35 TAPE PRINTER

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section is reissued to update technical information and to present the 35 Tape Printer description and principles of operation in a new format. Since this is a general revision, marginal arrows used to indicate changes have been omitted.

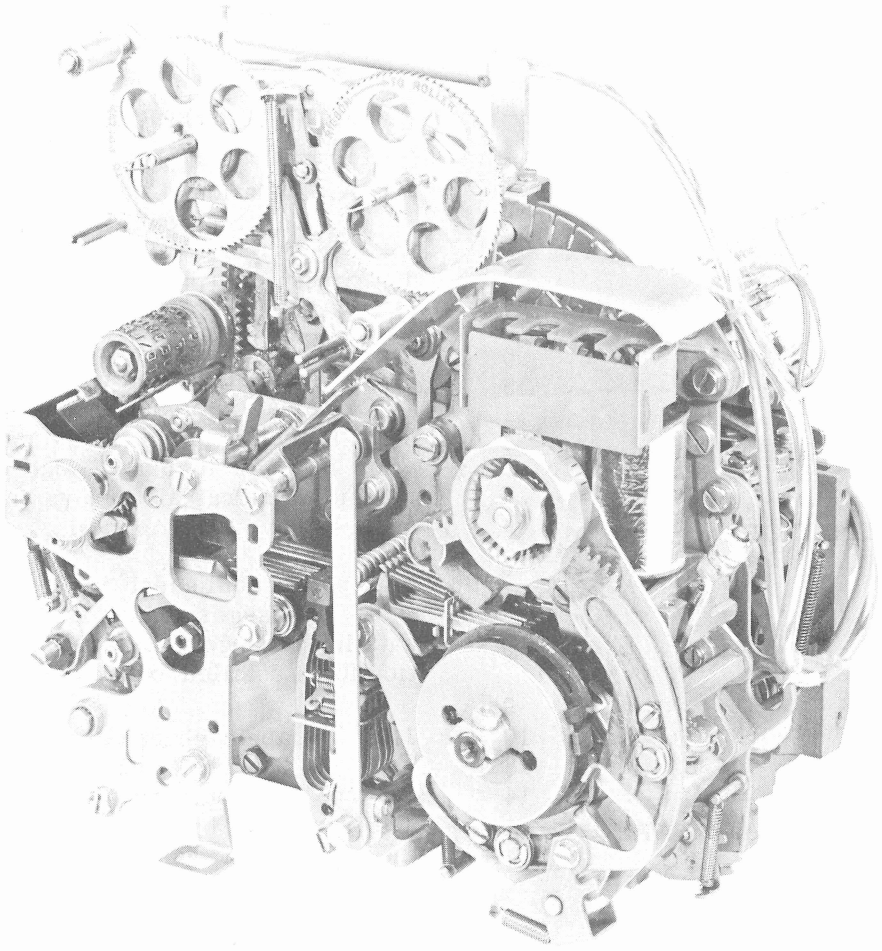
1.02 The equipment is designed to receive messages transmitted in an eight-level data interchange code. See the applicable section for a detailed explanation of the code.

1.03 Graphic characters (such as A, B, C, 1, 2, 3, #, *, %) are printed in black ink. Control functions (such as BELL, EOA, EOT) are translated by the selecting mechanism into the mechanical equivalent of their complementary figures or numeric graphics but, determined by the design of the unit, printing is suppressed (units with one-color ribbons) or occurs in red ink (units with two-color ribbons).

1.04 Code signals are applied to a magnet associated with a selector mechanism, which interprets the signals and initiates controls of the motion involved in typing. A range finder is used to refine the mechanical orientation of the selector mechanism to the signaling code. The selector clutch is held latched by the selector magnets until an incoming signal intelligence initiates typing by engaging the clutch.

1.05 Motive power is received through a gear on the rear of the main shaft. The shaft connects to the motor through the intermediate gearing mechanism of the associated equipment. Rotation of the main shaft is distributed by two all-steel internal expansion clutches, one a selector clutch, the other a function clutch.

Prepared for American Telephone and Telegraph Company by Teletype Corporation



(Front View)

Figure 1 - Typical 35 Tape Printer

When engaged, the clutches permit their associated mechanisms to operate at the speed established by rotation of the main shaft. Operating speeds of 60, 75, or 100 words per minute are available through changes in gears.

1.06 The function clutch is tripped by the selector mechanism to initiate transfer of motion from the main shaft to the printing and tape feeding mechanisms. A transfer mechanism initiates type wheel positioning and printing functions, while a tape feeding mechanism feeds 3/8 inch tape. No code holes or feed holes are perforated. The tape may be threaded and manually advanced by a handwheel.

1.07 The 35 tape printer may be equipped with a manual interfering rubout tape feed-out mechanism which feeds out a length of unprinted tape whenever an operating lever is held manually in its feed-out position.

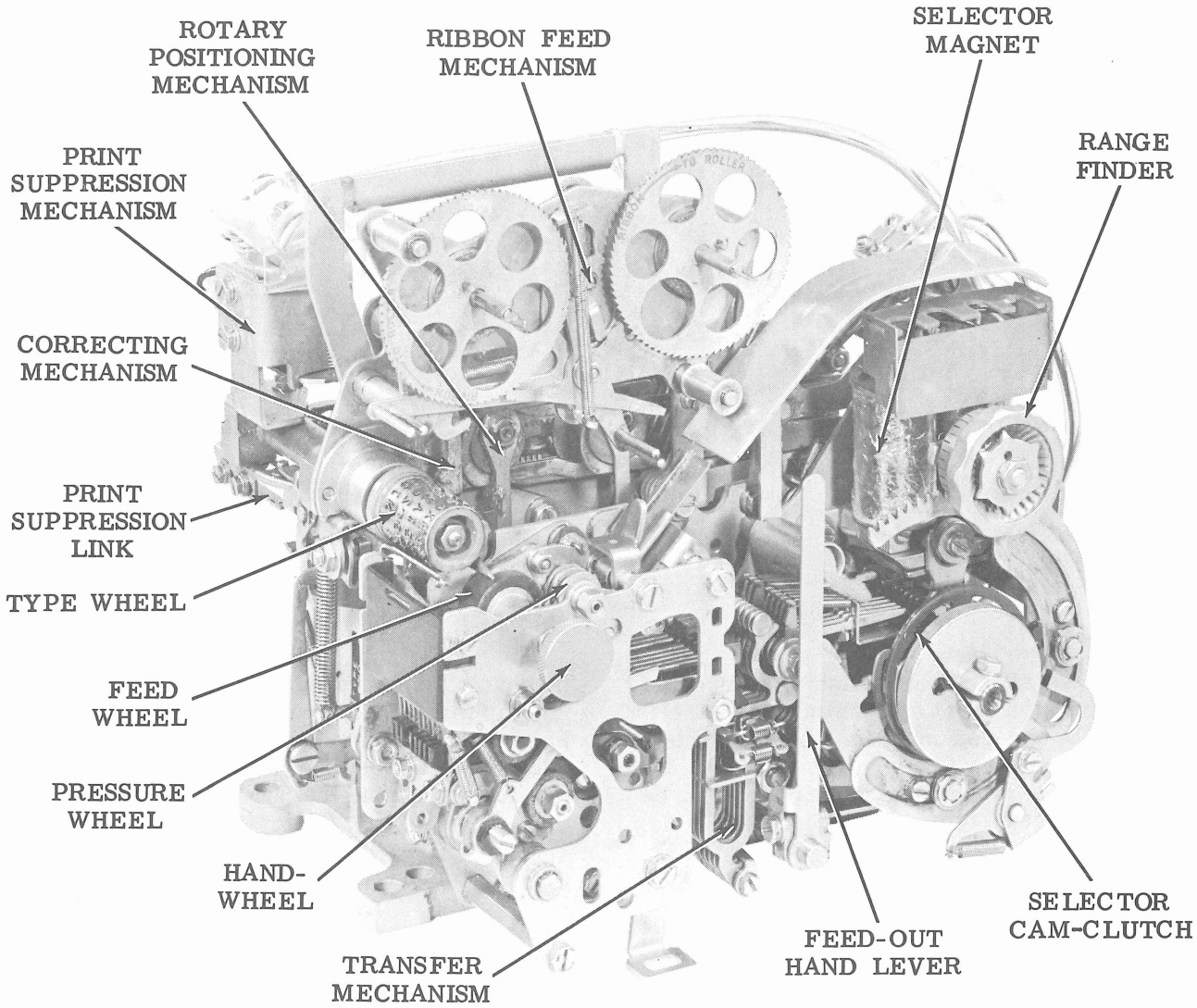
1.08 Unless stated to the contrary, references in the text to left or right indicate the operators left or right, facing the front of the

unit, the selector mechanism at the right and the punch mechanism at the left. In illustrations, unless specifically labeled otherwise, it is assumed that the equipment is being viewed from the front. Pivot points are shown in the drawings by circles or elipses which are solid black to indicate fixed points and crosshatched to indicate floating points.

PHYSICAL DESCRIPTION (Figures 2 and 3)

1.09 A cast frame provides mounting facilities for the various mechanisms which comprise the tape printer. The frame is, in turn, mounted on associated equipment through which the necessary electrical and motive power connections are made. A 36-point connector for all electrical input requirements of the reperforator is mounted at the rear of the unit. For detailed descriptions of associated equipment, motor, and cabinet, refer to the appropriate sections.

1.10 Mechanical motion, transmitted through an intermediate gear mechanism, drives a gear at the rear of the main shaft. Rotation of the main shaft is transmitted directly to the drum of each of two cam-clutch mechanisms. External changes in speed of the driving power, through a gear shift mechanism or gear changes, will permit changes from 60 to 75 or 100 words per minute in the operating speed.



(Left Front View)

Figure 2 - 35 Tape Printer

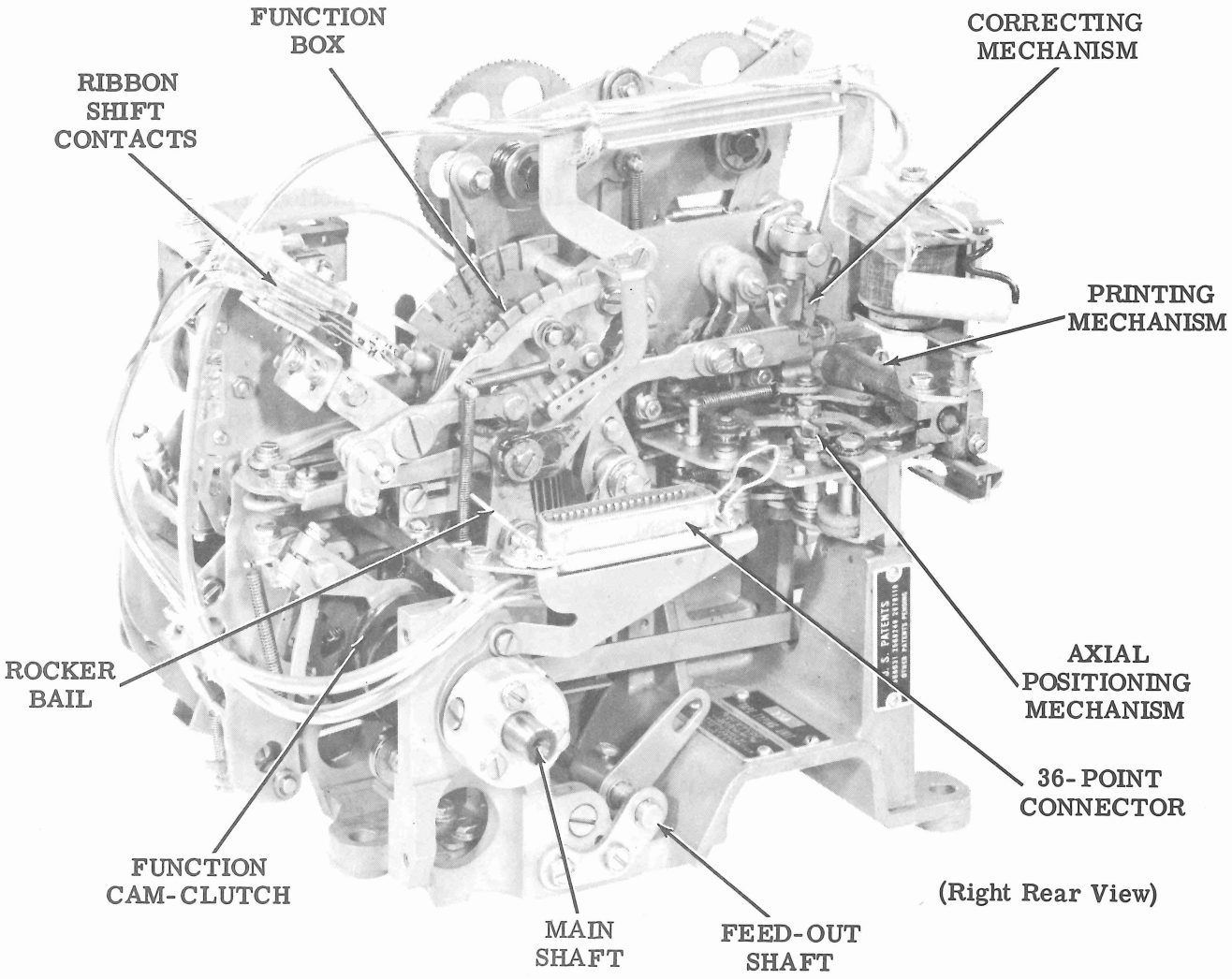


Figure 3 - 35 Tape Printer

1.11 The selecting mechanism is mounted around the front end of the main shaft. It includes a two-coil magnet, a selector cam-clutch, and a range finder. By means of the range finder, the selecting mechanism can be adjusted in relation to the signal code.

