CHAPTER 3
FUNCTIONAL DESCRIPTION

3-1. INTRODUCTION. This chapter provides a functional description of Model 28 Compact Page Printer (CPP) KSR and RO Teletypewriter Sets presented in a three-level format. The first level discussion is a brief overall functional description based on a simplified block diagram. The second-level discussion is a detailed functional description supported by a pictorial functional diagram. The third-level discussion provides detailed descriptions of the operation of mechanical assemblies.

3-2. OVERALL FUNCTIONAL DESCRIPTION. High-level CPPs are discussed in paragraph 3-2.1, and low-level CPPs are discussed in paragraph 3-2.2.

3-2.1 OVERALL FUNCTIONAL DESCRIPTION (HIGH-LEVEL). Figure 3-1 shows significant electrical signal and mechanical energy paths between units of high-level CPP teletypewriter sets. Units common to both KSR and RO and units peculiar to KSR only or RO only are indicated. Keyboard unit functions are not applicable to the RO. Primary power (115 VAC, 60 Hz) is supplied directly to the primary of a step-down transformer mounted in the cover unit and is also supplied, through the power switch, to the motor unit. The 5.6-volt ac output of the transformer is used to supply power to the copy lights. The motor unit drives mechanisms in the typing unit and the distributor (KSR only) through the gear shift assembly which determines the speed of a main shaft. Speed of operation is controlled by the speed selector switch, mechanically linked to the gear shift assembly. Local line feed (LOC LF) and local carriage return (LOC CR) function keys on the keyboard (KSR) or control hood (RO) are mechanically linked to the typing unit and initiate their respective functions when pressed. Character or function keys on the keyboard are mechanically linked to a code bar mechanism in the keyboard transmitter. The mechanical signal code on the codebar mechanism is converted to a parallel, 5-bit electrical signal code by code-level contacts in the keyboard transmitter. The distributor serializes the 5-bit signal code which is used to key an external dc loop current power supply to generate mark/space signals. The mark/space signal code (0.060 amperes mark and 0 amperes space) is applied to selector magnets in the local typing unit and sent out on the signal line to a remote typing unit. The typing units print the character or perform the function previously selected at the keyboard (KSR) or determined by the received signal code (RO).

3-2.2 OVERALL FUNCTIONAL DESCRIPTION (LOW-LEVEL). Figure 3-2 shows significant electrical signal and mechanical energy paths between units of low-level CPP teletypewriter sets. Units common to both KSR and RO and units peculiar to KSR only or RO only are indicated. Keyboard unit functions are not applicable to the RO. Primary power (115 VAC, 60 Hz) is supplied directly to the primary of a step-down transformer mounted in the cover unit (RO

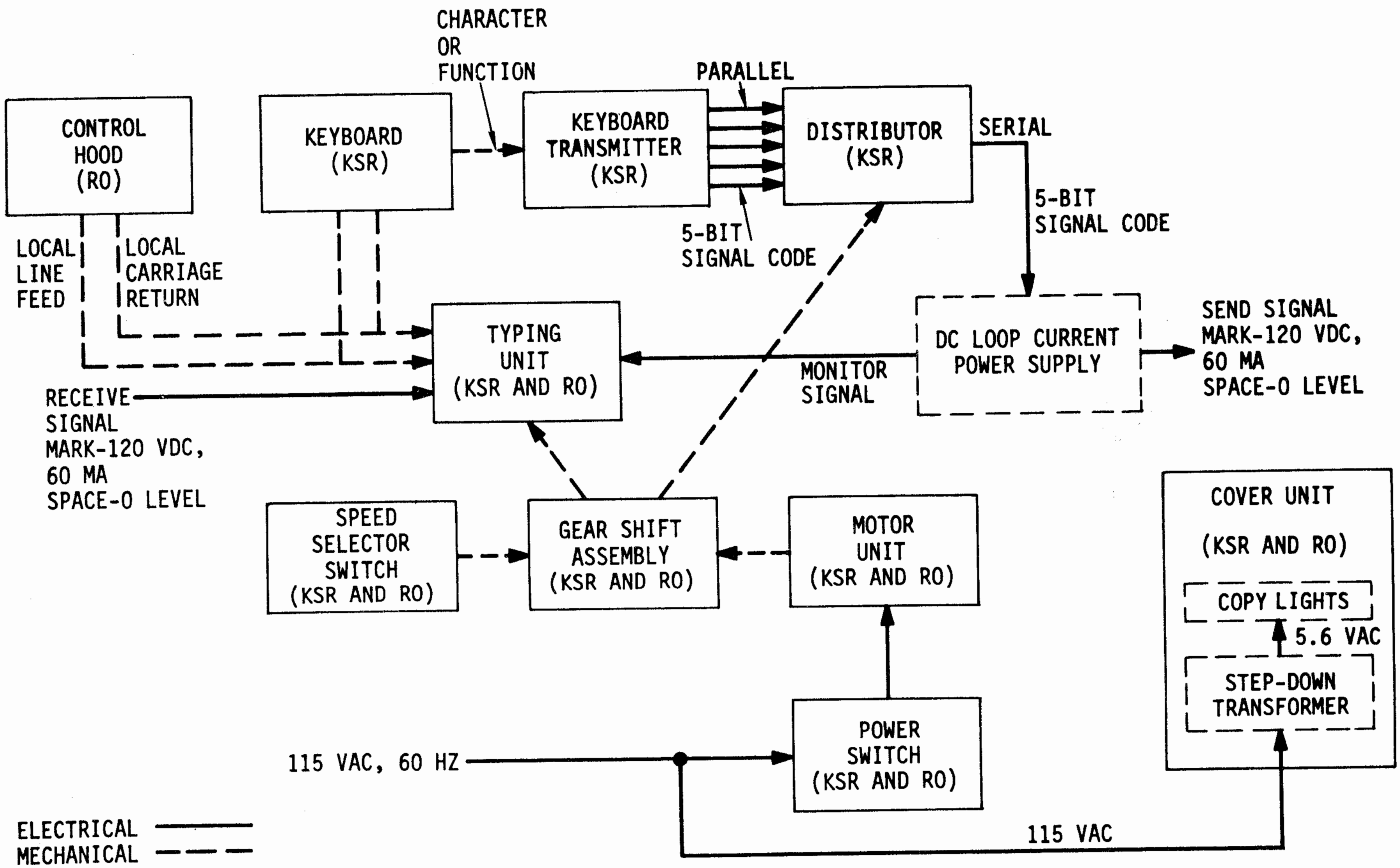


Figure 3-1. CPP (KSR and RO) Overall Functional Block Diagram (High-Level)

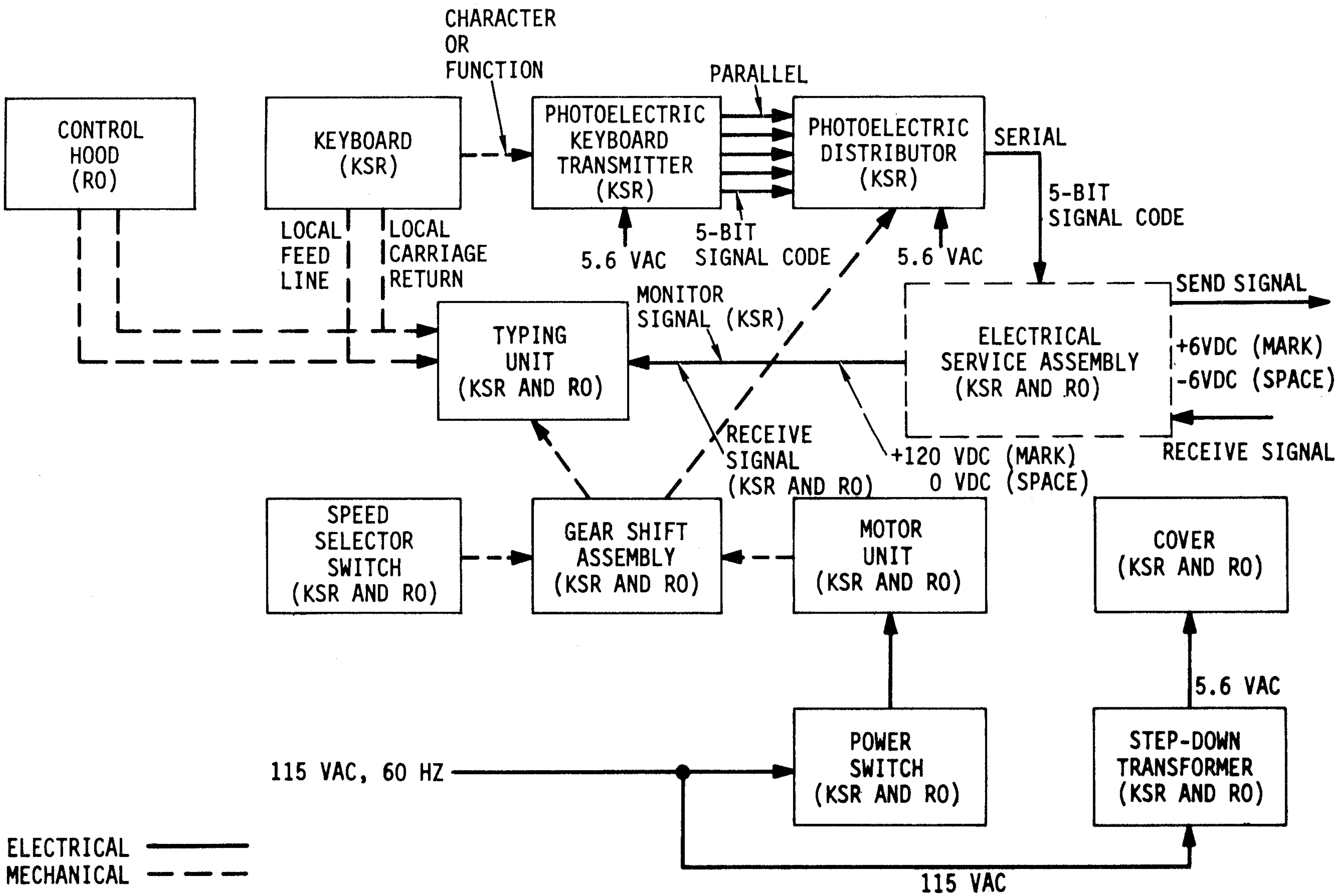


Figure 3-2. CPP (KSR and RO) Overall Functional Block Diagram (Low-Level)

only) and is also supplied, through the power switch, to the motor unit. In the low-level KSR set, the step-down transformer is mounted on the typing unit. The 5.6-volt ac output of the transformer is routed to the cover to supply power to the copy lights. The 5.6-volt ac is also used to supply the lamp assemblies in the photoelectric keyboard transmitter and distributor. The motor unit drives mechanisms in the typing unit and the photoelectric distributor (KSR only) through the gear shift assembly which determines the speed of a main shaft. Speed of operation is controlled by the speed selector switch, mechanically linked to the gear shift assembly. Local line feed (LOC LF) and local carriage return (LOC CR) function keys on the keyboard (KSR) and control hood (RO) are mechanically linked to the typing unit and initiate their respective functions when pressed. Character or function keys on the keyboard are mechanically linked to a code bar mechanism in the photoelectric keyboard transmitter. The mechanical signal code on the code bar mechanism is converted to a parallel, 5-bit electrical signal code by the photoelectric assembly in the keyboard transmitter. The photoelectric distributor serializes the 5-bit signal code which is applied to the input of the electrical service assembly (ESA). Circuit cards in the ESA develop the ±6-vdc send signal and the 0.060/0.0 ampere monitor signal applied to the selector magnets in the typing unit. The ±6-volt receive signal is converted in the ESA to the 0.060/0.0 ampere receive signal required to drive the selector magnet. The typing units print the character or perform the function previously selected at the keyboard (KSR) or determined by the received signal code (RO).

3-3. DETAILED FUNCTIONAL DESCRIPTION. As shown in figure 3-3, basic functions of the CPP telegraphic communications network, are the transmission (KSR only) and reception of telegraphic coded signals and printing of messages represented by the coded signals. The power distribution function supports both electrical and mechanical functions. Unless otherwise noted the following discussions apply to both high-level and low-level equipment.

a. <u>Power Distribution</u>. Distribution of electrical power is shown in the schematic diagrams provided in Chapter 5 Distribution of mechanical power is discussed in the following paragraphs.

(1) <u>Motor Unit</u>. Mechanical motion for driving the typing unit and distributor through the gear shift assembly is provided by a 1/20 horsepower, two-pole, single-phase, synchronous motor unit.

(2) <u>Gear Shift Assembly</u>. The three-speed gear shift assembly transfers rotational motion from the motor distributor mechanism and to the main shaft in the typing unit. The output speed of the gear shift assembly can be manually selected, by the speed selector switch, while the motor unit is in the idle or running condition.

(3) <u>Main Shaft</u>. Motive power for the main shaft is applied to the driven gear centrally located on the shaft. The main shaft rotates at the output speed of the gear shift

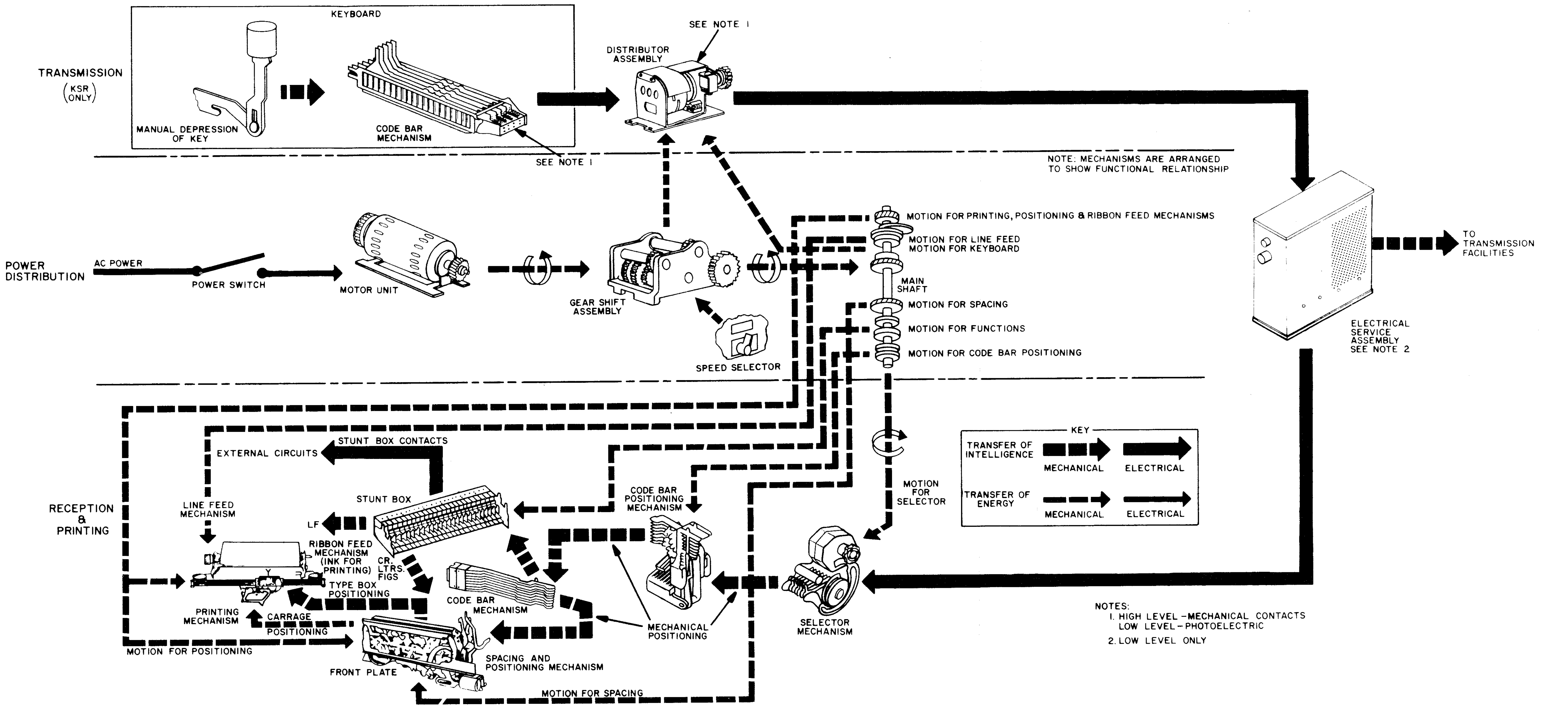


Figure 3-3. CPP Detailed Functional Diagram

assembly. Six all-steel internal expansion clutches convert the rotary motion of the main shaft to the linear mechanical requirements for operation of the teletypewriter set. 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 mechanism.

b. Transmission (KSR Only). The transmission function is accomplished by the keyboard unit.

(1) Keyboard Unit (High-Level). The keyboard unit consists of the keyboard transmitter and the distributor assembly. The keyboard transmitter provides a means for selecting a character or function, presetting local contacts, and initiating transmission. The selected character is then sequentially distributed on the signal line by the distributor assembly. A second character cannot be selected until the first character has been distributed. When a character or function key is pressed, a code combination is mechanically set up on the code bar mechanism. The code bar mechanism is mechanically linked to wire contacts. The wire contacts at the keyboard transmitter are electrically connected to their respective distributor contacts through parallel wires. When the wire contacts are positioned by depressing a keytop, the distributor magnet wire contact is also closed to energize the distributor clutch magnet. When the distributor clutch magnet is energized, the distributor clutch is tripped to engage its cam sleeve with the distributor main shaft. The rotating cam sleeve sequentially operates the code level contacts to extend signal line current to existing marking or spacing wire contacts at the keyboard transmitter. Additional cams on the distributor sleeve operate (1) a timing contact which opens the clutch magnet circuit and (2) a reset contact which operates a solenoid to reset the keyboard transmitter.

NOTE

The following discussion is applicable to low-level CPP sets with photoelectric keyboard units. Some low-level CPP equipments have contact assemblies with goldplated wire contacts, mounted in rfi enclosures, which function in the same manner as described above for high-level equipment.

(2) Keyboard Unit (Low-Level). The low-level keyboard unit consists of a photoelectric keyboard transmitter and a photoelectric distributor assembly. The keyboard transmitter provides a means for selecting a character or function, presetting photoelectric shutter window assemblies, and initiating transmission. The selected character is then sequentially distributed to an electrical service assembly by the distributor assembly. A second character cannot be selected until the first character has been distributed. When a character or function key is pressed, a code combination is mechanically set up on the code bar mechanism. The code bar mechanism is mechanically linked to shutter windows in the keyboard transmitter

photoelectric assembly. The photoelectric assembly forms the code combination into a parallel, 5-bit electrical signal which is photoelectrically converted in the distributor assembly to a serial, 5-bit electrical signal. The serial output of the distributor assembly is applied to the input of the electrical service assembly.

c. Reception and Printing. Reception and printing functions are accomplished by mechanisms in the typing unit. The basic function of the typing unit (figures 3-4 and 3-5) 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. 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. 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 independently of the signal line from the local keyboard or base mechanism. 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. 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. Rotary motion from the gear shift assembly 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. 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.

(1) Selecting Mechanism. A selecting mechanism translates the signaling code combinations into corresponding mechanical arrangements which control code bars in a code bar mechanism. It includes a two-coil magnet that connects in series with the

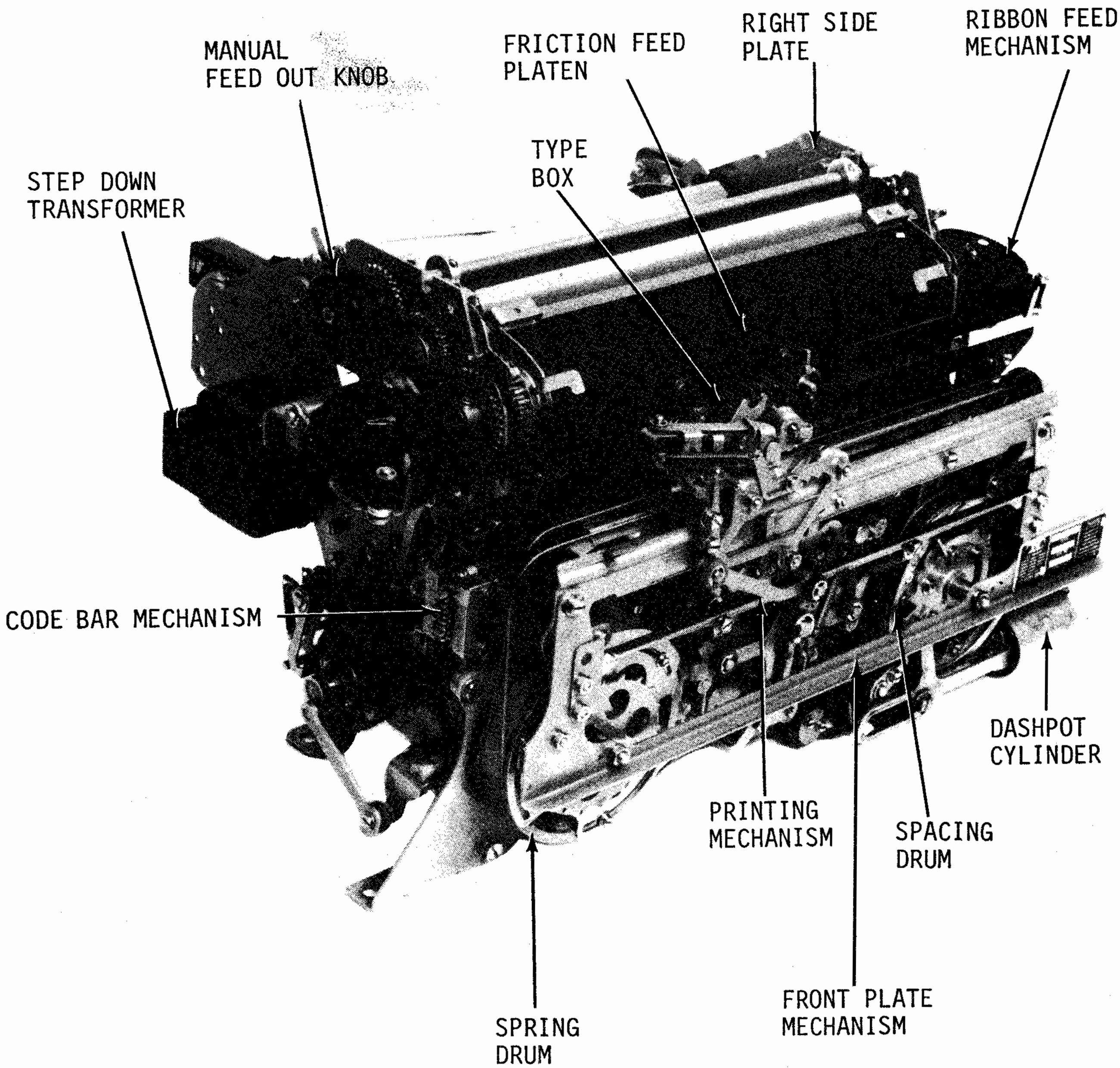


Figure 3-4. Typing Unit (Friction Feed) (Front View)

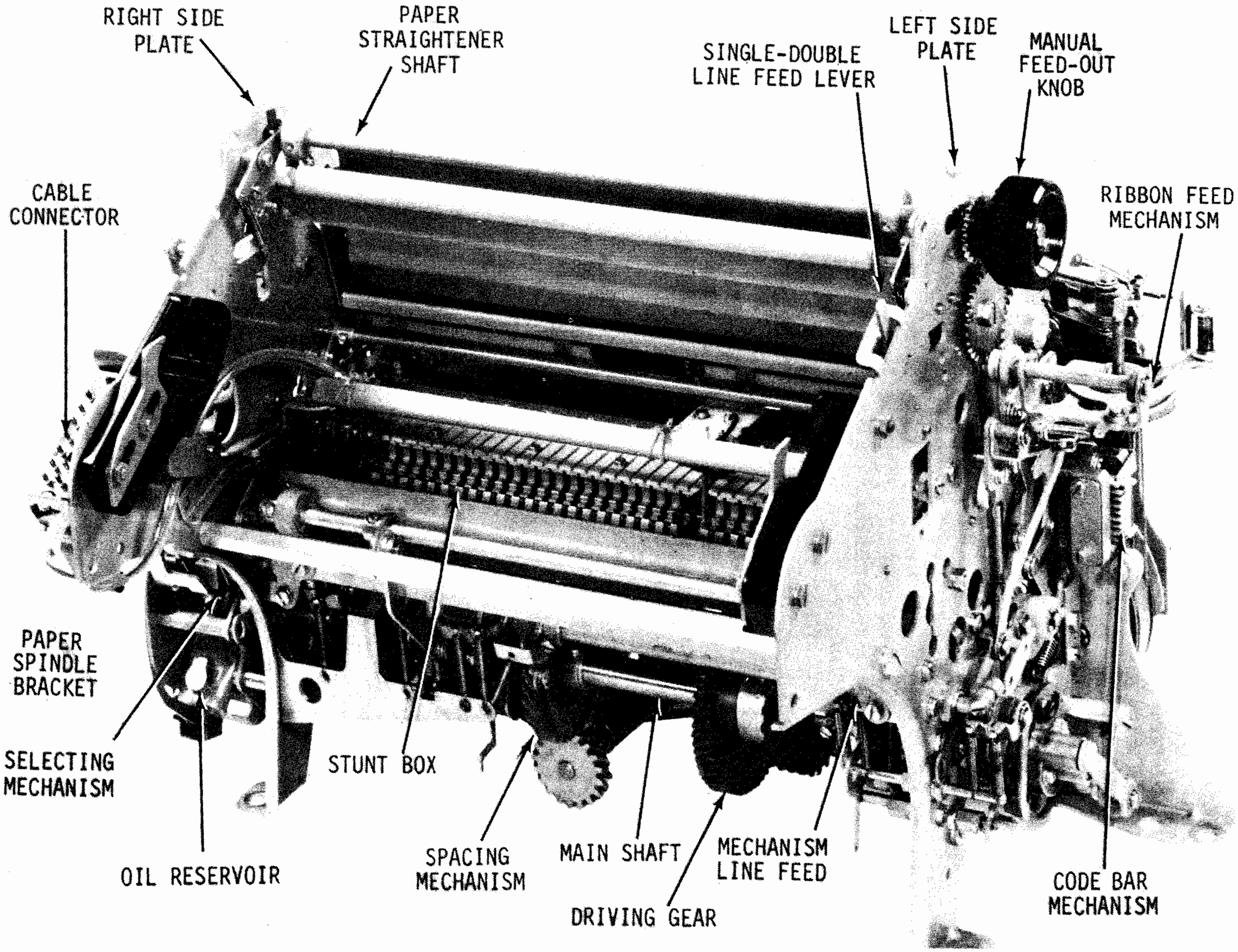


Figure 3-5. Typing Unit (Left Rear View)

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. 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. The selector cam clutch, driven by the main shaft, 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.

(2) Code Bar Mechanism. The code bar mechanism, when positioned by the selecting mechanism to correspond to the input code intelligence, sets up mechanical requirements for type box positioning, printing, and stunt box operation. 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.

(3) Printing Mechanism. 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 the horizontal positioning mechanism operated by the code bars, spacing mechanisms and carriage return, and the print hammer mechanism. The code bar mechanism 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 and horizontal positioning of the type box, ribbon feed, and printing. The main rocker shaft provides power from the type box clutch (and main shaft), and the code bars determine the specific application of that power required for each input signal code combination representing a graphic. A cam plate on the main rocker shaft trips the spacing clutch stop mechanism to engage the spacing clutch, except when spacing is suppressed. 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. 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.

(4) Spacing Mechanism. The spacing mechanism moves the type box and printing mechanism one character space to the right each time a graphic character is received and imprinted. A suppression mechanism prevents spacing on receipt of certain non-typing functions. The spacing clutch, when tripped by the cam plate on the printing mechanism main rocker shaft, 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.

(5) Line Feed Mechanism. 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. The line feed clutch operates mechanical linkages which advance the paper one or two spaces by rotating the platen. The function clutch controls the function bail and the stripper bail. The function reset bail permits transfer of 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.

