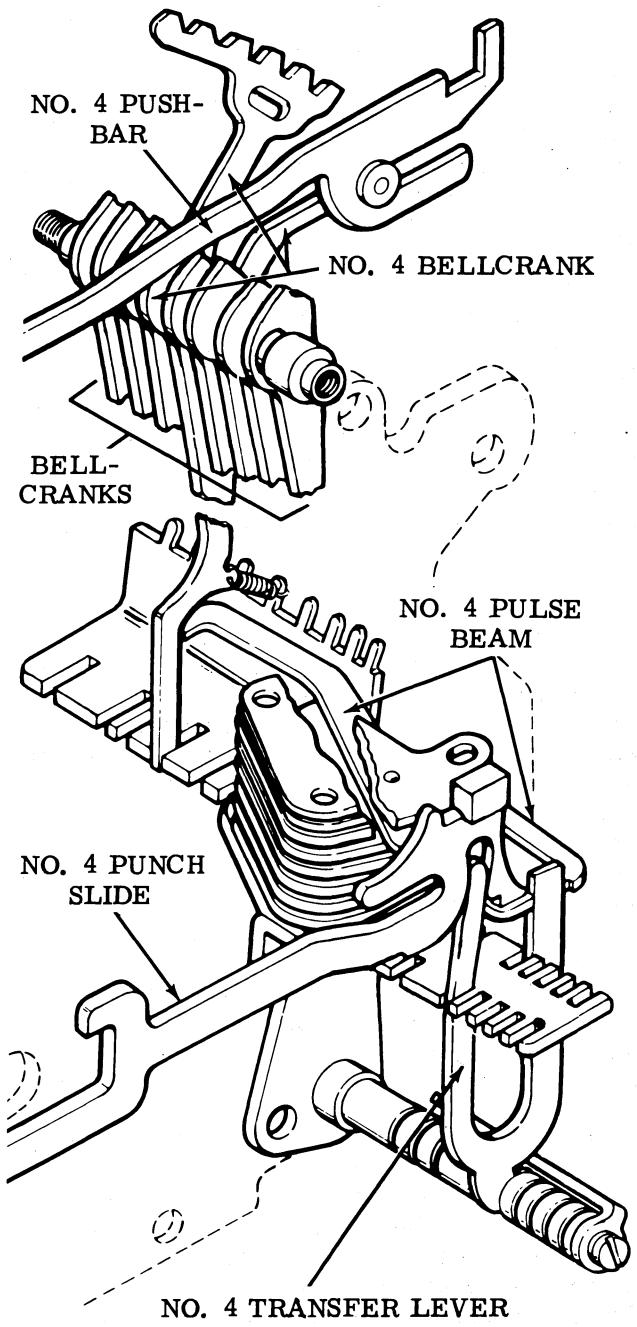
5.11 When the rangefinder knob (Figure 10) is pushed inward and rotated, its attached rangefinder gear moves the rangefinder sector (which supports the stop arm bail, stop arm, and latchlever) either clockwise or counterclockwise about the selector cam-clutch. This changes the angular position at which the selector cam-clutch stops with respect to the marking and spacing locklevers. When an optimum setting is obtained, the rangefinder knob is released. Its inner teeth engage the teeth of the indexing lock stud and hold the rangefinder mechanism in position. The setting may be read on the range scale opposite a fixed index mark.

TRANSFER

5.12 The function of the transfer mechanism (Figure 14) is threefold:

(1) It provides a path for the signal intelligence from the selector to the associated pushbar in the typewheel positioning mechanism.

(2) It provides a path for the signal intelligence from other signal sources to the typewheel positioning mechanism.



(Left Front View)

Figure 14 - Transfer Mechanism

(3) It provides a means for setting up the print suppression contacts to initiate print suppression.

5.13 The transfer levers engage the punch slides at one end, as illustrated by the no. 4 transfer lever in Figure 14. The transfer levers all pivot about a common point and, at

various distances from this pivot, engage their corresponding transfer beams. The opposite end of the transfer beam is coupled to one arm of a bellcrank lever. The opposite arm of the number 1, 2, 3, 4, 5, and 7 bellcrank levers engage their associated pushbars. Since the no. 6 and 8 bits do not control the position of the typewheel, they do not have associated pushbars. When a selected punch slide falls forward, the corresponding pushbar is raised upward and into engagement with the rocker bail. The rotation controlling pushbar corresponding to the fifth code impulse is different from the 1, 2, 3, and 4 pushbars. This pushbar is actuated by the rocker bail when the fifth code impulse is spacing and is not activated when the fifth code impulse is marking; all other pushbars engage when their respective code impulses are marking.

5.14 The no. 6 and no. 7 bellcranks, associated with a set of transfer contacts in the function box, control the print suppression armature and its related mechanism. These contacts, when mounted and positioned, are both normally closed (normally spacing) permitting current to activate the print suppression mechanism as the unit is turned on. Codes employing the no. 6 and/or no. 7 bits marking open the contacts (no current) allowing the magnet and its mechanism to deactivate and print the respective characters. Therefore, printing is suppressed on characters such as carriage return, line feed, rubout, etc, which have no. 6 and no. 7 bits both spacing. The alphas and numerics are normally printed and have no. 6 or no. 7 marking.

5.15 The bellcranks are provided with an arrangement of projections and slots which either block or permit the entrance of a sensing blade. The function box provides slots for up to six sensing blades which can be coded to respond to any of 256 code combinations. Contact assemblies associated with the sensing blades provide a means of supplying a pulse of between 10 and 14 milliseconds for control purposes with external circuitry.

6. MOTION FOR TYPING AND PERFORATING

GENERAL

6.01 The motion of the selector shaft is conveyed to the mechanisms concerned with typing and perforation by the function mechanism, which is comprised of a cam-clutch (Figure 9), a clutch trip assembly (Figure 15), and a rocker bail (Figure 16).

FUNCTION CAM-CLUTCH AND CLUTCH TRIP ASSEMBLY

6.02 The trip assembly is shown in its unoperated condition in Figure 15. A follower lever rides on a function trip cam which is part of the selecting cam-clutch (Figure 9). Near the end of the selecting cycle, as the selector shaft rotates counterclockwise, the high part of the cam pivots the follower lever (Figure 15) which, through an attached adjusting arm, rotates a main trip lever counterclockwise. A reset bail trip lever attached to the main trip lever lowers the perforator reset bail and releases the punch slides, and an upper arm of the main trip lever moves out of the way of a clutch release, which falls against a down-stop and rotates a trip shaft counterclockwise. Immediately, the low part of the trip cam allows the follower lever to return to its unoperated position, and the upper arm of the main trip lever moves down against the release. When the trip shaft is rotated by the release, it moves an attached clutch trip lever out of engagement with the clutch shoe lever. The clutch engages and the cam-clutch begins its cycle. The internal operation of the clutch is the same as that of the selector clutch, described in 5.05 and 5.06 of this section.

6.03 About midway through the function cycle, an eccentric pin on the function cam lifts a reset arm, which rotates the trip shaft clockwise. The release is moved up and allows the main trip lever to fall against the adjusting arm and raise the reset bail. The eccentric pin then moves out from under the reset arm, and the release is permitted to return to its unoperated position against the main trip lever. When the cam-clutch assembly completes its cycle, the clutch shoe lever strikes the trip lever, and the clutch is disengaged.

ROCKER BAIL

6.04 The function cam and the rocker bail (Figure 16) translate the rotation of the function shaft into simple harmonic motion, which the bail distributes to the following:

(a) Ribbon feed mechanism.

(b) Perforator.

(c) Correcting mechanism.

