28 TYPING AND NONTYPING PERFORATORS

DESCRIPTION AND PRINCIPLES OF OPERATION

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1. GENERAL

1.01 This section provides a description and outlines the principles of operation for two types of perforators: one a nontyping perforator and the other a typing perforator.

1.02 The following description and principles of operation will apply to both units except for that portion pertaining to typing mechanism only.

1.03 In this section, reference to left or right indicates the operators left or right facing the front of the unit in its operating position.

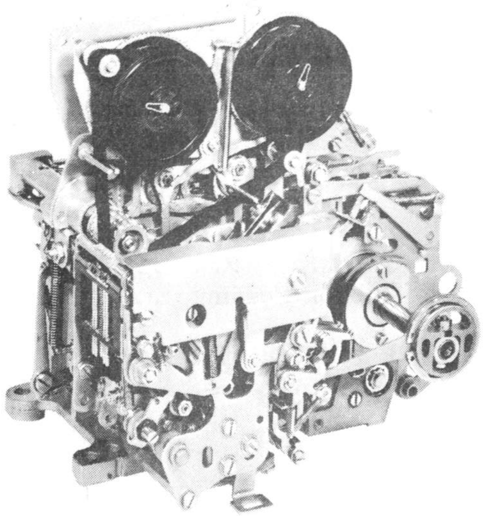


Figure 1 - Typing Perforator

2. GENERAL DESCRIPTION

2.01 The 28 typing and nontyping perforators are mechanical units that are used with an associated keyboard from which code selections are derived and mechanically transferred into the perforator (Figures 1 and 2).

2.02 The perforators produce a coded, perforated tape as dictated by its associated keyboard. Two types of perforators are available: a nontyping perforator and a typing perforator. Each type is capable of producing either chadless tape or fully perforated tape. The typing perforator is capable of producing perforated tape and typing thereon simultaneously. The tape may be chadless with typing on top of the chads which are not completely severed, or it may be fully perforated tape with typing between the feed holes.

2.03 In general the two units have the same function and perforating mechanisms, but the typing perforator has, in addition, the necessary mechanisms to perform typing on tape.

2.04 Each unit receives its driving power from a motor unit through drive shafting on the associated keyboard. Selection is derived mechanically from the keyboard.

2.05 A perforator consists principally of a two-shaft drive mechanism, function mechanism, transfer mechanism, perforating mechanism, and a typing mechanism for the typing perforator only (Figures 3 and 5).

CODE

2.06 The code combinations are set up by simultaneous selection of the punch slides. If a punch slide is released by its latch, it represents a marking condition. If a punch slide is not released by its latch, it represents a spacing condition. Every code combination includes five elements that carry the intelligence, each of which may be either marking or spacing. Marking elements in the intelligence code produce holes in the tape whereas spacing elements do not. The row of smaller holes between the second and third levels are tape feed holes and do not enter into the code permutation.

2.07 The total number of permutations of a five-unit code is two to the fifth power, or 32. In order to produce more than 32 characters and functions, a letters-figures shift operation is designed into the typing equipment. This permits each permutation, excluding those used to shift and unshift the apparatus, to represent two characters or functions. Figure 7 shows the code combinations.

3. DETAILED DESCRIPTION

FUNCTION

3.01 The function mechanism consists of a jack shaft with a gear for driving the main shaft. The main shaft assembly includes a clutch assembly and cams for actuating a rocker bail. The clutches differ in the two types of perforators in that the nontyping perforator has a two-stop clutch which stops twice during each revolution and performs its function in one half of

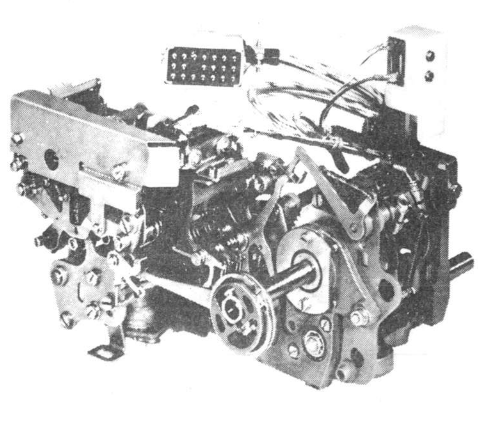


Figure 2 - Nontyping Perforator

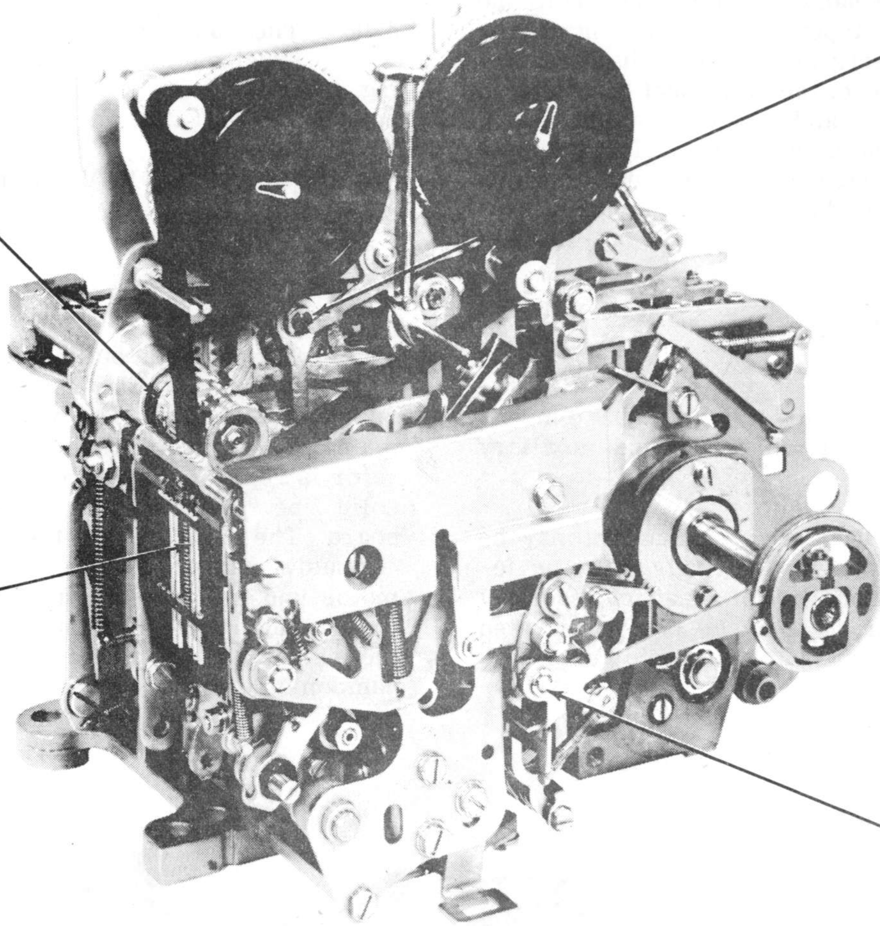


Figure 3 - Typing Perforator (Front View)

a revolution. This makes the nontyping perforator capable of operating twice as fast as a unit with a one-stop clutch. The typing perforator uses a one-stop clutch because the typing mechanism limits its speed of operation. The cams of the function shaft assembly are used to provide motion for the rocker bail, the main source of power for all functions except selection.

SELECTION

3.02 Selection is accomplished mechanically from an associated keyboard through its codebar extensions. An extension is positioned to operate each punch slide latch on the perforating mechanism when selection is made, and a perforator trip lever latch is in position to trip the perforator clutch when selection is applied at the keyboard.

PERFORATING

3.03 The perforator mechanism consists of a set of five punch slides, punch block assembly containing punch pins, toggle bail and reset bail assembly, and a tape feeding assembly. A perforator drive link connects the toggle bail and reset bail assembly to the rocker bail which provides motion for operation of the perforator mechanism.

TYPING

3.04 In addition to the function, selecting, and perforating mechanisms, the typing perforator encompasses other mechanisms necessary for printing on tape. The selection is passed through a transfer mechanism to a function box and pushbars which control a rotary positioning mechanism and an axial positioning mechanism to position a typewheel for printing. A correcting mechanism further corrects the positioning of the typewheel. A printing mechanism driven directly by the rocker bail actuates a print hammer after the typewheel has reached its correct position, and impels the print hammer upward to drive the tape and inked ribbon against the typewheel. A ribbon feed mechanism, which advances an inked ribbon one space during each operation, is actuated by the rocker bail through a ribbon drive arm.

VARIABLE FEATURES

3.05 Some variable features used with the perforators are: tape backspace mechanism, code reading contacts, and auxiliary contacts.

3.06 The tape backspace mechanism may be manually operated entirely on the perforator, or, with the addition of a magnet assembly on the perforator, it may be power operated from a keylever and switch assembly on a keyboard.

3.07 The code reading contacts are operated by the punch slides to read the code combinations which are being perforated.

3.08 The auxiliary timing contacts provide synchronizing pulses for the code reading contacts.

4. PRINCIPLES OF OPERATION

GENERAL

4.01 The general outline of operation of the two perforators is shown in the block diagram (Figure 6). The broken lines represent the nontyping perforator while the typing perforator is represented by both a broken line and solid line. Selection is applied from the keyboard. The main shaft of the perforator is continuously rotated by power from an associated motor and shafting on an associated keyboard base. The rotary motion is transferred from the main shaft through an all-steel internal expansion clutch to the function cam.

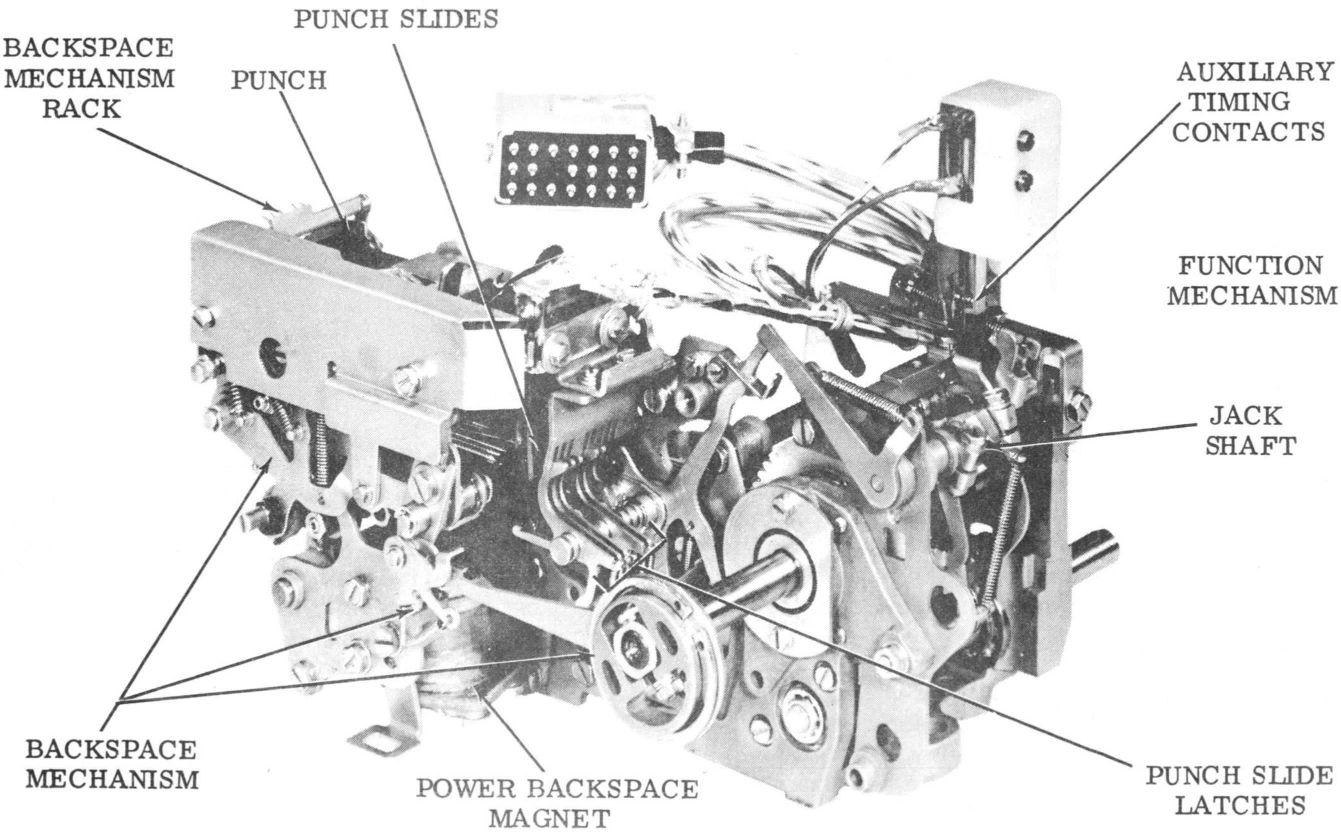


Figure 4 - Nontyping Perforator (Front View)