(6) Stunt Box. A typical stunt box (figure 3-6) is a compact, self-contained device with memory storage capabilities that provide 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

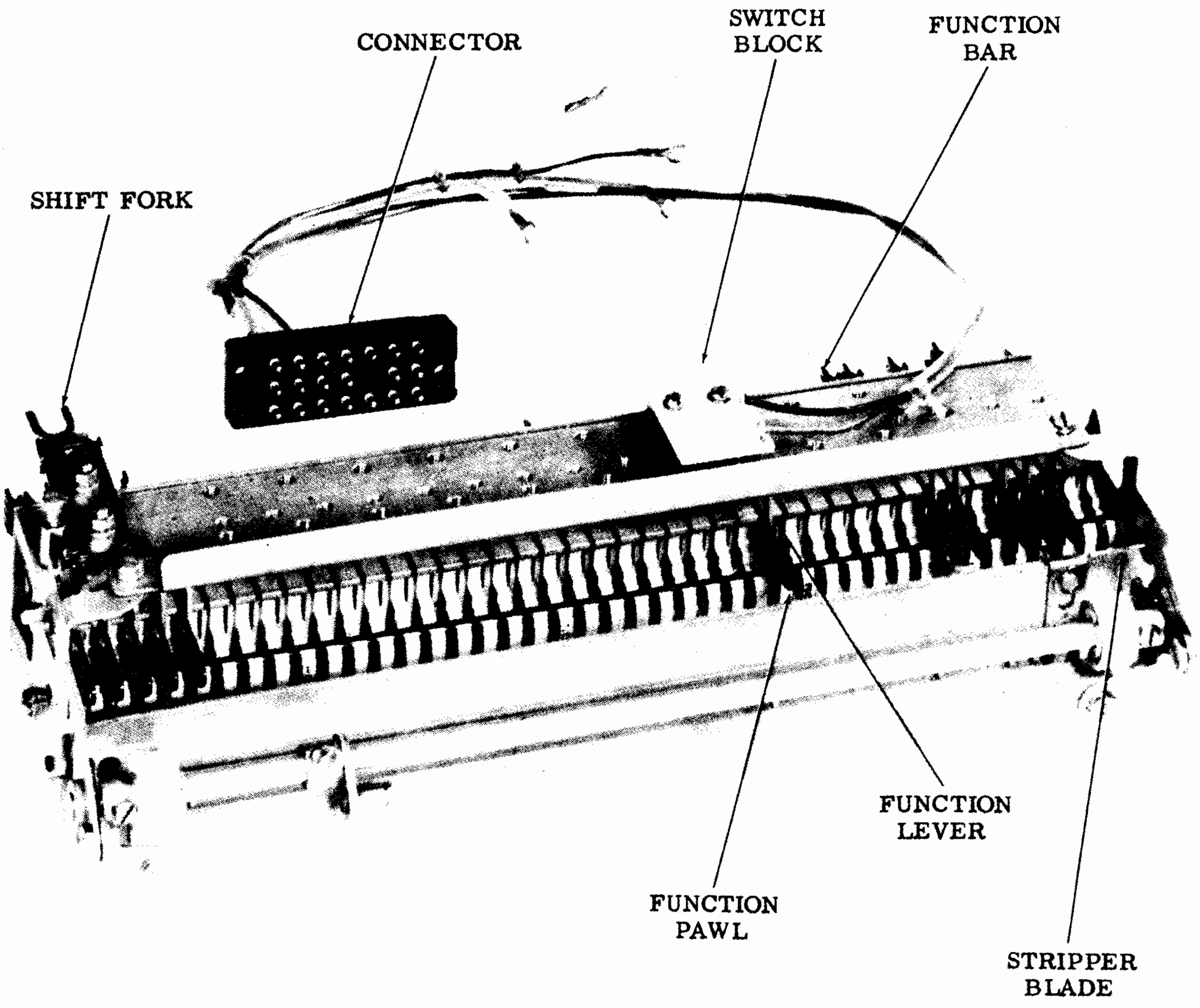


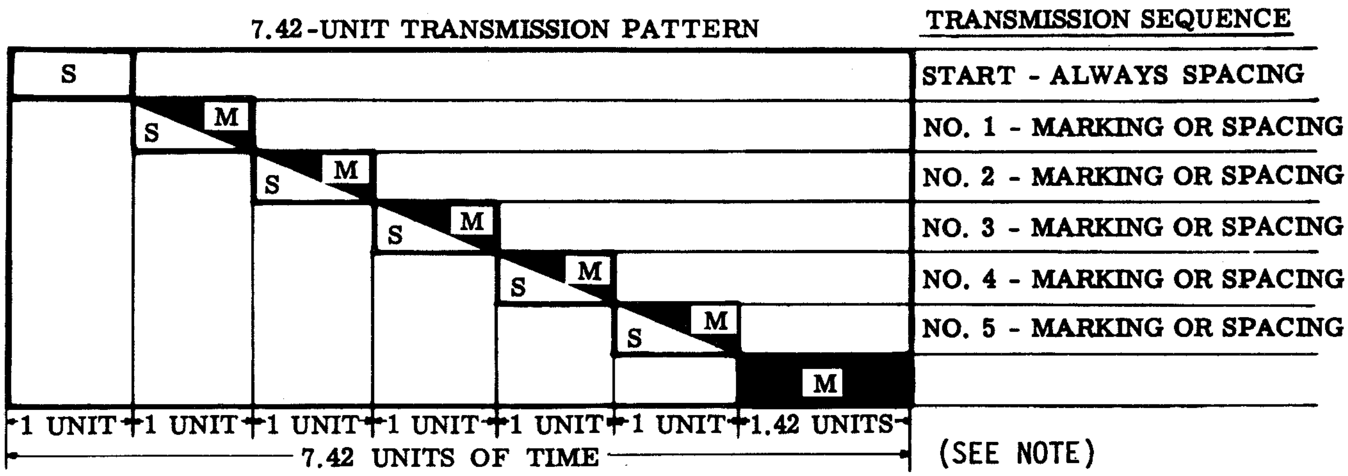
Figure 3-6. Typical Stunt Box

internal functions within the typing unit; electrical control of functions within the teletypewriter set; and electrical control of external equipment.

(7) Ribbon Feed Mechanism. 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.

(8) Paper Feed Mechanism. 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 by friction feed.

(9) Signaling Code. Information is received by the typing unit in the form of a 7.0 or 7.42 unit start-stop signaling code (figure 3-7) 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 ensure 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. The code representation for the graphics R and Y are shown in figure 3-8. In these combinations, alternate marking and spacing conditions for the intelligence pulses are required. In different signaling codes used with 28 teletypewriter equipment, the length of the stop pulse may vary. For example, in the code shown in figure 3-7, 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. 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 typical character arrangement is shown in figure 3-7. The black 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.



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	1	●	●		●	●	●				●	●						●		●		●		●	●	●	●					●	●
	2	●		●				●		●	●	●	●				●	●	●			●	●	●						●		●	●
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(TYPICAL CHARACTER ARRANGEMENT) b.

NOTE: FOR 7.0 UNIT CODE, ALL UNITS OF TIME ARE EQUAL

Figure 3-7. Signaling Code

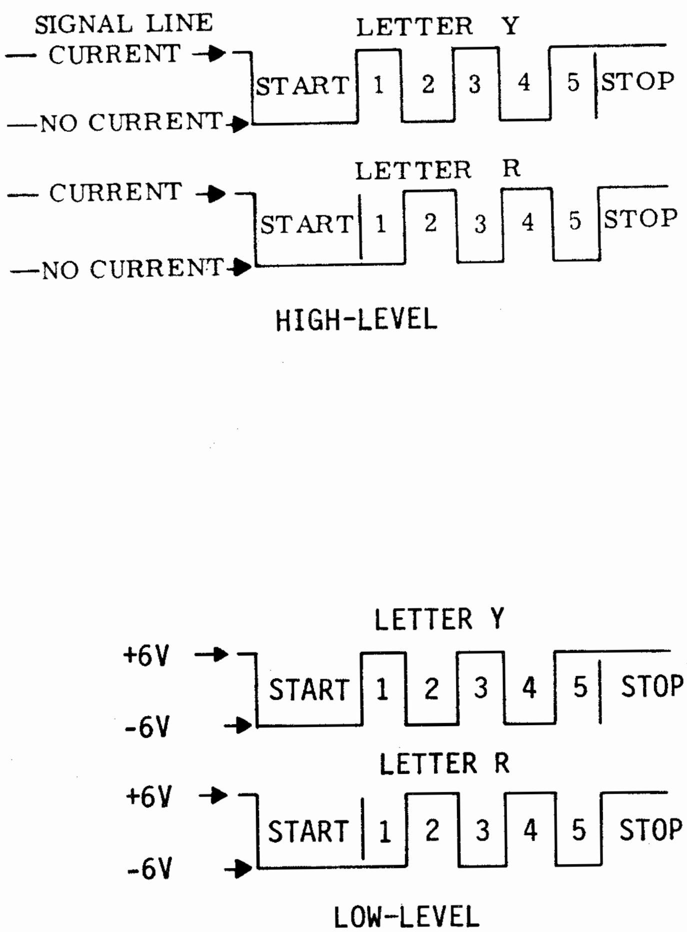

Figure 3-8. Code Representation of Letters R and Y

3-4. ELECTRICAL CIRCUITS. Electrical circuit information is provided for high-level and low-level CPP equipment in paragraphs 3-4.1 and 3-4.2, respectively.

3-4.1 ELECTRICAL CIRCUITS (HIGH-LEVEL). High-level CPP schematics and wiring diagrams are provided in figures 5-1 through 5-7.

3-4.2 ELECTRICAL CIRCUITS (LOW-LEVEL). Low-level CPP schematics and wiring diagrams are provided in figures 5-8 through 5-29. Electrical Service Assemblies (ESAs) used in conjunction with low-level CPP equipment are discussed in paragraph 3-4.3.

3-4.3. ELECTRICAL SERVICE ASSEMBLIES. The following paragraphs present technical descriptions and theory of operation for ESAs used with CPP low-level teletypewriter equipment. As noted in Chapter 1, the ESAs are metal shielded containers which vary in configuration for different applications. They are used as a housing for electronic components which serve to suppress radio frequency interference and provide low-level transmission of telegraph signals. Figure 3-9 shows a typical CPP ESA. The ESA low-level radio-frequency components are used in conjunction with shielded cabling to form a complete shielded electrical system for rfi suppression. CPP electrical service assemblies differ from one another primarily because of the number of circuit board connectors provided for the associated keyers and drivers. Table 1-1 of Chapter 1 lists the three ESAs used with low-level CPP sets and identifies the circuit cards contained in each. As noted in the table, the following circuit cards are used:

PS - Power Supply
CMD - Clutch Magnet Driver
LLK - Low-Level Keyer
SMD - Selector Magnet Driver

ESAs 323120 and 323121 are used in CPP KSR sets. Figures 5-19 and 5-20 in Chapter 5 are the wiring and schematic diagrams, respectively, of ESA 323120, which houses the KSR CMD circuit cards and is single shielded. Figures 5-23 and 5-24 of Chapter 5 are the wiring and schematic diagrams, respectively, of ESA 323121, which houses the KSR SMD and LLK circuit cards and is double shielded. ESA 321231 (figure 3-9) is used in CPP RO sets to house the SMD circiut card and is double shielded. Wiring and schematic diagrams for ESA 321231 are shown in figures 5-13 and 5-14, respectively, of Chapter 5. Figures 3-10 and 3-11, respectively, show typical parts of single and double-shielded ESAs. ESA single and double shielding is discussed in paragraph 1-3.2g of Chapter 1. All CPP ESA's contain the same 321290 power supply circuit board assembly with the 321130 power supply circuit card. A typical ESA, showing circuit card connectors, is shown in figure 3-12.

a. <u>ESA Power Supply Circuits</u>. CPP ESA power supply circuits utilize the TP321290 0.5 ampere power supply shown in figure 3-13. When installed in a shielded ESA containing the proper transformer and filter assembly, this power supply is intended as the radio frequency interference suppression power source in CPP systems requiring low-level rfi.

(1) <u>Technical Description</u>. An assembly

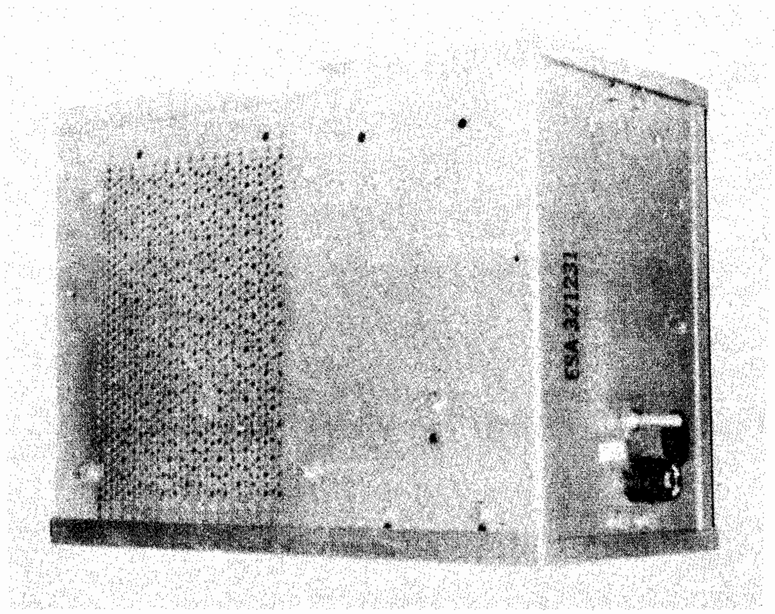

Figure 3-9. ESA for Table Mounting - Double Box Construction

drawing of the TP321290 power supply assembly and a schematic diagram of its associated 321130 circuit board assembly, respectively, are shown in figures 5-15 and 5-16 of Chapter 5.

(a) The power supply is plugged into the 15-pin TP148458 connector in the ESA that has a TP198650 polarizing key between pins M and N. Refer to table 1-1 of Chapter 1 for information regarding the applicable power supply card to be used with the particular set and to the wiring diagram package for the applicable wiring diagrams. See also the applicable ESA wiring and schematic diagrams (figures 5-13, 5-14, 5-19, 5-20, 5-23, 5-24) in Chapter 5.

(b) The transformer and filter circuits for the power supplies are located in part of their associated ESAs. The power transistor and heat sink are included as part of the TP321290 circuit card assembly.

(c) The ESAs are normally wired so that one 250 ohms (25 watts) resistor is connected across the collector-emitter of transistor Q1 when each associated SMD or CMD is inserted in its connector to reduce power dissipation in Q1. (This is equivalent to paralleling Q1 with 250 ohms for each 0.150 ampere, approximately, of load current.)

(d) Fuse F102 limits the output current to a total of 0.5 ampere.

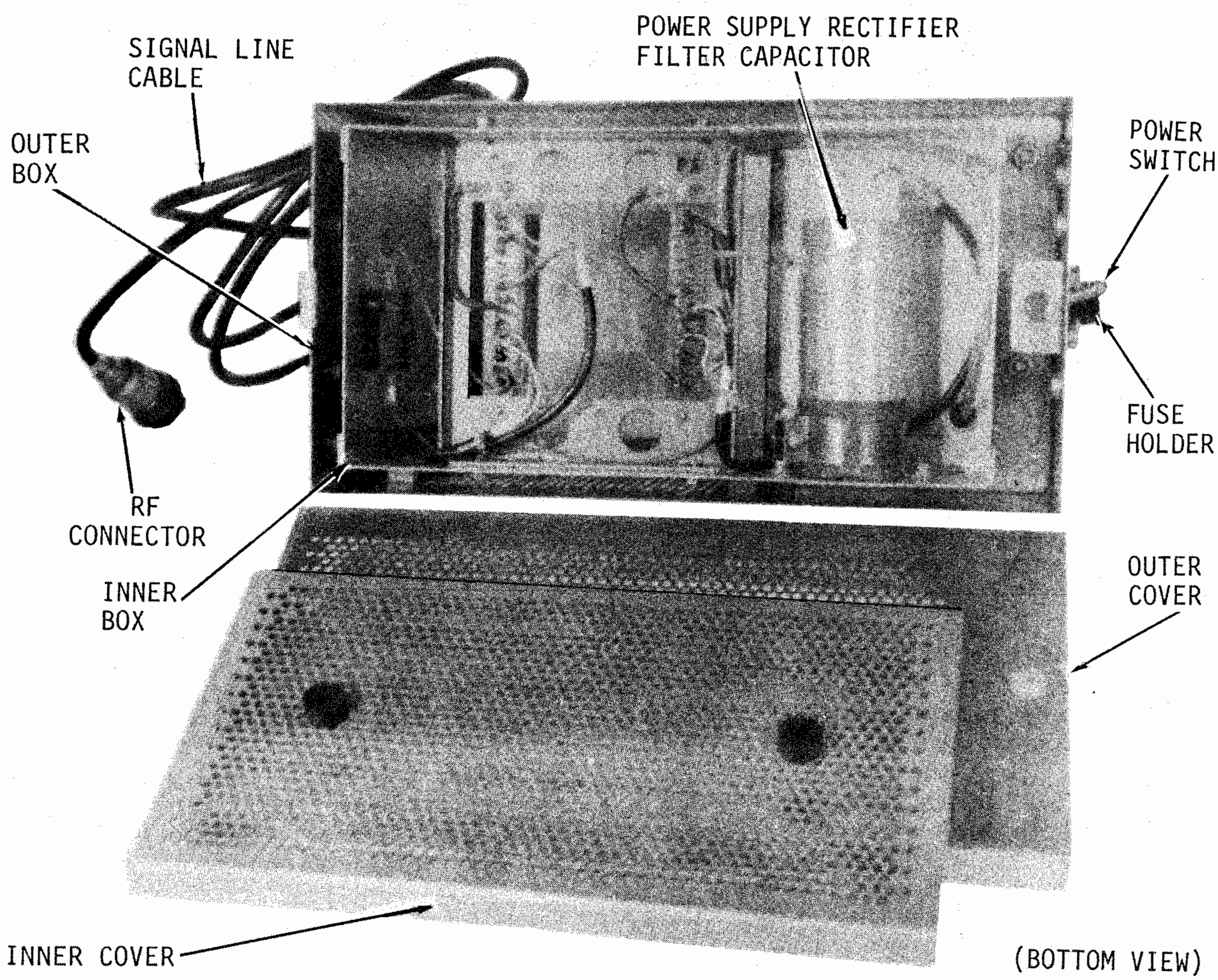

Figure 3-10. Typical Parts of an ESA - Double Box Construction (Bottom View)

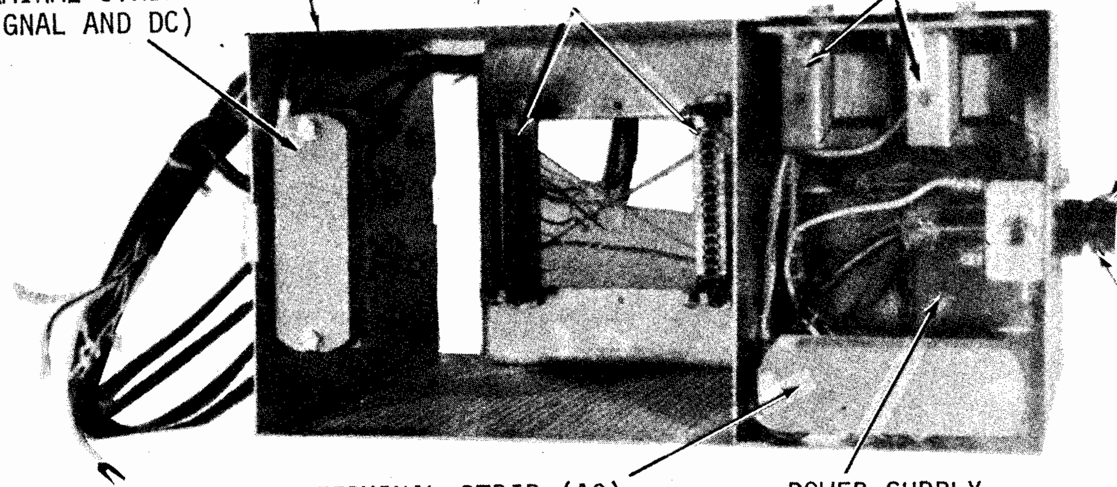

Figure 10 - Typical Parts of an ESA — Single Box Construction

Figure 3-11. Typical Parts of an ESA - Single Box Construction (Top View, Covers Removed)

(2) Technical Data. In the following paragraphs, the technical data refers to the complete power supply, including transformer and filter components in the associated electricl service assembly. The data applies to 0.5 ampere power supplies when installed in an electrical service assembly that accomodates from one to three selector magnet drivers (SMD) or clutch magnet drivers (CMD). (See also Table 1-2, Reference Data, in Chapter 1.)

(a) Input: 100 VAC to 130 VAC, 45 to 66 Hertz.

(b) Output:

1. +47 VDC to +53 VDC at 0.5 ampere maximum.

2. +6.6 VDC to +7.8 VDC at 0.018 ampere maximum.

3. ±6.6 VDC to -7.8 VDC at 0.018 ampere maximum.

(c) Fusing

1. AC: 0.8 ampere, slow-blowing (TP162360).

2. DC: 0.5 ampere, fast-blowing (TP131807).

(d) Operating Ambient Temperature: +40 F to +120 F.

(3) Theory of Operation. The following paragraphs explain the general

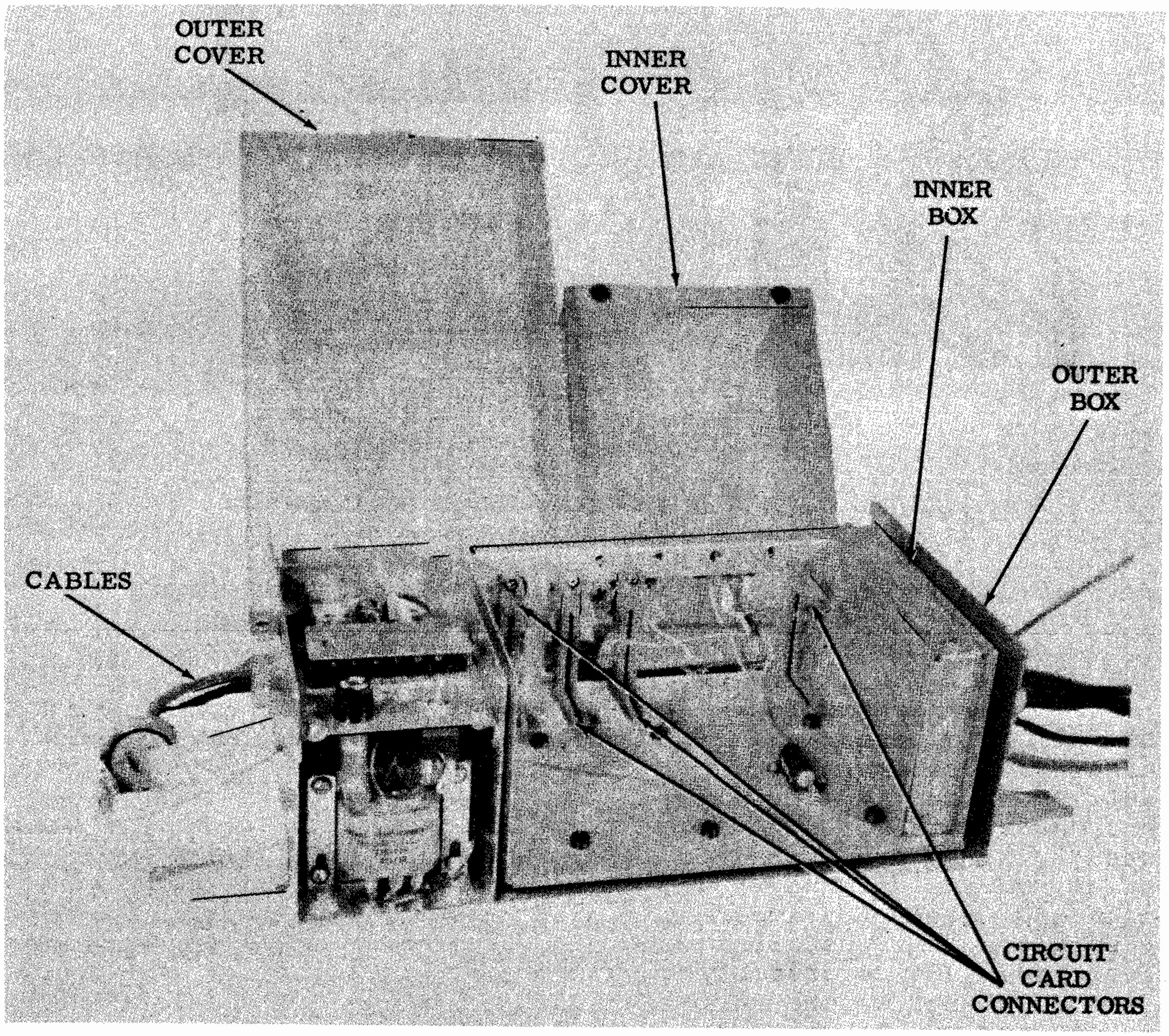

Figure 3-12. Typical ESA Showing Circuit Card Connectors

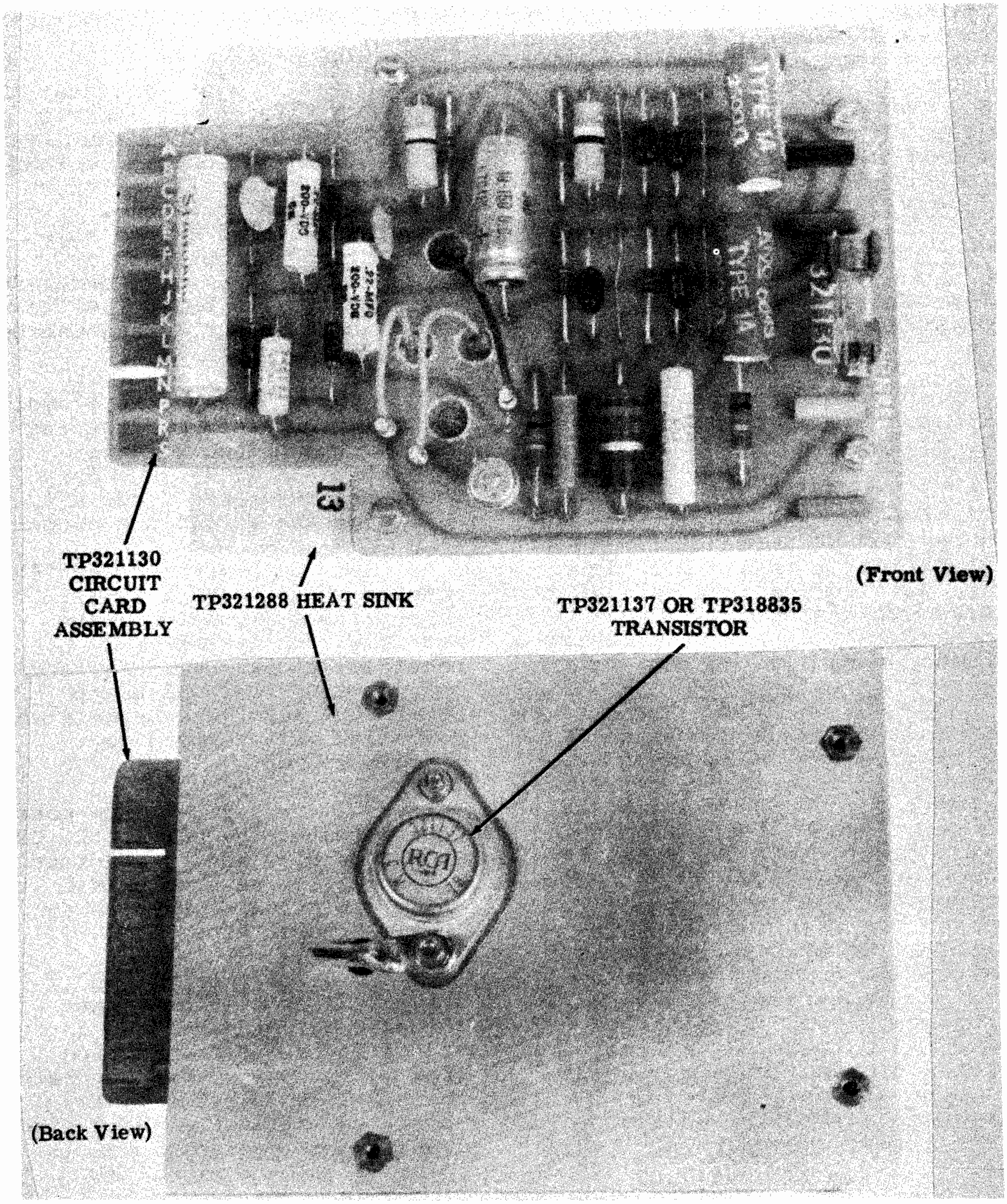

Figure 3-13. One-Half Ampere Power Supply (TP321290)

operation of the power supply circuit card assembly when it is installed in an ESA. The transformer and filter are included as part of the ESA. See figures 5-15 and 5-16 in Chapter 5 for power supply circuitry. For additional information refer to the ESA diagrams in Chapter 5 for the specific set that is used.

(a) Transformer T1, capacitor C8 or C102, filter component L1, L2, C9, C10, C11, and C12 are all located in the ESA, not on the circuit card assembly. (Refer to figure 3-13 and ESA wiring diagrams in Chapter 5).

(b) Transformer T1, diodes CR1, CR3, and capacitor C8 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc. In ESAs containing CMD circuit cards, capacitor C102 performs a function similar to that of C3.

(c) Transistors Q1 and Q2 form a two stage series voltage regulating element. Both transistors are always conducting with the base emitter drop of each transistor at approximately 0.7 volt. The drop across R2 (used in conjunction with capacitor C5 for rfi noise suppression) is negligible. In effect, the emitter of Q1 (dc output) is clamped to the same potential as the reference diode combination CR7 and CR12 (nominally +47 volts). The difference between the dc output and unregulated dc appears across the collector-emitter junction of Q1.

(d) Resistor R1 limits the current that divides between the CR7-CR12 reference diodes and the base of Q2, which is a gain stage for Q1. The base current of Q1 (Q2 collector current) is the base current of Q2 multiplied by the dc current gain (H_{FE}) of Q2.

(e) Resistor R7 acts as a bleeder and assures that Q1 and Q2 will conduct even when no load is conected across the output terminals. Without R7 and no load connected, the output would rise to the same value as the unregulated dc. However, a minimum load of 0.150 ampere must also be applied to maintain the +53 volt regulation limit.

(f) The +7 volt output is obtained by dropping the unregulated dc voltage through resistor R4 to supply the Zener reference diode CR6, which appears across the output.

(g) R5 and CR5 provide -7 volts in a similar manner; however, a full-wave rectifier consisting of rectifier diodes CR2, CR4, and capacitor C4 is required to obtain the negative unregulated potential with respect to circuit common.

(h) A low-pass filter consisting of L1, L2, C9, C10, C11, C12, and transformer shielding are used to obtain noise isolation between power line and power supply.

b. <u>Selector Magnet Driver</u>. The selector magnet driver (SMD) provides two inputs and makes possible reception from either one of two separate transmitters (single input operation) while the input line from the other transmitter is open. A spacing signal at either input will provide a spacing output. In order to function properly, the SMD is installed in a double-shielded enclosure and used in conjunction with the appropriate

ESAs where extreme rfi suppression is required. It is not intended for general use.

(1) Technical Description. The TP323810 SMD is a 15-pin circuit card assembly designed to plug into an associated ESA as an integral part of its components. When used in conjunction with proper power supply and filter assemblies, it is intended for radio frequency interference suppression of receiving selector noise in systems requiring this suppression. Figure 3-14 shows the SMD circuit card. Refer to figures 5-17 and 5-18 in Chapter 5, respectively, for the SMD circuit board assembly drawing and schematic diagram.

(2) Technical Data. The following technical data is applicable to the TP323810 SMD circuit card.

(a) The input current to the TP323810 SMD is a low-level +6 volts for a marking state, and a -6 volt for a spacing state.

(b) The output current of the SMD is 60 milliamperes ±10% during the marking state. The output is zero during the spacing state.

(c) The SMD assumes the marking state with positive input voltages not greater than 0.5 volt and the spacing state with negative voltages not greater than 0.5 volt. The marking and spacing switching levels are

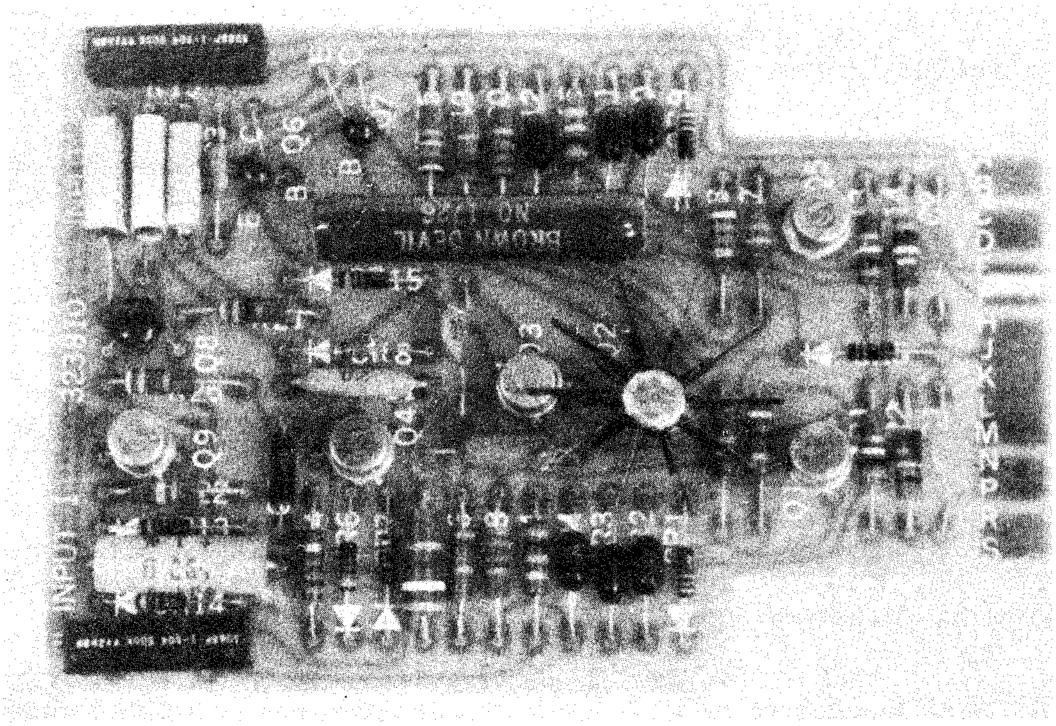

Figure 3-14. Selector Magnet Driver (SMD) (TP323810)

adjustable within 10% of each other. This requirement applies to either input.