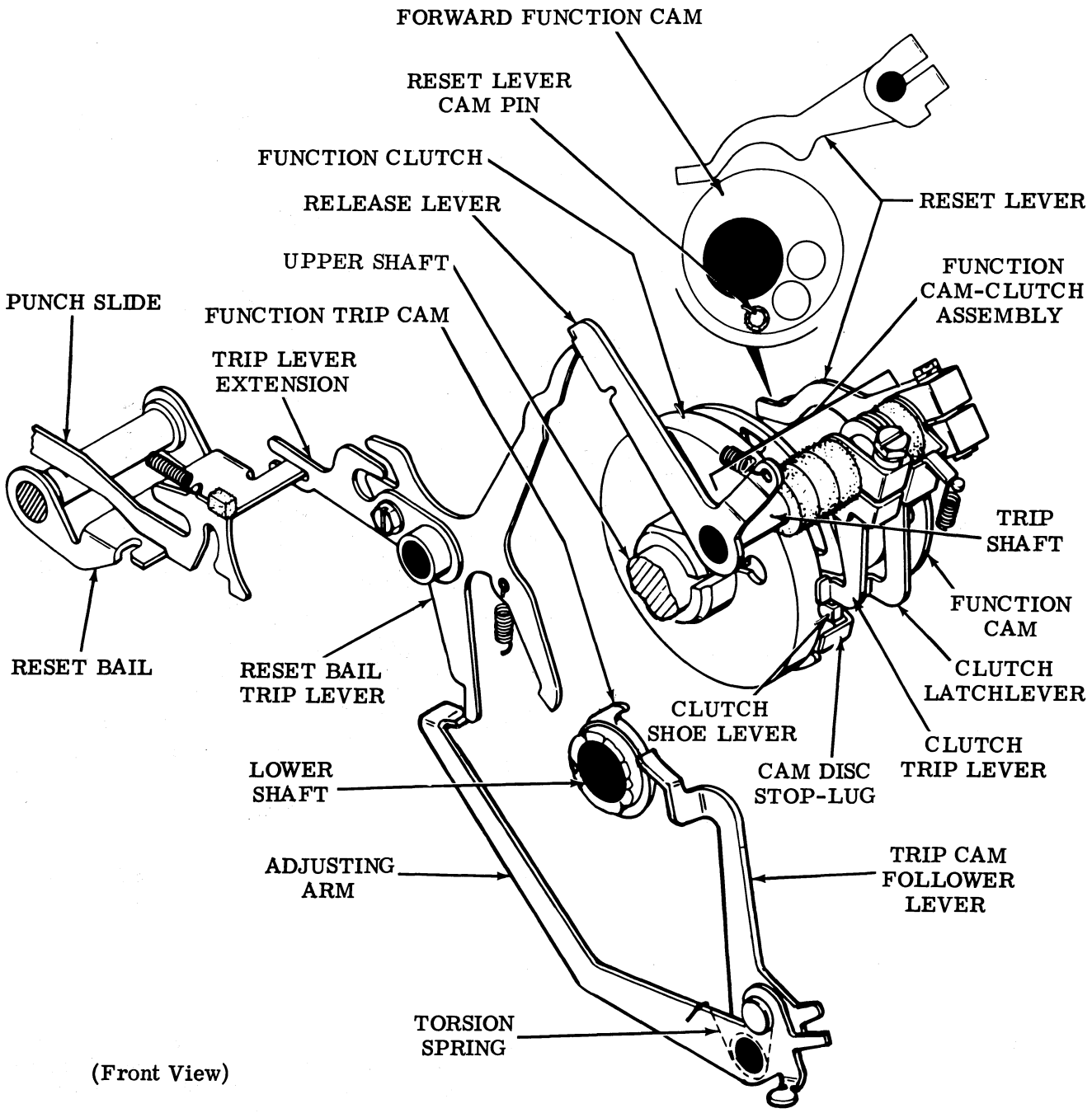


Figure 15 - Function Cam-Clutch and Clutch Trip Assembly

(d) Function box.

(e) Printing mechanism.

(f) Pushbars of the axial and rotary positioning mechanisms.

The bail is shown in its home position in Figure 16. Each function cycle, the function cams bear against the rollers and cause the bail to rock to the right (as viewed from the rear in Figure 16) during the first part of the cycle and then back to the home position during the latter part of the cycle.

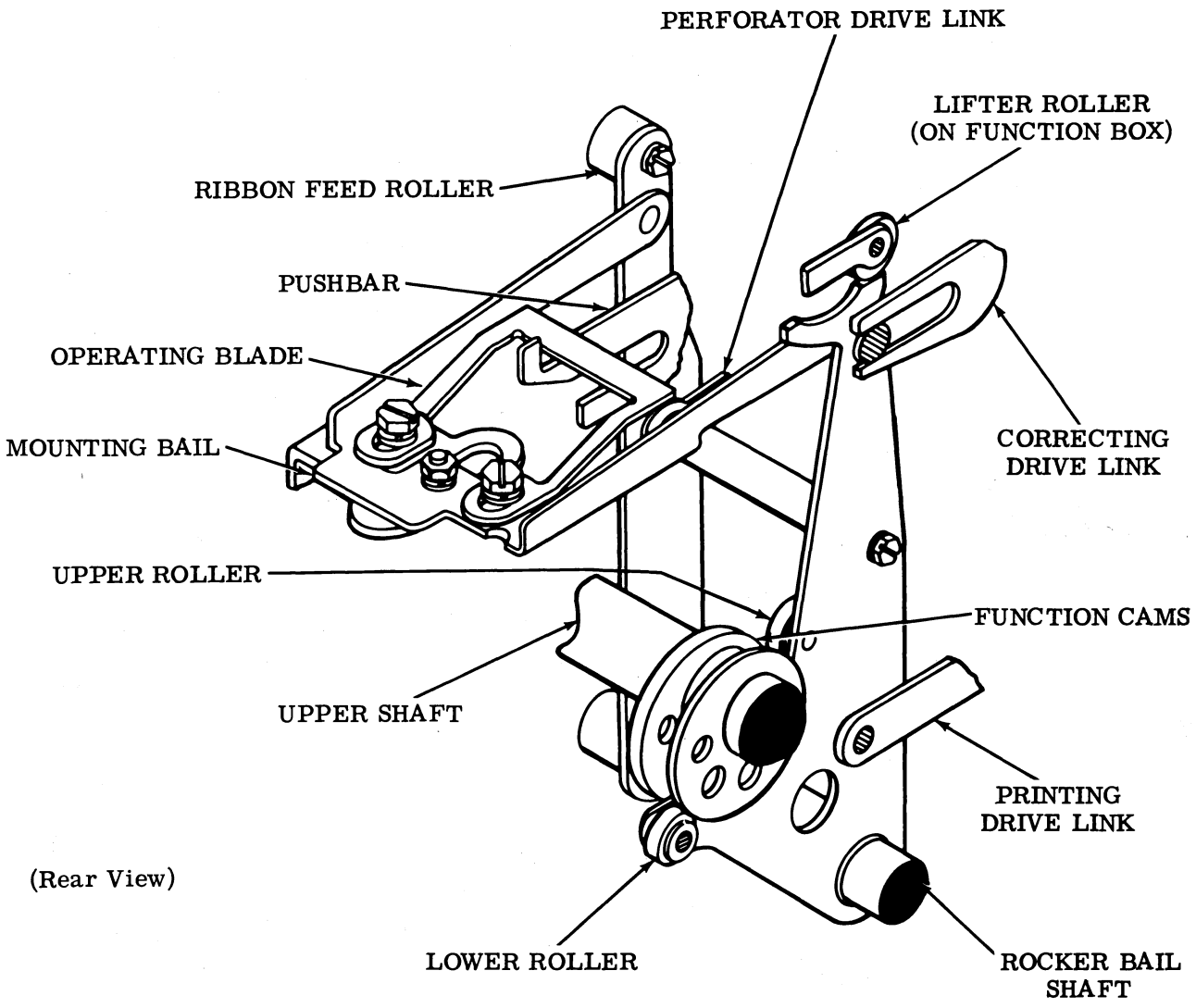


Figure 16 - Rocker Bail Assembly

7. TYPING

GENERAL

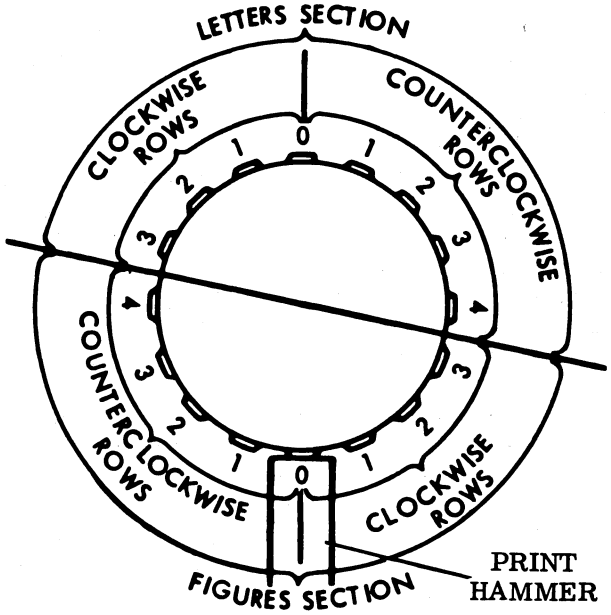
7.01 The characters used to type the received intelligence — letters, figures, and symbols representing various functions — are embossed on the cylindrical surface of the metal typewheel (Figure 17). During the function cycle, the axial and rotary positioning mechanisms (Figures 18 and 20), having received the intelligence from the transfer mechanism, position the wheel so that the character represented by the received code combination is selected. Following typewheel positioning, the correcting mechanism (Figures 18 and 20) accurately aligns the selected character. Then the printing mechanism (Figure 22), by means of a hammer, drives the tape and inked ribbon against the wheel and imprints the character. A ribbon feed mechanism (Figure 23) advances the ribbon and reverses its direction of feed when one of two ribbon spools is depleted. Near the end of the function cycle the axial positioning mechanism retracts the typewheel. On units equipped with the last character visibility feature, the forward portion of the ribbon is used for printing. When the typewheel retracts, the last printed character is visible. The letters or the figures code combination sets up an arrangement in the transfer mechanism which permits the function box (Figure 21) to operate and cause the rotary positioning mechanism to shift the typewheel.