1.12 The function cam-clutch is tripped by the selecting mechanism. It drives the rocker bail, which transmits power to the printing and tape feeding mechanisms.

1.13 The rocker bail drives the axial and rotary positioning mechanisms and their respective correcting mechanisms to position the type wheel according to intelligence information mechanically conveyed from the selecting mechanism through a transfer mechanism. The printing mechanism and ribbon feed mechanism combine to impose the inked image of the selected graphic from the type wheel to the tape.

1.14 A print suppression mechanism or a ribbon shift mechanism, actuated by ribbon shift contacts on the function box, either permits the ribbon to advance fully to print graphics in black or retards the advance of the ribbon to prevent printing or to print the selected character in red. This occurs when the code for a function, rather than a graphic, is transmitted to the tape printer selecting mechanism.

1.15 The tape feed mechanism accommodates 3/8-inch wide tape. The tape is fed by a rubber feed wheel and metal pressure wheel.

1.16 The mechanical linkage of selector push levers, slide latches, and slides interconnects the selector and tape feeding mechanism. The transfer mechanism interconnects the selector and printing mechanism.

TECHNICAL DATA

A. Approximate Dimensions

Width	7-1/2 inches
Depth	6-1/2 inches
Height	8 inches
Weight	7-1/2 pounds

B. Signal

Code	Sequential, 11-unit, start-stop
Current	0.060 ampere (or 0.500 ampere with selector magnet driver)

C. Tape

Type	Standard communications
Width	3/8 inch

2. PRINCIPLES OF OPERATION

2.01 The basic function of the 35 tape printer is to record information in printed form on 3/8-inch wide communications tape. The information is received from a signal line in the form of signaling code combinations which represent characters or functions. The printer translates these combinations into mechanical motions which print and advance the tape.

2.02 Character representations, or graphics, are alphabetic, numeral, or symbol intelligence typed on tape in black ink. Function representations are the coded equivalent of operations auxiliary to transmission or reception of the graphics, such as carriage return, line feed or signal bell, and are either suppressed or printed in red ink (1.03).

2.03 All operations of the tape printer, including differentiation between graphic and function (or control) character representation are fully automatic in response to input signal characteristics.

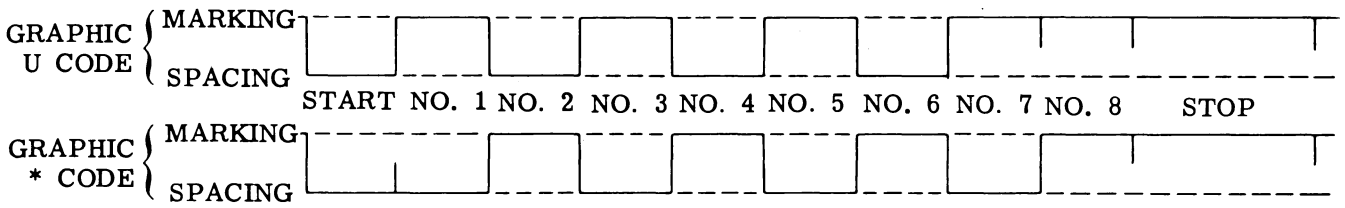
2.04 The unit is referred to as being in the idling condition when the main shaft is turning and the signal circuit is closed, so that no message is being received. The unit is referred to as running open when the main shaft is turning and no signal is applied to the selector magnets.

2.05 The speed of the equipment is usually given in operations per minute. Each operation includes the receiving of a code combination, the cycling of two cam-clutches, the printing of a character, and the advancing of the tape. Speed in words per minute is roughly one-sixth of the operations per minute.

SIGNALING CODE

2.06 Information is received by the printer in the form on an 11-bit, start-stop signaling code 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 transmissions, 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 4). 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 (referred to as an 11.0 unit transmission pattern). The start and stop bits ensure synchronization between the transmitting and receiving equipment. The marking condition of the eighth bit further enlarges the marking interval at the end of each code combination transmitted.

2.07 The code representations for the graphics U and * are illustrated in Figure 4. In these combinations, alternate marking and spacing conditions for the intelligence bits are required.



* Note: No. 8 bit may be marking or spacing when shifted for even parity (number or marking bits always an even number).

Figure 4 - Signaling Code

2.08 The total number of permutations of an eight-level, 11-unit code (with the eighth level always marking) is two to the seventh power, or 128. Specific character and function representations may vary with equipment.

GENERAL OUTLINE OF OPERATION (Figure 5)

2.09 The relationship of the operating mechanisms of the 35 tape printer is illustrated in the block diagram (Figure 5). Rotary motion from an external source is applied directly to the rear of the main shaft through intermediate gears. The main shaft rotates constantly as long as the unit is under power. A 0.060 ampere signal to the selector magnet (or a 0.500 ampere circuit through a selector magnet driver in an associated electrical service unit) is externally supplied, as is the 115 v ac circuit to operate the ribbon shift magnet. External electrical circuitry is supplied through a 36-point connector at the rear of the unit (Figure 3).

2.10 The signaling code combinations, such as the combination representing the graphic U, plotted at the left of Figure 5, are applied to the selecting mechanism. The start pulse of each code combination causes the selector, through a trip assembly, to trip the selecting cam-clutch. The main 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 tape feeding mechanisms. The selecting cam-clutch is then disengaged and remains inoperative until the next code combination is received.

2.11 The function cam-clutch, driven by the main shaft, imparts motion to the rocker bail throughout the function cycle. The rocker