(d) Each input of the SMD has a minimum input resistance of 50,000 ohms.

(e) The maximum input capacitance of either input is 2500 picofarads.

(f) Overall receiving margins of properly adjusted Model 28 type selectors driven by this SMD (polar rectangular wave input) should exceed 70 points at either input.

(g) The SMD provides a marking output when both inputs are open.

(h) Both inputs cannot be in the marking condition simultaneously without producing a garbled output.

(i) The SMD operates at bit rates up to 75 baud.

(j) It operates in a free-air ambient temperature of 70°C (158°F). Storage temperature should not exceed 85°C (185°F).

(k) The SMD operates from a power supply delivering 47 to 53 VDC.

(l) The power consumption under any combination of power source, environmental, and component conditions is 8.5 watts maximum.

(m) The TP323810 SMD, together with associated ESA and power supply, is intended for use with equipment requiring low-level rfi (polar-EMC) operation.

(3) Principles of Operation. The following electrical theory requires reference to figure 3-14. Refer also to figures 5-17 and 5-18 in Chapter 5.

(a) The TP323810 SMD is basically a direct coupled amplifier providing a current gain of approximately 80 db The first two stages (Q1, Q6, or Q5, Q7) provide the necessary gain to drive a Schmitt trigger (Q8 and Q9). Q2, Q3, and Q4 comprise a power regulator stage which provides the power supply with a constant load.

(b) In the marking state with a positive voltage with respect to common applied to each input (or a positive voltage on one input, the other open), Q1 and Q5 conduct, which in turn saturate Q6 and Q7. In this marking state the voltage drop from the emitter of Q6 to the collector of Q7 is less than the voltage drop from the CR15 anode to the Q8 emitter. Under this condition, the base-emitter junction of Q8 is reverse biased, thus turning Q8 off. With Q8 off, the Q9 base will conduct through R26 and thus energize the external selector magnet in the collector circuit. Transistor Q9 base current is sufficient to saturate the collector. In this condition, selector magnet current is determined primarily by the value of the limiting resistor R23 and the power regulator output voltage.

(c) In the spacing state, with a negative voltage on input 1, input 2, or both inputs, the respective input transistor or transistors (Q1, Q5) are off. In this condition Q6-Q7 collector current is cutoff and the base of Q8 conducts. Transistor Q8 base current is sufficient to saturate the collector. The Q8 emitter-collector saturation voltage is less than the forward drop across CR13 thus reverse biasing the base emitter junction of Q9. With this junction reverse biased, Q9 collector current is cutoff and the selector magnet is de-energized.

(d) Because of the difference in magnitude of Q8 and Q9 load currents, the drop across R21 will be greater in the marking state than in spacing. This means that the input voltage to the third stage (Q6 VCE + Q7 VCE) necessary to change the state of Q8 will be different depending on the previous state. Specifically, a larger combined Q6 and Q7 collector-emitter voltage is required to turn on Q8 than to turn off Q8. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize the selector coil and negative going input signals to de-energize the coil.

(e) Resistors R4, R16, and potentiometers R3 and R15 serve to bias Q1 and Q5 and set the center of the switching interval. Emitter resistors R7 and R18 assist in gain stabilization. Resistors R6, R8 and R19, and R20 form voltage dividers to bias CR2, CR3, CR4 and CR10, CR11, CR12. These diodes exhibit temperature characteristics such that together with R7 and R18, effective temperature compensation is obtained to stabilize the switching level of the SMD. Diode CR5 establishes a voltage reference for the first stages to insure switching level stability.

(f) When low resistance transmitters (about 100 ohms) are used to key the driver, R1 and R13 have no significant effect on the operation of the circuit. However, when the line resistance is high (open line), R1 and R13 apply sufficient bias to driver Q1 and Q5 into conduction. This operation will maintain the terminal equipment in the idle state when input lines are open, or allow single line operation by simulating a marking signal on the other input.

(g) In the power regulator, CR8 and the base-emitter junction of Q4 establish a voltage reference for R11 which determines the current drain of the unit. Diodes CR6, CR7 and the base-emitter junction of Q3 serve to clamp the Q4 collector at a low voltage so as to minimize power dissipation in Q4. As the power requirement of the circuitry following the regulator decreases, the ouput voltage of the regulator will begin to rise. This rise corresponds to a decrease in Q4 collector-base voltage. The effect is to increase the forward bias on the base-emitter junction of Q3 and cause increased collector conduction. This collector current increases the conduction of Q2 whereby Q2 and R10 absorb the excess power. Q2 functions as a variable resistance so as to maintain a constant resistance across the output of the regulator regardless of the state of the driver circuitry. As a consequence of this, the power supply sees a constant load, regardless of driver state.

(h) Capacitors C4 and C5 provide negative feedback to reduce transient generation in the driver. Capacitors C3, C7 and C8 are radio frequency bypass capacitors to eliminate any parasitic oscillations that may occur as a result of switching.

c. Low-Level Keyer. The following paragraphs provide technical description, technical data, and principles of operation for the low level keyer (LLK) circuit card used in CPP KSR ESAs.

(1) Technical Description. Refer to figure 5-25 in Chapter 5 for a schematic diagram of the TP323130 LLK.

(a) The TP323030 LLK is a circuit card assembly approximately 2-1/4 by 4-1/2 inches. It is designed to plug into a 15-pin connector that is wired into the ESA where it becomes an integral component for the suppression of radio frequency interference (rfi).

(b) The TP323130 LLK is for use in photoelectric systems (such as Model 28/32 keyboard) requiring a low-level interface and extreme rfi suppression. It is used in conjunction with a TP333069 CMD.

(c) Each keyer is designed to operate into a high resistance load such as the TP323810 SMD.

(d) An external power source, mounted in the associated ESA, is required to operate the keyers.

(2) Technical Data. The following technical data is applicable to the LLK circuit card. All low-level keyer features for the TP323130 circuit card given in the following paragraphs assume the use of the TP321268 filter card assembly.

(a) Maximum unloaded power consumption of each keyer is less than 50 milliwatts.

(b) The output of the TP323130 keyer is +6.0 volts ±1.0 Volt corresponding to the marking state and -6.0 volts ±1.0 volt corresponding to the spacing state.

(c) The marking and spacing output voltages should be balanced to within 10 percent of each other.

(d) The outputs from two TP321268 filter card assemblies may be paralleled for parallel operation of either of two transmitters.

(e) The nominal output impedance is 100 ohms.

(f) The keyers operate at bit rates up to 75 baud.

(g) Maximum short circuit output current is 60 milliamperes.

(h) The TP323130 keyer operates into a load resistance of 500 ohms minimum.

(i) The keyer and TP321268 filter card assembly operate in a maximum free-air ambient temperature of 70°C (158°F). Storage temperature should not exceed 85°C (185°F).

(j) The TP323130 keyer operates from a power source delivering ±7.2 VDC ±0.6 volt. Maximum unloaded power consumption is less than 50 milliwatts.

(k) The mark and space symmetry at zero volt (output waveform) may be adjusted within 10 percent of each other by the 5 megohm potentiometer on the keyer card for the TP323130 keyer.

(l) The keyer is intended for use on signal lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.

(3) Principles of Operation. All references in the following paragraphs are made with respect to the LLK schematic diagram, figure 5-25 of Chapter 5.

(a) The TP323130 keyer takes a 250 uA (min) photocell signal from the distributor and by means of passive and active filtering, shapes the output.

(b) In the marking state (photocell illuminated), Q5 is turned off causing the bases of Q1 and Q2 to go positive through the passive shaping network made up of R2, C1 and R4. With the bases of Q1 and Q2 positive, Q1 will turn on turning Q4 off and Q2 will turn off turning Q3 on. Capacitor C2, resistors R6, R9, and capacitor C3 further shape the wave by providing feedback and phase shift thereby controlling the rate at which the active filter Q1, Q2, Q3, and Q4 will switch.

(c) In the spacing state (photocell dark), Q5 is turned on providing a negative signal to the bases of Q1 and Q2. The switching occurs as in figure 5-25 except, transistors that are off turn on and those that are on turn off.

(d) During the transition from on to off and off to on, one of the output transistors of the active filter is always conducting. This will provide a smooth transition from plus volts through zero volt to minus volts and back again. The rate of switching being controlled by the feedback and phase shift of C2, R6, R9 and C3.

(e) Diode CR1 compensates for the nonsymmetry of the first stage. Resistors R10 and R5 and capacitors C6 and C7 provide for the proper output impedance and some additional shaping.

d. Clutch Magnet Driver (CMD). The following paragraphs describe the TP333069 CMD circuit card and outline the electrical theory that applies when the card is installed (plugged) into a shielded ESA containing the proper power supply and filter assemblies.

(1) Technical Description. Refer to figures 5-21 and 5-22, respectively, in Chapter 5 for the assembly drawing and the schematic diagram of the CMD circuit card.

(a) The CMD is a solid state, direct coupled amplifier built as a plug-in circuit card assembly approximately 2-1/2 by 4-1/4 inches. It requires an external power source. All connections are made through a 15-pin circuit card connector.

(b) The CMD output drives a Model 28 type transmitting clutch upon receipt of a low-level input pulse. It is to be used with the proper associated equipment and is not for general use.

(c) CMDs are adaptable to various Model 28 type equipment sets through the use of associated modification kits. Each CMD (one or more) is part of, or associated with some electrical service assembly (ESA). The number of CMDs used depends on the number of clutch magnets used in the set.

(2) Technical Data. The following technical data is applicable to the TP333069 CMD.

(a) The CMD receives low-level signals (+6 volts clutch coil energized, -6 volt coil de-energized, nominal) and operates a Model 28 type clutch.

(b) The TP333069 must be used with 278 magnet coils. The output current during the energized state for the CMD is 35 to 56 ma (single 278M coil for photoelectric distributor clutch).

(c) Operation is considered satisfactory when the incoming synchronous pluse complies with the following requirements:

1. Minimum sync pulse duration = 20 ms.

2. Maximum sync pulse duration = 40 ms or 2 bit lengths, whichever is longer.

3. Minimum sync pulse period = 110 percent of transmitted character length.

NOTE

When operating a keyboard the maximum pulsing rate (minimum period), the machine may not respond to each synchronous pulse when in repeat mode.

4. Under condition (c)3, start pulse delay should be between 15 and 35 mS. (Delay is measured from zero volt of the positive going input synchronous pulse signal to the beginning of the start pulse at the signal generator contacts.)

(d) The TP333069 CMD assumes the energized state with positive input voltages not greater than +0.5 volt and the de-energized state with negative voltages not greater than -0.5 volt.

(e) The energized and de-energized switching levels as defined in (d) are adjustable to within 10 percent of each other.

(f) The TP333069 CMD should have a minimum input resistance of 50,000 ohms.

(g) The maximum input capacitance is 2500 picofarads.

(h) The CMD provides a spacing (de-energized) output when the input line is open.

(i) The CMD operates in a free air ambient temperature range of 0°C (32°F) to 65°C (150°F).

(j) The TP333069 CMD operates from a power supply delivering +47 to +53 VDC.

(k) Power consumption under any combination of power source, environmental, and component conditions is 13 watts maximum.

(l) The TP333069 CMD is intended for use on clock lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.

(m) The TP333069 CMD, when used with associated power supplies, is intended for use with interfaces conforming to the following requirements:

1. FED STD. 222 Section 3102 b.

2. MIL STD. 188B.

(3) Principles of Operation. All circuit references in the following paragraphs are made with respect to the circuit board assembly drawing, and schematic wiring diagram of the CMD. Refer to figures 5-21 and 5-22 in Chapter 5.

(a) The TP333069 CMD is basically a direct coupled amplifier providing a current gain of approximately 60 db. The first two stages (Q1 and Q2) provide the necessary gain to drive a Schmitt trigger (Q3 and Q4). Q5 and CR2 comprise a power regulator stage which provides the power supply with a constant load.

(b) In the marking state, with a positive voltage with respect to common applied to the input side of the Q1 base resistor R5, Q1 conducts, which in turn saturates Q2. In this condition, the sum of the voltage drops around the loop R14, Q2 collector-emitter and Q3 base-emitter is in a condition to reverse bias the base-emitter junction of Q3 and thus cutoff Q3 collector current. The Q4 base current increases the voltage drop across R15 in order to satisfy loop conditions established by the power regulator voltage, R14, CR8, and Q4 base-emitter voltage. The Q4 base current is sufficient to saturate the collector. In this condition, load current is determined primarily by the load resistance, R17, and the power regulator output voltage.

(c) In the spacing state, with a negative input voltage, Q1 is cutoff with reverse base-emitter bias established by the reverse transient protection diode CR3. With Q1 off, Q2 does not conduct. Consequently, to satisfy loop conditions established by R13, Q3 base-emitter, R14, and the regulator voltage, Q3 conducts to raise the voltage across R13. Base current is sufficient to saturate the Q3 collector. The Q3 collector-emitter voltage is less than CR8 voltage, which in turn reverse biases the base-emitter junction of Q4. With the latter junction reverse biased, the Q4 collector is cut-off.

(d) The collector circuit at Q2 has been interrupted and brought out to the connector contacts at the bottom of the card. This circuit must be completed externally or Q3 cannot be turned off and the magnet coils are held de-energized. The circuit thus affords a degree of local magnet control.

(e) Because of the difference in magnitude of Q3 and Q4 load currents, the drop across R14 will be greater in the marking state than in spacing state. This means that input voltage to the third state (Q3 VCE) necessary to change the state of Q3 will be different depending on the previous state. Specifically, a larger Q2 collector-emitter voltage is required to turn on Q3 than to turn off Q3. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize the load coil and negative going input signals to de-energize the load coil.

(f) Resistor R6 and potentiometer R7 serve to bias Q1 and set the center of the switching interval. Emitter resistor R8 assists in gain stabilization. R11 and R9 form a voltage divider to bias CR4, CR5, and CR6. These diodes exhibit temperature characteristics such that together with R8, effective temperature compensation is obtained to stabilize the switching level of the driver. CR7 establishes a voltage reference for the first stage to insure switching level stability.

(g) When a low resistance transmitter (about 100 ohms) is used to key the driver, R4 has little significance on the operation of the circuit. However, when the input resistance is extremely high, R4 applies sufficient bias to Q1 to cutoff. This operation will maintain the terminal equipment in the idle state when the input line is open circuited.

(h) In the power regulator, CR1 and the base-emitter junction of Q5 establish a voltage reference for R1 and R2 which determines the current drain of the unit. As the driver demands less power from the regulator, such as being in the de-energized state, the excess current (excess over energized current) is shunted through Zener diode CR2. This operation maintains a relatively constant load for the external power supply. R2 is adjusted to set minimum CR2 current for voltage regulation.

(i) Coil L1 and capacitor C1 serve to reduce noise generated by Zener diode CR2.

(j) Capacitors C3 and C6 provide negative feedback to reduce transient generation in the driver. C5 and C7 are radio frequency bypass capacitors to eliminate any parasitic oscillations that may occur during high speed switching.

(k) Diode CR9, C4 and R16 form a transient limiting network to protect Q4 from excessive reverse transient present when switching inductive loads.

3-5. TYPING UNIT MECHANICAL MOTION DESCRIPTIONS. The following paragraphs provide a detailed functional description of the mechanical assemblies used to perform the various functions of the typing unit. The typing unit discussions are applicable to both high-level and low-level configurations of KSR and RO CPP teletypewriter sets.

a. <u>Distribution of Motion</u>. Refer to figure 3-15.

NOTE

In the following discussions, unless otherwise stated, references to "left" or

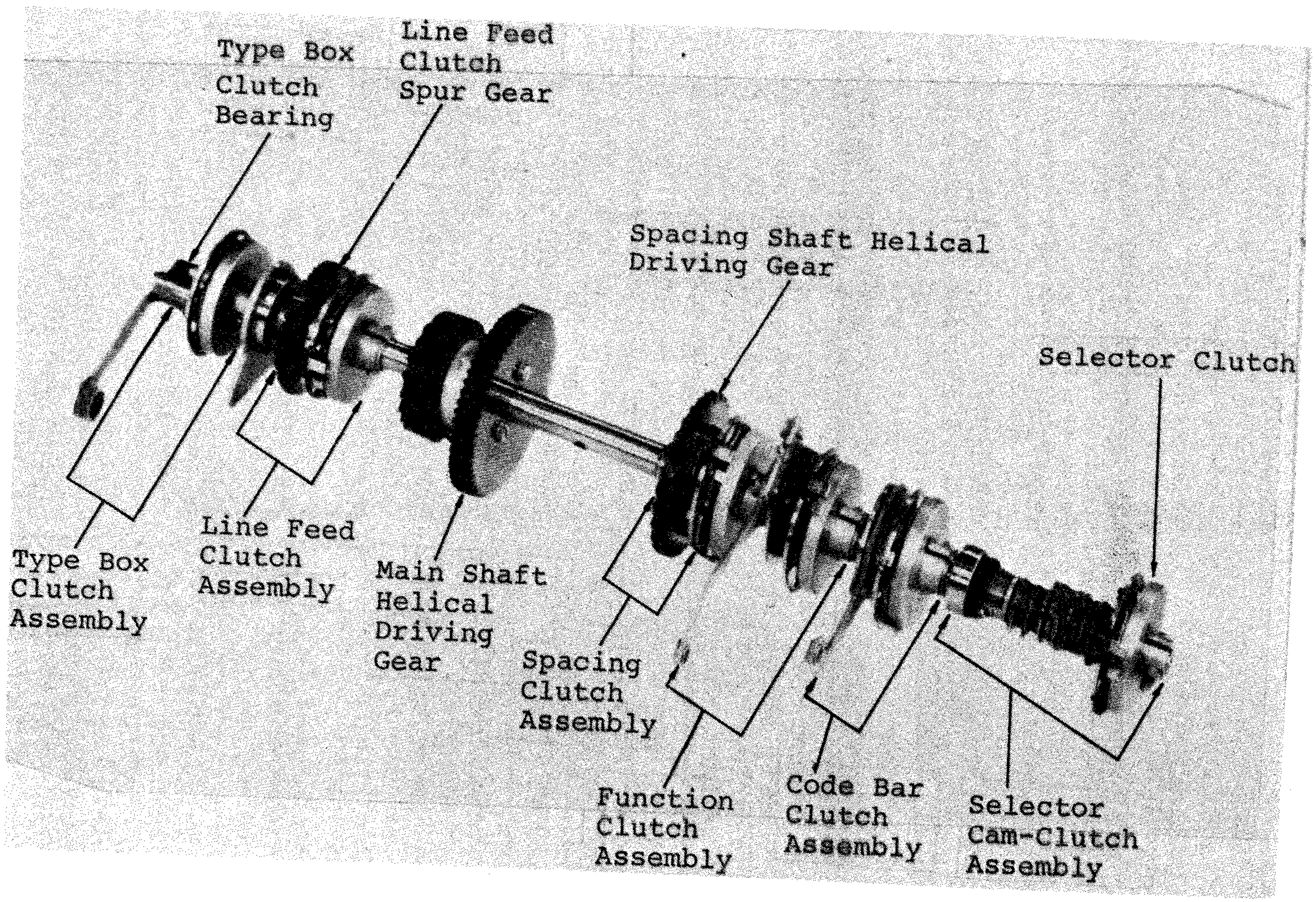

Figure 3-15. Main Shaft (Right Front View)

"right" and "rear" or "forward" assume that the technician is facing the front of unit with selector mechanism at the right and type box at the front.

(1) General. 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. Centrally located on the shaft are two driving gears. The larger gear meshes with the gear mechanism of the gear shift assembly to transmit power from the motor to the typing unit. The smaller gear is not used in CPP applications. 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. The spacing and line feed clutches are three-stop clutches (figure 3-16), each permitting their associated mechanisms to operate through one-third of a revolution of the main shaft. All other clutches are one-stop clutches (figures 3-17 and 3-18), operating through an entire revolution of the main shaft.

(2) One-Stop Clutches. The clutch drums are attached to and rotate with the main shaft (figure 3-15). In the disengaged position, as shown in figure 3-17, 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 (figure 3-18) toward the rear of the typing unit, away from the clutch, thus releasing stop lug A and the lower end of shoe lever B. (figure 3-18). The upper end of lever B pivots around 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. 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 (figure 3-17), 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

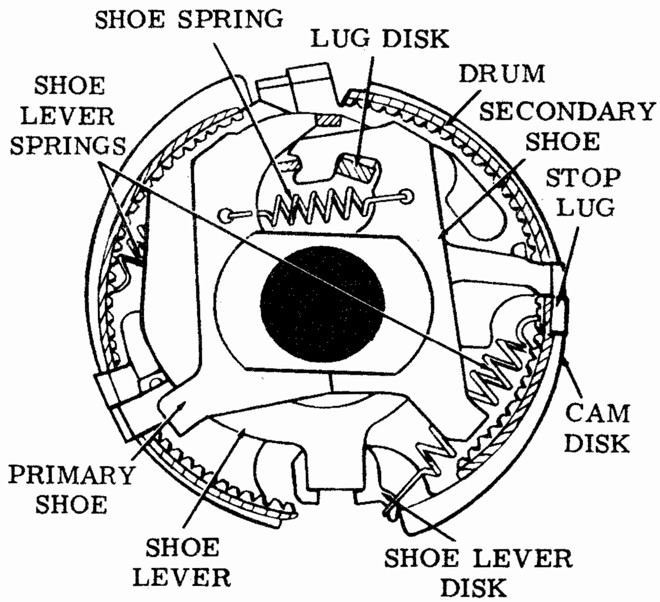

Figure 3-16. Three-Stop Clutch

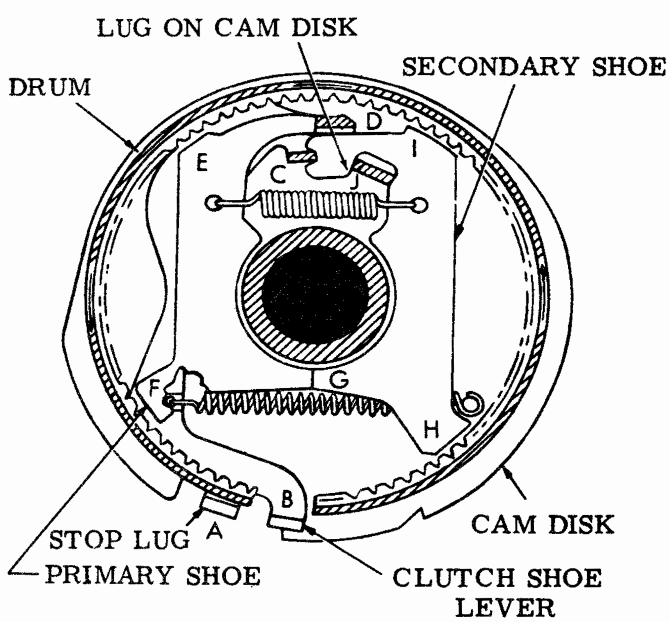

Figure 3-17. One-Stop Clutch (Disengaged)

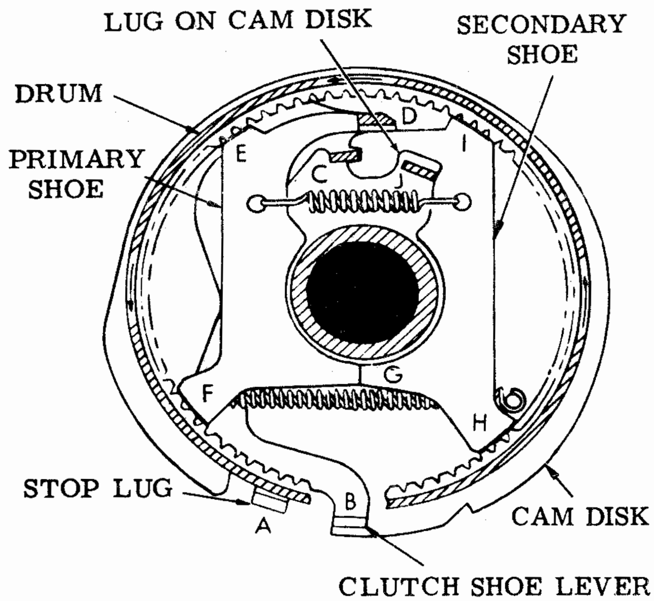

Figure 3-18. One-Stop Clutch (Engaged)

its stop position until the clutch is again engaged.

(3) Three-Stop Clutches. Two of the clutches, spacing and line feed (figure 3-16), have three sets of lugs equally spaced about their periphery. The action is as described in paragraph (2) above, but the clutch is permitted to rotate through only one-third revolution before the stop lever and latch lever halt its motion.

b. Selection. The selection function of the typing unit is discussed in the following paragraphs.

(1) General. 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.

(2) Selector Mechanism. Refer to figures 3-19 and 3-20. The selector cam clutch comprises, from right to left (figure 3-15), the clutch, the stop arm bail cam, the fifth, fourth, and 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. During the time in which a closed line circuit (marking) condition exists, the selector

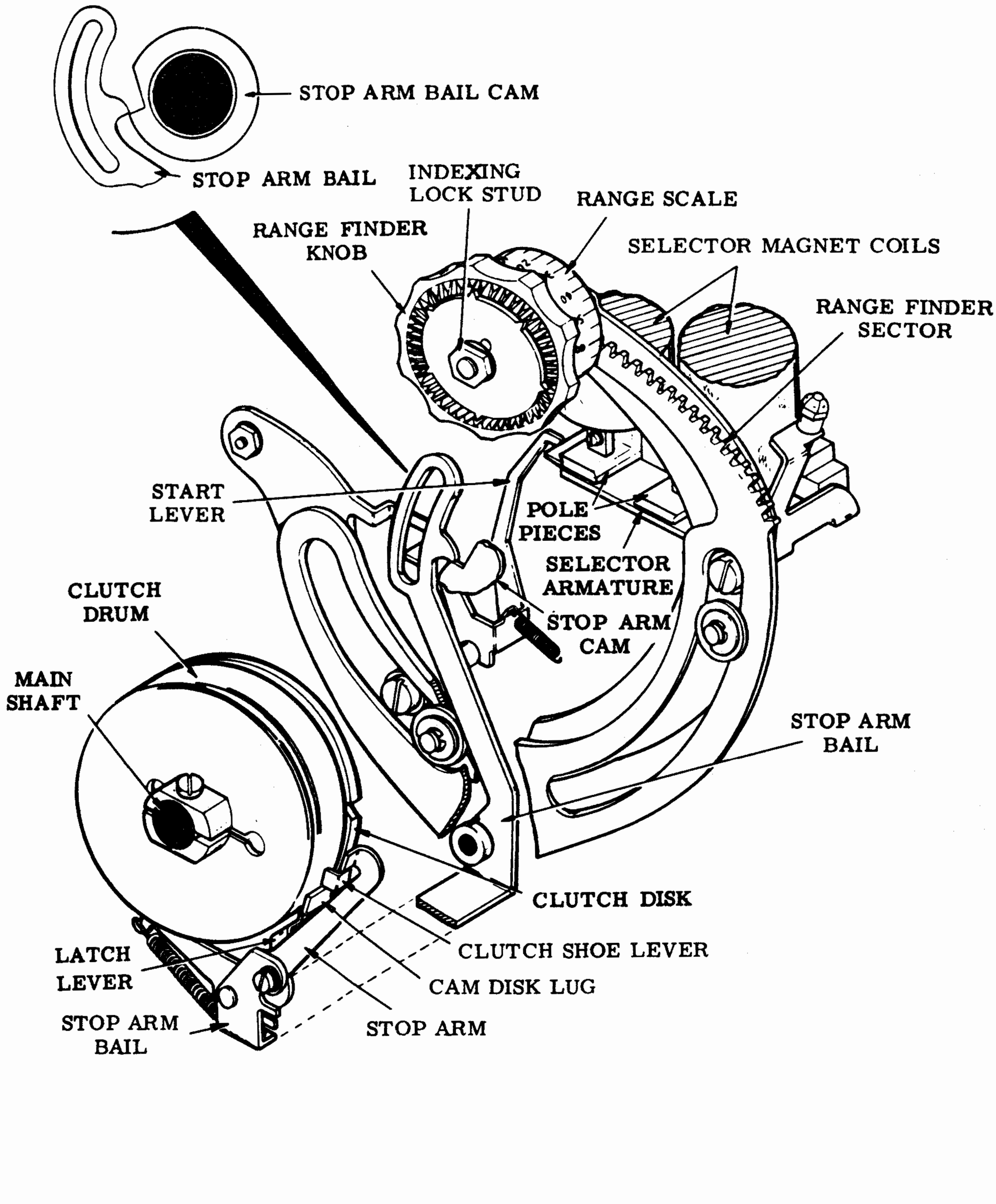

Figure 3-19. Selector Clutch and Range Finder (Right Front View)

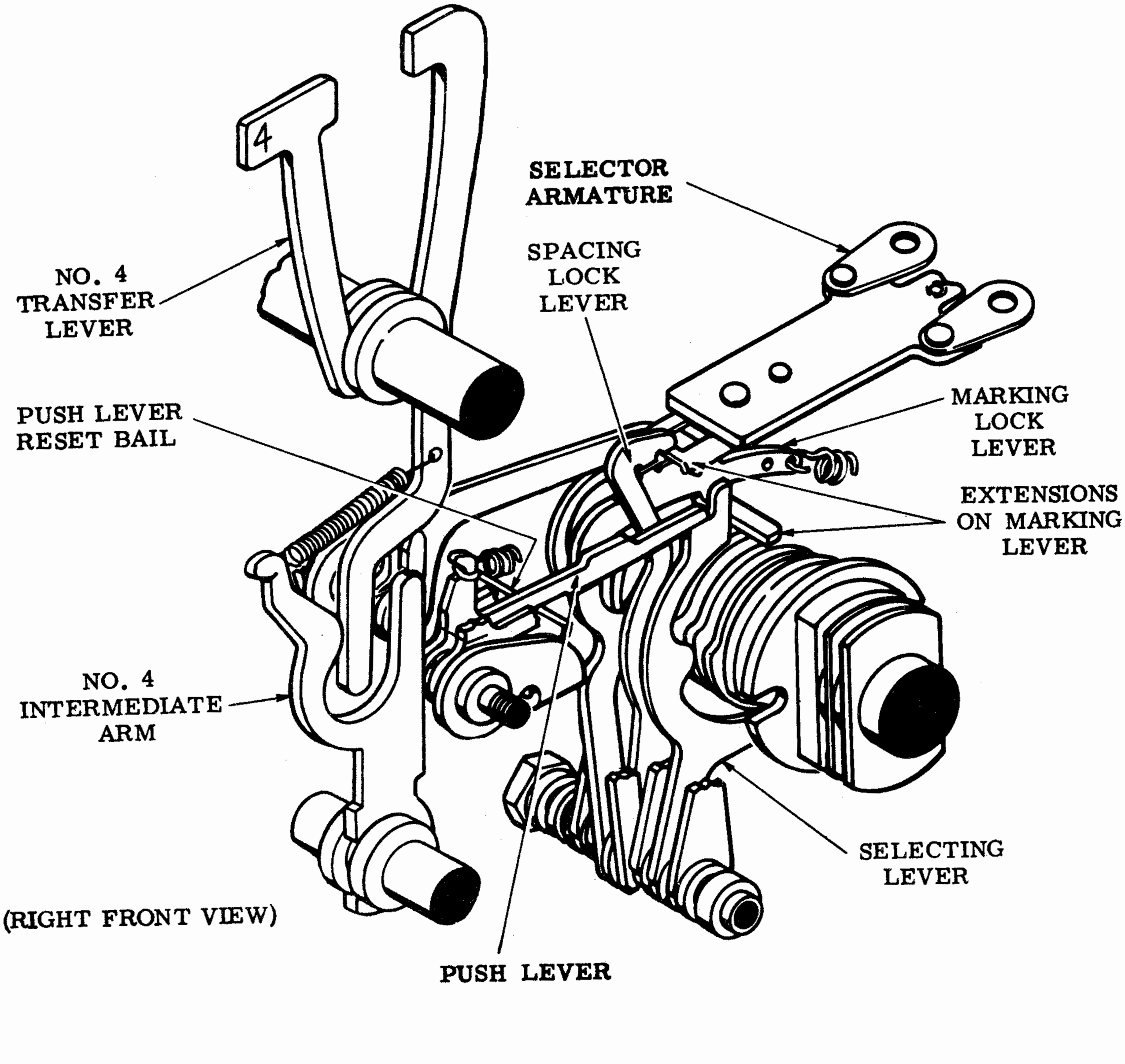

Figure 3-20. Selecting Mechanism and Transfer Mechanism

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 (figure 3-19). 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. 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 (figure 3-20). When a marking pulse is received, the spacing lock lever is blocked by the end of the armature, and the marking lock lever swings 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. 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 levers are also moved forward. Unselected push levers 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. 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.

