



BULLETIN 216B

DESCRIPTION AND
PRINCIPLES OF OPERATION
MODEL 28 SEND-RECEIVE (KSR) AND
RECEIVE-ONLY (RO)
TELETYPEWRITER SETS



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INTRODUCTION

Bulletin 216B provides description and principles of operation for the Send Receive (KSR) and Receive-Only (RO) Teletypewriter Sets and associated component units.

The Bulletin is made up of a group of appropriate independent sections. The sections are complete within themselves; they are separately identified by title and section number and the pages of each section are numbered consecutively, independent of other sections.

The identifying number of a section, a 9-digit number, appears at the top of each page of the section, in the left corner of left-hand pages and the right corner of right-hand pages.

To locate specific information, refer to the table of contents. Find the name of the involved component in column one and the title of the section in column two. The correct 9-digit section number will then be found in column three. The sections are arranged in the order shown in the table of contents. Turn to page one of the section indicated where the contents of that section will be found (except where a section is small and does not require a listing of contents).



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Note: For information on motor units, see Bulletin 295B.



28 KEYBOARD SEND-RECEIVE (KSR) AND RECEIVE-ONLY (RO)

TELETYPEWRITER SETS

DESCRIPTION

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1. GENERAL

1.01 The 28 Keyboard Send-Receive (KSR) Teletypewriter Sets are electromechanical apparatus that provide terminal facilities for exchanging page-printed messages over appropriate transmission facilities including telegraph lines, telephone networks, and radio channels. An operator sends the messages by typing them on a keyboard, and the originating set and those at distant stations print them on

page-width copy paper or continuous business forms. The sets translate the messages to a serial start-stop (teletypewriter) code for transmission and convert the code to printed characters at the point of reception. They will operate at various speeds up to 100 words per minute.

1.02 The 28 Receive-Only (RO) Sets are similar to the KSR Sets, but have no keyboard sending facilities. They are used in applications that require only the reception of page-printed messages.

1.03 The KSR and RO Sets can be used for recorded communication either cross office or cross country. With the proper modifications, they will function in dial or other switched-line networks. Utilizing the capabilities of a built-in switching device, the stunt box, the Sets will operate in selective calling systems(par. 5.01), and provide local or remote control of external equipment or operations.

2. VARIATIONS

2.01 The sets are available in several configurations to meet varying installation and operational requirements:

- (a) Floor Model Set - A floor-standing set with additional space for accessory equipment (Fig. 1).
- (b) Table Model Set - Identical to the Floor Model Set except that it contains no additional space and it rests on a table (Fig. 2).
- (c) Rack Mounted Set - Equipped with a close-fitting enclosure, is compact and rests on an equipment rack or on a table (Fig. 3).
- (d) Wall Mounted Set - May be mounted on a wall surface to conserve floor space (Fig. 4).
- (e) Multiple KSR and RO Set - Provides two RO and one KSR, or three RO sets in a single enclosure (Fig. 5).

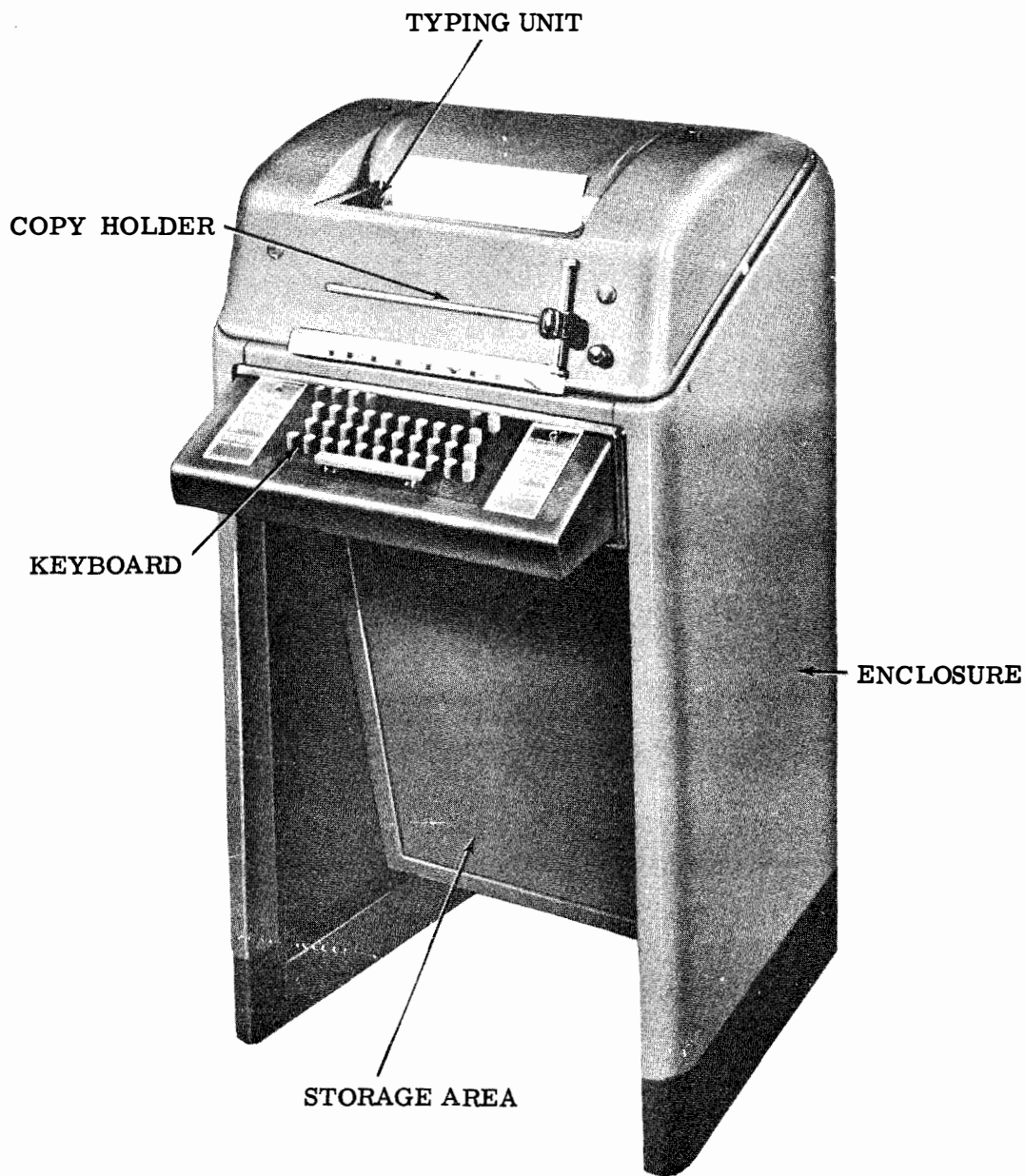


Figure 1 - Floor Model Keyboard Send-Receive (KSR) Teletypewriter Set

3. COMPONENTS

3.01 The component complement of a KSR Set may vary from one installation to another, depending upon the operational requirements. In general, a KSR Set consists of a typing unit, a keyboard base, motor unit, electrical service unit, and enclosure. A complete description of these components will be found in the appropriate section for a particular component.

3.02 The motor unit and typing unit are mounted on the base portion of the keyboard. The motor unit supplies rotary motion through a gear set to the typing unit which, in turn, supplies it to the keyboard. Gear sets may be interchanged to obtain various operating speeds up to 100 WPM. The keyboard and electrical service unit are mounted in a cabinet or enclosed by covers. The receive-only base replaces the keyboard in the Receive-Only Set.

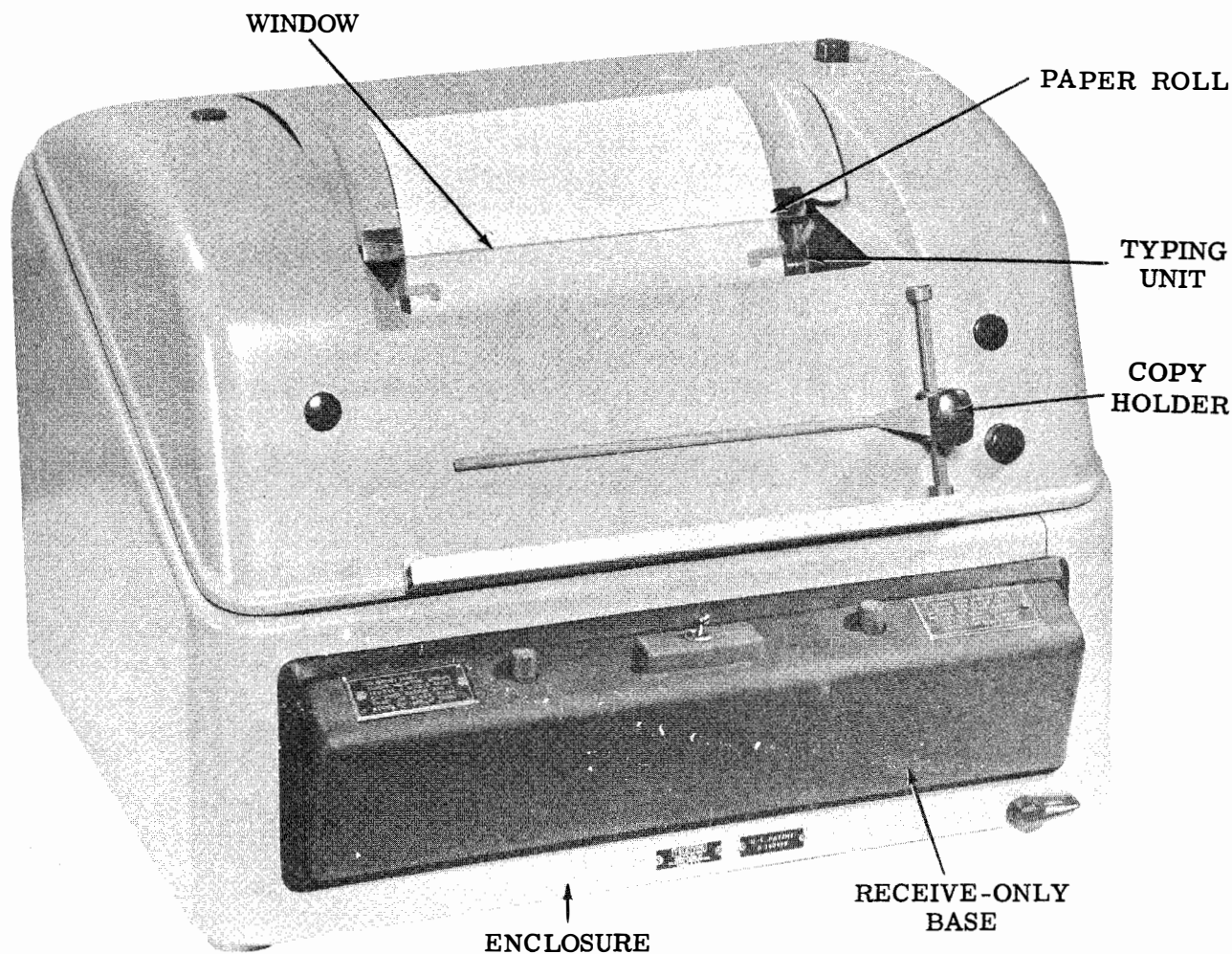


Figure 2 - Table Model Receive-Only (RO) Teletypewriter Set

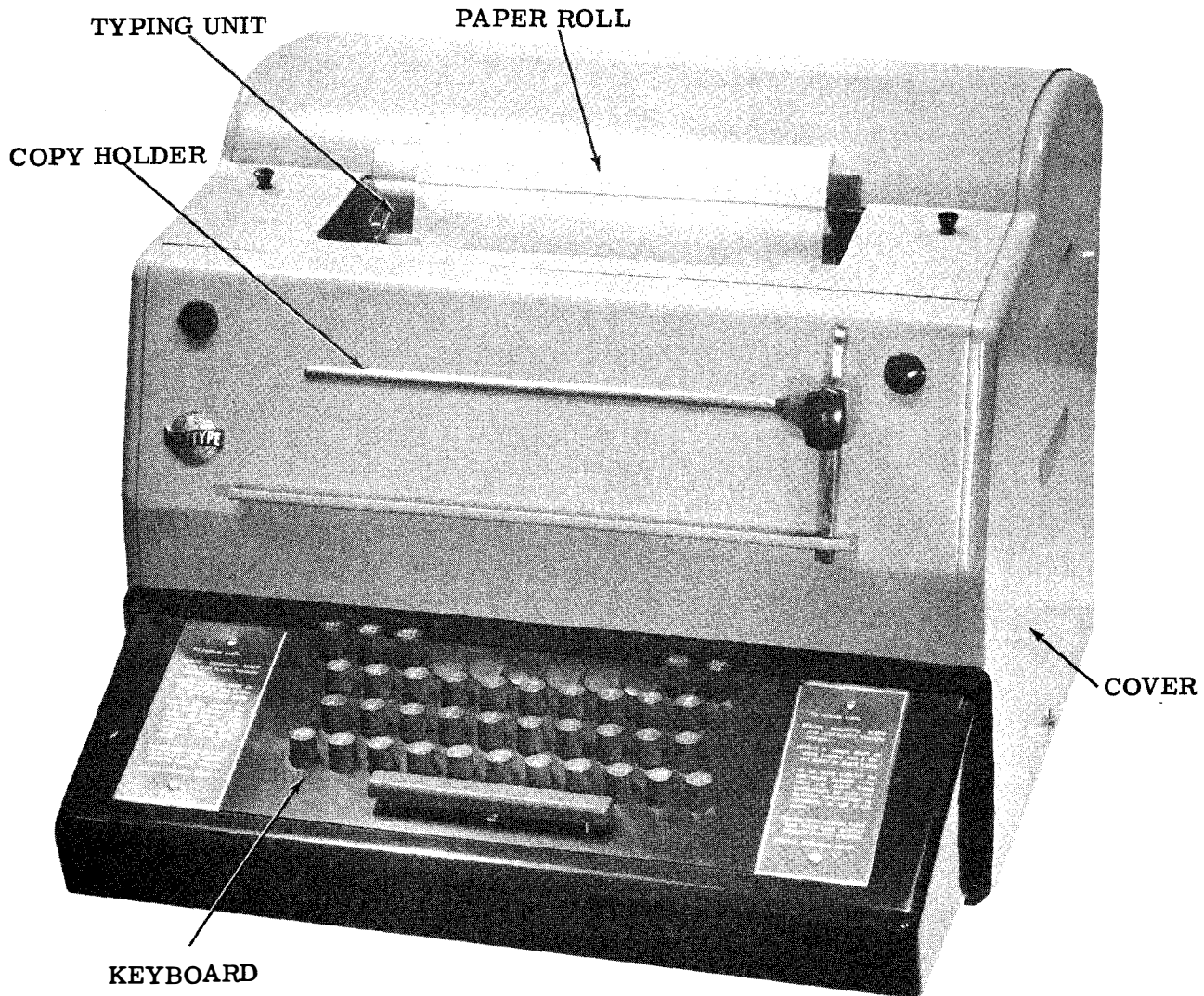


Figure 3 - Rack Mounted Send-Receive (KSR) Teletypewriter Set

TYPING UNIT (Fig. 6)

3.03 The typing unit contains the mechanism necessary for translating electrical input signals into printed, alpha-numeric characters or functional control operations. The unit may be equipped to accommodate either friction or sprocket feed paper, in single or multi-copy form, either rolled or fan folded. It includes a stunt box that provides, non-printing functions such as case shifting, carriage return and line

feed and, in addition, switching facilities for remote controls, station selection, and other applications.

SEND-RECEIVE KEYBOARD AND RECEIVE-ONLY BASE (Figs. 2 and 6)

3.04 Both the send-receive keyboard and the receive-only base provide mounting facilities for the typing unit, motor, driving gears, and various mechanisms required for control of

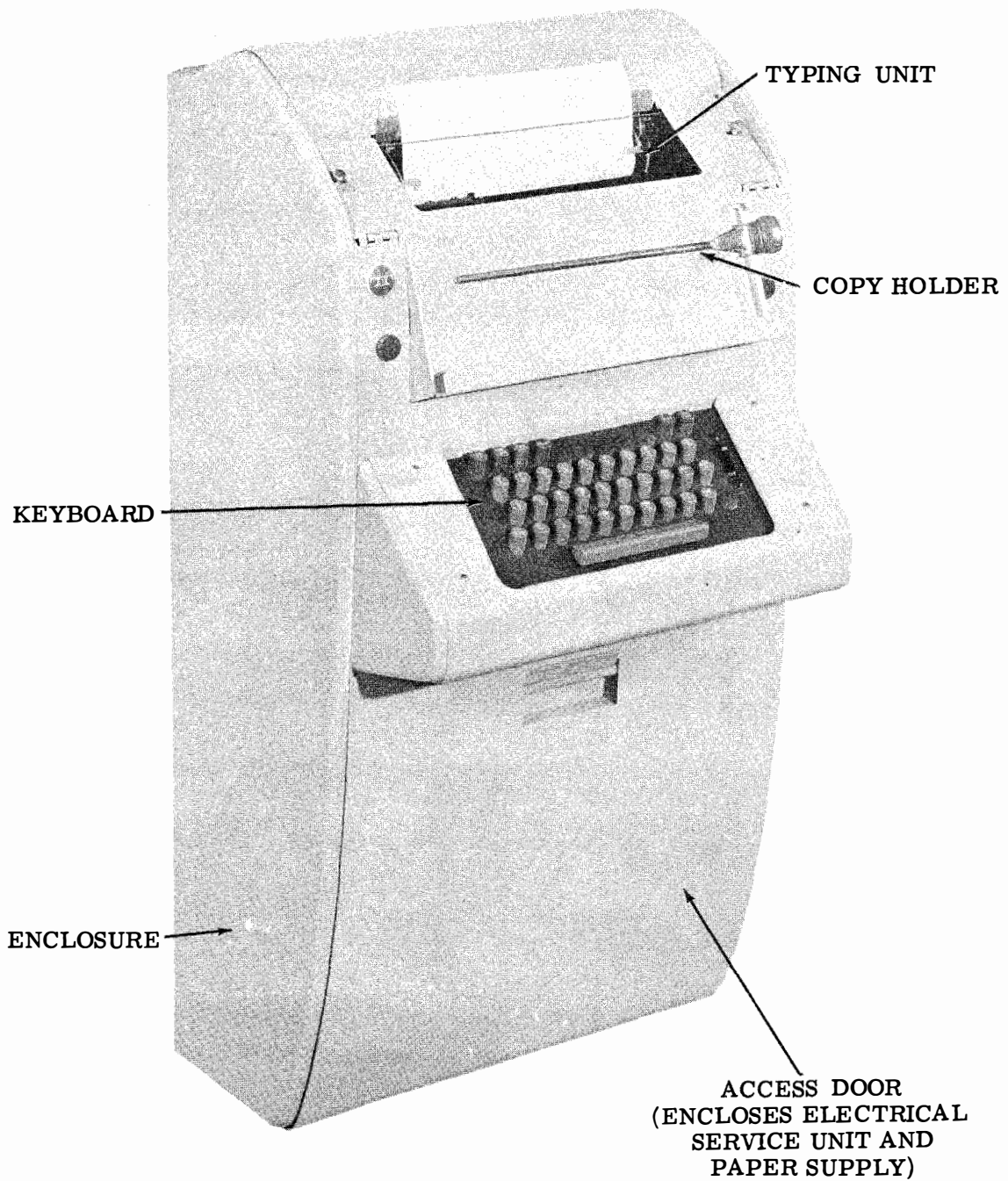


Figure 4 - Wall Mounted Send-Receive (KSR) Teletypewriter Set

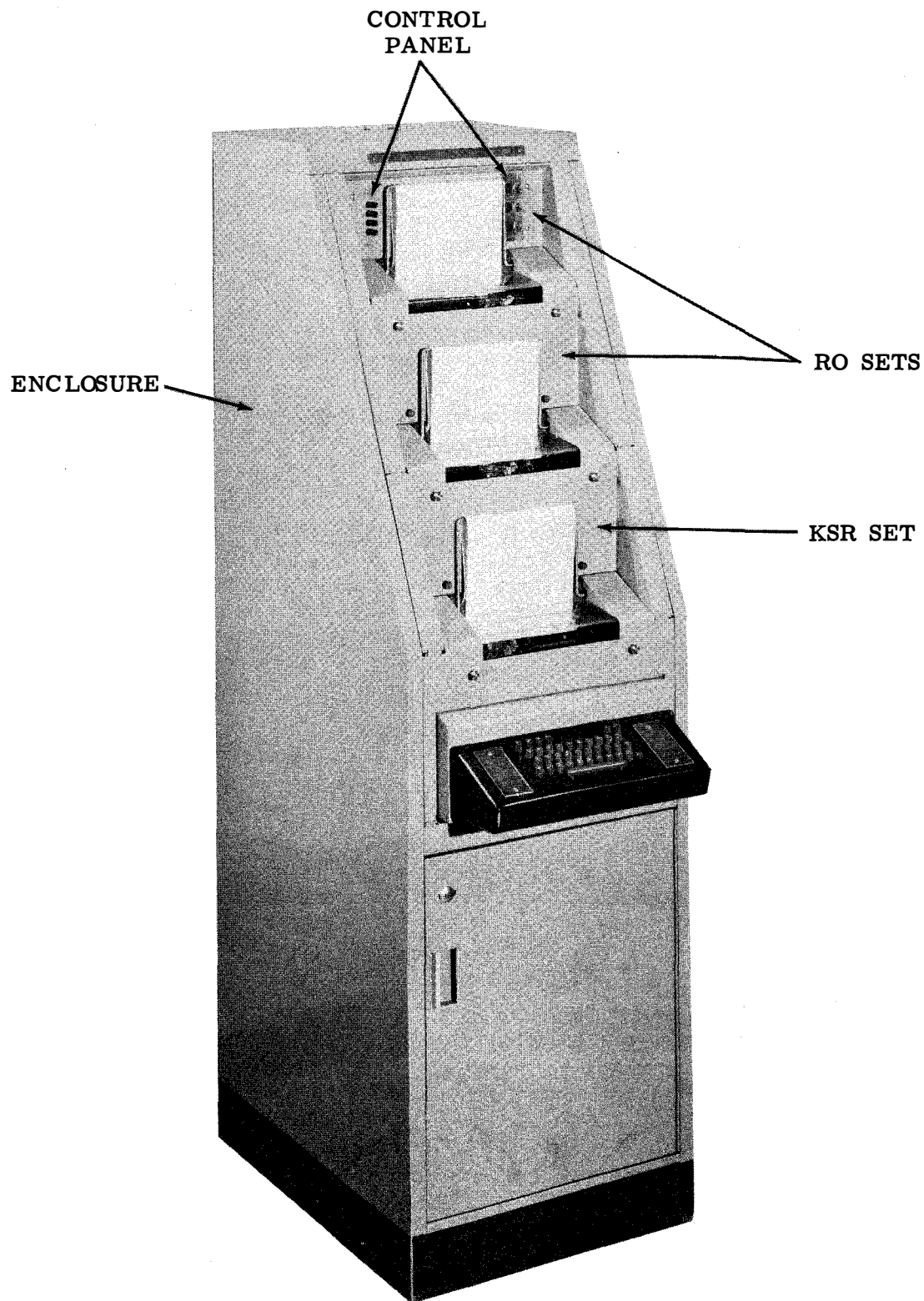


Figure 5 - Typical Multiple KSR and RO Set

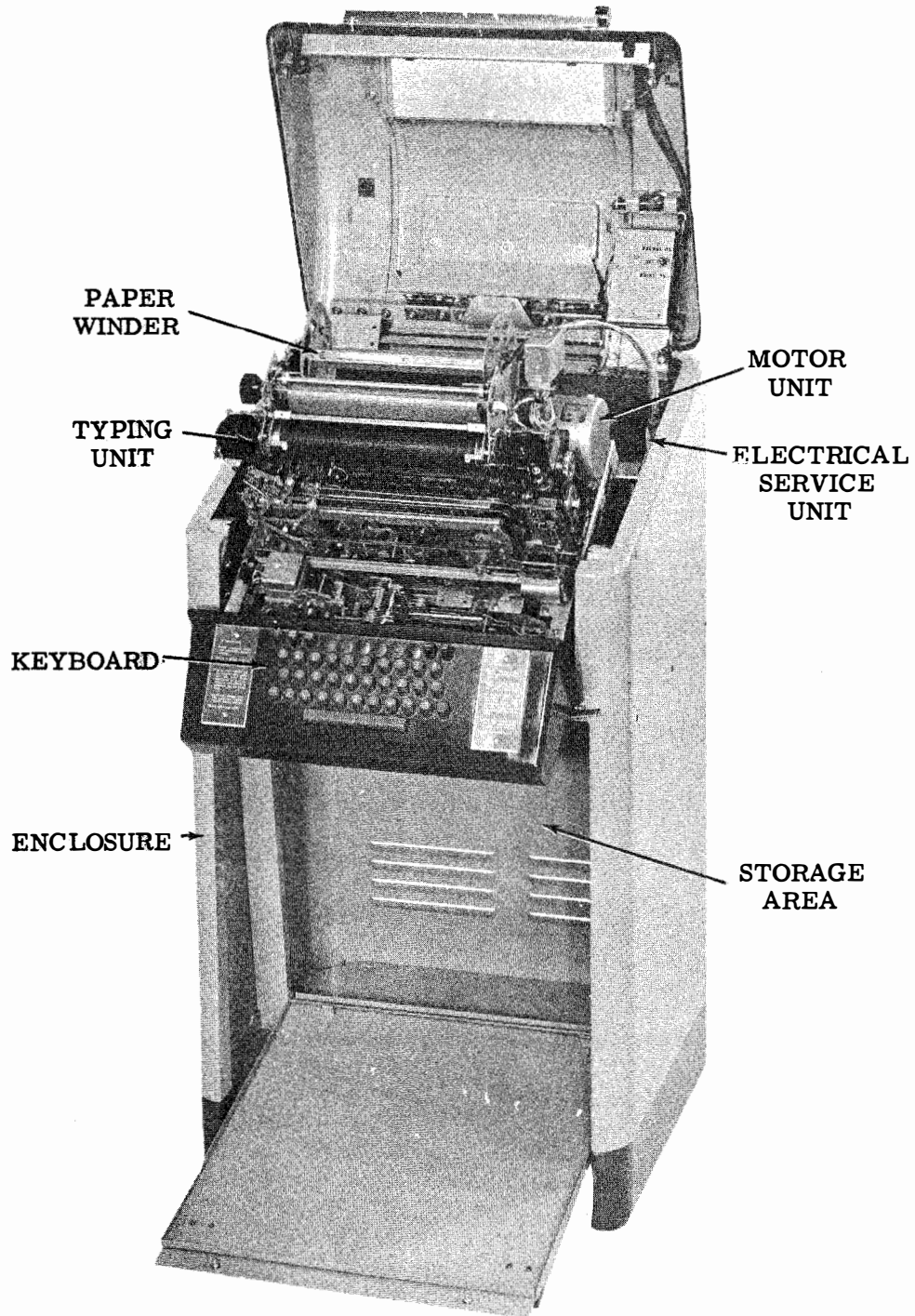


Figure 6 - Floor Model Keyboard Send-Receive (KSR) Teletypewriter Set (Interior View)

SECTION 573-100-100

the set. Unlike the receive-only base, the send-receive keyboard is equipped with mechanisms for generating and transmitting a teletypewriter signal.

MOTOR UNITS (Fig. 6)

3.05 The motor units that provide mechanical motion for KSR and RO sets are of two basic types: ac synchronous and ac/dc series governed. The ac synchronous motor is used when the power source is regulated; the ac/dc series governed motor operates from either regulated or unregulated power. The latter is required where only unregulated power is available. The units operate at the same speed, and to accommodate varying load requirements they are available in standard and heavy-duty horsepower ratings.

ELECTRICAL SERVICE UNIT (Fig. 6)

3.06 The electrical service unit serves as the area of concentration for the wiring of KSR and RO sets, and provides mounting facilities for various electrical assemblies and components. It may include such optional assemblies as a line (polar) relay, line shunt relay, rectifier, motor control mechanism, and selector magnet driver. The set's main power switch, convenience outlet and fuse, terminal blocks, and interconnecting cables may also be included.

ENCLOSURES (Figs. 1 through 5)

3.07 The components of KSR and RO sets may be housed in the following enclosures: the floor model, the table model, the rack mounted cover, the wall mounted enclosure, and the multiple KSR and RO enclosure. The enclosures are of sheet metal construction and are finished internally and externally in baked enamel.

4. VARIABLE FEATURES

4.01 A wide variety of optional features are available with the equipment. These features, which provide special, non-printing operations or control facilities, or serve as an aid in operation, are in most cases readily installed in the field. Some of the features are described briefly below.

(a) Horizontal Tabulator - Permits rapid movement of the typebox to predetermined positions on the copy paper.

(b) Vertical Tabulator - Advances a form to any predetermined position within the form.

(c) Form Feed-Out - Advances a form to the first printing line on the succeeding form from any point on the previous form.

(d) Automatic Carriage Return - Line Feed - These functions occur simultaneously should the sending station fail to initiate them, when the typebox reaches the right margin.

(e) Motor Control - Starts or stops the set's motor during active or idle transmission periods, or in response to other, predetermined signal-line or separate-line conditions.

(f) Answer-Back - With this feature, KSR sets can automatically transmit their station identification character sequence, upon request of another station, or by local control.

(g) Accessories - A number of accessories are available to facilitate paper and form handling, including low-supply indicator alarms, special trays and shelves, and paper winders.

5. SELECTIVE CALLING

5.01 Selective calling operation is a method of message transmission control, in which traffic is selectively directed only to those sets actually concerned with the information being transmitted. Each set in the circuit, which maybe standard line or radio, is assigned an identification code. The code may be made up of any character or sequence of characters. Recognition of this code, and other selective calling codes, is made by the stunt box in the typing unit of each set. The typing unit, upon recognition of the proper code, will be placed in the select-non-print condition. When this occurs, direct printing is suppressed while the selector mechanism and the stunt box remain active. In this way, the typing unit monitors signal line conditions, but does not respond, either to print or to perform a function, until it receives instructions in the form of selective calling code sequences.

6. TECHNICAL DATA

vert parallel input to required sequential form.

SIGNAL REQUIREMENTS

A. Sequential - Five intelligence levels, with start-stop pulses.

- (1) Neutral - Selector magnets directly connected to signal line.
- (2) Polar - Line relay or selector magnet driver required.

B. Parallel (Neutral) - An accessory multi-wire distributor unit is necessary to con-

POWER REQUIREMENTS (TYPICAL)

A. Sets with Synchronous Motor Units - 115 vac, $\pm 10\%$, $60 \pm .75\%$ cycles, single phase.

B. Sets with Governed Motor Units

- (1) 115 vac $\pm 10\%$, 50-60 cycles, single phase.
- (2) 115 vdc with external resistance.

OPERATING SPEEDS

Characters or Operations	Per-Minute	600	460	428	404	400	390	368
	Per-Second	10.0	7.7	7.1	6.7	6.7	6.5	6.1
Unit Code		7.42	7.42	7.00	7.42	7.50	7.00	7.42
Bauds (Bits-per-second)		74.2	56.9	50.00			45.5	
Frequency (Cycles/Second)		37.1	28.4	25.00			22.8	
Length in Milliseconds	One Character	100	130	140	149	150	154	163
	Unit Pulse	13.5	17.6	20.0	20.0	20.0	22.0	22.0
	Stop Pulse	19.1	24.9	20.0	28.5	30.0	22.0	31.2

APPROXIMATE DIMENSIONS (INCHES)

Set	Height	Width	Depth
Floor Model KSR RO	39	20-1/2	24
	39	20-1/2	21
Table Model KSR RO	16	20-1/2	24
	16	20-1/2	21
Rack Mounted KSR RO	12	17	24
	12	17	21
Wall Mounted KSR RO	30-3/4	16-1/2	14-1/2
	30-3/4	16-1/2	11-1/2
Typical Multiple KSR and RO	72	21-1/2	28

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PRINTED CHARACTERS

A. Type Pallet Arrangements - Standard, upper case arrangements include:

- (1) Communications (Punctuation symbols)
- (2) Fractions
- (3) Weather symbols

Individual pallets for upper and lower case characters are available separately for field installation.

B. Type Styles and Spacing (Typical)

Style	Character Height		Horizontal Characters Per Inch		Vertical Lines Per Inch	
	Caps	Fraction	Single	SPACE - Double	Single	FEED - Double
Murray Gothic	.103"	.162"	10	5	6	3
Gothic	.103"	none	10	5	6	3
Gothic	.103"	.162"	12	6	6	3
Long Gothic	.120"	.170"	10	5	6	3
Large Gothic	.180"	.180"	10	5	-	3

PLATENS

	Friction Feed	Sprocket Feed
Construction	Rubber covered cylinder, fixed to platen shaft.	Rubber covered cylinder, free on platen shaft.
Length	8-3/4"	Selected for desired form width.
Paper Width	Any width up to 8-1/2"	Minimum: 3-5/8" Maximum: 9"
Characters per line (10 per inch)	Margin is adjustable from 1 to 85 characters	Margin is adjustable from 1 to maximum number indicated in chart.

SPROCKET FEED PLATENS

Form Width in Inches	Maximum Characters* Per Line	Form Width in Inches	Maximum Characters* Per Line
9	77	5-3/4	44
8-1/2	72	5-1/2	42
8	67	5	37
7-1/2	62	4-1/2	32
7	57	4-5/16	30
6-1/2	52	4-1/4	29
6-3/8	51	4	27
6-1/4	50	3-5/8	23
6	47		

* Based on ten characters per inch with allowance of three characters for platen end play.

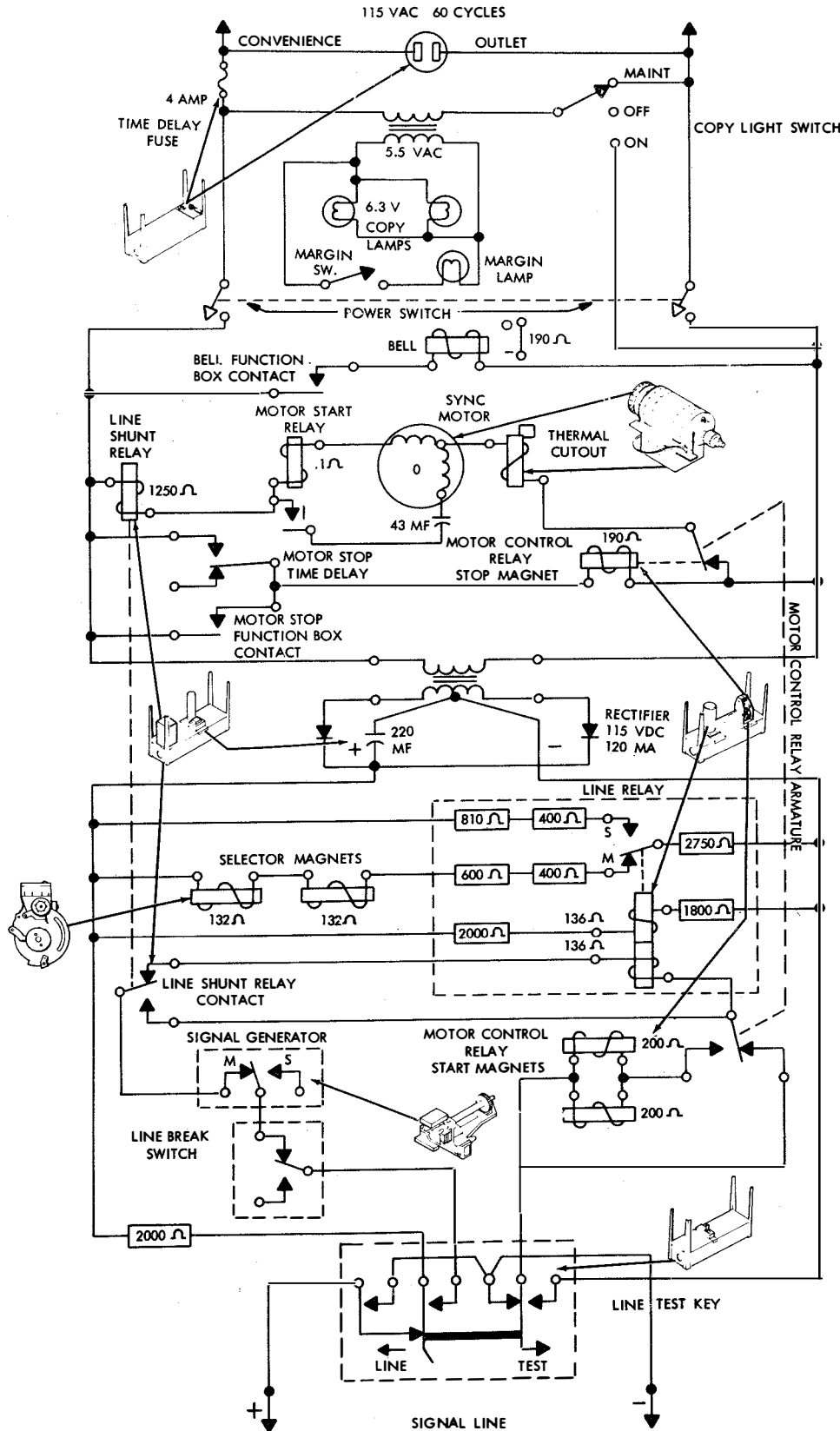


Figure 7 - Typical Keyboard Send-Receive (KSR) Teletypewriter Set (Schematic Diagram)

SECTION 573-100-100

TYPING UNIT RIBBON

Style Black record ribbon
Length 33 feet
Width 1/2 inch
Thickness 0.0055 inch

TYPING UNIT PAPER (FRICTION FEED)

Type Standard yellow paper roll
Outside diameter 4-1/2 inch
Width 8.45 inch
Length 325 feet
Core diameter 1 inch
Core thickness 0.125 inch

28 TYPING UNIT

DESCRIPTION AND PRINCIPLES OF OPERATION

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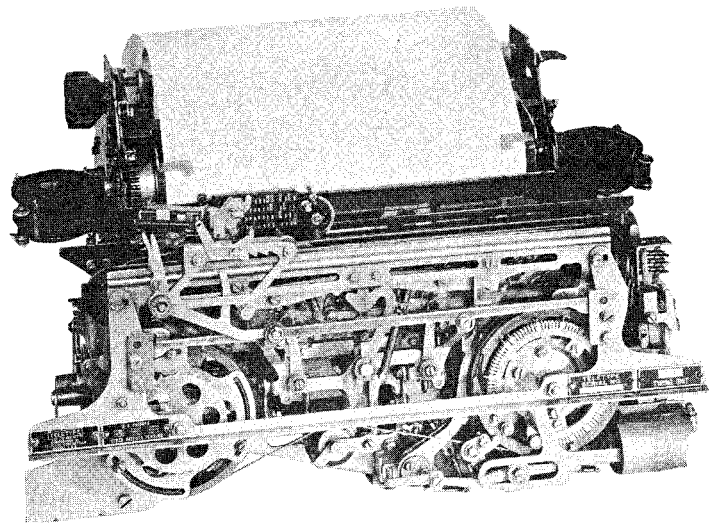


Figure 1 - 28 Typing Unit

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1. GENERAL

1.01 The 28 typing unit is an electromechanical unit that translates a five-level, electrical, start-stop (teletypewriter) code into mechanical motions that print information on page-width paper. It will operate at various speeds up to 100 words per minute. There are two basic units: The friction feed which prints on single or multiple copy paper fed from a roll, and the sprocket feed which prints on folded, form-feed paper with perforations spaced to fit teeth on the platen. In addition, a number of variable features are available.

1.02 Unless stated to the contrary, references in the text to "left" or "right" indicate the operator's right or left, facing the front of the unit, the selector mechanism at the right, and the type box at the front. 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 ellipses which are solid black to indicate fixed pivot points and crosshatched to indicate floating points.

1.03 With the main shaft under power (associated equipment main power supply on), the typing unit is described as running closed when a steady current (marking) condition is maintained in the signal line and no signal intelligence is received. It is described as running open when a no current (spacing) condition is maintained through an interruption in signal line current.

2. DESCRIPTION

GENERAL (Figs. 1 through 5)

2.01 The basic function of the 28 typing unit is to record in page printed form information received from a signal line in the form of a signaling code combination which represents characters or functions. The typing unit translates these electrical code combinations into mechanical motions which imprint the message or initiate the indicated function, such as line feed, carriage return, or signal bell. Printing is accomplished through an inked ribbon upon paper rolled around a horizontally stationary platen while the type and printing mechanism move from left to right across the page. All operations of the typing unit are performed automatically in response to input signal code combinations. A few local off-line functions such as line feed, or carriage return may be initiated

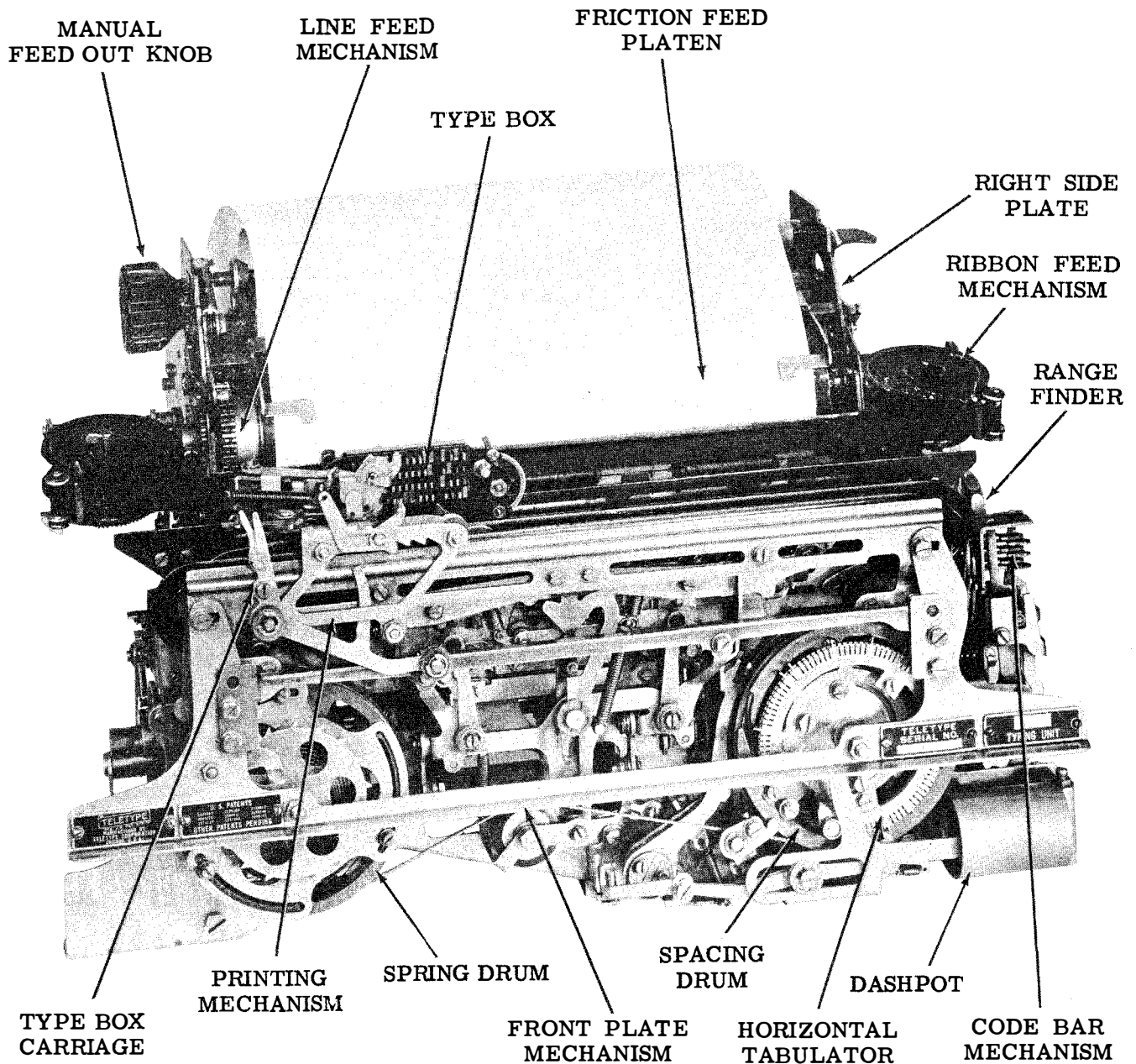


Figure 2 - 28 Typing Unit (Friction Feed) (Front View)

independently of the signal line from the local keyboard or base mechanism.

2.02 Character representations, or graphics, are the alphabetic, numeral or symbol intelligence equivalent of the input code combinations. Function representations are the coded equivalent of non-typing operations auxiliary to reception of the graphics, such as line feed, carriage return, or signal bell.

2.03 The speed of operation of the equipment is usually given in operations per minute. Speed in words per minute is roughly one-sixth of the operations per minute. The typing unit is designed to operate at 60, 75 or 100 words per minute, depending on the gear ratio used on associated equipment.

2.04 The typing unit is mounted on a receive-only base or a keyboard. Rotary mechanical motion for its operation and information

in the form of the signaling code come from external sources. A front plate and side plates provide mounting facilities for the various assemblies and mechanisms that make up the unit.