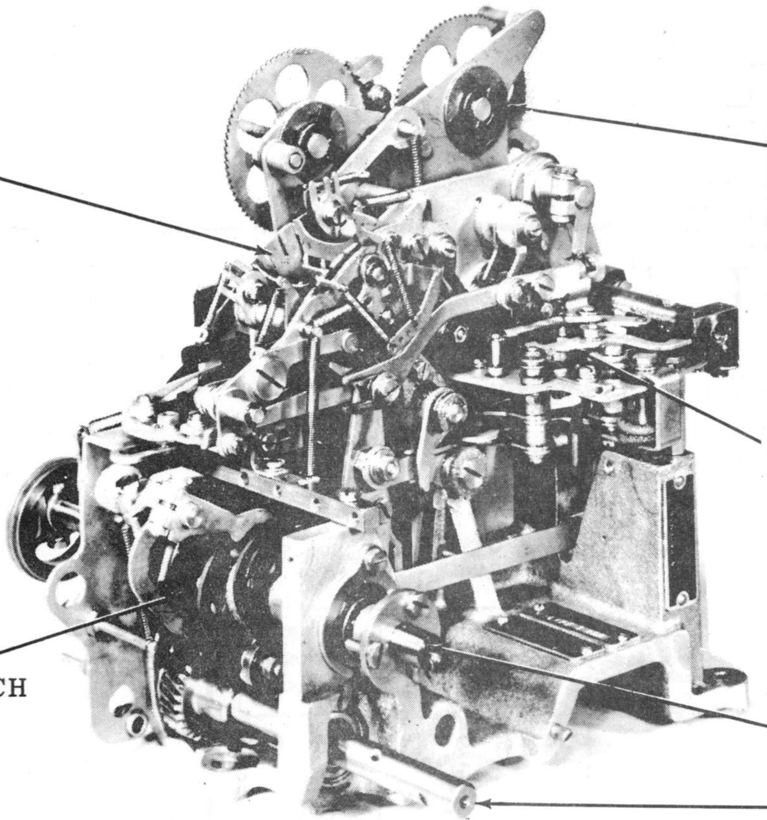


Figure 5 - Typing Perforator (Rear View)

4.02 The function cam drives a rocker bail to transfer the motion derived from the main shaft into simple harmonic motion which drives the other mechanisms of the unit.

SELECTION AND TRANSLATION

4.03 The code combinations set up by keylever on the keyboard are transferred through codebar extensions which move to the right and trip a punch slide latch for each marking condition of the code combination (Figure 7).

A. Clutch Operation

4.04 The typing perforator uses a one-stop function clutch, whereas the nontyping perforator uses a two-stop function clutch. The functions performed are essentially the same except that in the nontyping unit the function is performed during a one-half turn of the main shaft and therefore is capable of operating twice as fast as the typing unit. The typing unit is limited to a slower speed because of the typing operation performed. The operating principle of the internal mechanisms are the same except two shoe levers are used to disengage the clutch twice for each revolution of the clutch in the nontyping perforator.

One-Stop Clutch Operation (Figures 8 and 9)

4.05 The clutch drum is attached to and rotates in unison with the main shaft. In the disengaged position, as shown in Figure 9, the clutch shoes do not contact the drum, and the shoes and cam disc are held stationary. Engagement is accomplished by moving the clutch trip lever, Figure 12, away from the clutch and thus releasing stop lug A and the lower end of shoe lever B (Figure 8). 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

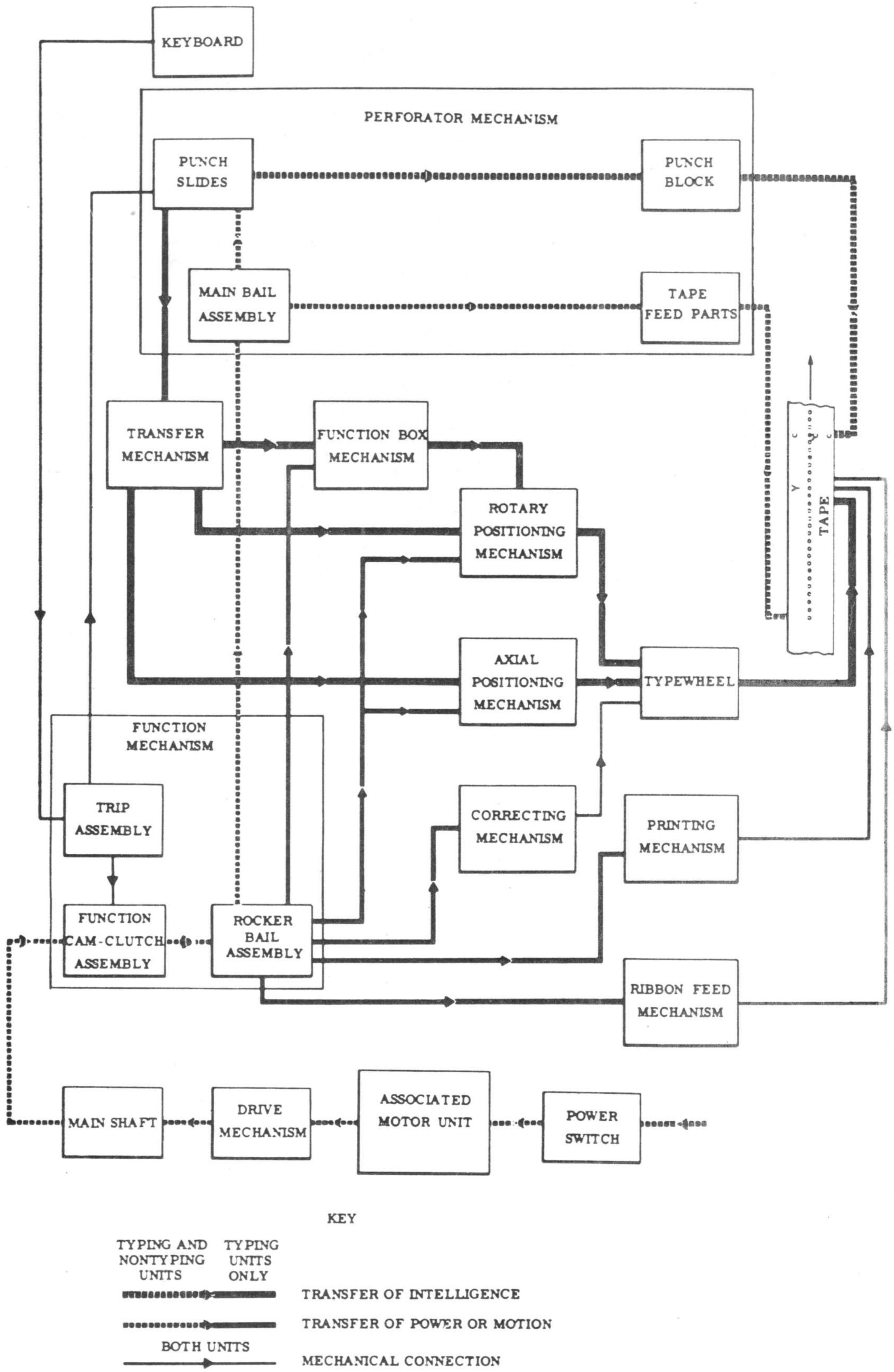


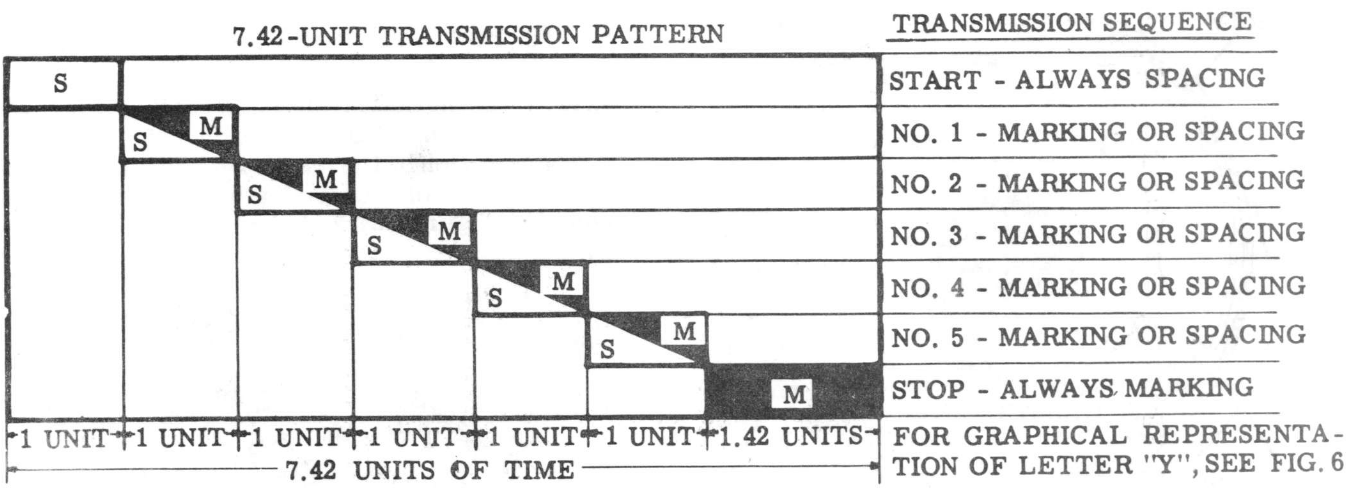
Figure 6 - Block Diagram for Typing and Nontyping Perforators

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.

4.06 Disengagement is effected when the lower end of shoe lever B strikes the clutch trip lever. Lug A and the lower end of the shoe lever are brought together (Figure 8), 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 and the cam is held in its stop position until the clutch is again engaged.

Two-Stop Clutch Operation (Figure 10)

4.07 The operation of the two-stop clutch, which is used exclusively on the function cam clutch of the two-shaft unit, is similar to that of the one-stop clutch, the major difference being that it can be stopped after 180 degrees of rotation rather than 360 degrees. The two-stop clutch is shown disengaged in Figure 10. When the stop arm is moved away from A, the shoe lever disc under spring tension pivots counterclockwise and carries with it the shoe lever which engages the shoe lever disc at B. The shoe lever moves the primary shoe to the left and engagement is completed as described in Paragraphs 4.05 and 4.06. After the cam clutch rotates 180 degrees, the shoe lever disc strikes the stop arm at A'. The shoe lever disc and shoe lever are pivoted clockwise and the clutch is disengaged as outlined in Paragraph 4.06.



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(TYPICAL CHARACTER ARRANGEMENT)

Figure 7 - Code Chart

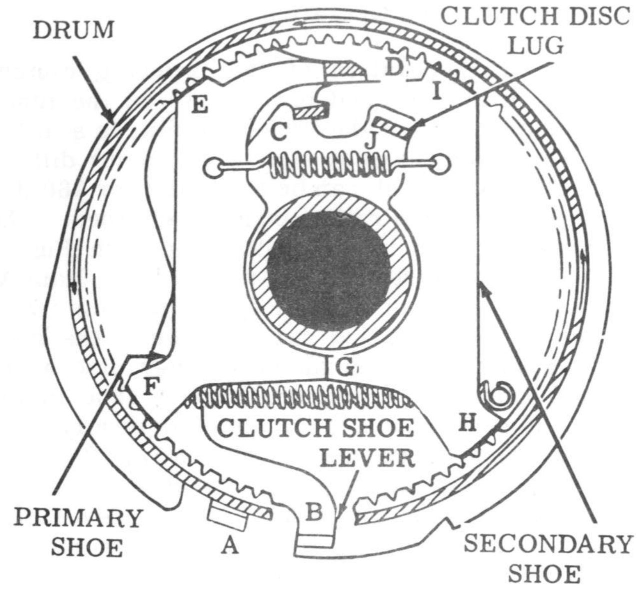


Figure 8 - One-Stop Clutch (Engaged)

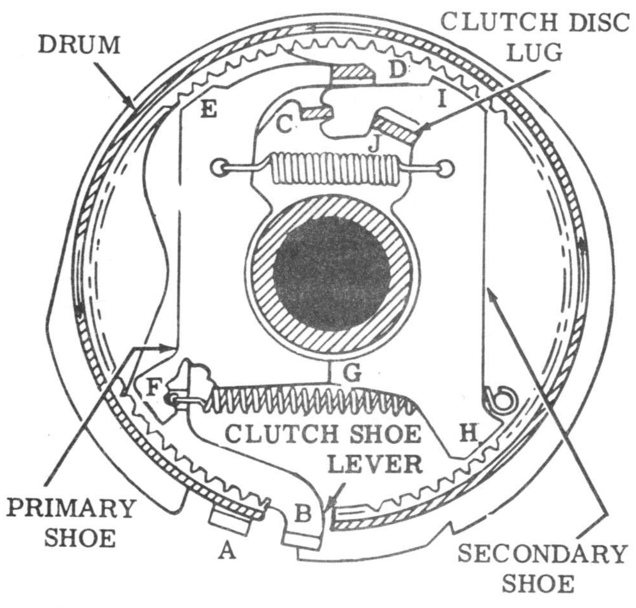


Figure 9 - One-Stop Clutch (Disengaged)

B. Transfer

4.08 Near the end of selection, the transfer mechanism moves the intelligence in the form of a mechanical arrangement from the punch slides to the function box and positioning mechanisms. Included in the mechanism are five linkages, each of which is associated with a punch slide. A linkage consists of a transfer lever, a pulse beam and a bell crank. Since the linkages are similar, only the no. 4 is shown in its entirety in Figure 11.