(3) Orientation. 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. When the range finder knob (figure 3-9) 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.

c. Positioning the Code Bars. The code bars in the typing unit are positioned as described in the following paragraphs.

(1) Code Bar Mechanism. Refer to figure 3-21. 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 selecting mechanism push levers 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 levers through a mechanical linkage, intermediate arms, and transfer levers. Power to position the selected code bar shift bar, 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.

(2) Code Bar Operation. Refer to figures 3-21, 3-22, and 3-23. Each selector push lever has an associated intermediate arm, transfer lever, and code bar shift bar (figure 3-21). 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

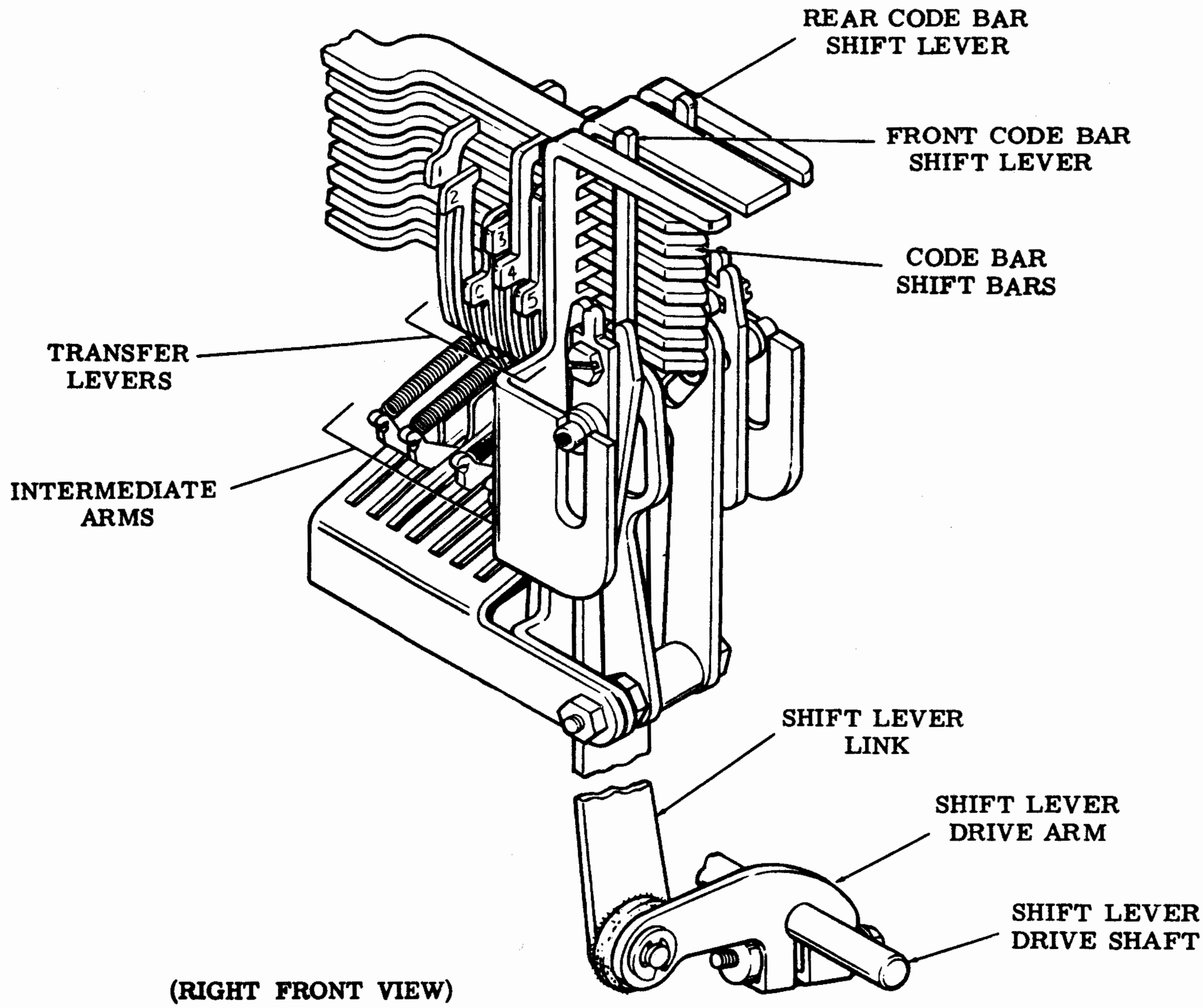

Figure 3-21. Code Bar Mechanism

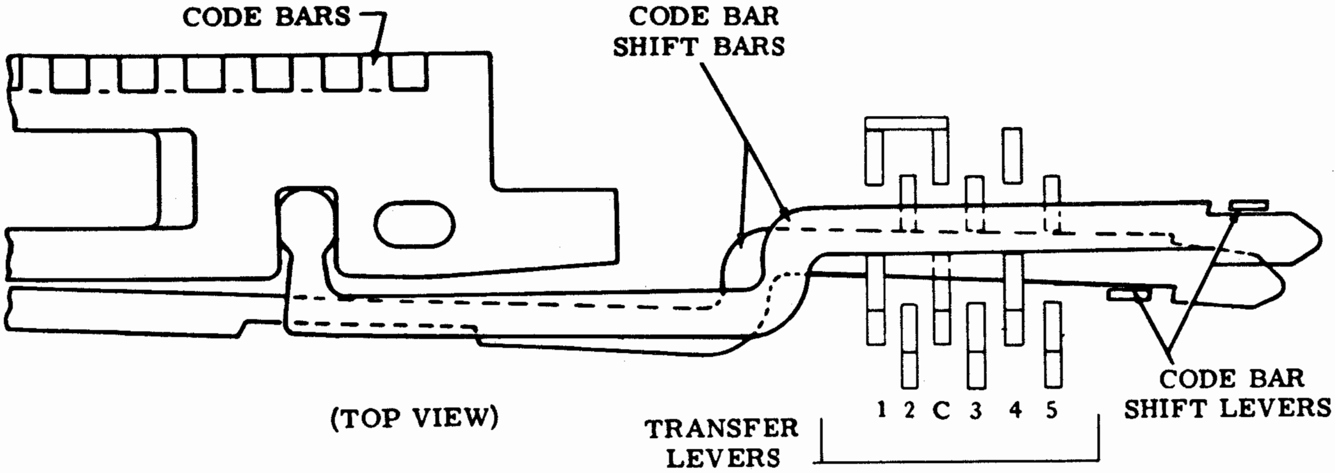

Figure 3-22. Code Bar Shift Bar Positioning

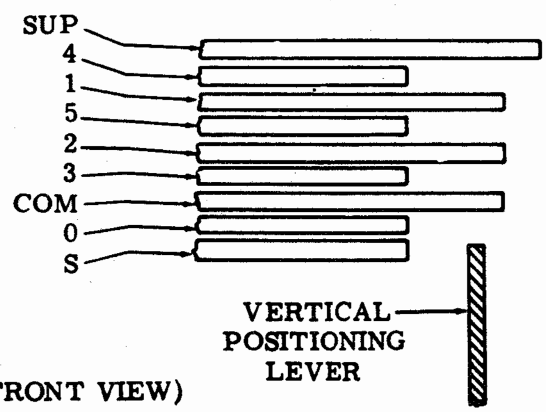

Figure 3-23. Vertical Arrangement of Code Bars

number 1 or number 2 push bar is selected, the associated transfer levers position the common code bar shift bar to the rear (marking). Both ends of these code bars determine vertical positioning of the type box (figure 3-24). As the selector cam clutch completes its revolution, the trip shaft operating lever rides to the peak of the code bar clutch trip cam (figure 3-15). This causes the shaft to 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. Rotation 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 right, the rear lever moving to the left. 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 lever, as it moves to the left (figure 3-22), 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. 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.

(3) Code Bar Arrangement. Refer to figure 3-17. 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).

d. Positioning the Type Box. The type box is positioned as described in the following paragraphs.

(1) General. 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 figure 3-24 for arrangement of graphics which are represented on the type box pallets. See figure 3-7 for input signal code permutations equivalent to each graphic representation. 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

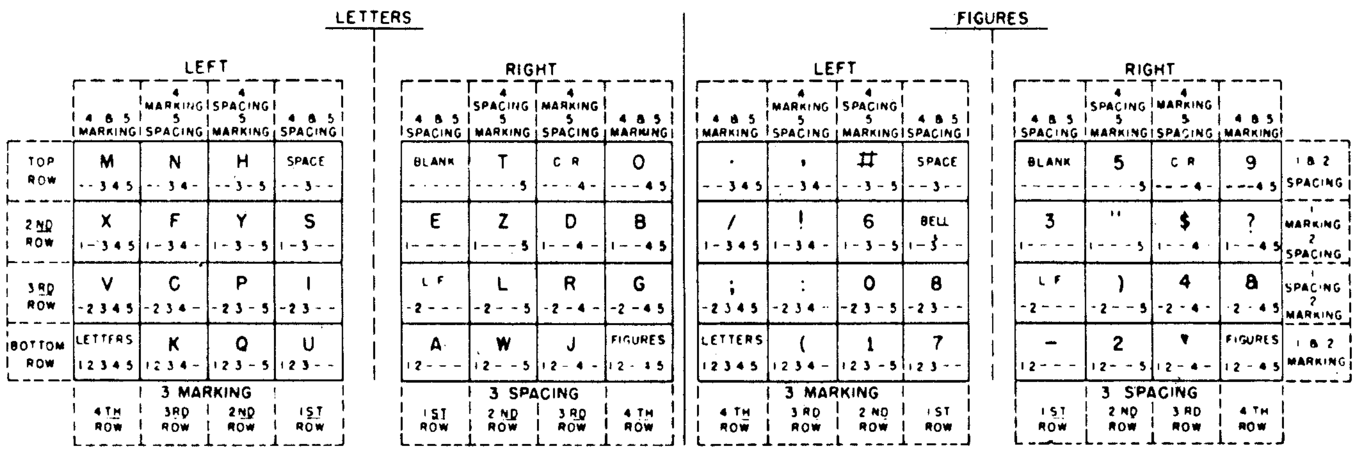

Figure 3-24. Typical Type Box Pallet Arrangement

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. The lower right rear end of the upper draw wire rope is fastened to the spacing drum. From this point, it passes partway around the spacing drum, upward and around the right rail pulley, over to the left rail pulley and downward to the spring drum. After passing partway 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 (figure 3-25). 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. 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 with it 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 of such a length that only one at a time may be fully extended.

(2) Letters-Figures Shift. Refer to figure 3-26. 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 as follows: the lowermost 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 engages 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. Upon receipt of the signal code for the letters shift operation, the

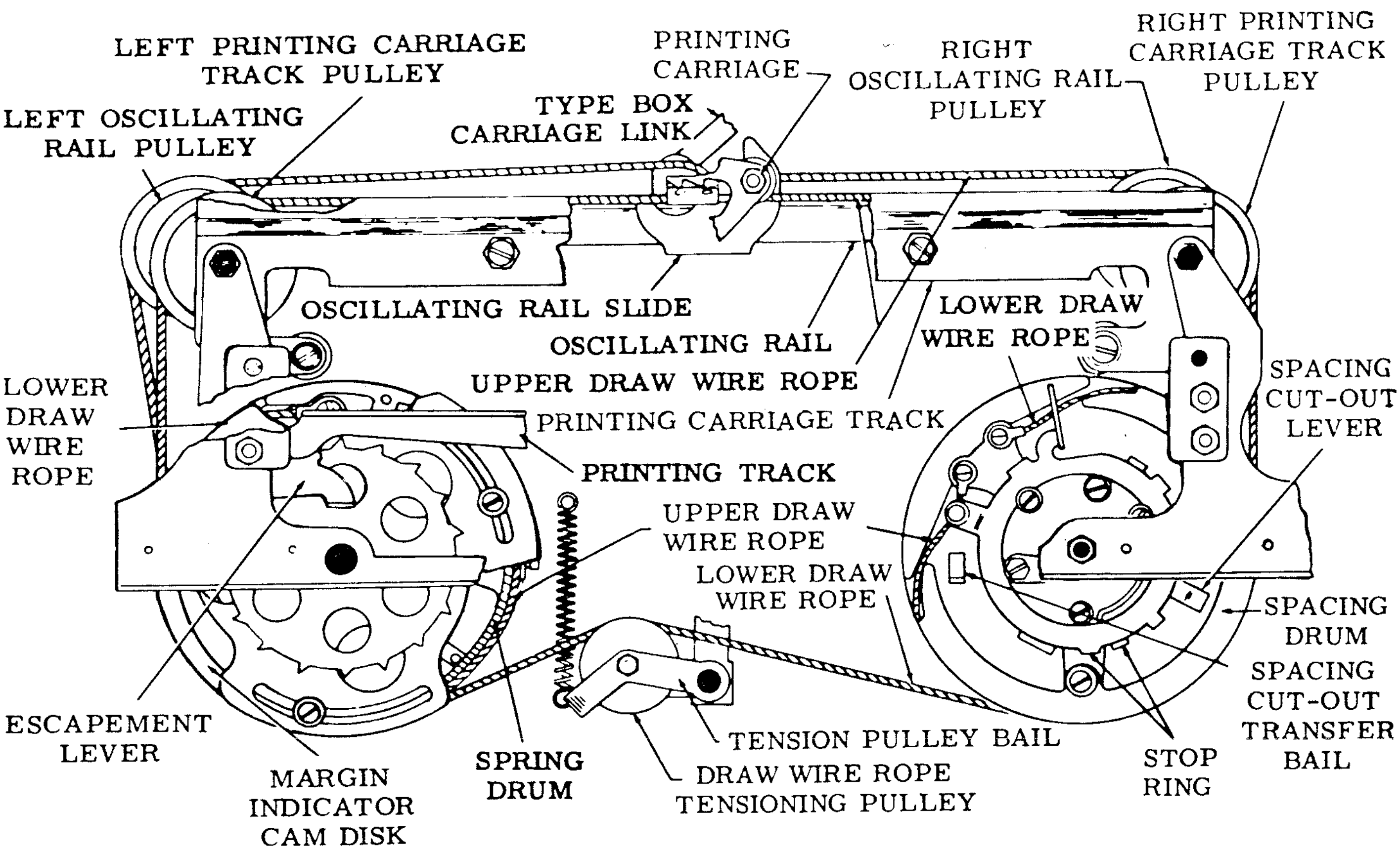

Figure 3-25. Draw-Wire Rope and Drums (Front View)

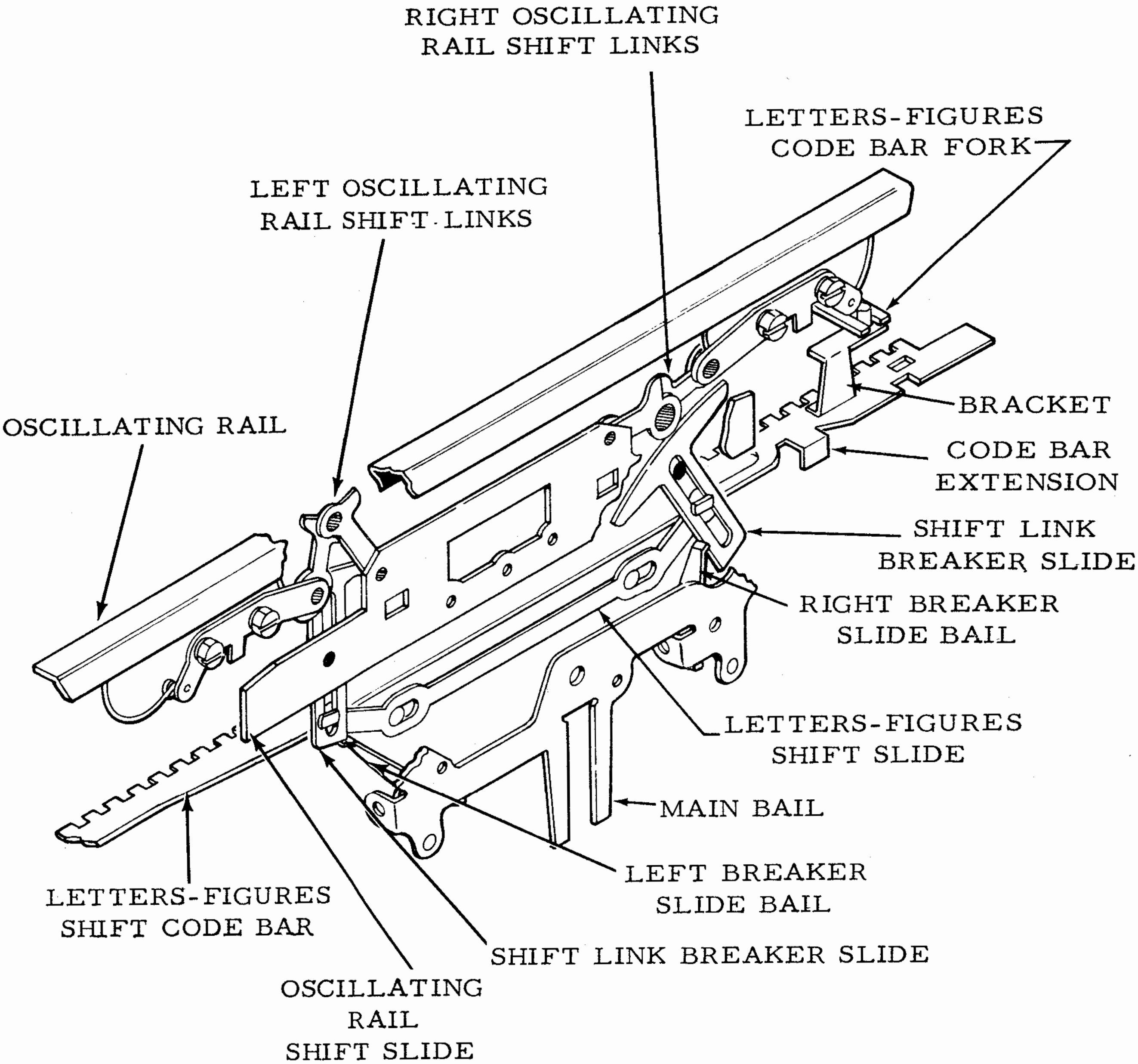

Figure 3-26. Letters-Figures Shift Mechanism
(Left Front View)

shift slide is moved to the right. This positions the left shift link vertically with its lower end over the left breaker slide bail. The right breaker slide is positioned so 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 left, and the figures field of the type box is in line for printing.

(3) Vertical Positioning. Refer to figure 3-27. 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: the number 1 and number 2 code bars determine selection of the horizontal row. The number 3 code bar determines if 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. Four code bars (longer than the others) extend through the right code bar bracket and serve as stops for the right vertical positioning levers. 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, 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, rotate the clutch trip lever shaft. As the shaft turns, it first causes the function clutch lever to release the function clutch (figure 3-28) 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. 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 (figure 3-27). 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. 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

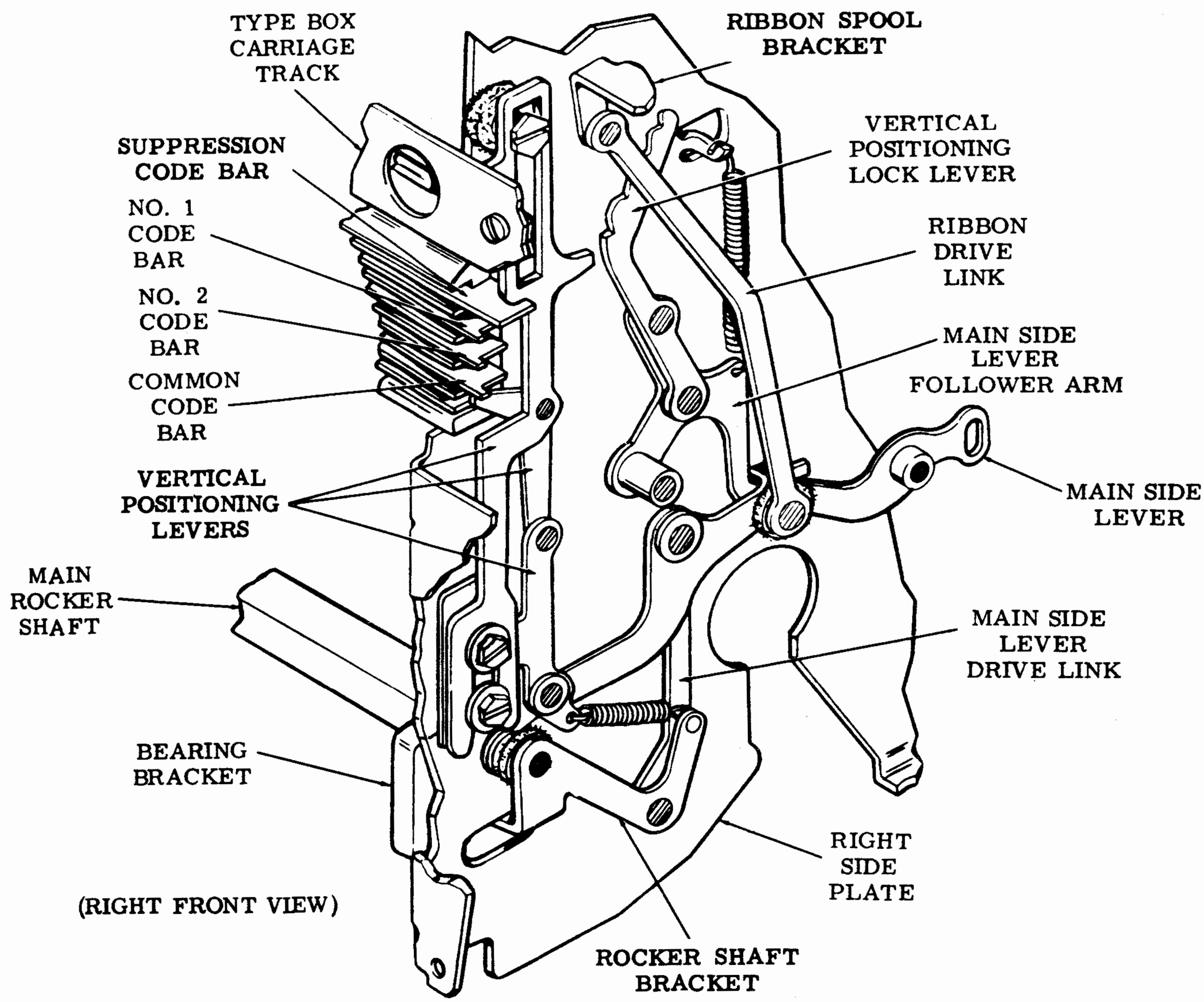

Figure 3-27. Vertical Positioning Mechanism

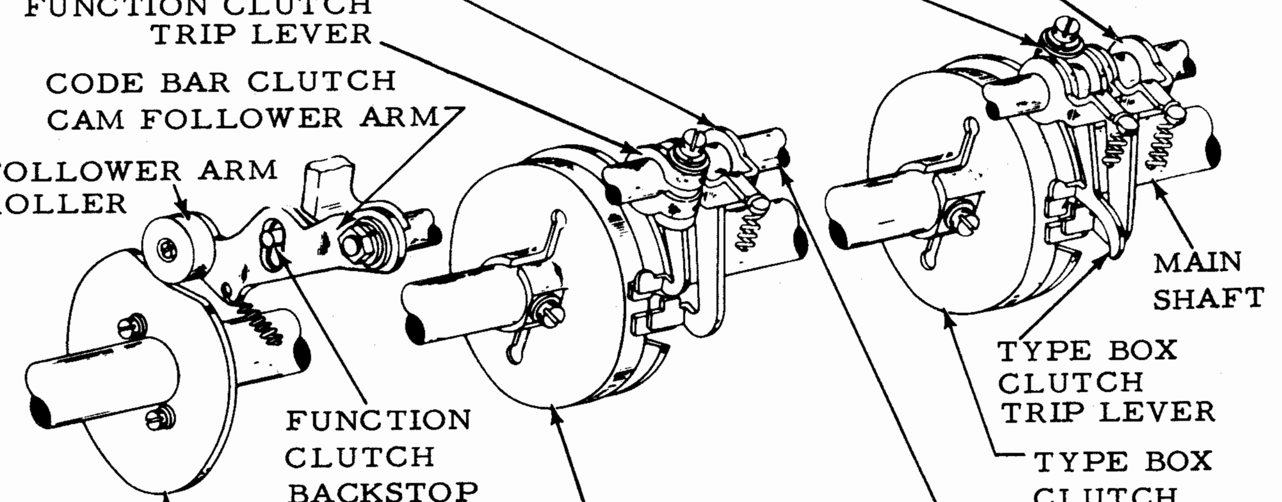

Figure 3-28. Clutch Trip Mechanism (Right Rear View)

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) is 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 is 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.

