

32 TYPING UNIT  
 GENERAL DESCRIPTION AND  
 PRINCIPLES OF OPERATION

CONTENTS	PAGE
1. GENERAL . . . . .	1
2. DESCRIPTION . . . . .	1
TECHNICAL DATA . . . . .	1
3. TELETYPEWRITER SIGNALING CODE . . . . .	3
4. PRINCIPLES OF OPERATION . . . . .	5
OUTLINE OF OPERATION . . . . .	5
A. Power Distribution . . . . .	5
B. Transmission . . . . .	5
C. Function Mechanism . . . . .	5
D. Spacing Mechanism . . . . .	5
E. Paper Feed Mechanism — Friction Feed . . . . .	5
F. Form Feed Mechanism — Sprocket Feed . . . . .	5
DETAILED OPERATION . . . . .	5
A. Motor . . . . .	5
B. Main Shaft . . . . .	9
C. Clutches . . . . .	9
D. Signal Reception . . . . .	11
E. Distributor Mechanism . . . . .	11
F. Selector Mechanism . . . . .	11
G. Range Finder . . . . .	17
H. Codebar Mechanism . . . . .	18
I. Function Mechanism . . . . .	21
J. Printing . . . . .	21
K. Print Suppression Mechanism . . . . .	30
L. Ribbon Mechanism . . . . .	32
M. Spacing Mechanism . . . . .	34
N. Space Suppression . . . . .	35
O. Carriage Return Mechanism . . . . .	37
P. Paper or Form Feeding . . . . .	37
Q. Margin Bell and End of Line Bell . . . . .	43
R. Automatic Carriage Return — Line Feed . . . . .	43
S. Answer-Back Mechanism . . . . .	43
5. OPTIONAL FEATURES . . . . .	50
PRINT-NONPRINT . . . . .	50

1. GENERAL

1.01 This section provides general description and principles of operation for the 32 typing unit. It describes the teletypewriter code used by the typing unit to transmit and receive messages, outlines in general the overall operation, and explains in detail the operation of the components that make up the typing unit. It is reissued to add operating temperature requirements, information concerning carriage return-line feed for sprocket feed units, and a description of a print-nonprint mechanism. Marginal arrows indicate changes and additions.

1.02 References to left, right, front, or rear consider the typing unit as viewed by the operator.

1.03 In the illustrations fixed pivots are solid black, and floating pivots — those mounted on parts that move are crosshatched.

1.04 The 32 typing unit is an electromechanical receiving device which prints graphics on a paper copy according to a code and performs nonprinting functions.

2. DESCRIPTION

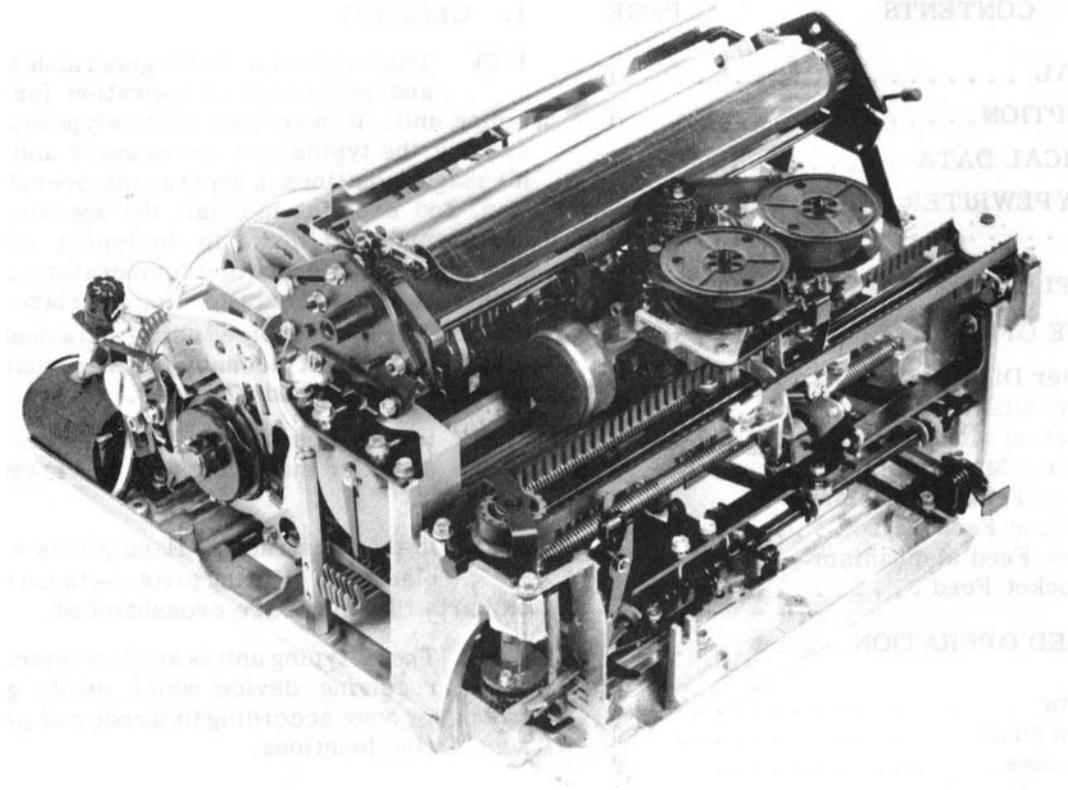
TECHNICAL DATA

**CAUTION: THIS EQUIPMENT IS INTENDED TO BE OPERATED IN A ROOM ENVIRONMENT WITHIN THE TEMPERATURE RANGE OF 40° F TO 110° F. SERIOUS DAMAGE TO IT COULD RESULT IF THIS RANGE IS EXCEEDED. IN THIS CONNECTION, PARTICULAR CAUTION SHOULD BE EXERCISED IN USING ACOUSTICAL OR OTHER ENCLOSURES.**

2.01 Speed . . . . . 60, 66, 75, or 100 wpm

2.02 Dimensions and Weight (Approximate)

Width . . . . .	13 inches
Depth . . . . .	14 inches
Height . . . . .	8 inches
Weight . . . . .	40 pounds



(Left Front View)

Figure 1 - 32 Typing Unit

2.03 Signal Code Characteristics

5-level  
7.5-unit transmission pattern

2.04 Electrical

Power requirements . . . . 115 volts ac  $\pm 10\%$   
50 or 60 Hz  $\pm 0.45$  Hz, single phase

Signal line current . . . . . 0.020 or 0.060  
ampere

Nominal input to selector . . . . . 0.500  
ampere at 20 volts dc

Operating margins — all signal contacts  
and distributor

Long telegraph loops. . . . . 0.015 to  
0.070 ampere at 48 to  
240 volts dc inductive

Short telegraph loops . . . . . 0.058 to  
0.072 ampere at 16 to  
22 volts dc resistive

2.05 Printing and Paper or Form Handling

Feed

Friction or Sprocket: Six lines per inch,  
adjustable for single or  
double line feed.

Paper or Form

Friction Feed: 8-1/2 inches wide, max 5-  
inch diameter roll.

Sprocket Feed: 8-1/2 inches wide, 7-, 8-1/2-,  
9-, 10-, 11-, and 12-inch  
form lengths or multiples  
of 1/3 or 1/2 thereof.

Characters and Line

Friction Feed: 10 characters per inch, max  
74 character line

Sprocket Feed: 10 characters per inch, max  
72 character line

Legible Copies

Friction Feed: Original and one copy; when  
pressure sensitive paper is used, Original  
and two copies

Sprocket Feed: Original and two copies

2.06 Motor (TP181870)

Type . . . . . Synchronous, capacitor start  
Input . . . . . 115 volts ac  $\pm 10\%$ , 60 Hz,  
single phase

Input current . . . . . 2 amperes  
Watts (max input) . . . . . 120  
Speed . . . . . 3600 rpm  
Temperature (max) . . . . . 130° C  
Power factor . . . . . 36%

2.07 Motor (TP182241)

Type . . . . . Synchronous, split phase  
Input . . . . . 115 volts ac  $\pm 10\%$ , 60 Hz,  
single phase

Input current . . . . . 1.6 ampere  
Watts (max input) . . . . . 110  
Speed . . . . . 3600 rpm  
Temperature (max) . . . . . 130° C  
Power factor . . . . . 40%

2.08 Motor (TP182267)

Type . . . . . Synchronous, split phase  
Input . . . . . 115 volts ac  $\pm 10\%$ ,  
50 Hz, single phase

Input current . . . . . 1.7 ampere  
Watts (max input) . . . . . 110  
Speed . . . . . 3000 rpm  
Temperature (max) . . . . . 130° C  
Power factor . . . . . 40%

2.09 Environment: Relative humidity 90% in  
a temperature range of 60° F to 100° F.

3. TELETYPEWRITER SIGNALING CODE

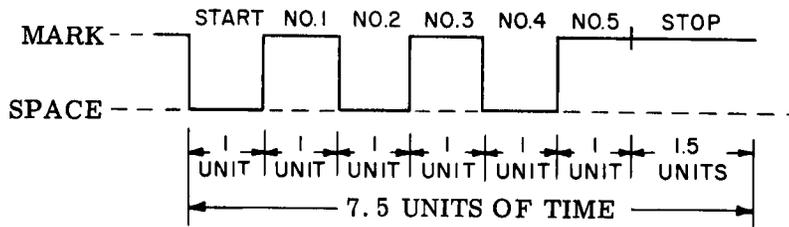
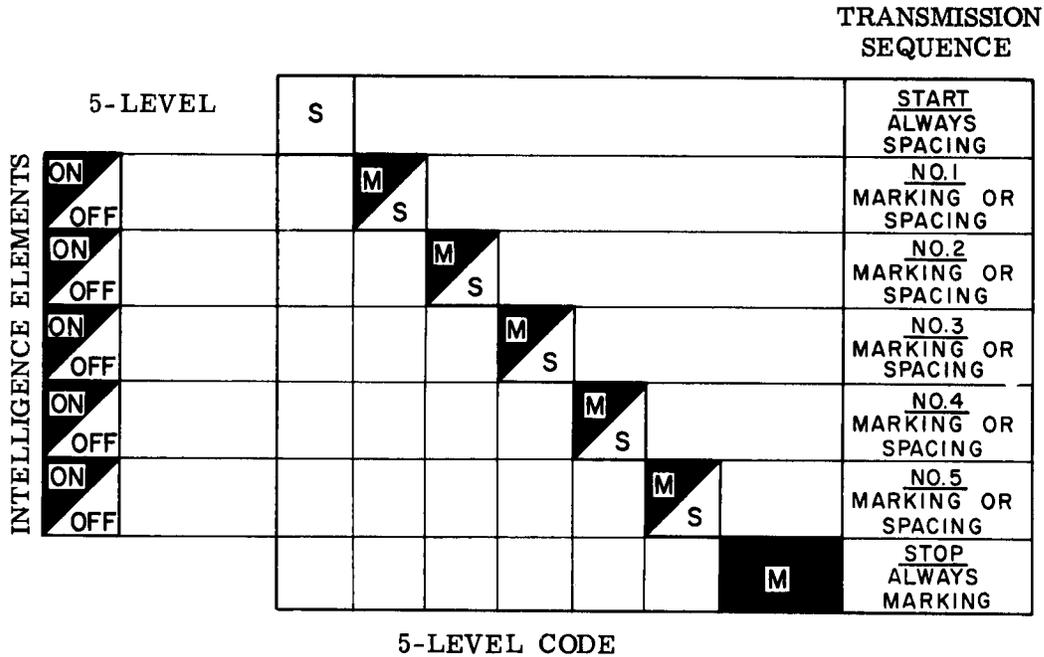
3.01 The 32 Teletypewriter Set transmits and  
receives messages in the form of a start-  
stop signaling code. In this code each character  
or function is represented by current and no-  
current time intervals. Current flowing in the  
signal line is referred to as marking; no-current  
flowing in the signal line is referred to as spac-  
ing. To represent a character or a function  
seven pulses are used. The first pulse, which is  
always spacing, is the start pulse. The next five  
pulses are the intelligence pulses. The seventh  
pulse, which is always marking, is the stop  
pulse. The first and seventh pulses are used to  
synchronize sending and receiving equipment.

3.02 The time interval of the stop pulse may  
vary. If the interval of the stop pulse is  
made 1.5 times the length of the other pulses,  
the code will be a 7.5-unit code.

Start pulse	1 unit of time
Intelligence pulses	5 units of time
Stop pulse	<u>1.5 units of time</u> 7.5-unit code

3.03 Marking and spacing combinations of the five intelligence pulses can represent 2 to the 5th or 32 characters. To accommodate more than 32 characters a letters-figures shift is designed into the typing unit. This is similar

to lower and upper case of a typewriter and permits each code combination, excluding the two that shift the equipment, to represent two characters for each key on the keyboard, or 64 characters altogether (Figure 2).



FIGURES	-	5/8	W	U	3	1/4	8	8	'	1/2	3/4	.	7/8	9	0	1	4	BELL	5	7	3/8	2	/	6	"	BLANK	LETTERS	FIGURES	SPACE	CARRIAGE RETURN	LINE FEED
LETTERS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z					
1	●	●		●	●	●				●	●					●		●		●	●	●	●	●	●	●	●	●	●		
2	●		●				●		●	●	●	●				●	●	●			●	●	●				●	●		●	
3			●		●		●	●	●		●	●	●	●	●	●		●		●	●	●	●	●	●		●		●		
4		●	●	●		●	●		●	●	●	●	●	●	●		●				●		●	●		●	●	●	●		
5		●				●	●				●	●	●	●	●				●		●	●	●	●	●	●	●	●	●		

CHARACTER ARRANGEMENTS

Figure 2 - Teletypewriter Signaling Code (5-Level)

## 4. PRINCIPLES OF OPERATION

### OUTLINE OF OPERATION (Figure 3)

#### A. Power Distribution

4.01 Operation of the motor switch supplies ac electrical power to the motor. By means of intermediate drive parts the rotary motion of the motor is transferred to a distributor shaft. The distributor shaft drives the main shaft and, by means of a clutch, provides motion for the distributor mechanism.

#### B. Transmission

4.02 The distributor receives a parallel output from the keyboard and converts it into a serial start-stop code combination. A selector magnet driver receives the distributor serial output and converts it into a form suitable to operate the selector mechanism. The selector mechanism in turn receives the signal and positions the codebar mechanism.

#### C. Function Mechanism

4.03 Controlled by the codebar mechanism, the function mechanism enables the typing unit to perform functions supplementary to printing. The standard functions are: "blank," "letters," "spacing," "carriage return," and "line feed." In response to the reception of "letters" or "figures" code combinations, the function mechanism conditions the codebar mechanism to cause printing in the lower or upper case, respectively. It also causes the codebar mechanism to suppress printing on receipt of all functions.

#### D. Spacing Mechanism

4.04 The spacing mechanism positions the carriage so that the characters are properly located horizontally on the paper. It spaces the carriage each time printing occurs and when the "space" code combination is received. The function mechanism suppresses spacing on the receipt of all functions except "space." At the receipt of "carriage return" code combination, the function mechanism causes the spacing mechanism to return the carriage to the left margin, so that a new printing line can be started.

#### E. Paper Feed Mechanism — Friction Feed

4.05 The paper feed mechanism positions the paper vertically so that the characters are properly located in lines on the paper. At the receipt of the "line feed" code combination, the function mechanism causes the line feed mechanism to raise the paper to the next printing line.

#### F. Form Feed Mechanism — Sprocket Feed

4.06 The form-out mechanism positions the form vertically so that the characters are properly located in lines on the form. At the receipt of the "line feed" or "form-out" code combination, the main shaft, through a line feed clutch, causes the platen to raise the form to either the next printing line or one form length, depending upon which function (line feed or form-out) is used.

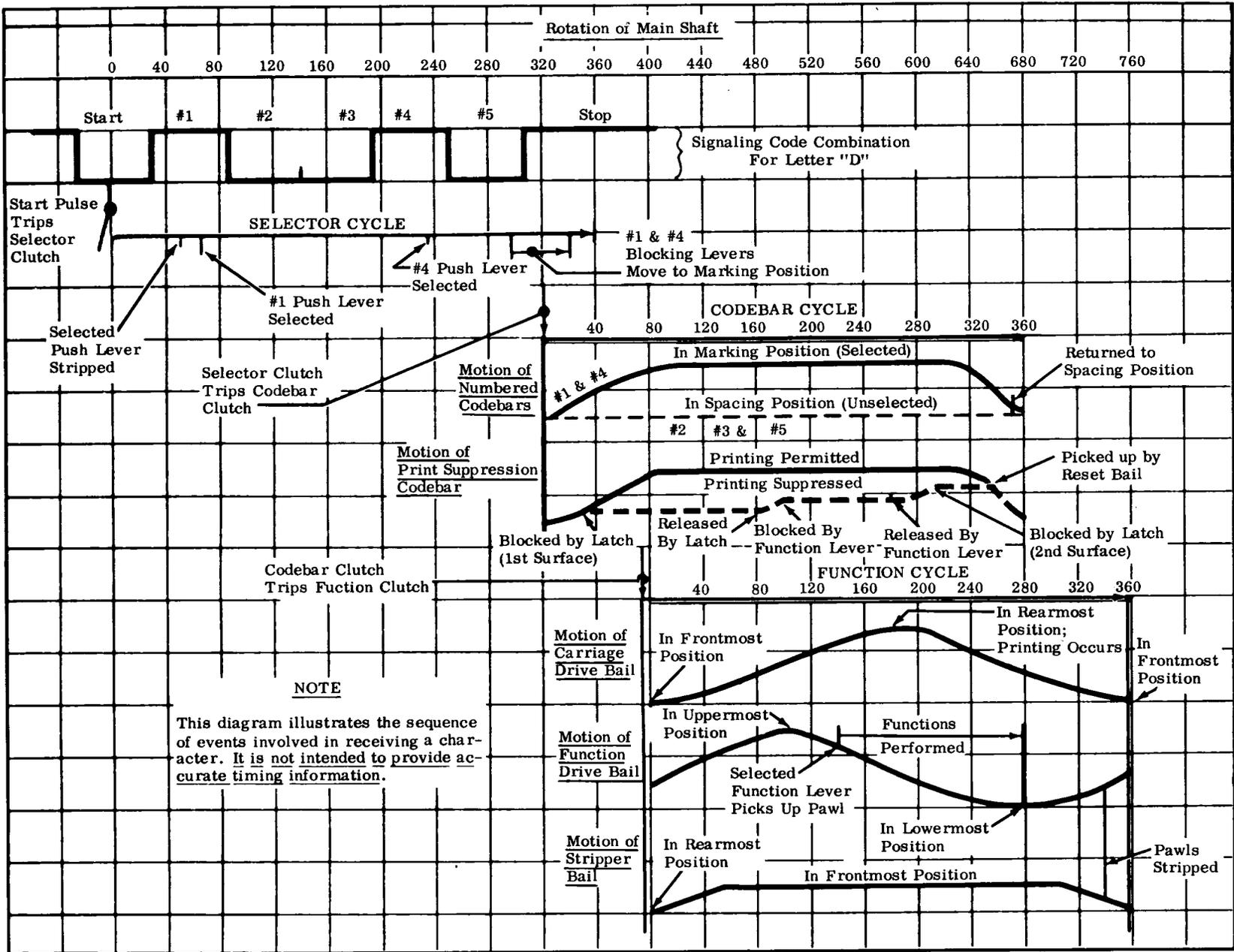
## DETAILED OPERATION

### A. Motor

4.07 The motor used on the 32 typing unit has a run winding and a start winding connected in parallel. (See wiring diagram 4405WD.) The start winding is in series with an electrolytic capacitor and the contacts at a current-sensitive start relay. The run winding is connected to a run capacitor. When the motor circuit is closed, the initial surge of current energizes the relay coil, closing the relay contacts. The magnetic flux, produced by the run and start windings, starts the rotor turning. As the rotor accelerates, the current, through the windings, capacitor, and relay decreases. When it drops to a predetermined level, the relay coil opens the contacts and removes the start winding from the circuit. Using the run winding alone, the motor continues to accelerate until it reaches synchronous speed.

4.08 The rotary motion produced by the motor is transferred through a motor pinion, an intermediate gear pulley, and a motor belt to a distributor gear pulley. The latter drives a main shaft gear and also a distributor clutch, which provides motion for the keyboard and distributor mechanism (Figure 4).

CHART 1 - SEQUENCE DIAGRAM - 32 TYPING UNIT OPERATION



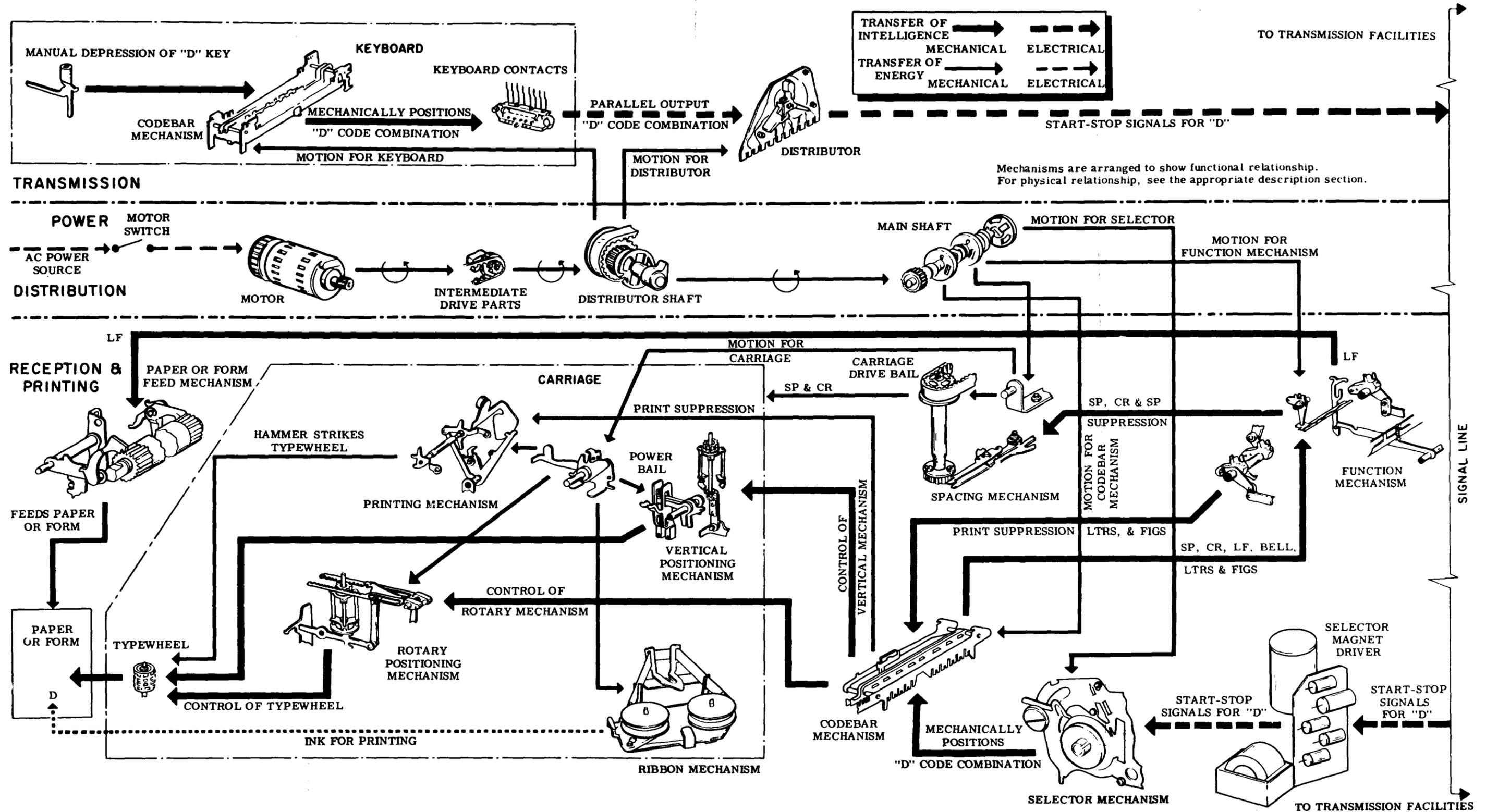


Figure 3 - Schematic Diagram - Typing Unit Operation

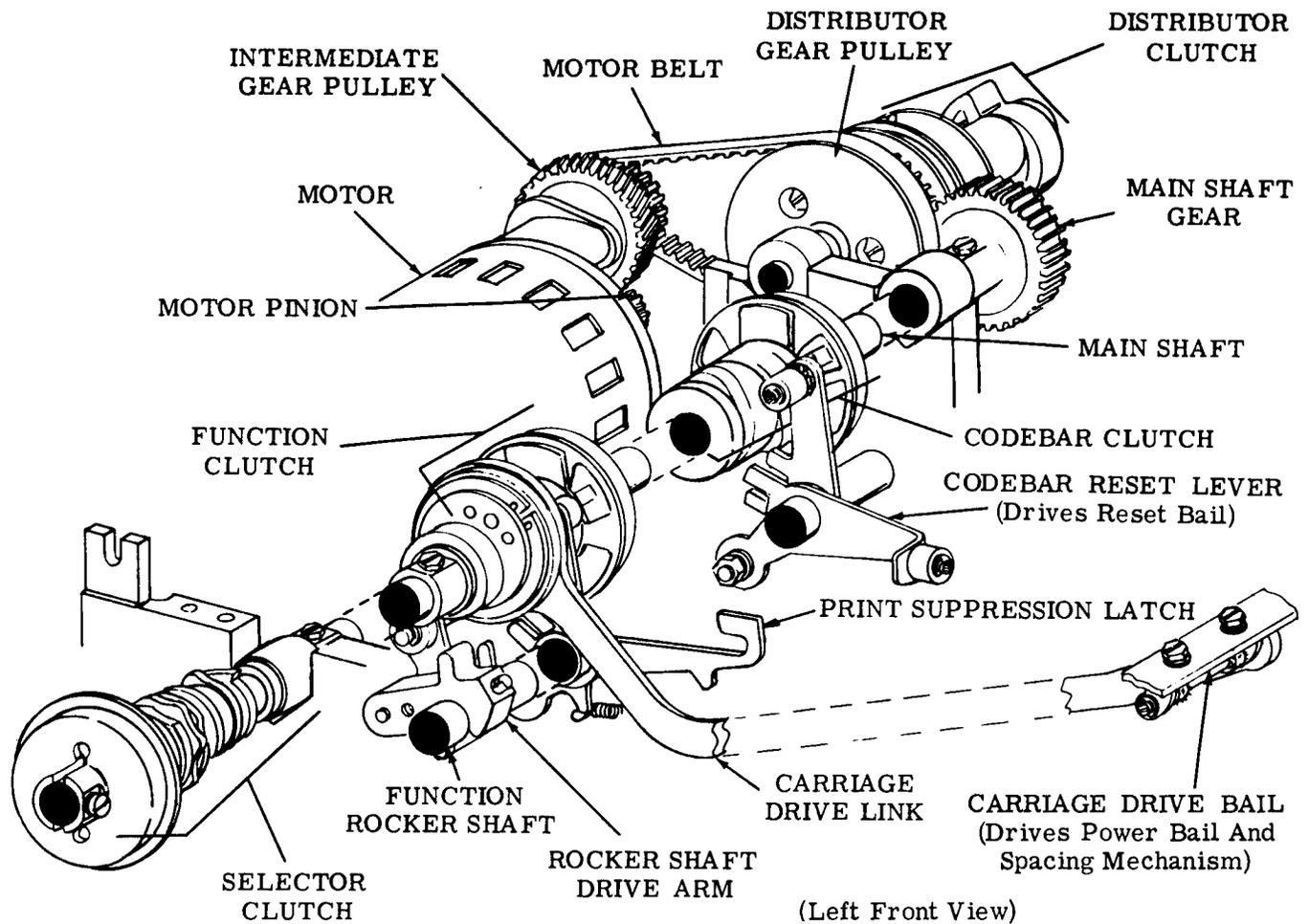


Figure 4 - Motor and Drive Mechanism

### B. Main Shaft

4.09 The main shaft receives motion from the motor, and by means of clutches distributes it to drive all the mechanisms in the typing unit except the distributor mechanism. The distributor mechanism is driven by the motor directly as explained in 4.08. The main shaft drives three clutches: the selector clutch, the function clutch, and the codebar clutch (Figure 5). In sprocket feed units the main shaft also drives the form feed clutch.

