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TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS WITH PARTS LIST

VOLUME 1

TELETYPEWRITER SET
AUTOMATIC SEND-RECEIVE
MODEL 28

Manufactured by
Teletype Corporation

Manual Prepared by
Western Technical Associates
N00039-76-C-0153

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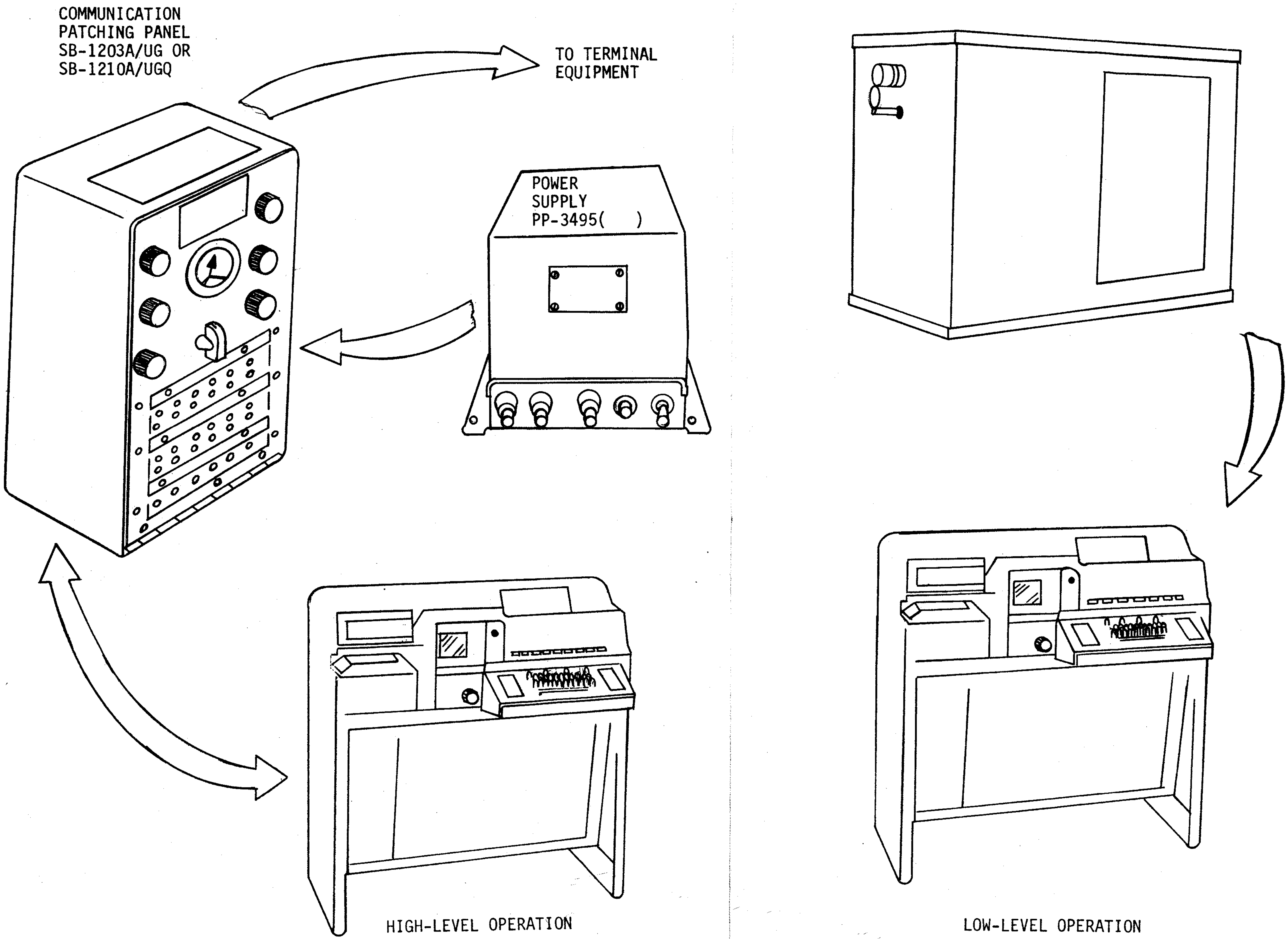


Figure 1-1. Automatic Send-Receive (ASR) Model 28 Teletypewriter Set

CHAPTER 1
GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1. SAFETY PRECAUTIONS. To stress the importance of employing proper safety techniques while performing maintenance procedures on the equipment involved, the user of this manual is directed to thoroughly familiarize himself with the safety precautions described in Chapter 4, paragraph 4-4.

1-2. INTRODUCTION. This manual provides information and instructions for installation, operation, and maintenance of Automatic Send-Receive (ASR) Teletypewriter Set Model 28 (Figure 1-1). Maintenance information includes instructions for testing, performing preventive maintenance, adjustments, troubleshooting, and repairing. A parts list is also included. ASR configurations covered by this manual are described in the matrixes referenced in paragraph 1-6.

1-3. EQUIPMENT DESCRIPTION. The ASR Model 28 set is an electromechanical apparatus capable of operating as a self-contained message originating and receiving center. It is used to exchange printed and tape perforated messages between two or more stations connected by appropriate transmission facilities (telegraph lines, telephone networks, and radio channels). Figures 1-2 and 1-3 are front views of the configuration currently in use.

a. General. Messages are received electrically via the transmission facility and are printed on page-size copy paper or continuous business forms. With page-printed monitoring, the ASR set can electrically transmit messages which are originated by either perforated tape or keyboard operation. Messages may be perforated and printed on tape for separate transmission with or without simultaneous transmission and page-printed monitoring. Certain ASR sets are equipped to receive messages in printed and perforated tape form and, at the same time, prepare tape off-line. Transmission between stations is accomplished electrically using the Baudot teletypewriter signaling code. The ASR set operates at speeds up to 107 words per minute (wpm).

b. High- and Low-Level. This manual covers both high-level and low-level configurations of ASR sets. High-level ASR sets are used in applications wherein radio frequency interference (RFI) does not present a problem. Low-level ASR sets have RFI suppression features incorporated. One of the RFI suppression features is the use of a low-level signaling code from which the term low-level is derived. The low-level signaling code is the +6-volt (mark) and -6-volt (space) polar code levels versus that of the 0.060 amperes (mark) and 0 amperes (space) neutral code levels used in the high-level sets. High-level ASR equipment is described in paragraph 1-3.1 and low-level equipment is described in paragraph 1-3.2.

1-3.1 EQUIPMENT DESCRIPTION (HIGH-LEVEL). The ASR set is

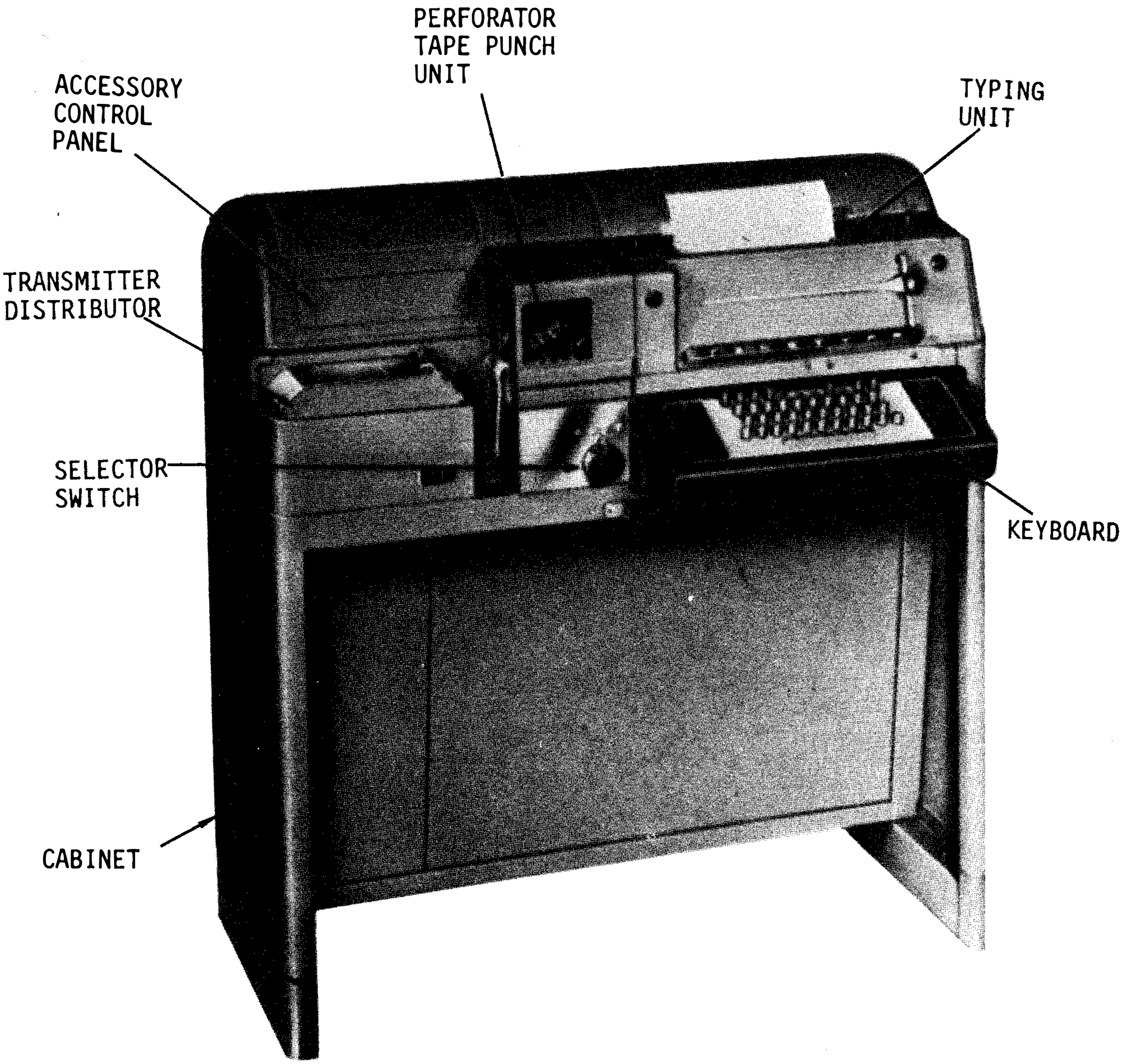


Figure 1-2. Typical Automatic Send-Receive (ASR) Teletypewriter Set

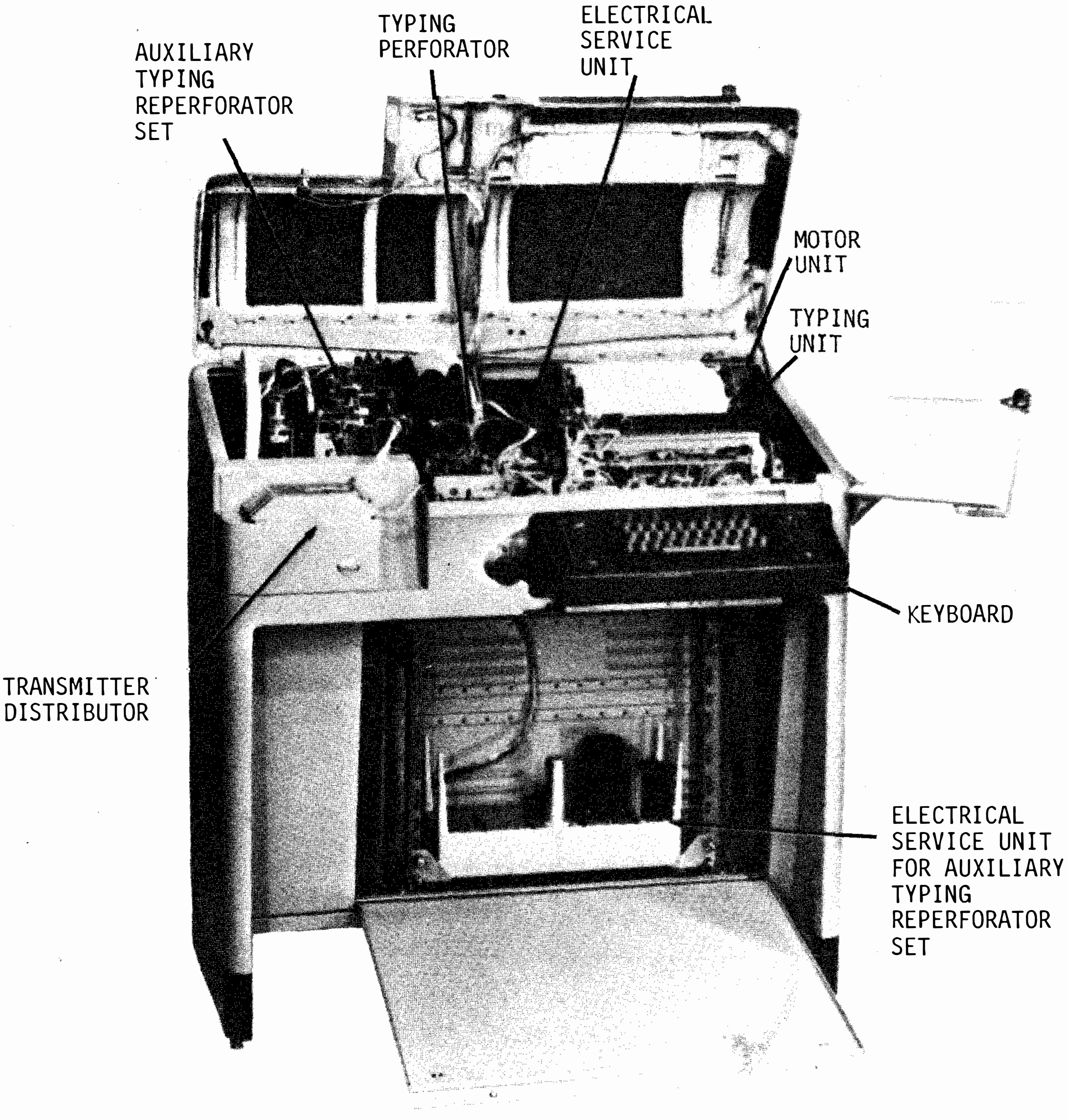


Figure 1-3. Typical Automatic Send-Receive (ASR) Set Model 28, Interior View

made up of a group of seven basic components; typing unit, keyboard, perforator (tape punch), transmitter-distributor, electrical service unit, motor unit, and cabinet. To meet varying installation and operational requirements, the selection of the particular kind of component is often varied, but without changing the basic arrangement. In addition to the basic component arrangement of the ASR set, is the inclusion of an auxiliary typing reperforator set. Space is provided in the cabinet for this completely independent receiving unit. ASR set components and variations are briefly described in the following paragraphs.

a. Typing Unit. The typing unit contains the mechanisms necessary for translating electrical input signals into printed, alphanumeric characters or functional control operations. The unit may be equipped to accommodate either friction or sprocket feed paper, in single or multicopy form, either rolled or fan folded. It includes a stunt box that provides non-printing functions such as case shifting, carriage return and line-feed and, in addition, switching facilities for remote controls, station selection and other applications. The basic function of the Model 28 typing unit, shown in Figures 1-4, 1-5, and 1-6 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 mechanisms move from left to right across the page. All operations of the typing unit are performed automatically in response to input signal code combinations. A few local off-line functions such as line-feed, or carriage return may be initiated independently of the signal line from the local keyboard or base mechanism. Character representations, or graphics, are the alphabetic, numeric or symbol intelligence equivalent of the input code combinations. Function representations are the coded equivalent of non-typing operations auxiliary to reception of the graphics, such as line-feed, carriage return, or signal bell. The 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, 100, or 107 wpm, depending on the gear ratio used on associated equipment. The typing unit is mounted on a keyboard base. Rotary mechanical motion for its operation and information in the form of the signaling code come from external sources. A front plate and side plates provide mounting facilities for the various assemblies and mechanisms that make up the unit.

(1) Main Shaft. Motive power for operation of the typing unit is received through the intermediate gear mechanism mounted on the keyboard base. Refer to Figure 1-7. Power is applied to the driven gear, centrally located

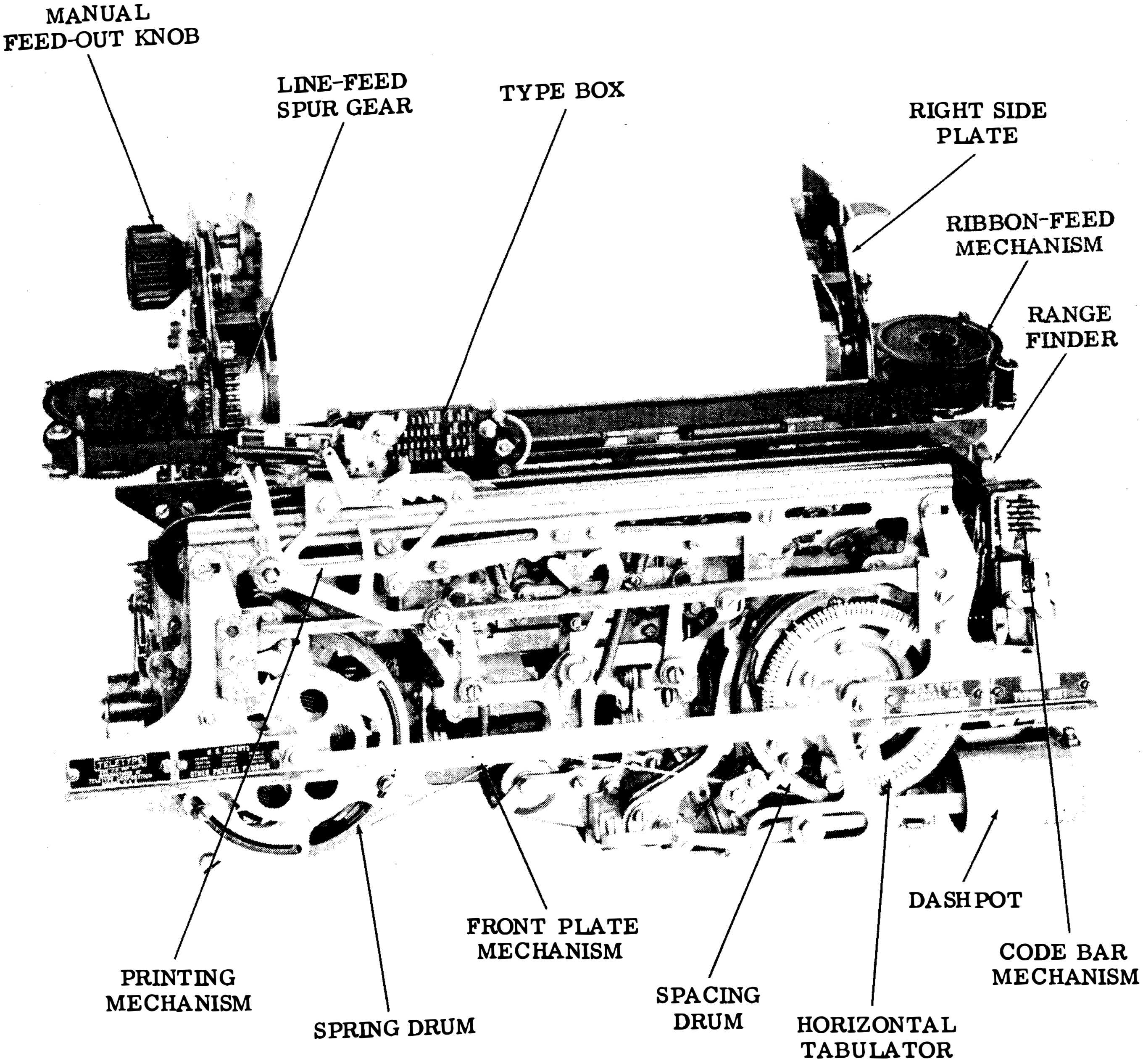


Figure 1-4. Typing Unit Model 28 (Friction Feed), Front View

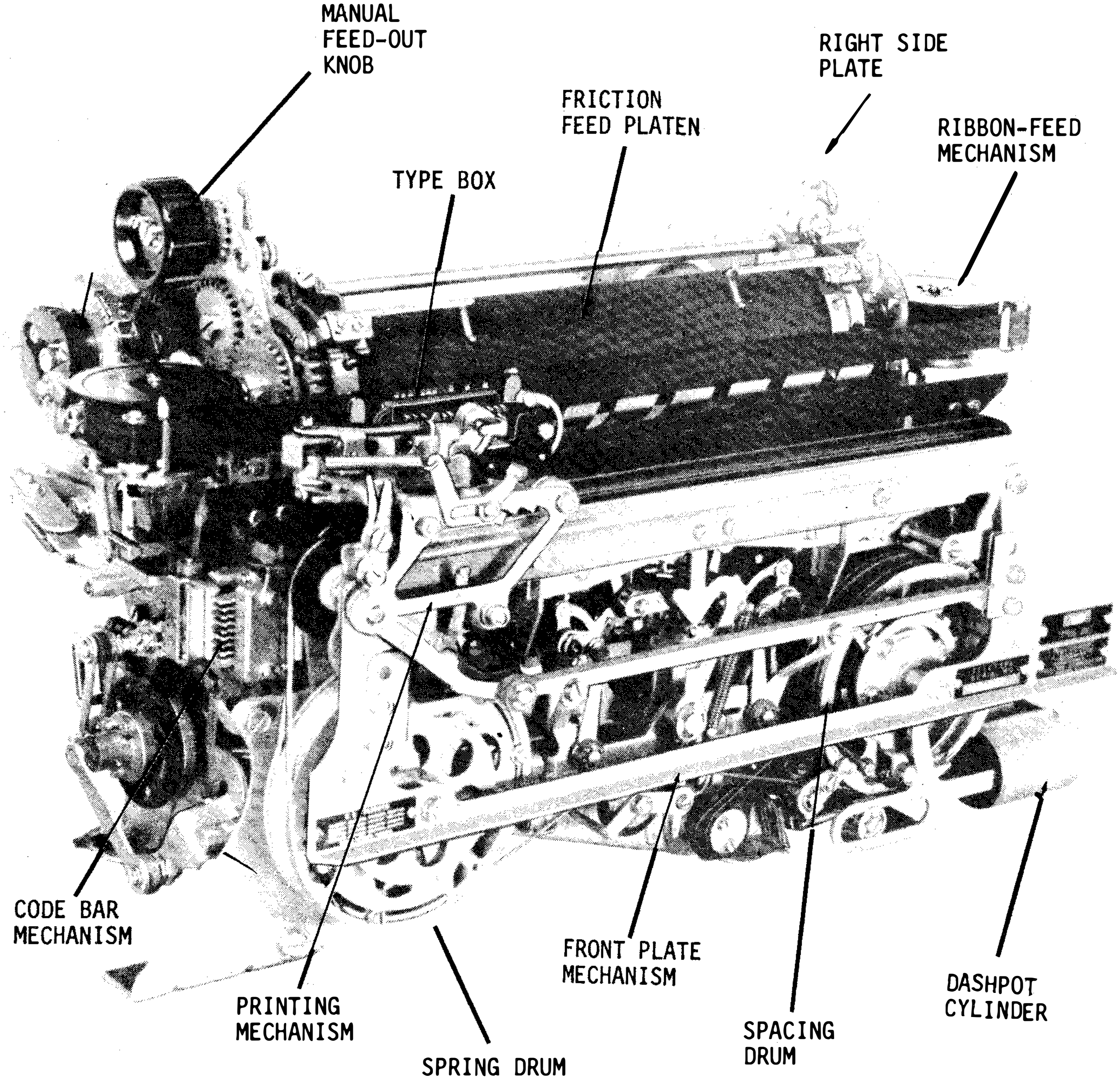


Figure 1-5. Typing Unit Model 28 (Sprocket Feed), Left Front View

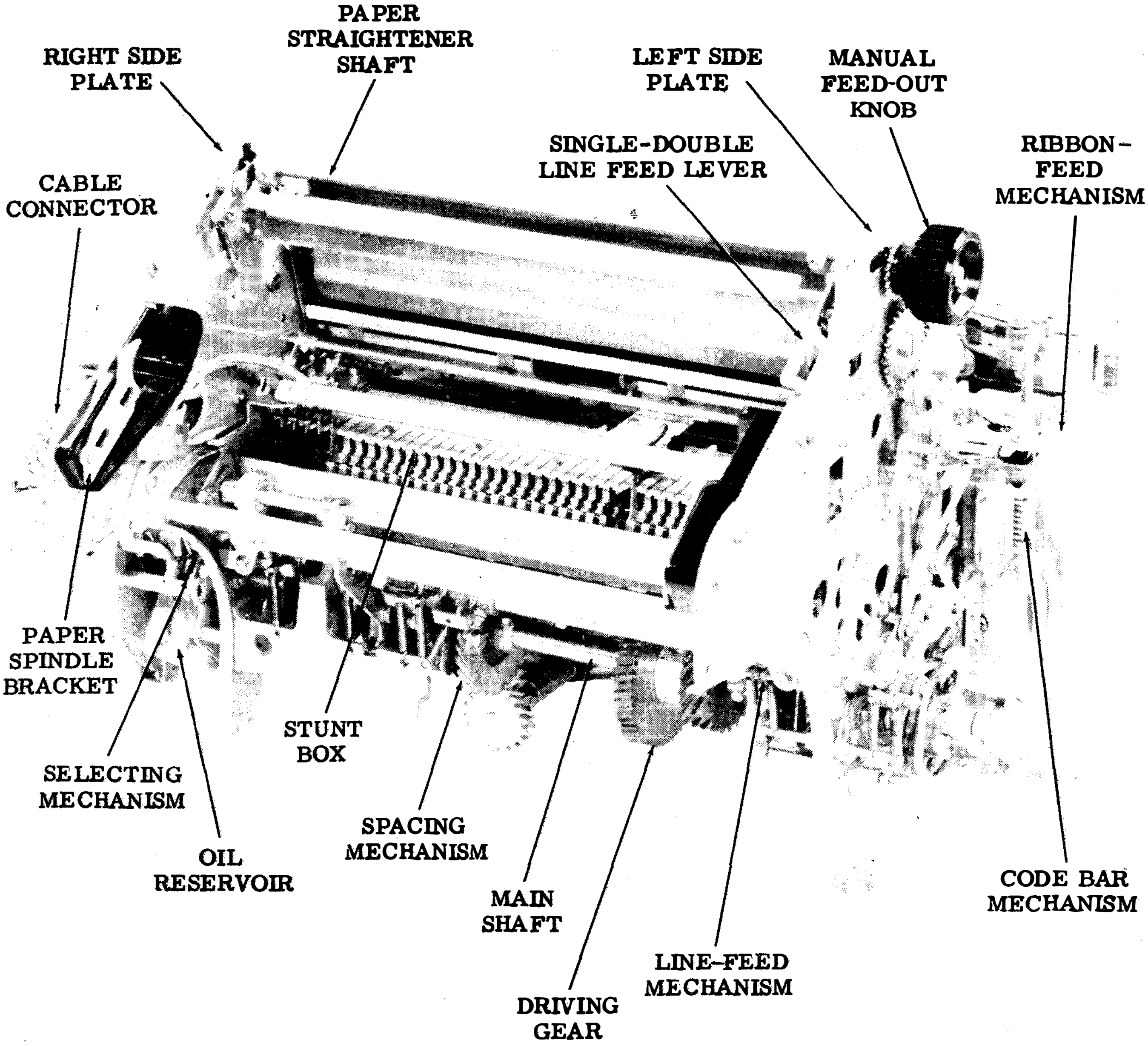


Figure 1-6. Typing Unit Model 28, Left Rear View

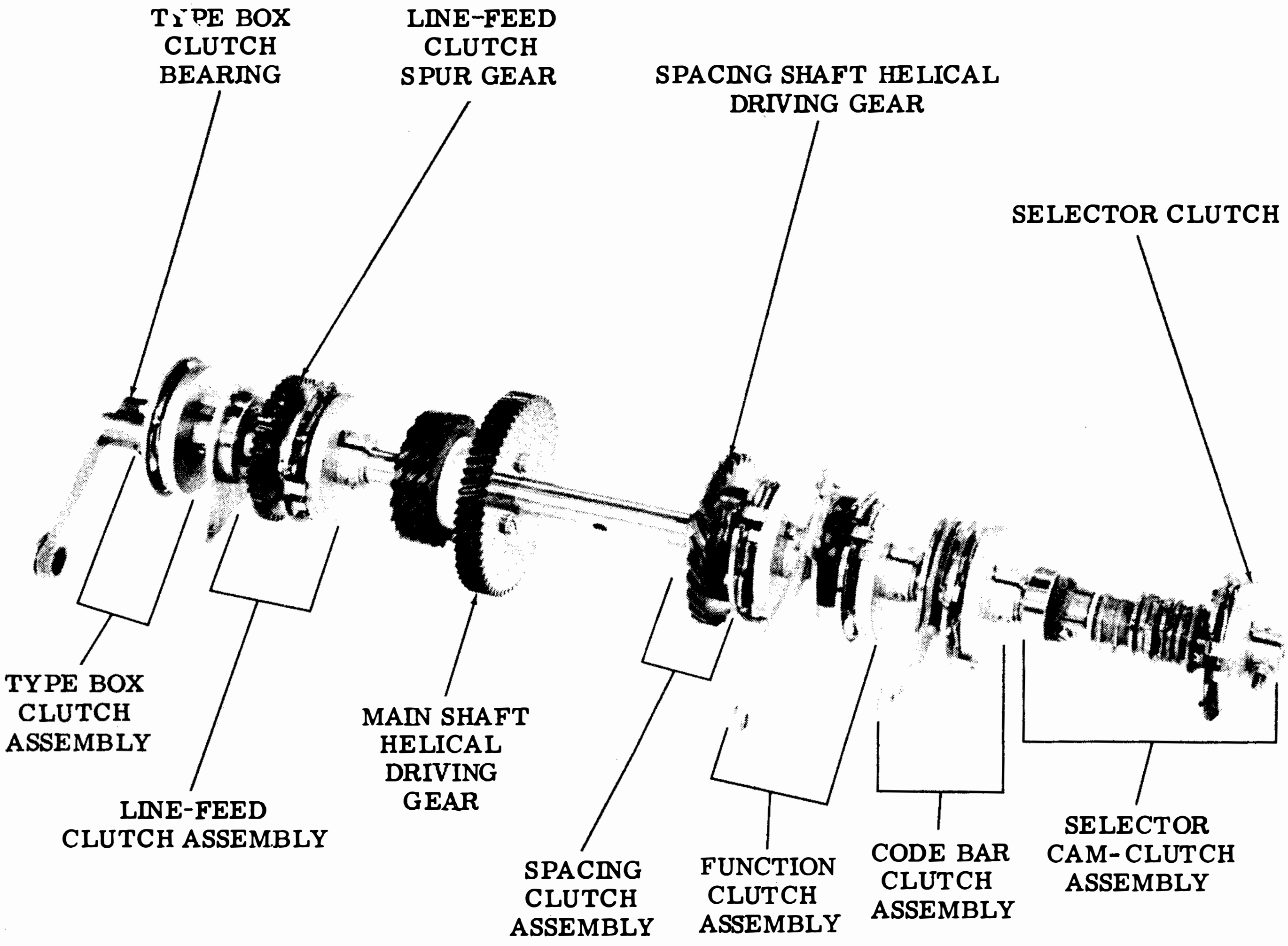


Figure 1-7. Main Shaft, Right Front View

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, 100, or 107 wpm, depending upon external gear ratios. Six all-steel internal expansion clutches convert the rotary motion of the main shaft to the linear mechanical requirements 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.

(2) Selecting Mechanism. A selecting mechanism (Figure 1-8) translates the signaling code combinations into corresponding mechanical arrangements which control the code bars. It includes a two-coil magnet that connects in series with the external signal line. The coils may be wired in either series or parallel to accommodate 0.020-ampere or 0.060-ampere line currents. A range finder is used to refine the mechanical orientation of the selector to the signaling code.

(3) Code Bar Mechanism. The code bar mechanism (Figure 1-9), 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.

(4) Printing Mechanism. When mechanically conditioned by the code bar mechanism, the printing mechanism (Figure 1-10) prints the selected character and spaces to the next printing area on the paper, or spaces without printing, or on units so equipped, tabulates horizontally, or returns the type box to the left hand printing margin. The mechanism includes horizontal positioning mechanism operated by the code bars, spacing mechanisms and carriage return, and the print hammer mechanism. 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.

(5) Spacing Mechanism. The spacing mechanism (Figure 1-11) moves the type box and printing mechanism one character to the right each time a graphic character is received and imprinted. A suppression mechanism prevents spacing on receipt of certain non-typing functions. On sprocket feed typing units the spacing mechanism may be adapted to the page to predetermined stop positions.

(6) Line-Feed Mechanism. The line-feed mechanism (Figure 1-12) 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 keyboard. On sprocket feed typing units, the line-feed mechanism may be

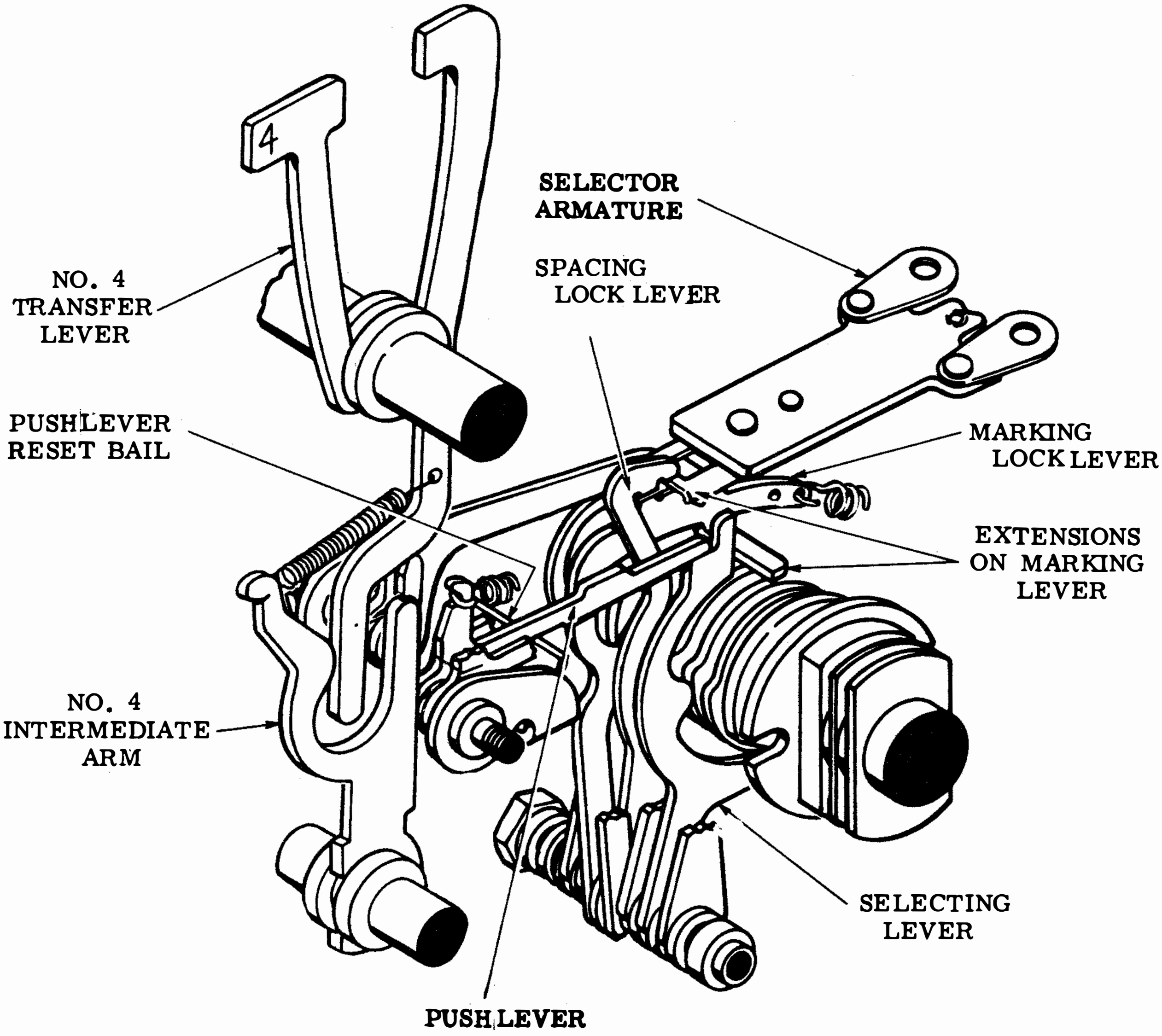


Figure 1-8. Selecting Mechanism and Transfer Mechanism, Right Front View

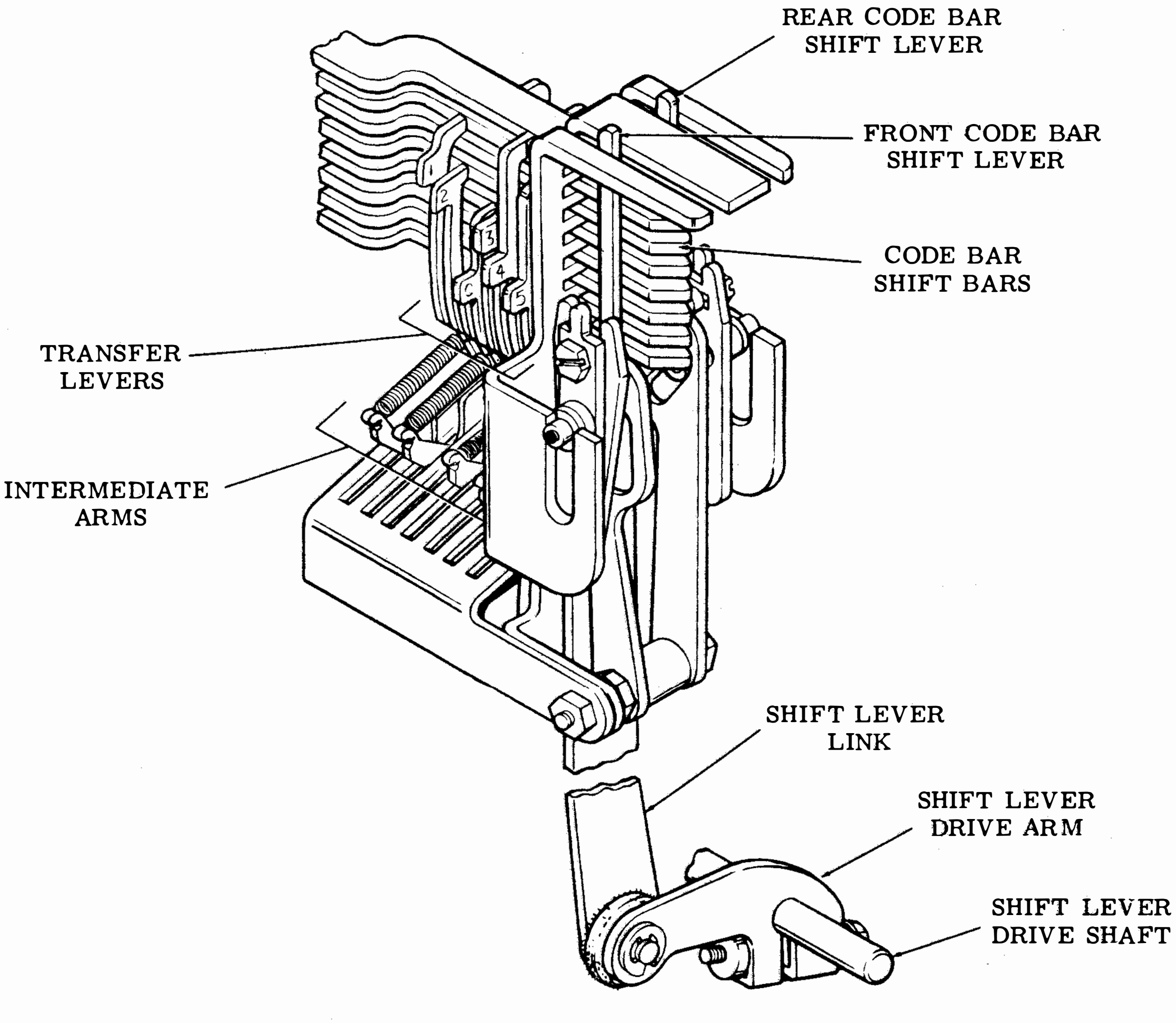


Figure 1-9. Code Bar Mechanism, Right Front View

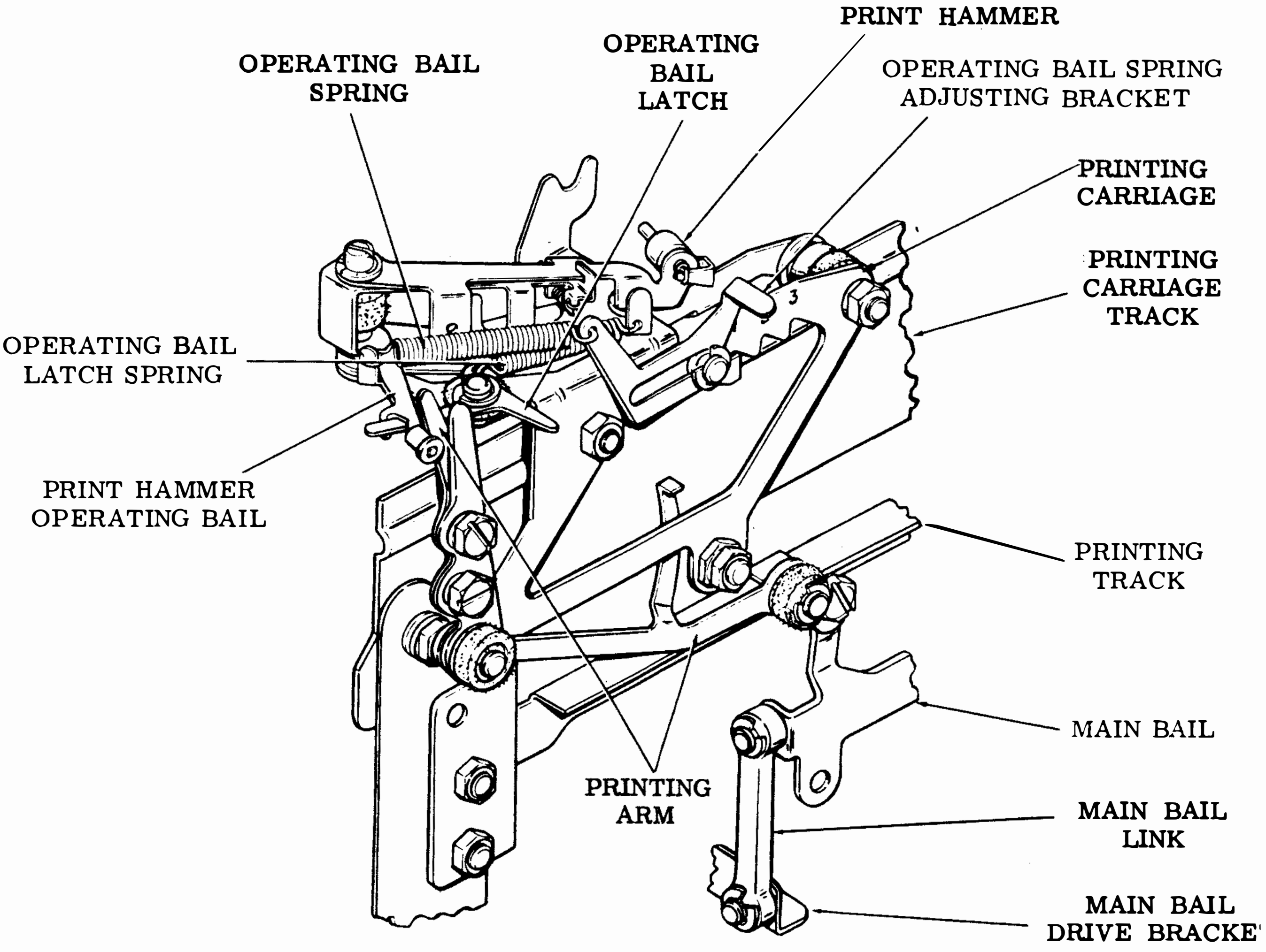


Figure 1-10. Printing Hammer and Carriage, Left Front View

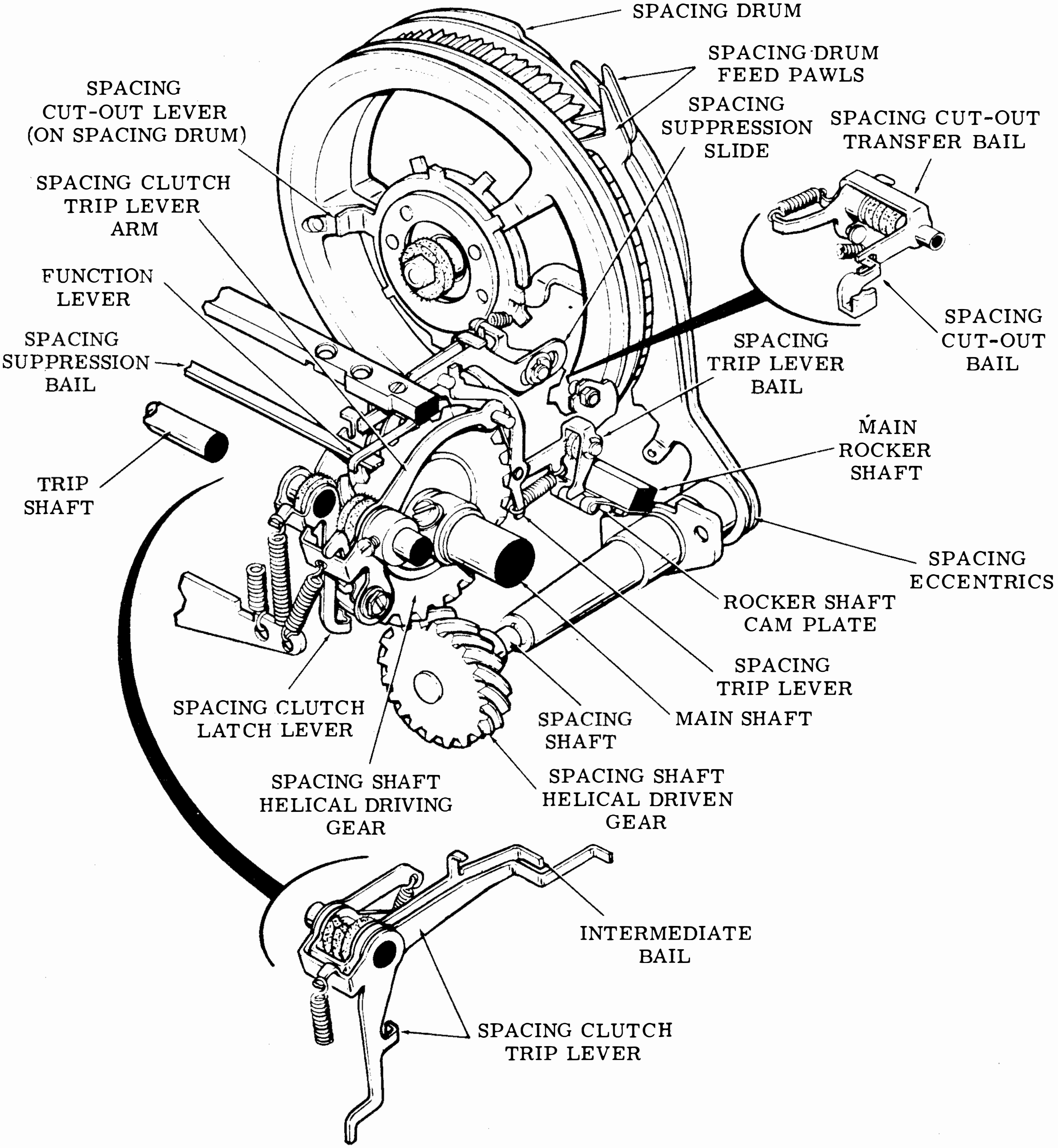


Figure 1-11. Spacing Mechanism, Left Rear View

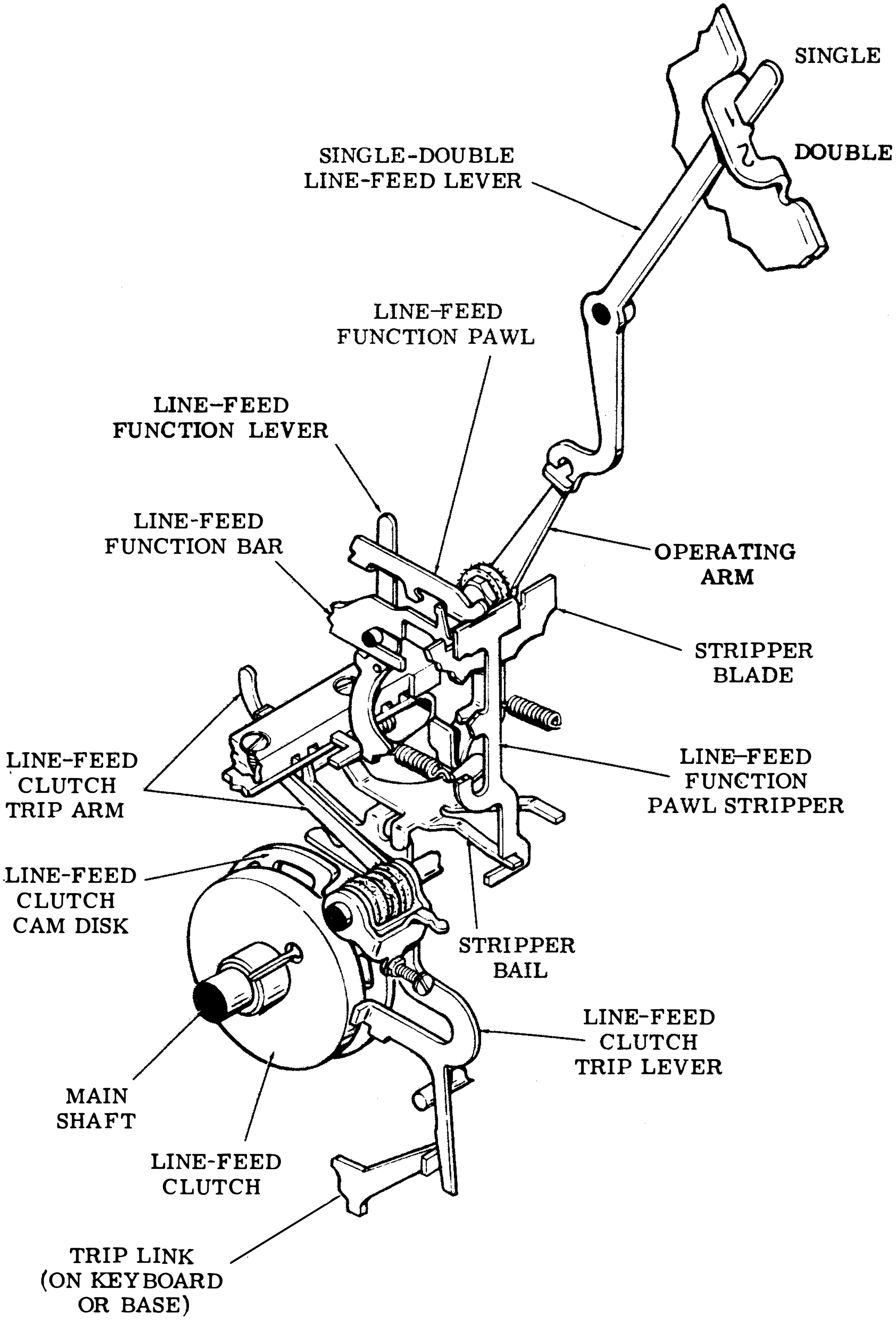


Figure 1-12. Line-Feed Mechanism, Left Rear View

adapted to vertical tabulation and to rapid form feed-out.

(7) Stunt Box. The stunt box, shown in Figure 1-13, is a compact, self-contained device with memory storage capabilities that provides the typing unit with the facilities of a built-in sequence selector. In effect, it allows the 32 available LETTERS and FIGURES character combinations to be used again for special, non-printing operatings, without the sacrifice of printed characters. It operates in response to combinations set up in the code bar mechanism with a single character or several characters in sequential combination used to initiate a single function. In general, the stunt box may be programmed to perform three basic types of operation: mechanical initialization of internal functions within the typing unit; electrical control of functions within the teletypewriter set; and electrical control of external equipment.

(8) Ribbon-Feed Mechanism. A ribbon-feed mechanism (Figure 1-14) passes an inked fabric ribbon between the type box and the paper. The mechanism advances the ribbon horizontally when each character has been printed and automatically reverses the direction of ribbon-feed when one of the two ribbon spools has been emptied.

(9) Paper Feed Mechanism. The platen and paper feed mechanisms (Figure 1-15) are located at the top of the printer, between the two side plates. A manual paper or form feed-out knob is located at the top of the left side plate. Paper is fed from a supply at the rear of the printer either by friction feed or on sprockets located on the ends of the platen.

(10) Signaling Code. Information is received by the typing unit in the form of a 7.42 unit start-stop signaling code (Figure 1-16) in which each character (graphic or function) is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking and those in which no current flows are spacing. Every combination includes five pulses (also referred to as levels) that carry the intelligence, each of which may be either marking or spacing. To insure synchronization between the transmitting and receiving equipment, a start pulse which is always spacing is added at the beginning of each combination of intelligence pulses, and a stop pulse which is always marking is added at the end.

b. Keyboard. The keyboard (Figure 1-17) contains the mechanisms for generating and transmitting a teletypewriter signal. It also provides mounting facilities for the typing unit, one of four tape punch units, a motor unit, and the necessary driving gears and cross-shafts. Typing and perforating functions originate from the operation of keytops. The keyboard assembly consists of a keylever guide assembly, front frame, guideplate, keylevers, and ball lock assembly. The keylever guide assembly accommodates all code and function levers.

(1) Signal Generator. The signal generator (Figure 1-18) consists of a

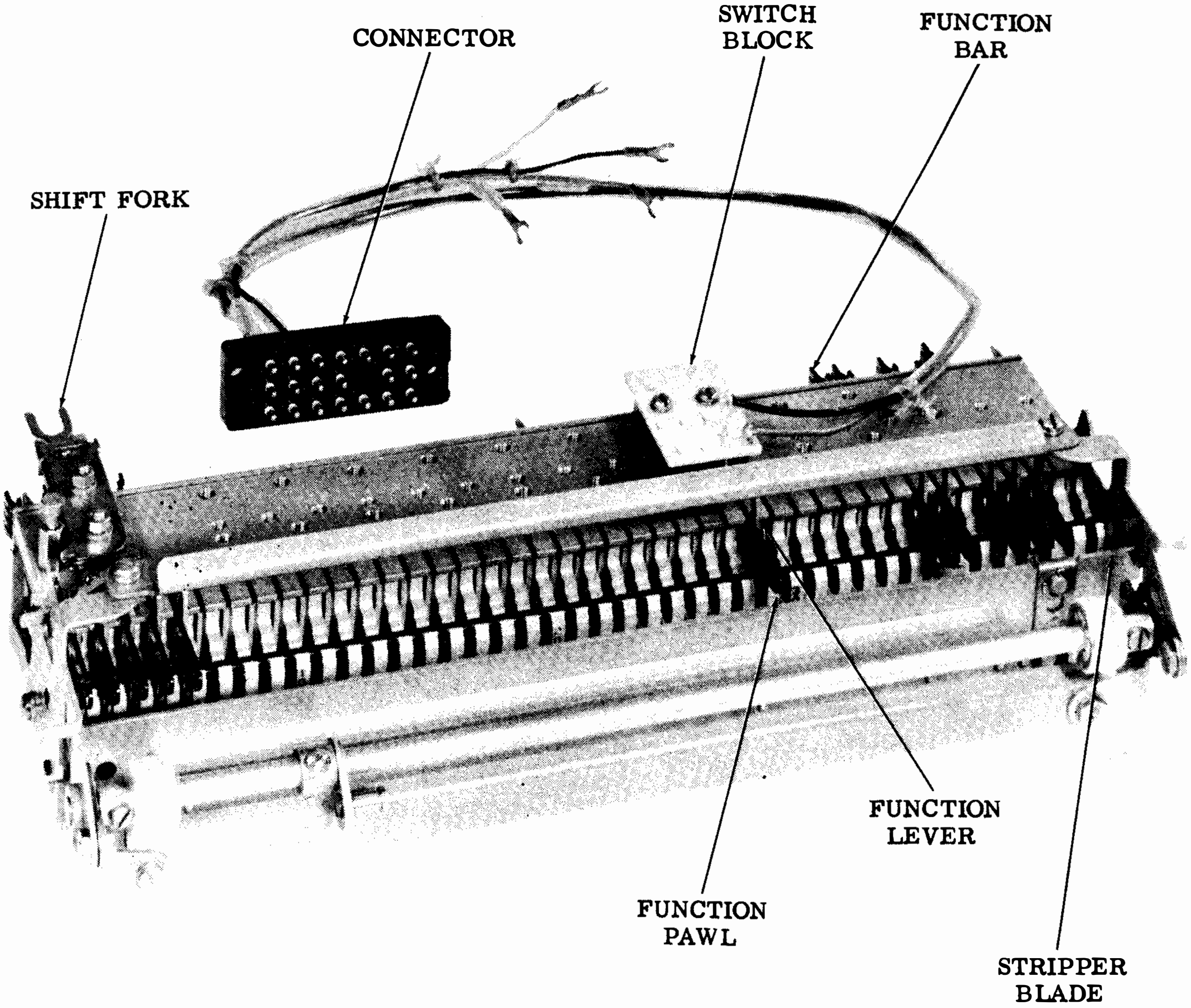


Figure 1-13. Typical Stunt Box, Top View

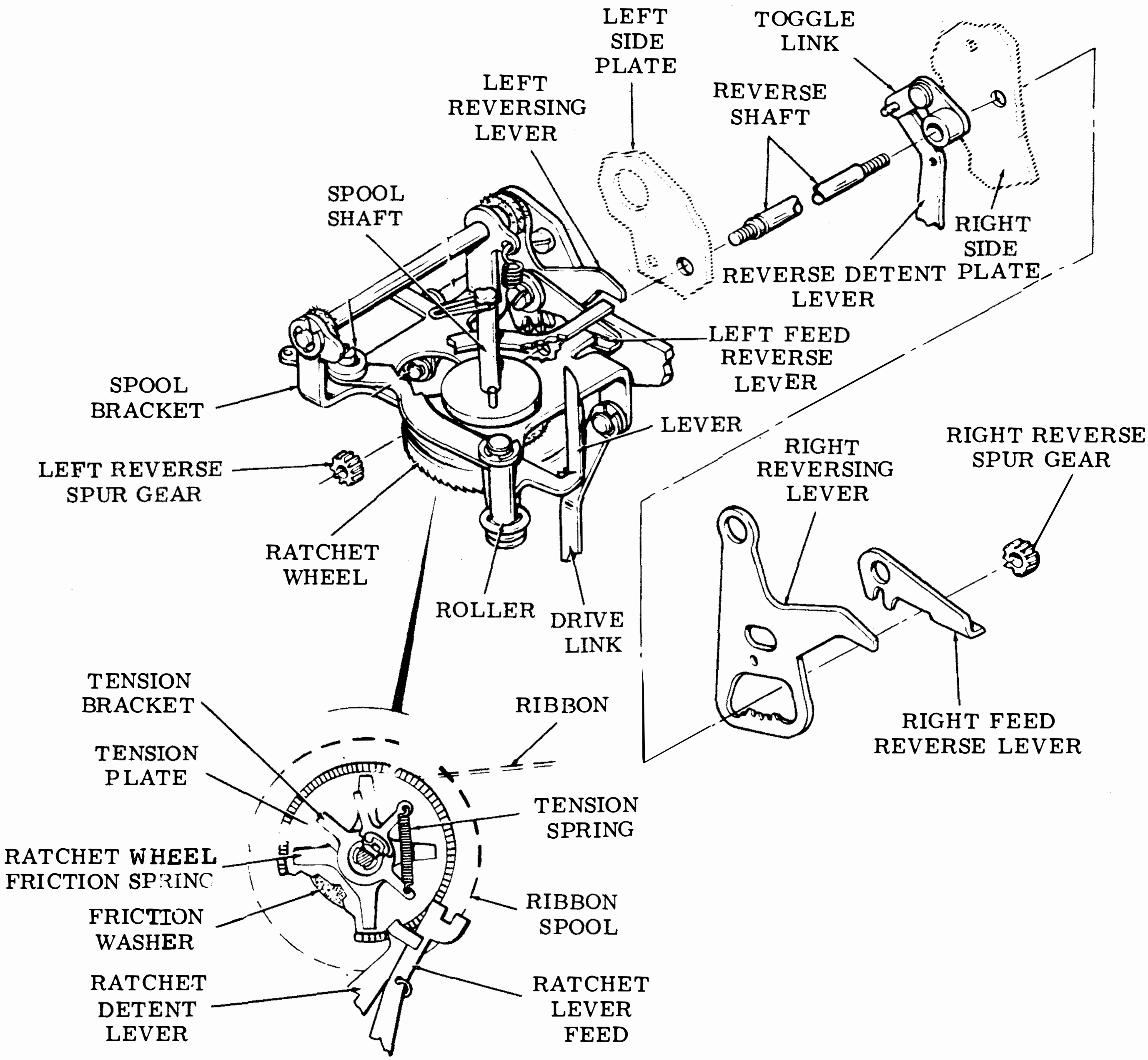


Figure 1-14. Ribbon-Feed Mechanism, Left Front View

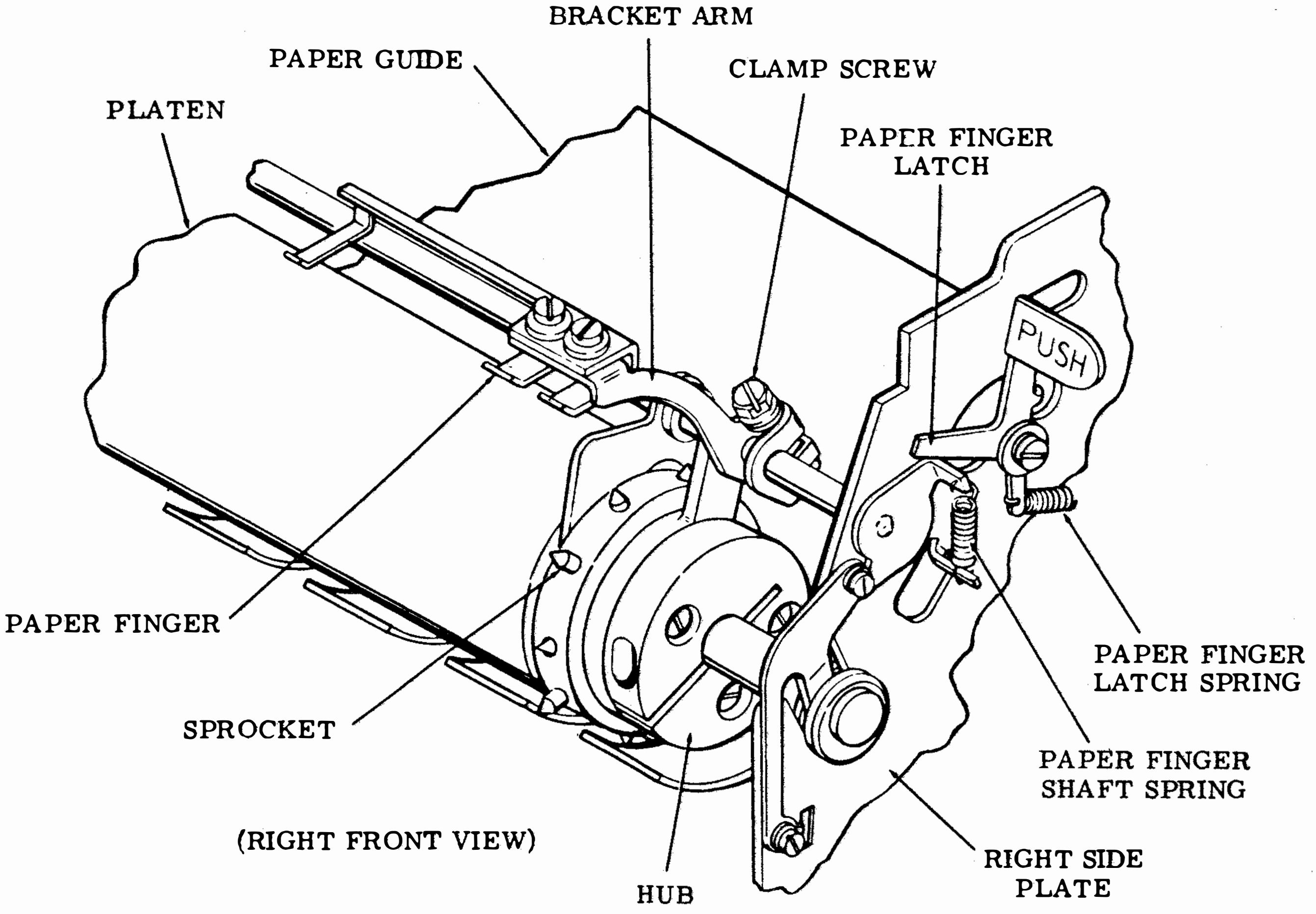
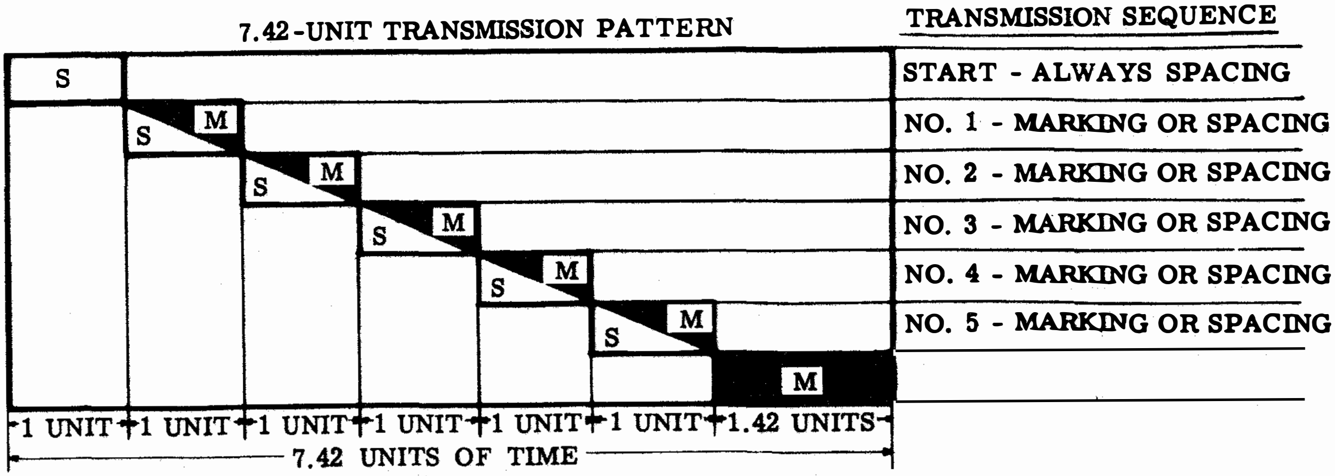


Figure 1-15. Platen and Paper Feed Mechanism



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(TYPICAL CHARACTER ARRANGEMENT)

Figure 1-16. Signaling Code

frame assembly; front and rear plate assemblies; gear, shaft, clutch and cam assembly; and a contact box assembly. The clutch stop levers and latchlever are mounted on the frame. The code bar assembly and non-repeat lever with its guide are mounted on the rear plate. The front plate acts as a mount for the detent plate assembly; transfer bail and stud; transfer levers with their guide springs, and mounting studs; and the locking bail with its stud and spring. The cam, clutch, and shaft assembly is mounted between the front and rear plates. The cam is one piece of machined steel with eight lobes. The seven lobes which generate pulse signals, are equal in contour and are positioned at uniform angles with one another. The eighth lobe differs in contour, and is used to actuate the transfer lever locking bail. The univeral bail latchlever with its eccentric bushing is fastened to the right front of the frame. This latchlever extends to the rear over the code bar bail latch and the non-repeat lever pawl. The contact box assembly is mounted on the front plate. It is composed of a fiber insulating strip, a contact toggle assembly and phenolic base, drive link, and an arc suppressor, or RF filter.

(2) Reset Cam Follower Bracket Assembly. The reset cam follower bracket assembly (figure 1-19) consists of a hollow shaft with internal oilite bearings pivoting on a fixed shaft. A hooked arm on one end of the hollow shaft connects the hollow shaft to the clutch trip bar assembly. An adjustable arm and roller on the other end of the hollow shaft follows the reset cam on the perforator main shaft. The

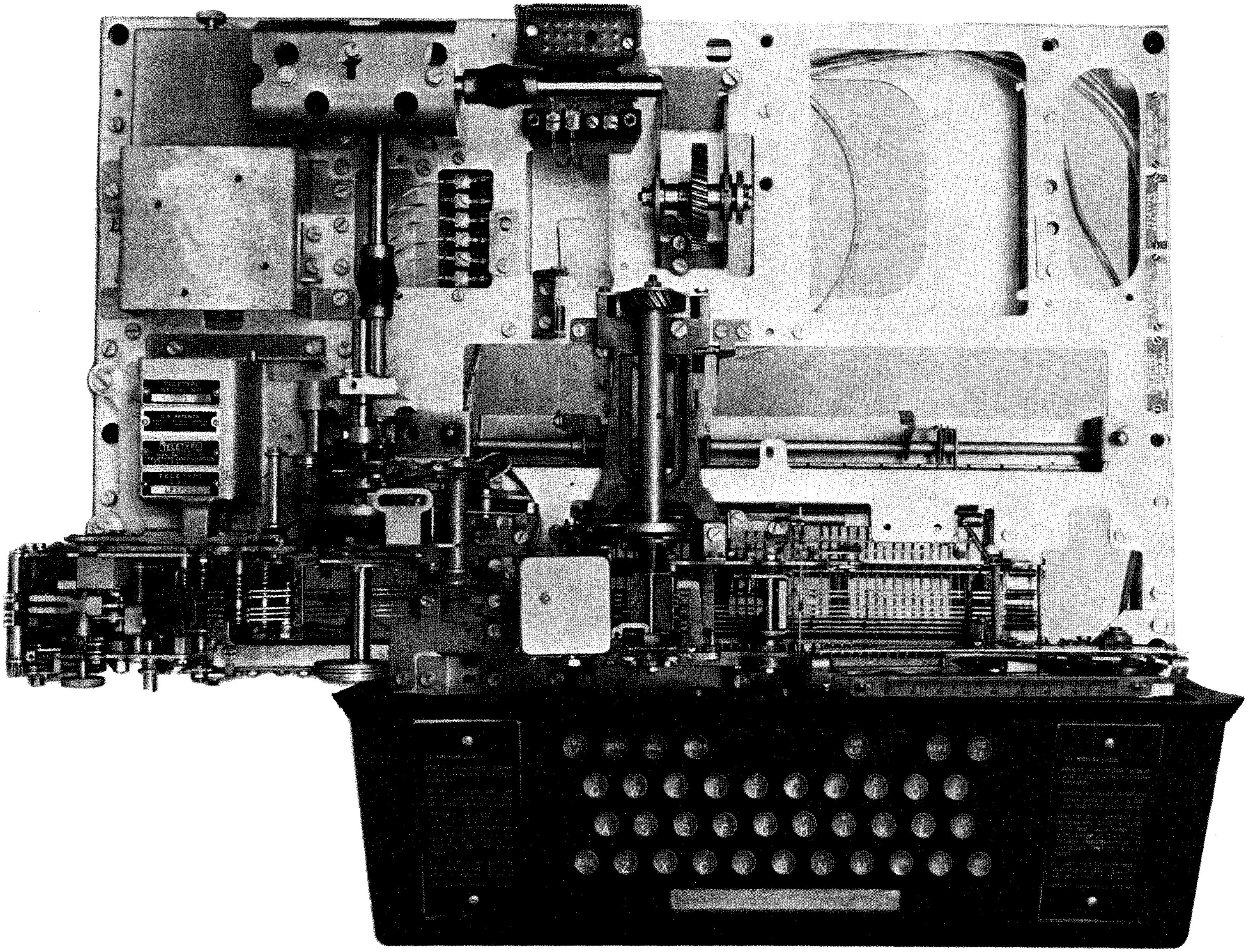


Figure 1-17. ASR Keyboard

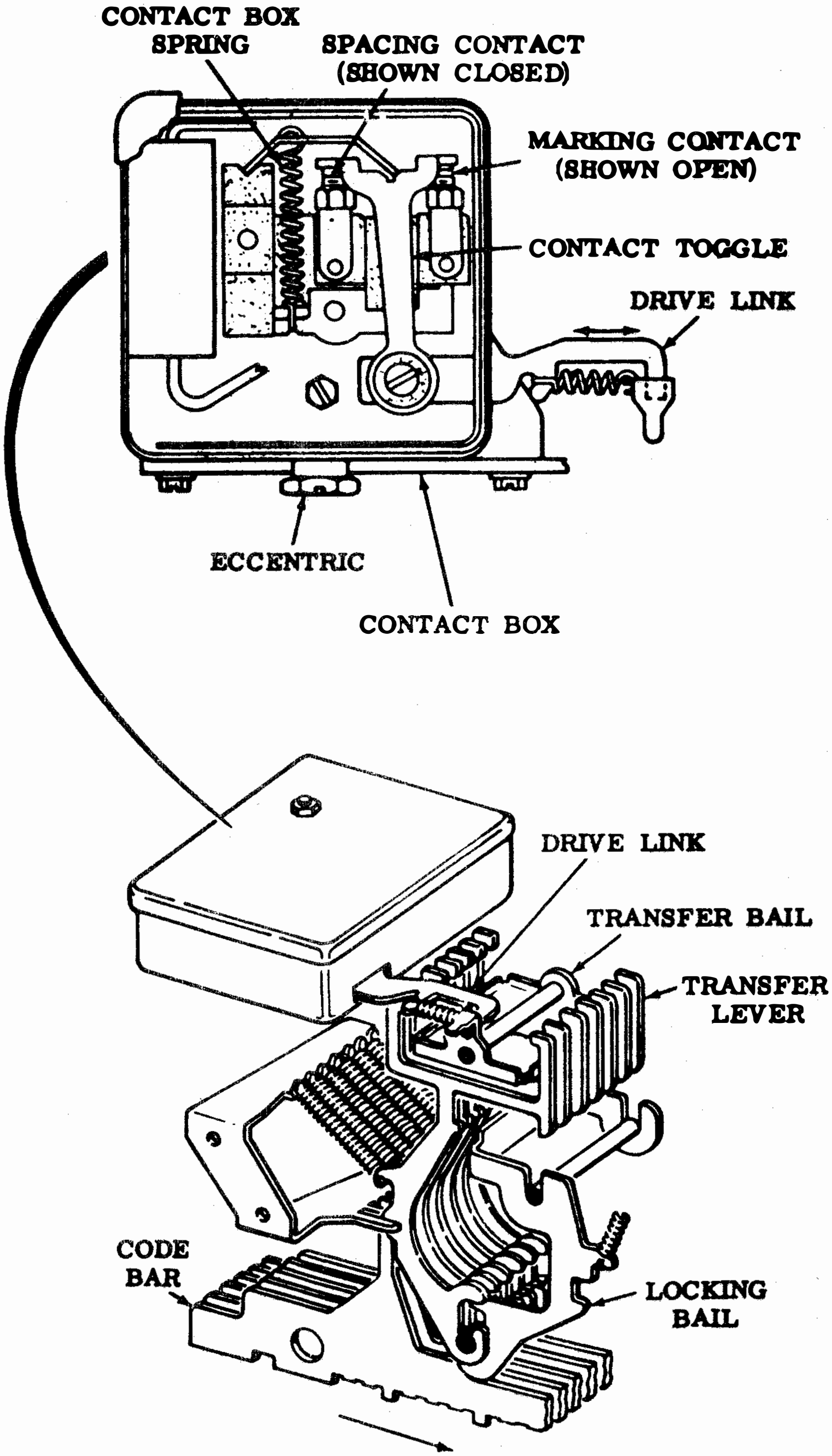


Figure 1-18. Transfer Lever, Contact Box Mechanism Signal Generator Drive Link

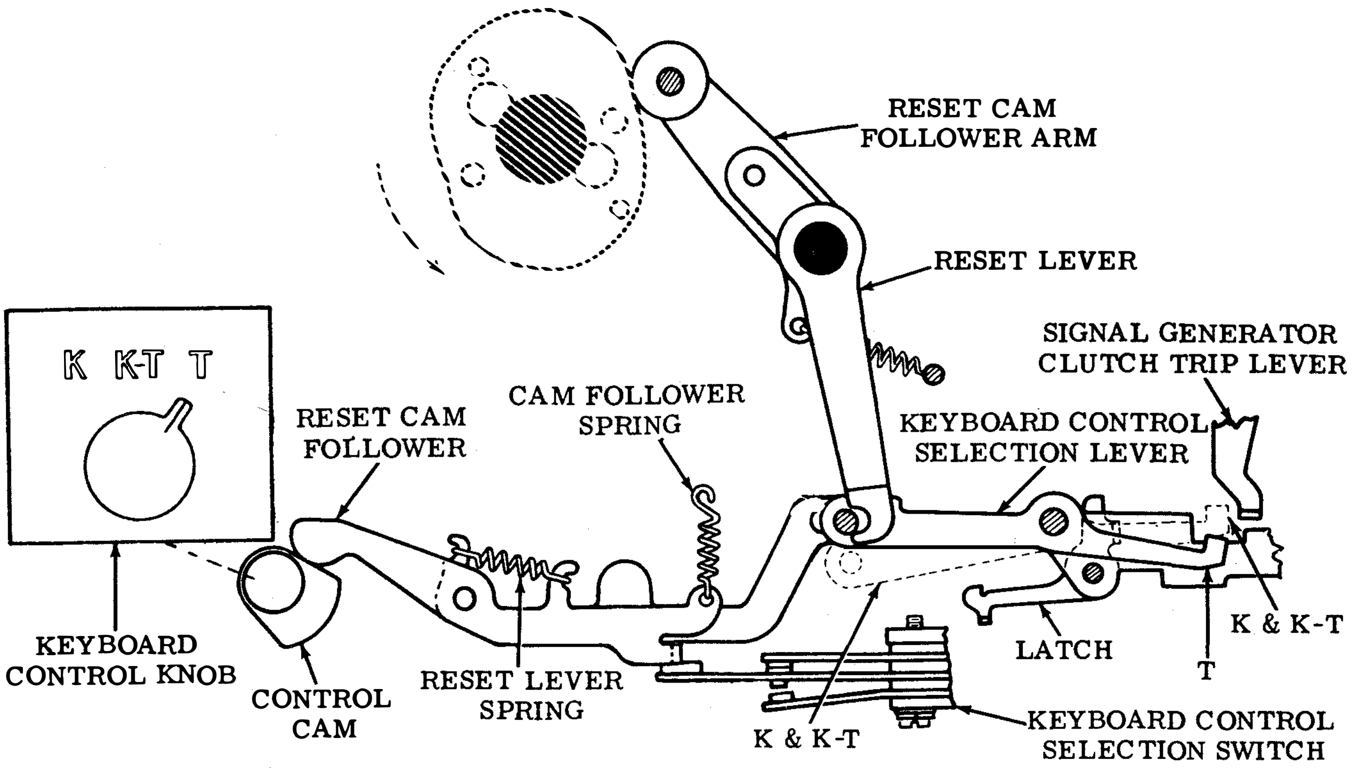


Figure 1-19. Reset Cam Follower Bracket Assembly

entire assembly provides linkage between the clutch trip bar and the cam on the associated perforator when the mode selector is in T position, thereby permitting the keyboard to be reset at high speeds.

(3) <u>Code Bar Extension Basket Assembly</u>. The primary purpose of the code bar extension basket assembly (Figure 1-20) is to transmit character information from the keyboard code bars to a perforator, and to serve as control center for the various functions of perforator-transmitter base. This assembly consists of the following major components:

(a) The code bar extensions which are used to transmit character information from the keyboard to the punch.

(b) The clutch trip bar extension which links the clutch trip bar to the perforator clutch trip lever extension in K-T and T positions.

(c) The code bar extension blocking bail, which blocks the selection of code bar extensions and character counter code bars in the K position. It also prevents the perforator clutch from being tripped in K position.

(d) The selector lever assembly, which permits the signal generator clutch to be tripped in K and K-T positions. It also prevents the signal generator from being tripped in T position. The control cam, which drives the auxiliary electric switch and provides the K, K-T, and

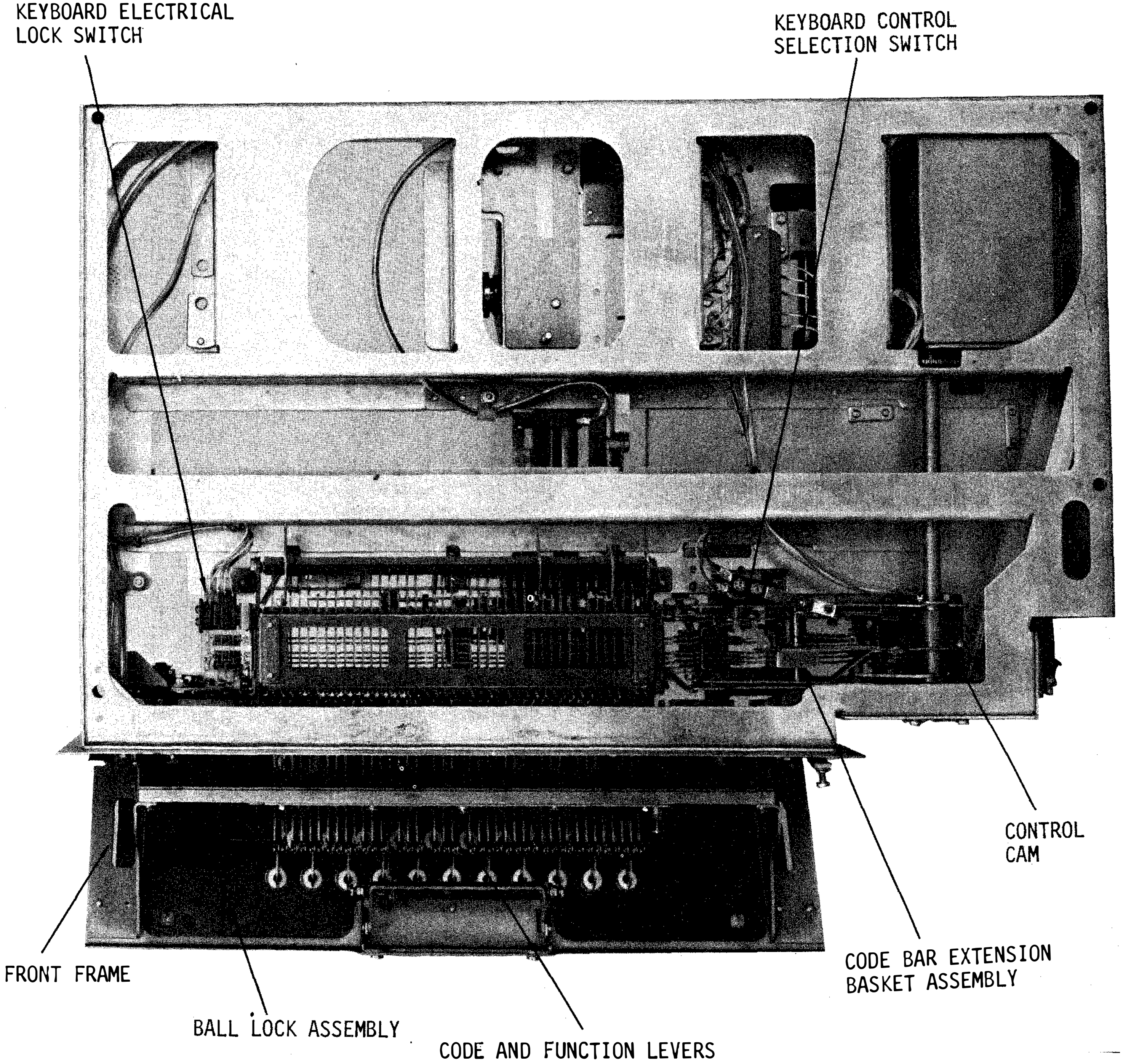


Figure 1-20. Code Bar Extension Basket Assembly, Bottom View

T operations of the perforator transmitter.

c. Perforator-Transmitter Base. The Model 28 perforator-transmitter base (Figure 1-21) is an electromechanical unit which provides means for transmitting coded electrical impulses to a signal line and/or means for mechanically operating any one of four associated perforators; a non-typing perforator, a typing perforator, a non-typing reperforator, or a typing reperforator. It also serves as a base mounting for an associated page typing unit for monitoring the message being transmitted from the keyboard. With direct keyboard transmission, linkage to the perforating mechanism is depressed to disassociate the punching mechanism from the keyboard operation. Under this condition, if a typing or non-typing reperforator is being used, circuitry can be established to permit the reperforator to receive incoming traffic from a second line circuit. Several variable features, such as a character counter, electrical keyboard lock code contacts, timing contacts, signal line break, tape backspace, paper feed-out, and motor start are available as optional features. Maximum keyboard speeds are 368, 460, and 600 operations per minute (opm) in the K and K-T positions. In the T position, maximum speed is 900 operations per minute (opm). These speeds are for a 5-unit start-stop code (7.42 unit).

(1) Mode Switching. A mode selecting mechanism is provided for switching the unit into any one of three positions (K, K-T, and T) to perform the following functions:

(a) Direct keyboard transmission to a signal line with monitoring of the message by a page typing unit (K position).

(b) Direct keyboard transmission and simultaneous operation of a perforator or reperforator with monitoring of a message by a typing unit (K-T position).

(c) Operation of a perforator or reperforator only (T position).

(2) Components. Perforator-Transmitter components are shown in Figures 1-20 and 1-21. The base is a reinforced aluminum sheet metal box frame on which all other assemblies are mounted.

d. Perforator (Tape Punch) Units. One of four different tape punch units is available with the ASR set. These units contain the mechanisms that translate electrical or mechanical inputs into perforations in the tape or both perforations and printed characters. The tape prepared by the units may be either fully-perforated or partially perforated (chadless). Two of the units are perforators and are operated and actuated mechanically by the keyboard. The non-typing perforator prepares only perforations in the tape. The typing perforator, in addition to perforating the tape, types messages on the tape. The remaining two units available are reperforators, which are equipped with a selector mechanism to receive inputs electrically. The non-typing reperforator prepares only perforations in the tape. The typing reperforator produces perforations and types on the

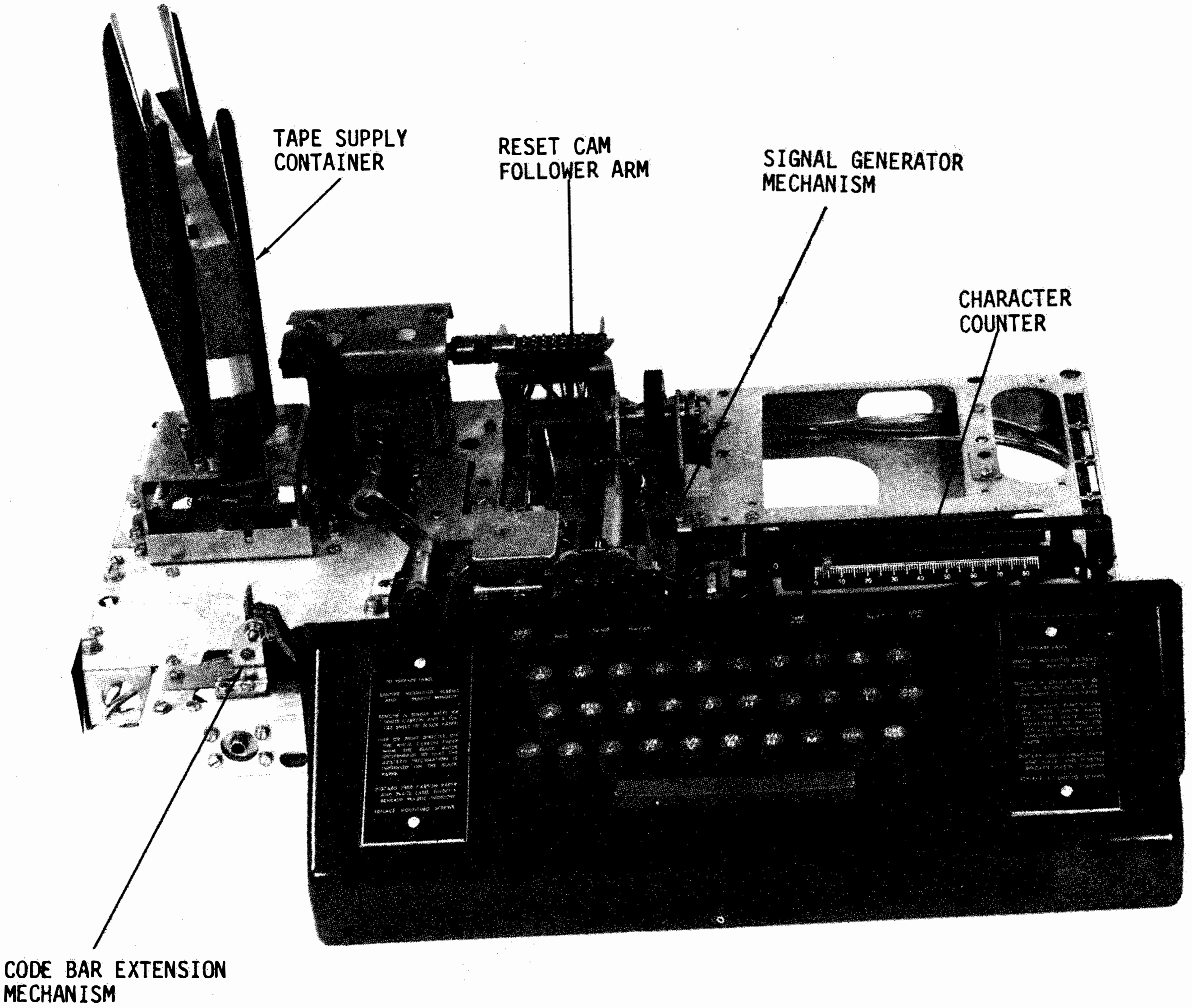


Figure 1-21. Model 28 Perforator - Transmitter Base

tape. They may also be actuated mechanically. The ASR set may be equipped with an auxiliary typing reperforator set. This completely independent set contains the following components:

(1) Typing reperforator unit.

(2) An electrical service unit installed in the lower right side of the cabinet (Figure 1-22).

(3) Motor unit (with a variable speed gear shift mechanism is available with some units. This allows selection of 60, 75, or 107 wpm speeds.

e. Typing and Non-typing Perforators. The Model 28 typing and non-typing perforators, shown in Figures 1-23 and 1-24, are mechanical units that are used with an associated keyboard from which code selections are derived and mechanically transferred into the perforator. The perforators produce a coded, perforated tape as dictated by its associated keyboard. Two types of perforators are available: a non-typing perforator and a typing perforator. Each type is capable of producing either chadless tape or fully perforated tape. The typing perforator is capable of producing perforated tape and typing thereon simultaneously. The tape may be chadless with typing on top of the chads which are not completely severed, or it may be fully perforated tape with typing between the feed holes. In general, the two units have the same function and perforating mechanisms, but the typing perforator has, in addition, the necessary mechanisms to perform typing on tape. Each unit receives its driving power from a motor unit through drive shafting on the associated keyboard. Selection is derived mechanically from the keyboard. A perforator consists principally of a two-shaft drive mechanism, function mechanism, transfer mechanism, perforating mechanism, and a typing mechanism for the typing perforator only.

(1) Signaling Code. The code combinations are set up by simultaneous selection of the punch slides. If a punch slide is released by its latch, it presents a marking condition. If a punch slide is not released by its latch, it represents a spacing condition. Every code combination includes five elements that carry the intelligence, each of which may be either marking or spacing. Marking elements in the intelligence code produce holes in the tape whereas spacing elements do not. The row of smaller holes between the second and third levels are tape feed holes and do not enter into the code permutation. The total number of permutations of a five-unit code is two to the fifth power, or 32. In order to produce more than 32 characters and functions, a LETTERS-FIGURES shift operation is designed into the typing equipment. This permits each permutation, excluding those used to shift and unshift the apparatus, to represent two characters or functions. Figure 1-16 shows the code combinations.

(2) Function Mechanism. The function mechanism consists of a jack shaft with a gear for driving the main shaft. The main shaft assembly includes a clutch assembly and cams for actuating a rocker bail. The clutches differ in the two types of

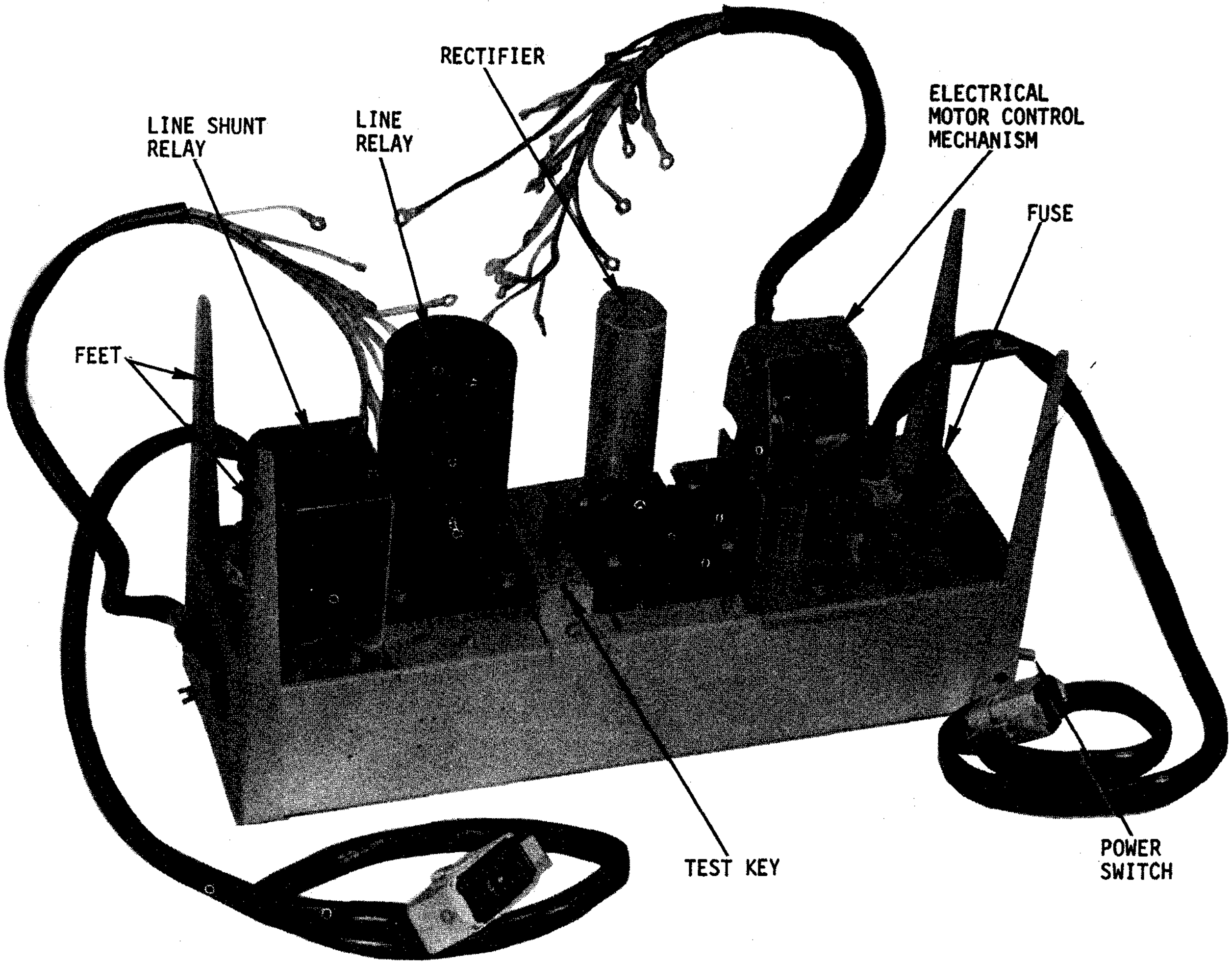


Figure 1-22. Typical Model 28 Electrical Service Unit

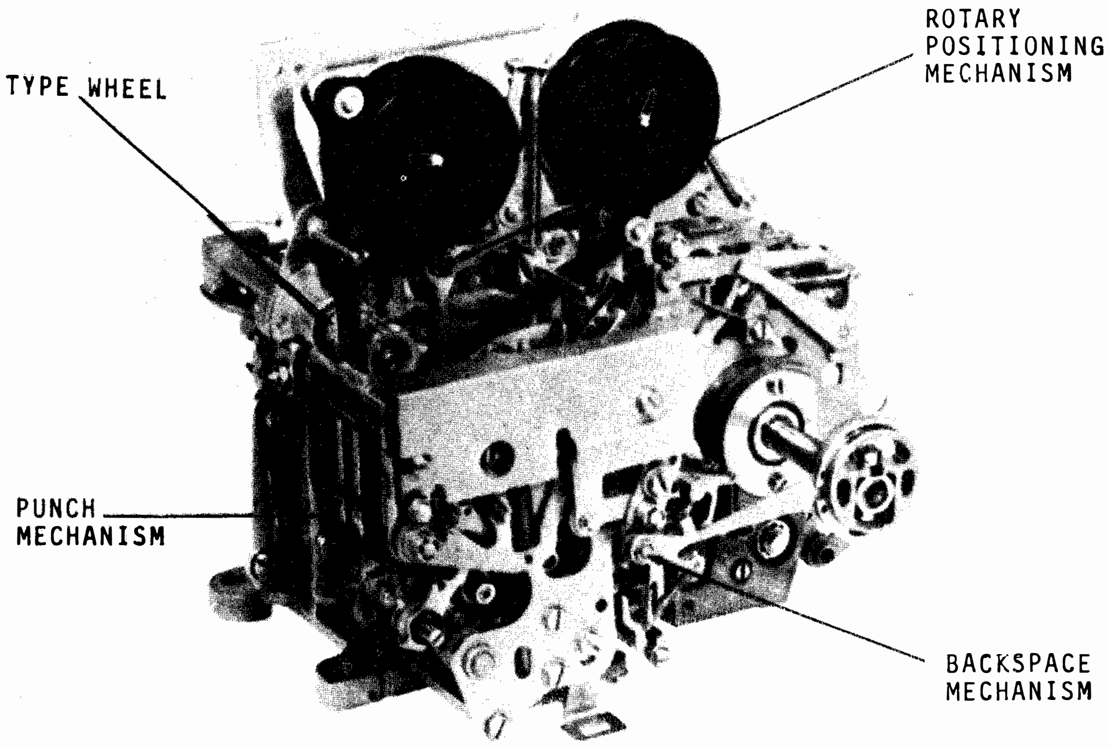


Figure 1-23. Typing Perforator, Front View

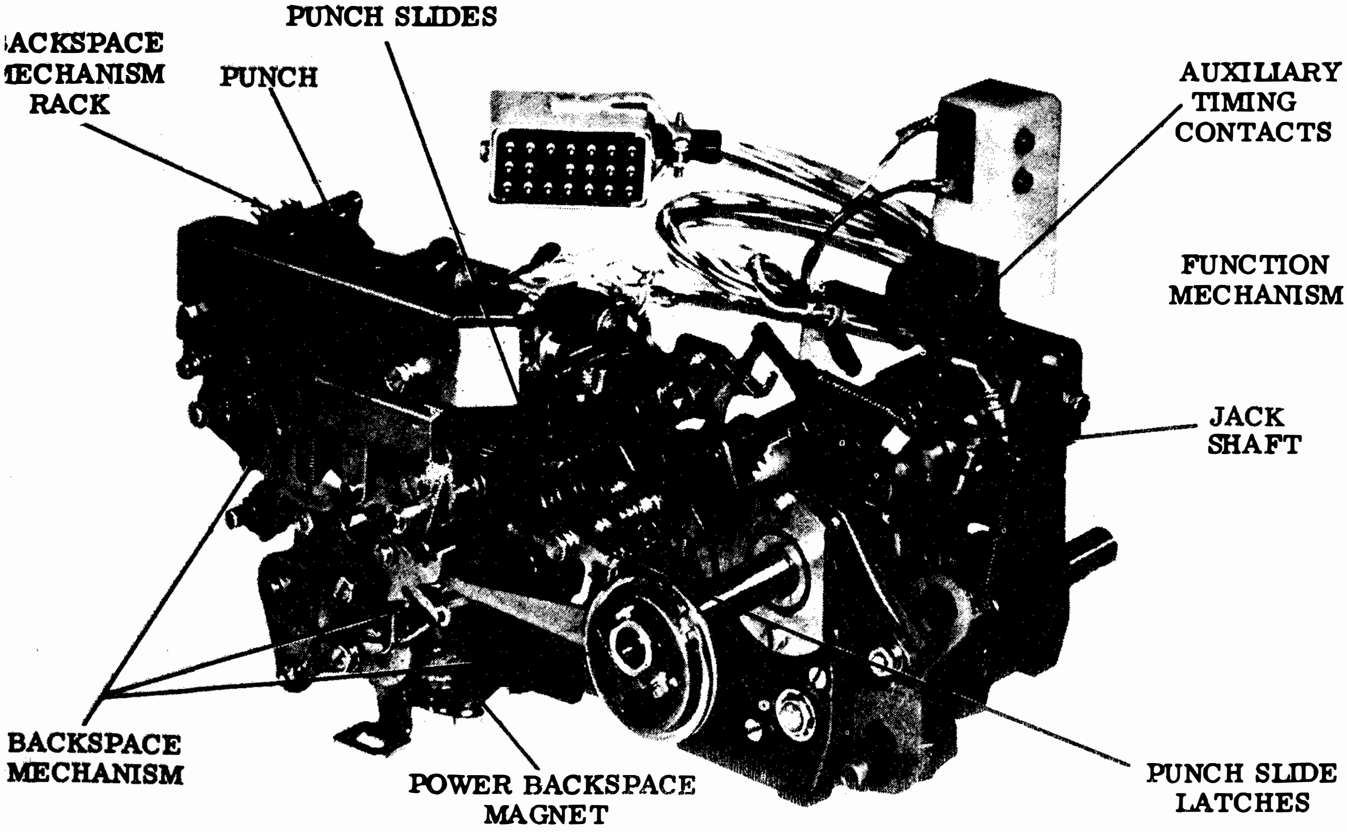


Figure 1-24. Non-typing Perforator, Front View

perforators in that the non-typing perforator has a two-stop clutch which stops twice during each revolution and performs its function in one-half of a revolution. This makes the non-typing perforator capable of operating twice as fast as a unit with a one-stop clutch. The typing perforator uses a one-stop clutch because the typing mechanism limits its speed of operation. The cams of the function shaft assembly are used to provide motion for the rocker bail, the main source of power for all functions except selection.

(3) Selection. Selection is accomplished mechanically from an associated keyboard through its code bar extensions. An extension is positioned to operate each punch slide latch on the perforating mechanism when selection is made, and a perforator trip lever latch is in position to trip the perforator clutch when selection is applied at the keyboard.

(4) Perforating. The perforator mechanism consists of a set of five punch slides, punch block assembly containing punch pins, toggle bail and reset bail assembly, and a tape feeding assembly. A perforator drive link connects the toggle bail and reset bail assembly to the rocker bail which provides motion for operation of the perforator mechanism.

(5) Typing. In addition to the function, selecting, and perforating mechanism, the typing perforator encompasses other mechanisms necessary for printing on tape. The selection is passed through a transfer mechanism to a function box and pushbars which control a rotary positioning mechanism and an axial positioning mechanism to position a type wheel for printing. A correcting mechanism further corrects the positioning of the type wheel. A printing mechanism driven directly by the rocker bail actuates a print hammer after the type wheel has reached its correct position, and impels the print hammer upward to drive the tape and inked ribbon against the type wheel. A ribbon feed mechanism, which advances an inked ribbon one space during each operation, is actuated by the rocker bail through a ribbon drive arm.

(6) Variable Features. Some variable features used with the perforators are: tape backspace mechanism, code reading contacts, and auxiliary contacts. The tape backspace mechanism may be manually operated entirely on the perforator, or, with the addition of a magnet assembly on the perforator, it may be power operated from a keylever and switch assembly on a keyboard. The code reading contacts are operated by the punch slides to read the code combinations which are being perforated. The auxiliary timing contacts provide synchronizing pulses for the code reading contacts.

f. Transmitter Distributors. A transmitter distributor (TD) in Figure 1-25 contains the necessary mechanisms to advance the tape, read its perforations, and to convert these into teletypewriter signals. The transmitter distributor is installed on a separate base, but receives motive power from the keyboard-mounted motor unit. This unit is controlled by a

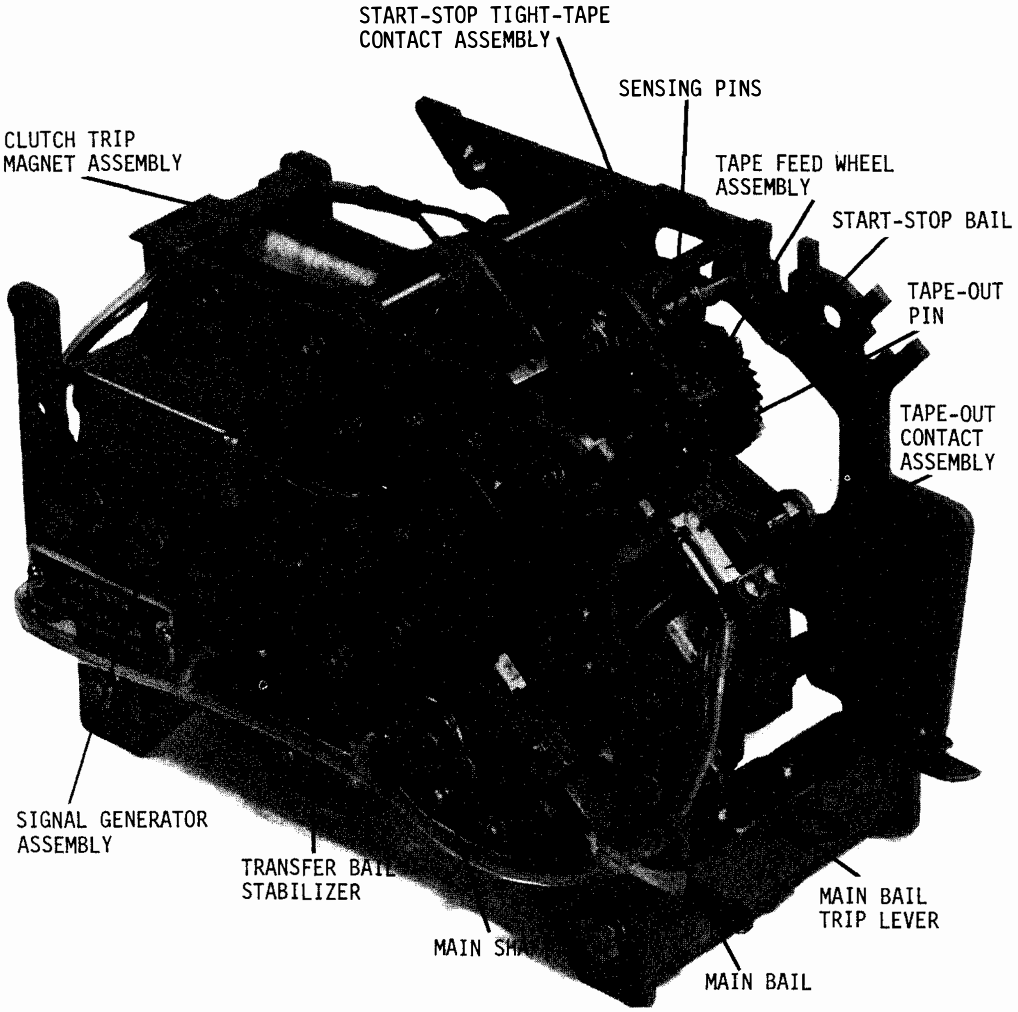


Figure 1-25. Transmitter Distributor Unit, Cover Plate, Top Plate, and Tape Guideplate Removed

three-position start-stop switch which is accessible to the operator. The ASR set uses one basic type transmitter distributor which has a fixed head and single contact. It contains a stationary tape reading head and a single-head contact distributor. Output is sequential.

(1) TD Base. The TD base, shown in Figure 1-26, is used in the ASR set to mount the TD unit. All TD bases are similar in structure, consisting of an aluminum casting designed to be mounted on the cradle in the left side of the ASR cabinet. The TD base serves as a mounting for two drive shafts with bearings, and a gear. These shafts are at a right angle to each other and transfer driving motion from the power shaft of the perforator-transmitter base to the TD. The speed at which the TD runs may be changed by changing the set of gears between the two shafts. These gears are not considered a part of the base. Where necessary, adjustable stops are provided to determine the front to rear position of the TD. A gear guard is provided for the speed gears as a safety measure and for protection of the gears. Most of the early designed TD bases have no electrical connections. Later designed bases and some early designed bases, however, have a cable with a connector at each end. These connectors are fastened to the base by brackets in a suitable location for connecting electrical circuits from the TD to an associated electrical service unit cable.

(2) TD Unit. The single contact TD unit, shown in Figure 1-27, is an electromechanical device, which reads code combinations perforated in tape, translates these combinations into electrical impulses, and transmits them in the form of a 5-level start-stop permutation code to one or more receiving stations. The TD unit can be used as a component in a self-contained set, in an ASR set, or a gang-mounted arrangement. The TD uses a single camshaft to start, and sequentially perform, the functions of sensing the intelligence stored in a perforated 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 accepts either chadless or fully perforated tape (Figure 1-28). The signal generator assembly (Figure 1-27) includes a contact toggle assembly, a drive link, a cover, and an eccentric for adjusting the signal contacts. 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.

(3) Configuration. The following operating mechanisms of the TD are contained between three parallel plates:

(a) The tape sensing mechanism which consists of a bank of sensing pins (Figure 1-25), each with its

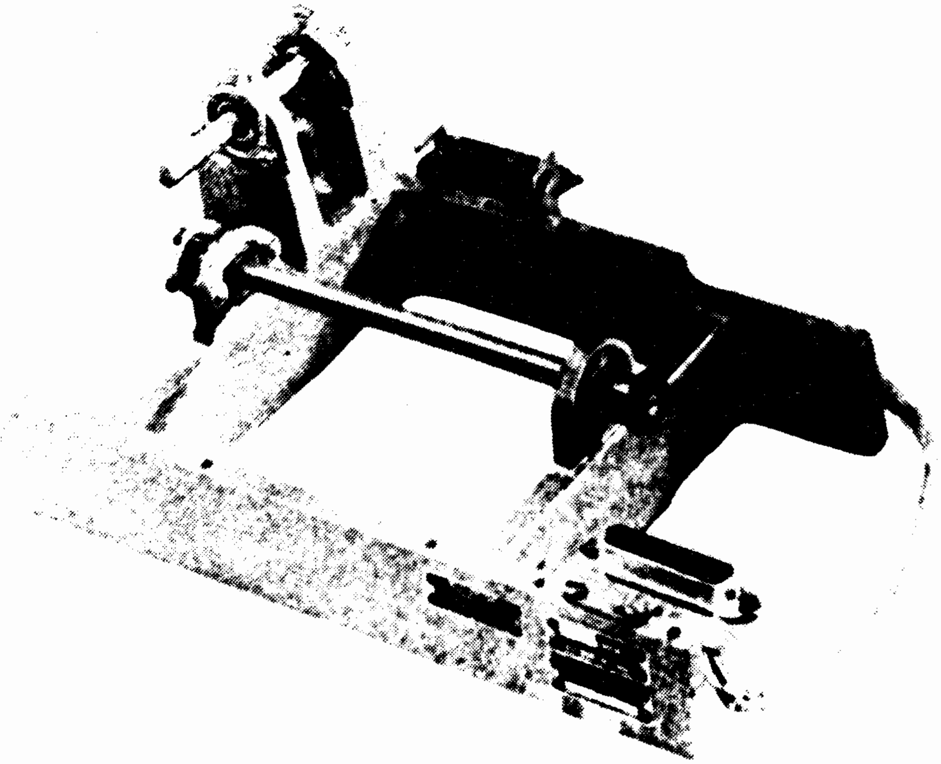


Figure 1-26. Typical ASR Transmitter Distributor Base

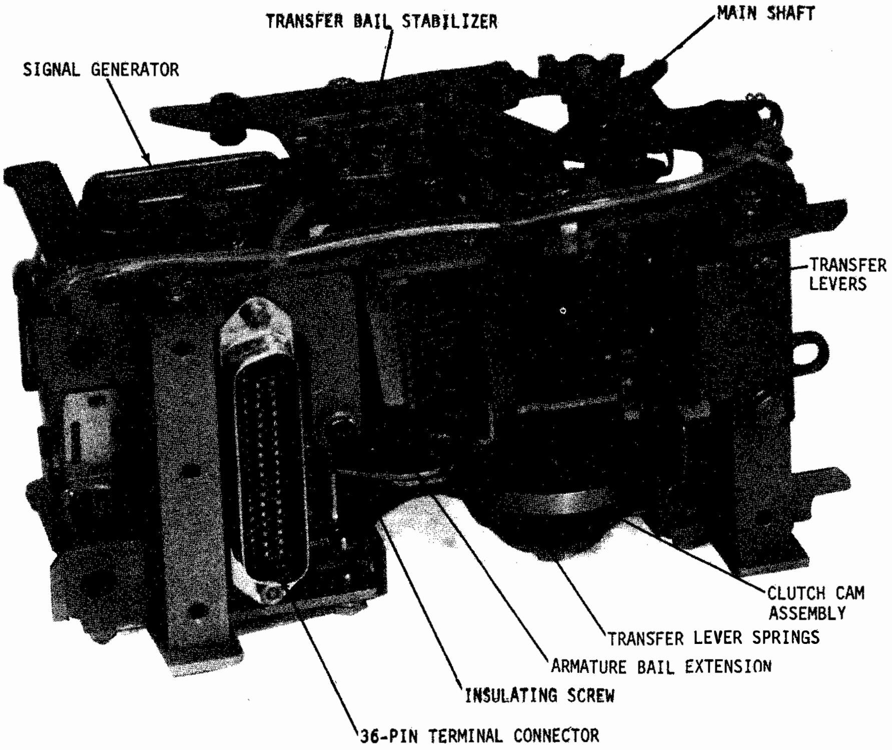
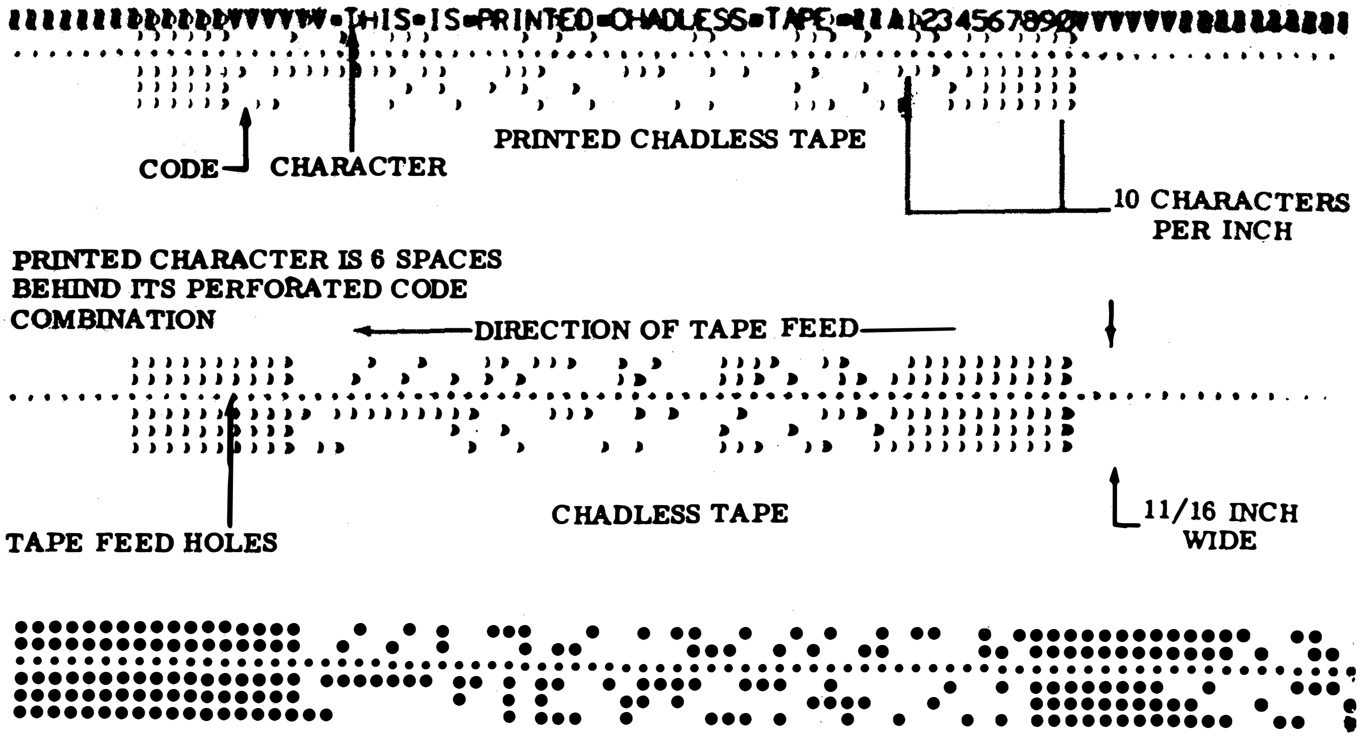


Figure 1-27. Transmitter Distributor Unit, Bottom View



FULLY PERFORATED TAPE

Figure 1-28. Standard 5-Level Perforated Tapes

corresponding transfer lever (Figure 1-27).

(b) The main shaft assembly (figures 1-25 and 1-27), which is centrally located in the lower portion of the unit, has the outer race of each ball bearing clamped to the respective front and rear plates. The main shaft assembly consists of multiple cams, eccentrics, and a clutch. Motor power to the shaft is obtained from an external source and is controlled by the clutch and the clutch trip magnet assembly.

(c) A tape feed mechanism that accommodates either chadless or fully perforated tape.

(d) A tape-out pin (Figure 1-25), located to the right of the sensing pins, stops transmission if there is no tape in the sensing mechanism.

(e) A quick disconnect 36-pin terminal or plug which aligns with its mate on a base, facilitates making electrical connections (Figure 1-27).

(f) A tape lid which has the following components:

1. A three-position control lever for manual control of the unit. The lever positions are FREE, STOP, and RUN.

2. A pair of adjustable guides (figure 1-29) for aligning and locating 11/16- or 7/8-inch wide tape over the feed wheel. An index line scored in the tape guides 0.600 inch (6 characters) ahead

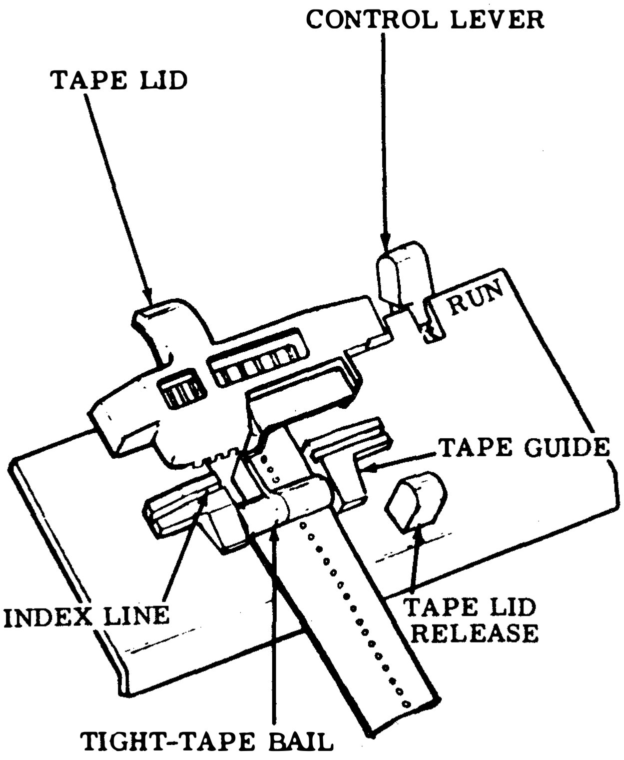


Figure 1-29. Tape Guideplate

of the sensing pins to aid in aligning the tape.