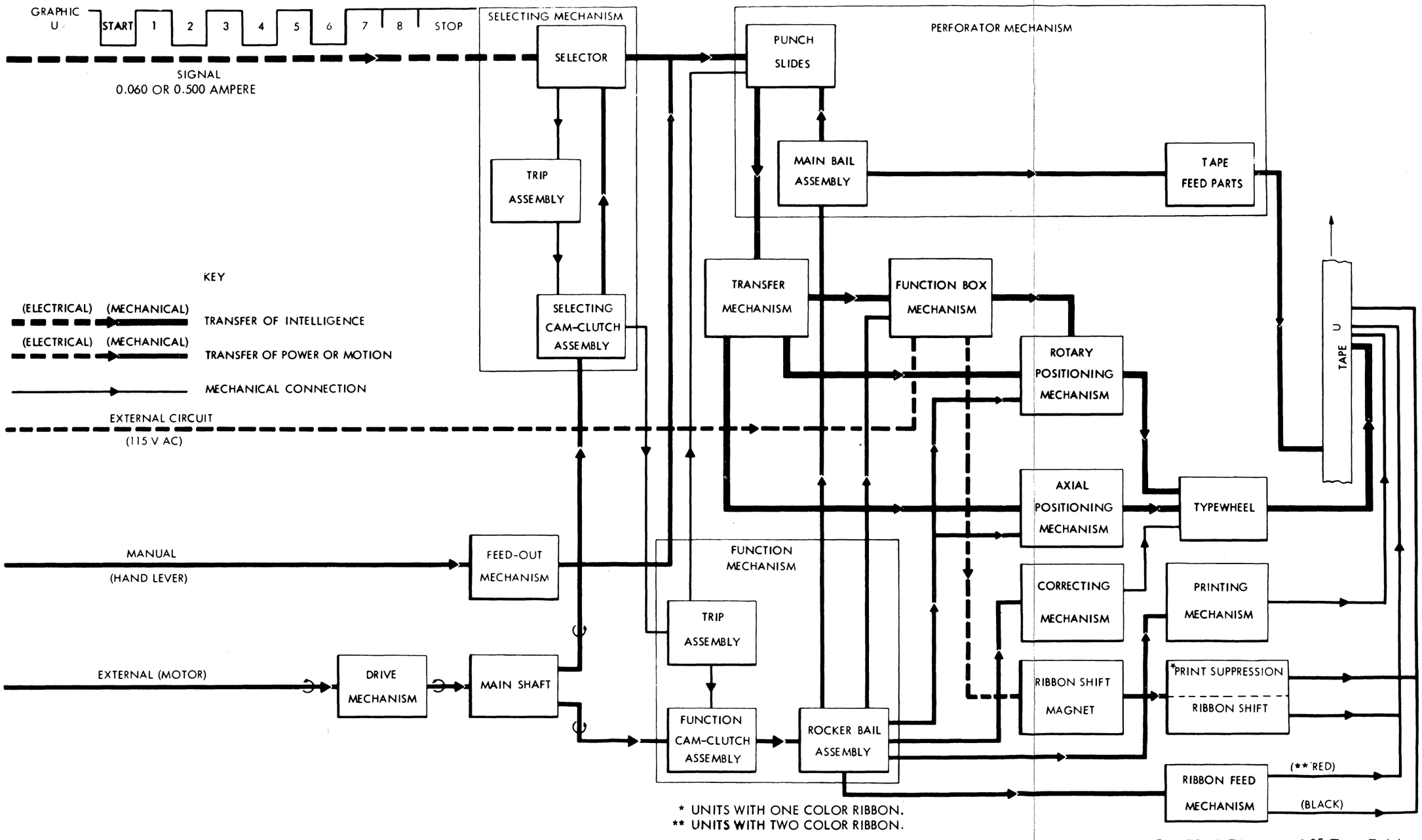


Figure 5 - Block Diagram of 35 Tape Printer

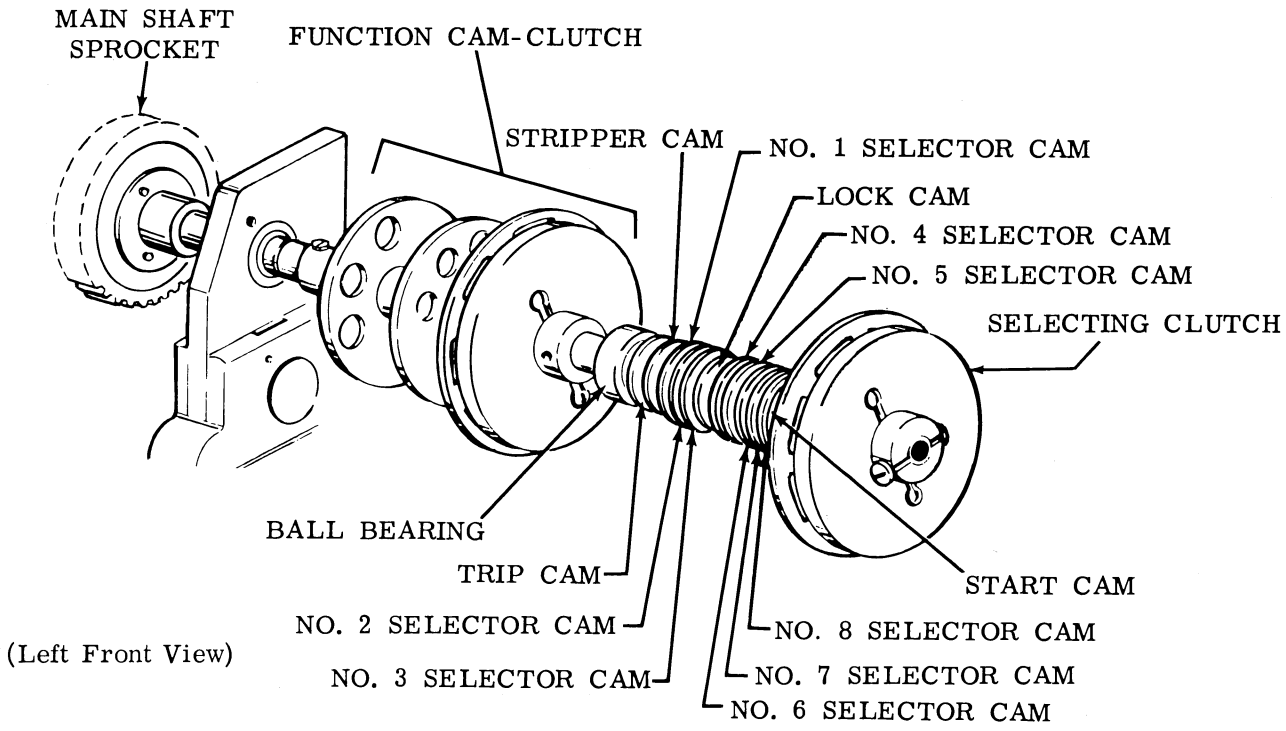


Figure 6 - Main Shaft

bail transfers the motion to the positioning mechanisms, the tape feed mechanism and the printing mechanism.

2.12 The transfer mechanism, having received its arrangement from the selector, causes positioning of the axial and rotary positioning mechanisms, which select the type wheel character to be printed.

2.13 Late in the function cycle, the tape feed parts advance the tape one character space. The function cam-clutch is then disengaged and remains stationary until again tripped by the selecting cam-clutch or by the tape feed-out mechanism if so equipped. The operations of the printer may overlap if the code combinations are being received fast enough. For example, while the printer is advancing the tape and the printing mechanism is printing, the selecting mechanism may be processing the next combination.

MOTION (Figure 6)

2.14 Rotary motion from an external source is applied to the main shaft through intermediate gears, which rotate continuously at a constant speed as long as the unit is under power. Selecting and function cam-clutches distribute this motion to the selecting and function mechanisms as described below.

SELECTION

A. General

2.15 The selecting mechanism, made up of a selector (2.21), a clutch trip assembly (Figure 7), and a cam-clutch (Figure 6),

translates the signaling code combinations into mechanical arrangements which govern tape printing and feeding. 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. By means of a range finder assembly (Figure 7), 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 on through the transfer mechanism to control the positioning printing mechanisms (2.27).

B. Reception and Translation

Selecting Cam-Clutch and Trip Assembly (Figures 6 and 7)

2.16 The selecting cam-clutch includes (from right to left in Figure 6) 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 circuit is closed (marking, the selector magnet coils are energized and hold the selector armature up against the magnet pole pieces (Figure 7). In this position, the armature blocks the start lever, and the cam-clutch is held stationary between the stop arm and latchlever.

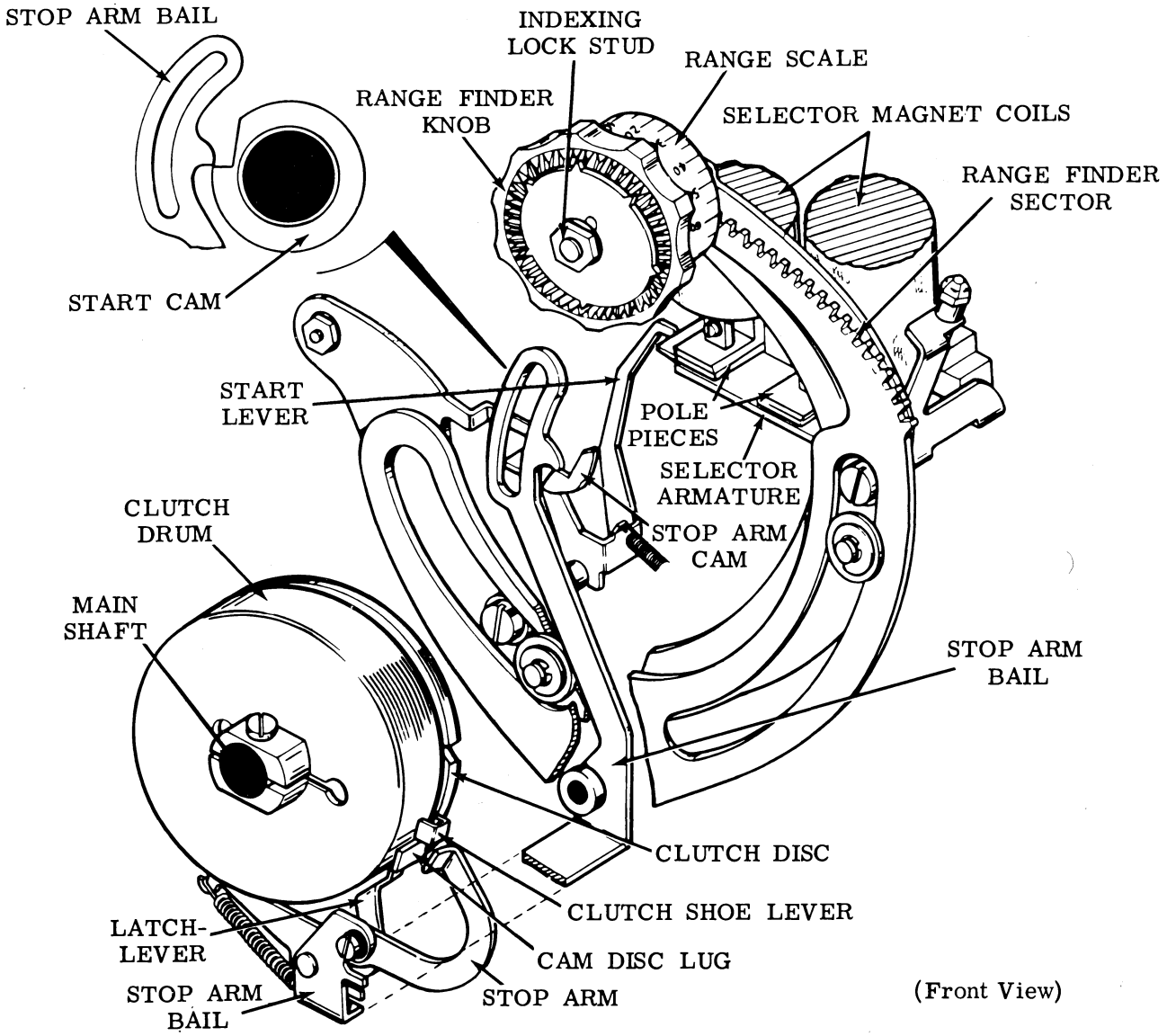
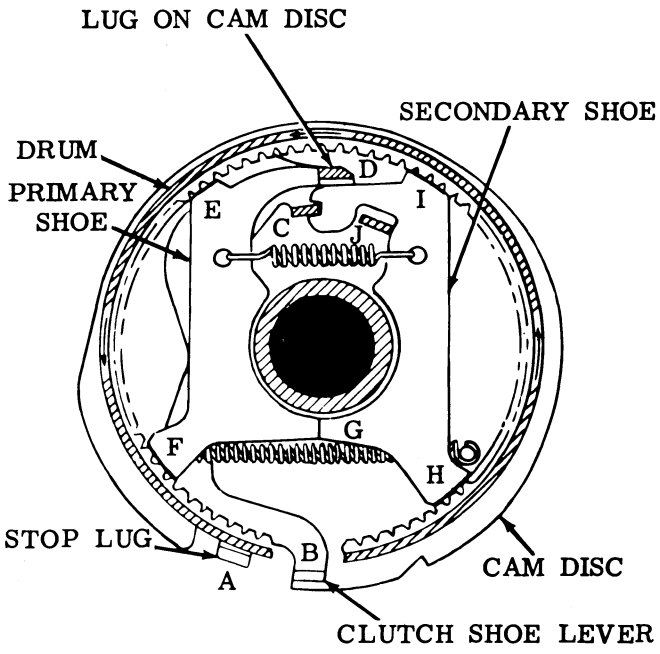
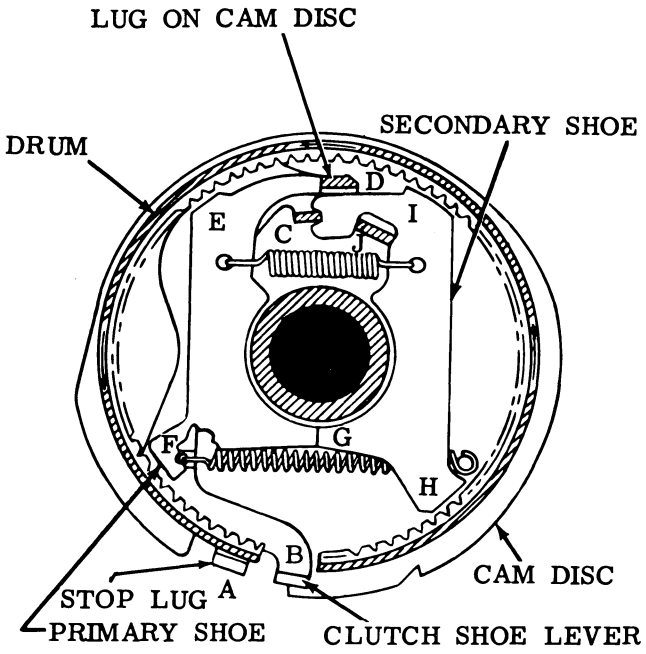


Figure 7 - Range Finder and Selecting Cam-Clutch Assembly



(Front View)

Figure 8 - Clutch, Engaged



(Front View)

Figure 9 - Clutch, Disengaged

2.17 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 7). 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 (2.21 to 2.23).

2.18 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 latch-lever drops into an indent in the cam disc, and the clutch is held disengaged until the next code combination is received.

Clutch Operation (Figures 8 and 9)

2.19 The clutch drum is attached to and rotates in unison with the main shaft (Figure 6). 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 stop arm (Figure 7) 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 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.