(4) Horizontal Positioning. Refer to figures 3-29 and 3-30. A bracket attached to the main rocker shaft applies vertical motion to the main bail by means of two main bail links (figure 3-29). Attached to each end of the oscillating rail shift 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 shift slide links to the left. When the

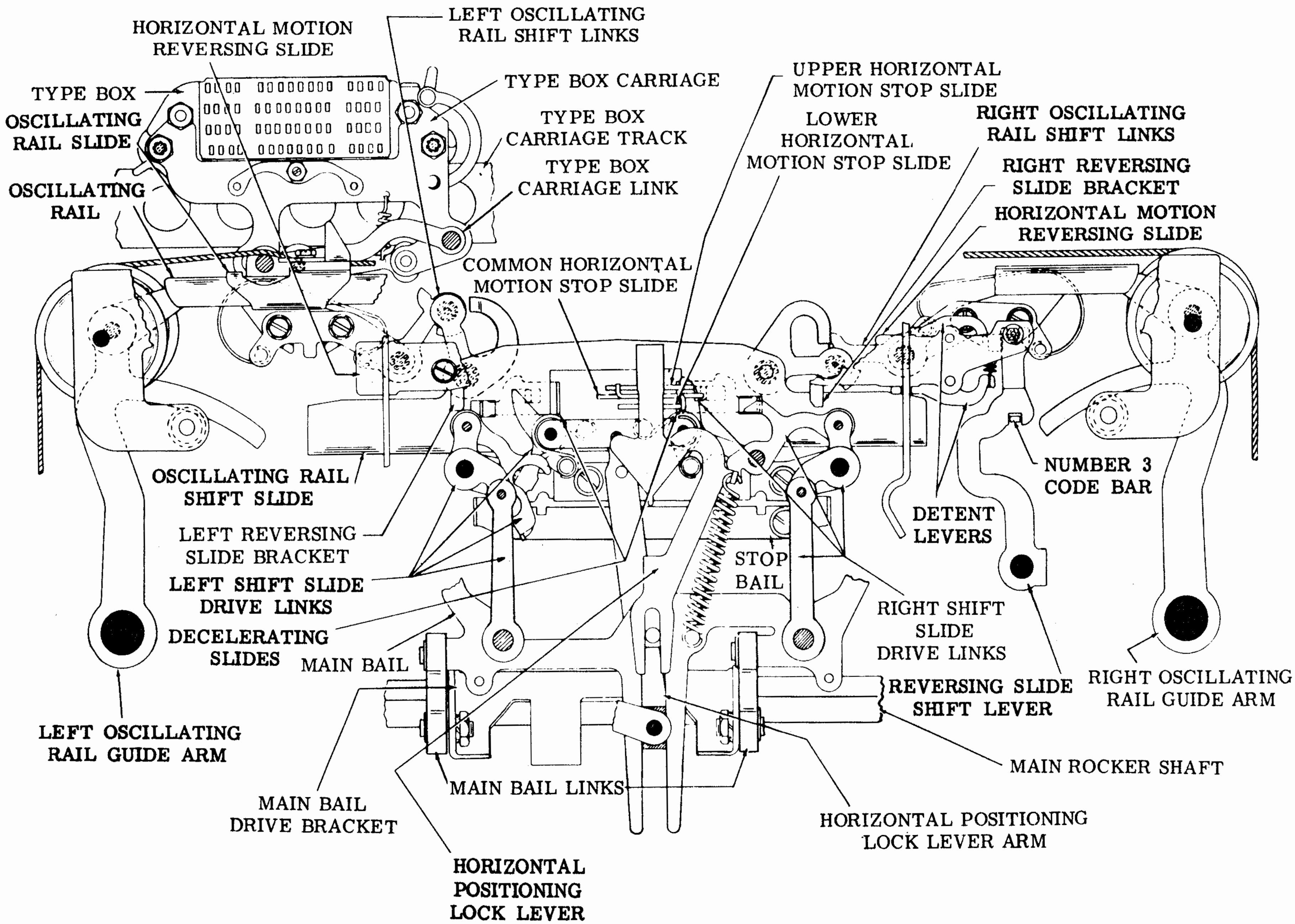

Figure 3-29. Horizontal Positioning Mechanism (Front View)

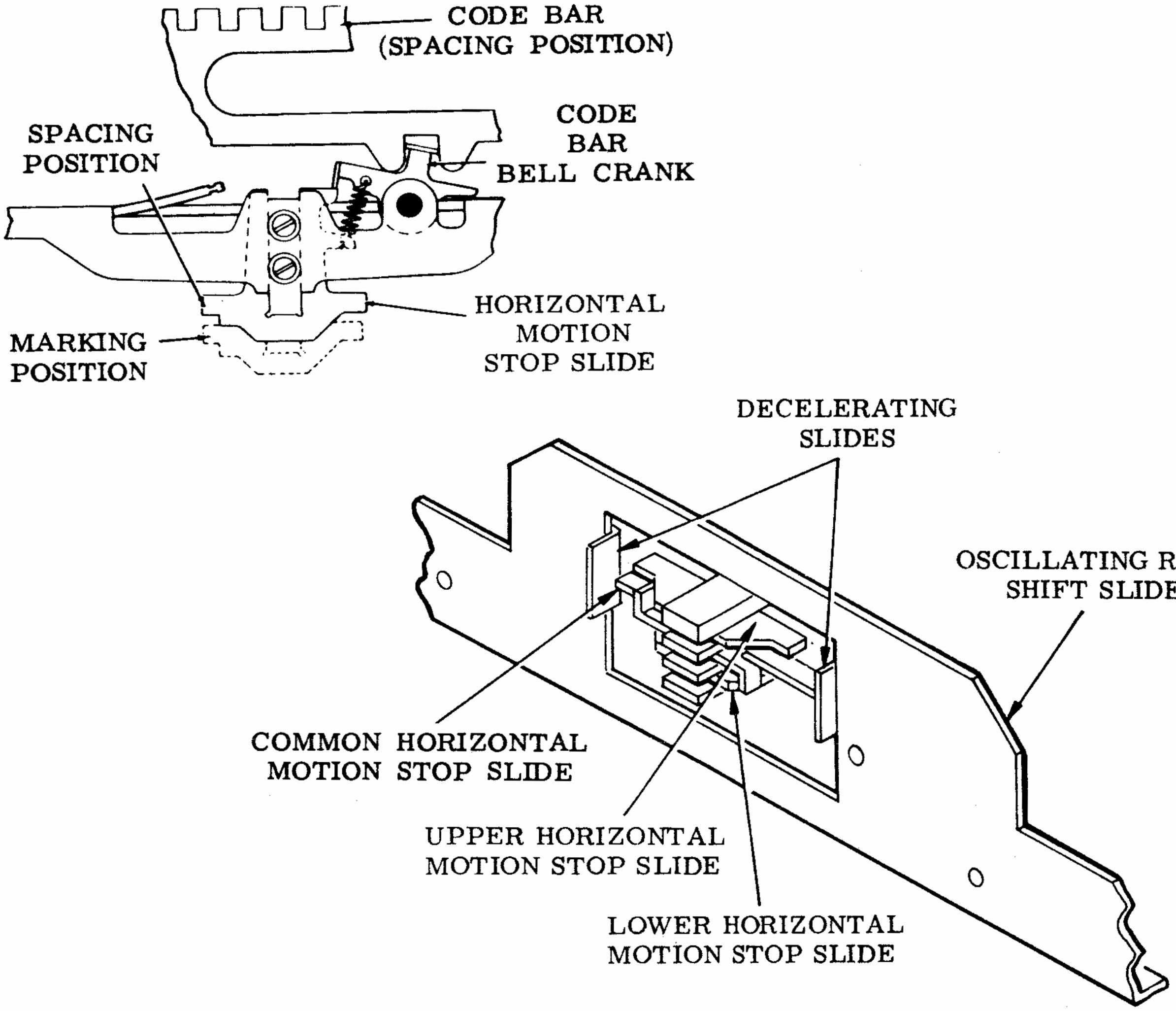

Figure 3-30. Horizontal Motion Stop Slides
(Right Front View)

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. After determination of the field (figures or letters) and the group of vertical rows in which the character to be printed are located, the number 4 and number 5 code bars operate three horizontal motion stop slides to determine the row in that group in which the character is to be found (figure 3-30). 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 bell crank. Each, in turn, moves a horizontal motion stop slide toward the front (marking) or toward the rear (spacing) (figure 3-30). 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 (figure 3-29). 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. 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 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. 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.

e. Printing. 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.

(1) Positioning. Refer to figures 3-29 and 3-31. 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.

(2) Operation. The printing track which is located on the front of the typing unit (figure 3-31) 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

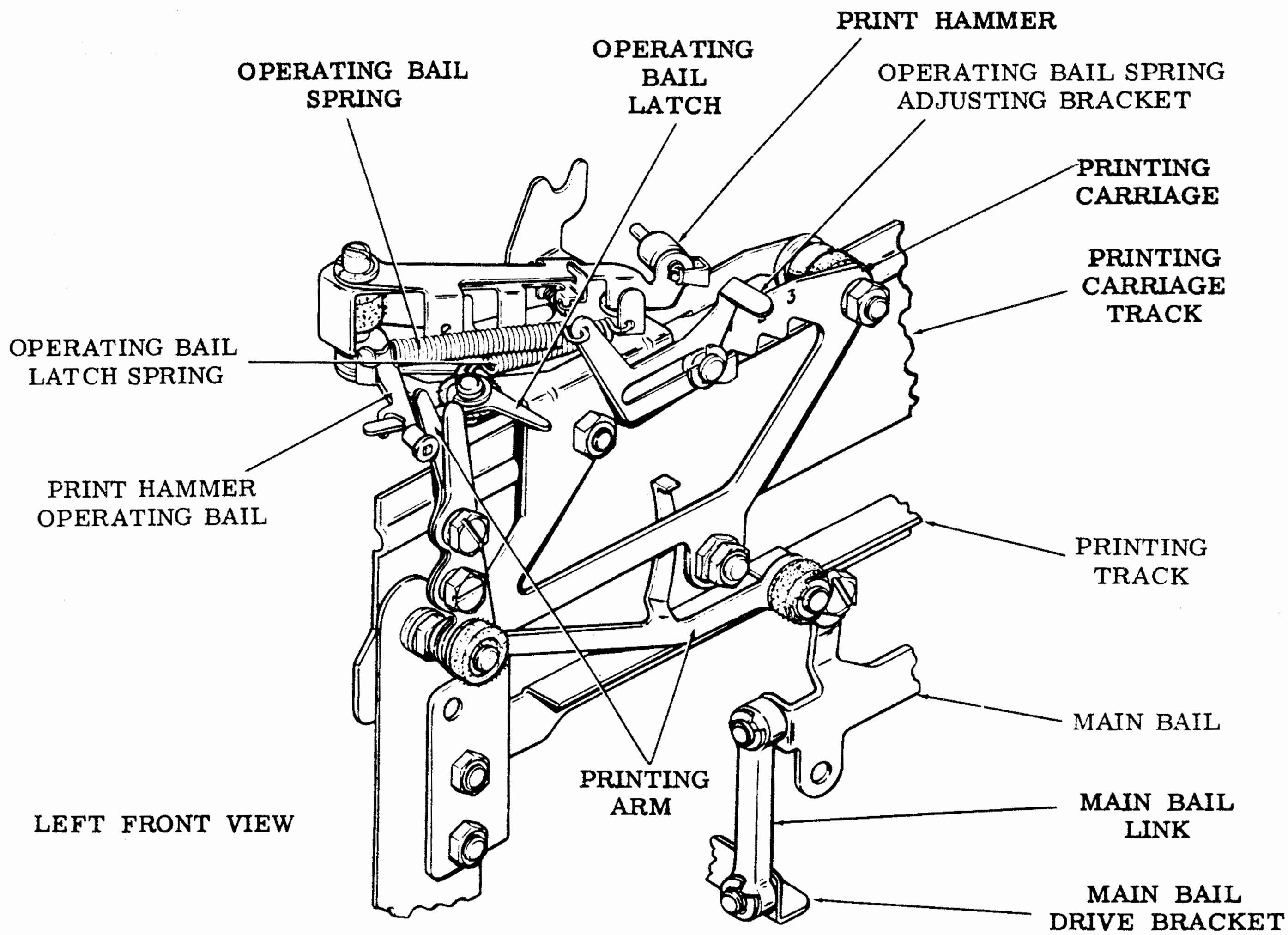

Figure 3-31. Print Hammer and Carriage

clockwise against its spring tension until it becomes latched by the operating bail latch. 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.

f. Spacing. The spacing function is accomplished as described in the following paragraphs.

(1) General. Refer to figures 3-31 and 3-32. To space the printed characters 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 shown in figure 3-25, the carriages are connected to a draw wire rope 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 (figure 3-32). 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 of a revolution each time the spacing clutch is tripped. This allows the feed pawls to advance the spacing drum by one ratchet tooth. The same trip shaft which, through a cam on the code bar clutch 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. A cam plate (figure 3-32) 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. 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

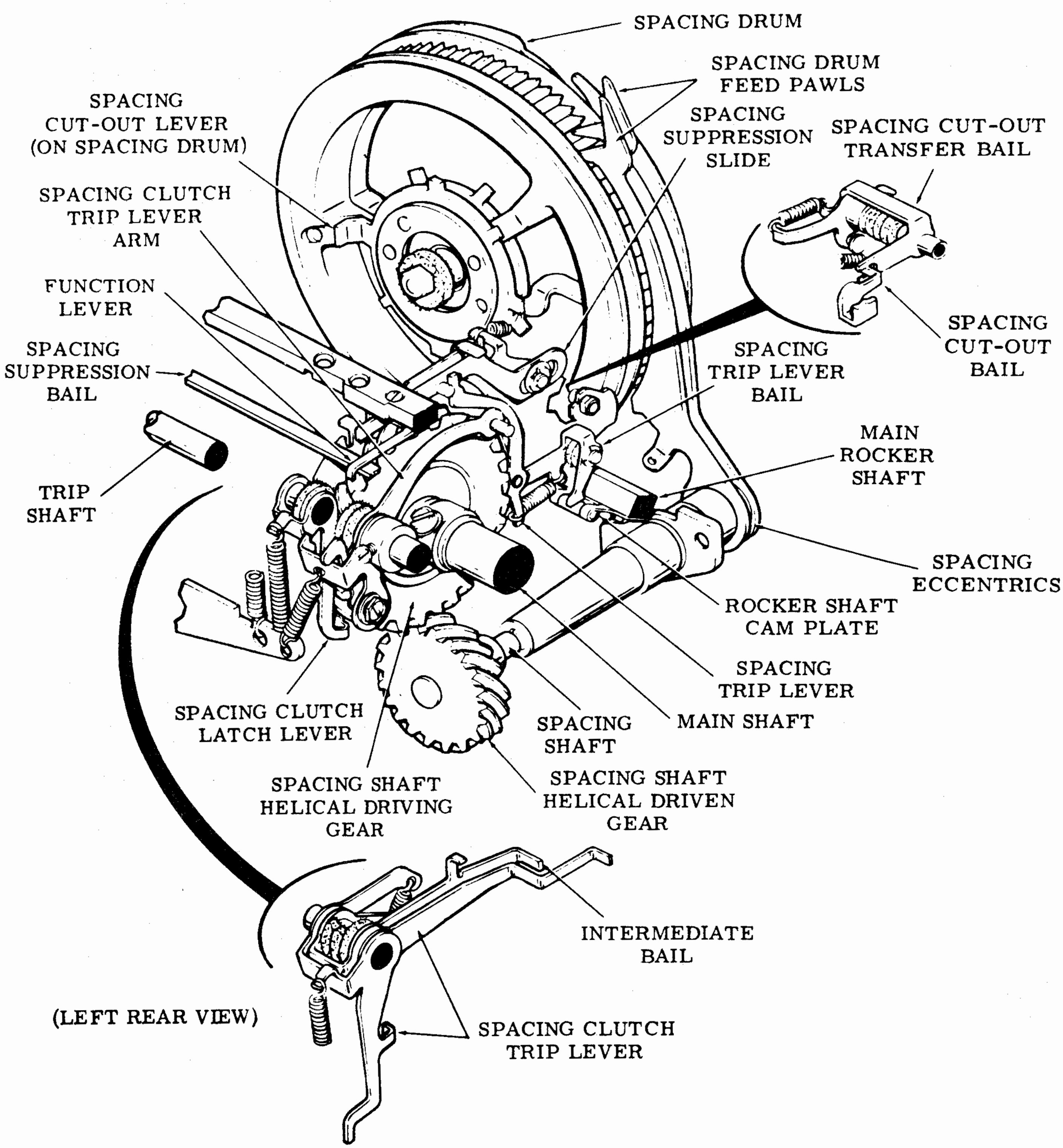

Figure 3-32. Spacing Mechanism

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.

(2) Space Function. 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. 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.

(3) Space Suppression. Refer to figure 3-32. 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. 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. When the carriages are near their extreme right position, a cut-out ring on the spacing drum engages the spacing cut-out transfer bail, which in turn operates the spacing cut-out bail. The ring and the end of the spacing cut-out transfer bail are shown in figure 3-25. 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.

(4) Margin Indicator. Refer to figure 3-25. 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.

g. Ribbon Feeding. The ribbon feeding function of the typing unit is discussed in the following paragraphs.

(1) General. Refer to figure 3-33. 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 (figure 3-27). At their uppermost position, 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. Each of the ribbon mechanisms consists of a bracket which is hinged at its rear end, and upon which is mounted a ribbon spool shaft. 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.

(2) Operation. A ribbon tension plate which is keyed to the hub of the ribbon ratchet wheel has two projecting lugs (A and B, figure 3-33) which 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 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). In order for the ribbon to be pulled from one ribbon spool to the other, only one of the ribbon mechanisms 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.

(3) Ribbon Reversing. When the ribbon has been completely unwound from one spool, it is necessary to reverse 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

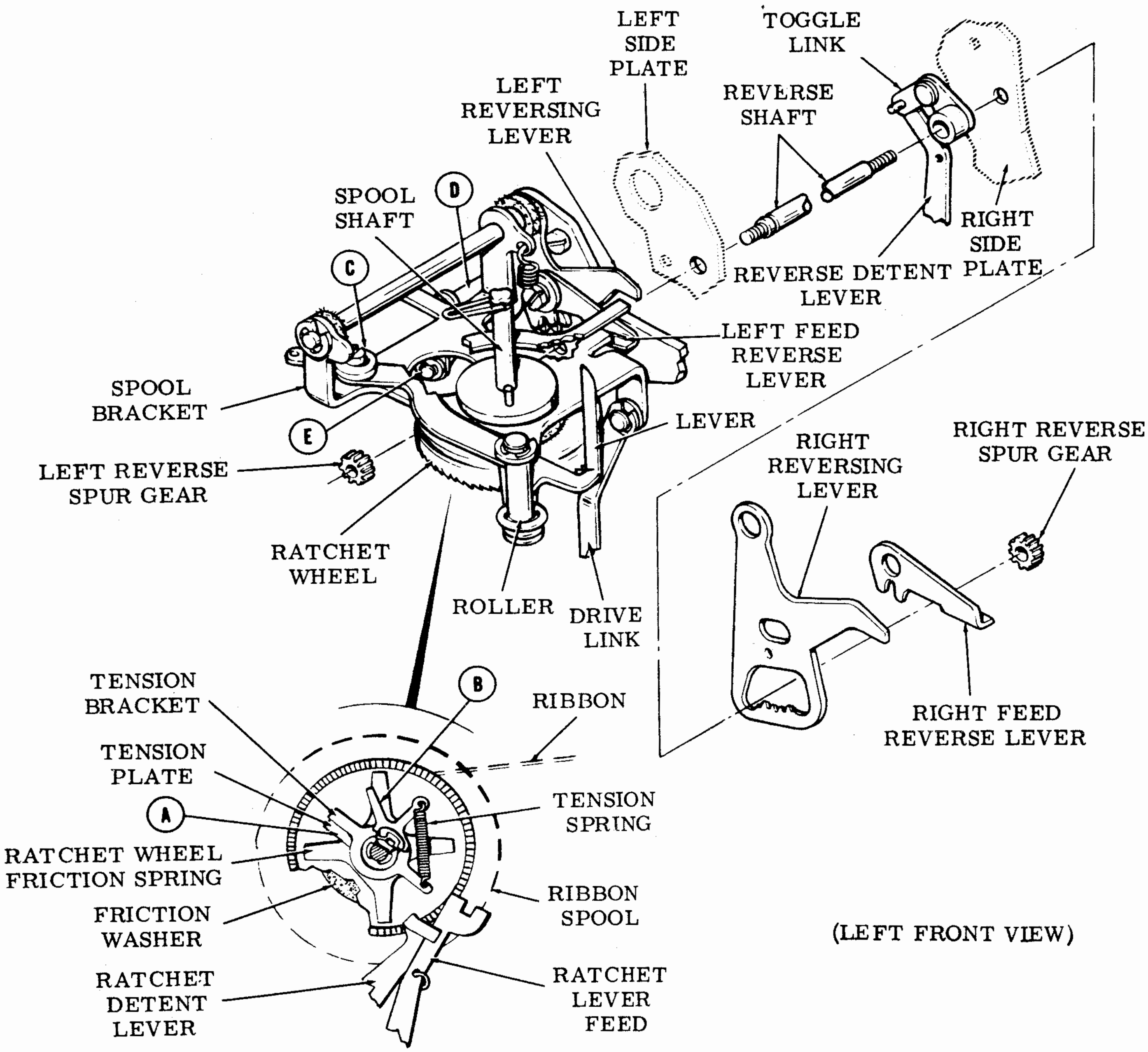

Figure 3-33. Ribbon Feeding Mechanism

other set. While the ribbon is passing 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 (figure 3-33). 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. 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 figure 3-33. 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 held taut by the previously extended ribbon tension spring.

h. <u>Paper Feeding (Friction Feed)</u>. Paper for the page printed message is stored on a roll 8-1/2 inches wide, mounted on a paper spindle suspended between 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 (figure 3-34) and between the platen and the 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 across the front of the platen hold copy paper firmly against the plate, in position for printing.

i. <u>Stunt Box Operation</u>. Operation of the stunt box is described in the following paragraphs.

(1) <u>Functions</u>. Refer to figure 3-35. 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. Spacing may technically be considered a function, but it is

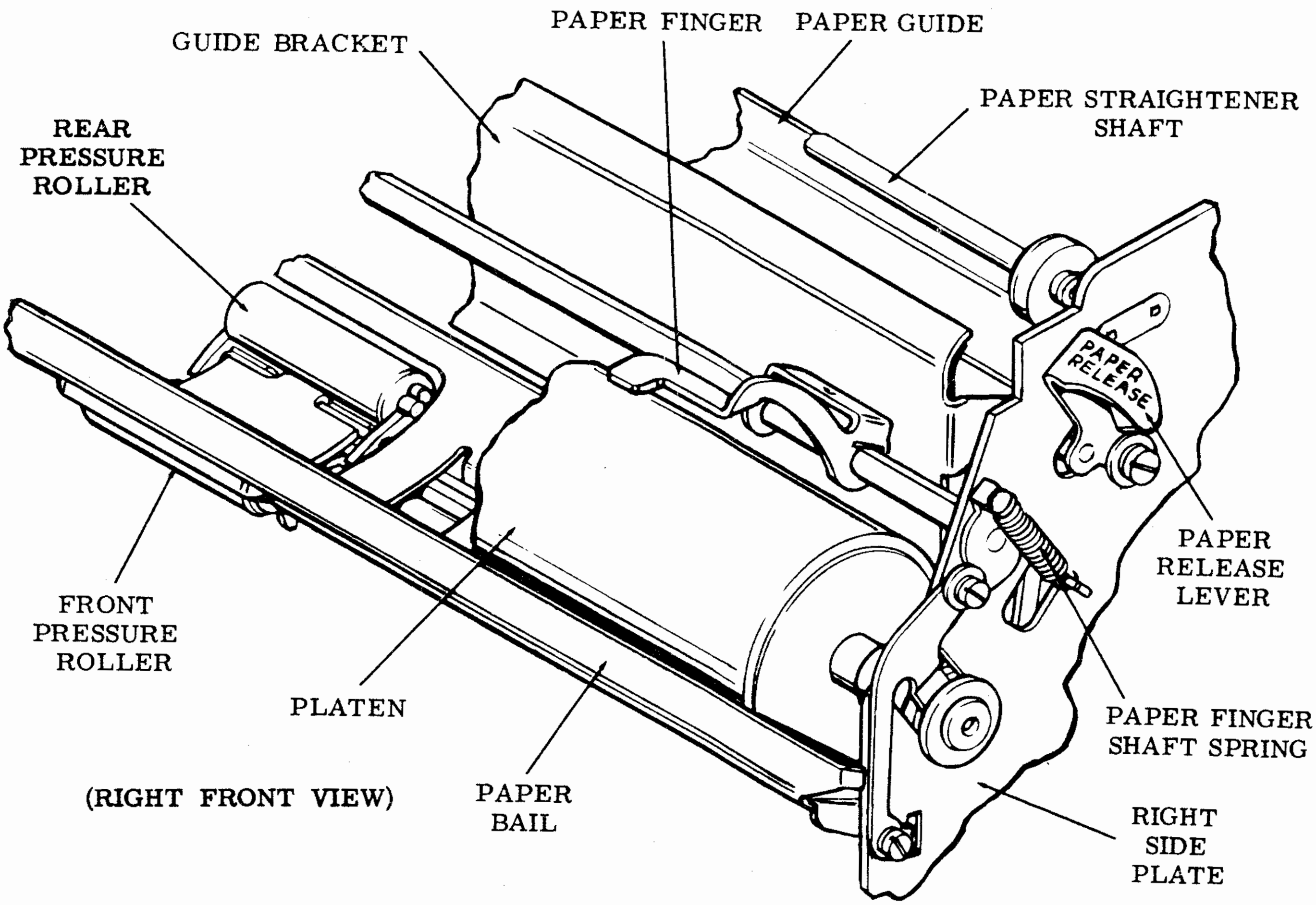

Figure 3-34. Friction Feed Platen Mechanism

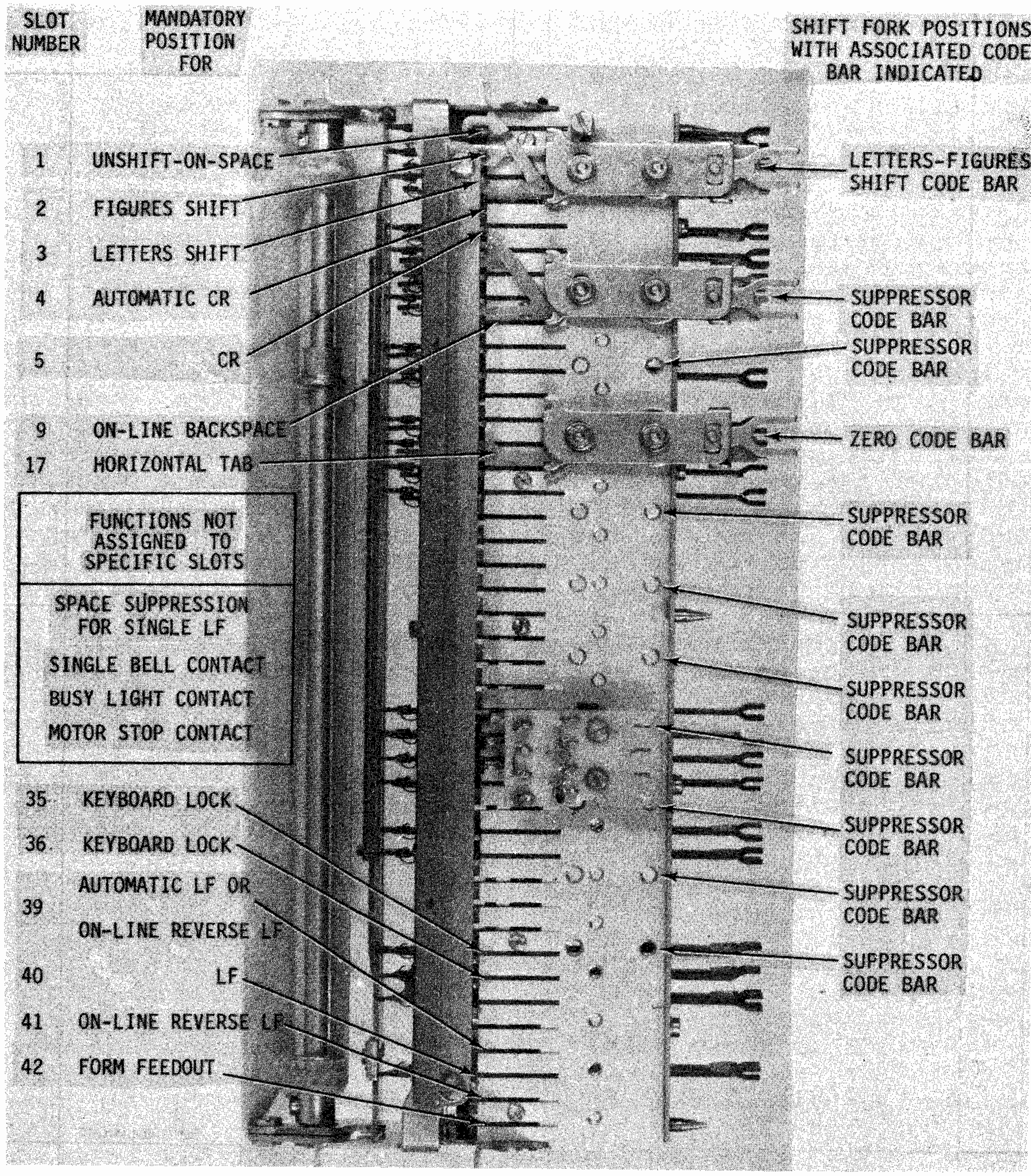

Figure 3-35. Stunt Box (Top View)

mechanically associated with the printing operation, except when suppressed by function mechanisms. As in printing, the reception of function codes results in the positioning of the code bars. The back edges of the code bars are notches (figure 3-36). Positioned directly behind the code bars is a stunt box, which contains the function bars for the various functions (figure 3-35 and 3-36). 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. When the function clutch is engaged (figure 3-28), 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 (figure 3-37). As the spring-tensioned function bars are released, they move forward to bear against the code bars. If 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 (figure 3-38). 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 (figure 3-39). When the function bar reset bail blade releases the function bars, any selected bar will move sufficiently forward (to the left, in figure 3-39) 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, figure 3-40). 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, and the selected levers move the bail forward. Either the upper or the lower end operates the indicated function. Near the end of the function cycle, a stripper blade (figure 3-36) 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.