4.09 The linkages associated with the unselected punch slides remain in their unselected position as in Figures 11 and 12. However, the selected slides in moving to the left, pivot the associated transfer levers which, in turn, move corresponding pulse beams clockwise (as viewed from above). The selected beams allow associated bell cranks under spring tension to pivot counterclockwise and lift attached pushbars. The pushbars, in turn, control the positioning mechanisms. In the period of the last half of the function cycle, the selected slides are moved back to the right (4.46) and return the linkages to their unselected position.

4.10 Slotted upper arms of the bell cranks extend up into the function box and control its operation as described in Paragraph 4.34. An additional bell crank, not associated with a transfer linkage, is specifically concerned with the letters-figures shift.

MOTION FOR TYPING AND PERFORATING

A. General

4.11 The motion of the main shaft is conveyed to the mechanisms concerned with typing and perforation by the function mechanism, which is comprised of a cam clutch, a clutch trip assembly (Figure 12) and a rocker bail (Figures 13 and 14).

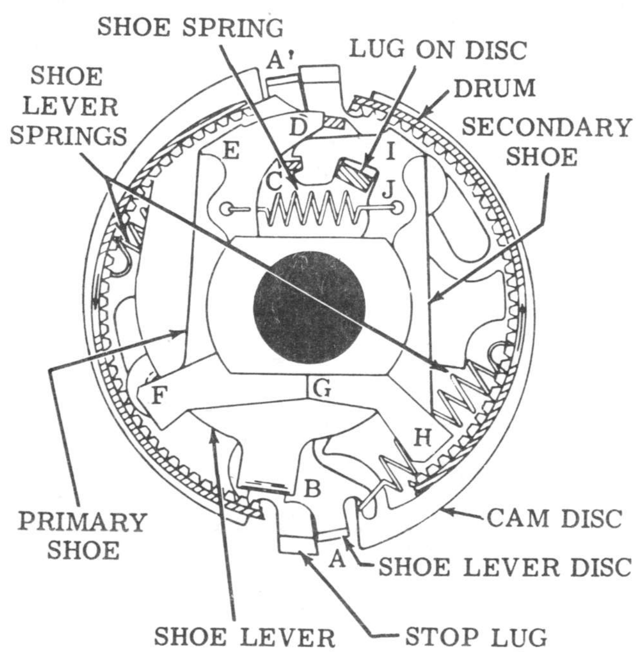


Figure 10 - Two-Stop Clutch

B. Function Cam Clutch and Clutch Trip Assembly

4.12 The trip assembly is shown in its unoperated condition in Figure 12. Through codebar extensions and a clutch trip bar link, Figure 12, operation of a keylever on an associated keyboard releases the punch slide latches and trips the function clutch. A perforator trip lever latch is positioned underneath an extension of the perforator trip lever. When a keylever is operated, the perforator trip lever latch 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 (4.43); 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 perforator trip lever latch returns 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 in Paragraph 4.05.

4.13 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 raise the reset bail as it moves to its downstop. The pin on the reset cam 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 clutch completes its cycle, the clutch shoe lever strikes the trip lever, and the clutch disengages.

C. Rocker Bail (Figures 13 and 14)

4.14 The function cams and the rocker bail translate the rotation of the main shaft into simple harmonic motion, which the rocker bail distributes to the operating mechanisms of the unit.

4.15 Since the nontyping perforator operates only the mechanism for perforating tape, a different rocker bail is used to drive the punch mechanism only (Figure 14).

4.16 The rocker bail, used in the typing perforator, includes two upward extensions which transfer the harmonic motion to:

(a) Ribbon feed mechanism

(b) Perforator

(c) Correcting mechanism

(d) Function box

(e) Printing mechanism

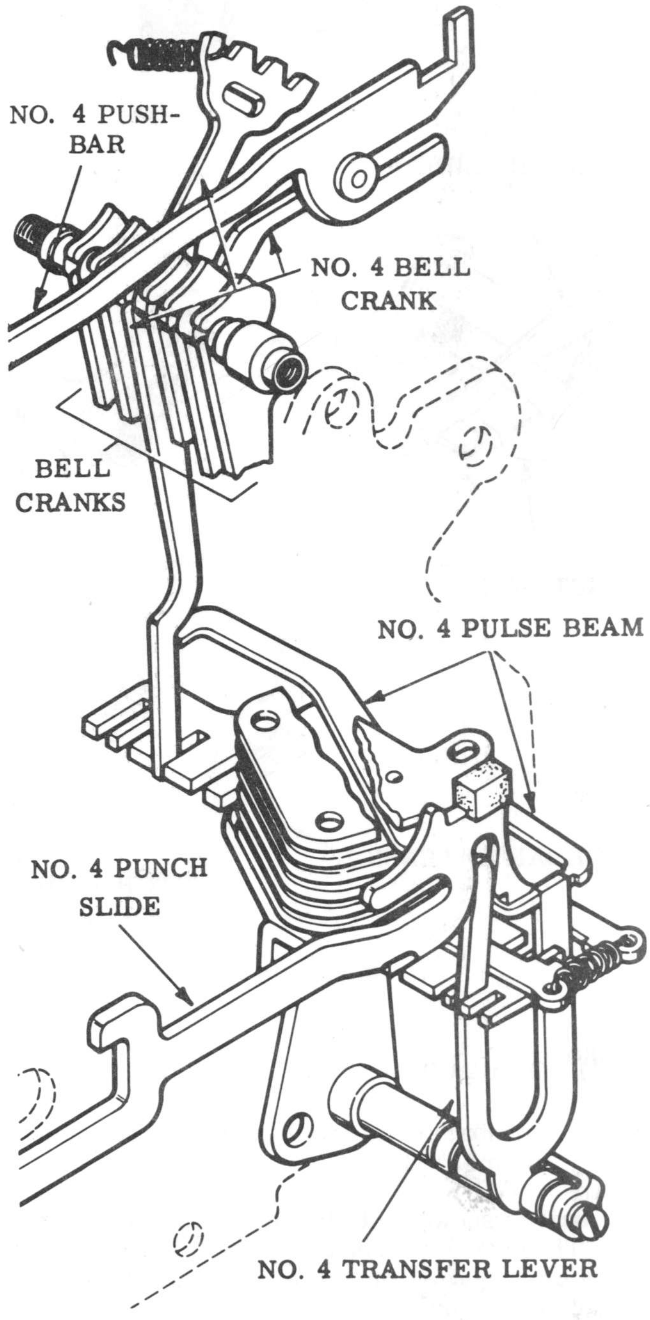


Figure 11 - Transfer Mechanism

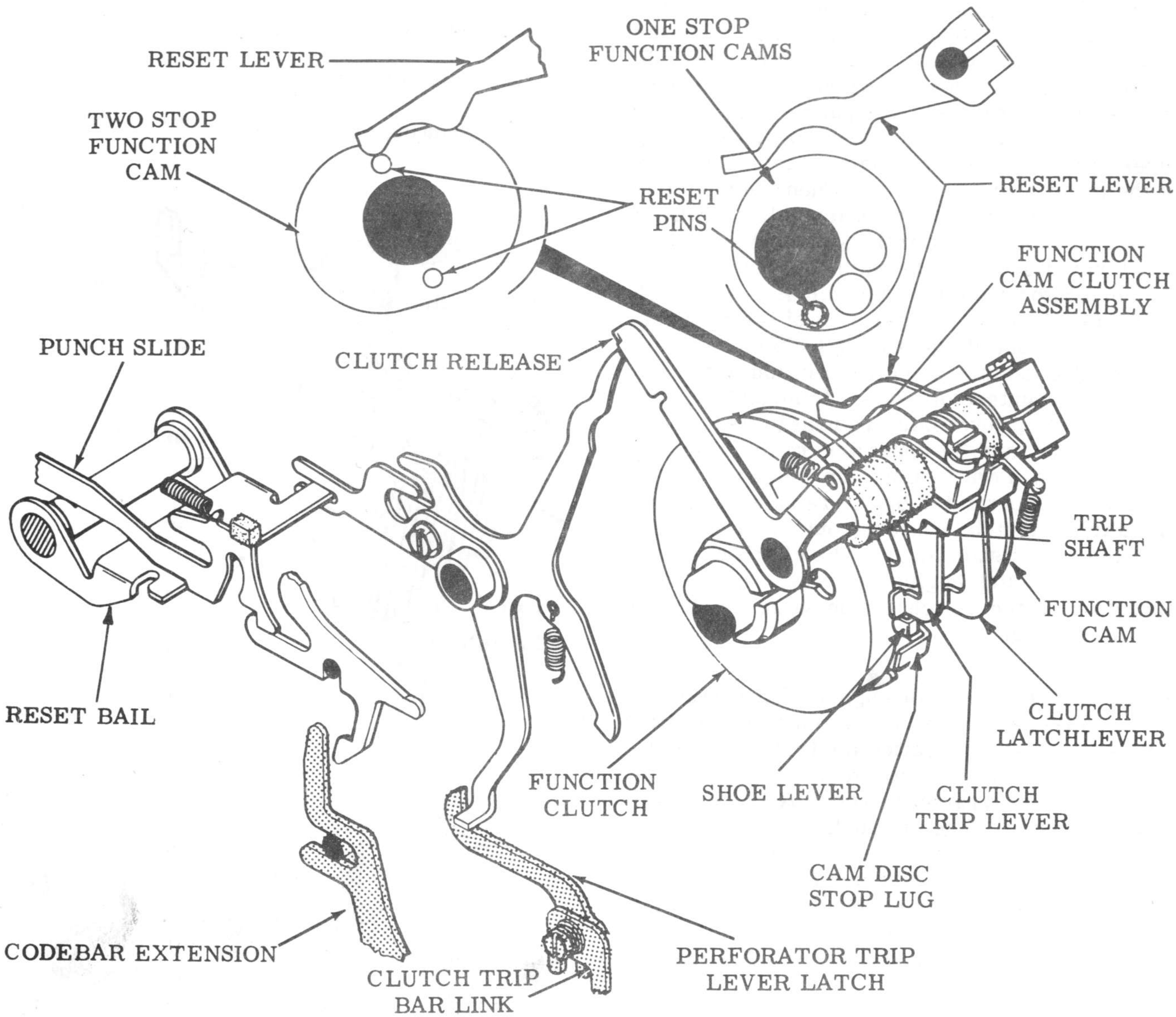


Figure 12 - Function Cam Clutch and Clutch Trip Assembly

(f) Oscillating assembly

(g) Pushbars of the axial and rotary positioning mechanisms

The bail is shown in its home position in Figure 13. Through 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 14) during the first half of the cycle and then back to the home position during the latter part of the cycle.

TYPING

A. General

4.17 The characters used to type the received intelligence - letters, figures, and symbols representing various functions - are embossed on the cylinderal surface of the metal typewheel (Figure 15). During the function cycle, the axial and rotary positioning mechanisms (Figures 16 and 18), 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 16 and 18) accurately aligns the selected character. Then the printing mechanism (Figure 20), by means of a hammer, drives the tape and inked ribbon against the wheel and imprints the character. A ribbon feed mechanism (Figure 21) 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 and a ribbon guide so that 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 19) to operate and cause the rotary positioning mechanism to shift the typewheel through 180 degrees of rotation.

B. Typewheel Positioning

General

4.18 A typical typewheel character arrangement is shown in Figure 15 in which the wheel's cylindrical surface 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. 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, 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.