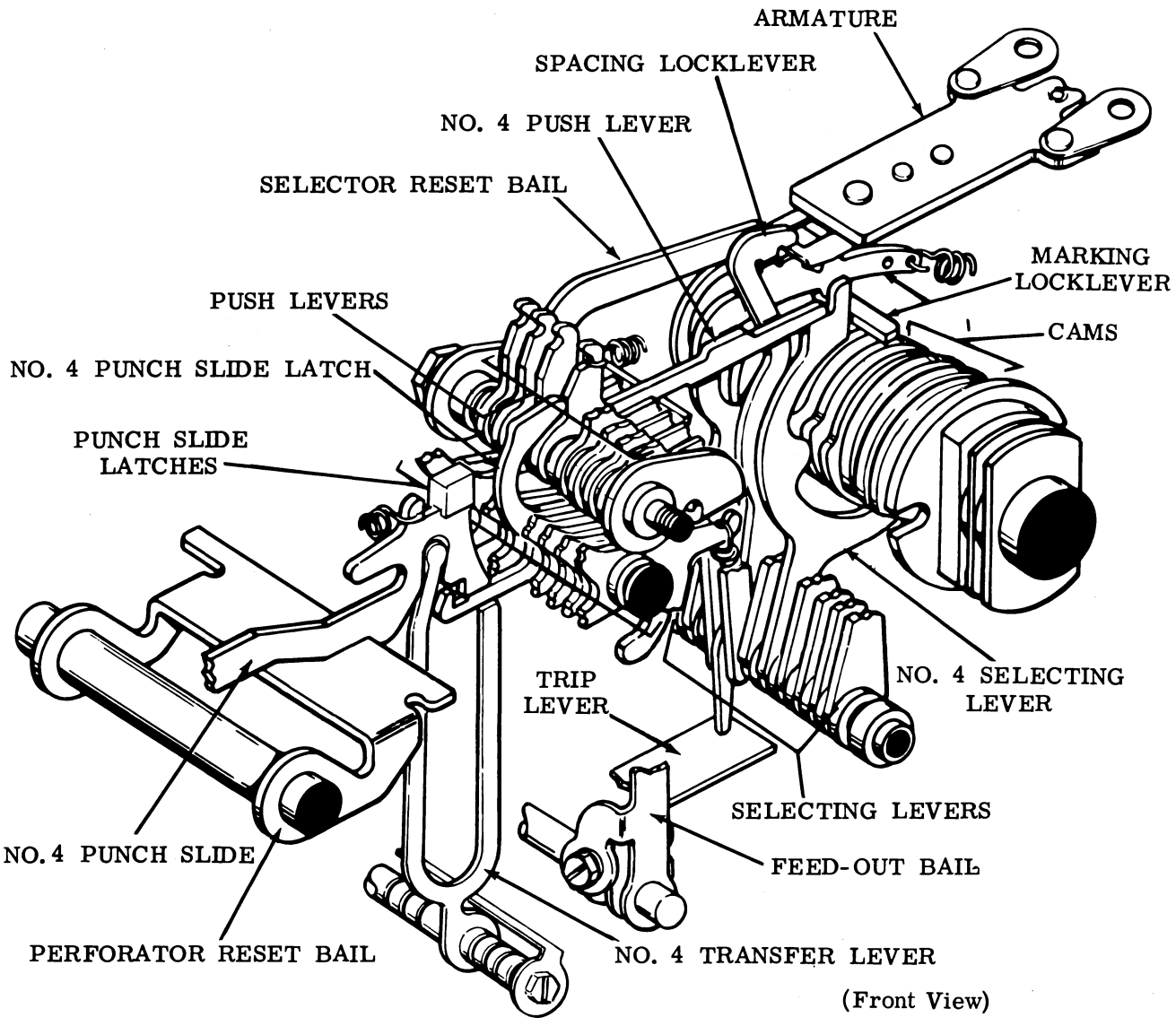


Figure 10 - Selector

2.20 Disengagement is affected when the lower end of shoe lever B strikes the stop arm (Figure 7). 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 (2.18) and the cam is held in its stop position until the clutch is again engaged.

Selector Operation (Figures 6, 7, and 10)

2.21 The selector assembly consists primarily of two magnet coils (Figure 6), an armature and associated bails, levers and latches (Figure 10). Eight linkages, each of which consists of a selecting lever, a push lever 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 10. 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 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 lock-

lever 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 push lever falls off a step on the selecting lever.

2.22 As the cam rotates, the selecting levers, together with any selected push levers, 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 push levers remain to the right. When the next code combination is received, a selector reset bail, lifted by its cam (Figure 10), strips the selected push levers from the selecting levers, and the push levers are returned to the right by their springs.

2.23 The selected push levers, in moving to the left, rotate associated punch slide latches counterclockwise (Figure 10). Just before the eighth push lever is selected, the selecting cam, through the function trip assembly, causes the perforator reset bail to release the punch slides (2.27). 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 push levers are repositioned at the beginning of the next selecting cycle.

C. Orientation (Figure 7)

2.24 In order to provide the greatest amount of tolerance when receiving distorted signals, the selecting mechanism should be adjusted so that the sampling interval falls within the portion of the signal least likely to be distorted. To make this adjustment, the operating margins are established through the range finder, which provides a means of varying the sampling interval.

2.25 When the range finder knob (Figure 7) is pushed inward and rotated, its attached range finder gear moves the range finder sector (which supports the stop arm bail, stop arm, and latchlever) either clockwise or counterclockwise about the selector cam-clutch. This

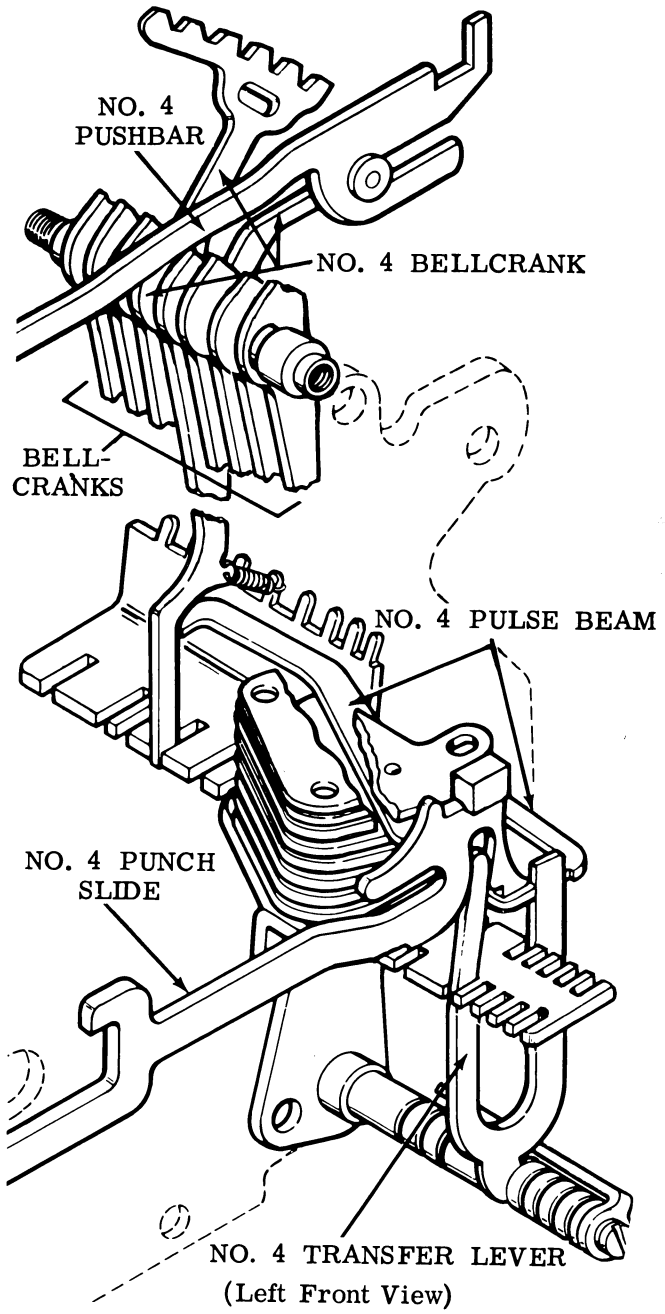


Figure 11 - Transfer Mechanism

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 range finder knob is released. Its inner teeth engage the teeth of the indexing lock stud and hold the range finder mechanism in position. The setting may be read on the range scale opposite a fixed index mark.

D. Transfer (Figure 11)

2.26 The function of the transfer mechanism is threefold:

(a) It provides a path for the signal intelligence from the selector to the associated pushbar in the type wheel positioning mechanism,

(b) It provides a path for the signal intelligence from other signal sources to the type wheel positioning mechanism, and

(c) It provides a means for setting up the ribbon color shift contacts to condition the ribbon for red or black printing or to set up the contacts for print suppression.

2.27 The transfer levers engage the punch slides at one end, as illustrated by the no. 4 transfer lever in Figure 11. 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 lever, engages its associated pushbar. Since the no. 6 and 8 pulses do not control the position of the type wheel, they do not have an associated pushbar. When a selected punch slide falls forward, the corresponding pushbar is raised upwards and into engagement with the rocker bail.

2.28 The no. 6 and 7 bellcranks have an additional arm which controls a transfer contact assembly in the function box. This pair of contacts is used to control the ribbon shift magnet which, in turn, controls print suppression or the color of the printed character. Current is allowed to pass through the contacts when the no. 6 and 7 pulses are opposite polarity, such as no. 6 marking, no. 7 spacing, or no. 6 spacing, no. 7 marking. Current is not allowed to pass when the no. 6 and no. 7 pulses are of the same polarity.

2.29 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.

MOTION FOR TYPING AND TAPE FEEDING

A. General

2.30 The motion of the main shaft is conveyed to the mechanisms concerned with typing and tape feeding by the function mechanism, which is comprised of a cam-clutch (Figure 6), a clutch trip assembly (Figure 12) and a rocker bail (Figure 13).

B. Function Cam-Clutch and Clutch Trip Assembly (Figure 12)

2.31 The trip assembly is shown in its unoperated condition in Figure 12. A follower lever rides on a function trip cam which is part of the selecting cam-clutch (Figure 6). Near the end of the selecting cycle, as the main shaft rotates counterclockwise, the high part of the cam pivots the follower lever (Figure 12) 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. An upper arm of the main trip lever moves out of the way of a clutch release, which falls against a downstop 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 2.19 and 2.20.

2.32 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.

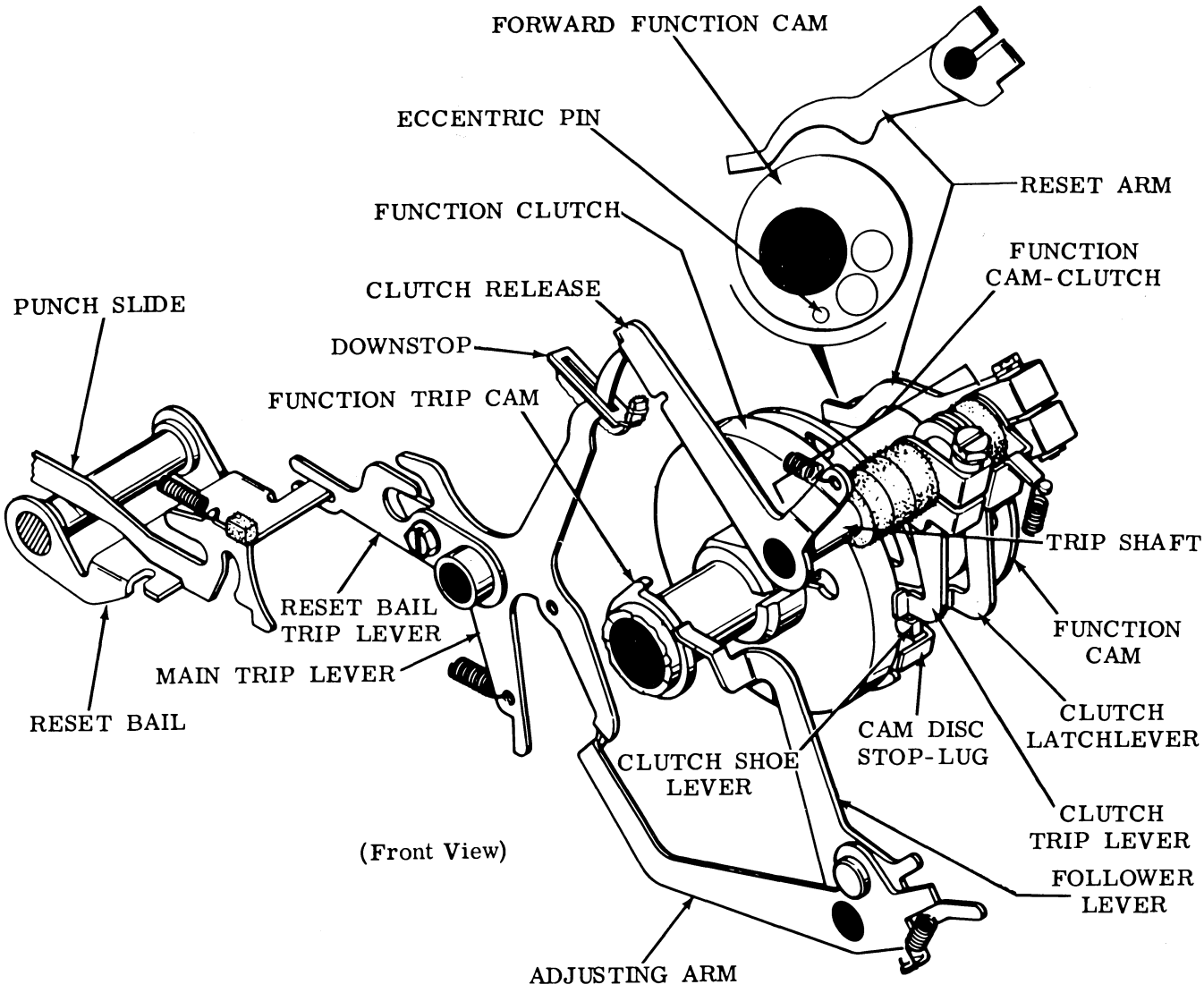


Figure 12 - Function Cam-Clutch and Clutch Trip Assembly

C. Rocker Bail Assembly (Figure 13)

2.33 The function cam and the rocker bail translate the rotation of the main shaft into simple harmonic motion, which the bail distributes to the following:

Ribbon feed mechanism

Tape feed mechanism

Correcting mechanism

Function box

Printing mechanism

Oscillating assembly

Pushbars of the axial and rotary positioning mechanisms.