(2) <u>Carriage Return Function</u>. Refer to figures 3-41 and 3-36. 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 (figure 3-41). 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

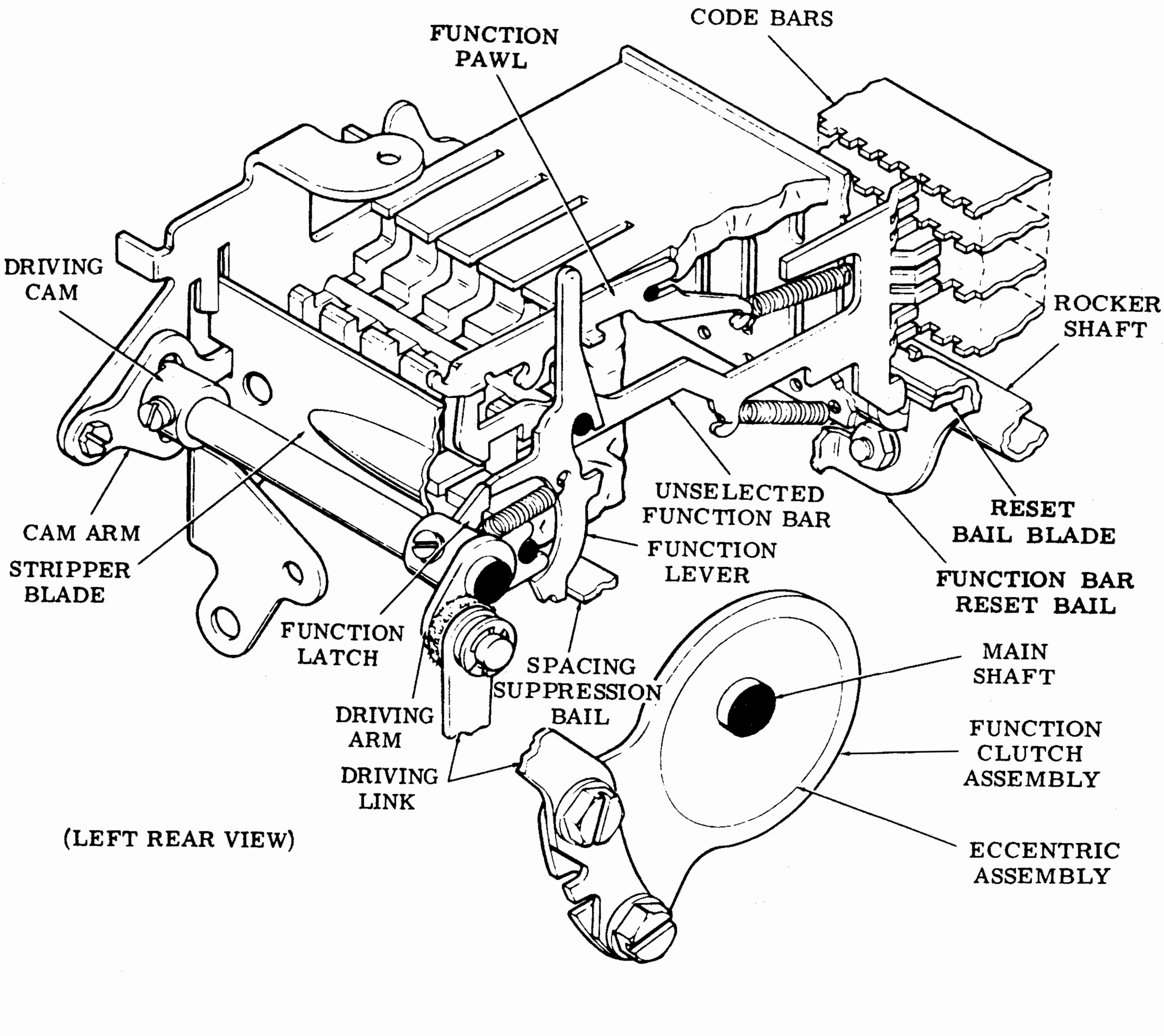

Figure 3-36. Stunt Box (Function Linkage Unselected)

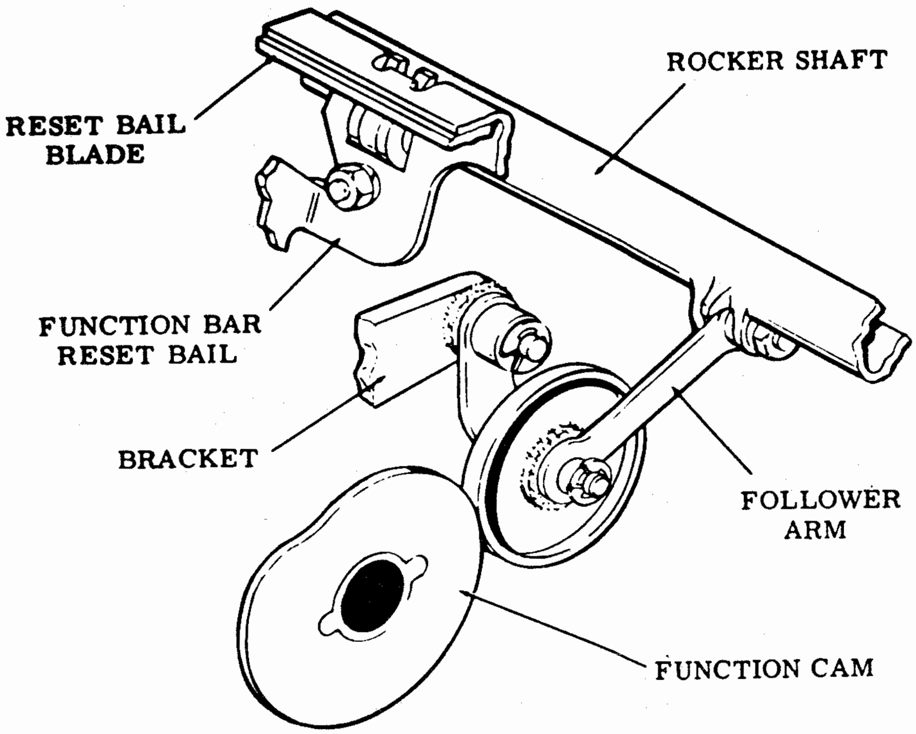

Figure 3-37. Reset Bail Mecahnism

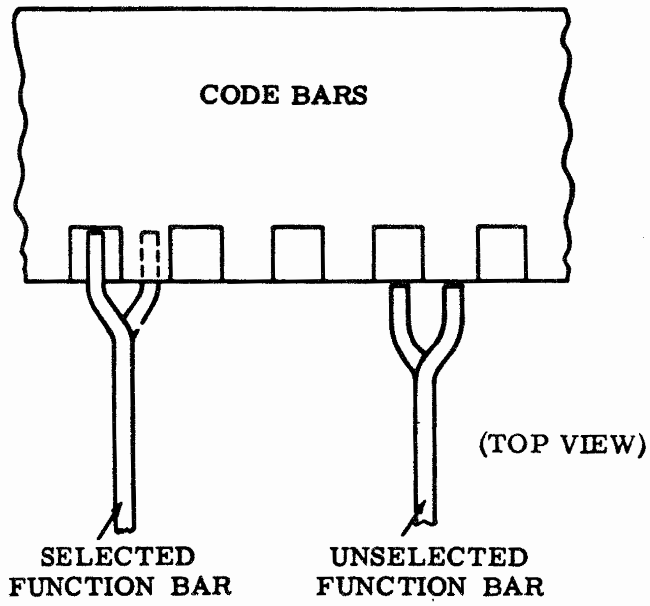

Figure 3-38. Function Bar Selection

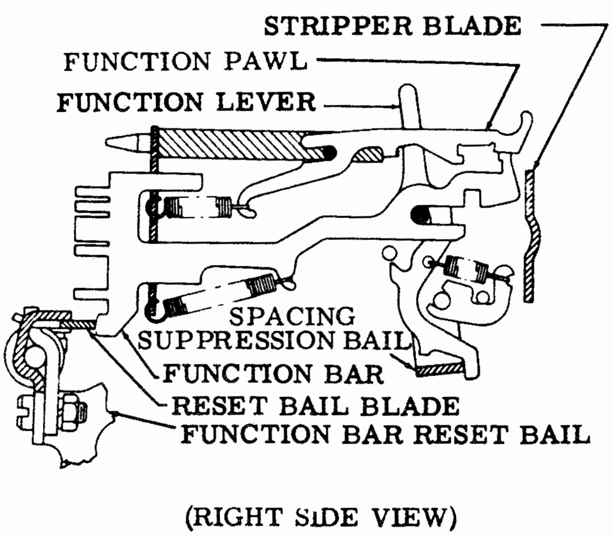

Figure 3-39. Typical Function Linkage (Unselected)

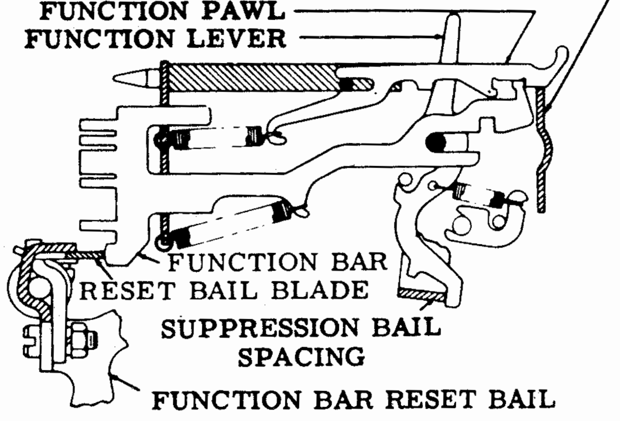

Figure 3-40. Typical Function Linkage (Selected)

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 (figure 3-42). 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 line 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

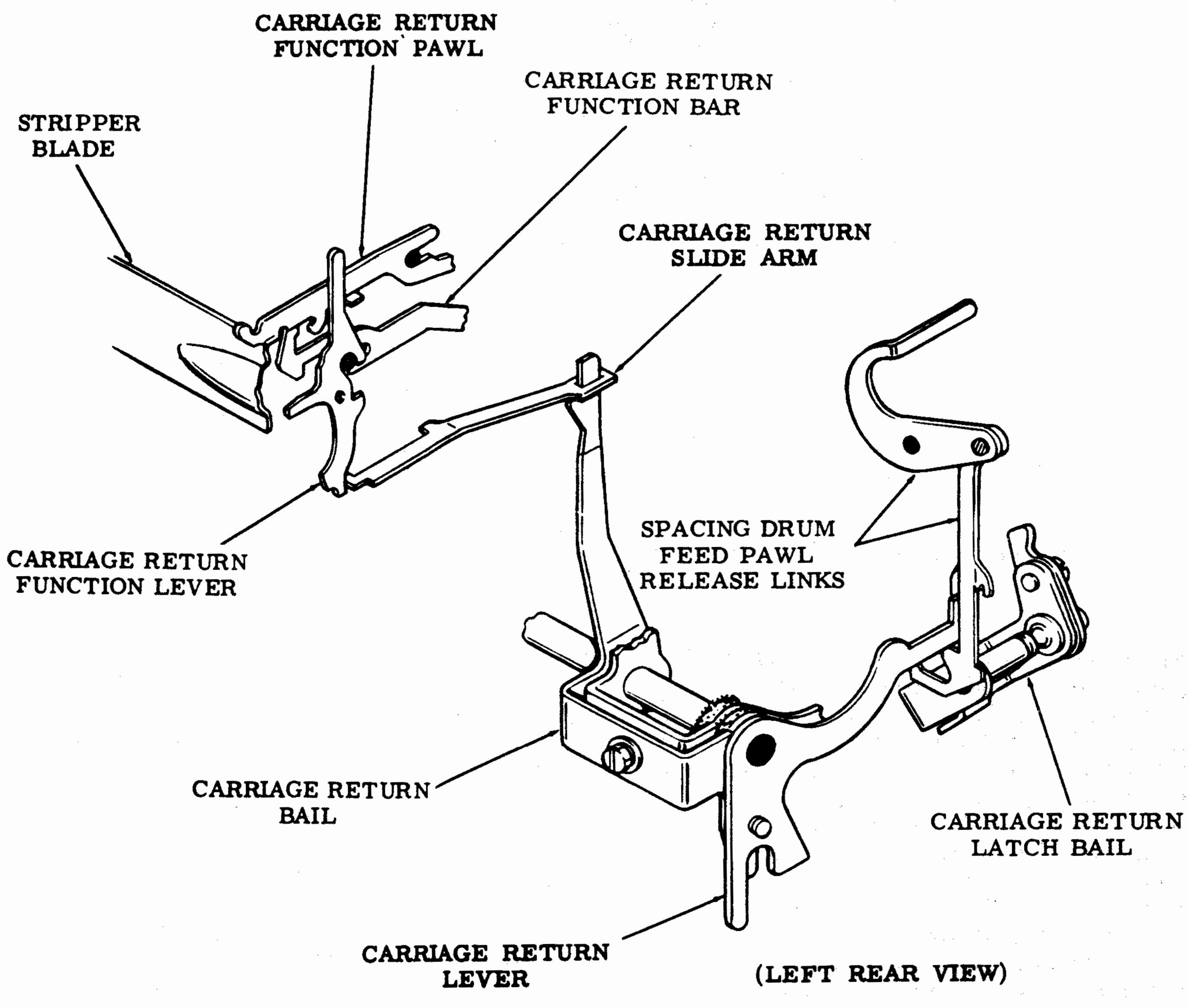

Figure 3-41. Carriage Return Function Mechanism

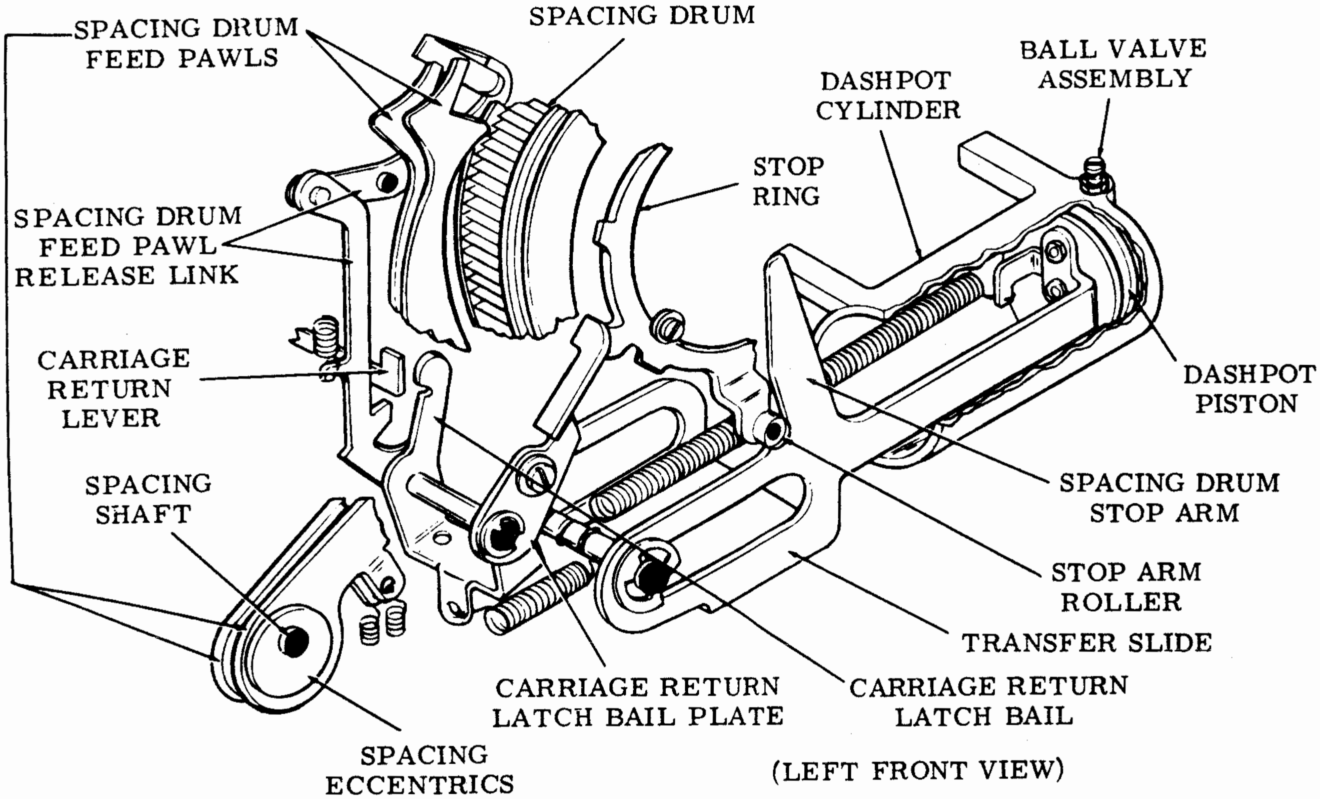

Figure 3-42. Carriage Return Mechanism

latch bail disengages the carriage return lever, and the feed pawls are again permitted to engage the spacing drum. 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 (figure 3-41) 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.

(3) Line Feed Function. Refer to figures 3-43 and 3-44. 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 line feed, permits two line feed function bars, pawls, and levers to operate. The function linkage at the far left of the stunt box (figure 3-43) 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 until the trip lever releases the three-stop line feed clutch. The line feed gearing is such that each 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. 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 revoluation, 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. 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 (figure 3-43). 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 the 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. 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

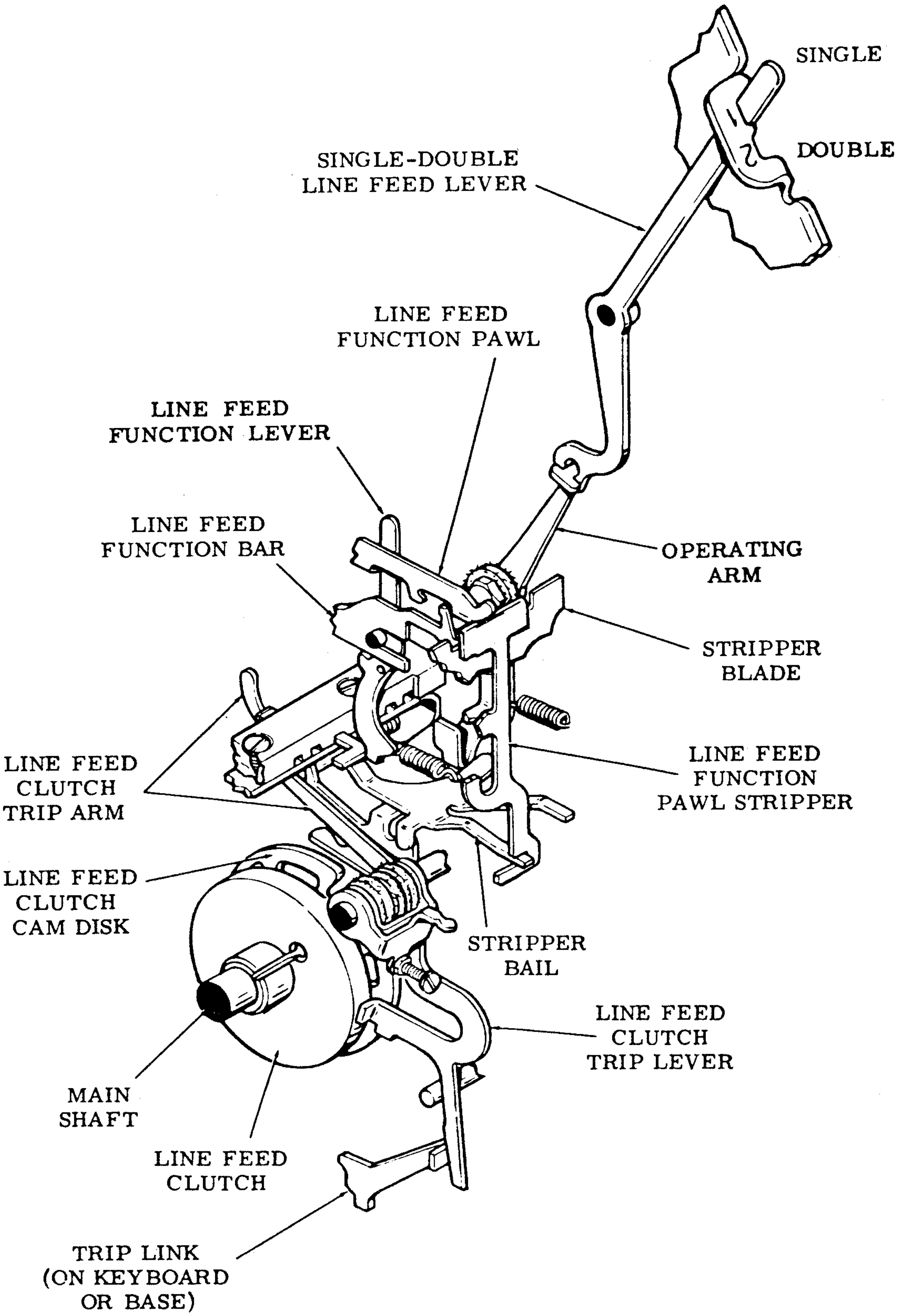

Figure 3-43. Line Feed Mechanism (Left Rear View)

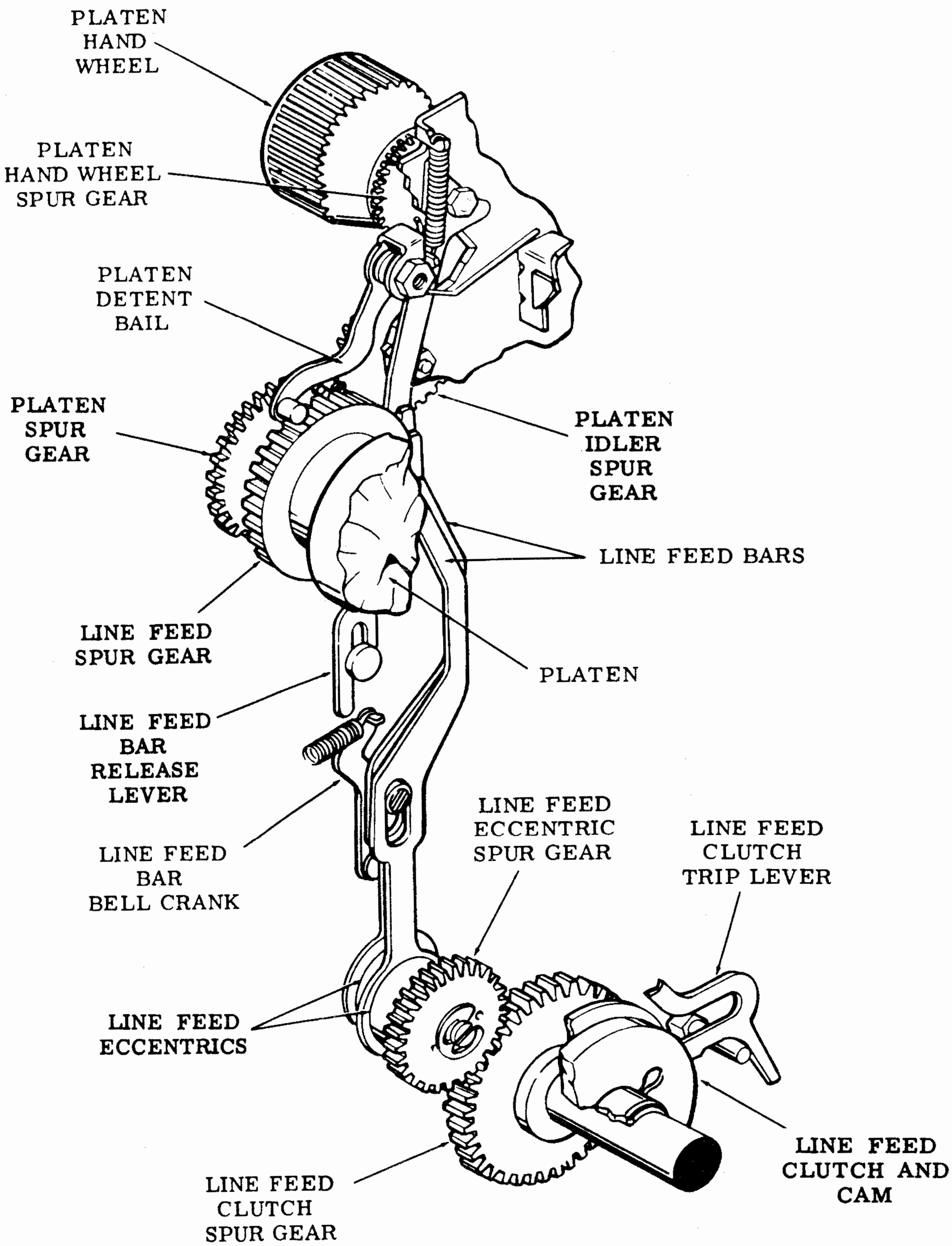

Figure 3-44. Line Feed Mechanism (Right Front View)

suppressing spacing on single line feed 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. Each one-third revolution of the line feed clutch causes its attached spur gear (figure 3-44) 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. 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 (figure 3-43) bears on the line feed bar bell crank and causes it to disengage the line feed bars from the line feed spur gear. 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 (figure 3-43), when rotated to the rear (counterclockwise, veiwed 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.

(4) <u>Letters-Figures Shift Function</u>. Refer to figure 3-26. Upon reception of the letters or figures signal code, the letters and figures function bars, pawls, and levers initiate the letters or figures shift. The upper ends of the function levers engage the letters and figures function slides. The front ends of these function slides have camming surfaces which, 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. Movement of the letters-figures code bar results in the positioning of the type box, through related mechanisms, for printing of letters or figures.

(5) <u>Stunt Box Contacts</u>. Refer to figures 3-45 and 3-40. 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, which are determined by external

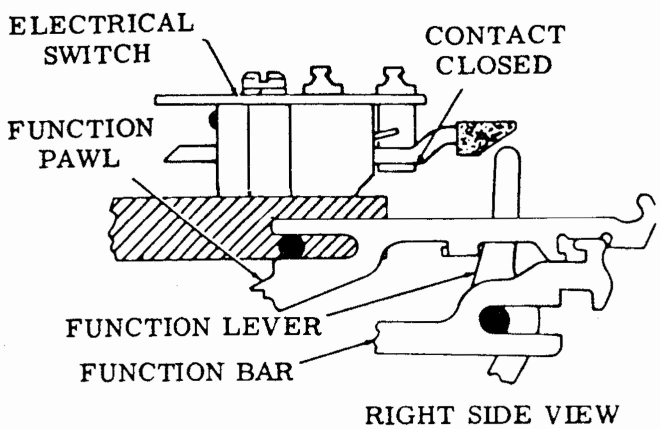

Figure 3-45. Typical Stunt Box Contact (Unoperated)

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 (figure 3-45) and selected (figure 3-46) condition.

3-6. KEYBOARD UNIT MECHANICAL MOTION DESCRIPTIONS. Keyboard units used in high-level CPP equipment are discussed in paragraph 3-6.1, and keyboard units used in low-level CPP equipment are discussed in paragraph 3-6.2.

3-6.1 KEYBOARD UNIT MECHANICAL MOTION DESCRIPTIONS (HIGH-LEVEL). The following paragraphs provide a detailed description of the mechanical assemblies used to perform the various functions of the high-level keyboard units.

a. General. The primary functions of the keyboard unit are to send binary code information on the signal line. The receive-only base unit, having no sending facilities, receives binary code information only. To perform the sending function the keyboard unit is equipped with a keyboard transmitter mechanism for manually setting a code combination, and a distributor mechanism for automatically distributing the code combination on the signal line.

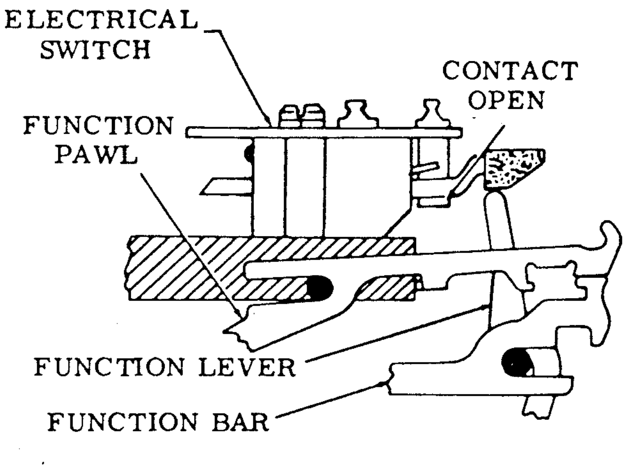

Figure 3-46. Typical Stunt Box Contact (Operated)

b. <u>Keyboard Transmitter</u>. To initiate transmission of a character or function a key is pressed, moving a keylever down. The keylever moving down initially contacts the code bar mechanism to start the code bar T-levers rotating clockwise and/or counterclockwise. As the keylever descends, it engages the universal code bar which, through a tie link, releases the universal lever. As the universal lever rises, the code bar T-levers are locked, and the contact bail is rotated to release the contact wires. When the contact bail is released, a power contact wire touches its terminal to initiate transmission through the distributor. At the end of the distributor cycle, the reset mechanism drives the universal lever downward to the latched position. As the universal lever descends, the contact bail is returned to its unoperated position, and the code bar T-levers become unblocked. Another character can then be selected. The operation of the keyboard transmitter is discussed in the order in which the mechanisms respond. The active mechanisms are:

Code bar mechanism
Universal mechanism
Contact mechanism
Reset mechanism

The support mechanisms are:

Repeat mechanism
Line break mechanism
Local function keys

(1) <u>Code Bar Mechanism</u>. For each code level,

there is a corresponding code bar submechanism consisting of a front bar, rear bar, tie link, and two T-levers (figure 3-47). Collectively, the code bar submechanisms make up the code bar mechanism. The submechanisms, numbering one through five from the rear to the front, correspond to the five code levels. The single bar nearest the front is the universal code bar and is related to the universal mechanism. The front and rear bars in each code bar submechanism have slots in their top edges and are complimentary coded; i.e., for each keylever location, one bar is slotted where the other bar is solid. Each submechanism has a marking and a spacing position. A slot in the rear bar permits the front bar to descend under pressure of a keylever, establishing a marking condition for that code level in a selected character. A slot in the front bar permits the rear bar to descend for a spacing condition. Therefore, in the marking condition, the front bar is down; the rear bar is up, and the right T-lever is clockwise. The spacing condition is the opposite: front bar up, rear bar down, and right T-lever in the counterclockwise position. When the T-levers are rotated to either clockwise (marking) or counterclockwise (spacing) positions, their associated contact wires are against (marking) or held away from (spacing) the signal terminal strip in the contact mechanism. The extensions on the right T-levers are held to either the left or right by the released universal lever. This prevents another key being depressed until the universal lever is reset. After a key is depressed, it is returned immediately to its original up position by a leaf spring attached to the frame. However, the code combination, representing the key's character, remains in the code bar mechanism. When a new key is depressed, only the submechanisms whose code levels differ from the preceding combination, are operated. As a keylever is driven towards the bottom of its travel, it engages the universal code bar to trip the universal mechanism.