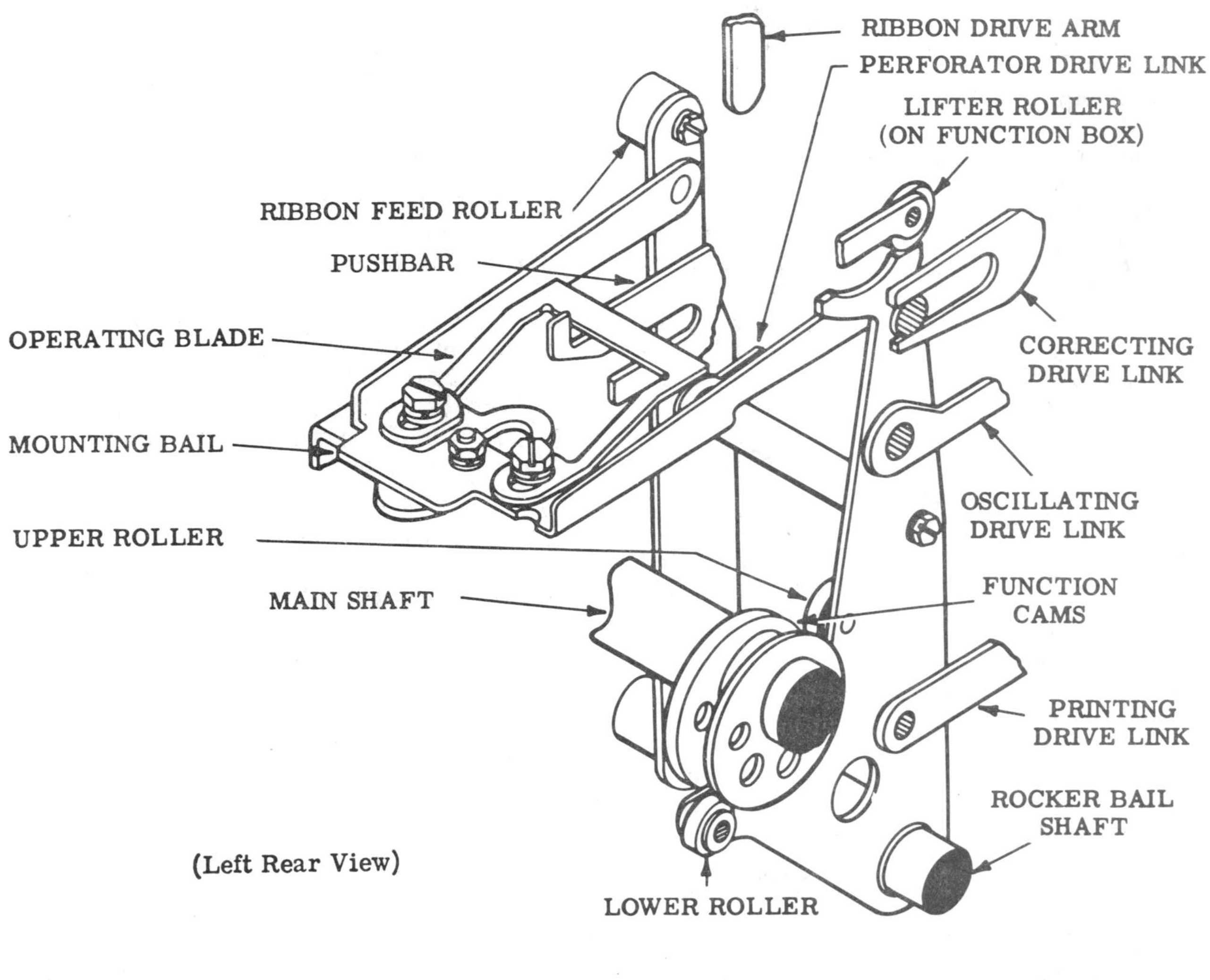


Figure 13 - Typing Perforator Rocker Bail Assembly

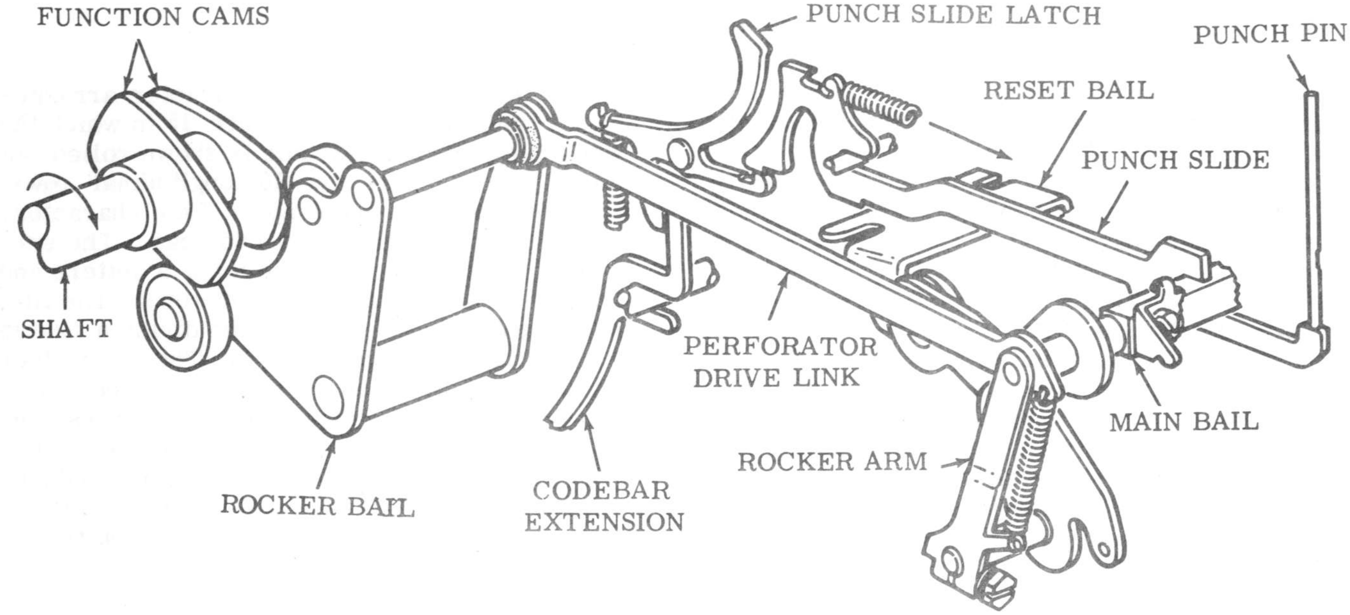


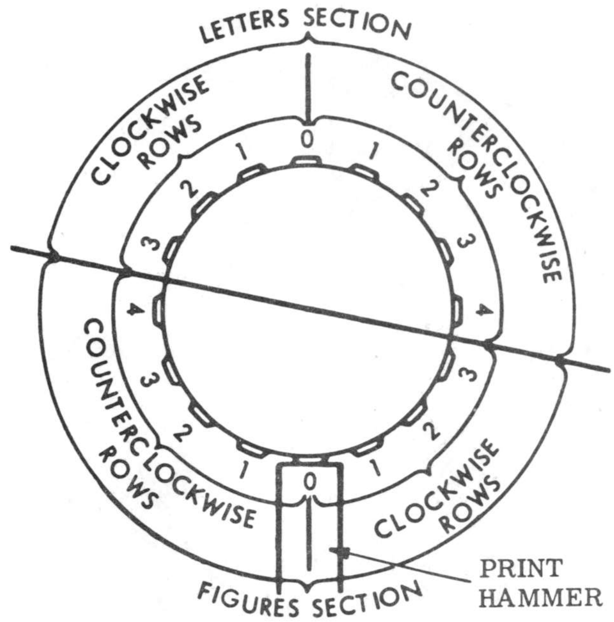
Figure 14 - Nontyping Perforator Rocker Bail

4.19 Each printing operation (excluding those devoted to the letters-figures shift) begins and ends with the typewheel in the home 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 (4.27), 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 so as 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 so as 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 element of the code. The letters-figures shift (4.33), which consists of rotating the wheel eight rows from the home position of one section to that of the other, requires a separate operation of the equipment and results in the printing of the letters or figures symbol.

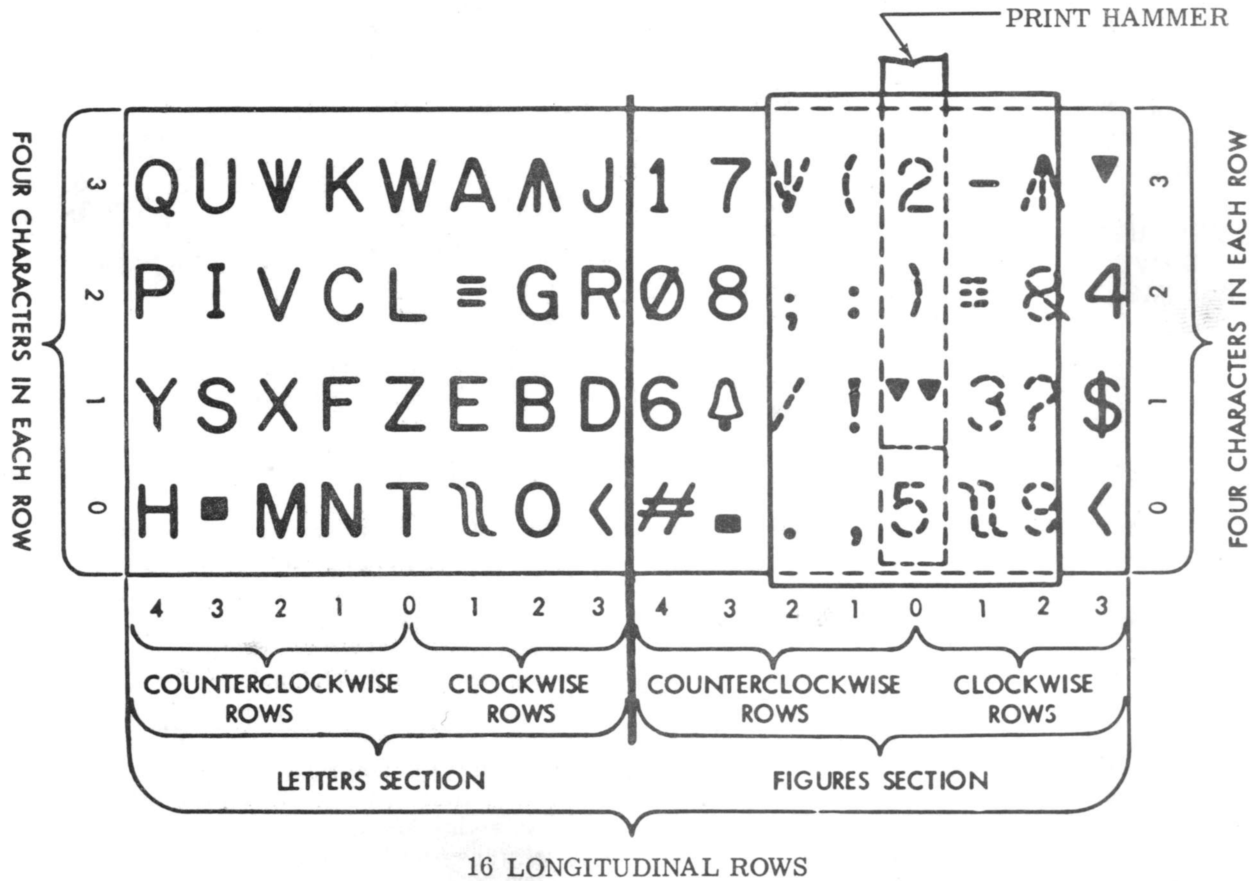
4.20 To illustrate the above, if the wheel is in the figures condition, as shown in Figure 16, and the numeral "5" is to be printed, there is no movement of the wheel during the printing operation, because "5" is already at the point of contact of the hammer. However, if the letter "I" is to be printed, the signaling code for letters must first be viewed to shift the typewheel 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 "I" is at the point of contact of the hammer. Printing takes place, and the wheel is then returned to the letters home position.

