BULLETIN 280B
VOL. 1

TECHNICAL MANUAL
MODEL 35
AUTOMATIC SEND-RECEIVE
TELETYPEWRITER SET
(ASR)

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INTRODUCTION

Bulletin 280B is a technical manual that provides general and specific technical information about the Model 35 Automatic Send-Receive Teletypewriter Set and its component units.

The Bulletin is made up of two volumes. Volume 1 contains descriptions and principles of operation, installation, service and maintenance, lubrication, and disassembly and reassembly. Volume 2 contains adjustments.

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

The identifying number of a section, a 9-digit number, appears at the top of each page of the section, in the left corner of left-hand pages and the right corner of right-hand pages. The sections are placed in the manual in ascending numerical order.

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

The sections comprising this bulletin are now stocked separately and may be individually ordered if the entire bulletin is not needed.

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FILING INSTRUCTIONS

1. The following filing instructions apply to changes sent to the field.
2. Asterisks (*) in the table of contents indicate changes.
3. When the issue of a section changes, replace the old issue with the attached new one.
4. In the case of addendums, turn to the affected section and follow the instructions on the first page of the attached addendum.
5. Replace the old table of contents with this new one.

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

35 AUTOMATIC SEND-RECEIVE TELETYPEWRITER SET

GENERAL DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section has been generally revised to include recent engineering changes and to add late 35 type equipment.

1.02 The 35 Automatic Send-Receive (ASR) Set is basically an electro-mechanical device capable, when properly adapted, of sending and receiving messages over telephone networks, telegraph lines, or radio channels. The set accommodates message transmission at 100 words a minute. All messages (received or transmitted) may be typed on either page size copy paper or continuous business forms and they may be punched in paper tape with or without the message typed on the tape, depending on the equipment combinations and options used.

1.03 The component complement of an ASR Set may vary from one installation to another, depending upon the installation requirements. In general, an ASR Set will consist of a page printer, keyboard with reperforator, motor unit, transmitter distributor and its base assembly, electrical service unit, and cabinet. A call control unit is included with sets that operate with tone modulation over telephone networks (switched network service).

1.04 A data set, required for operation of the ASR Set over the telephone network, is mounted on the apparatus rack in the pedestal of the cabinet of sets so equipped. It is not supplied as a part of the ASR Set.

2. COMPONENTS

CABINET (Figure 1)

2.01 The cabinet is designed to house the components of the 35 ASR Set. It is a floor standing enclosure made up of two main parts: the pedestal, or lower cabinet, and the cover, or upper cabinet.

(a) The pedestal is of sheet metal construction, and rests on two feet which extend forward to support the weight of the set. Cabinets used with sets that print data on continuous business forms should be equipped also with rearward extending feet to prevent tilting of the enclosure due to the weight of the form container on the back of the cabinet. An equipment supporting pan is spot welded to the top of the pedestal. The pan contains

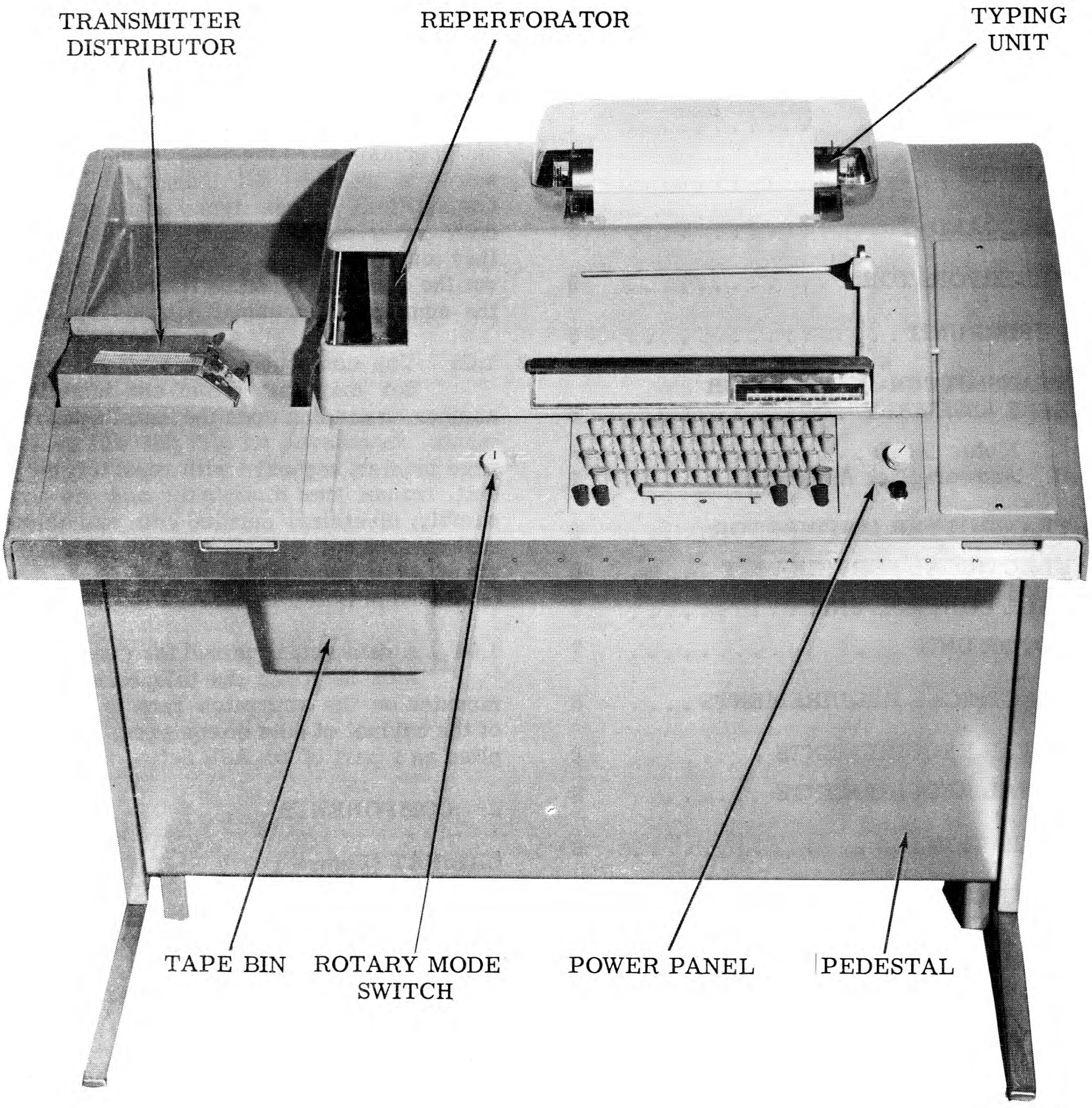


Figure 1 - 35 Automatic Send-Receive Set
(Private Line Service)

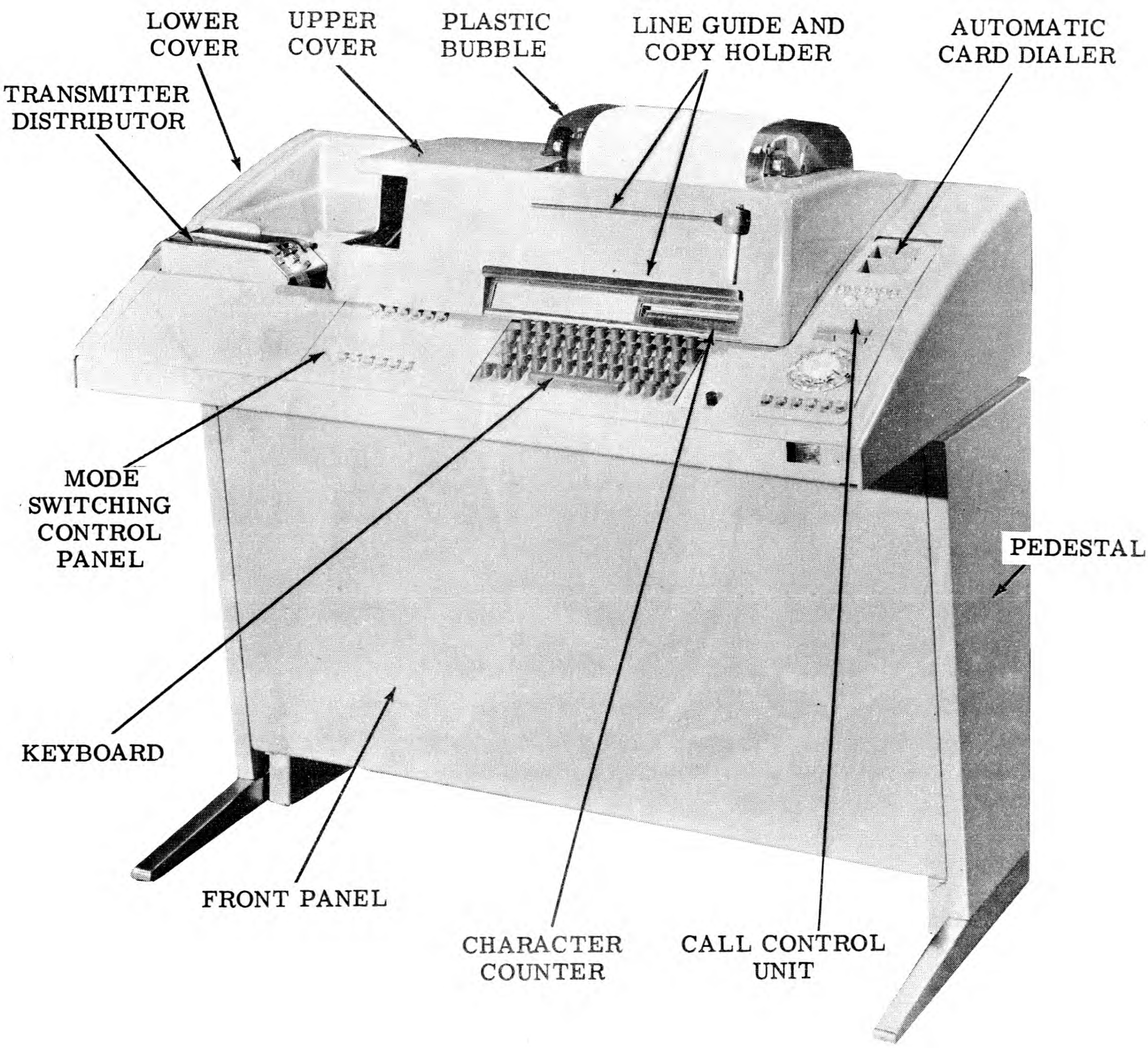


Figure 2 - 35 Automatic Send-Receive Set
(Switched Network Service)

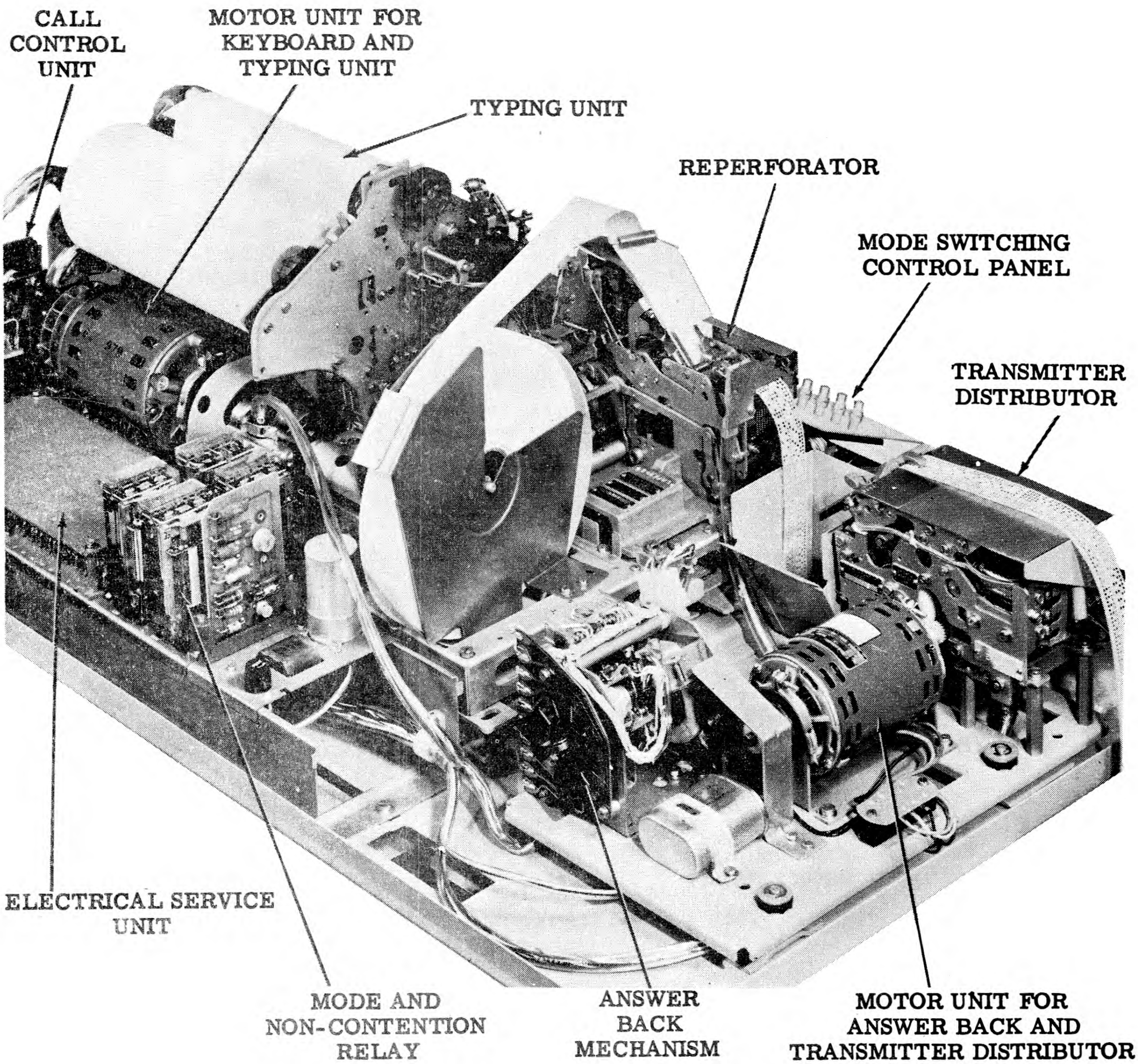


Figure 3 - 35 Automatic Send Receive Set Components

mounting facilities for the components of the set, including a shock-mounted cradle onto which the keyboard base is secured. A removable panel on the front of the pedestal provides access to the apparatus mounting rack, which is used to support any necessary relay assemblies or a data set.

(b) The cover is also of sheet metal construction, and consists of a lower cover and a hinged upper cover. In an earlier model the cover rests on four rubber vibration isolators, three of which have locating pins to align it with the pan. In later models the cover is hinged and designed to pivot clear of enclosed equipment when opened. Hinge pins can be separated for complete removal of the cover. The upper cover is hinged to the lower cover to provide access to the equipment for changing the paper supply and ink ribbons. An information and character counter window is located in the lower front of the upper cover. A clear plastic bubble is located on top of the upper cover for viewing the copy and observing operation of the typing unit. A laminated glass window, in front of the plastic bubble, enables the operator to view the copy as it is typed. The rear edge of the glass provides a paper tearing surface for removal of typed copy. A window is also located at the left front of the upper cover for viewing the perforated tape, and an adjustable metal edge is provided for tearing the tape.

2.02 The cabinet is equipped with a copyholder and line guide for short copy, and copy illuminating lamps for the typing unit and reperforator areas.

KEYBOARD (Figure 2)

2.03 The keyboard mounts on the cradle assembly of the cabinet pan, and provides support for the motor unit, typing unit, reperforator, and intermediate gear assembly of an ASR Set. The front of the keyboard extends forward beyond the edge of the cabinet pedestal to place the typing keys in a convenient operating position. The keys are positioned in a four row arrangement with most punctuation marks and control symbols indicated as upper keytop characters. Refer to the appropriate section for an explanation of the character code arrangement for the keytop control and graphic symbols.

2.04 The keyboard incorporates code selecting and signal generating mechanisms (including parity - see 3.02), and signal line and power line circuits. Motive power for activating the keyboard is derived from the motor unit and intermediate gear assembly, and through a gear arrangement on the typing unit main shaft. The reperforator receives its driving power from the motor unit via a jack shaft and gearing arrangement located on the keyboard.

REPERFORATOR (Figure 2)

2.05 The reperforator is located at the left front corner of the keyboard. It fully perforates eight level tape supplied from a reel located behind the unit. In sets that are equipped with a typing reperforator the message is also printed on the perforated tape. Chad from the punched tape is diverted from the punch head to a chad container located below the ASR cabinet pan assembly.

2.06 The reperforator operates in response to line signals or signals generated by keyboard operation. The selection of operating mode is controlled by pushbuttons on the automatic mode switching control panel in sets used with telephone switched networks and by a rotary mode switch to the left of the keyboard in sets used in standard (dc or private line) applications.

TYPING UNIT (Figure 2)

2.07 The typing unit incorporates the necessary electrical and mechanical elements to translate the signaling code combinations into mechanical actions which print the messages and perform functions incidental thereto. The typing unit is mounted centrally on the keyboard, in front of the motor unit and intermediate gear assembly.

2.08 Code signals are applied to a two coil magnet associated with a selecting mechanism which interprets the signals and controls the mechanical action involved in typing a character or performing a required function. Means are provided for orientating the selector to the received signal. The ac motor is geared to the main shaft of the typing unit by way of the intermediate gear assembly mentioned in 2.04. Typing and various functional sections of the typing unit are activated by individual clutches.

2.09 Typing is produced by type pallets which are arranged in a small type box. In operation the type box moves across the paper and presents the proper type pallets to the printing hammer while the platen remains stationary. The pallets are driven forward against the inked ribbon and paper to print characters.

2.10 The friction feed typing unit uses single or multicopy paper from a five inch diameter roll. The roll of paper is mounted between the side frames of the typing unit, and passes around the platen, which is a cylinder free to rotate on its axis. A low paper switch is operated when a low paper supply condition exists. In addition to the above functions, built in facilities in a function box permit the operation of associated contacts on predetermined code combinations for certain recognition or remote functions.

2.11 The sprocket feed typing unit uses form feed paper. The forms enter the cabinet through a slot at the rear of the cabinet. The supply of form feed paper is kept on a form supply and accumulating shelf attached to the rear of the cabinet, on sets so equipped. The forms are advanced around the platen by sprockets located at both ends of the platen. Vertical and horizontal tabulation and remote form feed-out are additional features of this typing unit.

2.12 Selector magnet signal lines and function box contact lines are connected to their associated circuits by way of a connector receptacle located on the right frame of the typing unit towards the rear.

TRANSMITTER DISTRIBUTOR BASE ASSEMBLY (Figure 2)

2.13 The transmitter distributor base assembly provides mounting facilities for a transmitter distributor and a motor. In switched network sets, the answer-back mechanism is also mounted on this base assembly. The base is located to the left of the keyboard in the cabinet, and is secured to the cabinet pan by means of four studs with flexible rubber mounts for vibration isolation.

2.14 The transmitter distributor base assembly consists of a sheet metal mounting plate, an answer-back assembly if so equipped, a motor and pinions for driving the answer-back and the transmitter distributor units, electrical terminal board and connector facilities, and mounting parts for a transmitter distributor unit.

A. Motor

2.15 The motor for the transmitter distributor is a four pole, 1/100 horsepower, 60 cycle, 1800 RPM synchronous type. It is mounted on the base assembly between the answer-back and transmitter distributor units, and furnishes driving power for each. In standard sets operation of the motor is controlled by the rotary mode switch. In switched network systems the motor may be controlled remotely or by operation of the proper push button on the mode switching control panel.

B. Answer-Back Assembly

2.16 The answer-back feature is found on sets used in switched network systems. The answer-back assembly is located at the rear of the transmitter distributor base assembly. Its main components are a coded message drum, a main shaft, and a distributor assembly. The answer-back receives its motive power from the motor via the intermediate gear assembly on the transmitter distributor base.

2.17 The answer-back assembly is designed to distribute, upon receipt of a WRU (who are you) or HERE IS signal, a predetermined sequence of characters which serves to identify the station. A maximum of 20 characters may be transmitted. The character sequence is determined by the manner in which the message drum is coded by the customer.

TRANSMITTER DISTRIBUTOR (Figure 2)

2.18 The transmitter distributor is located at the front of its base assembly, and is supported by three mounting studs. The unit receives its motive power from the motor mounted toward the rear of the base. (This is the same motor that drives the answer-back assembly.)

2.19 The transmitter distributor consists, basically, of a sensing mechanism to read the eight level perforated tape, and a distributing mechanism to transmit the coded message over the signal lines. A control lever is located near the right rear corner of the unit to manually operate the mechanism while loading and positioning the tape into the reading head. This control lever detents in any one of three positions; run, stop, and free, in most units. In other units the lever is spring biased to the RUN position and must be held manually to the FREE position while loading tape. Operation of the transmitter distributor is controlled in standard sets by the position of the rotary mode switch. In switched networks application it is controlled by selection of the proper pushbutton on the switching control panel or remotely when the proper code combination is received at the set.

ELECTRICAL SERVICE UNIT

2.20 The electrical service unit is mounted on the cabinet pan directly behind the typing unit. It consists of a main chassis and a number of mounting plate assemblies. Each mounting plate assembly consists of a functional group of components. The assemblies mount on the chassis and are interconnected, as required, with strapping.

2.21 In general, the features contained in the electrical service unit for standard sets consist of:

(a) A basic facilities assembly containing the convenience and copylight receptacles main fuse, power and signal line terminal board, copylight transformer, line-local relay, and power panel connector.

(b) A power cord.

(c) A strapping field which provides interconnection facilities between the components of the set, and between the components and the signal line.

(d) Two selector magnet drivers, required for keying the page printer and reperforator selectors.

2.22 Features contained in the electrical service unit for switched network sets consist of:

(a) Convenience and copylight receptacles and transformer, and a main terminal board.

(b) The strapping field which provides for interconnection of various set components.

(c) Mode switching control panel and cable assembly.

(d) Noncontention relay and wiring field.

(e) Signal regenerator circuit components for outgoing signal improvement.

(f) Selector magnet driver assembly and power supply for keying the reperforator selector.

(g) Transmitter distributor control circuits.

CALL CONTROL UNIT

2.23 The call control unit is a component required in switched network service. Used in conjunction with a data set, it provides facilities for initiating, accepting, controlling, and completing calls. The assembly is located to the right of the page printer, and is mounted on the cabinet pan. It extends from the front to the rear of the set, and is higher at the rear than at the front.

2.24 A speaker, for monitoring the progress of calls, is mounted at the front of the unit. (An optional hand held receiver may also be used.) Immediately behind and above the speaker is a row of six illuminating pushbuttons designated from left to right: ORIG (originate), CLR (clear), ANS (answer), TST (test), LCL (local), and BUZ-RLS (buzzer release).

2.25 Behind the front row of illuminating pushbuttons is a rotary or touch-tone dialing mechanism for making connections with called stations through dial switching facilities. Behind the dial mechanism is a cluster of four controls: a combined BRK-RLS (break-release) lamp and pushbutton (white, upper), a REST lamp (amber), and an OUT OF SERVICE switch.

2.26 In addition to the above, the call control assembly includes the following features:

(a) A ringer mechanism to signal incoming calls.

(b) A transistorized selector magnet driver to amplify the incoming line signal for efficient operation of the selector mechanism.

(c) A transistorized amplifier to drive the call monitoring speaker.

(d) A volume control to set speaker level.

(e) Fuses, for protection of the main power and selector magnet circuits.

(f) A cable termination area at the rear.

(g) An ac power cord, with polarized plug, for connection of the set to the power line.

(h) Provisions for mounting an automatic pulsing or tone card dialing mechanism.

MOTOR UNIT

2.27 The motor unit consists of a 1/20 horsepower synchronous motor cradled in a mounting bracket assembly. It is equipped with an overload device to protect the motor. The motor assembly is located in the right rear corner of the keyboard base and supplied rotary motion for the keyboard, typing unit, and reperforator mechanisms.

3. ELECTRICAL REQUIREMENTS

POWER REQUIREMENTS

3.01 The ASR Set operates on 115 volts ac ± 10% single phase, 60 cycles ± 0.5 cycle. The power cord is a three pin, grounded type, and has a length of six feet external to the cabinet.

SIGNAL REQUIREMENTS

3.02 Data is received or transmitted using the ASCII eight level data interchange code. The data interchange code is an eleven unit, equal bit code. The start bit, always transmitted as spacing, eight intelligence bits, and a stop pulse two bits in length and always transmitted as marking for synchronization purposes, make up the code. Intelligence bits one through seven may be either marking or spacing depending upon the character or function to be transmitted. The eighth bit is always marking unless the set is equipped to provide an even parity output. In the event even parity is provided, the eighth bit may be either marking or spacing in order to always supply an even number of marking pulses for each code transmitted. (This is a feature of sets that provide error detection.) At an operating speed of 100 wpm, each bit is 9.09 milliseconds in length. See the applicable section for a detailed description of the code.

3.03 The dc signal received over the incoming line is an on-off (mark-space) current type which varies from zero ampere (spacing) to 0.020 ampere (marking). In sets used in tone modulation circuits a data set provides the 0.020 ampere dc signals by demodulating ac tones that have been transmitted over telephone lines.

3.04 The dc signals from the incoming line or from the data set are amplified to 0.500 ampere marking and zero ampere spacing pulses by the selector magnet driver.

4. OPERATION

4.01 The operation of 35 type sets differs from set to set, depending upon the equipment complement and the service for which the set is designed. In general, two types of application will be discussed: sets that operate over standard private lines and whose signal is transmitted as dc pulses, and sets that operate over telephone networks and employ a call control unit in conjunction with a data set to transmit by means of tone (or frequency) modulation.

STANDARD OPERATION (PRIVATE LINE)

4.02 The 35 ASR Set for private line applications is capable of sending and receiving data over a 20 milliampere half duplex or full duplex (optional) signal line. The input signals are converted to 500 milliampere signals, necessary to key the typing unit and reperforator selectors, by two solid state selector magnet drivers. The set may be equipped with a friction feed typing unit or a sprocket feed typing unit. The typing unit monitors all traffic which is transmitted from the keyboard or transmitter distributor, or received from a distant terminal. A manually operated rotary mode switch provides the desired mode of operation.

4.03 Data is transmitted from the keyboard or transmitter distributor using the eight level American Standard Code for Information Interchange (ASCII). The sending units insert additional marking pulses wherever necessary to keep the number of marking pulses even. This results in an even parity output. The code received or transmitted consists of neutral binary serialized signals.

4.04 The set is able to transmit on line and prepare subsequent traffic off line simultaneously. Other coded data may also be transmitted by the transmitter distributor or received by the reperforator.

A. Manual Controls

4.05 To the right of the keyboard is located the power panel which supports the end of line indicator (red), rotary power switch, and a BREAK switch and lamp combination (white). To the left of the keyboard is mounted the rotary mode switch.

(1) The set is turned on by rotating the power switch to the ON LINE position for operating on the external signal line or to LOC for operation on the local signal line.

(2) The BREAK pushbutton is used to immediately stop transmission over the line. It blinds the keyboard signal generator output, opens the transmitter distributor clutch trip magnet circuit, and illuminates the BREAK lamp. (It also operates the electrical motor control of sets on the line that are so equipped.) The ability to transmit must then be restored by operating the BRK RLS key on the keyboard.

(a) The keyboard signal generator output is blinded only when the set is in the K and KT modes.

(b) A BREAK condition does not affect the sets ability to monitor traffic.

(3) The position of the mode switch determines the mode of operation of the set. The set can be switched into the modes when either on line or in local condition. The positions are as follows:

K - keyboard
KT - keyboard tape
T - tape
TTS - tape - tape send
TTR - tape - tape receive

The last two positions, TTS and TTR, may be disabled where not applicable.

B. Modes of Operation

4.06 The following discussion of the modes of operation assumes a half duplex signal line.

4.07 K (Keyboard) Operation: The keyboard and typing unit are connected to the external line. Transmission is provided from the keyboard and is monitored by the typing unit. The transmitter distributor is disabled and the reperforator is placed on the auxiliary local circuit. LOC operation is the same with the keyboard and typing unit connected to the local signal line.

4.08 KT (Keyboard-Tape) Operation: The keyboard, typing unit, transmitter distributor, and reperforator are connected to the external signal line. When the transmitter distributor is transmitting, the message is copied by the typing unit and a duplicate tape punched by the reperforator. The keyboard should not be operated when the transmitter distributor is sending. When the keyboard is transmitting, the message is copied by the typing unit and tape is punched by the reperforator. In this case the transmitter distributor should not be operated. LOC operation will be the same except the units are connected to the local signal line.

4.09 T (Tape) Operation: The transmitter distributor and typing unit are connected to the external signal line. The typing unit copies what is being transmitted from the transmitter distributor or received from a distant station. The keyboard and reperforator are on the auxiliary local circuit. Tape can be prepared on the reperforator from the keyboard without interfering with transmission on the external signal line. LOC operation will be the same except the transmitter distributor and typing unit are connected to the local signal line.

4.10 TTS (Tape-Tape Send) Operation: The transmitter distributor transmits data other than ASCII coded data over the external signal line. The typing unit is blinded to outgoing and incoming traffic. The keyboard and reperforator are connected in the auxiliary local circuit and can be used to prepare subsequent traffic.

4.11 TTR (Tape-Tape Receive) Operation: The reperforator is connected to the external signal line to receive from a distant station data other than ASCII coded data. The transmitter distributor is disabled, the typing unit is blinded and the keyboard is in the auxiliary local circuit. TTR and TTS modes in LOC operation provide no functional use.

C. Set Functions

4.12 The set includes certain nonprinting functions necessary for controlling both the local station equipment and distant station sets. These functions are accomplished by depressing the CTRL key and the desired function key on the keyboard simultaneously.

(a) Local and distant station equipment functions:

(1) TAB (horizontal tabulation), VT (vertical tabulation), and FORM (form-out) functions are used only in sets containing sprocket feed typing units. The function occurs at both the sending and receiving stations.

(2) A signal bell operates through function box make contacts in the typing unit at both the sending and receiving stations.

(b) Local station equipment functions:

(1) Operation of the CR (carriage return) key releases the type box carriage allowing it to return to the left.

(2) The LOC LF (local line feed) key, when depressed, causes the paper or form to feed out of the printer at an accelerated rate.

(3) The REPT (repeat) key and any other key associated with a character depressed simultaneously results in repeated transmission of the character.

(4) The LOC BSP (local backspace) key, when operated, causes the backspace magnet on the reperforator to energize, operating the backspace mechanism. The tape is backspaced one character each time the key is operated.

(5) Operation of the SHIFT key simultaneously with any other key having a graphic symbol on the upper half of the keytop results in transmission of that code combination.

(6) The BREAK key when operated causes the keyboard to be electrically shunted.

(7) The BRK-RLS key allows the receive-break switch to return to its unoperated position, unblinding the keyboard.

(8) ALT MODE (alternate mode) key provides other functions (customer option) in station equipment. Pressing ALT MODE key before operating the desired function key will provide the nonprinting function.

D. Variable Features (Options)

4.13 The electrical motor control is an option that allows the customer to have the set controlled remotely by other stations on the line, giving unattended operation. The motor control is placed in series with the signal line so that when a sending station transmits a "break" the motor control operates to turn the set on (see 4.05 (2)). After message transmission is completed, the sending station turns the local stations off by sending the EOT (end-of-transmission) code. In this system the rotary power switch remains in the ON LINE position during operating hours.

4.14 Full duplex operation permits receiving messages and transmitting them at the same time without interference between the two signals. This is accomplished by electrically separating the sending and receiving loops of the set by changes in the wiring on the basic facilities assembly in the electrical service unit and connecting the loops to the appropriate duplex signal lines.

OPERATION OF SWITCHED NETWORK SERVICE SETS

4.15 A more detailed explanation of operation of these sets will be found in the section describing the 35 Call Control Unit.

4.16 A call is originated by depressing the ORIG pushbutton. The ORIG lamp will light and remain on for the duration of the call. A dial tone (or busy signal) will be heard over the speaker in the set. Upon receipt of the dial tone, the operator may proceed to dial the desired telephone number. The progress of the call is monitored over the speaker. If the line is busy, depress the CLR (clear) pushbutton and try again. Dialing may be accomplished as follows, depending upon the equipment of a particular set:

- Rotary dial - used in the same manner as a telephone dial.
- Pulsing card dial - a card with the desired station's number punched in it is inserted into the card slot and pushed in. After the START bar is depressed the number is automatically dialed as the card advances out of the slot. Depress RELEASE bar to remove card.
- Touch-tone dial - depress the numbered pushbuttons in correct sequence. Each digit creates a tone which can be heard over the loudspeaker.
- Touch-tone card dial - operates same as pulsing card dial except the card is released by depressing the START bar a second time.

4.17 When a distant station is called, the ringer will momentarily sound and the set will automatically answer. The ANS (answer) lamp will light, and remain on for the duration of the call. If the set is in LCL (local) mode, the automatic answer feature is disabled, and the ANS pushbutton must be depressed in order to answer the call.

4.18 Other features of the set include the following:

(a) Provision is made for insertion of an auxiliary receive only typing reperforator (ROTR) selector magnet driver in series with the typing unit selector magnet driver. In this way, a perforated and typed record of message transaction can be prepared on tape. A detailed description of the ROTR Set will be found in the appropriate section.

(b) The OUT OF SERVICE switch will make the set unresponsive to incoming calls. The OUT OF SERVICE lamp will light and the ringer becomes inoperative. As an option the station can be made to appear off hook (busy) to the central office.

(c) Paper handling controls of the ASR Set provide low paper alarm circuits, a paper out disconnect feature, and a form control and tabulating system.

(1) Low paper alarm is given by a buzzer. A BUZ RLS (buzzer release) key silences the buzzer and lights the BUZ RLS lamp. The paper supply must be replenished and the key released to return the set to normal.

(2) The automatic answer circuit is disabled by operation of the low paper switch or when the tape supply runs low in the auxiliary ROTR set. However, an operator can over-ride the disabled automatic answer circuit by manually answering.

(3) The paper out disconnect feature in sprocket feed typing units performs the same function as the CLR key. It is used in conjunction with low paper contacts, so that no calls will be accepted following the disconnect until paper is replaced in the set.

(4) The form feed operation in a sprocket feed typing unit is initiated from the function box following recognition of the FORM code operation. It is also tripped whenever the data set disconnects, unless the paper is already between forms.

(5) The sprocket feed typing unit is also equipped with horizontal and vertical tabulation mechanisms which are controlled by code recognition in the function box.

(d) The WRU (who are you) key (E), when held down simultaneously with the CTRL (control) key, allows either station to operate the distant stations answer-back.

(e) The RU (are you) key (F), when held down with the CTRL key, allows a station to communicate with a distant station equipped with this confirmation type answer-back mechanism. It is not automatic and depends upon operation of certain contacts in the function box of the receiving typing unit to trip the abbreviated answer-back.

(f) The HERE IS key allows a station to send its own answer-back code combination to the distant station. This key should be blocked at RU stations to prevent manual answering of an invalid RU sequence.

(g) The BREAK pushbutton is used by either station to immediately stop transmission without losing the connection. The BREAK will blind both sending and receiving keyboards so no transmission can occur. The condition is indicated by the lighting of the BREAK lamp in the BRK RLS pushbutton. The BREAK pushbutton should not be operated when the set is in LCL mode.

(h) The RESTRAIN lamp lights to warn the typist to slow down when communicating with a slower speed TWX station. If the conversion apparatus is overloaded, a BREAK signal will be generated. This BREAK is distinguished by the fact that both the RESTRAIN and BREAK lamps are lighted. To restore transmission, the BRK RLS pushbutton must be operated.

(i) The EOT (end-of-transmission) code combination is transmitted from the keyboard to disconnect a call. This operates contacts in the function boxes of the sending and receiving typing units to provide a fast disconnect by the data set.

(j) To use the set for practice typing and other off-line functions, depress the LCL (local) pushbutton. This will turn the motor unit on and disable the automatic answer-back mechanism. The ringer will signal any incoming calls. These can be answered by depressing the ANS pushbutton.

(k) If the TEST key is operated while the set is connected to a test center, the message sent by the test center will be turned around and sent back for analysis.

(l) The automatic mode switching control panel, at the left of the keyboard, furnishes the operator with the facilities to:

(1) Prepare tape while transmitting or receiving traffic. (The TTS and TTR button extensions are blocked where this feature is not used.)

(2) Transmit or receive traffic using codes foreign to the equipment, i.e., codes other than ASCII.

(3) Receive traffic on tape and by page copy simultaneously.

(4) Revert to a common mode of operation upon clearing the set or on a break or call disconnect.

35 TYPING UNIT

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section has been revised to include recent engineering changes and to add late 35 type equipment.

1.02 In the descriptions and principles of operation used in this section, a basic printer mechanism equally applicable to both units covered is presumed. Unless specifically limited to a certain unit, all descriptions and

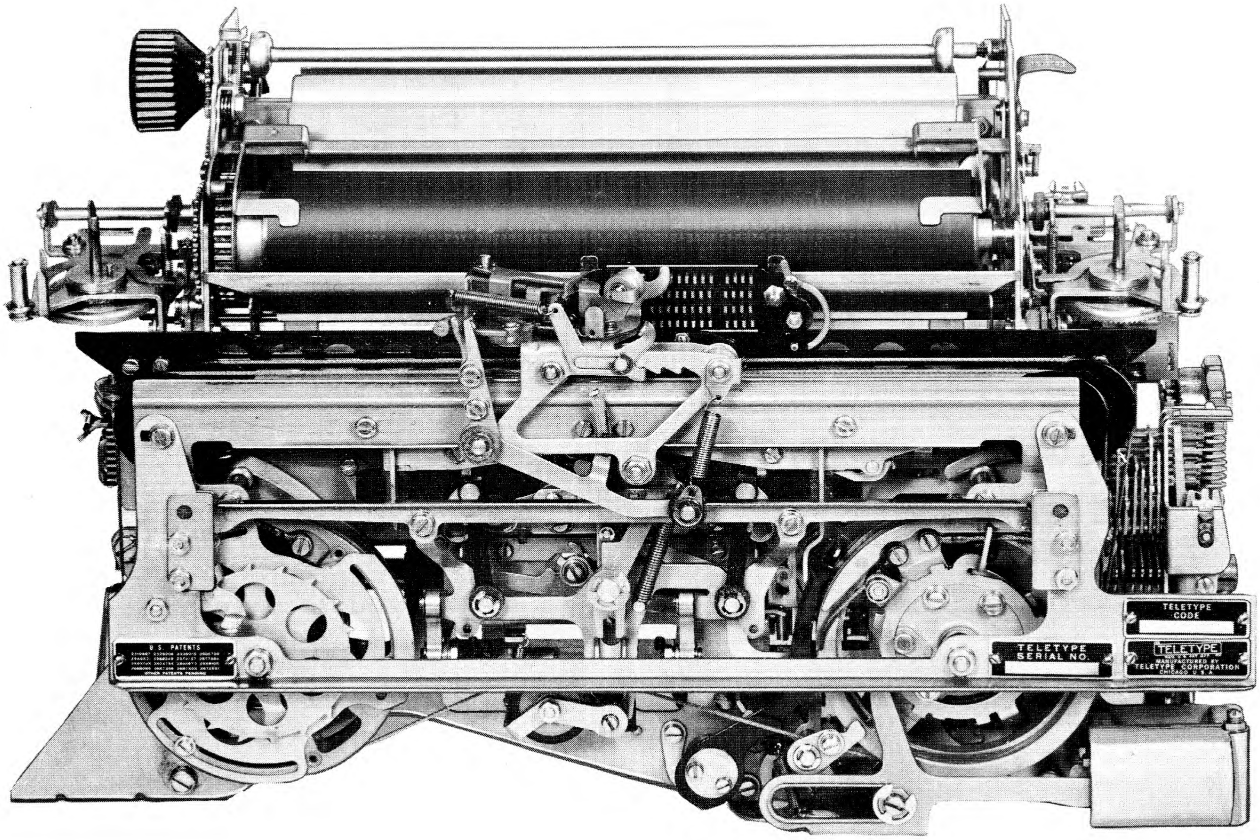


Figure 1 - Friction Feed Typing Unit

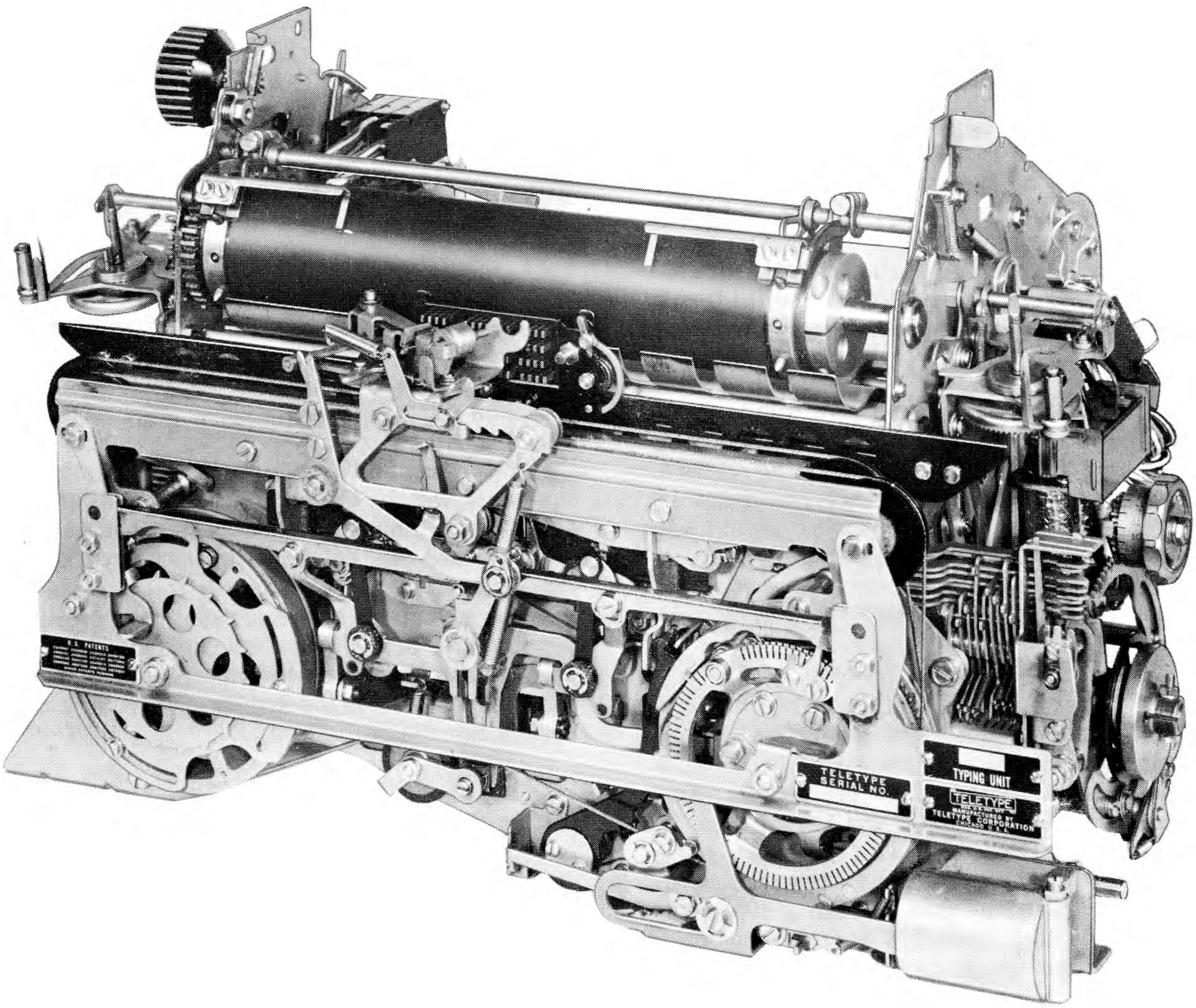


Figure 2 - Sprocket Feed Typing Unit

illustrations may be considered as pertaining to both the friction feed typing unit and the sprocket feed typing unit. Variable or optional features of either or both printers are considered separately after discussion of the basic printer.

1.03 Unless stated to the contrary, references in the text to left or right indicate the operator's right or left, facing the front of the unit, the selector mechanism at the right, and the type box at the front. In illustrations, unless specifically labeled otherwise, it is assumed that the equipment is being viewed from the front. Pivot points are shown in the drawings by circles or elipses which are solid black to indicate fixed pivot points and crosshatched to indicate floating points.

1.04 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.

1.05 The typing unit is an electro-mechanical device to translate eight level signal code combinations sequentially received in an 11.0 unit transmission pattern into mechanical actions which print the message and perform functions incidental thereto. The friction feed typing unit (Fig. 1) prints the message upon single or multiple copy paper from a five inch diameter roll. The sprocket feed typing unit (Fig. 2) prints the message on flat folded form feed paper with marginal perforations spaced to fit the sprocket teeth on the typing unit platen.

1.06 Motive power for operation of the typing unit is received through the intermediate gear mechanism of the base or keyboard base on which the unit is mounted. Power is applied to the driven gear, centrally located on the main shaft at the rear of the typing unit. The main shaft rotates at a constant speed to operate the equipment at speeds of 60, 75 or 100 words per minute, depending upon external gear ratios.

1.07 Six all-steel internal expansion clutches convert the rotary motion of the main shaft to the linear mechanical requirements for operation of the printer. The clutches rotate with the main shaft when engaged and do not rotate when disengaged (latched). From left to right in their installed position on the main shaft, the clutches control the type box, line feed, spacing, function, code bar and selecting mechanisms, respectively.

1.08 The line feed and spacing clutches on the friction feed typing unit are each provided with three sets of stop lugs (six sets on the sprocket feed unit), permitting operation of associated mechanisms through one-third (or one-sixth) of a revolution of the main shaft each time they are engaged.

1.09 Clutch engagement usually is initiated by an incoming electrical signal code which is sensed by the selecting mechanism. The selector, code bar and function clutches operate on each incoming signal. The spacing and printing clutches normally operate on each incoming signal, but these operations may be suppressed if the code combination received represents a function for which there is no graphic (printed) equivalent. The line feed clutch normally does not operate except in response to a code for the line feed function. Both the line feed and spacing clutches, however, may be operated independently of all other mechanisms by a direct mechanical linkage to the associated keyboard or base for local line feeding or spacing or carriage return functions.

1.10 The selecting mechanism, in addition to the clutch, includes a two-coil magnet in series with the external signal line. The magnets are operated on a 0.500 ampere circuit from a selector magnet driver in the electrical service unit. A range finder is used to refine the mechanical orientation of the selector to the signaling code.

1.11 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.

1.12 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.

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

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

1.15 The stunt box operates in response to permutations equivalent to non-typing function code combinations set up in the code bar mechanism. The stunt box mechanisms initiate either mechanical or electrical switching sequences for operating the associated function or for the control of external equipment.

PHYSICAL DESCRIPTION (Fig. 3 and 4)

1.16 The mechanisms and sub-assemblies of which the typing unit is constructed are mounted upon or suspended between the left and the right side plate assemblies and the front plate assembly. The selecting mechanism is mounted on the right side plate. The main shaft, code bar mechanism, platen and paper feed mechanism, type box and stunt box are suspended between the side plates. The type box positioning and printing mechanisms are located in the front plate assembly.

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

1.18 The code bar mechanism consists of the code bar positioning mechanism, which is operated through the selector cam clutch, the code bars, which operate the type box positioning and stunt box selection mechanisms, and the printing suppression mechanism. The suppression mechanism is located at the left end of the code bars.

1.19 The stunt box mechanism, when one of its operating components is selected by the code bar mechanism, is operated by a function bail and a stripper bail. Completion of the selected function is accomplished either by electrical switching, through various switches mountable on top of the stunt box, or by direct mechanical linkage to printer mechanisms, such as the carriage return and line feed functions.

1.20 The line feed mechanism is operated through the line feed clutch and levers and gears mounted on the left side plate. On sprocket feed typing units so equipped, the vertical tabulation mechanism is also mounted on the left side plate, as is a solenoid operated form feed mechanism. Both mechanisms operate through the line feed clutch.

1.21 The printing mechanism located in the front plate assembly is operated by a shaft suspended between the side plates. The mechanism includes horizontal positioning mechanisms operated by the code bars, spacing mechanisms and carriage return, and the print hammer 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 on units so equipped, tabulates horizontally, or returns the type box to the left hand printing margin.

1.22 The type box is positioned vertically by a code bar operated linkage in the right side frame and horizontally by the front plate mechanism. The removable type box, with individually removable pallets for each graphic character representation required in the signal code, moves from left to right in front of the platen. As each code combination is set up in the code bar mechanism, the vertical and horizontal positioning mechanisms and the shift mechanism locate the selected graphic character in position for printing.

1.23 A ribbon feed mechanism passes an inked fabric ribbon between the type box and the paper. The ribbon mechanism advances the ribbon horizontally when each character has been printed. The mechanism automatically reverses the direction of ribbon feed when one of the two ribbon spools has been emptied.

1.24 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

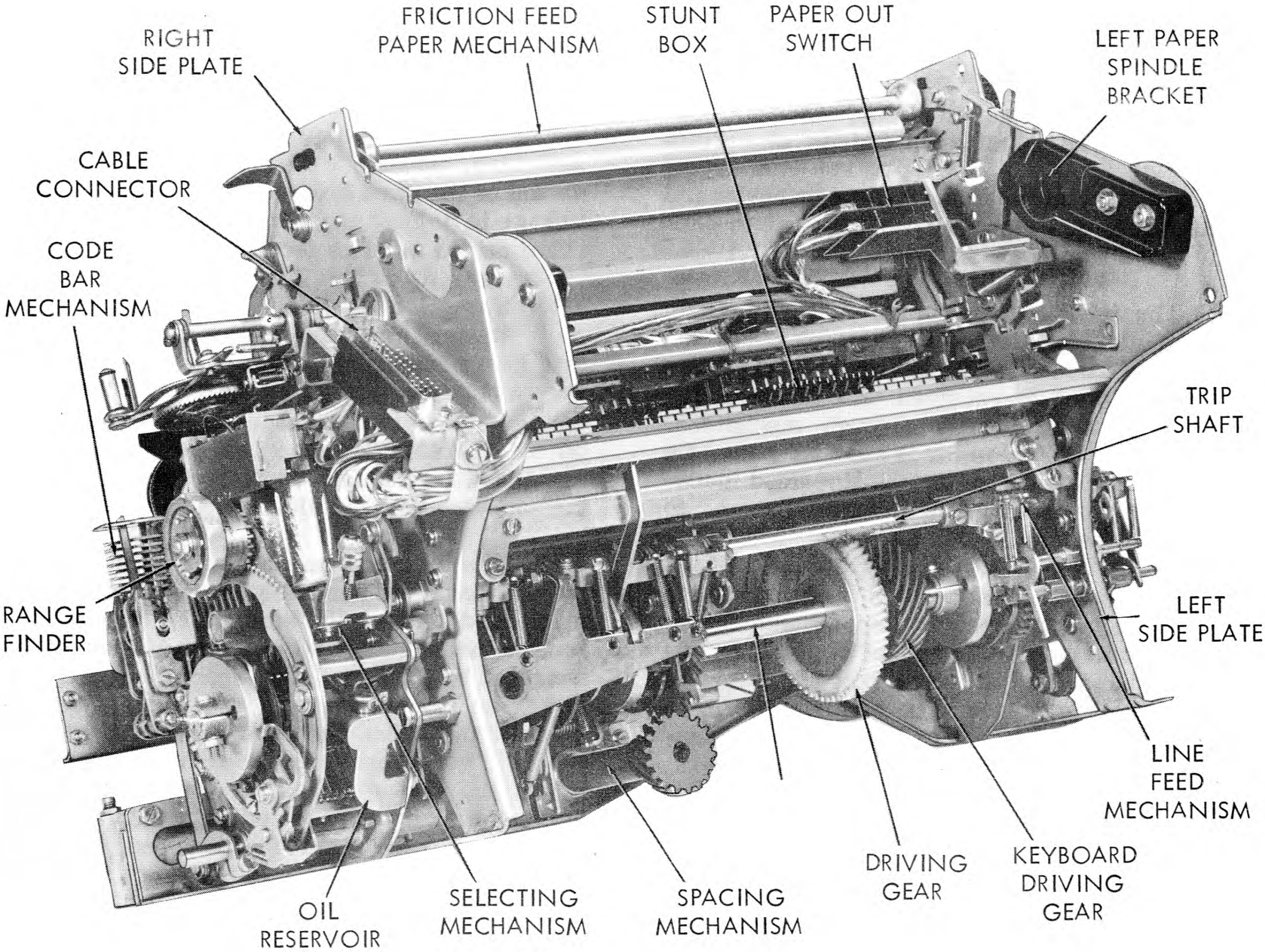


Figure 3 - 35 Typing Unit (Friction Feed) (Right Rear View)

at the rear of the printer either by friction feed or on sprockets located on the ends of the platen.

1.25 Mechanical off-line control of line feed and carriage return functions from the local base or keyboard base is accomplished through linkage of the base and the function trip mechanisms involved. A solenoid operated form feed mechanism at the rear of the left side plate is peculair to sprocket feed typing units so equipped.

TECHNICAL DATA

A. Approximate Dimensions

Width . . . . 15-1/2 inches
Depth . . . . 10-1/2 inches
Height . . . . 9-3/4 inches
Weight
Friction Feed . . . . 19 pounds
Sprocket Feed . . . . 22 pounds

B. Signal

Code . . . . Sequential, 11-unit, **Start-Stop**
Current . . . . 0.500 amperes

C. Electrical Requirements

1.26 All electrical requirements for operation of the 35 typing unit are supplied through associated equipment, such as a base, keyboard base or electrical service unit. Refer to the

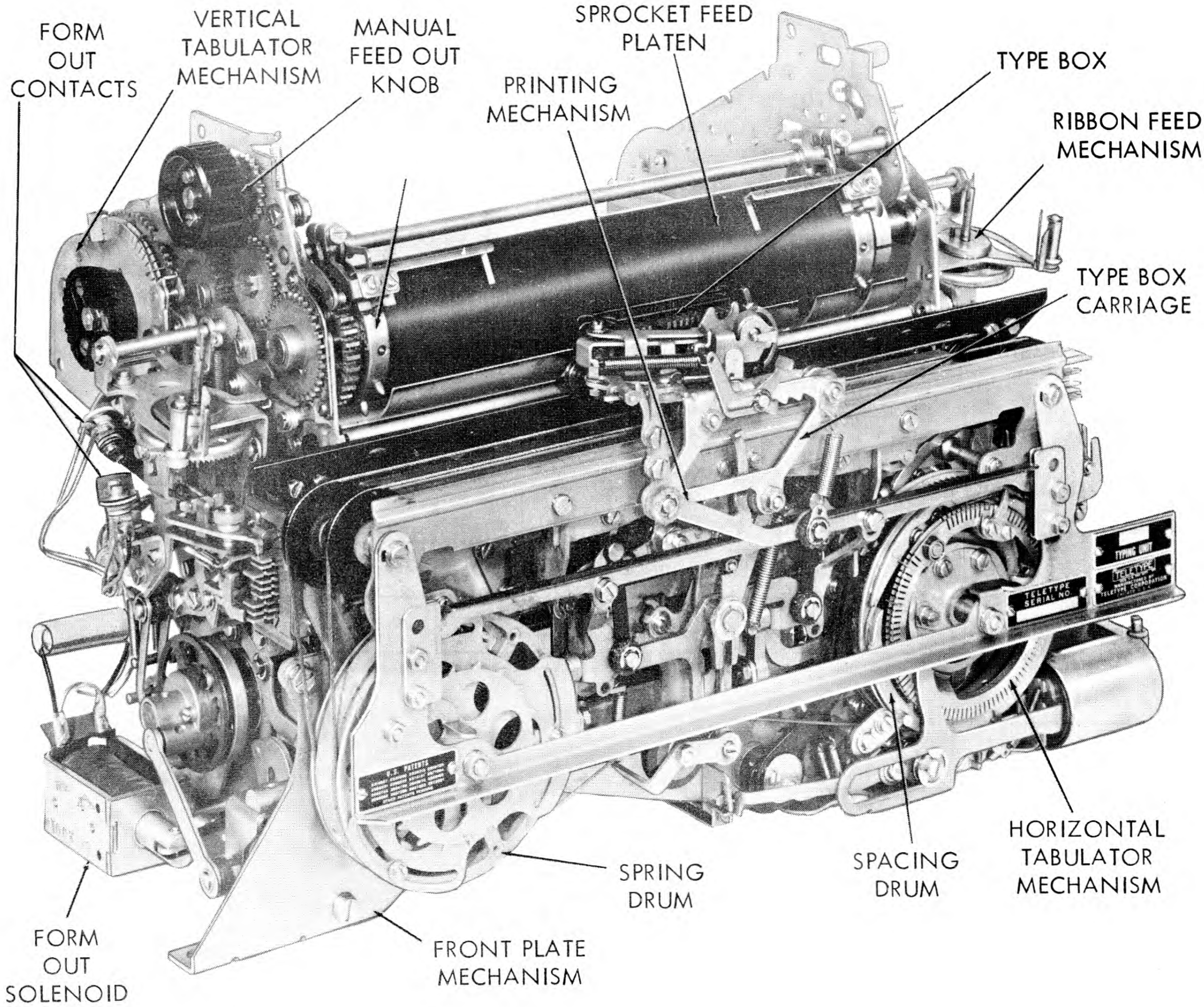


Figure 4 - 35 Typing Unit (Sprocket Feed) (Left Front View)

applicable section for a detailed discussion of the signal and power input. All electrical connections to the typing unit are made through a cable connector mounted just above the selecting mechanism on the right side plate.

1.27 A 500 milliampere DC signal current is required to operate the selector magnets.

1.28 Electrical contacts for certain variable features, such as the paper out alarm and the form out alarm, horizontal tabulator, vertical tabulator and form out and the local form out solenoid require 110 v ac circuitry. The circuits to stunt box switching contacts are generally 110 v ac, but the specific nature of these circuits depends upon the external controls operated by the contacts.

2. PRINCIPLES OF OPERATION

2.01 The basic function of the 35 typing unit is to record in page printed form information received from a signal line in the form of a signaling code combination which represents characters or functions. The typing unit translates these electrical code combinations into mechanical motions which imprint the message or initiate the indicated function, such as line feed, carriage return, or signal bell. Printing is accomplished through an inked ribbon upon paper rolled around a horizontally stationary platen while the type and printing mechanism move from left to right across the page. All operations of the typing unit are performed automatically in response to input signal code combinations. A few local off-line functions such as line feed, carriage return or form out may be initiated independently of the signal line from the local keyboard or base mechanism.

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

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

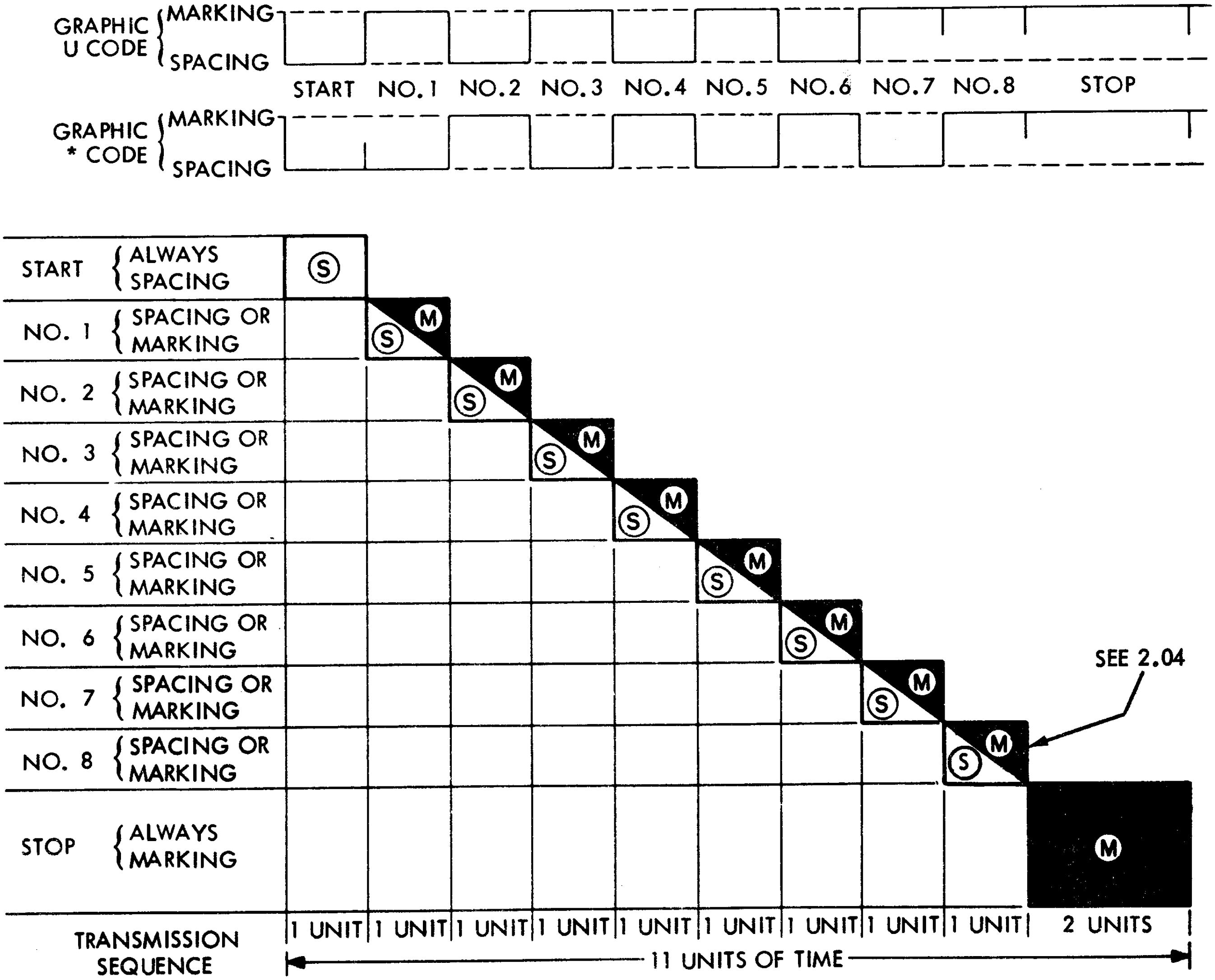


Figure 5 - 11.0 Unit Transmission Pattern Signaling Code

SIGNALING CODE (Fig. 5)

2.04 Information is received by the typing unit in the eight level American Standard Code for Information Interchange (ASCII). Each character 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 during which no current flows as spacing. Each combination includes eight bits that carry the intelligence, each of which may be either marking or spacing (except the eighth bit). The eighth bit is always marking unless the set is equipped to provide an even parity output. With even parity, the eighth bit may be either marking or spacing in order to always provide an even number of marking pulses for each combination. The intelligence bits are preceded by a start bit (always spacing and are followed by two stop bits (always marking). Thus each combination consists of 11.0 units of time (referred to as an 11.0 unit transmission pattern). The start and stop bits ensure synchronization between the transmitting and receiving equipment by bringing the receiving equipment to a complete halt at the end of each combination.

2.05 The code representations for the graphics U and * are illustrated in Fig. 5. in these combinations, alternate marking and spacing condition for the intelligence bits are required.

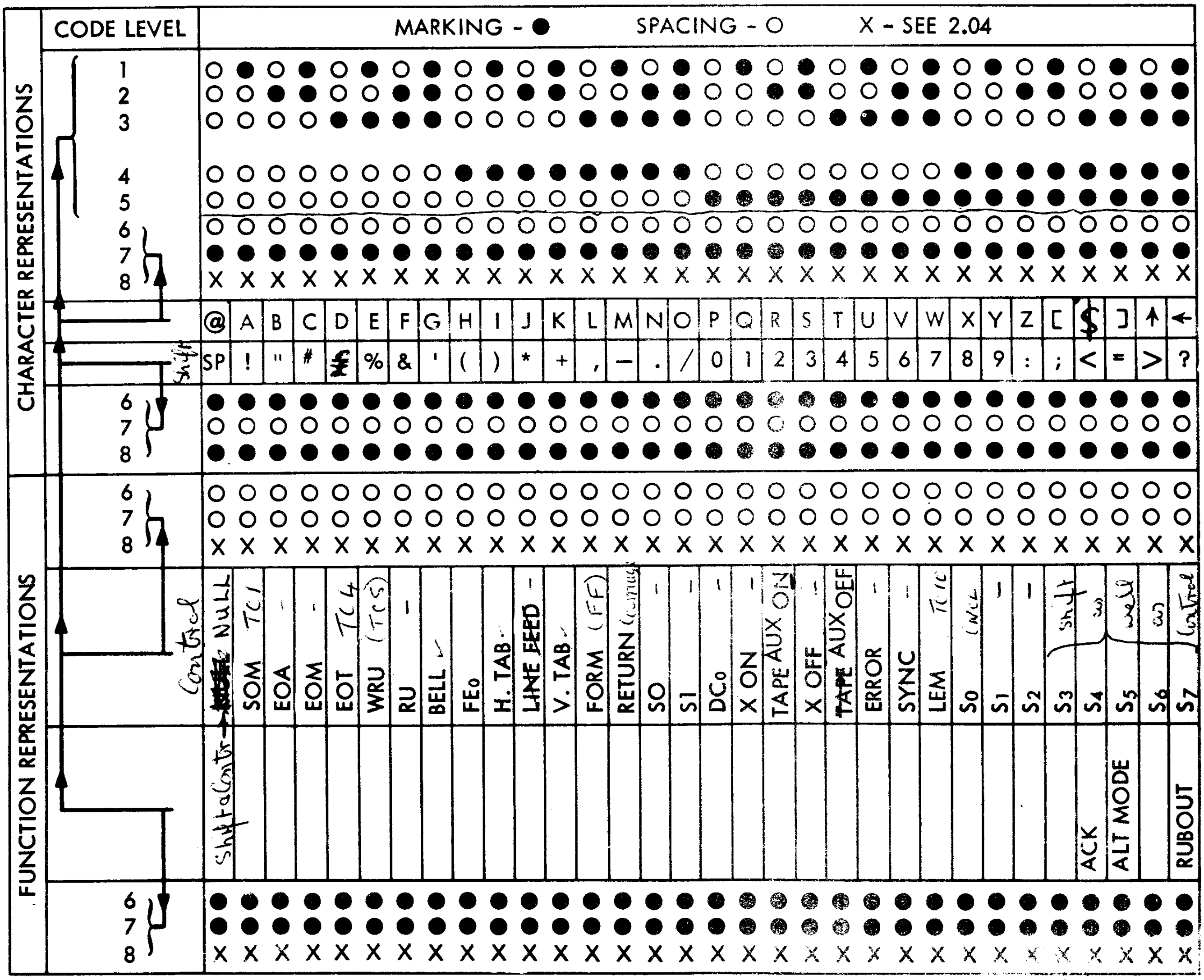


Figure 6 - Graphic and Function Code Representations

2.06 The total number of permutations of an eight level, eleven unit code (with the eighth level always marking) is two to the seventh power, or 128. Specific character and function representations may vary with equipment. The characters (graphics) and functions commonly represented on associated keyboards are illustrated, with their signal code equivalent, in Fig. 6. Function representations which are blank are unassigned in the current application, but the equipment can be readily adapted to their recognition and execution. For a more complete discussion of the signaling code, refer to the applicable section.

GENERAL OUTLINE OF OPERATION (Fig. 7)

2.07 The relationship of the operating mechanisms of the 35 typing unit are illustrated in the block diagram (Fig. 7). Rotary motion from the intermediate gear mechanism of an associated base or keyboard base is applied to the main shaft, which turns constantly as long as the associated unit is under power. A 0.500 ampere signal to the selector magnets initiates operating sequences. The application of 115 v ac circuits to the stunt box and to various switches and controls is dependent upon external circuitry and associated equipment.

2.08 The signaling code combinations are applied to the selecting mechanism through pins 1 and 2 of the 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.

2.09 The selector cam clutch is driven by the main shaft, like the other clutches. When it is engaged by the main shaft, however, it effectively converts the incoming electrical signal into mechanical marking or spacing operations which are equivalent to corresponding bits in the signal code.

2.10 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 printer 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.

2.11 The function clutch controls the function bail and the stripper bail. The function 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.

2.12 The line feed clutch operates mechanical linkages which advance the paper one or two line spaces by rotating the platen. On sprocket feed typing units so equipped, the vertical tabulation mechanism and form out mechanism also operate the line feed clutch trip mechanism.

2.13 The code bar mechanism (Par. 2.10) and the code bar clutch operate in combination either to trip or to block the tripping of the type box clutch. In the latter case, all printing mechanisms are idle as print suppression permits performance of a function without interference with the page printed message. When the type box clutch is tripped, it initiates mechanisms involved in vertical positioning of the type box, shift, horizontal type box positioning, ribbon feed and printing. The main rocker bail 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 bail trips the spacing clutch stop mechanism to engage the spacing clutch, except when spacing is suppressed.

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

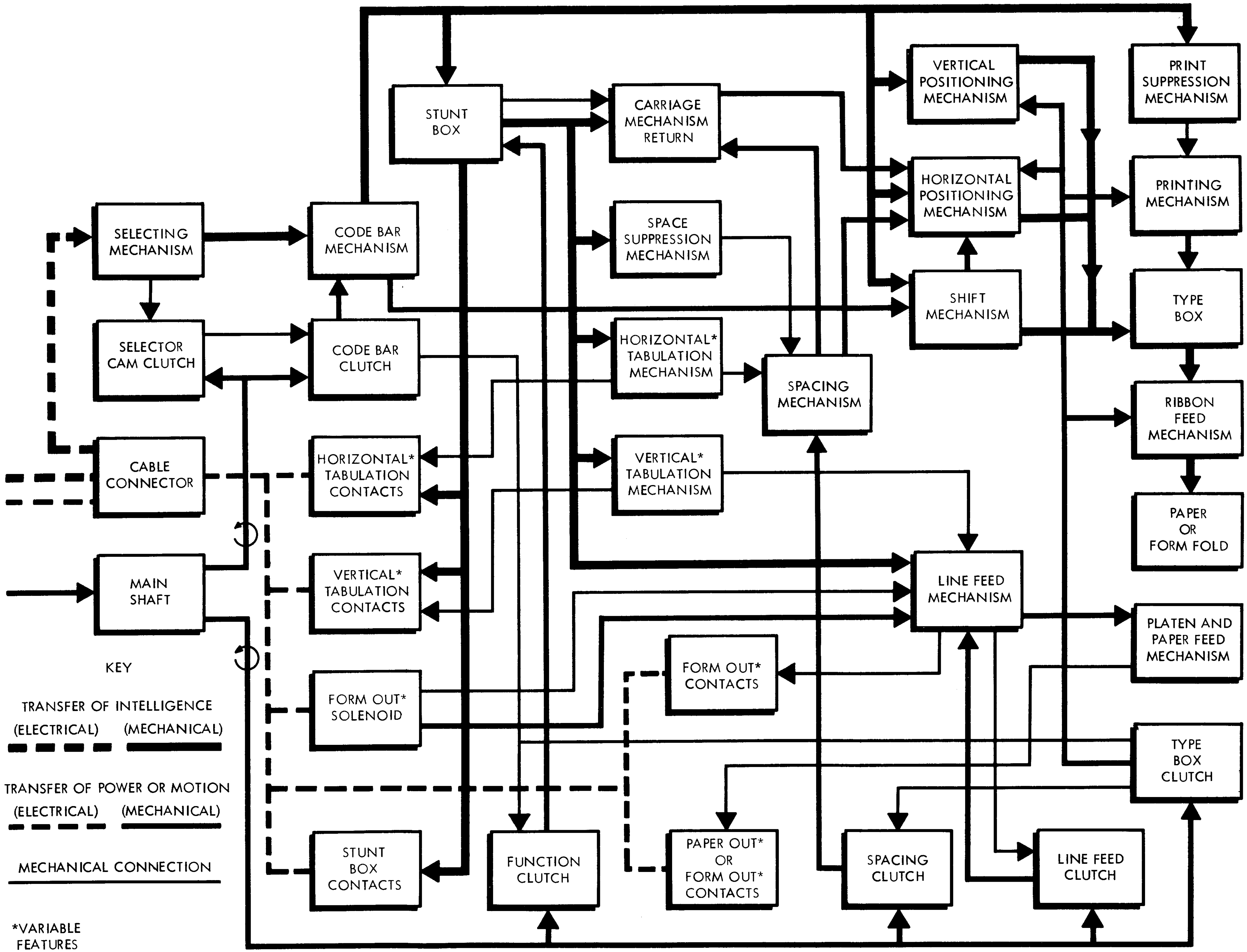


Figure 7 - 35 Typing Unit Block Diagram

2.15 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 unsuppressed operating cycle. 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 or form. 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.

MAIN SHAFT (Fig. 8)

A. General

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

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

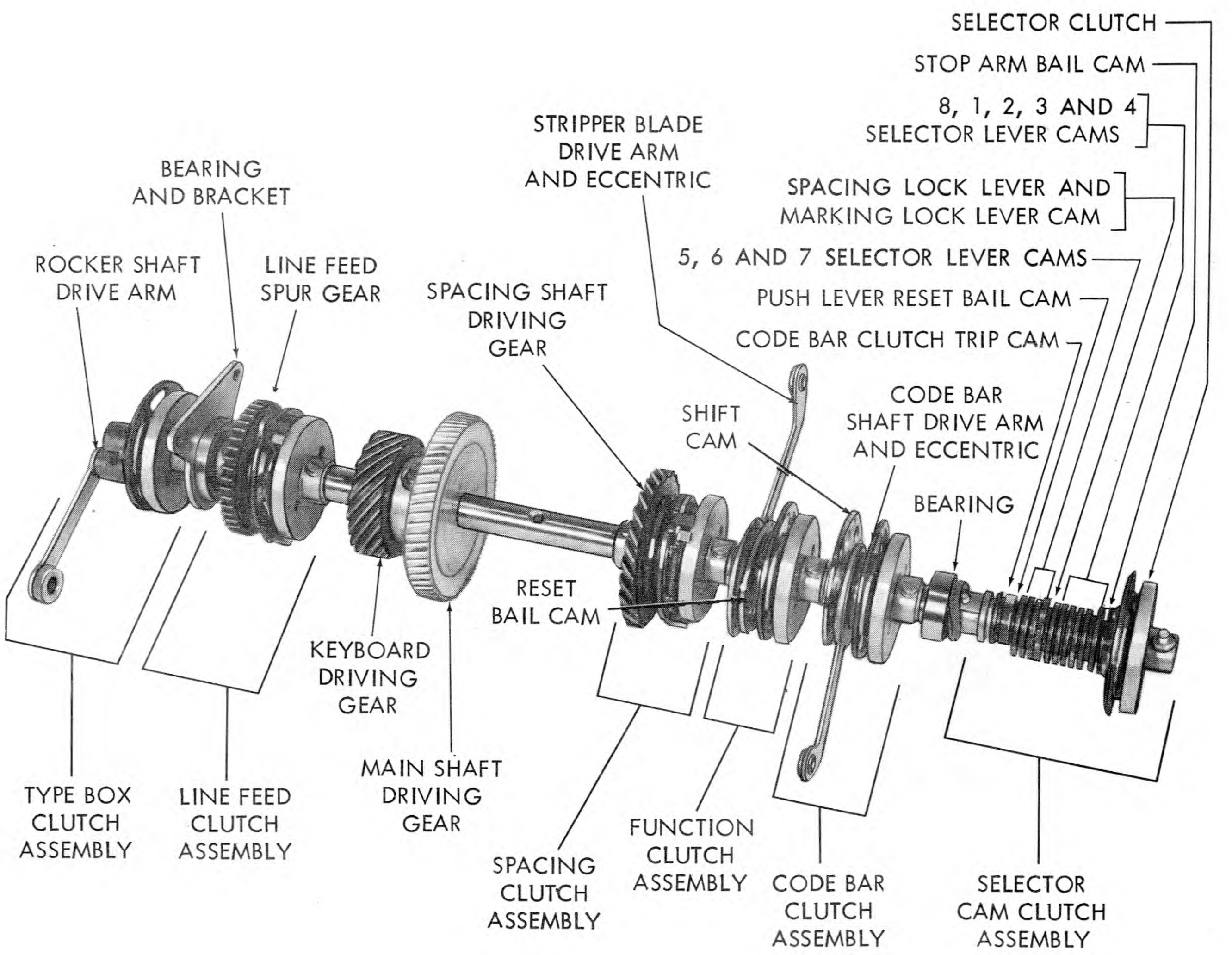


Figure 8 - Main Shaft

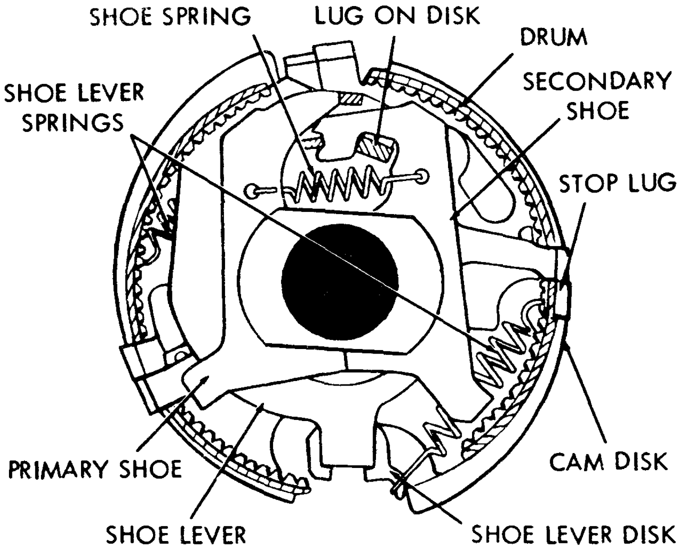


Figure 9 - Three Stop Clutch

smaller gear drives the signal generator mechanism of an associated keyboard base.

2.18 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.

2.19 The spacing and line feed clutches are three stop clutches (Fig. 9), each permitting their associated mechanism to operate through one-third of a revolution of the main shaft. All other clutches are one stop clutches (Fig. 10 and 11), operating through an entire revolution of the main shaft.

B. One Stop Clutches (Fig. 10 and 11)

2.20 The clutch drums are attached to and rotate with the main shaft (Fig. 8). In the disengaged position, as shown in Fig. 10, the clutch shoes do not contact the drum, and the shoes and cam disk are held stationary. Engagement is accomplished by moving the stop arm (Fig. 11) toward the rear of the typing unit, away from the clutch, thus releasing stop lug A and the lower end of shoe lever B (Fig. 11). The upper end of lever B pivots about its ear C,

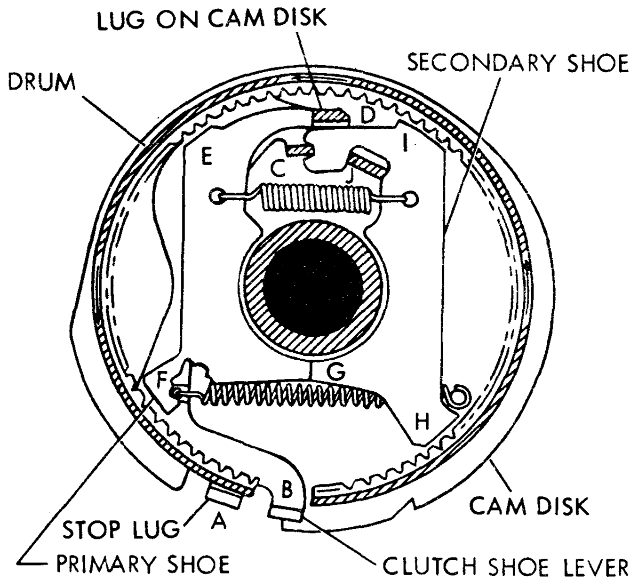


Figure 10 - One Stop Clutch (Disengaged)

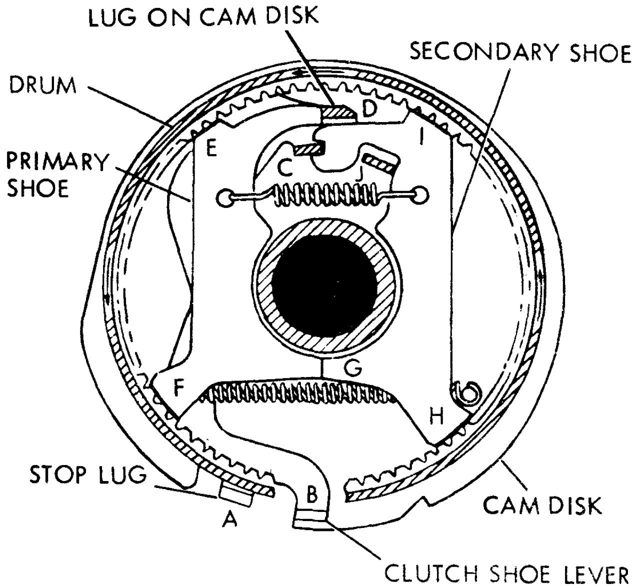


Figure 11 - One Stop Clutch (Engaged)

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.

2.21 Disengagement is effected when the lower end of shoe lever B strikes the stop arm. Lug A and the lower end of the shoe lever are brought together (Fig. 10), and the upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum. The latch lever seats in the indent in the cam disk, and the cam is held in its stop position until the clutch is again engaged.

C. Three Stop Clutches (Fig. 9)

2.22 Two of the clutches, spacing and line feed, have three sets of lugs equally spaced about their periphery. The action is as described in Par. 2.20-2.21, but the clutch is permitted to rotate through only one-third revolution before the stop lever and latch lever halt its motion.

D. Six Stop Clutches

2.23 On the sprocket feed typing unit, the line feed clutch has six stops (instead of three, as on the friction feed typing unit). The six sets of lugs are equally spaced about their periphery and the action is the same as that described in Par. 2.20-2.21, but the clutch is permitted to rotate through only one-sixth revolution before the stop lever and latch lever halt its motion.

SELECTION

2.24 The selecting mechanism consists of two magnet coils, an armature with an anti-bounce stop, a selector cam clutch, and the associated levers, arms, bails and slides necessary to convert the electrical bits of the start-stop code to the mechanical arrangements which govern the character to be printed and the function to be performed. The selector cam clutch assembly comprises, from right to left (Fig. 8), the clutch; the stop arm bail cam; the eighth, first, second, third and fourth selector lever cams; the cam for spacing and marking lock levers; the fifth, sixth and seventh selector lever cams; the push lever reset bail cam; and the code bar clutch trip cam.

2.25 During the time in which a closed line circuit (marking) condition exists, the selector magnet coils are energized and hold the selector armature against the selector magnet pole pieces. In this stop position, the selector armature blocks the start lever (Fig. 12). While the signal for any character or function is being received, the start (spacing) bit 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 bit 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.

2.26 The series of seven selecting levers (the eighth position, always marking, is not equipped with a selecting lever) and a marking lock lever ride their respective cams on the selector cam clutch. As the marking or spacing signal bits are applied to the selector magnets, the selector cam clutch rotates and actuates the selector levers. When a spacing bit 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 bit is received. Extensions on the marking lock lever prevent the selector levers from

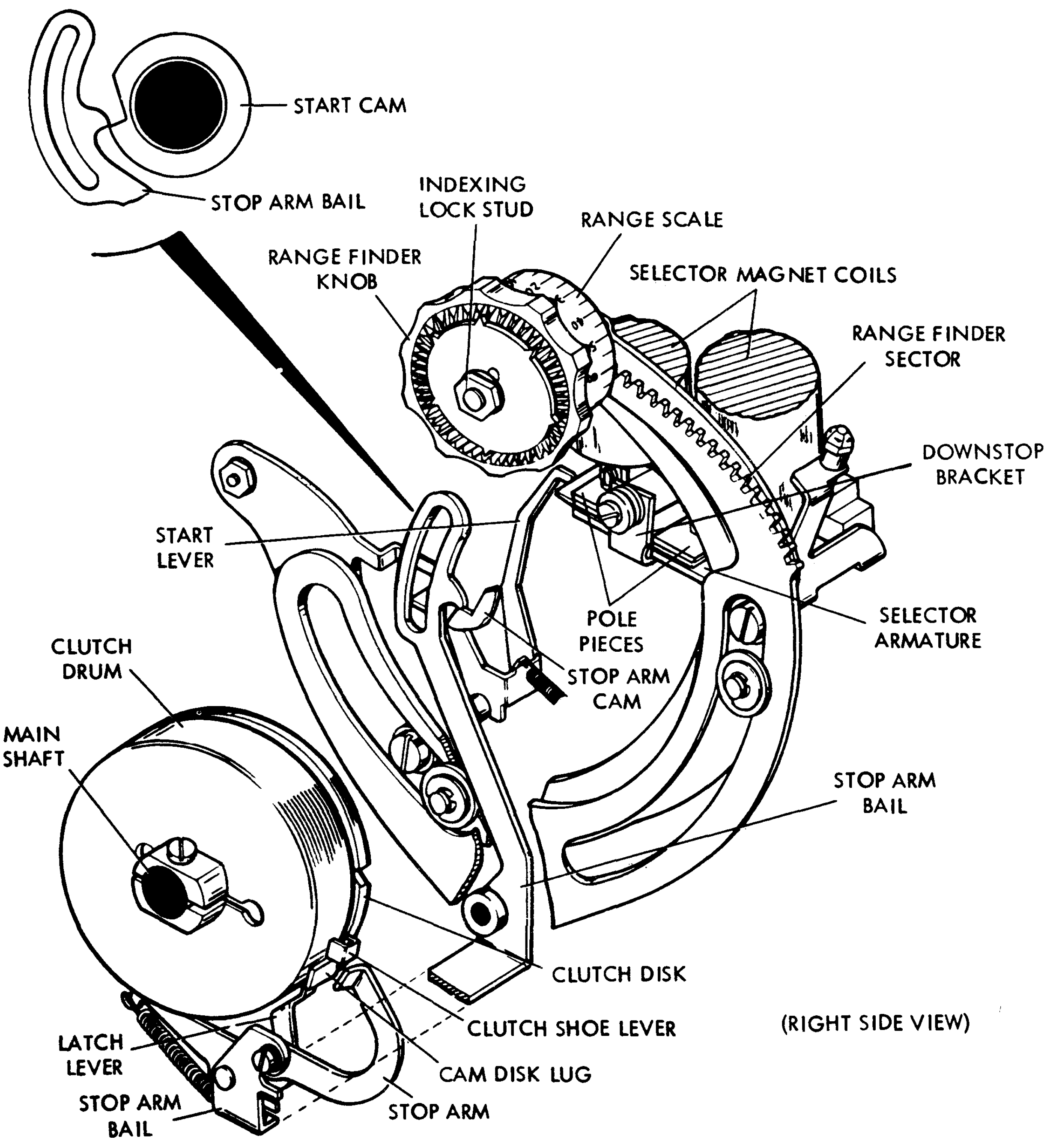


Figure 12 - Selector Clutch and Range Finder

following their cams (Fig. 13). When a marking bit 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 bit 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.

2.27 Each selecting lever has an associated push lever which drops into a notch on the top of the selecting lever when the selecting lever falls into the indent in its cam. As the selector cam clutch rotates, each selecting lever is moved forward as it rides to the high part of its cam. Selected (dropped) push bars are also moved forward. Unselected push bars remain in the rear position, on top of the notch of the selecting lever. When all seven code bits have been received, push levers are held in their selected or unselected position until the next start bit is received.

2.28 When the subsequent start bit is received, the cam clutch is again engaged. The push lever reset bail, following its cam, unlatches the selected push levers. The push levers then return to their unselected (rear) position under their spring tension.

ORIENTATION

2.29 In order to establish the operating margins for the typing unit, it is necessary that the sampling of the signal by the selecting mechanism occur at the most favorable portion of the signal element. This is referred to as orientation.

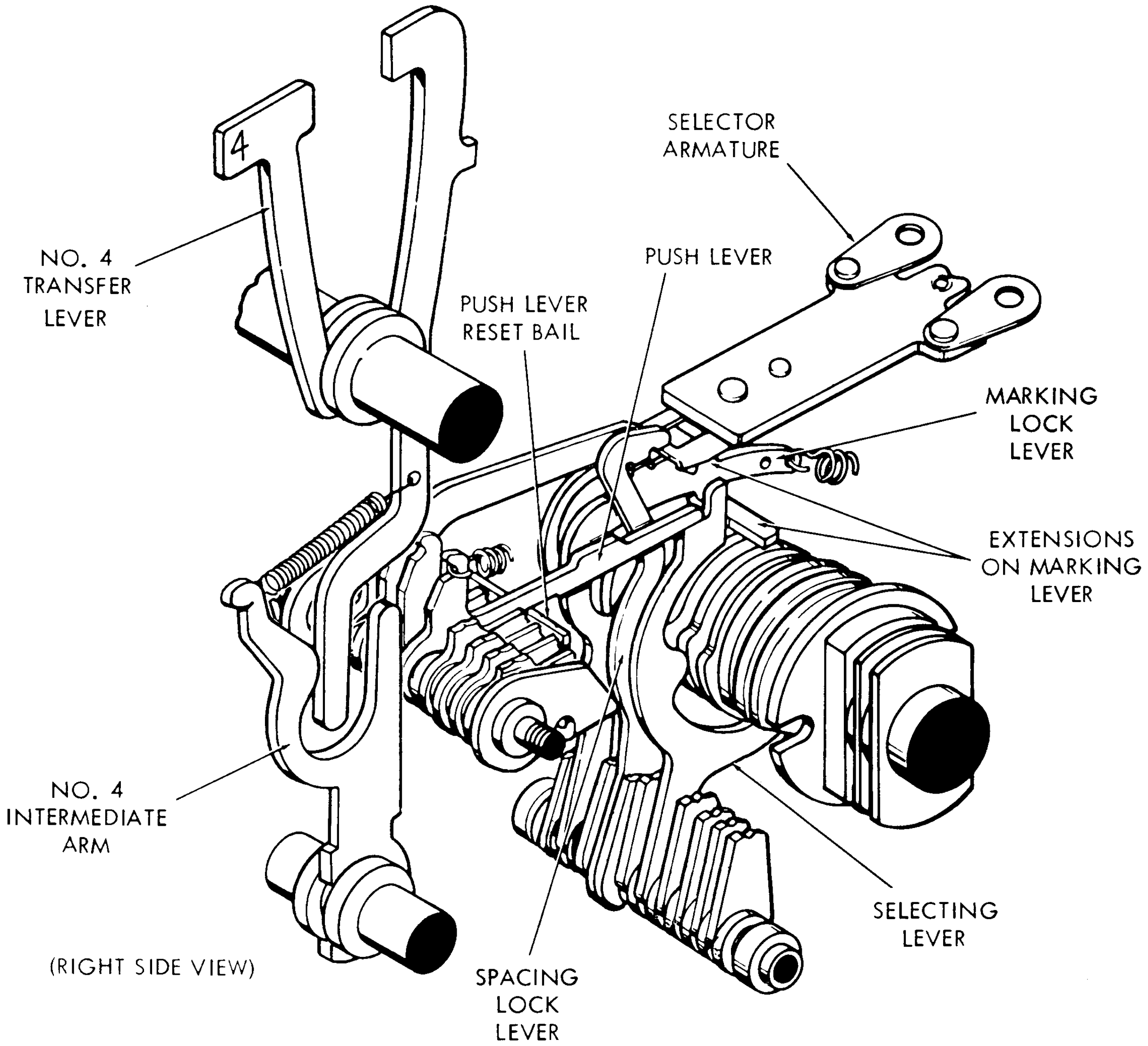


Figure 13 - Selecting Mechanism and Transfer Mechanism

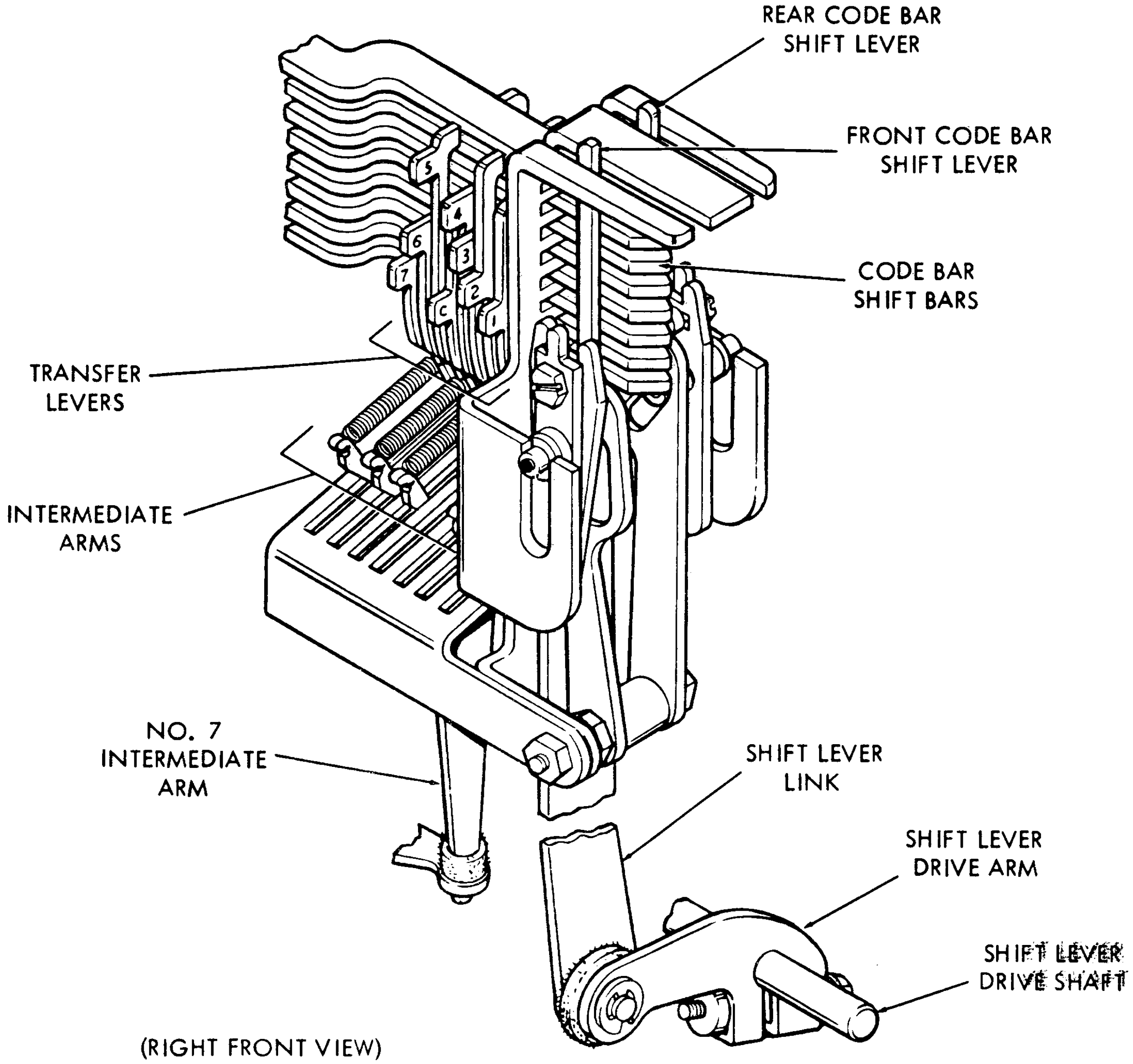


Figure 14 - Code Bar Mechanism

2.30 When the range finder knob (Fig. 12) 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.

PRINTING MECHANSIM

A. Code Bar Mechanism (Fig. 14)

General

2.31 The character printed or the function executed 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 bars. The code bars are positioned by code bar shift bars which move to the left for marking and to the right

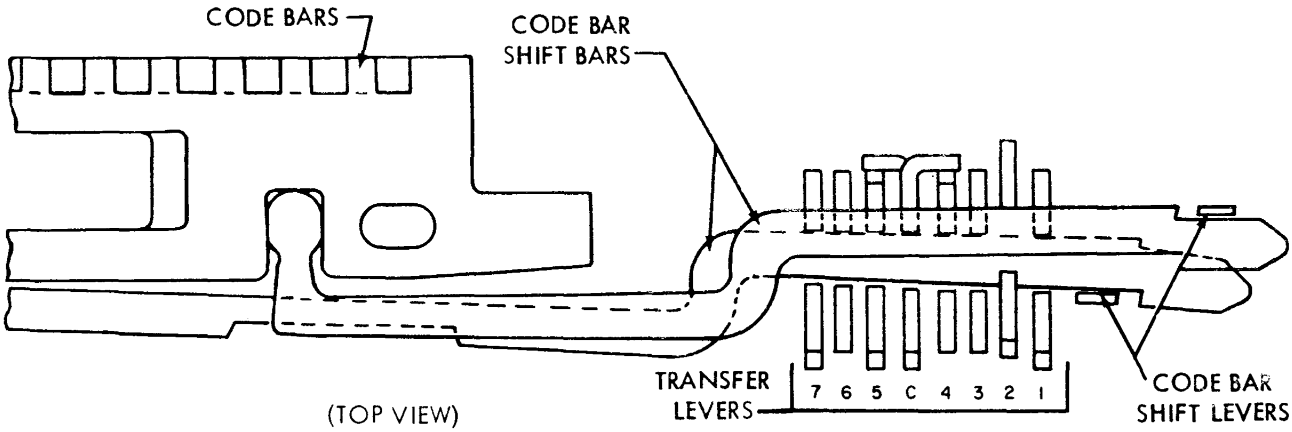


Figure 15 - Code Bar Shift Bar Positioning

for spacing. The shift bars, positioned to the rear for marking and forward for spacing, are pushed into marking position by selected push bars through a mechanical linkage intermediate arms and transfer levers.

2.32 Power to position the selected code bar levers, and through them the code bars, is supplied by the code bar clutch. The code bar clutch is engaged by its cam on the selector cam clutch (Par. 2.24). The code bar clutch also drives a cam through which the shift mechanism is operated and the function and type box clutches are engaged.

2.33 At the left end of the code bar mechanism, a printing suppression mechanism is operated by the code bars. The blocking levers are rotated by the code bars to prevent release of the type box clutch trip lever through a blocking bail.

Code Bar Positioning (Fig. 14, 15 and 16)

2.34 Each selector push lever (Par. 2.26) has an associated intermediate arm, transfer lever and code bar shift bar (Fig. 14). 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 (fourth from left, operating the common code bar, third from bottom) has two extensions which pass behind the numbers 4 (to the right) and 5 (to the left) transfer levers. There is no connection between the common transfer lever and the selecting mechanism, but when either the number 4 or number 5 push bar is selected, the associated transfer levers position the common code bar shift bar to the rear (marking). The right ends of these code bars determine vertical positioning of the type box (Fig. 16).

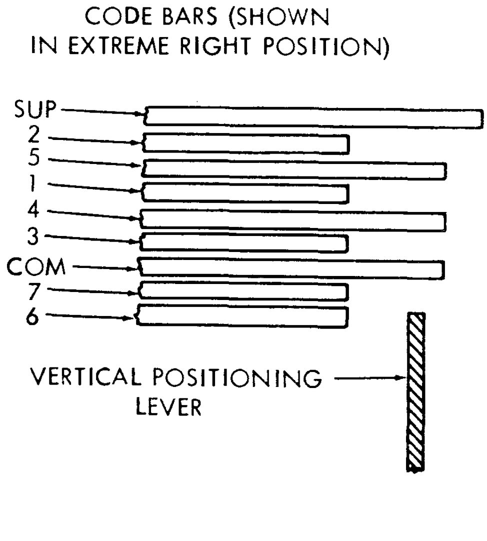


Figure 16 - Vertical Arrangement of Code Bars

2.35 As the selector cam clutch completes its revolution, the trip shaft operating lever rides to the peak of the code bar clutch trip cam (Fig. 8). 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 left, the rear lever moving to the right. Any code bar shift bar in marking position (left) during the previous operating cycle is moved to spacing position (right) by the forward shift lever, unless the transfer lever is once again holding that bar to the rear (marking). The rear shift bar, as it moves to the left (Fig. 15) 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.

2.36 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.

Arrangement of Code Bars (Fig. 16)

2.37 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 2, number 5, number 1, number 4, number 3, common, number 7 and number 6. In the typing units as furnished, a disabling clip engages a notch at the left end of the upper (suppression) code bar. This code bar, when used, is operated by the function box for print suppression through the print suppression mechanism (Par. 2.56 - 2.59). There is no shift bar and transfer mechanism linkage for the suppression code bar.

B. Type Box and Type Box Carriage

General

2.38 All of the characters (graphics) that may be printed by the typing unit are formed by type pallets which are arranged in a type box. The type box is mounted in a carriage from which it may be removed for cleaning or replacement. In order to print any selected character, the type box carriage is so positioned that the character on the pallet is directly over the desired location on the paper. Since the pallets are arranged in four horizontal rows and sixteen vertical rows, it is necessary to position the type box carriage both horizontally and vertically. See Fig. 17 for arrangement of graphics which are represented on the type box pallets. See Fig. 6 for input signal code permutations equivalent to each graphic representation.

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

2.40 The lower right rear end of the upper draw wire rope is fastened to the spacing drum. From this point, it passes part way around the spacing drum, upward and around the right rail pulley and downward to the spring drum. After passing part way around the spring drum, the upper draw wire rope is doubled backward around it and passes upward to the left printing carriage rail pulley over to the right printing carriage rail pulley, and downward to the spacing drum to which it is again fastened. The lower draw wire rope is fastened at its left end to the spring drum and, at its right end, to the spacing drum. It acts in opposition to the upper draw wire rope and holds the two drums in phase (Fig. 18). 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.

2.41 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

7S = FIGURES FIELD

1M 2M 3M	1S 2M 3M	1M 2S 3M	1S 2S 3M	1S 2S 3S	1M 2S 3S	1S 2M 3S	1M 2M 3S	
▼ 123- -6-8	& -23- -6-8	% 1-3- -6-8	$ --3- -6-8	NO PALLET	! 1--- -6-8	▼▼ -2-- -6-8	# 12-- -6-8	4S 5S
7 123- 56-8	6 -23- 56-8	5 1-3- 56-8	4 --3- 56-8	0 ---- 56-8	1 1--- 56-8	2 -2-- 56-8	3 12-- 56-8	4S 5M
/ 1234 -6-8	. -234 -6-8	− 1-34 -6-8	, --34 -6-8	(---4 -6-8	) 1--4 -6-8	* -2-4 -6-8	+ 12-4 -6-8	4M 5S
? 1234 56-8	> -234 56-8	= 1-34 56-8	< --34 56-8	8 ---4 56-8	9 1--4 56-8	: -2-4 56-8	; 12-4 56-8	4M 5M

7M = LETTERS FIELD

1M 2M 3M	1S 2M 3M	1M 2S 3M	1S 2S 3M	1S 2S 3S	1M 2S 3S	1S 2M 3S	1M 2M 3S	
G 123- --78	F -23- --78	E 1-3- --78	D --3- --78	@ ---- --78	A 1--- --78	B -2-- --78	C 12-- --78	4S 5S
W 123- 5-78	V -23- 5-78	U 1-3- 5-78	T --3- 5-78	P ---- 5-78	Q 1--- 5-78	R -2-- 5-78	S 12-- 5-78	4S 5M
O 1234 --78	N -234 --78	M 1-34 --78	L --34 --78	H ---4 --78	I 1--4 --78	J -2-4 --78	K 12-4 --78	4M 5S
← 1234 5-78	↑ -234 5-78	] 1-34 5-78	\ --34 5-78	X ---4 5-78	Y 1--4 5-78	Z -2-4 5-78	[12-4 5-78	4M 5M

Figure 17 - Type Box Pallet Arrangement

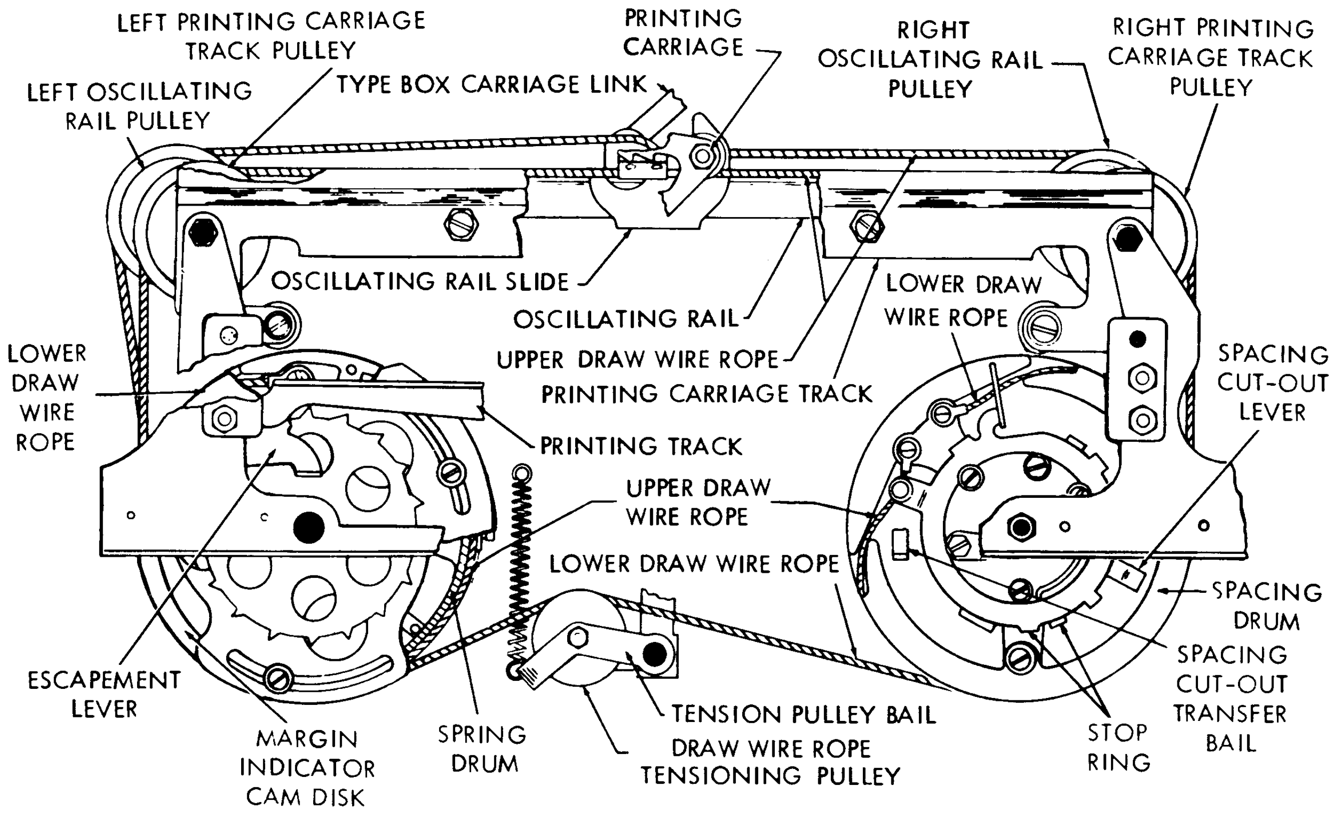


Figure 18 - Draw Wire Rope and Drums

shift slide. The links are pivoted and are such a length that only one at a time may be fully extended.

Shift Mechanism (Fig. 19)

2.42 Mechanical limitations of the equipment restrict selection from the type box pallets to four horizontal and eight vertical rows. Since there are sixteen vertical rows in the type box, a means is provided for determination of which of two fields, figures (left half of the type box) or letters (right half of the type box), will be presented for positioning. This is accomplished by the shift mechanism, operation of which is initiated by the code bar mechanism. The seventh bit in the input signal code determines the field selection as figures (number 7 spacing) or letters (number 7 marking).

2.43 Two pawls on the shift selector arm (Fig. 19) are positioned left (spacing) or right (marking) by a tail descending from the seventh code bar mechanism intermediate arm. The selector arm and its pawls are mounted to the lower front corner of the right side plate and extend through slots in two shift pawls on the rear of the front plate mechanism. When moved (simultaneously) to the left (spacing) position, the shift pawls are positioned so that the shift drive pawl, driven upward by the code bar clutch shift lever cam shaft, would strike the right pawl,

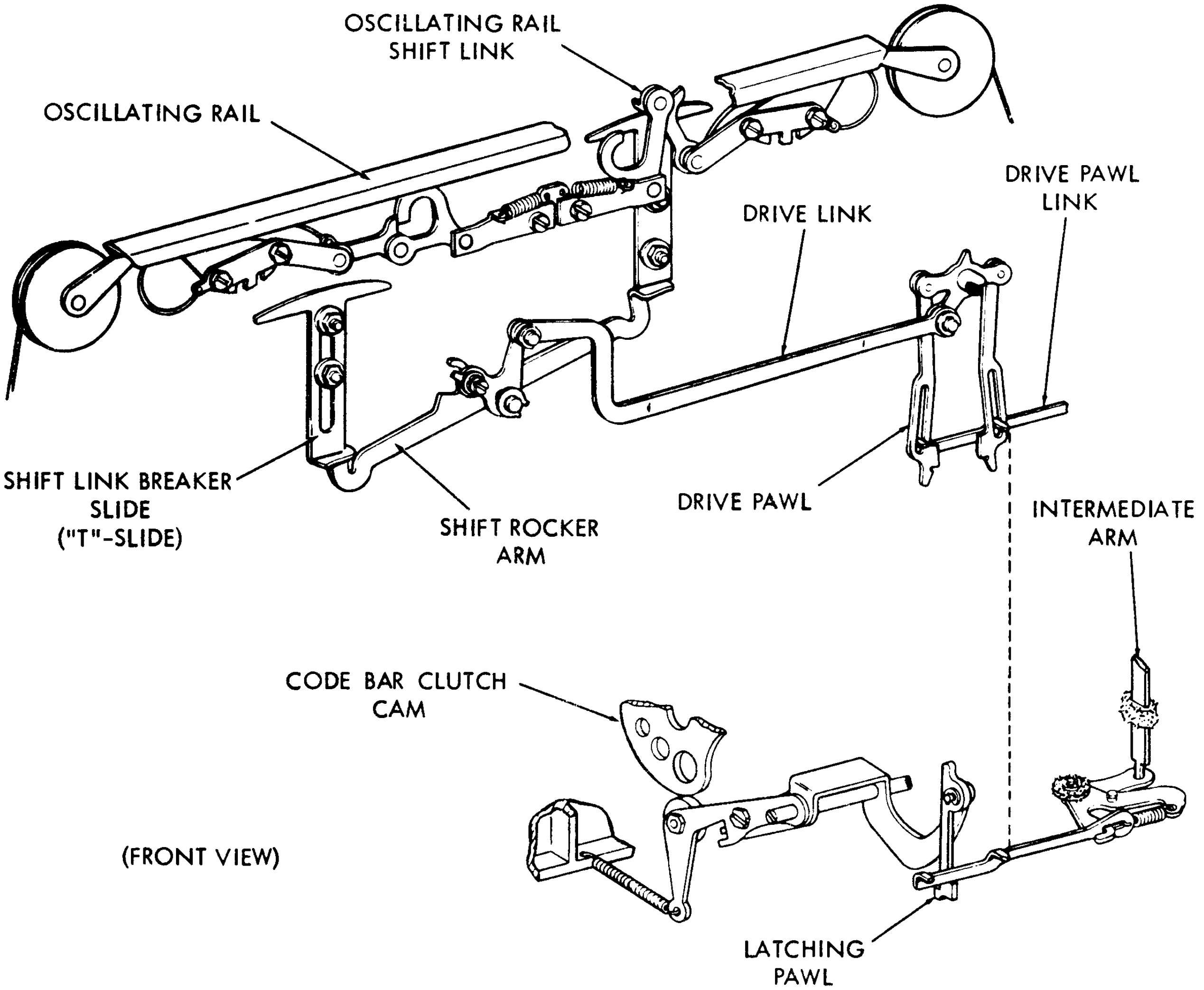


Figure 19 - Shift Mechanism

driving it upward. When moved to the right (marking), the shift drive pawl lifts the left pawl. If the right shift pawl is already raised, a spacing signal on the seventh intelligence bit would not affect the shift mechanism. A marking signal would not affect the mechanism when the left pawl is raised in the preceding operating cycle.

2.44 The left and right shift pawls operate a toggle on the rear of the front plate mechanism, rotating the toggle clockwise for marking, counterclockwise for spacing. The toggle is linked to the shift rocker lever (Fig. 20). When rotated clockwise, the shift rocker lever initiates a figures (number 7 code bar spacing) shift. When rotated counterclockwise, the shift rocker lever initiates a shift to the letters field. The rocker bail raises the left or right shift breaker slide, breaking the oscillating rail shift links above the raised slide. This permits the oscillating rail to shift to the opposite end of its travel limits, setting up the figures field for printing when moved to the right and the letters field when moved to the left.

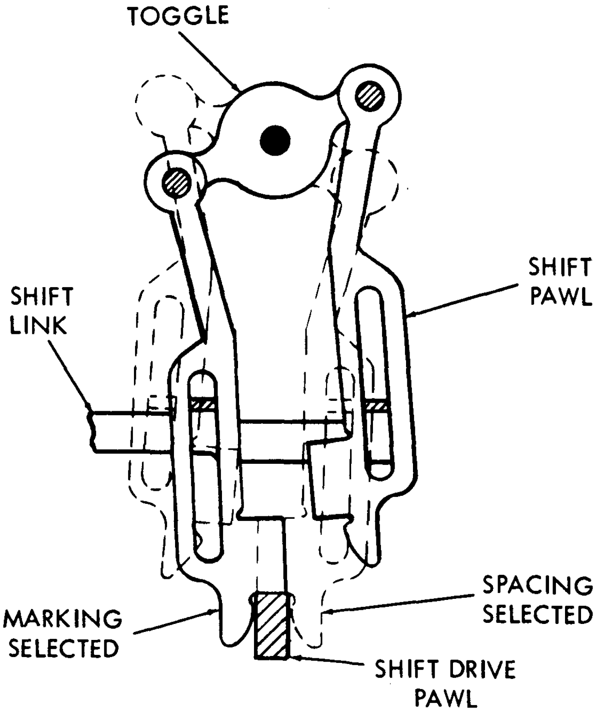


Figure 20 - Shift Mechanism Positioning

Type Box Positioning

2.45 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:

2.46 The number 4 and number 5 code bars determine the selection of the horizontal row. The number 3 code bar determines whether the selection is to be made from the left four vertical rows (in either the figures or the letters field, as determined by the shift mechanism, Par. 2.42-2.44) or the right four vertical rows. The number 1 and number 2 code bars determine the selection of one row from the four vertical rows predetermined by the number 3 code bar.

2.47 Four code bars (longer than the others) extend through the right code bar bracket and serve as stops for the right vertical positioning levers (Fig. 21). They are (from top to bottom) the suppression, number 5, number 4 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, rotates the clutch trip lever shaft. As the shaft turns, it first causes the function clutch lever to release the function clutch (Fig. 22) and then causes the type box clutch trip arm to engage its trip lever and release the type box clutch. When the type box clutch completes its revolution, it is disengaged by its trip lever and latch lever in the same manner as was the code bar clutch (Par. 2.36). During its rotation, the type box clutch operates a drive link and a bracket to cause the main rocker shaft to oscillate. This, in turn, through its left and right brackets and the main side drive links, extends the motion to the vertical positioning levers (Fig. 21). These levers are driven upward until they strike a projecting code bar, which causes them to buckle. The type box carriage track is mounted between the vertical positioning levers, and its vertical motion is controlled by them.

2.48 When the number 4 and number 5 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 in line for printing. When the number 5 code bar is toward the left (marking), the common code

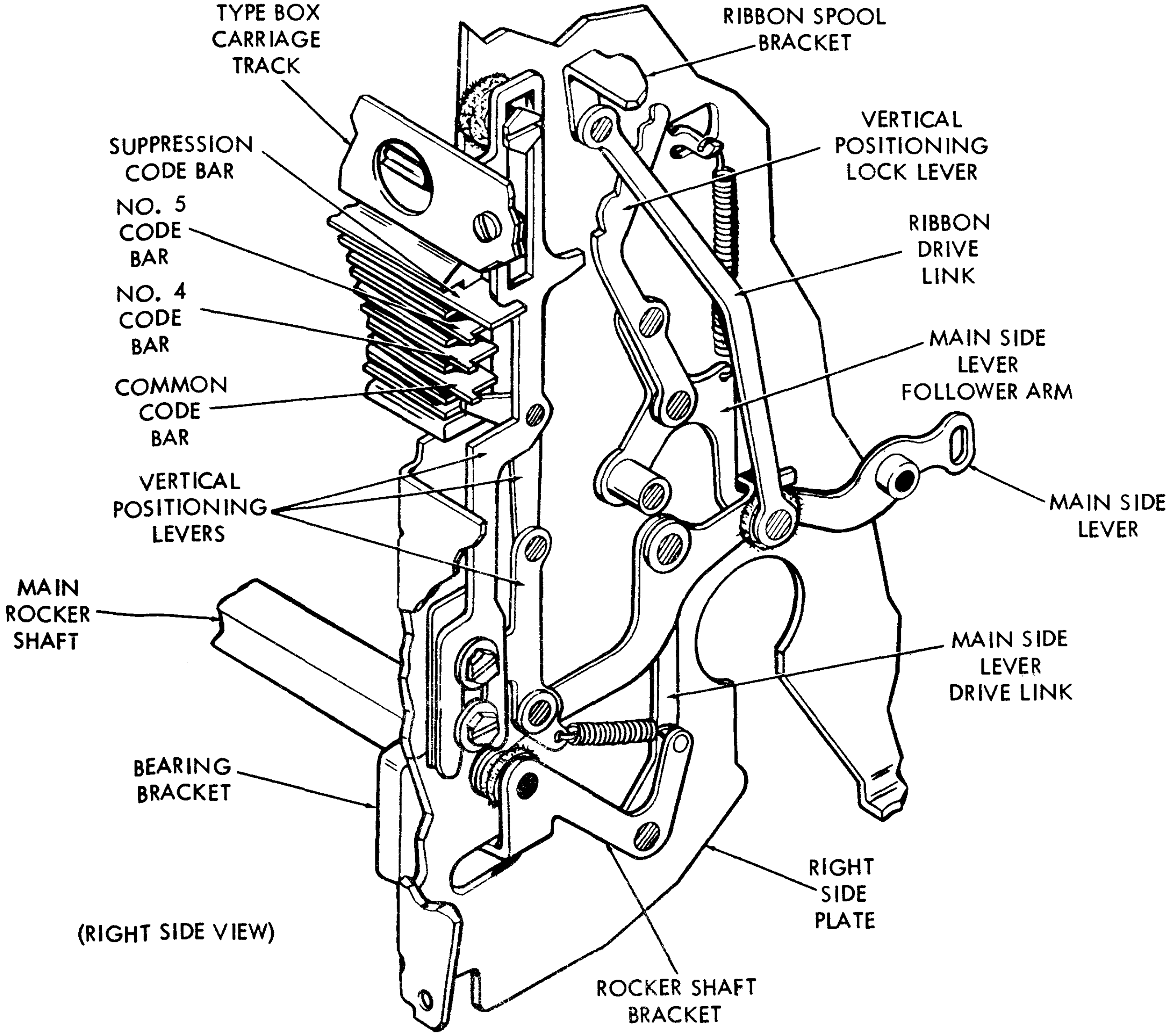


Figure 21 - Right Side Plate Mechanisms

bar is toward the left. If the number 4 code bar is toward the right (spacing), it blocks the vertical positioning levers, and the second row of pallets (from the top) are then in line for printing. When the number 4 code bar is toward the left (marking), the common code bar is toward the left. If the number 5 code bar is toward the right (spacing), it blocks the vertical positioning levers, and the third row of pallets is in line for printing. When both the number 4 and number 5 code bars are to the left (marking), the common code bar is also to the left. The print suppression code bar blocks the vertical positioning levers, and the fourth (bottom) row of pallets in the type box are then in line for printing. At each of the four levels at which the vertical positioning levers may be stopped, they are locked momentarily by lock levers controlled by the main side lever follower arms.

2.49 A bracket attached to the main rocker shaft applies vertical motion to the main bail by means of two main bail links (Fig. 23). Attached to each end of the oscillating rail shift slide are pivoted buckling type drive links which extend downward to each end of the main bail. As the main bail moves downward under impetus of the type box clutch, the left shift slide links, if not buckled, will try to shift the oscillating rail slide drive links toward the right, while the right shift slide drive links, if not buckled, will try to shift the oscillating rail shift slide links to the left. When the number 3 code bar is shifted toward the left (marking), the horizontal motion reversing slide is shifted toward the left by the reversing slide shift lever and is held there by detent levers. A bracket near the right end of the reversing slide will then make contact with the right shift slide drive links and cause them to buckle. As the main bail is driven downward, the unbuckled left shift slide drive links will start to shift the oscillating rail shift slide toward the right. This positions the type box so that the characters to be printed will be located in the left half of the figures or the letters field. In a similar manner, when the number 3 code bar is shifted toward the right (spacing), the horizontal motion reversing slide is also shifted toward the right by the shift lever and is held there by the detent levers. A bracket near the left end of the horizontal motion reversing slide then makes contact with the left shift slide drive links and causes them to buckle. As the main bail is driven downward, the unbuckled right shift slide drive links will start to shift the oscillating rail shift slide toward the left. This positions the type box so that the characters to be printed will be located in the right half of the figures or the letters field.

2.50 After determination of the field (figures or letters) and the group of vertical rows in which the character to be printed is located, the number 1 and number 2 code bars operate three horizontal motion stop slides to determine the row in that group in which the character is to be found (Fig. 23). 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

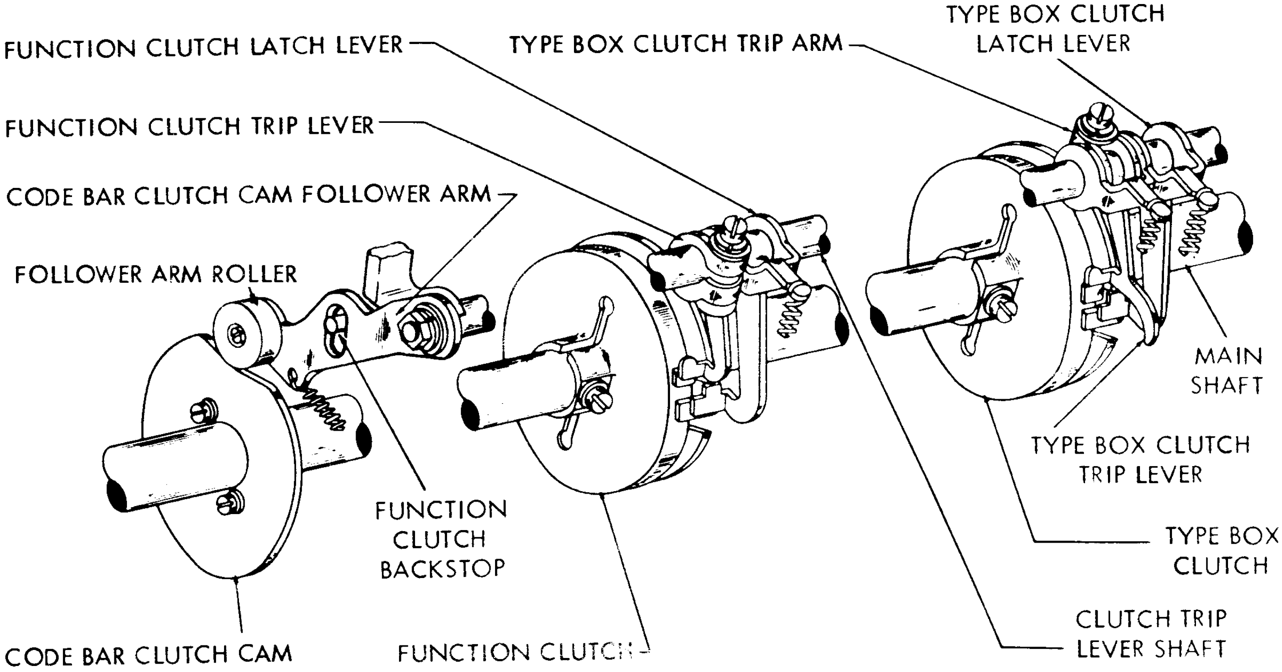


Figure 22 - Clutch Trip Mechanisms

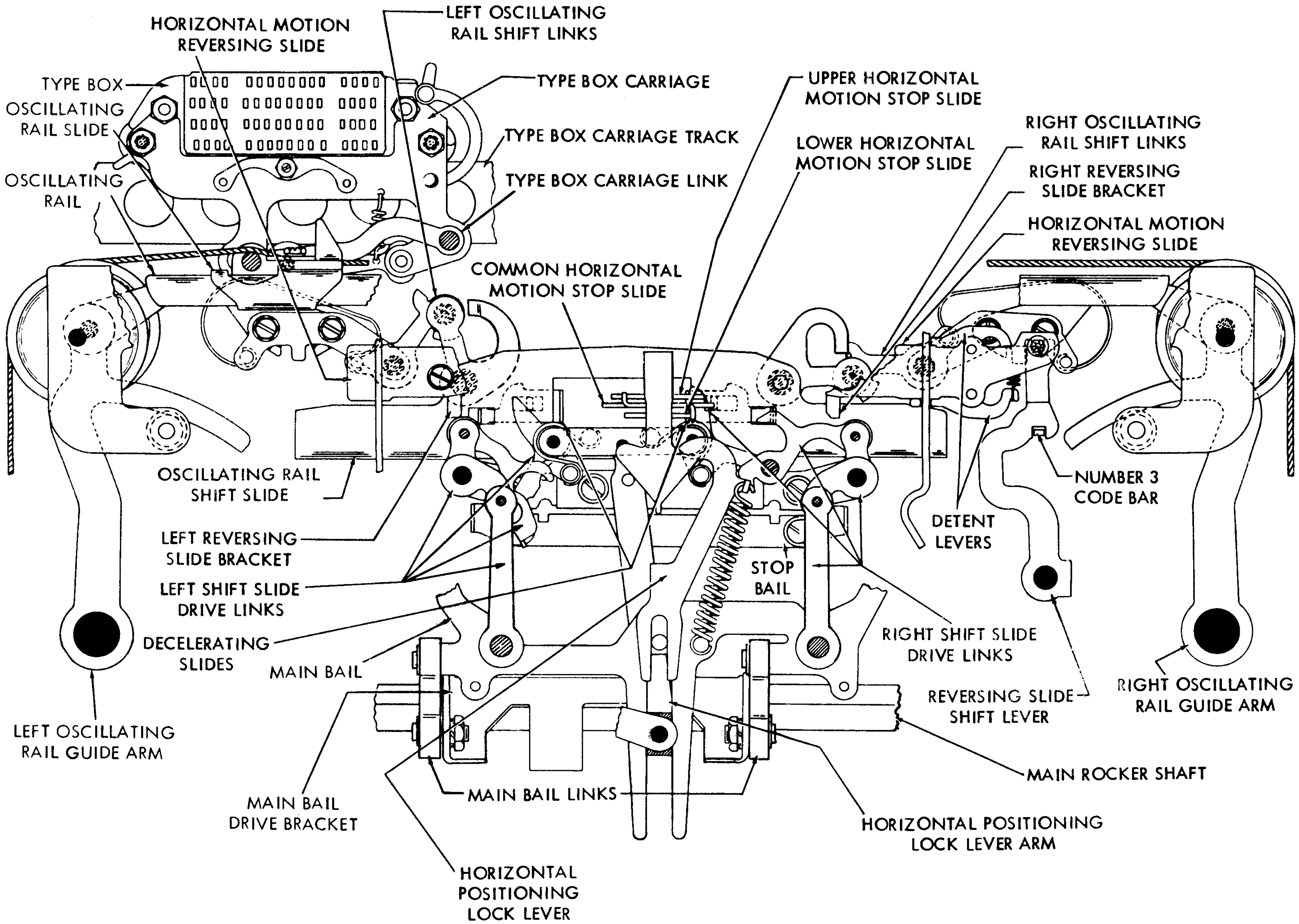


Figure 23 - Horizontal Positioning Mechanisms

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 1 and number 2 code bars each operate a code bar bail bell crank. Each, in turn, moves a horizontal motion stop slide toward the front (marking) or toward the rear (spacing) (Fig. 24). A third (common) stop slide (spring tensioned toward the rear) is located between the upper and lower stop slides and has projections which pass across the front edges of these slides (Fig. 23). Each stop slide is of a different length. The common stop slide, which is the longest stop, has an additional stop on its shank, so that it serves as the shortest stop when all the slides are moved forward. The upper slide (operated from the number 2 code bar) is the second longest stop, and the lower slide (operated from the number 1 code bar) is the third longest stop.

2.51 When both the number 1 and number 2 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 2 code bar is toward the right (spacing), and the number 1 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 2 code bar is toward the left (marking) and the number 1 code bar is toward the right (spacing), the upper and the common stop slides are toward the front and the lower stop slide is toward the rear. The oscillating rail shift slide is moved toward the right or left of its central position until it is stopped by one end of the lower stop slide. This positions the third vertical row (right or left of the center of the figures field or the letters field) in line for printing. When both the number 1 and the number 2 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.

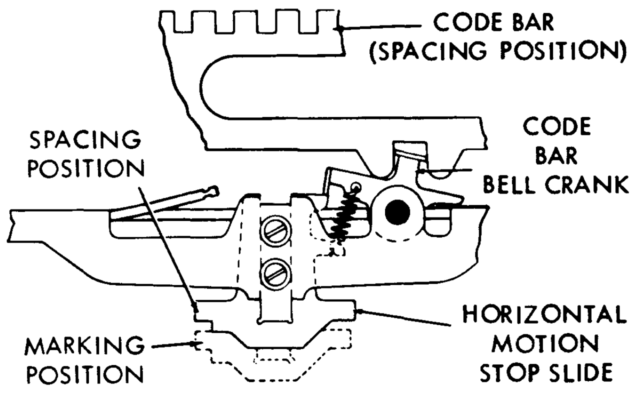


Figure 24 - Stop Slide Positioning

C. Print Hammer and Printing Carriage (Fig. 25)

General

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

Positioning

2.53 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.

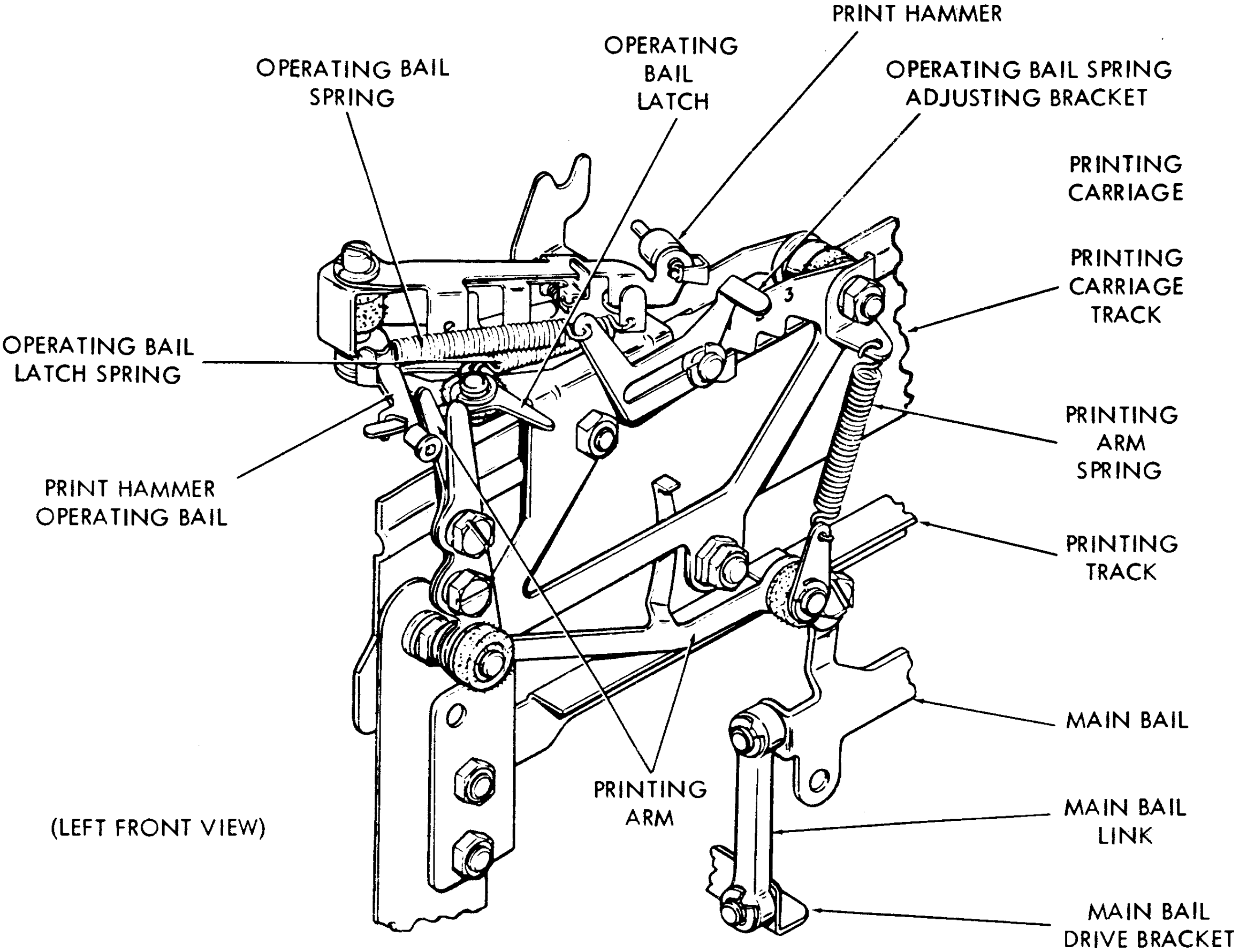


Figure 25 - Print Hammer and Carriage

Printing

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

2.55 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

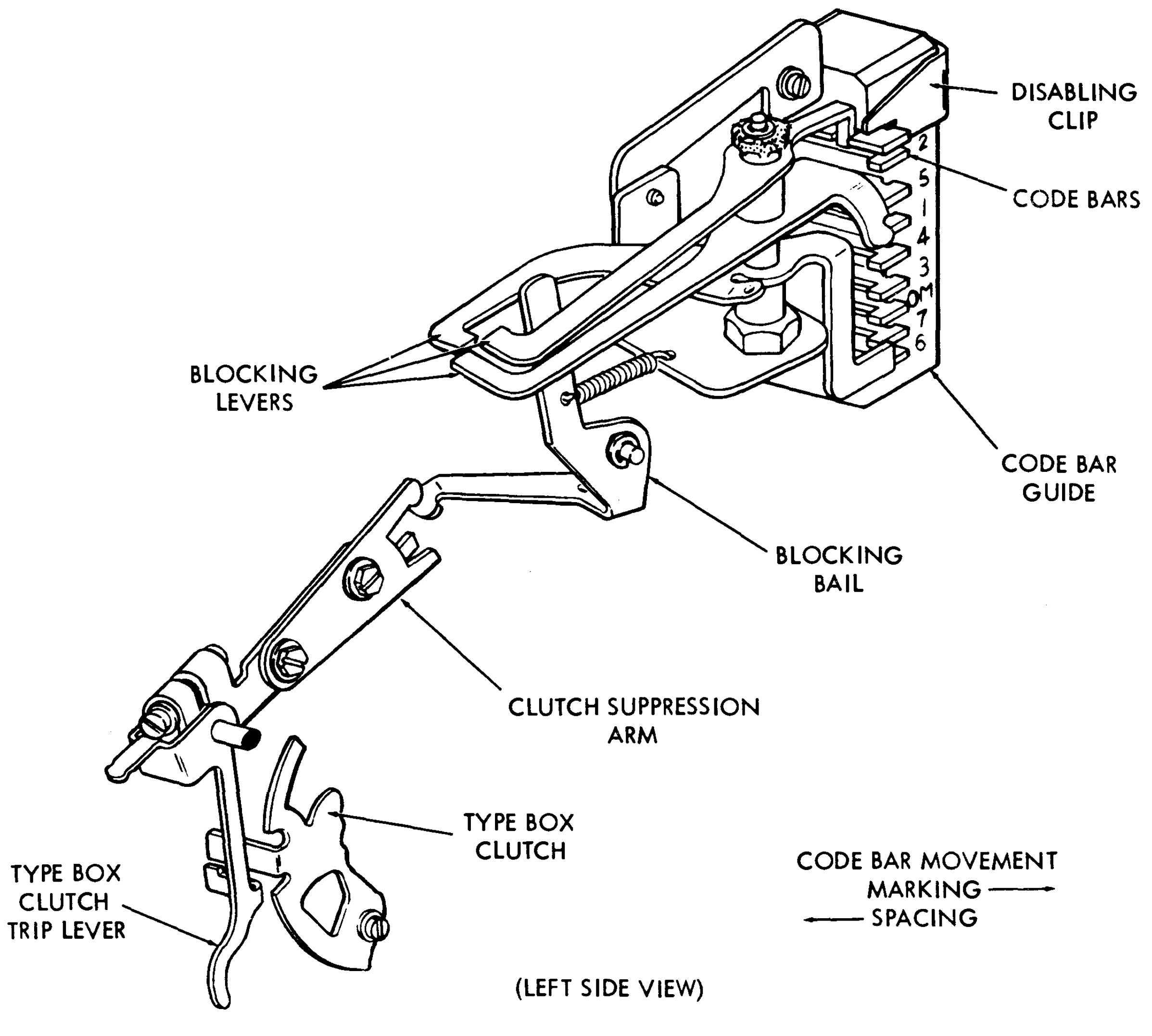


Figure 26 - Print Suppression Mechanism

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.

D. Print Suppression (Fig. 26)

2.56 A print suppression mechanism designed to prevent printing and spacing on non-printing function code combination signal input is located on the left end of the code bar mechanism and operated by the code bars. Three blocking levers are pivoted by the code bars either to pass or block the blocking bail, which in turn permits operation of the type box clutch trip lever or blocks its operation through a clutch suppression arm. The effect is to block the trip lever, and suppress printing, when the sixth and seventh code bits are simultaneously spacing, or when the third, fourth, fifth, sixth and seventh code bits are simultaneously marking.

2.57 The front end of the lower blocking lever (Fig. 26) rotates counterclockwise (top view) when the number 6 and number 7 code bars are in spacing position (right). The blocking bail is then blocked by the rear of the blocking lever. When either of these code bars is in marking position (left), the lever is rotated clockwise to free the blocking bail, permitting the clutch suppression arm to rotate when the clutch trip lever is rotated by the trip shaft.

2.58 The front end of the center blocking lever is engaged by notches in the numbers 3, 4, 5, 6, and 7 code bars in such a way that when any are in the spacing position, the lever is rotated counterclockwise to permit free movement of the blocking bail, thus permitting engagement of the type box clutch. When all of these code bars are marking, the blocking lever is rotated clockwise to suppress printing through the blocking bail.

2.59 The upper blocking lever is controlled by the suppression code bar. Since the suppression code bar is retained in spacing position by a disabling clip, the blocking lever is held in counterclockwise position, permitting printing at all times. The suppression code bar, if operated, would be operated from the stunt box.

SPACING MECHANISM

A. General

2.60 To space the printed character properly, the type box and printing carriages must be advanced with each character printed. The spacing must also be accomplished when the input signal code combination represents a letter space. As was shown in Par. 2.40 and Fig. 18, 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 thus the carriages, to the left. The spacing drum has ratchet teeth about its perimeter which are engaged by the eccentric driven spacing drum feed pawls (Fig. 27). The spacing shaft which mounts the spacing eccentrics is driven through its helical gear attached to the three stop spacing clutch on the main shaft. The gear ratio of 1-1/2 to 1 causes the spacing shaft to turn one-half a revolution each time the spacing clutch is tripped. This allows the feed pawls to advance the spacing drum by one ratchet tooth.

2.61 The same trip shaft which, through a cam on the code bar clutch (Par. 2.10), 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 (Par. 2.47). A cam plate (Fig. 27) 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.

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

B. Spacing Function

2.63 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 the sixth bit marking). The function is executed through the code bar clutch, tripping the printing clutch, and the spacing clutch as described in Par. 2.60-2.62. 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.

C. Spacing Suppression (Fig. 27)

2.64 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.

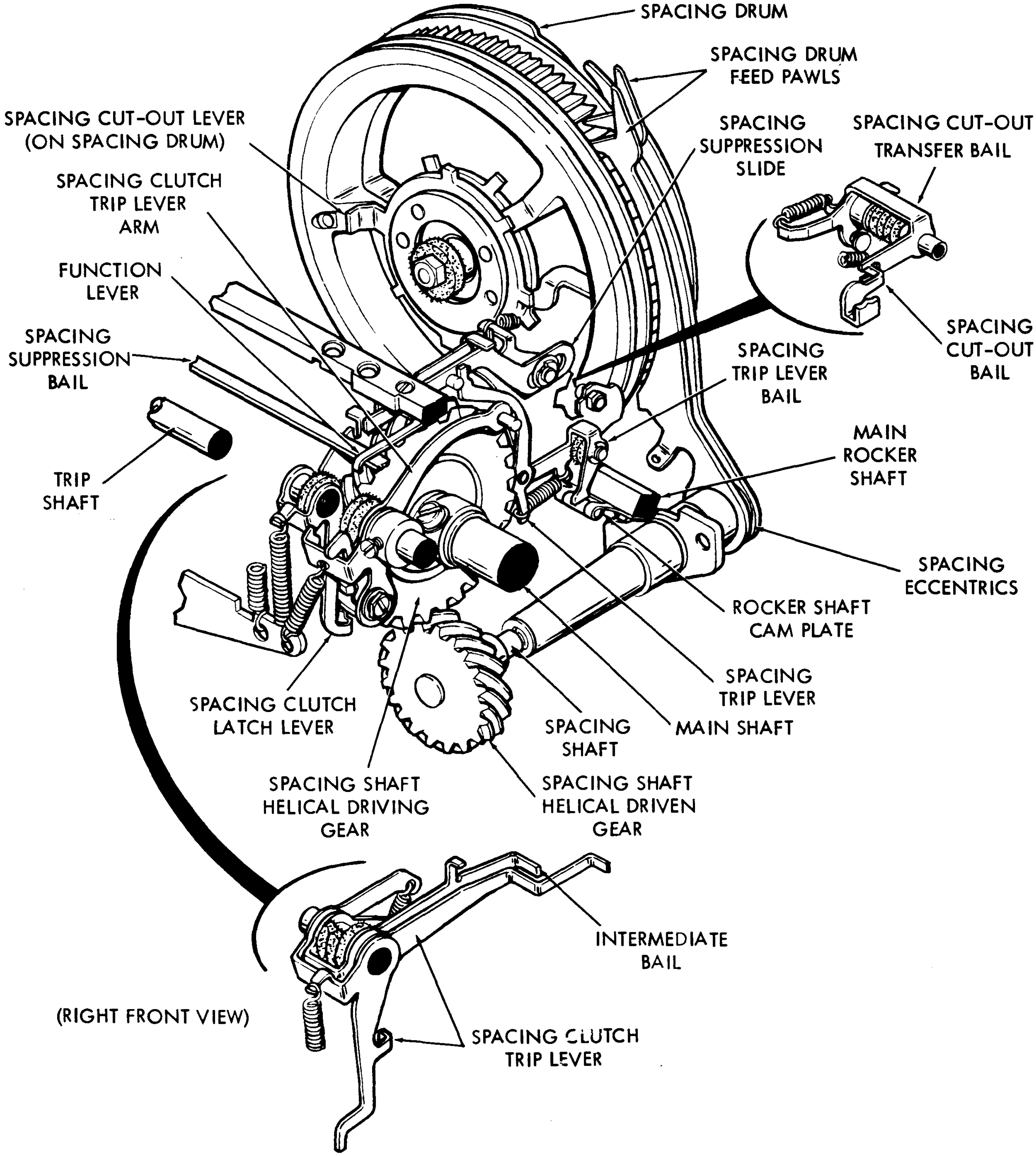


Figure 27 - Spacing Mechanism

2.65 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.

2.66 When the carriages are near their extreme right position, a cut-out ring on the spacing drum engages the spacing cut-out transfer bail (Fig. 27), which in turn operates the spacing cut-out bail. The ring and the end of the spacing cut-out transfer bail are shown in Fig. 18. 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

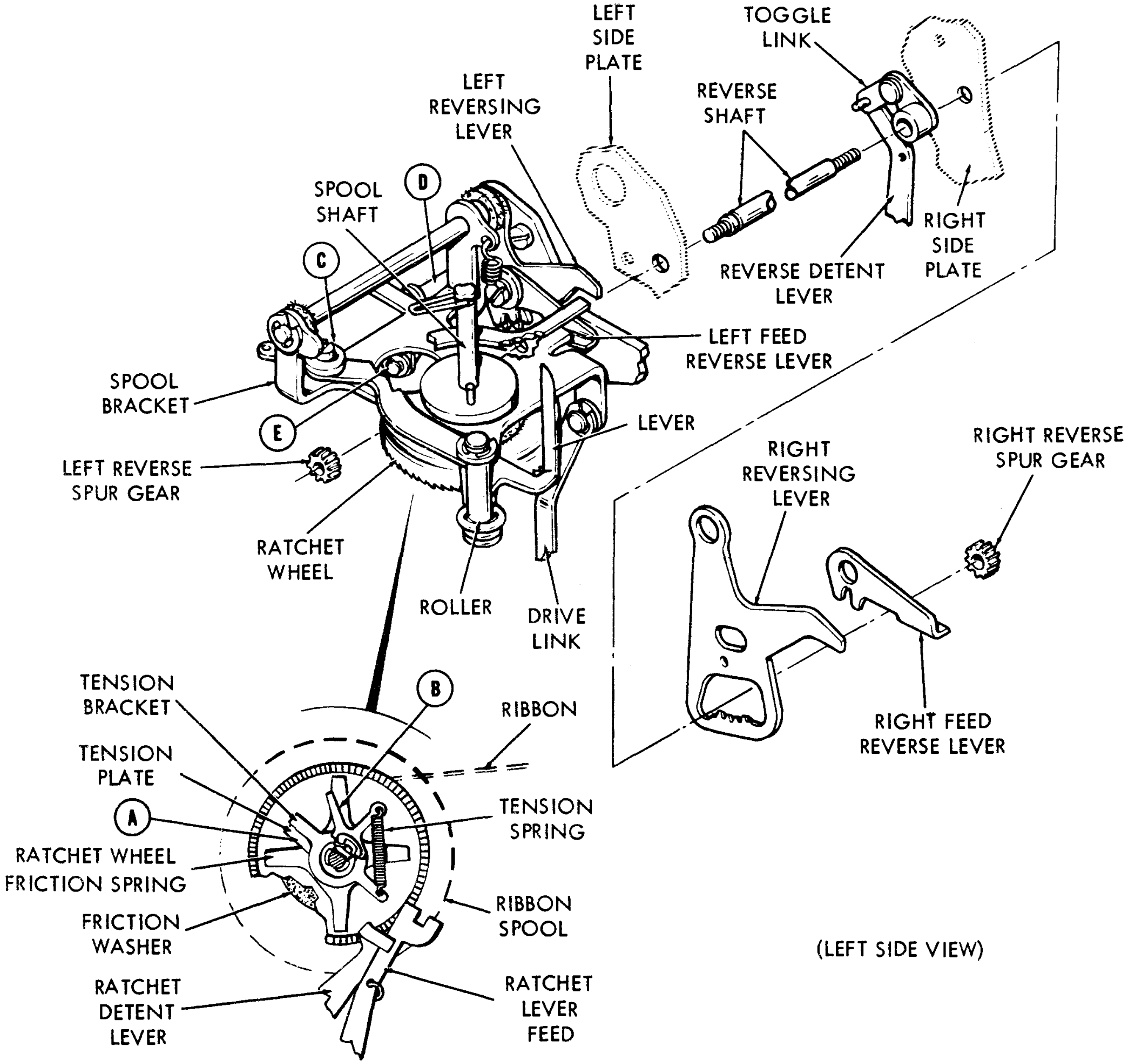


Figure 28 - Ribbon Feed and Reverse Mechanisms

which the typing unit may print is eighty-five, including spacing function spaces. In order to prevent spacing beyond this point with subsequent damage to the equipment, several teeth are omitted from the spacing drum ratchet wheel.

D. Margin Indicator (Fig. 18)

2.67 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.

RIBBON FEED MECHANISM (Fig. 28)

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

2.69 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 (Fig. 28). 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.

2.70 A ribbon tension plate which is keyed to the hub of the ribbon ratchet wheel has two projecting lugs (A and B, Fig. 28) that straddle the lug on the ribbon tension bracket. A ribbon tension spring tends to maintain the ribbon tension bracket against lug A of the ribbon tension plate. In operation, the ribbon spool bracket, driven by the ribbon drive link, pivots about point C. The ratchet feed and ratchet detent levers pivot about points D and E respectively and are held against the teeth on the ribbon ratchet wheel by their springs. As the ribbon spool bracket is moved upward, the ratchet wheel feed lever skips over one tooth, while the ratchet detent lever holds the ribbon ratchet wheel from turning backward. When the ribbon spool bracket is moved downward, the ratchet feed lever engages a ratchet tooth and pushes the ratchet wheel. A tooth on the ribbon ratchet wheel then skips over the ratchet detent lever. The teeth on the left and right ribbon ratchet wheels face in opposite directions so that when their feed levers are engaged, the left ribbon ratchet wheel turns counterclockwise (viewed from the top). 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.

2.71 When the ribbon has been completely unwound from one spool, it is necessary to reverse its direction so it can rewind. This is accomplished automatically by disengaging one set of ratchet feed and ratchet detent levers and engaging the other set. While the ribbon is 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 (Fig. 28). 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 Fig. 28. 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

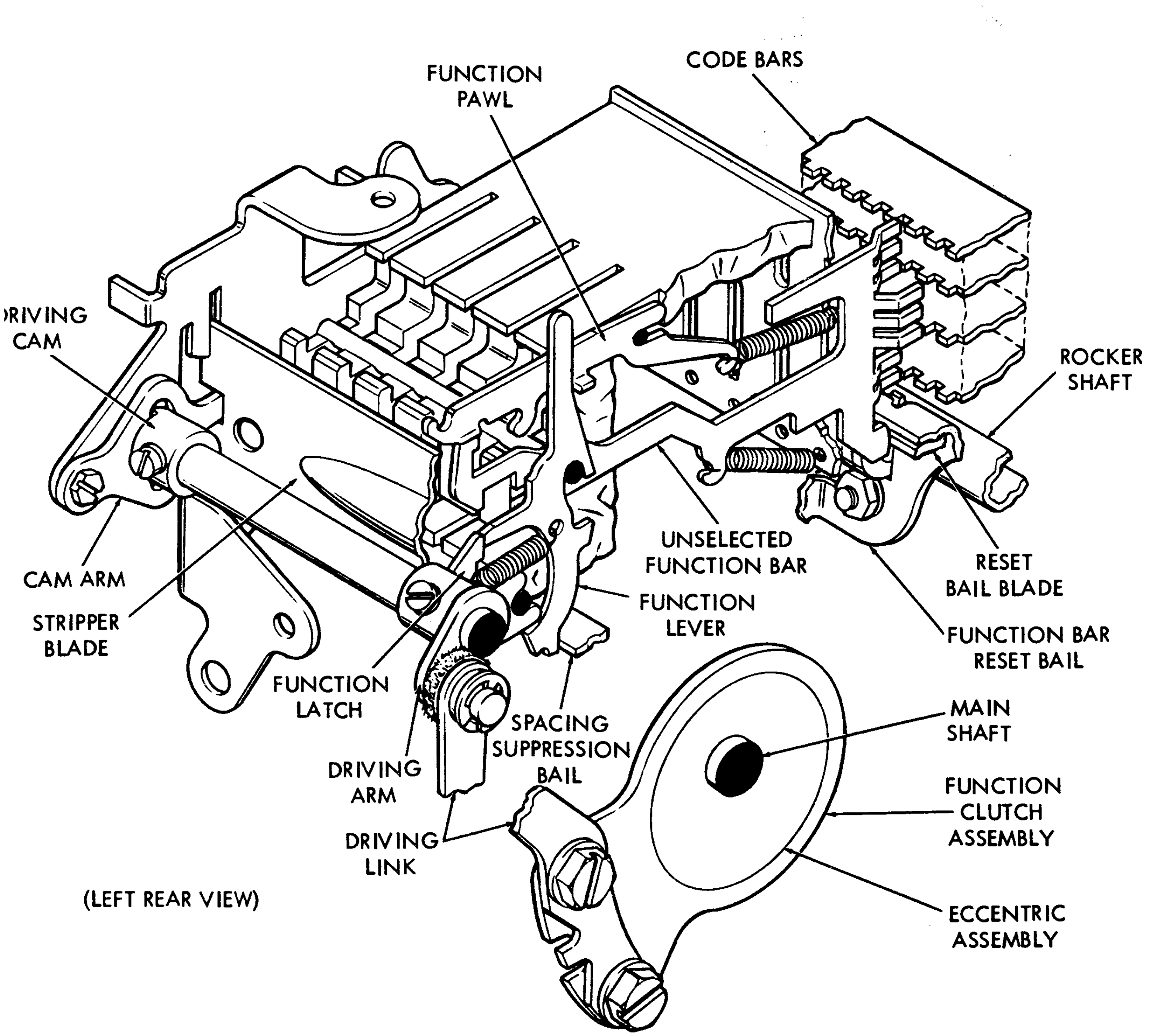


Figure 29 - Stunt Box (Function Linkage Unselected)

;ame time a pin on the left ribbon reversing .ever moves the left ribbon feed reversing lever ıpward to permit the left ratchet feed and detent .evers to engage the left ribbon ratchet wheel. Thus, the ribbon mechanisms are positioned to :ewind the ribbon on the left ribbon spool. When .t nears its end on the right ribbon spool, the :ibbon is again reversed in a manner similar o that just described. During the reversing :ycle, the ribbon is maintained taut by the pre- /iously extended ribbon tension spring.

FUNCTIONS

A. General

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

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

2.73 As in printing, the reception of function codes results in the positioning of the code bars (Par. 2.31-2.37). The back edges of the code bars are notched (Fig. 29). Positioned directly behind the code bars is a stunt box, which contains the function bars for the various functions (Fig. 30 and 31). The function bars used on the friction feed typing unit (Fig. 30) are applicable to the sprocket feed typing unit (Fig. 31), with some additional function bars as shown in the illustrations. 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.

2.74 When the function clutch is engaged (Fig. 22), it rotates and extends motion to the function bar reset bail (through the intervening cam and follower arm and function rocker shaft) to cause the function bar reset bail with its attached reset bail blade to release the function bars momentarily (Fig. 32). 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 code bar to continue to move

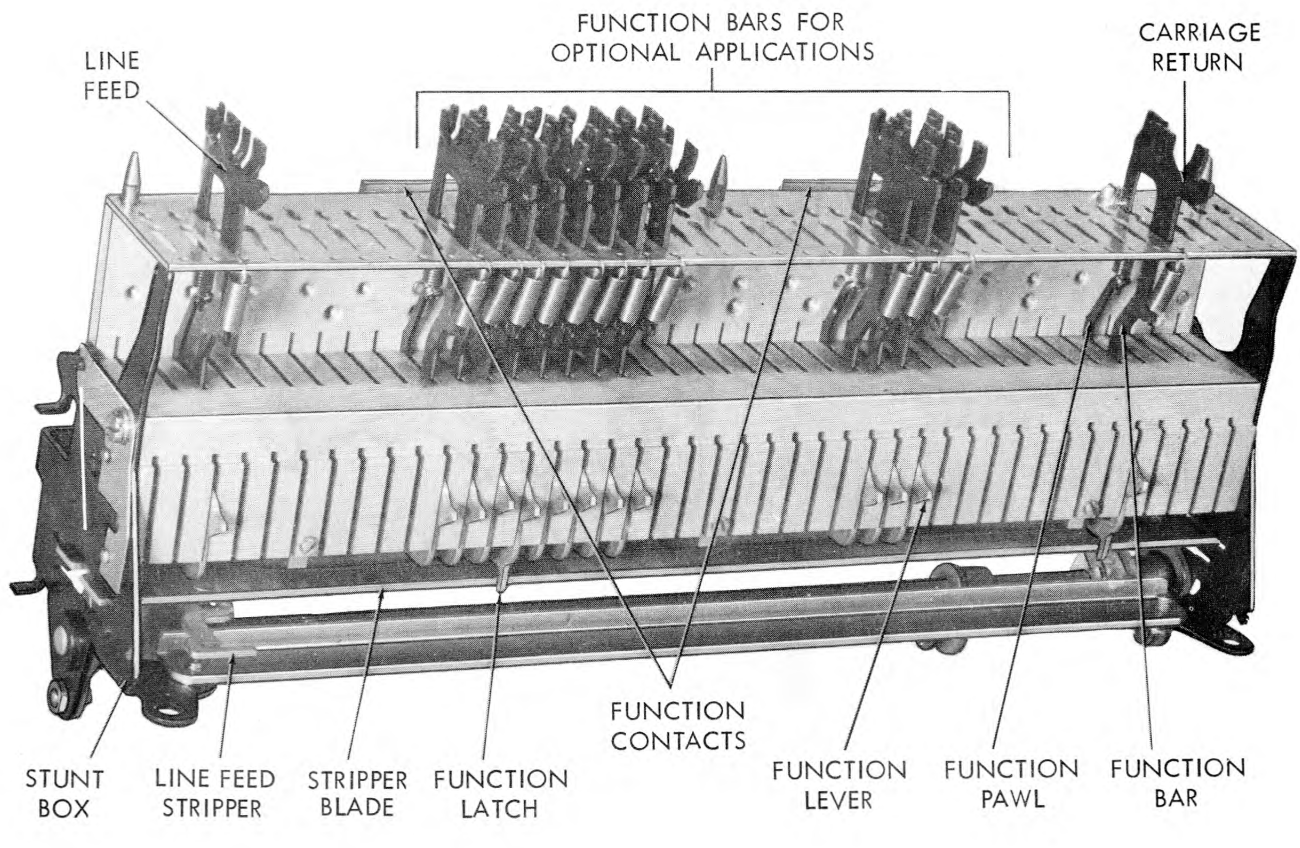


Figure 30 - Typical Stunt Box (Bottom View)

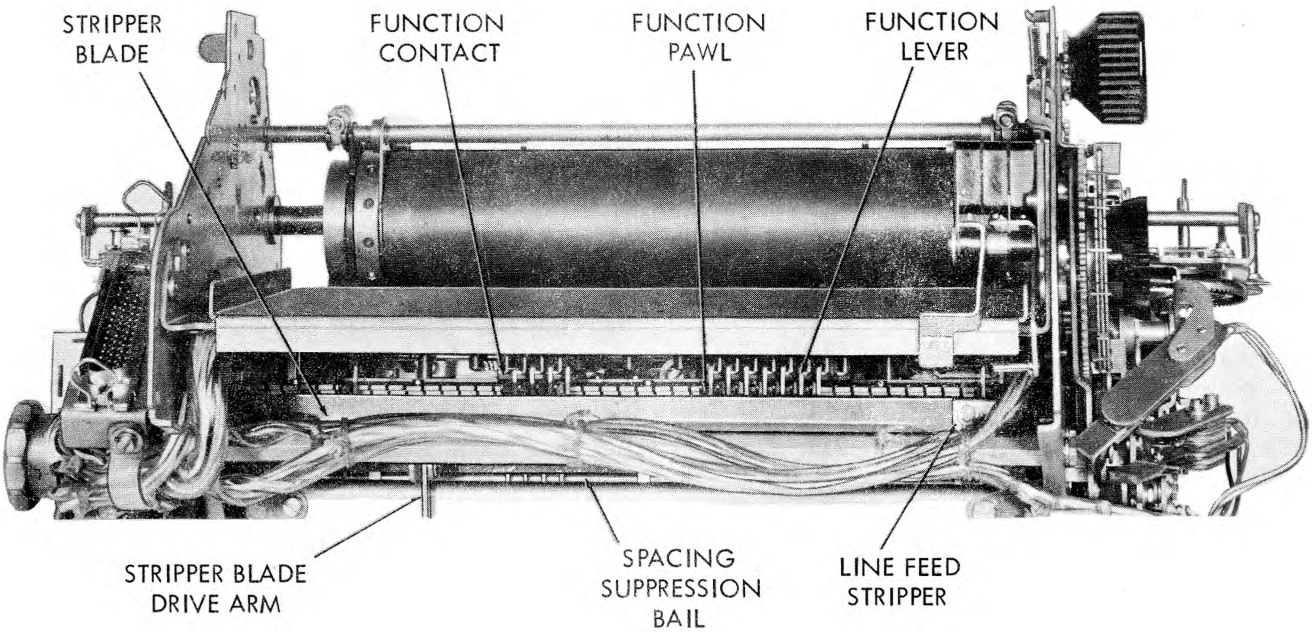


Figure 31 - Stunt Box Installed in Sprocket Feed Typing Unit (Rear View)

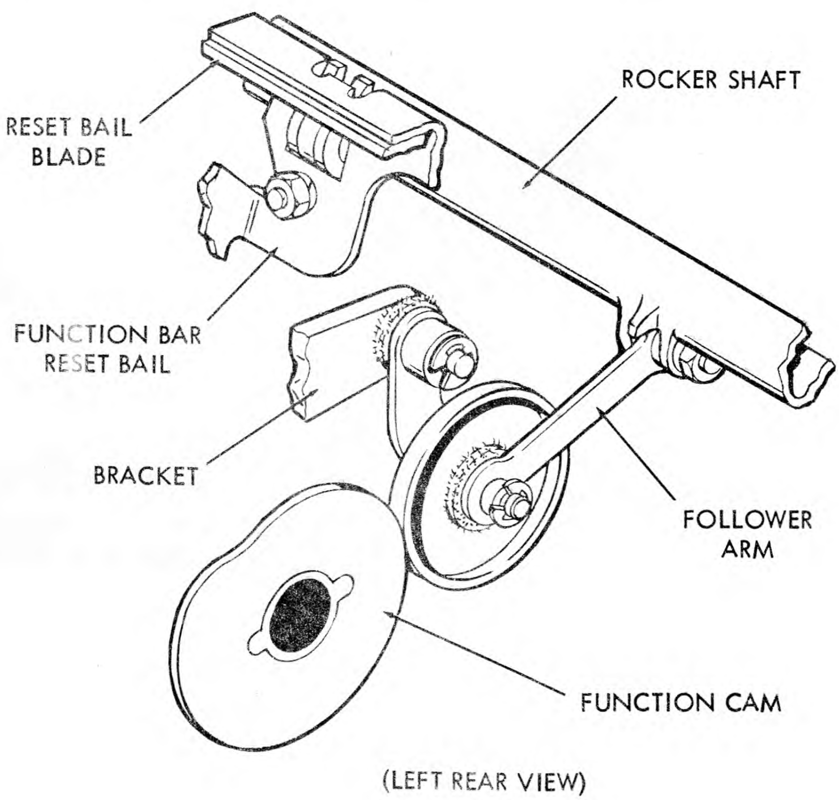


Figure 32 - Reset Bail Mechanism

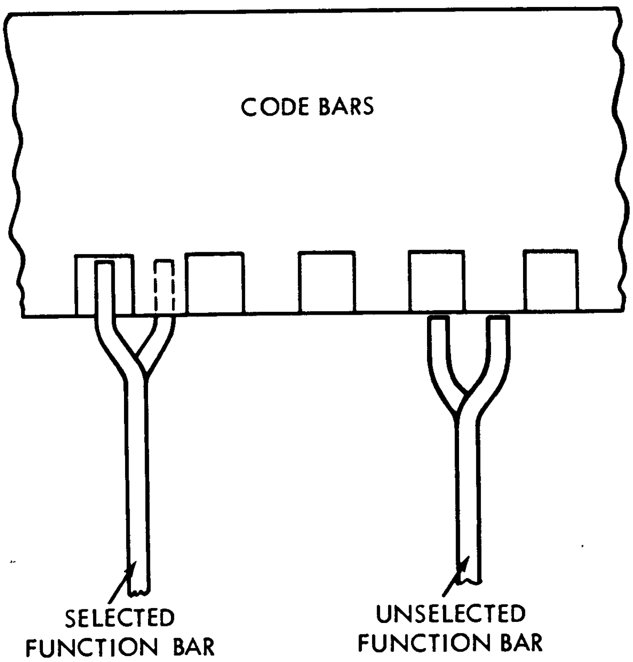


Figure 33 - Function Bar Selection

forward into the code bars, while the other function bars are blocked by one or more code bars (Fig. 33).