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

TYPING

A. General

2.34 The characters used to type the received intelligence — letters, figures, and symbols representing various functions — are embossed on the cylindrical surface of the metal type wheel (Figure 14). During the function

cycle, the axial and rotary positioning mechanisms (Figures 15 and 17), having received the intelligence from the transfer mechanism, position the wheel so that the character represented by the received code combination is selected. Following type wheel positioning the correcting mechanism (Figures 15 and 17) accurately aligns the selected character. Then the printing mechanism (Figure 19), by means of a hammer, drives the tape and inked ribbon against the wheel and imprints the character. A ribbon feed mechanism (Figure 20) 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 type wheel 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 18) to operate and cause the rotary positioning mechanism to shift the type wheel.

B. Type Wheel Positioning

General

2.35 A typical type wheel character arrangement is shown in Figure 14 where the wheel 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, 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.

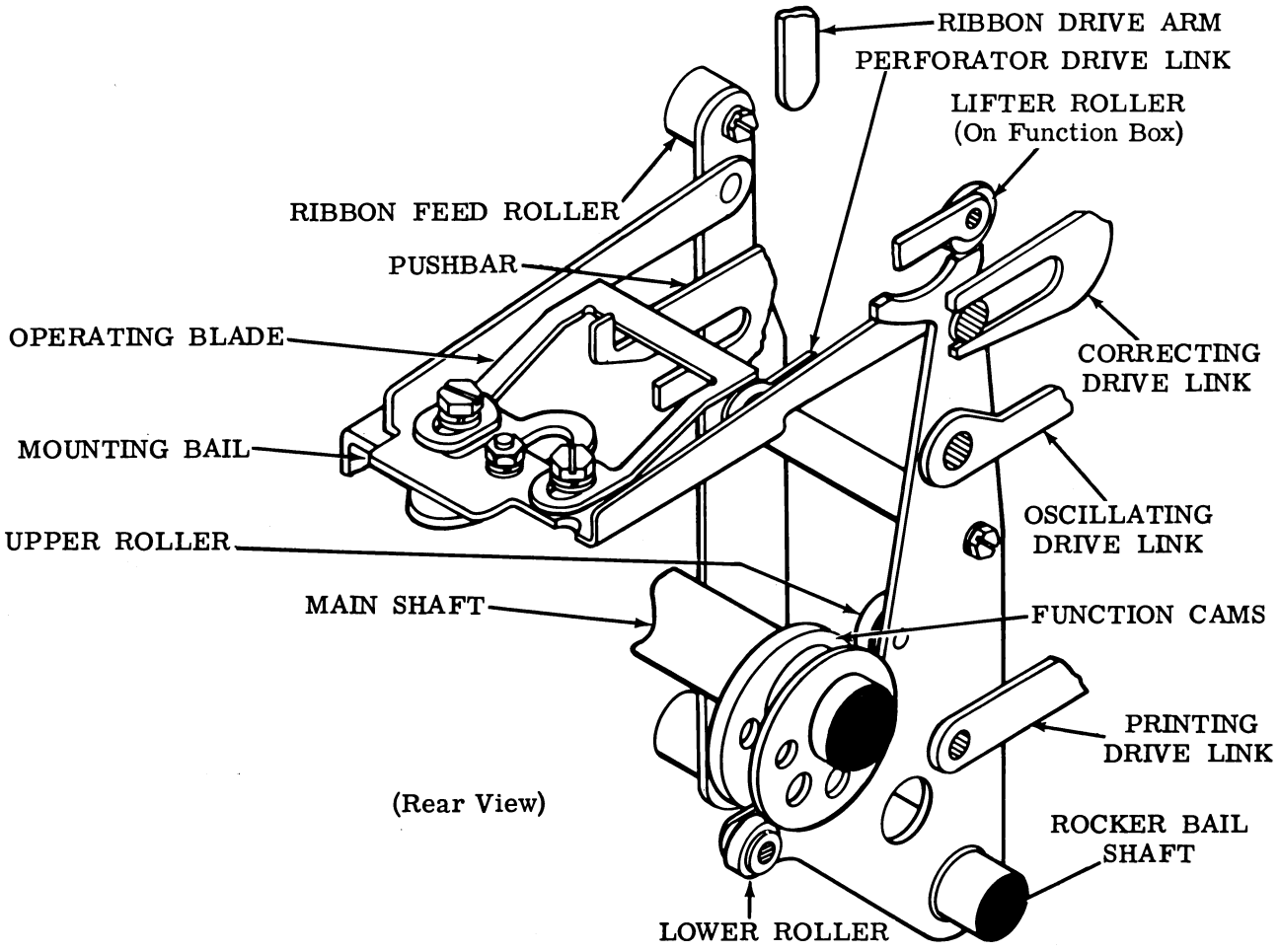
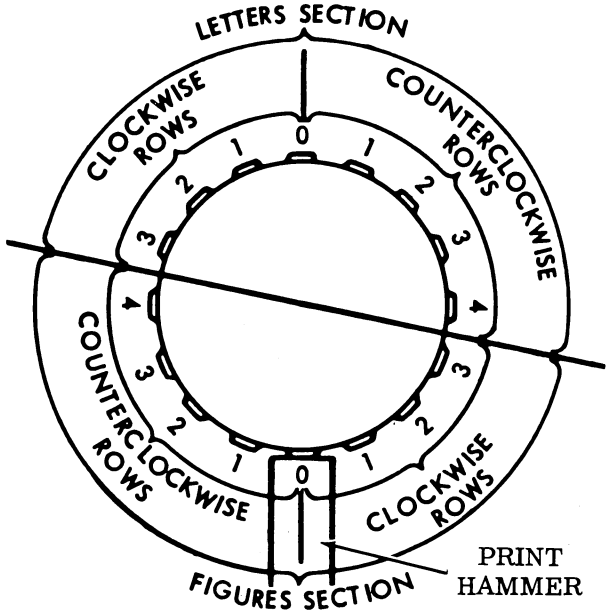
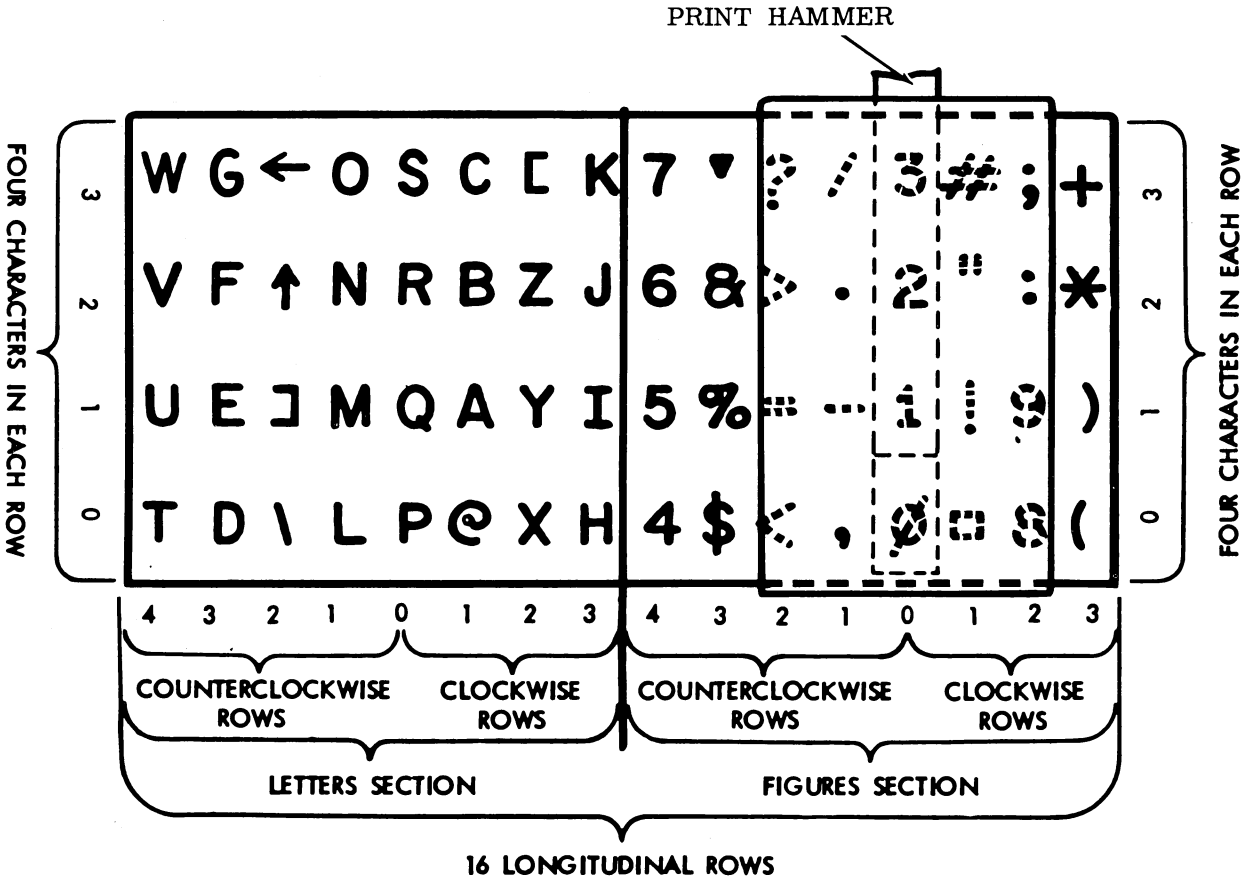


Figure 13 - Rocker Bail Assembly

2.36 Each printing operation (excluding those devoted to the letters-figures shift) begins and ends with the type wheel 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 (2.44), 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