Rotary Positioning (Figures 16 and 17)

4.21 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 16 and 17. 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



A. FRONT VIEW SHOWING 16 LONGITUDINAL ROWS



B. TOP VIEW SHOWING CYLINDRICAL SURFACE IN A PLANE

Figure 15 - Typical Typewheel Character Arrangement

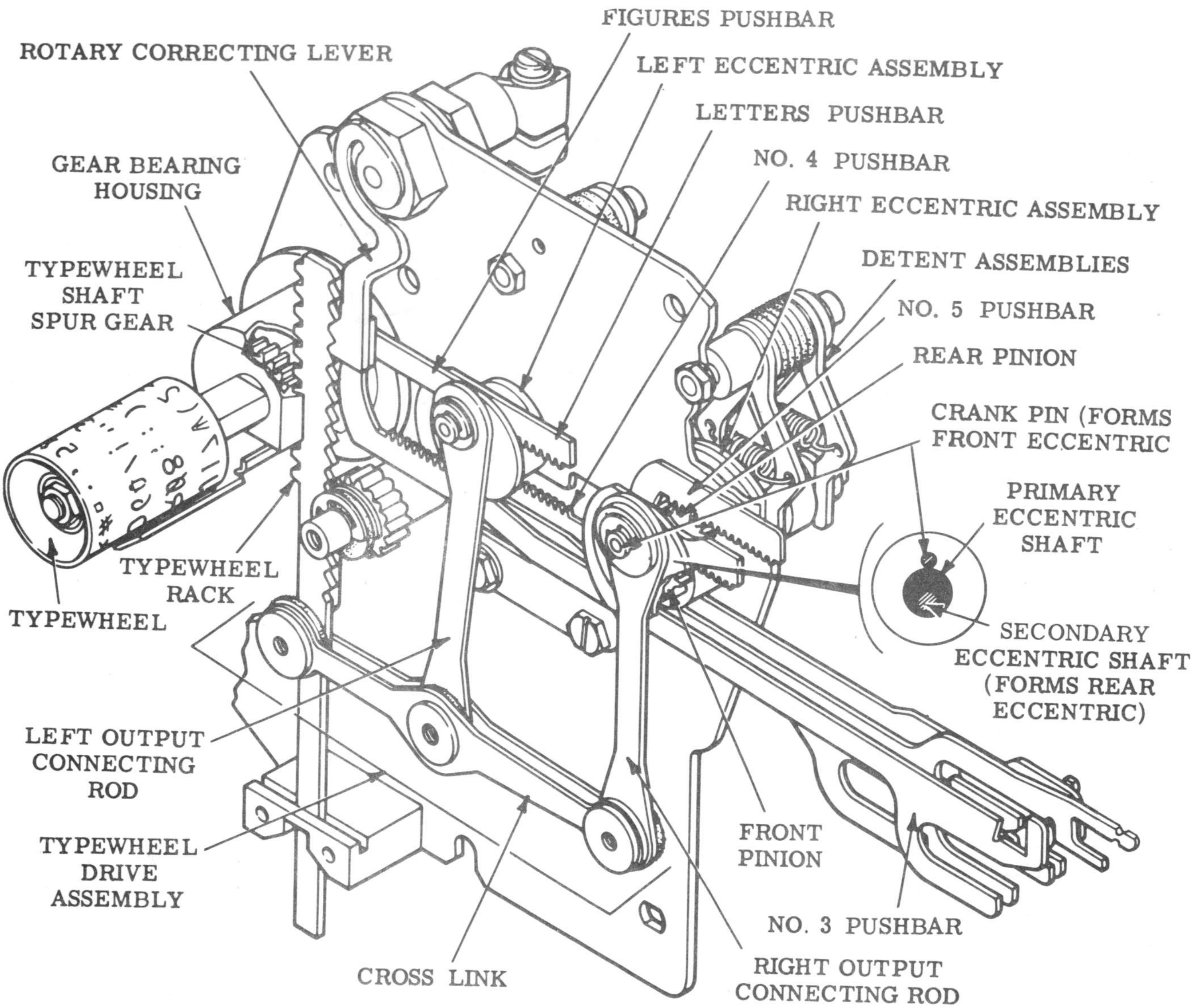


Figure 16 - Rotary Positioning Mechanism

eccentric assemblies is engaged by the rack of a pushbar: the no. 3 bar engages the rear pinion, and the no. 5 engages the right pinion. The left front pinion is engaged by both the letters and the figures pushbar.

4.22 The eccentric assemblies are linked to a typewheel shaft by a drive assembly as shown in Figure 16. 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 18). 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.

4.23 When in response to a marking pulse a pushbar is lifted by its bell crank, as described in 4.07, the rocker bail operating blade (see Figures 14 and 17) 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 positions where the eccentric is again detented. The preceding does not apply to the no. 5 pushbar which is designed so that it is selected - moved to the left - on spacing rather than on marking, nor to the left front eccentric which affects the letters-figures shift (4.33). 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).

4.24 In the right assembly the home position of the rear eccentric is down and the home position of front eccentric is up (Figure 17). Thus their displacements are in opposite directions - up for the rear and down for the 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 16). 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 15)

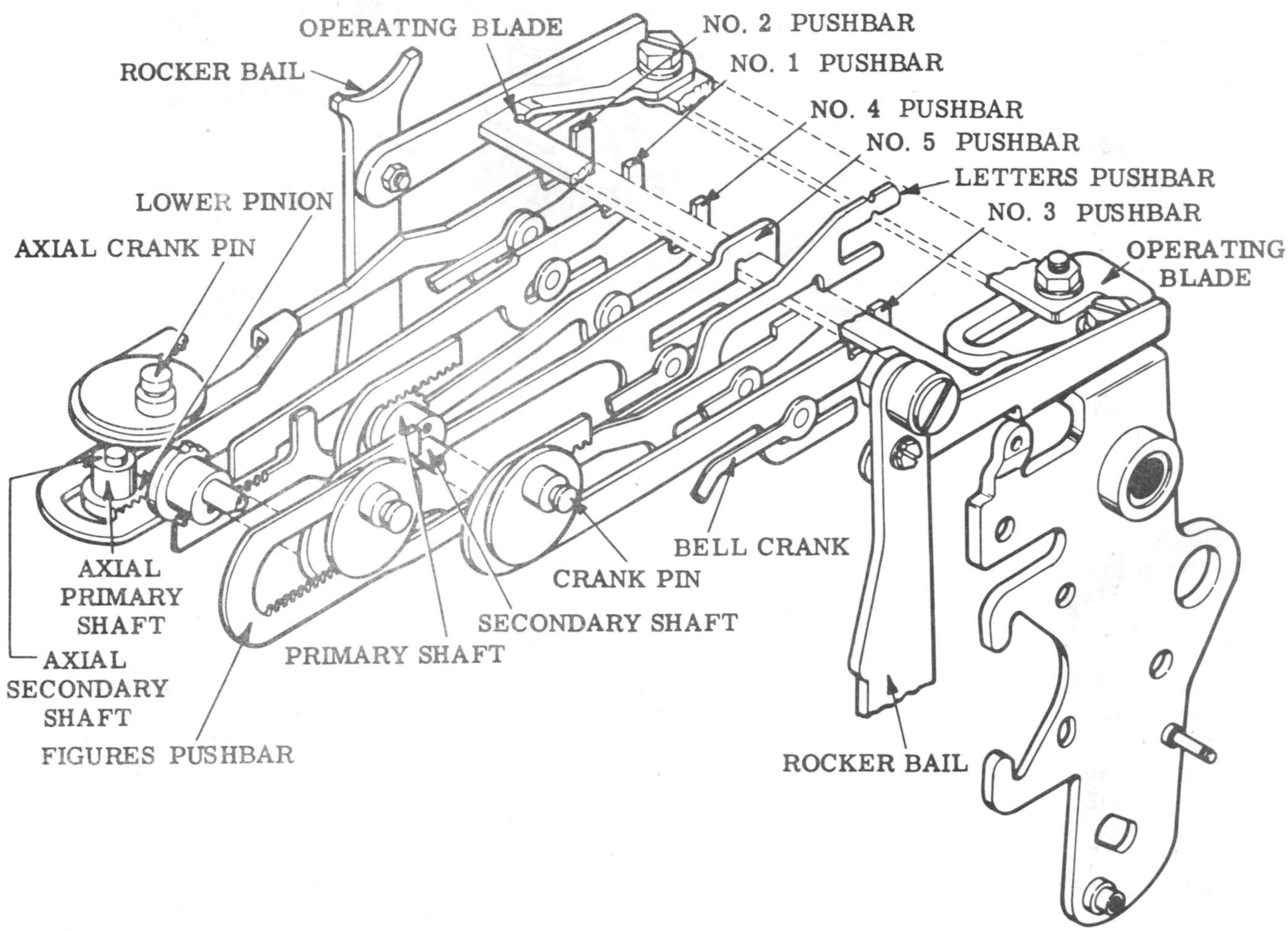


Figure 17 - Pushbars and Eccentric Assemblies

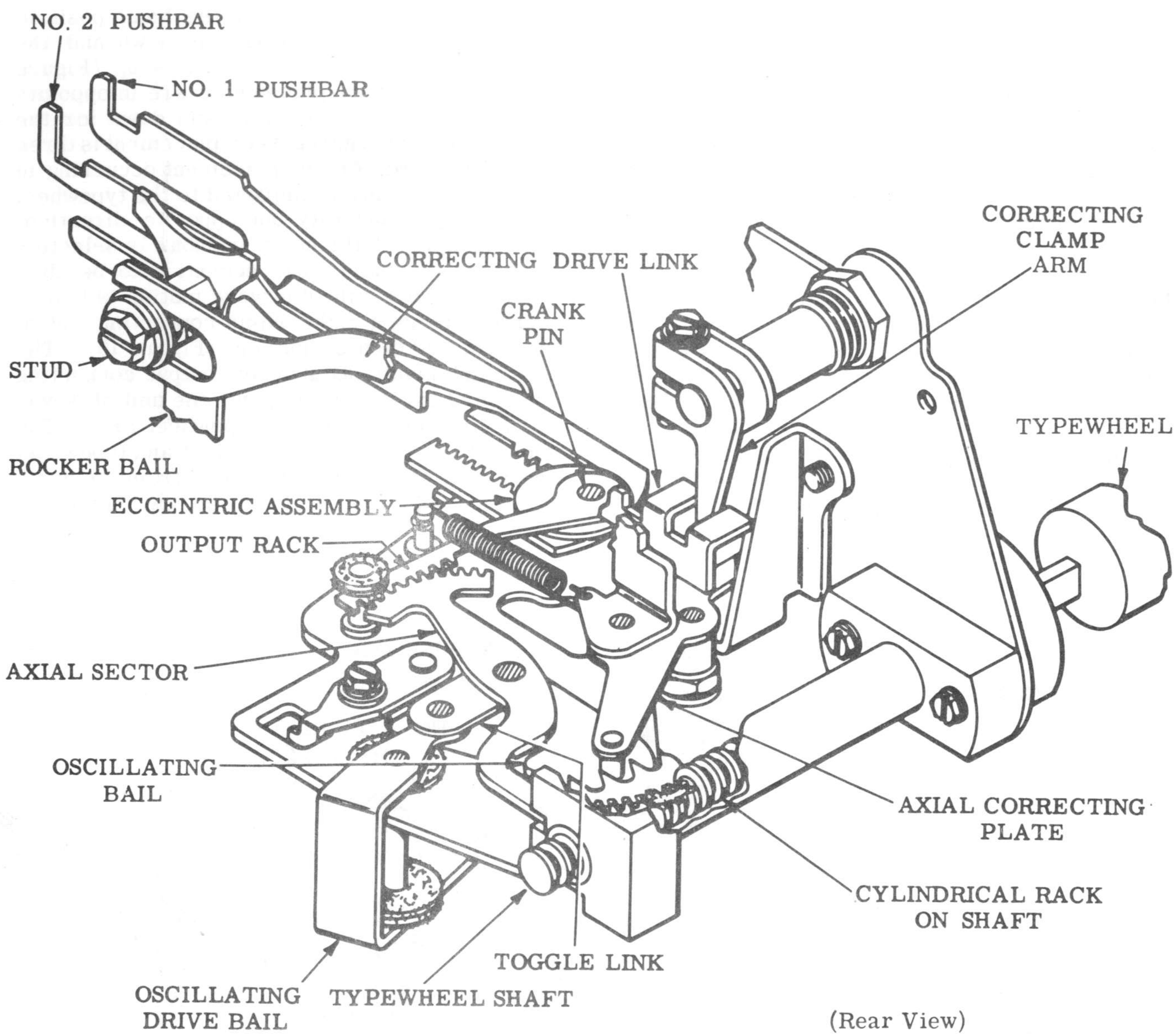


Figure 18 - Axial Positioning Mechanism

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. Selection of both the three and five type bars results in a three-row, counterclockwise rotation of the typewheel.

4.25 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 the no. 5 pushbar is selected, the 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 the typewheel two rows clockwise from its home position.