2.75 Associated with each function bar in the stunt box is a function pawl and a function lever. In the unselected position, the function bar is not latched with its function pawl (Fig. 34). When the function bar reset bail blade releases the function bars, any selected bar will move sufficiently forward (to the left, in Fig. 34) to permit it to engage its function pawl. Then, as the reset bail blade returns the function bar to its initial position, the function bar carries the function pawl to the rear (to the right, Fig. 35). 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 (Par. 2.65), selected levers moving the bail forward. Either the upper or the lower end operates the indicated function.

2.76 Near the end of the function cycle, a stripper blade (Fig. 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 (Par. 2.36).

B. Carriage Return Function

2.77 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,

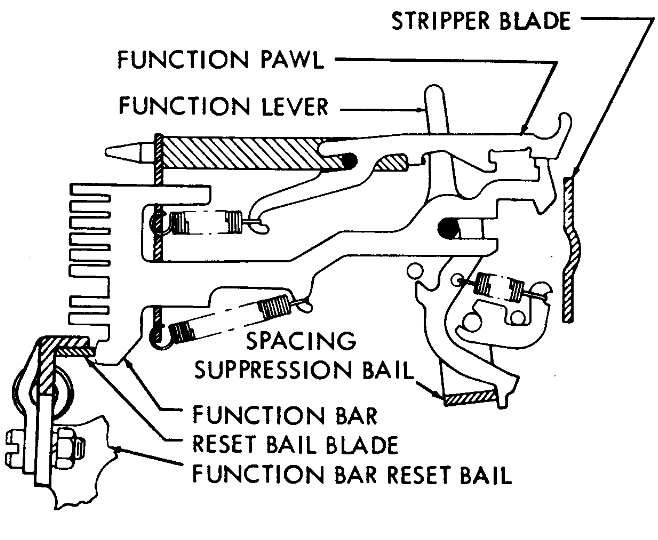


Figure 34 - Typical Function Linkage (Unselected)

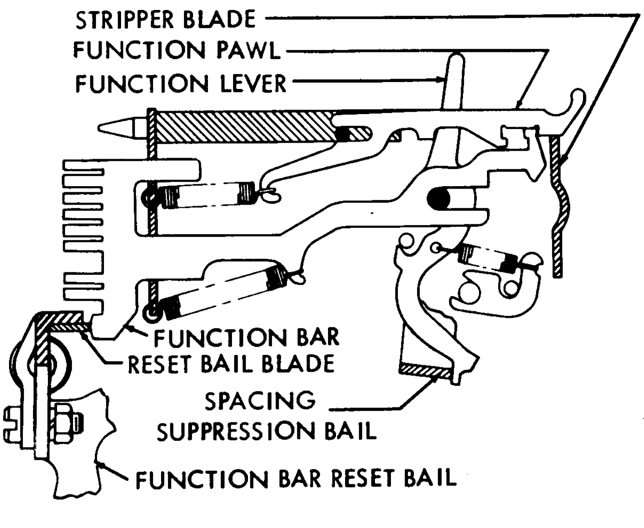


Figure 35 - Typical Function Linkage (Selected)

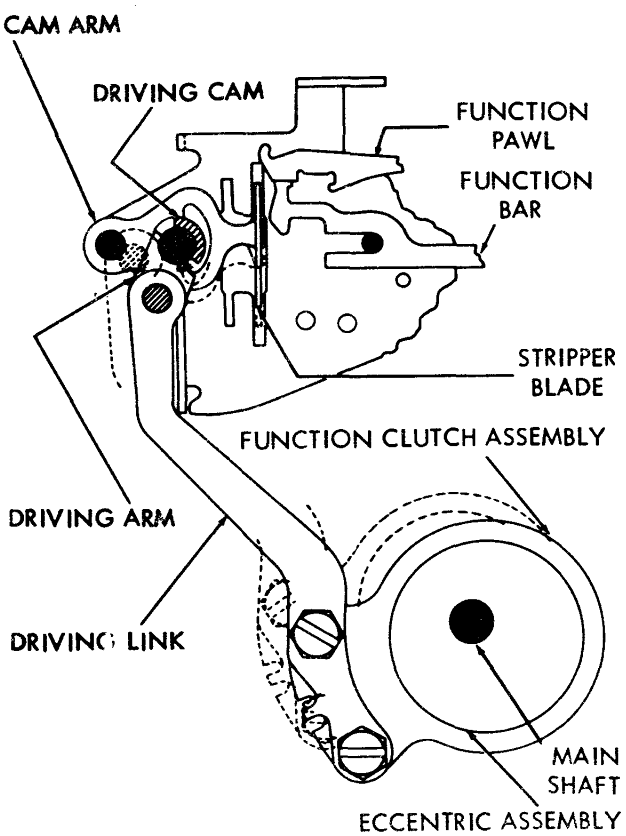


Figure 36 - Stripper Blade Mechanism

pawl and lever to operate (Fig. 37). The lower end of the function lever engages the carriage return slide arm and pushes it forward. The slide arm, in turn, moves the carriage return bail and its lever about their pivot point. As the front portion of the lever moves downward, it takes with it the lower section of the spacing drum feed pawl release link. This causes the upper portion of the link to turn and disengage the spacing drum feed pawls from the spacing drum (Fig. 38).

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

2.79 Local (off-line) operation of the carriage return mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the carriage return lever (Fig. 37), 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.

C. Line Feed Function

2.80 The line feed function mechanism is located in the left end of the typing unit. The code bar mechanism set to correspond to an input signal code combination for spacing permits two line feed function bars, pawls and levers to operate. The function linkage at the far left of the stunt box (third from the left on sprocket feed typing units equipped for vertical tabulation) operates the line feed mechanism (Fig. 39). The function bar positioned in slot 29 of the stunt box is used, in connection with line feed, only for space suppression (Par. 2.83). The lower end of the line feed function lever engages the line feed slide arm and pushes it forward. The slide arm, in turn, moves the line feed clutch trip arm and the trip lever above their pivot point until the trip lever releases the three stop line feed clutch. The line feed gearing is such that each 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.

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

2.82 The stripper bail on which the slotted line feed function pawl stripper rides may

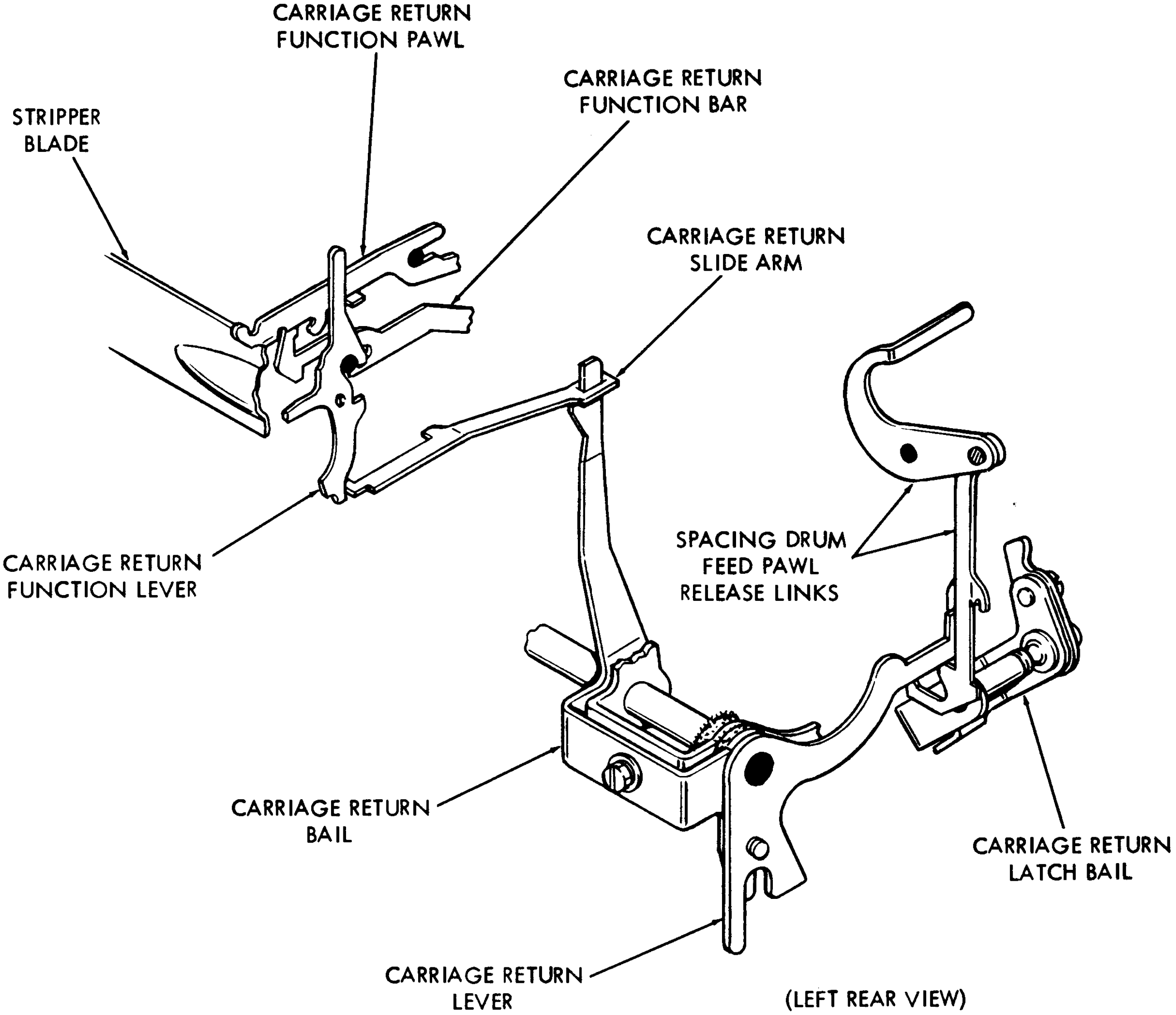


Figure 37 - Carriage Return Function Mechanism

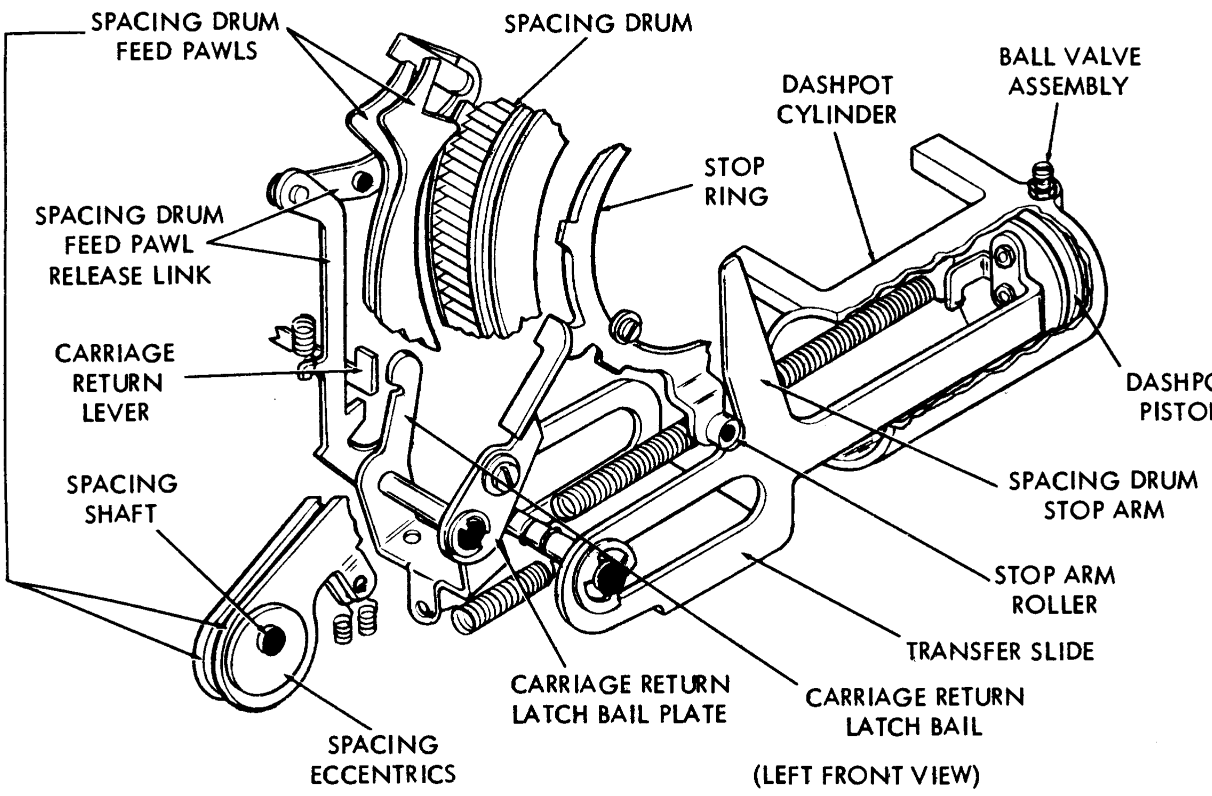


Figure 38 - Carriage Return Mechanism

be shifted toward the right (double) or to the left (single) by action of the single or double line feed lever (Fig. 40). The upper end of the pivoted single or double line feed lever protrudes from the upper left of the left side plate of the typing unit, where it rides in the two position side frame detent extension. When the lever is in position 1, the stripper bail engages line feed function stripper to raise it into contact with the function pawl before the stripper blade would strike it. When the lever is moved to the rear (position 2), the bail is disengaged from the blade, and the stripper blade strikes the function pawl in the normal cycling of the function box stripper blade.

Note: On Typing Units equipped for vertical tabulation and form out, the operating principle of the stripper mechanism in single line feed operation is as described here. The line feed function pawl stripper, however, is of a different design to accommodate the additional form out and vertical tabulation functions.

2.83 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 slot 29 of the stunt box for the purpose of 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 (Par. 2-36).

2.84 Each one-third revolution of the line feed clutch causes its attached spur gear (Fig. 40) 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

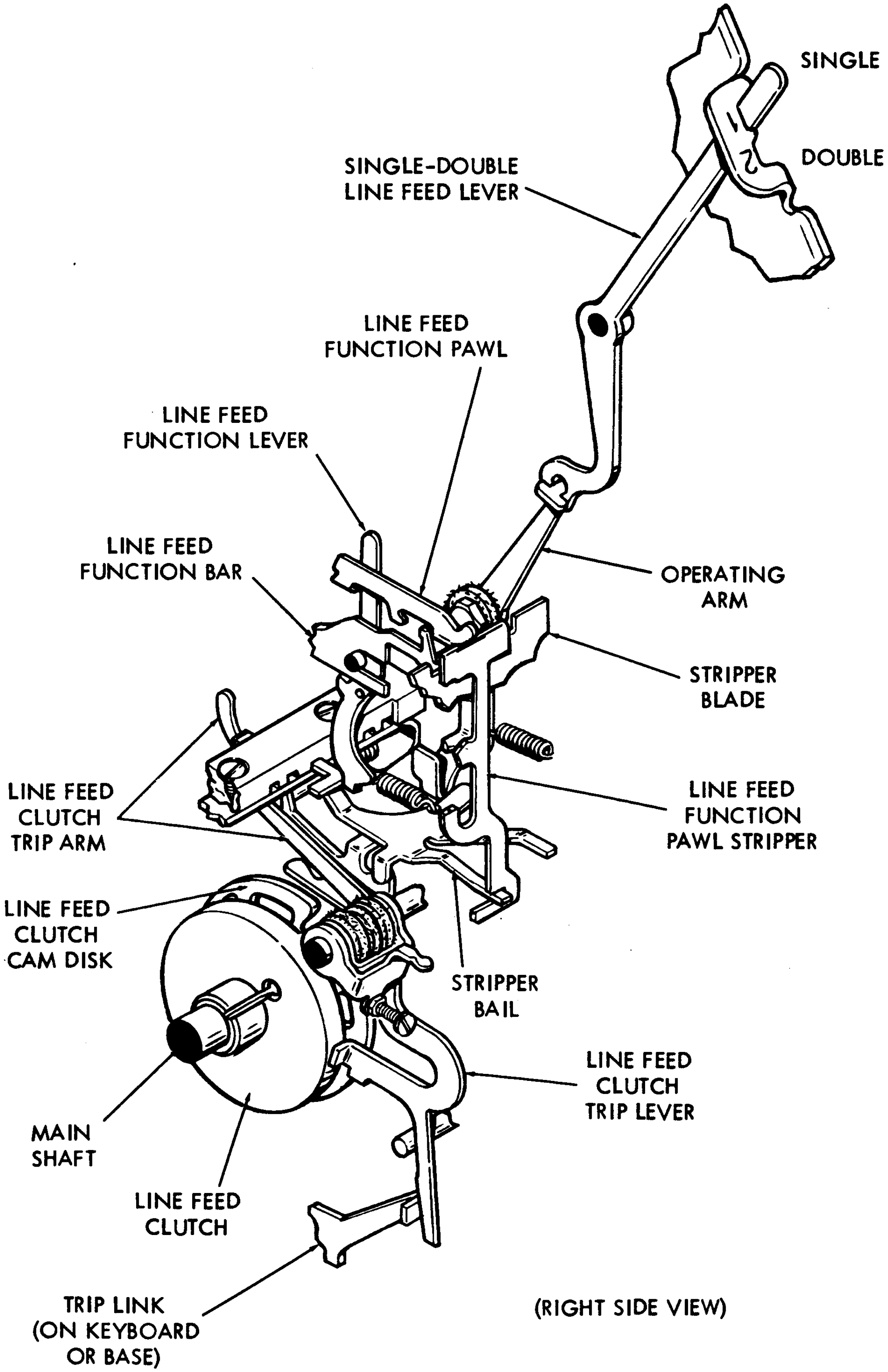


Figure 39 - Line Feed Mechanism

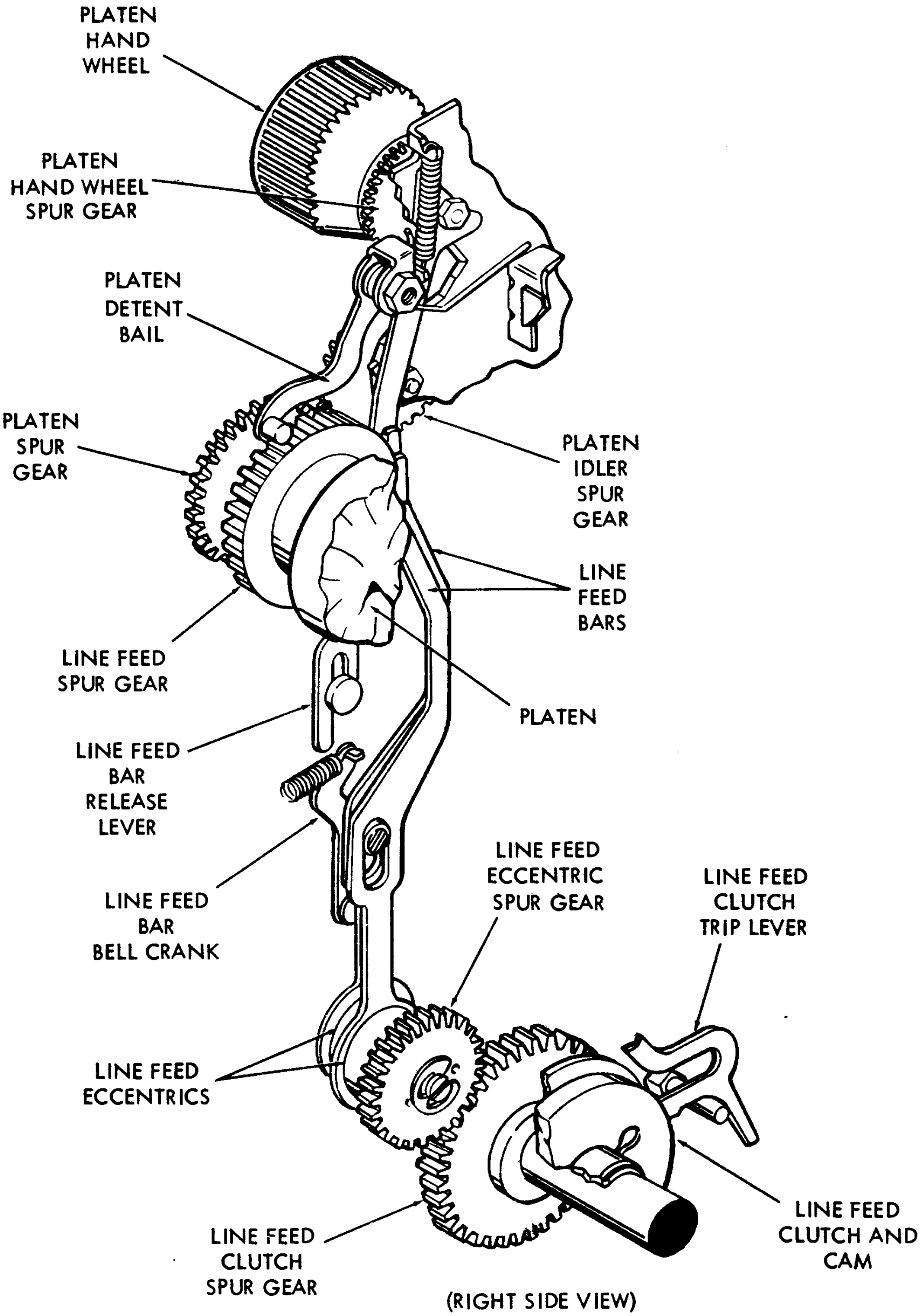


Figure 40 - Single-Double Line Feed Lever

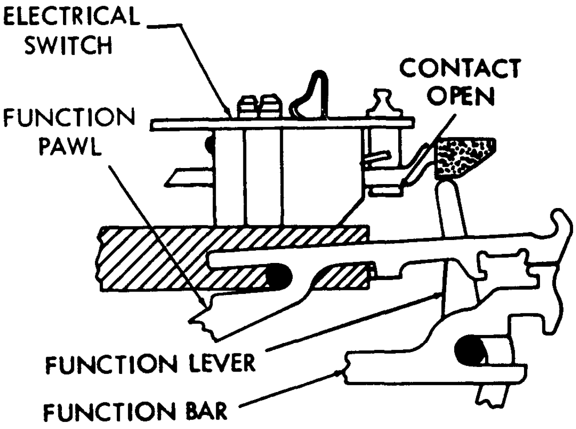


Figure 41 - Typical Box Contact (Unselected)

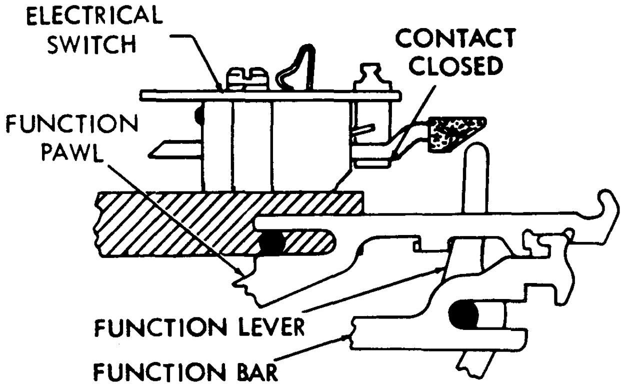


Figure 42 - Typical Box Contact (Selected)

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.

2.85 When it is desired to position the platen manually, this may be accomplished by bearing down on and rotating the platen handwheel at the top of the right side plate. This causes the platen handwheel spur gear to engage the platen idler gear, which in turn is engaged with the platen spur gear on the platen shaft. At the same time, the line feed bar release lever (Fig. 40) bears on the line feed bar bell crank and causes it to disengage the line feed bars from the line feed spur gear.

2.86 Local (off-line) operation of the line feed mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the line feed clutch trip lever (Fig. 39), when rotated to the rear (counterclockwise, viewed from the right), operates the line feed mechanism in the same way as when this lever is operated by the function box. Since the clutch is manually engaged, line feed is continuous until released at the keyboard or base.

D. Stunt Box Contacts (Fig. 41 and 42)

2.87 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 requirements. The contact arm configuration is changed as required to either make or break the contact when the associated function lever is in selected (rear) position. All contacts are wired through the cable connector located on the right side plate. A typical contact (NO) is illustrated in unselected (Fig. 41) and selected (Fig. 42) condition.

2.88 The contact operated by the function linkage in slot 14 of the stunt box operates in response to an input signal code combination representing R1 OFF (Receiver Off). This is a normally closed contact.

2.89 The contacts operated by the function linkages in slots 15, 16, 27, 28, 30 and 32 of the stunt box are normally open contacts. They operate in response to the following input signal code combinations (from right to left on the stunt box) in sets operating in switched network service.

15	R1 ON	Receiver On
16	BELL	Signal Bell
27	EOT	End of Transmission
28	X-ON	Transmitter On
30	ACK	Acknowledge
32	RU	Are You

2.90 The contacts operated by the function linkages in slots 25 and 26 (in sets operating in switched network service) both operate in response to an input signal code combination representing WRU (Who Are You). The

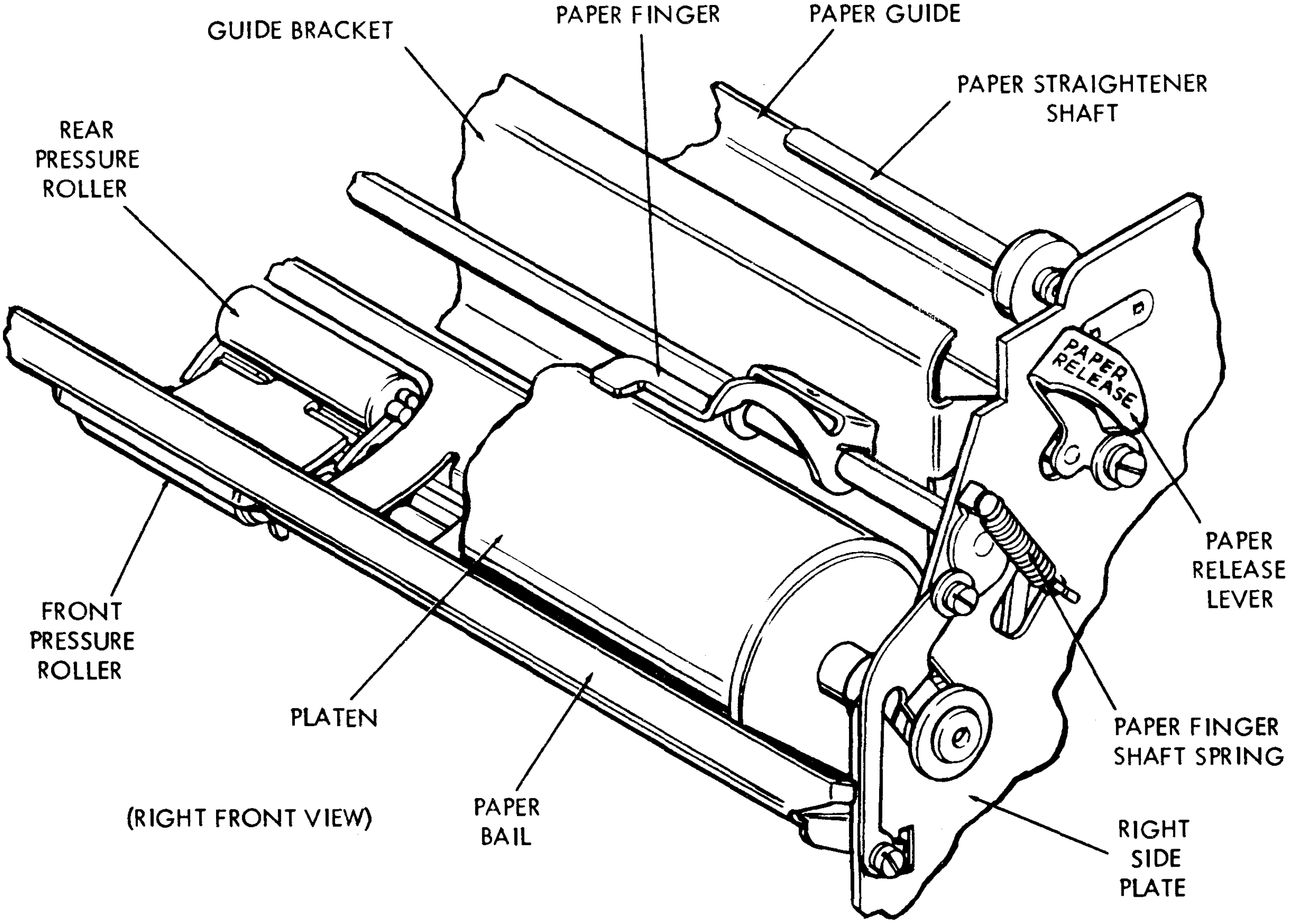


Figure 43 - Friction Feed Platen Mechanism

contact operated by the function linkage in slot 31 operates on X-OFF (Transmitter Off) code. These switches are all SPDT contacts.

2.91 When the ACK code is received (by sets operating in switched network service) the function linkage in slot 30 of the stunt box is operated. This linkage also engages the adjoining line feed function bar linkage in slot 29 when it pushes rearward on an ear of the line feed function lever. The line feed function lever ear latches the ACK function bar, and the contact operated is held closed until it is released when a line feed input signal code combination is received.

3. FRICTION FEED TYPING UNIT

GENERAL DESCRIPTION

3.01 The friction feed typing unit includes all features of the basic printer described in Par. 1 and 2 of this section. In addition, it has a friction feed paper mechanism.

PRINCIPLES OF OPERATION

3.02 The operation of the friction feed typing unit is as described in Par. 2 of this section. In addition, the equipment has a friction feed paper mechanism.

3.03 Paper for the page printed message is stored on a roll 8-1/2 inches wide, mounted on a paper spindle suspended between the two side plates at the rear of the typing unit. From the roll, the paper passes over a paper straightener shaft, downward behind the platen (Fig. 43) and between the platen and three pressure rollers. A paper pressure bail at the front of the platen equalizes pressure brought to bear on the paper by the pressure rollers. The

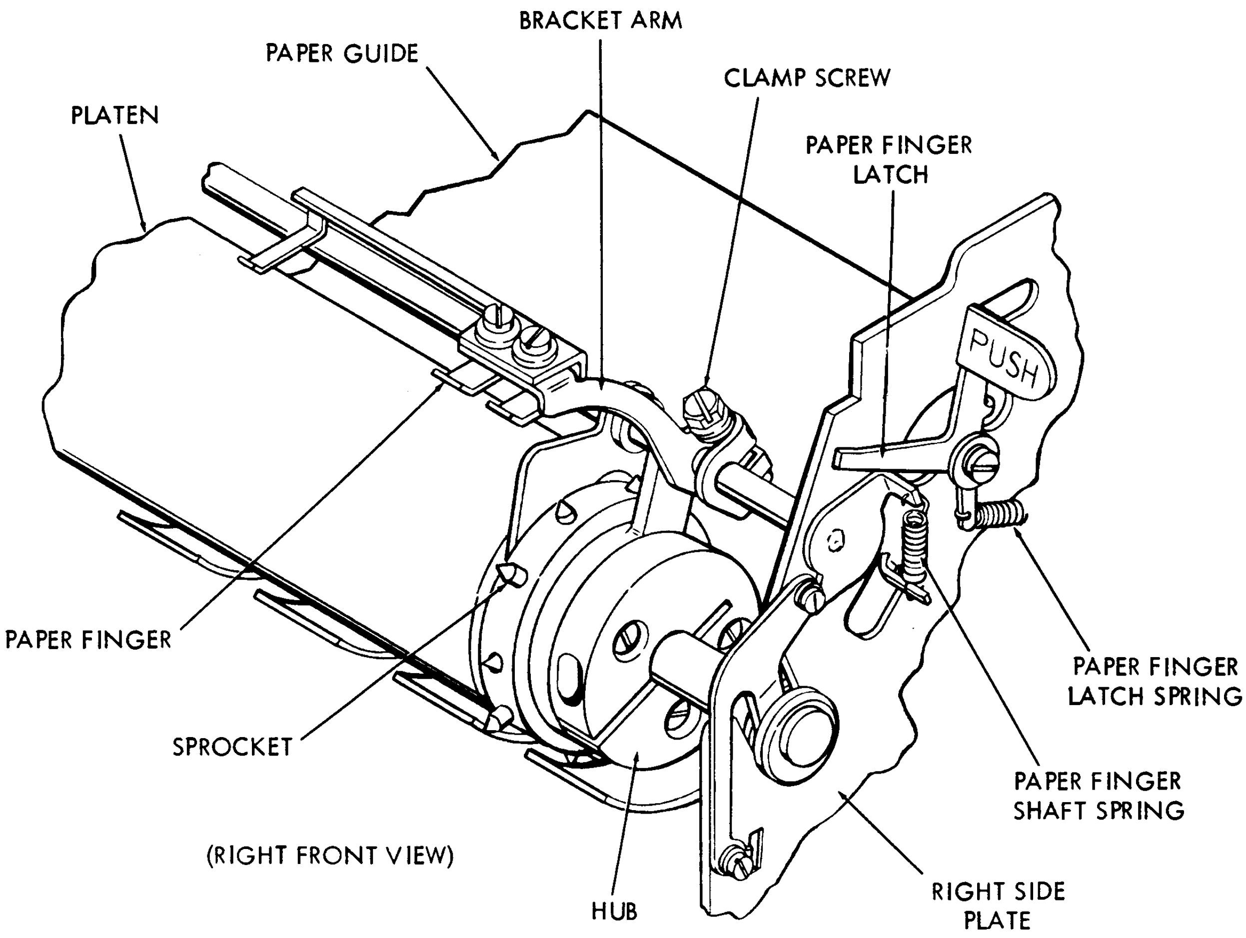


Figure 44 - Sprocket Feed Platen Mechanism

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 platen, in position for printing.

4. SPROCKET FEED TYPING UNIT

GENERAL DESCRIPTION

4.01 The sprocket feed typing unit includes all features of the basic printer described in Par. 1 and 2 of this section. In addition, it has a sprocket feed mechanism for insertion of a form fold paper supply for the page printed message.

PRINCIPLES OF OPERATION

4.02 The operation of the sprocket feed typing unit is as described in Par. 2 of this section. In addition, the equipment has a sprocketed form fold feeding platen.

4.03 The platen is equipped at each end with an eleven pin sprocket, with pins spaced to accommodate holes along the edges of form fold paper for the page printed message (Fig. 44). The spring loaded pins are cammed (within the platen) so that the two bottom and two top pins on each side at the front of the platen are extended, while all others are retracted. Extended pins engage the holes in the form fold and pull the paper into page printing position over the front of the platen, where it is held by two paper fingers. At the rear of the platen, the form fold is fed through an aperture at the back of the cabinet housing the typing unit, across a flat paper guide, and under the bottom of the platen. Paper feeding and line feeding are as described for the basic printer (Par. 2.80-2.85). Paper fingers are released to a spring loaded upright position by pushing a lever marked "PUSH" on the top of the right side plate to the rear. The fingers are repositioned by depressing them manually until the end of the paper guide shaft latches an indent on the release lever.

5. VARIABLE FEATURES

PAPER OUT CONTACTS (Fig. 45)

5.01 A bell crank follower lever is positioned to be held by spring tension against the bottom side of the paper supply roll. When a little less than 1/4 inch remains on the paper supply roll, the bell crank operates the lower of two microswitches, to close a normally open circuit and energize an external warning device. If the paper roll is not replaced, as more paper is used, the bell crank follower is rotated farther until the upper switch is operated. This SPDT contact interrupts operation of the typing unit and indicates a busy line condition to other stations on the signal line.

FORM OUT AND PAPER JAM CONTACTS

5.02 Three switches mounted on the inside of the left side plate, above the paper guide, are operated by a low paper and paper jam lever and an end-of-form lever (Fig. 46), both of which ride above the feeding form. The low paper lever, first to operate, energizes an external warning signal through the left switch when paper is low or through the center switch when there is a jam in the form feeding mechanism. The form out switch operates through the right switch to terminate printing operations and signal the equipment as busy to prevent further message reception.

HORIZONTAL TABULATION

5.03 The spacing drum for typing units equipped for horizontal tabulation has a slotted

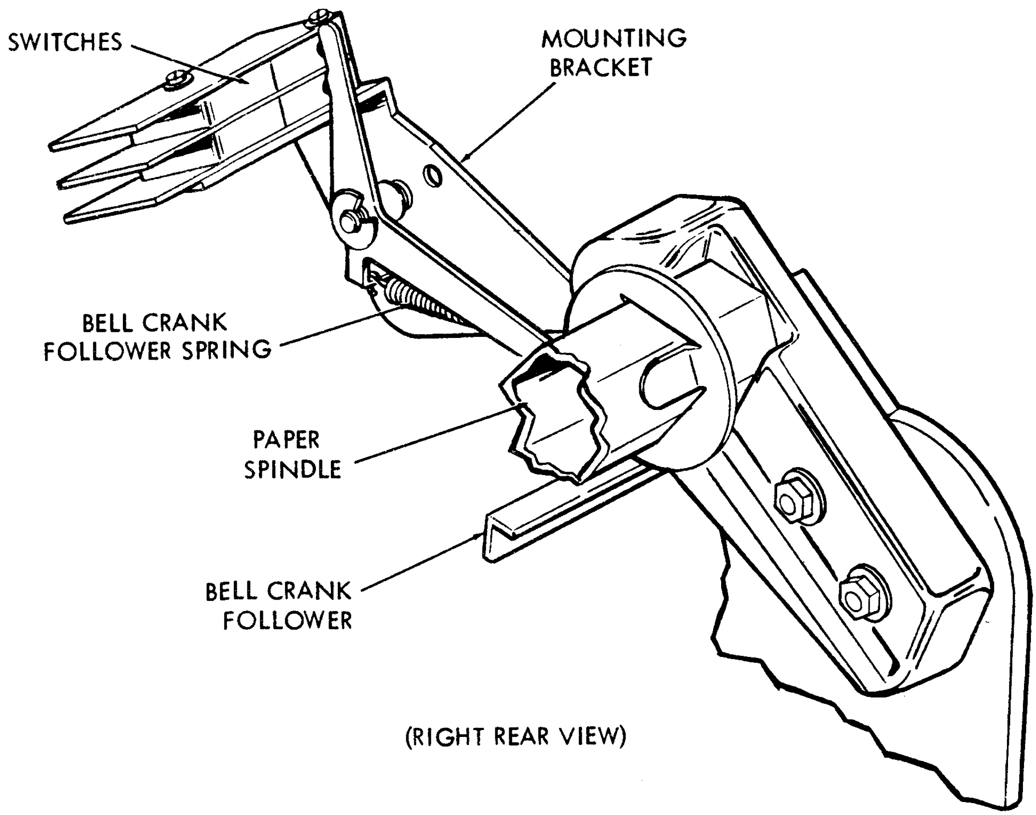


Figure 45 - Paper Out Contacts (Friction Feed)

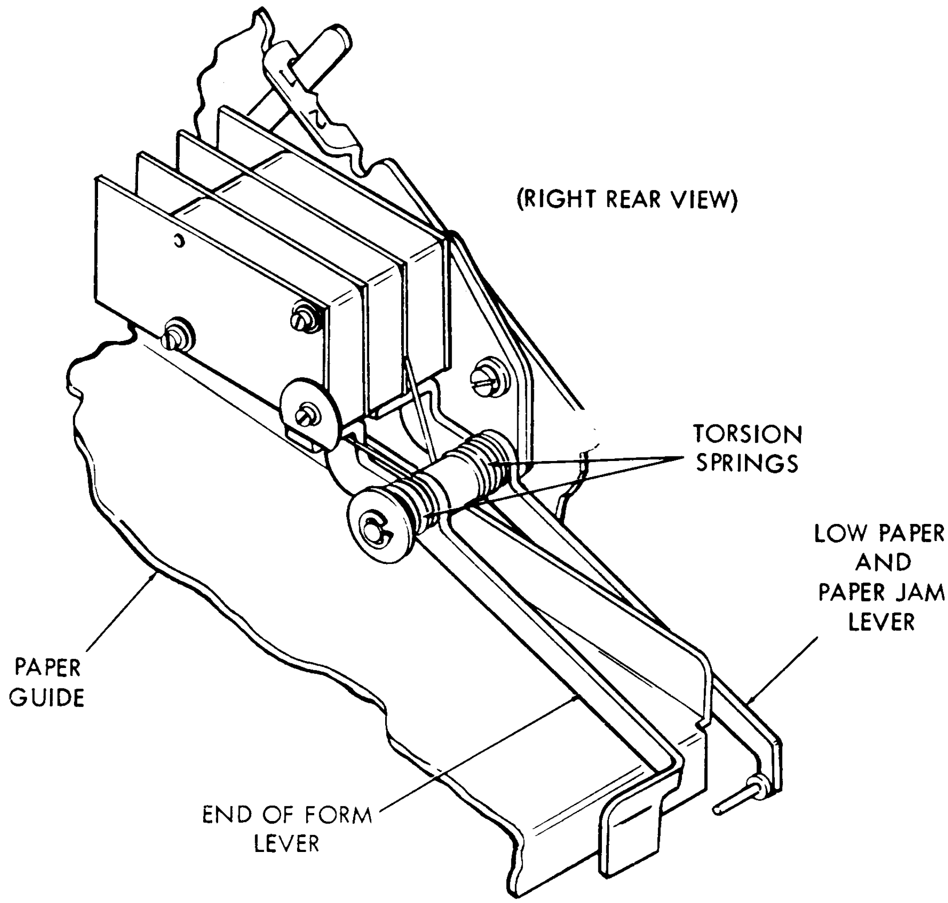


Figure 46 - Form Out and Paper Jam Contacts (Sprocket Feed)

tab stop ring mounted over the face of the spacing drum, in place of the carriage return ring on the basic printer. The ring (Fig. 47), when coded for the desired tabulation, will allow the carriage to be moved rapidly, at a speed three times that of normal spacing, to predetermined horizontal positions on the printed page.

5.04 Reception of the input signal code combination representing horizontal tabulation operates the associated stunt box mechanisms to move the function lever forward. The function lever moves the horizontal tabulator slide (Fig. 48) forward. As the slide arm moves forward, it engages the operating lever cam plate, causing the operating lever to pivot about its mounting stud, located at the center of the lever. As the upper end of the operating lever moves forward, the extension link attached to the lower end of the lever moves to the rear. Near the end of its travel, the extension link clears the blocking lever, allowing it to move down into position to block the link from moving forward.

5.05 Tripping the spacing clutch is initiated in the same way as for normal printing (Par. 2.60-2.62). As the trip lever moves down, however, it hooks over and pulls down the intermediate trip bail (Fig. 47). The intermediate bail in turn pulls down the stop lever arm and trips the clutch stop lever, which is clamped to the lower end of the stop arm. The spacing clutch then starts to rotate. The stop lever arm in its unoperated position rests against the intermediate bail.

5.06 Fastened to and moving as part of the operating lever is the latch bail adjusting plate (Fig. 48). Mounted to the stud on the upper end of the adjusting plate is the stop lever arm latch bail. The latch bail in its rest position is held forward by spring tension against a projection on the adjusting plate. Therefore, when the upper

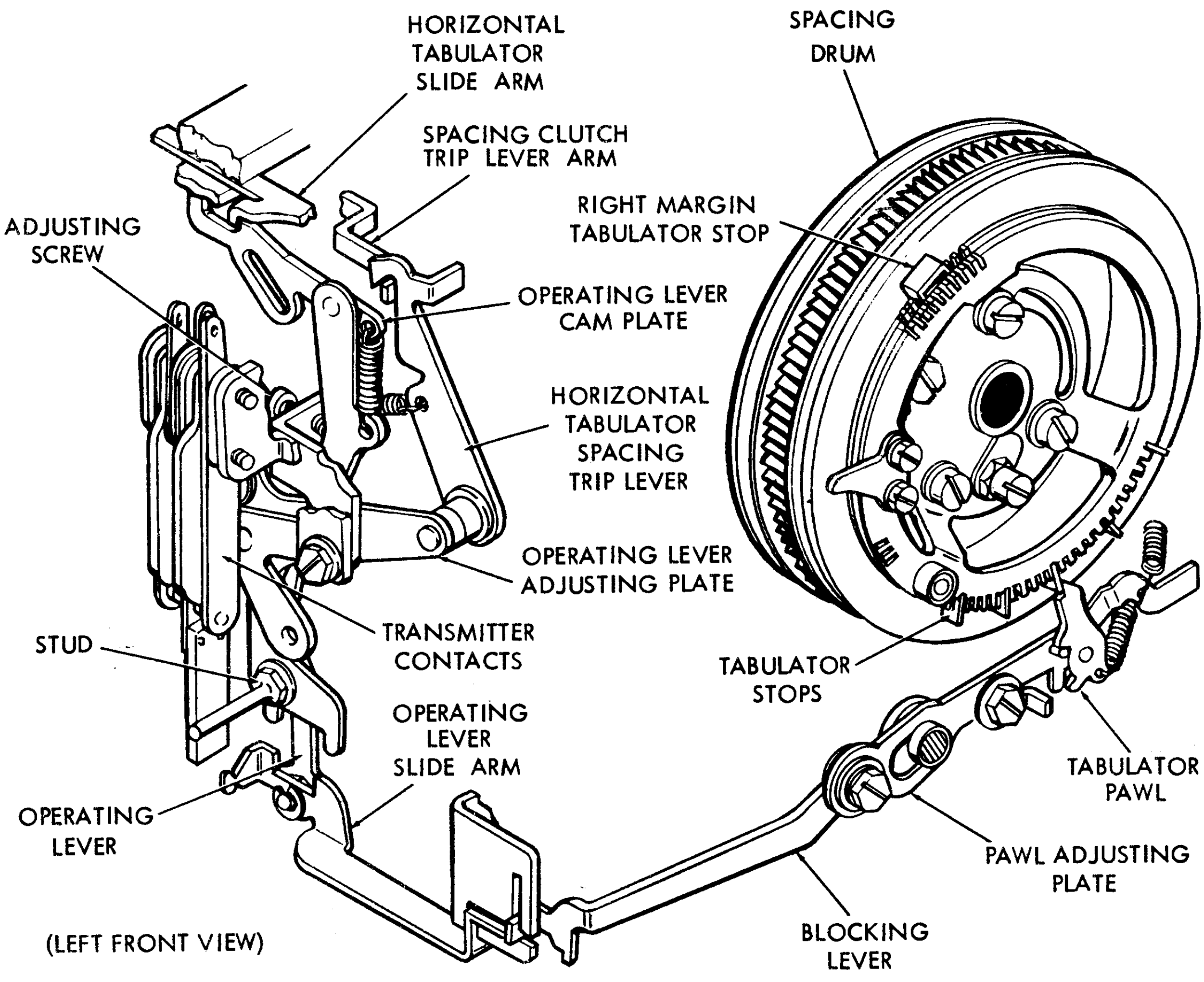


Figure 47 - Horizontal Tabulation Mechanism

end of the operating lever moves forward, the latch bail moves with it until the upper end of the latch bail strikes the spacing stop lever arm, which would not have been pulled down yet. The operating lever continues moving until it reaches its forward position, but the latch bail resting against the stop lever arm is prevented from going any farther and pivots around its mounting stud. Later, when the stop lever arm is pulled down by the spacing trip lever, the forward end of the stop lever arm comes below the latching surface of the latch bail. The latch bail then moves forward over the stop lever arm, latching it down as long as the operating lever is held in its operated position.

5.07 As the spacing clutch starts to rotate, the cam plate stripper bail (Fig. 48) engages the cam lobe on the spacing clutch restoring cam. This pivots the stripper bail about its shaft, causing the operating lever cam plate to be pivoted downward, out of engagement with the slide arm. The operating lever then drops back slightly until the lever extension link butts up against the blocking lever, which is in the down position. Thus, the operating lever is held operated, the spacing stop lever arm is latched down by the latch bail, and the spacing clutch will rotate until the blocking lever is tripped, unblocking the operating lever extension link.

5.08 As the spacing clutch rotates, the spacing drum will rotate until a tab stop attached to the drum reaches the tabulator pawl mounted on the blocking lever (Fig. 47). As the tab stop moves across the pawl, the pawl is moved down,

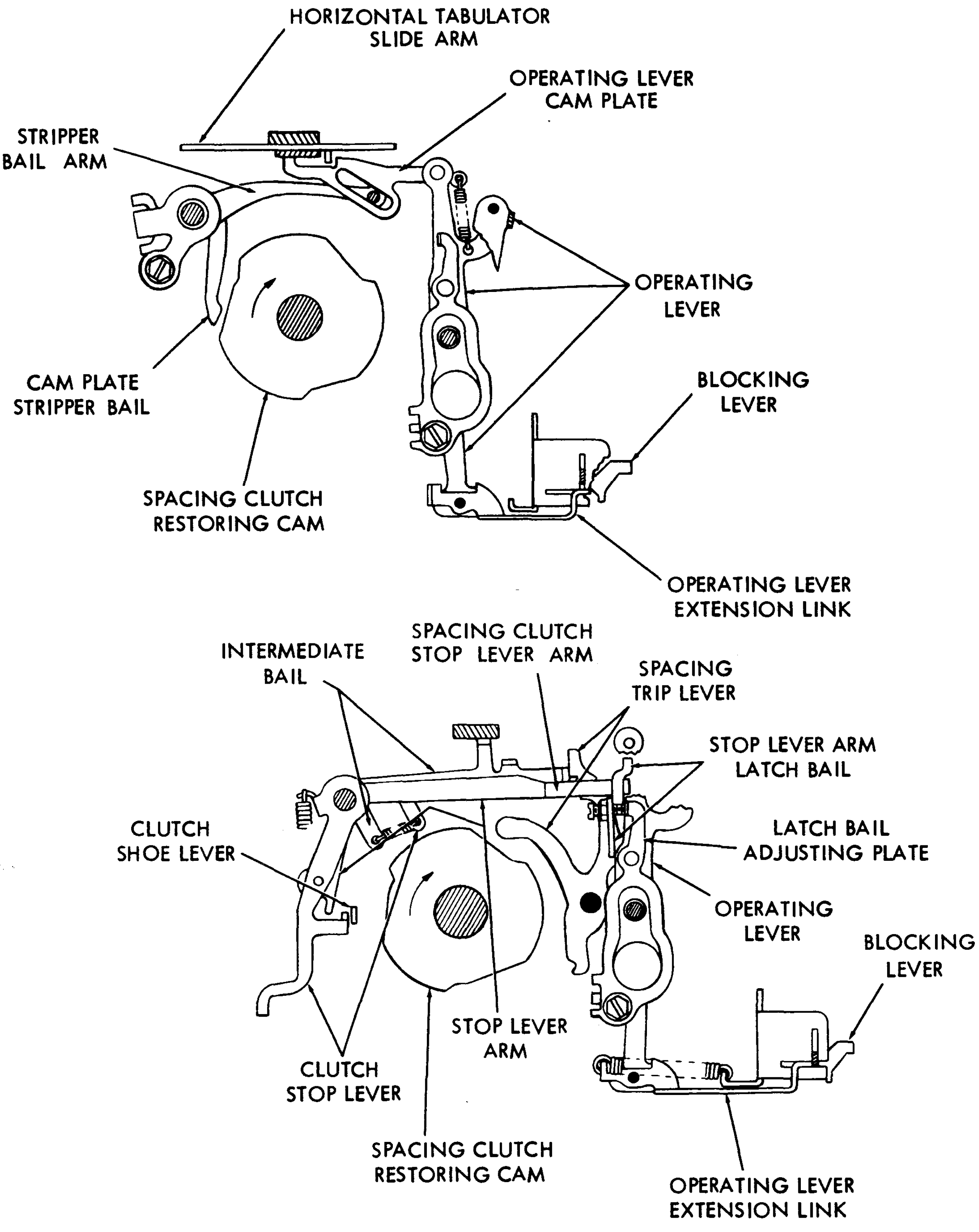


Figure 48 - Horizontal Tabulation

causing the blocking lever to rotate about its mounting stud and releasing the operating lever extension link. The operating lever returns to its unoperated position. The latch bail releases the stop lever arm, and the clutch stop lever blocks further rotation of the spacing clutch. The tabulator function slide arm returns to its unoperated (rear) position when the function pawl is stripped from the function bar during the normal operation of the function stripper blade.

5.09 When the printing carriage nears the right margin position, the spacing cut-out lever (Fig. 27) on the spacing drum engages the lower surface of the bail extension pawl. The extension pawl and bail rotate together due to

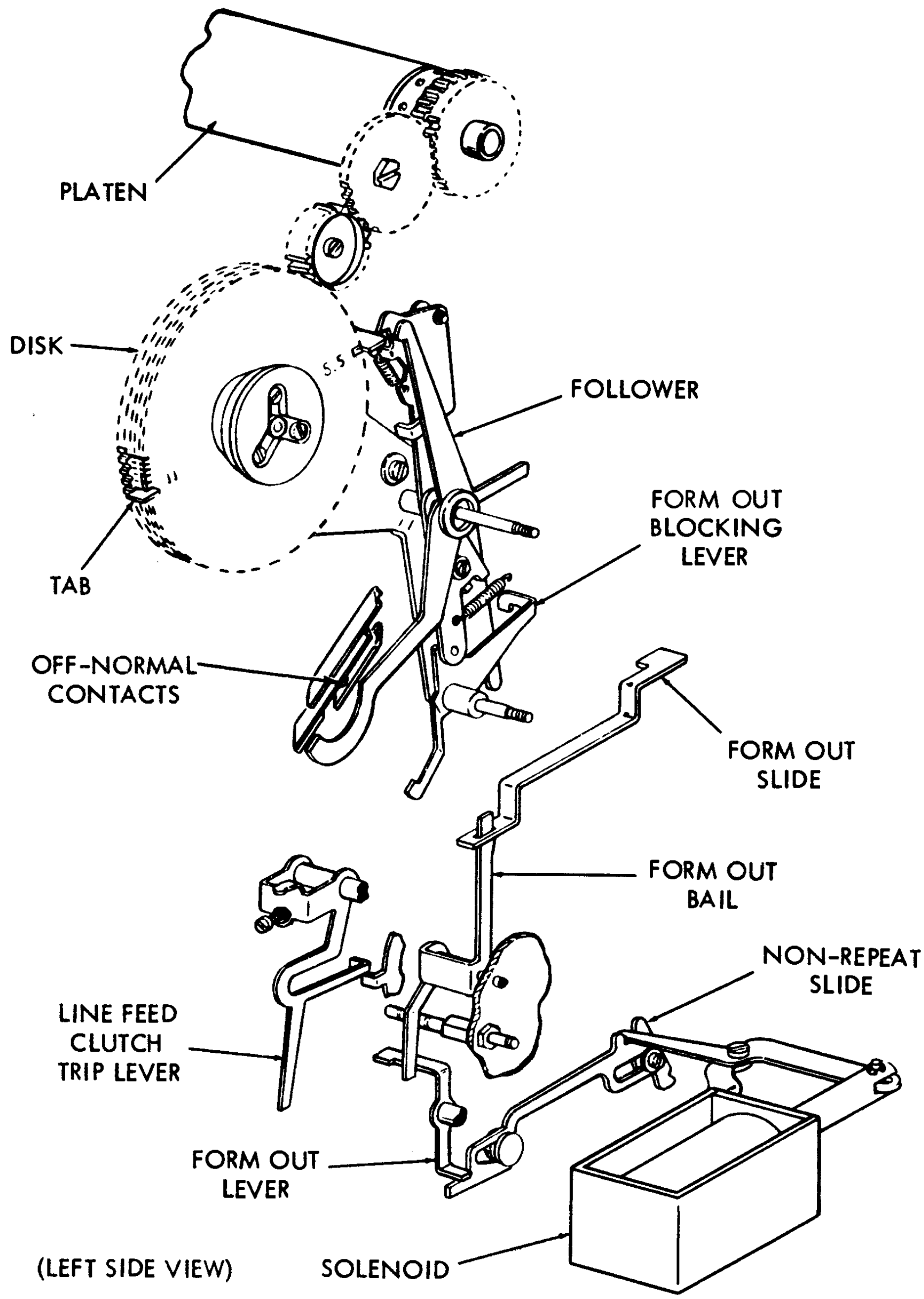


Figure 49 - Form Out Mechanism (Sprocket Feed)

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

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

FORM OUT AND VERTICAL TABULATION

5.11 Ten form starter gears and disks (Fig. 49) are available to adapt sprocket feed typing unit to form out accommodation of forms two to fifteen inches in length with vertical tabulation in 1-inch increments, or of two to ten inches in length with vertical tabulation in 1/2-inch increments. The form out mechanism automatically advances a form to the first printing line on the succeeding form from any point on the previous form. The vertical tabulation mechanism advances a form to any pre-determined position within the form.

5.12 When the input signal code combination representing form out is received, mechanical linkage activated by the stunt box trips the form out mechanism. In addition, the form out mechanism is tripped whenever the data set disconnects, unless the paper is already between forms. The data set energizes a form out solenoid during the disconnect sequence if the off normal contacts are closed.

5.13 The sequence of operation of vertical tabulation is similar to that of the form out mechanism (5.11-5.12). When an input signal code combination representing vertical tabulation is received, the associated function mechanism operates a vertical tabulation slide. The slide, moving forward, engages the line feed slide, which in turn engages the line feed clutch (2.80). The vertical tabulation blocking lever blocks the vertical tabulation slide in operated position, allowing the line feed clutch to rotate continuously.

5.14 The vertical tabulation slide remains blocked by the blocking lever until the tabulation index plate on the disk engages the bail which in turn rotates the blocking lever counterclockwise, allowing the vertical tabulation slide and the line feed slide to return to their unoperated position. The line feed clutch is disengaged, and the function mechanism is stripped to its unoperated position.

5.15 A set of transmitter control and motor hold contacts operates on both form out and vertical tabulation cycling. The lower contacts are opened when either cycle begins, to interrupt circuits to an external transmitter distributor set. The upper contacts are simultaneously closed, to operate an external motor hold mechanism.

35 TYPING UNIT

LUBRICATION

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to include recent engineering information and to add late 35 equipment. Changes and additions are indicated by arrows placed in the margins.

1.02 The 35 Typing Unit should be lubricated as directed in this section. The figures indicate points to be lubricated and the kind and quantity of lubricant to be used. Figures 1 and 2 illustrate the general areas of lubrication on the friction feed unit and Figure 3 shows the lubrication areas on the sprocket feed unit. Lubricate the typing unit just prior to placing it in service. After a few weeks in service, relubricate to make certain that all points receive lubrication. Thereafter, the typing unit should be lubricated at 1500 hour intervals or every six months, whichever occurs first.

1.03 Use KS7470 oil at all locations where the use of oil is indicated. Use KS7471 grease on all surfaces where grease is indicated.

1.04 All spring wicks and felt oilers should be saturated. The friction surfaces of all moving parts should be thoroughly lubricated. Over-lubrication, however, which will permit oil or grease to drip or be thrown on other parts, should be avoided. Special care must be taken to prevent any oil or grease from getting between the selector armature and its magnetic pole faces. Keep all electrical contacts free of oil and grease.

1.05 Apply a thick film of grease to all gears and the spacing clutch reset cam plate.

1.06 Apply oil to all cams, including the camming surfaces of each clutch disk.

1.07 The photographs show the paragraph numbers referring to particular line drawings of mechanisms and where these mechanisms are located on the unit. Parts in the line drawings are shown in an upright position unless otherwise specified. Reference to left or right, up or down, front or rear, etc., apply to the unit in its normal operating position as viewed from the operator's position in front of the unit.

1.08 The illustration symbols indicate the following lubrication directions:

0	Apply 1 drop of oil.
02	Apply 2 drops of oil.
03	Apply 3 drops of oil.
020	Apply 20 drops of oil, etc.
G	Apply thin film of grease.
SAT	Saturate (felt oilers, washer, wicks) with oil.

Note: During each lubrication period, check the following adjustments:

1. PRINTING CARRIAGE POSITION.
2. PRINTING HAMMER BEARING STUD.
3. PRINTING HAMMER STOP BRACKET. (Also see note after PRINTING ARM adjustment.)
4. LOWER DRAW WIRE ROPE.
5. DASHPOT VENT SCREW. (Check Dashpot Transfer Slide for freeness.)

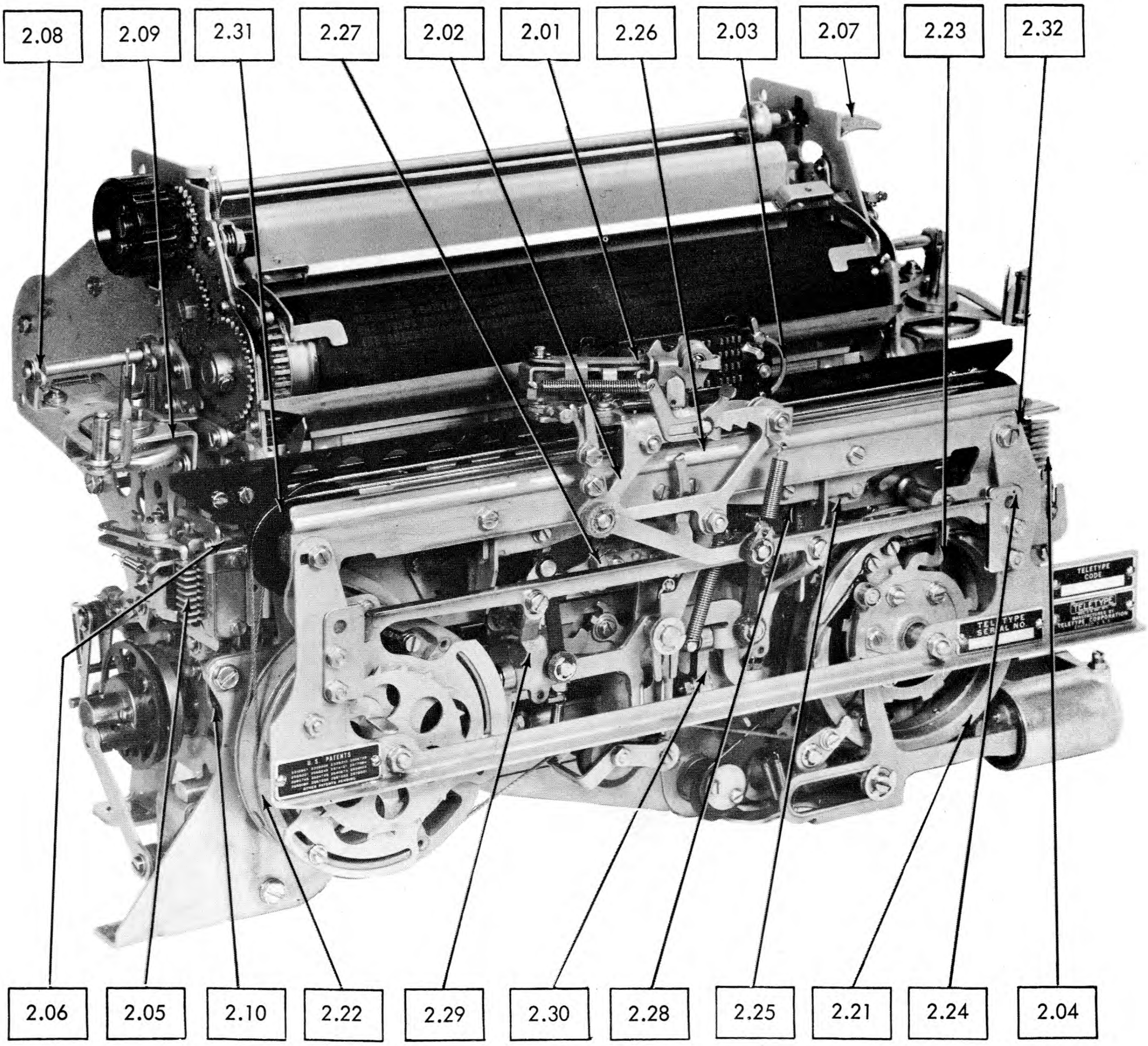


Figure 1 - 35 Typing Unit (Friction Feed), Left Front View

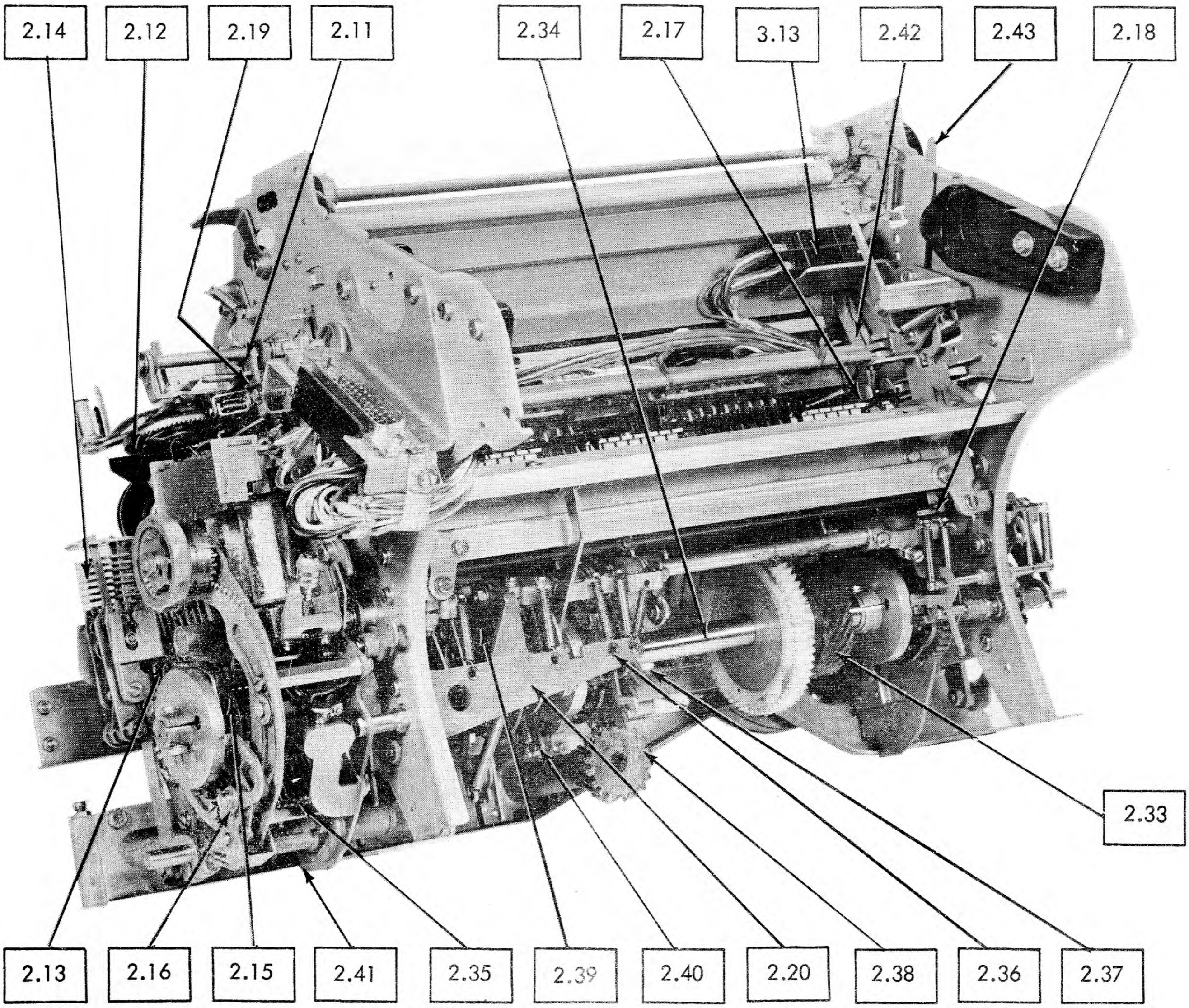
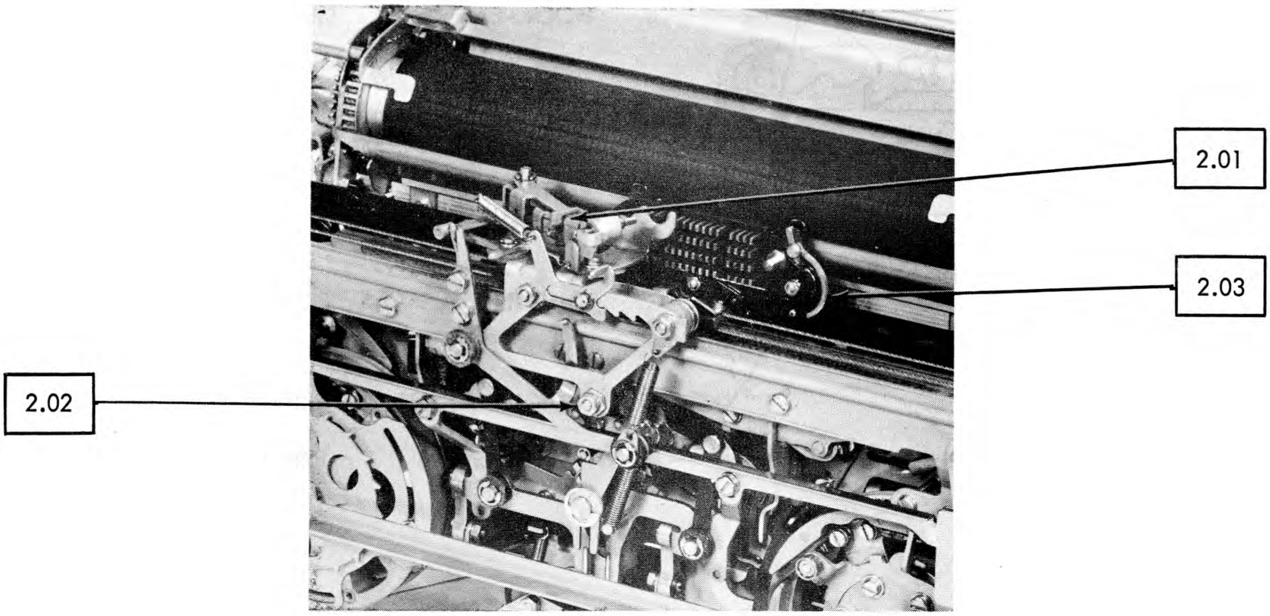


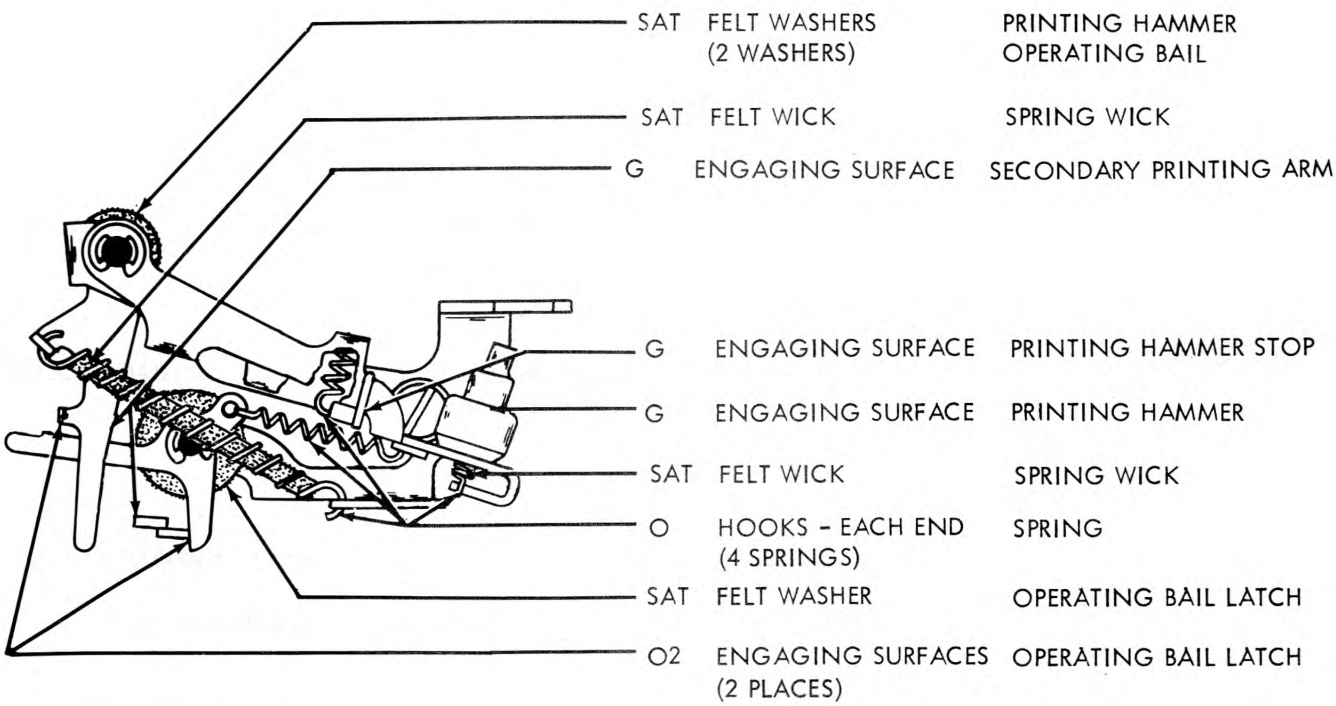
Figure 2 - 35 Typing Unit (Friction Feed), Right Rear View

2. BASIC UNIT

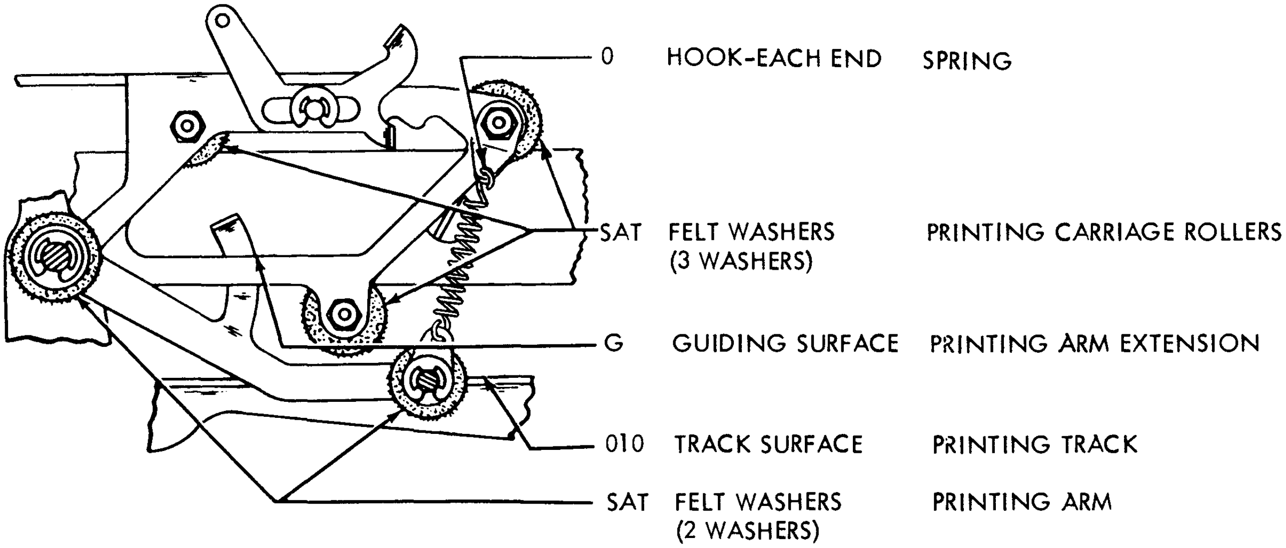


(FRONT VIEW)

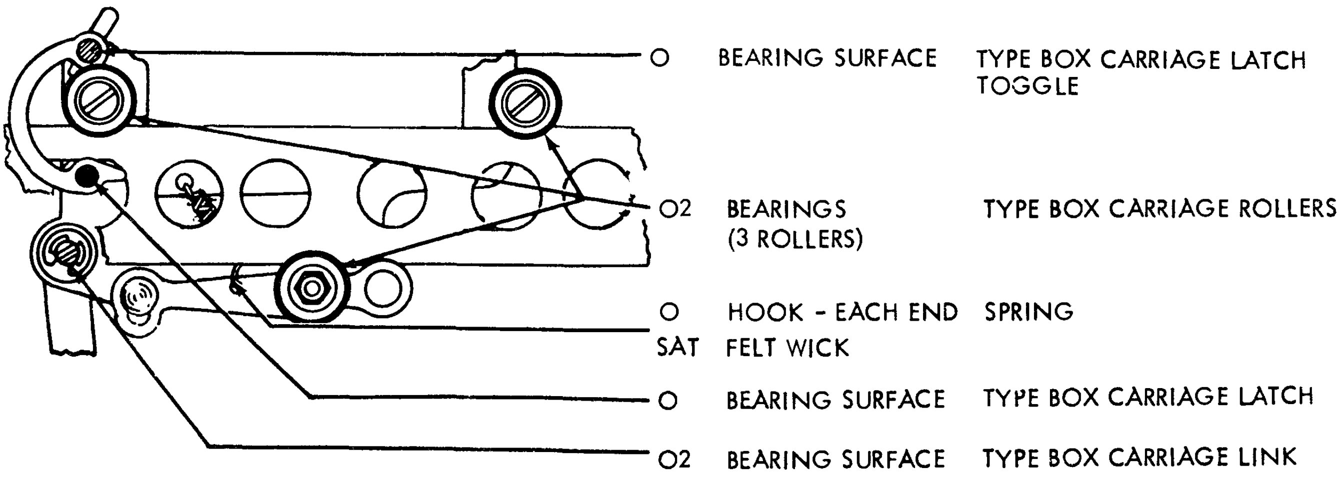
2.01 Printing Mechanism



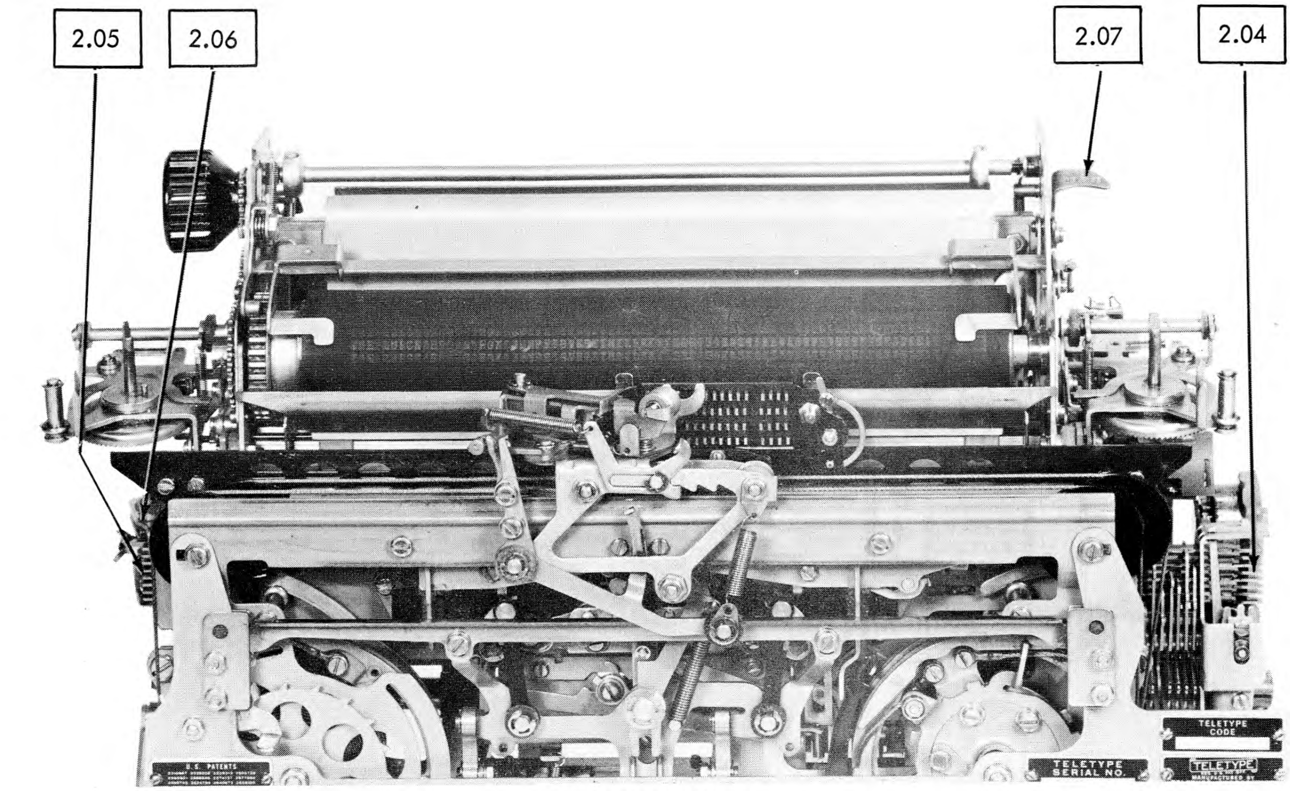
2.02 Printing Mechanism continued



2.03 Type Box Carriage Mechanism

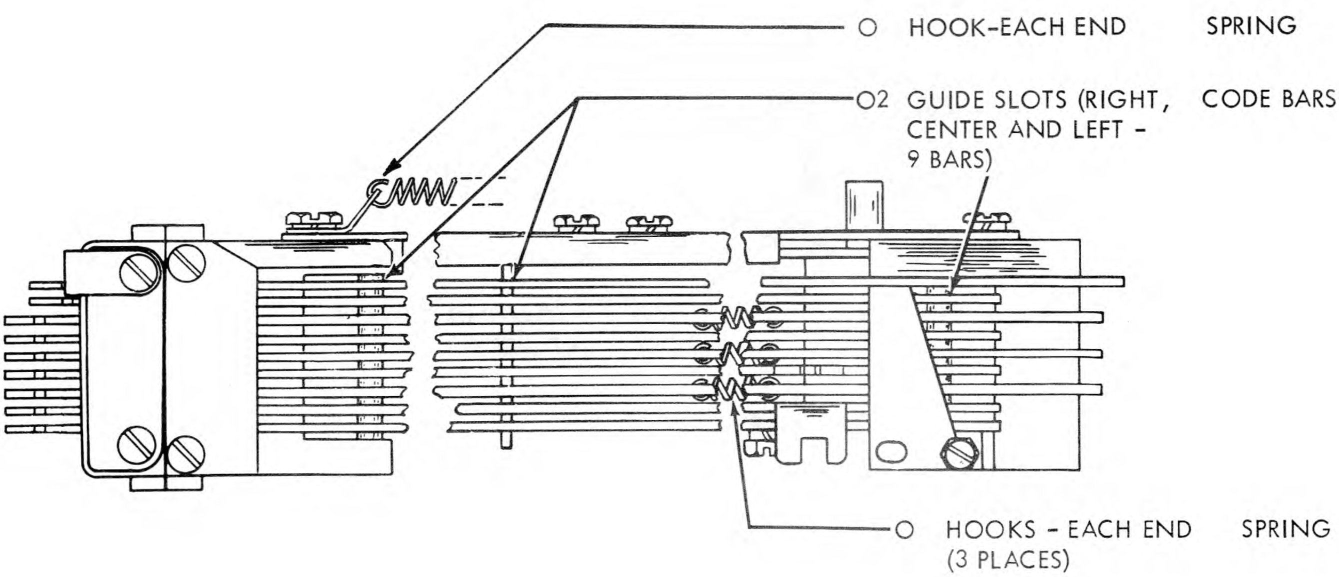


(REAR VIEW)

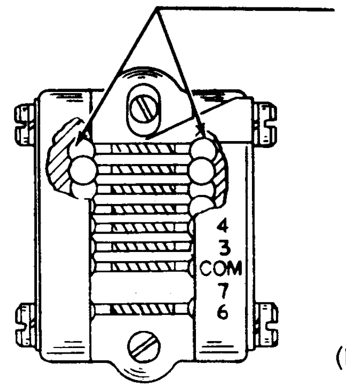


(FRONT VIEW)

2.04 Code Bar Mechanism



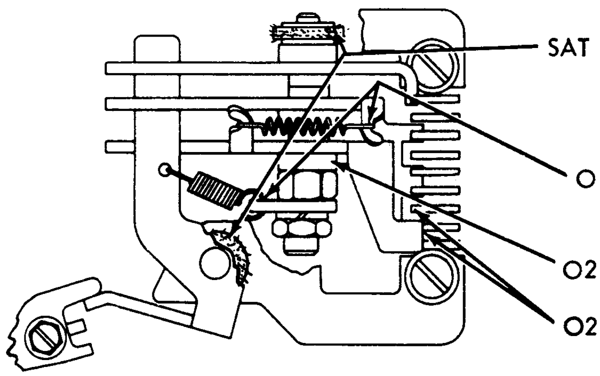
2.05 Code Bar Detents



CODE BAR DETENT

(LEFT SIDE)

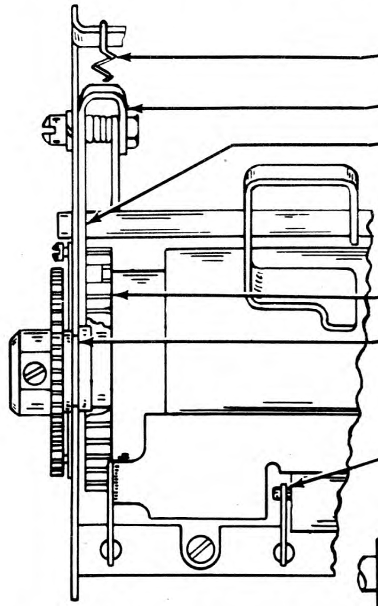
2.06 Print Suppression Mechanism



SAT	FELT WASHERS (3 WASHERS)	ECCENTRIC POST AND BLOCKING BAIL BLADE
O	HOOKS-BOTH ENDS (2 SPRINGS)	SPRINGS
O2	BEARING SURFACE	ECCENTRIC POST
O2	ENGAGING SURFACE (4 PLACES)	BLOCKING LEVERS

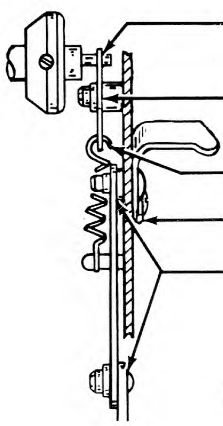
(LEFT SIDE)

2.07 Paper Feed Mechanism



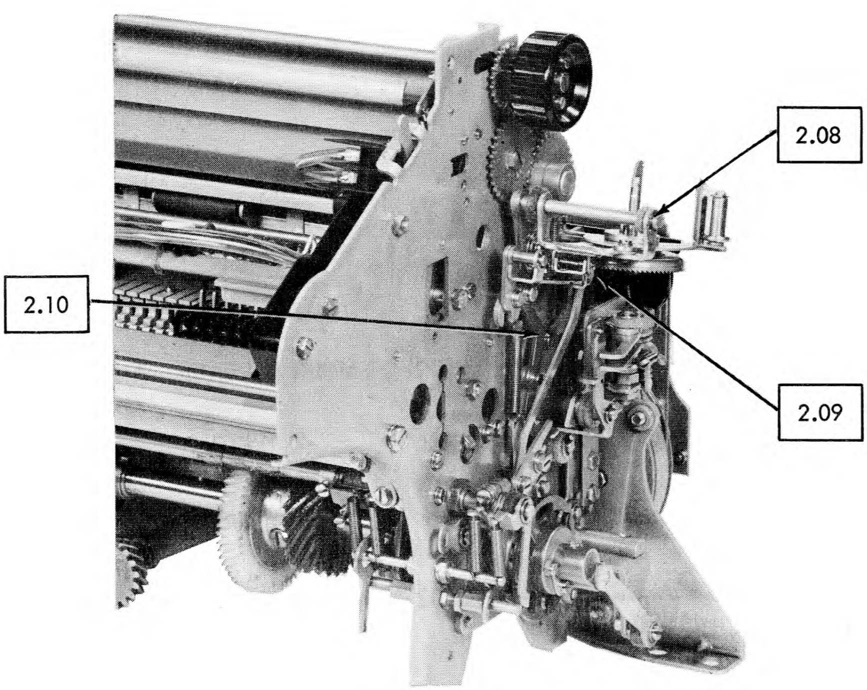
O	HOOKS - EACH END	SPRING
O2	BEARING SURFACE	PLATEN DETENT BAIL
O2	BEARING SURFACE (EACH END)	PAPER FINGER SHAFT
G	TEETH (2 GEARS)	PLATEN GEARS
O2	BEARINGS (EACH END)	PLATEN SHAFT
O	BEARING SURFACES-EACH END (6 ROLLERS)	PAPER PRESSURE ROLLER SHAFTS (WIPE OFF EXCESS OIL)

(LEFT SIDE)



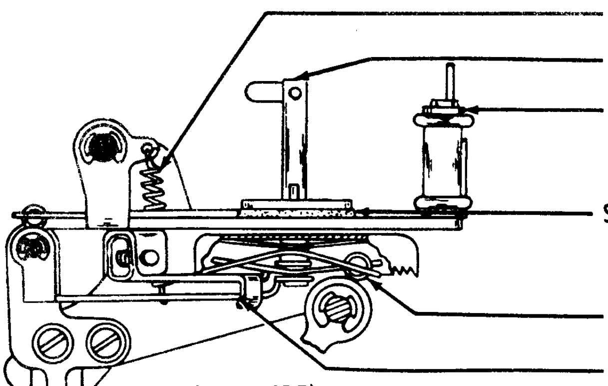
O2	BEARING SURFACES (EACH END)	PAPER STRAIGHTENER SHAFT
O2	BEARING SURFACES (RIGHT AND LEFT)	PAPER STRAIGHTENER LEVERS
O	HOOKS - EACH END	SPRING
O2	BEARING SURFACE	RELEASE LEVER
O2	BEARING SURFACES (EACH END)	RELEASE LEVER LINK

(RIGHT SIDE)

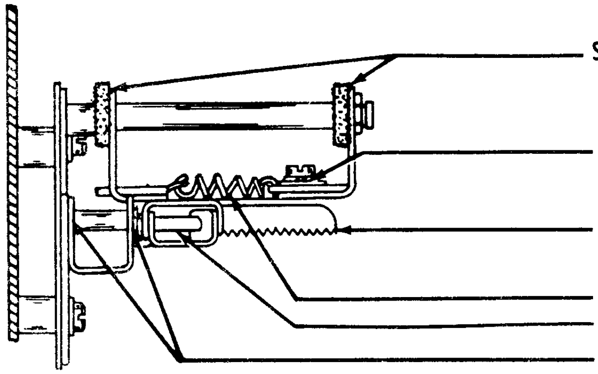


(LEFT REAR VIEW)

2.08 Ribbon Feed Mechanism (Left Side)

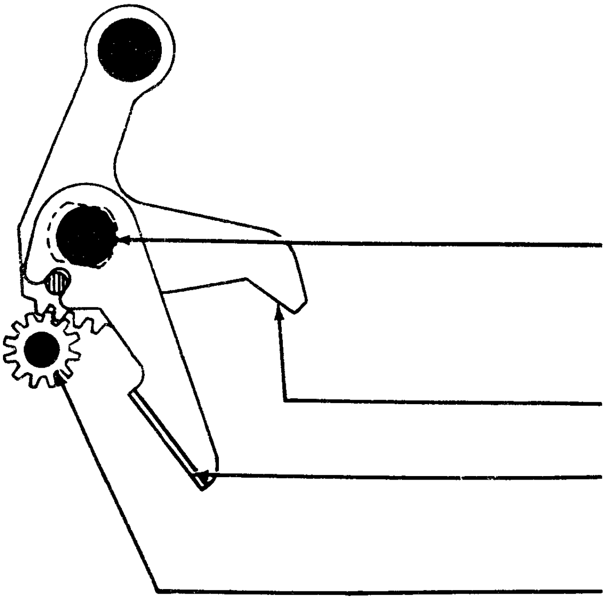


(LEFT SIDE)

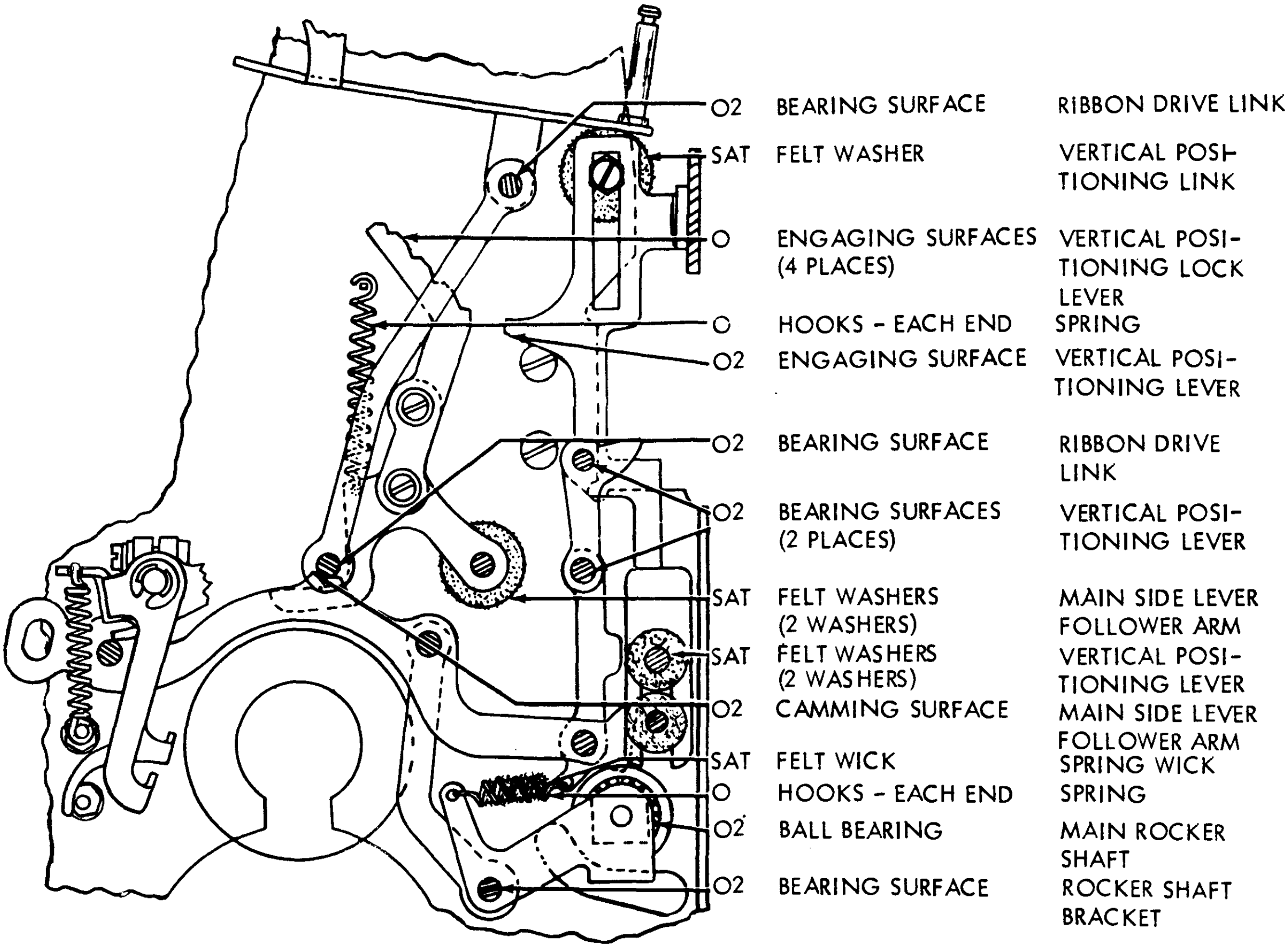


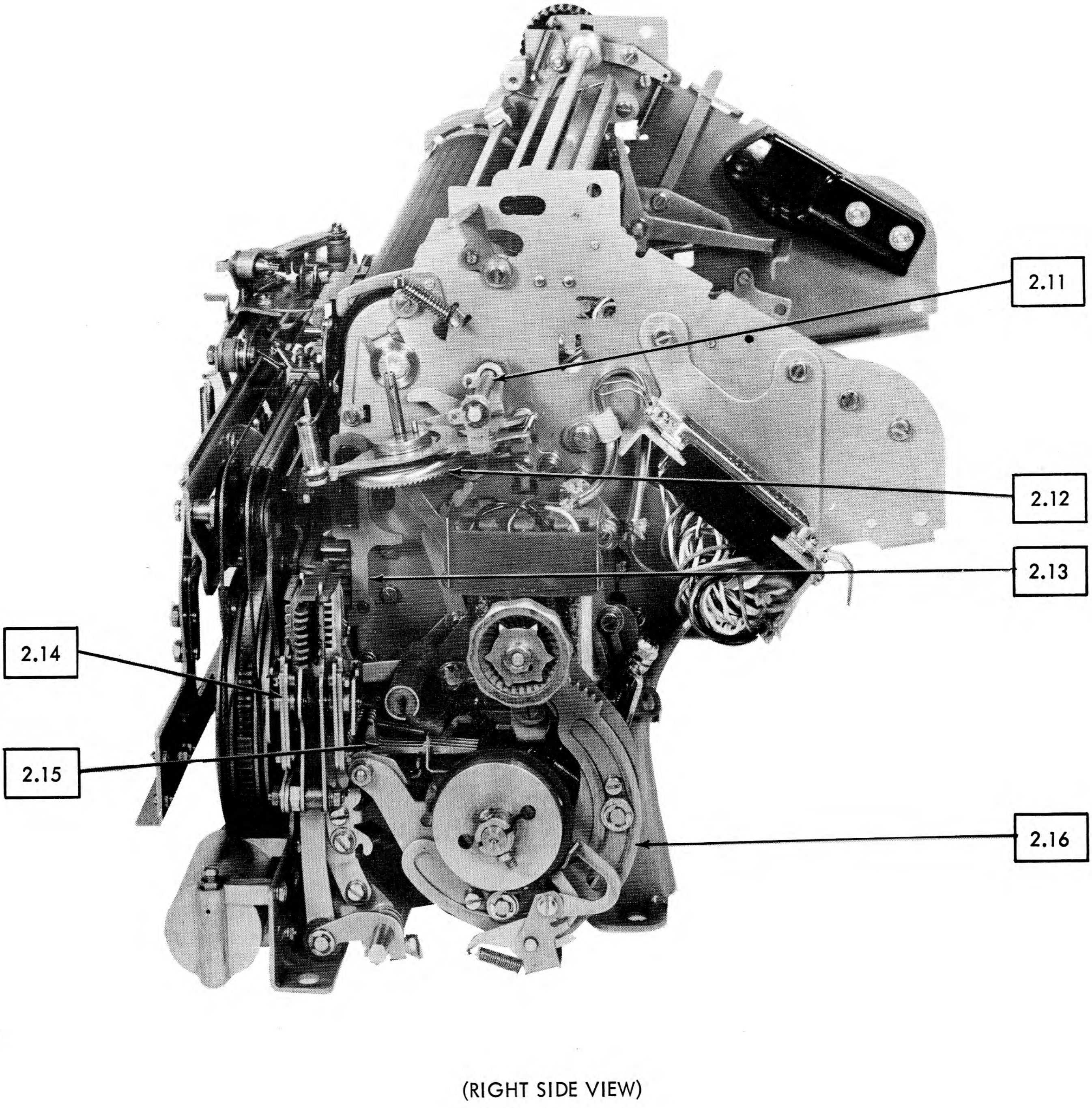
(REAR VIEW)

2.09 Ribbon Feed Mechanism continued



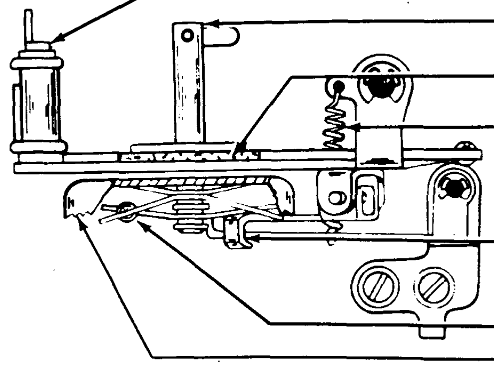
2.10 Vertical Positioning Mechanism (Left Side)





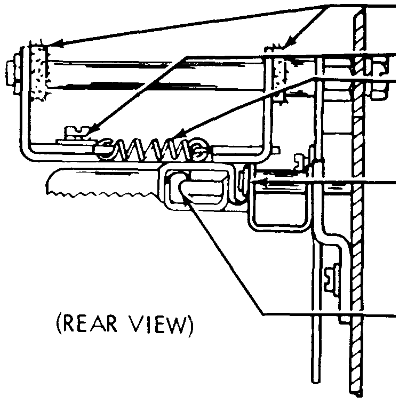
(RIGHT SIDE VIEW)

2.11 Ribbon Feed Mechanism (Right Side)



02	BEARING SURFACE	RIBBON ROLLER SHAFT
02	BEARING SURFACE	RIBBON SPOOL TOGGLE
SAT	FELT WASHER	RIBBON SPOOL SHAFT
0	HOOKS-EACH END	RIBBON FEED LEVER SPRING
02	ENGAGING SURFACE	RIBBON DETENT LEVER
0	HOOKS-EACH END	RIBBON RATCHET WHEEL SPRING
G	TEETH	RIBBON RATCHET WHEEL

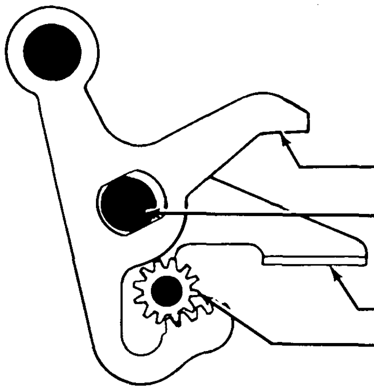
(RIGHT SIDE VIEW)



SAT	FELT WASHERS (2 WASHERS)	RIBBON FEED LEVER BAIL
02	BEARING SURFACE	RIBBON LEVER
0	HOOKS-EACH END	SPRING
02	BEARING SURFACES	RATCHET FEED LEVER SHAFT
02	BEARING SURFACE (2 PLACES)	RIBBON DETENT LEVER SHAFT

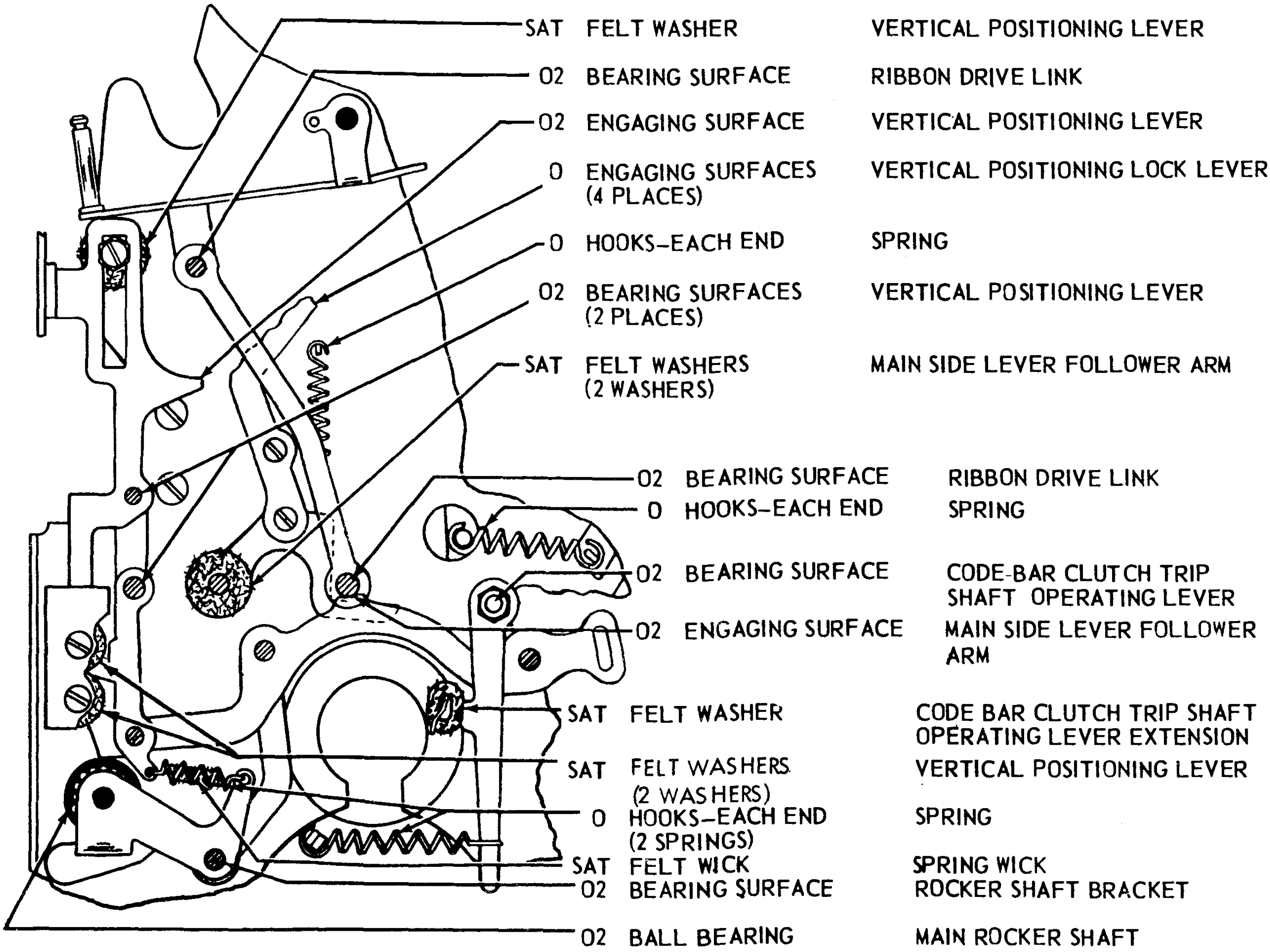
(REAR VIEW)

2.12 Ribbon Feed Mechanism continued

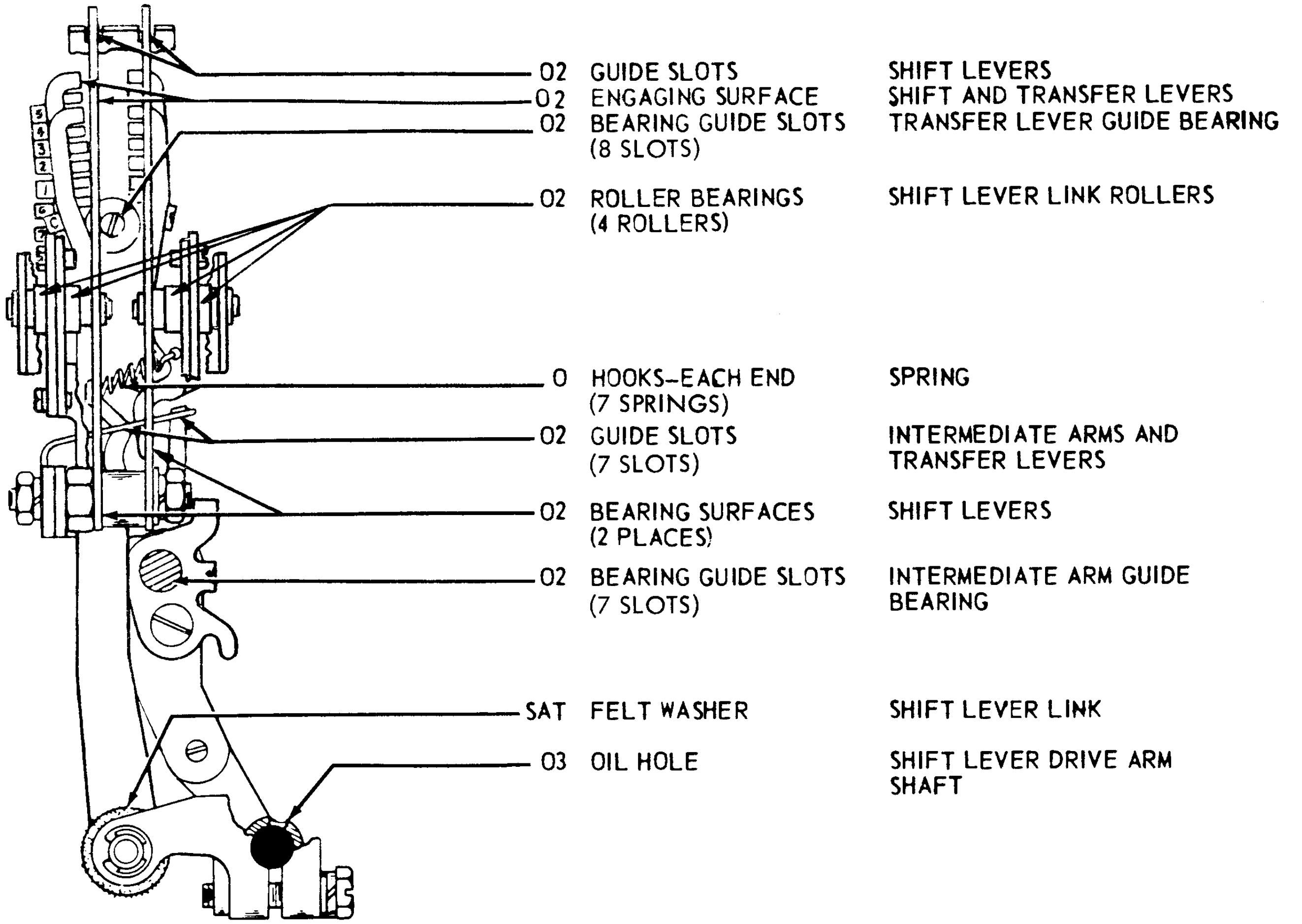


02	ENGAGING SURFACE	RIBBON REVERSING LEVER
02	BEARING SURFACE	RIBBON REVERSE LEVERS
02	ENGAGING SURFACE	RIBBON REVERSE LEVER
G	TEETH	RIBBON REVERSE SPUR GEAR

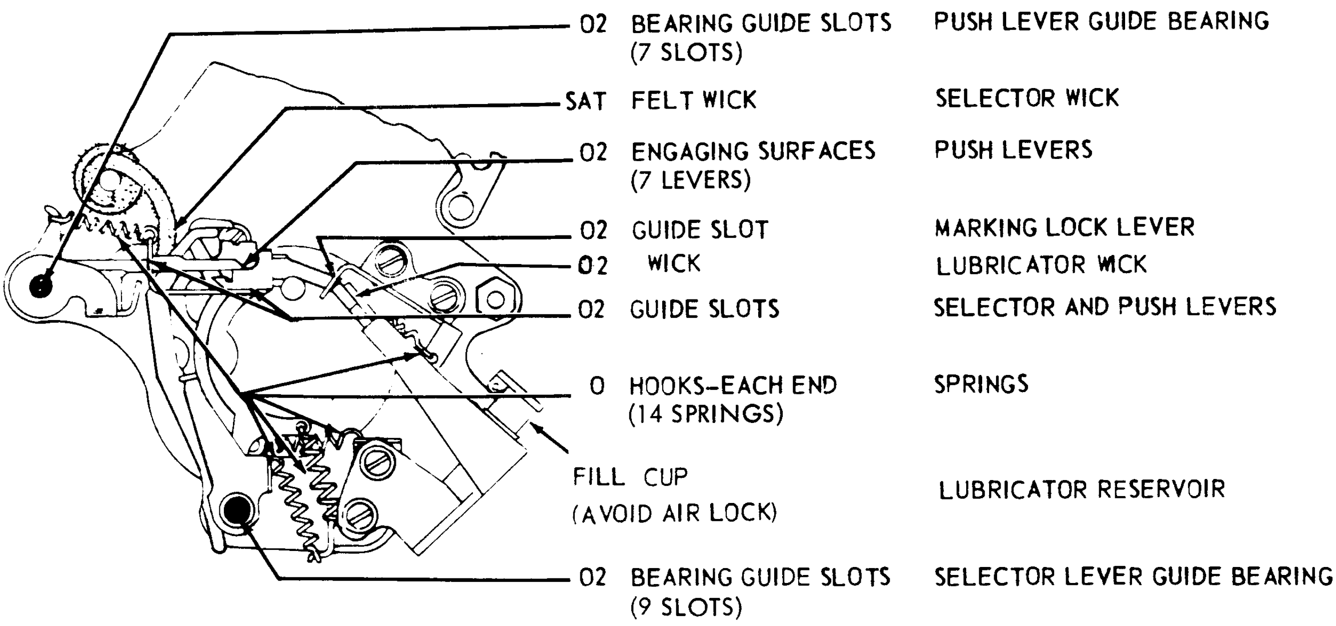
2.13 Vertical Positioning Mechanism (Right Side)



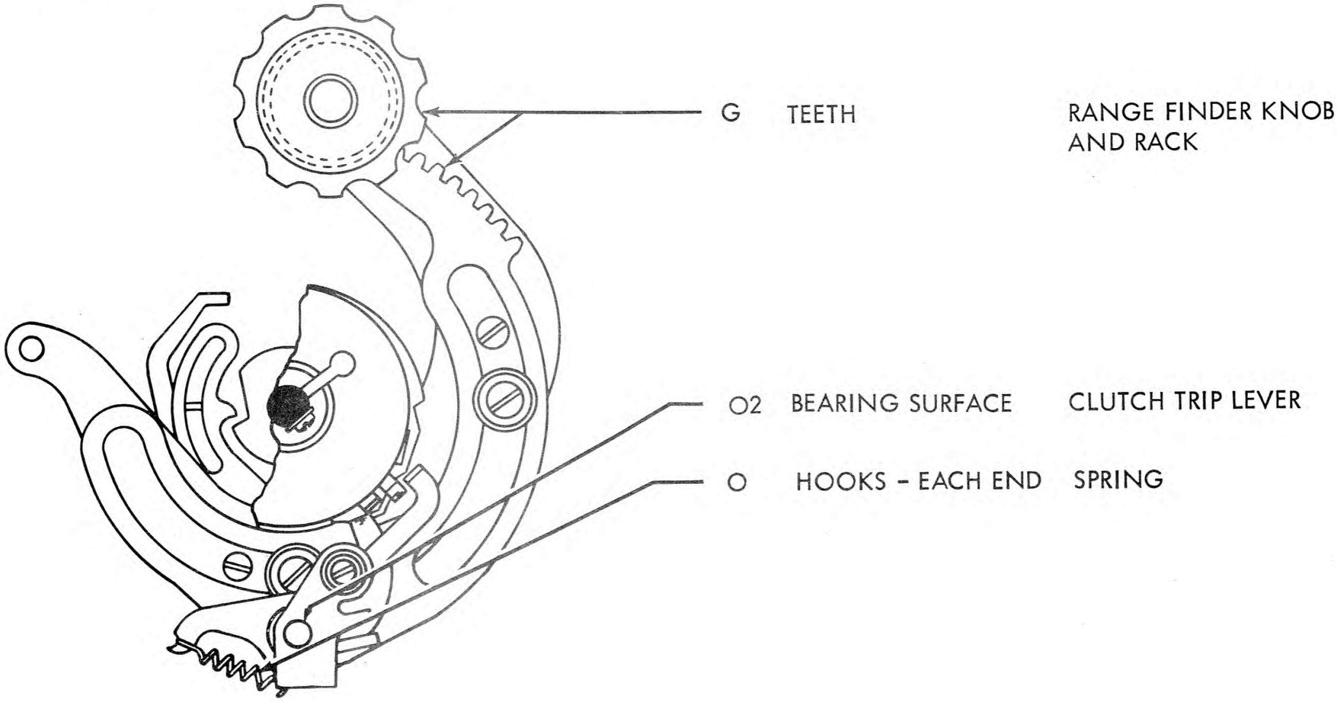
2.14 Code Bar Mechanism

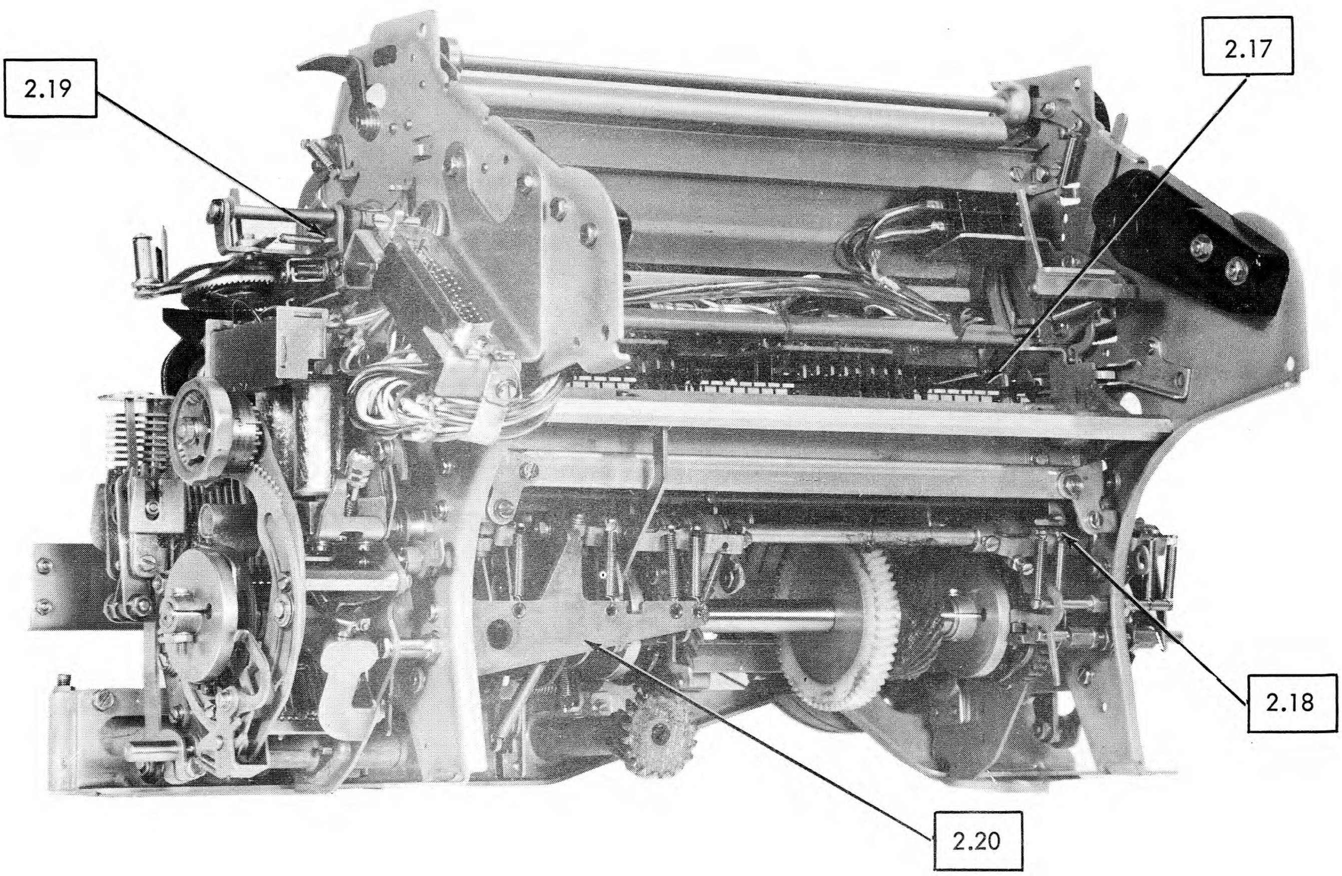


2.15 Selector Mechanism



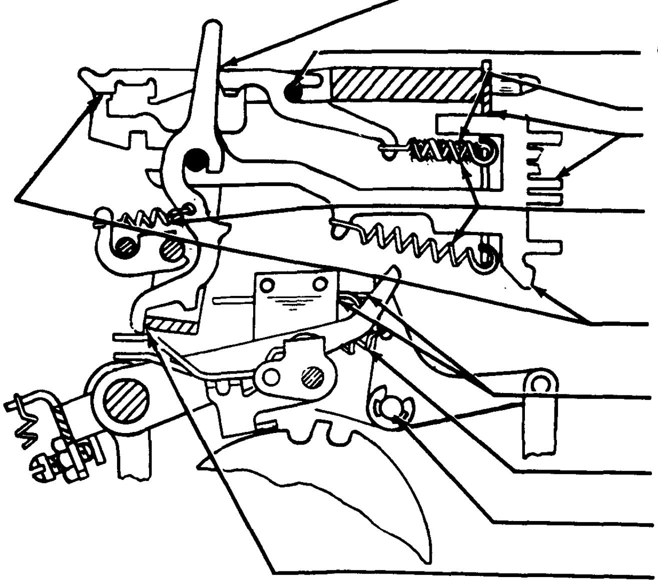
2.16 Selector Mechanism continued





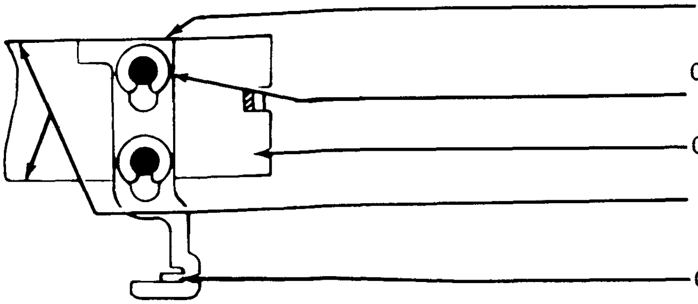
(REAR VIEW)

2.17 Stunt Box Mechanism



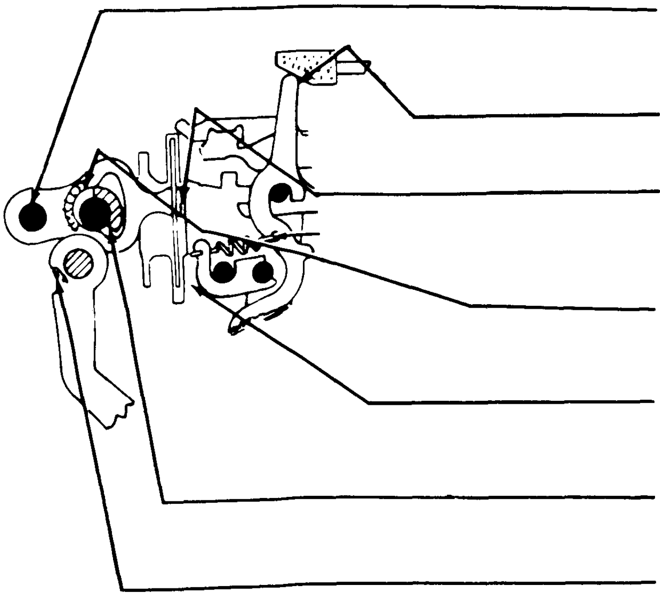
O2	GUIDE SLOTS (11 LEVERS)	FUNCTION LEVERS
O2	GUIDE SLOTS (11 PAWLS)	FUNCTION PAWLS
SAT	EACH FELT WICK	FUNCTION PAWL SPRINGS
O2	GUIDE SLOTS (11 LEVERS)	FUNCTION BARS
O	HOOKS - EACH END (33 SPRINGS)	SPRING
O2	ENGAGING SURFACES (FRONT & REAR - 11 BARS)	FUNCTION BARS
O2	GUIDE AND ENGAGING SURFACES	LINE FEED SLIDE ARM
O	HOOKS - EACH END	SPRING
O2	BEARING SURFACE	KEYBOARD LOCK LEVER
O2	ENGAGING SURFACES (11 LEVERS)	FUNCTION LEVERS

2.18 Stripper Blade Mechanism



0	ENGAGING SURFACE	LINE FEED STRIPPER SLIDE
02	GUIDE SURFACES (2 PLACES)	STRIPPER SLIDE
02	GUIDE SURFACES (EACH END)	STRIPPER BLADE
G	ENGAGING SURFACES (2 PLACES)	STRIPPER BLADE
02	ENGAGING SURFACE	STRIPPER BAIL

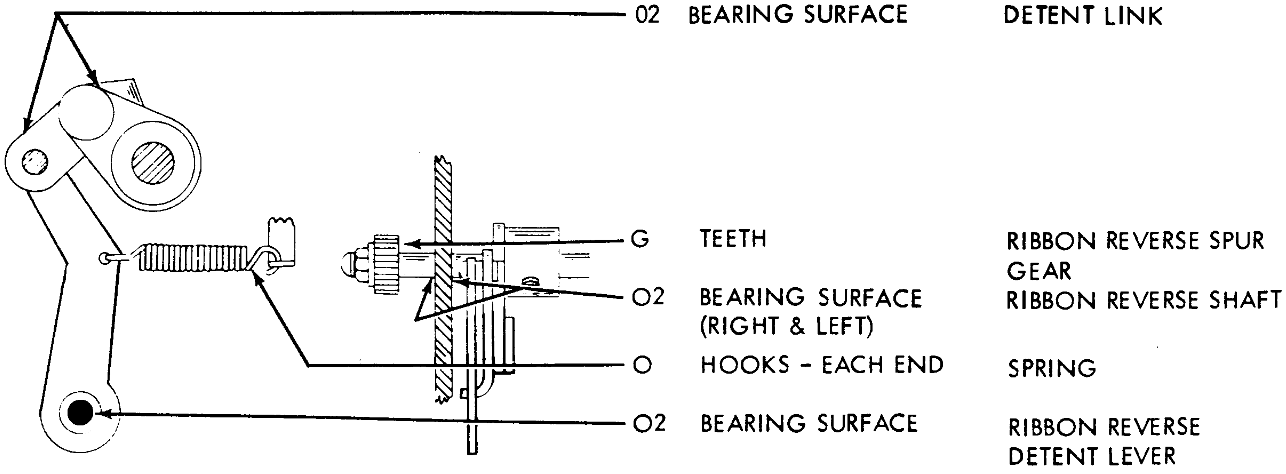
(REAR VIEW)



02	BEARING SURFACES (2 BEARINGS)	CAM ARMS
G	ENGAGING SURFACES (EACH ARM)	CONTACT ARM
G	ENGAGING SURFACES (2 ARMS)	CAM ARMS
SAT	FELT WASHERS (4 WASHERS)	DRIVING CAM
02	GUIDE SLOTS (EACH END)	STRIPPER BLADE
G	CAMMING SURFACES (2 CAMS)	DRIVING CAM
SAT	FELT WASHER	STRIPPER BLADE DRIVING ARM

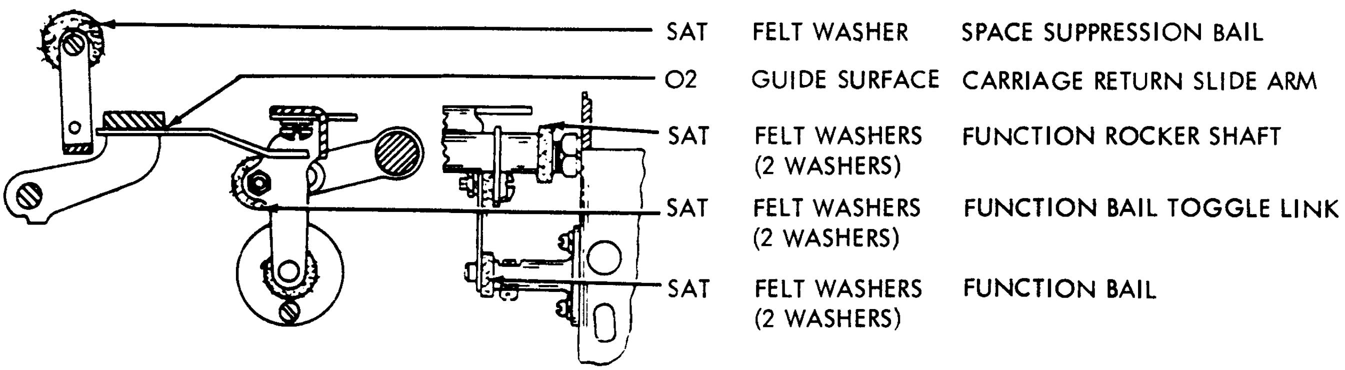
(LEFT SIDE VIEW)

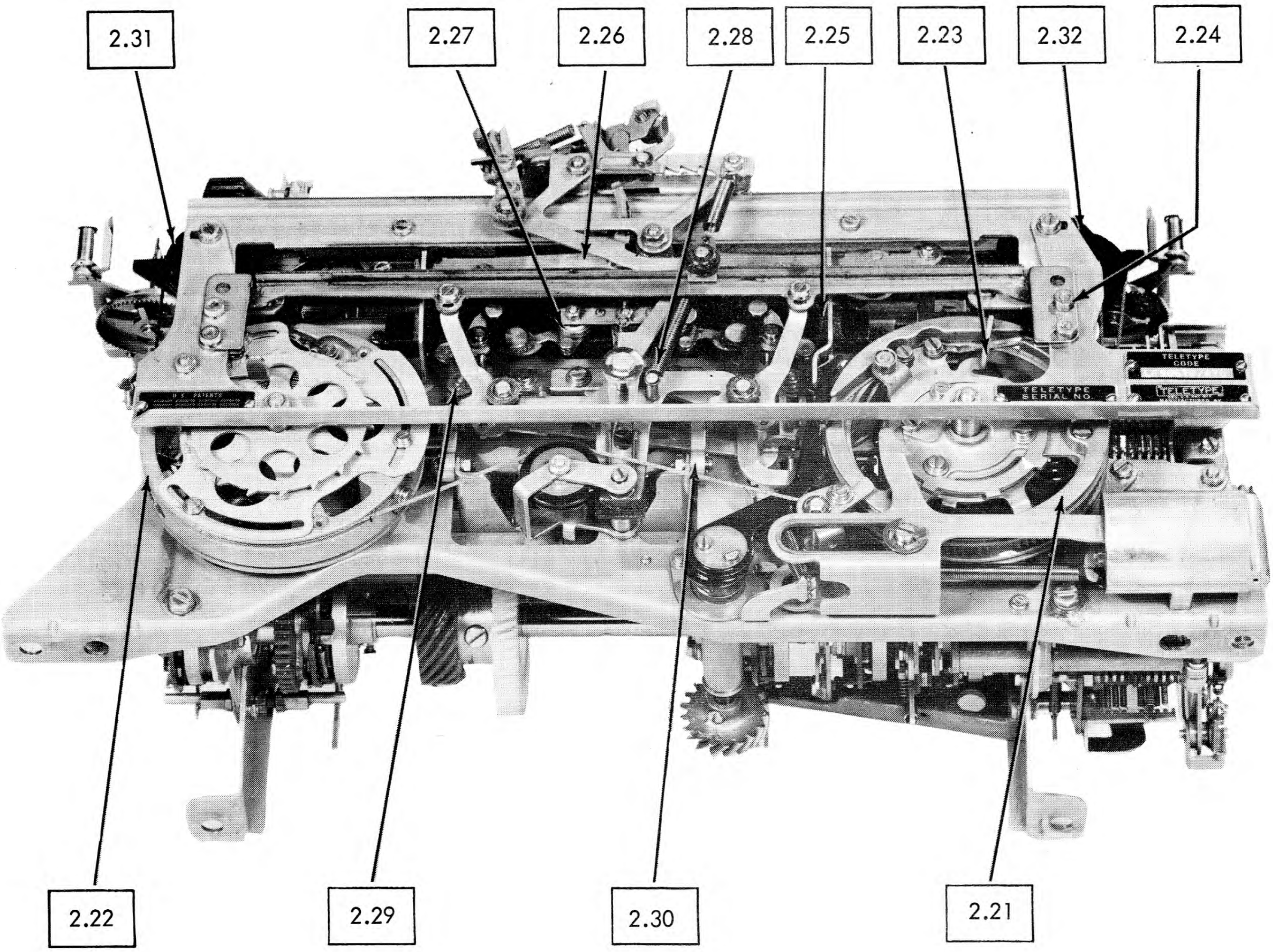
2.19 Ribbon Reverse Mechanism



(RIGHT REAR VIEW)

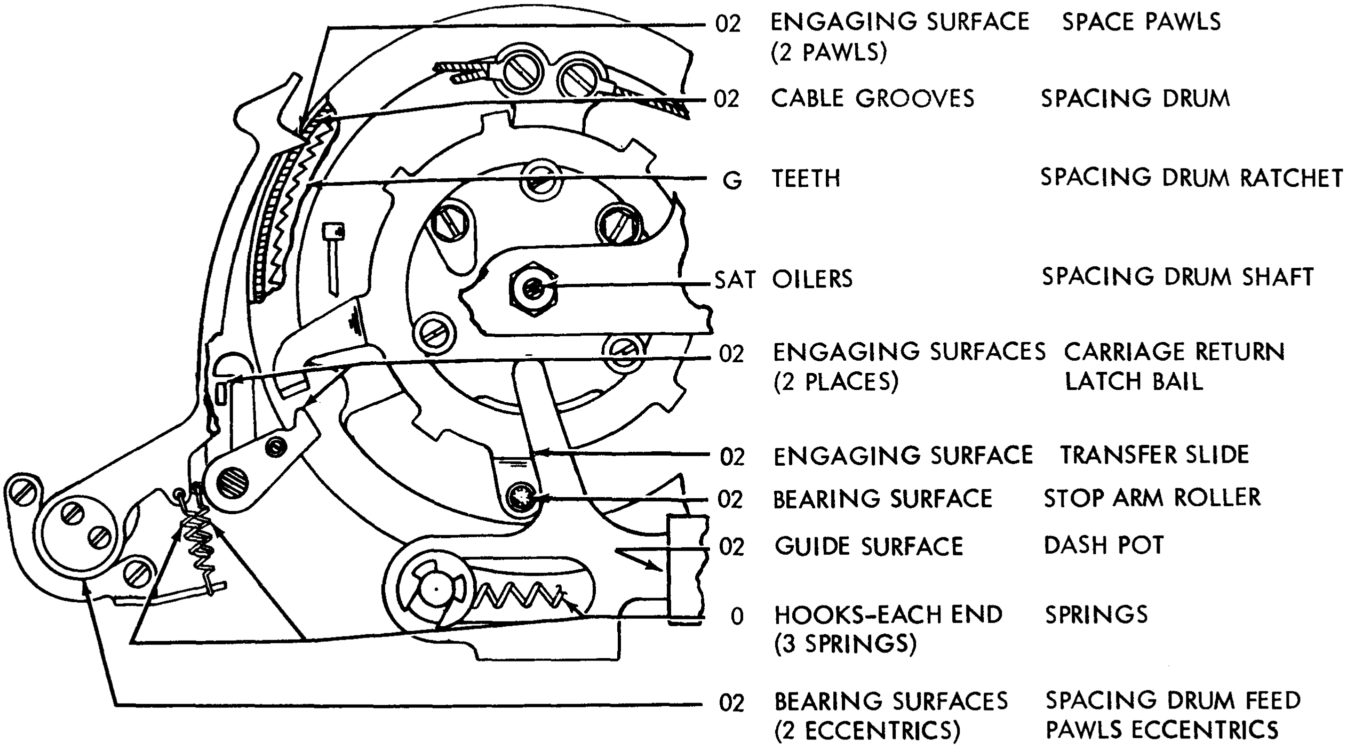
2.20 Function Rocker Shaft Mechanism



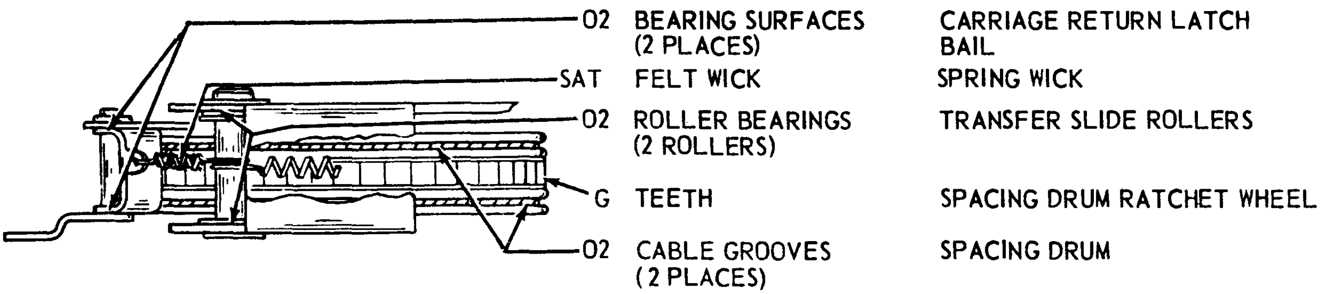


(FRONT VIEW)

2.21 Spacing Drum Mechanism

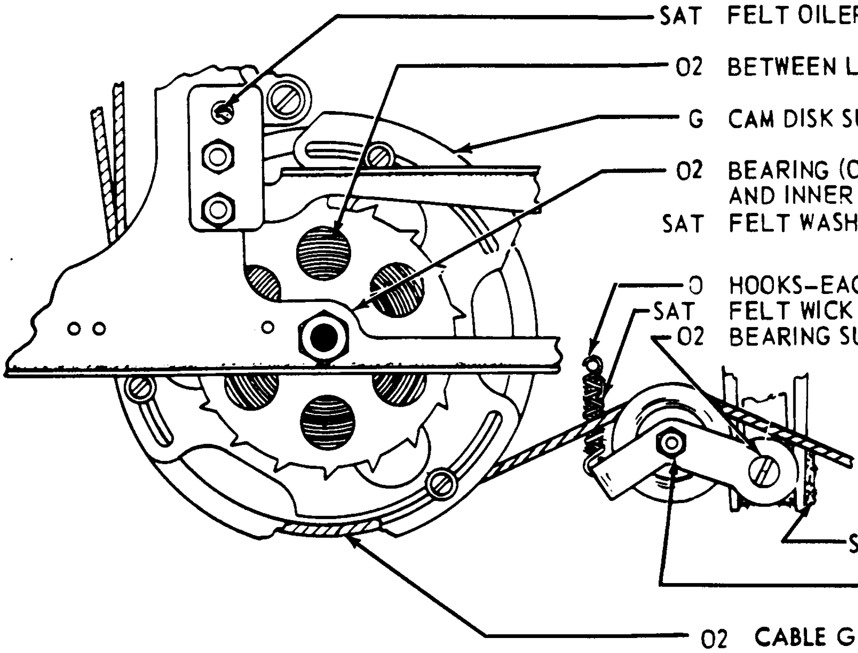


(FRONT VIEW)

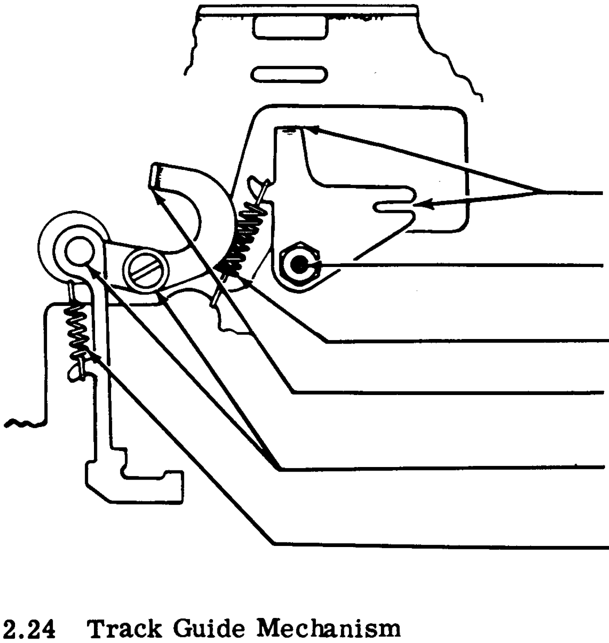


(BOTTOM VIEW)

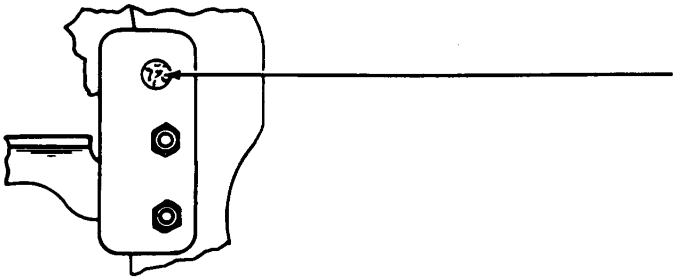
2.22 Carriage Return Mechanism



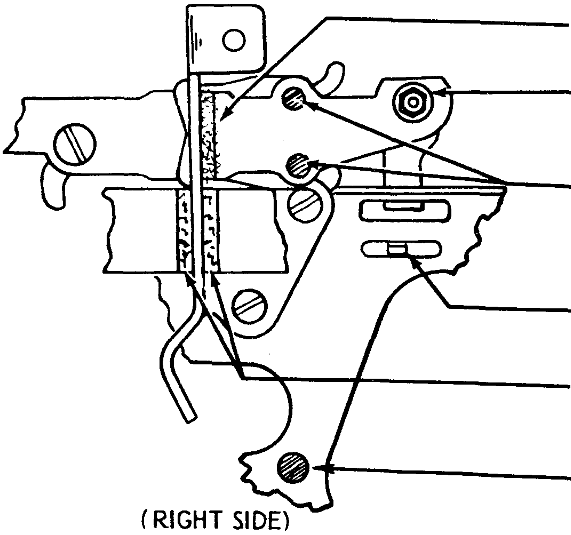
2.23 Spacing Drum Feed Mechanism



2.24 Track Guide Mechanism

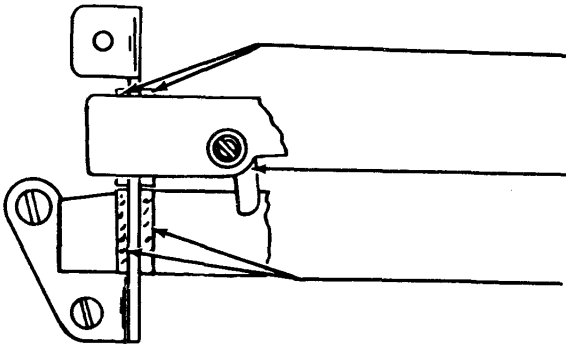


2.25 Horizontal Positioning Mechanism (Front View)



(RIGHT SIDE)

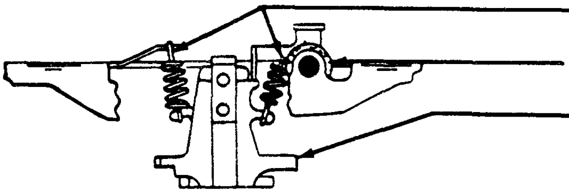
SAT	FELT WASHER	HORIZONTAL REVERSING SLIDE
02	ENGAGING SURFACE	HORIZONTAL REVERSING SLIDE SHIFT LEVER
02	DETENTS (2 DETENTS)	DETENT BAILS
02	ENGAGING SURFACE	HORIZONTAL REVERSING SLIDE SHIFT LEVER
SAT	FELT WASHERS (2 WASHERS)	OSCILLATING RAIL SHIFT SLIDE
02	BEARING SURFACE	HORIZONTAL REVERSING SLIDE SHIFT LEVER



(LEFT SIDE)

SAT	FELT WASHERS (2 WASHERS)	HORIZONTAL REVERSING SLIDE
02	ENGAGING SURFACES (2 PLACES)	HORIZONTAL REVERSING SLIDE
SAT	FELT WASHERS (2 WASHERS)	OSCILLATING RAIL SHIFT SLIDE

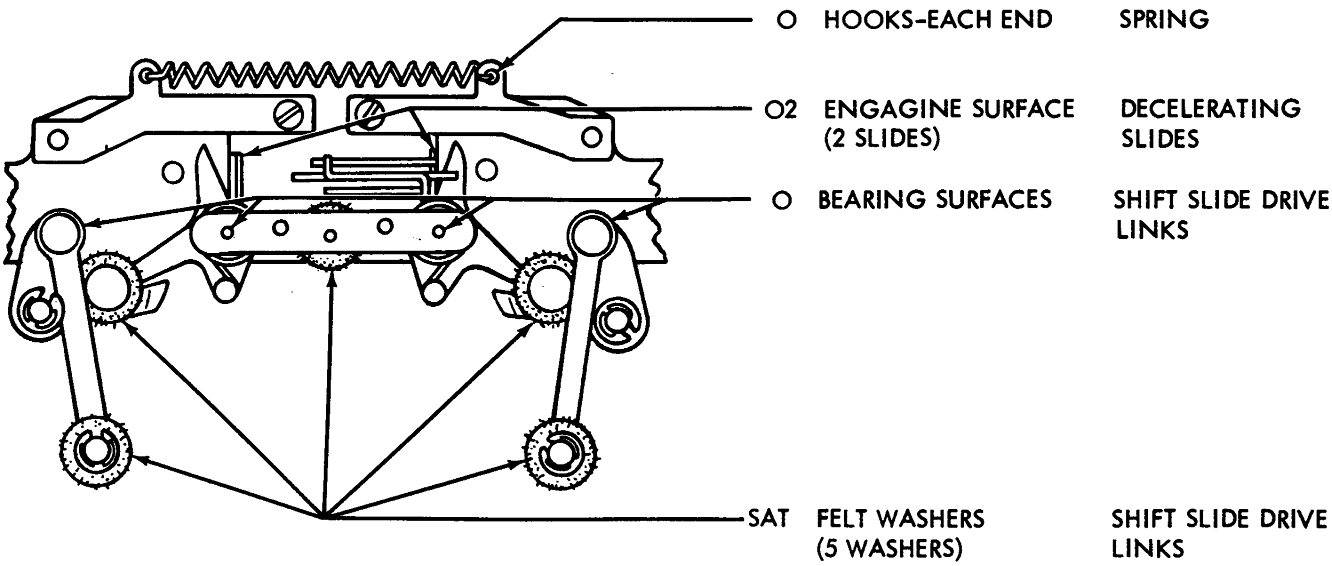
2.26 Horizontal Positioning Mechanism continued



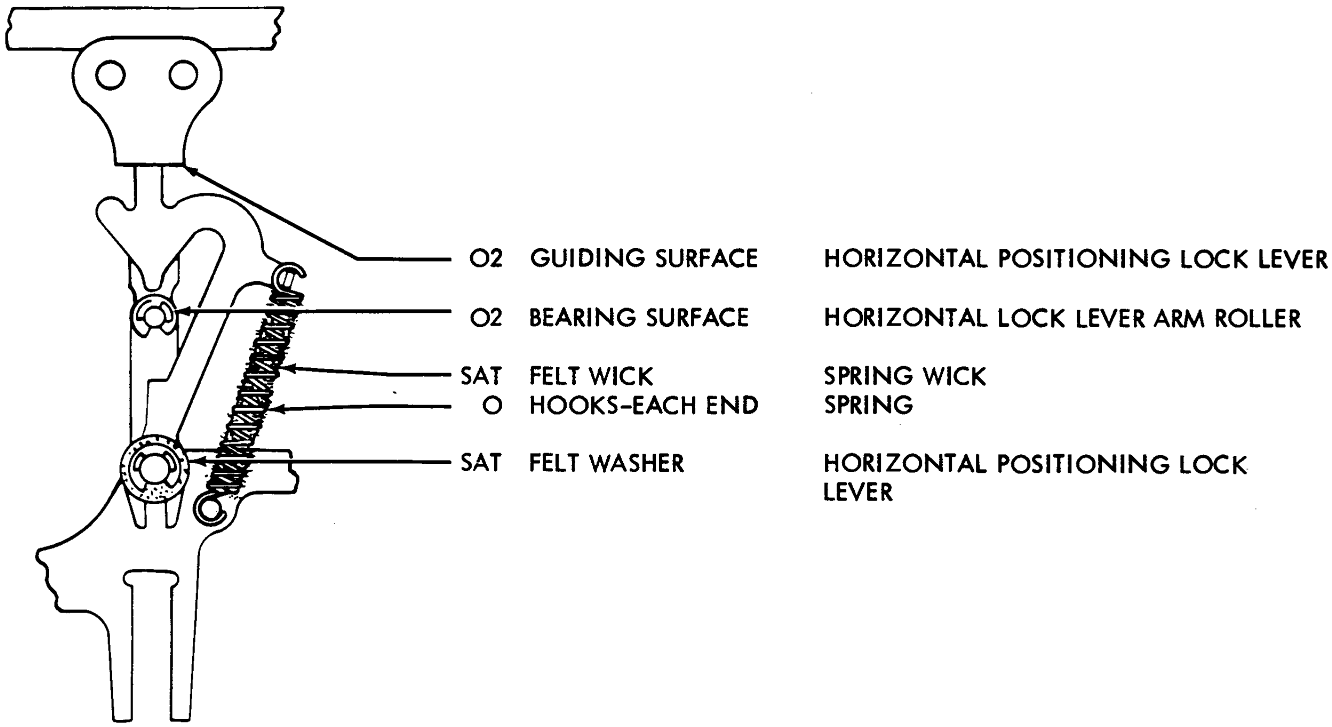
(TOP VIEW)

O	HOOKS-EACH END	SPRING
SAT	FELT WASHER	CODE BAR BELL CRANK
02	ENGAGING SURFACES (3 SLIDES)	HORIZONTAL MOTION STOP SLIDES

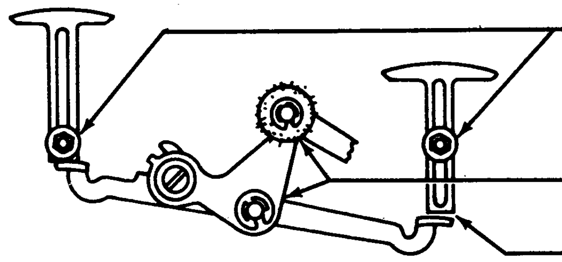
2.27 Horizontal Positioning Mechanism continued



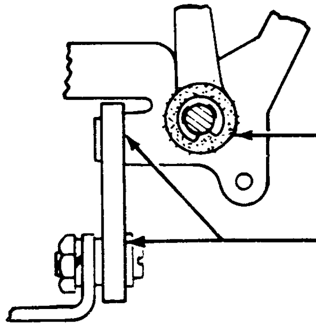
2.28 Horizontal Positioning Mechanism continued



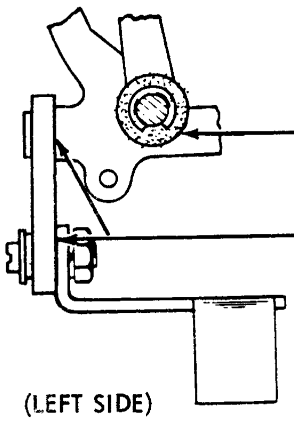
2.29 Horizontal Positioning Drive Mechanism



2.30 Shift Mechanism

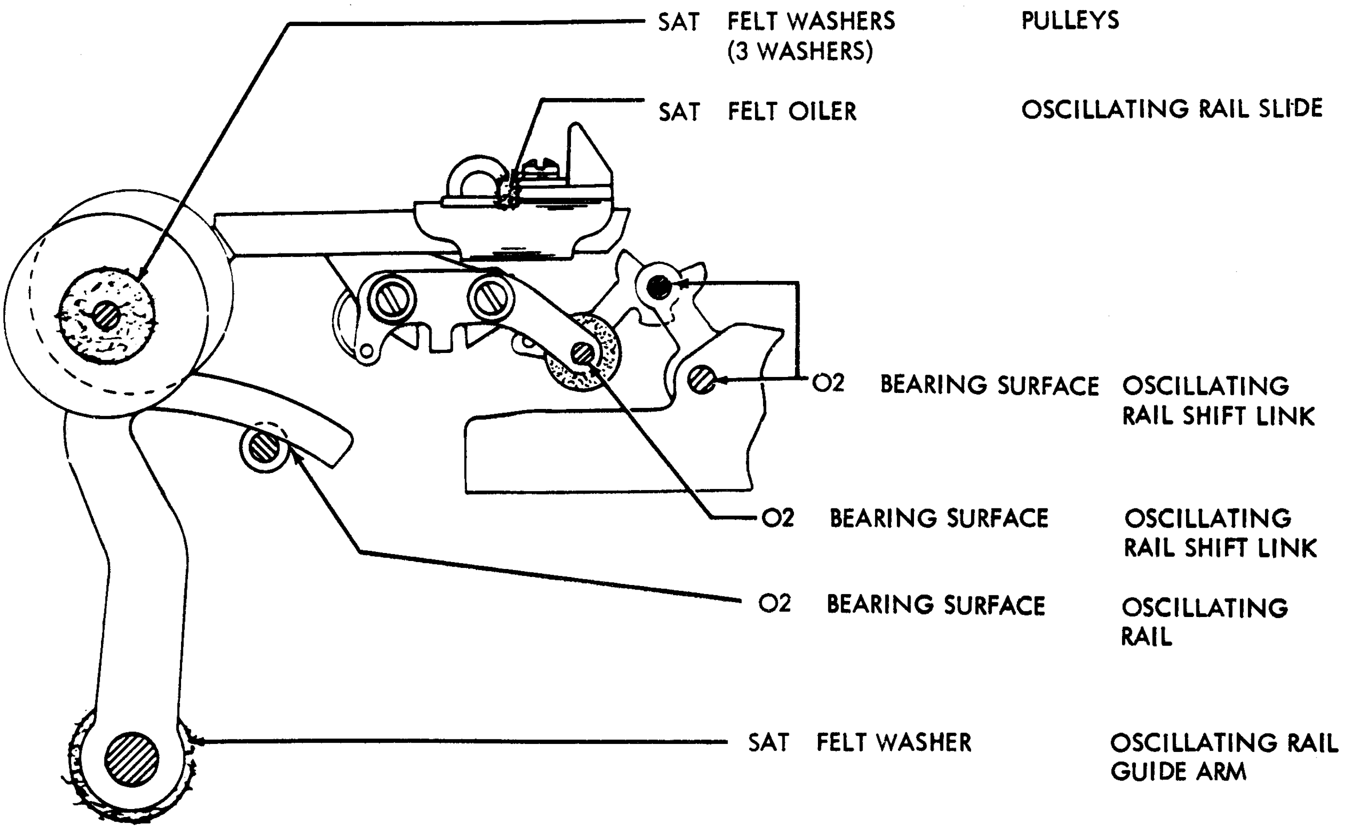


(RIGHT SIDE)

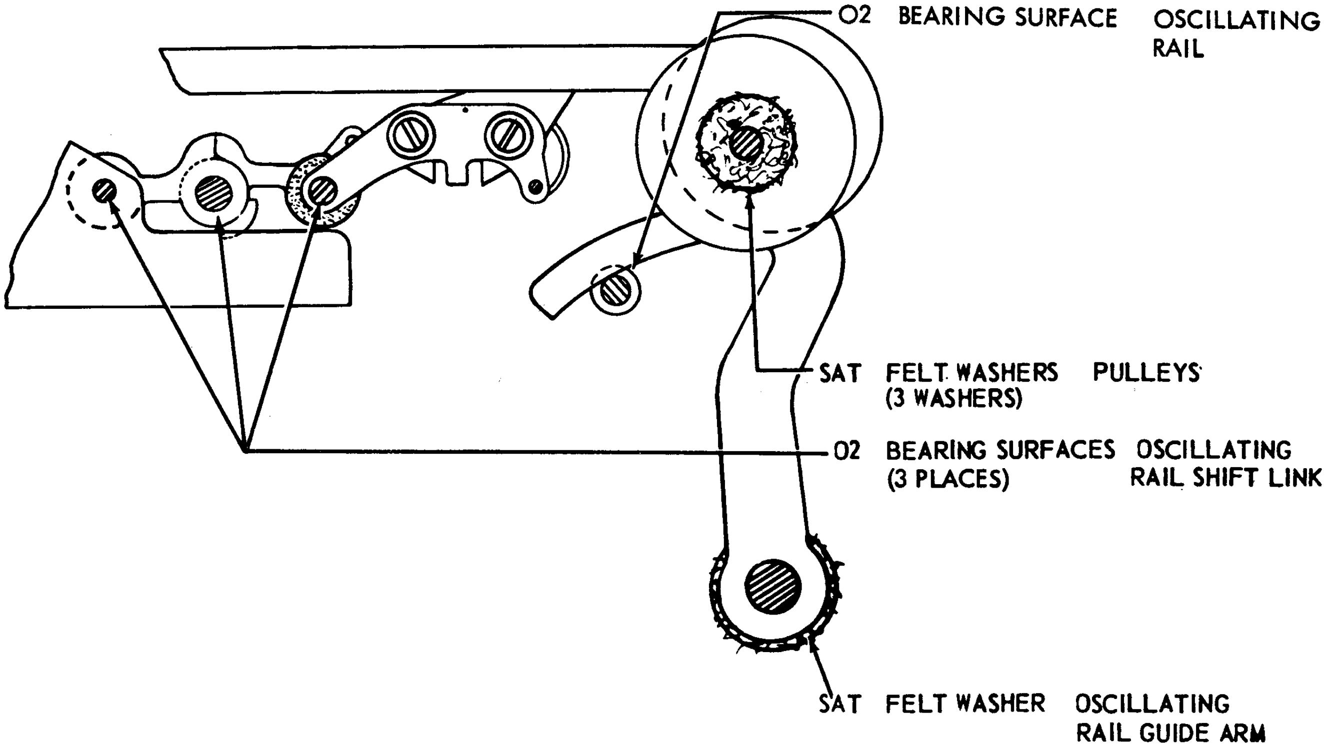


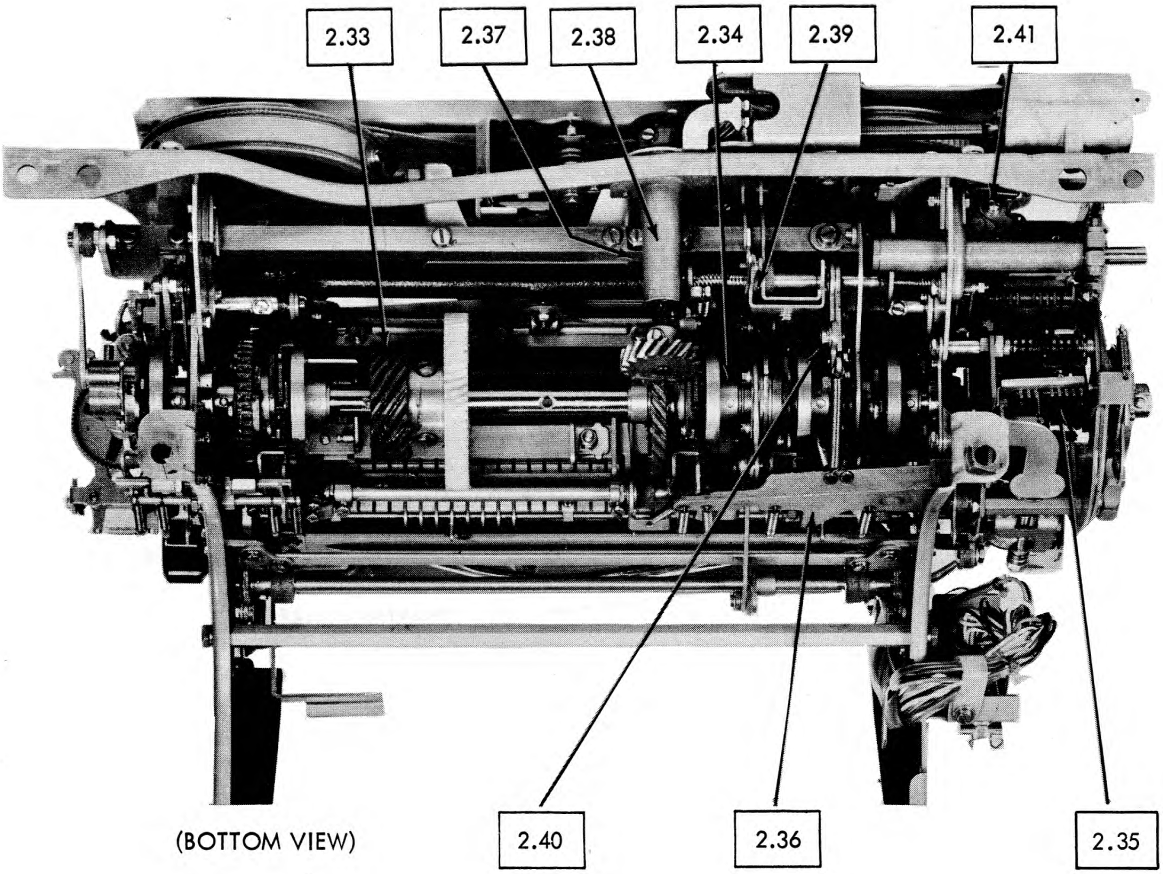
(LEFT SIDE)

2.31 Oscillating Mechanism

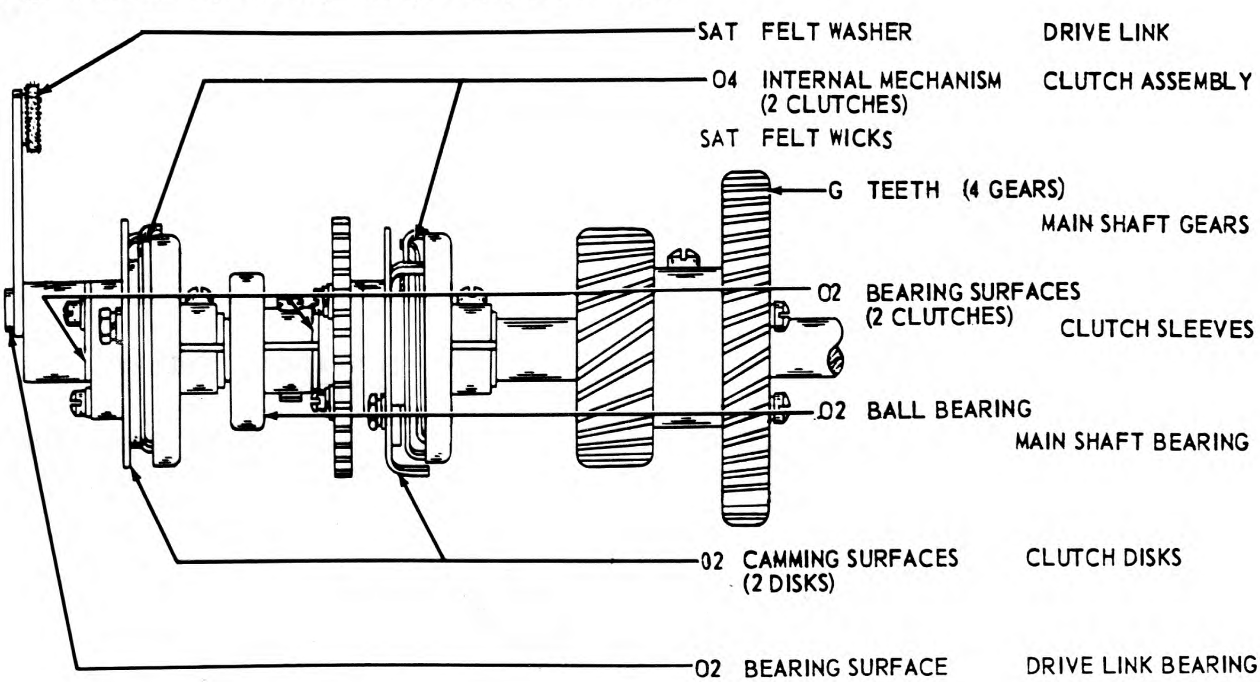


2.32 Oscillating Mechanism continued

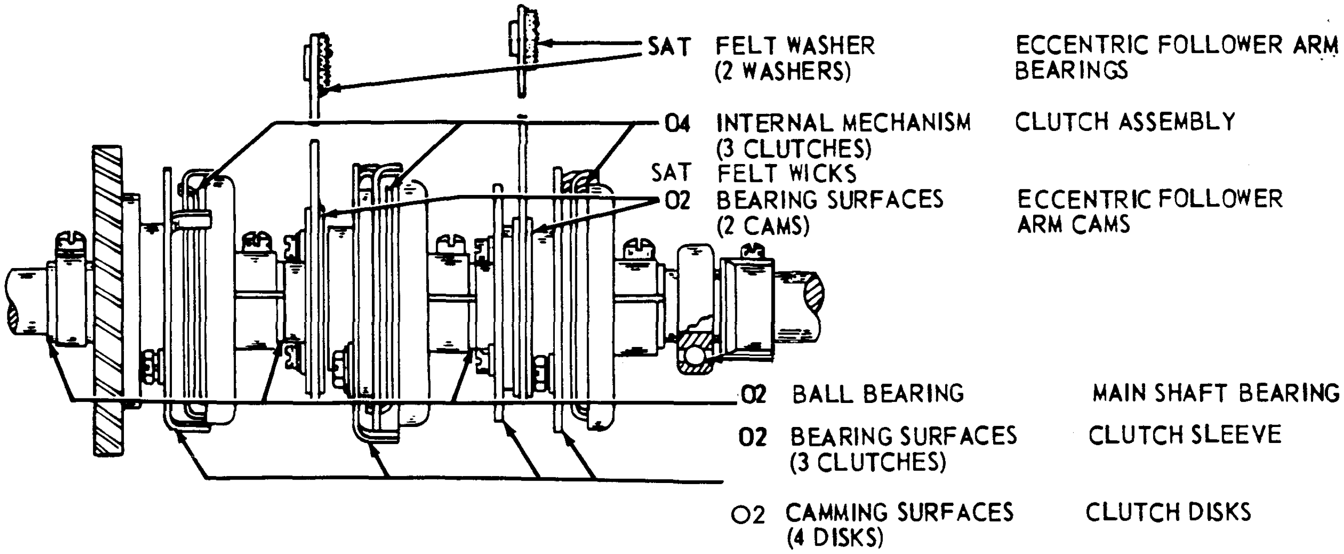




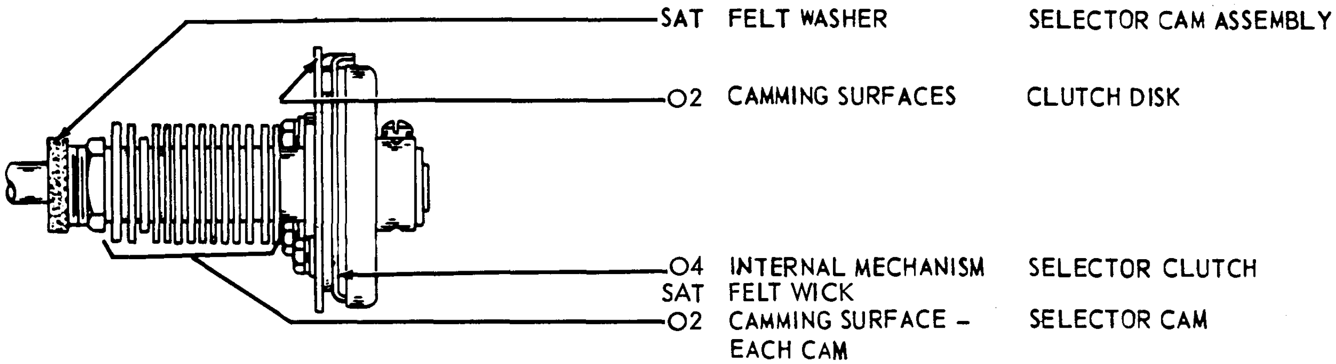
2.33 Main Shaft (Clutches, Gears, etc.) (Bottom View)