FRONT VIEW SHOWING
16 LONGITUDINAL ROWS



TOP VIEW SHOWING CYLINDRICAL SURFACE IN A PLANE

Figure 14 - Typical Type Wheel Character Arrangement

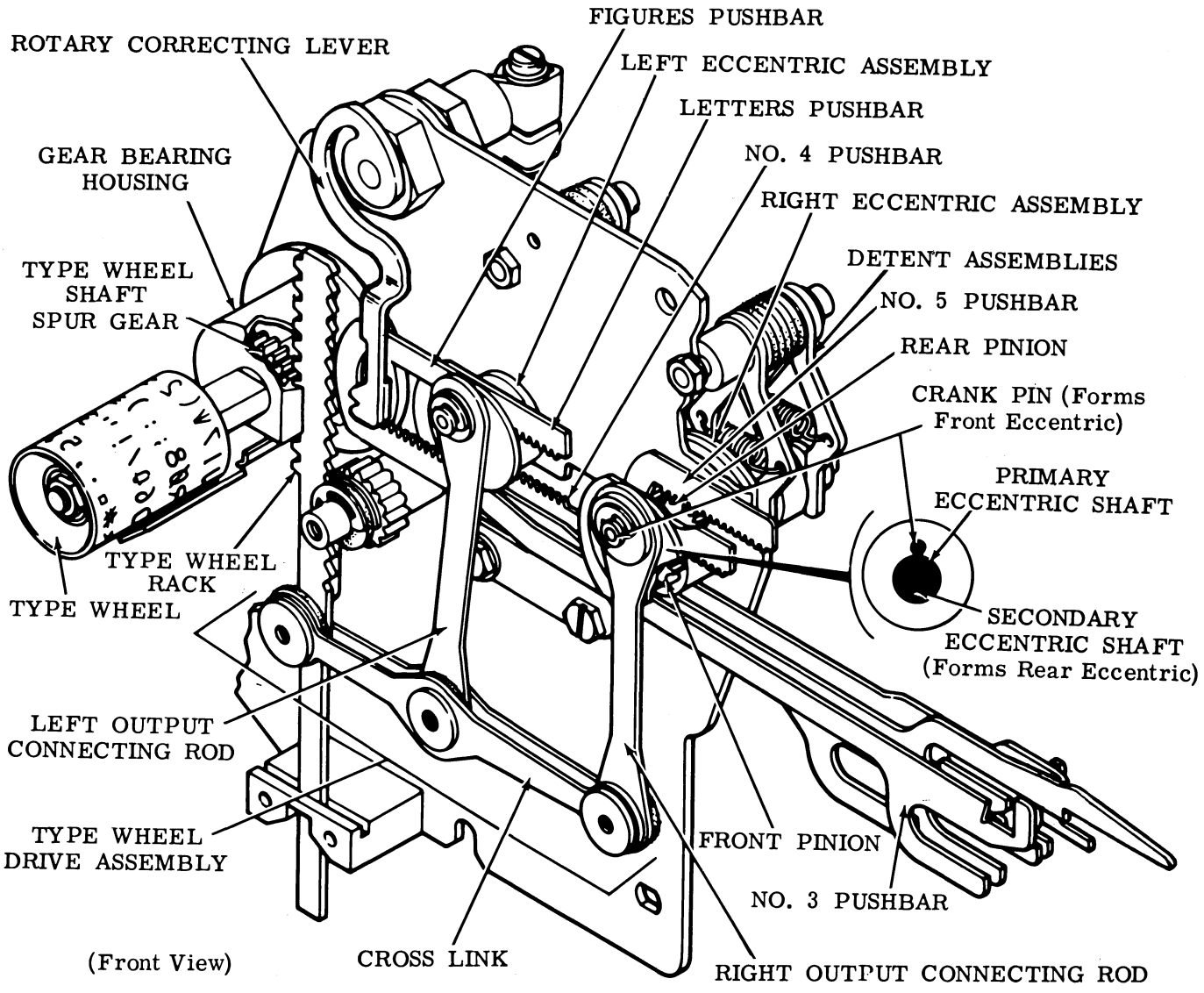


Figure 15 - Rotary Positioning Mechanism

forward and rearward along its axis so as to select the proper character in the row. Rotation of the type wheel to print in either the letters or the figures section is controlled by the no. 7 bit of the code.

2.37 To illustrate the above, if the wheel is in the figures condition, as shown in Figure 14, 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.

Rotary Positioning (Figures 15 and 16)

2.38 The rotary positioning mechanism revolves the type wheel 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 15 and 16. Each assembly includes a

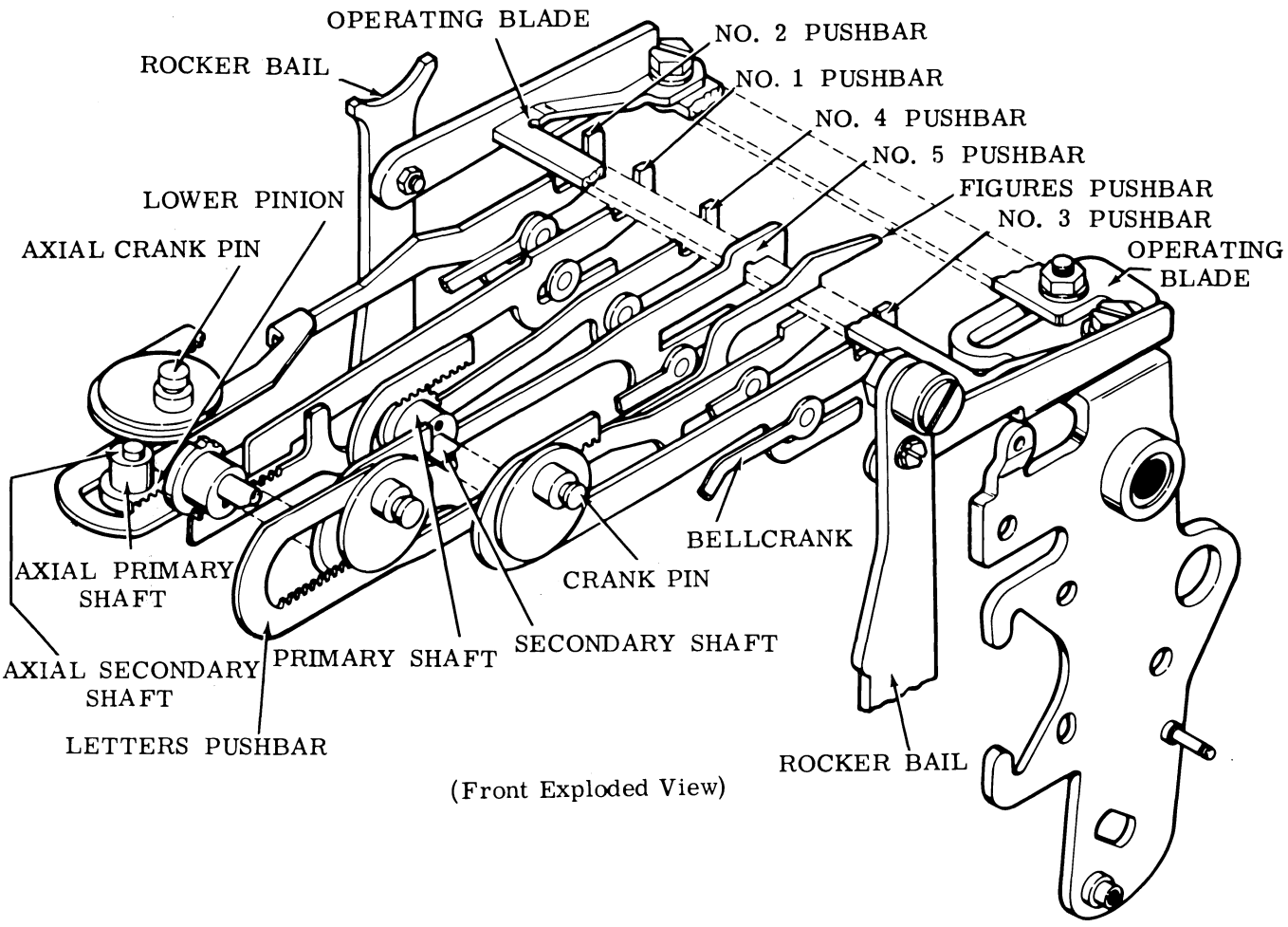


Figure 16 - Pushbars and Eccentric Assemblies

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.

2.39 The eccentric assemblies are linked to a type wheel shaft by a type wheel drive assembly as shown in Figure 15. The type wheel 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 17). A spur gear which meshes with a type wheel 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.

2.40 When, in response to a marking pulse, a pushbar is lifted by its bellcrank, as described in 2.27 of this section, the rocker bail operating blade (see Figures 13 and 16) 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 2.50. 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).

2.41 In the right assembly the home position of the rear eccentric is down and the home position of the front eccentric is up (Figure 16). 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 type wheel 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 15). The cross link pivots about a left output connecting rod and at its left end imparts one unit of downward displacement to the type wheel rack. The rack rotates the spur gear, shaft, and type wheel one row of characters clockwise from the home position, and the no. 1 clockwise row (Figure 14) is presented to the print hammer at the time of printing. On its right stroke the no. 5 pushbar returns the eccentric and the type wheel 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 type wheel; and selection of both the three and five bars results in a three-row, counterclockwise rotation of the type wheel.

2.42 The home position of the left rear eccentric is up, and any displacement appearing in the left assembly is transferred to the type wheel rack in double quantity in the same direction. When the no. 4 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 type wheel rack which rotates the type wheel two rows clockwise from its home position.

2.43 When both eccentric assemblies are displaced, the motion occurring in the type wheel 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 type wheel. 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 14).

Axial Positioning (Figures 16, 17, and 19)

2.44 The functions of the axial positioning mechanism are to position the type wheel so that the proper character in the selected row is aligned with the hammer at the time of printing and to retract the type wheel 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 16 and 17). 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 type wheel shaft by an axial output rack and sector as shown in Figure 17.

2.45 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).

2.46 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 (2.47), and the no. 0 character of the selected row is aligned with the hammer at the time of printing (Figure 14). 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 type wheel shaft, moves

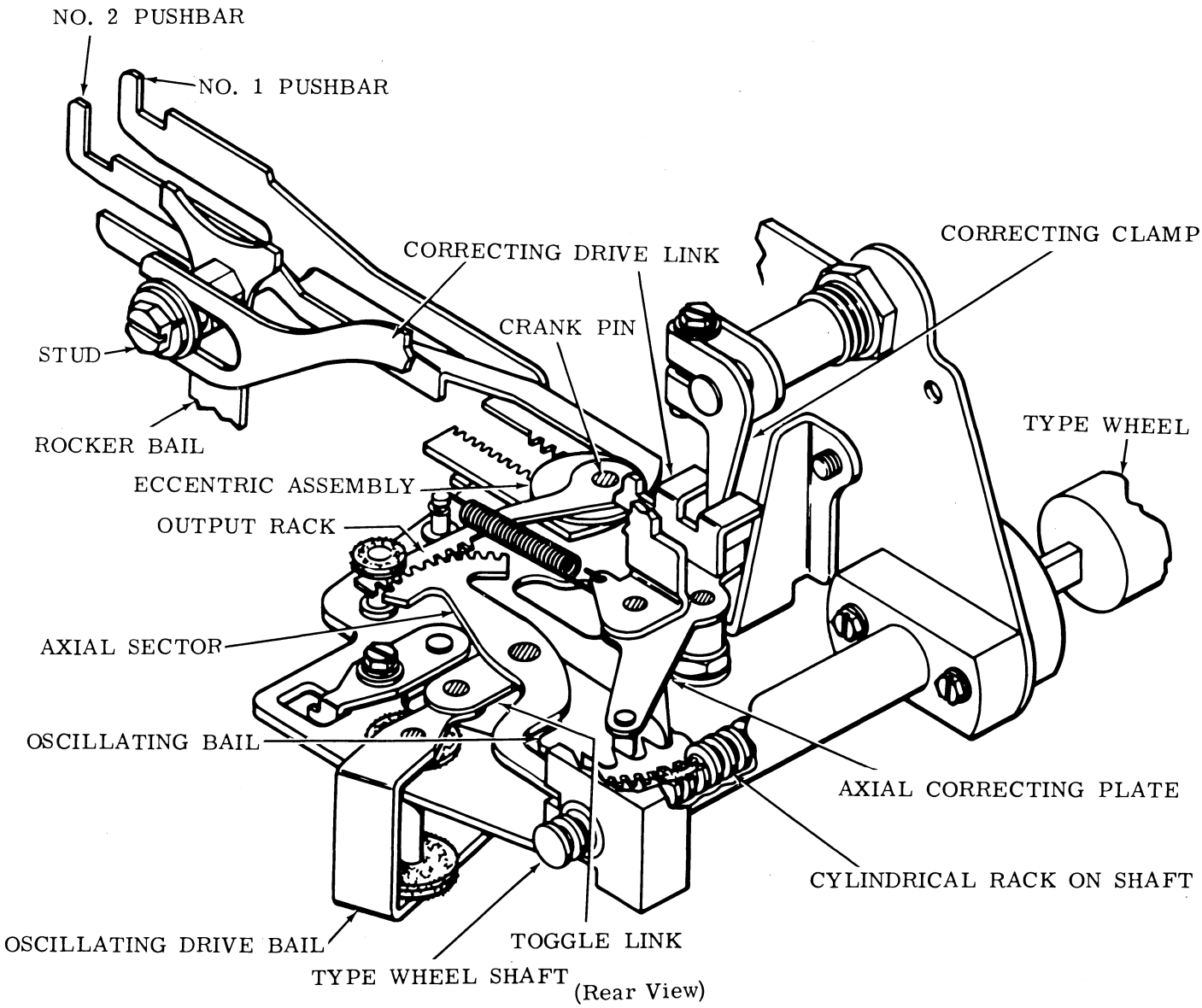


Figure 17 - Axial Positioning Mechanism

the type wheel 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 type wheel 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.