### C. Clutches

4.10 The clutches used on the 32 typing unit are all-metal internal expansion clutches (Figure 6). This type of clutch functions somewhat like the brakes of a car. When the clutch is tripped (or engaged) two shoes expand against a notched drum. The force of the expanded shoes against the clutch drum is enough to engage the drum. As the drum rotates, the whole clutch and any mechanism attached to it will rotate.

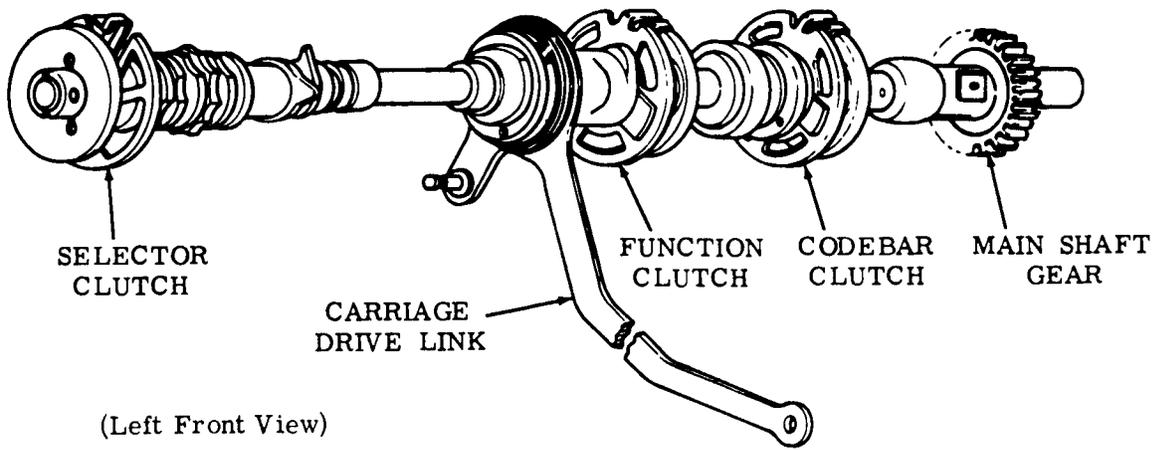


Figure 5 - Main Shaft

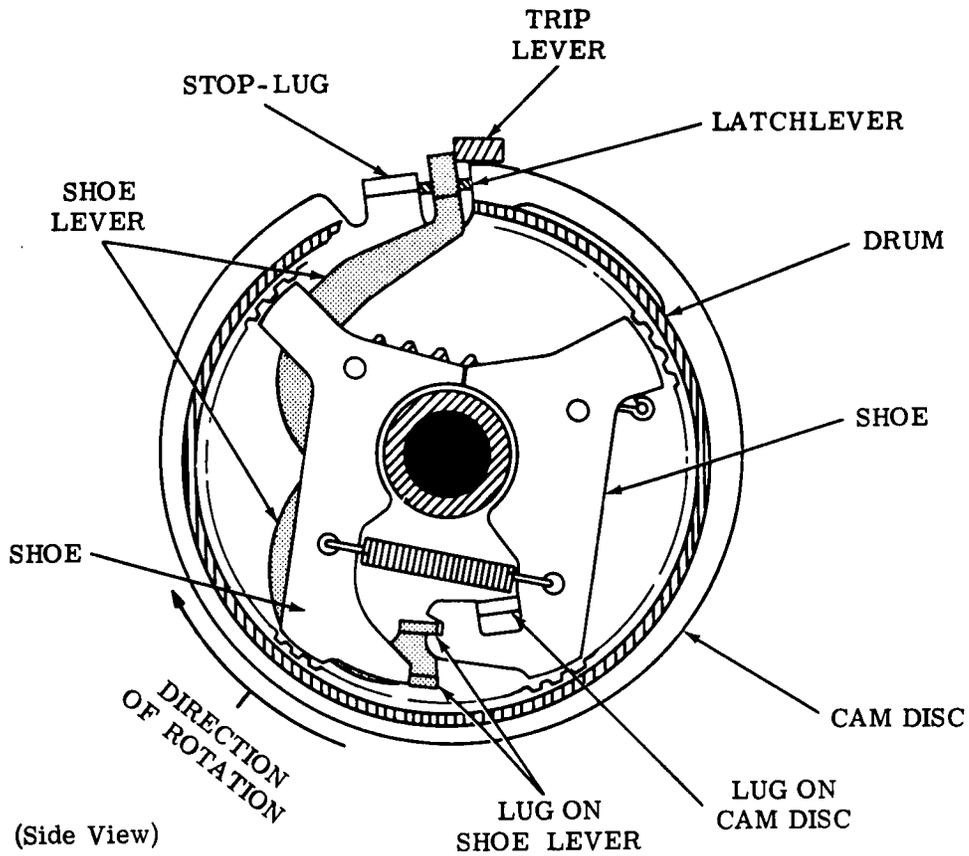


Figure 6 - Internal Expansion Clutch

4.11 The clutch drum is attached to and rotates with a shaft. In the stop (or disengaged) position, a trip lever and a latchlever hold the shoe lever, two shoes, a cam disc, and a cam sleeve stationary. When the trip lever moves away from the shoe lever, the shoe lever, under spring tension, moves away from the stop lug on the cam disc. By means of two lugs, the shoe lever expands the shoes until they contact the notched surface of the drum. The drum causes the shoes to rotate. By means of a lug on the cam disc, the shoes rotate the disc and the sleeve attached to it. The clutch is now engaged, and the cam sleeve rotates in unison with the shaft.

4.12 When the trip lever moves to its stop position, it is struck by the shoe lever. The cam disc continues to rotate until the latchlever seats in its notch, and the shoe lever and stop-lug are pinched together by the trip lever and latchlever. A spring holds the shoes together, away from the drum. The clutch is now disengaged.

#### D. Signal Reception

4.13 The signal received by the typing unit may originate either remotely or locally. Locally the signal may originate either in the keyboard or the tape reader. In either case, the incoming signal is received as a parallel output to the distributor. The distributor changes the parallel signal into a serial start-stop output and sends it to the selector magnet driver for current amplification. From the selector magnet driver the signal goes to the selector. The following paragraphs will consider the signal as originating in the keyboard. Refer to Section 574-171-100TC for description of keyboard operation.

#### E. Distributor Mechanism (Figure 7)

4.14 When a keytop is depressed on the keyboard, the corresponding code combination is set up in the keyboard contacts. Simultaneously the universal lever moves up. An H-plate connects the universal lever of the keyboard to the distributor clutch trip linkage in the typing unit. As the universal lever moves up the H-plate pivots the distributor trip linkage. The distributor trip linkage is connected to the clutch trip lever. As the linkage moves forward, the trip lever is moved away from the shoe lever and the distributor clutch engages.

4.15 The clutch disc is attached to the distributor shaft. A brush holder mounted at the end of the distributor shaft rotates two carbon brushes over the segments of the distributor disc. A spring fastened to the brush holder serves two purposes: it holds the carbon brushes firmly against the segments, and serves to close the current loop between the outer and inner ring of the distributor disc.

4.16 The distributor disc has two rings. The inner ring is solid. The outer ring is broken into seven segments corresponding to the start, stop, and the five intelligence pulses.

(a) In the stop position, the outer brush rests on the stop segment, and the current flows in the signal circuit which is closed. (The signal path is from one side of the line through the start segment, the inner ring, the brushes, the stop segment, the common terminal, and the break contact to the other side of the line.) Thus a marking condition exists. Assume that the D key is depressed. The (1--4-) code combination is set up in the keyboard contacts.

(b) The distributor clutch is tripped, and the brush holder begins its revolution. While the brush is on the start segment, the circuit is open, no current flows, and a spacing element is transmitted. While it is on the no. 1 segment, the circuit is closed. (The signal path is through the start segment, the inner ring, the brushes, the no. 1 segment, the closed no. 1 contact, the common terminal, and the break contact.) Thus, current flows, and a marking element is transmitted. While the brush is on the no. 2 and no. 3 segments, since the no. 2 and no. 3 contacts are open, the circuit is broken, no current flows, and spacing elements are transmitted. In a similar manner, a no. 4 marking element and a no. 5 spacing element are transmitted. When the brush reaches the stop segment, the distributor clutch is disengaged, and the line again becomes marking (Figure 8).

#### F. Selector Mechanism

4.17 The selector mechanism receives the code combinations from the selector magnet driver and converts them to mechanical arrangements that control the codebar mechanism.

4.18 A magnet coil is wired by two leads to the output of the selector magnet driver. In the stop condition the output of the selector magnet driver is marking. This keeps the coil

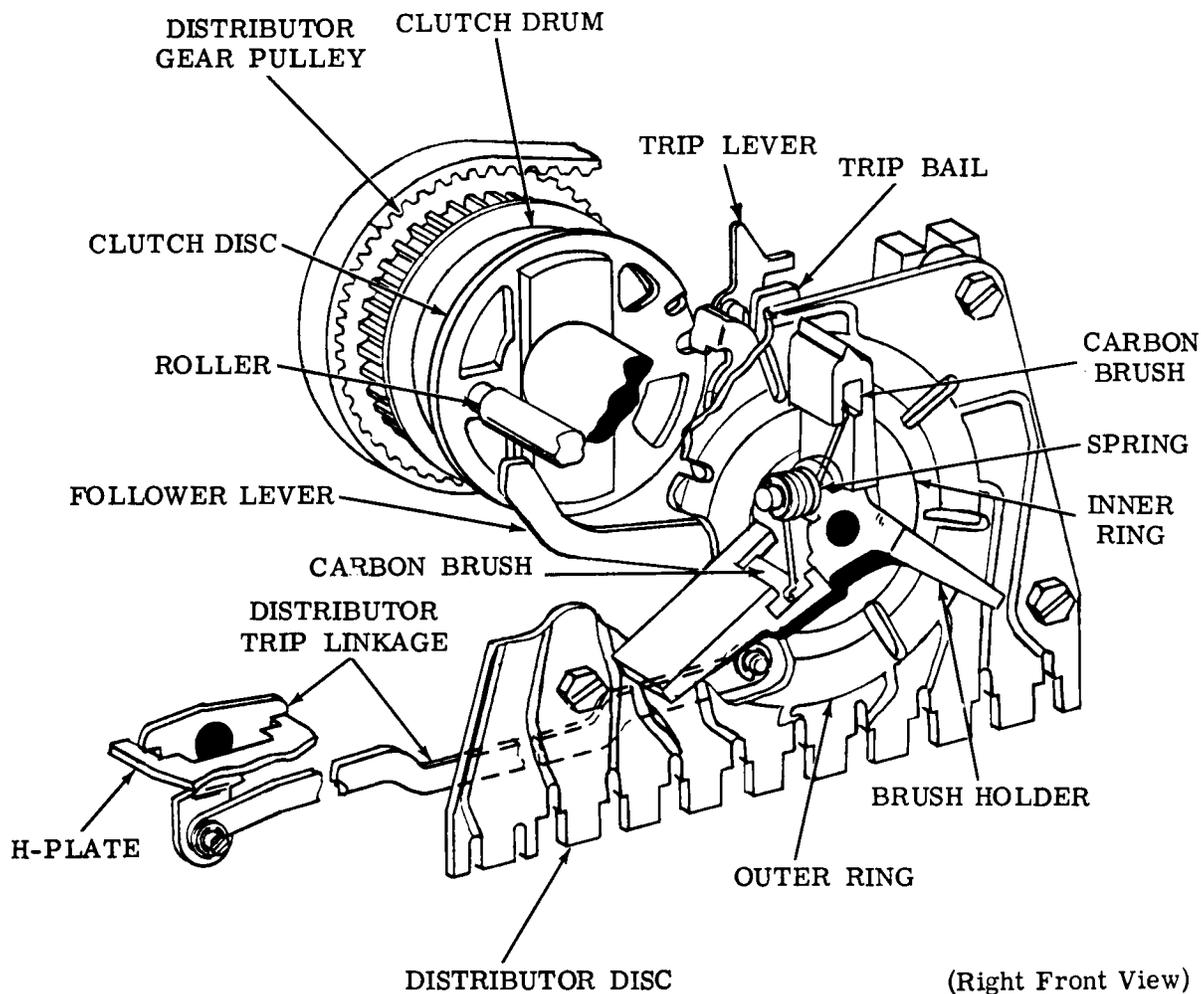


Figure 7 - Distributor Mechanism

energized and the armature attracted to the magnet core. In this attracted position the armature blocks the start lever (Figure 9).

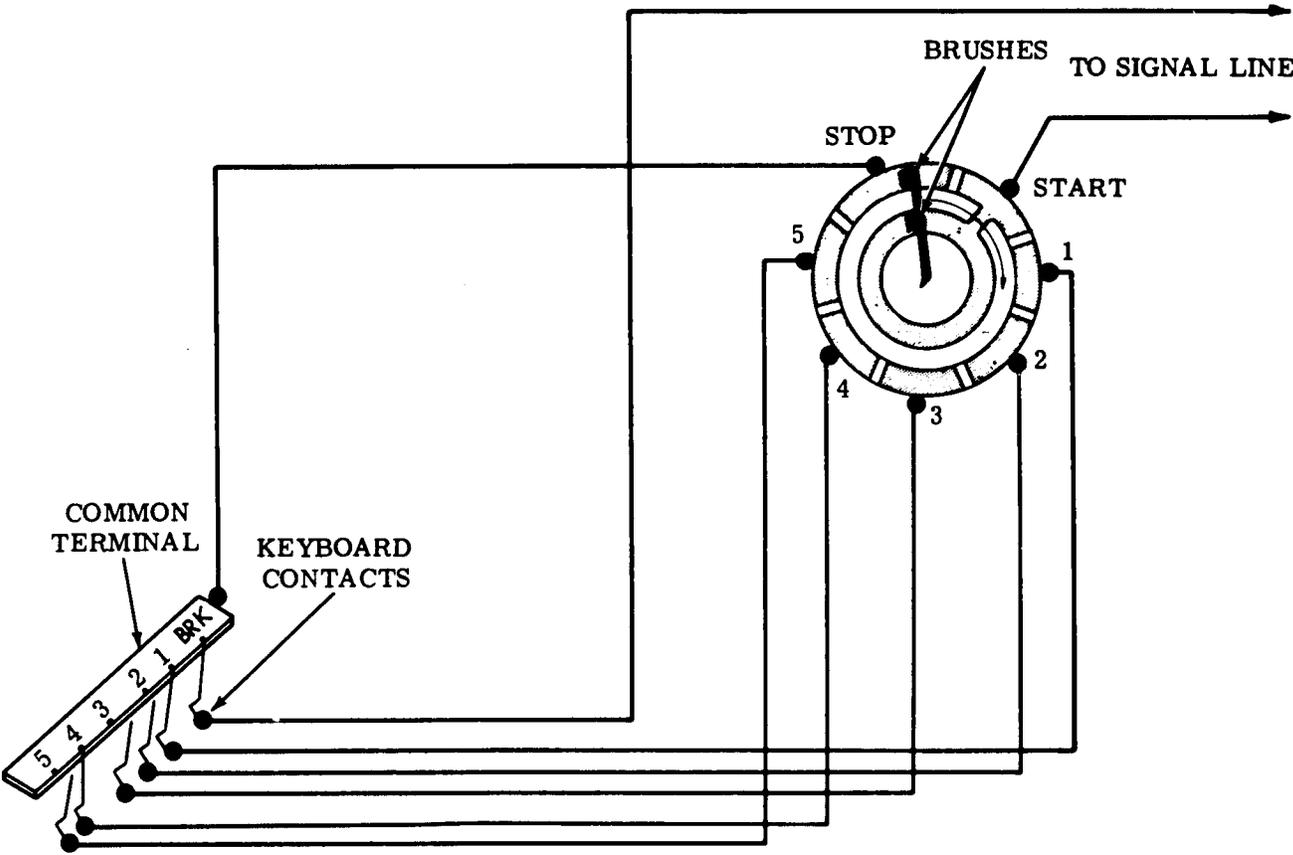
4.19 When a code combination is received the start pulse (spacing) de-energizes the coil, and the armature drops away from the magnet. No longer blocked, the spring biased start lever overtravels the armature, causing two things to happen (Figure 9).

- (a) The start cam follower associated with the start lever falls into the indent of the start cam.
- (b) As the start cam follower falls into the indent, the trip lever associated with it moves away from the clutch shoe lever, allowing the selector clutch to engage.

4.20 Once engaged the selector clutch makes one complete revolution. The start cam follower remains in the indent of the start cam just enough to trip the clutch. It then comes out of the indent and rides the cam. This keeps the start lever away from the armature which will now be attracted if the incoming pulses are marking and unattracted if the pulses are spacing (Figure 9).

4.21 As the selector clutch rotates, the spacing locklever, the push lever reset bail, the codebar clutch trip follower arm, and five selector levers ride individual cams under spring tension (Figure 11).

4.22 Early in the selector cycle the high part of the push lever reset cam pivots the push lever reset bail. In its motion the bail resets all the spring biased push levers selected