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

4. A spring-loaded tape lid (Figure 1-29) that snaps open when the red tape lid release plunger is depressed.

(4) Electrical Circuits. The TD has two electrical circuits, the clutch trip magnet (control) circuit and the signal circuit. The clutch trip magnet circuit consists of the clutch trip magnet coils which are in series with the tape-out, start-stop, and tight-tape contact assemblies. The signal circuit consists of the transmitter signal generator contacts wired to provide neutral operation.

g. Auxiliary Typing Reperforator Base. The base, shown in Figure 1-30, is used in the ASR set for mounting an auxiliary typing reperforator unit. The base is a simply designed structure of steel plates which serve as a mounting for a typing reperforator, a motor unit, tape container, gear bracket assembly, and a bracket on which electrical connections are made. The gear bracket assembly, driven directly by a motor, may contain two shafts with interchangeable gears for speed change, or it may be a gear shift assembly by which speed change may be accomplished by moving a lever to any one of three positions. A reperforator driving sprocket is mounted on the gear assembly for driving the reperforator unit by means of a timing belt. Motor mounting facilities are provided on the lower level of the base so that the motor is located in

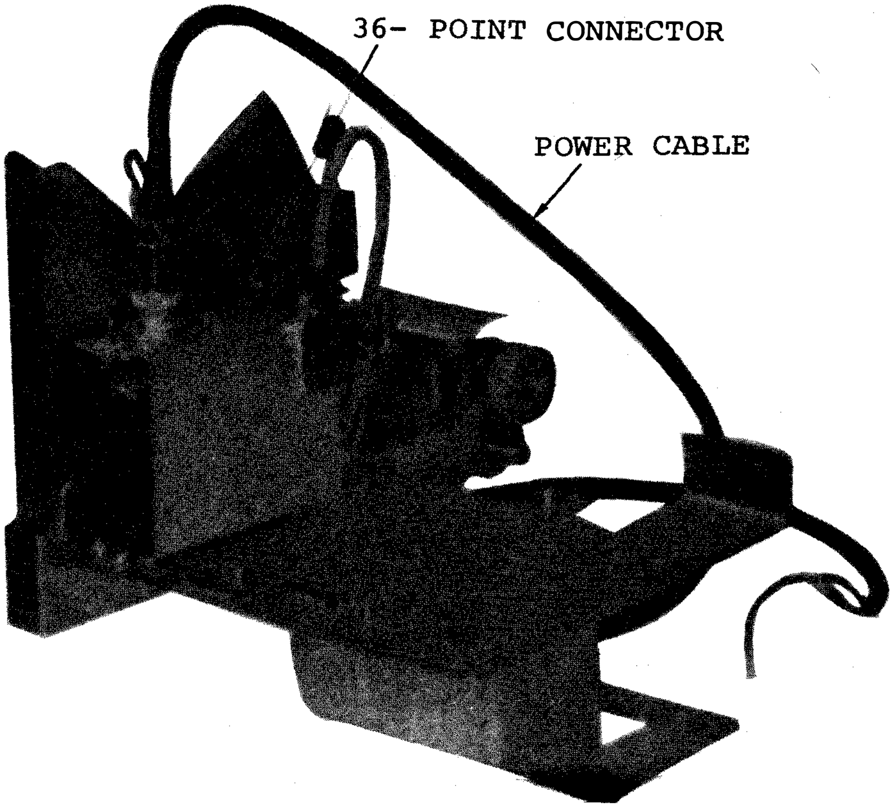


Figure 1-30. Typical ASR Auxiliary Typing Reperforator Base

position for driving the gear assembly. The tape container accommodates a full roll of tape, which is directed out through a tape guide with roller to the typing reperforator. A low-tape electrical switch assembly is provided in the tape container. A tape-out switch lever rides the diminishing roll of tape to actuate an electrical switch when a prescribed level is reached. The electrical connections are made on a bracket assembly adjacent to the tape container. A power cable connector is provided to accept electrical power from the cabinet terminal board. A power switch provides means for switching power to and from the auxiliary typing reperforator unit. A 36-point connector is provided to accept cable connections from an associated electrical service unit. From the 36-point connector a cable emerges to carry electrical connections to a connector on the typing reperforator.

h. Typing Reperforator Unit. The Model 28 typing reperforator shown in Figures 1-31, 1-32, and 1-33 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 type and perforate the tape. The typing reperforator is available in two variations: The fully-perforated tape unit (Figure 1-33) and the chadless tape unit (Figure 1-31) and prints between the feed holes. The chadless-tape typing reperforator prepares partially punched (hinged chad) tape and prints along the upper edge of the tape. Except for these

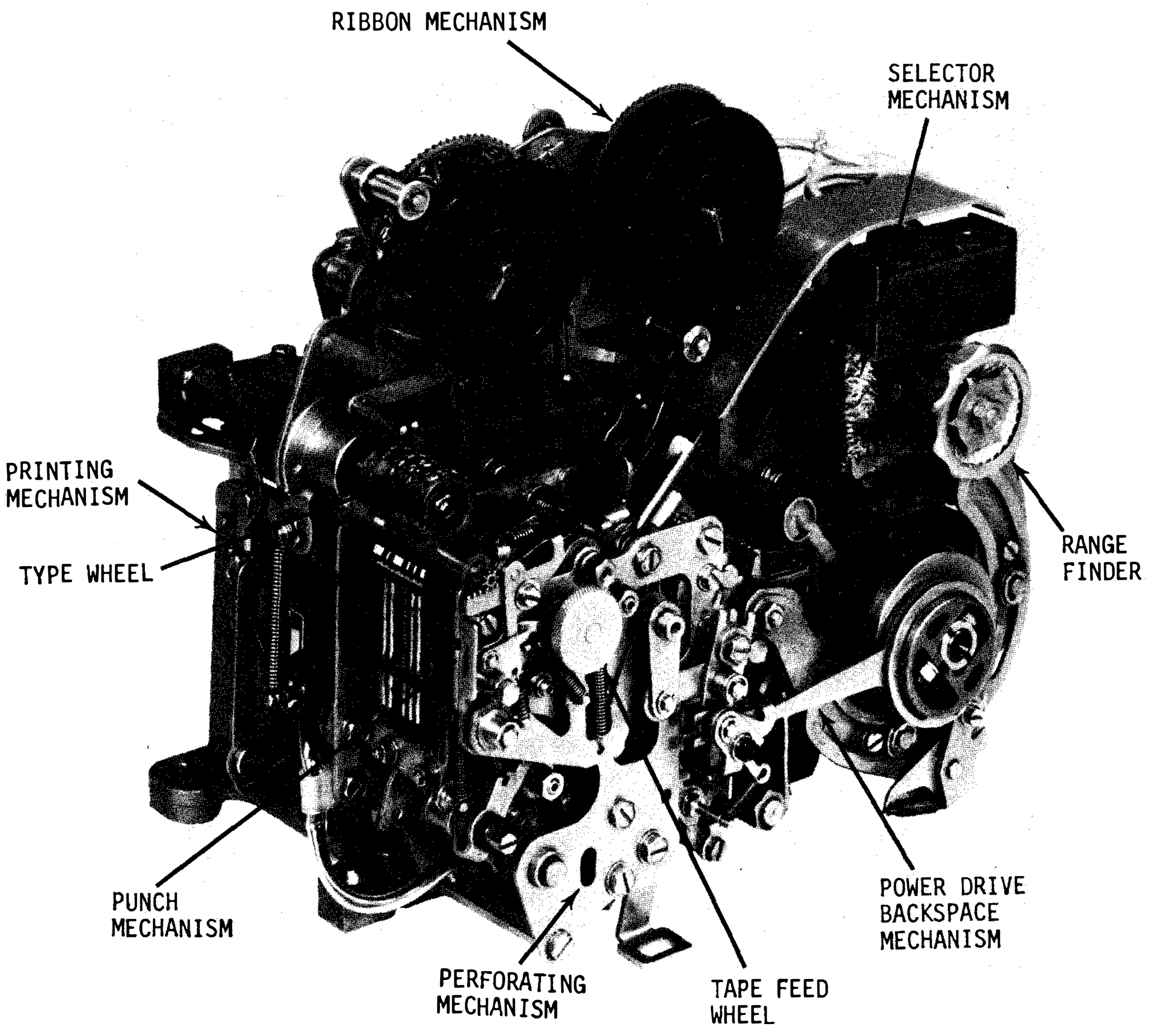


Figure 1-31. Typing Reperforator Unit Model 28 (Chadless Tape), Left Front View

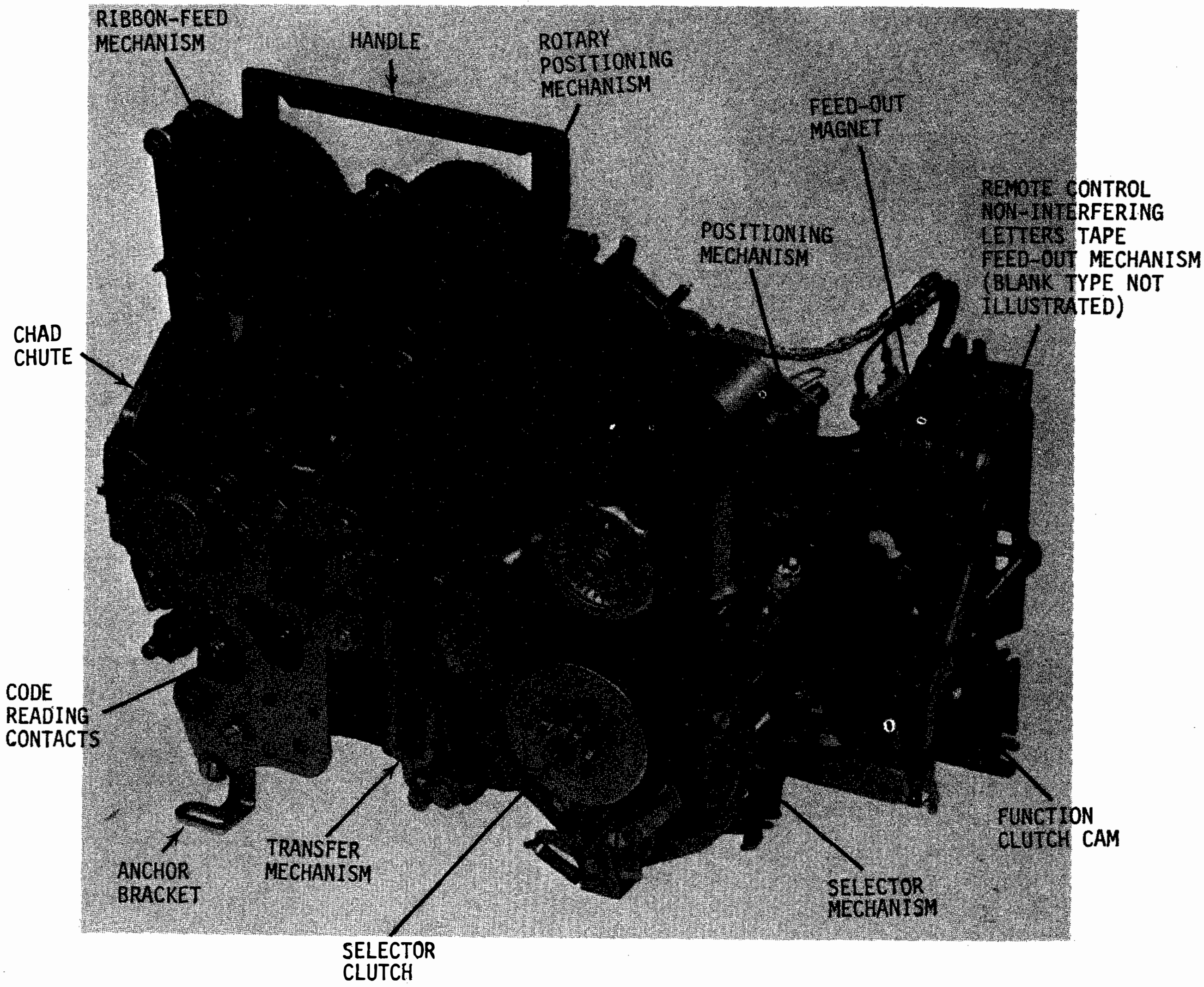


Figure 1-32. Typing Reperforator Unit Model 28 (Fully Perforated Tape), Left Rear View

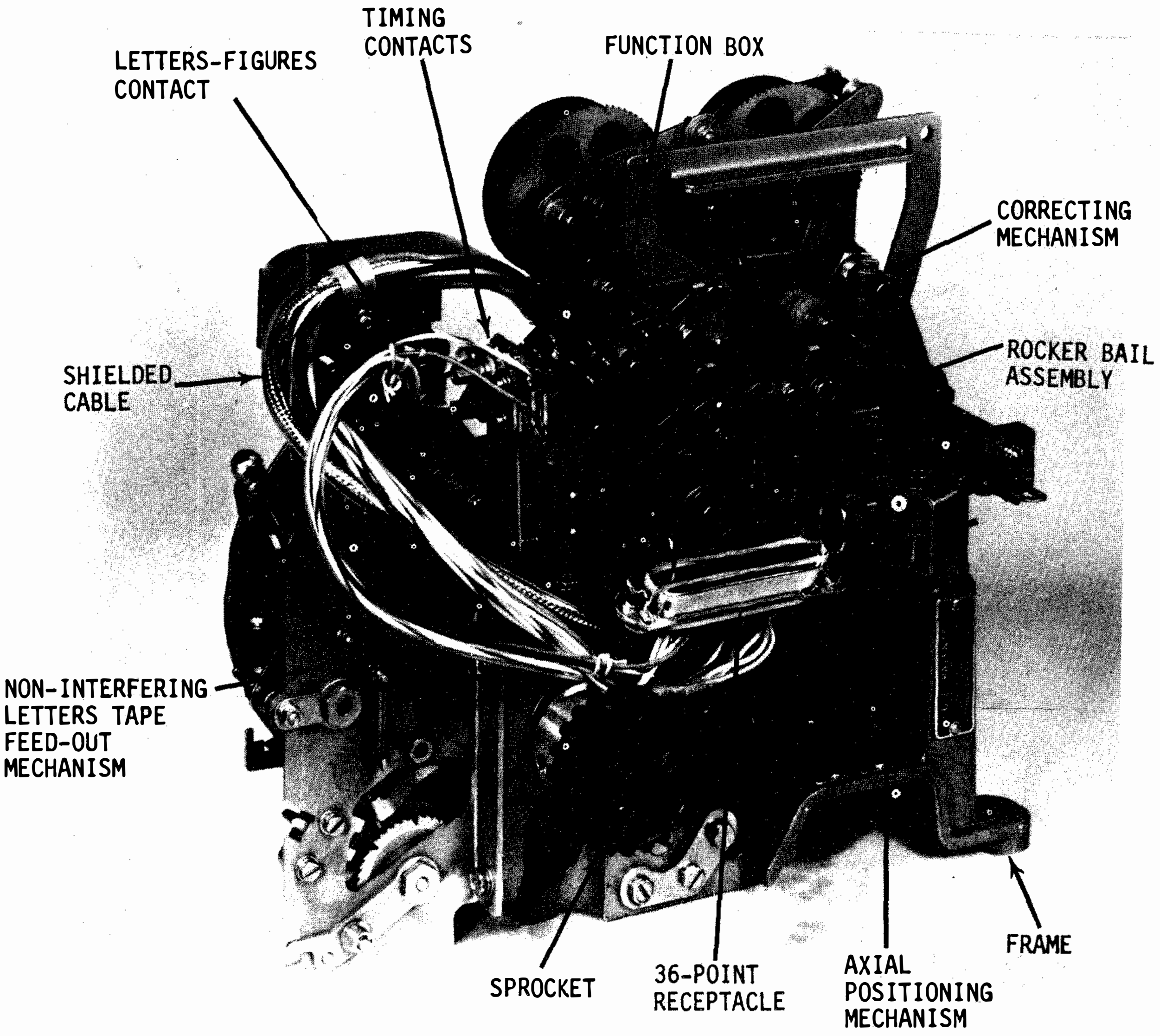


Figure 1-33. Typing Reperforator Unit Model 28 (Fully Perforated Tape), Front View

differences, the units are identical. 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 referred to as running open when the main shaft is turning and no signal is applied to the selector magnets. The following paragraphs describe the mechanisms that comprise the typing reperforator units.

(1) Rotary Motion Distribution. 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 power, through a gear shift mechanism or gear changes, permit changes from 60 to 75 or 107 wpm in the typing reperforator operating speed. A rocker bail further distributes the motion to the mechanisms involved in printing and perforation.

(2) Selecting Mechanism. A selecting mechanism, which includes a two-coil magnet wired to the signal line, converts the electrical code combinations into mechanical arrangements which govern the printing and perforation. The magnet 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.

(3) Type Wheel and Positioning Mechanisms. The characters used in printing are embossed on a bakelite type wheel which may be 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.

(4) Printing, Ribbon-Feed and Perforating Mechanisms. A printing mechanism utilizes a hammer to drive the tape and inked ribbon against the type wheel and imprint the selected characters. The ribbon is advanced by a ribbon-feed mechanism. A perforating mechanism steps the tape, punches feed holes and perforates chadless (or fully perforated) code holes corresponding to the code pulses received by the selecting mechanism. The tape is threaded by means of a handwheel. Printing and perforating occur simultaneously at a punch block, but the characters are printed six spaces to the right of the corresponding code combinations. The type wheel is retracted at the end of each operation to make the last printed character visible.

(5) Function Box. A function box enables the unit to perform various auxiliary functions including the LETTERS-FIGURES shift, unshift on space and signal bell.

(6) Frame Assembly. 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 36-point connector for all electrical input requirements is provided.

(7) Variable Features. A number of variable features are available with the

typing reperforator, 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 furnish electrical pulses for remote use. They include timing, code reading, and audible and visual indicator actuating contacts.

(b) Two basic types of backspace mechanisms 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 permit the inclusion of a predetermined length of BLANK or LETTERS perforated tape following the perforation of a message. The extra length of tape facilitates tape handling. Normally, the interfering tape feed-out mechanism operates at the end of a message. A message can not be received during the feed-out period. The non-interfering tape feed-out mechanisms have provisions for operating messages that are received during the feed-out period. The mechanisms may be operated automatically, manually, or by remote control.

(d) Print suppression on function feature prevents the printing of a predetermined character when the character or function is selected.

(e) Universal function blade contains removable tines so that it may be coded to accommodate any desired function box requirement.

(f) The typing reperforator unit used in the ASR set contains an additional shaft that enables its perforator and typing mechanisms to be operated at a different speed from that of its selecting mechanism.

(8) <u>Signaling Code</u> The typing reperforator operates on the principle of electromechanical conversion of message characters (see Figure 1-16) in terms of a signal code. Teletypewriter equipment utilizes the Baudot code, a five-unit start-stop signaling code, in which each character or function is represented by a combination of marking current and spacing current time intervals. In a polar signal circuit, intervals during which current flows in a positive direction are referred to as marking elements, and intervals during which current flows in the opposite direction as spacing elements. In a neutral signal circuit, intervals during which current flows in the curcuit are referred to as marking elements, and intervals during which no current flows as spacing elements.

i. <u>Electrical Service Unit</u>. The Model 28 electrical service unit (ESU) serves as an area of concentration for the wiring of Model 28-type apparatus and provides mounting facilities for various electrical assemblies and components. The operational facilities provided by the ESU vary, depending upon the number and complexity of functions performed by the set. Complete operation of an ESU requires connection with other components of the set with which it is used. The ESU, shown in Figure 1-24, consists, basically, of a metal frame, or chassis, and a number of mounting plate assemblies. The chassis has four legs that permit the unit to be turned upside down for maintenance purposes. Cutouts for routing cables or mounting switches and controls, as required, are provided. The mounting plate assemblies are installed on the blank top of the chassis. Unused positions are occupied by blank mounting plates. Terminal boards and cables, required for interconnection of the assemblies with other components, are provided by the installed assemblies. Some of the features that may be mounted on the ESU are listed below:

(1) Line shunt relay assembly.

(2) Line (polar) relay assembly.

(3) Rectifier assembly.

(4) Line test key assembly.

(5) Capacitor-resistor assembly.

(6) Motor control assembly.

(7) Signal line limiting resistance.

(8) Convenience outlets (115 vac).

(9) Convenience outlet fuses.

(10) Power switch (may be installed directly on chassis).

(11) Selector magnet driver.

j. Cabinet. The ASR cabinet, shown in Figure 1-34, is an enclosure with its cover and all external faceplates. The cabinet protects the enclosed components against dust, possible damage from external sources, and reduces the operating noise level. The cabinet, of sheet metal construction, is finished internally and externally in baked enamel. The cabinet is 38-1/2 inches high, 46 inches wide with the offset copyholder (36 inches wide without the offset copyholder), 18-1/4 inches deep, and weighs approximately 150 pounds.

k. Motor Units. The motor units that provide mechanical motion for the ASR set are of two basic types; ac synchronous and ac/dc series governed. The ac synchronous motor is used when the power source is regulated; the ac/dc series governed motor operates from either regulated or unregulated power. The latter is required where only unregulated power is available. The units operate at the same speed and are rated heavy-duty to accomodate the ASR set load requirements.

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

(1) Horizontal Tabulator. Permits rapid movement of the typing unit type box to predetermined positions on the copy paper.

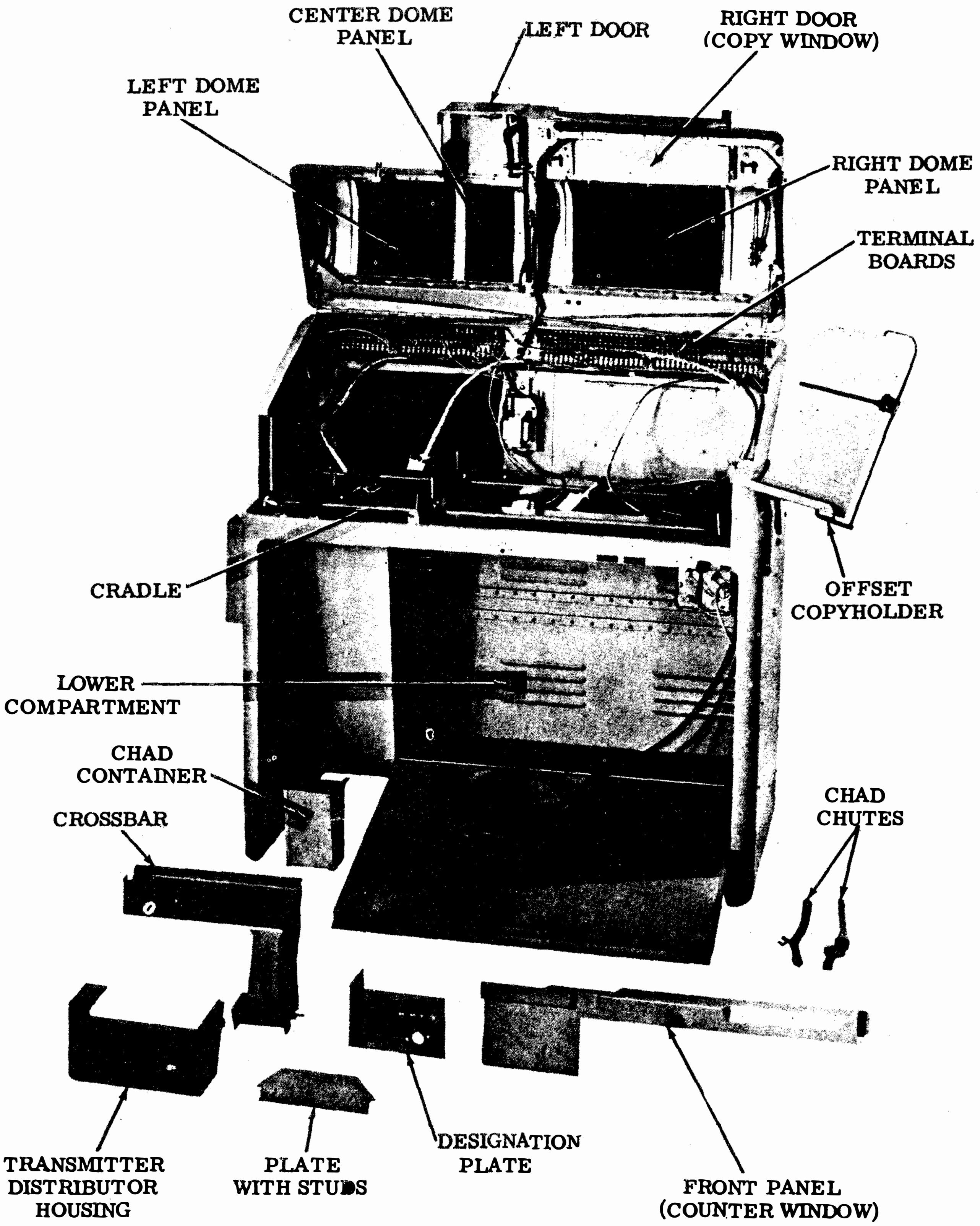


Figure 1-34. Teletypewriter Cabinet for Automatic Send-Receive (ASR) Sets Model 28 (Dome Cover Open)

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

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

(4) Automatic Carriage Return/Line-Feed. These function occur simultaneously should the sending station fail to initiate them when the type box reaches the right margin.

(5) Contact Mechanisms. A number of electrical contact mechanisms are available to provide control of external equipment or for other special applications. These include code reading, timing, auxiliary, and LETTERS-FIGURES contact mechanisms.

(6) Tape Feed-Out Mechanism. This mechanism may be installed on the tape punch units. It operates automatically or manually to feed out a length of BLANK or LETTERS perforated tape for convenience in tape handling. Tape feeding may be either interfering or non-interfering.

(7) Backspace Mechanism. This mechaism, operated manually or with power-drive, retracts tape back through the punch block to allow erroneously perforated data to be obliterated by replacement with the LETTERS code combination.

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

1-3.2 EQUIPMENT DESCRIPTION (LOW-LEVEL). Low-level ASR teletypewriter equipment differs from high-level equipment in that radio frequency interference (RFI) suppression features have been incorporated in several of the low-level components. The following paragraphs describe the RFI suppression features and point out the areas of difference between high and low-level equipment. Unless otherwise stated, high-level discussions in paragraph 1-3.1 also apply to corresponding low-level components.

a. RFI Suppression. RFI suppression as applied to teletypewriter equipment is accomplished by means of shielding and wave shaping a low-level electrical telegraph signal throughout the equipment. The installations vary with each set, but produce the same results of ensuring signal line privacy.

(1) Signaling. The code is transmitted by means of a ±6-volt polar signal through a network of shielded cables to the shielded container of an electrical service assembly (ESA). A +6-volt signal is mark; a -6-volt signal is space.

(2) Electrical Service Assembly (ESA). The ESA is an electrically shielded container in which shielded cables terminate. It also serves as a housing for certain components such as plug-in selector magnet driver circuit cards, clutch magnet driver circuit cards, keyer circuit cards, power supply circuit cards, and relays. ESAs which house low-level keyers (LLK) and

selector magnet drivers (SMD) have double shielded containers and double shielded cables with appropriate connectors for LLK and SMD connections to external equipment.

(3) Cabling. The shielded cabling varies with each set according to need. Each component unit of a set is equipped with sufficient shielding, in the form of metallic enclosures and shielded cables, to suppress signal radiation. All signal generators and magnet assemblies in the signal circuitry are shielded by means of metal containers attached to their respective cables. Interconnecting cables join the component units to the electrical service assembly by means of metal connectors which screw together for a tight shielded connection.

b. ASR Set RFI Components. A shielded RFI selector mechanism is used in the typing unit of the ASR sets. A shielded contact box assembly is used in the signal generator mechanism of the keyboard unit of ASR sets.

(1) RFI Selector Mechanism. The RFI selector mechanism (figure 1-35) mounts on the upper right side frame of the typing unit or the main frame of the reperforator. The selector consists of a special three-pin electrical receptacle, double-shielded cable and metallic container. The three-pin electrical receptacle ensures a secure and shielded electrical connection to other associated apparatus. The double shielded cable electrically connects the three-pin electrical receptacle to the selector magnets. The shielded cable is composed of three electrical conductors encircled by braided inner and outer shields. The inner and outer braided shields are electrically separated from each other and the three electrical conductors by flexible solid dielectric. The metallic container functions as a shielded enclosure for the selector magnet assembly. Enclosed within the metallic container are the selector magnet coils, coil mounting bracket, and selector armature. Each selector magnet coil contains an electrostatic shield which surrounds the coil windings. The selector coil mounting bracket provides mounting facilities for the coils, armature, and biasing spring. The receptacle, shielded cable, metallic container, and selector coils provide RFI suppression when used with associated RFI equipment.

(2) RFI Signal Generator Contact Box Assembly. The RFI signal generator contact box assembly (figure 1-36) as applied to keyboards, consists of a double-shielded contact box, a contact assembly, a filter card assembly, and a double-shielded signal line cable with receptacle.

(a) Contact Box. The RFI signal generator contact box is composed of an inner metallic box completely enclosed by an outer metallic box. They are physically fastened together with insulating material to provide electrical isolation.

(b) Contact Assembly. The contact assembly is provided with gold-plated contacts to permit low voltage operation. It is electrically insulated from the inner box which encloses it.

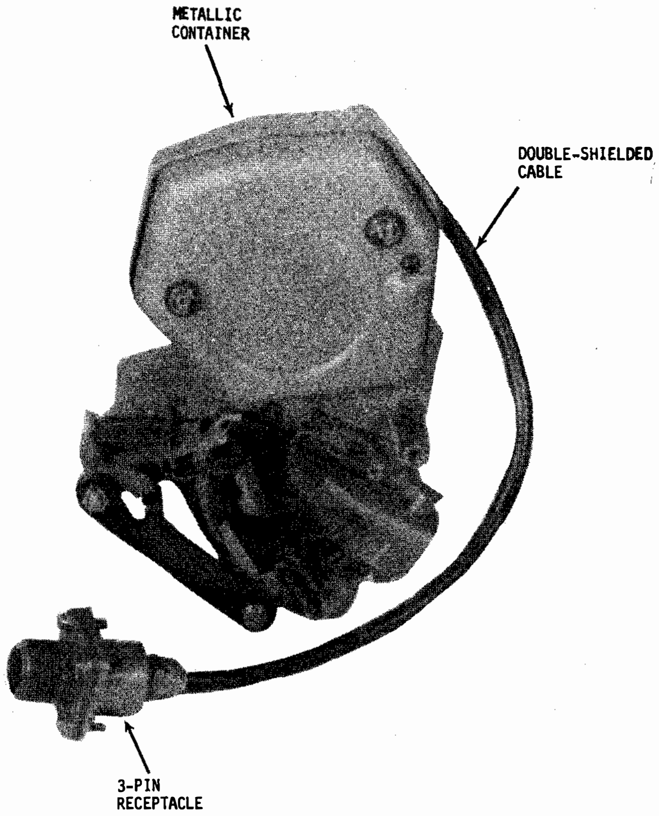


Figure 1-35. RFI Selector Mechanism

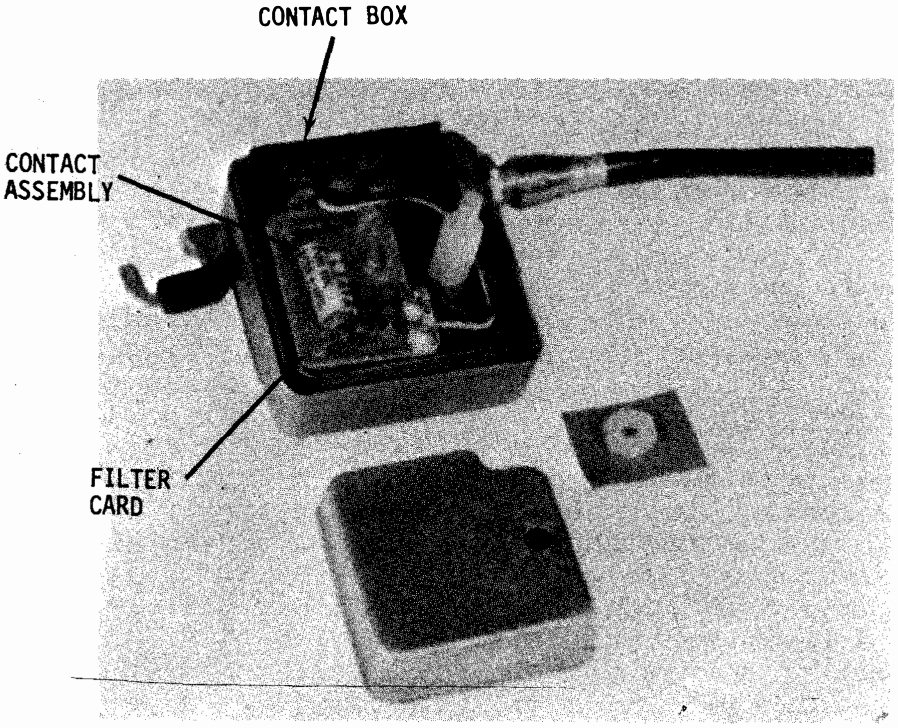


Figure 1-36. RFI Signal Generator Contact Box Assembly

(c) Filter Card Assembly. The filter card assembly is a network of three resistors and a capacitor mounted on a circuit board. It is mounted on the contact assembly within the inner box. When used in conjunction with associated shielded cables, power supplies, and keyer, the filter provides a low-level interface and RFI suppression.

(d) Signal Line Cable Assembly. A double-shielded cable assembly is provided to electrically connect the contact box to a three-pin electrical receptacle. The shielded cable is composed of three electrical conductors encircled by braided inner and outer shields. Two of the three internal wires are electrically insulated, and transfer the telegraphic signals to associated equipment. The remaining wire is bare and electrically connected to the inner contact box, inner braid shield, and cable receptacle. The inner and outer braided shields are electrically separated from each other and the wire by flexible solid dielectric. The inner braid is electrically connected to the inner contact box and the outer braid is electrically connected to the outer contact box. The cable assembly provides RFI suppression when used with associated RFI equipment.

c. Synchronous Pulse. A synchronous pulse mechanism on RFI keyboards provides a means of remotely controlling the signal generator mechanism in order to govern the rate of signal transmission. The incoming low-level synchronizing pulse is applied to the clutch magnet driver circuit which in turn supplies power necessary to operate the clutch trip magnet. The clutch magnet conditioning contacts are gold-plated and have an associated filter circuit to provide RFI suppression. In addition, the clutch magnet conditioning contacts control the clutch magnet driver circuit.

1-3.3 ELECTRICAL SERVICE ASSEMBLY. In low-level configurations an electrical service assembly (ESA) is used instead of the load current power supply. The following paragraphs describe briefly the components comprising the ESA with their functions.

a. Electrical Service Assemblies. Electrical service assemblies (ESAs) are metal shielded containers which vary for different applications. A typical ESA is shown in Figure 1-37. ESAs are used as housing for electronic components which serve to suppress RFI and provide low-level transmission of telegraph signals. The three types of ESAs used with low-level ASR teletypewriter sets are listed in Table 1-3 along with the number of connectors provided for associated LLK, SMD, and CMD circuit cards (figure 1-38). ESAs which house LLK and/or SMD circuit cards require double-shielded box construction. An inner aluminum box functions as an electrostatic shield and is electrically isolated from an outer box which serves as a magnetic shield. CMD circuit cards do not require a double box construction. Single box construction is adequate for the CMD and serves as a combined electrostatic-magnetic shield. The inner box contains a mounting plate with printed circuit board connectors to accommodate a power supply with printed circuit board assembly and the required number of CMD,

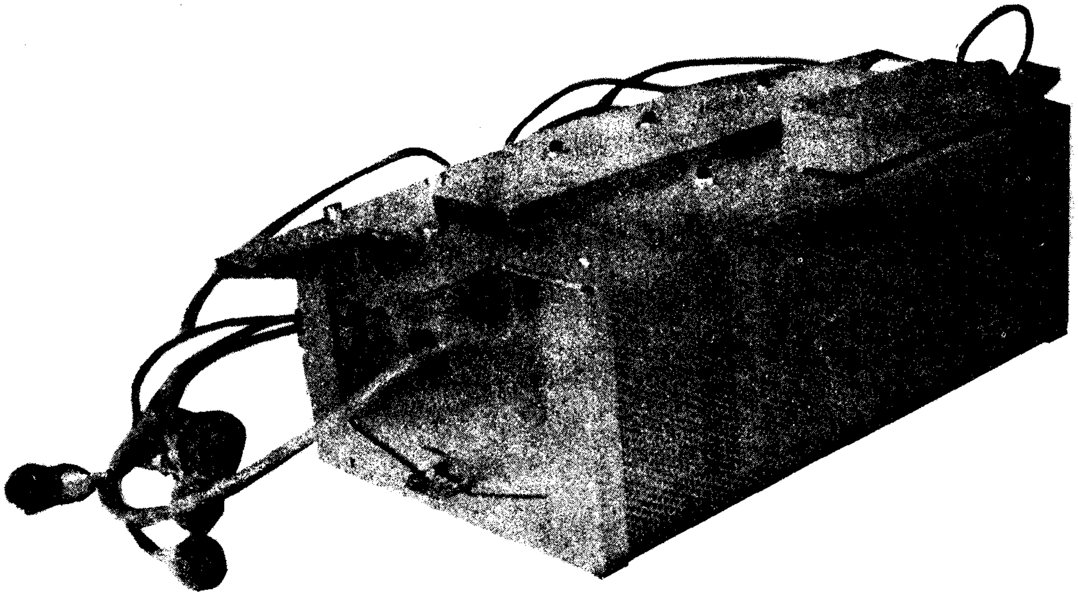


Figure 1-37. ESA for Rack Mounting - Double-Box Construction

SMD, and LLK circuit cards. A screw terminal strip is provided for connecting the signal line. The power supply rectifier filter capacitor is also located in the inner box. The outer box contains the inner box, a power supply transformer, power line filter, and a screw terminal block for ac power connections. A power switch and fuse are located on one side of the outer box. The power supply transformer and rectifier filter capacitor form an assembly which, when used with a ESA power supply card, will meet power supply requirements.

b. ESA Designs. The ESAs are shielded metal containers which vary in configuration for different applications. They differ primarily because of the number of IRs (isolation relays) and circuit board connectors which are provided for the associated keyers and drivers, as well as whether they are designed to be table-mounted or installed in a cabinet. ESAs that house low-level keyer (LLK) or selector magnet drivers (SMD) require double-shielded box construction. An inner aluminum box functions as an electrostatic shield and is electrically isolated from an outer box which serves as a magnetic shield. Single-box construction (figure 1-39 and 1-40) is adequate for the clutch magnet driver (CMD) circuit cards which serves as a combined electrostatic-magnetic shield. The inner box contains a mounting plate with circuit board connectors to accommodate a power supply printed circuit board assembly and the required number of CMD, SMD, and LLK circuit cards. A screw terminal strip is provided for connecting the signal line. The outer box contains the inner box, a power

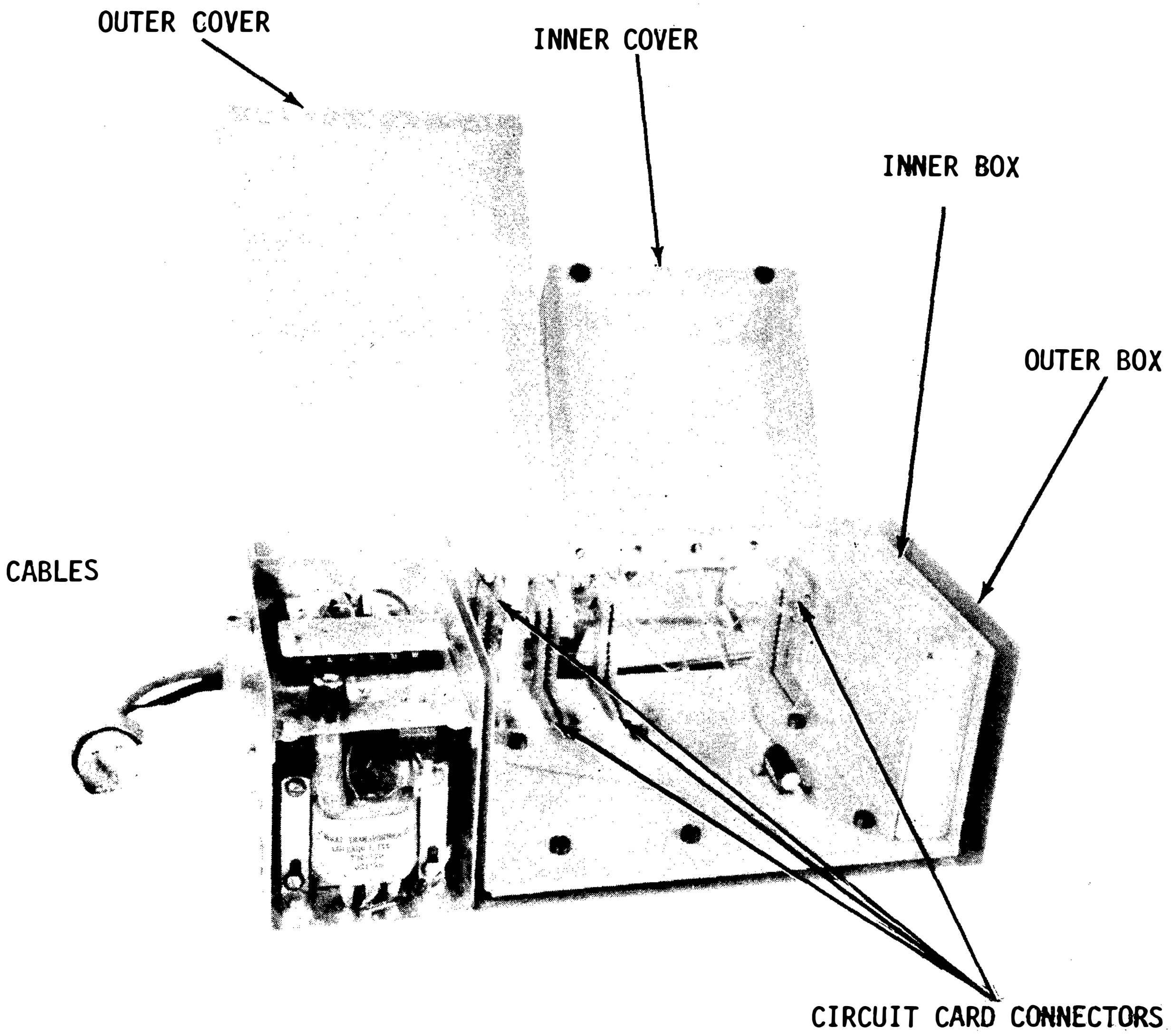


Figure 1-38. ESA Showing Circuit Card Connectors

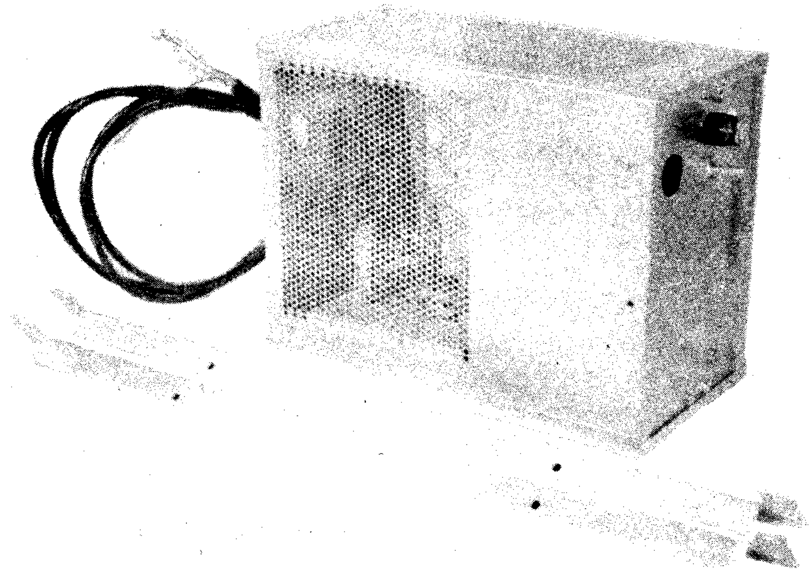


Figure 1-39. Typical ESA for Rack Mounting - Single-Box Construction

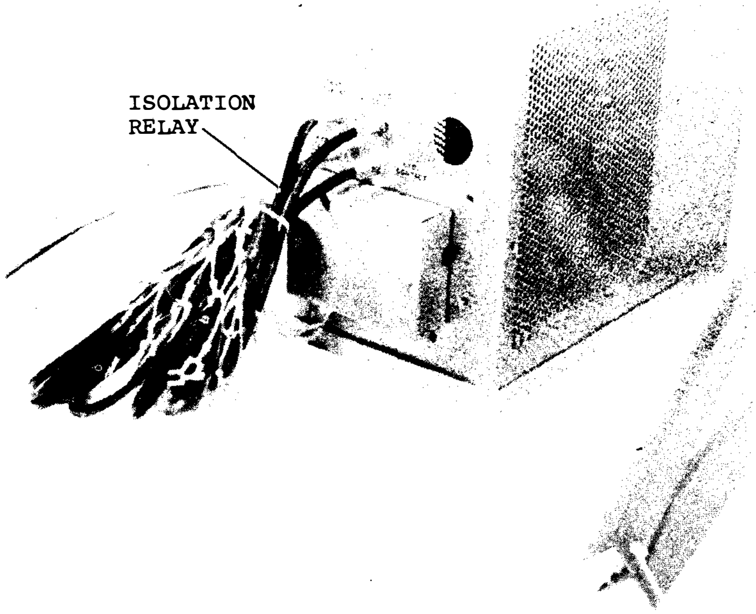


Figure 1-40. ESA for Rack Mounting - Single-Box Construction, Showing Isolation Relay

supply transformer, power line filter, and a screw terminal block for ac power connections. A power switch and fuse are located on one side of the box. The rectifier filter capacitor is housed within the inner box. Single-box and double-box ESAs are designed to be table-mounted. Figure 1-42 shows relative positions of inner and outer boxes and covers and circuit card connectors in a double-shielded ESA.

c. ESA Components. Figure 1-41 is a top view and figure 1-42 is a bottom view of a double-shielded ESA. Figure 1-43 is an exploded view of an ESA having single-box construction, showing typical components. Figure 1-44 shows locations of typical cards used in an ESA. Refer to the circuit discussions in Chapter 3 for a detailed discussion of the operation of each of these circuit cards.

d. ESA Circuit Cards. The following paragraphs include a basic description of the physical properties and operating characteristics of the circuit cards used in the ESA.

(1) Selector Magnet Driver (SMD). The TP323810 selector magnet driver is a 15-pin circuit card assembly designed to plug into an associated ESA as an integral part of its components. When used in conjunction with proper power supply and filter assemblies, it is intended for RFI suppression of receiving selector noise in systems requiring this suppression. Figure 1-45 is a front view of the circuit card. The SMD provides two inputs and makes possible reception from either one of two separate transmitters (single input operation) while the input line from the other transmitter is open. A spacing signal at either input will provide a spacing output. In order to function properly, the SMD should be installed in a double-shielded enclosure and used in conjunction with the appropriate ESAs where extreme RFI suppression is required. It is not intended for general use. The input current to the SMD is a low-level +6-volt input for a marking state, and a -6-volt for a spacing state. The output current of the SMD is 60 milliamperes ±10 percent during the marking state. The output is zero during the spacing state. The SMD assumes the marking state with positive input voltages not greater than +0.5 volt dc and the spacing state with negative voltages not greater than 0.5 volt dc. The marking and spacing switching levels are adjustable within 10 percent of each other. This requirement applies to either input. Each input of the SMD has a minimum input resistance of 50,000 ohms. The maximum input capacitance of either input is 2500 picofarads. Overall receiving margins of properly adjusted Model 28 selectors driven by this SMD (polar rectangular wave input) should exceed 70 points at either input. The SMD provides a marking output when both inputs are open. Both inputs cannot be in the marking condition simultaneously without producing a garbled output. The SMD operates at bit rates up to 75 baud. It operates in a free-air ambient temperature of 70 degrees Centigrade (158 degrees Fahrenheit). Storage temperature should not exceed 85 degrees Centigrade (185 degrees Fahrenheit). The SMD operates from a power supply delivering 47 to 53 volts dc. The power consumption under any

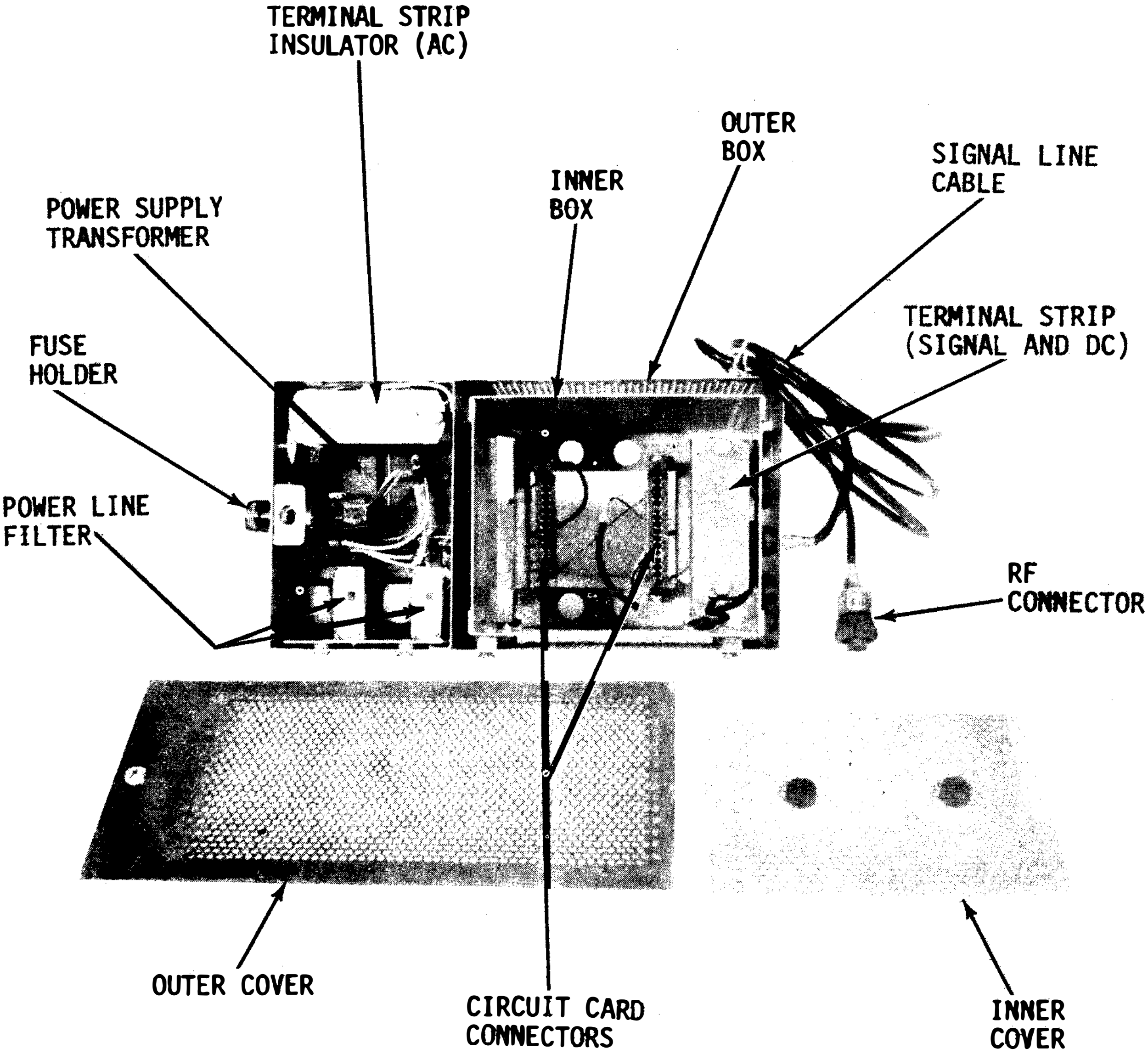


Figure 1-41. Typical Parts of an ESA - Double-Box Construction, Top View

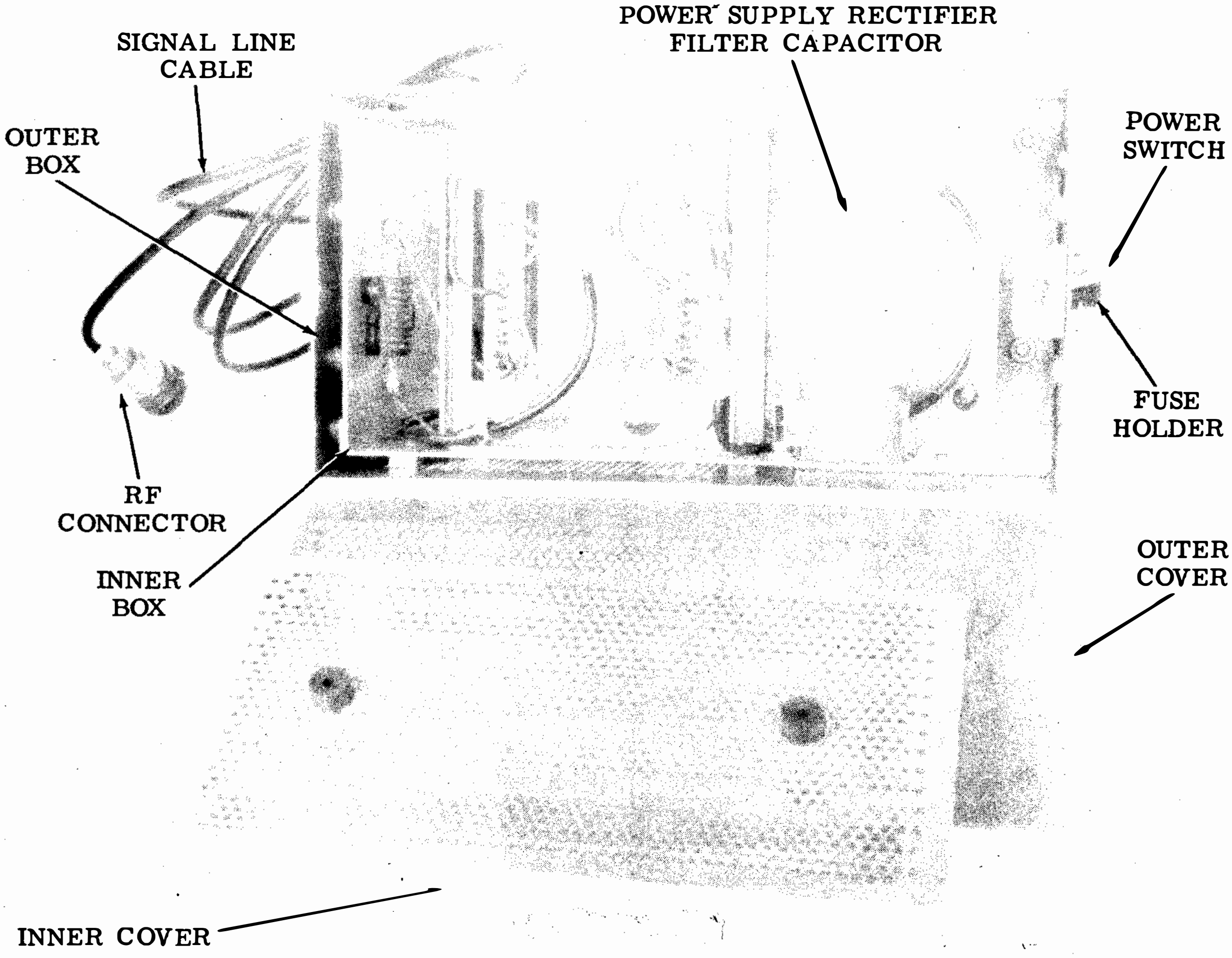


Figure 1-42. Typical Parts of an ESA - Double-Box Construction, Bottom View

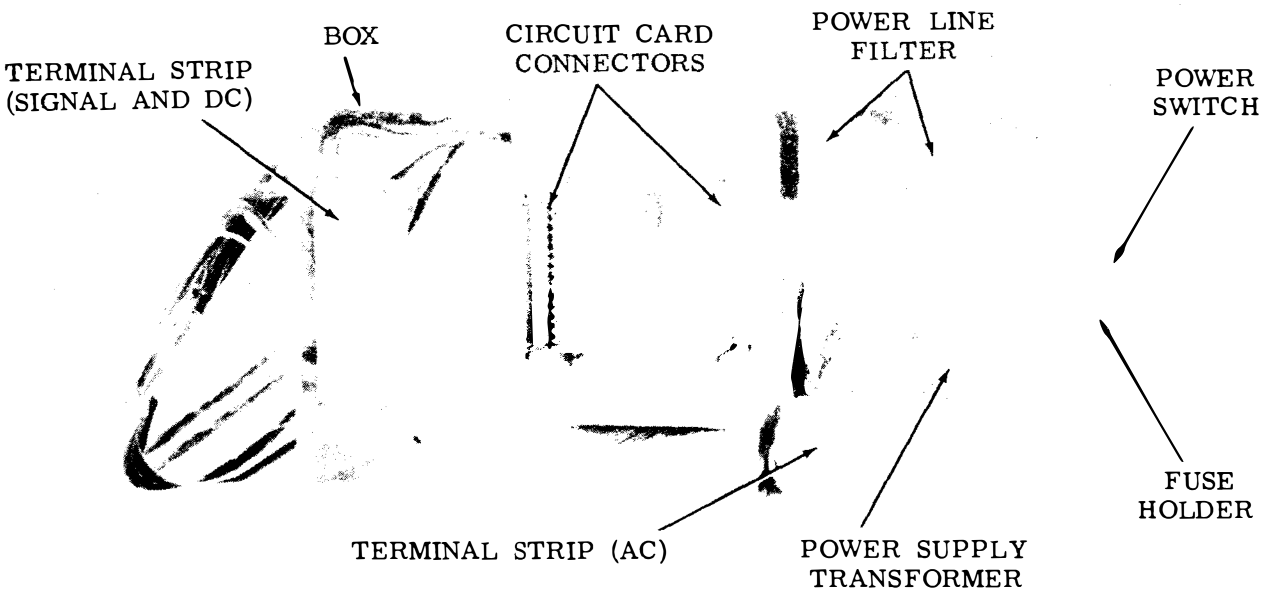


Figure 1-43. Typical Parts of an ESA - Single-Box Construction, Top View (With Covers Removed)

combination of power source, environmental, and component conditions is 8.5 watts maximum. The SMD, together with associated ESA and power supply, is intended for use with equipment requiring low-level RFI (polar-EMC) operation.

(2) Low-Level Keyer (TP303142). The low-level keyers (LLK) are circuit card assemblies approximately 2-1/4 by 4-1/2 inches. They are designed to plug into a 15-pin connector that is wired into the ESA where it becomes an integral component for the suppression of RFI. A front view of this circuit card is shown in figure 1-46. The TP303142 LLK, when used in conjunction with the TP321268 filter card assembly, is intended for use with the TP323644 and TP323645 signal generator (one contact) assemblies. This LLK is adaptable to various types of Model 28-type equipment when used with the applicable ESA and is designed to operate from one set of contacts. However, two signal generator outputs (filter card outputs) may be paralleled to drive one signal line from either of two signal generators. Each keyer is designed to operate into a high-resistance load such as the TP323810 SMD. An external power source, mounted in the associated ESA, is required to operate the keyers. All low-level keyer features for the TP303142 given in the following paragraphs assume the use of the TP321268 filter card assembly. Maximum unloaded power consumption of each keyer is less than 50 milliwatts. The output of the TP303142 keyer is +6.0-volts dc ±1.0-volt corresponding to the marking state and -6.0-volts dc ±1.0-volt corresponding to the spacing state. The marking and spacing output voltages should

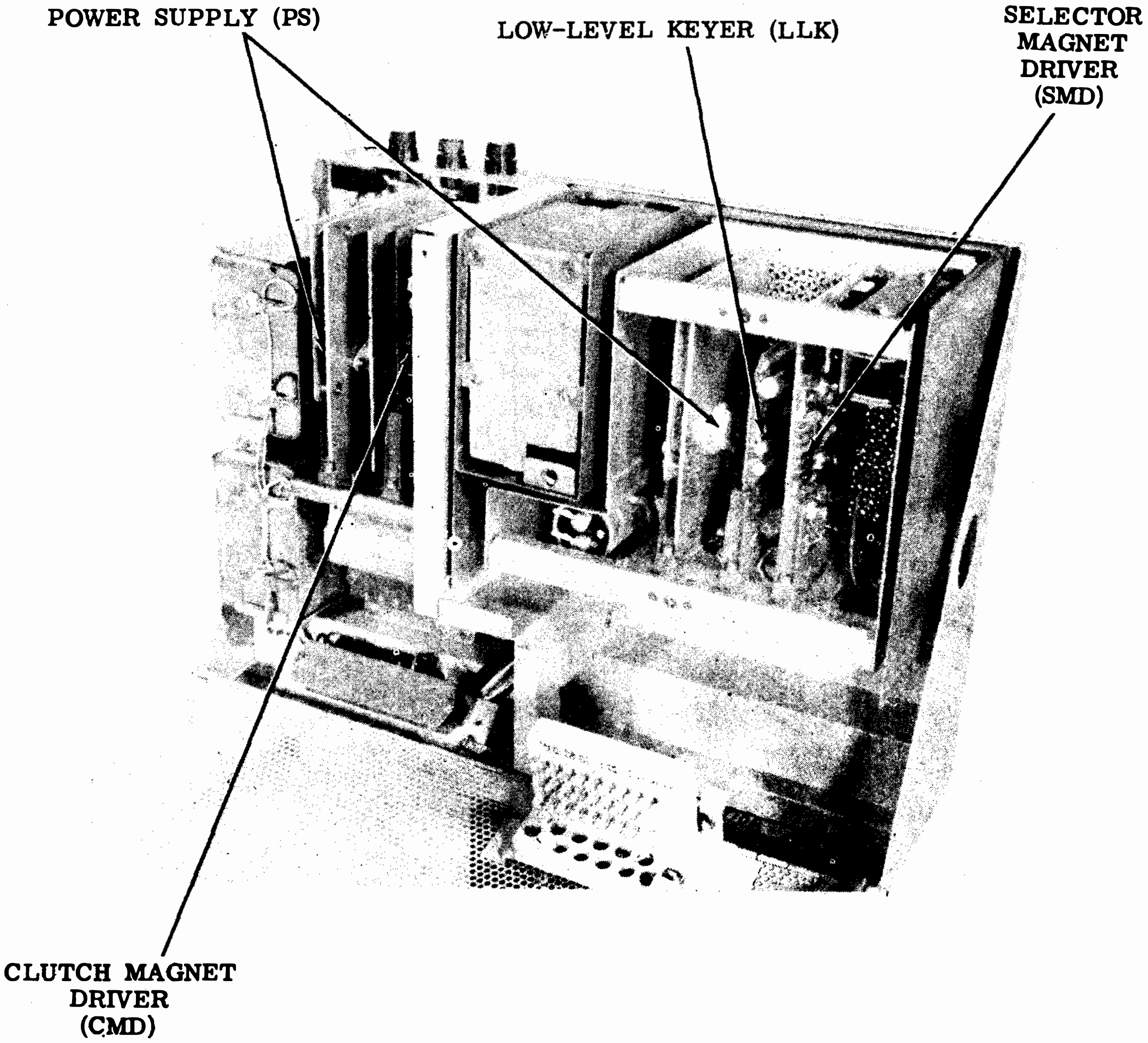


Figure 1-44. ESA Showing Typical Circuit Cards

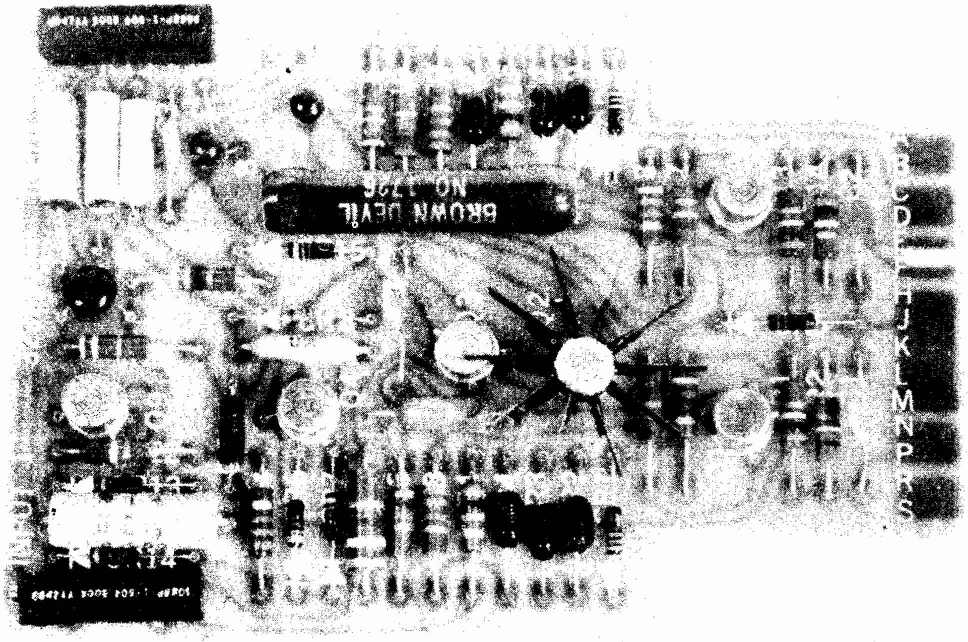


Figure 1-45. Selector Magnet Driver (SMD) TP323810

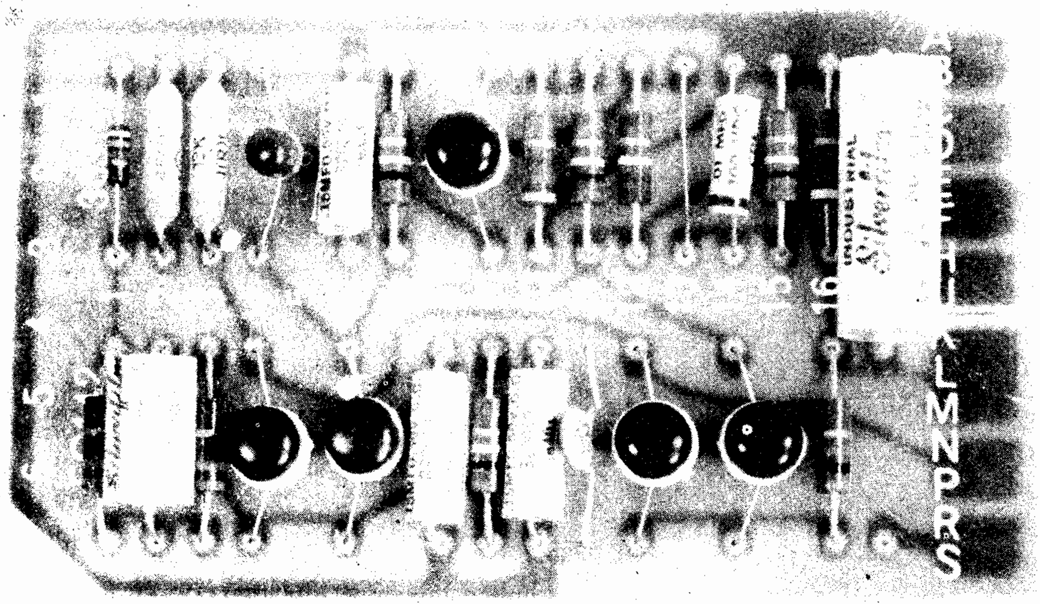


Figure 1-46. Low-Level Keyer TP303142

be balanced to within 10 percent of each other. The TP303142 keyer operates from the spacing contacts (mark contact open, space contact closed) of the TP323645 or TP323644 signal generator assembly. The outputs from two TP321268 filter card assemblies may be paralleled for parallel operation of either of two transmitters. The nominal output impendance is 100 ohms. The keyers operate at bit rates up to 75 baud. Maximum short circuit output current is 60 milliamperes. The TP303142 keyer operates into a load resistance of 5000 ohms minimum. The keyers and TP321268 filter card assembly operate in a maximum free-air ambient temperature of 70 degrees Centigrade (158 degrees Fahrenheit). Storage temperature should not exceed 85 degrees Centigrade (185 degrees Fahrenheit). The TP303142 keyer operates from a power source delivering ±7.42 volts dc ±6.0 volts. Maximum unloaded power consumption is less than 50 milliwatts. The mark and space symmetry at zero volt (output waveform) is adjustable by means of the signal generator position adjustment for the TP303142 keyer. The outputs may be adjusted within 10 percent of each other by the 5-megohm potentiometer on the keyer card. The keyer is intended for use on signal lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.

(3) <u>Power Supply Card (General Description)</u>. The power supply card used in the ESA generates 0.5 ampere. The circuit card, when installed in a shielded ESA containing the proper transformer and filter assembly, are intended as a radio interference power source in systems requiring low-level RFI. The required power supply should be plugged into the 15-pin TP148458 connector in the ESA that has a TP198650 polarizing key between pins M and N for the 0.5-ampere power supply. Refer to Table 1-4 for information regarding the applicable power supply card to be used with the particular set and to the wiring diagram packages in Chapter 5 for the applicable wiring diagrams. See Figure 1-47 for a typical card. The transformer and filter circuits for the power supply card are located in part of the associated ESA. The power transistor and heat sink for the 0.5-ampere power supply are included as part of the TP321290 circuit card assembly. The amperage rating and quantity of power supply circuit cards to be used (one per ESA) will depend upon the equipment used. Each power supply circuit card assembly is a part of some ESA. Each ESA is part of equipment used in low-level operation.

(4) <u>Power Supply (0.5-Ampere) Card</u>. The following technical data applies to 0.5-ampere power supplies when installed in an ESA that accommodates from one to three selector magnet drivers (SMD) or clutch magnet drivers (CMD).

(a) <u>Input</u>: 100 volts ac to 130 volts ac, 45 to 66 Hertz

(b) <u>Output</u>:

1. A +47 volts dc to +53 volts dc at 0.5-ampere maximum

2. A +6.6 volts dc to +7.8 volts dc at 0.018-ampere maximum

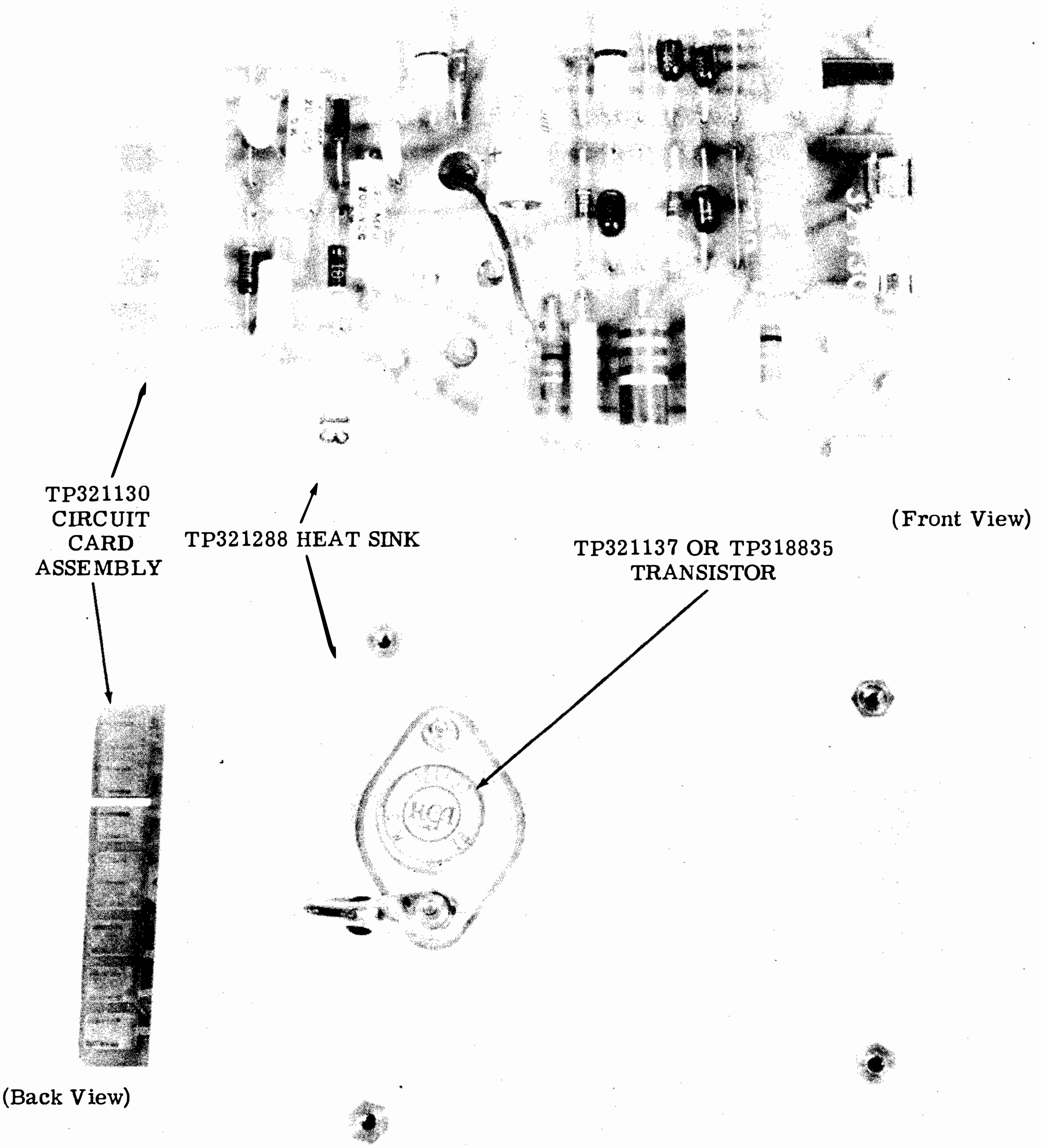


Figure 1-47. 0.5-Ampere Power Supply (TP321290)

(c) Fusing:

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

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

(d) Operating Ambient Temperature: +40 degrees Fahrenheit to 120 degrees Fahrenheit with cooling fan.

(5) Clutch Magnet Driver. The following paragraphs describe the TP321991 clutch magnet driver (CMD) circuit card and outlines the electrical theory when installed (plugged into a shielded ESA containing the proper power supply and filter assemblies). Refer to Figure 1-48 for a front view of this circuit card. The CMD is a solid-state, direct-coupled amplifier built as a plug-in circuit card assembly approximately 2-1/2 by 4-1/4 inches. It requires an external power source. All connections are made through a 15-pin circuit card connector. The CMD output drives a Model 28 transmitting clutch upon receipt of a low-level input pulse. It is to be used with the proper associated equipment and is not for general use. These CMDs are adaptable to various Model 28 equipment sets through the use of associated modification kits. Each CMD (one or more) is part of, or associated with, some ESA. The number of CMDs used depends on the number of clutch magnets used in the set. The CMDs receive low-level signals (+6-volt clutch coil energized, -6-volt coil de-energized, nominal) and operate a Model 28 clutch. The TP321991 CMD is designed for use with 256M or 252M coils, depending on the type of transmitting equipment used. The output current during

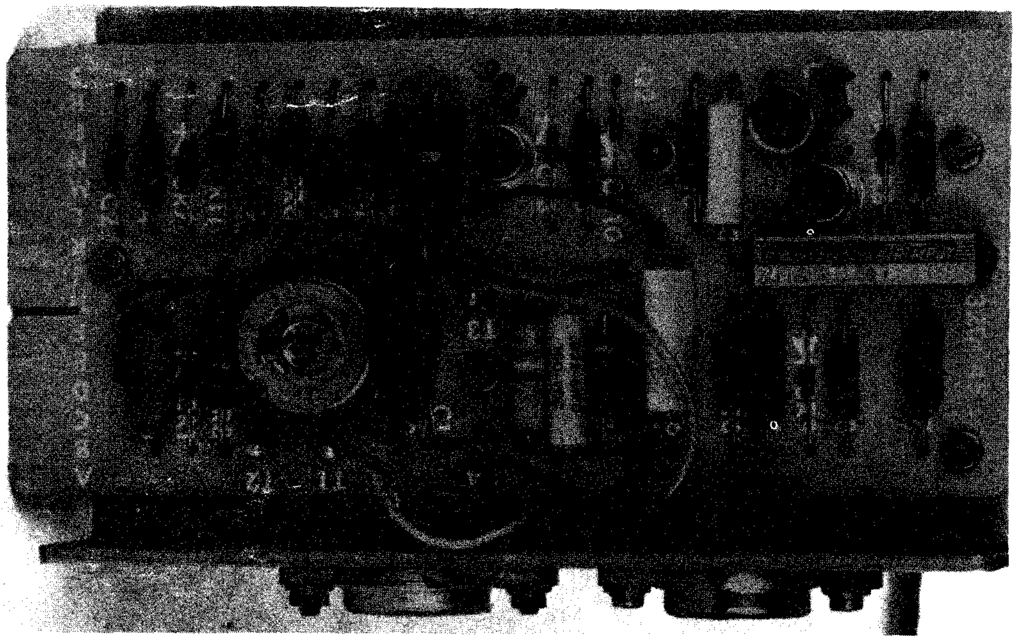


Figure 1-48. Clutch Magnet Driver (CMD) TP321991 for Low-Level Operation

the energized state for the CMD is:

(a) The 252M Coil (Single coil for LAKs) 107 to 132 milliamperes

NOTE

When operating an LAK at the maximum pulsing rate (minimum period), the machine may not respond to each synchronous pulse when in the REPEAT mode.

(b) Operation is considered satisfactory when the incoming synchronous pulse complies with the following requirements:

1. Minimum sync pulse duration = 20 milliseconds.

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

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

(6) Under the conditions of 1 through 3 above, start pulse delay should be between 15 and 35 milliseconds. (Delay is measured from zero volt of the positive-going input synchronous pulse signal to the beginning of the start pulse at the signal generator contacts.) If the TP321268 filter card assembly and TP303142 keyer are used, a nominal 6 milliseconds must be added to the delay to account for delay in the keyer. The TP321991 CMD assumes the energized state with positive input voltages not greater than +0.5-volt and the de-energized state with negative voltages not greater than -0.5-volt. The energized and de-energized switching levels as defined in the previous sentence are adjustable to within 10 percent of each other. The TP321991 CMD should have a minimum input resistance of 50,000 ohms. The maximum input capacitance is 2500 picofarads. The CMD provides a spacing (de-energized) output when the input line is open. The clutch magnet driver operates in a free air ambient temperature range of zero degree Centigrade (32 degrees Fahrenheit) to 65 degrees Centigrade (150 degrees Fahrenheit). Storage temperature should not exceed 85 degrees Centrigrade (185 degrees Fahrenheit). The TP321991 CMD operates from a power supply delivering +47 to +53 volts dc. Power consumption under any combination of power source, environmental, and component conditions is 13 watts maximum. The TP321991 CMD is intended for use on clock lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet. The TP321991 CMD, when used with associated power supplies, is intended for use with interfaces conforming to the following requirements:

(a) Federal Standard 222 section 3102b.

(b) MIL-STD-188B.

e. <u>Electronic Message Numbering Module</u>. RFI suppressed ASR sets may be equipped with an electronic message numbering module shown in Figure 1-49. The electronic message numbering modules are low-level electronic devices using integrated circuitry.

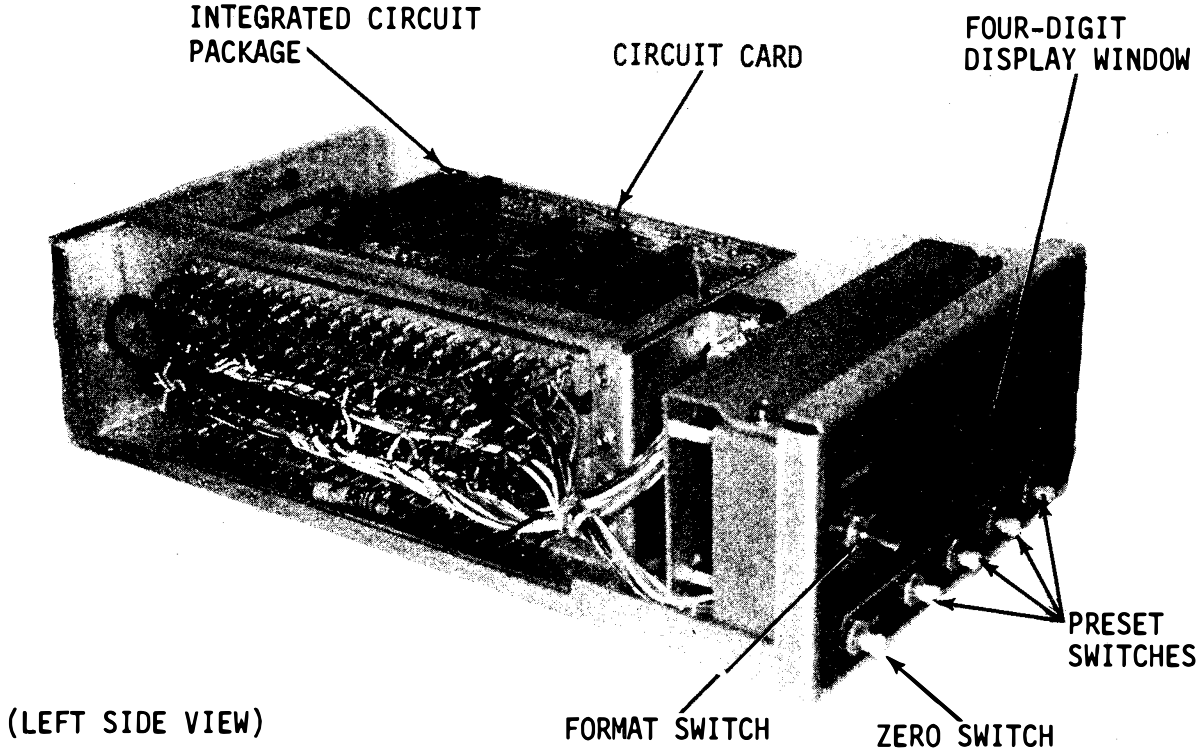


Figure 1 - Numbering Module

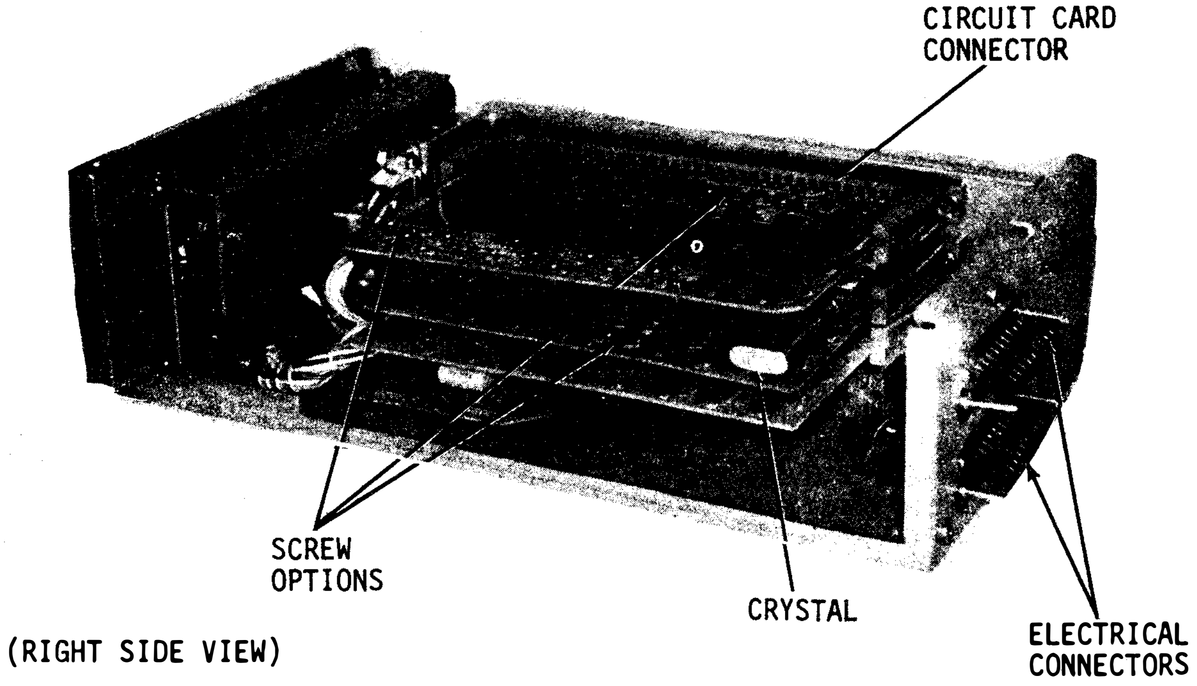


Figure 1-49. Numbering Module

They provide a means of electrically counting, storing, and visually indicating the number of messages transmitted from a telegraphic signal line. Each numbering module is composed of a metal chassis, circuit cards and associated circuit card connectors, gas-filled readout tubes, and electrical connectors. Each metal chassis provides the framework on which all components of a numbering module are mounted. The circuit cards are composed of resistors, capacitors, integrated circuit packages, etc. The circuit card connectors provide a mounting facility for the circuit cards and terminals for associated electrical connections. Two electrical connectors in the rear of each module provide an electrical connection to associated RFI networks. The four gas-filled readout tubes are mounted on a circuit card located behind the display window. The tubes provide a visual numerical indication of messages transmitted from a signal line. The wire screen in front of the readout tubes provides RFI suppression.

NOTE

The electronic message numbering modules are not interchageable with the electromechanical message identification modules (early design).

1-4. RELATIONSHIP OF UNITS. Figure 1-1 shows the component relationship between an Automatic Send-Receive Teletypewriter Set.

1-5. REFERENCE DATA. Table 1-1 lists the physical properties and operating characteristics of the ASR teletypewriter set and its components.

1-6. EQUIPMENT, ACCESSORIES, AND DOCUMENTS SUPPLIED. Tables 1-2, 1-3, and 1-4 are matrix showing high-level and low-level teletype sets with covers, keyboards and bases, motors, etc., available. Both models and the equivalent Navy designation are included for each set.

1-7. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED. Table 1-5 lists the test equipment and publications required but not supplied with the unit.

Table 1-1. Reference Data

Item	Property or Characteristic						
Nomenclature	Automatic Send - Receive (ASR) Teletypewriter Sets Model 28						
Manufacturer	Teletype Corporation, Skokie, Illinois						
Weight and Dimensions	Height (in.)	Width (in.)	Depth (in.)	Vol (cu ft) Crated	Uncrated	Weight (lb) Crated	Uncrated
Typical Equipment							
CY-2529U/G/LAAC200 Cabinet	39	36	18-1/2 *23			530	260
Motor Units Navy Designation							
PD-18U/LMU49	5-3/4	8-1/2	4		.11		9
PD-17A/U/LMU3	9-3/4	7	13-3/4		0.6		15
PD-18A/U							
PD-67U/LMU12							
PD-77A/U/LMU39							
PD-108UG/LMU38							

*Depth including keyboard

Table 1-1. Reference Data - Continued

Item			Property or Characteristic			
Type Styles and Spacing (Typical)						
Styles	Character Cap (in.)	Height Fraction (in.)	Horiz Character/in. Single-Space-Double		Vertical Line/in. Single-Feed-Double	
Murray	0.103	0.162	10	5	6	3
Gothic	0.108	none	10	5	6	3
Gothic	0.103	0.162	12	6	6	3
Long Gothic	0.120	0.170	10	5	6	3
Large	0.180	0.180	10	5	-	3

Sprocket-Feed Platen Data

Form Width in Inches	9, 8-1/2, 8, 7-1/2, 7, 6-1/2, 6-3/8, 6-1/4, 6, 5-3/4, 5-1/2, 5, 4-1/2, 4-5/16, 4-1/4, 4, 3-5/8
Maximum *Characters Per Line	44, 42, 37, 32, 30, 29, 27, 23

*Base on 10 characters per inch with allowance of three characters per platen end play.

Table 1-1. Reference Data - Continued

Item	Property or Characteristic			
Printed Characters	Height (in.)		Width (in.)	
	Standard	Maximum	Standard	Maximum
Chadless	0.120	0.193	0.075	0.085
Fully Perforated	0.100		0.046	

Operating Speeds

Unit Code	7.00	7.00	7.00	7.00	7.42	7.42	7.42	7.42	7.50	7.50	7.50
*OPM	390	428	636	643	368	404	460	600	364	400	600
Baud	45.5	50.0	74.2	75.0	45.5	50.0	56.9	7.42	45.5	50.0	75.0
Pulse Length	0.022	0.020	0.0135	0.0133	0.022	0.020	0.0175	0.0135	0.022	0.020	0.0133
Frequency	22.75	25.0	37.1	37.5	22.75	25.0	28.45	37.1	22.75	25.0	37.5
Characters Per Second	6.5	7.1	10.6	10.7	6.0	6.7	7.7	10.0	6.1	6.7	10.0
Words Per Minute (WPM)	65	71.4	106	107	60	67.3	75	100	60.6	66.6	100

*Operations per minute

Table 1-1. Reference Data - Continued

Item	Property or Characteristic					
	Length (in.)		Width (in.)		Thickness (in.)	
Tape - Black Record Ribbon	33		0.50		0.005	
Typing Unit Paper Data (Friction Feed)	Outside Diameter (in.)		Width (in.)	Length (in.)	Core Diameter (in.)	Core Thickness (in.)
Type - Standard Yellow Paper Roll	4.5		8.5	325	1.0	0.125
Typing Units						
MX-115 B/UG/ LP14RN/AY or MX-2984 UG Automatic Typer	21-3/4	16-5/8	22-5/8		4.3	54
MX-1422A/UG/ LP14RE/AY	9-3/4	15-1/4	10			19-Friction Feed 22-Sprocket Feed
TT-325UG/LP14RN/AHF						
TT-372UG/LP108RN/AY						
TT-378UG/LP108RE/ACX						
TT-400UG/LP14RE/ACX						

Table 1-1. Reference Data - Continued

Item	Property or Characteristic						
Weight and Dimensions	Height (in.)	Width (in.)	Depth (in.)	Vol (cu ft)		Weight (lb)	
				Crated	Uncrated	Crated	Uncrated
TT-437UG/LP14RN/AJG							
TT-441UG/LP14RE/AJG							
TT-374UG/LP108RN/AGH							
TT-436UG/LP14RN/AJE							
Electrical Service Units							
SB-959UG/LESU13							
SB-1061UG/LESU12							
SB-1302UG/LESU73							
SB-2611UG/LESU96							
SB-2680UG/LESU111							
Transmitter Distributor	5	7-1/2	3-5/8				
TT-251UG/LXD3							
TT-439UG/LXD27							
TT-311UG/LXD11							

Table 1-1. Reference Data - Continued

Item	Property or Characteristic						
Weight and Dimensions	Height (in.)	Width (in.)	Depth (in.)	Vol (cu ft) Crated	Vol (cu ft) Uncrated	Weight (lb) Crated	Weight (lb) Uncrated
Transmitter Distributor Base							
MT2099UG/LCXB1							
MT2452UG/LCXB13							
Keyboard Base							
MX-2643UG/LAK4ARN							
MX-2858UG/LAK4ARE							
TT-371UG/LAK31ARN							
TT-377UG/LAK31ARE							
TT-433UG/LAK42BRJ							
TT-440UG/LAK42ARE							
TT-475UG/LAK46ARN							
Typing Reperforator							
TT-266UG/LPR9/AWA	8	7-1/2	6-1/2			7-1/2	
TT-267UG/LPR9/ARE							
TT-373UG/LPR51/BRP							

Table 1-1. Reference Data - Continued

Item	Property or Characteristic						
Weight and Dimensions	Height (in.)	Width (in.)	Depth (in.)	Vol (cu ft)		Weight (lb)	
				Crated	Uncrated	Crated	Uncrated
TT-375UG/LPR51BWA							
TT-379UG/LPR51BRH							
TT-380UG/LPR52BRH							
Tape: 10 holes per inch							
Type: Standard Communications Perforations five-level chadless or fully perforated		11/16					
Reperforator Base							
MT-2234UG/LRB6							
MT-2272UG/LRB42							
MT-2625UG/LRB36							
MT-3369UG/LRB51							
Paper Winder							
RL235/UG/LPW300BR							

Table 1-1. Reference Data - Continued

Item	Property or Characteristic			
Standard and Heavy Duty Synchronous Motor Units				
	LMU3	LMU38	LMU12	LMU50
Rated Horsepower	1/20	1/20	1/12	1/12
Input Voltage	115 VAC, ±10%	115 VAC, ±10%	115 VAC, ±10%	115 VAC, ±10%
Phase	Single	Single	Single	Single
Frequency	60 Hz, ±0.75%	50 Hz, ±0.75%	60 Hz, ±0.75%	50 Hz, ±0.75%
Input Current (amps)				
Starting	9.0	8.3	12.25	14.5
Running	1.85	2.4	2.8	2.68
Power Factor (Full Load)	30%	35%	44.75%	34.4%
Watts Input (Full Load)	65	107	132.9	148

Table 1-1. Reference Data - Continued

Item	Property or Characteristic			
LMU39				
Rated Horsepower	1/15			
Input Voltage	115 VAC ±10%			
Phase	Single			
Frequency (Hertz)	25	50	60	DC
Input Current (Full Load)				
Starting	4.5 amps	4.0 amps	2.8 amps	3.4 amps
Running	2.1 amps	2.3 amps	1.8 amps	1.7 amps
Power Input (Watts)	235	200	190	194
Power Factor (Full Load)	96.8%	87%	79%	-
Heat Dissipation (Watts)	130	97.2	94.2	111
Series Resistor (Ohms)	25	-	-	50
Target Indicator	4, 6 and 35 Spot			
Governor Speed	3600			
Rotation (Viewed from Computator End)	CCW			
Mounting	LMU39 - Upright			
RF Shielding	LMU41			

Table 1-1. Reference Data - Continued

Item	Property or Characteristic			
RF Suppression	LMU41			
LMU41				
Rated Horsepower	1/20			
Input Voltage	115 VAC ±10%			
Phase	Single			
Frequency (Hertz)	25	50	60	DC
Input Current (Full Load)				
Starting	2.4 amps	2.7 amps	1.9 amps	1.8 amps
Running	1.18 amps	1.34 amps	1.12 amps	0.93 amps
Power Input (Watts)	123	114	1.12	1.07
Power Factor (Full Load)	90%	74%	71%	-
Heat Dissipation (Watts)	86	87	55	70
Series Resistor (Ohms)	25	-	-	50
Target Indicator	4, 6 and 35 Spot			
Governor Speed	3600			
Rotation (Viewed from Computator End)	CCW			
Mounting	Upright			

Table 1-1. Reference Data - Continued

Item	Property or Characteristic	
RF Shielding	LMU41	
RF Suppression	LMU41	
	Motor Unit Identification	
Miniature Synchronous Motor Units	Standard and Heavy Duty Motor Units	Series Governed Motor Units
LMU3	LMU3, LMU38, LMU50	LMU39, LMU41

Table 1-2. ASR Equipment Matrix, High-Level Teletypewriter Sets

	SETS CONTAINING BOTH PERFORATOR-TRANSMITTER AND A REPERFORATOR UNIT																																														
	KEYBOARD						TYPING UNIT											PERF-XMTR		TYPING REPERF		TYPING REPERF BASES			XMTR DISTRI-BUTORS		TD BA-SE	ELECTRICAL SERVICE UNIT					CAB	MOTORS						PAPER WINDER	GEARSETS						
NAVY DESIGNATION	MX-2643/UG	MX-2858/UG	TT-433/UG	TT-433/UG	TT-475/UG	TT-440/UG	MX-1115B/UG	MX-1422A/UG	MX-2984/UG	TT-325/UG	TT-400/UG	TT-436/UG	TT-436/UG	TT-437/UG	TT-437/UG	TT-441/UG	TT-443/UG	TT-252/UG	TT-265/UG	TT-266/UG	TT-267/UG	MT-2234/UG	MT-2625/UG	MT-3369/UG	TT-251/UG	TT-439/UG	MT-2099/UG	SB-959/UG	SB-1061/UG	SB-1302/UG	SB-2611/UG	SB-2680/UG	CY-2529/UG	PD-17A/U	PD-18A/U	PD-67/U	PD-77A/U	PD-108/UG	PD-111/U	RL-235/UG	A	B	C	D	E		
MANUFACTURE'S DESIGNATION	LAK4ARN	LAK4ARE	LAK42ARN	LAK42BRJ	LAK46ARN	LAK42ARE	LP14RN/AY	LP14RE/AY	LP14RN/AGH	LP14RN/AHF	LP14RE/ACX	LP14RN/AJE	LP14WY/AJE	LP14RN/AJG	LP14WY/AJG	LP14RE/AJG	LP14RN/AJF	LTPE1AWA	LTPE1ARE	LPR9/AWA	LPR9/ARE	LRB6	LRB36	LRB51	LXD3	LX1D27	LCXB1	LESU13	LESU12	LESU73	LESU96	LESU111	LAAC200BR	LMU3	LMU41	LMU12	LMU39	LMU38	LMU50	LPW300BR	SEE DRAWING NUMBER LIST					DRAWING NUMBER LIST	
WIRING DIAGRAM	5-1	5-1	5-3	5-3	5-3	5-3	5-4	5-4	5-4	5-4	5-4	5-4	5-4	5-4	5-4	5-4	5-4			5-6	5-6	5-7 5-8	5-8 5-9	5-8 5-9	5-10	5-10		5-11 5-12	5-13 5-14	5-15 5-16	5-17 5-18	5-19 5-20	5-21	5-22	5-22	5-22	5-22	5-22	5-22								
AN/UGC-6	X						X											X		X		X			X		X	X	X				X	X		X					X					A	161859
AN/UGC-6X	X						X											X		X		X			X		X	X	X				X		X		X				X						161860
AN/UGC-6A	X								X									X		X		X			X		X	X	X				X	X		X					X						161861
AN/UGC-6AX	X								X									X		X		X			X		X	X	X				X		X		X				X						
AN/UGC-6B	X									X								X		X		X			X		X	X		X			X	X		X							X			B	161859
AN/UGC-6C	X									X								X		X			X		X		X	X		X			X	X		X							X				161861
AN/UGC-6D			X				X					X						X		X			X			X	X		X				X	X		X						X					163300
AN/UGC-6E			X									X						X		X			X			X	X		X			X	X	X		X						X					
AN/UGC-6F			X											X				X		X			X			X	X		X			X	X	X		X						X				C	163300
AN/UGC-6FX			X											X				X		X			X			X	X		X			X	X		X		X					X					164580
AN/UGC-6G			X															X		X			X			X	X		X			X	X	X		X								X			164583
AN/UGC-6HX					X									X				X		X				X		X	X		X			X	X					X	X			X					
AN/UGC-6J				X											X			X		X			X			X	X				X	X	X	X		X				X		X				D	161859
AN/UGC-6JX				X											X			X		X			X			X	X				X	X	X		X		X			X		X					161860
AN/UGC-6K				X											X			X		X			X			X	X				X	X	X	X		X						X					161861
AN/UGC-6L				X									X					X		X			X			X	X				X	X	X	X		X											159660
AN/UGC-6MY				X									X					X		X				X		X	X				X	X	X					X	X	X							159700
AN/UGC-6NX				X													X	X		X			X			X	X				X	X	X		X		X			X							305577
AN/UGC-8		X						X											X		X	X	X		X		X	X	X				X	X		X					X						305579
AN/UGC-8X		X						X											X		X	X			X		X	X	X				X		X		X				X						
AN/UGC-8A		X									X								X		X	X			X		X	X	X				X	X		X					X					E	160677
AN/UGC-8AX		X									X								X		X	X			X		X	X	X				X		X		X								X		161859
AN/UGC-8B						X										X			X		X					X	X		X			X	X	X		X						X					161861

Table 1-3. ASR Equipment Matrix High-Level Teletypewriter Sets

	SETS CONTAINING A REPERFORATOR ON THE PERFORATOR TRANSMITTER AND NO AUXILIARY REPERFORATOR																																						
	CABINETS		KEYBOARDS					TYPING UNITS							PERF XMTR		TYPING REPERFORATOR					REPERF BASE	TRANSMITTER DISTRIBUTORS			TD BASES		ELECTRICAL SERVICE UNIT			MOTOR UNIT								
NAVY DESIGNATION	CY-2529/UG	CY-3682/UG	MX-2643/UG	MX-2858/UG	TT-371/UG	TT-377/UG	TT-433/UG	MX-1115B/UG	MX-1422A/UG	MX-2984/UG	TT-372/UG	TT-374/UG	TT-378/UG	TT-437/UG	TT-252/UG	TT-265/UG	TT-373/UG	TT-375/UG	TT-379/UG	TT-380/UG	TT-375/UG	MT-2272/UG	TT-251/UG	TT-311/UG	TT-439/UG	MT-2099/UG	MT-2452/UG	SB-959/UG	SB-1061/UG	SB-2680/UG	PD-17A/U	PD-18A/U	PD-67/U	PD-77A/U	A	B	C	D	E
MANUFACTURERS DESIGNATION	LAAC200BR	LAAC237BR	LAK4ARE	LAK4ARE	LAK31ARN	LAK31ARE	LAK42BRJ	LP14RN/AY	LP14RE/AY	LP14RN/AGH	LP108RN/AY	LP108RN/AGH	LP108RE/ACX	LP14WY/AJG	LTPE1AWA	LTPE1ARE	LPR51BRP	LPR51BWA	LPR51BRH	LPR52BRH	LPR52BWA	LRB42	LXD3	LXD11	LXD27	LCXB1	LCXB13	LESU13	LESU12	LESU11	LMU3	LMU41	LMU12	LMU39	SEE DRAWING NUMBER LIST				
WIRING DIAGRAM	5-21	5-21	5-1	5-1	5-2	5-2	5-3	5-4	5-4	5-4	5-4	5-5	5-4	5-4			5-6 5-23	5-6	5-6 5-23	5-6	5-6	5-8 5-9	5-10	5-24	5-10	5-25	5-25	5-11 5-12	5-13 5-14	5-19 5-20	5-22	5-22	5-22	5-22					
AN/UGC-5	X		X					X							X								X			X		X					X		X				
AN/UGC-5X	X		X					X							X								X			X		X						X			X		
AN/UGC-5A	X		X							X					X								X			X		X					X		X				
AN/UGC-5AX	X		X							X					X								X			X		X						X			X		
AN/UGC-5B	X													X	X										X	X				X			X			X		X	
AN/UGC-5BX	X													X	X										X	X				X				X		X		X	
AN/UGC-5C	X													X	X										X	X				X			X			X			X
AN/UGC-7	X			X					X							X							X			X		X					X						X
AN/UGC-7X	X			X					X							X							X			X		X				X		X					X
AN/UGC-15		X			X						X							X				*		X			X	X					X						X
AN/UGC-15X		X			X						X						X					*		X			X	X						X					X
AN/UGC-16		X			X						X							X				X		X			X	X	X		X		X						
AN/UGC-16A		X			X							X						X			X	X		X			X	X	X		X		X						
AN/UGC-18		X				X							X						X	X		X		X			X	X	X		X		X						

*INFORMATION NOT CURRENTLY AVAILABLE

DRAWING NUMBER LIST

A.	161859 161860 161861
B.	161859 161861 163300
C.	164583 164584 164585
D.	160675 160676 160677
E.	163454 163457 163499 163502 163504 163505 173776 173795 173992

Table 1-4 ASR Equipment Matrix Low-Level Teletypwriter Sets

	CABINET				NUMBERING MODULES		PAPER WINDER	KEYBOARD				TYPING UNIT				TYPING REPERFORATOR							TYPING REPERF BASE		TD		TD BASE		ESU	ELECTRICAL SERVICE ASSY			PRINTED CIRCUIT BOARDS				MOTOR UNIT						GEARSET												
																																											BAUD												
NAVY DESIGNATION							RL-235/UG	TT-598/UG				TT-596/UG	TT-596/UG	TT-597/UG	TT-597/UG		TT-600/UG		TT-601/UG						TT-602					ESA	ESA	ESA	LLK(POLAR LINE KEYER)	0.5 AMP POWER SUPPLY	CLUTCH MAGNET DRIVER	SELECTOR MAGNET DRIVER	PD-17A/U	PD67/U	PD-108/UG	PD-111/U	PD-77A/U	PD-18A/U	74.2	74.2	74.2	75	75	75	75	75	75	75	75	75	75
MANUFACTURERS DESIGNATION	LAAC251BR	LAAC252BR	LAAC255BR	LAAC259BR	328000	328010	LPW300BR	LAK50BSS	LAK51ARN	LAK51BRJ	LAK55BSS	LP134RN/AJG	LP134WY/AJG	LP135YD/AGM	LP136BG/AGM	LPR72/BRP	LPR73/BRP	LTPE1BRP	LPR74/BRP	LTPE6BRP	LPR82/BRP	LPR85/BRP	LRB59	LRB60	LXD37	LXD38	LCXB24	LCXB27	LESU/23	323811(S19)	323812(CLUTCH)	323815(S19)	303142	321290	321991	323810	LMU3	LMU12	LMU38	LMU50	LMU39	LMU41	158027	159700	161295	163451	163454	163502	163505	312705	319908	319917	329071	329072	333607
WIRING DIAGRAM	5-26	5-27	5-26	5-28	5-39 5-40	5-39 5-40	5-29	5-30	5-31	5-31	5-31	5-32	5-32	5-33	5-33								5-34	5-34	5-35	5-35	5-36	5-37	5-38	5-41 5-42	5-43 5-44	5-45 5-46	5-47	5-50	5-52	5-51	5-22	5-22	5-22	5-22	5-22	5-22													
AN/UGC-48 28RFX4800A/005/AAR/BR	X								X			X				X		X						X		X	X		X	X	X		X	X	X	X	X	X					X		X								X		
AN/UGC-48X 28RFX4800A/005/ANX/BR	X								X			X				X		X						X		X	X		X	X	X		X	X	X	X			X	X				X								X		X	
AN/UGC-48A 28RFX4801A/012/AAR/BR			X							X			X							X		X		X		X		X	X	X	X		X	X	X	X	X	X																	
AN/UGC-48BY			X							X			X							X		X		X		X	X		X	X	X		X	X	X	X													X						
AN/UGC-49 28RFX4000B/009/AYF/BR		X						X							X		X		X				X		X		X		X		X	X	X	X	X	X	X	X								X	X	X					X		
AN/UGC-49X 28RFX4000B/009/BWP/BR		X						X							X		X		X				X		X		X		X		X	X	X	X	X	X					X	X				X			X	X	X			X	
AN/UGC-54 28RFX4001B/009/AWF/BR		X					X				X				X		X				X		X		X		X		X		X	X	X	X	X	X					X	X				X	X	X	X				X		
AN/UGC-54B		X					X				X			X			X				X		X		X		X		X		X	X	X	X	X	X													X						
AN/UGC-57 28RFX4002B/009/AYF/BR		X					X				X				X		X				X		X		X		X		X		X	X	X	X	X	X	X	X								X	X	X					X		
AN/UGC-90 28RFX4004B/013/DAF/BR				X	X	X		X							X		X		X				X		X			X	X		X	X	X	X	X	X	X	X								X		X					X		X
AN/UGC-90X				X	X	X		X							X		X		X				X		X			X	X		X	X	X	X	X	X					X	X													
28RFX4001A/005/ABE/BR		X					X							X													X				X	X									X	X	X		X										

Table 1-5. Equipment Required But Not Supplied

Category	Recommended Equipment	Alternate	Equipment Test Parameters	Application
Telegraph Signal Generator	Test Set, Telegraph AN/UGM-8B(V)	Equivalent	Provides controlled signals, both distorted and undistorted, at all commonly used transmission speeds and code formats. Refer to NAVELEX 0967-LP-378-4010.	Maintenance, Trouble-shooting
Telegraph Signal Analyzer	Test Set, Telegraph TS-2616/UGC	Equivalent	Measure timing distortion in start-stop and synchronous data telegraph signals. Refer to NAVSHIPS 0967-125-8010.	Maintenance, Trouble-shooting
Volt-ohm-milliammeter	Multimeter AN/USM-311	Equivalent	VAC - 115, 5.6 amps. VDC - 115, 7.5, 1.5 amps. 60 MA, 70 uMA Resistance - Continuity measurements	Maintenance, Trouble-shooting
Tools	Teletype Repair Kit TK-188/U	Equivalent		Maintenance, Repair

CHAPTER 2
OPERATION

2-1. INTRODUCTION. This chapter describes the operation of Automatic Send-Receive (ASR) Teletypewriter Set Model 28 from a maintenance standpoint. Operation of the ASR Teletypewriter set when installed as part of a system is covered in the appropriate system manual.

2-2. CONTROLS AND INDICATORS. ASR teletypewriter controls and indicators are shown in Figures 2-1 and 2-2 and briefly described in Table 2-1.

2-3. OPERATING PROCEDURES. Procedures for operating ASR sets are provided in Table 2-2. If abnormal indications are encountered, refer to Chapter 5 for troubleshooting information.

NOTE

> If ASR set is a low-level configuration, the proper switch on the associated ESAs must be set to the appropriate position for turn-on and turn-off.

2-4. OPERATOR MAINTENANCE. Operator maintenance is limited to replacing paper and installing a new ribbon. Refer to Figures 2-3 and 2-4.

a. Paper Installation. To install paper, remove paper spindle by sliding one of the spindle retainers toward the rear. Insert spindle in a roll of paper and remount it so that the paper unwinds from underneath. With the paper release lever toward the rear, route the paper up over the paper straightener shaft, down, and under the platen as shown in Figure 2-3.

b. Ribbon Installation. To install ribbon, remove both spools from the ribbon spool shafts. Engage the hook on the end of the new ribbon in the hub of the empty spool. Wind a few turns of the ribbon onto the empty spool in the same direction that it comes off the full spool. Make sure that the reversing eyelet has been wound up on the empty spool. Place the spools on the ribbon spool shafts so that the ribbon on the right spool comes off the right side and the ribbon on the left spool comes off the left side without twisting. Thread the ribbon around the roller and through the reverse lever slots as shown in Figure 2-4.

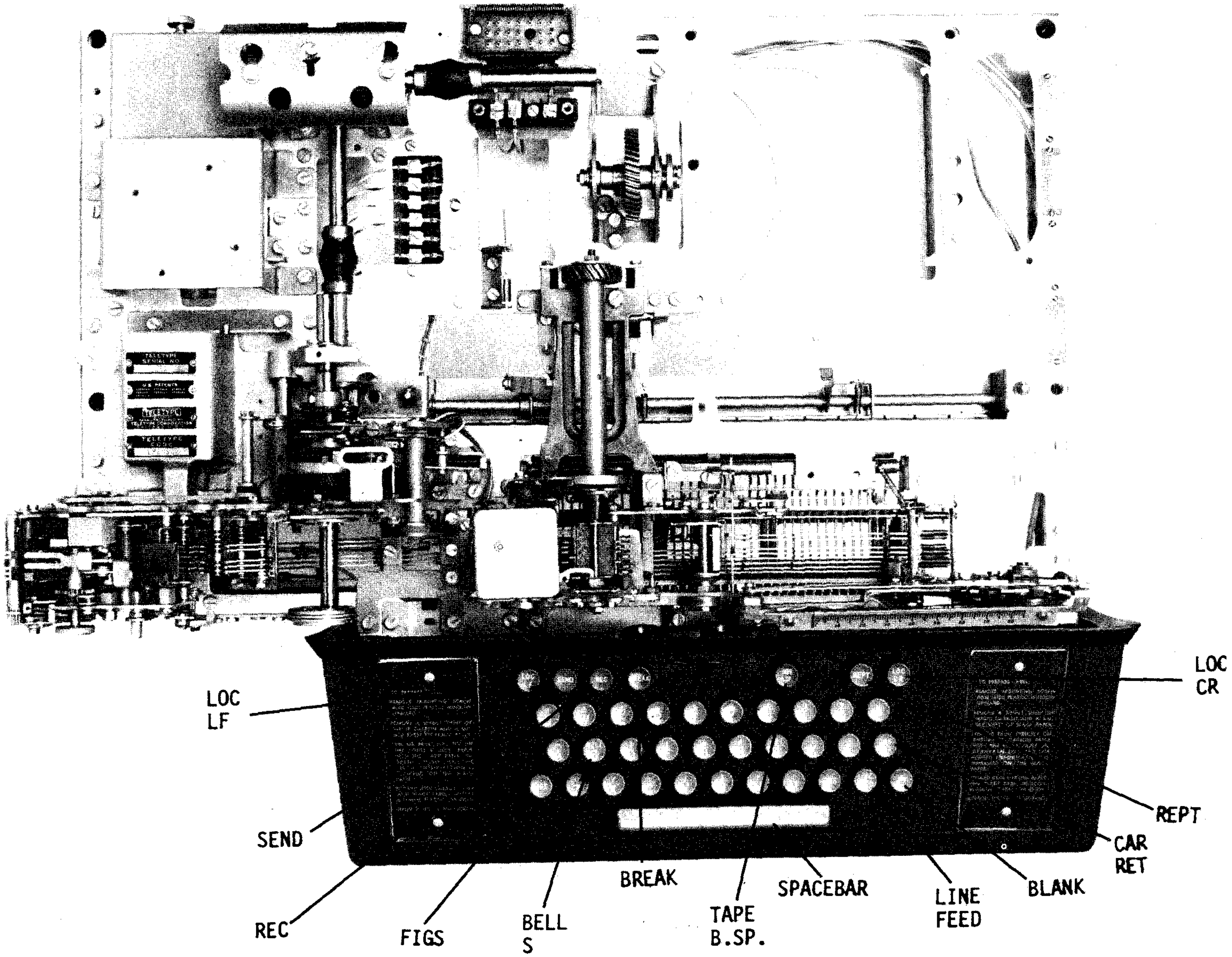


Figure 2-1. ASR Keyboard Model 28 Controls and Indicators

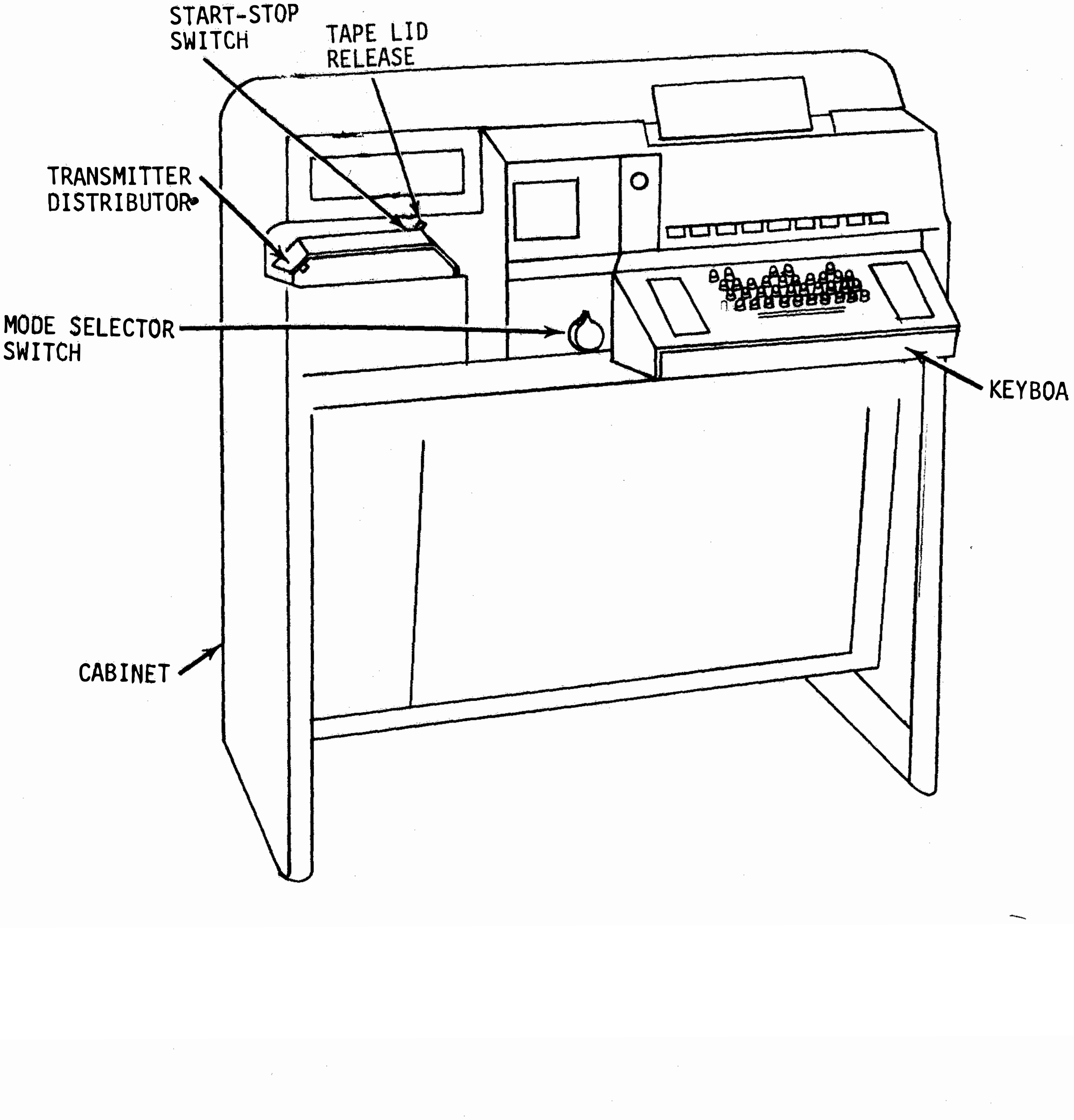


Figure 2-2. ASR Cabinet Model 28 Controls and Indicators

Table 2-1. Control and Indicator Functions

Control/Indicator	Function
Main power ON-OFF switch	Mechanically linked to operate power toggle switch on LESU. Controls primary ac power application to ASR set.
K, K-T and T mode selector switch	A three-position mode selector switch, mounted on the front panel of the cabinet. The switch permits the operator to place the ASR set into one of three operating conditions. Refer to Figure 2-2.
LINE-TEST switch	Mechanically linked to LINE-TEST switch on LESU. In LINE position, ASR set operates normally to receive and originate messages over the signal line linked to a remote station. When set to TEST position, ASR set is disconnected from signal line and operates in a local loop condition.
NORMAL ON-OFF-MAINT. ON cabinet lights switch	NORMAL ON and OFF positions control cabinet lights when main power ON-OFF switch is set to ON. MAINT. ON position allows technician to turn cabinet lights on with main power ON-OFF switch set to OFF.
Function keys	When pressed, manually sets code bar mechanism to signal code combination for function selected. Signal code combination is distributed to signal line. Signal code is transmitted to local typing unit, for monitoring, and to remote typing unit. Signal code combination, received by typing units, activates mechanism corresponding to function selected.
FIGS key	Selects FIGURES signal code combination. Figures shift function initiated at typing units. Results in positioning of type box, through related mechanism, for printing of figures, punctuation marks, or other upper case symbols.
LTRS key	Selects LETTERS signal code combination. Letters shift function initiated at typing units. Results in positioning of type box, through related mechanism, for printing of letters.

Table 2-1. Control and Indicator Functions - Continued

Control/Indicator	Function
CAR RET key	Selects CARRIAGE RETURN signal code combination. Carriage return function initiated at typing unit. Results in returning printing type box carriage, through related mechanisms, toward left side of typing unit.
LINE FEED key	Selects LINE-FEED signal code combination. Line-feed function initiated at typing units. Results in advancing platen, through related mechanisms, either one line or two lines depending on position of single-double line-feed lever.
REC key	When pressed, causes signal generator to be shunted, preventing signal generation. Key remains depressed until released by pressing SEND key.
SEND key	When pressed, removes shunt from signal generator, allowing signals to be generated.
Upper case S key FIGS key pressed	Pressing S key causes bell to ring.
BLANK key	Pressing key twice in succession operates keyboard lock, SEND key must be pressed to resume operation. Pressing key alternately with other keys (except REC and BREAK keys) will not lock keyboard.
REPT key	When pressed, together with any other key (except local function keys), causes repeated transmission of function or character selected.
BREAK key	When pressed for about 2 seconds, interrupts signal line causing typing units to run "open". Since depressing the BREAK key operates the keyboard lock, it is necessary to depress the SEND key to resume transmission.
TAPE B.SP. key	Reverses direction of tape feed in perforator for the space required by a single character code. Enables operator to delete a character code, punched in error on the tape, by pressing LTRS key after operation of TAPE B.SP. key.

Table 2-1. Control and Indicator Functions - Continued

Control/Indicator	Function
Local function keys	Linked directly to typing unit. Mechanically initiates functions normally initiated by signal code combination.
LOC LF key	When pressed, causes paper to feed from the typing unit at approximately three times the speed obtained when the LINE FEED and REPT keys are held depressed.
LOC CR key	When pressed, carriage returns to left margin as described under CAR RET key.
Character keys	When pressed, manually sets code bar mechanism to code combination for character distributed to signal line. The signal code is transmitted to the local typing unit, for monitoring, and to remote typing unit. Signal code combination, received by typing units, activates printing mechanism to print letter or figure character selected, depending on which shift function has been previously selected.
Spacebar	Manually sets code bar mechanism to space signal code combination. Signal code combination received by typing unit activates spacing mechanism.
Margin/End-of-Line indicator	In K and K-T modes, indicator illuminates when typing unit carriage reaches present end-of-line activating margin indicator switch on base. In T mode, indicator illuminates when six characters before counted end-of-line position is reached activating end-of-line switch.
Character counter	Counts number of characters per line. Resets to zero when carriage return function is activated.
<u>Transmitter Distributor</u>	Refer to Figure 2-2.
Tape lid release plunger	When pressed, causes spring-loaded tape lid to snap open.

Table 2-1. Control and Indicator Functions - Continued

Control/Indicator	Function
Start-stop switch.	Controls TD operation.
FREE position	Clutch magnet de-energized; tape-feed wheel rotates freely, allowing tape to be properly positioned in tape feed mechanism.
RUN position	Clutch magnet energized; tape transmitted through tape feed mechanism.
STOP position	Clutch magnet de-energized; tape transmission stops.
Tight tape lever.	Stops tape transmission if tape lid is lifted due to taut or tangled tape.
<u>Auxiliary Typing Reperforator Unit</u>	
AUX. REPERF. MOTOR switch	Controls application of primary ac power to motor unit.
TAPE FEED OUT switch	When operated, feeds out a predetermined amount of tape.

Table 2-2. ASR Operating Procedures

Step	Action	Normal Indication
1.	Turn-On. To turn on teletypewriter set, proceed as follows:	
a.	Ensure all ASR units are properly interconnected.	
b.	Ensure primary power cord is plugged-in to ac outlet.	
c.	Set cabinet lights switch to MAINT. ON.	Cabinet lights illuminate.
d.	Set cabinet lights switch to OFF.	Cabinet lights extinguish.
e.	Set cabinet lights switch to NORMAL ON.	Cabinet lights remain extinguished.
f.	Ensure start-stop switch on TD is in the STOP position.	
g.	Set main power ON-OFF switch to ON. NOTE ASR set is now conditioned for service depending on settings of LINE-TEST key and K, K-T and T mode selector switch.	Cabinet lights illuminate and motor starts running.
2.	Operating Tests K Mode. Check for proper operation of ASR set as follows:	
a.	Set LINE-TEST key to LINE.	
b.	Set mode selector switch to K.	

Table 2-2. ASR Operating Procedures - Continued

Step	Action	Normal Indication
c.	Press LINE FEED key.	Paper advances one or two lines depending on position of single-double line-feed lever (located inside on the typing unit).
d.	Press each character key.	Proper character is printed.
e.	Press CAR RET key.	Type box carriage returns to left margin.
f.	Press REPT and LINE-FEED keys simultaneously. Note paper advance speed.	Line-feed function repeats.
g.	Press LOC LF key. Hold pressed and note paper advance speed.	Paper feeds from typing unit at approximately three times the speed noted in step f.
h.	Press REC (keyboard lock) key. Press several character keys.	REC key remains depressed causing signal generator to be shunted; no characters print.
i.	Press SEND (keyboard unlock) key. Press several character keys.	REC key releases, removing shunt from signal generator; characters print normally.
j.	Press BREAK key and hold approximately two seconds.	Keyboard locks as in step h.
k.	Press SEND (keyboard unlock) key.	Keyboard unlocks as in step i.
l.	Press and hold REPT key along with any other key (except local function and blank keys).	Associated character prints or function operates, repeatedly.
m.	Press LOC CR key.	Carriage returns to left-hand margin.
n.	Press FIGS key and then press S character key several times.	Bell rings once clearly each time key is pressed.

Table 2-2. ASR Operating Procedures - Continued

Step	Action	Normal Indication
o.	Press BLANK key alternately with any other key (except local function keys).	Keyboard remains unlocked.
p.	Press BLANK key twice in succession.	Keyboard locks as in step h.
q.	Press SEND (keyboard unlock) key.	Keyboard unlocks as in step i.
r.	Press spacebar.	Space required for one character occurs on page printer or space code combination is perforated on tape.
s.	Press FIGS key and then press several character keys.	Symbols indicated on upper part of character keys are printed.
t.	Press LTRS key and then several character keys.	Characters indicated on lower part of character keys are printed.
u.	Press TAPE B. SP. key.	Tape in perforator reverses direction for space required for one character code.
v.	Set LINE-TEST key to TEST. Repeat steps c through u.	Same as for steps c through u except operation will be on a local loop. NOTE No break in signal line should occur as LINE-TEST key is switched.
w.	Type several lines of characters and observe character counter and margin indicator lamp.	Margin indicator lamp illuminates six characters before end of a page-printed line.

Table 2-2. ASR Operating Procedures - Continued

Step	Action	Normal Indication
3.	Operating Tests - K-T Mode. Check for proper operation of ASR set as follows:	
a.	Set mode selector switch to K-T.	
b.	Set LINE-TEST key to LINE.	
c.	Press each character key.	Correct character prints on page printer and is perforated on tape characters are counted on character counter.
d.	Press BLANK and REPT keys simultaneously.	Tape feeds out without interruption.
e.	Press E and REPT keys simultaneously.	(a) Character counter counts without missing. (b) End-of-line indicator illuminates when preset count is reached.
f.	Press CAR RET key.	Character counter resets to zero.
g.	Press E key.	Character counter advances one character.
h.	Repeat steps 2h through 2u.	Same as for steps 2h through 2u.
i.	Verify TD is operating properly.	TD transmits messages from the perforated tape. Refer to Chapter 3.
j.	Set LINE-TEST switch to TEST. Repeat steps c through i.	Same as for steps c through i except operation will be on local loop.

NOTE

No break in signal line should occur as LINE-TEST key is switched.

Table 2-2. ASR Operating Procedures - Continued

Step	Action	Normal Indication
4.	<u>Operating Tests - T Mode</u>. Check for proper operation of ASR set as follows:	
a.	Set mode selector switch to T.	
b.	Set LINE-TEST key to LINE.	
c.	Press BLANK and REPT keys simultaneously.	Tape feeds out of tape punch at high speed without interruption until keys are released.
d.	Press E and REPT keys simultaneously.	Margin indicator illuminates six characters before preset end-of-line position of character counter.
e.	Set LINE-TEST key to TEST. Repeat steps c and d.	Same as for steps c and d except operation will be on a local loop.

NOTE

Left and right margins are adjusted at time of installation. Operator should not attempt to make these adjustments.

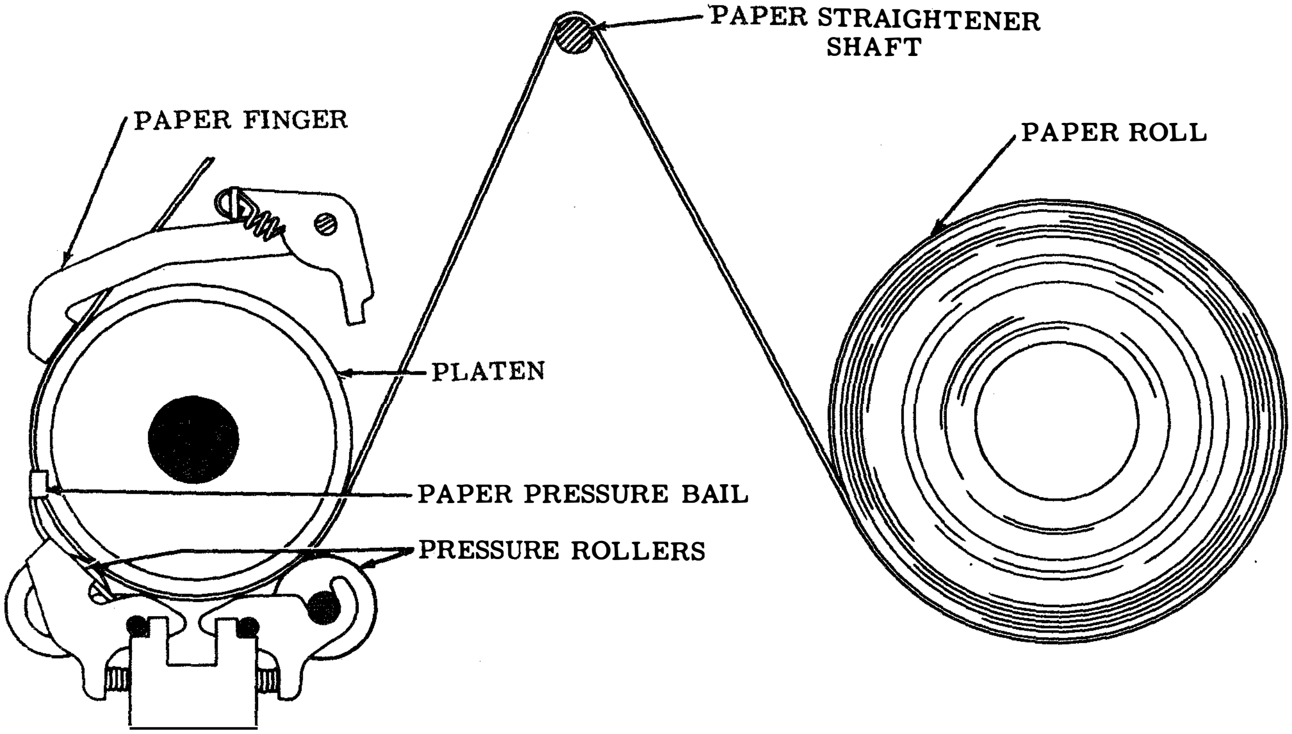


Figure 2-3. Path of Paper

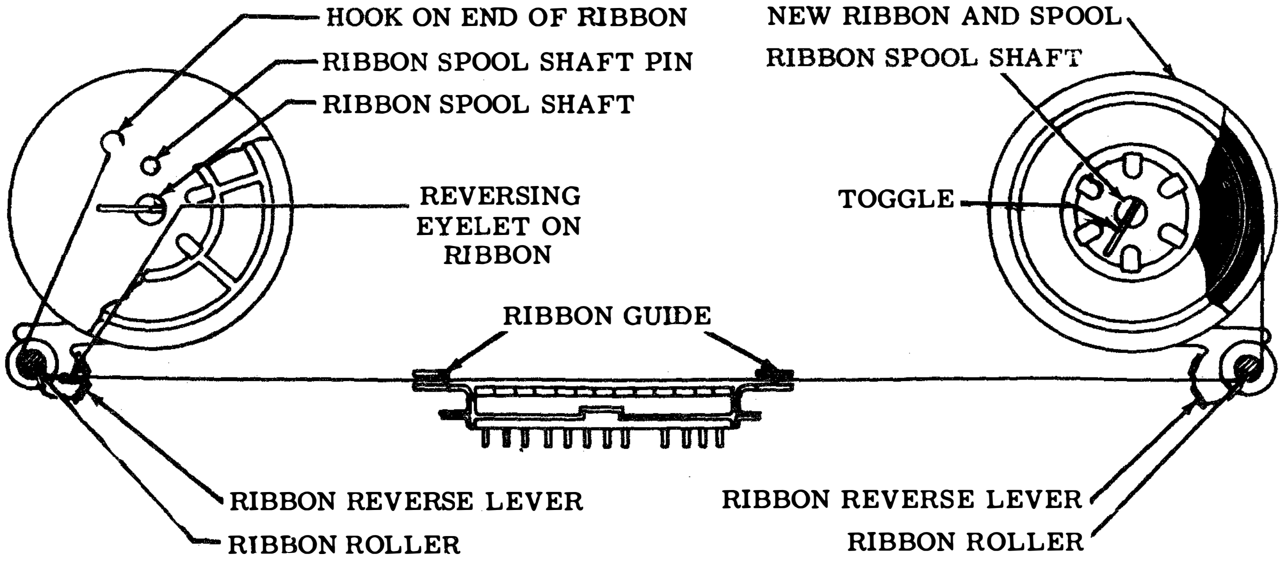


Figure 2-4. Path of Ribbon

CHAPTER 3
FUNCTIONAL DESCRIPTION

3-1. INTRODUCTION. This chapter provides a functional description of the Automatic Send-Receive (ASR) Teletypewriter Sets Model 28. Descriptions are divided into a general system description keyed to a basic system diagram. A functional block diagram follows showing signal paths and the functional blocks comprising each of the blocks in the system block diagram. A brief description of the function performed by each of these blocks and the interaction between these blocks is keyed to the functional block diagram. The third level of circuit theory includes a detailed discussion of each assembly including illustrations of mechanical linkages and schematics where applicable. Refer to the schematics and wiring diagrams in Chapter 5 for a complete display of circuit paths and system wiring.