2.47 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 17 and 19). 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 forepart 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 type wheel 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 project and retract the ribbon guide which would obstruct the view of the character (Figure 19).

Correction (Figures 15 and 17).

2.48 After the type wheel 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 17). The shaft pivots a rotary correcting lever (Figure 15) which is equipped with an indentation that engages a tooth in a type wheel rack. There is a tooth in the rack for each row of characters (16 in all), and they are so correlated with the type wheel 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 17). Thus the type wheel 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.

2.49 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 type wheel 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.

Type Wheel Shift (Figures 15 and 18)

2.50 The type wheel shift from the letters to the figures printing segment (or figures to letters) is controlled by the no. 7 selector push lever 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.

2.51 To shift the type wheel from the figures section to the letters section, a marking no. 7 pulse must be received by the unit. This will cause the no. 7 punch slide to be selected and move to the left (2.22). 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 (2.33). The operating blade simultaneously pushes the letters pushbar to the left and the figures pushbar to the right, resulting in rotation of the type wheel to the letters section. As long as the no. 7 pulse is marking, the letters pushbar will remain in this left-most position.

2.52 When the no. 7 pulse 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 type wheel to the figures position. As the figures pushbar moves left, the letters pushbar simultaneously moves to the right.

2.53 As long as the no. 7 pulse is spacing, the letters-figures pushbars will not be lifted and, therefore, the letters pushbar will not be moved to the left (2.52). The type wheel

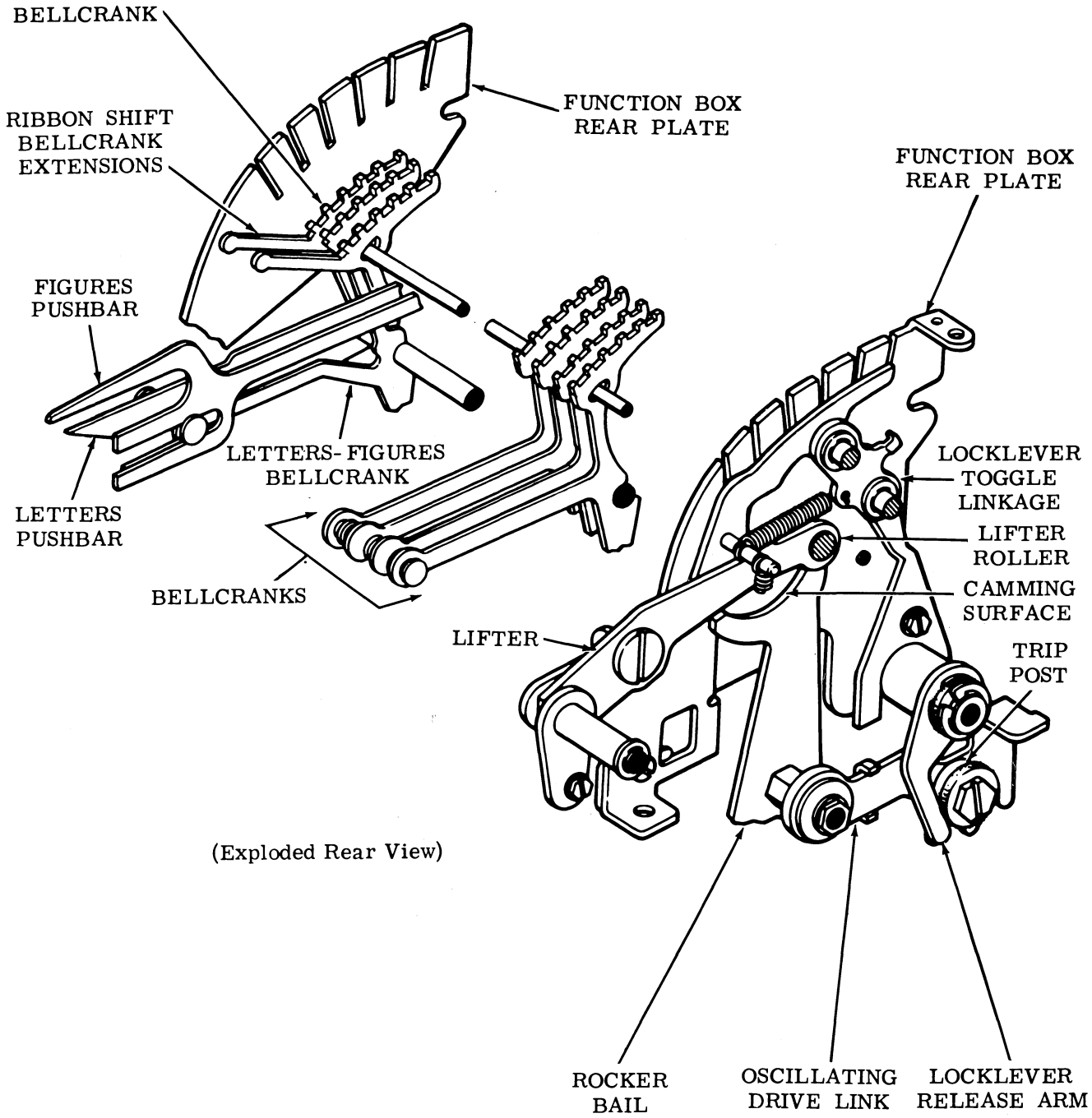


Figure 18 - Function Box

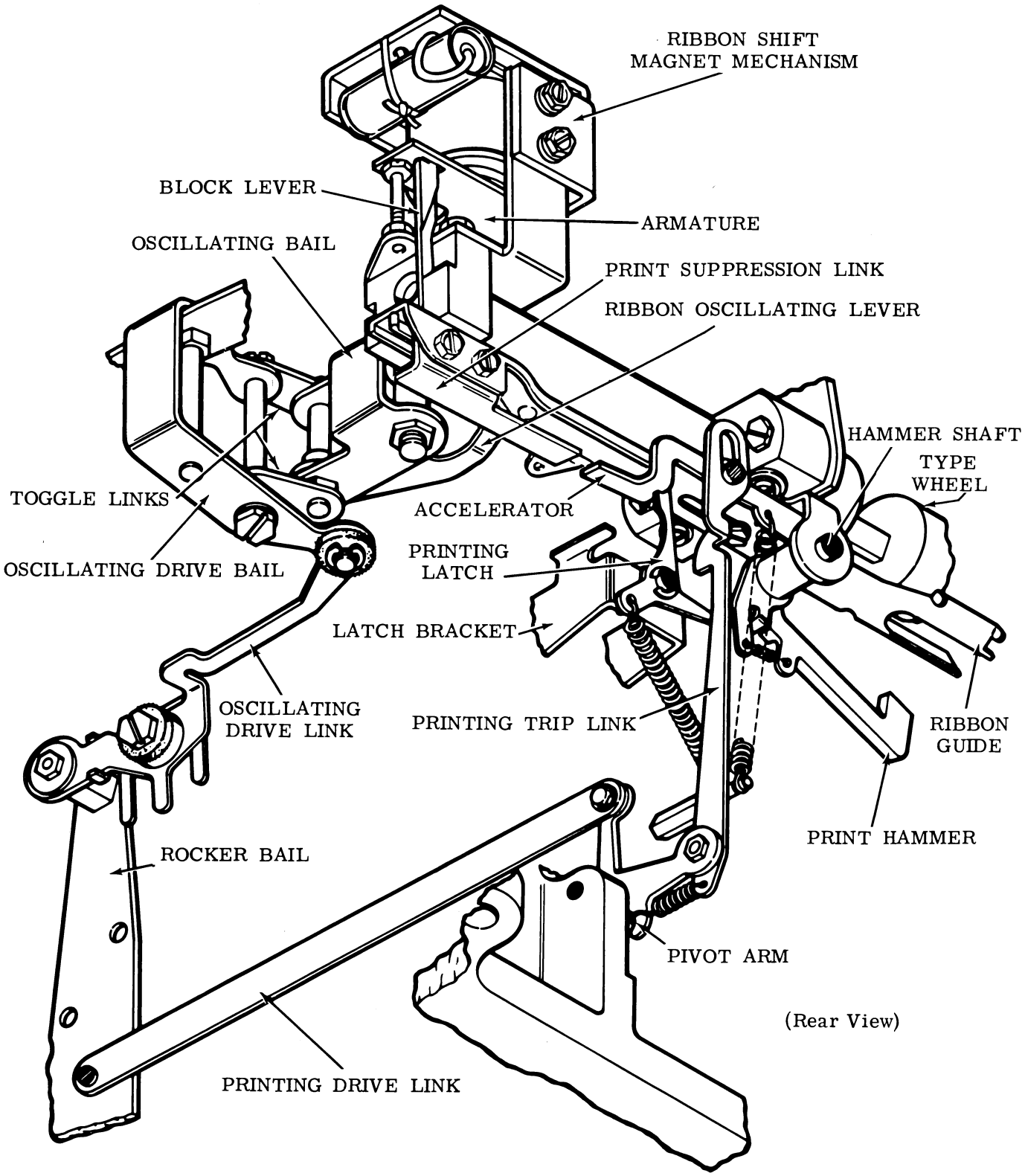


Figure 19 - Printing Mechanism

will shift back to the letters section only upon receipt of a no. 7 marking pulse by the reperforator.