LETTER "D" SET UP  
IN KEYBOARD CONTACTS

Figure 8 - Signal Wiring for 32 Typing Unit Distributor

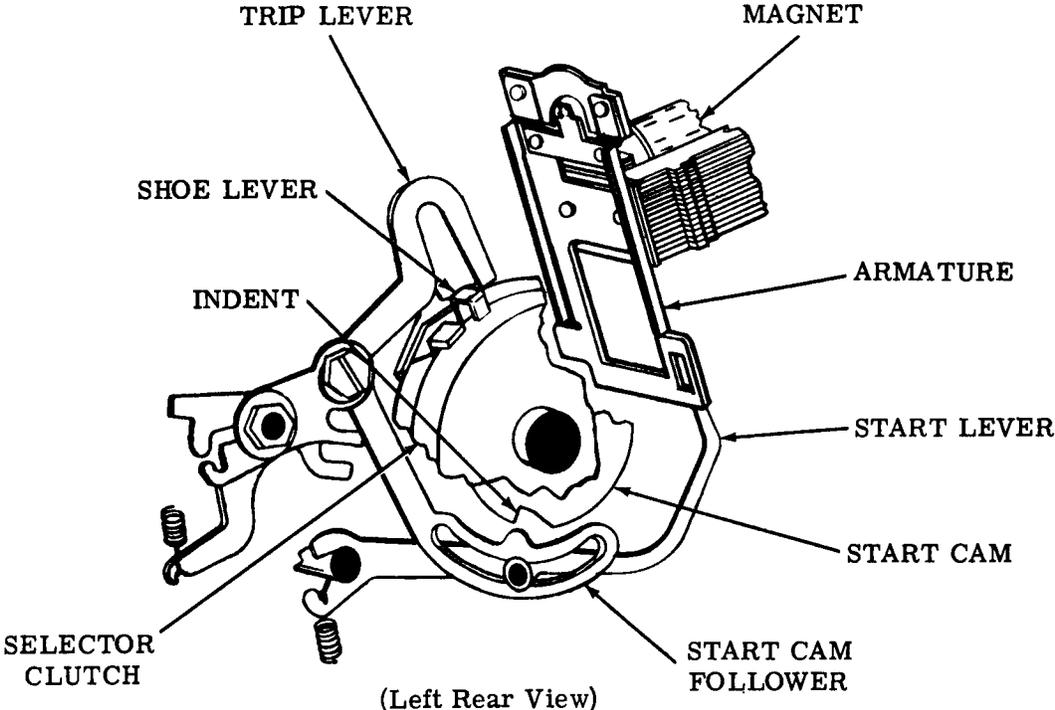


Figure 9 - Selector Clutch Trip Mechanism

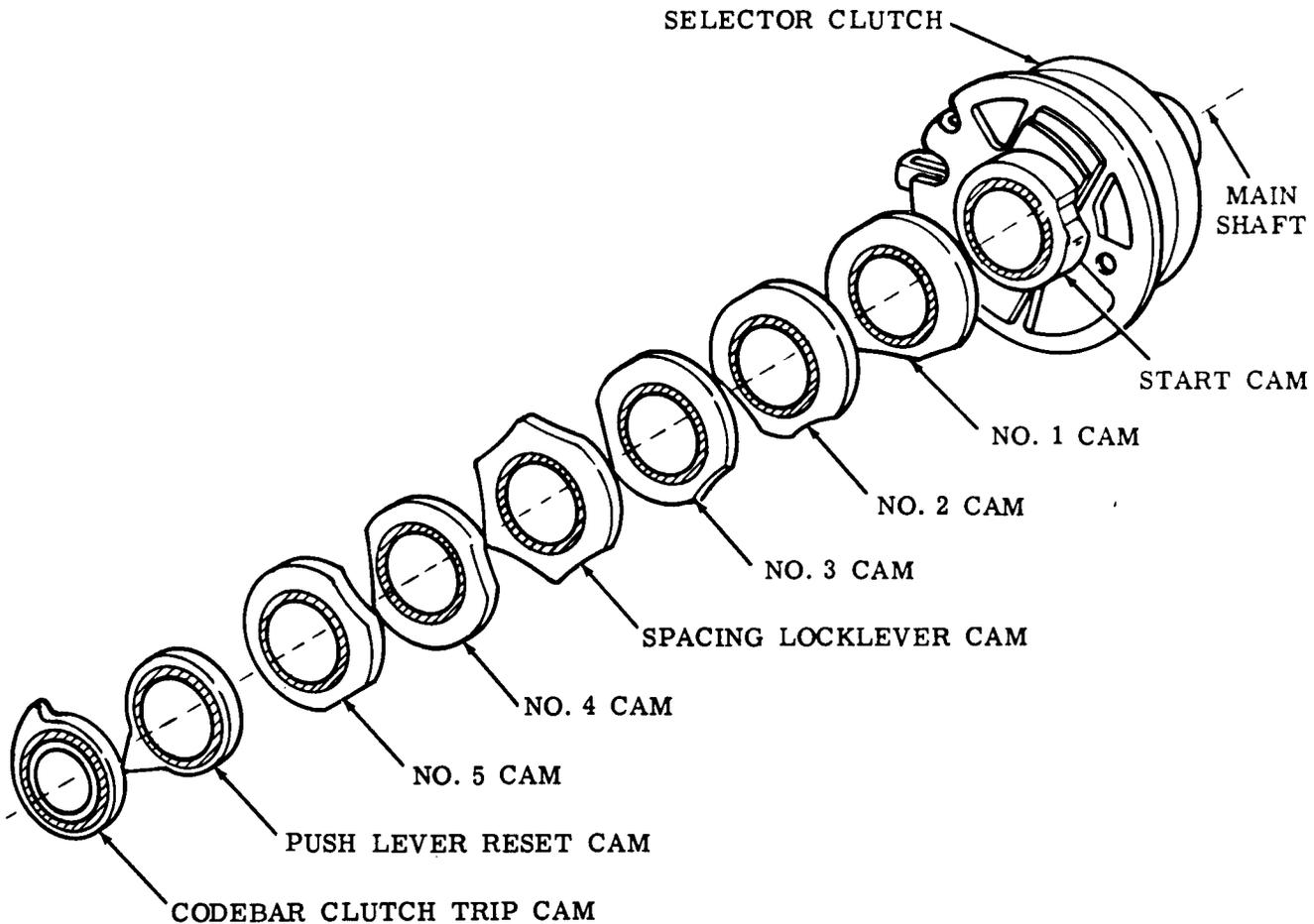


Figure 10 - Selector Cam Sleeve

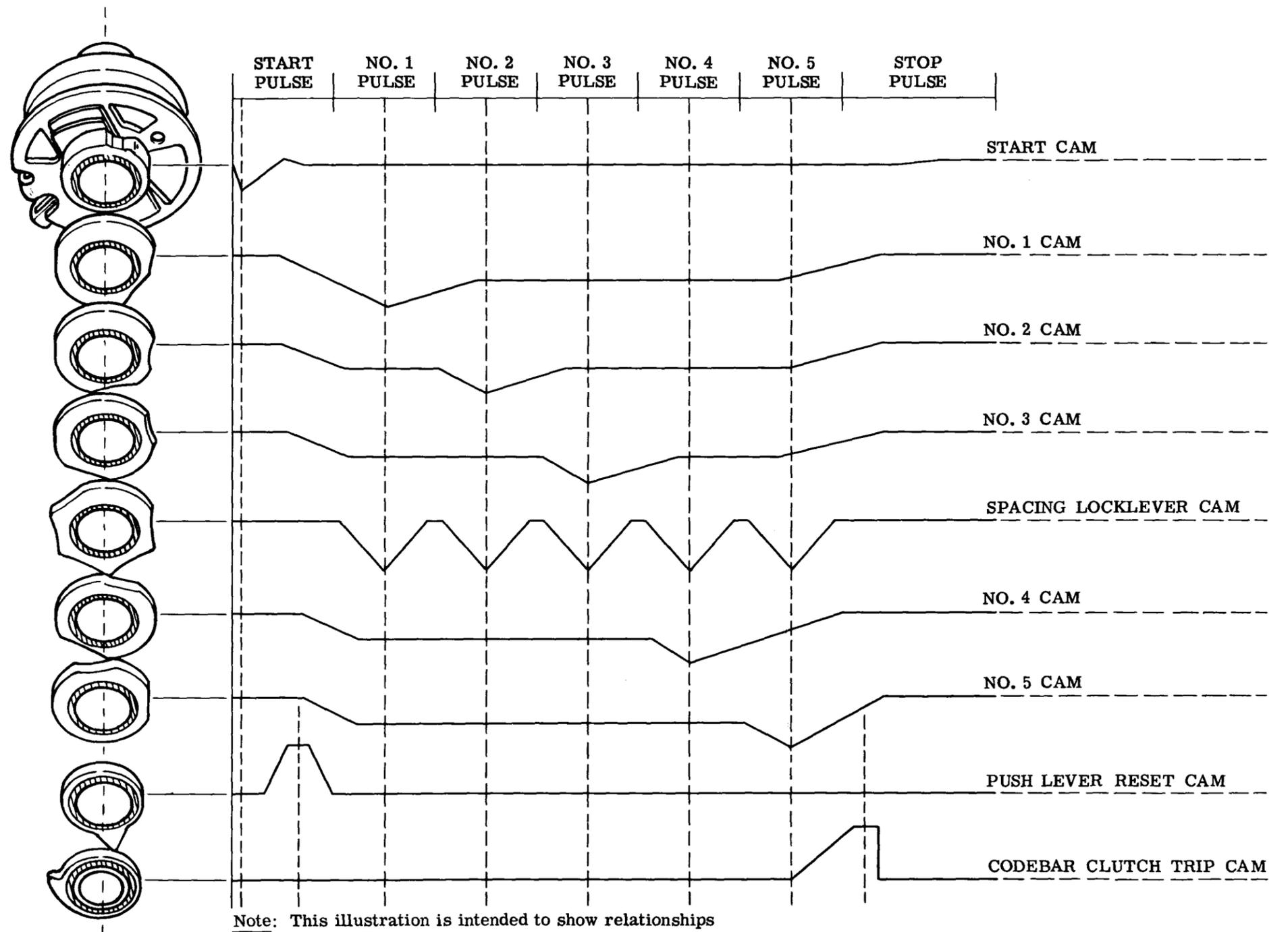
in the previous cycle. Once reset the push levers can be positioned either marking or spacing as the intelligence pulses are received.

4.23 The selector cam sleeve illustrated in Figure 10 has nine cam surfaces. The nine cams are positioned in a staggered fashion so that a sampling sequence can take place. As mentioned above the start cam performs its function, and soon after the push lever reset cam is operated. Following these, the spacing locklever cam and the five intelligence cams operate in sequence.

4.24 If the intelligence pulse is spacing it de-energizes the magnet coil and the armature is in the unattracted position. The spacing locklever moves up, holding the armature in this position during the sampling interval. The selector lever is prevented from moving up into the indent of its cam by the armature, and the push lever remains in its unselected (spacing) position in front of the selector lever (Figure 12).

4.25 If the intelligence pulse is marking the armature is attracted, moving out of the way of the selector lever, blocking the spacing locklever. The selector lever moves up into the indent of its cam, locking the armature in its marking position during the sampling interval. This permits the spring biased push lever to move rearward under the selector lever (Figure 12).

4.26 As the code combination is received, each intelligence pulse is sampled in turn, and the corresponding selector levers and push levers are positioned accordingly. The contours of the selector cams are such that near the end of the cycle they drive the selector levers and selected push levers downward to their marking position. In this position their slotted portions are up. Blocking levers associated with the unselected push levers remain down in a spacing position. Blocking levers associated with the selected push levers pivot upward in a marking position (Figure 12).



Note: This illustration is intended to show relationships of operations. It is not meant to be a timing chart.

Figure 11 - Sequence and Relationships of Selector Cams Operation

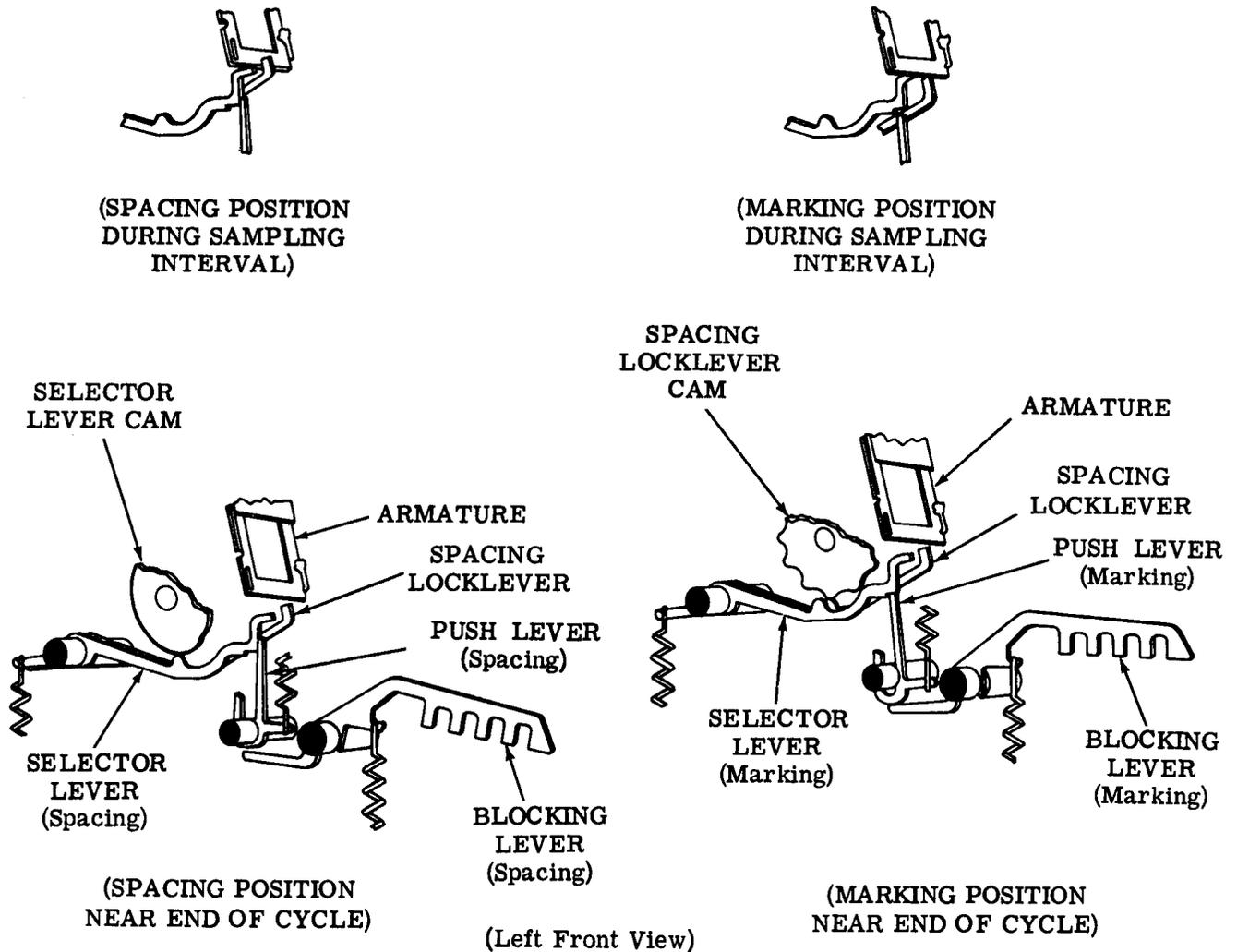


Figure 12 - Selector Mechanism

4.27 Near the end of the cycle, the trip follower arm is moved rearward by its cam and trips the codebar clutch.

4.28 When the stop pulse (marking) is received at the end of the code combination, the armature moves to its marking position above the start lever, where it prevents the start cam follower from falling into the indent of its cam. In this position the follower holds the trip lever down so that, when the selector clutch completes its cycle, its shoe lever strikes the trip lever, and the clutch is disengaged.

4.29 As an example, assume that the letter D(1--4-) code combination is received by the typing unit. The start pulse (spacing) trips the selector clutch, which begins its cycle. The stripper bail strips all previously selected push levers from the selector levers. The intelligence

pulses are sampled in order, and the no. 1 and no. 4 push levers are selected. Near the end of the cycle, the selector clutch cams the no. 1 and no. 4 push levers down, and they pivot the no. 1 and no. 4 blocking levers up to their marking position. The no. 2, 3, and 5 blocking levers remain down in their spacing position. The trip cam causes the trip follower arm to trip the codebar clutch. The stop pulse (marking) disengages the selector clutch, and the selector returns to its stop position.

#### G. Range Finder

4.30 For optimum operation of the typing unit, the selector must sample the code elements at the most favorable time. The range finder provides a means of determining this time by establishing a range of operating margins.

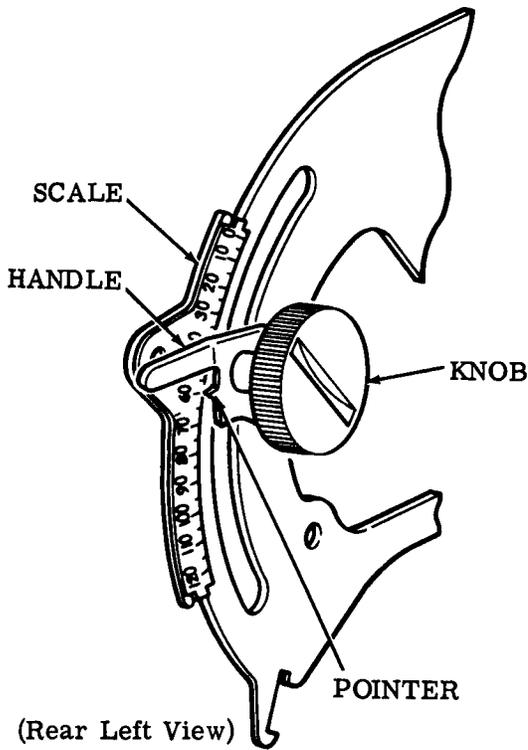


Figure 13 - Range Finder

4.31 When the range finder knob is loosened, a pointer may be moved along a range scale by a handle. This changes the angular position of the trip lever and latchlever with respect to the main shaft, and thus changes the position where the selector clutch begins and ends its cycle. The effect of this operation is to change the time in the cycle when the selector samples each code pulse.

4.32 Rotating the pointer counterclockwise from 60, the center of the scale, causes the selector to sample the trailing portion of the pulse. Rotating the pointer clockwise causes the selector to sample the leading edge. To establish the margins of the operating range, the pointer is moved first in one direction, then in the other, until errors in printing occur. The pointer is then set at the center of the range, and the knob tightened (Figure 13)

#### H. Codebar Mechanism

4.33 As mentioned in 4.27, near the end of the selector cycle (towards the end of the fifth pulse) the codebar clutch trip cam pivots the codebar clutch trip follower arm. The arm, through a trip shaft, pivots the trip lever out of

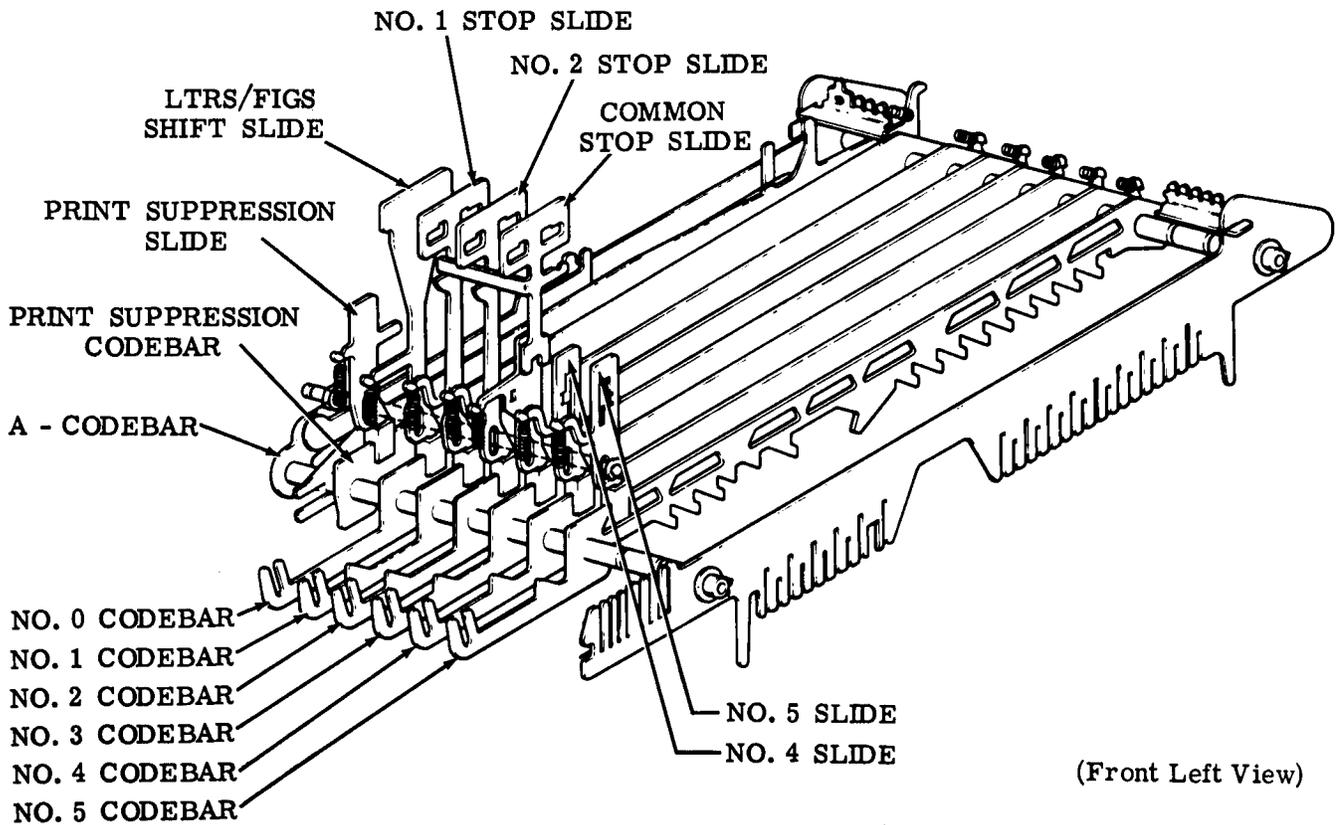


Figure 14 - Codebar Arrangement

the way of the shoe lever. The codebar clutch engages and makes one revolution.

4.34 As the codebar clutch rotates, the codebar reset lever follows its camming surface under the pressure of the codebar reset bail spring. The rotary motion of the cam is applied as an oscillating motion to the codebar reset lever. The codebar reset lever in turn applies its motion to the codebar reset bail which oscillates from right to left when viewed from the front of the unit.

4.35 There are eight codebars in the 32 typing unit (Figure 14) whose function is to sense the marking and spacing positions of the blocking levers (Figure 15). As the reset bail

pivots, the codebars (except the no. 0 codebar) move up and to the left to sense the positions of the blocking levers. If a blocking lever is up (marking) the codebar moves fully up and to the left in a marking condition. If a blocking lever is down (spacing) a projection on the blocking lever comes in contact with a projection on the codebar, keeping it in a down position. The operation of individual codebars will be described in succeeding paragraphs in conjunction with other mechanisms. Function levers positioned under the codebars and carriage slides riding the top of the codebars will be described later.

4.36 Early in the codebar cycle a trip cam pivots a follower arm, which trips the function clutch. Near the end of the cycle the

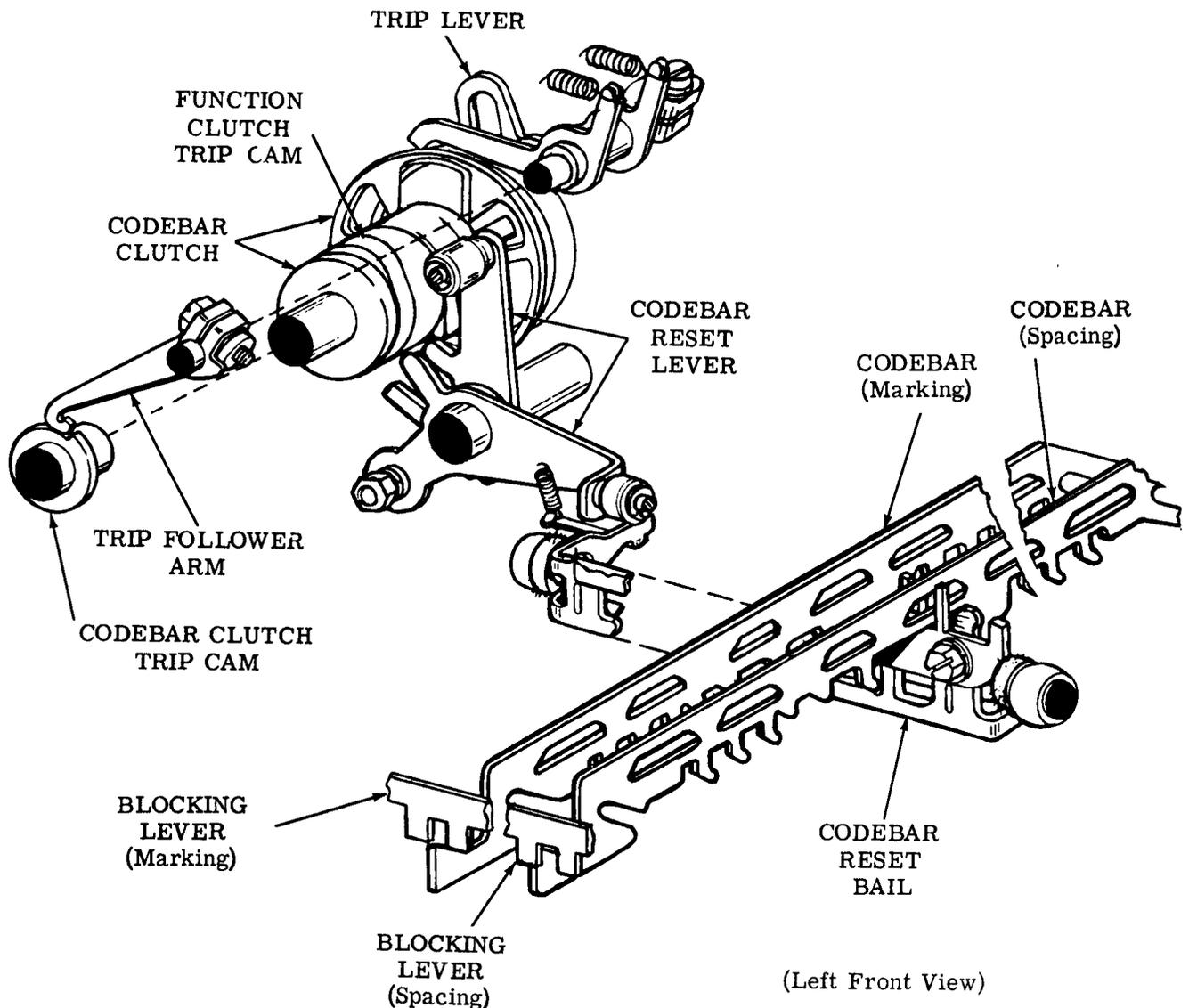


Figure 15 - Codebar Mechanism

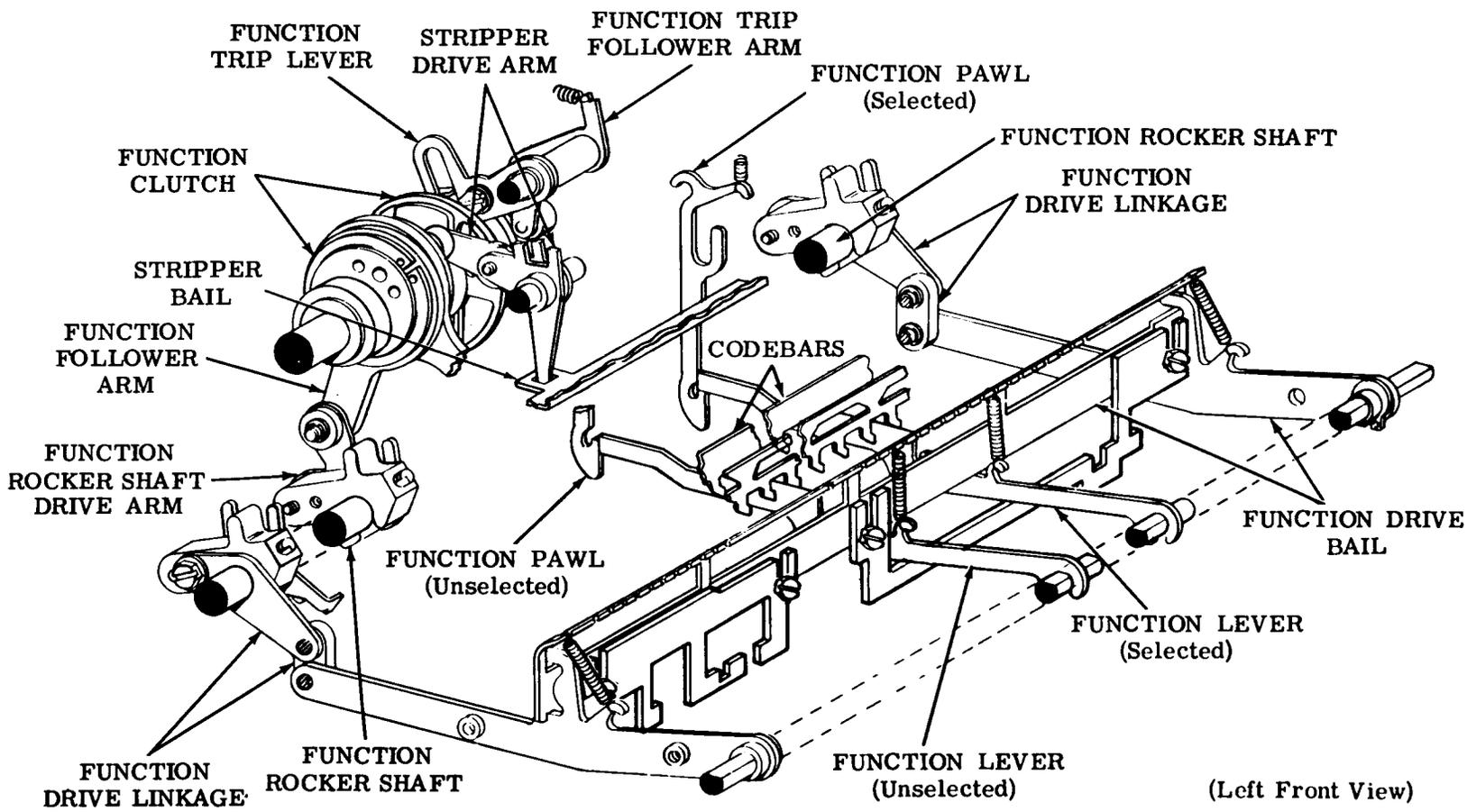


Figure 16 - Function Mechanism

(Left Front View)

cam, through the reset lever, pivots the reset bail to the right. This allows the codebars to return to their stop (down and right) position.