TYPEWHEEL POSITIONING

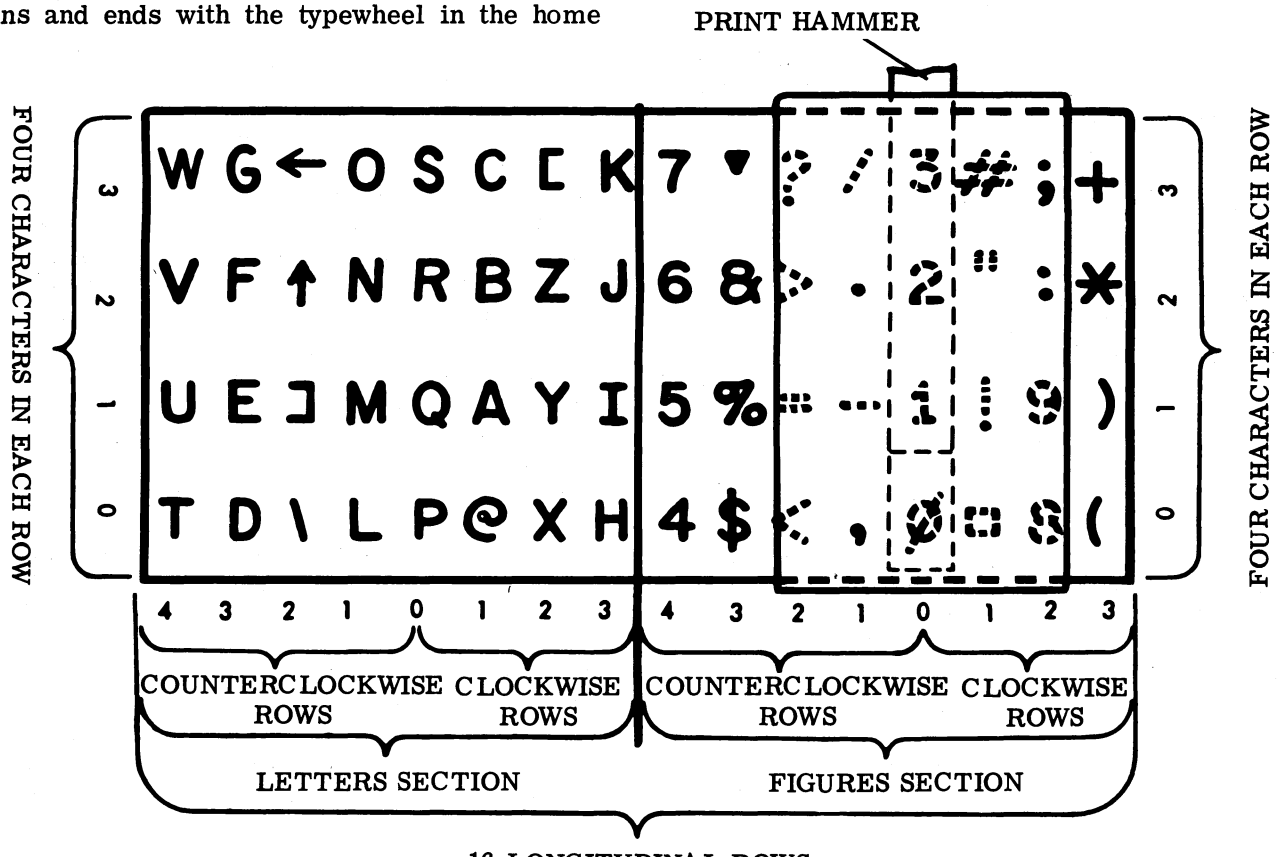
A. General

7.02 A typical typewheel character arrangement is shown in Figure 17. The cylindrical surface of the wheel is shown rolled out into a plane. There are 16 longitudinal rows, each of which is made up of four characters numbered 0 to 4 from front to rear. The surface is divided into two sections, a letters and a figures, each containing eight rows. The fifth row counterclockwise from the division line in both sections is numbered 0, and there are four rows in one direction from 0 numbered 1 to 4 and designated as counterclockwise rows, and three rows in the other direction numbered 1 to 3 and designated as clockwise rows. It should be noted that the clockwise and counterclockwise modifiers refer to the direction of rotation of the wheel to select the rows and not to their position on the wheel.

7.03 Each printing operation (excluding those devoted to the letters-figures shift) begins and ends with the typewheel in the home



(Front View Showing 16 Longitudinal Rows)



(Top View Showing Cylindrical Surface in a Plane)

Figure 17 - Typical Typewheel Character Arrangement

position of the section containing the character to be printed, ie, with the no. 0 character of the no. 0 row at the point of contact of the print hammer. (Actually, inasmuch as the wheel is retracted to show the last printed character (7.11), the no. 0 character is slightly to the rear, but for this discussion it will be assumed that it is at the point of contact.) During the printing operation the axial and rotary positioning mechanisms, transferring separate but simultaneous motions to the wheel, position it so that the character represented by the received code combination is at the point of contact of the hammer at the time of printing. The rotary mechanism, which is controlled by the no. 3, 4, and 5 selecting elements of the code, revolves the wheel to select the proper row; and the axial mechanism, which is governed by the no. 1 and 2 elements, moves it forward and rearward along its axis to select the proper character in the row. Rotation of the typewheel to print in either the letters or the figures section is controlled by the no. 7 bit of the code.

7.04 To illustrate the above, if the wheel is in the figures condition, as shown in Figure 17, and the numeral "0" is to be printed, there is no movement of the wheel during the printing operation, because "0" is already at the point of contact of the hammer. However, if the letter "F" is to be printed, the wheel is first shifted eight rows to the letters home position. Then during the next operation it is rotated three rows counterclockwise and moved forward two characters so that "F" is at the point of contact of the hammer. Printing takes place, and the wheel is then returned to the letters home position.

B. Rotary Positioning

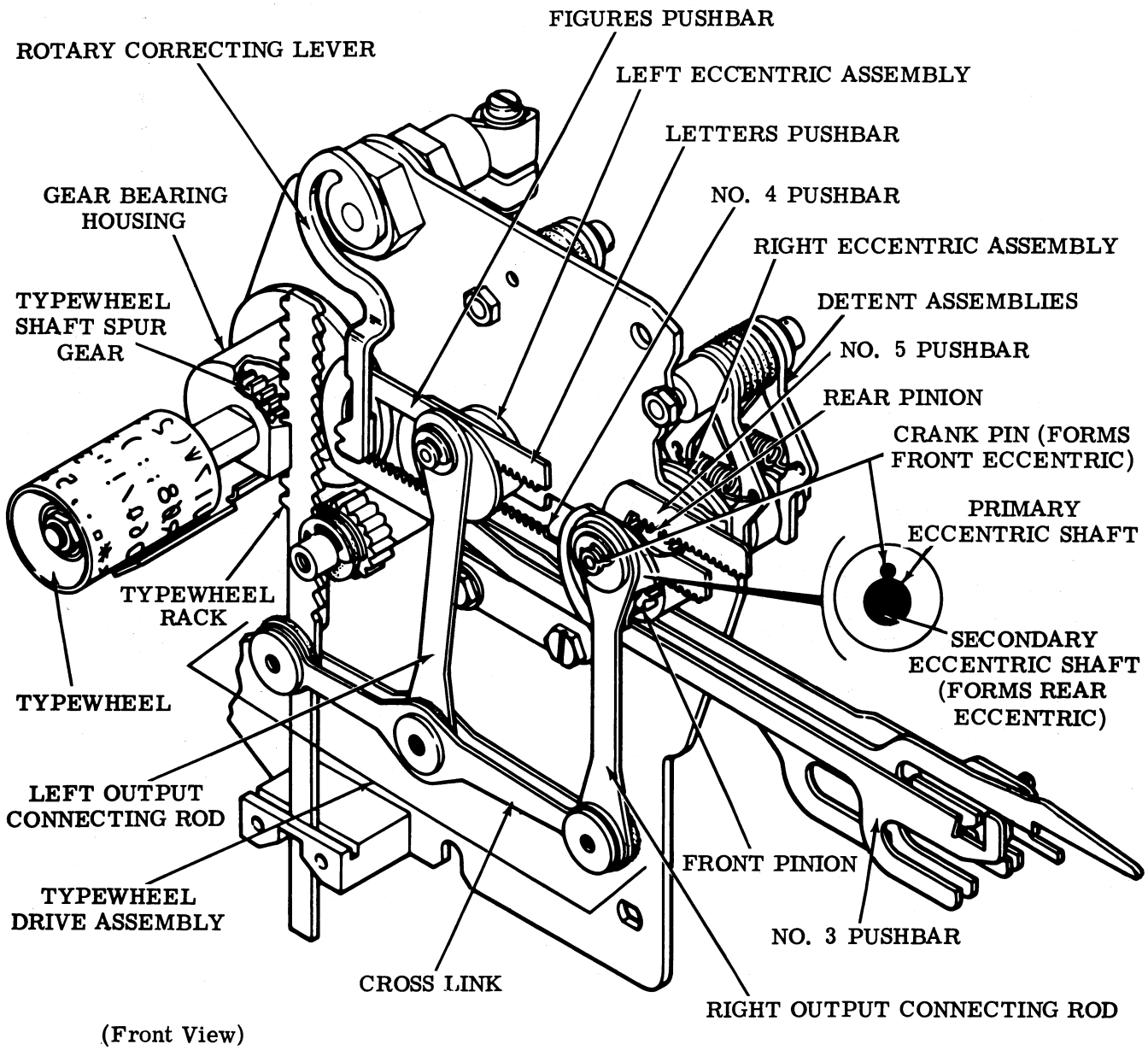
7.05 The rotary positioning mechanism revolves the typewheel so that the row containing the character to be printed is aligned with the print hammer at the time of printing. Mounted on the front plate, the mechanism includes two eccentric assemblies as shown in Figures 18 and 19. Each assembly includes a primary shaft, a section of which is formed into a pinion. A secondary shaft, mounted in the primary and offset from its center, forms an eccentric, referred to as the rear eccentric. A portion of the secondary shaft is also a pinion, and a crank pin mounted on its disc-like forward surface forms a secondary, or front, eccentric. Each of the four pinions of the two eccentric assemblies is engaged by the rack of a pushbar: the no. 3 bar engages the right front pinion, the no. 4 engages the left rear pinion, and the no. 5 engages the right rear pinion. The left front pinion is engaged by both the letters and the figures pushbar.