(2) <u>Universal Mechanism</u>. The universal mechanism releases the contact bail on the contact mechanism, and locks the code bar submechanisms. The universal code bar, when depressed by a keylever, causes its associated T-lever and tie link to rotate clockwise (figure 3-48). The tie link extension in contact with the tab on the nonrepeat lever, causes the latchlever to pivot towards the left to unblock the universal lever. The universal lever is released and moves up, under spring tension, to lift the nonrepeat lever tab. The spring force raising the universal lever causes the universal lever to drive the tab above the tie link extension. When the tab rises above the tie link extension, the nonrepeat lever and latchlever return to the right. With the universal lever up, the nonrepeat lever is up, and the latch lever leans against the universal lever. In the released position, the universal lever locks the code bar submechanisms, and permits the contact bail (on the contact mechanism) to pivot clockwise. The code level contact wires and power contact wire are released. When the power contact wire touches the ac terminal strip, a current path to the distributor clutch magnet is established. The distributor clutch magnet is

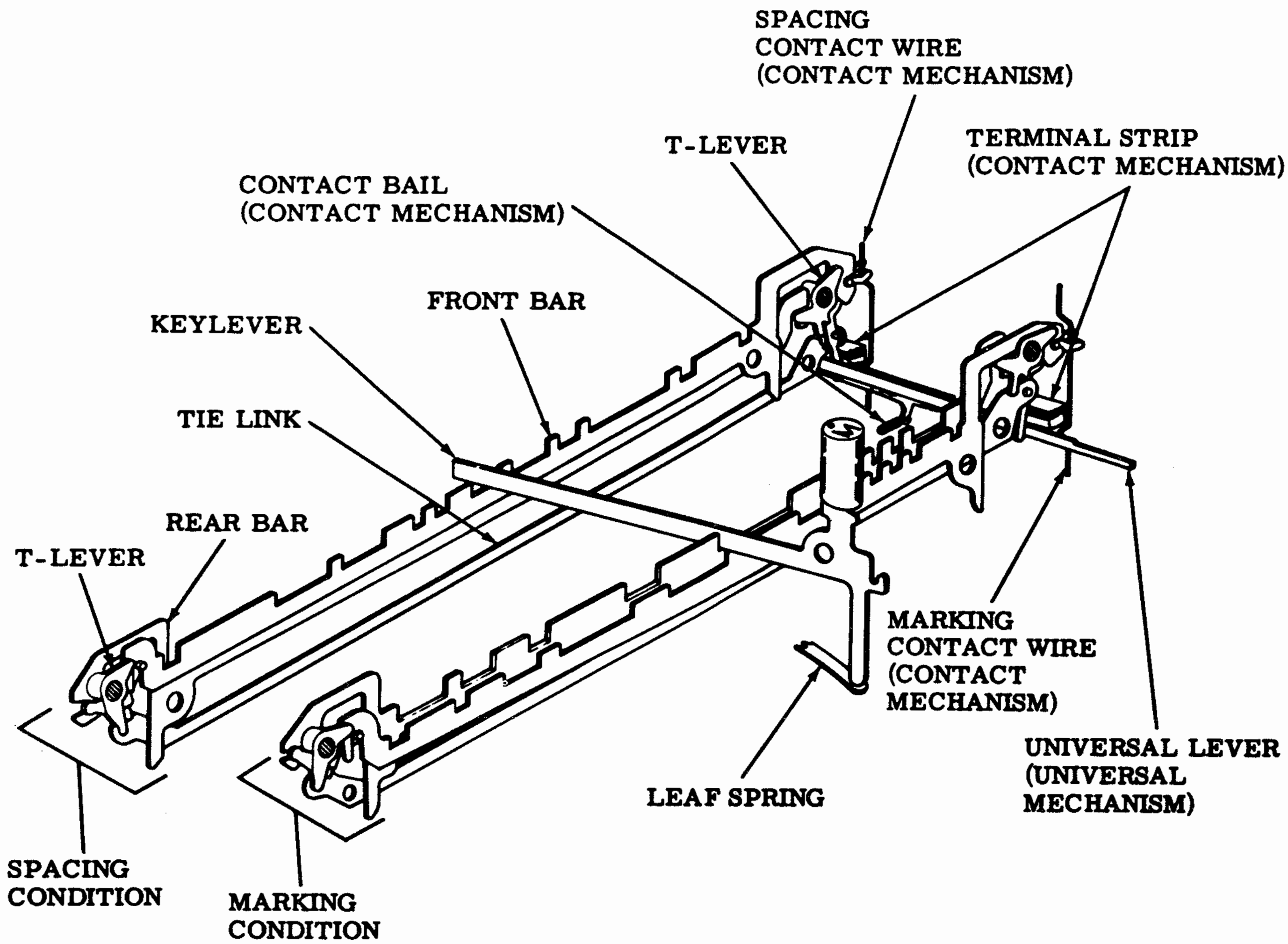

Figure 3-47. Code Bar Mechanism

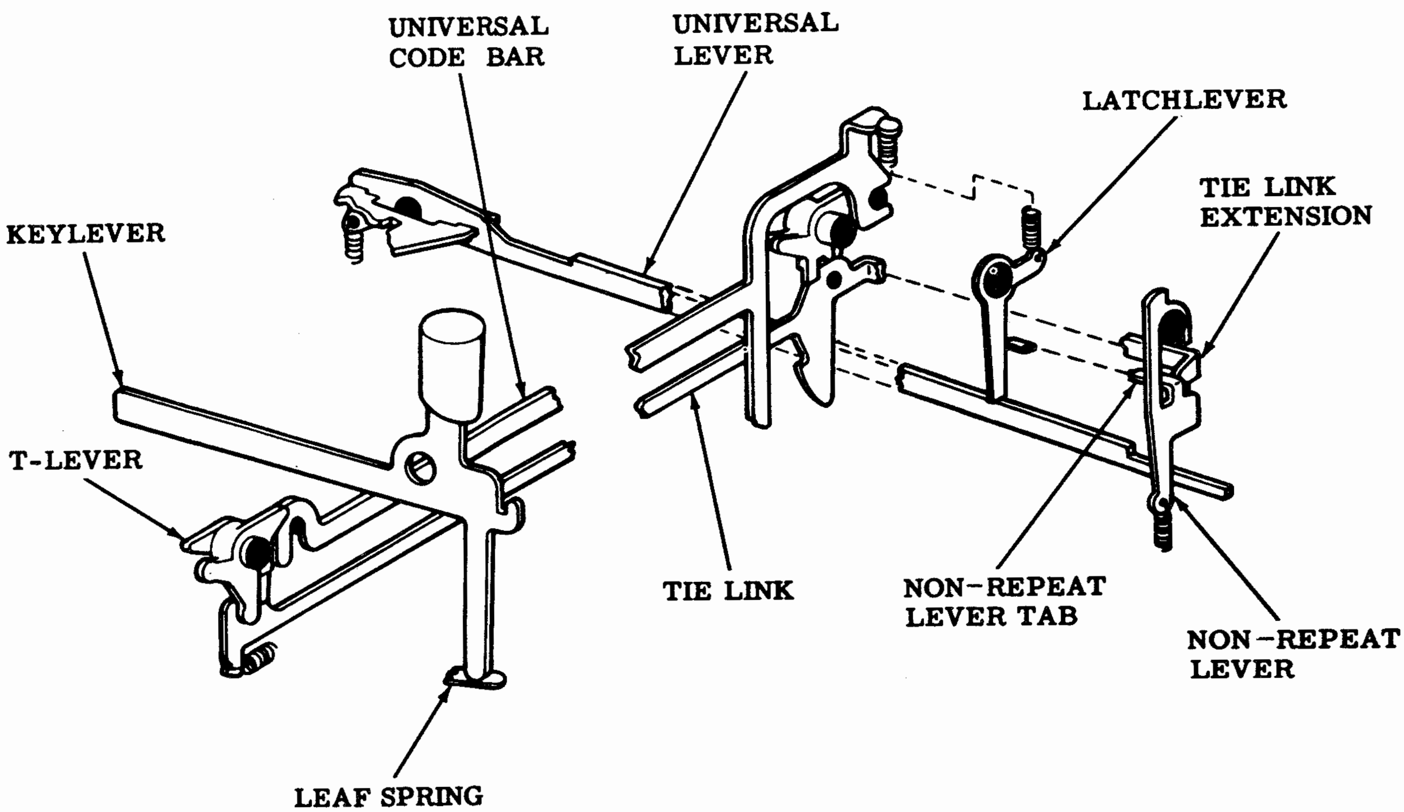

Figure 3-48. Universal Mechanism

subsequently deenergized when a set of timing contacts at the distributor is opened. As the distributor cycle ends, an additional set of contacts at the distributor is closed to energize the reset solenoid on the keyboard transmitter. The universal lever is driven back to its down position where it is latched by the latchlever. Should a keylever remain depressed beyond the end of the distributor cycle, the tie link extension prevents the non-repeat lever from returning to its reset condition. The non-repeat lever tab hangs on top of the tie link extension as the unaffected latchlever holds the universal lever down. When the keylever is released, the tie link extension moves back to the right, and the non-repeat lever shifts downward allowing the tab to fall between the latchlever and the tie link extension.

(d) Contact Mechanism. The contact mechanism (figure 3-49) responds to inputs from the code bar universal, and reset mechanisms. The code bar mechanism operates a set of T-levers into marking and/or spacing positions, and the universal mechanism releases the contact wires in the contact mechanism. A contact wire is associated with each code bar submechanism. Subsequent to code selection, the universal mechanism is tripped to release the contact bail and lock the code selection. The contact bail releases the five code level contact wires and one power contact wire. In the reset condition of the keyboard transmitter, the contact bail holds the contact wires away from their respective T-levers. When the universal lever is released, the contact bail rotates clockwise to release all contact wires against either the terminal strip for marking conditions, or individual T-levers for spacing conditions. When the contact bail rotates, the power contact wire is always marking against the ac terminal strip. The contact bail is returned to its reset position when the universal lever is returned by the reset mechanism.

(4) Reset Mechanism. A solenoid mounted on the rear of the keyboard transmitter, is used to reset the universal lever. The reset mechanism (figure 3-50) includes a solenoid, reset shaft, and reset arm, and is operated by an electrical pulse received from the distributor. The pulse originates from a set of contacts that are closed during the final segment of the distributor cycle. When energized, the solenoid plunger rotates the reset shaft and reset arm to drive the universal lever down.

(5) Repeat Mechanism. The repeat mechanism (figure 3-51) consists of a repeat keylever and a miniature switch. When operated, the repeat keylever depresses the switch to (1) close the distributor clutch magnet circuit and (2) open the reset solenoid circuit. The distributor continues to operate and permits repeated transmission of the character as long as the REPT key is depressed. To avoid loss of the character, the character keylever and repeat keylever should be held down simultaneously.

(6) Line Break Mechanism. The line break mechanism consists of a break keylever, T-lever, and contact wire. The signal line current is interrupted when the BREAK

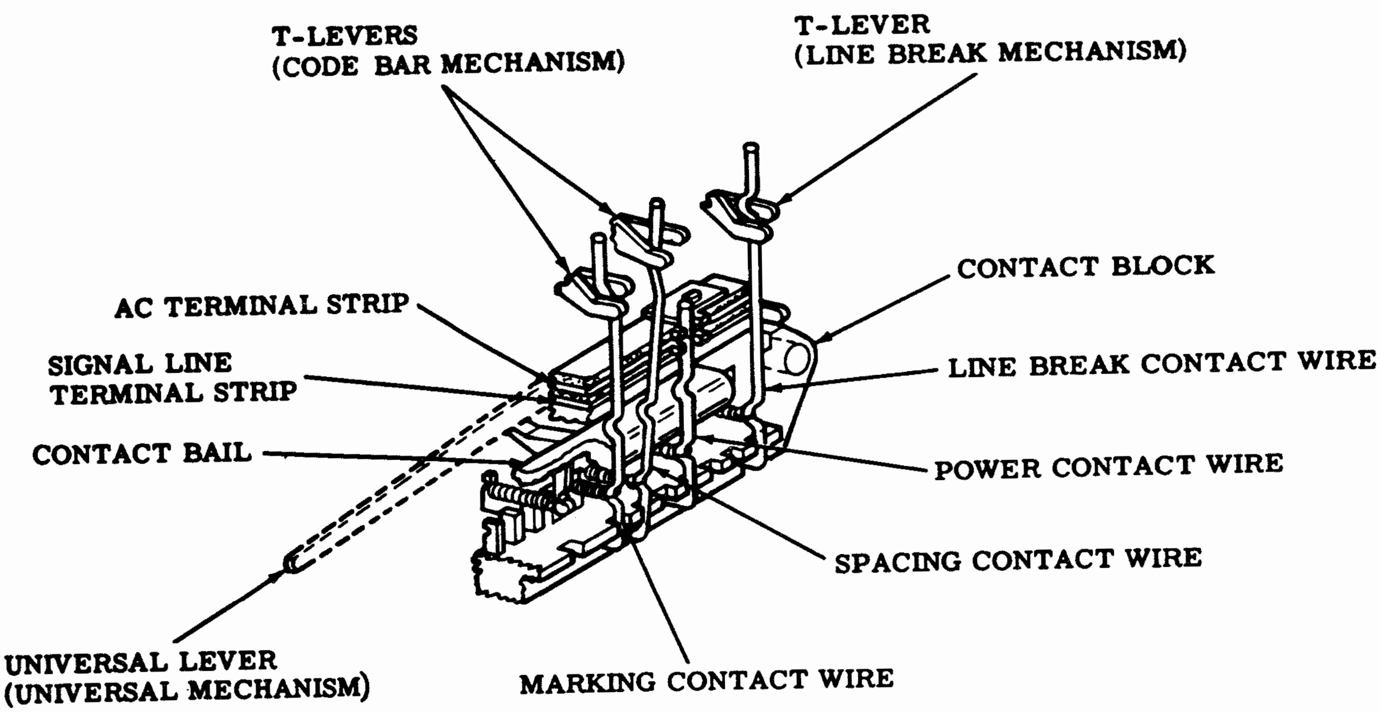

Figure 3-49. Contact Mechanism

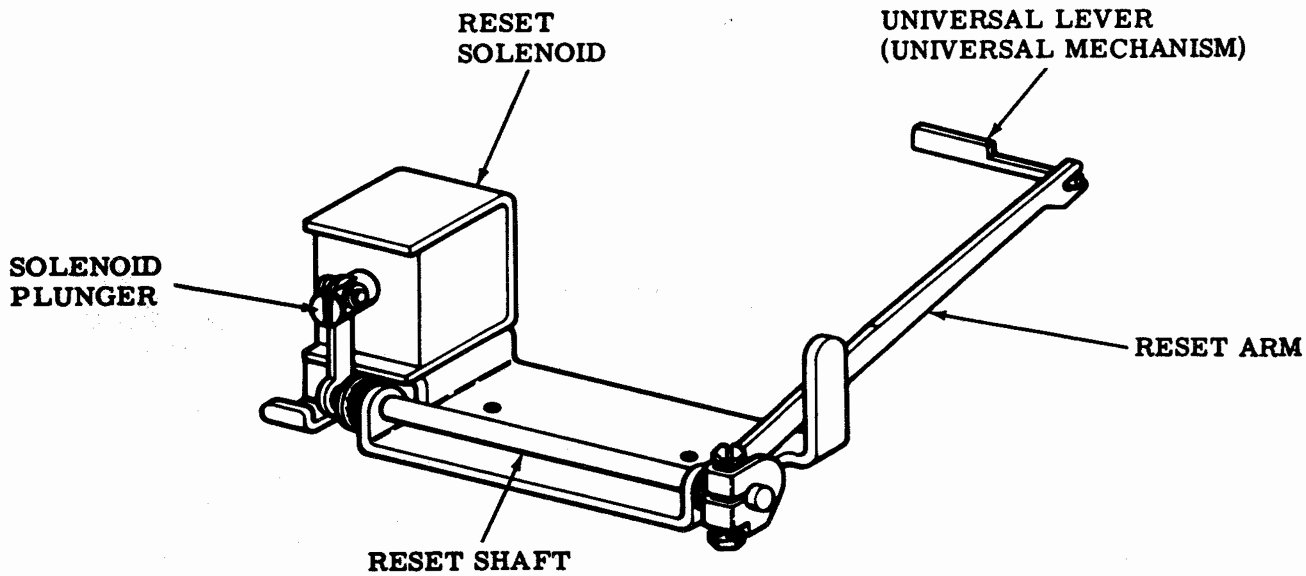

Figure 3-50. Reset Mechanism

key is depressed. The signal line remains open until the key is released. The contact wire is a serial link in the signal line.

(7) <u>Local Function Keys</u>. In addition to the normal signal line keys, the keyboard transmitter is equipped with a local line feed key and a local carriage return key. The local function keytops are red to readily distinguish them from the signal line function keys.

c. <u>Distributor</u>. The distributor mechanism (figure 3-52) sequentially applies signal line current to the keyboard transmitter mechanism, and controls the electrical power circuits which operate the distributor clutch magnet and keyboard transmitter reset solenoid. The timing functions are initiated when a keytop at the keyboard transmitter is depressed. The keytop presets the code level contact wires and closes a power contact wire to allow current to flow to the distributor clutch magnet. When energized, the distributor clutch magnet attracts an armature to release the clutch trip lever. When the clutch shoe lever is released, the clutch shoes engage the cam sleeve with the main shaft. A cam on the rotating cam sleeve opens a set of timing contacts to deenergize the distributor clutch magnet. (The pulse for the distributor clutch magnet is initiated by the keyboard transmitter and terminated by the distributor.) The clutch magnet armature is mechanically reset as the high part of the

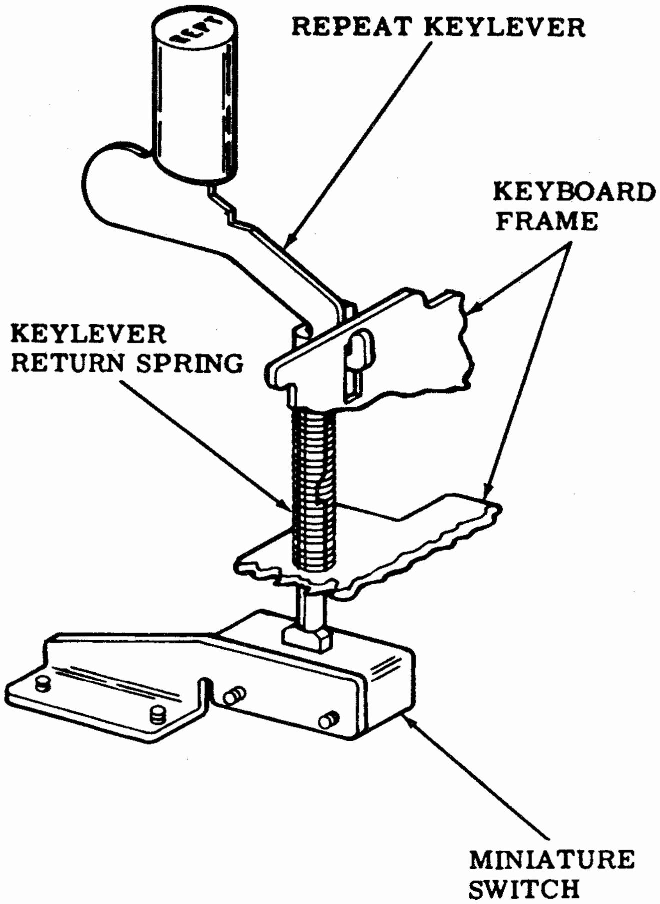

Figure 3-51. Repeat Mechanism

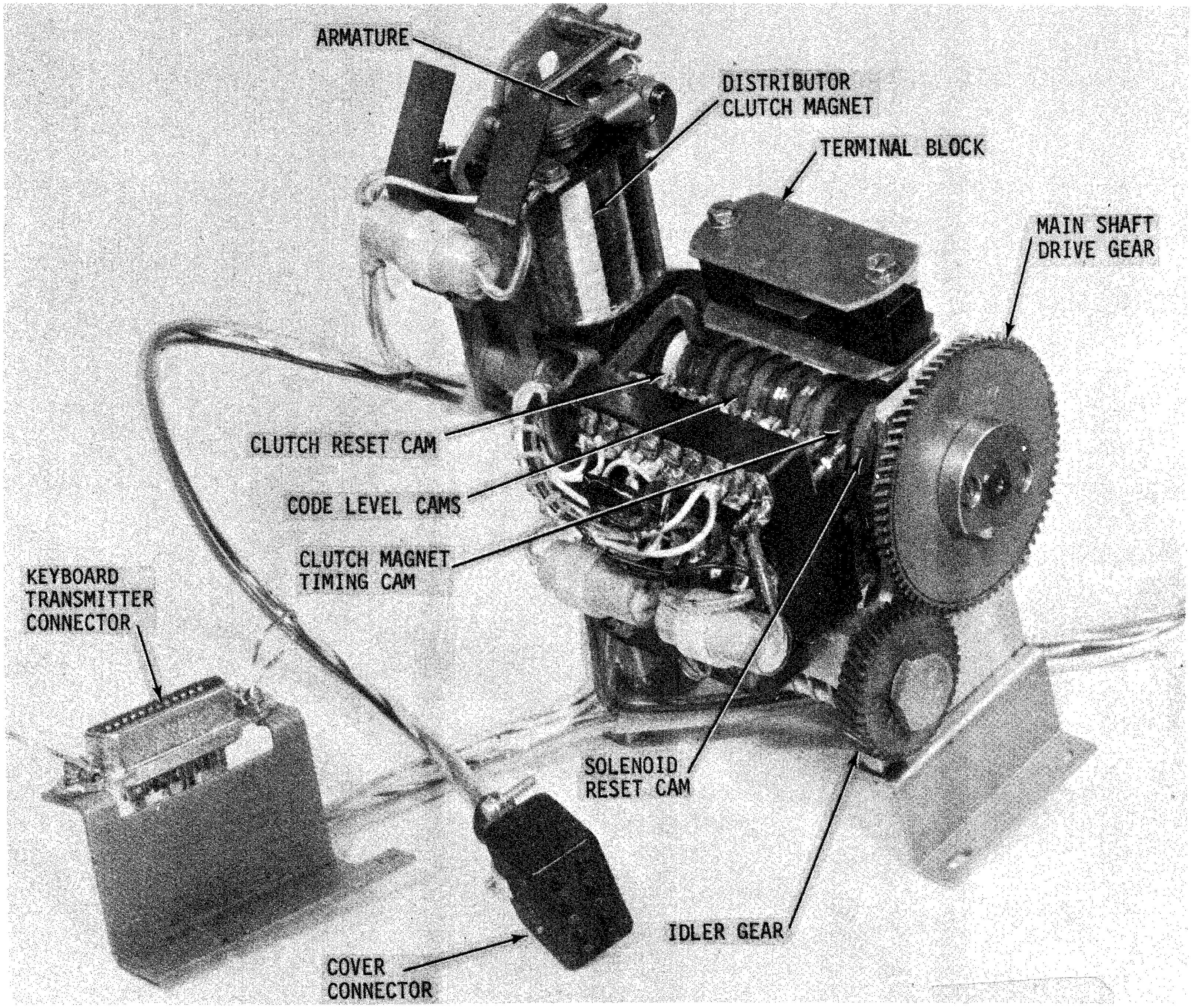

Figure 3-52. Distributor Mechanism

clutch reset cam rotates the reset lever away from the armature. The armature, under spring tension, rises to lock the trip lever. The signal line, before and during the brief start interval (for the distributor) remains closed by the stop cam and contacts at the distributor. The keyboard transmitter contacts are linked in parallel with the distributor contacts, and are sensed as current is applied sequentially. There are six cams on the distributor cam sleeve to actuate the five code level and stop contacts in the distributor contact block. A flat on each cam causes the follower to close the contacts. Initially, before current is admitted to the code level contacts, the stop contact is opened for one unit of time. Then, in succession while the stop contact remains opened, signal line current is directed through each set of code level contacts as their respective follower arms are operated. After the fifth set of code level contacts is opened, the stop contact is closed to reestablish constant current on the signal line. The duration of each code pulse is controlled by the dwell period of the cams. For a 7.42 unit code, the dimensionless time length for the start and each code level pulse is one unit, and for the stop pulse is 1.42 units. For a 7.00 unit code, the start, code level and stop pulses are all one unit in length. During transmission of the fifth code pulse, the solenoid reset contacts are closed to reset the keyboard transmitter mechanism. The pulse terminates or the reset contacts are opened before the distributor completes its rotational cycle.

d. <u>3-Speed Gear Shift Assembly</u>. The gear shift assembly (figure 3-53) transfers rotational motion from the motor unit to the distributor mechanism (KSR only) and the typing unit. The output speed of the gear assembly can be manually selected while the motor unit is in the idle or running condition. The assembly drive shaft, driven by the motor pinion, rotates at a constant speed. Three variable sized gears are attached to the assembly drive shaft, with pins. The gears mesh with three free wheeling gears on the variable speed shaft. A sliding key attached to the shift linkage engages one of three gear ratios with the variable speed shaft. A spur gear on the variable speed shaft transfers rotational motion to an idler shaft which drives the gear on the main shaft of the typing unit. A second output is taken from the spur gear on the variable speed shaft to turn another idler shaft. The output from this idler shaft is transferred to the distributor idler gear which conveys rotational motion to the gear on the distributor main shaft. Neither the typing unit nor the distributor will operated unless their respective clutches engage associated cam sleeves with their main shafts. The selector on the front edge of the set operates a shift link in the rear to select one of three Bauds. The shift link positions the collar and sliding key to engage a single gear ratio with the variable speed shaft.

e. <u>Mounting Base</u>. The mounting base provides facilities for securing the mechanisms to the keyboard or base units. There are two locating studs on the base to properly align the typing unit when securing it to the base.

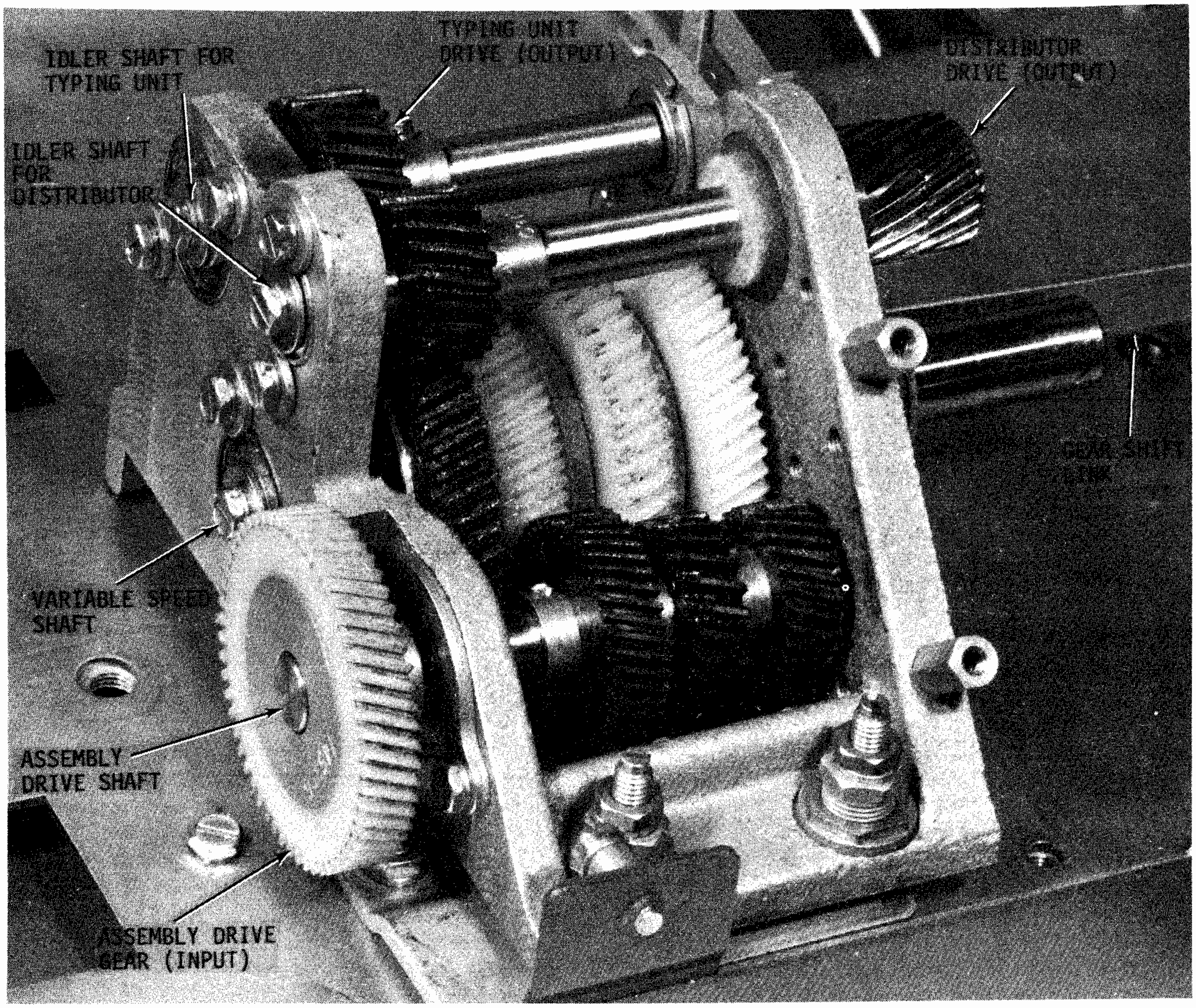

Figure 3-53. 3-Speed Gear Shift Assembly

(1) Margin Indicator Switch. The margin indicator switch is mounted on the keyboard unit and is opened by the carriage pulley on the typing unit. The switch lever is held against the switch button by a spring. When the switch is closed, a neon bulb on the cover is illuminated. Electrical connections exist between the indicator switch, terminal blocks, cover connector, and neon bulb.

(2) Local Functions. The local functions are intended to provide local control of certain functions without disturbing the signal loop. The local function keytops are red to distinguish them from the signal line function keytops.

(3) Local Carriage Return. The local carriage return mechanism trips the carriage return function to return the type box and printing hammer to the left margin of the typing unit. Since the function is performed mechanically, the signal line is uninterrupted, and other typing units on the signal line are undisturbed. When the local carriage return (LOC CR) keylever is depressed, the associated bail is rotated toward the rear of the base (figure 3-54). The trip link, pinned to the local carriage return bail, slides under the guide bracket to trip the carriage return lever on the typing unit. The same carriage return lever is tripped internally when the coded function for carriage return is received by the typing unit.

(4) Local Line Feed. The local line feed mechanism performs the function of advancing the platen without disturbing other typing units on the signal line. The mechanism trips the line feed clutch trip lever on the typing unit. When the local line feed keylever (LOC LF) is depressed, the rear of the local line feed bail is raised against the line feed lever (figure 3-55). The lever is rotated toward the rear to cause the line feed trip link to slide to the rear. The line feed clutch trip lever releases the clutch shoe lever on the typing unit. The line feed mechanism on the typing unit advances the platen.

f. Variable Features. Variable features of CPP teletypewriter equipment are discussed in the following paragraphs.

(1) Time Delay Mechanism. A time delay mechanism (figure 3-56) is available to close a set of contacts after a number of idle revolutions of the typing unit main shaft. The mechanism provides an electrical pulse to operate a stop magnet assembly (in a separate service unit) which opens the power circuit and shunts the signal line.

NOTE

The stop magnet assembly is not installed in the Model 28 Compact Teletypewriter Set, but is available for installation in a separate electrical service unit.