#### I. Function Mechanism

4.37 The function mechanism illustrated in Figure 16 enables the typing unit to perform functions at the receipt of the proper code combinations. Functions are operations supplementary to printing the message, such as carriage return and line feed.

4.38 Early in the codebar cycle a cam pivots the function trip follower arm, which moves the function trip lever out of engagement with its shoe lever. The function clutch engages and makes one complete revolution. The function drive cam, through a follower arm and drive arm, causes the function rocker shaft to rock. The function rocker shaft, through two drive linkages, moves a function drive bail up during the first part of the cycle and down during the middle portion.

4.39 The underside of the codebars are coded by a series of notches and projections. Under the codebars are a number of function levers which pivot on the same shaft as the function drive bail, and are connected to the bail by springs. As the bail moves up, the springs pull the function levers up so they sense the codebars. If a lever encounters one or more projections, it is retained in its down position against the tension of its spring. If the slots line up such that an opening is provided for a function lever, the lever moves all the way up to its selected position.

4.40 In most cases, when a function lever moves up to a certain level it is latched by an associated function pawl. Then, when the function drive bail pulls the lever and latched pawl down during the middle portion of the cycle, the pawl provides the motion to effect the function.

4.41 Near the beginning of the function cycle, a cam pivots a drive arm which moves the function stripper bail frontward. Near the end of the cycle, the cam permits the drive arm under spring tension to move the stripper bail rearward and strip any latched function pawls from their selected function levers.

4.42 The operation of the individual function levers and pawls is covered under the individual functions.

#### J. Printing

##### General

4.43 The printing of characters on paper is accomplished by the print carriage shown in Figure 17.

##### Typewheel

4.44 The characters used in printing are embossed on the cylindrical surface of a typewheel. A typewheel character arrangement is shown in Figure 18, in which the cylindrical surface is rolled out flat. The characters are arranged in 16 vertical rows of 4 characters each. For the sake of explanation, the typewheel is divided into clockwise and counterclockwise fields to indicate in which direction the typewheel is rotated to select the rows. The rows are then numbered 1 through 8 in each direction from the borderline between the fields. The characters in each row are designated the "1st" through the "4th" from top to bottom.

4.45 Again, for the sake of explanation, a printing area is indicated in Figure 18. This is the area the selected character must be in if it is to be printed when the print hammer strikes the typewheel against the platen. As shown in Figure 18, the borderline between the fields is under the printing area when the typing unit is in the stop condition. During the first part of each function cycle, vertical and rotary positioning mechanisms impart separate, but simultaneous motions to the typewheel to select the proper character. The rotary mechanism rotates it either clockwise or counterclockwise to align the proper row with the printing area. The vertical mechanism raises it to place the proper character in the printing area. During the latter part of the function cycle, the typewheel is returned to its stop position.

4.46 For example, assume that the code combination representing the letter D is received by the typing unit. The rotary mechanism rotates the typewheel four and one-half rows clockwise, and the vertical mechanism raises it two rows plus the distance below the printing area. The print hammer strikes the typewheel and the typewheel imprints the letter D. The positioning mechanisms then return the typewheel to its stop position.

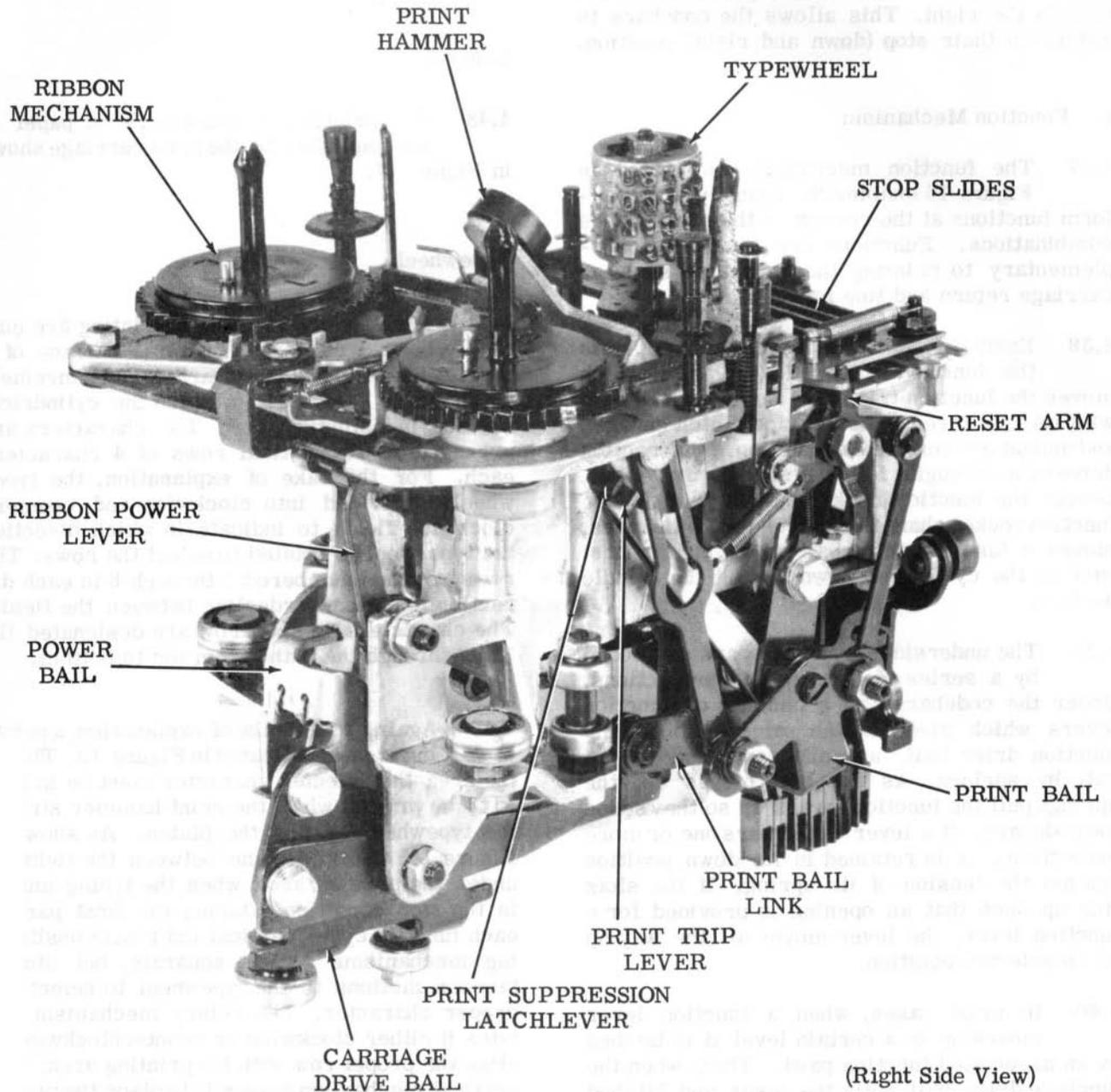


Figure 17 - Print Carriage

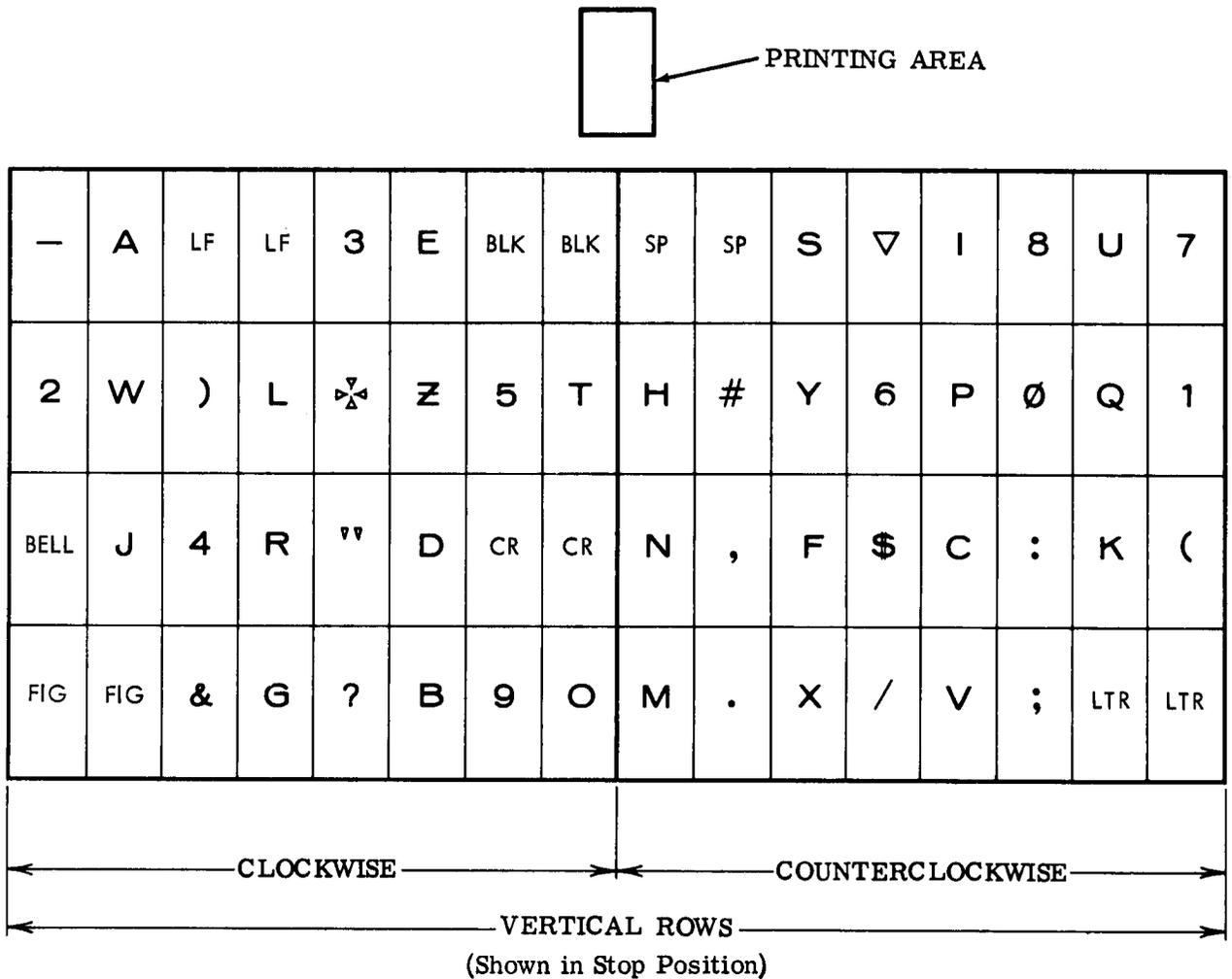


Figure 18 - Typical Typewheel Arrangement (As Printed)

**Power**

4.47 As the function clutch rotates (4.36) an eccentric cam imparts oscillating motion through a carriage drive link to the carriage drive bail (Figure 4). The bail pivots rearward during the first part of the cycle and frontward to its stop position during the latter part. In doing so, it causes a power bail on the carriage to pivot first clockwise (as viewed from the left), then counterclockwise (Figure 19). The power bail has two rollers that move along the drive bail and permit it to receive the motion regardless of the carriage position along the printing line.

**Rotary Positioning**

4.48 The direction that the typewheel rotates from the stop position is determined by the no. 3 codebar. If the no. 3 codebar is mark-

ing the typewheel rotates counterclockwise. If it is spacing the typewheel rotates clockwise.

4.49 When a code combination is received in which the no. 3 intelligence pulse is marking, the no. 3 codebar moves up and to the left. A slide mounted on the codebar, through a linkage, pivots a rotary drive arm down (Figure 19). The rotary drive arm has alternate tabs at its end. With the no. 3 codebar marking and the arm pivoted down, the upper left tab engages the left rotary rack. If the no. 3 intelligence pulse is spacing, the no. 3 codebar is down, the rotary drive arm is pivoted up, and the lower right tab engages the right rack (Figure 19).

4.50 A rotary drive bail is held against the power bail by a spring. As these bails rock clockwise (as viewed from the left) during the first part of the function cycle, the drive

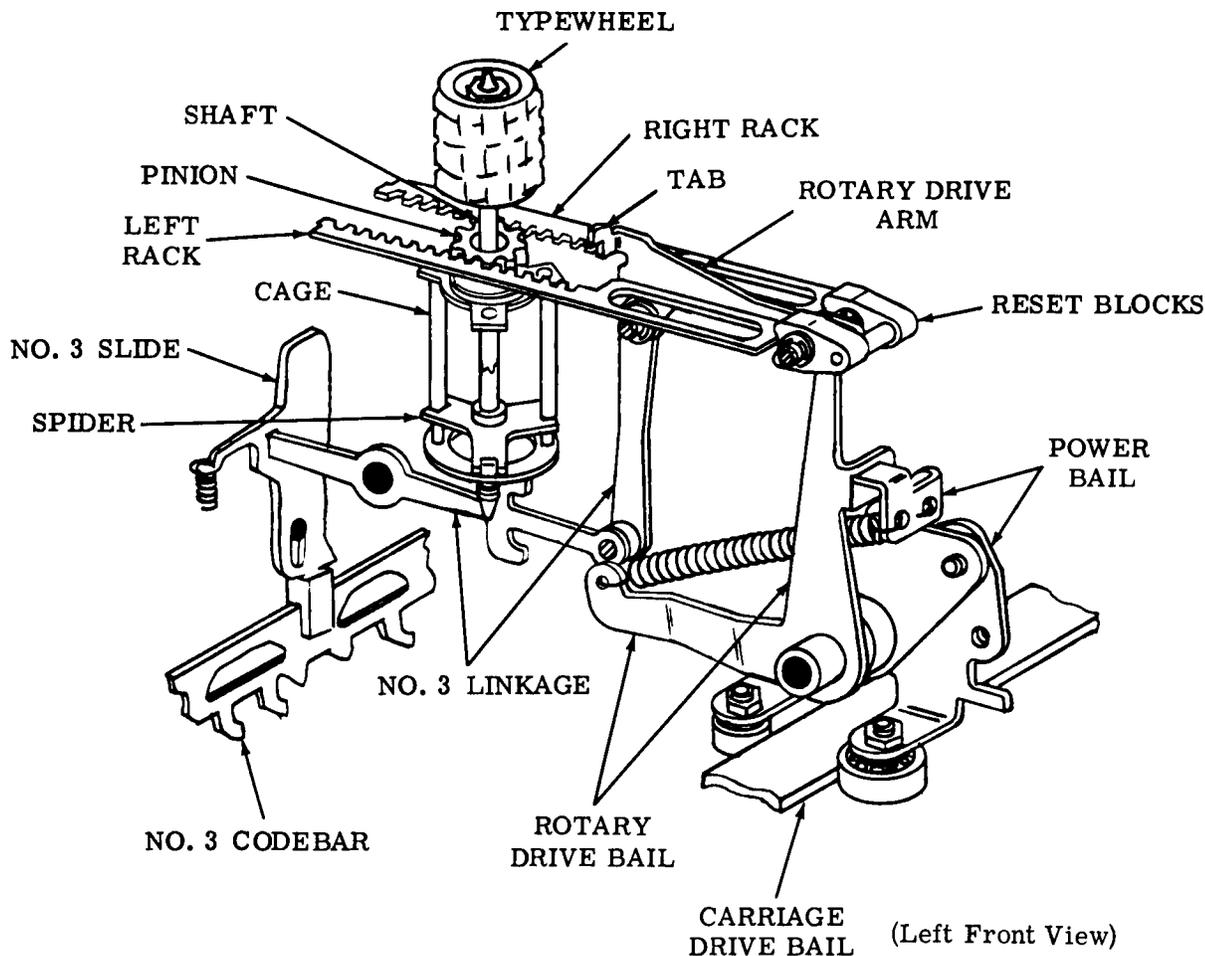


Figure 19 - Rotary Positioning Mechanism

arm, which is attached to the rotary drive bail, moves toward the front. If the rotary drive arm is down (marking), it pulls the left rack with it, causing a rotary pinion, a cage, a spider, a shaft, and the typewheel to rotate counterclockwise (as viewed from the top). If the rotary drive arm is up (spacing), it pulls the right rack, rotating the pinion, cage, spider, shaft, and typewheel clockwise. As the power bail and rotary drive bail rock back to their stop position during the latter part of the function cycle, two reset blocks on the drive bail return the racks and the typewheel to their stop position.

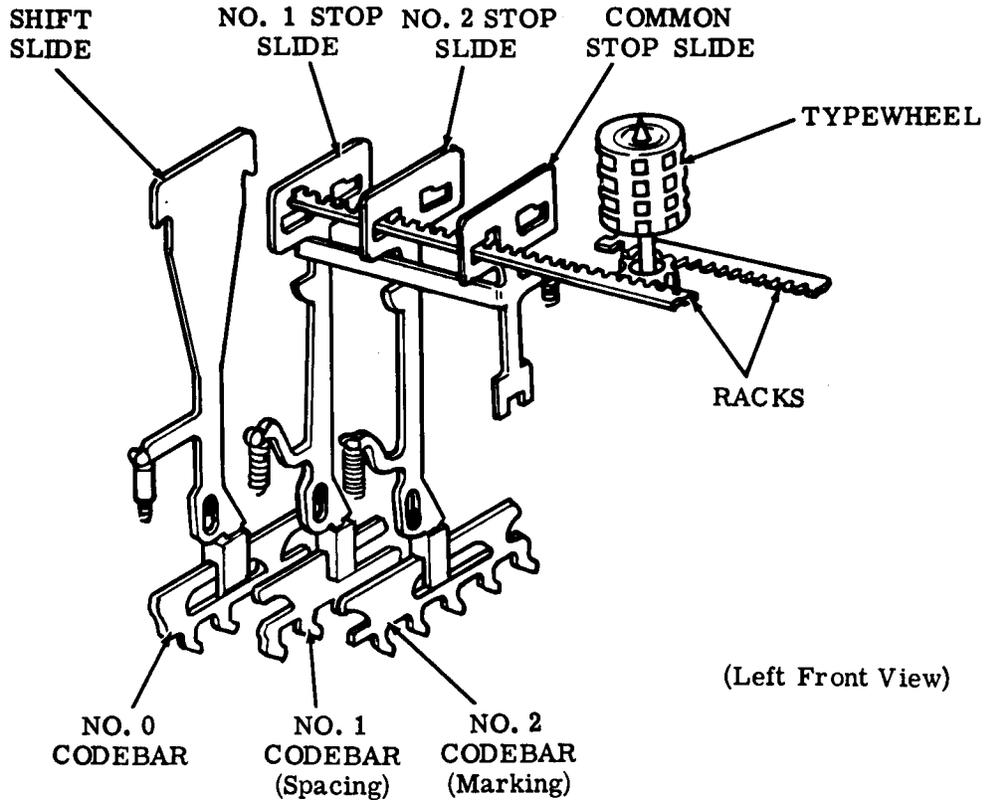
#### Degree of Rotation

4.51 How far the typewheel rotates in either direction is determined by the no. 0, no. 1, and no. 2 codebars.

4.52 The no. 0 codebar controls the position of the Letters/Figures shift slide. The no. 1 and no. 2 codebars control the positions of the no. 1, no. 2, and the common stop slides. These stop slides ride the codebars and therefore are up when the codebars are marking and down when the codebars are spacing (Figure 20).

4.53 The function of the stop slides is to stop either rack in its rearward travel. When a rack is stopped, the rotary drive bail stops, and the continuing motion of the power bail is dissipated by the spring.

4.54 The position of each stop slide determines how much the rack will travel before it is stopped. When a stop slide is down, it blocks the rack; when it is up, the rack will pass through a slot in the slide and continue to travel until blocked by another slide. The shift slide has no slot and will block the rack whether it is up or down (Figure 20).



(Left Front View)

Figure 20 - Rotary Positioning Stop Slides

4.55 Depending on the position of the shift slide, the rack will travel to position either the odd or even rows of the typewheel. In the "Letters" condition, the shift slide is down, blocked by the front stop surface of the rotary stop plate. The no. 1, no. 2, and common stop slides remain locked in the slots of the slide plate. The corresponding positions of the common, no. 2, no. 1, and shift slide will effect 1, 3, 5, and 7 rows of typewheel rotation respectively (Figure 21).

4.56 In the "Figures" condition the shift slide is up, blocked by the rear stop surface of the rotary stop plate. The two slide guide-plates, under spring tension, move to the rear. This positions all four stop slides to the rear enough to reflect one additional row of typewheel rotation. Thus, in the "Figures" condition the common stop slide, the no. 2, no. 1, and shift slide will effect 2, 4, 6, and 8 rows of typewheel rotation respectively (Figure 21).