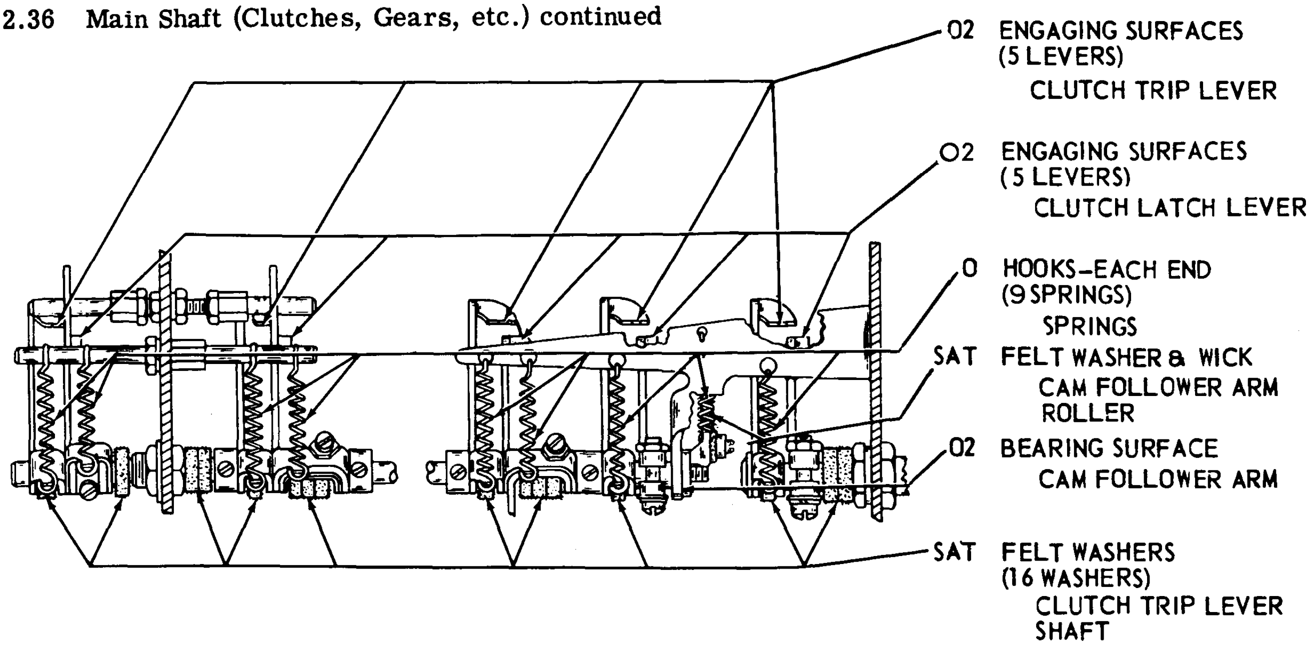
2.34 Main Shaft Mechanism



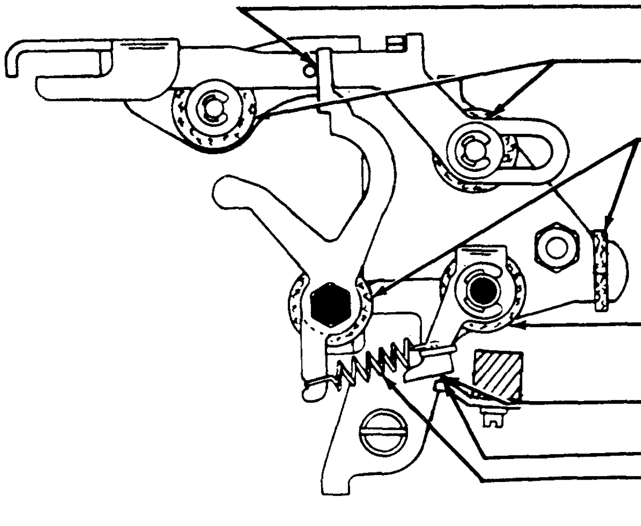
2.35 Selector Cam-Clutch Assembly



2.36 Main Shaft (Clutches, Gears, etc.) continued

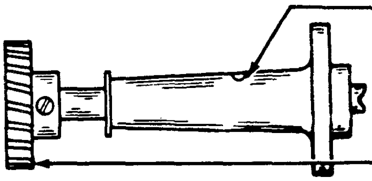


2.37 Spacing Mechanism



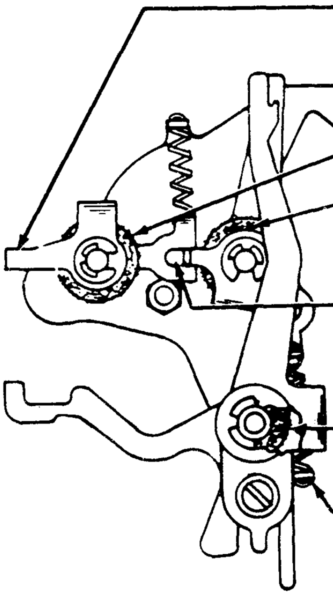
O2	ENGAGING SURFACES	SPACING TRIP LEVER
SAT	FELT WASHERS (2 WASHERS)	SPACING SUPPRESSION SLIDE
SAT	FELT WASHER	SPACING TRIP LEVER
SAT	FELT WASHER	SPACING TRIP LEVER BAIL SHAFT
O2	ENGAGING SURFACE	SPACING TRIP LEVER BAIL
G	ENGAGING SURFACE	TRIP RESET CAM PLATE
O	HOOKS–EACH END (2 SPRINGS)	SPRING

2.38 Spacing Mechanism continued



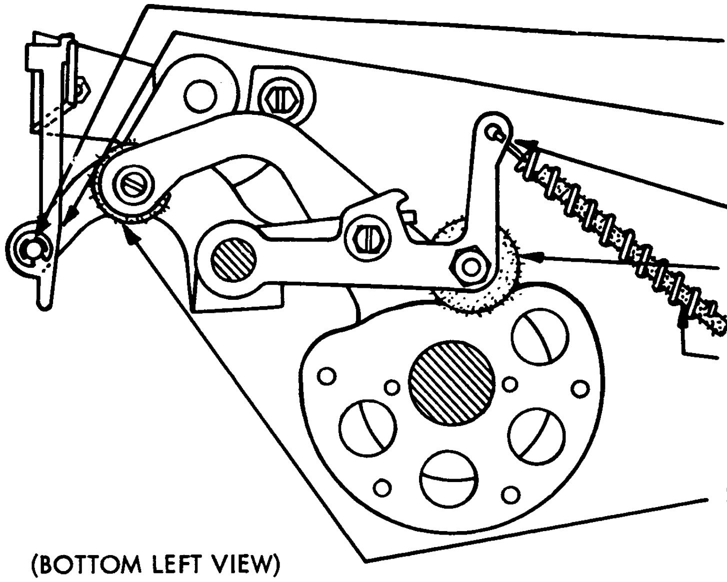
O2	OIL HOLE	SPACING SHAFT
G	TEETH	SPACING SHAFT GEAR

2.39 Spacing Mechanism continued



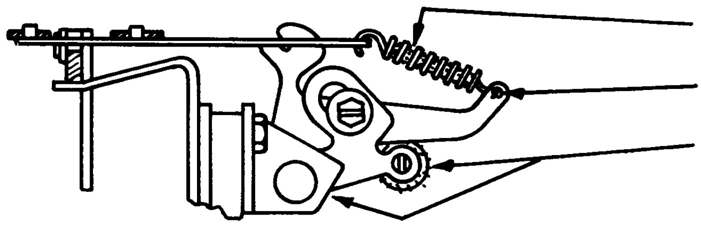
O2	ENGAGING SURFACE	SPACING CUT-OUT TRANSFER BAIL
SAT	FELT WASHERS (2 WASHERS)	SPACING CUT-OUT TRANSFER BAIL
SAT	FELT WASHER	SPACING CUT-OUT BAIL
O2	ENGAGING SURFACE	SPACING CUT-OUT BAIL
SAT	FELT WASHERS (2 WASHERS)	CARRIAGE RETURN BAIL SHAFT
O	HOOKS–EACH END	SPRING

2.40 Shift Selector Mechanism

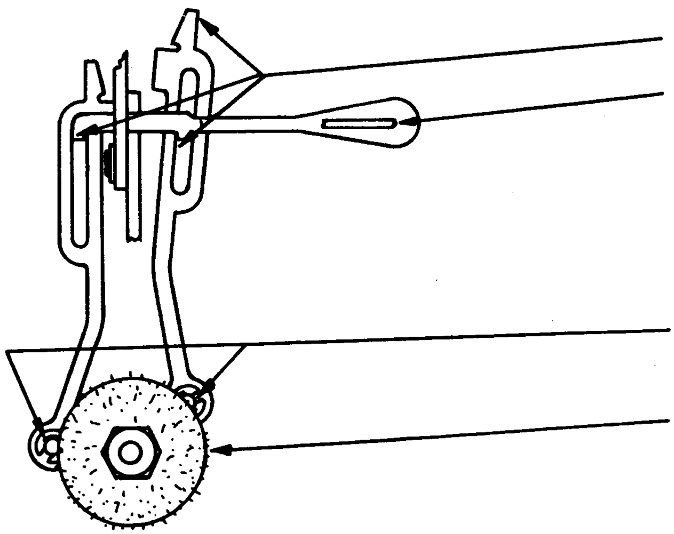


(BOTTOM LEFT VIEW)

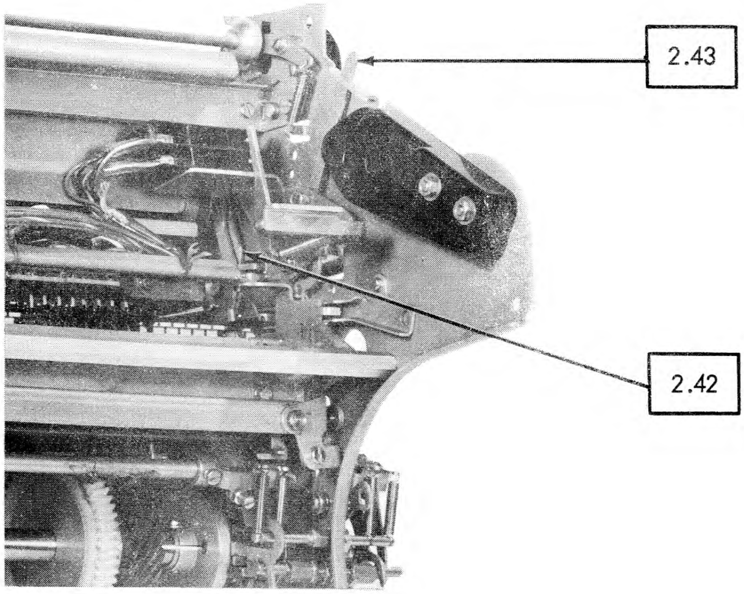
2.41 Shift Selector Mechanism continued



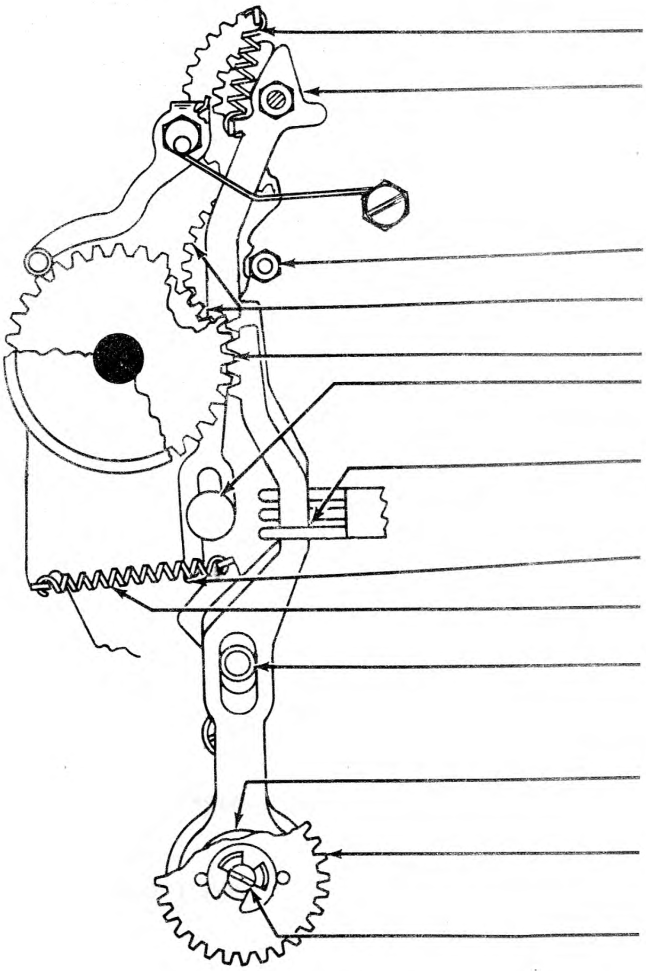
(BOTTOM VIEW)



(REAR VIEW)

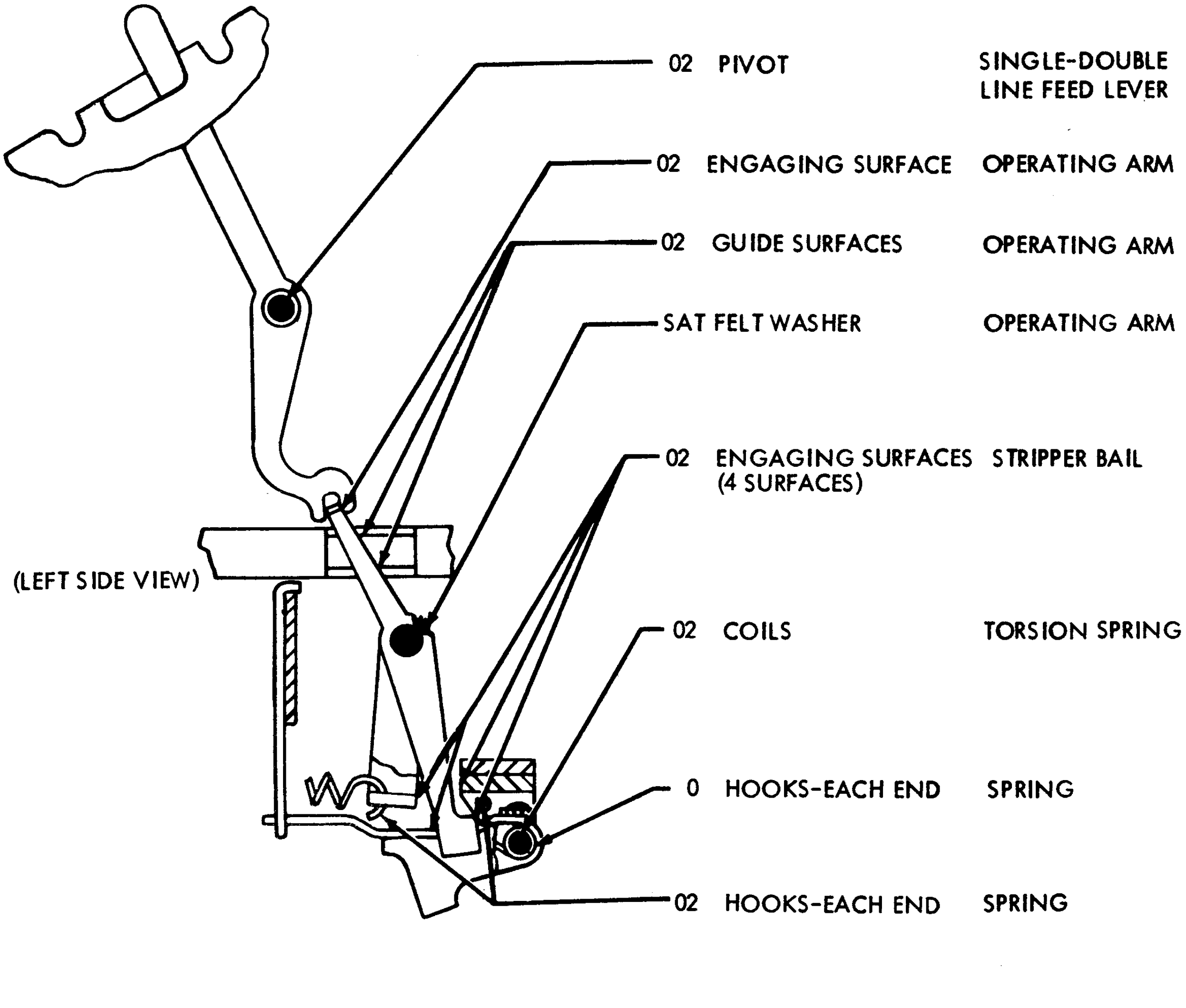


2.42 Line Feed Mechanism



O	HOOKS–EACH END	SPRING
02	BEARING SURFACE	PLATEN HAND WHEEL
02	BEARING SURFACE	PLATEN IDLER SPUR GEAR
G	TEETH (2 GEARS)	PLATEN SPUR GEARS
02	ENGAGING SURFACE	LINE FEED BARS
02	GUIDING SURFACE	LINE FEED BAR RELEASE LEVER
02	GUIDING SURFACES (2 BARS)	LINE FEED BARS
02	ENGAGING SURFACE	LINE FEED BAR RELEASE LEVER
O	HOOKS–EACH END	SPRING
02	GUIDING SURFACES (2 BARS)	LINE FEED BAR BELL CRANK
02	BEARING SURFACES (2 BEARINGS)	LINE FEED BAR ECCENTRIC BEARING
G	TEETH	LINE FEED CLUTCH SPUR GEAR
02	BEARING SURFACE	LINE FEED CLUTCH SPUR GEAR SHAFT

2.43 Single-Double Line Feed Mechanism



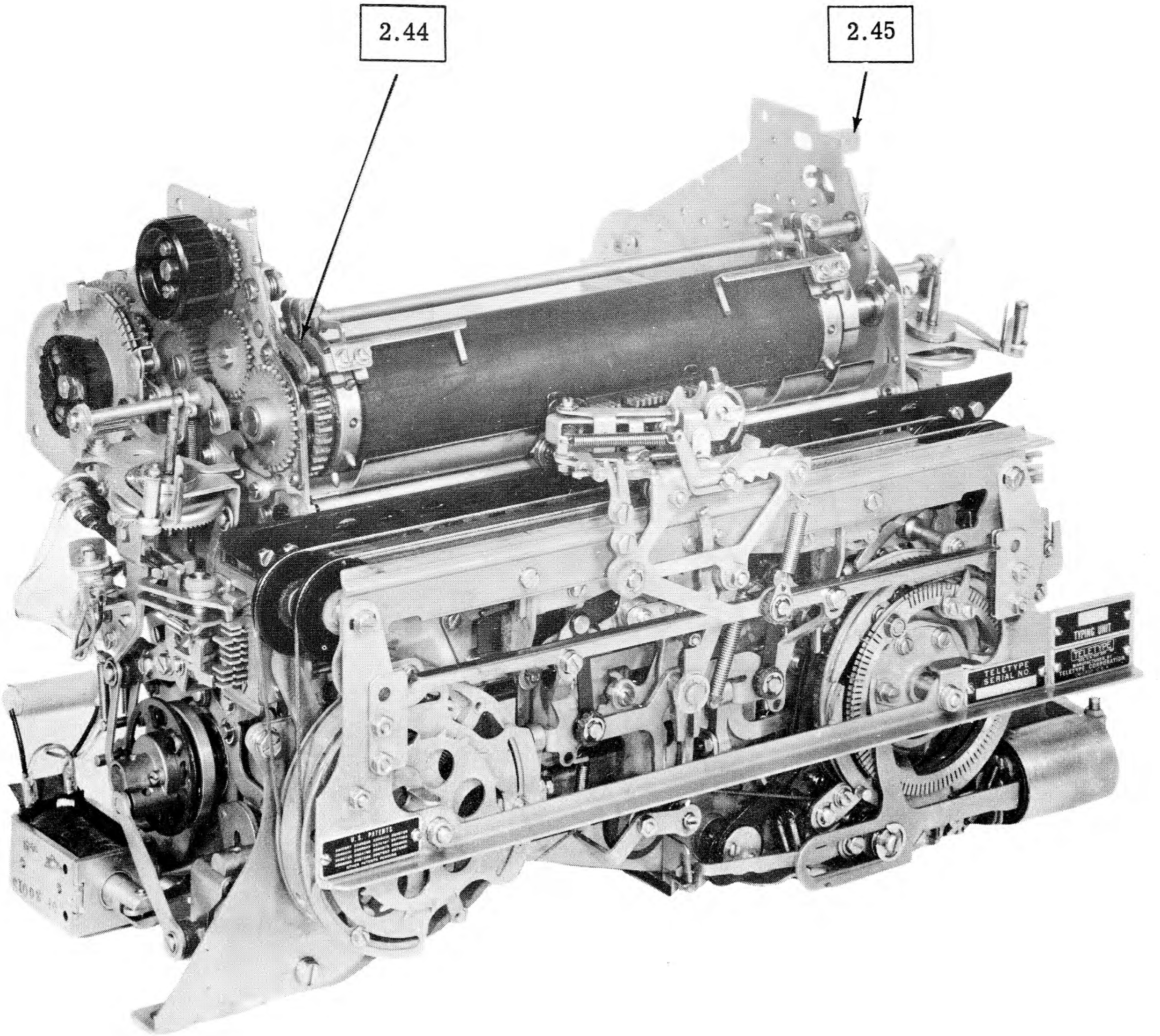
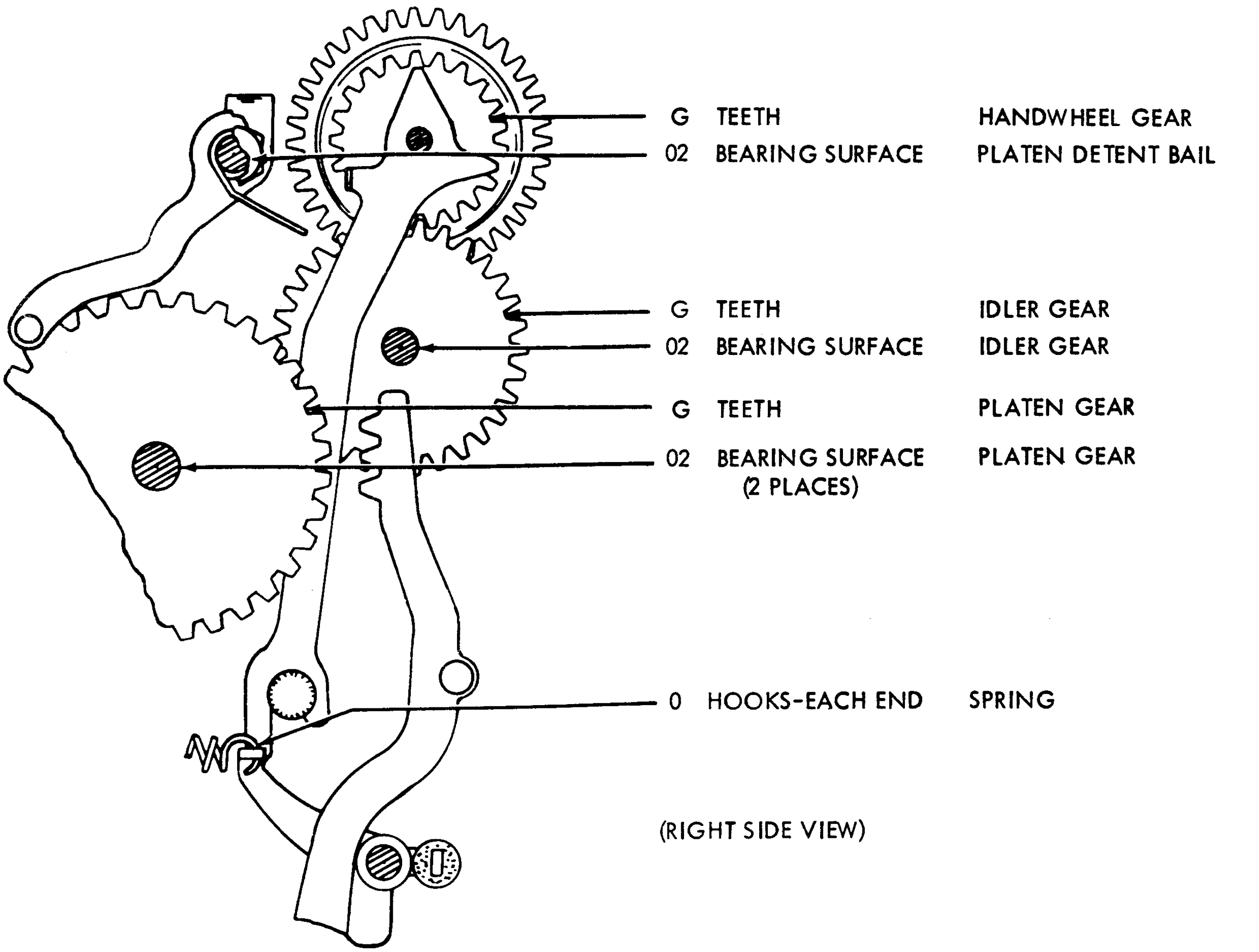
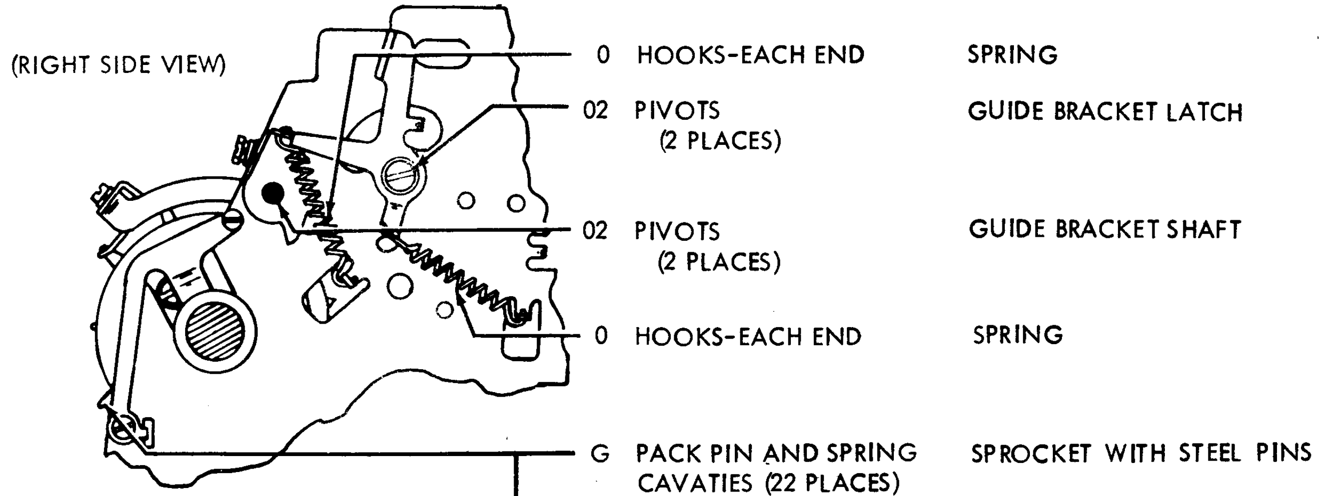


Figure 3 - 35 Typing Unit (Sprocket Feed), Left Front View

2.44 Line Feed Mechanism (Sprocket Feed)

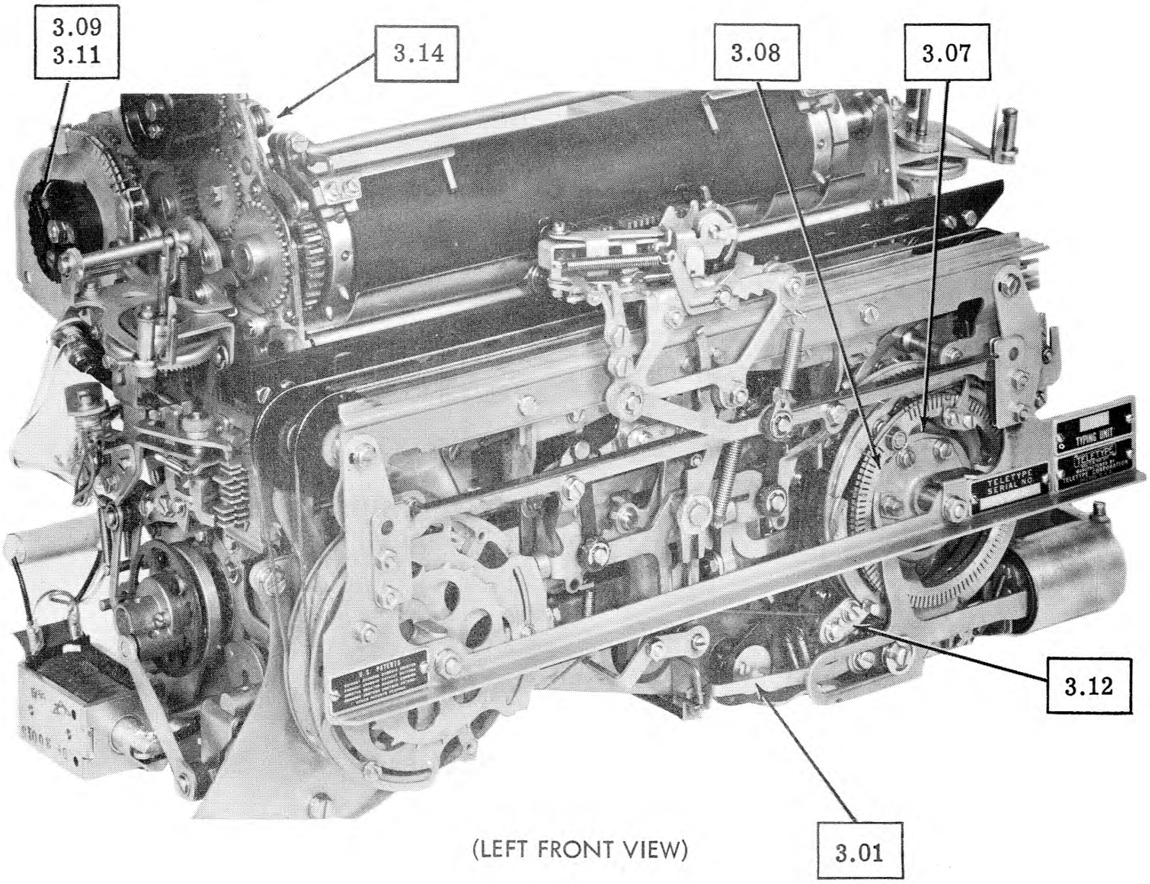


2.45 Sprocket-Feed Paper Mechanism

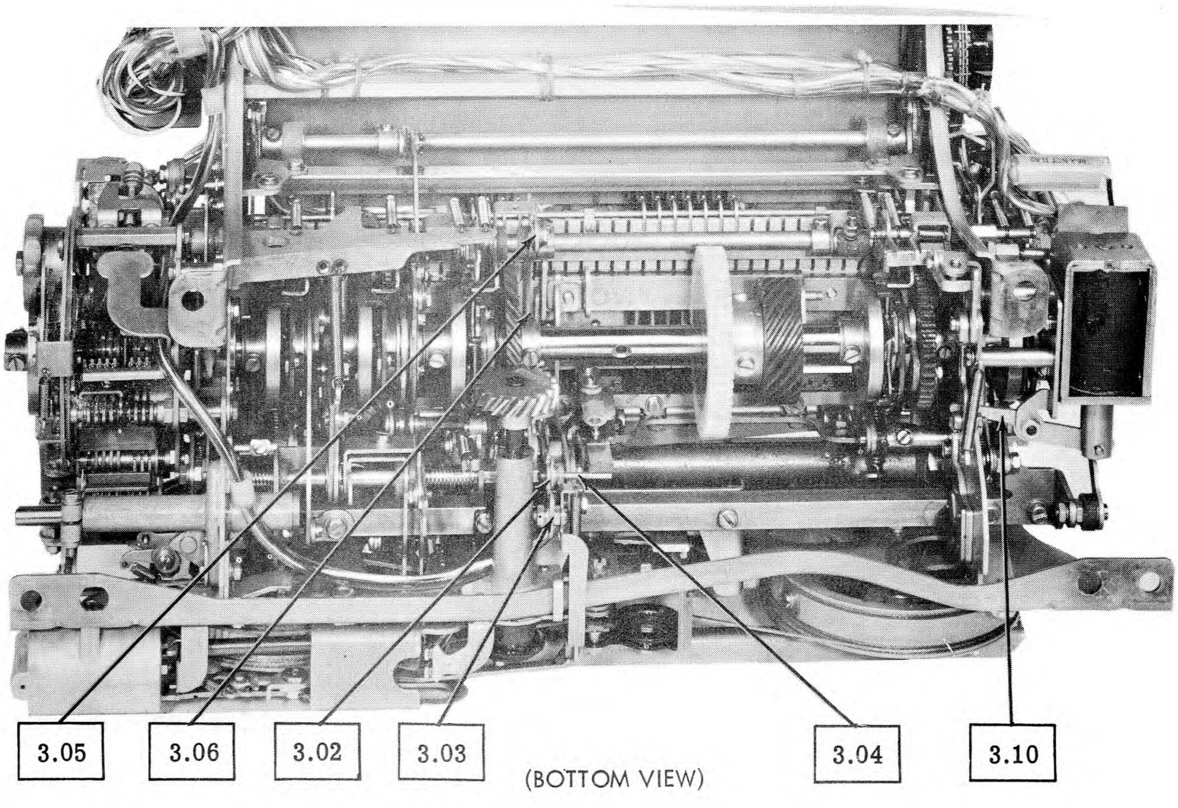


NOTE: BEFORE ATTEMPTING TO DISASSEMBLE THE 153700 PLATEN HUB, SEE DISASSEMBLY AND REASSEMBLY INSTRUCTIONS IN THE APPROPRIATE SECTION.

3. VARIABLE FEATURES

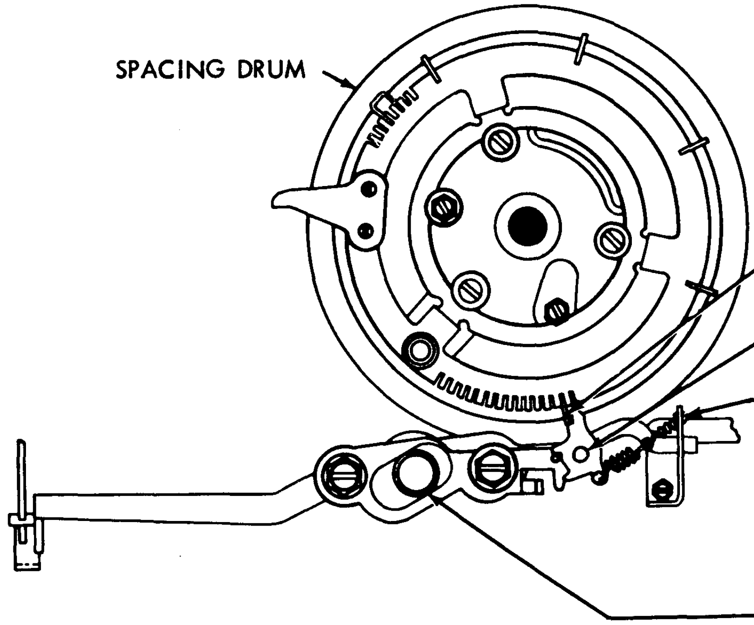


(LEFT FRONT VIEW)

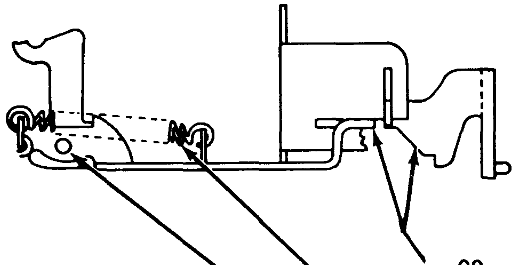


(BOTTOM VIEW)

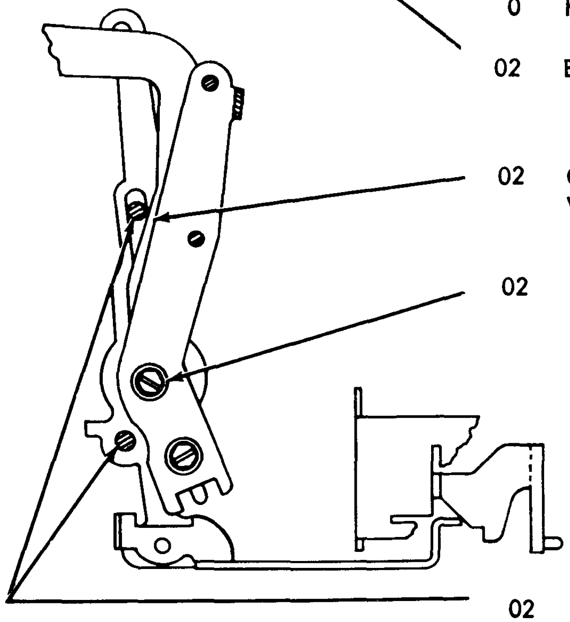
3.01 Horizontal Tabulator - Blocking Lever



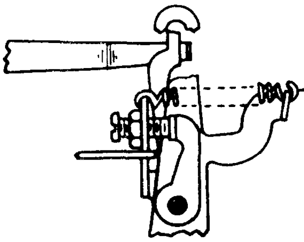
3.02 Horizontal Tabulator - Slide Arm



3.03 Horizontal Tabulator - Operating Lever

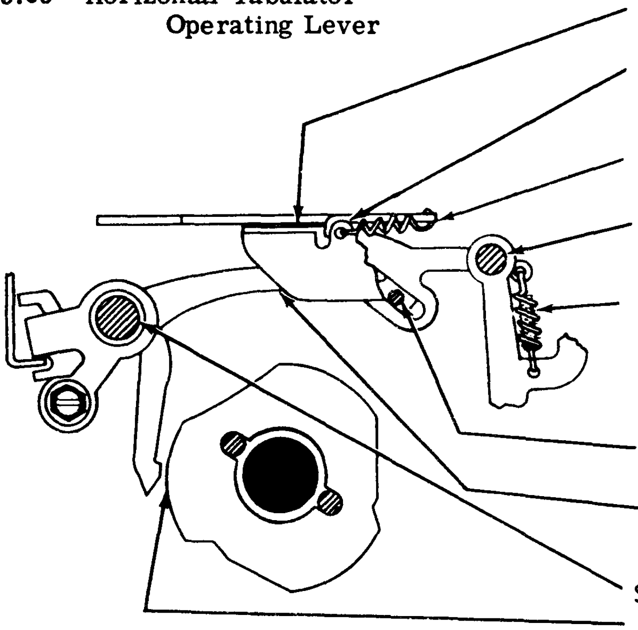


3.04 Horizontal Tabulator - Latch Bail



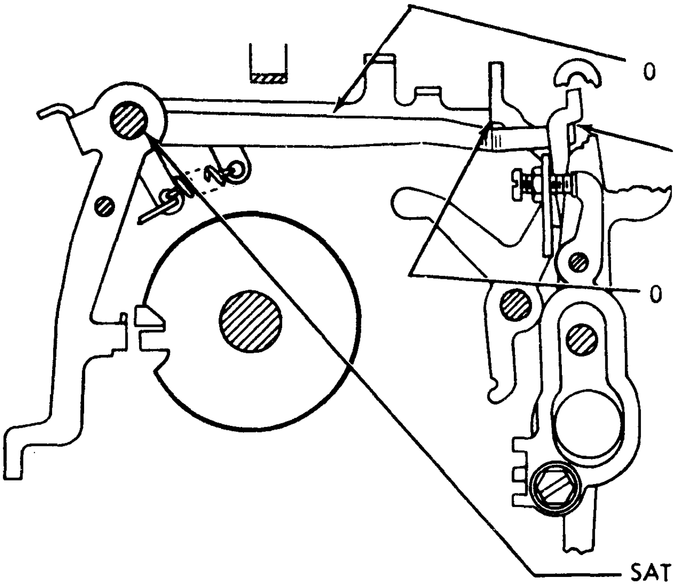
0	HOOKS - EACH END	LATCH BAIL SPRING

3.05 Horizontal Tabulator - Operating Lever



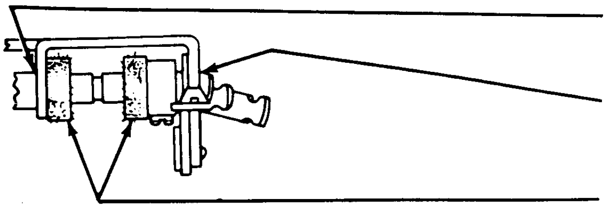
02	GUIDE SURFACES	OPERATING LEVER
02	CONTACT WITH SLIDE ARM	OPERATING LEVER
0	HOOKS - EACH END	SLIDE ARM SPRING
02	BEARING SURFACE	OPERATING LEVER
SAT	FELT WICK	SPRING
02	SLOT CAMMING SURFACE	OPERATING LEVER
02	BRACKET CONTACT SURFACE	OPERATING LEVER
SAT	FELT WASHERS	STRIPPER BAIL SHAFT
G	CAMMING SURFACE	SPACING CLUTCH RESTORING CAM

3.06 Horizontal Tabulator - Intermediate Bail



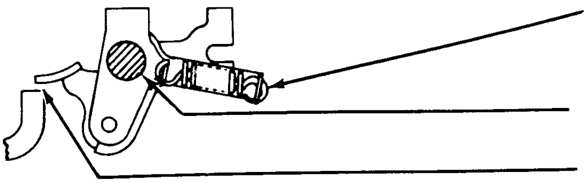
0	CONTACT SURFACE TRIP LEVER ARM	INTERMEDIATE BAIL
02	CONTACTING SURFACE	SPACING TRIP LEVER ARM
0	CONTACT SURFACE SPACING TRIP LEVER	INTERMEDIATE BAIL
SAT	FELT WASHER	TRIP LEVER ARM SHAFT

3.07 Bail Extension Arm



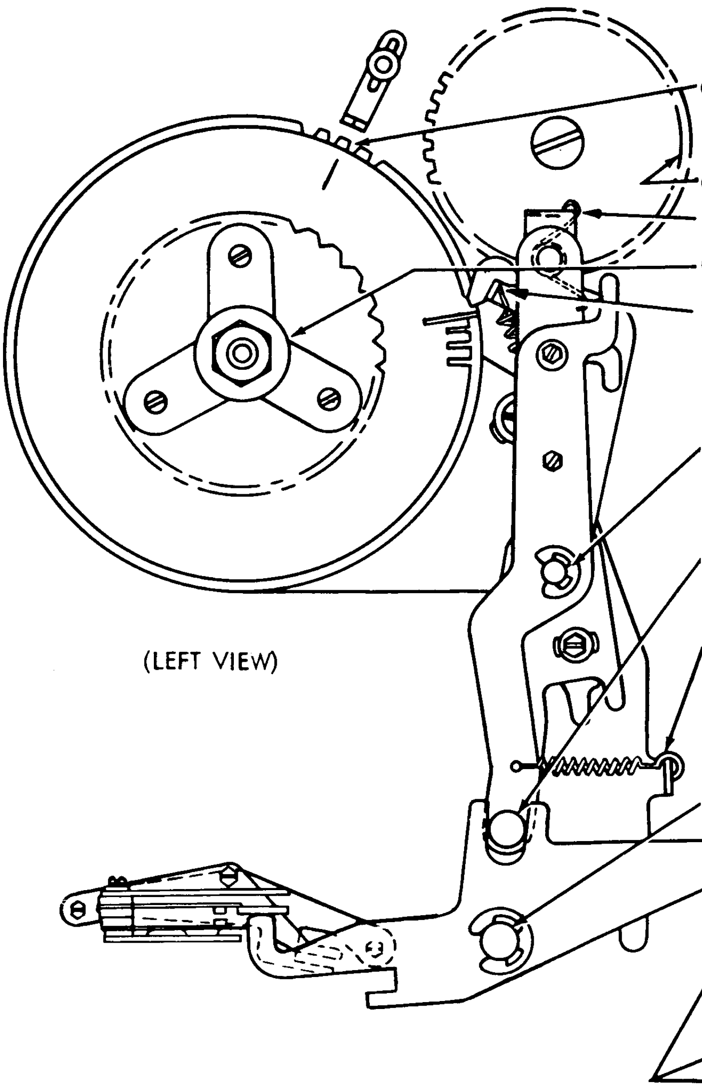
02	BEARING SURFACE	SPACING CUTOUT TRANSFER BAIL
02	BAIL CONTACTING SURFACE	SPACING CUTOUT TRANSFER BAIL
SAT	FELT WASHER	TRANSFER BAIL STUD

3.08 Spacing Cut-Out Transfer Bail



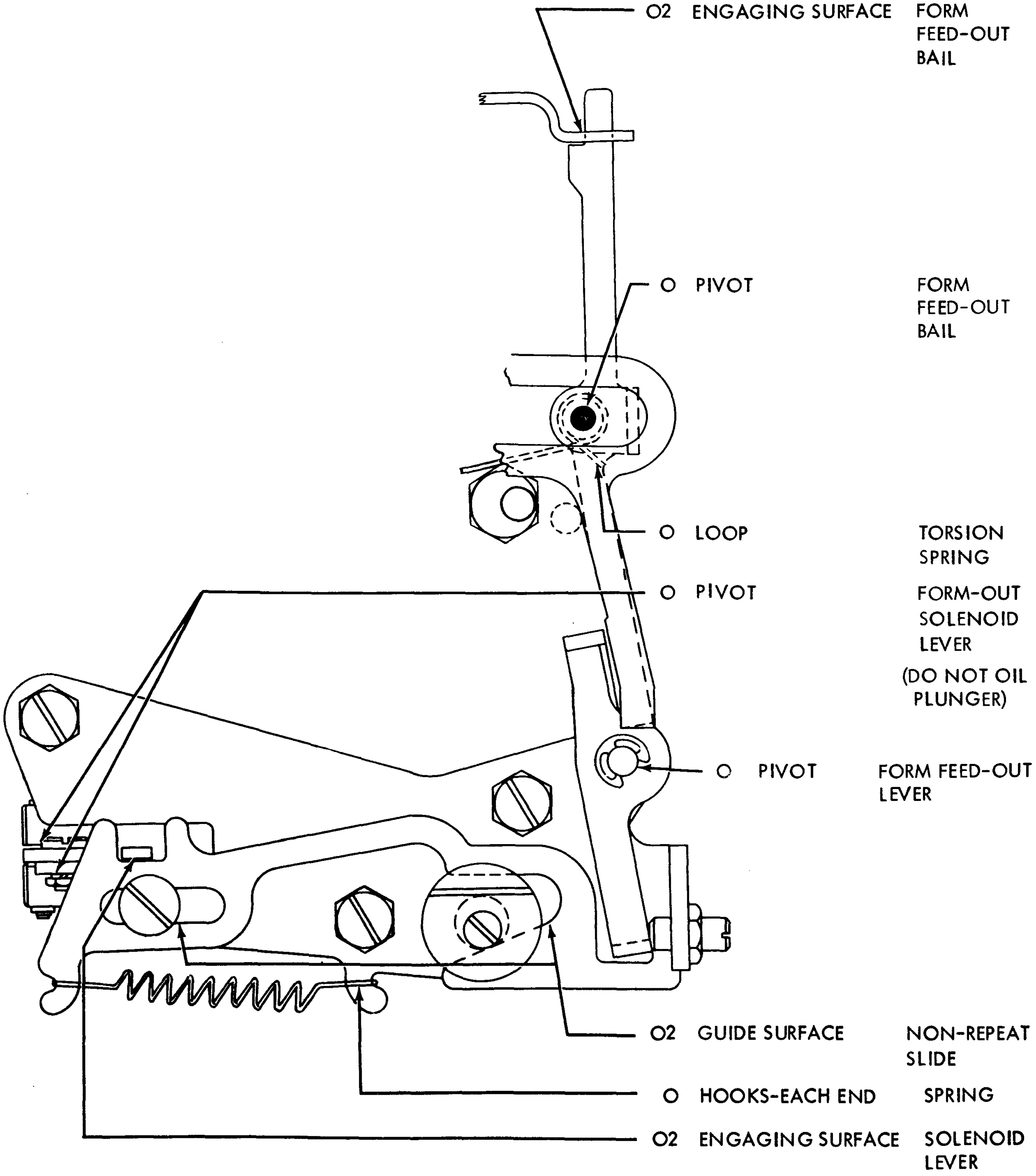
0	HOOKS - EACH END	SPACE SUPPRESSION BY PASS SPRING.
02	BEARING SURFACE	BAIL EXTENSION ARM
02	CONTACT SURFACE WITH SPACING CUT-OUT LEVER	BAIL EXTENSION ARM

3.09 Vertical Tabulator and Transmitter Distributor Control Mechanism



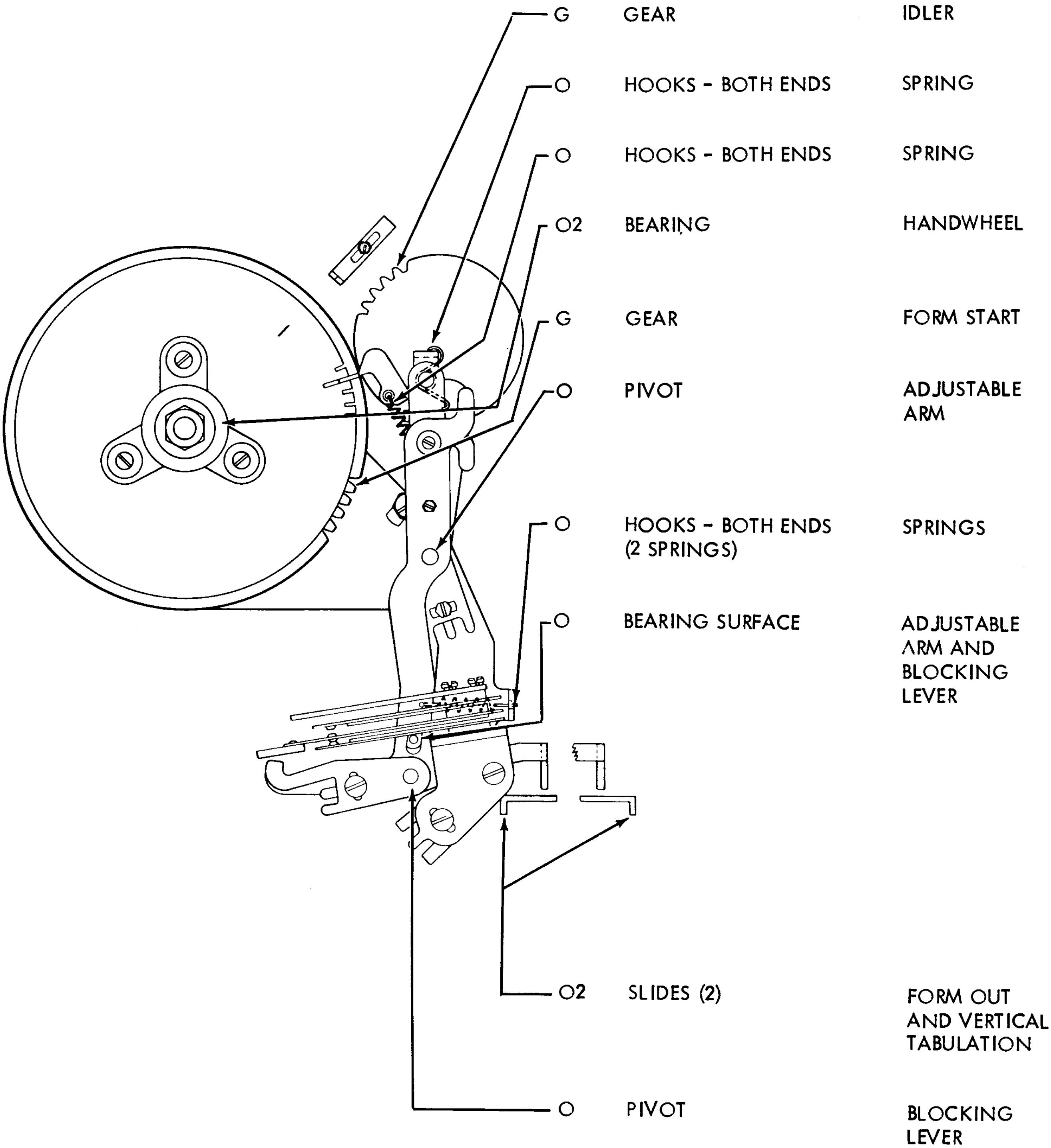
G	GEAR	PAGE FEED-OUT
G	GEAR	IDLER
0	HOOKS-BOTH ENDS	SPRING
O2	BEARING	HANDWHEEL
0	HOOKS-BOTH ENDS	SPRINGS
O	PIVOT	ADJUSTABLE ARM
O	BEARING SURFACE	ADJUSTABLE ARM AND BLOCKING LEVER
O	HOOK-BOTH ENDS (2 SPRINGS)	SPRINGS
O	PIVOT	BLOCKING LEVER
O	SLIDES (2)	PAGE FEED-OUT AND VERTICAL TAB

3.10 Form Feed-out Mechanism

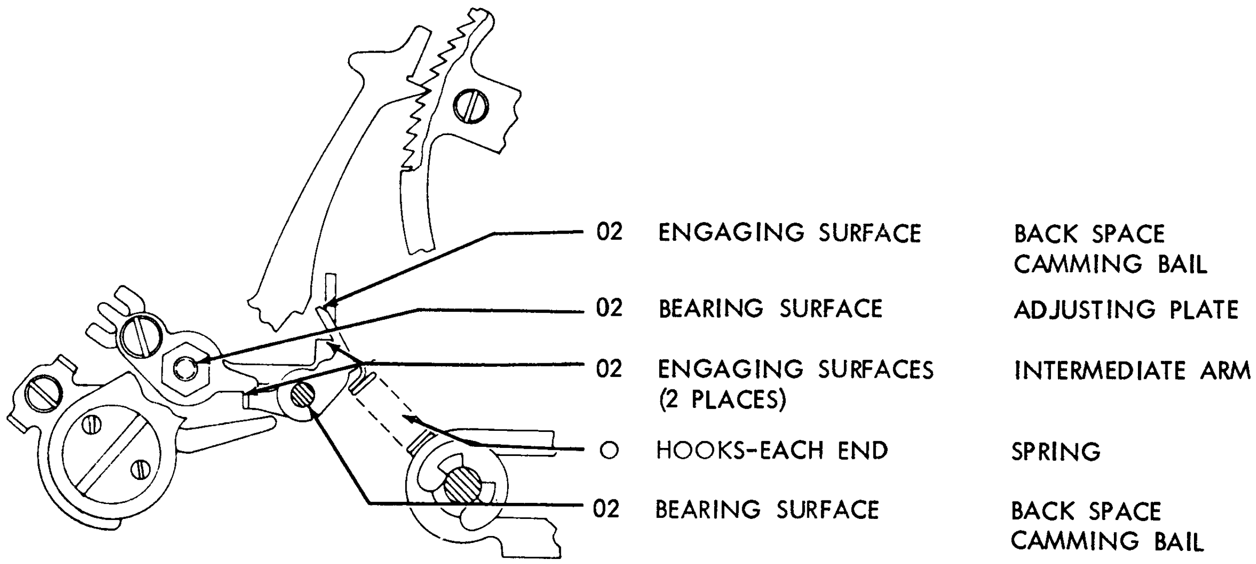


(LEFT FRAME VIEWED FROM RIGHT REAR)

3.11 Vertical Tabulator Mechanism (For Switched Network Service)

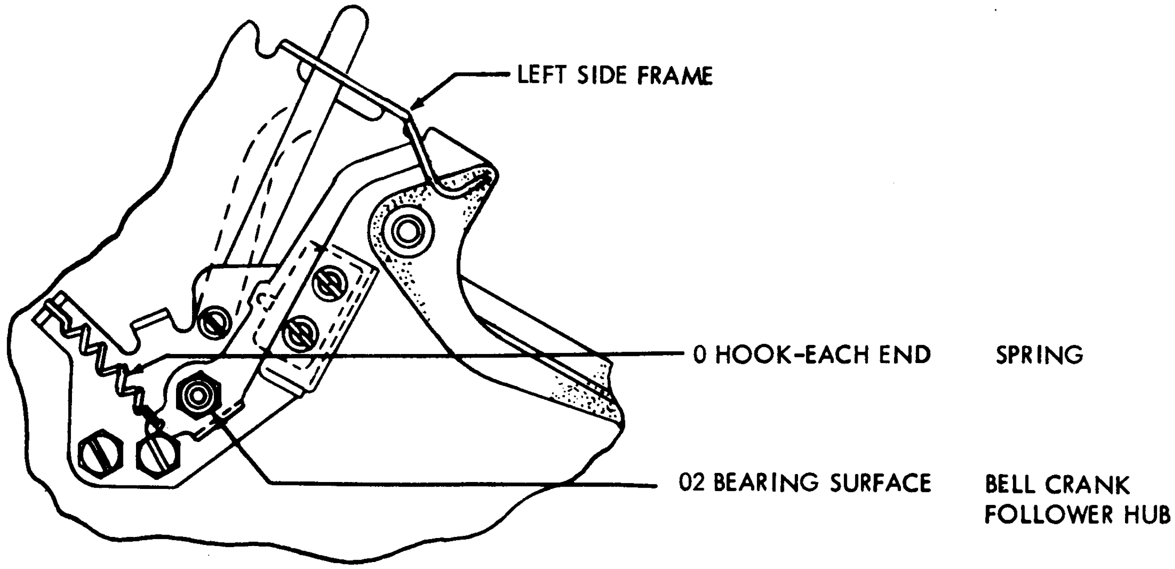


3.12 Local Back Space Mechanism

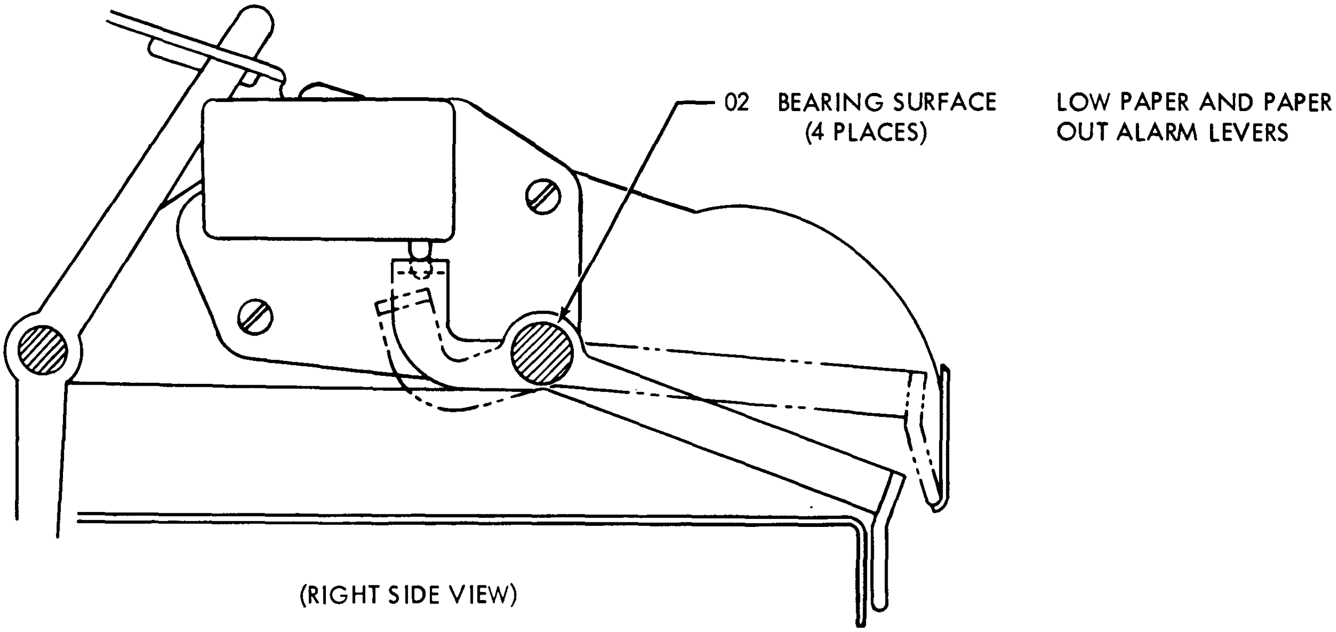


(FRONT VIEW)

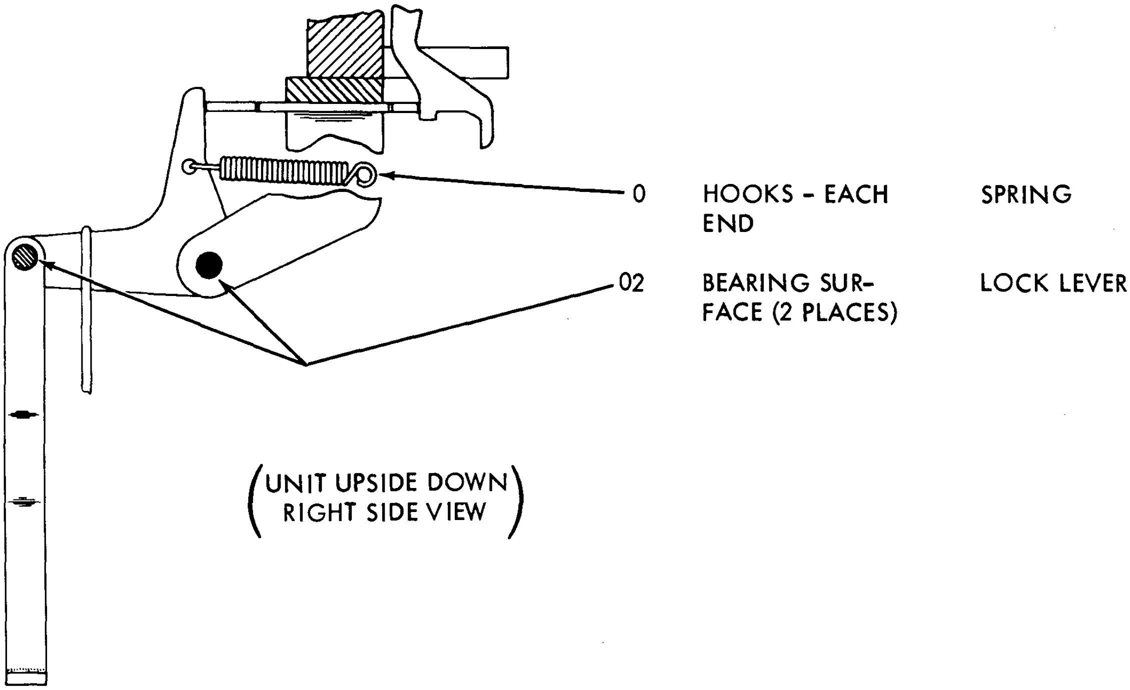
3.13 Paper-Out Alarm Mechanism (Friction Feed)



3.14 Low Paper and Paper Out Alarm Mechanism (Sprocket Feed)



3.15 Keyboard Lock Mechanism



35 TYPING UNIT

DISASSEMBLY AND REASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 Disassembly, as outlined in this section, covers a procedure for removing the principal sub-assemblies which make up the unit.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication and adjustments can be accomplished simply by removing the subject component from the cabinet. If possible, disassembly should be confined to sub-assemblies, which can, in some cases, be removed without disturbing adjustments. When reassembling the sub-assemblies, be sure to check all associated adjustments, clearances and spring tensions.

1.04 If a part that is mounted on shims is removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted.

1.05 Retaining rings (Tru-arcs) are made of spring steel and have a tendency to release suddenly when attempting to remove them. Loss of these retainers can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.06 Avoid loss of springs in disassembly by holding one spring loop with the left hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.07 Raise cabinet lid or enclosure cover (after removing the control panel bezel and the copylight plug) and remove the typing unit from its base by removing the four screws that secure it to its keyboard or base. Remove the cable plug connector from the side frame. Lift the typing unit off.

Note: On sets equipped with a form supply container on the rear of the cabinet, a rearward foot extension should be in

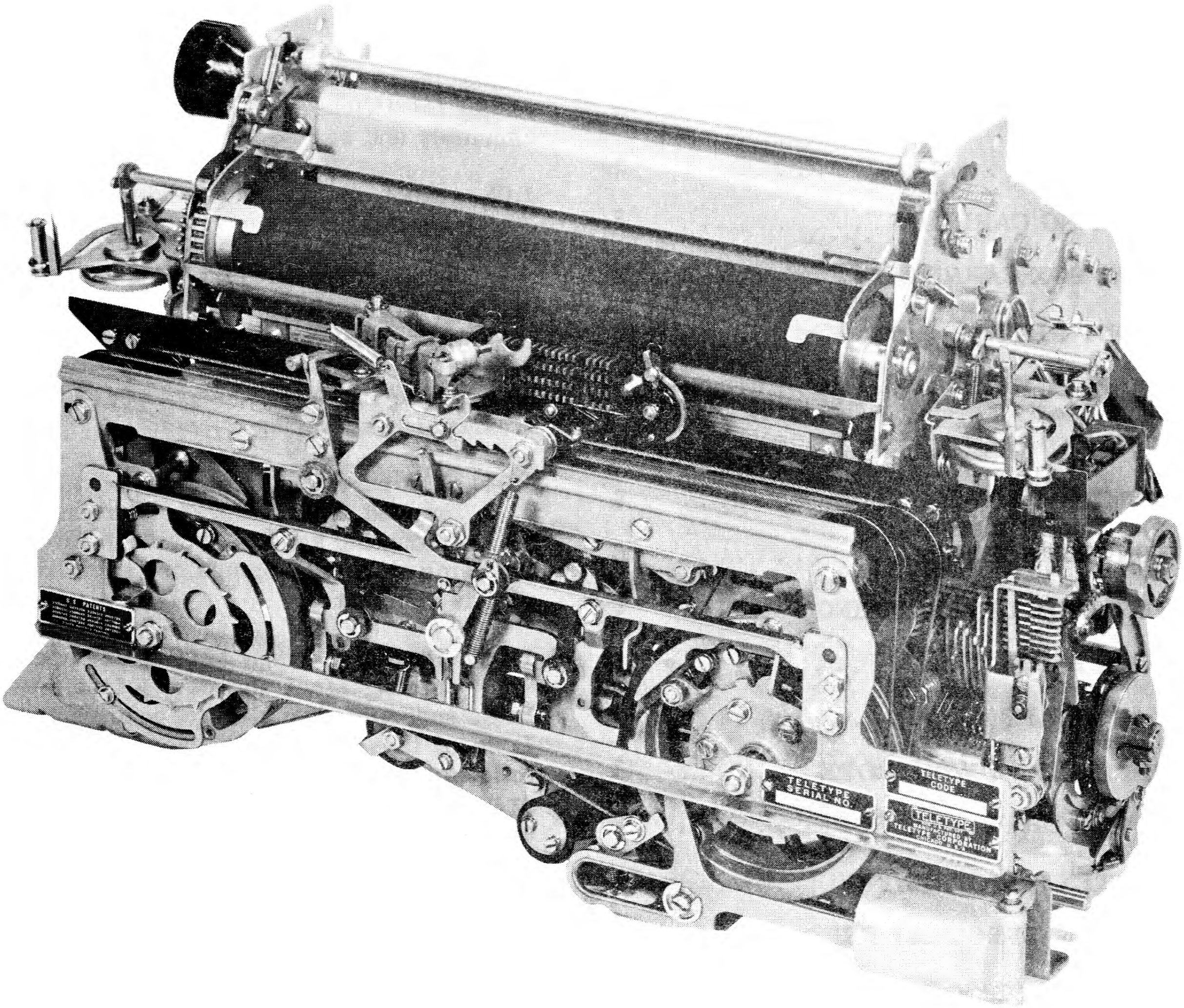


Figure 1 - 35 Typing Unit - Friction Feed

position on the cabinet. This prevents the cabinet from tilting when the typing unit is removed.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a sub-assembly from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

TYPE BOX

2.02 To Remove: Trip the type box latch to the right. Lift the right end of the type box upward to an angle of approximately 45 degrees and pull toward the right to disengage it from the left hand bearing stud.

(a) To disassemble the type box for replacing type pallet or spring, remove both screws and nuts that secure the front plate to the rear plate assembly. Separate the two plates.

(b) Remove the spring from the pallet by compressing it slightly and pulling the formed end out of the slot in the pallet.

(c) If the pallet is being replaced the spring should also be replaced. In any change or replacement, where the spring is removed, it should be replaced with a new one.

(d) When installing the spring make certain that the formed end extends through the slot in the pallet.

(e) To reassemble the type box, line up the front plate with the rear plate assembly and draw the two plates together until the head of the pallet leaves the rear plate by approximately 1/16 inch. This may be accomplished by using two 6-40 screws (at least 11/32" long) and nuts in place of the two screws and nuts removed when disassembling, and tighten them only enough to hold the pallets as specified above. Do not clamp the plates together until all pallets have been moved into their correct position.

(f) Manipulate the pallets until they fall into their respective openings in the front plate. Press the plates together.

(g) Replace the screws and nuts used in step (e) with screws and nuts removed in step (a).

2.03 To Replace Type Box: Reverse the procedure used in removing it.

CAUTION: TO AVOID SPRINGING THE TYPE BOX LATCH, THE TYPE BOX SHOULD BE FIRMLY SEATED ON THE BEARING STUD AND THE POINT OF THE LATCH SHOULD BE PLACED IN THE NOTCH OF THE TYPE BOX PLATE BEFORE MOVING THE LATCH TO ITS LOCKED POSITION.

PRINTING CARRIAGE

2.04 To Remove: Loosen the two screws in the printing-carriage clamp plate and disengage the carriage from the upper draw-wire rope. Move the carriage to the left of its track and tilt the lower part forward to disengage the rollers from the track.

2.05 To Replace: Make certain that the printing arm is correctly re-engaged with the printing track. Position the carriage clamp on the upper draw-wire rope for correct printing carriage position as specified in the adjustment section.

TYPE BOX CARRIAGE

2.06 To Remove: Move the type box carriage to its extreme right hand position.

(a) Select a character which will shift the type box to its uppermost position.

(b) Remove the ribbon from the ribbon guide.

(c) Remove the retainer ring from the stud in the right hand end of the type box carriage link. Disengage the link from the carriage.

(d) Hold the ribbon guide forward and the right ribbon reverse lever back. Pull the carriage toward the right to disengage it from the carriage track.

FRONT PLATE

2.07 To Remove: Manually move the type box carriage to the extreme right. Select any character in the bottom row of the type box and rotate main shaft until type box carriage is in its uppermost position.

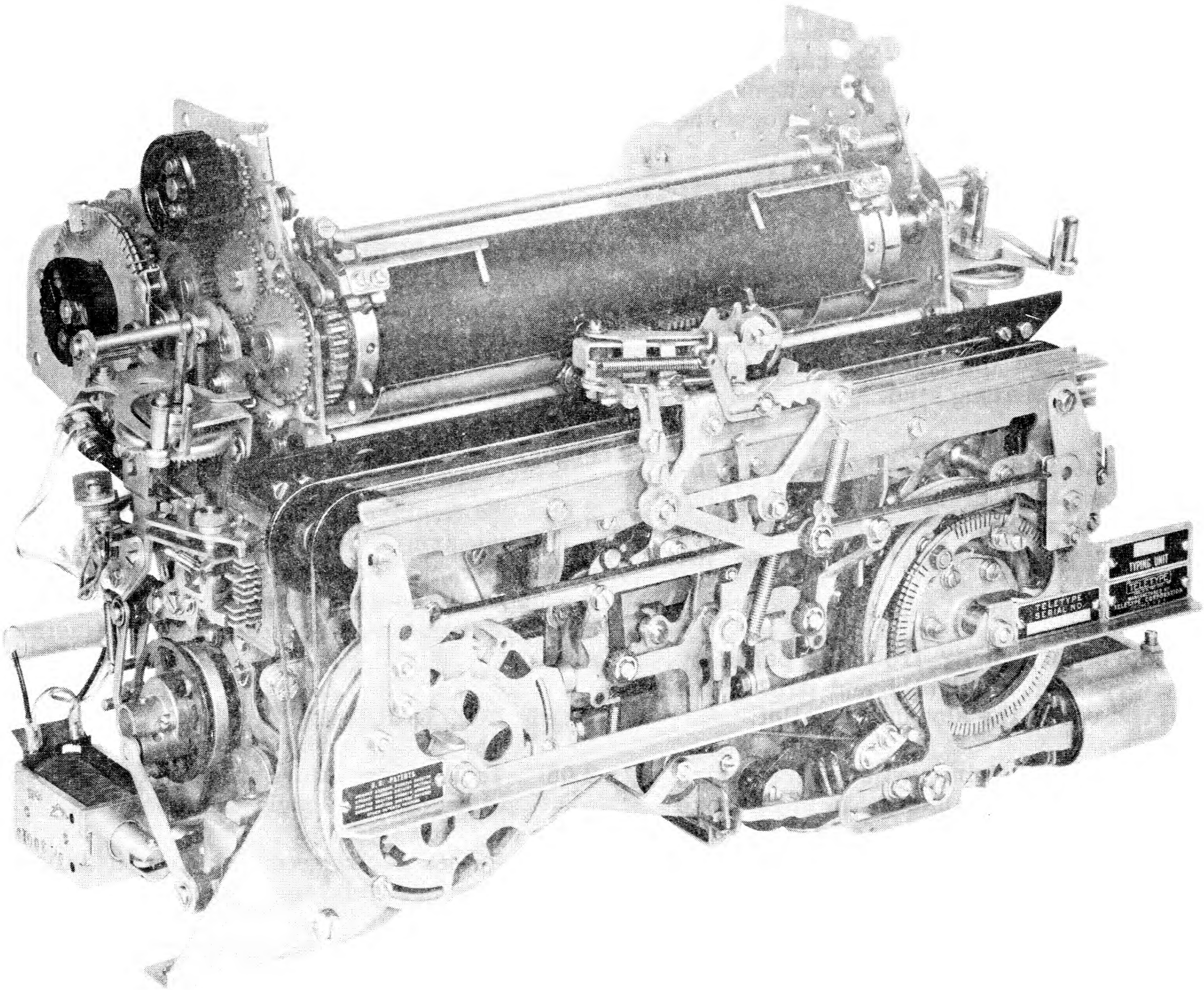


Figure 2 - 35 Typing Unit - Sprocket Feed

(a) Remove the retainer ring from the type box carriage link right hand stud and disengage the link from the carriage. (See instructions for removing the link retainer in 2.06(c).)

(b) Remove the three screws, which secure the main bail drive bracket to the rocker shaft.

(c) Remove the spacing shaft gear.

(d) Remove the four screws which secure the front plate assembly to the typing unit side frames.

(e) Pull the front plate assembly forward to disengage it from its connecting parts in the typing unit.

2.08 To Replace Front Plate: Make certain that the TP150770 and TP150771 code bar bell cranks, the TP170063 reversing slide shift lever, TP157972 automatic CR - LF bell crank, if so equipped, and the TP152545 carriage return lever extension are properly engaged with their mating parts before tightening the front plate mounting screws.

2.09 Replace the spacing shaft gear. See appropriate section for adjustment on phasing the spacing gears.

STUNT BOX

2.10 To Remove: The procedure for removing the stunt box proper is essentially the same for both the friction feed units and sprocket feed units except that, preparatory to removing it from the sprocket feed unit, a number of other assemblies must first be removed, as follows:

(a) Remove the two contact bracket assemblies and the magnet assembly from outside the left side frame.

(b) Remove the form-out switch assembly from the inside of the left side frame.

(c) Snap the form feed paper guide upward and slide it out.

(d) Unfasten the cable from the tie bar.

2.11 Remove the TP151627 rear tie bar from typing unit side frames.

(a) Remove the line feed function pawl stripper from the TP160577 stripper blade.

(b) Remove the screws which secure the stunt box assembly in the typing unit.

(c) Remove the screw from the TP153291 cam shaft drive arm, and slide the drive arm to the left, out of engagement with the stripper blade drive arm.

(d) Lift the stunt box assembly upward to disengage it from its locating brackets and pull toward the rear to disengage all code bar forks from the code bars. Remove the connector receptacle from the right side frame and disconnect the wires from selector magnets. Remove the stunt box.

Note: Proceed with 2.12 through 2.16 before replacing stunt box.

STUNT BOX SWITCH

2.12 To replace the contact arm spring in a stunt box switch, remove the two screws that hold the contact plate to the block.

(a) Remove the contact plate assembly from the contact block.

(b) Remove the contact arm(s) from the contact plate assembly by slipping contact arm spring out of engagement with the center lug of the section being replaced.

(c) Place the new spring in position on the contact plate.

(d) Before mounting the contact plate on the block make sure the end of the spring rests on top of the formed-over portion of the contact clip. There should be some clearance between the low end of the spring (front) and the upper edge of the contact arm to avoid interference with the normal movement of the contact arm.

(e) Replace the contact plate assembly, with the contact arms removed, into the contact block. Mount the contact block in the required location with the two screws friction tight.

(f) Insert the pointed end of the contact arm, notch downward, between the bent up end of the spring and the formed-over portion of the contact clip. Push the arm into its operating position in the contact block.

(g) Before tightening the contact plate screws, see appropriate section on adjusting information.

FUNCTION BAR

2.13 To remove a function bar, first unhook the function bar spring.

(a) Hold the function bar toward the rear of the stunt box and disengage its function pawl from the function bar.

(b) Pull the function bar toward the front to remove it from the stunt box.

FUNCTION PAWL

2.14 To remove a function pawl after the function bar has been removed:

(a) Remove the pawl spring.

(b) Hold associated function lever back.

(c) Remove the pawl from top of stunt box.

FUNCTION LEVER

2.15 To remove a function lever after the function bar and function pawl have been removed:

(a) Remove the TP152889 shaft retainer plate.

(b) Remove the TP150547 shaft nearest the front of the stunt box.

(c) Unhook spring from function lever and remove the lever through top of stunt box.

FUNCTION LEVER SPRING PLATE

2.16 To remove a function lever spring plate or latch after the function bar, function pawl and function lever have been removed:

(a) Loosen the screws that fasten the three TP150689 guide blocks to the lower side of the guide bar.

(b) Remove the spring from the TP152660 spring plate or TP154613 latch.

(c) Pull downward on the function-lever spring plate or latch to snap it out of engagement with the retainer shaft.

2.17 To replace the stunt box, push it forward in its guide rails to within 1/8 inch of its final position.

2.18 Manually disengage the function pawls from their function bars and push the stunt box assembly forward and downward until it is latched in place on its locating brackets.

2.19 Replace the stunt box mounting screws, receptacle and selector magnet wires. (If unit is sprocket feed, replace other assemblies removed.)

CODE BARS

2.20 To unblock the suppression code bar, loosen the TP151152 screw that mounts the TP154650 code bar clip and the retaining plate to the left hand code bar guide bracket and rotate the code bar clip up out of engagement with the suppression code bar. Tighten the screws.

2.21 To Remove the Code Bar Assembly: First, remove the stunt box assembly and the front plate assembly as previously described.

(a) Remove the screws and lock washers which secure the code bar assembly to the side frame.

(b) Remove the TP150301 code bar shift bar retainer plate from right-hand code bar guide bracket.

(c) Unblock the suppression code bar as instructed in 2.20. Remove the TP152548 and TP152255 code bar shift bars and springs from the code bars and pull the code bar assembly forward and to the left.

2.22 To Reinstall Code Bar Assembly: Reverse the procedure used in removing it, except do not tighten the mounting screws.

(a) Hook the short extension of the TP152257 spring in the spring hole of the code bar. The short extension of the spring should be hooked from the bottom of the code bar and the long extension should be hooked over the top of the code bar shift bar.

(b) Loosen the TP151630 code bar assembly tie bar screws and hold the code bar guide brackets back and downward firmly against their locating surfaces on the side frame and tighten the four mounting screws.

(c) Tighten the two tie bar screws.

MAIN SHAFT

2.23 To Remove Main Shaft. The selector cam-clutch assembly must be removed.

(a) Set the typing unit upside down.

(b) Return the carriage to its left hand position.

(c) Remove the screw that secures the spacing shaft in the spacing collar.

(d) Remove the spacing shaft with gear.

(e) Remove the screw that secures the collar and the clamp to right end of main shaft.

(f) Remove the TP152573 main shaft right hand bearing retainer plate.

(g) Remove the TP150010 retainer plate at the TP150046 clutch bearing and remove the TP150244 link.

(h) Remove the two screws from the TP152537 main shaft left hand bearing clamp.

(i) Unhook the springs from the trip levers and latch levers associated with all clutches. Position the code bar clutch so that the low part of the clutch cam clears the spring arm on the cam follower. Unhook the code bar clutch cam follower spring.

(j) Remove the TP153300 function clutch arm by removing the two screws and retainer ring if present.

(k) Unhook the spring from the TP153573 function bar.

(l) Move the main shaft assembly toward the left to disengage the code bar clutch and function clutch links from their connecting pins.

(m) Lift the left end of the shaft assembly out of the side frame. Position the shaft so that the function clutch link passes the suppression assembly bracket, then remove the shaft assembly from the typing unit.

Note: Disassembly of the main shaft and the clutch assemblies can be accomplished by referring to the exploded views contained in the appropriate parts literature. It should be noted, that when assembling clutches that have cams and disks marked "O" for identification, the marked side of the parts should face away from the clutch side of the assembly. Function and code bar clutches should have their driving links assembled so that the longer end of the hub faces away from the clutch side of the assembly.

2.24 To Reinstall Shaft Assembly: Reverse the procedure used in removing it. The line feed clutch spur gear should be positioned with its flat side toward the line feed clutch spacer and with the indentation in the gear toward the special washer between the gear and the main shaft ball bearing.

2.25 To phase the spacing gears, and remake the stripper blade drive cam position adjustment refer to the appropriate adjustment section.

UPPER DRAW WIRE ROPE

2.26 To Remove Upper Draw Wire Rope: Return the carriage to the left hand position.

(a) Loosen the nut on the front end of the spring drum stud. Operate the ratchet escapement lever to unwind the carriage return spring.

(b) Remove the upper draw wire rope from the clamp plate on the printing carriage, and the clamp on the oscillating rail slide.

(c) Loosen the clamp screw that secures the upper draw wire rope to the spring drum. Remove the wire rope from the drum.

(d) Remove the screw in the spacing drum that secures the ends of the wire rope. Remove the rope from the drum.

LOWER DRAW WIRE ROPE

2.27 To Remove Lower Draw Wire Rope: Remove the screw that secures the wire rope to the spacing drum. Remove the end of the rope from the drum.

(a) After loosening the screws that secure the TP150796 margin indicator cam disk on the spring drum, position the disk to expose the lower draw wire rope mounting screw.

(b) Remove the lower draw wire rope screw and rope from the spring drum.

(c) Loosen the screws in the pulley bearing studs that mount draw wire rope pulleys and move the studs toward the center of the typing unit.

2.28 To Replace Draw Wire Rope: Make certain that the lower draw wire rope is in front of the upper draw wire rope in the track around the drums.

2.29 Adjust the position of the type box, the printing carriage, and the wire rope tension as specified in the appropriate adjusting section.

PLATEN (FRICTION FEED)

2.30 To Remove Platen: Remove the line feed spur gear.

(a) Remove the TP150719 and TP150720 platen bearing retainers.

(b) Remove the TP152832 paper straightener shaft.

(c) Hold off the detent and lift the platen out of the side frame.

2.31 When replacing each platen bearing retainer, put its upper screw in first. Leave the screw slightly loose. Press the lower end of the retainer downward and hook it into the elongated hole in the side frame. Replace the lower screw. Tighten both screws.

PLATEN (SPROCKET FEED)

2.32 To Remove Platen: Remove the paper fingers or guide bracket assembly.

(a) Remove the spur gear from left end.

(b) Remove the TP150719 and TP150720 platen bearing retainers.

(c) Hold off the detent bail and remove the platen.

(d) Remove sprocket hub assembly from platen assembly.

(e) Insert the TP153673 shaft tool into the hub and fasten it with the TP151346 screw.

(f) Remove the TP157286 clamp and TP153699 cam from the assembly.

(g) Insert the hub into the TP153797 retaining tool.

Note: These tools must be used when disassembling the TP153700 platen hub in order to hold the spring loaded pins in place when the feed cam is replaced.

2.33 To Replace a Pin: Rotate the hub assembly within the retaining tool, with a tommy wrench inserted in the shaft tool, until the desired pin is opposite the notch in the retaining tool. A pin may then be removed or replaced. Grease pin cylinder liberally before inserting new pin.

CAUTION: WHILE ROTATING THE HUB, THE NOTCH MUST BE COVERED TO PREVENT THE PINS FROM BEING RELEASED. SINCE THE PINS ARE SPRING LOADED, THEY CAN EJECT WITH CONSIDERABLE FORCE.

2.34 To Replace Platen: Reverse the procedure used in removing it. In replacing the TP153686 right sleeve bearing, the chamfer side or side marked "O" must face the end of the shaft and the wide part placed toward the front of the unit. When replacing each platen bearing retainer, put its upper screw in first. Leave the screw slightly loose. Press the lower end of the retainer downward and hook it into the elongated hole in the side frame. Replace the lower screw. Tighten both screws.

SELECTOR CAM-CLUTCH

2.35 To Remove Selector Cam-Clutch: Lift and move to rear the TP170238 push lever reset bail cam follower from its cam and latch it in its raised position on the push lever guide. Lift the selector levers and the marking lock lever by moving the marking lock lever forward until the armature drops behind it.

(a) Remove the screw which mounts the selector clutch drum and position the cam clutch so that the stop lug on the clutch-cam disk is in the uppermost position.

(b) Place TP170238 pushlever-reset bail in raised position. Hold TP170198 stop arm and TP170236 marking lock lever to left, grasp cam-clutch by cam-disk (not by drum) and pull forward while rotating cam-clutch slowly. Cam-clutch should come off easily. Do not force it.

2.36 To Replace Cam-Clutch Assembly: Reverse the procedure used in removing it except as the cam-clutch approaches its fully installed position, move the trip shaft lever and the cam-clutch latch lever so that they ride on their respective cams. Restore the push lever reset bail and the armature to their operating position.

SELECTOR MECHANISM

2.37 To Remove Selector Mechanism: The cam-clutch assembly must first be removed. See 2.35.

(a) Remove the TP151658 screw that secures the selector mechanism to the TP170118 intermediate bracket on the code bar positioning mechanism.

(b) Remove from the selector mechanism the spring which connects with the common transfer lever on the code bar positioning mechanism.

(c) Remove the remaining three selector mounting screws and lift the selector from the main shaft bearing housing.

CODE BAR POSITIONING MECHANISM

2.38 To Remove Code Bar Positioning Mechanism: Unhook from the selector the spring attached to the common transfer lever and restore any operating push levers to the spacing position by raising the TP170238 push-lever-reset bail.

(a) Loosen the clamp screw on the TP150447 shift lever drive arm, and remove the two screws which mount the mechanism - one to the side frame and one to the selector mounting plate.

(b) Manipulate the transfer levers and TP152548 or TP152255 code bar shift bars while gently twisting the mechanism so as to slide the mechanism off the code bar shift bars.

2.39 To Remove Code Bar Positioning Mechanism on the typing unit: Rotate the main shaft in the stop position, push the code bar shift bars to the marking position (left front view). Manipulate the code bar shift bars and transfer levers so that the shift bars line up with their respective slots in the TP170117 bracket, and slide the shift bars through the slots, one at a time, leaving the bottom slot vacant.

RANGE FINDER ASSEMBLY

2.40 To Remove the Range Finder Assembly: Remove the two screws and the nut that mount it to the selector-mounting plate. Move the TP152438 stop arm bail forward so that it disengages from the TP170237 start lever and clears the selector clutch disk, while rocking the range finder assembly back and forth as it is removed.

SELECTOR MAGNET ASSEMBLY

2.41 To Remove Selector Magnet Assembly: Remove the two screws and nut which mount the range finder to the selector.

(a) Remove the selector-magnet cable from the coil terminal screws.

(b) Remove the two magnet assembly mounting screws and lift the assembly out.

35 KEYBOARD FOR AUTOMATIC SEND-RECEIVE SETS

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section is reissued to add information on gold-plated, signal generator contacts and later design even parity. Arrows in the margin indicate changes and additions.

1.02 The 35 Keyboard for automatic send-receive sets provides a means for transmitting coded electrical impulses to a signal line and/or controlling the perforation of tape for use in a tape transmitter (Figure 1). It is designed to support a typing unit and a motor unit, and to utilize either a nontyping perforator, a typing perforator, a nontyping reperforator or a typing reperforator. In addition the keyboard may be equipped with a number of variable features.

DESCRIPTION OF COMPONENTS

A. Base

1.03 The base is a reinforced aluminum sheet metal box frame on which all other assemblies are mounted.

B. Keyboard Assembly

1.04 The keyboard assembly consists of a keylever guide assembly, front frame, guideplate, keylevers, and ball lock assembly.

1.05 The keylever guide assembly accommodates all code and function levers.

C. Signal Generator

1.06 The signal generator consists of a frame assembly; front and rear plate assemblies; gear, shaft, clutch and cam assembly; and a contact box assembly (Figure 8).

1.07 The clutch stop and latchlevers are mounted on the frame.

1.08 The codebar assembly and nonrepeat lever with its guide are mounted on the rear plate.

1.09 The front plate acts as a mount for the detent plate assembly; transfer bail and stud; transfer levers with their guides, springs, and mounting studs; and the locking bail with its stud and spring.

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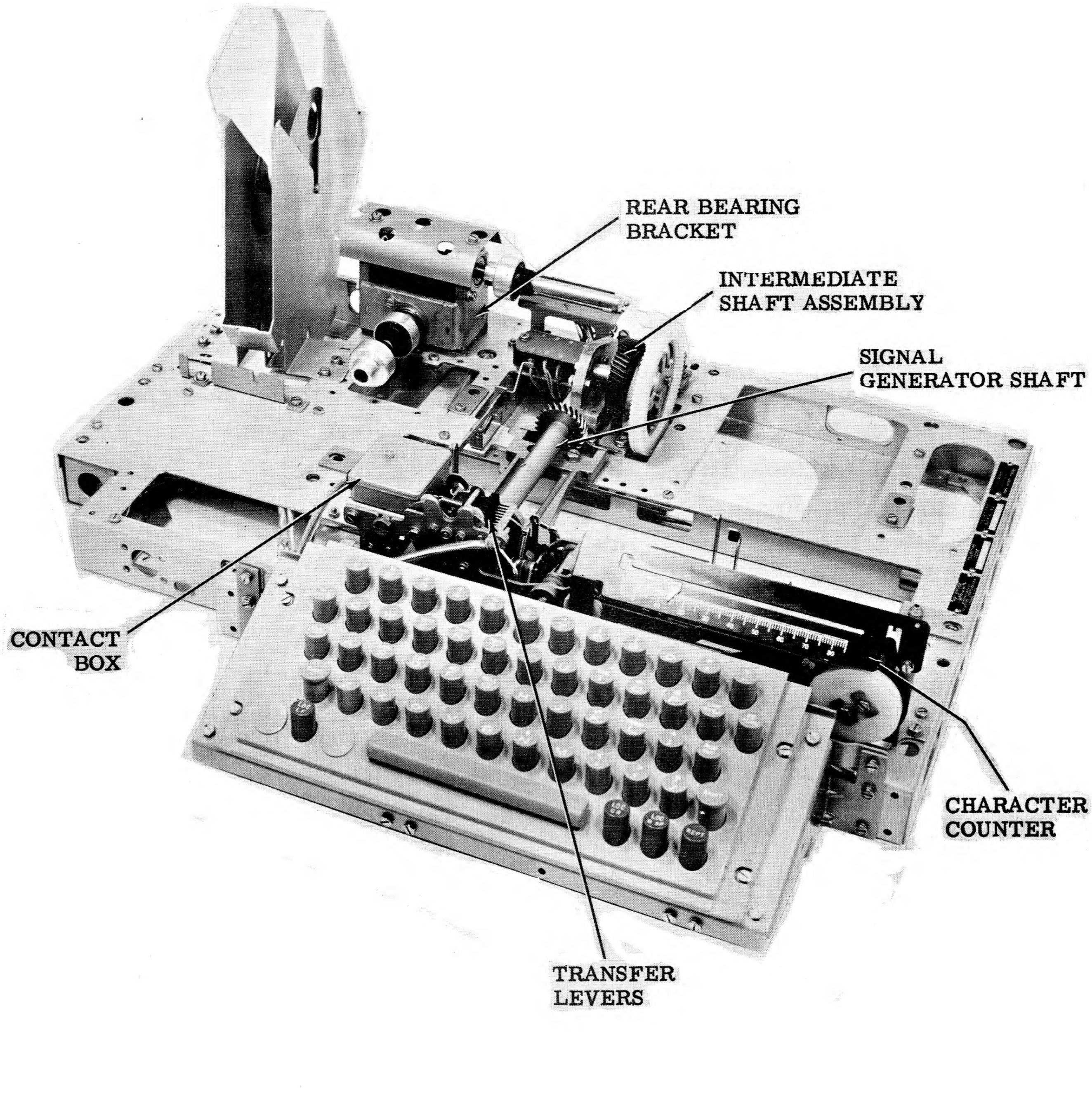


Figure 1 - Typical 35 Keyboard for Automatic Send-Receive Sets (Front View)

1.10 The cam, clutch, and shaft assembly is mounted between the front and rear plates. The cam is one piece of machined steel with ten lobes. The eight lobes which generate pulse signals are equal in contour and are positioned at uniform angles with one another. The number four cam differs in contour, and is used to actuate the transfer lever locking bail.

1.11 The universal bail latchlever with its eccentric bushing is fastened to the right front of the frame. This latchlever extends to the rear over the codebar bail latch and the nonrepeat lever pawl.

1.12 The contact box assembly is mounted on the front plate. It is composed of a fiber insulating strip, a contact toggle assembly, phenolic base, and drive link.

1.13 The signal contacts may be made of either tungsten or gold-plated tungsten.

Note: Gold-plated contacts may be used for both standard applications (including those with data sets) and special low-level applications. However, once used for standard application, they may not be suitable for special low-level application.

2. PRINCIPLES OF OPERATION

2.01 The following paragraphs cover the operating principles of the 35 Keyboard for Automatic Send-Receive Sets. This unit provides for manual, eight-level, signal generation.

KEYBOARD MECHANISM

2.02 The keyboard mechanism and optional features are mounted on the base. These mechanisms include the intermediate gear, codebar mechanism with keylevers, signal generator mechanism, various function mechanisms and a character counter mechanism. Necessary circuitry is brought out to a connector mounted at the rear center of the base (Figure 2). The signal generator shaft, through a helical gear on the rear of the shaft, is operated by the main shaft of the typing unit which, in turn, derives its power from the motor unit.

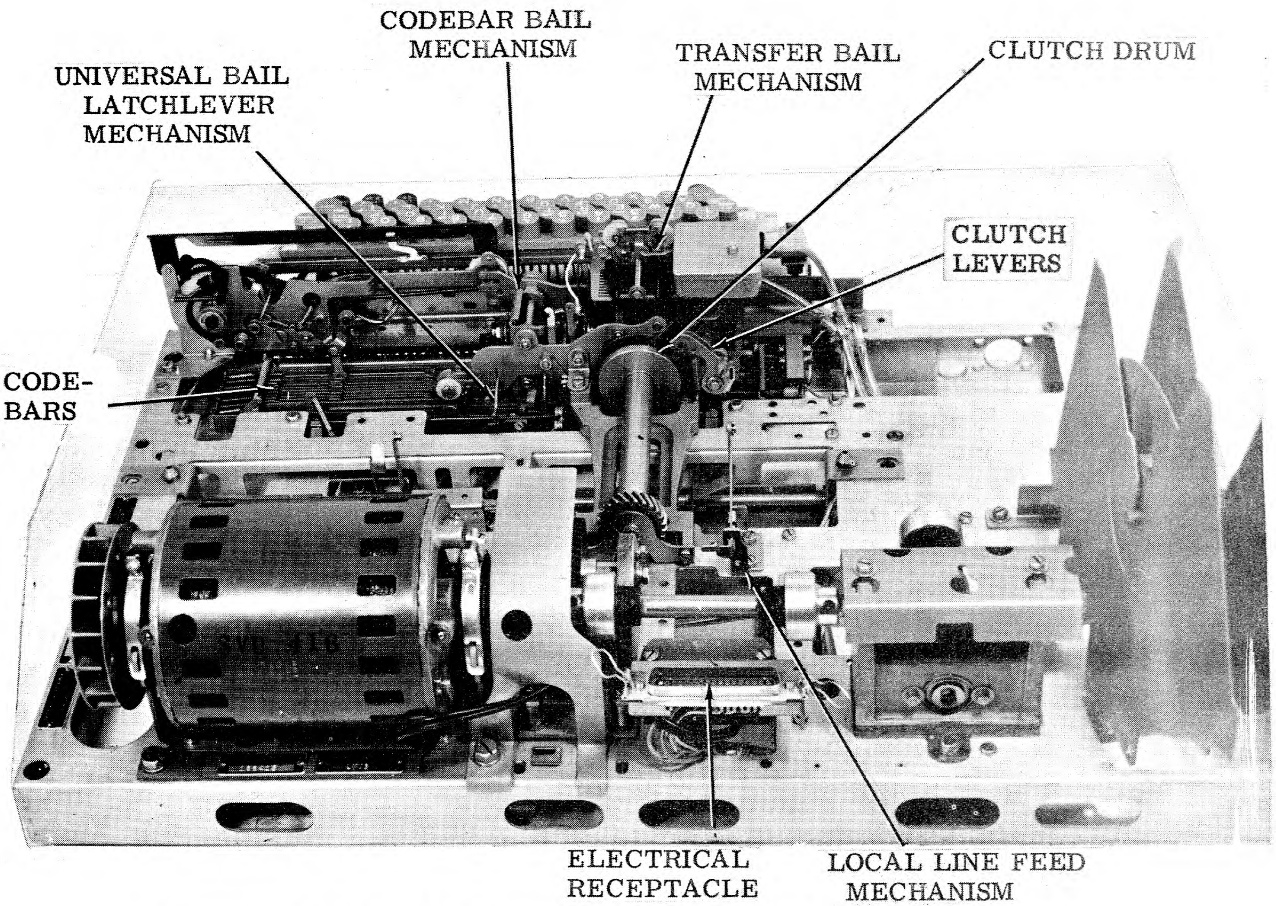


Figure 2 - Typical 35 Keyboard for Automatic Send-Receive Sets (Rear View)

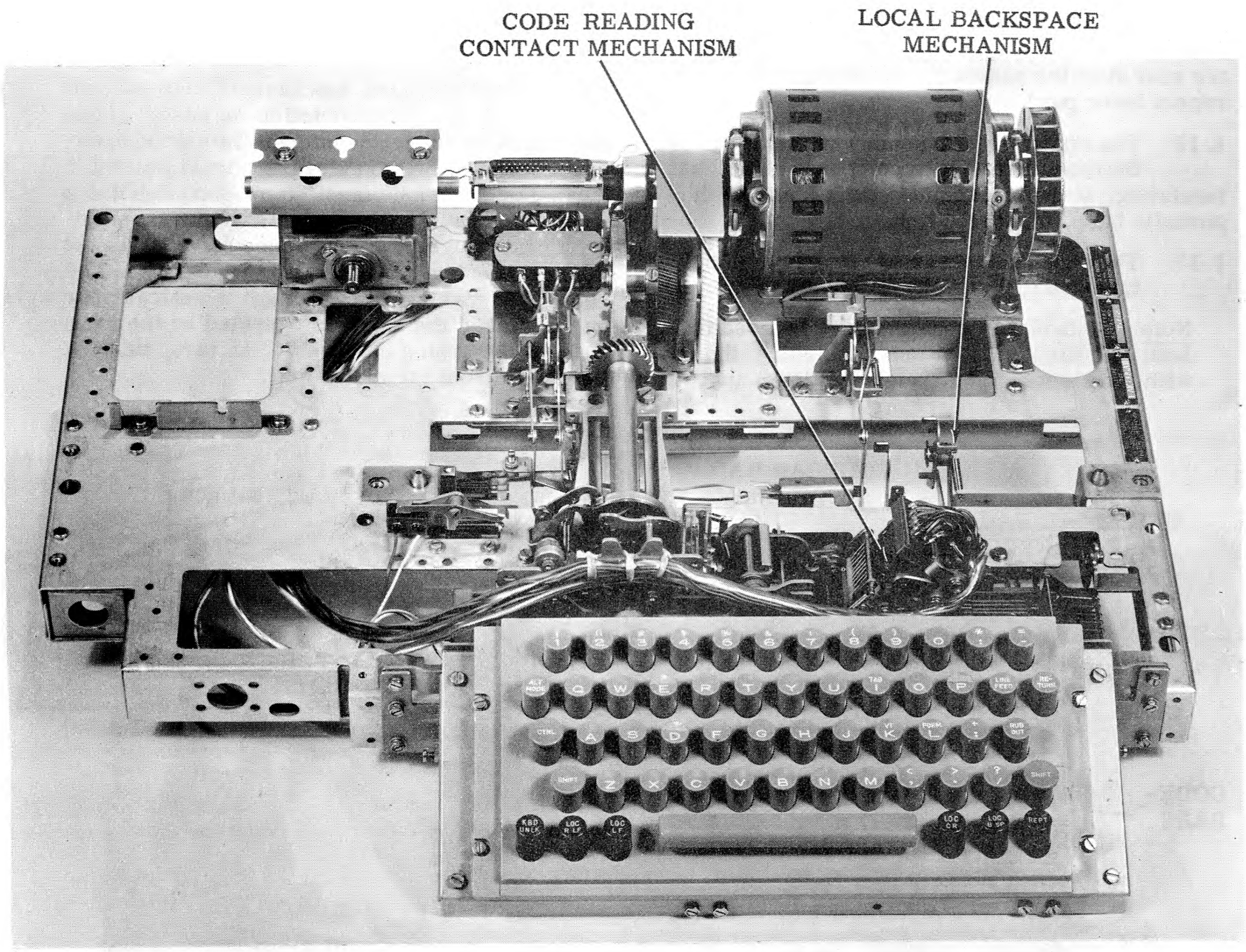


Figure 3 - Typical Keyboard for Automatic Send-Receive Sets (Front View)

CODE BAR MECHANISM.

2.03 As a code selecting keytop is depressed, its corresponding codelever rotates about its pivot point (Figure 4). The rear end of the codelever comes up and rotates the universal bail. The extension arm on the top of the universal bail is moved out of engagement with the step at the rear end of the universal bail latch. This occurs when the key and corresponding codelever are about two-thirds of the way toward full stroke. The universal bail latch then moves downward under spring force developed by the universal bail spring. As this latch descends, it strikes the codebar reset bail latchlever and carries it downward. When the corner of the reset bail latch descends beyond the center line of the needle bearing (mounted on the reset bail), the various spring forces acting on the reset bail cause it to swing to the right. This in turn permits the various codebars to move to the right in the direction of the spring forces acting on each codebar. As all this happens, the codelever is moved up to its full position by the manual input into the keytop. Hence, the codelever may stop some of the codebars from moving to their extreme right position. The codebars have vertical extensions that engage a curved part of the signal generator transfer levers. Those codebars that are permitted to move to the extreme right, move the corresponding transfer lever to the right also. However, those codebars that are stopped (because their teeth engage the activated codelever) do not quite touch or move their corresponding transfer levers. Therefore these transfer levers remain in their normal left hand position (Figure 8).

2.04 Simultaneously with the trip-off of the reset bail and the movement of the codebars to the right, the clutch tripbar (located in the rear slots of the codebar guides) moves to the right. This clutch tripbar engages the clutch stop latch and moves it out of its latched position with the clutch stop lug.

2.05 The motor unit that mounts on the rear right corner of the keyboard base supplies the mechanical power to drive the associated typing unit, and the signal generator shaft that is geared to the printer main shaft.

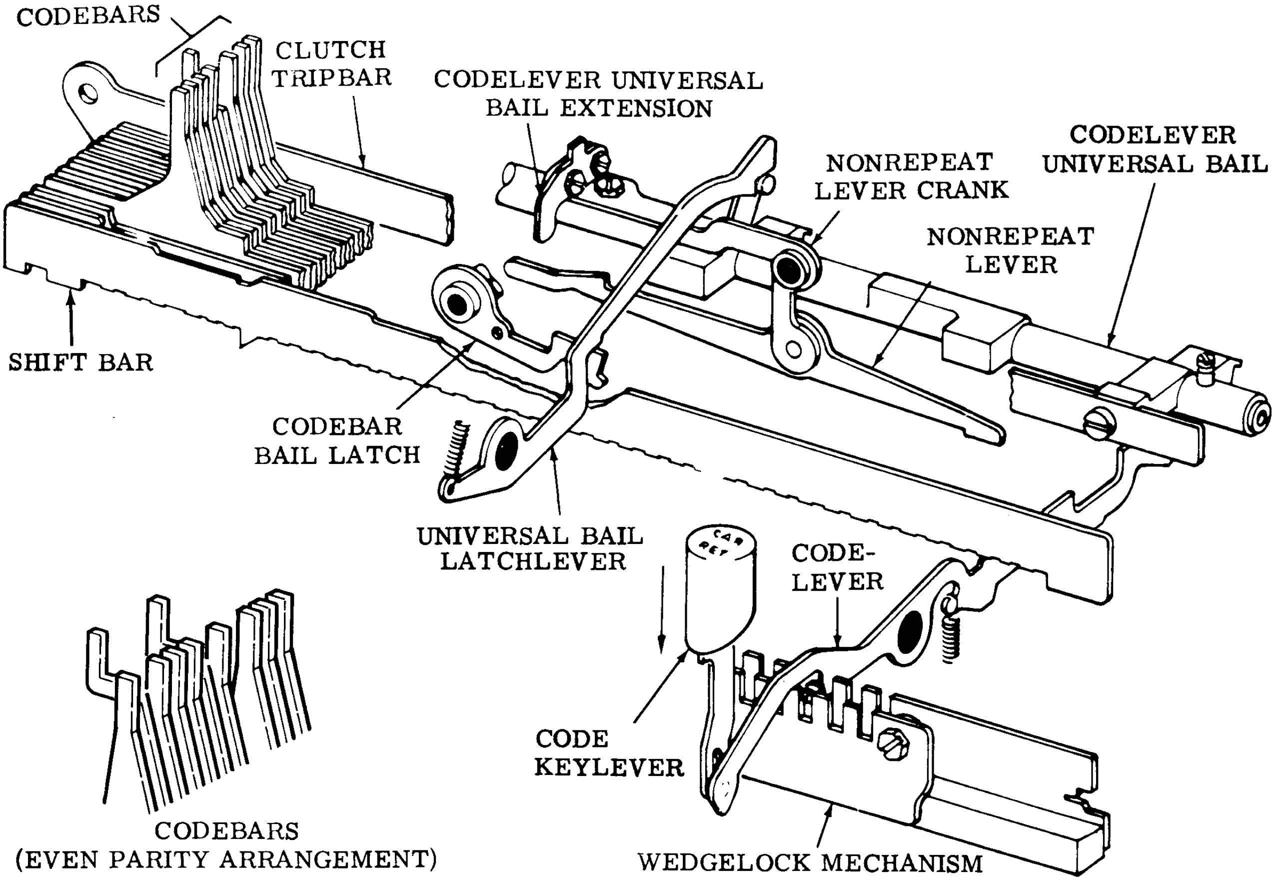


Figure 4 - Codebar and Codelever Universal Bail Mechanism

2.06 When the clutch is tripped, the spring loaded shoes in the clutch mechanism engage serrated teeth on the inside of the clutch drum. The clutch drum rotates continuously when the keyboard is turned on, because it is part of the shaft that mounts the signal generator gear (Figure 2). Since the clutch shoes are mounted on a plate that is part of the cam assembly, the cam rotates (clockwise as viewed from the front of the keyboard) when the clutch engages.

2.07 The arrangement of the cam assembly is such that the fourth cam from rear begins to push downward on its corresponding transfer lever (Figure 8). At almost the same time, the first cam from the front begins to move the transfer lever locking bail upward. The blade portion of this locking bail goes up beside a downward projection on each transfer lever. The locking projection is left or right of the locking bail, depending upon the position of the transfer lever as set up by the permutation action of the codebars. Thus, in the first few degrees of cam rotation, the permutated position of the transfer levers is locked into position and the codebars are free to be reset to their normal latched position.

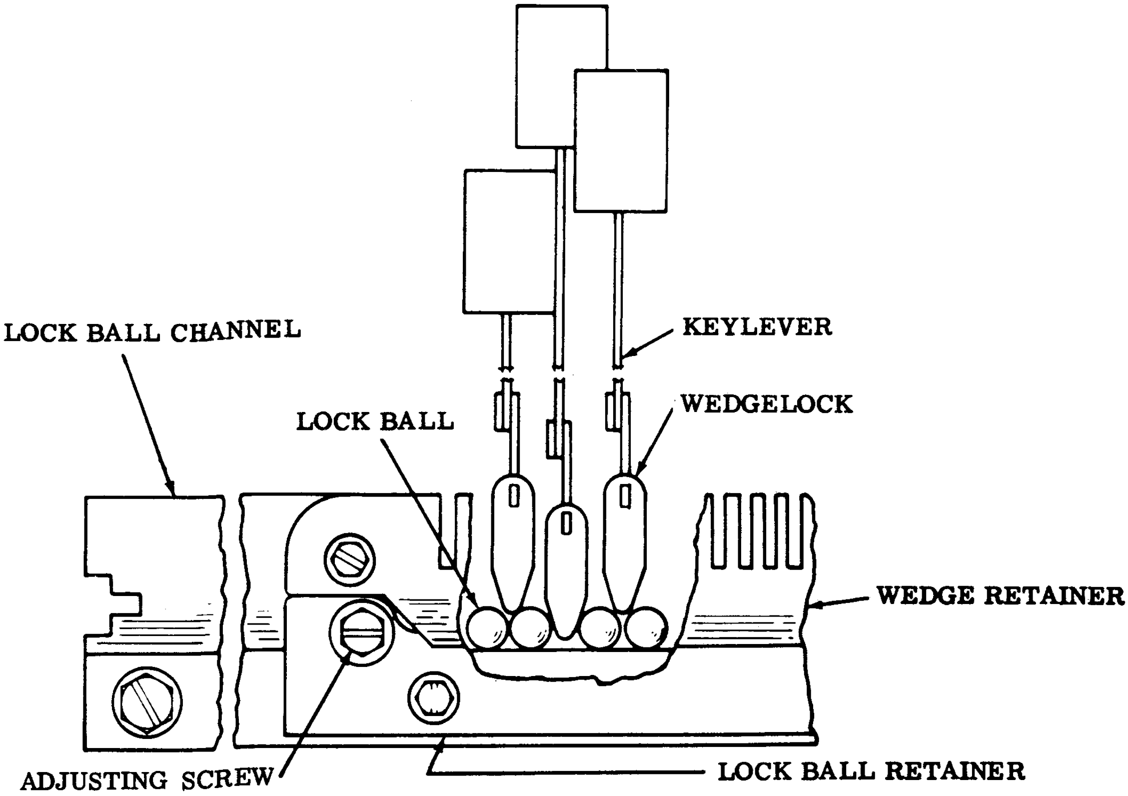


Figure 5 - Wedgelock Mechanism

2.08 The fourth cam engages its transfer lever first and moves it down (Figure 8). Since the start pulse is always spacing, no codebar is required to engage this lever. This lever is always held to the left by its spring. Thus, as the fourth cam moves the lever down, the hook (at the upper right side of the transfer lever) engages the right hand side of the transfer (rocker) bail. This tips the transfer bail to the right, and pulls the contact drive link to the right. The resulting action of the toggle is such that the left hand set of contacts acts as a pivot, and the right hand contacts begin to open. When these contacts are open, the result is a spacing pulse (no current) in the signal circuit. The first (start) pulse of any character code is always a spacing pulse.

2.09 The number 1 cam and the transfer lever move downward next. In turn, the upper left hook of the associated transfer lever pulls down on the rocker bail, holding it to the right or tilting it back to the left. This pushes the drive link to the left (or right), resulting in closing the right (or left) hand contacts and allowing a marking (or spacing) pulse to be transmitted.

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

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

2.12 Reset of the codebars is accomplished by means of an eccentric on the front of the cam assembly, which drives an eccentric follower arm (Figure 6). This arm engages a stud on the side of the reset bail, and pulls the reset

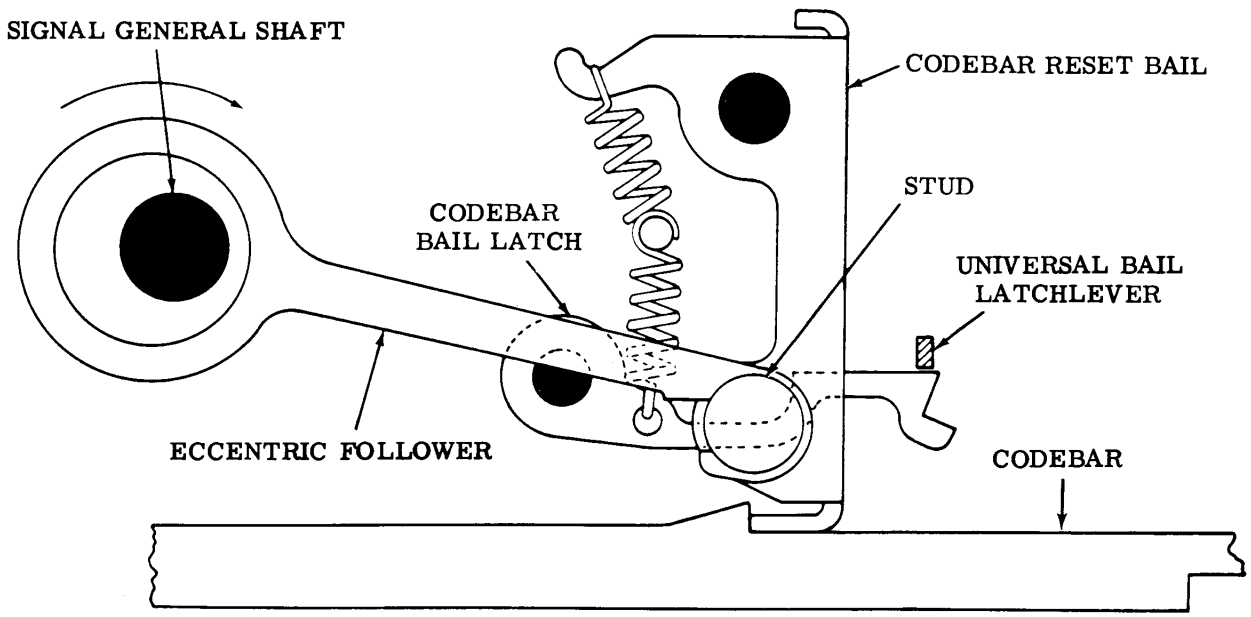


Figure 6 - Codebar Bail Mechanism

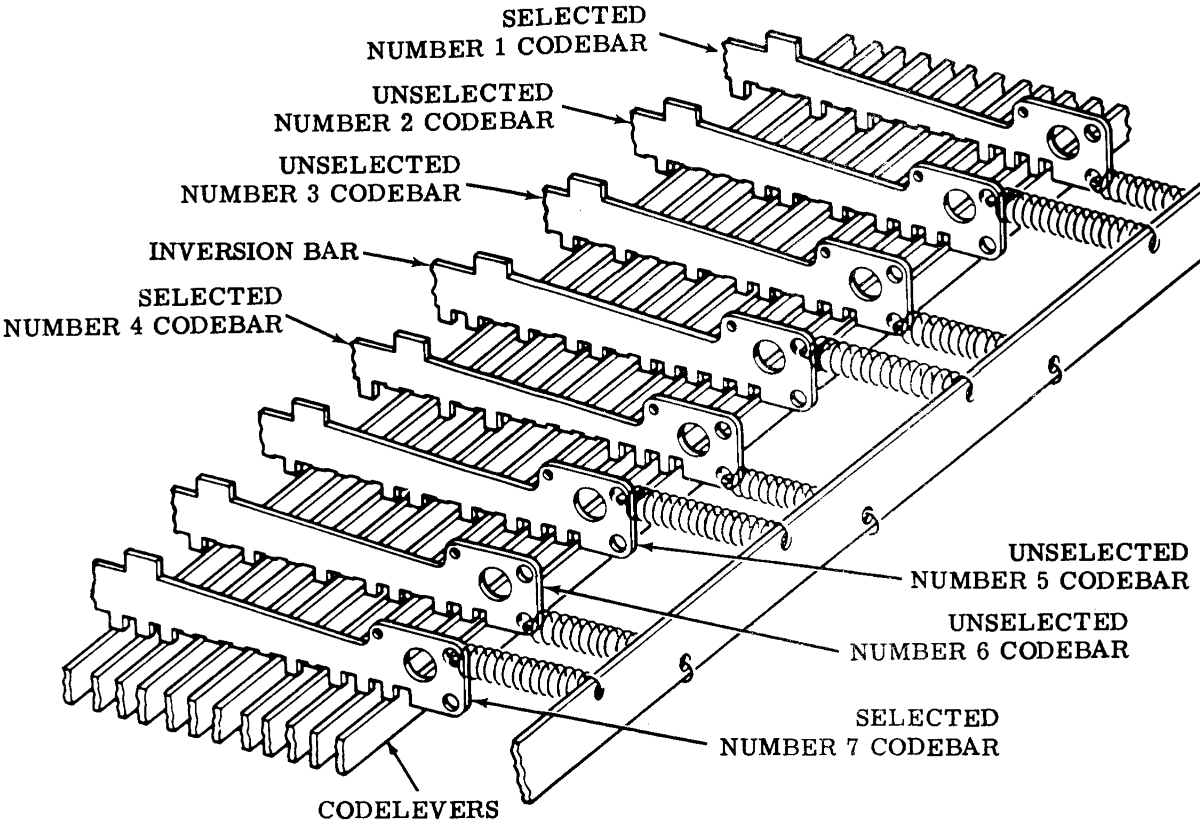


Figure 7 - Codebar Selection

bail to the left as the cam rotates. At the peak position of the reset eccentric, the codebar reset bail is clear of the needle bearing stud. This permits the latch spring to pull the latch up into the locking position. The codebar reset bail is latched as the eccentric drives the follower arm back to its initial position. As the codebar reset bail is moved to the left into reset, it engages projections on the permutation codebars, clutch tripbar, and a step on the nonrepeat lever. This moves all these elements to the left into the latched reset position.

2.13 The reset eccentric is so positioned in angular relationship to the remainder of the cam that pickup of the codebars, and nonrepeat lever, begins at 92-1/2°. At 145° the codebars have moved to the left sufficiently to permit the codelever (that determined the permutation) to drop down out of the universal bail. This permits the universal bail to rotate forward and kick the nonrepeat lever down off the reset bail. At the same time, the extension on the universal bail moves in under its latchlever and holds this latchlever up. With the universal bail latch held up, the reset bail continues to move to the left. Full reset occurs at approximately 180° of cam rotation. As soon as the universal bail moves forward, a second keytop can be operated. However, from that point on, full time of cam rotation must expire before a third and successive keys may be operated.

REPEAT MECHANISM

2.14 Operation of the REPT keylever simultaneously with one of the keylevers in the three lower rows or the space bar disables the nonrepeat mechanism and causes the character or function selected to be repeated as long as the REPT keylever is held operated. The operated REPT keylever causes its function lever to raise the right end of the nonrepeat lever (Figure 9) and rotates it about its pivot point. In this position, the nonrepeat lever cannot be engaged and operated by the codebar bail, therefore, the nonrepeat lever crank will not reset the operated codebar bail latch. The codebar bail and universal bail latchlever are thus maintained in their operated positions and the codebar bail follows the eccentric arm movement back and forth until the REPT keylever is released.

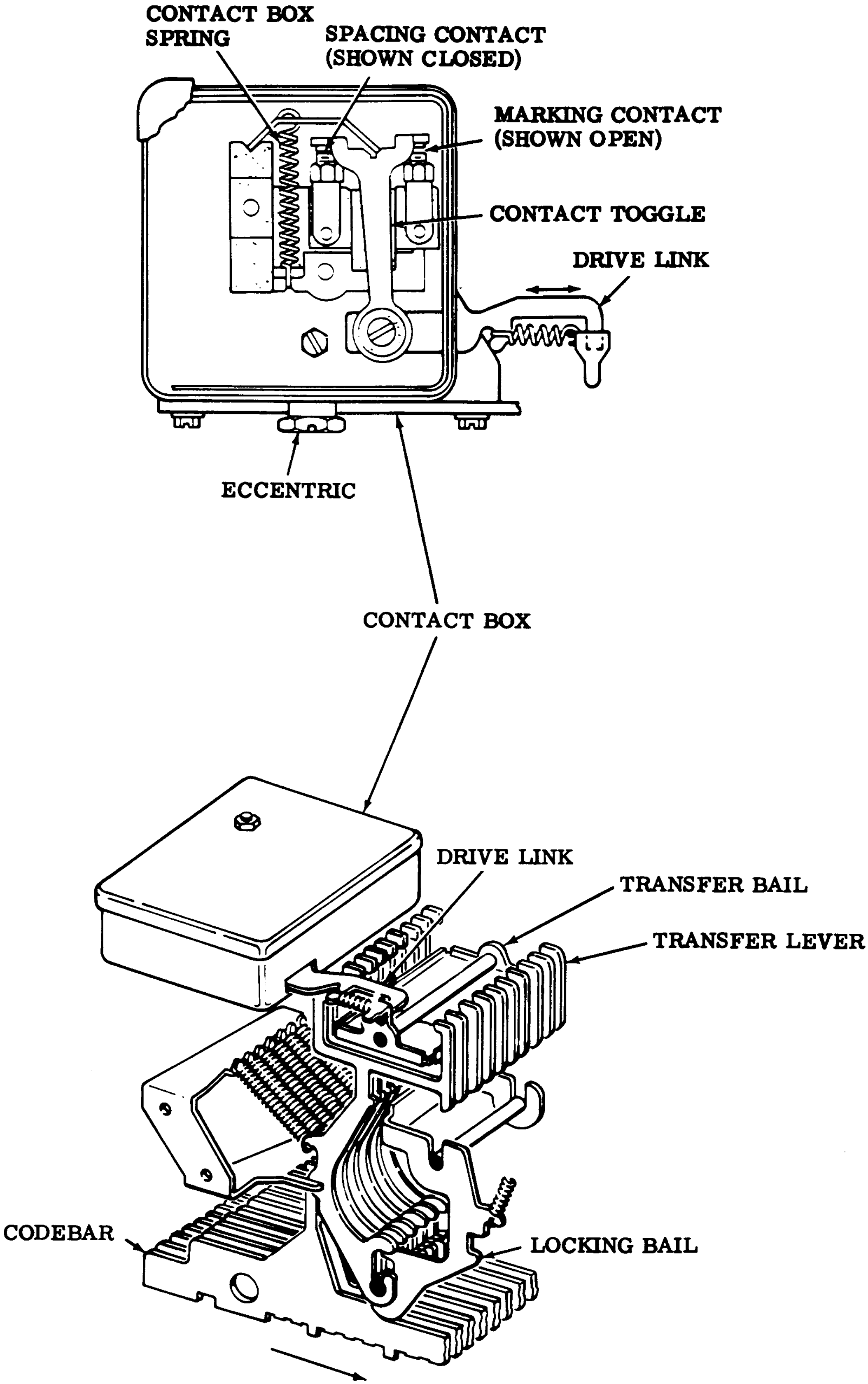


Figure 8 - Transfer Lever Mechanism and Contact Box Mechanism

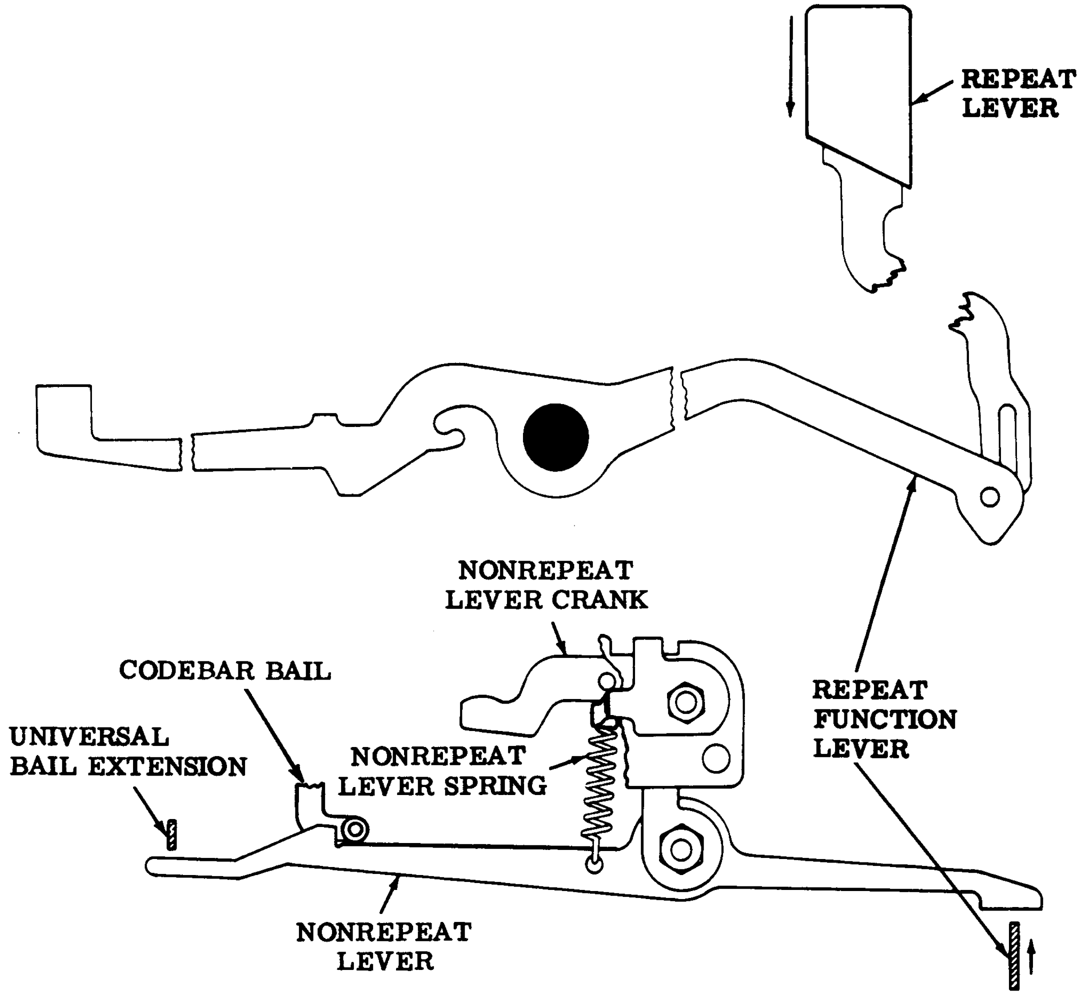


Figure 9 - Repeat Mechanism

CONTROL KEY MECHANISM

2.15 Operating the control key produces the upper case of a specific key by deleting the number 7 pulse. This is done by the control codelever blocking the number 7 codebar from falling to the right.

SHIFT KEY MECHANISM

2.16 To obtain a shift bit inversion case character, the enlarged shift key (at either side of the keyboard) is held down while depressing a complimentary key. The shift key preconditions the keyboard for the function of adding or deleting (as the case may be) the number 5 code bit, to obtain its complimentary key code. This is accomplished by means of a shift codelever engaging a diagonal camming surface, on the under side of the shift lockbar (outer slot of the codebar guide), and directing its motion to the left. The bail, riding the upper diagonal camming surface, is raised. This allows the inversion codebar (feed hole slot) to fall only when the complimentary key is depressed. This inversion bar, upon falling to the right, operates the transfer lever number 5 pulse by a mechanical connection. The code transmitted is then the addition or omission of the number 5 pulse, combined with the transfer levers selected by the complimentary key.

LOCAL LINE FEED MECHANISM

2.17 When the LOC LF keylever on the keyboard is depressed, paper is fed out of the associated typing unit when power is on. The mechanism operates as follows: Depressing the LOC LF keylever raises the forward end of the local line feed bail (Figure 10). This bail pivots and its upper end pushes the attached local line

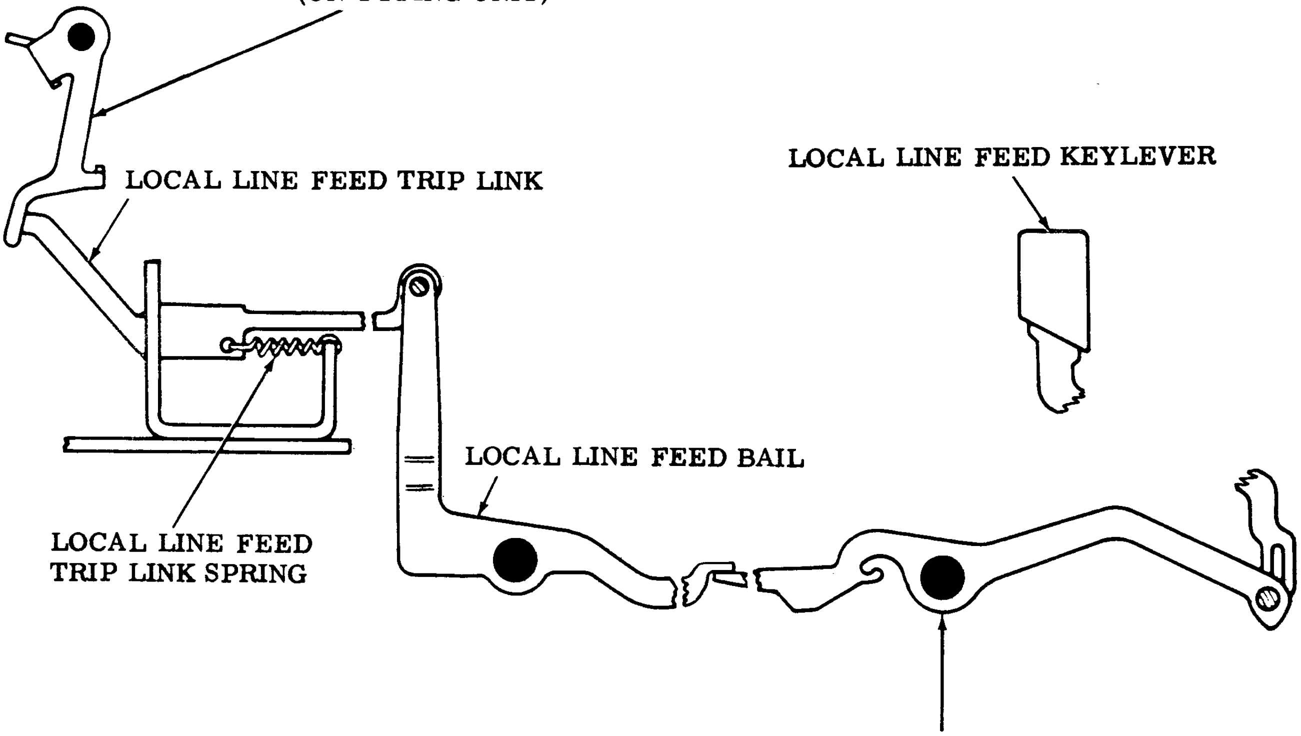


Figure 10 - Local Line Feed Mechanism

feed trip link toward the rear until the link engages the line feed clutch trip lever on the typing unit. Thus, the line feed mechanism on the local typing unit is made to operate without a signal and other typing units on the same line circuit are not disturbed.

LOCAL CARRIAGE RETURN MECHANISM

2.18 The local carriage return mechanism enables the operator to trip the carriage return mechanism on the associated typing unit, thereby causing the type box carriage to be fully returned to its normal position at the beginning of a line of copy. This mechanism operates as follows: When the LOC CR keylever (Figure 11) is depressed, its function lever rises and, in turn, raises the forward end of the local carriage return bail. This bail rotates about its pivot point until the upper end engages the carriage return lever on the typing unit. The carriage return mechanism operates in this manner without a signal that would cause other units in the line circuit to function.

3. VARIABLE FEATURES

CODE READING CONTACT MECHANISM (See Figure 3)

3.01 Used in place of the signal contact box, the code reading contact mechanism enables a keyboard to transmit its output in parallel-wire form. The mechanism contains a bank of contacts which assume spacing (open) and marking (closed) positions, as determined by codebar selection. Each contact has an intermediate lever and latchlever for actuation. The contacts are reset by a drive arm associated with the eccentric follower (2.12). Operation is as follows:

3.02 Following the depression of a keytop, selected codebars are moved to the extreme right position (2.03). Their corresponding latchlevers are engaged and moved to the right, unlatching the associated intermediate lever. This results in contact closure and the transmission of a marking pulse from the actuated contacts. Contacts associated with unselected codebars remain open, or spacing.

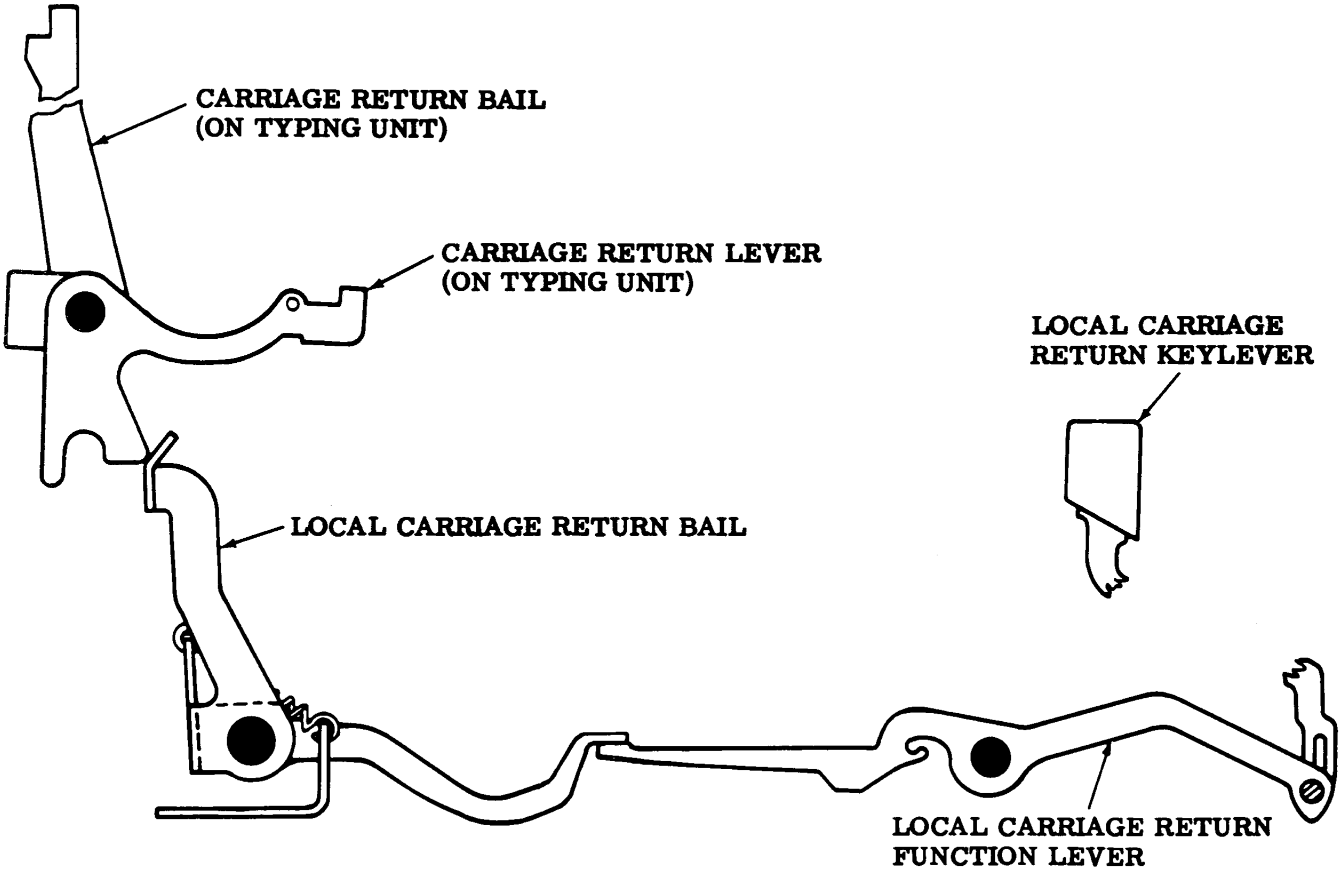


Figure 11 - Local Carriage Return Mechanism

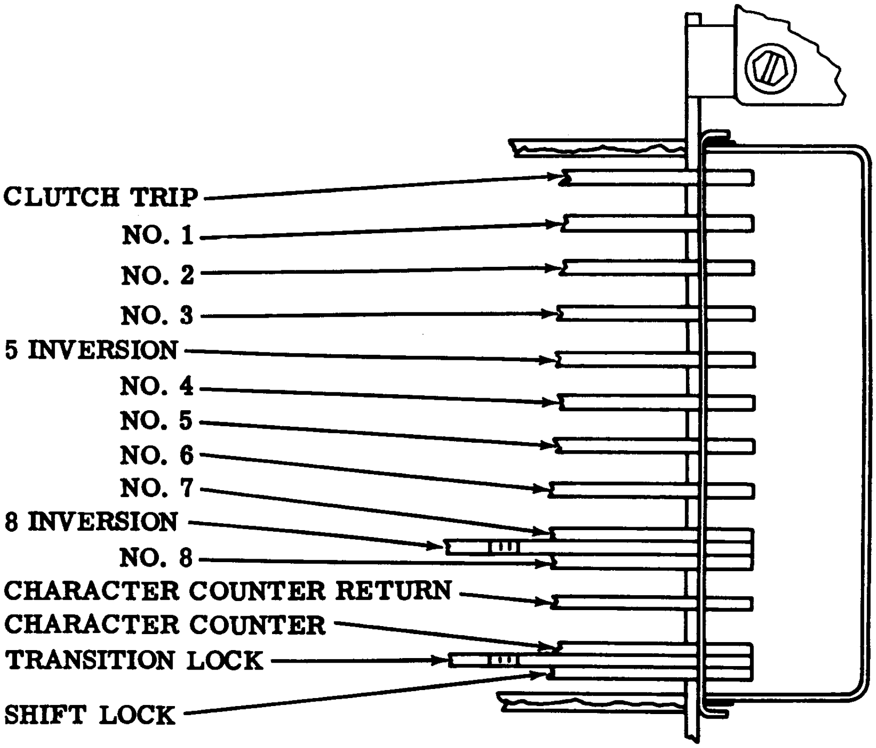


Figure 12 - Early Design Codebar Arrangement With Even Parity

3.03 The contacts are reset by means of an extension drive arm between the eccentric follower drive arm and the code reading contact reset bail. As the eccentric rotates to the reset position, the bail drives the intermediate levers to their latched position.

EVEN PARITY

3.04 In keyboards equipped to provide an even parity output, the eighth bit of the signal code may be either marking or spacing, in order to always supply an even number of marking pulses for each code combination transmitted.

A. Early Design (See Figure 12)

Shift With Even Parity

3.05 Depression of this key and its related mechanism will invert the number 5 and 8 marking bit to spacing or a spacing bit to a marking bit, as the case may be. This is another means of obtaining an upper case or symbol associated with a particular keytop and is accomplished by holding down the enlarged SHIFT key (at either side of the keyboard) while depressing a complimentary key. The shift codelever prevents the number 5 and number 8 codebars from falling and at the same time preconditions the keyboard for the function of inverting the space-to-mark bit or the mark-to-space bit, as required to obtain its complimentary key code with parity. This is accomplished by means of a shift codelever engaging a diagonal camming surface on the underside of the shift lockbar and the transition bar, directing their motion to the left. The shift lockbar blocks out the selected group of keys while the transition bar prohibits the complimentary keys from being actuated prematurely through its "saw tooth" design. As the motion to the left develops, the upper bail with its two blocking tines riding the upper diagonal camming surface is raised permitting the number 5 inversion and number 8 inversion codebars if coded marking, to fall only when the complimentary key is depressed. These inversion and associated codebars, upon falling to the right, permit the proper combination of marking bits to be presented with even parity.

Control Key With Even Parity

3.06 Depression of the CTRL (control) key will cause the number 7 bit to space and invert the number 8 bit. This is another means of obtaining an upper case function, with even parity, associated with a particular keytop. This is accomplished by holding the CTRL key down while depressing a complimentary key. The CTRL key codelever engages a diagonal camming surface on the underside of the transition codebar, directing its motion to the left, as it blocks the number 7, number 8, and number 5 inversion bars from falling to the right (mark). As the motion to the left develops, the upper bail again rides the upper diagonal camming surface, permitting the number 8 inversion codebar, if coded marking, to fall only when the complimentary key is depressed. This operation deletes number 7 and inverts number 8 in the selection of the regular assigned code of the complimentary key code, developing a control code with even parity.

B. Later Design (See Figure 13)

Shift With Even Parity

3.07 Depression of the SHIFT key and its related mechanism inverts the number 5 and number 8 marking bits to spacing or spacing bits to marking as the case may be. This is a means of obtaining an upper case or symbol associated with a particular keytop and is accomplished by holding down the enlarged SHIFT key (at either side of the keyboard) while depressing a complimentary key. The shift codelever prevents the no. 5 codebar from falling and at the same time conditions the keyboard for the function of inverting the space-to-mark bit or the mark-to-space bit as required to obtain its complimentary key code with parity. This is accomplished by means of a shift codelever engaging a diagonal camming surface on the underside of the shift lockbar directing its motion to the left. The shift lockbar serves a dual purpose; it blocks out the selected group of keys and inhibits the complimentary keys from being actuated prematurely. As the motion to the left develops, the upper bail riding the upper diagonal camming surface on the shift lockbar, is raised. This raises the blocking tine and permits the no. 5 inversion codebar, if coded marking, to fall. At the same time a pivoted follower attached to the shift lockbar, rides up a "V" shaped camming surface on the control lockbar. This raises the blocking surface of the lower blocking bail allowing the no. 8 inversion codebar to fall, if coded marking, and blocks the no. 8 codebar. Upon falling to the right, the codebars unlatch their respective transfer levers causing the proper permutation to be generated.

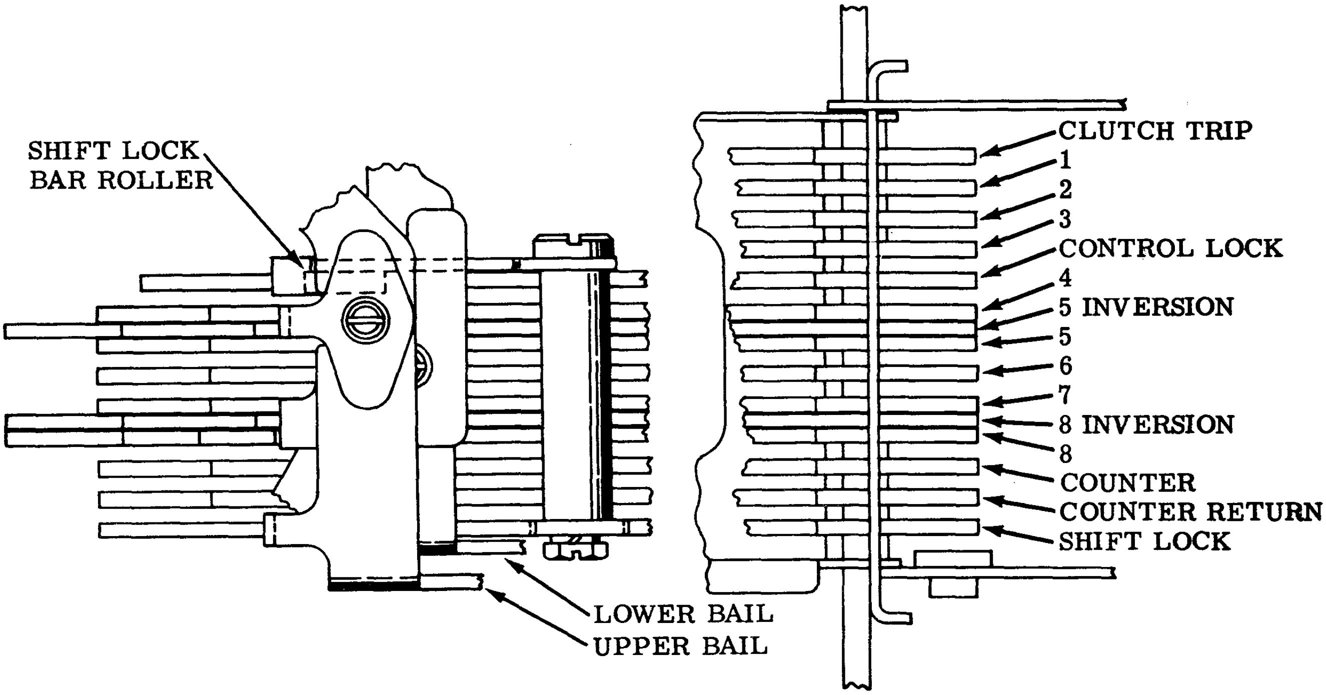


Figure 13 - Later Design Codebar Arrangement With Even Parity

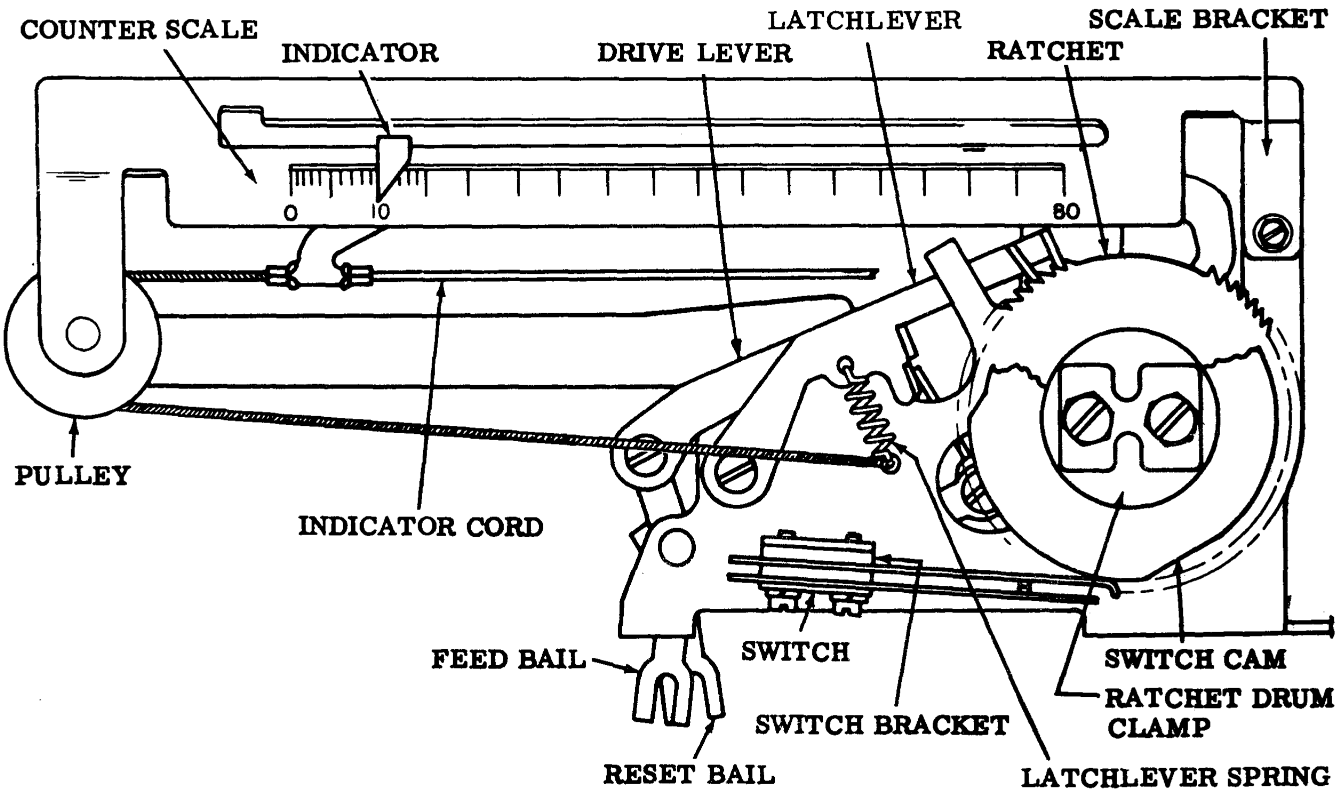


Figure 14 - Character Counter Mechanism, Front View

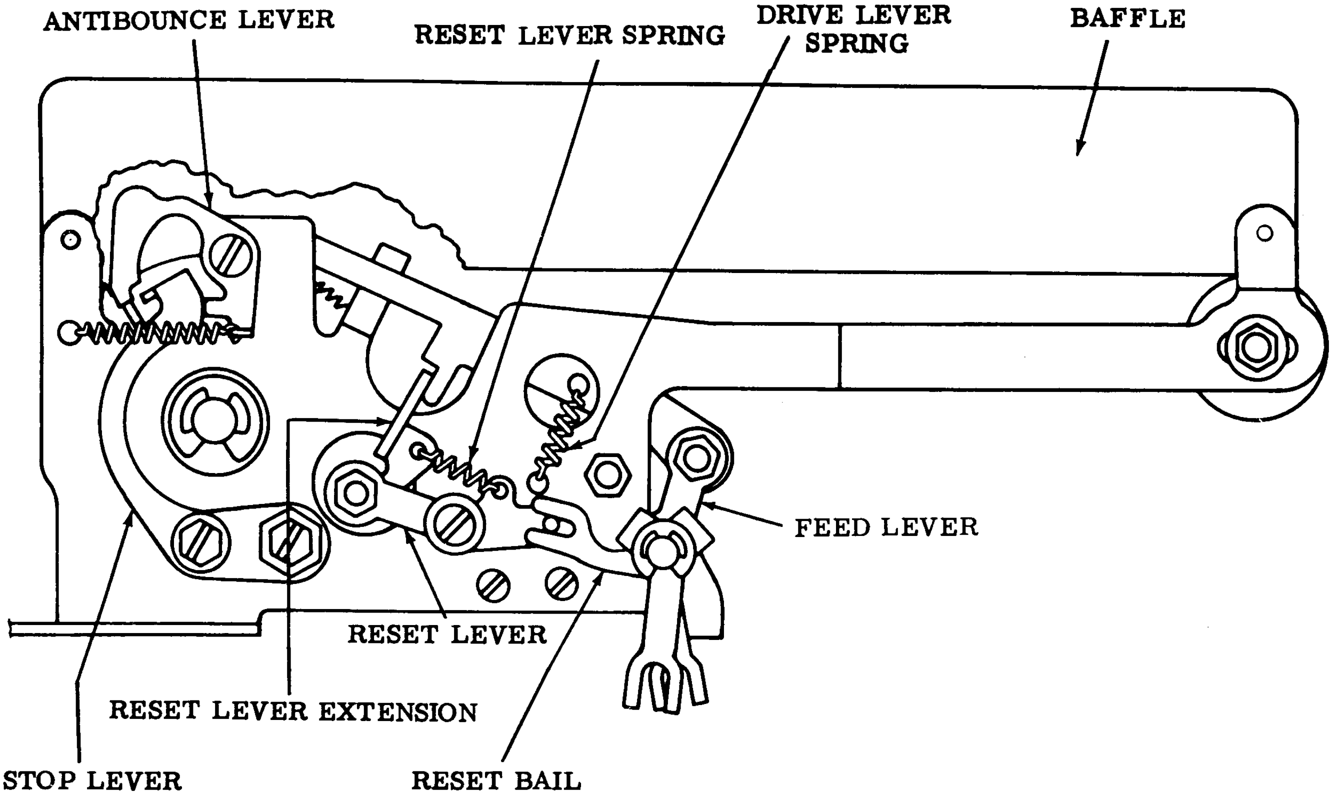


Figure 15 - Character Counter Mechanism, Rear View

Control Key With Even Parity

3.08 Depression of the CTRL (control) key will cause the seventh bit to space and the eighth bit to invert. This is a means of obtaining a control function with an even parity bit. It is accomplished by holding the control key down while depressing a complimentary key. The CTRL key operates a control lockbar, which serves the purpose of both blocking out those keys to which a control is not associated and preventing a complimentary key from being actuated prematurely, by means of its saw tooth design. The CTRL key codelever engages a diagonal camming surface on the underside of the control lockbar directing its motion to the left, as it blocks the no. 7 codebar from falling to the right (mark position). As motion develops, the follower engages the "V" shaped camming surface of the control lockbar, and moves up, raising the lower blocking bail. The lower bail, in its upward travel, unblocks the no. 8 inversion codebar and permits it to fall to the right (if coded marking). As the codebars fall to the right they operate their respective transfer levers causing the proper permutation to be generated.

3.09 The design of the keyboard allows the depression of the SHIFT and CTRL keys simultaneously. Holding the SHIFT and CTRL key down while depressing the proper complimentary key will generate S3 through S7 and NULL. As the SHIFT and CTRL keys are depressed their key codelevers engage a diagonal camming surface on the underside of their respective lockbars directing them to move to the left. As the shift lockbar moves, its upper diagonal camming surface causes the upper blocking bail to rise, unblocking the no. 5 inversion codebar so that it may fall to the right if marking. The SHIFT key codelever blocks the no. 5 codebar. As the control lockbar moves, the follower attached to the shift lockbar rides in the "V" shaped camming surface on the control lockbar. Since the total travel of the two lockbars. is the same the follower will not ride up on either of the camming surfaces and the lower blocking bail remains in its normal position. This causes the no. 8 inversion codebar to remain blocked and allows the no. 8 codebar to fall to the right when marking. The codebars, upon falling to the right, permit the proper combination of marking bit 1 through 8 to be generated.

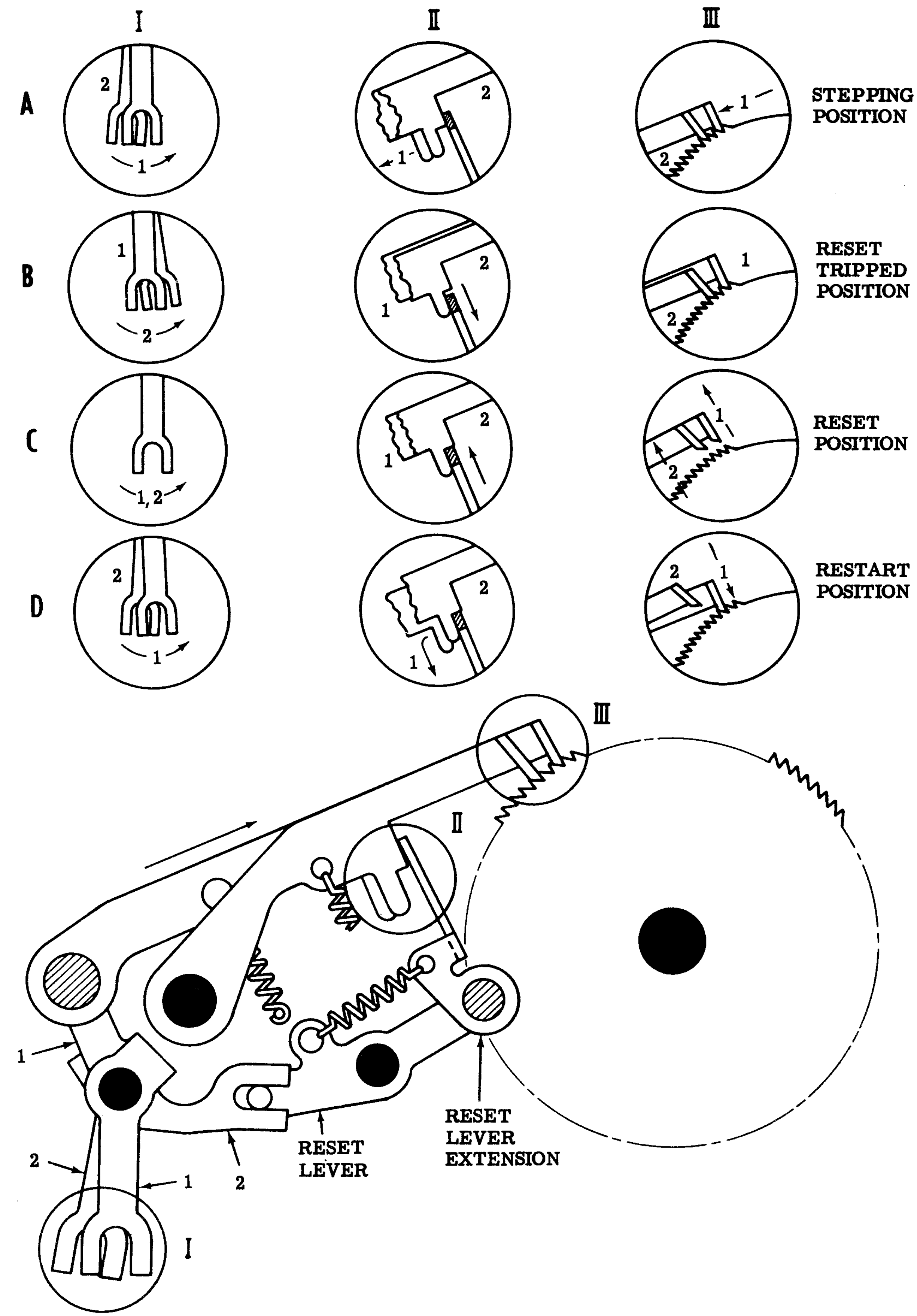


Figure 16 - Operation of Character Counter Mechanism

CHARACTER COUNTER MECHANISM

A. General (See Figures 14, 15, and 16)

3.10 The character counter is driven mechanically from the perforator transmitter by the action of the counter and carriage return codebars located in the second and third slots of the codebar basket. These bars provide drive projections which engage the forks of the feed and reset bails of the counter. As the codebars fall to the right when a key on the keyboard is struck, the counter mechanism is tripped. As the keyboard is reset under power, the counter performs its required functions. These functions may be divided into three distinct phases of operation. Figure 16 illustrates these three phases of operation and also the normal position of the counter mechanism.

B. Stepping

3.11 Referring to sequence A, Figure 16, as a key is struck the codebars fall to the right, carrying with it feed bail 1. The drive lever, which is linked to the feed bail, moves to the left slightly more than one tooth. As the codebars are reset under power, stepping bail 1 moves clockwise, causing the drive lever to advance the ratchet drum one tooth. The drive pawl prevents the ratchet drum from rotating counterclockwise until it is again tripped for the following character. When this occurs the ratchet drum rotates slightly counterclockwise, coming to rest against the latchlever.

C. Counter Reset

3.12 Sequence B, Figure 16, illustrates the tripped position of the counter mechanism for a reset function. Reset bail 2 moves counterclockwise as its codebar falls to the right, causing the reset lever in turn to rotate clockwise. As the reset lever rotates clockwise the reset lever extension moves downward until it falls under the shoulder of the projection on the drive and latchlevers under the action of its spring. When the counter bars are reset as in C, Figure 16 the reset bail is rotated clockwise to its original position, causing the reset lever to rotate counterclockwise, carrying the reset lever extension upward, and moving both the drive and latchlevers out of engagement with the ratchet teeth. The mechanism remains in this condition and the ratchet drum assembly rotates rapidly counterclockwise (under the action of its return spring) until it reaches its zero position.

3.13 As the ratchet drum reaches its zero position, a stop on the ratchet strikes a stop lever fastened to the frame. The elastic impact is transmitted through the stop lever to the antibounce lever whose lower end is normally in contact with the stop lever. The antibounce lever rotates counterclockwise, dropping in behind the ratchet stop. As the ratchet drum rebounds from the stop lever, its stop strikes the antibounce lever, preventing further motion and maintaining the antibounce lever in its actuated position. The ratchet continues to operate between the stoplever and antibounce lever until the energy in the system has been largely dissipated. The ratchet stop then remains in contact with the stop lever, permitting the antibounce lever to return to its normal position.

D. Restart

3.14 Sequence D, Figure 16, illustrates the restarting action of the counter mechanism for the character following carriage return. As a key on the keyboard is depressed, the counter codebar falls to the right, the feed bail moves counterclockwise and the drive lever moves to the left. As the drive lever moves to the left it is disengaged from the reset lever extension and falls into engagement with the ratchet tooth. As the codebars are reset under power, the feed bail rotates clockwise and the feed lever begins to move to the right. As it does, its projection pushes the reset lever extension to the right and out of engagement with the latchlever, which falls into engagement with the ratchet drum. As the drive lever completes its stroke, it steps the ratchet one tooth as in the normal stepping operation.

E. End Of Line Switch

3.15 The end-of-line switch operates the end-of-line indicator light located in the cabinet to signal the end of a typed page printer line.

3.16 Operation of the character counter end-of line indicator switch is controlled by a switch cam (Figure 14). The switch cam rotates with the ratchet drum and can be adjusted to close the switch at any typed line length of from 10 to 80 characters.