4.26 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 ex-

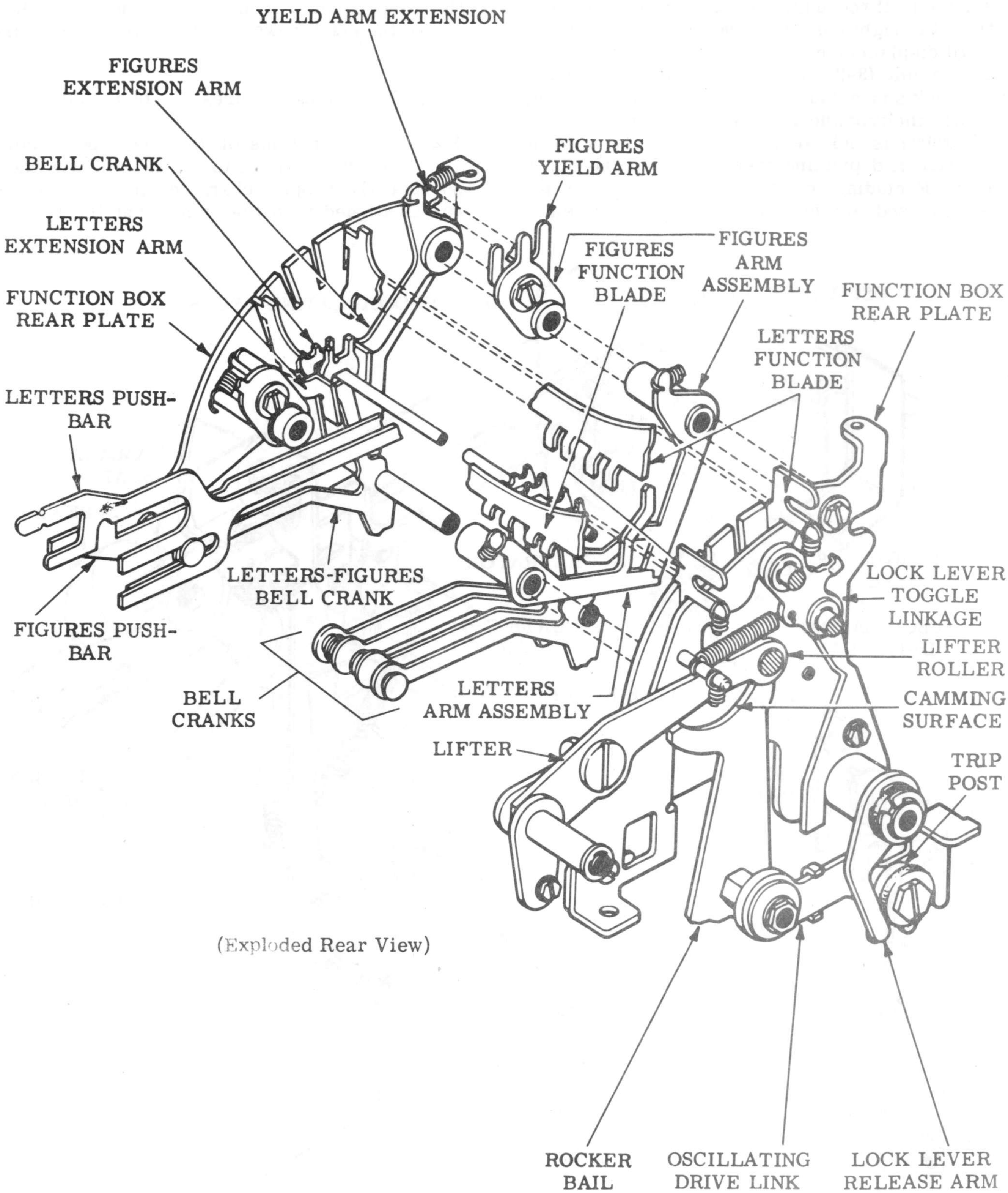


Figure 19 - Function Box

ample, 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 15).

Axial Positioning (Figures 17, 18 and 20)

4.27 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

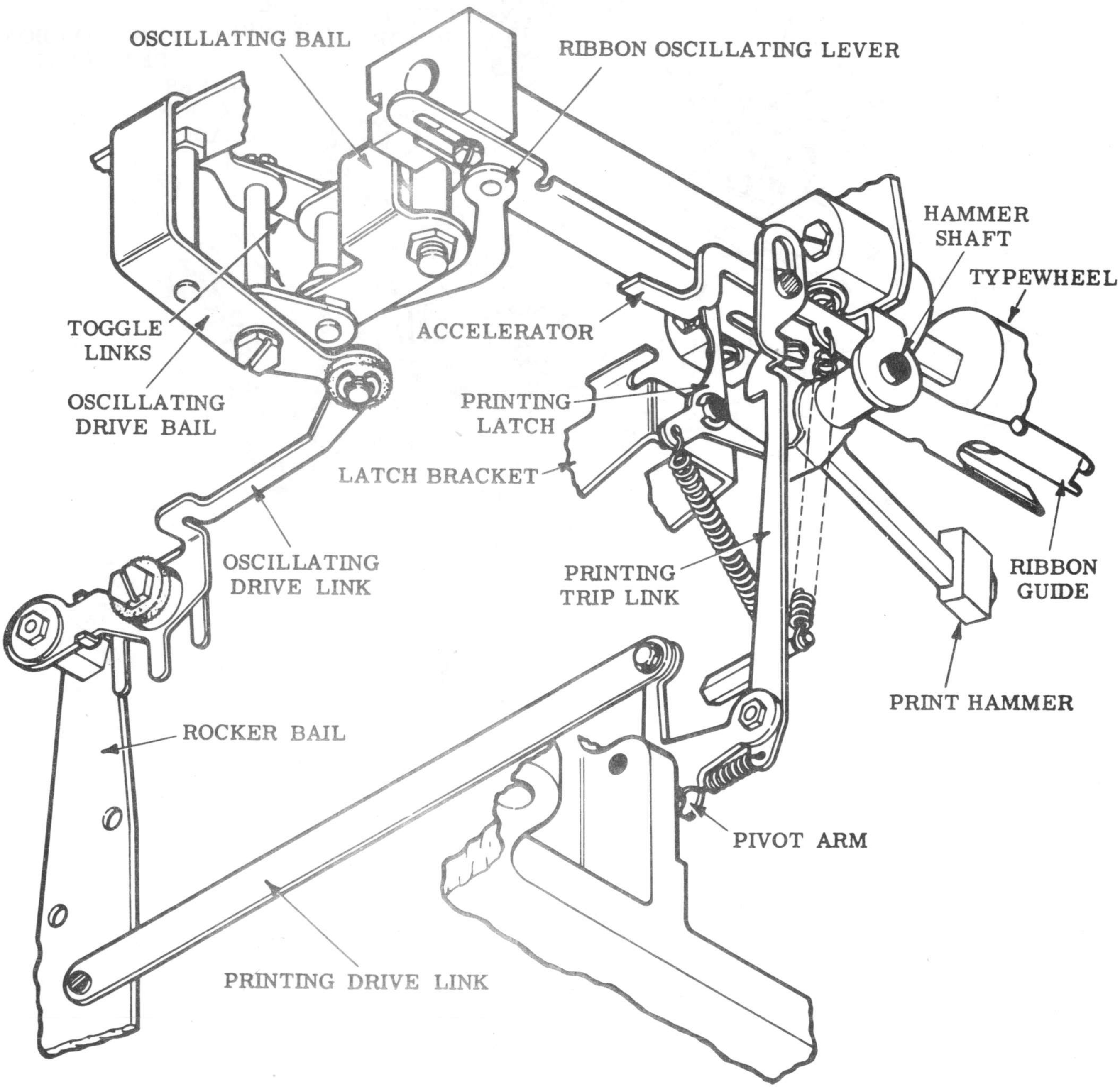


Figure 20 - Printing Mechanism

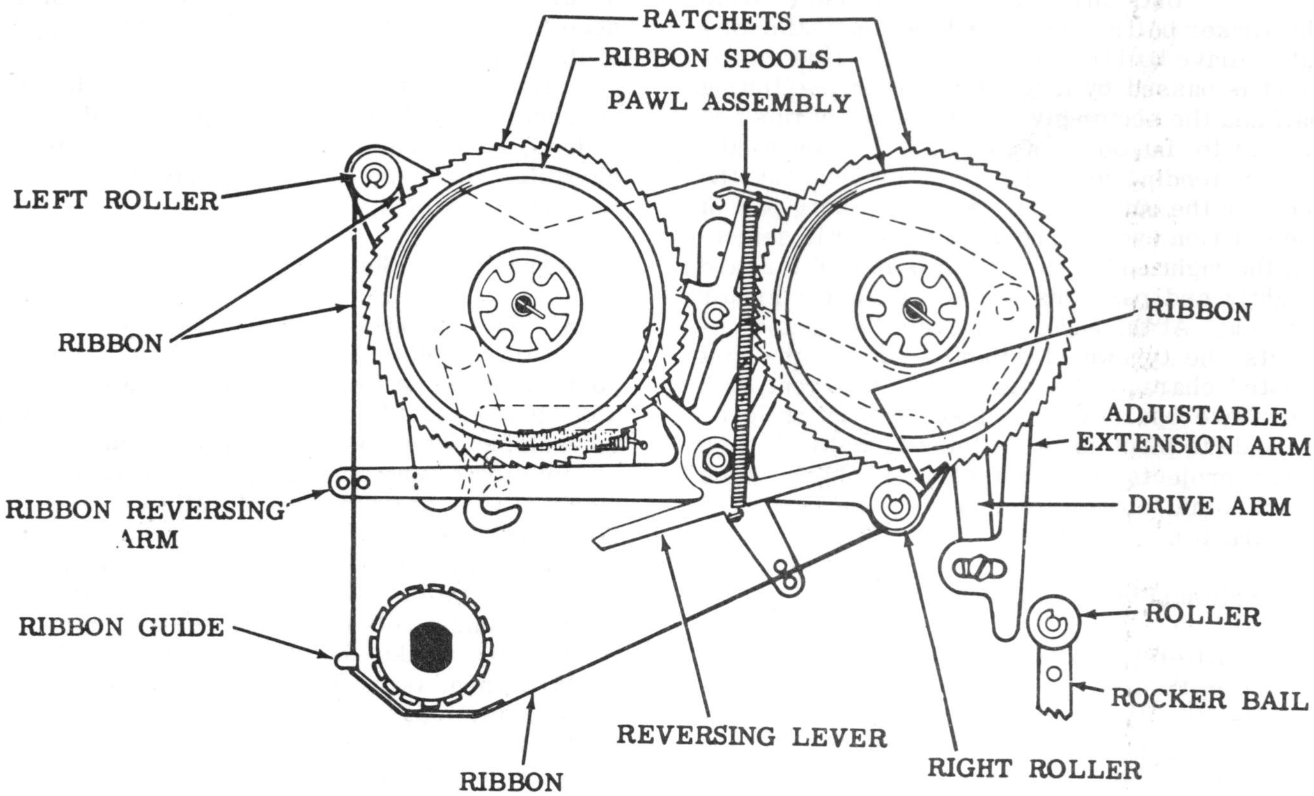


Figure 21 - Ribbon Feed Mechanism

printing, and to retract the typewheel and ribbon guide at the end of the function cycle so that the last typed character is visible. 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 17 and 18). 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 18.

4.28 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).

4.29 If during a function cycle neither pushbar is selected, no motion occurs in the axial positioning mechanism with the exception of that resulting from the oscillating assembly (4.30), and the no. 0 character of the selected row is aligned with the hammer at the time of printing (Figure 15). 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 positions. 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.

4.30 With each cycle of the function clutch, an oscillating drive link transfers from the rocker bail an unselected motion to an oscillating drive bail (Figures 18 and 20). This movement is passed by toggle links to an oscillating bail and 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. During the fore part of the function cycle, if no axial pushbar is selected, the right end of the sector is moved forward slightly and positions the no. 0 character for printing. At the end of any cycle the sector retracts the typewheel slightly so that the last printed character is visible. Concurrent with the above operation, a ribbon oscillating lever is made to pivot about its left end and with each cycle projects and retracts the ribbon guide which would obstruct the view of the character (Figure 20).

Correction (Figures 16 and 18)

4.31 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 18). The shaft pivots a rotary correcting lever (Figure 16) 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 18). 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.

4.32 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.

Letters-Figures Shift (Figures 16 and 19)

4.33 The purpose of the letters-figures shift is to rotate the typewheel from the home position of one section to that of the other (Figure 15). It is effected by means of the function box mechanism which is made up of a number of assemblies mounted on two plates located at the upper rear of the typing reperforator (Figure 19). When the unit is in the letters condition, as shown in Figures 16 and 19, and the figures code combination (12-45) is received, the transfer mechanism sets up the figures arrangement in the bell cranks during the selecting cycle (4.08). Then, as the rocker bail moves from its home position during the first part of the function cycle, a lifter roller, under spring pressure, follows a camming surface on the rear arm of the bail (Figure 19). The lifter allows letters and figures function blades to move down and, by means of tines on their lower surface, feel for an opening in the slotted upper arms of the bell cranks.