4.57 The specific rows on the typewheel are determined as follows:

- (a) No. 3 Pulse Marking - Counterclockwise Field

"LETTERS" Condition - Shift Slide Spacing Odd Rows Selected

Row 1 - 1 spacing  
 2 spacing  
 common spacing ) stop slides

Row 3 - 1 marking  
 2 spacing  
 common marking

Row 5 - 1 spacing  
 2 marking  
 common marking

Row 7 - 1 marking  
 2 marking  
 common marking

"FIGURES" Condition — Shift Slide Marking Even Rows Selected

Row 2 — 1 spacing  
2 spacing  
common spacing

Row 4 — 1 marking  
2 spacing  
common spacing

Row 6 — 1 spacing  
2 marking  
common marking

Row 8 — 1 marking  
2 marking  
common marking

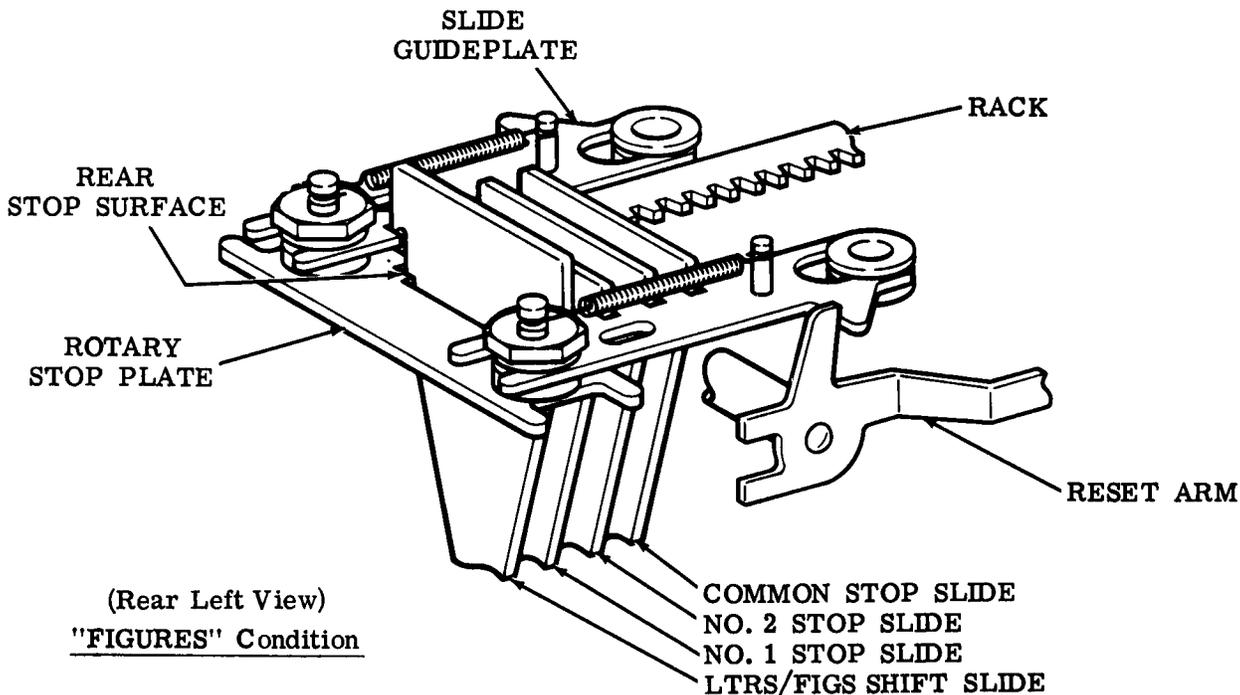
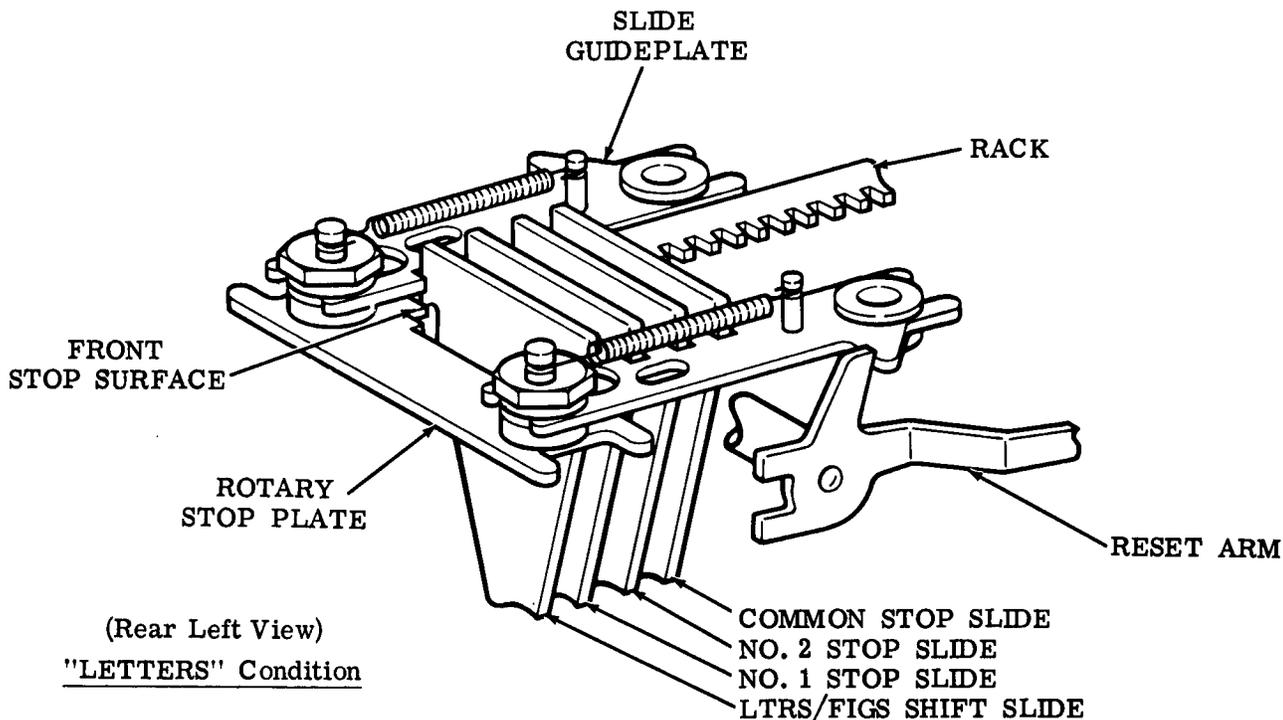


Figure 21 - Rotary Positioning Mechanism

(b) No. 3 Pulse Spacing — Clockwise Field

"LETTERS" Condition — Shift Slide Spacing Odd Rows Selected

Row 1 — 1 spacing  
2 spacing  
common spacing) stop slides

Row 3 — 1 marking  
2 spacing  
common marking

Row 5 — 1 spacing  
2 marking  
common marking

Row 7 — 1 marking  
2 marking  
common marking

"FIGURES" Condition — Shift Slide Marking Even Rows Selected

Row 2 — 1 spacing  
2 spacing  
common spacing

Row 4 — 1 marking  
2 spacing  
common spacing

Row 6 — 1 spacing  
2 marking  
common marking

Row 8 — 1 marking  
2 marking  
common marking

4.58 Refer to Chart 2 for a summary of marking and spacing conditions, and other pertinent information about rotary positioning.

CHART 2 - SUMMARY OF ROTARY POSITIONING CONDITIONS

INTELLIGENCE PULSES		CODEBARS				STOP SLIDES				FIELD		CLOCKWISE ROWS OF ROTATION								COUNTERCLOCKWISE ROWS OF ROTATION							
MARK	SPACE	0	1	2	3	SHIFT	1	2	C	CW	CCW	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
					S					X																	
	3				M						X																
		1	2	3	S	S	S	S	S	S	S	X		X													
		1	2	3	M	S	S	S	M	S	S	X		X													
1			2	3	S	M	S	S	S	M	S	M	X				X										
1			2	3	M	M	S	S	M	M	S	M	X				X										
	2	1		3	S	S	M	S	S	S	M	M	X				X										
	2	1		3	M	S	M	S	M	S	M	M	X				X										
1	2			3	S	M	M	S	S	M	M	M	X					X									
1	2			3	M	M	M	S	M	M	M	M	X						X								
		3	1	2	S	S	S	M	S	S	S	S	X							X							
		3	1	2	M	S	S	M	M	S	S	S	X								X						
1		3		2	S	M	S	M	S	M	S	M	X									X					
1		3		2	M	M	S	M	M	M	S	M	X										X				
	2	3	1		S	S	M	M	S	S	M	M	X										X				
	2	3	1		M	S	M	M	M	S	M	M	X												X		
1	2	3			S	M	M	M	S	M	M	M	X													X	
1	2	3			M	M	M	M	M	M	M	M	X														X

Note: C = common stop slide  
 CW = clockwise rotation of typewheel  
 CCW = counterclockwise rotation of typewheel  
 M = marking condition  
 S = spacing condition

## 4.59 Letters-Figures Shift

(a) On receipt of the "Figures" code combination, the codebars permit a figures function lever to rise to its upposition, where it is latched by its function pawl. Then, as the lever and pawl are pulled down by the function bail during the middle portion of the function cycle, an extension on the pawl moves the letters blocking lever to its down position, where it is latched by its pawl and no longer blocks the no. 0 codebar. The typing unit is now in "Figures" condition and the no. 0 codebar will move to its up position each codebar cycle until the "Letters" code combination is received (Figure 22).

(b) On receipt of the "Letters" code combination, the codebars permit the letters function lever to move to its up position, where it is latched by its function pawl. As the lever and pawl are pulled down by the function bail during the middle portion of the cycle, the pawl contacts a slanting extension of the blocking lever pawl and moves it rearward until it unlatches the blocking lever. The latter then is permitted to move up and block the no. 0 codebar. Thus the typing unit is returned to the "Letters" condition (Figure 22).

## Vertical Positioning

4.60 The vertical positioning mechanism positions the typewheel so that the proper character in the selected row is in the printing area at the time of printing.

4.61 Vertical positioning is determined by the no. 4 and no. 5 codebars and their associated no. 4, no. 5, and common stop arms (Figure 23).

4.62 A vertical drive bail is held against the power bail by a spring. When these bails rock clockwise (as viewed from the left) during the first part of the function cycle, the vertical drive bail, through a drive arm, lifts the spider, typewheel shaft, and typewheel. How far the typewheel is raised is determined by three stop arms that are positioned in response to the no. 4 and no. 5 pulses. When the drive bail encounters an arm, it is stopped and its spring extends as the power bail continues to pivot. The spider moves up and down the bars of the cage, and thus permits rotary motion to be transferred to the typewheel regardless of its vertical position.

4.63 When a code combination is received in which the no. 4 and no. 5 pulses are spacing, the no. 4 and no. 5 codebars and their respective vertical slides remain down, spacing, and no motion is transferred to the stop arms. As the rear extension of the vertical drive bail rises, it strikes the common stop arm, which is the longest. This permits the typewheel to be raised to the point where the first character in the selected row is in the printing area at the time of printing.

4.64 When the no. 4 pulse is spacing and the no. 5 is marking, the no. 5 codebar moves its vertical slide up early in the codebar cycle. The slide pivots the common and the no. 5 stop arms rearward, out of the way of the drive bail. The bail thus strikes the no. 4 arm (the second longest), and the second character in the selected row is placed in the printing area.

4.65 When the no. 4 pulse is marking and the no. 5 spacing, the no. 4 slide pivots the no. 4 and common stop arms out of the way. The bail strikes the no. 5 stop arm (the shortest), and the third character is placed in the printing area.

4.66 When both the no. 4 and no. 5 pulses are marking, all three stop arms are pivoted out of the way. The bail moves up until it strikes the shoulder on the common stop arm, and the fourth character is placed in the printing area.

## Printing Mechanism

4.67 After the typewheel has been positioned during the first half of the function cycle, the printing mechanism (Figure 24) supplies the impact which drives the selected character against the ribbon and paper. Provisions are included whereby printing is suppressed during functions.

4.68 As the power bail rocks during the first part of the function cycle, it imparts through a link clockwise motion (as viewed from the right) to a print bail. This bail, through a link and pivot shaft, pivots two reset arms. Midway in the cycle, the right arm moves a print trip lever out of engagement with a shoulder on the print hammer bail. A torsion spring snaps the hammer bail rearward, and the hammer drives the typewheel and ribbon against the paper. The lower end of the typewheel shaft pivots on the vertical drive arm (Figure 23) and

CHART 3 - SUMMARY OF VERTICAL POSITIONING CONDITIONS

INTELLIGENCE PULSES		CODE-BARS		STOP ARMS			VERTICAL ROWS OF TYPEWHEEL POSITIONING
MARK	SPACE	4	5	4	5	C	
	4 5	S	S	S	S	S	1 VERTICAL ROW
	5 4	S	M	S	M	M	2 VERTICAL ROWS
4		M	S	M	S	M	3 VERTICAL ROWS
4	5	M	M	M	M	M	4 VERTICAL ROWS

M - Mark  
 S - Space  
 C - Common stop arm

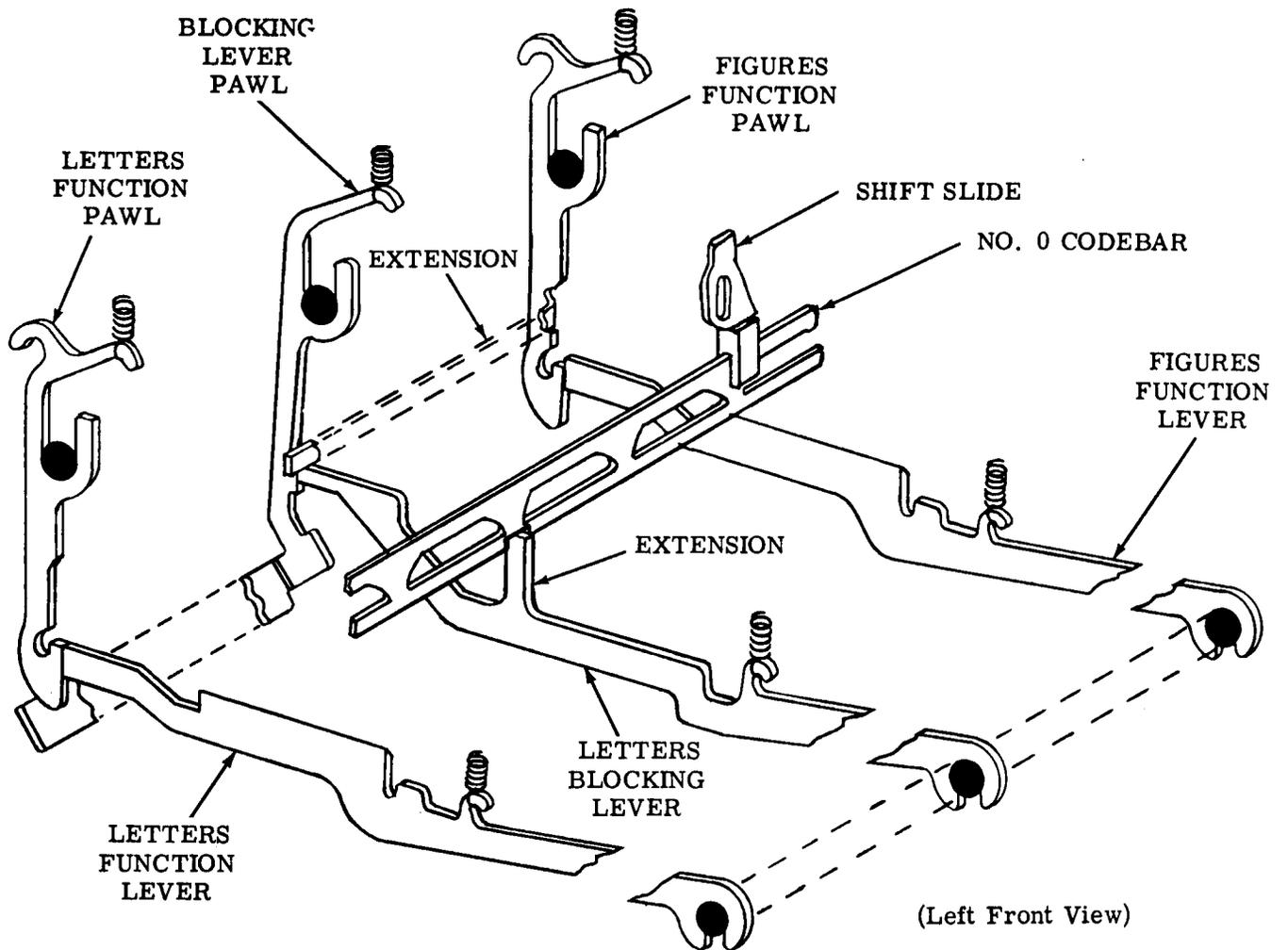


Figure 22 - Letters-Figures Shift Mechanism

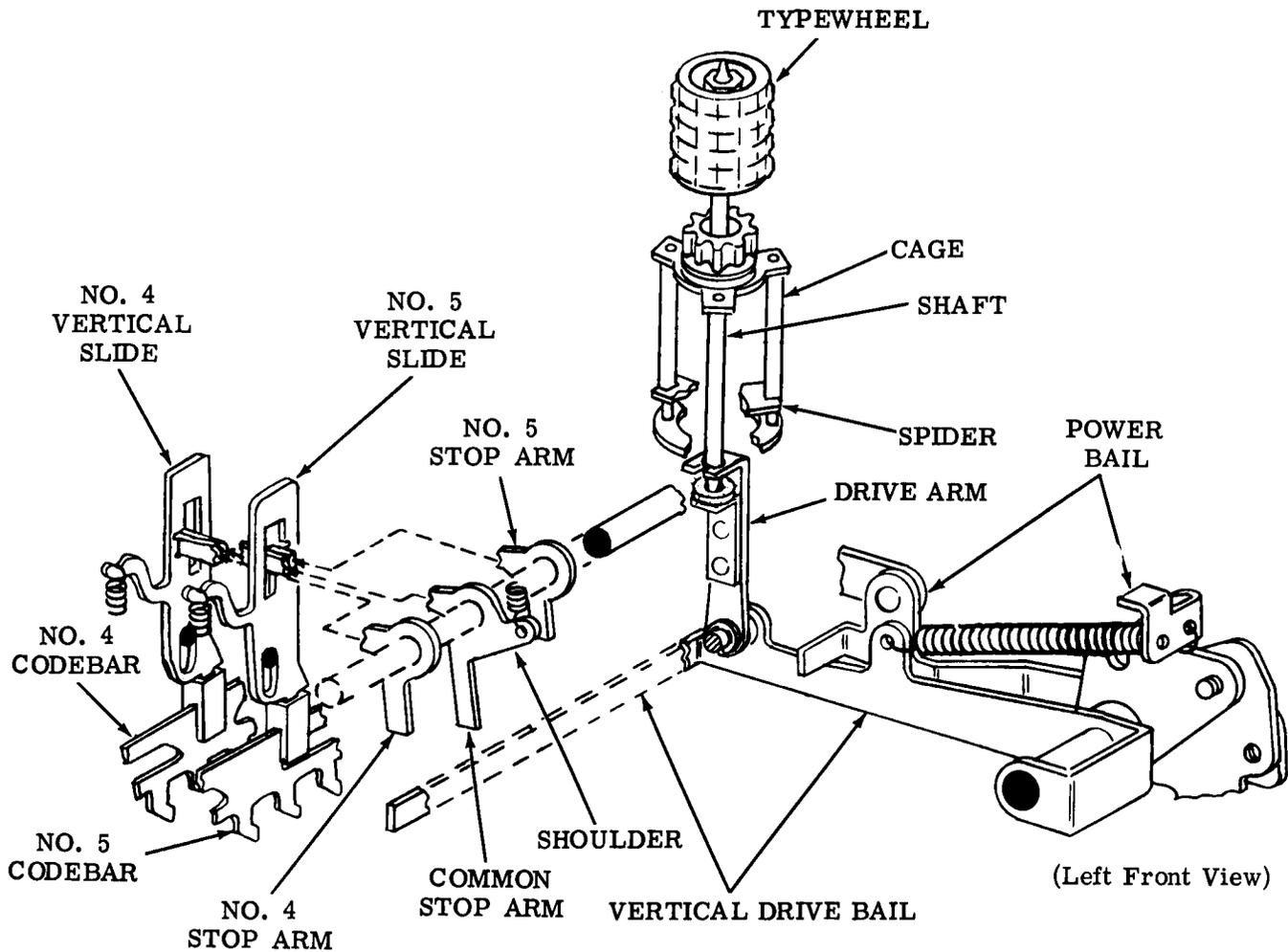


Figure 23 - Vertical Positioning Mechanism

permits the wheel to be driven rearward. The hammer bail has a soft head which strikes the typewheel without damage (Figure 24).

4.69 During the last half of the cycle, the power bail returns the printing parts to their stop positions, and a print reset arm attached to the print bail returns the print hammer bail to its stop position, where it is latched by the print trip lever.

#### K. Print Suppression Mechanism

4.70 Whenever a function code combination is received, printing is suppressed. As the other codebars rise early in the codebar cycle, a print suppression codebar is held down by a print suppression latch. Early in the function

cycle, after any of the function levers have been selected, the latch is pivoted away from the codebar by a print suppression cam on the function clutch (Figure 25).

4.71 If no function lever has been selected, the print suppression codebar moves up and to the left to its selected position. A print suppression slide follows the motion of this codebar and pivots a print suppression latch-lever out of the way of the shoulder on the print hammer bail. Thus, when the print trip lever releases the bail, its hammer is permitted to strike the typewheel, and printing occurs as covered in 4.66.

4.72 If any function lever moves up to its selected position, it engages one of a series of notches in the print suppression code-

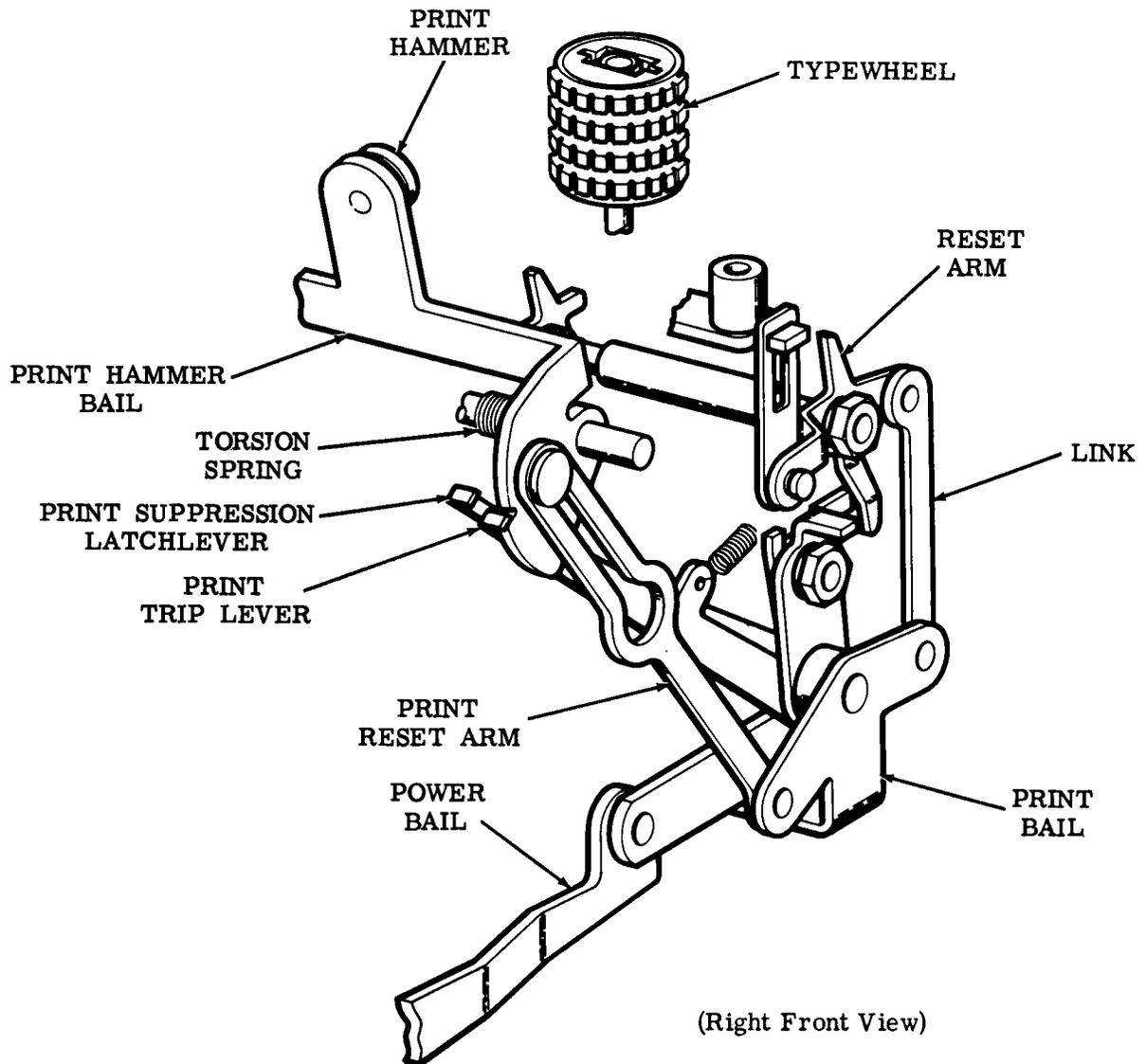


Figure 24 - Printing Mechanism

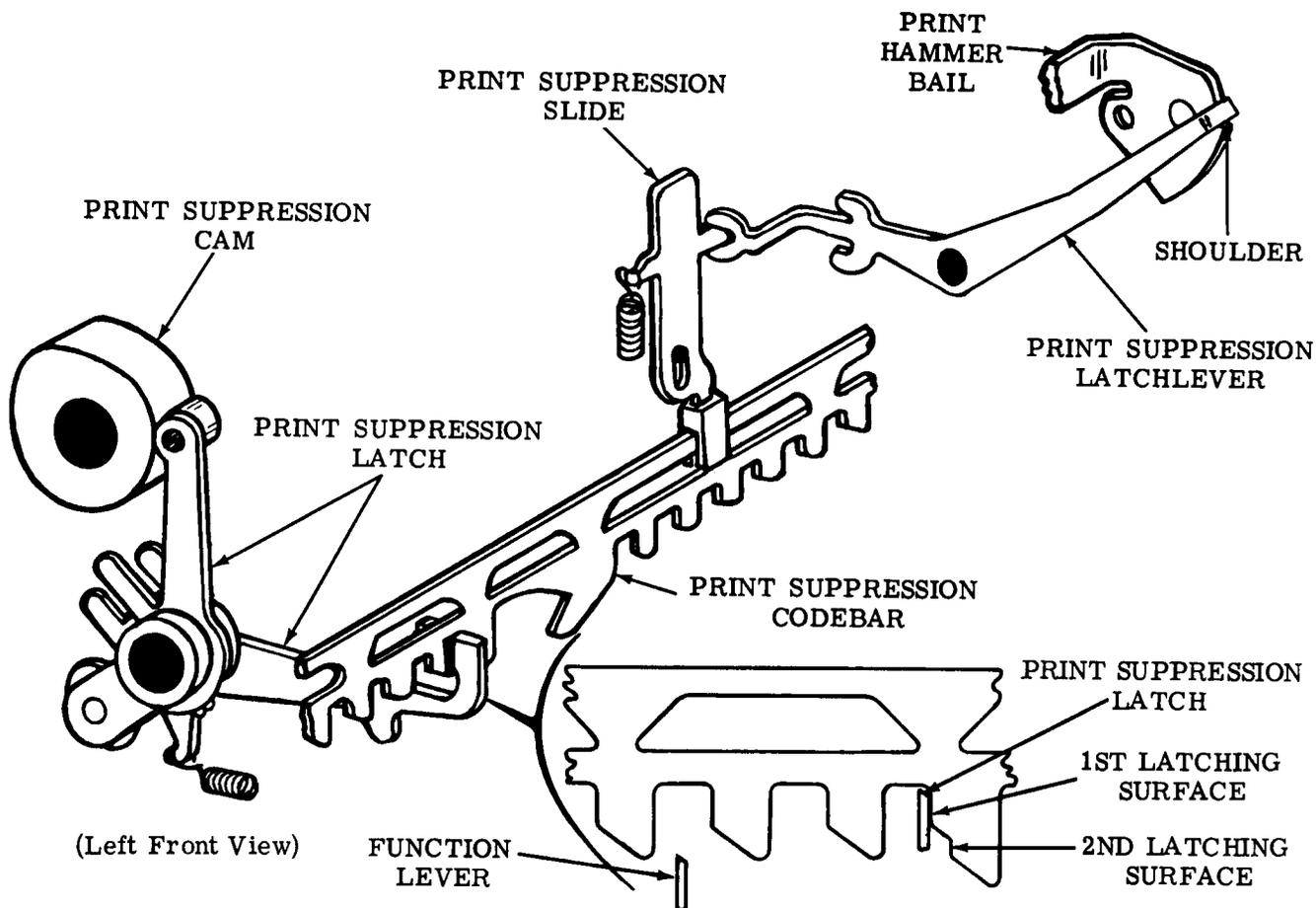


Figure 25 - Print Suppression Mechanism

bar. When the latch releases the codebar, the selected function lever prevents it from moving all the way to its selected position. Thus, the print suppression latchlever is not pivoted and catches the shoulder when the hammer bail is released by the trip lever. The hammer does not reach the typewheel, and printing is suppressed (Figure 24).