3-2. OVERALL FUNCTIONAL DESCRIPTION. High-level ASR Teletypewriter Sets are discussed in paragraph 3-2.1, and low-level ASRs are discussed in paragraph 3-10.

3-2.1 OVERALL FUNCTIONAL DESCRIPTION (HIGH-LEVEL). Figure 3-1 shows significant electrical signal and mechanical energy paths between units of high-level ASR teletypewriter sets. Primary power, 115-volts ac, 60 Hertz, is supplied directly to the primary of a step-down transformer mounted in the cover unit and is also supplied, through the power switch, to the motor unit. The 5.6-volt ac output of the transformer is used to supply power to the copy lights. The motor unit drives mechanisms in the typing unit and the signal generator through the intermediate gear assembly which determines the speed of a main shaft. Speed of operation is controlled by selection of the proper gear set installed in the intermediate gear assembly. Local line feed (LOC LF) and local carriage return (LOC CR) function keys on the ASR keyboard are mechanically linked to the typing unit and initiate their respective functions when pressed. Character or function keys on the keyboard are mechanically linked to a code bar mechanism in the keyboard transmitter. The mechanical signal code on the code bar mechanism is converted to a parallel, 5-bit electrical signal code by code-level contacts in the keyboard transmitter. The signal generator serializes the 5-bit signal code which is used to key an external dc loop current power supply to generate mark/space signals. The mark/space signal code (0.060-amperes mark and 0-amperes space) is applied to selector magnets in the local typing unit and sent out on the signal line to a remote typing unit. The typing units print the character or perform the function previously selected at the ASR keyboard as determined by the receive signal code.

a. <u>ASR Set Operating Modes</u>. The ASR Sets are interconnected electrically or mechanically to provide a wide range of possibilities for sending, receiving or storing teletypewriter messages.

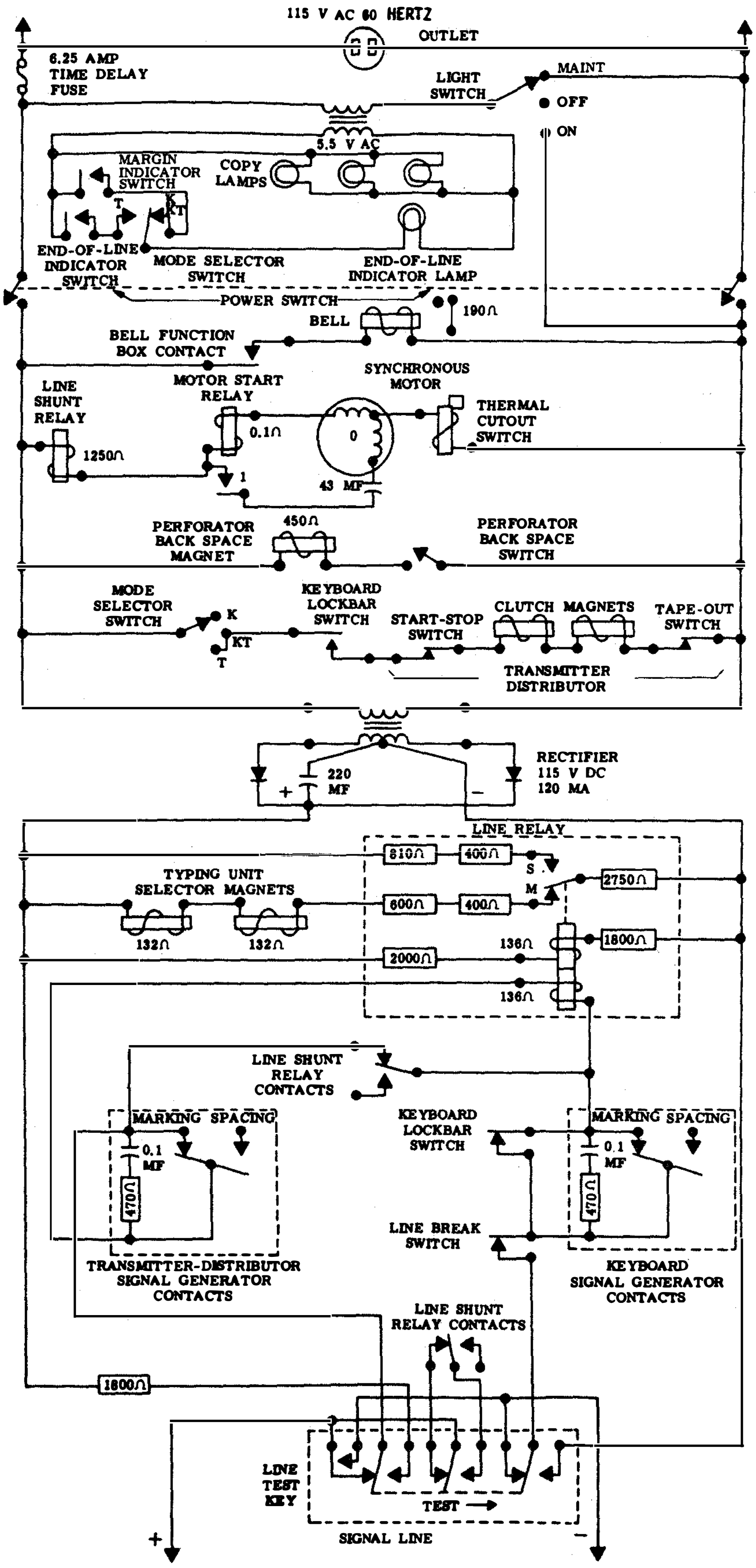


Figure 3-1. Typical Automatic Send-Receive (ASR) Teletypewriter Set Model 28 Schematic Diagram

Electrical connections between the components are routed through the electrical service unit. Transmitted signals are initiated through the keyboard or the transmitter distributor, Figure 3-2. Received signals are recorded by the typing unit which also monitors local, off-line transmissions. The tape punch (typing or non-typing perforator or repreforator unit) prepares tape on which received or locally prepared messages may be stored for future transmission by the transmitter distributor. The keyboard, tape punch unit, typing unit, and transmitter distributor receive their motive power from a single motor unit. A three-position mode selector switch, mounted on the front panel of the cabinet, permits the operator to place the ASR Set into one of three operating conditions. Placing the selector switch in the K (keyboard position) conditions the ASR Set so that messages may be transmitted from the keyboard. All messages transmitted are recorded on the typing unit. Placing the selector switch in the K-T (keyboard-tape position) enables the ASR Set to transmit from its keyboard and, at the same time, record all transmissions in both punched tape and page-printed form. Placing the selector switch in the T (tape position) conditions the ASR Set so that operation of the keyboard produces punched tape only. No external transmissions occur. However, the typing unit is operable and will record all received messages. The transmitter distributor is controlled by a start-stop switch which is accessible for operation by the operator. Transmissions are automatically stopped by tight-tape or tape-out devices, which are incorporated in the transmitter distributor, should these tape conditions occur. Control of the optional Auxiliary Typing Reperforator Set is provided either by controls located on the accessory control panel on the front of the cabinet, or by controls located on the typing reperforator base and accessible through a cabinet access lid. The Auxiliary Typing Reperforator Set is connected to a separate signal line circuit and may therefore receive and record messages simultaneously with, but independent of, other ASR Set operations.

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

c. <u>Transmitter Distributor Unit</u>. The transmitter distributor (TD) unit is for transmission of messages only. Coded representations of alphabetical and numerical symbols and teletypewriter functions are read from pre-punched tape and converted into electrical signal intelligence for connecting two or more ships or stations equipped with compatible units. Operation of the sets is fully automatic when tape is properly installed in the reading head, the main power switch is in ON position, and the start-stop switch is in RUN position.

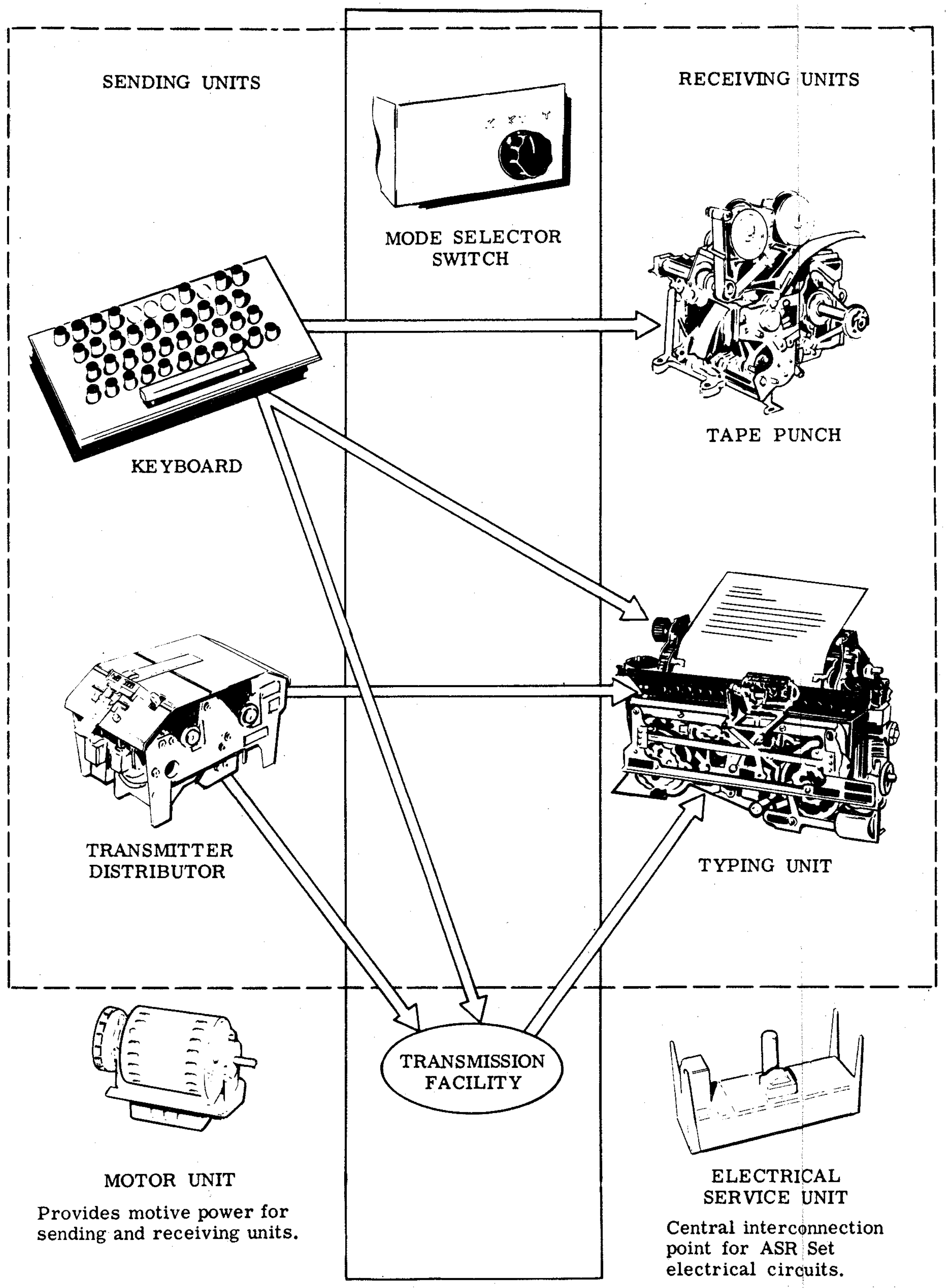
(1) The signals transmitted by TDs are of the neutral polar type (open and close) direct current, 7.42 unit start-stop pattern, with a nominal speed of 368 operations per minute (opm). Gearing changes can adapt the equipment to 460 or 600 opm, with equivalent word speeds of 60, 75 or 107-words per minute (wpm). The equipment will operate on either 0.060 or 0.020-ampere signal current, externally supplied.

(2) TDs receive motive power from a keyboard mounted motor unit, that provides power for the ASR unit. The motor requires a power supply of 115 volts ac (plus or minus 10 percent), 60 Hertz, single phase alternating current. To avoid loss in receiving margin with this type of motor, the frequency regulation must be within plus or minus one-half cycle. Governed motors and motors operating on direct current are available for Transmitter Distributor TT-187/UG only but are not furnished with the set.

d. Signaling Code. TD sets operate on the principle of electromechanical conversion of message characters, equivalent to alphabetical or numerical characters or standard teletypewriter functions, Figure 3-3. Teletypewriter equipment utilizes the Baudot code, a five-unit start-stop signaling code in which each character or function is represented by a combination of current and no-current time intervals. In a neutral teletype circuit, intervals during which current flows in the signal circuit are referred to as "marking" elements, and intervals during which no current flows as "spacing" elements. Every combination includes five elements that carry the intelligence, each of which may be either marking or spacing.

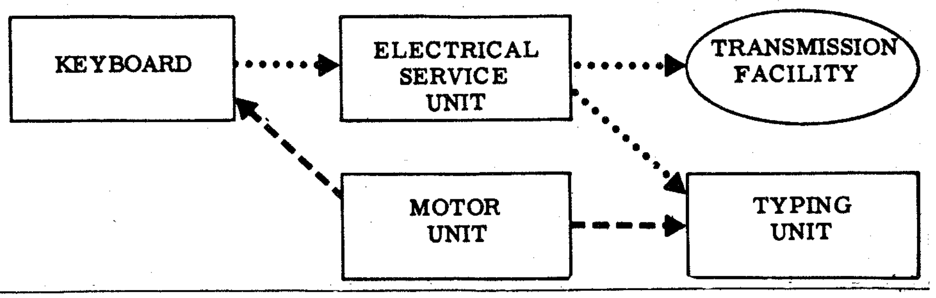
(1) The intelligence elements are preceded by a start element (always marking) which is 1.42 times as long as each of the other elements. Thus, each combination consists of 7.42 units of time (referred to as a 7.42 unit transmission pattern). The start and stop elements provide for mechanical synchronization between the transmitting and receiving equipment. A graphic illustration of the marking and spacing elements in each sequence may be found in Figure 3-4, Code Representation of the LETTERS "R" and "Y". All five elements are marking in the LETTERS code. The BLANK code is comprised of five spacing elements.

(2) Some telegraph systems employ a 7.00 unit transmission pattern in which the stop element is equal to each of the other elements. Interoperation between 7.42 and 7.00 apparatus is satisfactory providing the operating speeds selected yield identical pulse lengths. The signaling frequency is expressed in dot cycles per second. One cycle



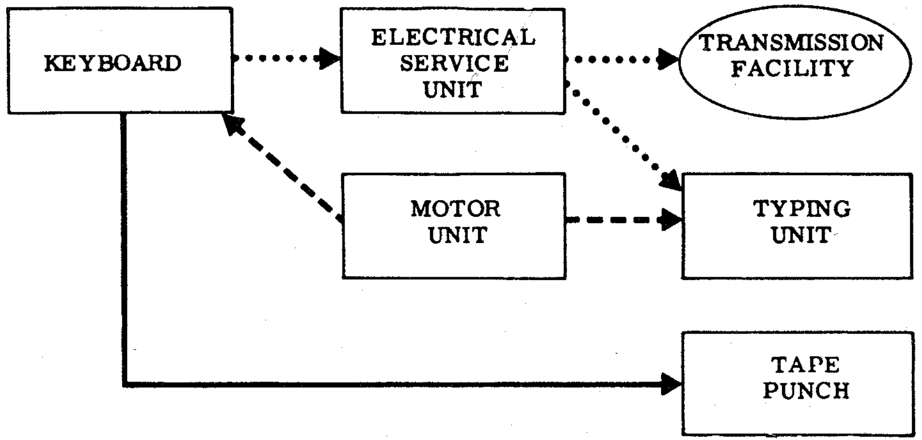
K

Messages are transmitted from the keyboard and recorded on the typing unit. Received messages are recorded on the typing unit.



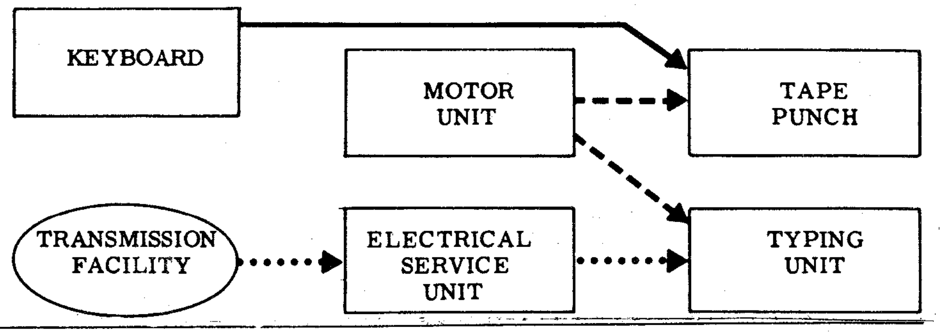
K-T

Messages are transmitted from the keyboard and recorded on both the typing unit and tape punch unit (perforator or reperforator). Perforator (illustrated) is actuated mechanically; reperforator is actuated electrically and may be used, as can the typing unit, to record received messages. Reperforator may also be actuated mechanically.

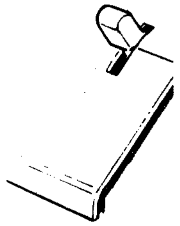


T

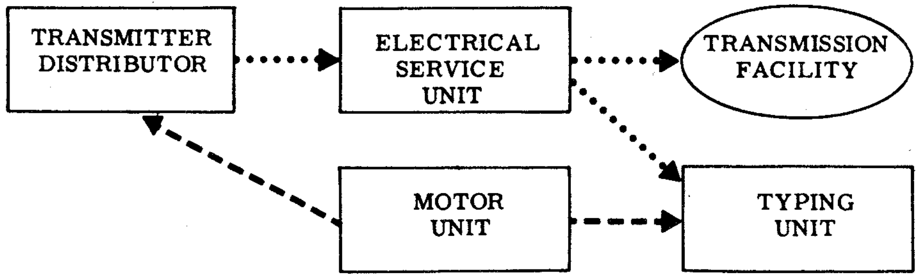
No external transmissions occur. Messages typed on the keyboard are recorded by the tape punch unit. Received messages are recorded on the typing unit, and/or reperforator.



TRANSMITTER DISTRIBUTOR OPERATION

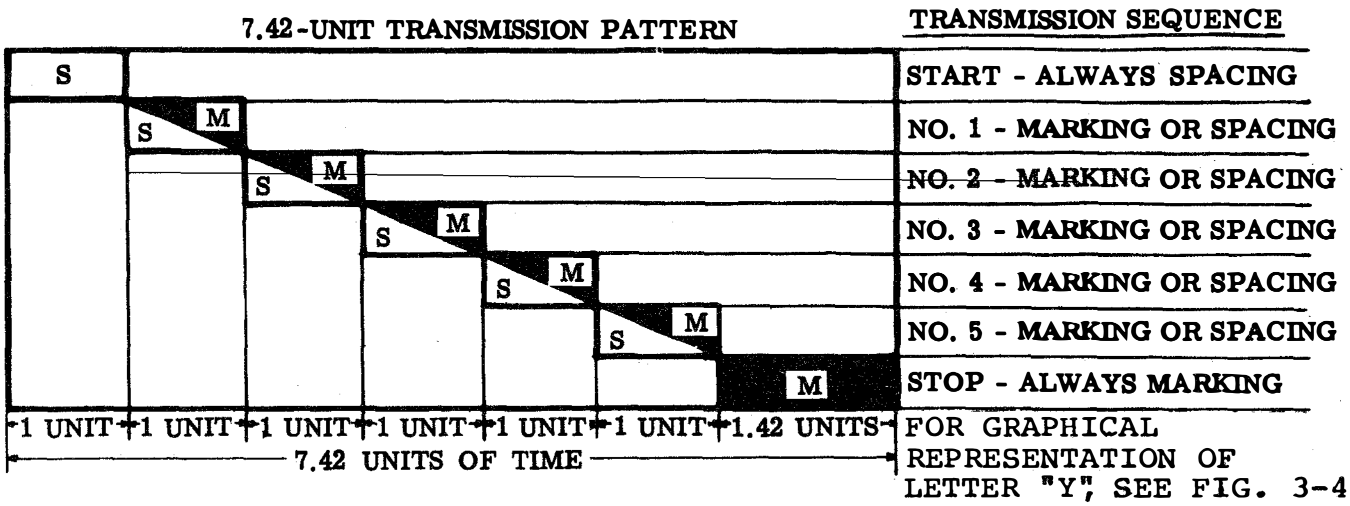


The transmitter distributor, controlled by a start-stop switch, may be operated in place of the keyboard in all operating modes. Transmitted messages are recorded by the typing unit and reperforator-type tape punch unit.



Transfer of Intelligence		Transfer of Motive Power
Electrical	Mechanical	
••••••••••••►	———►	- - - - - - - - -►

Figure 3-2. Typical ASR Set Model 28, Operating Modes



FIGURES	-	?	:	$	3	!	&	#	8	'	(	)	.	,	9	0	1	4	🔔	5	7	;	2	/	6	"	≀	<	≡	▮	∨	∧
LETTERS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	BLANK	C.R.	L.F.	SPACE	LTR.	FIG.
1	●	●		●	●	●				●	●						●		●		●		●	●	●	●					●	●
2	●		●				●		●	●	●	●				●	●	●			●	●	●						●		●	●
FEED HOLES	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3			●			●		●	●		●		●	●		●	●		●		●	●		●	●					●	●	
4		●	●	●		●	●			●	●		●	●	●			●				●		●				●			●	●
5		●					●	●				●	●		●	●	●			●		●	●	●	●	●					●	●

(TYPICAL CHARACTER ARRANGEMENT)

Figure 3-3. Signaling Code

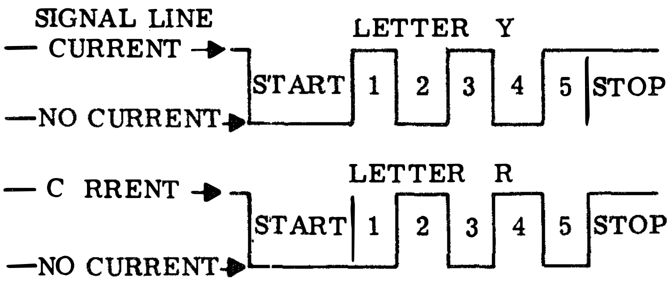


Figure 3-4. Code Representation of R and Y

consists of one current pulse followed by a no-current pulse. The equipment speed in baud is equal to twice the frequency. Speed in words per minute is roughly equivalent to one-sixth the operations per minute.

(3) The TD uses a single camshaft to start, and sequentially perform, the functions of sensing the intelligence stored in a perforated 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 accepts either chadless or fully perforated tape (figure 1-31).

e. Functions. The basic operation of the TD is to mechanically sense perforated tape and transfer the information to the signal generator, which performs the actual signal transmission (figure 3-5).

(1) The TD can be thought of as having two basic functions. The transmitter (tape reader) senses or reads the punched code combinations in the tape and transfers this data mechanically to the distributor.

(2) The signal generator assembly converts the parallel signal from the transmitter into sequential, start-stop signals for distribution on line.

(3) The operating mechanisms of the TD and their function are described in the following paragraphs, refer to Figure 3-5.

(a) Tape Sensing Mechanism. The tape sensing mechanism consisting of a bank of sensing pins feels the perforated tape, Figure 1-28.

(b) Main Shaft Assembly. The main shaft assembly consisting of multiple cams, gears, eccentrics, and a clutch, drives the TD through its various functions.

(c) Tape Feed Mechanism. The tape feed mechanism used with chadless or fully perforated tape, feeds the tape through the TD.

(d) Tape-Out Pin. The tape-out pin will stop transmission when the tape runs out. The pin located under the tape will project upward when there is no tape in the sensing head. Transmission then is halted by the opening of the clutch trip magnet circuit which causes the clutch to disengage.

(e) Quick Disconnect. A 36-pin terminal or plug which connects to a mating receptacle located on the base facilitates making the electrical connections (figure 1-30).

(f) Tape Lid. The spring loaded tape lid, Figure 1-29, springs open when the red tape lid release plunger is depressed. A control lever having the following three positions FREE, STOP, and RUN is used manually to control the unit. The adjustable guides, Figure 1-29, are used for aligning and locating the 11/16 or 7/8-inch wide tape over the feed wheel. A tight tape device on the tape lid will stop transmission in the event the tape becomes tangled or too tight. The tight tape device actuates the same components, acts in a like manner as the tape-out mechanism.

3-2.2 AUXILIARY TYPING REPERFORATOR SYSTEM OPERATION. Figure 1-31 is a left-front view

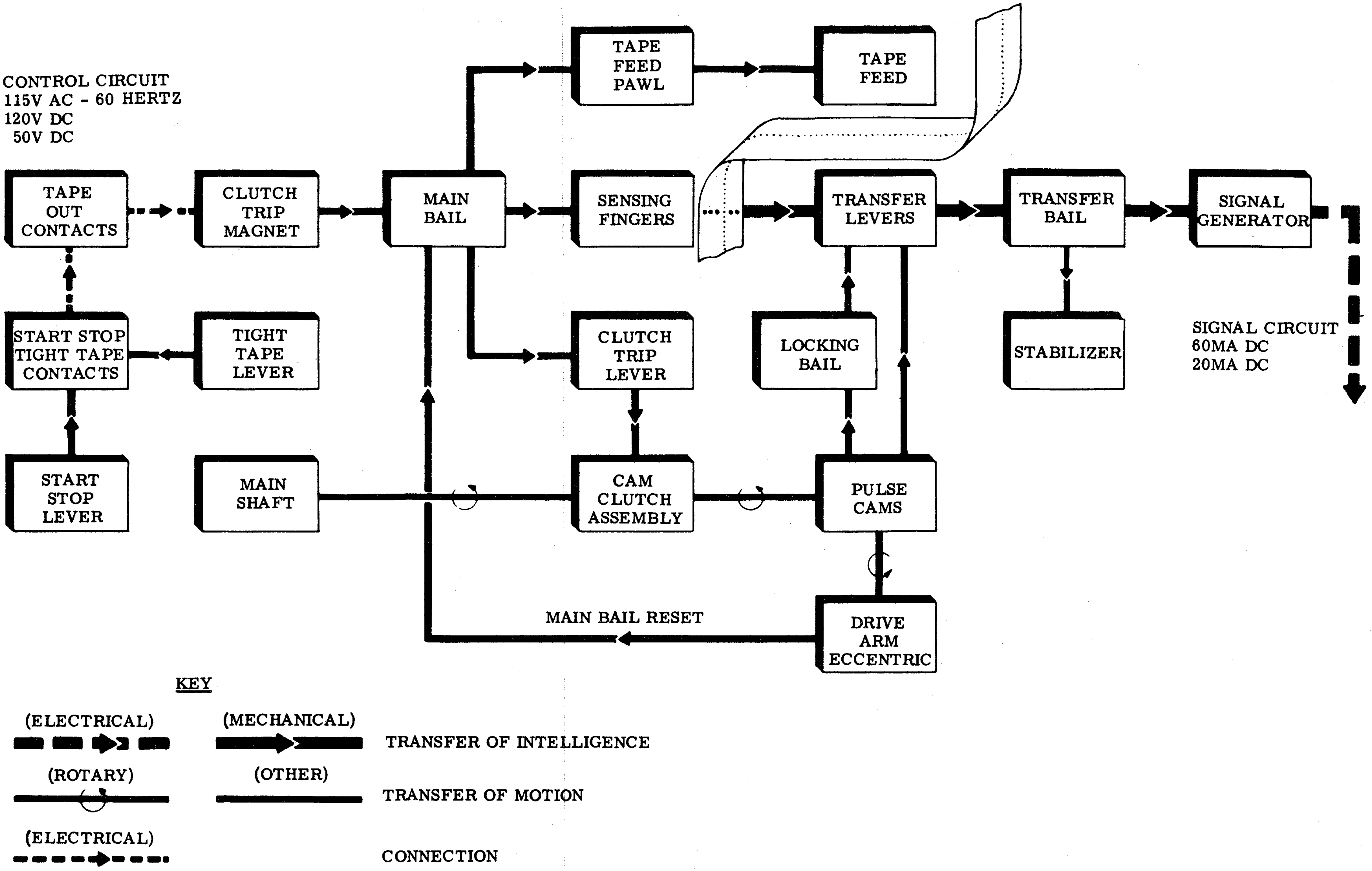


Figure 3-5. Functional Block Diagram of Transmitter Distributor Unit

of the chadless type Typing Reperforator Unit Model 28, showing the location of principal assemblies. Figures 1-32 and 1-33 show a left-rear view and a front view, respectively, of the typing reperforator unit for fully perforated tape. The fully perforated tape typing reperforator unit prepares fully punched tape and prints between the feed holes. The chadless-type typing reperforator unit prepares partially punched (hinged chad) tape and prints along the upper edge of the tape. Except for these differences, the two typing reperforator units are identical.

3-3. AUXILIARY TYPING REPERFORATOR BASIC BLOCK DIAGRAM DESCRIPTION. Figure 3-6 is a basic block diagram showing in simplified format the functional blocks and basic signal paths comprising the unit. The diagram contains nine mechanisms, each of which is described briefly in the following paragraphs.

a. Drive Mechanism. The typing operation, which causes characters to be imprinted on tape, is caused by striking a print hammer against selected characters on a rotating bakelite type wheel. The type wheel is driven through a gear train and clutch arrangement by an ac motor mounted on the base of the unit. The main shaft rotates continuously as long as power is applied. The unit is referred to as being in the idling condition when the main shaft is turning and the signal circuit is closed, so that no signal is being received. The unit is referred to as running open when the main shaft is turning and no signal is applied to the selector magnets.

b. Selecting Mechanism. Selection of the character to be punched or printed is made by pressing a key in the keyboard or when a five-level code is received over the transmission line to the set. In either case this causes a series of electrical impulses representing the desired character to be generated. The selector mechanism, made up of a selector, a clutch trip assembly, and a cam-clutch, translates the signaling code combinations into mechanical arrangements which govern tape printing and perforating. The electrical pulses comprising each code combination are applied to a magnet on the selector. An 0.020 or 0.060-ampere signal is applied externally to the selector magnet. External electrical signals are applied through a 36-pin connector at the rear of the unit, as shown in Figure 1-33. The two-coil selector magnet may be wired in series for the 0.020-ampere signal or in parallel for 0.060-ampere operation. A range finder permits adjustment of the selector in relation to the signaling code.

c. Perforator Mechanism. This block contains the punch slides and components used to physically punch the code for the desired character in the tape. The mechanical arrangements are passed on through the transfer mechanism to control the position and printing mechanisms, and to the punch slides to control the punching operation.

d. Transfer Mechanism. Near the end of each selecting cycle, the transfer mechanism moves the intelligence in the form of a mechanical arrangement from the punch slides to the

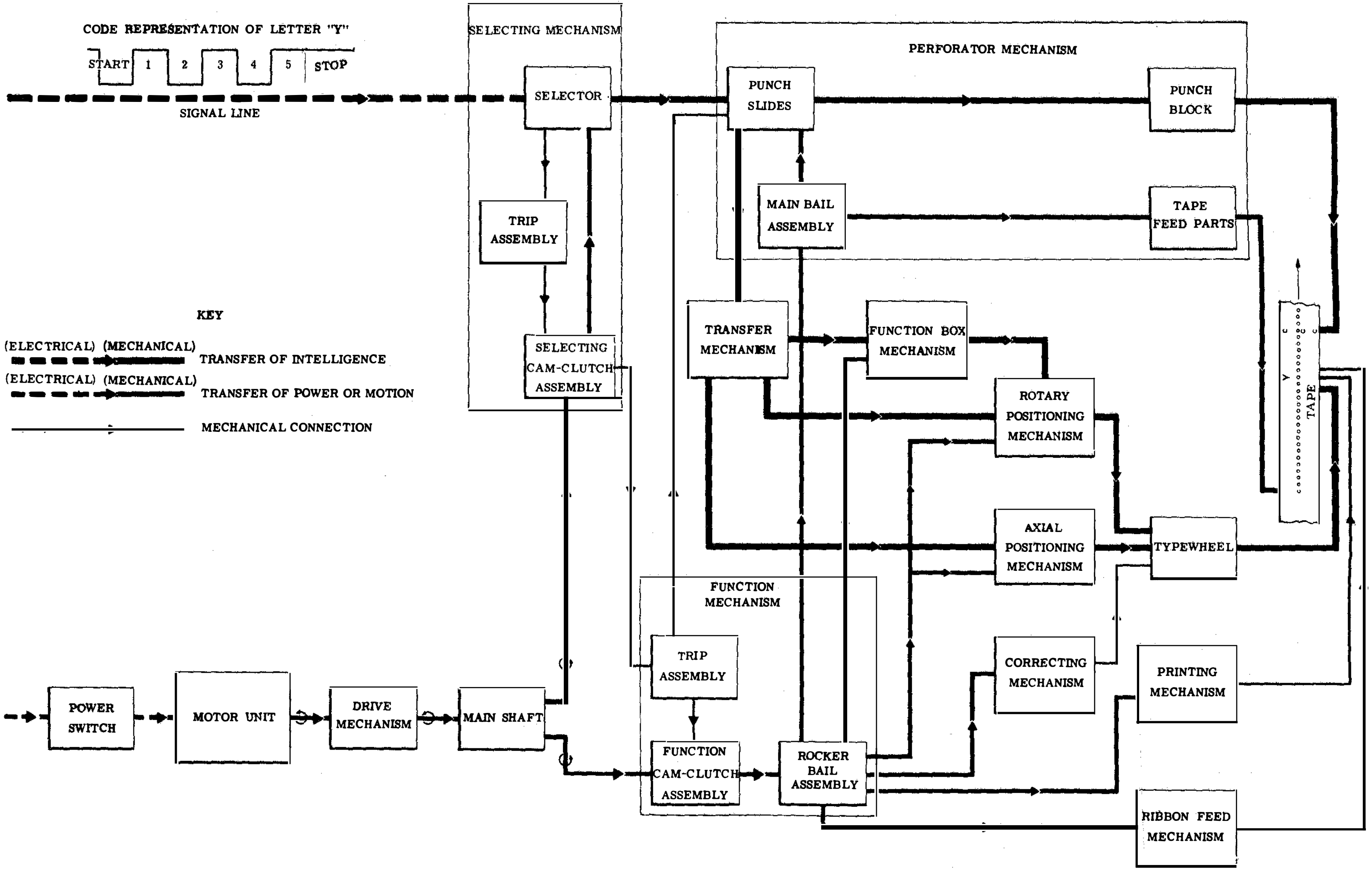


Figure 3-6. Typing Reperforator Unit Block Diagram

function box mechanism and to the positioning mechanisms. Five mechanical linkages are included in the transfer mechanism, each associated with a punch slide to produce the five-level code described in paragraph 3-2.1d.

e. Function Box Mechanism. The function box mechanism enables the unit to perform various auxiliary functions including LETTERS-FIGURES shift, unshift-on-space, and signal bell, as described in the discussion of variable features. The function box conveys the motion of the main shaft to the mechanisms concerned with the actual typing and punching operations.

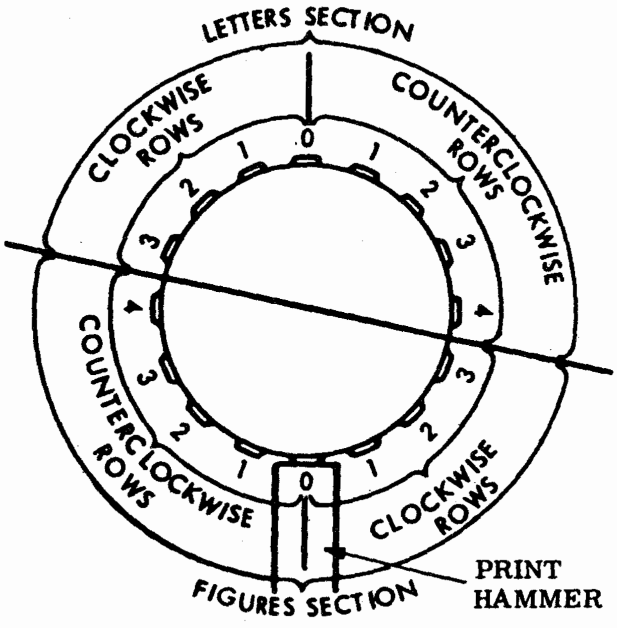
f. Positioning Mechanisms. This basic block is made up of three functional assemblies which operate independently to position the type wheel during the typing operation. The operation of each of these three mechanisms is described in the functional block diagram description.

g. Type Wheel. The character to be used to type the intelligence on tape, either figure, letter, or special symbol, is embossed on a cylindrical bakelite type wheel which is rotated by an ac motor through a mechanical gear train and clutch arrangement as previously stated. During the function cycle the rotary and axial positioning mechanisms, having received the intelligence from the transfer mechanism, position the type wheel so that the character generated by the depressed key or received on the transmission line is selected and accurately positioned for printing. A typical type wheel character arrangement is shown in Figure 3-7, in which the wheel's cylindrical surface is shown rolled into a plane.

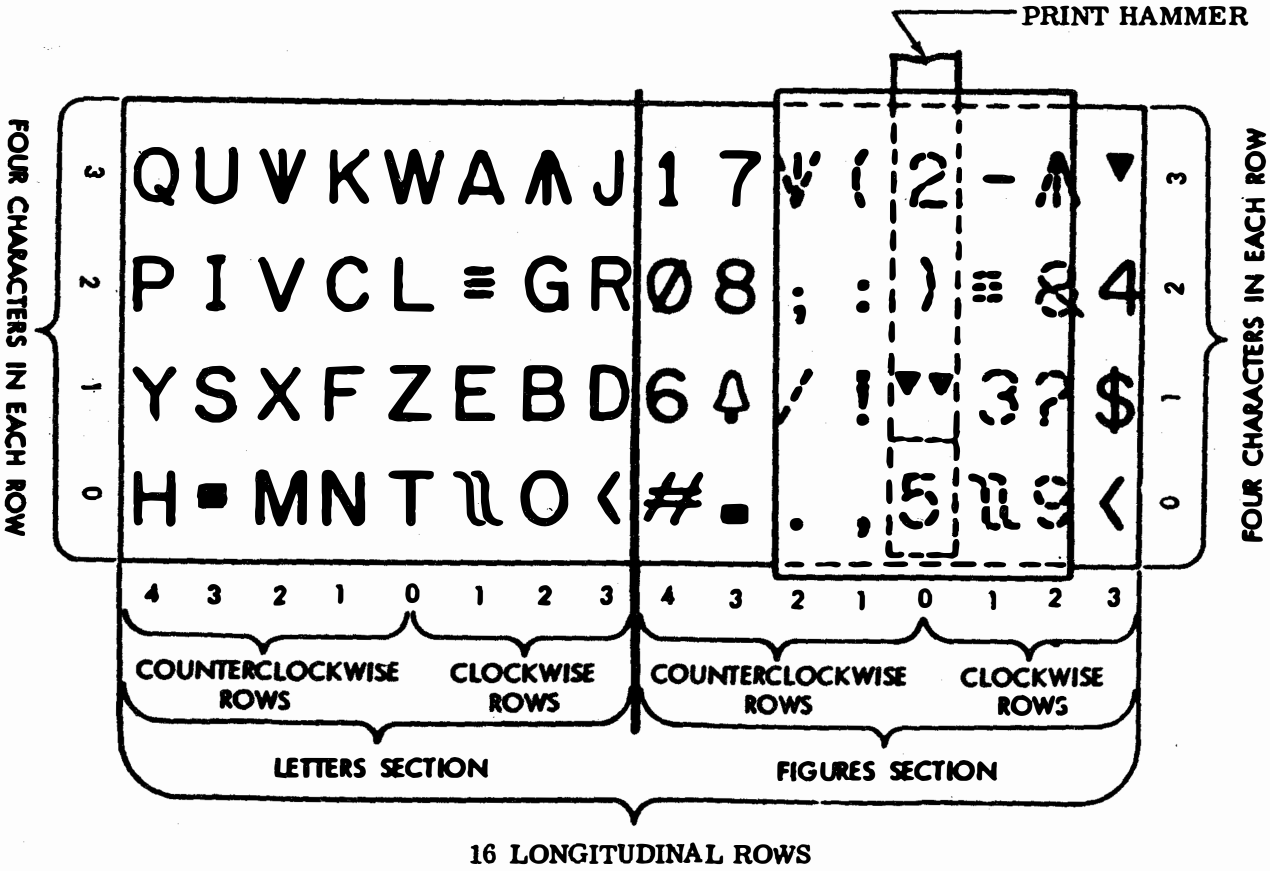
h. Printing Mechanism. After the type wheel has been positioned and corrected, the printing mechanism supplies the impact which drives the paper and inked ribbon against the selected character. It effects this operation by means of a shaft supported by a bracket attached to the type wheel bearing housing.

i. Ribbon-Feed Mechanism. The characters are imprinted on the tape in ink supplied by an inked ribbon which is held between the tape and the type wheel by a guide. The inked ribbon is advanced after printing each character by a ribbon-feed mechanism. The path of the ribbon is down to the right off the top of a right spool, under a right follower, through right pins on the reversing arm, through the ribbon guide, up through left pins on the reversing arm, and to the right over the top of a left spool. A line drawing of the ribbon path is shown in Figure 3-8.

j. Tape. The perforating mechanism steps the tape, punches feed holes, and perforates chadless (or fully perforated) code holes received by the selecting mechanism. The tape is threaded by means of a handwheel. Printing and punching occur simultaneously at a punch block, both the characters are printed, 10 characters per inch, six spaces to the right of the corresponding code combinations. The type wheel is retracted at the end of each operation to make the last printed character visible.



FRONT VIEW SHOWING 16 LONGITUDINAL ROWS



TOP VIEW SHOWING CYLINDRICAL SURFACE IN A PLANE

Figure 3-7. Typical Type Wheel Character Arrangement

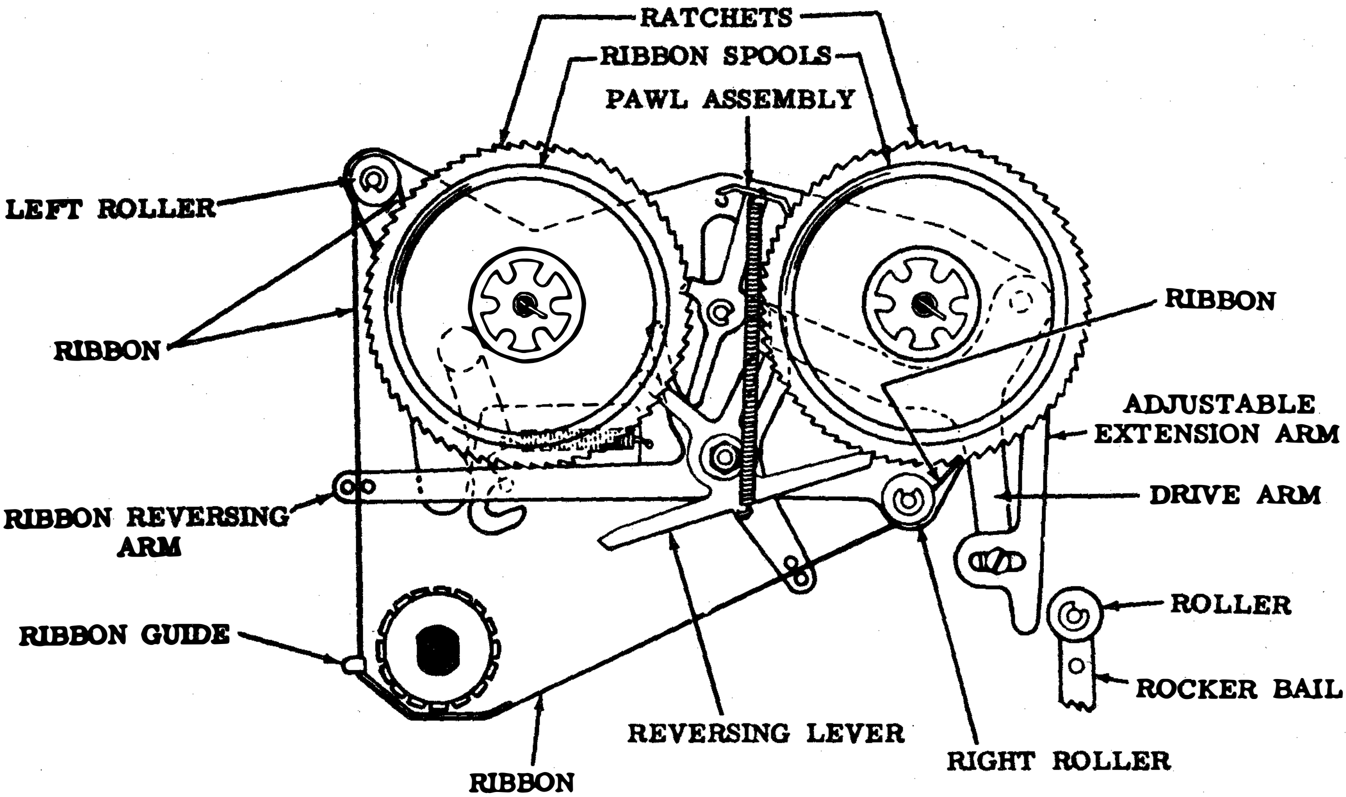


Figure 3-8. Ribbon-Feed Mechanism

3-4. VARIABLE FEATURES. A number of features not shown on the clock diagram are available with the typing reperforator. Some of these features are described briefly in the following paragraphs and discussed in more detail later in the chapter.

a. Contact Mechanisms. These mechanisms furnish electrical pulses for remote use. They include timing, code reading, and audible and visible indicator actuating contacts.

b. Backspace Mechanisms. Two basic 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 print the inclusion of a predetermined length of BLANK or LETTERS-perforated tape following a message. This operation facilitates handling. Normally, the interfering tape feed-out mechanism operates at the end of a message. A message can not be received during the feed-out period. The non-interfering tape feed-out mechanisms have provisions for operating messages that are received during the feed-out period. The mechanisms may be operated manually, automatically, or by remote control.

d. Print Suppression on Function. This feature inhibits printing of a predetermined character when this character or function is selected.

e. Motor Control Mechanisms. These deivces start or stop the motor used to rotate the type wheel in response to a predetermined signal level or line condition.

f. Universal Function Blade. This blade contains removable tines so that it may be coded to accomodate any desired function box requirement.

g. Variable Speed Configuration. A variation of the reperforator unit is a configuration containing an additional shaft that enables its perforator and typing mechanisms to be operated at a different speed from that of its selecting mechanism.

3-5. SIGNALING CODE. The typing reperforator operates on the principle of electromechanical conversion of message characters in terms of a signal code. As shown in Figure 3-3, five signal levels comprise the code for the character to be printed or punched. A start bit (always spacing) precedes the first bit in the coded character, with the fifth character bit followed by a stop bit (always marking).

a. Baudot Code. Teletypewriter equipment uses the Baudot code, a five-level start-stop signaling code in which each character or function is represented by a combination of marking current and spacing current time intervals. In a polar signaling circuit, intervals during which current flows in a positive direction are referred to as marking elements, with intervals during which current flows in the opposite direction designated as spacing elements. In a neutral signal circuit, intervals during which current flows in the circuit are referred to as marking elements, and intervals during which no current flows as spacing elements.

b. Five-Level Configuration. Every code combination includes five elements that carry the intelligence, each of which may be either marking or spacing. The start and stop elements provide for mechanical synchronization between the transmitting and receiving equipment. All five elements are marked in the letters code. The blank code consists of five spacing elements.

c. Code Permutation. The total number of permutations of a five-unit code is two to the fifth power, or 32. In order to transmit more than 32 characters and functions, a LETTERS-FIGURES shift operation is designed into the equipment. This permits each permutation, excluding those used to shift and unshift the apparatus, to represent two characters or functions.

d. Typing Speeds. The typing reperforator may operate with a 7.00, 7.42, or 7.50 unit transmission pattern, as listed in Table 1-1. The signaling frequency is expressed in dot cycles-per-second, one cycle consisting of a positive current pulse followed by a negative current pulse. The equipment speed in baud is equal to twice the frequency (refer to table 1-1). Speed in words per minute(wpm) is roughly equivalent to one-sixth the operations per minute (opm). Marking elements in the intelligence code are represented by holes, while spacing elements consist of an absence of holes. The row of smaller holes between the second and third levels are tape feed holes and do not enter into the code permutation.

3-6. AUXILIARY TYPING REPERFORATOR FUNCTIONAL BLOCK DIAGRAM DESCRIPTION. The following paragraphs comprise a brief description of each of the functional blocks on the functional block diagram in Figure 3-6. The interaction between functional blocks and assemblies also is briefly discussed.

a. Power Switch. The typing reperforator has a power switch electrically connected in the ungrounded leg of the ac power input path, as shown in the system schematic, Figure 3-1. In low-level configurations, the ESA has its own power switch. The ac input is applied to the tape feed-out switch and the backspace switch, which require a 115-volt input, and to the ac motor used to rotate the main shaft. The type and location of the power switch used will vary according to the individual set configuration.

b. Motor Unit. A 1/20-horsepower ac motor is used to supply rotary motion, through a gear train and clutch assembly to the reperforator unit and the keyboard. The motor is physically mounted on the base of the reperforator. Either of two basic types of motor, ac synchronous or ac/dc series governed, may be used. The ac synchronous motor is used when the power source is regulated, while the ac/dc series governed motor operates from either regulated or unregulated power sources. Both motors rotate at the same speed, and both may be standard or heavy-duty models according to their adaptations. Note on Figure 3-1 that the motor contains both a starting winding, used to overcome inertial torque, and an operating winding. When power is first applied to the motor both windings are energized and the starting capacitor begins to charge. When the capacitor is fully charged the motor start relay drops and the starting winding is de-energized. A thermal cutout relay is included for overheat conditions, and closes automatically when excessive ambient temperature exists, bypassing the motor and shutting off the unit.

c. Drive Mechanism. The motor supplies rotary motion, through a gearset, to the typing reperforator unit. Gearsets may be interchanged to obtain various operational speeds. This may also be accomplished by an optional variable-speed drive mechanism.

d. Main Shaft. The main shaft and selecting cam-clutch assembly, shown from right to left in Figure 3-9, includes the clutch, stop arm bail cam, fifth, fourth and third selector cams, cams for the spacing and marking locklevers, second and first selector cams, selector reset bail cam, and the function trip cam. The cam-clutch is controlled by the selector through the clutch trip assembly, as described in the detailed discussion of this assembly. During the time in which the signal circuit is closed (marking), the selector magnet coils are energized and hold the selector armature up against the magnet pole pieces. In this position, the armature blocks the lever, and the cam-clutch is held stationary between the stop arm and latch-lever. At the end of the function cycle the cam-clutch is disengaged from the ac motor.

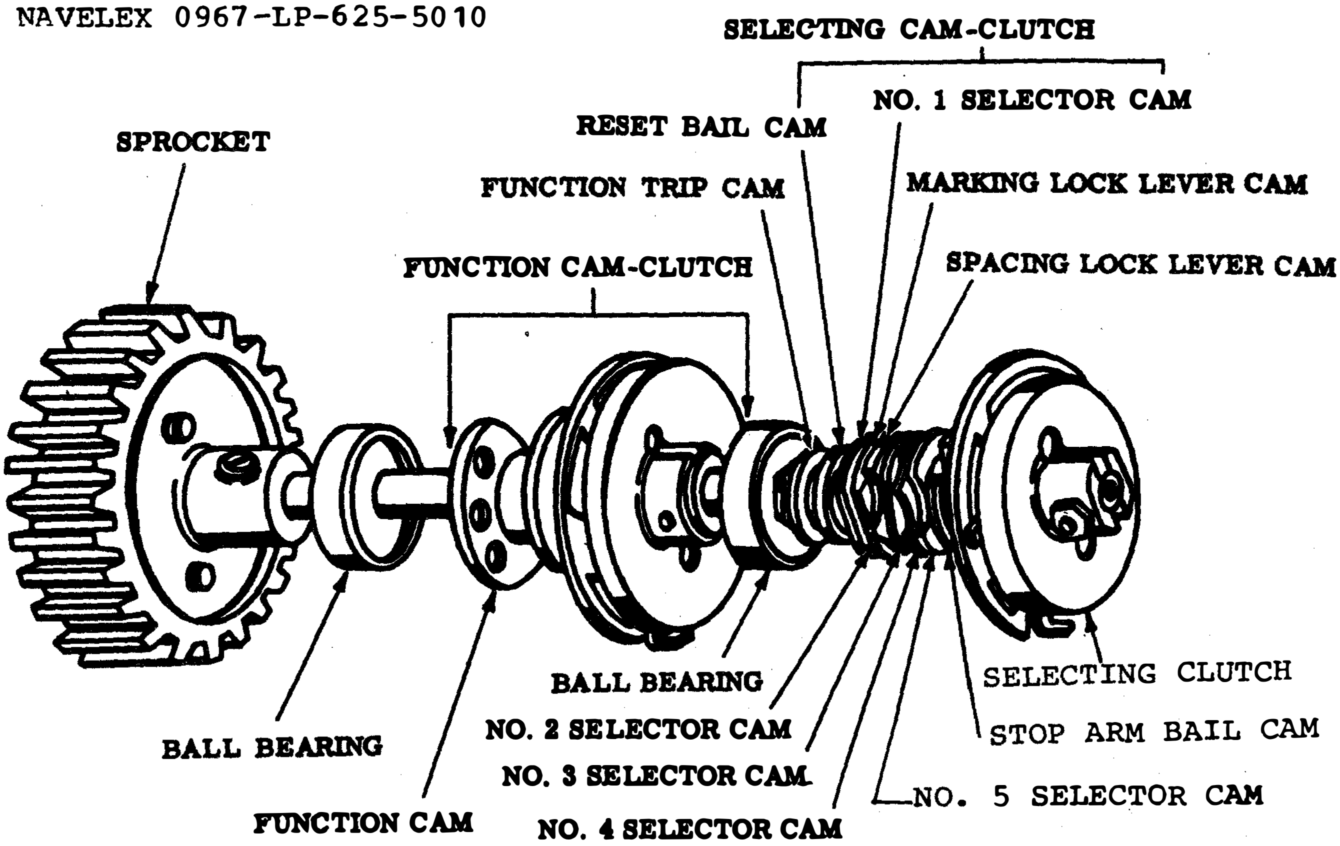


Figure 3-9. Main Shaft, Left Side View

e. Selector. The signaling code combination, such as the combination representing the character "Y", plotted in the upper left-hand corner of Figure 3-6, is applied to the selecting mechanism. The start pulse of the character being received causes the selector, through a trip assembly, to trip the selecting cam-clutch, initiating the selection cycle.

f. Trip Assembly. Near the end of the selecting cycle, the cam-clutch actuates the function cam-clutch in the function mechanism to operate the printing and perforating actions. The selection cam-clutch is then de-energized and remains inoperative until the next code combination is received. The trip assembly is active during these functions.

g. Selecting Cam-Clutch Assembly. The selecting cam clutch assembly participates in transferring timed motion of the code combination into a corresponding mechanical arrangement. The main shaft imparts motion to the selecting cam-clutch when the clutch is engaged at the start of the selecting cycle, and controls clutch operation throughout the selecting cycle until the clutch is disengaged at the end of the cycle.

h. Main Bail Assembly. The main bail assembly transfers the motion of the rocker bail assembly in the function box to align the punch slides in the perforator mechanism. This ensures that printing and punching operations are synchronized.

i. Punch Slides. The outputs of the function and transfer mechanisms are routed to both the positioning and printing mechanism and to the perforator mechanism, so that printing and punching of the selected character will be performed simultaneously. When the five punch slides are actuated by the selector, punches are aligned to perforate the tape in accordance with the hole positions for the character to be punched.

j. Punch Block. The punch block operates in conjunction with selected pins to perforate the tape at the same time the selected character is being typed by the printing mechanism.

k. Tape-Feed Parts. The tape-feed parts making up part of the perforator mechanism include a toggle bail, a slide post, toggle links, draglinks, and the punch slide reset bail. As the perforating mechanism punches the selected hole combination, motion of the main bail assembly causes the tape to be advanced one character space before the next code combination is received. Note that the selecting and punching/printing operations occur simultaneously. That is, while the perforating mechanism is punching the hole positions for the selected character and the printing mechanism is impressing the character on the tape, the selecting mechanism may be processing the next code combination.

l. Function Cam-Clutch and Trip Assemblies. The function cam-clutch, like the selector cam-clutch, is driven by the main shaft as shown in Figure 3-9. This clutch is engaged throughout the function cycle in the same manner that the selection cam-clutch is controlled by the main shaft throughout the selection cycle, and is actuated by a similar trip assembly. The function cam-clutch and the rocker bail assembly translate the rotation of the main shaft into simple harmonic motion.

m. Rocker Bail Assembly. This assembly, in conjunction with the function cam-clutch, distributes rotary motion of the main shaft to the following mechanisms:

(1) Ribbon-feed mechanism.

(2) Perforator.

(3) Correcting mechanism.

(4) Function box.

(5) Printing mechanism.

(6) Oscillating assembly.

(7) Pushbars of the Axial and Rotary Positioning Mechanisms. During the first part of each function cycle the cams bear against the roller, causing the bail assembly to rock to the right. During the latter part of the cycle, the bail assembly returns to the home position as the rotary motion of the cams is reversed.

n. Transfer Mechanism. Near the end of each selecting cycle, the transfer mechanism moves the intelligence in the form of a mechanical arrangement from the punch slides to the function box mechanism and to the positioning mechanisms. Five mechanical linkages are included in the transfer mechanism, each associated with a punch slide, to produce the five-level code described in paragraph 3-2.1d.

o. Function Box Mechanism. The function box mechanism enables the unit to perform various auxiliary functions including LETTERS-FIGURES shift, unshift-on-space, and signal bell. The function box conveys the motion of the main shaft to the mechanisms concerned with the actual printing and punching.

p. Type Wheel. As shown on the expanded view of the type wheel in Figure 3-7, there are 16 longitudinal rows, each of which is made up of four characters numbered from 0 through 4 from front to rear. The surface is divided into a letters section and a figures section, with each section consisting of eight longitudinal rows. The fifth row, in a counterclockwise direction from the division line, is numbered 0, with four rows in one direction. These are designated counterclockwise, while three rows in the other direction are designated clockwise rows, as shown in Figure 3-7. 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 of the wheel. The position of the print hammer relative to the type wheel is also shown.

q. Rotary Positioning Mechanism. The rotary positioning mechanism, which is controlled by the numbers 3, 4, and 5 selecting elements of the code, rotates the type wheel so that the row containing the selected character to be printed is aligned with the print hammer at time of printing.

r. Axial Positioning Mechanism. The functions of the axial positioning mechanism are to position the type wheel to the front so that the proper character in the selected row is aligned with the print hammer at the time of printing and to retract the type wheel and ribbon guide at the end of the function cycle so that the last typed character is visible. It is controlled by pushbars actuated by numbers 1 and 2 of the code.

s. Correcting Mechanism. After the type wheel has been positioned by the rotary and axial positioning mechanisms, the selected character is more accurately aligned for printing by the correcting mechanism which compensates for any play or backlash in the positioning linkages.

t. Printing Mechanism. Following type wheel positioning and final correction, the printing mechanism is activated. This assembly, by means of a hammer, drives the tape and inked ribbon forcibly against the type wheel, imprinting the selected character on the tape.

u. Ribbon-Feed Mechanism. Immediately after the selected character has been typed, a ribbon-feed mechanism advances the inked ribbon one character space, and reverses its direction when one of two ribbon spools is depleted. Near the end of the function cycle the axial positioning mechanism retracts the type wheel and a ribbon guide so that the last printed character is visible. The LETTERS or the FIGURES code sets up an arrangement in the transfer mechanism which permits the function box to operate and to cause the rotary positioning mechanism to shift the type wheel 180 degrees of rotation.

v. Base Assembly. The base assembly is a simple designed structure of steel plates which serve as a mounting for a typing reperforator. A motor unit, tape container, gear bracket assembly, and a bracket on which electrical connections are made are incorporated on the base. Motor mounting facilities are provided on the lower level of the base. The motor is located in a position for driving the gear assembly.

(1) Gear Shaft. The gear bracket assembly which is driven directly by the motor, may contain, two shafts with interchageable gears for speed change, or it may be a gear-shift assembly which changes the speed by moving the lever to any one of three positions. A reperforator driving sprocket is mounted on the gear assembly which drives the reperforator unit by means of a timing belt.

(2) Tape Container. The tape container accommodates a full roll of tape. The tape is directed out through a tape guide using a roller to carry it to the typing reperforator. A low tape electrical switch assembly is provided in the tape container. A tape-out switch lever rides on the surface of the diminishing roll of tape which actuates an electrical switch when a prescribed level of tape is reached.

w. Electrical Characteristics. The electrical connections are made on a bracket assembly adjacent to the tape container. A power cable connector is provided to accept electrical power from the cabinet terminal board.

(1) A power switch provides a means for switching power to and from the typing reperforator unit.

(2) A 36-point connector is provided to accept cable connections from a mating receptacle on the typing reperforator.

(3) A cable is connected to the 36-point connector which carries the electrical connections to a connector on the typing reperforator.

3-7. DETAILED FUNCTIONAL DESCRIPTION OF TYPING REPERFORATOR. The following paragraphs comprise a series of detailed discussions pertaining to the functional blocks and general descriptions in the previous paragraphs. Additional assemblies such as mechanisms used to perform variable feature functions are not described in the functional block discussion. The detailed theory of operation of each of these mechanisms also is discussed. Unless stated to the contrary, references in text to "left" or "right" indicate the operator's left or right, facing the front of the unit. The selector mechanism will be 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 solid black to indicate fixed points and cross hatched to indicate floating points.

3-7.1 RECEPTION AND TRANSLATION. The mechanisms associated with reception and translation functions are discussed and their operational theory described in the following paragraphs.

a. Selecting Cam-Clutch and Trip Assembly. The components comprising this assembly are shown in Figure

3-10. When a code combination is received, the start element (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. 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 limmediately rides to the high part of the cam, where it remains to hold the start lever away from the armature while the intelligence pulses of the code are received and processed by the selector. When the stop element at the end of the code combination is received, the armature is pulled up blocking 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 latchlever drops into a detent in the cam disk, and the clutch is held disengaged until the next code combination is received.

b. Clutch Operation. Clutch operation is described in the following paragraph.

(1) Engagement. The clutch drum is attached to and rotates in unison with the main shaft, as shown in Figure 3-10. In the disengaged position, shown in Figure 3-11, the clutch shoes do not contact the drum and the shoes and cam disk are held stationary. Engagement is accomplished by moving the stop arm, shown in Figure 3-12, away from the clutch, thus releasing stop lug A and the lower end of shoe lever B. The upper end of lever B pivots around its ear C, which bears against the upper end of the secondary shoe. The ear D and the upper end of the primary shoe are moved 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. Forces involved are multiplied at each of the preceding steps. The aggregate force is applied through the shoes to lug J on the clutch cam disk, and the disk and attached cam turn in unison with the drum.

(2) Disengagement. Clutch disengagement is affected when the lower end of shoe lever B strikes the stop arm shown in Figure 3-11. Lug A and the lower end of the shoe lever are brought together as shown in Figure 3-12 and the upper end of lever B pivots around its ear C. This allows its other ear D to move toward the right. The upper spring then pulls the shoes together and away from the drum. The latchlever seats in the detent in the cam disk and the cam is held in its stop position until the clutch is again engaged.

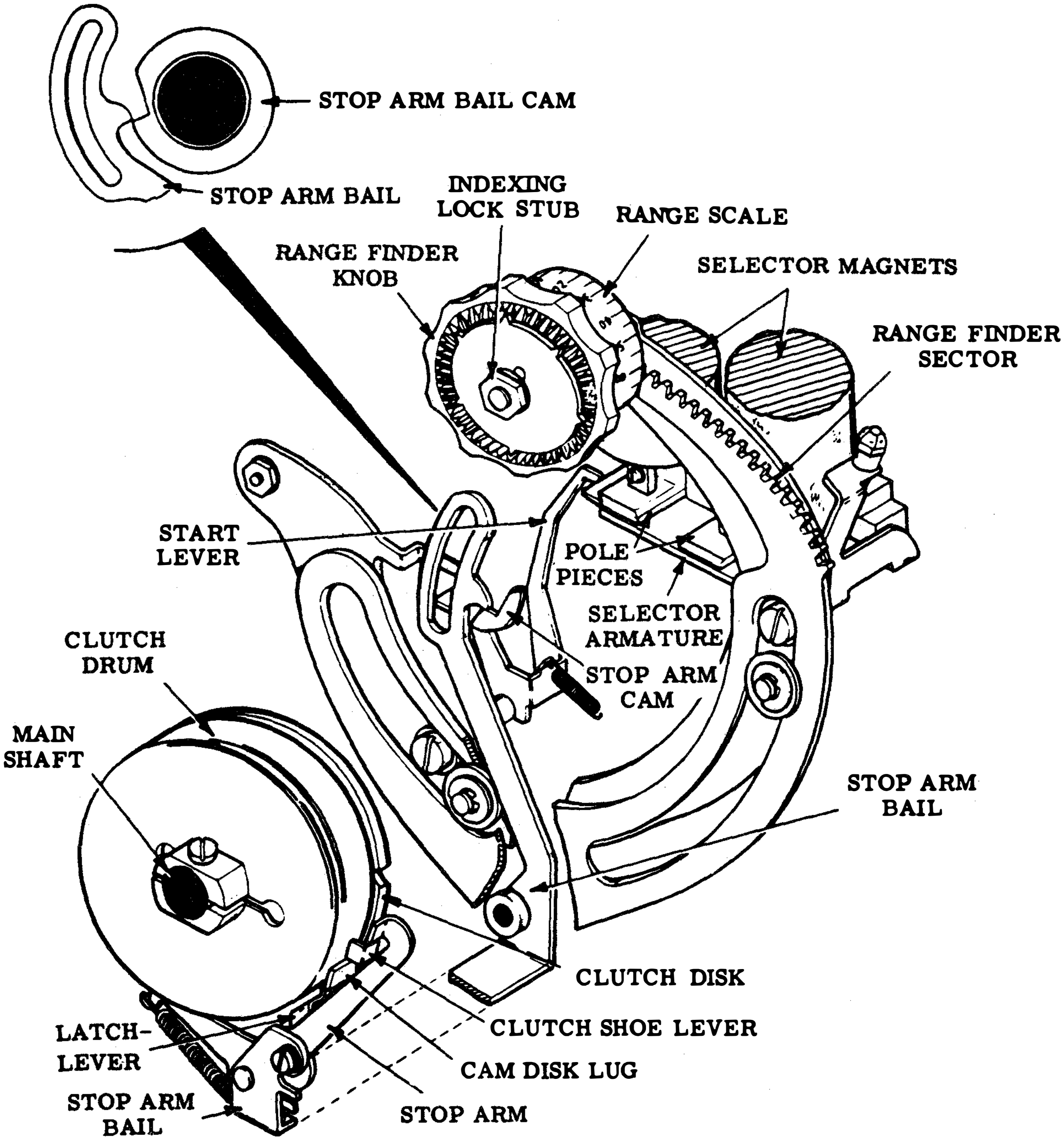


Figure 3-10. Selector Clutch and Range Finder, Right Side View

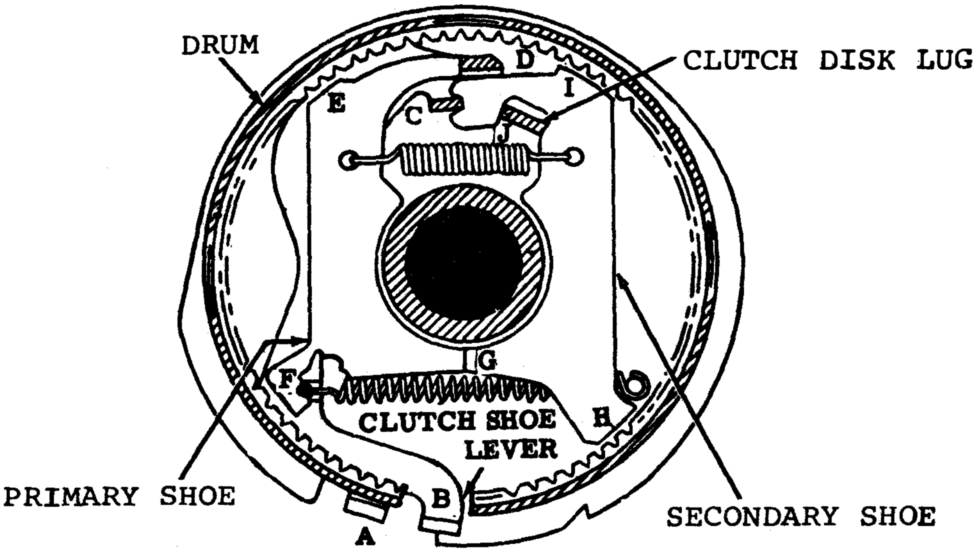


Figure 3-11. Clutch, Disengaged

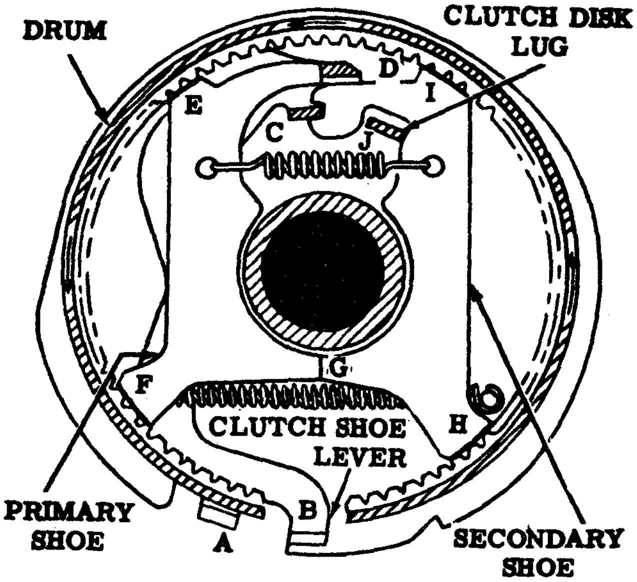


Figure 3-12. Clutch, Engaged

c. Selector Operation. The selector assembly consists primarily of two magnet coils (figure 3-10), an armature and associated bails, levers, and latches (figure 3-10). Five 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 number 4 is shown in its entirety in Figure 3-13. As the selecting elements of the code combination are applied to the magnet, the cam actuates the selecting levers. When a spacing element 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 element 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 detent 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. 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 3-13), strips the selected pushlevers from the selecting levers, and the pushlevers are turned to the right by their springs. The selected pushlevers, in moving to the left, rotate associated punch slide latches counterclockwise (figure 3-13). Just before the fifth pushlever is selected the selecting cam acting through the function trip assembly, causes the perforator reset bail to release the punch slides. The unselected latches retain their associated slides to the right, while the selected latches permit their slides to move to the left under spring tension. During the latter part of the function cycle, the reset bail returns the punch slides to their unselected position. The latches under spring tension return to their unselected position when the pushlevers are repositioned at the beginning of the next selecting cycle.

d. Orientation. For optimum performance, the selecting mechanism should be adjusted to sample the signaling code elements 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. When the range finder knob (figure 3-10) 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

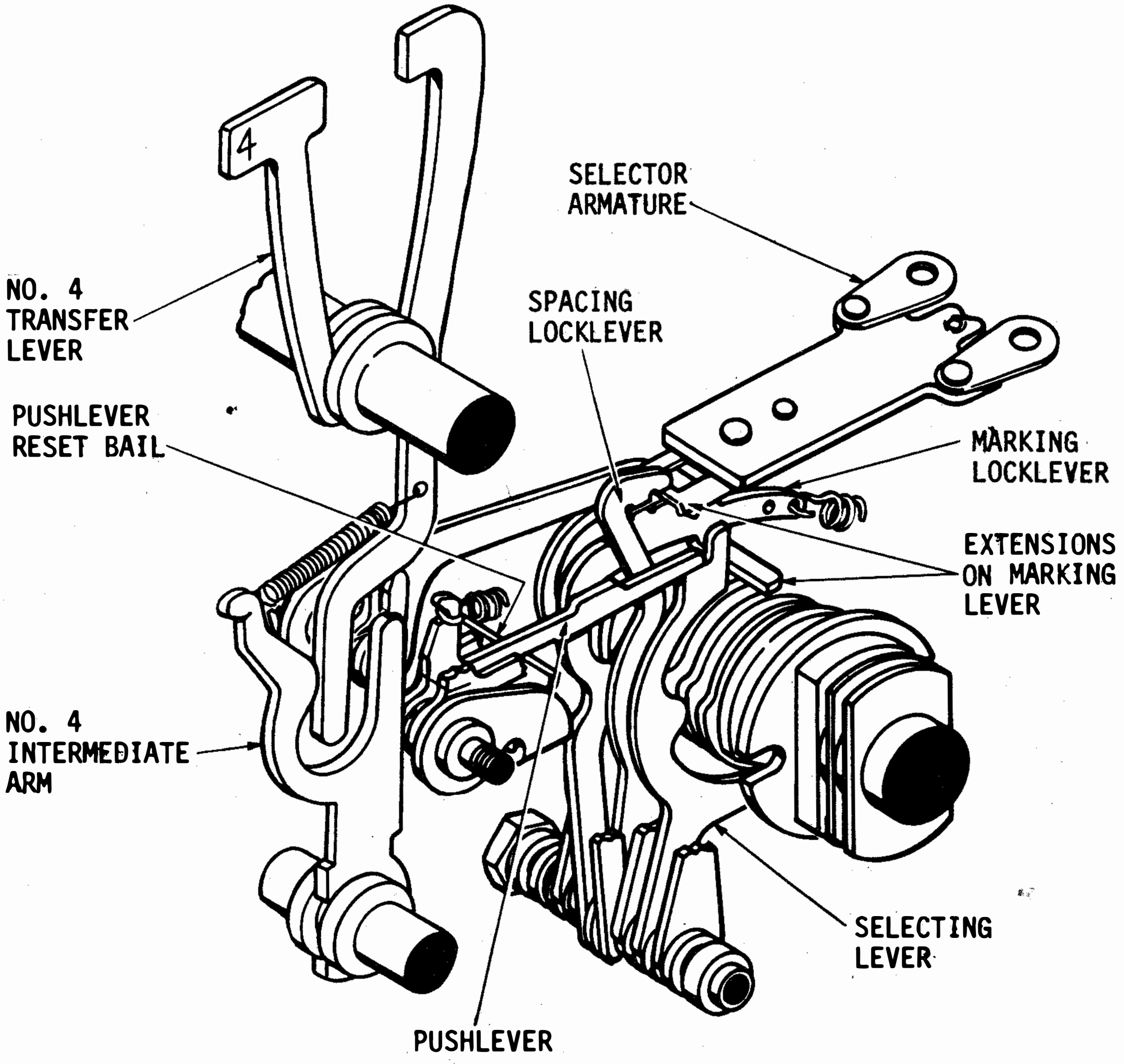


Figure 3-13. Selecting Mechanism and Transfer Mechanism, Right Front View

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.

e. Transfer. Transfer of motion near the end of each selecting cycle is accomplished by five linkages in the transfer mechanism. A linkage, shown in Figure 3-14, consists of a transfer lever, a pulse beam, and a bellcrank. Since the linkages are similar, only the number 4 linkage is shown in its entirety. The linkages associated with the unselected punch slides, described in paragraph 3-8.1c, remain in their unselected position, as shown. However, the selected slides in moving to the left, pivot the associated transfer levers which, in turn, move corresponding pulse beams clockwise (as viewed from above). The selected beams allow associated bellcranks under spring tension to pivot counterclockwise and lift attached pushbars. The pushbars, in turn, control the positioning mechanisms. In the period of the last half of the function cycle, the selected slides are moved back to the right and return the linkages to their unselected postions. Slotted upper arms of the bellcranks extend up into the function box and control its operation as described in the discussion of positioning mechanisms. An additional bellcrank, not associated with a transfer linkage, is specifically concerned with the LETTERS-FIGURES shift.

3-8. MOTION FOR TYPING AND PERFORATING. The motion of the main shaft is conveyed to the mechanisms concerned with typing and perforating by the function box mechanism, as described in the functional block diagram discussion, paragraph 3-6. Functional descriptions of the three assemblies comprising this mechanism are included in the following paragraphs.

a. Function Cam-Clutch and Clutch Trip Assembly. The trip assembly is shown in its unoperated condition in Figure 3-15. A follower lever rides on a function trip cam which is part of the selecting cam-clutch. Near the end of the selecting cycle, as the main shaft rotates counterclockwise, the high part of the cam pivots the follower lever 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, and 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 paragraph 3-7.1a. About midway through the function cycle, an eccentric pin on the function cam lifts a reset arm,

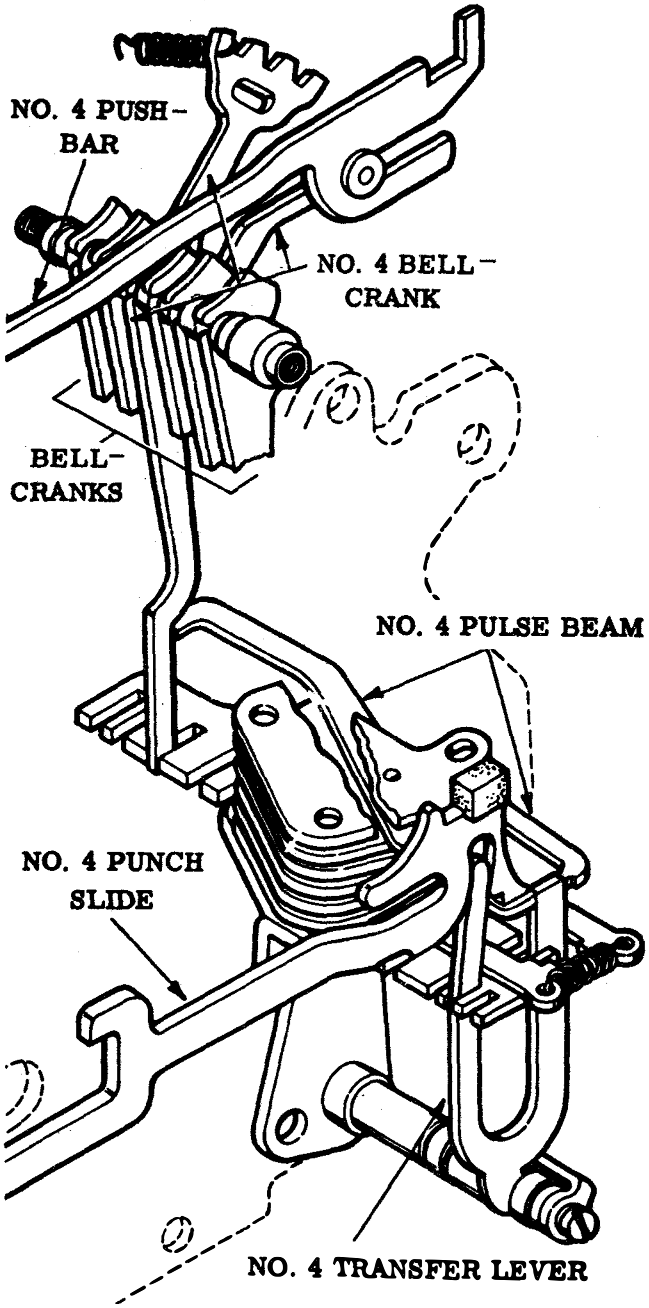


Figure 3-14. Transfer Mechanism

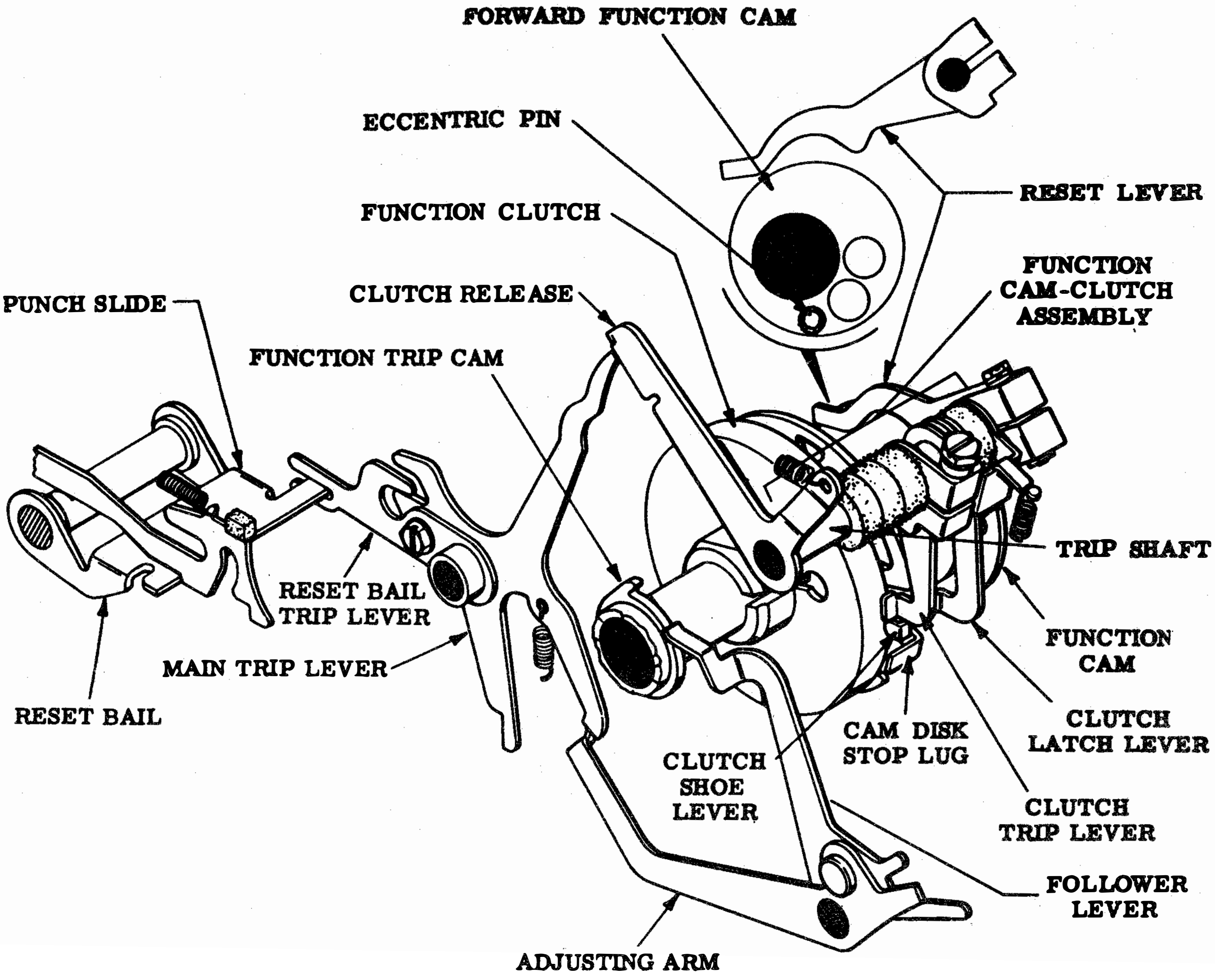


Figure 3-15. Function Cam-Clutch and Clutch Trip Assembly

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.

b. Rocker Bail Assembly. The bail is shown in its home position in Figure 3-16. During each function cycle, one function cam bears against the upper roller and causes the bail to rock to the right (as viewed from the rear in figure 3-16) during the first part of the cycle. During the latter part of the cycle the rocker bail is moved back to its home position as other function cams bear against the upper roller.

3-8.1 TYPE WHEEL POSITIONING. The operation of each mechanism used to position the type wheel is discussed in detail in the following paragraphs. The description of the type wheel as discussed in the functional block diagram description and shown in Figure 3-7 should be reviewed to obtain a more complete understanding of the positioning function before attempting to analyze these discussions.

a. General Operation. Each printing operation begins and ends with the type wheel in the home position of the section containing the character to be printed. That is, the number 0 character of the number 0 row is at the point of contact of the print hammer. Actually, inasmuch as the wheel is retracted to show the last printed character, the number 0 character is slightly to the rear, but for this discussion it will be assumed that this is the point of contact. During the printing operation the axial and rotary positioning mechanisms, transferring separate but simultaneous motions to the wheel, position it so that the character represented by the received code combination is at the point of contact of the hammer at the time of printing. The rotary mechanism, which is controlled by the number 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 number 1 and 2 elements, moves it forward and rearward along its axis so as to select the proper character in the row. The LETTERS-FIGURES shift, which consists of rotating the wheel eight rows from the home position of one section to that of the other, requires a separate operation of the equipment and results in the printing of the LETTERS or FIGURES symbol. To illustrate the above, if the wheel is in the "LETTERS" position, as shown in Figure 3-17, and the numeral "5" is to be printed, there is no movement of the wheel during the printing operation, because "5" is already at the point of contact of the hammer. However, if the letter "I" is to be printed, the signaling code for LETTERS must first be viewed to shift the type wheel 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 "I" is at the point of contact of the hammer. Printing takes place, and the wheel is then returned to the LETTERS home position.

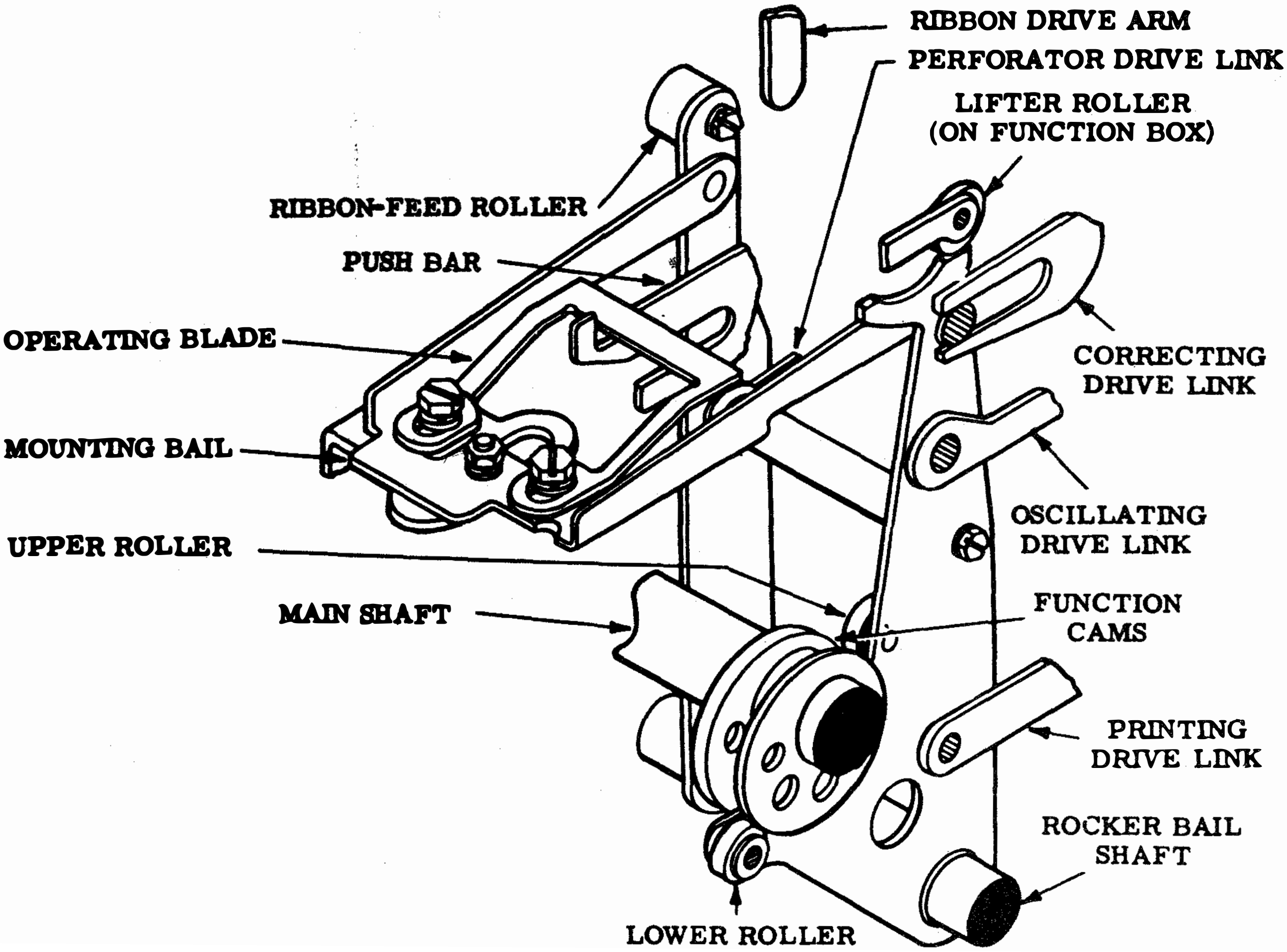


Figure 3-16. Rocker Bail Assembly, Rear View

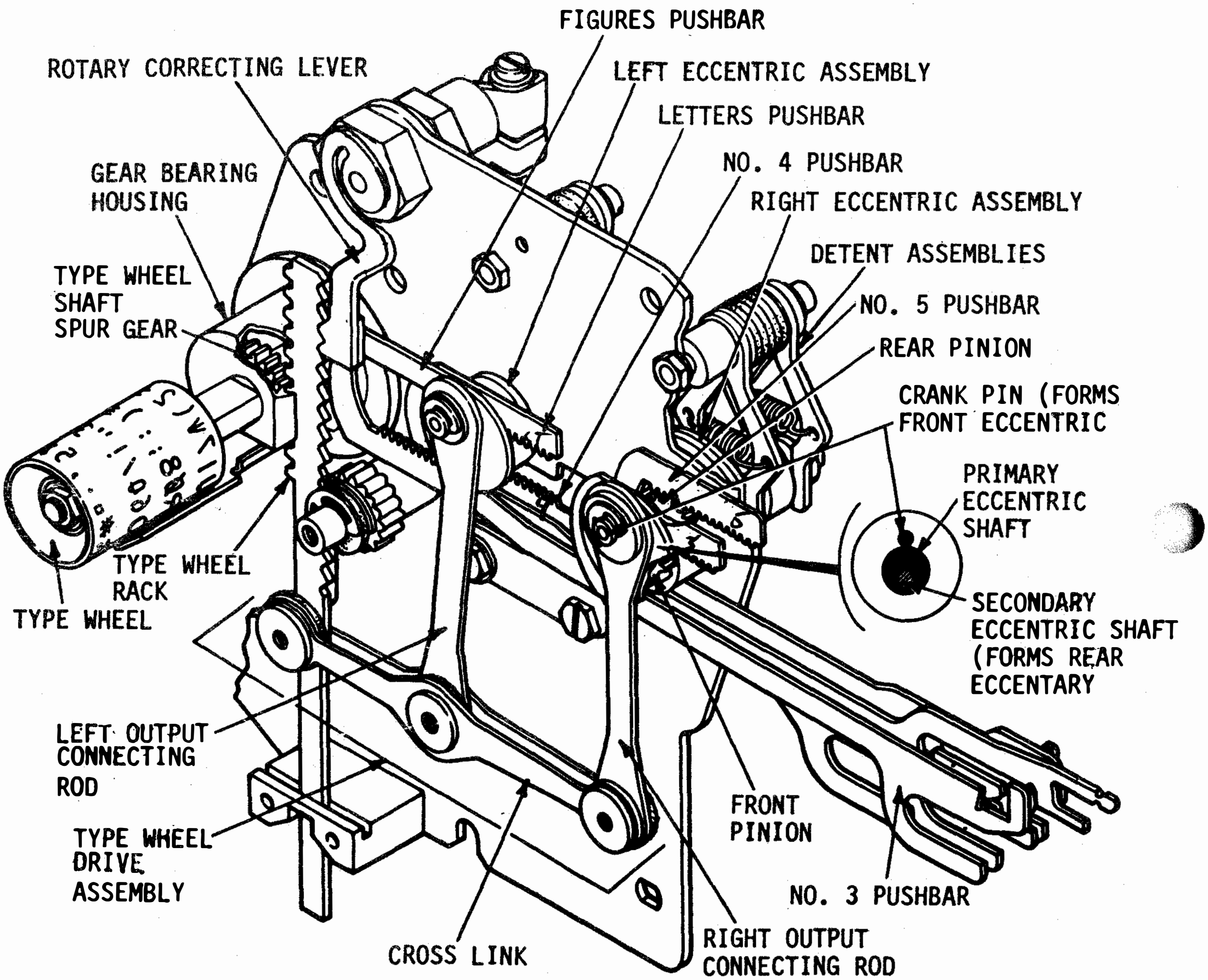


Figure 3-17. Rotary Positioning Mechanism

b. Rotary Positioning. This mechanism, mounted on the front plate of the typing reperforator, includes two eccentric assemblies shown in Figure 3-17. Each assembly contains 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 eccentric, referred to as the rear eccentric. A portion of the secondary shaft is also a pinion, and a crank pin mounted on its disk-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 number 3 bar engages the rear pinion, and the number 5 engages the right pinion. The left front pinion is engaged by both the LETTERS and the FIGURES pushbar. The eccentric assemblies are linked to the type wheel shaft by a drive assembly as shown in Figure 3-17. 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. 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 has flats in its circumference which bear against flats in the gear to ensure that it rotates when the gear rotates. When a pushbar is lifted by its bellcrank, in response to a marking pulse as described in paragraph 3-7.1e, the rocker bail operating blade, Figure 3-18, engages a slot in the bar and moves it to the left during the first part of the function cycle. The bar, by means of its rack and the mating pinion, rotates the associated eccentric one-half revolution where it is locked in position by a detent assembly while printing takes place. When the bail rocks back to the right during the latter part of the cycle, it returns the bar and eccentric to their home position where the eccentric is again detented. The preceding does not apply to the number 5 pushbar which is designed so that it is selected (moved to the left) on spacing rather than on marking, nor to the left-front eccentric which affects the LETTERS-FIGURES shift. 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). In the right assembly the home position of the rear eccentric is down and the home position of front eccentric is up (figure 3-17). 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

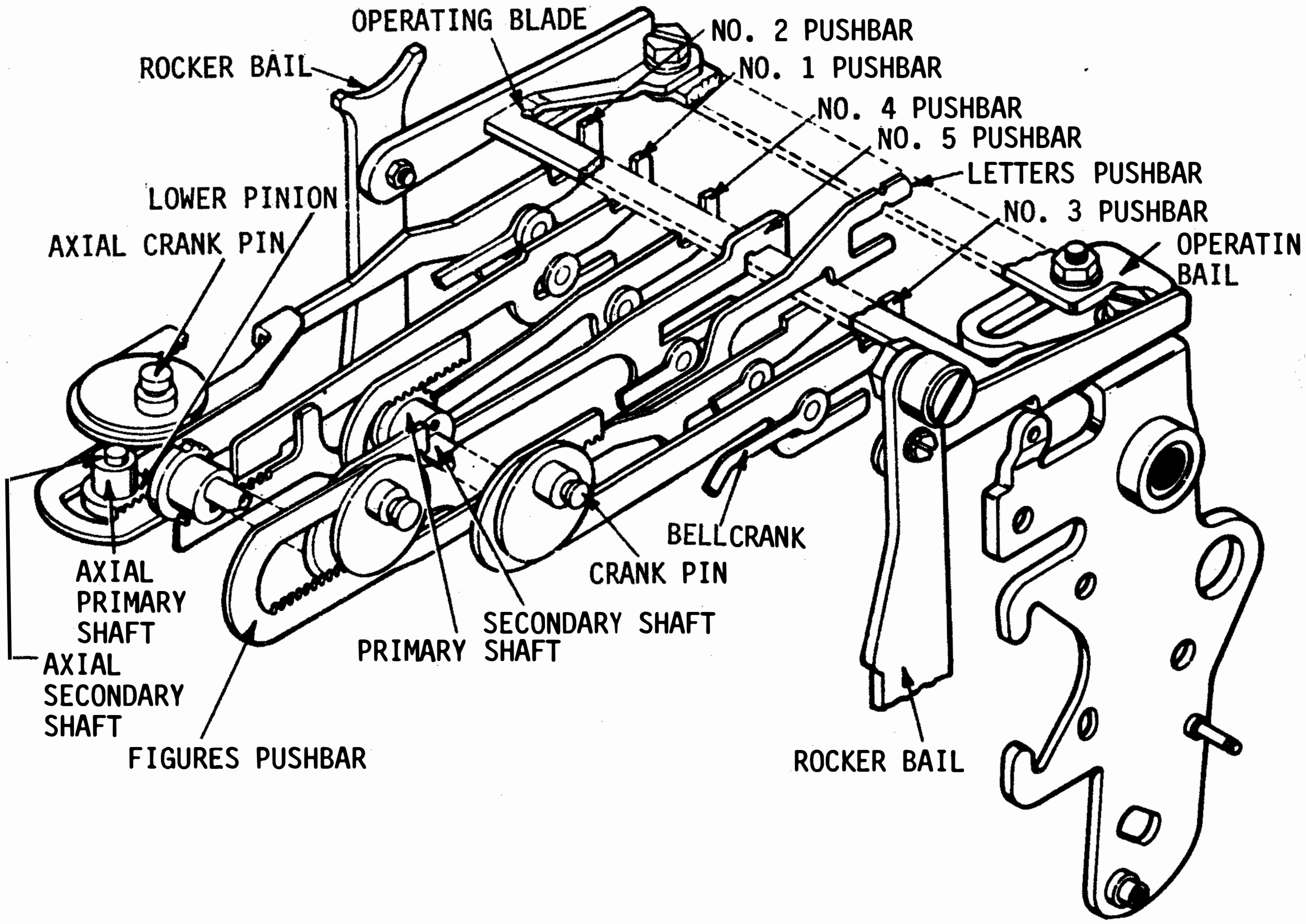


Figure 3-18. Pushbars and Eccentric Assemblies

occurring in the right assembly is imparted to the type wheel rack in equal quantity but opposite direction. For example, if the number 5 pushbar is selected, it causes the right-rear eccentric to be displaced, and one unit of upward motion is transferred through a right output connecting rod to the right end of a cross link (figure 3-17). 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 number 1 clockwise row (figure 3-17) is presented to the print hammer at the time of printing. On its right stroke the number 5 pushbar returns the eccentric and the type wheel to their home positions. In a similar manner, selection of the number 3 pushbar results in a four-unit downward displacement of the right front eccentric and a four-row, counterclockwise rotation of the type wheel. Selection of both the three and five type bars results in a three-row, counterclockwise rotation of the type wheel. 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 number 5 pushbar is selected, the left-rear eccentric is displaced one unit downward. This movement is conveyed through the left output connecting rod to the approximate mid-point 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. When both eccentric assemblies are displaced, the motion occurring in the type wheel rack is equal to the algebraic sum of the motions resulting from each assembly. For example, if the numbers 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 number 3, 4 nor number 5 pushbar is selected, the mechanism remains inactive and printing takes place in the number 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 3-7).

c. Axial Positioning. This mechanism mounts on an axial bracket supported by the frame and the front plate, as shown in Figure 3-19, in a manner similar to the rotary positioning mechanism. Two eccentrics, a lower whose pinion is driven by the number 1 pushbar, and an upper whose pinion is driven by the number 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 3-19. The selection of either the number 1 or number 2 pushbars results in the maximum displacement toward the rear of the associated eccentric, and the eccentrics

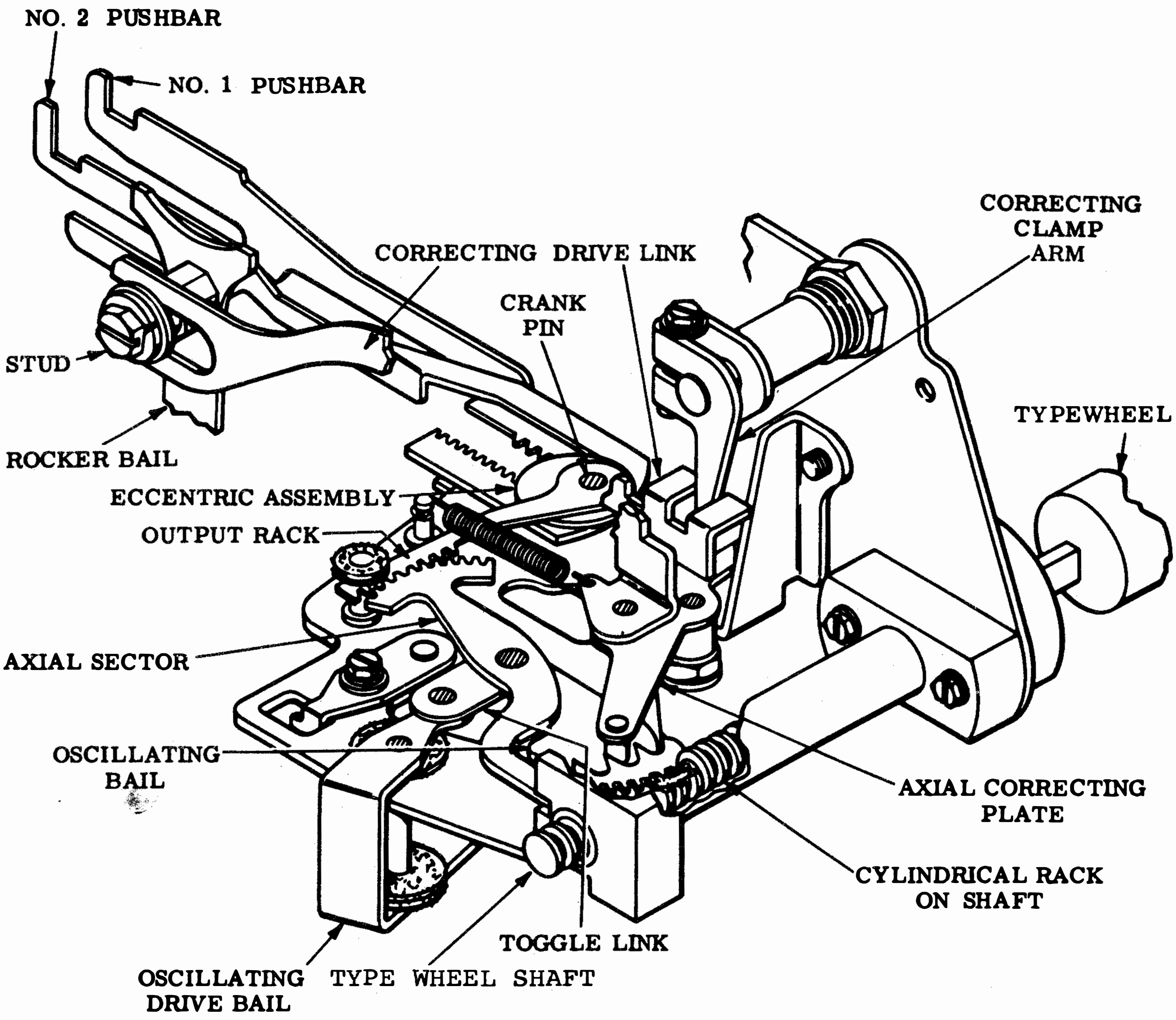


Figure 3-19. Axial Positioning Mechanism, Rear View

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). 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, and the number 0 character of the selected row is aligned with the hammer at the time of printing (figure 3-7). On the other hand, if the number 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 number 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 number 2 pushbar is selected the number 2 character is printed, and if both pushbars are selected, the number 3 character is printed. The cylindrical rack has no lead, and the shaft can thus be rotated while being moved axially. 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 3-19 and 3-20. 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 fore part of the function cycle, if no axial pushbar is selected, the right end of the sector is moved forward slightly and positions the number 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 to retract the ribbon guide which would obstruct the view of the character (figure 3-20).

d. <u>Correction</u>. During each function cycle the rocker bail transfers motion through a correction drive link to a correcting clamp and shaft, as shown in Figure 3-19. The shaft pivots a rotary correcting lever (see figure 3-17) 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 correction plate counterclockwise (as viewed from the above), and a roller mounted on the plate engages a notch in the axial sector (figure 3-19). Thus the type wheel is accurately aligned in both fields of motion just before printing takes place. During the latter part of the

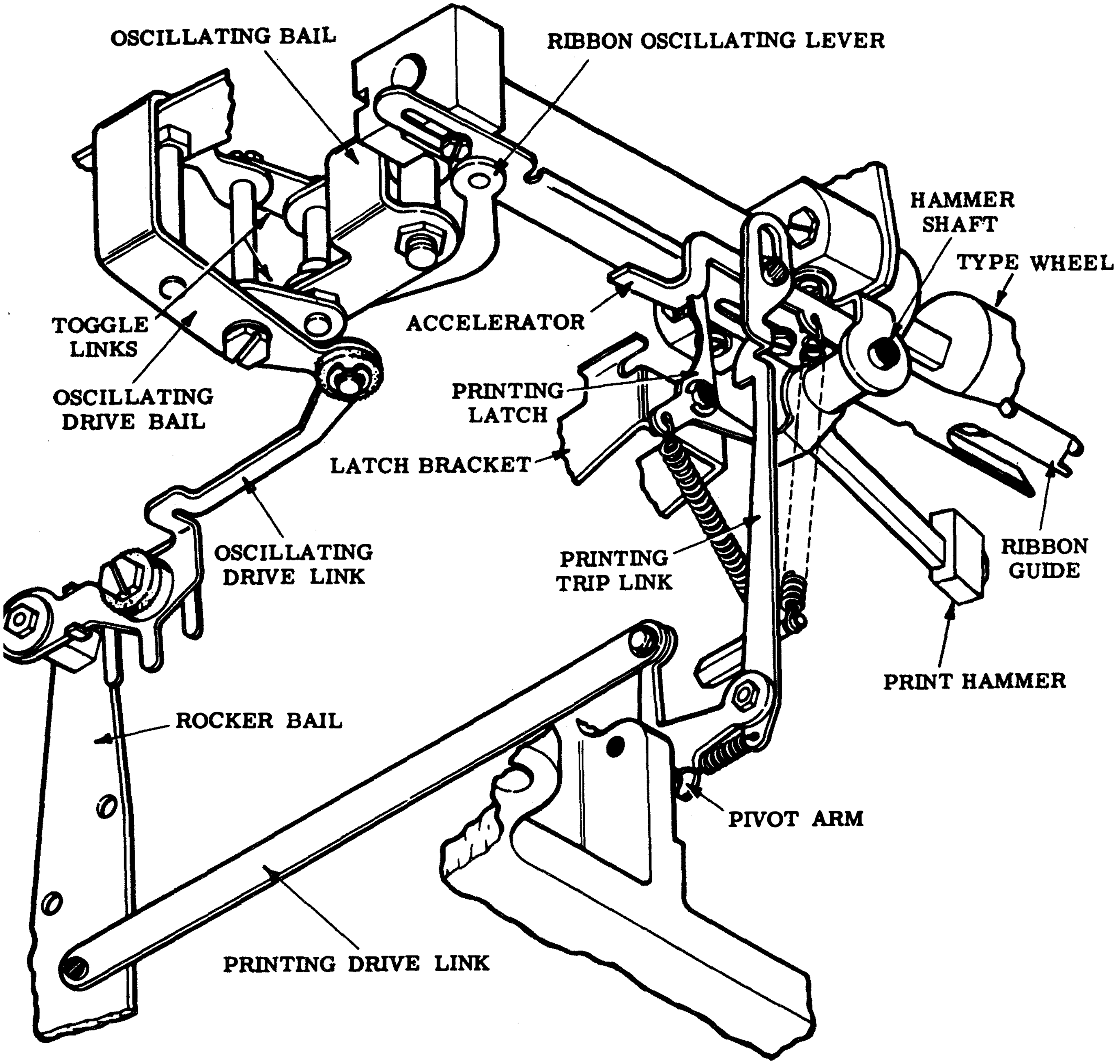


Figure 3-20. Printing Mechanism

function cycle, a correction drive link spring returns the correction mechanism to its home position. Since the rocker bail is the source of motion for both the pushbars and the positioning mechanism, correction must take place at a point near enough to the extreme travel of the bail so 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. LETTERS-FIGURES Shift. The purpose of the LETTERS-FIGURES shift is to rotate the type wheel from the home position of one section to that of the other (figure 3-7). It is effected by means of the function box mechanism which is made up of a number of assemblies mounted on two plates located at the upper rear of the typing reperforator, Figure 3-21. When the unit is in the LETTERS condition, as shown in Figures 3-7 and 3-21, and the FIGURES code combination (12-45) is received, the transfer mechanism sets up the FIGURES arrangement in the bellcranks during the selecting cycle. Then, as the rocker bail moves from its home position during the first part of the function cycle, a lifter roller under spring pressure follows a camming surface on the rear arm of the bail (figure 3-21), and the lifter allows LETTERS and FIGURES function blades to move down and, by means of tines on their lower surface, feel for an opening in the slotted upper arms of the bellcranks. The slot arrangement of the numbers 1, 2, 4 and 5 bellcranks are identical and permit the entry of both function blades when all are selected. However, on receipt of the FIGURES code combination the number 3 bellcrank permits entry of the FIGURES blade while blocking the LETTERS blade. In moving all the way down, the FIGURES blade encounters a projection of a FIGURES arm assembly and causes the arm assemblies to shift from their LETTERS to FIGURES position. A yield arm extension attached to the FIGURES arm assembly pivots a FIGURES extention arm away from the LETTERS-FIGURES bellcrank. A LETTERS extension arm under spring tension rotates the bellcrank clockwise (figure 3-21) and the bellcrank lifts the LETTERS and FIGURES pushbars. As the bail reaches its extreme position, the lifter is cammed up and raises the function blades. While the LETTERS-FIGURES bellcrank is being positioned by the function box, the numbers 1, 2 and 4 push- bars are selected, the type wheel is moved two rows clockwise and three characters forward, and the FIGURES symbol is printed. On its return stroke, the rocker bail operating blade encounters a shoulder on the FIGURES pushbar (which was lifted as described above) and moves the bar to the right as viewed from the front in Figures 3-18 and 3-21. The common pinion moves the LETTERS pushbar to the left, and the left-front eccentric shifts from its up to down position. Since the type wheel has been displaced two rows clockwise during the first part of the

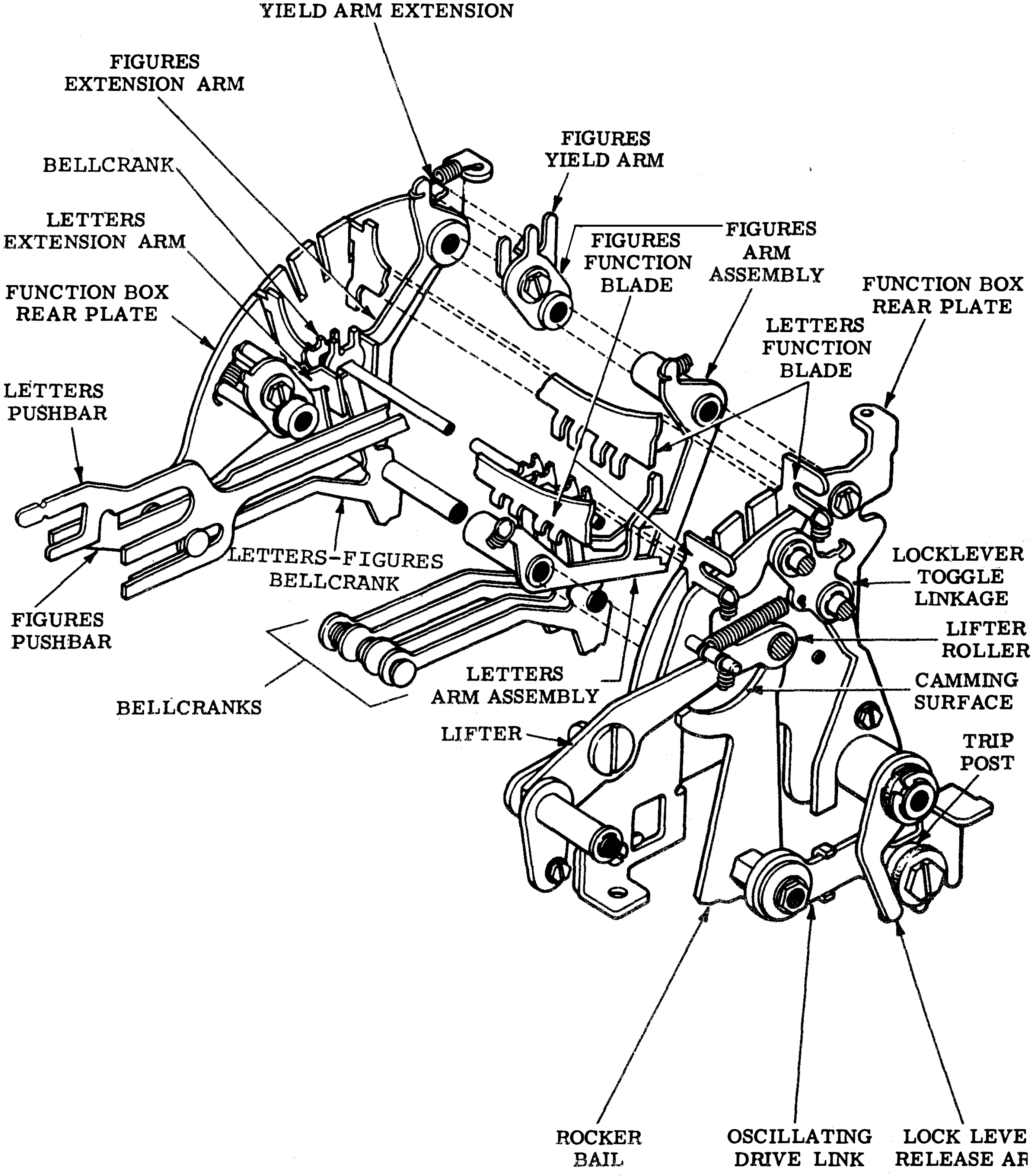


Figure 3-21. Function Box, Rear View

cycle, it is rotated six more rows to the FIGURES home position. As the bail returns to its home position during the last half of the cycle, a locklever toggle linkage (figure 3-21) prevents the lifter roller from following its camming surface, and the lifter holds the function blades up so they do not drop onto the bellcranks. As the bail nears its home position, a trip post riding on the oscillating drive link strikes a lock release arm, buckling the toggle linkage and permitting the lifter roller to again fall on the bail camming surface. In a manner similar to that described above, when the LETTERS code combination (12345) is received, the function box causes the LETTERS-FIGURES bellcrank to lower the LETTERS and FIGURES pushbars. The wheel is rotated two rows counterclockwise during the first part of the cycle and six more rows to the LETTERS home position during the last part of the cycle, and the LETTERS bar is moved to the right. The preliminary two-row rotation of the type wheel, which is made possible by selecting the number 5 pushbar on spacing rather than marking, provides less throw and smoother operation than would be possible if the complete eight-row displacement were affected during the latter part of the cycle. During each operation the lifter permits the function blades to move down and feel for an opening, but except for the shift operations they are blocked by slotted arms of the bellcranks.

3-8.2 PRINTING. The printing mechanism affects the printing of the character on the tape by means of a print hammer which is actuated by the rocker bail assembly. Operation of these assemblies is described in the following paragraphs.

a. Print Hammer. The print hammer is mounted on a shaft supported by a bracket attached to the type wheel bearing housing. In its unoperated condition, as illustrated in Figure 3-20, the hammer is held against an accelerator by a relatively weak spring. The accelerator is mounted on the hammer shaft, and in its upper position the hammer is retained by a printing latch against the tension of a relatively strong spring.

b. Rocker Bail Assembly. The rocker bail, during the initial part of the function cycle, moves a printing drive link to the right (as viewed from the rear in figure 3-20), causing a pivot arm to rotate clockwise. The arm lowers a trip link which slides in an elongated slot. Near the end of the rocker bail's travel, the trip link pivots the latch which releases the accelerator. Under the spring tension, the accelerator snaps down and impels the hammer upward. The face of the hammer drives the tape and inked ribbon up against the type wheel and imprints the selected character on the tape. The accelerator does not follow the hammer through the complete printing stroke. 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.

3-8.3 RIBBON-FEEDING. 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. The ribbon is advanced in this manner during each operation until the ribbon-feed mechanism is reversed. The ribbon-feed mechanism is shown in Figure 3-8. 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.

3-8.4 PERFORATING. Either of two types of tape perforation may be performed, depending on whether fully perforated or chadless (hinged chad) type tape is to be used. Operation of both type mechanisms are described in the following paragraphs.

a. Perforating-Chadless Units. As described in paragraph 3-8a, the reset bail is lowered near the end of the selecting cycle and releases the five punch slides shown in Figure 3-22. The selected slides move to the left and the unselected slides are held to the right side by their latches. In the selected position, a projection of each slide extends over the slide post. 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 pivot about the same point as the drag links, and thus become an integral part of the main bail assembly during the perforating stroke. A retractor bail, which engages notches in the punch pins, is pivoted clockwise as the pins move up through the tape. Approximately midway through the function cycle, the function trip assembly lifts the reset bail. During the last half of the cycle, the toggle bail is rotated clockwise and lowers the punch slides. The reset bail, moved to the right by the toggle links, drives the slides back to their unselected positions, where it holds them until the next operation. The retractor bail, under spring pressure, holds the punch pins down against the slides until the pins are retracted below the tape. The notches in the pins are long enough to allow the retractor bail to pivot its full amount without lifting the unselected pins against the tape, but are short enough to permit the bail to serve as a downstop for the pins, and thus hold them in the block. A compression spring is mounted on the number 3 punch pin, and four

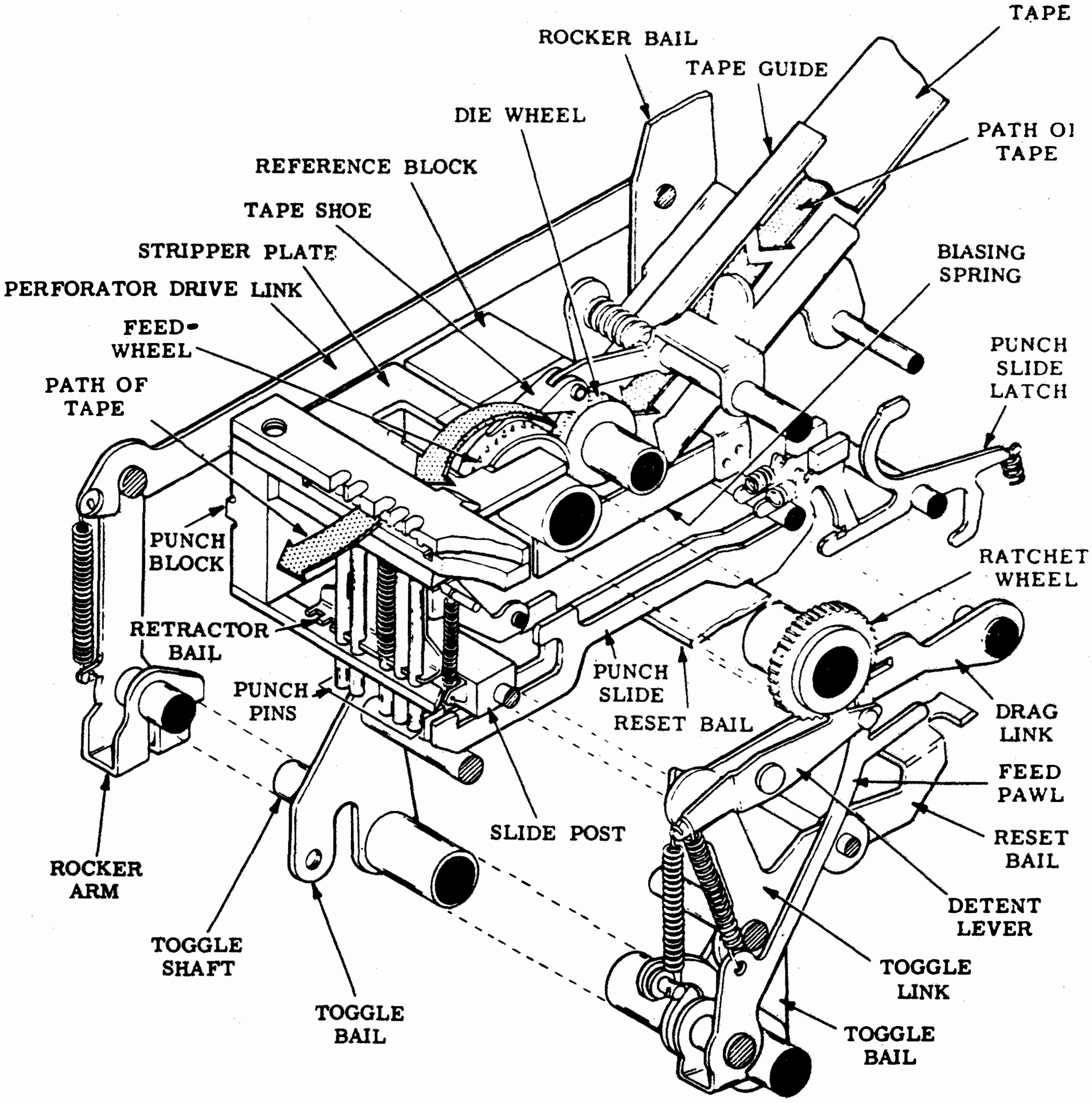


Figure 3-22. Perforating Mechanism - Chadless Tape Unit

tension springs are hooked to the slide post and the retractor bail. The main bail assembly, the retractor bail, and the selected slides and punch pins move as a unit during the perforating stroke, and the retractor bail tension springs are not part of the load on the toggle shaft. The openings in the block above the tape, through which the selected pins protrude, are semicircular, so that only the rear portion of the hole is severed.

b. Perforating-Fully Perforated Units. As previously stated, the reset bail is lowered near the end of the selecting cycle, releasing the five punch slides shown in Figure 3-23. 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 pivot about the same point as the drag links, and 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, as shown in Figure 3-23. 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. The opening in the die block above the tape, through which the pins protrude, are circular so that the entire hole is punched. A chad chute, mounted on the reperforator punch block, mates with a chute on the base, and carries the chad punched from the tape into a chad container.