MAIN SHAFT

2.05 Motive power for operation of the typing unit is received through the intermediate gear mechanism of the base or keyboard base

on which the unit is mounted. Power is applied to the driven gear, centrally located on the main shaft at the rear of the typing unit. The main shaft rotates at a constant speed to operate the equipment at speeds of 60, 75 or 100 words per minute, depending upon external gear ratios.

2.06 Six all-steel internal expansion clutches convert the rotary motion of the main shaft to the linear mechanical requirements for

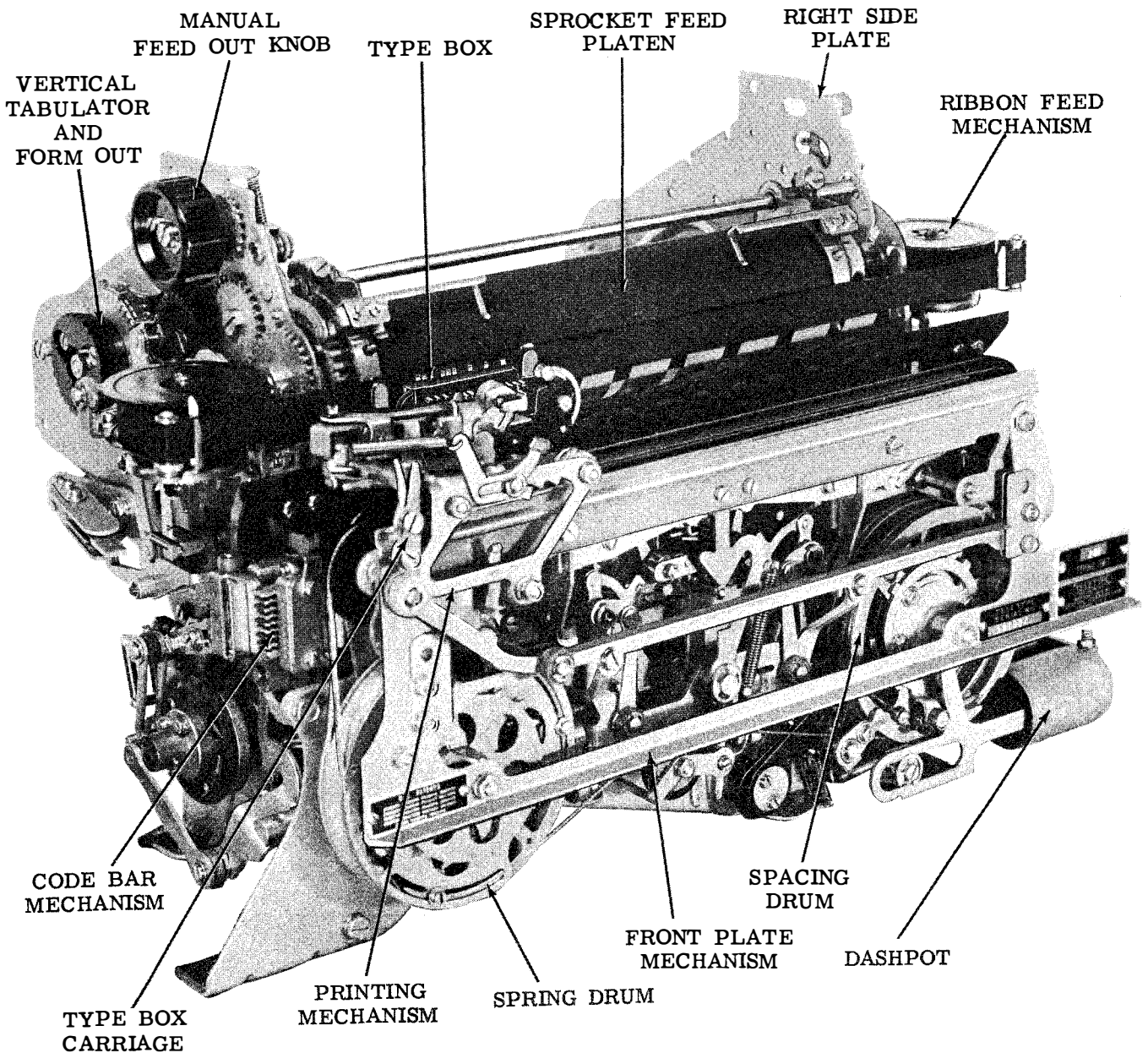


Figure 3 - 28 Typing Unit (Sprocket Feed) (Right Front View)

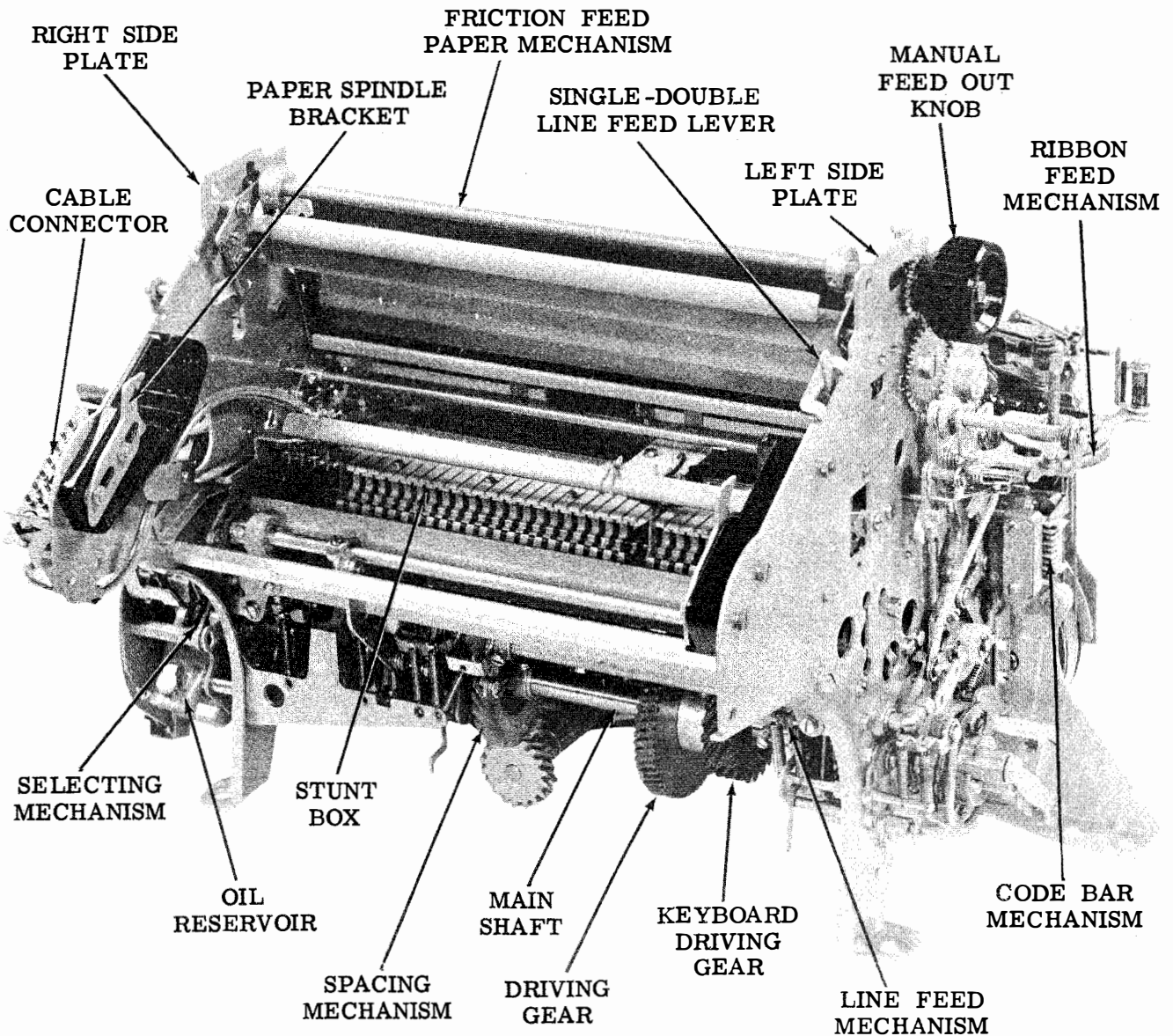


Figure 4 - 28 Typing Unit (Left Rear View)

operation of the printer. The clutches rotate with the main shaft when engaged and do not rotate when disengaged (latched). From left to right in their installed position on the main shaft, the clutches control the type box, line feed, spacing, function, code bar and selecting mechanisms, respectively.

SELECTING MECHANISM

2.07 A selecting mechanism translates the signaling code combinations into corresponding mechanical arrangements which control

the code bars. It includes a two-coil magnet that connects in series with the external signal line. The coils may be wired in either series or parallel to accommodate 0.020 ampere or 0.060 ampere line currents. A range finder is used to refine the mechanical orientation of the selector to the signaling code.

CODE BAR MECHANISM

2.08 The code bar mechanism, when positioned by the selecting mechanism to correspond to the input code intelligence, sets up mechanical

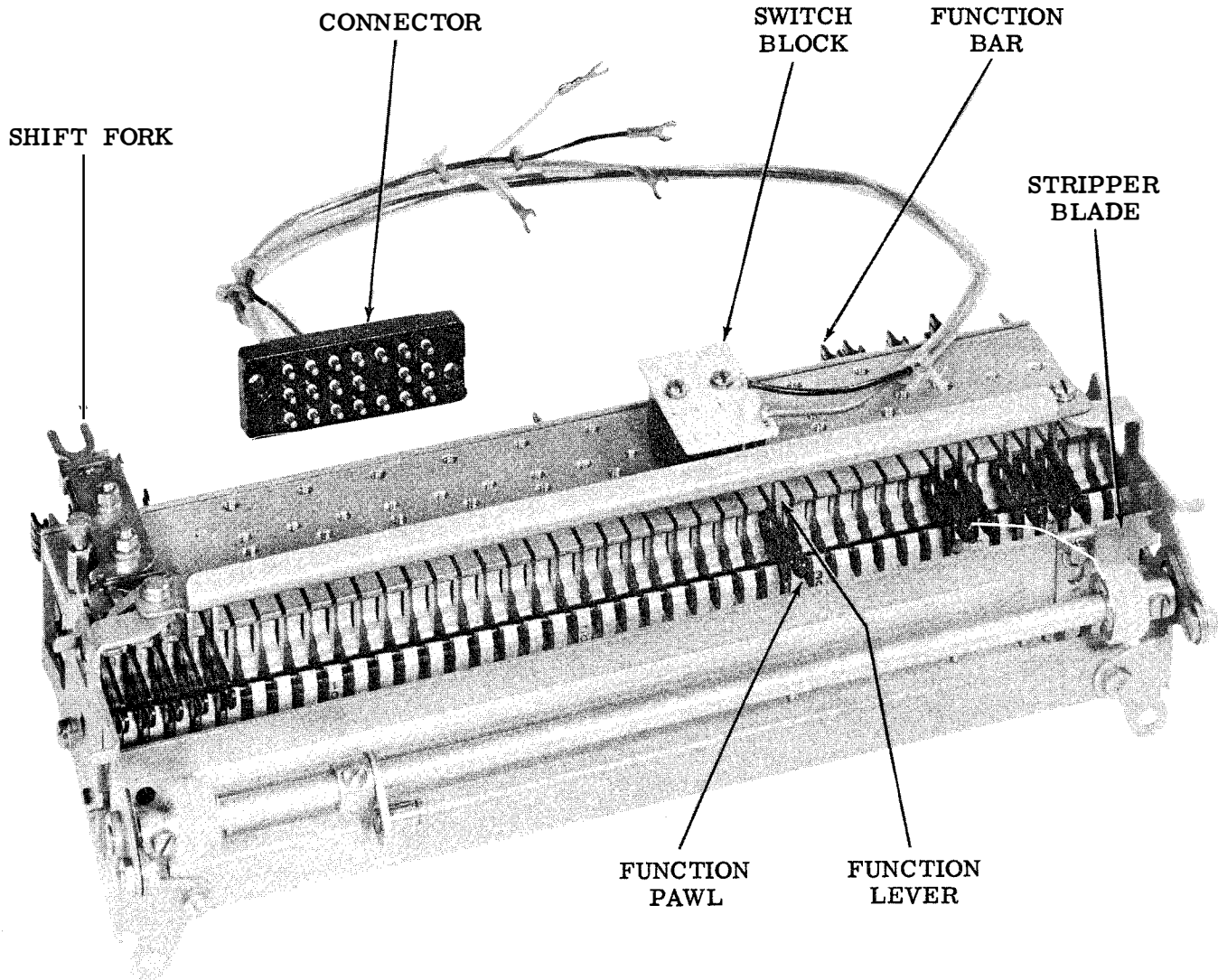


Figure 5 - Stunt Box (Rear View)

requirements for type box positioning, printing and stunt box operation.

PRINTING MECHANISM

2.09 When mechanically conditioned by the code bar mechanism, the printing mechanism prints the selected character and spaces

to the next printing area on the paper, or spaces without printing, or on units so equipped, tabulates horizontally, or returns the type box to the left hand printing margin. The mechanism includes horizontal positioning mechanism operated by the code bars, spacing mechanisms and carriage return, and the print hammer mechanism.

2.10 The type box is capable of vertical and horizontal positioning in response to the permutations set up by the code bar mechanism. When positioned to correspond to the input code intelligence, the type box presents a single type pallet with the embossed graphic equivalent of the selected code for printing. Printing is accomplished when this pallet is struck by the print hammer to press an inked ribbon against the paper, which is supported by the typing unit platen.

SPACING MECHANISM

2.11 The spacing mechanism moves the type box and printing mechanism one character to the right each time a graphic character is received and imprinted. A suppression mechanism prevents spacing on receipt of certain non-typing functions. On sprocket feed typing units, the spacing mechanism may be adapted to the page to predetermined stop positions.

LINE FEED MECHANISM

2.12 The line feed mechanism permits single or double line advance of paper in the platen mechanism when the code combination for this function is received. The function may also be initiated locally through mechanical linkage with the base or keyboard base. On sprocket feed typing units, the line feed mechanism may be adapted to vertical tabulation and to rapid form feed out.

STUNT BOX (Fig. 5)

2.13 The stunt box is a compact, self-contained device with memory storage capabilities that provides the typing unit with the facilities of a built-in sequence selector. In effect, it allows the 32 available letters and figures character combinations to be used again for special, non-printing operations, without the sacrifice of printed characters. It operates in response to combinations set up in the code bar mechanism with a single character or several characters in sequential combination used to initiate a single function. In general, the stunt box may be programmed to perform three basic types of operation: mechanical initiation of internal functions within the typing unit; electrical control of functions within the Teletypewriter Set; and electrical control of external equipment.

RIBBON FEED MECHANISM

2.14 A ribbon feed mechanism passes an inked fabric ribbon between the type box and the paper. The mechanism advances the ribbon

horizontally when each character has been printed and automatically reverses the direction of ribbon feed when one of the two ribbon spools has been emptied.

PAPER FEED MECHANISM

2.15 The platen and paper feed mechanisms are located at the top of the printer, between the two side plates. A manual paper or form feed out knob is located at the top of the left side plate. Paper is fed from a supply at the rear of the printer either by friction feed or on sprockets located on the ends of the platen.

3. TECHNICAL DATA

APPROXIMATE DIMENSIONS

Width	15-1/4 inches
Depth	10 inches
Height	9-3/4 inches
Weight	
Friction Feed	19 pounds
Sprocket Feed	22 pounds

SIGNAL REQUIREMENTS

Code	Sequential, 7.42 unit, Start-Stop
Current	
Selector coils in series	0.020 amperes
Selector coils in parallel	0.060 amperes

3.01 All electrical requirements for operation of the 28 typing unit are supplied through associated equipment, such as a base, keyboard base or electrical service unit. All electrical connections to the typing unit are made through a cable connector, mounted just above the selecting mechanism on the right side (Fig. 3).

3.02 The selector magnets may be operated with 0.020 ampere (coils in series) or 0.060 ampere (coils in parallel) dc signal line current. Signal-line inputs of the neutral form (non-polar) may be applied directly to the selector magnets. Polar signals require the use of a line relay.

3.03 Electrical contacts for certain variable features, such as the paper out alarm and the form out alarm, horizontal tabulator, vertical tabulator and form out generally require 115 vac circuitry. The circuits to stunt box switching contacts are determined by the specific nature of external controls operated by the contacts.

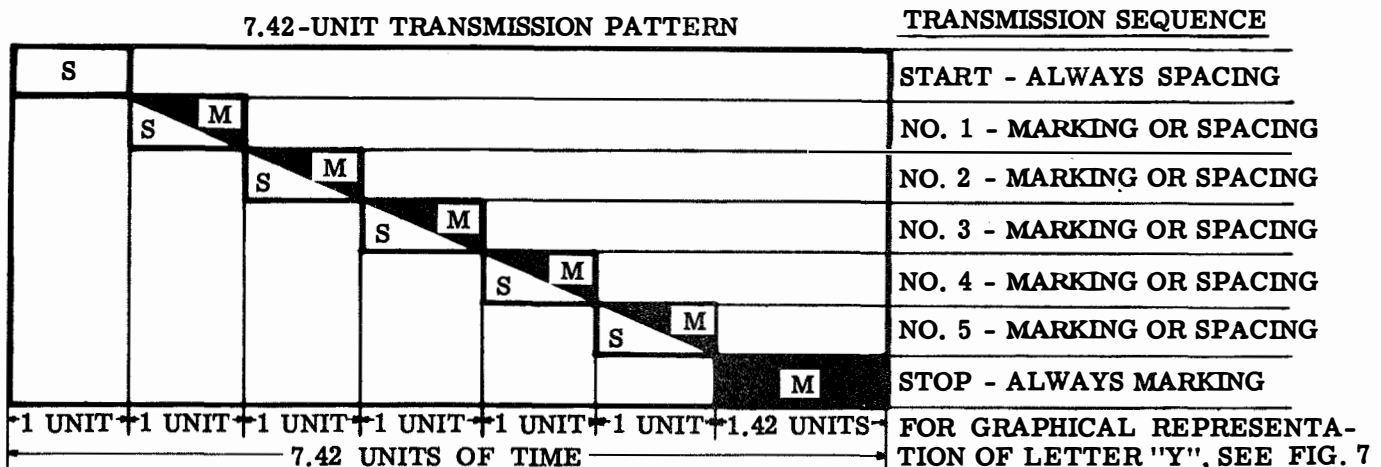
SIGNALING CODE (Fig. 6)

3.04 Information is received by the typing unit in the form of a 7.42 unit 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 those in which no current flows are spacing. Every combination includes five pulses (also referred to as levels) that carry the intelligence, each of which may be either marking or spacing. To insure synchronization between the transmitting and receiving equipment, a start pulse which is always spacing is added at the beginning of each combination of intelligence pulses, and a stop pulse which is always marking is added at the end.

3.05 The code representation for the graphics R and Y are illustrated in Figure 7. In these combinations, alternate marking and spacing conditions for the intelligence pulses are required.

3.06 In different signaling codes used with 28 teletypewriter equipment, the length of the stop pulse may vary. For example, in the code illustrated in Figure 6, the length of the stop pulse is 1.42 times the other pulses. Thus, the transmission of a graphic requires 7.42 units of time. It is therefore said to have a 7.42 unit transmission pattern. The stop pulse may be equal in duration to the other pulses in some applications, in which case the transmission code would have a 7.0 unit transmission pattern.

3.07 The total number of permutations of a five level (5 intelligence pulses) code is two to the fifth power, or 32. To accommodate more than 32 graphics, a letters-figures shift is designed into the typing unit. This is similar to the lower and upper case of a typewriter and permits each code combination, excluding the two used to shift the equipment, to represent two characters.



a.

FIGURES	-	?	:	\$	3	!	&	#	8	'	()	.	,	9	ø	1	4	Δ	5	7	;	2	/	6	"	∞	<	≡	■	V	Λ	
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	BLANK	C.R.	L.F.	SPACE	LTR.	FIG.	
1	●	●		●	●	●				●	●				●	●			●	●	●	●	●	●	●	●					●	●	
2	●		●				●		●	●	●	●			●	●	●			●	●	●	●					●				●	●
FEED HOLES	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3			●			●	●	●		●	●	●	●	●	●	●			●	●	●	●	●	●	●	●					●	●	
4		●	●	●		●	●	●		●	●	●	●	●	●	●			●	●	●	●	●	●	●	●					●	●	
5	●						●	●			●	●	●	●	●	●			●	●	●	●	●	●	●	●					●	●	

(TYPICAL CHARACTER ARRANGEMENT) b.

Figure 6 - Signaling Code

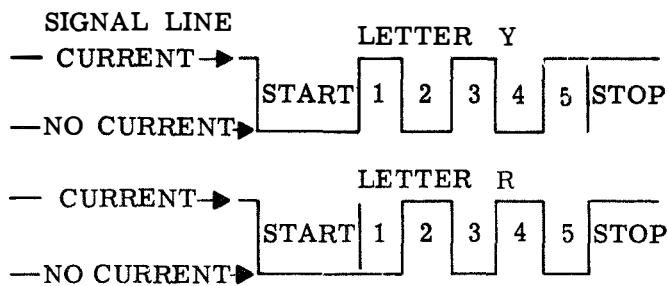


Figure 7 - Code Representation of R and Y

3.08 A typical character arrangement is shown on the chart of Figure 6. The block circles represent marking pulses, the blank squares spacing pulses. When the letters code combination (12345) is transmitted, it conditions all typing units connected to the circuit to print, at the receipt of all following code combinations, the characters in the letters (lower case) line on the chart. Similarly, when the figures code combination (12-45) is transmitted, it conditions the typing units to print the character or perform functions in the figure (upper case) line on the chart.

4. GENERAL OUTLINE OF OPERATION

4.01 The friction feed typing unit (Fig. 2) and the sprocket feed typing unit (Fig. 3) are essentially identical, except for differences in the paper feeding mechanisms. The following description of operation applies to both units, with the difference covered in par. 12 (friction feed) and par. 14 (sprocket feed).

4.02 The relationship of the operating mechanisms of the 28 typing unit are illustrated in the block diagram (Fig. 8). Rotary motion from the intermediate gear mechanism of an associated base or keyboard base is applied to the main shaft, which turns constantly as long as the associated unit is under power. A signal applied to the selector magnets initiates operating sequences. The application of voltage to the stunt box and to various switches and controls is dependent upon external circuitry and associated equipment.

4.03 The signaling code combinations are applied to the selecting mechanism through a cable connector located just above the selector

magnets. The start pulse (spacing) of each code combination permits the start lever to fall to the rear behind the magnet armature and rotate to trip the selector cam clutch. The range finder mechanism permits adjustment of the angular relationship of the trip-off point to the optimum quality incoming line signal.

4.04 The selector cam clutch, driven by the main shaft, as are all clutches, converts the incoming signal into mechanical marking or spacing equivalents of each pulse in the signal code. A cam on the selector cam clutch engages the code bar clutch when a signal code combination has been translated and locked in a mechanical arrangement in the selecting mechanism.

4.05 The code bar clutch initiates mechanical actions which position the code bars in patterns determined by the selecting mechanism (marking-left, spacing-right), and condition the typing unit for type box positioning, function selection and printing. A cam operated by the code bar clutch operates the function clutch and type box clutch trip mechanisms.

4.06 The function clutch controls the function bail and the stripper bail. The function reset bail permits transfer to intelligence from the code bars to the function mechanism and, upon receipt of a function code, operates the function linkage or switch or contact corresponding to the input signal code. The stripper bail resets selected function mechanisms. When the input signal calls for carriage return function, direct mechanical linkage between the stunt box and the spacing mechanism initiates this function. When the input signal calls for line feed, the function mechanism trips the line feed mechanism, engaging the line feed clutch.

4.07 The line feed clutch operates mechanical linkages which advance the paper one or two spaces by rotating the platen. On units so equipped, the page feed out mechanism also operates the line feed clutch trip mechanism.

4.08 The code bar mechanism (4.04) and the code bar clutch operate in combination to trip the type box clutch. When the type box clutch is tripped, it initiates mechanisms involved in vertical positioning of the type box, horizontal type box positioning, ribbon feed and printing. The main rocker bail provides power from the type box clutch (and main shaft), and the codebars determine the specific application of that power required for each input signal code combination representing a graphic. A cam plate on the main rocker bail trips the spacing

clutch stop mechanism to engage the spacing clutch, except when spacing is suppressed.

4.09 The spacing clutch, when tripped by the cam plate on the printing mechanism main rocker bail, advances the type box and printing hammer one character space to the right across the paper. Spacing suppression may be initiated by the function mechanism, to permit execution of a non-typing function without interference with the page printed message by the carriage return mechanism or by the printing mechanism when the type box reaches the end of a printed line.

4.10 The type box, positioned by the printing and spacing mechanisms in accordance with intelligence set up in the code bars, presents a single graphic in printing position for each operating cycle. To prevent printing during a function selection, the type box is positioned to present a vacant type-pallet position. At the proper moment, with the type box locked in printing position, a spring loaded print hammer is released to tap the selected type pallet sharply against the inked ribbon and the paper. A cleanly imprinted graphic character corresponding to the input signal code combination results, and the printing mechanism trips the spacing clutch to move both the type box and the print hammer to the next horizontal printing position to the right.

5. DISTRIBUTION OF MOTION (Fig. 9)

GENERAL

5.01 The main shaft is located in the lower rear portion of the typing unit, supported between the two side frames by ball bearings. It extends the full width of the unit.

5.02 Centrally located on the shaft are two driving gears. The larger gear meshes with the intermediate gear mechanism of the associated base or keyboard base to transmit power from the motor to the typing unit. The smaller gear drives the signal generator mechanism of an associated keyboard base.

5.03 Power take-off from the constantly rotating main shaft is controlled by six clutches, each of which, when tripped (engaged, or unlatched) drives its associated mechanism. From the right end of the shaft, these clutches may be identified as the selector clutch (with cam sleeve), the code bar clutch, the function clutch, the spacing clutch, the line feed clutch

and the type box clutch. The sequence in which these clutches are tripped is, selector, code bar, function, type box, spacing and line feed. However, the type box and spacing clutch engagement may be suppressed under certain operating conditions, and the line feed clutch is operative only upon a specific set of input signal code combinations.

5.04 The spacing and line feed clutches are three stop clutches (Fig. 10), each permitting their associated mechanism to operate through one-third of a revolution of the main shaft. All other clutches are one stop clutches (Figs. 11 and 12), operating through an entire revolution of the main shaft.

ONE STOP CLUTCHES (Figs. 11 and 12)

5.05 The clutch drums are attached to and rotate with the main shaft (Fig. 9). In the disengaged position, as shown in Fig. 11, the clutch shoes do not contact the drum, and the shoes and cam disk are held stationary. Engagement is accomplished by moving the stop arm (Fig. 12) toward the rear of the typing unit, away from the clutch, thus releasing stop lug A and the lower end of shoe lever B (Fig. 12). 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 lower end of the secondary shoe then bears against 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 disk, and the disk and attached cam turn in unison with the drum.

5.06 Disengagement is effected when the lower end of shoe lever B strikes the stop arm. Lug A and the lower end of the shoe lever are brought together (Fig. 11), and the upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum. The latch lever seats in the indent in the cam disk, and the cam is held in its stop position until the clutch is again engaged.

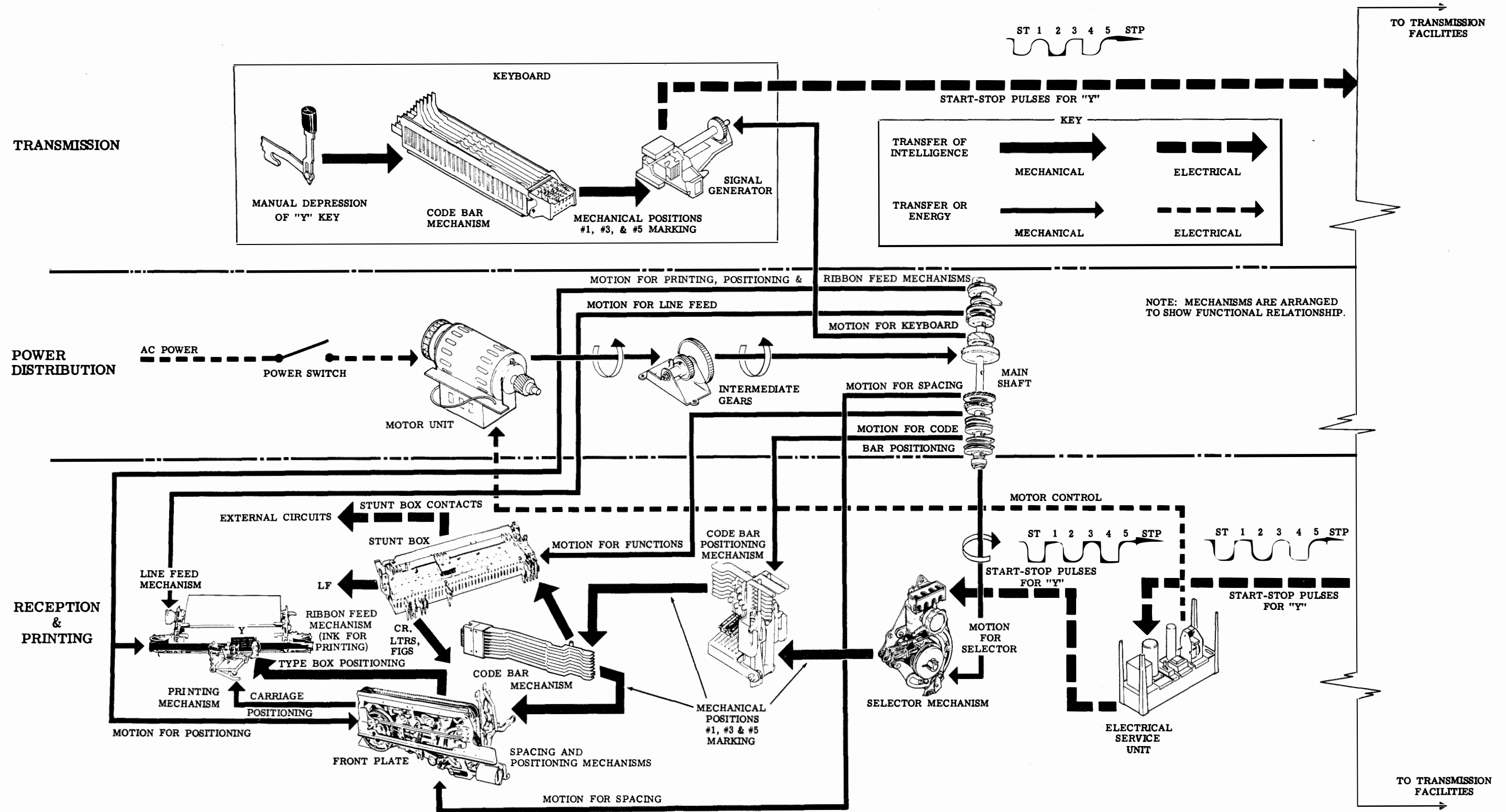


Figure 8 - 28 Typing Unit, Schematic Diagram

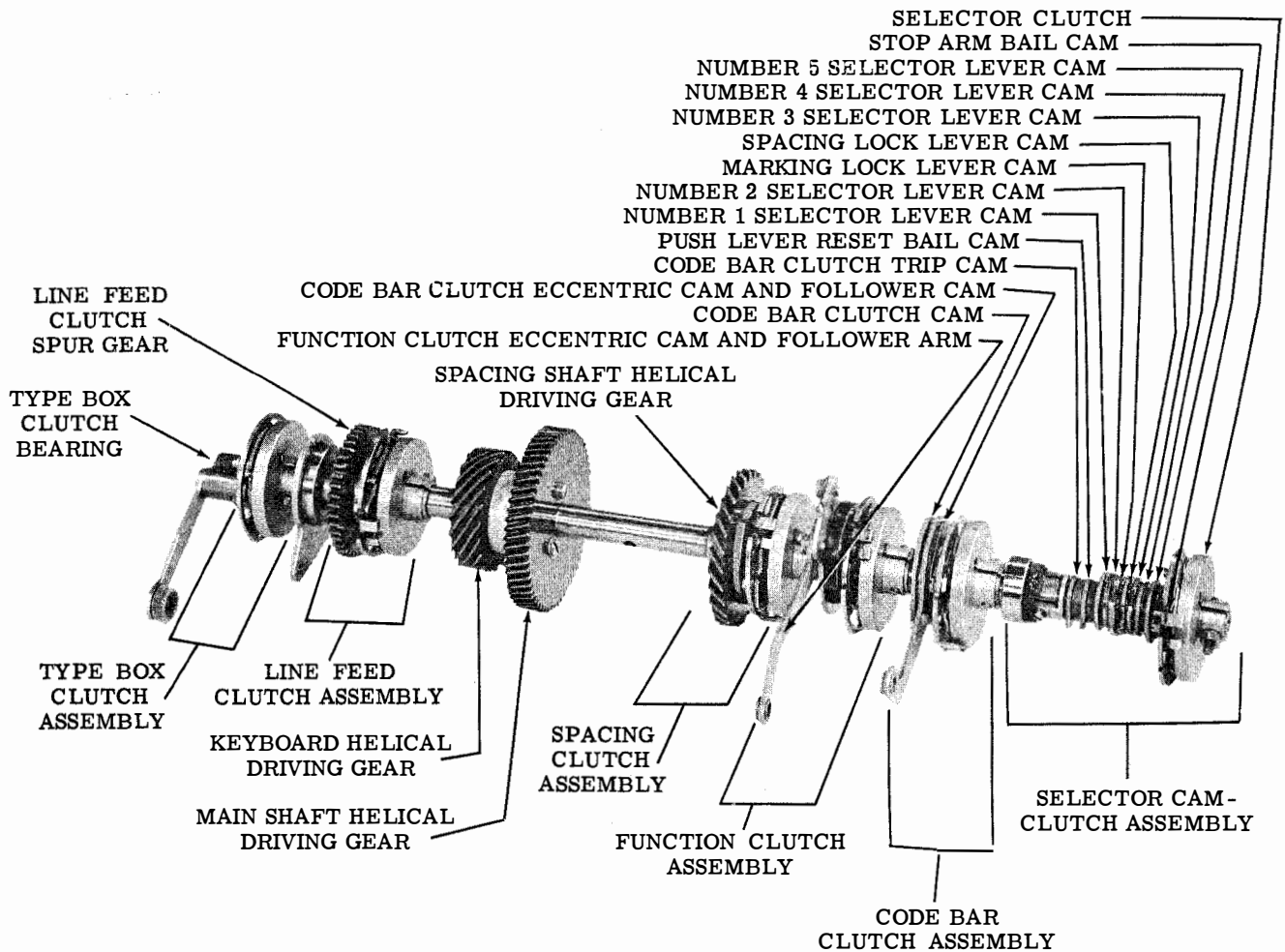


Figure 9 - Main Shaft

THREE STOP CLUTCHES (Fig. 10)

5.07 Two of the clutches, spacing and line feed, have three sets of lugs equally spaced about their periphery. The action is as described in 5.05-5.06, but the clutch is permitted to rotate through only one-third revolution before the stop lever and latch lever halt its motion.

6. SELECTION

GENERAL

6.01 The selecting mechanism consists of two magnet coils, an armature, a selector cam clutch, and the associated levers, arms,

bails and slides necessary to convert the electrical pulses of the start-stop code to the mechanical arrangements which govern the character to be printed and the function to be performed.

SELECTOR MECHANISM (Figs. 9, 13 and 14)

6.02 The selector cam clutch comprises, from right to left (Fig. 9) the clutch, the stop arm bail cam, the fifth, fourth, and the third selector lever cams, the cam for spacing and marking lock levers, the second and first selector lever cams, the push lever reset bail cam, and the code bar clutch trip cam.

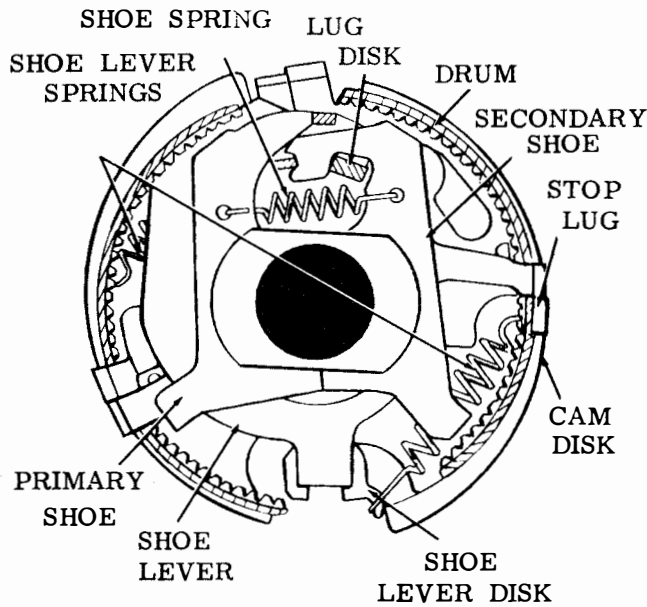


Figure 10 - Three Stop Clutch

6.03 During the time in which a closed line circuit (marking) condition exists, the selector magnet coils are energized and hold the selector armature against the selector magnet pole pieces. In this stop position, the selector armature blocks the start lever (Fig. 13). While the signal for any character or function

is being received, the start (spacing) pulse releases the selector armature which, under the tension of its spring, moves away from the magnet cores, and thus unlatches the start lever. The start lever rotates clockwise (as viewed from the right) under tension of its spring, moving the stop arm bail into the indent of the first cam. 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 selector cam clutch engages and begins to rotate. The stop arm bail immediately rides to the high part of its cam, where it remains to hold the start lever away from the selector armature during the reception of the signal code combination. When the stop pulse at the end of the signal code combination is received, the selector armature is pulled up to block the start lever. Thus, the stop arm bail is prevented from dropping into the indent of its cam, and the attached stop arm is held so as to stop the clutch shoe lever. The clutch cam disk upon which the latch lever rides has an indent as its stop position. When the clutch shoe lever strikes the stop arm, the inertia of the cam disk assembly causes it to continue to turn until its lug makes contact with the lug on the clutch shoe lever. At this point, the latch lever drops into the indent in the cam disk, and the clutch is held disengaged until the next start bit is received.

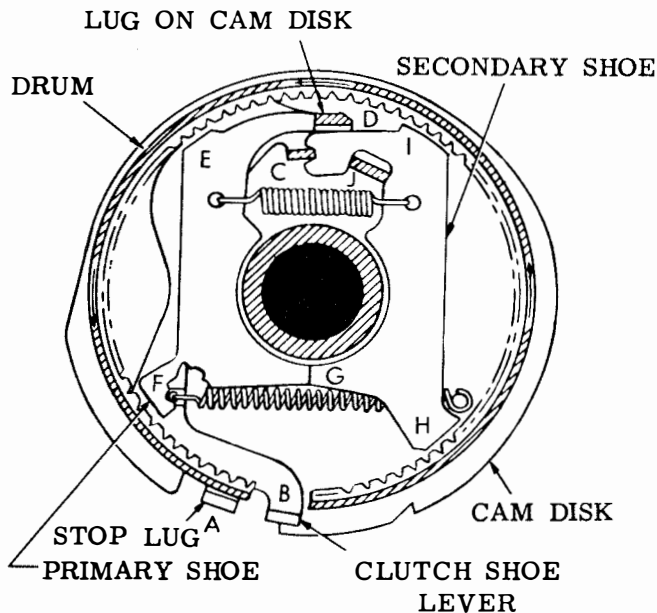


Figure 11 - One Stop Clutch (Disengaged)

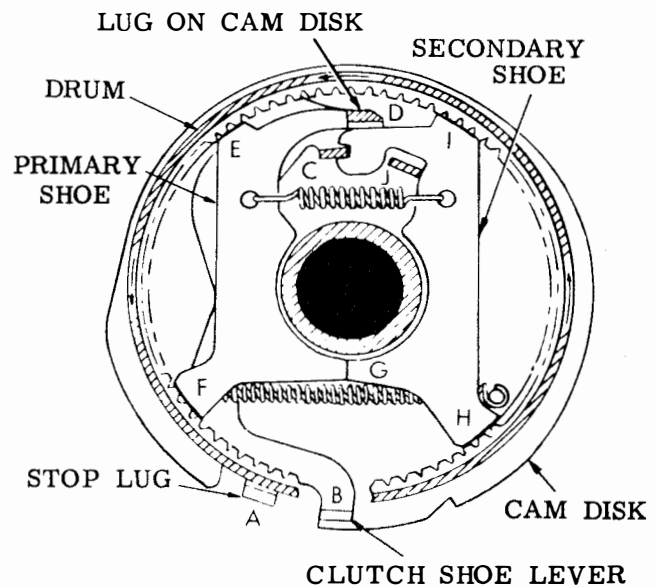


Figure 12 - One Stop Clutch (Engaged)

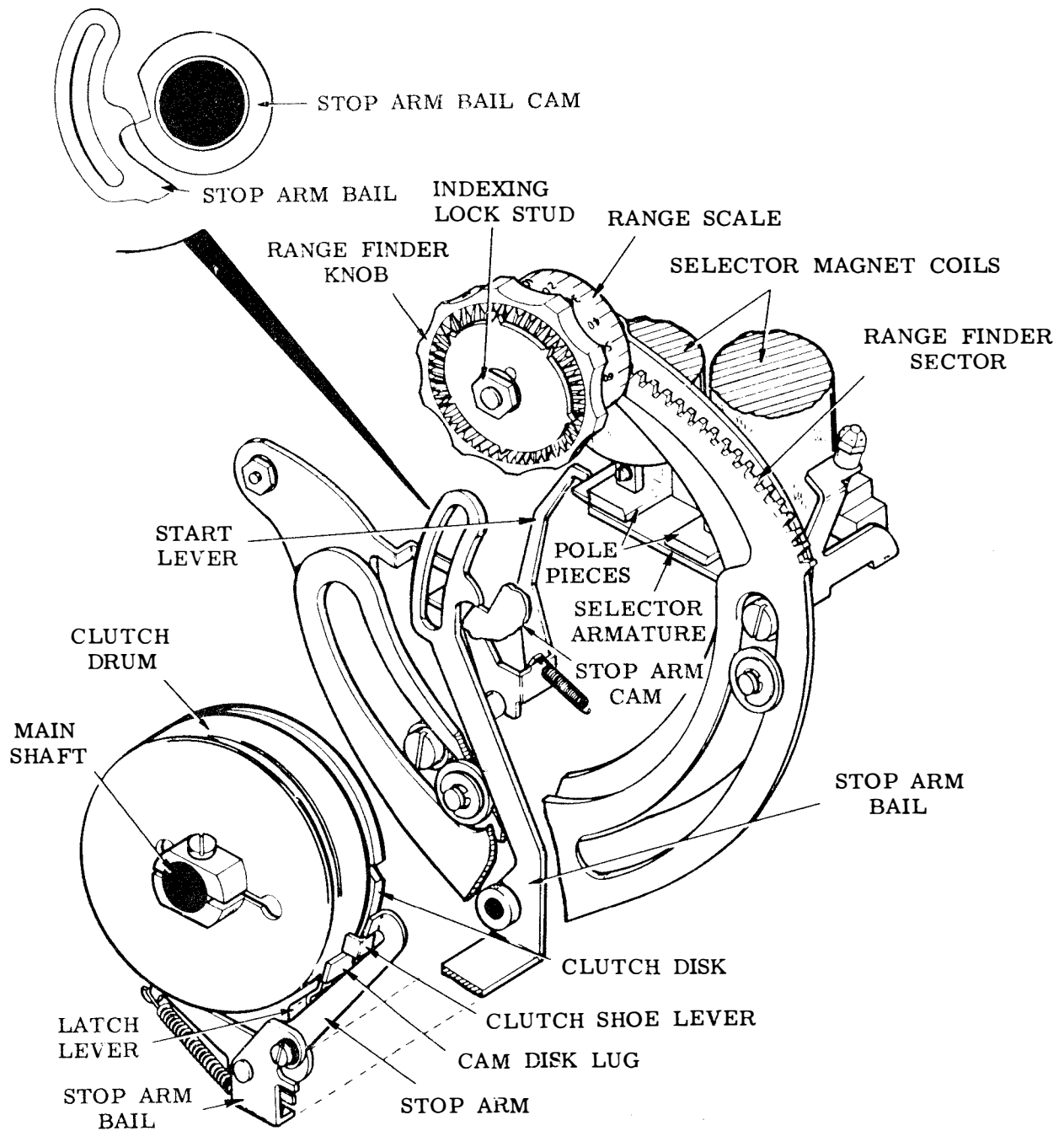


Figure 13 - Selector Clutch and Range Finder

6.04 The series of five selecting levers and a marking lock lever ride their respective cams on the selector cam clutch. As the marking or spacing signal pulses are applied to the selector magnets, the selector cam clutch rotates and actuates the selector levers. When a spacing pulse is received, the marking lock lever is blocked by the end of the armature, and

the spacing lock lever swings toward the rear, above the armature, and locks it in the spacing position until the next signal pulse is received. Extensions on the marking lock lever prevent the selector levers from following their cams (Fig. 14). When a marking pulse is received, the spacing lock lever is blocked by the end of the armature, and the marking lock lever swings

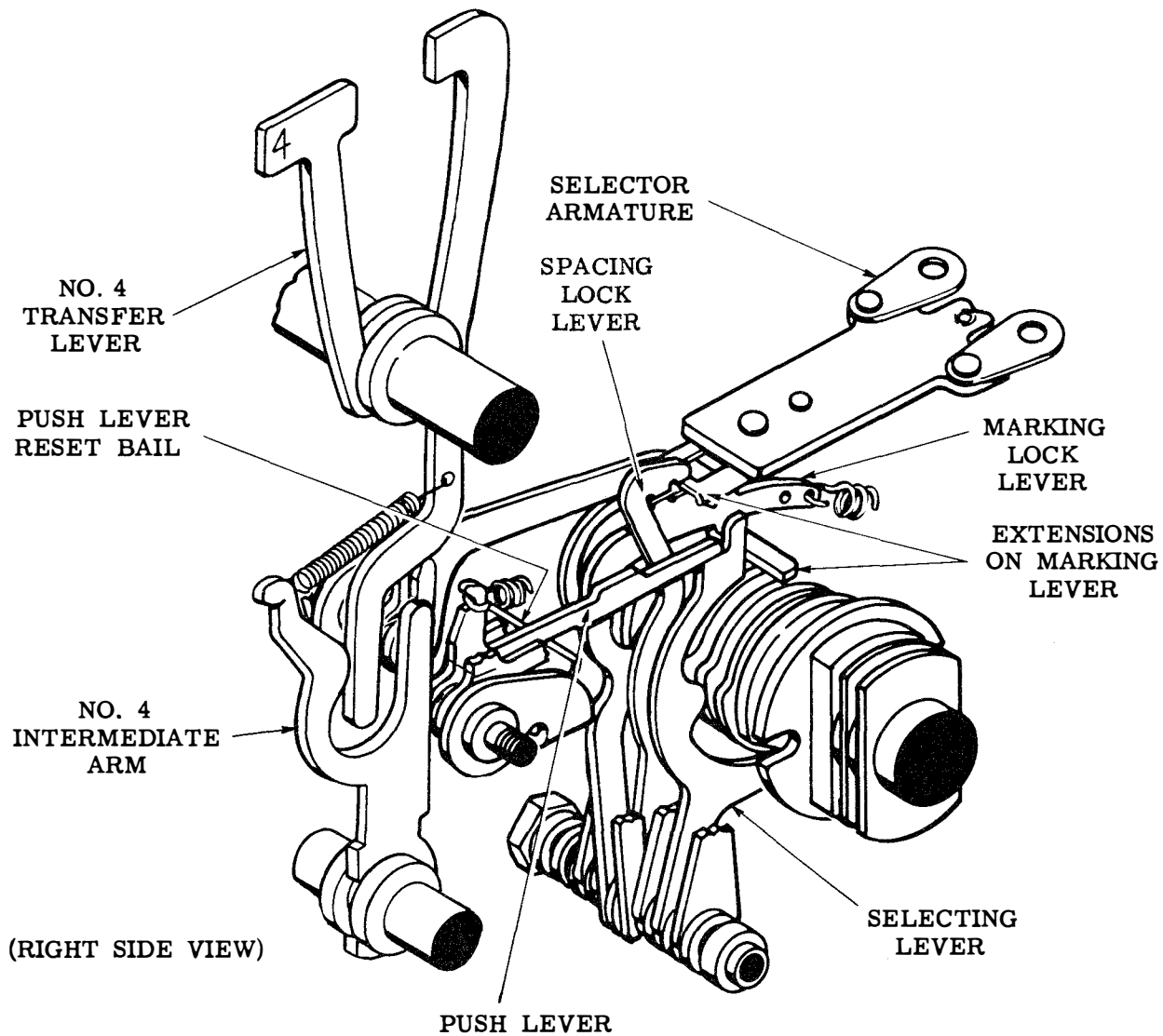


Figure 14 - Selecting Mechanism and Transfer Mechanism

to the rear, below the armature, to lock it in the marking position until the next signal pulse is received. During this marking condition, the selector levers are not blocked by the marking lock lever and are permitted to move against their respective cams. The selecting lever that is opposite the indent in its cam while the armature is locked in marking condition swings to the rear, or selected, position momentarily.