4.73 As the selected function lever moves down and withdraws from the notch in the print suppression codebar, the latch, which has been returned to its stop position, engages a second latching surface on the codebar. This prevents the codebar from rising when the function lever is withdrawn, thus causing printing to occur before the print hammer is completely reset in its stop position. The print suppression codebar is completely reset with the rest of the codebars at the end of the codebar cycle, and at that time the latch engages the first latching surface (Figure 25).

#### L. Ribbon Mechanism

4.74 The ribbon mechanism illustrated in Figure 26 supplies the ink for printing. As the typing unit operates, the mechanism feeds the ribbon from one spool to the other, and reverses the direction of feed when the spool is nearly depleted.

4.75 As the power bail rocks during the first part of the function cycle, it pivots a ribbon power lever, which moves a ribbon drive lever rearward. A feed pawl which rides on the drive lever acts on a ratchet to rotate a ribbon spool. A check pawl drops into the succeeding tooth and detents the ratchet until it is again rotated during the next operation.

4.76 The mechanism continues to rotate one spool until the other is nearly depleted. An eyelet in the ribbon then engages a ribbon reversing arm. As the eyelet is pulled against the arm, the latter moves to a point where a

detent spring shifts it to its alternate position, where one of its reversing extensions falls ahead of an extension on the feed pawl. As the pawl moves forward, during the last half of the cycle, it strikes the arm extension and is pivoted to its alternate position against the other ratchet. In doing this, it strikes an extension on the check pawl and pivots it to its alternate position against the other ratchet. The depleted spool is now rotated to take up the ribbon until the other spool is nearly depleted, when reversal again takes place.

4.77 The ribbon guide, which is spring biased upward, is mounted so that it will slide up and down on posts. As the print pivot shaft turns during the first half of the cycle, the two pivot arms permit the guide to rise so that it is between the selected character and the paper midway in the cycle. At this time the print hammer drives the typewheel and the ribbon against the paper. During the last half of the cycle, the pivot arms retract the guide and ribbon to their stop position so that the printed characters are visible.

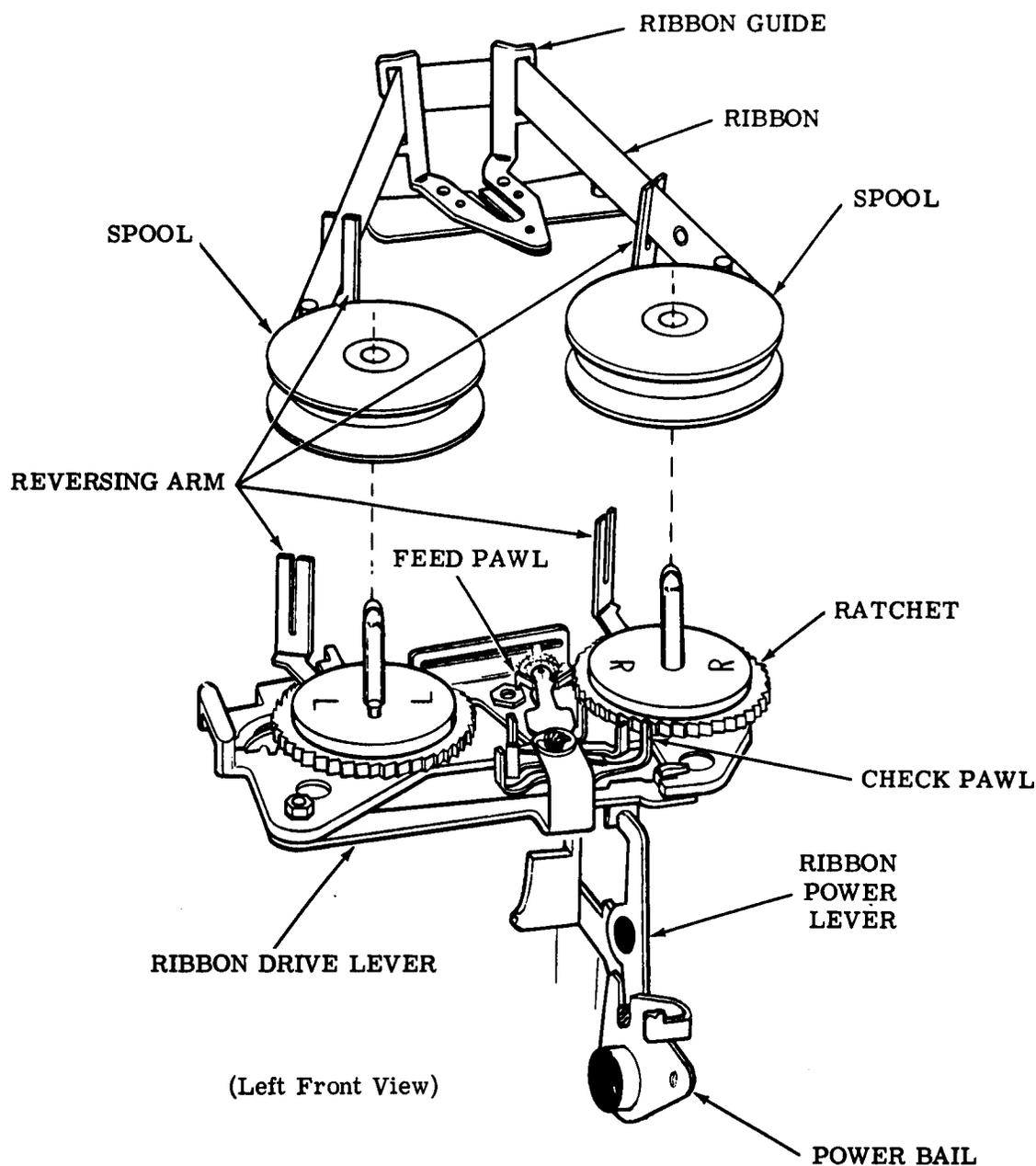


Figure 26 - Ribbon Mechanism

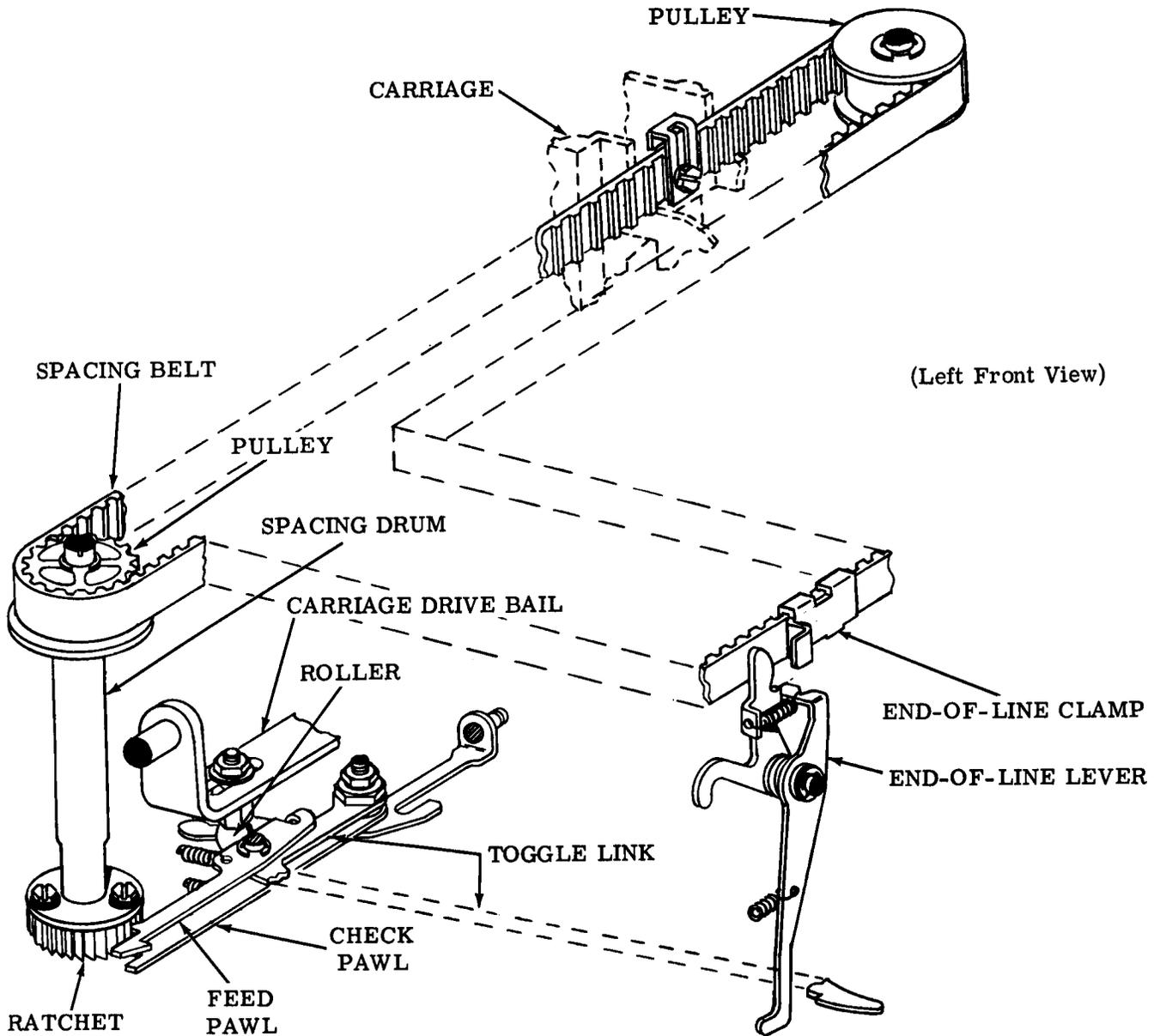


Figure 27 - Spacing Mechanism

### M. Spacing Mechanism

4.78 The spacing mechanism illustrated in Figure 27 positions the carriage so that the printed characters are properly horizontal on the paper. Each time a character is printed, the carriage is positioned one character to the right. Spacing is suppressed on all functions except "space" when spacing occurs and printing is suppressed. At the end of the printing line, spacing is suppressed and the typing unit overprints. When the "carriage return" function is received, the carriage is returned to the left margin.

Note: With the automatic carriage return — line feed feature, spacing is not suppressed at the end of a line. Also, the typing unit does not overprint at the end of a line. The carriage is automatically returned to the left margin when it reaches a predetermined point.

4.79 As the carriage drive bail moves rearward during the first part of the function cycle, a small roller mounted near the left end permits a toggle linkage consisting of a spacing feed pawl and toggle link to buckle rearward under spring tension. The feed pawl moves to

the right and engages the next tooth on the ratchet. The ratchet is part of the spacing drum. When the roller moves towards the front during the other part of the cycle, it unbuckles the toggle linkage, and the pawl is moved to the left and rotates the drum one tooth. This motion is imparted by a pulley at the top of the drum to a spacing belt which is looped around a pulley on the right side of the typing unit. The spacing belt in turn moves the carriage to the right one space against the tension of a large carriage return spring. The carriage is held in this position by a check pawl, which engages the spacing drum ratchet.

4.80 When the "space" code combination is received, the codebars permit the space function lever to move up to its selected position early in the function cycle. This motion is transferred, through a space linkage, to a space lever which moves the print suppression latch out of the way of the toggle linkage. The spacing linkage buckles completely and spacing takes place as described. Printing is suppressed as described in 4.70 through 4.73.

#### N. Space Suppression

4.81 On Functions: On every function except "space," the spacing as well as the printing must be suppressed (Figure 28). When a character to be printed is received, the print suppression codebar moves up and to the left. In doing so, it pivots a space suppression latch so that it is moved to the right, out of the way of the toggle linkage. This permits the linkage to buckle and effect spacing.

4.82 On the other hand, when a function is received, the print suppression codebar remains down and to the right, and does not pivot the space suppression latch. In this position, the space suppression latch engages the toggle linkage and prevents it from buckling all the way, and the feed pawl does not move far enough to engage the next tooth. Thus, the spacing drum is not rotated, and the carriage is not spaced.

4.83 At End-of-Line: When the carriage reaches the right margin, a clamp on the spacing belt pivots an end-of-line lever counter-

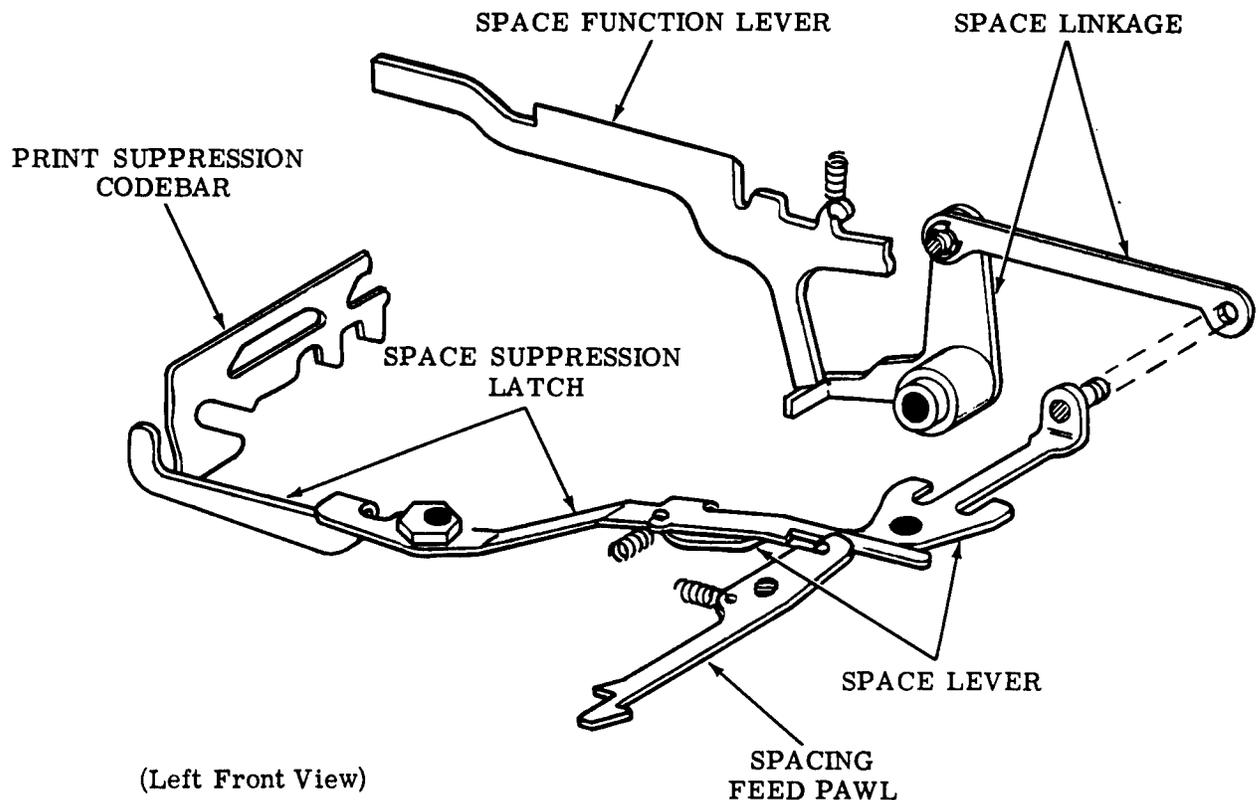


Figure 28 - Space Function and Space Suppression Mechanism

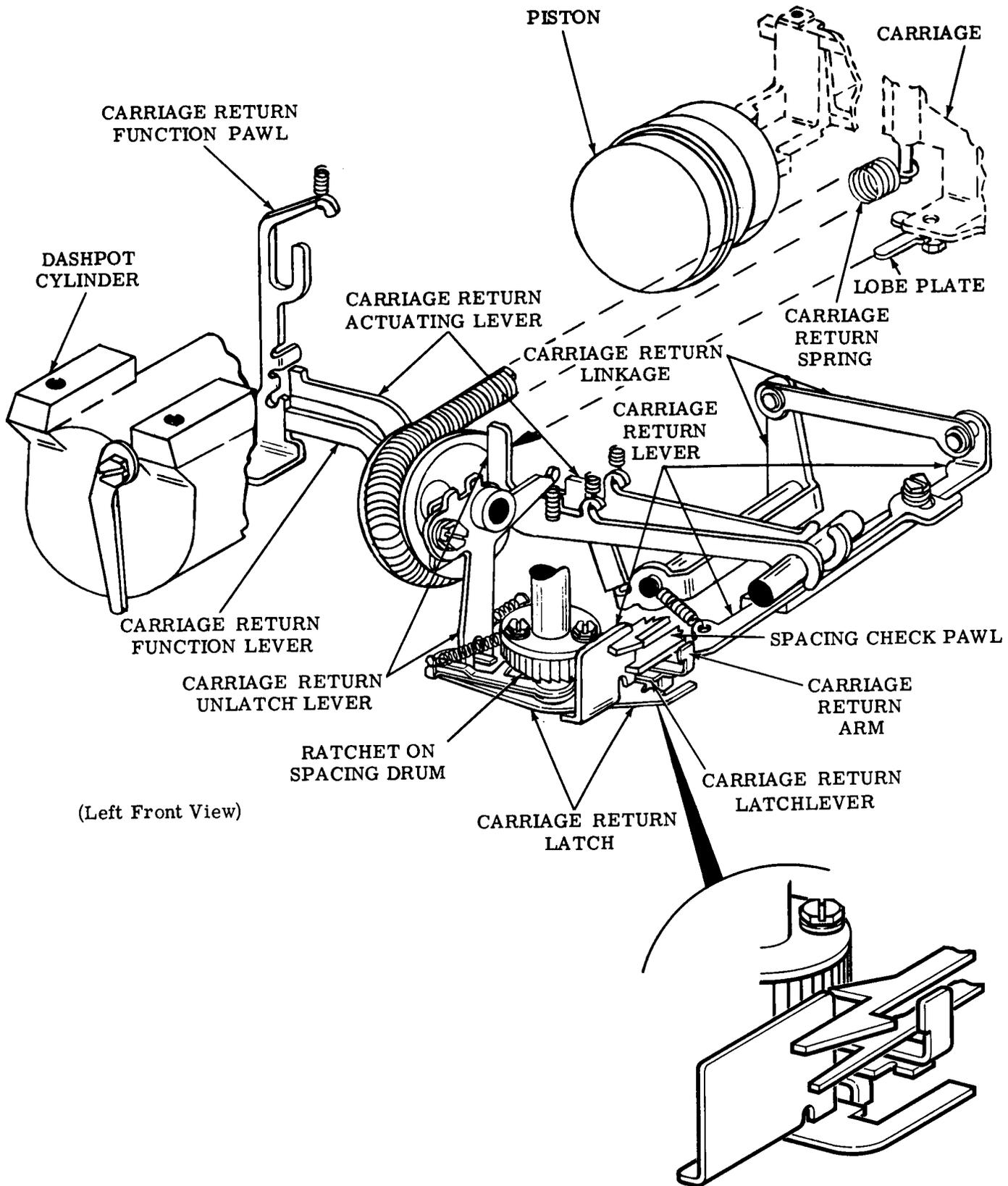


Figure 29 - Carriage Return Mechanism

clockwise. In this position, a latching surface on the spacing toggle link engages the end-of-line lever and prevents the linkage from buckling and effecting spacing. Thus, spacing is suppressed, and the typing unit overprints at the right margin until the "carriage return" code combination is received.

Note: With the automatic carriage return — line feed feature, spacing is not suppressed at the end of a line. Also, the typing unit does not overprint at the end of a line. The carriage is automatically returned to the left margin when it reaches a predetermined point.

#### O. Carriage Return Mechanism

4.84 The carriage return mechanism is illustrated in Figure 29.

4.85 When the carriage return code combination is received, the carriage return function lever moves to its selected position. In this fully up position, the carriage return function lever engages the carriage return function pawl. As the function bail moves the lever and pawl down during the middle portion of the cycle, an extension on the pawl drives the carriage return actuating lever down also. This motion is transferred by means of linkages to the carriage return lever. In moving forward, the carriage return lever is latched by both the carriage return latchlever and carriage return latch.

4.86 In moving forward the carriage return lever also disengages the spacing pawl and check pawl from the spacing drum ratchet. The carriage return spring then pulls the carriage back to the left margin. As the carriage nears the left margin, a lobe plate on the carriage strikes the unlatch lever. This unlatches the carriage return lever and the carriage return latch. However the carriage return lever remains engaged by the latchlever and cannot move to the rear to allow the pawls to engage. When a code combination is received in which spacing is not suppressed, the carriage return lever allows the feed and check pawls to again engage the ratchet. This is accomplished by the feed pawl moving to the right and back to unlatch the carriage return arm and latchlever from the carriage return lever. The latter, under spring tension, moves toward the rear of the unit allowing the pawls to engage the ratchet. Late in the function cycle the carriage return function pawl is stripped from its function lever by the stripper bail.

4.87 As the carriage approaches the left margin at relatively high speed, a piston on the carriage enters a dashpot cylinder and compresses the air ahead of it. The air forms a cushion which slows the carriage and then, as it escapes through a small variable hole at the left end of the cylinder, permits the carriage to be stopped at the left margin without excessive shock.

#### P. Paper or Form Feeding

##### Friction Feed

4.88 The paper feed mechanism used on friction feed typing units is illustrated in Figure 30.

4.89 The paper feed mechanism positions the paper vertically so that the printed characters are properly located in lines on the paper. It feeds the paper on receipt of the "line feed" code combination. It may be adjusted for either single or double line feed.

4.90 The paper feeds off a roll and is led around a platen that positions it vertically in front of the typewheel. A paper guideplate leads it down around the platen. A pressure roller, which sits in a cutout in the guide, holds the paper against the platen, so that it is fed when the platen rotates. A curved wire shaft biases the pressure roller and guideplate against the paper. The pressure is released by a lever on the right end of the shaft. The paper is held around the front of the platen by a wire guide and is led up out of the typing unit by a deflector guide. It can be manually fed by a knob on the left end of the platen.

4.91 When the "line feed" code combination is received, the codebars permit the line feed function lever to move up to its selected position early in the function cycle. The function lever, in turn, moves up a line feed blocking lever, which is engaged by the latching surface of a line feed drive link. As the left drive arm on the function rocker shaft moves down during the middle portion of the cycle, a line feed arm engages the blocking lever and moves it down. This motion is transferred, through a line feed linkage, to a pawl which engages a ratchet on the left end of the platen. The pawl rotates the platen and thus feeds the paper up one or two lines depending on how the mechanism is adjusted.