3-8.5 FEEDING - FULLY PERFORATED AND CHADLESS UNITS. 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 (figures 3-22 and 3-23). A feed pawl driven by the toggle bail acts upon a ratchet and rotates the feed wheel which, by means of 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 of the ratchet is high during the first half of the cycle (to hold the tape in position during 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 guide spring holds it back

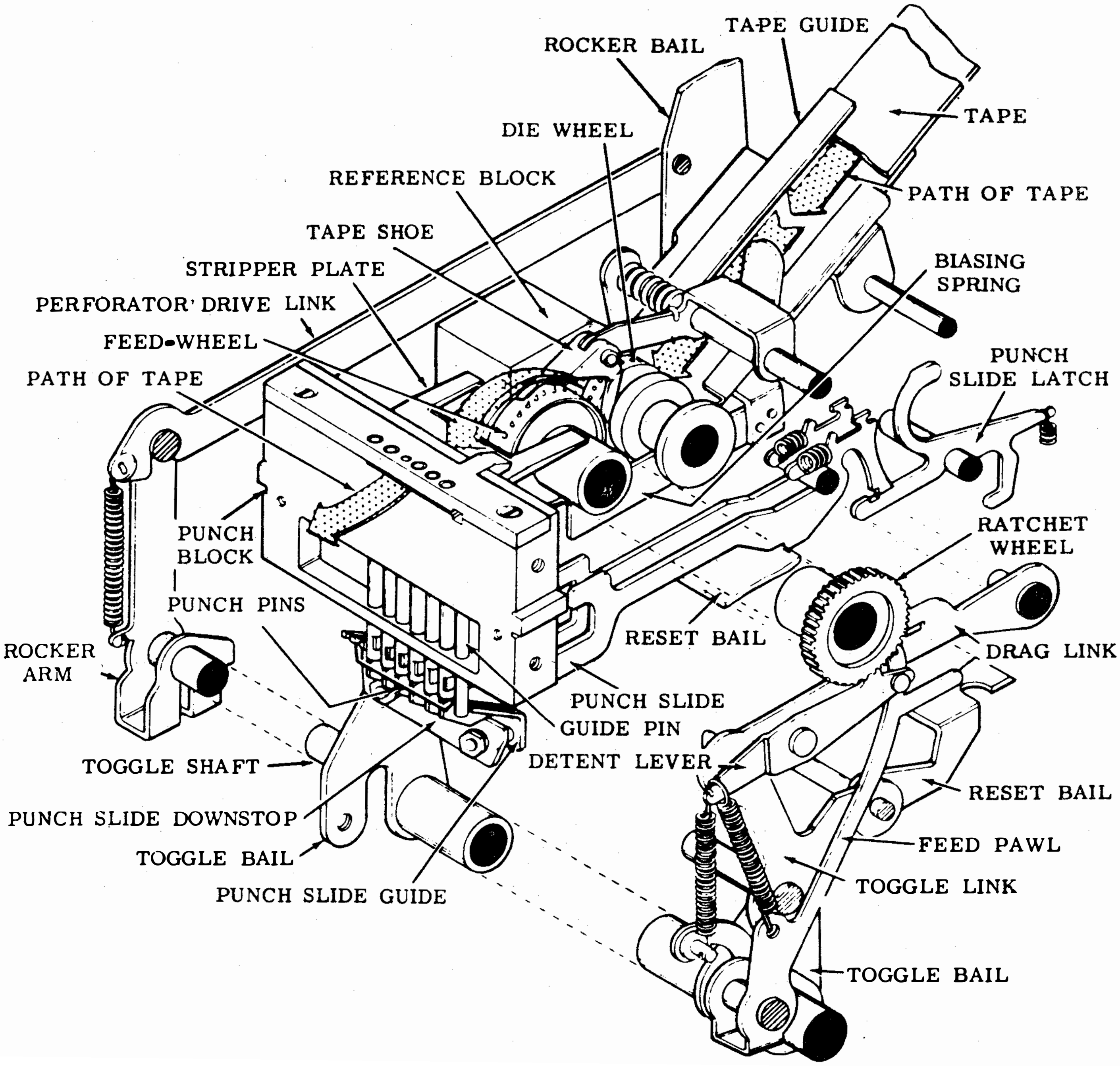


Figure 3-23. Perforating Mechanism - Fully Perforated Unit

against a reference block so that the feed holes are punched a uniform distance from the edge. The tape is stripped from the feed wheel by a stripper plate, passes into the punch block where it is printed and perforated, and finally emerges at the left. A guide spring, by holding the tape back against a reference surface on the block, maintains a uniform relationship between the code perforations and the edge of the tape.

3-9. DETAILED FUNCTIONAL DESCRIPTION, VARIABLE FEATURES. A number of variable features may be installed as part of the typing reperforator set. The following paragraphs describe in detail the theory of operation of these units.

3-9.1 CONTACT ASSEMBLIES. Contact assemblies which may be installed as part of the typing reperforator include the Selector Mechanism Timing Contacts, LETTERS-FIGURES Contacts, Signal Bell Contacts, End of Feed-Out Timing Contacts, and Timing Contacts. The operation of each of these mechanisms is described in the following paragraphs.

a. Selector Mechanism Timing Contacts. Operating in conjunction with an additional cam mounted on the selector cam assembly, shown in Figure 3-24, 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 postion.

b. LETTERS-FIGURES Contacts. 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 operation lever is not in contact with the center contact spring and the center and upper contact points are made. 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. 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. The contacts are shown in Figure 3-25. With the unit in the FIGURES condition and the SIGNAL BELL code combination (1-3--) received at the selector mechanism, the number 1 and 3 bellcranks rotate in response to the marking pulses, and the number 5 bellcrank rotates in response to a spacing pulse. In this position, 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, drop with the blade and

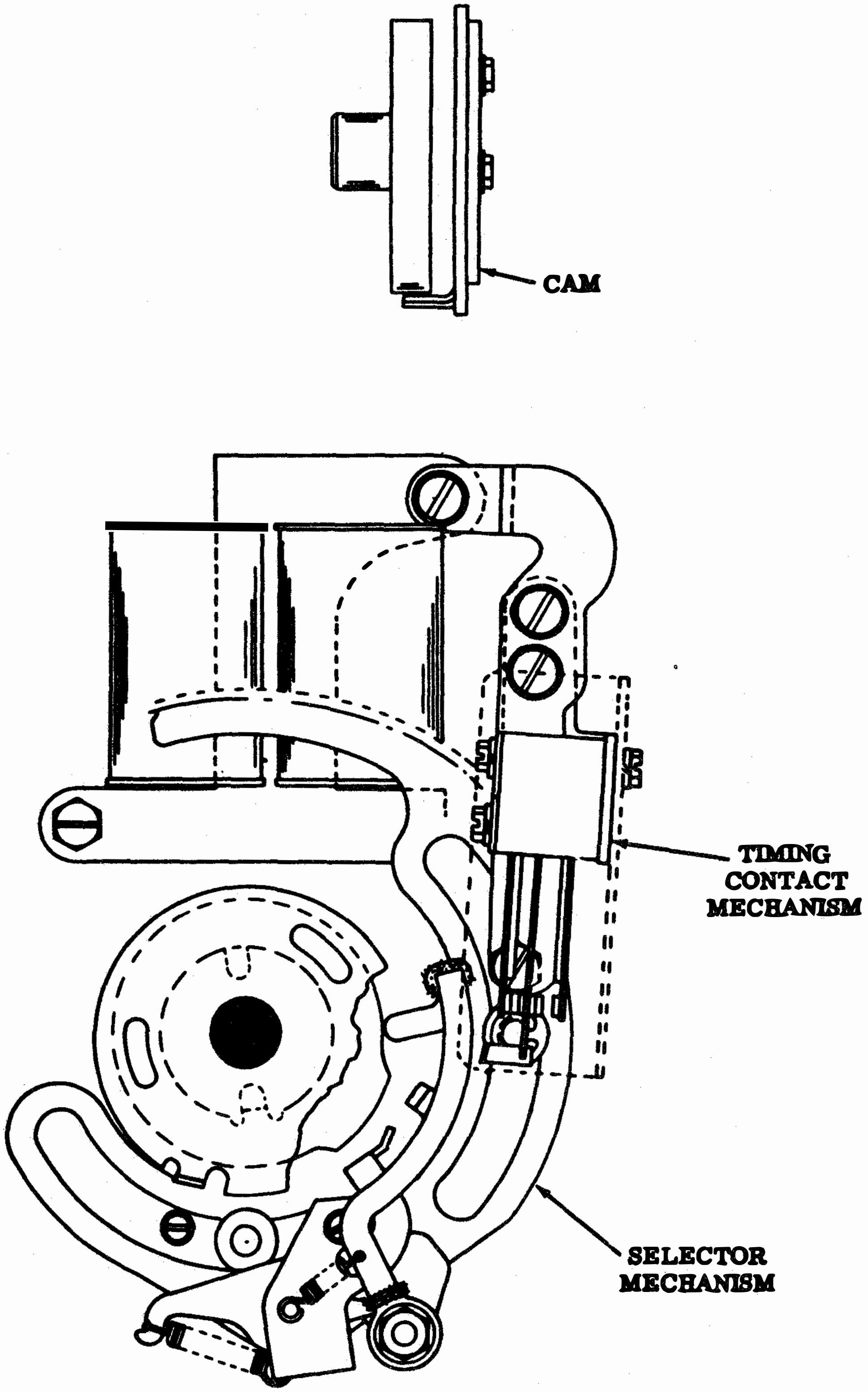


Figure 3-24. Selector Magnet Timing Contacts

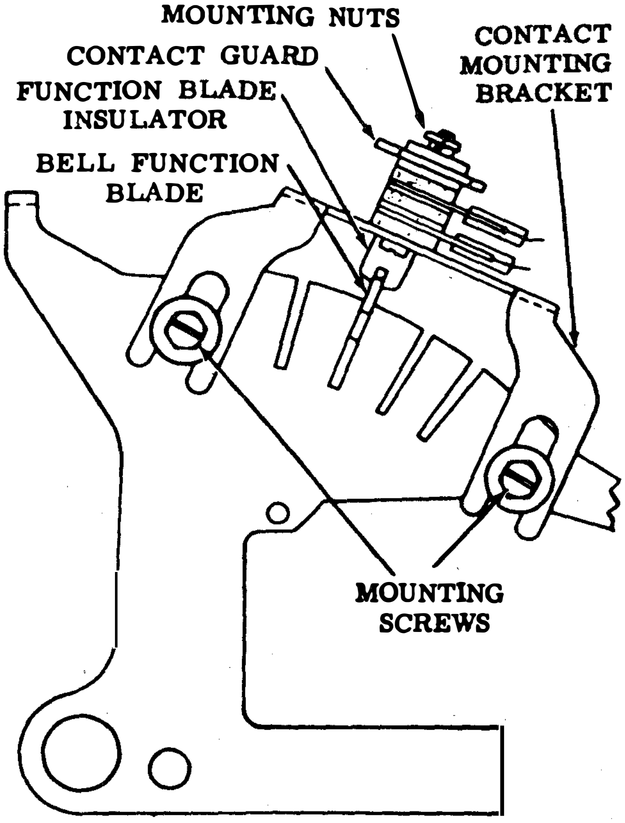


Figure 3-25. Signal Bell Contacts

the contacts close. In the LETTERS condition, the FIGURES bellcrank blocks the signal bell function blade.

d. <u>End of Feed-Out Timing Contacts</u>. This contact assembly, used in conjunction with the non-interfering LETTERS (or BLANK) tape feed-out mechanism, 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. 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. Refer to the discussion of the remote control tape feed-out for additional theory concerning this function.

e. <u>Timing Contacts</u>. When connected to external circuits, these contacts provide electrical pulses which may be synchronized with the code-reading contacts for circuit control purposes. Either single or double-contact mechanisms are available. The contacts, which are of the transfer type, are actuated by bails which receive motion from the typing reperforator function cam.

3-9.2 UNIVERSAL FUNCTION BLADE. 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. The universal function blade is shown in Figure 3-26.

3-9.3 PRINT SUPPRESSION-ON-FUNCTION. This feature utilizes a print hammer stop that permits the hammer to strike the top of the characters on the type wheel

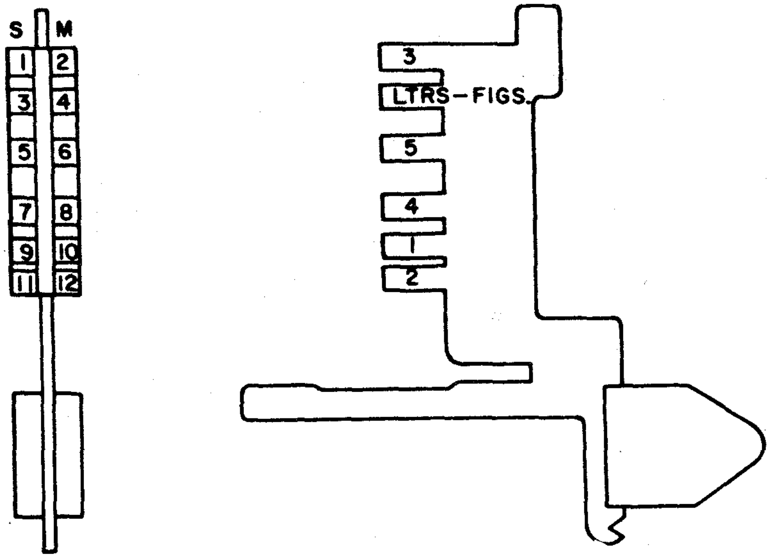


Figure 3-26. Universal Function Blade

but not the base surface. Therefore, if a character or function symbol is relocated in the base surface, printing will not occur when this character or function is selected.

3-9.4 INTERFERING LETTERS TAPE FEED-OUT. The theory of operation of this function is described in the following paragraphs.

a. General. This feature enables the typing reperforator to step out tape containing successive LETTERS 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. LETTERS 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 can not be received during the feed-out period. The mechanism is shown operated in Figure 3-27.

b. Initiation. When the typing reperforator is in the idling condition, the selector magnet is energized and the start lever is blocked as shown in Figure 3-27. Feed-out is initiated by moving a hand lever to the left (figure 3-27). 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, it is equivalent to all intelligence elements of the signaling code being marking. As a result, the

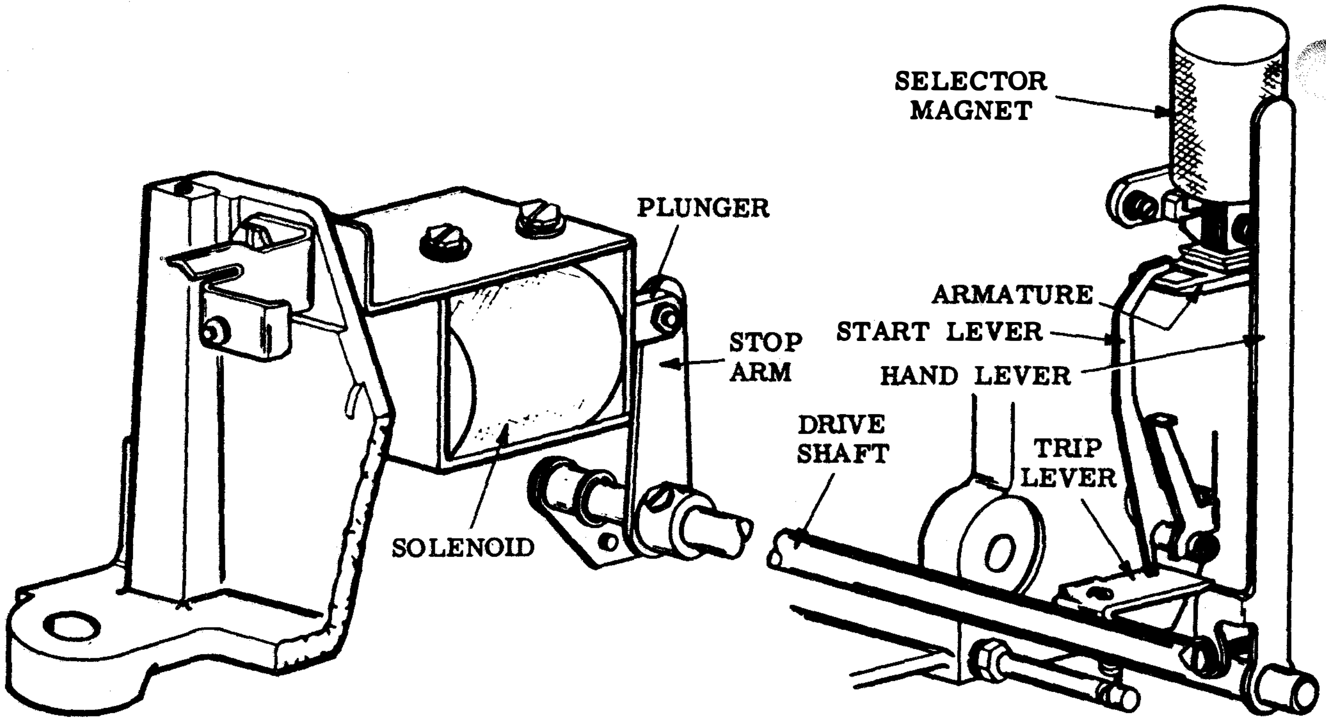


Figure 3-27. Manual Interfering LETTERS Tape Feed-Out Mechanism

LETTERS symbol is printed, the LETTERS code combination (12345) 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. 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, 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. By the use of an additional set of parts, the LETTERS feed-out operation can be initiated by an electrical pulse from an external source. When the solenoid (figure 3-27) 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 affected as described in the description of the initiation operation. 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 the discussion of the termination operation.

3-9.5 REMOTE CONTROL NON-INTERFERING BLANK TAPE FEED-OUT. The following paragraphs describe this operation.

a. General. A predetermined length of blank (unperforated) tape may be stepped out 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 non-repeat latch prevents successive tape feed-out operations 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. Feed-out initiation is described in the following paragraph.

b. Initiation. 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 detent of its cam and the connecting link positions the release lever on the lower step of the latchlever. The non-repeat 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 non-repeat latch prevents the drive bail from again falling into the detent of its cam.) As the drive bail reaches the detent of its cam, the blocking latch rides over the non-repeat latch. The drive bail then reaches the high part of its cam and the non-repeat 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 non-repeat latch.

c. Metering. When the drive bail positions the release levers on the lower step of the latchlever as described above, metering takes place. The release lever has now permitted the check pawl and feed 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. A bail that follows a cam attached to the main shaft engages the function clutch trip lever. When the cam follower enters the detent 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 ensure 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 the previous paragraph, 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. 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. <u>Storage</u>. The purpose of the storage mechanism 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.

3-9.6 REMOTE CONTROL NON-INTERFERING LETTERS TAPE FEED-OUT. The operation of this mechanism is essentially the same as that of the remote-control non-interfering blank tape feed-out mechanism. This feature, however, does not contain a blocking link on the stripper cam follower shaft. Therefore, the tape output is perforated in the LETTERS code combination (12345). This mechanism is shown in Figure 3-28.

3-9.7 BACKSPACE MECHANISMS. These mechanisms are described in the following paragraphs.

a. <u>General</u>. 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 LETTERS code combination in its place. The backspace mechanism may be operated manually or it may include power drive. The mechanism used with chadless tape differs from that used with fully perforated tape in that it contains a tape rake for depressing the chad. The mechanisms are shown in Figure 3-29.

b. <u>Manual Backspace (Fully Perforated Tape)</u>. 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.

c. <u>Manual Backspace (Chadless Tape)</u>. Depressing the handle of the backspacing bell-crank disengages the perforator

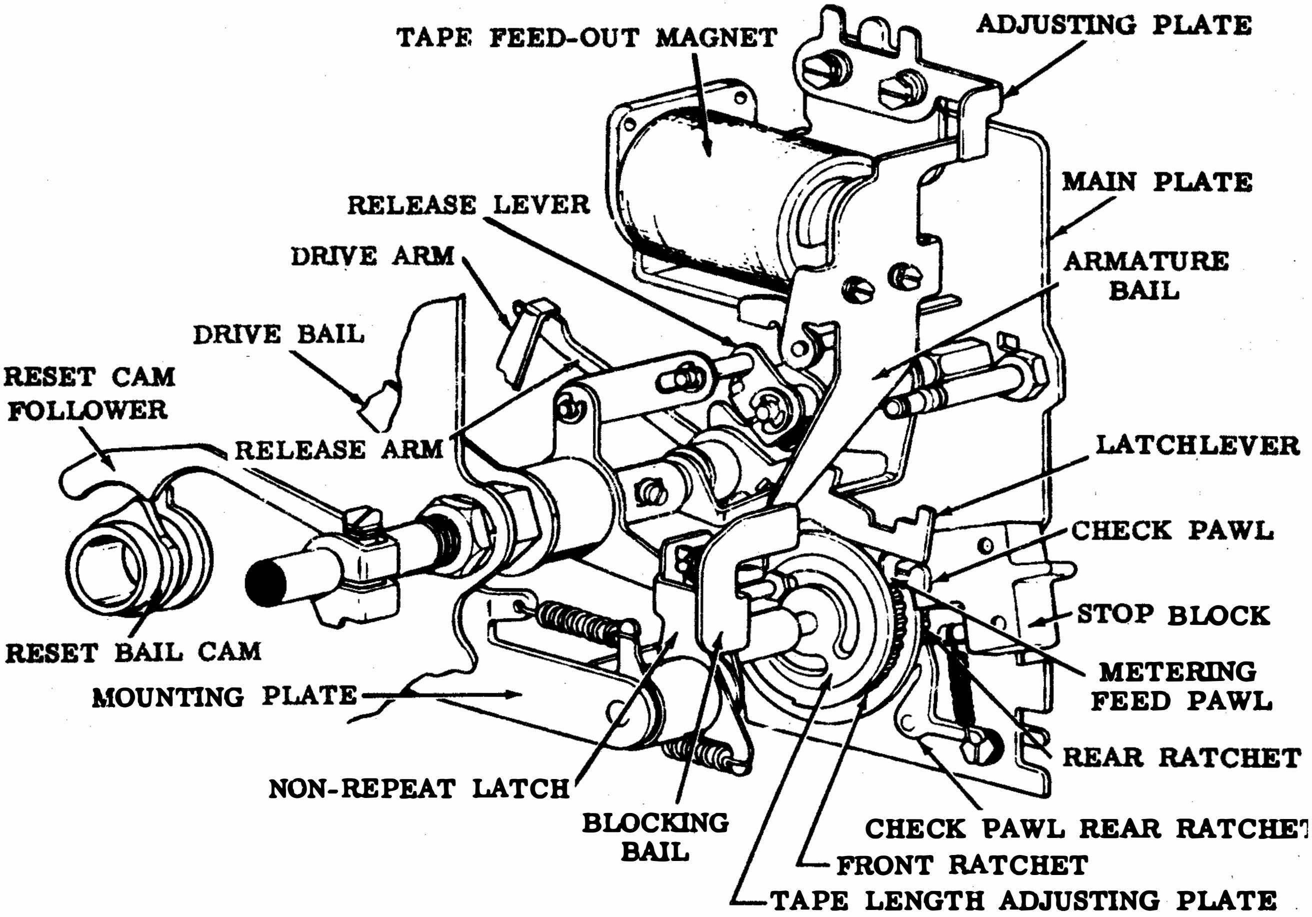


Figure 3-28. Remote Control Non-Interfering LETTERS Tape Feed-Out Mechanism

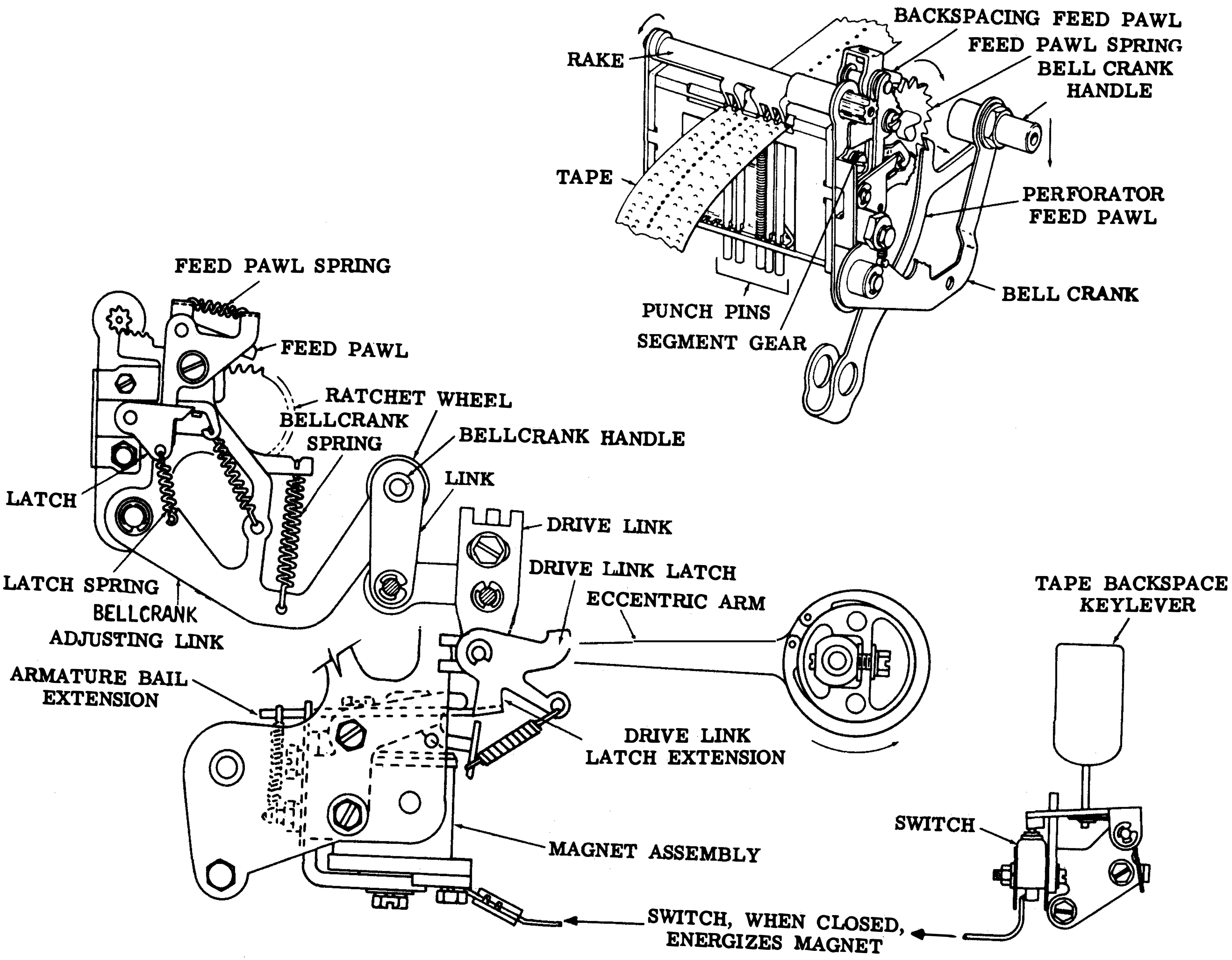


Figure 3-29. Backspace Mechanism

feed pawl from the feed wheel ratchet and simultaneously rotates the rake to depress the chads. 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.

d. Power Drive Backspace. 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 the bellcrank, after which operation is as previously described.

3-10. OVERALL FUNCTIONAL DESCRIPTION (LOW-LEVEL). The high-level ASR discussion in paragraph 3-2.1 is also applicable to low-level equipment. Low-level ASR operation is accomplished by incorporating a radio frequency interference (RFI) suppressed signal generator contact box assembly and an electrical service assembly (ESA). The ESA permits use of a low-level signaling code on the signaling lines (+6 volts mark and -6 volts space). The low-level signaling code along with the shielded contact box assembly, which uses gold-plated contacts, suppresses spurious radiations of communications intelligence thus assuring signal line privacy.

3-11. DETAILED FUNCTIONAL DESCRIPTION OF THE TRANSMITTER DISTRIBUTOR (TD). The following paragraphs give a detailed functional description of the TD used in the ASR sets. A functional block diagram (figure 3-5) illustrates the operation of the TD mechanical assemblies in detail. Discussions are applicable to both high-level and low-level ASR sets unless otherwise noted.

a. Transmitter Distributor Action. The operating cycle starts with the transmitter distributor in the idle signal line condition, the drive motor running, tape in the unit, and the external portions of the transmitter distributor circuits complete. Moving the control lever, Figures 3-5 and 3-30, to the RUN position, energizes the clutch trip magnet by completing the circuit through the start-stop and tight-tape contact assembly. Thus, the contact closes to complete the clutch trip magnet circuit, energizes the magnet, and pulls the armature up. The armature bail extension (figure 3-30) cams the main bail latchlever about its pivot post to release the main bail.

(1) The clutch trip bail is reset by an eccentric on the main bail. The eccentric rides in the slot of the clutch trip bail. When the eccentric on the spring biased main bail cams the clutch trip bail, the trip bail, in turn, moves the clutch trip lever (figure 3-30) away from its latch. When the main bail is released, the clutch trip bail is also released by the interconnection. The main bail swings up drawn by the main bail spring and causes two actions to occur.

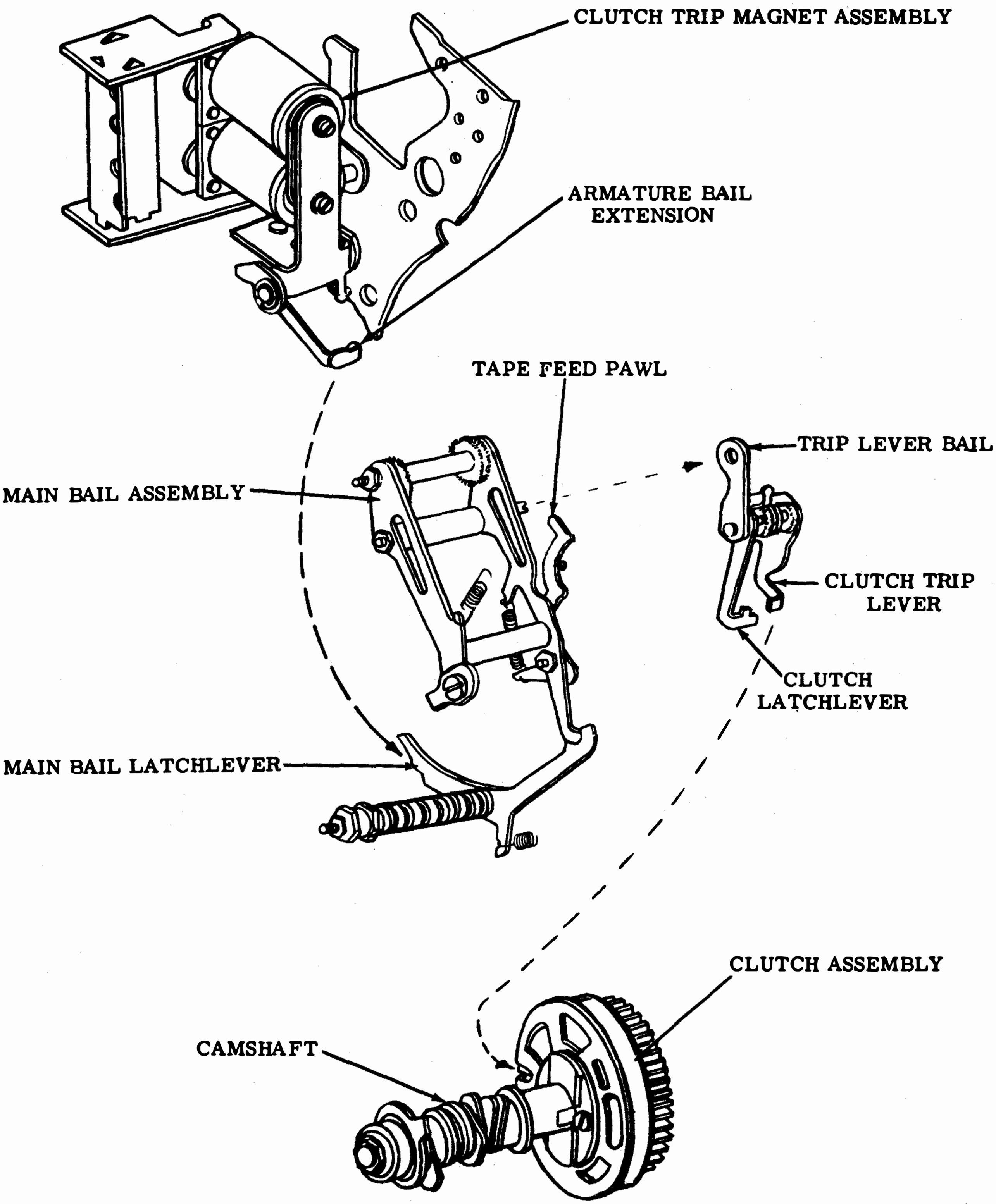


Figure 3-30. Function Control Mechanism

(2) First, the main bail raises the feed pawl, Figure 3-31, one tooth on the feed wheel ratchet. Secondly, the main bail permits the sensing pins to rise to read the perforations in the tape. If any of the sensing pins sense a perforation in the tape they extend upward through the perforations until stopped by the spacer on the main bail, and in extending upward rotate their associated transfer levers up.

(3) In rotating upward, the transfer lever extensions are brought above the line of action of the blade on the locking bail. If any of the sensing pins do not sense a perforation in the tape, the associated transfer levers remain stationary. The extensions on these transfer levers remain below the line of action of the locking blade on the locking bail, Figure 3-32.

(4) 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 camshaft rotating (figure 3-30).

(5) As the cam shaft 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 up by its spring. In its upward travel, the locking blade of the bail is positioned between the lower extension of the selected transfer levers and locks them into position (figure 3-32).

(6) Further rotation of the main shaft moves the lobe of the start cam into position so it cams its respective transfer lever. Since the start transfer lever has no sensing pin, the lever is always in the spacing position. The start transfer lever upper finger hooks the upper side of the transfer bail and causes it to pivot clockwise. The transfer bail extension, Figure 3-33, moves the signal generator drive link causing the toggle to open the marking contact and close the spacing contact in the signal generator contact assembly. The extension, in moving to the spacing position, forces the marking latch on the stabilizer, Figure 3-34, out of its way and continues its travel far enough to let the spacing latch fall into the latching position simulating a detent action.

(7) The shaft continues its rotation until the cam for the first pulse, Figure 3-35, cams its transfer lever. Depending on the position of the transfer lever finger, upper or lower, 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 previously been rotated. However, if the preceding pulse is different, the extension on the transfer bail moves the drive link and causes the toggle to open the closed contact and close the open contact. The extension also forces its way past the latch and continues its way until the opposite latch on the stabilizer can fall into position.

(8) The action of the cams for the second, third, fourth, and fifth pulses follow the action of the first pulse in order and repeat the same action as described for the first pulse (figure 3-35).

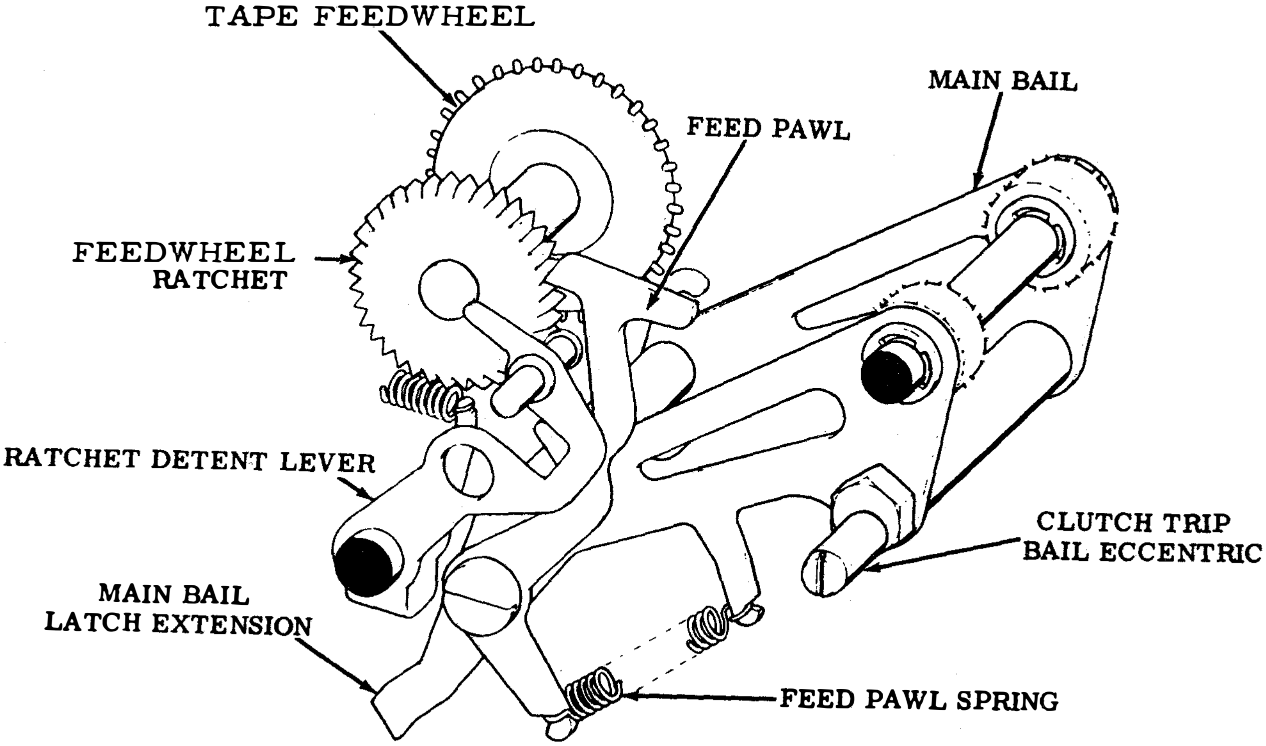


Figure 3-31. Tape Feed Mechanism, Rear View

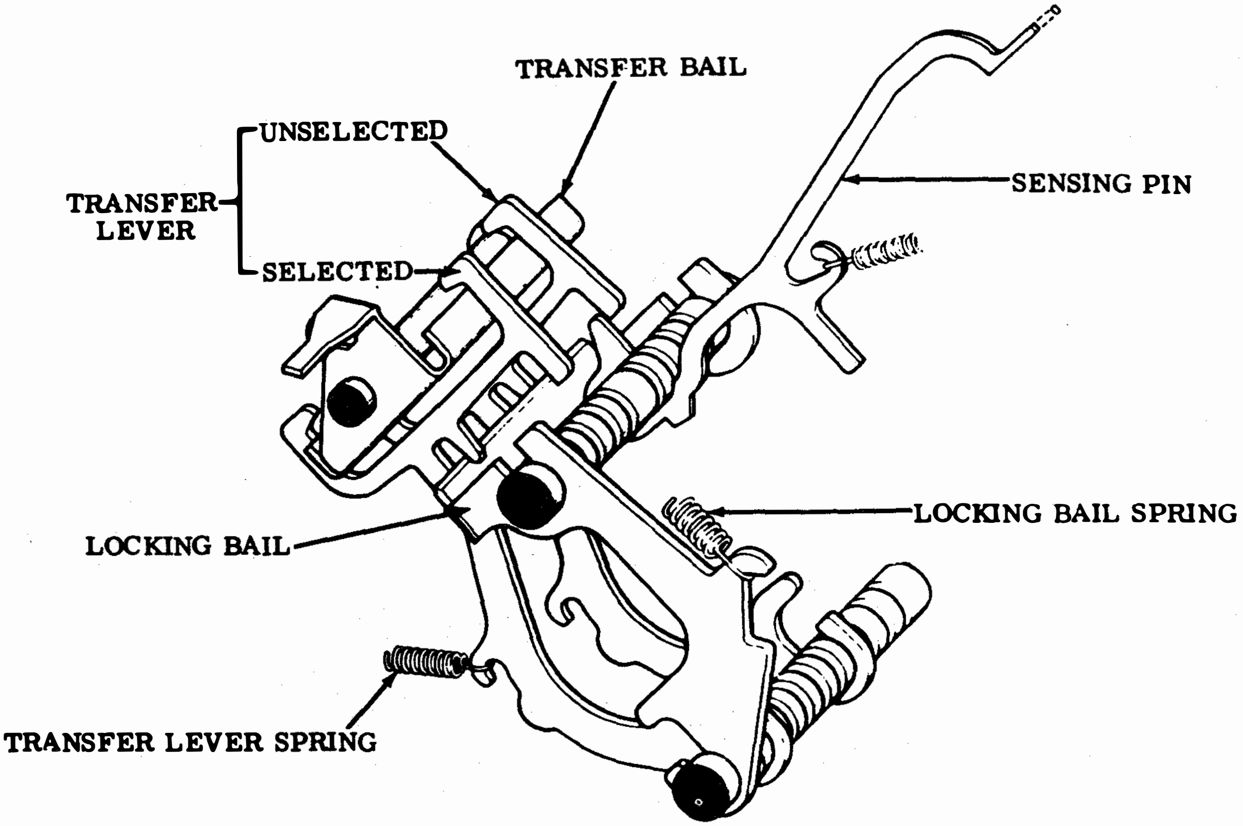


Figure 3-32. Locking Bail and Transfer Mechanism

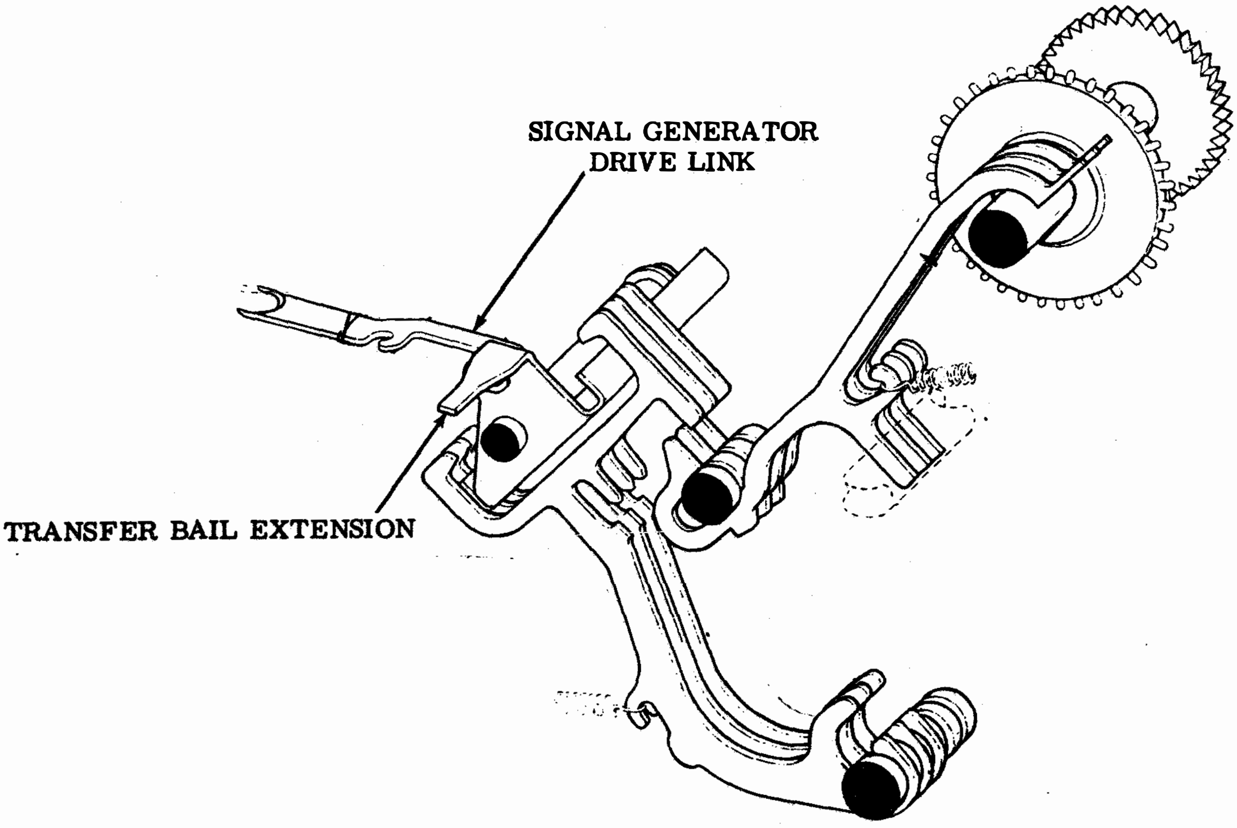


Figure 3-33. Transfer Lever

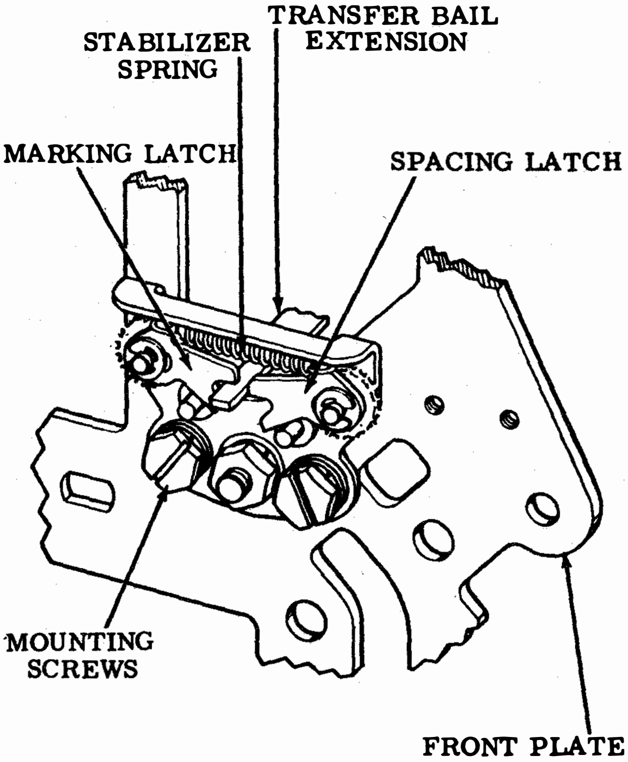


Figure 3-34. Transfer Bail Stabilizer

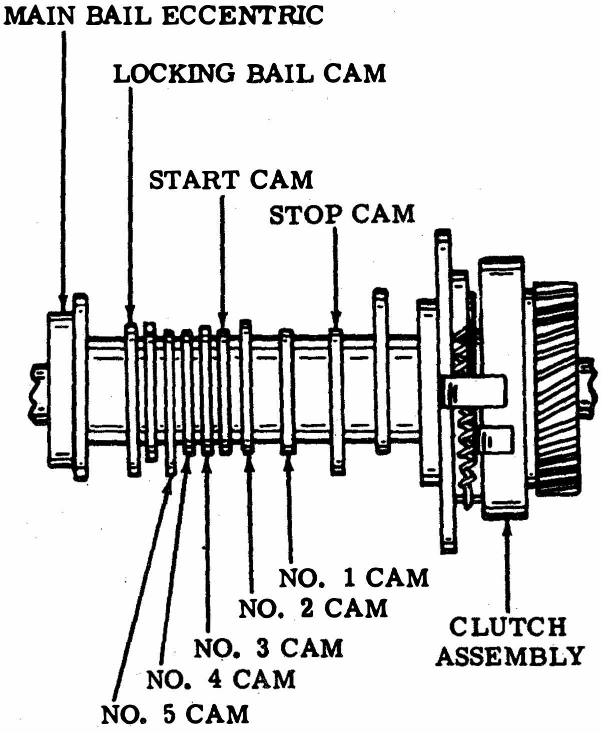


Figure 3-35. Clutch Cam Shaft Assembly

(9) The cam for the stop pulse follows that of the fifth pulse and the train of action is the same as that of the first pulse except that the stop pulse has no sensing pin, and its transfer lever is blocked. Thus, its lower finger always hooks the transfer bail causing a marking pulse on the completion of each character.

(10) The tape feed pawl, Figure 3-36, 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.

(11) 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 up, and the main shaft starts to rotate until the unit runs out of tape.

b. Stopping the Action The code sensing pins cannot differentiate between a no-tape condition and perforations; therefore, the unit operates as if five perforations were sensed and goes through the actions previously described. However, if the tape-out sensing pin senses that there is no tape in the unit, the tape-out pin moves upward, lifting the swinger pad of the tape-out contact assembly and opens the clutch trip magnet circuit.

(1) Since the tape-out contacts are in series with the start-stop and tight-tape contacts, the clutch trip magnet becomes de-energized and releases its armature. This action permits the armature bail extension to pivot out of its blocking position and allows the main bail latchlever to be moved by its spring (figure 3-32).

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

c. Clutch Operation. Clutch functions are discussed in the following paragraphs.

(1) Clutch Engaged. The clutch is engaged (figure 3-12) by releasing the low 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 suceeding step, the final force developed at point I is very great. This force is applied to the lug J on the clutch cam disk causing it to turn in step with the drum. The

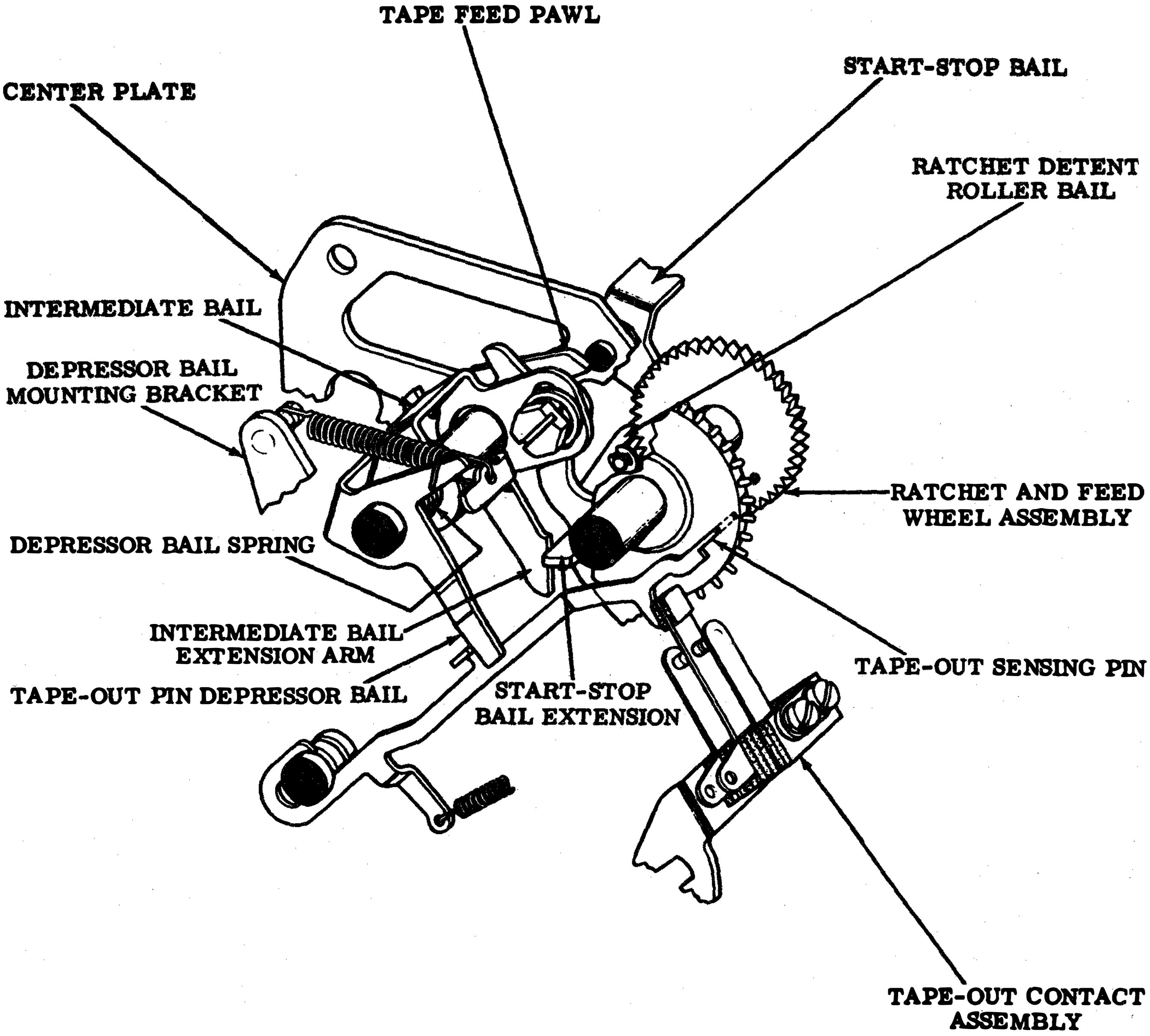


Figure 3-36. Freewheeling and Tape-Out Mechanism

cam disk on the clutch, connected to the cam shaft, imparts a rotary motion to the cam assembly.

(2) Clutch Disengaged. The clutch is disengaged (figure 3-11) 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.

d. Tape Lid Operation. Functions of the tape lid are discussed in the following paragraphs.

(1) Opening. When the tape lid release plunger, Figure 3-37, is pressed, the shaft portion of the plunger 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 to swing down under action of its spring. Since the latching post is mounted on the tape lid behind the pivot point and below the tape guideplate, it causes the main part of the tape lid to swing upward (open) when the post swings downward.

(2) Closing. The tape lid is manually closed by pressing it down against the tape guideplate. As 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.

e. Control Lever. Control lever functions are discussed in the following paragraphs.

(1) RUN Position. To start transmission, the transmitter distributor unit must be in an idle signal line condition, the drive motor running, tape in the unit, and the external portions of the transmitter distributor circuits complete. Moving the control lever to the RUN position, energizes the clutch trip magnet by completing the circuit through the start-stop and tight-tape contact assembly. Thus, the contact closes to complete the clutch trip magnet circuit, energizes the magnet, and pulls the armature up. The armature bail extension then cams the main bail latchlever about its pivot post to release the main bail.

(2) STOP Position. When the control lever is pushed to its center or STOP position, the cam surface of the lever cams the start-stop 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 action breaks the circuit to the clutch magnet assembly causing the armature to drop to its unattracted (de-energized) position.

(3) FREE Position. When the control lever is placed in the FREE position, the cam surface of the lever actuates the start-stop lever bail causing the bail to pivot. As the bail pivots, its extension moves the swinger pad on the start-stop assembly upward, opening the contacts and braking the circuit to the clutch magnet assembly. The start-stop lever

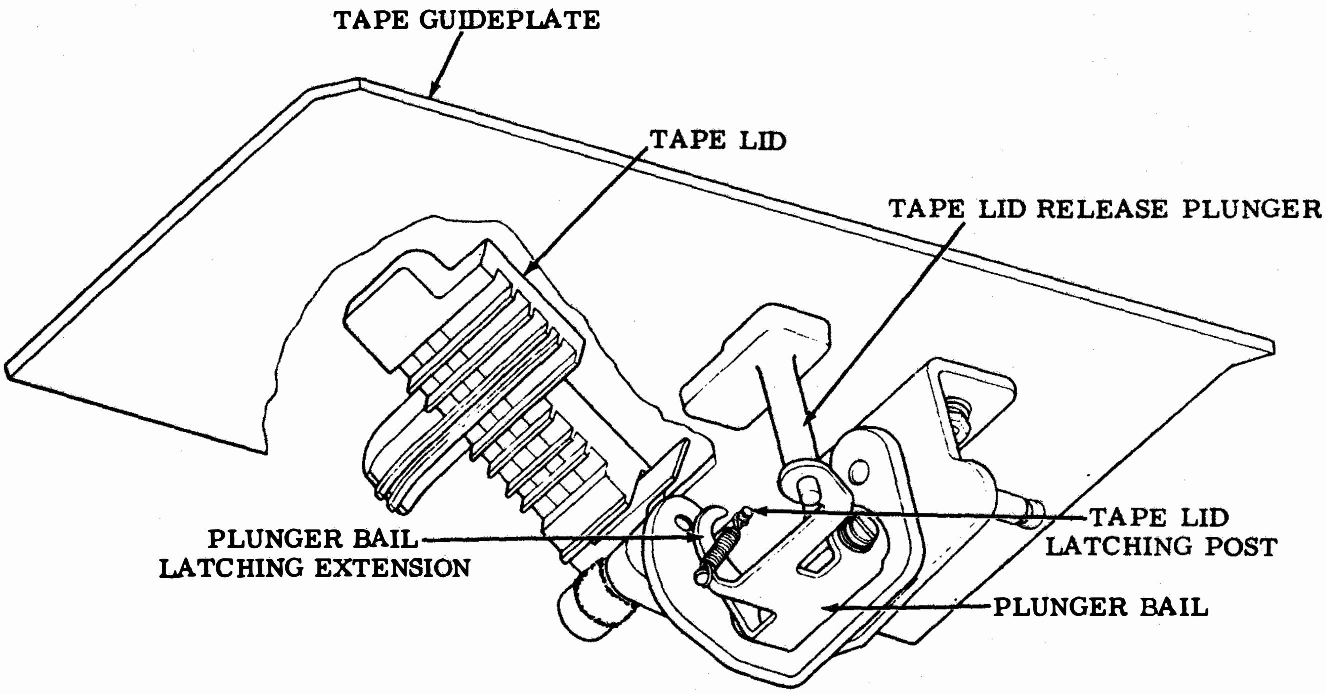


Figure 3-37. Tape Lid Mechanism, Bottom View

pushes the feed pawl and the ratchet detent roller away from the feed ratchet allowing the feed wheel to rotate freely. The start-stop lever extension also cams the intermediate bail extension arm which rotates the intermediate bail. The intermediate bail, in rotating, allows the spring-loaded tape-out pin depressor bail to follow. The depressor bail with its mechanism is mounted on a bracket attached to the front plate. The result of this camming action is the depressing of the tape-out sensing pin to a flush or below flush position relative to the tape guideplate. The position of the tape-out sensing pin allows free passage of the tape under the tape lid, Figure 3-38.

f. Tape Conditions. Tape condition sensing functions are discussed in the following paragraphs.

(1) Tight or Tangled Tape. A tight or tangled tape raises the tight-tape bail arm, Figure 3-39. The bail pivots and its extension cams the tight-tape intermediate arm assembly to which the tight tape arm is attached. When the arm assembly is cammed, the associated tight-tape arm lifts the swinger on the start-stop, tight-tape contact assembly up (figure 3-39), opening the clutch trip magnet circuit, causing transmission to stop.

(2) Tape-Out Sensing Pin. The tape-out sensing pin (figure 3-36) is to the right and slightly forward of the five aligned tape sensing pins. When the tape-out sensing pin is in a depressed position, the circuit is closed, and the unit transmits. Thus, with tape in the unit and the tape lid down, the tape holds the tape-out pin in a depressed position and the circuit is complete. When no tape is present, the tape-out sensing pin thrusts up into a hole provided in the tape lid. The rising of the pin opens the tape-out assembly contacts, which opens the clutch magnet circuit, and transmission stops.

3-12. ELECTRICAL CIRCUITS. ASR electrical circuits are shown in schematics and wiring diagrams included in Chapter 5, Troubleshooting.

3-12.1 MOTOR UNITS. The motor units that provide electromechanical rotating motion for operating various teletypewriter apparatus are of two basic types; synchronous and series governed. Both types are self-contained motor units, with characteristics adaptable for use with standard power sources. The synchronous type motor units are available in miniature (25 millihorsepower), standard, and heavy duty ratings. These motor units must be operated from a standard, single-phase, regulated power source with specifications as listed in Table 1-1. The series governed type motor unit is available in standard and heavy duty horsepower ratings and may be operated from regulated or unregulated, standard, single-phase power sources, or dc (direct current). The series governed type motor unit is also available for operation with 48 volts dc only. Specifications are given in Table 1-1.

a. Standard and Heavy Duty Synchronous Motor Units. The standard and heavy duty synchronous motor units, Figure 3-40, consists of a two-pole wound stator and two end shields that support a ball bearing rotor. A combination handwheel

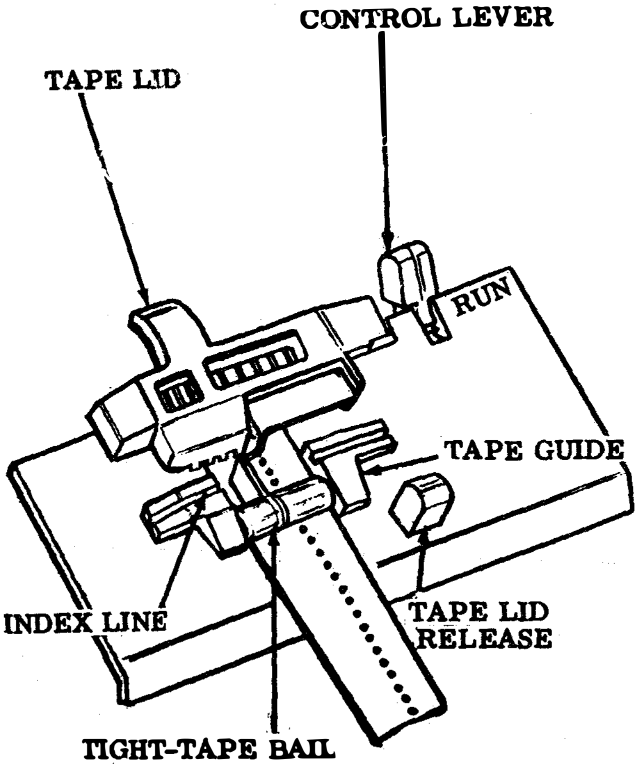


Figure 3-38. Tape Guideplate

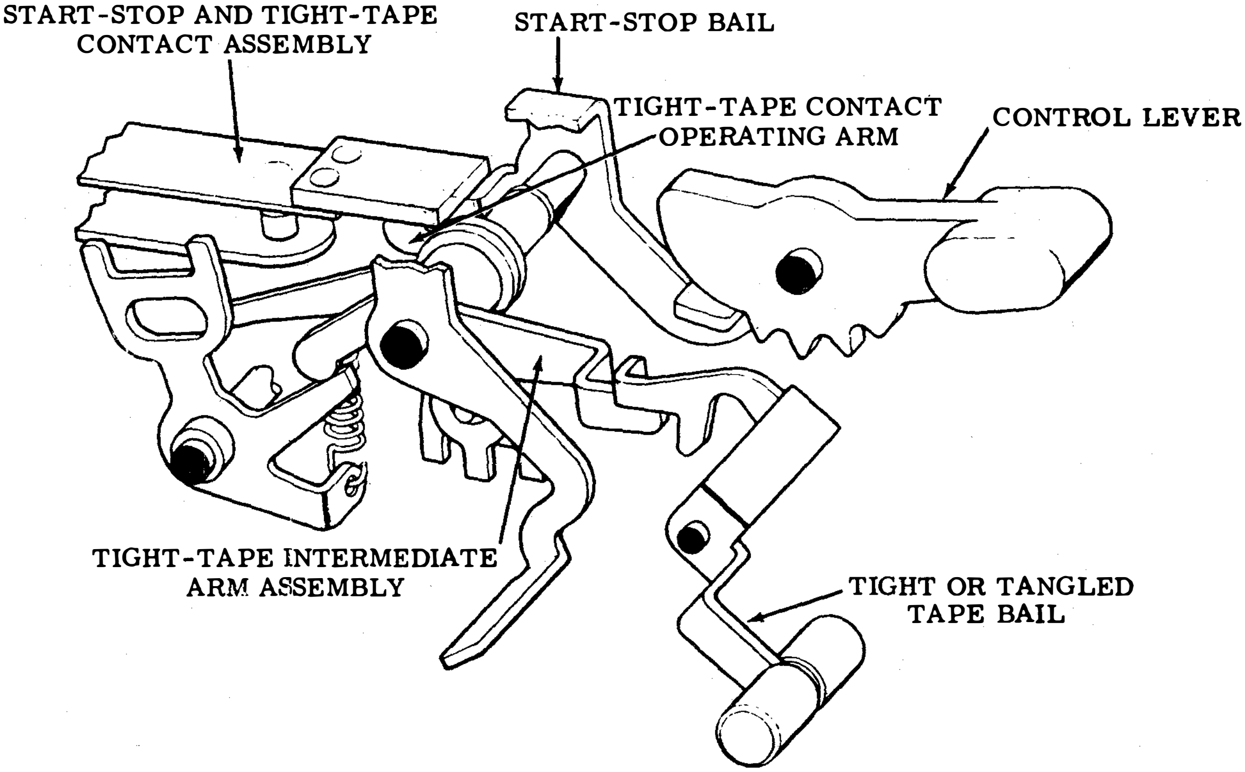


Figure 3-39. Start-Stop and Tight-Tape Switch Mechanism

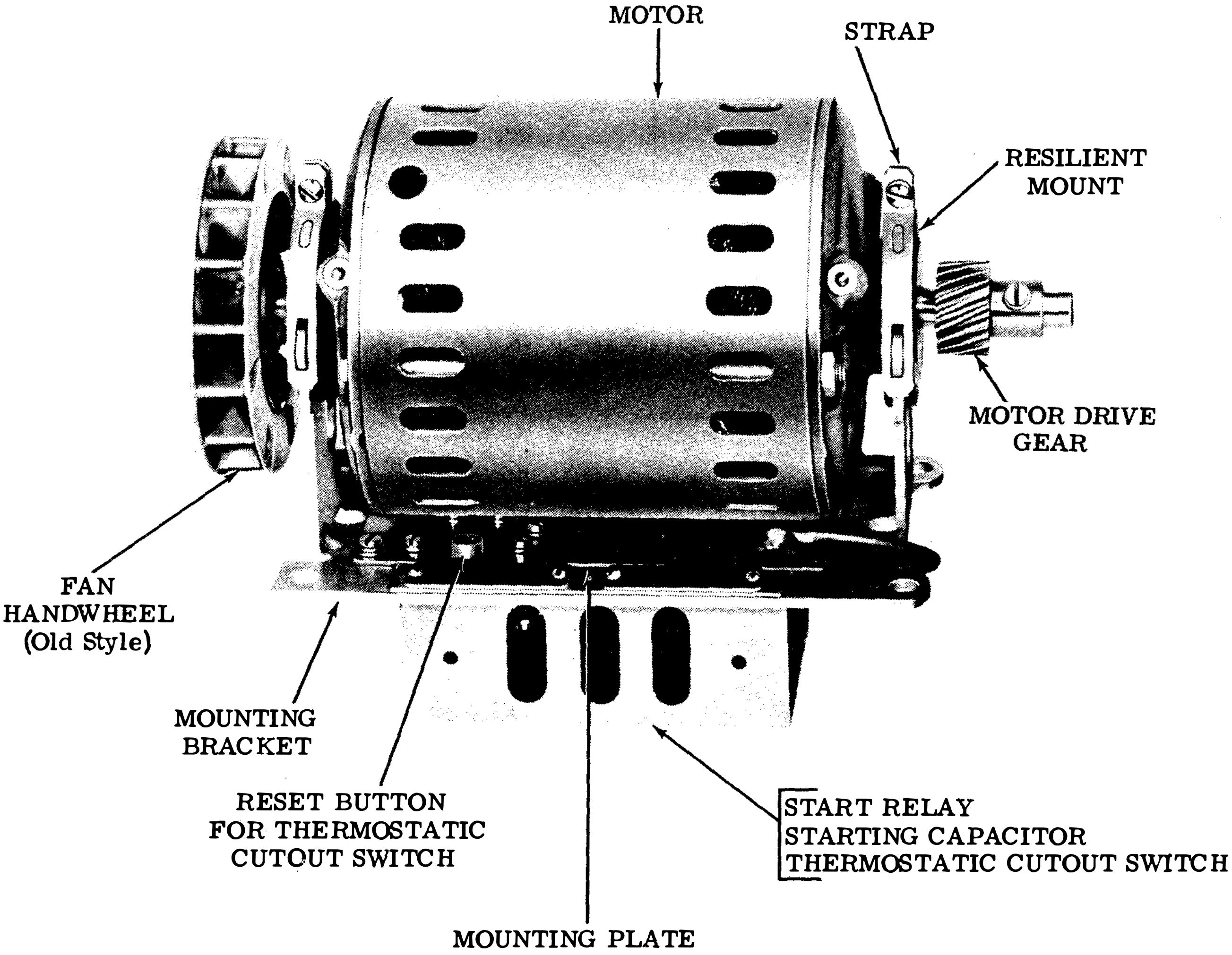


Figure 3-40. Typical Standard or Heavy Duty Synchronous Motor Unit with New-Style Plastic Handwheel

and fan (new style handwheel (figure 3-40) and fan is made of plastic) is mounted on the motor shaft, and two fans are mounted at each end of the rotor within the end shields. The opposite end of the shaft contains a tapped hole for mounting the driving gear. A motor starting relay, starting capacitor, and thermostatic cutout switch are mounted in a compartment of the motor mounting bracket. The thermostatic cutout switch, which is reset manually, protects the motor winding from excessive current drawn by the motor. The motor is supported by resilient mounts which are part of the end shields and which are held in place by straps attached to the mounting bracket. The resilient mounts tend to reduce the transmission of vibration from the motor to the driven associated apparatus. Variations of the standard and heavy duty synchronous motor units include: 3600-rpm, 60-Hertz units, and 3000-rpm, 50-Hertz units, operation; 1/20-horsepower rating; replacement of the fan with a gear to reverse the direction of rotation for such applications as the high speed punch unit. Some standard and heavy duty synchronous motor units have the start relay and start capacitor held in position with springs by hooking the ends of the spring through the projections in the sides of the mounting bracket.

b. Series Governed Motor Units. The series governed motor units, Figure 3-41, typically consist of a motor, speed regulator (governor) protective and control devices, and a mounting. The 1/20-horsepower series governed motor unit (ac/dc and ac only) consists of a series type motor, speed governor, motor mounting bracket, and a housing for the governor resistors and spark suppression capacitor. The governor is mounted on an extension of the armature shaft and includes a fan that circulates air through the motor. The opposite end of the shaft contains a tapped hole for mounting the driving gear. Targets for speed checking purposes are provided on the governor cover. The motor is mounted by means of resilient mounts at each end shield that are fastened to the mounting bracket by straps. The ac only motor unit is furnished with a bidirectional switch controlled governor. A variation of the 1/20-horsepower series governed motor unit described above is available with electrostatic shielding and RFI noise suppression. Variable speed (ac/dc and ac only) 1/20-horsepower motor units are similar to the units described above but have a gear arrangement permitting changing the motor speed manually while the motor is in operation. The ac only motor unit is furnished with a bidirectional switch controlled governor. The 1/15-horsepower motor units (ac/dc and ac only) are similar to the units described above but are equipped with electrostatic shielding and radio frequency noise suppression. The ac only motor unit is furnished with a bidirectional switch controlled governor.

3-12.2 TYPING UNIT. The following paragraphs describe the function and operation of the typing unit used in the ASR set. Reception and printing functions are accomplished by mechanisms in the typing unit. The basic function of the typing unit, Figures 3-42 and 3-43 is to record in page-printed form information received from a signal line in the form of a

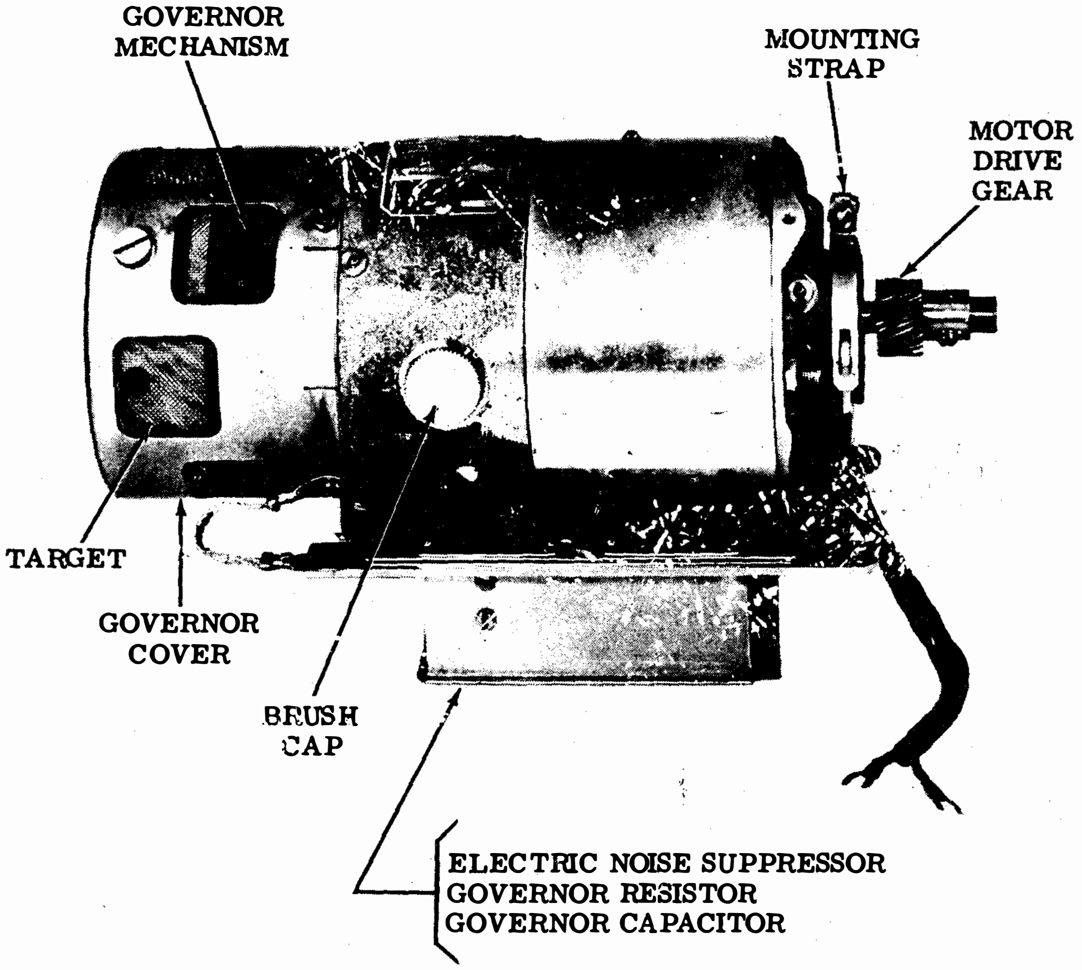


Figure 3-41. Typical Series Governed Motor Unit

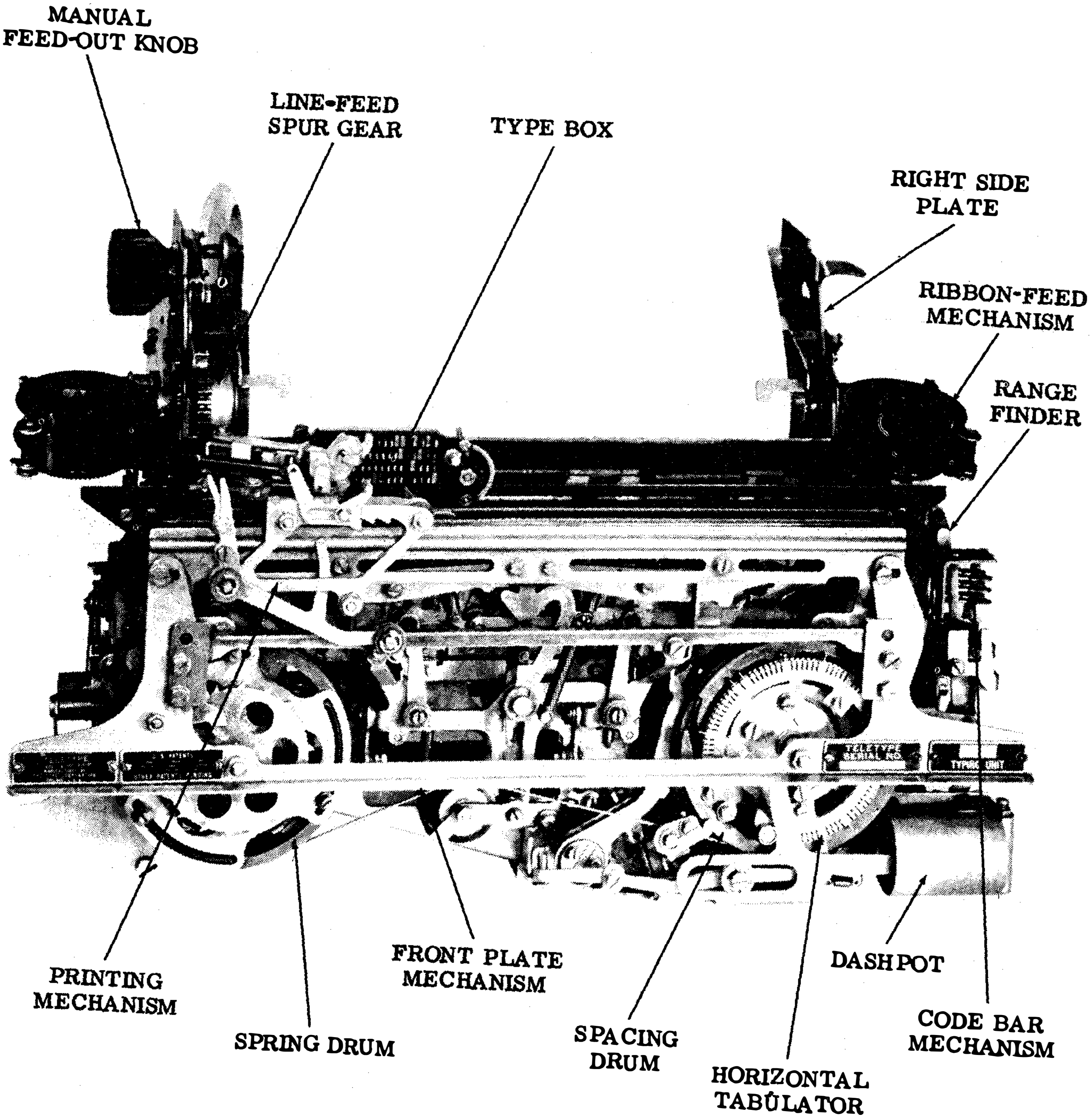


Figure 3-42. Typing Unit Model 28 (Friction Feed), Front View

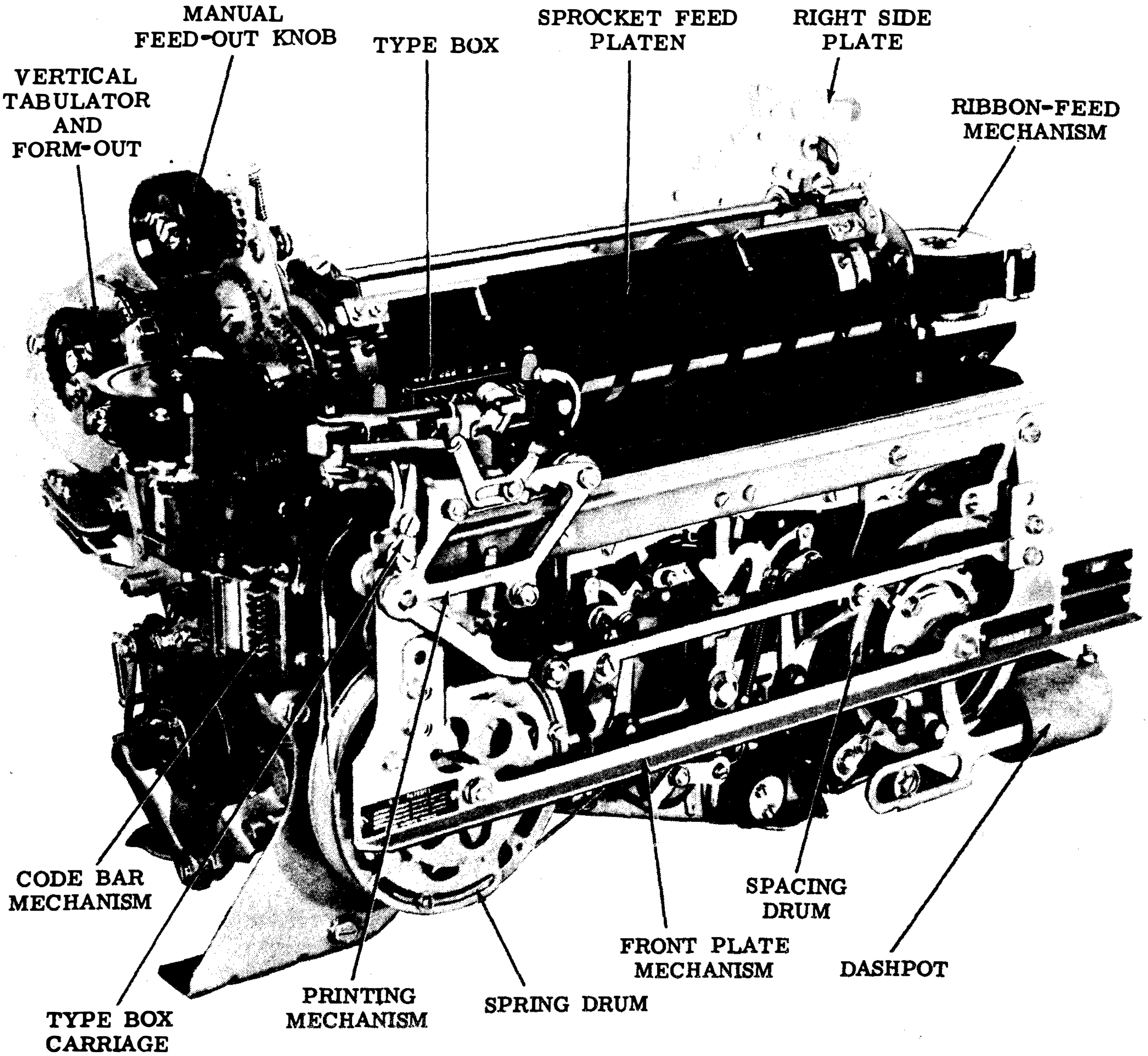


Figure 3-43. Typing Unit Model 28 (Sprocket Feed), Left Front View

signaling code combination which represents characters or functions. Character representations, or graphics, are the alphabetic, numeric, or symbol intelligence equivalent of the input code combinations. Function representations are the coded equivalent of non-typing operations auxiliary to reception of the graphics, such as line-feed, carriage return, or signal bell. The typing unit translates these electrical code combinations into mechanical motions which imprint the message or initiate the indicated function, such as line-feed, carriage return, or signal bell. Printing is accomplished through an inked ribbon upon paper rolled around a horizontal stationary platen while the type and printing mechanism move from left to right across the page. All operations of the typing unit are performed automatically in response to input signal code combinations. A few local off-line functions such as line-feed or carriage return may be initiated independently of the signal line from the local keyboard or base mechanism. Speed in wpm is roughly one-sixth of the opm. The typing unit is designed to operate at 60, 75, 100, or 107 wpm, depending on the gear ratio used on associated equipment. Rotary mechanical motion for its operation, and information in the form of the signaling code, come from external sources. A front plate and side plates provide mounting facilities for the various assemblies and mechanisms that make up the unit. A signal applied to the selector magnets initiates operating sequences. The application of voltage to the stunt box and to various switches and controls is dependent upon external circuitry and associated equipment. With the main shaft under power (associated equipment main power supply on), the typing unit is described as running closed when a steady current (marking) condition is maintained in the signal line and no signal intelligence is received. It is described as running open when a no current (spacing) condition is maintained through an interruption in signal line current.

a. General. The friction feed typing unit (figure 3-42) and the sprocket feed typing unit (figure 3-43) are essentially identical. They differ only in the paper feeding mechanisms. The following description of the operation applies to both units, differences will be pointed out in the following chapters. The relationship of the operating mechanism of the ASR Model 28 typing unit are illustrated in Figure 3-44. Rotary motion from the intermediate gear mechanism of an associated base is applied to the main shaft. The shaft turns constantly as long as the associated unit is under power. A signal is applied to the selector magnets initiating operating sequences. The application of voltage to the stunt box and to various switches and controls is dependent upon external circuitry and associated equipment.

b. Signaling Code. The signaling code combinations are applied to the selecting mechanism through a cable connector located just above the selector magnets. The start pulse (spacing) of each code combination permits the start lever to fall to the rear behind the magnet armature and rotate

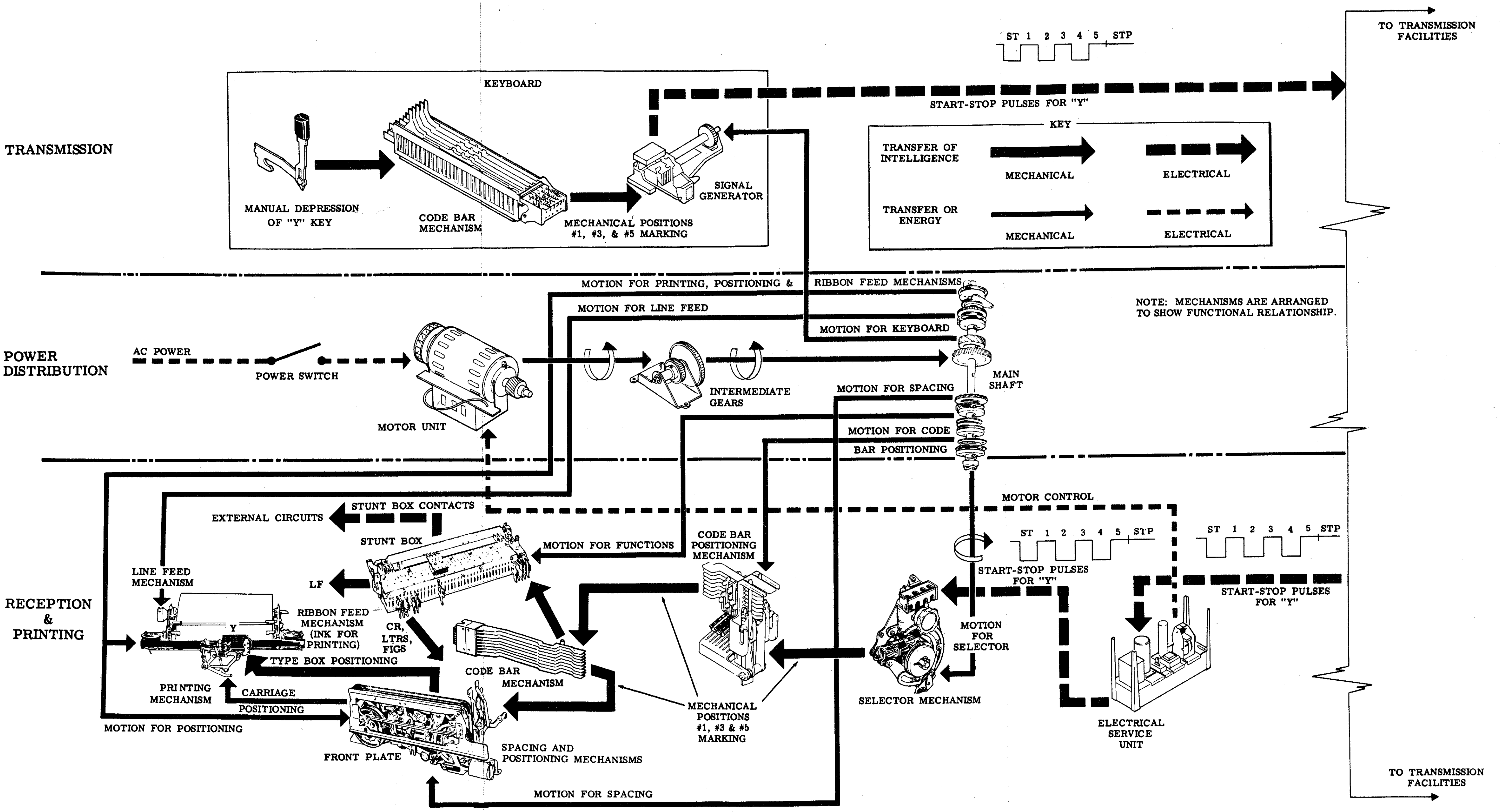


Figure 3-44. Typing Unit Model 28, Schematic Diagram

to trip the selector cam clutch. The range finder mechanism (figure 3-10) permits adjustment of the angular relationship of the trip-off point to the optimum quality incoming line signal. Information is received by the typing unit in the form of a 7/42 unit start-stop signaling code (figure 3-3) in which each character (graphic) or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking, and those in which no current flows are spacing. Every combination includes five pulses (also referred to as levels) that carry the intelligence, each of which may be either marking or spacing. To ensure synchronization between the transmitting and receiving equipment, a start pulse which is always spacing is added at the beginning of each combination of intelligence pulses, and a stop pulse which is always marking is added at the end. The code representation for the graphics R and Y are shown in Figure 3-4. In these combinations, alternate marking and spacing conditions for the intelligence pulses are required. In different signaling codes used with Model 28 teletypewriter equipment, the length of the stop pulse may vary. For example, in the code shown in Figure 3-3, the length of the stop pulse is 1.42 times the other pulses. Thus, the transmission of a graphic requires 7.42 units of time. It is therefore said to have a 7.42 unit transmission pattern. The stop pulse may be equal in duration to the other pulses in some applications, in which case the transmission code would have a 7.0 unit transmission pattern. The total number of permutations of a five-level (five intelligence pulses) code is two to the fifth power, or 32. To accommodate more than 32 graphics, a LETTERS-FIGURES shift is designed into the typing unit. This is similar to the lower and upper case of a typewriter and permits each code combination, excluding the two used to shift the equipment, to represent two characters. A typical character arrangement is shown in Figure 3-3. The black circles represent marking pulses, the blank squares spacing pulses. When the LETTERS code combination (12345) is transmitted, it conditions all typing units connected to the circuit to print, at the receipt of all following code combinations, the characters in the LETTERS (lower case) line on the chart. Similarly, when the FIGURES code combination (12-45) is transmitted, it conditions the typing units to print the character or perform functions in the FIGURES (upper case) line on the chart.

c. Main Shaft. Motive power for the main shaft is applied to the driven gear centrally located on the shaft, Figure 3-45. The main shaft rotates at the output speed of the intermediate gear assembly. Six all-steel internal expansion clutches convert the rotary motion of the main shaft to the linear mechanical requirements for operation of the teletypewriter set. The clutches rotate with the main shaft when engaged and do not rotate when disengaged (latched). From left to right in their installed position on the main shaft, the clutches control the type box, line-feed, spacing, function, code bar, and selecting mechanism.

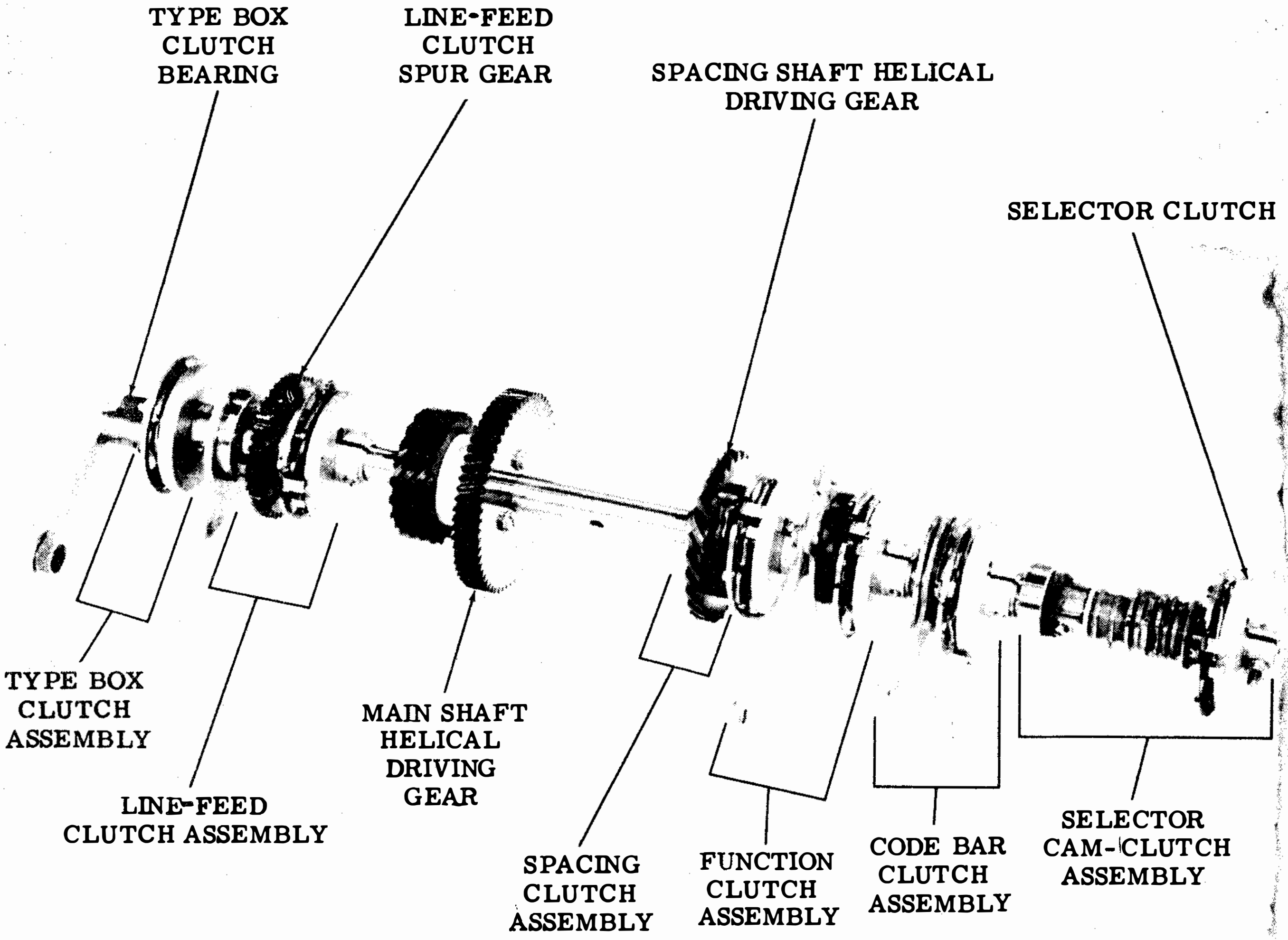


Figure 3-45. Main Shaft Assemlby, Right Front View

d. Selector Cam-Clutch. The selector cam-clutch, and all clutches are driven by the main shaft (figure 3-45). The selector cam-clutch converts the incoming signal into mechanical marking or spacing equivalents of each pulse in the signal code. A cam on the selector cam-clutch engages a code bar clutch when a signal combination has been translated and locked in a mechanical arrangement in the selecting mechanism.

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

f. Function Clutch. The function clutch controls the function bail and the stripper bail. The function reset bail allows 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 the contact relating to the input signal code. The stripper bail resets selected function mechanisms. When the input signal calls for the 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, thus engaging the line-feed clutch, refer to Figure 3-45.

g. Line-Feed Clutch. The line-feed clutch operates mechanical linkages which advance the paper one or two spaces by rotating the platen. On units so equipped, the page feed-out mechanism also operates the line-feed clutch trip mechanism. The line-feed clutch is fully covered in paragraph 3-12.3c.

h. Code Bar Mechanism. The code bar mechanism (see paragraph 3-12.5b) and the code bar clutch operate in combination to trip the type box clutch. When the type box clutch is tripped, it initiates mechanisms involved in vertical positioning of the type box, horizontal type box positioning, ribbon-feed and printing. The main rocker bail provides power from the type box clutch (driven by the main shaft, see figure 3-45) and 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.

i. Spacing Clutch and Mechanism. The spacing clutch and mechanism is covered fully in paragraph 3-12.3c.

j. Type Box. The type box is positioned by the printing and spacing mechanisms in relation to intelligence set up in the code bars. It presents a single graphic in printing position for each operating cycle. To prevent printing during a function selection, the type box is positioned to present a vacant type-pallet position. At the proper moment and the type box locked in printing position, a spring loaded print hammer is released to tap the selected type pallet sharply against the inked ribbon and the paper. A clearly imprinted graphic character corresponding to the input signal code combination results. At the same time, 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.

3-12.3 DISTRIBUTION OF MOTION. Refer to Figure 3-45. The following paragraphs describe the distribution of motion and power to various components of the typing unit.

a. General. The main shaft with its various cams, clutches and eccentrics is located in the lower rear portion of the typing unit. It is supported between the two side frames by ball bearings. The main shaft extends across the full width of the typing unit. 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 the power from the motor to the typing unit. The smaller gear drives the signal generator mechanism of an associated keyboard base.

b. Main Shaft. Power take-off from the constantly rotating main shaft, Figure 3-45, is controlled by six clutches, each of which, when tripped (engaged or disengaged) drives its associated mechanism. From the right end of the shaft, these clutches may be identified as the selector clutch (with cam sleeves), the code bar clutch, the function, spacing, line-feed and the type box clutch. The clutches are tripped in the following sequence:

(1) Selector clutch, one-stop clutch.

(2) Code bar clutch, one-stop clutch.

(3) Function clutch, one-stop clutch.

(4) Type box clutch, one-stop clutch.

(5) Spacing clutch, three-stop clutch.

(6) Line-feed clutch, three-stop clutch.

The type box and spacing clutch engagement may be suppressed under certain operating conditions, and the line-feed clutch is operative only upon a specific set of input signal code combinations. The spacing and line-feed clutches are three-stop clutches, Figure 3-46, each permitting their associated mechanism to operate through one-third of a revolution of the main shaft.

c. One-Stop Clutches. The clutch drums are attached to and rotate with the main shaft (figure 3-45). In the disengaged position, as illustrated in Figure 3-47, the clutch shoe does not contact the drum, and the shoes and cam disk are held stationary. By moving the stop arm, as illustrated in Figure 3-48, toward the rear of the typing unit, away from the clutch and releasing the stop-lug A and the lower end of the shoe lever B, the clutch will become engaged. The upper end of the lever B pivots about its ear C, which bears against the upper end of the secondary shoe. This moves the ear D and the upper end of the primary shoe toward the left until the shoe contacts the notched inner surface of the rotating drum at

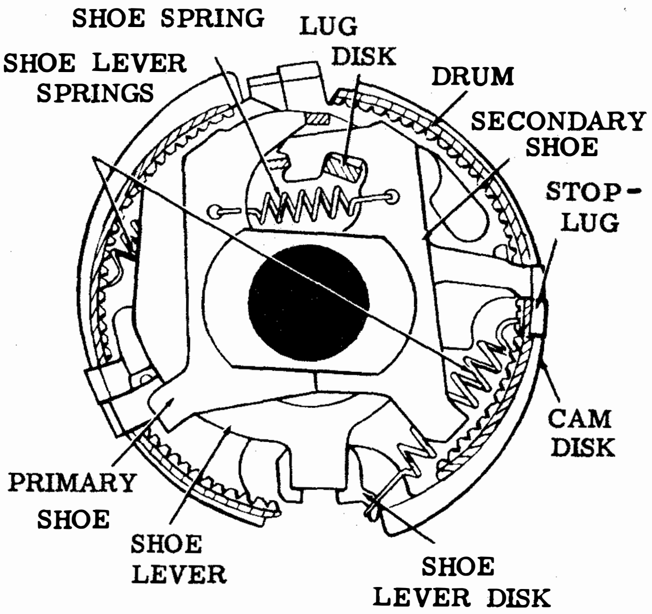


Figure 3-46. Three-Stop Clutch

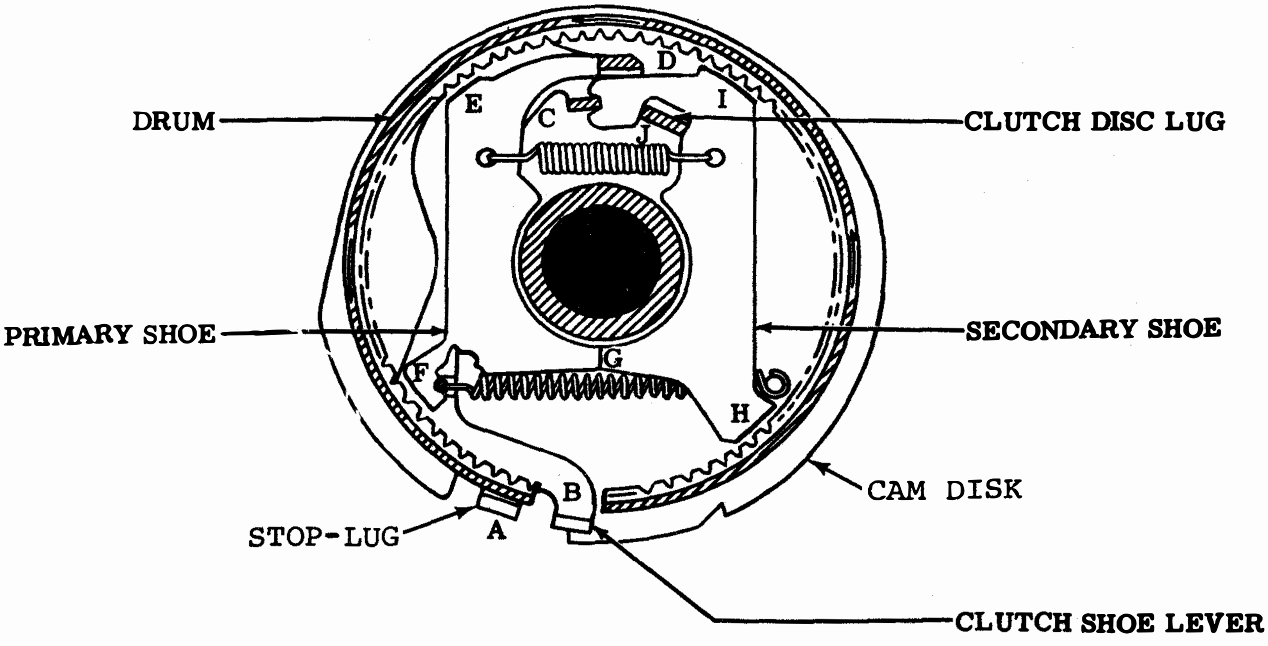


Figure 3-47. One-Stop Clutch, Disengaged

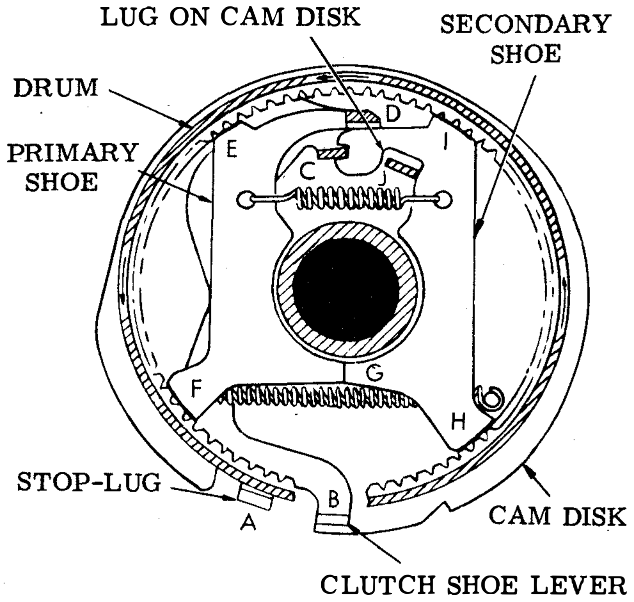


Figure 3-48. One-Stop Clutch, Engaged

point E. The drum turning clockwise drives the primary shoe downward so that it again makes contact with the drum at point F. At this point, the combined forces acting on the primary shoe causes 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 total force is applied through the shoes to lug J on the clutch cam disk, the disk and attached cam, turn in unison with the drum. Disengagement is affected when the lower end of the shoe lever B strikes the stop arm. Lug A and the lower end of the shoe lever are brought together as illustrated in Figures 3-47. The upper end of lever B pivots about its ear C and permits 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 disk, and the cam is held in its stop position until the clutch is again engaged.

d. Three-Stop Clutches. The spacing and line-feed clutch both have three sets of lugs equally spaced about their periphery. The action is as described for the one-stop clutch, but the clutch is permitted to rotate through only one-third revolution before the stop lever and latchlever stops its action.

3-12.4 SELECTION. The following paragraphs describe the function and operation of the selector mechanism.

a. General. The selecting mechanism consists of two magnet coils, an armature, a selector cam clutch, and associated levers, arms, bails and slides necessary to convert the electrical pulses of the start-stop code to the mechanical arrangement which govern the character to be printed and the function to be performed.

b. Selector Mechanism. The selector cam-clutch, described in paragraph 3-12.2d comprises, from right to left as illustrated in Figure 3-45, the clutch, the stop arm bail cam, the fifth, fourth, and the third selector lever cams, the cam for spacing and marking locklevers, the second and first selector lever cams, the pushlever reset bail cam, and the code bar clutch trip cam, Figures 3-10 and 3-49. A selecting mechanism (figure 3-10) translates the signaling code combination into corresponding mechanical arrangements which control code bars in a code bar mechanism. It includes a two-coil magnet that connects in series with the external signal line. The coils may be wired in either series or parallel to accommodate 0.020-ampere or 0.060-ampere line currents. A range finder is used to refine the mechanical orientation of the selector to the signaling code. The signaling code combinations are applied to the selecting mechanism through a cable connector located just above the selector magnets. The start pulse (spacing) of each code combination permits the start lever to fall to the rear behind the magnet armature, and rotate to trip the selector cam clutch. The range finder mechanism permits adjustment of the angular relationship of the trip-off point to the optimum quality incoming line signal. The selector cam clutch, driven by the main shaft, converts the incoming signal into mechanical marking or spacing equivalents of each pulse in the signal code. A cam on the selector cam clutch engages the code bar clutch when a signal code combination has been translated and locked in a mechanical arrangement in the selecting mechanism.

c. Selecting Cam-Clutch and Trip Assembly. The function of the selector cam clutch, selector mechanism, and trip assembly is described in paragraph 3-7.1a.

3-12.5 ORIENTATION. Orientation or range finder adjustment (figure 3-10) is covered in paragraph 3-7.1d.

a. Positioning the Code Bars. The code bar mechanism is illustrated in Figure 3-50. The character printed or the function performed by the typing unit is basically determined by the code bar mechanism which translates the input signal intelligence into mechanical form, and is then transmitted from the selecting mechanism pushbars. The code bars are positioned by code bar shiftbars which move to the left for marking and to the right for spacing. The shiftbars, positioned to the rear for marking and forward for spacing, are pushed into marking position by selected pushbars through a mechanical linkage, intermediate arms and transfer levers, refer to Figure 3-51. Power to position the selected code bar levers, and the related code bars is supplied by the code bar clutch. The code bar clutch is engaged by its cam on the selector cam clutch.

b. Code Bar Operation. Each selector pushlever has an associated intermediate arm, transfer lever and code bar shift bar. In addition, there is a common transfer lever with its code bar shiftbar. When a

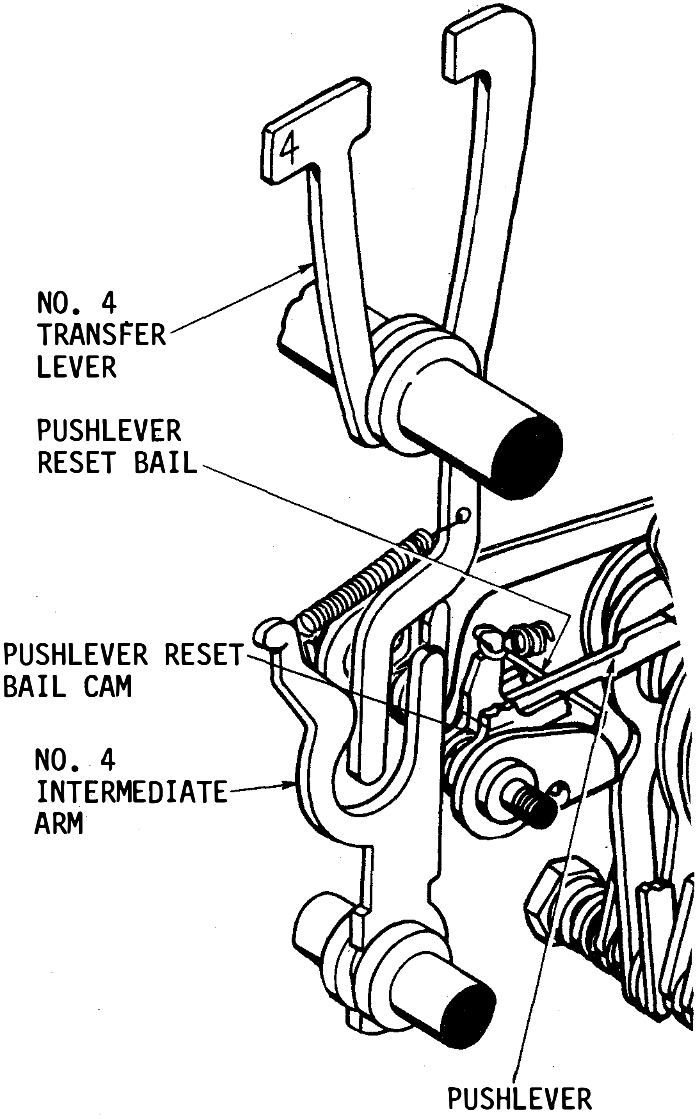


Figure 3-49. Pushlever Reset Bail Cam, Right Front View

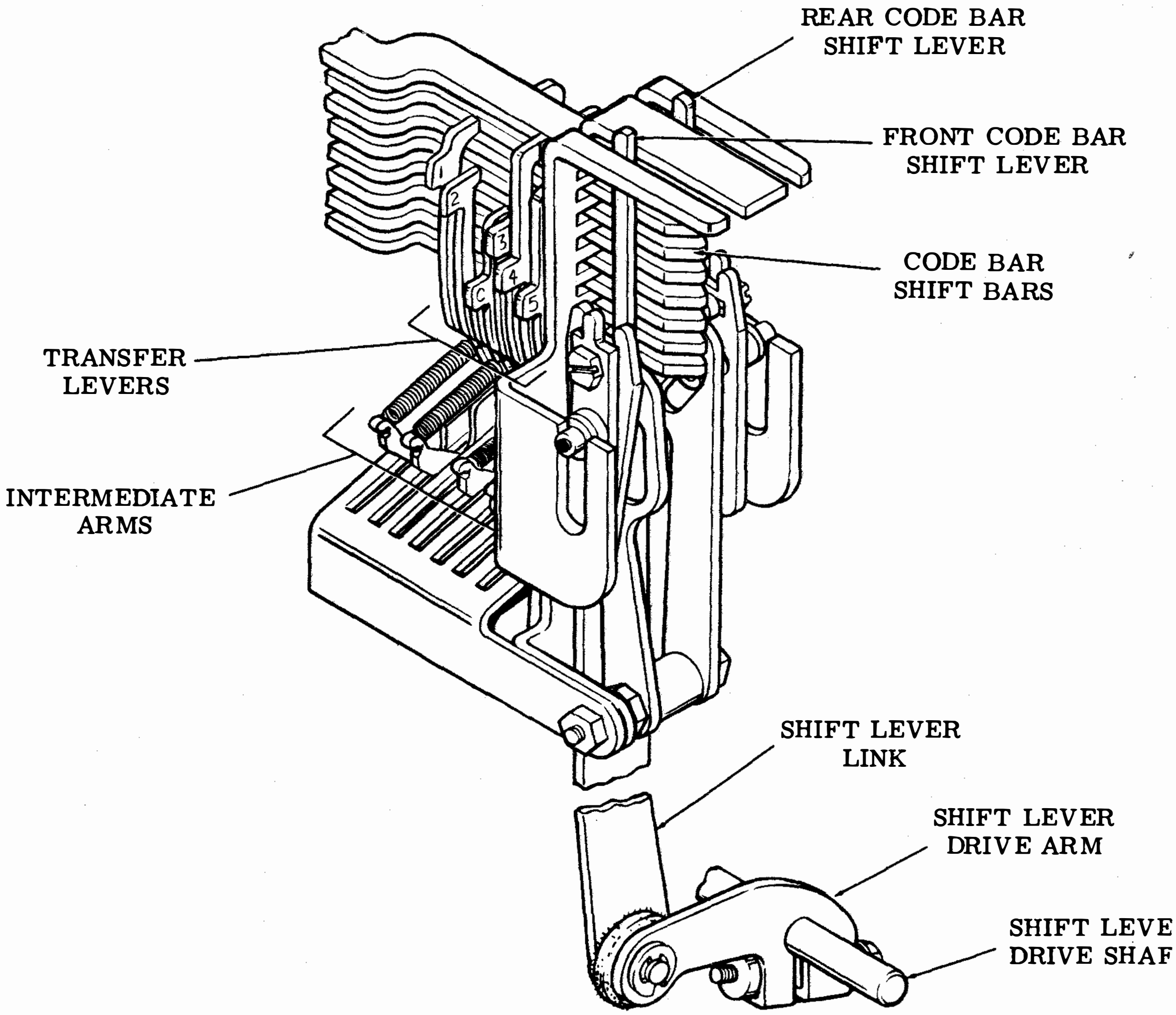


Figure 3-50. Code Bar Mechanism, Right Front View

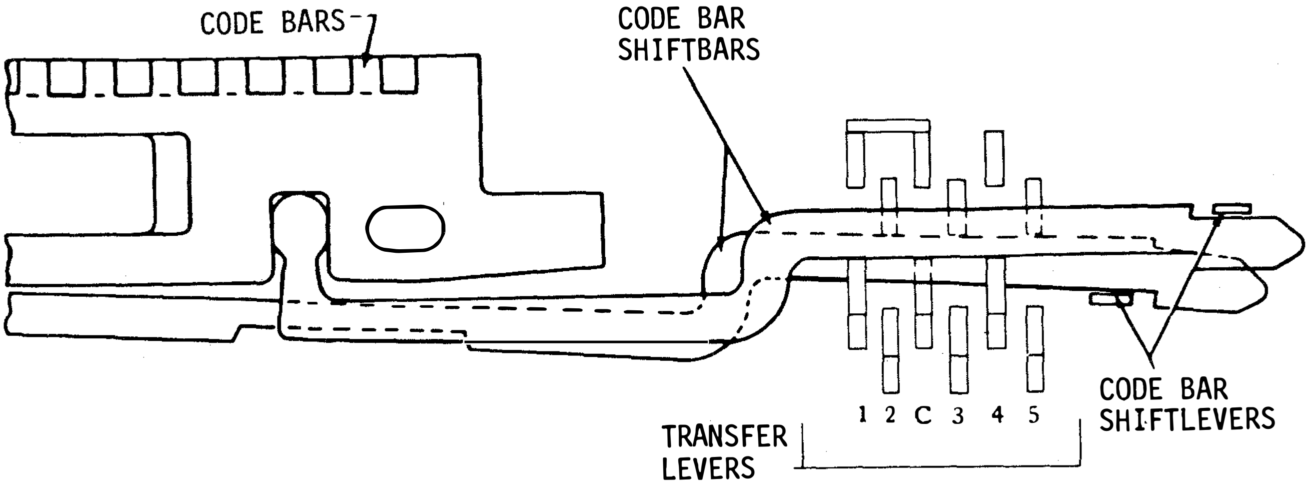


Figure 3-51. Code Bar Shiftbar Positioning, Top View

pushlever 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 shiftbar in spacing position. When a pushlever is moved forward (marking), it rotates the intermediate arm counterclockwise, positioning the transfer lever to the rear (marking) and holding the code bar shiftbar in marking position. The common transfer lever (third from left, operating the common code bar, third from bottom) has an extension which passes behind the number 1 and 2 transfer levers. There is no connection between the common transfer lever and the selecting mechanism, but when either the number 1 or number 2 pushbar is selected, the associated transfer levers position the common code bar shiftbar to the rear (marking). The right ends of these code bars determine vertical positioning of the type box. Refer to Figures 3-50, 3-51, and 3-52. As the selector cam-clutch completes its revolution, the trip shaft operating lever rides to the peak of the code bar clutch trip cam. 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 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 shiftbar in marking position (left) during the previous operating cycle is moved to spacing position (right) by the forward shift

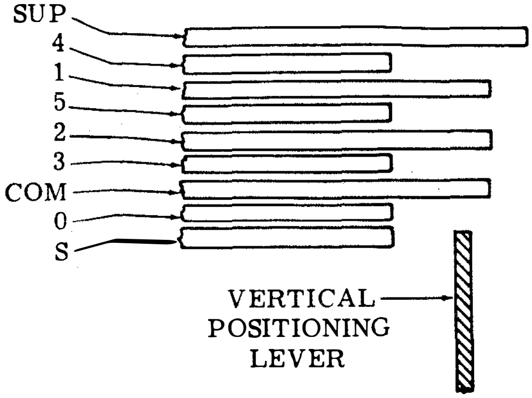


Figure 3-52. Vertical Arrangement of Code Bars, Front View

lever, unless the transfer lever is once again holding that bar to the rear (marking). The rear shiftbar, as it moves to the left (figure 3-51), carries with it any code bar shiftbar held in the marking position, completing the transfer of intelligence from the selecting mechanism to the code bars. At the end of one revolution, the code bar clutch trip lever strikes the clutch shoe lever. Inertia of the cam disk assembly causes it to continue to turn to permit the latchlever to drop into the indent in the cam disk, and the clutch is held disengaged. The code bars, code bar shiftbars and shift levers are held in the selected position, but the transfer levers and intermediate arms are free to position the shiftbars forward or to the rear in response to new input signal intelligence from the selector.

c. Code Bar Arrangement. A total of nine code bars in marking (left) or spacing (right) position convey mechanically translated signal intelligence to the typing and function mechanism. The code bars are arranged from top to bottom as follows:

Suppression, No. 4
No. 1
No. 5
No. 2
No. 3, common, zero (0) and LETTERS-FIGURES shift (S).

d. Positioning the Type Box. 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. Refer to Figure 3-53. 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. 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 top is fastened at its left end to the spring drum and, at its right end, to the spacing drum. It acts in opposition to the upper draw-wire rope and holds the two drums in phase, Figure 3-54. A tensioning pulley rides the underside of the lower draw-wire rope, to take up any slack which

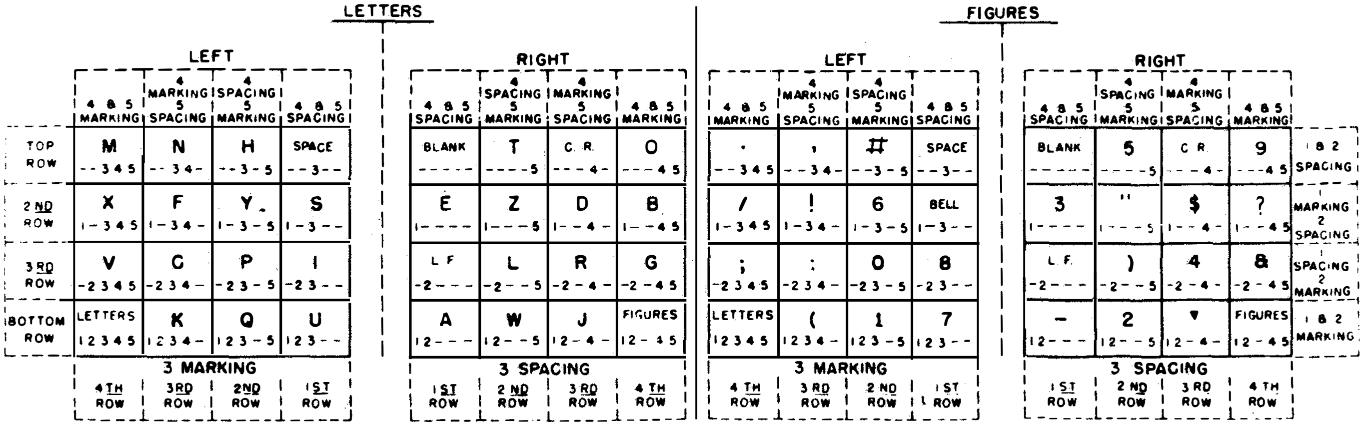


Figure 3-53. Typical Type Box Pallet Arrangement

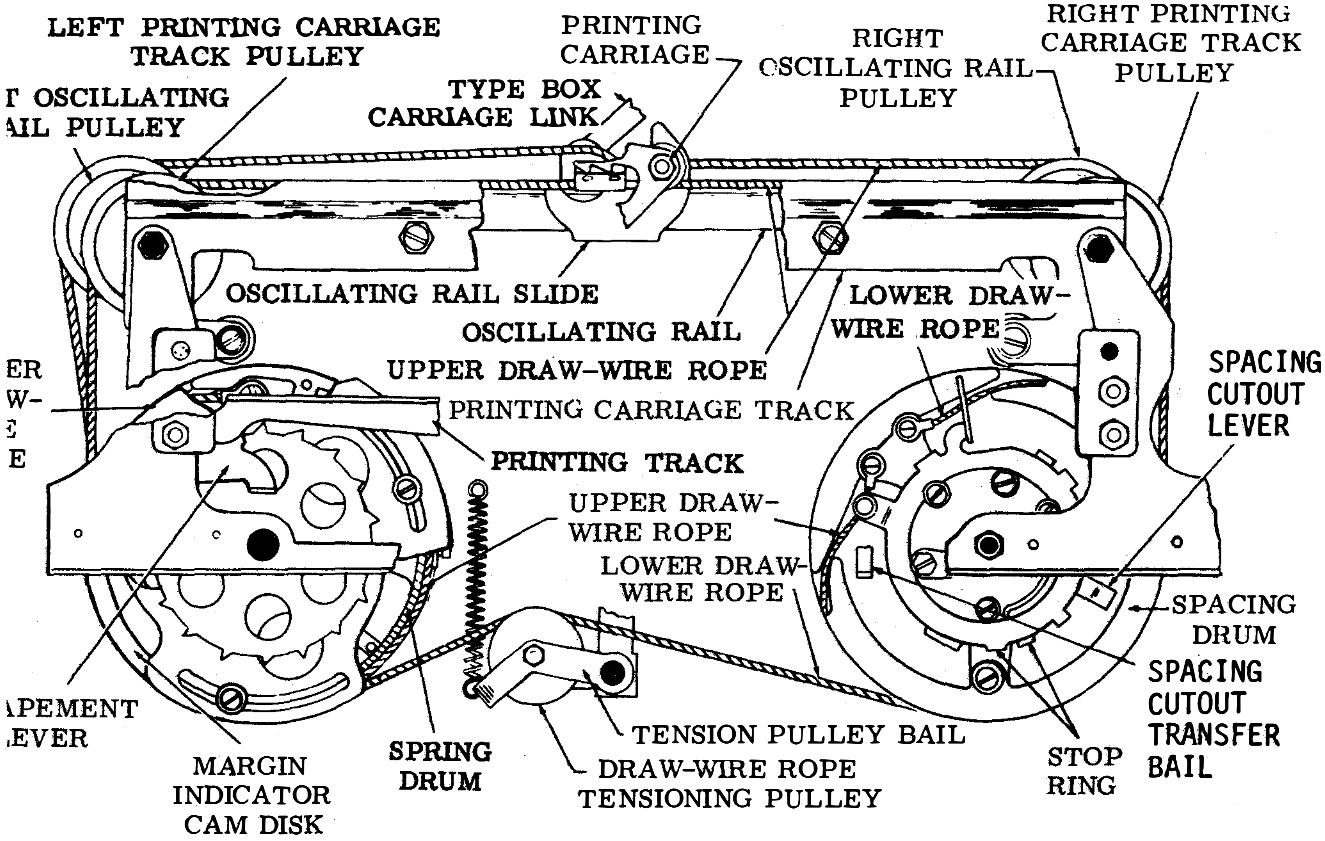


Figure 3-54. Draw-Wire Rope and Drums, Front View

may occur due to stretching of the upper and lower draw-wire ropes. The oscillating rail is supported by pivoted arms at each end. These arms which extend downward are pivoted on the typing unit frame at their lower ends. Thus, the oscillating rail and draw-wire rope that it carries with it may be shifted to the left or right with no change in position relative to each other. The oscillating rail shift slide and two oscillating rail shift links are used to accomplish the horizontal positioning of the oscillating rail and also connect it with the oscillating rail shift slide. The links are pivoted and are such a length that only one at a time may be fully extended.

e. LETTERS-FIGURES Shift. Refer to Figure 3-55. Mechanical limitations restrict the selection from the type box pallets to four horizontal rows and eight vertical rows. With a total of sixteen vertical rows in the type box, it is necessary to determine which of two fields, LETTERS (left half of type box) or FIGURES (right half of type box) will be presented for printing. To accomplish this, a special non-printing signal combination is used for each shift operation. Upon receipt of the LETTERS or FIGURES shift signal, mechanisms provided in the stunt box initiate the shifting operation. This, as are other non-printing operations, is described under Functions. The operation of the mechanisms that perform the actual shifting of the type box, however, are described below. The lowermost code bar, designated S, contains a pin near its right end that projects upward to permit engagement with the stunt box. The code bar is positioned to the left (the FIGURES position) or to the right (the LETTERS position). A slotted extension of the S code bar engages a tongue from the right end of the LETTERS-FIGURES shift slide and causes it to follow the S code bar movements. Pins at the end of the shift slide serve as lower guides for the right and left shift link breaker slides. Pins which project from the front plate serve as upper guides and pivot points. The main bail has left and right breaker slide bails mounted on its ends. Upon receipt of the signal code for the LETTERS shift operation, the shift slide is moved to the right (figure 3-55). This positions the left shift link vertically with its lower end over the left breaker slide bail. The right breaker slide is positioned such that its lower end is to the right of the right breaker slide bail. As the main bail moves upward, the right breaker slide bail clears the right breaker slide, but the left breaker slide bail engages the left breaker slide and moves it upward. As a result of this action, the left oscillating rail shift links open and the oscillating rail is permitted to be moved to the right. This action presents the LETTERS field in line for printing. In a similar manner, when the signal code for the FIGURES shift is received, the right oscillating rail shift links are opened, the oscillating rail shifts to left, and the FIGURES field of the type box is in line for printing.

f. Vertical Positioning. Refer to Figure 3-56. The selection of the various characters from the four horizontal rows and eight vertical rows in either field (FIGURES or LETTERS) and the

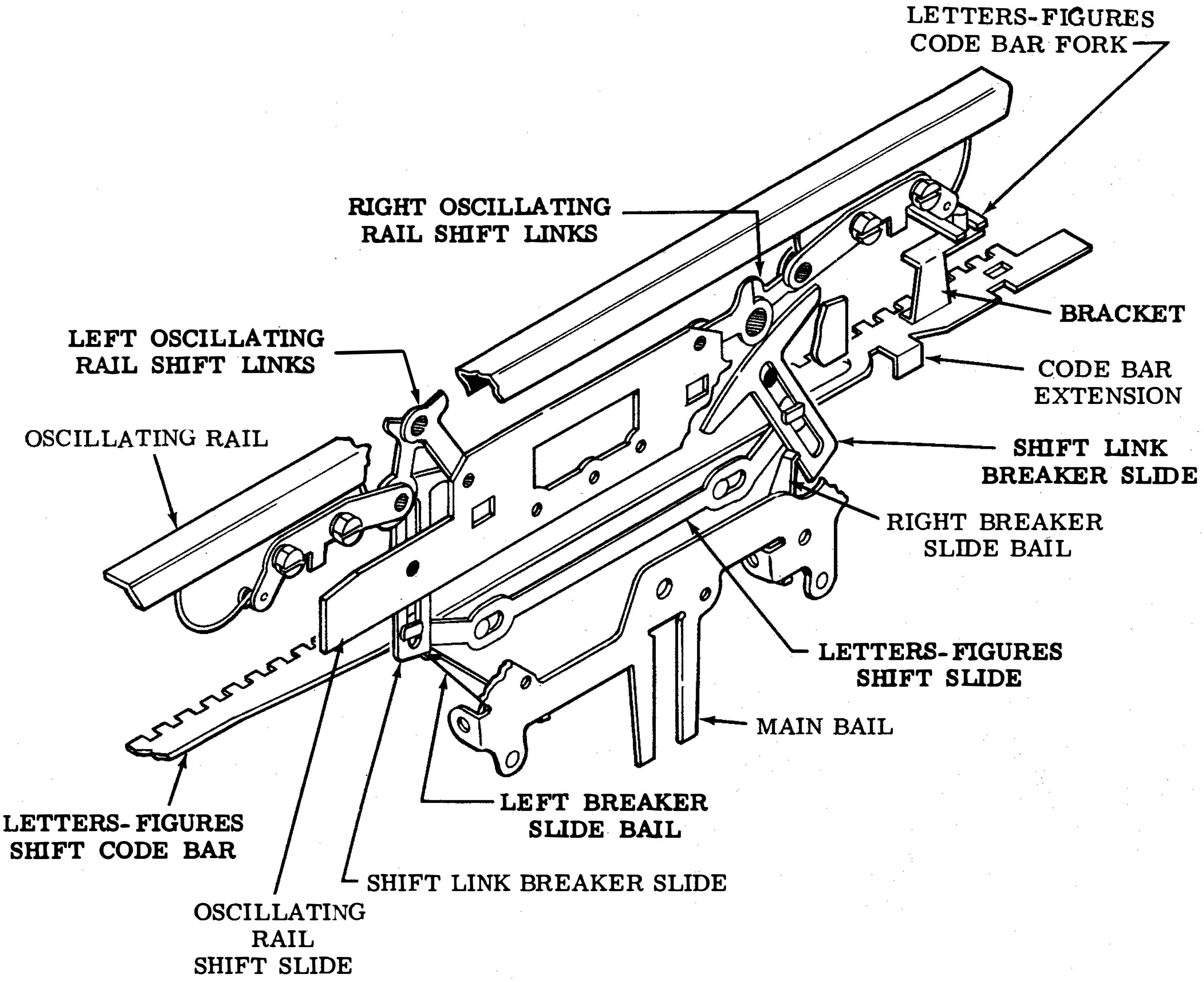


Figure 3-55. LETTERS-FIGURES Shift Mechanism, Left Front View

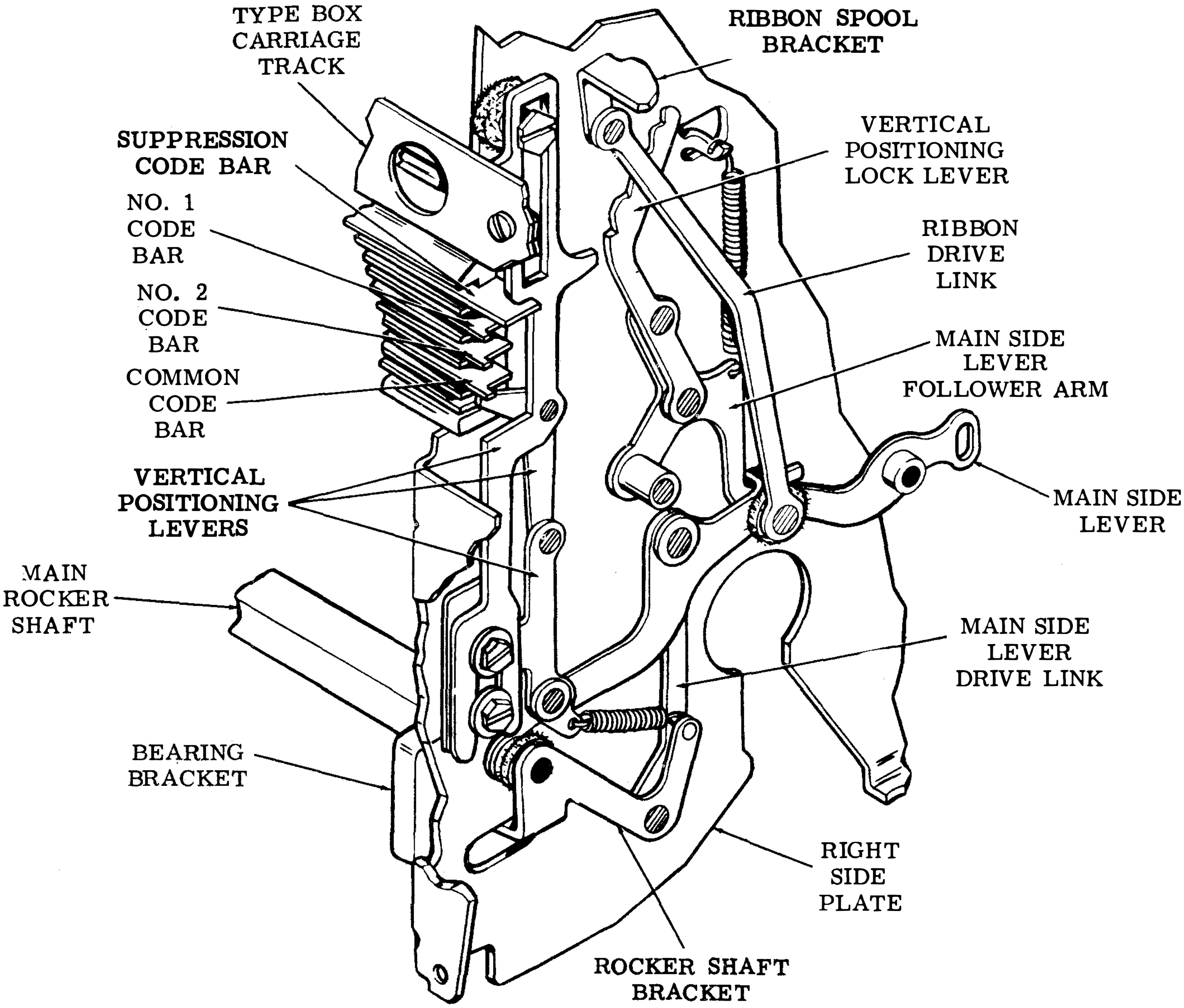


Figure 3-56. Vertical Positioning Mechanism, Right Front View

printing of those characters take place as follows:

(1) The number 1 and number 2 code bars determine the selection of the horizontal row. The number 3 code bar determines whether the selection is to be made from the left four vertical rows or the right four vertical rows (in either the FIGURES or LETTERS field). The number 4 and number 5 code bars determine the selection of one row from the four vertical rows predetermined by the number 3 code bar.