When combined with the time delay mechanism, the stop magnet assembly completes the requirements for developing the time delay motor stop circuits. A break in the signal line current is necessary to reactivate an RO or KSR set after a time delay motor stop mechanism has interrupted

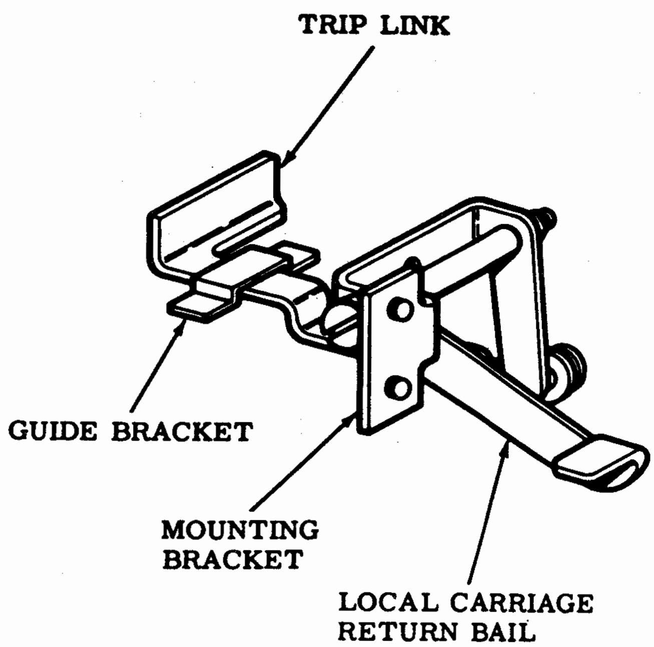

Figure 3-54. Local Carriage Return Mechanism

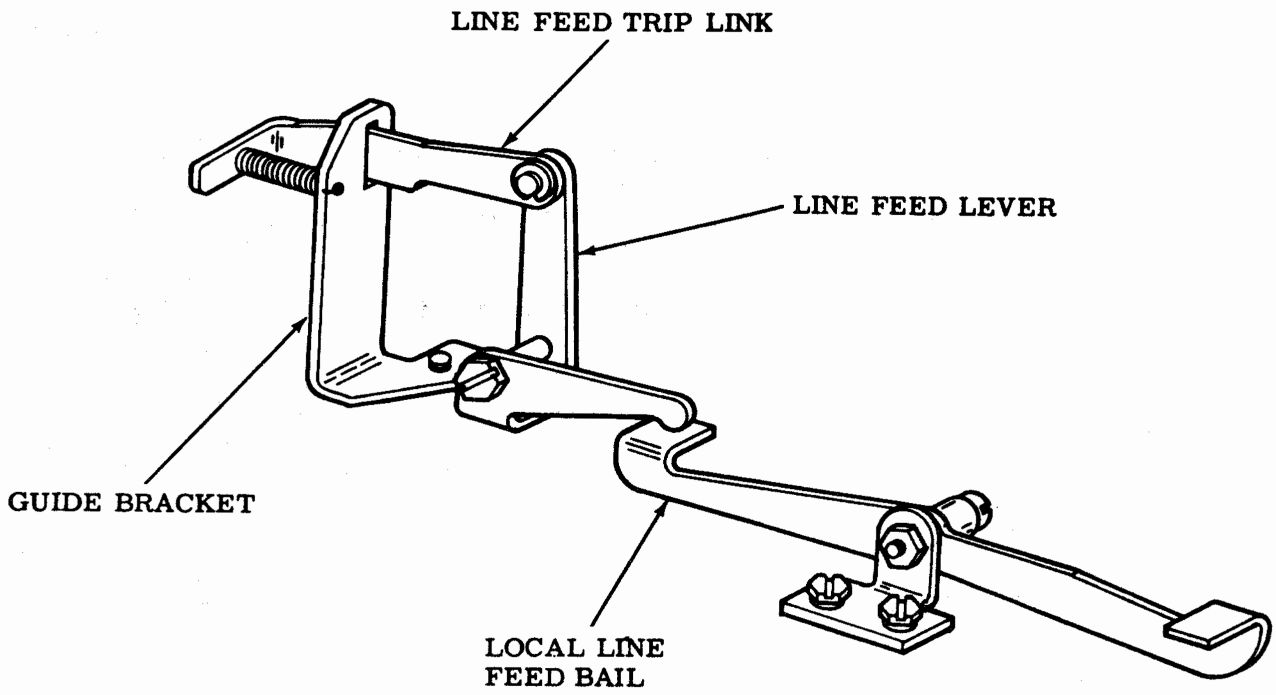

Figure 3-55. Local Line Feed Mechanism

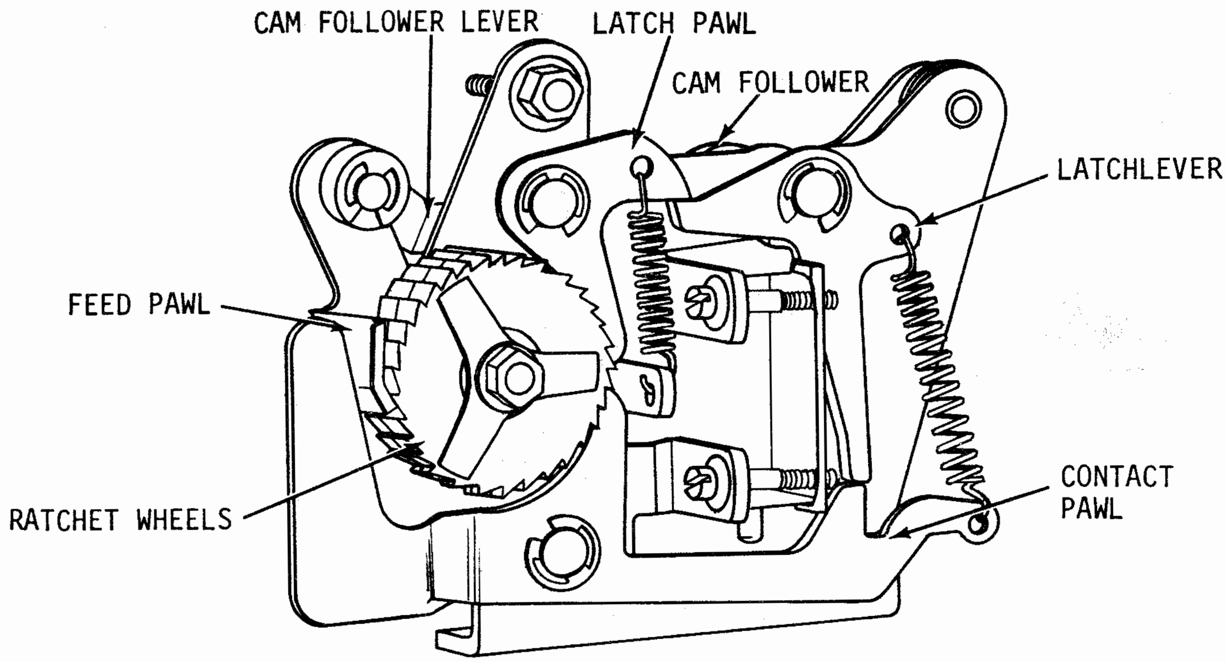

Figure 3-56. Time Delay Mechanism

continuous-but-idle-operation. The time delay mechanism is mounted on the base and is located under the typing unit main shaft. A cam on the typing unit main shaft provides motion to operate the cam follower lever on the time delay mechanism. The motion imparted to the feed pawl advances a pair of ratchet wheels. One ratchet wheel has 27 teeth, and the other has 28 teeth. A single feed pawl, attached to the cam follower lever, advances the pair of ratchet wheels one notch with each revolution of the typing unit main shaft. As the pair advances, one wheel turns a little faster than the other. The ratchet wheel with the 27 teeth advances 1/756th revolution more than the wheel with 28 teeth. It requires 756 ratchet advances to align adjacent points on the two wheels. The latch pawl rides on the inside flanges of the ratchet wheels. Each flange has a semi-circular hole in its camming surface. Both holes must be aligned to permit the latch pawl to snap into the indentation. After 756 revolutions of the typing unit main shaft, the holes on the ratchet wheel flanges are adjacent for nearly one revolution of the ratchet wheels. When the adjacent holes pass under the latch pawl, the latch pawl, under spring tension, snaps into the indentation, briefly. When deflected, the latch pawl rotates the latchlever out of engagement with the contact pawl. The contact pawl is released to bear against the inside flanges of the ratchet wheels. One of two conditions may exist on the signal line during the next 756 revolutions of the typing unit main shaft. Should a line break occur - character transmission or physical break - to activate the typing unit mechanisms, the rocker shaft bail on the typing unit will engage the end of the contact pawl and cause the pawl to be relatched by the latchlever. If no line break occurs, the typing unit mechanisms, other than the main shaft, remain idle; the holes in the flanges reach alignment, and the contact pawl snaps into the indentation. The contact pawl, upon snapping into the indentation, depresses the plunger on the time delay switch. In operation, the delay will vary within a given time range for each Baud. The approximate values for the time delay ranges are given in table 3-1.

3-6.2 KEYBOARD UNIT MECHANICAL MOTION DESCRIPTIONS (LOW-LEVEL).

NOTE

The following discussion is applicable to low-level CPP sets with photoelectric keyboard units. Some low-level CPP equipments have contact assemblies with gold-plated wire contacts, mounted in rfi enclosures, which function in the same manner as described above for high-level equipment.

The following paragraphs provide a detailed description of the mechanical and photoelectrical assemblies used to perform the various functions of the low-level keyboard unit. Discussions in paragraphs 3-6.1d, e, and for the 3-speed gear shift assembly, mounting base, and variable features are also applicable to low-level CPP equipment. The keyboard unit consists of the keyboard transmitter and the distributor.

a. Keyboard Transmitter. The operation of the keyboard transmitter is discussed in the order in which the mechanisms operate.

(1) Code Bar Mechanism. Refer to figures 3-57 and 3-58. The purpose of the code bar mechanism (figure 3-57) is to preset the necessary code level shutter windows (figure 3-58) for transmission of each character or function. For each code level there is a corresponding code bar submechanism. They are numbered one through five, rear to front, to correspond to the five-level code. The code bar submechanism consists of a front bar, rear bar, tie link, and two T-levers

(a) Positioning for a Mark. To initiate transmission of a mark, a key is pressed moving the keylever down. The keylever moving down strikes the code bar submechanism moving the front bar down to a marking condition. The front bar, when moving down, moves the T-levers in a clockwise direction. The right T-lever moves the shutter down allowing light to pass through the shutter window to a photoelectric cell. The T-levers when rotating clockwise move the tie-link to the left. When the key is released, the leaf spring moves the keylever up, moving the key up to the normal stop position.

(b) Positioning for a Space. To initiate transmission of a space, a key is pressed moving the keylever

Table 3-1. Time Delay Range

Baud	Time Delay Minimum (Minutes)	Maximum (Minutes)
45.5	1.8	3.6
50.0	1.6	3.3
74.2	1.1	2.2
75.0	1.1	2.2

down. The keylever moving down strikes the code bar submechanism moving the rear bar down for a space. The rear bar, when moving down, moves the T-levers in a counterclockwise direction. The right T-lever moves the shutter up, which blocks the light from going to the photocell. The T-levers when rotating counterclockwise move the tie link to the right. When the key is released, the leaf spring moves the keylever up, moving the key up to the normal stop position.

NOTE

The tie-link serves to hold the T-levers in the proper relationship to each other and facilitates the up and down movement of the front and rear bars.

(2) Universal Mechanism. Refer to figures 3-59 and 3-60. The purpose of the universal mechanism is to lock the T-levers in the selected position during transmission of a character or function. When a key or the spacebar is pressed, it moves the keylever down. Near the bottom of the keylever travel it comes into contact with the universal code bar and moves it down. When the universal code bar moves down, it causes the right universal T-lever to rotate clockwise. When the right universal T-lever is rotated clockwise, the tie link moves to the left. The tie link extension comes into contact with the non-repeat lever tab and rotates it clockwise. The non-repeat lever tab, in moving to the left, rotates the latch lever clockwise out of the path of the universal lever. With the latchlever out of the way, the universal lever rotates counterclockwise, or the front end will move up, to lift up on the non-repeat lever. When the

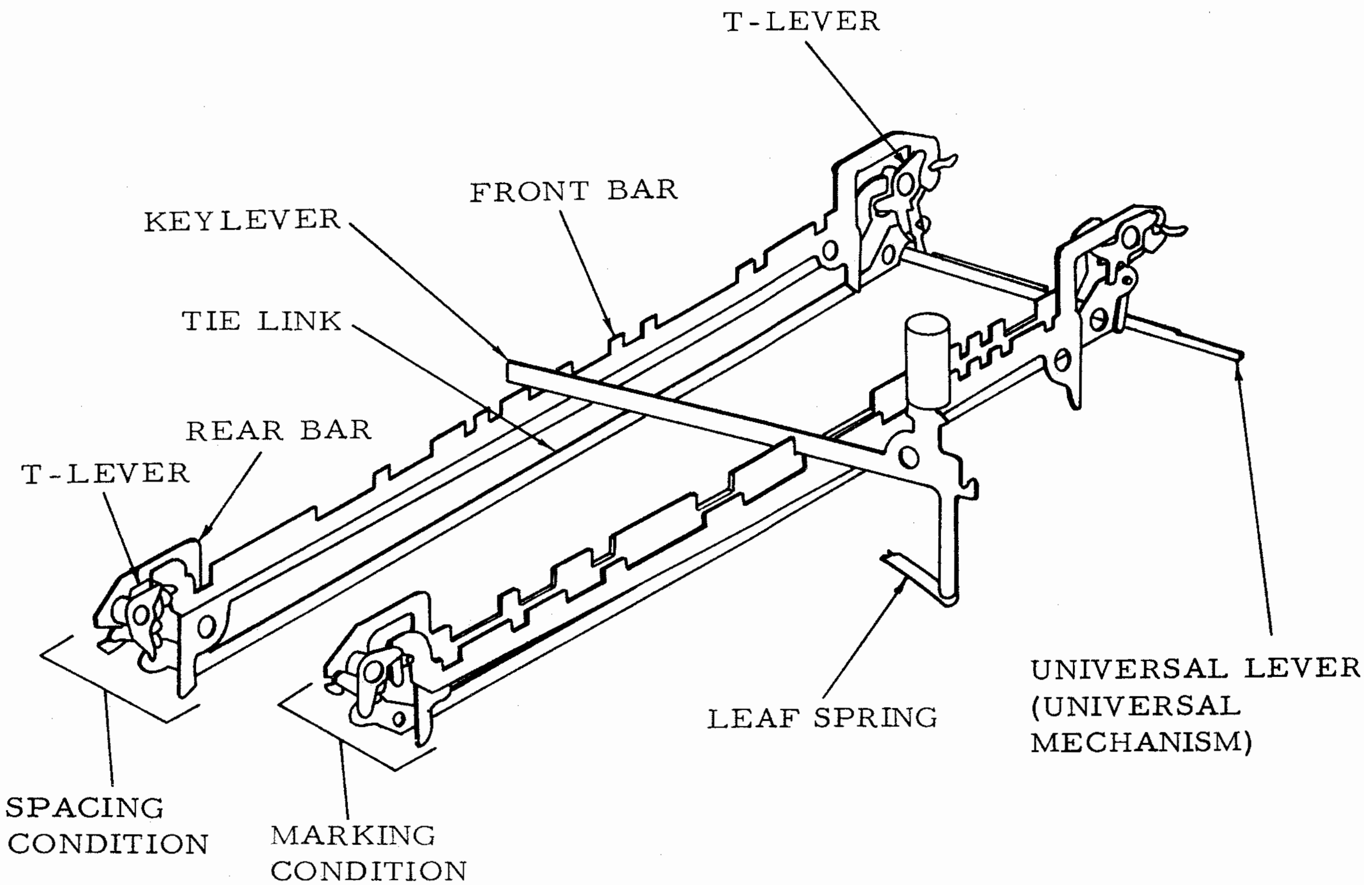

Figure 3-57. Code Bar Mechanism

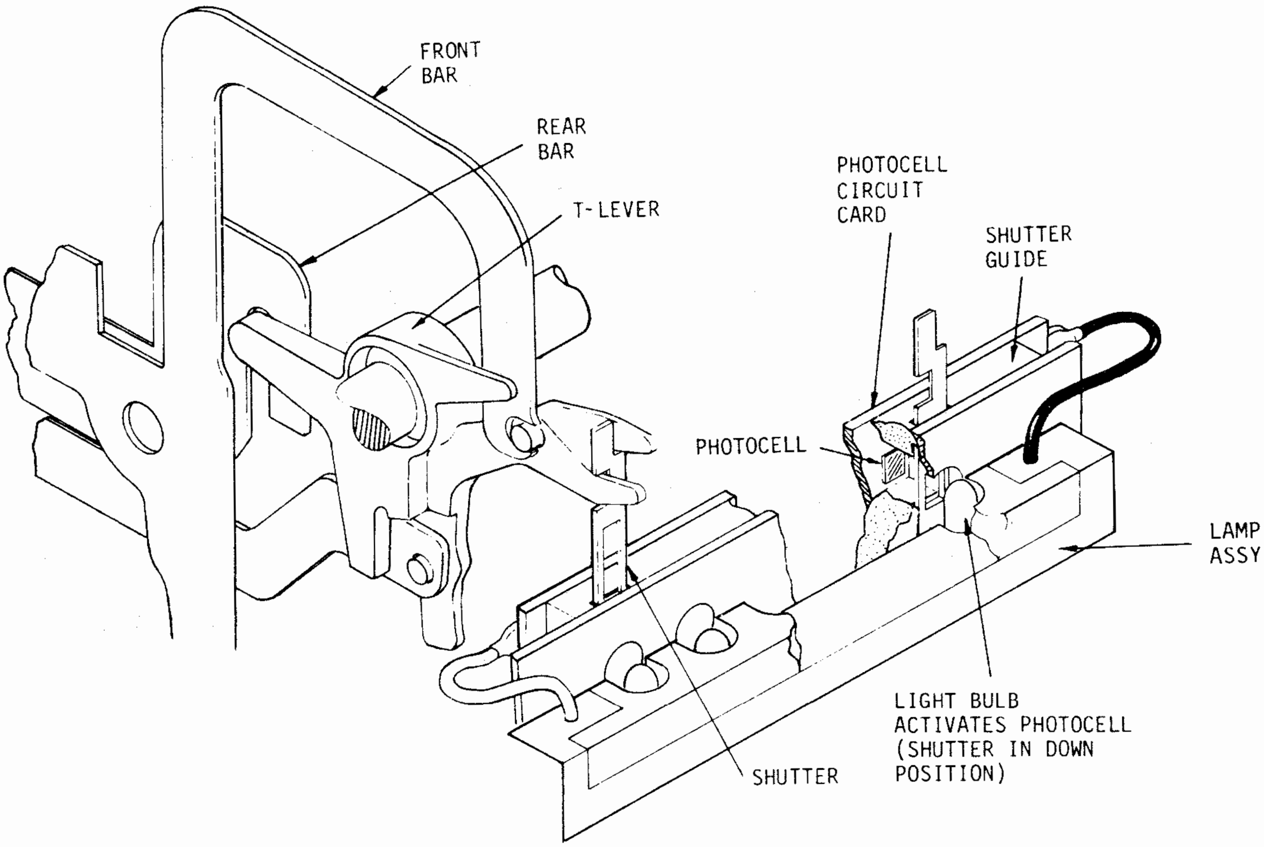

Figure 3-58. Shutter Window Mechanism

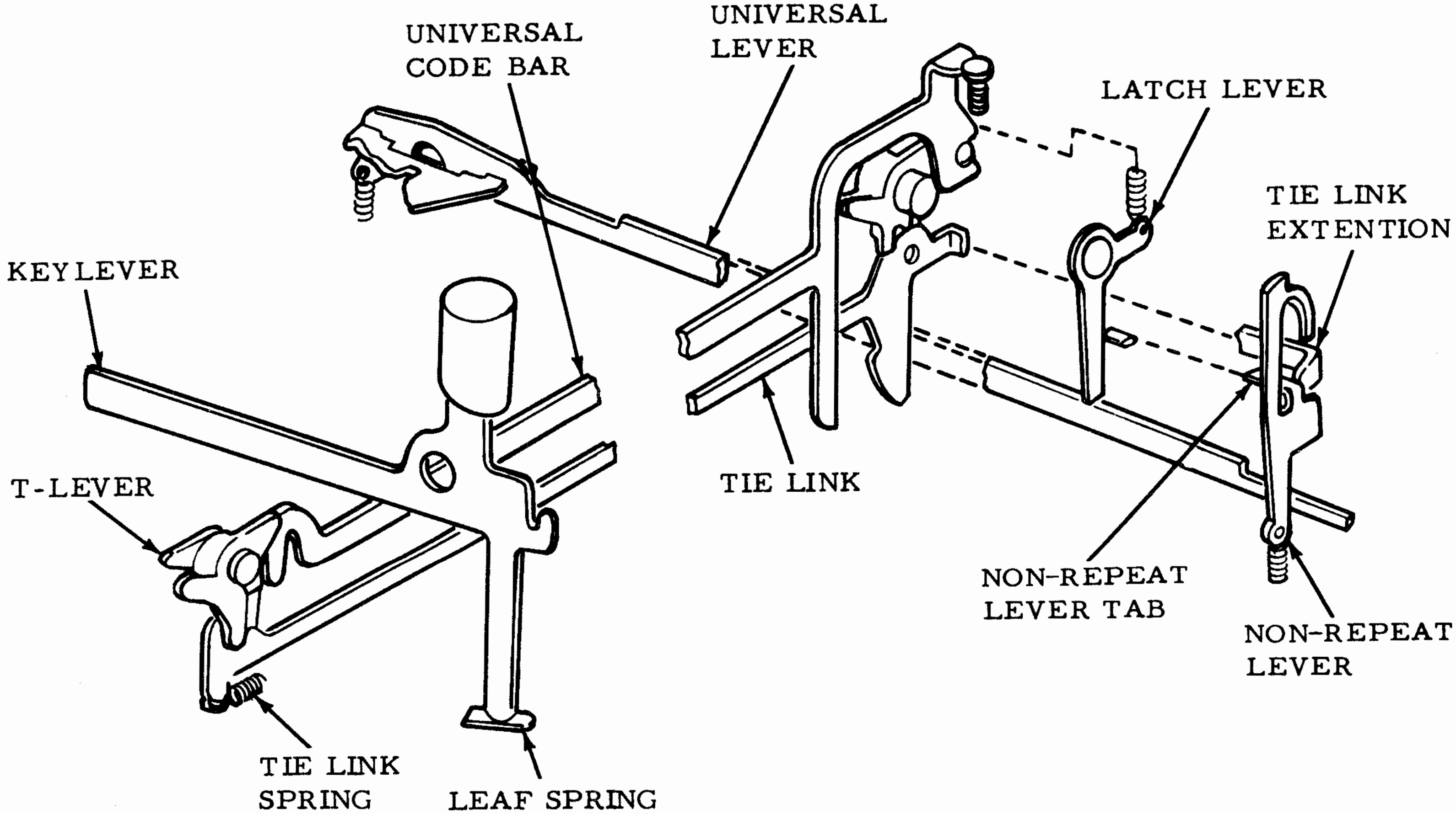

Figure 3-59. Universal Mechanism (Left Front View)

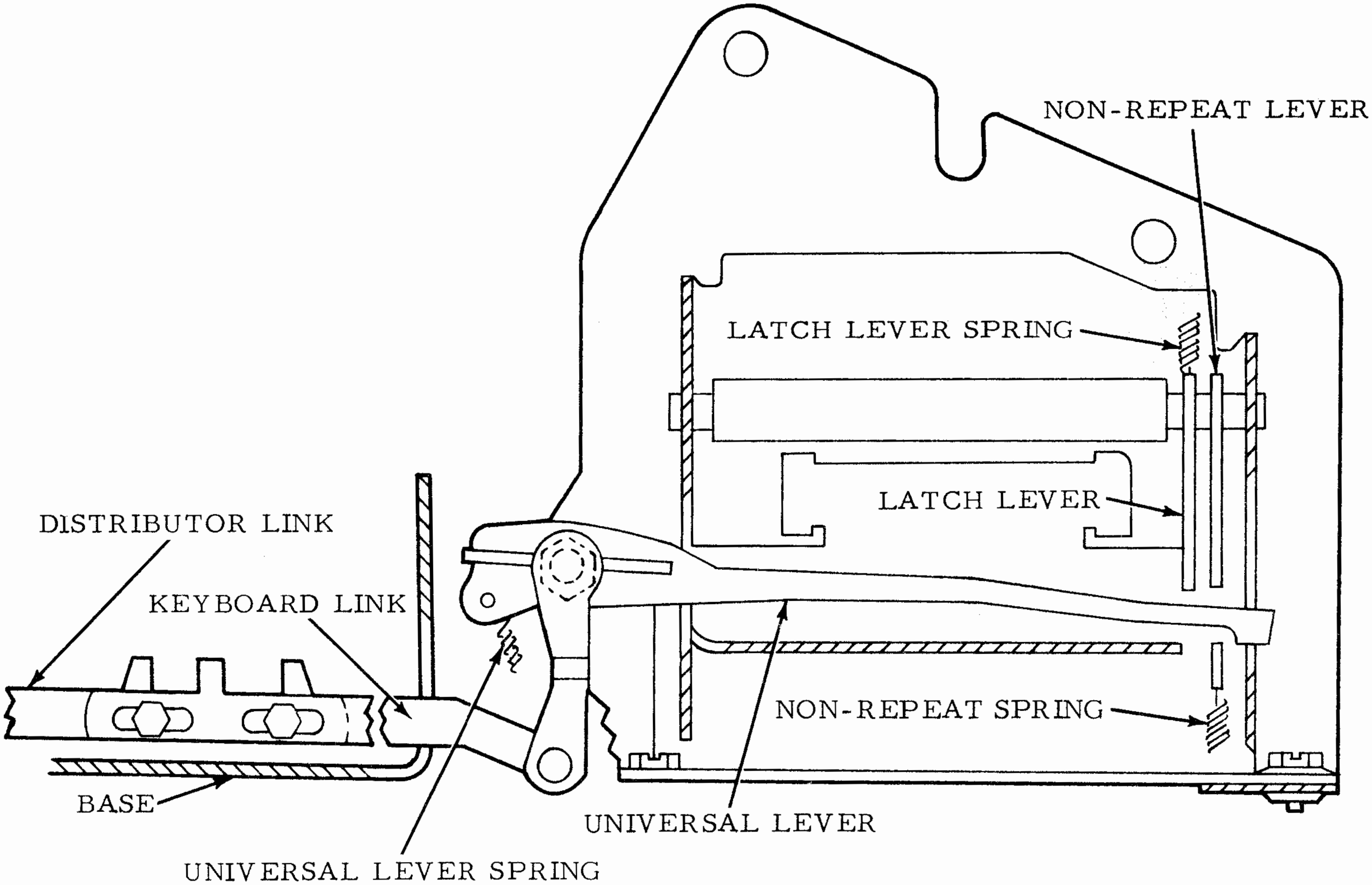

Figure 3-60. Universal Mechanism (Left Side View)

non-repeat lever moves up, it takes the non-repeat lever tab up and moves away from the tie link extension allowing the non-repeat lever to rotate counterclockwise. This allows the latchlever to rotate counterclockwise against the universal lever. In the operated condition, the universal lever holds the T-lever extensions (code bar submechanism) either left or right thus preventing another key from being pressed until the universal lever is reset.

(a) Keyboard Reset. The purpose of the keyobard reset is to reset the universal mechanism in preparation for the next character or function. Near the end of the fifth code-level pulse the clutch cam disk roller moves the distributor link to the rear, which rotates the reset shaft clockwise (figure 3-60). As the reset shaft rotates clockwise it will move the universal lever down in front. As the universal lever moves down in front it allows the latchlever spring to move the latchlever clockwise, over the top of the universal lever. As the universal lever moves down in front it also moves away from the non-repeat lever allowing the non-repeat lever spring to move the non-repeat lever down, moving the non-repeat lever tab down between the universal tie link extension and the latchlever.

(b) Non-Repeat Mechanism. Should a keylever remain pressed beyond the end of the distributor cycle, the tie link extension prevents the non-repeat lever from returning to its reset condition. The non-repeat lever tab hangs on top of the tie link extension. The latchlever, unaffected by the tie link or non-repeat lever, moves to the right, over the top of the universal lever when it moves down, and blocks it, not allowing the universal lever to move up until the keylever is released. At this time, the tie link extension moves back to the right, and the non-repeat lever shifts downward allowing the non-repeat lever tab to fall between the latchlever and the tie link extension (the normal stop position).

b. Photoelectric Distributor Mechanism. The operation of the distributor mechanism is discussed in the following paragraphs. Refer to figure 3-61.

(1) General. Mounted on the distributor clutch is a drive arm, which engages with a drum that has slots cut into it. The slots are arranged in a predetermined interval around the drum. Mounted below the drum are six lamps and mounted in the drum are photoelectric cells which correspond to the five character or function code-level pulses and the stop pulse. As the distributor clutch engages and rotates the drum, a slot corresponding to the stop pulse moves past the lamp that produces the start pulse. Approximately 13.5 milliseconds after the start pulse, as the drum continues to rotate, another slot presents itself to the next lamp. If the shutter is down in the keyboard transmitter, current flows through photoelectric cells in both the keyboard transmitter and the distributor, causing the first code-level pulse to be a mark. If the shutter is up, no current flows and the pulse is a

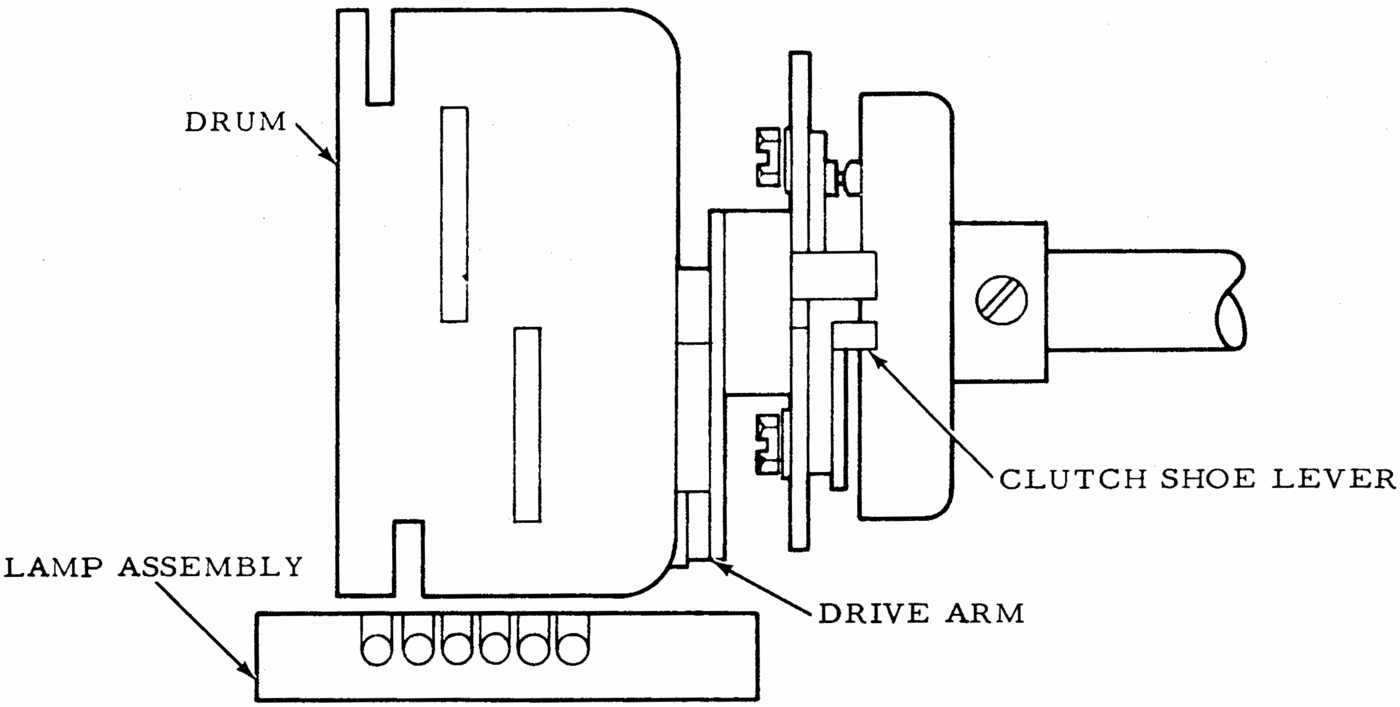

Figure 3-61. Photoelectric Distributor Mechanism

space. The same thing happens for the next four code-level pulses. Then, the slot in the drum corresponding to the stop pulse presents itself causing current to flow, producing the stop pulse as the distributor disengages and the drum is approaching the end of its rotation.

(2) Engaging and Disengaging Distributor Clutch. The distributor clutch is engaged and disengaged as described in the following paragraphs.

(a) Engaging. As the universal lever moves up in front, the rear moves the reset shaft ccounterclockwise, which pulls the keyboard link to the front, causing the reset bail to rotate counterclockwise, moving away from the adjusting plate on the latch bail. At this time, the latch bail spring moves the latch bail counterclockwise. A tab on the latch bail moves against the trip lever, moving it away from the distributor clutch, engaging the clutch.

(b) Disengaging. As the clutch cam disk roller moves the reset bail clockwise, the reset bail moves against the adjusting plate on the latch bail and moves the latch bail clockwise, moving the tab away from the trip lever, allowing the trip lever spring to move the trip lever back into the path of the clutch shoe lever, disengaging the distributor clutch.