LOCAL BACKSPACE MECHANISM (See Figure 17)

3.17 Two types of local backspace mechanisms are used. Earlier designed keyboards used a combination mechanical and power back space. The mechanical linkage operated the

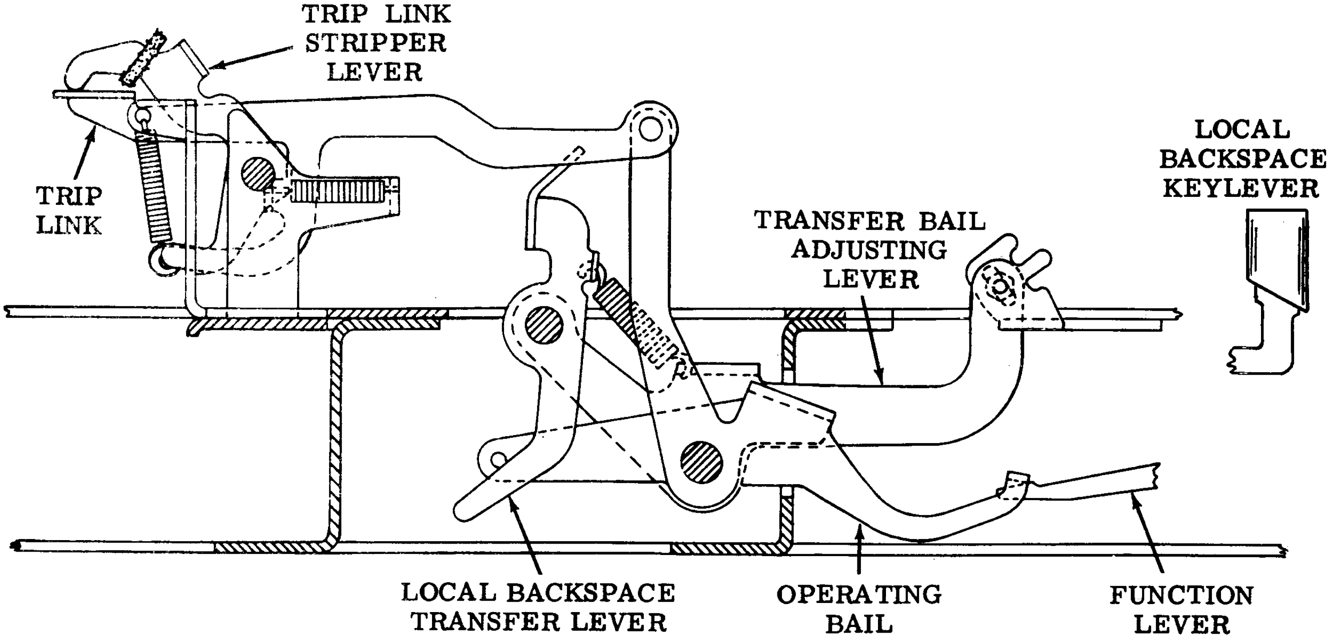


Figure 17 - Local Backspace Mechanism

typing unit backspace and the switch (power) operated the reperforator backspace. The later design keyboards use only the power operated backspace. The main difference being the location of the backspace key on the keyboard. The earlier design located the backspace key on the right side of the keyboard and the later design locates the backspace key on the left side of the keyboard.

(a) Mechanical Linkage. Depressing the local backspace keylever causes its function lever to raise the forward end of the local backspace operating bail, rotating the bail about its mounting shaft. A pin in the rear (left) arm of the bail engages the cam surface on the lower end of the backspace transfer bail. When the operating bail is rotated, the downward motion of the pin causes the upper end of the transfer bail to engage the backspace bail on the typing unit and rotate the backspace bail about its shaft.

(b) Power Drive Backspace Mechanism. The power drive backspace mechanism is used to backspace perforated tape to delete errors in character information. Backspacing is accomplished automatically by pressing the B SP, keylever on the keyboard. When the keylever is depressed, the switch associated with the tape backspace button assembly is closed. The circuit to the magnet assembly of the power drive backspace mechanism is then energized, causing the armature bail to fall.

4. TECHNICAL DATA

A. Signal

Code . . . . Sequential, 11-unit eight-level, start-stop

Operating Limits

Standard Applications

Voltage . . . . 30 to 60 v dc
Current . . . . 0 to 60 milliamperes

Special Low-Voltage Applications (Gold-plated signal contacts)

Normal operation . . . 3 to 20 v dc at max of 60 milliamperes

Max Power Level . . . . . 120 milliamperes at 20 to 70 v dc

Note: If this power level is exceeded for appreciable time, it may damage gold plating and make contacts unfit for special low-voltage applications.

B. Operating Speeds

Standard Speed . . 60, 75 or 100 words per minute with standard speed change gears

Intermediate Speed . . . Available by using special speed change gears

Special Speed . . . . . Available by using a governor controlled motor in place of the synchronous type normally used

C. Electrical Requirements

4.01 Electrical contacts for certain optional features, such as the answer-back mechanism, and signal regenerator circuit generally require 110 v ac circuitry, however the specific nature of these circuits depend on the external controls operated by the contacts.

35 KEYBOARD FOR AUTOMATIC SEND-RECEIVE SETS

LUBRICATION

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to include recent engineering information. Since this is a general revision, marginal arrows to indicate changes have been omitted.

1.02 The 35 keyboard should be lubricated as directed in this section. The figures indicate points to be lubricated and the kind and quantity of lubricant to be used. Lubricate the keyboard just prior to placing it in service. After a few weeks in service, relubricate to make certain that all points receive lubrication. The following lubrication schedule should be followed thereafter.

Operating Speeds in Words per Minute	Lubrication Interval
60	3000 hours or 1 year*
75	2400 hours or 9 months*
100	1500 hours or 6 months*

*Whichever occurs first.

1.03 Use KS7470 oil at all locations where the use of oil is indicated. Use KS7471 grease on all surfaces where grease is indicated.

1.04 All spring wicks and felt oilers should be saturated. The friction surfaces of all moving parts should be thoroughly lubricated. Overlubrication, however, which will permit oil or grease to drip or be thrown on other parts, should be avoided. Special care must be taken to prevent any oil or grease from getting between electrical contacts.

1.05 Apply a thick film of grease to all gears.

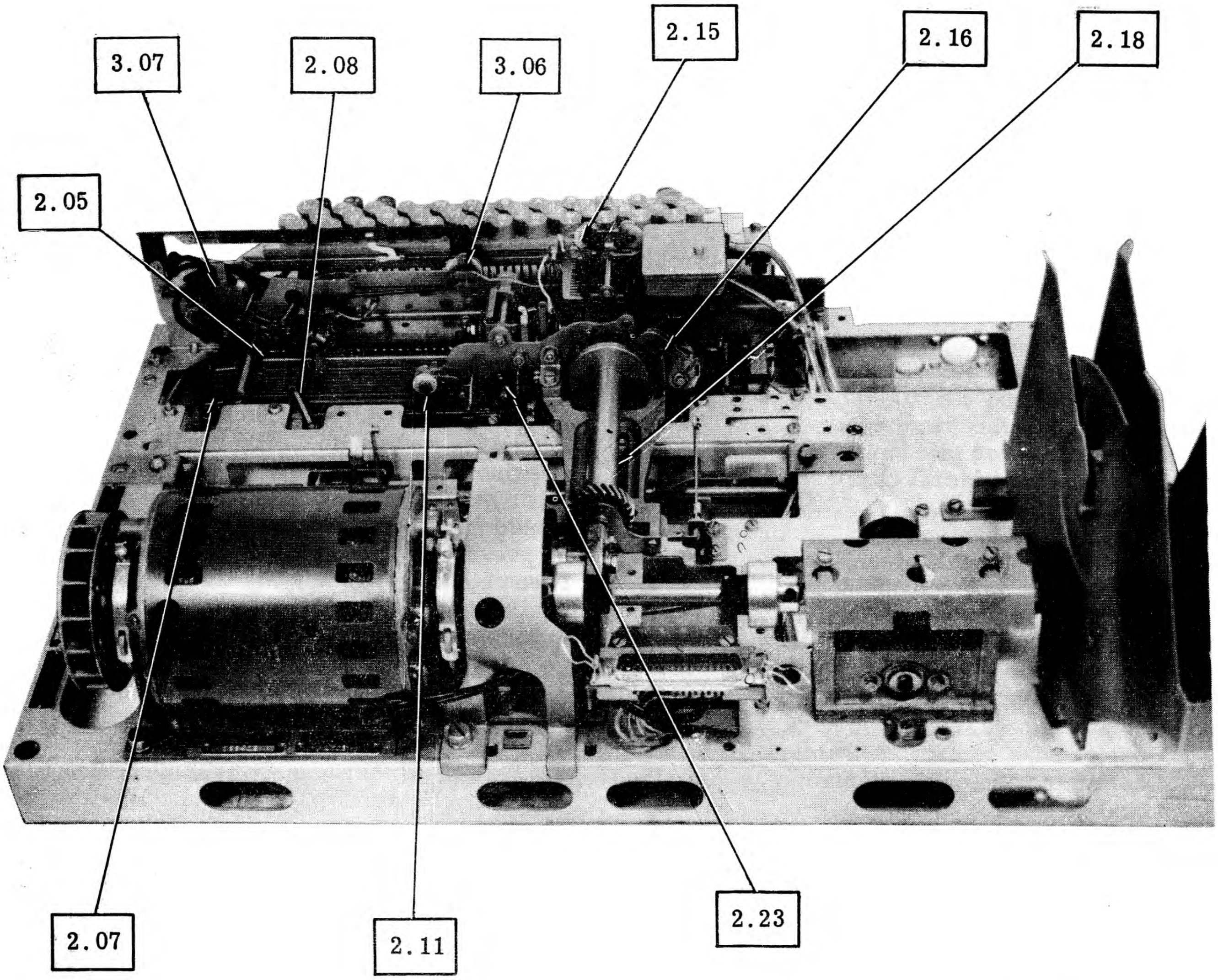
1.06 Apply oil to all cams, including the camming surfaces of each clutch disc.

1.07 The photographs show the paragraph numbers referring to particular line drawings of mechanisms and where these mechanisms are located on the unit. Parts in the line drawings are shown in an upright position unless otherwise specified.

1.08 The illustration symbols indicate the following lubrication directions:

O1 Apply 1 drop of oil.
O2 Apply 2 drops of oil.
O3 Apply 3 drops of oil, etc.
G Apply thin film of grease.
SAT Saturate (felt oilers, washers, wicks) with oil.

2. BASIC UNIT



(Rear View)

Figure 1 - Keyboard for Automatic Send-Receive Sets

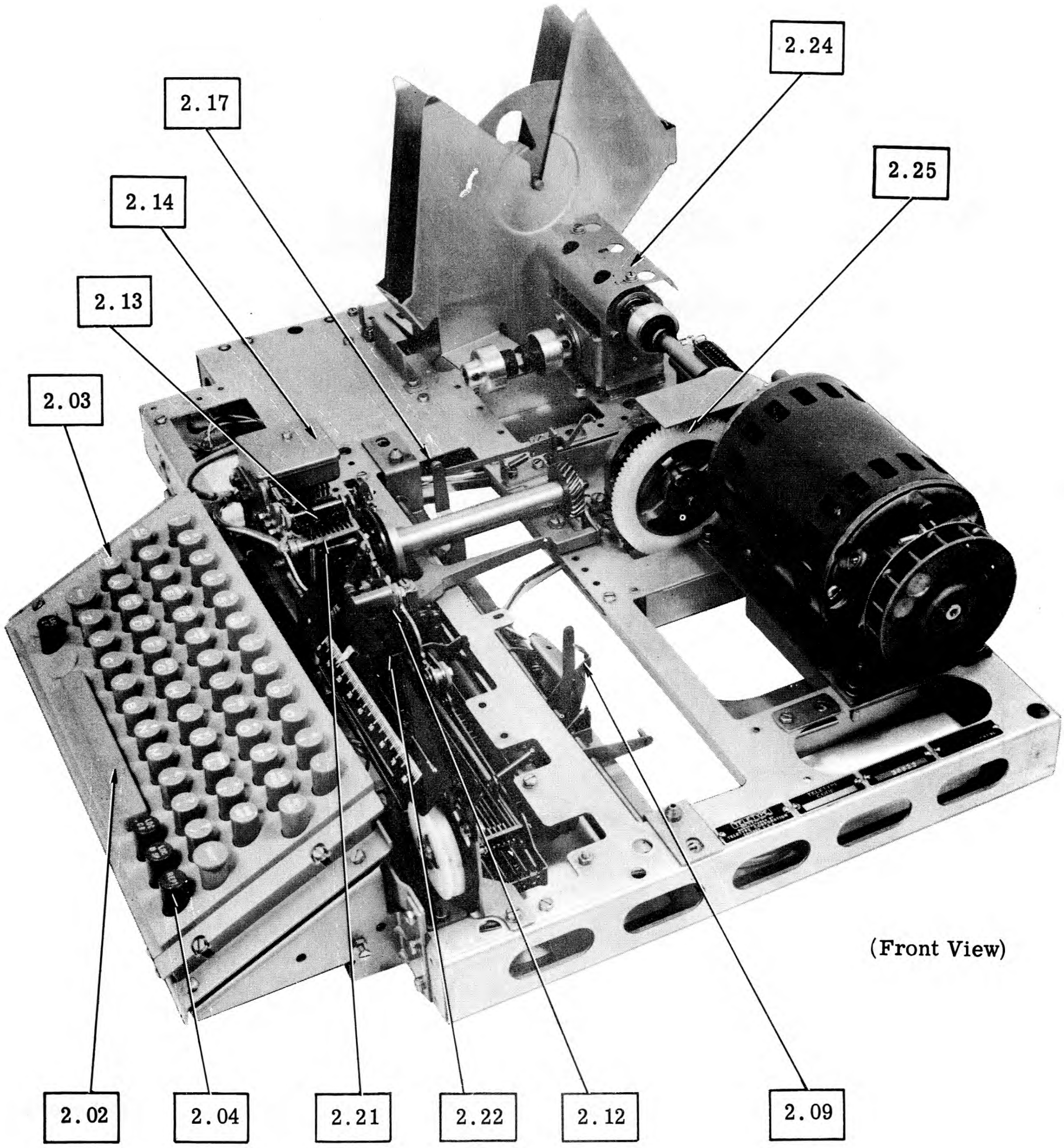
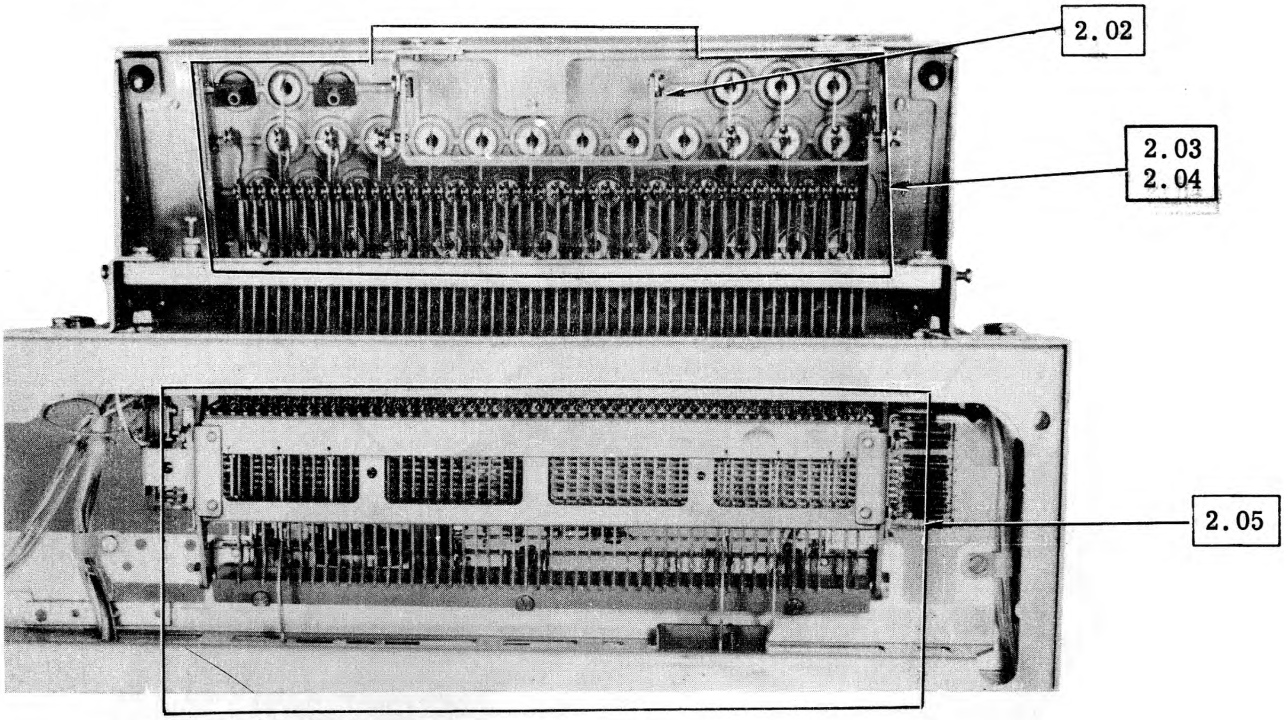


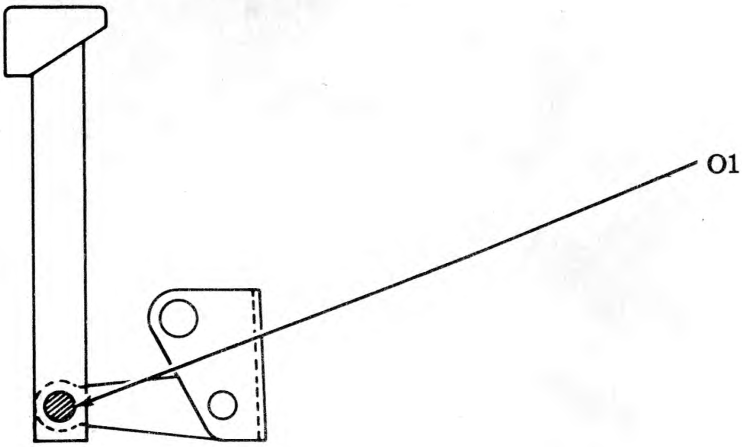
Figure 2 - Keyboard for Automatic Send-Receive Sets

2.01 Keyboard

Note: Rest keyboard bottom up.

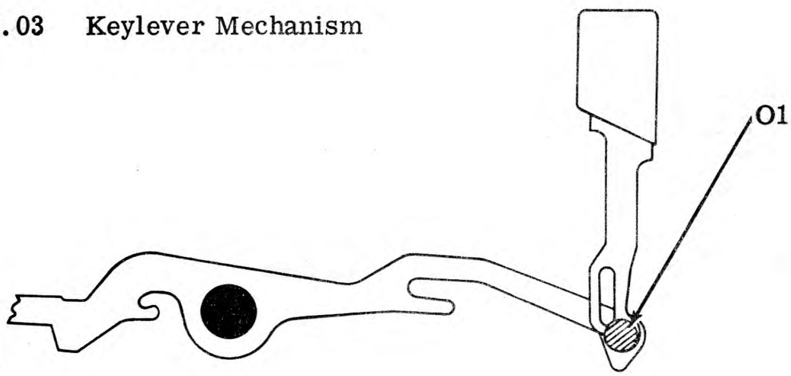


2.02 Spacebar Mechanism



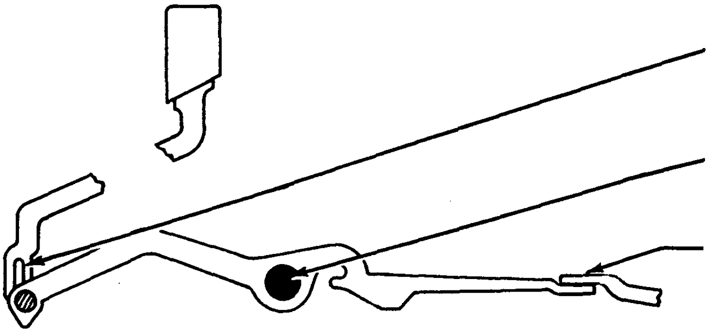
O1	Bearing Surface (Left & Right)	Spacebar

2.03 Keylever Mechanism



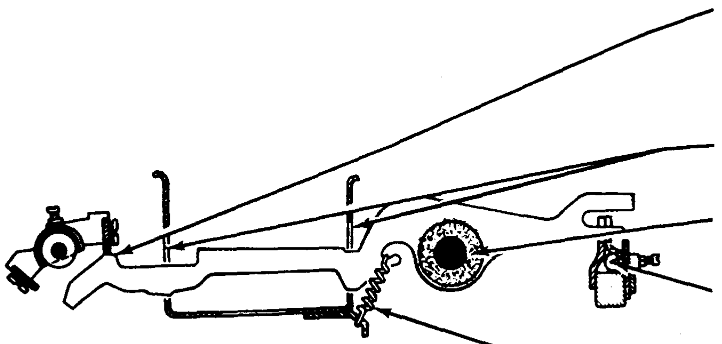
O1	Engaging Surface (49 Levers)	Keytop Levers

2.04 Function Lever Mechanism



O1	Engaging Surface	Function Keylever
O1	Bearing Surface	Function Lever
G	Contact Surface	Function Lever

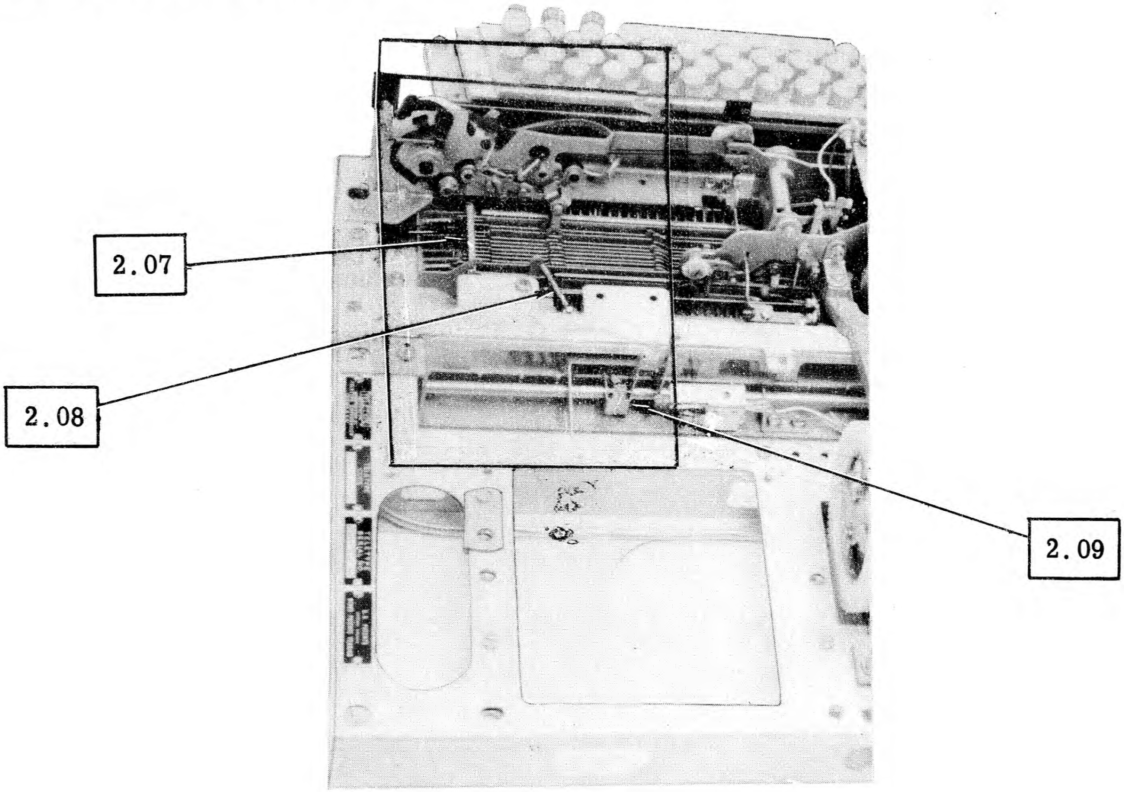
2.05 Code Lever Mechanism



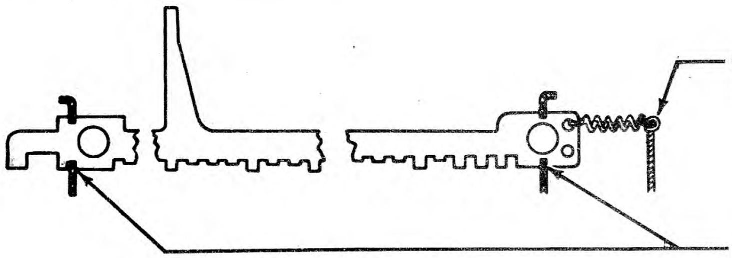
G	Contacting Surface (47 Levers)	Code Lever Universal Bail
O1	Guide Slots (53 Levers)	Code Levers
SAT	Felt Washers (8 Washers)	Code Lever Shaft
O1	Bearing Surfaces (47 Wedges)	Lock Ball Track
O1	Hooks (Each End) (50 Springs)	Springs

2.06 Keyboard Codebars

Note: Rest keyboard in upright position.

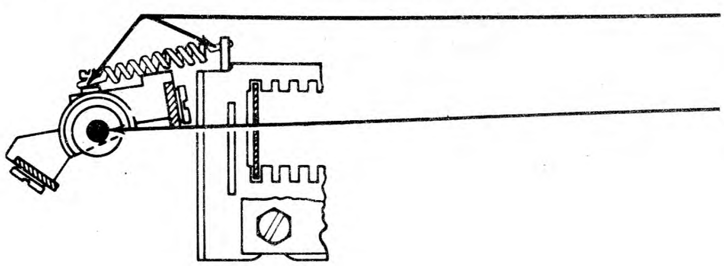


2.07 Codebar Mechanism



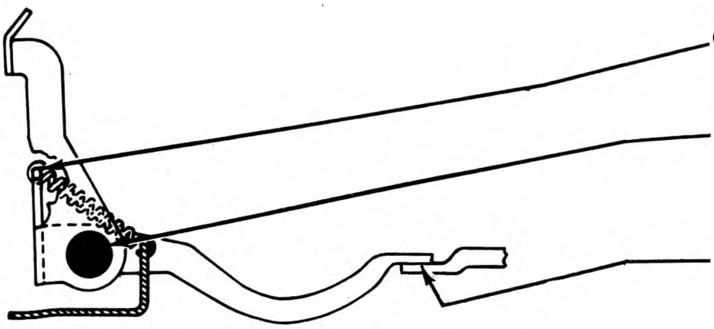
O1	Hooks (Each End) (12 Springs)	Springs
O1	Guide Slots (Left and Right - Top and Bottom)	Codebar Guides

2.08 Code Lever Universal Bail Mechanism



O1	Hooks (Each End)	Spring
O2	Bearing Surface (Both Ends)	Code Lever Universal Bail

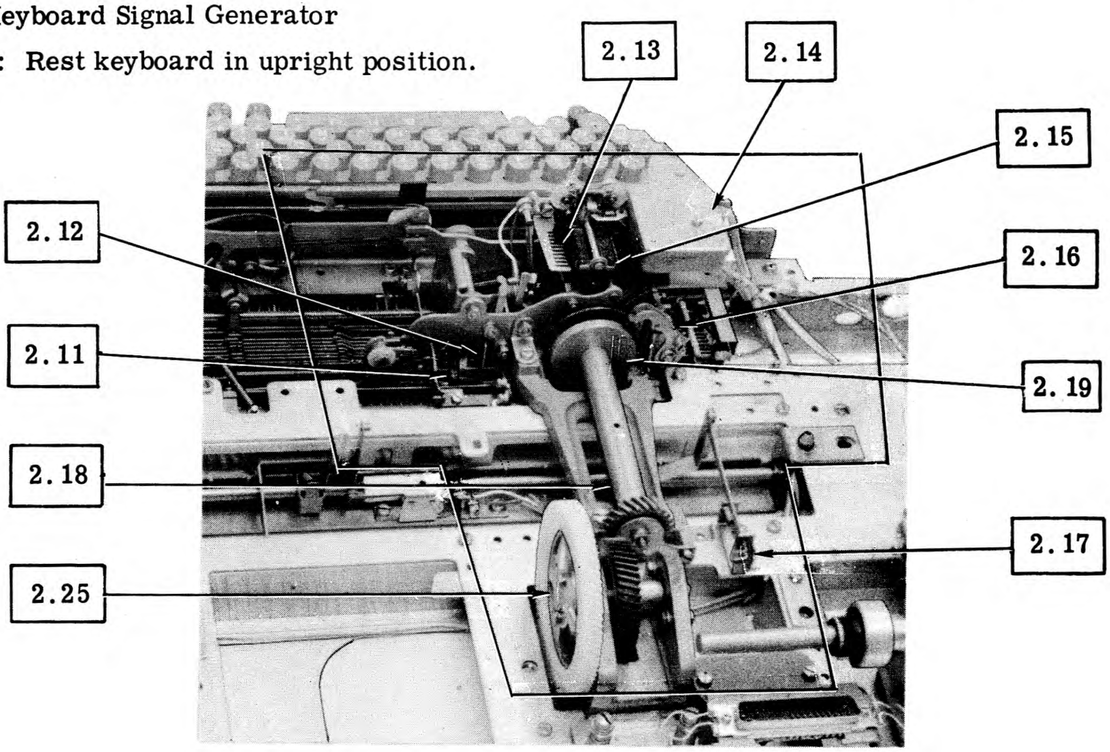
2.09 Local Carriage Return Mechanism



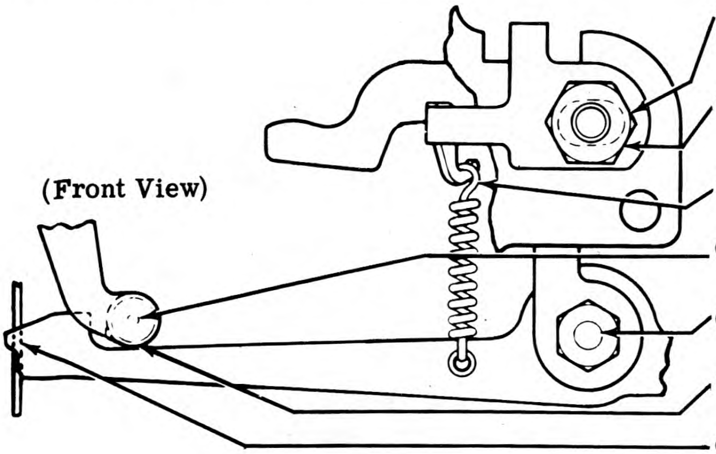
O1	Hooks (Each End)	Spring
O1	Bearing Surface (2 Places)	Local Carriage Return Function Bail
G	Engaging Surface	Local Carriage Return Function Lever

2.10 Keyboard Signal Generator

Note: Rest keyboard in upright position.

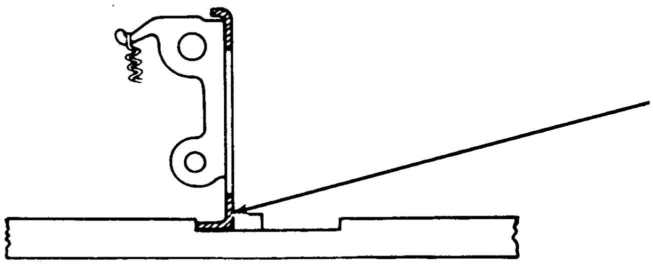


2.11 Nonrepeat Lever Mechanism



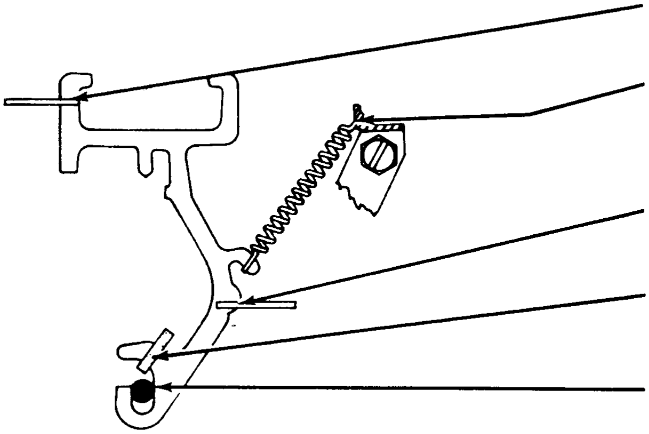
SAT	Felt Washer (Rear View)	Nonrepeat Lever Crank
O2	Bearing Surface	Nonrepeat Lever Crank
O1	Hooks (Each End)	Spring
O1	Bearing Surface	Codebar Bail Roller
O2	Bearing Surface	Nonrepeat Lever
G	Engaging Surface	Nonrepeat Lever
O2	Guide Slot	Nonrepeat Lever

2.12 Clutch Tripbar Mechanism



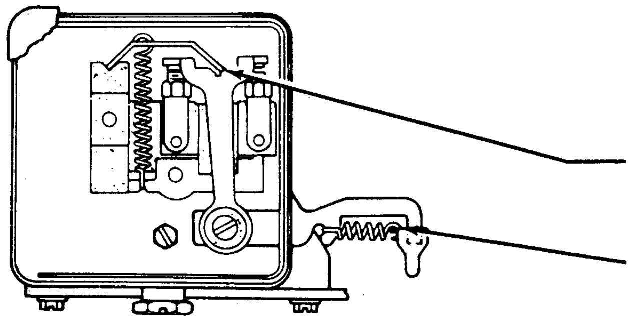
G	Slot	Clutch Tripbar Wear Plate

2.13 Transfer Lever Mechanism



O1	Guide Slots (10 Levers)	Transfer Levers
O1	Hooks (Each End) (10 Springs)	Springs
O1	Guide Slots (10 Levers)	Transfer Levers
SAT	Felt Washers (5 Washers)	Camming Surfaces
O1	Guide Slots (10 Levers)	Transfer Levers

2.14 Contact Box

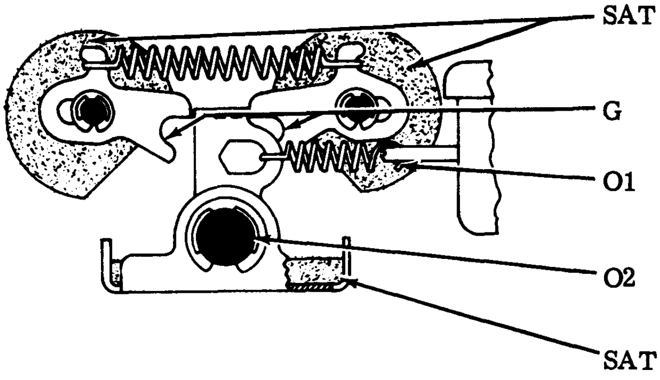


Disassembly: Remove nut and lockwasher securing contact box cover and remove cover.

G	Engaging Surface	Contact Toggle
O1	Hooks (Each End)	Spring

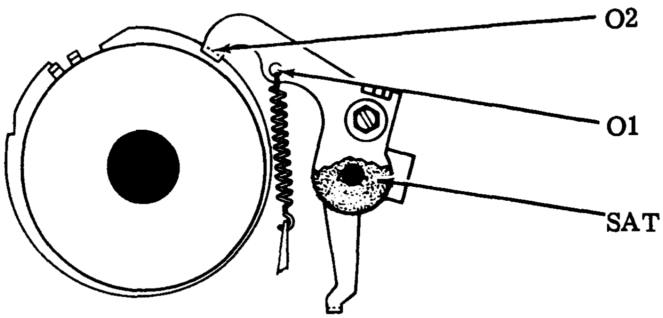
Note: The marking "DO NOT OIL" on the signal contact box cover should be interpreted literally. Portions of the mechanism should be greased as indicated, but no oil should be used.

2.15 . Transfer Bail Mechanism



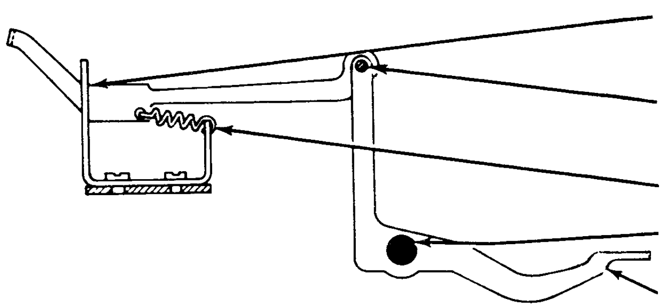
SAT	Felt Washers (2 Washers)	Latches
G	Engaging Surfaces	Transfer Bail
O1	Hooks (Each End) (2 Springs)	Springs
O2	Bearing Surface (Each End)	Transfer Bail
SAT	Oil Wick	Transfer Bail

2.16 Keyboard Clutch Mechanism



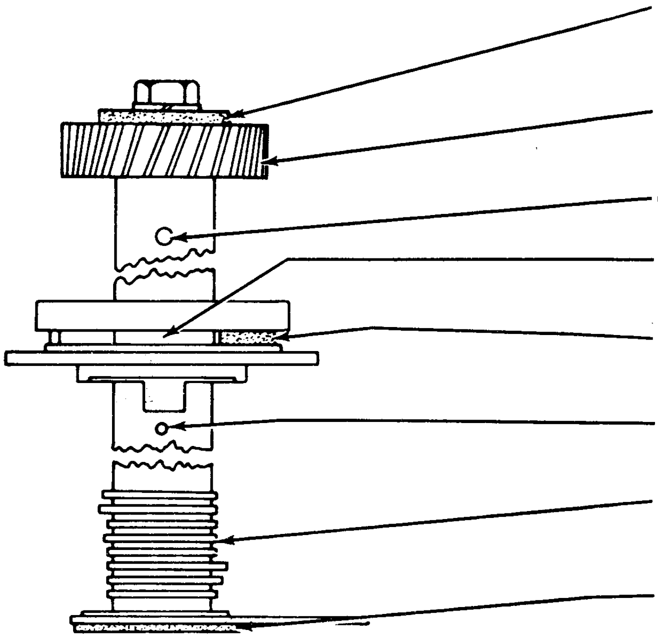
O2	Latching Surface	Clutch Stop Lever and Clutch Latch-lever
O1	Hooks (Each End) (2 Springs)	Springs
SAT	Felt Washers (2 Front & Rear)	Clutch Tripbail

2.17 Local Line Feed Mechanism



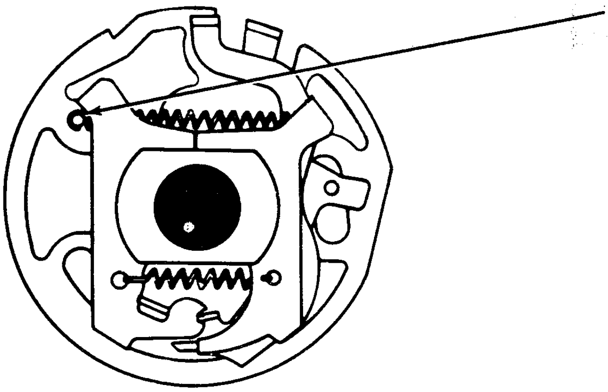
O2	Guide Slot	Local Line Feed Trip Link
O1	Bearing Surface	Local Line Feed Function Lever
O1	Hooks (Each End)	Spring
	Bearing Surface	Function Bail
G	Engaging Surface	Local Line Feed Function Lever

2.18 Keyboard Shaft Mechanism



SAT	Felt Washer	Signal Generator Shaft
G	Gear Teeth	Signal Generator Shaft
O20	Oil Hole	Signal Generator Shaft
SAT	Internal Mechanism	Keyboard Clutch
SAT	Felt Wick	Keyboard Clutch
O20	Oil Hole	Signal Generator Cam
O2	Camming Surface Each Cam	Signal Generator Cam
SAT	Felt Washer	Signal Generator Shaft

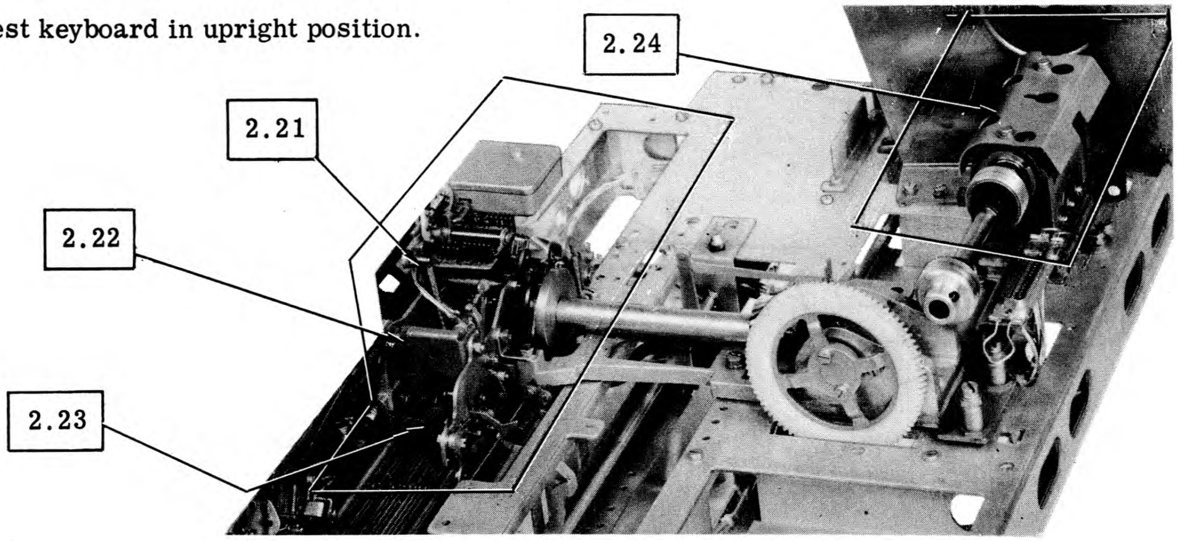
2.19 Keyboard Clutch



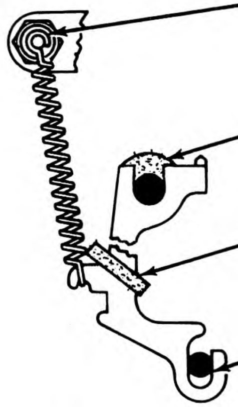
G	Hooks (Each End)	Clutch Shoe Lever Spring

2.20 Keyboard Signal Generator and Gear Assembly

Note: Rest keyboard in upright position.

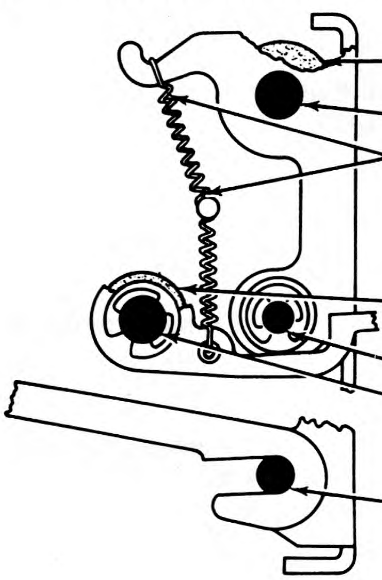


2.21 Locking Bail Mechanism



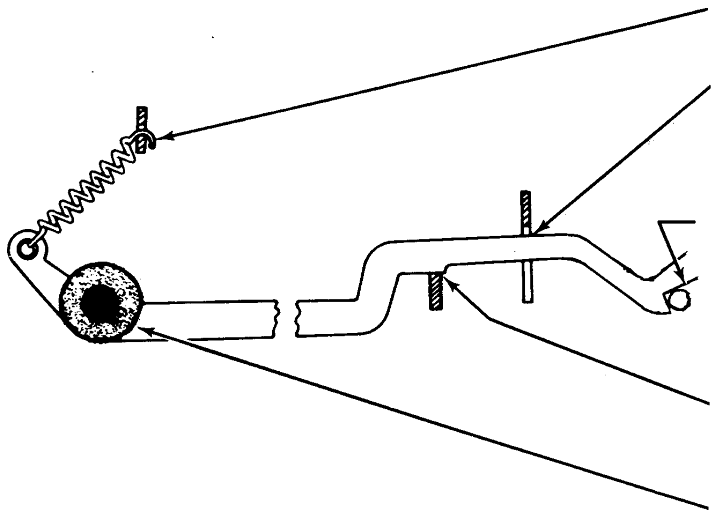
O1	Hooks (Each End)	Spring
SAT	Felt Washers (2 Washers - Front and Rear)	Locking Bail Post
SAT	Felt Wick	Camming Surfaces
O1	Guide Slots (3 Slots)	Locking Bail

2.22 Codebar Bail Mechanism



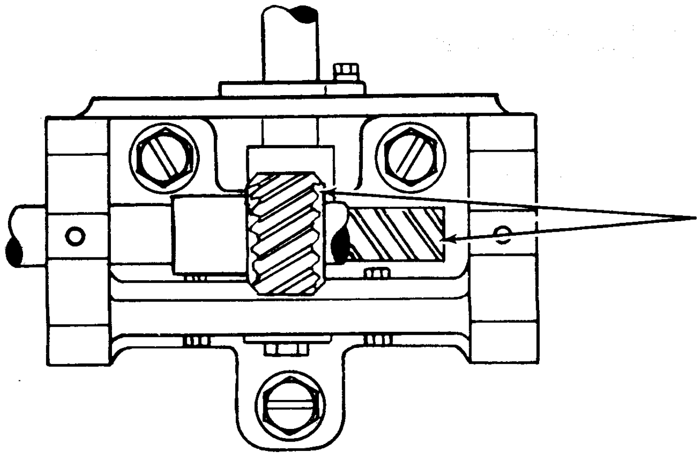
SAT	Felt Washers (2 Washers)	Codebar Bail
O1	Bearing Surface (2 Places)	Codebar Bail
O1	Hooks (Each End) (2 Springs)	Springs
SAT	Felt Washer	Codebar Bail Latch
O4	Bearing	Codebar Bail
O2	Bearing Surface	Codebar Bail Latch
O2	Engaging Surface	Eccentric Follower

2.23 Universal Bail Latchlever Mechanism



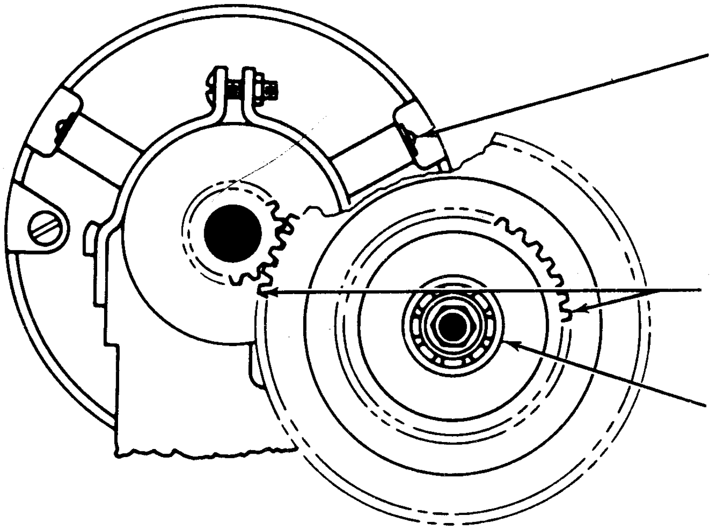
O1	Hooks (Each End)	Spring
O2	Guide Slot (Each Side of Slot)	Universal Bail Latchlever
G	Engaging Surface	Codebar Bail Extension
O1	Engaging Surface	Reset Bail Latch
SAT	Felt Washer	Universal Bail Latchlever

2.24 Rear Bearing Bracket Gear Mechanism



G	Gear Teeth	Rear Bearing Bracket Gear

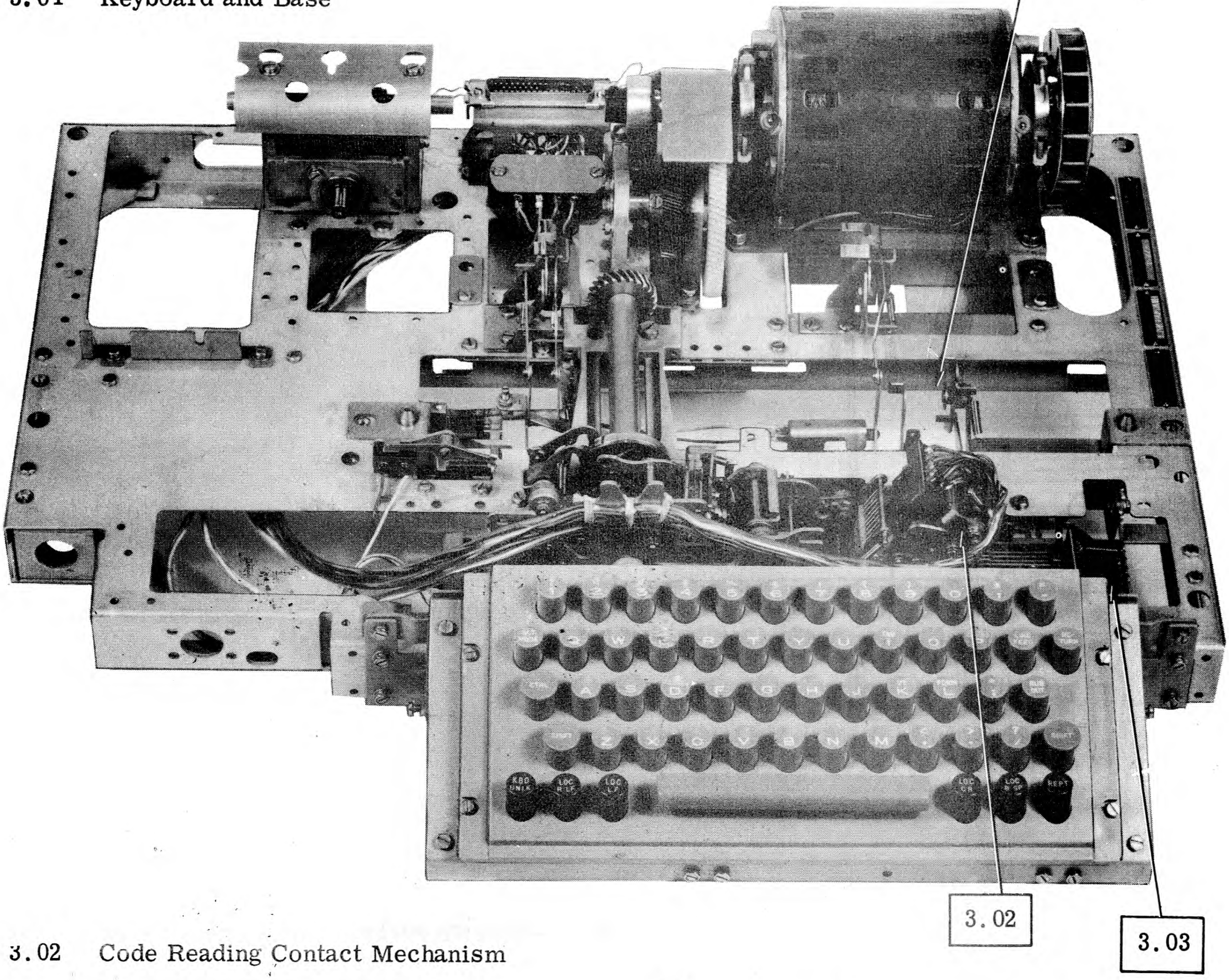
2.25 Intermediate Gear Mechanism



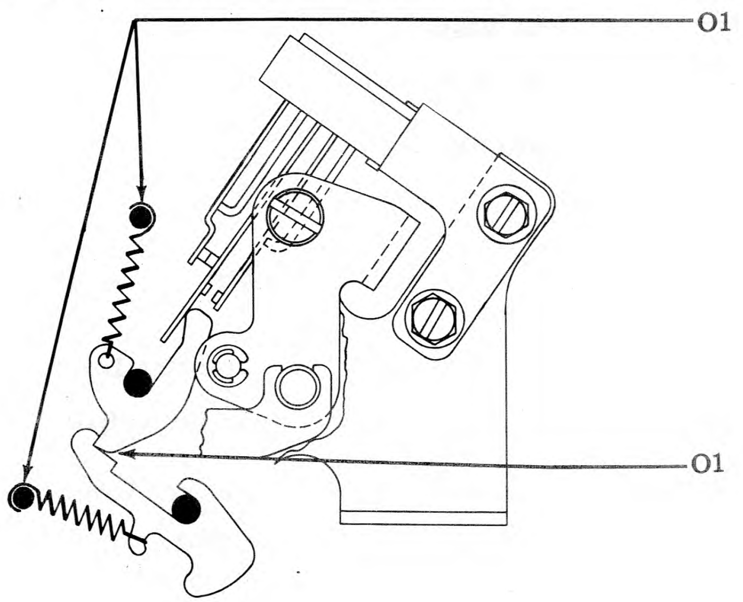
O2	Oiler (Each End, Right and Left)	Motor Shaft
G	Teeth (2 Gears)	Intermediate Gears
O2	Ball Bearing (2 Bearings)	Intermediate Gear Shaft

3. VARIABLE FEATURES

3.01 Keyboard and Base



3.02 Code Reading Contact Mechanism

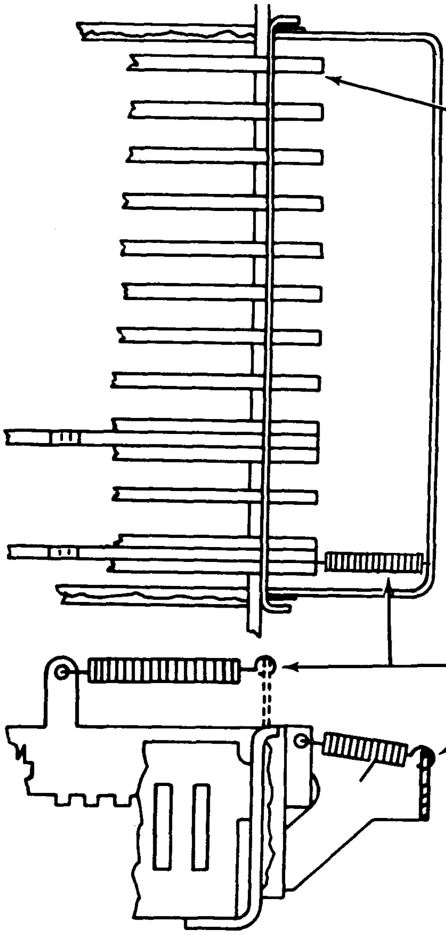


Hooks (Each End) Spring

Note: Keep contacts free of lubricant.

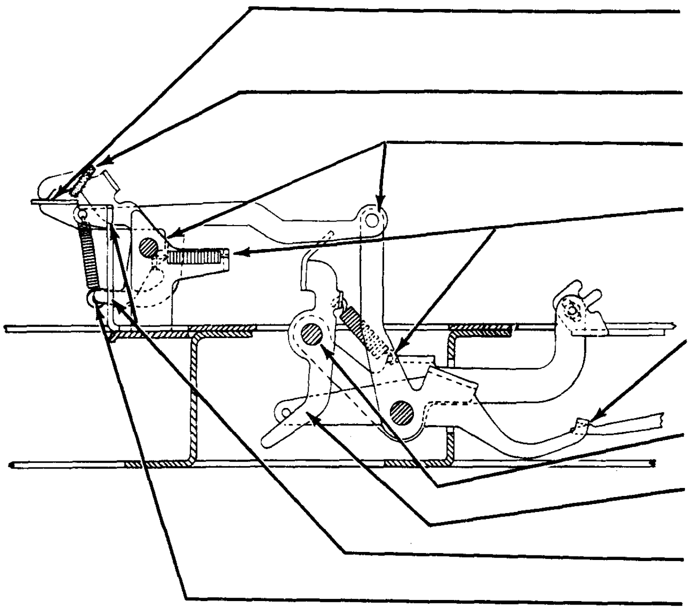
Engaging Surface Intermediate Lever

3.03 Codebar Mechanism (Even Parity)



O1	Guide Slots (Left and Right-Top and Bottom) See 2.05	Codebar Guides
O1	Hooks (Each End) (15 Springs)	Spring

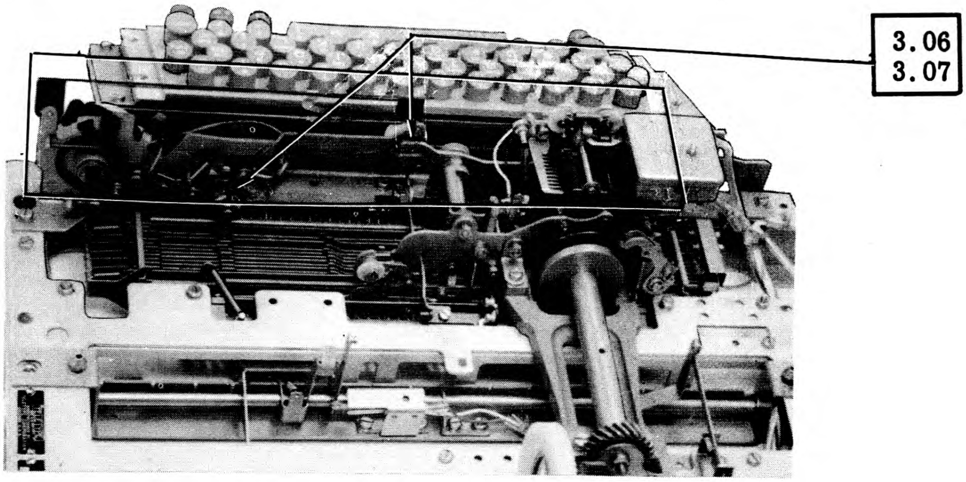
3.04 Local Backstop Mechanism



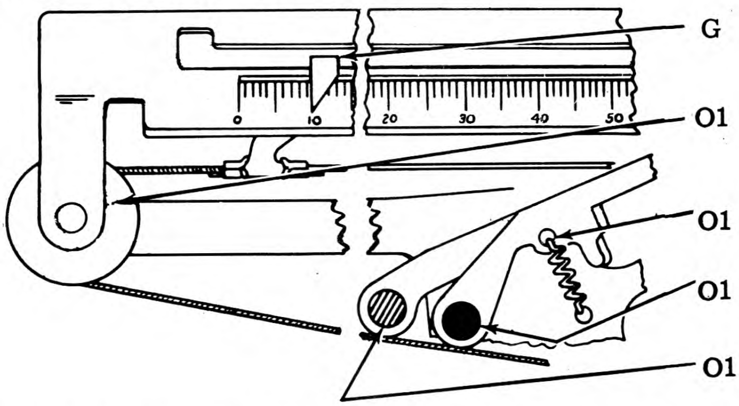
O2	Engaging Surface	Trip link
SAT	Felt Washer	Operating Bail
O2	Bearing Surface	Operating Bail
O1	Hooks (Each End)	Spring
G	Engaging Surface	Function Lever
O2	Bearing Surface	Transfer Lever
O2	Engaging Surface	Operating Bail
O2	Guide Slots	Stripper Lever
O1	Hooks (Each End)	Spring

3.05 Keyboard Character Counter

Note: Rest keyboard in upright position.

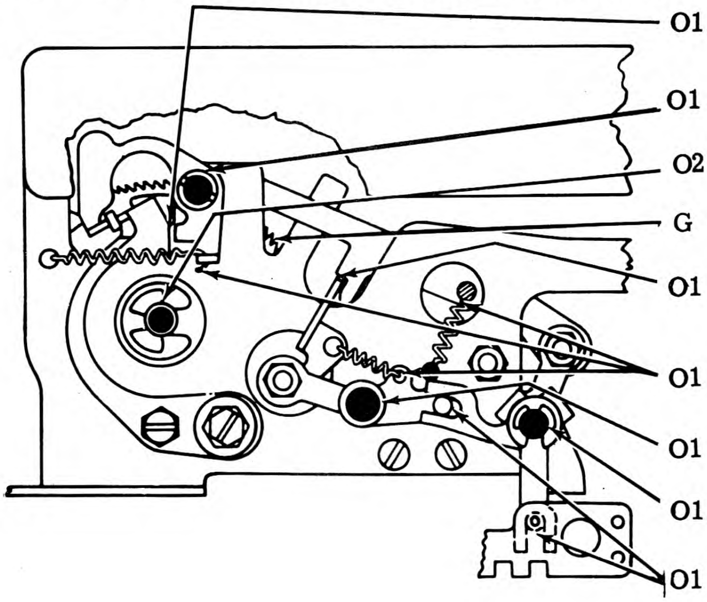


3.06 Character Counter Mechanism



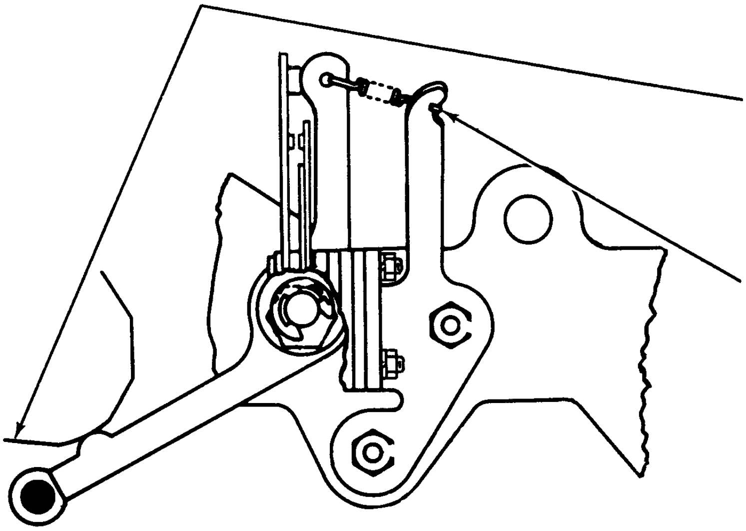
G	Engaging Surface	Counter Scale Bracket
O1	Bearing Surface	Indicator Cord Pulley
O1	Hooks (Each End)	Spring
O1	Bearing Surface	Ratchet Latch-lever
O1	Bearing Surface	Ratchet Drive Lever

3.07 Character Counter Mechanism (continued)



O1	Contact Surface	Antibounce Latch
O1	Bearing Surface	Antibounce Latch
O2	Bearing Surface	Ratchet Drum
G	Teeth	Ratchet
O1	Engaging Surfaces (2 Places)	Reset Lever Extension
O1	Hooks (Each End) (3 Springs)	Spring
O1	Bearing Surface	Reset Bail
O1	Bearing Surface	Drive Lever Feed Bail
O1	Engaging Surfaces (3 Surfaces)	Drive Lever Feed Bail & Reset Bail

3.08 Timing Contact Mechanism

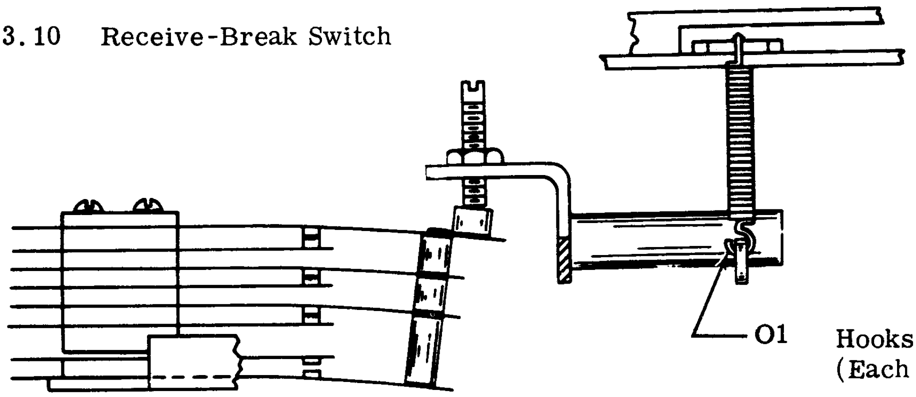


O2	Each Cam Surface	Cam
O1	Hooks (Each End)	Spring

3.09 Auxiliary Contact

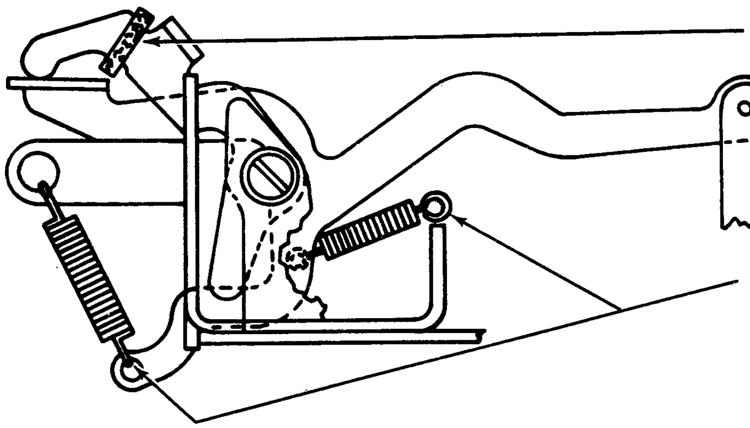
USE 3.08

3.10 Receive-Break Switch



O1	Hooks (Each End)	Spring

3.11 Local Single Line Feed Mechanism



SAT	Felt Washer	Trip Lever
O1	Hooks (Each End) (2 Springs)	Spring

35 KEYBOARD FOR AUTOMATIC SEND-RECEIVE SET

DISASSEMBLY AND REASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 Disassembly, as outlined in this section, covers a procedure for removing the principal sub-assemblies which make up the unit.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication and adjustments can be accomplished simply by removing the subject component from the cabinet. If possible, disassembly should be confined to sub-assemblies, which can, in some cases, be removed without disturbing adjustments. When reassembling the sub-assemblies, be sure to check all associated adjustments, clearances and spring tensions.

1.04 If a part that is mounted on shims is removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted.

1.05 Retaining rings (Tru-arcs) are made of spring steel and have a tendency to release suddenly when being removed. Loss of these retainers can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.06 Avoid loss of springs in disassembly by holding one spring loop with the left hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.07 Raise cabinet lid or enclosure cover (after removing the control panel bezel) and remove the typing unit from its base by removing the four screws that secure it to its keyboard or base. Remove the cable plug connector from the side frame. Lift the typing unit off.

> Note: On sets equipped with a form supply container on the rear of the cabinet, rearward foot extensions should be in position to prevent the cabinet from tilting when any of the components are removed.

1.08 Remove the four TP151549 screws that secure the base to the cradle or subbase. Disconnect the cable plug from the connector at the rear of the keyboard base. Remove the base with the motor unit and non-typing reperforator still in position.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a subassembly from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

SIGNAL GENERATOR

2.02 To Remove: Take cover off contact box and disconnect the signal line leads. Pull up on the line cable, with its strain relief and grommet intact, and push it aside out of the way.

2.03 Remove two mounting screws at front of the signal generator frame casting and one at the rear.

2.04 Hold the TP170372 universal bail back so that the TP170392 non-repeat lever clears, without stretching its spring, when the signal generator is lifted out.

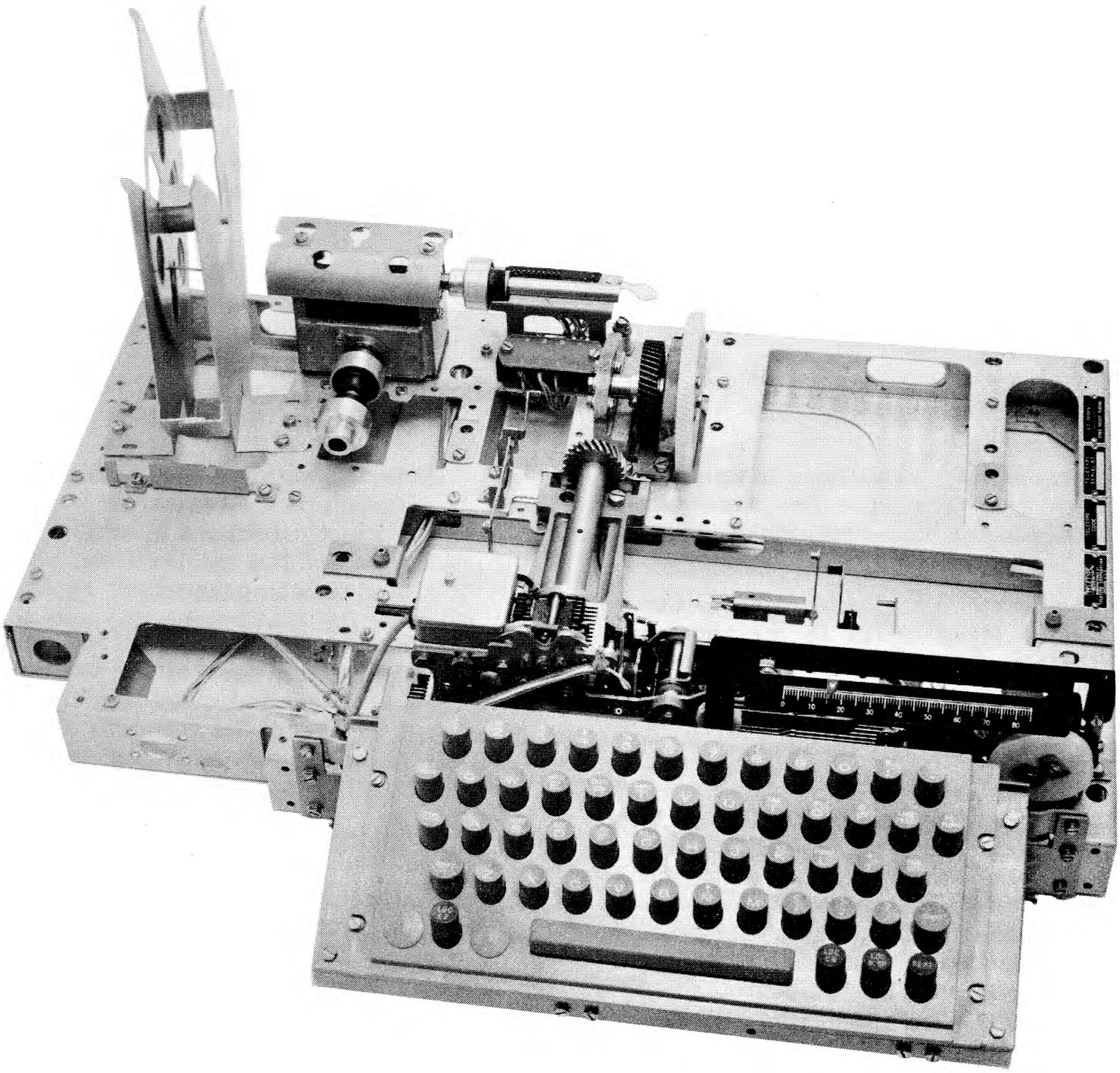


Figure 1 - 35 Keyboard for ASR Set

CAUTION: PREVENT THE NON-REPEAT LEVER FROM BEING PULLED TOO FAR DOWNWARD. IF IT IS PULLED DOWNWARD AS MUCH AS 90° FROM ITS OPERATING POSITION, THE SPRING WILL BE STRESSED BEYOND ITS ELASTIC LIMIT. MAKE SURE THE LEVER IS IN ITS SLOT BEFORE SETTING IT DOWN.

2.05 To disassemble the signal generator for replacing parts, the following procedure should be used:

(a) Disconnect the suppressor leads at the contact terminals.

(b) Unhook the drive link spring. Remove the two contact box bracket mounting screws. Disengage the drive link from the transfer bail and lift the contact box off.

(c) Remove the lock nut from the top of the phenolic block. Turn the box over and remove the two screws which secure the contact assembly in place. Slip the drive link out through the slot in the contact box and disconnect the link from the contact toggle by removing the connecting screw and insulator bushing.

(d) To remove the TP154034 clutch stop arm, unhook the spring and unscrew the adjusting screw.

(e) To remove the TP170392 non-repeat lever, unscrew the lock nut and remove the shoulder mounting screw.

(f) To remove the TP154010 transfer bail, unhook the drive link spring. Remove the lock nut at the end of the transfer bail shaft on the front plate of the signal generator. Disengage the drive link from the transfer bail and pull the bail and shaft toward the rear.

(g) To remove the TP154036 detent plate, after the transfer bail and shaft have been taken out, remove the two detent plate mounting screws on the front plate of the signal generator. The detent plate assembly can then be lifted out of place. The TP156516 detent latches can then be taken off by removing the retainer from the studs.

(h) To remove the TP158268 code bar bail latch, remove the retainer from the end of its stud. Unhook the spring from the latch. Strip the latch off to allow the code bar bail to move to its extreme right hand position. Work the latch to the front off its stud.

(i) To remove the TP154236 universal bail latch lever after the non-repeat lever mechanism is removed, unhook the spring. Remove the mounting screw and eccentric bushing. Move the latch lever toward the rear to extract it from its slot.

(j) To remove the TP160090 transfer levers:

(1) Trip the clutch and rotate the shaft approximately 270 degrees. Unhook the locking bail spring. The locking bail can be dropped down and unhooked from the guide post under the cam. Reach underneath the assembly and turn the locking bail clockwise. It may be necessary to move the gear back and forth to get clearance to drop the locking bail out of the upper guide post through the bottom of the assembly.

(2) Remove the screws from the upper right hand TP170391 transfer lever guide, and rotate the guide about the locking bail spring post so that it does not interfere with removing the transfer lever.

(3) Remove the transfer lever springs. Remove the TP151631 screw and lock washer from the TP154094 right angle clamp in back of rear plate. Remove the TP3599 nut and lock washer from the TP192534 locking bail post. Remove the nut from the rear end of the TP170388 guide post. Loosen to the end of the threads the nut on the rear end of TP154015 code bar bail mounting post. Remove the TP192589 stop pin.

(4) Drop the transfer lever. Reach under the cam with a pair of tweezers and remove the oil wicks.

(5) Unhook the transfer levers from the lower guide post and pull them up out of the assembly one at a time from rear to front. If the same levers are to go back into the assembly, number them in a manner to insure replacement in the same sequence.

(k) To remove the cam shaft assembly:

(1) With the locking bail removed, remove the two screws from the TP154101

rear gear plate, and the nut from the front end of the shaft.

(2) Hold the stop lever and latch lever out of the way and pull rearward on the shaft assembly to disengage it from the front plate. The entire cam clutch and shaft assembly can be removed toward the rear by gently rotating rearward. The eccentric follower arm and spacer washers will fall free and must be carefully positioned when reassembling.

(3) To remove the cam (with clutch) from the shaft, disengage the clutch by holding the clutch shoe lever against the stop lug and sliding the cam off the shaft. For ease of reassembly, tie the clutch shoe lever and stop lug together with wire. Place the shaft in first.

(4) After the cam and clutch assembly are removed, the clutch itself may be disassembled from the cam. To do so, carefully remove the springs. Remove the clutch shoes. Remove the two clamp screws in the clutch disk, and then remove the disk. The clutch disk can then be removed from the cam by removing the two screws securing it to the cam.

Note: If a new cam is being installed, the clutch shoes and disk should be tried in their respective grooves to see that they move freely before reassembly.

(l) To remove the TP154240 code bar bail, unhook its spring. Remove the lock nut at the front and rear ends of the TP154015 pivot shaft. Remove the lock nut from the rear end of the TP170388 transfer lever guide post. Remove the nut from the rear end of the TP192534 upper locking bail guide post (if these nuts have not already been removed). Pull the rear plate toward the rear until the code bar bail pivot post clears sufficiently to be removed.

KEYBOARD

2.06 To disassemble the keyboard assembly for replacing parts, two procedures may be followed: (a) With keyboard removed from base; (b) With keyboard attached to base.

(a) Keyboard removed from base.

(1) To remove the keyboard from the base, remove the four screws which hold the front frame to the front of the base.

(2) From the top of the base remove the two screws with flat washers at the right and left rear side of the code bar assembly brackets. Remove the two screws at the extreme left and right ends of the right angle bracket at the front of the code bar assembly. Remove the screw and cable clamp at the left of this bracket.

(3) When these eight screws have been removed, the keyboard assembly can be removed from the base by tipping it upward slightly at the front and pulling it forward so as to disengage the function levers. Note that all the function levers are under their corresponding function bails, so that they may be replaced correctly when reassembling.

(4) Remove the four screws from the space bar. Lift space bar out. Remove the four screws from the plastic keylever guide plate. Lift the guide plate out.

(5) To remove a keylever, hook one lug of the associated code lever, and the other lug in the slot of the keylever. A pull forward on the tool will snap the keylever from its code lever.

(6) Disconnect the TP154021 space bail link at its code lever by removing its retainer. Remove the screw at each end of the lock bail track to remove the track. The TP154080 wedgelocks may then be removed from their code levers.

(7) To remove the code bars after the signal generator has been removed, unhook the code bar springs from the spring bracket at the right end. Leave springs on code bars. Loosen the adjusting screws at the right and left end bracket. Lift the code bar guides to the top limit of their adjusting slots. Move the code bar to the right until it clears the left hand guide. Lift the code bar slightly and move it to the left until it clears the right hand guide.

(8) To remove a function lever or code lever after the keyboard assembly has been dismantled to the keylever guide assembly stage and the code bars have been removed, turn the assembly upside

down. Remove all code lever springs. Remove the inner retainer from the pivot shaft and pull the shaft out until the levers are free. Remove the levers toward the front.

(b) With keyboard attached to base.

(1) To remove a keylever assembly, hook the end lug of the keylever remover over the top of its associated code lever and the other lug in the slot of the keylever. A pull forward will snap each keylever from its pivot stud on the code lever.

(2) To remove the lock ball channel, remove the 4-40 screws at each end of the wedge retainer plate. Loosen the clamp at the center. As the wedge retainer is removed note the number of spacer washers at each end. Remove the mounting screws at each end of the lock ball bar assembly to free it from the keyboard.

(3) The 53 lock balls can be removed by taking the adjusting screw out at the end channel and permitting the balls to roll out.

(4) Remove the pivot screws which fasten the space bar assembly to the space bar bail. Remove the hold-down screw located under the space bar, and the two screws at each end of the keylever guide plate. Work the guide plate upward and off the keylevers.

(5) To remove the universal bail, set the keyboard up vertically on its rear side using the motor as a prop. Remove the bail spring. Loosen the lock nut on each universal bail pilot screw. Back off one pilot screw and lift the bail out.

(6) To reinstall the keylever guide plate with the keylevers attached, flip them all toward the rear. Place the front edge of the guide plate on the frame and push the keylevers of the front row into their respective holes. Then work in the second, third and fourth rows in a similar manner.

2.07 To remove the character counter, take out the two screws which fasten the TP179279 character counter bracket to the base and lift the assembly out.

35 TAPE READER BASES (FOR ASR SETS)

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to include information pertinent to new models and to rearrange text.

1.02 The primary concern of this section is the description and principles of operation of the bases used to mount 35 tape reader units in ASR sets. For information regarding adjustment and lubrication refer to other related 574-223-series sections.

1.03 The 35 tape reader bases include a base plate, gear assembly drive motor, and in some instances, an answer-back unit. In those instances where the answer-back unit is not included, the base provides mounting and drive facilities for a multiple-wire (parallel) distributor. The distributor itself is not part of the base. The primary function of the bases is, of course, to mount a tape reader unit in an ASR set. Some bases will mount two such tape readers.

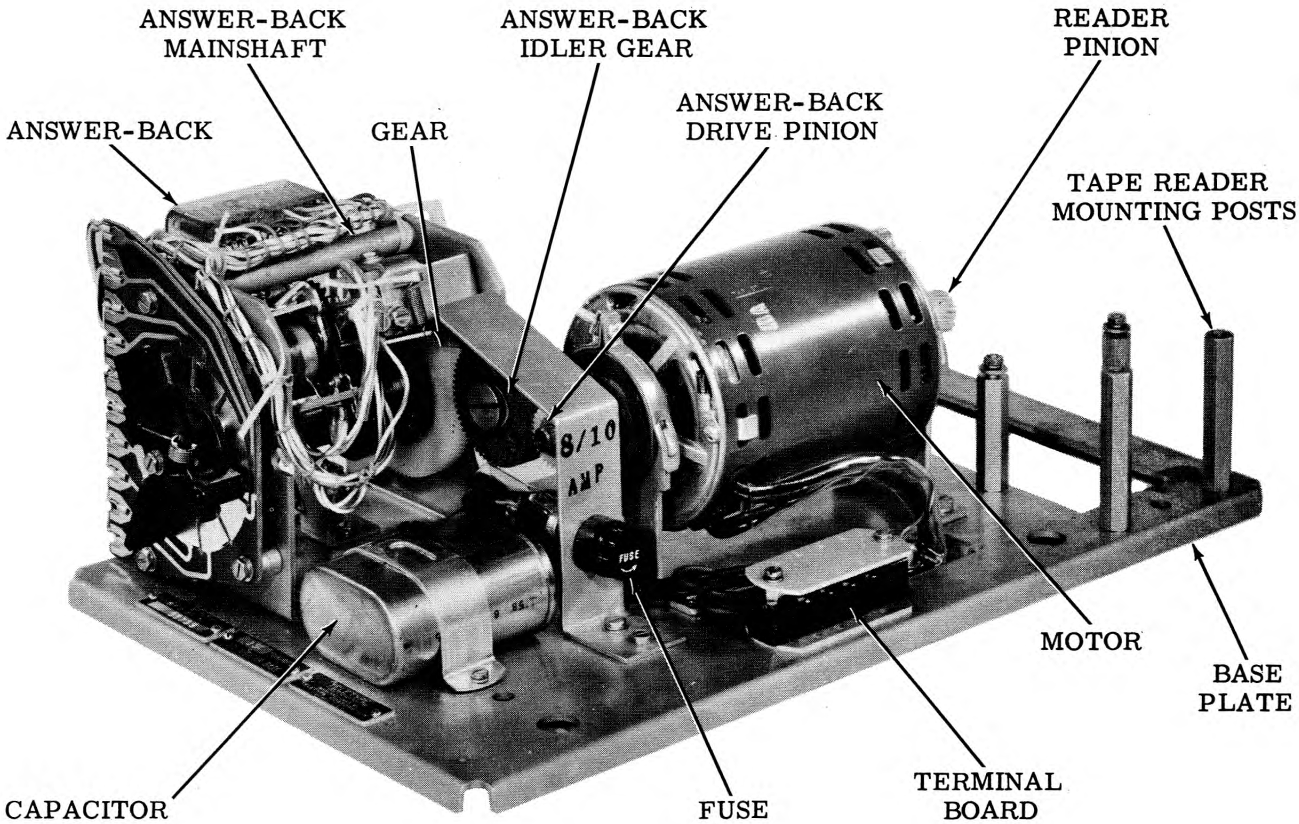


Figure 1 - 35 Tape Reader Base (Typical)

1.04 The base plate itself is made of sheet metal, formed at the edges for greater rigidity. The dimensions of the plate may vary from one model base to another. Where the base is to mount two tape readers, an extension plate is used.

1.05 The bases also include whatever gears are necessary to drive the answer-back or distributor assemblies as well as the tape reader(s).

1.06 Two types of motors are employed, the type of motor depending upon the particular base. These motors are described briefly in the paragraphs following.

(a) One motor is a 4-pole, split phase (capacitor-run) synchronous unit which operates at 1800 rpm from a 115 volt ± 10%, 60 cps (only) source. It is fitted with sintered bronze bearings. A 3 uf oil dielectric type capacitor provides the phase shift for the capacitor winding. A time delay fuse protects the motor against overload.

(b) A second type motor is a 2-pole, capacitor-start synchronous unit which operates at 3600 rpm from a nominal 115 volt 60 cps source. It is fitted with sintered bronze bearings. An 88-108 uf capacitor provides the phase shift for the start winding. As the motor approaches operating speed the starting winding is opened by contacts of an associated starting relay. A time delay fuse protects the motor against overload.

1.07 For information concerning the answer-back or distributor unit, refer to the pertinent section.

1.08 Terminal boards, capacitors, connectors and various mechanical parts, which may vary from one base to the other, are provided as required.

2. PRINCIPLES OF OPERATION

2.01 The operation of the tape reader base is fairly straightforward (Figure 1). A pinion affixed to one end of the motor shaft drives the tape reader directly or through an intermediate gear arrangement. The answer-back or distributor units may be driven from a rear motor pinion or through the intermediate gear arrangement.

2.02 For information regarding the answer-back or distributor units refer to the appropriate section.

35 NON-TYPING REPERFORATOR

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION (Fig. 1)

1.01 This section is reissued to include as a standard a complete general description and basic principles of operation of the 35 Non-Typing Reperforator.

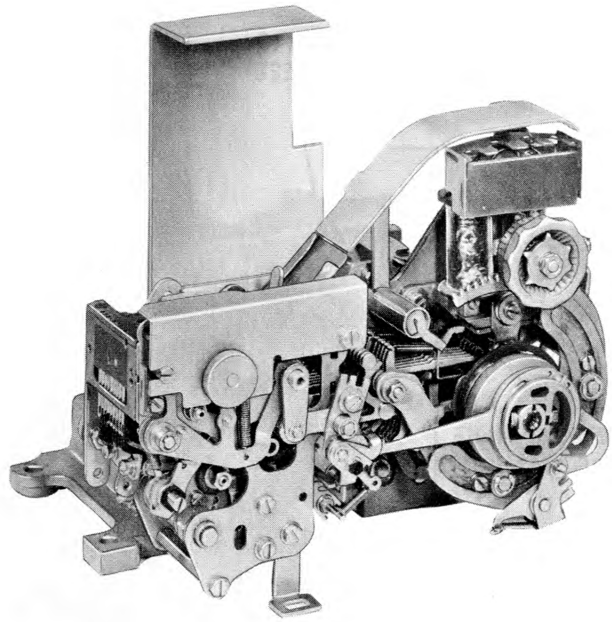


Figure 1 - 35 Non-Typing Reperforator

1.02 The 35 Non-Typing Reperforator is an electro-mechanical unit which records information in tape as combinations of perforations representative of the presence or absence of a signal pulse in each of the eight levels of intelligence electrically fed into the unit and its selecting magnets. The information is received in the form of an electrical signaling code which is translated into the necessary mechanical motions to perforate the code holes and feed the tape. Motive power for the mechanical features of the unit must be provided by an external source, such as a motor unit and drive mechanism.

1.03 Motive power is received through a jack shaft geared at the rear to the main shaft. Rotation of the main shaft is distributed by two all-steel internal expansion clutches, one a

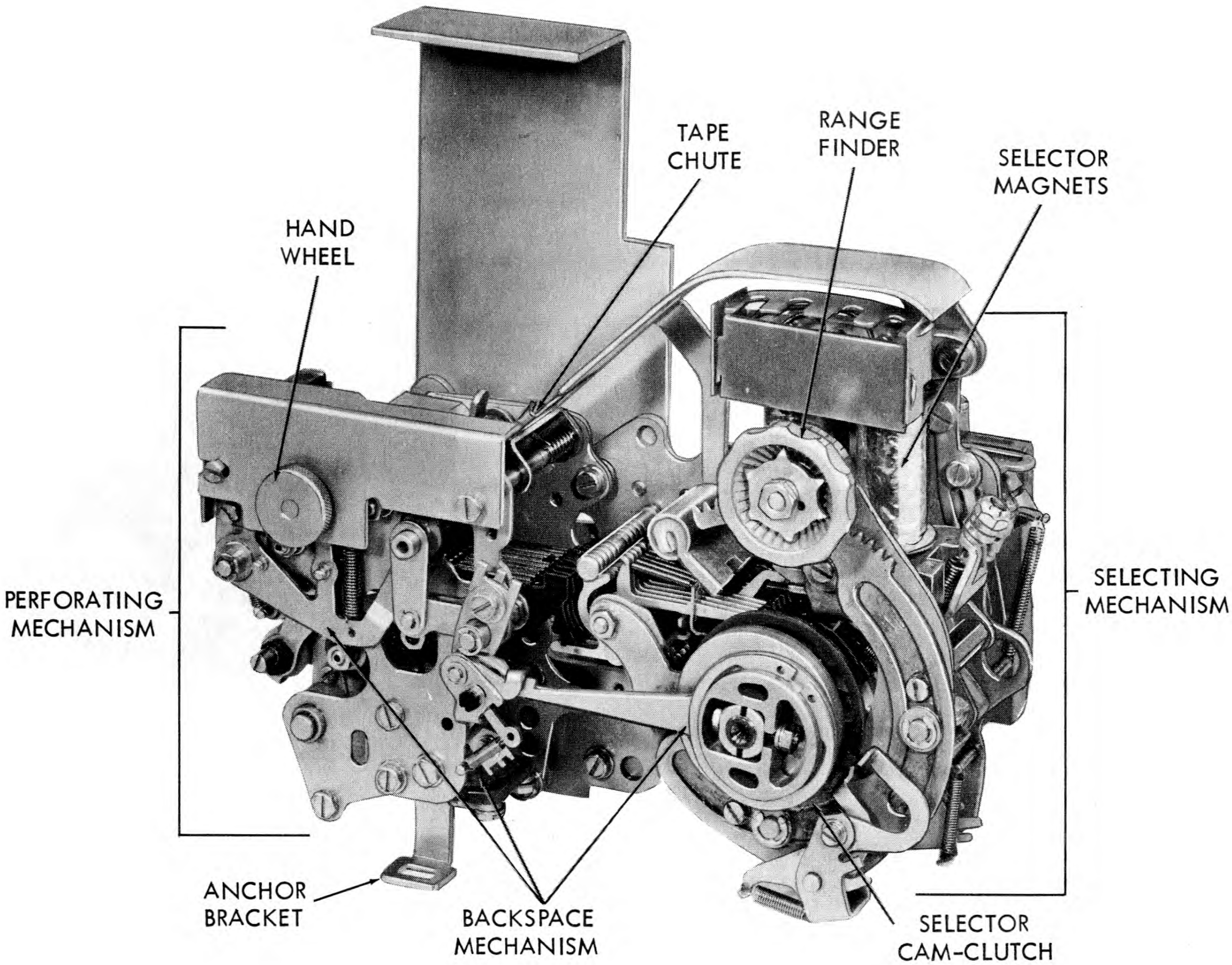


Figure 2 - 35 Non-Typing Reperforator

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

1.04 The selecting mechanism, in addition to the clutch, includes a two-coil magnet in series with the external signal line. The magnets are operated on an 0.500 ampere circuit from a selector magnet driver in the electrical service unit. A range finder is used to refine the mechanical orientation of the selector mechanism to the signaling code.

1.05 The function clutch is tripped by the selector mechanism to initiate transfer of motion from the main shaft to the perforating mechanism. A feed and die wheel advances the one inch tape to the punch block, where the feed hole and code holes are punched, fully perforated, in a code pattern established by mechanical linkage to the selector mechanism. The tape may be threaded and manually advanced by a hand wheel. This equipment has no provision for any alpha-numerical imprint corresponding to the code.

1.06 Perfo. ated code holes correspond to the marking, or current, pulses in the signal circuit. Unperforated portions of the tape correspond to the spacing, or no-current, pulses in the signal circuit. Reading from the rear as the tape feeds from the punch block, the code holes represent the 1, 2 and 3 bits of the signal code, the feed hole, and the 4, 5, 6, 7 and 8

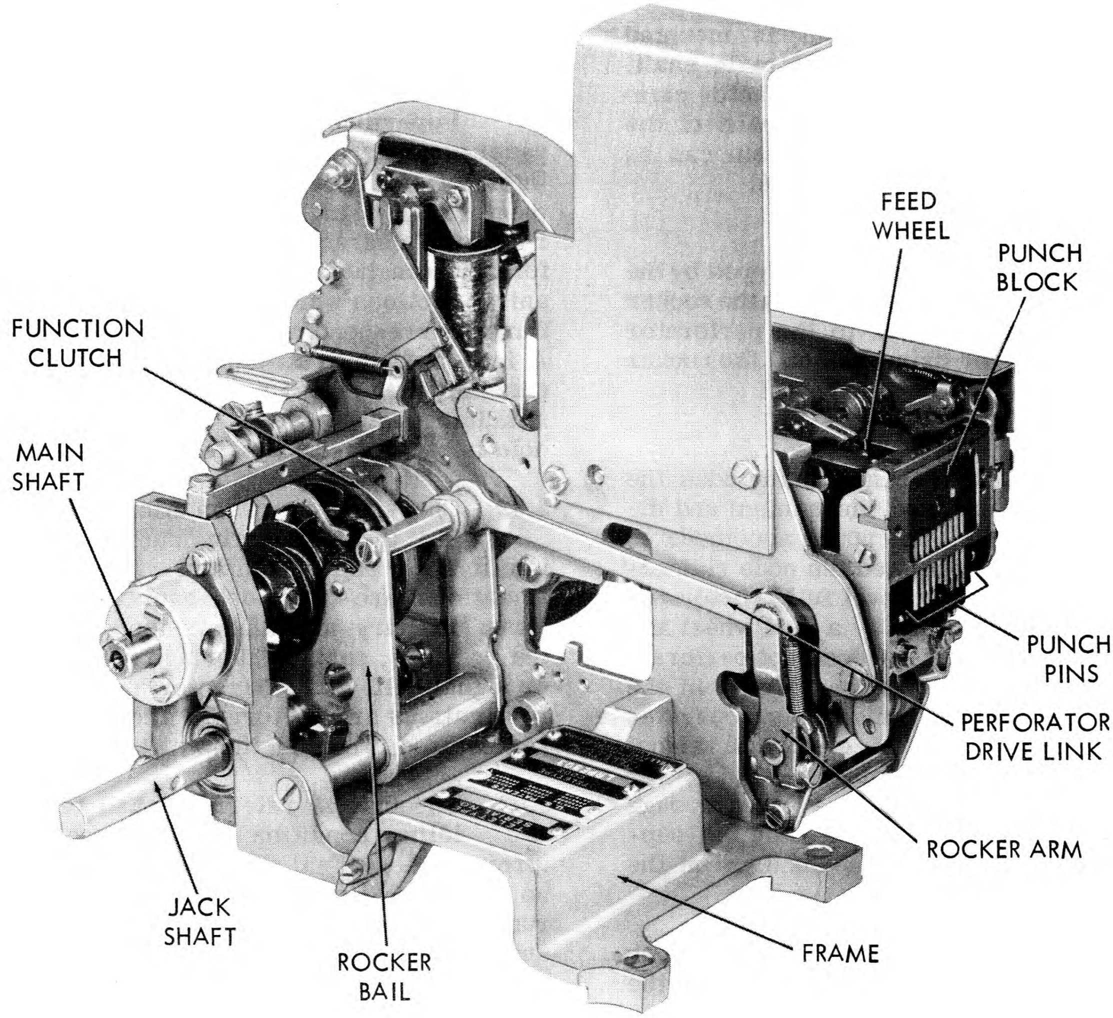


Figure 3 - 35 Non-Typing Reperforator (Left Rear View)

bits. Since the eighth bit in the code is always marking, the eighth, or foremost, code hole is always perforated. The equipment is designed to operate on an 11 unit transmission pattern utilizing an eight level start-stop code.

1.07 Unless stated to the contrary, references in the text to "left" or "right" indicate the operator's right or left, facing the front of the unit, the selector mechanism at the right and the punch mechanism at the left. In illustrations, unless specifically labeled otherwise, it is assumed that the equipment is being viewed from the front. Pivot points are shown in the drawings by circles or elipses which are solid black to indicate fixed points and crosshatched to indicate floating points.

PHYSICAL DESCRIPTION (Fig. 2 and 3)

1.08 A cast frame provides mounting facilities for the various mechanisms which comprise the Non-Typing Reperforator.

1.09 Two shafts, a jack shaft located directly beneath the main shaft, transmit externally supplied power to rotate the two cam-clutch mechanisms. The jack shaft connects to the intermediate gearing of the associated equipment and is geared to the main shaft at the rear of the unit. Changes in the gearing of the jack shaft and main shaft will permit changes from 60 to 75 or 100 words per minute operating speed.

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

1.11 The function cam-clutch is tripped by the selecting mechanism. It drives the rocker bail, which transmits power to the perforator through the perforator drive link and the rocker arm.

1.12 The perforator mechanism includes the punch, the tape feed mechanism and the backspace mechanism. The punch accomodates one inch wide tape, perforated ten code characters to the inch with eight level fully perforated code holes. The tape is fed by a feed wheel and die wheel which indents but does not perforate the tape. The feed hole is perforated in the punch block. The backspace mechanism operates in response to an external electrical signal applied to the backspace magnet. Power for reversing the movement of the tape through the punch, one character at a time, is supplied through an eccentric mechanism on the front end of the main shaft.

1.13 The mechanical linkage of selector push levers and punch slide latches and the perforator punch slides interconnects the selector and perforator mechanisms.

TECHNICAL DATA

A. Approximate Dimensions

Width	7-1/2 inches
Depth	6-1/2 inches
Height	6 inches
Weight	5-1/2 pounds

B. Signal

Code	Sequential, 11-unit start-stop
Current	0.500 amperes

C. Tape (standard communications)

Width	1 inch
Perforations	eight-level, fully perforated
Holes/inch	10

Feed holes and code holes in line

2. PRINCIPLES OF OPERATION

2.01 The basic function of the 35 Non-Typing Reperforator is to record information in paper tape as fully perforated code holes. The information is received from a signal line in the form of signaling code combinations which represent characters or functions. The reperforator translates these combinations into mechanical motions which advance the tape and perforate corresponding combinations of code holes. A feed hole used to advance that tape through transmitting or reading equipment is perforated simultaneously with the code hole. The feed hole is of smaller diameter than the code holes.

2.02 Character representations, or graphics, are the alphabetic, numeral or symbol intelligence representations. Function representations are the coded equivalent of operations auxiliary to transmission or reception of the graphics, such as carriage return, line feed, or signal bell. Both character and function representations are perforated into the tape, so it can be used in conjunction with typing equipment.

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

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

SIGNALING CODE (Fig. 4)

2.05 Information is received by the reperforator in the form of an eleven bit start-stop signaling code in which each character (graphic) or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking and during which no current flows as spacing. Every combination includes eight bits that carry the intelligence, each of which may be either marking or spacing (except that in current applications the eighth bit is always spacing), as shown in Fig. 4. The intelligence bits are preceded by a start bit (always spacing) and are followed by two stop bits (always marking). Thus

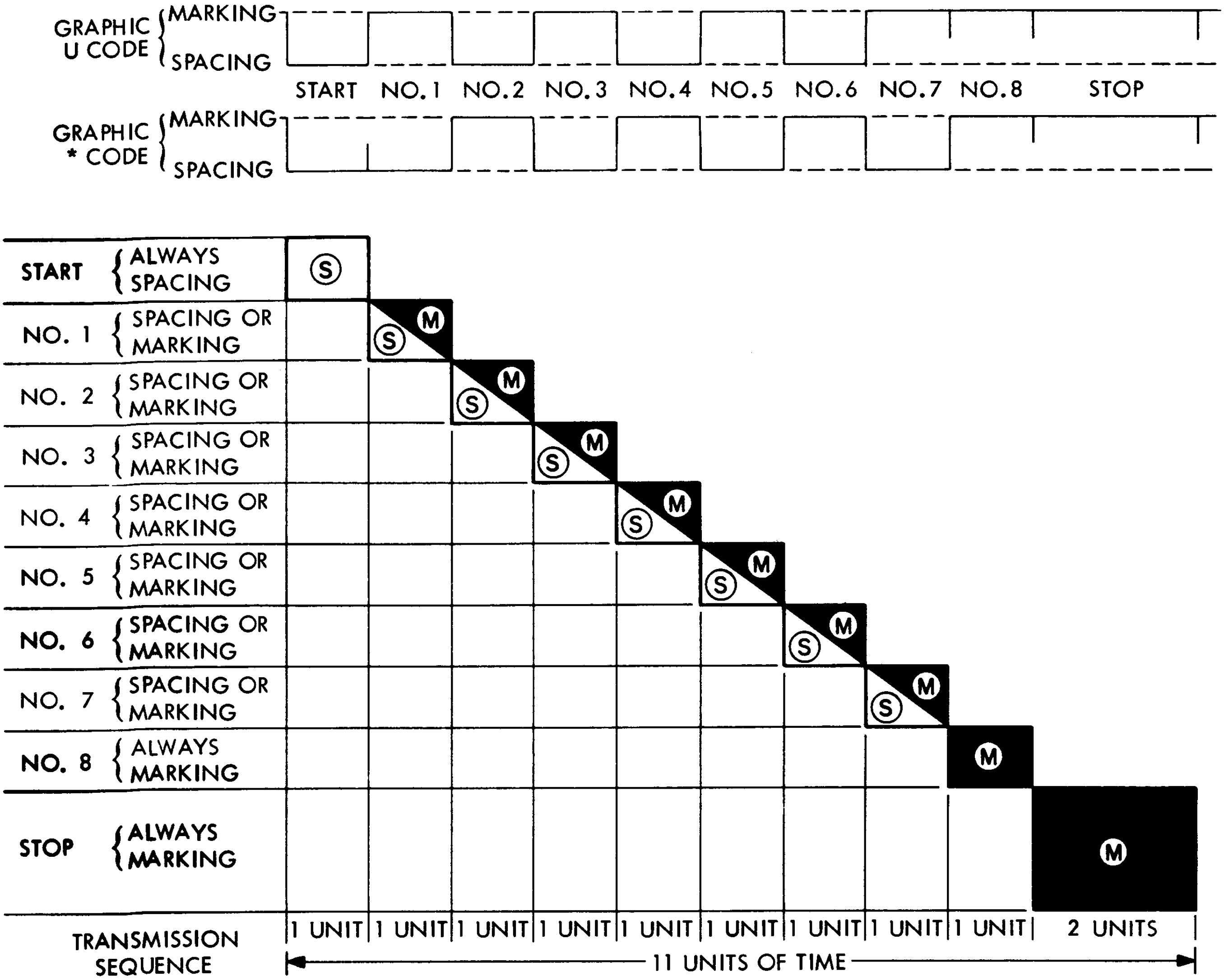


Figure 4 - Signaling Code

each combination consists of 11.0 units of time (referred to as an 11.0 unit transmission pattern). The start and stop bits ensure synchronization between the transmitting and receiving equipment by bringing the receiving equipment to a complete stop at the end of each combination. The marking condition of the eighth bit further enlarges the marking interval at the end of each code combination transmitted.

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

2.07 The total number of permutations of an eight level, 11 unit code (with the eighth level always marking) is two to the seventh power, or 128. Specific character and function representations may vary with equipment. The characters (graphics) and functions commonly represented on associated keyboards and typing units are illustrated in Fig. 5. Function representations which are blank are unassigned. For a more complete discussion of the signaling code, refer to the applicable section.

2.08 Marking bits in the intelligence code are represented by holes and spacing bits by the absence of holes. The eighth code level is always marking (perforated). The row of smaller

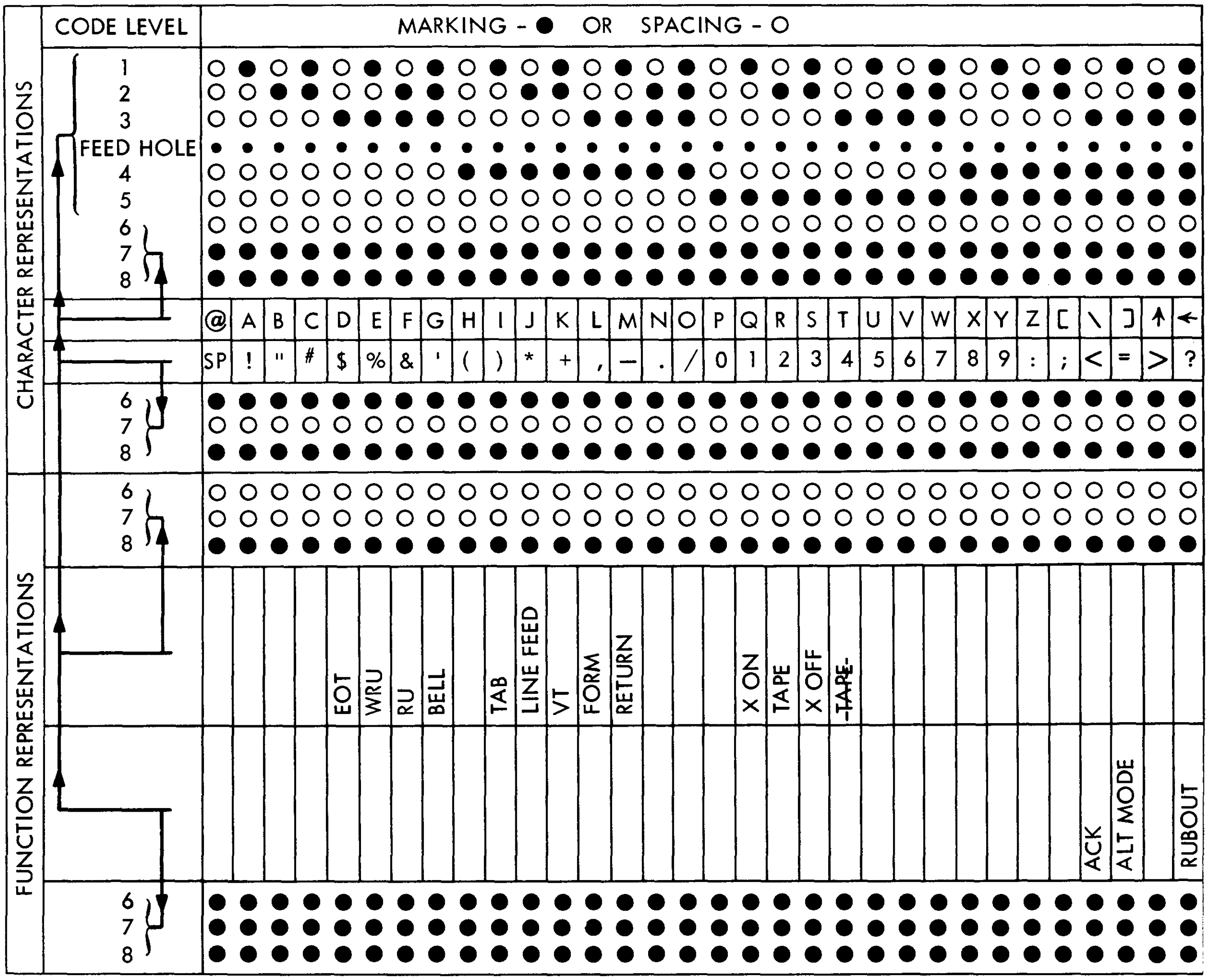


Figure 5 - Code Representations of Characters (Graphics) and Functions

holes between the third and fourth levels are tape feed holes and do not enter into the code permutation.

GENERAL OUTLINE OF OPERATION (Fig. 6)

2.09 The relationship of the operating mechanisms of the 35 Non-Typing Reperforator are illustrated in the block diagram (Fig. 6). Rotary motion from an external source is applied to the main shaft through the jack shaft, which turns constantly as long as the unit is under power. An 0.500 ampere signal to the selector magnets and a 115 V AC pulsing circuit to the backspace magnet are also externally supplied.

2.10 The signaling code combinations, such as the combination representing the graphic U, plotted at the left Fig. 6, are applied to the selecting mechanism. The start pulse of each code combination causes the selector, through a trip assembly, to trip the selecting cam-clutch. The main shaft then imparts motion to the cam-clutch throughout the selecting cycle. The cam-clutch mechanism, in turn, transfers timed motion to the selector, which converts the intelligence bits of the code combination into a corresponding mechanical arrangement. Near the end of the selecting cycle, the cam-clutch actuates the function trip assembly. The latter trips the function cam-clutch and releases the punch slides of the perforating mechanism

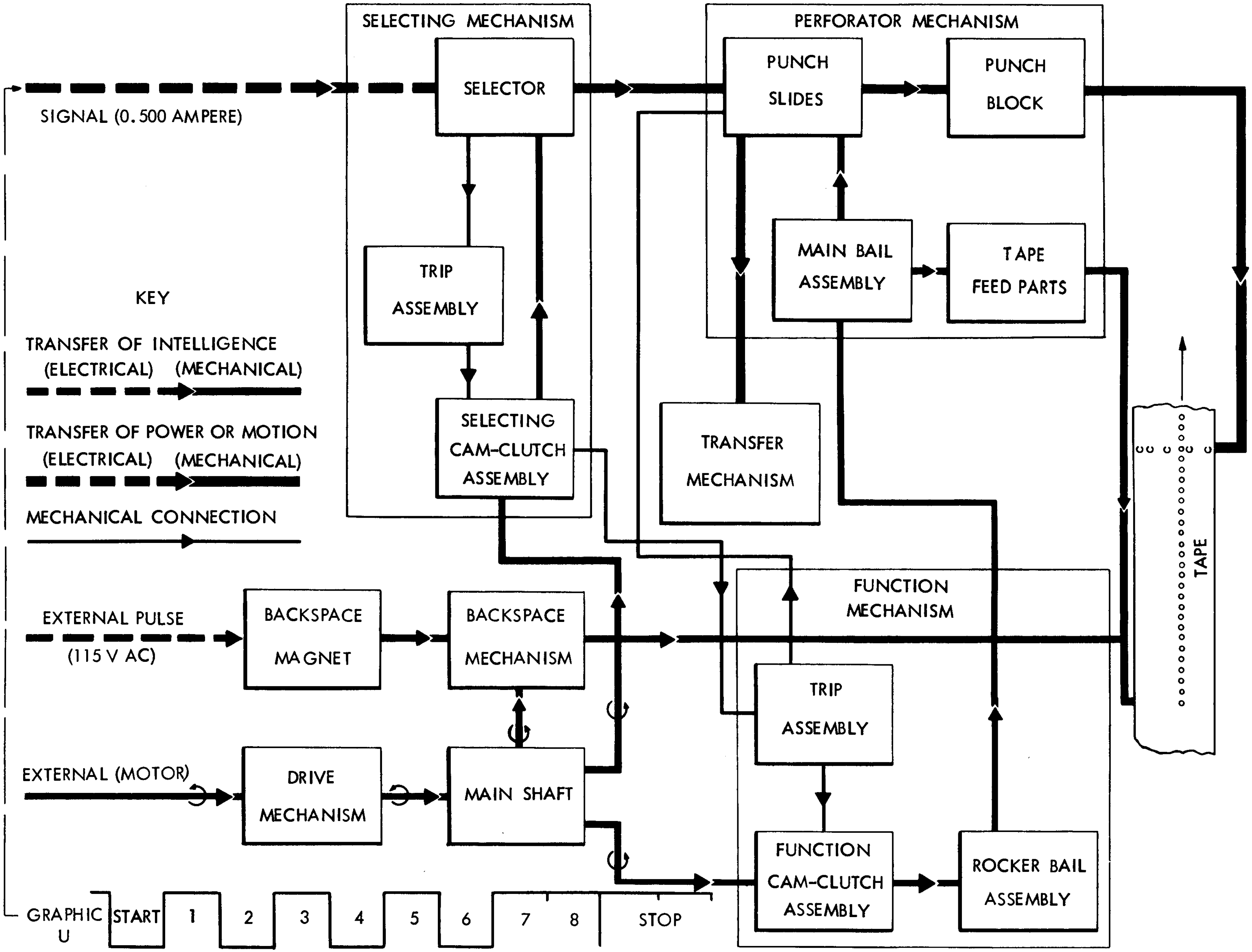


Figure 6 - Block Diagram of 35 Non-Typing Reperforator

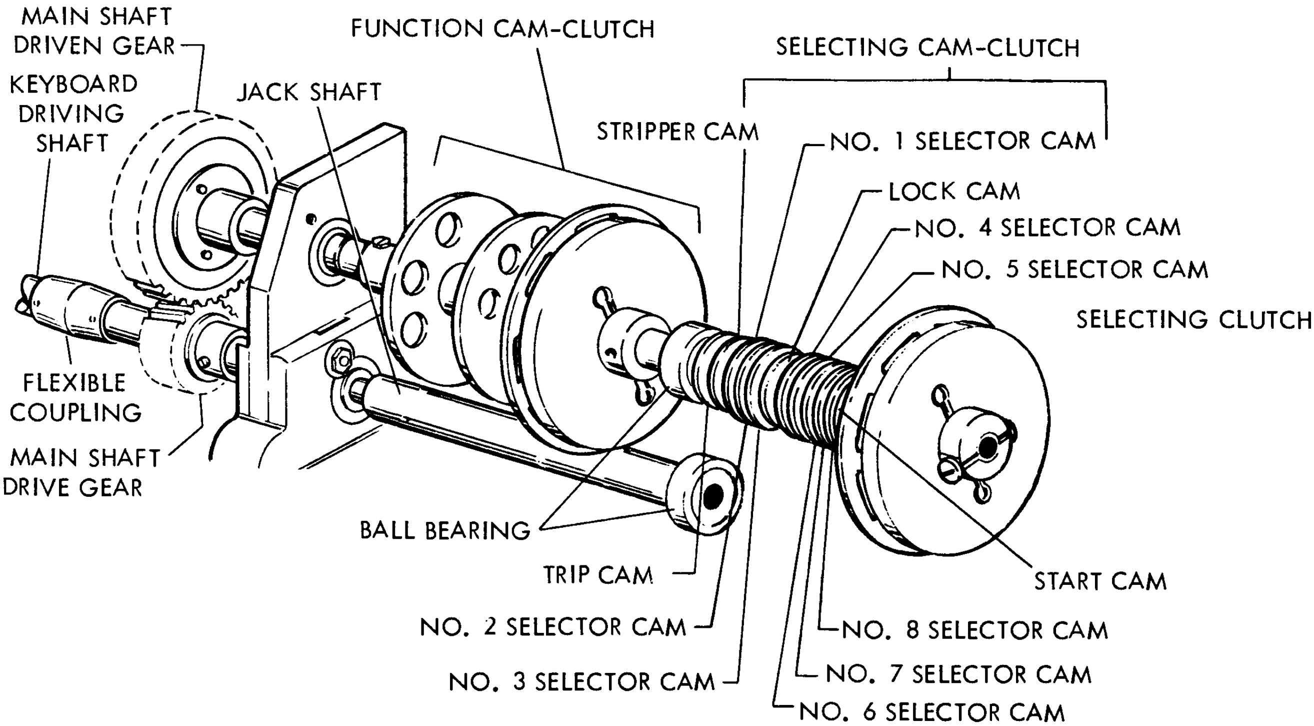


Figure 7 - Main Shaft and Jack Shaft

so that they can receive the code arrangement from the selector. The selecting cam-clutch is then disengaged and remains inoperative until the next code combination is received.

2.11 The function cam-clutch, driven by the main shaft, imparts motion to the rocker bail throughout the function cycle. The rocker bail transfers the motion to the perforator main bail which, in turn, distributes it to the punch slides and the tape feed parts. The punch slides, having received the arrangement from the selector, cause the punch pins to perforate code holes in the tape corresponding to the code pulses received by the selecting mechanism. Late in the function cycle, the tape feed parts advance the tape one character space. The function cam-clutch is then disengaged and remains stationary until again tripped by the selecting cam-clutch. The operations of the reperforator may overlap if the code combinations are being received fast enough. For example, while the perforating mechanism is punching the code combination and advancing the tape, the selecting mechanism may be processing the next code combination.

MOTION (Fig. 7)

2.12 Rotary motion from an external source is received by the main shaft, through the jack shaft (see Fig. 7) which rotates continuously as long as the unit is under power. Selecting and function cam-clutches distribute this motion to the selecting and function mechanisms as described below.

SELECTION

A. General

2.13 The selecting mechanism, made up of a selector (Par. 2.19), a clutch trip assembly (Fig. 8) and a cam-clutch (Fig. 7), translates the signaling code combinations into mechanical arrangements which govern the perforation of the tape. The electrical pulses comprising each code combination are applied to a magnet of the selector. The magnet, through an armature, controls the clutch trip assembly and the parts associated with translation. The cam-clutch transfers timed motion to the selector and also trips the function cam-clutch. By

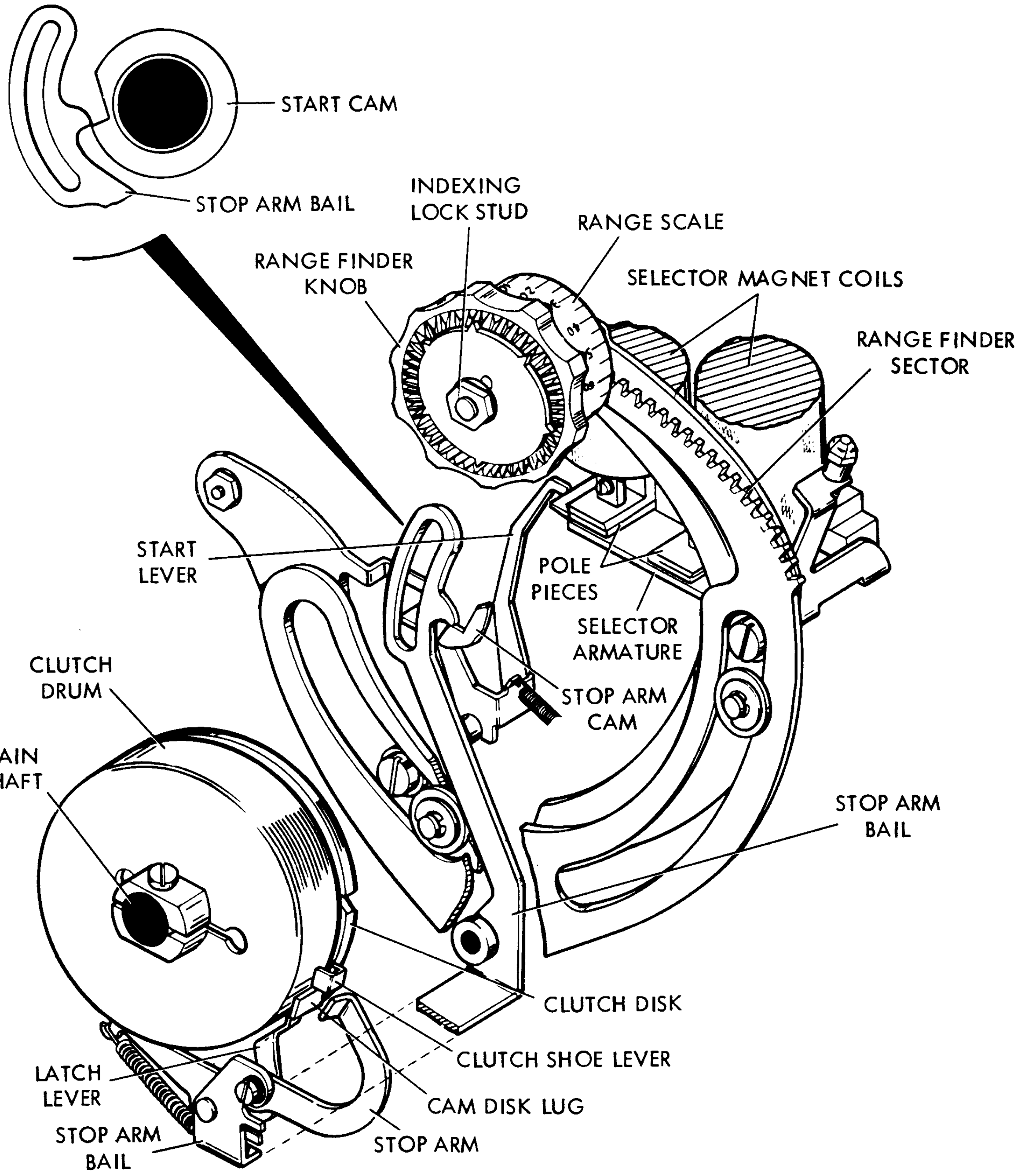


Figure 8 - Range Finder and Selecting Cam-Clutch Trip Assembly

means of a range finder assembly (Fig. 8), the selecting mechanism can be adjusted to sample the code bits at the most favorable time for optimum operation. The mechanical arrangements produced by the selecting mechanism are passed on to the punch slides which control the perforating mechanism (Par. 2.21).

B. Reception and Translation

Selecting Cam-Clutch and Trip Assembly (Fig. 7 and 8)

2.14 The selecting cam-clutch includes (from right to left in Fig. 7) the clutch, the start cam, the eighth, seventh, sixth, fifth and fourth pulse cams, the lock cam, the third, second and first pulse cams, the stripper cam and the trip cam. During the time in which the signal line current is closed (marking), the selector magnet coils are energized and hold the selector armature up against the magnet pole pieces (Fig. 8). In this position, the armature blocks the start lever, and the cam-clutch is held stationary between the stop arm and latch lever.

2.15 When a code combination is received, the start bit (spacing) de-energizes the magnet, and the selector armature under tension of its spring moves down out of the way of the start lever. The start lever turns clockwise under spring pressure and moves the stop arm bail into the indent of the start cam (Fig. 8). As the stop arm bail rotates about its pivot point, the attached stop arm is moved out of engagement with the clutch shoe lever. The selecting cam-clutch engages and begins to rotate counterclockwise. The stop arm bail immediately rides to the high part of its cam, where it remains to hold the start lever away from the armature while the intelligence bits of the code are received and processed by the selector (Par. 2.19 to 2.21).

2.16 When the stop bit at the end of the code combination is received, the armature is pulled up and blocks the start lever. Thus the stop arm bail is prevented from dropping into the low part of its cam, and the attached stop arm is held in position to stop the clutch shoe lever. When the clutch shoe lever strikes the stop arm, the inertia of a cam disk causes it to continue to turn until its lug makes contact with the clutch shoe lever. At this point, a latch lever drops into an indent in the cam disk, and the clutch is held disengaged until the next code combination is received.

Clutch operation (Fig. 9 and 10)

2.17 The clutch drum is attached to and rotates in unison with the main shaft (Fig. 7). In the disengaged position, as shown in Fig. 10, the clutch shoes do not contact the drum,

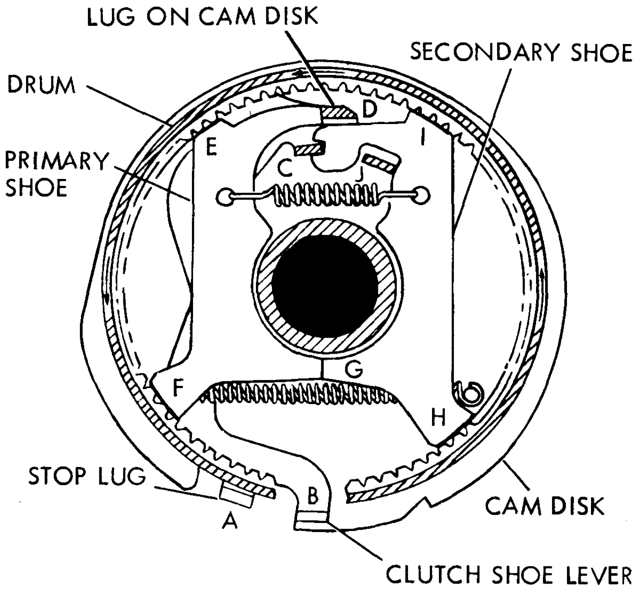


Figure 9 - Clutch, Engaged

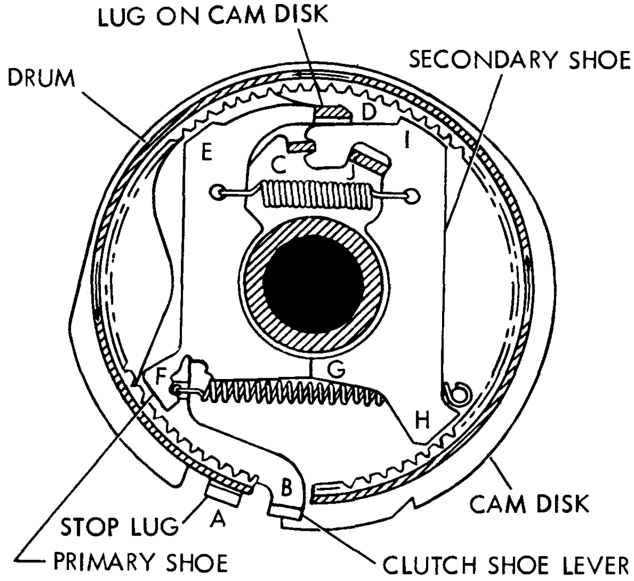


Figure 10 - Clutch, Disengaged

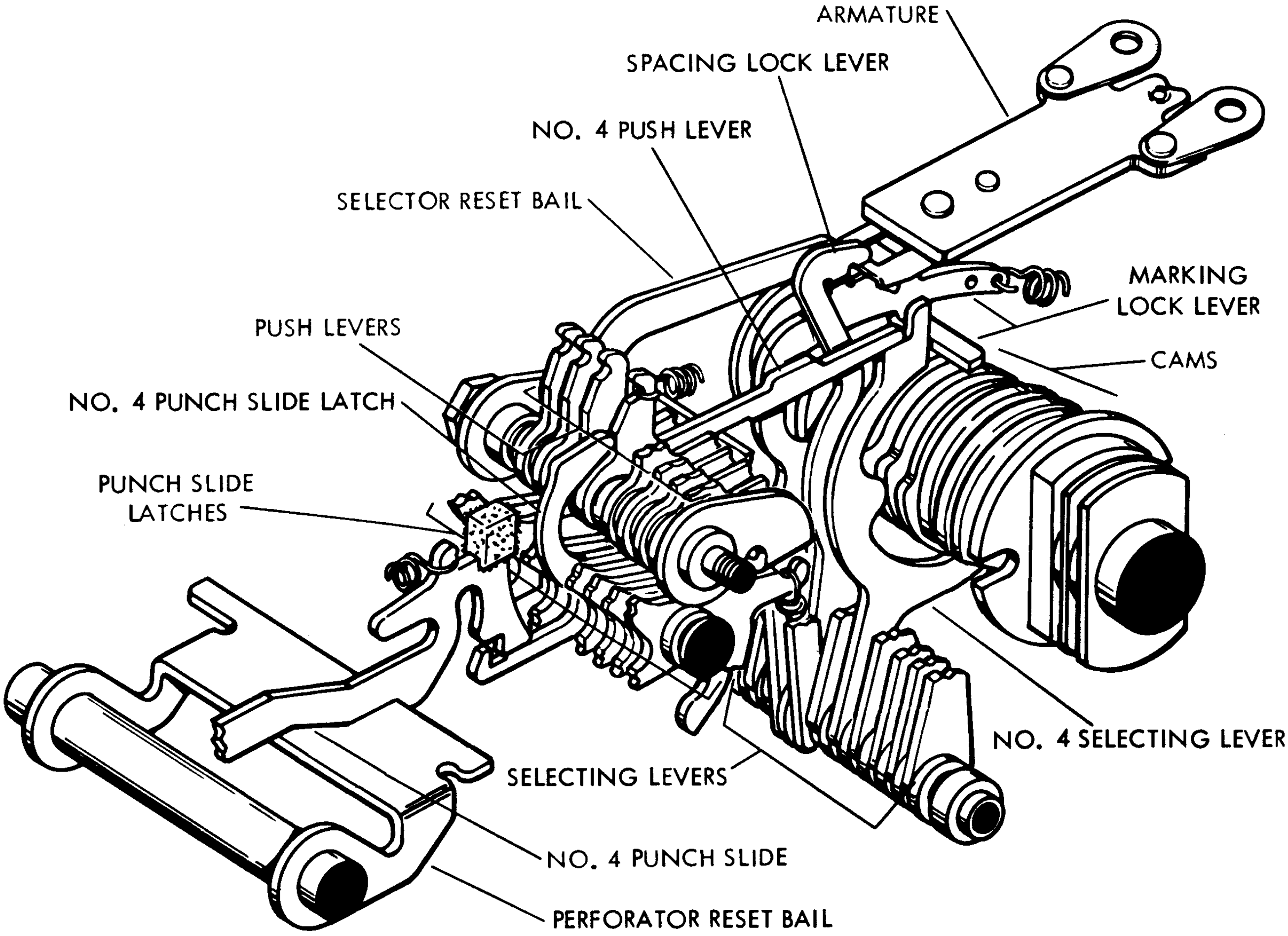


Figure 11 - Selector

and the shoes and cam disk are held stationary. Engagement is accomplished by moving the stop arm (Fig. 8) away from the clutch and thus releasing stop lug A and the lower end of shoe lever B (Fig. 9). The upper end of lever B pivots about its ear C, which bears against the upper end of the secondary shoe, and moves its ear D and the upper end of the primary shoe toward the left until the shoe makes contact with the notched inner surface of the rotating drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward so that it again makes contact with the drum at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point G. The lower end of the secondary shoe then bears against the drum at point H. The drum drives this shoe upward so that it again makes contact with the drum at point I. The forces involved are multipled 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.

2.18 Disengagement is effected when the lower end of shoe lever B strikes the stop arm (Fig. 10). Lug A and the lower end of the shoe lever are brought together (Fig. 2-7), 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 (Par. 2.16) and the cam is held in its stop position until the clutch is again engaged.

Selector Operation (Fig. 7, 8 and 11)

2.19 The selector assembly consists primarily of two magnet coils (Fig. 8), an armature and associated bails, levers and latches (Fig. 11). Eight linkages, each of which consists of a selecting lever, a push lever and a punch slide latch, link the selector cam with the punch slides. Since the linkages are identical, only the No. 4 is shown in its entirety in Fig. 11. As the selecting bits of the code combination are applied to the magnet, the cam actuates the selecting levers. When a spacing bit is received, a marking lock lever is blocked by the end of the armature, and a spacing lock lever swings to the right above the armature and locks it in the spacing position until the next signal transition occurs. Extensions on the marking lock lever prevent the selecting levers from following their cams. When a marking bit is received, the spacing lock lever is blocked by the end of the armature, and the marking lock lever swings to the right below the armature and locks it in the marking position until the next signal transition occurs. During this marking condition, the selecting levers are not blocked by the marking lock lever extensions, but are permitted to move against their respective cams. The selecting lever that is opposite the indent in its cam, while the armature maintains a marking condition, swings to the right, or selected, position, and the end of an associated push lever falls off a step on the selecting lever.

2.20 As the cam rotates, the selecting levers, together with any selected push levers, are moved to the left by the high part of their respective cams, where they remain until the next code combination is received. The unselected push levers remain to the right. When the next code combination is received, a selector reset bail, lifted by its cam (Fig. 11), strips the selected push levers from the selecting levers, and the push levers are returned to the right by their springs.

2.21 The selected push levers, in moving to the left, rotate associated punch slide latches counterclockwise (Fig. 11). Just before the eighth push lever is selected, the selecting cam through the function trip assembly causes the perforator reset bail to release the punch slides (Par. 2.25). The unselected latches retain their associated slides to the right, while the selected latches permit their slides to move to the left under spring tension. During the latter part of the function cycle, the reset bail returns the punch slides to their unselected position (Par. 2.30). The latches under spring tension return to their unselected position when the push levers are repositioned at the beginning of the next selecting cycle.

C. Orientation (Fig. 8)

2.22 For optimum performance, the selecting mechanism should be adjusted to sample the signaling code bits at the most favorable time. To make this adjustment, the operating margins are established through the range finder, which provides a means of varying the time of sampling. The obtaining of this optimum setting is referred to as orientation.

2.23 When the range finder knob (Fig. 8) is pushed inward and rotated, its attached range finder gear moves the range finder sector (which supports 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 marking and spacing lock levers. When an optimum setting is obtained, the range finder knob is released. Its inner teeth engage the teeth of the indexing lock stud and hold the range finder mechanism in position. The setting may be read on the range scale opposite a fixed index mark.

MOTION FOR PERFORATING AND FEEDING

A. General

2.24 The motion of the main shaft is conveyed to the perforating mechanism by the function mechanism, which is comprised of a cam-clutch (Fig. 7), a rocker bail (Fig. 13) and a clutch trip assembly (Fig. 12).

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

2.25 The trip assembly is shown in its unoperated condition in Fig. 12. A follower lever rides on a function trip cam which is part of the selecting cam-clutch (Fig. 7). Near the end of the selecting cycle, as the main shaft rotates counterclockwise, the high part of the cam pivots the follower lever (Fig. 12) which, through an attached adjusting arm, rotates a main trip lever counterclockwise. A reset bail trip lever attached to the main trip lever lowers the perforator reset bail and releases the punch slides (Par. 2.29); and an upper arm of the main trip lever moves out of the way of a clutch release, which falls against a down-stop and rotates a trip shaft counterclockwise. Immediately, the low part of the trip cam

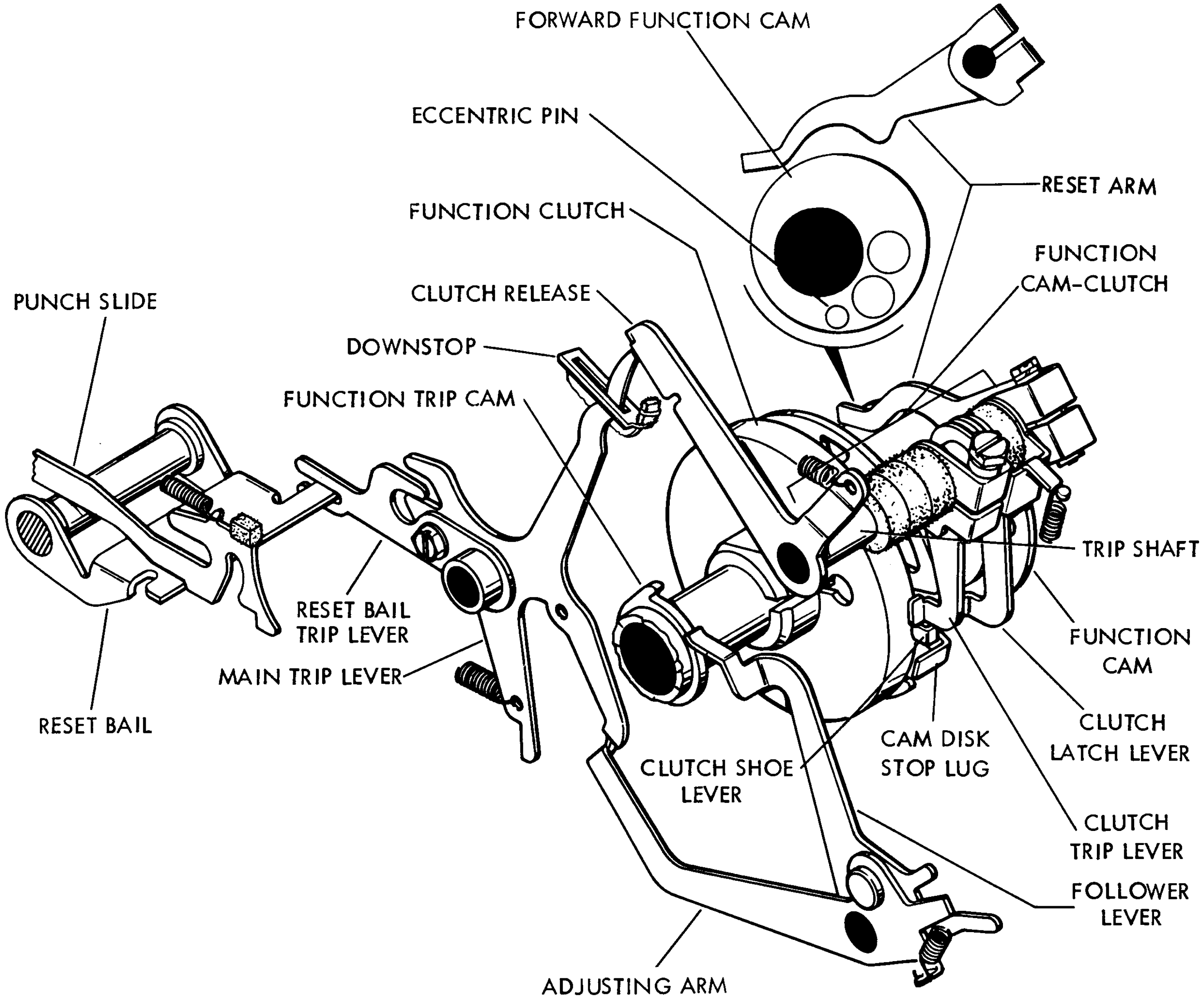


Figure 12 - Function Cam-Clutch and Clutch Trip Assembly

allows the follower lever to return to its unoperated position, and the upper arm of the main trip lever moves down against the release. When the trip shaft is rotated by the release, it moves an attached clutch trip lever out of engagement with the clutch shoe lever. The clutch engages, and the cam-clutch begins its cycle. The internal operation of the clutch is the same as that of the selector clutch described in Par. 2.17 and 2.18 of this section.

2.26 About midway through the function cycle, an eccentric pin on the function cam lifts a reset arm, which rotates the trip shaft clockwise. The release is moved up and allows the main trip lever to fall against the adjusting arm and raise the reset bail. The eccentric pin then moves out from under the reset arm, and the release is permitted to return to its unoperated position against the main trip lever. When the cam-clutch assembly completes its cycle, the clutch shoe lever strikes the trip lever, and the clutch is disengaged.

C. Rocker Bail (Fig. 13)

2.27 The function cam and the rocker bail translate the rotation of the shaft into simple harmonic motion which the bail transfers to the perforating mechanism (Fig. 13).

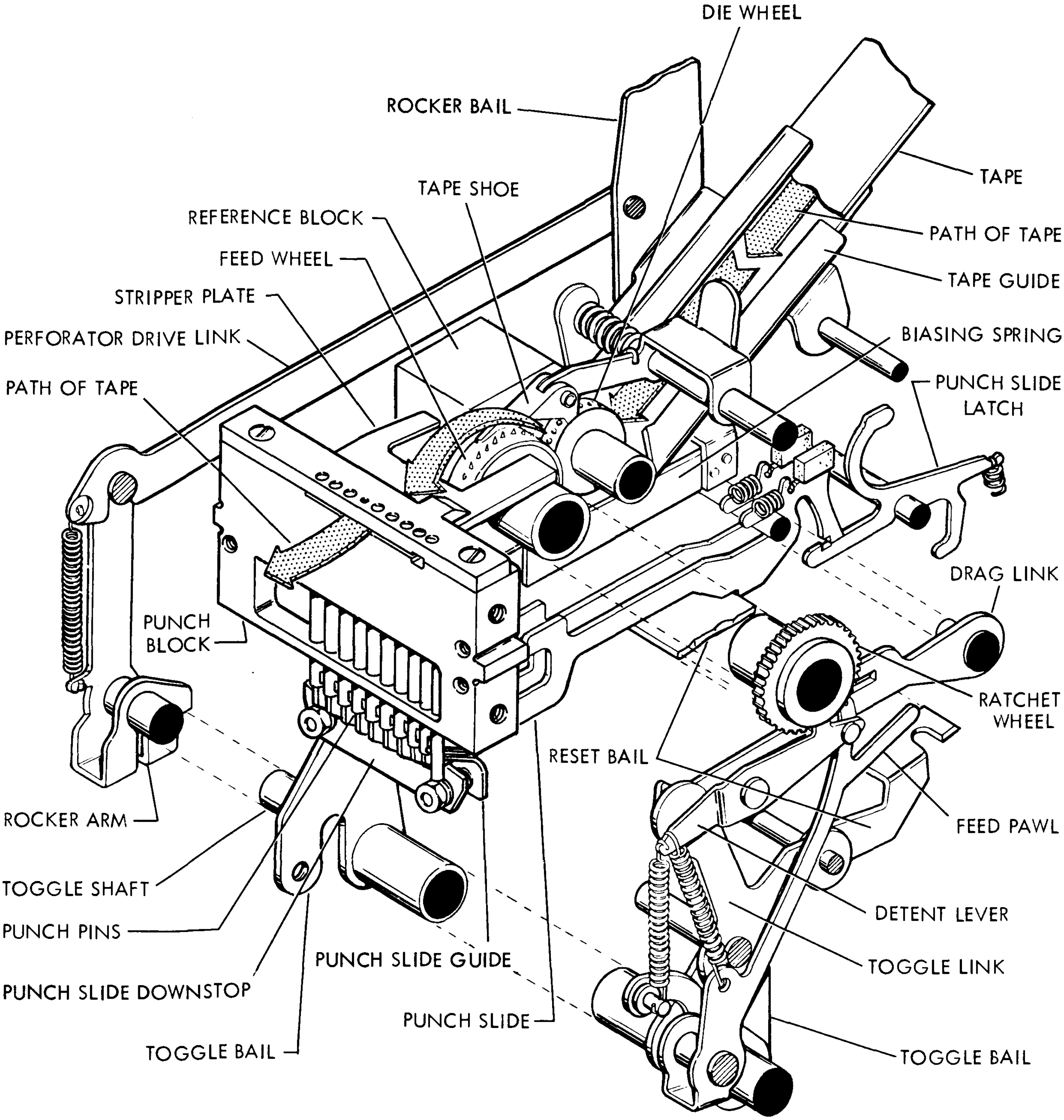


Figure 13 - Perforating Mechanism

Each function cycle, the function cams bear against the rollers and cause the bail to rock to the left during the first part of the cycle and then back to its home position during the latter part of the cycle.

TAPE PERFORATING AND FEEDING (Fig. 13)

A. General

2.28 The perforating mechanism rolls the tape between a feed wheel and a die wheel, which does not perforate the feed hole but merely regulates the amount of tape feed. The punch perforates round holes corresponding to the code combinations received from the signal line and perforates a smaller feed hole positioned between the third and fourth intelligence levels. Intelligence is received from the selecting mechanism by the punch slides, which select the proper punch pins in a punch block assembly (Fig. 13). Motion from the rocker bail is distributed to the pins and the tape feed parts by a main bail assembly, which includes a toggle bail, a toggle shaft, a slide post, toggle links, drag links and the punch slide reset bail.

B. Perforating

2.29 As described in Par. 2.25, near the end of the selecting cycle, the reset bail is lowered and releases the eight punch slides (Fig. 13). The selected slides move to the left, and the unselected slides are retained to the right by their latches. In the selected position, a projection of each slide extends over the slide post. Since a feed hole is perforated every operation, the punch slide associated with the feed hole punch pin is designed so that it is always in a selected position. During the first part of the function cycle, the rocker bail moves to the left and, by means of a drive link and rocker arm, rotates the toggle shaft and bail counterclockwise. Toggle links attached to the front and rear of the bail lift the slide post and move the reset bail to the left. The selected slides are carried upward by the post and force the associated pins through the tape. The slides thus become an integral part of the main bail assembly during the perforating stroke. Approximately midway through the function cycle, the function trip assembly lifts the reset bail.

2.30 During the last half of the cycle, the toggle bail is rotated clockwise, pulling the slide post down and lowering the selected punch slides. The punch slides, which engage notches in their respective punch pins, pull the punch pins down below the tape. The main bail assembly and the selected punch slides and their associated punch pins move as a unit during the perforating stroke, both up and down. The punch pins are positively driven and retracted to produce the fully perforated tape.

C. Feeding

2.31 Tape feeding is accomplished after perforation during the last half of each function cycle. The tape is threaded down through a tape guide and then up between a feed wheel and die wheel (Fig. 13). A feed pawl, driven by the toggle bail, acts upon a ratchet and rotates the feed wheel which, by means of sharp pins and a slot in the die wheel, advances the tape one character at a time. A detent with a roller that rides on the ratchet holds the feed wheel and tape in position during perforation. The detent and feed pawl springs are so positioned that the pressure of the detent on the ratchet is high during the first half of the perforation, but is low during idling and the last half of the cycle to facilitate tape threading and feeding. A tape shoe retains the tape on the feed wheel, and a biasing spring holds it back against a reference block so that the feed holes are punched a constant distance from the edge. The tape is stripped from the feed wheel by a stripper plate, passes into the punch block where it is perforated and finally emerges at the left.

D. Power Drive Backspace Mechanism

2.32 The power drive backspace mechanism is used to reverse the tape feed to delete errors in perforated information. The application of an external pulse (115 V AC) initiated by a backspace key on an associated keyboard unit moves the perforated tape one code space to the right with each pulse. The mechanism (Fig. 2) consists of a magnet, an eccentric drive on the front end of the main shaft, and a feed assembly at the punch block.

2.33 When the magnet is energized, the armature bail is pulled downward. An extension on the bail disengages a drive link latch, which drops, engaging a notch on the eccentric arm. As the main shaft moves the eccentric arm to the left, a bell crank is depressed, contacting the perforator feed pawl and disengaging it. The backspace feed pawl engages the feed wheel ratchet and rotates the feed mechanism counterclockwise. When the magnet is de-energized, the drive link is disengaged from the eccentric arm, which slides freely along the pivot post of the drive link.

35 NON-TYPING REPERFORATOR

LUBRICATION

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to include recent engineering changes.

1.02 This section provides lubrication information for the 35 Non-Typing Reperforator. General areas of the equipment are shown by photographs. Specific points to receive lubricant are indicated by line drawings and descriptive text. The symbols in the text indicate the following directions:

O	Apply one drop of oil.
O2	Apply two drops of oil.
O3	Apply three drops of oil, etc.
G	Apply thin coat of grease.
SAT	Saturate with oil. (Felt washers, etc.)

KS7470 oil and KS7471 grease should be used as shown above. Beacon 325 grease (TP195298) should be used where indicated on drawings.

1.03 The equipment should be thoroughly lubricated, but over-lubrication which might allow oil to drop or grease to be thrown on other parts should be avoided. Special care should be exercised to prevent lubricant from getting between armature and pole faces or between electrical contact points.

1.04 The following general instructions supplement the specific lubricating points illustrated on subsequent pages. Where specific instructions are applicable to one-shaft or two-shaft units, this is noted in the instructions.

Apply one drop of oil to all spring hooks.

Apply a light film of oil to all cam surfaces.

Apply a thick coat of grease to all gears.

Saturate all felt washers, oilers, etc.

Apply oil to all pivot points.

Apply oil to all sliding surfaces.

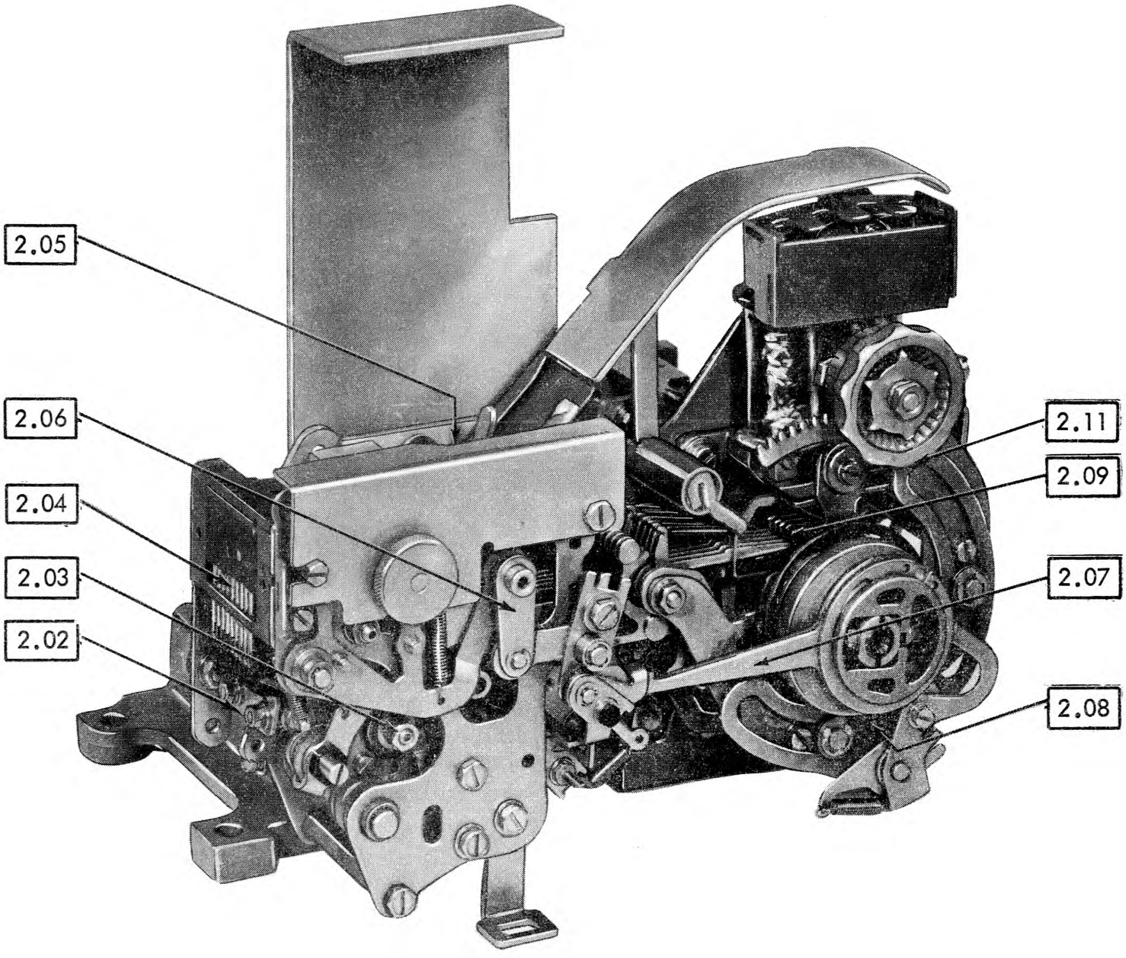
1.05 All equipment should be lubricated before being placed in service or prior to storage. After a few weeks of service, relubricate to make certain that all specified points have received lubricant. Thereafter, the following schedule should be adhered to:

Operating Speed	Lubrication Interval
60 W.P.M.	3,000 hours or 1 year*
75 W.P.M.	2,400 hours or 9 months*
100 W.P.M.	1,500 hours or 6 months*

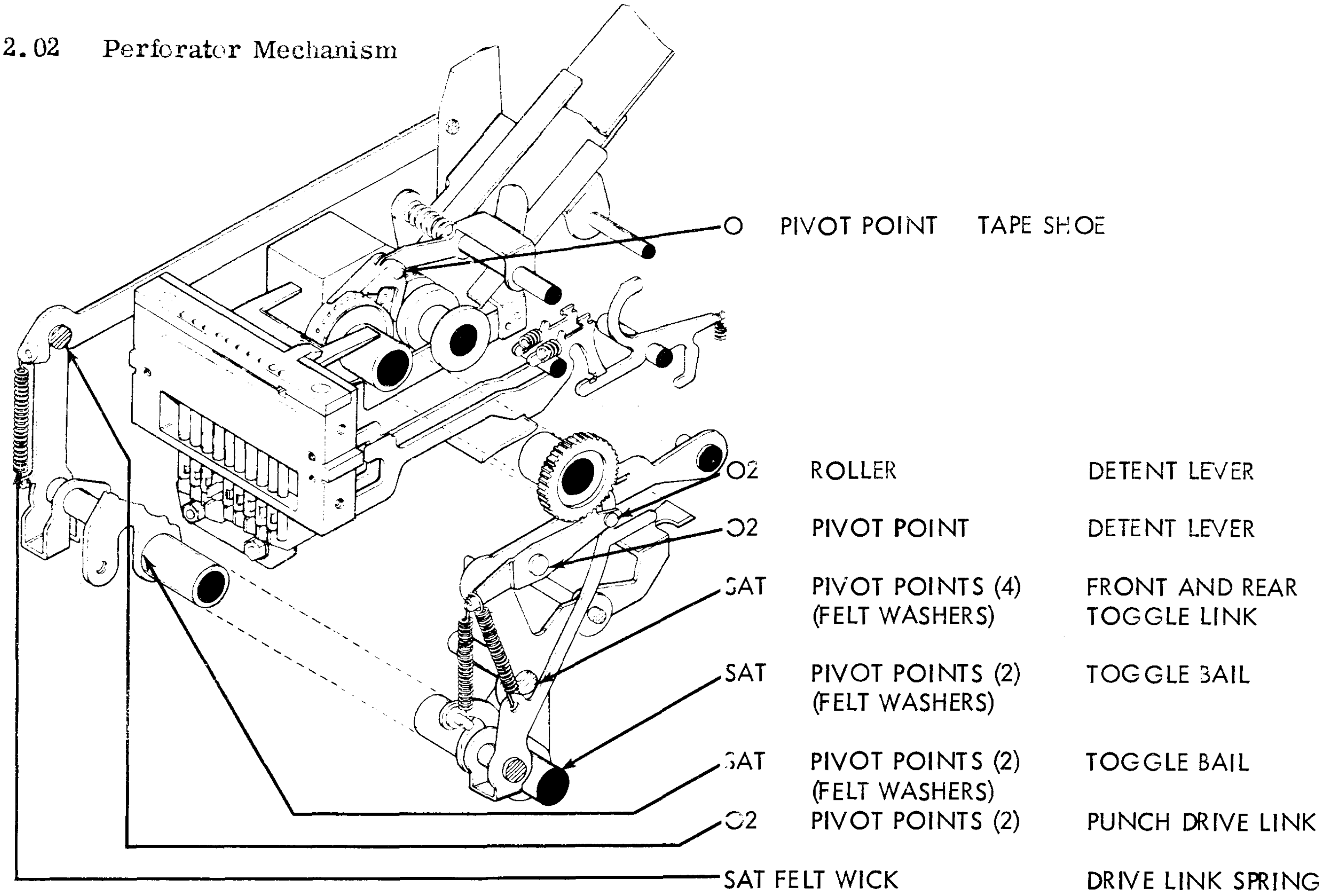
*Whichever comes first.

2. LUBRICATION

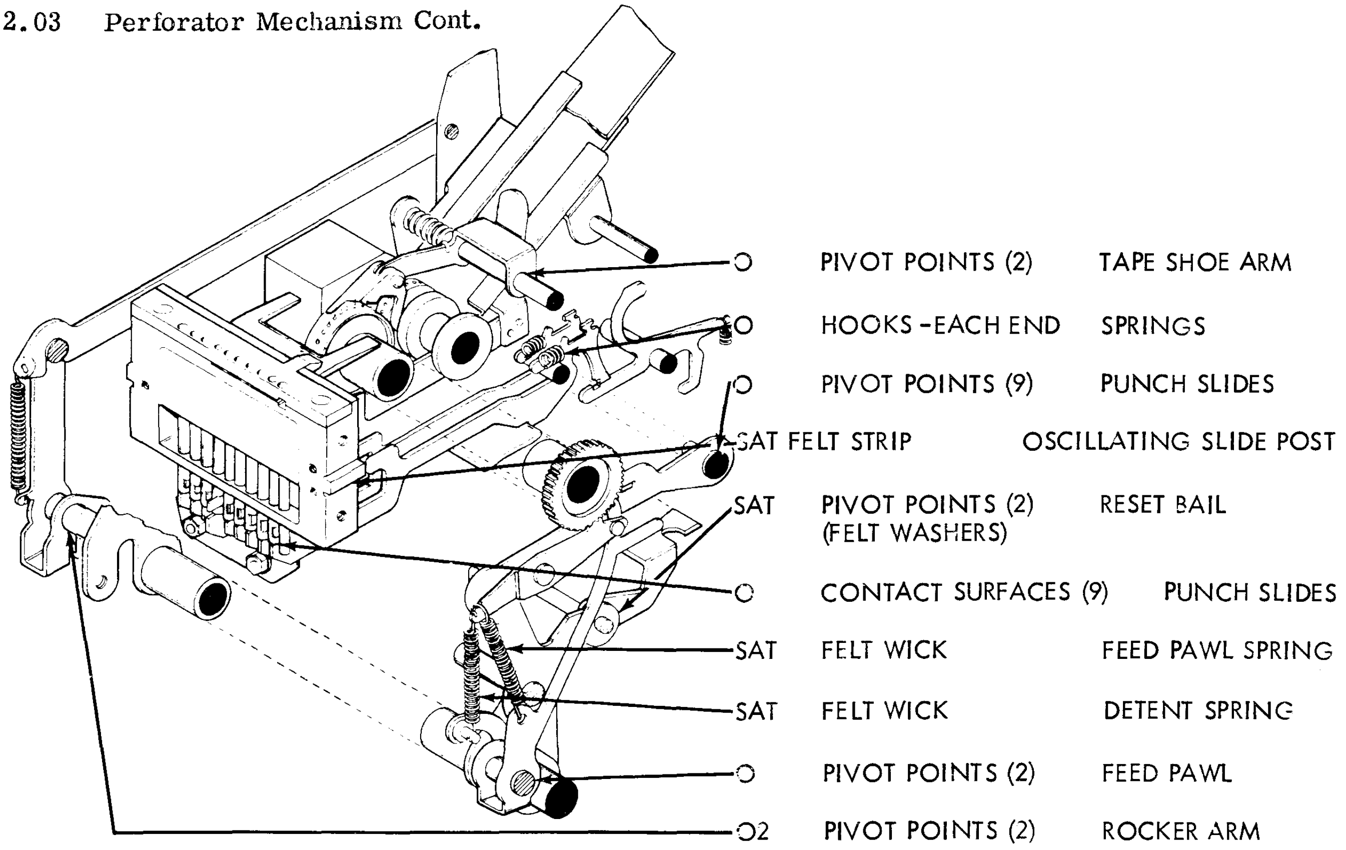
2.01 Non-Typing Reperforator (Left Front View)



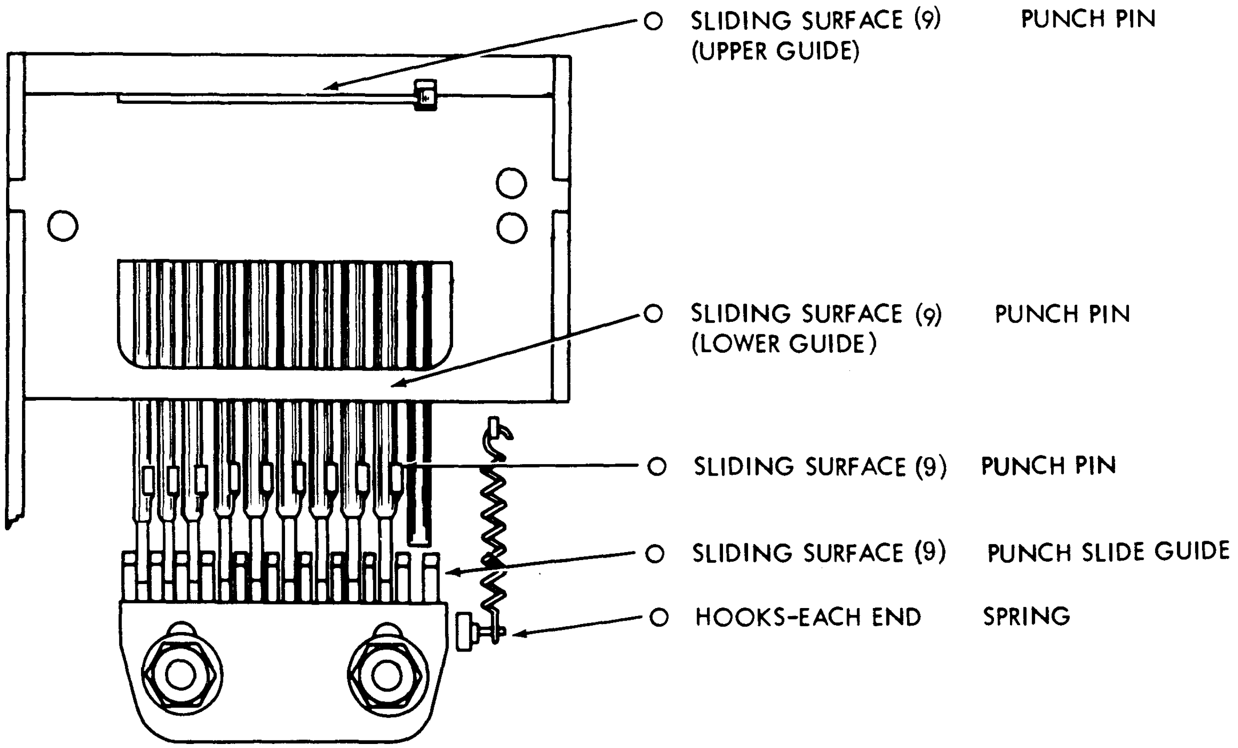
2.02 Perforator Mechanism



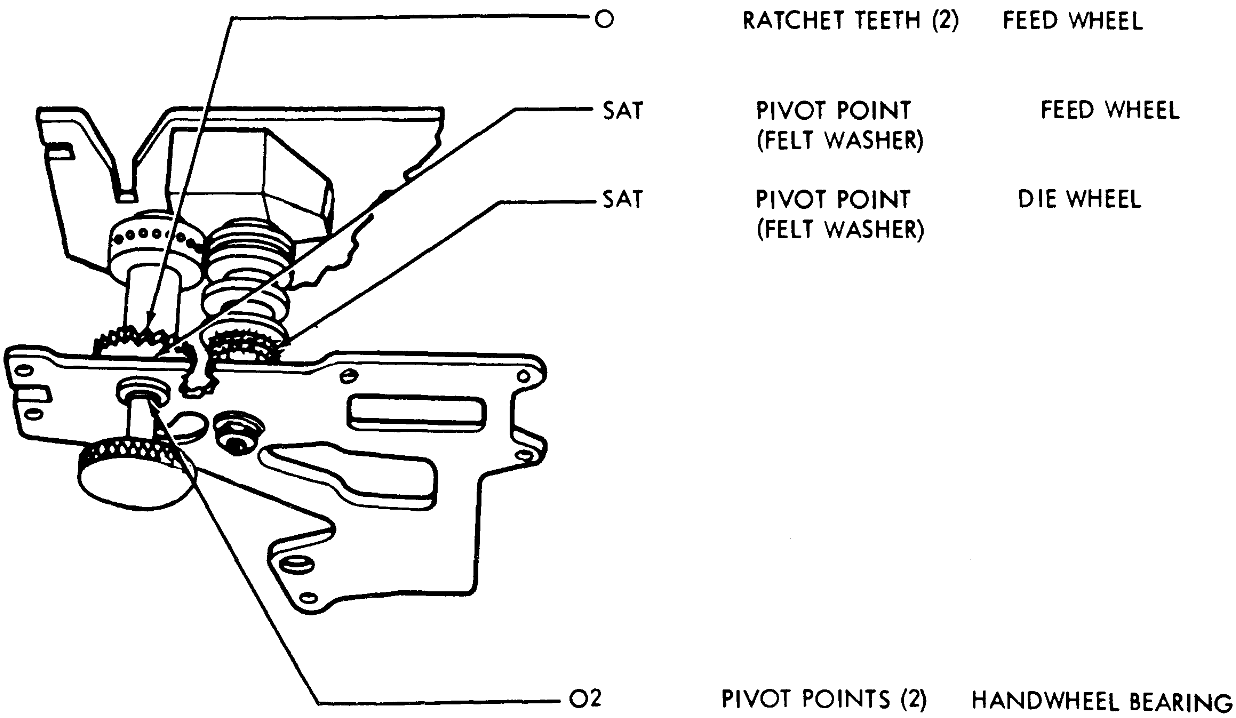
2.03 Perforator Mechanism Cont.