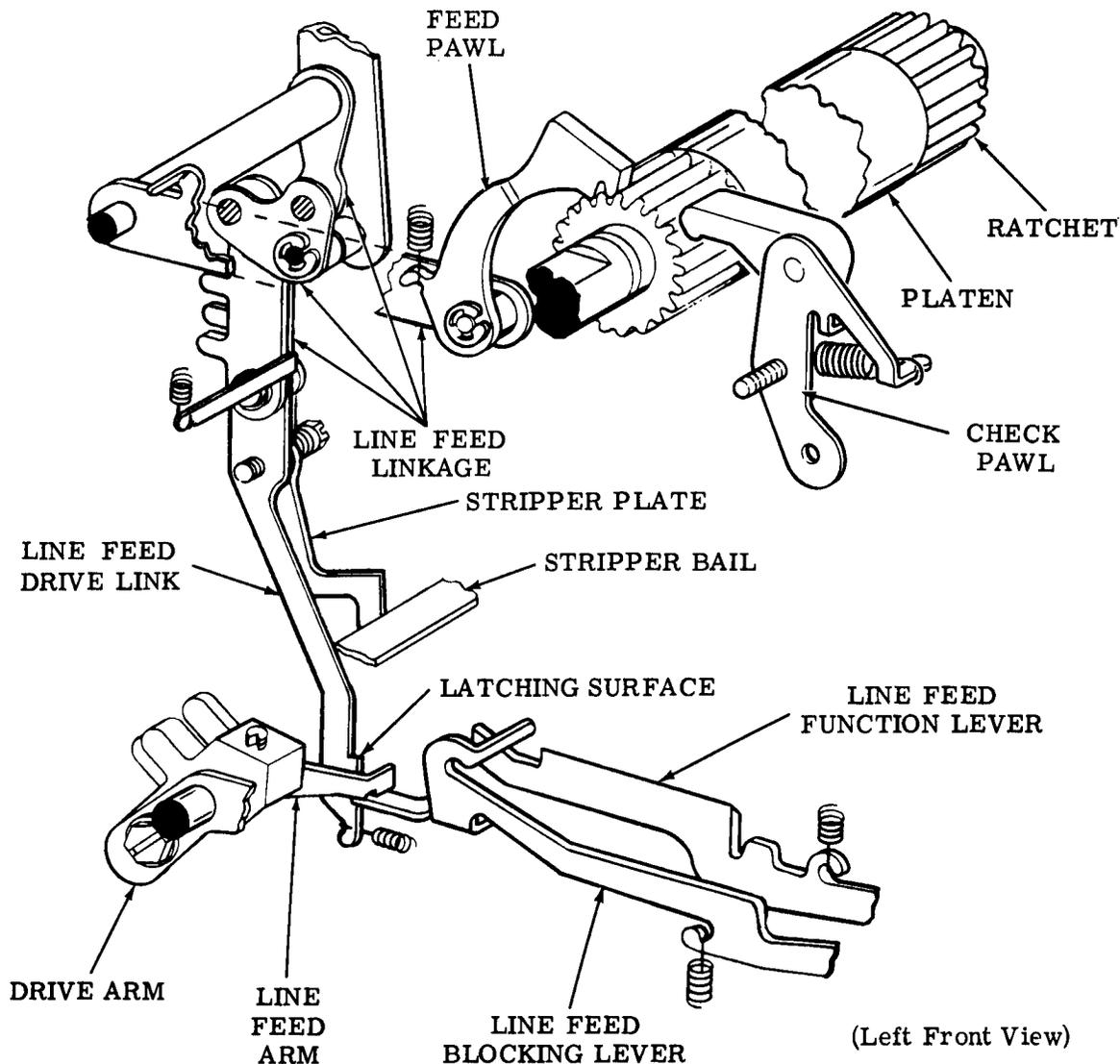


Figure 30 - Paper Feed Mechanism (Friction Feed)

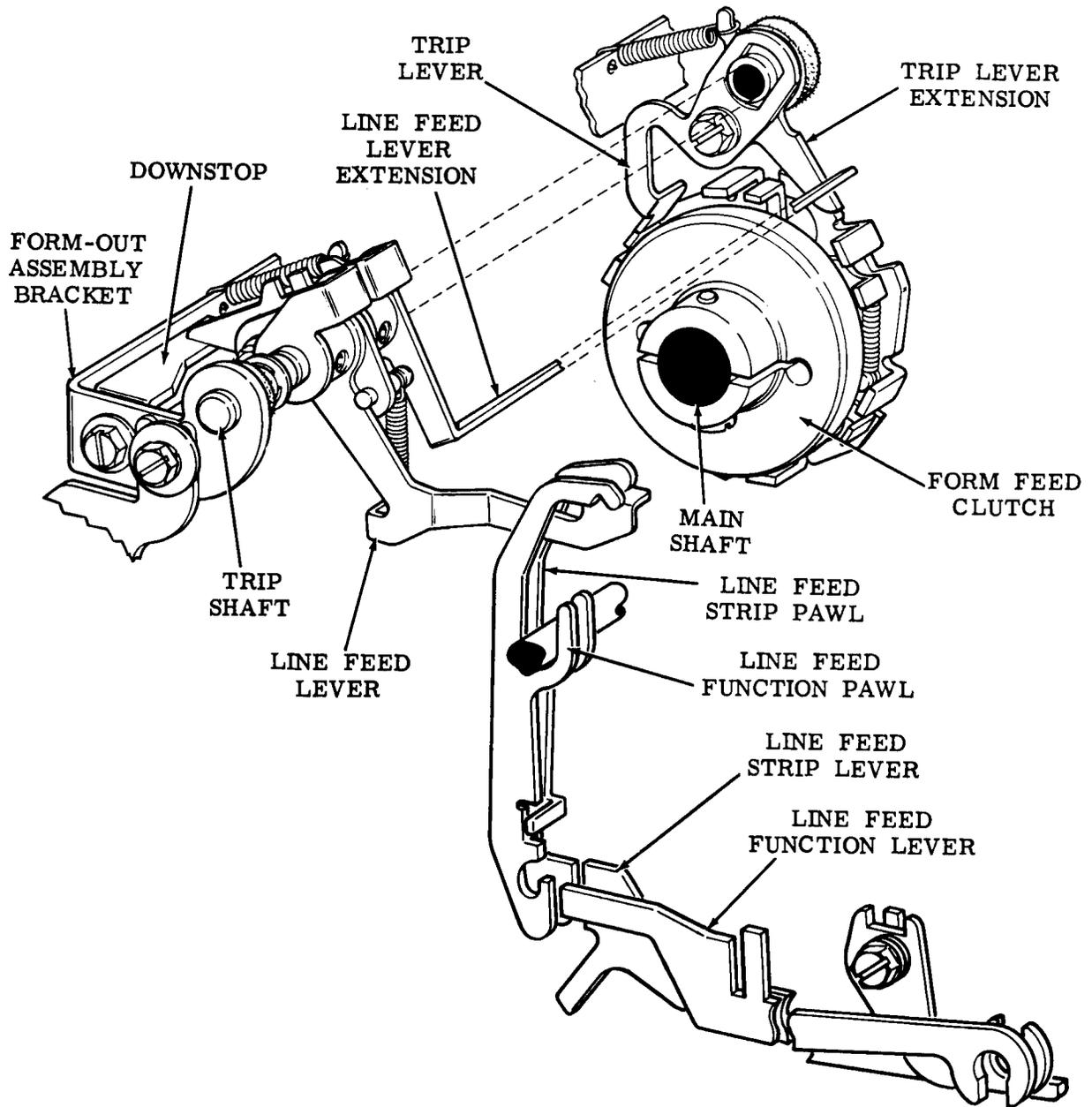
4.92 The feed pawl is guided into the teeth of the platen ratchet by two posts. A check pawl riding on the ratchet at the left side of the platen holds the platen firmly until the platen is again rotated. At the end of the cycle the function stripper bail contacts a stripper plate and strips the drive link from the blocking lever.

#### Sprocket Feed

4.93 The platen drive mechanism illustrated in Figure 32 rotates the platen and vertically positions forms so that the printed characters are properly located in their lines. The platen drive mechanism is activated through the form-out and form feed mechanisms (Figures

31 and 33) and controlled by the form feed clutch. It feeds forms upon receipt of either the "line feed" or "form-out" code combination and may be adjusted for single or double line feed.

4.94 Forms feed from a conveniently located stack of forms. They feed under a paper roll spindle and, if used, a low-paper arm and a paper-out arm. From here, the forms, led by a paper guideplate, engage sprocket pins and advance between the platen and two paper guides until vertically positioned in front of the type-wheel. The two paper guides and a wire guide hold the forms to the front of the platen and insure that the forms advance around the platen



(Left Front View)

Figure 31 - Form Feed Mechanism (Sprocket Feed)

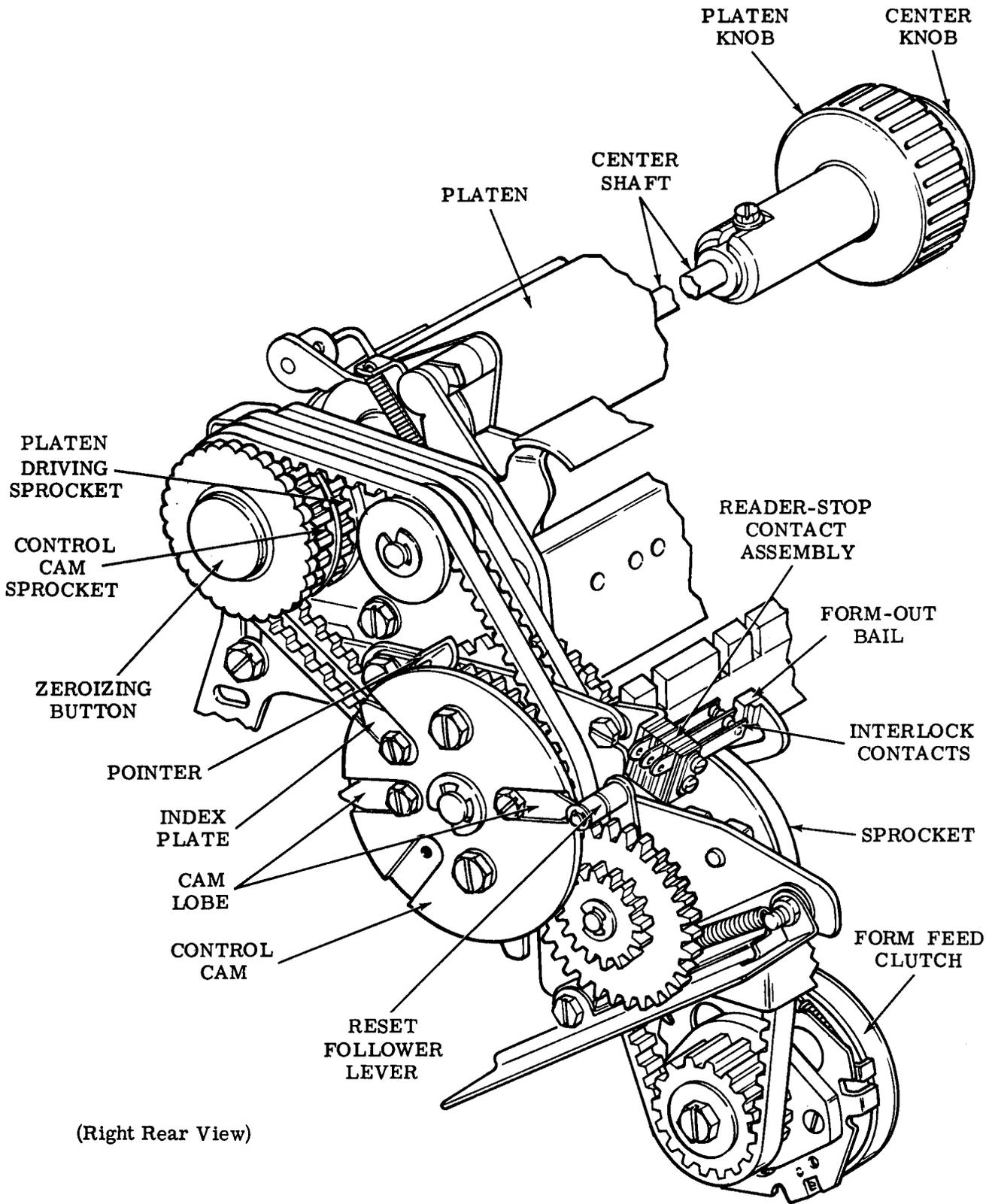


Figure 32 - Platen Drive Mechanism (Sprocket Feed)

while moving up and out of the typing unit. As the forms move out of the typing unit, they go over the paper roll spindle, which separates incoming from out-going forms.

Note: Forms can be manually fed by depressing the center knob and rotating the platen knob located on the left end of the platen.

4.95 **Form Feed:** When the typing unit receives the "line feed" code combination, the line feed function lever (Figure 31) moves up to engage the line feed function pawl in slot no. 13. The function pawl, by means of a lug, connects with the line feed strip pawl in the adjacent slot on the function casting (slot M). During the function cycle the function pawl engages and pulls down the strip pawl. The strip pawl pivots the line feed lever. An extension on the line feed lever contacts the trip lever extension which pivots the clutch trip lever away from the shoe lever on the form feed clutch. The clutch engages and the typing unit advances the form for single or double line feed by means of the platen drive mechanism.

4.96 Late in the function cycle the strip pawl strikes the tail of the line feed strip lever and moves to the rear. The lug on the strip pawl moves the function pawl to the rear, disengaging it from the function lever. Due to spring tension the line feed lever and its extension return to their up position. Likewise the trip lever extension and the trip lever return to their front position. The trip lever strikes the clutch shoe lever and the clutch is disengaged (latched).

4.97 The number of lines the form advances depends on how much the clutch rotates before it is disengaged. If the clutch becomes disengaged at the first shoe lever the form will advance one line; if the clutch becomes disengaged at the second shoe lever, the form will advance two lines; and so on. The amount of clutch rotation depends on how soon the strip pawl comes in contact with the line feed lever. Of course this time will depend upon the distance between the strip pawl and the line feed lever. When the distance is small (0 — .010 inch) the clutch will trip and engage sooner, rotating a greater amount before it is disengaged. Double line feed will result. If the distance is greater (0.110 — 0.130 inch) the clutch will trip and engage later, rotating a smaller amount before it is latched. Single line feed will result.

4.98 **Form-Out:** When the typing unit receives the "form-out" code combination, the form-out function lever (Figure 33) moves up to engage the form-out function pawl in slot no. 14. During the function cycle the pawl is pulled down. This action pivots the latchlever assembly which becomes disengaged from the form-out lever. Due to spring tension the form-out lever pivots to the rear. An extension on the form-out lever pivots the trip lever extension which in turn moves the clutch trip lever away from the clutch shoe lever. The form feed lever engages and remains engaged throughout the form-out cycle.

4.99 When engaged the clutch drives the platen drive mechanism which consists of belts, gears, and sprockets. The platen drive mechanism is illustrated in Figure 32.

4.100 As long as the form-out lever stays pulled to the rear by spring tension, the form will advance except as regulated by the control cam of the platen drive mechanism. Whenever the platen rotates, the control cam, being related to the platen by belts and gears, also rotates. The rotating cam, through cam lobes, a reset follower lever, and a reset bail initiates the action to terminate the advance of the platen and the form-out cycle.

4.101 When a cam lobe contacts the reset follower lever and rotates it toward the rear, a reset bail also rotates and pivots the form-out lever extension away from the trip lever extension. The trip lever engages a shoe lever and disengages the clutch, terminating form-out.

4.102 With the form-out just terminated the reset follower lever remains on the high part of a cam lobe, and the reset bail blocks the form-out lever from rotating to its latched position. When a "form feed" code combination is received, however, the control cam rotates and the reset follower lever moves from the high part of the cam lobe. This causes the reset bail to rotate downward and move away from the form-out lever extension. As a result, the form-out lever is permitted to latch. The typing unit can now receive another "form-out" command.

Note: It is in order to allow the cam lobe to clear the reset follower lever that a "form feed" command is given before another form-out cycle can begin.

4.103 The gearing on the platen drive mechanism varies to accommodate various size forms.

4.104 When the platen drive mechanism advances the form one or two lines during "form feed" the cam lobe rotates an equivalent distance. Then, when "form-out" is received the rest of the form will be advanced with the cam lobe merely rotating until it strikes the reset follower lever.

4.105 The control cam could have three lobes with the result that the form may be advanced one-third the distance for which the gears were installed. For example, if the gears on the platen drive mechanism were designed to advance a form of a certain length, by installing cam lobes this length can be varied to smaller lengths.

4.106 When an Automatic Send-Receive Teletypewriter Set receives a "form-out" code combination, the form-out bail (Figure

32) is rotated towards the front by the form-out lever extension. This action causes the interlock contacts of the reader-stop contact assembly to be operated with the following results:

(a) A pair of normally closed contacts are opened during the "form-out" function. This stops the tape reader from transmitting and prevents characters "on the fly" from being printed.

(b) A pair of normally open contacts are closed. This keeps the typing unit motor operating in case the typing unit is turned off before the form-out cycle is completed. Thus, synchronization of the forms is maintained.

4.107 The form can be manually advanced any length by pressing the zeroizing button on the platen (Figure 32). This will disengage the platen from the platen drive sprocket and allow it to rotate freely.

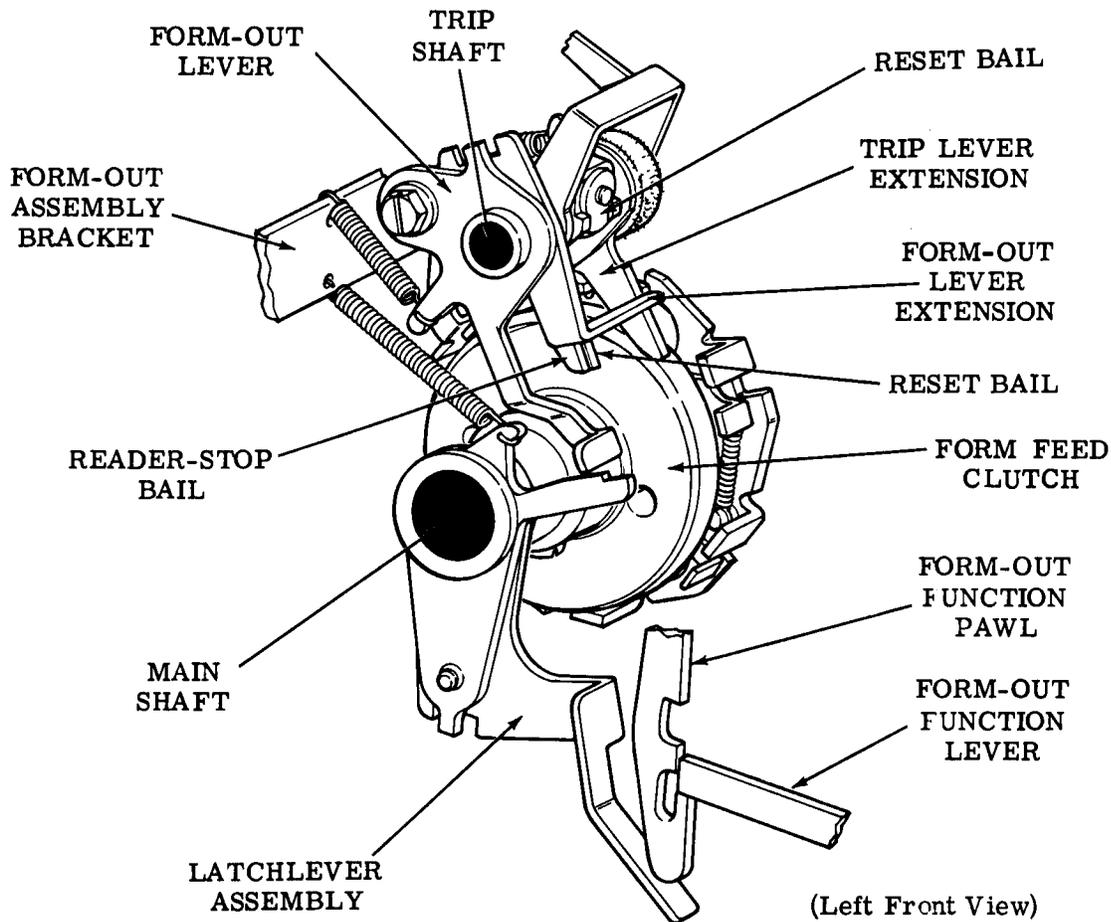


Figure 33 - Form-Out Mechanism (Sprocket Feed)

## Q. Marginal Bell and End of Line Bell

4.108 Margin Bell: As the carriage moves to the right during printing, the carriage upper rear roller makes contact with and depresses a latch which is secured to a lever mounted on the rear rail. As the latch is depressed, the lever is rotated and moves the automatic carriage return — line feed codebar to the right, a short distance, where a notch in the codebar permits the bell function lever to move up to its selected position, where it is latched by its function pawl. During the middle portion of the function cycle, the lever moves the pawl down against the pressure of the latter spring. When the stripper bail strips the pawl late in the function cycle, the pawl moves up and causes a clapper mounted on a wire spring to snap up and ring a gong.

4.109 End of Line Bell: Operation proceeds in the same manner as described for margin bell except that a projection on the carriage picks up the automatic carriage return — line feed codebar at a predetermined point, and moves the codebar to the right a short distance until a notch in the codebar permits the bell function lever to move up to its selected position.

## R. Automatic Carriage Return — Line Feed

4.110 As described for the end of line bell (4.109), the carriage picks up the automatic carriage return — line feed codebar at a predetermined point and moves it to the right. When the carriage reaches the right margin, a notch in the codebar permits an automatic carriage return — line feed function lever to move up to its selected position, where it is latched by its function pawl.

4.111 The automatic carriage return — line feed function lever, in turn, moves the line feed blocking lever up to where it is latched by the line feed link. Line feed then occurs as described in 4.88 through 4.92 and 4.95 through 4.97.

4.112 When the automatic carriage return — line feed function lever and its function pawl are pulled down during the middle portion of the cycle, the pawl encounters an extension on the carriage return function pawl and moves it down. Carriage return then occurs as described in 4.84 through 4.87.

## S. Answer-Back Mechanism

4.113 The answer-back mechanism illustrated in Figures 35, 36, and 37 automatically transmits a predetermined sequence of characters for identification purposes.

4.114 A drum is coded with characters making up the answer-back sequence. When the answer-back mechanism is actuated, it rotates the drum, which sets up the code combinations in a set of answer-back contacts. The distributor converts the positions of the contacts to start-stop signals for transmission. After the answer-back sequence has been transmitted, the answer-back mechanism returns itself to its unoperated condition. For reasons that will be described below, provisions are made for shunting the signal line during sensing of the first answer-back character of each cycle and to prevent the answer-back from being actuated by the local generation of the answer-back call character.

4.115 The answer-back drum illustrated in Figure 34 has 11 levels as follows:

- (a) Five numbered levels
- (b) Feed ratchet
- (c) Stop cam
- (d) Character suppression
- (e) Three more numbered levels

4.116 Viewing the answer-back drum from the numbered end, it has 21 rows, ST (start) and 1 through 20. The feed ratchet serves to rotate the drum. The stop cam has tines which can be removed at various points so that the length of the answer-back message can be varied. The character suppression level is used to shunt the first answer-back character from the signal line. By breaking off tines in the various rows at the numbered intelligence levels, the drum may be coded to generate the proper answer-back characters. For example, if the first character of an answer-back message to be transmitted is the letter D code combination (1--4-), tines at the no. 1 and no. 4 levels should be broken off in the appropriate row where the answer-back message is to start. The second character of the message would be coded into the next succeeding row.

Note 1: All answer-back messages should be preceded by the "carriage return," "line feed," and "letters" code combinations.

Note 2: For details on answer-back drum coding refer to the installation section.