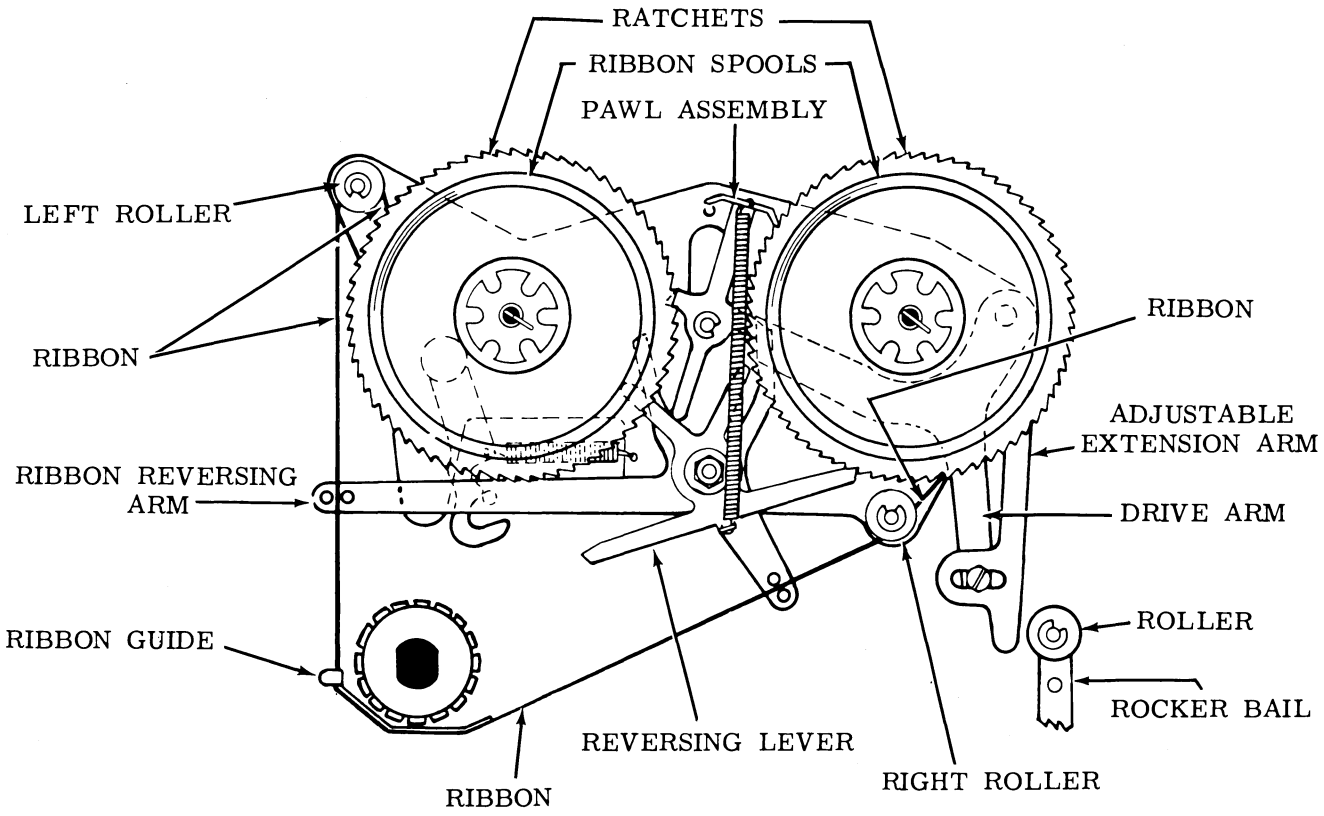
C. Printing (Figure 19)

2.54 After the type wheel 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 type wheel bearing housing. In its unoperated condition, as illustrated in Figure 19, 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.

2.55 The rocker bail, during the forepart of the function cycle, moves a printing drive link to the right (as viewed from the rear in Figure 19) 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 type wheel and imprints the selected character on the tape. The imprint may be in black or red as determined by the ribbon shift mechanism (2.59). 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 20)

2.56 The characters are typed in ink supplied by ribbon which is held between the tape and the type wheel by a guide and advanced by the ribbon feed mechanism (Figure 20). The path



(Front View)

Figure 20 - Ribbon Feed Mechanism

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.

2.57 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.

2.58 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.

E. Ribbon Shift Mechanism (Two-Color Printing) (Figure 19)

2.59 As the ribbon carrier drive arm is driven by the motion of the axial oscillator lever, the ribbon carrier follows by the action of a spring. When the ribbon color shift magnet is energized and its armature attracted, a blocking lever is removed from the path of the ribbon carrier placing the black portion of the red-black ribbon over the print hammer. If on the other hand, the ribbon shift magnet is not energized, the blocking lever blocks the ribbon carrier which leaves the red portion of the red-black ribbon over the print hammer resulting in a red character.

2.60 When the no. 6 and 7 signal bits are the same, both marking or both spacing, the ribbon shift magnet is de-energized, and a red character is printed. If, however, the no. 6 and 7 bits are different, one marking, the other spacing, the ribbon shift magnet is energized, and a black character will be printed.

F. Print Suppression Mechanism (One-Color Printing) (Figure 19)

2.61 The print suppression mechanism blocks the movement of the ribbon carrier when, because the ribbon shift magnet contacts are either both spacing or both marking, current passes through the ribbon shift magnet. Printing occurs, as described in 2.54 and 2.55. When the magnet is de-energized, the block lever drops to permit full travel of the ribbon carrier (Figure 19). The print suppression link is moved under the accelerator. When the printing latch is released, movement of the accelerator is blocked, and printing does not occur. Since tape feeding is not affected, the print suppression cycle results in a blank space in the tape.

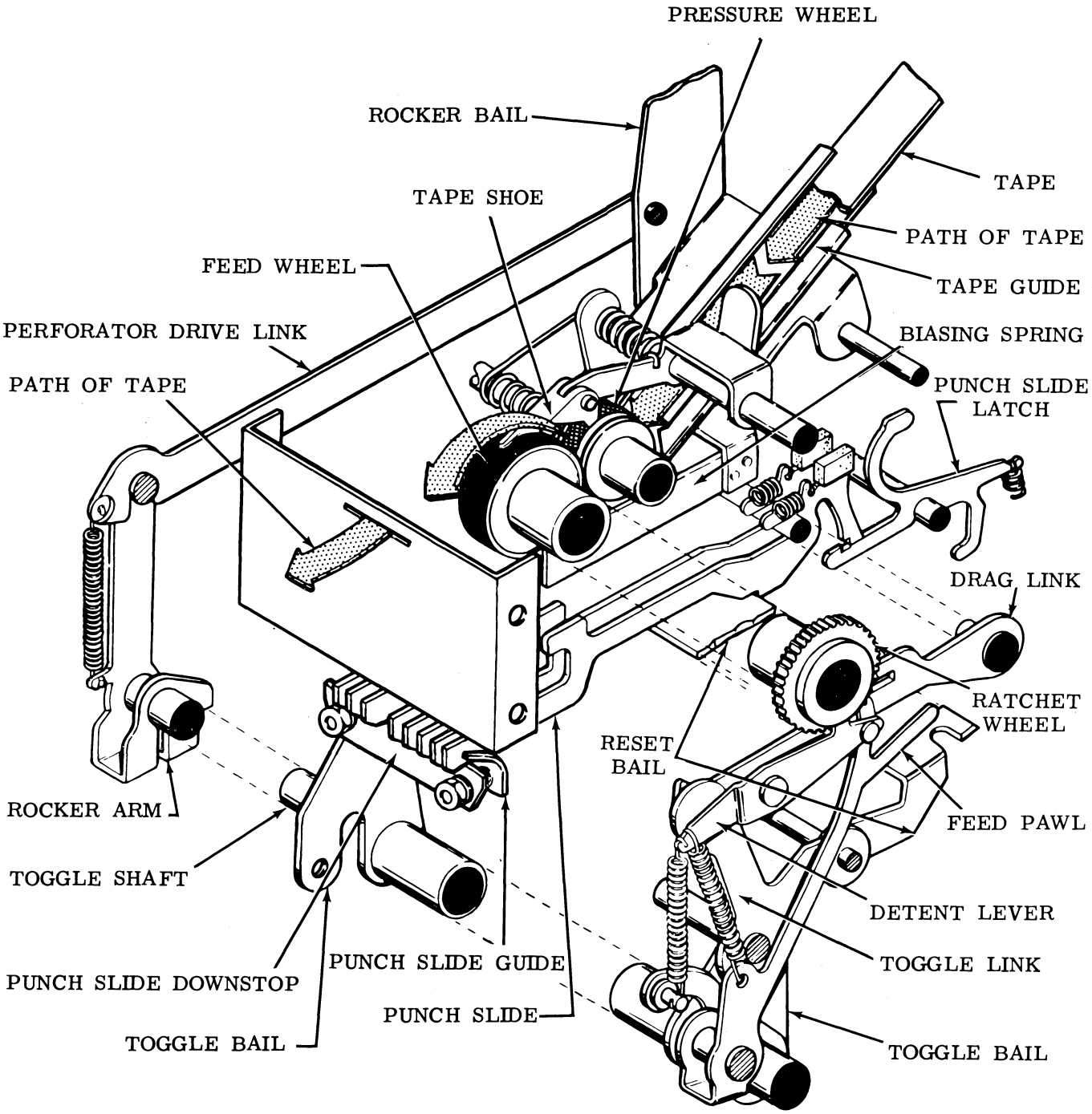
TAPE FEEDING (Figure 21)

A. General

2.62 The tape feeding mechanism rolls the tape between a rubber feed wheel and a metal pressure wheel, which does not perforate a feed hole but merely regulates the amount of tape feed. Intelligence is received from the selecting mechanism by the punch slides. Motion from the rocker bail is distributed to the pins and the tape feed parts (Figure 21) by a main bail assembly, which includes a toggle bail. a toggle shaft, a slide post, toggle links, drag links, and the punch slide reset bail.

B. Feeding

2.63 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 rubber feed wheel and a metal pressure wheel (Figure 21). A feed pawl, driven by the toggle bail, acts upon a ratchet and rotates the feed wheel which advances the tape. A detent with a roller that rides on the ratchet holds the feed wheel and tape in position during printing. 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 printing, but is low during idling and the last half of the cycle to facilitate tape threading and feeding. The shoulder of the pressure



(Left Front Exploded View)

Figure 21 - Tape Feeding Mechanism

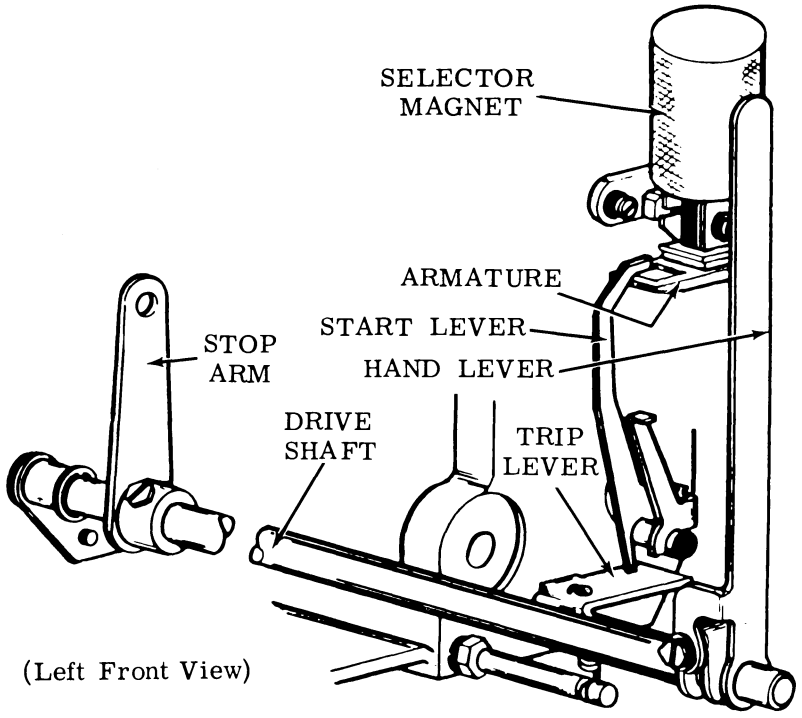


Figure 22 - Manual Interfering Tape Feed-Out Mechanism

wheel helps guide the tape directly onto the feed wheel. The tape shoe retains the tape on the feed wheel.

MANUAL INTERFERING TAPE FEED-OUT (Figure 22)

A. Initiation

2.64 When the unit is in idling condition, the selector magnet is energized, and the start lever is blocked by the selector armature as shown in Figure 7. Feed-out is initiated by moving a feed-out hand lever to the left (Figure 22). A drive shaft affixed to the hand lever rotates a trip lever, which lifts the start lever. The latter clears the armature and under spring tension rotates clockwise. The selecting cam-clutch engages, as described in 2.16, and the unit undergoes a complete operation. Since the selector magnet remains energized, it is equivalent to all bits of the signaling code being marking; and the RUBOUT symbol is printed. The tape advances one character. As long as the hand lever is retained to the left, the start lever will trip the selecting cam-clutch, and feed-out will continue.

B. Termination

2.65 Feed-out is terminated by releasing the hand lever. The drive shaft and trip lever rotate clockwise under spring tension and lower the start lever. When the stop arm bail and start lever are moved to the left by the stop arm bail cam, the start lever is blocked by the armature, the selecting cam-clutch is disengaged and the unit is returned to its idling condition.

2.66 A message received during the feed-out cycle will be garbled.