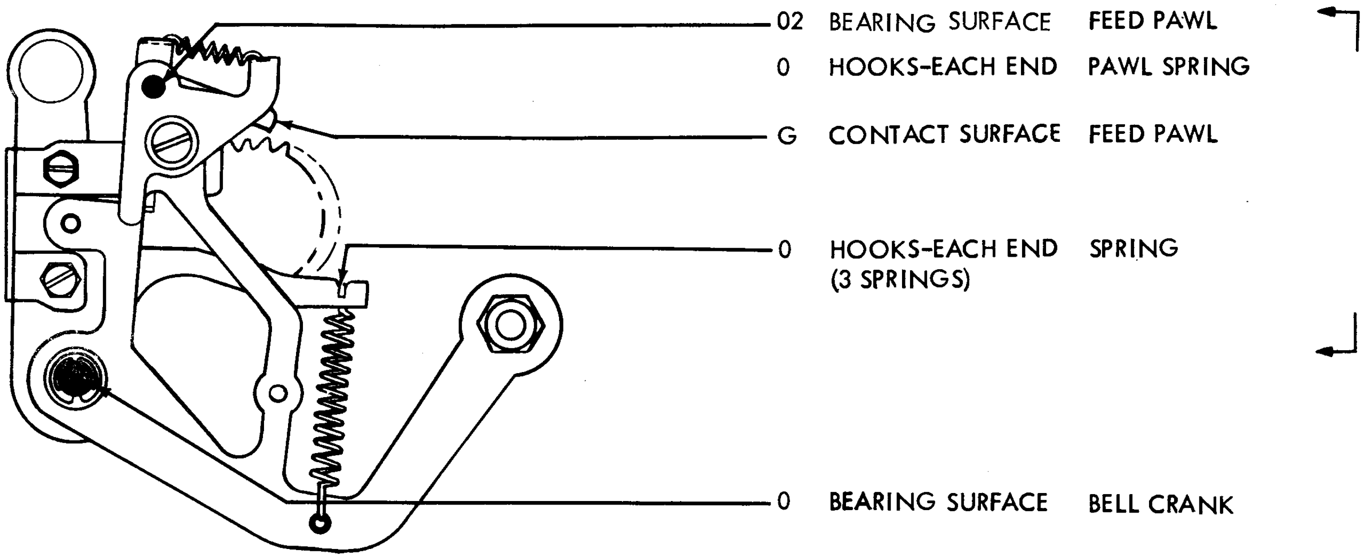
2.04 Punch Mechanism



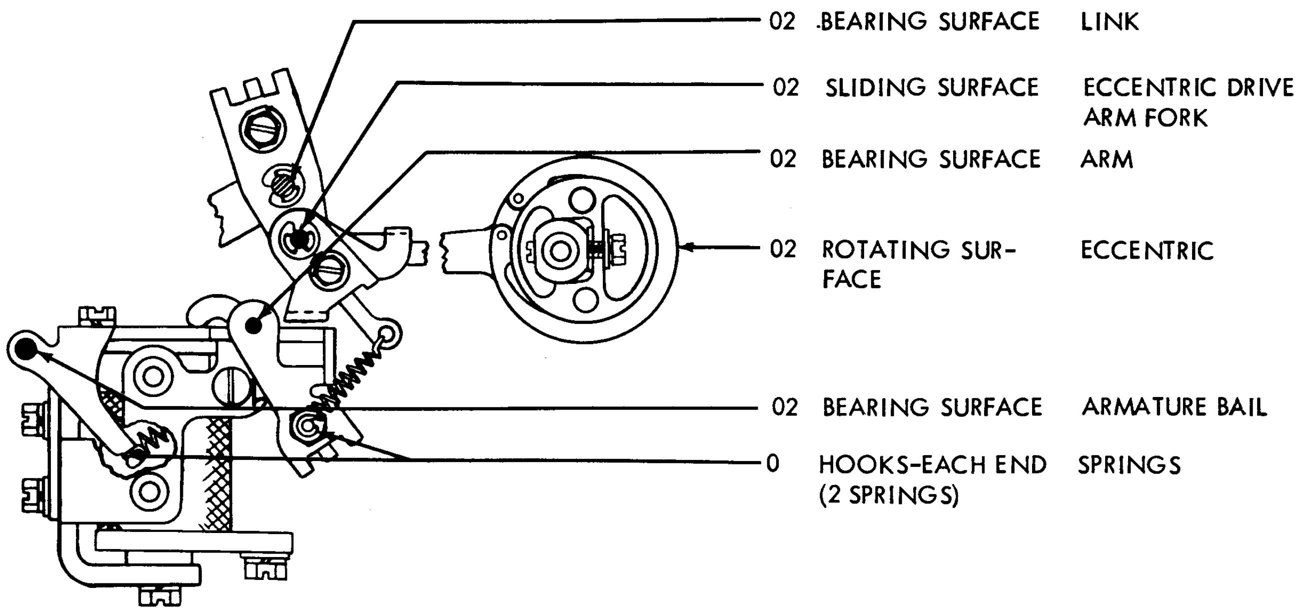
2.05 Feed Mechanism



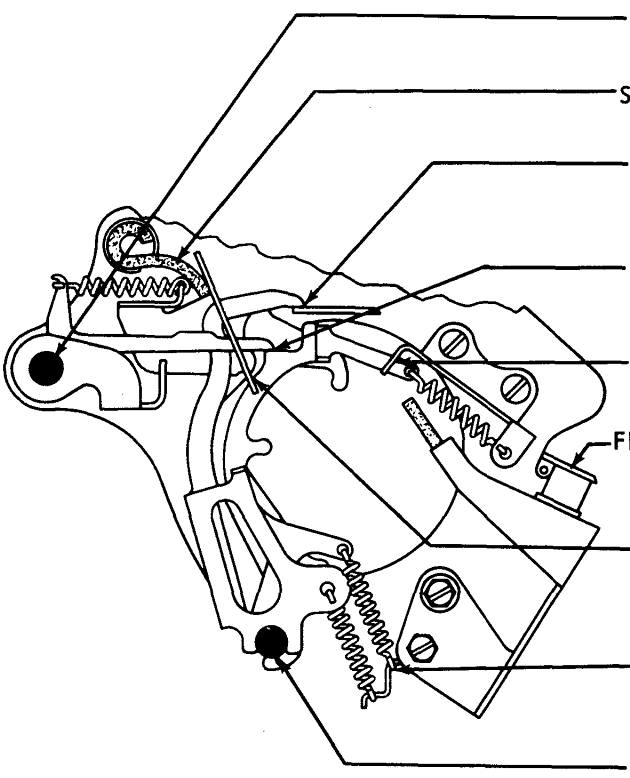
2.06 Manual Backspace Mechanism



2.07 Power Drive Backspace Mechanism

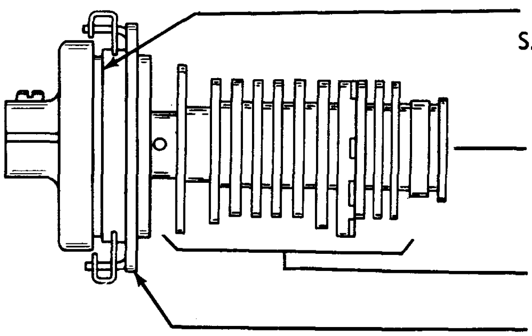


2.08 Selector Mechanism



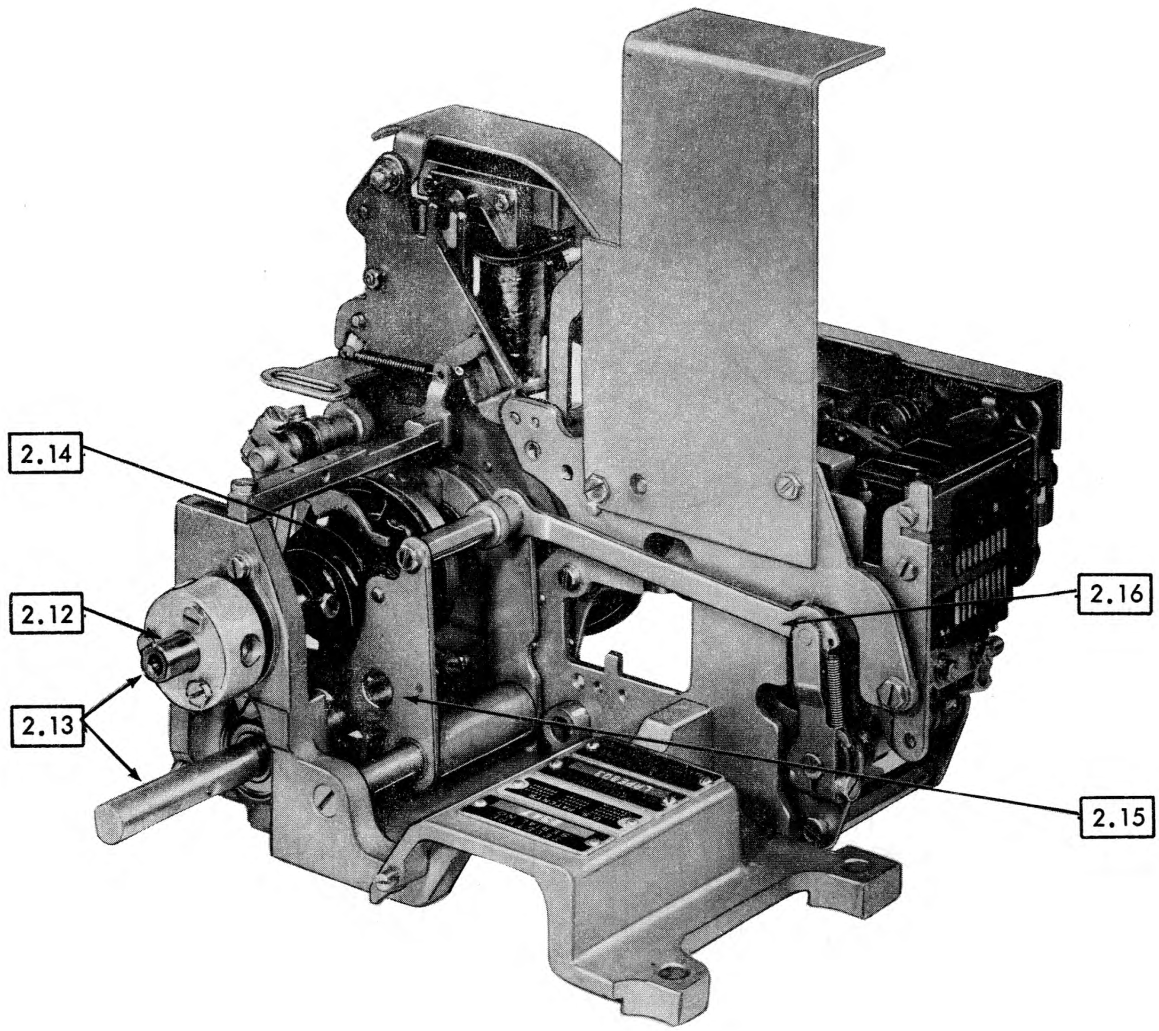
02	BEARING GUIDE SLOTS (8 SLOTS)	PUSH LEVER GUIDE BEARING
SAT	FELT WICK	SELECTOR WICK
02	ENGAGING SURFACE	TIP OF ARMATURE EXTENSION
02	ENGAGING SURFACES (5 LEVERS)	PUSH LEVERS
02	GUIDE SLOT	MARKING LOCK LEVER
FILL	OIL CUP	SELECTOR LUBRICATOR ASSEMBLY
02	GUIDE SLOTS	SELECTOR AND PUSH LEVERS
0	HOOKS - EACH END (14 SPRINGS)	SELECTOR SPRINGS
02	BEARING GUIDE SLOTS	SELECTOR AND LOCK LEVER GUIDE SLOTS

2.09 Selector Cam-Clutch

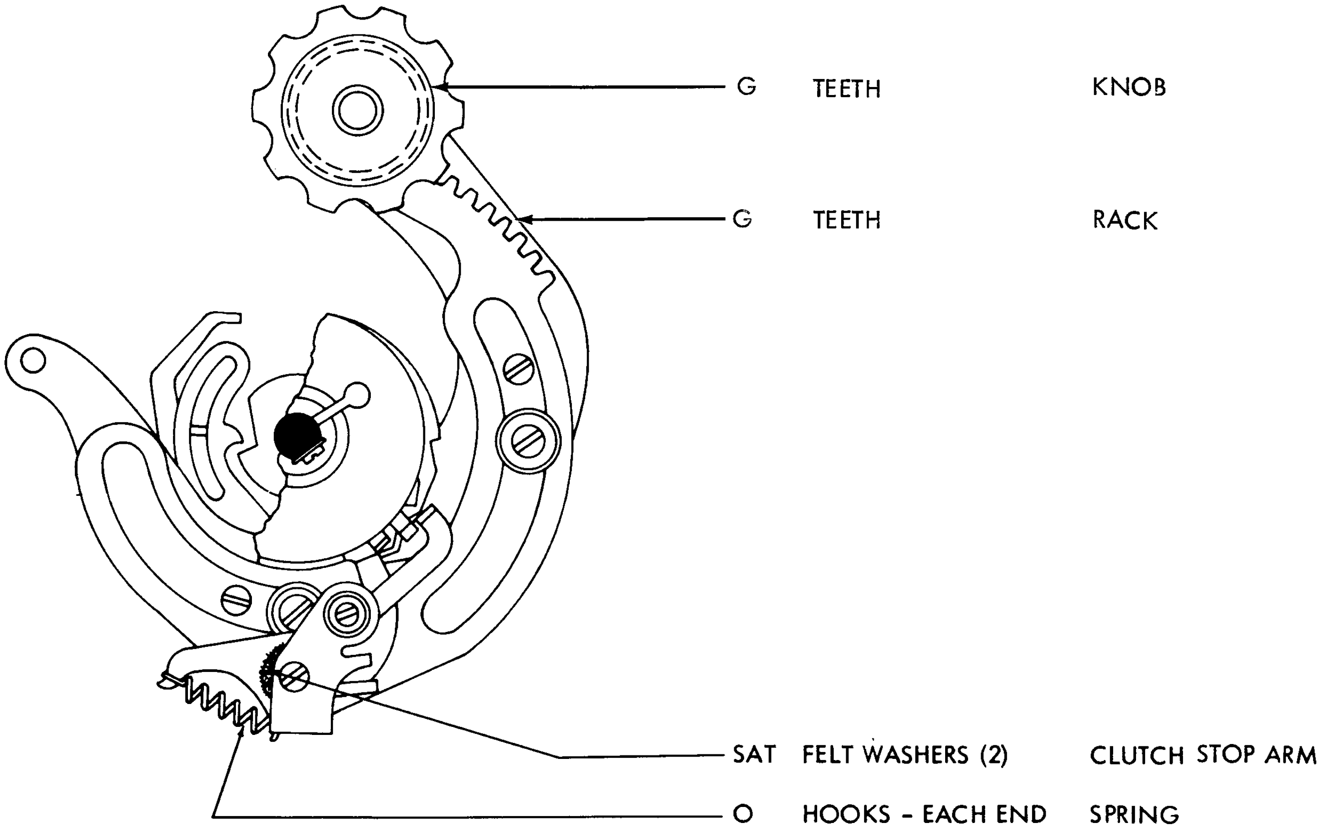


04 SAT	INTERNAL MECHANISM FELT WICK	SELECTOR CLUTCH
02	OIL HOLES - 2	CAM SLEEVE BEARING
02	CAMMING SURFACES	SELECTOR CAM SLEEVE
02	CAMMING SURFACE	CLUTCH DISK

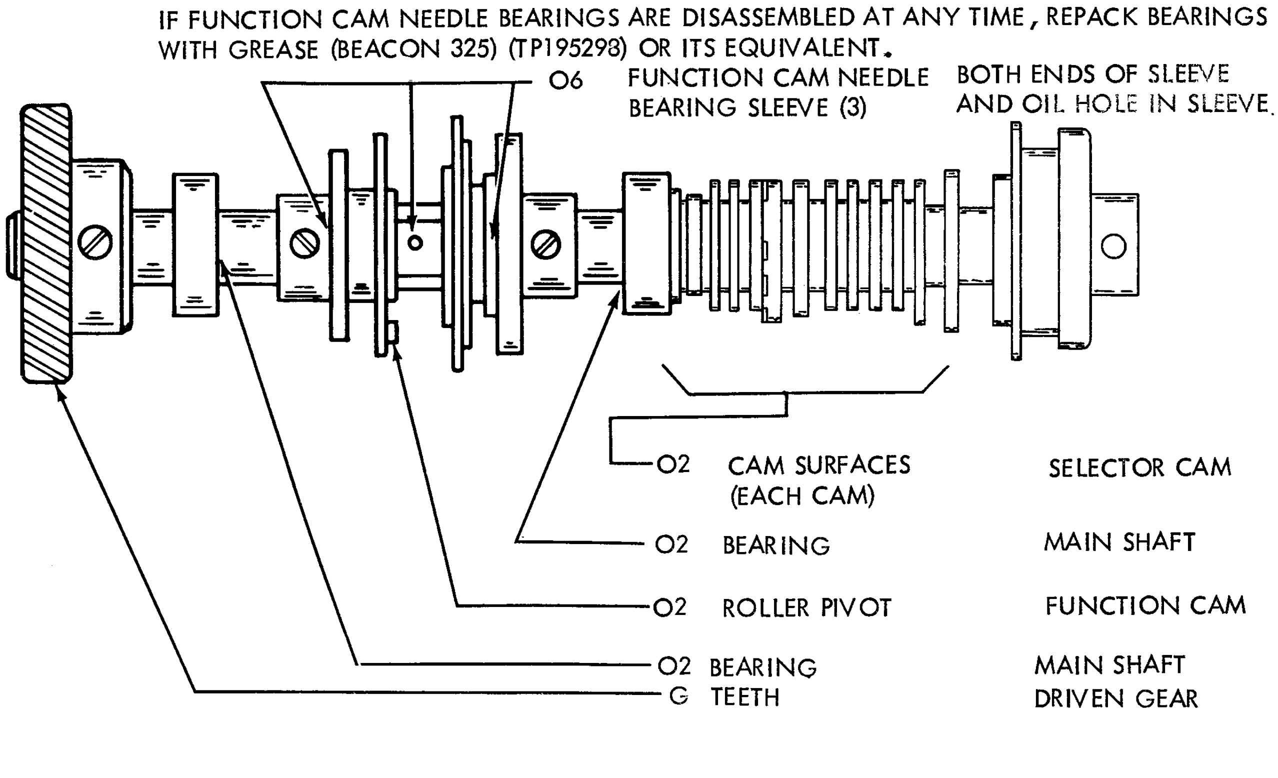
2.10 Non-Typing Reperforator (Left Rear View)



2.11 Range Finder Mechanism

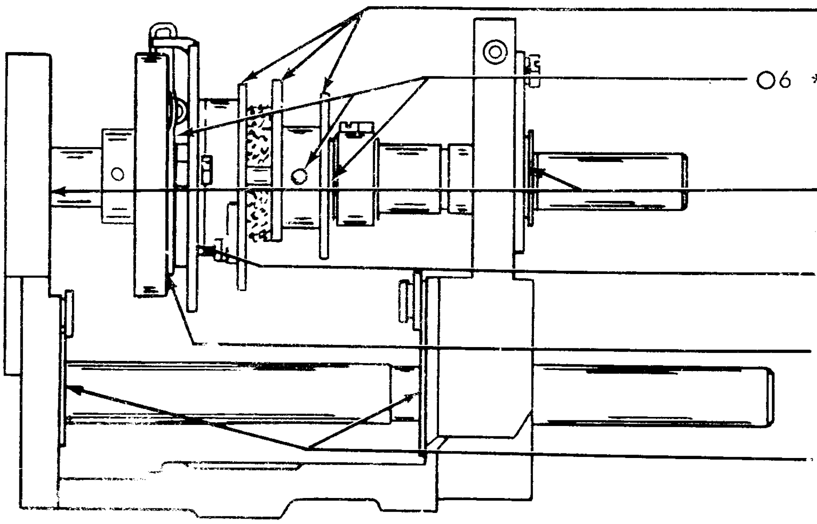


2.12 Main Shaft Mechanism



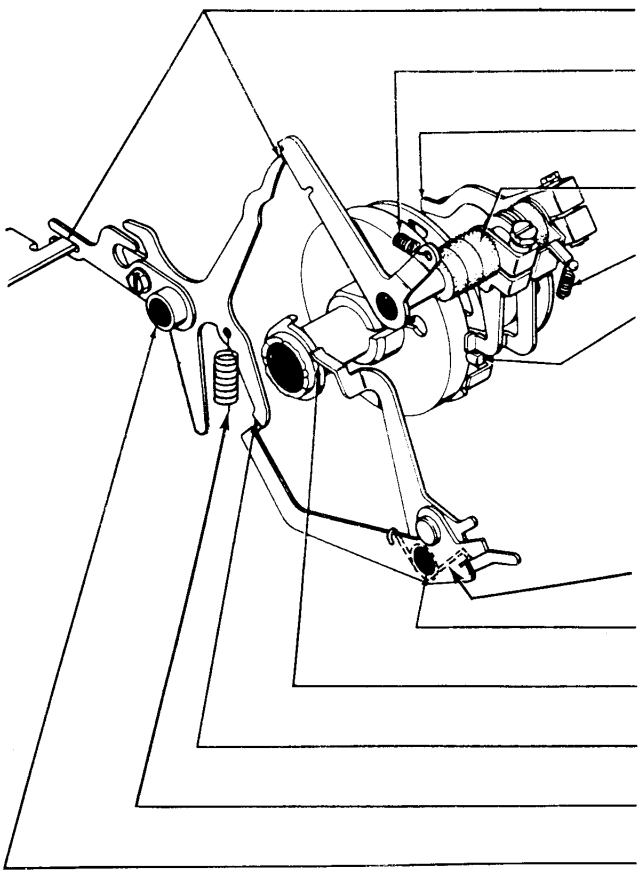
2.13 Main and Jack Shaft Mechanisms (Two Shaft Units)

*IF FUNCTION CAM NEEDLE BEARINGS ARE DISASSEMBLED AT ANY TIME, REPACK BEARINGS WITH GREASE (BEACON 325) (TP195293) OR ITS EQUIVALENT.



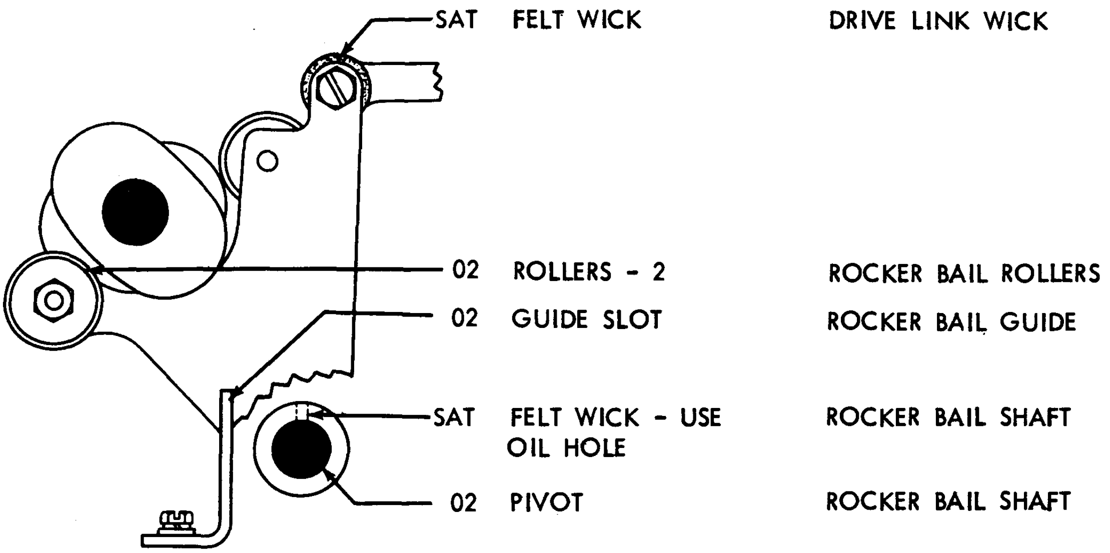
G	CAMMING SURFACES (2)	FUNCTION CAM
O6	*FUNCTION CAM NEEDLE BEARING SLEEVE (3)	BOTH ENDS OF SLEEVE AND OIL HOLE IN SLEEVE
O2	BEARING SURFACES	BALL BEARINGS (2)
O	CAMMING SURFACE	CLUTCH CAM DISK
O	BEARING SURFACE	FUNCTION CLUTCH DRUM
O2	BEARING SURFACES	BALL BEARINGS (2)

2.14 Function Cam-Clutch Trip Mechanism

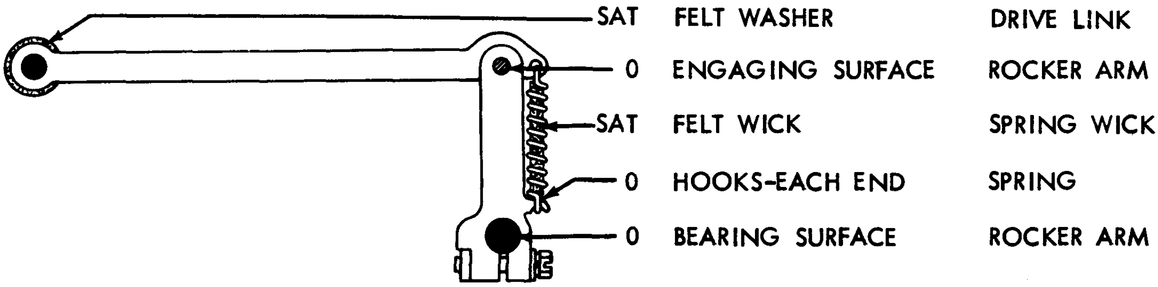


O	CONTACT POINTS (2)	MAIN TRIP LEVER
O	HOOKS - EACH END	CLUTCH RELEASE SPRING
G	CONTACT SURFACE	RESET LEVER
SAT	FELT WASHERS	CLUTCH TRIP SHAFT
O	HOOKS - EACH END	LATCH LEVER SPRING
O	CONTACT SURFACE	CLUTCH STOP LUG
O	HOOKS - EACH END	FOLLOWER LEVER SPRING
O	PIVOT POINT	TRIP CAM FOLLOWER LEVER
O	CONTACT SURFACE	TRIP CAM FOLLOWER LEVER
O	CONTACT POINT	MAIN TRIP LEVER
O	HOOKS - EACH END	MAIN TRIP LEVER SPRING
O	PIVOT POINT	MAIN TRIP LEVER

2.15 Rocker Bail Mechanism



2.16 Rocker Arm



35 NON-TYPING REPERFORATOR

DISASSEMBLY AND REASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 Disassembly as outlined in this section covers a procedure for removing the principal sub-assemblies which make up the unit.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication and adjustments can be accomplished simply by removing the subject component from the cabinet. If possible, disassembly should be confined to sub-assemblies, which can, in some cases, be removed without disturbing adjustments. When reassembling the sub-assemblies, be sure to check all associated adjustments, clearances and spring tensions.

1.04 If a part that is mounted on shims is removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted.

1.05 Retaining rings are made of spring steel and have a tendency to release suddenly when being removed. Loss of these retainers can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.06 Avoid loss of springs in disassembly by holding one spring loop with the left hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.07 Raise cabinet lid or enclosure cover (after removing the control panel bezel and copy-light plug) and remove the typing unit from its base by removing the four screws that secure it to its keyboard or base. Remove the cable plug connector from the side frame. Lift the typing unit off.

Note: On sets equipped with a form supply container on the rear of the cabinet, rearward foot extensions should be in position on the cabinet. This prevents the cabinet from tilting when the typing unit is removed.

1.08 Assuming that the typing unit and keyboard base have been removed from the cabinet, remove the non-typing reperforator from the base as follows:

(a) Disconnect the wires from the selector magnets.

(b) Loosen the set screws on the coupling located on the rear of the shaft. Slide the coupling and/or short shaft so as to disengage it. Remove the screw which fastens the TP170199 anchor bracket to the base. Remove the three screws which secure the reperforator to the base. Carefully lift the reperforator upward and tilt to one side.

(c) Disconnect the wires from the backspace magnet, and remove the unit from the base.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a sub-assembly from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

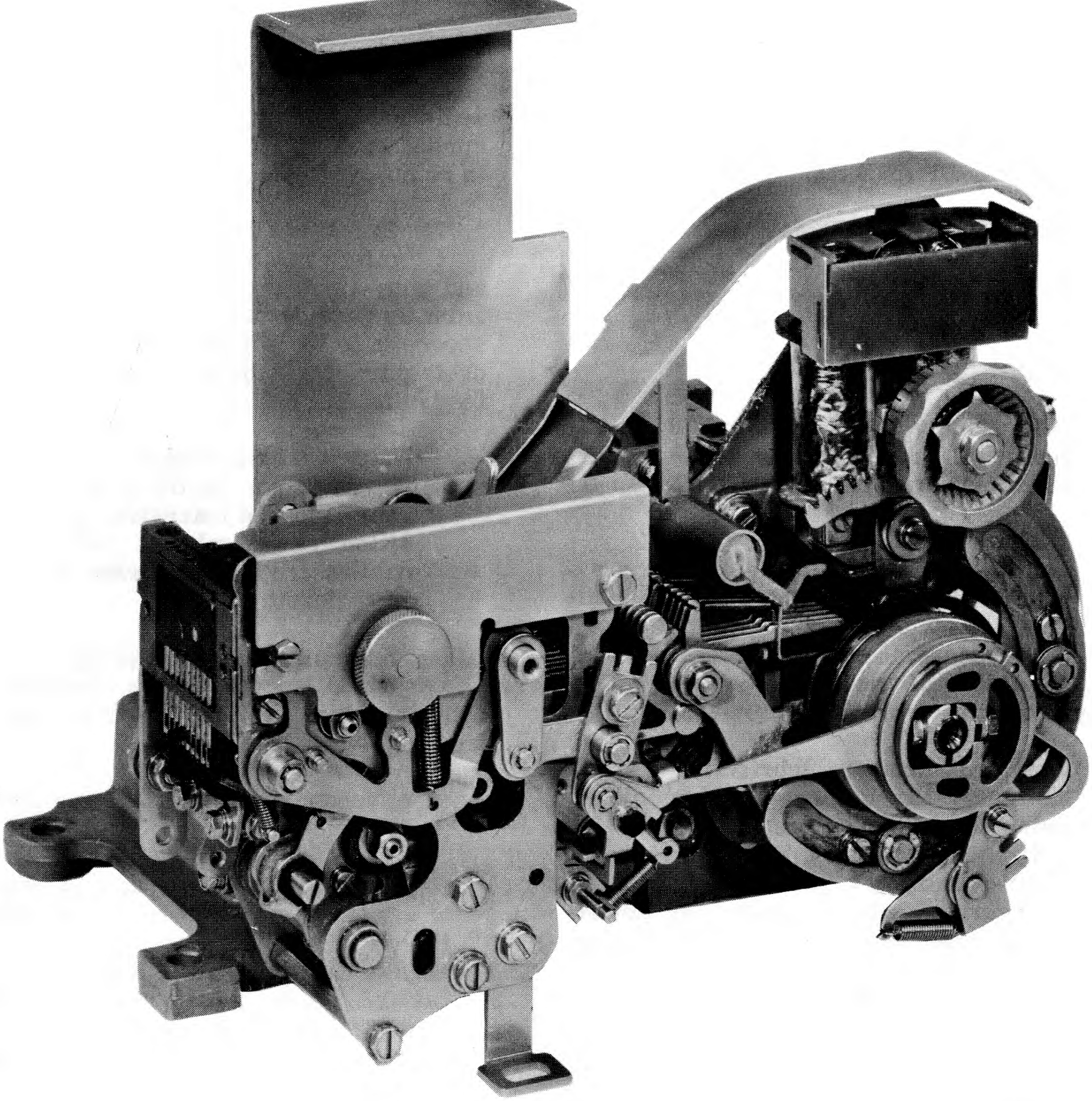


Figure 1 - 35 Non-Typing Reperforator - Left Front View

SELECTOR MECHANISM

2.02 Remove the screw, nut and lock washer that secure the selector clutch drum and the backspace eccentric hub to the main shaft. Lift eccentric drive arm off. Place the TP170238 reset bail in its raised position. Hold the TP170198 stop lever and the TP170236 marking lock lever out of the way while slowly pulling forward on the cam-clutch until it is removed.

2.03 Unhook the spring on the TP150355 function clutch latch lever. Remove the TP156472 spring post by removing its lock nut and lock washer. Remove the screw and lock washer that secure the TP170234 selector lever guide to the selector plate. Remove the oil wick and the oil wick holder. The selector mechanism can now be taken off.

PUNCH MECHANISM

2.04 Unhook the spring from the TP170211 rocker arm and the TP156412 drive link.

2.05 Remove the two screws and one stud which secure the punch assembly rear plate to the main plate.

2.06 To remove the rocker bail assembly, remove the nut, lock washer and adjusting lever guide from the TP156366 shaft. Remove the shaft and the rocker bail assembly.

2.07 To remove the main shaft assembly after the selector cam-clutch has been removed (Par. 2.02), remove the spring from the TP150355 latch lever. Remove the retaining ring, spring washer and flat washer from the forward end of the main shaft. Remove the screw and lock washer from the TP150000 clutch drum. Remove the screw and lock washer from the TP173340 collar. Remove the screw and lock washer from the rear bearing clamp.

2.08 Pull the main shaft out toward the rear, while removing the function clutch and collar.

35 TRANSMITTER DISTRIBUTOR (SINGLE CONTACT)

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section is reissued to convert it from a preliminary publication to a standard publication.

1.02 The 35 Transmitter Distributor provides means for translating code combinations, perforated in a paper tape, into electrical pulses and transmitting these pulses in the form of a eight-unit, start-stop permutation code to one or more receiving stations. Features incorporated in the design of the unit include the all steel internal expansion clutch, sensing pins located in line with the axis of the feed wheel, longer travel of the sensing pins, increased number of feed pins engaging the feed holes in the tape and minimum maintenance. Paragraph 1 of this section presents a brief description of the physical characteristics and functions of the unit. Paragraph 2 describes the principles of operation with a step by step accounting of the events occurring in a complete cycle.

1.03 Reference in the text to left, right, front or rear apply to the unit in its normal operating position as viewed from the front or operator's position. Pivot points are shown in the drawings by circles or ellipses which are solid black to indicate fixed points.

GENERAL

1.04 The 35 Transmitter-Distributor Unit is an electromechanical device using a single cam shaft to initiate and sequentially perform the functions of sensing the intelligence stored in the tape. An electrical contact is linked to certain mechanisms to translate the intelligence sensed into pulses of current (marking) and no current (spacing). The unit will accept an eight level tape of one inch width fully perforated. The tape may be inserted without lifting the tape lid by moving the start-stop lever to the free wheeling position. Otherwise, the feed wheel is detented and the tape-out pin extended so that the tape is blocked from sliding under the lid.

1.05 The unit is arranged so that the components are readily accessible for adjustment or replacement. In the same manner, new features or mechanisms may be installed with a minimum amount of disassembly.

PHYSICAL DESCRIPTION

1.06 The mechanisms of the transmitter distributor are supported between three vertical plates (front, center, and rear) which are separated a fixed distance by spacers or tie bars. The cam shaft is located in the lower right section of the unit with the outer race of each ball bearing clamped to the respective front and rear plate. Motive power to the shaft is controlled by the clutch located on the rear end of the shaft and the clutch trip magnet assembly attached to the rear plate. See Figure 3. As the clutch trip magnet is energized, the clutch mechanism is allowed to engage the outer drum that is rotating continuously, transmitting its motion to the cam shaft. The top of the unit is enclosed by three formed plates -- the tape guide plate, the top plate and the cover plate. With tape in the transmitter distributor, movement of the start-stop lever to the right operates contacts to energize the clutch trip magnet which releases the main bail and the clutch. The main bail causes the sensing fingers to sense the tape perforations and initiates the tape feed operation. The clutch is engaged to start the cam shaft rotating. Transfer levers associated with the sensing pins cause the transfer bail to be shifted to the right or left in accordance with the intelligence sensed. The transfer bail in turn moves the signal generator toggle link and contacts to their marking or spacing position. Thus the perforations for each character in the tape are read and pulses, number 1 through 8, are generated sequentially. The tape is advanced to the next character and the cycle repeated. The unit operates at a speed of 100 words per minute.

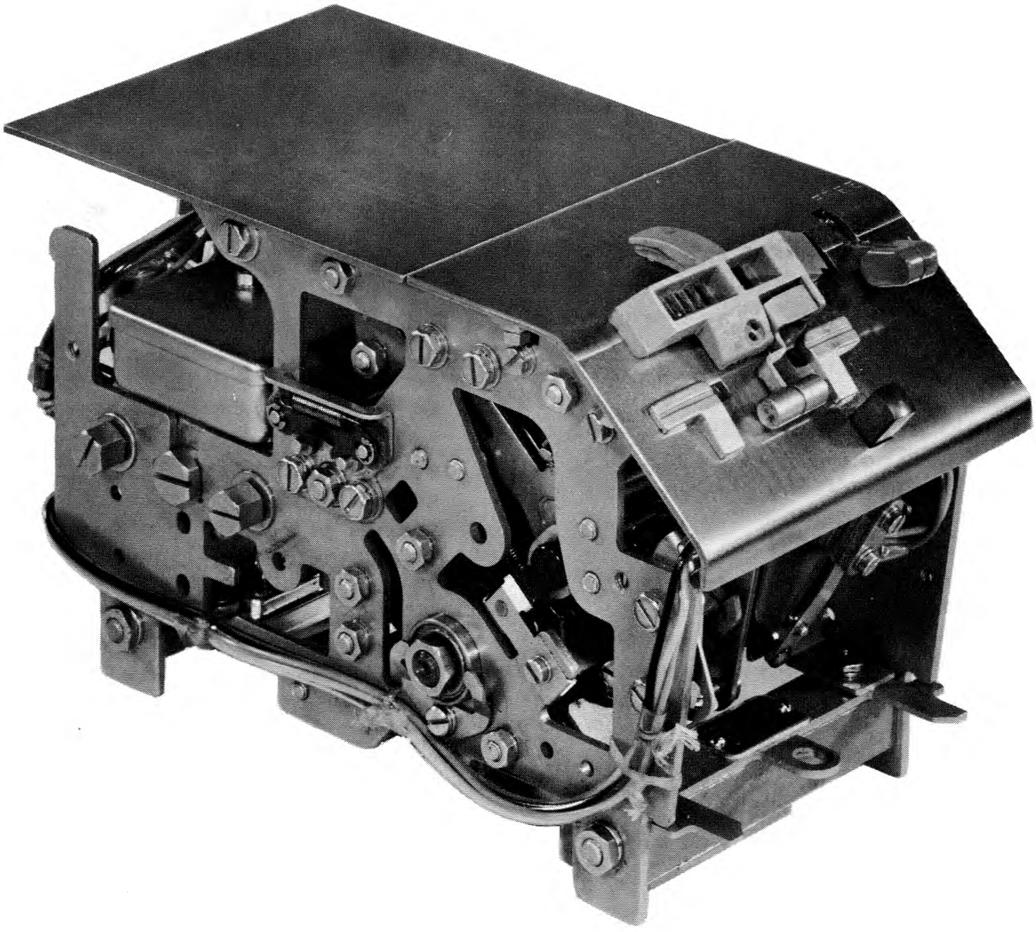


Figure 1 - 35 Transmitter Distributor Assembly

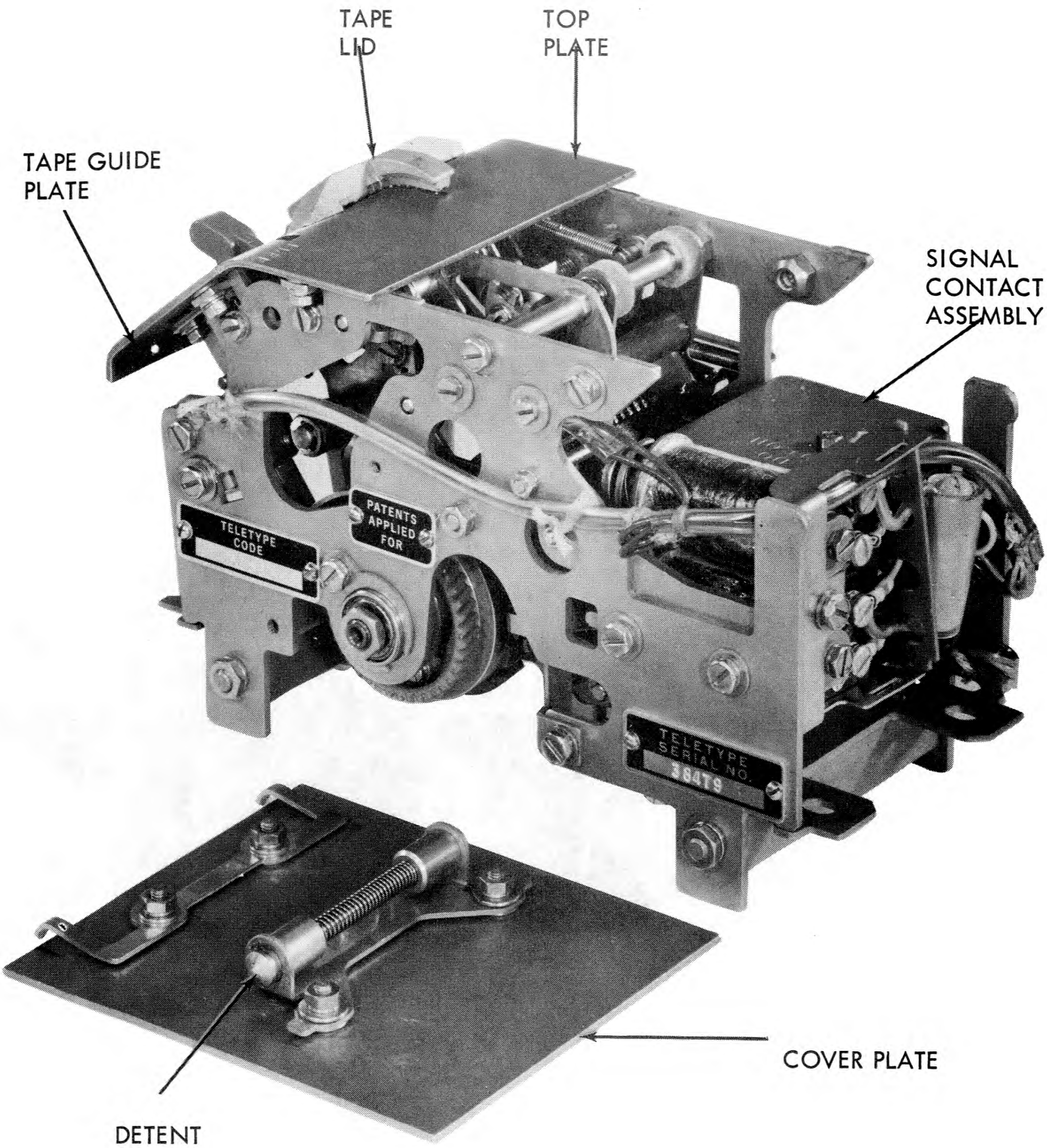


Figure 2 - 35 Transmitter Distributor Cover Plate Removed

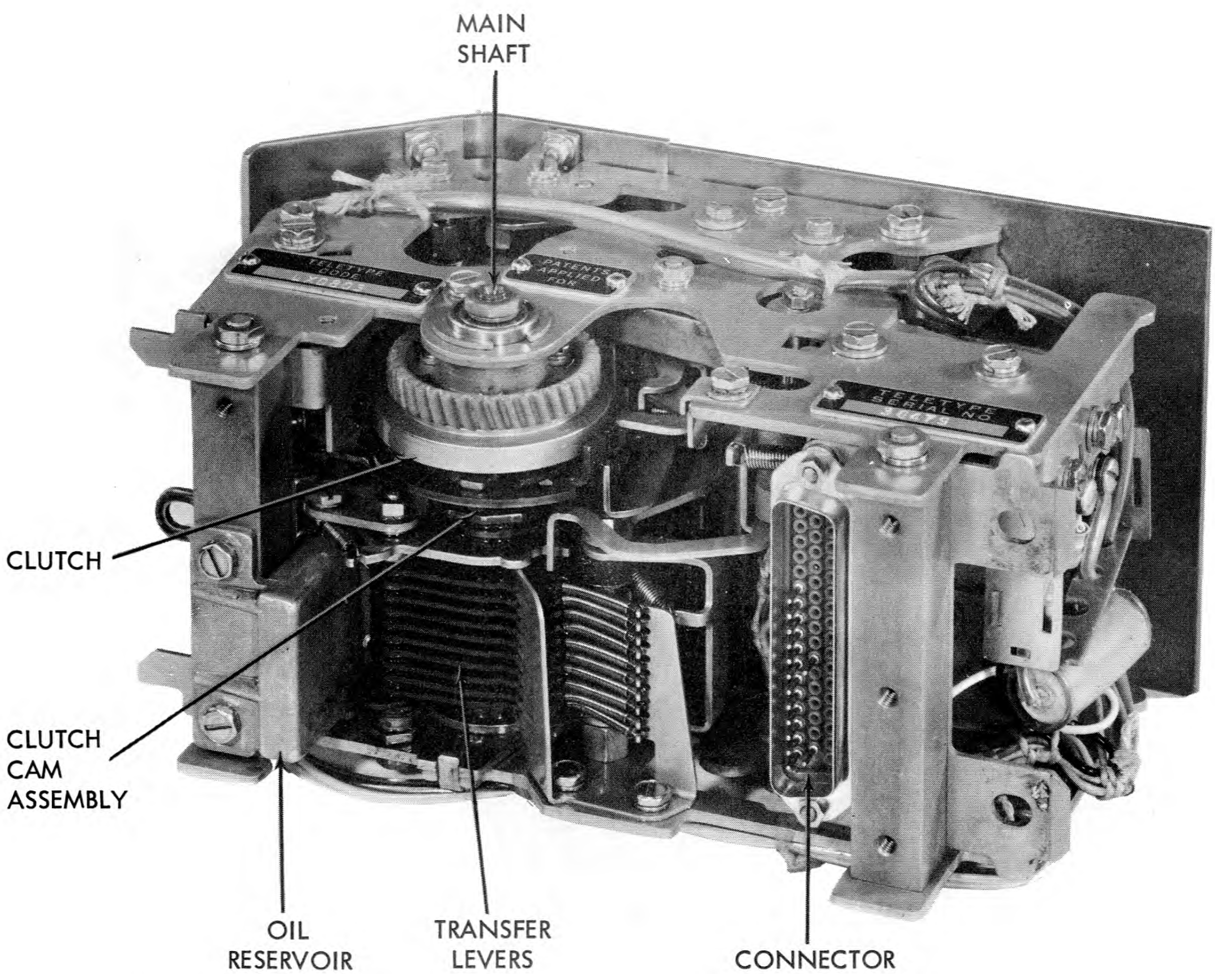


Figure 3 - 35 Transmitter Distributor, Bottom View

A. Special Features

1.07 Accommodates fully perforated eight level tape.

1.08 A control lever with start-stop and free-wheeling positions. The latter position permits free wheeling of the tape feed wheel which facilitates insertion or removal of tape.

1.09 A pair of adjustable guides are provided for aligning and locating tape over the feed wheel. Figure 4.

1.10 An index line has been scored in the tape guides 0.600" (six characters) ahead of the sensing pins to aid in aligning tape start position.

1.11 A tight tape device on the tape lid stops transmission if the tape becomes taut or tangled.

1.12 A tape-out pin located to the right of the sensing pins stops transmission if there is no tape in the sensing head. (The pin is advanced 4 characters from the sensing pins. A rub-out deleter mechanism consisting of a bail, a guide and a spring is located among the sensing levers. This mechanism causes the clutch magnet circuit to open when an all marking combination is sensed by the transmitter.

1.13 A spring loaded tape lid that snaps open when the red tape lid button is depressed.

1.14 A quick disconnect connect plug which aligns with its mate on the base and facilitates making electrical connections as well as simplifying handling during servicing. Figure 3.

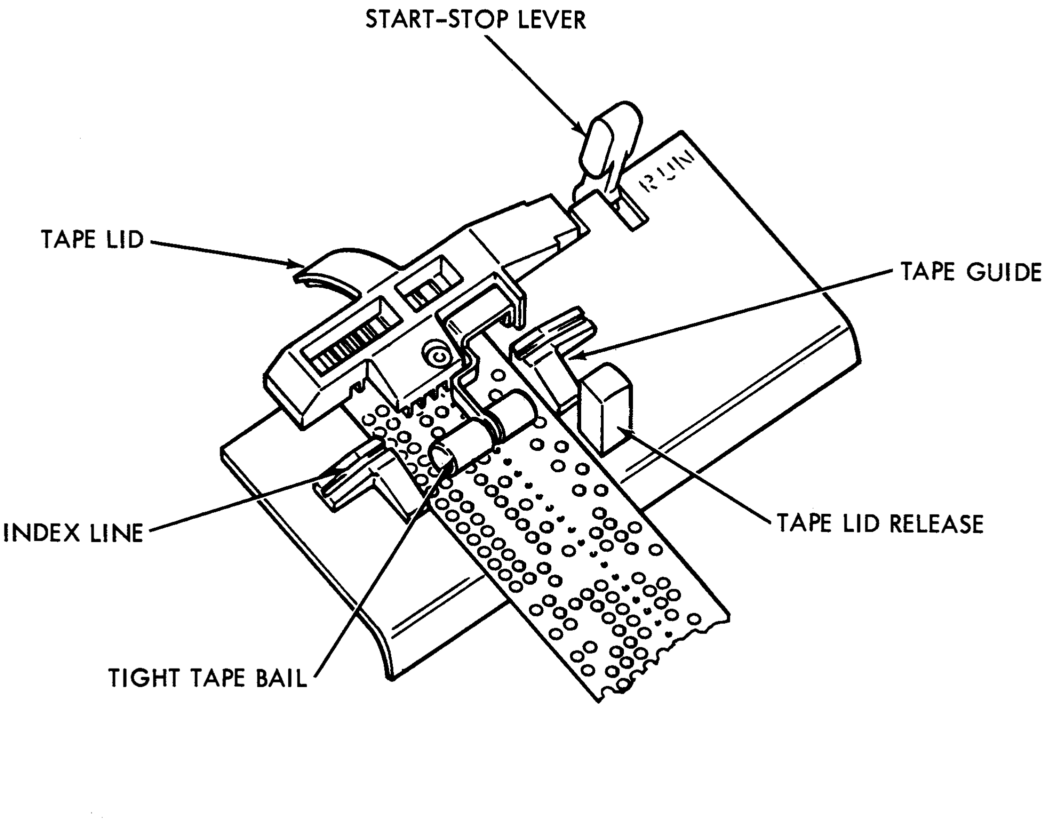


Figure 4 - Tape Guide Plate

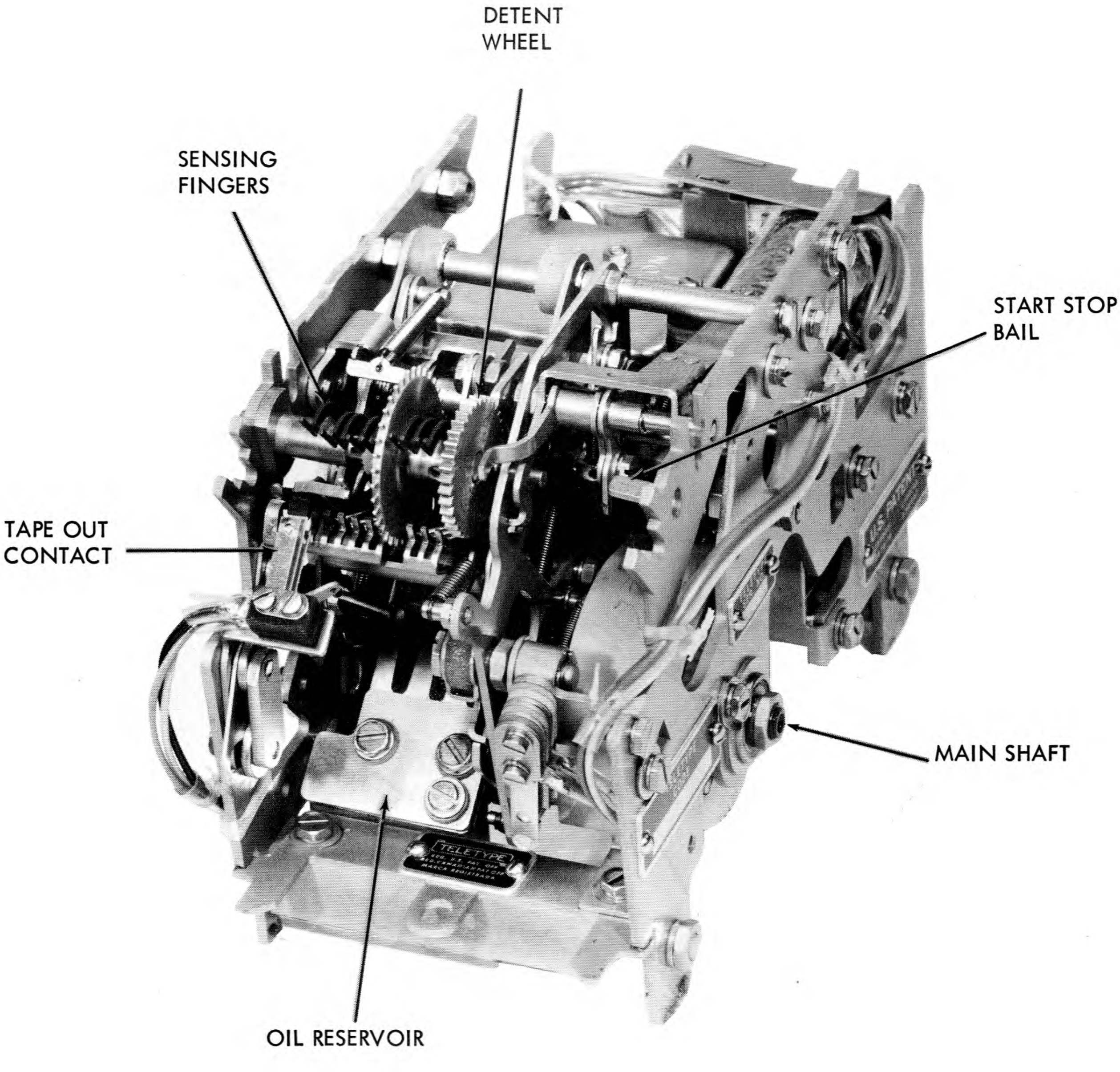


Figure 5 - Transmitter Distributor, Covers Removed (End View)

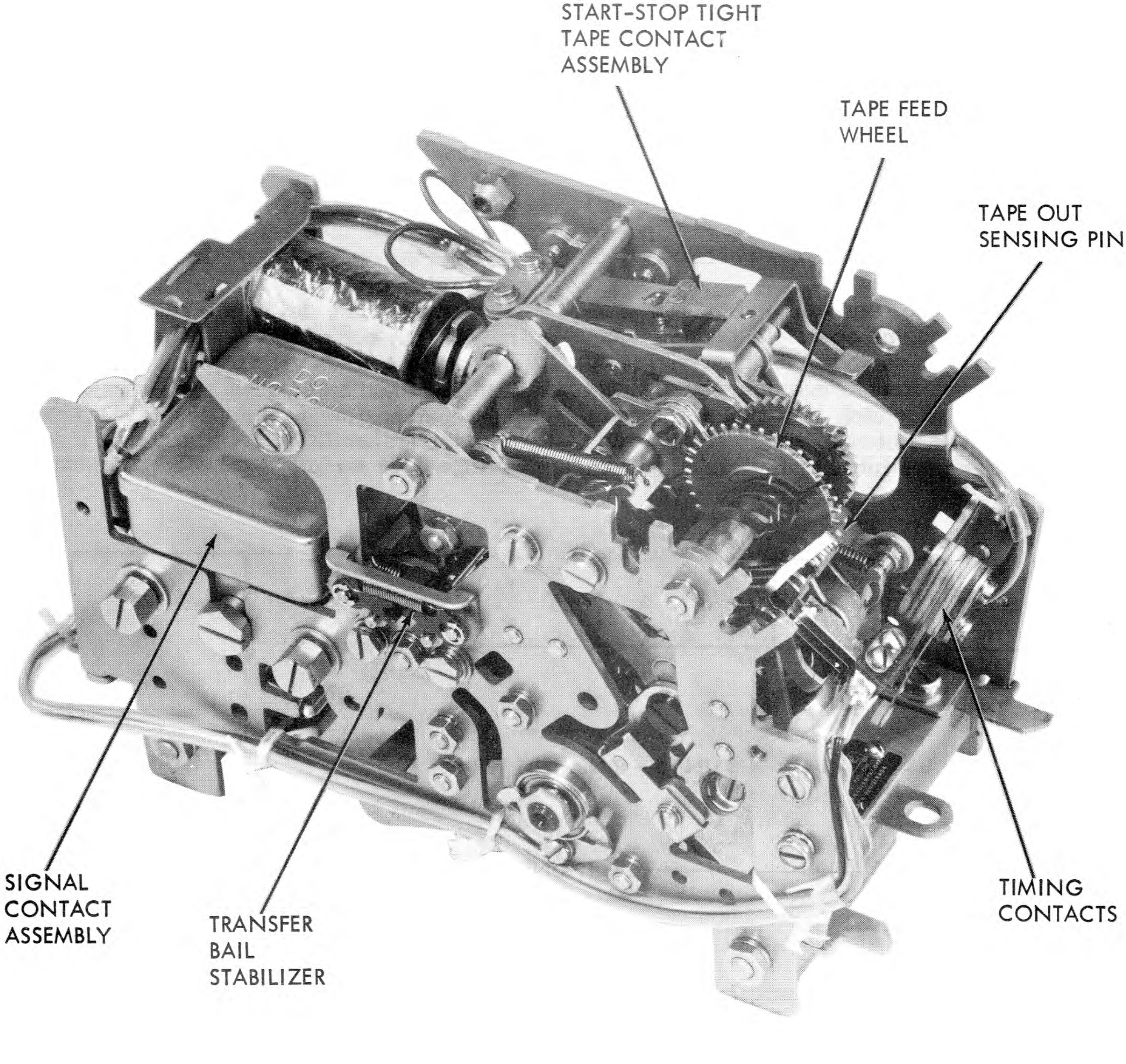


Figure 6 - Transmitter Distributor, Covers Removed (Side View)

B. Physical Data

Approximate dimensions of transmitter:

Width - - - - - - 7-1/2 inches
Depth - - - - - - 3-5/8 inches
Height- - - - - - 5 inches
Weight - - - - - 7 pounds

ELECTRICAL CHARACTERISTICS

A. Control Circuit

1.15 The control circuit (clutch trip magnet) should operate from a 48 VDC $\pm 10\%$ power source with an external 500 ohm resistor.

1.16 The tight tape, tape-out and manual control mechanisms operate contact assemblies which are in series with the clutch trip magnet assembly. Actuation of any one of these devices opens the clutch trip magnet circuit which causes the clutch to be disengaged and the transmitter goes into an idle line condition.

Note: Overload protection must be provided external to the unit.

B. Signal Circuit

1.17 The Signal Contacts in the transmitter signal generator operates on 40 milliamperes at -20 volts DC to +20 volts DC.

1.18 The signalling code transmitted is an eight unit, start-stop neutral code consisting of current and no current intervals, or pulses. See Figure 7. A marking pulse is a measured interval of time during which current flow is permitted through closure of a contact. A spacing pulse is a measured interval of time during which the flow of current is interrupted through the opening of a contact. The transmission pattern for a complete character consists of a start pulse (always spacing), eight code pulses (any one of which may be either marking or spacing) and a stop pulse (always marking). The start and stop pulses are necessary to keep the receiving telegraph apparatus in synchronism with the transmitter. See eight level data interchange code section, for code arrangements.

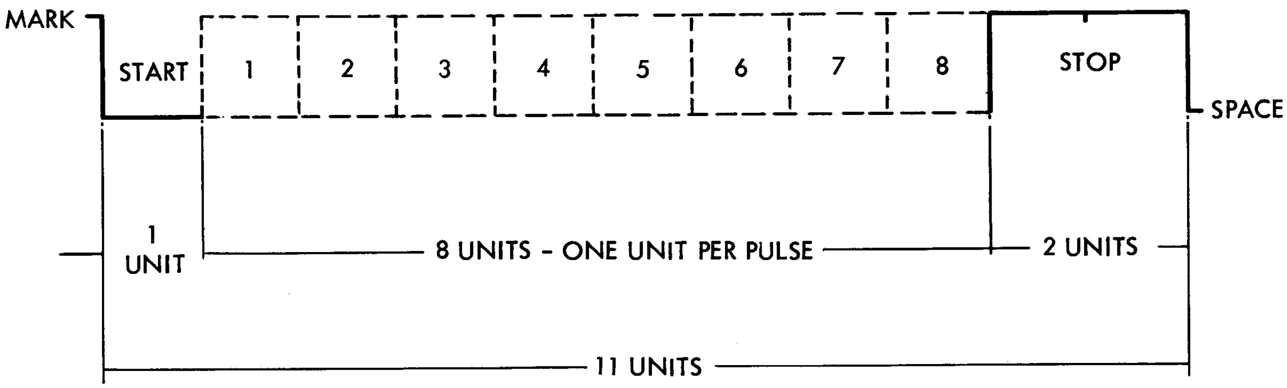


Figure 7 - Eleven Unit Transmission Pattern

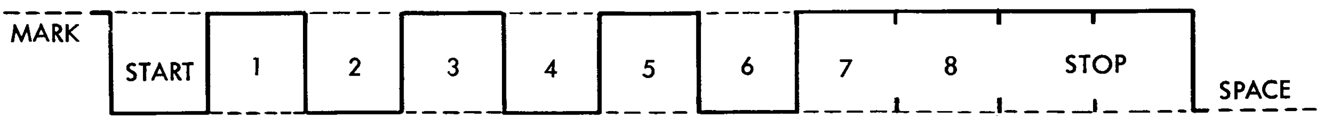


Figure 8 - Graphic Representation of the Letter "U"
(See Eight Level Data Interchange Code for Code Arrangements)

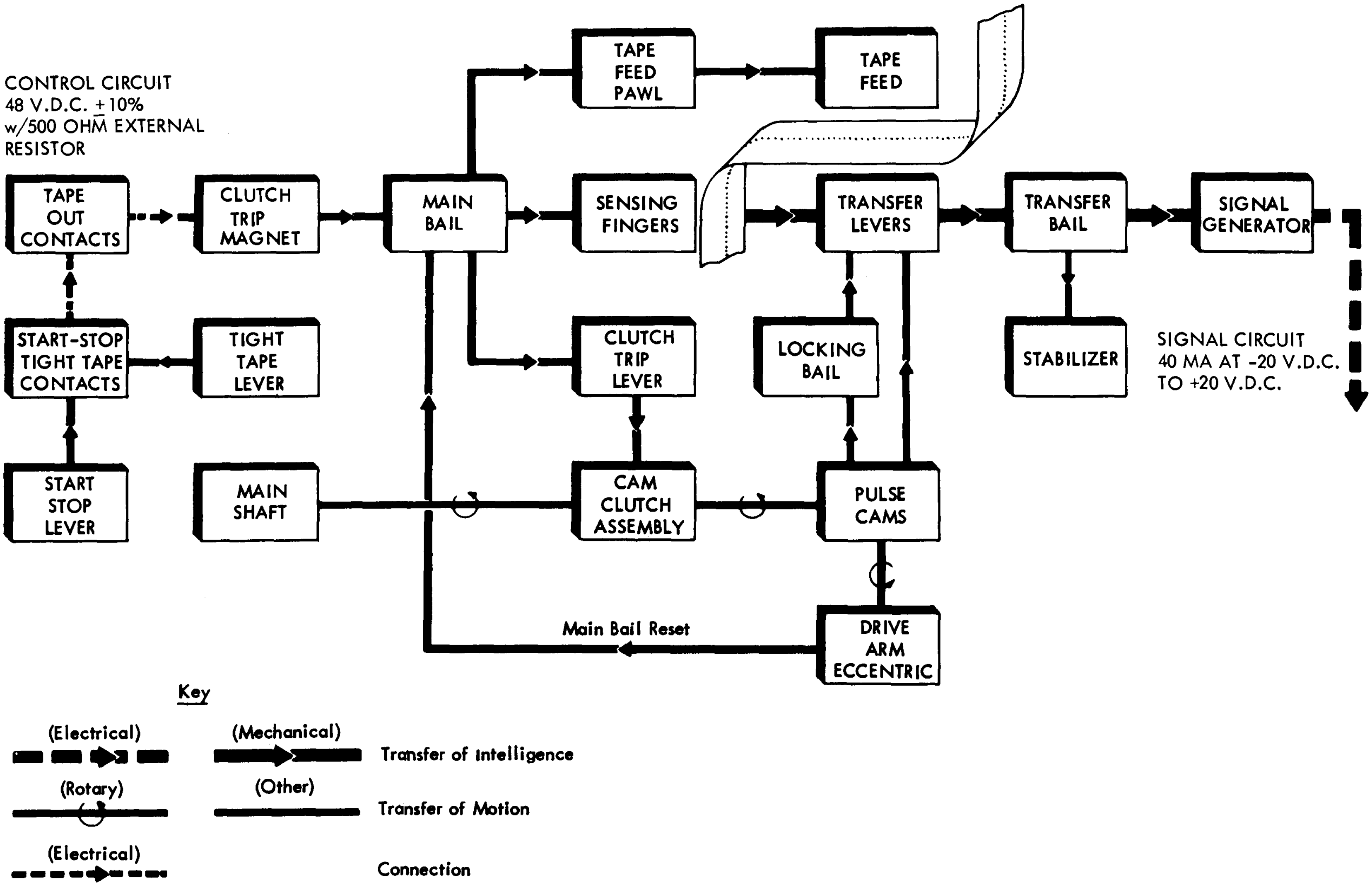


Figure 9 - Functional Block Diagram of Transmitter Distributor

2. PRINCIPLES OF OPERATION

GENERAL

2.01 In the following description of the sequence of operations of the 35 Transmitter Distributor, the unit is assumed to be operating under normal conditions.

2.02 External portions of the transmitter-distributor circuits completed (i.e. correct source of operating potential across both control circuit and signal generating circuit as covered in Paragraph 1).

2.03 Start-stop lever in its off (center) position.

2.04 Driving motor running and the unit in the idle line condition (clutch disengaged and main shaft stationary).

2.05 Tape in the transmitter-distributor guide plate with the lid closed.

OPERATING SEQUENCE

A. Clutch Trip Magnet

2.06 Push the start-stop lever to its (RUN) position. The camming surface of the start-stop lever allows the start-stop bail to move upward. As the bail pivots on its mounting, the left extension of the bail moves away from the bakelite portion of the swinger of the start-stop tight-tape contact assembly. Thus the contact is closed to complete the clutch trip magnet circuit, energize the magnet and pull the armature up. The armature bail extension cams the main bail latch lever about its pivot post to release the main bail.

B. Main Bail

2.07 The main bail swings upward due to the tension of the main bail spring and initiates the actions as follows.

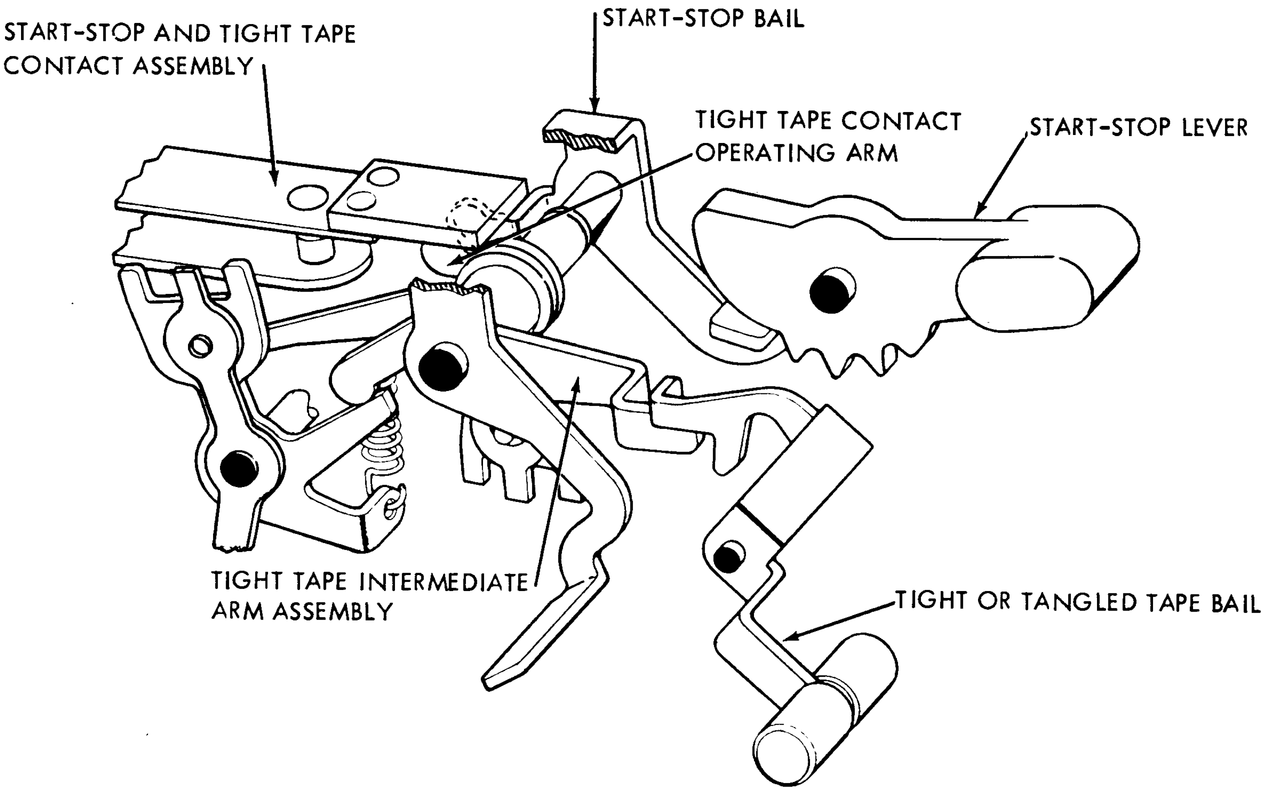


Figure 10 - Start-Stop and Tight Tape Switch Mechanisms

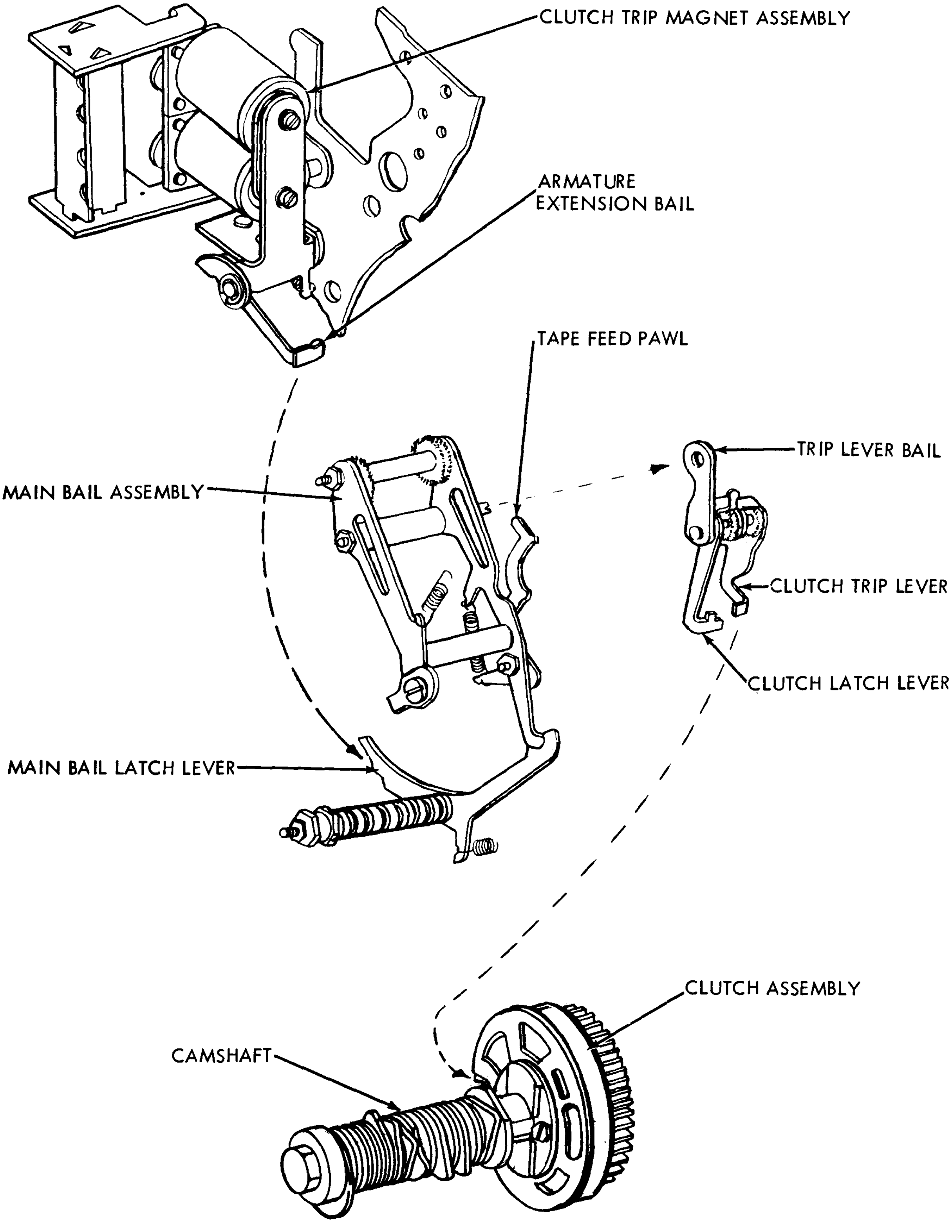


Figure 11 - Function Control Mechanism

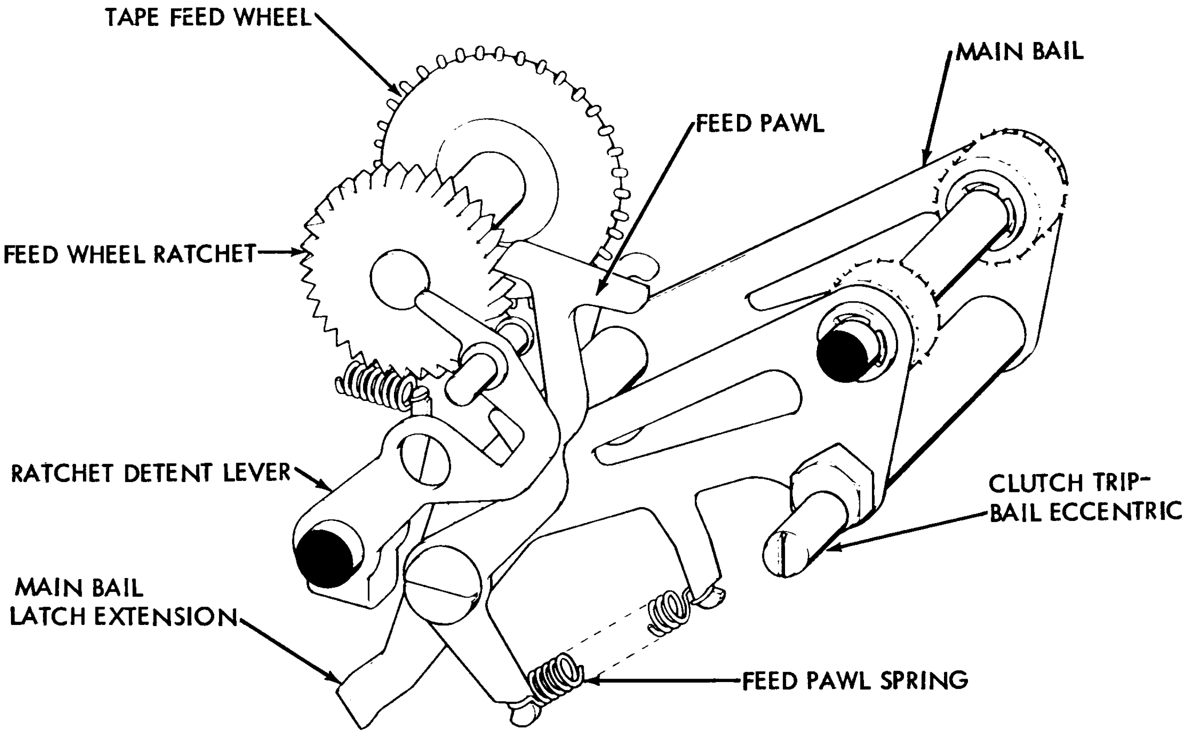


Figure 12 - Tape Feed Mechanism - Rear View

2.08 The feed pawl is raised one tooth on the feed wheel ratchet. Figure 12.

2.09 The clutch trip lever moves away from its latch when the eccentric post on the spring biased main bail cams the clutch trip bail; the trip bail in turn moves the clutch trip lever. (The eccentric on the main bail rides in the slot of the clutch trip bail so that when the main bail is released the clutch trip bail is also released by the interconnection.) Figure 11.

2.10 The sensing fingers, responding to the action of their springs, follow the main bail in its upward travel to sense the tape in the tape guide plate. If one or more of the sensing fingers encounter a perforation in the tape the fingers will extend through the perforations until the projections on the sensing fingers strike the bottom of the main bail spacer post. The sensing fingers that extend through the tape move their associated transfer levers upward so that they are brought above the line of action of the blade on the locking bail. If any of the sensing fingers do not sense a perforation in the tape the associated transfer levers remain stationary and their extensions remain below the line of action of the locking blade on the locking bail. Figure 14.

C. Clutch Trip Lever

2.11 During the movement of the main bail, the clutch trip bail pivots on its axis and pushes the clutch trip lever away from the shoe release lever to engage the clutch and start the main shaft rotating. Figure 11.

D. Locking Bail

2.12 As the cam sleeve continues its rotation, the high part of the locking bail cam moves away from the locking bail and permits the locking bail to be pulled upward by its spring. In its upward travel, the locking blade of the bail is positioned between the lower extensions of the selected transfer levers and locks them in position. Figure 13.

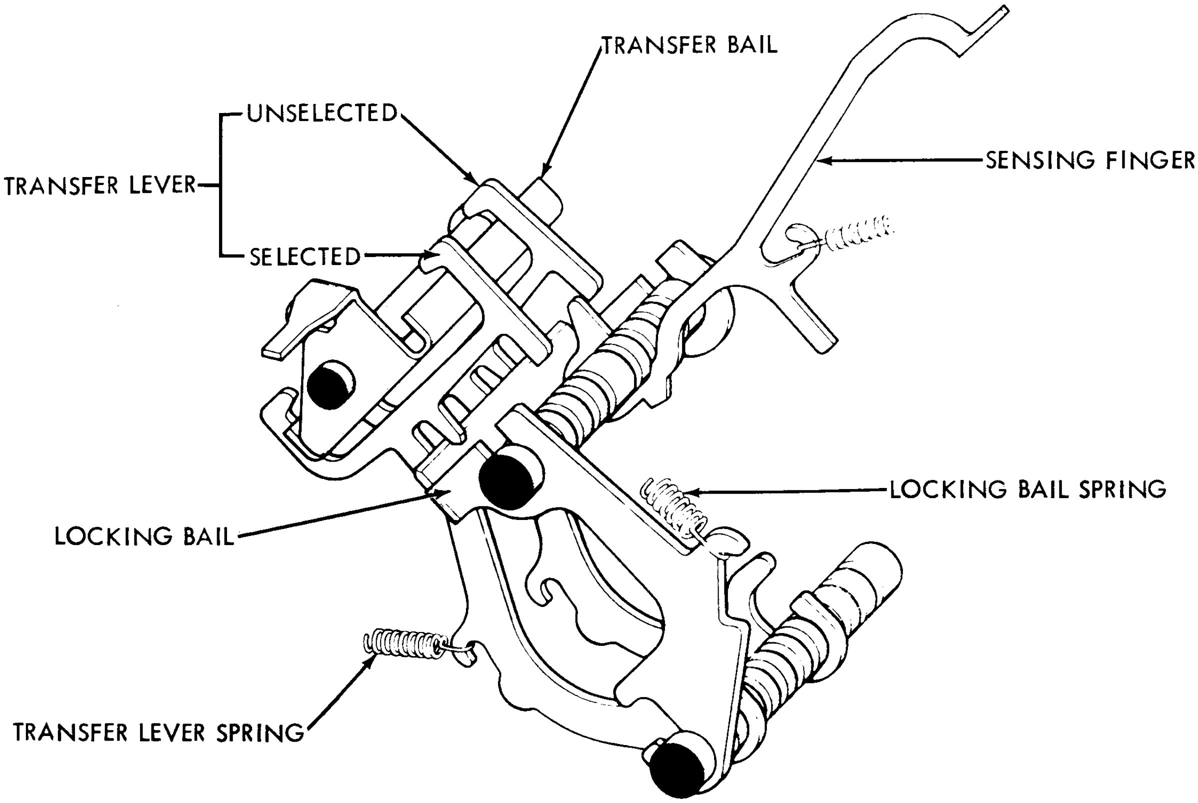


Figure 13 - Locking Bail and Transfer Lever Mechanisms

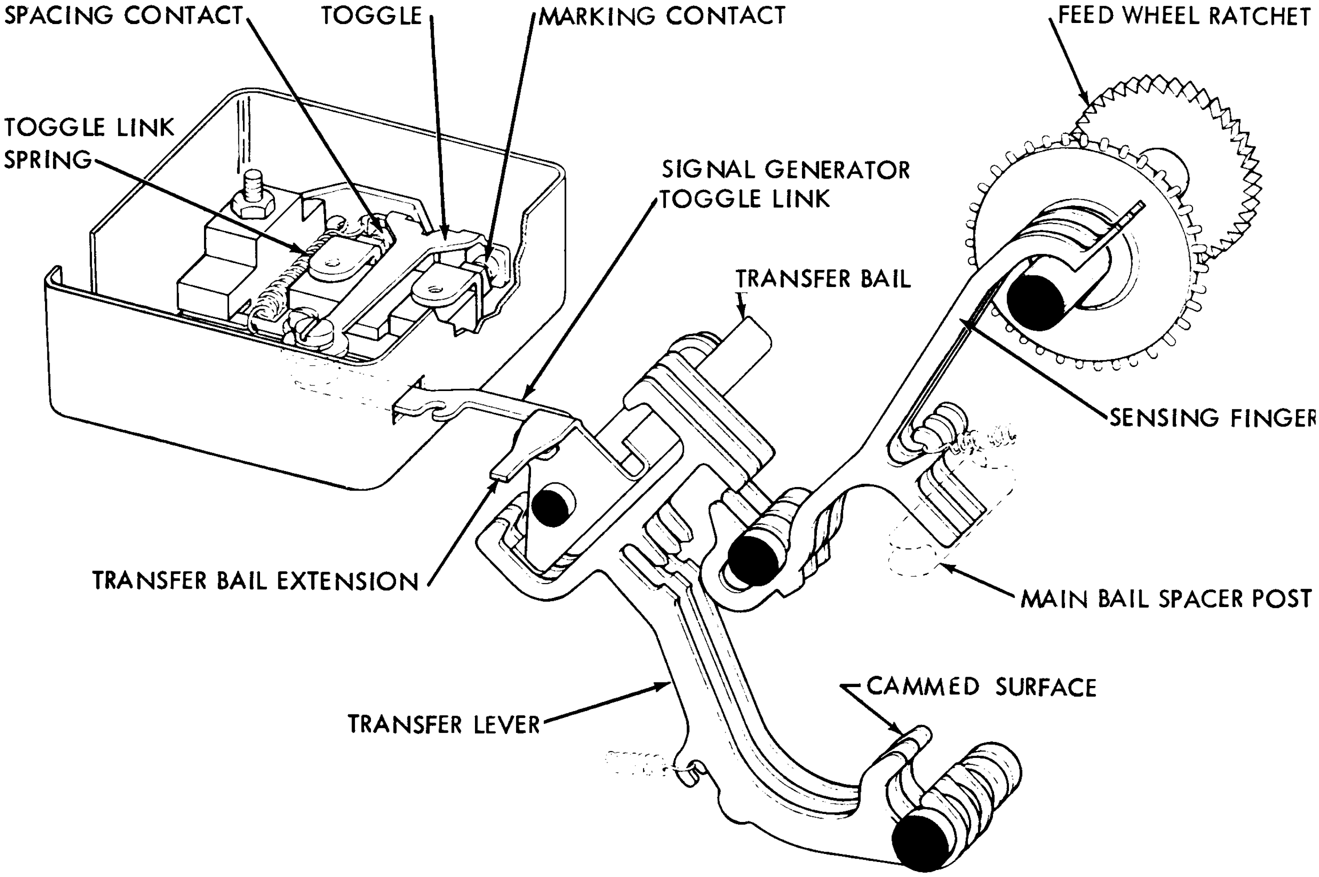


Figure 14 - Transfer Lever and Signal Generator Mechanisms

E. Start Pulse

2.13 Further rotation of the main shaft moves the lobe of the start cam into position and shifts its transfer lever downward. Since the start transfer lever has no sensing finger, the lever is always in the spacing position. The start transfer lever's upper finger hooks the upper side of the transfer bail and causes it to move clockwise. (NOTE: All transfer levers except the start and stop are arranged to move in two directions. The forked end of these eight levers can be moved from the spacing position to the marking position by the associated sensing levers. The transfer levers are also moved downward and to the right in a sequence that is timed to actuate the transfer bail in accordance with the 11.0 unit transmission pattern. See Figure 7. The transfer bail extension moves the signal generator toggle link which causes the toggle to open the marking contact and close the spacing contact in the signal generator contact assembly. Figure 14. The extension, in moving to the spacing position, forces the marking latch on the stabilizer Figures 6 and 15 out of its way and continues its travel far enough to let the spacing latch fall into the latching position simulating a detent action.

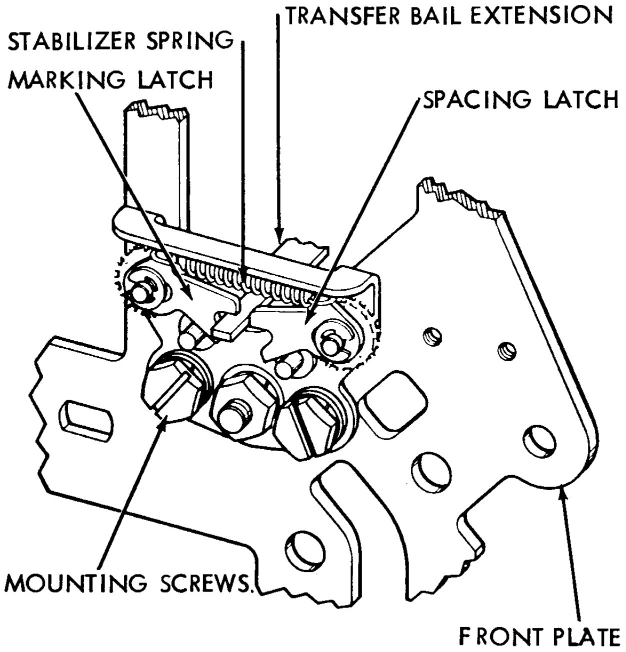


Figure 15 - Transfer Bail Stabilizer

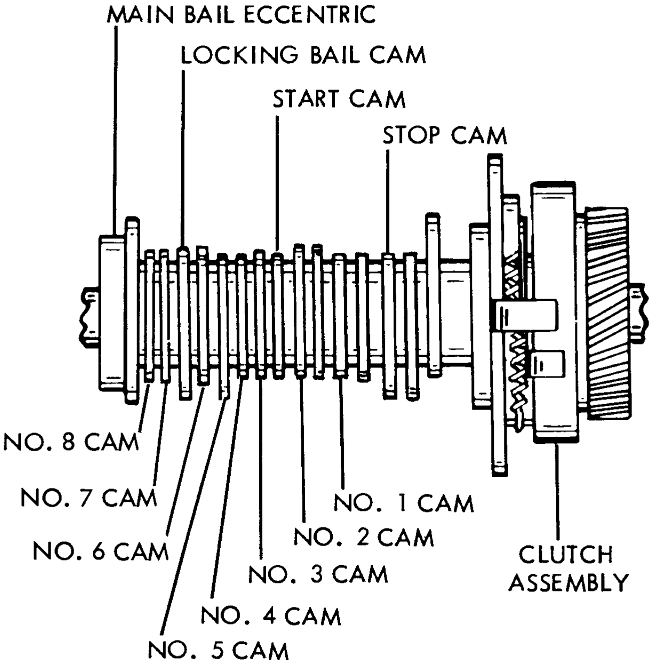


Figure 16 - Clutch Camshaft Assembly

F. First Pulse

2.14 As the shaft rotates further, the cam for the first pulse moves its transfer lever downward and toward the right. Depending on the position of the transfer lever finger (upper fork engaging bail - spacing; lower fork engaging bail - marking), the transfer bail is rotated if the pulse to be transmitted is not the same as the preceding pulse. If the preceding pulse is the same no action occurs because the bail has been previously rotated. If the preceding pulse was different, the extension on the transfer bail moves the toggle link and causes the toggle to open the closed contact and close the open contact.

G. Succeeding Pulses

2.15 The remaining pulses are generated in the same manner as the first. The action is repeated as each cam moves its associated transfer lever, in sequence, as described in Paragraph 2.14.

H. Stop Pulse

2.16 The stop pulse cam follows the eighth pulse cam as the main shaft is completing its cycle. Again the action is the same as that for the first pulse, except that, since the stop pulse has no sensing finger and its transfer lever is blocked, its lower finger always hooks the transfer bail resulting in a marking pulse on the completion of each character.

I. Main Bail Drive Arm

2.17 As the cam for the first pulse starts its action, the drive arm eccentric (Figure 18) starts to cam the drive arm downward. The drive arm pulls on the eccentric stud of the main bail causing the main bail to pivot downward to complete the operations initiated when the main bail was originally released (Paragraphs 2.06 and 2.07).

2.18 The main bail in pivoting downward withdraws the sensing fingers that are extended.

2.19 It pulls down on the tape feed pawl advancing the tape to the next set of perforations.

2.20 The main bail is moved to its latching position, however, it does not latch since tape is still in the tape head and the latch is held in the nonlatching position by the armature bail extension.

J. Tape Feed

2.21 The tape feed pawl advances the tape feed ratchet one tooth against the action of the ratchet detent roller. The tape feed ratchet is part of the tape feed wheel. The tape feed wheel advances the tape one character. The ratchet detent roller bears between two teeth on the ratchet and serves to hold the feed wheel and tape in position during the sensing portion of the operating cycle. Figure 12.

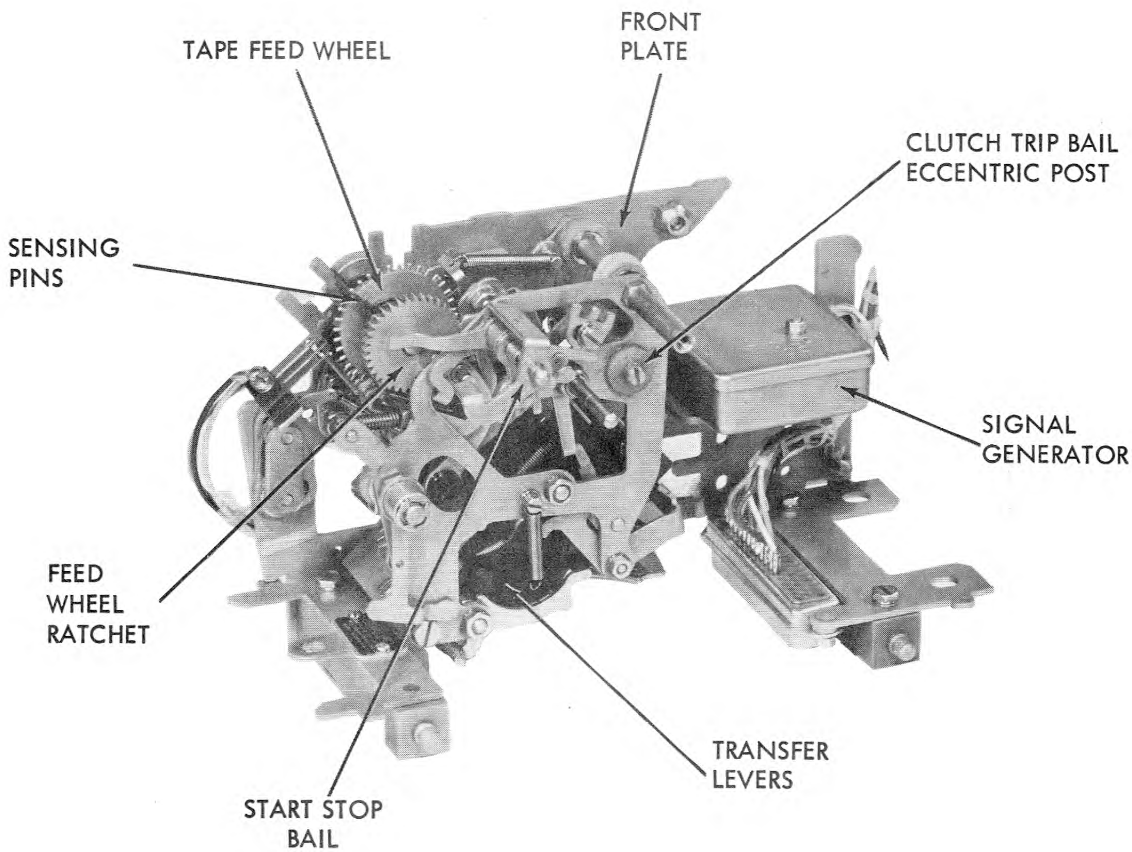


Figure 17 - Front Plate Assembly - Rear View

K. Repeating the Action

2.22 Since the clutch trip bail does not latch, the drive arm moves again to its upper position. In so doing, repetition occurs when the main bail swings upward and the main shaft starts to rotate, until the unit runs out of tape.

STOPPING THE ACTION

A. Tape Out Sensing

2.23 The code sensing fingers cannot differentiate between a no tape condition and perforations; therefore, the unit operates as if eight perforations were sensed and goes through the actions previously described. However, the tape out sensing pin feature senses that there is no tape in the tape guide plate. The tape-out pin moves upward to lift the swinger of the tape-out contact assembly and open the clutch trip magnet circuit.

B. Latching Main Bail

2.24 Since the tape-out contacts are in series with the start-stop tight-tape contacts, the clutch trip magnet becomes de-energized and releases its armature. This permits the armature extension to pivot out of its blocking position and allow the main bail latch to be moved by its spring. Figures 11 and 19.

C. Blocking Action of Clutch

2.25 As the main bail is latched the clutch trip lever blocks the clutch shoe lever. When the clutch is blocked the inertia of the mechanism causes the clutch to rotate far enough to permit its latch to fall into the notch on the clutch cam disk.

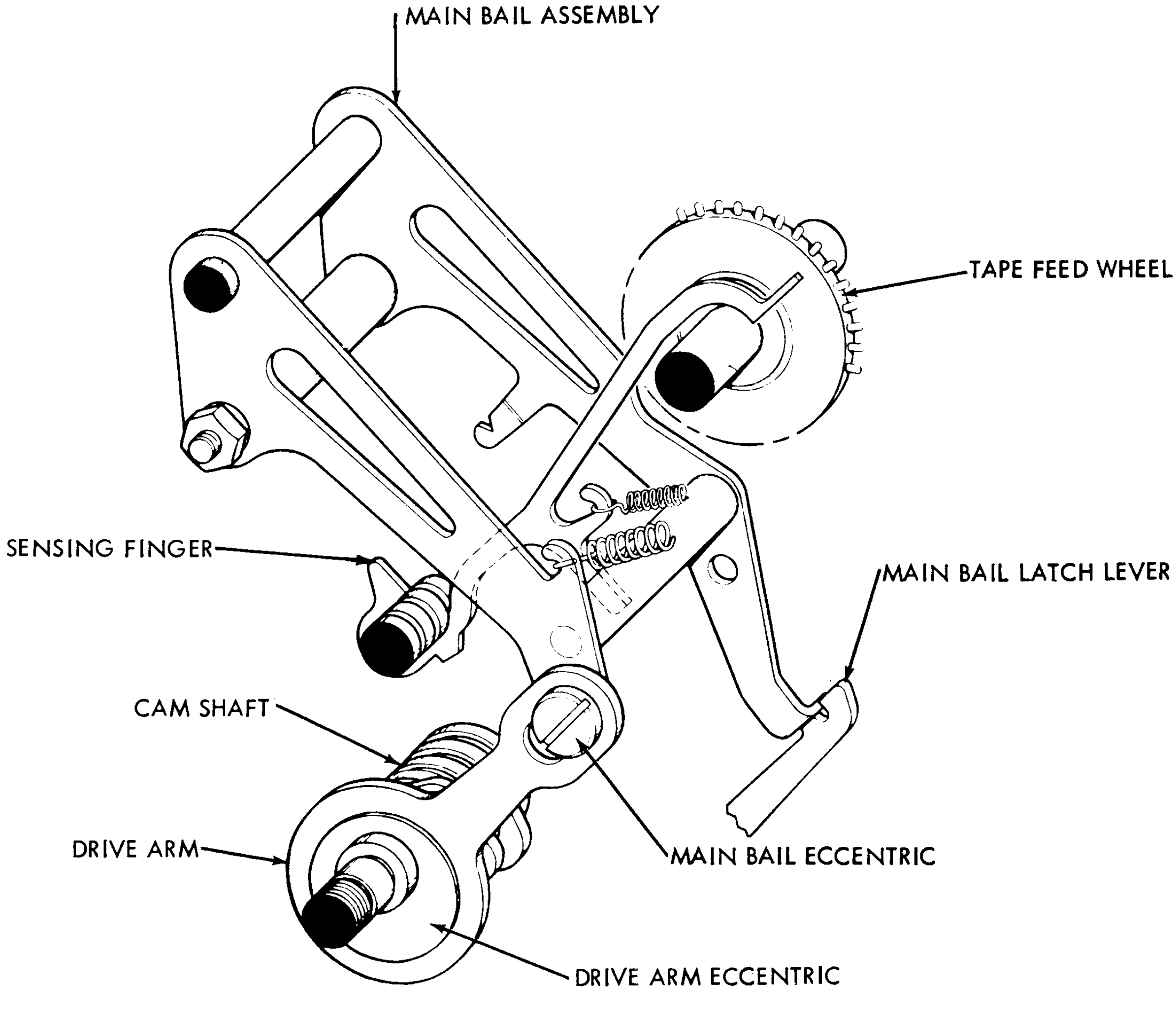


Figure 18 - Main Bail and Drive Arm Mechanism

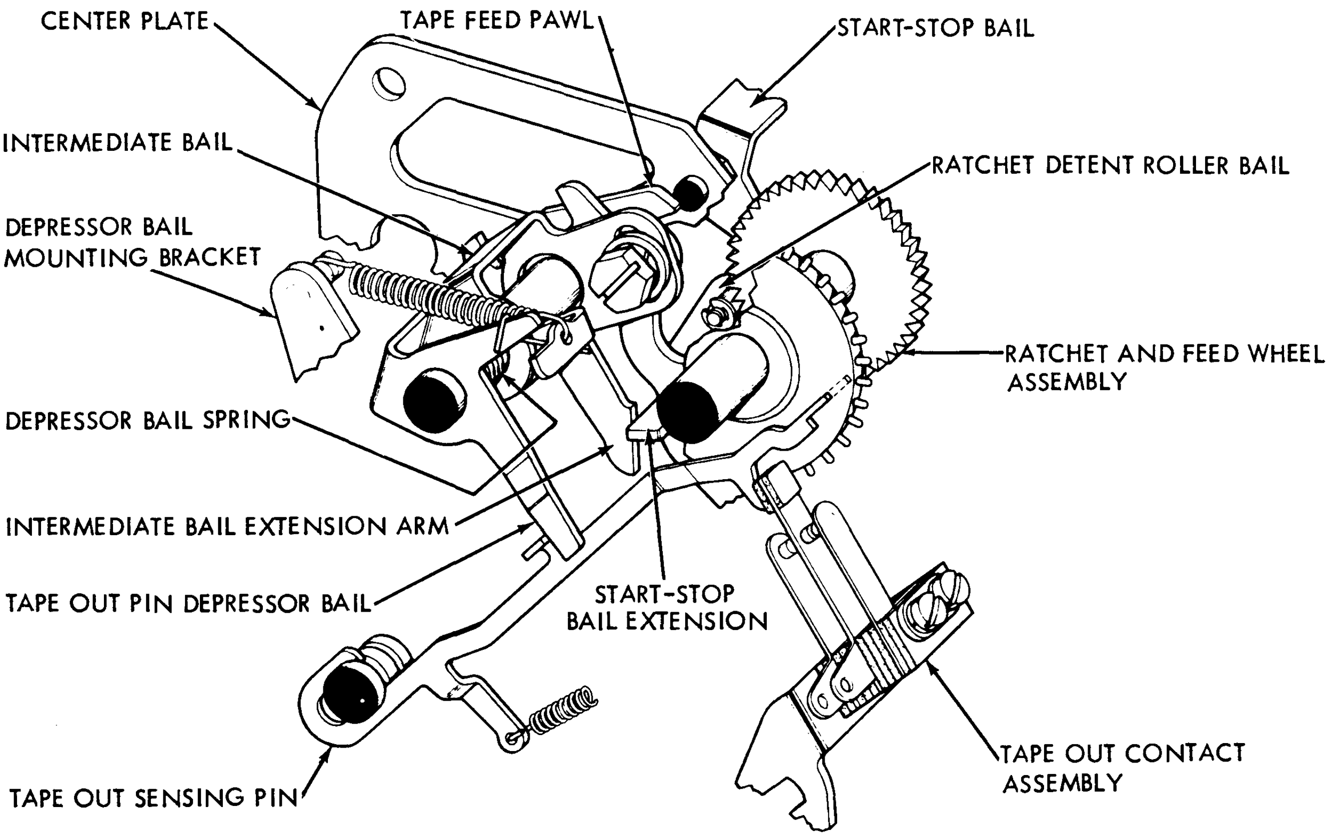


Figure 19 - Free Wheeling and Tape Out Mechanisms

CLUTCH OPERATION

A. Clutch Engagement

2.26 Figure 20A is accomplished by releasing the lower end of lever B. The upper end of lever B pivots about its ear C (which bears against the upper end of the secondary shoe) and moves its ear D, and the upper end of the primary shoe, toward the left until the shoe makes contact with the drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward, so that it again makes contact with the drum, this time 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 H. The revolving drum acts to drive this shoe upward so that it again makes contact with the drum at point I. Since the forces involved are multiplied at each succeeding step, the final force developed at point I is very great. This force is applied to the lug J on the clutch cam disk to cause it to turn in step with the drum. The cam disk on the clutch is connected to the cam shaft imparting rotary motion to the cam assembly.

B. Clutch Disengagement

2.27 Figure 20B is accomplished by bringing together lug A on the clutch cam disk, and the lower end of the clutch shoe lever B. 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.

TAPE LID OPERATION

A. Opening

2.28 When the tape lid button is pressed, the shaft portion of the button presses against the tape lid plunger bail extension causing the bail to pivot. The bail, in pivoting, moves its latching extension from under the tape lid latching post permitting the post to swing downward under action of its spring. Since the latching post is mounted on the tape lid behind the pivot point and below the tape guide plate it causes the main part of the tape lid to swing upward (open) when the post swings downward. Figure 21.

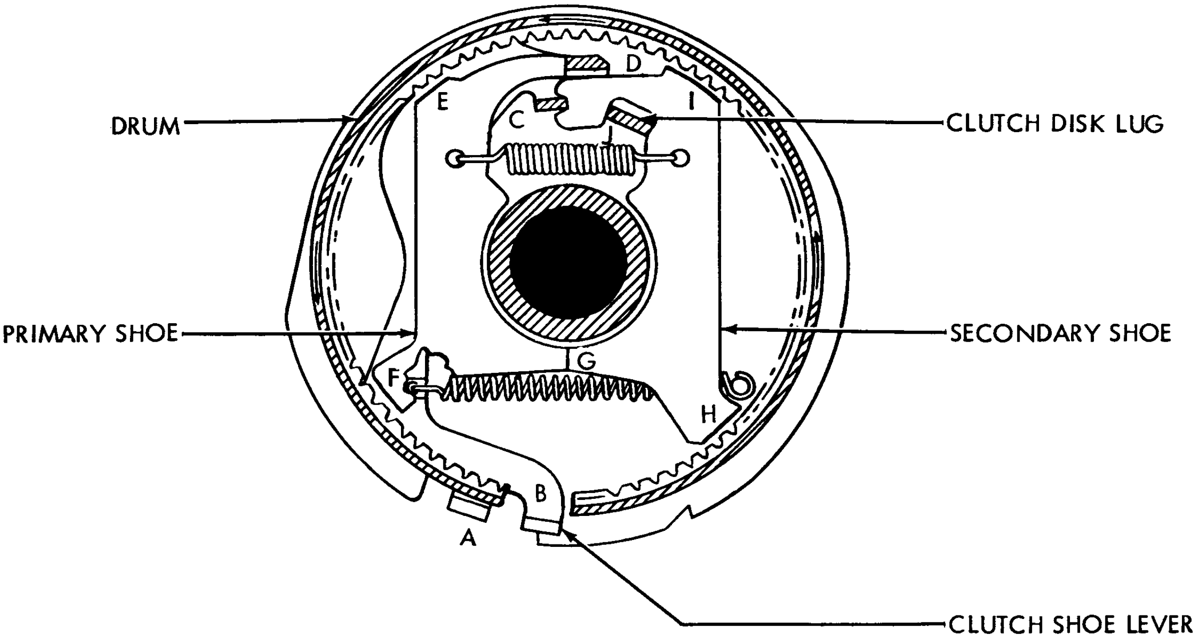


Figure 20A - Clutch - Engaged

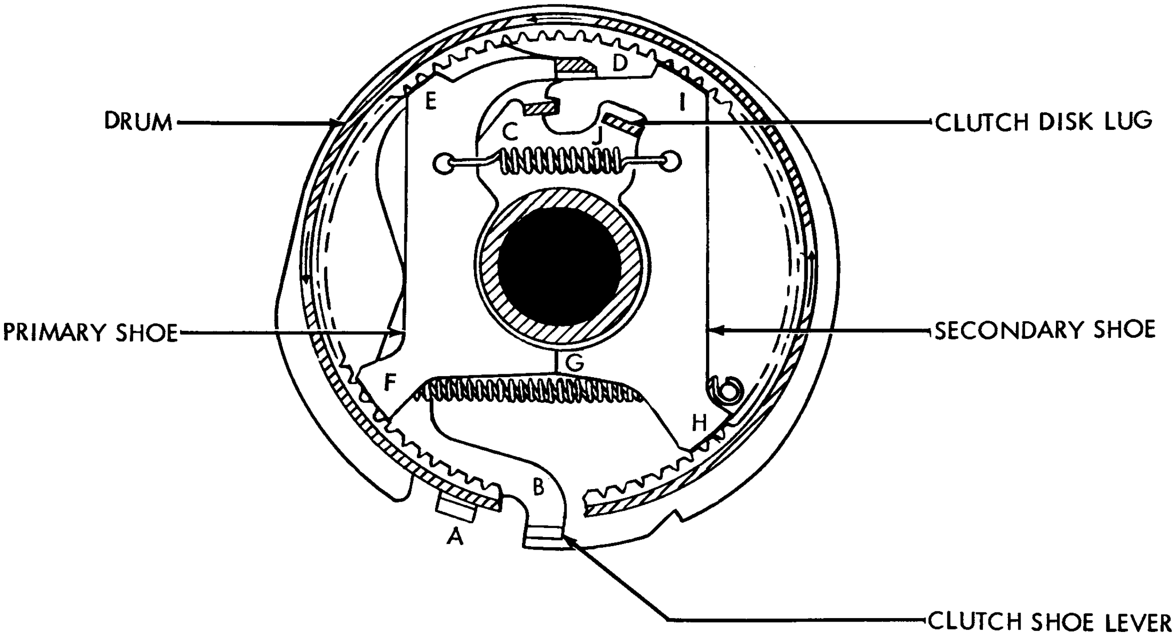


Figure 20B - Clutch - Disengaged

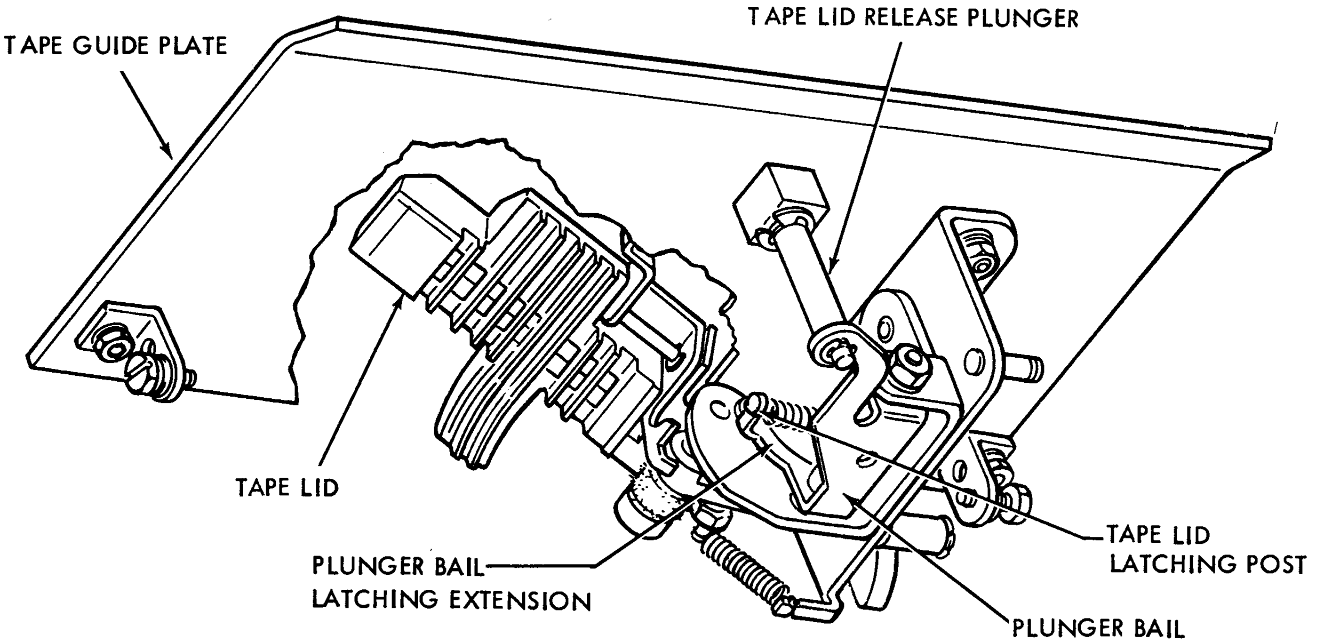


Figure 21 - Tape Lid Mechanism - Bottom View

B. Closing

2.29 The tape lid is closed manually by pressing it against the tape position. When the tape lid is closed, the latching post swings up and cams the latching extension out of its way until it passes the end of the extension which then is pulled under the post, by spring action, latching the post and tape lid.

START STOP LEVER

A. Start Position

2.30 To start transmission - see Paragraph 2.06.

B. Stop Position

2.31 To stop transmission. When the control lever is pushed to its center or stop position, the cam surface of the lever cams the control lever bail causing the bail to pivot. As the bail pivots, its extension cams the swinger pad upward on the start-stop contact assembly opening the contacts. This breaks the circuit to the clutch magnet assembly causing the armature to be released to its unattracted position. Figure 10.

C. Free Wheeling Position

2.32 Free wheeling feed wheel (Figure 19). The control lever is operated the same as in Par. 2.31 except that the lever is pushed to the extreme left position and the extension on the start-stop bail pushes the feed pawl and the ratchet detent roller away from the feed ratchet allowing the feed wheel to rotate freely. The bail extension also cams the intermediate bail extension arm which rotates the intermediate bail. The intermediate bail, in rotating, permits the spring loaded tape-out pin depressor bail to follow. The depressor bail, with its operating mechanism, is mounted on a bracket. The bracket is, in turn, mounted on the front plate. The result of this camming action is the depressing of the tape-out sensing pin to a flush or below flush condition relative to the tape guide plate. This permits free passage of the tape under the tape lid.

TIGHT OR TANGLED TAPE FEATURE

2.33 Tight or Tangled Tape raises the tight tape bail arm (Figure 10). The bail pivots and its extension cams the tight tape intermediate arm assembly on which is secured the tight tape arm. When the arm assembly is cammed, the associated tight tape arm lifts the swinger of the start-stop, tight tape contact assembly upwards and opens the clutch trip magnet circuit. Transmission stops.

TAPE OUT SENSING PIN

2.34 Tape-out sensing pin (Figure 19) is located on the tape guide plate to the right and slightly forward of the eight tape sensing fingers. With the tape-out pin in the depressed position, the swinger on the tape-out contact assembly is released and its contacts closed. The unit will then transmit if the series wired start-stop tight tape contacts are closed. Therefore, when tape is in the unit with the tape lid closed, the tape holds the tape out sensing pin in the depressed position and allows the unit to run. When no tape is sensed the spring loaded sensing pin travels upward and into a hole provided in the tape lid. An extension on the pin engages the swinger on the tape out contact assembly pushing the swinger up opening its contacts. This interrupts the clutch magnet circuit so that transmission ceases.

2.35 A rub-out deleter bail is held up against the lower projections of the sensing pins by a spring. When an all marking code combination is sensed in the tape, all sensing pins move upward followed by the deleter bail at approximately 72 degrees of the main shaft cycle. The projection of the bail presses the start transfer bail upward. At 81 degrees in the cycle, the tape-out contact opens the circuit to the transmitter clutch magnet. The locking bail locks the transfer bail and the transfer levers in their selected position. The lobe of the start pulse cam moves its transfer lever as the cycle continues. The lower finger of the start transfer lever hooks the lower side of the transfer bail leaving it in the marking condition caused by the previous stop pulse. The other transfer levers being in the marking condition cause the transfer bail to remain in the marking position until the tape advances and the new permutation code is read. The clutch trip magnet circuit closes again at 212 degrees of the cycle. The effect on the line is a continual flow of current as if the unit had stopped sending for the period of time necessary to transmit one level of code information. When any permutation code other than all marking is sensed, the rub-out bail is held downward and a normal space start pulse is sent.

ELECTRICAL CIRCUITS

2.36 Electrical circuits in the transmitter distributor are the clutch trip magnet circuit, and the timing pulse circuit. The clutch trip magnet circuit consists of the clutch trip magnet coils in series with the start-stop, tight-tape, and tape-out contact assemblies. The signal circuit consists of the transmitter signal generator contacts wired to provide neutral operation. The timing pulse circuit consists of the timing pulse contacts wired to provide an open pulse for each unit of the eleven unit code.

35 TRANSMITTER DISTRIBUTOR

LUBRICATION

CONTENTS PAGE

1. GENERAL

1.01 This section is revised to include additional information on lubrication and to update format. Since this is a general revision, marginal arrows, used to indicate changes, have been omitted.

1.02 The 35 transmitter distributor should be lubricated as directed in this section. The figures indicate points to be lubricated and the kind and quantity of lubricant to be used. Lubricate the unit just prior to placing it in service. After a few weeks in service, relubricate to make certain that all points receive lubrication. The following lubrication schedule should be followed thereafter.

Operating Speed in Words per Minute	Lubricating Interval
60	3000 hr or 1 yr*
75	2400 hr or 9 mo*
100	1500 hr or 6 mo*

*Whichever occurs first.

1.03 Use KS7470 oil at all locations where the use of oil is indicated. Use KS7471 grease on all surfaces where grease is indicated.

1.04 All spring wicks and felt oilers should be saturated. The friction surfaces of all moving parts should be thoroughly lubricated. Overlubrication should be avoided. Special care must be taken to prevent any oil or grease from getting between the clutch armature and its magnet pole faces or between electrical contacts.

1.05 Apply a thick film of grease to all gears.

1.06 Apply oil to all cams, including the camming surfaces of the clutch disc.

1.07 The photographs show the paragraph numbers referring to particular line drawings of mechanisms and where these mechanisms are located on the unit. Parts in the line drawings are shown in an upright position unless otherwise specified.

1.08 The illustration symbols indicate the following lubrication directions:

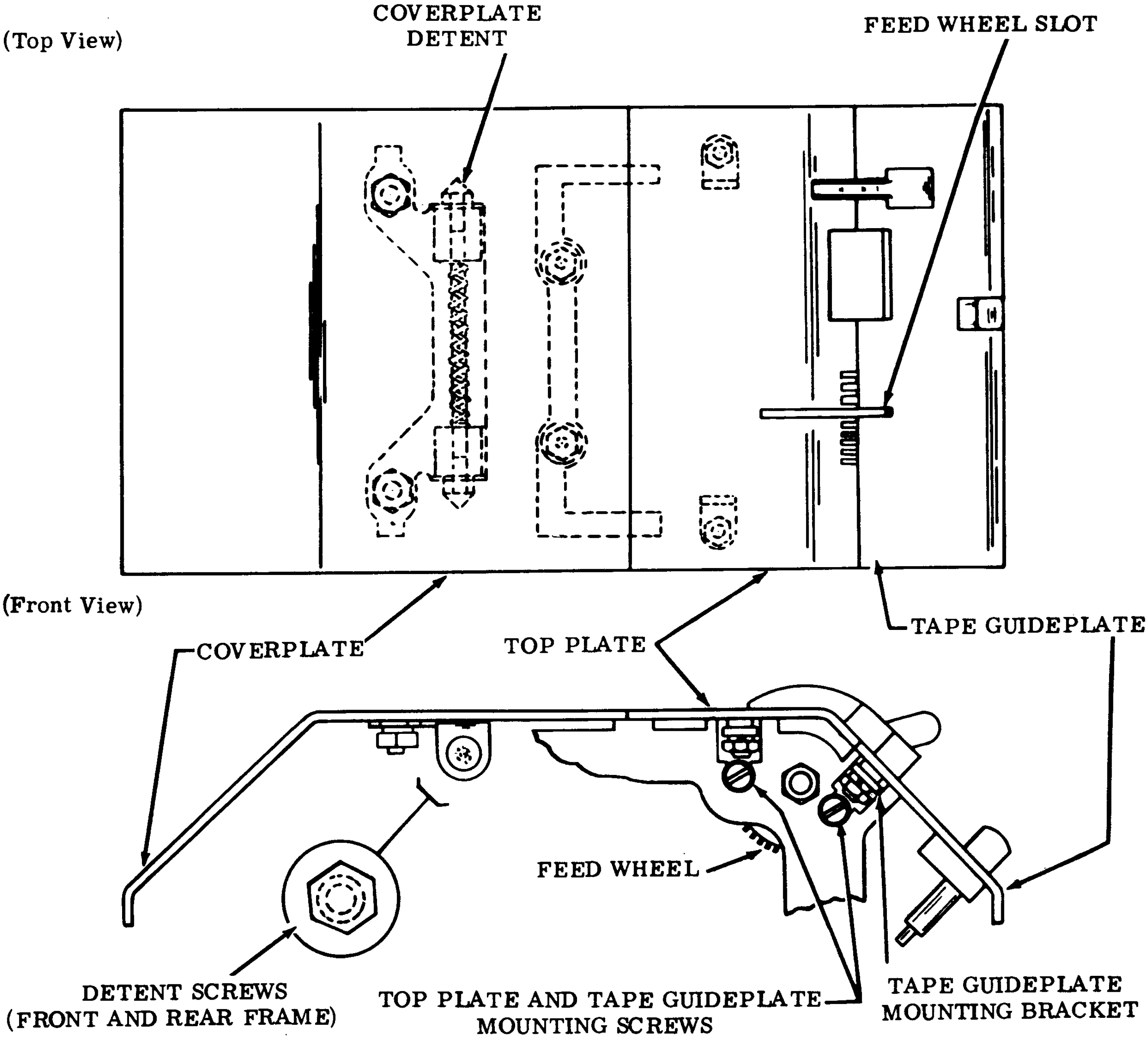
Symbol	Meaning
O1	Apply 1 drop of oil.
O2	Apply 2 drops of oil.
O3	Apply 3 drops of oil.
O20	Apply 20 drops of oil, etc.
G	Apply thin film of grease.
SAT	Saturate (felt oilers, washer, wicks) with oil.

1.09 Instructions

(1) REMOVING COVERPLATE: Lift left end of plate to release the detent fasteners then slide coverplate toward the left. Replace cover in the reverse order.

(2) REMOVING TOP PLATE: Loosen the front and rear mounting screws. Lift top plate upward.

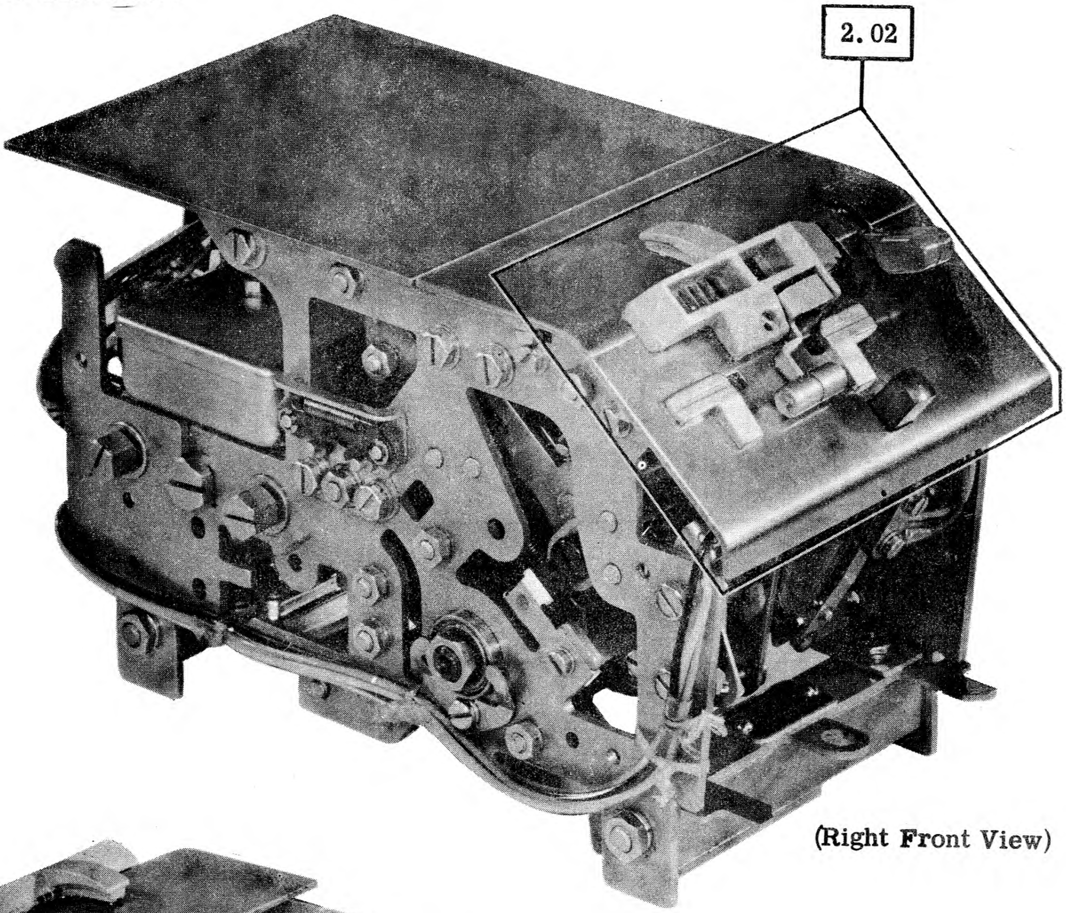
(3) REMAINING TAPE GUIDEPLATE: Loosen the tape guideplate mounting screws. Lift the tape guideplate.



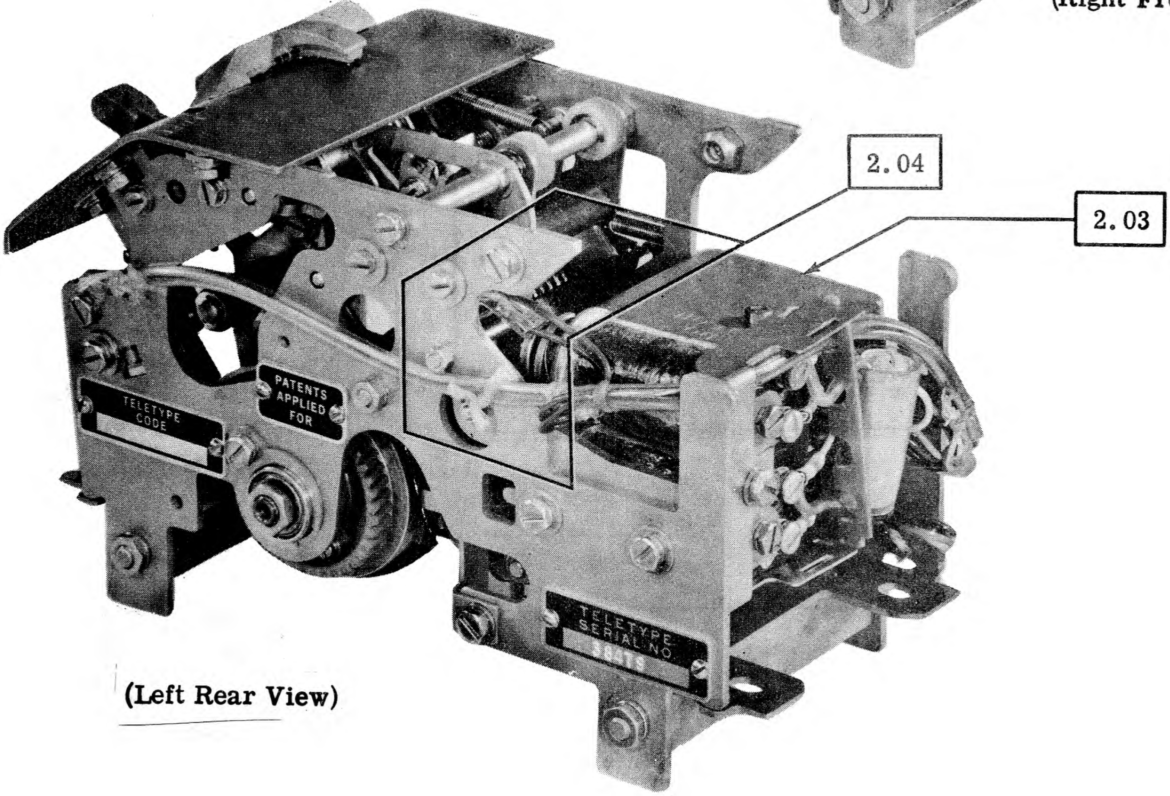
(4) REMOVING TRANSMITTER DISTRIBUTOR ASSEMBLY: Remove the screws which attach the unit to the base, and lift unit up to disengage the gear. Disconnect electrical plug.

2. LUBRICATION

2.01 Transmitter Distributor

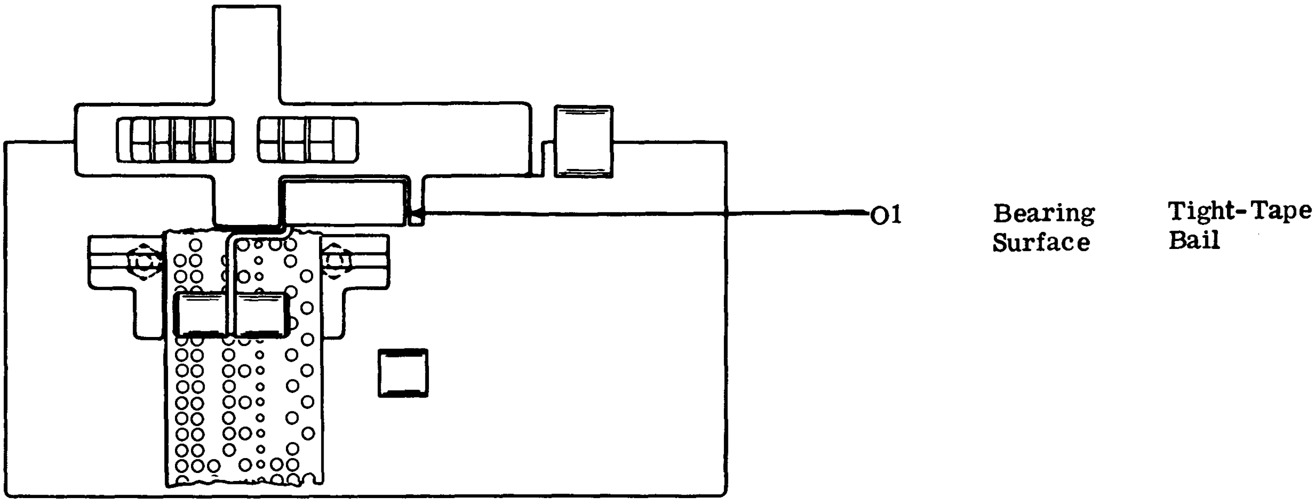


(Right Front View)

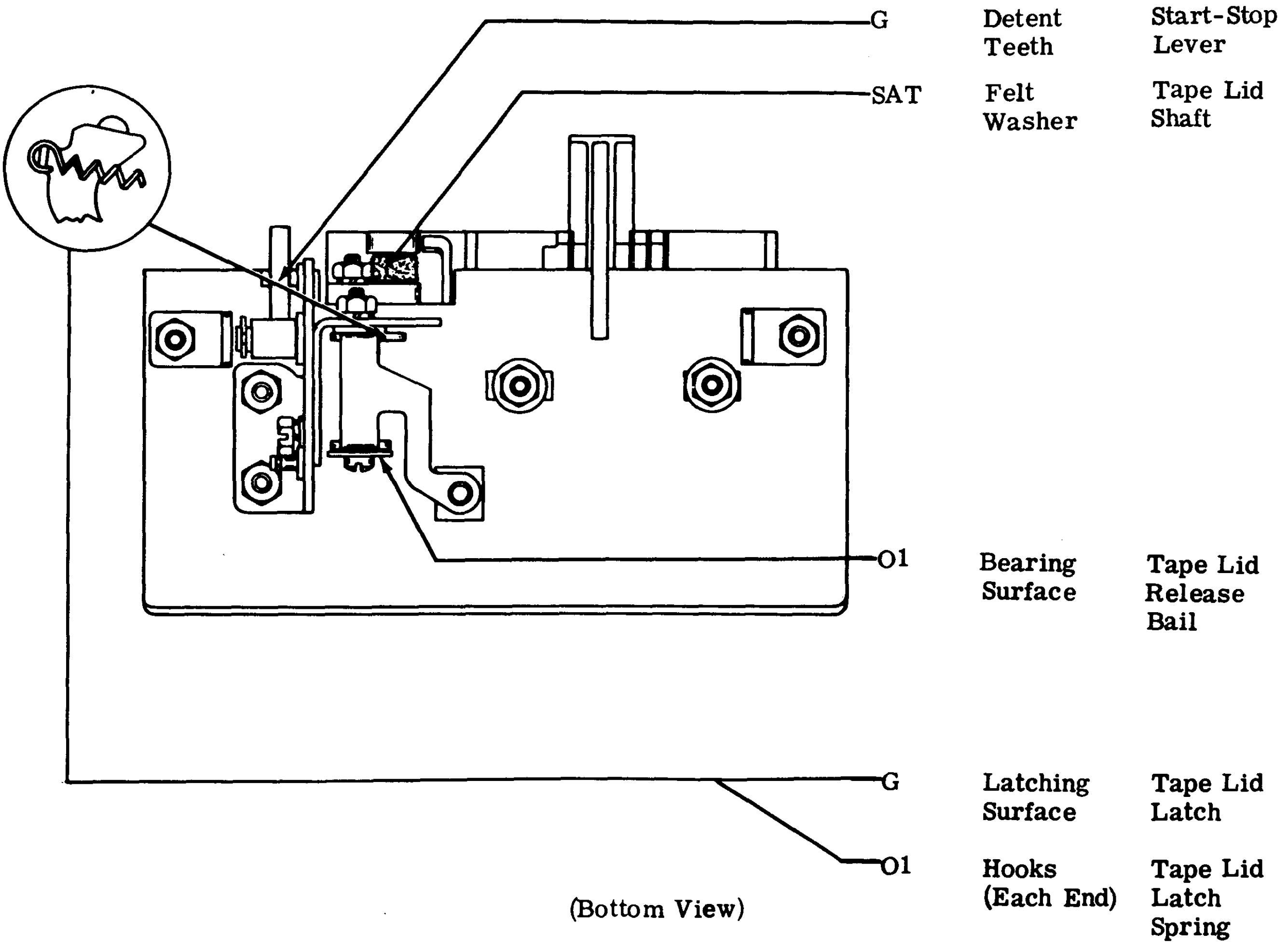


(Left Rear View)

2.02 Tape Guideplate

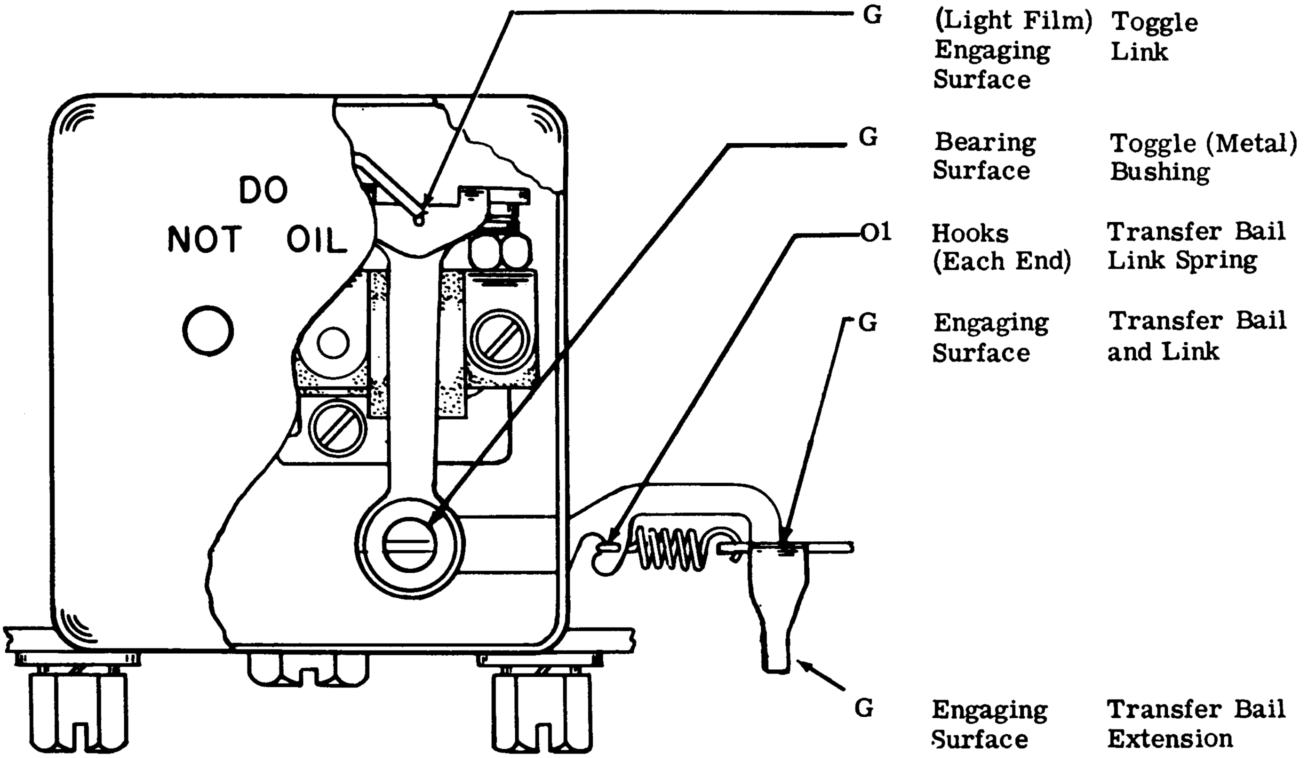


(Top View)



(Bottom View)

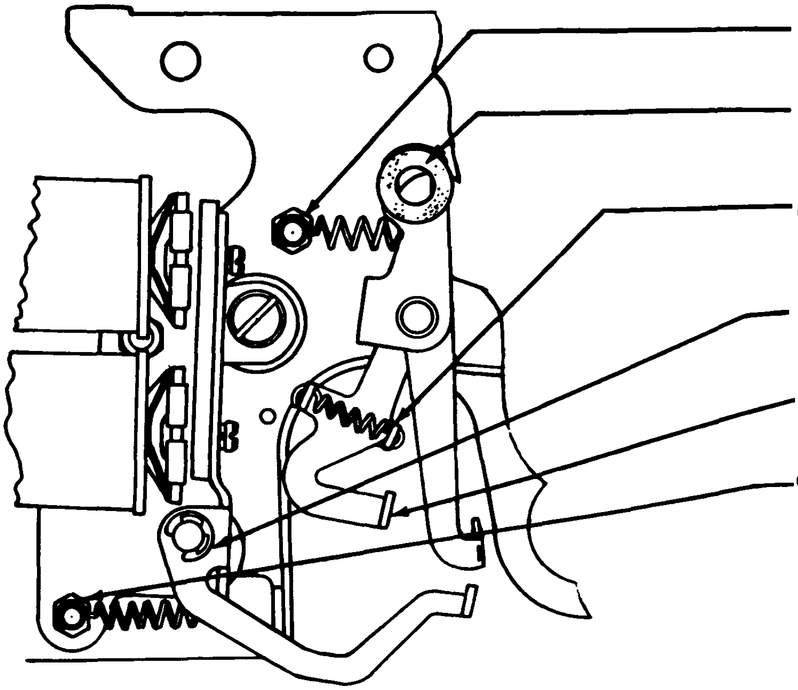
2.03 Signal Contact Assembly



(Top View)

Note: The marking DO NOT OIL on the signal contact box should be interpreted literally. Portions of the mechanism should be greased as indicated, but no oil should be used.

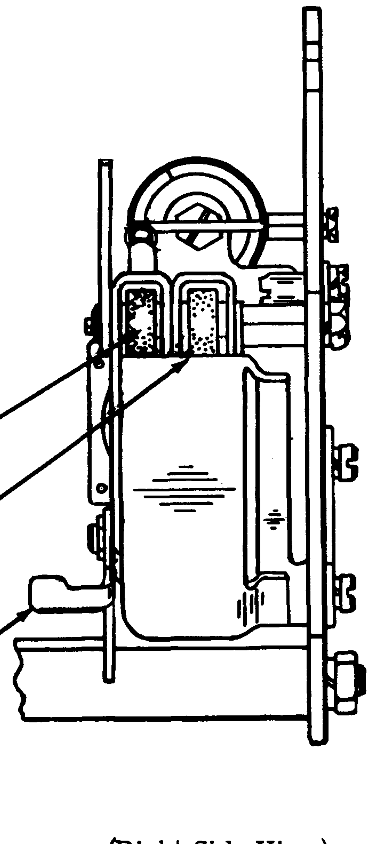
2.04 Clutch Trip Assembly



O1	Hooks (Each End)	Latchlever Spring
SAT	Felt Washer	Clutch Trip Bail
O1	Hooks (Each End)	Trip Lever Spring
SAT	Felt Washers	Armature Bail
O1	Engaging Surface	Trip Lever
O1	Hooks (Each End)	Armature Spring

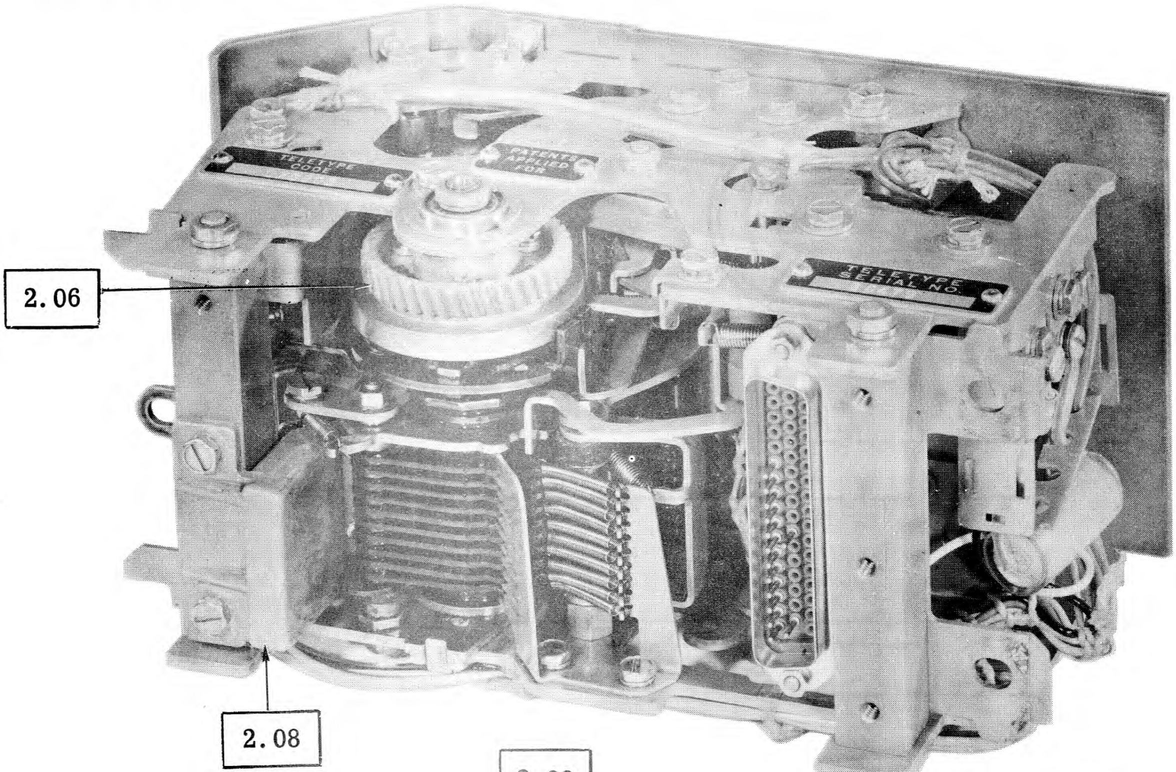
(Front View)

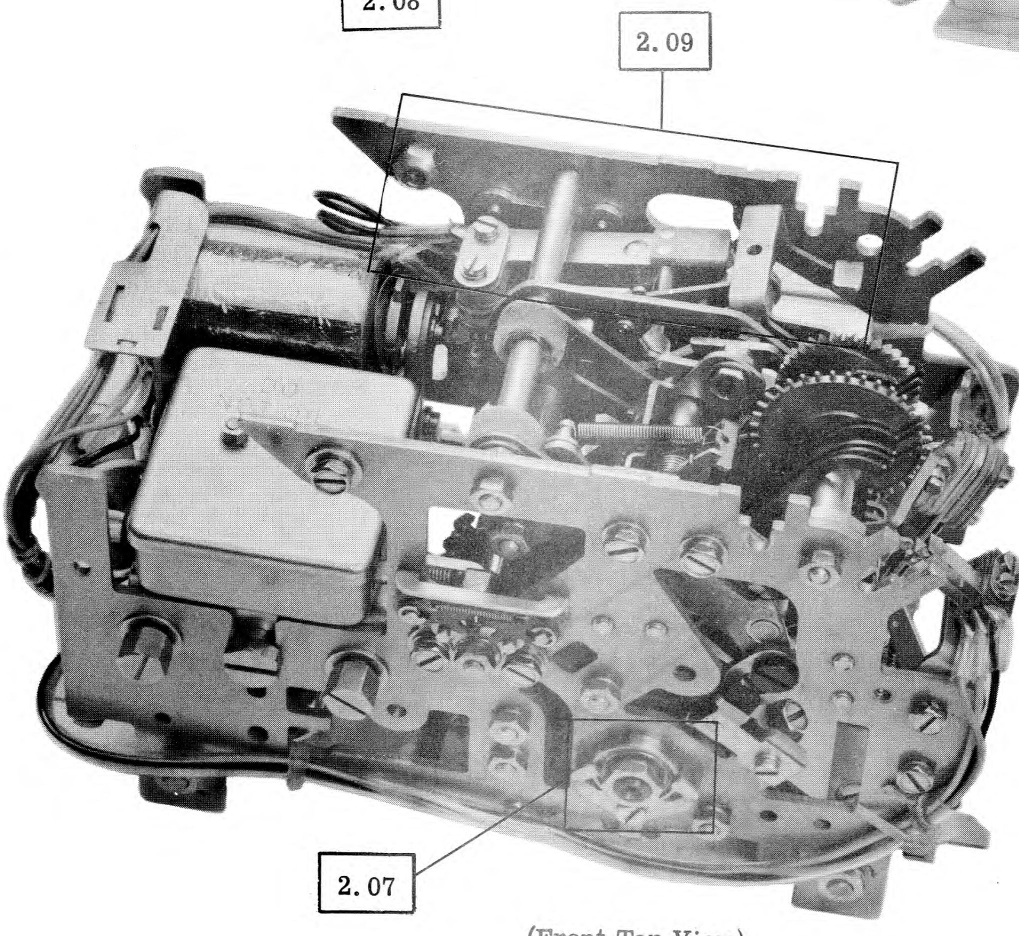
SAT	Felt Washer	Latchlever
SAT	Felt Washer	Trip Lever
G	Engaging Surface	Armature Bail Extension



(Right Side View)

2.05 **Transmitter Distributor**

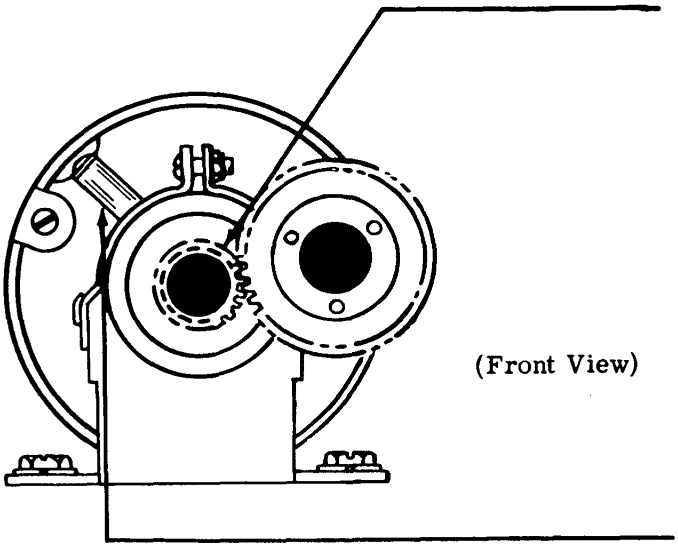




(Bottom View)

(Front Top View)

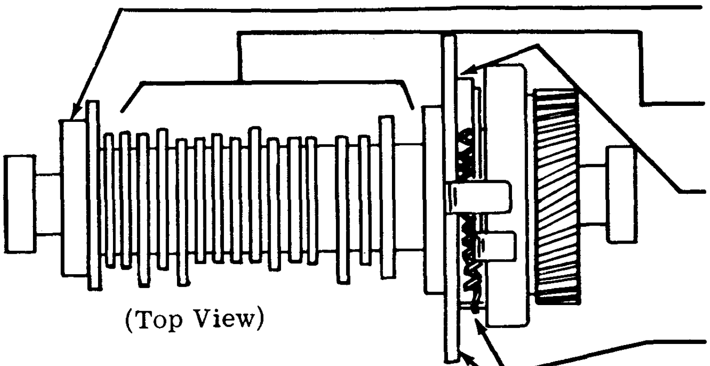
2.06 Gear Train



(Front View)

G	Teeth	Motor Pinion
O2	Ball Oiler	Motor Bearing

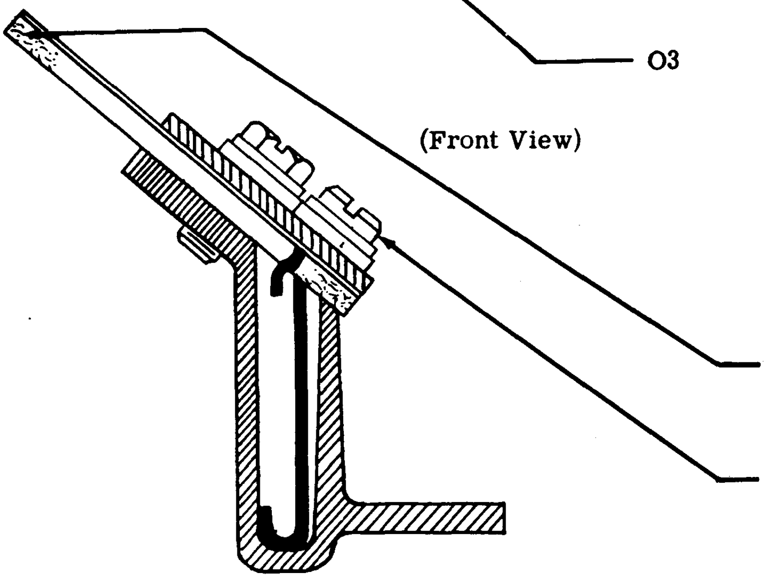
2.07 Main Shaft



(Top View)

O2	Camming Surface	Driving Arm Cam
O1	Camming Surfaces	Cam Sleeve
SAT	Internal Mechanism and Felt Wick	Clutch
G	Hooks (Each End)	Clutch Shoe Lever Spring
O3	Camming Surface	Clutch Disc

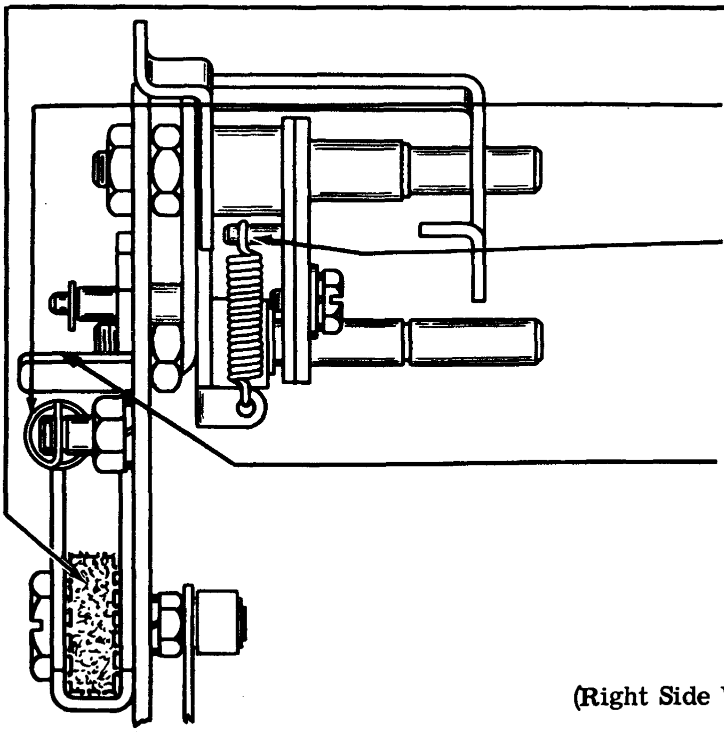
2.08 Oil Reservoir



(Front View)

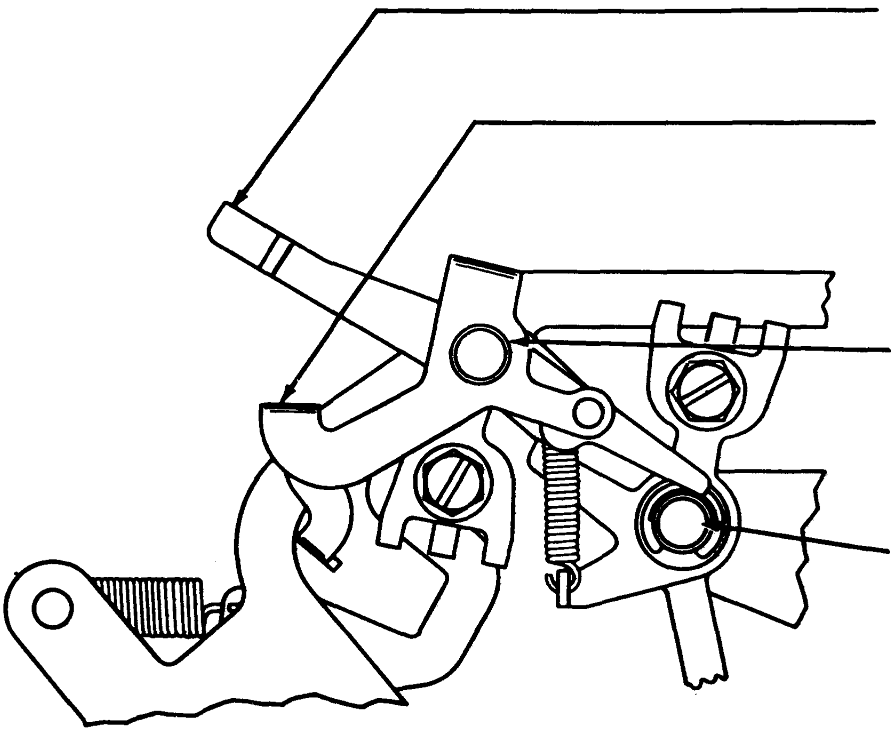
SAT	Leather Wick	Cam Oiler
FILL	Reservoir	Cam Oiler

2.09 Center Plate Assembly



SAT	Felt Washer	Ratchet Detent Bail
O1	Hooks (Each End)	Detent Bail Spring
O1	Hooks (Each End)	Tight-Tape Arm
G	Engaging Surface	Start-Stop Bail Extension

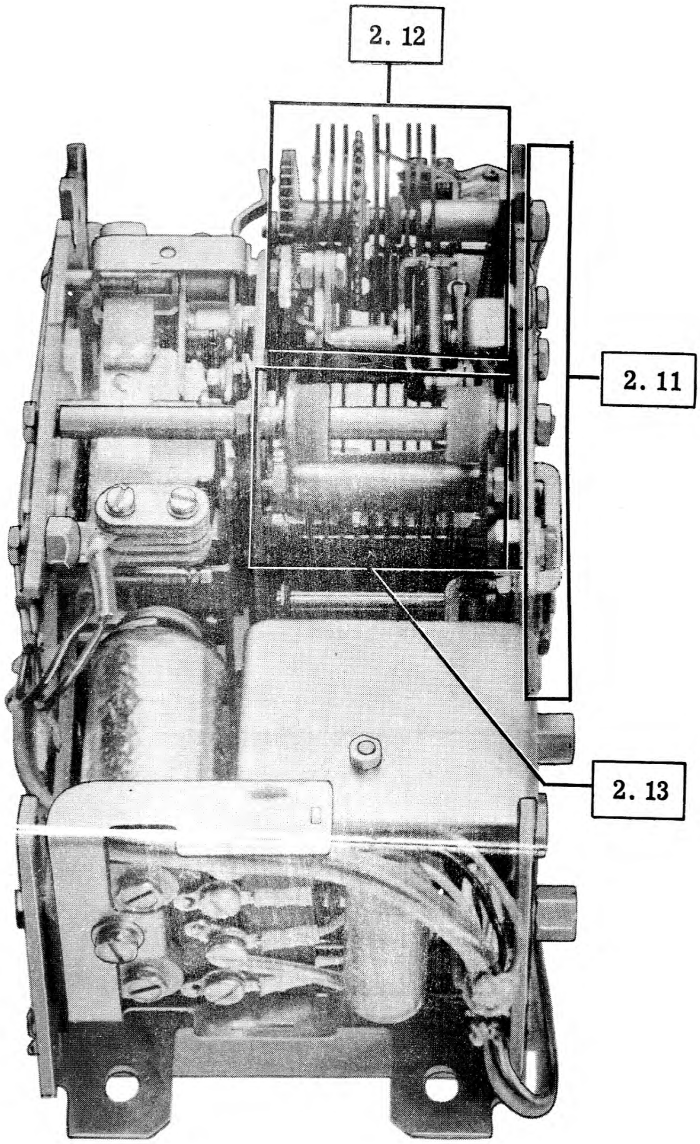
(Right Side View)



G	Engaging Surface	Tight-Tape Arm
G	Engaging Surface	Start-Stop Bail
O1	Bearing Surface	Start-Stop Bail
O1	Bearing Surface	Yield Arm

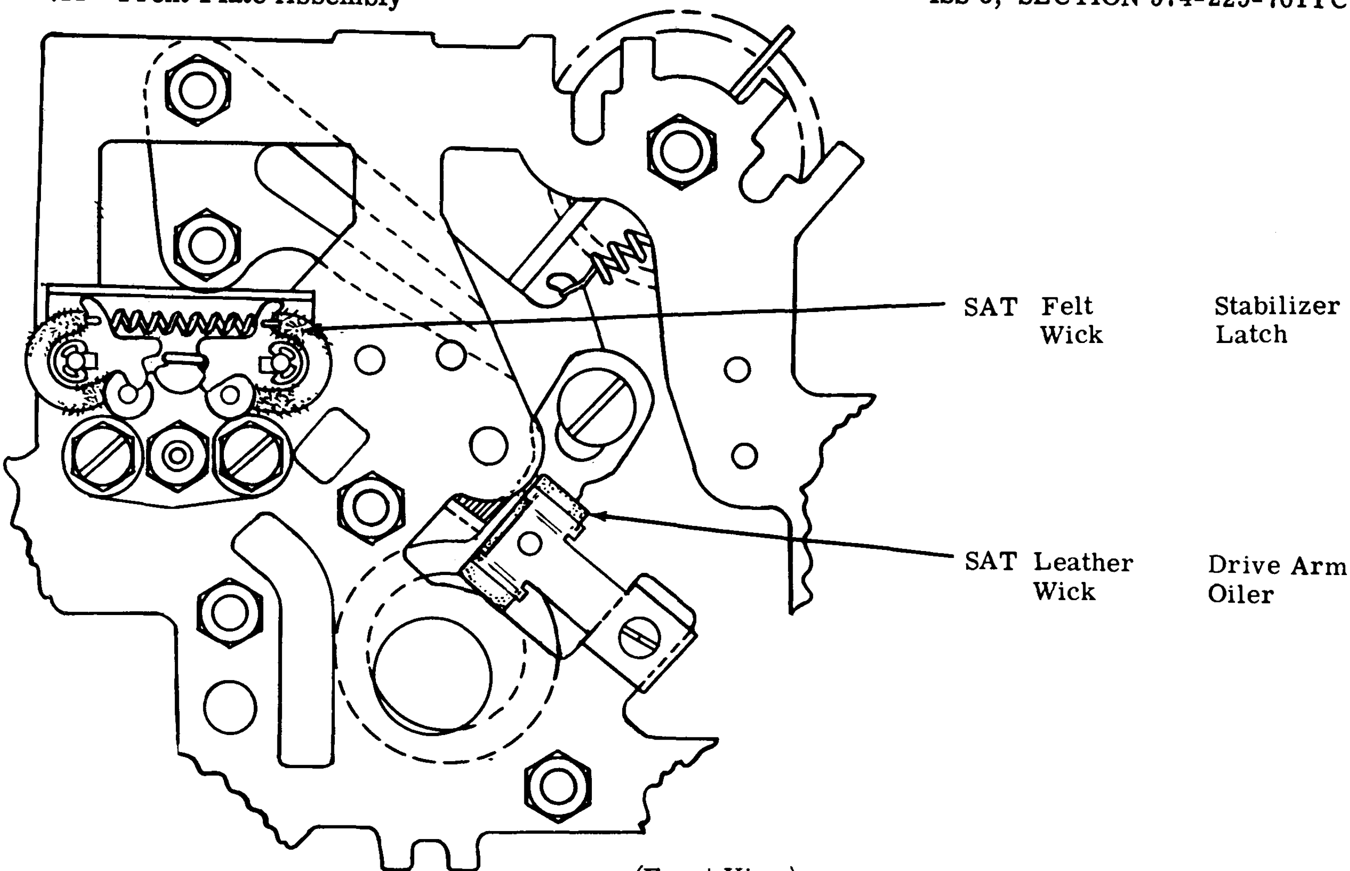
(Rear View)

2.10 Transmitter Distributor



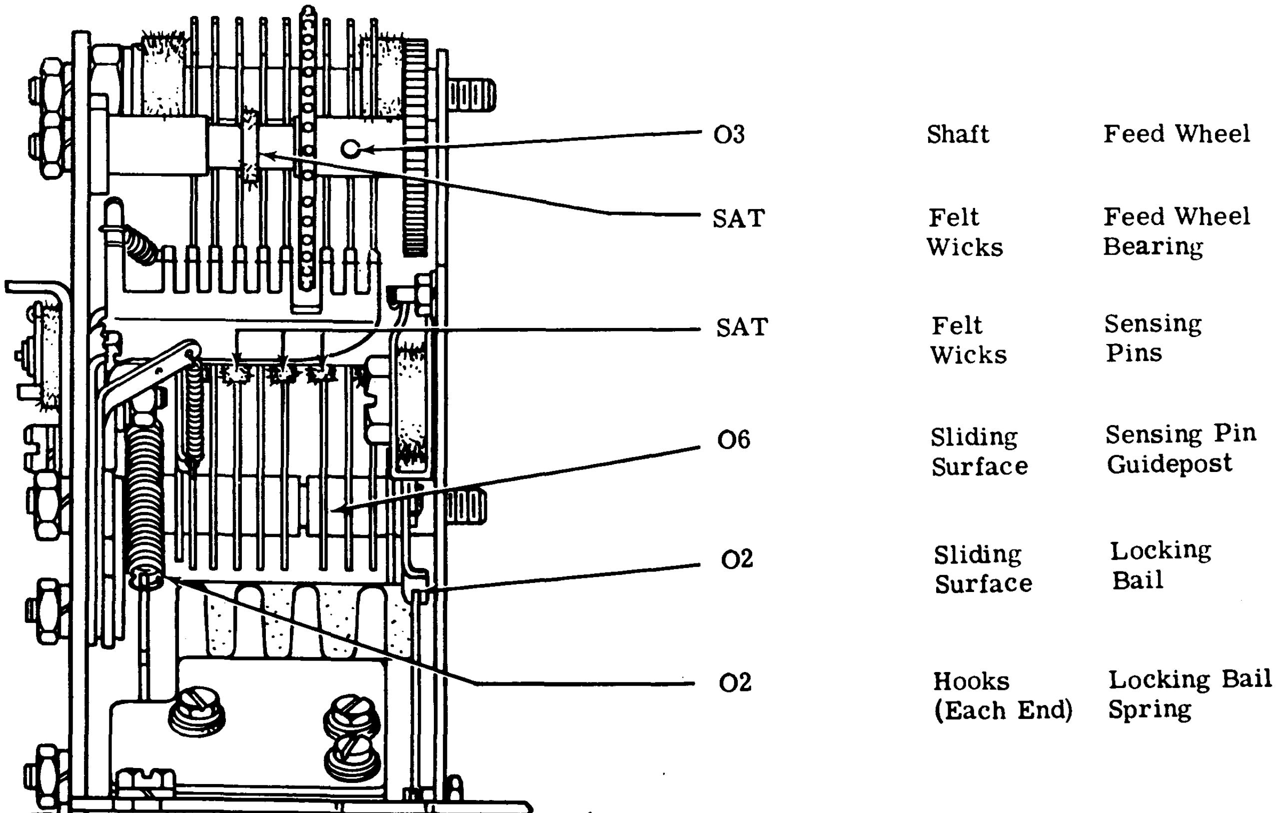
(Left Top View)

2.11 Front Plate Assembly



(Front View)

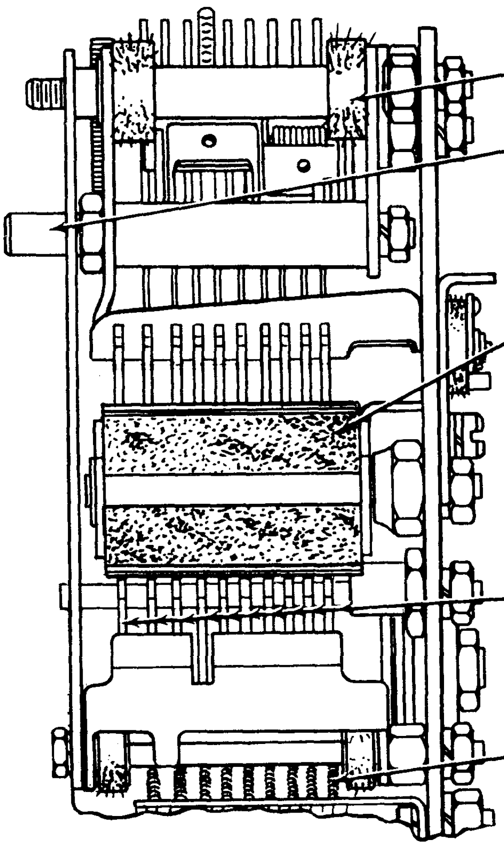
2.12 Sensing and Feed Mechanism



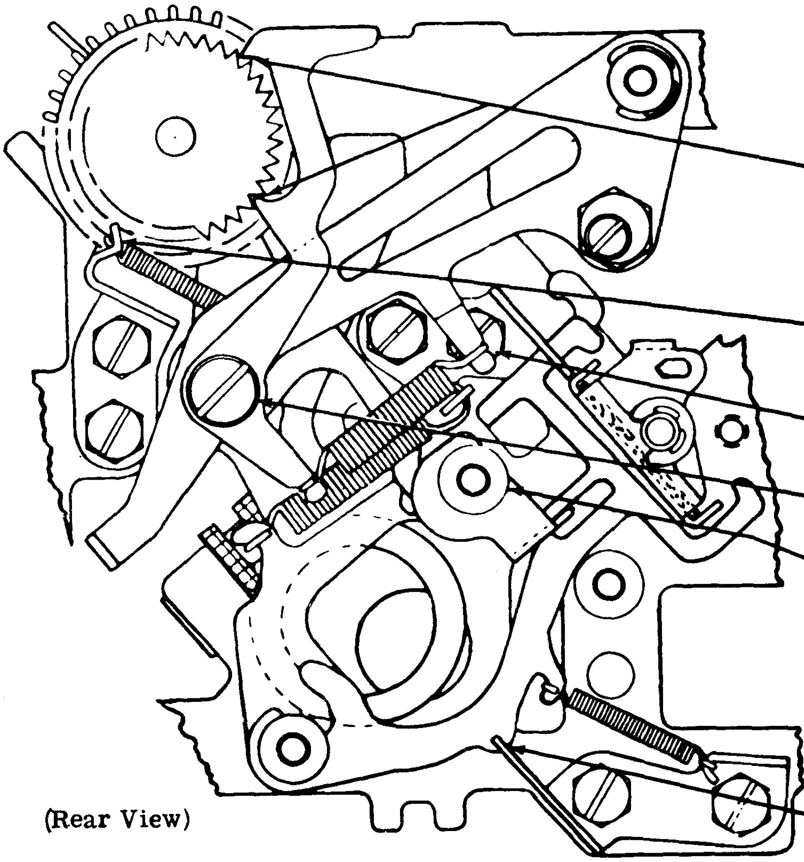
(Right Side View)

2.13 Transfer Mechanism

(Left Top View)



SAT	Each Felt Washer	Main Bail Pivots
G	Sliding Surface	Bail Drive Post
SAT	Leather Pad	Transfer Bail
O1	Sliding Surfaces	Transfer Levers
O1	Hooks (Each End)	Transfer Lever Springs
O1	Hooks (Each End)	Locking Bail Spring

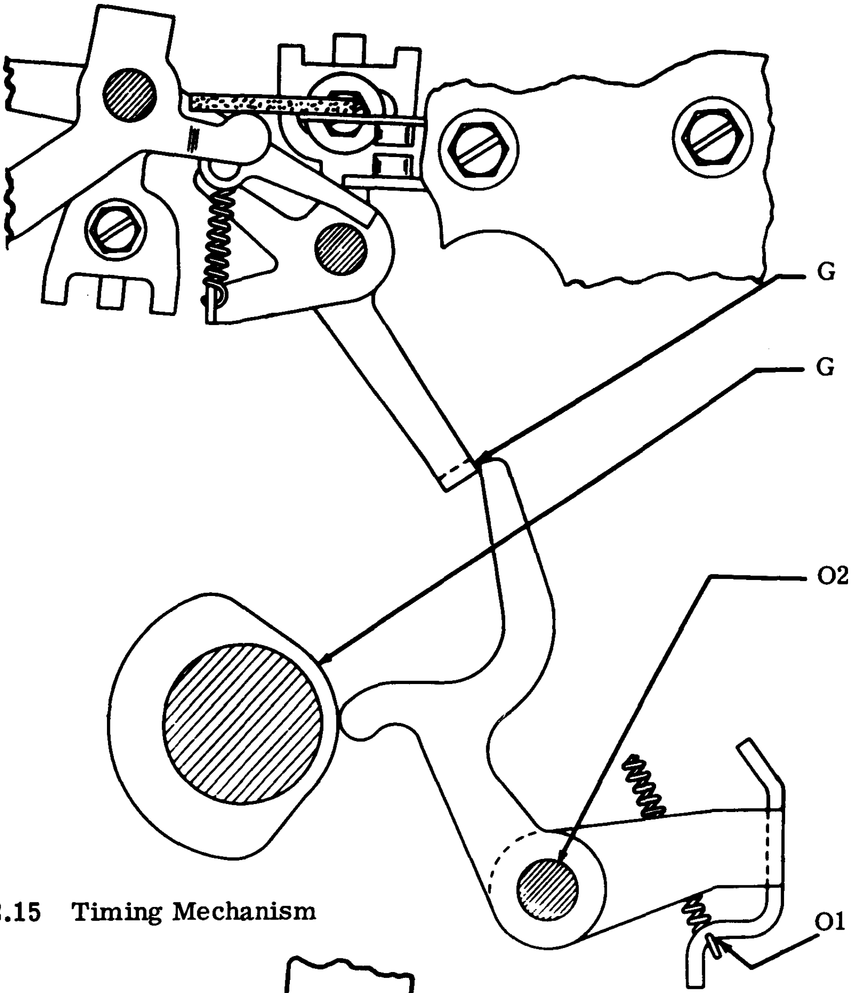


(Rear View)

O1	Teeth	Feed Pawl and Ratchet Wheel
O1	Hooks (Each End)	Main Bail Spring
O1	Hooks (Each End)	Feed Pawl Spring
O1	Sliding Surface	Feed Pawl Pivot
O1	Engaging Surface	Locking Bail
O1	Sliding Surface	Transfer Levers

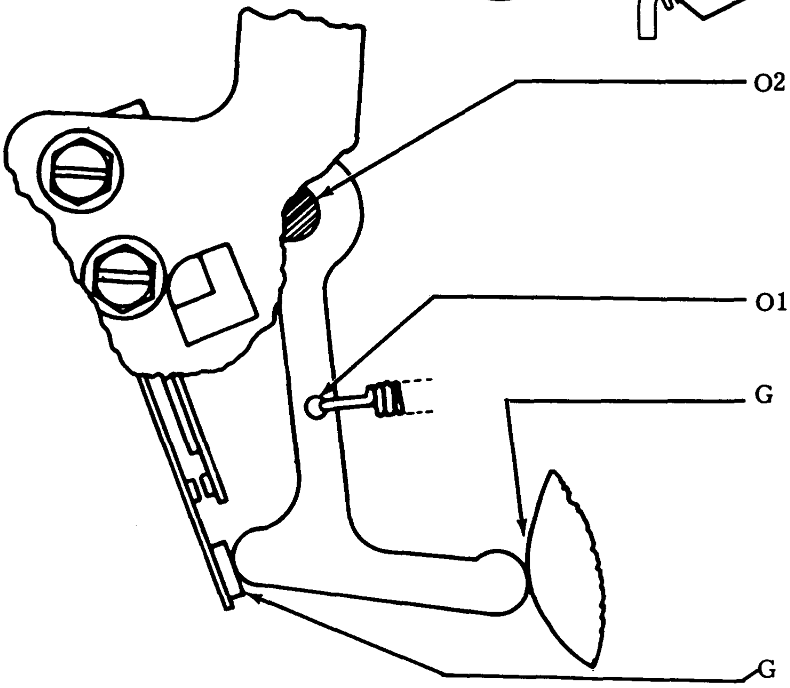
2.14 Rubout Sensing Mechanism

(Rear View)



G	Engaging Surface	Timing Arm
G	Light Film	Timing Cam
O2	Bearing Surface	Timing Bail
O1	Hooks (Each End)	Spring

2.15 Timing Mechanism

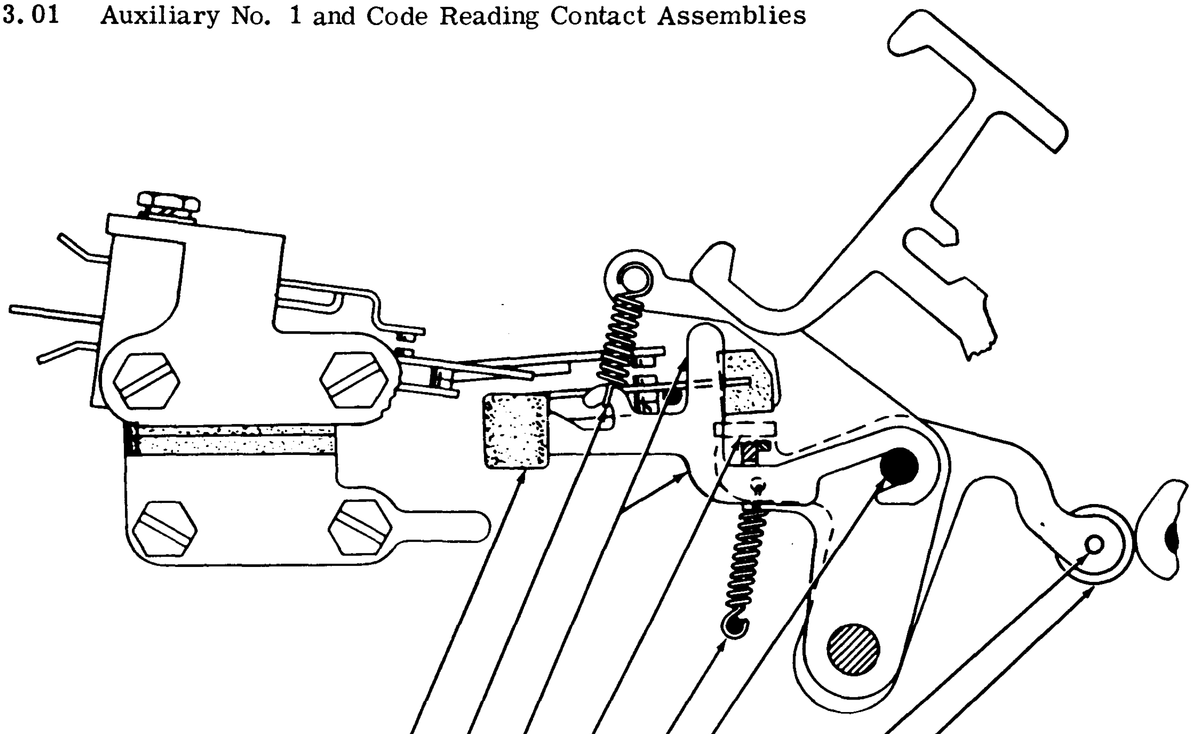


O2	Bearing Surface	Cam Follower
O1	Hooks (Each End)	Spring
G	Light Film	Cam
G	Insulator Surface	Swinger

(Rear View)

3. VARIABLE FEATURES

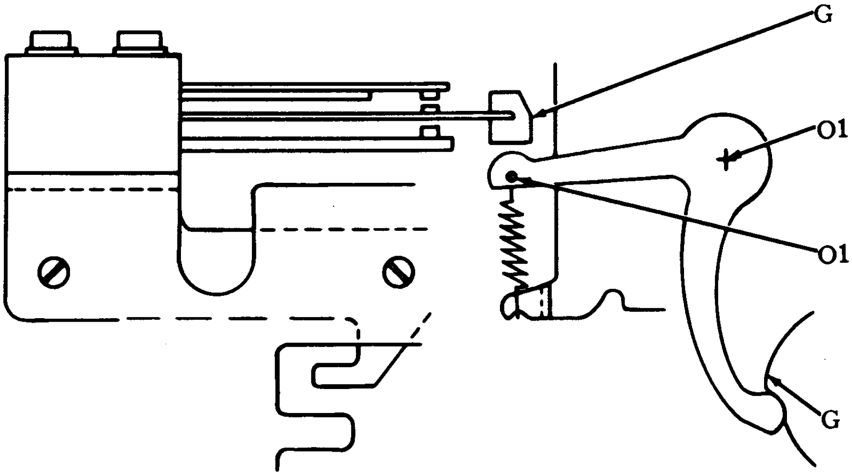
3.01 Auxiliary No. 1 and Code Reading Contact Assemblies



(Front View)

G	Bearing Surface	Split Bail Roller
O1	Bearing Surface	Split Bail Roller
O1	Bearing Surface (Each End)	Split Bail
O1	Each Loop	Spring
G	Contact Surface	Insulator
O1	Contacting Surface	Sensing Arm
O1	Each Loop	Spring
G	Contact Surface	Insulator

3.02 Auxiliary No. 2 Contact Assembly



Contact Surface	Insulator
Pivot Point	Cam Follower
Each Loop	Spring
Cam Surface	Auxiliary No. 2 Contact Cam

(Front View)

35 TRANSMITTER DISTRIBUTOR (SINGLE CONTACT)

DISASSEMBLY AND REASSEMBLY

1. GENERAL

1.01 Disassembly as outlined in this section covers a procedure for removing the principal sub-assemblies which make up the unit.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication and adjustments can be accomplished simply by removing the subject component from the cabinet. If possible, disassembly should be confined to sub-assemblies, which can, in some cases, be removed without disturbing adjustments. When reassembling the sub-assemblies, be sure to check all associated adjustments, clearances and spring tensions.