6.05 Each selecting lever has an associated push lever which drops into a notch on the top of the selecting lever when the selecting lever falls into the indent in its cam. As the

selector cam clutch rotates, each selecting lever is moved forward as it rides to the high part of its cam. Selected (dropped) push bars are also moved forward. Unselected push bars remain in the rear position, on top of the notch of the selecting lever. When all five code pulses have been received, push levers are held in their selected or unselected position until the next start bit is received.

6.06 When the subsequent start pulse is received, the cam clutch is again engaged. The push lever reset bail, following its cam, unlatches the selected push levers. The push

levers then return to their unselected (rear) position under their spring tension.

ORIENTATION

6.07 For optimum performance, the selecting mechanism should sample the code elements at the most favorable time. Manual operation of the range finder varies the time of sampling between the operating margins. Adjusting the range finder is called orientation.

6.08 When the range finder knob (Fig. 13) is pushed inward and rotated, its attached range finder gear moves the range finder sector (which mounts the stop arm bail, stop arm and latch lever) either clockwise or counterclockwise about the selector cam clutch. This changes

the angular position at which the selector cam clutch stops with respect to the selecting levers. When an optimum setting is obtained, the range finder knob is released. Its inner teeth engage the teeth of the indexing lock stud to lock the range finder mechanism in position. The setting may be read on the range finder scale opposite the fixed index mark.

7. POSITIONING THE CODE BARS

CODE BAR MECHANISM (Fig. 15)

7.01 The character printed or the function performed by the typing unit is basically determined by the code bar mechanism, to which the input signal intelligence, translated into mechanical form, is transmitted from the

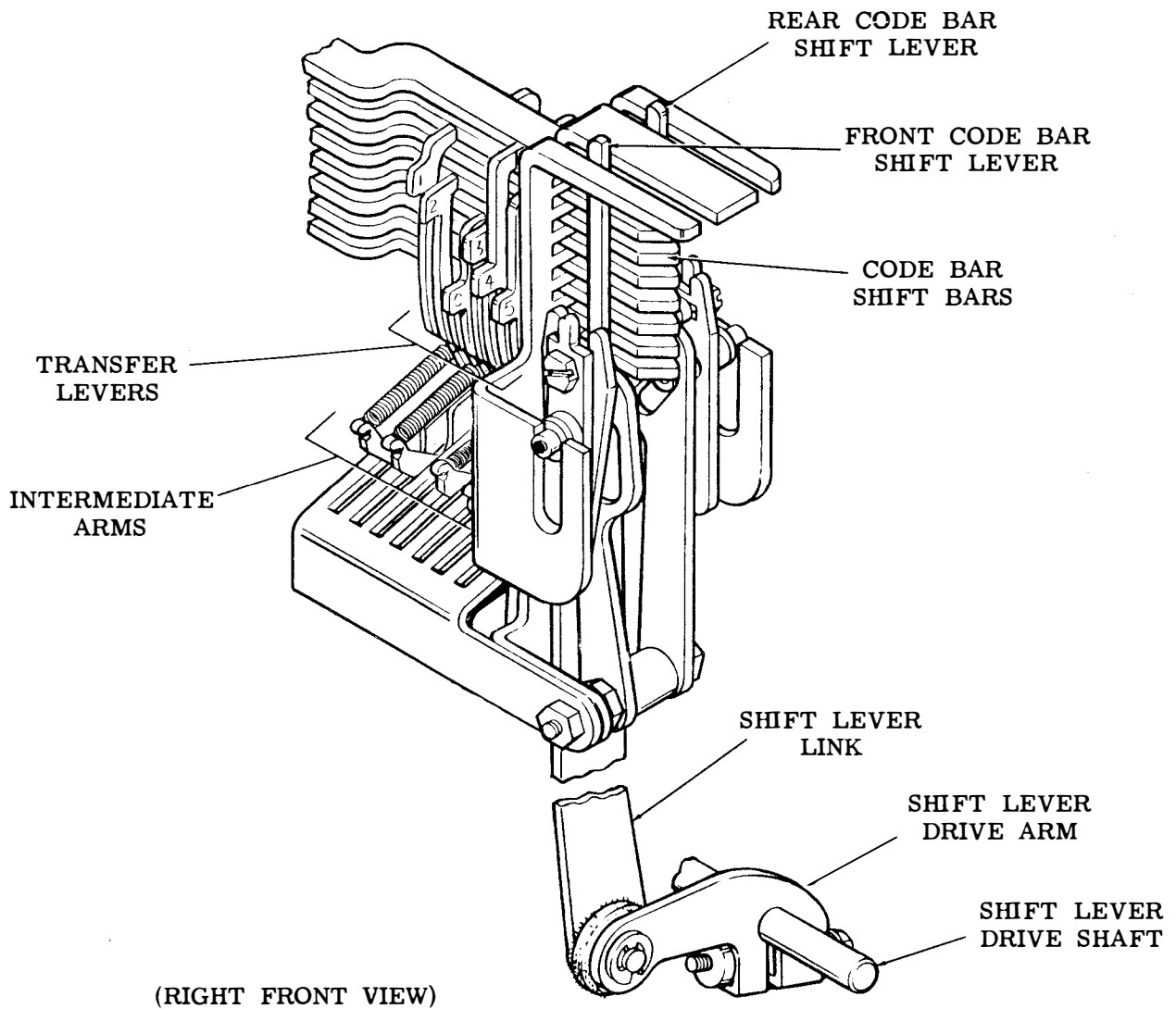


Figure 15 - Code Bar Mechanism

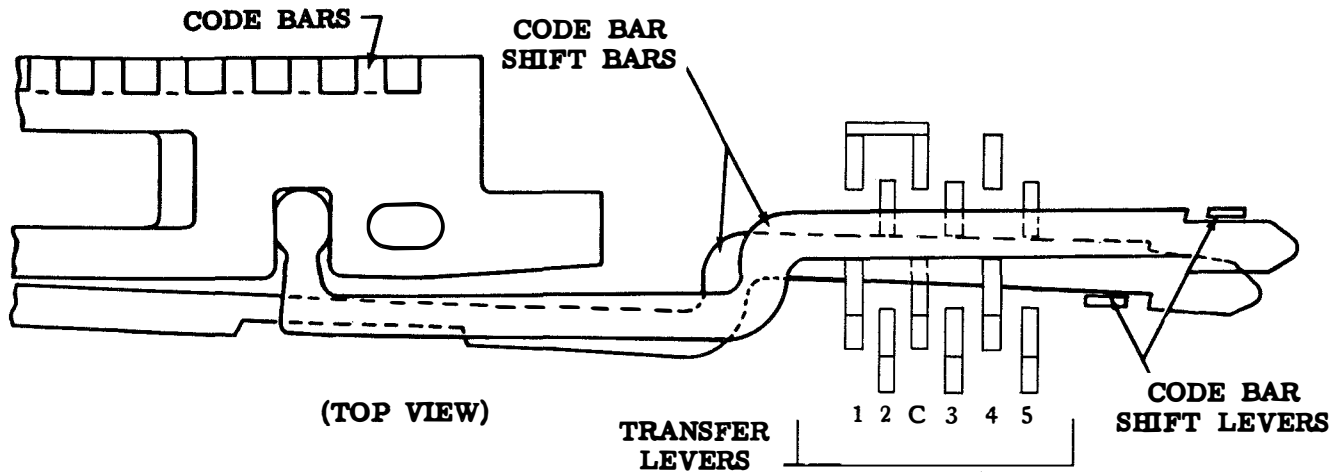


Figure 16 - Code Bar Shift Bar Positioning

selecting mechanism push bars. The code bars are positioned by code bar shift bars which move to the left for marking and to the right for spacing. The shift bars, positioned to the rear for marking and forward for spacing, are pushed into marking position by selected push bars through a mechanical linkage intermediate arms and transfer levers.

7.02 Power to position the selected code bar levers, and through them the code bars, is supplied by the code bar clutch. The code bar clutch is engaged by its cam on the selector cam clutch (6.02).

CODE BAR OPERATION (Figs. 15, 16 and 17)

7.03 Each selector push lever (6.04) has an associated intermediate arm, transfer lever, and code bar shift bar (Fig. 15). In addition, there is a common transfer lever with its code bar shift bar. When a push lever is toward the rear (spacing) its associated intermediate arm and transfer lever are pulled toward each other by a spring. The upper end of the transfer lever is held forward (spacing), holding the code bar shift bar in spacing position. When a push lever is moved forward (marking), it rotates the intermediate arm counterclockwise, positioning the transfer lever to the rear (marking) and holding the code bar shift bar in marking position. The common transfer lever (third from left, operating the common code bar, third from bottom) has an extension which passes behind the number 1 and 2 transfer levers. There is no connection between the common transfer lever and the selecting mechanism, but when either the number 1 or number 2 push bar is selected, the associated transfer levers position the common code bar shift bar to the rear (marking). The right ends of these code bars determine vertical positioning of the type box (Fig. 17).

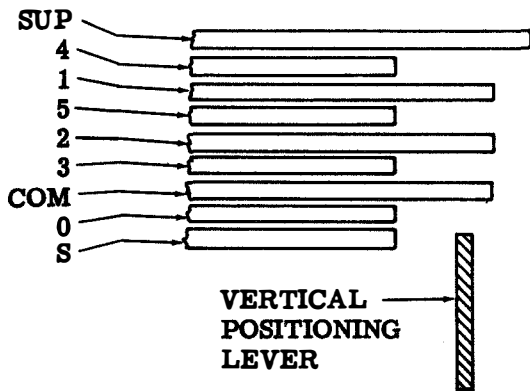


Figure 17 - Vertical Arrangement of Code Bars

7.04 As the selector cam clutch completes its revolution, the trip shaft operating lever rides to the peak of the code bar clutch trip cam (Fig. 9). The peak of the shaft turn slightly (counterclockwise, viewed from the right) to move the code bar clutch trip lever away from the clutch stop lug and engage the clutch. Rota-

tion of the clutch operates an eccentric and the shift lever drive shaft, shift lever drive arm and shift lever drive link. The drive link moves two code bar shift levers in a scissors like action, the front lever moving to the left, the rear lever moving to the right. Any code bar shift bar in marking position(left) during the previous operating cycle is moved to spacing position (right) by the forward shift lever, unless the transfer lever is once again holding that bar to the rear (marking). The rear shift bar, as it moves to the left (Fig. 16) carries with it any code bar shift bar held in the marking position, completing the transfer of intelligence from the selecting mechanism to the code bars.

7.05 At the end of one revolution, the code bar clutch trip lever strikes the clutch shoe lever. Inertia of the cam disk assembly causes it to continue to turn to permit the latch lever to drop into the indent in the cam disk, and the clutch is held disengaged. The code bars, code bar shift bars and shift levers are held in the selected position, but the transfer levers and intermediate arms are free to position the shift bars forward or to the rear in response to new input signal intelligence from the selector.

CODE BAR ARRANGEMENT (Fig. 17)

7.06 A total of nine code bars in marking (left) or spacing (right) position convey mechanically translated signal intelligence to the typing and function mechanisms. The code bars are arranged from top to bottom as follows: suppression, number 4, number 1, number 5, number 2, number 3, common, zero (0) and letters-figures shift (S).

8. POSITIONING THE TYPE BOX

GENERAL

8.01 All of the characters (graphics) that may be printed by the typing unit are formed by type pallets which are arranged in a type box. The type box is mounted in a carriage from which it may be removed for cleaning or replacement. In order to print any selected character, the type box carriage is so positioned that the character on the pallet is directly over the desired location on the paper. Since the pallets are arranged in four horizontal rows and sixteen vertical rows, it is necessary to position the type box carriage both horizontally and vertically. See Fig. 18 for arrangement of graphics which are represented on the type box pallets. See Fig. 6 for input signal code permutations equivalent to each graphic representation.

8.02 The type box carriage rides on rollers over a track which is moved vertically for positioning in that particular plane. The carriage is positioned horizontally on its track by the oscillating rail slide and type box carriage link. The slide rides the oscillating rail and is clamped to the rear section of the upper draw wire rope. The link provides a flexible connection to permit the type box carriage to follow both the vertical movement of the type box carriage track and the horizontal movement of the oscillating rail slide.

8.03 The lower right rear end of the upper draw wire rope is fastened to the spacing drum. From this point, it passes part way around the spacing drum, upward and around

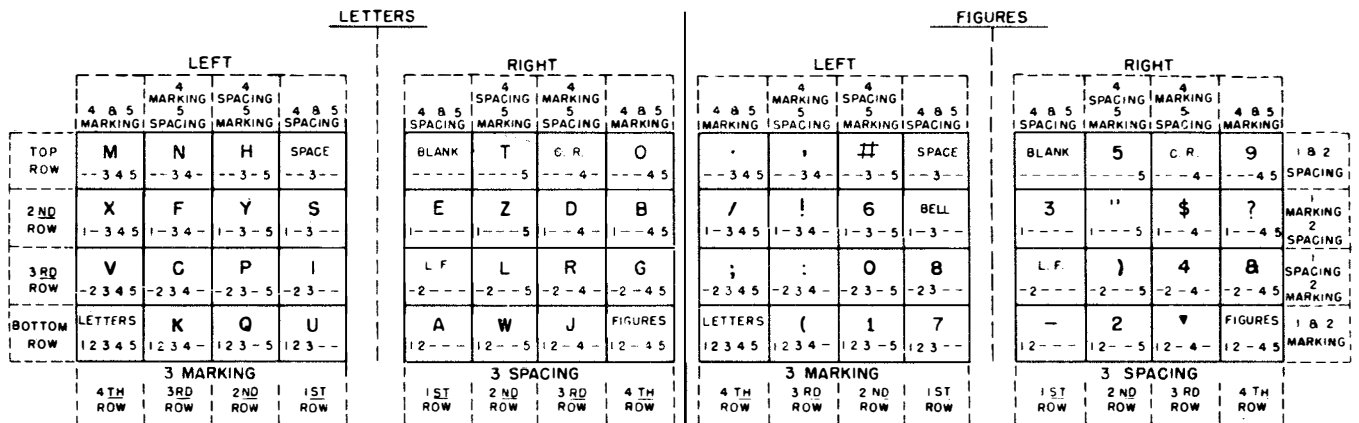


Figure 18 - Typical Type Box Pallet Arrangement

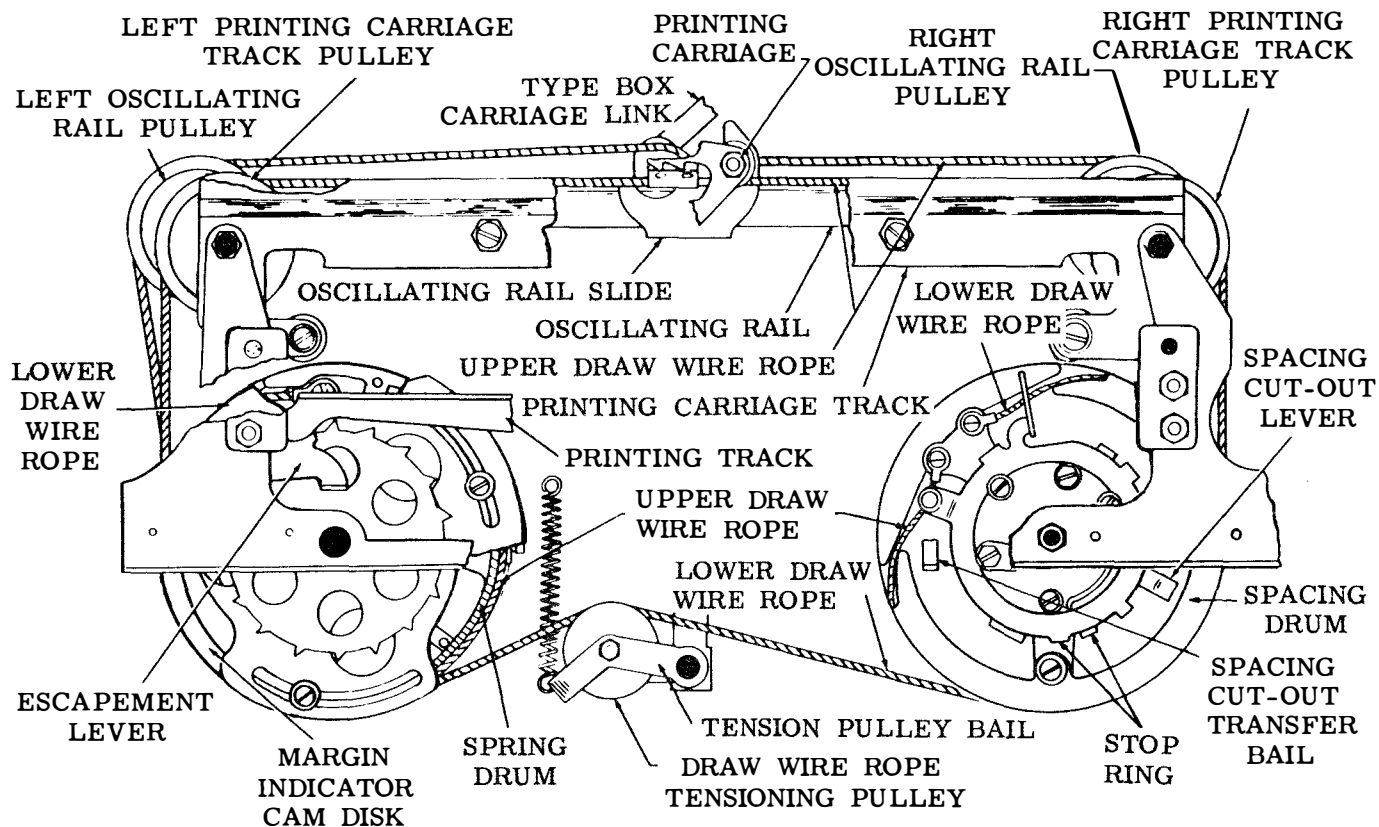


Figure 19 - Draw Wire Rope and Drums

the right rail pulley and downward to the spring drum. After passing part way around the spring drum, the upper draw wire rope is doubled backward around it and passes upward to the left printing carriage rail pulley over to the right printing carriage rail pulley, and downward to the spacing drum to which it is again fastened. The lower draw wire rope is fastened at its left end to the spring drum and, at its right end, to the spacing drum. It acts in opposition to the upper draw wire rope and holds the two drums in phase (Fig. 19). A tensioning pulley rides the under side of the lower draw wire rope, to take up any slack which may occur due to stretching of the upper and lower draw wire ropes.

8.04 The oscillating rail is supported by pivoted arms at each end. These arms which extend downward are pivoted on the typing unit frame at their lower ends. Thus, the oscillating rail and draw wire rope that it carries or which may be shifted to the left or right with no change in position relative to each other. The oscillating rail shift slide and two oscillating rail shift

links are used to accomplish the horizontal positioning of the oscillating rail and also connect it with the oscillating rail shift slide. The links are pivoted and are such a length that only one at a time may be fully extended.

LETTERS-FIGURES SHIFT (Fig. 20)

8.05 Mechanical limitations restrict the selection from the type box pallets to four horizontal rows and eight vertical rows. With a total of sixteen vertical rows in the type box, it is necessary to determine which of two fields, letters (left half of type box) or figures (right half of type box) will be presented for printing. To accomplish this, a special non-printing signal combination is used for each shift operation. Upon receipt of the letters or figures shift signal, mechanisms provided in the stunt box initiate the shifting operation. This, as are other non-printing operations, is described under Functions. The operation of the mechanisms that perform the actual shifting of the type box, however, are described below.

8.06 The lower most code bar, designated S, contains a pin near its right end that projects upward to permit engagement with the stunt box. The code bar is positioned to the left (the figures position) or to the right (the letters position). A slotted extension of the S code bar engage a tongue from the right end of the letters-figures shift slide and causes it to follow the S code bar movements. Pins at the end of the shift slide serve as lower guides for the right and left shift link breaker slides. Pins which project from the front plate serve as upper guides and pivot points. The main bail has left and right breaker slide bails mounted on its ends.

8.07 Upon receipt of the signal code for the letters shift operation, the shift slide is

moved to the right (Fig. 20). This positions the left shift link vertically with its lower end over the left breaker slide bail. The right breaker slide is positioned such that its lower end is to the right of the right breaker slide bail. As the main bail moves upward, the right breaker slide bail clears the right breaker slide, but the left breaker slide bail engages the left breaker slide and moves it upward. As a result of this action, the left oscillating rail shift links open and the oscillating rail is permitted to be moved to the right. This action presents the letters field in line for printing. In a similar manner, when the signal code for the figures shift is received, the right oscillating rail shift links are opened, the oscillating rail shifts to left, and the figures field of the type box is in line for printing.

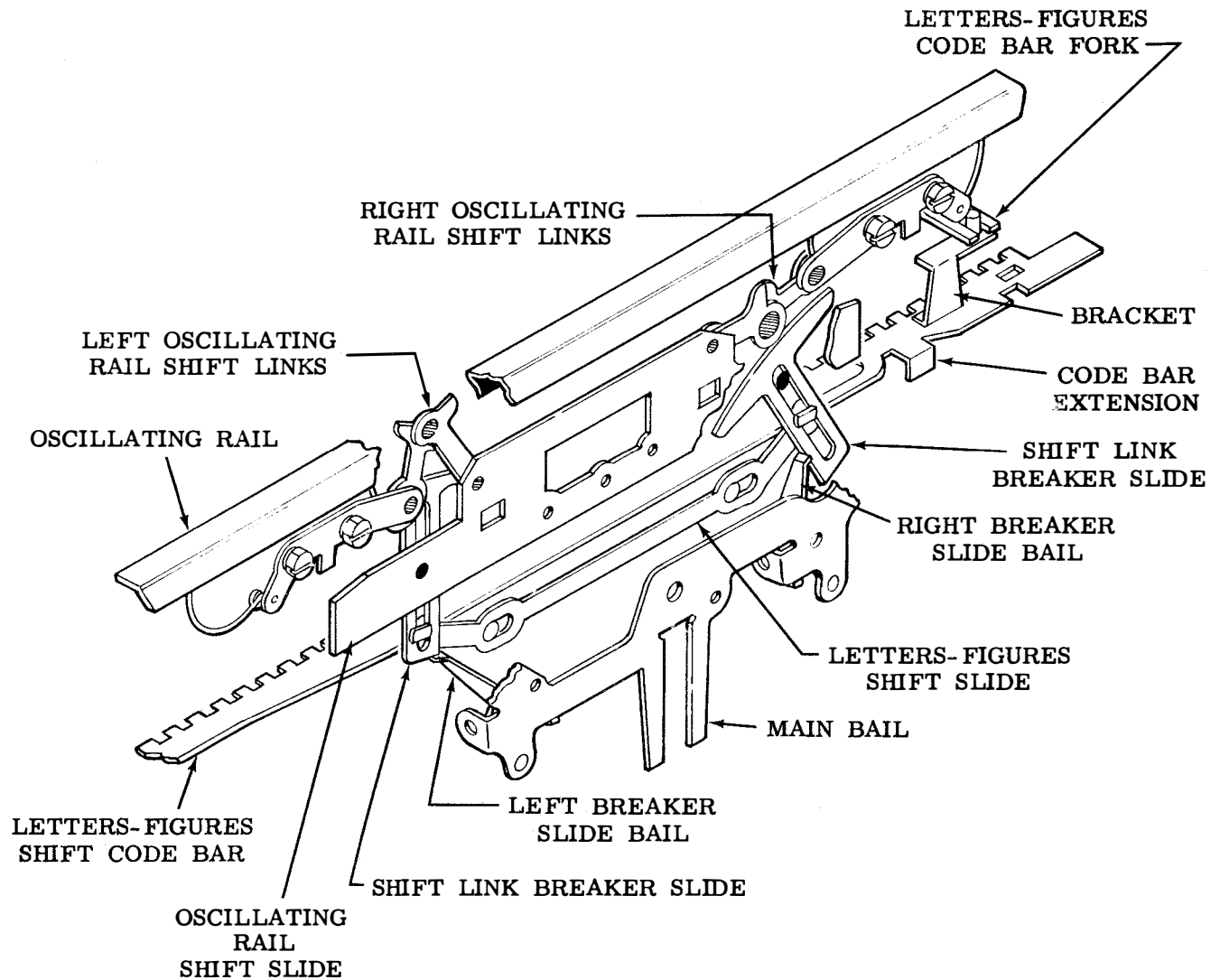


Figure 20 - Letters- Figures Shift Mechanism

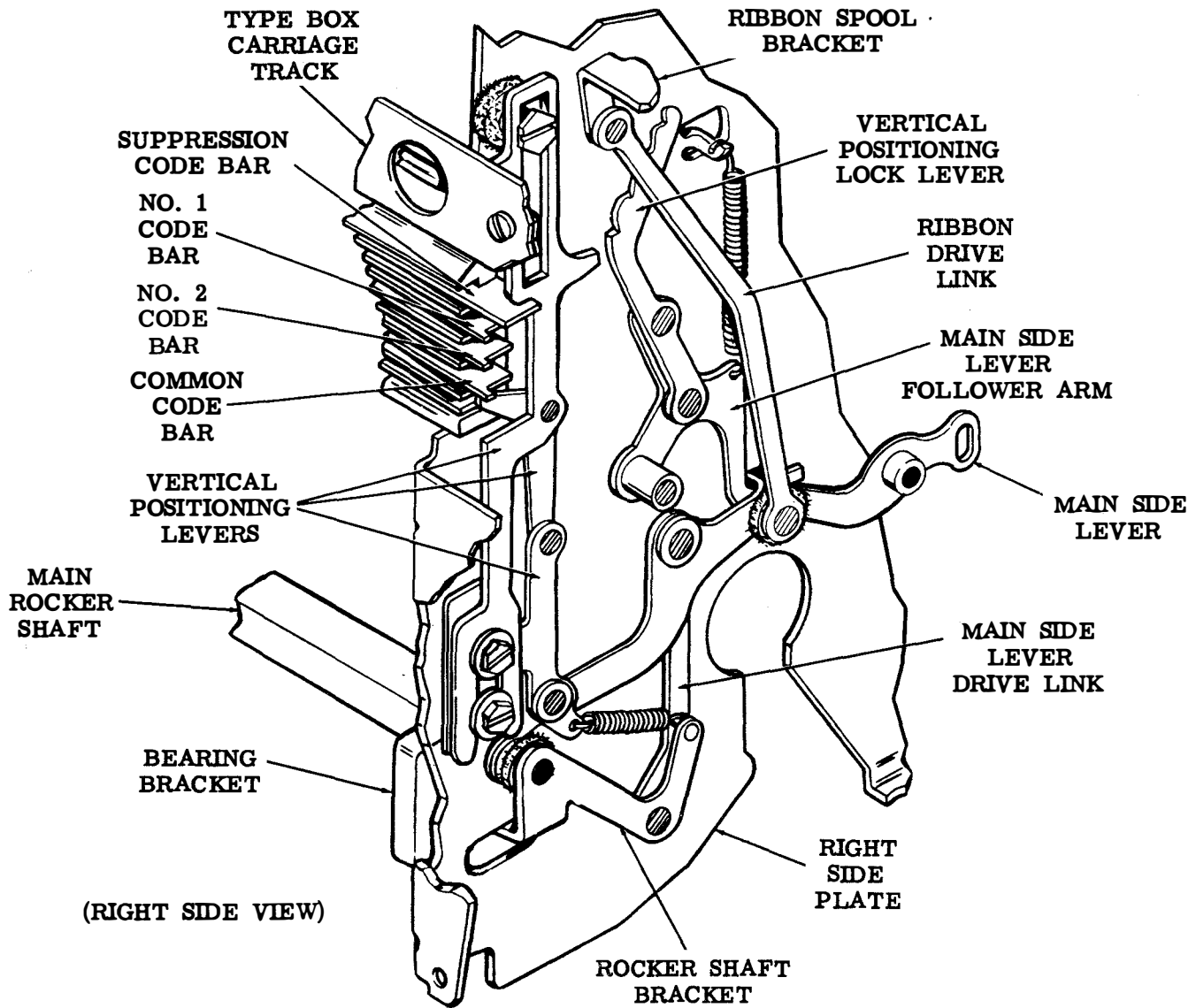


Figure 21 - Right Side Plate Mechanisms

VERTICAL POSITIONING (Fig. 21)

8.08 The selection of the various characters from the four horizontal rows and eight vertical rows in either field (figures or letters) and the printing of those characters take place as follows:

8.09 The number 1 and number 2 code bars determine the selection of the horizontal row. The number 3 code bar determines whether the selection is to be made from the left four vertical rows or the right four vertical rows (in

either the figures or the letters field). The number 4 and number 5 code bars determine the selection of one row from the four vertical rows predetermined by the number 3 code bar.

8.10 Four code bars (longer than the others) extend through the right code bar bracket and serve as stops for the right vertical positioning levers (Fig. 21). They are (from top to bottom) the suppression, number 1, number 2 and common code bars. Notches are arranged in the left ends of these code bars so that the left side vertical positioning levers are stopped,

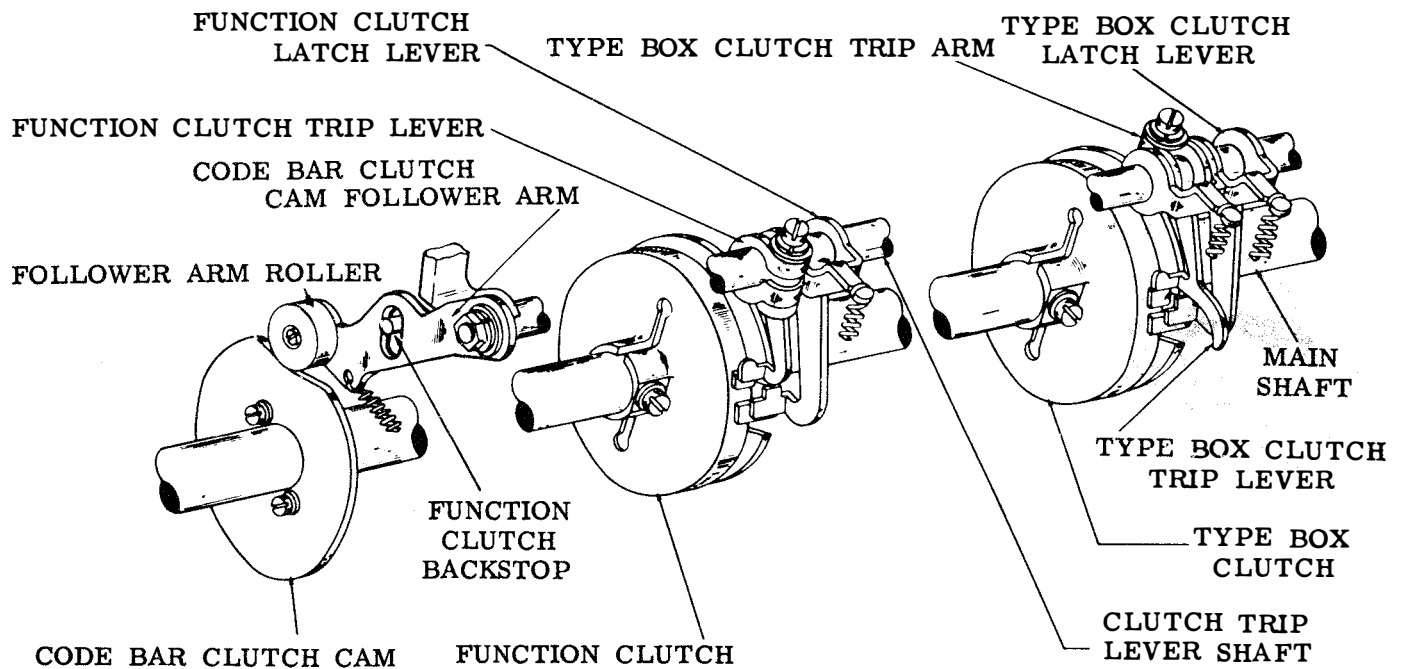


Figure 22 - Clutch Trip Mechanism

in each case, by the same bar that blocks the right side levers. After all code bars have been positioned by the code bar positioning mechanism, the code bar clutch cam follower arm and its roller, in traversing the sloping indent on the code bar clutch cam, rotates the clutch trip lever shaft. As the shaft turns, it first causes the function clutch lever to release the function clutch (Fig. 22) and then causes the type box clutch trip arm to engage its trip lever and release the type box clutch. When the type box clutch completes its revolution, it is disengaged by its trip lever and latch lever in the same manner as was the code bar clutch (7.05). During its rotation, the type box clutch operates a drive link and a bracket to cause the main rocker shaft to oscillate. This, in turn, through its left and right brackets and the main side drive links, extends the motion to the vertical positioning levers (Fig. 21). These levers are driven upward until they strike a projecting code bar, which causes them to buckle. The type box carriage track is mounted between the vertical positioning levers, and its vertical motion is controlled by them.

8.11 When the number 1 and number 2 code bars are toward the right (spacing), the common code bar is also toward the right, where it blocks the vertical positioning levers.

The top row of pallets in the type box are then in line for printing. When the number 1 code bar is toward the left (marking), the common code bar is toward the left. If the number 2 code bar is toward the right (spacing), it blocks the vertical positioning levers, and the second row of pallets (from the top) are then in line for printing. When the number 1 code bar is toward the right (spacing), and the number 2 code bar is toward the left (marking), the common code bar is toward the left. The number 1 code bar blocks the vertical positioning levers and the third row of pallets is in line for printing. When both the number 1 and number 2 code bars are to the left (marking), the common code bar is also to the left. The suppression code bar blocks the vertical positioning levers, and the fourth (bottom) row of pallets in the type box are then in line for printing. At each of the four levels at which the vertical positioning levers may be stopped, they are locked momentarily by lock levers controlled by the main side lever follower arms.

HORIZONTAL POSITIONING (Figs. 23 and 24)

8.12 A bracket attached to the main rocker shaft applies vertical motion to the main bail by means of two main bail links (Fig. 23). Attached to each end of the oscillating rail shift

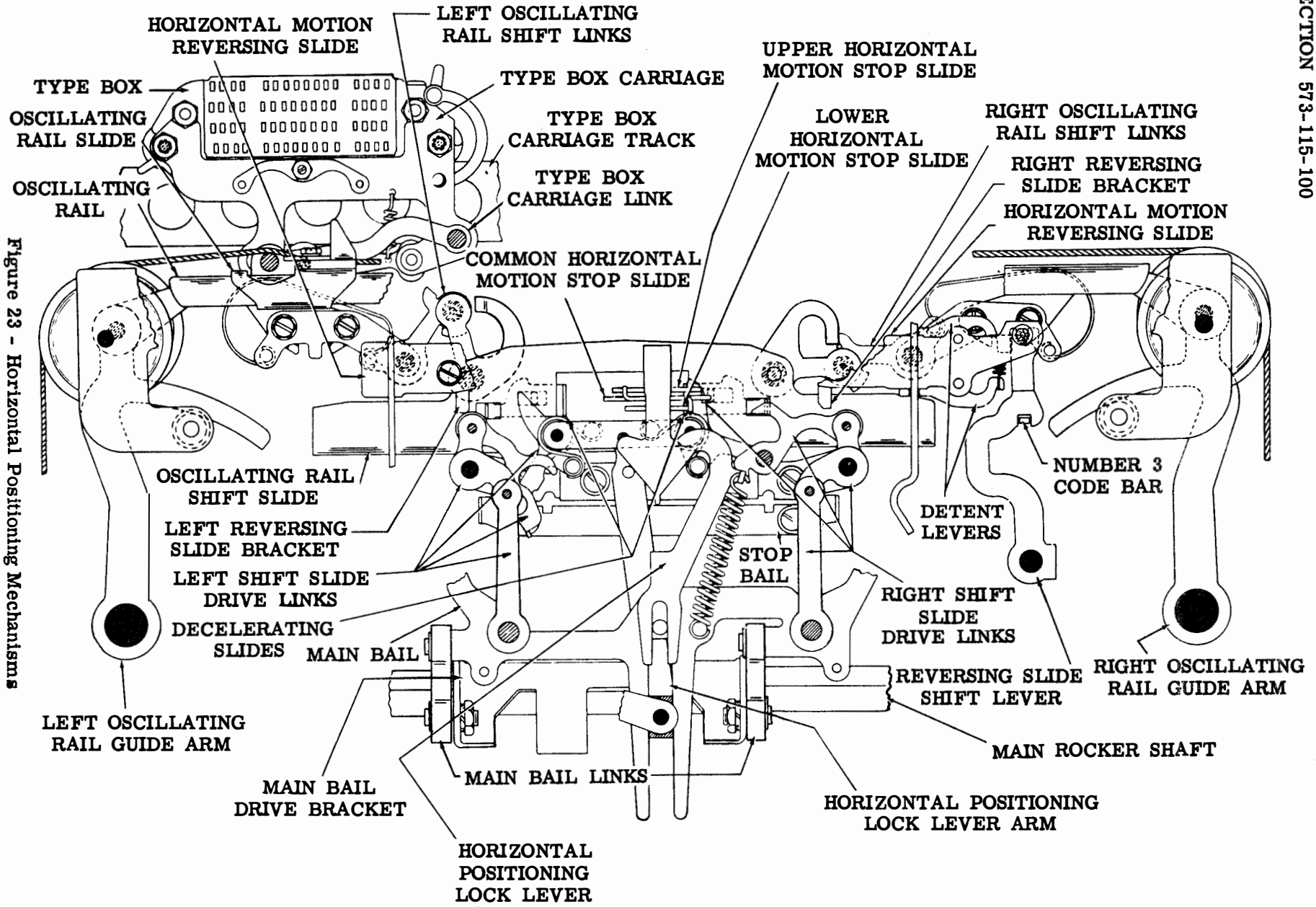


Figure 23 - Horizontal Positioning Mechanisms

slide are pivoted, buckling-type drive links which extend downward to each end of the main bail. As the main bail moves downward under impetus of the type box clutch, the left shift slide links, if not buckled, will try to shift the oscillating rail slide drive links toward the right, while the right slide drive links, if not buckled, will try to shift the oscillating rail shift slide links to the left. When the number 3 code bar is shifted toward the left (marking), the horizontal motion reversing slide is shifted toward the left by the reversing slide shift lever, and is held there by detent levers. A bracket near the right end of the reversing slide will then make contact with the right shift slide drive links and cause them to buckle. As the main bail is driven downward, the unbuckled left shift slide drive links will start to shift the oscillating rail shift slide toward the right. This positions the type box so that the characters to be printed

will be located in the left half of the figures or the letters field. In a similar manner, when the number 3 code bar is shifted toward the right (spacing), the horizontal motion reversing slide is also shifted toward the right by the shift lever and is held there by the detent levers. A bracket near the left end of the horizontal motion reversing slide then makes contact with the left shift slide drive links and causes them to buckle. As the main bail is driven downward, the unbuckled right shift slide drive links will start to shift the oscillating rail shift slide toward the left. This positions the type box so that the characters to be printed will be located in the right half of the figures or the letters field.