(2) Four code bars (longer than the others) extend through the right code bar bracket and serve as stops for the right vertical positioning levers (figure 3-56). They are (from top to bottom) the suppression, number 1, number 2, and common code bars. Notches are arranged in the left ends of these code bars so that the left side vertical positioning levers are stopped, in each case, by the same bar that blocks the right side levers. After all code bars have been positioned by the code bar positioning mechanism, the code bar clutch cam follower arm and its roller, in traversing the sloping indent on the code bar clutch cam, rotates the clutch trip lever shaft. As the shaft turns, it first causes the function clutch, Figure 3-57. 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 latchlever in the same manner as was the code bar clutch. During its rotation, the type box clutch operates a drive link and a bracket to cause the main rocker shaft to oscillate. This, in turn, through its left and right

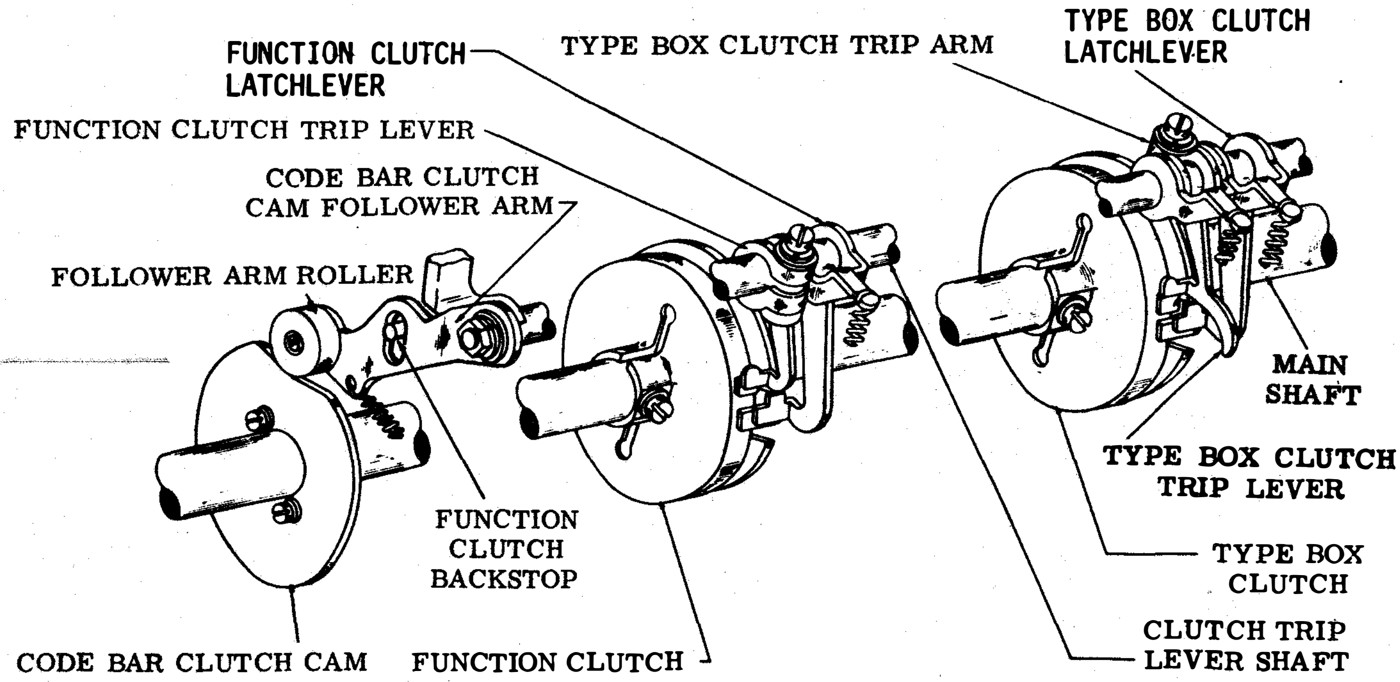


Figure 3-57. Clutch Trip Mechanism, Right Rear View

brackets and the main side drive links, extends the motion to the vertical positioning levers (figure 3-56). 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.

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

g. <u>Horizontal Positioning</u>. A bracket attached to the main rocker shaft applies a vertical motion to the main bail by means of two main bail links as illustrated in Figure 3-58. Fastened 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 driving force of the type box clutch, the left shift slide links, if not buckled, will try to shift the oscillating rail slide drive links toward the right, while the right slide drive links, if not buckled, will try to shift the oscillating rail shift slide links to the left. When the number 3 code bar is shifted toward the left (marking), the horizontal motion reversing slide is shifted toward the left by the reversing slide shift lever, and is held there by detent levers. A bracket near the right end of the reversing slide will then make contact with the right shift slide drive links and cause them to buckle. As the main bail is driven downward, the unbuckled left shift slide drive links will start to shift the oscillating rail shift slide toward the right. This will position the type box so that the characters to be printed will be located in the left half of the FIGURES or 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 will then make contact with the left shift slide drive links and they will buckle. As the main bail is driven downward, the unbuckled

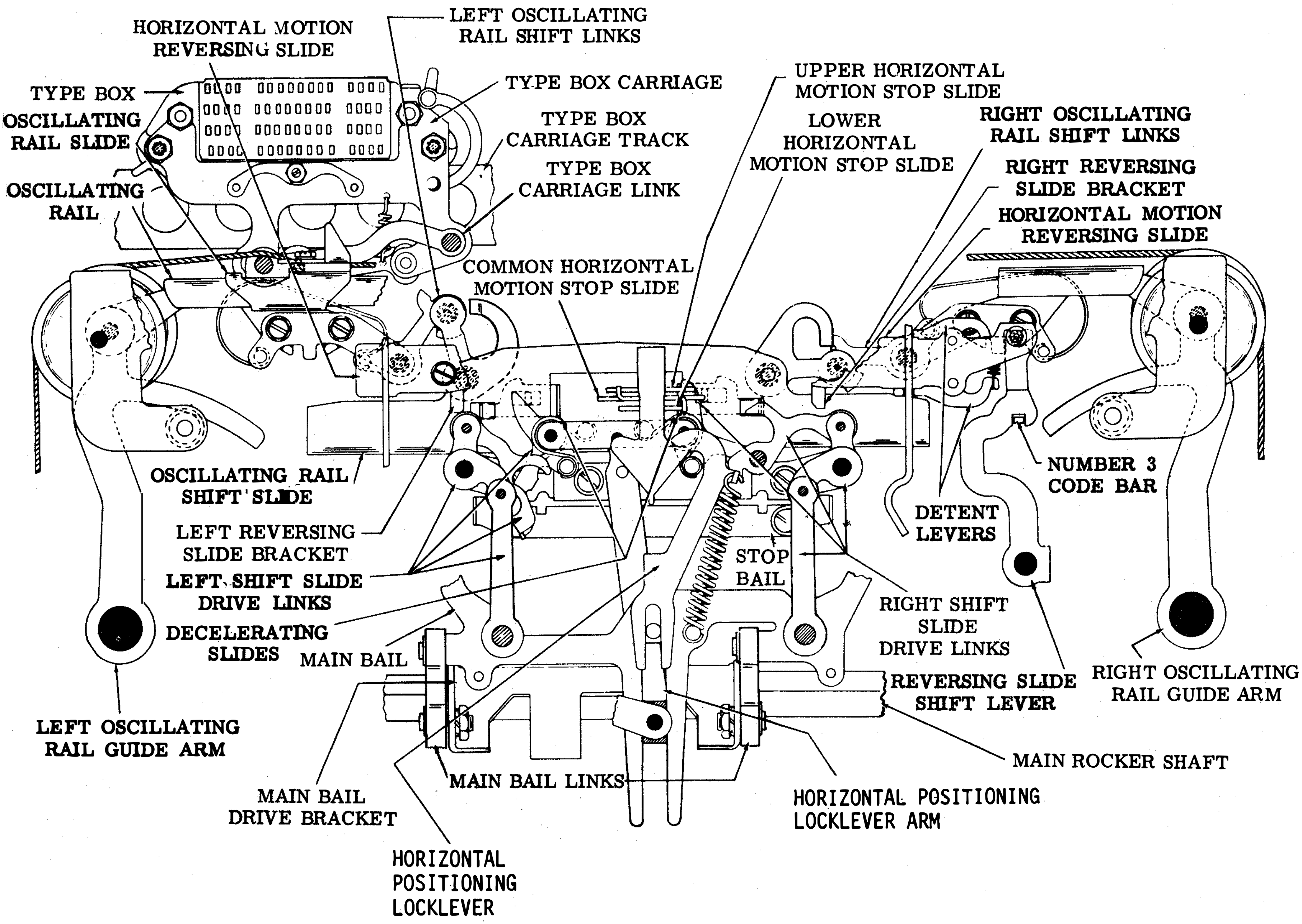


Figure 3-58. Horizontal Positioning Mechanism, Front View

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 LETTERS field.

(1) After determination of the field (FIGURES or LETTERS) and the group of vertical rows in which the characters to be printed are located, the number 4 and the number 5 code bars operate three horizontal motion stop slides to determine the row in that group in which the character is to be found, Figure 3-59. A wedge shaped horizontal positioning locklever which is pulled downward by the main bail through a yield spring bears against the horizontal positioning locklever 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 comes to rest when it strikes the blocked decelerating slide. This, in turn, ends the downward excursion of the locklever, 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 ocillating rail shift slide. It is during this time that the horizontal motion stop slides are positioned for the selection of the next character. The number 4 and number 5 code bars each operate a code bar bail bellcrank. Each, in turn, moves a horizontal motion stop slide toward the front (marking) or toward the rear (spacing) (figure 3-59). A third (common) stop slide (spring tensioned toward the rear) is located between the upper and lower stop slides. These slides have projections which pass across the front edges of these slides (figure 3-58). 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 is the second longest stop (operated from number 4 code bar), and the lower slide (operated from the number 5 code bar) is the third longest stop.

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

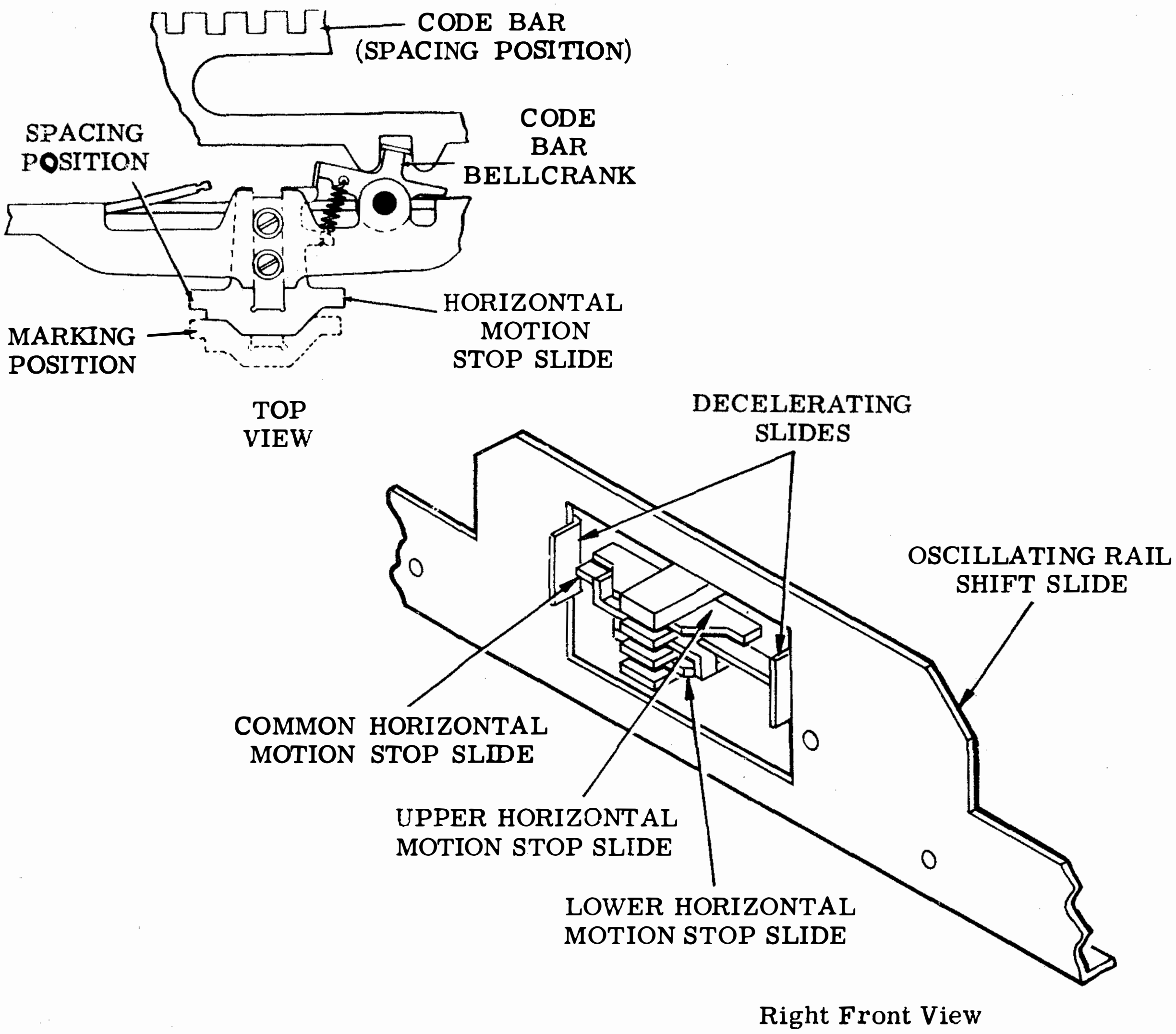


Figure 3-59. Horizontal Motion Stop Slides

FIGURES field or the LETTERS field) in line for printing. When the number 4 code bar is toward the left (marking) and the number 5 code bar is toward the right (spacing), the upper and the common stop slides are toward the front and the lower stop slide is toward the rear. The oscillating rail shift slide is moved toward the right or left of its central position until it is stopped by one end of the lower stop slide. This positions the third vertical row (right or left of the center of the FIGURES field or the LETTERS field) in line for printing.

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

h. Printing Mechanism. When mechanically conditioned by the code bar mechanism, the printing mechanism prints the selected character, and spaces to the next printing area on the paper, or spaces without printing, or on units so equipped, tabulates horizontally, or returns the type box to the left hand printing margin. The mechanism includes the horizontal positioning mechanism operated by the code bars, spacing mechanisms and carriage return, and the print hammer mechanism. The code bar mechanism and the code bar clutch operate in combination to trip the type box clutch. When the type box clutch is tripped, it initiates mechanisms involved in vertical and horizontal positioning of the type box, ribbon-feed, and printing. The main rocker 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. The type box, positioned by the printing and spacing mechanisms in accordance with intelligence set up in the code bars, presents a single graphic in printing position for each operating cycle. To prevent printing during a function selection, the type box is positioned to present a vacant type-pallet position. At the proper moment, with the type box locked in printing position, a spring loaded print hammer is released to tap the selected type pallet sharply against the inked ribbon and the paper. A cleanly imprinted graphic character corresponding to the input signal code combination results, and the printing mechanism trips the spacing clutch to move both the type box and the print hammer to the next horizontal printing position to the right. The type box is capable of vertical and horizontal positioning in response to the permutations set up by the code bar mechanism. When positioned to correspond to the input code intelligence, the type box presents a single type pallet with the embossed graphic equivalent of the selected code for printing. Printing is accomplished when this pallet is struck by the print hammer to press an inked ribbon against the paper, which is supported by the typing unit platen.

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

(2) Operation. The printing track located on the front of the typing unit, is secured to an extension at each end of the main bail. See Figures 3-42, 3-43, and 3-60.

(a) As the main bail reciprocates vertically, it extends the motion through the printing track, which travels in the guides located at each end of the track. The printing arm extends downward from the printing carriage and rides the printing track.

(b) 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.

(c) 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, driven by the operating bail, is swung toward the type box. When the operating bail is stopped, momentum causes the print hammer bail to continue its travel against the tension of the print hammer bail spring until the printing hammer strikes the selected type pallet. The force with which the hammer strikes is adjustable to three positions marked on the carriage.

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

(1) Spacing. To space the printed character properly, the type box and printing carriages must be advanced with each character printed, Figures 3-60 and 3-61. The spacing must also be accomplished when the input signal code combination represents a LETTER space. As

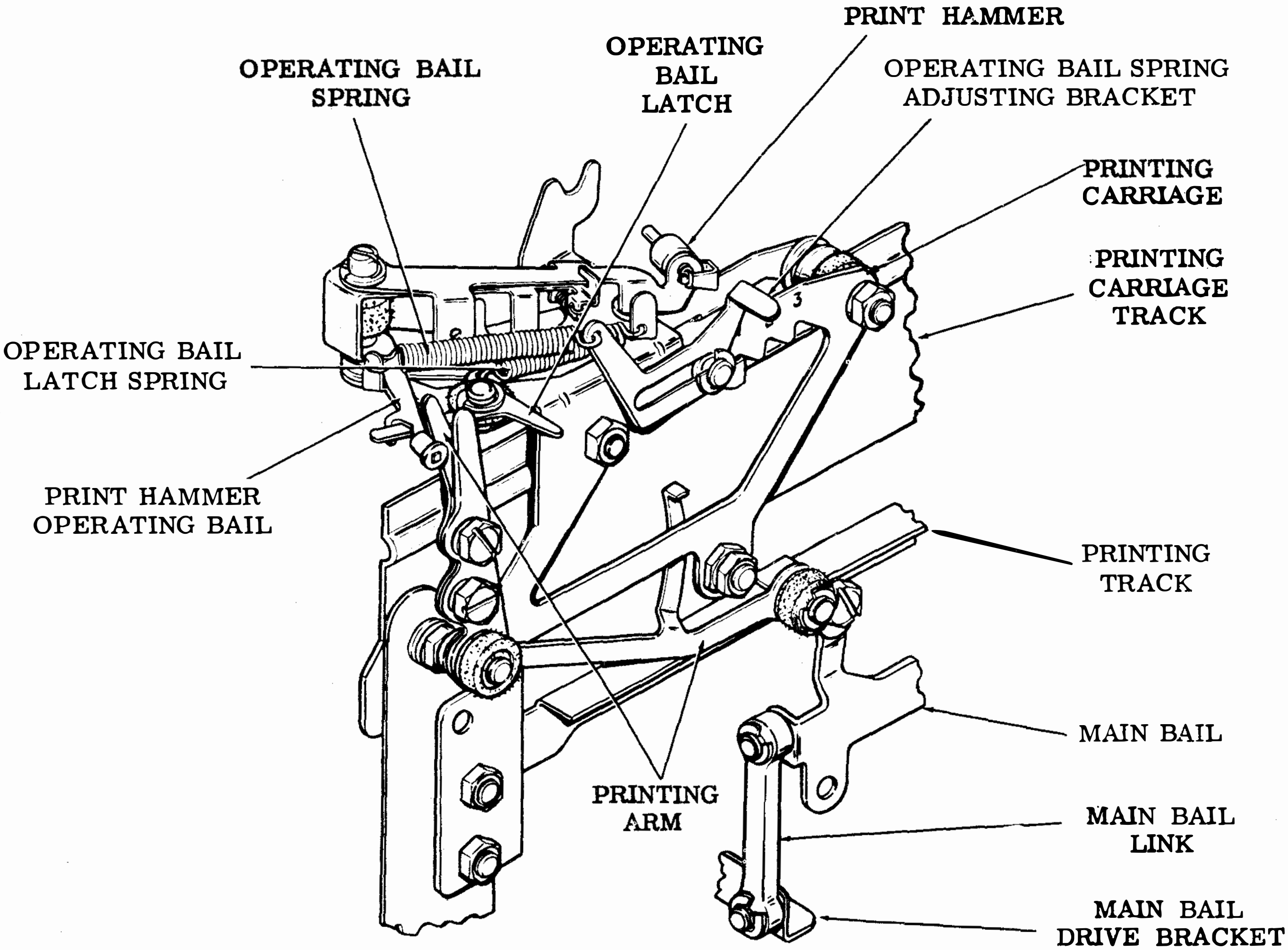


Figure 3-60. Print Hammer and Carriage, Left Front View

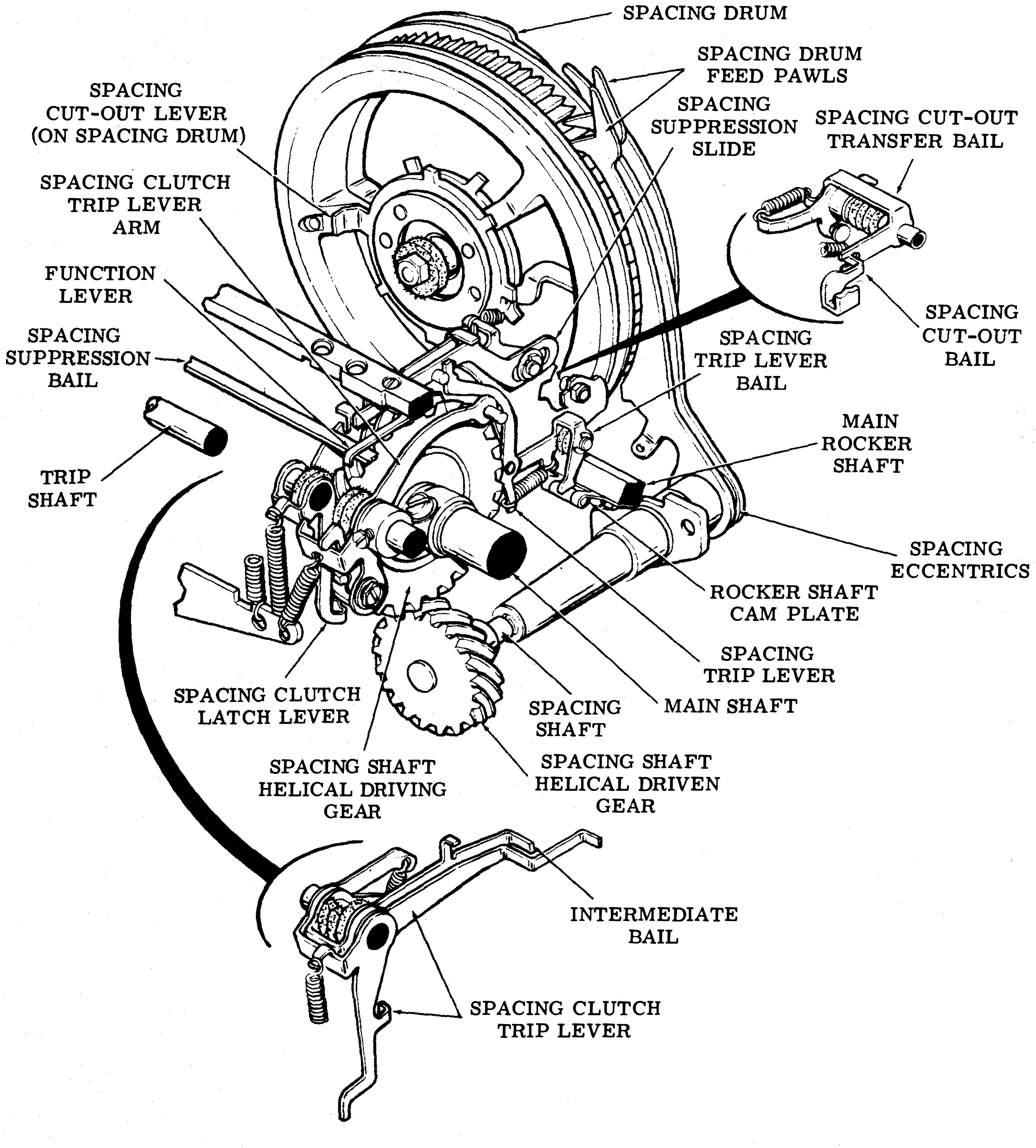


Figure 3-61. Spacing Mechanism, Left Rear View

was shown in Figure 3-54, the carriage is connected to a draw-wire rope which, in turn, is fastened to the spring drum and the spacing drum. The purpose of the spring drum, which contains a torsion spring, is to tension the draw-wire rope and pull the carriage to the left. The spacing drum has ratchet teeth about its perimeter which are engaged by the eccentric driven spacing drum feed pawls (figure 3-61).

(a) 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. The same trip shaft, through a cam on the code bar clutch, trips the function clutch and 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 and will oscillate the main rocker shaft and drive the printing mechanism.

(b) A cam plate (figure 3-61) 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. This causes the latched-up spacing clutch trip lever arm to operate the spacing clutch trip lever and engage the spacing clutch. Before the spacing clutch completes one-third of a revolution, its restoring cam moves the spacing trip lever about its pivot point until it releases the spacing clutch trip lever. The spacing clutch trip lever 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 latchlever 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 latchlever drops into an indent in the cam disk, and the clutch is held disengaged until the trip lever is again operated.

(2) Space Function. The non-typing function by which spacing between words or any spacing other than that which accompanies printing is initiated when the code bars are set in a combination equivalent to the spacing code combination (all spacing except third pulse marking). The function is executed through the code bar clutch, tripping the printing clutch and the spacing clutch. For this function, the type box is positioned so that a vacant pallet (top horizontal row, first right row in the FIGURES field) is presented beneath the type hammer. No printing occurs when the type hammer is tripped in its normal fashion. The stunt box is not involved in the execution of this function.

(3) Space Suppression. When certain non-typing functions are selected or when the carriage reaches the 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 upper end of the spacing trip lever forward and prevent it from engaging the spacing clutch trip lever (figure 3-61).

(a) 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 and the function mechanism is operated the bail is engaged and moved forward. The suppression slide moves forward with the bail and prevents engagement of the spacing clutch.

(b) When the carriage is near the extreme right position, a cutout ring on the spacing drum engages the spacing cutout transfer bail (figure 3-61), which in turn operates the spacing cutout bail. The ring and the end of the spacing cutout transfer bail are shown in Figure 3-54. The spacing cutout bail shifts the spacing suppression slide forward and prevents engagement of the spacing clutch until the carriage is returned. The maximum number of characters which the typing unit may print is eighty-five, including spacing function spaces. In order to prevent spacing beyond this point, and subsequent damage to the equipment, several teeth are omitted from the spacing drum ratchet wheel.

(4) Margin Indicator. 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 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.

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

(1) Ribbon-Feeding. The following paragraphs describe the ribbon-feed mechanism, operation and function, Figure 3-62.

(a) The left and right ribbon-feed mechanisms oscillate in a vertical plane with each revolution of the type box clutch. They are driven by ribbon drive links attached to the main side levers (figure 3-56). At their uppermost positions, the ribbon mechanisms position the ribbon relative to the horizontal type box row being printed. After each character is printed, the ribbon mechanisms are dropped downward together with and behind the type box, to permit viewing of the last printed character. The ribbon is held in place at the

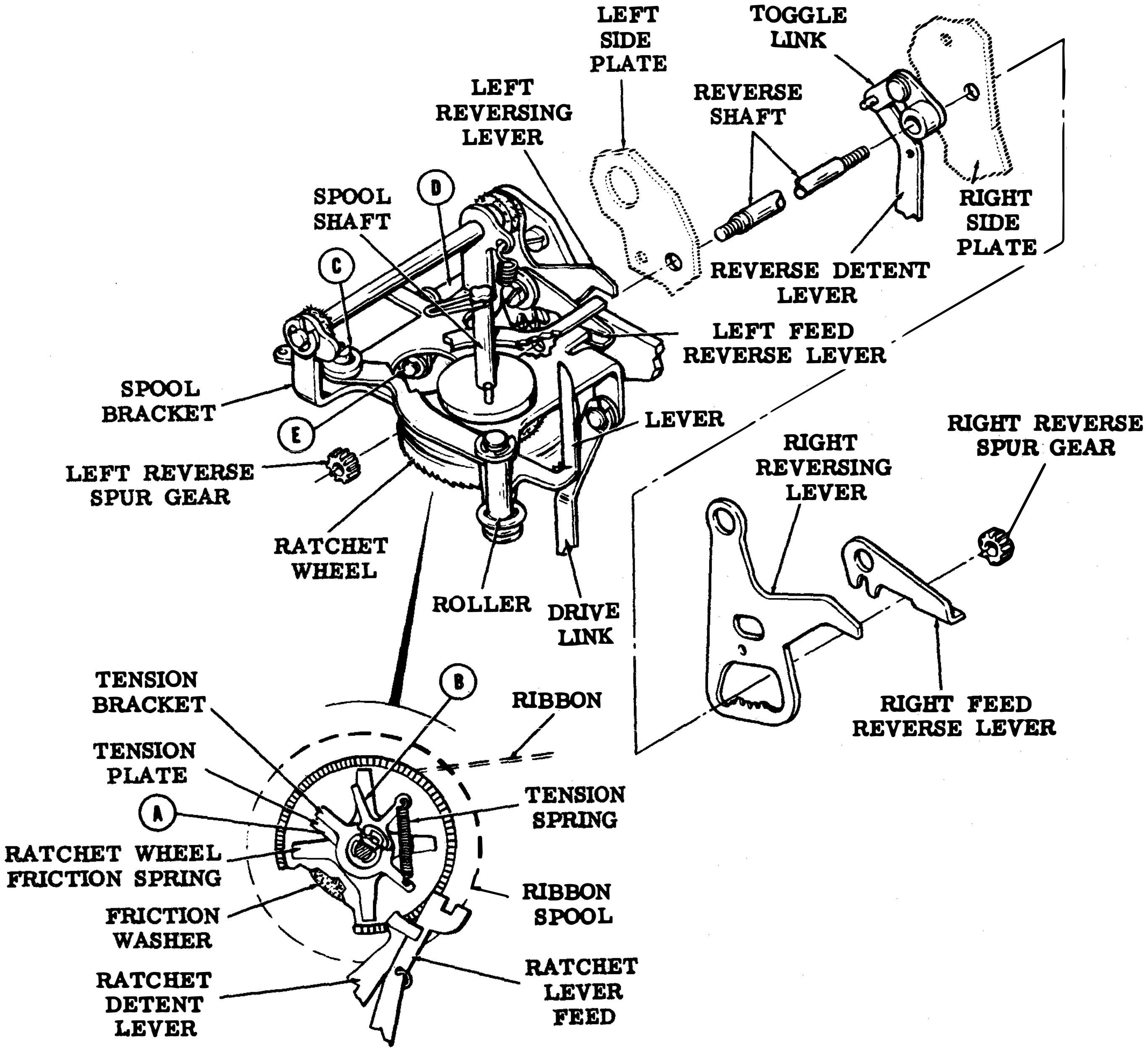


Figure 3-62. Ribbon-Feeding Mechanism, Left Front View

point of printing by a ribbon guide fastened to the rear of the type box carriage.

(b) Each of the ribbon mechanisms consist of a bracket which is hinged at its rear end, and upon which is mounted a ribbon spool shaft (figure 3-62). A ribbon tension bracket is keyed to the lower end of the ribbon spool shaft. A ribbon ratchet wheel is mounted freely on the ribbon spool shaft just below the ribbon spool bracket, from which it is separated by a friction washer. This applies a constant drag to the ratchet wheel.

(2) Operation. Operation of the ribbon-feed mechanism is described in the following paragraphs.

(a) A ribbon tension plate which is keyed to the hub of the ribbon ratchet wheel has two projecting lugs (A and B, figure 3-62) that stradle 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).

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

(3) Ribbon Reversing. When the ribbon has been completely unwound from one spool, it is necessary to reverse 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 (figure 3-62). 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.

(a) The next time the ribbon mechanism is moved upward, the displaced ribbon lever engages the end of the left ribbon reversing lever and causes it to move to the position shown in phantom in Figure 3-62.

(b) As the lever moves, its teeth rotate the left spur gear which, through the ribbon reverse shaft, turns the detent cam and the right spur gear. As the right spur gear moves the right ribbon reversing lever downward, a pin on the lever drives the right ribbon-feed lever downward to disengage the ratchet feed and wheel. At the same time a pin on the left ribbon reversing lever moves the left ribbon-feed reversing lever upward to permit the left ratchet feed and detent levers to engage the left ribbon ratchet wheel. Thus, the ribbon mechanisms are positioned to rewind the ribbon on the left ribbon spool. When it nears its end on the right ribbon spool, the ribbon is again reversed in a manner similar to that just described. During the reversing cycle, the ribbon is maintained taut by the previously extended ribbon tension spring.

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

(1) Paper Feed (Friction Feed). Paper (friction feed) operation and function is described in the following paragraphs, Figure 3-63.

(a) Paper for the page-printed message is stored on an 8-1/2-inch wide roll. The paper roll is mounted on a spindle and suspended between the two side plates at the rear of the typing unit. Leaving the roll, the paper is guided over a paper straightener shaft, then travels downward behind the platen and three pressure rollers.

(b) A paper pressure bail at the front of the platen equalizes pressure brought to bear on the paper by the pressure rollers. When it is necessary to straighten or remove the paper from the platen, the pressure bail can be released by rotating clockwise the paper release lever, located at the top rear of the right side plate. Two paper fingers operated on a spring tension shaft across the front of the platen hold the copy paper firmly against the plate in position for printing.

(2) Paper Feed (Sprocket Feed). Paper (sprocket feed) operation and function are same as friction feed except for the different platens and sprockets, Figure 3-64. Paper fingers are released to a spring loaded upright position by pushing a lever marked PUSH on the top rear of the right side plate. The fingers are repositioned by depressing them manually until the end of the paper guide shaft latches an indent on the release lever.

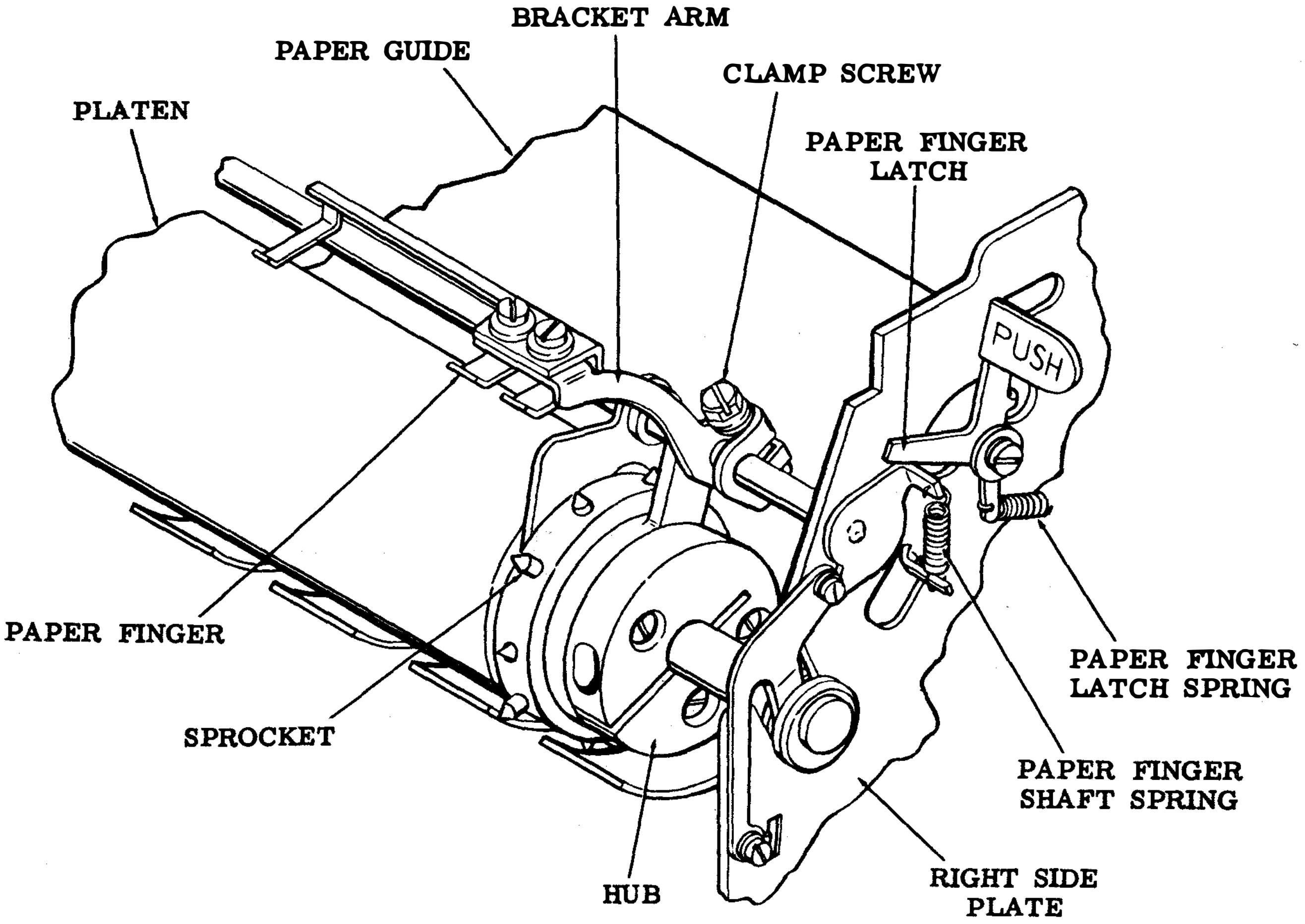


Figure 3-63. Friction Feed Platen Mechanism, Right Front View

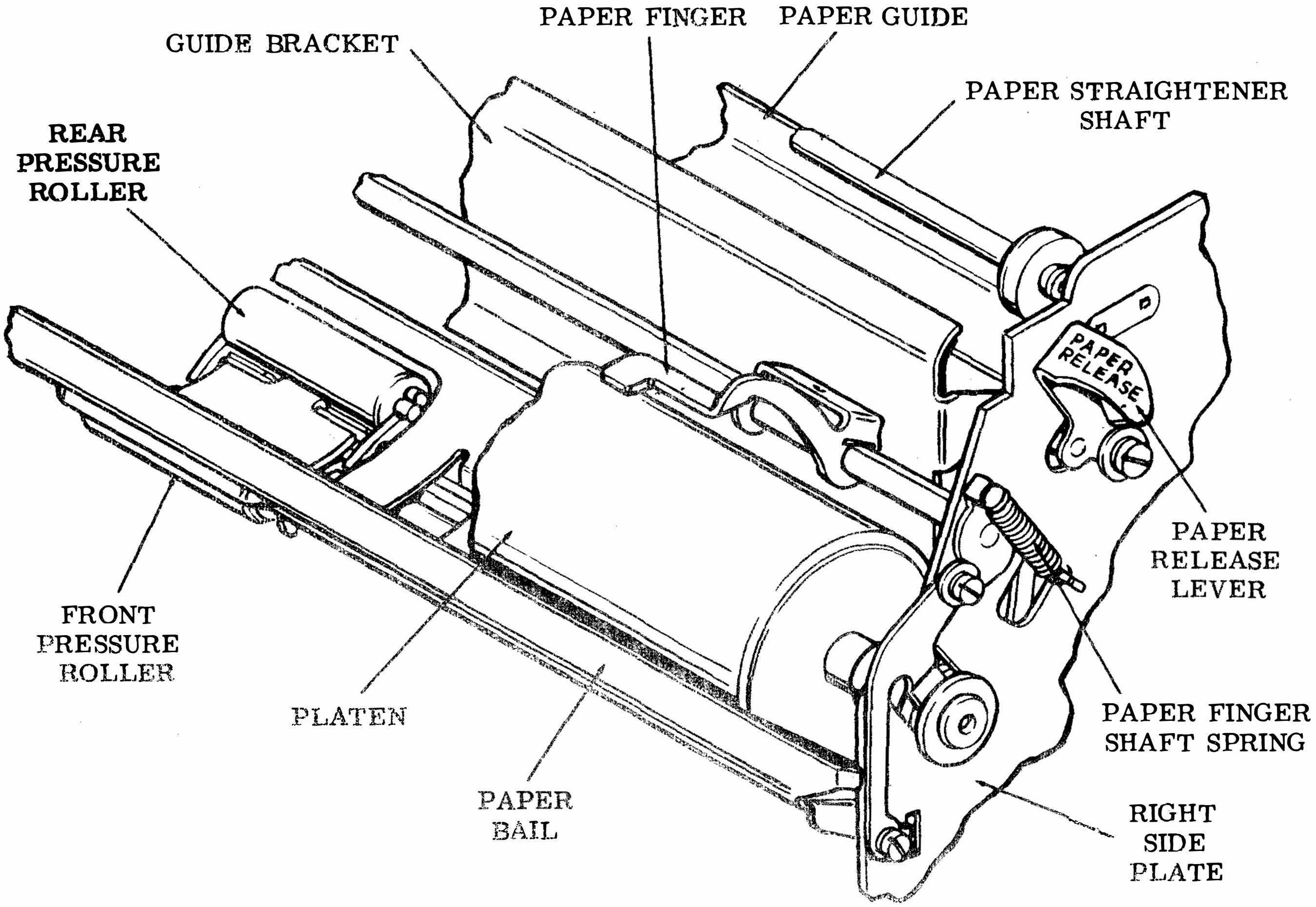


Figure 3-64. Sprocket Feed Platen Mechanism, Right Front View

1. Stunt Box. The stunt box, Figure 3-65, is a compact self-contained device with memory storage capabilities that provide the typing unit with the facilities of a built-in sequence selector. In effect, it allows the 32 available LETTERS and FIGURES character combinations to be used again for special, non-printing operations, without the sacrifice of printed characters. It operates in response to combinations set up in the code bar mechanism, with a single character or several characters in sequential combination used to initiate a single function. In general, the stunt box may be programmed to perform three basic types of operation: mechanical initiation of internal functions within the typing unit; electrical control of functions within the teletypewriter set; and electrical control of external equipment. The following paragraphs describe the function and operation of the stunt box.

(1) 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) As in printing, the reception of function codes results in the positioning of the code bars. The back edges of the code bars are notched as shown in Figure 3-66. Positioned directly behind the code bars is a stunt box, which contains the function bars for the various functions (figures 3-65 and 3-66). 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.

(3) When the function clutch is engaged (figure 3-57), 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 as illustrated in Figure 3-67. As the spring-tensioned function bars are released, they move forward to bear against the code bars. If the code bars are positioned for a function, each tine on the function bar for that function will be opposite a notch in the code bar. This will permit the selected function bar to continue to move forward into the code bars, while the other function bars are blocked by one or more code bars, Figure 3-68.

(4) Associated with each function bar in the stunt box is a function pawl and a function lever. In the unselected position, the function bar is not latched with its function pawl, Figure 3-69. When the function bar reset bail

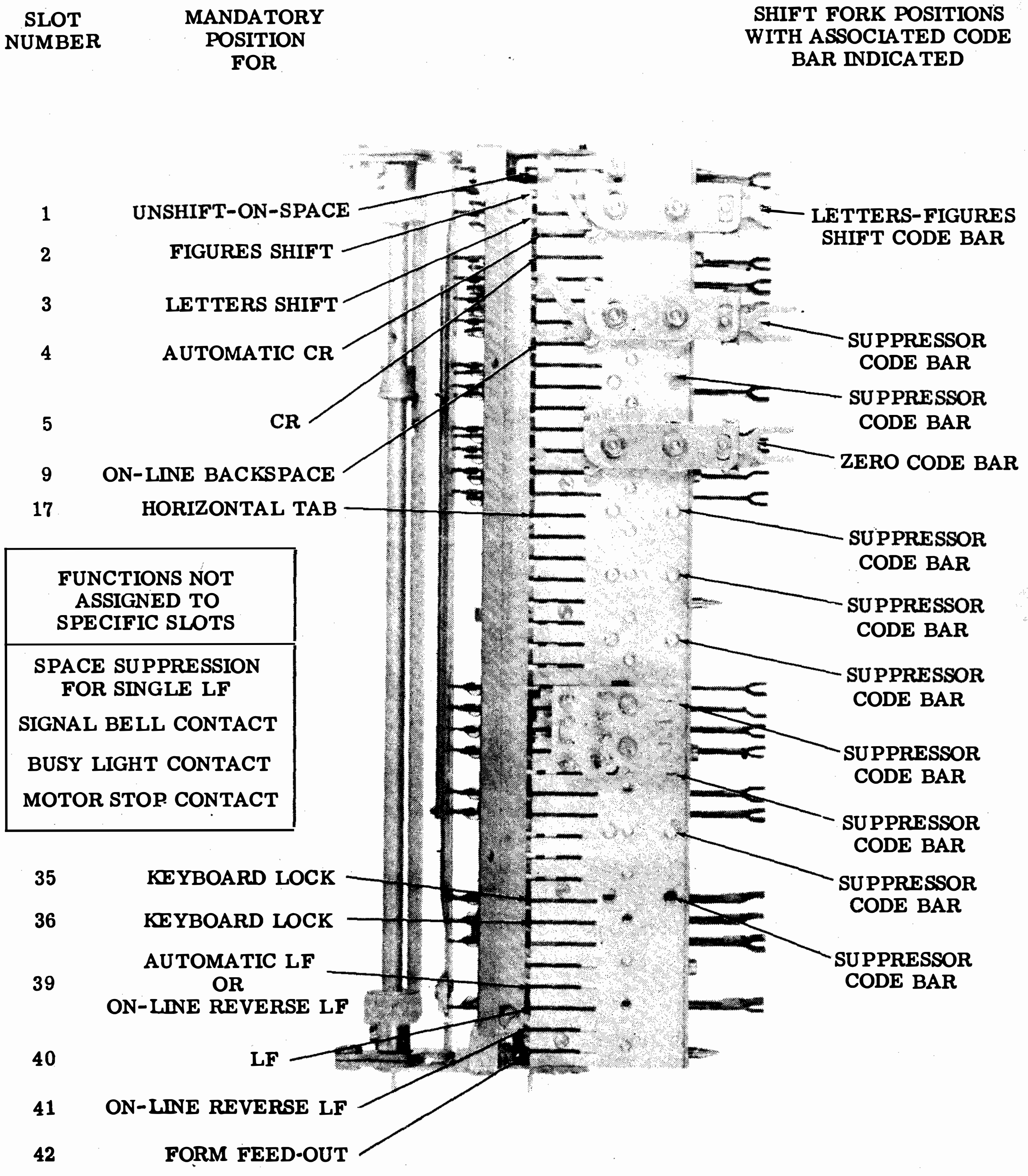


Figure 3-65. Stunt Box, Top View

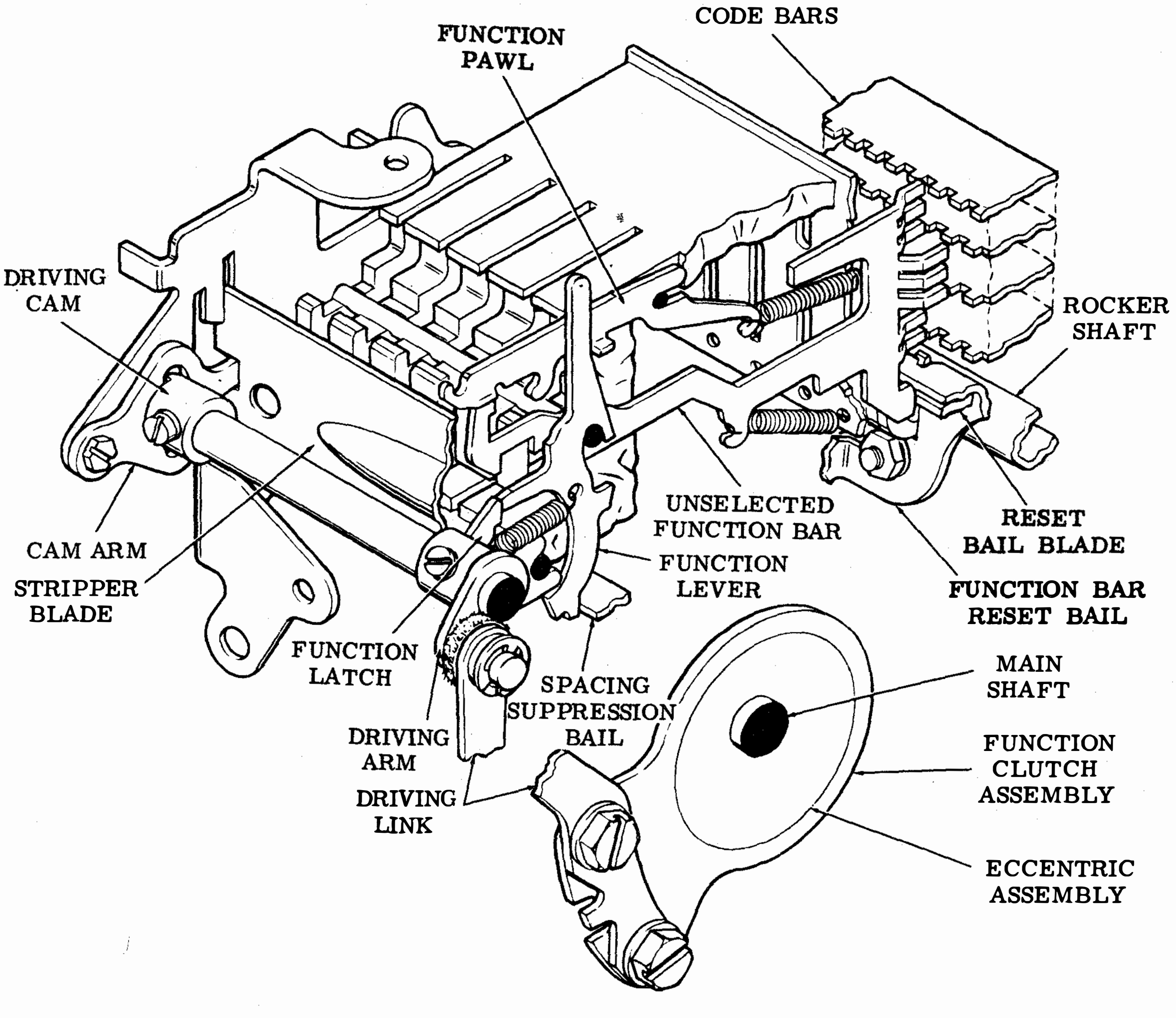


Figure 3-66. Stunt Box (Function Linkage Unselected), Left Rear View

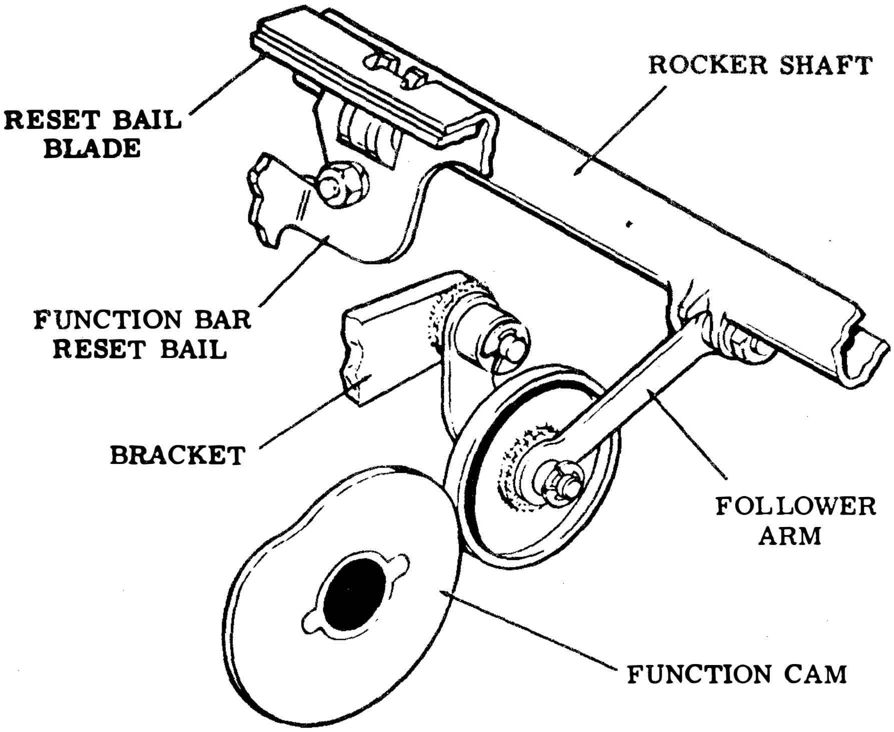


Figure 3-67. Reset Bail Mechanism, Left Rear View

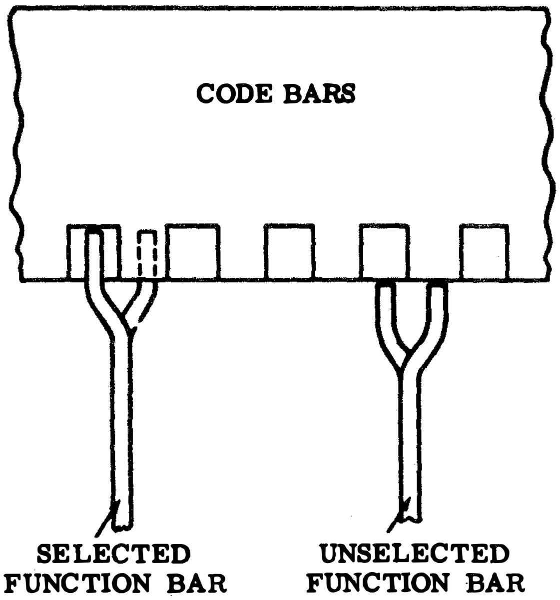


Figure 3-68. Function Bar Selection, Top View

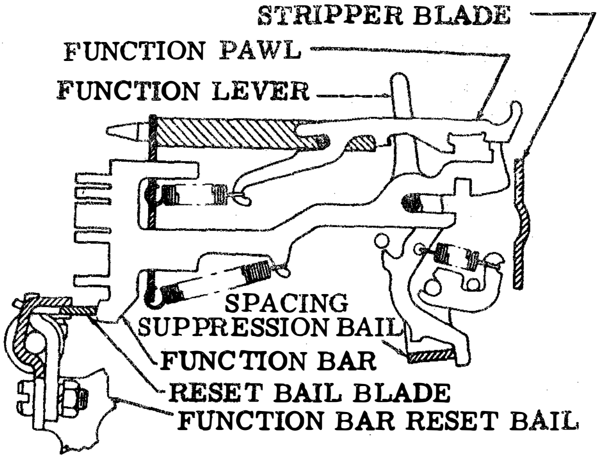


Figure 3-69. Typical Function Linkage (Unselected), Right Side View

blade releases the function bars, any selected bar will move sufficiently forward (to the left), Figure 3-69, to permit it to engage its function pawl. Then, as the reset bail blade returns the function bar to its initial position, the function bar carries the function pawl to the rear (to the right), Figure 3-70. The function pawl, in turn, moves the function lever clockwise about its pivot point. A projection at the lower end of most function levers operates the spacing suppression bail, and the selected levers move the bail forward. Either the upper or the lower end operates the indicated function.

(5) Near the end of the function cycle, a stripper blade (figure 3-66) 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 latchlever falls into the indent of the clutch cam, in the same manner as described in connection with the code bar clutch.

m. Carriage Return Function. The following paragraphs describe the carriage return function mechanism. Refer to Figures 3-71 and 3-72.

(1) The carriage return function mechanism is located in the right end of the typing unit. Reception of the input signal code combination for the function causes the function bar, pawl and lever to operate (figure 3-71). The lower end of the function lever engages the carriage return

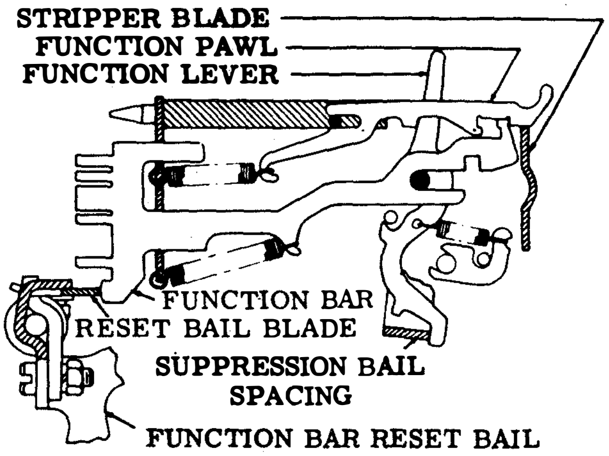


Figure 3-70. Typical Function Linkage (Selected), Right Side View

slide arm and pushes it forward. 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 (figure 3-72).

(2) 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 carriage 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 setscrew 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

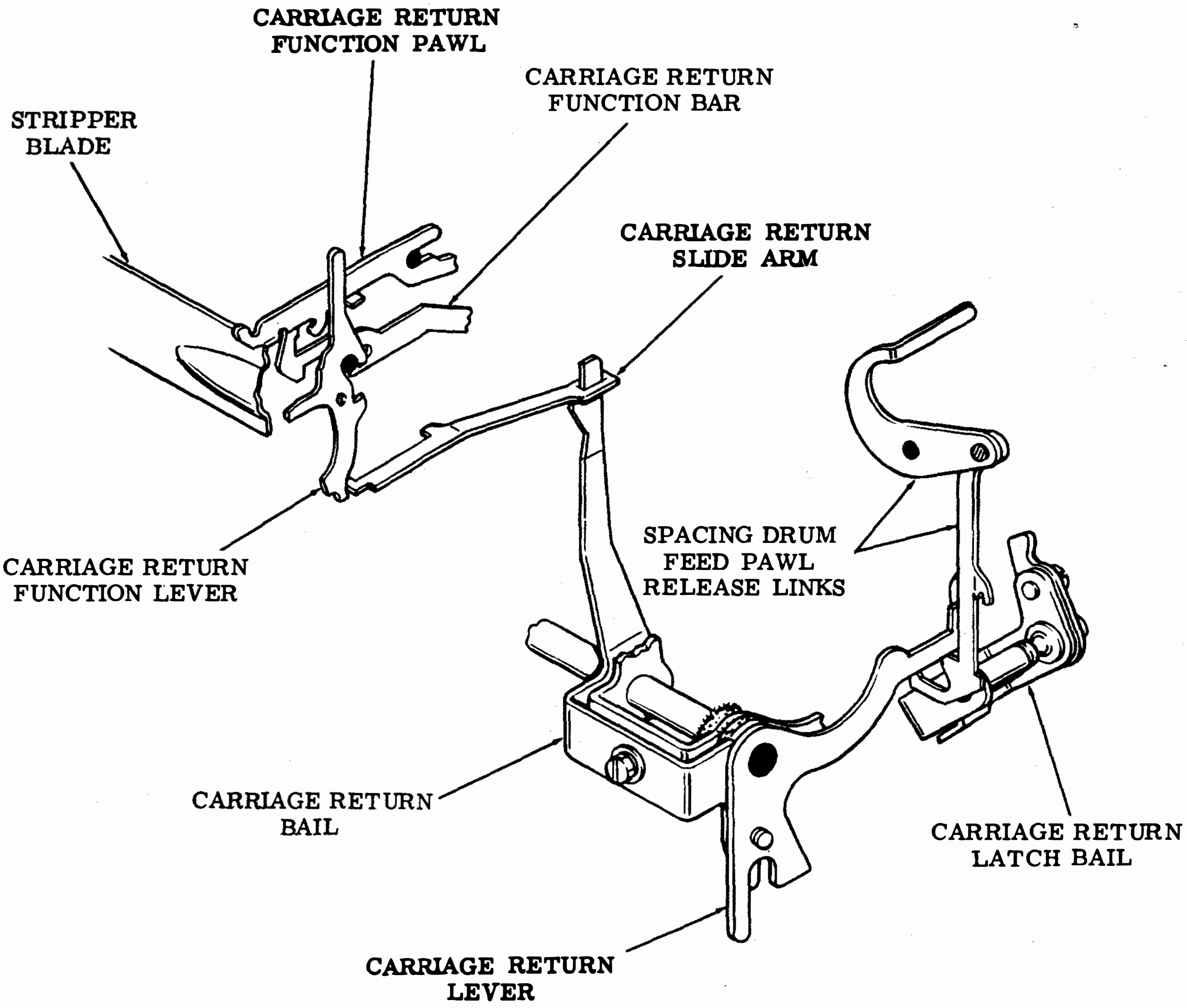


Figure 3-71. Carriage Return Function Mechanism, Left Rear View

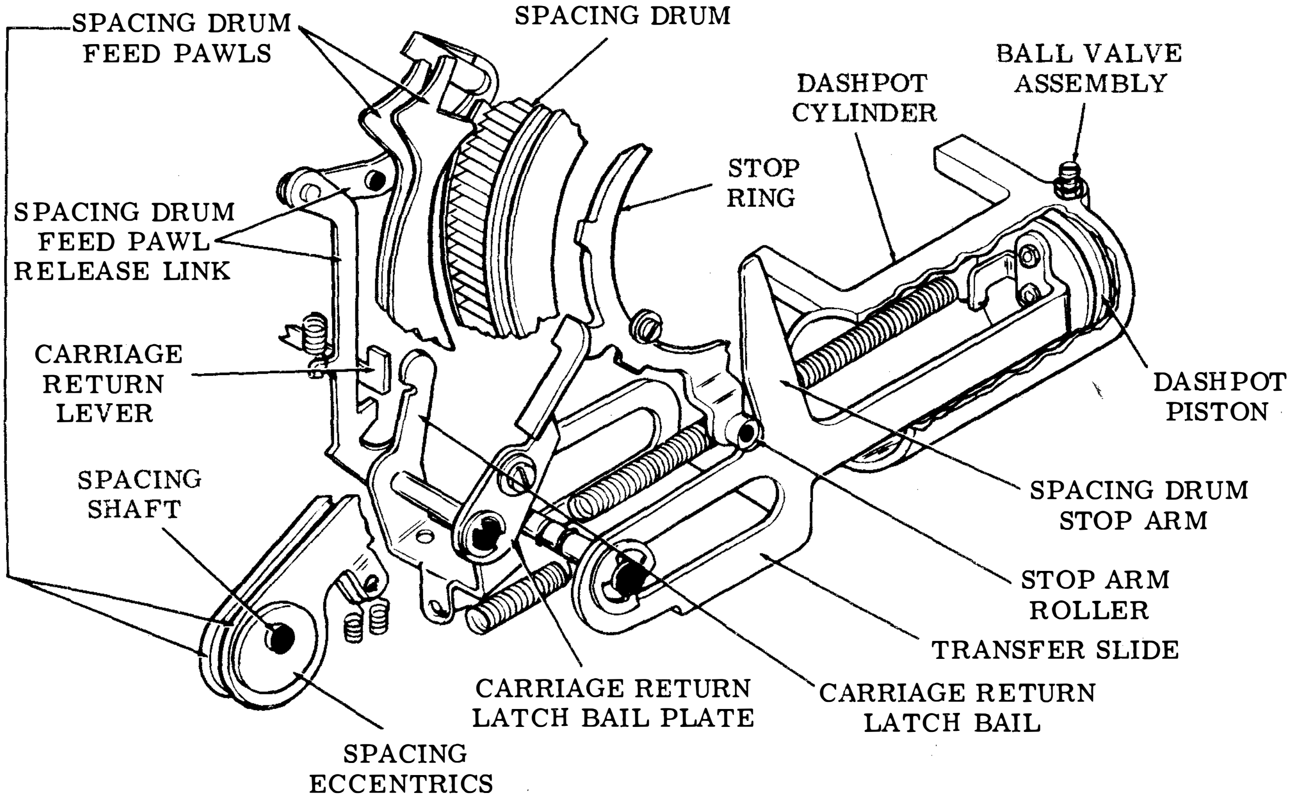


Figure 3-72. Carriage Return Function Mechanism, Left Front View

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.

(3) Local (off-line) operation of the carriage return mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the carriage return lever (figure 3-71), 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.

n. Line-Feed Mechanism. The line feed mechanism permits single or double line advance of paper in the platen mechanism when the code combination for this function is received. The function may also be initiated locally through mechanical linkage with the base or keyboard base. The line-feed clutch operates mechanical linkages which advance the paper one or two spaces by rotating the platen. The function clutch controls the function bail and the stripper bail. The function reset bail permits transfer of intelligence from the code bars to the function mechanism and, upon receipt of a function code, operates the function linkage or switch or contact corresponding to the input signal code. The stripper bail resets selected function mechanisms. When the input signal calls for carriage return function, direct mechanical linkage between the stunt box and the spacing mechanism initiates this function. When the input signal calls for line-feed, the function mechanism trips the line-feed mechanism, engaging the line-feed clutch. The following paragraphs describe the line-feed mechanism. Refer to Figures 3-73 and 3-74.

(1) The line-feed 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 (figure 3-73), operates the line-feed mechanism. The lower end of the line-feed function lever engages the line-feed slide arm and pushes it forward. The slide arm, in turn, moves the line-feed clutch trip arm and the trip lever above their pivot point until the trip lever releases the three-stop line-feed clutch. The line-feed gearing is such that each 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) 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

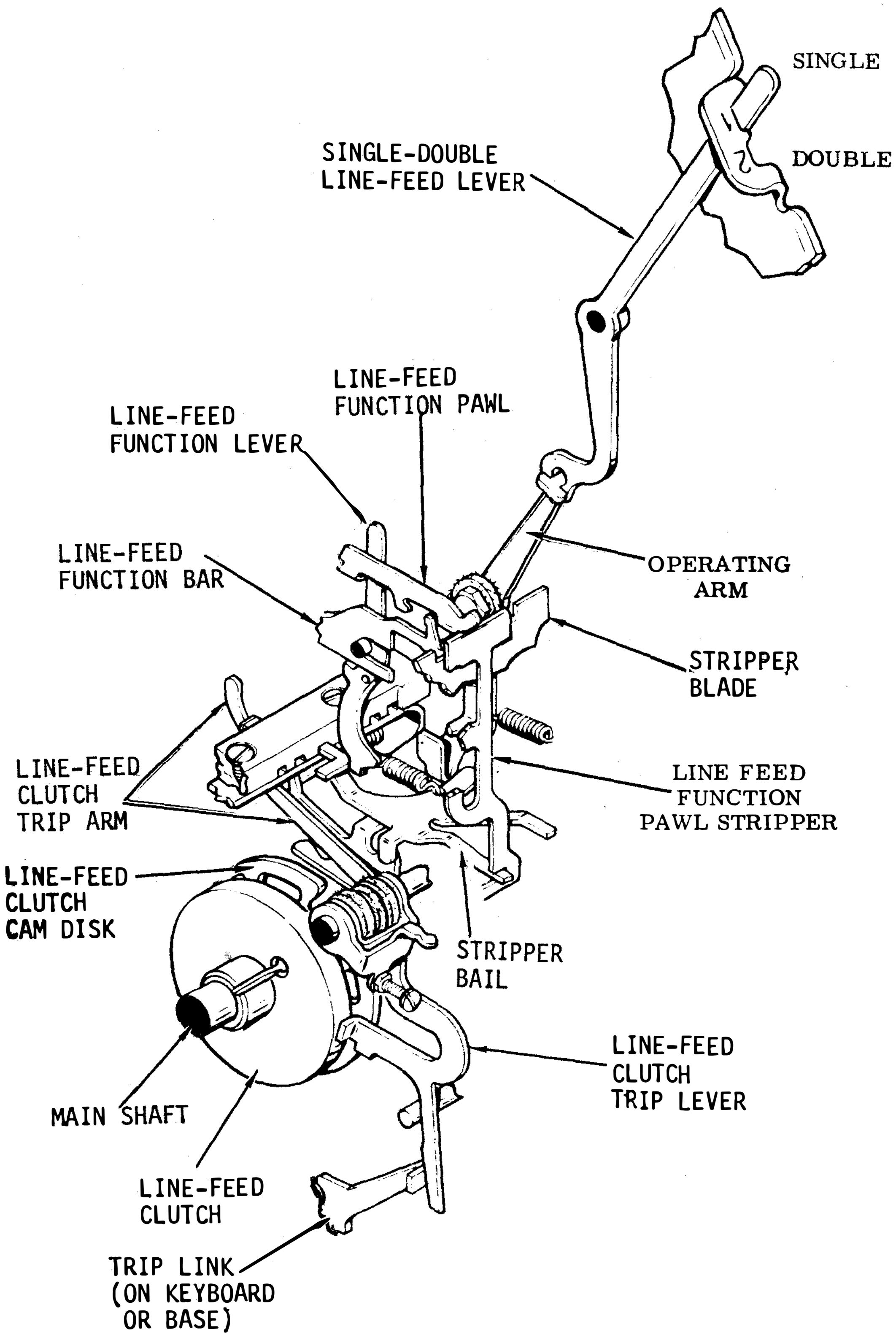


Figure 3-73. Line-Feed Mechanism, Left Rear View

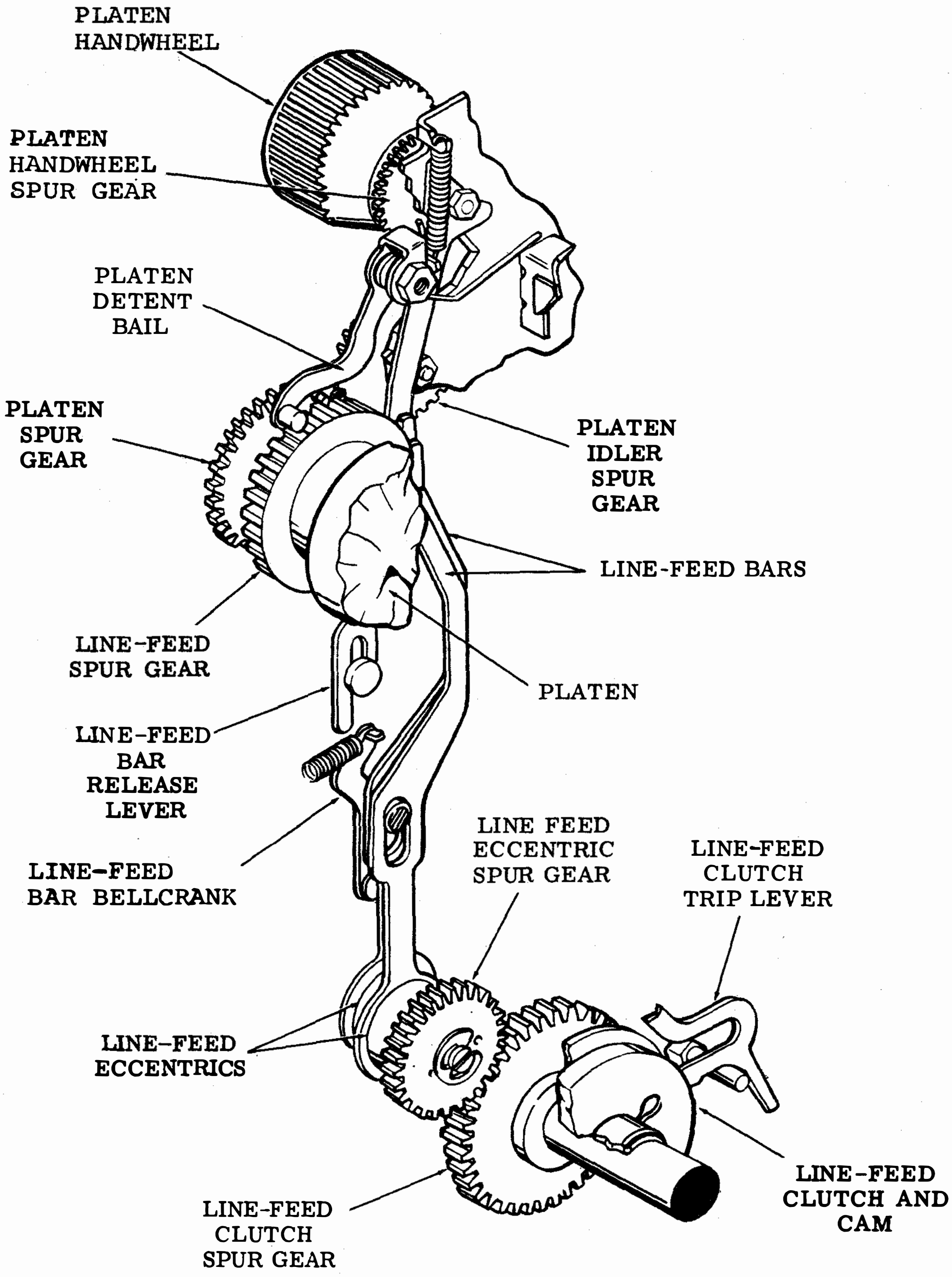


Figure 3-74. Line-Feed Mechanism and Spur Gear, Right Front View

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.

(3) The stripper bail on which the slotted line-feed function pawl stripper rides may be shifted toward the right (double) or to the left (single) by action of the single or double line-feed lever (figure 3-73). 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.

(4) When single line-feed is being used, the line-feed function lever is released too soon (by the line-feed function pawl stripper) to prevent spacing. Therefore, an additional line-feed function bar, pawl, and lever are installed in a slot of the stunt box for the purpose of suppressing spacing on single line-feed 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 latchlever drops into the indent in the clutch cam, in the same manner as described in connection with the code bar clutch.

(5) Each one-third revolution of the line-feed clutch causes its attached spur gear (figure 3-74) 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 bellcrank 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.

(6) 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 bears on the line-feed bar bellcrank and causes it to disengage the line-feed bars from the line-feed spur gear.

(7) Local(off-line) operation of the line-feed mechanism may be obtained from the keyboard base or base on which the typing unit is mounted. A projection beneath the line-feed clutch trip lever (figure 3-74), when rotated to the rear (counterclockwise, viewed from the right), operate

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.

o. LETTERS-FIGURES Shift Function. The following paragraphs describe the LETTERS-FIGURES shift function as illustrated in Figure 3-55.

(1) Upon reception of the LETTERS or FIGURES signal code, the LETTERS and FIGURES function bars, pawls, and levers initiate the LETTERS or FIGURES shift. The upper ends of the function levers engage the LETTERS and FIGURES function slides, as shown in Figure 3-55.

(2) The front ends of these function slides have a cammed surface which, when a slide is shifted to the rear by its function lever, move the LETTERS-FIGURES code bar fork to the right (LETTERS position) or to the left (FIGURES position). The fork engages a pin on the bracket which is fastened to the LETTERS-FIGURES shift code bar, and positions the code bar to the right or left (figure 3-55). Movement of the LETTERS-FIGURES code bar results in the positioning of the type box, through related mechanisms, for printing of LETTERS or FIGURES.

p. Stunt Box Contacts. The following paragraphs describe the operation of the stunt box contact and their function. Refer to Figures 3-75 and 3-76.

(1) For external circuit control and switching functions, the function levers may be positioned to operate normally-open, normally-closed, single-pole double-throw switches mounted on the top of the stunt box.

(2) 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 or rear position. All contacts are wired through the cable connector located on the right side plate. A typical contact (normally-open) is illustrated in Figure 3-75 in its unoperated position, and in Figure 3-76 in its operated position.

q. Typing Unit (Sprocket Feed). The following paragraphs describe the differences in the friction feed and sprocket feed typing units. Refer to Figures 3-43 and 3-64.

(1) Except for the differences in the platen and associated mechanisms, the sprocket feed typing unit includes all the features of the friction feed typing unit as described in paragraph 3-12.2a. A form-fold paper supply is inserted using a sprocket feed for the page-printed message instead of the friction type mechanism.

(2) The platen is equipped at each end with an eleven-pin sprocket. The pins are spaced to accommodate holes along the edges of the form-fold paper used for page-printed messages. The sprocket shown with the pins can be seen in Figure 3-64. The pins are cammed so that the two bottom and two top pins on each side at the front of the platen are extended, while all other pins are retracted. Extended pins

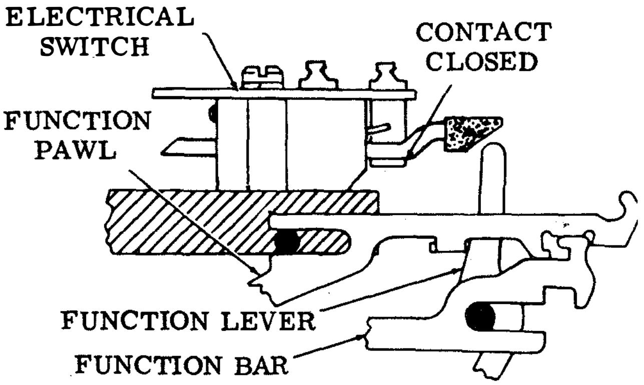


Figure 3-75. Typical Stunt Box Contact (Unoperated), Right Side View

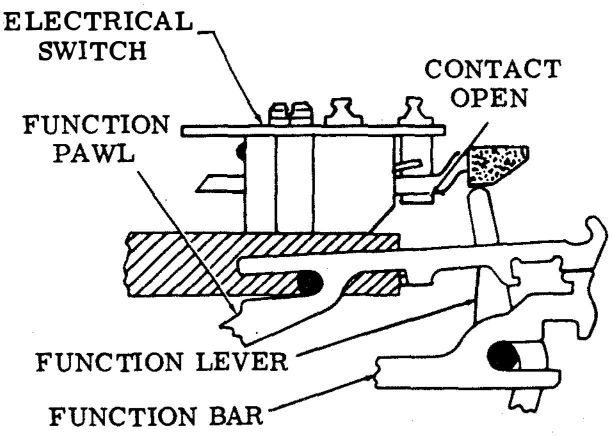


Figure 3-76. Typical Stunt Box Contact (Operated), Right Side View

engage the holes in the form-fold paper and pull the paper into page printing position over the front of the platen by two paper fingers. At the rear of the platen, the form-fold paper is fed through an aperture at the back of the enclosure housing the typing unit, then across a flat paper guide, and under the bottom of the platen.

(3) Paper feeding and line-feeding are described in paragraph 3-12.5n. Paper fingers are released to a spring loaded upright position by pushing a lever marked PUSH on the top rear of the right side plate. The fingers are repositioned by depressing them manually until the end of the paper guide shaft latches an indent on the release lever.

3-13. VARIABLE FEATURES. The following paragraphs describe the variable features that may be incorporated in the typing unit.

3-13.1 HORIZONTAL TABULATION. The following paragraphs describe the operation of the horizontal tabulation feature.

a. General. The spacing drum for typing units equipped for horizontal tabulation has a slotted tab stop ring mounted over the face of the spacing drum, in place of the carriage return ring on other units. The ring, Figure 3-77, 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.

b. Operation. 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 forward. Refer to Figure 3-78. 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.

(1) Tripping of the spacing clutch is initiated in the same way as for normal printing. As the trip lever moves down, it hooks over the intermediate trip bail and pulls it down (figure 3-78). 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.

(2) Fastened to and moving as part of the operating lever is the latch bail adjusting plate (figure 3-78). Mounted to the stud on the upper end of the adjusting plate is the stop lever arm latch bail. The latch bail in its rest position is held forward by spring tension against a projection on the adjusting plate. Therefore, when the upper end of the operating lever moves forward, the latch bail moves with it until the upper end of the latch bail strikes the spacing stop lever arm, which would not have been pulled

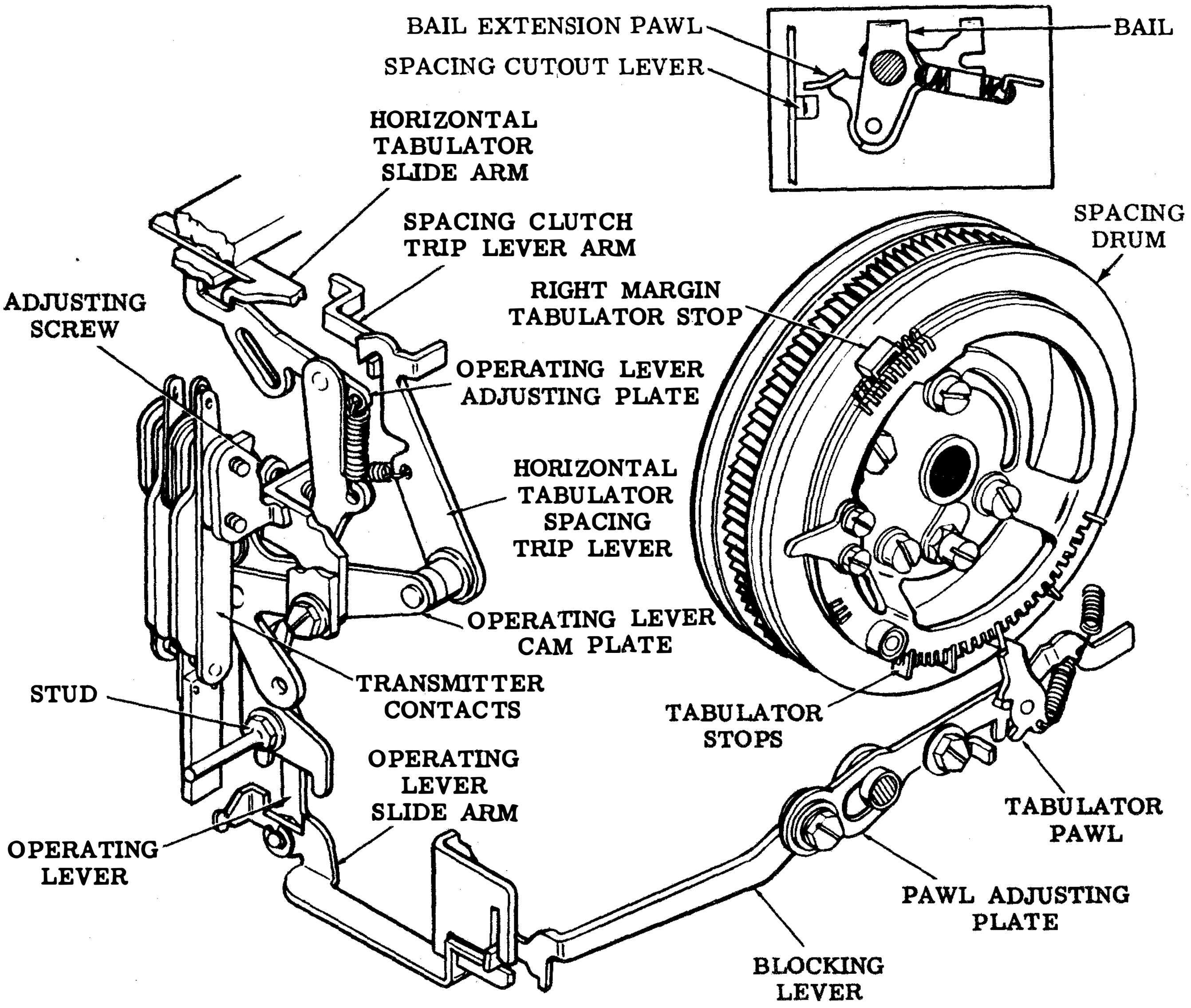


Figure 3-77. Horizontal Tabulator Mechanism, Left Front View

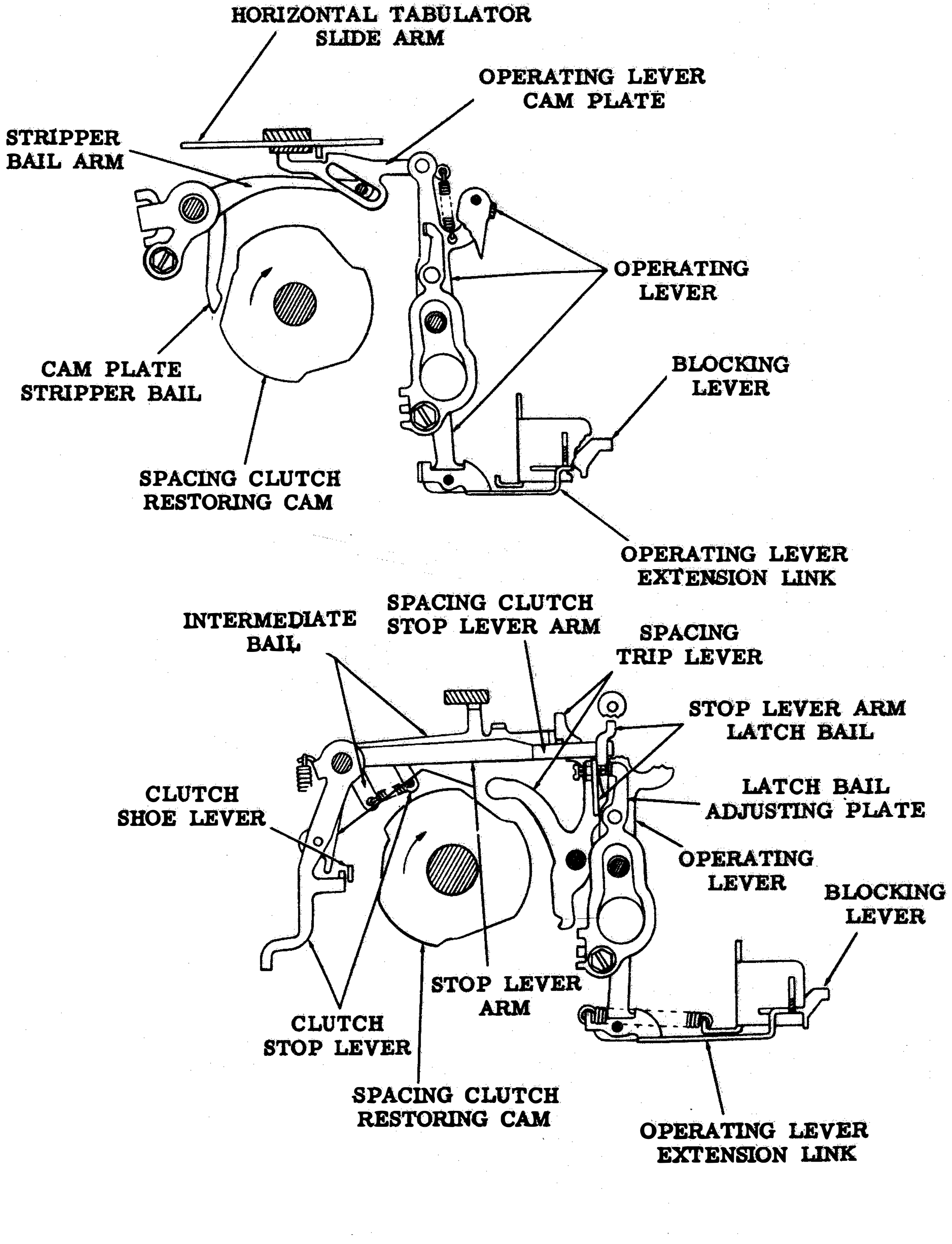


Figure 3-78. Horizontal Tabulator Mechanism, Left Side View

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.

(3) As the spacing clutch starts to rotate, the cam plate stripper bail 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.

(4) 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 (figure 3-77). As the tab stop moves across the pawl, the pawl is moved down, causing the blocking lever to rotate about its mounting stud and releasing the operating lever extension link. The operating lever returns to its unoperated position. The latch bail releases the stop lever arm, and the clutch stop lever blocks further rotation of the spacing clutch. The tabulator function slide arm returns to its unoperated (rear) position when the function pawl is stripped from the function bar during the normal operation of the function stripper blade.

(5) When the printing carriage nears the right margin position, the spacing cutout lever (figure 3-77) on the spacing drum engages the lower surface of the bail extension pawl. The extension pawl and bail rotate together, due to the pawl spring, until the bail is fully operated. When the transfer bail is in its operated position, the space suppression slide is operated, and further normal spacing is prevented. If the clutch were to continue to rotate, the spacing drum will continue to rotate after the transfer bail reaches its operated position. At this time, the bail reaches a fixed stop, but the extension pawl pivots about the lower pivot point permitting the cutout lever on the drum to go by the pawl. The transfer bail and the extension pawl will then return to their unoperated position. When the carriage returns, the space cutout lever engages the upper surface of the extension pawl, causing the pawl to pivot about the mounting shaft until the cutout lever is able to go by the pawl. The extension pawl is then returned to its unoperated position.

(6) 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.

3-13.2 VERTICAL TABULATION AND FORM-OUT. The following paragraphs describe the vertical tabulation and form-out mechanisms function and operation. Refer to Figure 3-79.

a. Gears and Index Disks. A number of form starter gears and index disks, as illustrated in Figure 3-79, is one of the variable features. They are available to adapt to sprocket feed typing units for form-out accommodation of forms 2 to 15 inches in length with vertical tabulation in 1-inch increments, or 2 to 10 inches in length with vertical tabulation in 1/2-inch increments. The form starter gear and the index disk are selected for the desired form length. The form-out mechanism automatically advances a form to the first printing line on the succeeding form from any point on the previous form. The vertical tabulation mechanism advances a form to any predetermined position within the form.

(1) When the input code combination representing the form-out is received, the associated stunt box mechanism linkage moves the form-out slide forward. As a result, the tabulator slide moves forward, moving the line-feed slide forward. This movement unlatches the line-feed clutch. With the line-feed clutch engaged, movement of the form-out slide is prevented by the form-out blocking lever and the line-feed mechanism operates continuously.

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

(3) The vertical tabulator slide remains in the operating position until the stop plate on the rotating disk engages the bail, which in turn raises the blocking lever and allows the vertical tabulation slide and the line-feed slide to return to their unoperated positions. The line-feed clutch is disengaged, and the function mechanism is stripped to its unoperated position.

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

b. Automatic Carriage Return/Line-Feed. The automatic carriage return/line-feed, another variable feature, operates through the stunt box mechanism each time the type box carriage advances to within one character of the right margin. Should an operator fail to originate these functions, this

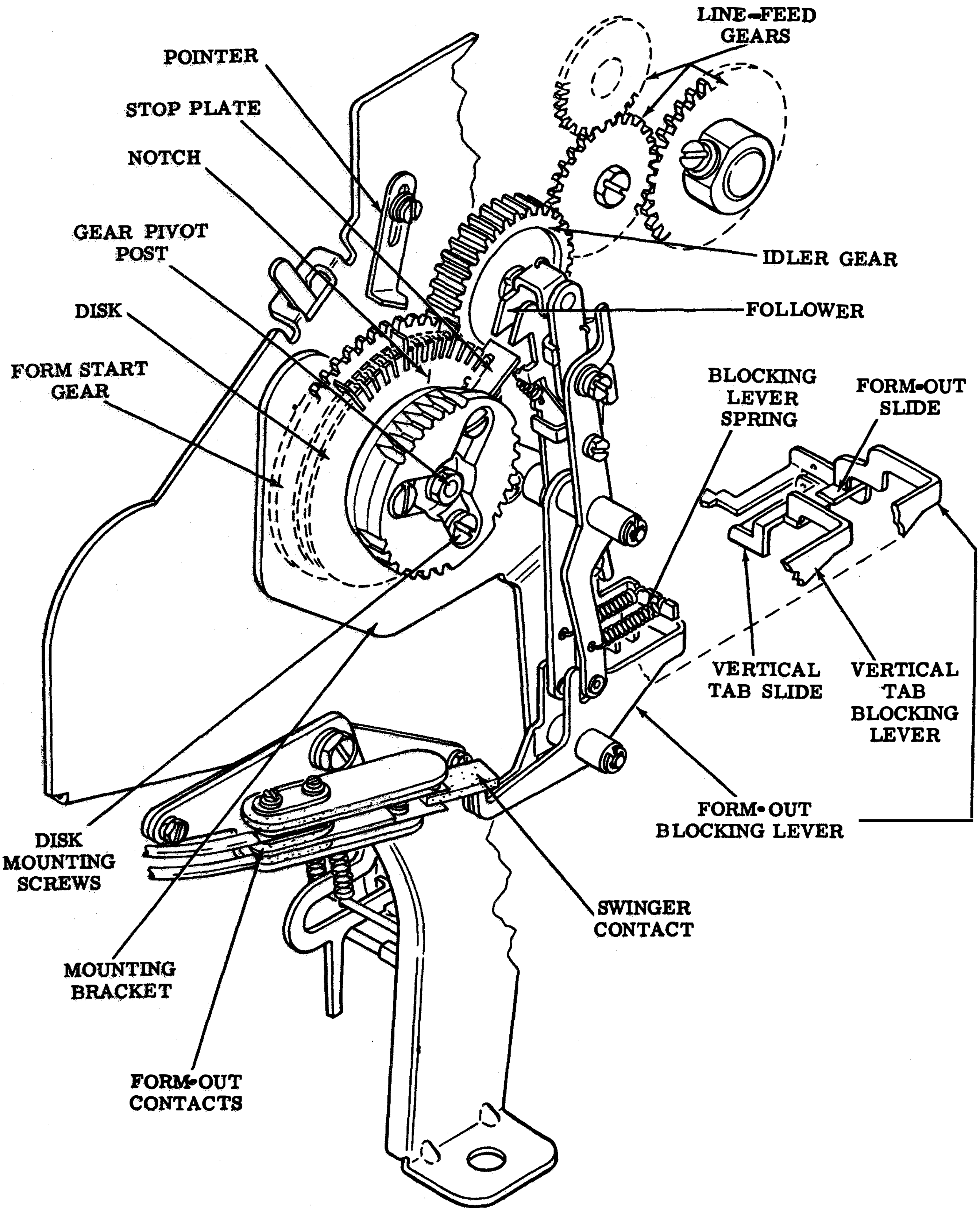


Figure 3-79. Vertical Tabulation and Form-Out Mechanism, Left Rear View

feature provides them automatically.

(1) Advancing the type box carriage to within one character of the right margin, the automatic carriage return bellcrank is tripped by an arm attached to the spacing drum, as illustrated in Figures 3-71 and 3-74. The bellcrank turns clockwise and positions the automatic carriage return/line-feed code bar, marked 0, to the right. Two identical function bars, each with a single code projection are provided in the stunt box, adjacent to the carriage return and line-feed function bars. The code bar normally blocks the function bars.

(2) When the automatic carriage return/line-feed code is positioned to the right, the function bars and related pawls and levers operate. The carriage return and line-feed slide arms are operated, and cause these functions to occur simultaneously.

c. Local Backspace. Each time the local backspace keylever on the associated keyboard unit is operated, a backspace occurs at the local typing unit.

(1) The keylever, through an operating bail and trip link engages the spacing clutch. As the spacing eccentric assembly rotates, the spacing feed pawl that is moving upward is prevented from engaging the teeth on the spacing drum by the action of the eccentric and the pivoting of the feed pawl on the backspace camming bail.

(2) This action results in the spacing drum rotating backwards under spring tension, following the feed pawl that is moving downward. After a single backspace occurs, the spacing clutch is disengaged by action of the trip link stripper, which rides on the clutch cam disk.

d. Unshift-on-Space. Each time the space function signal code is received, the unshift-on-space feature automatically shifts the type box to LETTERS position.

(1) A function bar and its function lever, adjacent to the LETTERS-FIGURES function mechanism, operates upon receipt of the space signal code.

(2) The function lever engages an extension of the LETTERS function slide. When a spacing function occurs, LETTERS shift will also occur. This feature may be disabled by the adjustment of a screw which raises the end of the function pawl from the function bar.

e. Signal Bell. The circuit of the signal bell magnet is controlled by a set of normally-open electrical contacts operated by the stunt box.

(1) The function bar for the signal bell function has six code lugs. Five of these are used for signal code combination, such as S or J, and one for LETTERS-FIGURES shift code bar.

(2) To select the signal bell function, the LETTERS-FIGURES code bar must be in, or shifted to the FIGURES position. When in this position, each time the signal code combination for the bell function is received, the

function lever will pulse the signal bell contact.

(3) If the LETTERS-FIGURES code bar is in the LETTERS position at this time, the signal bell function bar will be blocked.

3-13.3 KEYBOARD UNIT. The keyboard unit, Figure 3-80, is a device for converting the mechanical action resulting from the manual depression of a key into electrical pulses that are transmitted over a signal line. In addition, the keyboard unit provides mounting facilities for the typing and motor units of the ASR Teletypewriter Set, as well as for a variety of accessories.

a. General. The keyboard unit is installed on a base plate assembly. The front of the keyboard protrudes beyond the enclosure and is fitted with a rubber pad that seals the edges of the aperture from dust and for a silencing effect. Motive force for activating the keyboard is derived from the motor unit by way of the typing unit. The electrical wiring to and from the keyboard is terminated in a connector centrally located in the keyboard base. Fuses for the power circuits are located in the electrical service unit. The keyboard is operable on line at the following speeds; 60, 75, 100, and 107 words-per-minute (wpm); or 368, 460, and 600 operations-per-minute (opm). Operating speeds are varied by interchanging sets of gears that are supplied as optional components. The signal generator contact box may be adapted to provide either polar or neutral signals. The major sections of the keyboard are the base assembly, keyboard mechanism, and the signal generator mechanism.

(1) Base Assembly. The base assembly, Figure 3-81, provide mounting facilities for the keyboard and signal generator mechanisms, the intermediate gear assembly, cable and switch assembly, margin indicator switch, power terminal block, and optional accessories, such as the time delay and paper feed-out mechanisms. The intermediate gear assembly consists of two helical gears, a shaft, and a mounting bracket. The assembly transfers motive power from the motor to the associated typing unit. Changes in operating speed are made by changing the motor pinion and the intermediate gear assembly driving gear.

(2) Keyboard Mechanism. The keyboard mechanism contains the keytops, keylevers, code bars and levers, and other code selecting parts that transform the intelligence contained in the manual selection of a keytop into a teletypewriter code combination, represented by code bar positions. The code combination for the selected character is transferred from the code bars through transfer levers to the signal generator mechanism. The keytops are positioned in the conventional three-bank arrangement, with numerals, punctuation marks, and special symbols available in upper case positions. The spacebar is located centrally below these keys. Keytops for local carriage return and local line feed are provided above the standard keytops for facility of operation. This row has provisions for nine additional keys for optional and special operations. A wedge lock

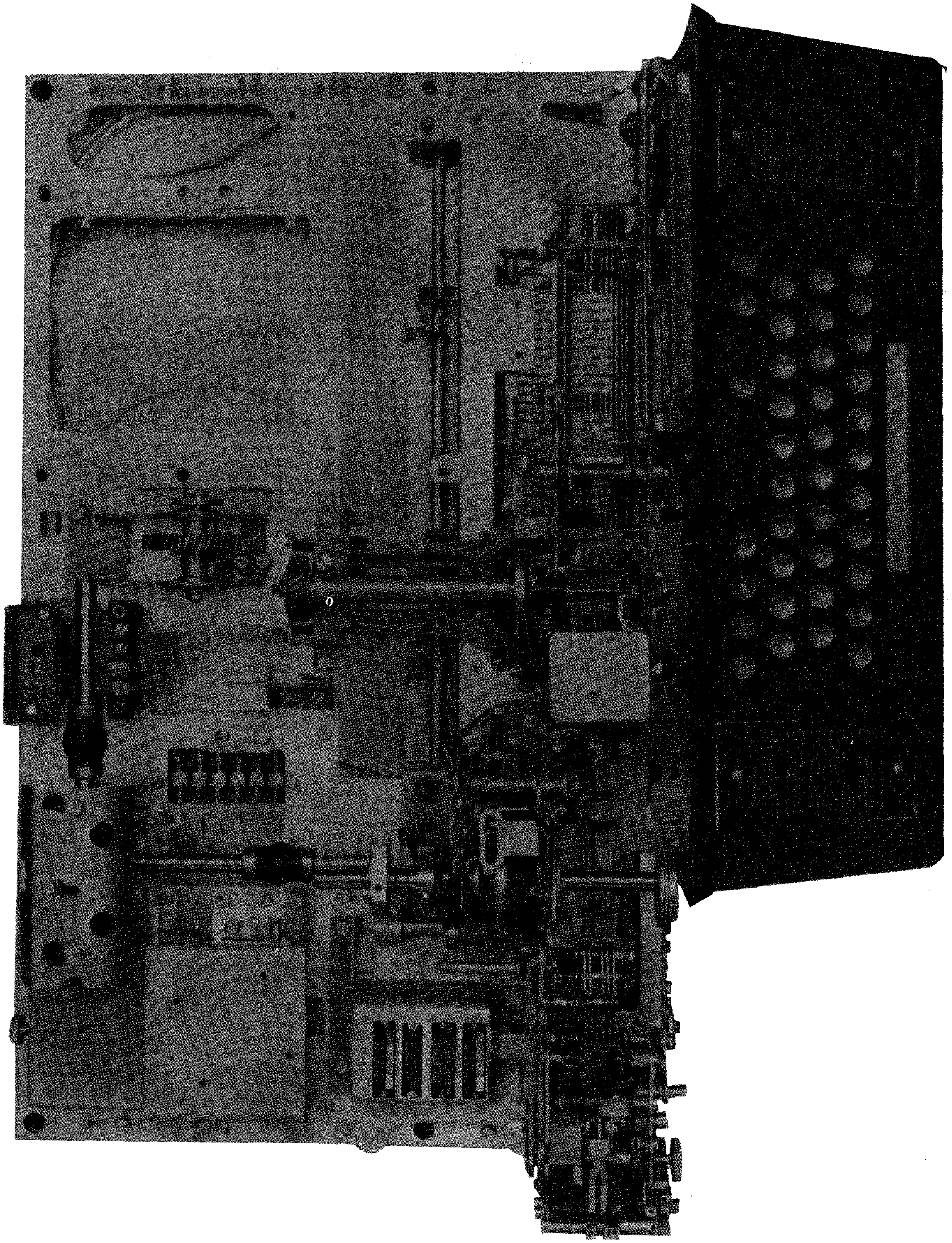


Figure 3-80. Keyboard Unit, Top View

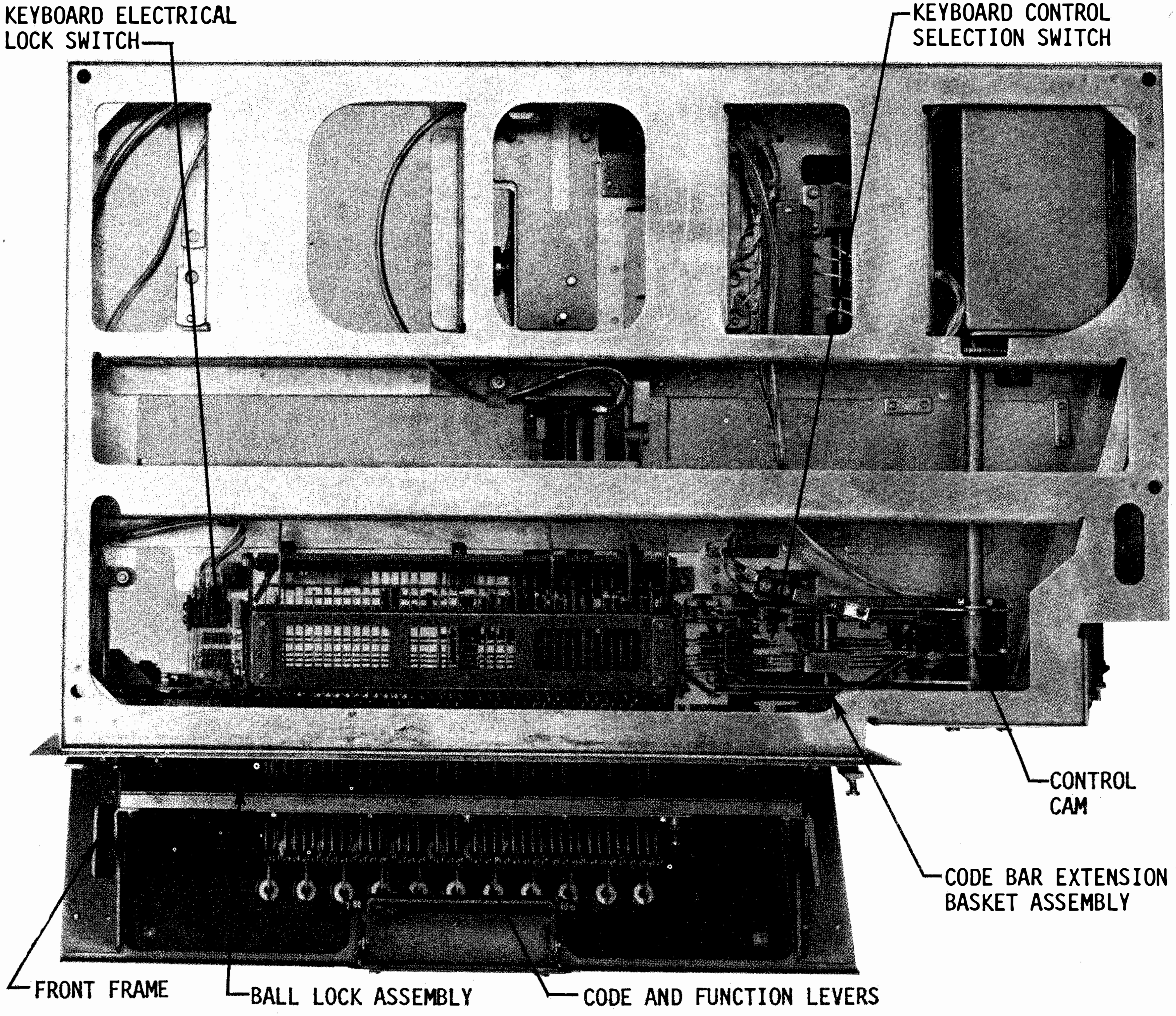


Figure 3-81. ASR Model 28 Base, Bottom View

assembly prevents the simultaneous depression of more than one keytop.

(3) Signal Generator Mechanism. The signal generator mechanism, Figure 3-82, generated the start-stop teletypewriter signal. It consists of, basically, an enclosed contact box containing a set of fulcrum-type transmitting contacts, a transfer bail that controls the opening and closing of the contacts, selector levers that engage the transfer bail in a sequence determined by the position of the code bars, and a multi-lobe cam which determines the pulse duration of the signal code elements. A shaft, which mounts a gear and clutch, receives motive power to drive the mechanism from a gear on the associated typing unit. The contact box will generate either neutral or polar signals, and may be equipped with an RFI or arc suppression network.

b. Keyboard Unit Variable Features. The keyboard unit has provisions for accommodating a variety of accessories, including the following:

(1) Motor start for page feed-out.

(2) Time delay motor stop.

(3) Local reverse line-feed.

(4) Local backspace.

(5) Signal line break.

(6) Keyboard lock and unlock.

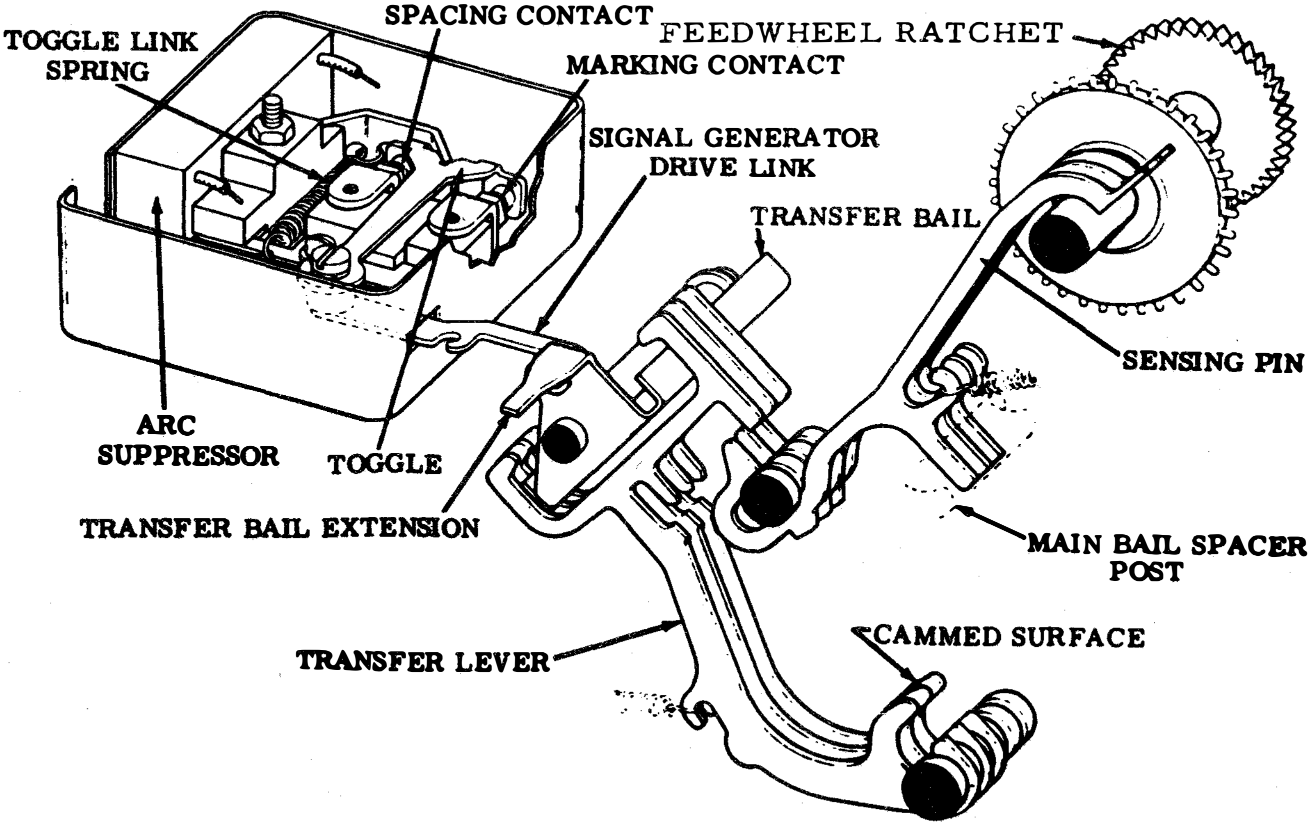


Figure 3-82. Transfer Lever and Signal Generator Mechanism

(7) Repetition of characters.

(8) Repeat-on-space.

(9) RFI and arc suppression.

(10) Answer-back (automatic station identification).

(11) Synchronous pulsed transmission.