7.06 The eccentric assemblies are linked to a typewheel shaft by a drive assembly as shown in Figure 18. The typewheel is secured to the front of the shaft which is supported by a bearing housing mounted at the left rear of the front plate (Figure 20). A spur gear which meshes with a typewheel rack rides on the shaft in a bearing housing. The shaft is free to move axially in the housings and the spur gear, but flats in its circumference which bear against flats in the gear ensure its rotating when the gear rotates.

7.07 When in response to a marking bit a pushbar is lifted by its bellcrank, as described in 5.13, the rocker bail operating blade (Figures 16 and 19) engages a slot in the bar and moves it to the left during the first part of the function cycle. The bar, by means of its rack and the mating pinion, rotates the associated eccentric one-half revolution where it is locked in position by a detent assembly while printing takes place. When the bail rocks back to the right during the latter part of the cycle, it returns the bar and eccentric to their home position where the eccentric is again detented. The preceding does not apply to the no. 7 pushbar, covered in 7.17. In both assemblies one-half revolution of the rear eccentric results in its maximum vertical displacement which is transferred through the front eccentric to a crank pin. Similarly, one-half revolution of the front eccentric results in its maximum displacement being transferred to the crank pin. If both eccentrics are rotated, the displacement of the crank pin is equal to the algebraic sum of the two displacements which may be in either the same or opposite directions. Both assemblies are so designed that, if the displacement of the rear eccentric is taken to be one unit, the displacement of the front eccentric is four units. Four permutations are thus available: zero (neither eccentric displaced), one unit (rear eccentric displaced), four units (front eccentric displaced), and five or three units depending on how the assembly is set up (both eccentrics displaced).

7.08 In the right assembly the home position of the rear eccentric is down and the home position of front eccentric is up (Figure 19). Thus their displacements are in opposite

directions — up for rear and down for front — and their aggregate displacement is three units downward. Any displacement occurring in the right assembly is imparted to the typewheel rack in equal quantity, but opposite direction. For example, if the no. 5 pushbar is selected, it causes the right rear eccentric to be displaced, and one unit of upward motion is transferred through a right output connecting rod to the right end of a cross link (Figure 18). The cross link pivots about a left output connecting rod and at its left end imparts one unit of downward displacement to the typewheel rack. The rack rotates the spur gear, shaft, and typewheel one row of characters clockwise from the home position, and the no. 1 clockwise row (Figure 17) is presented to the print hammer at the time of printing. On its right stroke the no. 5 pushbar returns the eccentric and the typewheel to their home positions. In a similar manner, selection of the no. 3 pushbar results in a four unit downward displacement of the right front eccentric and a four row, counterclockwise rotation of the typewheel; and selection of both the three and five bars results in a three row, counterclockwise rotation of the typewheel.

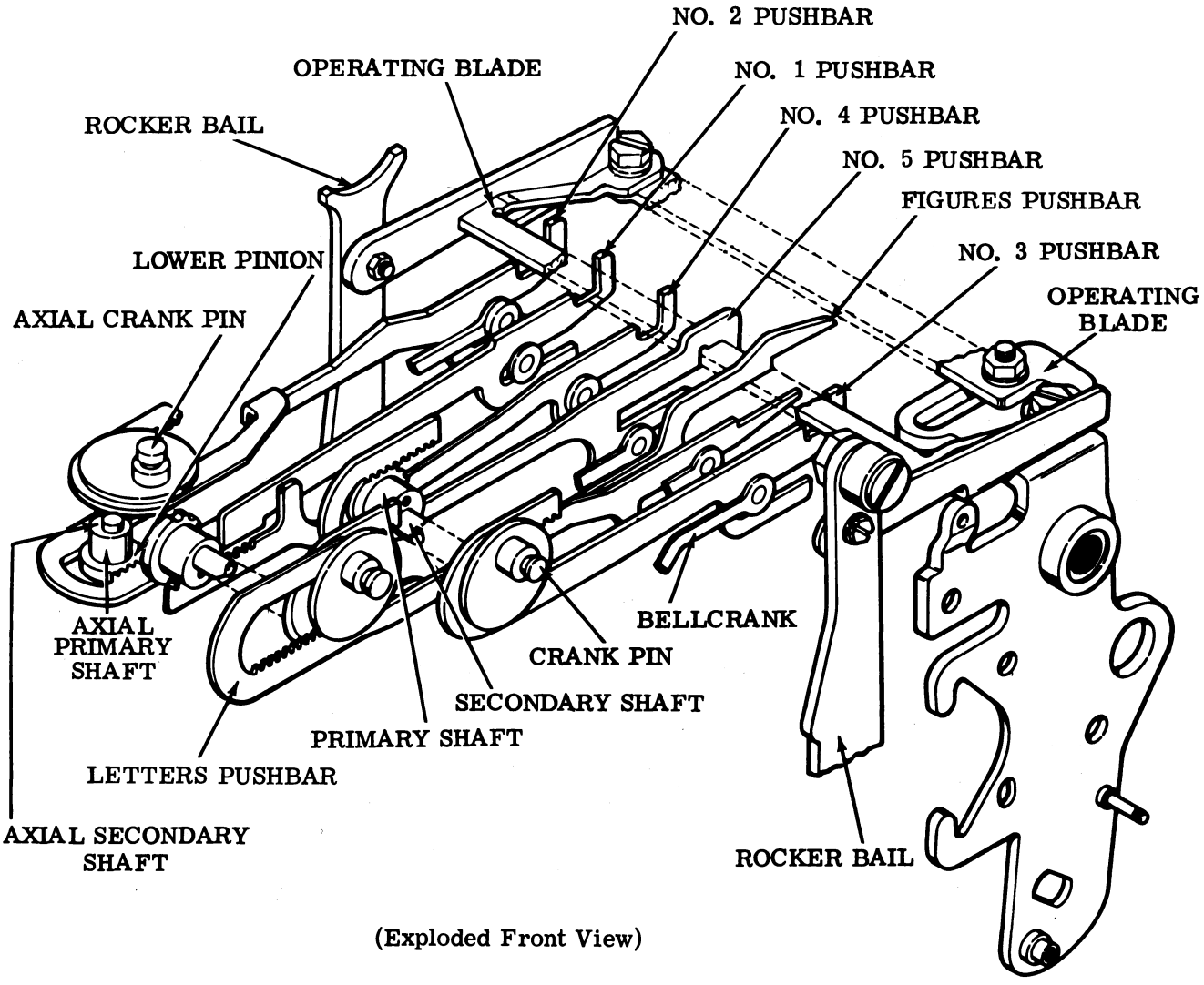


(Front View)

Figure 18 - Rotary Positioning Mechanism

7.09 The home position of the left rear eccentric is up, and any displacement appearing in the left assembly is transferred to the typewheel rack in double quantity in the same direction. When no. 4 pushbar is selected, left rear eccentric is displaced one unit downward. This movement is conveyed through the left output connecting rod to the approximate midpoint of the cross link. The cross link pivots about the right output connecting rod and its left end imparts two units of downward movement to the typewheel rack which rotates typewheel two rows clockwise from its home position.

7.10 When both eccentric assemblies are displaced, the motion occurring in the typewheel rack is equal to the algebraic sum of the motions resulting from each assembly. For example, if the no. 3, 4, and 5 pushbars are all selected, three units of upward displacement from the right assembly and two units of downward displacement from the left assembly occur as one unit (3-2 =1) of upward displacement in the rack and a counterclockwise rotation of one row in the typewheel. If neither the no. 3, 4, nor 5 pushbar is selected, the mechanism remains inactive and printing takes place in the no. 0 row. Excluding the left front eccentric, which is only used for the letters-figures shift, there are eight permutations available in the other three eccentrics, making it possible to select any of the eight rows in a given section (Figure 17).