8.13 After determination of the field (figures or letters) and the group of vertical rows in which the character to be printed is located, the number 4 and number 5 code bars operate

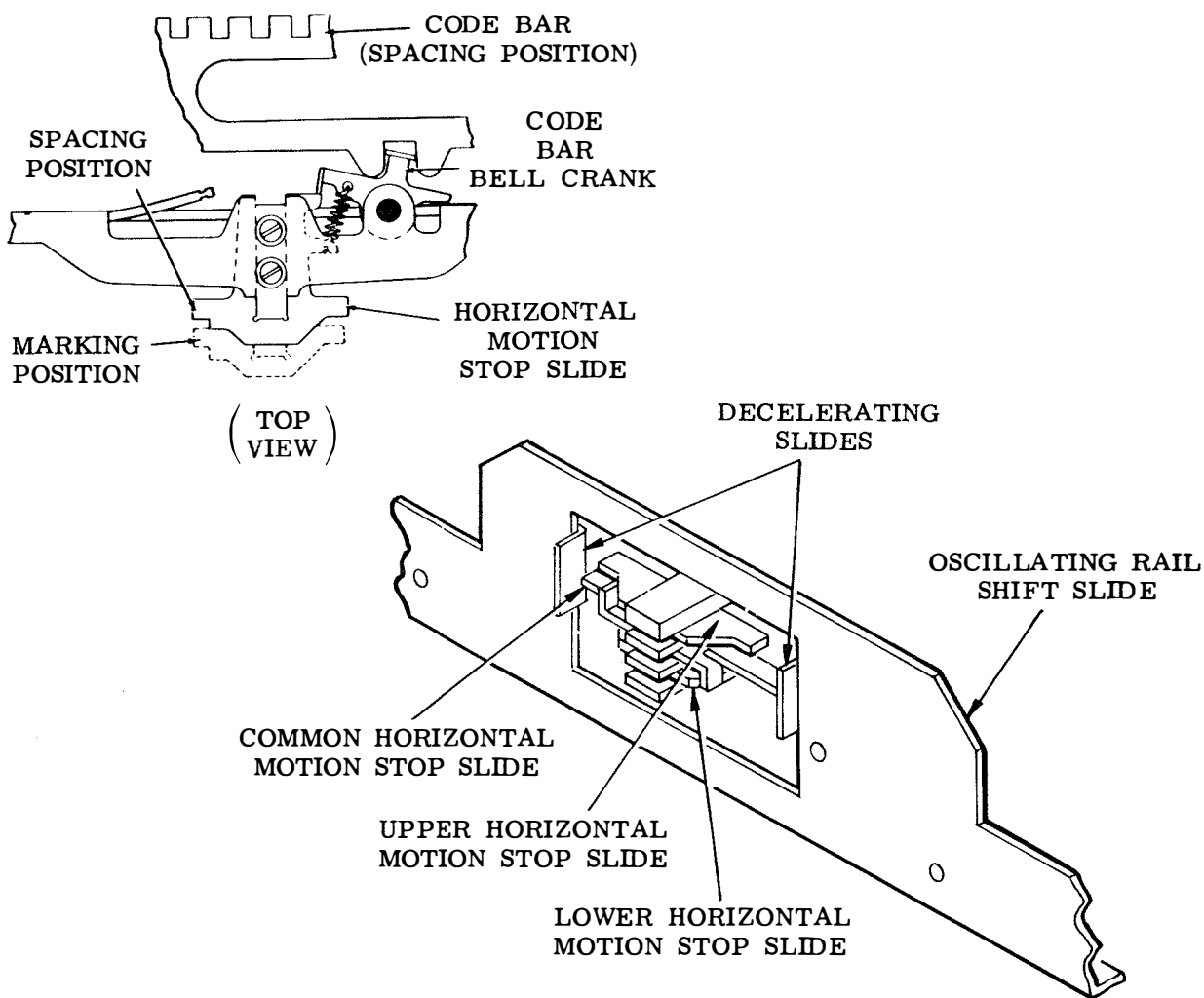


Figure 24 - Horizontal Motion Stop Slides

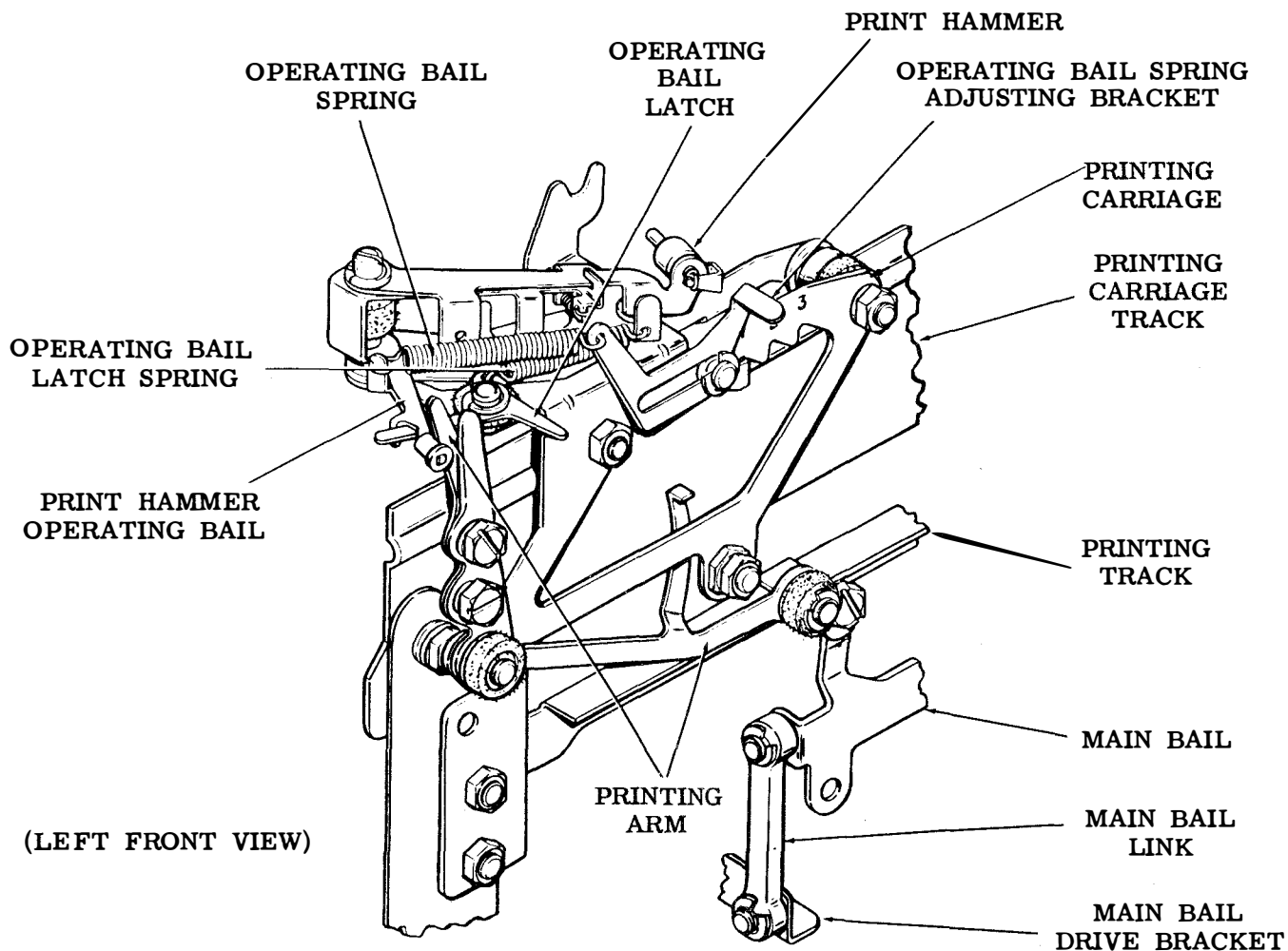


Figure 25 - Print Hammer and Carriage

three horizontal motion stop slides to determine the row in that group in which the character is to be found (Fig. 24). A wedge shaped horizontal positioning lock lever which is pulled downward by the main bail through a yield spring bears against the horizontal positioning lock lever arm. This arm drives the oscillating rail shift slide in the direction in which it was started (by the number 3 code bar selection) until one of two decelerating slides which are mounted on the oscillating rail shift slide strikes an unselected horizontal motion stop slide. A camming surface on the unbuckled shift slide drives the decelerating slide and causes the drive links to buckle. The oscillating rail shift slide finally comes to rest when it strikes the blocked decelerating slide. This, in turn, ends the downward excursion of the lock lever, and the yield spring

extends until the main bail reaches the lowest point of its oscillation. As the main bail returns upward, it centers the oscillating rail shift slide. It is during this time that the horizontal motion stop slides are positioned for the selection of the next character. The number 4 and number 5 code bars each operate a code bar bail bell crank. Each, in turn, moves a horizontal motion stop slide toward the front (marking) or toward the rear (spacing) (Fig. 24). A third (common) stop slide (spring tensioned toward the rear) is located between the upper and lower stop slides and has projections which pass across the front edges of these slides (Fig. 23). Each stop slide is of a different length. The common stop slide, which is the longest stop, has an additional stop on its shank, so that it serves as the shortest stop when all the slides are moved forward.

The upper slide (operated from the number 4 code bar) is the second longest stop, and the lower slide (operated from the number 5 code bar) is the third longest stop.

8.14 When both the number 4 and number 5 code bars are moved toward the right (spacing), their respective horizontal motion stop slides are toward the rear. The oscillating rail shift slide is moved to the right or left of its central position (determined by the number 3 code bar) until it is stopped by one end of the common horizontal motion stop slide. This positions the first vertical row (right or left of the center of the figures field or the letters field) in line for printing. When the number 4 code bar is toward the right (spacing), and the number 5 code bar is toward the left (marking), the lower and the common stop slides are toward the front, and the upper stop slide is toward the rear. The oscillating rail shift slide is moved to the right or left of its central position until it is stopped by one end of the upper stop slide. This positions the second vertical row (right or left of the center of the figures field or the letters field) in line for printing. When the number 4 code bar is toward the left (marking) and the number 5 code bar is toward the right (spacing), the upper and the common stop slides are toward the front and the lower stop slide is toward the rear. The oscillating rail shift slide is moved toward the right or left of its central position until it is stopped by one end of the lower stop slide. This positions the third vertical row (right or left of the center of the figures field or the letters field) in line for printing.

8.15 When both the number 4 and the number 5 code bars are toward the left (marking), their respective horizontal motion stop slides and the common stop slide are toward the front. The oscillating rail shift slide is moved toward the right or left of its central position until it is stopped by one side of the shank of the common stop slide. This positions the fourth vertical row (right or left of the center of the figures field or the letters field) in line for printing.

9. PRINTING

9.01 After the type box has been moved so that the selected type pallet is in its proper position, it must be struck by a print hammer in order to print. This is accomplished by the action of the printing carriage located on the printing carriage track at the top of the front plate mechanism.

POSITIONING (Figs. 23 and 25)

9.02 The printing carriage rides on rollers on the printing carriage track, which is rigidly attached to the typing unit front plate. The carriage is clamped to the forward section of the upper draw wire rope. This moves the carriage along its track in such a manner that the hammer advances to the next printing position after each character (graphic) is imprinted.

OPERATION

9.03 The printing track which is located on the front of the typing unit (Fig. 25) is fastened to an extension at each end of the main bail. As the main bail reciprocates vertically, it extends the motion through the printing track, which travels in guides located at each end of the track. The printing arm, which extends downward from the printing carriage, rides the printing track. As the arm follows the reciprocating motion of the track, its upper end moves first toward the left and then toward the right. When the upper end of the arm moves toward the left, it rotates the print hammer operating bail clockwise against its spring tension until it becomes latched by the operating bail latch.

9.04 The print hammer operating bail draws the print hammer away from the type box by means of the print hammer bail spring. When the upper end of the printing arm moves to its extreme right position, it makes contact with the latch and causes it to release the print hammer operating bail. The operating bail is swung in a counterclockwise direction by the operating bail spring until it strikes its stop. The print hammer bail, in being driven by the operating bail, is swung toward the type box. When the operating bail is stopped, momentum causes the print hammer bail to continue its travel against the tension of the print hammer bail spring until the printing hammer strikes the selected type pallet. The force with which the hammer strikes is adjustable to three positions marked on the carriage.

10. SPACING

GENERAL (Figs. 25 and 26)

10.01 To space the printed character properly, the type box and printing carriages must be advanced with each character printed. The spacing must also be accomplished when the input signal code combination represents a letter space. As was shown in 8.02 and Fig. 19, the carriages are connected to a draw wire rope

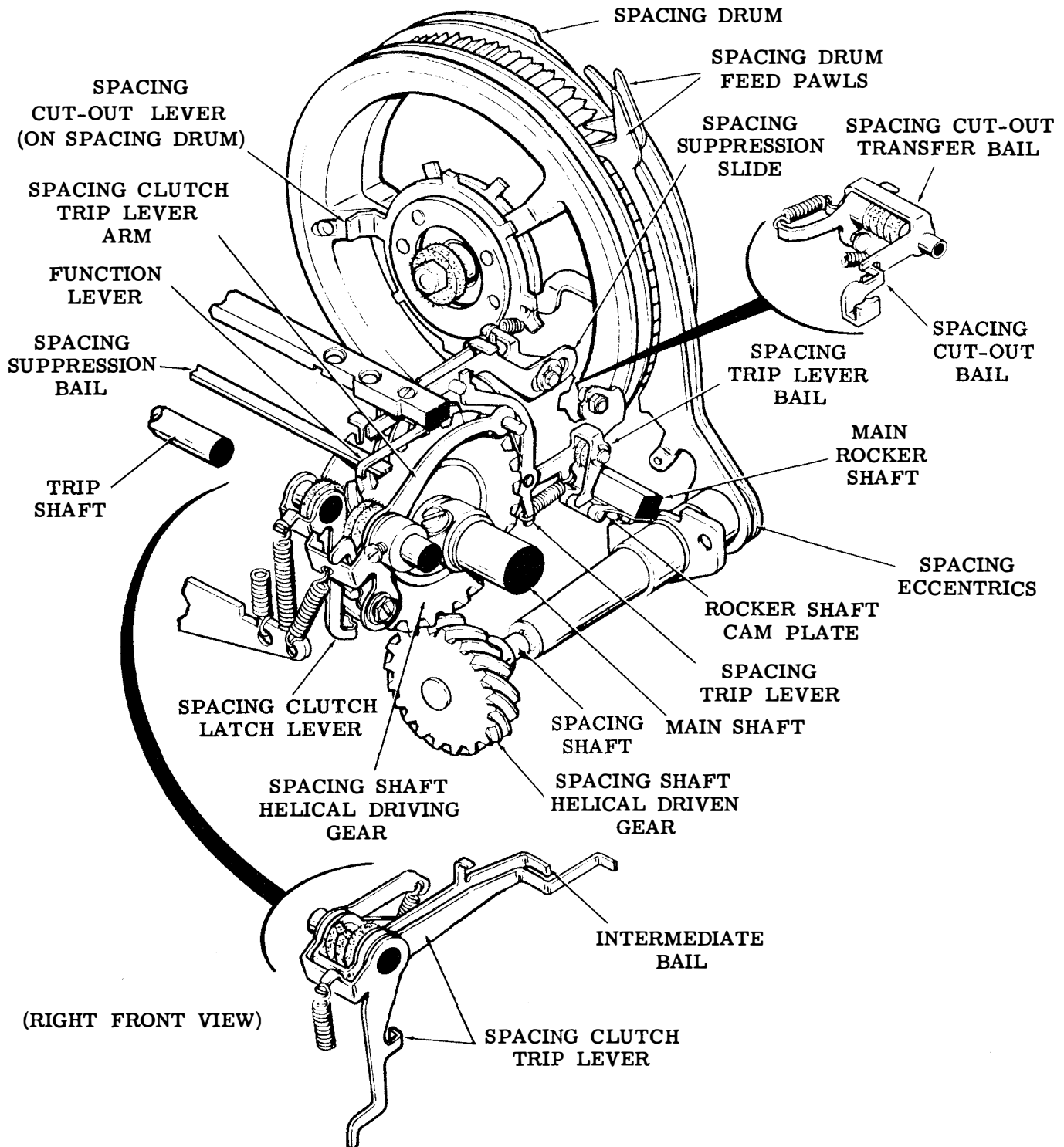


Figure 26 - Spacing Mechanism

which, in turn, is fastened to the spring drum and the spacing drum. The purpose of the spring drum, which contains a torsion spring, is to tension the draw wire rope and pull the carriages to the left. The spacing drum has ratchet teeth about its perimeter which are engaged by the eccentric driven spacing drum feed pawls (Fig. 26). The spacing shaft which mounts the spacing eccentrics is driven through its helical gear attached to the three stop spacing clutch on the main shaft. The gear ratio of 1-1/2 to 1 causes the spacing shaft to turn one-half a revolution each time the spacing clutch is tripped. This allows the feed pawls to advance the spacing drum by one ratchet tooth.

10.02 The same trip shaft which, through a cam on the code bar clutch (4.05) trips the function clutch, also rotates the type box clutch trip lever counterclockwise (viewed from the left). Unless movement of this lever is blocked by the print suppression mechanism, the type box clutch is engaged, oscillating the main rocker shaft, which drives the printing mechanism (8.10). A cam plate (Fig. 26) fastened to the bottom of the rocker shaft is moved upward by the shaft as it begins its movement. The cam plate operates the spacing trip lever bail. As this bail is rotated, it raises the spacing trip lever until it latches onto the spacing clutch trip lever arm. As the rocker shaft reverses its direction of rotation, the spacing trip lever bail and the trip lever move downward under spring tension, causing the latched up spacing clutch trip lever arm to operate the spacing clutch trip lever and engage the spacing clutch.

10.03 Before the spacing clutch completes one-third of a revolution, its restoring cam moves the spacing trip lever about its pivot point until it releases the spacing clutch trip lever, which returns to its normal position in time to stop the spacing clutch after one-third of a revolution. The spacing clutch three-stop cam disk upon which the latch lever rides has an indent at each stop position. When one of the three lugs on the clutch shoe lever disk strikes the spacing clutch trip lever, the inertia of the cam disk assembly causes it to turn until its lugs make contact with the lugs on the clutch shoe lever disk. The latch lever drops into an indent in the cam disk, and the clutch is held disengaged until the trip lever is again operated.

SPACE FUNCTION

10.04 The non-typing function by which spacing between words or any spacing other than that which accompanies printing is accomplished

is initiated when the code bars are set in a combination equivalent to the spacing code combination (all spacing except third pulse marking). The function is executed through the code bar clutch, tripping the printing clutch, and the spacing clutch as described in 10.01-10.03. For this function, the type box is positioned so that a vacant pallet (top horizontal row, first right row in the figures field) is presented beneath the type hammer. No printing occurs when the type hammer is tripped in its normal fashion. The stunt box is not involved in the execution of this function.

SPACE SUPPRESSION (Fig. 26)

10.05 When certain non-typing functions are selected or when the carriages reach their extreme right position, it is necessary to suppress spacing to avoid interference with the page printed message or damage to the equipment. This is accomplished by moving the spacing suppression slide forward to a point at which it will hold the upper end of the spacing trip lever forward and prevent it from engaging the spacing clutch trip lever.

10.06 In the case of spacing suppression on selection of a function code combination, the spacing suppression slide is shifted forward by the spacing suppression bail, mounted beneath the function box. When space suppressing function levers are selected, they engage the bail and, when the function mechanism is operated, move the bail forward. Moved forward with the bail, the suppression slide prevents engagement of the spacing clutch.

10.07 When the carriages are near their extreme right position, a cut-out ring on the spacing drum engages the spacing cut-out transfer bail (Fig. 26), which in turn operates the spacing cut-out bail. The ring and the end of the spacing cut-out transfer bail are shown in Fig. 19. The spacing cut-out bail shifts the spacing suppression slide forward and prevents engagement of the spacing clutch until the carriages are returned. The maximum number of characters which the typing unit may print is eighty-five, including spacing function spaces. In order to prevent spacing beyond this point, and subsequent damage to the equipment, several teeth are omitted from the spacing drum ratchet wheel.

MARGIN INDICATOR (Fig. 19)

10.08 When used in conjunction with a keyboard base, the typing unit actuates a margin indicator switch (base mounted). Before the type

box carriage reaches the end of its travel, an actuator mounted on the face of the spring drum operates the switch contact. The angular position of the cam disk with respect to the spring drum may be altered to change the point at which the indicator contact will be closed.

11. RIBBON FEEDING

DESCRIPTION (Fig. 27)

11.01 The left and right ribbon feed mechanisms oscillate in a vertical plane with

each revolution of the type box clutch. They are driven by ribbon drive links attached to the main side levers (Fig. 21). At their uppermost positions, the ribbon mechanisms position the ribbon relative to the horizontal type box row being printed. After each character is printed, the ribbon mechanisms are dropped downward together with and behind the type box, to permit viewing of the last printed character. The ribbon is held in place at the point of printing by a ribbon guide fastened to the rear of the type box carriage.

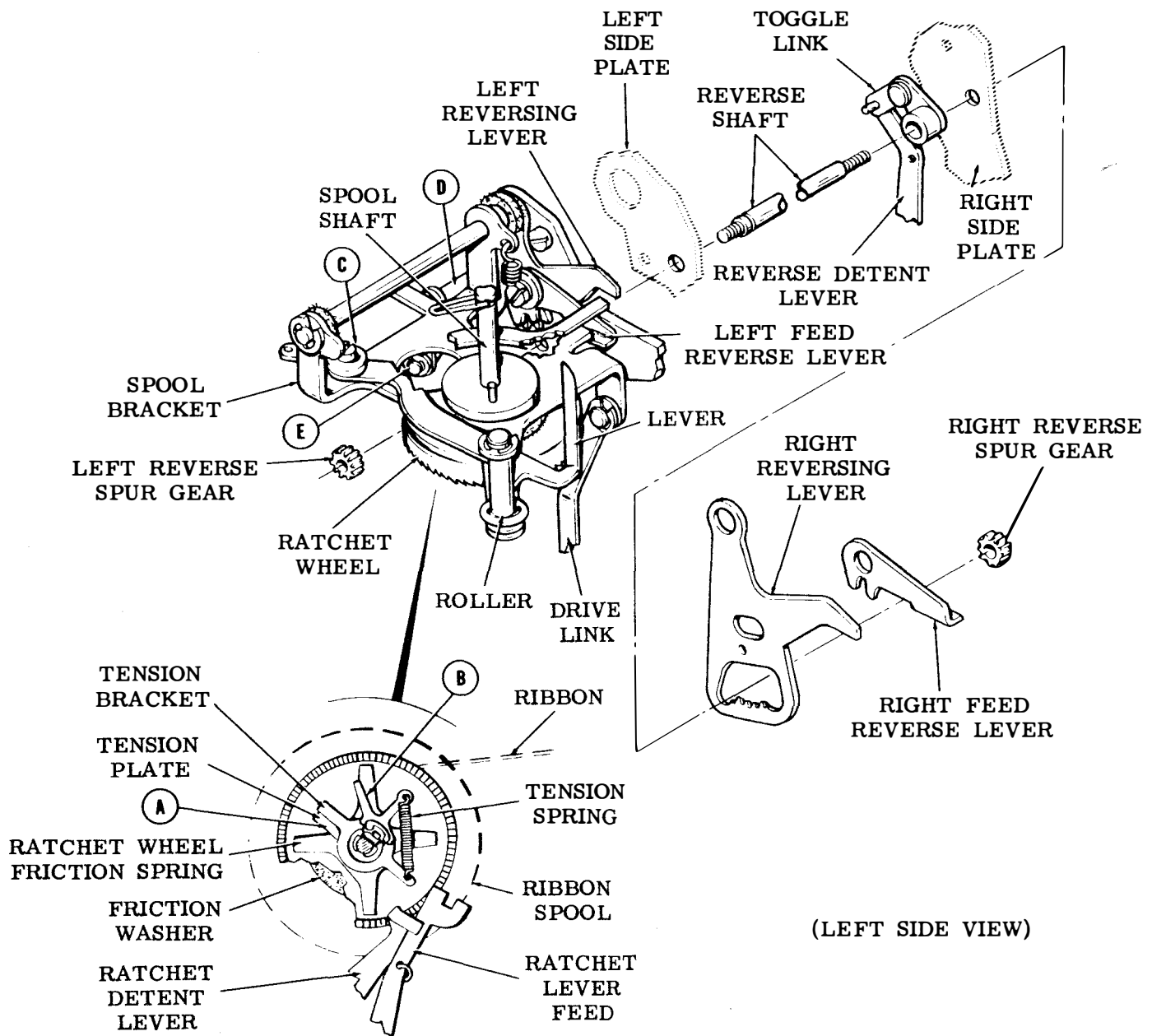


Figure 27 - Ribbon Feeding Mechanism

11.02 Each of the ribbon mechanisms consist of a bracket which is hinged at its rear end, and upon which is mounted a ribbon spool shaft (Fig. 27). A ribbon tension bracket is keyed to the lower end of the ribbon spool shaft. A ribbon ratchet wheel is mounted freely on the ribbon spool shaft just below the ribbon spool bracket, from which it is separated by a friction washer. This applies a constant drag to the ratchet wheel.

OPERATION

11.03 A ribbon tension plate which is keyed to the hub of the ribbon ratchet wheel has two projecting lugs (A and B, Fig. 27) that straddle the lug on the ribbon tension bracket. A ribbon tension spring tends to maintain the ribbon tension bracket against lug A of the ribbon tension plate. In operation, the ribbon spool bracket, driven by the ribbon drive link, pivots about point C. The ratchet feed and ratchet detent levers pivot about points D and E respectively and are held against the teeth on the ribbon ratchet wheel by their springs. As the ribbon spool bracket is moved upward, the ratchet wheel feed lever skips over one tooth, while the ratchet detent lever holds the ribbon ratchet wheel from turning backward. When the ribbon spool bracket is moved downward, the ratchet feed lever engages a ratchet tooth and pushes the ratchet wheel. A tooth on the ribbon ratchet wheel then skips over the ratchet detent lever. The teeth on the left and right ribbon ratchet wheels face in opposite directions so that when their feed levers are engaged, the left ribbon ratchet wheel turns counterclockwise (viewed from the top).

11.04 In order for the ribbon to be pulled from one ribbon spool to the other, only one of the ribbon mechanism can have its ratchet feed and ratchet detent levers engaged with its ribbon ratchet wheel at a time. As the ribbon ratchet wheel turns, the ribbon tension plate also turns, and extends the ribbon tension spring. When the lug B of the ribbon tension plate makes contact with the ribbon tension bracket, the ribbon spool shaft is made to turn, and the ribbon is wound on the ribbon spool.

RIBBON REVERSING

11.05 When the ribbon has been completely unwound from one spool, it is necessary to reverse its direction so it can rewind. This is accomplished automatically by disengaging one set of ratchet feed and ratchet detent levers and engaging the other set. While the ribbon is pass-

ing from the left spool to the right spool, the right set of levers is engaged. The left set is held disengaged against the tension of the springs by the left ribbon feed reverse lever, which is in its downward position (Fig. 27). The lever is held in this position by means of the ribbon reverse detent lever through the intervening ribbon reverse detent cam, ribbon reverse shaft and ribbon reverse spur gear. As the ribbon unwinds from the ribbon spool, it passes around the ribbon roller and through the slot in the end of the ribbon lever. When the ribbon nears its end of the ribbon spool, an eyelet which is fastened to the ribbon catches in the ribbon lever slot and pulls the lever toward the right.

11.06 The next time the ribbon mechanism is moved upward, the displaced ribbon lever engages the end of the left ribbon reversing lever and causes it to move to the position shown in phantom in Fig. 27. As the lever moves, its teeth rotate the left spur gear which, through the ribbon reverse shaft, turns the detent cam and the right spur gear. As the right spur gear moves the right ribbon reversing lever downward, a pin on the lever drives the right ribbon feed lever downward to disengage the ratchet feed and wheel. At the same time a pin on the left ribbon reversing lever moves the left ribbon feed reversing lever upward to permit the left ratchet feed and detent levers to engage the left ribbon ratchet wheel. Thus, the ribbon mechanisms are positioned to rewind the ribbon on the left ribbon spool. When it nears its end on the right ribbon spool, the ribbon is again reversed in a manner similar to that just described. During the reversing cycle, the ribbon is maintained taut by the previously extended ribbon tension spring.

12. PAPER FEEDING (FRICTION FEED)

12.01 Paper for the page printed message is stored on a roll 8-1/2 inches wide, mounted on a paper spindle suspended between the two side plates at the rear of the typing unit. From the roll, the paper passes over a paper straightener shaft, downward behind the platen (Fig. 28) and between the platen and three pressure rollers. A paper pressure bail at the front of the platen equalizes pressure brought to bear on the paper by the pressure rollers. The pressure bail can be released by rotating the paper release lever at the top of the right side plate to the rear (clockwise, viewed from the right) when it is necessary to straighten the paper or to remove paper from the platen. Two paper fingers operated on a spring tensioned shaft

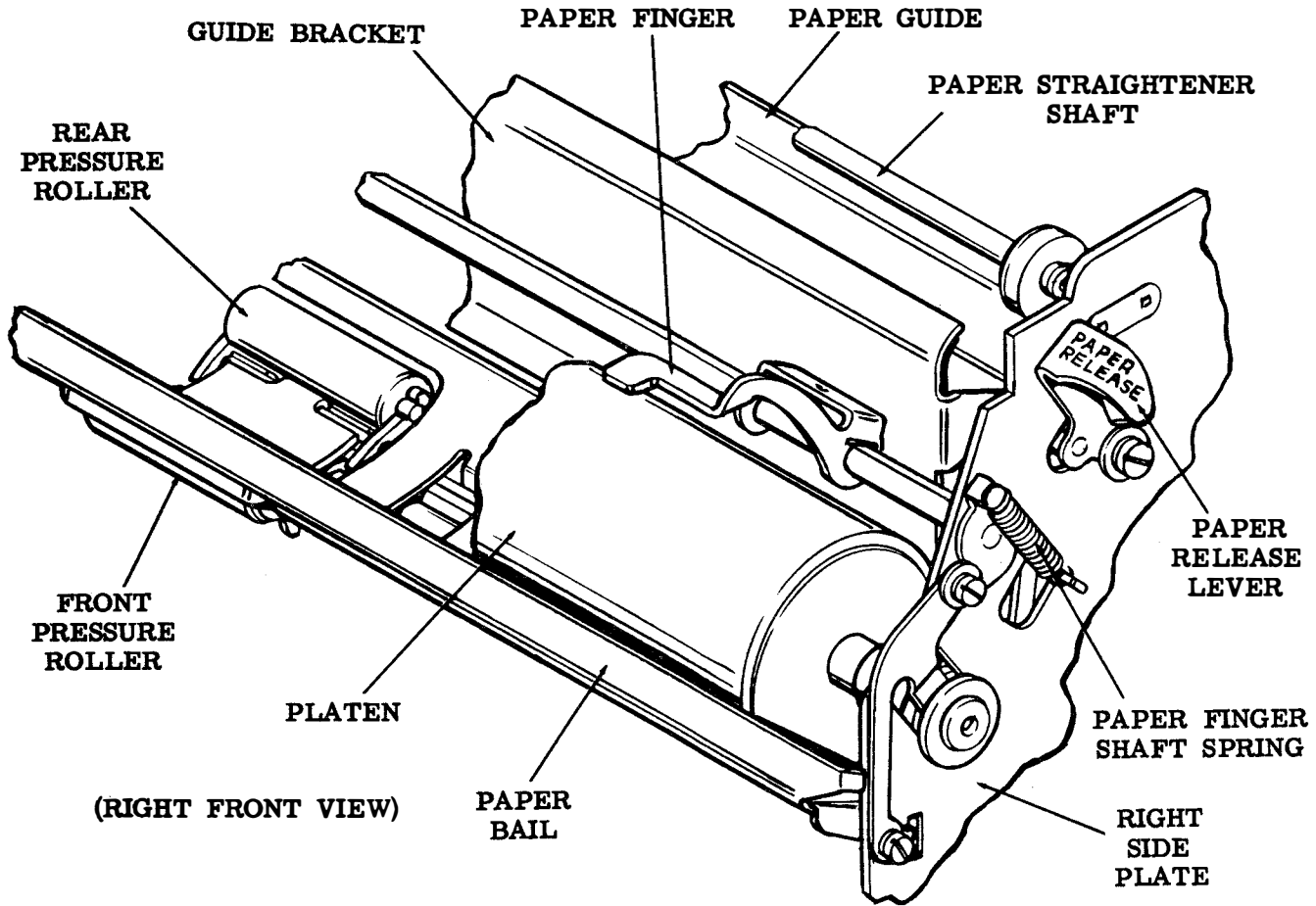


Figure 28 - Friction Feed Platen Mechanism

across the front of the platen hold copy paper firmly against the plate, in position for printing.

13. STUNT BOX OPERATION

FUNCTIONS (Fig. 29)

13.01 There are two types of operation which can be performed by the typing unit. The first embodies those mechanical actions which are directly necessary to the actual printing of a character (or space function). The second embodies mechanical action which alters the positions of the various mechanisms or activates external devices or circuits through switching contacts. The latter are known as functions.

Note: Spacing may technically be considered a function, but it is mechanically associated with the printing operation, except when suppressed by function mechanisms.

13.02 As in printing, the reception of function codes results in the positioning of the code bars (7.01). The back edges of the code bars are notched (Fig. 30). Positioned directly behind the code bars is a stunt box, which contains the function bars for the various functions (Figs. 29 and 30). Each function bar has a series of tines on its end, offset to one side or the other to correspond with the marking and spacing elements of the particular input signal code combination to which it is to respond. Tines positioned to the right are spacing; those to the left are marking.

13.03 When the function clutch is engaged (Fig. 22), it rotates and extends motion to the function bar reset bail (through the intervening cam and follower arm and function rocker shaft) to cause the function bar reset bail with its attached reset bail blade to release the function bars momentarily (Fig. 31). As the spring tensioned function bars are released, they move forward to bear against the code bars. If

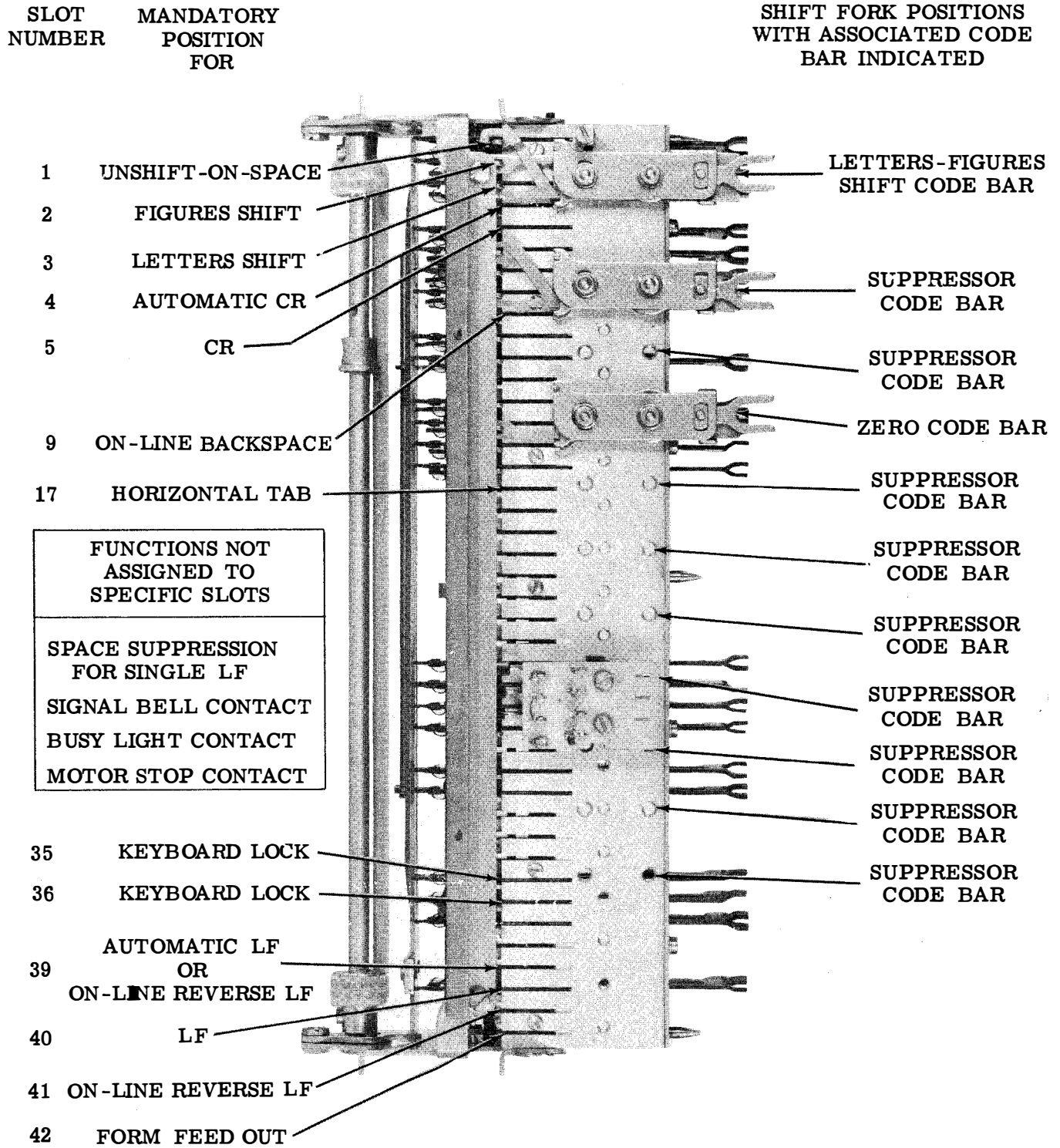


Figure 29 - Stunt Box (Top View)

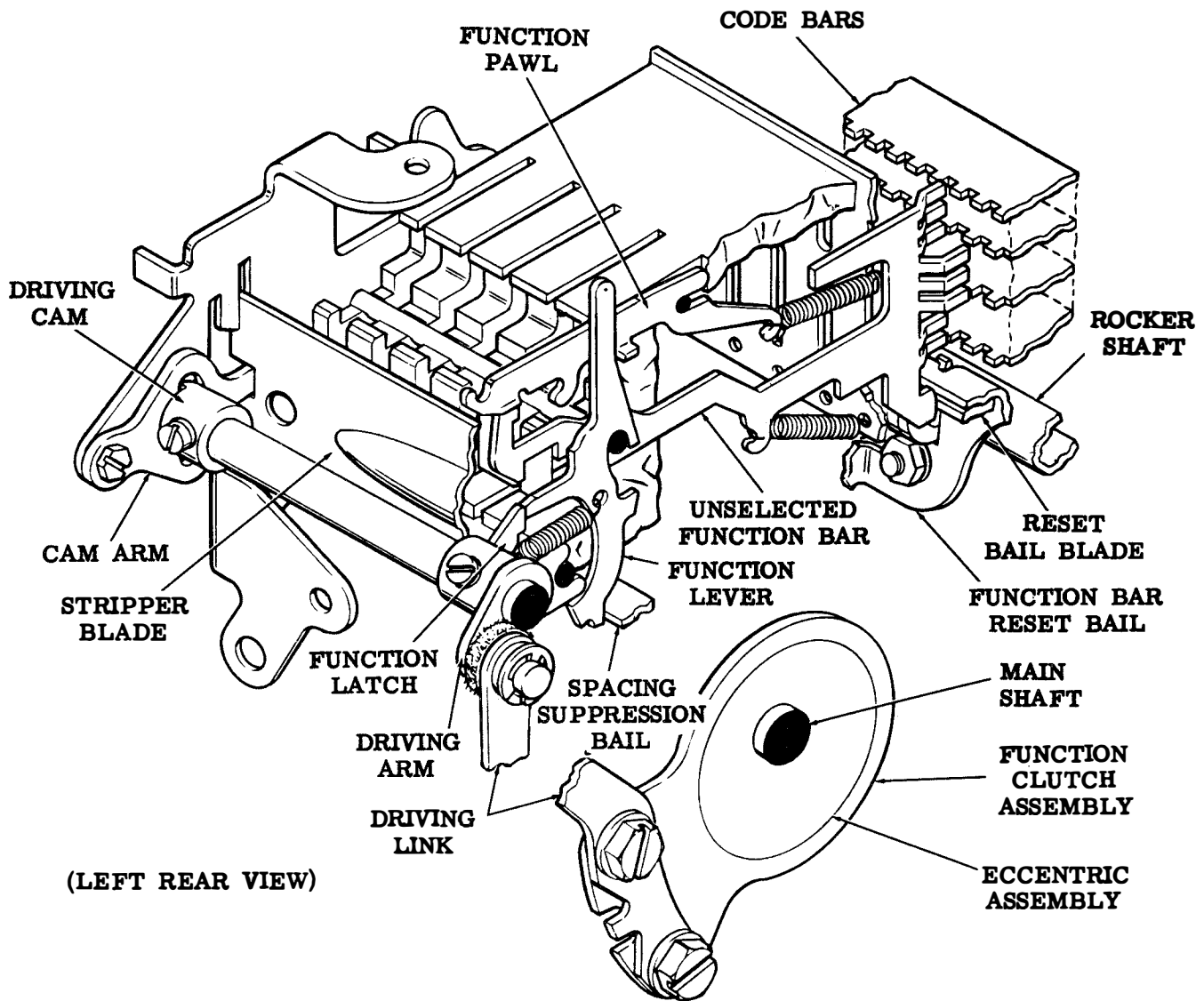


Figure 30 - Stunt Box (Function Linkage Unselected)

the code bars are positioned for a function, each tine on the function bar for that function will be opposite a notch in the code bar. This will permit the selected function bar to continue to move forward into the code bars, while the other function bars are blocked by one or more code bars (Fig. 32).

13.04 Associated with each function bar in the stunt box is a function pawl and a function lever. In the unselected position, the function bar is not latched with its function pawl (Fig. 33). When the function bar reset bail

blade releases the function bars, any selected bar will move sufficiently forward (to the left, in Fig. 33) to permit it to engage its function pawl. Then, as the reset bail blade returns the function bar to its initial position, the function bar carries the function pawl to the rear (to the right, Fig. 34). The function pawl, in turn, moves the function lever clockwise about its pivot point. A projection at the lower end of most function levers operates the spacing suppression bail (10.06), and the selected levers move the bail forward. Either the upper or the lower end operates the indicated function.

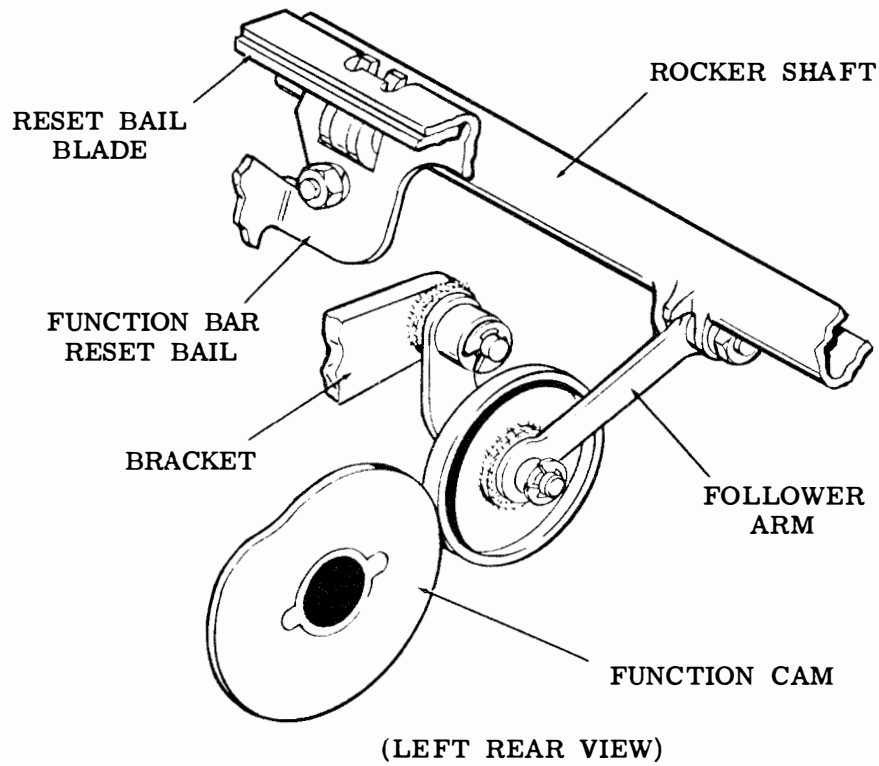


Figure 31 - Reset Bail Mechanism

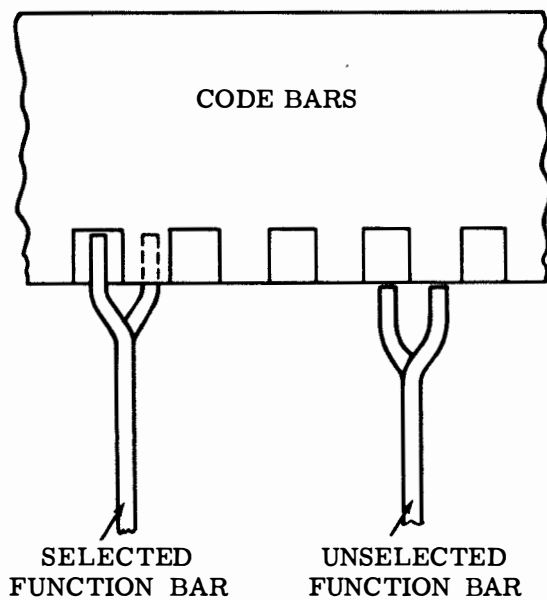


Figure 32 - Function Bar Selection

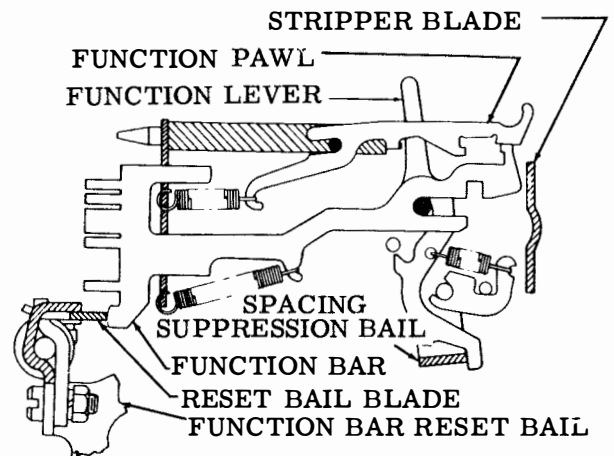


Figure 33 - Typical Function Linkage (Unselected)

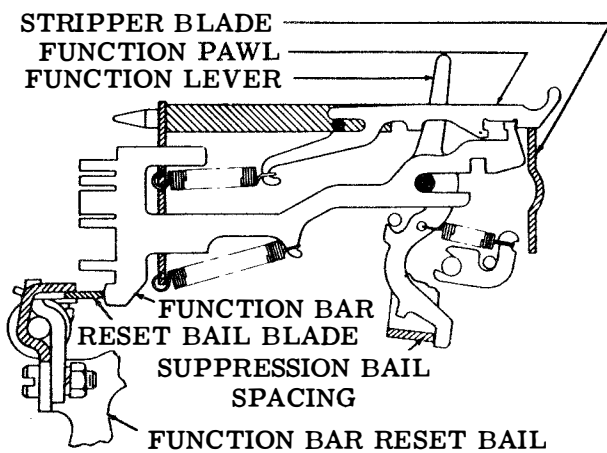


Figure 34 - Typical Function Linkage (Selected)

13.05 Near the end of the function cycle, a stripper blade (Fig. 30) operated by a cam on the function clutch assembly rises to engage any selected function pawl and strip it from its function bar. Springs return the released function pawl and the function lever to their original position. The function clutch is disengaged upon completion of one revolution when its latch lever falls into the indent of the clutch cam, in the same manner as described in connection with the code bar clutch (7.05).