1.04 If a part that is mounted on shims is removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted.

1.05 Retaining rings are made of spring steel and have a tendency to release suddenly when being removed. Loss of these retainers can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.06 Avoid loss of springs in disassembly by holding one spring loop with the left hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.07 Raise the upper cover and unplug the copy light cord. Lower the upper cover to its first latched position. Remove the control panel bezel at the right end of the cover. Unlatch the lower cover and raise it 90 degrees.

Note: On sets equipped with a form supply container on the rear of the cabinet, rearward foot extensions should be in position on the cabinet. This prevents the cabinet from tilting when components are removed.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a sub-assembly from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

2.02 Remove the tape chute at right end of the transmitter distributor by removing two screws underneath the cabinet shelf which secure the tape chute bracket to the cabinet shelf.

2.03 Remove the three screws which secure the transmitter to its base studs and lift the unit off.

2.04 Remove the TP192237 cover plate assembly by lifting it upward out of its detented position.

2.05 To remove the TP192599 top plate assembly, loosen the TP152893 clamp screw on each side of the unit and slide the top plate upward.

2.06 Remove the TP163999 tape guide plate assembly, loosen the clamp screw on each side of the unit and lift the guide plate upward.

2.07 Remove the 10-32 nuts and lock washers from the rear of the bottom posts. Remove the TP156588 bearing clamp from rear plate at the main shaft bearing.

2.08 Remove the 6-40 screw which secures the rear plate to the TP156622 post.

2.09 Pull the rear plate assembly apart from the front plate assembly. The wiring may be left intact unless it is necessary to remove it.

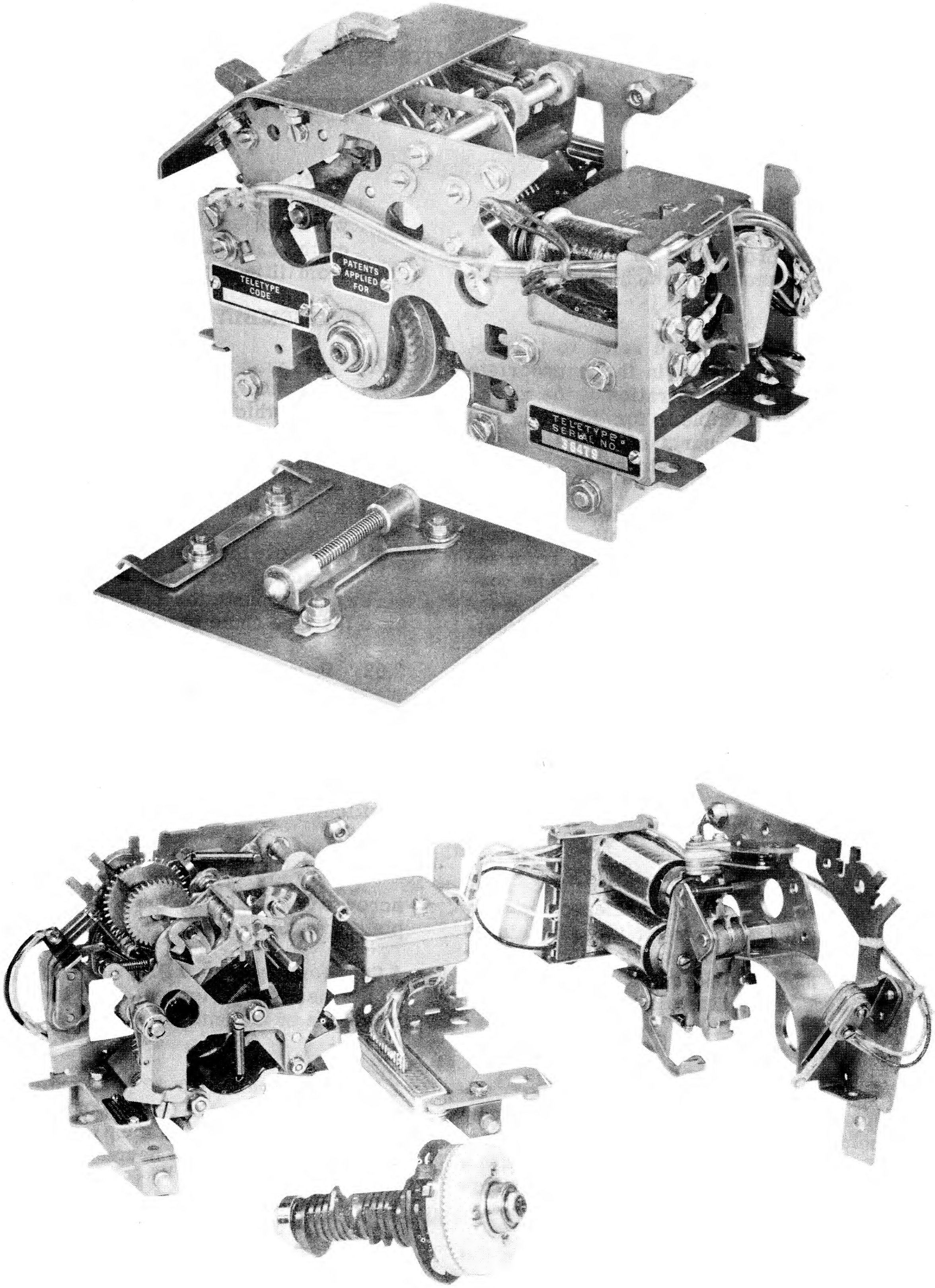


Figure 1 - 35 Transmitter Distributor-Cover Plate Removed (Upper)
Main Sub-Assemblies Removed (Lower)

2.10 To remove the main shaft, remove the TP156831 main shaft bearing clamp and the TP156832 plate from the front plate.

2.11 Remove the main shaft assembly.

2.12 Remove the two 6-40 nuts which secure the center plate to the two guide posts. Remove the TP7603 main bail latch spring.

2.13 Remove the center plate assembly.

2.14 To remove the clutch trip magnets, remove the two screws, lock washers, and flat washers that secure the bracket to the rear plate.

2.15 For further disassembly refer to the exploded views in parts literature. It may be necessary in some instances to remove some wiring. When this is done, make note of how wiring was originally placed.

35 ELECTRICAL SERVICE UNIT

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section has been generally revised to include information on recent 35 electrical service units. Because this issue is a general revision, marginal arrows that indicate changes have been omitted.

1.02 The 35 electrical service unit serves as an area of concentration for the wiring of 35-type apparatus and provides mounting facilities for various electrical assemblies and components.

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

1.04 Complete operation of an electrical service unit requires connections with other components of a set with which it is used. Additional information concerning the support functions of the unit may be found in sections discussing specific components and complete sets. Only independent features in the electrical service unit are discussed in this section, under principles of operation.

1.05 The electrical service units discussed in this section are used in all models of the following sets:

(a) 35 Receive Only (RO) Set.

(b) 35 Keyboard Send-Receive (KSR) Set.

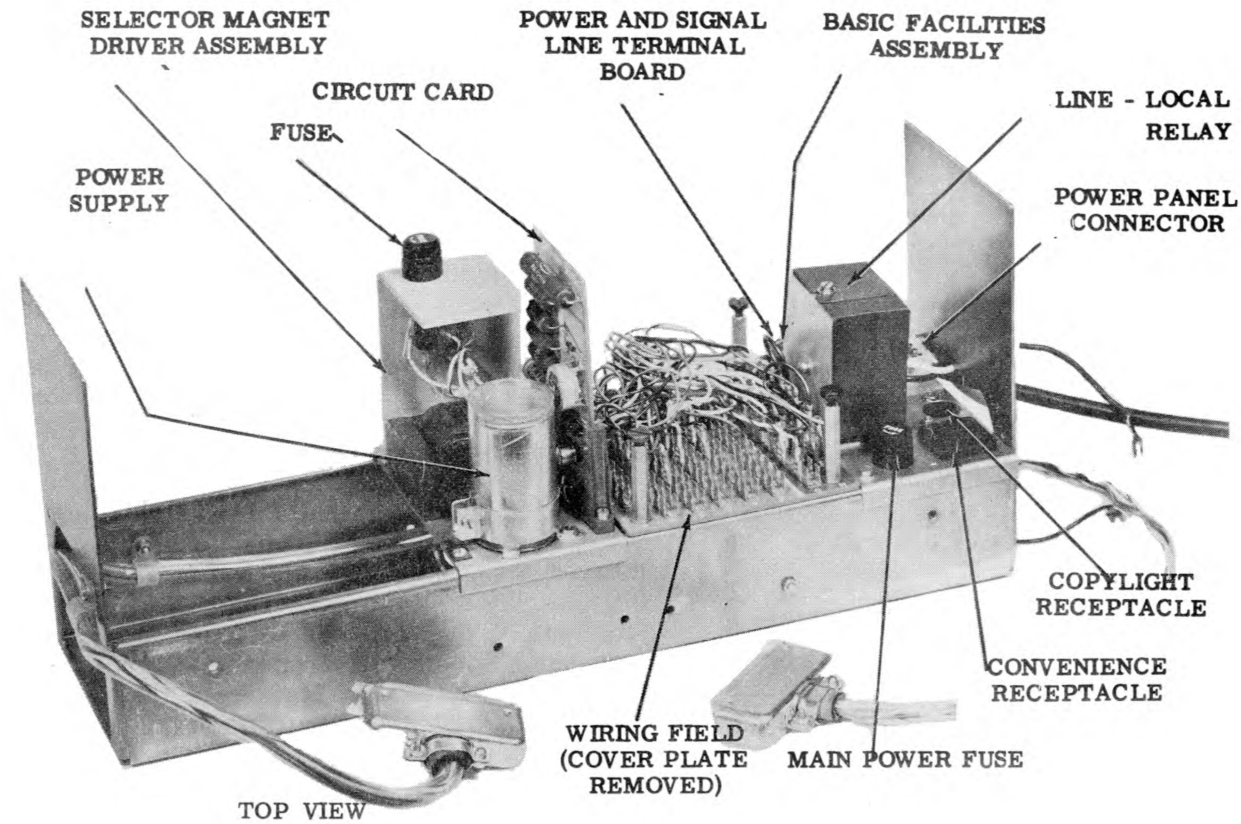
(c) 35 Automatic Send-Receive (ASR) Set.

(d) 35 Receive Only Typing Reperforator (ROTR) Set.

These sets may be utilized in a variety of installation configurations, including: private line applications, data communications networks, circuit switching networks, and computer installations.

2. DESCRIPTION (See Figures 1, 2, and 3)

2.01 The electrical service unit consists, basically, of a rectangular, metal chassis (or container) and a number of mounting plate assemblies. Each mounting plate assembly consists of a functional group of components. They are mounted on the chassis and are interconnected, as required, with strapping.



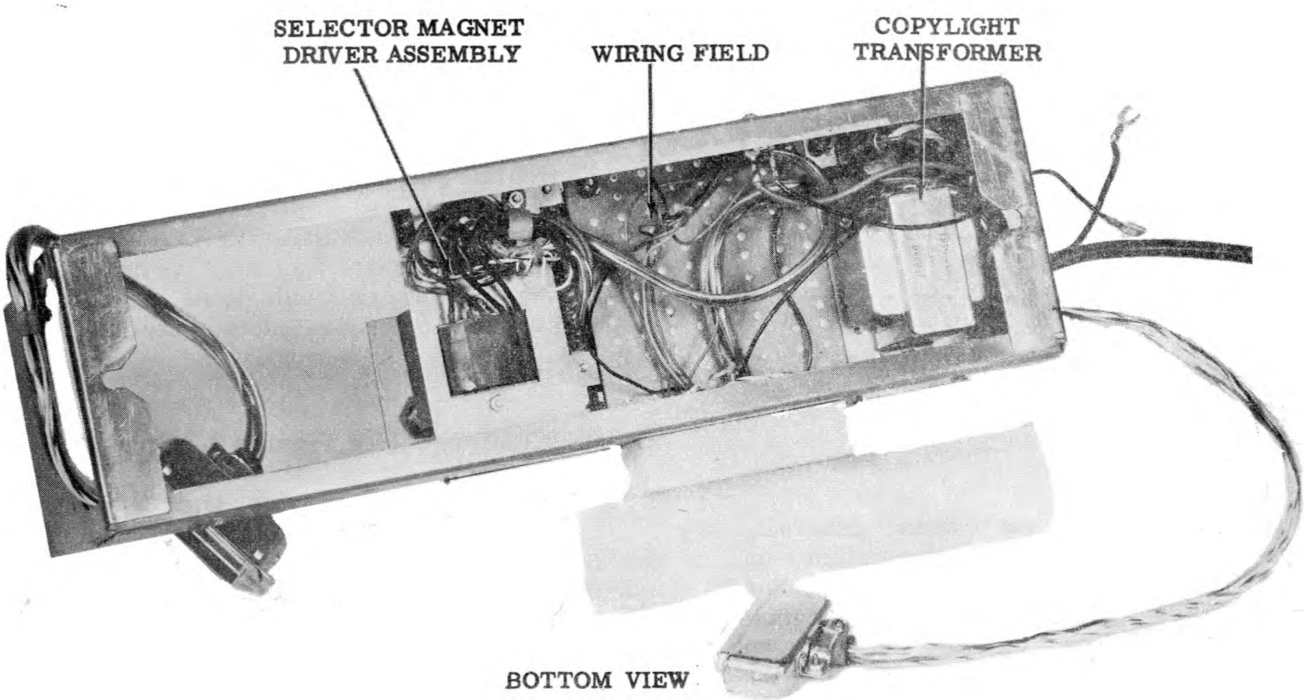


Figure 1 - Typical Electrical Service Unit for 35 KSR Set

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

(a) A copylight transformer to supply power to the set's copylights.

(b) A copylight receptacle.

(c) A convenience receptacle.

(d) Fuses for protection of the main power and other circuits.

(e) A power and signal line terminal board.

(f) A line-local relay to provide switching to either online or independent, local operation.

(g) A main terminal board to provide a wiring field for connection of cable assemblies to the electrical service unit.

(h) A motor control relay for remote control of the set's motor.

(i) A main power on-off switch.

(j) Ground strapping.

(k) Cable assemblies, as required, for interconnection with other components of the set. The set's power cord may also be included.

(l) A transistorized selector magnet driver assembly, to amplify the incoming line signal to 500 milliamperes for operation of the receiving circuit selector magnets. More than one assembly may be installed to accommodate the receiving circuits of a set. For example, in an ASR set, two assemblies may be used: one for the typing unit, the other for a reperforator.

(m) A signal regenerator circuit to improve the output of the keyboard signal generator.

(n) A tape feed-out relay to pulse a reperforator's tape feed-out magnet.

(o) A reperforator control relay to blind a typing reperforator's selector magnets to line signals.

(p) An automatic turn around traffic control circuit card and disabling switch.

(q) Control panel and cable assemblies, typically consisting of two panels and cabling. One panel may support the mode and other pushbutton controls, the other the end-of-line indicator lamp. In some electrical service units, only the cabling to the external controls panels is provided.

(r) A noncontention (NCT) relay to prevent a sending station's answer-back from operating when transmitting a WRU code.

(s) Automatic mode switch relays, or a manually operated rotary mode selector switch.

(t) A line jack connected across the external signal line for testing purposes.

(u) An auxiliary power supply.

(v) Character counter suppression components.

(w) A line-shunt relay, used in conjunction with a line test key and an auxiliary power supply, to allow local set operation.

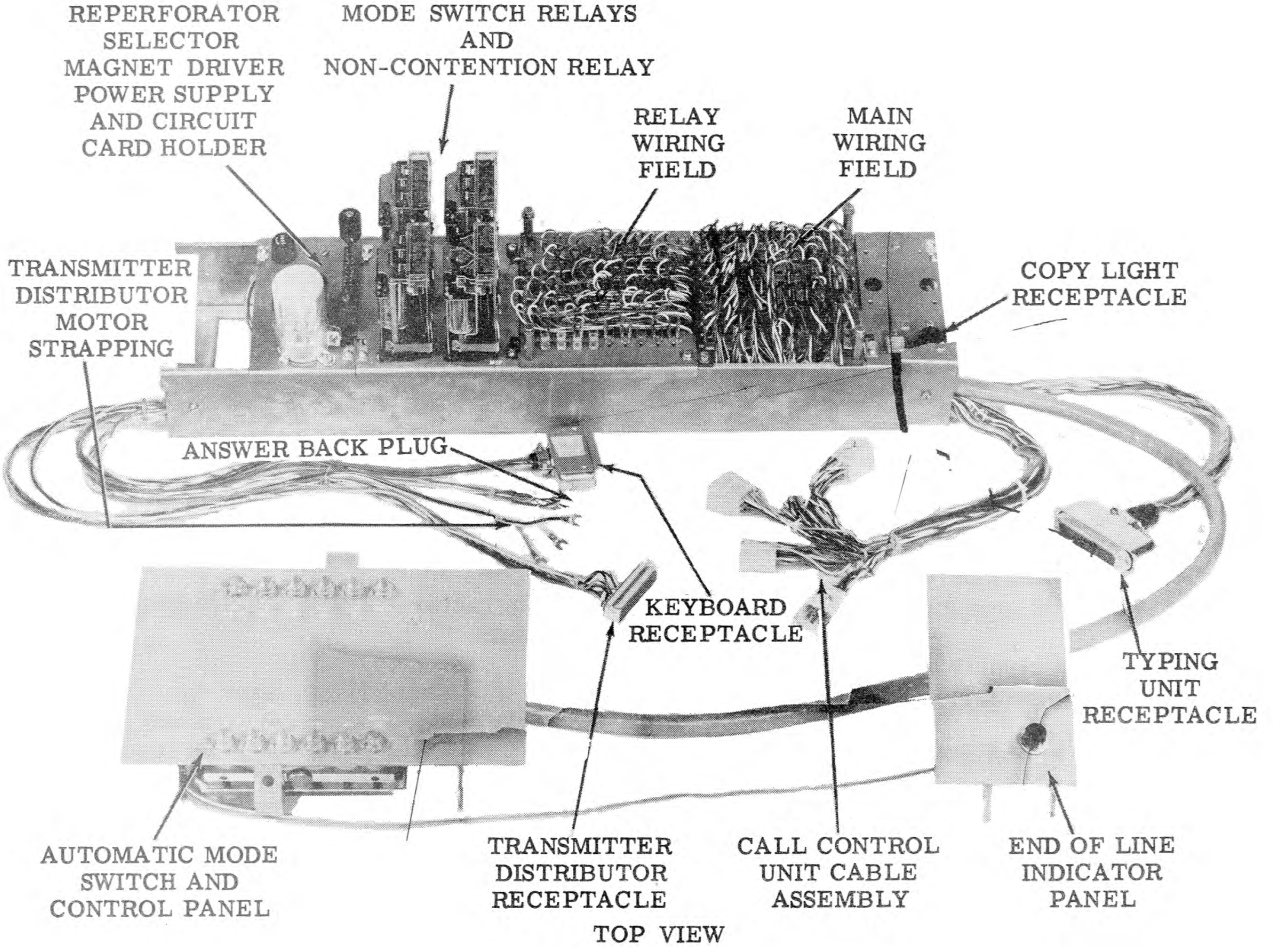
2.03 The electrical service unit used with standard (dc) sets is wired to provide half duplex signal line operation. The unit may be wired (optional) to obtain full duplex operation, which permits receiving messages and transmitting them at the same time without interference between the two signals. This is accomplished by electrically separating the sending and receiving loops of the set by making wiring changes in the electrical service unit and connecting the loops to the appropriate duplex signal lines.

3. PRINCIPLES OF OPERATION

GENERAL

3.01 Since the major function of the electrical service unit is to provide support for circuit facilities, only general operating principles of selected components are presented below. Detailed operating principles will be found in the sections which discuss these components in relation to set operation.

3.02 The wiring diagram for the electrical service unit is incorporated into the schematics which appear in the appropriate section for each 35 set (ie, RO, KSR, and ASR).



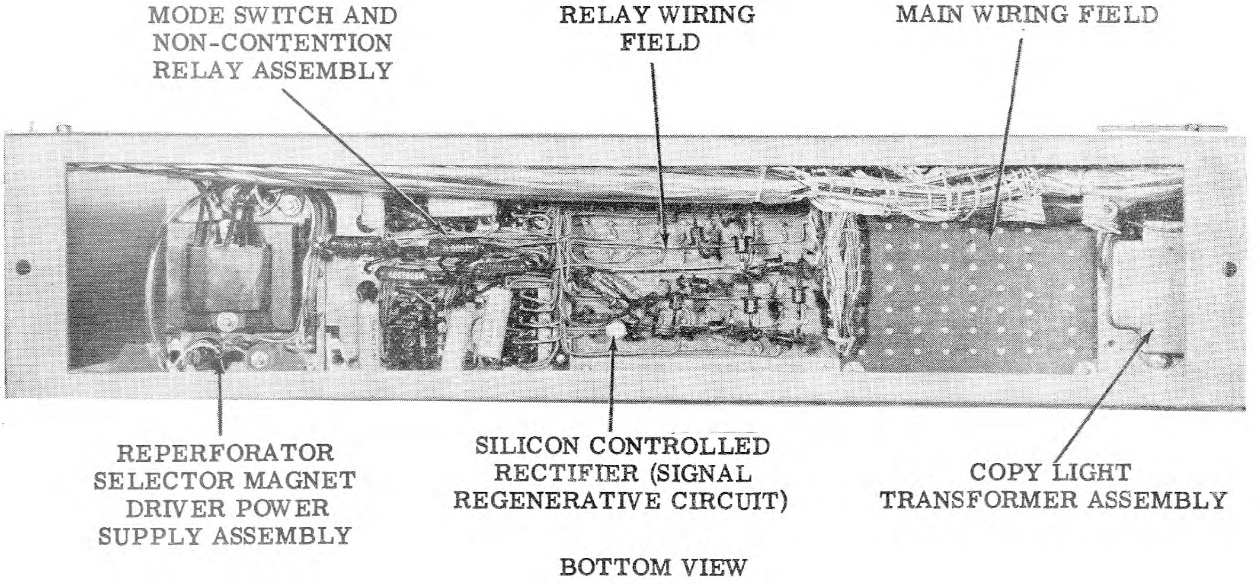


Figure 2 - Typical Electrical Service Unit for 35 ASR Set

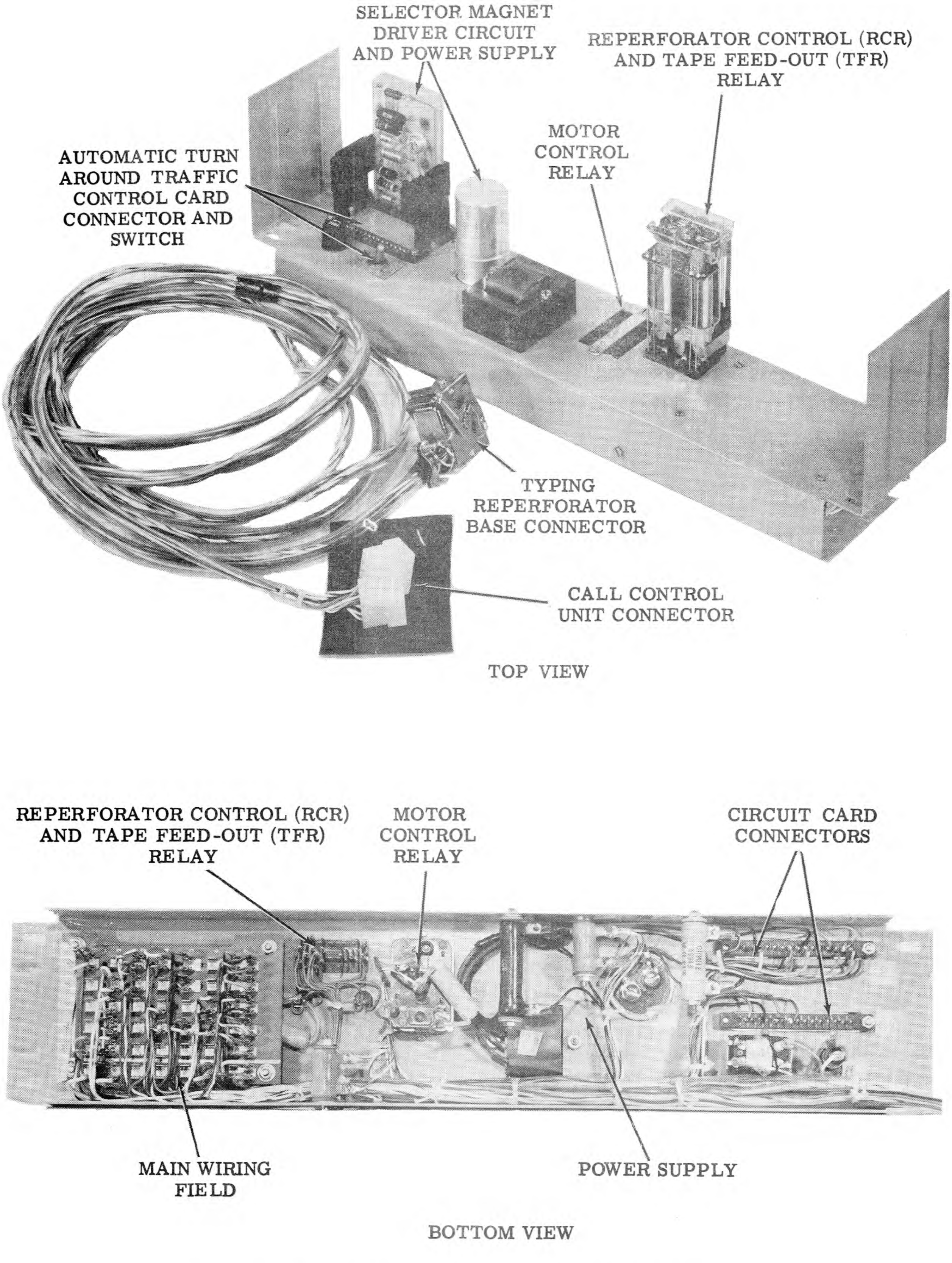


Figure 3 - Typical Electrical Service Unit for 35 ROTR Set

SELECTOR MAGNET DRIVER

3.03 The selector magnet driver assembly is a two stage transistorized amplifier capable of switching high output currents (0.500 ampere) at very closely controlled input current levels. The output of the driver is adjustable to 0.500 ampere output, but may change slightly due to normal supply voltage and component variations. Selector magnet driver assemblies are available which operate from either a 20 milliampere or a 60 milliampere line signal input.

CAUTION: DISCONNECT POWER TO SELECTOR MAGNET DRIVER ASSEMBLY - BEFORE REMOVING CIRCUIT CARD - TO AVOID DAMAGING TRANSISTORS.

LINE-LOCAL RELAY

3.04 The line-local relay is used to switch a set to either online or local operation. It is used in standard sets (dc) and is controlled by a rotary type power switch. With the switch in the ON position, the line-local relay energizes, placing the set's sending and receiving circuit in series with the signal line. The relay is energized via the selector magnet driver power supply (3.03).

3.05 Turning the power switch to the OFF position de-energizes the line-local relay. The external signal line to the set is shunted, but the selector magnets in the set's receiving circuits are held energized to prevent spurious characters from being typed or punched when the set is turned on and off.

3.06 With the power switch in the ONLINE position, the line-local relay is energized, and the signal generating and monitoring circuits of the set are connected into the signal line.

3.07 When the power switch is in the LOC (local) position, the set may be operated offline. The line-local relay de-energizes, shunting the external signal line to the set and connecting a local signal battery in series with the set's signal circuit.

ELECTRICAL MOTOR CONTROL

3.08 This feature permits a set's motor to be controlled remotely via the signal line. So equipped, the set may operate unattended. The sending station can turn the set on by sending a break, or turn it off after the data has been transmitted by sending the EOT code.

MOTOR CONTROL RELAY

3.09 The motor control relay is energized by the closing of the OR/AN relay contacts in the ASR or KSR set (a local key in these sets is also provided to energize this relay). The motor control relay is held operated until the motor hold contact on the feed-out mechanism of the typing reperforator breaks at the end of the feed-out cycle.

REPERFORATOR CONTROL RELAY

3.10 The reperforator control relay (RCR) has five sets of contacts used for the following functions:

(a) Selector magnet driver control.

(b) RCR relay locking.

(c) Tape-feed relay control.

(d) Feed-out magnet control.

(e) ROTR on lamp (in ASR) control.

The relay is energized by the closing of the R1 on contact in the ASR or KSR stunt box, or the ROTR ON key on the ASR control panel. The RCR relay is held energized by one of its own contacts, which is in series with the R1 off contact in the ASR or KSR stunt box.

3.11 The selector magnet driver control contact is normally closed, and shunts the signal line to the selector magnet driver, binding it to any signal. When the RCR relay is energized, the selector magnet driver will respond to the incoming signal.

AUTOMATIC TURN AROUND TRAFFIC CONTROL

3.12 The purpose of the automatic turn around traffic control (ATATC) is to blind the typing reperforator selector magnet driver to locally (ASR or KSR set) generated traffic, while allowing incoming traffic through. An all-traffic switch is provided to disable the ATATC.

TAPE FEED-OUT CONTROL RELAY

3.13 The tape feed-out control relay (TFR) is controlled by the reperforator control relay (RCR). A make contact on the TFR relay and a break contact on the RCR relay are wired in series with the tape feed-out magnet on the typing reperforator. When both relays are operated, the RCR contact is opened and the TFR contact is closed. When the RCR relay releases, the RCR contact closes and the TFR contact remains closed for 65 milliseconds (slow release). This allows the tape feed-out magnet to energize, initiating tape feed-out.

LINE-SHUNT RELAY

3.14 This feature permits local operation of a set in addition to online operation. When the LINE-TEST key is placed in the TEST position, the line-shunt relay de-energizes, shunting the external signal line and switching in an auxiliary power supply in series with the set's signal circuit.

CHARACTER COUNTER SUPPRESSION

3.15 Suppression of the character counter mechanism (ASR sets) is desirable from a standpoint of operating flexibility. Suppressing the character counter allows the operator to prepare tape in the tape mode, switch to keyboard mode and use the keyboard, and return to the tape mode without disturbing the character count.

MODE SWITCHING COMPONENTS

A. Automatic

3.16 Automatic mode switching components for ASR sets provide the following operating features:

(a) The ability to prepare tape while transmitting or receiving traffic.

(b) The ability to transmit or receive traffic using codes foreign to the set.

(c) The ability to receive traffic on tape and by page printer simultaneously.

(d) The ability to revert to a common mode of operation when clearing the set.

3.17 To provide these features, mode switching relays, which operate in conjunction with a pushbutton control panel, allow the operator to automatically select the set's operating mode. One of five modes may be selected: keyboard (K), keyboard-tape (KT), tape (T), tape-tape send (TTS), or tape-tape receive (TTR).

B. Manual

3.18 Manual mode switching components for ASR sets provide the (a), (b), and (c) operating features listed in Paragraph 3.16. A conveniently located rotary selector switch allows the operator to manually select the set's operating mode. One of five operating modes may be selected: K, KT, T, TTS, or TTR (see 3.17).

35 ELECTRICAL SERVICE UNIT

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section has been generally revised to include information on recent 35 electrical service units. Because this issue is a general revision, marginal arrows that indicate changes have been omitted.

1.02 The 35 electrical service unit serves as an area of concentration for the wiring of 35-type apparatus and provides mounting facilities for various electrical assemblies and components.

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

1.04 Complete operation of an electrical service unit requires connections with other components of a set with which it is used. Additional information concerning the support functions of the unit may be found in sections discussing specific components and complete sets. Only independent features in the electrical service unit are discussed in this section, under principles of operation.

1.05 The electrical service units discussed in this section are used in all models of the following sets:

(a) 35 Receive Only (RO) Set.

(b) 35 Keyboard Send-Receive (KSR) Set.

(c) 35 Automatic Send-Receive (ASR) Set.

(d) 35 Receive Only Typing Reperforator (ROTR) Set.

These sets may be utilized in a variety of installation configurations, including: private line applications, data communications networks, circuit switching networks, and computer installations.

2. DESCRIPTION (See Figures 1, 2, and 3)

2.01 The electrical service unit consists, basically, of a rectangular, metal chassis (or container) and a number of mounting plate assemblies. Each mounting plate assembly consists of a functional group of components. They are mounted on the chassis and are interconnected, as required, with strapping.

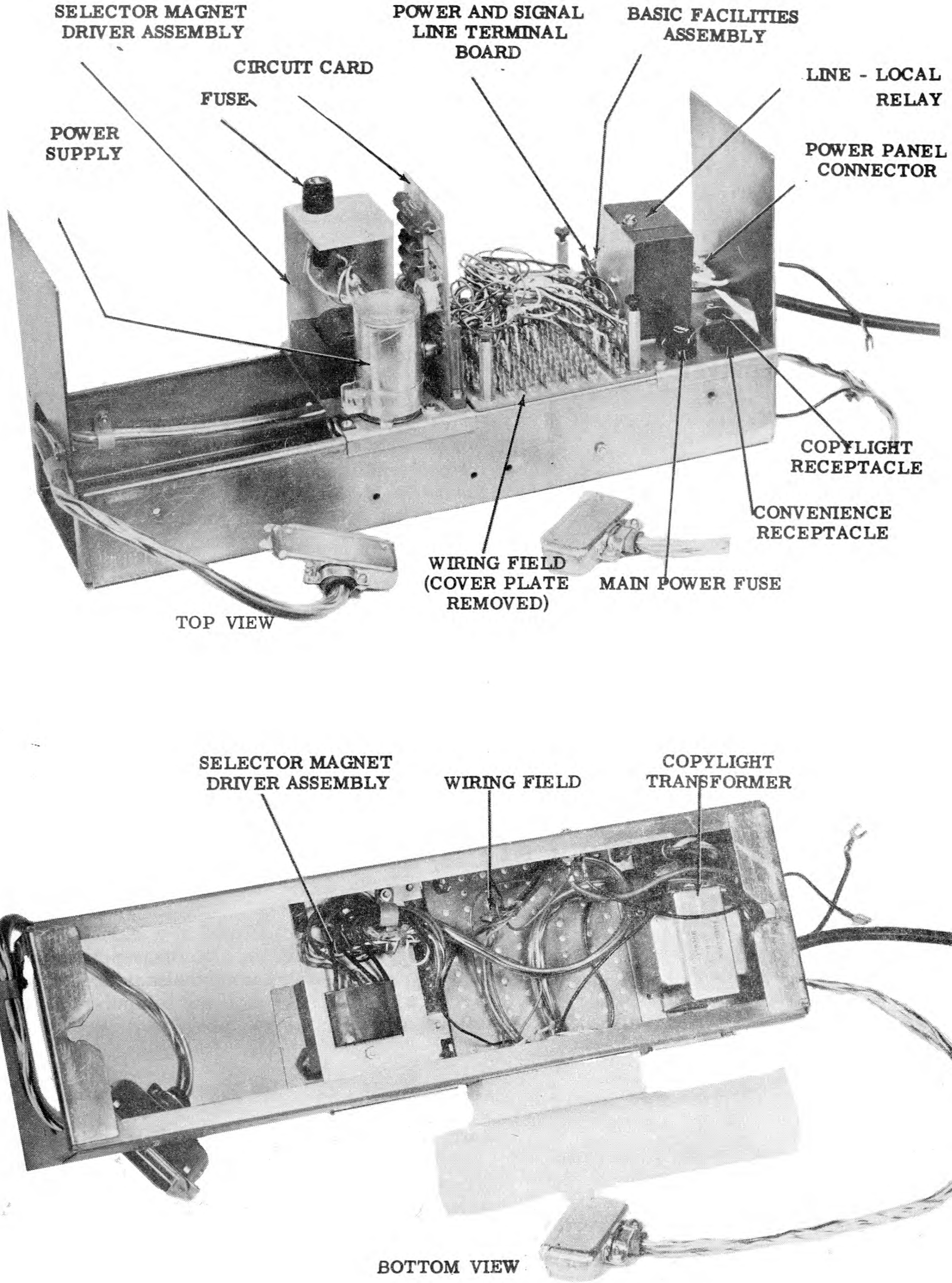


Figure 1 - Typical Electrical Service Unit for 35 KSR Set

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

(a) A copylight transformer to supply power to the set's copylights.

(b) A copylight receptacle.

(c) A convenience receptacle.

(d) Fuses for protection of the main power and other circuits.

(e) A power and signal line terminal board.

(f) A line-local relay to provide switching to either online or independent, local operation.

(g) A main terminal board to provide a wiring field for connection of cable assemblies to the electrical service unit.

(h) A motor control relay for remote control of the set's motor.

(i) A main power on-off switch.

(j) Ground strapping.

(k) Cable assemblies, as required, for interconnection with other components of the set. The set's power cord may also be included.

(l) A transistorized selector magnet driver assembly, to amplify the incoming line signal to 500 milliamperes for operation of the receiving circuit selector magnets. More than one assembly may be installed to accommodate the receiving circuits of a set. For example, in an ASR set, two assemblies may be used: one for the typing unit, the other for a reperforator.

(m) A signal regenerator circuit to improve the output of the keyboard signal generator.

(n) A tape feed-out relay to pulse a reperforator's tape feed-out magnet.

(o) A reperforator control relay to blind a typing reperforator's selector magnets to line signals.

(p) An automatic turn around traffic control circuit card and disabling switch.

(q) Control panel and cable assemblies, typically consisting of two panels and cabling. One panel may support the mode and other pushbutton controls, the other the end-of-line indicator lamp. In some electrical service units, only the cabling to the external controls panels is provided.

(r) A noncontention (NCT) relay to prevent a sending station's answer-back from operating when transmitting a WRU code.

(s) Automatic mode switch relays, or a manually operated rotary mode selector switch.

(t) A line jack connected across the external signal line for testing purposes.

(u) An auxiliary power supply.

(v) Character counter suppression components.

(w) A line-shunt relay, used in conjunction with a line test key and an auxiliary power supply, to allow local set operation.

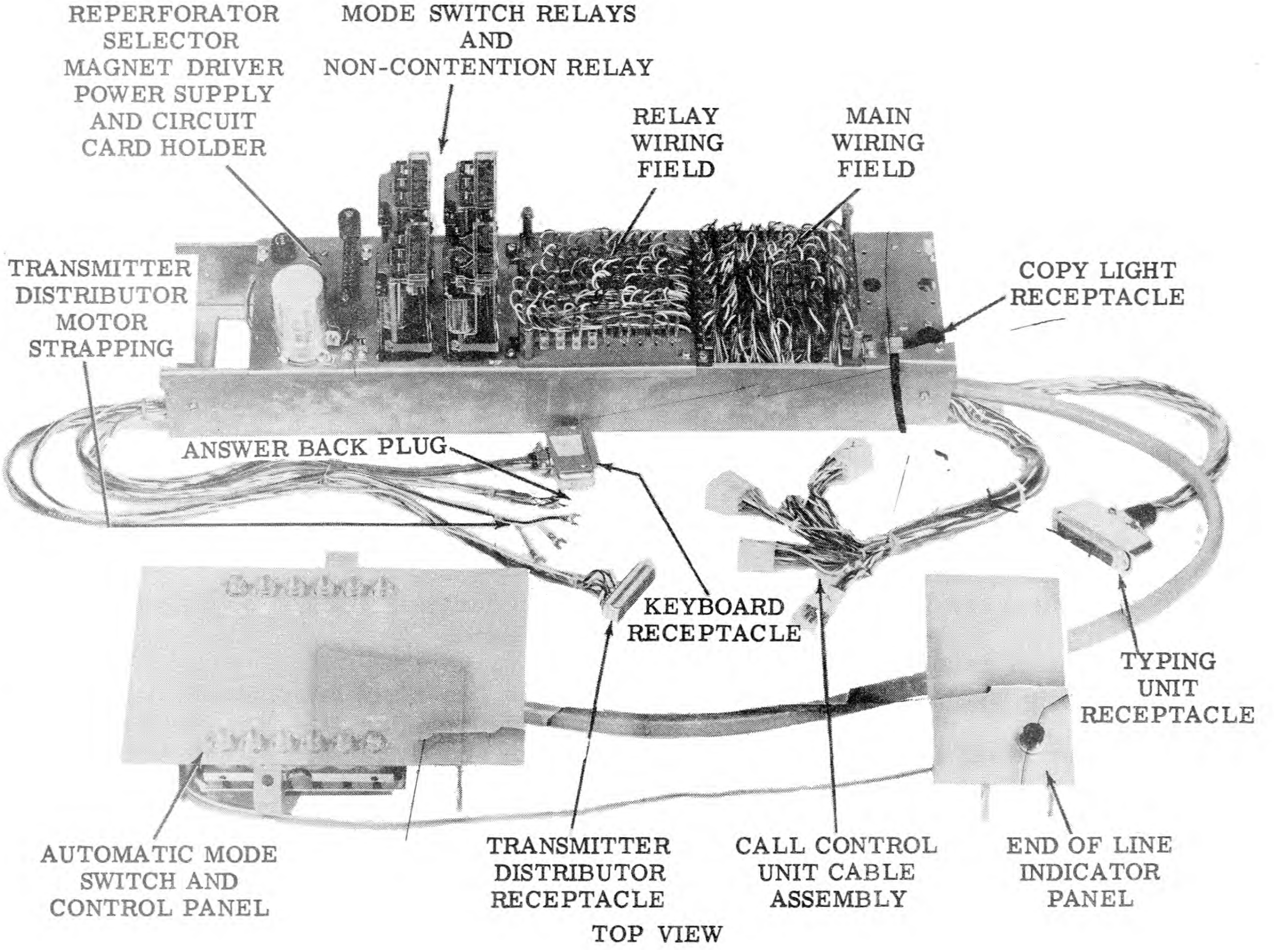
2.03 The electrical service unit used with standard (dc) sets is wired to provide half duplex signal line operation. The unit may be wired (optional) to obtain full duplex operation, which permits receiving messages and transmitting them at the same time without interference between the two signals. This is accomplished by electrically separating the sending and receiving loops of the set by making wiring changes in the electrical service unit and connecting the loops to the appropriate duplex signal lines.

3. PRINCIPLES OF OPERATION

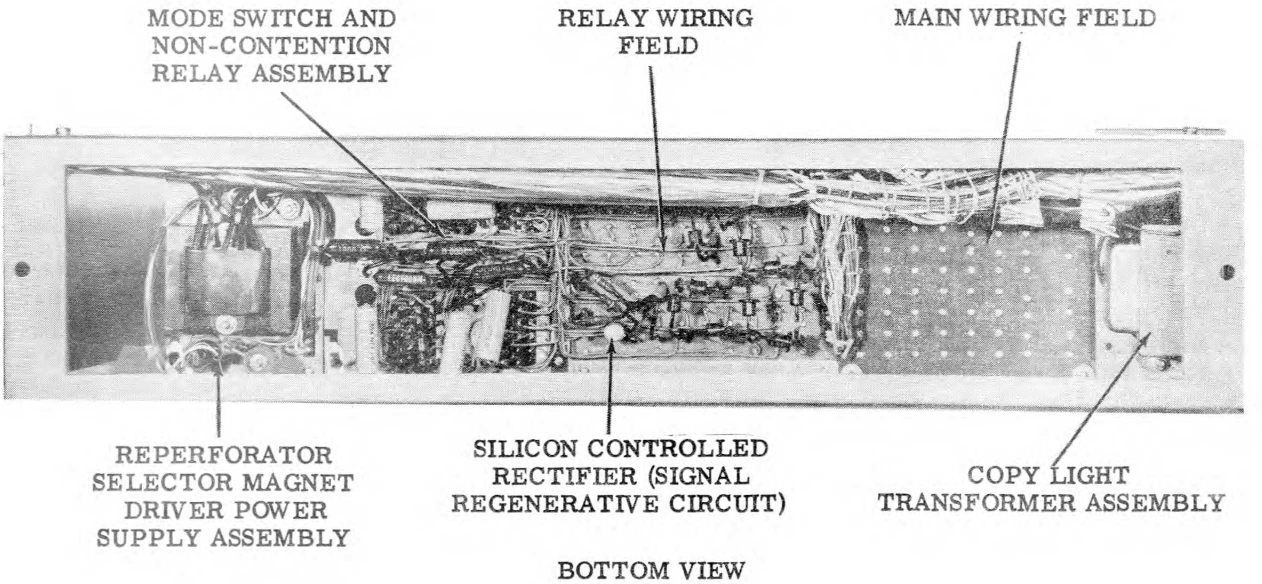
GENERAL

3.01 Since the major function of the electrical service unit is to provide support for circuit facilities, only general operating principles of selected components are presented below. Detailed operating principles will be found in the sections which discuss these components in relation to set operation.

3.02 The wiring diagram for the electrical service unit is incorporated into the schematics which appear in the appropriate section for each 35 set (ie, RO, KSR, and ASR).

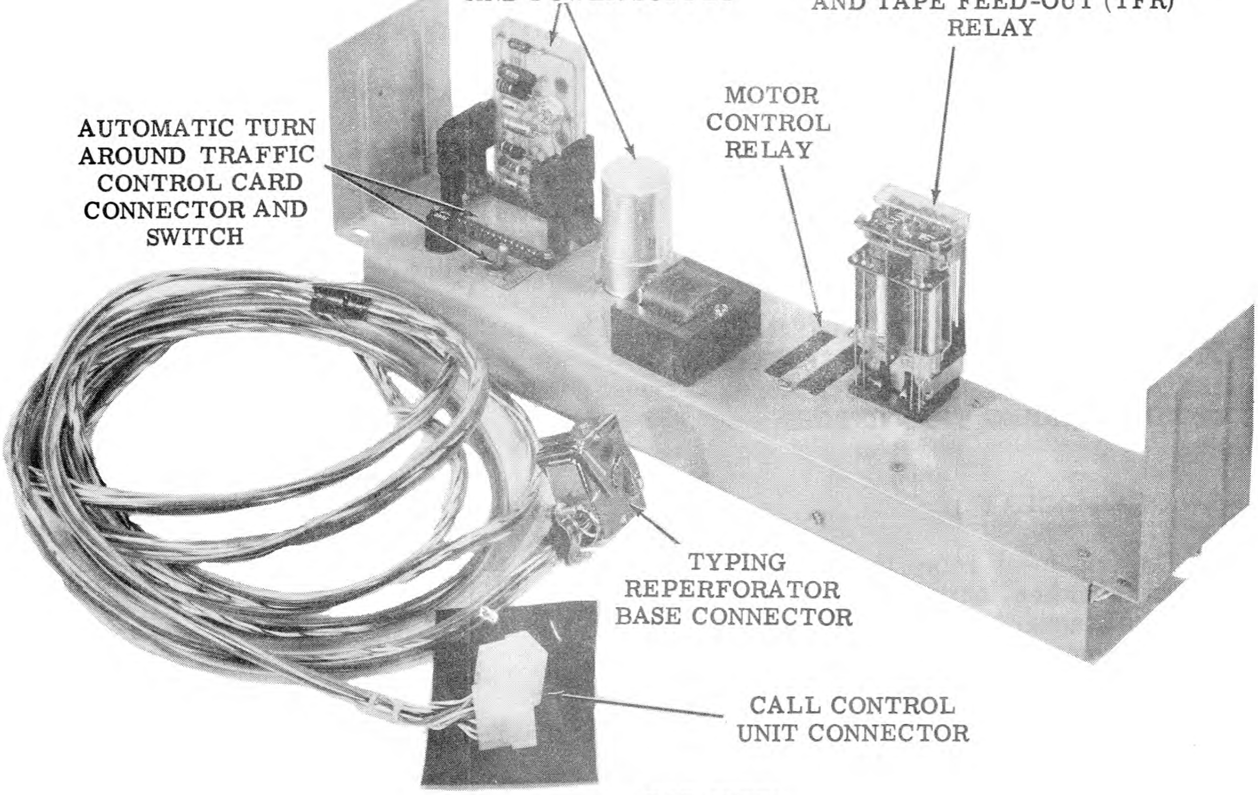


TOP VIEW

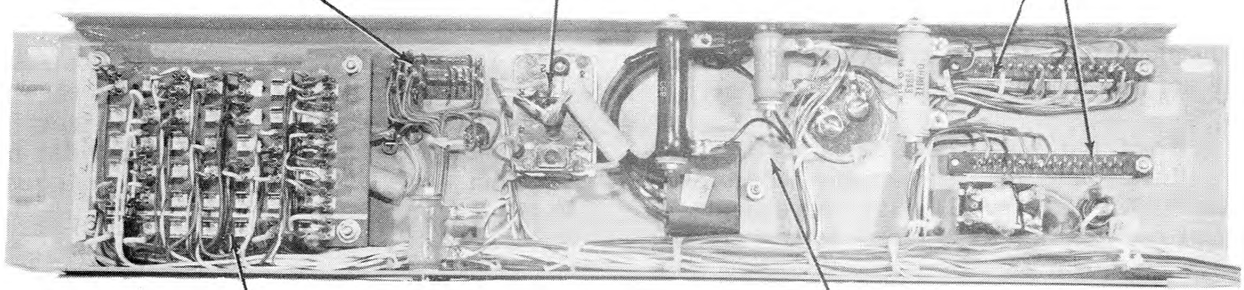


BOTTOM VIEW

Figure 2 - Typical Electrical Service Unit for 35 ASR Set



TOP VIEW



BOTTOM VIEW

Figure 3 - Typical Electrical Service Unit for 35 ROTR Set

SELECTOR MAGNET DRIVER

3.03 The selector magnet driver assembly is a two stage transistorized amplifier capable of switching high output currents (0.500 ampere) at very closely controlled input current levels. The output of the driver is adjustable to 0.500 ampere output, but may change slightly due to normal supply voltage and component variations. Selector magnet driver assemblies are available which operate from either a 20 milliampere or a 60 milliampere line signal input.

CAUTION: DISCONNECT POWER TO SELECTOR MAGNET DRIVER ASSEMBLY - BEFORE REMOVING CIRCUIT CARD - TO AVOID DAMAGING TRANSISTORS.

LINE-LOCAL RELAY

3.04 The line-local relay is used to switch a set to either online or local operation. It is used in standard sets (dc) and is controlled by a rotary type power switch. With the switch in the ON position, the line-local relay energizes, placing the set's sending and receiving circuit in series with the signal line. The relay is energized via the selector magnet driver power supply (3.03).

3.05 Turning the power switch to the OFF position de-energizes the line-local relay. The external signal line to the set is shunted, but the selector magnets in the set's receiving circuits are held energized to prevent spurious characters from being typed or punched when the set is turned on and off.

3.06 With the power switch in the ONLINE position, the line-local relay is energized, and the signal generating and monitoring circuits of the set are connected into the signal line.

3.07 When the power switch is in the LOC (local) position, the set may be operated offline. The line-local relay de-energizes, shunting the external signal line to the set and connecting a local signal battery in series with the set's signal circuit.

ELECTRICAL MOTOR CONTROL

3.08 This feature permits a set's motor to be controlled remotely via the signal line. So equipped, the set may operate unattended. The sending station can turn the set on by sending a break, or turn it off after the data has been transmitted by sending the EOT code.

MOTOR CONTROL RELAY

3.09 The motor control relay is energized by the closing of the OR/AN relay contacts in the ASR or KSR set (a local key in these sets is also provided to energize this relay). The motor control relay is held operated until the motor hold contact on the feed-out mechanism of the typing reperforator breaks at the end of the feed-out cycle.

REPERFORATOR CONTROL RELAY

3.10 The reperforator control relay (RCR) has five sets of contacts used for the following functions:

(a) Selector magnet driver control.

(b) RCR relay locking.

(c) Tape-feed relay control.

(d) Feed-out magnet control.

(e) ROTR on lamp (in ASR) control.

The relay is energized by the closing of the R1 on contact in the ASR or KSR stunt box, or the ROTR ON key on the ASR control panel. The RCR relay is held energized by one of its own contacts, which is in series with the R1 off contact in the ASR or KSR stunt box.

3.11 The selector magnet driver control contact is normally closed, and shunts the signal line to the selector magnet driver, binding it to any signal. When the RCR relay is energized, the selector magnet driver will respond to the incoming signal.

AUTOMATIC TURN AROUND TRAFFIC CONTROL

3.12 The purpose of the automatic turn around traffic control (ATATC) is to blind the typing reperforator selector magnet driver to locally (ASR or KSR set) generated traffic, while allowing incoming traffic through. An all-traffic switch is provided to disable the ATATC.

TAPE FEED-OUT CONTROL RELAY

3.13 The tape feed-out control relay (TFR) is controlled by the reperforator control relay (RCR). A make contact on the TFR relay and a break contact on the RCR relay are wired in series with the tape feed-out magnet on the typing reperforator. When both relays are operated, the RCR contact is opened and the TFR contact is closed. When the RCR relay releases, the RCR contact closes and the TFR contact remains closed for 65 milliseconds (slow release). This allows the tape feed-out magnet to energize, initiating tape feed-out.

LINE-SHUNT RELAY

3.14 This feature permits local operation of a set in addition to online operation. When the LINE-TEST key is placed in the TEST position, the line-shunt relay de-energizes, shunting the external signal line and switching in an auxiliary power supply in series with the set's signal circuit.

CHARACTER COUNTER SUPPRESSION

3.15 Suppression of the character counter mechanism (ASR sets) is desirable from a standpoint of operating flexibility. Suppressing the character counter allows the operator to prepare tape in the tape mode, switch to keyboard mode and use the keyboard, and return to the tape mode without disturbing the character count.

MODE SWITCHING COMPONENTS

A. Automatic

3.16 Automatic mode switching components for ASR sets provide the following operating features:

(a) The ability to prepare tape while transmitting or receiving traffic.

(b) The ability to transmit or receive traffic using codes foreign to the set.

(c) The ability to receive traffic on tape and by page printer simultaneously.

(d) The ability to revert to a common mode of operation when clearing the set.

3.17 To provide these features, mode switching relays, which operate in conjunction with a pushbutton control panel, allow the operator to automatically select the set's operating mode. One of five modes may be selected: keyboard (K), keyboard-tape (KT), tape (T), tape-tape send (TTS), or tape-tape receive (TTR).

B. Manual

3.18 Manual mode switching components for ASR sets provide the (a), (b), and (c) operating features listed in Paragraph 3.16. A conveniently located rotary selector switch allows the operator to manually select the set's operating mode. One of five operating modes may be selected: K, KT, T, TTS, or TTR (see 3.17).

35 CALL CONTROL UNIT

GENERAL DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section is reissued to convert it from a preliminary publication to a standard publication.

1.02 The 35 Call Control Unit (LCCU) is an electrical control device which, when used in conjunction with a Data Set, provides for both automatic and manual control of 35 page printing and tape equipment over standard telephone networks.

1.03 The call control units, as discussed in this section, are for use in the Bell System Wide Area Data Service (WADS) telephone network. Two different call control units are

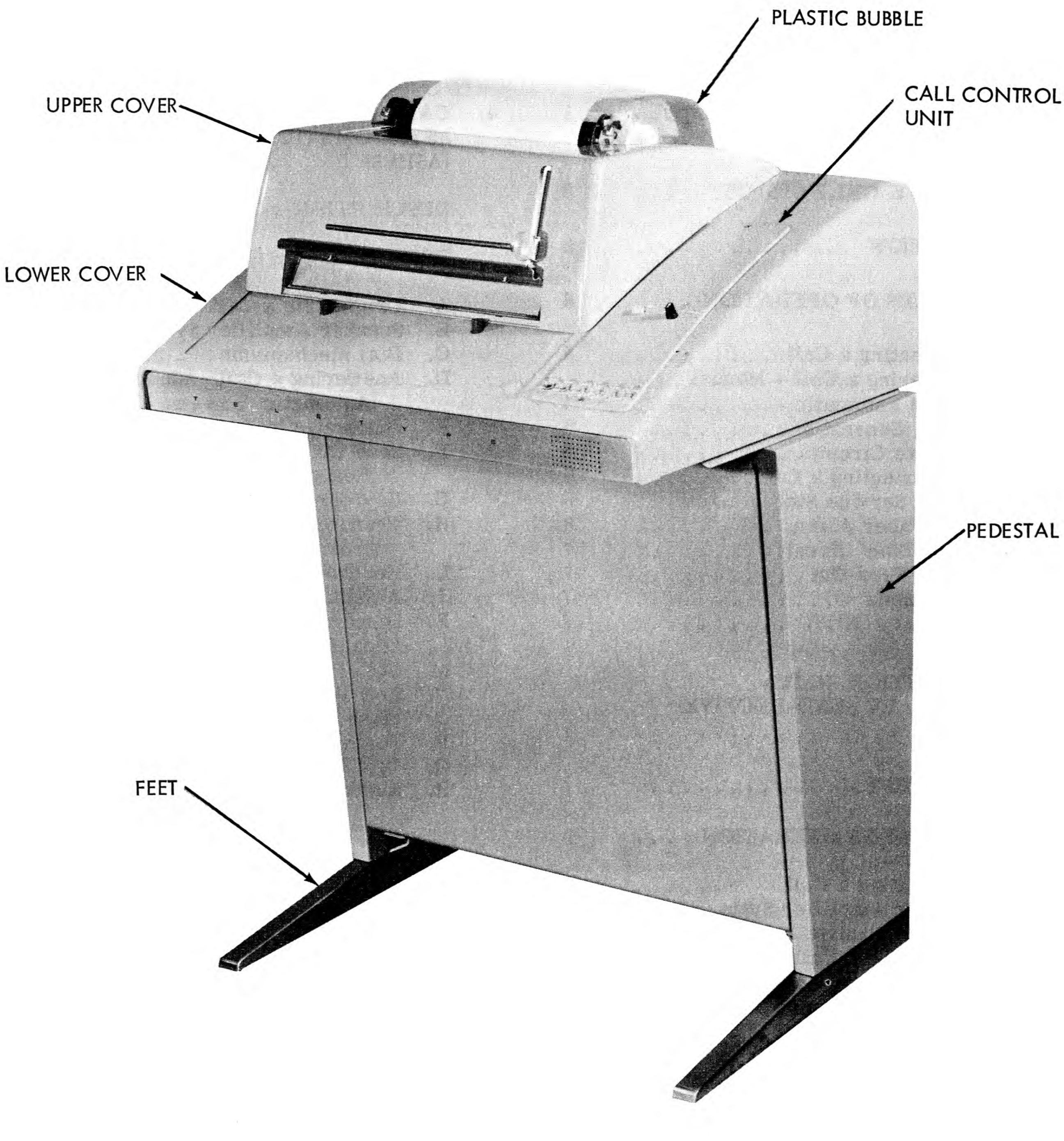


Figure 1 - Receive Only Set with Call Control Unit

utilized in this system: an LCCU 300 (Bell 35A), and an LCCU 301 (Bell 35B). The units are essentially identical in relation to their basic function (i.e., control of page printing and tape equipment in conjunction with a Data Set), differing mainly in the number of features and/or functions controlled by the units. As part of the WADS system, the call control units are used in the following sets:

(a) Call Control Unit LCCU 301 (Bell 35B) is used in the 35 Receiving-Only (RO) Set.

(b) Call Control Unit LCCU 300 (Bell 35A) is used in both the 35 Keyboard Send-Receive (KSR) and Automatic Send-Receive (ASR) Sets.

1.04 Complete operation of the call control units requires connections with a Data Set (see appropriate section), and with an electrical service unit (LESU) (see the appropriate section).

(a) Data Set: The Data Set's function is to provide the modulating and demodulating apparatus necessary for transmission of telegraph signals over telephone circuits. It also provides the call-connecting devices which condition the sending and receiving station(s) for reception and/or transmission of a message.

(b) Electrical Service Unit: The electrical service unit, used in conjunction with the call control unit, provides relay, circuit, and wiring facilities necessary to operate the various components, lights, and controls which are associated with a given set. The facilities provided by the electrical service unit will vary, depending on the number and complexity of functions performed by the set.

1.05 In the paragraphs that follow, the complete description and principles of operation of the call control units will be presented in the following order:

(a) Paragraph 2 will discuss the LCCU 301 (Bell 35B) as used in 35 RO Sets.

(b) Paragraph 3 will discuss the LCCU 300 (Bell 35A) as used in the 35 KSR Sets.

(c) Paragraph 4 will discuss the LCCU 300 (Bell 35A) as used in the 35 ASR Sets.

Operating principles of the associated electrical service units will be incorporated in the above discussions, as necessary. General description of the electrical service units, however, will be covered in another section. Discussion of the Data Set will be limited to a description of the call connection, input, and output circuits, but only in sufficient detail to indicate how they condition - or are conditioned by - the call control unit.

1.06 Wiring diagrams referred to in paragraphs 2, 3, and 4 may be found in the RO, KSR, or ASR section with which the Call Control Unit is associated.

2. CALL CONTROL UNIT - 35 RECEIVE-ONLY (RO) SET

DESCRIPTION (See Figure 1)

2.01 The Call Control Unit is located to the right of the page printer, mounted on the cabinet pan assembly. The LCCU extends from the front to the rear of the set, and is higher at the rear than at the front. At the front of the unit is a row of six illuminating push buttons designated (from left to right):

(1) ORIG (Originate)

(2) CLR (Clear)

(3) ANS (Answer)

(4) TST (Test)

(5) LCL (Local)

(6) BUZ RLS (Buzzer Release)

The first three (ORIG, CLR, and ANS) are momentary-type push buttons, while the last three are locking-type. An OUT OF SERVICE switch and lamp are located behind and above the six illuminating push buttons.

2.02 Other features of the call control unit include:

(a) A ringer mechanism to signal an incoming call.

(b) A transistorized selector magnet driver assembly.

(c) A power supply which provides the necessary operating potentials and current for the various controls and circuits.

(d) Fuses, for circuit protection, and a 117 volt convenience outlet.

(e) A cable termination area, at the rear, which provides eight female receptacles for interconnection of components.

(f) An AC power cord for connection of the set to the power line.

A BK (Break) switch, HERE IS switch, and terminals for connection of a dial are also provided. These facilities are normally used for maintenance purposes, and are not readily accessible when the set is in an operating condition, with its cover on.

2.03 In addition to the above, the call control unit can be adapted for the following features:

(a) A Make Busy circuit.

(b) Connection of an auxiliary receive-only typing reperforator (ROTR).

(c) Alternate mode functions.

PRINCIPLES OF OPERATION - See WD6040 (RO)

A. Originating a Call

2.04 General: Normally, only maintenance personnel will have reason to originate a call. Screw connections are provided to connect a temporary dialer for station calling purposes.

2.05 Calling: A call is originated by depressing the ORIG push button. This connects the station to the line, and lights the ORIG lamp. The lamp will remain lit until the originate mode is terminated. In cases where the Data Set relay will not lock up to connect the station to the line, the ORIG push button (a non-locking type) must be held depressed. If the line is busy, or a wrong number or no connection signal is received, depressing the CLR push button will disconnect the set from the line so the call can be re-made.

2.06 Hand Held Receiver: The receiver is used for monitoring the call progress. It is connected to the line via the buffer amplifier in the Data Set limiter. The line connection permits monitoring of supervisory signals when originating a call or when operating an out of service switch in the restore position.

2.07 Rotary Dial: For pulse dialing application, a rotary dialer can be temporarily connected to the call control unit for maintenance purposes. The manual rotary dial is equipped with a normally closed pulsing contact, and a normally opened off-normal contact. The pulsing contact is inserted into the telephone line when the station originates a call. When answering, a short circuit is applied across the pulsing contact. The off-normal contact is placed across the amplifier output, and silences the receiver whenever the dialing disk is moved.

B. Answering a Call - Manual and Automatic

Manual Answering

2.08 To answer a call manually, the ANS push button is momentarily depressed. This connects the station to the line, and lights the ANS lamp. The lamp remains lit until the answer mode is terminated. Manual answering is necessary only when the automatic answer-back circuit is disabled. The automatic answer-back circuit is disabled by the tabulating contacts, form feed contacts, low paper contacts, low tape contacts (auxiliary ROTR), Data Set relay contacts (when in local mode), and the out of service switch.

Automatic Answer Back

2.09 General: The answer-back message is a fixed series of characters used to identify a station. The mechanism is mounted behind the page printer, and consists of a commutation disk and brush type of distributor, and a coded drum with sensing contacts to determine the message. The drum has 21 positions for characters. This can be reduced to three sections of 7 positions by removing tines in the drum. The output can be blinded on a given character position by one of the sensing contacts if the associated tine on the drum is removed. The drum is coded to send the required message by removal of the appropriate tines on the drum. Any fixed message (from 1 to 20 characters in length) can be sent out by the answer back mechanism.

NOTE: The first character position must always be blinded for timing reasons.

2.10 Circuit Description: The answer-back drum is allowed to rotate by pulsing the armature coil from either the Data Set, WRU contacts in the page printer stunt box, or the HERE IS key. When the Data Set at an answering station makes a complete connection to the sending station, it puts ground on the answer-back coil circuit and allows the coil to energize and trip the answer back. When the drum starts rotating, the answer back off-normal contacts close and allow the non-repeat relay (ABR) to energize. The break contacts on the ABR relay open the pulsing circuit to the answer-back coil (ABC), and permit only a single operation of the mechanism. The make contacts on the ABR relay provide the holding circuit for the ABR relay until the call has been completed or the circuit interrupted.

2.11 During a call, the answer-back mechanism can be tripped manually via the HERE IS switch, or by stunt box code recognition (WRU). The make contacts provide ground to operate the answer-back clutch trip magnet.

C. Signal Generation

2.12 The receive-only (RO) set can send by operating the answer-back mechanism or break (BK) key. The answer-back distributor is connected to the Data Set. The BR key is connected to the Data Set on separate leads. The BK key sends a spacing signal which the Data Set limits to about 120 milliseconds. Thus, the local printer runs open for about 100 milliseconds until the break detector operates, lighting the break release lamp.

D. Receive Circuit

General

2.13 The Data Set supplies a 20 milliampere DC signal to the selector magnet driver associated with the page printer. The selector magnet driver amplifies the signal to 500 milliamperes to operate the selector on the page printer. The output of the selector magnet driver is automatically maintained at 500 milliamperes. Provision is made for insertion of an auxiliary ROTR selector magnet driver in series with the page printer selector magnet driver. The ROTR can be equipped with turn around traffic control to blind the ROTR selector magnet driver to locally generated traffic.

Selector Magnet Driver

2.14 General: The selector magnet driver is a two stage transistorized amplifier capable of switching high output currents (0.500 ampere) at very closely controlled input current levels. The output of the driver is automatically regulated, and is essentially independent of normal variations in power supply voltage and of selector magnet and current limiting resistance values.

NOTE: Not all sets will be equipped with a constant current selector magnet driver. In some early units, a non-regulated driver circuit card will be supplied instead. For a discussion of this circuit, refer to Par. 4.35 through 4.39 of this section.

2.15 Open Line: When the line circuit is open (SPACING), transistor Q1 will be turned on by the regulated current flowing through R1 into its base. This current, which is controlled by R1, will be set near the desired switching level. With Q1 conducting, Q2 will be cut off, since the potential at the base of Q2 will be more positive than at the emitter. In this condition, only small leakage currents will flow in the collector circuit.

2.16 Space-To-Mark Transition: As the SPACE-TO-MARK transition begins, the negative bias current flowing in the base of Q1 is diverted to the line circuit. As the line current rises toward the MARKING current value, it extracts base current from Q1. When the line current approaches the total current supplied to the base of Q1 to within 0.001 ampere, which is about one half the nominal mark current value, Q1 begins to turn OFF. Q2 will then begin to receive forward bias current from R8 and begin to turn ON. The base current will then be amplified by Q2, and a current which is a multiple of the base current will appear in the emitter circuit. This increase in emitter current results in an increase in the negative potential measured across R3. The increase in the negative potential at the emitter of Q1 causes it to go further into cut-off. The feedback process continues until the current in the selector magnet reaches a value which is determined by the zener reference voltage, clamp diode CR4, and the emitter resistance of Q2 (the emitter resistance of Q2 is adjusted by R4 to compensate for component variations). As the line current completes the transition to the final marking current value, the base of Q1 becomes positively biased. The positive bias current will be approximately one-half the total marking line current. The positive potential at the base of Q1 is clamped to approximately 0.6 volts by the input protecting varistor, CR5.

2.17 Mark-To-Space Transition: The line current, in changing from MARK-TO-SPACE, will finally reach the point where R1 will begin to supply some forward current to the base of Q1. The line current level at which this occurs will be a little more negative than the point at which the circuit switched from space to mark, due to the common emitter resistor voltage feedback. As Q1 begins to turn ON, the current through R8 will be diverted from the base of Q2 causing it to begin to turn OFF. As Q2 turns OFF, the voltage across R4 will begin to go positive, causing Q1 to be further turned ON. This effect gives regeneration to the MARK-TO-SPACE transition.

2.18 Mark-To-Space Switching Transient: When Q2 is turned off during the MARK-TO-SPACE transition, a negative voltage transient is developed at its collector. This transient is due to dissipation of the energy stored in the magnetic field of the driven magnet when energized by 0.500 ampere. If the high voltage developed at the collector of Q2 is not limited, it would continue to rise until the collector-to-emitter breakdown voltage is exceeded. It has been found that repeated breakdown of this kind causes deterioration of the transistor, and finally, a collector-to-emitter short circuit. Therefore, it is necessary to provide a transient suppressing network at the collector of Q2. The transient suppression network presently in use is a compromise which affords a minimum peak voltage combined with a magnet release time to provide for adequate printer margins. The network consists of C1 in parallel with R9. CR3 isolates the network from voltages more positive than negative battery potential.

E. Disconnecting a Call

2.19 A call is normally terminated by the EOT code combination which provides fast disconnect without introducing hit characters. This is accomplished by the Data Set, in response to EOT contact closures in the stunt boxes of both the sending and receiving sets.

2.20 A call connection can also be cleared manually by momentarily depressing the CLR push button. This triggers the clearing sequence in the Data Set, and lights the CLR lamp. The CLR lamp will remain lit for the duration of the call. During the first 100 milliseconds of the clearing sequence, the BK lamp will also light.

F. Out-of-Service Switch

2.21 The out-of-service switch prevents the automatic answering of incoming calls. In its NORMAL position, it has no effect or function (arrow upright); in the OUT-OF-SERVICE position (rotated counterclockwise and detented) it sets the following conditions.

(a) A contact is closed that applies power to the out-of-service light.

(b) A contact is closed and shorts the ringer coils. This makes the ringer inoperative. As an option the contact can be located to shunt both the ringer and series capacitor (i.e., the telephone line). This makes the station appear off hook or busy to the central office.

(c) A contact is opened that breaks the automatic answer circuit to the answer relay. This prevents the relay from operating in response to the ring up relay and thus the set will not answer.

2.22 For stations that are not in terminal hunting groups, the operator may return the set to service by turning the out-of-service switch to its NORMAL position. For terminal hunting stations, however, the operator must turn the switch to the RESTORE position and hold it until a dial tone is heard. In this position:

(a) A contact is closed that shorts the tip to ring (off-hook condition). This condition is detected by the central office which then releases the set from lock-out and applies the dial tone.

(b) A contact closes which completes a path from the ORIG lamp to ground.

G. Low Paper Alarm

2.23 A low paper alarm is provided in the page printer and the auxiliary ROTR, either of which can independently operate the low paper buzzer. The set provides low paper alarm circuits in friction feed sets and, in addition, a paper-out disconnect feature and a form out and tabulating system. The out-of-service switch may be used to facilitate paper insertion.

2.24 When a low paper condition occurs, make contacts in the low paper switch provide ground to the low paper buzzer permitting it to operate. Depressing the BUZ RLS key (locking) in the call control unit silences the buzzer and provides an operate path to the BUZ RLS lamp. Attempting to release the key without replenishing the paper supply will cause the buzzer to operate. When the paper has been replenished, the set is returned to normal by releasing the BUZ RLS key. When used with more complex circuits, the key can be made non-locking.

2.25 Break contacts on the low paper switch disable the automatic answer-back circuit placing the set in a don't answer condition. A low tape condition also prevents an automatic answer. The operator can override the don't answer condition by manually answering. If the low paper alarm occurs during a call, the operator has the option of completing the call before changing the paper or interrupting the call. To interrupt the call, the operator stops transmission by depressing the BREAK key followed by depressing the BK RLS key to notify the distant station of the problem. The connection is cleared by simultaneously operating the control and EOT keys. Turning the out-of-service switch to the detent position insures that the set will not automatically answer a call while paper is being replenished.

2.26 To restore the set to service, after paper has been inserted, depress the CLR button. This enables the low paper buzzer and the answer-back mechanism. Return the OUT-OF-SERVICE switch to its normal position. (For sets in terminal hunting groups, turn the switch to its RESTORE position and hold it there. When a dial tone is heard, release the switch.) The set is now in a normal idle operating position.

H. Make Busy Circuit

2.27 A make busy option is provided for specific applications. Separate low paper make contacts connect the make busy lead from the TIP side of the telephone line to the Data Set. The option is obtained by a wiring change in the electrical service unit wiring field. The contacts are adjusted so that as the paper runs low the alarms are activated before the make busy circuit takes effect.

I. Form Feed-Out

2.28 In the sprocket feed printers paper out make contacts provide a disconnect feature. These contacts, when paper has been exhausted, perform the same functions as the CLR key. The paper out contacts are used in conjunction with the low paper contacts therefore, no calls will be accepted following the disconnect until the paper supply has been replenished.

2.29 In sprocket feed printers the form feed mechanism is tripped mechanically from stunt box recognition of the FORM code and in addition whenever the Data Set disconnects unless the paper is between forms. The Data Set energizes the form out solenoid during the disconnect sequence when the form out off-normal contacts in the printer are closed.

2.30 The sprocket feed printer is also equipped with horizontal and vertical tabbing mechanisms which are controlled by code recognition in the stunt box. During the tabbing or form feed operation the associated stunt box contacts hold the motor control relay (MCR) energized and open the automatic answer back circuit. This allows the tabbing or form out operation to be completed before any subsequent call is answered.

J. Test Mode

2.31 If the TST key is operated while the set is connected to a test center, the message sent by the test center will be recorded on the page printer and turned around and sent back for analysis. This is accomplished by connecting the teletypewriter to the Data Set through a set of transfer contacts and a break contact to ground. This type of operation can be terminated by momentarily operating any of the non-locking keys which will then release the TST locking key.

K. Auxiliary ROTR

2.32 A set can be equipped with a self-contained typing reperforator which operates on the same signal as the page printer. The ROTR features automatic non-interfering tape feed out, turn-around-traffic-control, selective operation controlled by stunt box code recognition, all traffic switch, motor control, and low tape alarm contacts and lamps. Detailed description of the ROTR is covered in a separate section.

3. CALL CONTROL UNIT - 35 KEYBOARD SEND-RECEIVE (KSR) SET

DESCRIPTION (See Figure 2)

3.01 The Call Control Unit for the KSR Set is located to the right of the page printer and is mounted on the cabinet pan assembly. It is almost physically identical to the call control unit used in the 35 receive-only (RO) set (refer to Par. 2.01 and 2.02), but is electrically more complex.

3.02 The most obvious physical feature which distinguishes the LCCU 300 (Bell 35A) from the LCCU 301 (Bell 35B), is the presence of a rotary or touch-tone dialing mechanism located immediately behind the front row of illuminating push buttons.

3.03 The call control unit includes the following features:

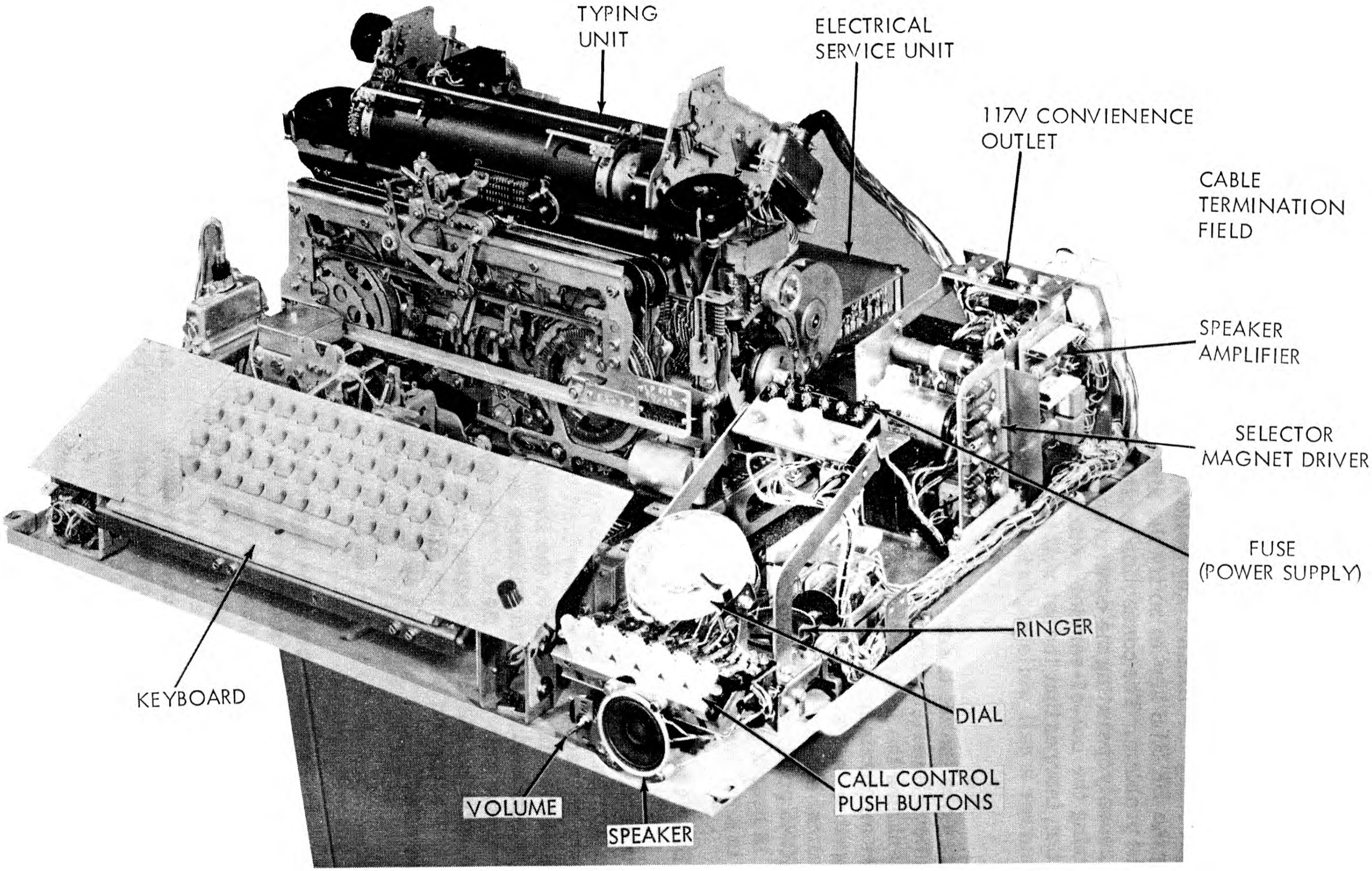


Figure 2. Keyboard Send Receive Set with Call Control Unit

(a) A ringer mechanism to signal an incoming call.

(b) A transistorized selector magnet driver assembly.

(c) A transistorized speaker - amplifier assembly.

(d) A volume control to set the speaker level.

(e) A power supply which provides the necessary operating potentials and current for the various controls and circuits.

(f) Fuses for circuit protection, and a 117 volt convenience outlet.

(g) A cable termination area, at the rear, which provides eight female receptacles for interconnection of components.

(h) An AC power cord for connection of the set to the power line.

(i) A combined break (BK) lamp and reset push button (white, upper), REST lamp (amber), OUT-OF-SERVICE lamp (white, lower), and out of service rotary switch. This group of controls is located behind the dial mechanism. The lamps which separate the controls are for future system use.

3.04 In addition to the above, the call control unit can be adapted for the following features:

(a) Automatic pulsing or tone card dial mechanism.

(b) Make busy circuit.

(c) Call progress lamps.

(d) Hand held receiver.

(e) Connection of an Auxiliary Receive-Only Typing Reperforator (ROTR).

PRINCIPLES OF OPERATION - See WD6020 (KSR)

A. Originating a Call

3.05 To originate a call, the ORIG nonlocking key is momentarily operated. This connects the station to the line and lights the ORIG lamp. The lamp remains lit until the originate mode is terminated. If the line is busy, or a wrong number or no connection signal is received, depressing the CLR push button will disconnect the set from the line so the call can be re-made.

B. Speaker Amplifier System

3.06 The loudspeaker amplifier is powered only after the ORIG key is operated, and is operated, and is quieted when the station connects. It has two inputs, one from the line via the buffer amplifier in the Data Set limiter and the other from the touch-tone dial (TTD). Three outputs are provided: (1) into the loudspeaker or optional hand held receiver, (2) into the line through the sending amplifier in the Data Set, and (3) an auxiliary output into the Data Set. The line to loudspeaker connections permits monitoring of supervisory signals when originating a call. The touch-tone dial-to-line and touch-tone dial-to-loudspeaker connection provides for amplification of the outgoing multifrequency dialing signals and for monitoring them during outpulsing. The line-to-second output connection is provided for the dial tone detector (when furnished). The various connections mentioned are established by switching in the Data Set, and by the common switch in the touch tone dial.

3.07 The speaker amplifier is a conventional direct coupled 2-transistor audio amplifier. The input signals from the line are fed through the receiving buffer amplifier in the Data Set into the primary winding of the input transformer. The primary winding continuously carries approximately 4 MA quiescent current from the receiving buffer amplifier. The other input, from the TTD, is fed directly into Q1 through C5A. Both inputs are DC isolated from the amplifier stages.

3.08 Two outputs are taken from transistor Q2A, one from the collector circuit and the other from the emitter.

(1) The collector output is fed through a step down output transformer (T2) into the loudspeaker (or receiver). Potentiometer RS is used to set proper volume for varying loop loss and ambient noise level. The TTD signals are independent of loop loss.

(2) The emitter output splits into two signal lines: one for injecting the multifrequency (MF) dial tones into the Data Set sending amplifier, and the other for feeding the dial tone detection circuit (when provided). The signal level from the emitter output is essentially independent from the setting of potentiometer RS.

3.09 By-passed R6A is a supply voltage dropping resistor. Diode CR1A is provided to block a sneak path (in the answer mode) from ground through the ANS and ORIG lamps. Without CR1A, the ORIG lamp would be dimly lit and the amplifier would not be silent, when the station is in the answer mode. The amplifier operates only in the originate mode until the station connects. In any mode other than originate, the ground is disconnected. When the station connects, the amplifier input is short circuited in Data Set.

C. Dial Mechanisms

Rotary Pulsing Dial

3.10 For pulse dialing application, a pulsing contact of the rotary dial is inserted in the telephone line. The manual rotary dial is equipped with a normally closed pulsing contact and a normally opened off-normal contact. The pulsing contact is inserted into the telephone line when the station originates a call. When answering, a short circuit is applied across the pulsing contact. The off-normal contact is placed across the output of the amplifier, and silences the loudspeaker (and receiver) whenever the dialing disk is moved.

Pulsing Card Dial

3.11 To use the card dialer, the ORIG key is operated. After dial tone has been received, a card with the telephone number punched is fully inserted in the slot. This operation winds a spring motor, which later pushes the card out of the slot as the dialing proceeds.

3.12 The dialer is started by momentarily depressing the START bar. This operates the DIAL START contact, and establishes a path from the ring side of the telephone line through point 5 on the dialer, the released pulsing relay contacts K (P), pulsing relay K (P), released HOME and DIAL START contacts, operated DIAL START contacts, and point 2 on the dialer to the tip side of the telephone line. The current from the central office battery operates the pulsing relay K (P), which transfers the ring to tip path to the Matrix. This path is closed or opened according to the code punched in the card. The dial pulse is transmitted as the sensing springs sense the holes in the card.

3.13 Sending of the dial pulse means interruption of the current in the telephone line. This releases the K (P) relay. Movement of the K (P) relay armature rotates the scanning drum by 1/16 revolution so that the next digit pulse can be sensed and transmitted as the K (P) relay reoperates. After two pulses have been transmitted, the HOME contacts operate and remain operated until the end of the scanning drum revolution. This establishes a direct operating path for the K (P) relay so that, when the station is returned on-hook in the middle of the digit, the digit pulsing can be completed and the drum will be returned to its normal (HOME) position.

3.14 In this manner, the drum completes the revolution in 16 steps. 10 of the steps are required to send the digit, and 6 to provide the interdigital time. At the completion of revolutions, an escapement is tripped which permits the next row of holes on the card to be placed in position for sensing.

3.15 This sequence is repeated at each row as the card advances out of the dial. If no STOP code is punched in the card, the dialer will keep advancing the card (even if no number code is punched) until the card is released. If a STOP code is sensed, the DIAL STOP contacts operate. With the HOME contacts released, a transmission path is established from the telephone line to the Data Set input as follows: RING - point 5, DIAL STOP contact operated, HOME contacts released, point 1, hybrid coil in the Data Set, TIP. The Data Set can then complete the connection.

3.16 When the station is connected, the card can be released by operating the RELEASE bar. No attempt should be made to release the card by operating the START bar, as this will trigger the dialing mechanism and the following short circuit will be placed across the output of the Data Set: point 1, HOME and DIAL START contacts released, DIAL START contacts operated, point 2. And, after the first two pulses on each revolution: point 1, HOME contacts operated, point 6. This shunt will prevent the station from receiving or sending until the card is disengaged. If this condition persists, the Data Set will disconnect.

Touch-Tone Dial

3.17 For multifrequency dialing (MF) application, the dialing frequencies generated by the touch-tone dial are fed through the loudspeaker amplifier and into the telephone line via the sending amplifier in the Data Set. The touch-tone dial can be equipped with the card dialer. To use it, the ORIG key is operated, creating the off-hook condition. When the dial tone is received, the card is inserted and the START bar is operated. The spring motor wound by insertion of the card pushes the card out of the dialer past sensing contacts. The contacts determine the dialing frequencies which are generated by the associated touch-tone dial. If the STOP code is punched in the card following the address, the dialing stops when the STOP code is read. The card should then be released by reoperating the START bar. Dialing proceeds much faster than with the pulsing card dialer. As the station connects, the output of the touch-tone dial is disconnected from the Data Set so that there is no hazard connected with improper operation of touch-tone dial or card dialer at that time.

3.18 The touch-tone multifrequency signal generator is a one transistor oscillator generating two frequencies any time a single push button is operated. Seven frequencies are provided, with each dial digit corresponding to two frequencies according to the table below:

Touch-Tone Frequencies CPS	Dial Digits 1209	1336	1477
697	1	2	3
770	4	5	6
851	7	8	9
941		10	

3.19 When the station is idle, a current of about 25 MA flows from ground through RT resistance of point 1 of the touch-tone dial; then through varistors RV3 and RV4, resistor R1, and out of point 6 to -20 V in the Data Set. The transistor Q1 is energized so that there will be no click when the circuit starts to generate the MF signal. The oscillations are suppressed by DC current through the tank coils T1 and T2 maintained by the potential difference across RV4. By interrupting this initial coil current the oscillation's build up time is minimized.

3.20 To dial a digit, a push button on the dialing plate is operated. This closes two frequency determining contacts, one for the T1-C1 tank circuit, and the other for the T2-C2 tank circuit. The Common Switch operates in following sequence:

(1) y-z contacts open, making the loudspeaker amplifier input available to MF signal only.

(2) s-t contacts close, and establish a path from the loudspeaker amplifier, through the sending amplifier in the Data Set, and into the line. The feedback through the receiving buffer amplifier in the Data Set back into the loudspeaker amplifier is disabled by previously opened y-z contacts.

(3) w_2-v contacts open, disabling the receiving buffer amplifier in the Data Set. This eliminates a possibility of false connect due to MF signals.

(4) q-p contacts open, together with w_2-v contacts, resetting the dial tone detecting circuit when furnished.

(5) w_1-u contacts open, interruping the DC current through the tank coils. Since the tanks T1-C1 and T2-C2 are coupled to the coils in Q1 circuit, the unit starts oscillating with a very short build-up time.

The same functions could be assured with w_2-v contacts operating first and y-z contacts eliminated. However, the interruption of current in the primary coil of the input transformer in the loudspeaker amplifier would cause a loud click to be heard every time a digit is dialed.

3.21 The frequencies above 1000 cycles per second are generated at a somewhat higher level to compensate for greater line loss at those frequencies. Also, there is a variation of amplitude for various digits. The PT resistor is set at the time of assembly of the attendant circuit with the Data Set for an output of 0 dbm on the line for the digit with highest output level.

Touch-Tone and Card Dialer

3.22 To use the automatic card dialer, the ORIG key is operated. After the dial tone has been received, a punched card is inserted into the slot and pushed down. The START bar is then momentarily operated. The card dialer proceeds with dialing under power of a spring motor wound by insertion of the card. When a STOP code is read, the dialing stops. The card should then be released by reoperating the START bar.

3.23 As seen in the wiring diagram, the sensing contacts in the card dialer are in parallel with the frequency determining contacts in the associated touch-tone dial. As the card advances out of the slot, the sensing contacts which sense the holes punched in the card determine the proper frequencies to be transmitted. This occurs for every row on the card. The normally opened E contacts in the card dialer are placed across the excitation w_1-u contacts in the TTD. When dialing manually, the E contacts are opened and there is no interference from the card dialer. With the card down in the slot, the operation of the START bar closes the E contacts and operates the common switch, through mechanical linkage, for the duration of dialing. The common switch connects the input and output circuits of the loudspeaker amplifier as described in Par. 3.20. Opening of the w_1-u contacts transfers the excitation function to the E contacts in the card dialer. As the card advances out of the slot, the E contacts open for each row exciting the TTD into generating the MF dial signals.

3.24 During dialing, there are short intervals of time when all the sensing contacts are opened and the E contacts are open. Therefore, the TTD will break into spurious oscillations somewhere between 7 KC and 14 KC. Although this frequency band is suppressed by the telephone line, these frequencies would be noticeable on the loudspeaker. The action of capacitors CT and C4A in the loudspeaker amplifier combine to suppress this spurious signal from reaching the loudspeaker.

3.25 Since the card advances out of the slot very rapidly, there is no need for a separate release bar. When the station connects, relay contacts in the Data Set (CON 8 in 101C) disconnect the MF signal input and remove any hazard connected with false operation of the MF dials.

D. Answering a Call - Manual and Automatic

Manual Answering

3.26 Refer to Par. 2.08, in this section, for a discussion of this circuit.

Automatic Answer-Back

3.27 Refer to Par. 2.09, in this section, for a general discussion of this circuit.

3.28 Circuit Description: The answer-back drum is allowed to rotate by pulsing the armature coil from either the Data Set, WRU contacts in the page printer stunt box, or the HERE IS key.

(a) When the Data Set at an answering station makes a complete connection to the sending station, it applies a ground to the answer-back coil circuit and allows the coil to energize and trip the answer back. When the drum starts rotating, the answer back off normal contacts close and allow the non-repeat relay (ABR) to energize. The break contacts on the ABR relay open the pulsing circuit to the answer-back coil (ABC) and permit only a single operation of the mechanism. The make contacts on the ABR relay provide the holding circuit for the ABR relay until the call has been completed or the circuit interrupted.

(b) During a call, the ABR relay holding circuit can be interrupted by either the operation of the HERE IS key or by recognition of the WRU code in the stunt box. This interrupting pulse allows the ABR relay to deenergize, allowing the answer-back mechanism to repeat its cycle.

(c) The page printers at both the sending and receiving stations recognize the WRU code, and the associated stunt box contacts are operated. However, only the receiving station's answer back is allowed to trip. The sending station's answer back is not operated as a result of the WRU contacts being electrically disabled by the non-contention relay (NCT) contacts.

(d) The non-contention relay is operated by the keyboard universal contact whenever the transmission is from the keyboard. The relay is slow release as a result of shorting its secondary windings by the NCT 6 make contacts. The release time of the NCT relay allows the WRU contacts to operate in the page printer stunt box without interrupting the ABR relay holding circuit. Thus the answer back at the station which originated the WRU does not operate.

(e) If the set originated the call, the answer back coil must be pulsed to provide operation. Transmitting a WRU character the NCT 12 break contacts interrupt the coil operating circuit through the WRU make contacts. Therefore, no answer-back operation is permitted. When the set receives a WRU and the contacts close in the stunt box the answer-back coil is connected to ground through the NCT 12 break contacts.

(f) If the set answered the call, the ABR relay holding circuit must be interrupted. Transmitting a WRU the NCT 8 make contacts allow the holding circuit to be continuous throughout the operation of the WRU stunt box contacts. When a WRU is received the WRU break contacts interrupt the ABR relay holding circuit permitting the answer-back mechanism to repeat its cycle.

(g) The HERE IS key allows the station to operate its answer back. At the originating station the HERE IS make contacts permit the answer-back coil to energize operating the answer-back mechanism. If the HERE IS key is continually depressed the ABR relay remains energized until the key has been released, providing the non-repeat feature.

(h) At the answering station the HERE IS contacts interrupt the ABR holding circuit allowing the ABR relay to de-energize. When the key is released the answer-back coil energizes permitting the answer back to cycle.

E. Send-Circuit - Signal Regenerator

General

3.29 The KSR can send by operating the keyboard, the answer-back mechanism or the BREAK key. The keyboard signal generator is connected to a signal regenerator which is in turn, connected to the Data Set. The answer back signal generator is in series with the output of the signal regenerator. The BREAK key is connected to the Data Set on separate leads. The signal regenerator is used to improve the signal quality obtained from the keyboard signal generator.

Signal Regenerator Circuit

3.30 The main component of the circuit is a silicon controlled rectifier (SCR) which is controlled by the keyboard timing contacts. The timing contacts are opened by a cam at the middle of each generated pulse from the signal generator, and switch the SCR on or off in accordance with the marking (closed) or spacing (open) condition of the signal generator.

3.31 When the timing contacts are open and the signal generator contacts are closed, the gate current, from +20 VDC through the 10,000 ohm resistor and the varistor to the gate, turns the SCR on producing a marking output. The SCR will remain on until the current through it drops below 8 milliamperes. Since the current can pass through either the signal generator marking contacts or the timing contacts the SCR stays on until both the timing contacts and the signal generator contacts are opened simultaneously. The mark to space transition is triggered by the timing contacts and therefore, the output of the SCR is as good as the timing of these contacts.

3.32 The BREAK key sends a spacing signal which the Data Set limits to about 120 milliseconds. Thus the local printer runs open for about 100 milliseconds until the break detector operates, lighting the break release lamp.

F. Receive Circuit

3.33 Refer to Par. 2.13 through 2.18, in this section, for a discussion of this circuit.

G. Disconnecting a Call

3.34 Refer to Par. 2.19 and 2.20 in this section, for a discussion of this circuit.

H. Local Mode

3.35 The local mode provides off-line operation of the set. The operator selects the local mode by depressing the LCL locking key. The LCL key lights the LCL lamp and operates the motor control relay (MCR) to energize the motor. The Data Set connects the sending circuit to the receiving circuit, and enables the keyboard and answer back to transmit to the page printer and the auxiliary ROTR (if one is used). A pair of make contacts on the LCL key operate to disable the turn-around-traffic-control so that the ROTR can receive local traffic in the LCL mode. If the set is in a terminal hunting group, the operator must turn the out-of-service switch to the RESTORE position until a dial tone is received after finishing the operation in the local mode.

I. Out-of-Service Switch

3.36 Refer to Par. 2.21 through 2.22(a), in this section, for a discussion of this circuit. In addition to operating a contact which shorts the tip to ring (Par. 2.22(a)) when in the RESTORE position, the switch also closes a contact which completes a path from the speaker-amplifier system to ground. This permits the amplifier to pass the line signals (dial tone).

J. Low Paper Alarm

3.37 Refer to Par. 2.23 through 2.26, in this section, for a discussion of this circuit.

K. Make Busy Circuit

3.38 Refer to Par. 2.27, in this section, for a discussion of this circuit.

L. Form Feed-Out

3.39 Refer to Par. 2.28 through 2.30, in this section, for a discussion of this circuit.

M. Test Mode

3.40 Refer to Par. 2.31, in this section, for a discussion of this circuit.

N. Auxiliary ROTR

3.41 Refer to Par. 2.32, in this section, for a discussion of this feature.

4. CALL CONTROL UNIT - 35 AUTOMATIC SEND-RECEIVE (ASR) SET

DESCRIPTION (See Figure 3)

4.01 Refer to Par. 3.01, in this section, for a description of the Call Control Unit.

4.02 Because of the more complex and flexible nature of the Automatic Send-Receive (ASR) Set, a more involved control system is required. Since the call control unit itself is identical to that used on the KSR Set (Par. 3 in this section), the necessary controls are included on the associated electrical service unit. As discussed in Par. 1.03 and 1.04, however, because of the close relationship between the call control unit and the electrical service unit, the operation of these controls will be discussed in this paragraph as though they were a part of the call control unit. Refer to the appropriate section for a description of the associated electrical service unit.

PRINCIPLES OF OPERATION - See WD6000 (ASR)

A. Originating a Call

4.03 Refer to Par. 3.05, in this section, for a description of this circuit.

B. Speaker - Amplifier System

4.04 For a discussion of this circuit, refer to Par. 3.06 through 3.09 in this section.

C. Dial Mechanisms

Rotary Pulsing Dial

4.05 Refer to Par. 3.10, in this section, for a discussion of this circuit.

Pulsing Card Dial

4.06 Refer to Par. 3.11 through 3.16, in this section, for a discussion of this circuit.

Touch-Tone Dial

4.07 Refer to Par. 3.17 through 3.21, in this section, for a discussion of this circuit.

Touch-Tone and Card Dialer

4.08 Refer to Par. 3.22 through 3.25, in this section, for a discussion of this circuit.

D. Answering a Call - Manual and Automatic

Manual Answering

4.09 Refer to Par. 2.08, inthis section, for a discussion of this circuit.

Automatic Answer Back

4.10 Refer to Par. 2.09, in this section, for a general discussion of the answer-back mechanism. Note that the mechanism is not located behind the page printer (as mentioned in Par. 2.09), but is mounted at the rear of the transmitter distributor base and is driven by its own motor unit.

4.11 Circuit Description: Refer to Par. 3.28 (a) through (h), in this section, for a discussion of this circuit. Note that the non-contention relay is also operated whenever the transmitter distributor is sending traffic, in addition to operating via the keyboard universal contact (refer to Par. 3.28 (d)).

E. Automatic Mode Switching

4.12 Automatic mode switching for the 35 ASR Set provides the:

(a) Ability to prepare tape while transmitting or receiving traffic,

(b) Ability to transmit or receive traffic using codes foreign to the equipment,

(c) Ability to receive traffic on tape and by page copy simultaneously,

(d) Ability to revert to a common mode of operation when clearing the set or on a break or call disconnect.

To obtain the feature mentioned above, the keyboard and reperforator are switched between the data set signal circuit and the auxiliary local circuit according to the following:

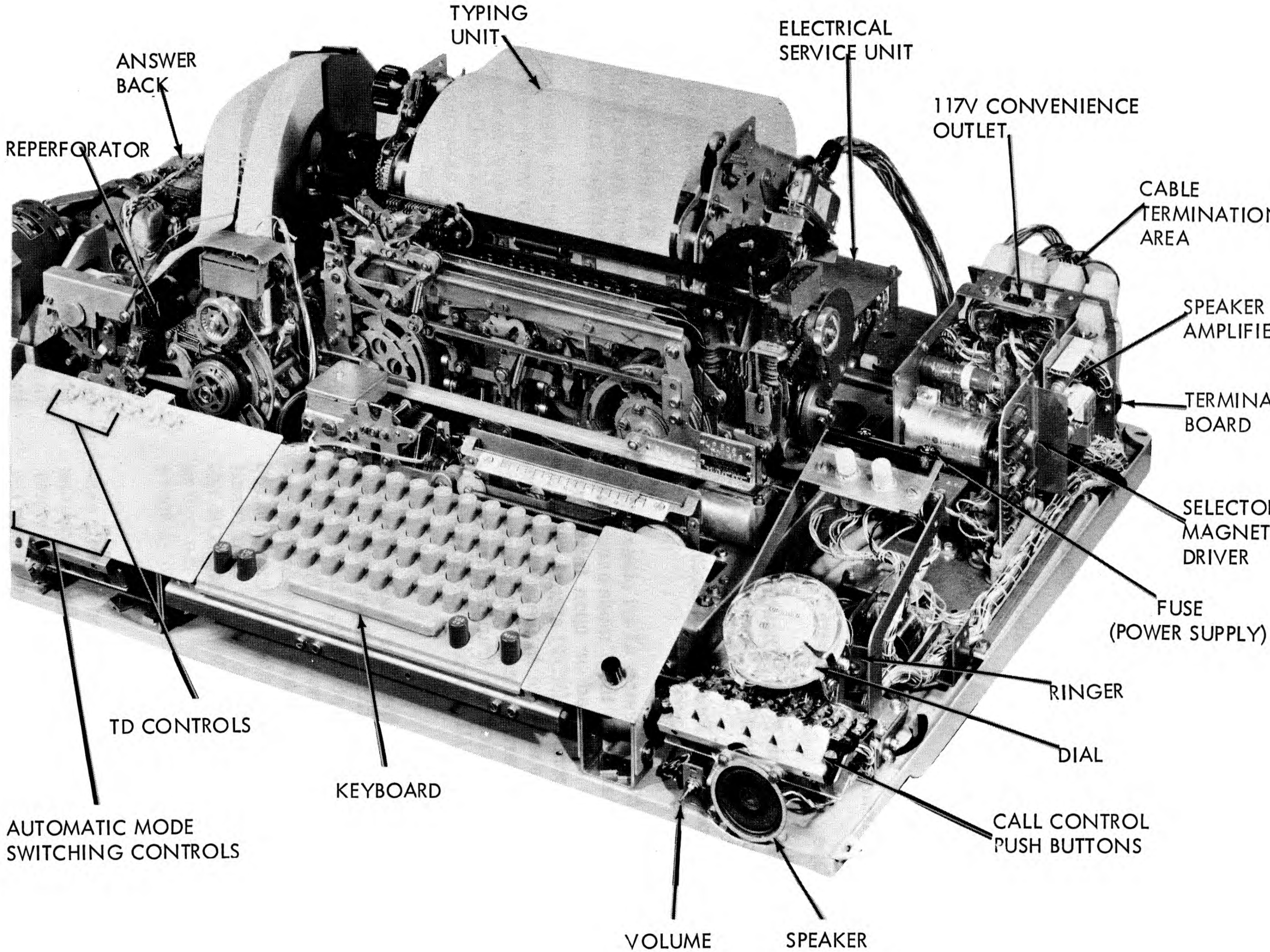


Figure 3 - Automatic Send Receive Set with Call Control Unit

MODE	TD	KBD	LRPE	LP
K	*	L	O	L
KT	L	L	L	L
T	L	O	O	L
TTs	L	O	O	B
TTr	*	O	L	B

L - Indicates signal line circuit

O - Indicates auxiliary local circuit

B - Indicates unit is blinded in signal line circuit

* - TD is disabled

K - Keyboard

KT - Keyboard - Tape

T - Tape

TTs - Tape-Tape Send (Disabled at customers request)

TTr - Tape-Tape Receive (Disabled at customers request)

4.13 Automatic reversion of all other modes (other than T) to the T mode occurs when the clear key is operated or upon initiating a break or call disconnect (EOT) signal. The set idles in the T mode when not in use. When either originating or answering a call, the set provides the necessary facilities for transmitting or receiving traffic and still provides auxiliary local operation.

4.14 In addition to the five mode keys, a MOTOR ON key has been provided. This key, when in the operate position, allows the set motors to remain on continuously. This feature allows the operator to prepare traffic in the auxiliary local circuit, after the set has been cleared on a call, without introducing garble as a result of the motors turning off. In the MOTOR ON position, the operator does not have the option of switching modes, but is allowed to prepare tape when in the T mode.

4.15 Operation of the LCL key on the call control unit will provide off line operations equivalent to those when the set is in the answer or originate conditions. Depressing either the ANS or ORIG keys when in local mode will revert any existing mode to the T mode of operation.

4.16 Switching from one mode into another is accomplished without transmitting a character to the line or punched in the reperforator tape. The reperforator is isolated from one circuit before it is switched into the other.

4.17 The components of the ASR Set will operate, depending on the mode selected, as follows:

(a) In the TTs and TTr modes the page printer is blinded by MSP 8 make contacts. These contacts provide a continuous 20 milliampere signal to the selector magnet driver.

(b) In the KT and TTr modes, the reperforator is connected to the line circuit through the MSR 6 and MSR 10 make contacts. During switching the MSR 2 make contacts provide a continuous 20 milliampere signal to the selector magnet driver and after switching has been completed the MSR 7 break contacts open this continuous signal circuit.

(c) In the K, KT, and T mode, the page printer is capable of monitoring both transmitted and received traffic.

(d) In the KT mode, the reperforator is also capable of monitoring transmitted traffic for future multiple transmissions.

4.18 All modes are associated with lamps that indicate in which mode the set is operating. The lamps are controlled by the mode switching relays, except the motor on lamp which is controlled by its associated key. For proper operation, a key must be depressed until its associated lamp is lit. The prominent feature of the automatic mode switching circuitry is that it permits simultaneous and uninterrupted performance of two separate operations.

F. Send Circuit - Signal Regenerator

General

4.19 The ASR Set can send by generation of pulses from the keyboard and transmitter distributor signal generators depending upon the mode of operation, the answer-back commutator, and the break key. The keyboard and transmitter distributor signal generators are connected in series to the signal regenerator which relays their outputs to the Data Set. The output from the answer back is in series with the signal regenerator output. The signal regenerator is used to improve the signal quality obtained from the keyboard and transmitter distributor signal generators.

Signal Regenerator Circuit

4.20 Refer to Par. 3.30 through 3.32, in this section, for a discussion of this circuit. Note that, besides being controlled via operation of the keyboard timing contacts, the SCR is also controlled when the transmitter distributor signal generator operates.

G. Keyboard Send Circuits

4.21 Of the five available modes of operation, K (keyboard) and KT (keyboard-tape) are the only two modes where transmission to the signal line is available from the keyboard. The keyboard is connected in the sending circuit through the MSK 8, MSK 2, and MSK 11, make contacts in both K and KT modes. Generated pulses from the keyboard signal generator and timing contacts provide operation of the SCR as described in Par. 4.20.

4.22 In the KT mode, the transmitter distributor is prevented from being accidentially operated, when transmitting from the keyboard, by the NCT 2 break contacts. The NCT (non-contention) relay is energized through the keyboard universal contact which closes every time a key on the keyboard is depressed.

4.23 When a break has been received from the distant station, the keyboard signal generator is shunted by the Data Set. To provide indication of the break condition the BRK RLS lamp, controlled by the Data Set, lights. To provide line operation from the keyboard the operator must depress the BRK RLS key.

4.24 When communicating with slower speed TWX stations, the operator will receive a visual indication to slow down by the restrain (REST) lamp. If the warning is ignored, a break occurs, lighting the BRK RLS lamp. To restore transmission, the BRK RLS key must be depressed.

H. Transmitter Distributor Control and Send Circuits

4.25 The transmitter distributor is capable of sending traffic to the line in the T, KT and TTs modes. With tape in the transmitter distributor, the operation of the TD ON key allows the TDC (TD control) relay to energize through the Tape Out contacts, the MSR 5 and MSK 5 break contacts, (MSR 1 make and MSP 10 break contacts in the KT mode), the TDC 4 and NCT 2 break contacts. After the TDC relay has pulled up, it is held energized through the TDC 5 make contacts to ground. The TDC 2 make contacts allow the transmitter distributor clutch trip magnets to energize tripping the start clutch. The TD ON lamp is lit through the TDC 1 make contacts.

4.26 The generated pulses from the transmitter distributor signal generator and timing contacts provide the input to the SCR, resulting in signal output to the Data Set. When the tape has completely passed through the transmitter distributor, the tape out contacts open permitting the TDC relay to de-energize. This results in de-energizing the clutch trip magnets and extinguishing the TD ON lamp.

4.27 When requesting a WRU from the transmitter distributor, a set of WRU stunt box break contacts in the sending printer open and allow the TDC to de-energize. The receiving station transmits an X ON code at the end of its identification. This will operate the stunt box make contacts in the originating station's page printer, allowing the TDC to energize. This requirement results in the switch on the transmitter distributor being biased in the run position and, therefore, requiring ON and OFF keys for manual operation of the unit. The originating station is prevented from remotely turning on the answering station's TD by the Data Set.

4.28 Transmitting the X OFF will also turn off the transmitter distributor. When either TAB, VT, or FORM is transmitted, the TD clutch trip magnets are de-energized until the tabbing or form-out operation has been completed.

4.29 The transmitter distributor signal generator is shunted by the Data Set when a break signal has been received from the distant station. The BRK RLS lamp lights, giving a visual indication of the break condition. Transmission is restored by the depression of the BRK RLS key.

4.30 When communicating with slower speed TWX stations, the transmitter distributor is controlled, from sending too rapidly, by the Data Set. The transmitter distributor clutch trip magnet circuit is opened intermittently to restrain transmission. During the time that transmission is restrained, the REST lamp is lit.

4.31 When desired, the set operator may prevent the transmitter distributor from operating upon receiving a stunt box start code. This is accomplished by the TD CALL IN key which, in normal position, prevents the controller from starting the transmitter distributor.

If the operator desires to have the transmitter distributor started by stunt box code, the TD CALL IN key is twisted to the ON position. Make contacts on the key permit the TD call in lamp to light.

I. Receive Circuits

4.32 The Data Set supplies a 20 milliampere DC signal to the selector magnet drivers associated with the page printer and reperforator. The selector magnet drivers are connected in series, and amplify the signal to 500 milliamperes to operate the selector magnets.

4.33 In early production ASR Sets, two different types of selector magnet drivers are supplied:

(1) A constant current driver used to control the page printer selector magnets. For a discussion of this driver, refer to Par. 2.14 through 2.18 in this section.

(2) A non-regulated driver used to control the reperforator selector magnets. Discussion of this driver will be found in Par. 4.35 through 4.39 of this section.

4.34 Provisions have been made for insertion of an auxiliary ROTR selector magnet driver in series with the page printer and reperforator drivers. The ROTR can only be operated in the signal line circuit either manually, by depressing the ROTR ON key, or by printer stunt box make contacts. The reperforator can be equipped with turn-around-traffic control which blinds both the reperforator and ROTR to locally generated traffic.

Selector Magnet Driver

4.35 General: The selector magnet driver is a two stage transistorized amplifier capable of switching high output currents (0.500 ampere) at very closely controlled input current levels. The output of the driver is adjustable to 0.500 ampere output, but may change slightly due to normal supply voltage and component variations.

4.36 Open Line: When the line circuit is open (SPACING), transistor Q1 will be turned on by the regulated current flowing through R1 into its base. This current, which is controlled by R1, will be set near the desired switching level. With Q1 conducting Q2 will be cut off, since the potential at the base of Q2 will be more positive than at the emitter. In this condition, only small leakage currents will flow in the collector circuit.

4.37 Space-To-Mark Transition: As the SPACE-TO-MARK transition begins, the negative bias current flowing in the base of Q1 is diverted to the line circuit. As the line current rises toward the MARK current value, it extracts base current from Q1. When the line current approaches the total current supplied to the base of Q1 to within 0.001 ampere, which is about half the nominal MARK current value, Q1 begins to turn OFF. Q2 will then begin to receive forward bias current from R3 and begin to turn ON. The base current will then be amplified by Q2, and a current which is a multiple of the base current will appear in the emitter circuit. This increase in emitter current results in an increase in the negative potential measured across R4. The emitter of Q1 will then go negative at the rate of increase of the current in Q2. This negative voltage feedback causes Q1 to go further into cutoff, allowing more current to be passed into the base of Q2. The feedback process continues until the current in Q2 reaches a value which is limited by the resistance in series with its collector-emitter circuit. As the line current rises past the halfway point, the base of Q1 will become positively biased. The positive bias current will be approximately equal to the line current minus the input bias current. The positive voltage developed will be clamped by the input, protecting varistor CR1 to approximately 0.6 volts.

4.38 Mark-To-Space Transition: The line current in changing from MARK-TO-SPACE will finally reach the point where R1 will begin to supply some forward current to the base of Q1. The line current level at which this occurs will be a little more negative than the point at which the circuit switched from space to mark due to the common emitter resistor voltage feedback. As Q1 begins to turn ON, the current through R3 will be diverted from the base of Q2 causing it to begin to turn OFF. As Q2 turns OFF, the voltage across R4 will begin to go positive, causing Q1 to be further turned ON. This effect gives regeneration to the MARK-TO-SPACE transition.

4.39 Mark-To-Space Switching Transient: When Q2 is turned off during the MARK-TO-SPACE transition, a negative voltage transient is developed at its collector. This transient is due to dissipation of the energy stored in the magnetic field of the driven magnet when energized by 0.500 ampere. If the high voltage developed at the collector of Q2 is not limited, it would continue to rise until the collector-to-emitter reach through breakdown voltage is exceeded. It has been found that repeated breakdown of this kind causes deterioration of the transistor and finally a collector-to-emitter short circuit. Therefore, it is necessary to provide a transient suppressing network at the collector of Q2. The transient suppression network presently in use is a compromise which affords a minimum peak voltage combined with a magnet release time which provide for adequate printer margins. The network consists of C1 in parallel with R5. CR3 isolates the network from voltages more positive than negative battery potential.

J. Auxiliary Local Circuits

4.40 The T and TTs modes provide the necessary facilities for secondary sets operation. In the T mode, the keyboard and reperforator are linked together in a 40 VDC, 20 milliampere auxiliary local circuit through the MSR 4, MSR 10, MSK 4, and MSK 7 break contacts. While in this mode, the operator can prepare traffic for future transmission while the printer is monitoring incoming traffic (or traffic being transmitted from the transmitter distributor).

4.41 The TTs mode is useful for transmitting foreign coded traffic, and provides the same auxiliary local circuit as the T mode does. In the TTs mode, the page printer is blinded by a continuous 20 milliampere DC signal.

K. Disconnecting a Call

4.42 Refer to Par. 2.13 through 2.18, in this section, for a discussion of this circuit.

L. Local Operation

4.43 Local operation permits the set to operate in an off line circuit. The operator selects the local operation by depressing the LCL locking key which lights the LCL lamp and energizes the motor control relay (MCR), turning on the set motors. The Data Set connects the sending and receiving circuits together enabling the keyboard, transmitter distributor, and answer-back mechanism to send to the page printer and reperforator (depending upon the mode of operation). The turn-around-traffic-control is disabled, by make contacts on the LCL key, allowing the reperforator and the auxiliary ROTR (if one is used) to receive the locally generated traffic.

4.44 If the set is in a terminal binary group, the operator, when she has completed the local operation, must turn the out-of-service switch to the restore position until dial tone is received. When the set is in local, any operating mode may be chosen. The operator may prepare traffic for future transmission while monitoring (or not monitoring), or make multiple tapes of any traffic simultaneously if an auxiliary ROTR is used.

M. Out of Service Switch

4.45 Refer to Par. 3.36, in this section, for a discussion of this circuit.

N. Low Paper Alarm

4.46 Refer to Par. 2.23 through 2.26, in this section, for a discussion of this circuit.

O. Make Busy Circuit

4.47 Refer to Par. 2.27, in this section, for a discussion of this circuit.

P. Form Feed-Out

4.48 Refer to Par. 2.28 through 2.30, in this section, for a discussion of this circuit.

Q. Test Mode

4.49 Refer to Par. 2.31, in this section, for a discussion of this circuit.

R. Auxiliary ROTR

4.50 Refer to Par. 2.32, in this section, for a discussion of this circuit.

35 CABINET FOR AUTOMATIC SEND-RECEIVE SETS

GENERAL DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL DESCRIPTION

1.01 This section has been generally revised to include recent engineering changes.

1.02 This 35 Cabinet is designed to house the components of the 35 Automatic Send Receive (ASR) Set.

1.03 The cabinet is floor mounted and provides facilities for supporting and enclosing a keyboard perforator base with motor and typing unit, an electrical service unit, a transmitter distributor base and transmitter-distributor, and a call-control unit. See Figure 1. An apparatus panel mounting rack is mounted within the pedestal. This is shown in Figure 2. The cabinet is approximately 38-1/2 inches in height, 40 inches in width and 24 inches in depth and weighs 105 pounds.

1.04 The various units of the 35 ASR Set are shown installed on the pan assembly in Figures 4 and 5.

2. DETAILED DESCRIPTION AND OPERATION

2.01 The cabinet consists of the following parts and subassemblies:

(a) Lower Cabinet

(1) Pedestal with pan and feet.

(2) Lower compartment panel.

(3) Left and right control panel mounting bracket assemblies and transmitter control panel and its mounting bracket assemblies.

(4) Cradle with vibration isolators and base mounting parts.

(5) Call control mounting brackets.

(6) Signal bell.

(7) Tape chute.

(b) Upper Cabinet (Cover)

(1) Hinged lower cover.

(2) Hinged upper cover.

(3) Upper cover latches.

(4) Information and character counter window.

(5) Paper routing access door or plastic bubble.

(6) Copylight and cable assembly.

(7) Upper cover counterbalance assemblies.

(8) Copyholder.

Note: Cabinets used with sets that print data on continuous business forms should be equipped with rearward extending feet to prevent tilting of the enclosure due to the weight of the form container on the back of the cabinet.

LOWER CABINET

2.02 The pedestal is of simple sheet metal box type construction. The top is ribbed for added strength. The equipment supporting pan is spot welded to the top of the pedestal, and two feet are assembled to the bottom of the pedestal. Two brackets are spot welded to the bottom of the pedestal (one on each side) to provide attachment points for the apparatus panel mounting rack. The top of the rack is fastened to two adjustable brackets at the top of the pedestal. A hole with welded nut is provided for mounting the right end of the electrical service unit. A slot at the left rear accommodates a sliding nut which is used to fasten the left end of the electrical service unit. The slot is provided to accommodate electrical service units of varying length. At the right rear of the pan is an opening for routing cables to the lower compartment, and a ground screw for attaching ground leads. Two hand grips are provided in the rear of the pedestal. At the left side are three brackets welded to the pan. There are two pairs of tapped holes in the front bracket and one pair in each

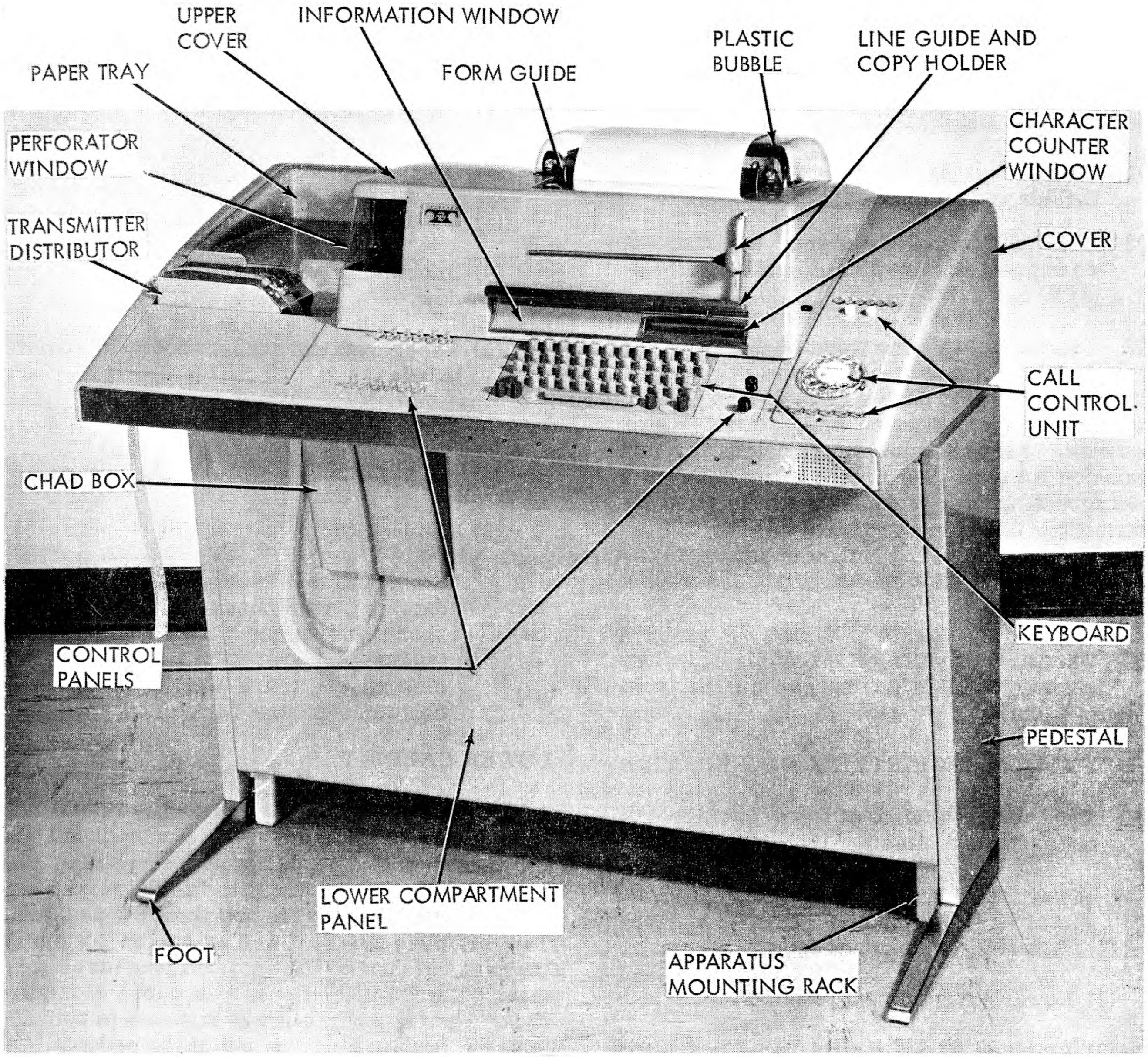


Figure 1 - 35 Automatic Send-Receive Set

of the rear brackets. One hole of each pair is used to mount the transmitter distributor base mounting stud, and the other is used for clamping the base to the vibration isolator immobilizing spacers during shipment. A hole in the rear at left center is for possible cable routing use. A small round hole in the front near the left center is to accommodate the chad chute.

2.03 Two fillister head screws are mounted in the sides at the bottom front of the pedestal. The heads of these screws serve as pivots for the lower compartment panel. The pivot brackets on the lower compartment panel are slotted so that the panel is easily removed. The top of the panel is fastened to the top of the pedestal by means of two pushbutton fasteners. Two holes in the upper left of the panel are used to mount a chad box.

2.04 In the front of the pan are the control panel and transmitter control panel mounting bracket assemblies. These assemblies consist of two upper brackets and a lower bracket. See Figure 3. The lower bracket has enlarged mounting holes to provide front to back and side to side adjustment of the control panels. The upper brackets have enlarged mounting holes and mount to the sides of the lower bracket to provide for vertical and angular adjustment of the control panels. The control panels, which are included with the electrical service unit, are attached to the upper brackets by means of shoulder screws included in the mounting bracket assemblies. The transmitter control panel is

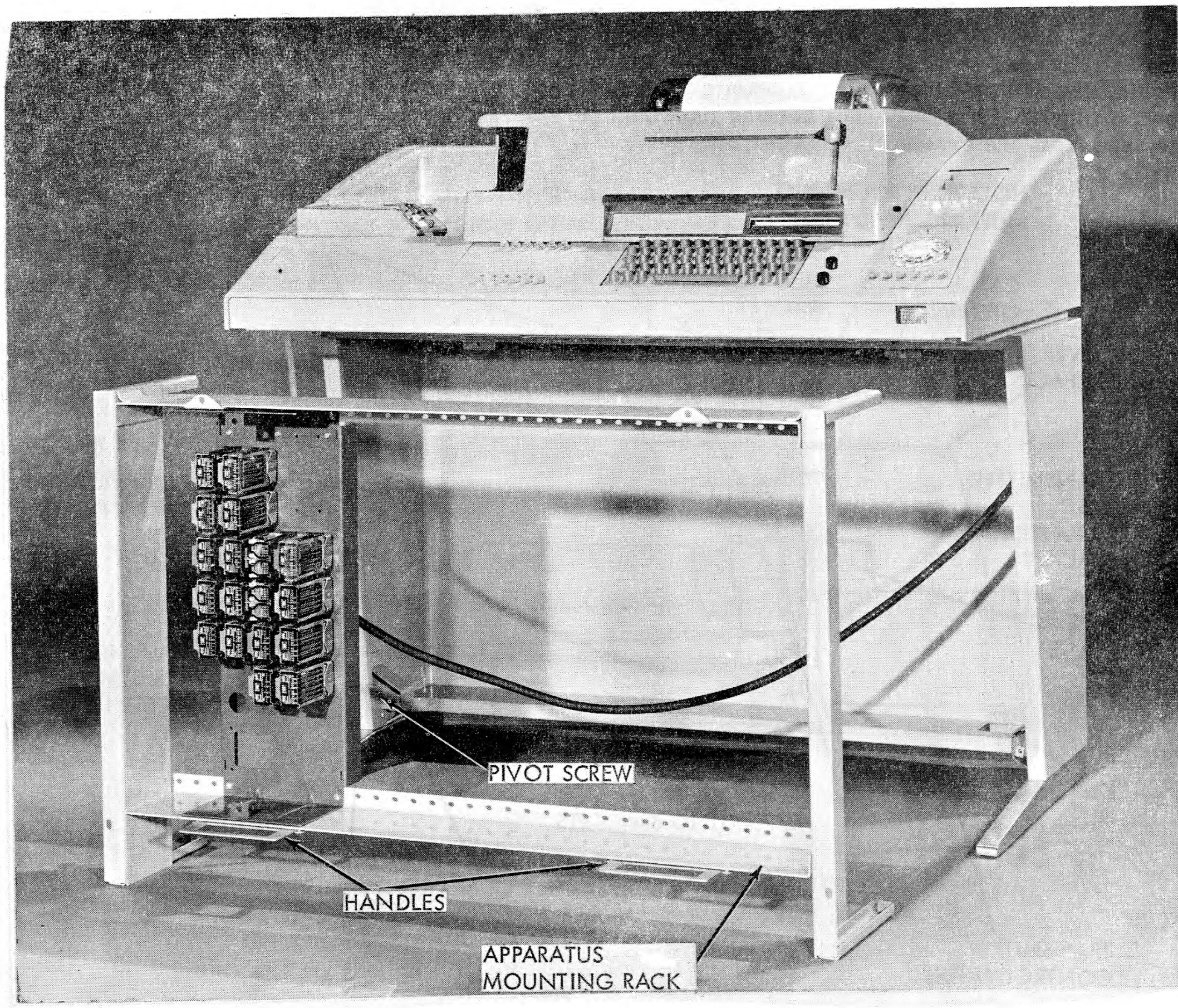


Figure 2 - 35 Cabinet With Apparatus Rack

included with the cabinet. The panels may be removed and replaced without readjustment of the brackets. Button head screws are used to fasten the control panel mounting bracket assemblies to the pan to avoid snagging of the screw heads on the operator's clothing.

2.05 The cradle consists of two channels with two welded cross pieces. The cradle is mounted to four adjustable bushings which are threaded into two channel brackets welded to the pan. Holes in the pan provide access to the bushings from below for adjusting the height of the cradle. The cradle mounting holes are elongated to provide front to rear adjustment of the cradle. The cradle mounting screws also serve to lock the adjustment bushing in place. The vibration isolators consist of a rubber ring and a rubber bushing. The bushing rests on the cradle and protrudes down through a hole in the cradle. The base mounting bracket rests on the bushing and a post welded to the bracket extends down through the bushing. The bushing isolates the base from the cradle. The rubber ring slips over the bottom of the bushing under the cradle, and a washer, lockwasher and nut secure the base mounting bracket to the cradle. Holes in extensions of the base mounting brackets provide for mounting the base for shipment. Shipping spacers are placed under the holes and between the channel brackets on the pan and the base mounting brackets. Shipping screws then clamp the base mounting brackets directly to the channel brackets, thus immobilizing the vibration isolators for shipping.

Note: Remove and discard the shipping screws and spacers from the cradle and from the transmitter distributor base (see 2.02) before placing the set in operation.

2.06 At the right side of the pan are four fixed brackets and one adjustable bracket for mounting the call control unit. The adjustable bracket provides horizontal adjustment of the dial, lights, and pushbuttons on the front portion of the call control unit so that they are posi-

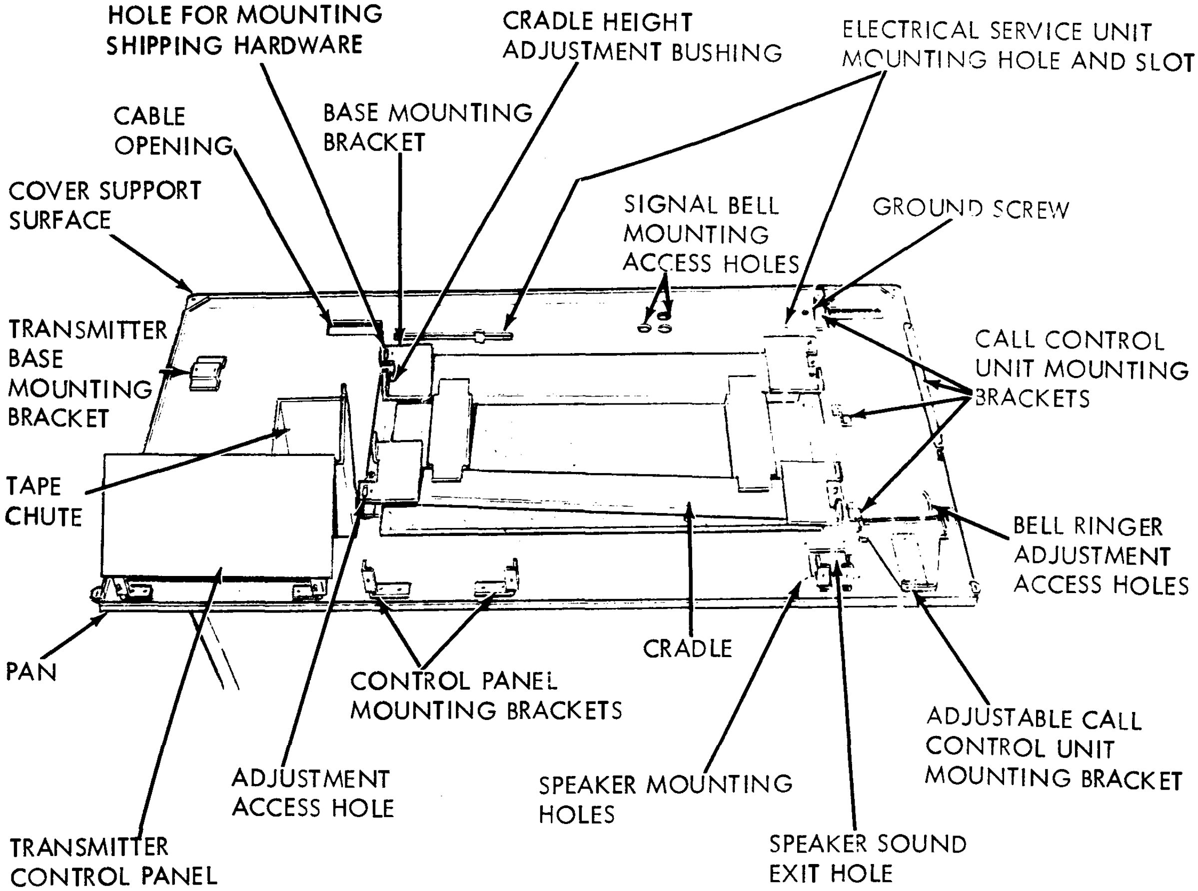


Figure 3 - Pan Assembly

tioned correctly in their respective openings on the bezel. A height adjustment is provided by slots in the call control unit where it mounts to the adjustable bracket. A slot is provided in the pan for access to the bell ringer adjustment on the call control unit. An opening in the pan is provided for the sound from the call control unit loudspeaker which mounts to the pan.

2.07 The signal bell is mounted at the left rear under the pan. Three holes in the pan provide access to the signal bell mounting screws from the top of the pan. The signal bell has two leads with quick connect terminals which plug into terminals on the electrical service unit.

2.08 The tape chute is mounted to an adjustable bracket in the front left center of the pan. It is adjustable vertically and horizontally and mounts above a square opening in the pan.

UPPER CABINET (COVER)

2.09 The cover is designed to be completely removable to furnish access to the enclosed equipment from the top and all sides. There are two designs; an earlier, on which the cover can be lifted off, and a later, on which the cover is hinged. Both of these designs are made up of a lower cover, an upper cover, and a plastic bubble. (See Figure 1.)

(a) The later design cover pivots clear of all enclosed equipment before it is removed from the pedestal. Pins, on hinges which are mounted to the cover, pivot in hinge brackets,

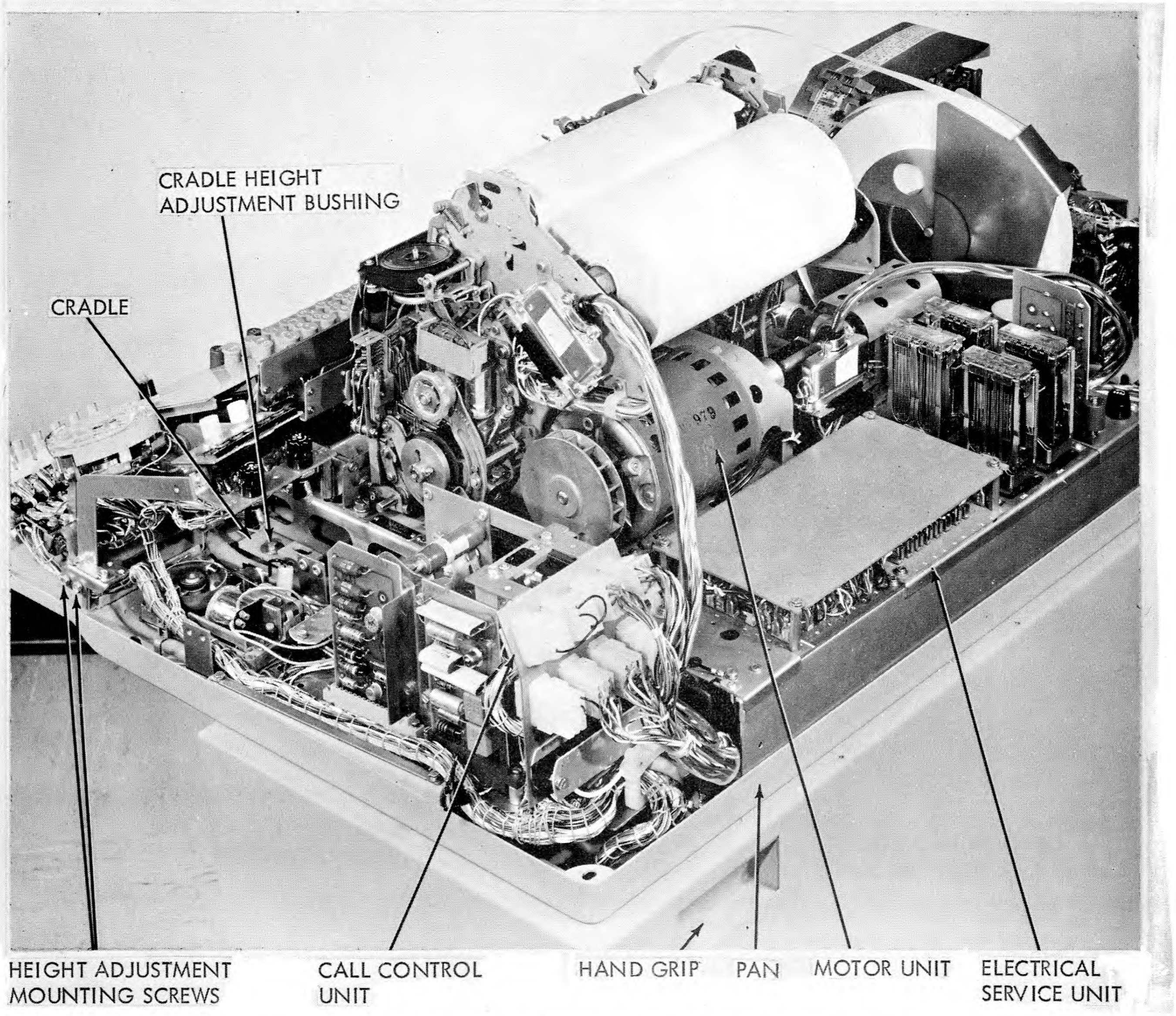


Figure 4 - 35 Cabinet - Cover Removed (Right Rear View)

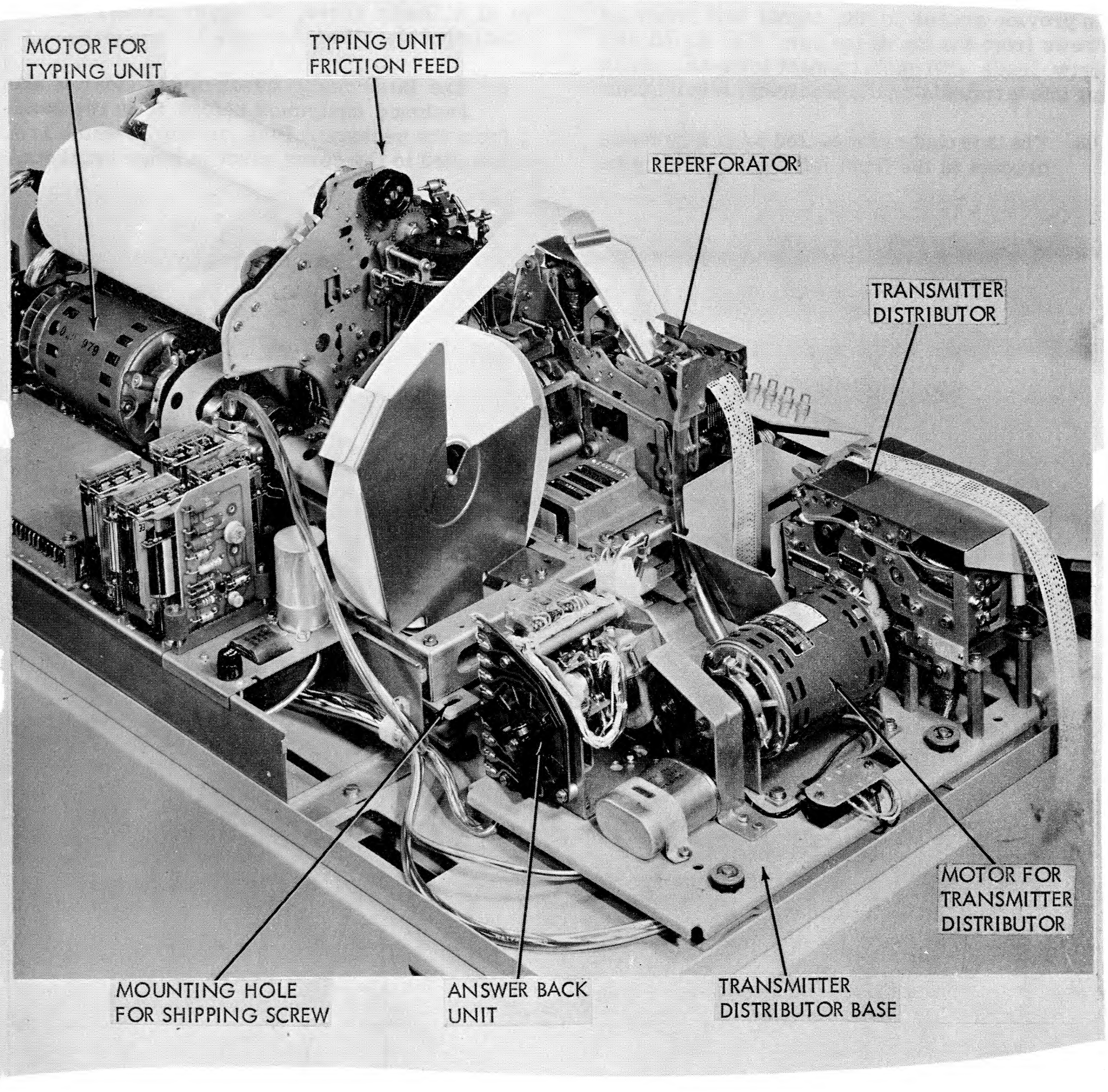


Figure 5 - 35 Cabinet - Cover Removed (Left Rear View)

that are mounted to the rear of the pan. A stop bracket locks the two parts of the left hinge together, but can be moved away when it is desired to remove the cover. Hand grips are provided in front for raising the cover. Because of the low pivot point of the lower cover, the upper cover must be opened to its partially open latched position in order to clear the enclosed equipment when the lower cover is raised. To insure that the upper cover will be opened before the lower cover is raised, the lower cover latch locks the cover to the pedestal and cannot be released until the upper cover is opened. Stop arms located at the left rear and right rear of the pedestal limit the backward travel when the lower cover is opened. The left stop arm is latching and holds the cover in its fully open position. In the front corners, adjustment bushings provide for adjusting the height of the front of the lower cover, and screws secure the lower cover to the pedestal.

Note: In all 35 type cabinets in which a call control unit is used, remove the call control bezel (Figure 1) before attempting to open or remove the cover. Failure to do so may result in damage to the manual controls that extend through the bezel. The copylamp plug should also be disconnected.

(b) The earlier design cover is not fastened, latched or hinged to the pedestal. It is removable from the pedestal by lifting straight up. At the four corners of the pan are surfaces for supporting the cover. The left rear surface has a hole which serves as the prime locating hole and the other surfaces have locating slots. The cover rests on four rubber vibration isolators. The left and right rear and right front isolators have locating pins which fit into the openings in the supporting surfaces on the pan to locate the cover.

2.10 In the rear of the lower cover is the paper slot with its cover held in place by two mounting nuts. When a sprocket feed typing unit is used, the paper slot cover is removed to allow form feed paper to enter the cabinet through the slot. Two holes on each side of the slot are used for mounting form feed paper guides.

2.11 The upper cover is hinged to the lower cover. Its purpose is to provide access to the equipment for installing the paper supply and changing ink ribbons. It is supported by a counterbalance on each side which is adjusted until the cover will remain in any position to which it is opened.

(a) In the later design a latch mechanism on each side of the upper cover latches it to the lower cover in the closed position or a partially open position. It is necessary to latch the upper cover in a partially open position to prevent it from striking the enclosed equipment when opening the lower cover.

(b) In the earlier design a latch mechanism on each side of the upper cover latches it to the lower cover in the closed position only.

2.12 An information window is located in the lower front of the upper cover. The window frame holds the window and its upper part serves as a support for copy held by the copyholder. Two rubber grommets in the front support the upper cover on the lower cover. The copy light cable and bracket form an assembly which is mounted to studs on the inner side of the front of the upper cover just below the window. The cable terminates in a two prong connector which plugs into the electrical service unit.

2.13 The paper routing access door serves as an aid to threading the typing unit paper out of the cover. It is made of a clear plastic in order to reduce the apparent height of the cabinet. Because of its appearance, it is referred to as the bubble. The bubble pivots at the rear in pivot brackets on the upper cover. Two spring detents in the front of the bubble latch against bearing surfaces in the upper cover to hold the bubble closed when the upper cover is raised. A friction feed paper guide is mounted to the front of the bubble . This guide may be removed and a sprocket feed form guide mounted in its place when a sprocket feed typing unit is used.

35 CABINET FOR AUTOMATIC SEND RECEIVE

TELETYPEWRITER SETS

LUBRICATION

CONTENTS PAR. NO.

1. GENERAL

1.01 The 35 Cabinet should be lubricated as directed in this section. The figures indicate the points to be lubricated and the quantity of lubricant to be used. Lubricate the assembly just prior to placing it in service.

1.02 The cabinet should be lubricated after each six months period of time or after each 1500 hours of service when the operating components of the set are serviced.

1.03 Use KS7470 oil at all points requiring oil and KS7471 grease at all points requiring grease.

1.04 The unit should be thoroughly lubricated, but over-lubrication, which might allow oil or grease to be thrown to other parts, should be avoided. The following general instructions supplement the specific lubrication points indicated:

a. Apply one drop of oil to all spring hooks.

b. Apply oil to all pivot points.

c. Apply oil to all sliding surfaces.

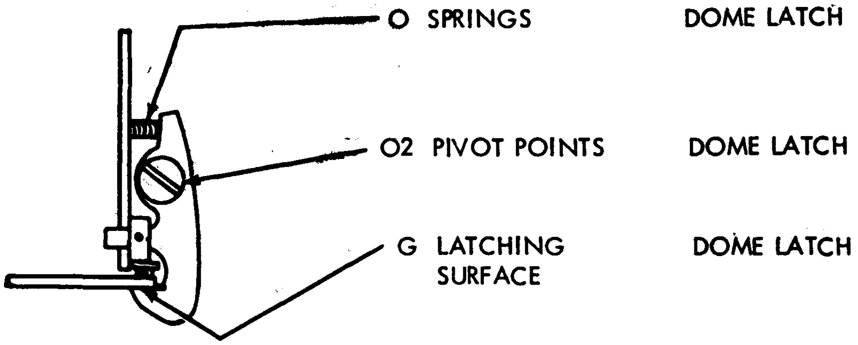
1.05 Specific lubrication requirements and the amount of lubricant are indicated at each lubrication point in accordance with the following code:

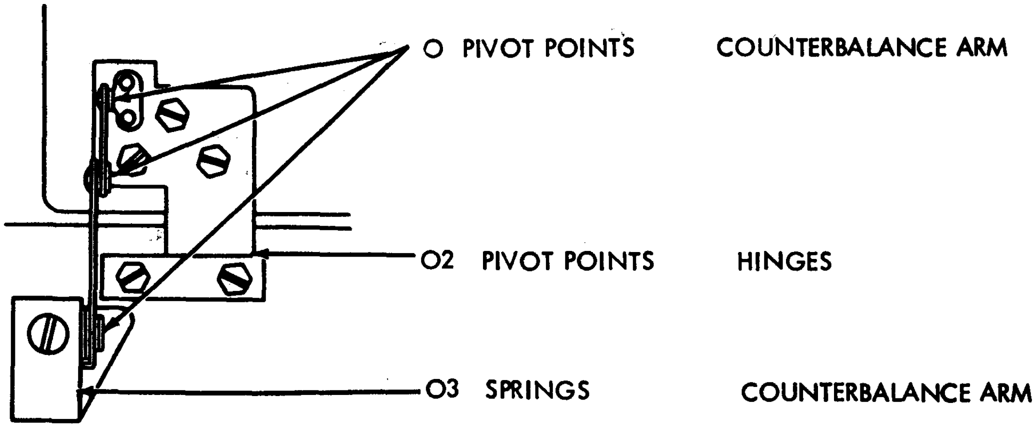
O	Apply 1 drop of oil.
O2	Apply 2 drops of oil.
O3	Apply 3 drops of oil.
G	Apply thin film of grease.

1.06 Remove any oil from finished surfaces with a soft clean cloth.

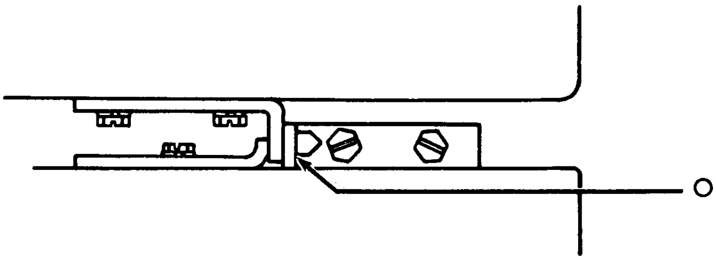
2. LUBRICATION

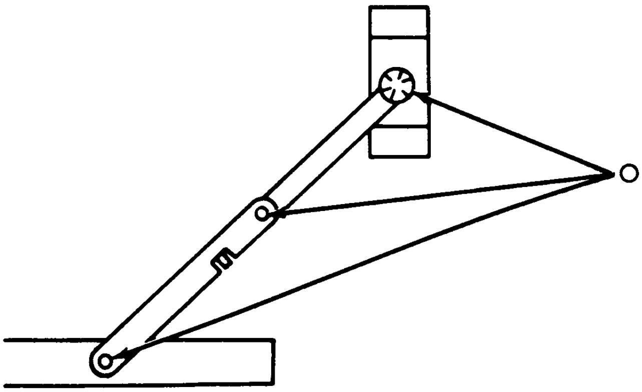
2.01 Upper Cover Hinge and Latch

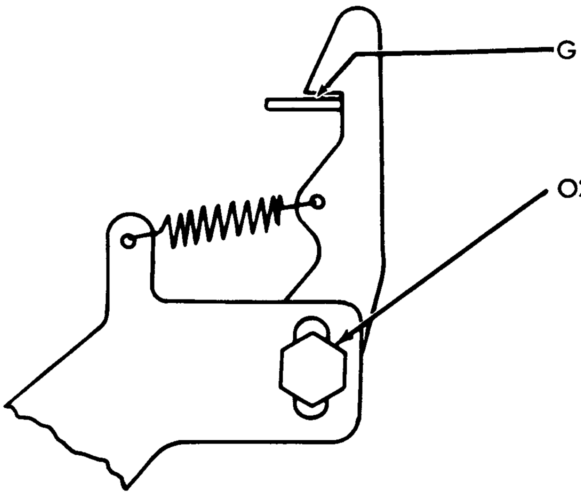




2.02 Lower Cover Hinge and Latch (Later Design Only)







35 REPERFORATOR BASES

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section provides descriptive and operating information for 35 reperforator bases.

1.02 The 35 reperforator bases consist of three different types: the 35 receiving-only (RO) base, the 35 multiple reperforator base, and the 35 auxiliary reperforator base. The bases provide a foundation for a motor unit and either one or three reperforator units, and for electrical and mechanical operational devices and accessories.

1.03 The approximate dimensions of the bases are shown below:

Base	Approximate Dimensions (Inches)		
	Height	Width	Depth
RO Reperforator Base			
Single-Plate	9-1/2	11	12-13/16
Double-Plate	10	13-9/32	12-13/16
Multiple Reperforator Base	9*	20-7/10	20-4/5
Auxiliary Reperforator Base	13	9-1/2	13

* With components and tape rolls.

2. RECEIVING-ONLY REPERFORATOR BASES

SINGLE-PLATE BASE (Not Illustrated)

2.01 This base contains a plate that rests on four metal feet and which serves as a foundation for the other components and accessories. Wiring, a power switch, a fuse, two terminal boards, and two electrical connectors comprise the electrical circuitry, and are mounted on a bracket at the rear of the plate. The reperforator unit is mounted by four tapped holes at the left front of the plate. The motor unit is supported by three posts and an adjusting plate. A tape container with roller, a wire guide and wooden filler for a tape roll is attached to the extreme right of the plate. A tape-out mechanism incorporating two switches which may be connected to visual or audible alarms is located in the rear of the tape container. A chad chute is provided for disposal of chad.

2.02 Motion is transferred from the motor unit to the reperforator by a single-speed drive mechanism. Gear sets may be interchanged to obtain different operating speeds.

DOUBLE-PLATE BASE (Figure 1)

2.03 In this base, an upper plate is separated from a somewhat larger lower plate, or subbase, by rubber vibration mounts. The subbase rests on the lower extension of the vibration mounts. Wiring, a power switch, a connector and two terminal boards comprise the electrical circuitry. (A variation of this base contains one electrical connector and one terminal board.)

2.04 The tape container, tape-out mechanism (Figure 2), and the mounting facilities for the motor unit are identical to those of the single-plate base (2.01). A low-tape lamp is mounted by a bracket on the tape container.

2.05 Motion is transferred from the motor unit to the reperforator unit through a single-speed drive mechanism. Gear sets may be interchanged to obtain different operating speeds.