(Exploded Front View)

Figure 19 - Pushbars and Eccentric Assemblies

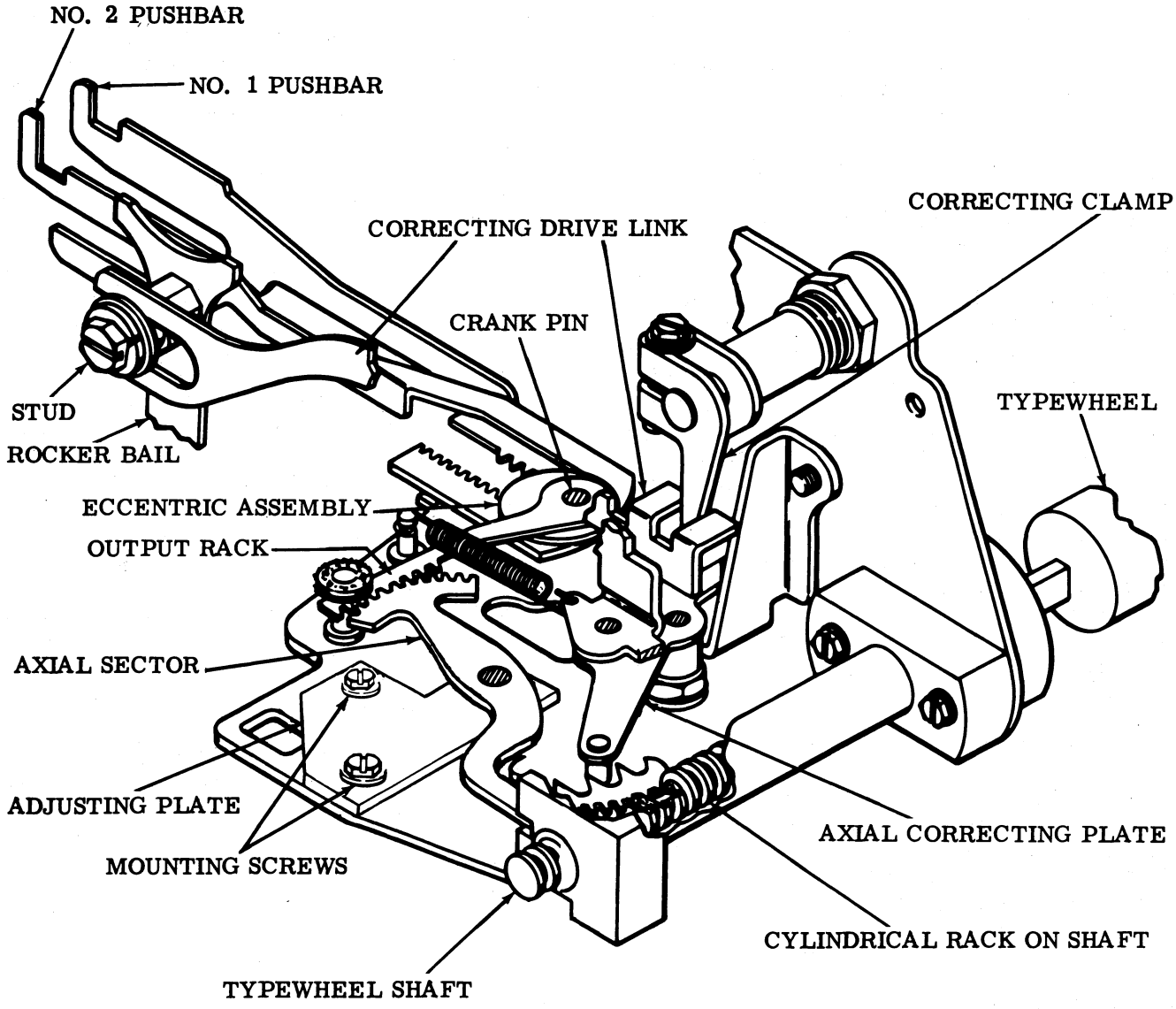


Figure 20 - Axial Positioning Mechanism

C. Axial Positioning

7.11 The functions of the axial positioning mechanism are to position the typewheel so that the proper character in the selected row is aligned with the hammer at the time of printing and to retract the typewheel and ribbon guide at the end of the function cycle. The mechanism mounts on an axial bracket supported by the frame and the front plate and includes an eccentric assembly similar to those of the rotary positioning mechanism (Figures 19 and 20). Two eccentrics, a lower whose pinion is driven by the no. 1 pushbar and upper whose pinion is driven by the no. 2 pushbar, rotate in a horizontal plane in bearing housings attached to the bracket. The eccentric assembly is linked to the typewheel shaft by an axial output rack and sector as shown in Figure 20.

7.12 The selection of either the no. 1 or no. 2 pushbar results in the maximum displacement toward the rear of the associated eccentric, and the eccentrics are so designed that, if the displacement of the lower is taken to be one unit, that of the upper is two units.

Again four permutations are available at the crank pin: zero (neither eccentric displaced), one unit (lower eccentric displaced), two units (upper eccentric displaced), and three units (both eccentrics displaced).

7.13 If during a function cycle neither pushbar is selected, no motion occurs in the axial positioning mechanism. The no. 0 character of the selected row is aligned with the hammer at the time of printing (Figure 17). On the other hand, if the no. 1 pushbar is selected, it causes the lower eccentric to revolve and one unit of displacement to be transferred by the crank pin to the axial output rack. The rack moves to the rear and passes the motion to the axial sector which pivots counterclockwise (as viewed from above). The right end of the sector, by means of a cylindrical rack in the typewheel shaft, moves the typewheel one character forward from its home position. The no. 1 character is printed, and when the pushbar reverts to its unselected position it returns the axial linkage and typewheel to their home position. If the no. 2 pushbar is selected the no. 2 character is printed, and if both pushbars are selected, the no. 3 character is printed. The cylindrical rack has no lead, and the shaft can thus be rotated while being moved axially.

7.14 With each cycle of the function clutch, a drive link transfers from the rocker bail an unselected motion (Figures 20 and 22). This movement is passed to the sector pivot. The effect of this action is to introduce a separate motion to the sector tending to cause it to pivot about the teeth on the output rack.

D. Position Correction

7.15 After the typewheel has been positioned by the axial and rotary positioning mechanisms, the selected character is more accurately aligned for printing by the correcting mechanism which compensates for any play and backlash in the positioning linkages. Each function cycle the rocker bail transfers motion through a correcting drive link to a correcting clamp and shaft (Figure 20). The shaft pivots a rotary correcting lever (Figure 18) which is equipped with an indentation that engages a tooth in a typewheel rack. There is a tooth in the rack for each row of characters (16 in all), and they are so correlated with the typewheel that when a tooth is engaged by the corrector its row is accurately aligned with the print hammer. Axial correction, which is accomplished simultaneously, is similar to rotary correction: the drive link rotates an axial correcting plate counterclockwise (as viewed from the above), and a roller mounted on the plate engages a notch in the axial sector (Figure 20). Thus, the typewheel is accurately aligned in both fields of motion just before printing takes place. During the latter part of the function cycle, a correcting drive link spring returns the correcting mechanism to its home position.

7.16 Since the rocker bail is the source of motion for both the pushbars and the positioning mechanisms, correction must take place at a point near enough to the extreme travel of the bail that it does not interfere with the movement of the typewheel rack or axial sector. In addition, because the rocker bail controls the tripping of the print hammer, which occurs very late in the bail's stroke, it becomes necessary to utilize the time between the tripping of the hammer and its striking the paper to accomplish correction. The delay in actuating the correcting mechanism is effected by allowing a drive stud on the rocker bail to slide in an elongated slot in the correcting drive link during the early part of the cycle.

E. Typewheel Shift

7.17 The typewheel shift (Figures 18 and 21) from the letters to the figures printing segment (or figures to letters) is controlled by the no. 7 selector pushlever through an associated train of levers in the transfer mechanism and two pushbars which engage a common pinion. The pushbars are connected to a common bellcrank which is, in turn, controlled by the no. 7 pulse beam and transfer lever.

7.18 To shift the typewheel from the figures section to the letters section, a marking no. 7 bit must be received by the unit. This will cause the no. 7 punch slide to be selected and move to the left (5.08). As the no. 7 punch slide moves left, it rotates its associated transfer lever counterclockwise which, in turn, pivots the no. 7 pulse beam clockwise. This allows the associated bellcrank to rotate counterclockwise, under spring tension, and lift the letters-figures pushbars until the step on the end of the letters pushbar is raised to a height which will bring it into engagement with the rocker bail operating blade when the blade moves to the left (6.04). The operating blade simultaneously pushes the letters pushbar to the left and the figures pushbar to the right, resulting in rotation of the typewheel to the letters section. As long as the no. 7 bit is marking, the letters pushbar will remain in this leftmost position.