CARRIAGE RETURN FUNCTION (Figs. 35 and 36)

13.06 The carriage return function mechanism is located in the right end of the typing unit. Reception of the input signal code combination for the function causes the function bar, pawl and lever to operate (Fig. 35). The lower end of the function lever engages the carriage return slide arm and pushes it forward. The slide arm, in turn, moves the carriage return bail and its lever about their pivot point. As the front portion of the lever moves downward, it takes with it the lower section of the spacing drum feed pawl release link. This causes the upper portion of the link to turn and disengage the spacing drum feed pawls from the spacing drum (Fig. 36).

13.07 When the carriage return lever reaches the lowest point, the carriage return latch bail locks it there. The disengagement of the spacing drum feed pawls from the spacing drum permits the spring drum to return the printing and type box carriages toward the left side of the typing unit. As the spacing drum nears the end of its counterclockwise rotation, the roller on the stop arm contacts the transfer slide which, in turn, drives the dashpot piston into the dashpot cylinder. A small passageway with an inlet from the inside of the cylinder and three outlets to the outside is incorporated in the end of the cylinder. Two of the openings to the outside are closed by a steel ball, which is held in its seat by means of a compression spring. A set screw which may be locked in place with a nut is used to regulate the spring pressure on the ball. The rate of deceleration provided by the cushioning effect of the trapped air is automatically regulated for various lengths of lines by means of the ball valve. This, together with the direct opening to the outside, determines the rate at which the air may escape from the cylinder. When the spacing drum reaches its extreme counterclockwise position, an extension on the stop arm trips the carriage return latch bail plate, which is fastened to the carriage return latch bail. The latch bail disengages the carriage return lever, and the feed pawls are again permitted to engage the spacing drum.

13.08 Local (off-line) operation of the carriage return mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the carriage return lever (Fig. 35), when rotated to the rear (counterclockwise, viewed from the right), operates the carriage return mechanism in the same way as when this lever is operated by the stunt box.

LINE FEED FUNCTION (Figs. 37 and 38)

13.09 The line feed function mechanism is located in the left end of the typing unit. The code bar mechanism set to correspond to an input signal code combination for spacing permits two line feed function bars, pawls and levers to operate. The function linkage at the far left of the stunt box (Fig. 37) operates the line feed mechanism. The lower end of the line feed function lever engages the line feed slide arm and pushes it forward. The slide arm, in turn, moves the line feed clutch trip arm and the trip lever above their pivot point until the trip lever releases the three stop line feed clutch. The line feed gearing is such that each

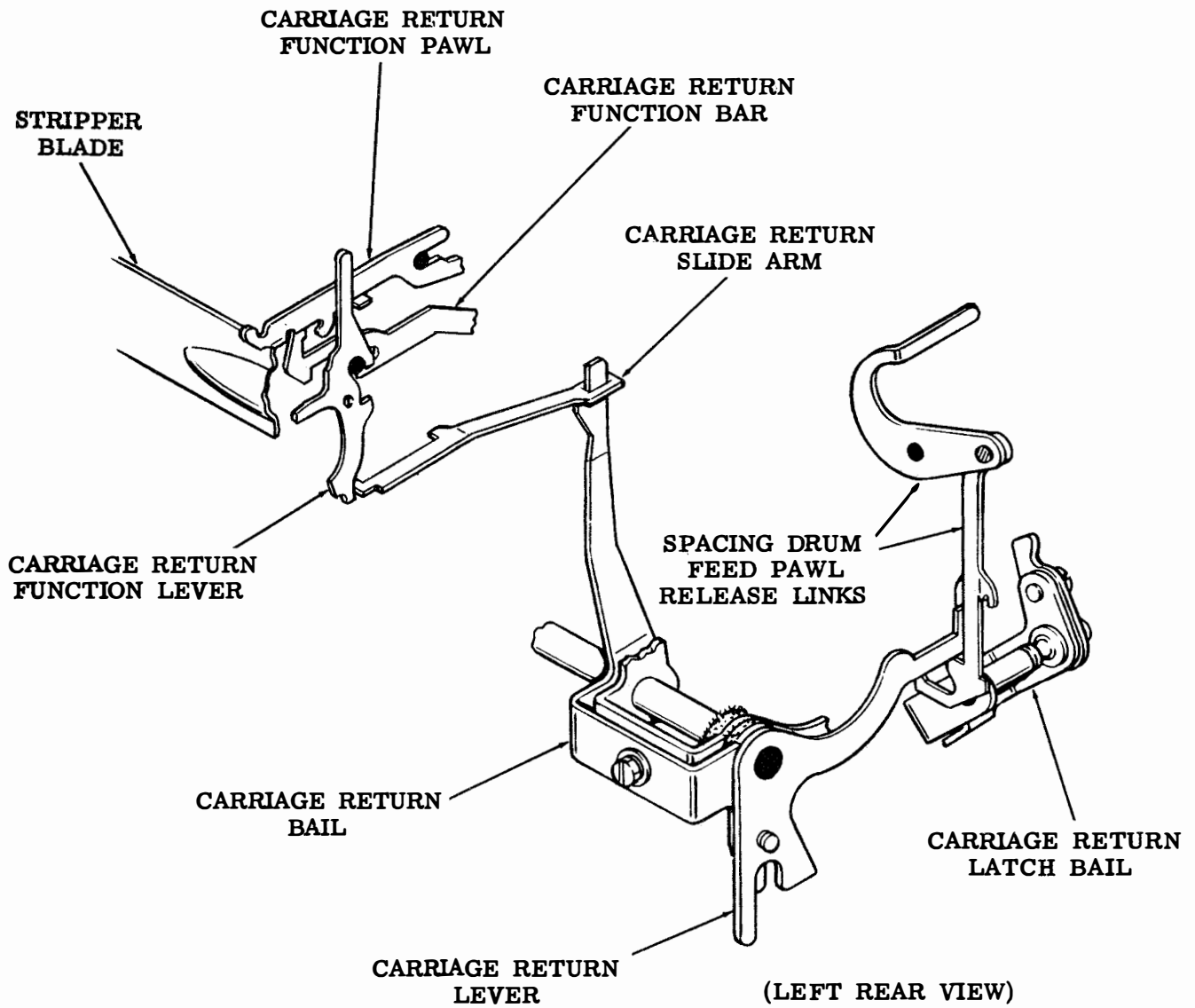


Figure 35 - Carriage Return Function Mechanism

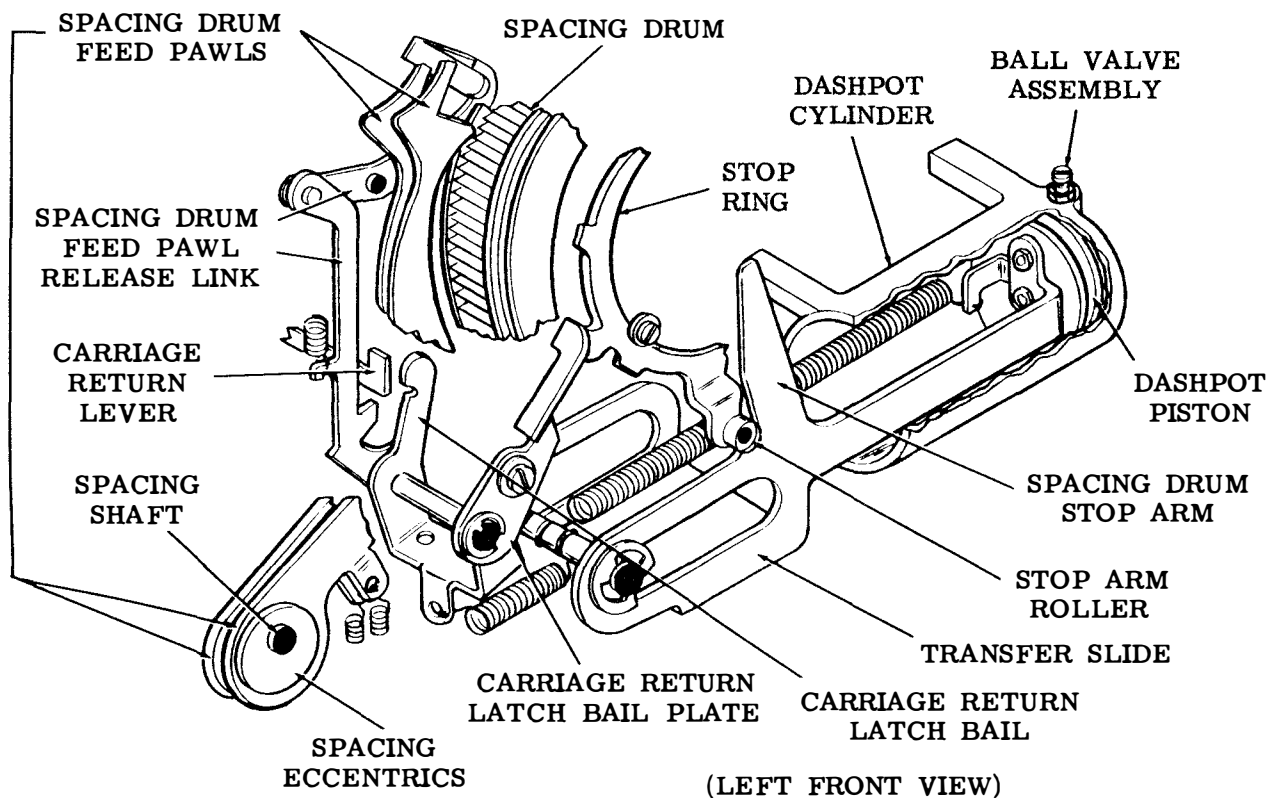


Figure 36 - Carriage Return Mechanism

one-third revolution of the clutch will advance the platen by one line. Therefore, the length of time that the line feed clutch trip lever is held away from the clutch will determine the number of line feeds that occur.

13.10 The timing relationship between the stripper blade cycle and the main shaft rotation is such that the function pawl is not stripped from a function bar until after more than one-third of a revolution of the clutch has occurred. Thus, the line feed clutch trip lever will stop the clutch after two-thirds of a revolution, or double line feed, has occurred. When single line feed is desired, it is necessary to strip the function pawl from the line feed function bar before the line feed clutch completes one-third of a revolution. This is accomplished by the use of an auxiliary function pawl stripper which is attached to the left end of the stripper bail. The cam disk on the three-stop line feed clutch provides the motive force to operate the stripper bail once each one-third revolution of the line feed clutch.

13.11 The stripper bail on which the slotted line feed function pawl stripper rides may be shifted toward the right (double) or to the left (single) by action of the single or double line feed lever (Fig. 37). The upper end of the pivoted single or double line feed lever protrudes from the upper left of the left side plate of the typing unit, where it rides in the two position side frame detent extension. When the lever is in position 1; the stripper bail engages line feed function stripper to raise it into contact with the function pawl before the stripper blade would strike it. When the lever is moved to the rear (position 2), the bail is disengaged from the blade, and the stripper blade strikes the function pawl in the normal cycling of the function box stripper blade.

13.12 When single line feed is being used, the line feed function lever is released too soon (by the line feed function pawl stripper) to prevent spacing. Therefore, an additional line feed function bar, pawl and lever are installed in a slot of the stunt box for the purpose of suppressing spacing on single line feed

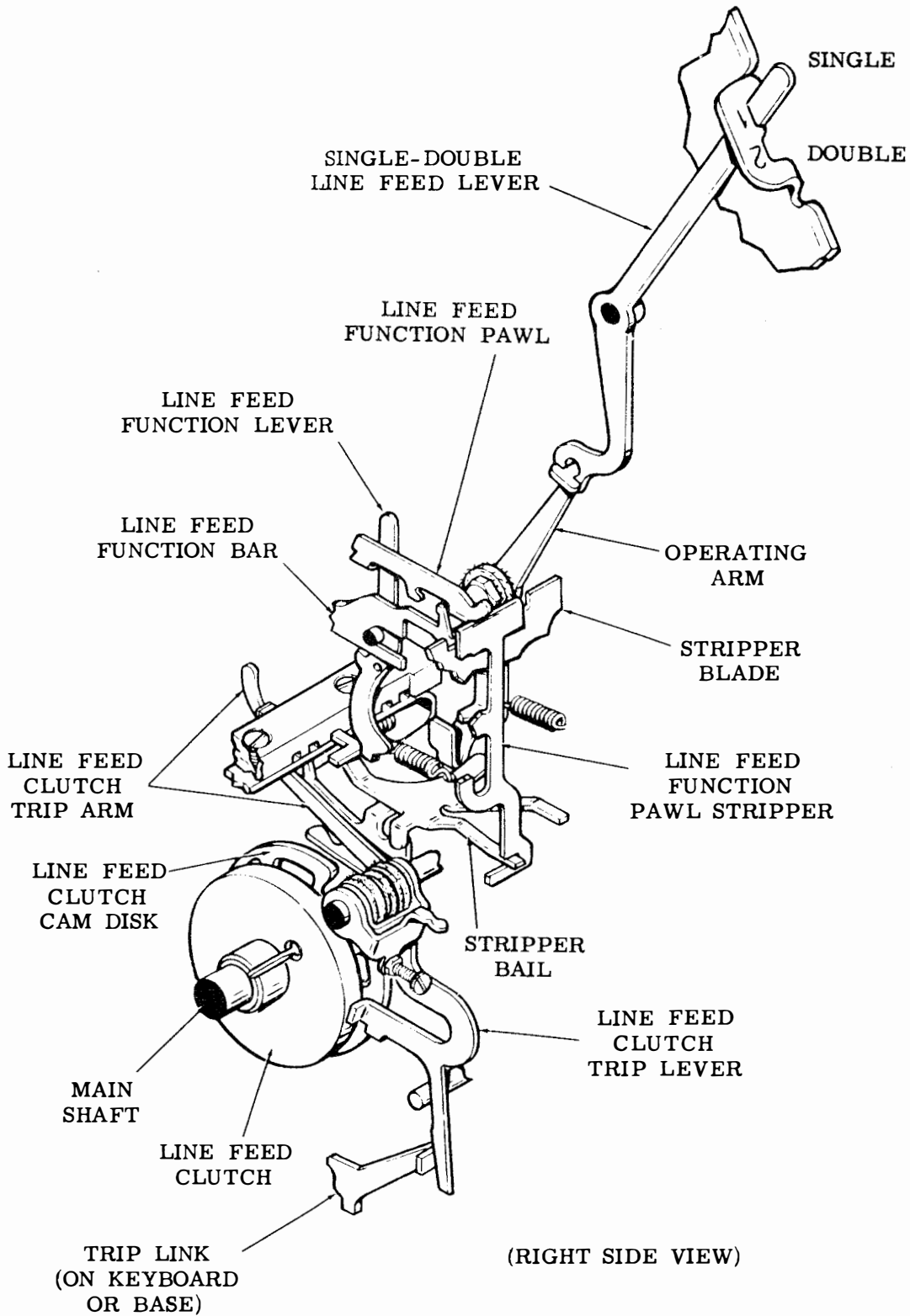


Figure 37 - Line Feed Mechanism

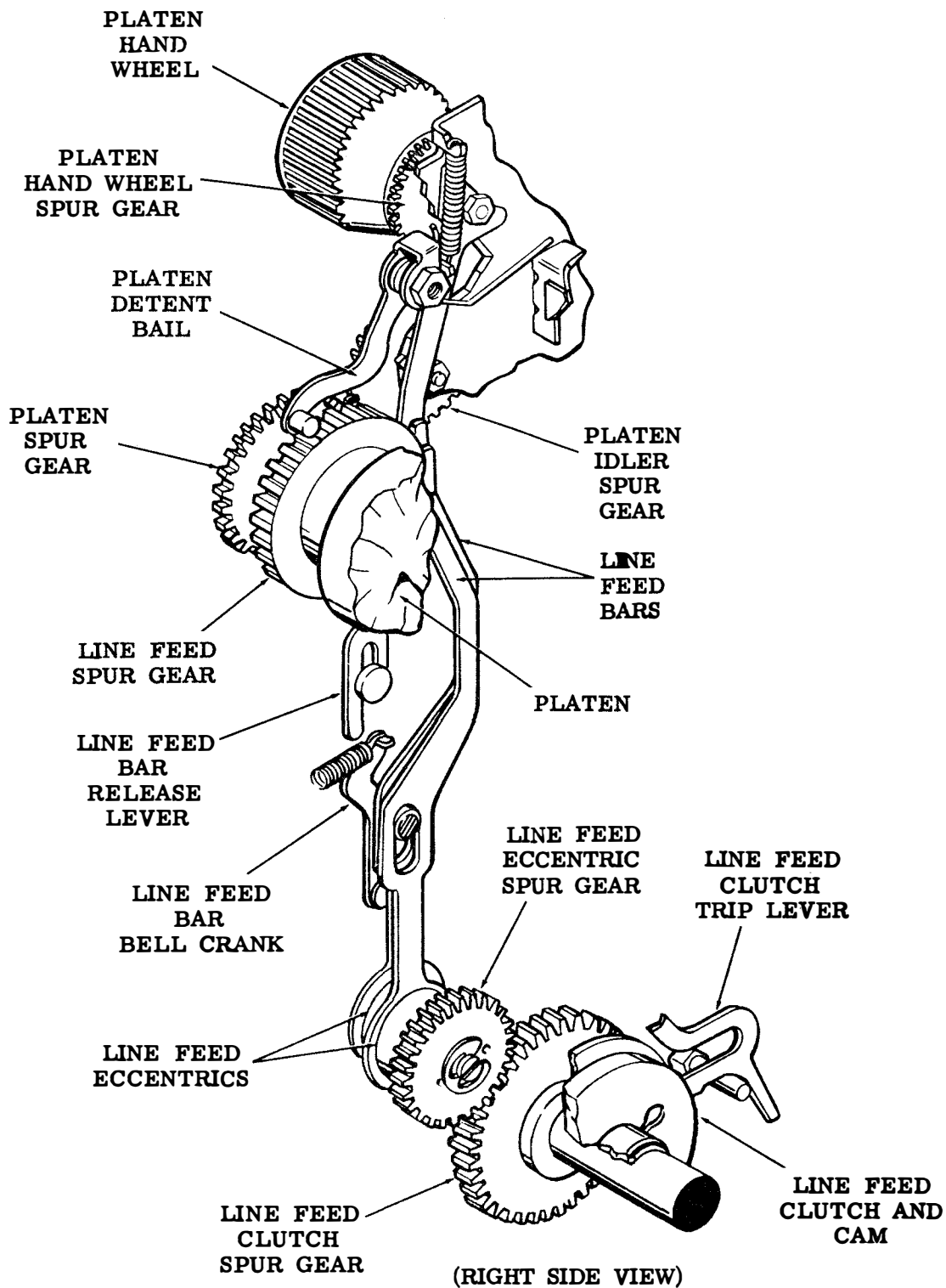


Figure 38 - Line Feed Mechanism

function. This mechanism, which always operates on the line feed function code bar arrangement, is released only by the stunt box stripper blade and, therefore, holds the spacing suppression bail operated (forward) until the spacing cycle is completed. After the line feed clutch is stopped by its trip lever, it is disengaged when the latch lever drops into the indent in the clutch cam, in the same manner as described in connection with the code bar clutch (7.05).

13.13 Each one-third revolution of the line feed clutch causes its attached spur gear (Fig. 38) to rotate the line feed eccentric spur gear and its attached eccentrics one-half of a revolution. The eccentrics, which are offset in opposite directions, each carry a line feed bar. These bars are guided by the line feed bar bell crank and alternately engage the line feed spur gear on the platen, advancing the platen one line for each one-half turn of the eccentrics. A platen detent bail engages the line feed spur gear to retain the platen at each setting.

13.14 When it is desired to position the platen manually, this may be accomplished by bearing down on and rotating the platen handwheel at the top of the right side plate. This causes the platen handwheel spur gear to engage the platen idler gear, which in turn is engaged with the platen spur gear on the platen shaft. At the same time, the line feed bar release lever (Fig. 38) bears on the line feed bar bell crank and causes it to disengage the line feed bars from the line feed spur gear.

13.15 Local (off-line) operation of the line feed mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the line feed clutch trip lever (Fig. 37), when rotated to the rear (counterclockwise, viewed from the right), operates the line feed mechanism in the same way as when this lever is operated by the function box. Since the clutch is manually engaged, line feed is continuous until released at the keyboard or base.

LETTERS-FIGURES SHIFT FUNCTION (Fig. 20)

13.16 Upon reception of the letters or figures signal code, the letters and figures function bars, pawls and levers initiate the letters or figures shift (8.05). The upper ends of the function levers engage the letters and figures function slides (Fig. 20). The front ends of these function slides have camming surfaces which,

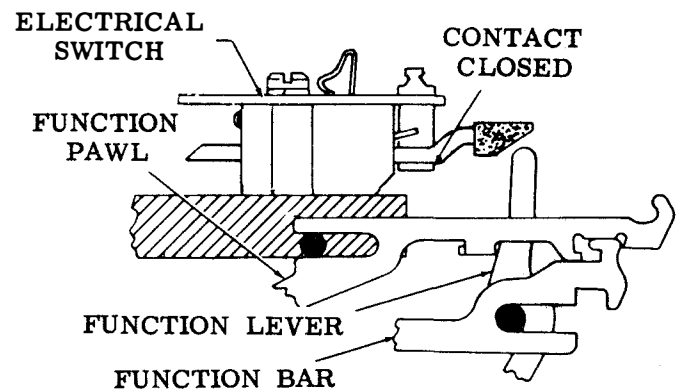


Figure 39 - Typical Stunt Box Contact (Unoperated)

when a slide is shifted to the rear by its function lever, move the letters-figures code bar fork to the right (letters position) or to the left (figures position). The fork engages a pin on the bracket which is fastened to the letters-figures shift code bar, and positions the code bar to the right or left (Fig. 20). Movement of the letters-figures code bar results in the positioning of the typebox, through related mechanisms, for printing of letters or figures, as described in 8.05.

STUNT BOX CONTACTS (Figs. 39 and 40)

13.17 For external circuit control and switching functions, the function levers may be positioned to operate normally open, normally closed, or SPDT switches mounted on the top of the stunt box. In general, the function contacts are similar except for electrical connections,

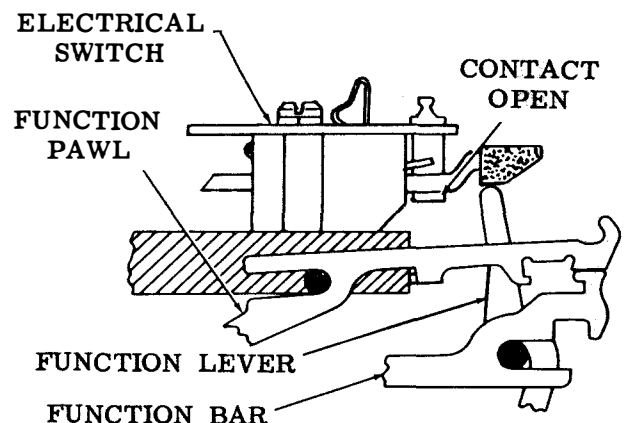


Figure 40 - Typical Stunt Box Contact (Operated)

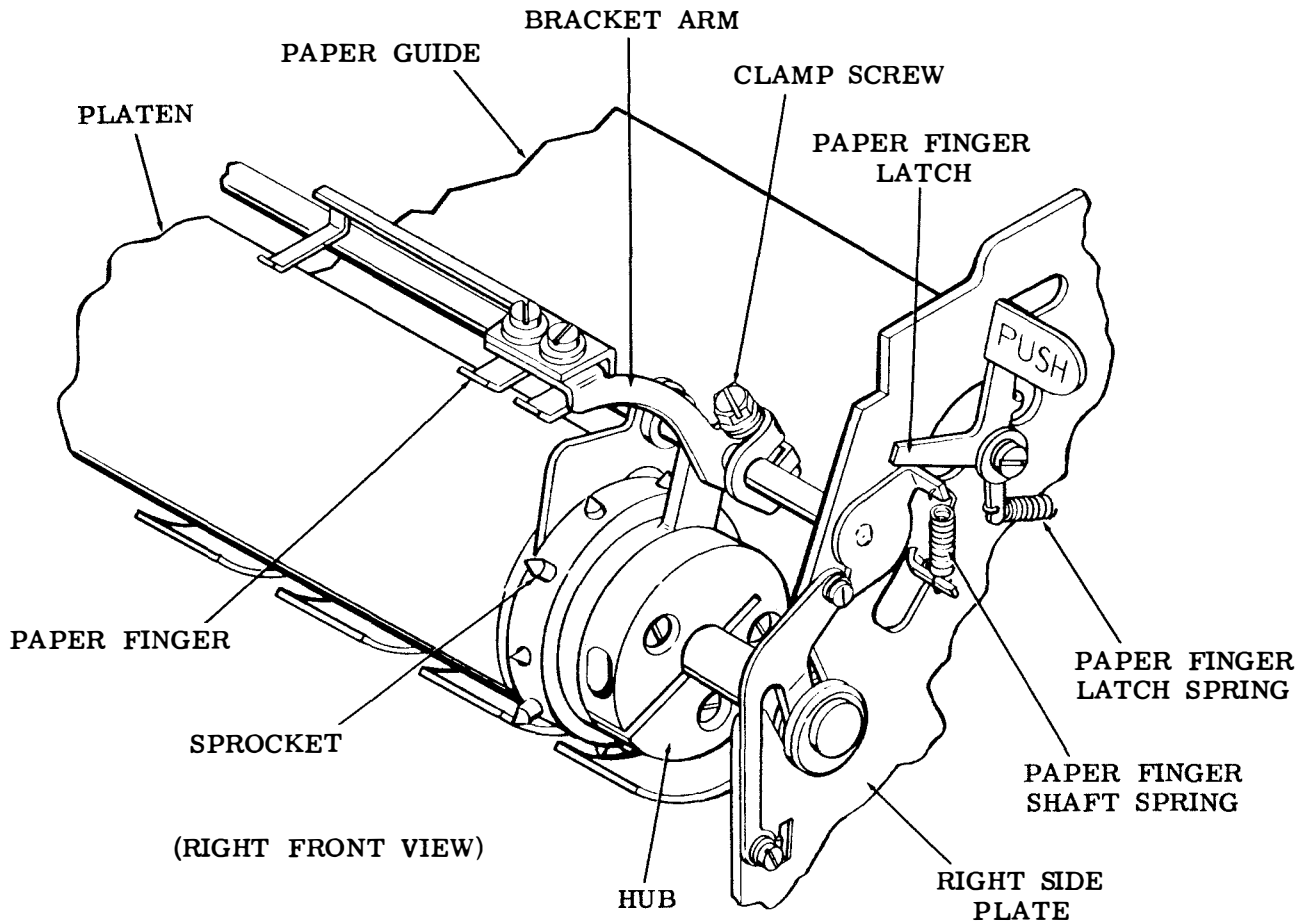


Figure 41 - Sprocket Feed Platen Mechanism

which are determined by external requirements. The contact arm configuration is changed as required to either make or break the contact when the associated function lever is in selected (rear) position. All contacts are wired through the cable connector located on the right side plate. A typical contact (NO) is illustrated in unselected (Fig. 39) and selected (Fig. 40) condition.

14. SPROCKET FEED TYPING UNIT

GENERAL (Figs. 3 and 41)

14.01 Except for differences in the platen and associated mechanisms (par. 2), the sprocket feed typing unit includes all features of the friction feed typing unit described in this section. It has a sprocket feed mechanism for insertion of a form-fold paper supply for the page printed message.

DESCRIPTION

14.02 The platen is equipped at each end with an eleven pin sprocket, with pins spaced to accommodate holes along the edges of form fold paper for the page printed message (Fig. 41). The pins are cammed (within the platen) so that the two bottom and two top pins on each side at the front of the platen are extended, while all others are retracted. Extended pins engage the holes in the form fold and pull the paper into page printing position over the front of the platen, where it is held by two paper fingers. At the rear of the platen, the form fold is fed through an aperture at the back of the enclosure housing the typing unit, across a flat paper guide, and under the bottom of the platen. Paper feeding and line feeding are as described in 13.09. Paper fingers are released to a spring loaded upright position by pushing a lever marked PUSH on the top of the right side plate to the rear. The fin-

gers are repositioned by depressing them manually until the end of the paper guide shaft latches an indent on the release lever.

15. VARIABLE FEATURES

HORIZONTAL TABULATION (Figs. 42 and 43)

15.01 The spacing drum for typing units equipped for horizontal tabulation has a slotted tab stop ring mounted over the face of the spacing drum, in place of the carriage return ring on other units. The ring (Fig. 42), when coded for the desired tabulation, will allow the carriage to be moved rapidly, at a speed three times that of normal spacing, to predetermined horizontal positions on the printed page.

15.02 Reception of the input signal code combination representing horizontal tabulation operates the associated stunt box mechanisms to move the function lever forward. The function lever moves the horizontal tabulator slide (Fig. 43) forward. As the slide arm moves forward, it engages the operating lever cam plate, causing the operating lever to pivot about its mounting stud, located at the center of the lever. As the upper end of the operating lever moves forward, the extension link attached to the lower end of the lever moves to the rear. Near the end of its travel, the extension link clears the blocking lever, allowing it to move down into position to block the link from moving forward.

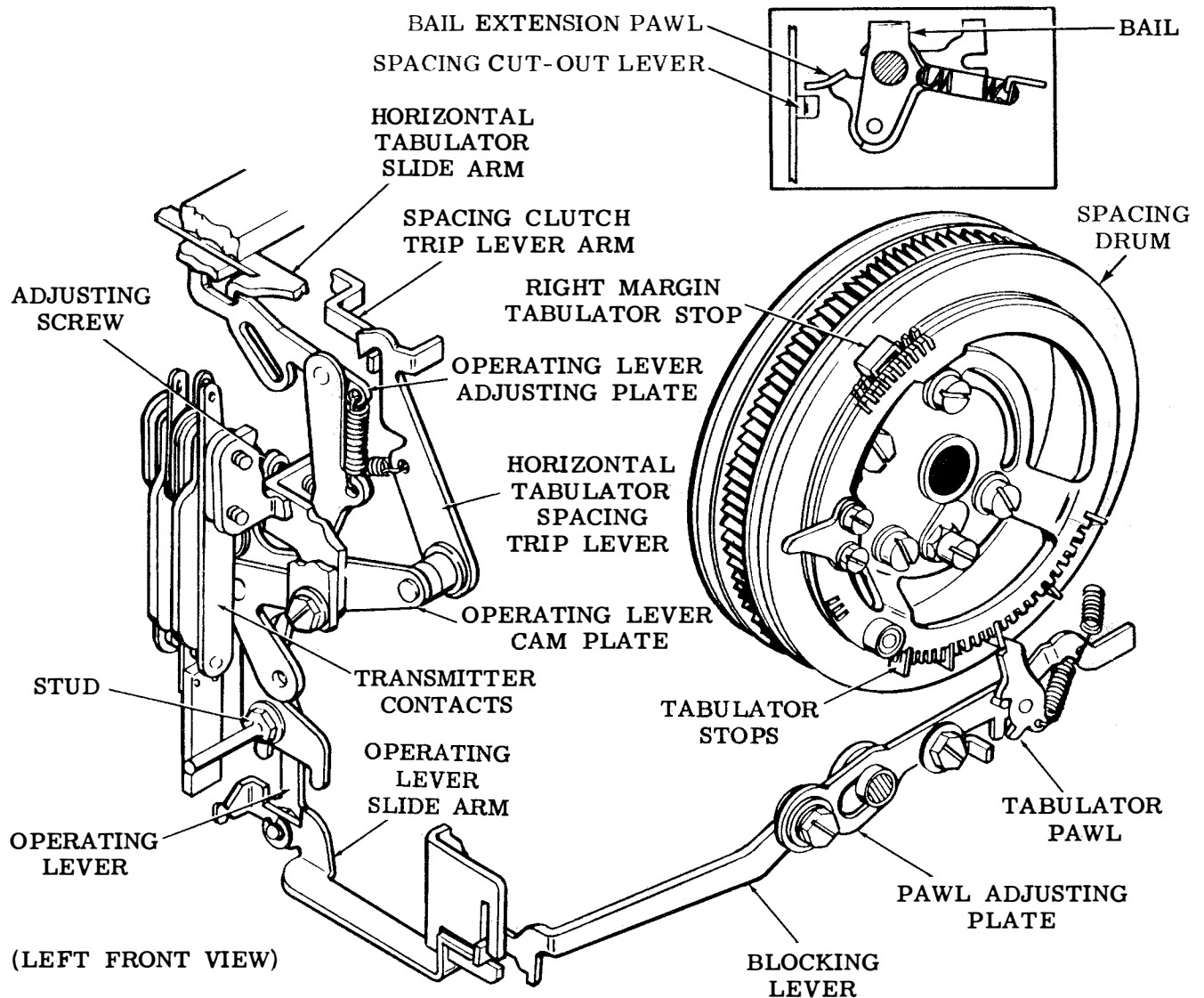


Figure 42 - Horizontal Tabulation Mechanism

15.03 Tripping of the spacing clutch is initiated in the same way as for normal printing (10.01-10.02). As the trip lever moves down, however, it hooks over and pulls down the intermediate trip bail (Fig. 43). The intermediate bail in turn pulls down the stop lever arm and trips the clutch stop lever, which is clamped to the lower end of the stop arm. The spacing clutch then starts to rotate. The stop lever arm in its unoperated position rests against the intermediate bail.

15.04 Fastened to and moving as part of the operating lever is the latch bail adjusting plate (Fig. 43). Mounted to the stud on the upper end of the adjusting plate is the stop lever arm latch bail. The latch bail in its rest position is held forward by spring tension against a projection on the adjusting plate. Therefore, when the upper end of the operating lever moves forward, the latch bail moves with it until the upper end of the latch bail strikes the spacing stop lever arm, which would not have been pulled down yet. The operating lever continues moving until it reaches its forward position, but the latch bail resting against the stop lever arm is prevented from going any farther and pivots around its mounting stud. Later, when the stop lever arm is pulled down by the spacing trip lever, the forward end of the stop lever arm comes below the latching surface of the latch bail. The latch bail then moves forward over the stop lever arm, latching it down as long as the operating lever is held in its operated position.

15.05 As the spacing clutch starts to rotate, the cam plate stripper bail (Fig. 43) engages the cam lobe on the spacing clutch restoring cam. This pivots the stripper bail about its shaft, causing the operating lever cam plate to be pivoted downward, out of engagement with the slide arm. The operating lever then drops back slightly until the lever extension link butts up against the blocking lever, which is in the down position. Thus, the operating lever is held operated, the spacing stop lever arm is latched down by the latch bail, and the spacing clutch will rotate until the blocking lever is tripped, unblocking the operating lever extension link.

15.06 As the spacing clutch rotates, the spacing drum will rotate until a tab stop attached to the drum reaches the tabulator pawl mounted on the blocking lever (Fig. 42). As the tab stop moves across the pawl, the pawl is moved down, causing the blocking lever to rotate about its mounting stud and releasing the operating lever extension link. The operating lever

returns to its unoperated position. The latch bail releases the stop lever arm, and the clutch stop lever blocks further rotation of the spacing clutch. The tabulator function slide arm returns to its unoperated (rear) position when the function pawl is stripped from the function bar during the normal operation of the function stripper blade.

15.07 When the printing carriage nears the right margin position, the spacing cut-out lever (Fig. 42) on the spacing drum engages the lower surface of the bail extension pawl. The extension pawl and bail rotate together due to the pawl spring until the bail is fully operated. When the transfer bail is in its operated position, the space suppression slide is operated, and further normal spacing is prevented. If the clutch were to continue to rotate, the spacing drum will continue to rotate after the transfer bail reaches its operated position. At this time, the bail reaches a fixed stop, but the extension pawl pivots about the lower pivot point, permitting the cut-out lever on the drum to go by the pawl. The transfer bail and the extension pawl will then return to their unoperated position. When the carriage returns, the space cut-out lever engages the upper surface of the extension pawl, causing the pawl to pivot about the mounting shaft until the cut-out lever is able to go by the pawl. The extension pawl is then returned to its unoperated position.

15.08 A set of contacts, the forward contacts interrupting operation of an associated transmitter distributor set during the tabulation operation, the rear operating a motor hold mechanism external to the typing unit, are operated simultaneously when the operating lever is in operating position.

VERTICAL TABULATION AND FORM OUT (Fig. 44)

15.09 A number of form starter gears and index discs (Fig. 44) are available to adapt sprocket feed typing units for form out accommodation of forms two to fifteen inches in length with vertical tabulation in 1-inch increments, or of two to ten inches in length with vertical tabulation in 1/2 inch increments. The form starter gear and the index disc are selected for the desired form length. The form out mechanism automatically advances a form to the first printing line on the succeeding form from any point on the previous form. The vertical tabulation mechanism advances a form to any predetermined position within the form.

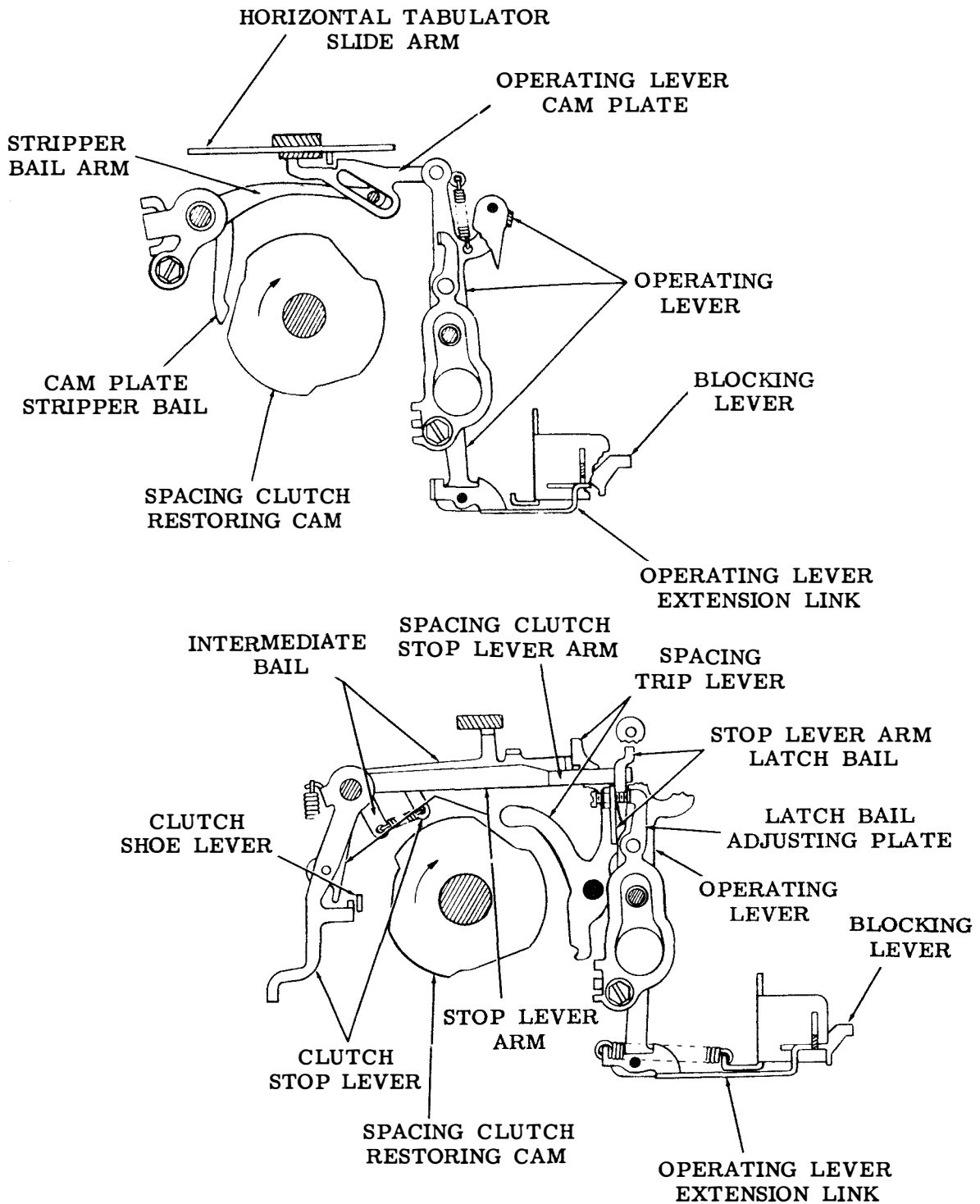


Figure 43 - Horizontal Tabulation

15.10 When the input signal code combination representing form out is received, the associated stunt box mechanism linkage moves the form out slide forward. As a result, the tabulator slide moves forward, moving the line

feed slide forward so that it unlatches the line feed clutch. With the line feed clutch engaged, movement of the form out slide is prevented by the form out blocking lever, and the line feed mechanism operates continuously.

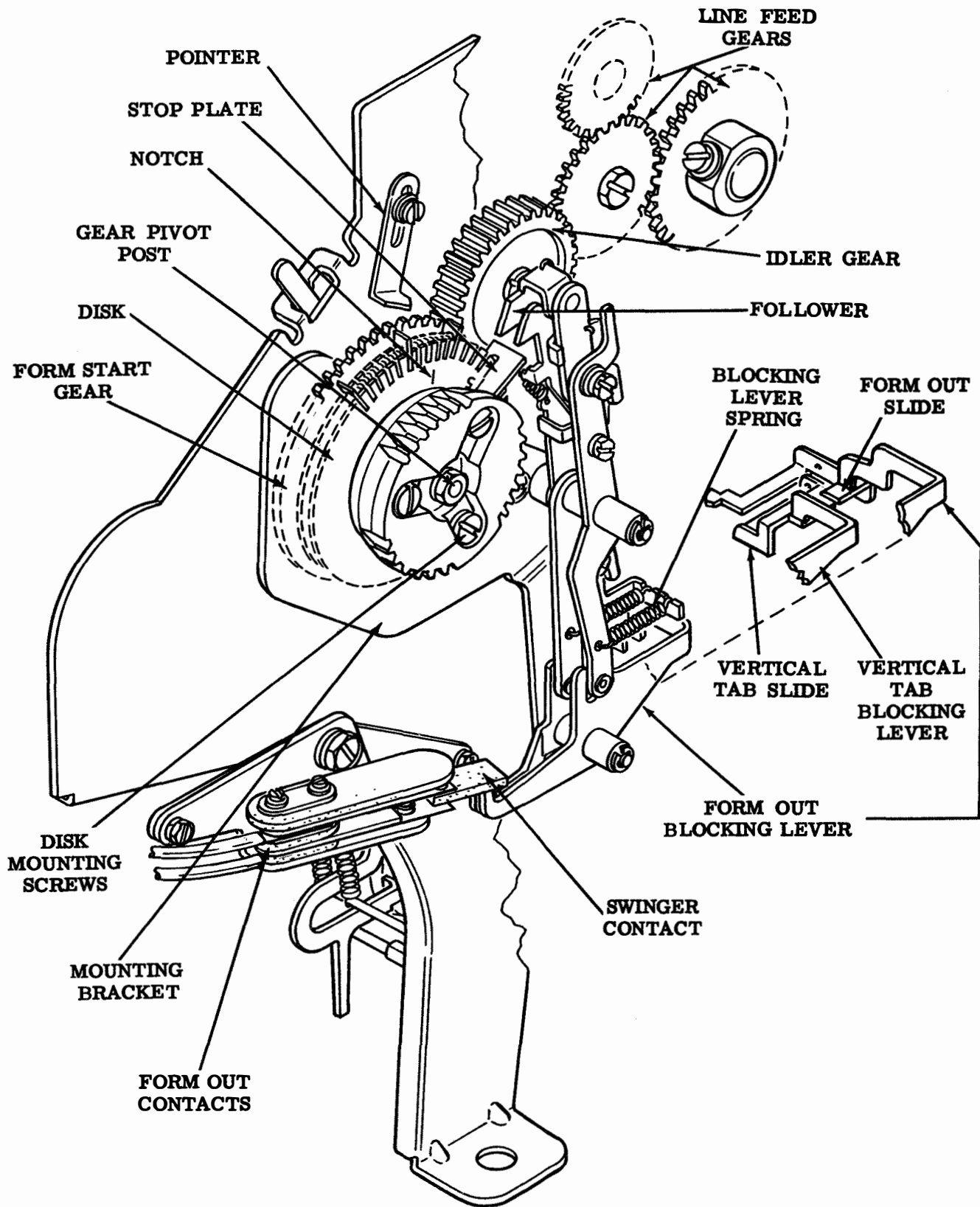


Figure 44 - Vertical Tabulation and Form Out Mechanisms

15.11 When the stop plate on the rotating disc engages the pawl, the form out blocking lever is moved upward, permitting the slides to return to their unoperated positions. When this occurs, the line feed clutch is disengaged, and the form out operation is terminated.

15.12 The sequence of operation of vertical tabulation is similar to that of the form out mechanism. When the input signal code combination representing vertical tabulation is received, the associated stunt box mechanism operates a vertical tabulator slide. The slide, moving forward, engages the line feed slide, which in turn engages the line feed clutch. The vertical tabulator blocking lever retains the vertical tabulator slide in the operated position, and the line feed clutch is permitted to rotate continuously.

15.13 The vertical tabulator slide remains in the operated position until the stop plate on the disc engages the bail, which in turn raises the blocking lever and allows the vertical tabulation slide and the line feed slide to return to their unoperated positions. The line feed clutch is disengaged, and the function mechanism is stripped to its unoperated position.

15.14 A set of transmitter control contacts operate on both vertical tabulation and form out cycling. The contacts contain an insulated swinger that rides on an extension of each blocking lever. When either blocking lever is in the operated position, the contacts are opened and, through external wiring, stop transmission from the associated transmitter-distributor.