3-14. ELECTRICAL SERVICE ASSEMBLY COMPONENTS. The following paragraphs include detailed functional descriptions of the circuit cards used in the ESA units found in low-level ASR teletypewriter sets. Refer to the paragraphs following the functional block diagram description for the operation of the ESA used in the set. The power supply circuit card employed in the ESA and used with the ASR 28 type equipment is 0.5 ampere. The 0.5-ampere card, when installed in a shielded ESA contains the proper transformer and filter assembly and is intended as a RFI suppression power source in systems requiring low-level RFI.

a. <u>ESA Using 0.5-Ampere Power Supply Card</u>. Refer to Figure 5-50 for the power supply card schematic diagram. Power supply transformer T1, diodes CR1, CR3, and power supply rectifier filter capacitor C8 form a full-wave rectifier to obtain a minimum of 58 volts unregulated dc. Transistors Q1 and Q2 form a two-stage series voltage regulating element. Both transistors are always conducting, with the base-emitter drop of each transistor at approximately 0.7 volt. The voltage drop across R2 is negligible. (Resistor R2 is used in conjunction with capacitor C5 for RFI noise suppression.) In effect, the emitter of Q1 is clamped to the same potential as the reference diode combination CR7 through CR12, ie, the dc output of Q1 is nominally 47 volts. The difference between the Q1 dc output and the unregulated dc appears across the collector-emitter junction of Q1. Figure 3-63 shows both front and rear views of this circuit card. Transistor Q2 is a gain stage for Q1. Resistor R1 limits the current that divides between the CR7 through CR12 reference diodes and the base of Q2. The base current of Q1 or the collector current of Q2 is equal to the base current of Q2 multiplied by the dc current gain (HFE) of Q2. Resistor R7 acts as a bleeder and assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R7 and no load connected, the output would rise to the same value as the unregulated dc. However, a minimum load of 0.150 ampere must also be applied to maintain the +53-volt regulation limit. The +7-volt output is obtained by dropping the unregulated dc voltage across resistor R4 to supply the Zener reference diode CR6 which is connected across the output. Resistor R5 and Zener diode CR5 provide a -7-volt output in the same manner previously described. However, a full-wave rectifier consisting of rectifier diodes CR2 and CR4 and capacitor C4 is required to obtain the negative unregulated potential with respect to the circuit common. Capacitors C1 through C3 suppress RFI noise transients which occur due to rectifier switching. Capacitors C6 and C7 and inductors L3 and L4 suppress Zener diode noise. The transformer shields and a low-pass filter consisting of L1, L2, and C9 through C12 provide noise isolation between power line and power supply. The ESAs are normally wired so that one 250-ohm (25-watt) resistor is connected across the collecter-emitter of Q1 when each associated SMD or CMD is inserted in its connector to reduce power dissipation in Q1. (This is equivalent to paralleling Q1 and 250 ohms for each, approximately 0.150-ampere of load current.) Fuse F102 limits the output current to a total of 0.5 ampere.

b. Selector Magnet Driver (SMD). The following electrical theory requires reference to Figure 3-83 and the schematic diagram in Figure 5-51. The TP323810 selector magnet driver (SMD) is basically a direct-coupled amplifier providing a current gain of approximately 80 dB. The first two stages (Q1, Q6, or Q5, Q7) provide the necessary gain to drive a Schmitt trigger (Q8 and Q9). Transistors Q2 through Q4 comprise a power regulator stage which provides the power supply with a constant load. In the marking state with a positive voltage with respect to common applied to each input (or a positive voltage on one input, the other open), Q1 and Q5 conduct, which in turn saturate Q6 and Q7. In this marking state, the voltage drop from the emitter of Q6 to the collector of Q7 is less than the voltage drop from the CR15 anode to the Q8 emitter. Under this condition, the base-emitter junction of Q8 is reverse-biased, thus turning Q8 off. With Q8 off, the Q9 base will conduct through R26 and thus energize the external selector magnet in the collector circuit. Transistor Q9 base current is sufficient to saturate the

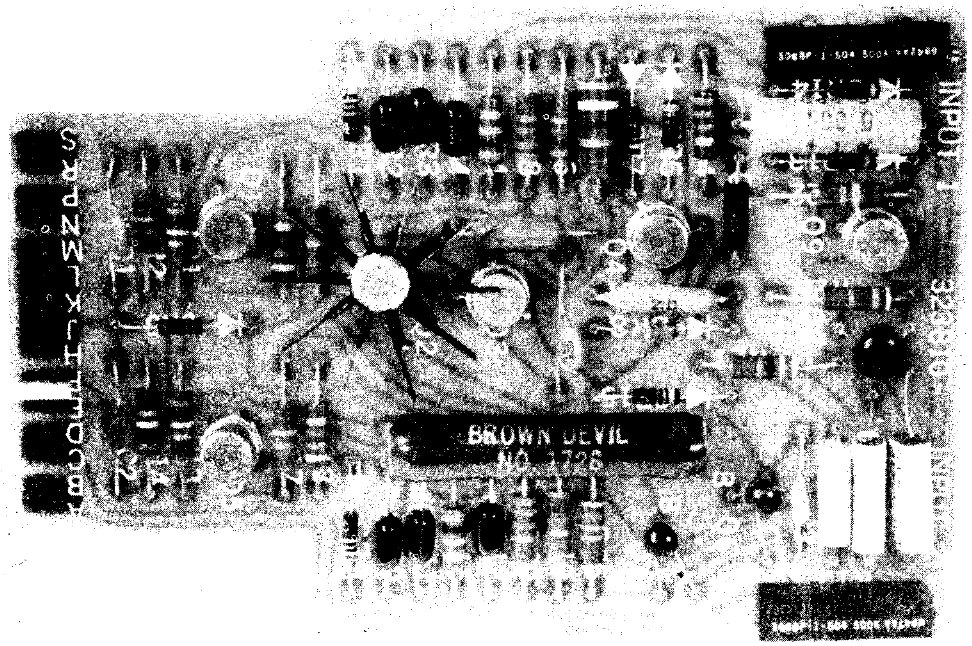


Figure 3-83. Selector Magnet Driver (SMD) TP323810

collector. In this condition, selector magnet current is determined primarily by the value of the limiting resistor R23 and the power regulator output voltage. In the spacing state, with a negative voltage on input 1, input 2, or both inputs, the respective input transistor or transistors (Q1, Q5) are off. In this condition Q6-Q7 collector current is cutoff and the base of Q8 conducts. Transistor Q8 base current is sufficient to saturate the collector. The Q8 emitter-collector saturation voltage is less than the forward drop across CR13 thus reverse biasing the base emitter junction of Q9. With this junction reverse biased, Q9 collector current is cutoff and the selector magnet is deenergized. Because of the difference in magnitude of Q8 and Q9 load currents, the drop across R21 will be greater in the marking state than in spacing. This means that the input voltage to the third state (Q6 VCE + Q7 VCE) necessary to change the state of Q8 will be different depending on the previous state. Specifically, a larger combined Q6 and Q7 collector-emitter voltage is required to turn on Q8 than to turn off Q8. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize the selector coil and negative going input signals to deenergize the coil. Resistors R4, R16, and potentiometers R3 and R15 serve to bias Q1 and Q5 and set the center of the switching interval. Emitter resistors R7 and R18 assist in gain stabilization. Resistors R6, R8, R19, and R20 form voltage dividers to bias CR2 through CR4 and CR10 through CR12. These diodes exhibit temperature characteristics such that together with R7 and R18, effective temperature compensation is obtained to stabilize the switching level of the SMD. Diode CR5 establishes a voltage reference for the first stages to ensure switching level stability. When low-resistance transmitters (about 100 ohms) are used to key the driver, R1 and R13 have no significant effect of the operation of the circuit. However, when the line resistance is high (open line), R1 and R13 apply sufficient bias to drive Q1 and Q5 into conduction. This operation will maintain the terminal equipment in the idle state when input lines are open, or will allow single-line operation by simulating a marking signal on the other input. In the power regulator, CR8 and the base-emitter junction of Q4 establish a voltage reference for R11 which determines the current drain of the unit. Diode CR6, CR7 and the base-emitter junction of Q3 serve to clamp the Q4 collector at a low voltage so as to minimize power dissipation in Q4. As the power requirement of the circuitry following the regulator decreases, the output voltage of the regulator will begin to rise. This rise corresponds to a decrease in Q4 collector-base voltage. The effect is to increase the forward bias on the base-emitter junction of Q3 and cause increased collector conduction. This collector current increases the conduction of Q2 whereby Q2 and R10 absorb the excess power. Q2 functions as a variable resistance so as to maintain a constant resistance across the output of the regulator regardless of the state of the driver circuitry. As a consequence of this, the power supply sees a constant load, regardless of driver state. Capacitors C4 and C5 provide negative feedback to reduce transient generation in the driver. Capacitors C3 and C7 and C8 are radio-frequency bypass capacitors to eliminate any parasitic oscillations that may occur as a result of switching.

c. Low-Level Keyer (LLK). The principles of operation of the TP303142 keyer circuit card are described in the following paragraphs. Refer to Figure 3-84 for a front view of the TP303142 circuit card and Figure 5-47 for a schematic diagram. The TP303142 low-level keyer is a neutral-to-polar converter which, by means of passive and active filtering, shapes the output waveform. In the marking state the signal generator contact is open and Q1 conducts to a level established by resistors R1, R2, and R11. Transistor Q1 conducts sufficient current to saturate the collector of Q2 which rises to slightly less than the positive supply voltage. With Q2 conducting, Q4 and Q6 also conduct. Transistor Q4 base current (equal to the total output load current divided by the product of Q4 and Q6 gains) is small and consequently the voltage drops across R6, R10, and R7 are insignificant. Transitor Q6 base current (equal to total output load current divided by the gain of Q6) is also small resulting in an insignificant voltage drop across R8. Thus, the output voltage is the power supply voltage minus the sum of Q2 voltage with collector-emitter saturated, Q4 base-emitter voltage and Q6 base-emitter voltage. The drop across R9 for normal output loads is insignificant. In the spacing state the signal generator contact is closed. In this state R1 is shunted by the

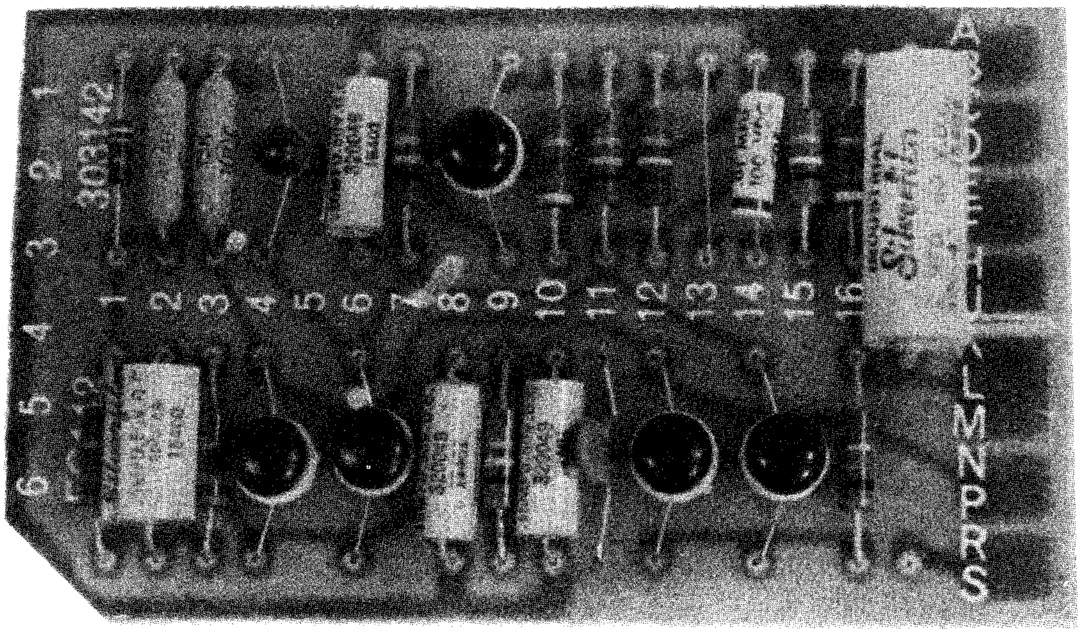


Figure 3-84. Low-Level Keyer TP303142

series combination of R13 through R15 thus reducing Q1 base voltage below the emitter voltage established by the voltage divider R3, R11. With the emitter being at a higher potential than the base, Q1 is turned off. With Q1 off, Q2 is off and its collector voltage approaches the negative supply voltage. In this state Q3 and Q5 conduct. For the same reasons as in the marking state, the output voltage is primarily a function of Q3 base-emitter voltage and Q5 base-emitter voltage. Diode CR1 is added to compensate the unsymmetrical properties associated with the second stage. During transitions, the nonsymmetric low-pass contact filter prefilters the input to the keyer. In addition, common mode effects due to the unbalanced strap capacitance of the contact assembly, are reduced. Capacitors C1 and C6 limit the high-frequency response of states 1 and 2, thus providing additional shaping. Stage 3 (Q4 and Q3) is a low-pass active filter. By means of C2 charging and discharaging through the feedback network, consisting of R6, R10, R7, and C2, the rise and fall times are lengthened to produce an acceptable spectrum (from RFI standpoint). Capacitors C3, C4, and C5 provide additional shaping by bypassing undesirable frequency components generated in Q3, Q4, Q5, and Q6. C7 is a radio frequency bypass capacitor to decouple the power supply.

d. Power Supply (0.5-Ampere) Card. Transformer T1, capacitor C8, filter components L1, L2, C9, and C10 through C12 are all located in the ESA, not on the circuit card assembly. Refer to Figure 3-85 and schematic diagram in Figure 5-50. Transformer T1, diodes CR1, CR3, and capacitor C8 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc. Transistors Q1 and Q2 form a two-stage series voltage regulating element. Both transistors are always conducting with the base-emitter drop of each transistor at approximately 0.7 volt. The drop across R2 (used in conjunction with C5 for noise suppression) is negligible. In effect, the emitter of Q1 (dc output) is clamped to the same potential as the reference diode combination CR7-CR12 (nominally 47 volts). The difference between the dc output and unregulated dc appears across the collector-emitter junction of Q1. Resistor R1 limits the current that divides between the CR7-CR12 reference diodes and the base of Q2, which is a gain stage for Q1. The base current of Q1 (Q2 collector current) is the base current of Q2 multiplied by the dc current gain (HFE) of Q2. Resistor R7 across the output acts as a bleeder and also assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R6, the output would rise to the same value as the unregulated dc with no load connected. The +7-volt output is obtained by dropping the unregulated dc voltage through resistor R4 to supply the Zener reference diode CR6, which appears across the output. R5 and CR5 provide -7 volts in a similar manner; however, a full-wave rectifier consisting of rectifier diodes CR2, CR4, and capacitor C4 is required to obtain the negative unregulated potential with respect to circuit common. Capacitors C1, C2, and C3 are used to suppress noise transients which occur due to rectifier switching. Capacitors C6 and C7 and inductors L3, L4

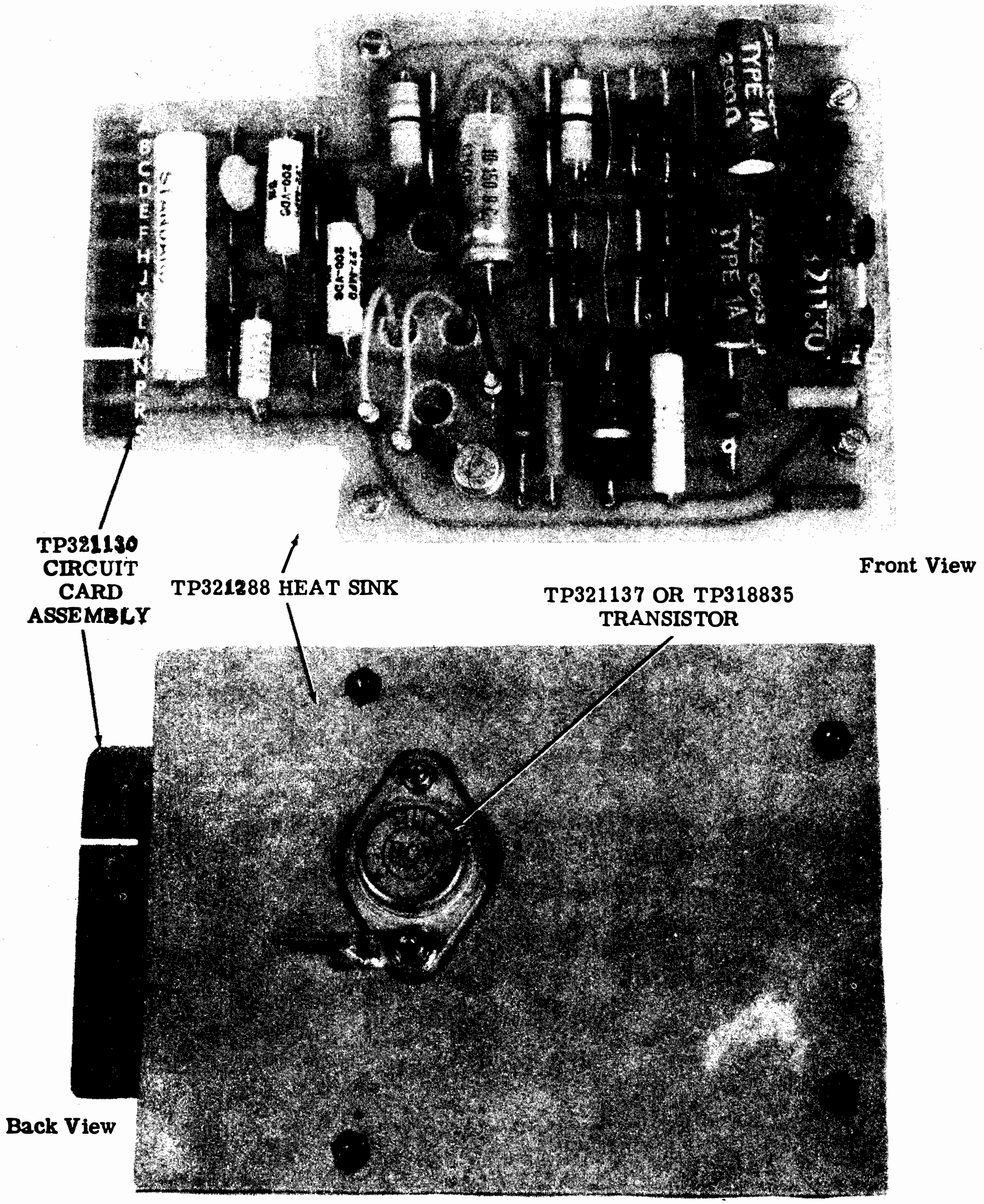


Figure 3-85. Power Supply (0.5-Ampere) TP321290

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

e. Electrical Theory (TP321991 CMD). All circuit references in the following paragraphs are made with respect to Figure 3-86, the circuit board assembly drawing, and schematic diagram in Figure 5-49. The driver is basically a direct-coupled amplifier providing a current gain of approximately 80 dB. The first two stages (Q1 and Q2) provide the necessary gain to drive a Schmitt trigger (Q3 and Q4). Q5 and CR2 comprise a power regulator stage which provides the power supply with a constant load. In the marking state, with a positive voltage with respect to common applied to the input side of the Q1 base resistor R5, Q1 conducts, which in turn saturates Q2. In this condition, the sum of the voltage drops around the loop R14, Q2 collector-emitter and Q3 base-emitter is in a condition to reverse bias the base-emitter junction of Q3 and thus cut off Q3 collector current. The Q4 base current increases the voltage drop across R15 in order to satisfy loop conditions established by the power regulator voltage, R14, CR8, and Q4 base-emitter voltage. The Q4 base current is sufficient to saturate the collector. In this condition, load current is determined primarily by the load resistance, R17, and the power regulator output voltage. In the spacing state, with a negative input voltage, Q1 is cutoff with reverse base-emitter bias established by the reverse transient protection diode CR3. With Q1 off, Q2 does not

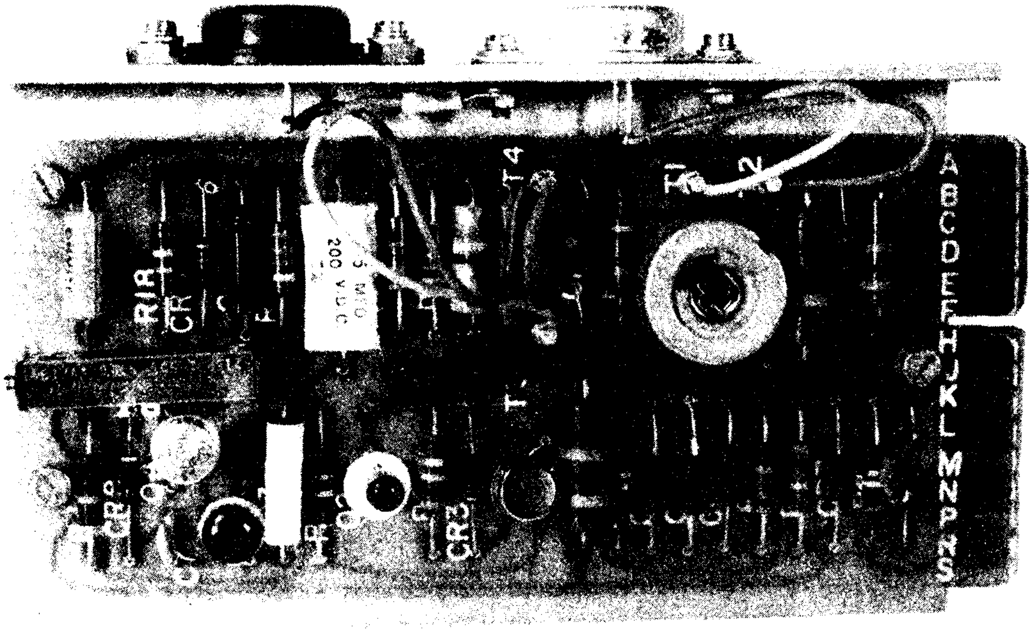


Figure 3-86. Clutch Magnet Driver (CMD) TP321991 for Low-Level Operation

conduct. Consequently, to satisfy loop conditions established by R13, Q3 base-emitter, R14, and the regulator voltage, Q3 conducts to raise the voltage across R13. Base current is sufficient to saturate the Q3 collector. The Q3 collector-emitter voltage is less than CR8 voltage, which in turn reverse biases the base-emitter junction of Q4. With the latter junction reverse-biased, the Q4 collector is cut-off. The collector circuit at Q2 has been interrupted and brought out to the connector contacts at the bottom of the card. This circuit must be completed externally or Q3 cannot be turned off and the magnet coils are held de-energized. The circuit thus affords a degree of local magnetic control. Because of the difference in magnitude of Q3 and Q4 load currents, the drop across R14 will be greater in the marking state than in spacing state. This means that input voltage to the third state (Q2 VCE) necessary to change the state of Q3 will be different depending on the previous state. Specifically, a larger Q2 collector-emitter voltage is required to turn on Q3 than to turn off Q3. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize and load coil and negative-going input signals to de-energize the load coil. Resistor R6 and potentiometer R7 serve to bias Q1 and set the center of the switching interval. Emitter resistor R8 assists in gain stabilization. R11 and R9 form a voltage divider to bias CR4 through CR6. These diodes exhibit temperature characteristics such that together with R8, effective temperature compensation is obtained to stabilize the switching level of the driver. CR7 establishes a voltage reference for the first stage to ensure switching level stability. When a low-resistance transmitter (about 100 ohms) is used to key the driver, R4 has little significance on the operation of the circuit. However, when the input resistance is extremely high, R4 applies sufficient bias to Q1 to cut it off. This operation will maintain the terminal equipment in the idle state when the input line is open-circuited. In the power regulator, CR1 and the base-emitter junction of Q5 establish a voltage reference for R1 and R2 which determines the current drain of the unit. As the driver demands less power from the regulator, such as being in the deenergized state, the excess current (excess over energized current) is shunted through Zener diode CR2. This operation maintains a relatively constant load for the external power supply. R2 is adjusted to set minimum CR2 current for voltage regulation. Coil L1 and capacitor C1 serve to reduce noise generated by Zener diode CR2. Capacitors C3 and C6 provide negative feedback to reduce transient generation in the driver. C5 and C7 are radio-frequency bypass capacitors to eliminate any parasitic oscillations that may occur during high-speed switching. Diode CR9, C4 and R16 form a transient-limiting network to protect Q4 from excessive reverse transient voltages present when switching inductive loads.

f. <u>ASR Electronic Message Numbering Module (Low-Level)</u>. The following paragraphs describe the electronic message numbering module low-level operation.

(1) Message Counter. The message counter circuit card contains the logic necessary for counting up to 9999 messages. A positive pulse at the units advance input will advance the first of four identical decade counters. The counters are arranged in an ascending order: units, tens, hundreds, and thousands. Inputs are provided to reset all of the counts to the zero count and to preset any desired number. Outputs of the decade counters are converted from decimal to Baudot code. The Baudot information is routed to an external serializer for signal line transmission. The counter outputs are also used to drive a visual display circuit. At the start of message counting, the message number reset circuit is grounded by the zero (set) switch. The switch is mounted on the front panel of the numbering module. To accomplish reset it is necessary to hold the preset switch in the preset position to provide a ground connection to the zero switch. Switch action causes a change from +5 volts to ground. The plug five volts is derived by resistor R2. Using this procedure resets all of the normal outputs of the counter flip-flops to a +5 volts. Counter flip-flops include the following: MLJ3-MLJ4; MLG3-MLG4; MLF3-MLF4; MLD3-MLD4. All counters are identical in operation with the exception of the carry features (advance after a counter of ten). Refer to Figure 3-87 for a typical count. Outputs are inverted binary code for the number being counted. The change from the nine count to the zero count advances the tens counter MLG-6 to zero. This same method is used to carry hundreds and thousands. The normal outputs of the counter flip-flops are used to drive the MC417 four

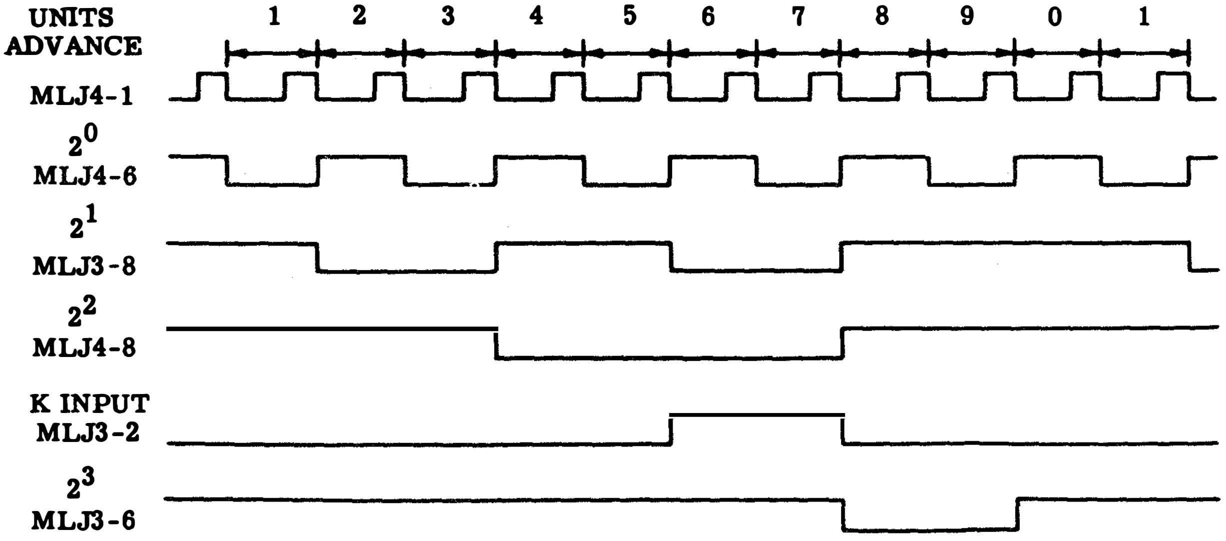


Figure 3-87. Typical Counter Operation

digit read-out card. The inverted outputs are gated by MLJ2. The units enable pulse is used to enable MLJ2 when the signal is at ground. The same method is used with the tens, hundreds and thousands counters. Outputs are strobed sequentially for decoding. This allows all the outputs to be connected together to form a wired AND connection. Binary coded numbers are routed sequentially to the binary coded decimal, on to the decimal decoder. It is then routed to the Baudot encoder. Refer to Figure 3-88 for a detailed code conversion. These outputs are used by the format scanner. When the external preset switch is held, ground is connected to MLE4-11 and all of the counters are ready to be preset. The thousands preset is a transfer switch. The switch is connected to MLE3, and pins 5 and 6. This group of gates forms a flip-flop circuit. The circuit provides an advance pulse to the counter and steps it once each time the switch is pressed. A similar circuit is used for the hundreds counter. On the tens counter only a portion of the preset circuit is on this circuit card. Additional logic for presetting of tens and units can be found on the format scanner.

(2) <u>Four-Digit Display</u>. The display circuit converts the inverted decimal output of the message counter to a visual decimal number. Conversion is accomplished by a single integrated circuit for each visual display tube. Refer to Figure 3-89 for the truth table. When a valid inverted binary coded decimal input is present, the gas in the readout tube near the selected character will ionize and illuminate the character. The four-digit display is driven by an inverted binary signal. Diode CR1 is used to lower the +5 voltage supply by approximately 0.7 volts. Components R1 and C1 are used as a high voltage filter. Resistors R2, R3, R4, and R5 are anode loads for the readout tubes. Resistor R6 is used to discharge C1 at power turn off to reduce a shock hazard.

(3) <u>Format Scanner</u>. The format scanner contains a 16-position scanner that distributes a programmable format. Included in the format are the following: Programmable station identity message number; Fixed characters Z, C, LTRS, and FIGS; Customer option of a 3 or 4 digit message number; the 4 or 5 character station identity, or combinations of each. Special screws are used to program these options. The screw is inserted in the appropriate hole in the circuit card for selected option. The format counter is reset when the negative pulse is applied to the format reset. Refer to Figure 3-90. The major portion of the format counter is made up of MLA1 and MLB1. Pins 6 and 8 of these flip-flop circuits are set to +5 volts on receipt of the reset pulse. The counter is now ready for scanner advance pulses. The negative advance pulse is inverted by MLD3 and delayed by the network consisting of R1 and C1. The format counter is basically a binary counter circuit (1-2-4-8). The 4-bit binary code from the counter circuit is routed to the input of a converter circuit consisting of MLA2, MLB2, and MLC2. This converter is a device that accepts 4-bit binary parallel information and converts it into two groups of 4-unit code (2 of 8 converter). Only one output of each group will be "high" (+5 volts) at one time. Refer to Figure 3-91. The output of the

BINARY CODE				DECIMAL CODE										BAUDOT CODE				
MLC2-6 EIGHTS	MLC2-3 FOURS	MLC2-8 TWOS	MLC2-11 ONES	MLC1-6 0	MLC1-8 1	MLB1-8 2	MLB1-6 3	MLB1-12 4	MLB2-12 5	MLB2-6 6	MLB2-8 7	MLC3-12 8	MLC3-6 9	MLA1-8 1	MLA1-6 2	MLB4-6 3	MLC3-8 4	MLB4-8 5
1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0
1	1	1	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0
1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	0
1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1
1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1
1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
1	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	0
1	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1
0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1
0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0

0 = 0 v

1 = +5 v

0 = SPACE

1 = MARK

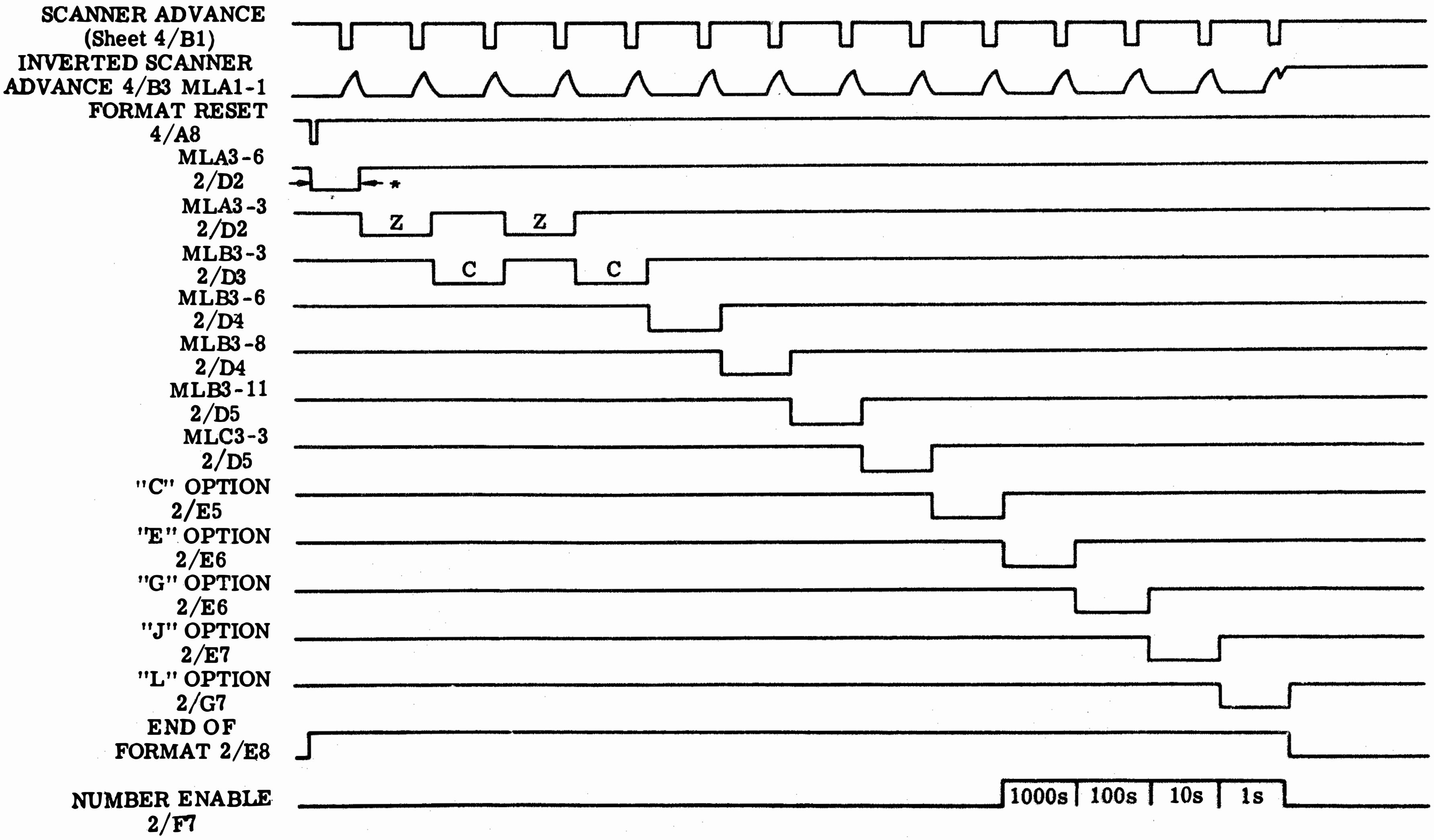
Figure 3-88. Code Conversion

ON OUTPUT	INPUTS			
	I_1	I_2	I_4	I_8
Z0	1	1	1	1
Z1	0	1	1	1
Z2	1	0	1	1
Z3	0	0	1	1
Z4	1	1	0	1
Z5	0	1	0	1
Z6	1	0	0	1
Z7	0	0	0	1
Z8	1	1	1	0
Z9	0	1	1	0

Note: With coding shown, only one of the outputs will be low at any time.

0 LOW STATE (≤0.4 V)
1 HIGH STATE (≥1.15 V)

Figure 3-89. Decimal Decoder Truth Table



* Period dependent on phase relationship between the tape-in and external synchronous pulse.

Figure 3-90. Format Scanner, Format Option

BINARY OUTPUTS (Continuous Scanner Advance)				2 OF 8 OUTPUTS (Read Left to Right)							
MLB1-8 EIGHTS	MLB1-6 FOURS	MLA1-8 TWOS	MLA1-6 ONES	FIRST GROUP OF FOUR				SECOND GROUP OF FOUR			
1	1	1	1	1	0	0	0	1	0	0	0
1	1	1	0	0	1	0	0	1	0	0	0
1	1	0	1	0	0	1	0	1	0	0	0
1	1	0	0	0	0	0	1	1	0	0	0
1	0	1	1	1	0	0	0	0	1	0	0
1	0	1	0	0	1	0	0	0	1	0	0
1	0	0	1	0	0	1	0	0	1	0	0
1	0	0	0	0	0	0	1	0	1	0	0
0	1	1	1	1	0	0	0	0	0	1	0
0	1	1	0	0	1	0	0	0	0	1	0
0	1	0	1	0	0	1	0	0	0	1	0
0	1	0	0	0	0	0	1	0	0	1	0
0	0	1	1	1	0	0	0	0	0	0	1
0	0	1	0	0	1	0	0	0	0	0	1
0	0	0	1	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	1	0	0	0	1
1	1	1	1	1	0	0	0	1	0	0	0

0 = 0 V

1 = +5 V

Figure 3-91. Four-Bit Binary to 2 of 8 Converters

2 of 8 converter is routed to a 1 of 16 converter. The 1 of 16 converter is composed of the following: MLA3; MLB3; MLC3; MLD3. This converter is a device that transfers coded parallel information from the 2 of 8 converter into 16 discrete outputs in sequential order. Only one output will be "low" (0 volts) at one time. Refer to Figure 3-90. The output signals from the 1 of 16 converter are used to strobe the format to the external serializer. The outputs of the serializer may be changed by the use of the screw insertion technique. Refer to Figure 3-92 using the following information: To obtain FORMAL OPTION 1, insert screws in position A, C, E, G, J, and L; To obtain FORMAT OPTION 2, insert screws in position A, C, F, H, and K; To obtain FORMAT OPTION 3, insert screws in position B, D, G, J, and L. The logic used presently to preset units and tens on the external message counter ic located on the format scanner card. The logic is ready for presetting when preset enable is held at ground by its switch. The tens preset transfer switch is connected to MLJ4, and pins 1 and 3. The flip-flop gate arrangement provides an advance pulse for the tens counter each time the preset switch is pressed. The units preset logic operates in a similar manner. The variable station identity circuit also uses the screw insertion programming technique. The option connections are shown within a dashed box on sheet 3 of the wiring diagrams for circuit card TP322024. The circular connections represent a screw option. When no screws are inserted, all characters are letters (all marks). When a screw is inserted the input is set for a space bit. The vertical bus, connected to the

CHARACTER NO.	FORMAT OPTION I (4 Digit)	FORMAT OPTION II (3 Digit - 4 Char.)	FORMAT OPTION III (3 Digit - 5 Char.)
1	Option (Char. 5)	Option (Char. 5)	Letters
2	Z	Z	Z
3	C	C	C
4	Z	Z	Z
5	C	C	C
6	Option (Char. 1)	Option (Char. 1)	Option (Char. 1)
7	Option (Char. 2)	Option (Char. 2)	Option (Char. 2)
8	Option (Char. 3)	Option (Char. 3)	Option (Char. 3)
9	Option (Char. 4)	Option (Char. 4)	Option (Char. 4)
10	Figures	Figures	Option (Char. 5)
11	Thousands	Hundreds	Figures
12	Hundreds	Tens	Hundreds
13	Tens	Units	Tens
14	Units	Letters	Units
15	Letters	Letters	Letters

Figure 3-92. Format Scanner, Multiple Options

scanner outputs, is used to strobe the characters into the external serializer. The markings on the circuit card should be examined to determine the proper character row and bit column. Gates MLH3, MLG3, and MLF3 are used to code the nonvariable characters Z, C, and FIGS. The data sample pulse is the strobe for the external serializer. The sending of the Z and C characters is illustrated in Figure 3-93.

(4) Reader Control and Serializer. The reader control and serializer circuit card provides control of the transmitter distributors either singly, or in tandem. A crystal oscillator is used with several binary dividers to obtain an internal bit clock. The crystal for the oscillator is inserted in a receptacle to obtain various Baud rates. The bit clock is used by the serializer to convert the parallel message number and station identity characters to serial data for line transmission. A two-stage crystal oscillator is used as a source for bit timing. Transistors Q1 and Q2 form the active part of a crystal controlled, free-running multivibrator. The crystal (XTL 1) and resistor R6 are used as feedback and stabilizing elements. The crystal tends to oscillate at only its resonant frequency. Resistor R6 limits the crystal power dissipation. Capacitor C2 couples the stabilized signal to Q1. Resistor R2 is used to provide negative feedback for additional stability. Resistor R4 increases the input impedance of Q2. Capacitor C1 is used to decouple higher than resonant frequencies. Resistor R5 provides bias for Q1 and resistors R1 and R3 are collector loads. The stable

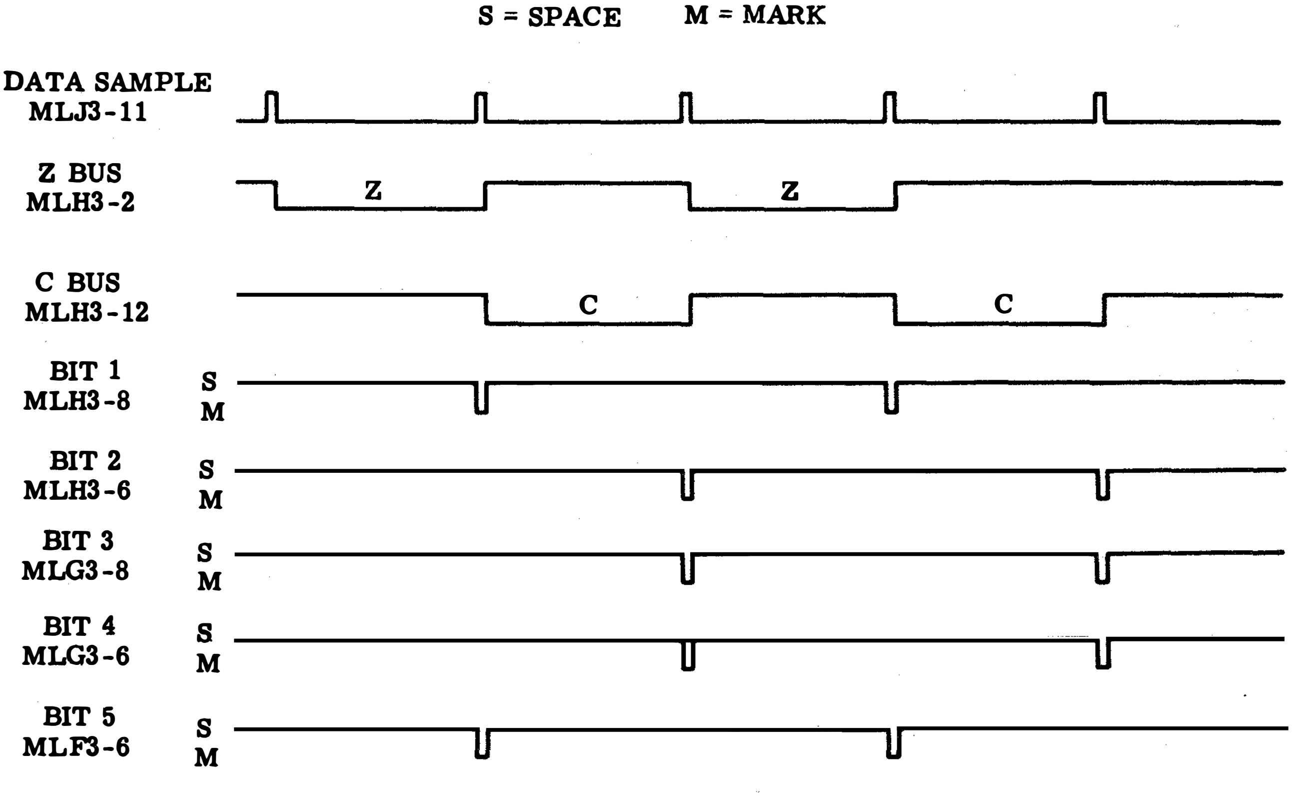


Figure 3-93. Data Sample

high frequency output of the crystal is inverted by MLA4 and divided down by flip-flops MLA1, MLB1, MLD1, and MLF1. The oscillator divider is reset at the start of each message and for each character on MLF1-4/D7. The crystal frequency is reinverted by MLA4 and exits on pin 33 for test purposes. When screws are inserted for 7.00 unit code (positions P and R), the flip-flop group divides the signal by 512. This yields the desired bit rate. When the 7.42 unit code is chosen (position M) and NO flip-flops MLB1-8 and MLD1-8 are effectively cleared at reset. This is accomplished by reversing the outputs. This has the same general effect as a clear direct signal. MLA1-5 will count ones, MLA1-9 will count twos, MLB1-5 counts fours, etc. This is how division is accomplished. Reversing the outputs of MLB1-8 and MLD1-8, the divider starts out with a count of 40 (MLB1-8 counts eights, MLD1-8 counts thirty twos, 32+8 = 40). The crystal frequency is now divided by 472 (0.92 bits), 512 - 40 = 472 but only for the first bit. Successive bits are divided by 512 (1 bit) until a character reset occurs. Refer to serializer timing diagram figure 3-94.

(5) Serializer. The major portion of the serializer is the 8-bit shift register comprised of MLE2, MLD2, and MLB2. Program screws at the oscillator dividers and the input of MLC3 allow the option of 7.00 or 7.42 unit code, refer to figure 3-94 for illustration of the 7.42 unit code. A positive voltage at the external synchronous pulse input (pin 29) is inverted by MLA4. The negative output is again inverted by another section of MLA4. The positive output at pin 30 of the circuit card is externally strapped and used to operate the reader step logic. Operation of the reader step logic is described in paragraph f. The negative voltage at MLA4-11 is externally strapped to the input of MLB3-5. The enable signal input is positive for MLC3-4. The negative output of MLC3-6 is delayed approximately 5 microseconds by R7, C3 and inverted by MLB3. The positive transition is used to prime the bit clock control register MLF1. The control register is set upon receipt of the next transition of the crystal oscillator. The positive output at MLF1-8 primes the bit clock control register and the next excursion of the crystal oscillator resets the register. This action results in a positive pulse at the input of MLG1-12. This gate inverts the signal and it is used to reset the oscillator. The inverted side of the bit clock control register is inverted by MLB3 and delayed approximately 5 microseconds by R8 and C4. The delayed positive pulse is inverted by MLB3 and is used as a data sample pulse. The bit clock control register is proportional to the synchronism with the crystal oscillator frequency. The data sample pulse sets a stop bit into MLE2-10. This action disables MLC3. The positive output of MLC3 is inverted by MLB3 and disables MLC3-5. This allows only one bit clock control pulse per character. The serialization of the character Z is illustrated in Figure 3-94. A negative pulse is the only marking information that need be present. The absence of a pulse is used for spacing condition. Each negative excursion of the bit clock at MLG1-8 will shift the mark and space information to the right, toward flip-flop

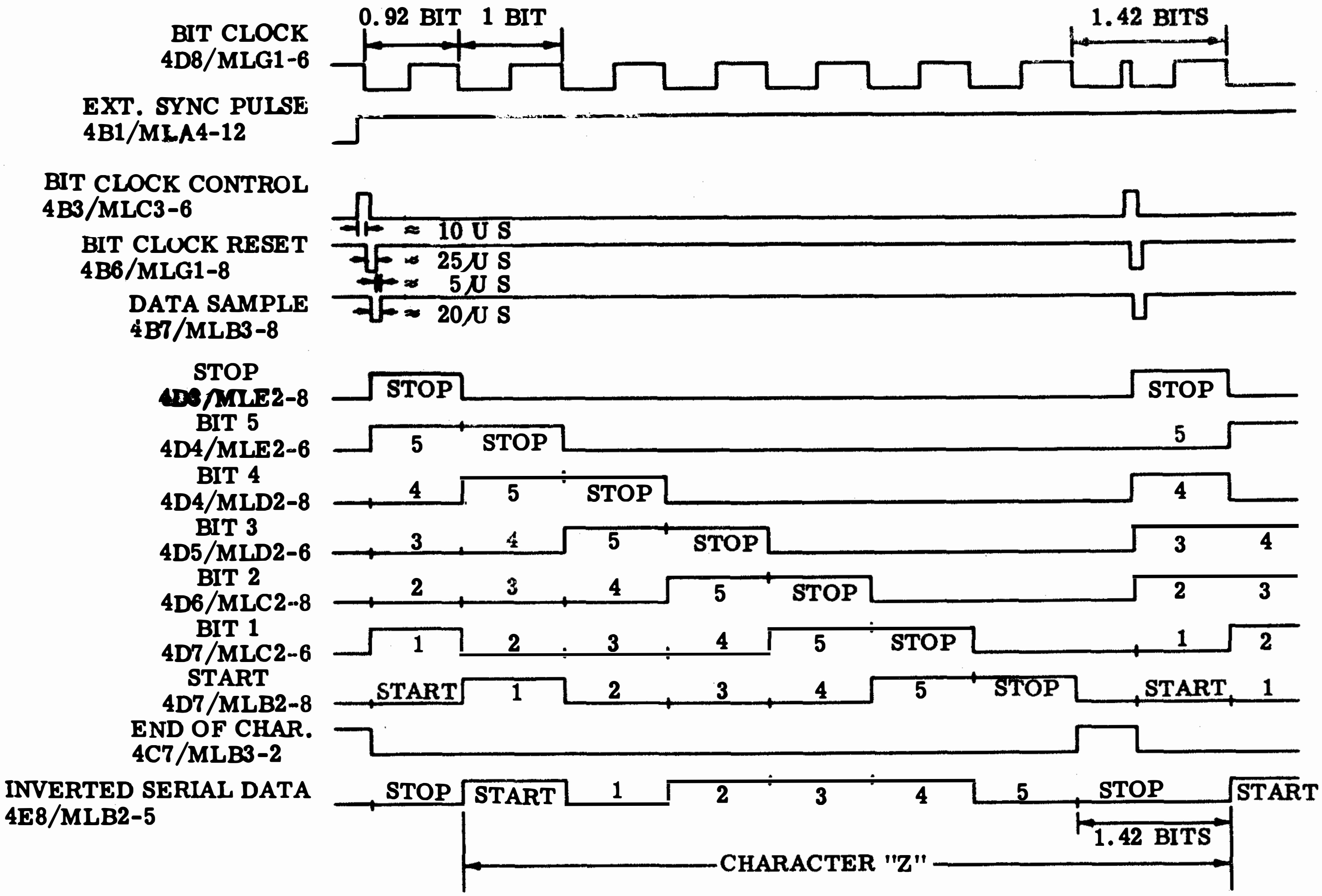


Figure 3-94. Serializer Timing Diagram (7.42 Unit Code Free Running)

MLB2. When the stop bit has shifted all the way through MLB2-8, all the inputs to MLC3 are high. When all the inputs to MLC3 are high, the output goes negative and starts the end of the character pulse. This immediately sets the stop bit into the last register MLB2. This is accomplished by holding the SD (set direct) input low. When the clock goes positive, MLC3-2 is enabled through option S and an oscillator reset pulse occurs. A data sample pulse is generated approximately 5 microseconds later. The oscillator reset causes the bit clock to reset to 0 volts. The data sample pulse sets a marking bit into the stop bit register MLE2-10. The marking bit disables the end of character gate MLC3 and unbinds MLB2-4. The next positive transition of the bit clock will be for MLG1-5 to shift the stop bit out of MLB2-5. The reset of the oscillator will produce a 0.92 bit. A total stop bit length of 1.42 is produced (0.50+0.92 = 1.42) at the end of the character pulse. The inverted serial signal at MLB2-5 is inverted by MLE3 (only during the format scan). The input control for this action is the inverted output of the reader enable register MLE4. The same signal is also used to control gate MLC3 through diode CR4 so the serializer will run only when sending the format. The output of MLE3-8 is shaped by R9, C5, and R10 then routed to an external keyer. The 7.00 unit operation is obtained when the program screw options P and R only are used. The major differences are the method of frequency division in the oscillator dividers and the exclusion of the bit clock signal from the bit clock control circuitry. The bit clock control gate MLC3 is now controlled by the end of the character pulse from MLB3-2. The end of the character pulse starts the bit clock control sequence and results in a unity stop pulse. Refer to Figure 3-95 for unit stepping operations.

g. Reader Control. The transmitter distributor contacts such as the reader inputs, run-stop, tight-tape and tape-out are closed to ground in the "in" and "run" position. Refer to Figure 3-96 for rear and front bit clock pulse generation. The inverted bit clock is converted by MLF4-2 and delayed by R14 and C6. The delayed output is combined with an AND function at the output of MLF4-10 and the bit clock that has been inverted by MLF4-12. The output of MLF4-10 is shown without a wired AND connection. This is done to illustrate the two inputs of the AND function. The resultant narrow pulse is used to sample the front reader control flip-flop MLG3 and MLG2. The normal bit clock is treated in a similar manner with the narrow rear bit clock pulse displaced by one-half a bit. The run-stop register MLG3-9 and the tape-out register MLF2-6 outputs are set to +5 volts by the rear bit clock when the rear run-stop and tape-in switches are closed to ground. Refer to Figure 3-97. The front run-stop and tape-out registers are inhibited from being set, while the rear tape-out register is active due to the inhibit signal at MLF2-9. The MLF3-4 and MLF3-2 gates are used to inhibit the set of rear and front tape-out registers. The inhibit mode is at zero volt. The input is called the remote serializer enable and tape-in inhibit. This input is controlled by the line seizure circuit when used with the TP328000 numbering module. This

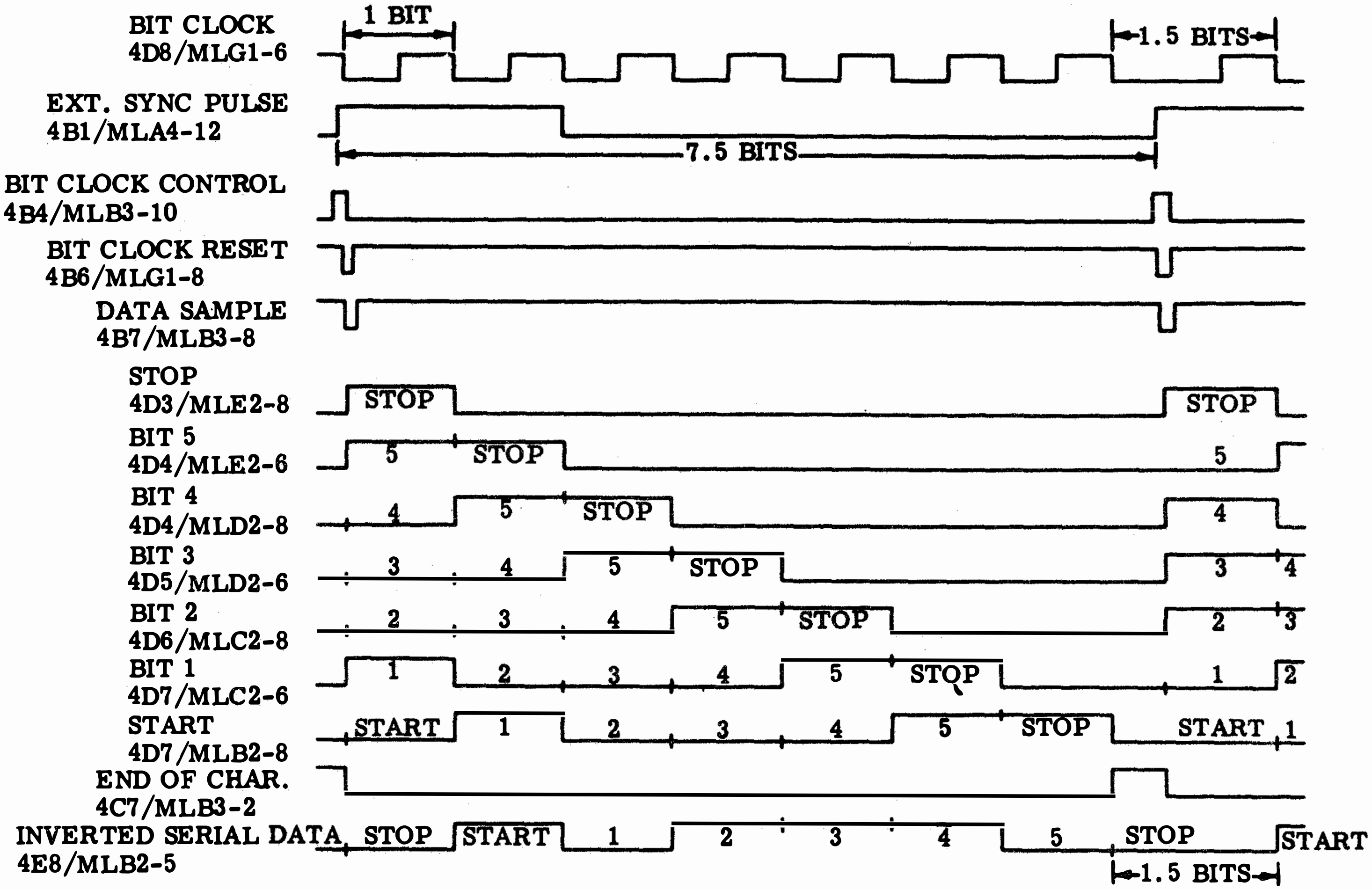


Figure 3-95. Serializer Timing Diagram (7.00 Unit Code, Stepped 7.5-Bit Character Length)

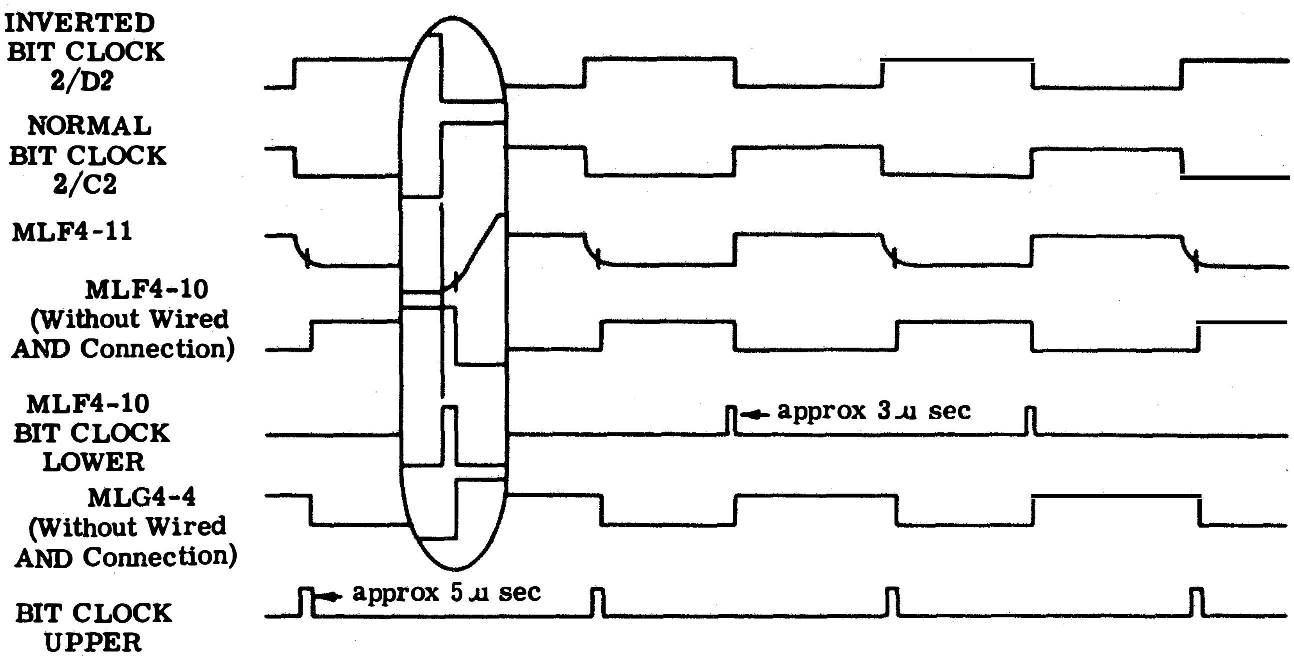


Figure 3-96. Conversion of Clock to Rear and Front Bit Clock

output connects to gate MLF3. These gates provide a +5-volt output when either the front or rear tape-out register is enabled. The output of MLF3-8 is delayed by R19 and C8 and inverted by MLH3. The delayed negative transition is gated with the output of MLF3-11 and the local form delete signal. The output of MLH4-6 is a narrow pulse unless the local format delete switch is turned on grounding MLH4-5. The negative format reset pulse is used to reset the scanner. The format reset signal is also used to generate the message number advance signal MLH4-8. The MLH4-9 input is used with the optional line assurance circuit card. The number will not advance when the input is at 0 volt. The bit clock control gate MLC3-1 is enabled by the +5 volt level output from MLH4-12. When the bit clock control gate is enabled, a data sample pulse is started. The data sample pulse starts the scanner and these pulses continue through the 15-character sequence. The end of format signal at MLB3-3 is inverted and used to set MLE4 (the reader enable register) on receipt of the next sample pulse. The output of register MLE4 (pin 6) is th last positive level needed to enable MLH2-12. The signal is inverted by MLH3. The positive output of MLH3 is shaped by resistor R17 and capacitor C2. C2 is mounted on connector P2 of the numbering modules. When the synchronous pulse is not used, the reader step is held high at +5 volts on receipt of the reader enable signal. This is called the free running mode. The inverted rear run-stop signal MLG4-8 primes both the run-stop and tape-out registers MLG3-12 and MLF2-4. This is to ensure that the tape-out register cannot be enabled until a normal run condition is transmitter distributor.

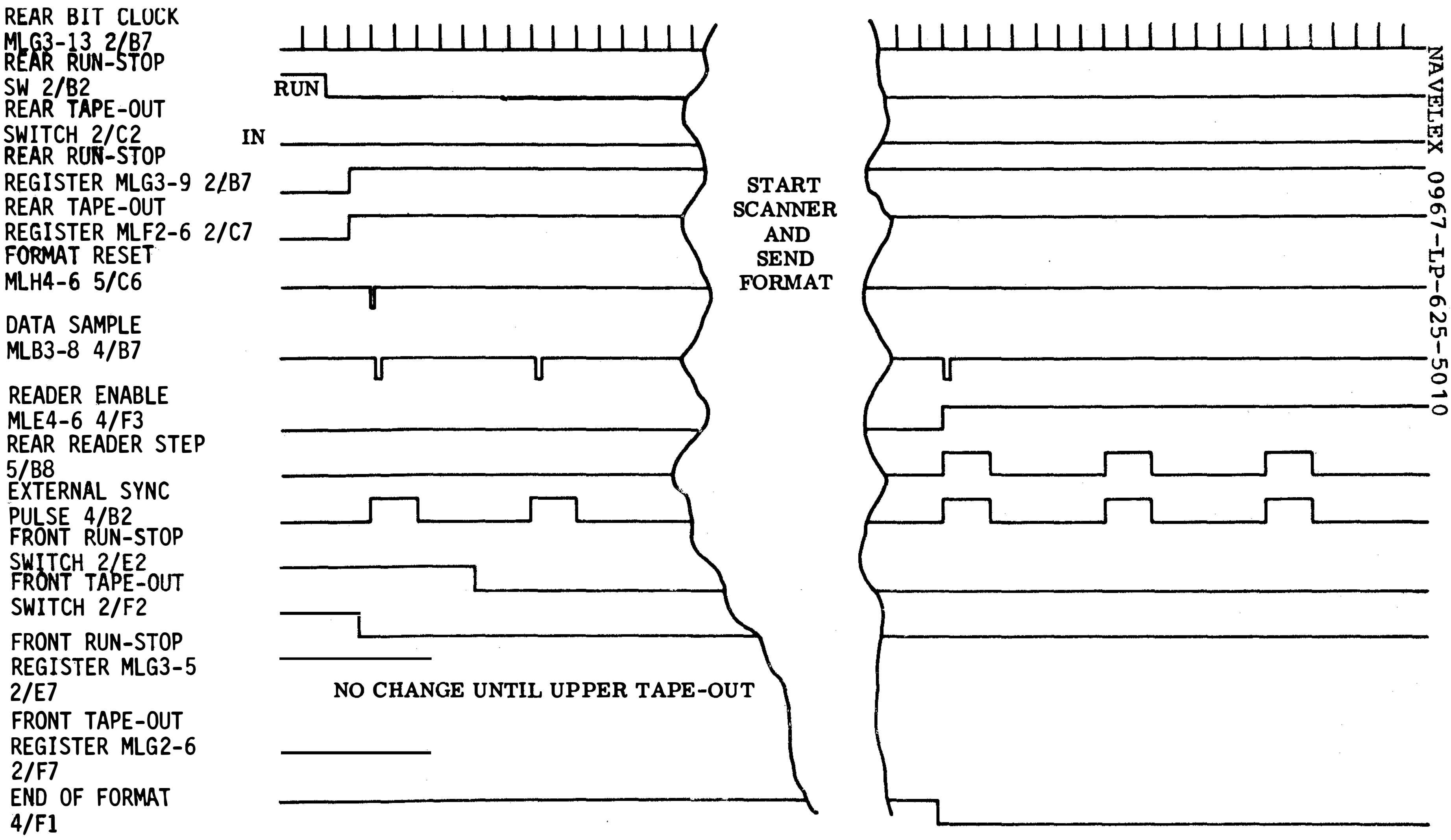


Figure 3-97. Reader Run-Stop Controls

established in the The end of the format signal is inverted at MLB3-4. This signal is used to prime reader enable register MLE4. The +5-volt output at MLE4-6 occurs after the last data sample pulse and is used as a clear signal for MLG2-12 or MLF2-12. This ensures that the tape-out register cannot be reset after being enabled until a full format is transmitted. The registers cannot be reset even if a premature tape-out occurs in the transmitter distributor.

(1) Tandem Operation. An external delay circuit is used for tandem operation but is not required for single channel operation. The connection between MLG2-9, MLG3-10, and MLF2-5 makes it impossible for the rear run-stop or tape-in registers to be on when the front tape-in register is on. A similar function is accomplished by MLF2-9, MLG3-4, and MLF2-5 for the rear tape-in register. Rear and front bit clocks are used to set these control flip-flops. There is a one-half bit delay between these clock signals. This is required to develop a format reset pulse. Refer to Figure 3-98. A longer pause in operation is necessary when running the transmitter distributor (TD) in tandem because of their long mechanical delays. This is accomplished by delaying the second tape-in register approximately 400 milliseconds. The rear bit clock clears the tape-in register as the rear TD runs out of tape. This causes the local transmitter busy signal to go idle (0 volt at pin 9). The line seizure circuit card uses this signal to initiate the 400 milliseconds (ms) negative pulse. This pulse is used to inhibit the tape-in register through MLF3-2 for the pulse duration. A similar operation takes place when switching from the inner to the outer transmitter distributor.

(2) Line Assurance. The optional line assurance card provides the proper signals for exercising the transmitter signal line approximately once every two minutes if the TD should stay idle for two minutes. If the local transmitter should go busy, the circuit will be reset and will not produce a format until the transmitter is idle for at least a minute. Transistor Q1 and associated components comprise an 8-second timer. This transistor stage drives a (divided by 16) counter comprised of dual flip-flop packages ML4 and ML5. For the counter to operate normally, the following conditions must exist. Inhibit line assurance input must be at ground (pin C) keeping transistor Q2 off. Local transmit busy line must be at ground (pin N). This signal is inverted by ML3-4 and allows the set direct inputs of the flip-flops to be high. Remote serializer enable input must be high (pin F). This pin controls the J and K inputs to the last flip-flop. This pin can be driven low by the line seizure card under seizure conditions and this would inhibit the counter. When flip-flop ML4 goes to its clear state (pin 8 low, pin 9 high) both inputs to ML2-3 are high for a short time due to the integrator circuit, composed of R10 and C6. Gate ML2-3 goes low and sets the latch consisting of ML1-2 and ML2-11. The signal is delayed by R4 and C3 when ML1-10 goes high. This signal is used by gates ML3-8, ML3-10 and ML3-12 and integrator R4 and C2 to develope a positive pulse at ML3-12. The positive pulse is

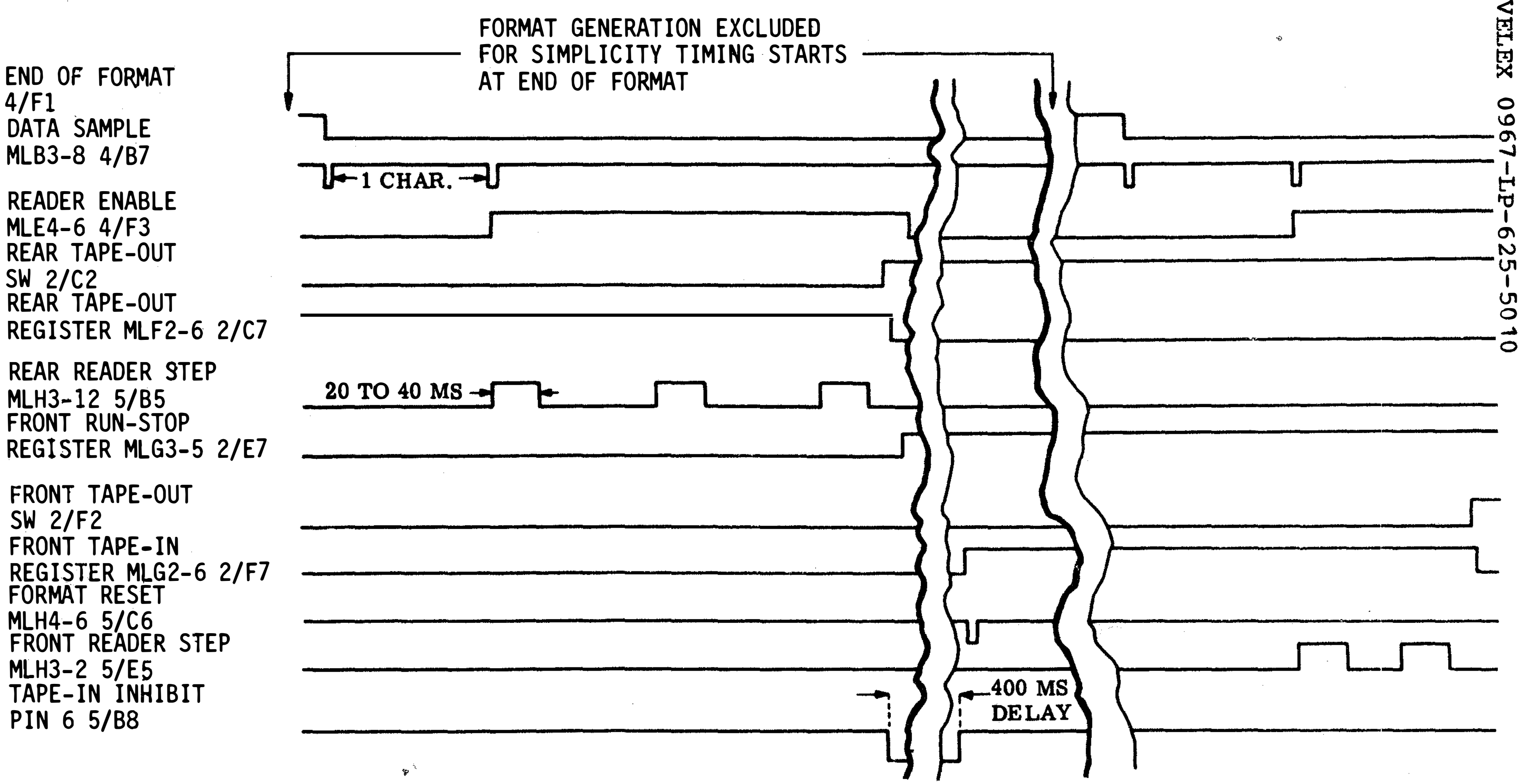


Figure 3-98. Tandem Transmitter Distributor Operation

inverted by ML3-6 and used as a format reset signal to reset the format scanner. The latch sets when ML1-2 goes high. When the outputs of ML1-4 and ML1-6 go low, gate ML2-8 is primed. The signal on pin E is used to prevent a number advance signal from the reader control and serializer. The signal on pin F is ued by the serializer circuit to prevent the tape-in registers from being energized if a tape-in signal is received. Pin L goes high when the format scanner steps to ZCZC portion of the format. When pin 8 goes low and pins 9 and 10 of ML2 are high, the data sample pulses are inhibited from having effect on the format scanner, thus deleting this portion of the format. When pin D goes low, the format scanner cycles to the end. This signal is inverted at ML1-8, both inputs to ML2-6 (high) and ML2-12 (low). This action resets the latch. When all three conditions remain unchanged, the cycle will repeat after approximately two minutes.

Table 4-1. Scheduled Maintenance Action Index

Periodicity	Maintenance Action	Reference
D	Inspect and clean as necessary.	4-5a
D	Check paper supply.	4-5a(7)
D	Inspect and lubricate if necessary.	4-6,4-7
W	Check points of range.	4-5b(1)
W	Clean selector magnet pole faces.	4-5b(2)
W	Check operation of keyboard.	2-3
M	Disassemble and inspect.	4-5c
M	Inspect main shaft.	4-5c(2)
M	Inspect function box.	4-5c(3)
M	Inspect keyboard.	4-5c(4)
M	Inspect selector mechanism.	4-5c(5)
M	Reassemble.	4-5c(6)
M	Check left margin.	4-5c(7)
M	Check right margin.	4-5c(8)
M	Inspect and lubricate transmitter distributor.	4-12
M	Inspect and lubricate reperforator.	4-11
M	Inspect and lubricate perforator.	4-8

Table 4-1. Scheduled Maintenance Action Index - Continued

Periodicity	Maintenance Action	Reference
Q	Disassemble and clean in cleaning solvent.	4-5d
O	Lubricate.	4-6,4-7
Q	Check adjustments.	4-5d(6)
Q	Inspect selector mechanism	4-5c(5)
Q or R	Conduct performance tests.	4-8

c. Resuscitation. Personnel working with or near high voltage should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

4-5. PREVENTIVE MAINTENANCE PROCEDURES. The following paragraphs contain scheduled preventive maintenance procedures referenced in Table 4-1.

a. Daily Inspection and Cleaning. Daily inspection and cleaning of the teletype machine is performed as follows:

CAUTION

Never increase tension on print hammer for darker print; replace the ribbon. When replacing type box, ensure that it is properly positioned and securely fastened. Ensure that ribbon is correctly installed.

(1) Inspect ribbon for wear and frayed edges; replace if required.

(2) Inspect wire rope for frayed ends, cuts, and broken strands; replace if required.

(3) Inspect type and type box for excessive wear on pallets; clean with stiff brush if smudging is evident.

(4) Inspect machine for loose, broken, or worn parts.

CAUTION

While cleaning teletype machine, ensure that springs

(e) Signal generator contacts (paragraph 6-4b(9)).

(f) Adjust clutches to the high side for 100-wpm operation.

4-6. CABINET LUBRICATION. The following paragraphs provide cabinet lubrication instructions and Table 4-2 specifies lubrication intervals which depend on the amount of daily operation and the speed of operation. Lubrication methods for the cabinet are indexed in Table 4-3 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the cabinet as viewed by the operator facing the unit.

b. Lubricate the cabinet just prior to placing it in service. After 300 to 500 operating hours, relubricate the cabinet. Recheck all clutch gaps; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Apply a thick film of grease to all gears and the spacing clutch trip cam plate. Apply oil to all cams, including the camming surfaces of each clutch disk. The following symbols apply to the specific lubrication instructions indicated in the line drawings.

Symbol		Meaning
O	-	Apply MIL-L-17672
G	-	Apply MIL-G-23827
SAT	-	Saturate with MIL-L-17672 oil

d. Apply MIL-L-17672 oil wherever the use of oil is indicated. Apply MIL-G-23827 grease on all surfaces wherever indicated. Whenever clutches are disassembled, apply a thin coat of grease to the shoe lever spring loops, and oil to the internal mechanisms. Fill lubricator reservoir at indicated intervals.

e. Lubricate the cabinet thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-7. ELECTRICAL SERVICE UNITS LUBRICATION. The following paragraphs provide electrical service units lubrication instructions and specify lubrication intervals (table 4-2) which depend on the amount of daily operation and the speed of operation.

Table 4-2. Lubrication Interval

(Based on 5-Day Week)*

	Daily Operation of Equipment		
Speed (wpm)	0-8 hrs	8-16 hrs	16-24 hrs
60	52 wks	39 wks	26 wks
66	52 wks	39 wks	26 wks
75	52 wks	39 wks	26 wks
100/107	39 wks	26 wks	13 wks
Newly Installed Equipments (All Speeds)	3 wks	2 wks	1 wk

*For a 6-day week operation, reduce lubrication intervals 15 percent. For a 7-day week operation, reduce lubrication intervals 30-percent.

Table 4-3. Cabinet Lubrication Chart Index

Figure	Title	Page No.
4-1	Cabinet Mechanism	4-8
4-2	Line Guide Mechanism	4-9
4-3	Dome Latch Mechanism	4-9
4-4	Low-Paper and Paper-Out switch Mechanism	4-10
4-5	Engaging Surface Stop Magnet Armature	

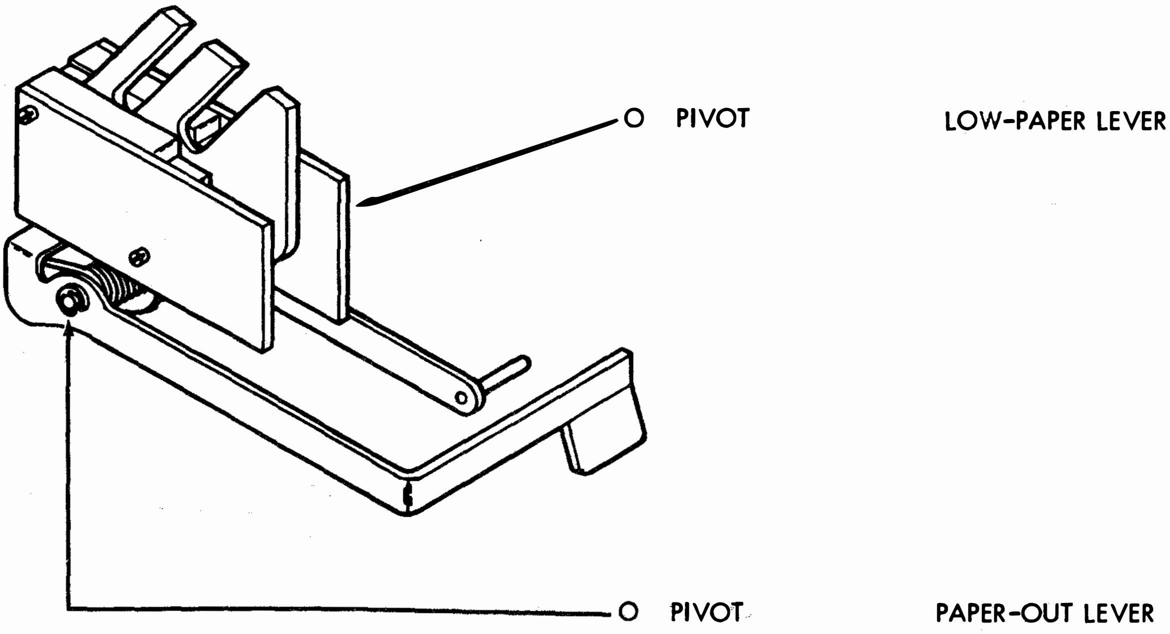


Figure 4-4. Low-Paper and Paper-Out Switch Mechanism

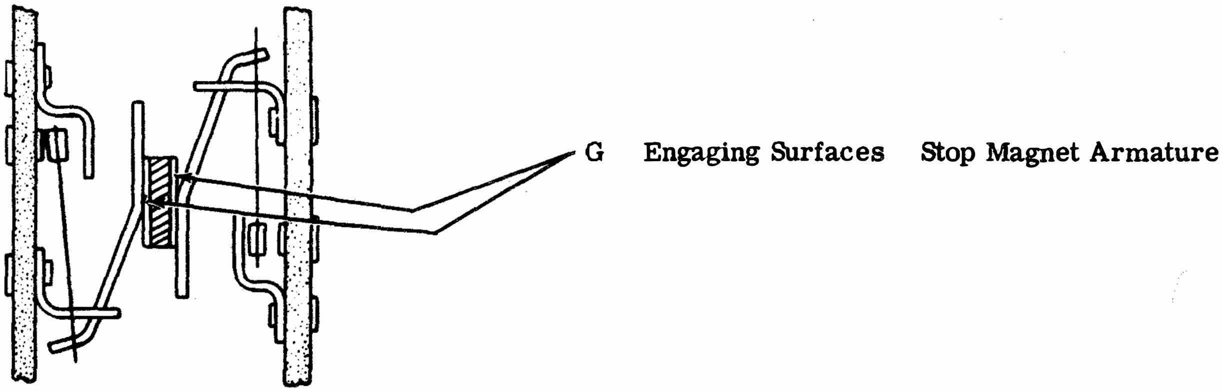


Figure 4-5. Engaging Surface Stop Magnet Armature

Lubrication methods for electrical service units are presented in the lubrication chart in Figure 4-5. The lubrication charts consist of a line drawing indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to electrical service units as viewed by the operator facing them.

b. Lubricate electrical service units just prior to placing set in service. After 300 to 500 operating hours, relubricate the electrical service units. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

d. Avoid over lubrication. Keep electrical contacts and wire insulations free of lubricants.

4-8. PERFORATOR-TRANSMITTER BASE LUBRICATION. The following paragraphs provide perforator-transmitter base lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the perforator-transmitter base are indexed in Table 4-4 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the perforator-transmitter base as viewed by the operator facing the unit.

b. Lubricate the perforator-transmitter base just prior to placing it in service. After 300 to 500 operating hours, relubricate the base. Recheck clutch gap; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Apply a thick film of grease to all gears and the spacing clutch trip cam plate. Apply oil to all cams, including the camming surfaces of each clutch disk. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

d. Whenever clutches are disassembled, apply a thin coat of grease to the shoe lever spring loops, and oil to the internal mechanisms.

e. Lubricate the perforator-transmitter base

Table 4-4. Perforator-Transmitter Base Lubrication Chart Index

Table 4-4. Perforator-Transmitter Base Lubrication Chart Index - Continued

Table 4-4. Perforator-Transmitter Base Lubrication Chart Index - Continued

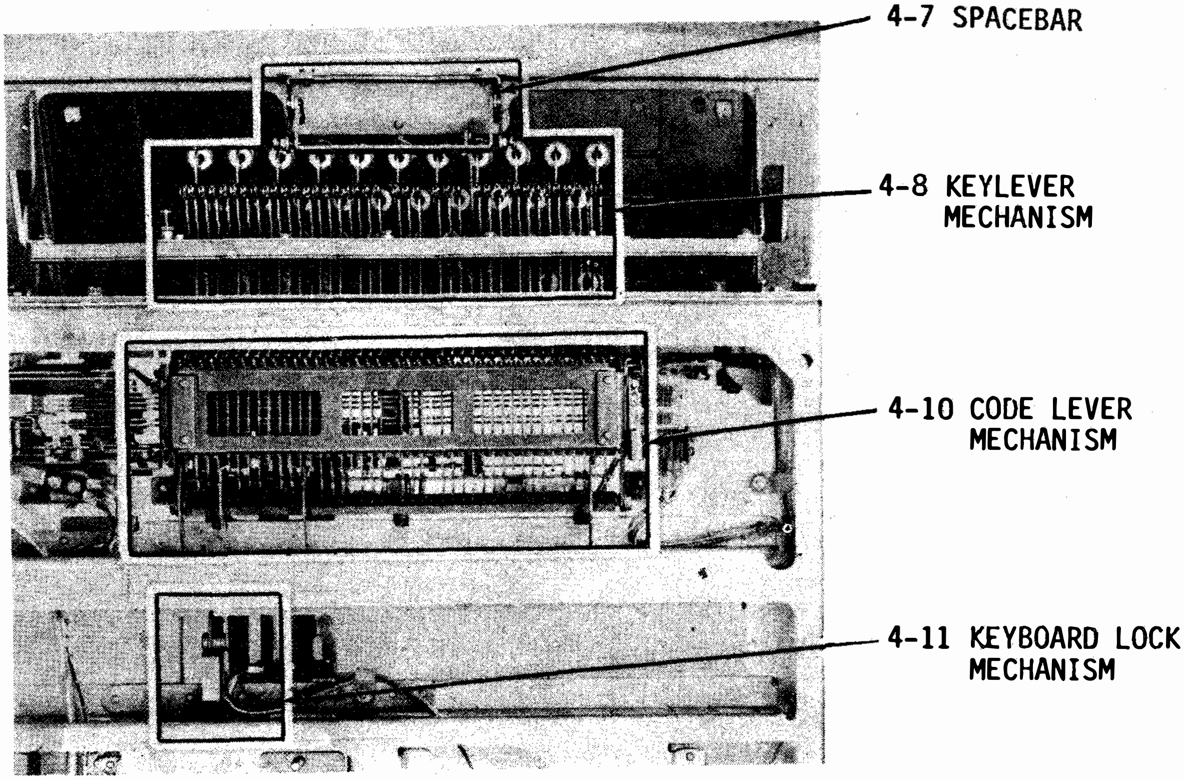


Figure 4-6. Keyboard Mechanism, Bottom View

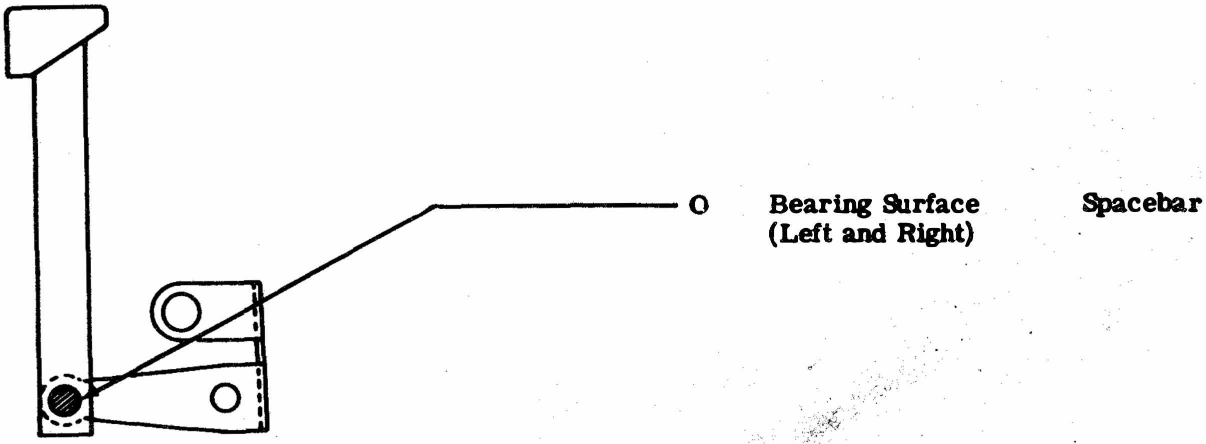
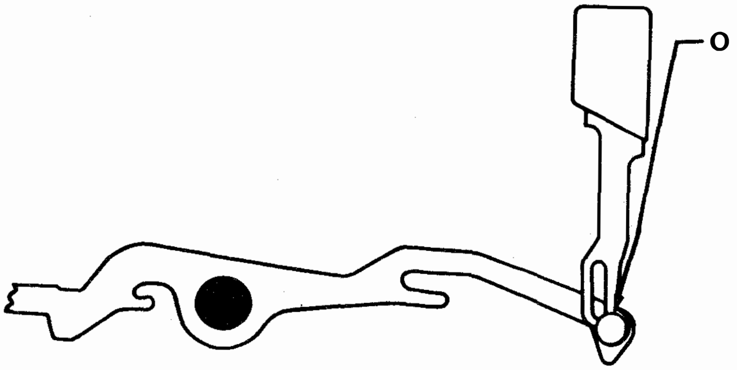
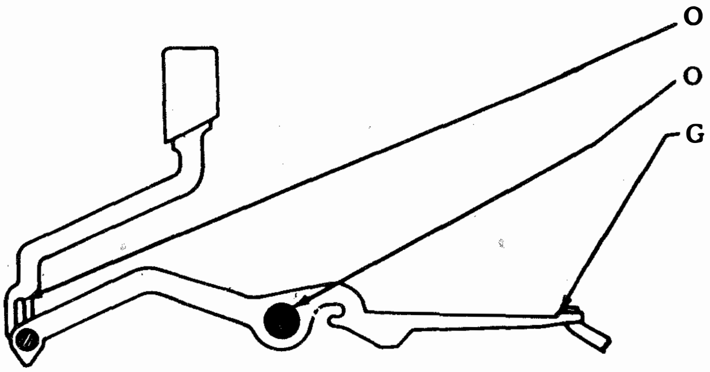


Figure 4-7. Spacebar Mechanism, Bottom View



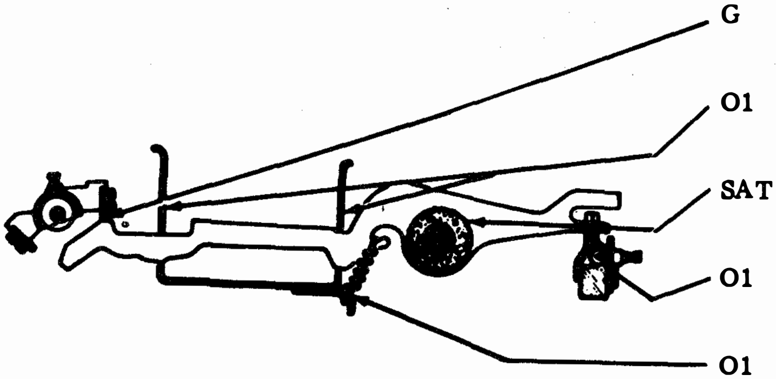
O	Engaging Surface (36 Levers)	Keytop Levers

Figure 4-8. Keylever Mechanism



O	Engaging Surface	Break Keylever
O	Bearing Surface	Function Lever
G	Contact Surface	Break Lever

Figure 4-9. Break Lever Mechanism



G	Contacting Surface (32 Levers)	Codelever Universal Bail
O1	Guide Slots (32 Levers)	Codelevers
SAT	Felt Washers (6 Washers)	Codelever Shaft
O1	Bearing Surface (32 Wedges)	Lock Ball Track
O1	Hooks - Each End (40 Springs)	Spring

Figure 4-10. Code Lever Mechanism

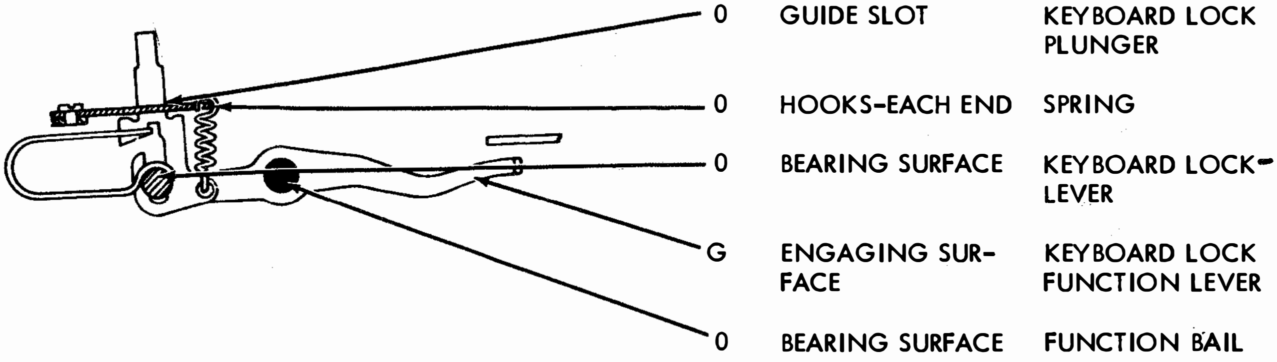


Figure 4-11. Keyboard Lock Mechanism

Figure 4-12. Extension Basket Mechanism, Bottom View

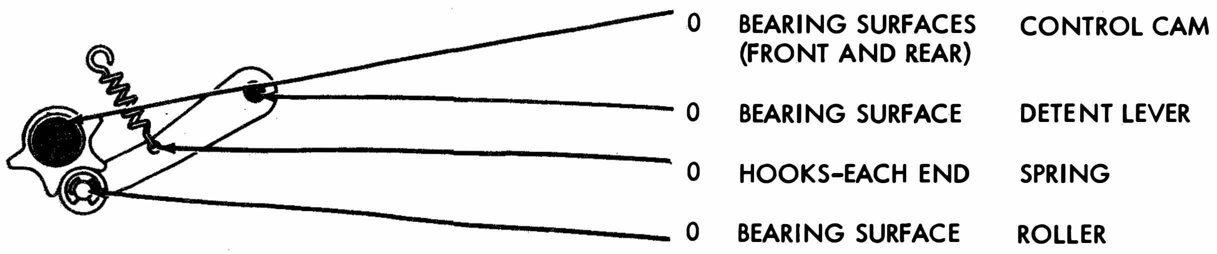


Figure 4-13. Detent Lever Mechanism

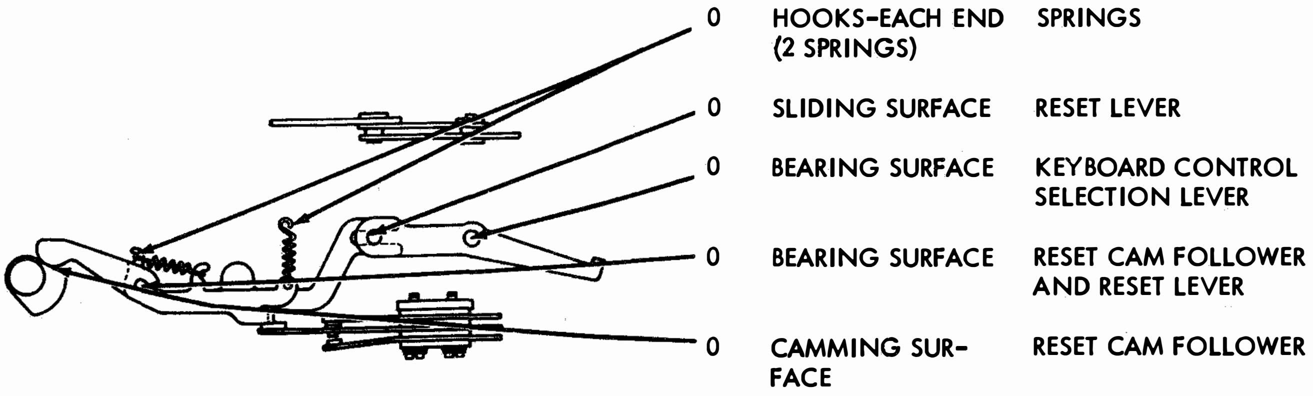


Figure 4-14. Selector Lever Mechanism

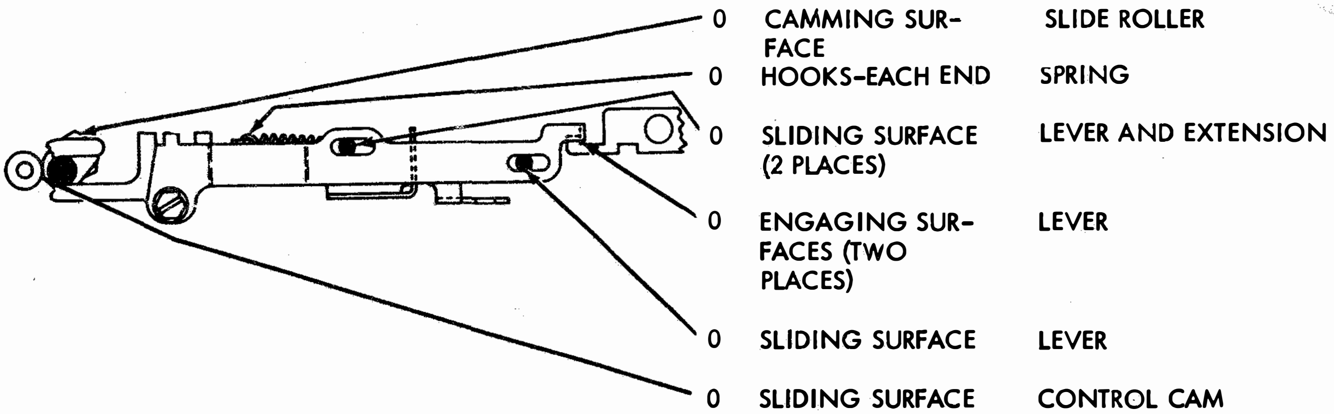


Figure 4-15. Code Bar Extension Bail Mechanism

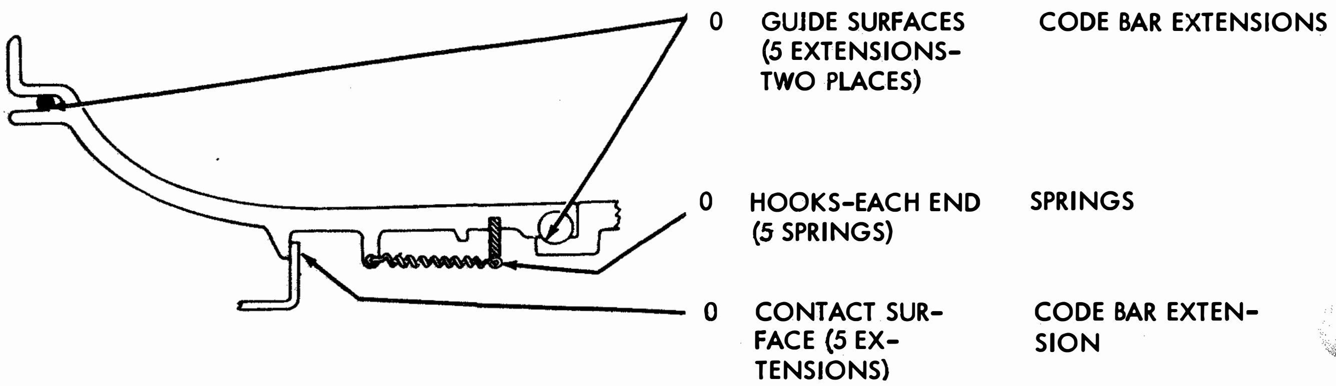
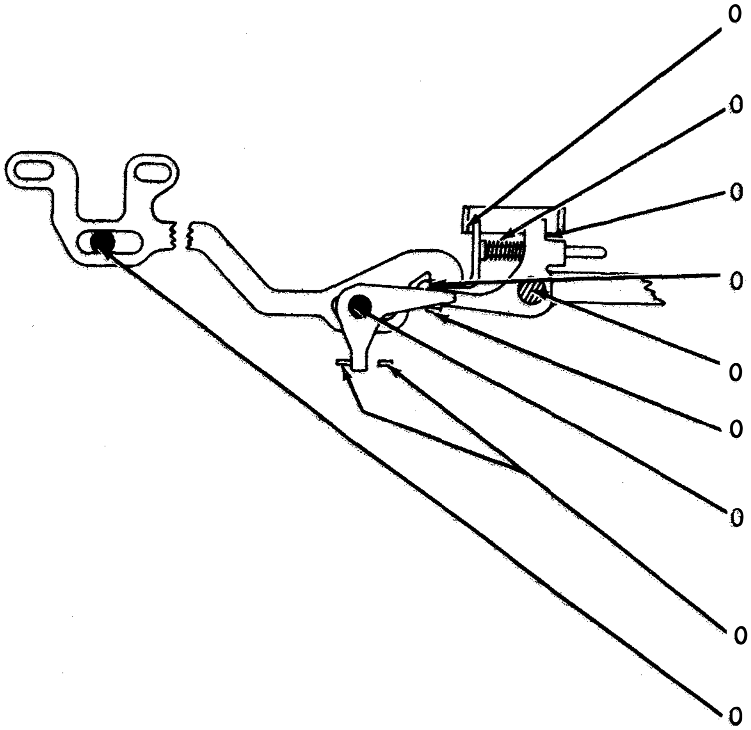


Figure 4-16. Code Bar Extension Mechanism



0	CONTACT SURFACE	CLUTCH TRIP BAR LINK EXTENSION
0	COMPRESSION SPRING-EACH END	LINK GUIDE PIN
0	CONTACT SURFACE	TRIP BAR LINK LATCH
0	ENGAGING SURFACE	CLUTCH TRIP BAR LINK
0	BEARING SURFACE	TRIP BAR LINK LATCH
0	CONTACT SURFACE	BELLCRANK
0	BEARING SURFACE AND SLIDING SURFACE	BELLCRANK AND CLUTCH TRIP BAR LINK
0	CONTACT SURFACE (BOTH SIDES)	BELLCRANK
0	SLIDING SURFACE	CLUTCH TRIP BAR LINK

Figure 4-17. Clutch Trip Bar Link Mechanism

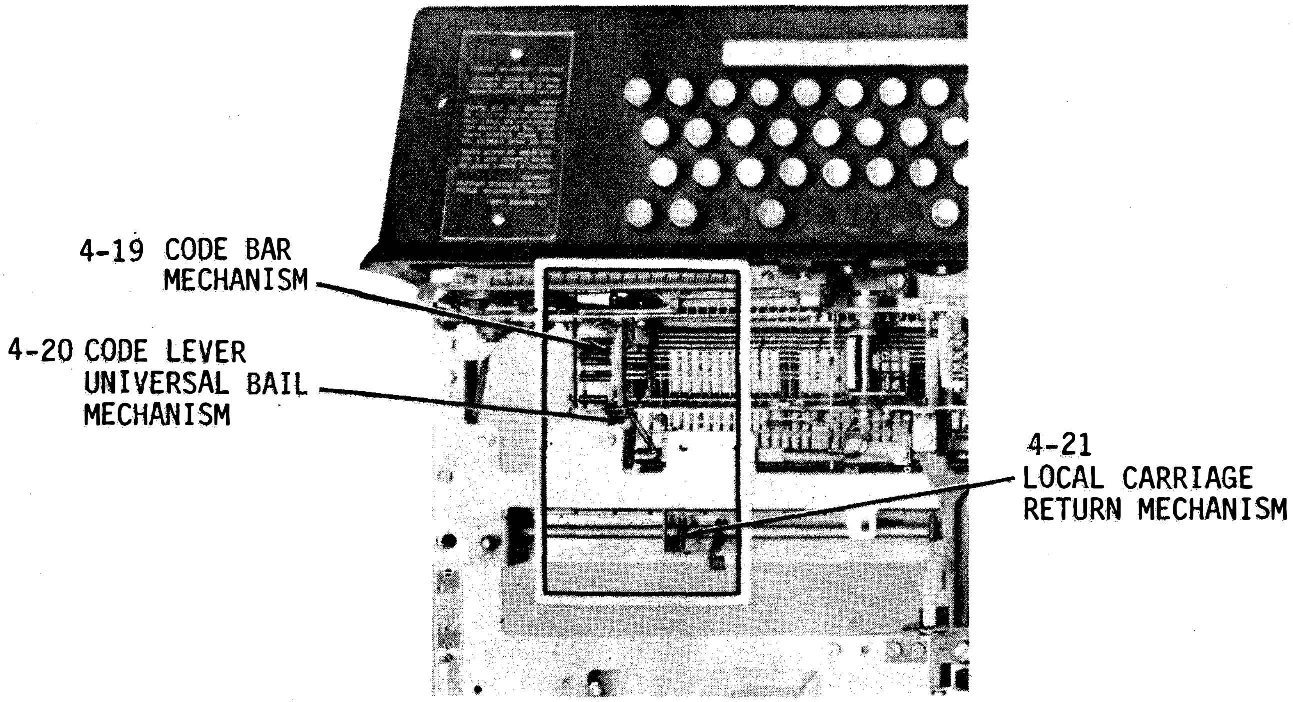


Figure 4-18. Code Bar and Local Line-Feed Mechanism, Top View

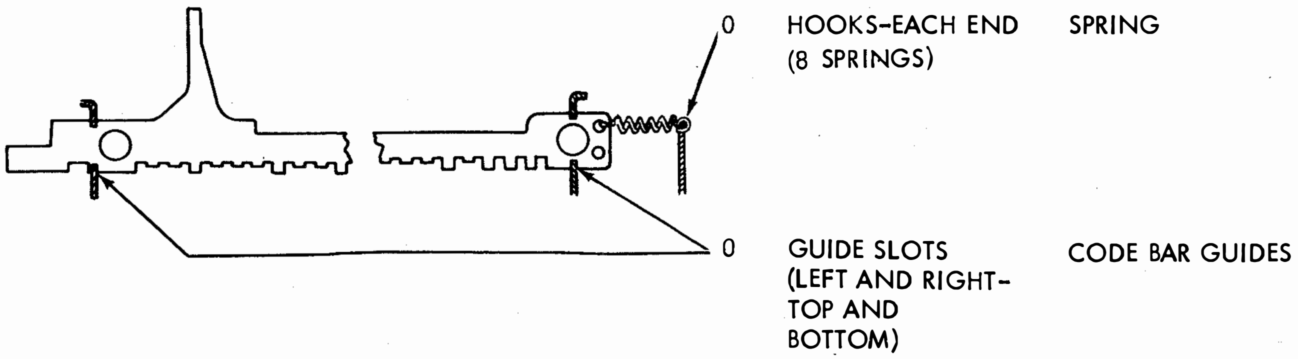


Figure 4-19. Code Bar Mechanism

Figure 4-20. Code Lever Universal Bail Mechanism

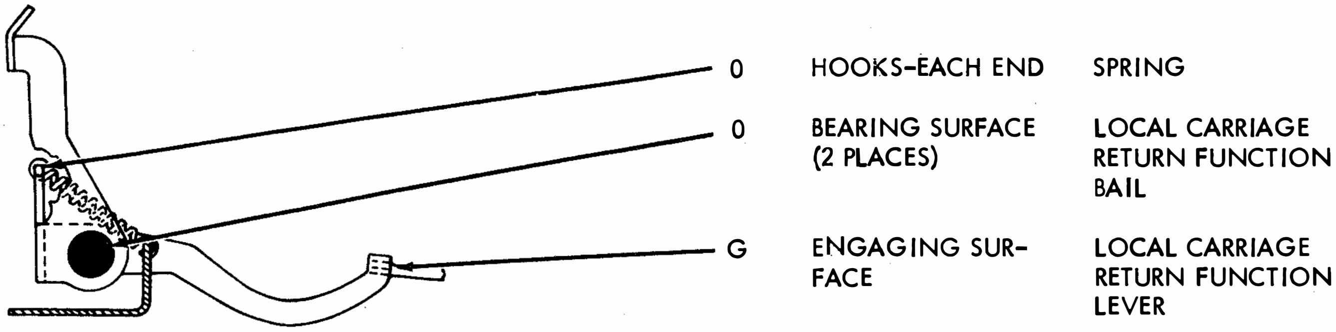


Figure 4-21. Local Carriage Return Mechanism

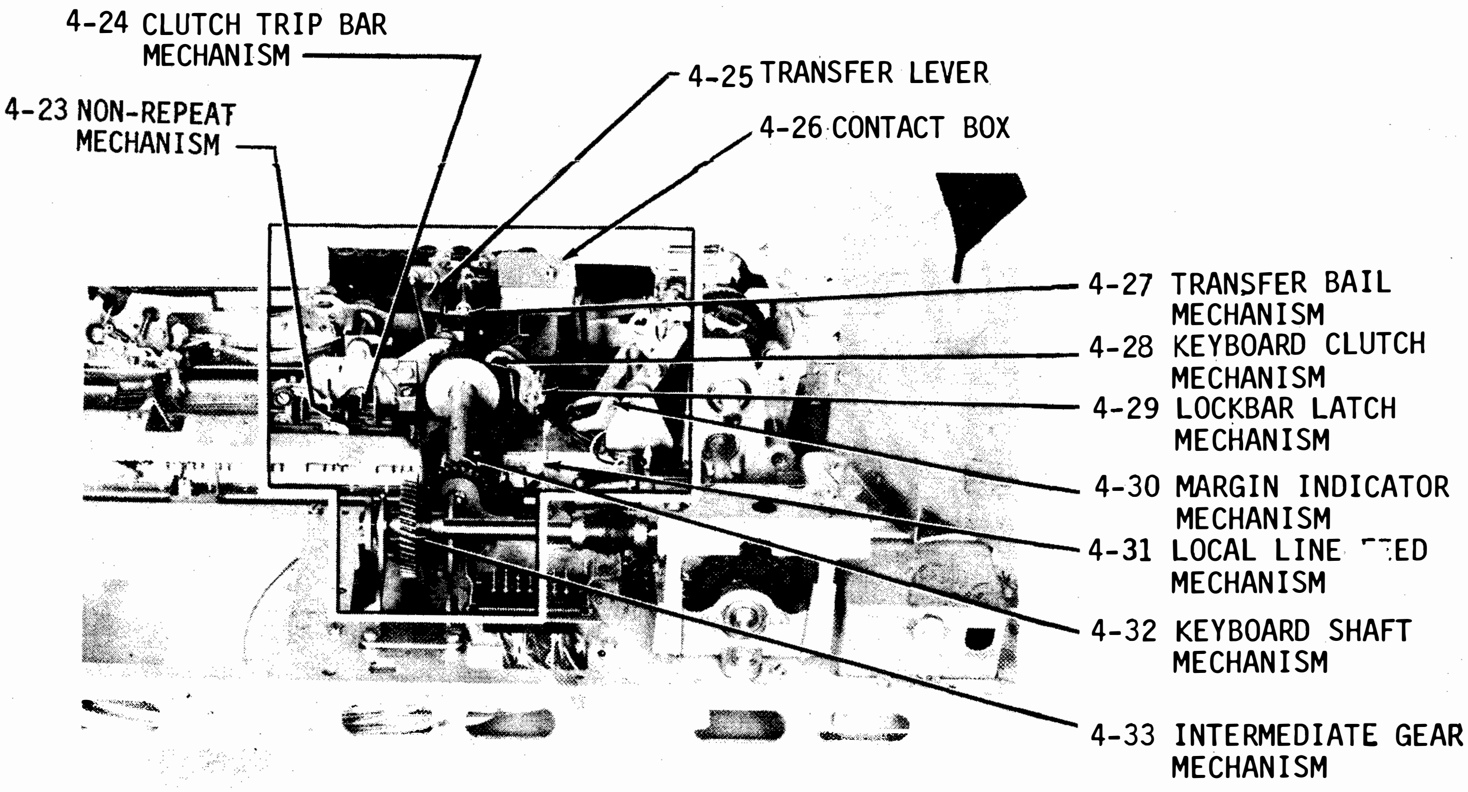
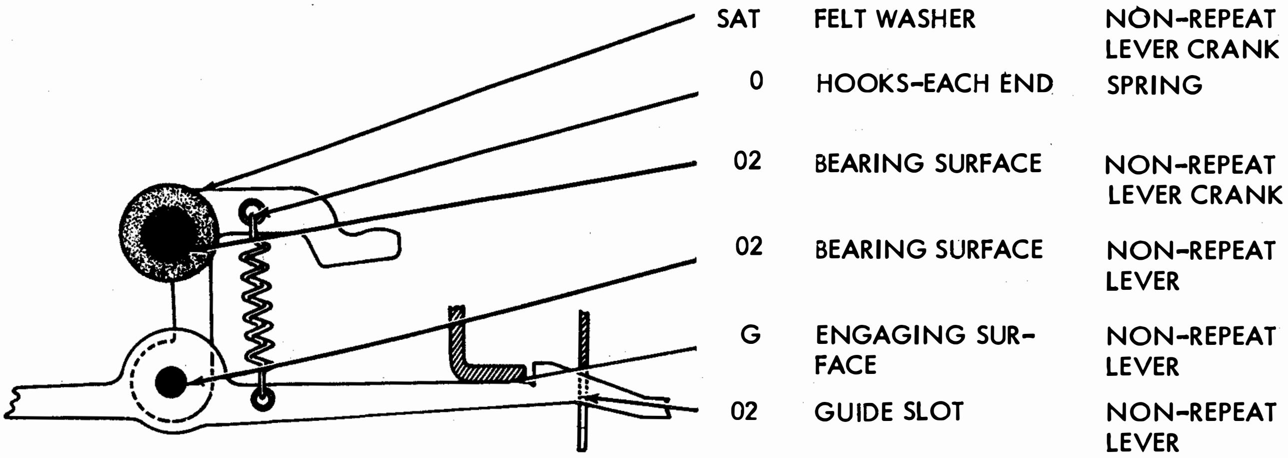
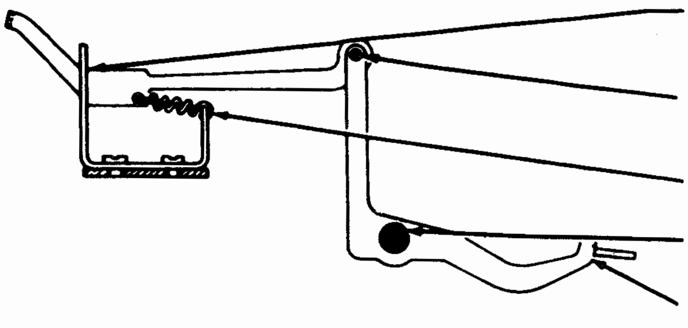


Figure 4-22. Signal Generator Mechanism, Rear View



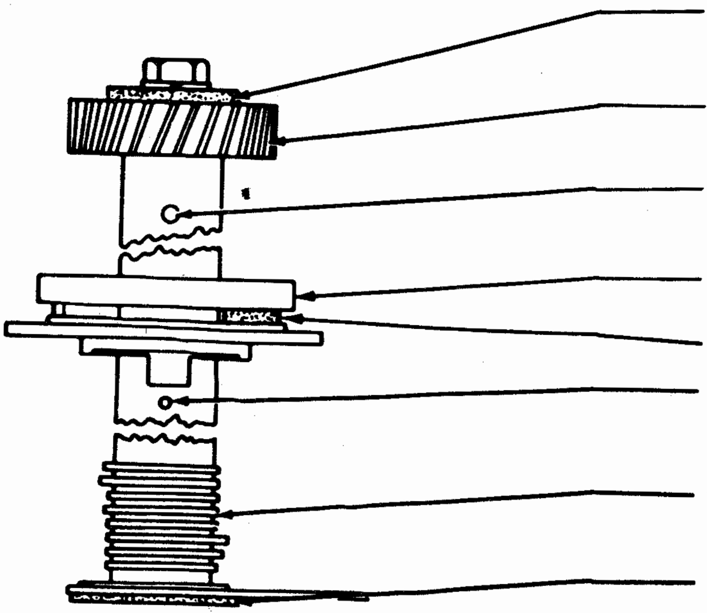
SAT	FELT WASHER	NON-REPEAT LEVER CRANK
0	HOOKS-EACH END	SPRING
02	BEARING SURFACE	NON-REPEAT LEVER CRANK
02	BEARING SURFACE	NON-REPEAT LEVER
G	ENGAGING SURFACE	NON-REPEAT LEVER
02	GUIDE SLOT	NON-REPEAT LEVER

Figure 4-23. Non-repeat Lever Mechanism, Rear View



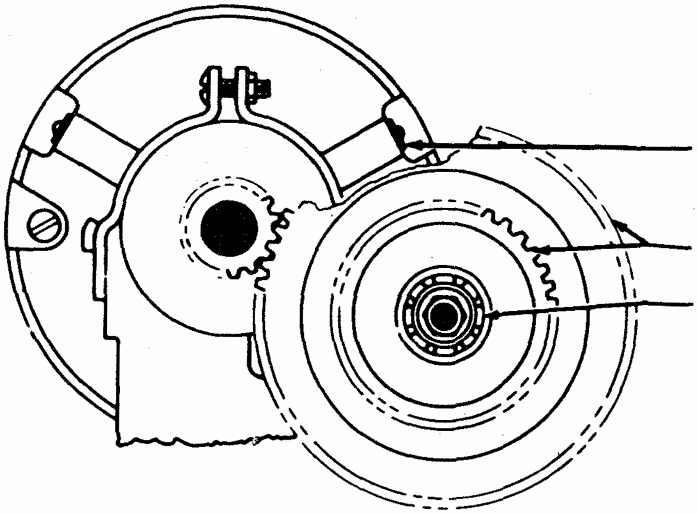
O2	Guide Slot	Local Line-Feed Trip Link
O	Bearing Surface	Local Line-Feed Function Lever
O	Hooks - Each End	Spring
O	Bearing Surface	Function Bail
G	Engaging Surface	Local Line-Feed Function Lever

Figure 4-31. Local Line-Feed Mechanism



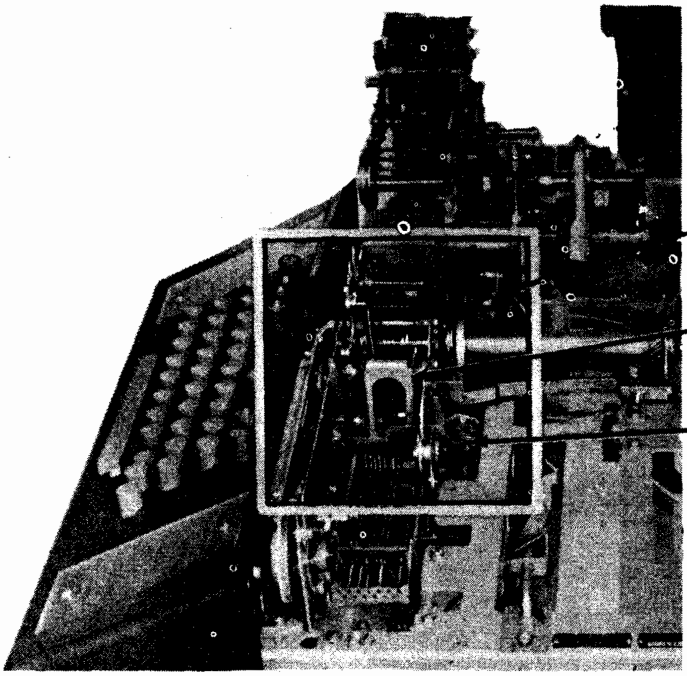
SAT	Felt Washer	Signal Generator Shaft
G	Gear Teeth	Signal Generator Shaft
O20	Oil Hole	Signal Generator Shaft
O4	Internal Mechanism	Keyboard Clutch
SAT	Felt Wick	Keyboard Clutch
O20	Oil Hole	Signal Generator Cam
O2	Camming Surface Each Cam	Signal Generator Cam
SAT	Felt Washer	Signal Generator Shaft

Figure 4-32. Keyboard Shaft Mechanism



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

Figure 4-33. Intermediate Gear Mechanism



4-35 LOCKING BAIL MECHANISM

4-36 CODE BAR BAIL MECHANISM

4-37 UNIVERSAL BAIL LATCHLEVER MECHANISM

Figure 4-34. Signal Generator Mechanism, Right Side View

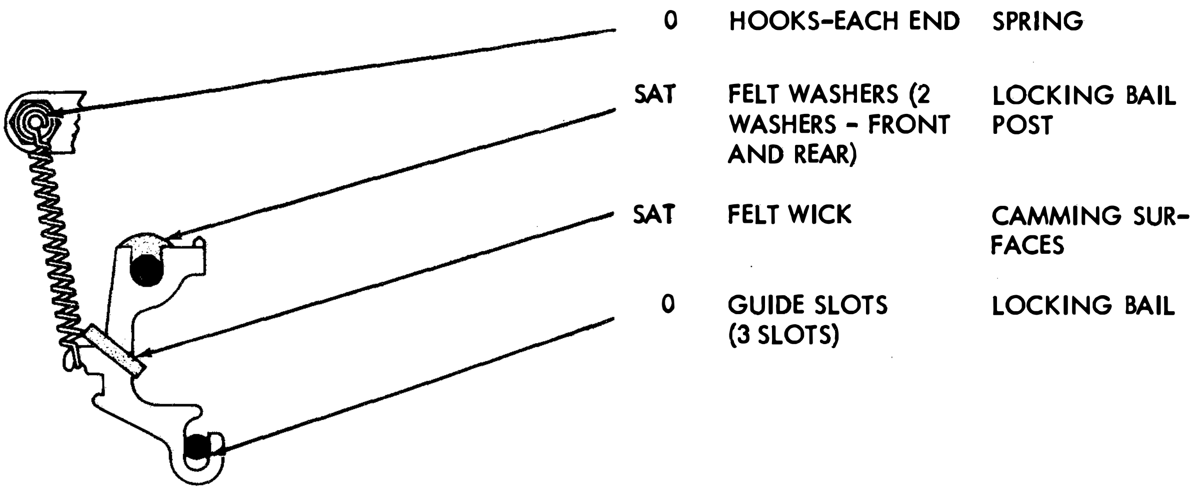


Figure 4-35. Locking Bail Mechanism

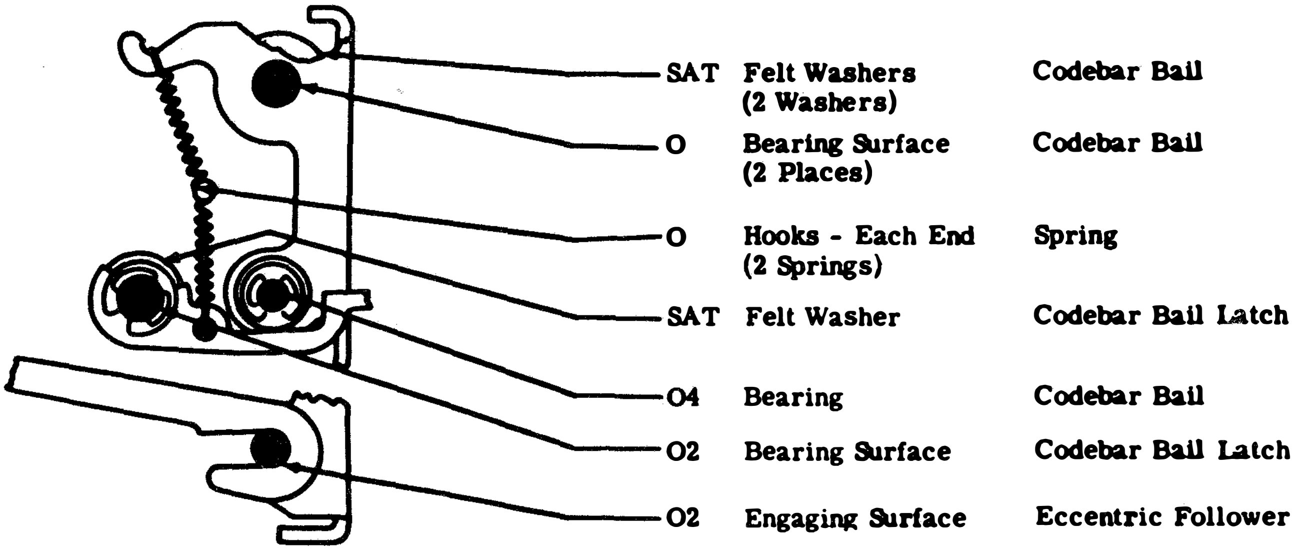
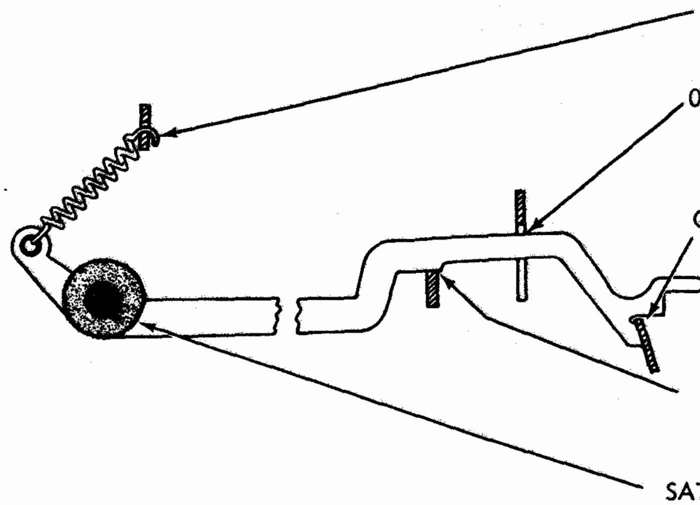
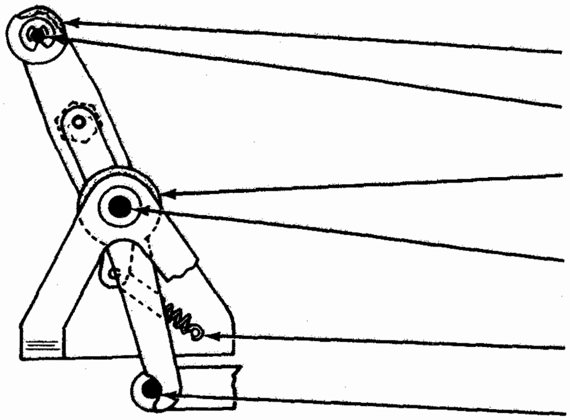


Figure 4-36. Code Bar Bail Mechanism



0	HOOKS (EACH END)	SPRING
02	GUIDE SLOT (EACH SIDE OF SLOT)	UNIVERSAL BAIL LATCH LEVER
G	ENGAGING SURFACE	CODE BAR BAIL EXTENSION
0	ENGAGING SURFACE	RESET BAIL LATCH
SAT	FELT WASHER	UNIVERSAL BAIL LATCH LEVER

Figure 4-37. Universal Bail Latchlever Mechanism



SAT	FELT WASHER	ROLLER
0	BEARING SURFACE	RETAINING RING
SAT	FELT WASHERS (FRONT & REAR)	RESET CAM FOLLOWER SHAFT
05	OIL HOLE	RESET CAM FOLLOWER SHAFT
0	HOOKS-EACH END	SPRING
0	ENGAGING SURFACE	RESET LEVER

Figure 4-38. Reset Cam Follower Mechanism

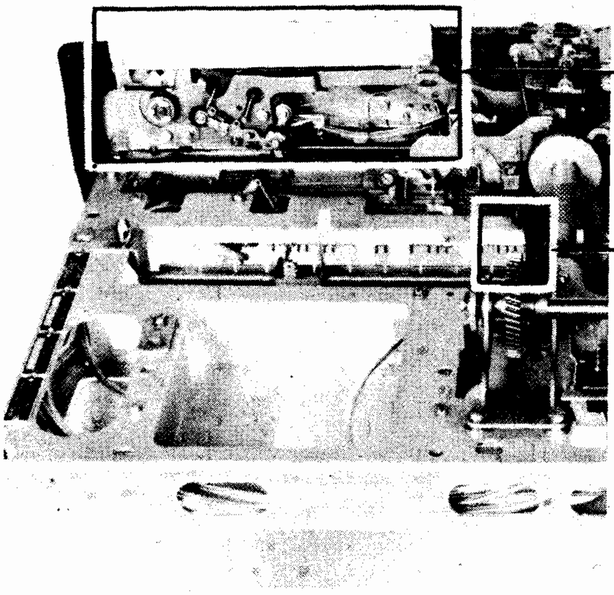


Figure 4-39. Character Counter and Electrical Line-Break Mechanisms, Rear View

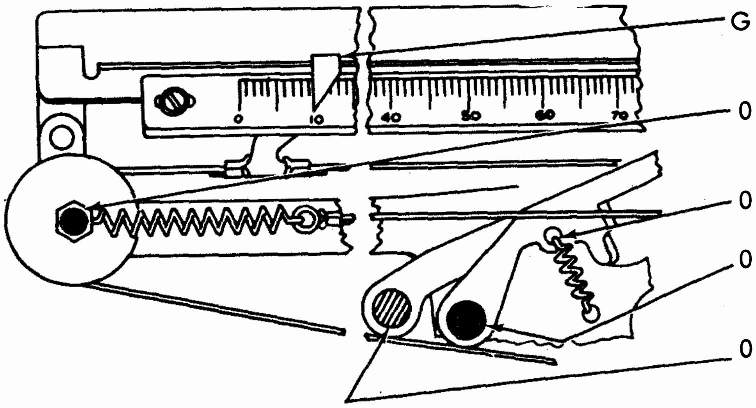
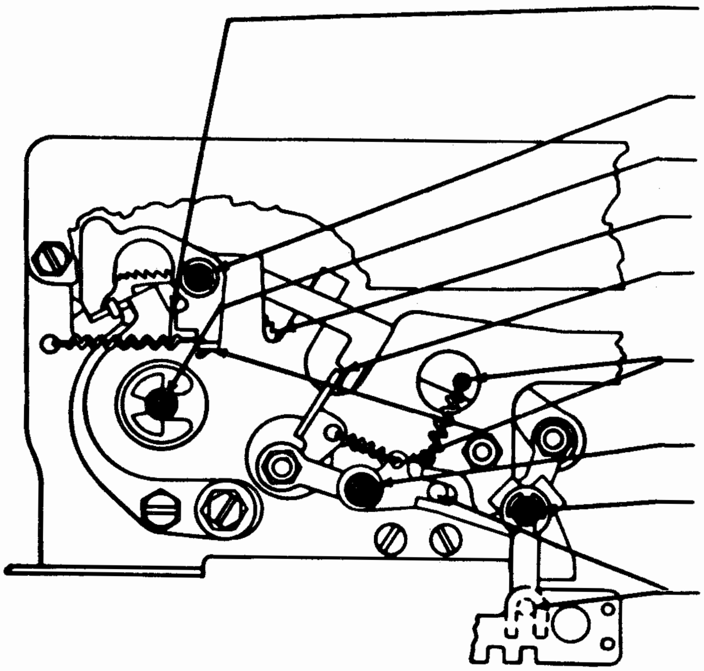
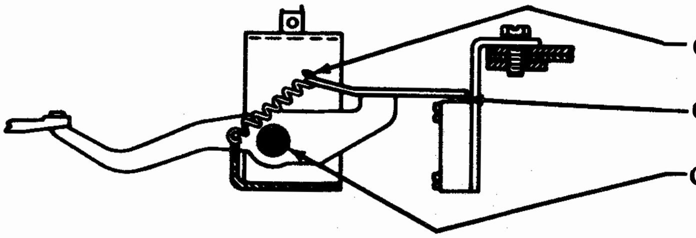


Figure 4-40. Character Counter Mechanism



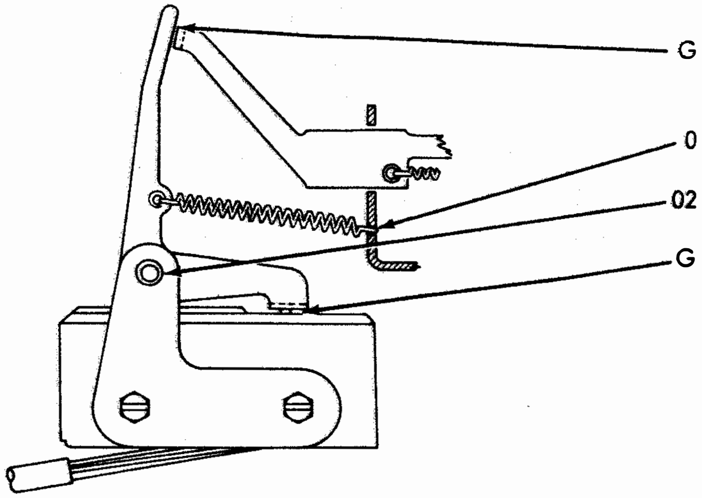
O	Contact Surface	Antibounce Latch
O	Bearing Surface	Antibounce Latch
O2	Bearing Surface	Ratchet Drum
G	Teeth	Ratchet
O	Engaging Surface (2 Places)	Reset Lever Extension
O	Hooks - Each End (3 Springs)	Spring
O	Bearing Surface	Reset Bail
O	Bearing Surface	Drive Lever Feed Bail
O	Engaging Surfaces (3 Surfaces)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

Figure 4-41. Character Counter Mechanism



O1	Hooks - Each End	Spring
G	Contact Surface	Sensitive Switch
O1	Bearing Surface	Break Lever

Figure 4-42. Electrical Line-Break Mechanism



G	ENGAGING SURFACE	LOCAL LINE-FEED TRIP LINK
0	HOOKS-EACH END	SPRING
02	BEARING SURFACE	LEVER
G	ENGAGING SURFACE	MAGNETIC BLOWOUT SWITCH

Figure 4-43. Local Paper Feed-Out Mechanism

NOTE:
REST PERFORATOR TRANSMITTER IN UPRIGHT POSITION.