7.19 When the no. 7 bit changes from marking to spacing, the punch slide will remain unselected, and the pushbars will not be lifted by the bellcrank-transfer lever linkage. The figures pushbar, which is furthest to the right, will then be in such a position that the step on its end extension will be engaged (and pushed) by the rocker bail operating blade as the blade moves to the left, resulting in rotation of the typewheel to the figures position. As the figures pushbar moves left, the letters pushbar simultaneously moves to the right.

7.20 As long as the no. 7 bit is spacing, the letters-figures pushbars will not be lifted and, therefore, the letters pushbar will not be moved to the left (7.18). The typewheel will shift back to the letters section only upon receipt of a no. 7 marking bit by the reperforator.

PRINTING

7.21 After the typewheel has been positioned and corrected, the printing mechanism supplies the impact which drives the card and ribbon against the selected character. It effects this operation by means of a print hammer which is mounted on a shaft supported by a bracket attached to the typewheel bearing housing. In its unoperated condition, as illustrated in Figure 22, the hammer is held against an accelerator by a relatively weak spring. The accelerator is mounted on the hammer shaft and is retained by a printing latch in its upper position against the tension of a relatively strong spring.

7.22 The rocker bail, during the fore part of the function cycle, moves a printing drive link to the right (as viewed from the rear in Figure 22) and causes a pivot arm to rotate clockwise. The arm lowers a trip link which slides in an elongated slot. Near the end of the rocker bail's travel, the trip link pivots the latch which releases the accelerator. Under the spring tension, the accelerator snaps down and impels the hammer upward. The face of the hammer drives the card and inked ribbon up against the typewheel and imprints the selected character on the card. Near the end of its travel, the accelerator encounters a projection on a latch bracket, and inertia carries the hammer the rest of the way. As the rocker bail returns to its home position, it causes the trip link to move up, release the latch and return the accelerator to its latched position.

RIBBON FEEDING

7.23 The characters are typed in ink supplied by an inked ribbon which is held between the card and the typewheel by a guide and advanced by the ribbon feed mechanism (Figure 23). The path of the ribbon is down to the right off the top of a right spool, under a right roller, through the guide, up through left pins on the reversing arm, over a left roller, and to the right over the top of a left spool.

7.24 Each function cycle, as the rocker bail nears the end of its left travel, a roller mounted on its forward arm pivots a drive arm clockwise. The drive arm lifts a feed pawl which advances the ribbon by rotating a ratchet on one of the ribbon spools one tooth. A retaining pawl under spring tension detents the ratchet while the feed pawl, during the latter part of the function cycle, is lowered so as to engage the next tooth. Each operation, the ribbon is advanced in this manner until the ribbon feed mechanism is reversed.

7.25 When a spool is almost depleted, a rivet in the ribbon encounters pins on the reversing arm, and the stress applied through the ribbon as it is rolled on the other spool pivots the arm. As the pawl assembly is lowered at the end of the next operation, an extension strikes the reversing arm, and the pawl is shifted against the other ribbon spool ratchet. The pawl's rounded lower extension pivots a reversing lever which shifts the retaining pawl so that it engages the opposite ratchet. The ribbon will then feed in the opposite direction until again reversed. A detent holds the reversing arm in position until its next reversal.

PRINT SUPPRESSION MECHANISM

7.26 Print suppression operates to block the movement of the print hammer and prevents contact between the card, inked ribbon, and typewheel.

8. PERFORATING AND PUNCH MECHANISM

A. Front Plate Assembly

8.01 The front plate assembly (Figure 2) provides mounting facilities for the front bearings of both feed wheels, the intermediate gear between them, and for the feed wheel adjusting screws. The position of the intermediate gear between the feed wheels is adjustable in