4.34 The slot arrangement of the no. 1, 2, 4 and 5 bell cranks is identical and permits the entry of both function blades when all are selected. However, on receipt of the figures code combination, the no. 3 bell crank permits entry of the figures blade while blocking the letters blade. In moving all the way down, the figures blade encounters a projection of a figures arm assembly and causes the arm assemblies to shift from their letters to figures position. A yield arm extension attached to the figures arm assembly pivots a figures extension arm away from the letters-figures bell crank. A letters extension arm, under spring tension, rotates the bell crank clockwise (Figure 19) and the bell crank lifts the letters and figures pushbars. As the bail reaches its extreme position, the lifter is cammed up and raises the function blades.

4.35 While the letters-figures bell crank is being positioned by the function box, the no. 1, 2 and 4 pushbars are selected, the typewheel is moved two rows clockwise and three characters forward, and the figures symbol is printed (4.21 - 4.27). On its return stroke, the rocker bail operating blade encounters a shoulder on the figures pushbar (which was lifted as described above) and moves the bar to the right as viewed from the front in Figures 16 and 17. The common pinion moves the letters pushbar to the left, and the left front eccentric shifts from its up to down position. Since the typewheel has been displaced two rows clockwise during the first part of the cycle, it is rotated six more rows to the figures home position. As the bail returns to its home position during the last half of the cycle, a lock lever toggle linkage (Figure 19) prevents the lifter roller from following its camming surface, and the lifter holds the function blades up so they do not drop onto the bell cranks. As the bail nears its home position, a trip post riding on the oscillating drive link strikes a lock release arm, buckling the toggle linkage and permitting the lifter roller to again fall on the bail camming surface.

4.36 In a manner similar to that just described, when the letters code combination (12345) is received, the function box causes the letters-figures bell crank to lower the letters and figures pushbars. The wheel is rotated two rows counterclockwise during the first part of the cycle, and six more rows to the letters home position during the last part of the cycle, and the letters bar is moved to the right. The primary two-row rotation of the typewheel, which is made possible by selecting the no. 5 pushbar on spacing rather than marking, provides less throw and smoother operation than would be possible if the complete eight-row displacement were effected during the latter part of the cycle. In each operation the lifter permits the function blades to move down and feel for an opening, except for the shift operations where they are blocked by slotted arms of the bell cranks.

C. Printing (Figure 20)

4.37 After the typewheel has been positioned and corrected, the printing mechanism supplies the impact which drives the paper 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 20, 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.

4.38 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 20) 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 tape and inked ribbon up against the typewheel and imprints the selected character on the tape. The accelerator does not follow the hammer through the complete printing stroke. 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.

D. Ribbon Feeding (Figure 21)

4.39 The characters are typed in ink supplied by an inked ribbon which is held between the tape and the typewheel by a guide and advanced by the ribbon feed mechanism (Figure 21). The path of the ribbon is down to the right off the top of a right spool, under a right roller, through right pins on the reversing arm, 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.

4.40 During 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.

4.41 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

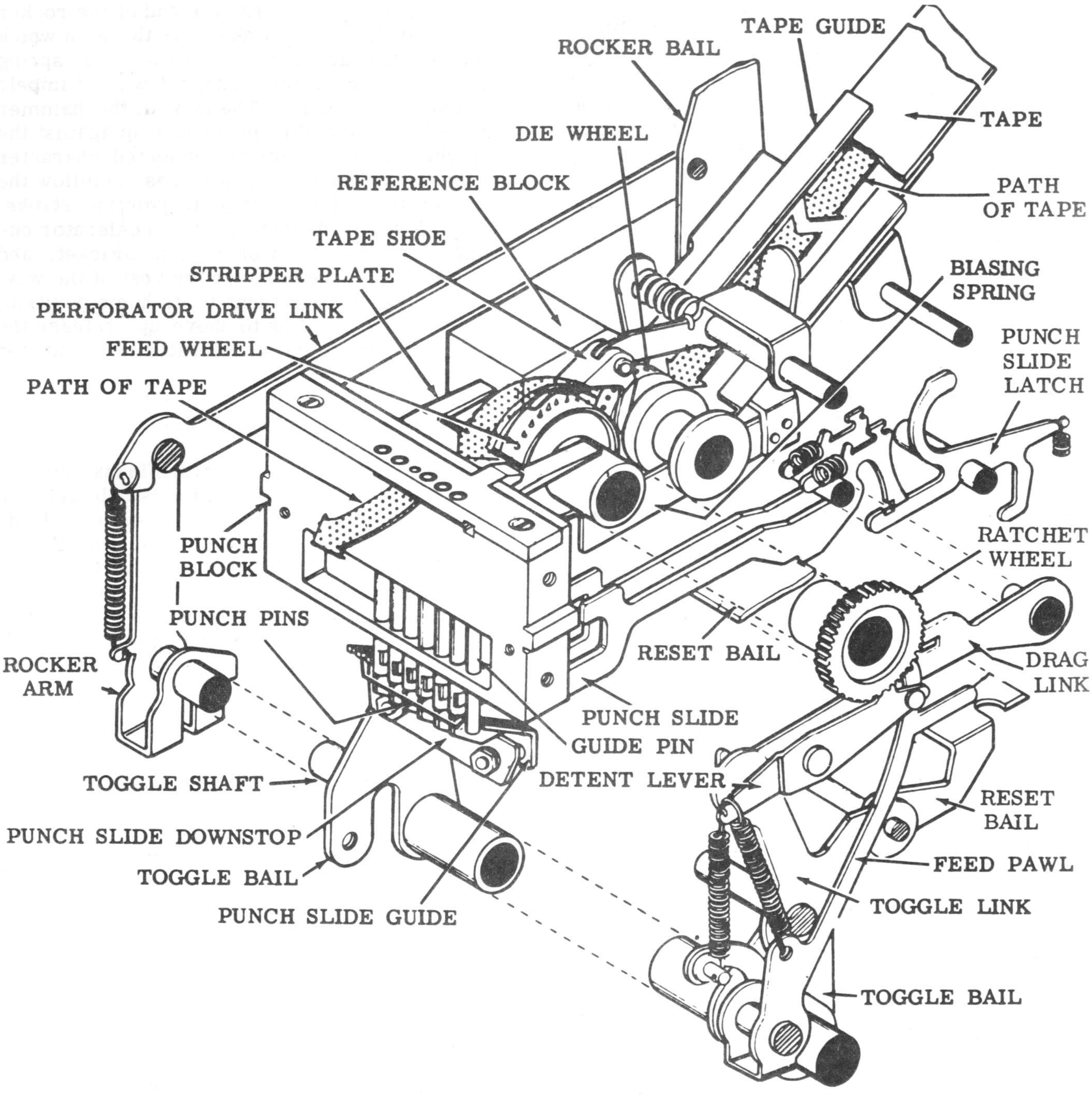


Figure 22 - Perforating Mechanism — Fully-Perforated Unit

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.

TAPE PERFORATING AND FEEDING

A. General

4.42 The perforating mechanism punches feed holes, advances the tape, and perforates combinations of code holes corresponding to the code combinations received from the keyboard. Intelligence is received from the keyboard by the punch slides, which select proper pins in a punch block assembly (Figures 22 and 23). Motion from the rocker bail is distributed to the pins and the tape feeding parts by a main bail assembly which includes a toggle bail, toggle shaft, slide post, toggle links, drag links, and the punch slide reset bail.

B. Perforating — Fully-Perforated Units (Figure 22)

4.43 After selection, the reset bail is lowered and releases the five punch slides (Figure 22). The selected slides move to the left, and the unselected slides are retained to the right by their latches. In the selected position, a projection of each slide extends over the slide post. Since a feed hole is perforated every operation, the punch slide associated with the feed-hole punch pin is designed so that it is always in a selected position. During the first part of the function cycle, the rocker bail moves to the left and, by means of a drive link and rocker arm, rotates the toggle shaft and bail counterclockwise. Toggle links attached to the front and rear of the bail lift the slide post and move the reset bail to the left. The selected slides are carried upward by the post and force the associated pins through the tape. The slides pivot about the same point as the drag links, and thus become an integral part of the main bail assembly during the perforating stroke. Approximately midway through the function cycle, the function trip assembly lifts the reset bail.

4.44 During the last half of the cycle, the toggle bail is rotated clockwise pulling the slide post down and lowering the selected punch slides. The punch slides, which engage notches in their respective punch pins, pull the punch pins down below the tape. The main bail assembly and the selected punch slides and their associated punch pins move as a unit during the perforating stroke. The openings in the die block above the tape, through which the pins protrude, are circular so that the entire hole is punched.

4.45 A chad chute, mounted on the reperforator punch block, mates with a chute on the base, and carries the chad punched from the tape into a chad container.

C. Perforating — Chadless Units (Figure 23)

4.46 Up to a certain point, the principle of operation of the chadless punch is the same as that for the fully perforated unit. After selection, the reset bail is lowered and releases the five punch slides (Figure 23). The selected slides move to the left, and the unselected slides are retained to the right by their latches. In the selected position, a projection of each slide extends over the slide post. During the first part of the function cycle, the rocker bail moves to the left and, by means of a drive link and rocker arm, rotates the toggle shaft and bail counterclockwise. Toggle links, attached to the front and rear of the bail, lift the slide post and move the reset bail to the left. The selected slides are carried upward by the post and force the associated pins through the tape. The slides pivot about the same point as the drag links, and thus become an integral part of the main bail assembly during the perforating stroke. A retractor bail, which engages notches in the punch pins, is pivoted clockwise as the pins move up through the tape. Approximately midway through the function cycle, the function trip assembly lifts the reset bail.

4.47 During the last half of the cycle, the toggle bail is rotated clockwise and lowers the punch slides. The reset bail, moved to the right by the toggle links, drives the slides back to their unselected positions where it holds them until the next operation. The retractor bail, under spring pressure, holds the punch pins down against the slides until the pins are retracted below the tape. The notches in the pins are long enough to allow the retractor bail to pivot its full amount without lifting the unselected pins against the tape, but are short enough to permit the bail to serve as a downstop for the pins, and thus hold them in the block. A compression spring is mounted on the no. 3 punch pin, and four tension springs are hooked to the slide post and the retractor bail. The main bail assembly, retractor bail, and selected slides and punch pins move as a unit during the perforating stroke, and the retractor bail tension springs are not part of the load on the toggle shaft. The openings in the block above the tape,

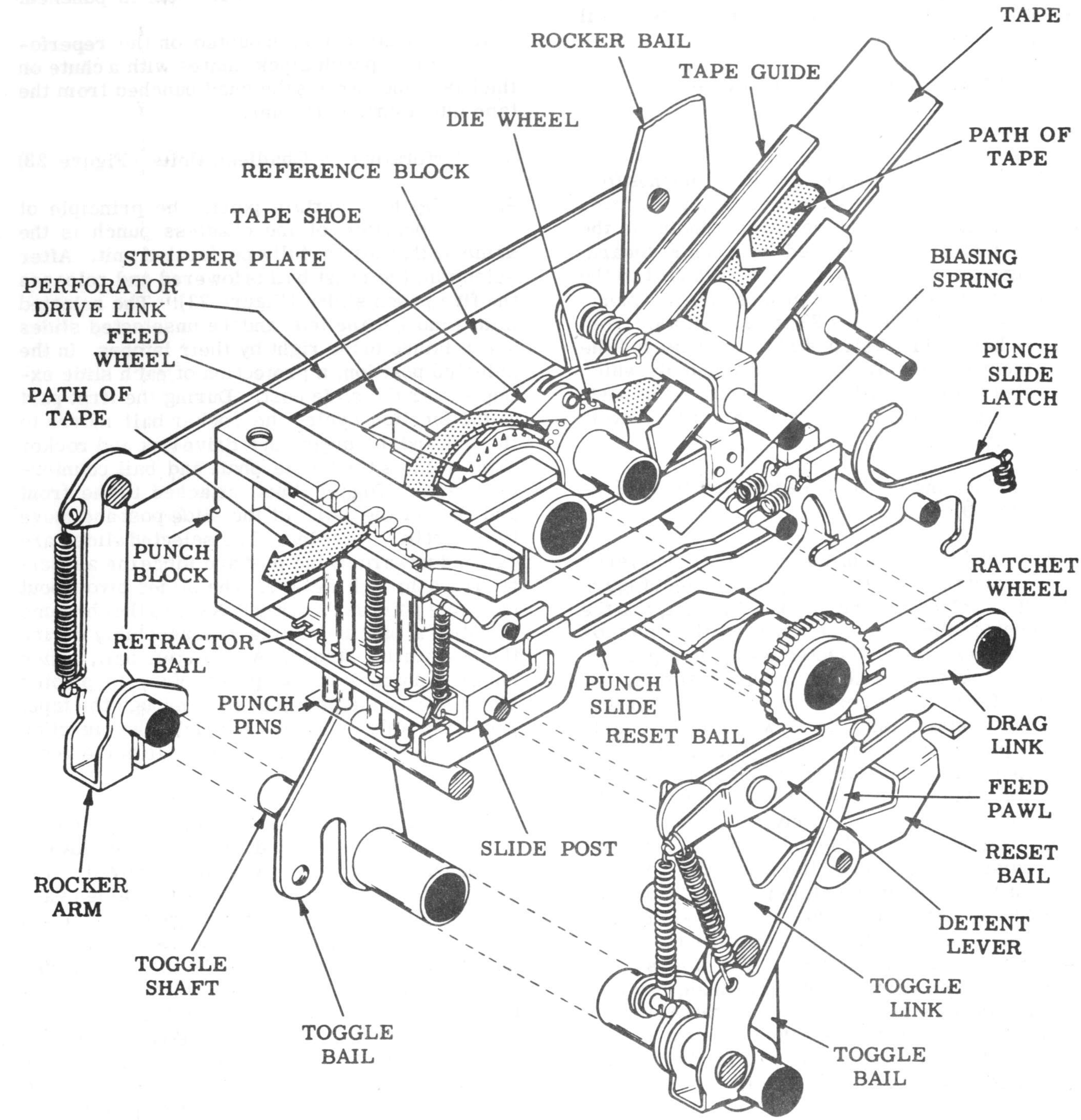


Figure 23 - Perforating Mechanism — Chadless Tape Unit

through which the selected pins protrude, are semicircular, so that only the rear portion of the hole is severed.