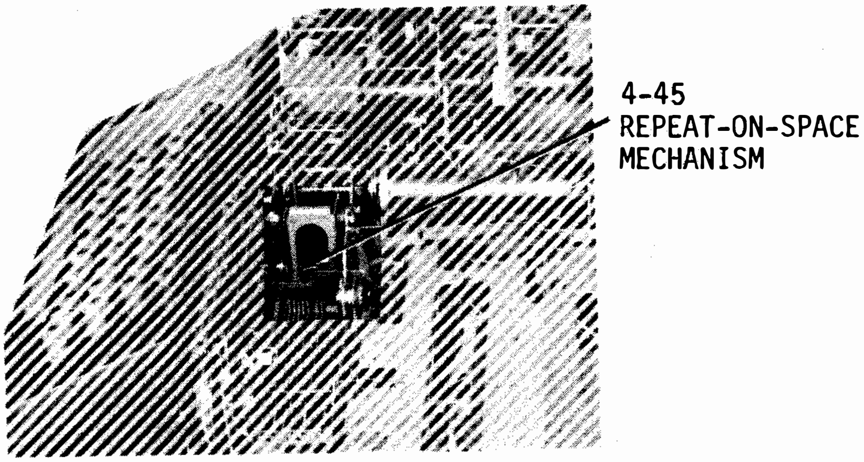


Figure 4-44. Repeat-on-Space Mechanism

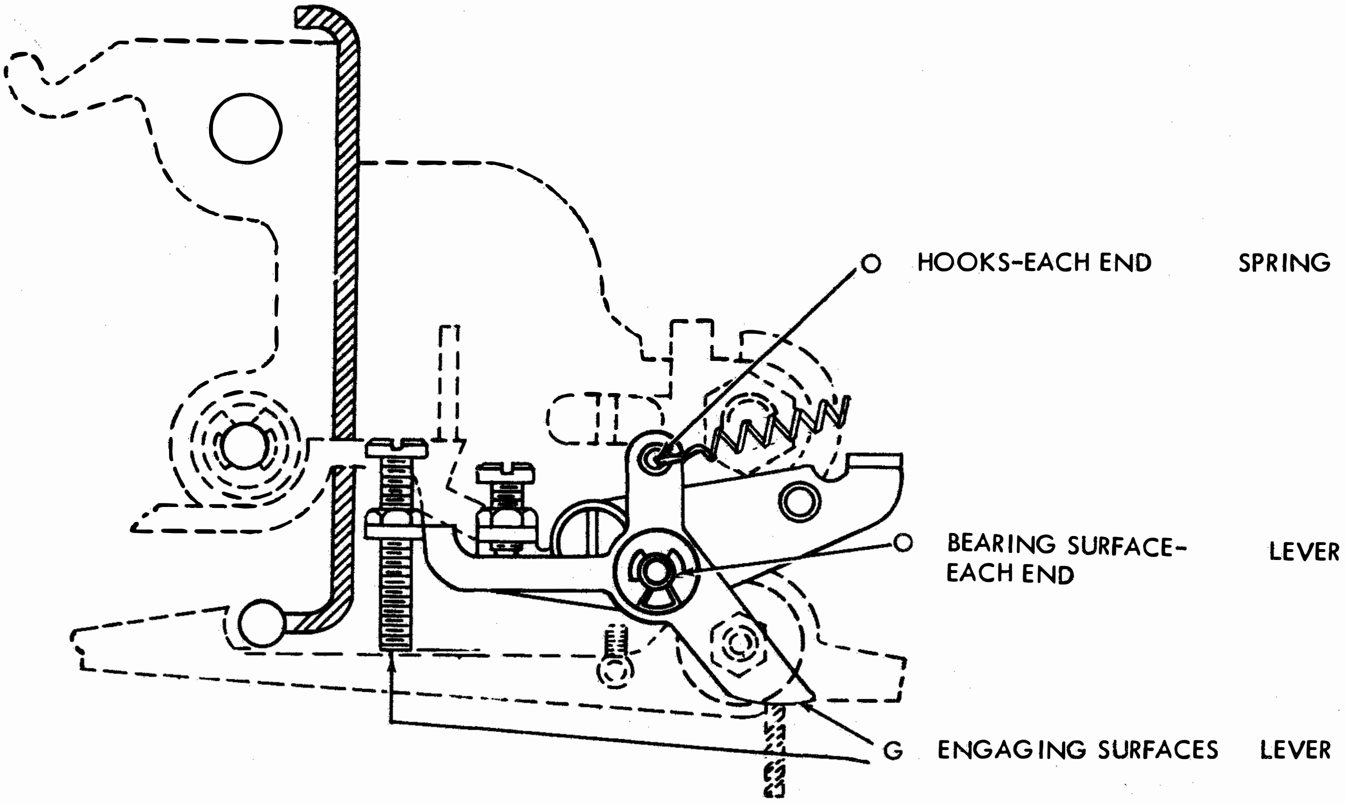


Figure 4-45. Repeat-on-Space Mechanism

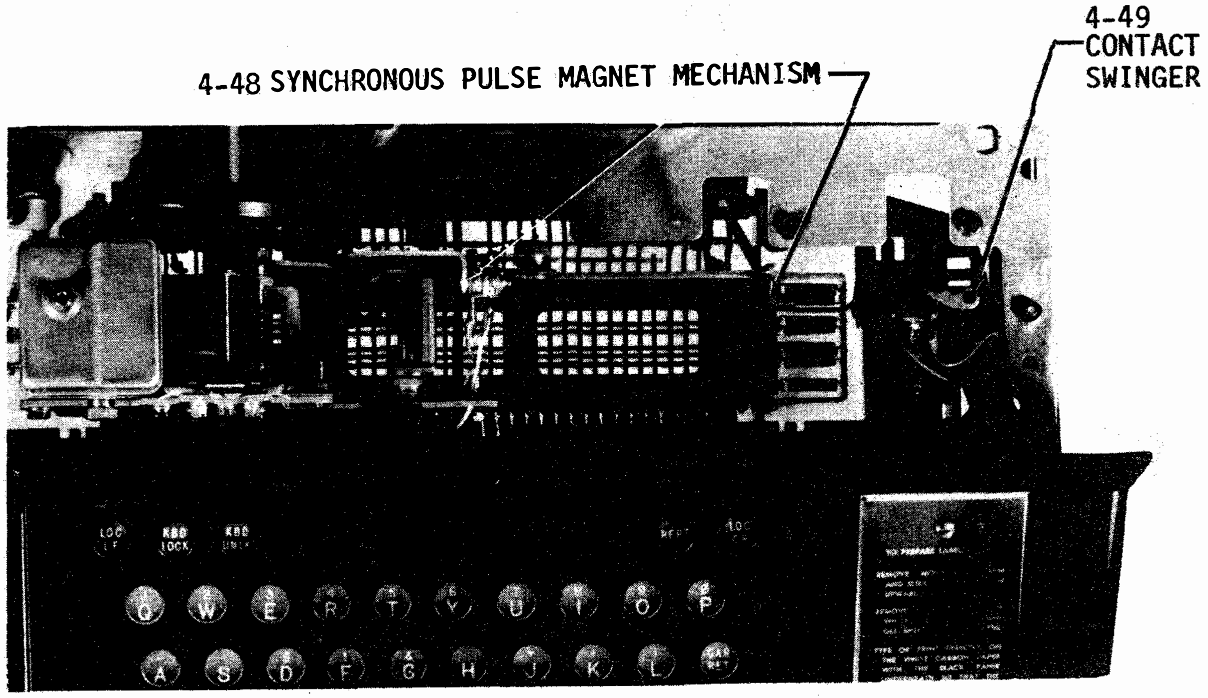


Figure 4-46. Synchronous Pulse, Front View

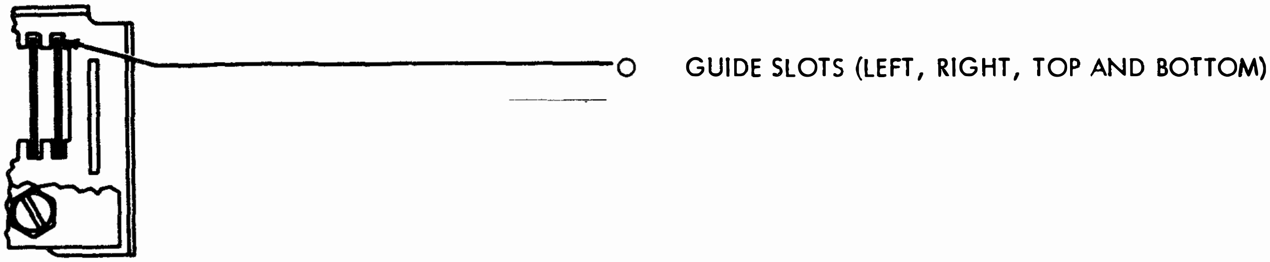


Figure 4-47. Code Bar Guide

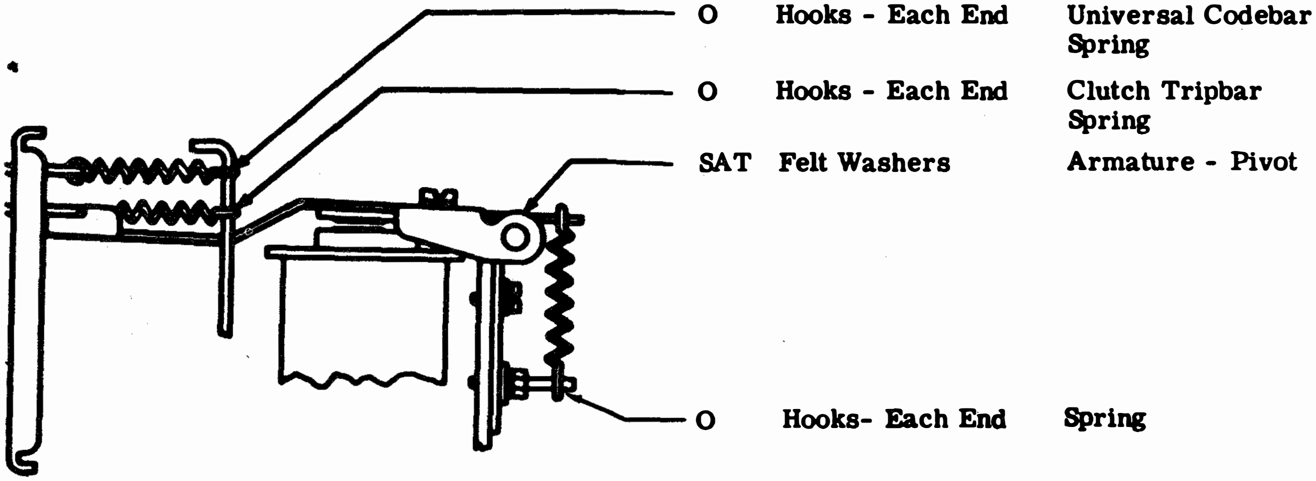


Figure 4-48. Synchronous Pulsed Magnet Mechanism

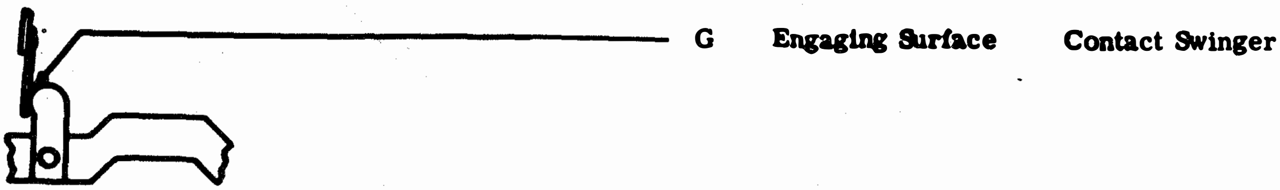


Figure 4-49. Contact Swinger

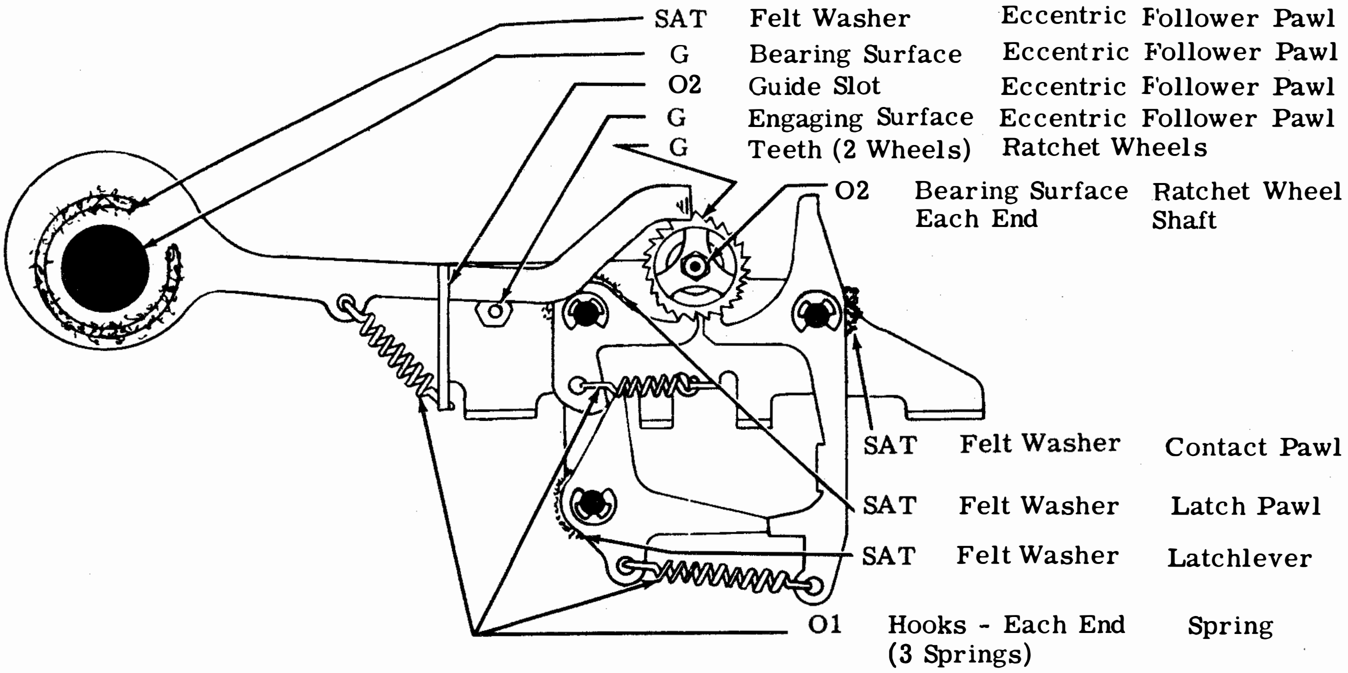


Figure 4-50. Time Delay Mechanism

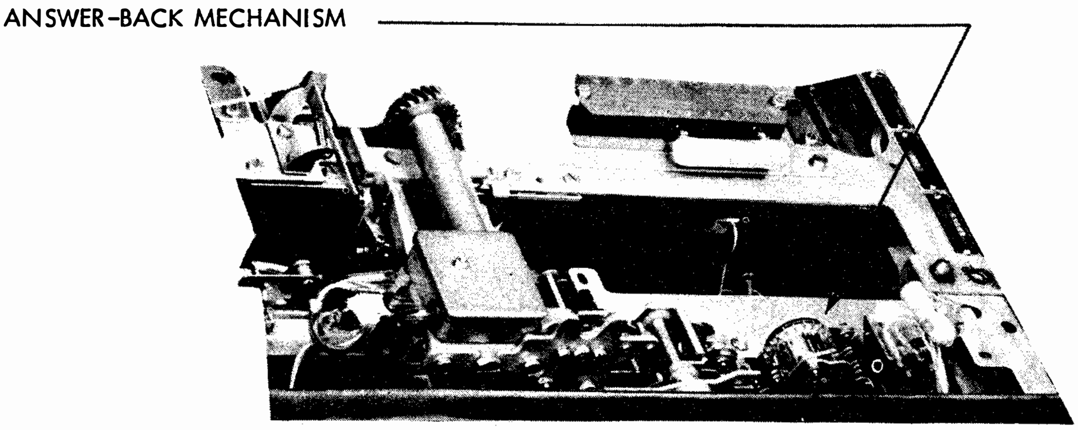


Figure 4-51. Answer-Back Mechanism

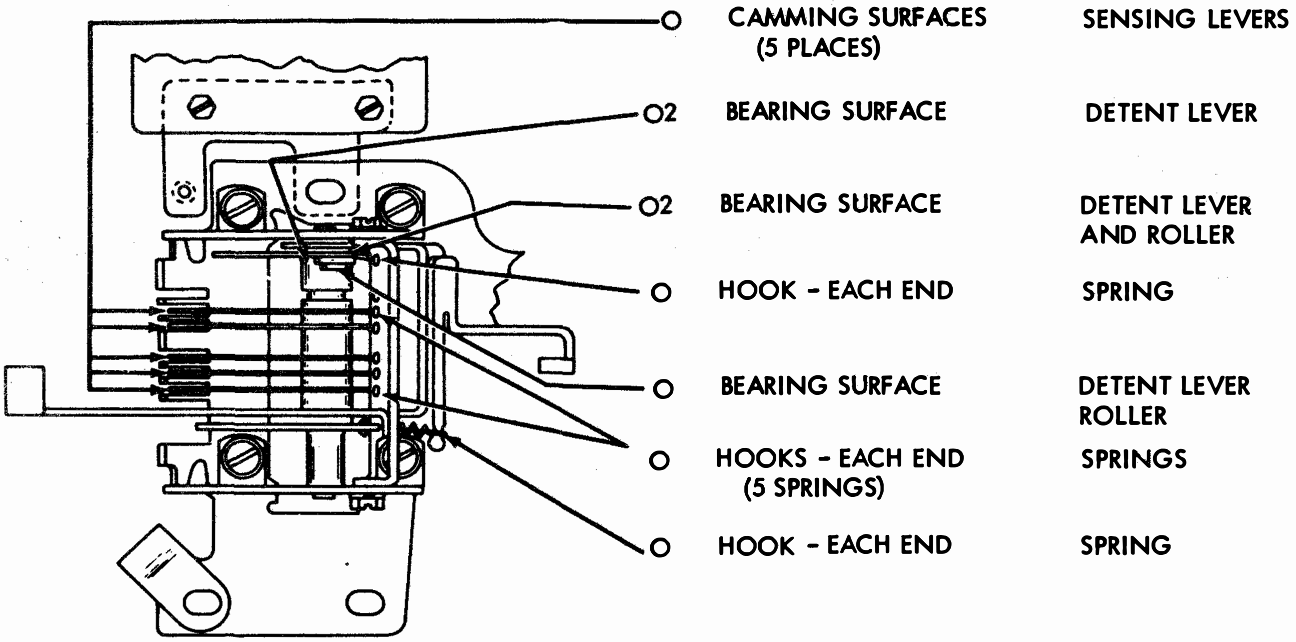


Figure 4-52. Answer-Back Sensing Lever Mechanism, Top View

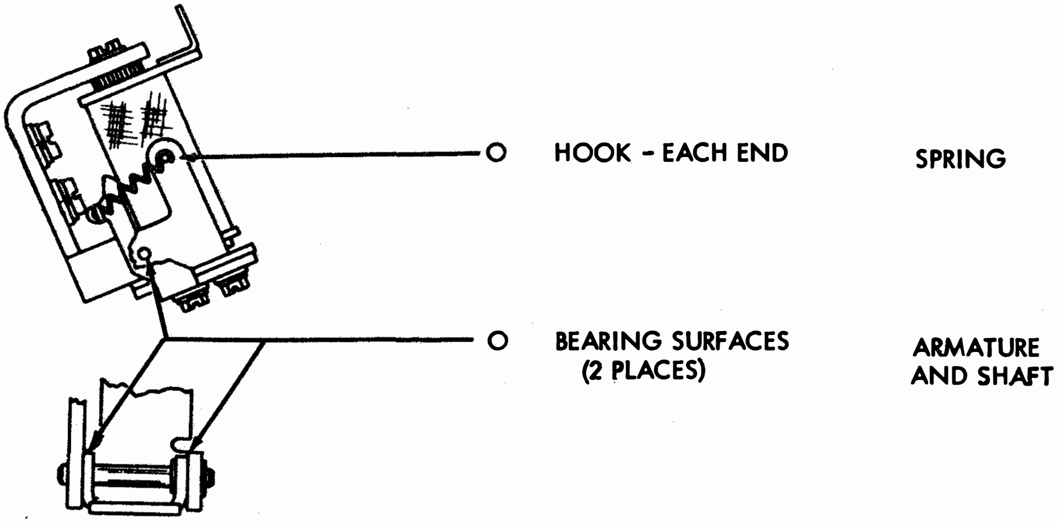
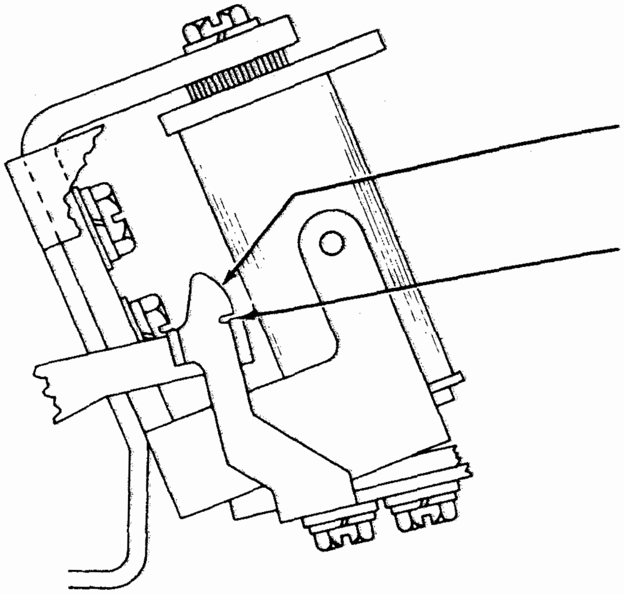
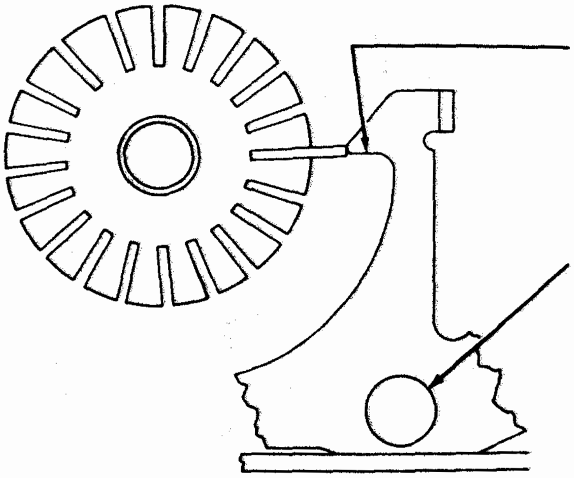


Figure 4-53. Answer-Back Armature Mechanism, Front View



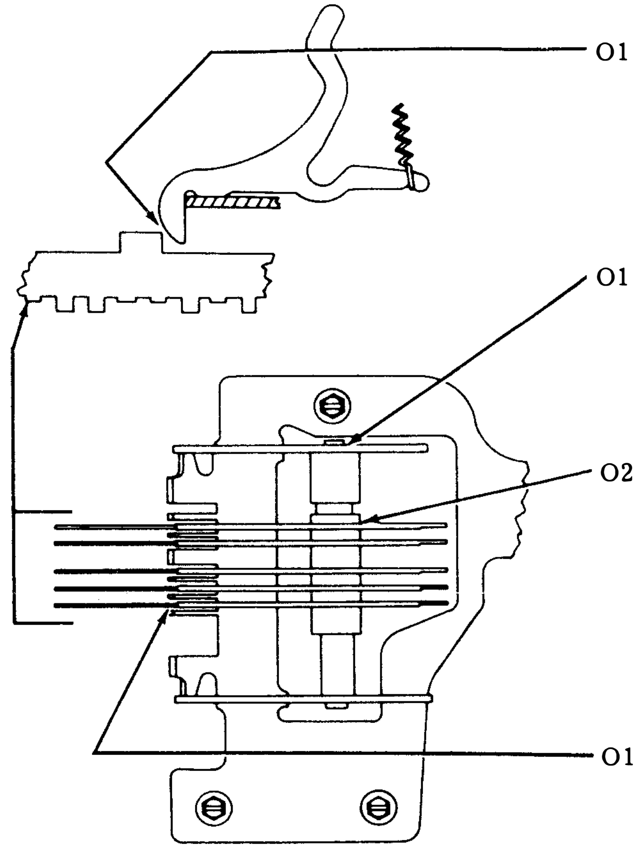
O1	Contacting Surface	Latch and Stop Lever
O1	Latching Surface	Latch and Stop Lever

Figure 4-54. Answer-Back Latch and Stop Lever Mechanism



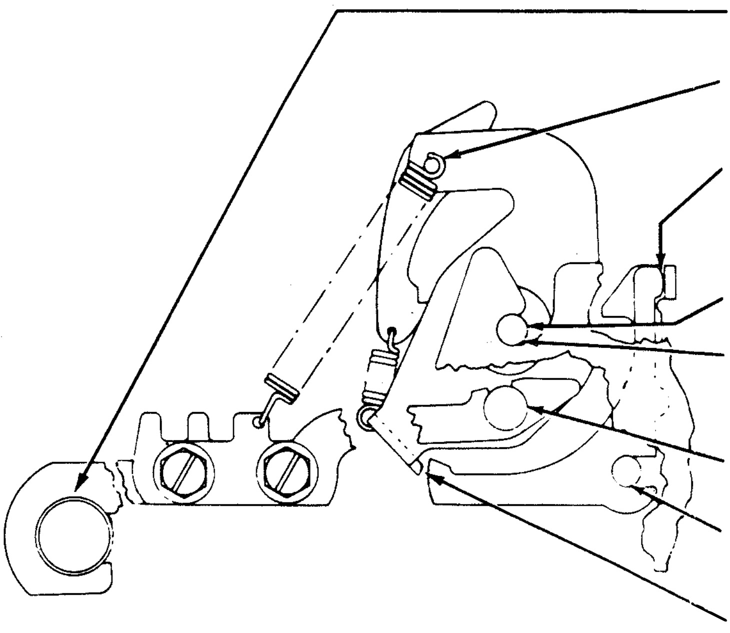
O1	Camming Surface	Stop Lever
O2	Bearing Surface (2 Places)	Stop Lever and Lever Pivot

Figure 4-55. Answer-Back Stop Lever, Front view



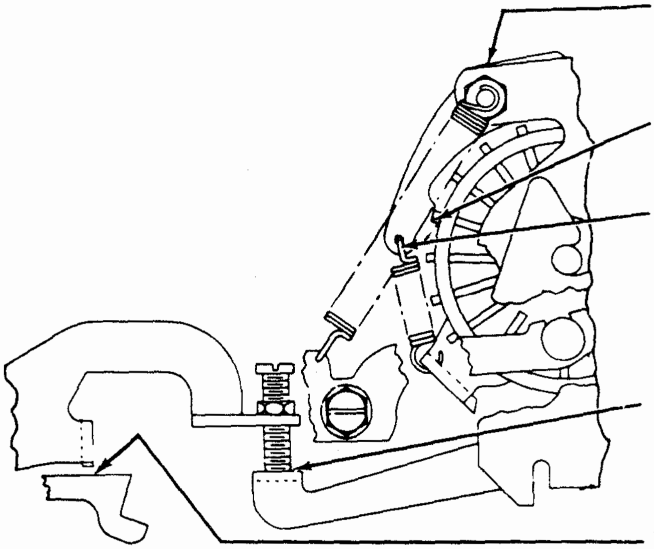
O1	Engaging Surfaces (5 Places)	Sensing Levers and Codebars
O1	Bearing Surface (Both Sides)	Levers Pivot and Side Plate
O2	Bearing Surfaces (5 Levers)	Sensing Levers and Levers Pivot
O1	Guiding Surfaces (5 Places)	Sensing Levers and Mounting Plate

Figure 4-56. Answer-Back Code Bars and Sensing Levers, Top View



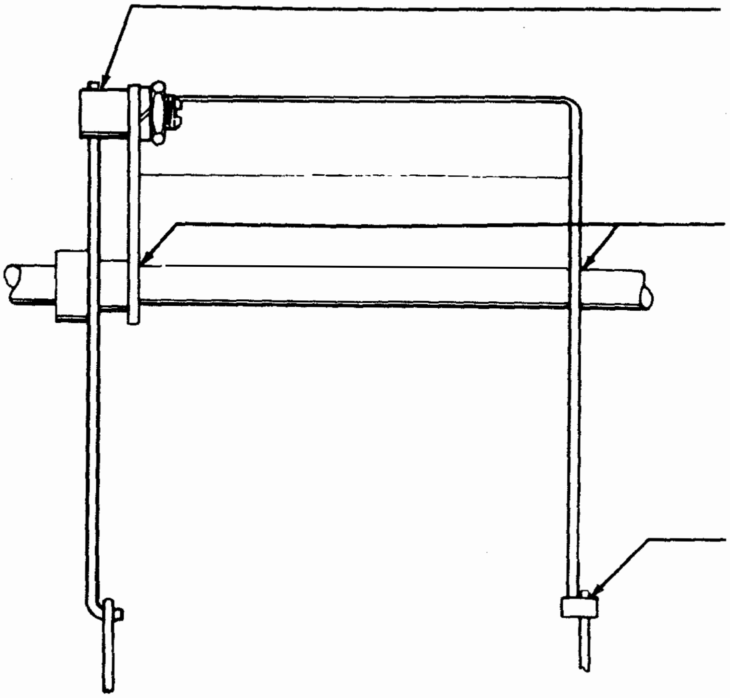
O2	Bearing Surface	Eccentric Stud and Drive Link
O1	Hook - Each End	Spring
O1	Engaging Surface	Blocking Lever and Stop Lever
G	Shaft	Drive Plate
O2	Bearing Surface (2 Plates)	Drive Plate Shaft and Side Plate
O1	Engaging Surface	Drive Link and Stud
O2	Bearing Surface	Blocking Lever and Lever Pivot
O1	Engaging Surface	Blocking Lever and Extension

Figure 4-57. Answer-Back Driving Mechanism, Front View



O2	Bearing Surface	Stepping Pawl and Eccentric Stud
O1	Contacting Surfaces	Stepping Pawl and Codeblades
O1	Hook - Each End	Spring
O1	Contacting Surface	Adjusting Screw
O1	Contacting Surface	Lever and Latch

Figure 4-58. Answer-Back Stepping Pawl, Front View



O1	Engaging Surfaces	Eccentric and Locklever
O1	Bearing Surfaces	Function Lever and Bail
G	Contacting Surface	"Here Is" Lever and Bail

Figure 4-59. Answer-Back Keyboard Lock Bail Mechanism

thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-9. TYPING UNIT LUBRICATION. The following paragraphs provide typing unit lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the typing unit are indexed in Table 4-5 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the typing unit as viewed by the operator facing the unit.

b. Lubricate the typing unit just prior to placing it in service. After 300 to 500 operating hours, relubricate the typing unit. Recheck all clutch gaps; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Apply a thick film of grease to all gears and the spacing clutch trip cam plate. Apply oil to all cams, including the camming surfaces of each clutch disk. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

d. Whenever clutches are disassembled, apply a thin coat of grease to the shoe lever spring loops, and oil to the internal mechanisms. Fill lubricator reservoir at indicated intervals.

e. Lubricate the typing unit thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-10. TYPING AND NON-TYPING TAPE PERFORATOR LUBRICATION. The following paragraphs provide perforator lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the typing and non-typing tape perforator are indexed in Table 4-6 and presented in lubrication

Table 4-5. Typing Unit Lubrication Chart Index

Table 4-5. Typing Unit Lubrication Chart Index - Continued

Table 4-5. Typing Unit Lubrication Chart Index - Continued

Figure	Title	Page No.
4-110	Line-Feed Mechanism	4-74
4-111	Paper Guide Area	4-75
4-112	Paper Guide Mechanism	4-75
4-113	Horizontal Tabulator Mechanism, Early Design	4-76
4-114	Tabulator Shaft Mechanism	4-76
4-115	Space Suppression Mechanism	4-76
4-116	Horizontal Tabulator Mechanism, Early Design	4-77
4-117	Operating Lever Mechanism	4-77
4-118	Spacing Clutch Mechanism	4-78
4-119	Selective Calling Mechanism	4-78
4-120	Stripper Bail Mechanism	4-79
4-121	Shift and Stripper Bail Mechanisms	4-79
4-122	Selective Calling Mechanism	4-80
4-123	Single-Double Line-Feed Mechanism	4-80
4-124	Function Reset Bail Mechanism	4-81
4-125	Selective Calling Mechanism	4-81
4-126	Clutch Suppression Mechanism	4-82
4-127	Local Backspace Mechanism	4-82
4-128	Pawl Mechanism	4-83
4-129	Trip Mechanism	4-83
4-130	Reverse Line-Feed Mechanism	4-84
4-131	Trip Mechanism	4-84
4-132	Line-Feed Mechanism	4-85
4-133	Page Feed-Out Mechanism	4-86

Table 4-5. Typing Unit Lubrication Chart Index - Continued

Table 4-5. Typing Unit Lubrication Chart Index - Continued

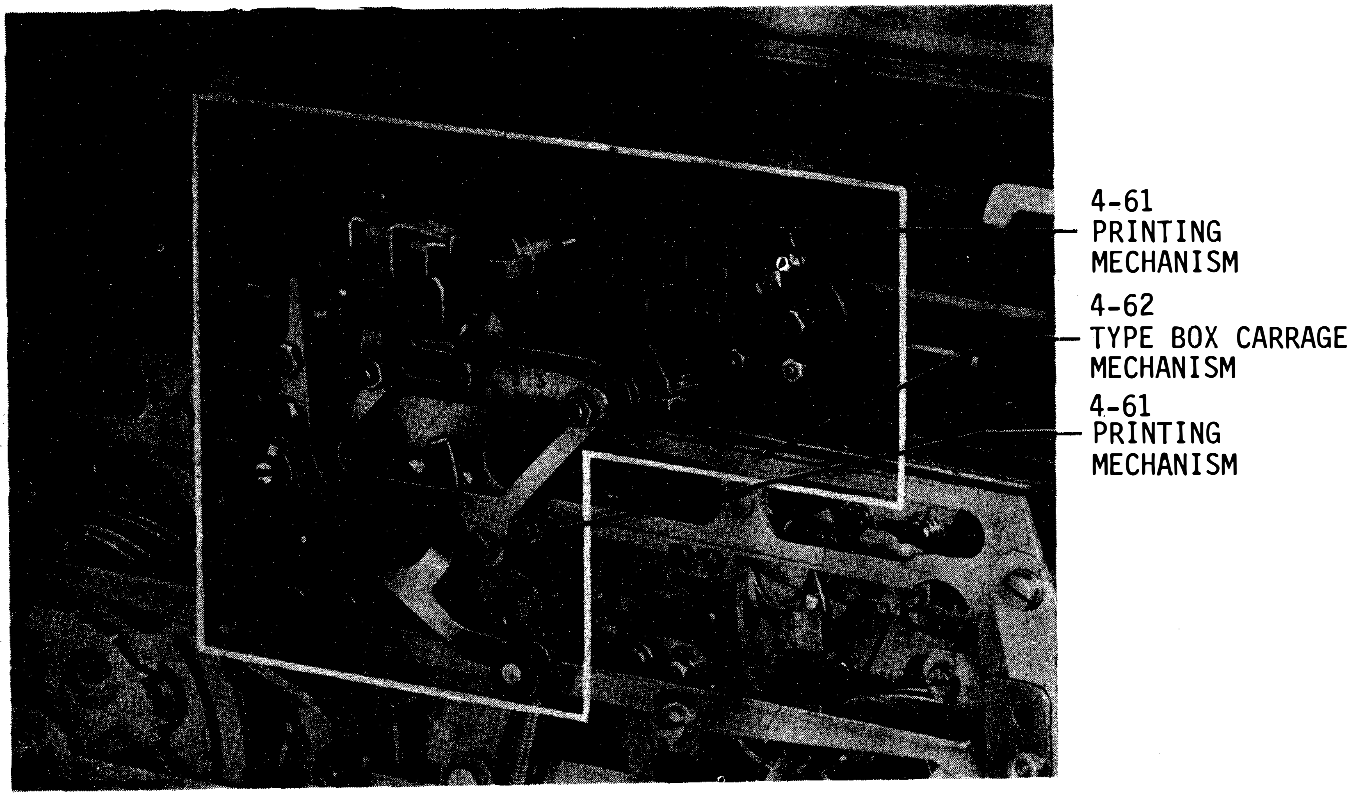
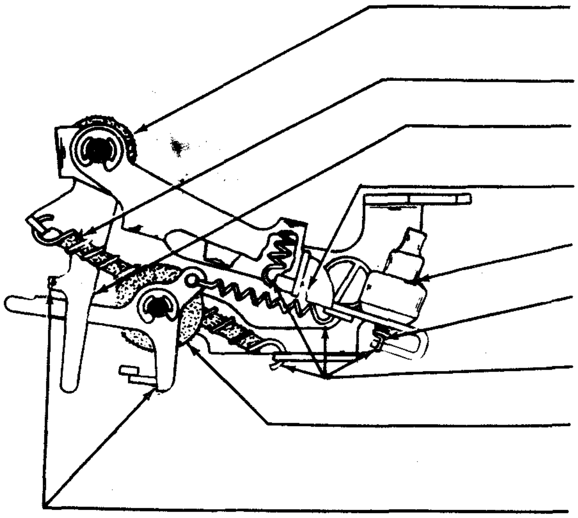
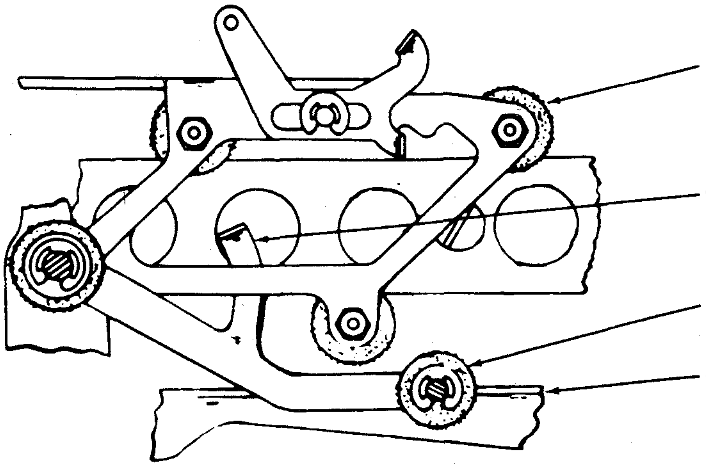


Figure 4-60. Printing Area, Front View



SAT	Felt Washers (2)	Printing Hammer Operating Bail
SAT	Spring Felt Wick	Secondary Printing Arm
G	Engaging Surface	Secondary Printing Arm
G	Engaging Surface	Printing Hammer Stop
G	Engaging Surface	Printing Hammer
SAT	Spring Felt Wick	Printing Hammer
O	Hooks	Springs
SAT	Felt Washer	Operating Bail Latch
O	Engaging Surfaces	Operating Bail Latch

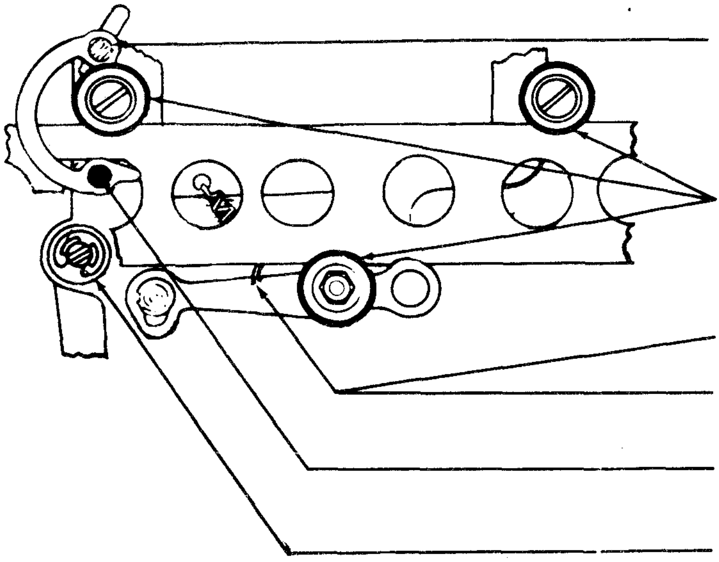
TOP VIEW



SAT	Felt Washers (3)	Carriage Rollers
G	Guiding Surface	Print Arm Extensio
SAT	Felt Washers (2)	Print Arm
O	Track Surface	Print Track

FRONT VIEW

Figure 4-61. Printing Mechanism



O	Bearing Surface	Typebox Latch Toggle
O	Bearings	Typebox Rollers
O	Hooks	Spring
SAT	Felt Wick	Spring
O	Bearing Surface	Typebox Latch
O	Bearing Surface	Typebox Link

Figure 4-62. Type Box Carriage Mechanism, Rear View

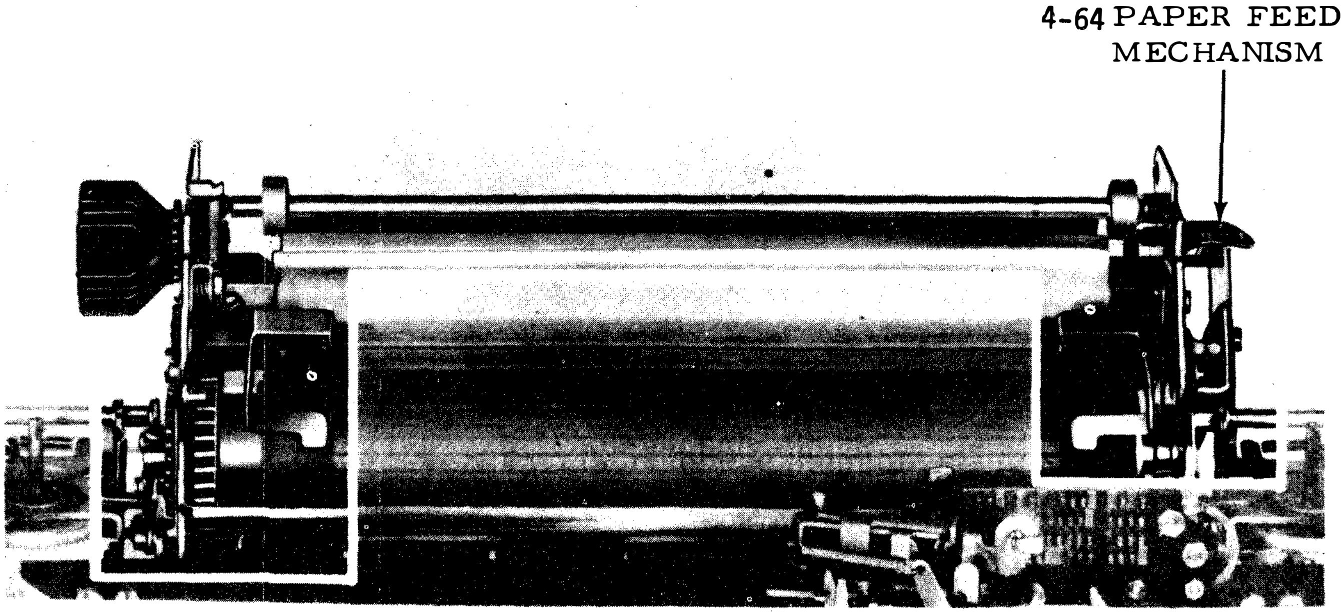


Figure 4-63. Paper Feed Area, Front View

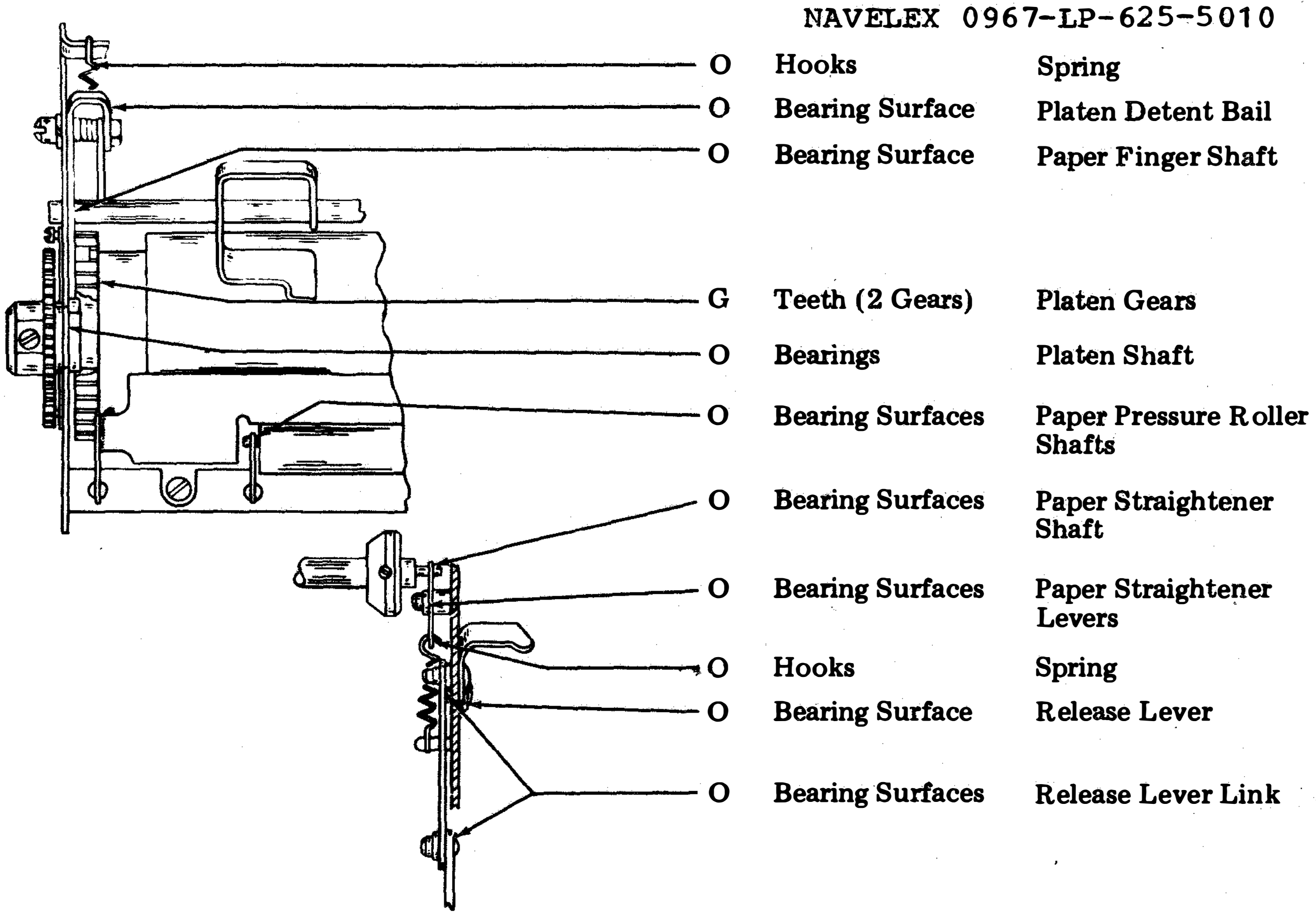
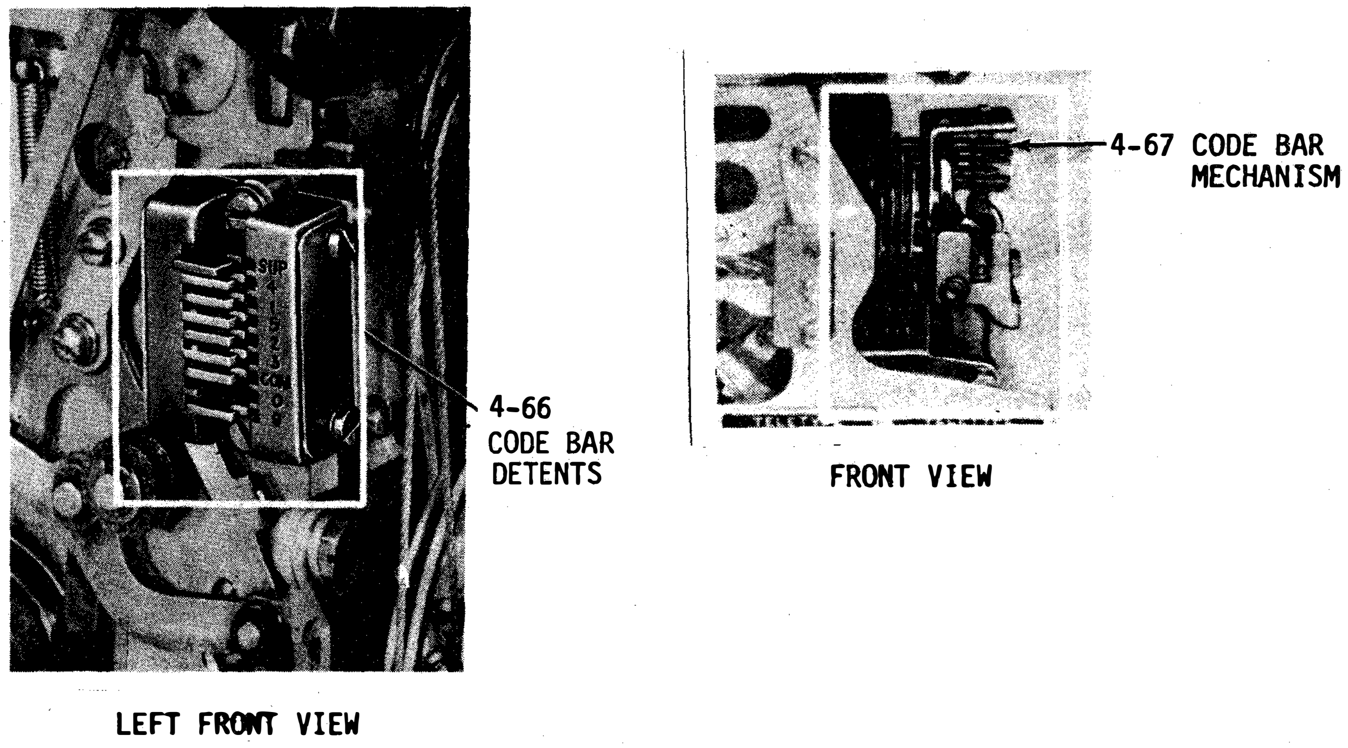


Figure 4-64. Paper Feed Mechanism, Front View



LEFT FRONT VIEW

FRONT VIEW

Figure 4-65. Code Bar Area

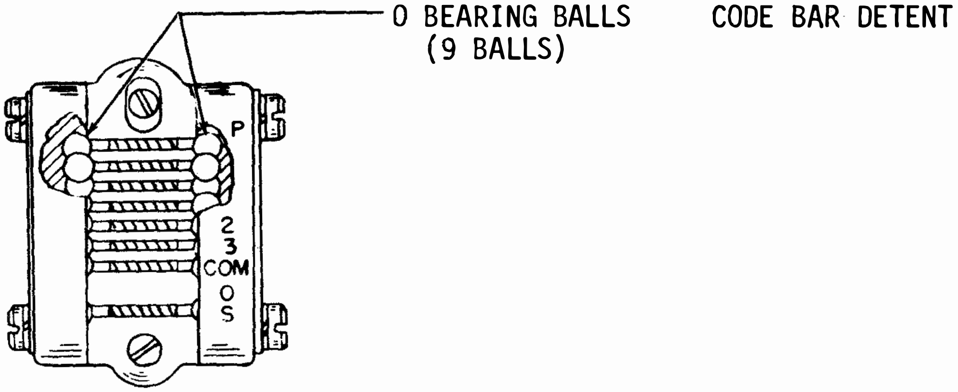


Figure 4-66. Code Bar Detents, Left Side View

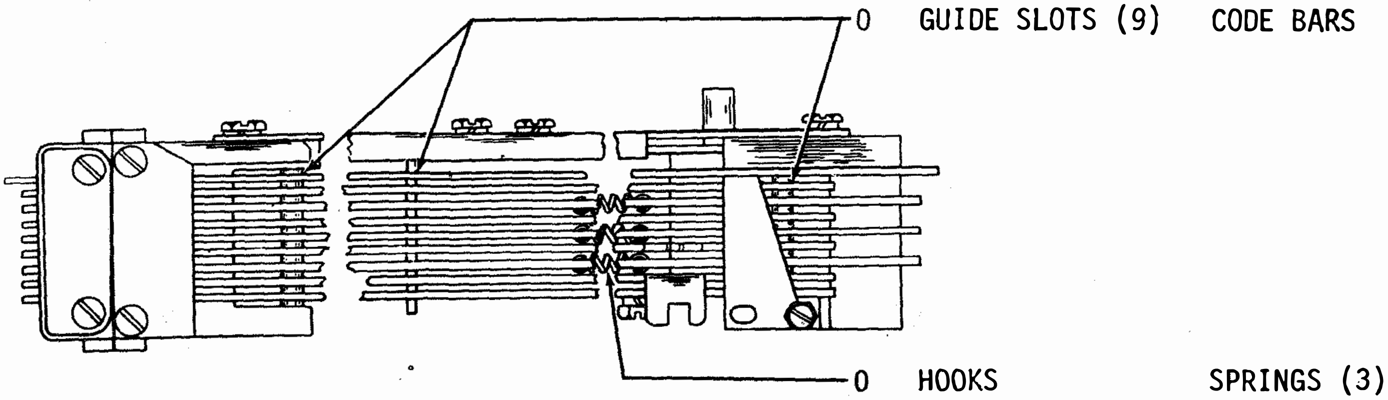


Figure 4-67. Code Bar Mechanism, Front View

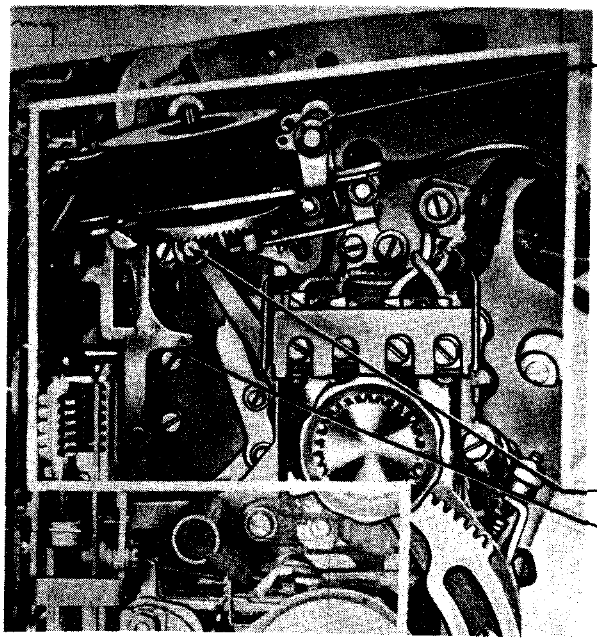
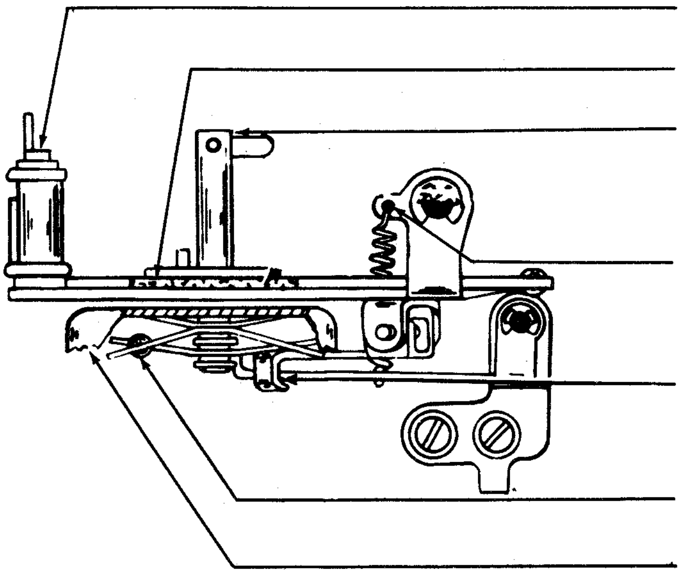
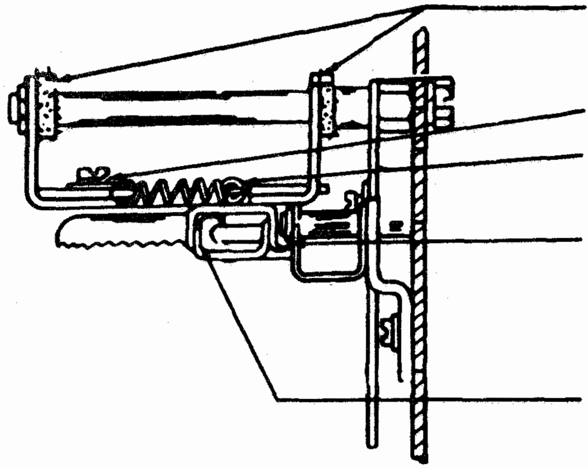


Figure 4-68. Ribbon Area, Right Side View



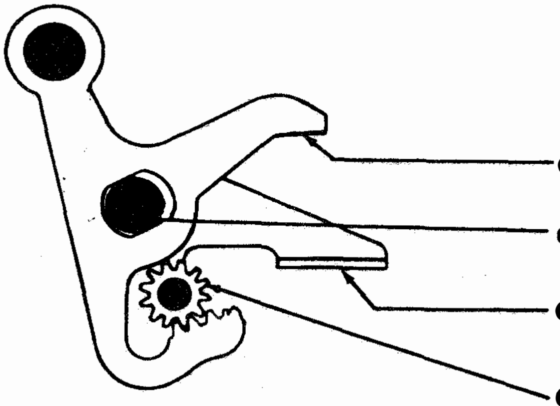
O	Bearing Surface	Ribbon Roller Shaft
SAT	Felt Washer	Ribbon Spool Shaft
O	Bearing Surface	Ribbon Spool Toggle
O	Hooks	Ribbon Feed Lever Spring
O	Engaging Surface	Ribbon Detent Lever
O	Hooks	Ribbon Ratchet Wheel Spring
G	Teeth	Ribbon Ratchet Wheel

Figure 4-69. Ribbon-Feed Mechanism, Right Side View



SAT	Felt Washers	Ribbon-Feed Lever Bail
O	Bearing Surface	Ribbon Lever
O	Hooks	Spring
O	Bearing Surface	Ratchet Feed Lever Shaft
O	Bearing Surface	Ribbon Detent Lever Shaft

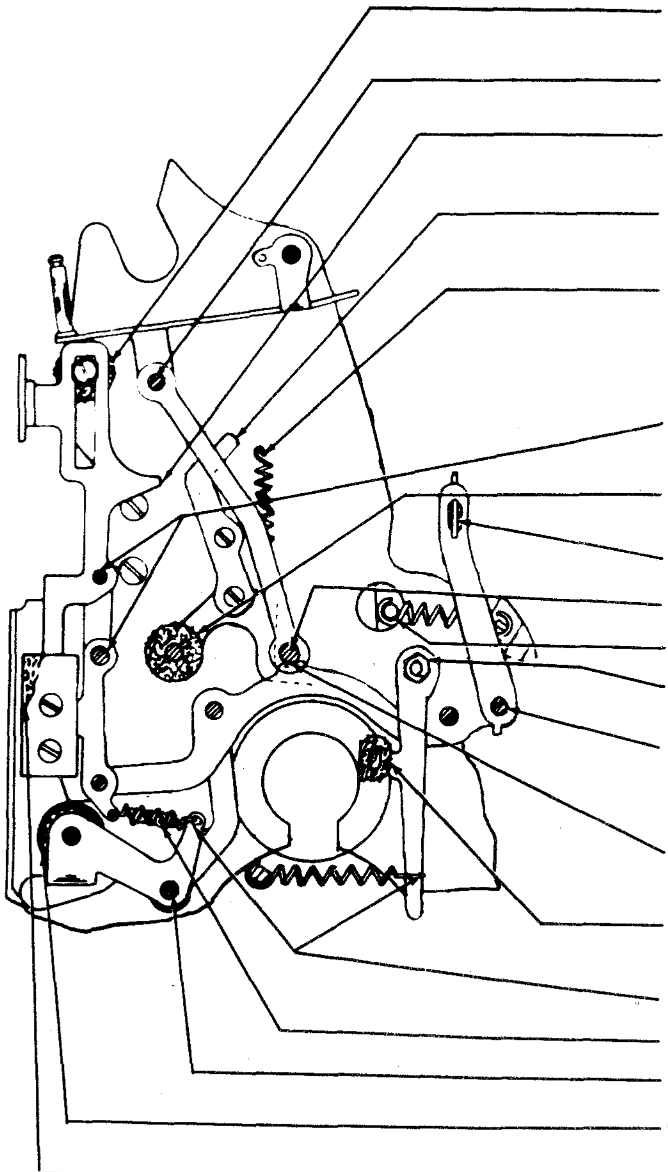
REAR VIEW



O	Engaging Surface	Ribbon Reversing Arm
O	Bearing Surface	Ribbon Reverse Levers
O	Engaging Surface	Ribbon Reverse Lever
G	Teeth	Ribbon Reverse Spur Gear

LEFT SIDE VIEW

Figure 4-70. Ribbon-Feed Mechanism



SAT	Felt Washer	Vertical Positioning Lever
O	Bearing Surface	Ribbon Drive Link
O	Engaging Surface	Vertical Positioning Lever
O	Engaging Surfaces	Vertical Positioning Locklever
O	Hooks	Spring
O	Bearing Surfaces	Vertical Positioning Lever
SAT	Felt Washers (2)	Main Side Lever Follower Arm
O	Guiding Surface	Stripper Blade
O	Bearing Surface	Ribbon Drive Link
O	Hooks	Spring
O	Bearing Surface	Operating Lever
O	Bearing Surface	Stripper Blade Arm
O	Engaging Surface	Main Side Lever Follower Arm
SAT	Felt Washer	Operating Lever Extension
O	Hooks	Spring
SAT	Spring Felt Wick	Rocker Shaft Bracket
O	Bearing Surface	Rocker Shaft Bracket
O	Ball Bearing	Main Rocker Shaft
SAT	Felt Oiler	Vertical Positioning Lever

Figure 4-71. Vertical Positioning Mechanism, Right Side View

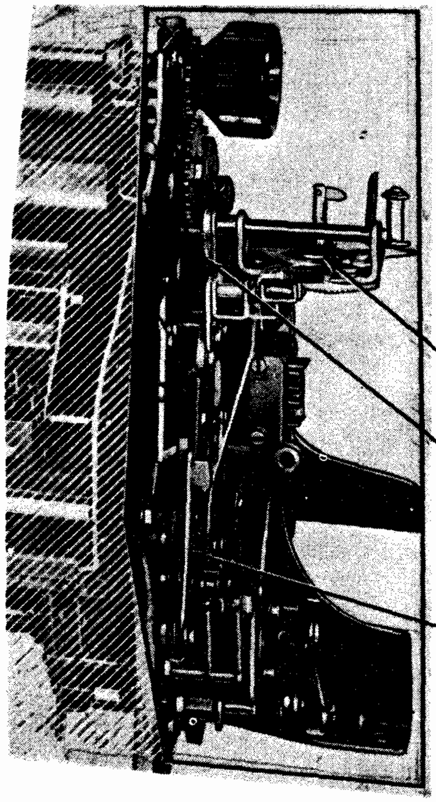
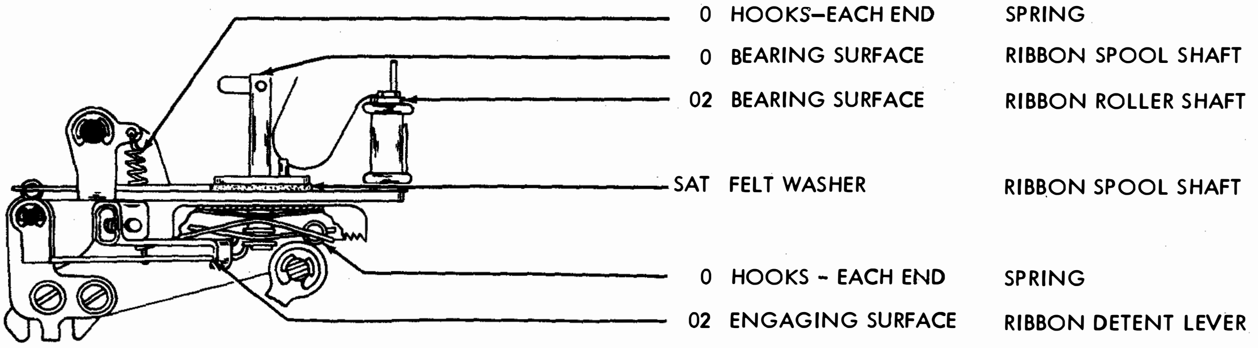
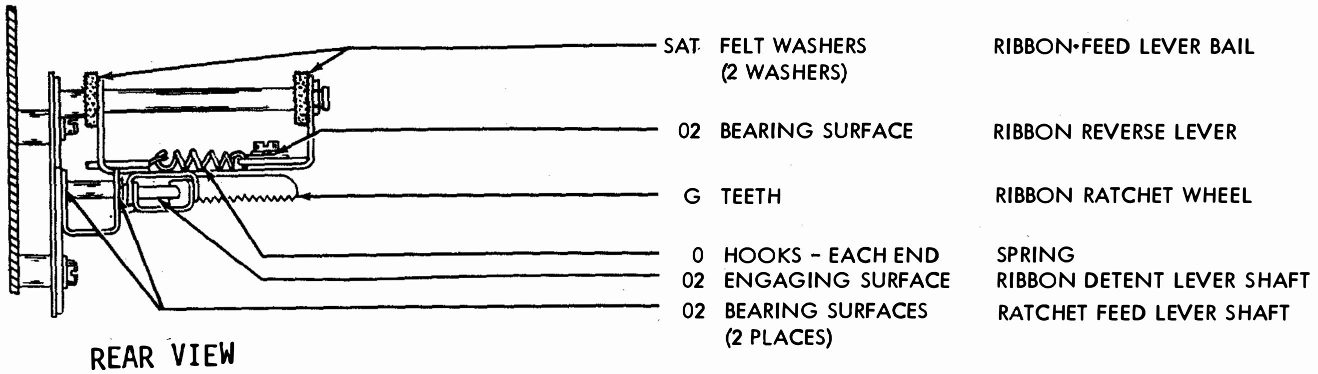


Figure 4-72. Ribbon Area, Left Rear View



LEFT SIDE



REAR VIEW

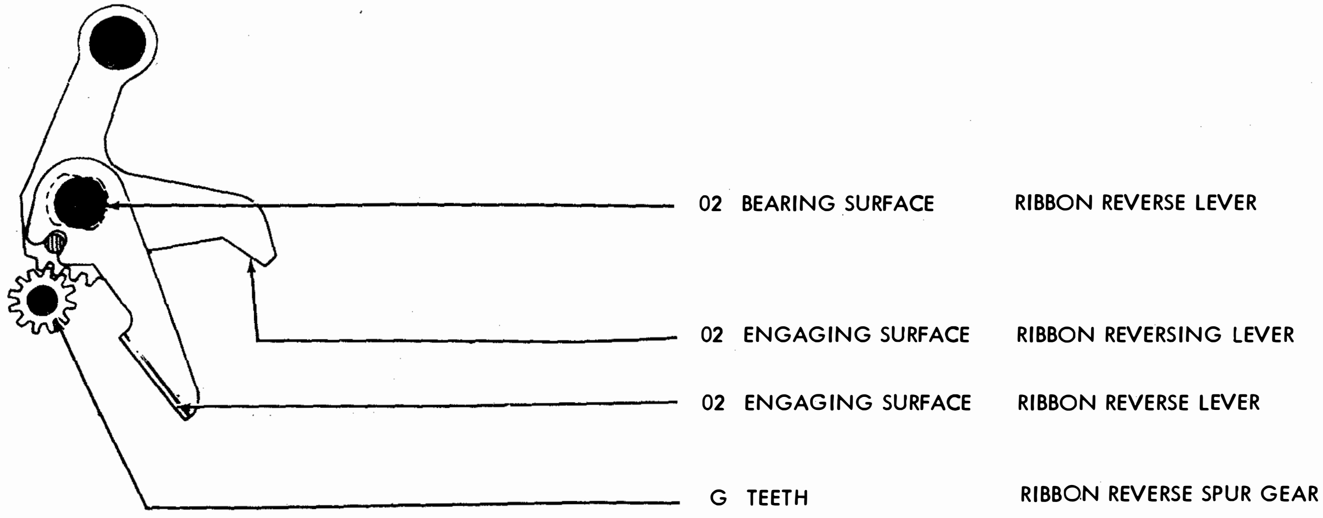
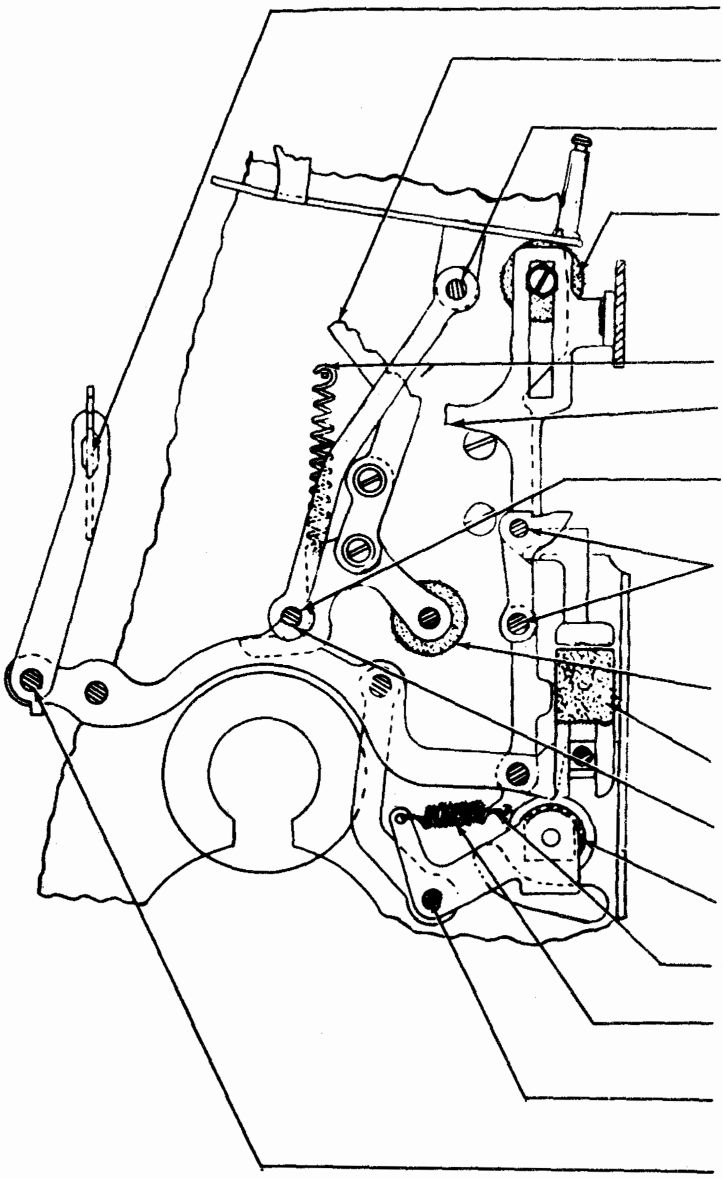


Figure 4-73. Ribbon-Feed Mechanism



O	Guiding Surface	Stripper Blade
O	Engaging Surfaces	Vertical Positioning Locklever
O	Bearing Surface	Ribbon Drive Link
SAT	Felt Washer	Vertical Positioning Link
O	Hooks	Spring
O	Engaging Surface	Vertical Positioning Lever
O	Bearing Surface	Ribbon Drive Link
O	Bearing Surfaces	Vertical Positioning Lever
SAT	Felt Washers (2)	Main Side Lever Follower Arm
SAT	Felt Oiler	Vertical Positioning Lever
O	Camming Surface	Main Side Lever Follower Arm
O	Ball Bearing	Main Rocker Shaft
O	Hooks	Spring
SAT	Spring Felt Wick	Rocker Shaft Bracket
O	Bearing Surface	Rocker Shaft Bracket
O	Bearing Surface	Stripper Blade Arm

Figure 4-74. Vertical Positioning Mechanism, Left Side View

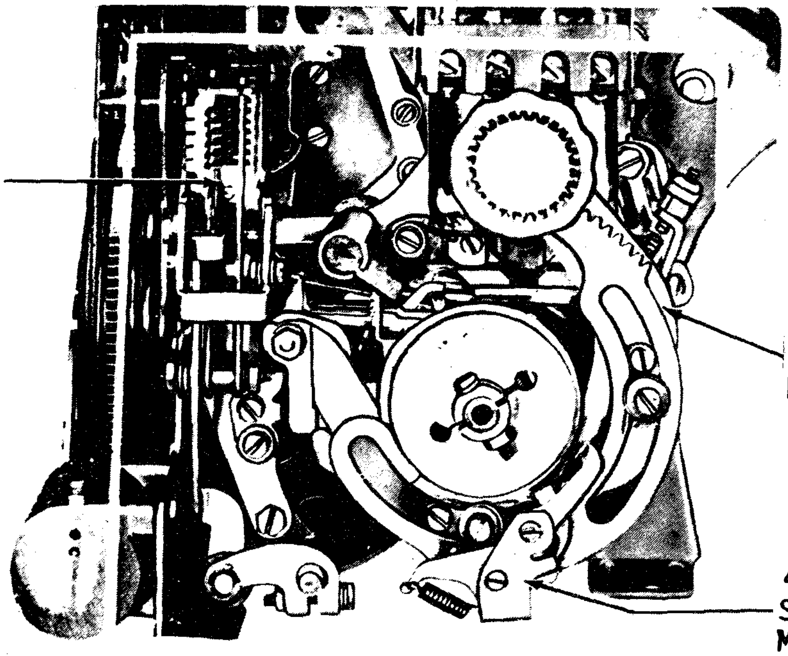
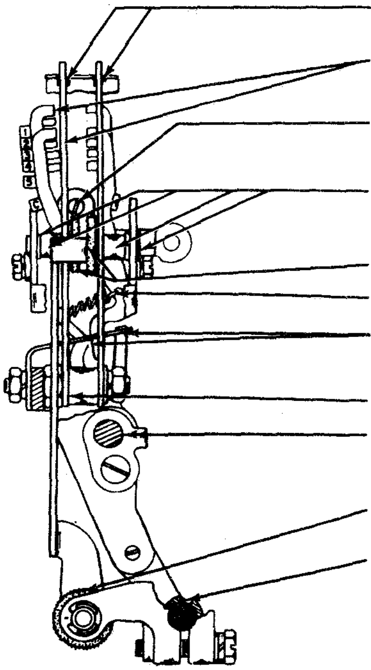
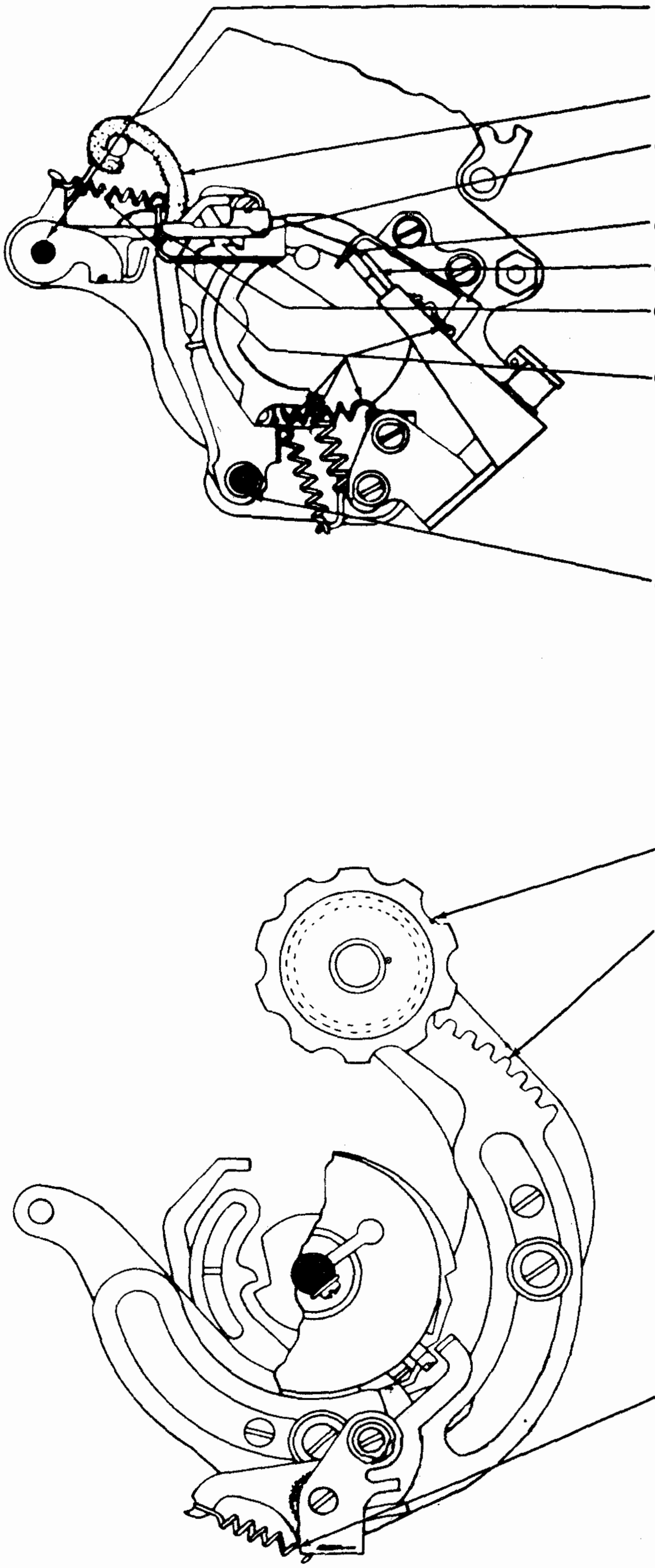


Figure 4-75. Selector Area, Right Side View



O	Guide Slots	Shift Levers
O	Engaging Surface	Shift and Transfer Levers
O	Bearing Guide Slots	Transfer Lever Guide Bearing
O	Roller Bearings	Shift Lever Link Rollers
SAT	Felt Washers	Shift Lever Link Shaft
O	Hooks	Springs
O	Guide Slots	Intermediate Arms and Transfer Levers
O	Bearing Surfaces	Shift Levers
O	Bearing Guide Slots	Intermediate Arm Guide Bearing
SAT	Felt Washer	Shift Lever Link
O	Oil Hole	Shift Lever Drive Arm Shaft

Figure 4-76. Code Bar Mechanism Area, Right Side View



O	Bearing Guide Slots	Push Lever Guide Bearing
SAT	Felt Wick	Selector Wick
O	Engaging Surfaces	Push Levers
O	Guide Slot	Marking Locklever
O	Wick	Lubricator Wick
O	Guide Slots	Selector and Push Levers
O	Hooks	Springs
O	Bearing Guide Slots	Selector Lever Guide Bearing
G	Teeth	Knob
G	Teeth	Gear
O	Hooks	Spring

Figure 4-77. Selector Mechanism, Right Side View

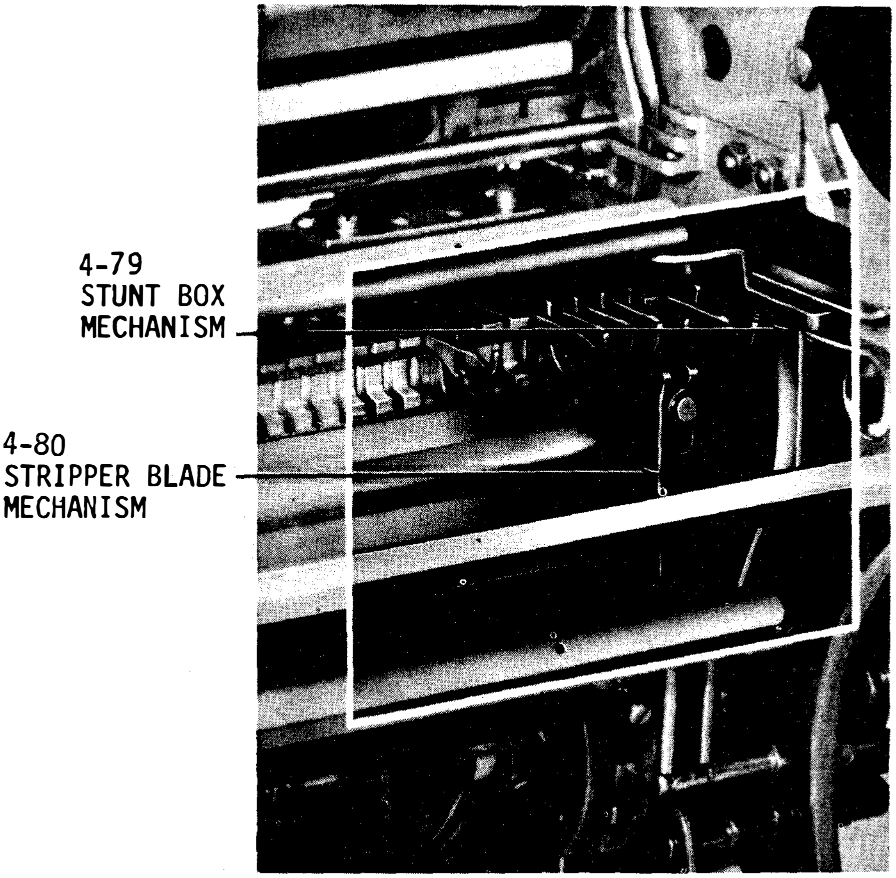
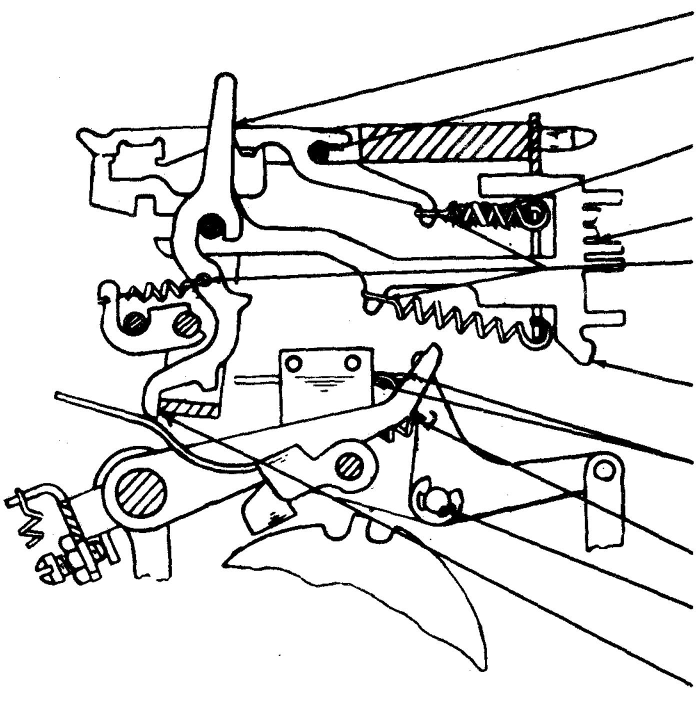
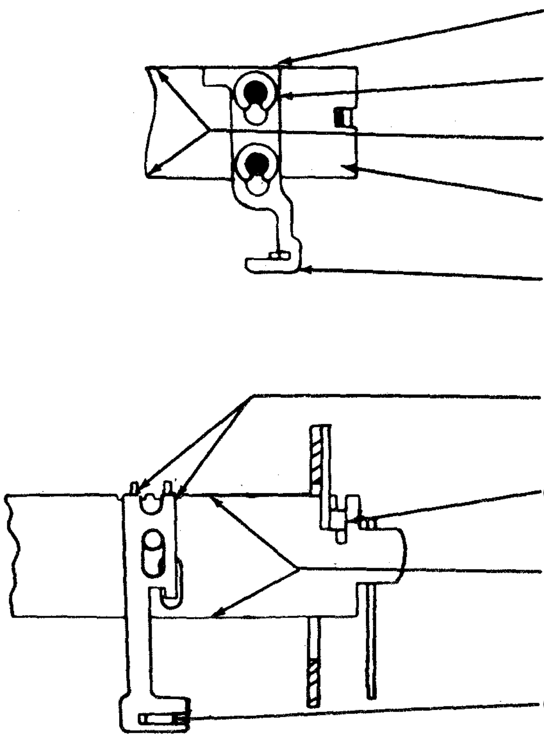


Figure 4-78. Function Area, Rear View



O	Guide Slots	Function Levers
O	Guide Slots	Function Pawls
SAT	Each Felt Wick	Function Pawl Springs
O	Guide Slots	Function Bars
O	Hooks	Springs
O	Engaging Surfaces	Function Bars (Front and Rear)
O	Guide Surfaces	Line Feed Slide Arm
O	Hooks	Spring
O	Bearing Surface	Keyboard Locklever
O	Engaging Surfaces	Function Levers

Figure 4-79. Stunt Box Mechanism, Right Side View



O	Engaging Surface	Line-Feed Stripper Slide
O	Guide Surfaces	Stripper Slide
G	Engaging Surfaces	Stripper Blade
O	Guide Surfaces	Stripper Blade
O	Engaging Surface	Stripper Blade
O	Engaging Surfaces	Line-Feed Function Pawl Stripper
O	Guiding Surface	Stripper Blade
G	Upper and Lower Surface	Stripper Blade
O	Guiding Surface	Stripper Bail

Figure 4-80. Stripper Blade Mechanism, (Late Design), Rear View

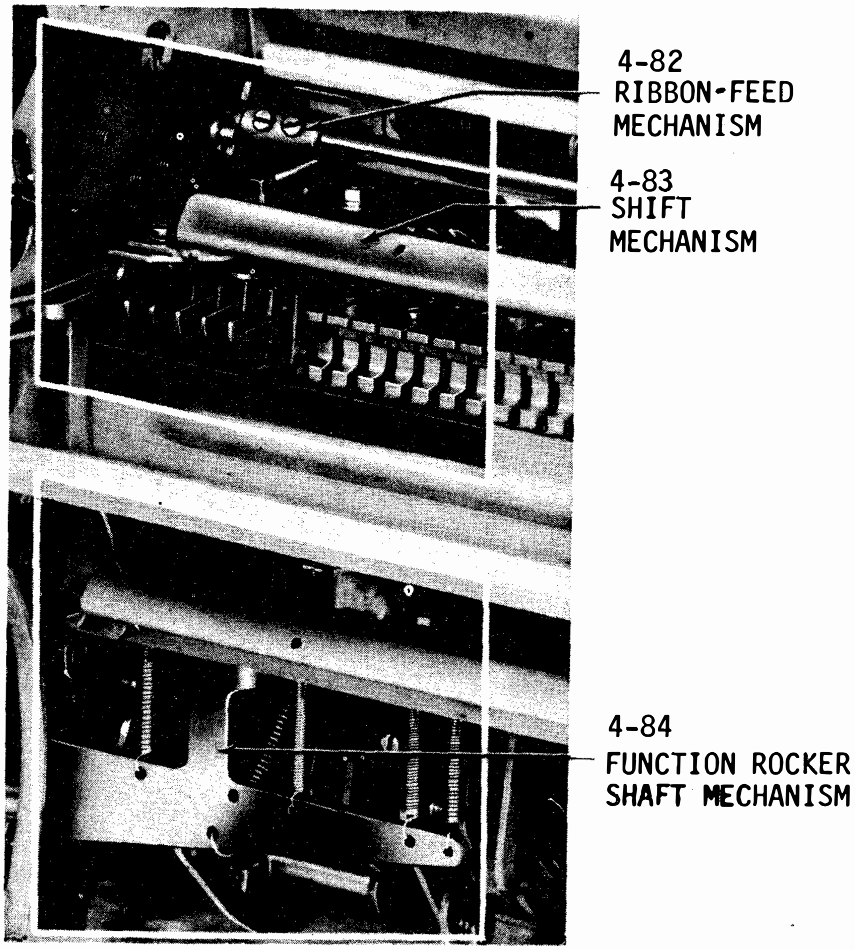
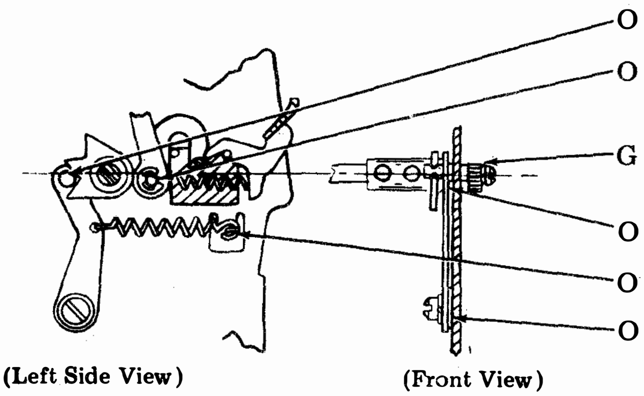
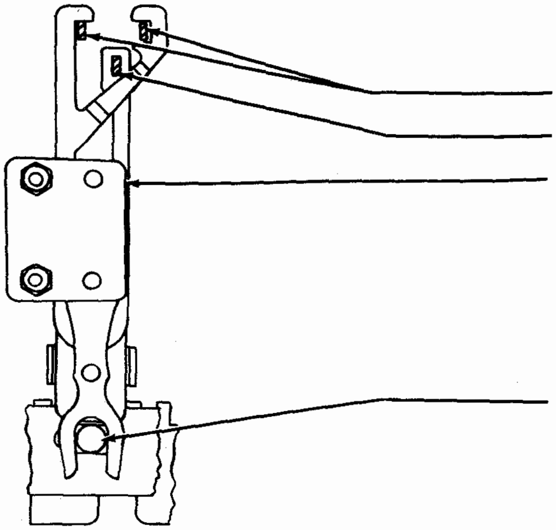


Figure 4-81. Function Area, Rear View



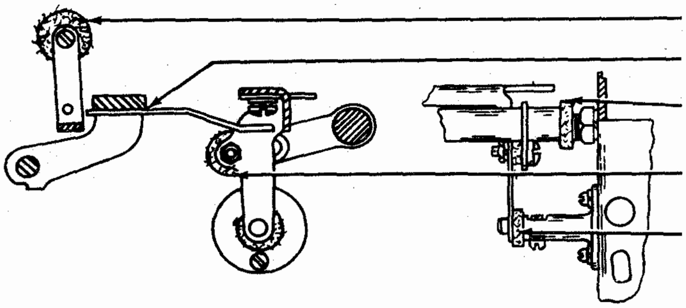
O	Engaging Surface	Ribbon Reverse Detent
O	Bearing Surface	Paper Release Lever
G	Teeth	Ribbon Reverse Spur Gear
O	Bearing	Ribbon Reverse Shaft
O	Hooks	Spring
O	Bearing Surface	Ribbon Reverse Detent

Figure 4-82. Ribbon Reverse Mechanism



0	ENGAGING SURFACES	LETTERS FUNCTION SLIDE
0	ENGAGING SURFACE	FIGURES FUNCTION SLIDE
02	GUIDING SURFACES (EACH SLIDE)	LETTERS AND FIGURES FUNCTION SLID
02	ENGAGING SURFACE	LETTERS-FIGURES CODE BAR FORK

Figure 4-83. Shift Mechanism, Top View



SAT	FELT WASHER	SPACE SUPPRESSION BAIL
O2	GUIDE SURFACE	CARRIAGE RETURN SLIDE ARM
SAT	FELT WASHERS (2 WASHERS)	FUNCTION ROCKER SHAFT
SAT	FELT WASHERS (2 WASHERS)	FUNCTION BAIL TOGGLE LINK
SAT	FELT WASHERS (2 WASHERS)	FUNCTION BAIL

Figure 4-84. Function Rocker Shaft Mechanism, Rear View

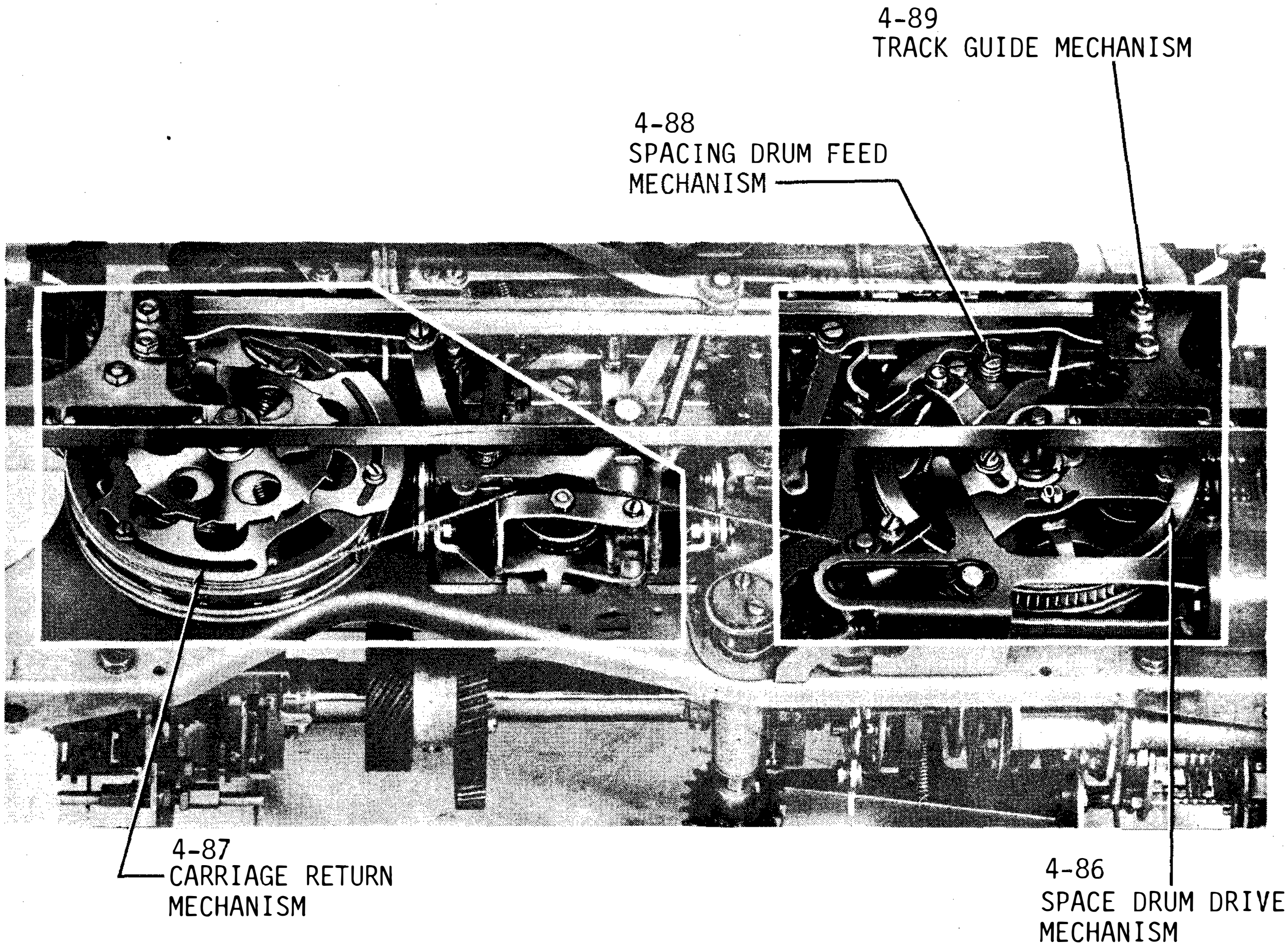


Figure 4-85. Spacing Area, Front View

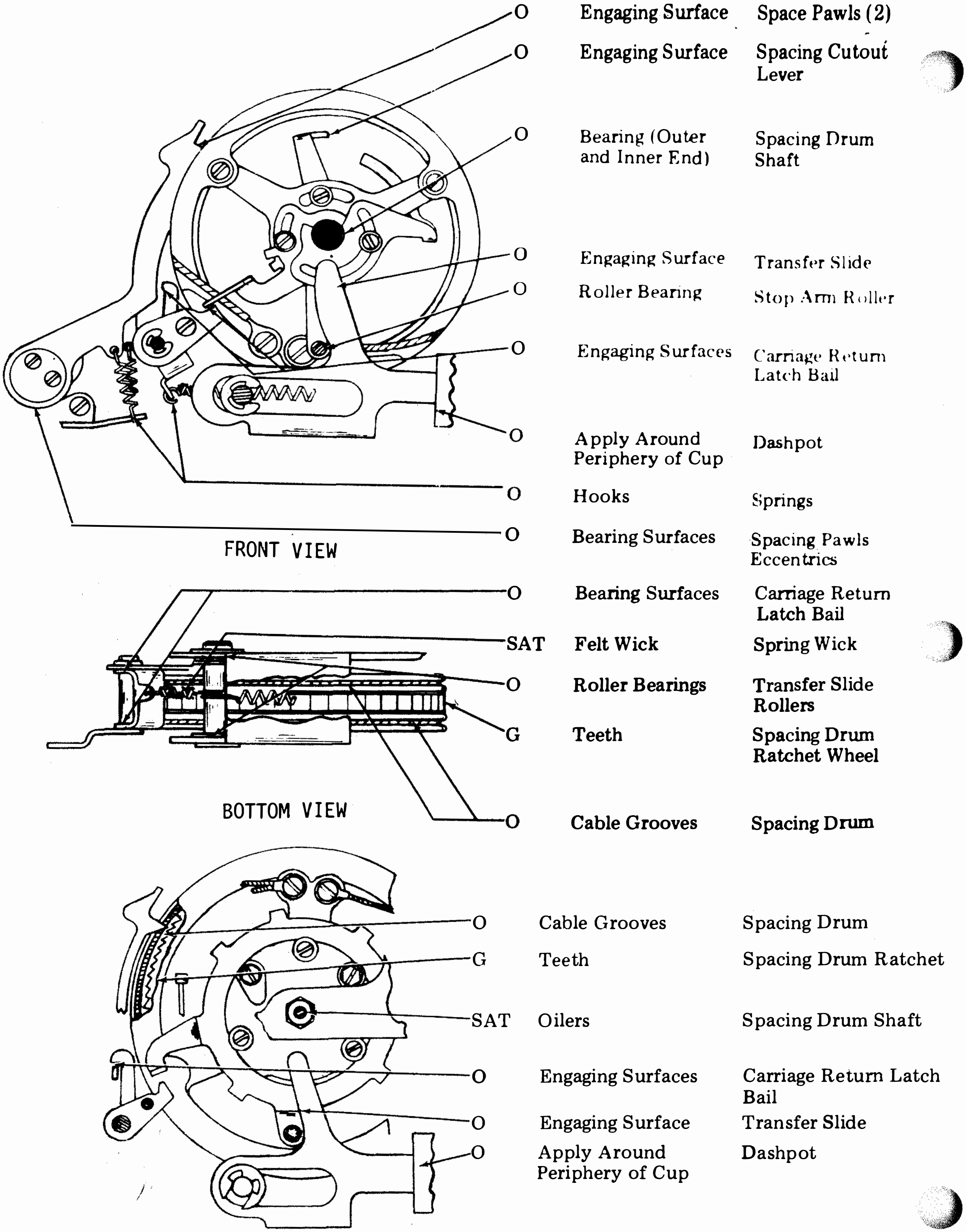
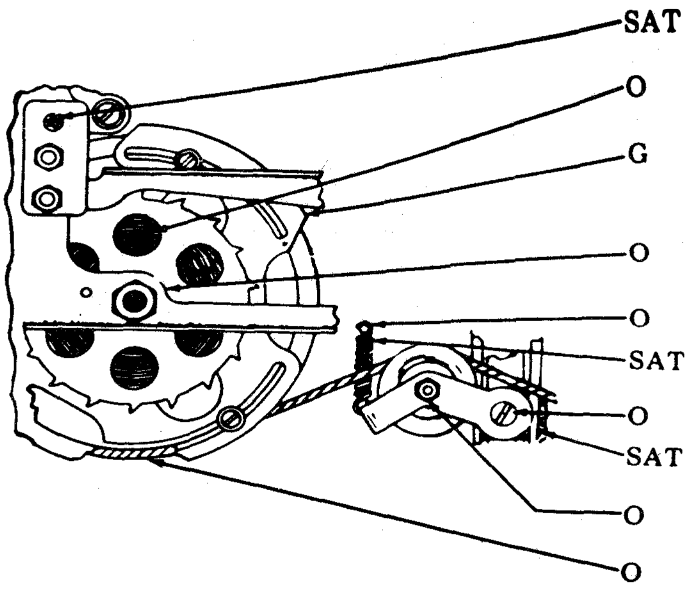
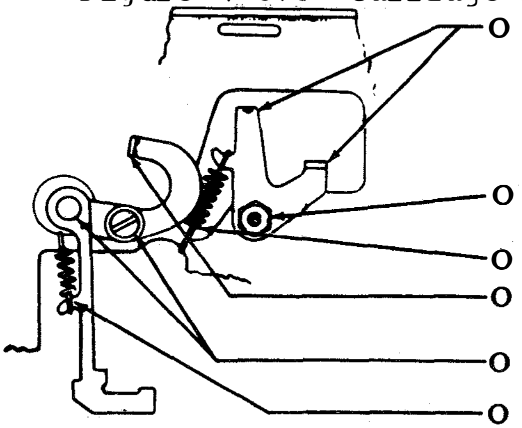


Figure 4-86. Spacing Drum Drive Mechanism, (Late Model)



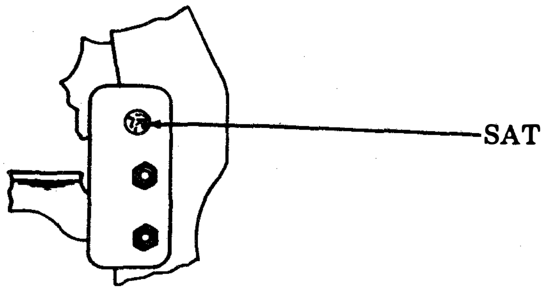
SAT	Felt Oiler	Printing Track Guide
O	Between Layers	Carriage Return Spring
G	Cam Disc Surface	Margin Indicator Cam Disc
O	Bearing (Outer and Inner End)	Carriage Return Spring Drum Shaft
O	Hooks	Spring
SAT	Spring Felt Wick	Tension Pulley Bail
O	Bearing Surface	Tension Pulley Bail
SAT	Felt Oiler	Main Bail
O	Bearing Surface	Pulley
O	Cable Grooves	Carriage Return Spring Drum

Figure 4-87. Carriage Return Mechanism, Front View



O	Engaging Surfaces	Automatic Carriage Return Bellcrank
O	Bearing Surface	Automatic Carriage Return Bellcrank
O	Hooks	Spring
O	Engaging Surface	Spacing Drum Feed Pawl Release Link
O	Bearing Surfaces	Spacing Drum Feed Pawl Release Link
O	Hooks	Spring

Figure 4-88. Spacing Drum Feed Mechanism, Front View



SAT	Felt Oiler	Printing Track Guide

Figure 4-89. Track Guide Mechanism, Front View

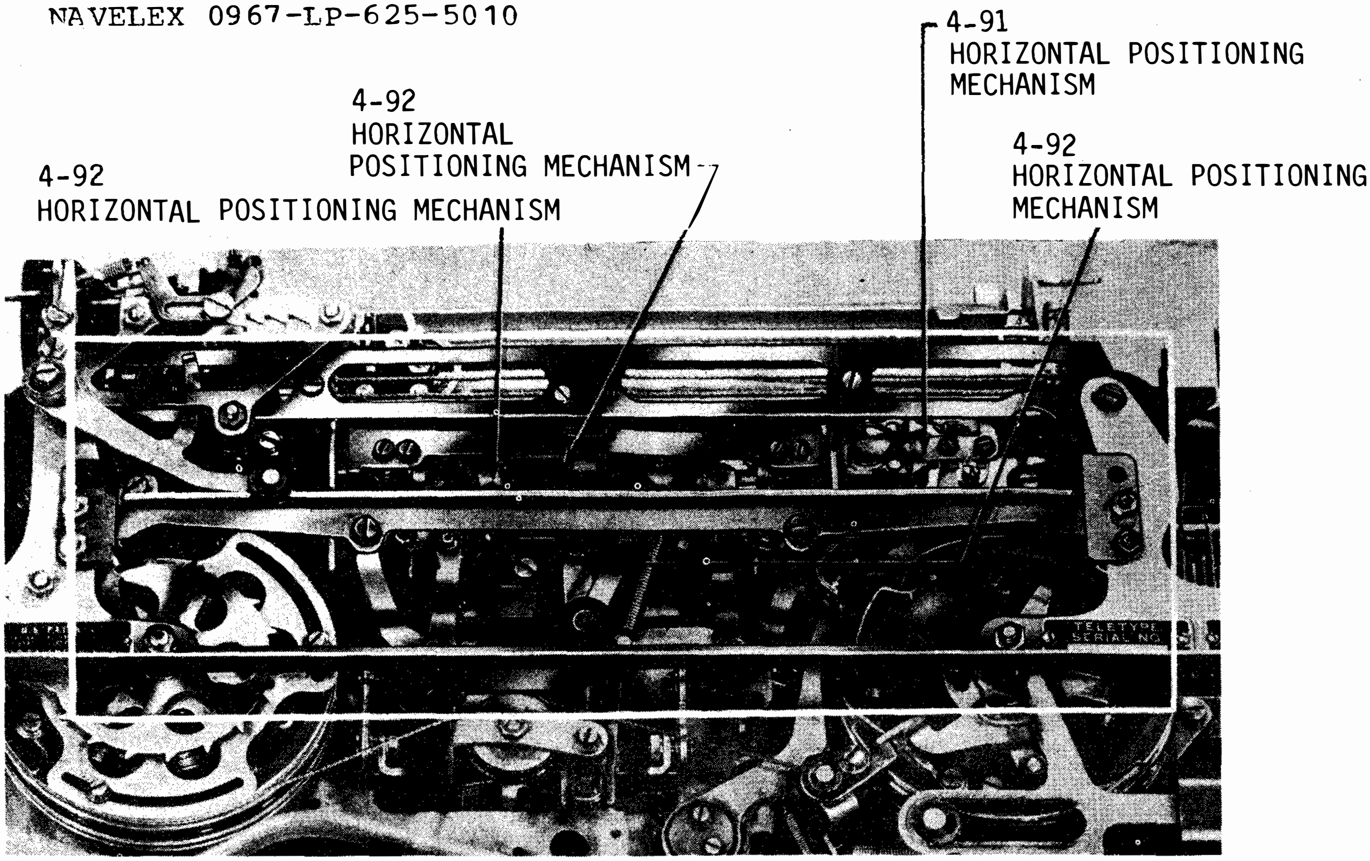


Figure 4-90. Horizontal Positioning Area, Front View

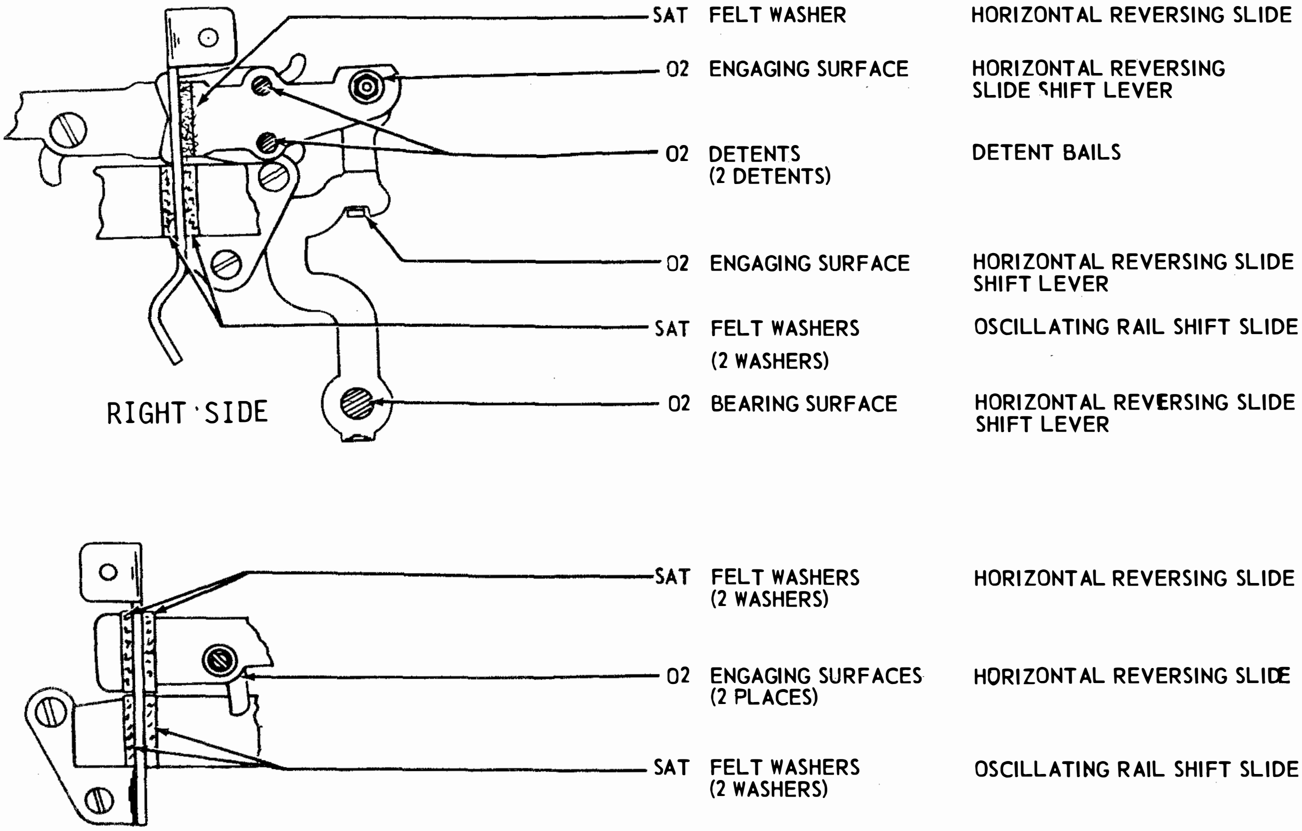


Figure 4-91. Horizontal Positioning Mechanism, Front View

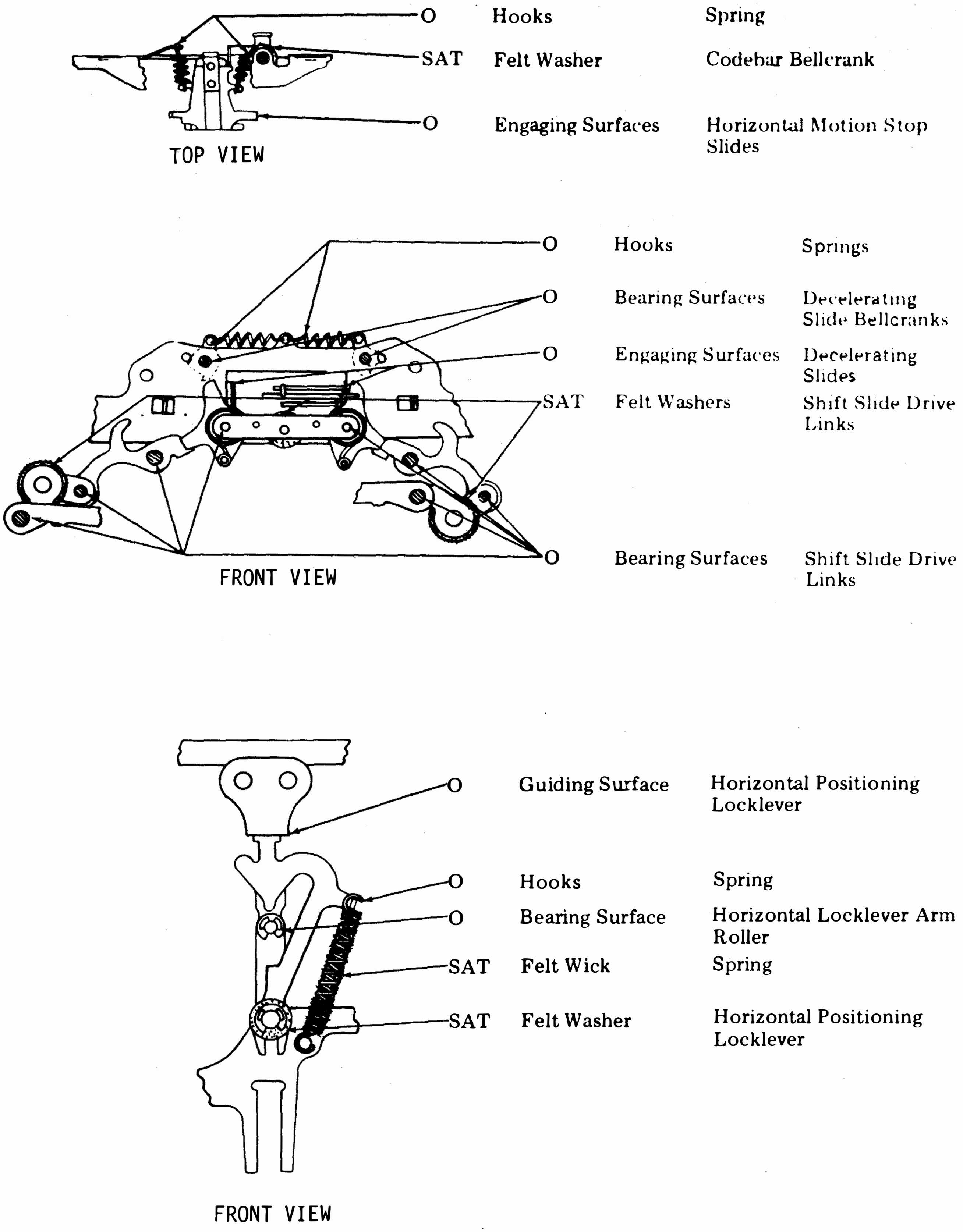


Figure 4-92. Horizontal Positioning Mechanism

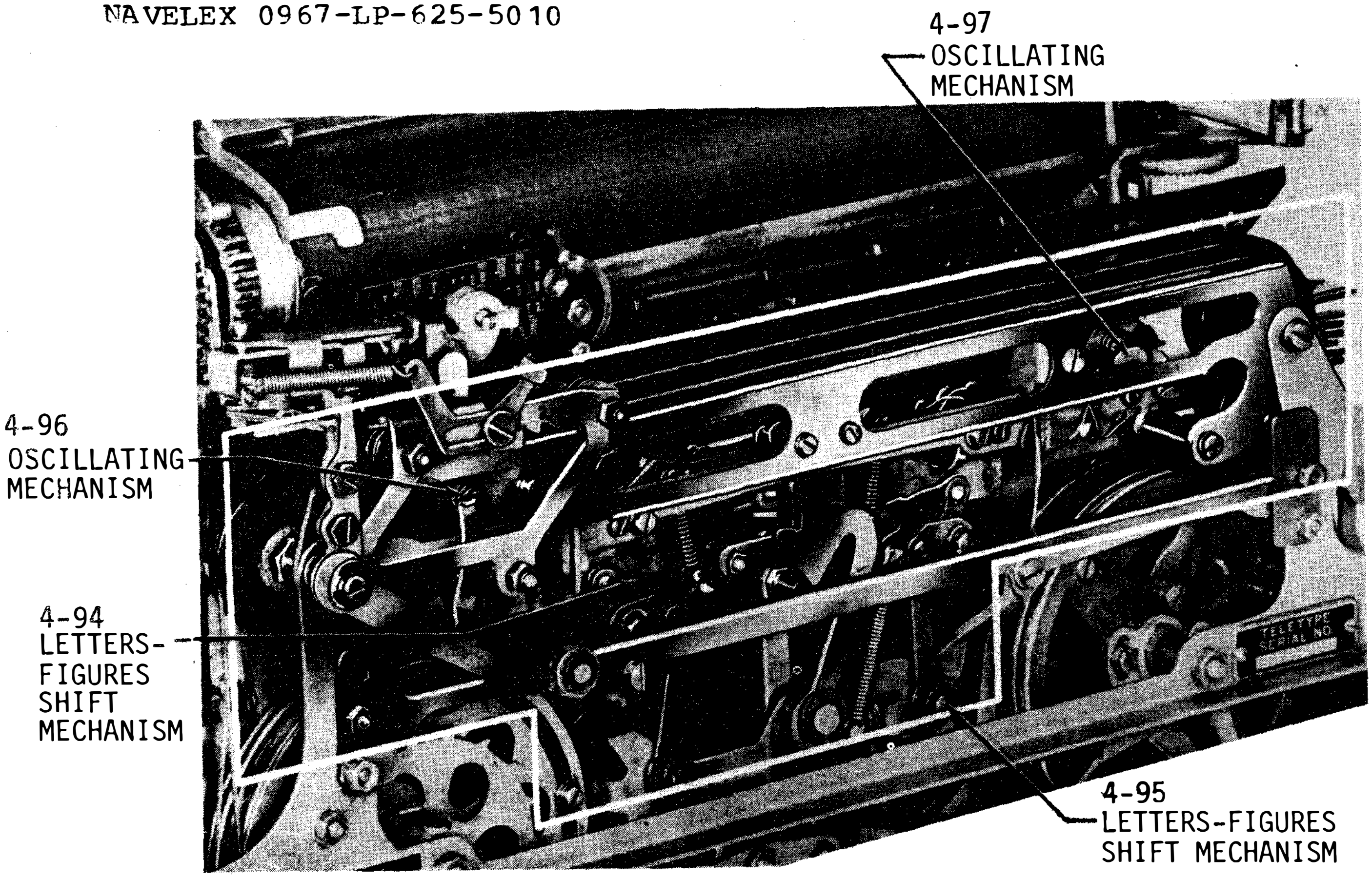
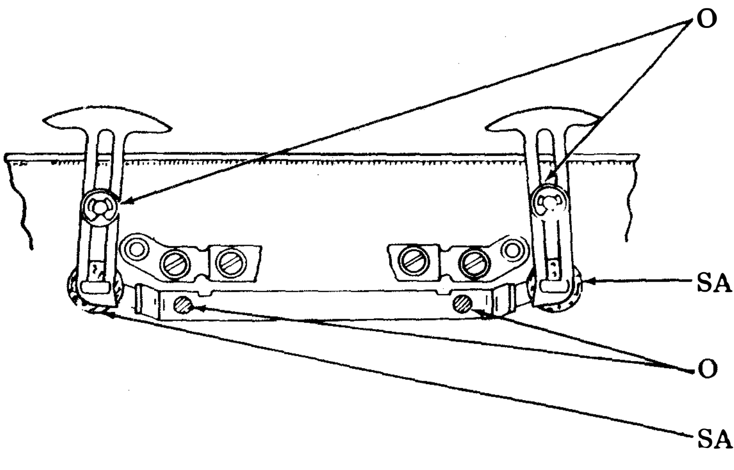
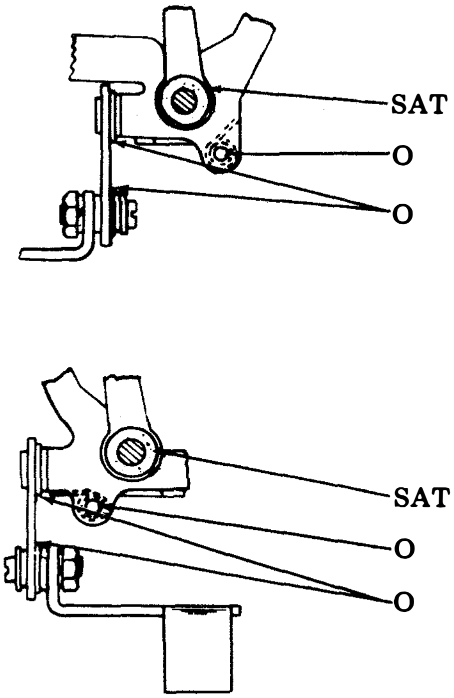


Figure 4-93. LETTERS-FIGURES Shift Area, Front View



O	Guiding Surfaces	Shift Link Breaker Slide
SAT	Felt Washer	Letters-Figures Shift Slide Post
O	Bearing Surfaces	Letters-Figures Shift Slide
SAT	Felt Washer	Letters-Figures Shift Slide Post

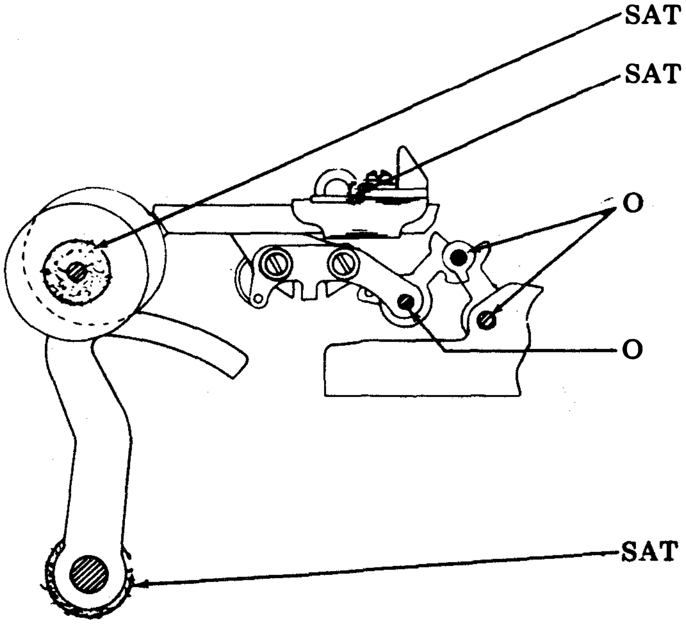
Figure 4-94. LETTERS-FIGURES Shift Mechanism, Front View



SAT	Felt Washer	Shift Slide Drive Link
O	Bearing Surface	Breaker Slide Bail
O	Bearing Surfaces	Main Bail Link

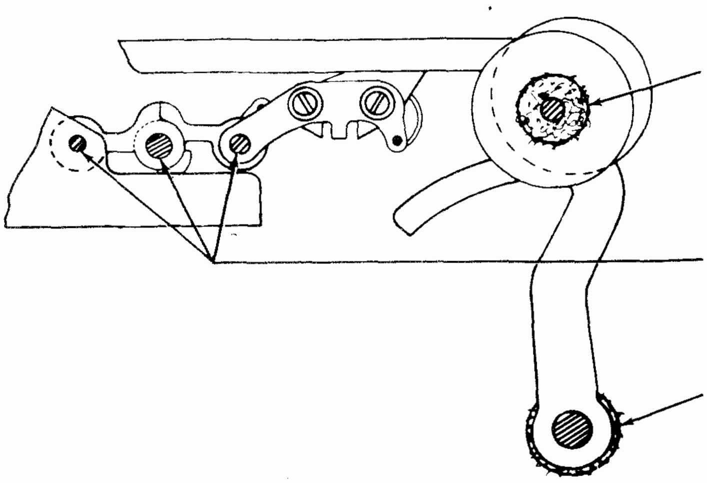
SAT	Felt Washer	Shift Slide Drive Link
O	Bearing Surface	Breaker Slide Bail
O	Bearing Surfaces	Main Bail Link

Figure 4-95. LETTERS-FIGURES Shift Mechanism, Front View



SAT	Felt Washers (3)	Pulleys
SAT	Felt Oiler	Oscillating Rail Slide
O	Bearing Surface	Oscillating Rail Shift Link
O	Bearing Surface	Oscillating Rail Shift Link
SAT	Felt Washer	Oscillating Rail Guide Arm

Figure 4-96. Oscillating Mechanism, Front View



SAT	Felt Washers (3)	Pulleys
O	Bearing Surfaces	Oscillating Rail Shift Link
SAT	Felt Washer	Oscillating Rail Guide Arm

Figure 4-97. Oscillating Mechanism, Front View

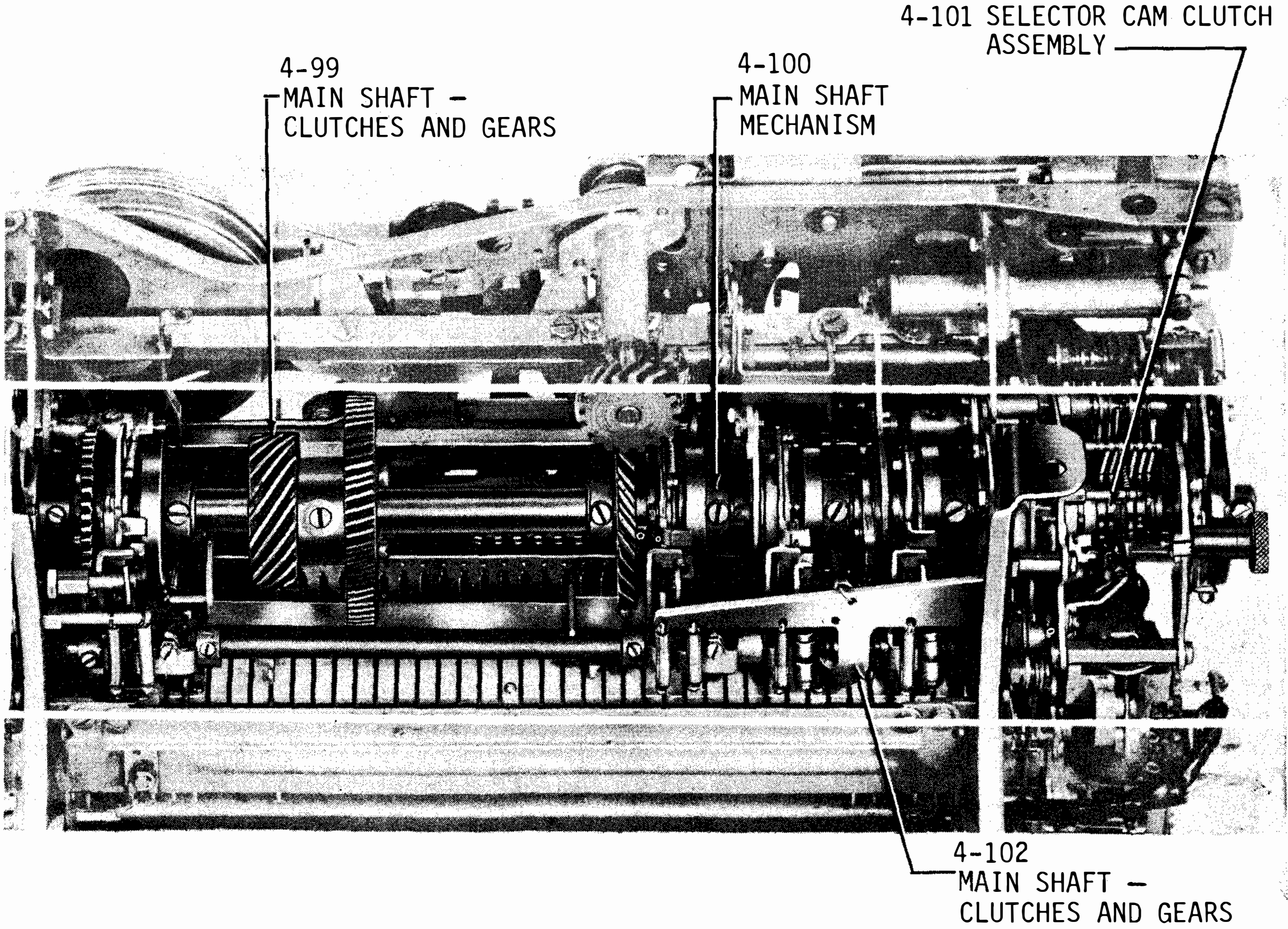
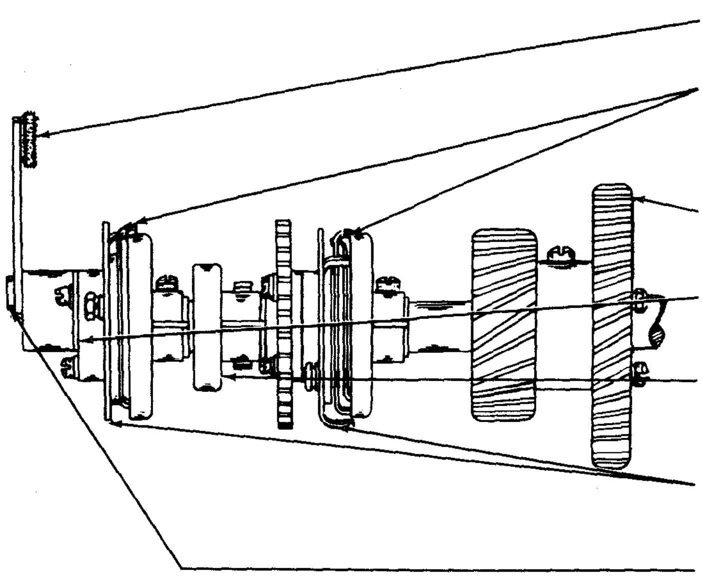
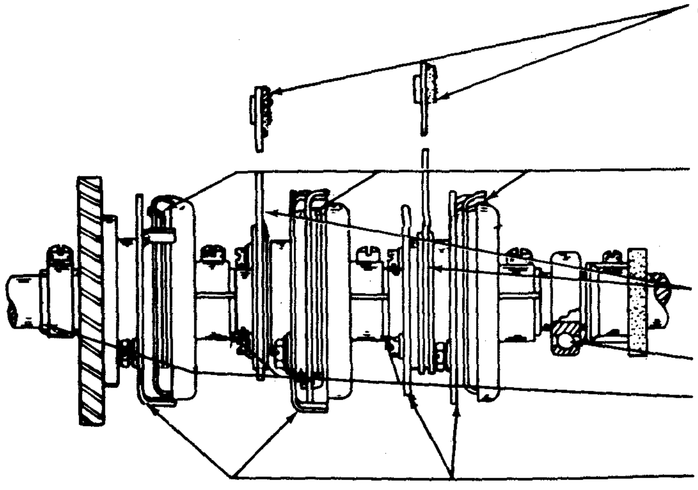


Figure 4-98. Main Shaft Area, Bottom View



SAT	Felt Washer	Drive Link
SAT	Internal Mechanisms (Felt Wicks and Springs)	Clutch Assemblies
G	Teeth (4 Gears)	Main Shaft Gears
O	Bearing Surfaces	Clutch Sleeves
O	Ball Bearing	Main Shaft Bearing
O	Camming Surfaces	Clutch Discs
O	Bearing Surface	Drive Link Bearing