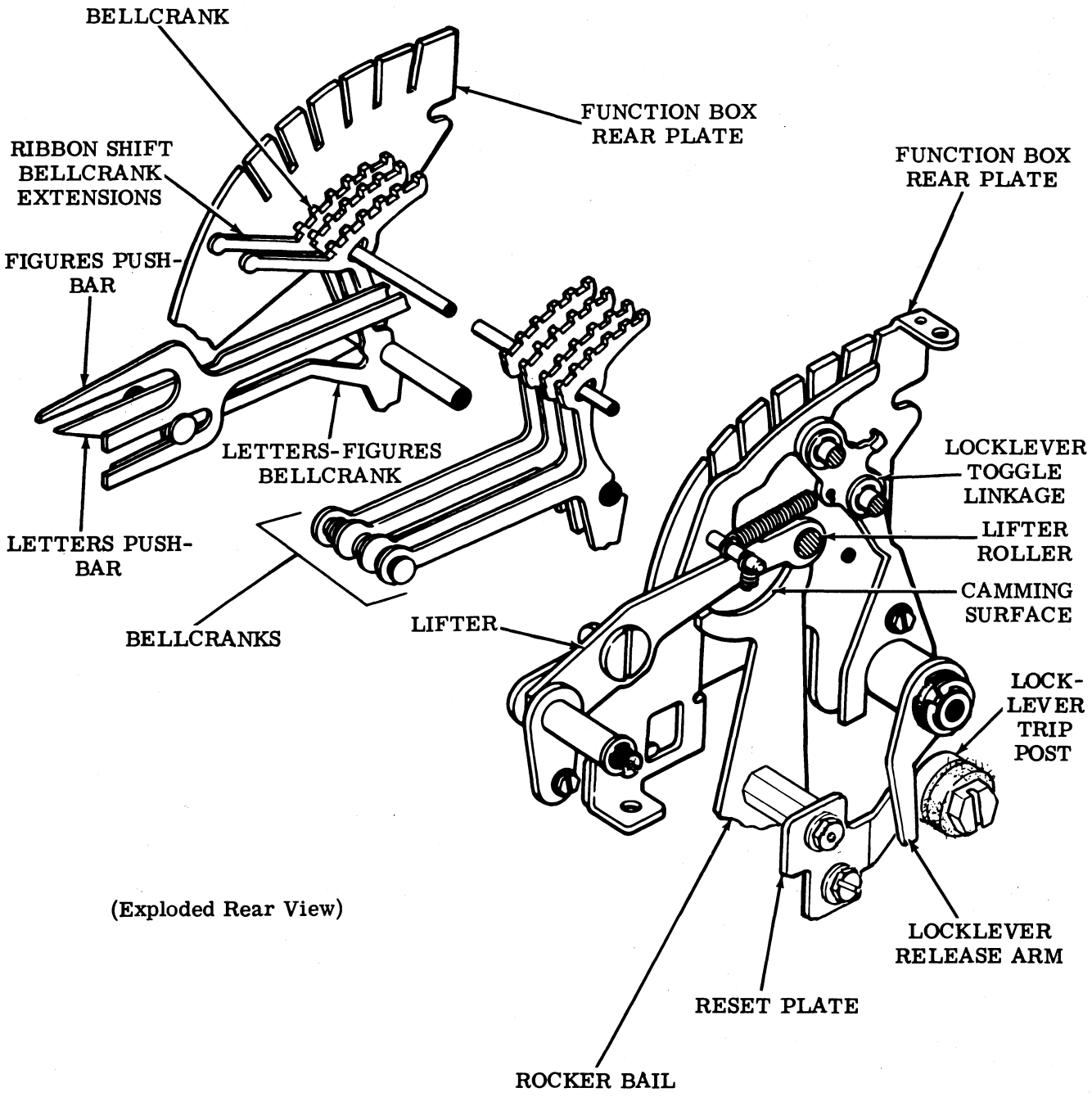


Figure 21 - Function Box

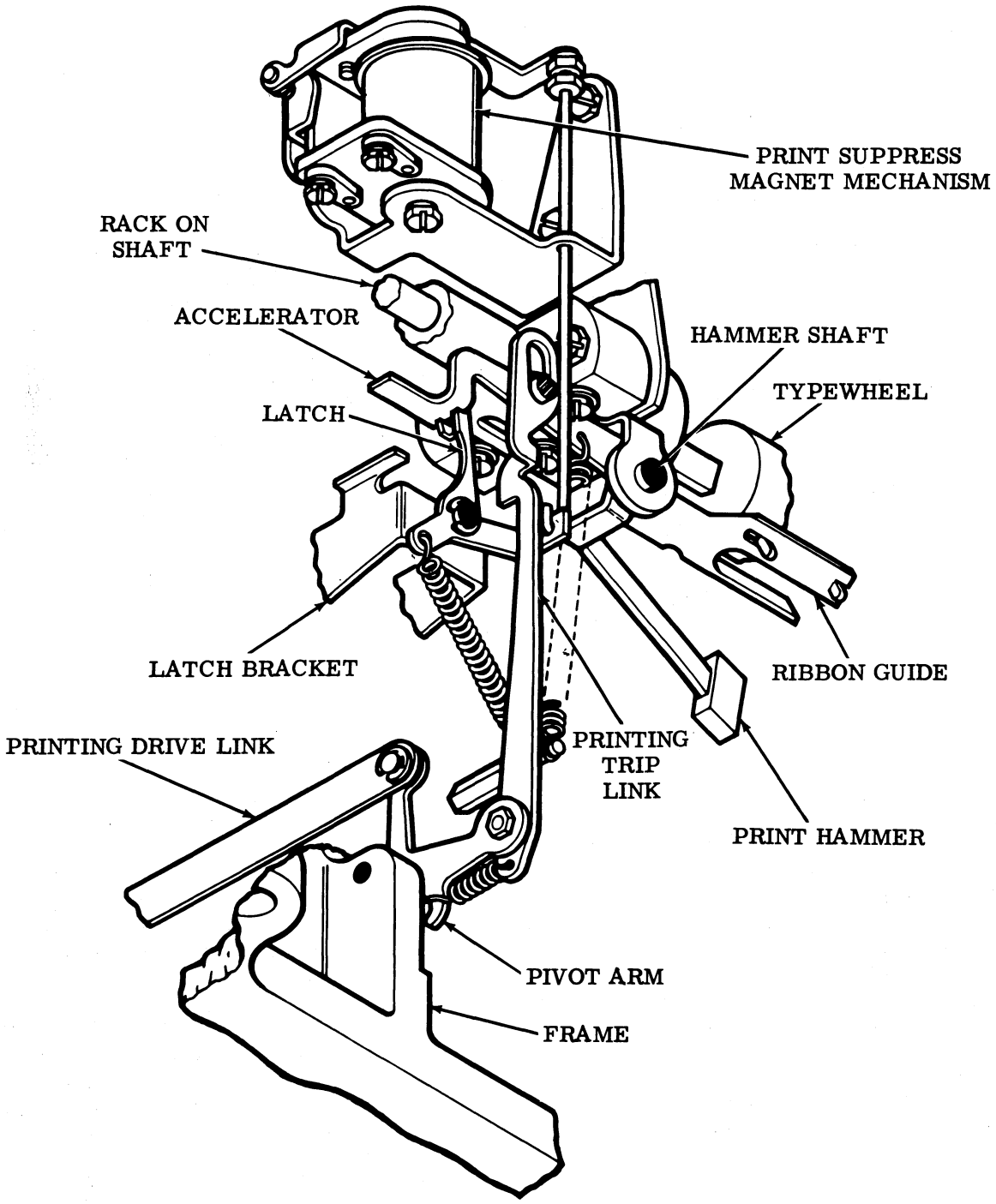


Figure 22 - Printing Mechanism

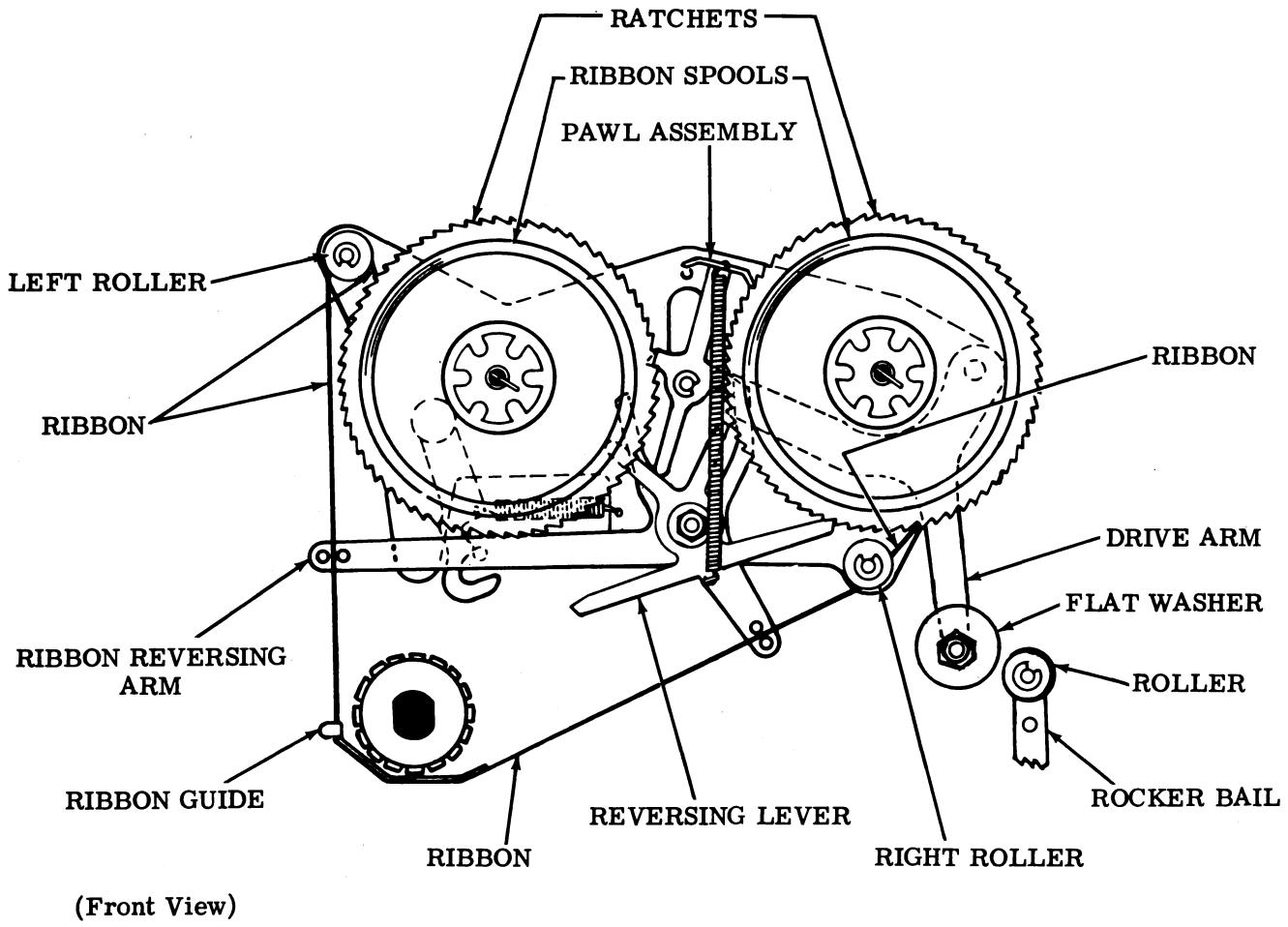


Figure 23 - Ribbon Feed Mechanism

order to maintain proper gear mesh and backlash. Both feed wheel adjusting screws allow alignment of the feed wheels in an axial direction which provides for control of the lateral relationship between the code holes and feed holes. Both adjusting screws have an independently adjustable disc which allows control of endplay of each feed wheel. The left feed wheel adjusting screw has an additional adjustable direction (rotational) for the phasing of the left feed wheel to the punch pins. This is accomplished by the rotational positioning of the left feed wheel shaft gear with respect to the shaft.

B. Center Plate Assembly

8.02 The center plate assembly (Figures 2 and 3) provides mounting places for the main bail assembly, eject mechanism, card sensing switch assembly, feed wheel detent, feed pawl guide, and serves as a structural part of the perforator.

C. Eject Mechanism

8.03 Operation of the eject mechanism (Figure 2) is initiated by the energizing of the eject solenoid. This activates the operating link down, which in turn rotates the two blocking levers counterclockwise to release the two rapid feed levers. The rapid feed levers then rotate counterclockwise until the rollers lie on the rapid feed shaft cam, one on each of the two peripheries. The cam rotates counterclockwise with six lobes (three on each periphery) pushing the two rapid feed levers alternately. The two pawls attached to the levers are biased against the right hand feed wheel ratchet by two springs. The alternating levers cause the ratchets to alternately push the feed wheel counterclockwise at six times the normal stepping rate. When the solenoid is released, the blocking levers are returned to their respective home positions. Then as the rapid feed levers are lifted by the high part of their cams; they latch onto blocking lever after which they no longer follow the cam.