AUTOMATIC CARRIAGE RETURN-LINE FEED

15.15 The automatic carriage return-line feed feature operates through stunt box mechanism each time the type box carriage advances to within one character of the right margin. Should an operator fail to originate these functions, this feature provides them automatically.

15.16 With the type box carriage advanced to within one character of the right margin, the automatic carriage return bell crank is tripped by an arm attached to the spacing drum (Fig. 26). The bell crank turns clockwise and positions the automatic carriage return-line feed code bar, marked O, to the right. Two identical function bars, each with a single code projection are provided in the stunt box, adjacent to the carriage return and line feed function bars. The code bar normally blocks the

function bars. When the automatic carriage return-line feed code bar is positioned to the right, however, the function bars and their associated pawls and levers operate. The carriage return and line feed slide arms are operated, and cause these functions to occur simultaneously.

LOCAL BACKSPACE

15.17 Each time the LOC BSP (local backspace) key lever on the associated keyboard unit is operated, a backspace occurs at the local typing unit. The key lever, through an operating bail and trip link engages the spacing clutch. As the spacing eccentric assembly rotates, the spacing feed pawl that is moving upward is prevented from engaging the teeth on the spacing drum by the action of the eccentric and the pivoting of the feed pawl on the back space camming bail. As a result, the spacing drum rotates backward under spring tension, following the feed pawl that is moving downward. After a single backspace occurs, the spacing clutch is disengaged by action of the trip link stripper, which rides on the clutch cam disc.

UNSHIFT ON SPACE

15.18 Each time the space function signal code is received, the unshift on space feature automatically shifts the type box to the letters position. A function bar and its function lever, located adjacent to the letters-figures function mechanism, operate upon receipt of the space signal code. The function lever engages an extension of the letters function slide. Therefore, when a spacing function occurs, letters shift will also occur, in the manner described in 8.05. This feature may be disabled by the adjustment of a screw which raises the end of the function pawl from the function bar.

SIGNAL BELL

15.19 The circuit to the signal bell magnet is controlled by a set of normally-open electrical contacts operated by the stunt box. The function bar for the signal bell function has six code lugs, five for the signal code combination, such as S or J, and one for the letters-figures shift code bar. To select the signal bell function, the letters-figures shift code bar must be in or shifted to the figures position. Then, each time the signal code combination for the bell function is received, the function lever will pulse the signal bell contact. If the letters-figures code bar is in the letters position at this time, it will block the signal bell function bar.



28 TELETYPEWRITER KEYBOARD AND BASE
 DESCRIPTION AND PRINCIPLES OF OPERATION

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3. PRINCIPLES OF OPERATION	6	1. GENERAL	
KEYBOARD	6	1.01 The 28 keyboard provides mounting and transmission facilities for the 28 Key- board Send-Receive (KSR) Teletypewriter Set. The 28 receive-only base provides mounting facilities for the 28 Receive-Only (RO) Tele- typewriter Set.	
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A. Local Carriage Return Mechanism	10	2.01 The 28 keyboard is a device for convert- ing the mechanical action resulting from the manual depression of a key into electrical pulses that are transmitted over a signal line. In addition, the keyboard provides mounting fa- cilities for the typing and motor units of a Key- board Send-Receive (KSR) Teletypewriter Set, as well as for a variety of accessories.	
B. Local Line Feed Mechanism	10		
C. Signal Line Break Mechanism	10	2.02 The keyboard is installed on a cradle assembly in the floor and table model enclosures, on a base plate assembly in the wall and rack mounted enclosures, and on slide-type mountings in the multiple KSR and RO cabinet. The front of the keyboard protrudes beyond the enclosure and is fitted with a rubber pad that seals the edges of the aperture from dust and for a silencing effect.	
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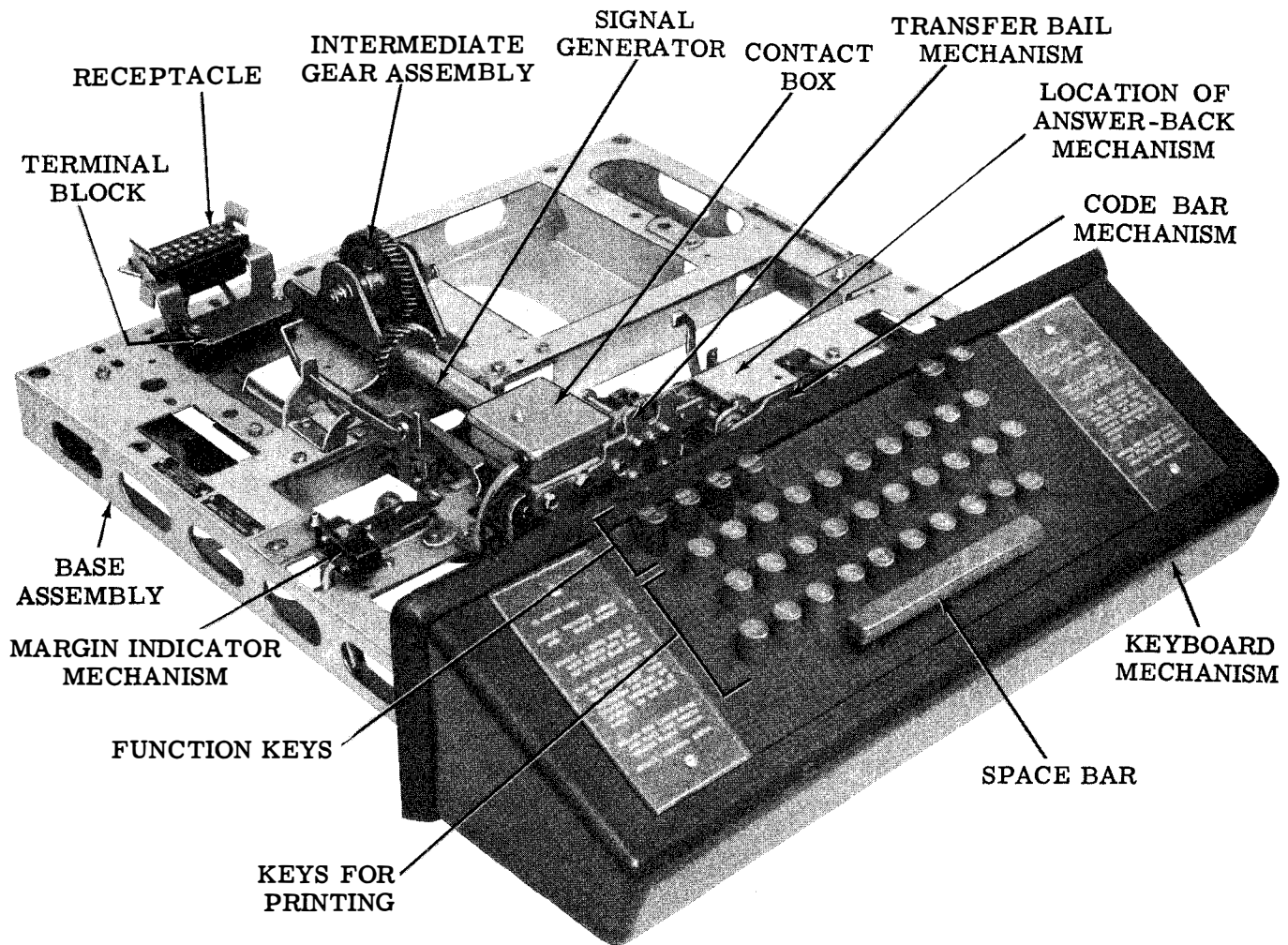


Figure 1 - 28 Teletypewriter Keyboard

2.03 Motive force for activating the keyboard is derived from the motor unit by way of the typing unit. The electrical wiring to and from the keyboard is terminated in a connector mounted at the left rear of the unit. Fuses for the power circuits are located in the electrical service unit.

2.04 The keyboard is operable on line at the following speeds; 60, 75 and 100 words-per-minute; or 368, 460, and 600 operations-per-minute. Operating speeds are varied by interchanging sets of gears that are supplied as optional components. The signal generator contact box may be adapted to provide either polar or neutral signals.

2.05 The major sections of the keyboard are the base assembly, keyboard mechanism, and the signal generator mechanism.

B. Base Assembly

2.06 The base assembly provides mounting facilities for the keyboard and signal generator mechanisms, the intermediate gear assembly, cable and switch assembly, margin indicator switch, power terminal block, and optional accessories, such as the time delay and paper feed-out mechanisms.

2.07 The intermediate gear assembly consists of two helical gears, a shaft, and a mounting bracket. The assembly transfers motive

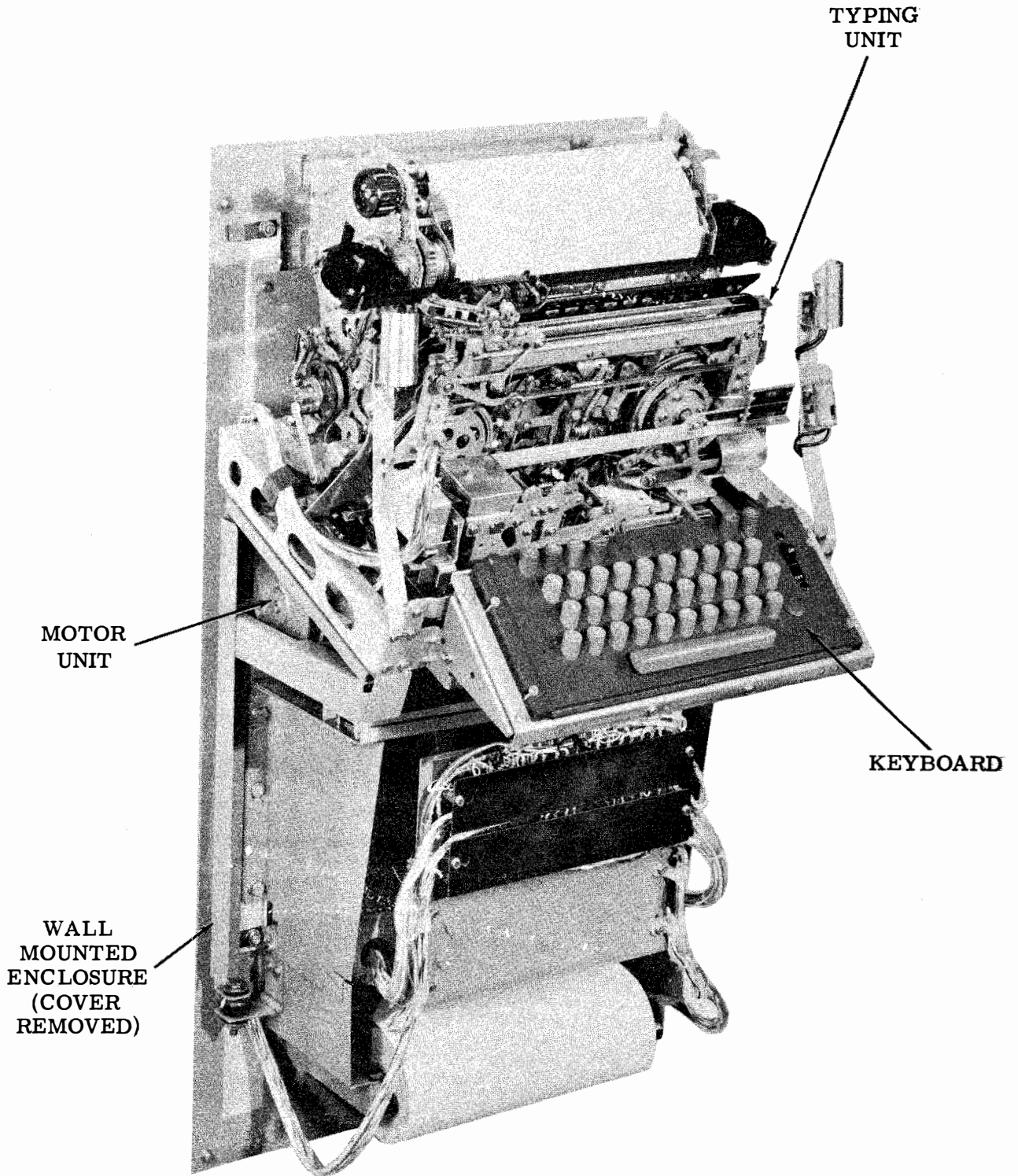


Figure 2 - 28 Teletypewriter Keyboard in Wall Mounted Set (Cover Removed)

power from the motor to the associated typing unit. Changes in operating speed are made by changing the motor pinion and the intermediate gear assembly driving gear.

C. Keyboard Mechanism

2.08 The keyboard mechanism contains the keytops, keylevers, code bars and levers and other code selecting parts that transform the intelligence contained in the manual selection of a keytop into a teletypewriter code combination, represented by code bar positions. The code combination for the selected character is transferred from the code bars through transfer levers to the signal generator mechanism.

2.09 The keytops are positioned in the conventional three-bank arrangement, with numerals, punctuation marks, and special symbols available in upper case positions. The space bar is located centrally below these keys. Keytops for local carriage return and local line feed are provided above the standard keytops for facility of operation. This row has provisions for 9 additional keys for optional, special operations. A wedge lock assembly prevents the simultaneous depression of more than one keytop.

D. Signal Generator Mechanism

2.10 The signal generator mechanism generates the start-stop teletypewriter signal. It consists of, basically, an enclosed contact box containing a set of fulcrum-type transmitting contacts, a transfer bail that controls the opening and closing of the contacts, selector levers that engage the transfer bail in a sequence determined by the position of the code bars, and a multi-lobe cam which determines the pulse duration of the signal code elements. A shaft, which mounts a gear and clutch, receives motive power to drive the mechanism from a gear on the associated typing unit.

2.11 The contact box will generate either neutral or polar signals, and may be equipped with an rf or arc suppression network.

E. Wall Mounted Keyboard (Fig. 2)

2.12 The keyboard used in wall mounted KSR sets differs from the standard keyboard in that its intermediate gear assembly contains one helical gear and one pulley. The motor unit mounts below the keyboard, on the left rear side, and its pinion engages with and drives the belt. The belt in turn engages with and drives the belt pulley and the attached intermediate shaft as-

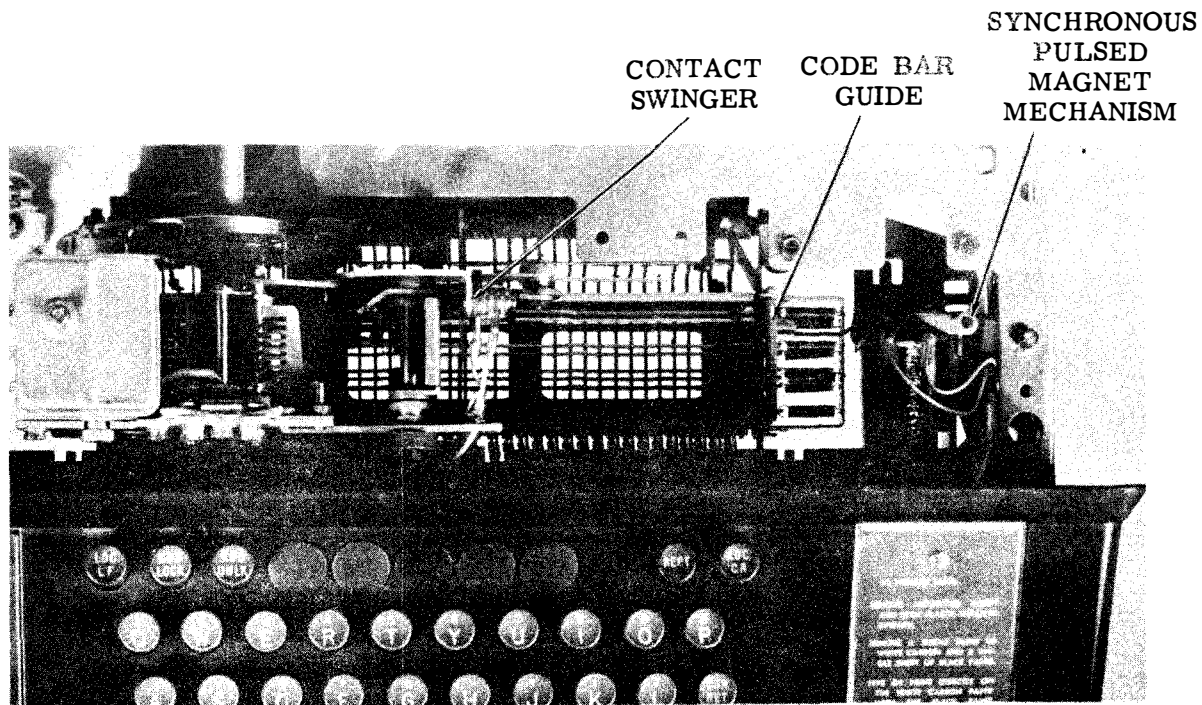


Figure 3 - 28 Teletypewriter Keyboard (Top View)

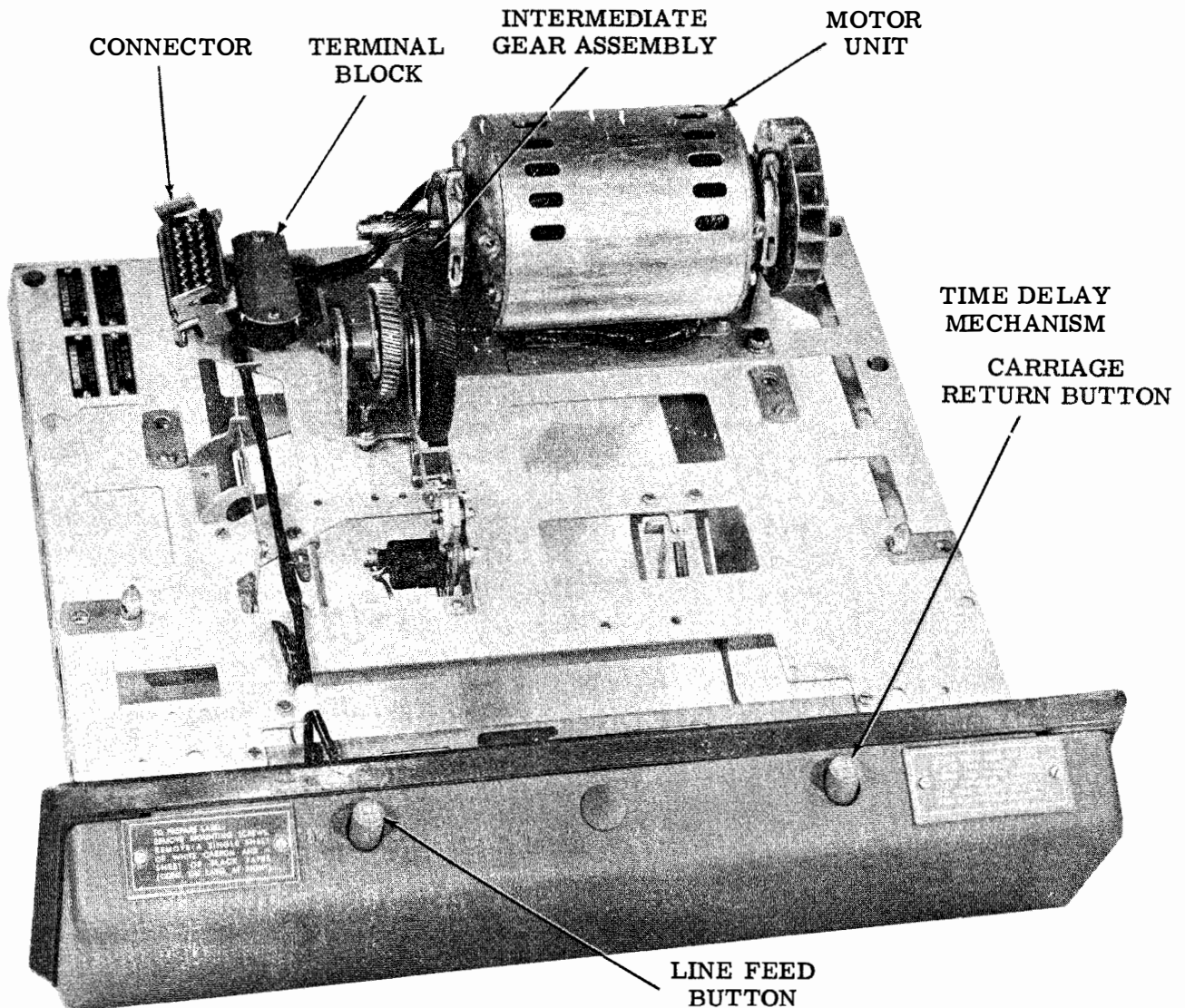


Figure 4 . 28 Teletypewriter Receive-Only Base with Motor Unit

sembly. A gear on the intermediate shaft assembly transfers the motive power to the typing unit.

F. Variable Features

2.13 The keyboard has provisions for accommodating a variety of accessories, including the following:

- (a) Motor start for page feed out.
- (b) Time delay motor stop.
- (c) Local reverse line feed.
- (d) Local back space.
- (e) Signal line break.
- (f) Keyboard lock and unlock.
- (g) Repetition of characters.
- (h) Repeat on space.
- (i) RF and arc suppression.
- (j) Answer-back (automatic station identification).
- (k) Synchronous pulsed transmission.

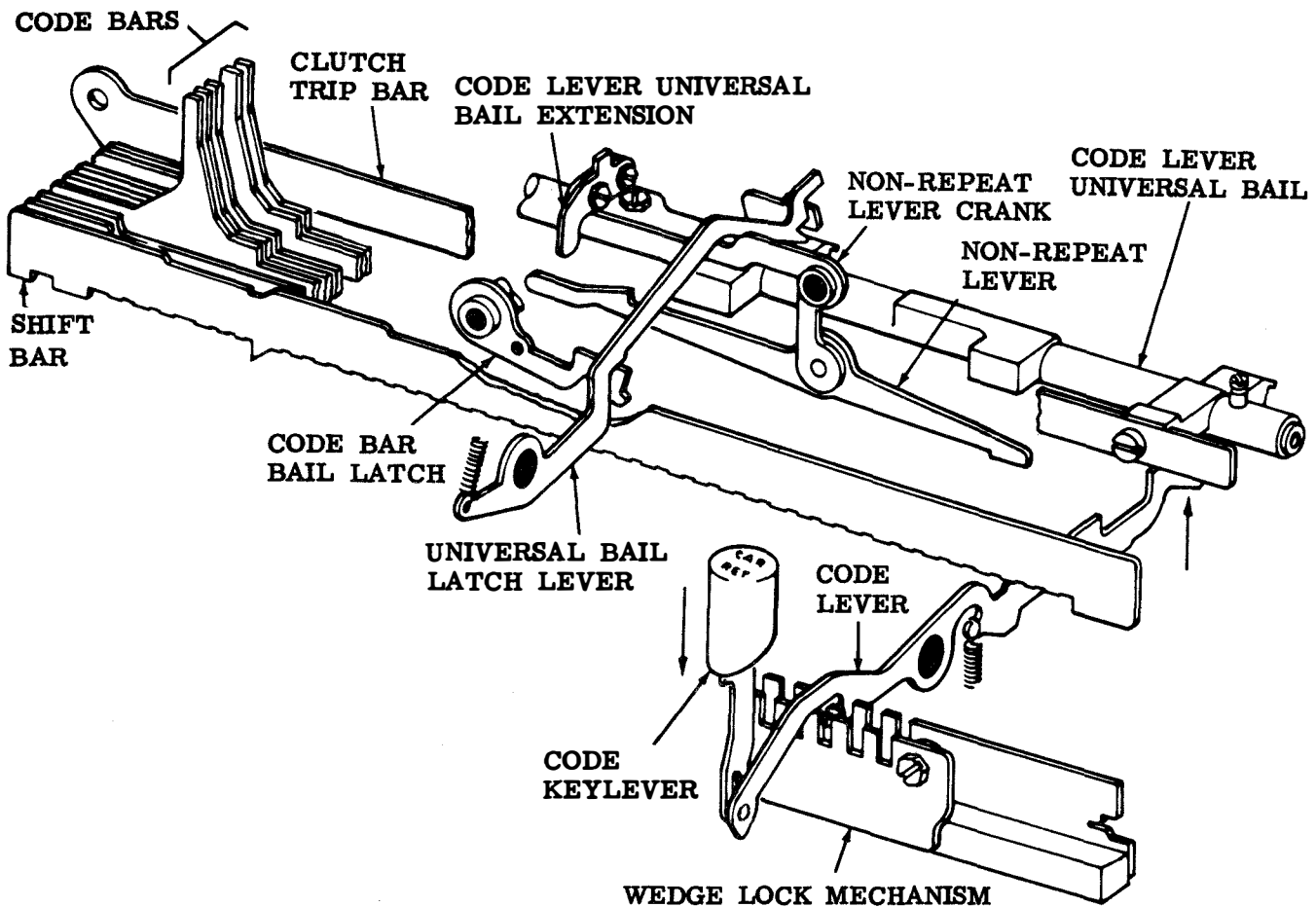


Figure 5 - Code Bar and Code Lever Universal Bail Mechanism

RECEIVE-ONLY BASE (Fig. 4)

2.14 The receive-only base is an aluminum, sheet metal structure used in place of the send-receive keyboard when receiving facilities only are required. It supports the motor unit and the typing unit and provides for carriage return and line feed operation of the local typing unit. It does not incorporate code selecting and signal generating mechanisms. The receive-only base may include the following accessories:

- (a) Signal line break.
- (b) Motor start for page feed out.
- (c) Time delay motor stop.
- (d) Margin indicator lamp contact.
- (e) Print/non-print switch.

- (f) Local transmitter control.

2.15 The wall mounted receive-only base used in wall mounted RO sets differs from the standard base in that its intermediate gear assembly contains only one helical gear, and a belt drive system is used.

3. PRINCIPLES OF OPERATION

KEYBOARD

A. Depression of Keys (Figs. 5 through 9)

3.01 As a code selecting keytop is depressed, the corresponding code lever rotates about its pivot point. The rear end of the code lever comes up and rotates the universal bail. The extension arm on the top of the universal bail moves out of engagement with the step at the rear end of the universal bail latch. This

occurs when the key and corresponding code lever are about two-thirds of the way toward full stroke. The universal bail latch then moves downward under spring force developed by the universal bail latch spring. As this latch comes down, it strikes the code bar reset bail latch lever and carries it downward. When the corner of the reset bail latch descends beyond the center line of the needle bearing (mounted on the reset bail), the various spring forces acting on the reset bail cause it to swing to the right. This in turn allows the various code bars to move to the right (in the direction of the spring forces acting on each code bar). During this time, the code lever is moved up to its full position. Therefore, the code lever may stop some of the code bars from moving to their extreme right hand position. The code bars have vertical extensions that engage a curved part of the signal generator transfer levers. Those code bars that are permitted to move to the extreme right also move the corresponding transfer lever to the right. However, those code bars that are stopped, because their teeth engage the actuated code lever, do not quite touch or move their corresponding transfer levers. Therefore, these

transfer levers remain in their normal left hand position (Fig. 8).

3.02 A locking wedge is mounted on the projection of the lower position of all code levers and function levers. When the lever is operated, its locking wedge moves downward between the lock balls in the lock ball channel preventing the simultaneous operation of more than one keylever (Fig. 6).

3.03 Simultaneously with the trip-off of the reset bail and the movement of the code bars to the right, the clutch trip bar (located in the rear slots of the code bar guides) moves to the right. This clutch trip bar engages the clutch stop lever and moves it out of latch with the clutch stop lug. Up to this point, all of the action has been caused by manual operation of the keytop and its associated code lever (Fig. 5).

3.04 The motor unit (mounted on the rear right corner of the keyboard base) supplies the mechanical power to drive the associated typing unit and the signal generator shaft that is geared to the typing unit main shaft. Re-

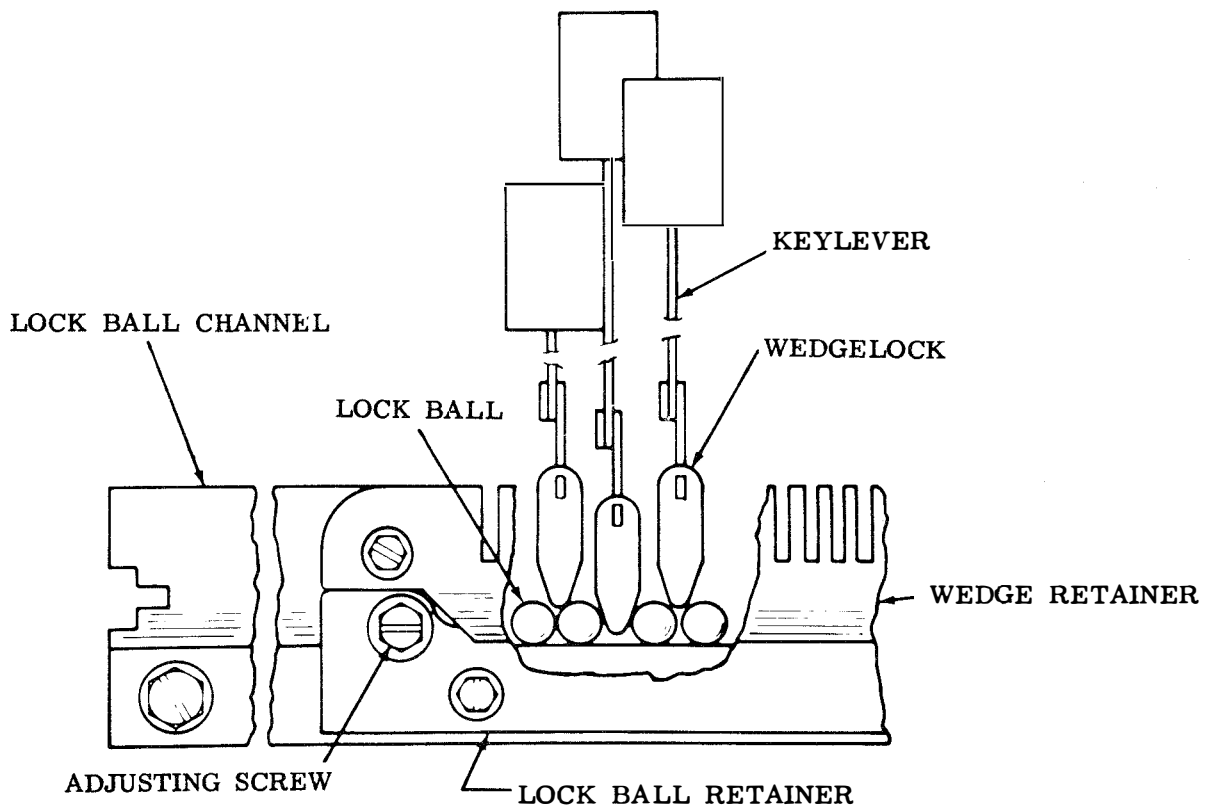


Figure 6 - Wedgelock Mechanism

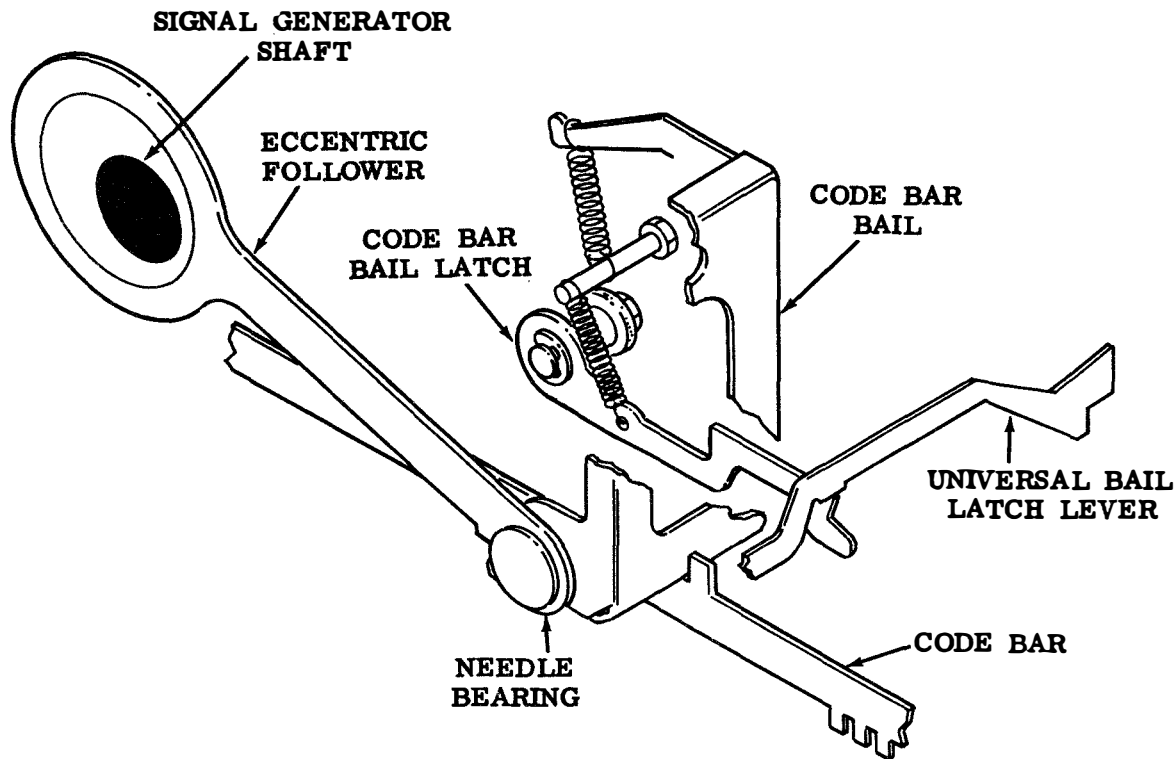


Figure 7 - Code Bar Mechanism

fer to the appropriate section for description and principles of operation for the motor unit.

B. Positioning of Code Bars (Figs. 5, 7 and 8)

3.05 Once the clutch is tripped, it rotates continuously as long as the keyboard is turned on. Since the clutch shoes are mounted on a plate that is part of the cam assembly, the cam begins to rotate (clockwise when viewed from the front of the keyboard).

3.06 The arrangement of the cam assembly is such that the third cam from the rear begins to push downward on its corresponding transfer lever. At almost the same time, the eighth cam from the rear begins to move the transfer lever locking bail upward. The blade portion of this locking bail goes up beside a downward projection on each transfer lever. The locking projection is left or right of the locking bail, depending upon the position of the transfer lever (as set up by the permutation action of the code bars). Thus, in the first few degrees of cam rotation, the permuted position of the transfer levers is located into position and the code bars are free to be reset in their normal latched position.

3.07 The cams and their corresponding transfer levers are numbered from rear to front. The number 3 cam engages its transfer lever first; and moves it down. Since the start pulse is always spacing, no code bar is required to engage this lever and it is always held to the left by its spring. Therefore, as the third cam moves the lever down, the hook at the upper right side of the transfer lever engages the right side of the transfer (rocker) bail. This tips the transfer bail to the right and pulls the contact drive link to the right. The resulting action of the contact toggle is such that the left set of contacts acts as a pivot and the right hand contacts begin to open. The right hand contacts control the signal current in single contact type operation. When these contacts are open, the result is no current in the signal circuit. Therefore, the first pulse, the start pulse of any character code is a spacing (no current) pulse.

3.08 The number 1 cam and the transfer lever move downward next. In turn, the upper left hook of the associated transfer lever pulls down on the rocker bail (holding it to the right or tilting it back to the left). This pushes the drive link to the left (or right) resulting in clos-

ing the right (or left) contacts and allowing a marking (or spacing) pulse to be transmitted.

3.09 Similarly, the remaining transfer levers 2, 4, 5 and 6 are pulled downward by their respective cams. The resulting pulse is marking if the transfer lever is to the right or spacing if it is to the left. The number 7 transfer lever is held to the right by a stop pin. Therefore, the last pulse (the stop pulse) is always marking (current on).

3.10 The locking bail is actuated by the number 8 cam lobe. This cam begins to move the locking bail up into its locking position almost as soon as the cam starts to rotate (Fig. 9). Full lock position occurs approximately at the half-way point of the start pulse (48-1/2 degrees of rotation). The dwell on the eighth cam from the front holds the lock bail in its lock position until after the beginning of the number 5 pulse. Then the cam pulls the bail down out of lock, and all transfer levers are free to return to their initial positions at a point about half-way through the stop pulse.

C. Resetting of the Code Bars (Fig. 7)

3.11 Reset of the code bars is accomplished by means of an eccentric on the front of the cam assembly, which drives an eccentric follower arm (Fig. 7). This arm engages a stud on the side of the reset bail and pulls the reset bail to the left as the cam rotates. At the peak position of the reset eccentric, the code bar reset bail latch is clear of the needle bearing stud. This permits the latch spring to pull the latch up into locking position and the code bar reset bail is latched as the eccentric drives the follower arm back to its initial position. As the code bar reset bail is moved to the left (into reset), it engages projections on the permutation code bars, clutch trip bar, and a step on the non-repeat lever. Thus, all of these elements are moved to the left into latched reset position.

3.12 The reset eccentric is positioned in angular relationship to the remainder of the cam so that pick-up of the code bars and non-repeat lever begins. Just after the number 2 pulse begins, near the end of the start pulse, the

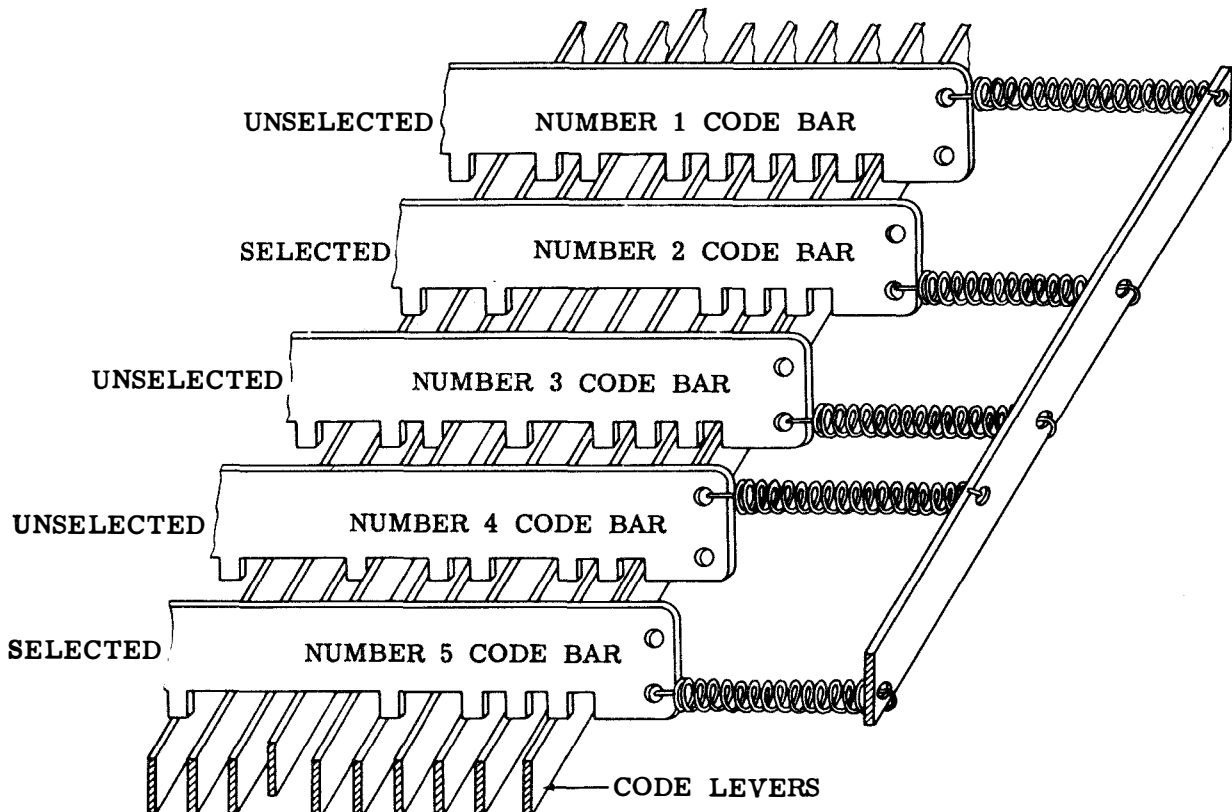


Figure 8 - Code Bar Selection

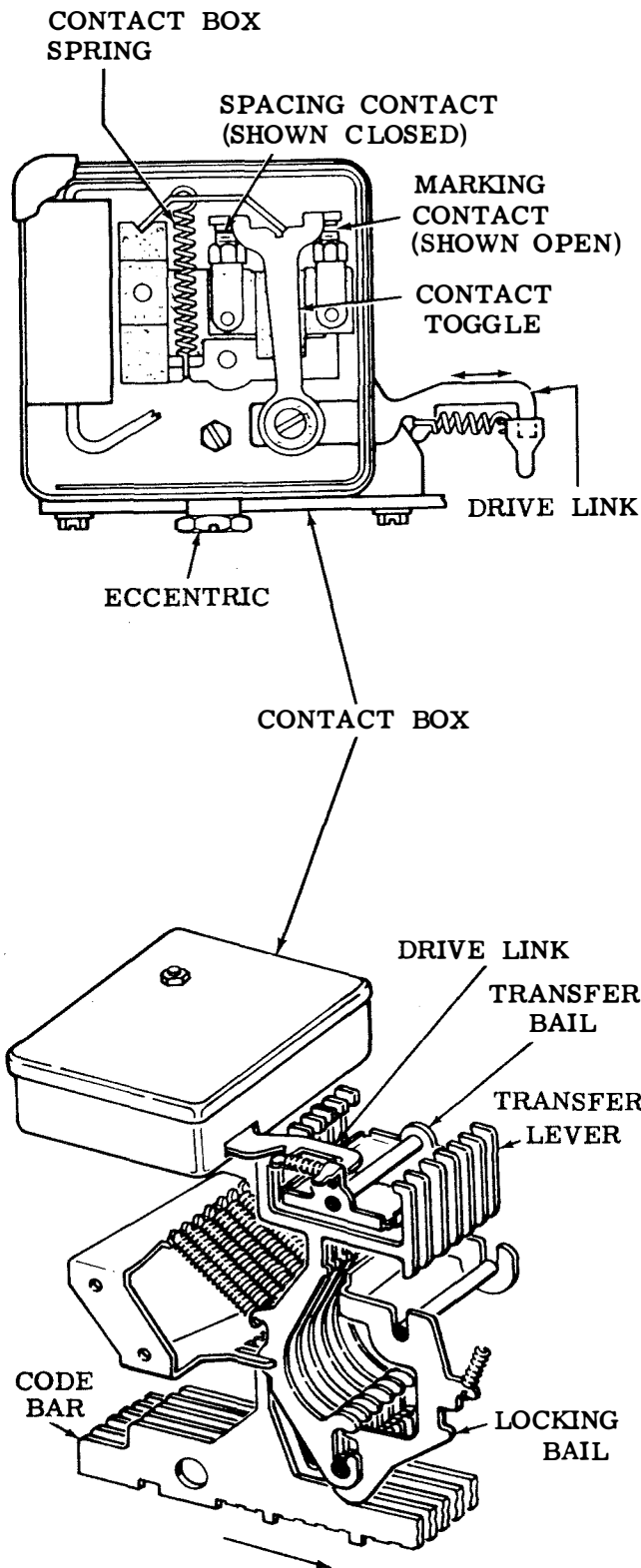


Figure 9 - Transfer Lever Mechanism and Contact Box Mechanism

code bars have been moved to the left a sufficient distance to permit the code lever (that determined the permutation) to drop down out of the universal bail. This permits the universal bail to rotate forward and move the non-repeat lever down and off the reset bail. At the same time, the extension of the universal bail moves in under its latch lever and holds this latch lever up almost in the same position that the pawl on the non-repeat lever had held it in the early reset movement. With the universal bail latch held up, the reset bail continues to move to the left. Full rest occurs at approximately 180 degrees of cam rotation 1/4 through the number 3 pulse). As soon as the universal bail is permitted to move forward, a second keytop can be depressed. However, from that point on, full time of cam rotation must expire before a third and successive keytops can be operated.

FUNCTION KEYS

A. Local Carriage Return Mechanism (Fig. 10)

3.13 Operation of the local carriage return keylever causes its function lever to raise the forward end of the local carriage return bail (Figure 10). The bail rotates about its pivot point until the upper end engages the carriage return lever on the typing unit. Thus, the carriage return mechanism on the local typing unit is made to operate without disturbing the other typing units on the same line circuit.

B. Local Line Feed Mechanism (Fig. 12)

3.14 Operation of the local line feed keylever causes its function lever to raise the forward end of the local line feed bail (Fig. 12). The bail rotates about its pivot point and the upper end pushes the trip link until the link engages the line feed clutch trip lever on the typing unit. The actuated line feed mechanism on the local typing unit operates without disturbing the other typing units on the same line circuit.

C. Signal Line Break Mechanism (Fig. 11)

3.15 Operation of the BREAK keylever opens the signal line circuit until the keylever is released. Depression of the keylever engages the signal break bail, lifting it upward. The upper area of the signal break bail moves downward and actuates the normally closed signal line switch. Upon release of the keylever, a return spring exerts a force that moves the upper end of the signal break bail upward, closing the signal line circuit.