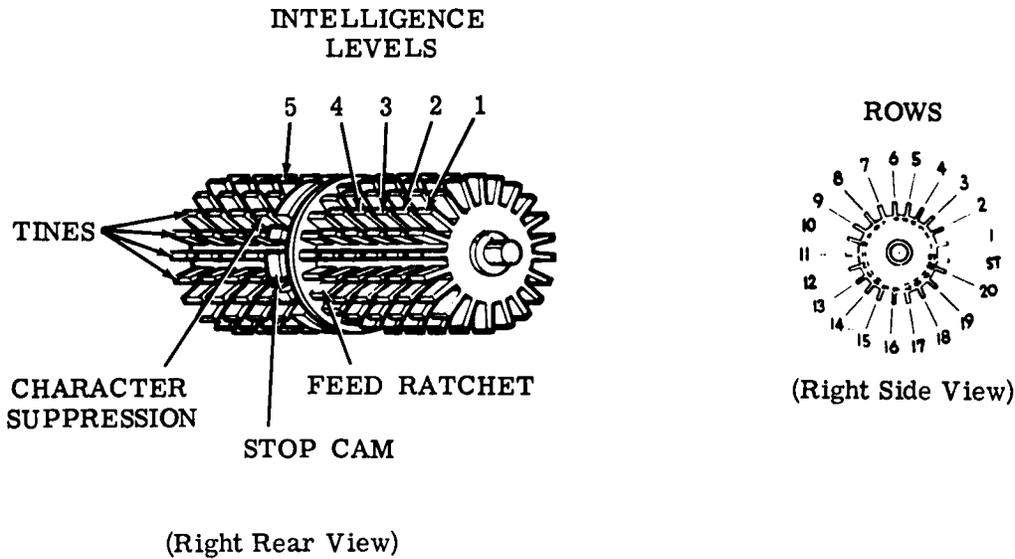


Figure 34 - Answer-Back Drum

4.117 The answer-back mechanism can be actuated in three ways.

- (a) Remotely, by the reception of a predetermined call character. By depressing the ENQ (Enquiry) keytop on the distant set a signal is received by the local set to answer-back.
- (b) Locally, by depressing the HERE IS key.
- (c) Automatically, by actuating the answer-back trip magnet mechanism from some external equipment, such as a data set.

4.118 Remote Actuation (Figure 35): When the answer-back call character is received by the typing unit, the answer-back function lever moves up to engage its function pawl in slot no. 15. As the function lever and pawl are moved down by the function bail, the pawl pivots the answer-back bail. In pivoting, the answer-back bail moves a trip link frontward. The trip link pivots the control lever out of the indentation on the stop cam. The control lever, through the stop bail, moves the trip lever rearward, out of engagement with the shoe lever, allowing the distributor clutch to engage.

4.119 When the distributor clutch begins to rotate, a cam roller moves up and permits the feed lever to pivot rearward against the control lever. The feed pawl attached to the

feed lever moves rearward to engage the next tooth on the drum ratchet. Near the end of the function cycle, the function pawl is stripped from its function lever by the stripper bail. The control lever, under spring tension, tends to return to its unoperated position in the indentation of the stop cam. This would terminate the answer-back operation by disengaging the distributor clutch. However, since the feed pawl is engaged with the next tooth on the ratchet, the spring tension on the control lever is not enough to overcome the combined tension of the feed lever spring and the drum detent. Thus, the mechanism remains in its operated condition throughout the distributor cycle.

4.120 Near the end of the distributor cycle, the cam roller on the distributor clutch moves the feed lever and feed pawl frontward, and the pawl acts on the ratchet to rotate the drum one tooth. The stop cam on the drum now prevents the control lever and trip lever from returning to their stop position. The distributor clutch thus continues to cycle and rotate the answer-back drum.

4.121 The answer-back contacts are wired in parallel with the keyboard contacts to the segments of the distributor disc. As the drum rotates during the answer-back operation, the contact wires, under spring tension, sense each row of tines. If a tine has been broken off at a given level in a row, the associated wire

moves forward to its marking position against a common terminal. On the other hand, if a time is present, it holds the wire away from the terminal in its spacing position. As the distributor clutch cycles, the distributor converts the positions of the contacts to sequential start-stop signals for transmission.

4.122 The drum continues to rotate until the next indentation in the stop cam is presented to the control lever. The latter then moves into the indentation and returns the associated parts to their unoperated position. The shoe lever then strikes the trip lever and disengages the distributor clutch. The mechanism is thus returned to its unoperated condition.

4.123 Local Actuation: When the HERE IS keytop is depressed on the keyboard, it pivots a bellcrank which moves the trip link

frontward. The trip link pivots the control lever to its operated position and the answer-back proceeds as described for remote actuation.

4.124 Automatic Actuation: The answer-back mechanism of a distant station may be actuated by completing a connection through the local data set or some other equipment. The trip magnet on the distant station is energized. Being energized it attracts the trip magnet armature which allows the trip lever to move rearward. A tab on the trip lever pivots the control lever out of the indent of the stop cam allowing the clutch to engage. As the clutch rotates the blocking cam also rotates. A blocking follower rides the blocking cam and rotates clockwise. By means of a tab, the blocking follower rotates the trip lever which latches against the de-energized armature extension. It remains in this position until the magnet is again energized.

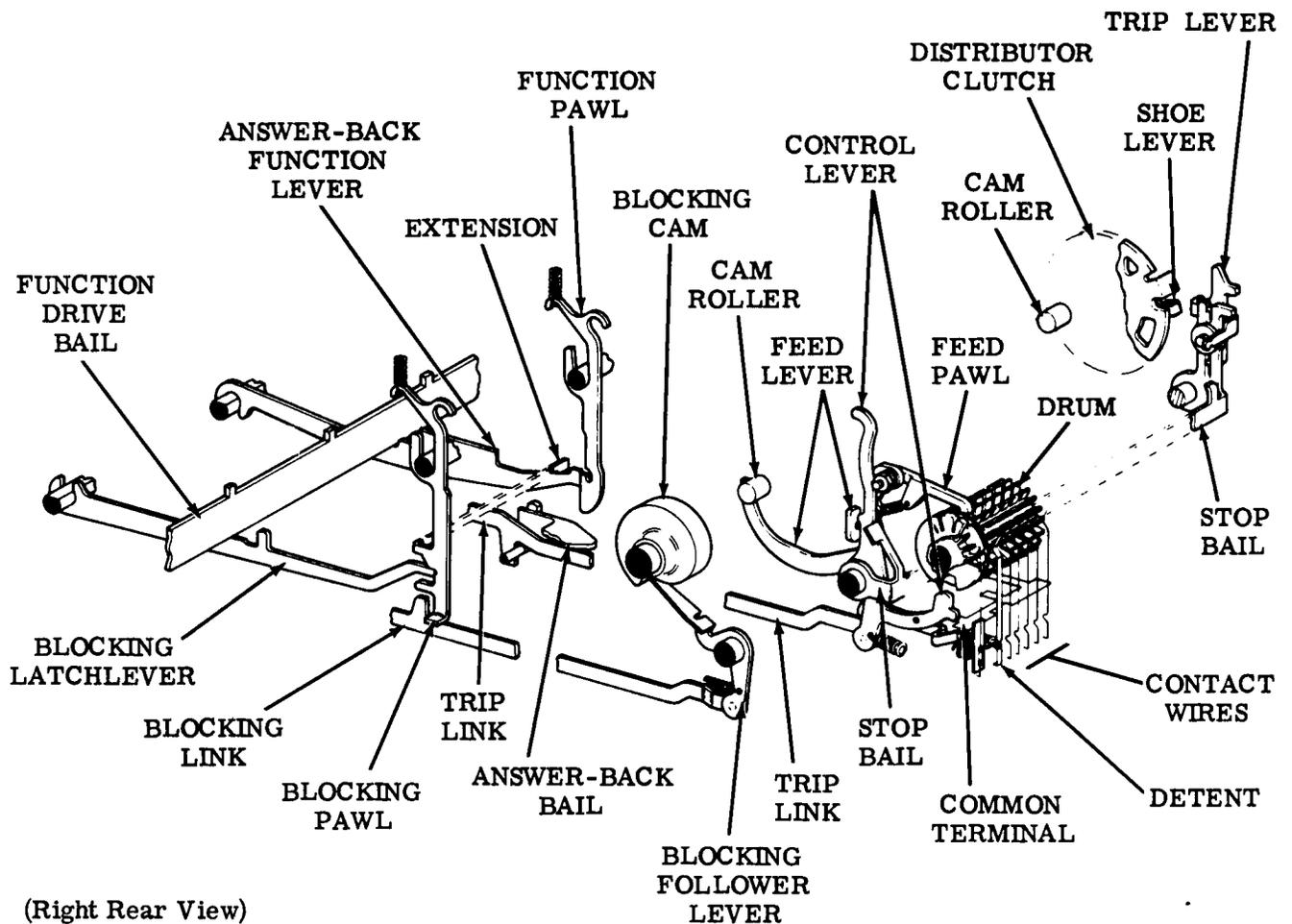


Figure 35 - Answer-Back Mechanism -- Remote Actuation

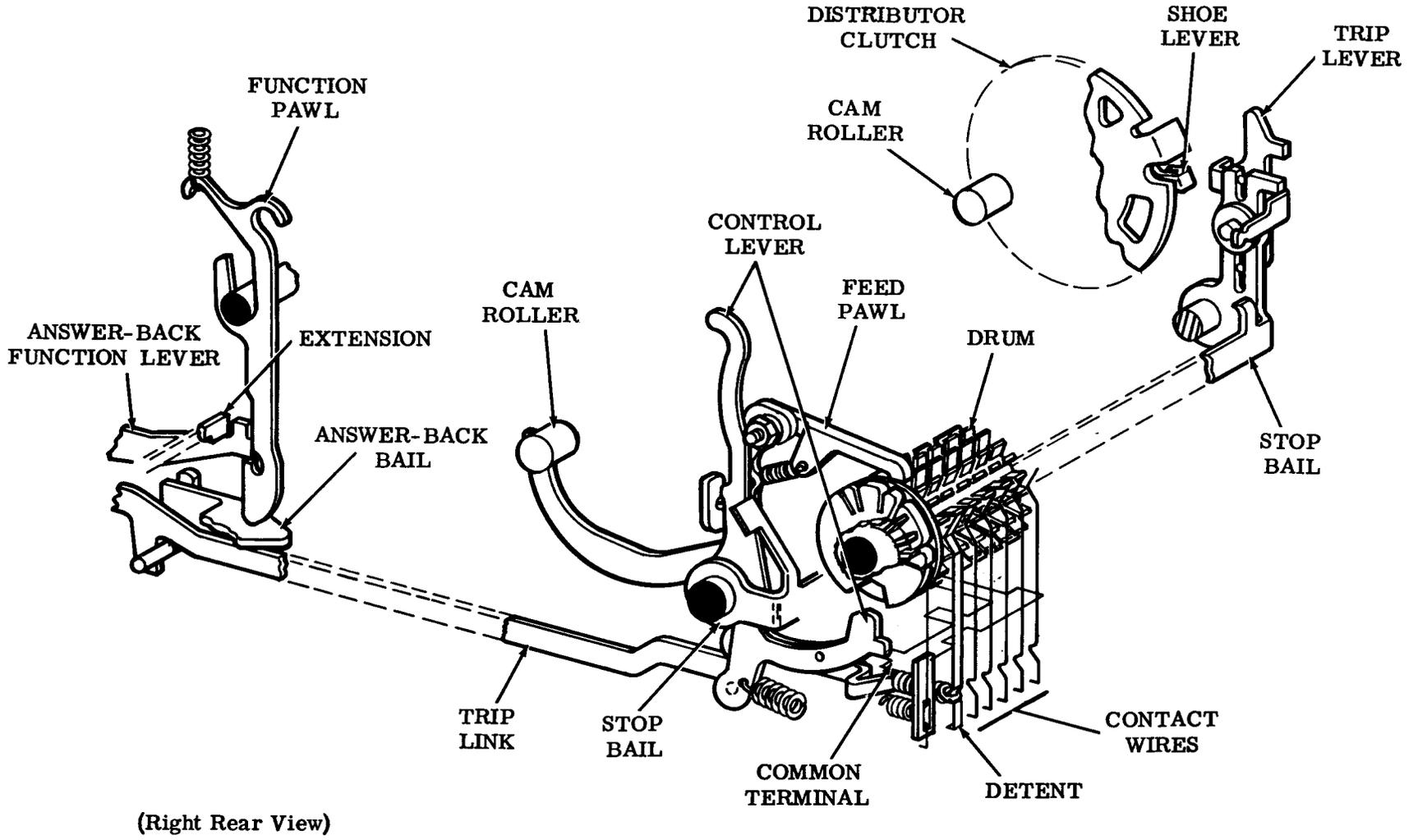


Figure 36 - Answer-Back Mechanism — Local Actuation

(Right Rear View)

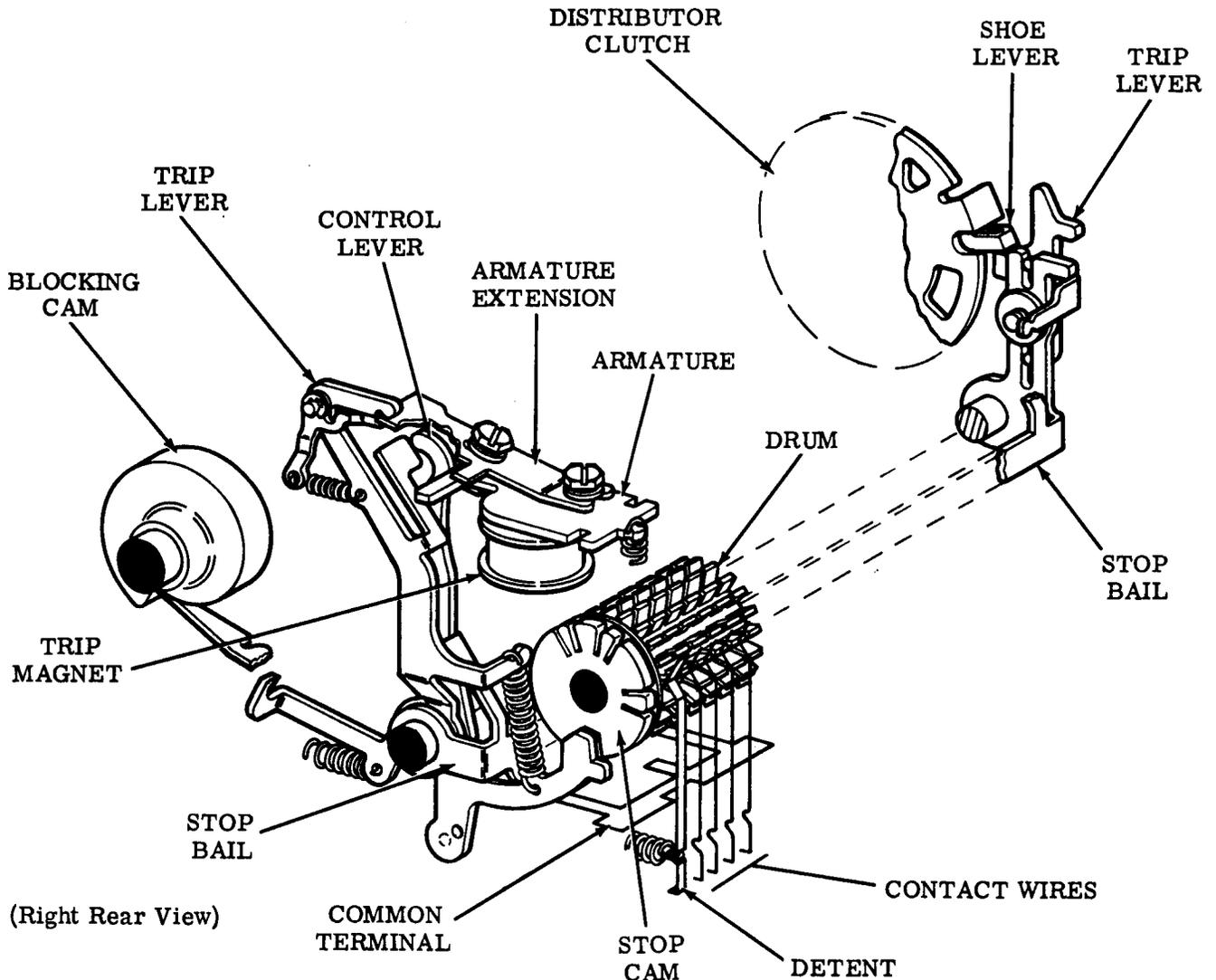


Figure 37 - Answer-Back Mechanism — Automatic Actuation

4.125 Since the answer-back keyboard, and tape reader (where used) contacts are wired in parallel with the distributor disc, the answer-back contacts must all be in their spacing position when the mechanism is unoperated, so that they do not interfere with keyboard or tape reader transmission. Therefore, because the answer-back feed mechanism does not feed the drum until near the end of the first cycle, the first character sensed should be all spacing to prevent garbling of the regular message sent from the keyboard and/or tape reader. However, an all "spacing" character is undesirable in some systems. Therefore, a way is provided for shunting transmission from the signal line during the sensing of the first answer-back character.

4.126 As mentioned above, the trip link moves frontward when the answer-back sequence is initiated and remains there until it is terminated. In this position it permits a character suppression contact wire to sense the drum character suppression level. The character suppression contact is wired so that it shunts transmission from the outgoing signal line when it is closed. The time at the character suppression level of the first character of each answer-back cycle must always be broken off in order to accomplish this. Thus the character suppression contact wire is selected and keeps the line marking until the second character is sensed. The tines are left in the character suppression level in other rows, except for certain conditions, such as to correct coding errors and

to vary the message length. This allows, in effect, one character delay before the message coded into the answer-back drum is transmitted. At the end of the operation, the trip link again moves rearward and holds the contact wire unselected while the mechanism is unoperated.

4.127 Answer-Back Suppression on Transmission: Since the typing unit receives every code combination that it transmits, the sending of the answer-back call character would actuate the local answer-back as well as the one at the distant station. To prevent this, a blocking mechanism prevents the function mechanism from operating in the answer-back area during transmission.

4.128 As the distributor clutch rotates, the blocking cam pivots the blocking follower lever which pulls a blocking link rearward. The link pivots the blocking pawl rearward until it releases a blocking latchlever which, under spring tension, moves up against the function drive bail. When the function drive bail and the blocking latchlever move up during the function cycle, the blocking latchlever cams the blocking pawl further rearward where an extension on the pawl is over an extension on the answer-back function lever. The function lever is thus prevented from moving up far enough to be latched by its pawl and initiate the answer-back sequence.

4.129 During the latter part of the distributor cycle, the blocking cam allows the blocking link to move frontward to its unoperated position. As the function drive bail moves down during the middle portion of the function cycle, it drives the blocking latchlever downward to the point where the blocking pawl is permitted to pivot frontward to its unoperated position. Thus every time a character is initiated locally, the distributor clutch cycles and operates the blocking mechanism which prevents the answer-back function lever from sensing the codebars and initiating the answer-back sequence regardless of what character is processed by the typing unit. On the other hand, when remotely initiated characters are received, the distributor clutch does not cycle, the blocking mechanism is not operated, and the function lever is permitted to

sense the codebars and initiate the answer-back sequence upon receipt of the predetermined call-character signal.

4.130 The length of the answer-back sequence can be varied either by altering the stop-cam level or the character-suppression level.

(a) Stop Cam: The answer-back mechanism can be coded for either 1-, 2-, or 3-cycle operation by removing the appropriate tine(s) from the stop-cam level. In 1-cycle operation, the stop cam in row "6" is removed. This coding yields a maximum of 20 rows which are available for coding different characters into the answer-back drum. There are actually 21 rows on the answer-back drum, but only 20 rows can be used for coding since one row is suppressed. The number of rows available for message coding is summarized below for 1-, 2-, or 3-cycle operation:

<u>Cycle Operation</u>	<u>Actual Rows</u>	<u>Available Rows</u>
1	21	20
2	10(11)*	9(10)*
3	7	6

\* Alternately, one then the other.

When multiple-cycle operation is employed, the answer-back sequence must be coded in each segment of the answer-back drum so that the same message will be transmitted each time the answer-back mechanism is initiated.

(b) Character Suppression: Quite often, due to message length, messages coded into the answer-back drum do not require the use of every available row for coding. Unneeded rows are eliminated from the message transmission by removing the unneeded character suppression tine(s). The answer-back drum will stop through its complete cycle, but the transmission of the coded characters from the unneeded rows will be shunted from the signal line.

CHART 4 - MARKING AND SPACING CONDITIONS

MECHANISM	MARKING	SPACING
Distributor	Current flow.	No current flow.
Selector armature	Armature attracted.	Armature unattracted.
Selector levers	Moves up into cam indent.	Prevented by armature extension from moving into cam indent.
Push levers	Positioned under selector levers.	Positioned in front of selector levers.
Blocking levers	Pivoted up.	Pivoted down.
Codebars	Up and left.	Down and to the right — stop position.
No. 3 codebar (Rotary positioning)	<ol style="list-style-type: none"> <li>1. When no. 3 codebar is marking typewheel turns counterclockwise.</li> <li>2. When no. 3 codebar is marking the rotary drive arm is down, engaging left rack.</li> </ol>	<ol style="list-style-type: none"> <li>1. When no. 3 codebar is spacing typewheel turns clockwise.</li> <li>2. When no. 3 codebar is spacing the rotary drive arm is up, engaging right rack.</li> </ol>
Stop slides	Up.	Down.
Stop arms	Pivoted the way of the vertical drive bail.	In stop position, blocking the travel of the vertical drive bail.
Contact wires (Answer-back mechanism)	Frontward, touching the common terminal.	Held back by the tines, away from the common contact.

5. OPTIONAL FEATURES

PRINT-NONPRINT

5.01 The print-nonprint mechanism allows transmission or reception of tape messages without printed page copy. A magnet operates in response to a signal. Operation of the magnet attracts an armature which pivots a bell-

crank (Figure 38). Operation of the bellcrank moves a nonprint codebar which blocks all the function levers except a special function lever. This special function lever rises every cycle. In so doing it blocks the print suppression codebar and thus printing is suppressed. An off signal places the armature in the unattracted position. The nonprint codebar then returns to its unoperated position under spring tension.

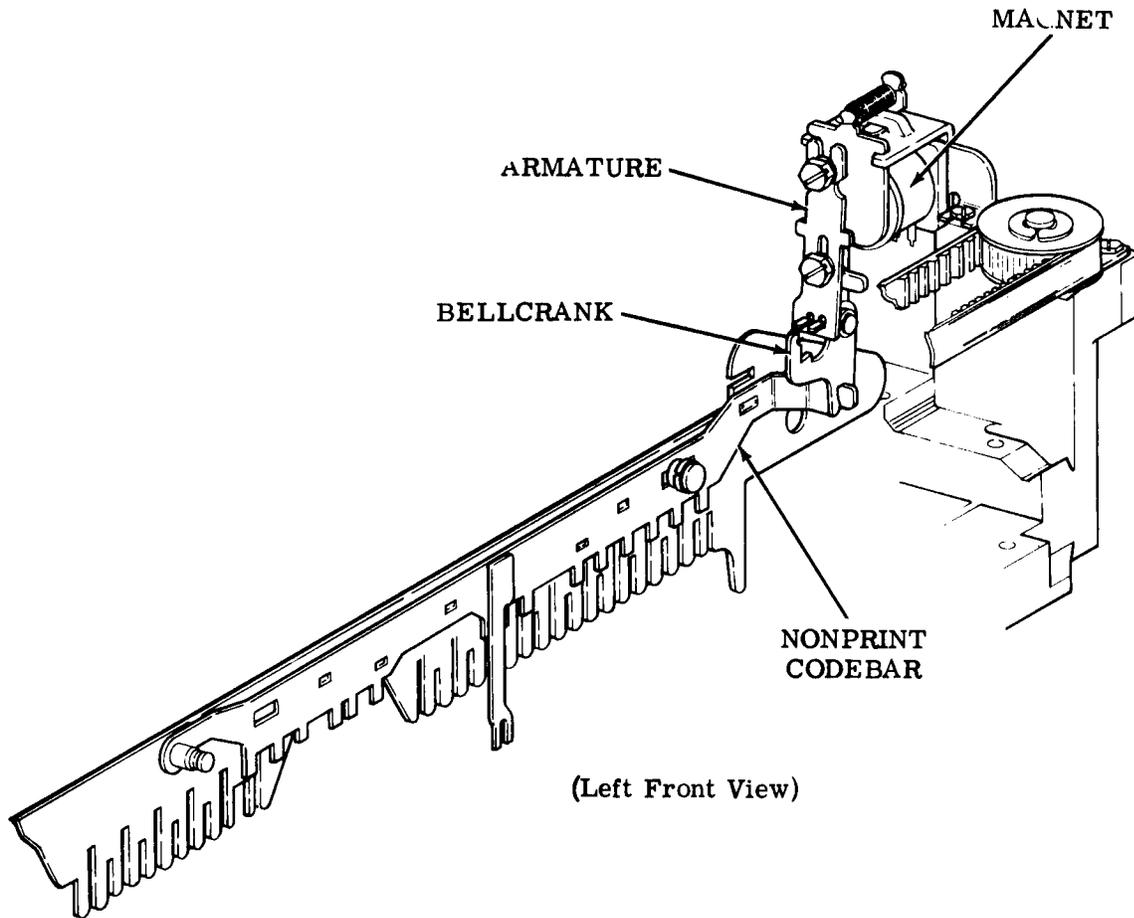


Figure 38 - Magnet Operated Print-Nonprint Mechanism