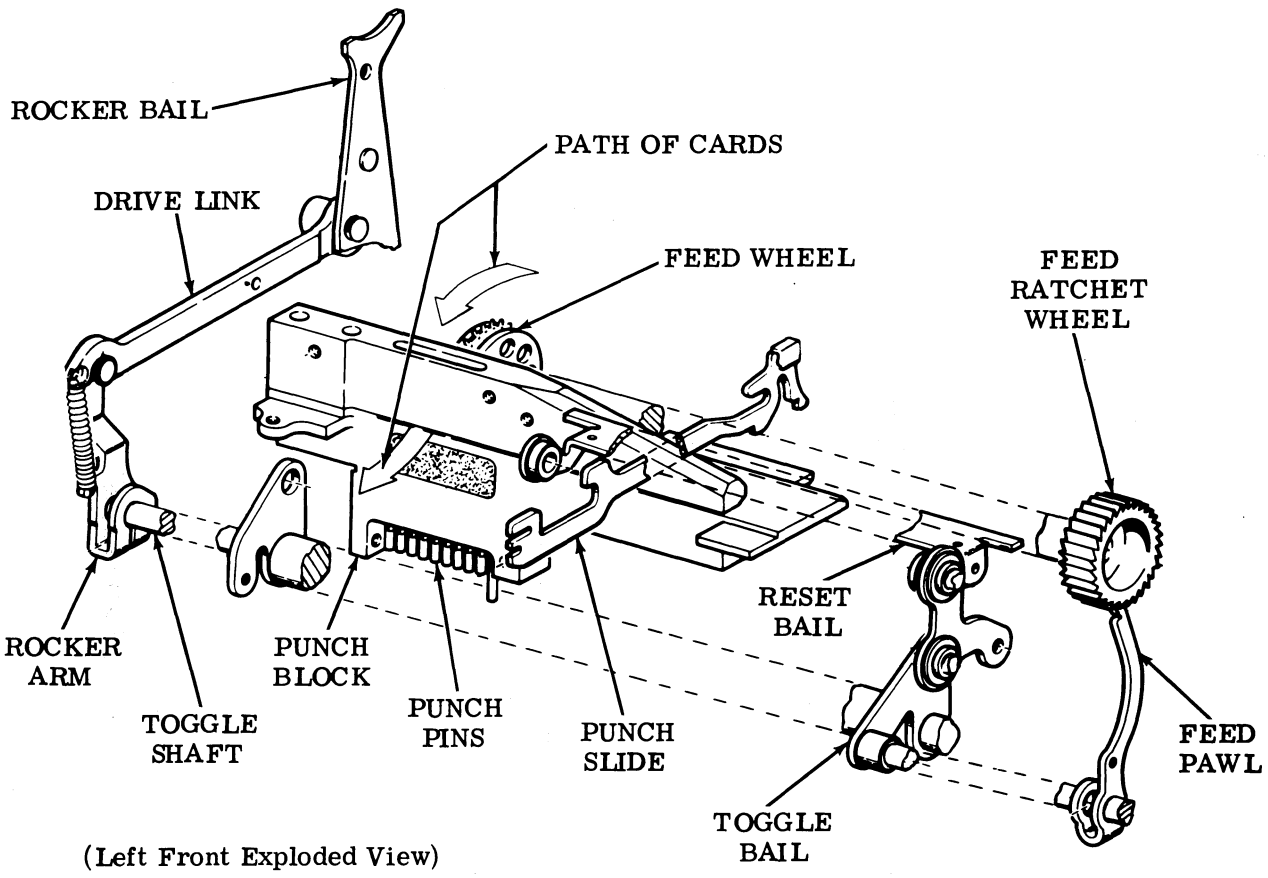


Figure 24 - Perforating Mechanism

D. Card Sensing Switches

8.04 When cards are inserted, three levers and their associated switches (Figure 2) are employed to sense the card's position. The sensing ends of the levers have a camming surface riding the bottom surface of the cards as they are fed through the unit. These levers are so aligned that a hole, which is found in each card, would be sensed by the levers as it passes over each respective high point. The three levers independently sense the same hole in three different positions. When the right hand position is sensed, the print suppression switch is actuated. The center position actuates the eject switch and the left position causes the burst switch to be actuated.

E. Rear Plate Assembly

8.05 The rear plate assembly (Figures 3 and 4) provides mounting places for the main bail assembly, punch selection slide guide, the punch slide downstop, the left top plate lid latch, act as the rear bearing mounting point of both feed wheels, and serves as a structural part of the reperforator.

F. Main Bail Assembly

8.06 The purpose of the main bail assembly (Figures 3 and 4) is to drive the selected punch slides and in turn the punch pins through a perforating cycle to feed the card to the next character position and to reset the punch selection slides to their unoperated positions. The main bail assembly consists of a main bail and a reset bail driven through a linkage by a toggle bail that is driven in turn by an arm connected to the rocker bail assembly. The punch slides pivot about the same center as the main bail. When the slides are selected, they fall under spring tension to their operated positions and become an integral part of the main bail during the card punching stroke. During the feeding stroke, the punch selection slides engage the reset bail and are driven to their unoperated positions where they remain until they are again

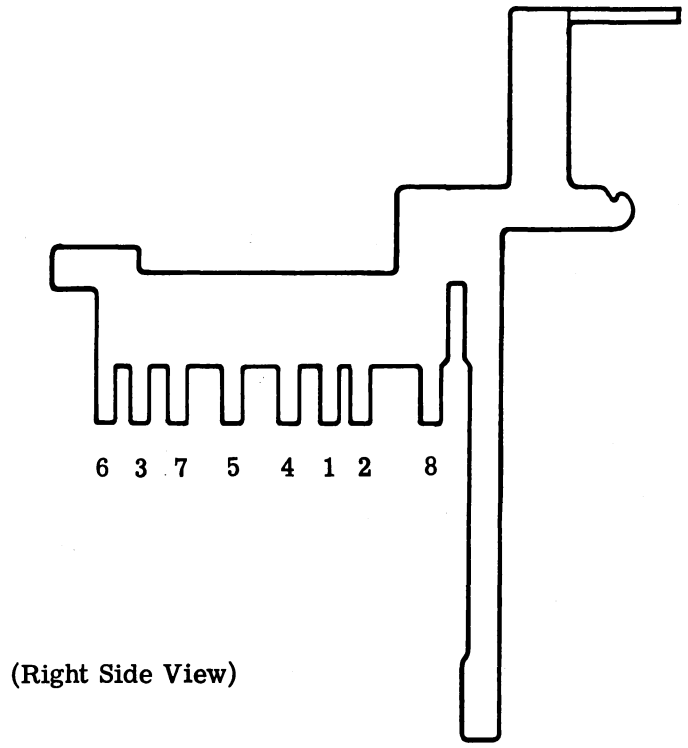


Figure 25 - Universal Function Blade

selected by the selector mechanism. The card feed functions by means of a feed pawl that is attached to the toggle bail. The feed pawl is mounted so that it operates on the front side of the center plate which is unlike the normal reperforator where the pawl operates on the backside. This allows the feed pawl to use the same ratchet as the rapid feed pawls. The feed pawl drives the feed wheel to its detented position during the second half of the function cycle.

G. Punch Block Assembly

8.07 As the cards are fed through the reperforator, they are guided into the punch block by the right hand feed wheel and the right rear top plate guide (Figures 2 and 5). Passing on through the block, the card engages a second left hand feed wheel for additional guiding and alignment purposes. Since the feed holes are prepunched, the relation of feed holes to the edge of the cards have been previously established. However, the requirement for ten holes to the inch must be met. The left hand feed wheel also serves as an assisting feed-out feature after the card has passed beyond the punch block.

H. Function Box Operation

8.08 A universal function blade (Figures 3, 4, and 25), specifically coded for card ejection and operation in conjunction with its associated switch, activates the eject solenoid and its mechanism. This function blade may be coded for any desired character or shift condition by removing tines. The function blade has removable tines in the marking and spacing positions for all levels.

I. Card Eject Contacts

8.09 The card ejection circuit consists of a code operated function box contact (Figure 4) assembly and two relays controlling the operation of the eject solenoid. A switch and extension arm are provided in the punch for the purpose of sensing through a common reference hole in the card the signaling of the end of the eject cycle. The function of the eject circuit is to both start and control the ejection of cards from the punch unit.

J. Print Suppress Contacts

8.10 The print suppression circuit consists of a set of contacts (Figure 3) in the function box, the print suppression magnet, and a switch arm and switch to again sense the reference hole in the card. This contact assembly consists of two swinger type leaf contact pile-ups. The swingers of these contacts are connected in common. These contacts are connected in the punch circuit so that the print suppress magnet energizes when both contacts are marking or both spacing.

K. Card Burster Mechanism

8.11 The burst mechanism (Figures 2, 3, 4, and 5) initiates and controls the separation of cards at the completion of the eject cycle. The bursting circuit consists of a relay, switch burster clutch trip magnet, and a switch arm to sense the common reference hole in the card. A second switch is provided to prevent the burster from operating when single card or the last card of a series of cards (fanfold) is being punched.

L. Manual Backspace Mechanism

8.12 The backspace mechanism (Figure 2) steps the card back through the punch block in order to delete perforated errors. The erroneously perforated code combinations in the retracted card is then obliterated by perforating the rubout code combination in its place. Operation of manual backspace mechanism is initiated by the energizing of the lowermost solenoid mounted on the center plate assembly. This activates the operating link to the left, to rotate the drive lever with pin clockwise and to release the normal feed pawl and two rapid feed pawls from their common feed ratchet. The backspace function is completed by manually rotating the shaft with handle and associated feed wheels in a clockwise direction to attain the desired card position in its reverse direction.

M. Null Character Generator Contact Assembly

8.13 The null character generator contacts (Figure 4) are activated by a cam segment which is mounted to the burst clutch disc. This produces a null character signal during the burst cycle which is sensed by the card reader circuitry as a signal to resume transmission.