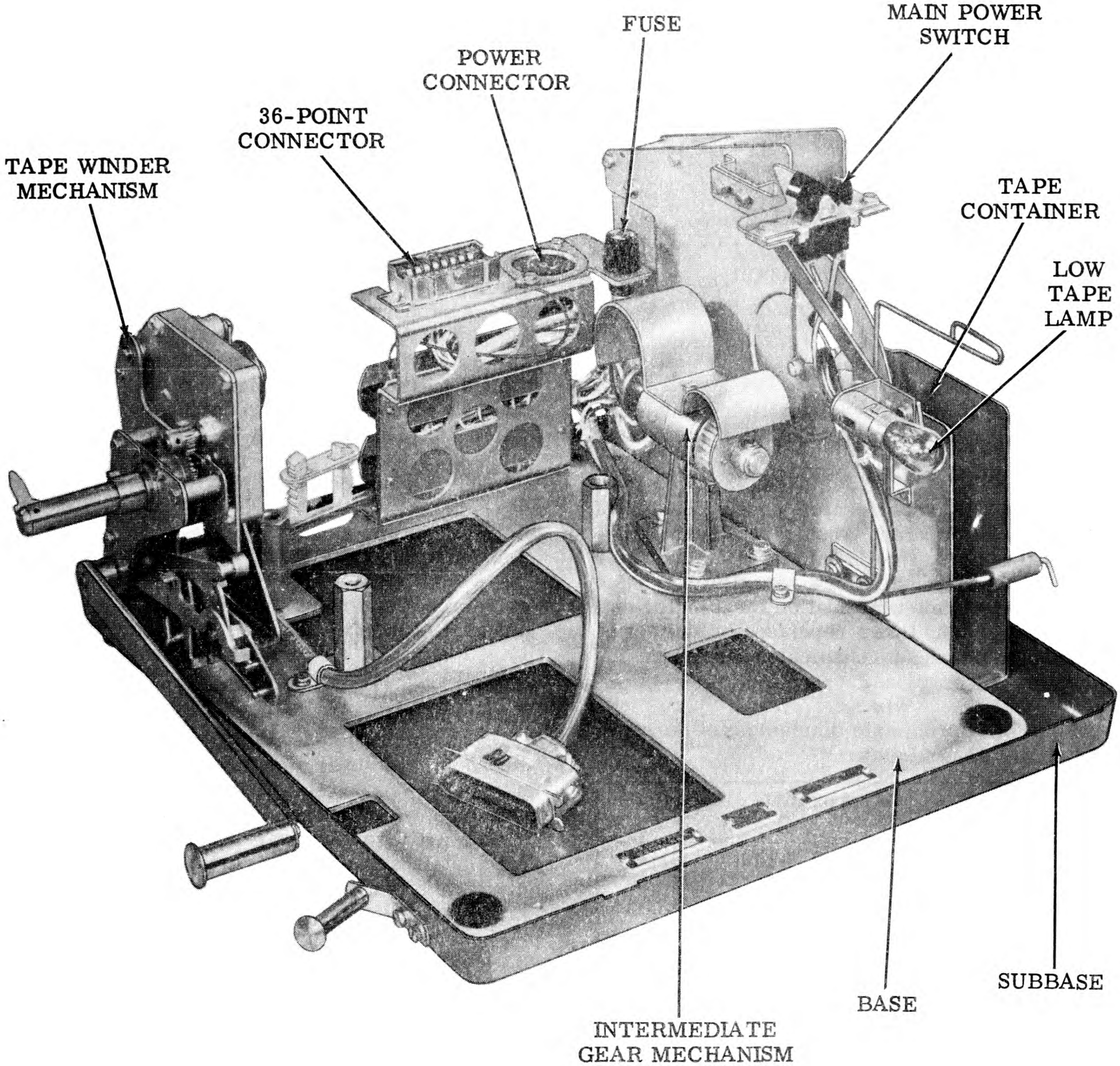


Figure 1 - Typical 35 Receiving-Only Reperforator Base

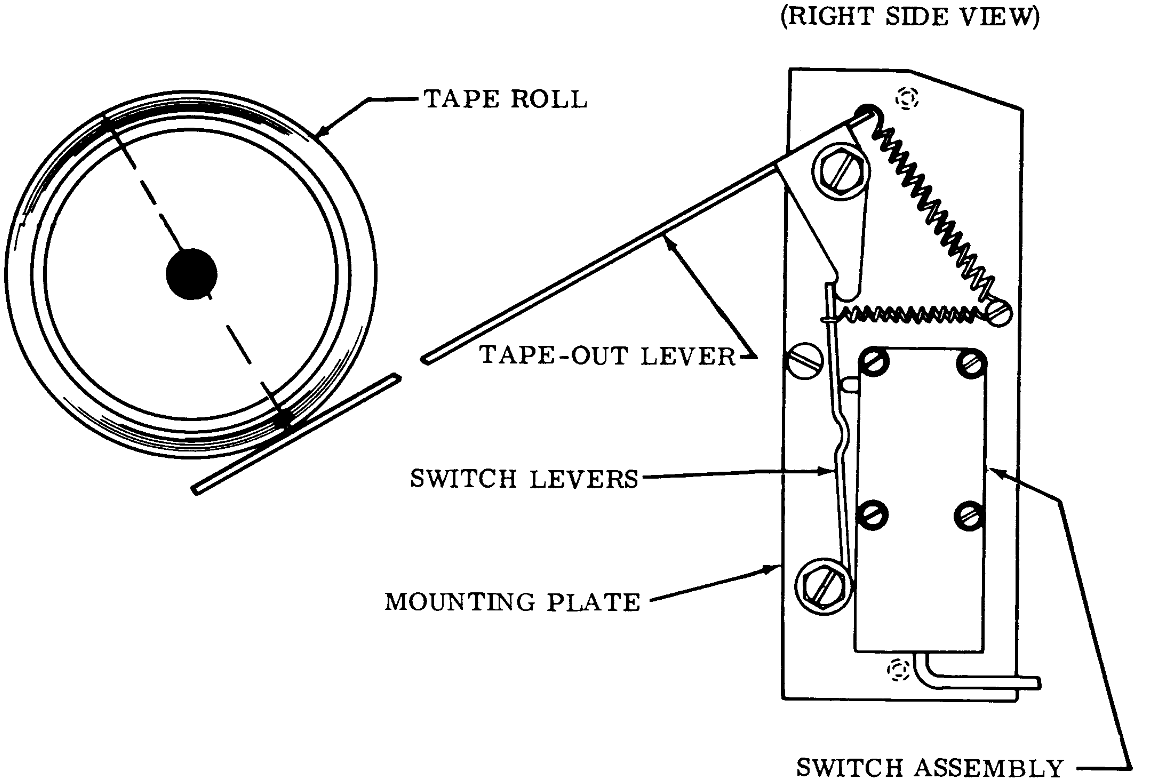


Figure 2 - Tape-Out Mechanism

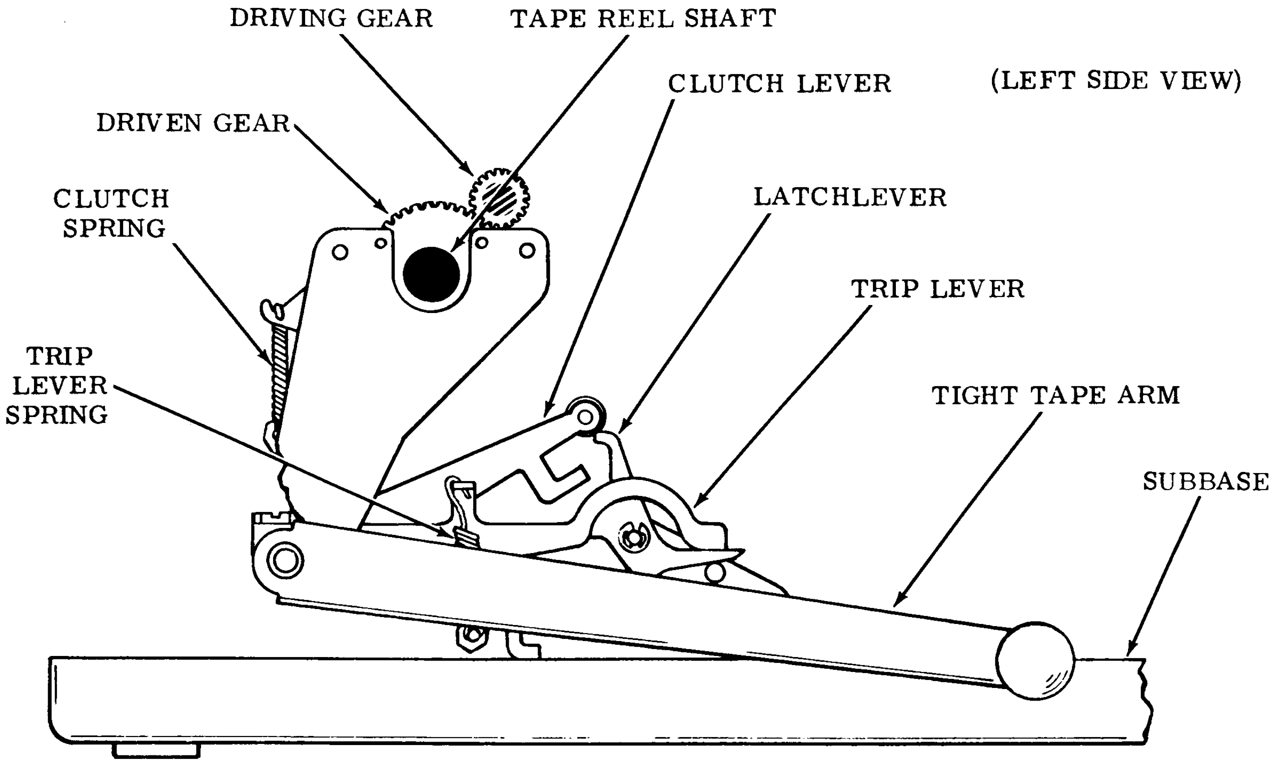


Figure 3 - Tape Winder Mechanism

2.06 Some bases are equipped with a tape winder mechanism (Figure 3) which winds the perforated tape on a tape reel. The tape winder mechanism mounts on the left side of the base and extends a rotating shaft and a tight-tape arm beyond the left side of the cover. The tape winder is driven off the rear of the motor unit by a belt and pulley. A sealed gear reduction mechanism drives the shaft and reel of tape attached to it. In its normally raised position, when the equipment is idling, the tight-tape arm and its associated trip lever and latch hold the driving gear upward, out of engagement with the driven gear. When the tape feeds from the reperforator, the tape arm is permitted to drop until the trip lever engages the right extension of the latchlever. The upper arm of the latchlever, rotating clockwise, releases the clutch lever which drops, under tension of its spring, permitting the gears to mesh. The tape winder is rotated in a clockwise direction until the tape arm is again raised, and the clutch lever lifts the gears out of engagement.

3. MULTIPLE REPERFORATOR BASE (Figure 4)

3.01 This base provides mounting facilities for three reperforator units and one motor unit, and for the necessary accessory

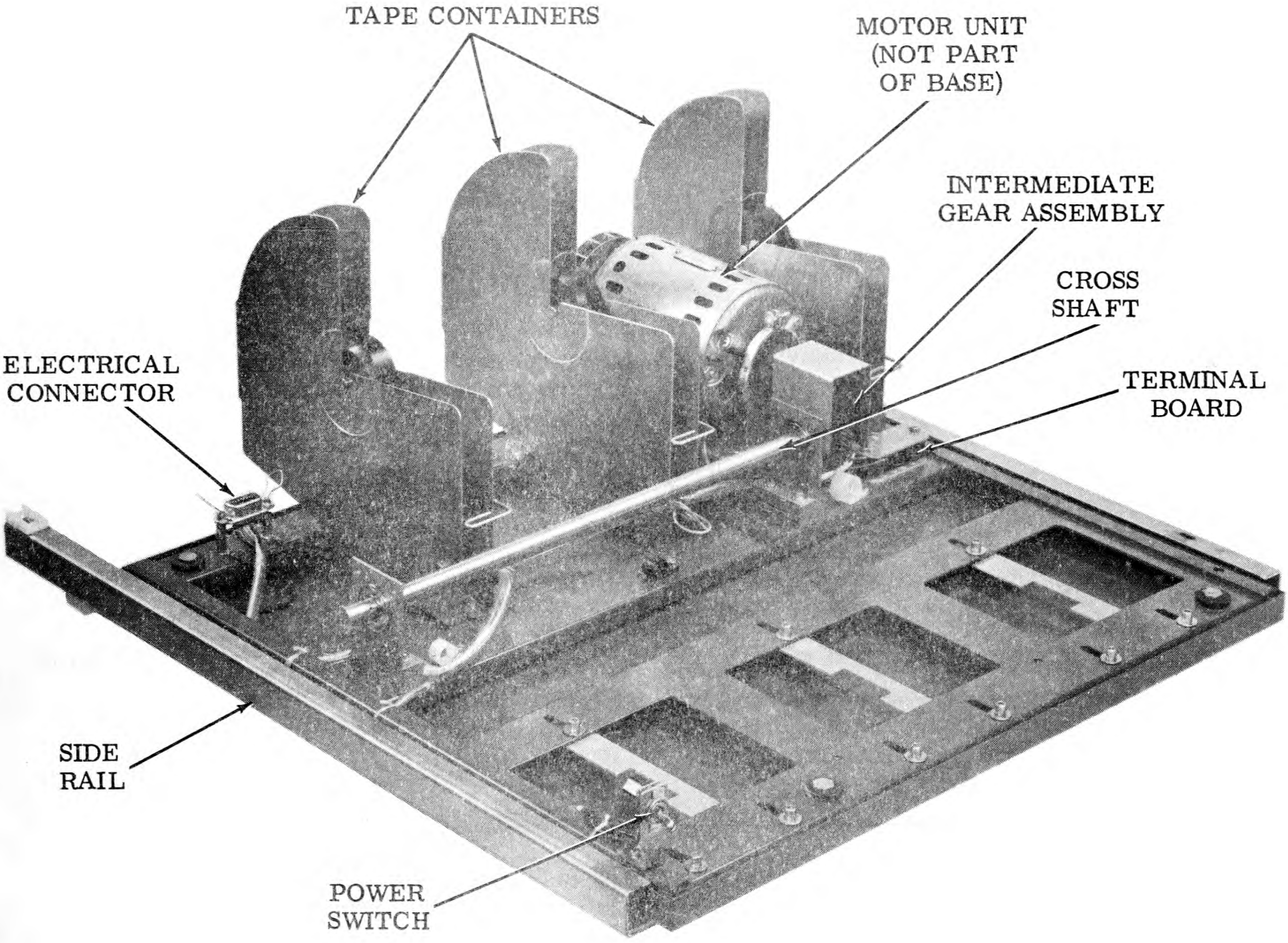


Figure 4 - Typical 35 Multiple Reperforator Base

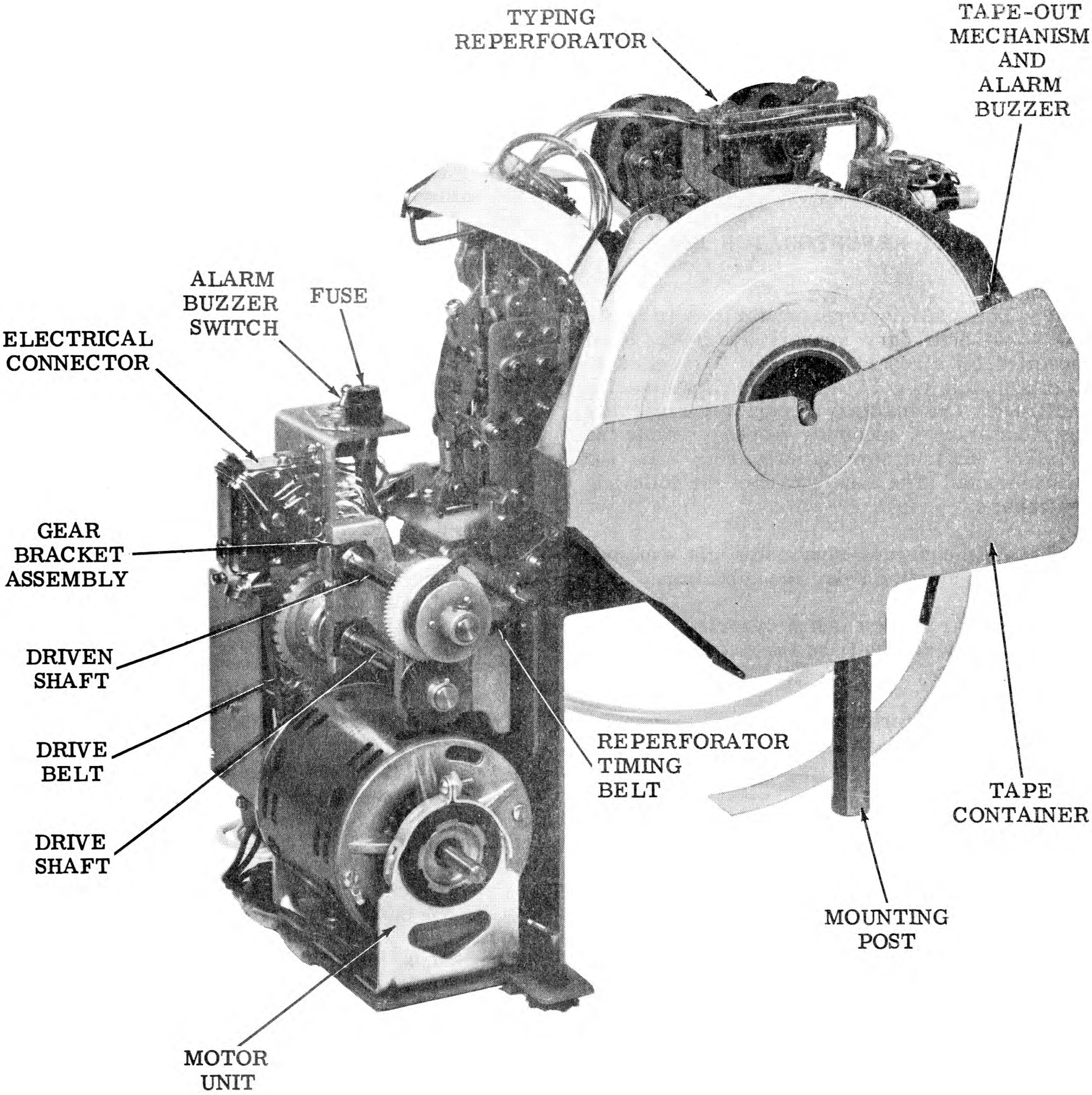


Figure 5 - Typical 35 Auxiliary Reperforator Base

equipment. A plate upon which the components are installed is separated from an oil pan by resilient mountings. Side rails are provided for installation of the base in a cabinet. Posts on an adjustment plate are provided for mounting a motor unit. Three tape containers equipped with tape-out switches, a connector, terminal blocks, and a main power switch, are also included. Three chad containers are provided to accommodate fully-perforated tape output reperforator units.

3.02 The reperforator units, which are mounted near the front of the base, receive rotary motion from the motor unit through a cross-shaft assembly and timing belts. Intermediate gear assemblies transfer the motion from the cross shaft to the reperforator units via timing belts. The units may operate at a common speed or at independently varied speeds. Speed changes are made by interchanging gears at the motor unit and in the intermediate gear assemblies.

4. AUXILIARY REPERFORATOR BASE (Figure 5)

4.01 The auxiliary reperforator base provides the necessary support and operational facilities for a reperforator unit serving as an auxiliary unit in a 35 Automatic Send-Receive (ASR) Set. The auxiliary reperforator permits the monitoring of incoming messages while the primary reperforator is preparing tape for transmission. The base includes the following features:

(a) A synchronous-type motor unit, equipped with starting relay and capacitor.

(b) A gear bracket assembly for transferring rotary motion from the motor unit to the reperforator.

(c) A power terminal block and connector, a fuse, a terminal board, a cable for connecting the reperforator, and a receptacle for interconnecting with an electrical service unit.

(d) A tape container for an 8-inch diameter tape roll (2-inch diameter core).

(e) A tape-out lamp, alarm buzzer, actuating switch assembly, and buzzer disabling switch.

(f) Tape routing and chad disposal devices.

(g) A base plate for mounting of the above features.

4.02 The base plate is mounted in the ASR cabinet by means of three hexagonal posts, with two posts supporting the rear of the plate and one longer post supporting the front of the plate. The plate is supported on the posts with rubber bushings which isolate it from the cabinet and prevent the transmission of vibration from the base to the cabinet.

4.03 The cable for connecting the reperforator supplies both the signal input and switched and fused power. When used with a typing reperforator it provides power for operation of the ribbon-shift mechanism and connects the tape-feed motor hold switch and tape-feed magnet with control circuits in the electrical service unit. These control circuits initiate tape feed-out and prevent the motor unit from turning off during a feed-out period.

4.04 The synchronous-type motor rotates at 3600 rpm and operates from 115 volts, 60 cycles ac power. It has two windings: a starting winding and a run winding. When power is applied to the motor unit initially, current flows through the start winding of the motor start relay which then closes the motor start contact, completing the series circuit to the start winding and capacitor. Current then flows through the starting and run windings of the motor, causing it to rotate. As the speed of the motor increases, current in the windings decreases. The motor start relay de-energizes, removing the starting winding and capacitor from the circuit, and current flows only through the motor run winding.

4.05 Rotary motion from the motor unit is transferred to the reperforator through the gear bracket assembly. The motion is coupled to the drive shaft of the gear bracket assembly through a 16-tooth motor sprocket, a drive belt, and a 32-tooth sprocket on the drive shaft. The drive shaft, rotating at 1800 rpm, transfers motion to the driven shaft by means of its 42-tooth gear which engages with a 63-tooth gear on the driven shaft. A 16-tooth sprocket on the driven shaft and a timing belt drive the 28-tooth sprocket on the reperforator main shaft at 685 rpm.

4.06 The tape-out circuitry consists of two switches mounted in tandem (Figure 2), an alarm buzzer, and a tape-out lamp. Operating current is supplied from circuitry in the associated electrical service unit. A normally-open tape-out switch contact is closed when the tape supply is low and illuminates the tape-out lamp and actuates the buzzer. A transfer contact operates a lamp and buzzer located on the ASR set cabinet and prevents automatic answer-back. A single-pole, double-throw switch permits the operator to turn off the buzzer when replacing the tape roll. The tape-out lamp remains on until the tape supply is replenished.

35 REPERFORATOR BASES

LUBRICATION

CONTENTS — PAGE

1. GENERAL

1.01 This section provides lubrication information for the following units: the 35 receiving-only reperforator base, the 35 auxiliary reperforator base (for Automatic Send-Receive (ASR) Set mounting), and the 35 multiple mounted reperforator base.

1.02 General areas of the bases are shown by photographs. Specific points of lubrication are indicated by line drawings and descriptive text. The symbols in the text indicate the following directions:

O1 Apply one drop of oil.
O2 Apply two drops of oil.
G Apply thin coat of grease.
SAT Saturate with oil (felt washers, etc).

KS7470 oil and KS7471 grease should be used.

1.03 The equipment should be thoroughly lubricated, but over-lubrication which might allow oil to drop or grease to be thrown on other parts should be avoided. Special care should be exercised to prevent lubricants from getting between armature and pole faces or between electrical contact points in the associated units.

1.04 The following general instructions supplement the specific lubricating points illustrated on subsequent pages.

(a) Apply one drop of oil to all spring hooks.

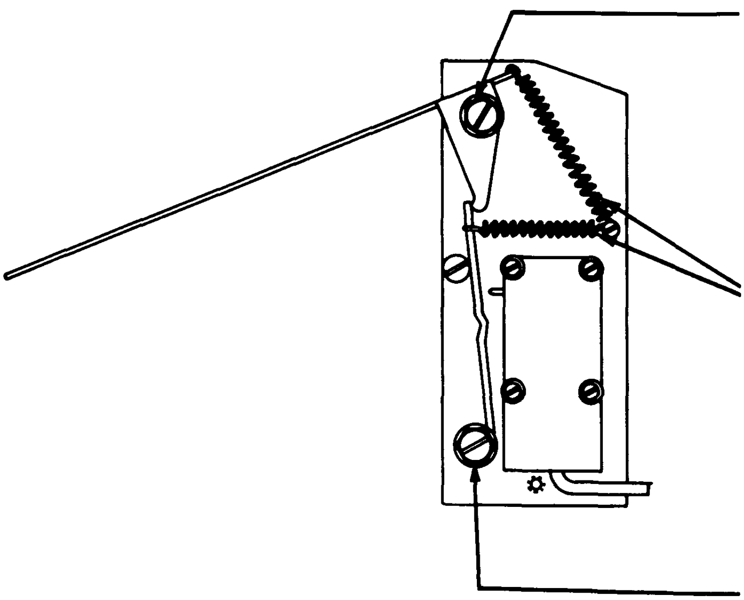
(b) Apply oil to all sliding surfaces.

(c) Saturate all felt washers.

1.05 The bases should be lubricated before being placed in service or prior to storage. After a few weeks of service, relubricate to make sure that all specified points have received lubricant. Thereafter, lubricate the bases every 1,500 operating hours, or 6 months, whichever occurs first.

2. REPERFORATOR BASES

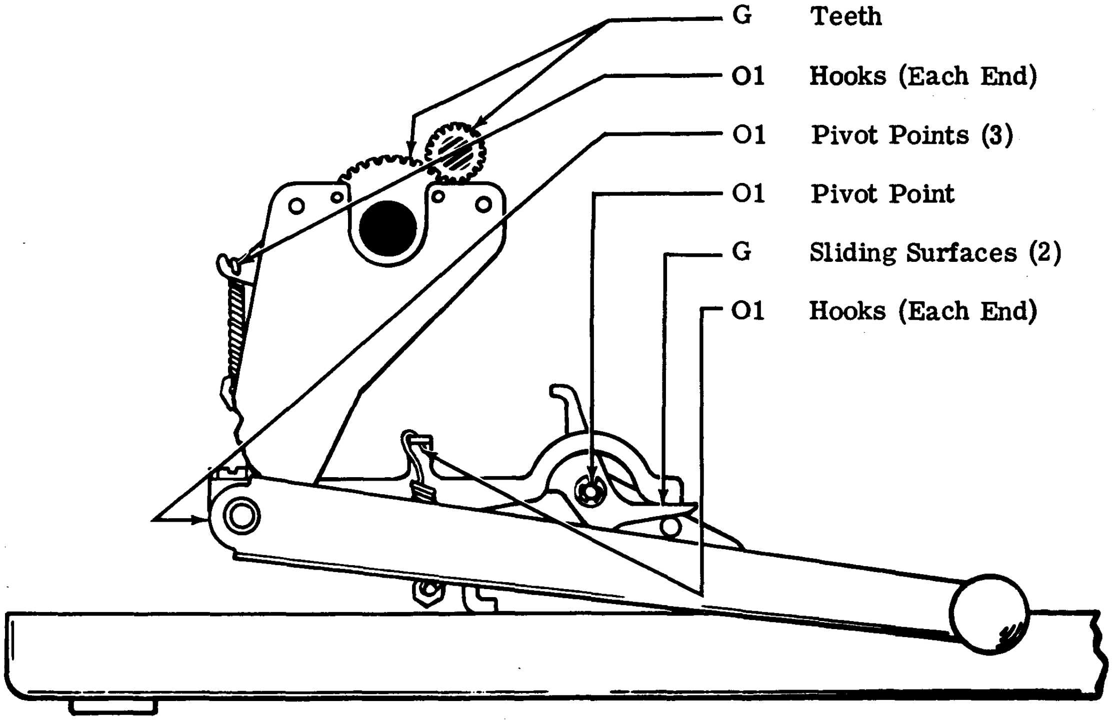
2.01 Tape-Out Switch Mechanism (All 35 Reperforator Bases)



O1	Pivot Points (2)	Tape Lever
O1	Hooks - Each End (2)	Springs (2)
O1	Pivot Point	Switch Levers (2)

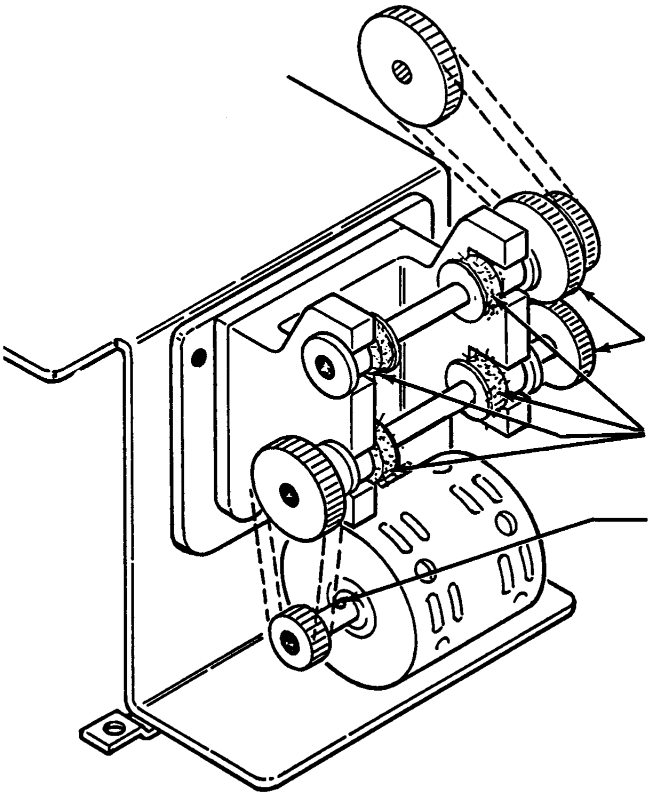
(RIGHT SIDE VIEW)

2.02 Tape Winder Mechanism (35 Receiving-Only Reperforator Bases)



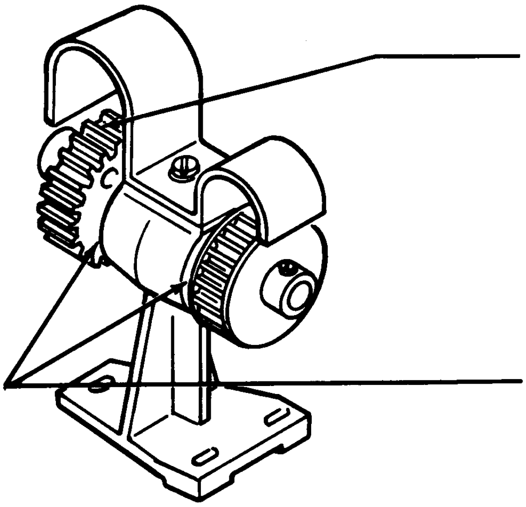
G	Teeth	Gears (2)
O1	Hooks (Each End)	Spring
O1	Pivot Points (3)	Tape Arm Shaft
O1	Pivot Point	Latchlever
G	Sliding Surfaces (2)	Latchlever
O1	Hooks (Each End)	Spring

2.03 Gear Bracket Assembly (35 Auxiliary Reperforator Base)



G	Gears (2)	Gear Bracket Assembly
SAT	Felt Washers (4)	Shafts
O2	Oil Hole (2)	Motor Bearings

2.04 Intermediate Drive Assembly (35 Receiving-Only Reperforator Bases)



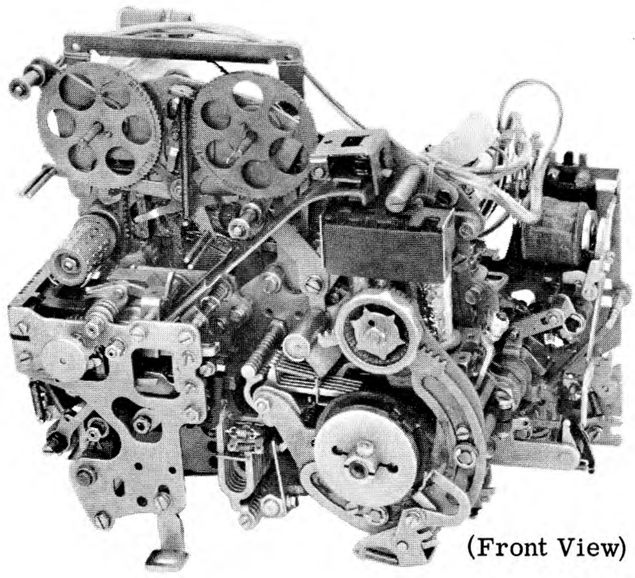
G	Gear	Gear Assembly
O2	Ball Bearing	Gear Assembly

35 TYPING REPERFORATOR (LPR)

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS PAGE

CONTENTS PAGE



(Front View)

Figure 1 - 35 Typing Reperforator

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

1.01 This section contains description and principles of operation for the 35 typing reperforator (Figures 1, 2, and 3). The section has been revised to include recent engineering changes and additions, and to rearrange the text, so as to bring the section generally up-to-date. Since this is an extensive revision, marginal arrows ordinarily used to indicate changes have been omitted.

1.02 The 35 typing reperforator is an electromechanical unit which records information on tape, both as printed characters and as code perforations. The information is received from a signal line in the form of an electrical signaling code (teletypewriter code), which is translated into mechanical motions to print and perforate. External gears permit operation at signaling speeds up to 100 wpm. Code and tape feed holes are fully perforated. The characters are printed between the feed holes. A number of variable features are available with the unit.

1.03 The unit is equipped to receive information transmitted in the eight level American Standard Code for Information Interchange (ASCII). See the applicable section for a detailed explanation of this code.

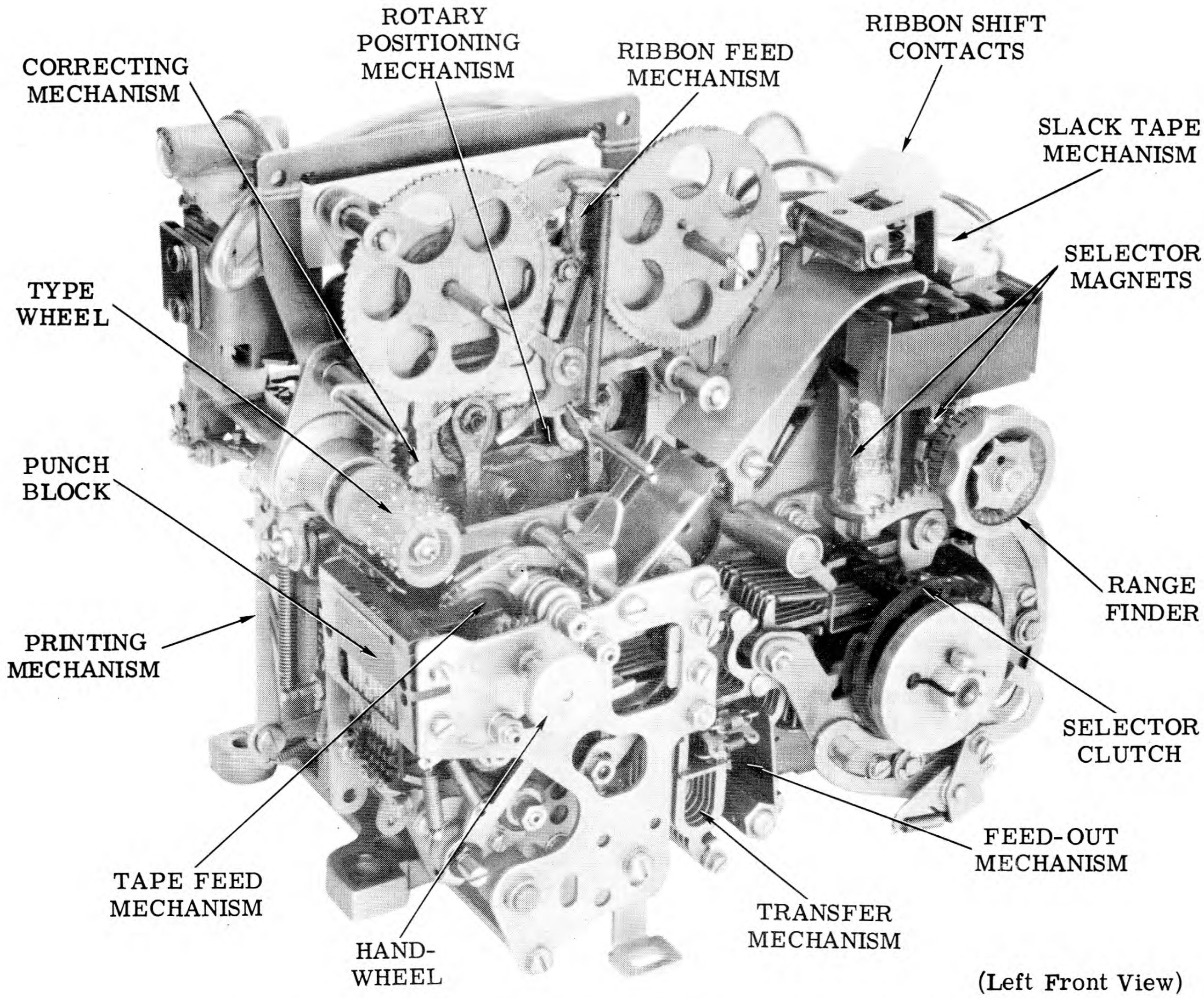


Figure 2 - Typical 35 Typing Reperforator (Without Chad Chute)

1.04 The characters perforated in the tape are six positions in advance of the printed characters. This should be considered when preparing the tape for transmission. The end of the tape should include all of the printed characters in the message, and the first printed character of the message must be preceded by at least six sets of code perforations.

1.05 For most applications the unit is equipped with a black-inked ribbon. All graphic characters (such as A, B, C, 1, 2, 3, #, *, %) are printed. Printing is suppressed when the code combination for a control function is received (eg, BELL, EOA, EOT). For special applications which require printing on receipt of control functions, the typing reperforator is equipped with a two-color ribbon (black and red). The graphic characters are printed in black; control functions are indicated by printing of their complementary graphic symbol in red. See Figure 4.

1.06 Perforated code holes correspond to the marking bits and unperforated code positions correspond to spacing bits. Reading from the rear as the tape feeds from the punch block, the code positions in the tape are: 1, 2, and 3, the feed hole, and the 4, 5, 6, 7, and 8 bits.

1.07 Unless stated otherwise, references in this section to left or right indicate the operators left or right, facing the front of the unit (selector mechanism at the right, punch mechanism at the left). In illustrations, unless noted otherwise, the views show the equipment as viewed from the front. Pivot points are shown by circles or elipses and are drawn solid black to indicate fixed points and crosshatched to indicate floating points.

2. DESCRIPTION

GENERAL

2.01 The following paragraphs describe the mechanisms that comprise the typing reperforator and discuss the differences between the several variations of the unit. Refer to Figures 2 and 3.

DRIVE MECHANISM (Figure 2)

2.02 Rotary motion from an external source is received by a main shaft and distributed by two cam-clutch assemblies. External changes in speed of the driving source, through a gear shift mechanism or change gears, permit changes from 60 to 75 or 100 words per minute in the typing reperforator operating speed. A rocker bail further distributes the motion to the mechanisms involved in printing and perforation.

SELECTING MECHANISM (Figure 2)

2.03 A selecting mechanism, which includes a two-coil magnet wired to the signal line, converts the electrical signaling code combinations into mechanical arrangements which govern the printing and perforation operations. The magnets may be wired for 0.500 ampere line current furnished by an external selector magnet driver or, depending on the unit, they may be wired in series for 0.020 ampere operation or in parallel for 0.060 ampere operation. A range finder permits adjustment of the selector in relation to the signaling code.

TYPE WHEEL AND POSITIONING MECHANISMS (Figure 2)

2.04 The characters used in printing are embossed on a metal type wheel which may be easily replaced to obtain different type faces and character arrangements. Controlled by the selecting and transfer mechanisms, axial and rotary positioning mechanisms, in conjunction with a correcting mechanism, select the proper characters by moving the type wheel.

PRINTING MECHANISM (Figure 2)

2.05 A printing mechanism utilizes a hammer to drive the tape and inked ribbon against the type wheel and imprint the selected character. Printing and perforating occur simultaneously at the punch block, but the characters are printed six positions to the right of the corresponding code combinations. On units equipped with the last character visibility feature, the type wheel is retracted at the end of each operating cycle to expose the last printed character.

RIBBON FEED MECHANISM (Figure 2)

2.06 The ribbon feed mechanism has two circular ratchets on which the ribbon spools are mounted. A feed pawl, which receives its motion from the rocker bail, advances the ribbon by rotating a ratchet once each cycle of operation. The direction of ribbon travel is automatically reversed when the supply spool is nearly depleted.

PERFORATING MECHANISM (Figure 2)

2.07 The perforating mechanism contains a punch block, punch pins, and drive parts. The punch pins, contained within the punch block, punch fully perforated code holes in the tape in response to mechanical arrangements received from the selector mechanism via punch slides and punch slide latches. A feed hole is perforated each cycle of operation. The mechanism receives its drive from a main bail assembly.

RIBBON SHIFT — PRINT SUPPRESSION MECHANISMS (Figure 3)

2.08 A ribbon shift mechanism is actuated by ribbon shift contacts associated with the function box. This mechanism permits the ribbon to advance fully to print graphics in black. When the signal code combinations for control functions are received, the ribbon shift mechanism will either actuate the print suppression mechanism to prevent printing (units with one color ribbons) or retard the advance of the ribbon to print the control function's complementary graphic in red (units with two color ribbons).

FUNCTION BOX (Figure 3)

2.09 A function box enables the typing reperforator to perform various auxiliary functions, such as the actuation of signal bell and EOT contacts.

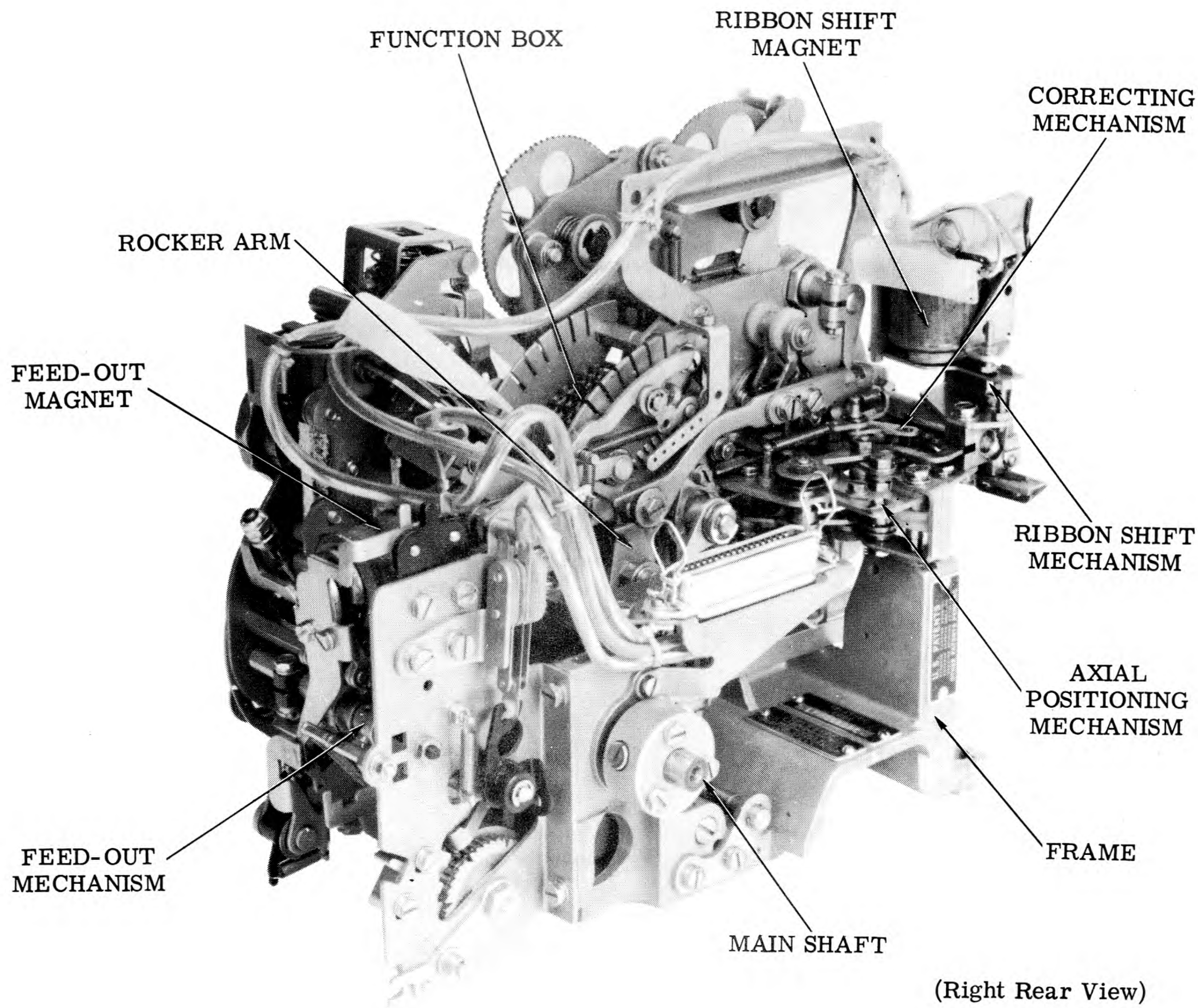


Figure 3 - Typical 35 Typing Reperforator

FRAME ASSEMBLY (Figures 2 and 3)

2.10 A cast frame provides mounting facilities for the various mechanisms which comprise the typing reperforator. The frame is, in turn, mounted on associated equipment through which the necessary electrical and motive power connections are made. A connector for all electrical input requirements is provided.

2.11 A variation of the typing reperforator contains an additional shaft that enables the perforator and typing mechanisms to be operated at a different speed from that of its selecting mechanism. It is used in applications such as the Automatic Send-Receive (ASR) Set and is described in another publication.

VARIABLE FEATURES

2.12 A number of variable features are available with the typing reperforator. These features, some of which are described below, enable the unit to perform special operations and may be installed either at the factory or in the field.

(a) Contact Mechanisms: These mechanisms furnish electrical pulses for external use and include the following types:

(1) Timing contacts for timed control of external equipment. For example, the selector mechanism may be equipped

CODE 1 2 3 4 5 6 7 8 *	CHARACTER REPRESENTATION	MEANING OF CHARACTER	CHARACTER PRINTED	COLOR
0 0 0 0 0 0 0 0	§ NULL	Blank (All bits spacing)	□	Red
● 0 0 0 0 0 0 ●	SOH	Start of Heading	!	Red
0 ● 0 0 0 0 0 ●	STX	Start of Text	"	Red
● ● 0 0 0 0 0 0	ETX	End of Text	#	Red
0 0 ● 0 0 0 0 ●	EOT	End of Transmission	$	Red
● 0 ● 0 0 0 0 0	WRU(ENQ)	Who Are You or Enquiry	%	Red
0 ● ● 0 0 0 0 0	§ ACK	Acknowledge	&	Red
● ● ● 0 0 0 0 ●	BELL	Bell	'	Red
0 0 0 ● 0 0 0 ●	BS	Backspace	(	Red
● 0 0 ● 0 0 0 0	TAB	Horizontal Tabulation	)	Red
0 ● 0 ● 0 0 0 0	LF	Line Feed	*	Red
● ● 0 ● 0 0 0 ●	VT	Vertical Tabulation	+	Red
0 0 ● ● 0 0 0 0	FORM	Form Feed	,	Red
● 0 ● ● 0 0 0 ●	RETURN	Carriage Return	-	Red
0 ● ● ● 0 0 0 ●	§ SO	Shift Out	.	Red
● ● ● ● 0 0 0 0	§ SI	Shift In	/	Red
0 0 0 0 ● 0 0 ●	§ DLE	Data Link Escape	0	Red
● 0 0 0 ● 0 0 0	X ON	Transmitter On	1	Red
0 ● 0 0 ● 0 0 0	TAPE	Receiver On	2	Red
● ● 0 0 ● 0 0 ●	X OFF	Transmitter Off	3	Red
0 0 ● 0 ● 0 0 0	~~TAPE~~	Receiver Off	4	Red
● 0 ● 0 ● 0 0 ●	§ NAK	Negative Acknowledge	5	Red
0 ● ● 0 ● 0 0 ●	§ SYN	Synchronization Idle	6	Red
● ● ● 0 ● 0 0 0	§ ETB	End of Text Block	7	Red
0 0 0 ● ● 0 0 0	§ CAN	Cancel	8	Red
● 0 0 ● ● 0 0 ●	§ EM	End of Media	9	Red
0 ● 0 ● ● 0 0 ●	§ SS	Start of Spl. Seq.	:	Red
● ● 0 ● ● 0 0 0	ESC	Escape (For Data Proc.)	;	Red
0 0 ● ● ● 0 0 ●	§ FS	Field Separator	<	Red
● 0 ● ● ● 0 0 0	§ GS	Groups Separator	=	Red
0 ● ● ● ● 0 0 0	§ RS	Record Separator	>	Red
● ● ● ● ● 0 0 ●	§ US	Unit Separator	?	Red
0 0 ● ● ● ● ● ●			\	Red
● 0 ● ● ● ● ● 0			]	Red
0 ● ● ● ● ● ● 0			↑	Red
● ● ● ● ● ● ● ●	RUB OUT	Delete (All bits marking)	←	Red

NOTE: Characters marked § have no associated keytop on 35 keyboards.

*The above chart indicates the code arrangement for even parity. When even parity is not used, the 8th bit is always marking.

Figure 4 - 8-Level ASCII Code Language (Controls) for Two-Color Typing Reperforators

with contacts which provide a signal each time the selector reaches its rest position.

(2) Letters-figures contacts which signal whether the typing reperforator is in the letters or figures condition.

(3) Code reading contacts enable the typing reperforator to convert the received serial data into parallel form.

(4) Several types of audible and visual indicator actuating contacts are available, such as the signal bell and end of transmission (EOT) contacts which are operated by the function box when their code combinations are received.

(b) Backspace Mechanism: Two types are available: manual and power drive. They are used to retract the tape in order to erase (obliterate) an error.

(c) Tape Feed-Out Mechanisms: Several different methods permit the inclusion of a predetermined length of blank or rubout perforated tape following the end of a message. The extra length of tape facilitates tape han-

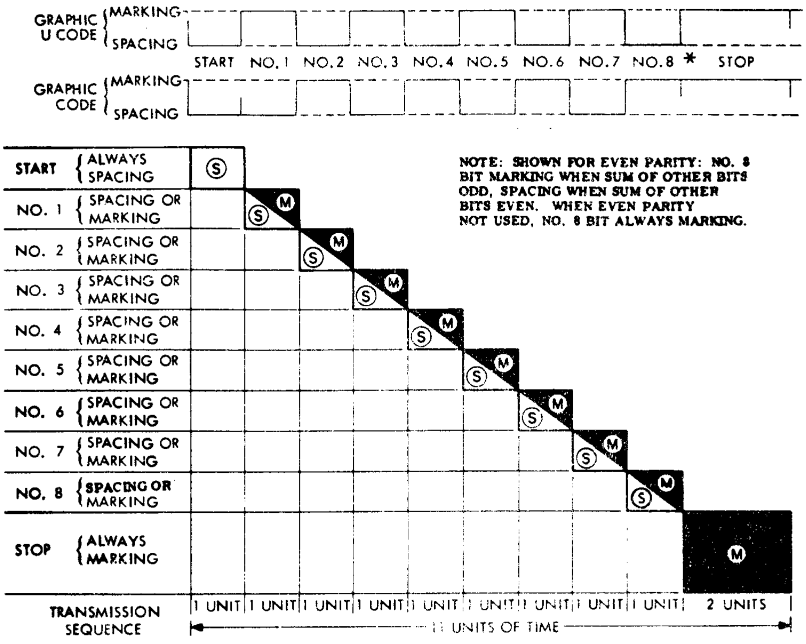


Figure 5 - Signaling Code

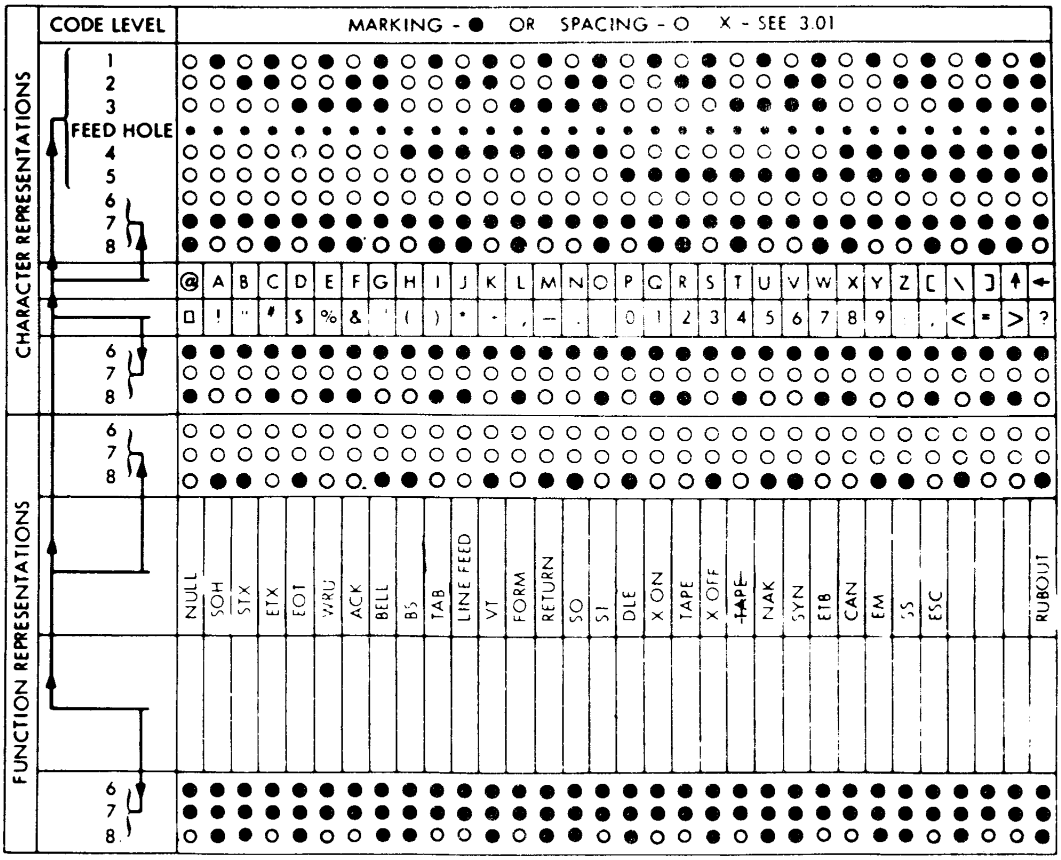


Figure 6 - Code Representations of Characters (Graphics) and Functions

dling. Normally, the interfering tape feed-out mechanism operates at the end of a message. A message cannot be received during a feed-out period. The noninterfering tape feed-out mechanisms have provisions for copying messages received during the feed-out period. The mechanisms may be operated manually, automatically, or by remote control.

(d) Print Suppression on Function: This feature is a standard on one-color ribbon units and is available with two-color ribbon units to prevent printing when control functions are received.

(e) Universal Function Blade: This blade contains removable tines so that it may be coded to accommodate a desired function box requirement.

3. TECHNICAL DATA

APPROXIMATE DIMENSIONS

Width . . . . 7-1/2 inches

Depth . . . . 6-1/2 inches

Height . . . . 8 inches

Weight . . . . 7-1/2 pounds

SIGNAL

Code. . . . . Sequential, 11-unit start-stop (3.01)

Current. . . . . . . 0.500 ampere with selector magnet driver. (Other units available to operate on either 0.020 or 0.060 ampere signal)

TAPE

Type . . . . Standard communications and ASCII
Width . . . . 1 inch
Perforations . . . . 8-level, fully perforated
Holes/inch. 10
Feed holes and code holes in line

PRINTED CHARACTERS

Height
Standard . . . . 0.100 inch
Maximum (Fractions) . . . . . 0.130 inch
Width . . . . 0.050 inch

Type style and character arrangement variable.

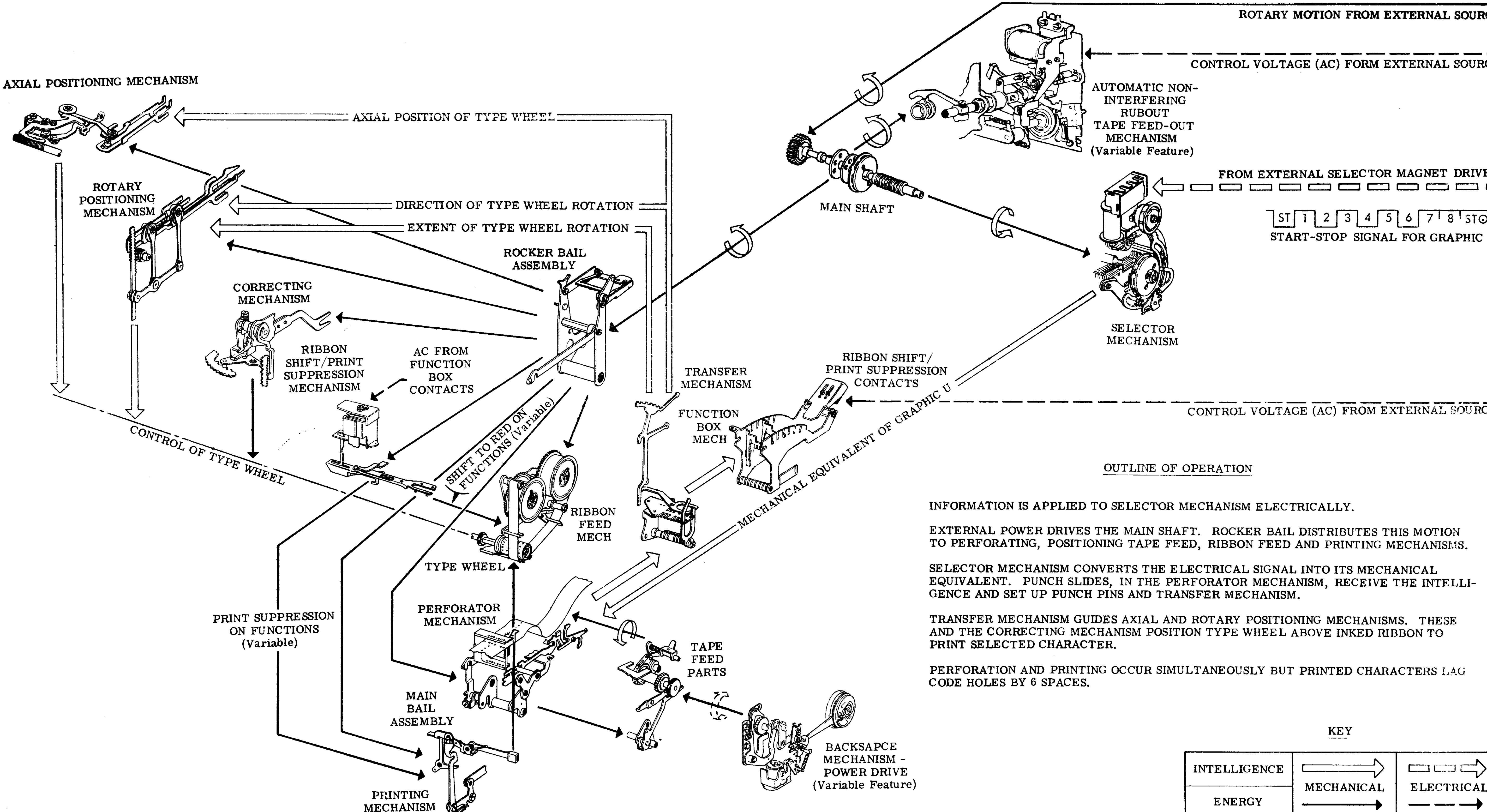
SIGNALING CODE (Figure 5)

3.01 Information is received by the reperforator in the form of an eleven-bit start-stop signaling code in which each character (graphic) or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking and during which no current flows as spacing. Every combination includes eight bits that carry the intelligence, each of which may be either marking or spacing. In present applications, the eighth bit is always marking. For even parity code transmission, the eighth bit may be either marking or spacing, so that the number of marking bits in the transmitted code is always an even number (Figure 5). The intelligence bits are preceded by a start bit (always spacing) and are followed by two stop bits (always marking). Thus each combination consists of 11.0 units of time (referred to as an 11.0 unit transmission pattern). The start and stop bits ensure synchronization between the transmitting and receiving equipment by bringing the receiving equipment to a complete stop at the end of each combination. The marking condition of the eighth bit further enlarges the marking interval at the end of each code combination transmitted.

3.02 The code representations for the graphics U and * are illustrated in Figure 5. In these combinations, alternate marking and spacing condition for the intelligence bits are required.

4. GENERAL OUTLINE OF OPERATION

4.01 The relationship of the operating mechanisms of the 35 typing reperforator are illustrated in the pictorial schematic diagram (Figure 7). Rotary motion from an external source is applied to the main shaft through a sprocket. The main shaft rotates constantly as long as the unit is under power. An externally supplied 115 v ac circuit is used to pulse the tape feed-out magnet and operate the ribbon shift magnet. The ribbon shift magnet is controlled by function box contacts to permit printing in black or red or, for one color ribbon units, to operate the print suppression mechanism which prevents printing on functions. The selector magnet coils usually operate on a 0.500 ampere circuit through a selector magnet driver. However, there are models available which are not used in conjunction with a selector magnet driver and these require 0.060 ampere to operate the selector magnet coils.



OUTLINE OF OPERATION

INFORMATION IS APPLIED TO SELECTOR MECHANISM ELECTRICALLY.

EXTERNAL POWER DRIVES THE MAIN SHAFT. ROCKER BAIL DISTRIBUTES THIS MOTION TO PERFORATING, POSITIONING TAPE FEED, RIBBON FEED AND PRINTING MECHANISMS.

SELECTOR MECHANISM CONVERTS THE ELECTRICAL SIGNAL INTO ITS MECHANICAL EQUIVALENT. PUNCH SLIDES, IN THE PERFORATOR MECHANISM, RECEIVE THE INTELLIGENCE AND SET UP PUNCH PINS AND TRANSFER MECHANISM.

TRANSFER MECHANISM GUIDES AXIAL AND ROTARY POSITIONING MECHANISMS. THESE AND THE CORRECTING MECHANISM POSITION TYPE WHEEL ABOVE INKED RIBBON TO PRINT SELECTED CHARACTER.

PERFORATION AND PRINTING OCCUR SIMULTANEOUSLY BUT PRINTED CHARACTERS LAG CODE HOLES BY 6 SPACES.

Figure 7 - Pictorial Diagram of Typical 35 Typing Reperforator

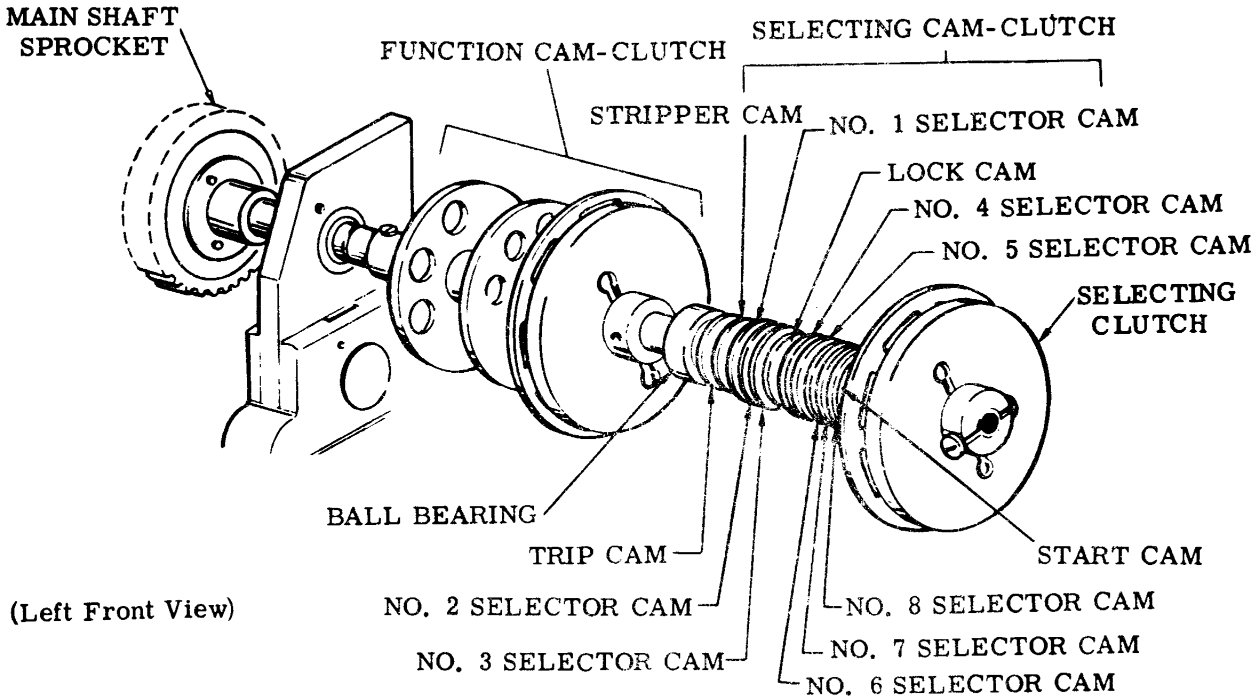


Figure 8 - Main Shaft

4.02 The signaling code combinations, such as the combination representing the graphic U, plotted at the left of Figure 7, are applied to the selecting mechanism. The start bit of each code combination causes the selector, through a trip assembly, to trip the selecting cam-clutch. The main shaft then imparts motion to the cam-clutch throughout the selecting cycle. The cam-clutch mechanism, in turn, transfers timed motion to the selector, which converts the intelligence bits of the code combination into a corresponding mechanical arrangement. Near the end of the selecting cycle, the cam-clutch actuates the function trip assembly. The latter trips the function cam-clutch to operate the printing and perforating mechanisms. The selecting cam-clutch is then disengaged and remains inoperative until the next code combination is received.

4.03 The function cam-clutch, driven by the main shaft, imparts motion to the rocker bail throughout the function cycle. The rocker bail transfers the motion to the perforating mechanism, the positioning mechanisms, the tape feed mechanism, and the printing mechanism.

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

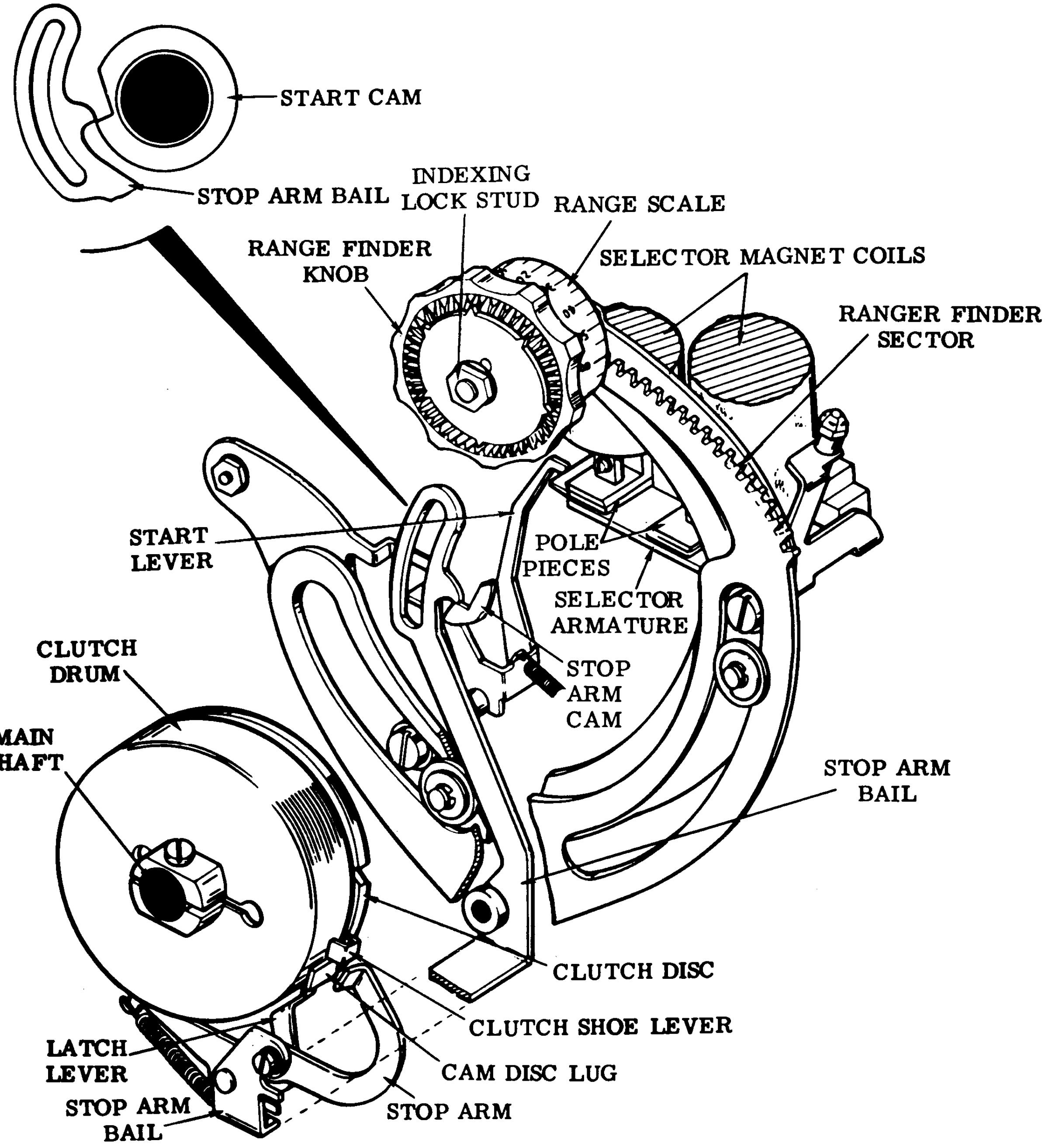
4.05 The punch slides, having received their arrangement from the selector, cause the punch pins to perforate code holes in the tape corresponding to the code bits received by the selecting mechanism. Late in the function cycle, the tape feed parts advance the tape one character space. The function cam-clutch is then disengaged and remains stationary until again tripped by the selecting cam-clutch or by the tape feed-out mechanism. The operations of the reperforator may overlap if the code combinations are being received fast enough. For example, while the perforating mechanism is punching the code combination, advancing the tape, and the printing mechanism is printing, the selecting mechanism may be processing the next code combination.

4.06 The backspace mechanism is operated manually or it receives its drive from the typing reperforator main shaft via an eccentric arm. It reverses the rotation of the tape feed wheel to retract the tape in the punch block.

5. SELECTION

GENERAL

5.01 The selecting mechanism, made up of a selector (5.07), a clutch trip assembly (Figure 9), and a cam-clutch (Figure 8), translates signaling code combinations into mechanical arrangements which govern tape printing and perforations. The electrical pulses com-



(Front View)

Figure 9 - Range Finder and Selecting Cam-Clutch Assembly

prising each code combination are applied to a magnet of the selector. The magnet, through an armature, controls the clutch trip assembly and the parts associated with translation. The cam-clutch transfers timed motion to the selector and also trips the function cam-clutch. By means of a range finder assembly (Figure 9), the selecting mechanism can be adjusted to sample the code bits at the most favorable time for optimum operation. The mechanical arrangements produced by the selecting mechanism are passed on through the transfer mechanism to control the positioning and printing mechanisms (5.13) and through the punch slides to control the perforating mechanism (5.09).

RECEPTION AND TRANSLATION

A. Selecting Cam-Clutch and Trip Assembly (Figures 8 and 9)

5.02 The selecting cam-clutch includes (from right to left in Figure 8) the clutch, the start cam, the eighth, seventh, sixth, fifth, and fourth pulse cams, the lock cam, the third, second, and first pulse cams, the stripper cam, and the trip cam. During the time in which the signal line current is closed (marking), the selector magnet coils are energized and hold the selector armature up against the magnet pole pieces (Figure 9). In this position, the armature blocks the start lever, and the cam-clutch is held stationary between the stop arm and latchlever.

5.03 When a code combination is received, the start bit (spacing) de-energizes the magnet, and the selector armature, under tension of its spring, moves down out of the way of the start lever. The start lever turns clockwise, under spring pressure, and moves the stop arm bail into the indent of the start cam (Figure 9). As the stop arm bail rotates about its pivot point, the attached stop arm is moved out of engagement with the clutch shoe lever. The selecting cam-clutch engages and begins to rotate counterclockwise. The stop arm bail immediately rides to the high part of the cam, where it remains to hold the start lever away from the armature while the intelligence bits of the code are received and processed by the selector (5.07 to 5.09).

5.04 When the stop bit at the end of the code combination is received, the armature is pulled up and blocks the start lever. Thus the stop arm bail is prevented from dropping into the low part of its cam, and the attached stop arm is held in position to stop the clutch stop lever. When the clutch shoe lever strikes the stop arm, the inertia of a cam disc causes it to continue to turn until its lug makes contact

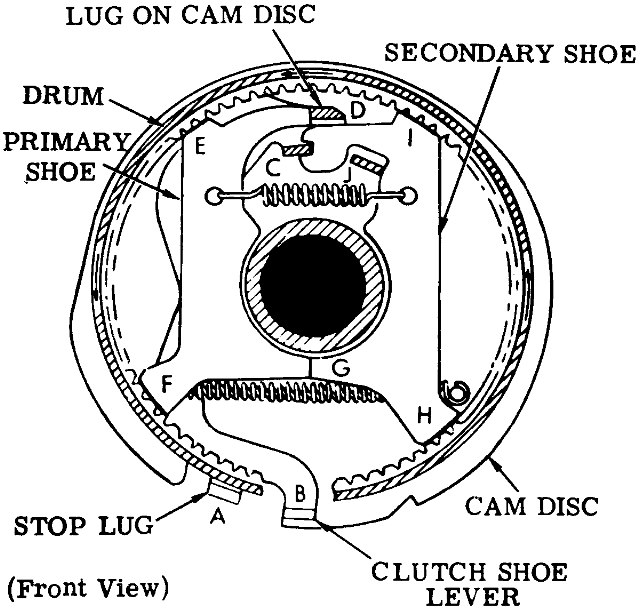


Figure 10 - Clutch, Engaged

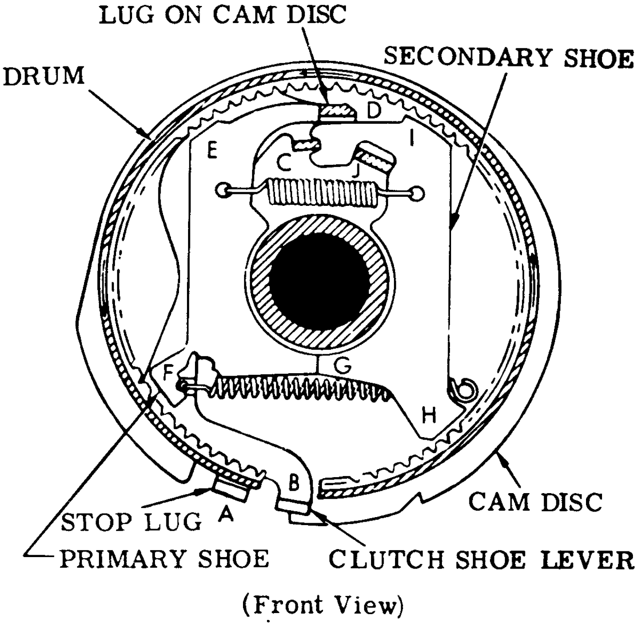


Figure 11 - Clutch, Disengaged

with the clutch shoe lever. At this point, a latchlever drops into an indent in the cam disc, and the clutch is held disengaged until the next code combination is received.

B. Clutch Operation (Figures 10 and 11)

5.05 The clutch drum is attached to and rotates in unison with the main shaft (Figure 8). In the disengaged position, as shown in Figure 11, the clutch shoes do not contact the drum, and the shoes and cam disc are held stationary. Engagement is accomplished by moving the stop arm (Figure 9) away from the clutch and thus releasing stop lug A and the lower end of shoe lever B (Figure 10). The upper end of lever B pivots about its ear C, which bears against the upper end of the secondary shoe, and moves its ear D and the upper end of the primary shoe toward the left until the shoe makes contact with the notched inner surface of the rotating drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward so that it again makes contact with the drum at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point G. The lever end of the secondary shoe then bears against the drum at point H. The drum drives this shoe upward so that it again makes contact with the drum at point I. The forces involved are multiplied at each of the preceding steps. The aggregate force is applied through the shoes to the lug J on the clutch cam disc, and the disc and attached cam turn in unison with the drum.

5.06 Disengagement is effected when the lower end of shoe lever B strikes the stop arm (Figure 9). Lug A and the lower end of the shoe lever are brought together (Figure 10), and the upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum. The latchlever seats in the indent in the cam disc (5.04) and the cam is held in its stop position until the clutch is again engaged.

C. Selector Operation (Figures 8, 9, and 12)

5.07 The selector assembly consists primarily of two magnet coils (Figure 9), an armature and associated bails, levers, and latches (Figure 12). Eight linkages, each of which consists of a selecting lever, a pushlever, and a puneh slide latch, link the selector cam with the punch slides. Since the linkages are identical, only the no. 4 is shown in its entirety in Figure 12. As the selecting bits of the code combination are applied to the magnet, the cam actuates the selecting levers. When a spacing bit is received, a marking locklever is blocked by the end of the armature, and a spacing locklever swings to the right above the armature and locks it in the spacing position until the next signal transition occurs. Extensions on the marking locklever prevent the selecting levers from following their cams. When a marking bit is received, the spacing locklever is blocked by the end of the armature, and the marking locklever swings to the right below the armature and locks it in the marking position until the next signal transition occurs. During this marking condition, the selecting levers are not blocked by the marking locklever extensions, but are permitted to move against their respective cams. The selecting lever that is opposite the indent in its cam, while the armature maintains a marking condition, swings to the right, or selected position, and the end of an associated pushlever falls off a step on the selecting lever.

5.08 As the cam rotates, the selecting levers, together with any selected pushlevers, are moved to the left by the high part of their respective cams, where they remain until the next code combination is received. The unselected pushlevers remain to the right. When the next code combination is received, a selector reset bail, lifted by its cam (Figure 12), strips the selected pushlevers from the selecting levers, and the pushlevers are returned to the right by their springs.

5.09 The selected pushlevers, in moving to the left, rotate associated punch slide latches counterclockwise (Figure 12). Just before the eighth pushlever is selected, the selecting cam, through the function trip assembly, causes the perforator reset bail to release the punch slides (5.13). The unselected latches retain their associated slides to the right, while the selected latches permit their slides to move to the left under spring tension. During the latter part of the function cycle, the reset bail returns the punch slides to their unselected position (8.02). The latches, under spring tension, return to their unselected position when the pushlevers are repositioned at the beginning of the next selecting cycle.

ORIENTATION (Figure 9)

5.10 For optimum performance, the selecting mechanism should be adjusted to sample the signaling code bits at the most favorable time. To make this adjustment, the operating margins are established through the range finder, which provides a means of varying the time of sampling. The obtaining of this optimum setting is referred to as orientation.

5.11 When the range finder knob (Figure 9) is pushed inward and rotated, its attached range finder gear moves the range finder sector (which supports the stop arm bail, stop arm and latchlever) either clockwise or counterclockwise about the selector cam-clutch. This changes the angular position at which the selector cam-clutch stops with respect to the marking and spacing locklevers. When an optimum setting is obtained, the range finder knob is released. Its inner teeth engage the teeth of the indexing lock stud and hold the range finder mechanism in position. The setting may be read on the range scale opposite a fixed index mark.

TRANSFER (Figure 13)

5.12 The function of the transfer mechanism is threefold:

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

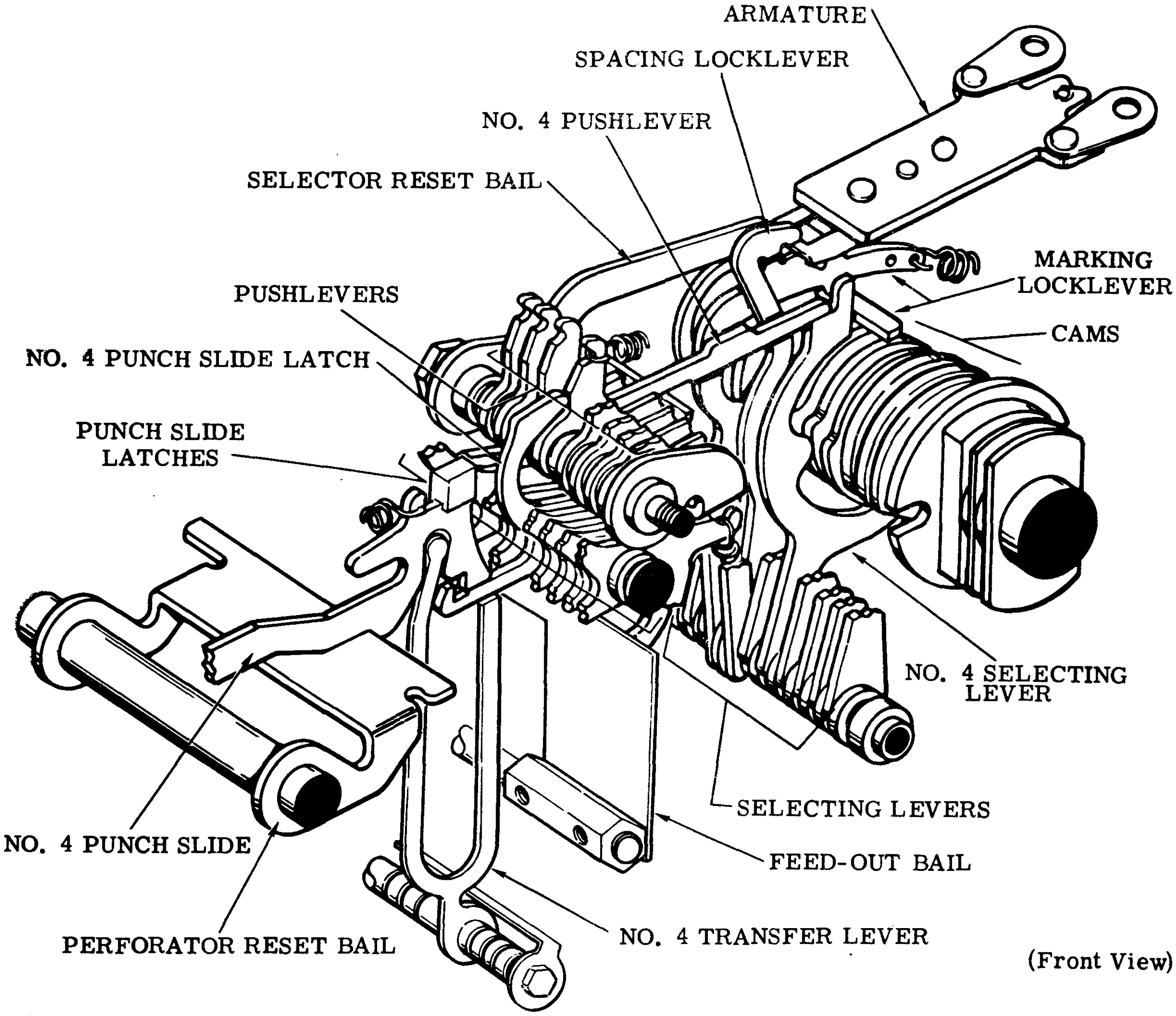


Figure 12 - Selector

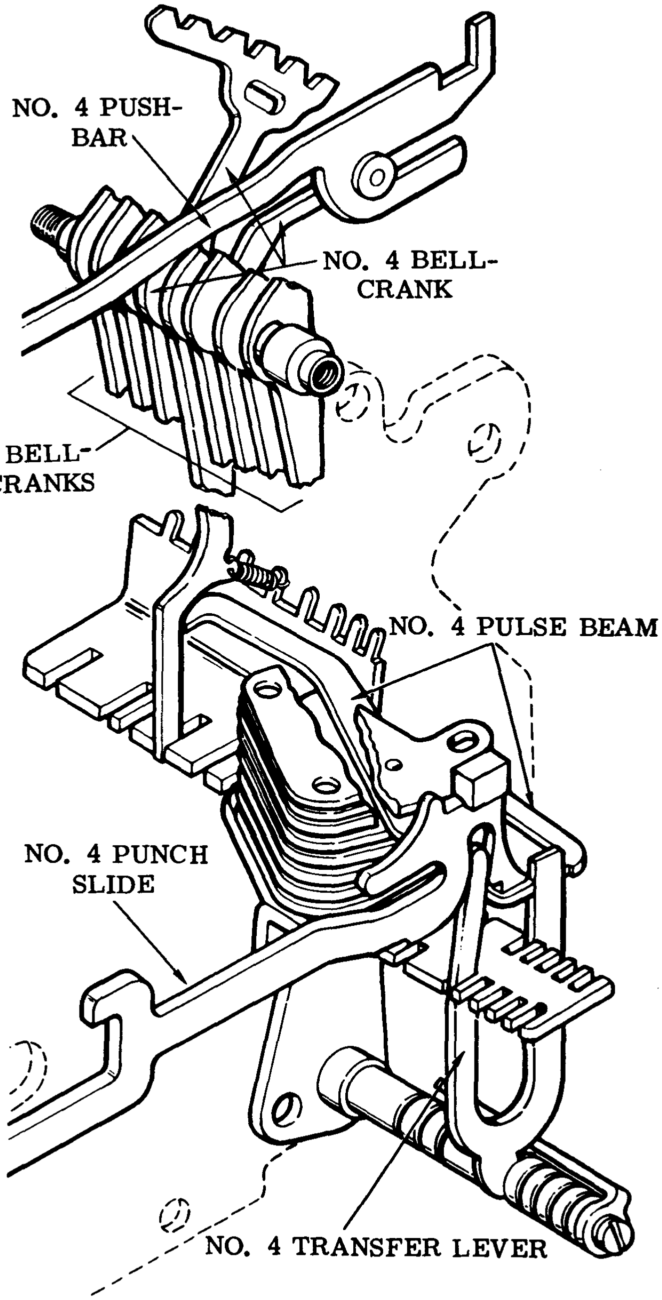
(2) It provides a path for the signal intelligence from other signal sources to the type wheel positioning mechanism.

(3) It provides a means for setting up the ribbon color shift contacts to condition ribbon for red or black printing or to initiate print suppression, determined by the unit.

5.13 The transfer levers engage the punch slides at one end, as illustrated by the no. 4 transfer lever in Figure 13. The transfer levers all pivot about a common point and, at various distances from this pivot, engage their corresponding transfer beams. The opposite end of the transfer beam is coupled to one arm of a bellcrank lever. The opposite arm of the number 1, 2, 3, 4, 5, and 7 bellcrank levers engage their associated pushbars. Since the no. 6 and 8 bits do not control the position of the type wheel, they do not have an associated pushbar. When a selected punch slide fails forward, the corresponding pushbar is raised upwards and into engagement with the rocker bail. An additional extension on the lower end of the latchlever is arranged to engage a bail on the tape feed-out mechanism.

5.14 The no. 6 and 7 bellcranks have an additional arm which controls a transfer contact assembly in the function box. This pair of contacts is used to control the ribbon shift magnet which, in turn, controls the color of the printed character or initiates print suppression (7.26 and 7.28). Current is allowed to pass through the contacts when the no. 6 and 7 bits are opposite polarity, such as no. 6 marking, no. 7 spacing, or no. 6 spacing, no. 7 marking. Current is not allowed to pass when the no. 6 and no. 7 bits are of the same polarity.

5.15 The bellcranks are provided with an arrangement of projections and slots which either block or permit the entrance of a sensing blade. The function box provides slots for up to six sensing blades which can be coded to respond to any of 256 code combinations. Contact assemblies associated with the sensing blades provide a means of supplying a pulse of between 10 and 14 milliseconds for control purposes with external circuitry.



(Left Front View)

Figure 13 - Transfer Mechanism

6. MOTION FOR TYPING AND PERFORATING

GENERAL

6.01 The motion of the main shaft is conveyed to the mechanisms concerned with typing and perforation by the function mechanism, which is comprised of a cam-clutch (Figure 8), a clutch trip assembly (Figure 14), and a rocker bail (Figure 15).

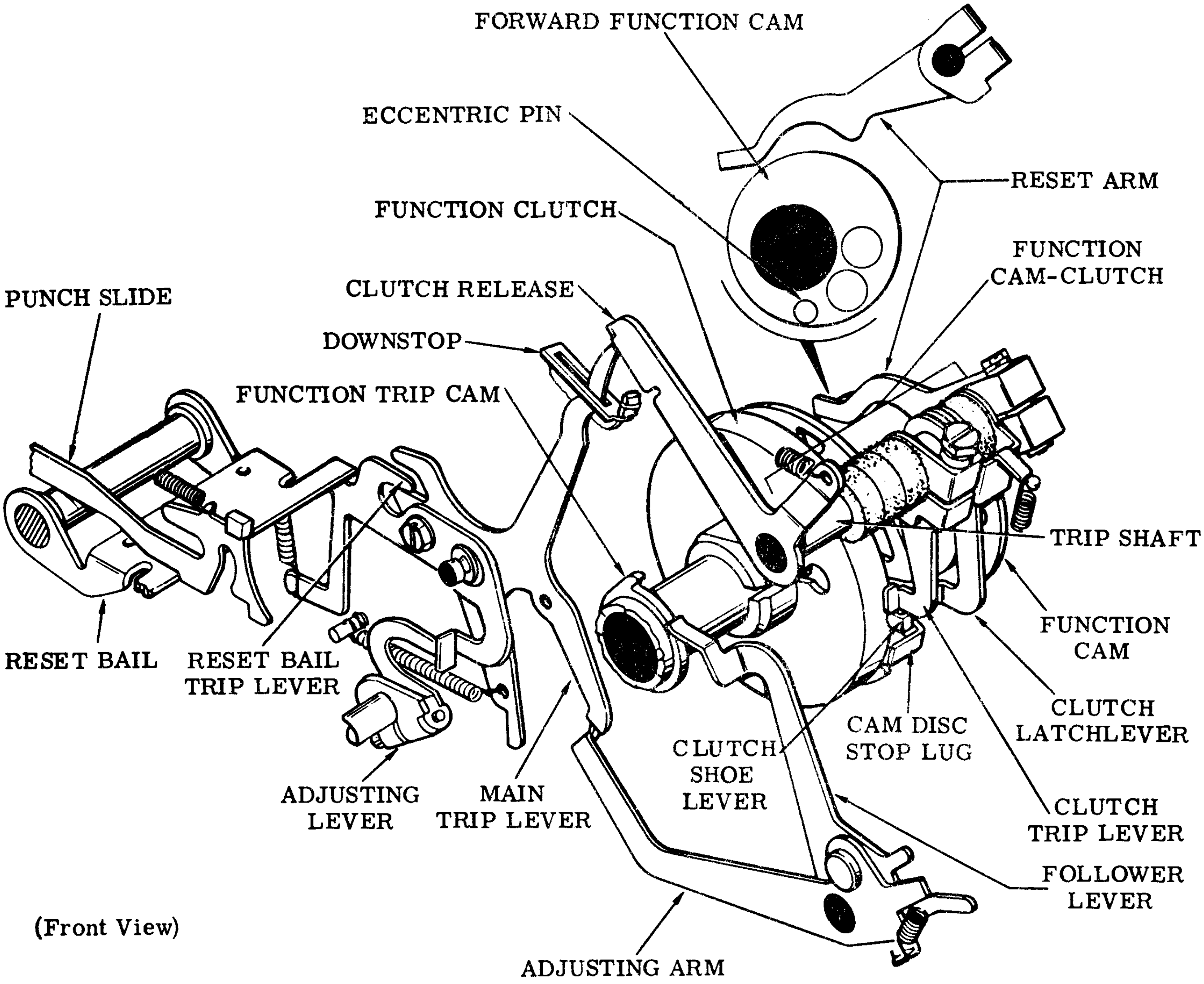


Figure 14 - Function Cam-Clutch and Clutch Trip Assembly

FUNCTION CAM-CLUTCH AND CLUTCH TRIP ASSEMBLY (Figure 14)

6.02 The trip assembly is shown in its unoperated condition in Figure 14. A follower lever rides on a function trip cam which is part of the selecting cam-clutch (Figure 8). Near the end of the selecting cycle, as the main shaft rotates counterclockwise, the high part of the cam pivots the follower lever (Figure 14) which, through an attached adjusting arm, rotates a main trip lever counterclockwise. A reset bail trip lever attached to the main trip lever lowers the perforator reset bail and releases the punch slides (8.02). An upper arm of the main trip lever moves out of the way of a clutch release, which falls against a downstop and rotates a trip shaft counterclockwise. Immediately, the low part of the trip cam allows the follower lever to return to its unoperated position, and the upper arm of the main trip lever moves down against the release. When the trip shaft is rotated by the release, it moves an attached clutch trip lever out of engagement with the clutch shoe lever. The clutch engages, and the cam-clutch begins its cycle. The internal operation of the clutch is the same as that of the selector clutch, described in 5.05 and 5.06.

6.03 About midway through the function cycle, an eccentric pin on the function cam lifts a reset arm, which rotates the trip shaft clock-

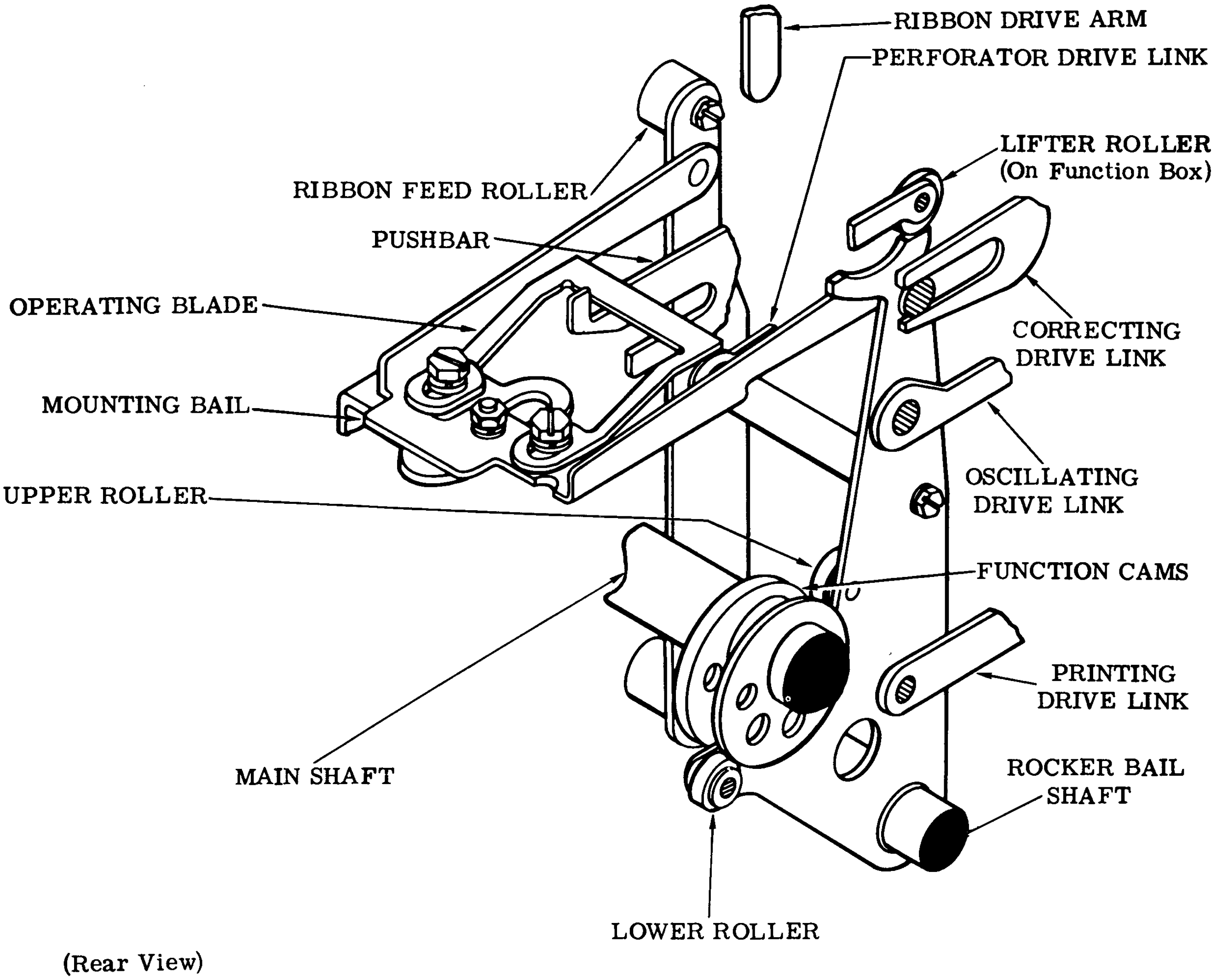


Figure 15 - Rocker Bail Assembly

wise. The release is moved up and allows the main trip lever to fall against the adjusting arm and raise the reset bail. The eccentric pin then moves out from under the reset arm, and the release is permitted to return to its unoperated position against the main trip lever. When the cam-clutch assembly completes its cycle, the clutch shoe lever strikes the trip lever, and the clutch is disengaged.

ROCKER BAIL (Figure 15)

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

(a) Ribbon feed mechanism.

(b) Perforator.

(c) Correcting mechanism.

(d) Function box.

(e) Printing mechanism.

(f) Oscillating assembly.

(g) Pushbars of the axial and rotary positioning mechanisms.

The bail is shown in its home position in Figure 15. Each function cycle, the function cams bear against the rollers and cause the bail to rock to the right (as viewed from the rear in Figure 15) during the first part of the cycle and then back to the home position during the latter part of the cycle.

7. TYPING

GENERAL

7.01 The characters used to type the received intelligence—letters, figures, and symbols representing various functions — are embossed on the cylindrical surface of the metal type wheel (Figure 16). During the function cycle, the axial and rotary positioning mechanisms (Figures 17 and 19), having received the intelligence from the transfer mechanism, position the wheel so that the character represented by the received code combination is selected. Following type wheel positioning, the correcting mechanism (Figures 17 and 19) accurately aligns the selected character. Then the printing mechanism (Figure 21), by means of a hammer, drives the tape and inked ribbon against the wheel and imprints the character. A ribbon feed mechanism (Figure 22) advances the ribbon and reverses its direction of feed when one of two ribbon spools is depleted. Near the end of the function cycle the axial positioning mechanism retracts the type wheel and a ribbon guide. On units equipped with the last character visibility feature, the forward portion of the ribbon is used for printing. When the type wheel and ribbon guide retract, the last printed character is visible. The letters or the figures code combination sets up an arrangement in the transfer mechanism which permits the function box (Figure 20) to operate and cause the rotary positioning mechanism to shift the type wheel.

TYPE WHEEL POSITIONING

A. General

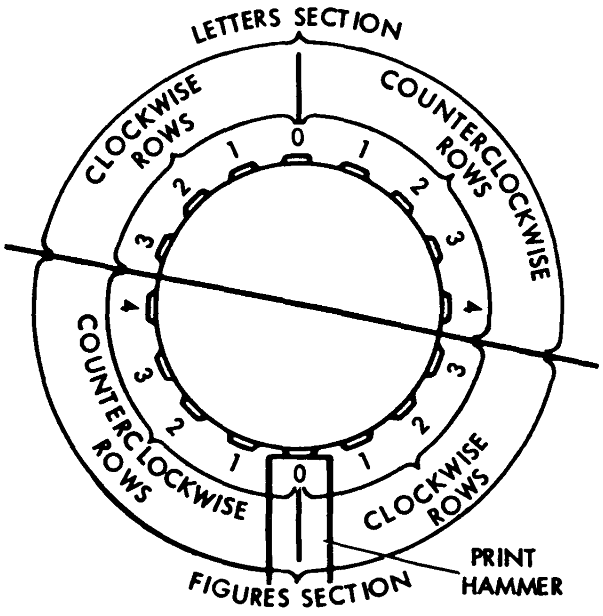
7.02 A typical type wheel character arrangement is shown in Figure 16. The cylindrical surface of the wheel is shown rolled out into a plane. There are 16 longitudinal rows, each of which is made up of four characters numbered 0 to 4 from front to rear. The surface is divided into two sections, a letters and a figures, each containing eight rows. The fifth row counterclockwise from the division line in both sections is numbered 0, and there are four rows in one direction from 0 numbered 1 to 4 and designated as counterclockwise rows, and three rows in the other direction numbered 1 to 3 and designated as clockwise rows. It should be noted that the clockwise and counterclockwise modifiers refer to the direction of rotation of the wheel to select the rows and not to their position on the wheel.

7.03 Each printing operation (excluding those devoted to the letters-figures shift) begins and ends with the type wheel in the home position of the section containing the character to be printed, ie, with the no. 0 character of the no. 0 row at the point of contact of the print hammer. (Actually, inasmuch as the wheel is retracted to show the last printed character (7.11), the no. 0 character is slightly to the rear, but for this discussion it will be assumed that it is at the point of contact.) During the printing operation the axial and rotary positioning mechanisms, transferring separate but simultaneous motions to the wheel, position it so that the character represented by the received code combination is at the point of contact of the hammer at time of printing. The rotary mechanism, which is controlled by the no. 3, 4, and 5 selecting elements of the code, revolves the wheel so as to select the proper row; and the axial mechanism, which is governed by the no. 1 and 2 elements, moves it forward and rearward along its axis so as to select the proper character in the row. Rotation of the type wheel to print in either the letters or the figures section is controlled by the no. 7 bit of the code.

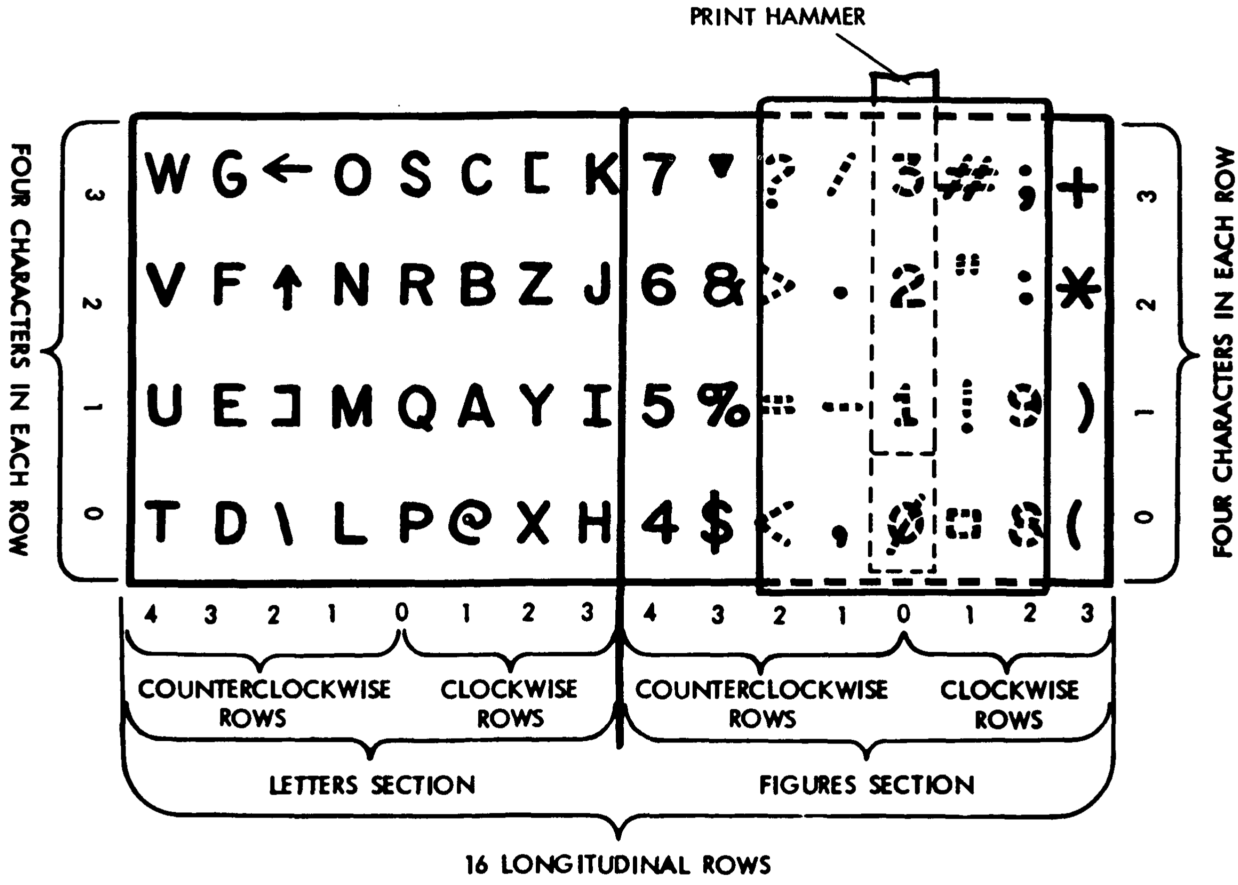
7.04 To illustrate the above, if the wheel is in the figures condition, as shown in Figure 16, and the numeral "0" is to be printed, there is no movement of the wheel during the printing operation, because "0" is already at the point of contact of the hammer. However, if the letter "F" is to be printed, the wheel is first shifted eight rows to the letters home position. Then during the next operation it is rotated three rows counterclockwise and moved forward two characters so that "F" is at the point of contact of the hammer. Printing takes place, and the wheel is then returned to the letters home position.

B. Rotary Positioning (Figures 17 and 18)

7.05 The rotary positioning mechanism revolves the type wheel so that the row containing the character to be printed is aligned with the print hammer at the time of printing. Mounted on the front plate, the mechanism includes two eccentric assemblies as shown in Figures 17 and 18. Each assembly includes a primary shaft, a section of which is formed into a pinion. A secondary shaft, mounted in the primary and offset from its center, forms an



FRONT VIEW SHOWING 16 LONGITUDINAL ROWS



TOP VIEW SHOWING CYLINDRICAL SURFACE IN A PLANE

Figure 16 - Typical Type Wheel Character Arrangement

eccentric, referred to as the rear eccentric. A portion of the secondary shaft is also a pinion, and a crank pin mounted on its disc-like forward surface forms a secondary, or front, eccentric. Each of the four pinions of the two eccentric assemblies is engaged by the rack of a pushbar: the no. 3 bar engages the right front pinion, the no. 4 engages the left rear pinion, and the no. 5 engages the right rear pinion. The left front pinion is engaged by both the letters and the figures pushbar.

7.06 The eccentric assemblies are linked to a type wheel shaft by a drive assembly as shown in Figure 17. The type wheel is secured to the front of the shaft which is supported by a bearing housing mounted at the left rear of the front plate (Figure 19). A spur gear which meshes with a type wheel rack rides on the shaft in a bearing housing. The shaft is free to move axially in the housings and the spur gear, but flats in its circumference which bear against flats in the gear ensure its rotating when the gear rotates.

7.07 When in response to a marking bit a pushbar is lifted by its bellcrank, as described in 5.13, the rocker bail operating blade (Figures 15 and 18) engages a slot in the bar and moves it to the left during the first part of the

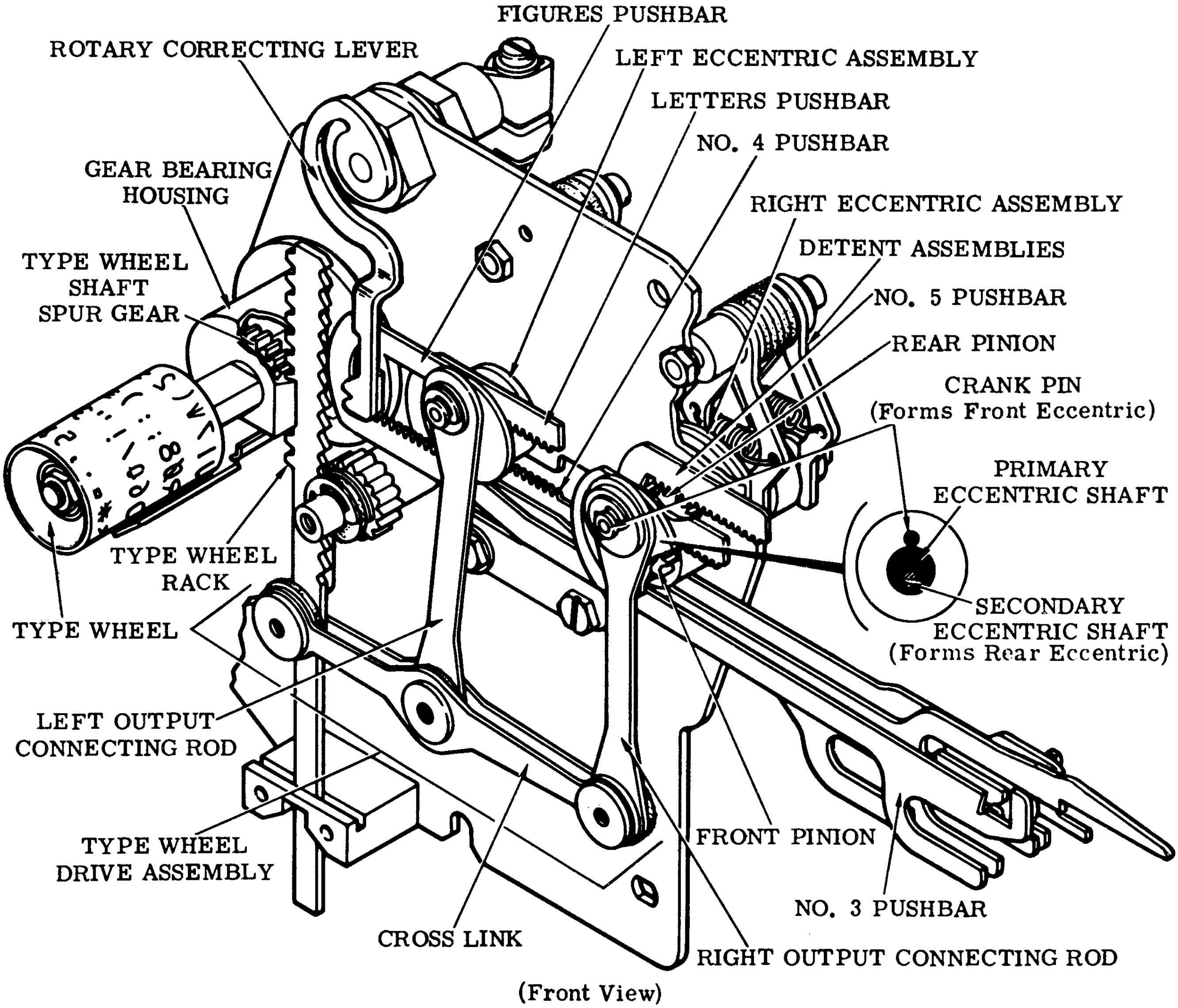


Figure 17 - Rotary Positioning Mechanism

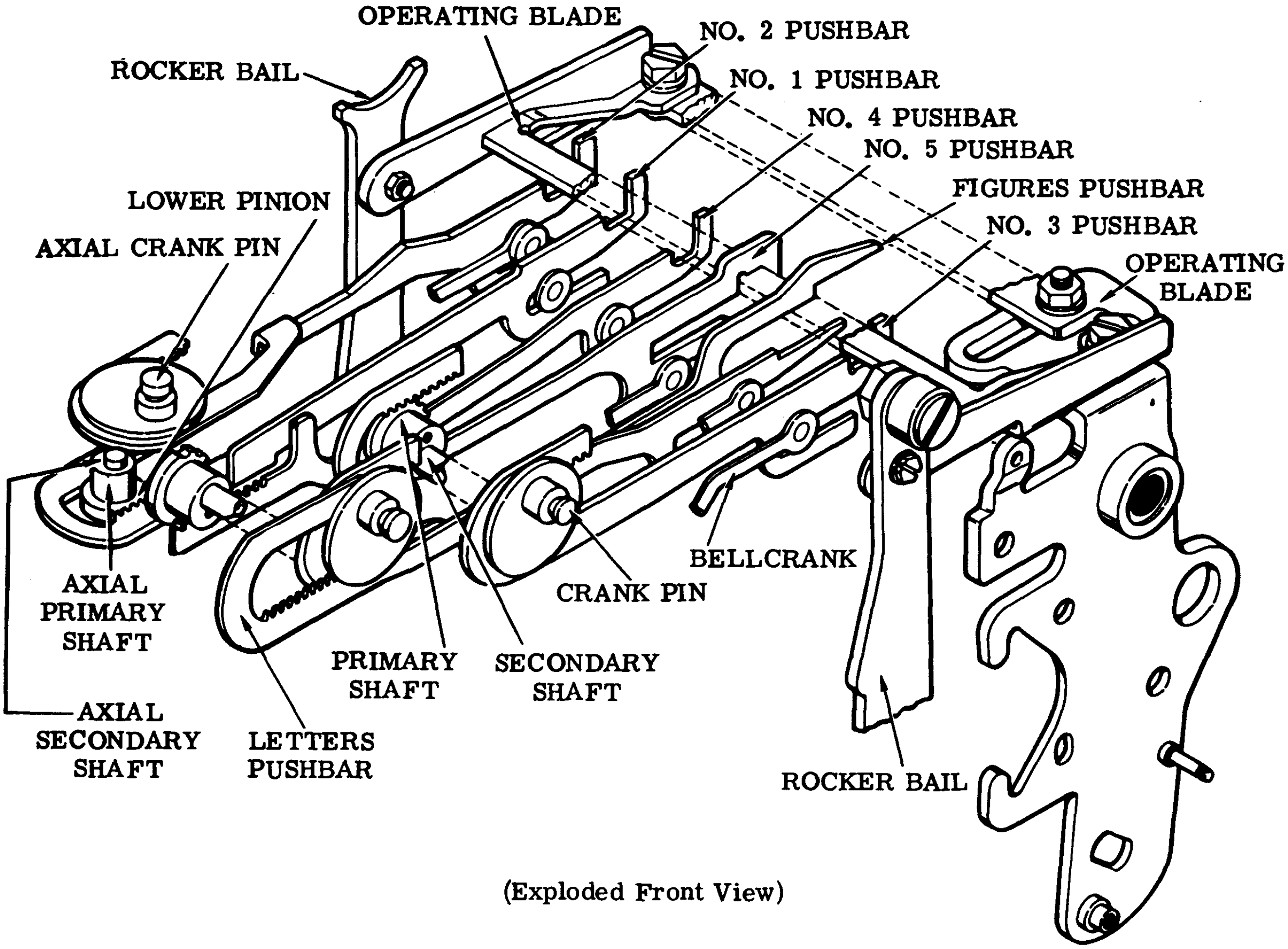


Figure 18 - Pushbars and Eccentric Assemblies

function cycle. The bar, by means of its rack and the mating pinion, rotates the associated eccentric one-half revolution where it is locked in position by a detent assembly while printing takes place. When the bail rocks back to the right during the latter part of the cycle, it returns the bar and eccentric to their home position where the eccentric is again detented. The preceding does not apply to the no. 7 pushbar, covered in 7.17. In both assemblies one-half revolution of the rear eccentric results in its maximum vertical displacement which is transferred through the front eccentric to a crank pin. Similarly, one-half revolution of the front eccentric results in its maximum displacement being transferred to the crank pin. If both eccentrics are rotated, the displacement of the crank pin is equal to the algebraic sum of the two displacements which may be in either the same or opposite directions. Both assemblies are so designed that, if the displacement of the rear eccentric is taken to be one unit, the displacement of the front eccentric is four units. Four permutations are thus available: zero (neither eccentric displaced), one unit (rear eccentric displaced), four units (front eccentric displaced), and five or three units depending on how the assembly is set up (both eccentrics displaced).

7.08 In the right assembly, the home position of the rear eccentric is down and the home position of the front eccentric is up (Figure 18). Thus, their displacements are in opposite directions — up for the rear and down for the front — and their aggregate displacement is three units downward. Any displacement occurring in the right assembly is imparted to the type wheel rack in equal quantity but opposite direction. For example, if the no. 5 pushbar is selected, it causes the right rear eccentric to be displaced, and one unit of upward motion

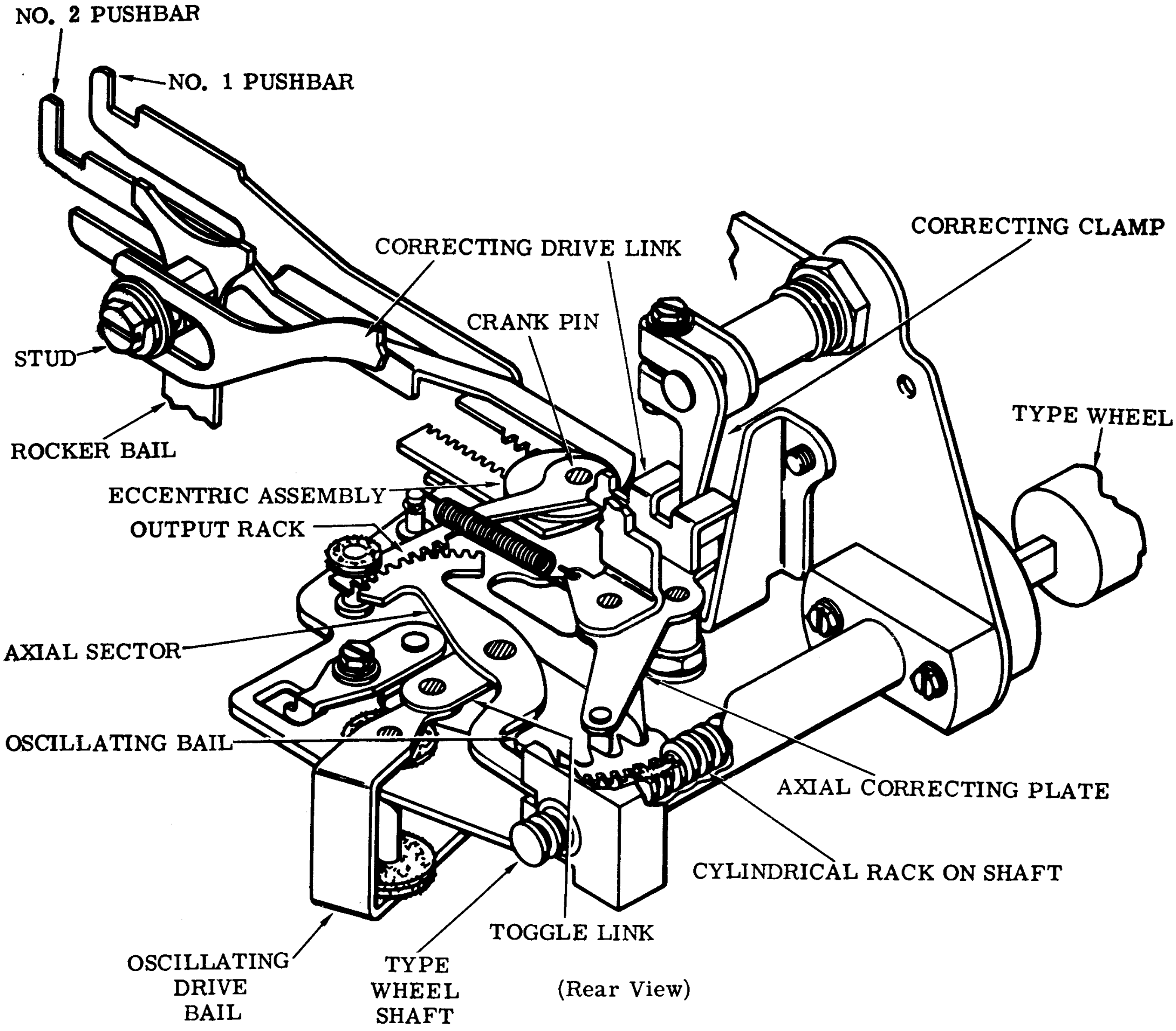


Figure 19. Axial Positioning Mechanism

is transferred through a right output connecting rod to the right end of a cross link (Figure 17). The cross link pivots about a left output connecting rod and at its left end imparts one unit of downward displacement to the type wheel rack. The rack rotates the spur gear, shaft, and type wheel one row of characters clockwise from the home position, and the no. 1 clockwise row (Figure 16) is presented to the print hammer at the time of printing. On its right stroke the no. 5 pushbar returns the eccentric and the type wheel to their home positions. In a similar manner, selection of the no. 3 pushbar results in a four unit downward displacement of the right front eccentric and a four-row, counterclockwise rotation of the type wheel; and selection of both the three and five bars results in a three-row, counterclockwise rotation of the type wheel.

7.09 The home position of the left rear eccentric is up, and any displacement appearing in the left assembly is transferred to the type wheel rack in double quantity in the same direction. When the no. 4 pushbar is selected, the left rear eccentric is displaced one unit downward. This movement is conveyed through the midpoint of the cross link. The cross link pivots about the right output connecting rod and its left end imparts two units of downward movement to the type wheel rack which rotates the type wheel two rows clockwise from its home position.

7.10 When both eccentric assemblies are displaced, the motion occuring in the type wheel rack is equal to the algebraic sum of the motions resulting from each assembly. For example, if the no. 3, 4, and 5 pushbars are all selected, three units of upward displacement from the right assembly and two units of downward displacement from the left assembly occur as one unit (3-2=1) of upward displacement in the rack and a counterclockwise rotation of one row in the type wheel. If neither the no. 3, 4, nor 5 pushbar is selected, the mechanism remains inactive and printing takes place in the no. 0 row. Excluding the left-front eccentric, which is only used for the letters-figures shift, there are eight permutations available in the other three eccentrics, making it possible to select any of the eight rows in a given section (Figure 16).

C. Axial Positioning (Figures 18, 19, and 21)

7.11 The functions of the axial positioning mechanism are to position the type wheel so that the proper character in the selected row is aligned with the hammer at the time of printing and to retract the type wheel and ribbon guide at the end of the function cycle. The mechanism mounts on an axial bracket supported by the frame and the front plate and includes an eccentric assembly similar to those of the rotary positioning mechanism (Figures 18 and 19). Two eccentrics, a lower whose pinion is driven by the no. 1 pushbar and upper whose pinion is driven by the no. 2 pushbar, rotate in a horizontal plane in bearing housings attached to the bracket. The eccentric assembly is linked to the type wheel shaft by an axial output rack and sector as shown in Figure 19.

7.12 The selection of either the no. 1 or no. 2 pushbar results in the maximum displacement toward the rear of the associated eccentric, and the eccentrics are so designed that, if the displacement of the lower is taken to be one unit, that of the upper is two units. Again four permutations are available at the crank pin: zero (neither eccentric displaced), one unit (lower eccentric displaced), two units (upper eccentric displaced), and three units (both eccentrics displaced).

7.13 If during a function cycle neither pushbar is selected, no motion occurs in the axial positioning mechanism with the exception of that resulting from the oscillating assembly (7.14), and the no. 0 character of the selected row is aligned with the hammer at the time of printing (Figure 16). On the other hand, if the no. 1 pushbar is selected, it causes the lower eccentric to revolve and one unit of displacement to be transferred by the crank pin to the axial output rack. The rack moves to the rear and passes the motion to the axial sector which pivots counterclockwise (as viewed from above). The right end of the sector, by means of a cylindrical rack in the type wheel shaft, moves the type wheel one character forward from its home position. The no. 1 character is printed, and when the pushbar reverts to its unselected position it returns the axial linkage and type wheel to their home position. If the no. 2 pushbar is selected, the no. 2 character is printed, and if both pushbars are selected, the no. 3 character is printed. The cylindrical rack has no lead, and the shaft can thus be rotated while being moved axially.

7.14 With each cycle of the function clutch, an oscillating drive link transfers from the rocker bail an unselected motion to an oscillating drive bail (Figures 19 and 21). This movement is passed by toggle links to an oscillating bail and the sector pivot. The effect of this action is to introduce a separate motion to the sector tending to cause it to pivot about the teeth on the output rack. During the forepart of the function cycle, if no axial pushbar is selected, the right end of the sector is moved forward slightly and positions the no. 0 character for printing. At the end of any cycle the sector retracts the type wheel slightly so that the last printed character is visible. Concurrent with the above operation, a ribbon oscillating lever is made to pivot about its left end and with each cycle project and retract the ribbon guide which would obstruct the view of the character (Figure 21).

D. Position Correction (Figures 17 and 19)

7.15 After the type wheel has been positioned by the axial and rotary positioning mechanisms, the selected character is more accurately aligned for printing by the correcting mechanism which compensates for any play and backlash in the positioning linkages. Each function cycle, the rocker bail transfers motion through a correcting drive link to a correcting clamp and shaft (Figure 19). The shaft pivots a rotary correcting lever (Figure 17) which is equipped with an indentation that engages a tooth in a type wheel rack. There is a tooth in the rack for each row of characters (16 in all), and they are so correlated with the type wheel that when a tooth is engaged by the corrector its row is accurately aligned with the print hammer. Axial correction, which is accomplished simultaneously, is similar to rotary correction: the drive link rotates an axial correcting plate counterclockwise (as viewed from above), and a roller mounted on the plate engages a notch in the axial sector (Figure 19). Thus, the type wheel is accurately aligned in both fields of motion just before printing takes place. During the latter part of the function cycle, a correcting drive link spring returns the correcting mechanism to its home position.

7.16 Since the rocker bail is the source of motion for both the pushbars and the positioning mechanisms, correction must take place at a point near enough to the extreme travel of the bail that it does not interfere with the movement of the type wheel rack or axial sector. In addition, because the rocker bail controls the tripping of the print hammer, which occurs very late in the bail's stroke, it becomes necessary to utilize the time between the tripping of the hammer and its striking the paper to accomplish correction. The delay in actuating the correcting mechanism is effected by allowing a drive stud on the rocker bail to slide in an elongated slot in the correcting drive link during the early part of the cycle.

E. Type Wheel Shift (Figures 17 and 20)

7.17 The type wheel shift from the letters to the figures printing segment (or figures to letters) is controlled by the no. 7 selector pushlever, through an associated train of levers in the transfer mechanism, and two pushbars which engage a common pinion. The pushbars are connected to a common bellcrank which is, in turn, controlled by the no. 7 pulse beam and transfer lever.

7.18 To shift the type wheel from the figures section to the letters section, a marking no. 7 bit must be received by the unit. This will cause the no. 7 punch slide to be selected and move to the left (5.08). As the no. 7 punch slide moves left, it rotates its associated transfer lever counterclockwise which, in turn, pivots the no. 7 pulse beam clockwise. This allows the associated bellcrank to rotate counterclockwise, under spring tension, and lift the letters-figures pushbars until the step on the end of the letters pushbar is raised to a height which will bring it into engagement with the rocker bail operating blade, when the blade moves to the left (6.04). The operating blade simultaneously pushes the letters pushbar to the left and the figures pushbar to the right, resulting in rotation of the type wheel to the letters section. As long as the no. 7 bit is marking, the letters pushbar will remain in this left-most position.

7.19 When the no. 7 bit changes from marking to spacing, the punch slide will remain unselected, and the pushbars will not be lifted by the bellcrank transfer lever linkage. The figures pushbar, which is furthest to the right, will then be in such a position that the step on its end extension will be engaged (and pushed) by the rocker bail operating blade as the blade moves to the left, resulting in rotation of the type wheel to the figures position. As the figures pushbar moves left, the letters pushbar simultaneously moves to the right.

7.20 As long as the no. 7 bit is spacing, the letters-figures pushbars will not be lifted and, therefore, the letters pushbar will not be moved to the left (7.18). The type wheel will shift back to the letters section only upon receipt of a no. 7 marking bit by the reperforator.

PRINTING (Figure 21)

7.21 After the type wheel has been positioned and corrected, the printing mechanism supplies the impact which drives the paper and ribbon against the selected character. It effects this operation by means of a print hammer which is mounted on a shaft supported by a bracket attached to the type wheel bearing housing. In its unoperated condition, as illustrated in Figure 21, the hammer is held against an accelerator by a relatively weak spring. The accelerator is mounted on the hammer shaft and is retained by a printing latch in its upper position against the tension of a relatively strong spring.

7.22 The rocker bail, during the forepart of the function cycle, moves a printing drive link to the right (as viewed from the rear in Figure 21) and causes a pivot arm to rotate clockwise. The arm lowers a trip link which slides in an elongated slot. Near the end of the rocker bail's travel, the trip link pivots the latch which releases the accelerator. Under the spring tension, the accelerator snaps down and impels the hammer upward. The face of the hammer drives the tape and inked ribbon up against the type wheel and imprints the selected character on the

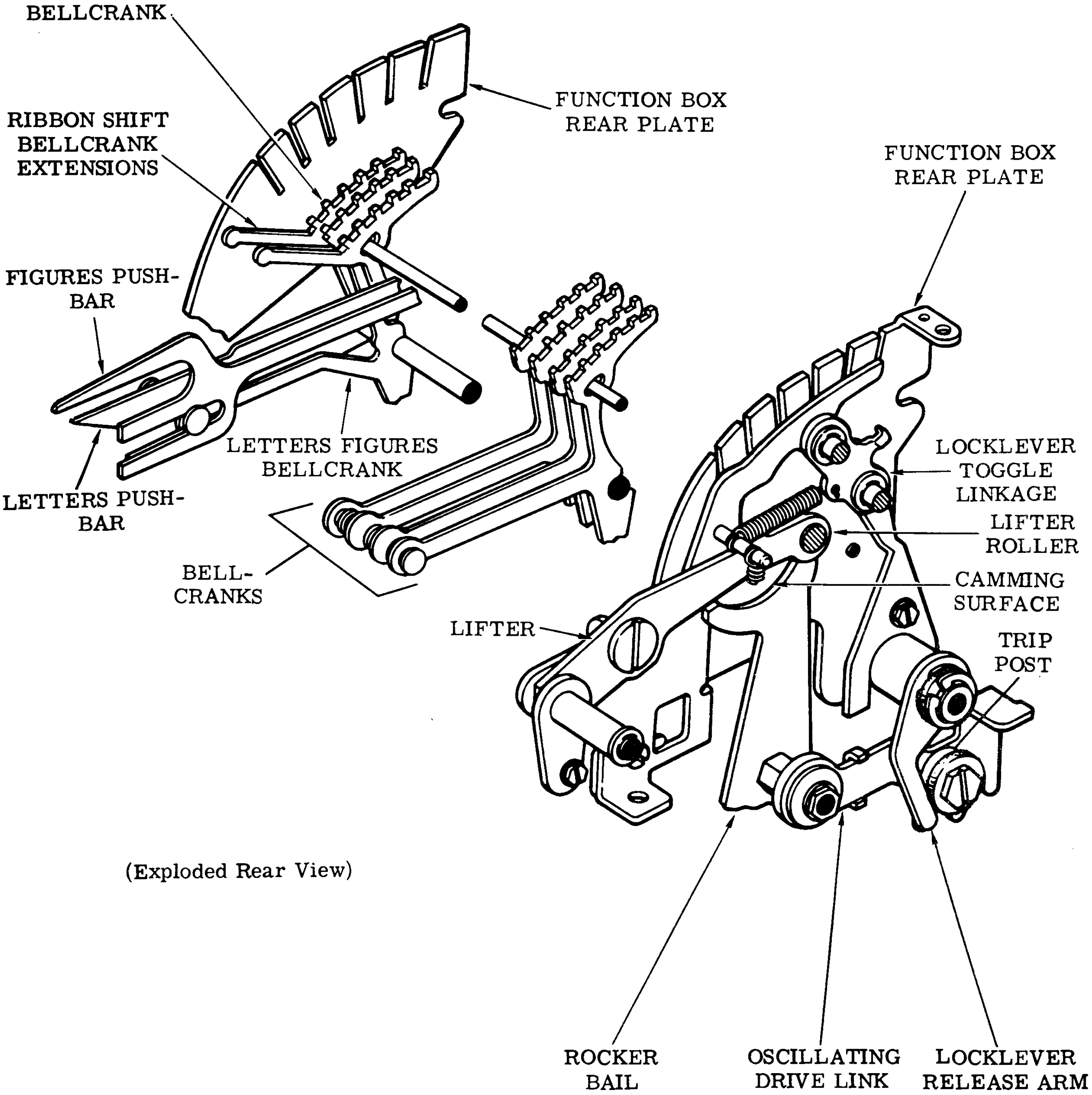


Figure 20 - Function Box

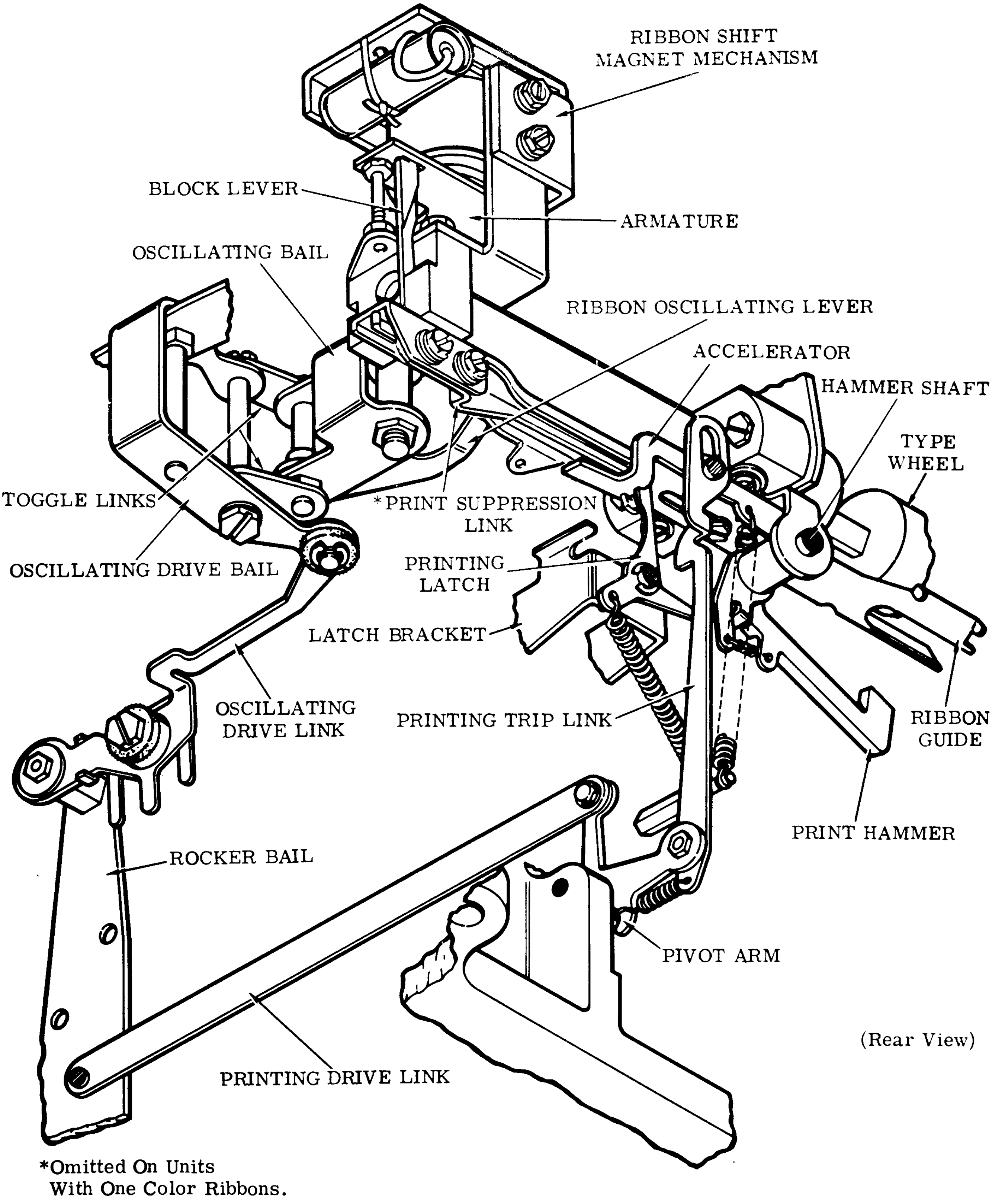


Figure 21 - Printing Mechanism

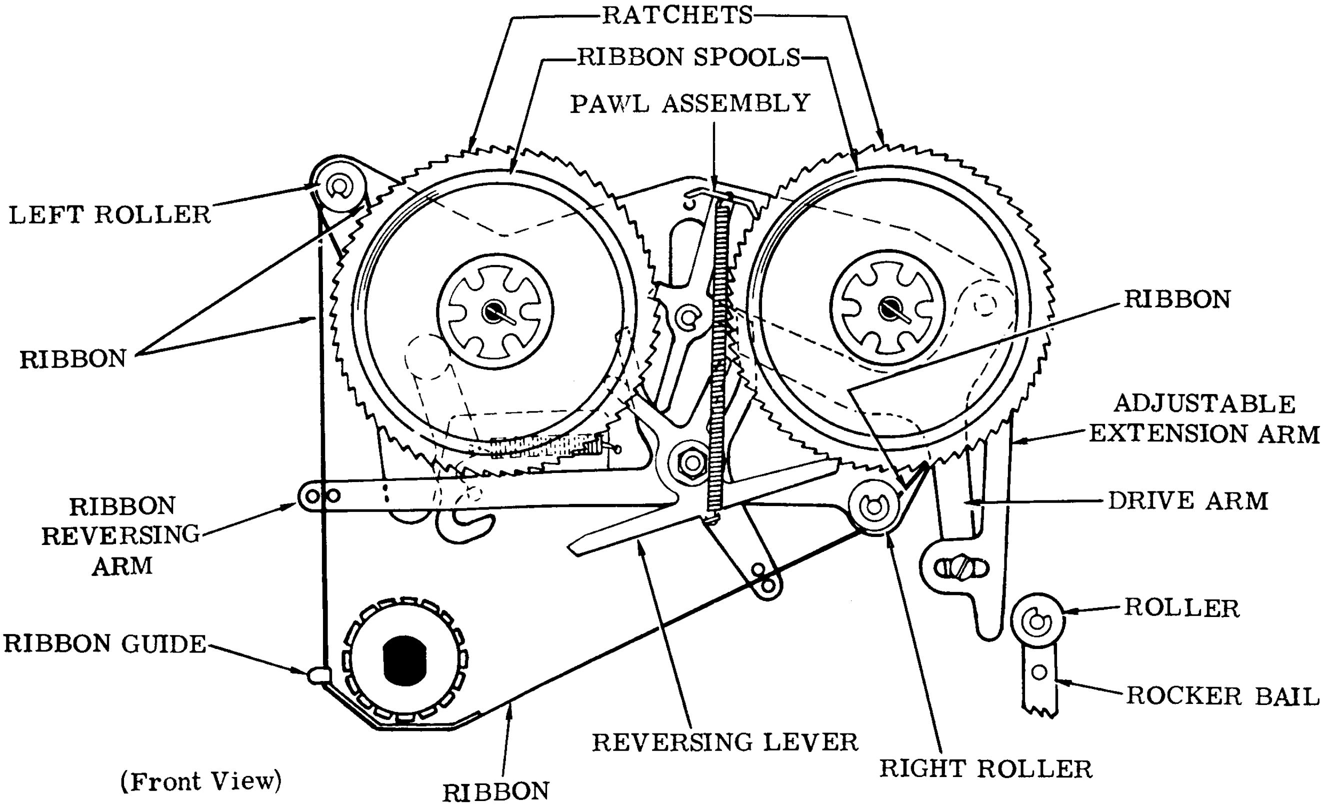


Figure 22 - Ribbon Feed Mechanism

tape. Near the end of its travel, the accelerator encounters a projection on a latch bracket, and inertia carries the hammer the rest of the way. As the rocker bail returns to its home position, it causes the trip link to move up, release the latch and return the accelerator to its latched position.

RIBBON FEEDING (Figure 22)

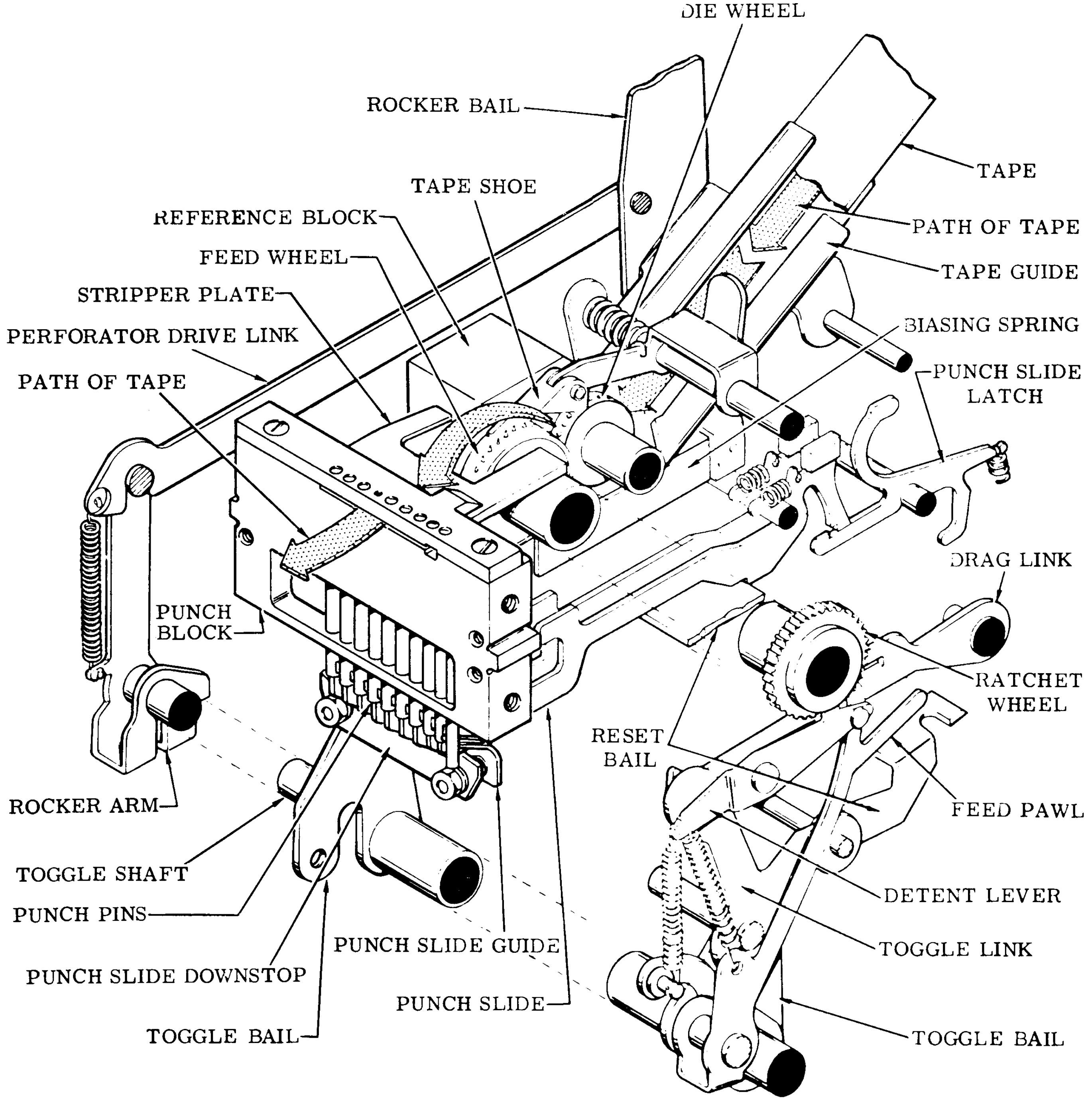
7.23 The characters are typed in ink supplied by the inked ribbon which is held between the tape and the type wheel by a guide and advanced by the ribbon feed mechanism (Figure 22). The path of the ribbon is down to the right off the top of a right spool, under a right roller, through the guide, up through left pins on the reversing arm, over a left roller, and to the right over the top of a left spool.

7.24 Each function cycle, as the rocker bail nears the end of its left travel, a roller mounted on its forward arm pivots a drive arm clockwise. The drive arm lifts a feed pawl which advances the ribbon, by rotating a ratchet on one of the ribbon spools, one tooth. A retaining pawl, under spring tension, detents the ratchet while the feed pawl, during the latter part of the function cycle, is lowered so as to engage the next tooth. Each operation, the ribbon is advanced in this manner until the ribbon feed mechanism is reversed.

7.25 When a spool is almost depleted, a rivet in the ribbon encounters pins on the reversing arm, and the stress applied through the ribbon as it is rolled on the other spool pivots the arm. As the pawl assembly is lowered at the end of the next operation, an extension strikes the reversing arm, and the pawl is shifted against the other ribbon spool ratchet. The pawl's rounded lower extension pivots a reversing lever which shifts the retaining pawl so that it engages the opposite ratchet. The ribbon will then feed in the opposite direction until again reversed. A detent holds the reversing arm in position until its next reversal.

RIBBON SHIFT MECHANISM (Figure 21)

7.26 On units designed for two color printing, as the ribbon carrier drive arm is driven by the motion of the axial oscillator lever, the ribbon carrier follows by the action of a spring.



(Left Front Exploded View)

Figure 23 - Perforating Mechanism

When the ribbon color shift magnet is energized and its armature attracted, a blocking lever is removed from the path of the ribbon carrier placing the black portion of the red-black ribbon over the print hammer. If, on the other hand, the ribbon shift magnet is not energized, the blocking lever blocks the ribbon carrier which leaves the red portion of the red-black ribbon over the print hammer resulting in a red character.

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

PRINT SUPPRESSION MECHANISM

7.28 Manual and automatic print suppression operate similarly to block the movement of the print hammer and prevent contact between the tape, inked ribbon, and type wheel. Manually controlled suppression operates through a lever extending from the front of the reperforator at the base of the punch pins.

7.29 Manual print suppression is accomplished by raising the NO PRINT lever at the front of the typing reperforator. This rotates a blocking extension across the top of the print hammer, preventing all printing, regardless of the input code.

7.30 Automatic printing suppression (Figure 21) is a function controlled by the ribbon shift mechanism and is used by typing reperforators with one color ribbons. Automatic printing suppression is operative on control function code combinations. An accelerator blocking link, attached to the ribbon carrier, prevents the print hammer accelerator from rotating downward when the release latch is disengaged. As a result, printing is suppressed whenever a no-current condition keeps the ribbon shift blocking link engaged with the ribbon carrier.

8. TAPE PERFORATING AND FEEDING (Figure 23)

GENERAL

8.01 The perforating mechanism rolls the tape between a feed wheel and a die wheel, which does not perforate the feed hole but merely regulates the amount of tape feed. The punch perforates round holes corresponding to the code combination received from the signal line and perforates a smaller feed hole positioned between the third and fourth intelligence levels. Intelligence is received from the selecting mechanism by the punch slides, which select the proper punch pins in a punch block assembly (Figure 23). Motion from the rocker bail is distributed to the pins and the tape feed parts by a main bail assembly, which includes a toggle bail, a toggle shaft, a slide post, toggle links, drag links, and the punch slide reset bail.

PERFORATING

8.02 As described in 6.02, near the end of the selecting cycle, the reset bail is lowered and releases the eight punch slides (Figure 13). The selected slides move to the left, and the unselected slides are retained to the right by their latches. In the selected position, a projection of each slide extends over the slide post. Since a feed hole is perforated every operation, the punch slide associated with the feed hole punch pin is designed so that it is always in a selected position. During the first part of the function cycle, the rocker bail moves to the left and, by means of a drive link and rocker arm, rotates the toggle shaft and bail counterclockwise. Toggle links attached to the front and rear of the bail lift the slide post and move the reset bail to the left. The selected slides are carried upward by the post and force the associated pins through the tape. The slides thus become an integral part of the main bail assembly during the perforating stroke. Approximately midway through the function cycle, the function trip assembly lifts the reset bail.

8.03 During the last half of the cycle, the toggle bail is rotated clockwise, pulling the slide post down and lowering the selected punch slides. The punch slides, which engage notches in their respective punch pins, pull the punch pins down below the tape. The main bail assembly and the selected punch slides and their associated punch pins move as a unit during the perforating stroke, both up and down. The punch pins are positively driven and retracted, to produce the fully perforated tape.

8.04 A chad chute, mounted on the reperforator punch block, mates with a chute on the mounting base. The chutes carry chad punched from the tape into a chad container on the tape handling stand. Refer to the appropriate section for a detailed discussion of the chad storing mechanisms.

FEEDING

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

8.06 The slack tape mechanism (Figure 2) is driven by the rocker bail of the perforator or reperforator. As the rocker bail moves toward the left, it rotates the tape depressor in a clockwise direction. When the tape depressor rotates, it pushes the tape down between the end of the tape platform and a post, causing a loop of tape to be formed. Since the tape is prevented from moving in a direction opposite to that of the tape feeding by the wedging action of a clamp plate, mounted on a post located between the loop and feed wheel, the loop of slack tape is formed

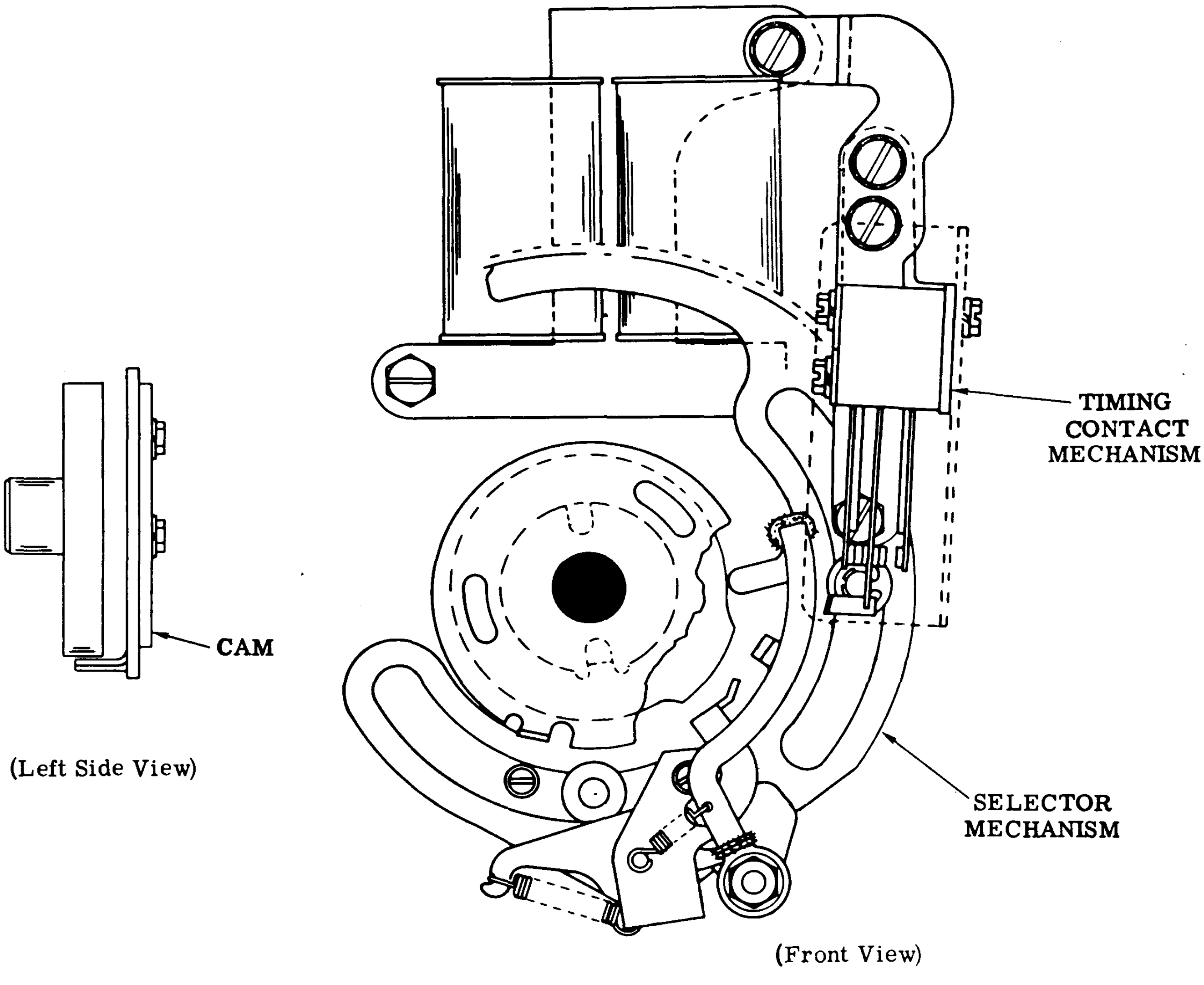


Figure 24 - Selector Magnet Timing Contacts

only from the tape pulled from the roll of tape. When the rocker bail moves back toward the right, the tape depressor is rotated in a counterclockwise direction, leaving a loop of load-free tape for the punch to feed.

9. VARIABLE FEATURES

CONTACT ASSEMBLIES

A. Selector Mechanism Timing Contacts (Figure 24)

9.01 Operating in conjunction with an additional cam mounted on the selector cam assembly, this timing contact set (break-make transfer) operates each cycle of selection. The actuating lever maintains a relationship with the rest position of the selector cam, because its pivot point is on the range scale selector rack. Therefore, the contact set is used to signal that the selector cam is in the rest position.

(Front View)

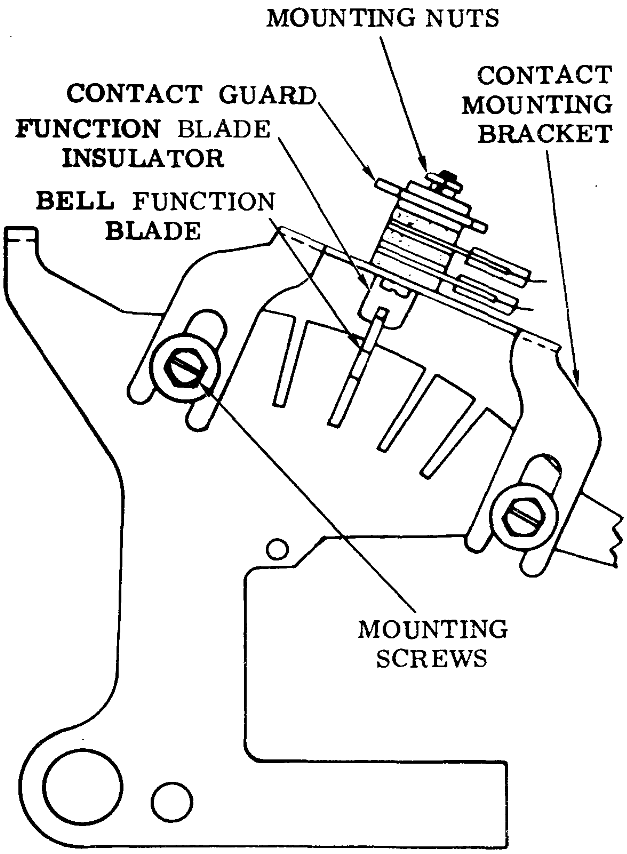


Figure 25 - Signal Bell Contacts

B. Letters-Figures Contacts

9.02 The letters-figures contact assembly is mounted on the rear of the selector mechanism and is operated by the upper extension of the letters pushbar. Its purpose is to give a remote signal to indicate whether the typing reperforator is in the letters or the figures condition. When the unit is in the letters condition, the letters pushbar is positioned towards the right and in contact with the operating lever. In this position (rotated counterclockwise) the operating lever is not in contact with the center contact spring and the center and upper contact points are made.

9.03 When the figures code combination is received, the letters pushbar is moved to the left and permits the operating lever to rotate clockwise and engage the center contact spring and break the contact between the center and upper contact points. As the operating lever rotates further, contact is made between the center and lower contact points.

C. Signal Bell Contacts (Figure 25)

9.04 Mounted on and controlled by the function box, these contacts provide an electrical pulse to actuate an audible alarm when the typing reperforator receives the signal bell code combination.

9.05 With the unit in the figures condition and the signal bell code combination is received at the selector mechanism, the bellcranks rotate in response to the marking and spacing bits. The slotted arms at the top of the bellcrank permit the signal bell function blade to drop under spring tension. The normally open signal bell contacts, fixed to the function blade drops with the blade, and the contacts close. In the letters condition, the figures bellcrank blocks the signal bell function blade.

D. End of Feed-Out Timing Contacts

9.06 Used in conjunction with the noninterfering rubout (or blank) tape feed-out mechanism, this contact assembly furnishes an electrical pulse to indicate the termination of feed-out. The contacts are actuated by a bail extension that receives its motion from the tape length adjusting plate (Figure 28). When the feed-out operation terminates, the plate engages and rotates the bail arm, causing the normally open contact to close and the normally closed contact to open.

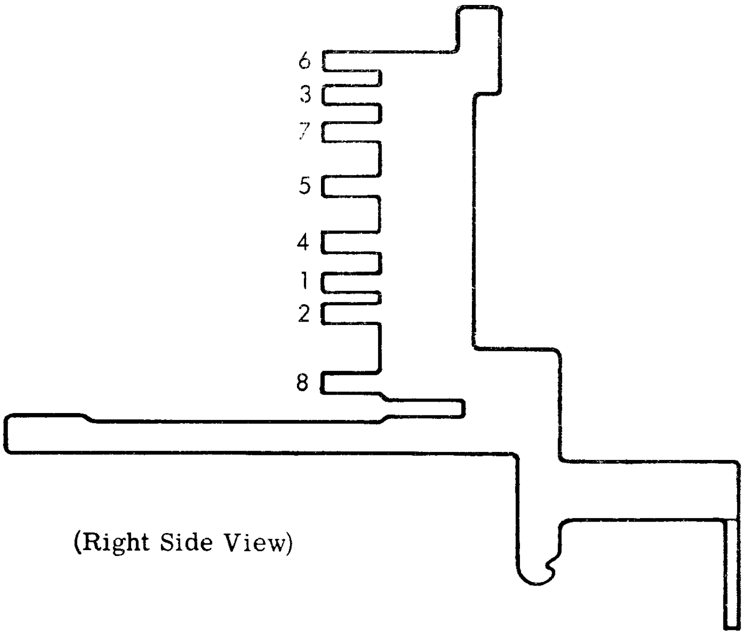


Figure 26 - Universal Function Blade

E. Code Reading Contacts

9.07 Consisting of a bank of eight contacts, each of which is actuated by a punch slide, the code reading contacts read the code combinations perforated by the typing reperforator and establish circuits corresponding to the eight elements. Either transfer or make contacts are available. Applications include error checking and parallel code input.

F. Timing Contacts

9.08 When connected to external circuits, the contacts provide electrical pulses which may be synchronized with the code reading contacts (9.07) for circuitry control purposes. Either single or double contact mechanisms are available. The contacts, which are of the transfer type, are acutated by bails which receive motion from the typing reperforator function cam.

UNIVERSAL FUNCTION BLADE (Figure 26)

9.09 This function blade may be coded for any desired character or shift condition by removing tines. The function blade has removable tines in the marking and spacing positions for all levels.

INTERFERING RUBOUT TAPE FEED-OUT

A. General

9.10 This feature enables the typing reperforator to step out tape containing successive rubout code combinations. The feed-out operation may be actuated locally by a hand lever or, with the addition of a separate set of parts, it may be controlled remotely by energizing a solenoid. Rubout feed-out will continue as long as the hand lever or solenoid is actuated. Since the mechanism's operation involves tripping the selector clutch while retaining the armature in its marking position, a message cannot be received during the feed-out period. The mechanism is shown operated in Figure 27.

B. Initiation

9.11 When the typing reperforator is in the idling condition, the selector magnet is energized and the start lever is blocked as shown in Figure 8. Feed-out is initiated by moving a hand lever to the left (Figure 27). A drive shaft affixed to the hand lever rotates a trip lever which lifts the start lever. The latter clears the armature and under spring tension rotates clockwise. The selecting cam-clutch engages and the unit undergoes a complete cycle of operation. Since the selector remains energized,

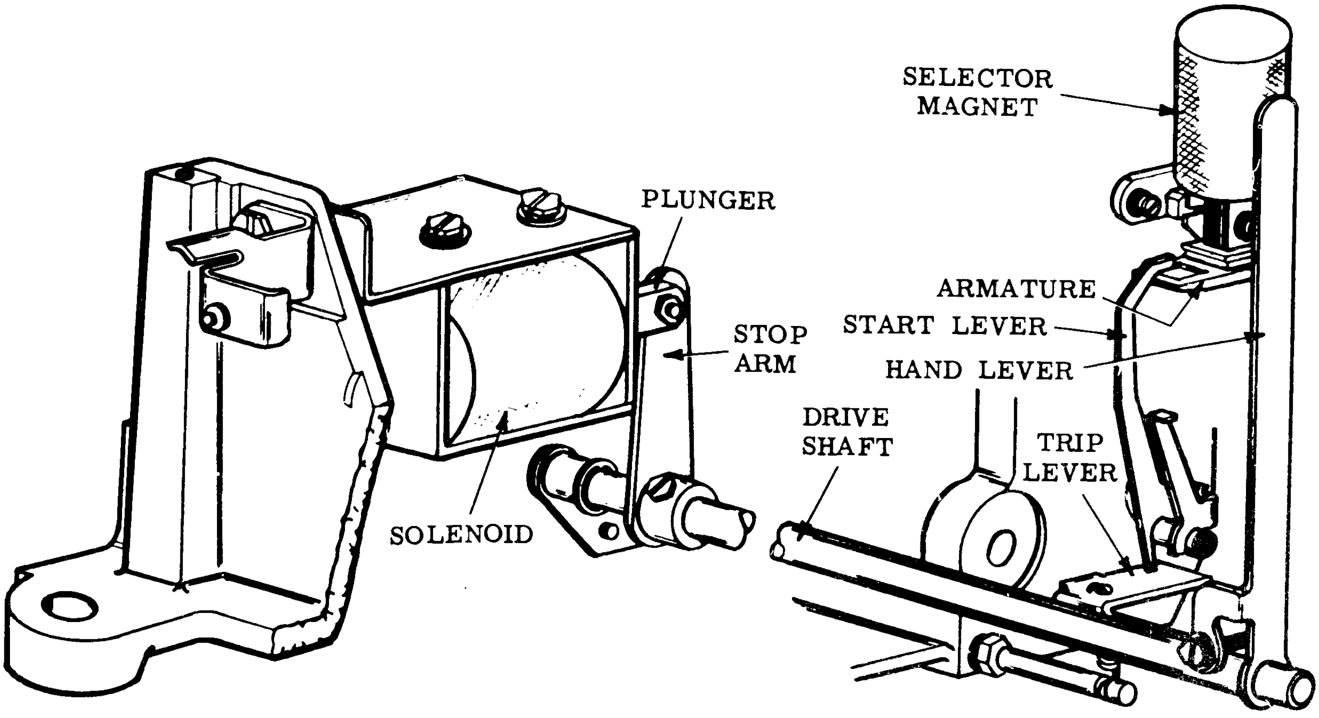


Figure 27 - Manual Interfering Rubout Tape Feed-Out Mechanism

it is equivalent to all intelligence bits of the signaling code marking. As a result, the rubout symbols are printed, the rubout code combination (12345678) is perforated and the tape is advanced one feed hole. As long as the hand lever is retained to the left, the start lever will trip the selecting cam-clutch and feed-out will continue.

C. Termination

9.12 Feed-out is terminated by releasing the hand lever. The driver shaft and trip lever rotate clockwise under spring tension and lower the start lever. When the stop arm bail and start lever are moved to the left by the stop arm bail cam (5.03), the start lever is blocked by the armature, the selecting cam-clutch is disengaged and the typing reperforator is returned to its idling condition. A message received during feed-out will be garbled.

D. Solenoid Operation

9.13 By the use of an additional set of parts, the rubout feed-out operation can be initiated by an electrical pulse from an external source. When the solenoid (Figure 27) is energized by the pulse, it pulls a plunger to the left. The plunger, through a stop arm and the drive shaft, causes the trip lever to lift the start lever, and feed-out is effected as described in 9.11. Feed-out will continue until the solenoid is deenergized at which time the plunger moves back to the right, the start lever is lowered and feed-out is terminated as described in 9.12.

REMOTE CONTROL NONINTERFERING BLANK TAPE FEED-OUT (Figure 28)

A. General

9.14 This feature steps out a predetermined length of blank (unperforated) tape at the end of each message by remote control. The operation is initiated by an electrical pulse from a remote source that is applied to a tape feed-out magnet. The feed-out is adjustable in steps of 0.6 inch, up to 18 inches. Messages received during any part of the feed-out cycle will be processed without interference or loss of content. A nonrepeat latch prevents successive tape feed-out operation from being initiated until the first feed-out sequence has been completed. At the end of the feed-out operation the mechanism stops and remains inactive until another cycle is initiated.