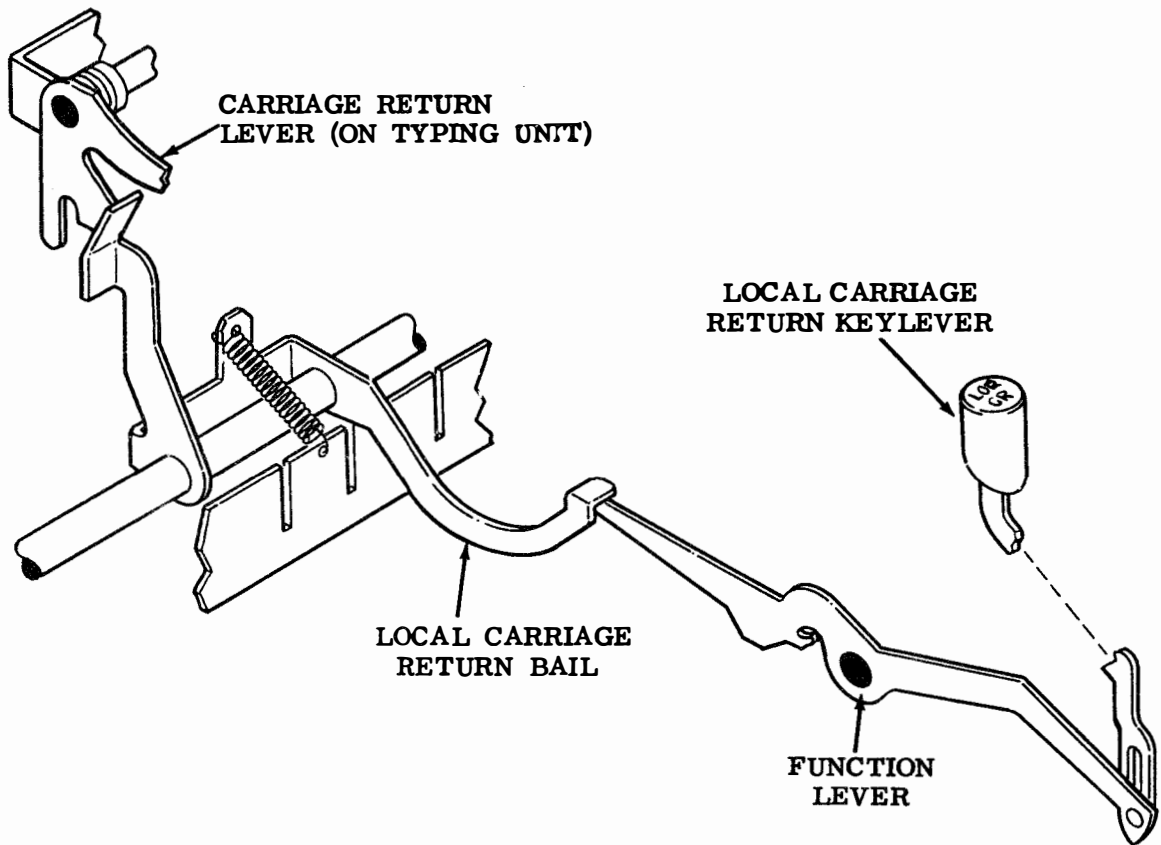


Figure 10 - Local Carriage Return Mechanism

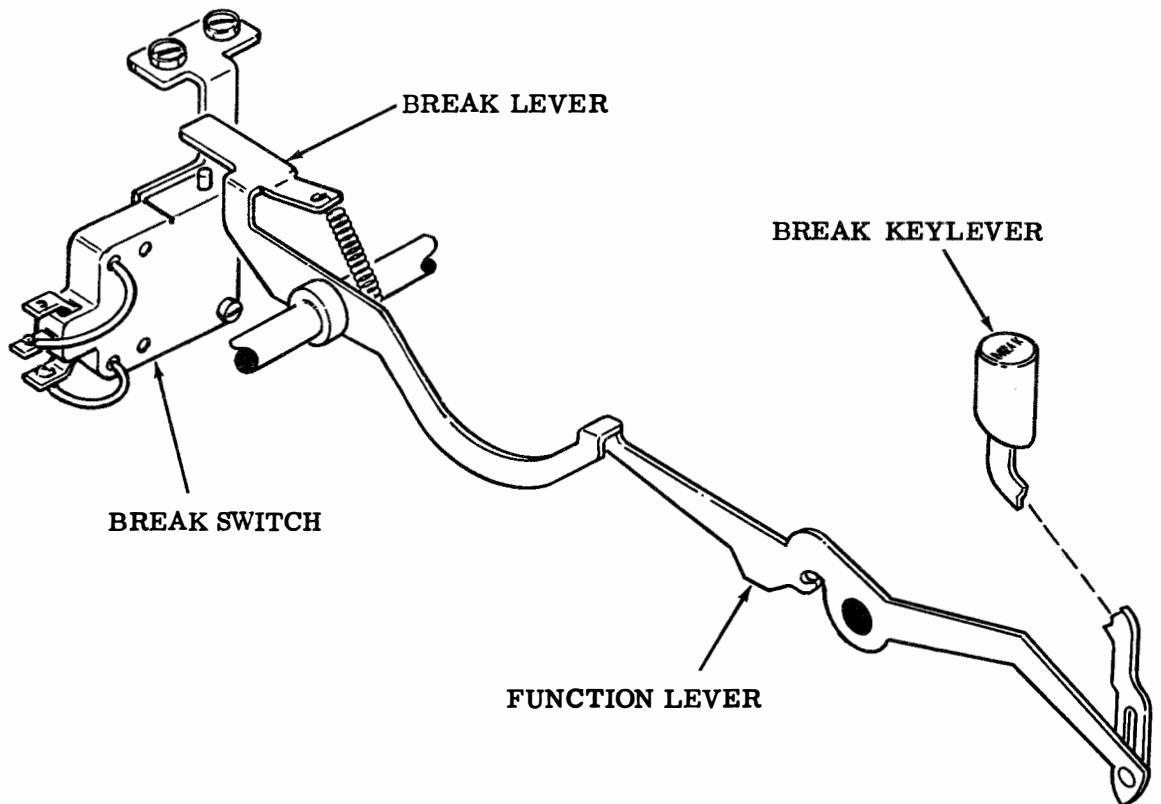


Figure 11 - Signal Line Break Mechanism

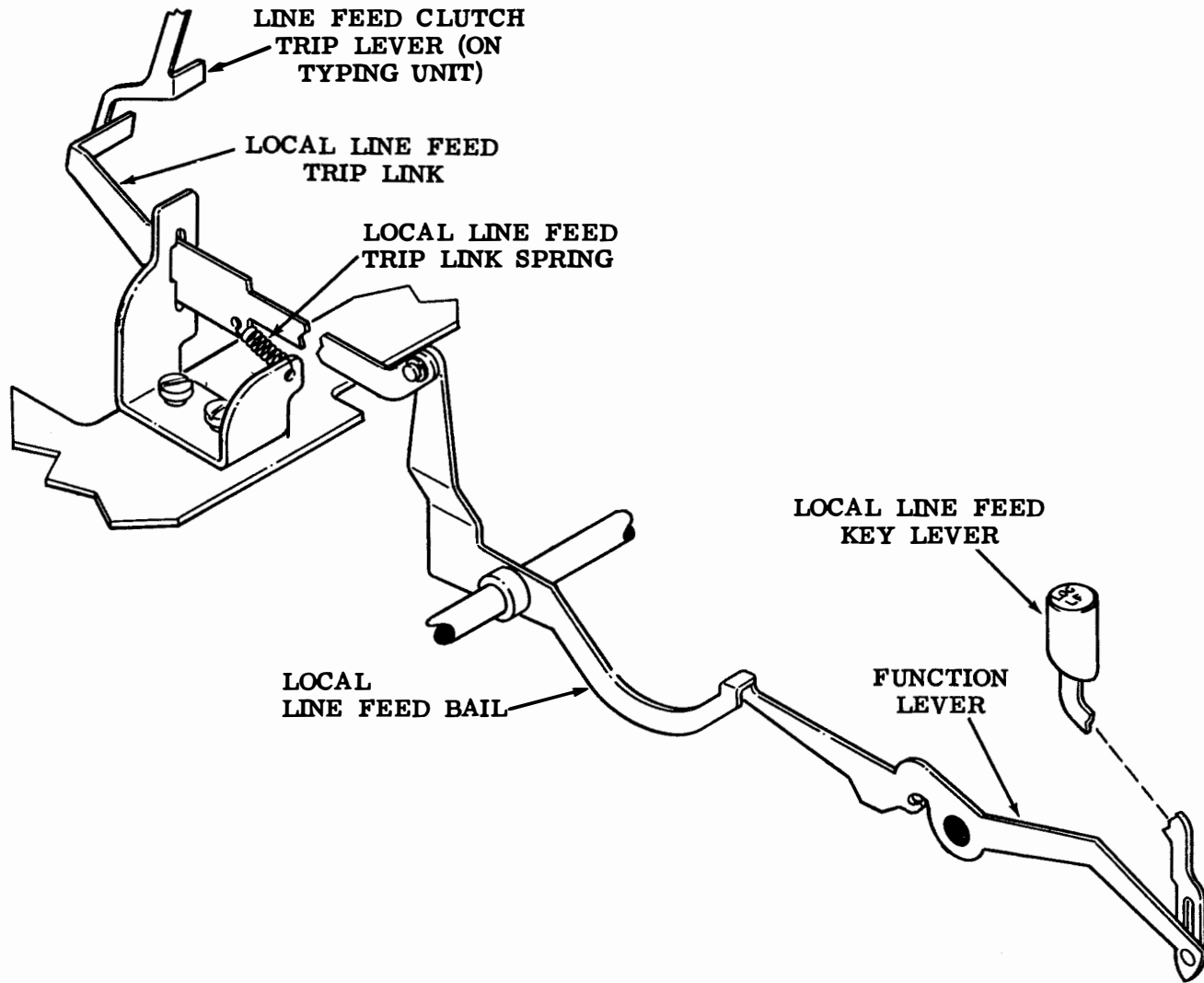


Figure 12 - Local Line Feed Mechanism

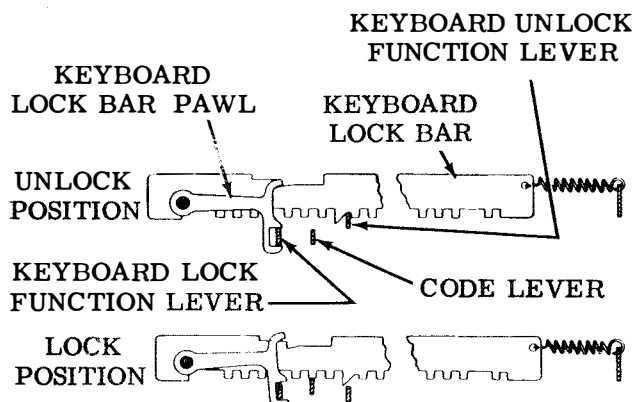


Figure 13 - Keyboard Lock Mechanism

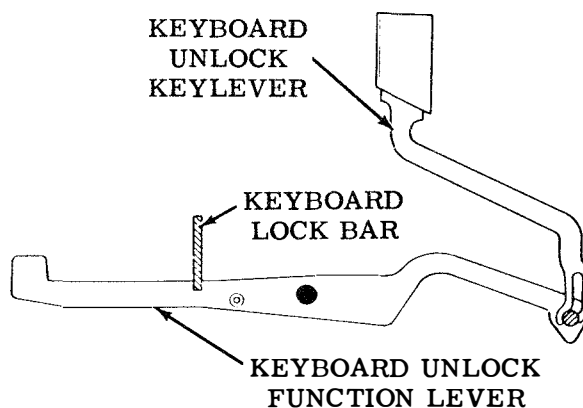


Figure 14 - Keyboard Unlock Mechanism

D. Keyboard Lock Mechanism (Fig. 13)

3.16 The keyboard may be locked manually (local) or electrically (remote). Local locking of the keyboard is achieved by operation of the keyboard lock (KBD LOCK) keylever, which causes its function lever to raise the lock bar pawl. Spring tension on the lock bar moves it to the extreme right position. In this position, the square teeth on the lower part of the lock bar are positioned over each code keylever. This restricts the movement of any selected keylever, preventing trip off of latches and the generation of a signal.

3.17 Remote keyboard locking occurs when two consecutive blank code signals are received by the associated typing unit. Reception of this code results in the keyboard lock lever to move downward. The lock lever engages the keyboard lock plunger and moves it downward. As the plunger operates, it exerts a pressure on a yield spring, which engages the keyboard lock bail. The lock bail rotates about its pivot point, engages the keyboard lock function lever, and raises it. This operation trips off the lock bar pawl. With the tripping of the lock bar pawl, the locking action that results is identical to that described above.

E. Keyboard Unlock Mechanism (Fig. 14)

3.18 Operation of the keyboard unlock keylever (KBD UNLK) causes its function lever to move the lock bar to the left to a position where the lock bar pawl falls into a notch in the top of the lock bar. In this position, the lock bar teeth are between code selection levers and do not restrict their operation.

F. Margin Indicator Mechanism (Fig. 15)

3.19 The margin indicator cam disc on the typing unit spring drum rotates with the drum as printing or spacing occurs. As the end of each line is approached, the cam surface of the disc makes contact with the margin indicator contact lever and rotates it clockwise about its pivot point (Fig. 15). When the contact lever leaves the switch plunger, the margin indicator switch closes the circuit to a margin indicator lamp, mounted in the set's enclosure. A carriage return cycle returns the cam disc to its starting position and opens the switch.

4. RECEIVE-ONLY BASE

4.01 The receive-only base is a structure which supports an intermediate gear assembly and provides mounting facilities for a typing unit and a motor unit. Two keylevers, CR (carriage return) and LF (line feed) are mounted on the front of the unit, and provide off-line operation only. All electrical wiring is brought into the base through a receptacle mounted at the left rear of the base (Fig. 4).

5. VARIABLE FEATURES

5.01 The operation of some of the mechanisms and components available as accessories to the keyboard or base (as indicated) is covered in the following paragraphs.

MOTOR START FOR PAGE FEED OUT

5.02 This accessory device installs on the keyboard or base and provides motor-driven feed out of copy paper when the LOC LF

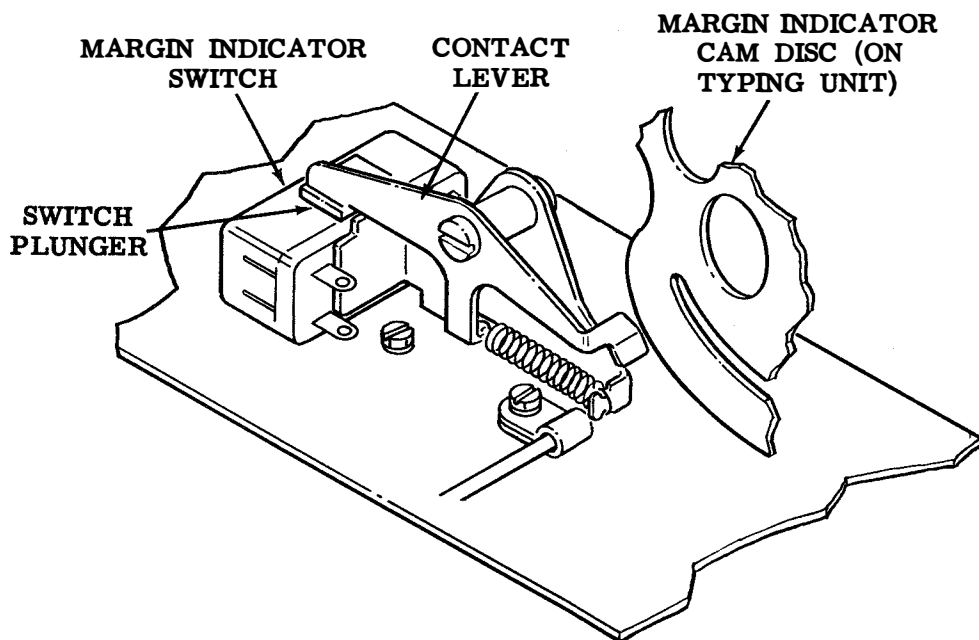


Figure 15 - Margin Indicator Mechanism

(local line feed) key is depressed. This operation may be performed independent of the position of the main power switch.

TIME DELAY MECHANISM (Fig. 16)

5.03 The time delay mechanism operates in conjunction with the motor control mechanism in the electrical service unit to provide automatic motor unit stop after a predetermined interval of idle signal line time has elapsed. The mechanism contains two ratchet wheels - one with 27 teeth, and one with 28 teeth. A reciprocating eccentric follower pawl, powered by the keyboard intermediate shaft, drives the ratchet wheels, one tooth at a time. The latch pawl rides the inside flanges of the ratchet wheels and controls the contact pawl latching lever, which holds the contact pawl away from the flanges. Each ratchet wheel has an indentation in its inside flange. After a maximum of 756 revolutions of the intermediate shaft, these indentations are adjacent for almost one revolution. When the adjacent indentations pass over the latch pawl, it drops into them, briefly, and then disengages the contact pawl latching lever from the contact pawl. This permits the contact pawl to ride the flanges of the ratchet wheels until either one of two events occur.

5.04 If a line signal is received before 756 revolutions of the intermediate shaft, the typing unit main bail drive extension engages the upper end of the contact pawl and causes it to again be latched by the contact pawl latching lever. This begins a new cycle of time measurement.

5.05 If a line signal is not received before 756 revolutions of the intermediate shaft, the indentations in the flanges of the ratchet wheels again become adjacent and permit the contact pawl to drop. This action results in a pulse transmission to the motor control mechanism, which responds by switching off the motor unit.

5.06 The time elapsed between the reception of the last line signal and the stopping of the motor unit varies with the operating speed. For 60 wpm, the range is 86 to 172 seconds; 75 wpm, 60 to 120 seconds; and 100 wpm, 53 to 106 seconds.

5.07 The mechanism may be disabled by adjusting an eccentric that moves the eccentric follower pawl out of engagement with the ratchet wheels. Motor unit operation may be restored by opening the signal line circuit (eg, depressing the BREAK keylever).

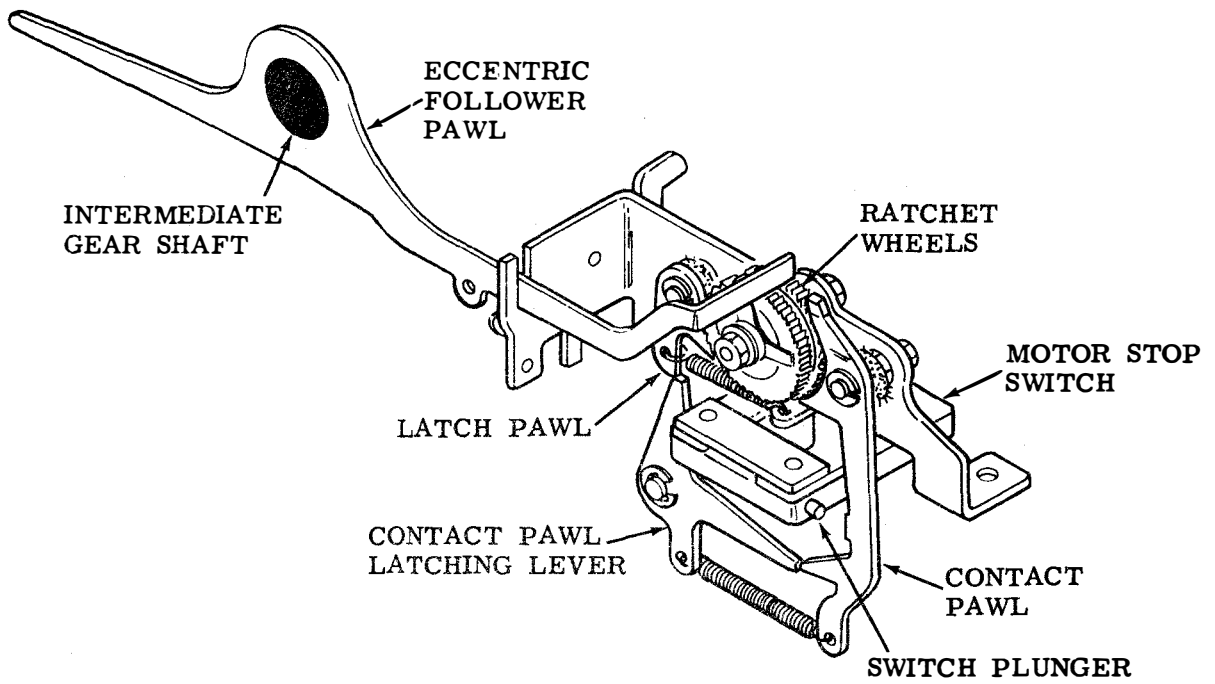


Figure 16 - Time Delay Mechanism

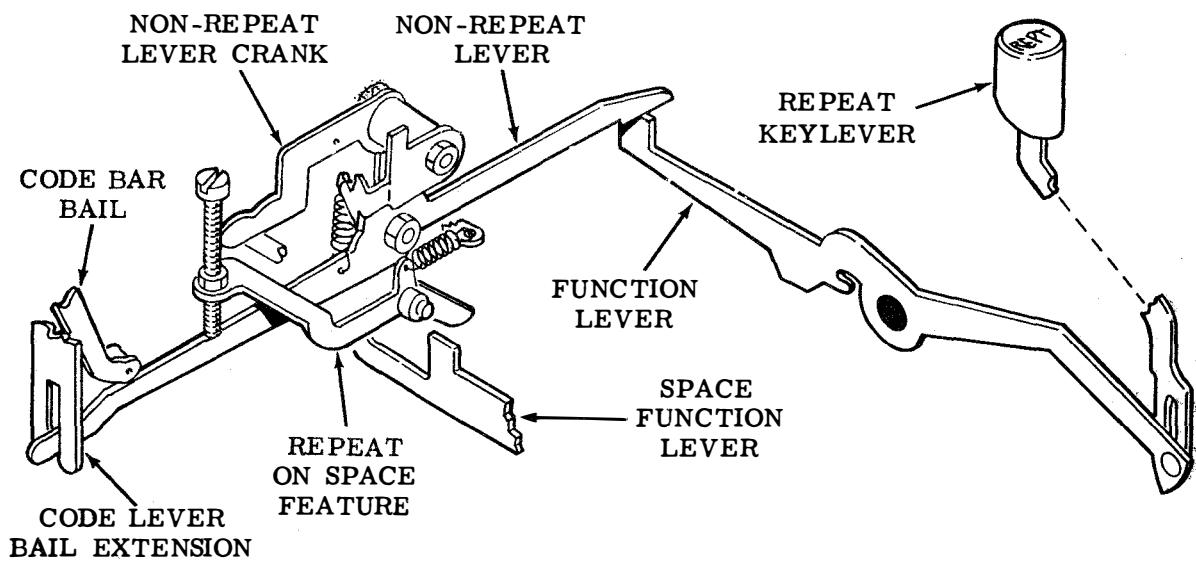


Figure 17 - Repeat Mechanism

LOCAL REVERSE LINE FEED

5.08 This mechanism is installed on a keyboard to enable off-line feeding of the copy paper in the downward (reverse) direction. The LOC R LF (local reverse line feed) keylever initiates the operation.

LOCAL BACK SPACE

5.09 This mechanism permits the insertion of a backspace at the local typing unit when the LOC BSP (local back space) keylever is operated. It is installed on the keyboard only. Refer to the sectionalized literature for the 28 typing unit for description of operation.

REPETITION OF CHARACTERS (Fig. 17)

5.10 To repeat a character, the REPT (repeat) keylever is operated simultaneously with one of the keylevers in the three-row bank, or the spacebar. Levers associated with the REPT keylever engage the non-repeat lever, preventing the reset bail from engaging the step. Therefore, the universal bail latch lever remains in the down position, preventing the code bar reset bail latch from moving up into the full latch position. This permits the reset bail to

follow the eccentric arm movement. As a result, the code bars and their transfer levers are in the permutation position at the start of each repetitive cycle, and the same pulse pattern is transmitted to the signal line.

REPEAT-ON-SPACE MECHANISM (Fig. 17)

5.11 A keyboard equipped with a repeat-on-space mechanism will automatically transmit the space function for as long as the space bar is operated. When the space bar is depressed, the rear portion of the space code lever engages and lifts the lower end of the space repeat lever. As the space repeat lever moves clockwise (viewed from the front), it engages the code bar bail latch lever. The code bar bail latch lever drops downward and is held in this position until the space bar is released.

RADIO FREQUENCY NOISE AND ARC SUPPRESSION

5.12 The keyboard may be equipped with rf noise and arcing suppression circuitry. Installed in the signal generator contact box, the suppression circuit may be for rf or arcing only, or a combination circuit for both types of interference.

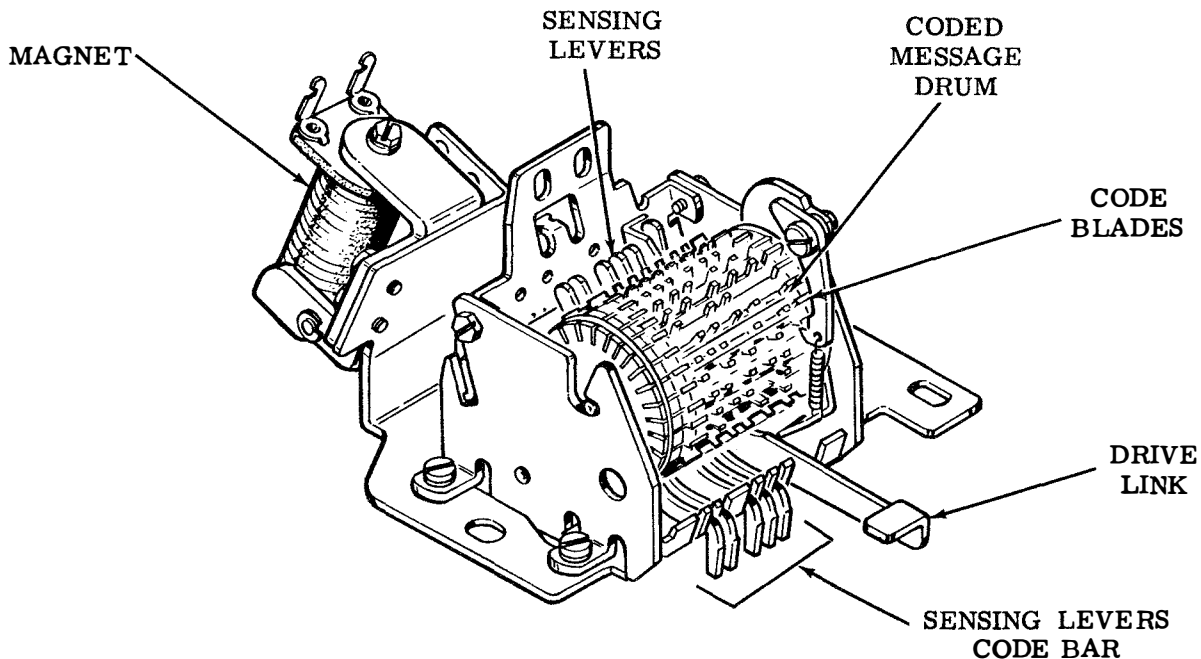


Figure 18 - Answer-Back Mechanism

ANSWER-BACK MECHANISM (Figs. 18 and 19)

5.13 The answer-back mechanism is an electro-mechanical device which permits the identity of a called station to be transmitted automatically to the originating station, in response to a coded, sequential message from the signal line. The HERE IS keytop is provided for manual operation. Transmissions are generated in the normal manner by the keyboard, which, through its code bar mechanism, reads the code combination contained in a message drum.

5.14 The mechanism is comprised basically, of a coded message drum, control relay, and keyboard contacts. The drum is coded for the desired combination by removing code tines from the 21 code blades provided, as required (Fig. 18). The first character transmitted is always a LTRS combination to place the called station in the unshift position; the other 20 may be any characters desired. However, the first transmission is usually followed by CR and LF. This sequence is also typically used to end a coded sequence, to insure that the answer-back message will appear at the beginning of a line at the distant station and that over-printing of the message will not occur. Typically, 16 characters are available for the answer-back identification.

5.15 The following explanation of operation uses the combination FIGS - D as an example. The combination used may vary with the application.

A. Called Station

5.16 The answer-back message is initiated at the called station by depressing the FIGS, upper case D combination at the originating station. The operation of the FIGS function box contact at the called station will de-energize the answer-back (non-contention) control relay if this relay is in an energized condition prior to the reception of the FIGS combination. The closing of the D function box contact then completes a circuit to the answer-back trip magnet via normally closed control relay contacts; the D contact also locks the keyboard through a lever extension to the blank-blank sequence locking mechanism, if the set is so equipped.

5.17 The closure of this circuit energizes the answer-back trip magnet and results in the counter-clockwise rotation of the armature and associated stop-lever latch, thereby unblocking and releasing the stop lever. Under the bias of a spring attached to the code bar bail

latch operating lever, the stop lever rotates counter-clockwise until it comes to rest against the mechanism base plate. Before coming to rest the stop lever moves the blocking lever counter-clockwise, thereby unblocking the drive plate and releasing it to its spring action. The drive plate rotates counter-clockwise to a stop where the attached drive link is in a position to accept the feeding motion from the keyboard code bar bail. As the stop lever continues its counter-clockwise rotation, the code bar bail latch operating lever rotates clockwise, striking the code bar bail latch. The latch rotates clockwise and releases the code bar bail. The code bar bail releases the keyboard code bars and the clutch trip bar, which move to the right under spring action. The clutch trip bar thereby trips the signal generator clutch and initiates an operating cycle.

5.18 While the code combination transmitted during the first cycle must be a letters combination, the code combinations of the succeeding 20 cycles may be any arbitrary character determined by the detachable code blades fastened to the code drum. The code combination on each blade is read by five sensing levers which transfer the code selections to a vertical projection on each of the 5 code bars. Each code combination is thus transmitted in the normal manner by the keyboard signal generator mechanism. A spacing condition occurs whenever a code bar is prevented from moving to the right by its associated sensing lever; unrestricted movement of a code bar results in a marking condition. Since the sensing levers must be held away from the code bars, in order to prevent their interference during normal keyboard operation, a stop code blade having a letters combination is used. This results in a letters combination for the first character.

5.19 Once during each rotation of the signal generator cam assembly, the code bar bail is pulled to the left by a cam eccentric, causing it to rotate clockwise. The bail thereby resets the keyboard code bars and, with the character generator drive link now in its released position, rotates the drive plate clockwise. This action causes the stepping pawl to step the code drum one position clockwise.

5.20 With the stop lever in its released position, the code bar bail latch operating lever also maintains the code bar bail latch in a released position. The signal generator mechanism will cycle continuously until it rotates the code drum one full revolution or 21 characters. The first code blade, which is the

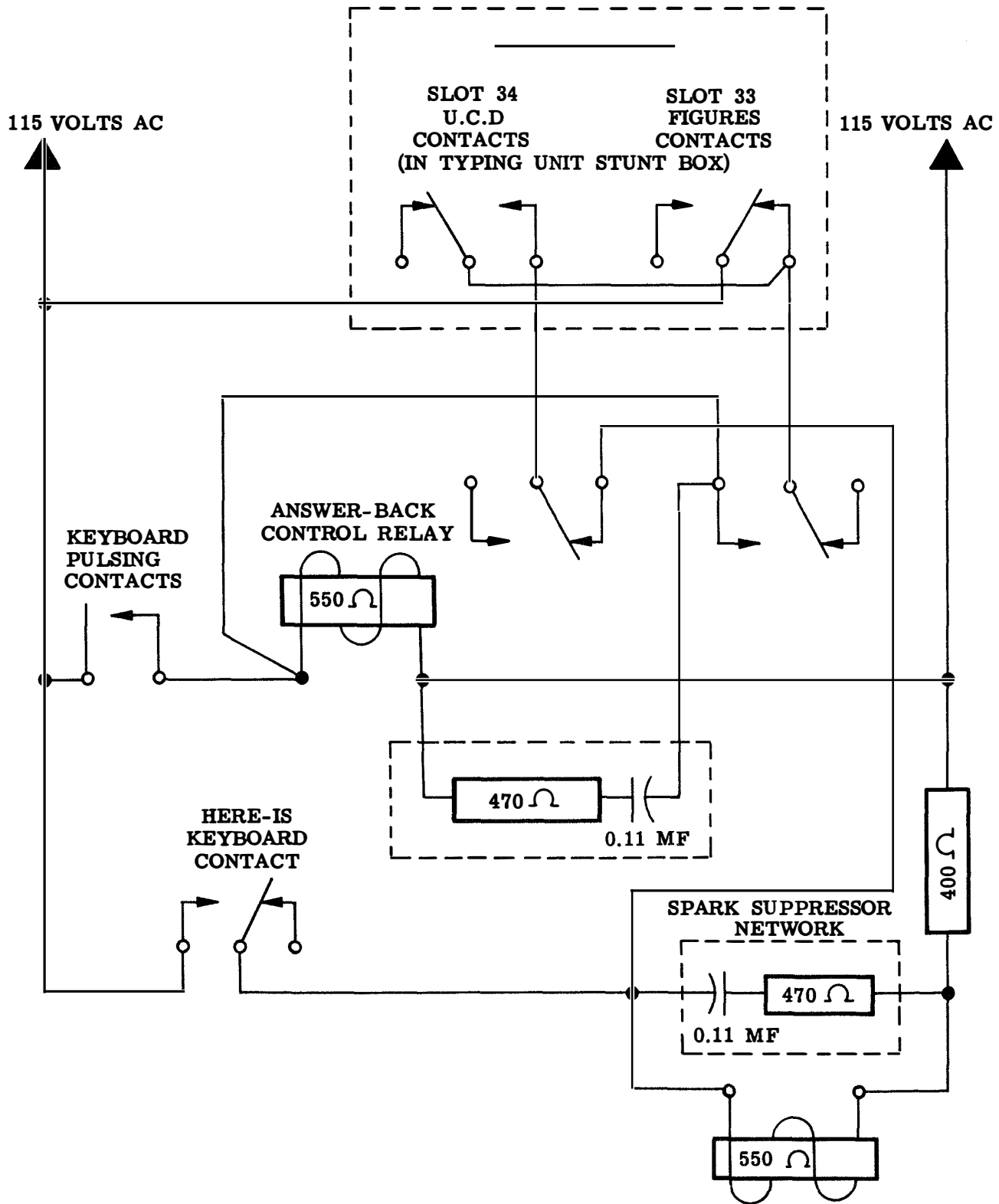


Figure 19 - Typical Answer-Back Circuit

stop code blade having a letters combination, has an additional projection. When it is being rotated into the sensing position, the projection contacts the stop lever, rotating it clockwise. The left extension of the stop lever rotates the code bar bail latch operating lever counter-clockwise, which in turn releases the code bar bail latch to the action of its attached spring. Continued rotation of the stop lever brings it in a position where if released to the action of the spring attached to the code bar bail latch operating lever, it will reverse rotation and become latched on the stop lever attached to the trip magnet armature. Such a position is reached when the stop code blade passes its area of contact with the stop lever which is just prior to the complete movement of the stop code blade into the sensing position.

5.21 When the code bar bail latch is released to its spring action, it rotates counter-clockwise in contact with the code bar bail latch roller until it latches the code bar bail. At this point the blocking lever is also released to its spring action and it rotates counter-clockwise until it rests against a projection on the stop lever. In this position the blocking lever holds the drive plate in its extreme clockwise position and the attached drive link is once more unable to follow the feeding motion from the code bar bail. Further operation of the signal generator and character generator is thus pre-

vented. At this point the operator must manually unlock the keyboard to restore it to its normal operating condition if the set is equipped with the blank-blank sequence locking mechanism.

B. Originating Station

5.22 The keyboard pulsing (or blinding) contact, mounted on the signal generator assembly, is operated every keyboard cycle by a cam which is mounted on the signal generator shaft. The pulsing contact is timed to close before the beginning of the start pulse and remain closed until after the end of the 5th pulse.

5.23 Each time it operates, the keyboard pulsing contact will energize the answer-back control relay; the control relay will remain energized via its own contacts, and the FIGS stunt box contact.

5.24 The FIGS stunt box function pawl in the typing unit is specially designed to engage the FIGS function bar at all times. The pawl is never stripped by the stripper bail. This means that the function pawl holds the function lever away from the FIGS contact. When the FIGS function bar is selected, it will permit the pawl and lever to move forward and operate the FIGS contact (the normal stunt box

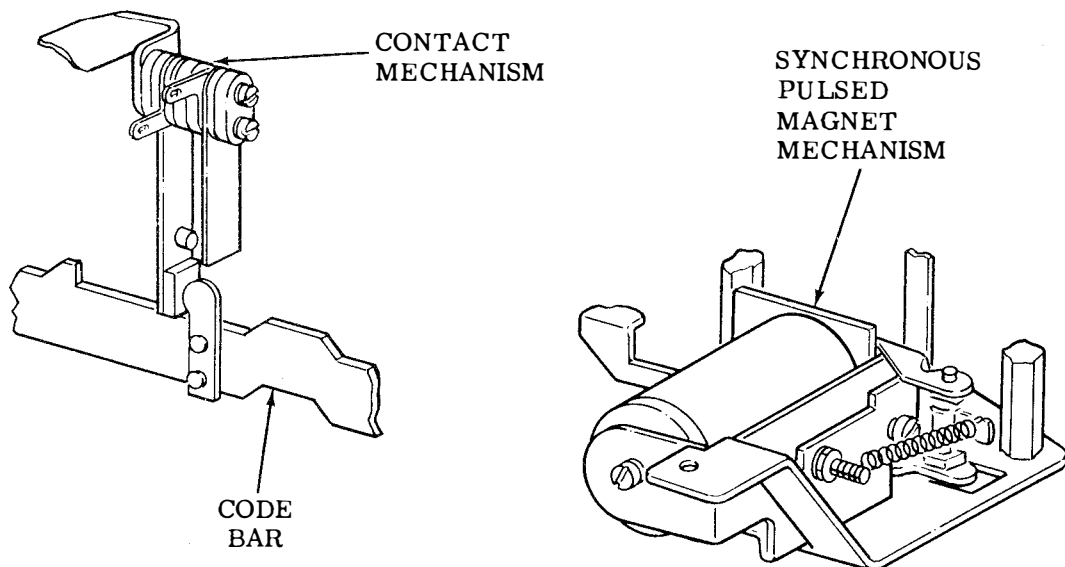


Figure 20 - Synchronous Pulsed Transmission Mechanism

operation is such that the contact does not operate until the selected function bar has first moved forward and then rearward).

5.25 This arrangement converts a normally-open, momentary-operate FIGS contact to a normally-closed, momentary-operate FIGS contact and advances the timing of the FIGS contact operation to insure that either the FIGS contact or the keyboard pulsing contact will keep the control relay energized during every signal generator cycle.

5.26 The local operator depresses the FIGS - D combination to call the remote station. The FIGS contact may or may not de-energize the control relay depending upon how long afterwards the operator depresses the D combination. In any event, the D combination will again energize the control relay, if necessary. The local answer-back will, therefore, be disabled due to the opening of the normally closed control relay contacts, which are in series with answer-back trip magnet.

SYNCHRONOUS PULSED TRANSMISSION (Fig. 3 and 20)

5.27 Upon operation in the appropriate key-lever, the reset bail in the keyboard is moved to the right and releases the selected code bars. The universal code bar (a modified clutch trip bar) is released and moved to the right also, at which time it closes the clutch magnet conditioning contact. This action enables the clutch trip magnet to respond to an externally supplied synchronous pulse (50 or 100 milliamperes of 20 millisecond duration). When energized by the synchronous pulse, the clutch trip magnet releases and moves the clutch trip bar to the right. This movement causes the clutch trip bail extension to trip the signal generator clutch. The signal generator cam shaft then rotates and transmits the selected signal.

5.28 During the single rotation of the signal generator cam shaft, the reset bail is rotated clockwise and latched. The universal code bar, clutch trip bar, and the five code bars are moved and held to the left by the reset bail.

28 ELECTRICAL SERVICE UNIT

DESCRIPTION AND PRINCIPLES OF OPERATION

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RECTIFIER ASSEMBLY	3
SIGNAL LINE LIMITING RESISTANCE	4
LINE TEST KEY ASSEMBLY	4
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B. Electrical Motor Control Mechanism	4
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1. GENERAL

1.01 The 28 electrical service units serve as an area of concentration for the wiring of 28-type apparatus and provide mounting facilities for various electrical assemblies and components.

1.02 The operational facilities provided by the electrical service unit vary, depending upon the number and complexity of functions performed by the set.

1.03 Complete operation of an electrical service unit requires connection with other components of the set with which it is used. Additional information concerning the support

functions of the unit may be found in sections discussing specific components and complete sets. Only independent features of the electrical service unit are discussed in this section, under Principles of Operation.

2. DESCRIPTION

2.01 The electrical service unit (Figure 1) consists, basically, of a metal frame, or chassis, and a number of mounting plate assemblies. The chassis has four legs that permit the unit to be turned upside down for maintenance purposes. Cutouts for routing cables or mounting switches and controls, as required, are provided. The mounting plate assemblies are installed on the blank top of the chassis. Unused positions are occupied by blank mounting plates. Terminal boards and cables, required for interconnection of the assemblies with other components, are provided by the installed assemblies.

2.02 Some of the features that may be mounted on the unit are listed below:

- (a) Line shunt relay assembly.
- (b) Line (polar) relay assembly.
- (c) Rectifier assembly.
- (d) Line test key assembly.
- (e) Capacitor-resistor assembly.
- (f) Motor control assembly.
- (g) Signal line limiting resistance.
- (h) Convenience outlets (115 ac).
- (i) Convenience outlet fuses.
- (j) Power switch (may be installed directly on chassis).
- (k) Selector magnet driver.

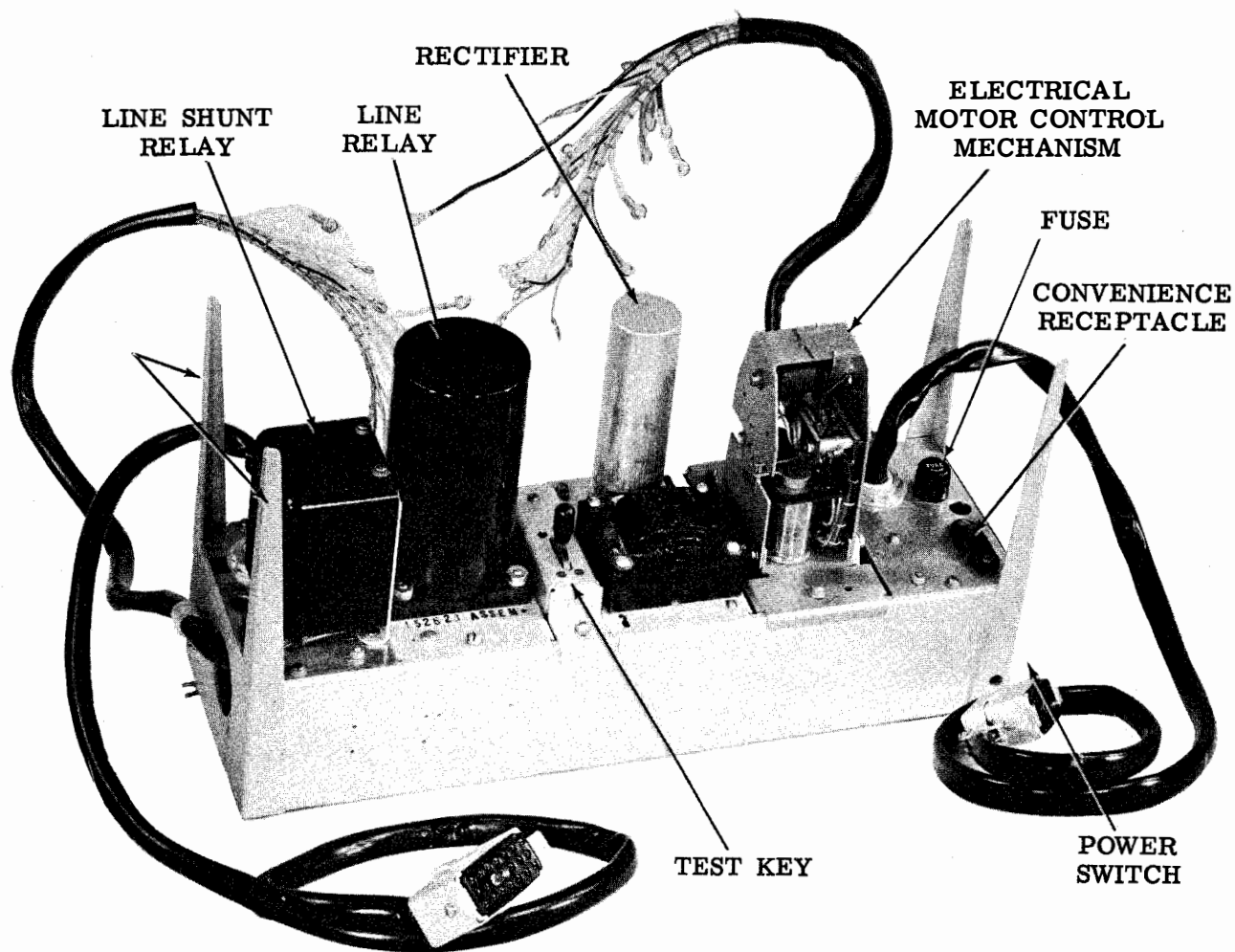


Figure 1 - Typical 28 Electrical Service Unit

3. PRINCIPLES OF OPERATION

LINE SHUNT RELAY (Figures 1 and 2)

3.01 The signal line is connected through the line shunt relay contacts, either to the line relay or directly to the selector magnets of a receiving unit; eg, a typing unit is shown in Figure 2. The solenoid of this relay is controlled by the main power switch and, if present, the motor control mechanism. If power is removed from the set, through opening of the main power switch or by action of the motor control mechanism (3.09), the relay releases and maintains signal line continuity while bypassing the local unit.