D. Feeding — Fully-Perforated and Chadless Units

4.48 Tape feeding is accomplished after perforation during the last half of each function cycle. The tape is threaded down through a tape guide and then up between a feed wheel and die wheel (Figures 22 and 23). A feed pawl driven by the toggle bail acts upon a ratchet and rotates the feed wheel which, by means of pins and a slot in the die wheel, advances the tape one character at a time. A detent, with a roller that rides on the ratchet, holds the feed wheel and tape in position during perforation. The detent and feed pawl springs are so positioned that the pressure of the detent on the ratchet is high during the first half of the cycle (to hold the tape in position during perforation), but is low during idling and the last half of the cycle, to facilitate tape threading and feeding. A tape shoe retains the tape on the feed wheel and a guide spring holds it back against a reference block so that the feed holes are punched a uniform distance from the edge. The tape is stripped from the feed wheel by a stripper plate, passes into the punch block where it is printed and perforated, and finally emerges at the left. A guide spring, by holding the tape back against a reference surface on the block, maintains a uniform relationship between the code perforations and the edge of the tape.

5. VARIABLE FEATURES

BACKSPACE MECHANISMS (Figures 4 and 24)

A. General

5.01 The backspace mechanism steps the tape back through the punch block in order to delete perforated errors. The erroneously perforated code combination in the retracted tape is then obliterated by perforating the letters code combination in its place. The backspace mechanism may be operated manually or it may include power drive. The mechanism used with chadless tape differs from that used with fully perforated tape in that it contains a tape rake for depressing the chad. The mechanisms are shown in Figure 24.

B. Manual Backspace (Fully-Perforated Tape)

5.02 Depressing the handle of the backspacing bell crank disengages the perforator feed pawl from the feed wheel ratchet. The backspacing feed pawl then engages the feed wheel ratchet and rotates the feed wheel clockwise, backspacing the tape to the next row of perforations.

C. Manual Backspace (Chadless Tape)

5.03 Depressing the handle of the backspacing bell crank disengages the perforator feed pawl from the feed wheel ratchet and simultaneously rotates the rack to depress the chads. The backspacing feed pawl then engages the feed wheel ratchet and rotates the feed wheel clockwise, backspacing the tape to the next row of perforations.

D. Power Drive Backspace

5.04 A start magnet in the power drive mechansim is energized by a remote source. When energized, the armature bail is pulled downward. An extension of the bail disengages the drive link latch, which drops and engages a notch in the eccentric arm. The eccentric arm, driven by the perforator main shaft, moves to the right. This action causes the bell crank handle to be depressed through a system of linkages between the drive link latch and the bell crank. The subsequent operation is as described in Paragraphs 5.02 and 5.03.

CODE READING CONTACT MECHANISM (Figure 25)

5.05 These contacts are used to electrically read the code combinations being perforated. The code information is fed to external electrical circuits for end use. The mechanism consists of a bank of five make-type contacts mounted adjacent to the perforator punch slides. Each contact is actuated by its associated punch slide. In the perforator stop position, each code reading contact is held open by engagement with an insulator on its associated punch slide. When the selected punch slides move toward the punch block during the selection cycle, the associated contacts close. The resulting electrical output consists of spacing and marking pulses corresponding to the code combinations being perforated.

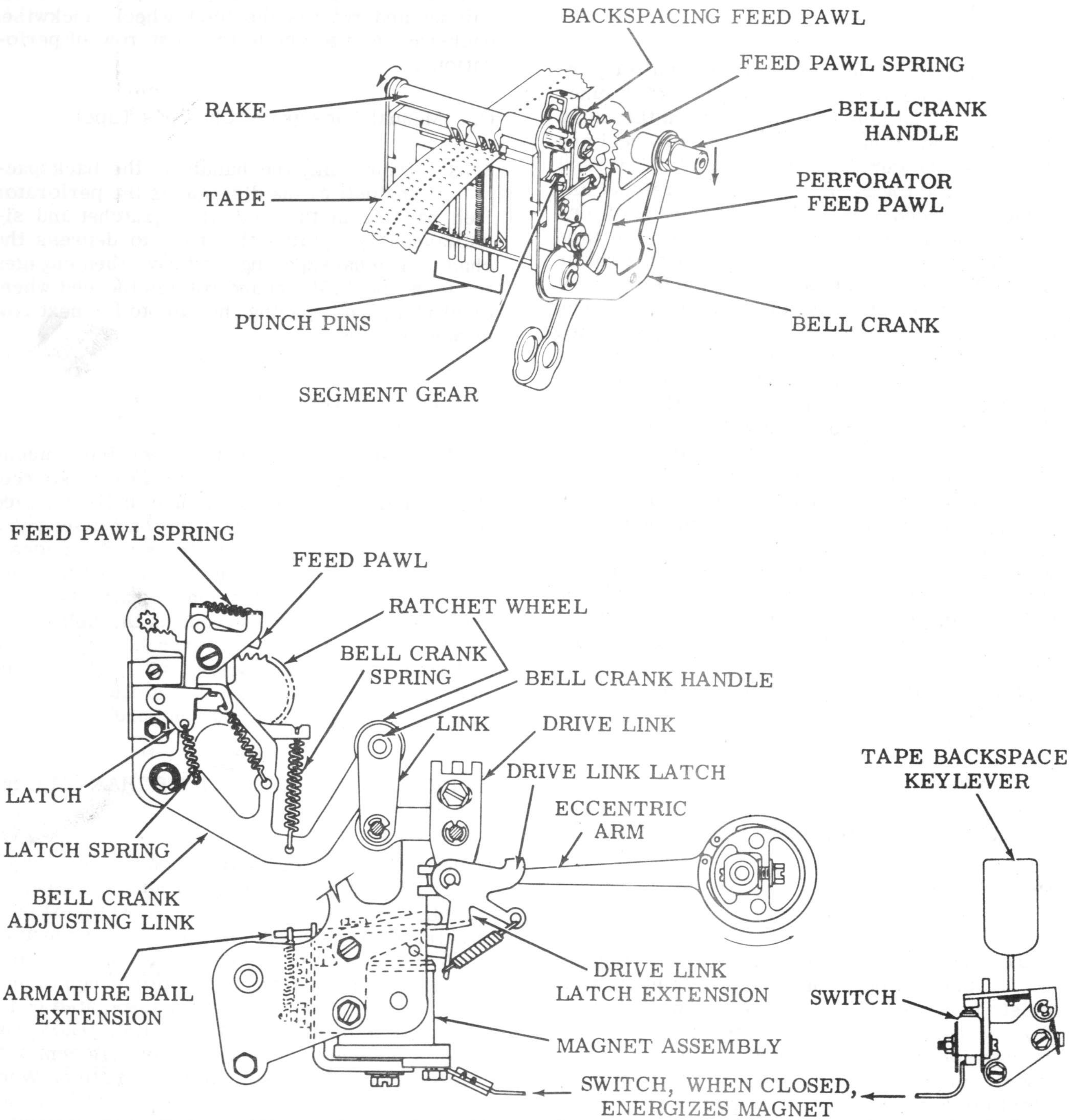


Figure 24 - Backspace Mechanism

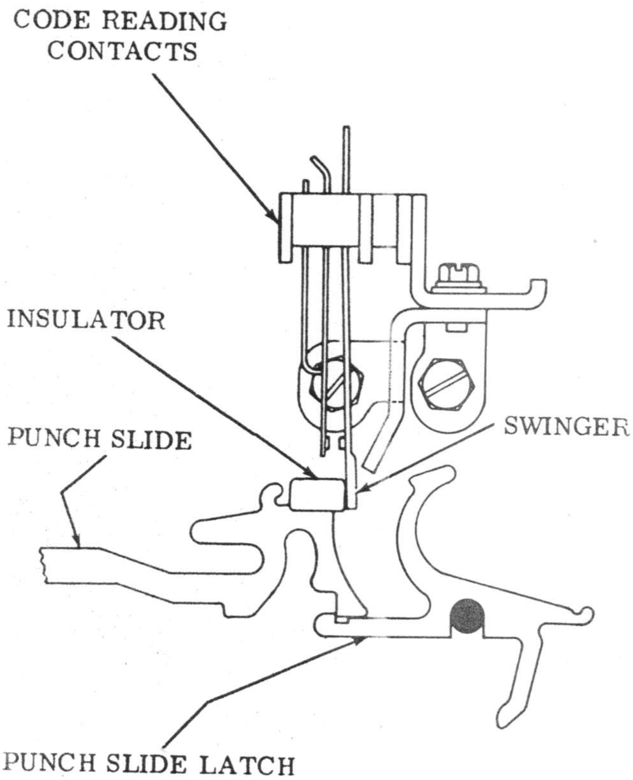


Figure 25 - Code Reading Contact Mechanism

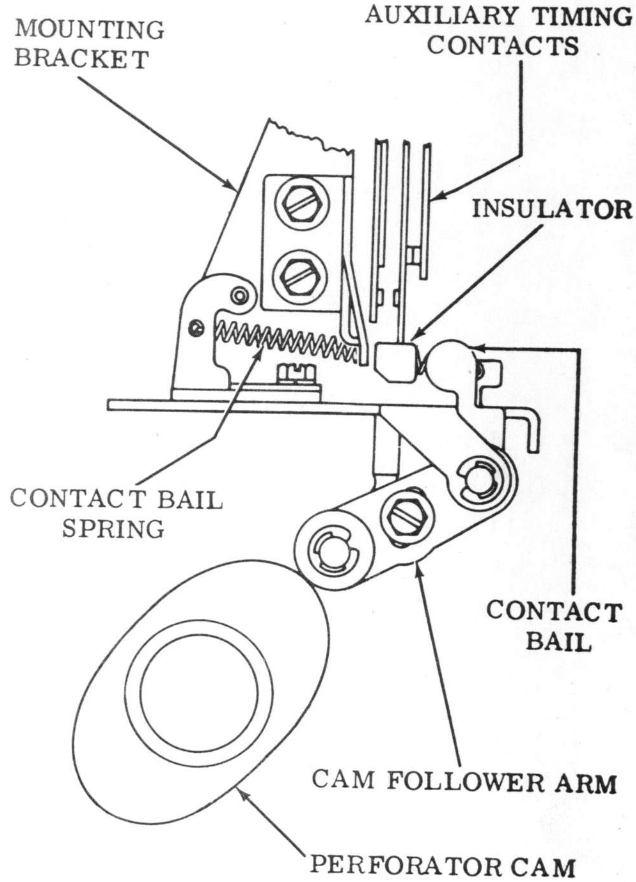


Figure 26 - Auxiliary Timing Contact Mechanism

AUXILIARY TIMING CONTACT MECHANISM (Figure 26)

5.06 This contact provides electrical pulses which are synchronized with the code reading contact pulses for circuitry control purposes. The mechanism consists essentially of a signal contact pile-up of the break-before-make type and a contact bail and cam follower arm. The mechanism is mounted to the frame of the perforator so that the cam follower arm is actuated by the perforator function cam. In the stop position, the contacts, bail, and cam follower arm are positioned as shown in Figure 26. When the cam rotates, the cam follower falls and the contact bail engages the swinger insulator to close the contacts at the left. On the second half of the cam cycle, the cam engages the cam follower roller and restores the contacts to their normal stop positions.