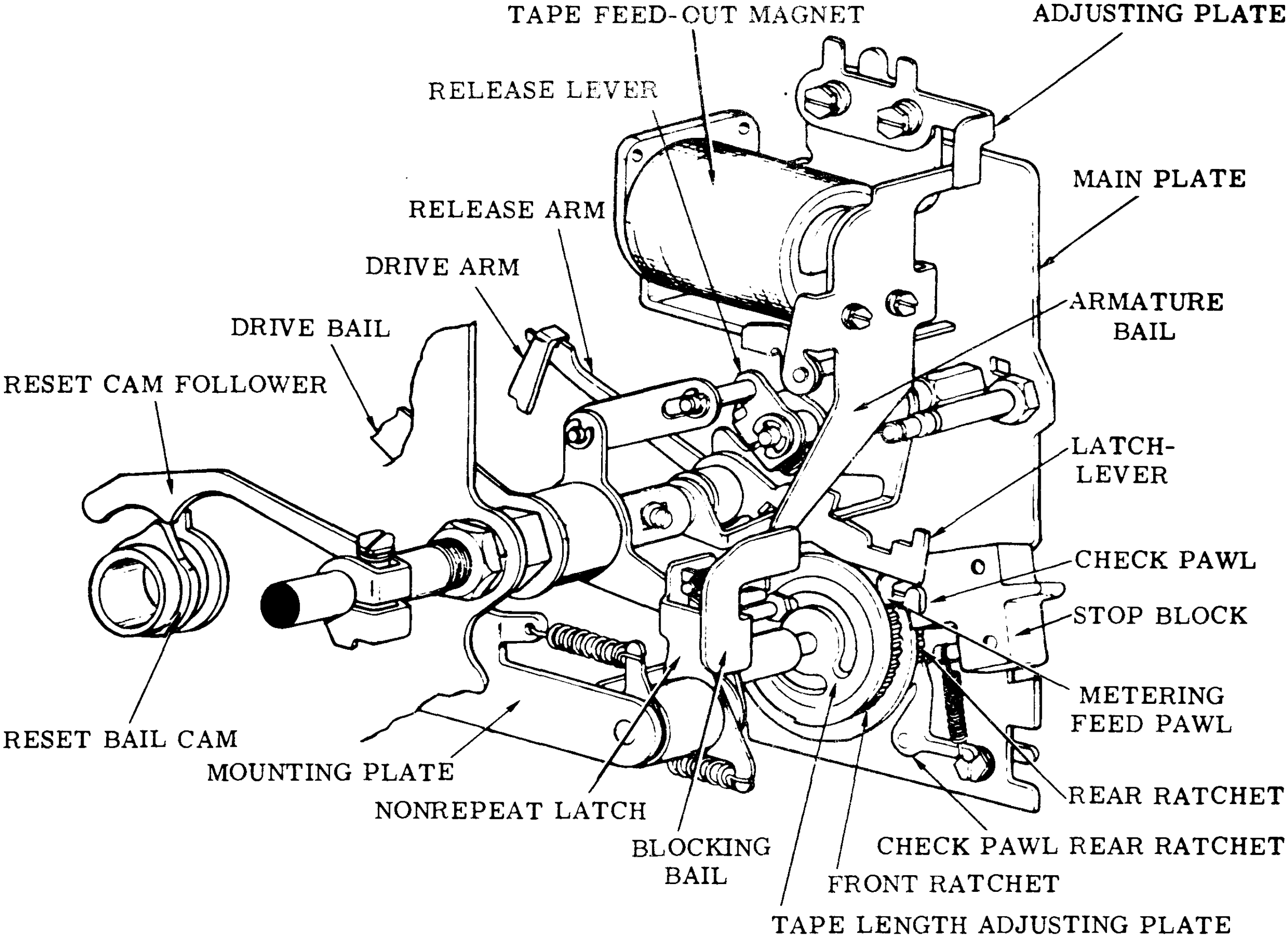


Figure 28 - Remote Control Noninterfering Rubout Tape Feed-Out Mechanism

B. Initiation

9.15 The feed-out operation is initiated when an electrical pulse is applied to the feed-out magnet with the typing reperforator in the idle condition. With the magnet energized, the armature bail moves the blocking bail out of engagement with the drive bail assembly. The spring loaded drive bail falls into the indent of its cam and the connecting link positions the release lever on the lower step of the latchlever. The nonrepeat latch is delayed one cycle by the spring loaded blocking latch on the drive bail. (If the start magnet is held energized longer than one cycle, the nonrepeat latch prevents the drive bail from again falling into the indent of its cam.) As the drive bail reaches the indent of its cam, the blocking latch rides over the nonrepeat latch. The drive bail then reaches the high part of its cam and the nonrepeat latch falls into engagement with the drive bail. When the start magnet is de-energized, the spring loaded blocking bail again engages the drive bail and, simultaneously, disengages the nonrepeat latch.

C. Metering

9.16 When the drive bail positions the release levers on the lower step of the latchlever as described in 9.15, metering takes place. The release lever has not permitted the check pawl to engage two adjacent ratchets. One of the ratchets is fed continually by the feed pawl. This ratchet has a deeper notch at every sixth tooth, so that the pawl engages the second ratchet on every sixth cycle. After the second ratchet has rotated an amount equivalent to two teeth, a follower, riding a cam attached to the ratchet, drops off its peak and unblocks the tripping mechanism. After a predetermined length of tape has been fed (as measured by the second ratchet), the latchlever is actuated, as it would be by the selector cam on receipt of a message, and the tripping mechanism is blocked to prevent further feeding. Simultaneously, the feed pawls are lifted off the ratchets, and the ratchets return to their zero position.

D. Tripping and Punch Blocking

9.17 A bail that follows a cam attached to the main shaft engages the function clutch trip lever. When the cam follower enters the indent of its cam, an operating spring causes the bail to operate the clutch trip lever. The perforating and printing mechanisms are then allowed to punch and print the character stored in the selector. However, to insure that only blank tape will be advanced, a blocking link is connected to the selector stripper cam follower shaft. When the magnet is energized and the drive bail positions the release lever on the lower step of the latchlever, as described in 9.16, the left end of the blocking link moves to the left and under the punch slide reset bail. Now, when the function clutch is tripped, the marking punch slides are blocked by the punch slide reset bail. The slide post on the front toggle links clears the punch slide projection on its upward movement. The punch slide reset bail then falls off the blocking link, but the punch slides cannot move forward into the marking position because they are blocked by the slide post.

9.18 Each time the main shaft rotates one revolution, a blank tape feed-out cycle is initiated, provided the function clutch trip lever bail is not blocked by the metering mechanism. Should an incoming message trip the metering mechanism, the tripping mechanism is immediately blocked from any further operation and the blocking link is pulled out of engagement with the punch slide reset bail.

E. Storage

9.19 The purpose of the storage is to hold the reset bail (perforating mechanism) in engagement with the punch slides until the slides are fully reset, so that they may recognize the first character set up in the punch slide latches by the selecting mechanism. This mechanism consists of a latch that is operated by a link attached to the punch slide reset bail toggle. During reception of an incoming message, the toggle mechanism pushes the latch out of the way of the reset bail prior to its being stripped by the clutch trip lever.

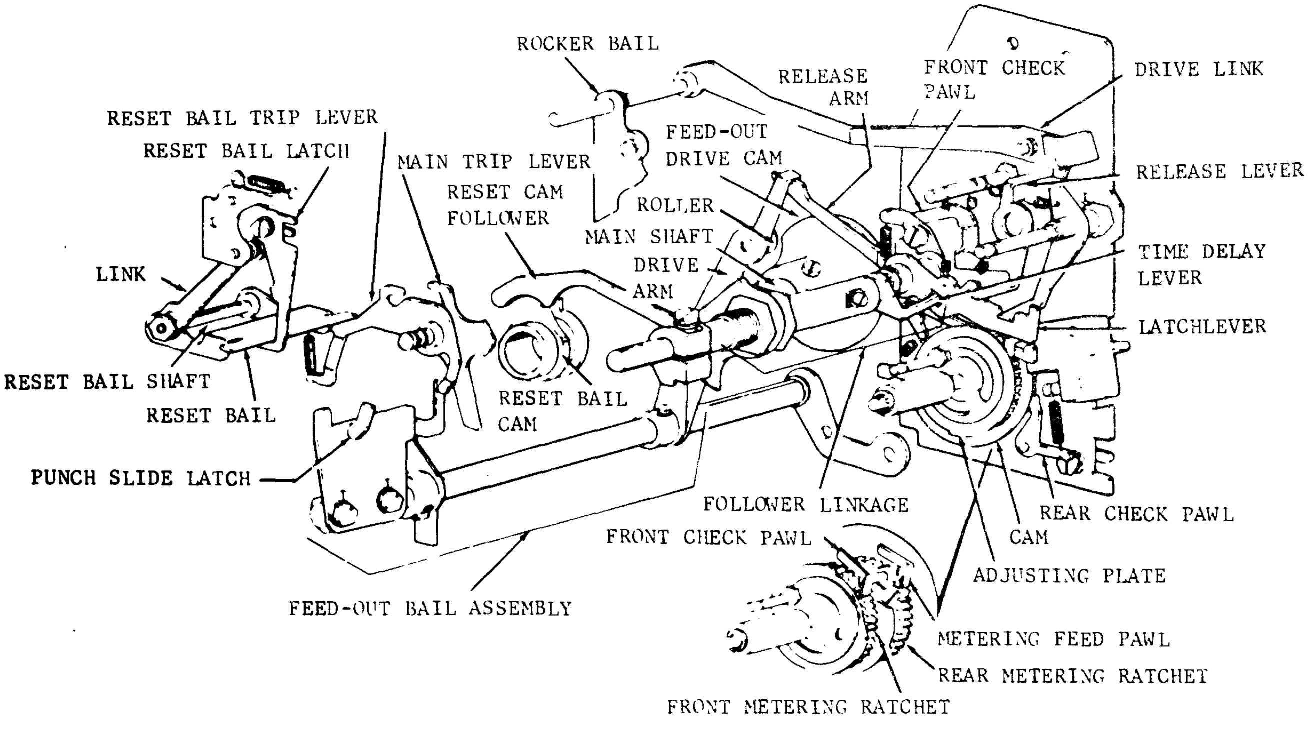


Figure 29 - Automatic Noninterfering Rubout Tape Feed-Out Mechanism

REMOTE CONTROL NONINTERFERING RUBOUT TAPE FEED-OUT (Figure 28)

9.20 The operation of this mechanism is essentially the same as that of the remote-control noninterfering blank tape feed-out mechanism (9.16). This feature, however, does not contain a blocking link on the stripper cam follower shaft (9.17). The tape output, therefore, is perforated in the rubout code combination.

AUTOMATIC NONINTERFERING RUBOUT TAPE FEED-OUT (Figure 29)

A. General

9.21 This feature automatically initiates the feed-out of a predetermined length of rubout perforated tape at the end of each message, following a fixed period of signal line idle time. The duration of delay between the termination of the message and the initiation of feed-out is determined by one of several available cams. (At 100 words per minute operation, for example, delays of approximately 4 seconds and 16 seconds are available.) The length of tape feed-out is also variable in increments of 0.6 inch up to 3.6 inches or 18 inches. The mechanism may be controlled remotely with the addition of a separate set of parts. Messages received during any part of the feed-out cycle are processed without interference or loss of content.

B. Initiation

9.22 The feed-out operation is automatically initiated by a fixed period of idle signal line. Through the interaction of a drive link operated by the rocker bail and a follower activated by the reset bail cam in the selector, the mechanism recognizes the end of a message. The timing of the selector while receiving a message is such that the reset bail cam raises its follower during the first part of the selector cycle. The follower, through a linkage, lowers a latchlever which permits a release lever to rotate clockwise. When the release lever is in its clockwise position, the mechanism is in its unoperated condition, as explained below. When the rocker bail goes to its extreme left position during the middle of the function cycle, the at-

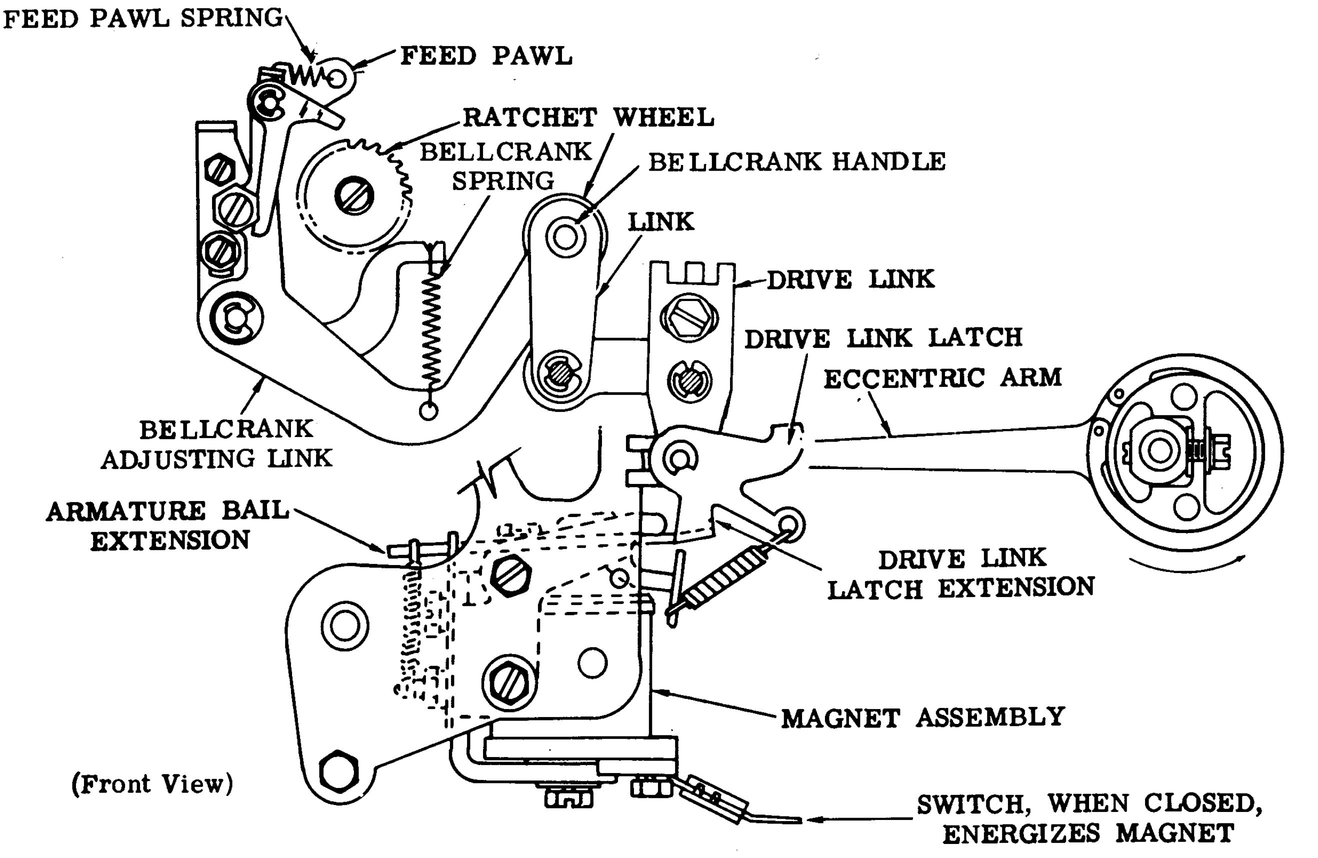


Figure 30 - Backspace Mechanisms

tached drive link rotates the release lever counterclockwise and places the mechanism in its operated condition, as explained in 9.26. Each time a new character is received, the above sequence occurs.

9.23 End of message recognition is obtained when the release lever is rotated counterclockwise by the rocker bail and then is not permitted to rotate clockwise by the follower.

C. Metering and Feed-Out

9.24 When the release lever rotates counterclockwise, it lowers a front check pawl onto two metering ratchets. These function as described in 9.22 above.

9.25 A time delay lever rides on a cam attached to the front ratchet. When the front ratchet rotates, the time delay lever rides to the low part of the cam and causes a release arm to release the drive arm of a feed-out bail assembly. A roller on the drive arm then rides, under spring pressure, on a feed-out drive cam on the main shaft. As the shaft rotates, each time the roller rides to the low part of the cam, the feed-out bail assembly does two things: 1) rotates the main trip lever counterclockwise and trips the function clutch, and 2) rotates the punch slide latches counterclockwise and sets up a rubout code combination. Thus, the reperforator feeds out rubout tape in the same manner as if the function clutch and punch slides had been actuated by the selector.

9.26 As the ratchets are rotated as described above, an adjusting plate on the front ratchet reaches the position where it rotates the latchlever clockwise. The latchlever, in turn, performs two actions: 1) through the time delay lever causes the release arm to latch the drive arm and terminate feed-out, and 2) permits the release lever to move to its clockwise position and lift the metering feed pawl and front check pawl off the ratchets. A spring returns the front ratchet to its start position. The mechanism remains in its unoperated condition until the next code combination is received. The adjusting plate is adjustable for varying lengths of tape feed-out.

D. Noninterference

9.27 When the first character of an incoming message is received during feed-out, the selector clutch is tripped and the reset cam follower causes the release lever to rotate clockwise. Feed-out is terminated, as described in 9.25. The incoming message is perforated.

9.28 When the first character is received during feed-out, the relationship between the selector cam and the function cam could be such that the reset bail would release the punch slides before the slides are fully reset. In this case, the first character of the incoming message would be lost. The purpose of the storage assembly is to prevent this. The storage assembly consists of a reset bail latch that is moved by a link attached to the reset bail shaft. During normal reception of messages, the link pushes the latch out of the way of the reset bail prior to the bail being lowered by the main trip lever. Whenever the condition described above occurs, the latch holds the bail in engagement with the slides until they are fully reset, so that they may recognize the first character set up in the punch slide latches by the selector.

BACKSPACE MECHANISMS (Figure 30)

A. General

9.29 The backspace mechanism steps the tape back through the punch block in order to delete perforated errors. The erroneously perforated code combination in the retracted tape is then obliterated by perforating the rubout code combination in its place. The backspace mechanism may be operated manually or it may include power drive (Figure 30).

B. Manual Backspace

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

9.31 After the tape has been retracted into the punch block, the set of code holes above the punch pins may be replaced with the rubout code combination (all bits marking).

C. Power Drive Backspace

9.32 A start magnet in the power drive mechanism is energized by a remote source. When energized, the armature bail is pulled downward. An extension of the bail disengages the drive link latch, which drops and engages a notch in the eccentric arm. The eccentric arm, driven by the perforator main shaft, moves to the right. This action causes the bellcrank handle to be depressed through a system of linkages between the drive link latch and bellcrank. The subsequent operation is as described in 9.30 and 9.31.

35 TYPING REPERFORATOR (LPR)

LUBRICATION

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to include additional lubrication procedures for the 35 typing reperforator. Since this is an extensive revision, marginal arrows ordinarily used to indicate changes have been omitted.

1.02 This section provides lubrication information for the 35 typing reperforator. General areas of the equipment are shown by photographs. Specific points to receive lubricant are indicated by line drawings and descriptive text. The symbols in the text indicate the following directions:

Symbol	Meaning
O1	Apply one drop of oil.
O2	Apply two drops of oil
O3	Apply three drops of oil, etc.
G	Apply thin coat of grease.
SAT	Saturate with oil. (Felt washers, etc.)

KS7470 oil and KS7471 grease should be used.

1.03 The equipment should be thoroughly lubricated, but over-lubrication which might allow oil to drop or grease to be thrown on other parts should be avoided. Special care should be exercised to prevent lubricant from getting between armatures and pole faces or between electrical contact points.

1.04 The following general instructions supplement the specific lubricating points illustrated on subsequent pages:

Apply one drop of oil to all spring hooks.
Apply a light film of oil to all cam surfaces.
Apply a thick coat of grease to all gears.
Saturate all felt washers, oilers, etc.
Apply oil to all pivot points.
Apply oil to all sliding surfaces.

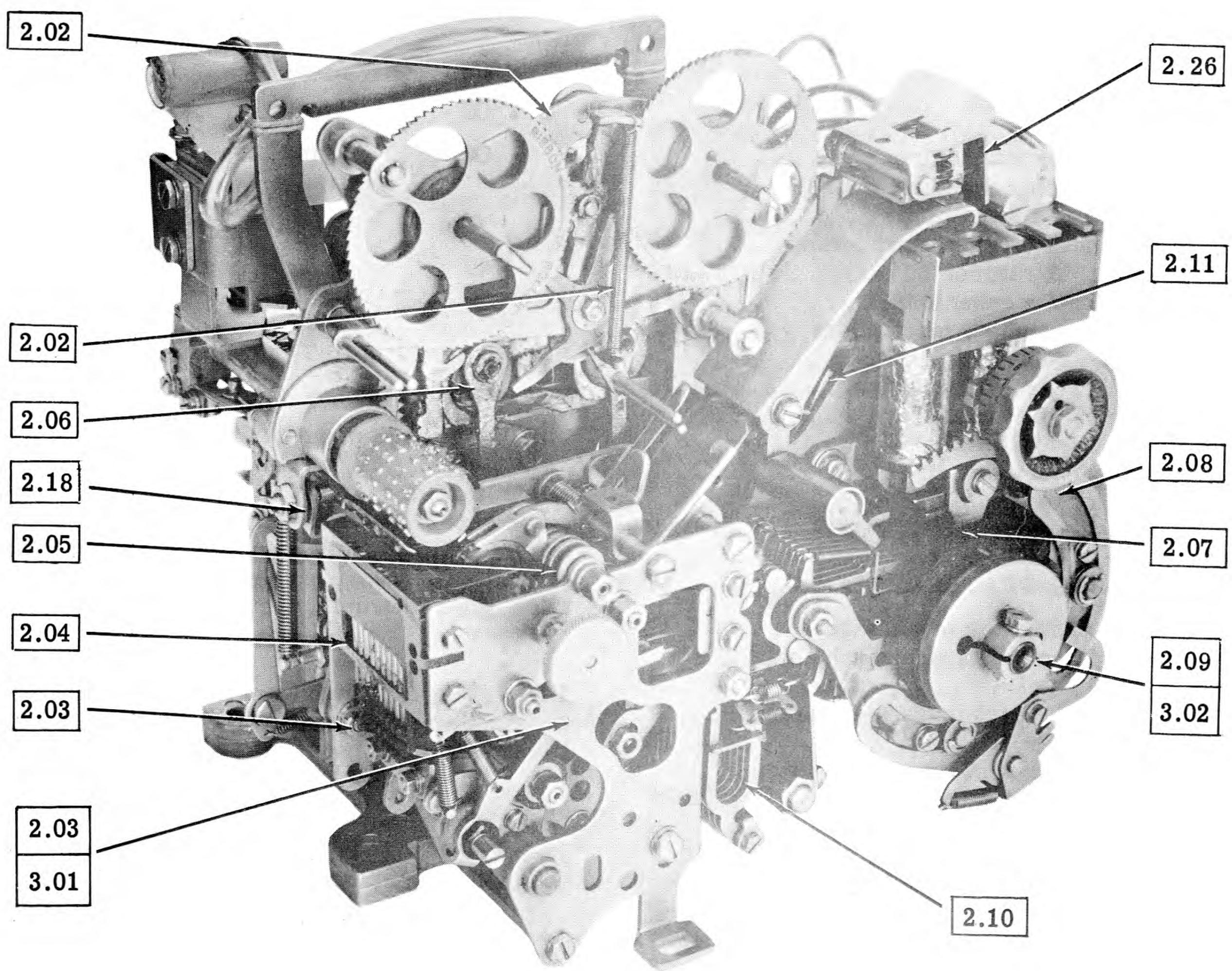
1.05 All equipment should be lubricated before being placed in service or prior to storage. After a few weeks of service, relubricate to make certain that all specified points have received lubricant. Thereafter, the following schedule should be adhered to:

Operating Speed	Lubrication Interval
60 W.P.M.	3000 hours or 1 year *
75 W.P.M.	2400 hours or 9 months *
100 W.P.M.	1500 hours or 6 months *

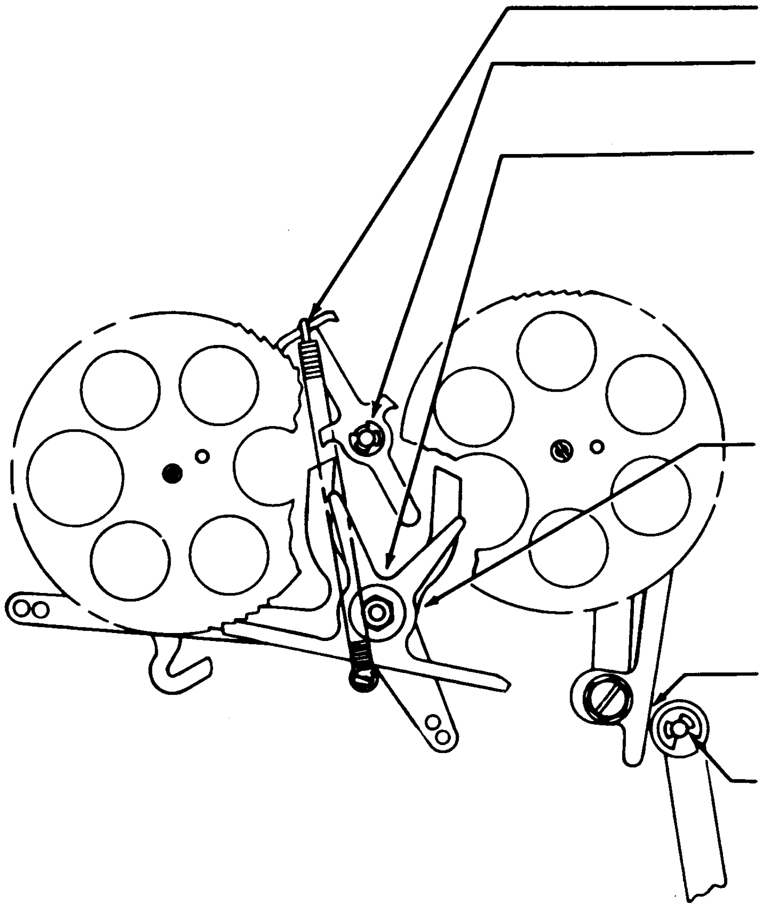
* Whichever occurs first.

2. BASIC UNIT

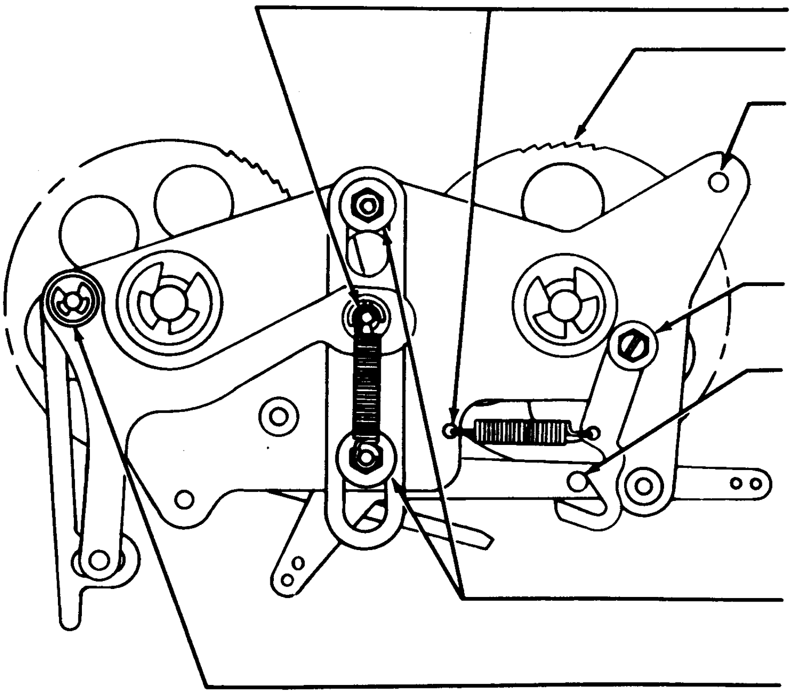
2.01 Typing Reperforator (Left Front View)



2.02 Ribbon Feed Mechanism

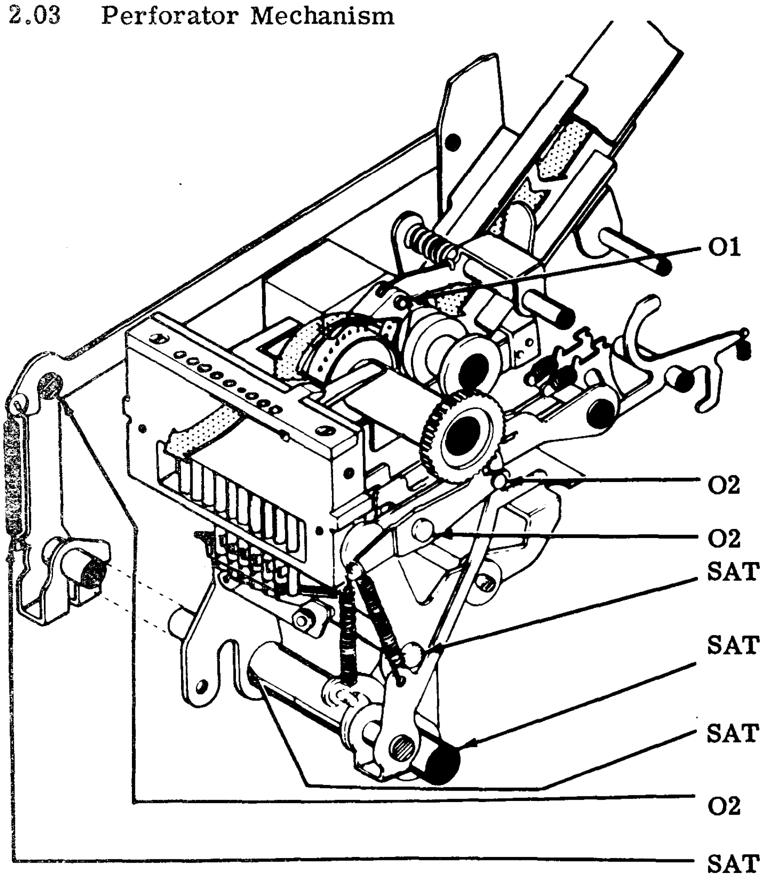


O1	Hooks (2)	Spring
O2	Pivot Point	Feed Pawl
O2	Pivot	Check Pawl
O2	Pivot Points (2)	Reversing Arm
G	Contacting Surface	Drive Arm Adjustable Extension
SAT	Felt Washer	Drive Arm Roller

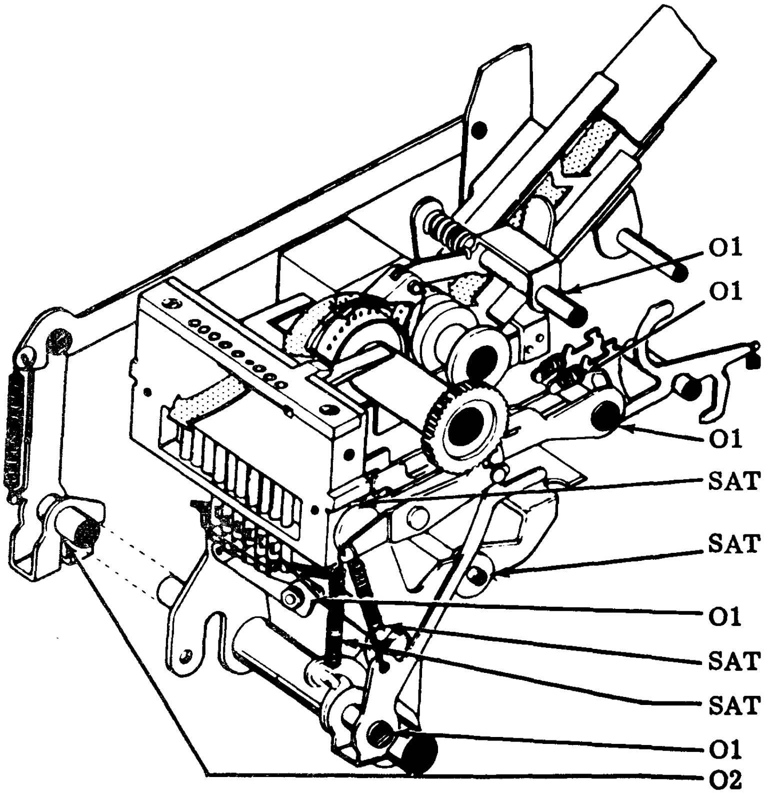


O1	Hooks (2)	Springs (2)
G	Teeth	Ratchet Wheel (2)
O2	Shaft	Rollers (2)
O2	Shaft, Felt Washers	Ratchet Wheel (2)
O2	Pivot	Detent
G	Contacting Surfaces	Detent
O2	Upper and Lower Bushing	Slide Lever
O2	Pivot	Drive Arm

2.03 Perforator Mechanism

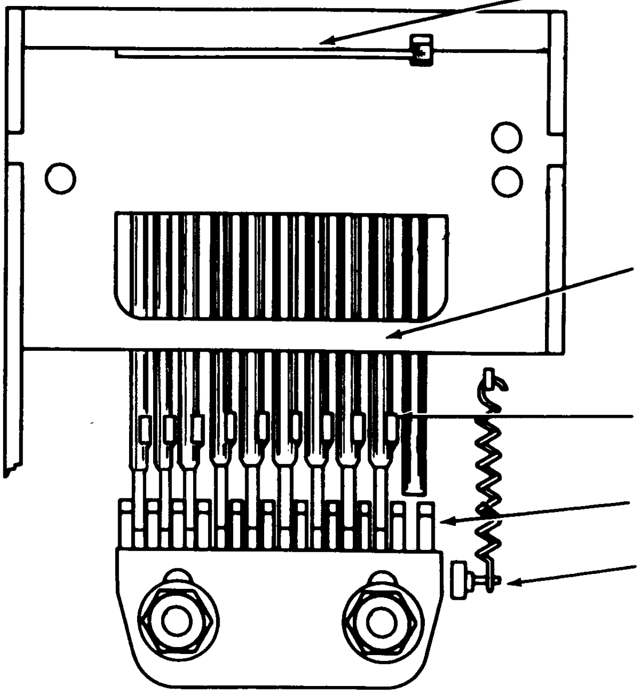


O1	Pivot Point	Tape Shoe
O2	Roller	Detent Lever
O2	Pivot Point	Detent Lever
SAT	Pivot Points (4) (Felt Washers)	Front and Rear Toggle Link
SAT	Pivot Points (2) (Felt Washers)	Toggle Bail
SAT	Pivot Points (2) (Felt Washers)	Toggle Bail
O2	Pivot Points (2)	Punch Drive Link
SAT	Felt Wick	Drive Link Spring



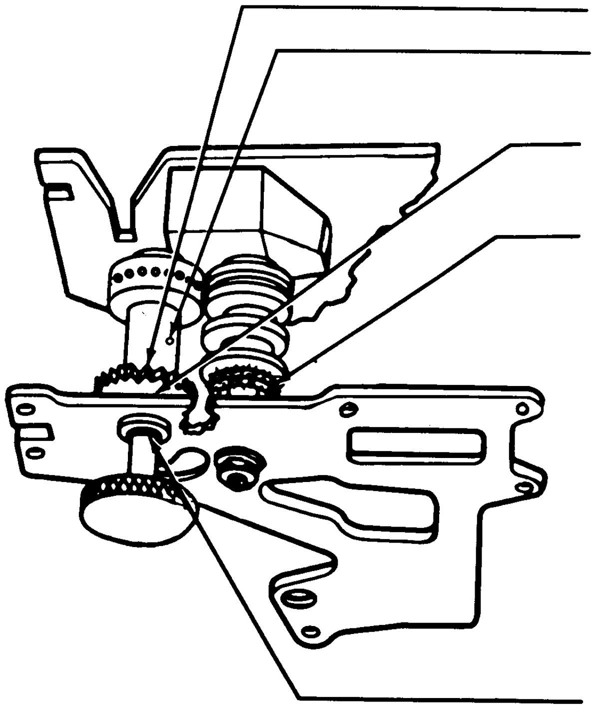
O1	Pivot Points (2)	Tape Shoe Arm
O1	Hooks - Each End	Springs
O1	Pivot Points (9)	Punch Slides
SAT	Felt Strip	Oscillating Slide Post
SAT	Pivot Points (2) (Felt Washers)	Reset Bail
O1	Contact Surfaces (9)	Punch Slides
SAT	Felt Wick	Feed Pawl Spring
SAT	Felt Wick	Detent Spring
O1	Pivot Points (2)	Feed Pawl
O2	Pivot Points (2)	Rocker Arm

2.04 Punch Mechanism



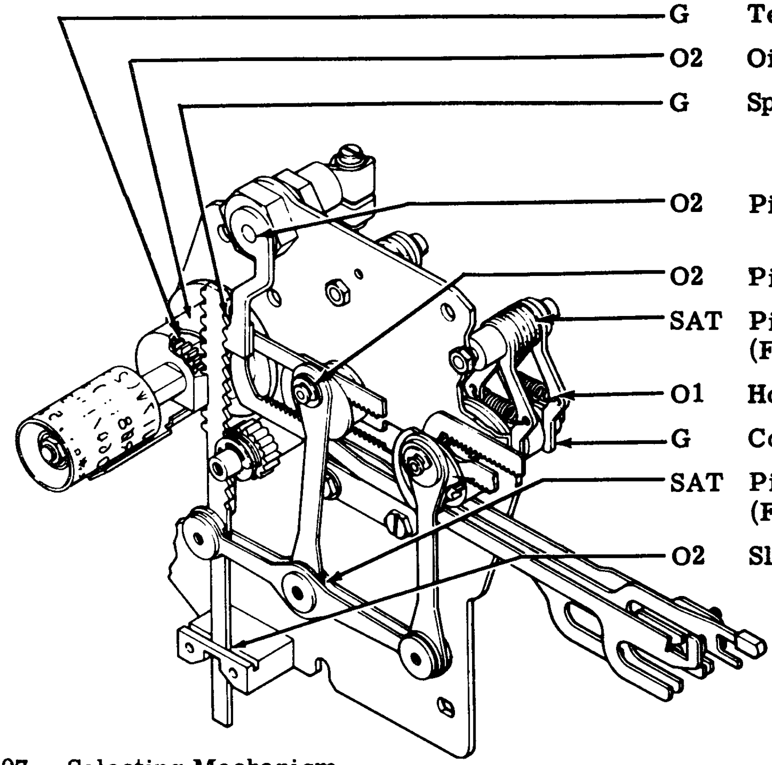
O1	Sliding Surface (9) (Upper Guide)	Punch Pin
O1	Sliding Surface (9) (Lower Guide)	Punch Pin
O1	Sliding Surface (9)	Punch Pin
O1	Sliding Surface (9)	Punch Slide Guide
O1	Hooks - Each End	Spring

2.05 Feed Mechanism



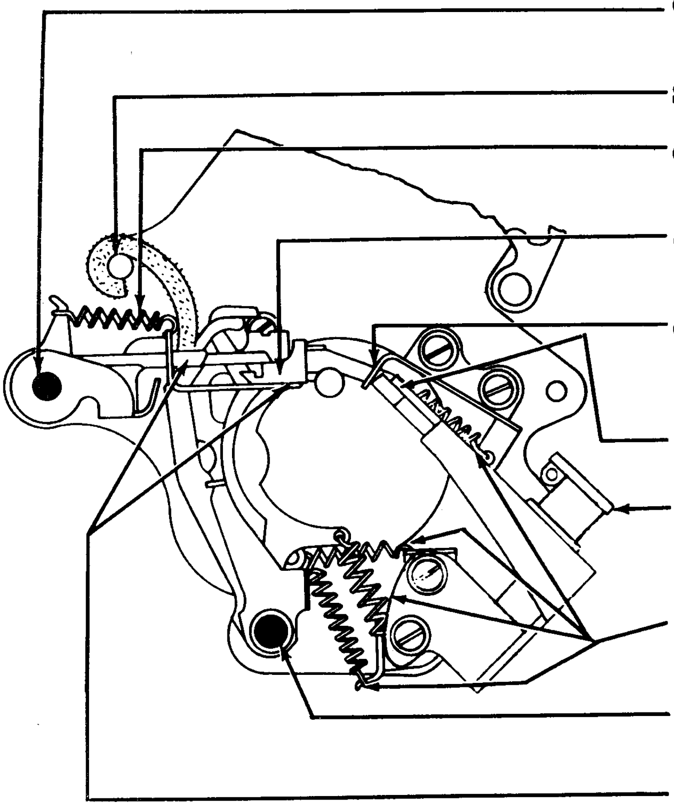
G	Ratchet Teeth (2)	Feed Wheel
O1	Oil Hole	Feed Wheel
SAT	Pivot Point (Felt Washer)	Feed Wheel
SAT	Pivot Point (Felt Washer)	Die Wheel
O2	Pivot Points (2)	Handwheel Bearing

2.06 Rotary Positioning Mechanism



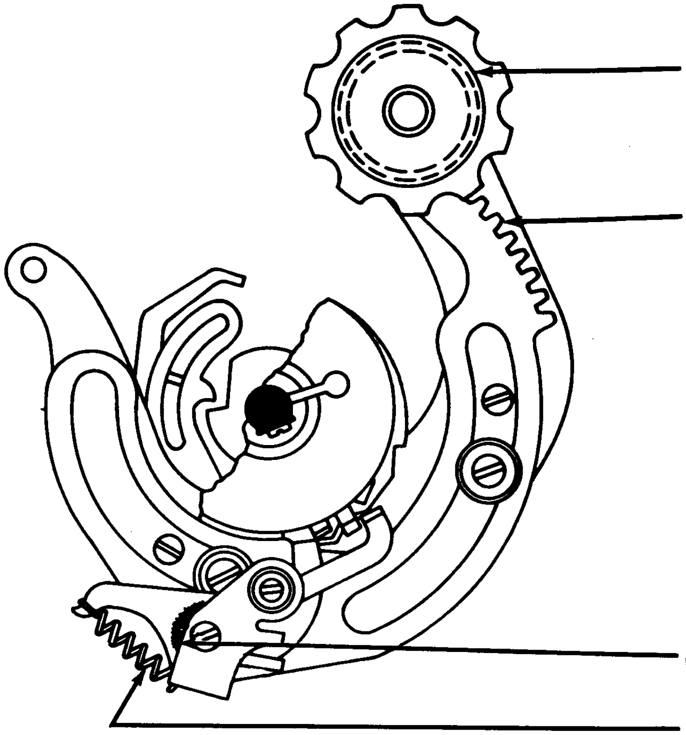
G	Teeth	Rotary Output Rack
O2	Oil Hole	Type Wheel Housing
G	Special Teeth	Rotary Output Rack Rotary Correcting Lever
O2	Pivot Point	Rotary Correcting Lever Shaft
O2	Pivot Points (2)	Connecting Rods
SAT	Pivot Points (Felt Washers)	Detent Levers (8)
O1	Hooks - Each End	Springs (4)
G	Contact Points	Detent Levers (8)
SAT	Pivot Points (3) (Felt Washers)	Cross Links
O2	Sliding Surface	Rotary Output Rack

2.07 Selecting Mechanism



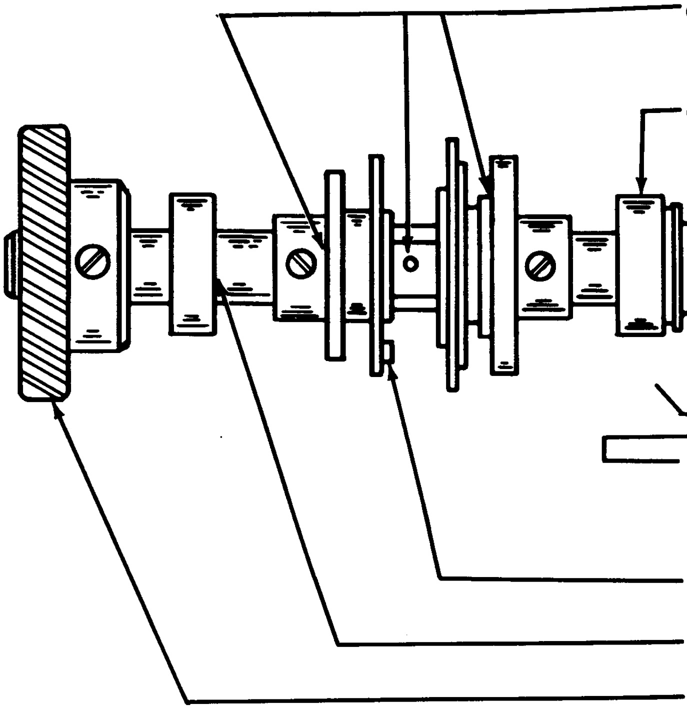
O2	Bearing Guide Slots (8)	Pushlever Guide
SAT	Felt Wick	Selector Wick
O1	Hooks - Each End (8)	Springs
O2	Engaging Surfaces (8)	Pushlevers
O2	Guide Slot	Marking Locklever
O2	Wick	Lubricator Wick
Fill Up (Avoid Airlock)		Lubricator Reservoir
O1	Hooks - Each End (12)	Springs
O2	Bearing Guide Slots (12)	Selector Lever Guide
O2	Guide Slots	Selector and Pushlever Guide

2.08 Range Finder Mechanism



G	Teeth	Knob
G	Teeth	Rack
SAT	Felt Washers (2)	Clutch Stop Arm
O1	Hooks - Each End	Spring

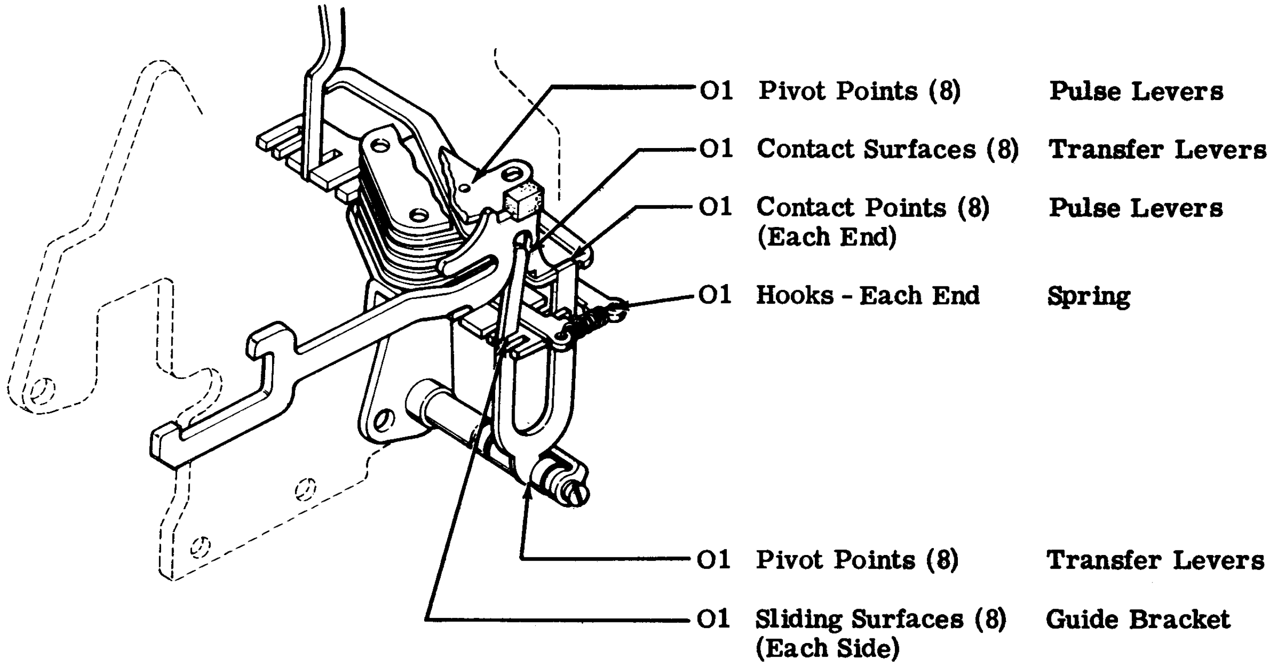
2.09 Mainshaft Mechanism



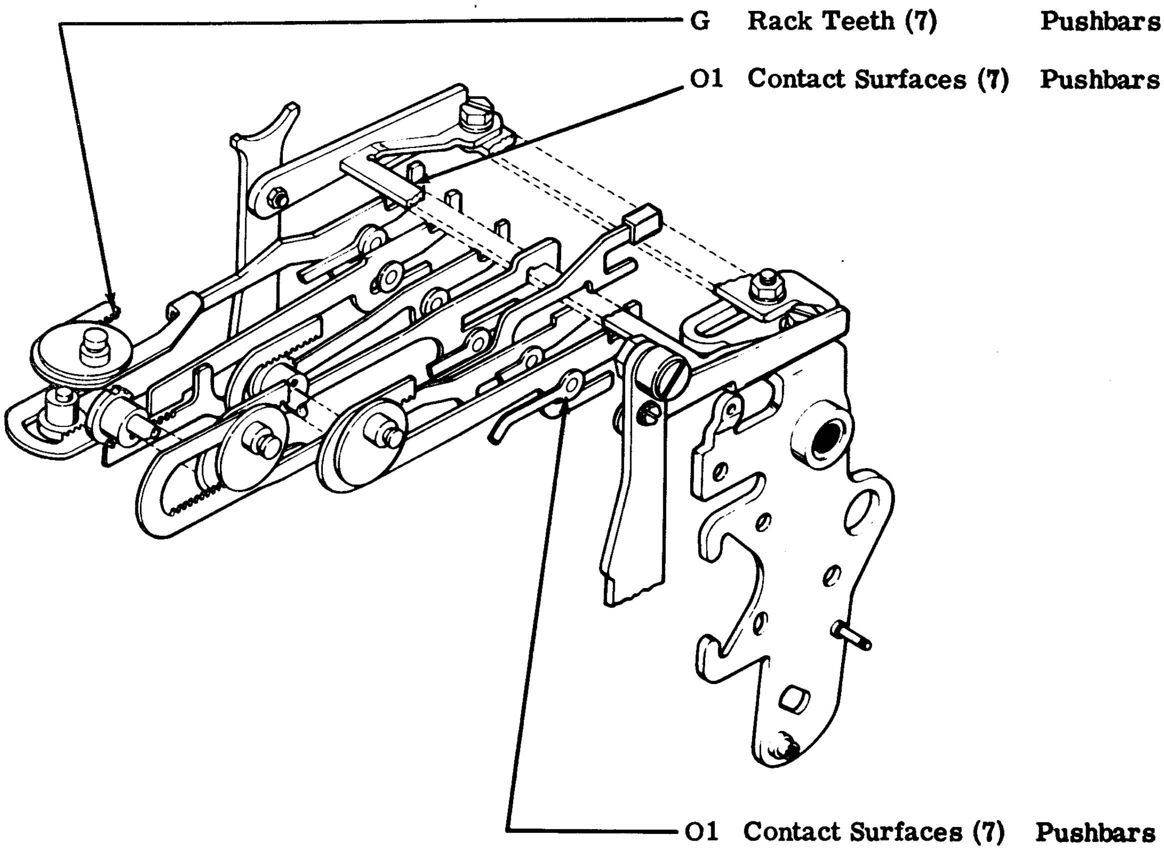
O6	Function Cam Needle Bearing Sleeve (3)	Both Ends of Sleeve and Oil Hole in Sleeve
O2	Bearing	Mainshaft
O2	Cam Surfaces (Each Cam)	Selector Cam
O2	Roller Pivot	Function Cam
O2	Bearing	Mainshaft
G	Teeth	*Driven Gear

*Note: Do not lubricate when unit is equipped with a belt driven sprocket.

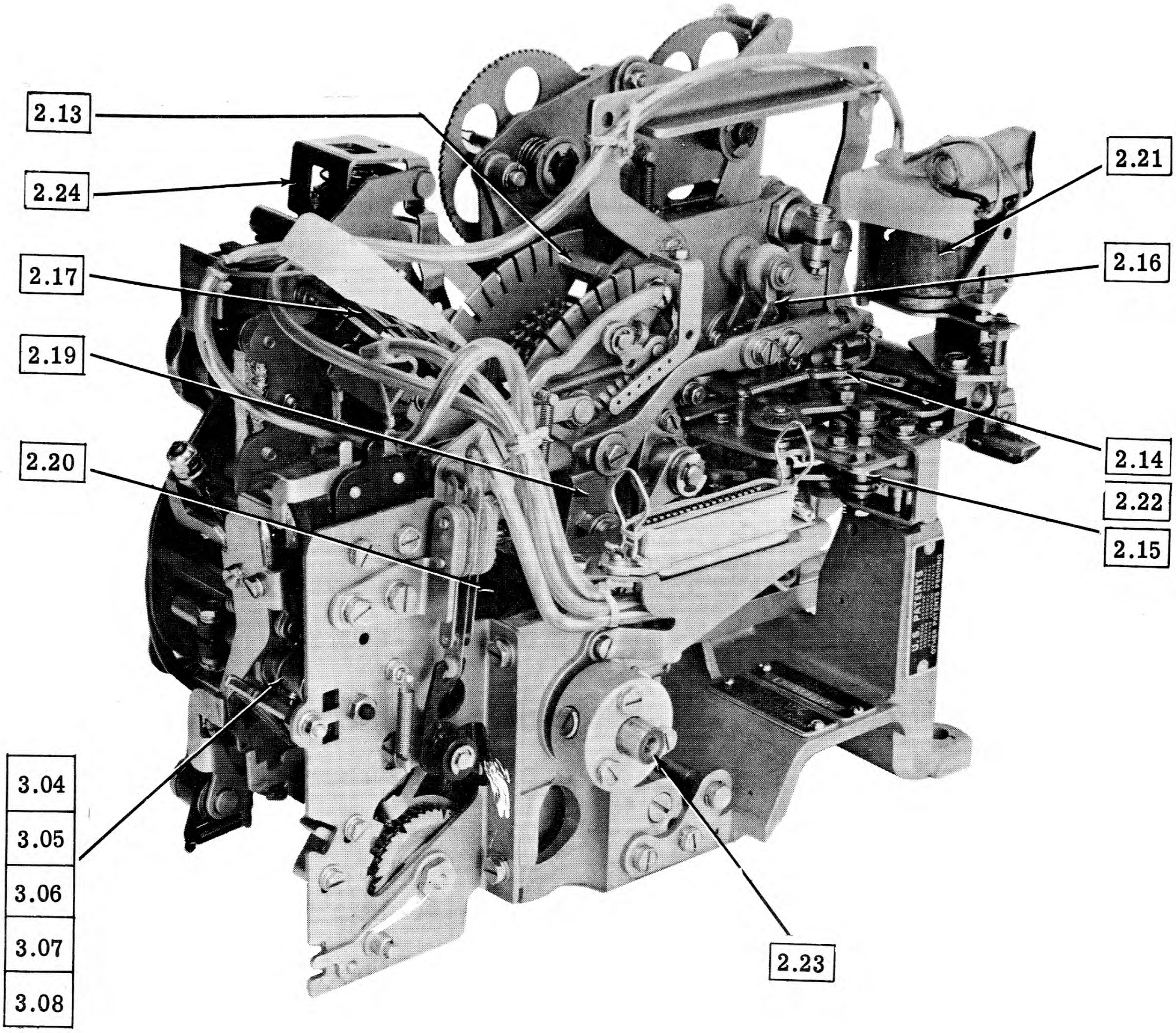
2.10 Transfer Mechanism



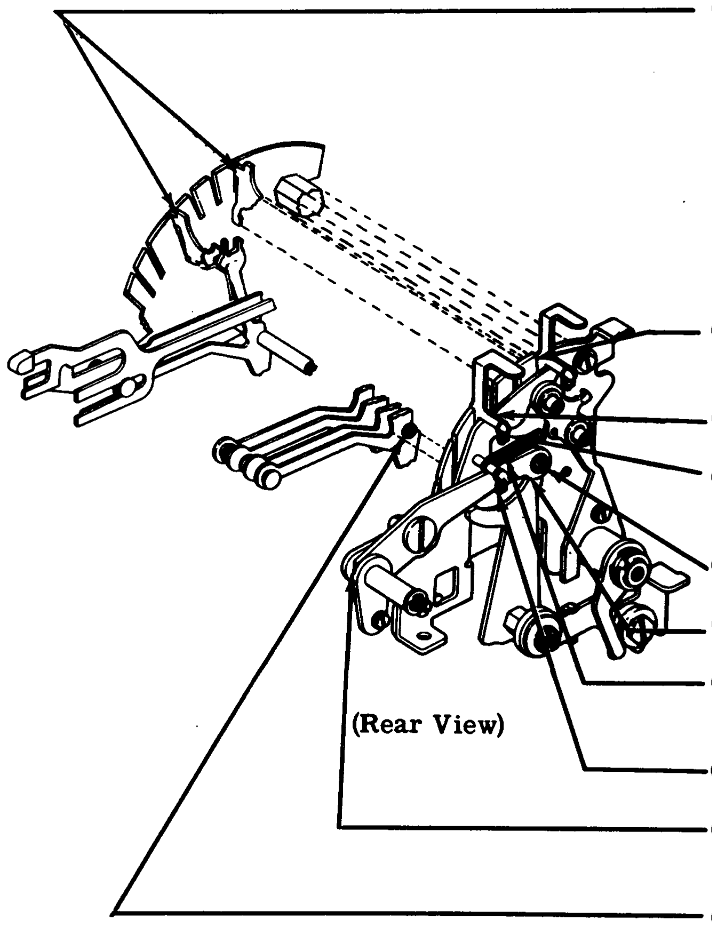
2.11 Pushbars



2.12 Typing Reperforator (Right Rear View)

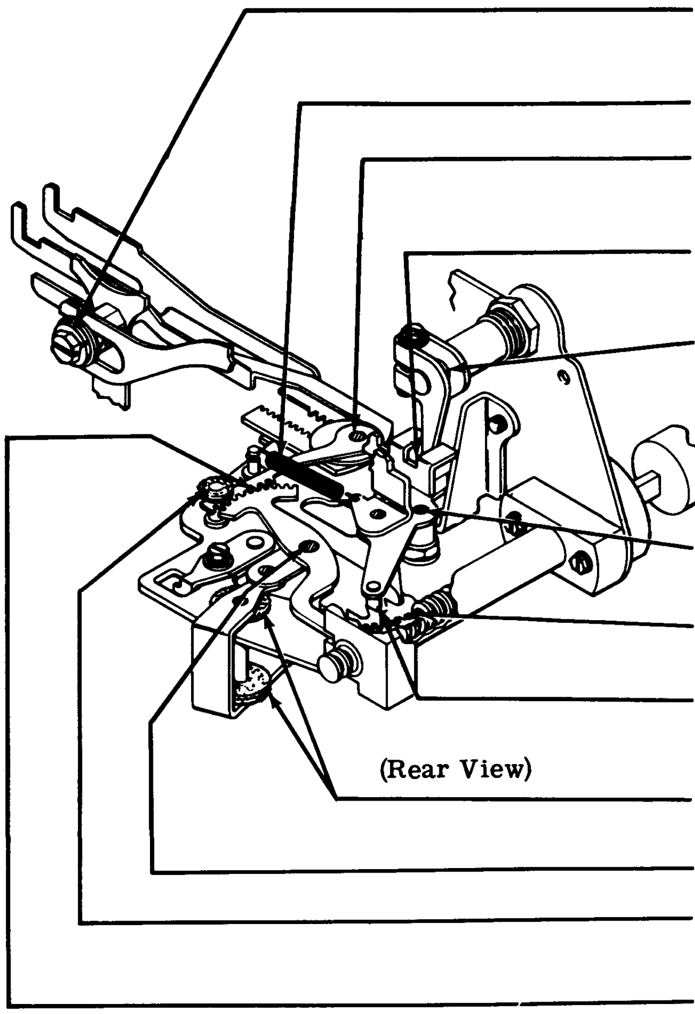


2.13 Function Box Mechanism



O1	Sliding Surfaces (Each Side)	Function Blades
O1	Sliding Surfaces (Each Side)	Function Blades
G	Contact Points (2)	Function Blades
O1	Hooks - Each End	Function Blade Springs (2)
O1	Pivot Point	Lifter Roller
G	Roller Surface	Lifter Roller
O1	Hooks - Each End	Lifter Toggle Link Spring
O1	Hooks - Each End	Lifter Spring
O1	Pivot Point	Function Blade Lifter
O1	Pivot Points (6)	Bellcranks

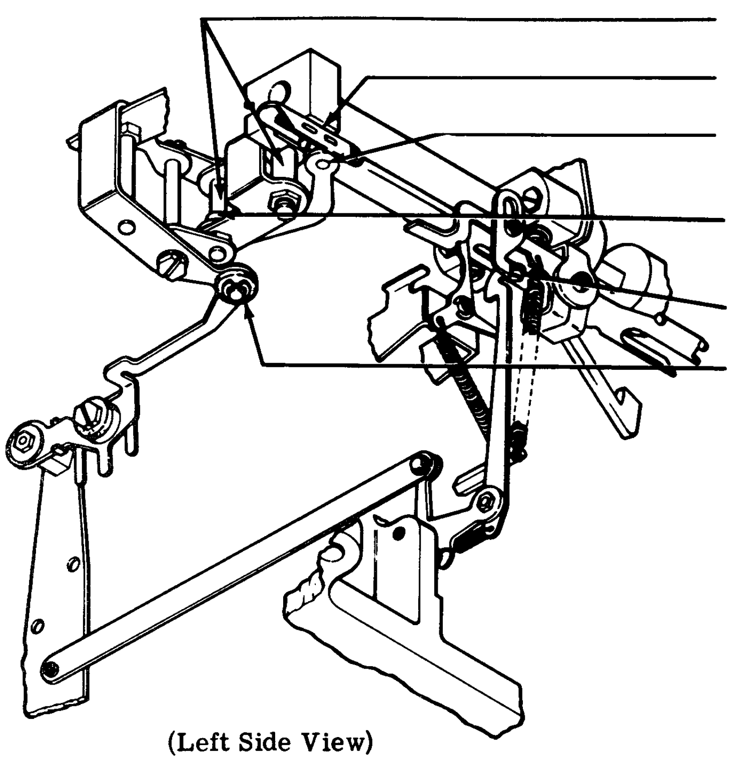
2.14 Axial Positioning Mechanism



(Rear View)

G	Sliding Guide Surfaces	Correcting Drive Link
O1	Hooks - Each End	Spring
O1	Pivot Point	Axial Output Rack
G	Contact Points	Rotary Correcting Clamp
O2	Pivot Point	Rotary Correcting Lever Shaft
O1	Pivot Point	Axial Correcting Plate
G	Teeth	Axial Sector Type Wheel Shaft
G	Contact Surface	Axial Correcting Plate Roller
SAT	Pivot Points (Felt Washers)	Oscillating Drive Bail
O1	Pivot Point	Axial Sector
SAT	Pivot Point (Felt Washer)	Guide Roller
G	Teeth	Axial Sector Axial Output Rack

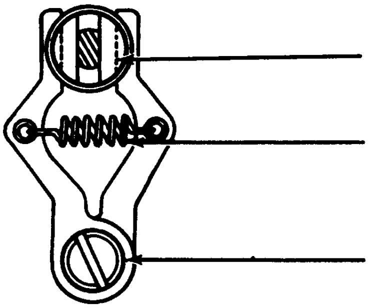
2.15 Axial Positioning Mechanism (continued)



O1	Pivot Point	Oscillating Bail
O1	Contact Surfaces	Ribbon Carrier
O1	Pivot Points	Ribbon Oscillating Lever
O1	Pivot Point (Felt Washer)	Ribbon Oscillating Lever
O1	Contact Surfaces	Ribbon Carrier
SAT	Pivot Points (2) (Felt Washers)	Oscillating Drive Link

(Left Side View)

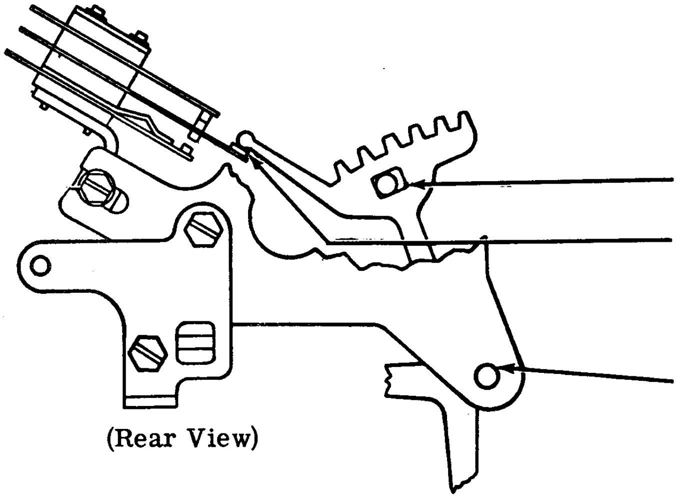
2.16 Detent Assemblies



O1	Detent Points	Detent Levers (4)
O1	Hooks - Each End	Detent Lever Springs (2)
SAT	Pivot Points (Felt Washers)	Detent Levers (4)

(Bottom View)

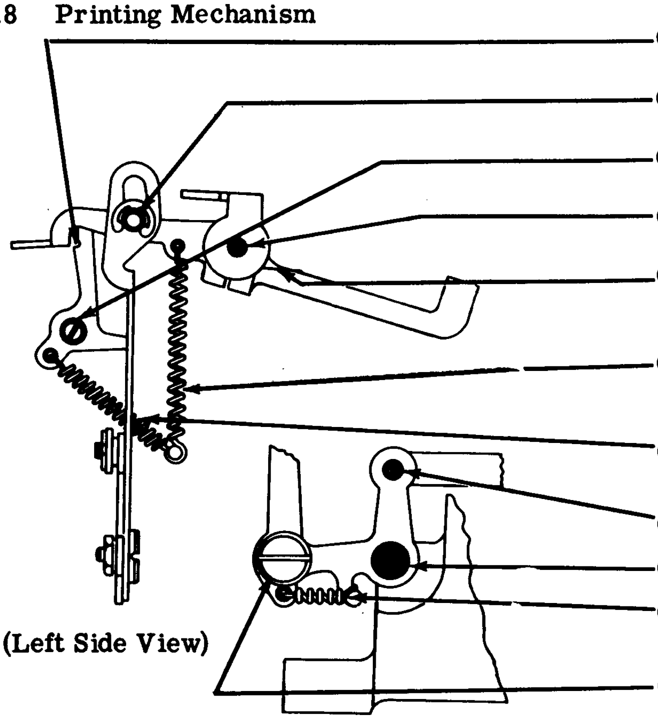
2.17 Ribbon Shift Contact Mechanism



O1	Sliding Surface	Stop Post
G	Surfaces	Swinger and Bellcrank
O1	Pivot	Bellcrank

(Rear View)

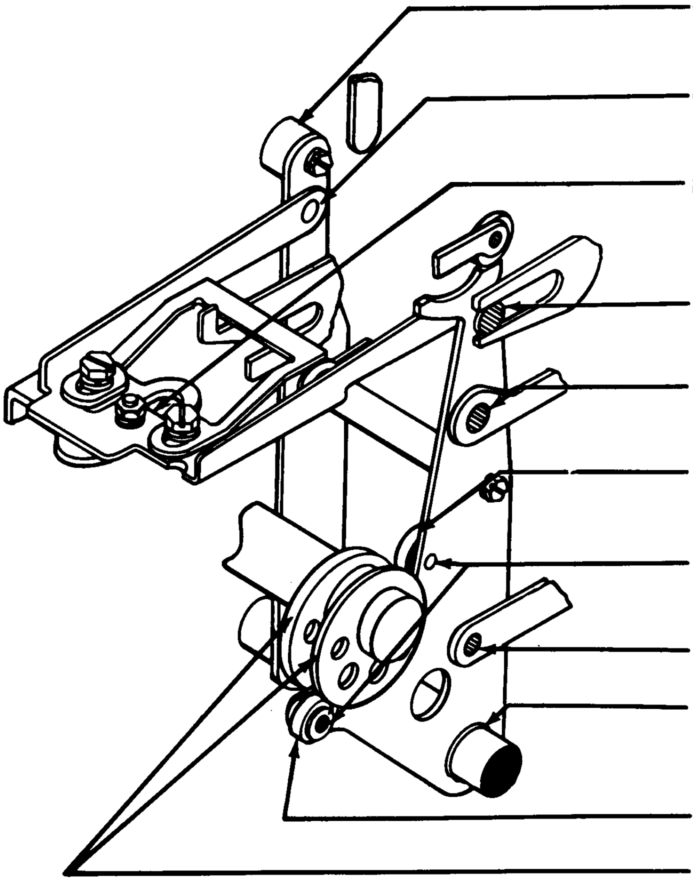
2.18 Printing Mechanism



(Left Side View)

G	Contact Surface	Printing Latch
O2	Sliding Surface	Printing Trip Link
O2	Pivot Point	Printing Latch
O2	Pivot Points	Print Hammer
O1	Hooks - Each End	Print Hammer Spring
O1	Hooks - Each End	Hammer Accelerator Spring
O1	Hooks - Each End	Printing Latch Spring
O1	Pivot Point	Printing Drive Link
O1	Pivot Point	Printing Pivot Arm
O1	Hooks - Each End	Printing Trip Link Spring
O1	Pivot Points (2)	Printing Pivot Arm

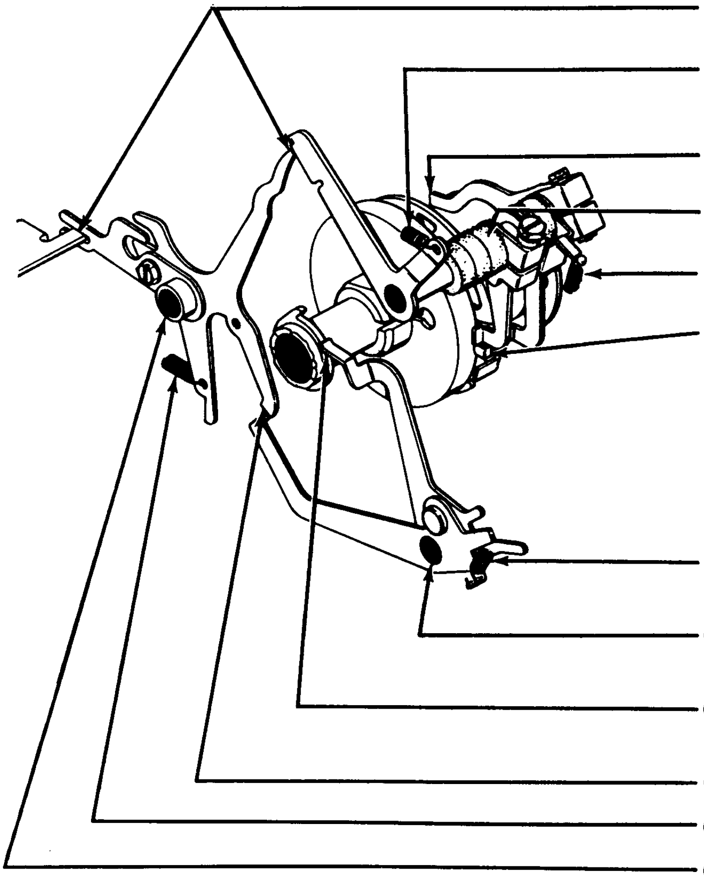
2.19 Rocker Bail Mechanism



(Rear View)

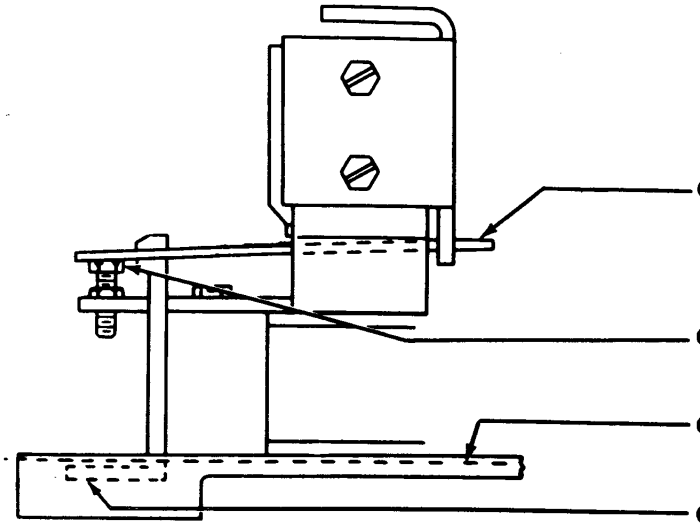
G	Contact Surface	Ribbon Feed Eccentric Stud
O1	Pivot Points	Pushbar Operating Blade
SAT	Sliding Surface (Felt Washer Under Blade)	Pushbar Operating Blade
G	Pivot Point	Correcting Drive Link
O1	Pivot Point	Oscillating Drive Link
O1	Roller Surface	Cam Follower Roller (Upper and Lower)
O1	Pivot Points	Cam Follower Rollers
O1	Pivot Point	Printing Drive Link
SAT	Pivot Point (Felt Strip)	Rocker Bail
O1	Roller Surface	Cam Follower Roller
O1	Contact Surface	Function Cam

2.20 Function Cam-Clutch Trip Mechanism



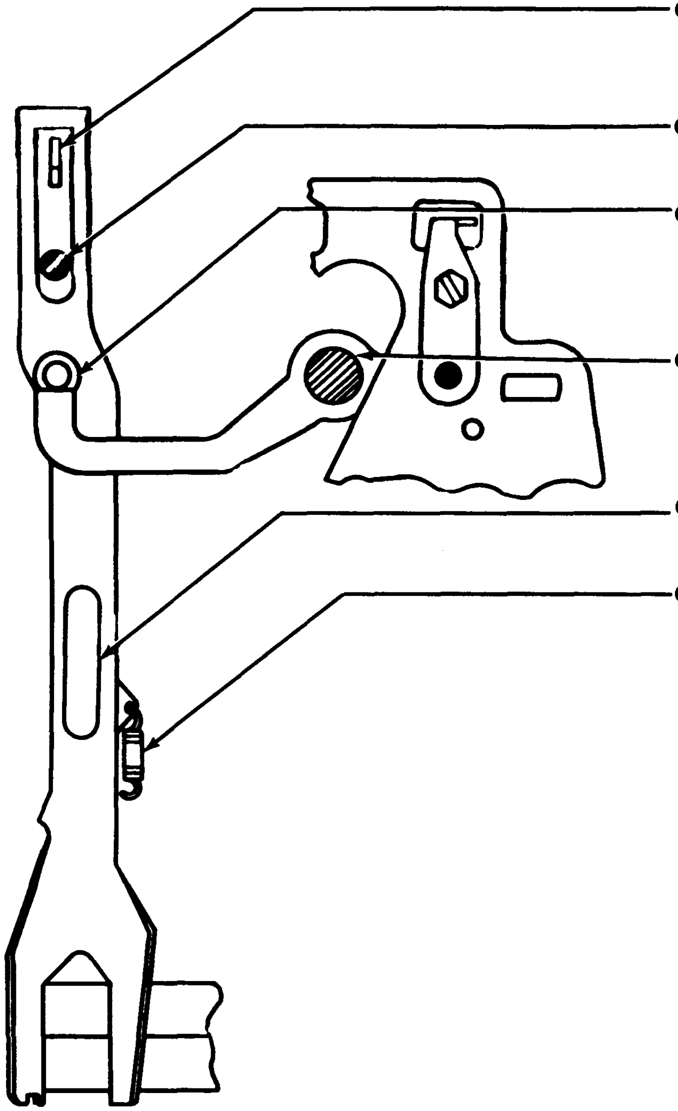
O1	Contact Points (2)	Trip Lever
O1	Hooks - Each End	Clutch Release Spring
G	Contact Surface	Reset Lever
SAT	Felt Washers	Clutch Trip Shaft
O1	Hooks - Each End	Latchlever Spring
O1	Contact Surface	Clutch Stop-Lug
O1	Hooks - Each End	Follower Lever Spring
O1	Pivot Point	Trip Cam Follower Lever
O1	Contact Surface	Trip Cam Follower Lever
O1	Contact Point	Trip Lever
O1	Hooks - Each End	Trip Lever Spring
O1	Pivot Point	Trip Lever

2.21 Ribbon Shift Magnet



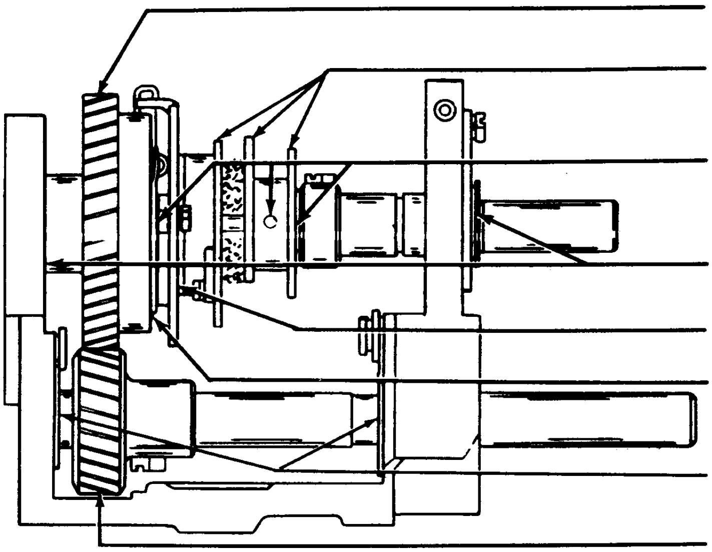
O1	Pivot Point	Armature Hinge
G	Contact Point	Downstop
G	Upper Surface	Print Suppression Link
O1	Contact Surfaces	Blocking Link

2.22 Ribbon Carrier Mechanism



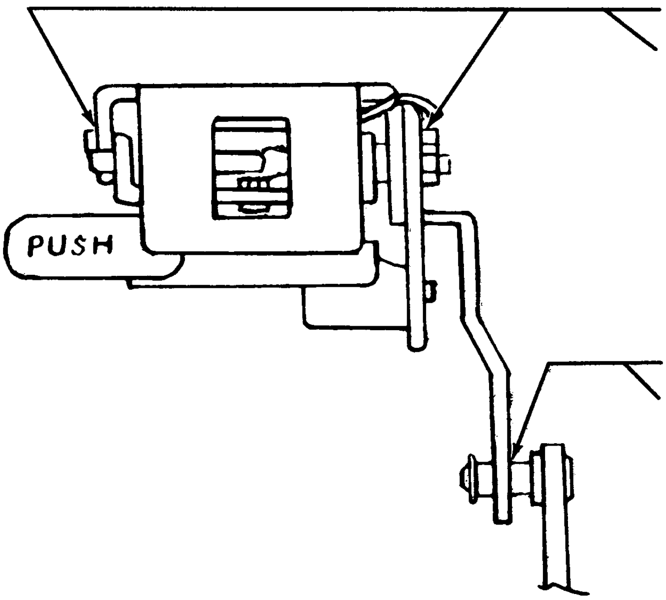
O1	Engaging Surfaces	Blocking Link
O2	Engaging Surfaces	Rear Guide Post
O1	Engaging Surfaces	Ribbon Oscillating Lever
O1	Pivot	Ribbon Oscillating Lever
O2	Engaging Surfaces	Ribbon Carrier
O1	Hooks - Each End	Spring

2.23 Jack Shaft Mechanism



G	Teeth	Gear
G	Camming Surfaces (2)	Function Cam
O6	Function Cam Needle Bearing Sleeve	Both Ends of Sleeve and Oil Hole in Sleeve
O2	Bearing Surfaces	Ball Bearings (2)
O1	Camming Surface	Clutch Cam Disc
O1	Bearing Surface	Function Clutch Drum
O2	Bearing Surfaces	Ball Bearings (2)
G	Teeth	Gears

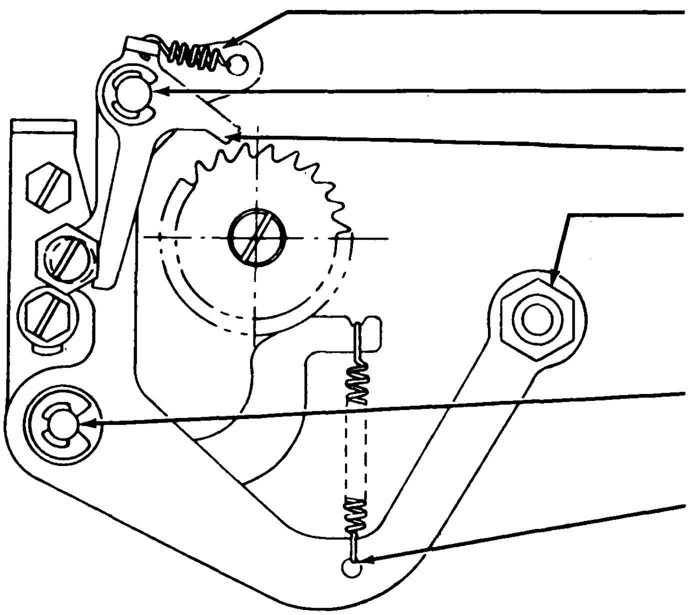
2.24 Tape Depressor Mechanism



O2	Pivot Points	Tape Depressor
G		
O2	Roller Surface	Drive Roller
G		

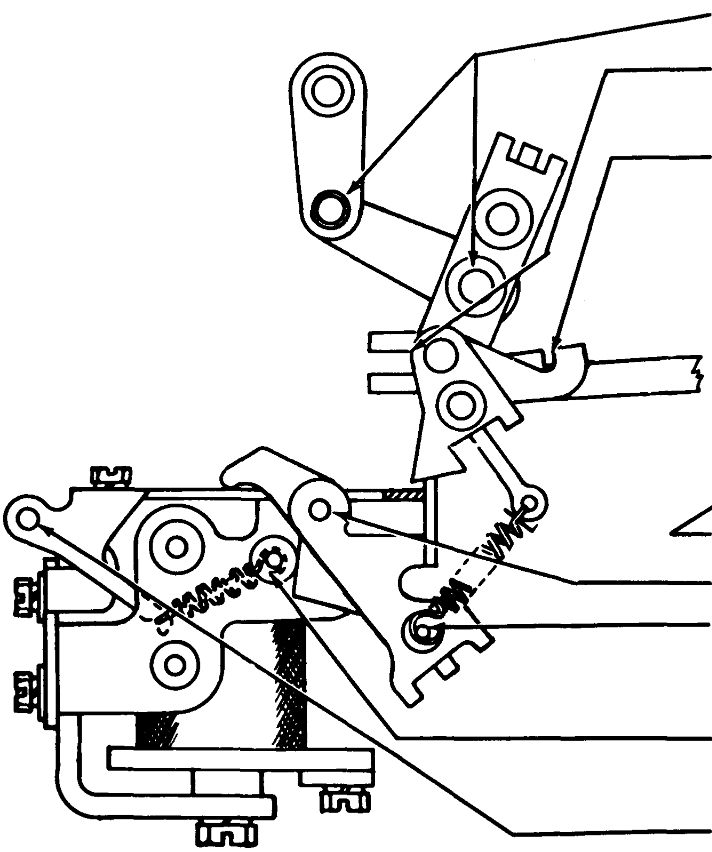
3. VARIABLE FEATURES

3.01 Manual Backspace Mechanism



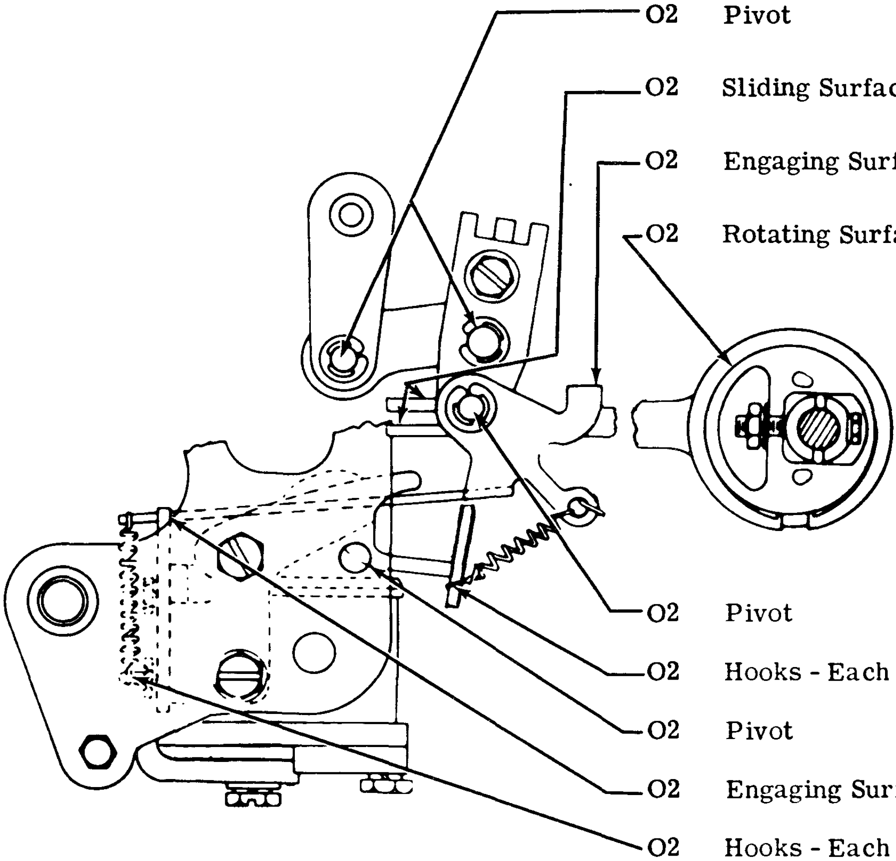
O2	Hooks - Each End	Backspace Pawl Spring
O2	Bearing Surface	Backspace Pawl
G	Feeding Surface	Backspace Pawl
O2	Bearing Surface	Nut, Shoulder
O2	Bearing Surface	Bellcrank
O2	Hooks - Each End	Bellcrank Spring

3.02 Power Drive Backspace Mechanism (Early Design)

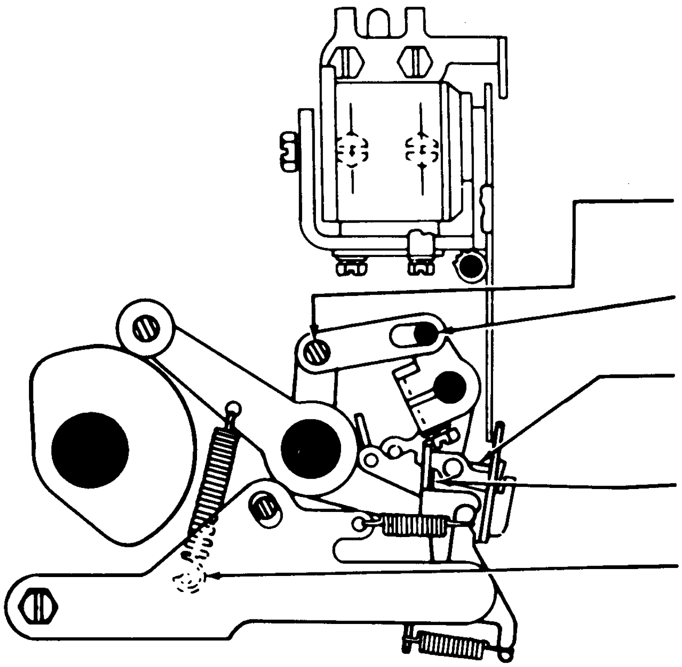


O2	Bearing Surface	Link
O2	Sliding Surface	Eccentric Drive Link Fork
O2	Engaging Surface	Latch
O2	Rotating Surface	Eccentric
O2	Bearing Surface	Arm
O2	Hooks - Each End	Armature Latch Spring
O2	Hooks - Each End	Armature Bail Spring
O2	Bearing Surface	Armature Bail

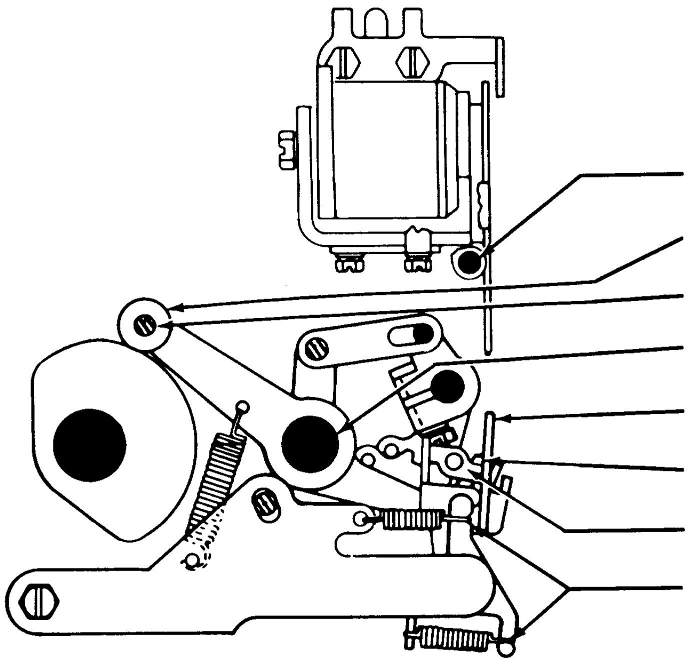
3.03 Power Drive Backspace Mechanism (Latest Design)



3.04 Remote Control Noninterfering Rubout Tape Feed-Out Mechanism

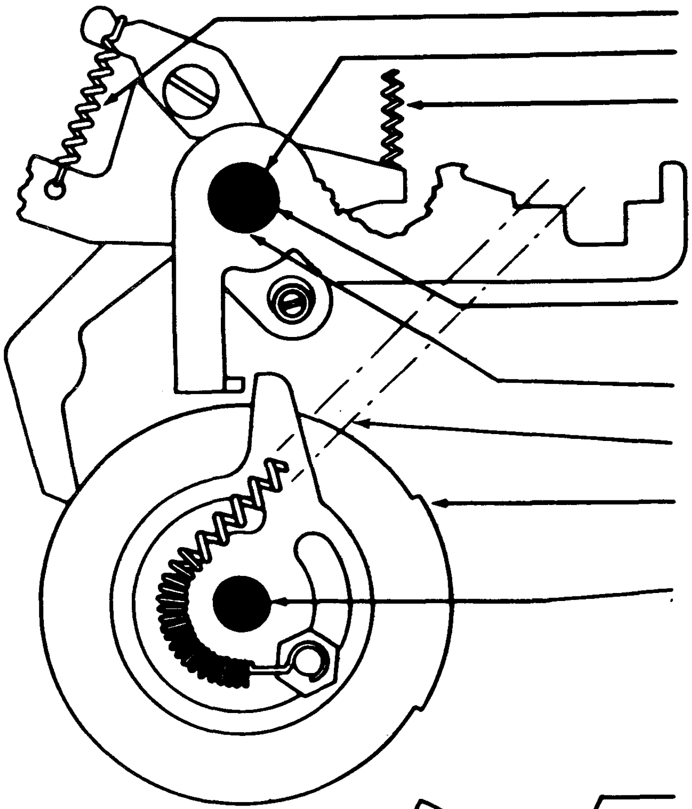


O2	Pivot Point	Drive Link
O2	Slide Surface	Drive Link
G	Contact Point	Release Lever
G	Contact Point	Latchlever
O2	Hooks - Each End	Spring

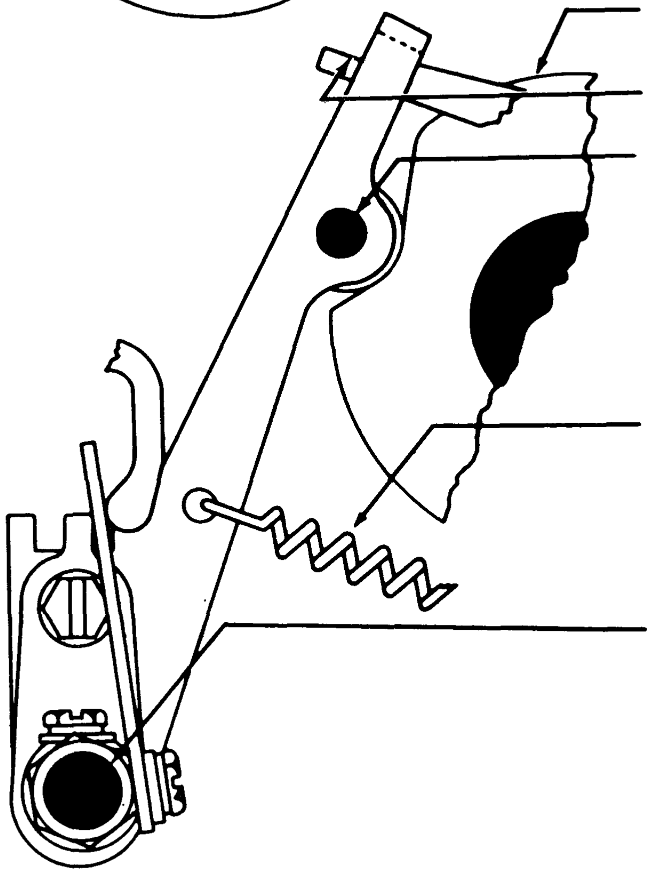


O2	Pivot Point	Armature Hinge
O2	Roller Surface	Drive Bail Roller
O2	Pivot Point	Drive Bail Roller
O2	Pivot Point	Drive Bail
G	Contact Point	Blocking Bail
G	Contact Point	Drive Bail
G	Contact Point	Blocking Latch
O1	Hooks - Each End (2)	Spring

3.05 Remote Control Noninterfering Rubout Tape Feed-Out Mechanism (continued)

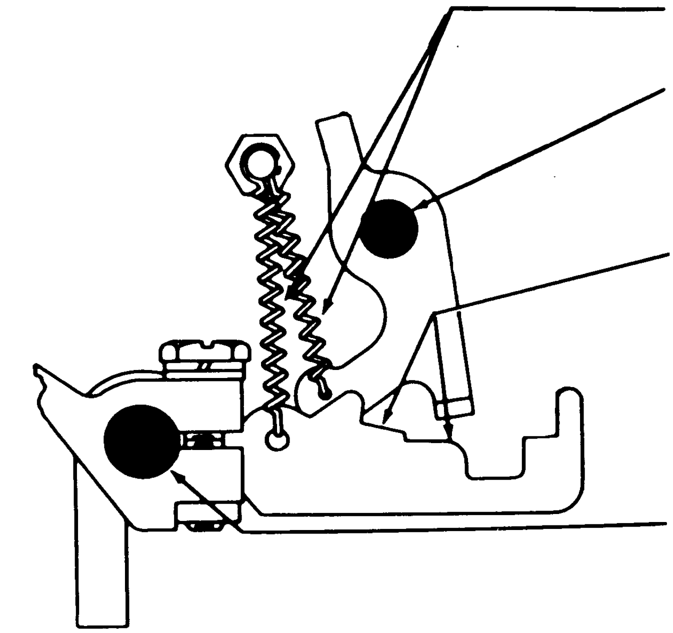


O1	Hooks - Each End	Spring
O2	Bearing Surface	Release Arm
O1	Hooks - Each End	Spring
O2	Bearing Surfaces (2)	Latchlever
O2	Bearing Surface	Time Delay Lever
O1	Hooks - Each End	Spring
G	Camming Surface	Time Delay Cam
O2	Bearing Surface	Time Delay Cam

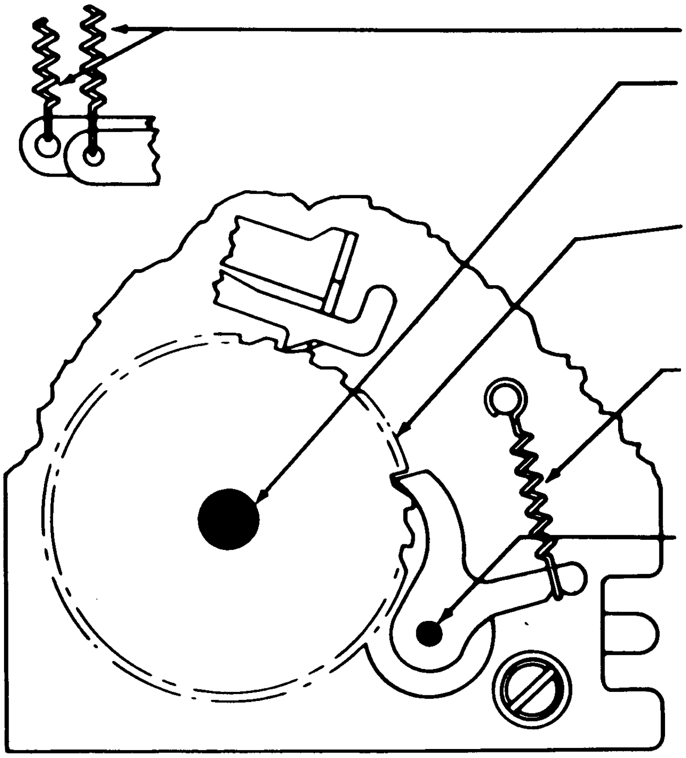


O2	Camming Surface	Drive Cam
O1	Contact Surface	Release Arm
O2	Bearing Surface	Roller
O1	Hooks - Each End	Spring
O2	Bearing Surfaces	Bearings (Front and Rear)

3.06 Remote Control Noninterfering Rubout Tape Feed-Out Mechanism (continued)

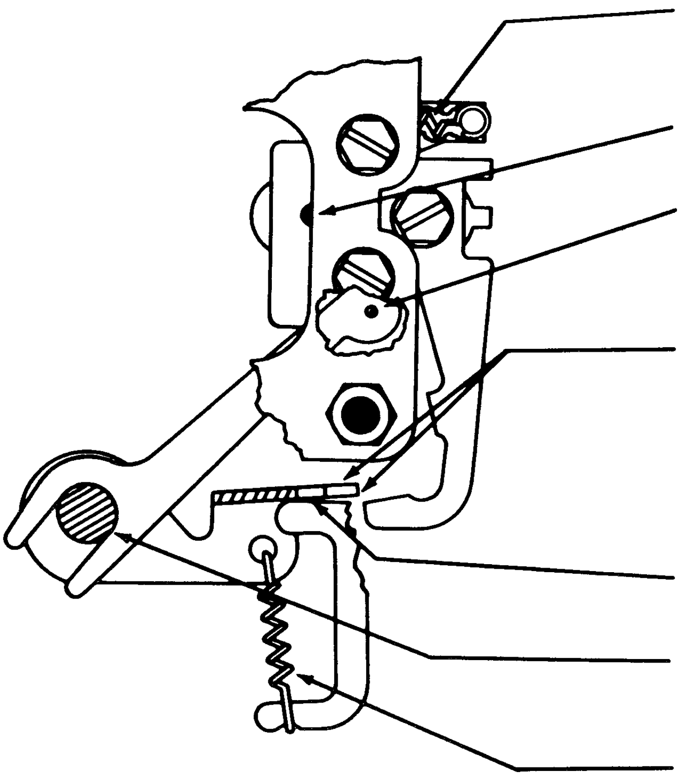


O1	Hooks - Each End	Springs (3)
O2	Bearing Surface	Release Lever
G	Contact Surfaces (2)	Latchlever
O2	Bearing Surfaces (2)	Reset Cam Follower

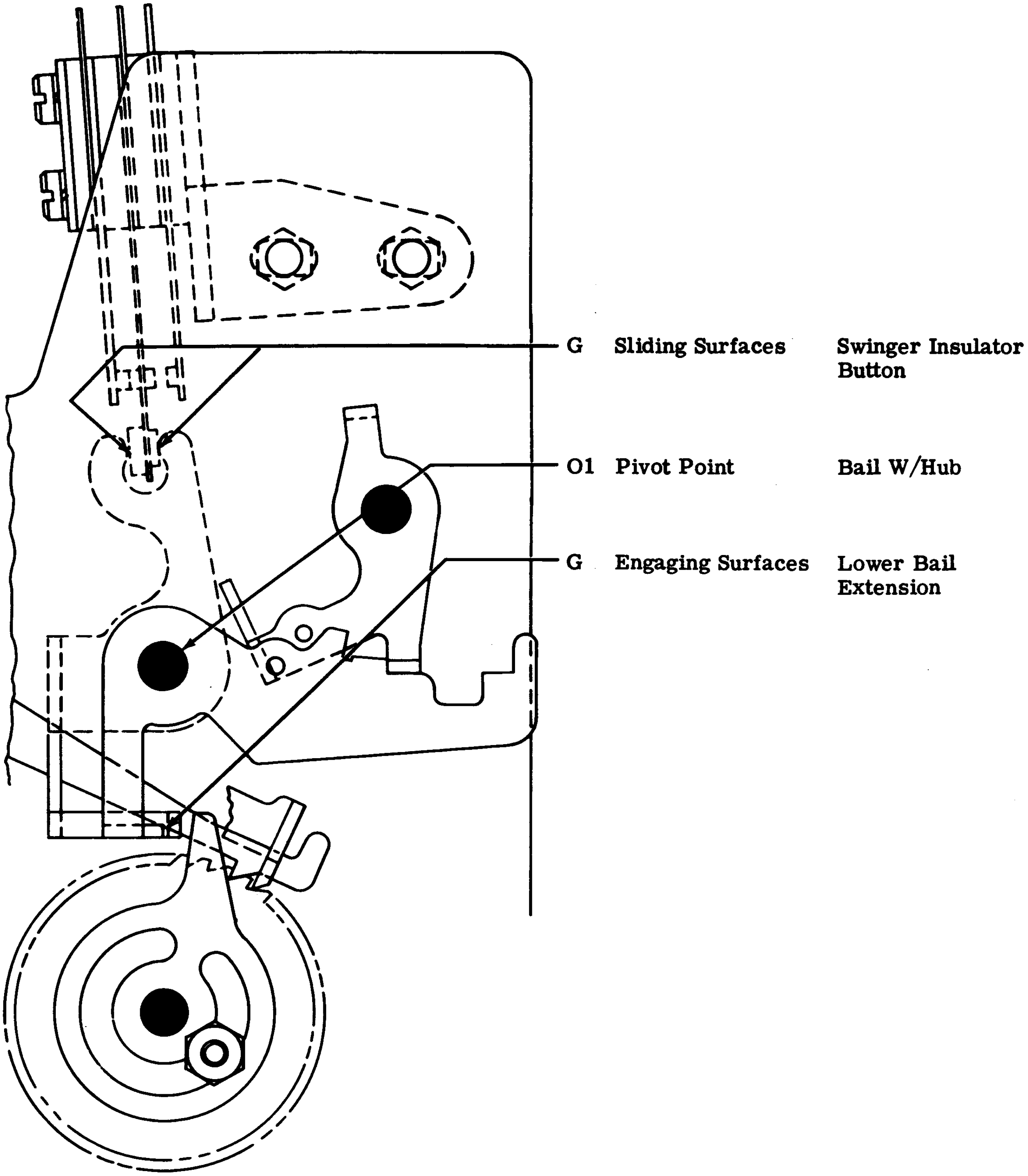


O1	Hooks - Each End	Springs (2)
O2	Bearing Surfaces (Place between Ratchets)	Ratchets (2)
G	Teeth	Ratchets (2)
O1	Hooks - Each End	Spring
O1	Pivot Point	Rear Check Pawl

3.07 Remote Control Noninterfering Rubout Tape Feed-Out Mechanism (continued)



3.08 Remote Control Noninterfering Rubout Tape Feed-Out Mechanism (continued)



35 TYPING REPERFORATOR (LPR)

DISASSEMBLY AND REASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 This section provides disassembly and reassembly for the 35 typing reperforator unit (Figures 1 and 2). It is revised to include recent engineering changes, additions, and to rearrange the text. Since this is an extensive revision, marginal arrows ordinarily used to indicate changes have been omitted.

CAUTION: REMOVE POWER FROM SET OR UNIT BEFORE STARTING ANY DISASSEMBLY PROCEDURES.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication, and adjustments can be accomplished simply by removing the subject component from the cabinet. If possible, disassembly should be confined to subassemblies, which can, in some cases, be removed without disturbing adjustments. When reassembling the subassemblies, be sure to check all associated adjustments, clearances and spring tensions.

1.04 If a part that is mounted on shims is removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted.

1.05 Retaining rings are made of spring steel and have a tendency to release suddenly when being removed. Loss of these retainers can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.06 Avoid loss of springs in disassembly by holding one spring loop with the left hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.07 Lift upward on the reperforator cover and remove it.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a subassembly from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

2.02 Unplug the connecting cable at the rear of the unit. Remove the screw, lockwasher, and washer which secure the TP170199 anchor bracket to the base plate. Remove the three casting mounting screws, lockwashers, washers, and belt. Remove the typing reperforator from the base.

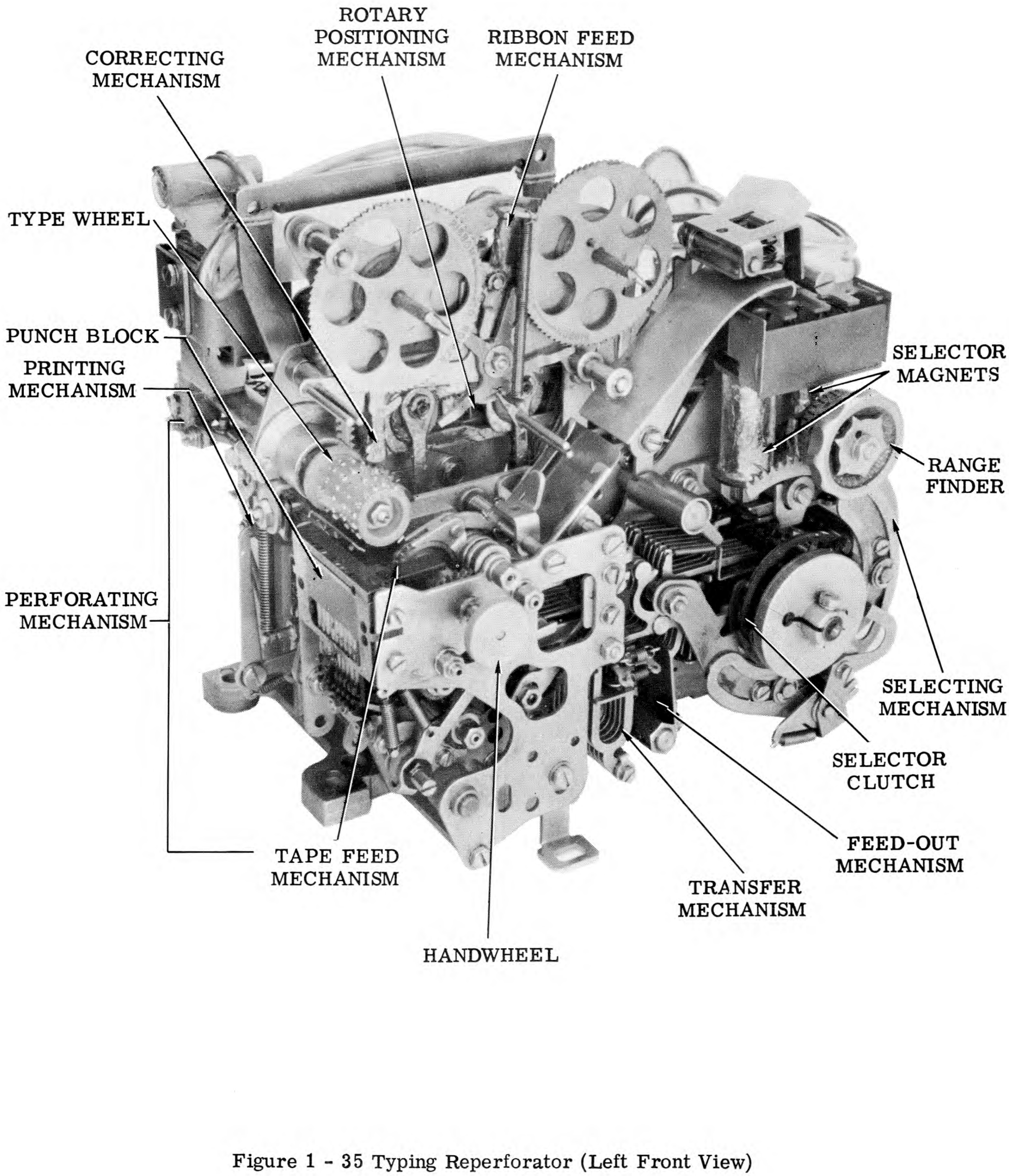


Figure 1 - 35 Typing Reperforator (Left Front View)

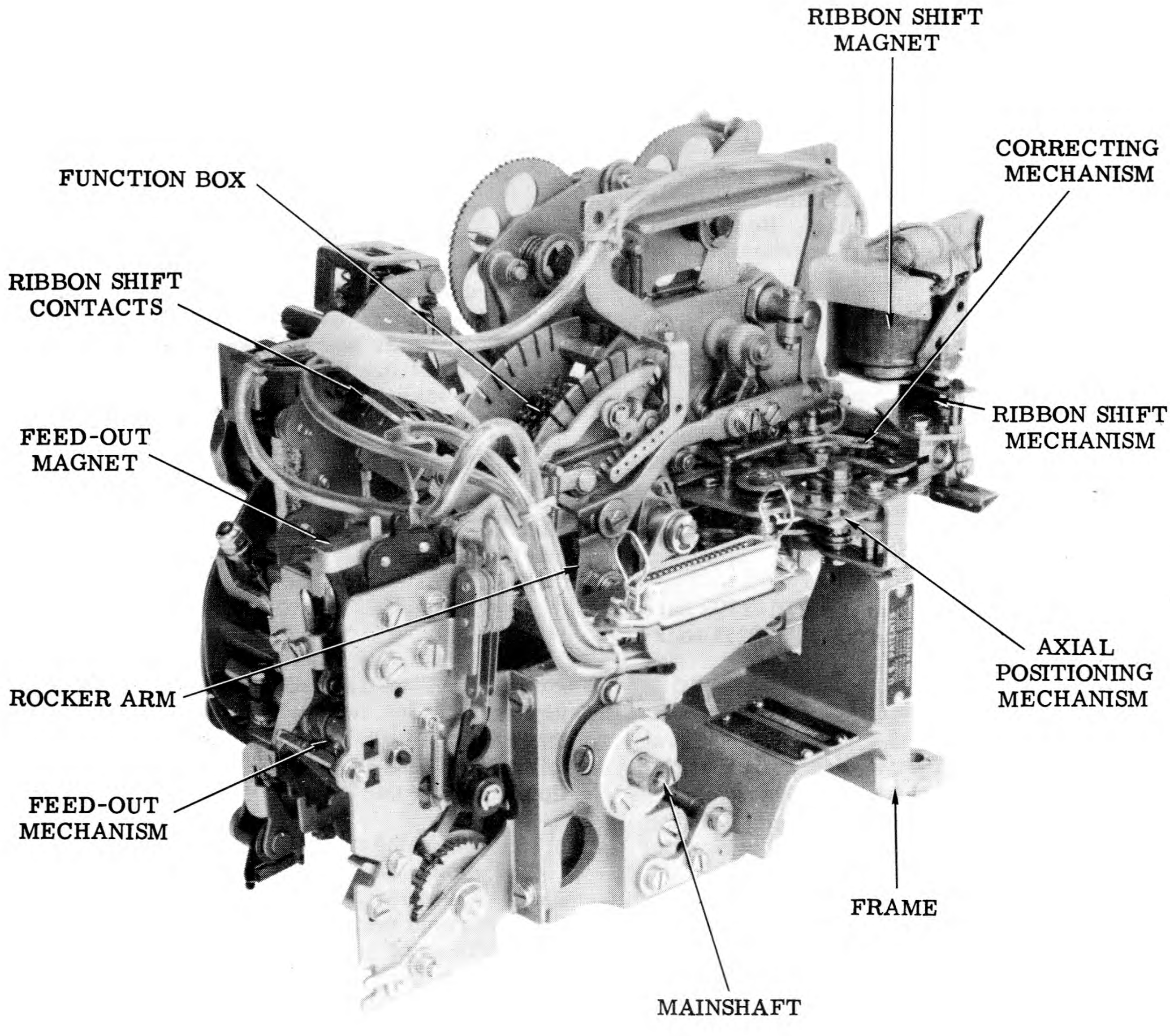


Figure 2 - 35 Typing Reperforator (Left Rear View)

SELECTOR MECHANISM

2.03 Remove the screw, nut, and lockwasher that secure the selector clutch drum to the mainshaft. Place the TP170238 reset bail in its raised position. Hold the TP170198 stop lever and the TP170236 marking locklever out of the way while slowly pulling forward on the cam-clutch until it is removed.

2.04 Unhook the spring on the TP150355 function clutch latchlever. Remove the TP156472 spring post by removing its locknut and lockwasher. Remove the screw and lock-washer that secure the TP170234 selector lever guide bracket to the selector plate. Remove the oil wick holder. The selector mechanism can now be taken off.

RIBBON FEED MECHANISM

2.05 Remove the ribbon. Remove the two mounting screws that mount the ribbon feed mechanism plate. Remove the ribbon feed mechanism.

PERFORATOR MECHANISM

2.06 Remove spring from the TP192709 perforator drive link and the TP170211 rocker arm.

2.07 Remove the TP159621 pivot screw with lockwasher from the TP159622 perforator adjusting clamp. Remove the TP151631 and TP151632 mounting screws (with lockwashers and flat washers) that fasten the TP156024 rear plate to the main plate. Remove the perforator mechanism.

2.08 To remount the perforator mechanism, reverse the procedure used to remove it. Make certain that the TP194162 reset bail fits in the fork of the TP193878 reset bail trip lever and that the TP173756 print hammer fits in its slot in the perforator mechanism.

TRANSFER MECHANISM

2.09 Remove the TP151736 main trip lever spring. Remove the TP151631 and TP151632 mounting screws (with lockwashers and flat washers) from the TP192820 transfer mounting bracket. Remove the transfer mechanism.

TYPING MECHANISM

2.10 To remove typing mechanism, remove the TP156872 operating blade from the rocker bail assembly by removing its two mounting screws with lockwashers, flat washers, and shims. Remove the retaining ring and disconnect the TP159512 printing trip link. Remove the nut, lockwasher, and flat washer from the TP156396 eccentric on the TP162350 rocker bail, and disconnect the TP159526 oscillating drive link. Remove TP154638 spring from the TP173981 accelerator and the spring from the TP192832 or TP320285 lifter.

2.11 Remove screw with lockwasher that fastens the TP195215 lifter plate to the bar on the frame. Remove the screw with lockwasher that secures the TP159525 axial bracket to the post on the frame. Remove the TP151631 screw (with lockwasher and flat washer) that fastens the TP192829 function box front plate to the TP192828 main plate. Remove the TP119653 retaining ring from the TP159659 idler gear eccentric shaft. Remove the eccentric shaft, TP159536 idler gear, TP151629 special nut and lockwasher by removing the TP159658 mounting screw. Remove the three TP151631 screws (with lockwashers and flat washers) that secure the TP192831 front plate to the frame. Remove the typing mechanism from the frame.

2.12 To remove function box mechanism, remove the TP151631 mounting screw (with lockwasher and two flat washers) that passes through the TP192844 function box rear plate into the TP192831 front plate. Remove the function box from the typing mechanism.

2.13 To remove axial plate assembly, remove the TP3870 correcting drive link spring. Remove the TP156413 correcting drive link by removing the retaining ring from the TP156378 axial correcting plate. Remove the retaining ring and disconnect the TP192883 ribbon guide from the TP192882 ribbon oscillating lever.

2.14 Remove the three mounting screws and lockwashers from the TP159525 axial plate. Remove the axial plate assembly.

2.15 To remount the axial plate assembly, reverse the procedure used to remove it. The rearmost tooth of the rack on the TP173775 type wheel shaft must mesh with the rearmost tooth space in the TP156294 axial sector, and the forward tooth space on the shaft: there is an extra tooth space on the forward portion of the shaft rack.

2.16 After the function box mechanism and axial plate assembly have been removed, the remainder of the typing mechanism is the front plate assembly.

2.17 To remove pushbars after removing the typing mechanism, remove the function box mechanism from the typing mechanism. Remove the pushbar by disengaging the pushbar rack from its associated pinion.

2.18 The correct gear tooth engagement of racks for pushbars 1 through 5 is as follows: In assembling the pushbars to the various eccentric assemblies, great care must be exercised to assure the correct rack-pinion gear mesh. The correct mesh is such that the first tooth on the pinion and the first tooth space on the rack are meshed. On later units this is identified by a mark on the pushbar and a mark on the eccentric. The last tooth on the pinion and the last tooth space on the rack should therefore also mesh.

CAUTION: MISALIGNMENT OF THE MESH BY AS LITTLE AS ONE TOOTH WILL PRODUCE A JAM IN THE MACHINE AND CAUSE PART BREAKAGE IF THE MACHINE IS PUT UNDER POWER WHILE THIS CONDITION EXISTS.

ROCKER BAIL ASSEMBLY

2.19 Disconnect the TP156937 printing drive link by removing the retaining ring at its left end. Remove the TP3598 nut, lockwasher, flat washer, felt washer, bushing, and TP151632 screw from the TP156871 operating blade mounting bail.

2.20 Remove the nut, lockwasher and adjusting lever guide TP156921, and remove the rocker bail shaft TP156366. Remove the rocker bail.

MAINSHAFT ASSEMBLY

2.21 Remove the spring from the function clutch latchlever. Remove the retaining ring, spring washer, and flat washers from the forward end of the TP170201 mainshaft.

2.22 Remove the screw and lockwasher from the TP150000 function clutch drum. Remove the screw and lockwasher from the collar TP173340. Remove the screw and lockwasher from the TP158745 bearing clamp.

2.23 Pull mainshaft out of rear of unit removing the cam-clutch and collar.

CAUTION: NOTE THE LOCATION OF MAINSHAFT NEEDLE ROLLER BEARINGS AS SHOWN ON ILLUSTRATIONS OF PARTS IN APPROPRIATE SECTION. MOVE MAINSHAFT TOWARD REAR OF UNIT A SMALL AMOUNT AT A TIME AND EXERCISE CARE NOT TO DROP OR CONTAMINATE THE 20 NEEDLE ROLLERS IN EACH RACE. A SMALL SPRING MAY BE STRETCHED AROUND THE SHAFT AND ROLLERS WITH THE ENDS OF THE SPRINGS HOOKED TOGETHER. THE GARTER SPRING WILL HOLD ROLLERS IN PLACE. WHEN REPLACING MAINSHAFT, MAKE SURE THE ROLLERS ARE CLEAN. LUBRICATE RACE BEARINGS WITH OIL (KS7470). APPLY A LIBERAL AMOUNT OF OIL AT EACH END OF BEARING SLEEVE.

Note: When the mainshaft is inserted in the cam-clutch, hold the latter firmly so that the drum is not pushed off the clutch. Compress the drum and cam disc together so that holes in the drum and clutch bearings are aligned.

28 AND 35 ANSWER-BACK UNIT

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. DESCRIPTION

1.01 This section is reissued to add coverage of the 5- and 8-level answer-back unit. Since this reissue is of a general nature, marginal arrows have been omitted.

1.02 The answer-back unit is an electromechanical device designed to transmit a predetermined message of not more than 21 characters. The desired message is precoded on the answer-back drum and is transmitted upon receipt of a request signal. The operational speed of the unit may be fixed at 60, 66, 75, or 100 words per minute by installing the proper gear set.

1.03 It may be mounted, with or without a cover, on any flat surface or on a cabinet, rack, or shelf (Figures 1 and 2). Although it is ordinarily used in conjunction with other teletypewriter equipment, it is mechanically independent of any other equipment. Only electrical connections for power and control circuits are required. In addition, the answer-back mechanism (Figures 3 and 4) may be mounted in a 35 Automatic Send-Receive (ASR), Keyboard Send-Receive (KSR), or Receive-Only (RO) Teletypewriter Set.

1.04 Variations of the answer-back unit are available for distributing either a 5-level, 7.42, or 7.5 unit code or an 8-level, 11.0 unit code. The 5-level answer-back unit has provisions in the code drum, contact wires, and internal wiring for adapting the answer-back mechanism to an 8-level code. Conversion can be accomplished by changing the distributor disc and making the proper wiring connections.

1.05 Mounting facilities, relay pull-up contacts, and internal wiring are included with the answer-back mechanism for field installation of a nonrepeat relay. The nonrepeat relay is utilized in cases where the duration of the trip pulse is longer than the answer-back cycle. The nonrepeat relay de-energizes the trip magnet at the instant the motor hold and relay pull-up contacts are closed.

1.06 The answer-back unit consists of the cover, base, answer-back mechanism motor, terminal block, fuse, fuse-holder, and capacitor.

COVER

1.07 The cover is sprayed on the inner surface with vibration damping material. In addition, pads are attached to the inner surface for absorbing noise from the operating mechanism. The left end of the cover is louvered to admit air for reducing the operating temperature of the unit.

BASE

1.08 The base provides mounting facilities for the terminal block, fuse, fuse-holder, capacitor, motor, answer-back mechanism, and cover. A pad is attached to the underside of

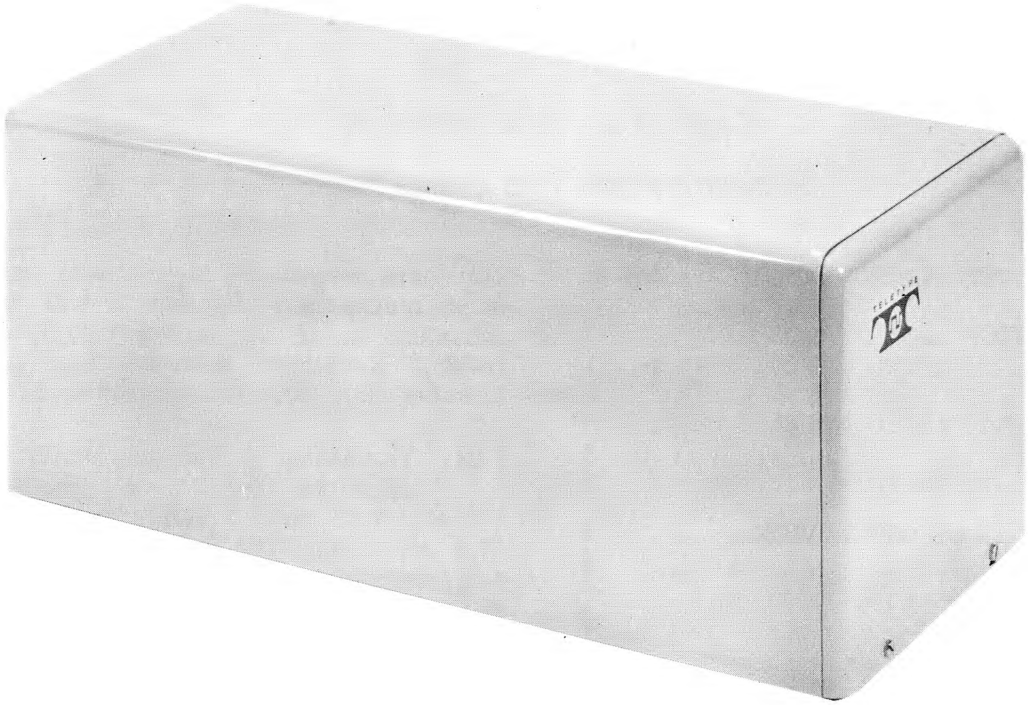


Figure 1 - Answer-Back Unit (With Cover)

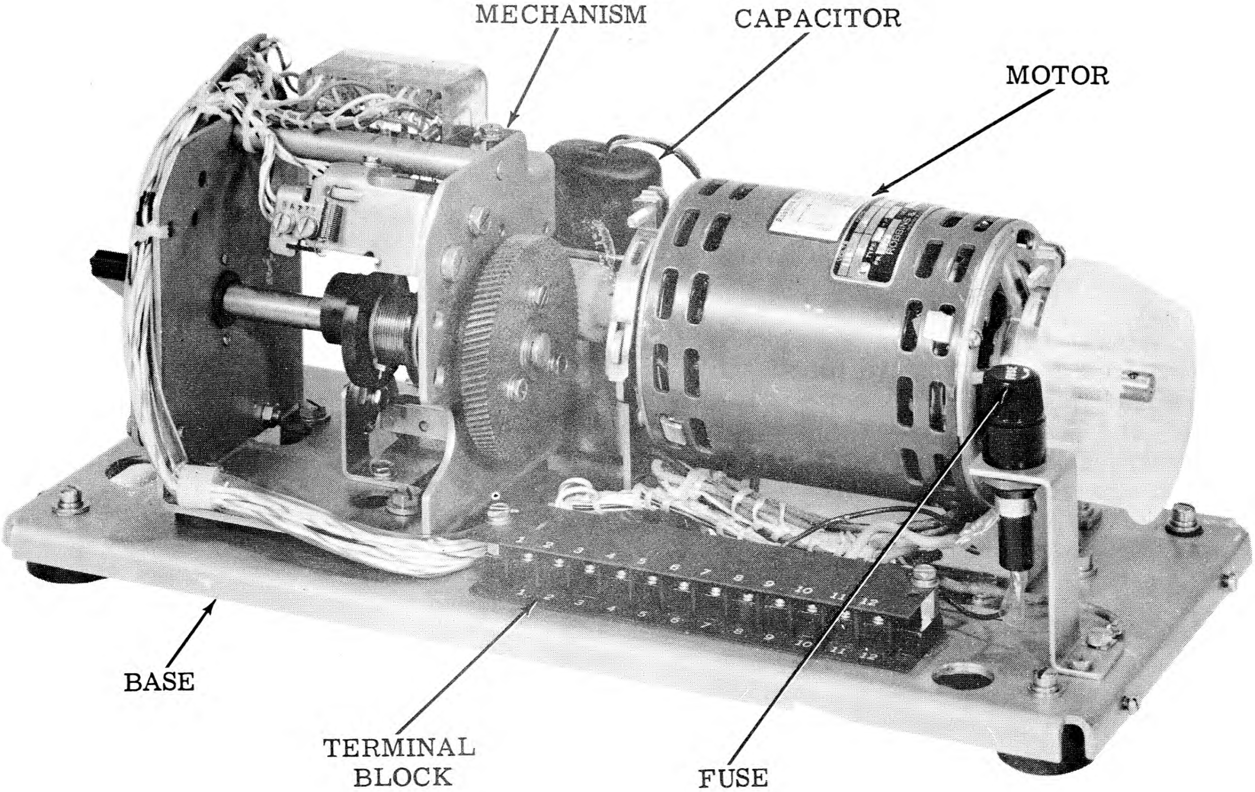


Figure 2 - Answer-Back Unit (Without Cover)

the base to reduce vibration. Four rubber feet support the base.

1.09 The internal wiring harness is attached to the terminal block for external signal, control, and power connections. The block has 12 terminals.

ANSWER-BACK MECHANISM

1.10 The answer-back mechanism may be mounted in the answer-back unit, or a 35 ASR, KSR, or RO Teletypewriter Set. The basic answer-back mechanism shown in Figures 3 and 4, consists of the following parts or subassemblies: trip magnet, code drum, main shaft, feed assembly, contact block, and distributor. The subassemblies are interconnected mechanically and/or electrically to perform all functions incidental to automatic message transmission. In addition, a double set of electrical contacts is provided for motor hold and relay pull-up operations. The motor hold contacts are required for applications where intermittent operation of the motor is both possible and desirable. The relay pull-up contacts apply to the application discussed in Paragraph 1.05.

MOTOR

1.11 A synchronous motor, rated at 1/100 hp and 1800 rpm for 115 $\pm$ 10 per cent volts ac operation, is used to drive the answer-back mechanism. The motor is equipped with two windings, a run winding and a capacitor winding for permanent split-phase capacitor operation. The capacitor is encased in metal and has a paper and oil dielectric. A time delay fuse is provided to open the power circuit if the motor is stalled.

GENERAL OPERATION

1.12 Briefly, the parts or subassemblies are interconnected to perform the following functions. An incoming pulse energizes the trip magnet whose armature is deflected to free the code drum, permit the clutch to engage the main shaft, and close a set of contacts. With the main shaft in rotation, the code drum is advanced to the first character position by the feed assembly. The individual contact wires for each code level are automatically set by the precoded character on the answer-back drum. Selected contact wires (marking) touch the common terminal on the contact block for subsequent translation into serial code. Signal power from the terminal block is applied to

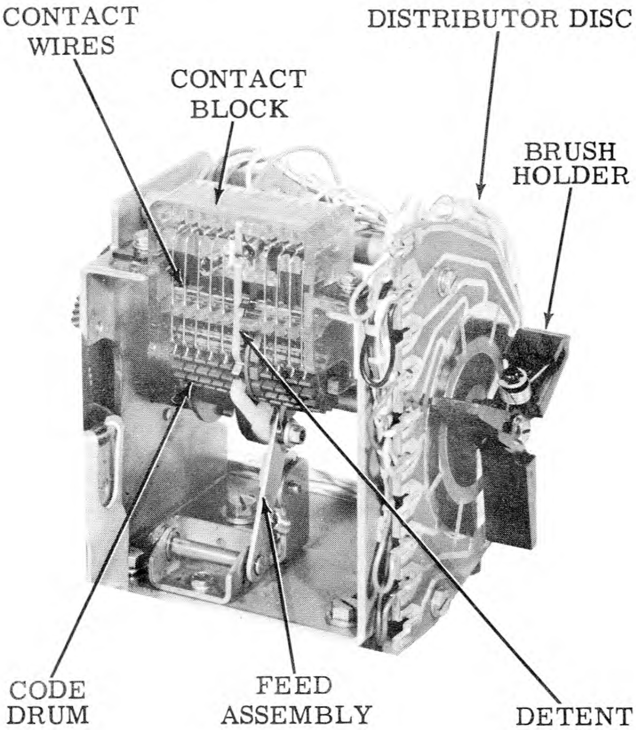


Figure 3 - Answer-Back Mechanism (Rear View)

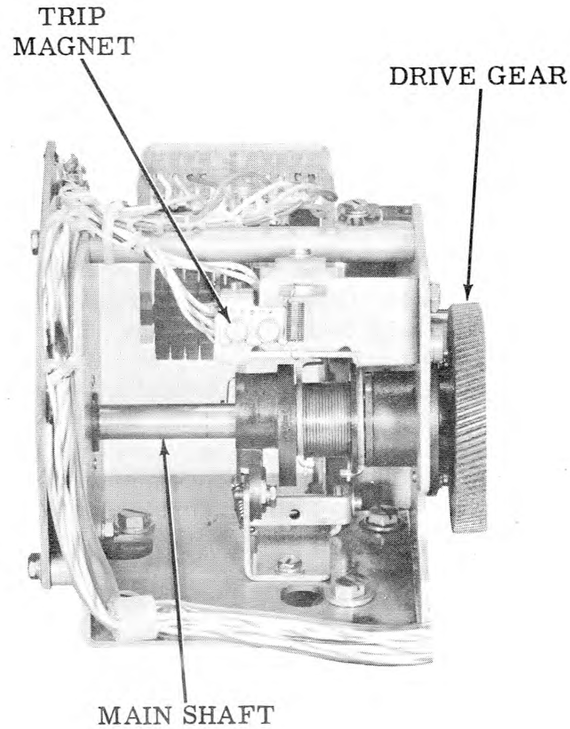


Figure 4 - Answer-Back Mechanism (Front View)

each code level on the contact block through the solid ring on the distributor disc. Each contact wire is sensed as the outer brush on the distributor sweeps its respective distributor segment. All operations necessary for one character transmission, are performed during a single rotation of the main shaft.

1.13 Viewing the code drum with the greater number of radial code tines to the left, there are six numbered (code) levels, feed ratchet, stop control cam, suppression level, and three numbered (code) levels.

1.14 The code drum is designed to function with systems employing 5- or 8-level signal codes. It has 21 rows of code tines and may be coded for one, two, or three cycle operation with message lengths not exceeding 21, 10, and 7 characters, respectively. For applications where the first character is suppressed, the message length is necessarily reduced by one character. The text of the message is further reduced by the number of functions which are peculiar to each system application.

1.15 The contact block, secured to the top rear of the main mounting bracket, contains nine contact wires with provisions for individual cable connections. The common terminal for selected contact wires is located approximately midway between the top and bottom of the contact wires. The detent for limiting the code drum advance to single steps is attached to the contact block.

1.16 The distributor includes a printed circuit with two conducting rings, and a brush holder with two brushes. One conducting ring is solid for applying current. The other ring is segmented with a conducting lead from each segment. The brush holder is fastened to the main shaft. It contains two carbon brushes which are held in place and connected to each other by a spring. One brush rides the solid ring and the other rides the segmented ring.

2. PRINCIPLES OF OPERATION

2.01 The answer-back unit is a self-contained electromechanical device, used for the transmission of a precoded message. The answer-back cycle is actuated when the unit is pulsed by an external request signal.

2.02 Electrical cabling which provides all wiring paths for the power, control, and signal lines is attached to the terminal block on the unit. Mechanical motion for the answer-back mechanism is transmitted through a set of speed change gears. The transmitting speed is determined by the speed change gears. Gear sets are available for operating the answer-back unit at 60, 66, 75, or 100 words per minute. When the motor is running, the answer-back mechanism is held in an idle condition by the disengaged spring clutch on the main shaft.

2.03 The base, fuse, capacitor, and cover are passive components. However, the answer-back mechanism is the principle electromechanical component and is discussed in greater detail in the following paragraphs.

2.04 The answer-back mechanism consists of a trip magnet, main shaft, feed assembly, code drum, contact block, and distributor. An incoming pulse energizes the trip magnet whose armature is deflected to free the code drum, permit the clutch to engage the main shaft, and close a set of contacts. With the main shaft in rotation, the code drum is advanced to the first character position by the feed assembly. The individual contact wires for each code level are automatically set by the precoded character on the code drum. Selected contact wires (marking) touch the common terminal on the contact block for subsequent translation into serial code. Signal power from the terminal block is applied to each code level on the contact block through the solid ring on the distributor disc. Each contact wire is sensed as the outer brush on the distributor sweeps its respective distributor segment. All operations necessary for one character transmission are performed during a single rotation of the main shaft.

TRIP MAGNET

2.05 The trip magnet is attached to the main mounting bracket of the answer-back mechanism as shown in Figure 5. The trip magnet consists of a yoke, magnet core, armature with spring, and electrical contact pile-up. The armature is held away from the magnet core by a spring connecting the rear edge of the armature to the yoke.

2.06 When an incoming pulse energizes the magnet, the attracted armature allows three simultaneous actions to take place. The

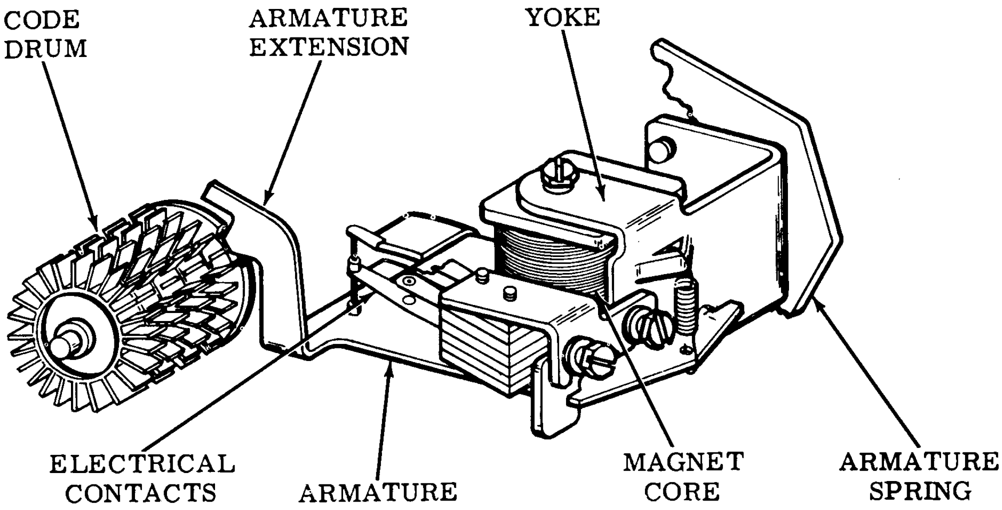


Figure 5 - Trip Magnet

armature extension is extracted from the code drum stop cam; the front edge of the armature permits the clutch release and shaft stop levers to engage the clutch; and the top face of the armature closes a set of electrical contacts. After the incoming pulse has diminished, the armature is physically supported by either mechanical elements on the main shaft or the stop cam on the code drum.

2.07 If the energizing pulse terminates before the code drum is advanced, the released clutch lever supports the armature. The feed takes place within 35 degrees rotation of the main shaft. Then the high part of the code drum stop cam supports the armature extension. When the last character to be distributed appears on the code drum, the motor hold cam, mounted on the main shaft, supports the bottom face of the armature. After distribution of the last character, the motor hold cam allows the armature to fall; the armature extension drops into the opening of the code drum stop cam. As the main shaft continues to rotate, the clutch release lever engages the front edge of the armature, releasing the clutch. Approximately 30 degrees later, the shaft stop lever is engaged to stop the main shaft in a predetermined position.

MAIN SHAFT

2.08 The main shaft delivers rotational motion for advancing the code drum by means of the feed assembly. It also provides rotational motion for distributing the parallel coded inputs from the contact block. The major elements on the main shaft are the drive gear, spring clutch, and motor hold and feed cam. The distributor brush holder is fastened to the opposite end of the main shaft. The drive end of the main shaft is shown in Figure 6.

SPRING CLUTCH

2.09 The main shaft is separated from the drive gear and clutch sleeve assembly by the spring clutch. See Figure 7. If the trip magnet armature is in the up or run position, the spring clutch engages the rotating clutch sleeve with the main shaft drum. When the armature falls into the stop position, the clutch release lever is engaged first, releasing the clutch, and approximately 30 degrees later, the shaft stop lever is engaged to stop the main shaft in a predetermined position.

2.10 The spring clutch consists of a clutch sleeve, clutch release lever and clutch release lever bearing, retractile spring, shaft stop lever, and shaft drum. One end of the retractile spring is keyed to the shaft stop lever and the other end is keyed to the clutch release lever. The shaft stop lever is secured to the shaft drum which is keyed to the main shaft. The clutch release lever turns freely on the clutch sleeve by means of the clutch release lever bearing. The gear and clutch sleeve assembly, bearing on the main shaft, extends to a plane midway under the retractile spring. The shaft drum, keyed to the main shaft, extends from the clutch sleeve to the shaft stop lever.

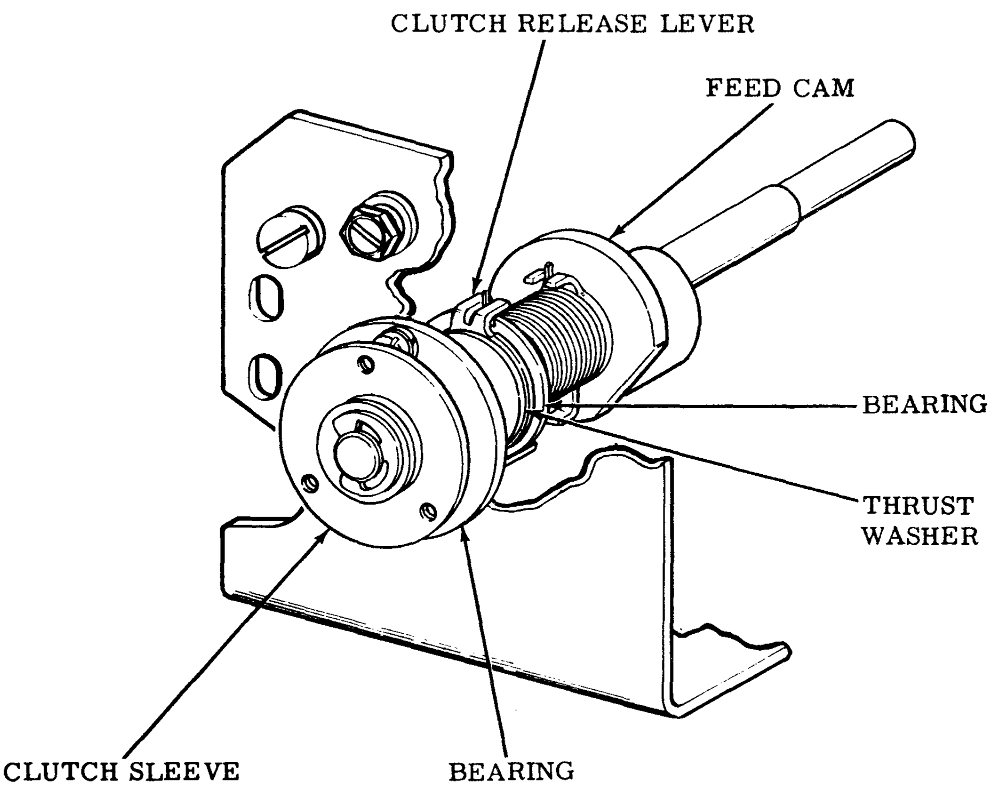


Figure 6 - Main Shaft

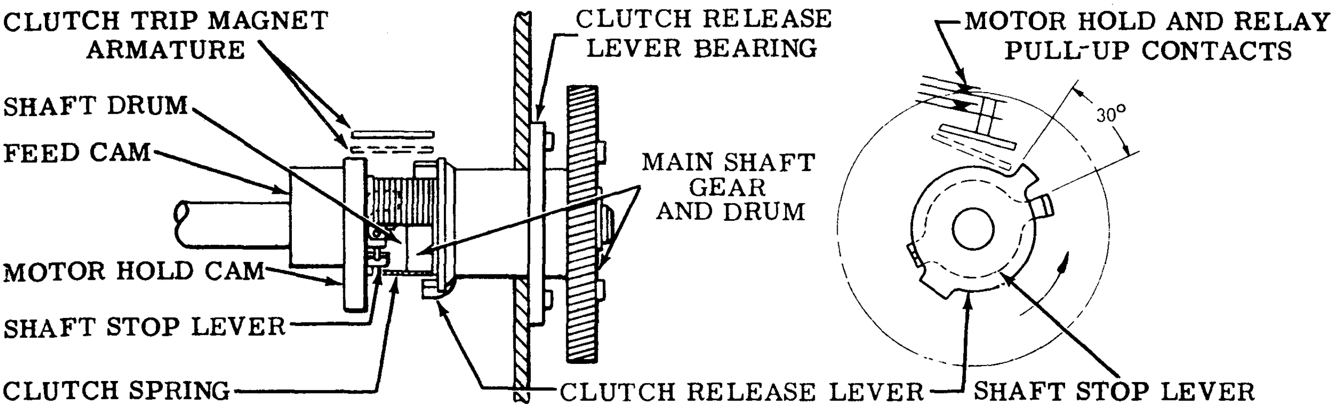


Figure 7 - Spring Clutch

2.11 The retractile spring is mounted over the clutch sleeve and shaft drum with a slight interference fit. When unstressed, the tangs or ends of the spring are approximately 30 degrees apart. As the tangs are forced into alignment, the inside diameter of the spring increases, thereby disengaging the inside surface of the spring from the outside surfaces of the clutch sleeve and shaft drum.

FEED MECHANISM

2.12 The feed mechanism is attached to the base of the main mounting bracket and consists of a feed lever bracket, feed bail, and feed pawl. The mechanism is shown in Figure 8.

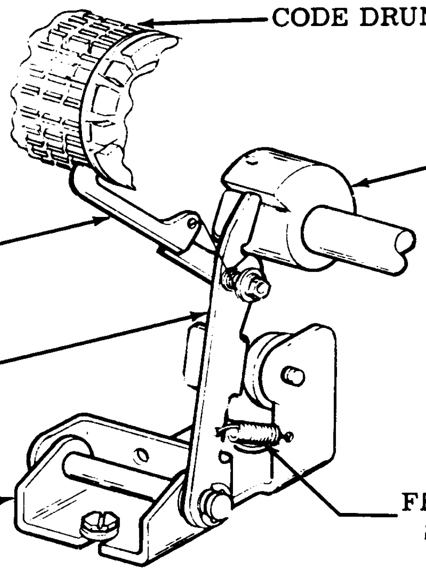


Figure 8 - Feed Mechanism

2.13 At 15 degrees rotation of the main shaft, the feed bail is pulled off the high part of the feed cam by the feed bail spring. Simultaneously, the feed pawl advances the code drum. The code drum is then detented so that the contact wires on the contact block are sensing the first character to be distributed. The feed cycle occurs within an interval of 20 degrees rotation of the main shaft.

CONTACT BLOCK

2.14 The contact block contains nine contact wires with provisions for cable connections, a detent spring, and a common terminal. The code drum is inserted in the slots formed by the contact block extensions. See Figure 3. The common terminal for selected contact wires is located approximately midway between the top and bottom of the contact wires. The contact wires are aligned to follow their respective tines on the code drum.

2.15 Wherever a plastic tine is removed from the code drum, the respective contact wire falls into its slot to meet the common terminal. All effective contact wires representing one coded character, are simultaneously preset at each step of the code drum. Signal current is routed from the terminal block and is sequentially applied to each contact wire through the distributor. The output from the common terminal on the contact block is transmitted over the line as a serial start-stop code.

DISTRIBUTOR

2.16 The distributor consists of a distributor disc and distributor brush holder with brushes. Each effective contact wire on the contact block is connected to its respective segmented level on the distributor disc. The distributor is shown in Figure 3. Signal current is transferred from the inner solid ring to the outer segmented ring through the distributor brushes. The electrical transfer occurs through the torsion spring connecting the set of brushes. The spring serves a double purpose, ie, applies mechanical pressure and provides electrical continuity between the brushes.

3. TECHNICAL DATA

A. Dimensions and Weight

3.01 The external dimensions and weight of the unit are:

(1) Height - 6 inches

(2) Width - 6 inches

(3) Length - 13-1/4 inches

(4) Weight - 13 pounds

B. Transmission Codes

3.02 Data is transmitted by the 5-level answer-back unit in the 7.42 or 7.5 unit code. One start bit, five intelligence bits, and a stop pulse 1.42 or 1.5 bits in length make up the code. The 8-level answer-back unit transmits data in the 11.0 unit code. One start bit, eight intelligence bits, and a stop pulse 2 bits in length make up the code. The 5-level unit may be converted to 8-level operation as previously discussed in Paragraph 1.04.

C. Speeds

3.03 The speed of the answer-back unit is determined by the speed change gears. Gear sets are available in both 5- and 8-level operation for the following speeds shown.

LEVEL	UNIT CODE	SPEED WORDS PER MINUTE	GEAR SET
5	7.42	60 100	TP305047 TP305048
5	7.5	60 66 75 100	TP194808 TP199096 TP194809 TP194815
8	11.0	100	TP194815

D. Electrical Requirements

3.04 Power input to the unit is 110 volts ac ± 10 per cent or 48 volts dc ± 10 per cent. The power input circuit is protected by a (slow-blow) 0.80 ampere fuse. Maximum current draw is 100 amperes with either power source. All power, control, and signal lines terminate in a 12-point screw-type terminal block.

28 AND 35 ANSWER-BACK UNIT

LUBRICATION

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to provide instructions for lubricating the 5- and 8-level answer-back unit. Since this revision is of a general nature, marginal arrows have been omitted.

1.02 The general lubrication areas are illustrated by photographs. The specific points to receive lubricant are indicated on line drawings with appropriate textual instructions. Line drawings and textual instructions follow each photograph and are keyed to the photograph by paragraph numbers.

1.03 The answer-back unit should be lubricated just before placing it in service. After a few weeks of service, relubricate to make certain that all points receive lubrication.

1.04 Thereafter, the answer-back unit should be lubricated after a service period of 1500 hours or 6 months, whichever occurs first.

1.05 Use standard KS7470 oil and KS7471 grease at all locations where the use of oil or grease is indicated. Apply two drops of oil to each motor bearing every four months.

1.06 The unit should be thoroughly lubricated, but overlubrication, which might allow oil to drop or grease to be thrown on other parts should be avoided. The following general instructions supplement the specific lubrication points indicated:

(a) Apply one drop of oil to all spring hooks, except those used on electrical contacts, and the nine distributor block contact (wire contacts) tension springs.

(b) Apply oil to all pivot points, except the stop armature pivot area.

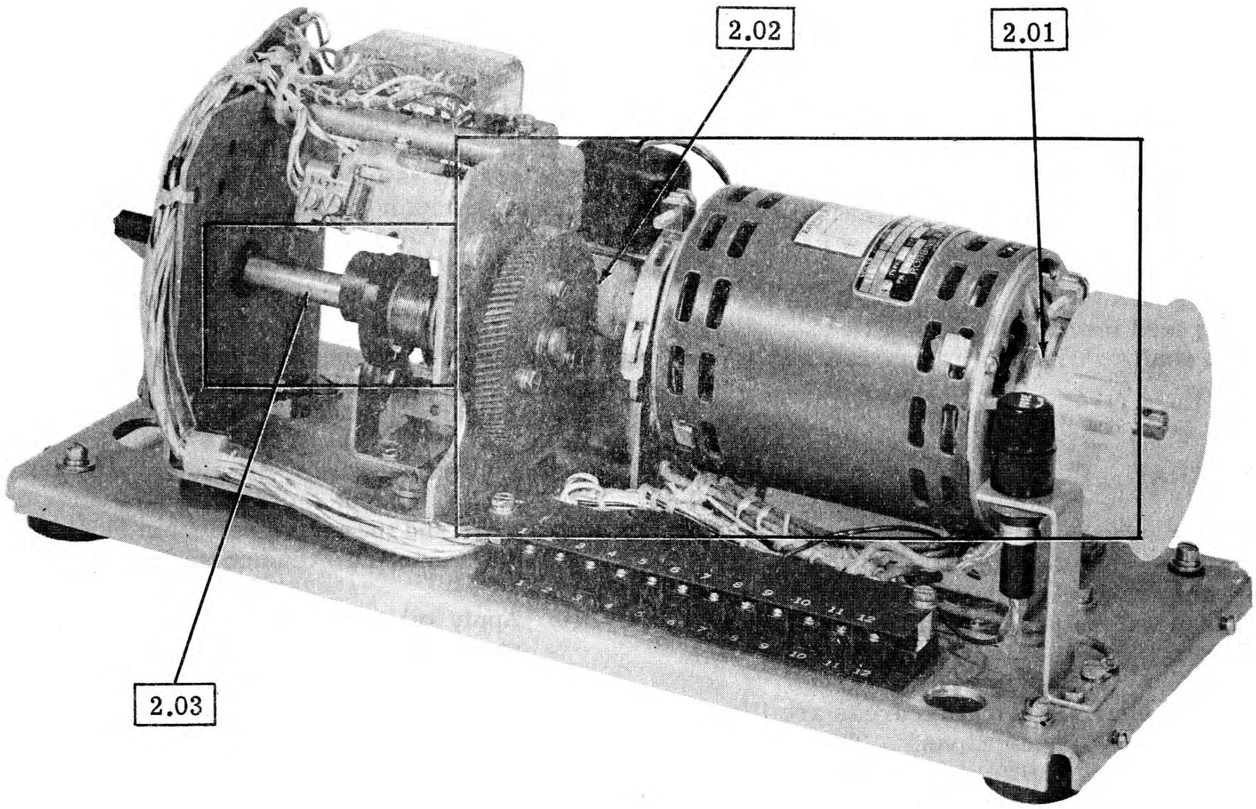
(c) Do not lubricate the distributor brushes and disc surface.

1.07 Exercise special care to prevent oil or grease from getting between the armature and pole piece of the clutch trip magnet. Keep all electrical contacts free from oil or grease.

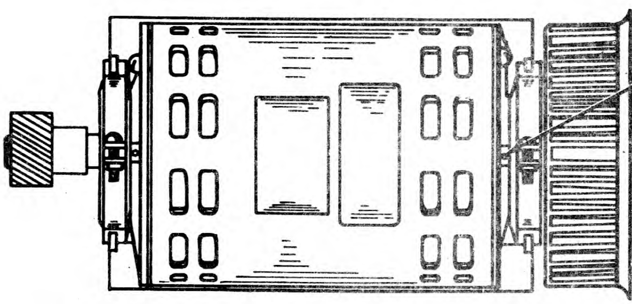
1.08 Specific lubrication requirements and the amount of lubricant are indicated at each lubrication point in accordance with the following code:

01 Apply 1 drop of oil.
02 Apply 2 drops of oil.
03 Apply 3 drops of oil.
G Apply thin film of grease.
SAT. Saturate (felt oilers, washers, wicks) with oil.

2. BASIC UNITS

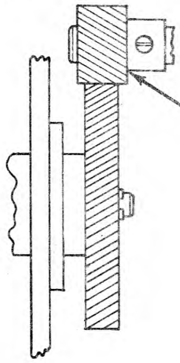


2.01 Motor (Lubricate Every Four Months)



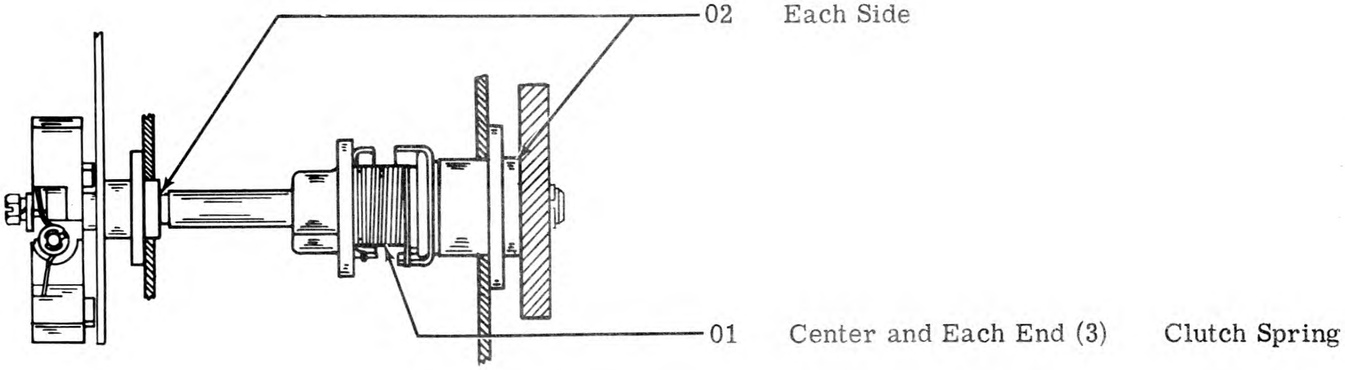
02	Each End	**Bearings**

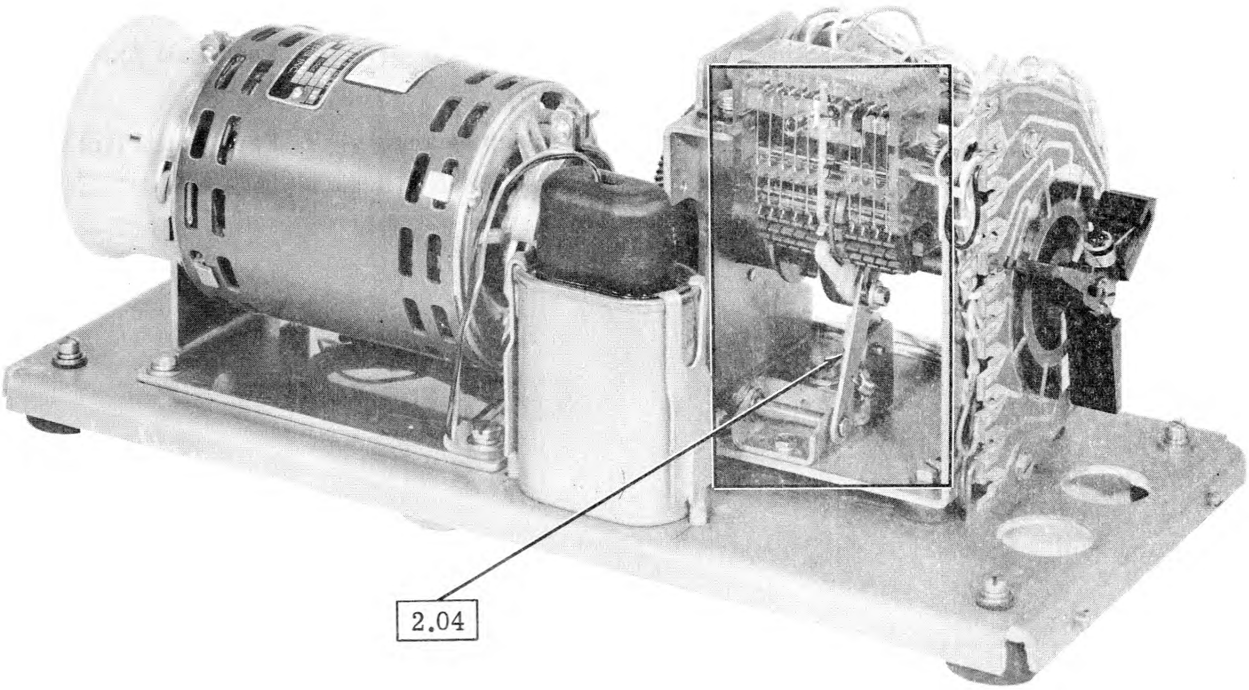
2.02 DRIVE GEARS



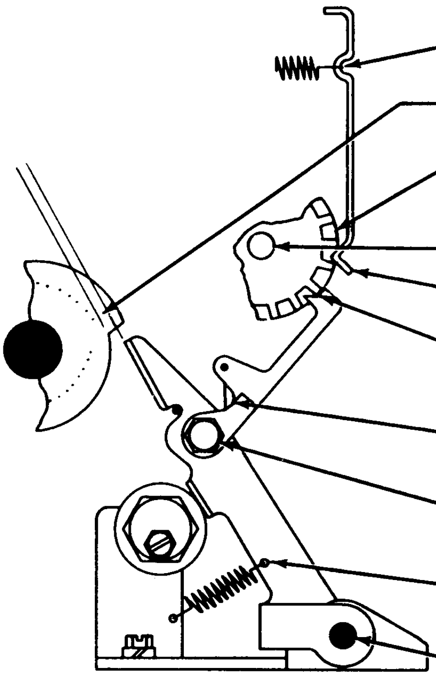
G	Surface	**Gears**

2.03 Main Shaft





2.04 Drum Feed Mechanism



01	Each End	Code Drum Detent Spring
01	Surface	Feed Cam
01	Light Coat	Cam on Answer-Back Drum
01	Bearing (Two)	Code Drum
01	Top and Bottom Ends	Code Drum Detent
01	Feeding Surface	Feed Pawl
01	Each End and Light Coat	Feed Pawl Torsion Spring
01	Pivot	Feed Pawl
01	Each End	Feed Bail Extension Spring
01	Each Bearing	Feed Bail Pivot Shaft

28 AND 35 ANSWER-BACK UNIT

DISASSEMBLY AND REASSEMBLY

CONTENTS PAGE

1. GENERAL

1.01 Disassembly, as outlined in this section, covers a procedure for removing the principle components which make up the answer-back unit.

1.02 The technician should refer to the exploded views found in the appropriate parts literature for an illustration of the unit to be disassembled, for location and visual identification of parts, and detailed disassembly and reassembly features.

1.03 Most maintenance, lubrication, and adjustments can be accomplished simply by removing the subject component from the unit. If possible, disassembly should be confined to components, which can, in some cases, be removed without disturbing adjustments. When reassembling the components, be sure to check all associated adjustments, clearances, and spring tensions.

1.04 Retaining rings (Tru-arcs) are made of spring steel and have a tendency to release suddenly when being removed. Loss of these retainers can be minimized as follows: Hold the retainer by hand to prevent it from rotating. Place the blade of a suitable screwdriver in the slot of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.05 Avoid loss of springs in disassembly by holding one spring loop by hand while gently removing the opposite loop with a spring hook. Do not stretch or distort springs in removing them.

1.06 References made from left to right, up or down, and front or rear apply to the answer-back unit as viewed from the side with the answer-back mechanism to the left and the motor to the right.

2. DISASSEMBLY AND REASSEMBLY

2.01 In removing a component from the unit, the procedure followed and the location from which parts are removed must be carefully noted so that reassembly can be done correctly. Where no specific instructions are given for reassembly, reverse the procedure used in removing it.

COVER AND TERMINAL BLOCK

2.02 To remove the TP194792 cover and TP111289 terminal block, the following procedure should be used:

(a) Loosen the four cover fastening screws and remove cover from base plate.

(b) Remove the flat washers, lockwashers, and screws which secure the upper insulator to the terminal block. Remove upper insulator.

(c) Remove the power and control cable spade type terminal lugs from under the screws on the terminal block.

(d) Remove the studs, terminal block, and lower insulator from the base plate.

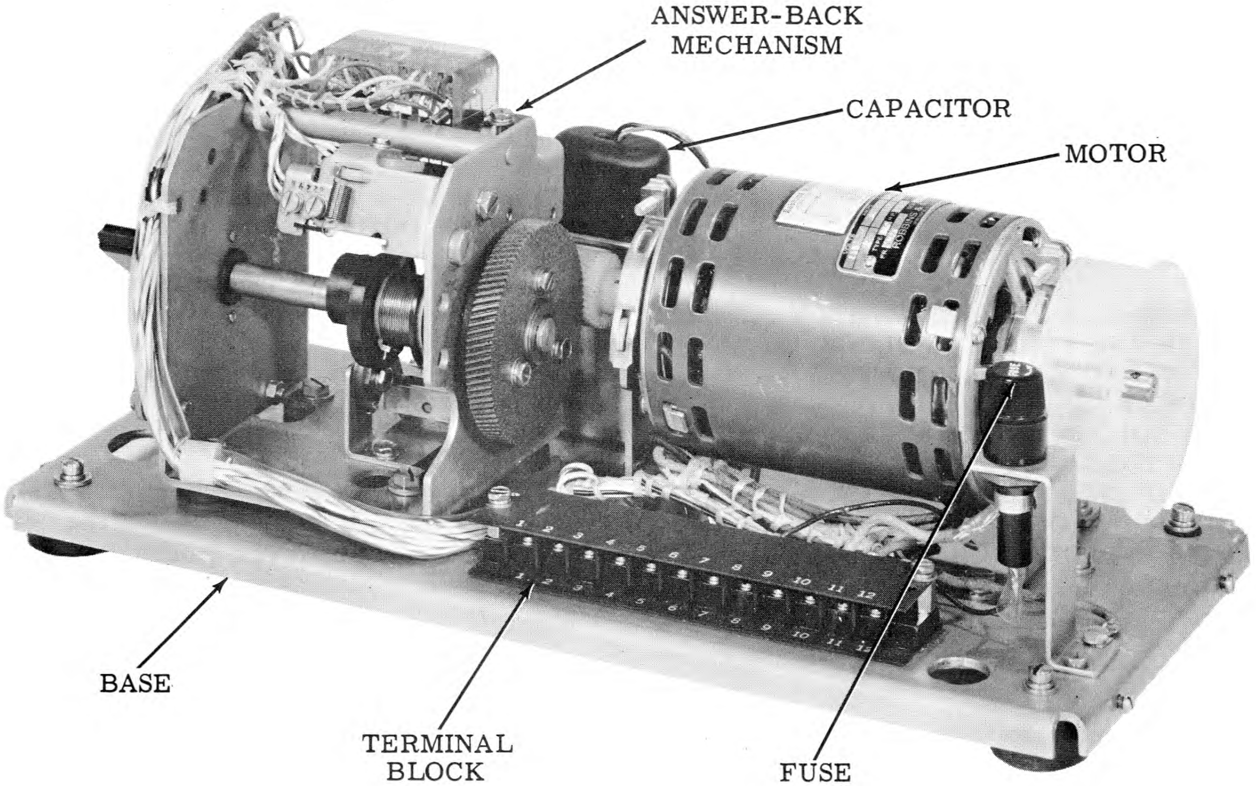


Figure 1 - Answer-Back Unit

MOTOR AND MOTOR MOUNTING BRACKET

2.03 Remove the TP192120 motor and TP192238 motor mounting bracket as follows:

(a) Remove the two TP151620 motor mounting straps from each end of motor. Lift motor from mounting bracket.

(b) Remove the four screws which secure motor mounting bracket. Lift bracket from base plate.

FUSE HOLDER AND BRACKET

2.04 Remove the TP116783 fuse holder and TP194814 fuse-holder bracket as follows:

(a) Remove the nut from lower end of fuse holder, and lift from fuse-holder bracket.

(b) Remove the two screws which secure fuse-holder bracket. Lift bracket from base plate.

CAPACITOR

2.05 To remove the TP192019 capacitor, remove the brackets from each side of capacitor and lift from base plate.

CODE DRUM

2.06 Remove the TP180827 code drum as follows:

(a) Lift the answer-back brace by means of its extension, to deflect all contact wires and the detent away from the code drum.

(b) Hold the feed pawl away and slip the code drum out. <u>Do not overextend the feed pawl spring</u>.

CONTACT BLOCK

2.07 To remove the TP180823 contact block, remove the screws, lockwashers, flat washers and spacers securing each side of the block and lift from bracket.

ANSWER-BACK MECHANISM AND BRACKET

2.08 Remove the three mounting screws from the TP194782 bracket and lift bracket and mechanism from base plate.

MAIN SHAFT

2.09 To remove the TP194784 main shaft from the answer-back mechanism proceed as follows:

(a) Remove the brush holder mounting screw, flat washer, and lockwasher. Remove the brush holder.

(b) Remove the three distributor disc mounting screws, flat washers, and lockwashers. Remove distributor.

(c) Remove the three mounting screws, flat washers, and lockwashers from the drive gear.

(d) Remove retaining ring, drive gear, and clutch sleeve by pulling over end of main shaft.

(e) Remove the mounting screws, flat washers, and lockwashers from each bearing on the main shaft and remove each bearing.

(f) Rotate main shaft until the flat portion of the motor hold cam is adjacent to the feed bail. Withdraw the shaft to the left until the right gear end clears the bracket. Slide shaft out from beneath the trip magnet.