LINE RELAY (Figures 1 and 2)

3.02 The line relay is used to reduce the effects of line distortion or to convert a polar signal to the neutral form required by the selector magnets. The relay has two windings: one, the line winding, is operated by the signal line and the other, the bias winding, is operated

by a local dc source, such as the rectifier assembly (3.05). Operation of the relay is as follows:

3.03 Signal Line Spacing: During a spacing (no current) pulse, current from the local dc source energizes the bias winding, causing the armature to be attracted to the space contact. In this position, no current is supplied to the selector magnets.

3.04 Signal Line Marking: During a marking (current) pulse, the signal line current applied to the line winding is of sufficient magnitude to create a magnetic flux that overcomes the attraction of the bias winding. The relay armature is attracted to the mark contact, which connects the local dc source to the selector magnets.

RECTIFIER ASSEMBLY (Figure 1)

3.05 The rectifier assembly (Figure 1) consists of a power transformer, two semiconductor type rectifiers arranged for full-wave

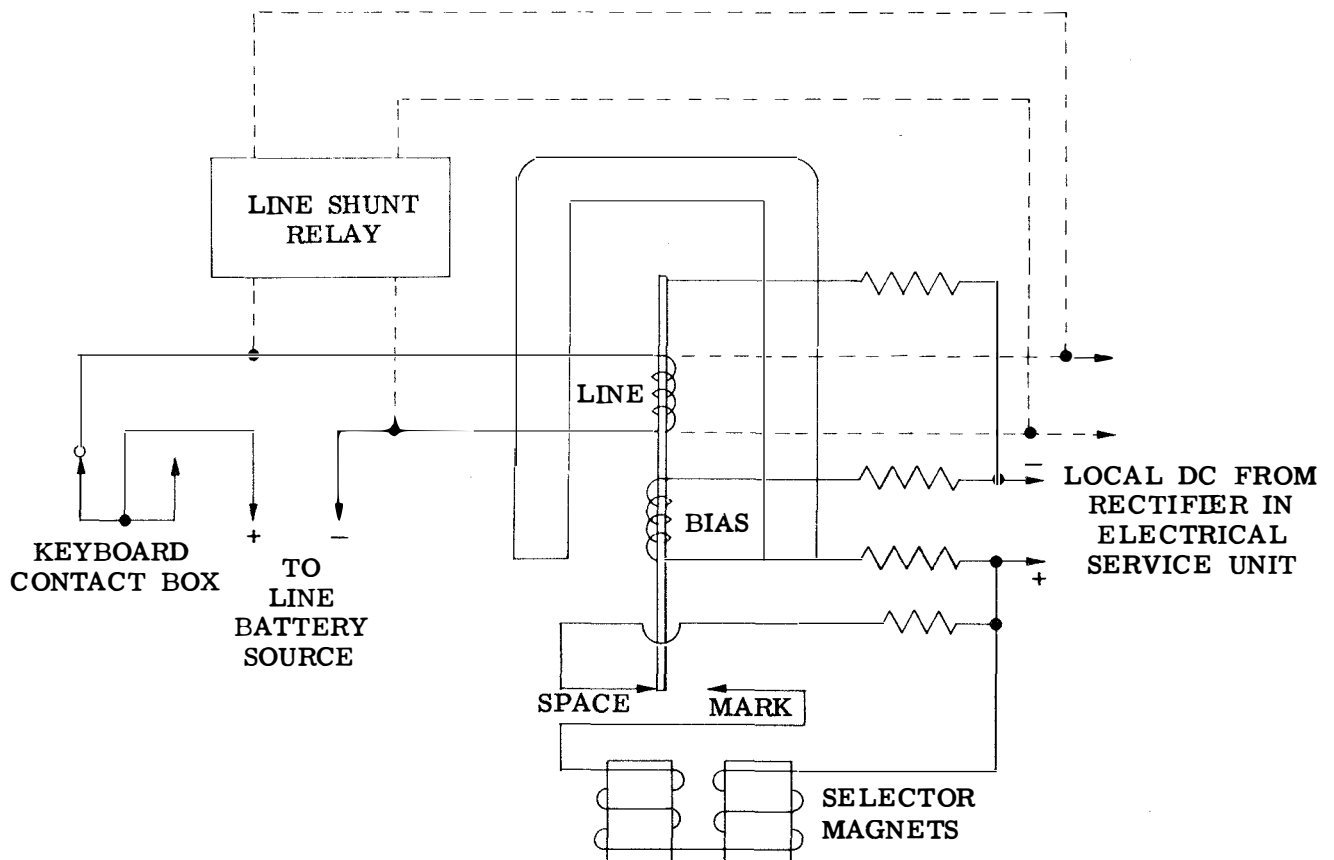


Figure 2 - Line Relay Circuit

rectification, and a filter capacitor. Rectifier assemblies are available providing outputs of 120, 300, and 500 ma., respectively. Each provides 120 vdc from an input of 115 vac ($\pm 5v$), 50 to 60 cps, single phase. The output of the rectifier is normally used in local circuits, such as the receiving unit selector magnets (3.01), the line relay bias winding (3.02), and the line test key assembly (3.07). The rectifier supplying 120 ma is generally adequate for applications such as the KSR, ROTR etc. The 300 ma and the 500 ma rectifier assemblies are necessary when additional external equipment are used.

SIGNAL LINE LIMITING RESISTANCE

3.06 Used in place of the line relay (3.02), an assembly containing a fixed or variable resistor (rheostat) may be installed to limit the signal line current to either 0.020 or 0.060 amperes.

LINE TEST KEY ASSEMBLY

3.07 The line test key assembly permits manual shunting of the signal line for independent operation of the set. The assembly may be wired to draw 0.020 or 0.060 amperes from the local dc supply. It contains an additional set of contacts that may be used to provide audible or visual indications.

CAPACITOR-RESISTOR ASSEMBLY

3.08 An assembly composed of a capacitor and resistor may be used to permit the operation of such local components as the ac/dc series governed motor unit or the line test key assembly from a direct dc source.

MOTOR CONTROL MECHANISMS

A. Relay Motor Control Mechanism

3.09 The relay motor control mechanism provides control of motors under two different operating conditions. Connected to control a separate loop, the relay motor control mechanism will stop all motors in the loop each time loop battery is applied or removed. Connected in the signal line circuit, the mechanism will stop all motors in the circuit whenever the signal line current is reversed.

3.10 The relay motor control mechanism consists of a solenoid operator, a single-pole, double-throw enclosed switch, a terminal block, and a cable for interconnection with the motor control and power terminal block of the electrical service unit. A rectifier assembly which mounts on the terminal block is required for reversed signal line operation.

3.11 In separate motor control loop operation, the contacts of the switch are placed in the motor power circuit. Control power, which is externally supplied, energizes the solenoid causing the switch contacts to change position. The switch contacts may be connected for motor start when the solenoid is energized and motor stop when the solenoid is de-energized, or motor start when the solenoid is de-energized and motor stop when the solenoid is energized. Resistors may be required to limit the control line current.

3.12 In reversed signal line current operation, the solenoid is inserted in the signal line circuit. The rectifier assembly is bridged across the solenoid coil with polarization that permits current flow when signals are being received. The rectifier exhibits a very low resistance in the forward direction, resulting in a negligible current flow through the solenoid coil, and minimum distortion of the signal. The switch contacts are connected in the motor power circuit to provide a closed circuit when the solenoid is de-energized. Reversing the polarity of the signal line current causes the solenoid to operate and the switch contacts to change position and open the motor power circuit.

B. Electrical Motor Control Mechanism (Figures 1 and 3)

3.13 The electrical motor control mechanism is controlled by signals generated by an external source such as a typing unit stunt box contact or by a keyboard or base unit time delay mechanism that responds to an idle signal line condition. When the mechanism is installed, the set's wiring is such that the circuit through the line shunt relay is under the control of the motor power switch in the motor control mechanism. The contacts of the line shunt relay shunt the selector magnets rather than the signal line. When the motor is de-energized by the electrical motor control mechanism, the line shunt relay is de-energized and its contacts shunt the selector magnets. This automatically sets up the double blank function in the typing unit stunt box and results in the locking up of the keyboard. The following description covers the

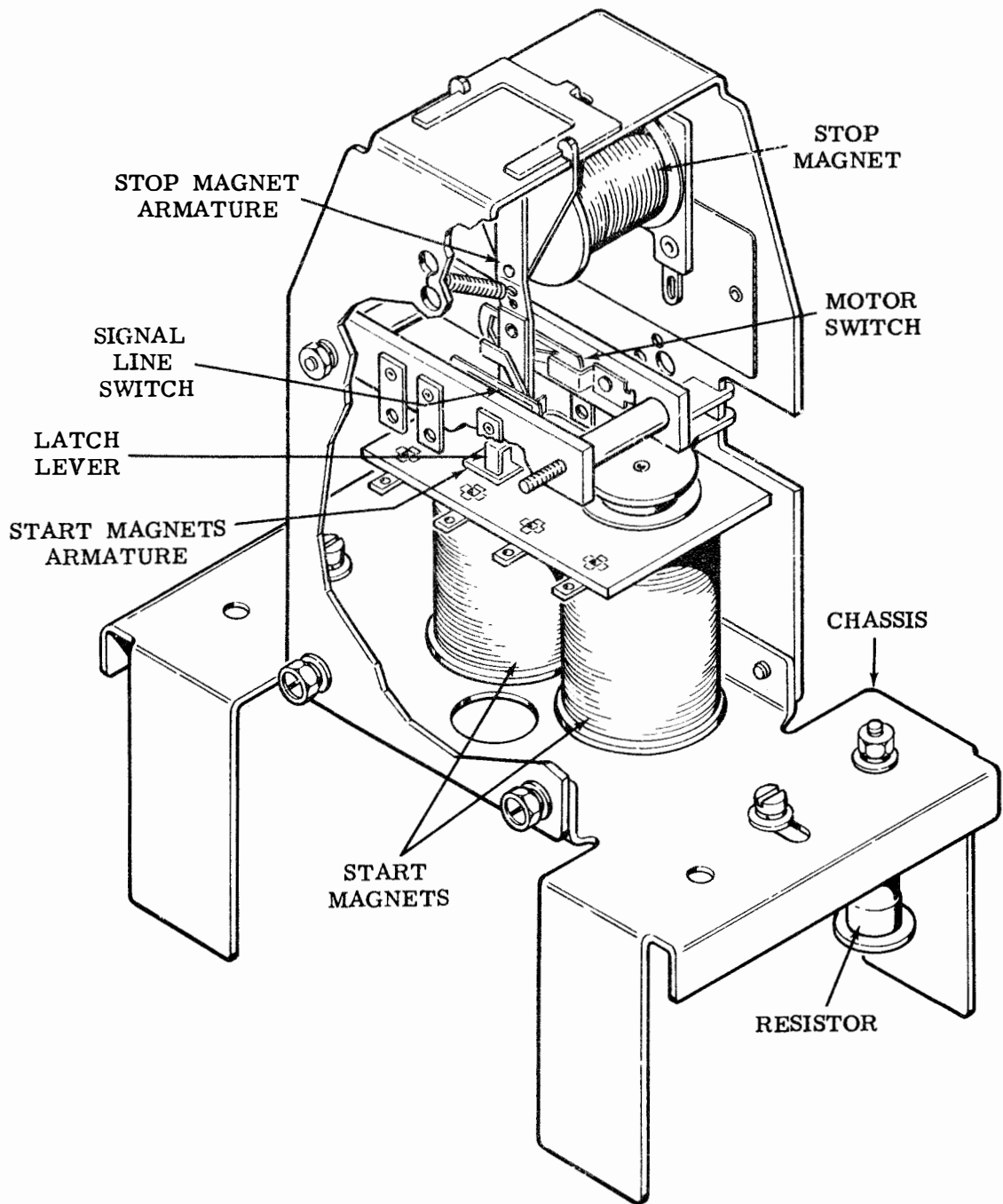


Figure 3 - Electrical Motor Control Mechanism

operation of the electrical motor control mechanism through a complete cycle.

Stop Position

3.14 In this position the motor is shut down, the line shunt relay is de-energized, the selector magnets are shunted, and the constant

signal line current holds the start magnets energized. The start magnet armature is positioned toward the right, where it is held by the latch lever. The motor power switch, operated by the stop magnet armature, is open and the original line switch completes the start magnet circuit.

Open Line Position

3.15 In this position, the signal line is open, the start magnets are de-energized, and the start magnet armature is released. With the release of the start magnet armature, the latch lever is also released, permitting the stop magnet armature to swing toward the left. The movement of the stop magnet armature is blocked, however, by the start magnet armature and is not sufficient to change the positions of the motor power and signal line switches.

Start Position

3.16 In this position, the signal line is closed, and the start magnets have been energized, the start magnet armature moved downward and the stop magnet armature released. The release of the stop magnet armature enabled the motor power and signal line switches to operate. The operated signal line switch shunted the start magnets from the signal line circuit. The operated motor power switch completed the circuit through the line shunt relay, removed the shunt from the selector magnets, and completed the circuit to the motor unit.

Stop Position

3.17 The electrical motor control mechanism will return to the stop position and stop the motor unit when a pulse is received from the control circuit (3.13). The pulse momentarily energizes the stop magnet, causing the stop magnet armature to swing to the right and operate the motor power and signal line switches. The signal line switch places the start magnet coils into the signal line circuit. The start magnet coils are then energized and the start magnet armature is pulled downward. This permits the latch lever to engage the stop magnet and hold it in the stop position. The operated motor power switch opens the circuit through the line shunt relay, shunting the selector magnets and opening the circuit to the motor unit.

SELECTOR MAGNET DRIVER ASSEMBLY

3.18 The selector magnet driver assembly is a solid-state device which repeats the line signals in a form that will effectively operate a selector mechanism. The assembly is normally used in place of the line relay for this equipment. For a detailed description of the selector magnet driver operation, refer to the applicable publications.

28 TELETYPEWRITER ENCLOSURES

DESCRIPTION

CONTENTS	PAGE	2. DESCRIPTION
1. GENERAL	1	FLOOR MODEL ENCLOSURE (Figures 1 and 2)
2. DESCRIPTION	1	2.01 The floor model enclosure contains an upper compartment for housing of the keyboard or receive-only base, the typing unit, and the electrical service unit, and a lower panel for storage or accessory equipment installation.
FLOOR MODEL ENCLOSURE	1	
TABLE MODEL ENCLOSURE	5	
RACK MOUNTED COVER	5	2.02 The upper compartment has a dome shaped lid, which is hinged at the rear. The dome is unlatched by a pushbutton and is counter-balanced by a stop arm mechanism that aids in raising and supporting it in the open position. The dome contains a window through which the printed copy may be viewed and which also serves as a copy tearing edge. Access to the copy is made through a hinged copy door that is unlatched by a pushbutton mechanism. Incandescent lamps located under the dome illuminate the copy. A three-position switch controls the copy lamps. Accessible when the dome is raised, the copy-lamp switch provides the following operating modes: NORMAL ON, OFF, and MAINT (maintenance) ON.
WALL MOUNTED ENCLOSURE	6	
MULTIPLE KSR AND RO ENCLOSURES	7	2.03 The cradle assembly, which forms the floor of the upper compartment, will accommodate either a keyboard or receive-only base. The cradle permits the mounted units to be tilted forward for inspection and maintenance.

1. GENERAL

1.01 The components of 28 Send-Receive (KSR) and Receive-Only (RO) Teletypewriter Sets may be installed in the following enclosures: the floor model, the table model, the rack mounted cover, the wall mounted cabinet, and the multiple KSR and RO enclosures.

1.02 The enclosures are of sheet metal construction and are finished internally and externally in baked enamel. Physical dimensions of each enclosure type are listed in Table 1.

TABLE 1. ENCLOSURE DIMENSIONS

	Height (Inches)	Width (Inches)	Depth (Inches)
Floor Model	39	20-1/2	18-1/2
Table Model	16	20-1/2	18-1/2
Rack Mounted	12	17	24
Wall Mounted	30-3/4	16-1/2	14-1/4
Multiple KSR and RO	72	21-1/2	28

2.04 Terminal boards for power and signal line connections are located on the inner rear wall. The electrical service unit is placed to the rear of the keyboard or receive-only base. Its power switch is controlled through a lever at the front of the enclosure.

2.05 Rubber sealing strips are applied to the edges of both the dome and the door of the lower panel for silencing purposes.

2.06 The floor model enclosures may be equipped with the following accessories:

- (a) A signal bell, to make audible those signals that are transmitted for supervisory purposes.

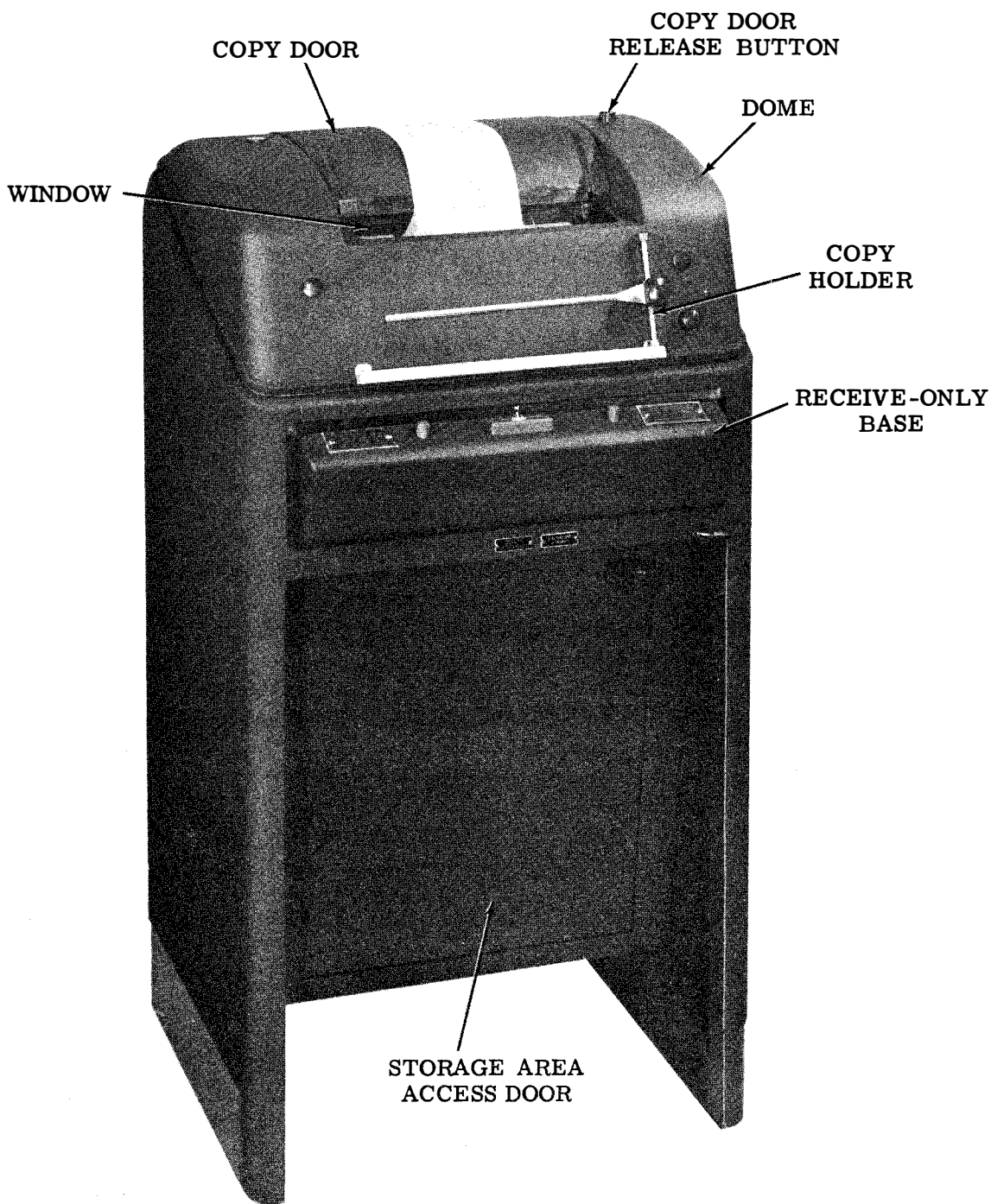


Figure 1 - Floor Model Enclosure

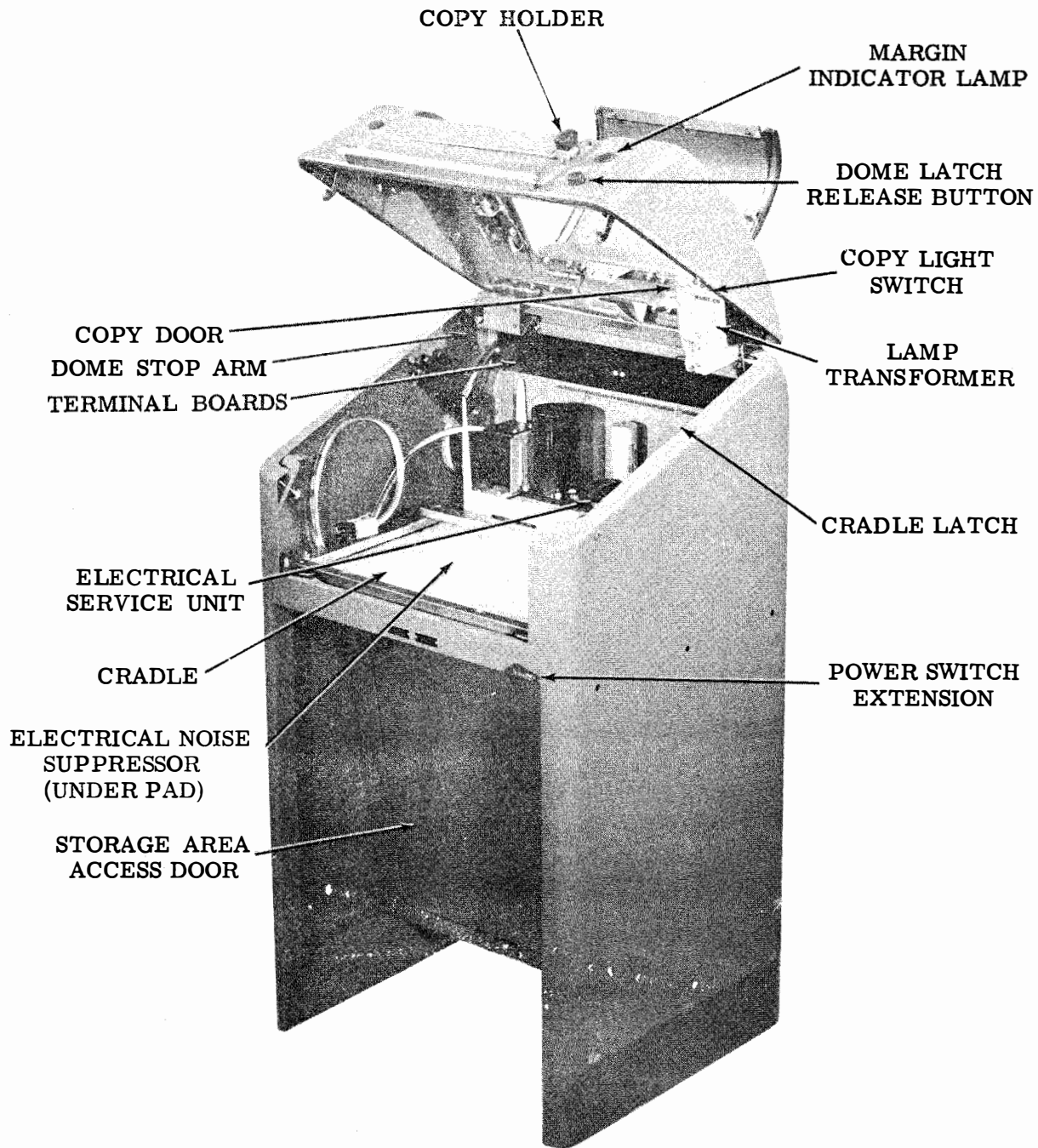


Figure 2 - Floor Model Enclosure (with Electrical Service Unit)

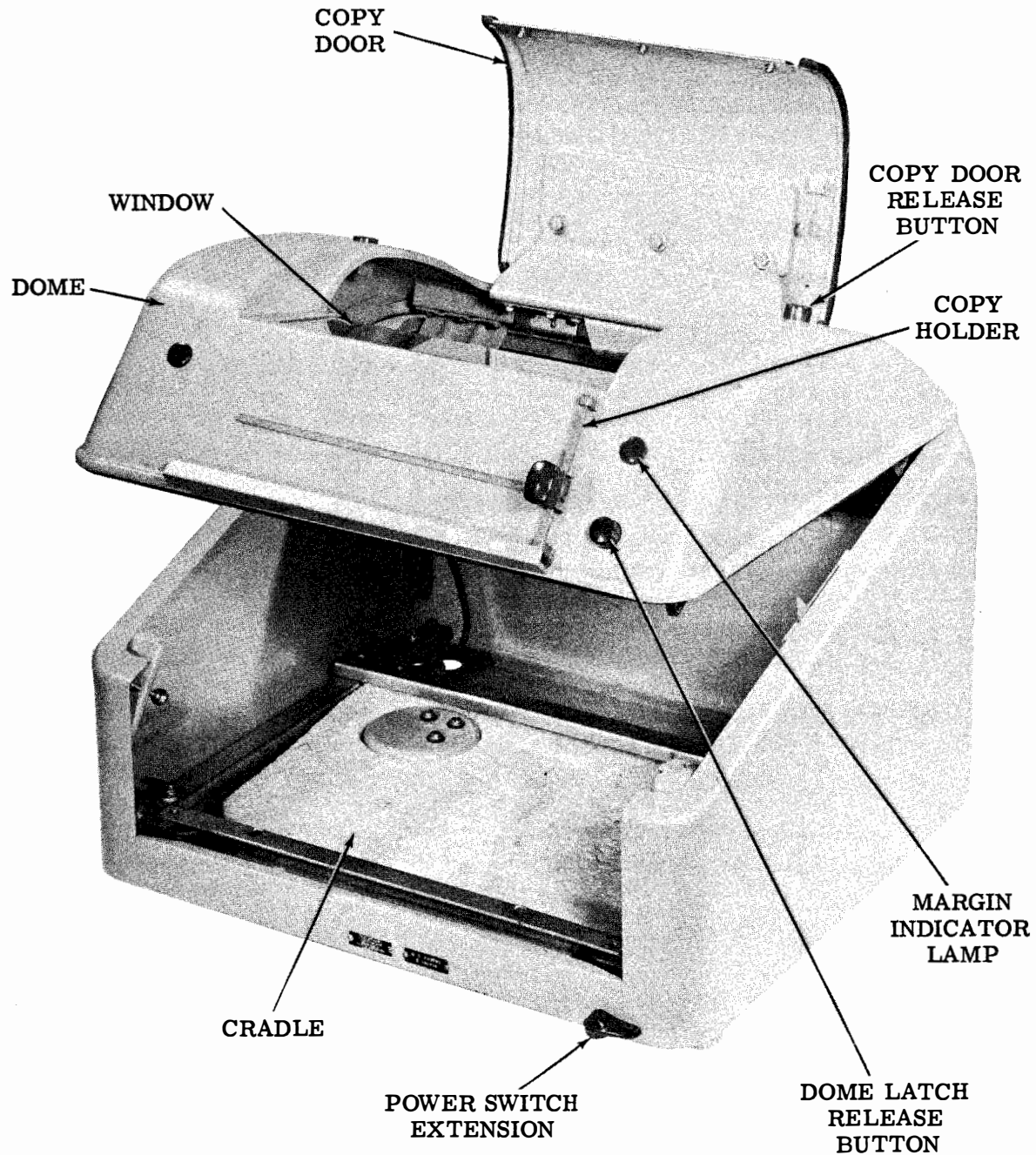


Figure 3 - Table Model Enclosure

- (b) Electrical noise suppressors, to minimize electromagnetic radiation from the signal and power lines.
- (c) A margin indicator lamp, which may be equipped with a line balancing resistor.
- (d) A copy tray, with a movable copy holder and line guide.
- (e) An offset copy holder.
- (f) An apparatus mounting rack, which installs in the lower panel, for mounting accessory equipment.
- (g) A sprocket-feed paper guide.
- (h) A directory holder.

- (i) A form-out alarm mechanism.
- (j) A busy line indicator lamp.
- (k) A paper supply and accumulating shelf.
- (l) A paper winder.

TABLE MODEL ENCLOSURE (Figure 3)

2.07 The table model enclosure differs from the floor model enclosure (2.01 to 2.06) in that it contains no storage area (lower level).

RACK MOUNTED COVER (Figure 4)

2.08 The rack mounted cover provides housing for a send-receive keyboard or receive-only base, motor, and typing unit; the electrical service unit is contained in a separate enclosure. The unit enclosure and the electrical service

unit enclosure are installed on a common base plate, with the cover occupying the forward section. The close-fitting design of the cover provides a reduction in weight and noise, and better sealing against dust.

2.09 Access to the interior of the enclosure is made through dual, hinged lids. The rear lid is held in the open position by a stop arm mechanism. The front lid is released by a pushbutton latch mechanism. It contains a transparent panel through which the printed copy may be viewed. The cover is secured to the base plate by a latching mechanism, which is operated by a lock lever from the front of the enclosure.

2.10 A copy lamp switch controls lamps that illuminate the printed copy. A margin indicator lamp and a copy tray, equipped with a movable copy holder and line guide, are also provided.

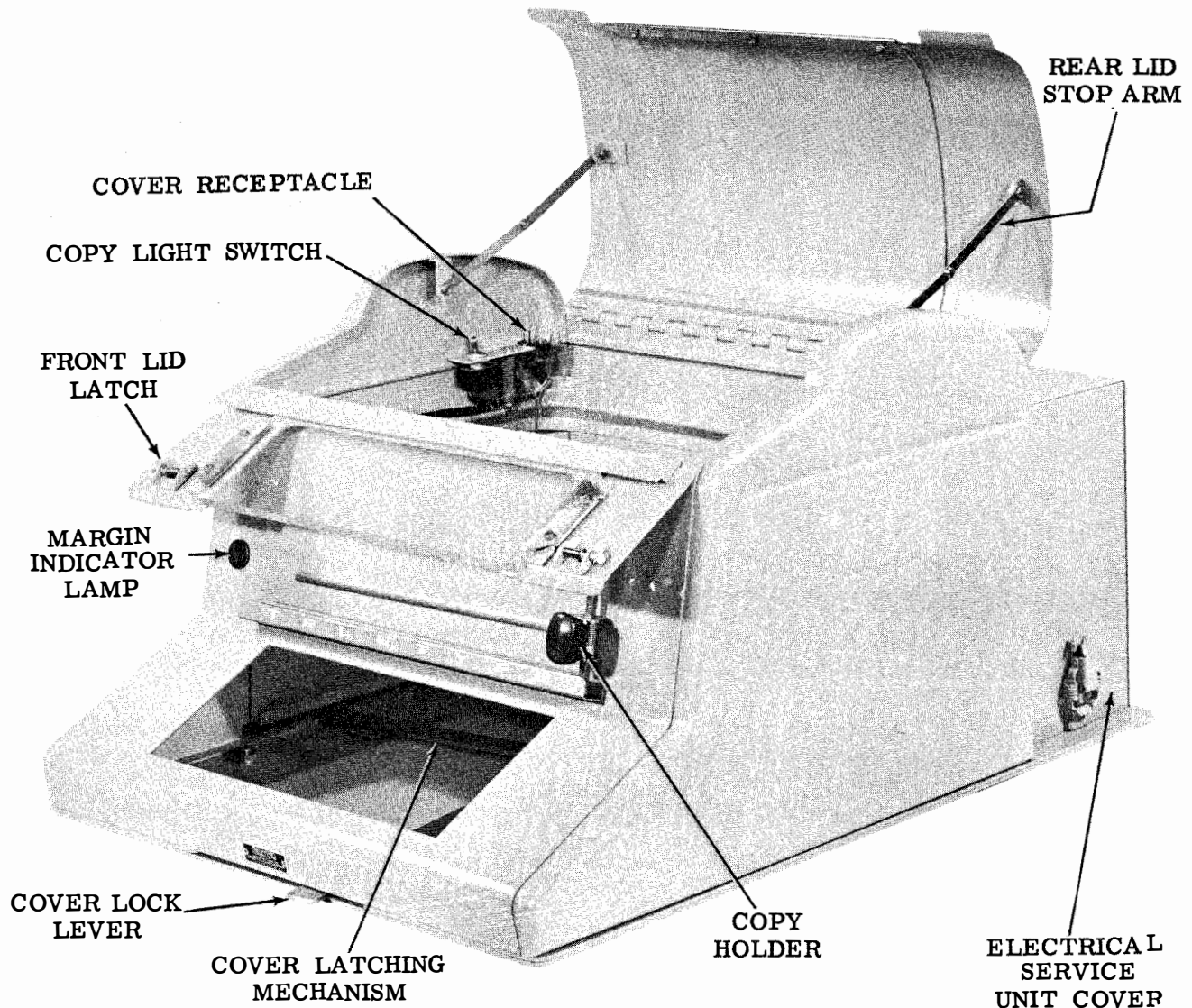


Figure 4 - Rack Mounted Cover

2.11 All external signal and power connections are made through terminal boards in the electrical service unit. A receptacle is provided in the cover for connection with the electrical service unit.

WALL MOUNTED ENCLOSURE (Figure 5)

2.12 The wall mounted enclosure provides housing for a KSR or RO Set. The enclosure is intended for installation directly to

the wall surface in areas where it is desired to conserve floor space. Mounting may be made to a variety of wall materials, including: masonry, hollow or solid wood, lath and plaster, plasterboard and tile walls.

2.13 The principal parts of the enclosure are the cover, back plate assembly, and the frame assembly. The cover contains a lid which may be opened for access to the typing unit ribbon mechanism, typebox and copy paper thread-

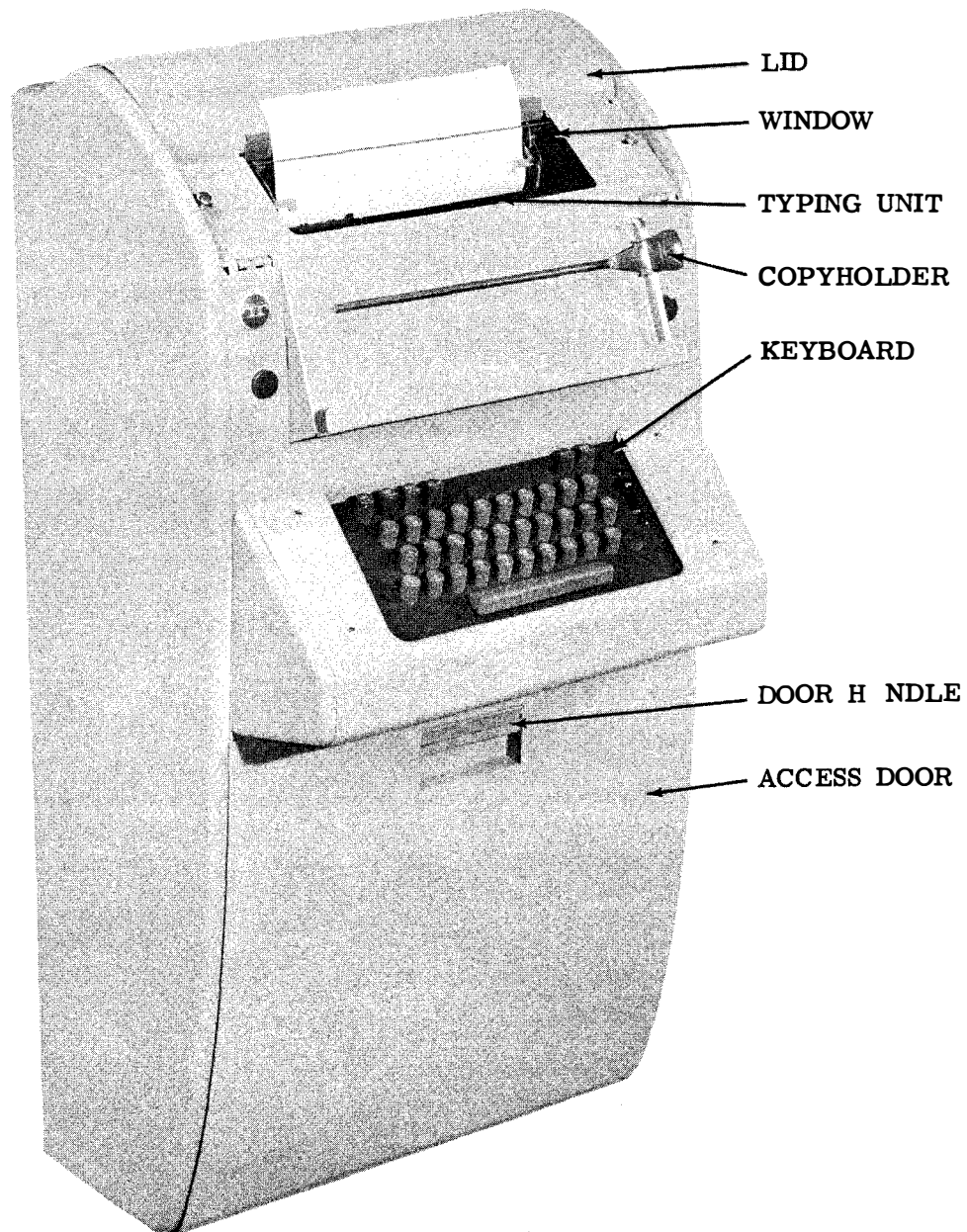


Figure 5 - Wall Mounted Enclosure

ing area, and a window for viewing the printed copy and for use as a copy paper tearing edge. A copy lamp, controlled by the motor-power switch, is provided for illumination of the printed copy. The front surface of the cover contains a copyholder tray with an adjustable, combination line guide and retainer. The lower level of the cover has a magnetically-latched door, which provides access to the electrical service unit and paper supply.

2.14 The backplate assembly is used to mount the enclosure to the wall surface. It contains a paper chute and provides support for the frame assembly, to which the cover is secured. One large, centrally positioned isolation mount, and two stabilizing mounts isolate the frame assembly from the back plate assembly.

MULTIPLE KSR AND RO ENCLOSURES (Figure 6)

2.15 The multiple KSR and RO enclosures provide housing facilities for either two RO sets and one KSR Set, or three RO Sets. In general, the enclosures accommodate the following methods of copy handling:

- (a) Single copy paper, fed out and torn off.
- (b) Single copy paper, displayed on a copy display rack and wound on a paper winder.
- (c) Two-ply paper, the first copy torn off, the second copy displayed and wound on a paper winder.

2.16 Typically, the enclosures are of double-frame construction, consisting of an inner and an outer frame. The inner frame contains three sets of slides, installed in a step-like arrangement for mounting the teletypewriter sets. They permit partial withdrawal of the sets for maintenance purposes. The lower level of the enclosure contains the electrical service assembly, installed on a mounting panel. In some enclosures, electrical service units are used. Access to the lower part of the enclosure is made through a hinged door. Access to the rear of the units may be made by removing the rear panel.

2.17 Each of the two upper sets of slides (and also the lowest set of slides if three RO sets are to be installed) contain a base plate with an intermediate gear assembly, paper

winder assembly and wiring for installing and connecting a typing unit and a motor unit. The lower set of slides mount a send-receive keyboard or receive-only base, equipped with a typing unit, motor unit and paper winder assembly.

2.18 In some enclosures, a hinged cover equipped with a copy window and push buttons for local control is installed at each teletypewriter position. In other enclosures, a single window is used. It may be raised for access to the equipment. Copy illumination systems may be provided for each position.

2.19 The enclosure may be equipped with a low-paper alarm system for each teletypewriter position. The alarm system includes a warning lamp and audible alarm, a reset switch, control relays, and a power supply. The alarm indicators and reset switch are generally installed on a control panel above the upper teletypewriter position.

2.20 When a KSR Set is installed, a panel that contains pushbutton switches for connecting the output of the keyboard to either of the three typing units, or to a separate line circuit may be provided (Fig. 6). The panel may also contain switches for the control of ac power and open line alarm lamps for each level.

2.21 The electrical service assembly may provide the following features:

- (a) Copy lamp transformers for the copy lamp systems.
- (b) Fuses for the ac circuits.
- (c) One main power switch for the ac power to the enclosure.
- (d) Control relays for switching the output of the keyboard to any of the typing unit circuits or to a separate line circuit. Power for operating the relays is supplied externally.
- (e) Adjustable resistors, one for each incoming signal line, for making line current adjustments.
- (f) Three selector magnet drivers (one for each typing unit) equipped with an open line sensing device which actuates an associated open line relay.

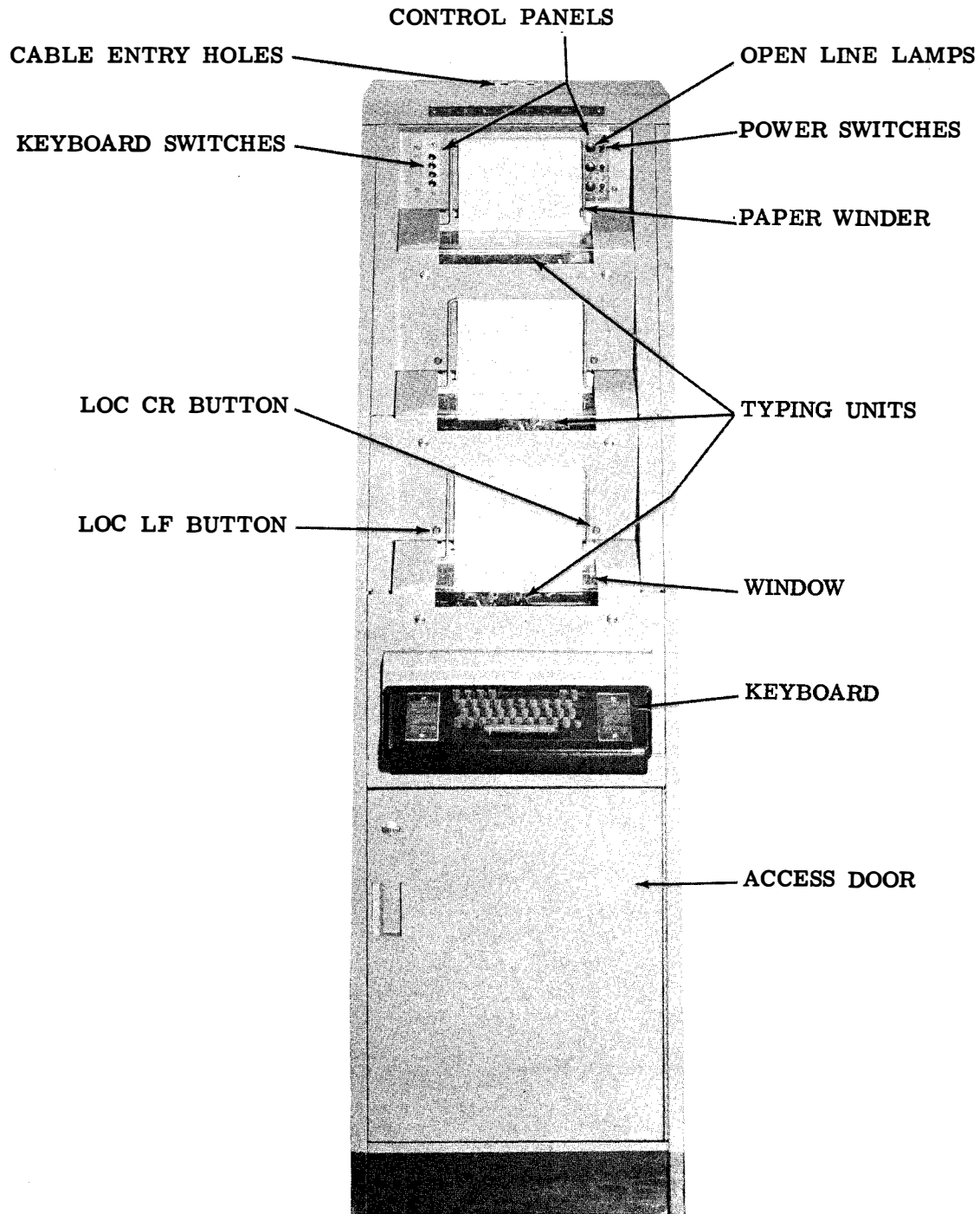


Figure 6 - Multiple KSR and RO Enclosure

(g) Terminal blocks and terminal boards for connections between the electrical service assembly and wiring of the enclosure.

2.22 External connections may enter the enclosure through several cable duct openings provided. Cabling to and from the electrical service assembly is of sufficient length to

allow the assembly to be pulled forward through the access door and set on the floor for maintenance purposes.

2.23 Accessories for the enclosure include a static eliminator for the copy paper in each teletypewriter position, direct-drive paper winders for the upper two positions, and copy display racks.