Figure 4-99. Main Shaft - Clutches and Gears, Bottom View



SAT	Felt Washers	Eccentric Follower Arm Bearings
SAT	Internal Mechanisms (Felt Wicks and Springs)	Clutch Assemblies
O	Bearing Surfaces	Eccentric Follower Arm Cam
O	Ball Bearing	Main Shaft Bearing
O	Bearing Surfaces	Clutch Sleeve
O	Camming Surfaces	Clutch Discs

Figure 4-100. Main Shaft Mechanism, Bottom View

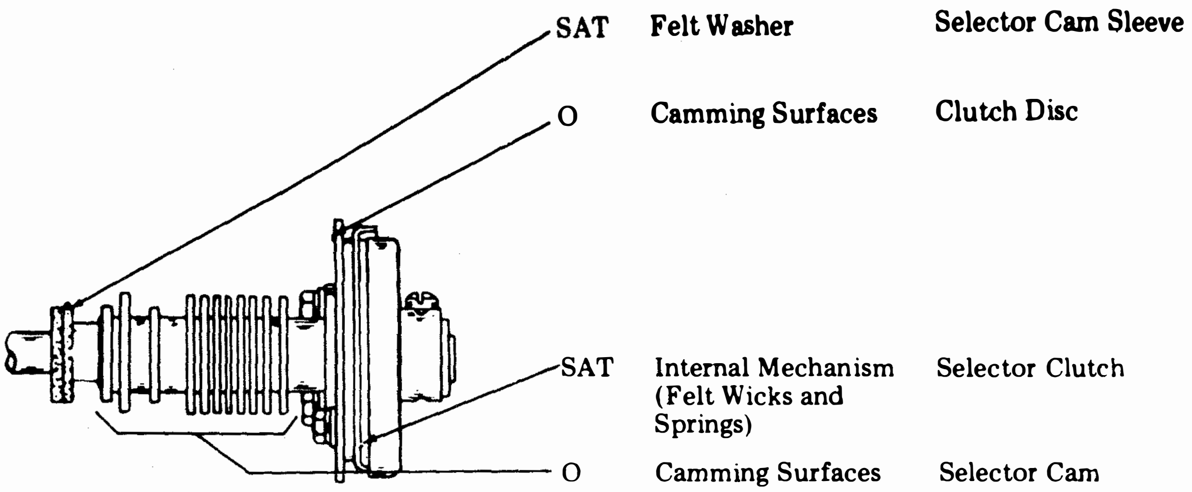


Figure 4-101. Selector Cam Clutch Assembly, Front View

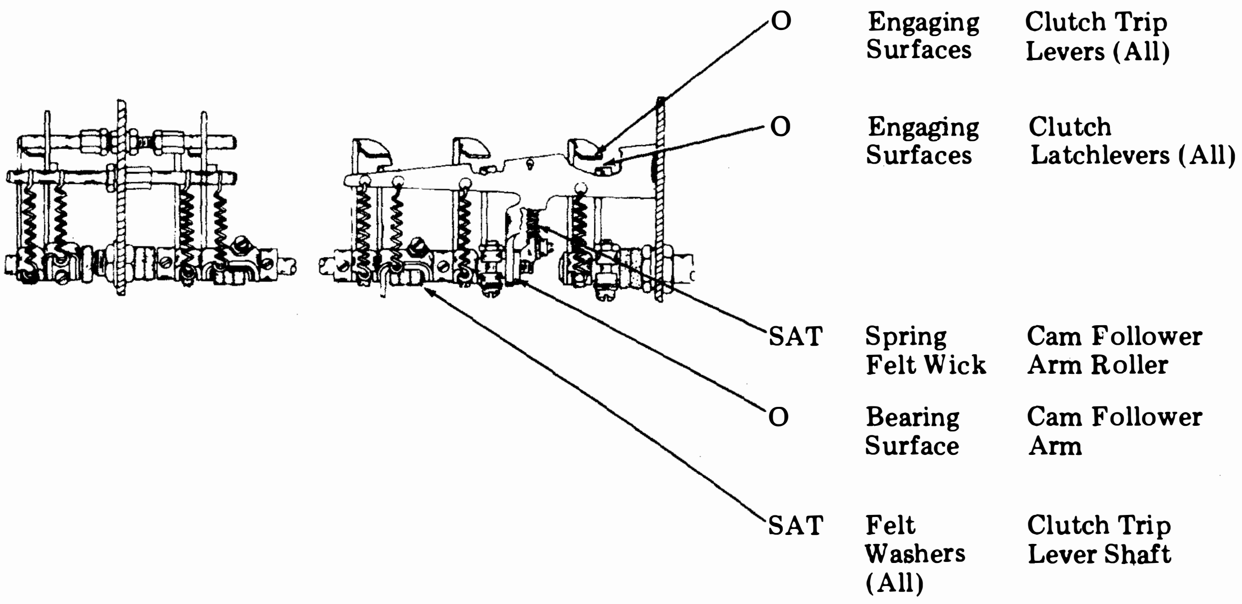


Figure 4-102. Main Shaft - Clutches and Gears, Rear View

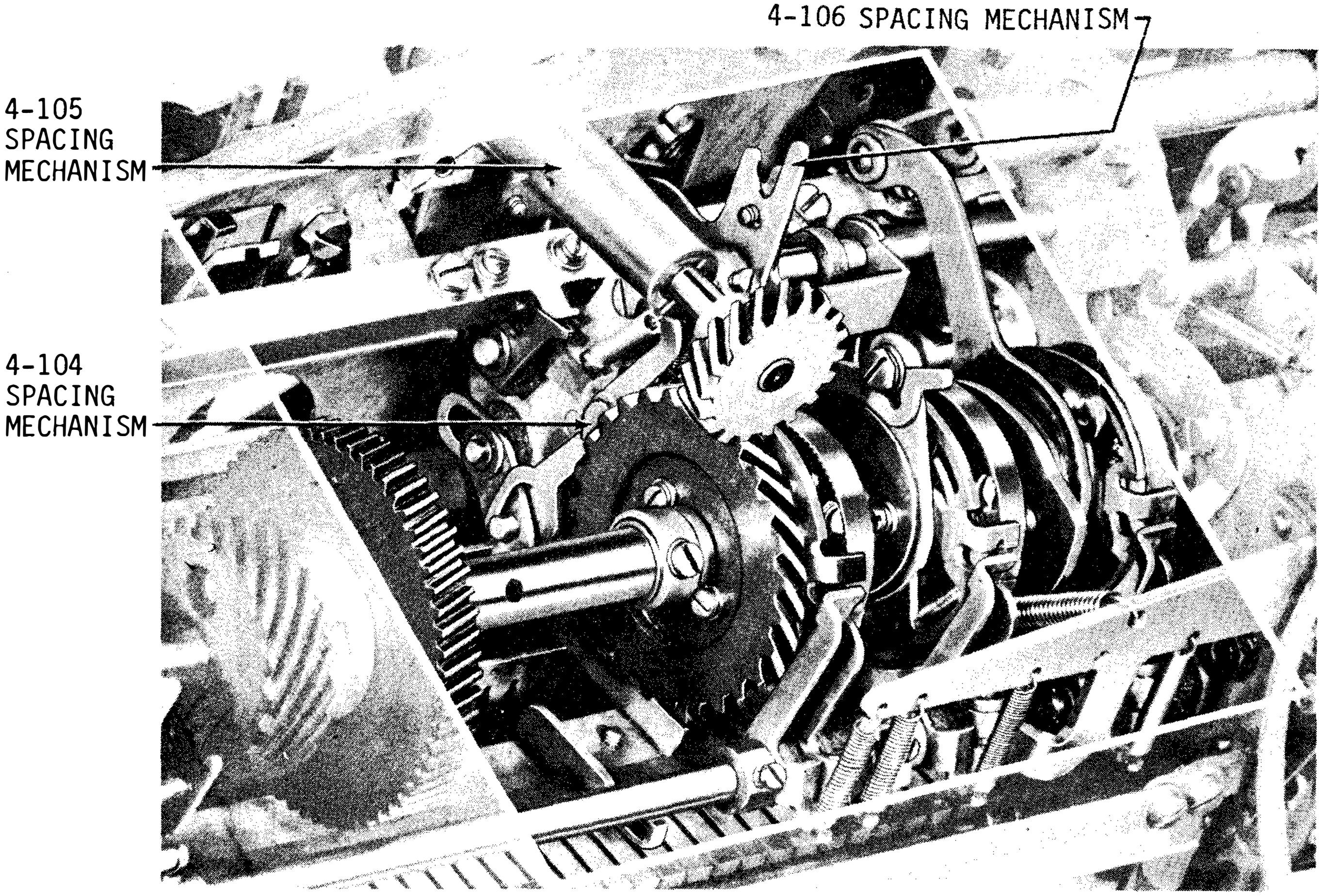
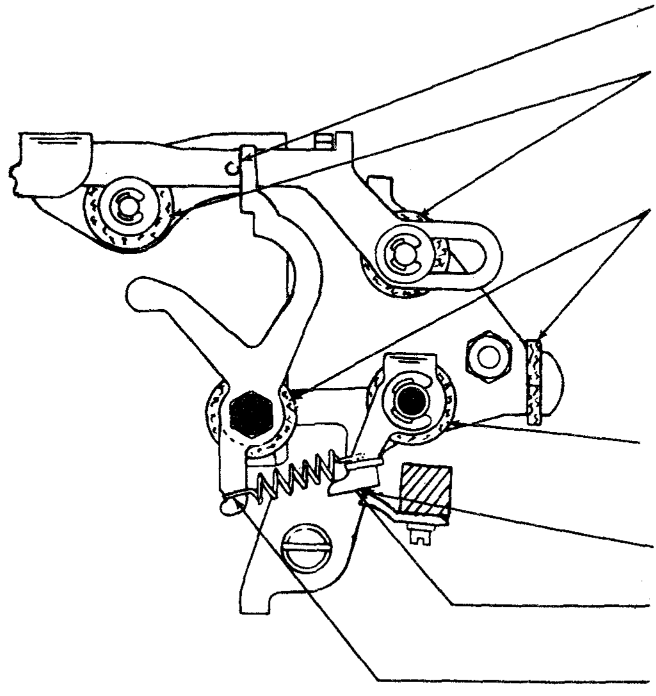
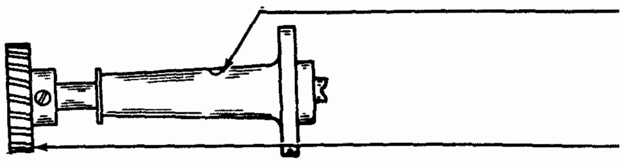


Figure 4-103. Spacing Area, Bottom View



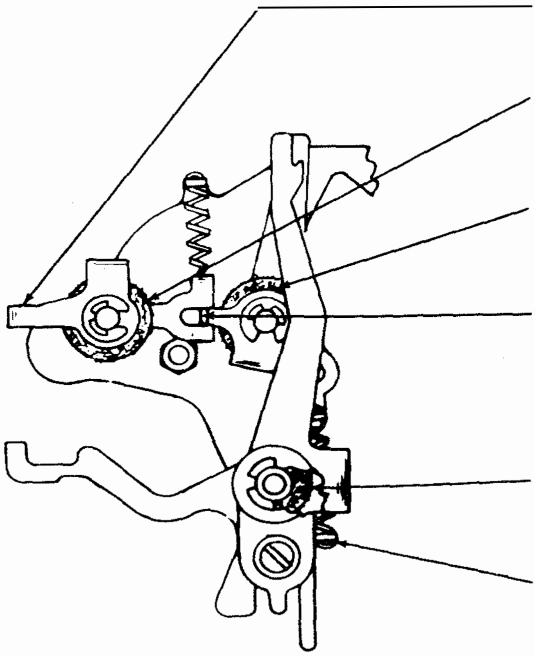
O	Engaging Surfaces	Spacing Trip Lever
SAT	Felt Washers	Spacing Suppression Slide
SAT	Felt Washers	Spacing Trip Lever
SAT	Felt Washer	Spacing Trip Lever Bail Shaft
O	Engaging Surface	Spacing Trip Lever Bail
G	Engaging Surface	Trip Reset Cam
O	Hooks	Springs

Figure 4-104. Spacing Mechanism, Left Side View



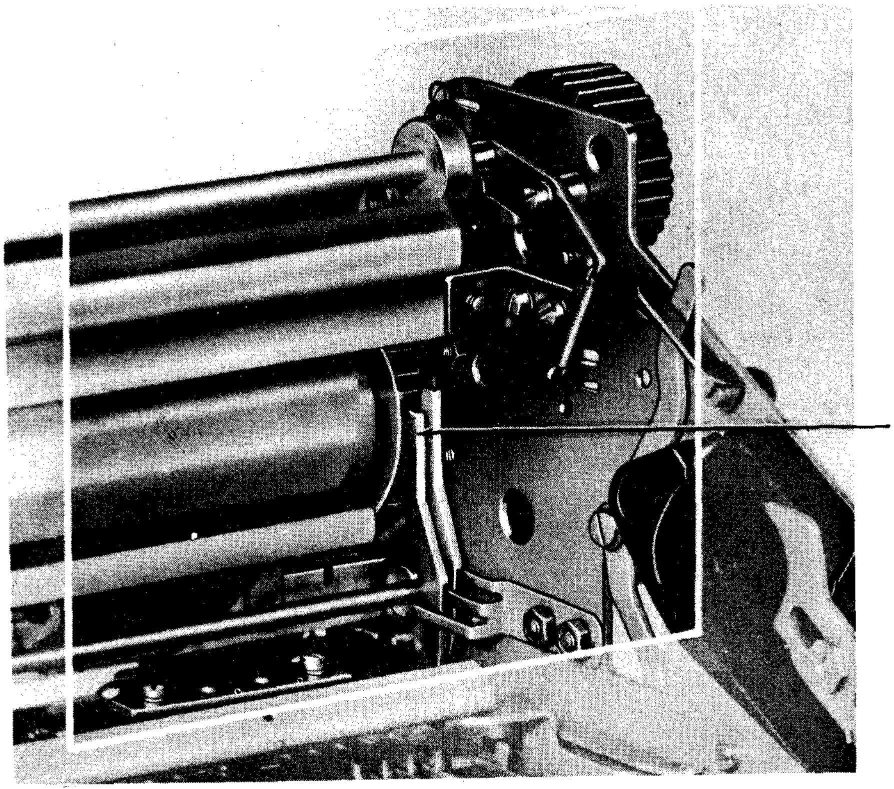
O2	OIL HOLE	SPACING SHAFT
G	TEETH	SPACING SHAFT GEAR

Figure 4-105. Spacing Mechanism, Left Side View



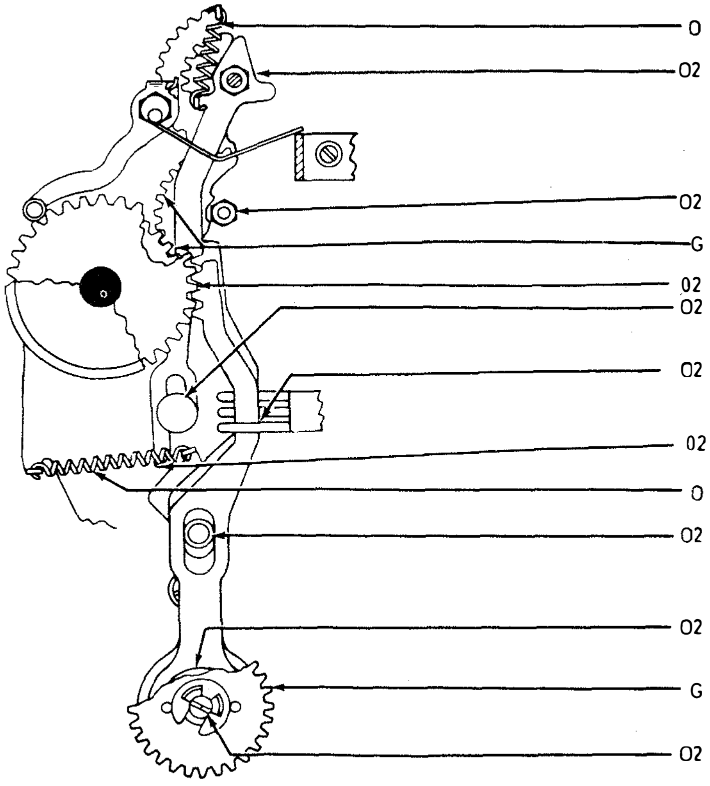
O	Engaging Surface	Spacing Cutout Transfer Bail
SAT	Felt Washers (2)	Spacing Cutout Transfer Bail
SAT	Felt Washer	Spacing Cutout Bail
O	Engaging Surface	Spacing Cutout Bail
SAT	Felt Washers (2)	Carriage Return Bail Shaft
O	Hooks	Spring

Figure 4-106. Spacing Mechanism, Right Side View



4-108
LINE-FEED
MECHANISM

Figure 4-107. Line-Feed Area, Rear View



0	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
0	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

Figure 4-108. Line-Feed Mechanism, Right Side View

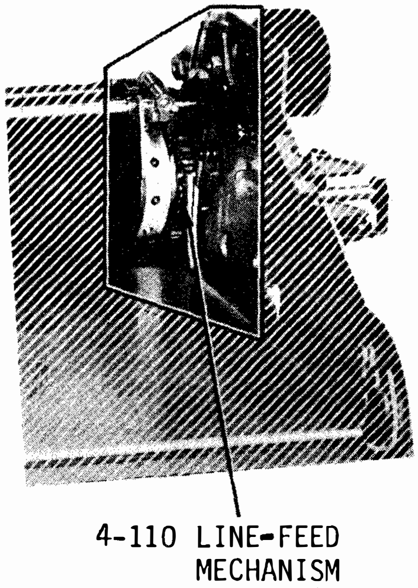


Figure 4-109. Line-Feed Area, Rear View

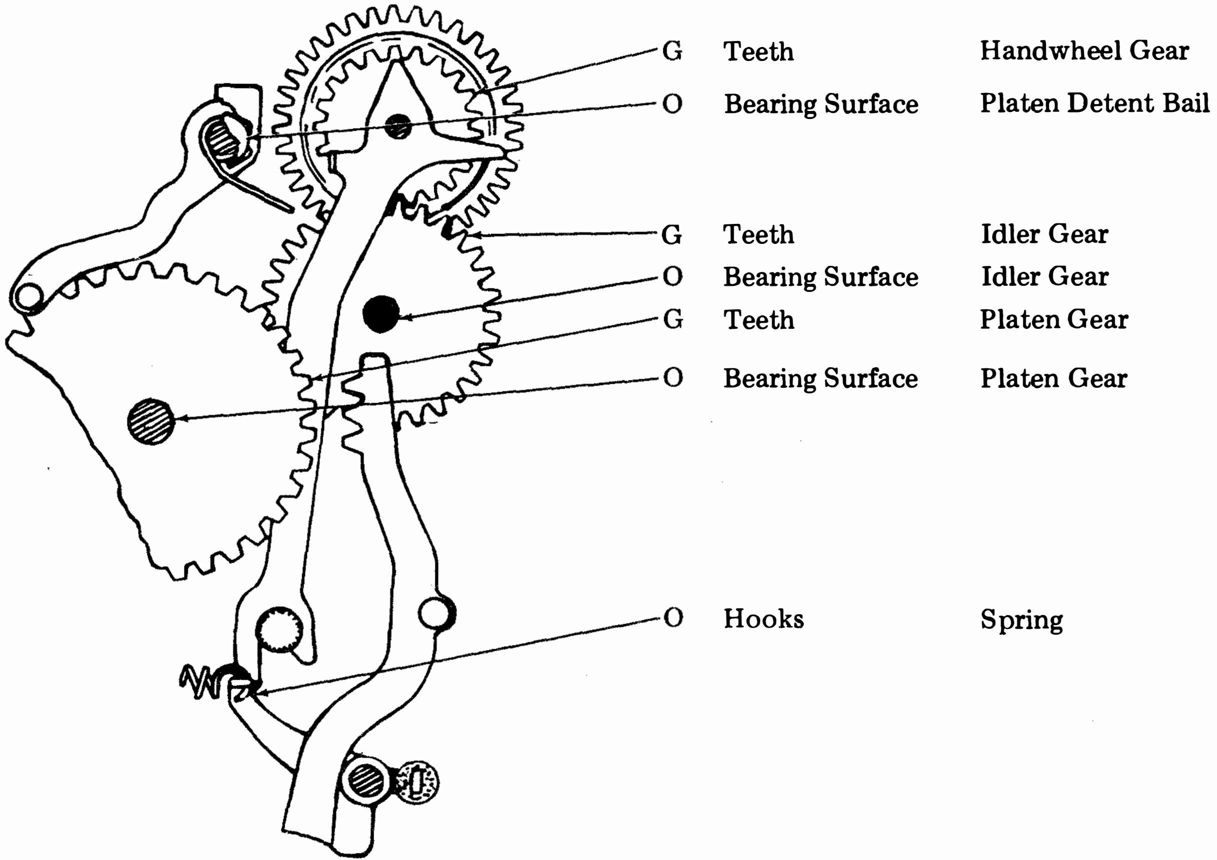


Figure 4-110. Line-Feed Mechanism, Right Side View

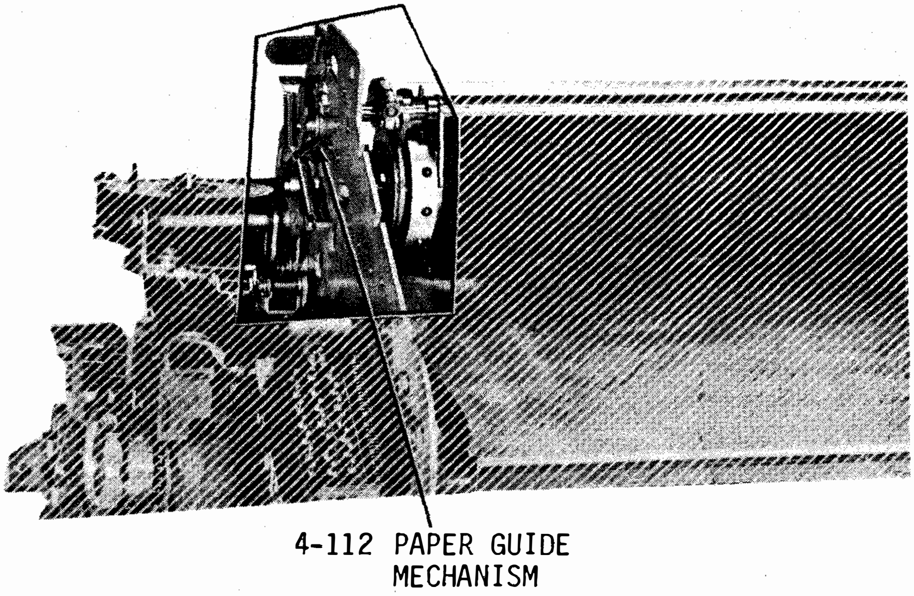
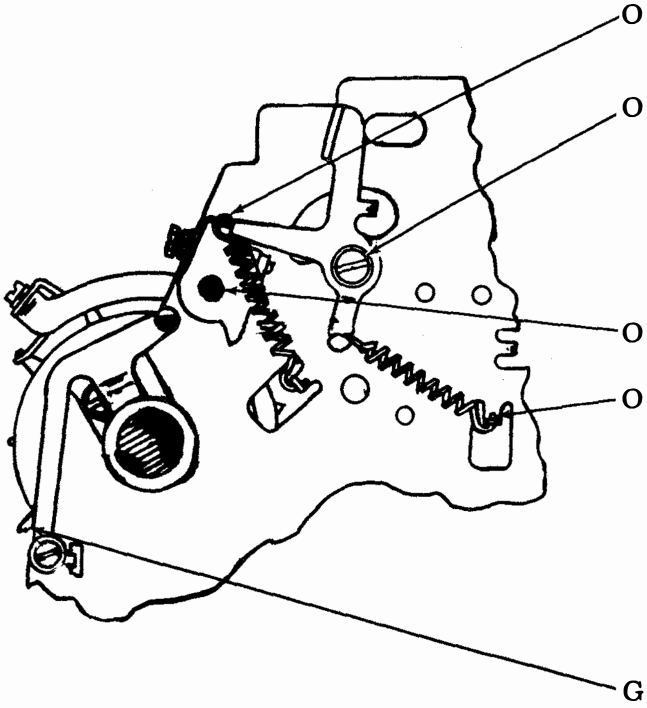


Figure 4-111. Paper Guide Area, Rear View



O	Hooks	Spring
O	Pivots (2 Places)	Guide Bracket Latch
O	Pivots (2 Places)	Guide Bracket Shaft
O	Hooks	Spring
G	Pack Pin and Spring Cavaties (22 Places)	Sprocket

Figure 4-112. Paper Guide Mechanism, Right Side View

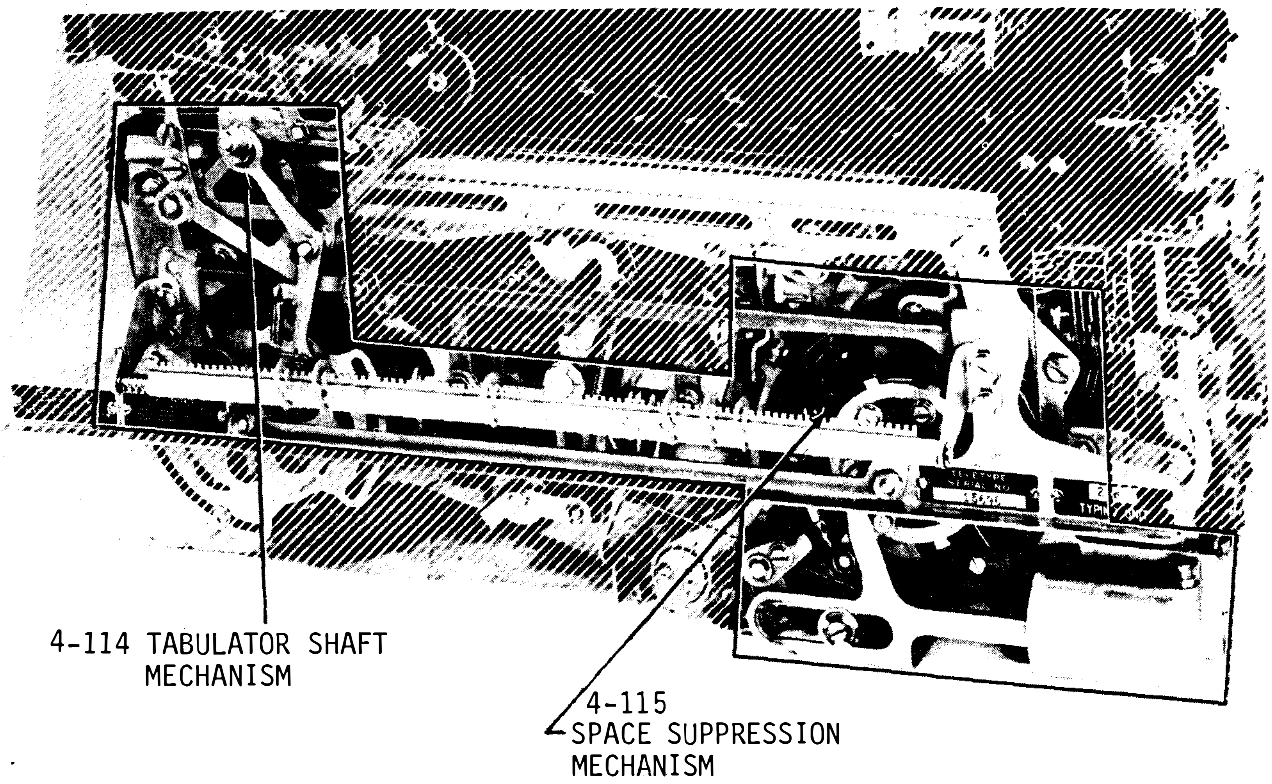
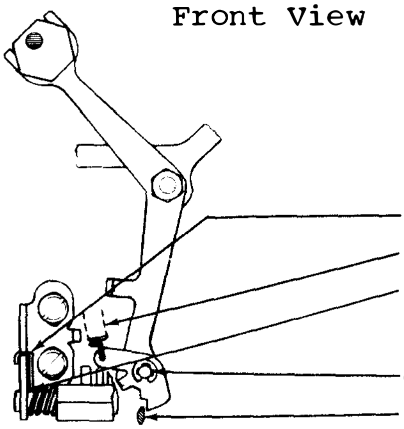
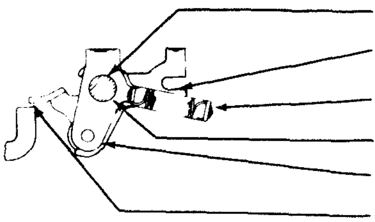


Figure 4-113. Horizontal Tabulator Mechanism, (Early Design), Front View



O	Hooks	Spring
O	Hooks	Spring Torsion Coils
O	Bearing Surfaces	Tabulator Shaft
O	Bearing Surface	Tabulator Pawl
O	Engaging Surfaces	Tabulator Stop Clip

Figure 4-114. Tabulator Shaft Mechanism, Front View



O	Bearing Surfaces	Spacing Cutout Transfer Bail
O	Engaging Surface	Spacing Cutout Transfer Bail
O	Hooks	Spring
SAT	Felt Washers (2)	Bail Stud
O	Bearing Surface	Bail Extension Arm
O	Engaging Surface	Spacing Cutout Transfer Bail

Figure 4-115. Space Suppression Mechanism, Right Side View

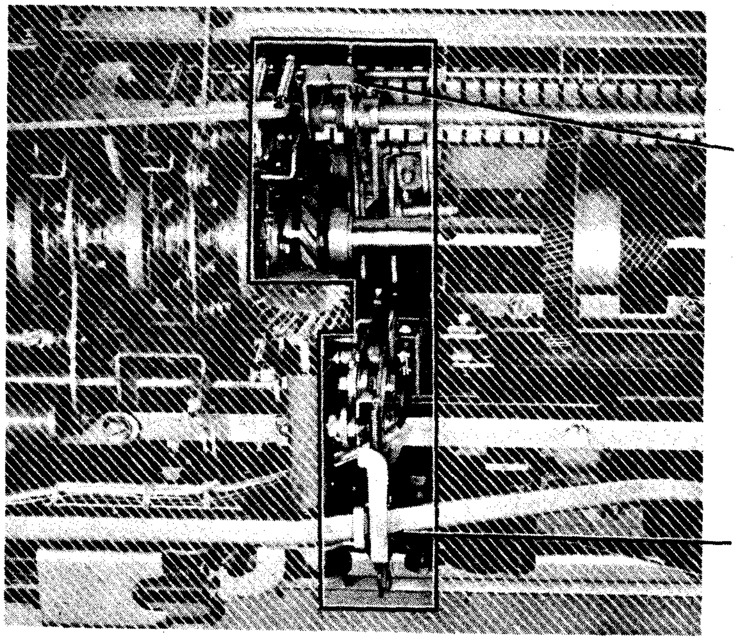
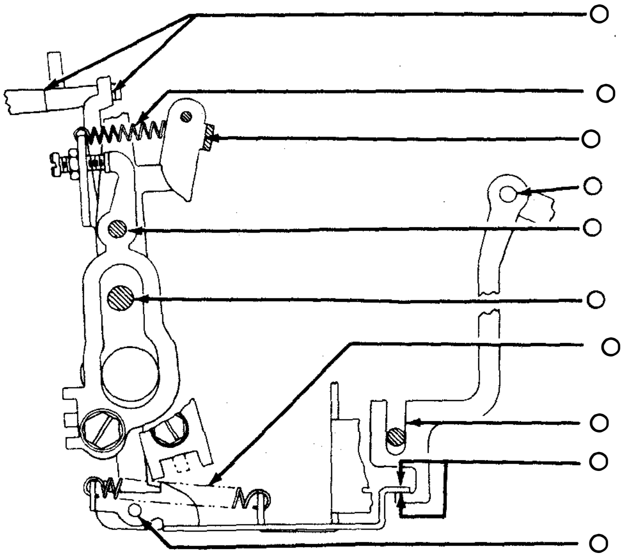
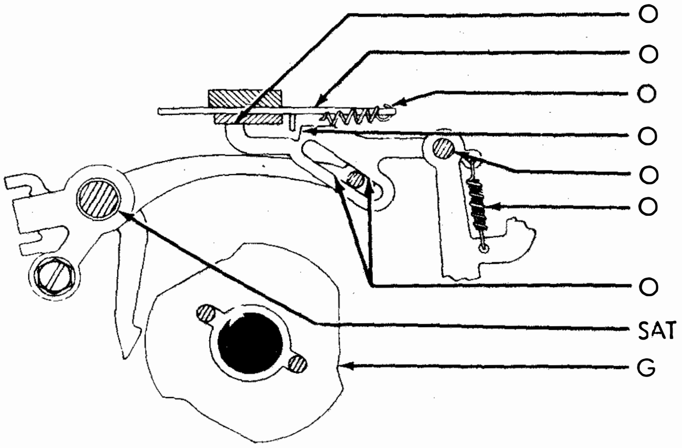


Figure 4-116. Horizontal Tabulator Mechanism, (Early Design) Bottom View



○	ENGAGING SURFACES (2 PLACES)	SPACING TRIP ARM
○	HOOKS - EACH END	SPRING
○	ENGAGING SURFACE	OPERATING LEVER
○	BEARING SURFACE	BLOCKING ARM
○	BEARING SURFACES (2 PLACES)	TRIP ARM LATCH BAIL
○	BEARING SURFACE	OPERATING LEVER
○	HOOKS - EACH END	SPRING
○	GUIDE SURFACE	BLOCKING ARM
○	ENGAGING SURFACES (2 PLACES)	SLIDE ARM
○	BEARING SURFACE	SLIDE ARM

Figure 4-117. Operating Lever Mechanism, Left Side View



O	GUIDE SURFACE	CAM ARM
O	GUIDE SURFACE	TABULATOR SLIDE ARM
O	HOOKS	SPRING
O	ENGAGING SURFACE	CAM ARM
O	BEARING SURFACES	CAM ARM
O	HOOKS	SPRING
O	CAMMING SURFACE	CAM ARM
SAT	FELT WASHERS (5)	CLUTCH TRIP SHAFT
G	CAMMING SURFACE	SPACING CLUTCH RESTORING CAM

Figure 4-118. Spacing Clutch Mechanism, Right Side View

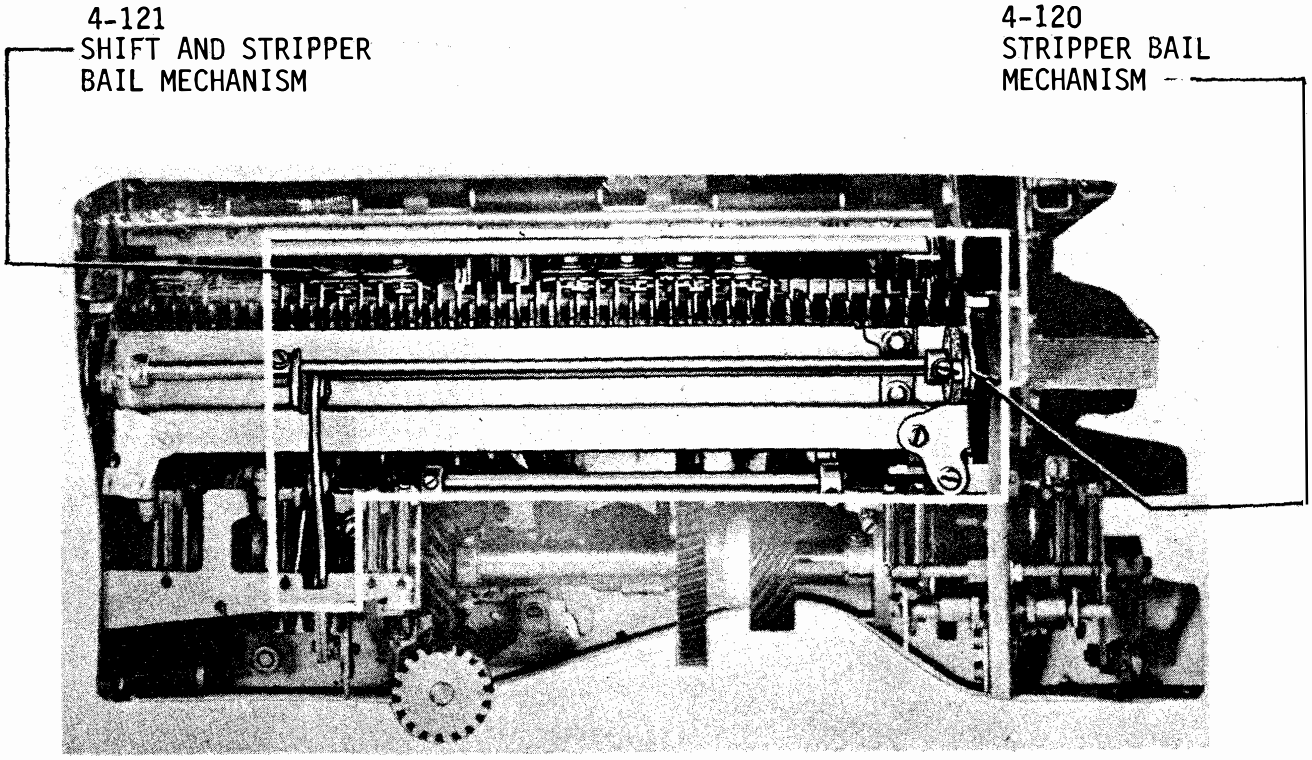


Figure 4-119. Selective Calling Mechanism, Rear View

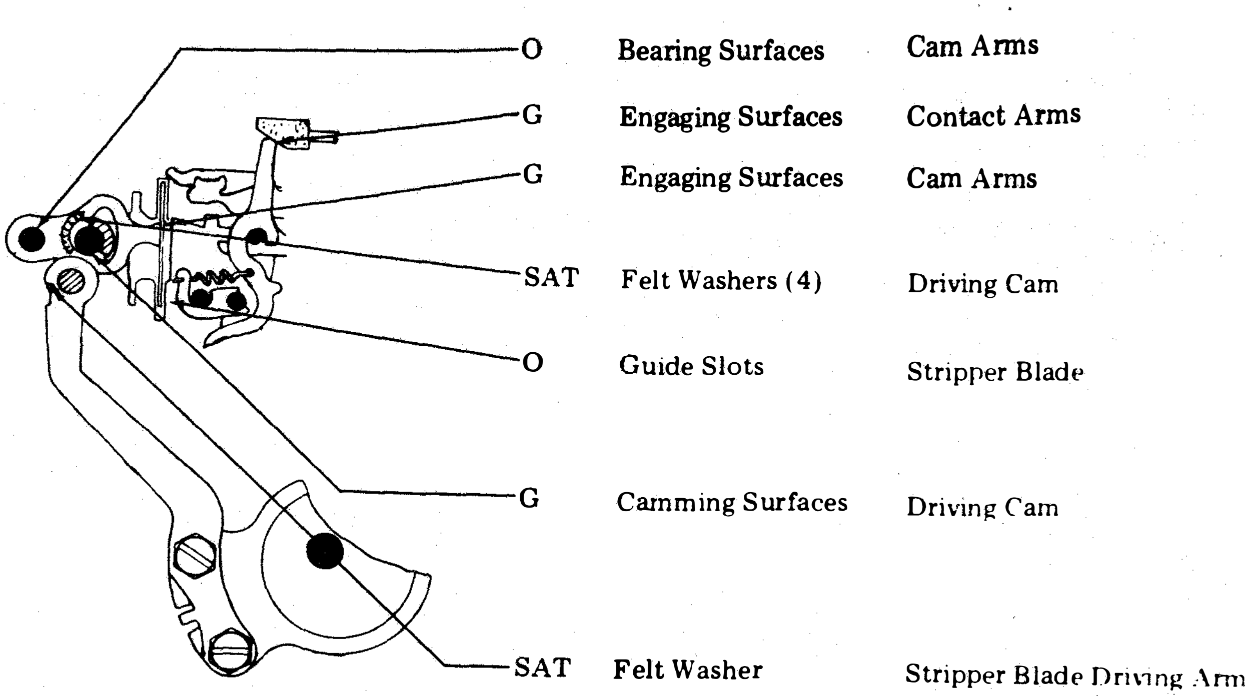


Figure 4-120. Stripper Bail Mechanism, Left Side View

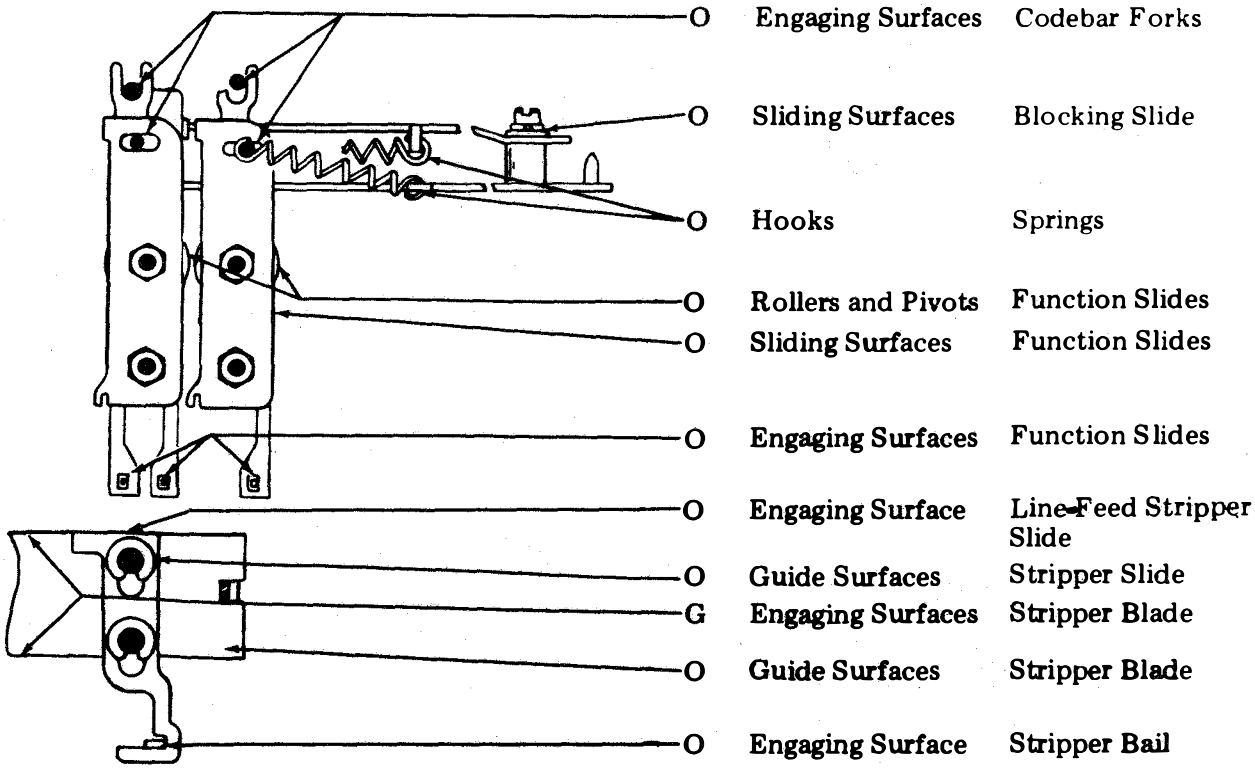


Figure 4-121. Shift and Stripper Bail Mechanisms, Rear View

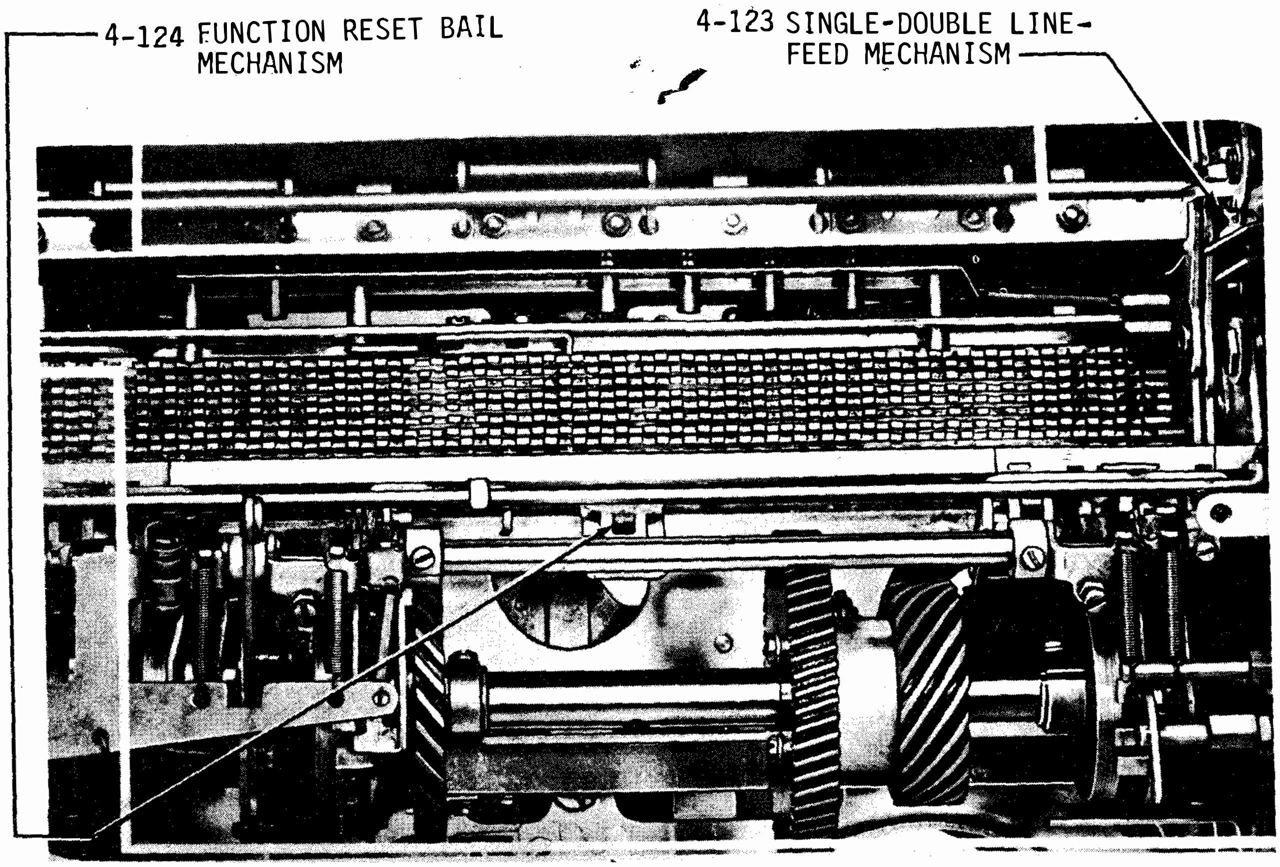


Figure 4-122. Selective Calling Mechanism, Rear View

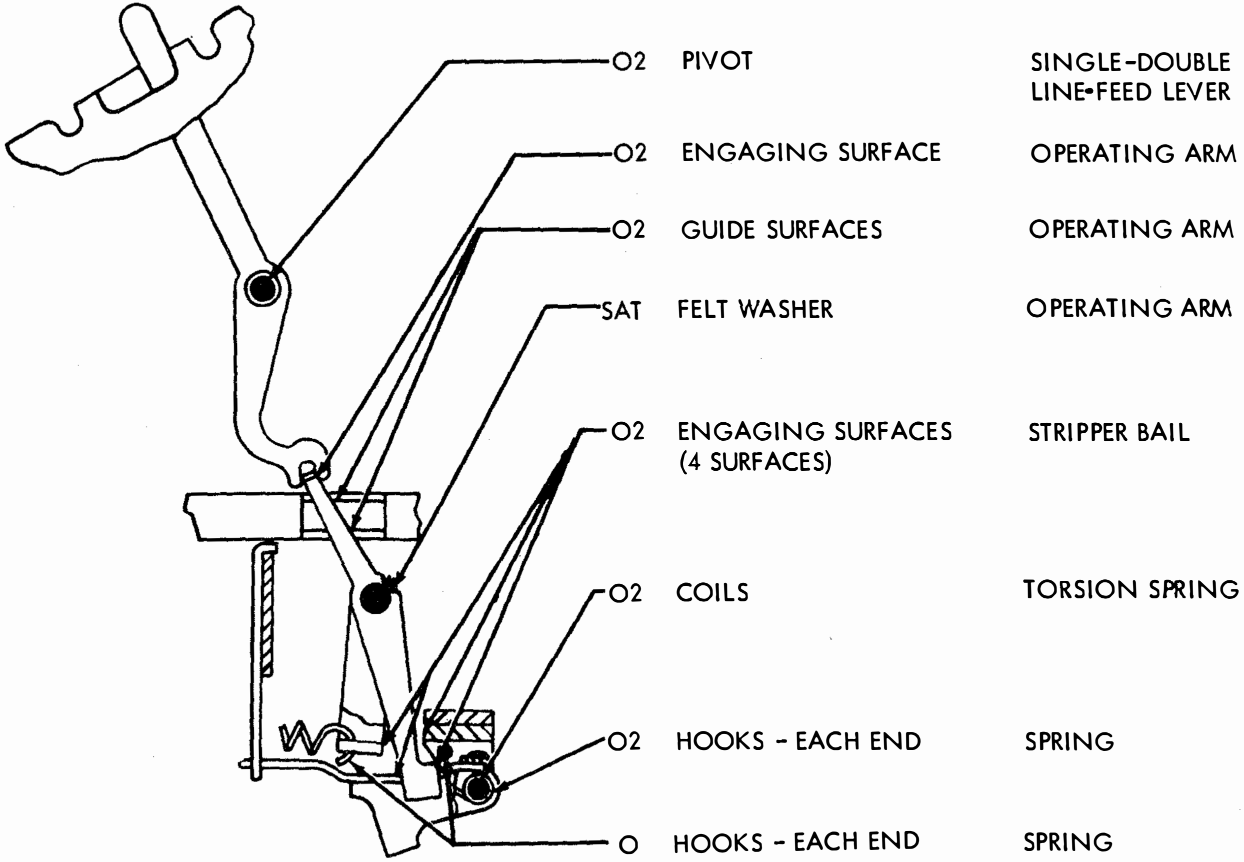
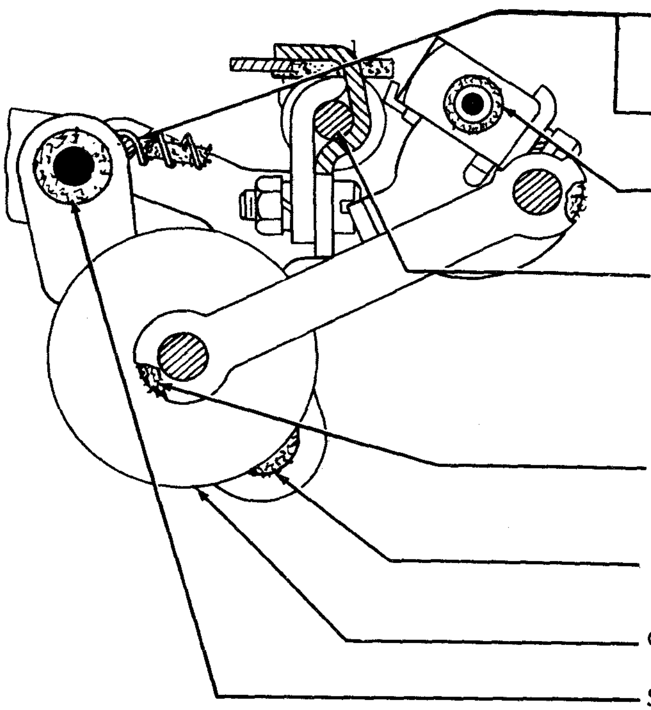


Figure 4-123. Single-Double Line-Feed Mechanism, Right Side View



O	HOOKS - EACH END (2 SPRINGS)	SPRINGS
SAT	FELT WICKS (2 SPRINGS)	SPRINGS
SAT	FELT WASHERS (2 BEARINGS)	CAM SHAFT
O2	BEARINGS (3 ROLLERS)	FUNCTION BAIL ROLLERS
SAT	FELT WASHERS (EACH END)	DRIVE LINK
SAT	FELT WASHERS (2 PIVOTS)	FUNCTION BAR RESET BAIL
G	ENGAGING SURFACE	FUNCTION CAM ROLLER
SAT	FELT WASHER	CAM ROLLER BRACKET LINK

Figure 4-124. Function Reset Bail Mechanism, Right Side View

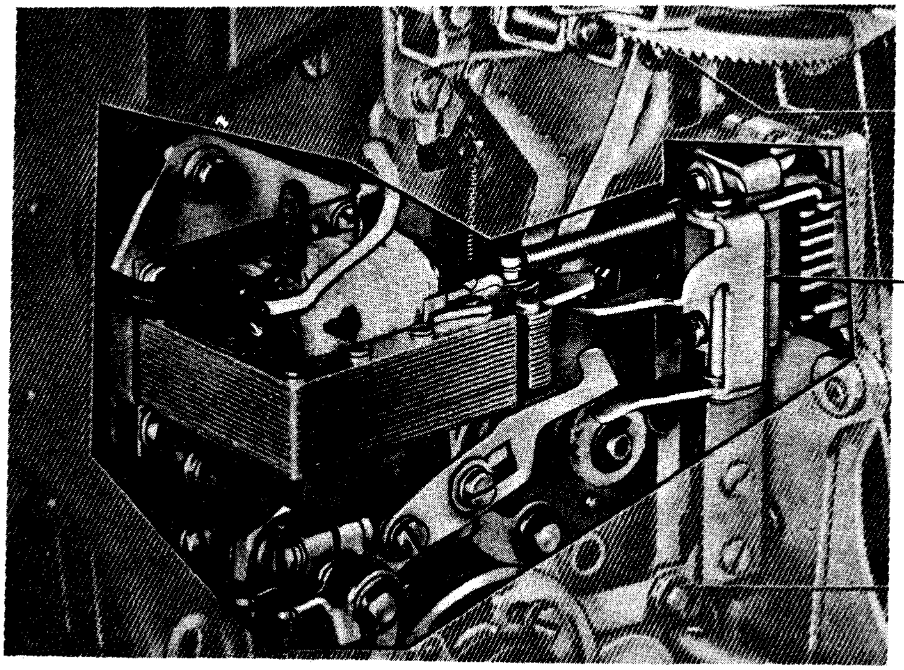


Figure 4-125. Selective Calling Mechanism, Left Side View

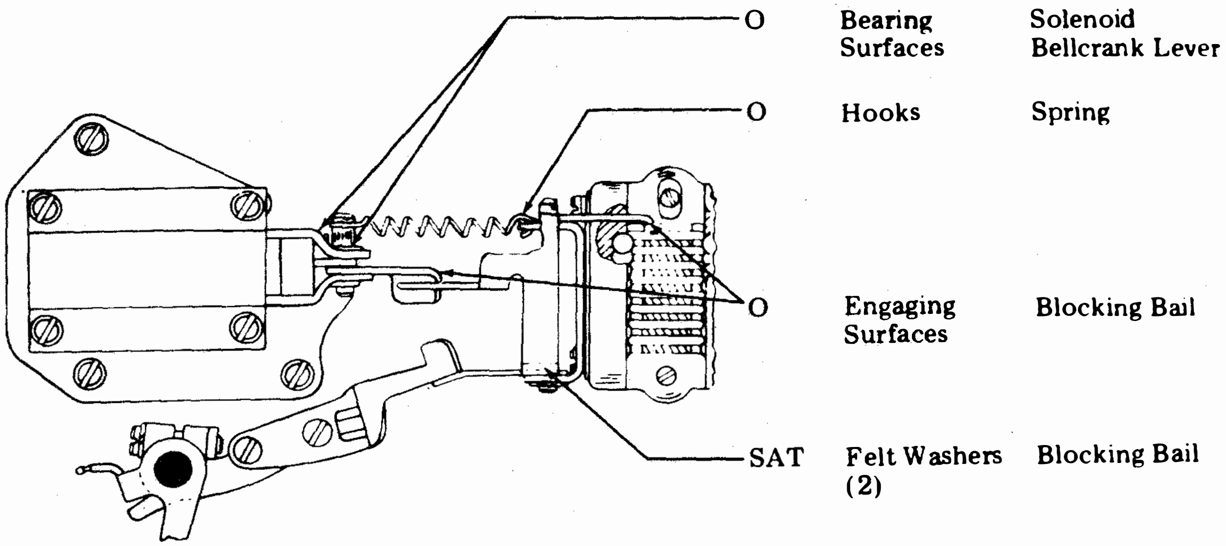


Figure 4-126. Clutch Suppression Mechanism, Left Side View

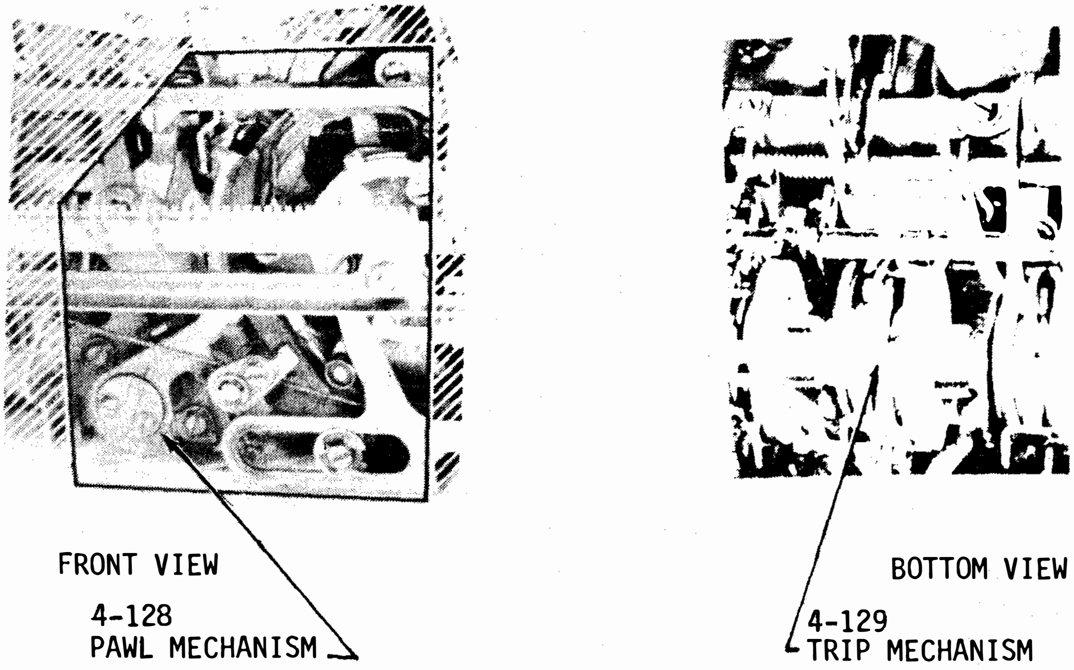
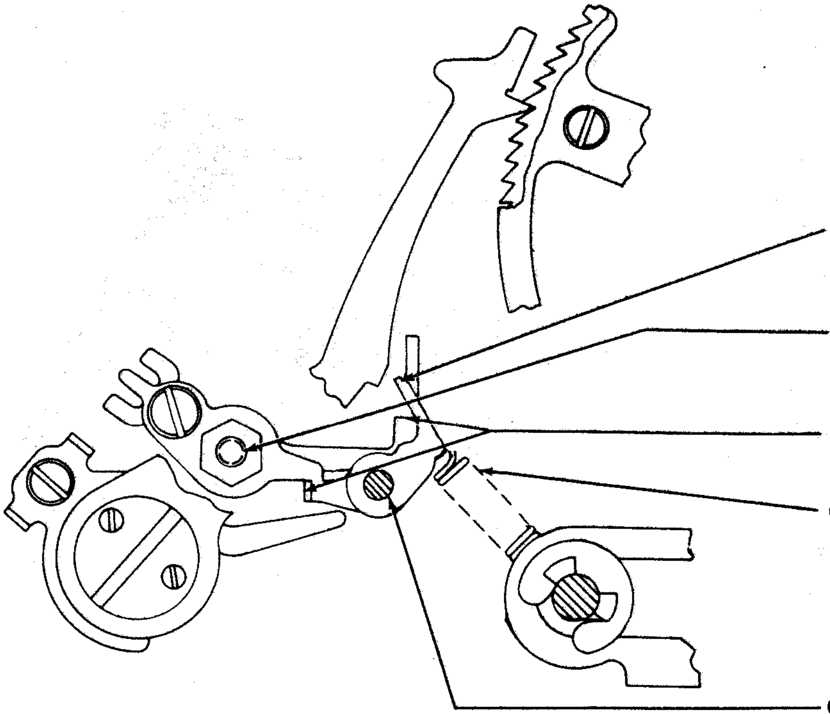
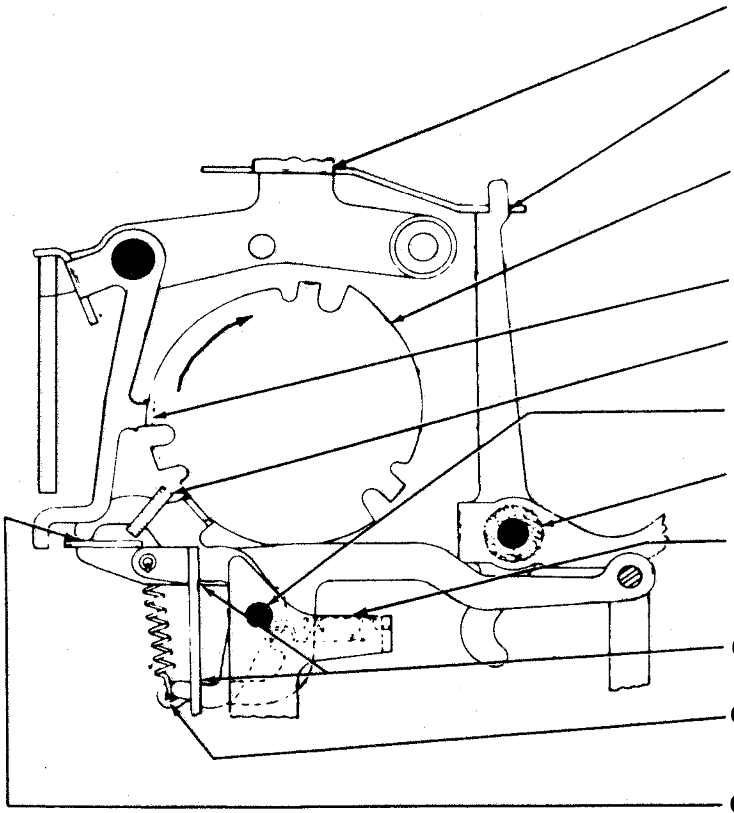


Figure 4-127. Local Backspace Mechanism



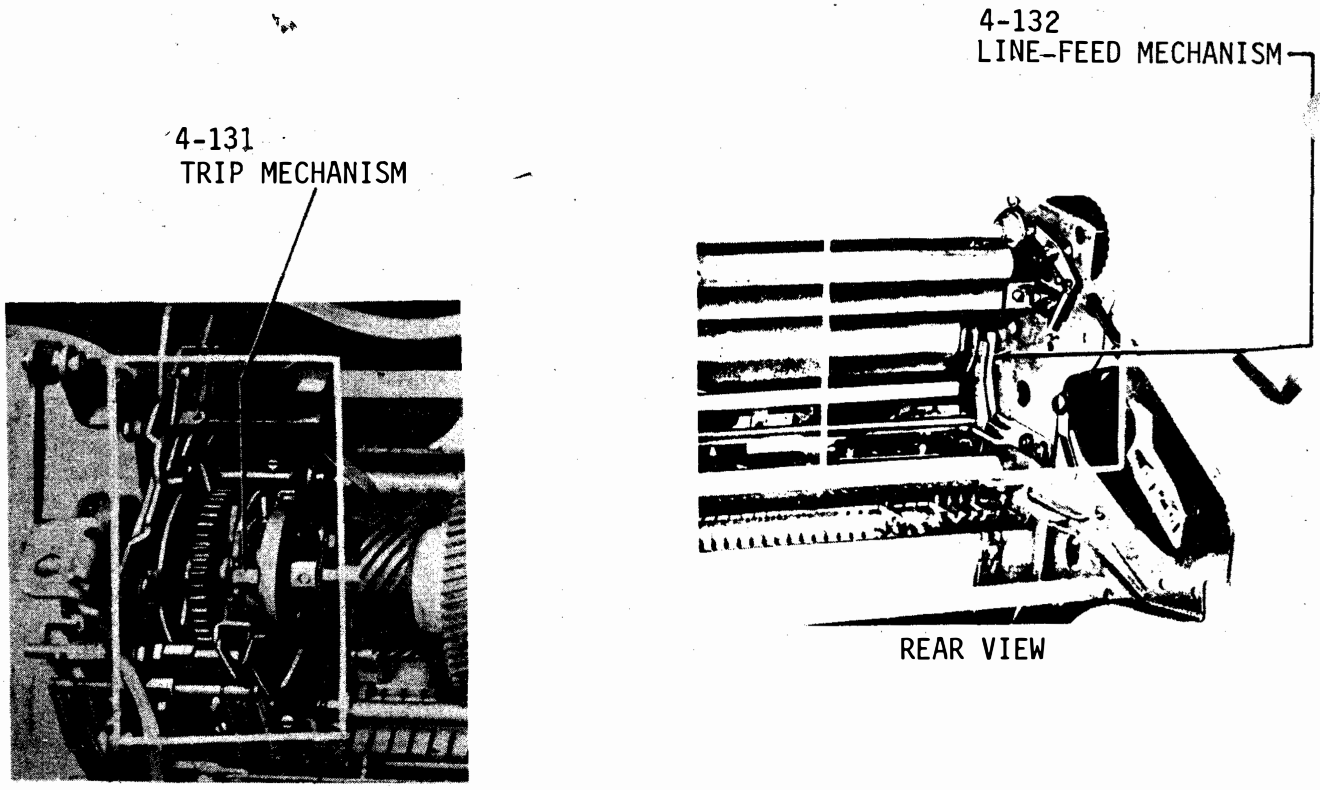
O	Engaging Surface	Backspace Camming Bail
O	Bearing Surface	Adjusting Plate
O	Engaging Surfaces	Intermediate Arm
O	Hooks	Spring
O	Bearing Surface	Backspace Camming Bail

Figure 4-128. Pawl Mechanism, Front View



O	Guide Surfaces	Backspace Slide Arm
O	Engaging Surface	Backspace Bail
G	Camming Surface	Spacing Clutch Cam Disc
O	Engaging Surface	Spacing Clutch Cam Disc
SAT	Felt Oiler	Trip Link Stripper Lever
O	Bearing Surface	Trip Link Stripper Lever
SAT	Felt Washers (2)	Backspace Bail
O	Hooks	Spring
O	Guide Slots	Trip Link Stripper Lever
O	Hooks	Spring
O	Engaging Surface	Trip Link Stripper Lever

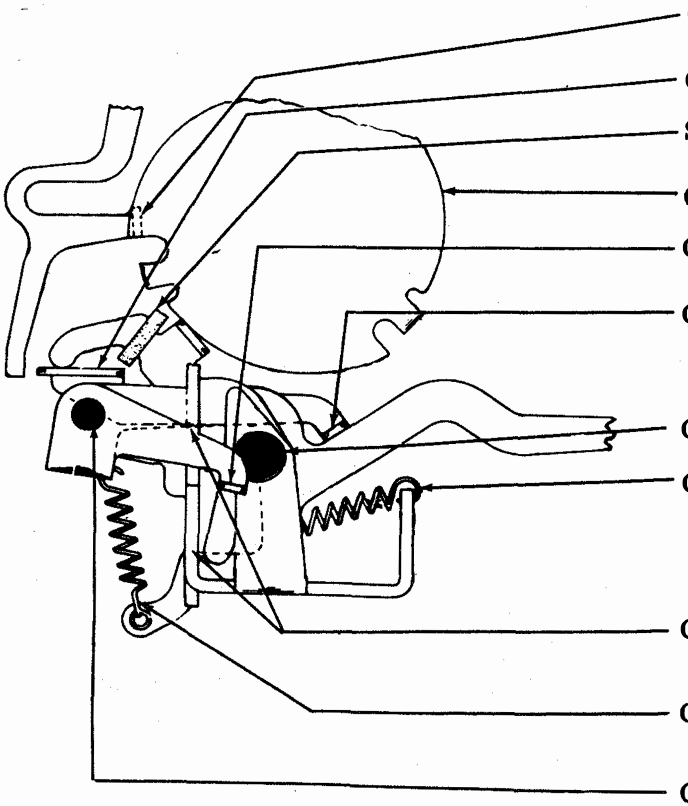
Figure 4-129. Trip Mechanism, Right Side View



BOTTOM VIEW

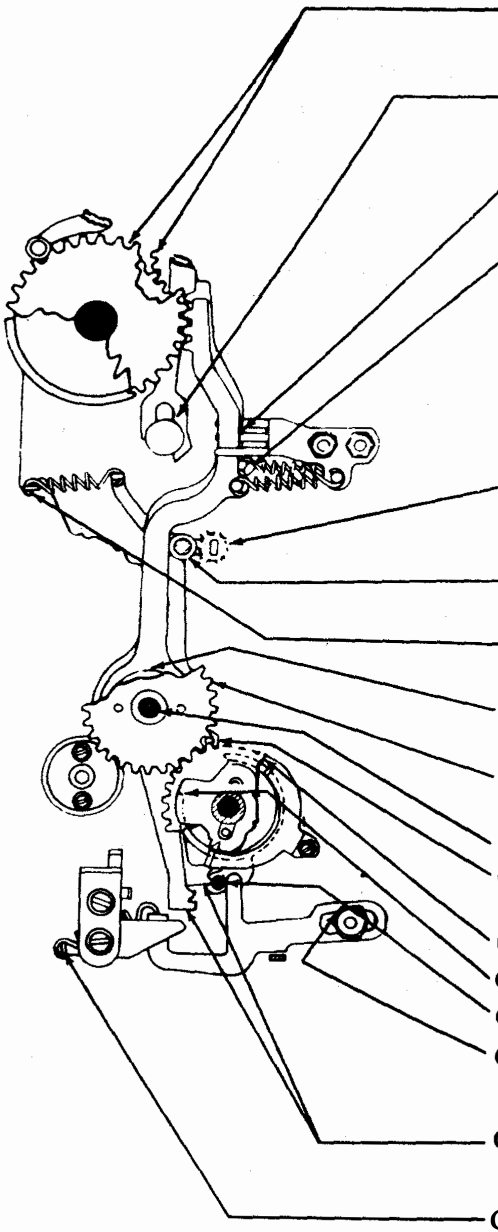
REAR VIEW

Figure 4-130. Reverse Line-Feed Mechanism



O	Engaging Surface	Line-Feed Clutch Trip Lever
O	Engaging Surface	Trip Link
SAT	Felt Oiler	Stripper Lever Cam Disc
G	Camming Surface	
O	Engaging Surface	Transfer Bail
O	Bearing Surface	Trip Link
O	Bearing Surface	Stripper Lever
O	Hooks	Spring
O	Guide Slots	Trip Link
O	Hooks	Spring
O	Bearing Surface	Transfer Bail

Figure 4-131. Trip Mechanism, Left Side View



G	Teeth (2 Gears)	Platen Spur Gears
O	Guide Surface	Line-Feed Bar Release Lever
O	Guide Surfaces	Line-Feed Bars (2)
O	Hooks	Springs (2)
SAT	Felt Oiler	Line-Feed Bar Bellcrank
O	Bearing Surface	Line-Feed Bar Bellcrank
O	Hooks	Spring
O	Bearing Surfaces	Line-Feed Bar Eccentric
G	Teeth	Line-Feed Clutch Spur Gear
O	Bearing Surface	Spur Gear
O	Bearing Surface	Line-Feed Bar Bellcrank
G	Teeth	Platen Spur Gear
O	Bearing Surfaces	Intermediate Lever
O	Bearing Surface	Roller
O	Bearing Surface	Reverse Line-Feed Slide Link
O	Engaging Surfaces	Line-Feed Bars (2)
O	Hooks	Spring

Figure 4-132. Line-Feed Mechanism, Right Side View

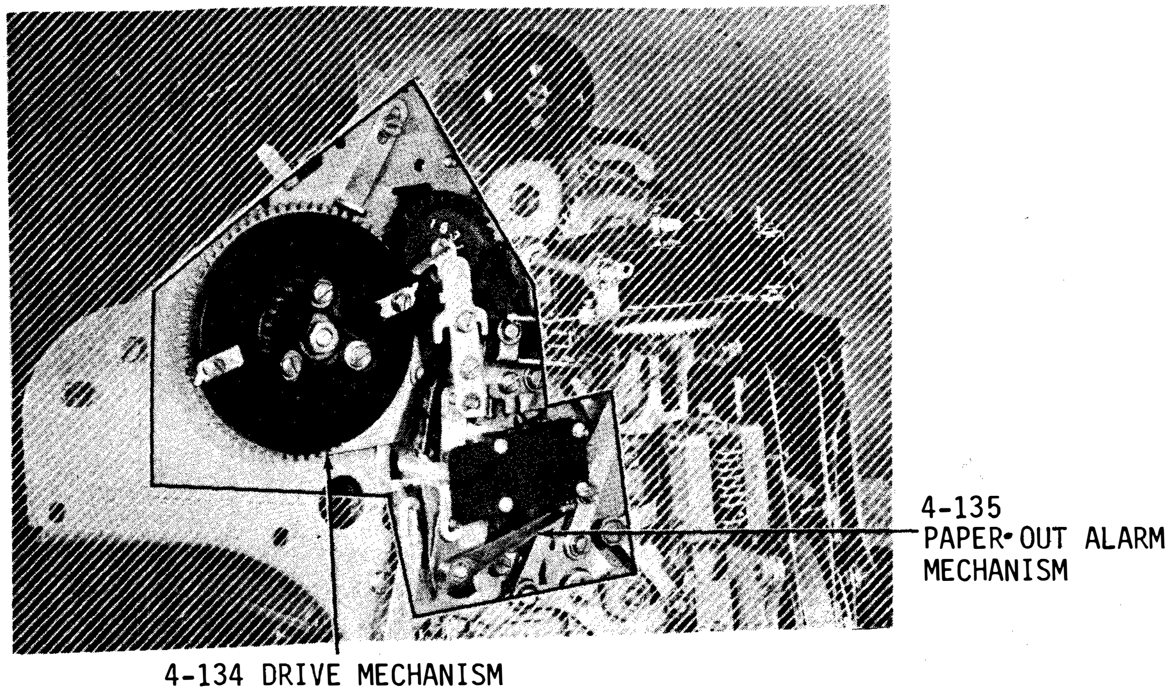


Figure 4-133. Page Feed-Out Mechanism, Left Rear View

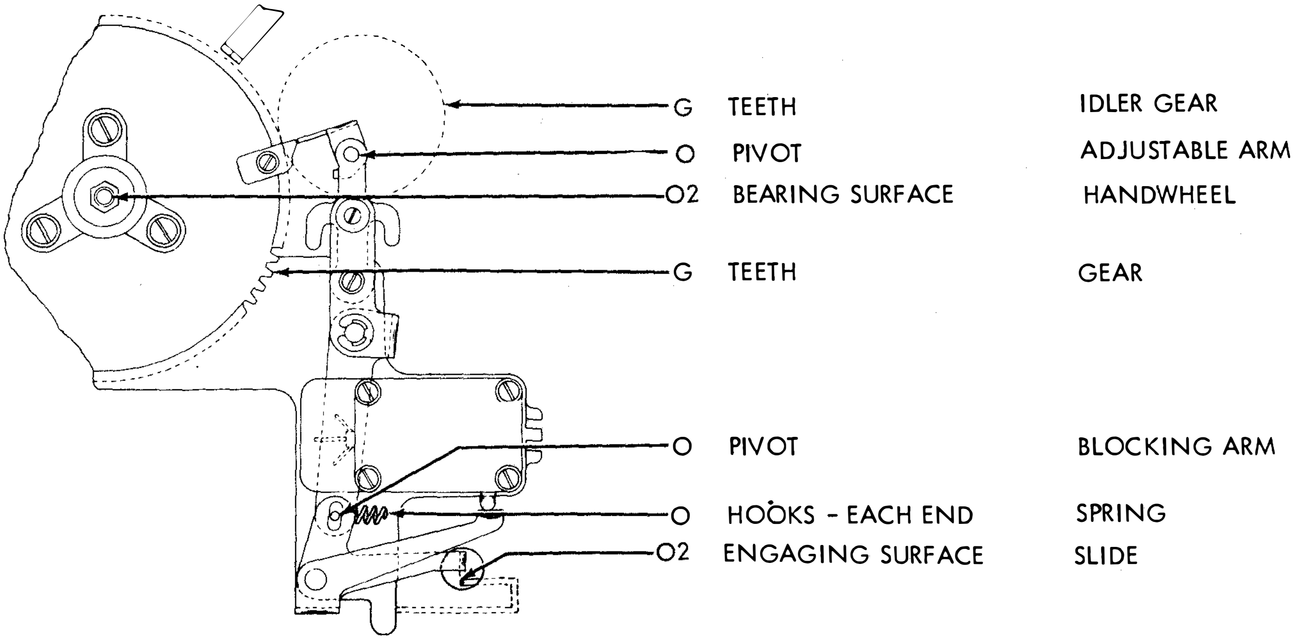


Figure 4-134. Drive Mechanism, Left Side View

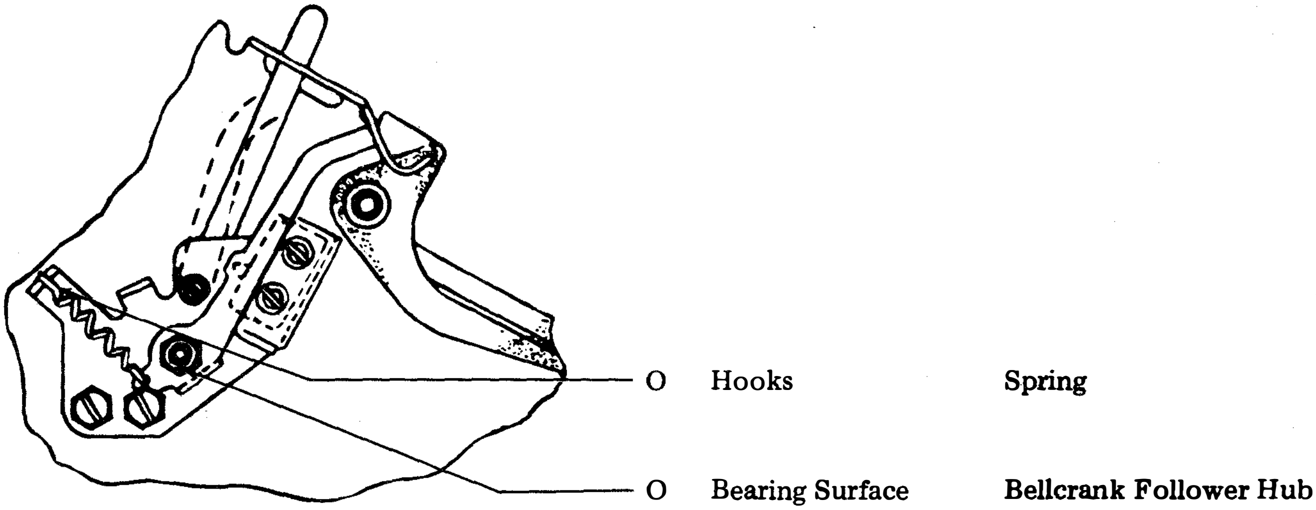


Figure 4-135. Paper-Out Alarm Mechanism, Left Side View

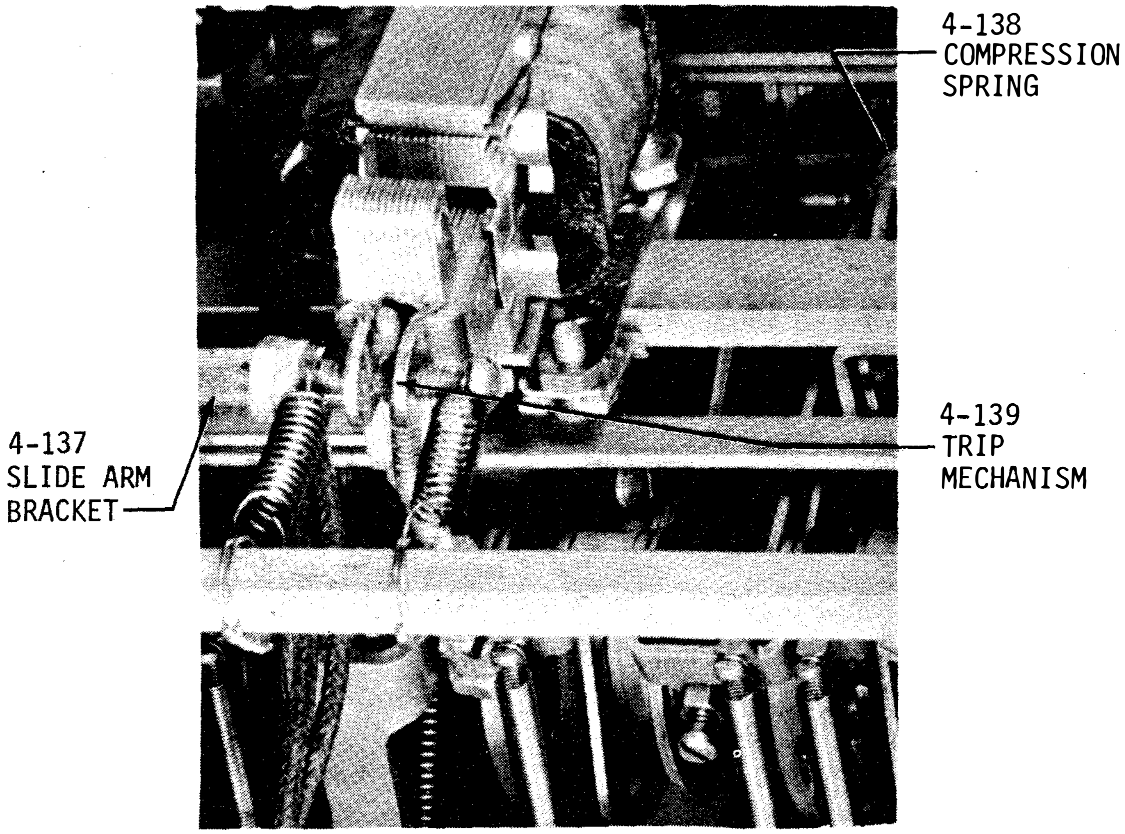
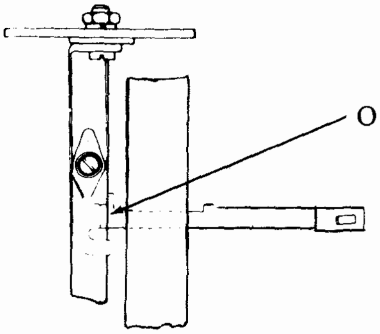
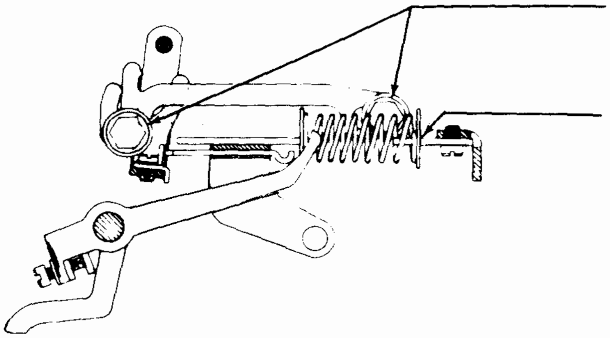


Figure 4-136. Continuous Spacing Mechanism, Rear View



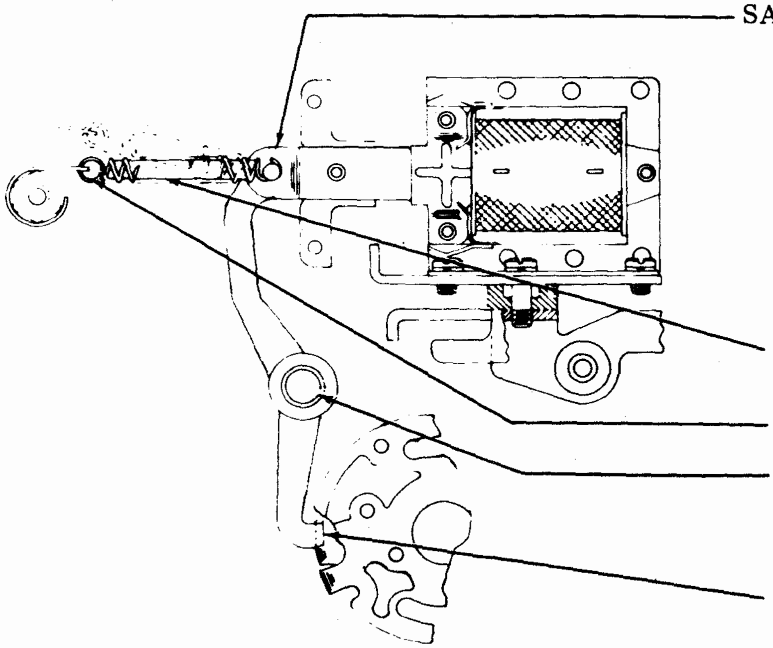
O	Engaging Surface (Two Brackets)	CR Slide Arm Bracket LF Slide Arm Bracket

Figure 4-137. Slide Arm Bracket



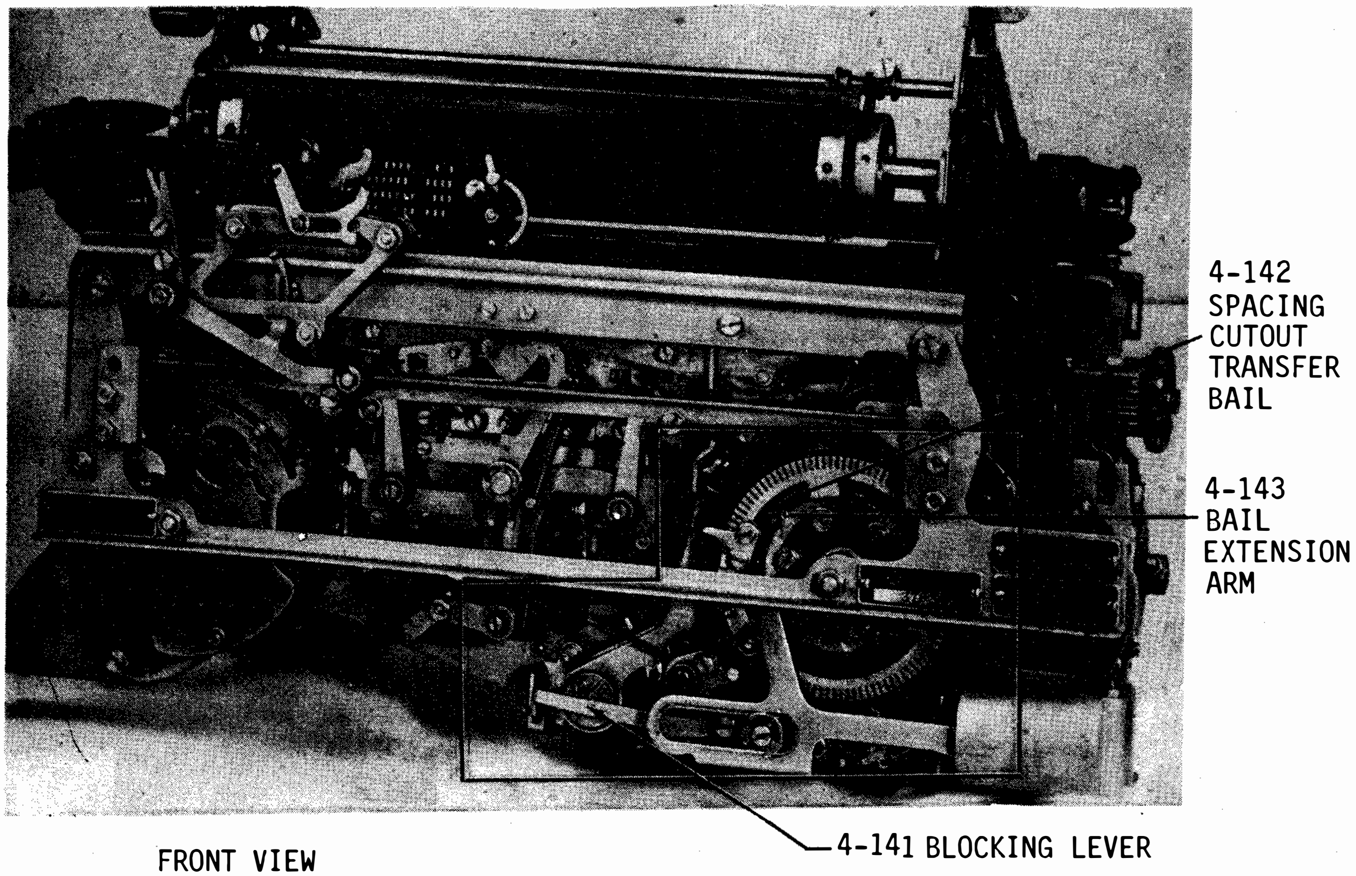
SAT	Felt Washers	Connecting Link
O	Engaging Surface	Compression Spring

Figure 4-138. Compression Spring

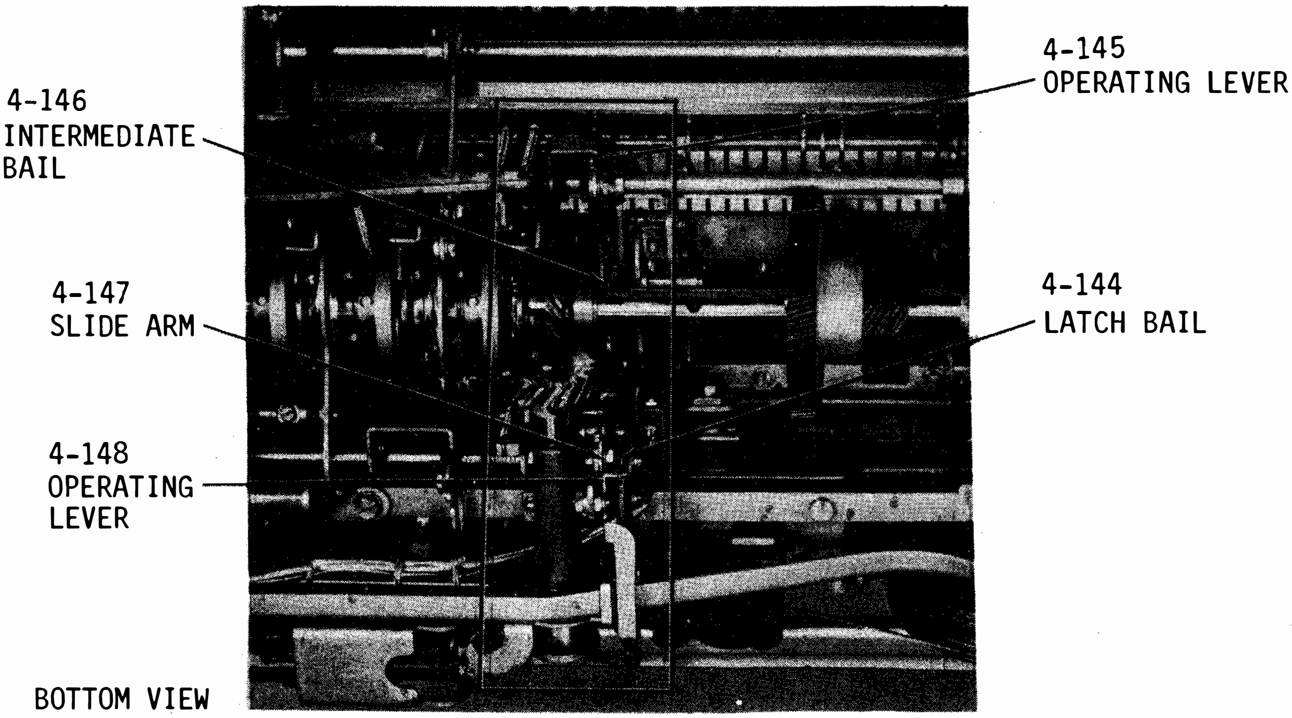


SAT	Felt Washer	Function Clutch Trip Lever
SAT	Felt Wick	Spring
O	Hooks	Spring
O	Bearing Surface	Function Clutch Trip Lever
O	Engaging Surface	Function Clutch Trip Lever

Figure 4-139. Trip Mechanism

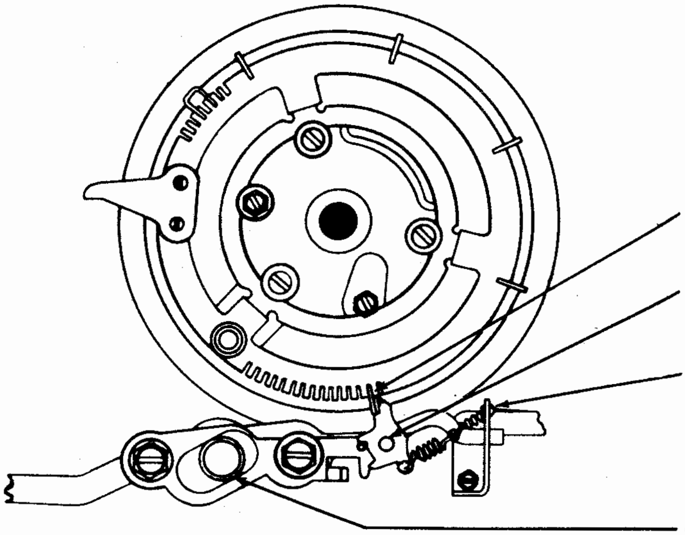


FRONT VIEW



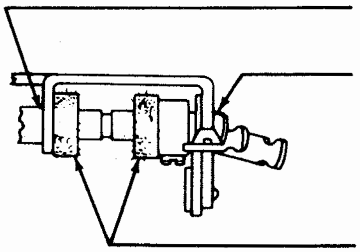
BOTTOM VIEW

Figure 4-140. Horizontal Tabulator Mechanism, (Late Design)



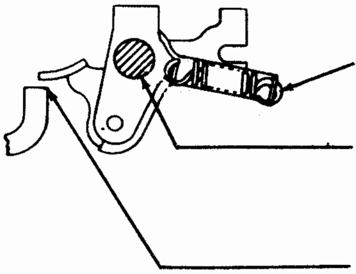
O	Engaging Surface	Tabulator Stops
O	Bearing Surface	Tabulator Pawl
O	Hooks	Springs
O	Bearing and Guide Surface	Blocking Lever

Figure 4-141. Blocking Lever, Front View



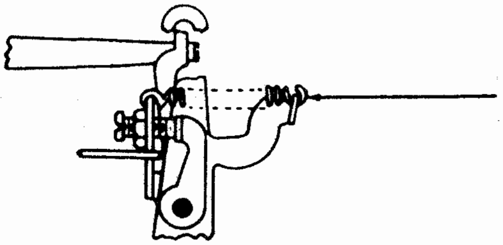
O	Bearing Surface	Spacing Cutout Transfer Bail
O	Bail Contacting Surface	Spacing Cutout Transfer Bail
SAT	Felt Washers	Transfer Bail Stud

Figure 4-142. Spacing Cutout Transfer Bail, Front View



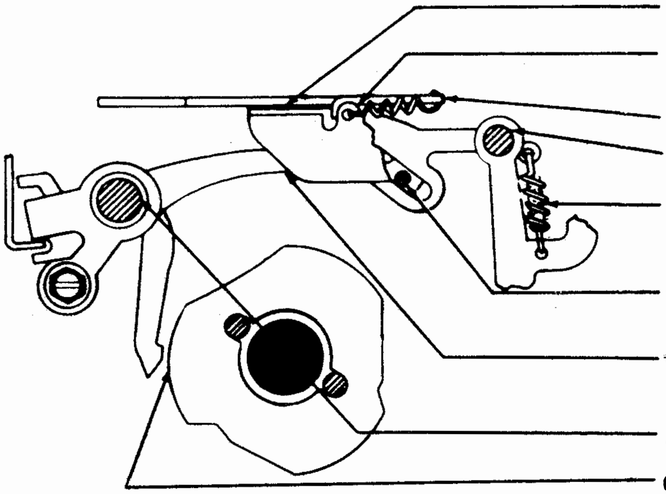
O	Hooks	Space Suppression Bypass Spring
O	Bearing Surface	Bail Extension Arm
O	Contact Surface With Spacing Cutout Lever	Bail Extension Arm

Figure 4-143. Bail Extension Arm, Right Side View



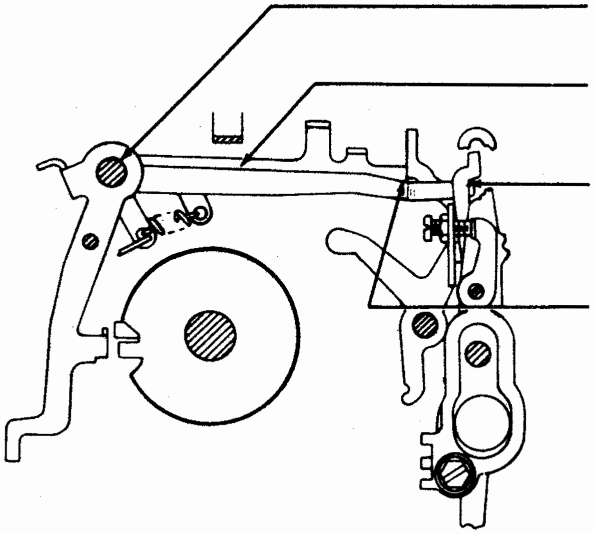
O	Hooks	Latch Bail Spring

Figure 4-144. Latch Bail, Right Side View



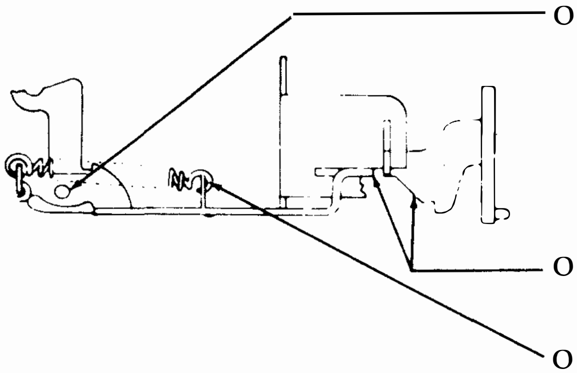
O	Guide Surfaces	Operating Lever
O	Contact With Slide Arm	Operating Lever
O	Hooks	Slide Arm Spring
O	Bearing Surface	Operating Lever
SAT	Felt Wick	Spring
O	Slot Camming Surface	Operating Lever
O	Bracket Contact Surface	Operating Lever
SAT	Felt Washers	Stripper Bail Shaft
G	Camming Surface	Spacing Clutch Restoring Cam

Figure 4-145. Operating Lever, Right Side View



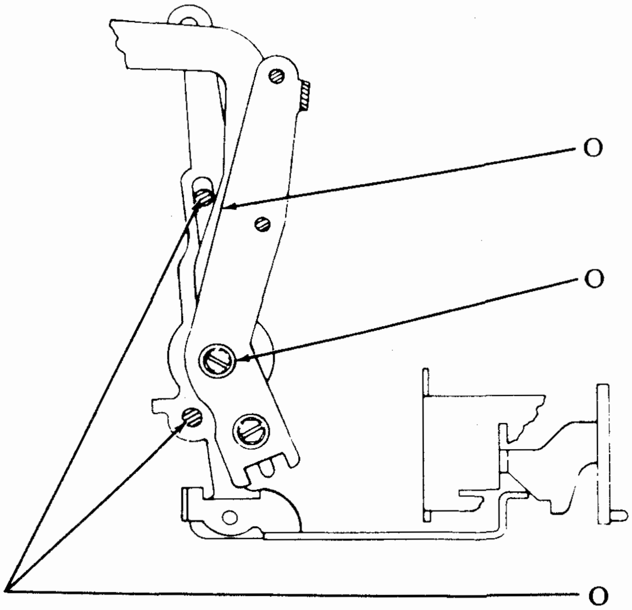
SAT	Felt Washer	Trip Lever Arm Shaft
O	Contact Surface Spacing Trip Lever	Intermediate Bail
O	Contacting Surface	Spacing Trip Lever Arm
O	Contact Surface Trip Lever Arm	Intermediate Bail

Figure 4-146. Intermediate Bail, Right Side View



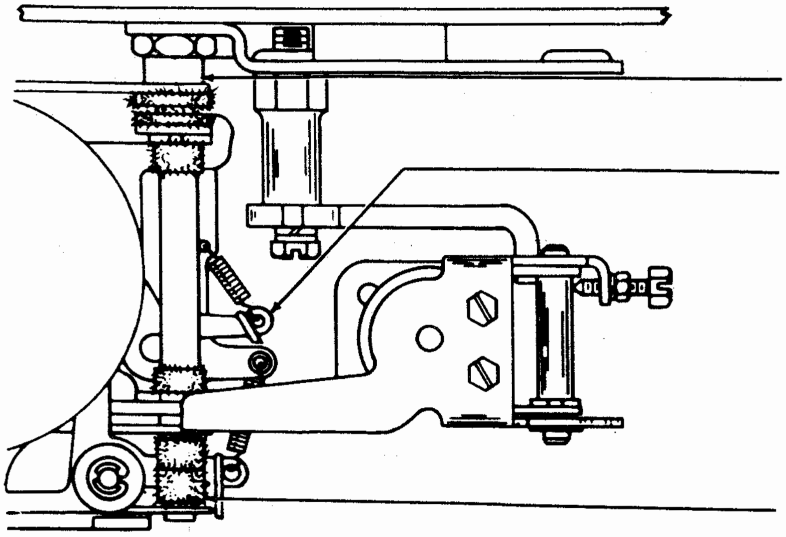
O	Bearing Surface	Operating Lever Slide Arm
O	Engaging Surface With Blocking Lever and Bracket	Operating Lever Slide Arm
O	Hooks	Slide Arm Spring

Figure 4-147. Slide Arm, Right Side View



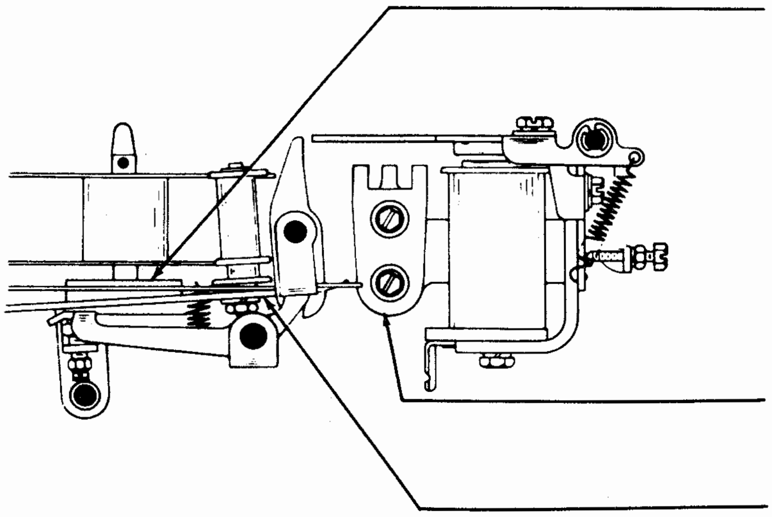
O	Contacting Surface With Adjusting Plate	Operating Lever
O	Bearing Surface	Trip Lever Arm Latch Bail
O	Bearing Surfaces	Operating Lever

Figure 4-148. Operating Lever, Right Side View



G	Shaft Mounting Surface	Oscillating Lever and Roller Bail
O	Engaging Surfaces	Ribbon Reversing Levers
SAT	Felt Washers	Ribbon Spool Bracket Shaft

Figure 4-149. Two-Color Ribbon Mechanism Oscillating Lever, Top View



SAT	Felt Washers	Ribbon Ratchet
O	Hinge and Stop Lever	Ribbon Magnet Bracket
O	Engaging Surfaces	Ribbon Spool Bracket

Figure 4-150. Two-Color Ribbon Mechanism Ribbon Operating Mechanism, Right Side View

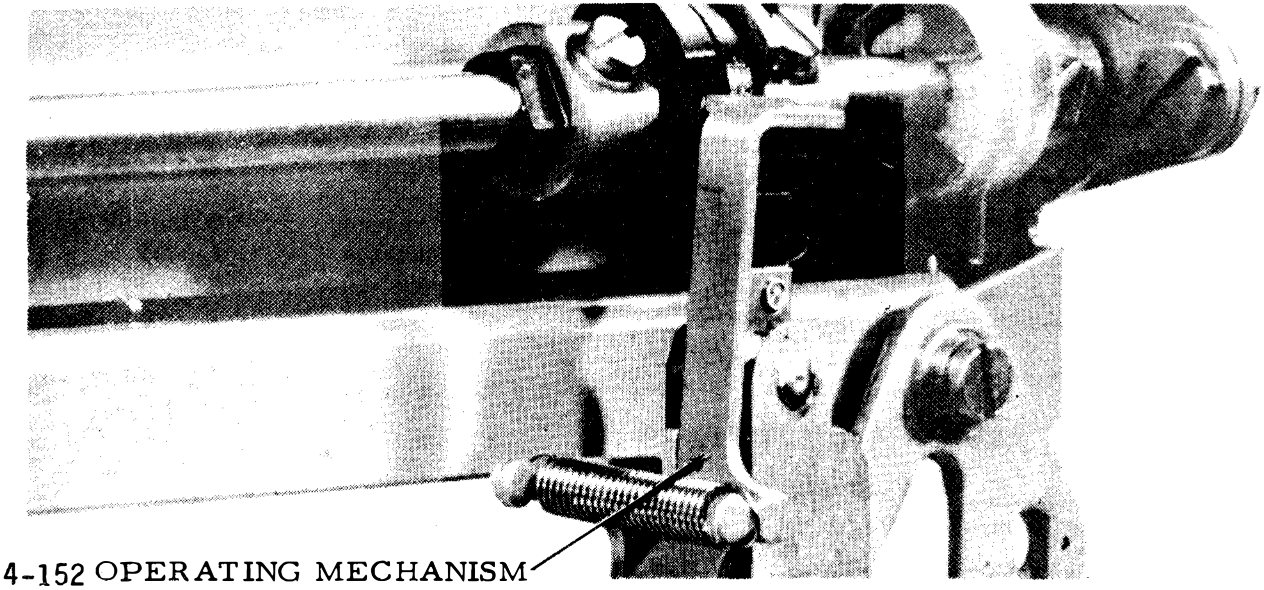


Figure 4-151. Universal Contact Stunt Box Mechanism, Rear View

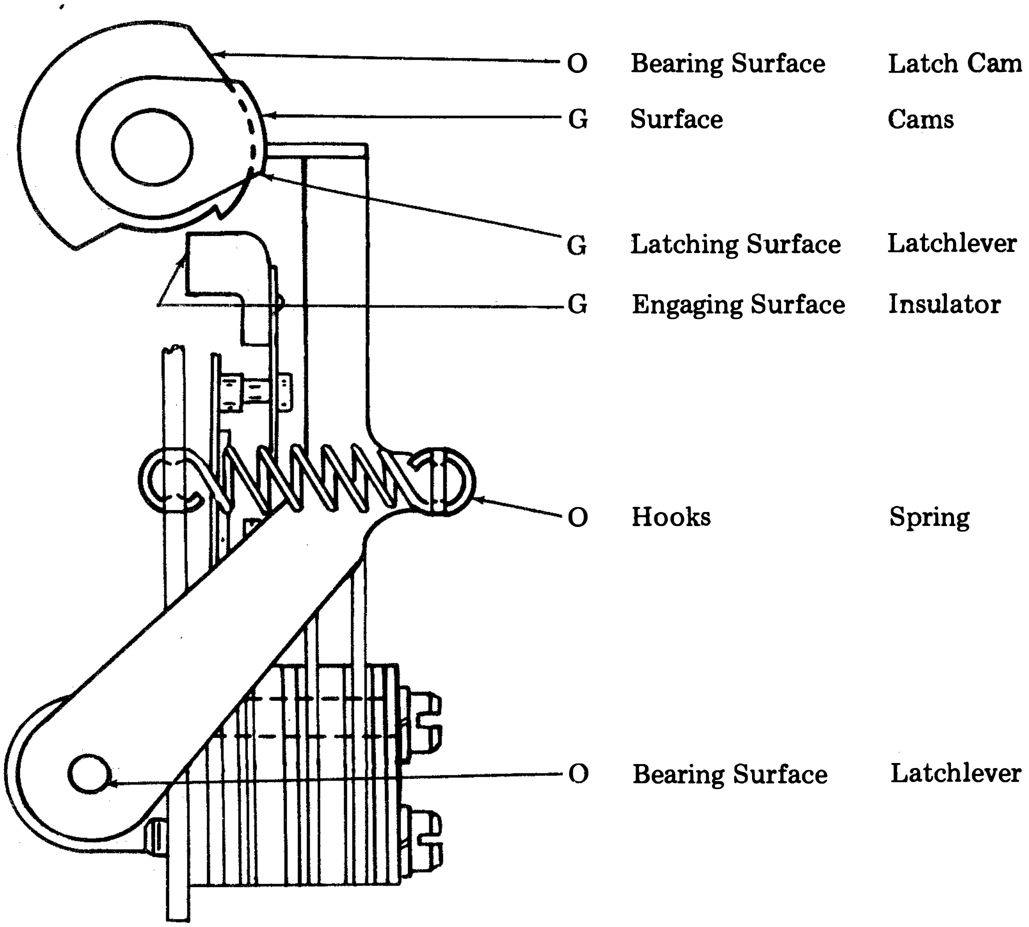


Figure 4-152. Operating Mechanism, Right Side View

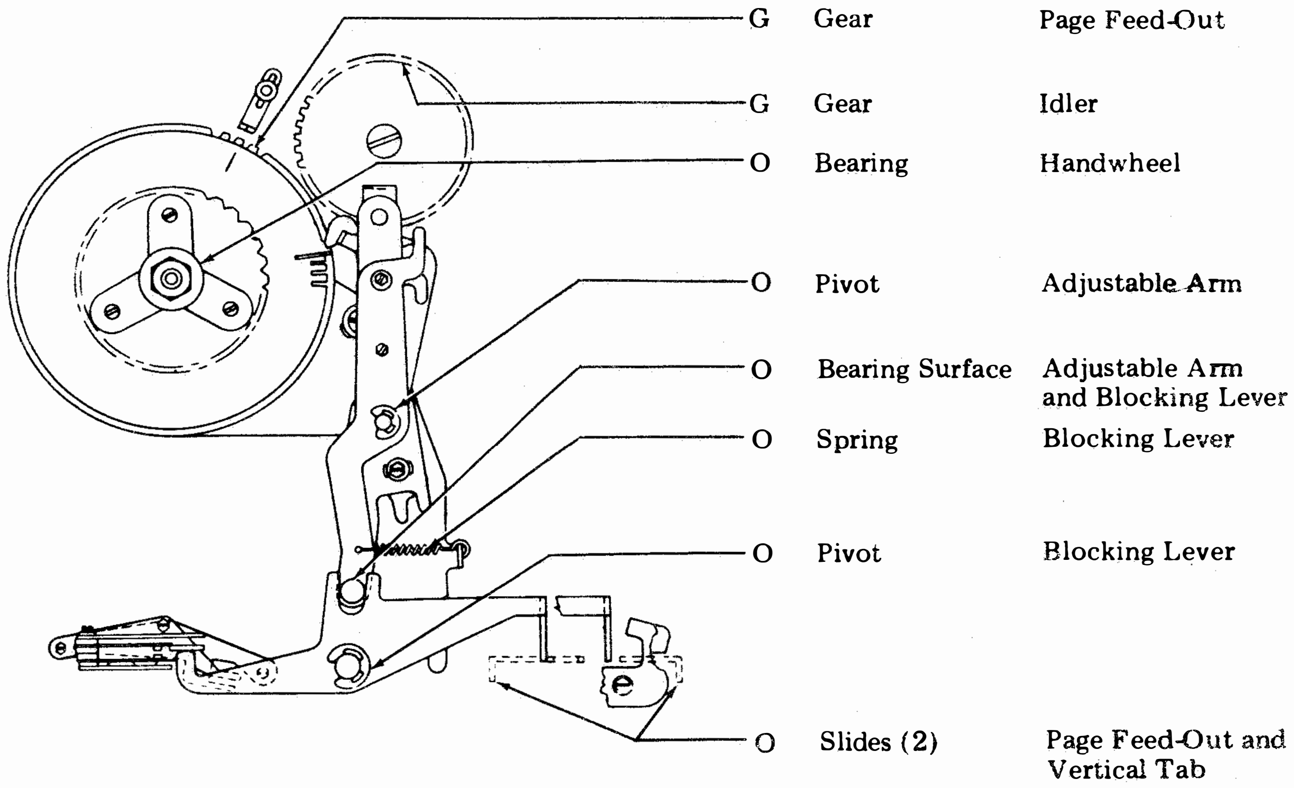


Figure 4-153. Vertical Tabulation and Transmitter Distributor Control Mechanism

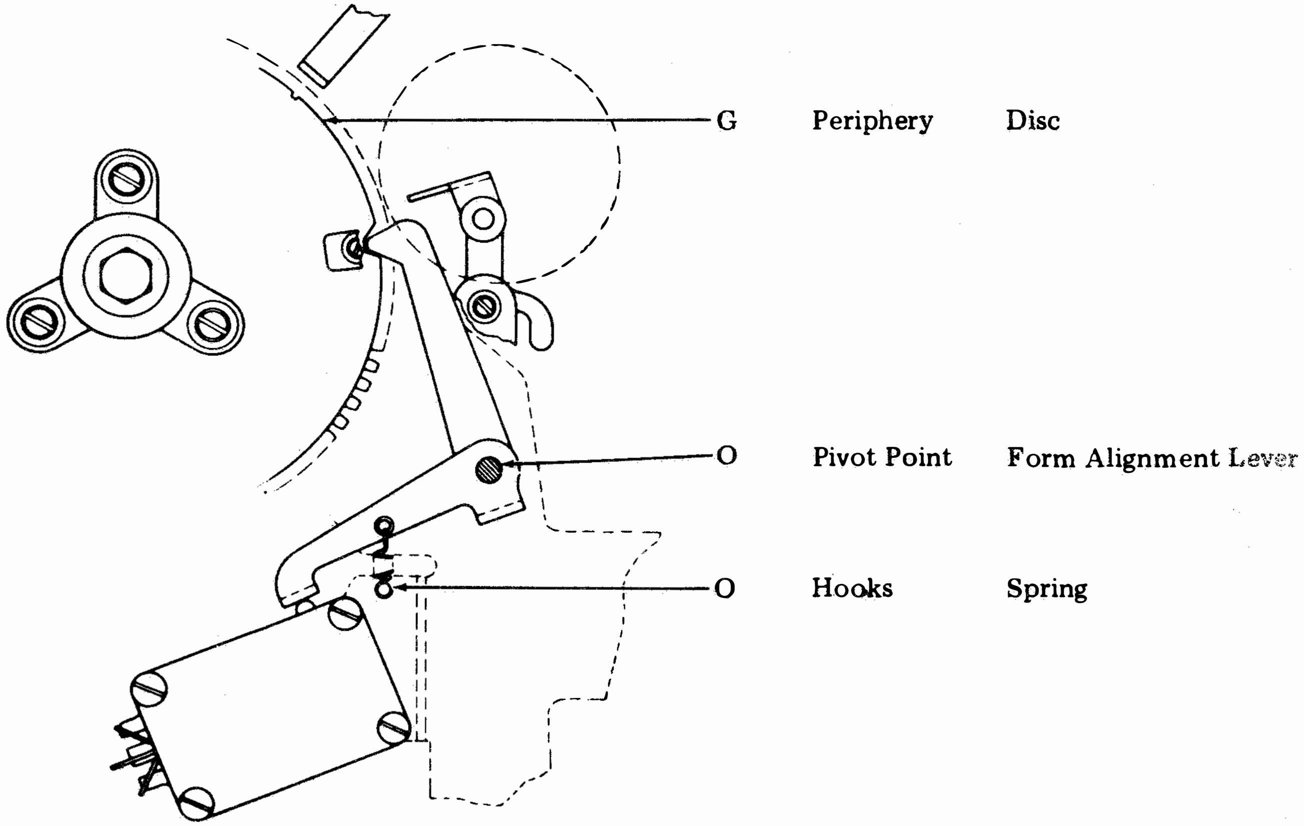
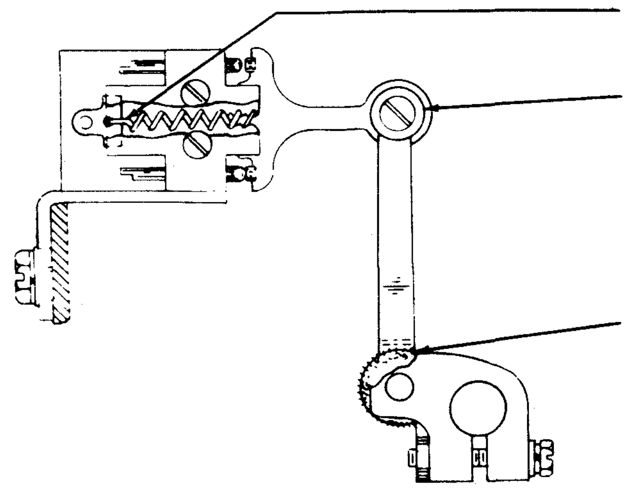
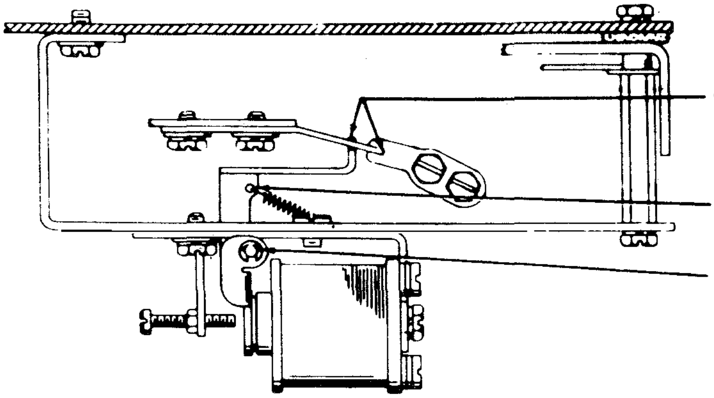


Figure 4-154. Form Alignment Switch Mechanism, Left Side View



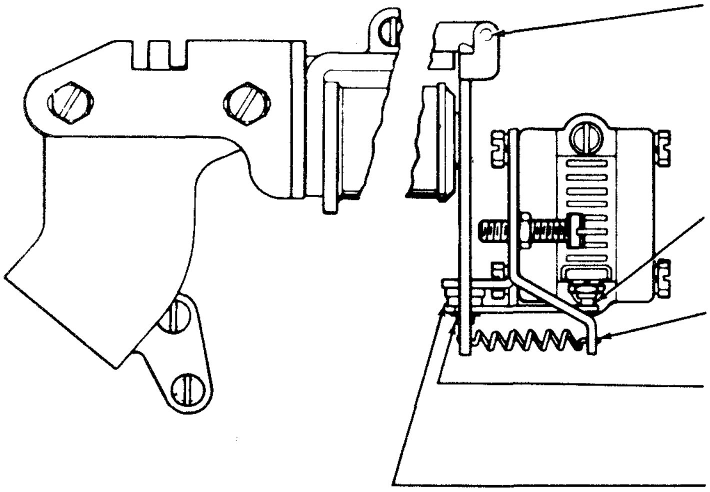
G	Hook	Spring
G	Both Faces Metal Sleeve	Contact Arm Insulator Assembly
SAT	Felt Washer	Arm

Figure 4-155. Universal Contact Selector Mechanism, Right Side View



G	Blocking Surface	Armature Extension Blocking Bail Extension Suppression Arm
O	Hooks	Spring
O	Pivots (2)	Armature

Figure 4-156. DC Magnet-Operated Print Suppression Mechanism, Left Side View



O	Pivots (2)	Shift Magnet Armature
O	Engaging Surface	Transfer Lever and Codebar Pilot Pin
O	Hooks	Spring
O	Engaging Surface	Shift Magnet Armature and Transfer Lever
O	Bearing	Transfer Lever

Figure 4-157. LETTERS-FIGURES Code Bar Shift Magnet Mechanism, Left Side View

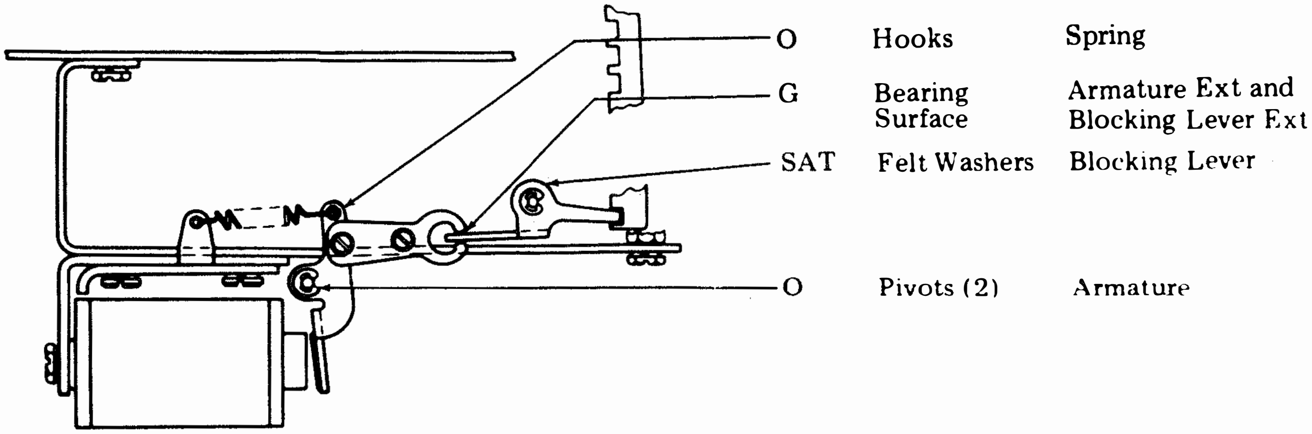


Figure 4-158. Print Suppression and Off-Line Stunt Shift Control Mechanism, Left Side View

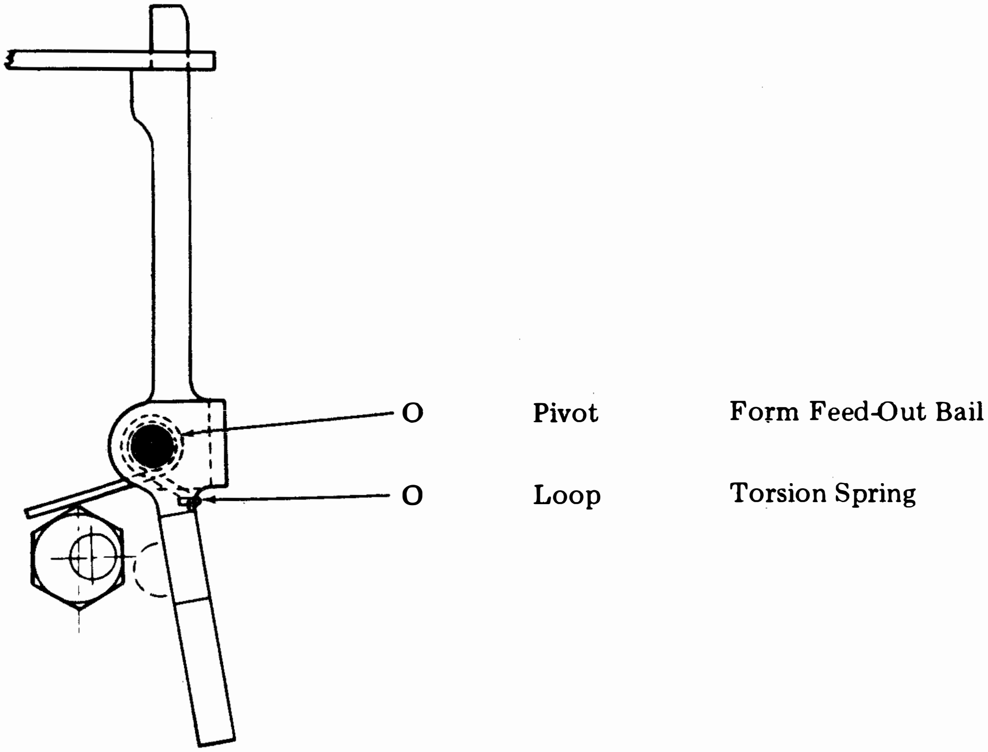


Figure 4-159. Form Feed-Out Mechanism, Right Rear View

Table 4-6. Typing and Non-typing Perforator Lubrication Chart Index

Table 4-6. Typing and Non-typing Perforator Lubrication Chart Index - Continued

Table 4-6. Typing and Non-typing Perforator Lubrication Chart Index - Continued

Figure	Title	Page No.
4-197	Manual and Power Drive Backspace Mechanism for Chadless Tape	4-117
4-198	Manual and Power Drive Backspace Mechanism for Fully Perforated Tape	4-117
4-199	Power Drive Backspace Mechanism, Early Design	4-118
4-200	Power Drive Backspace Mechanism, Latest Design	4-118
4-201	Single Auxiliary Timing Contacts Mechanism	4-119
4-202	Tape-Out Switch Mechanism	4-119
4-203	Unshift-on-Space Mechanism	4-120
4-204	Signal Bell Contact Mechanism	4-120

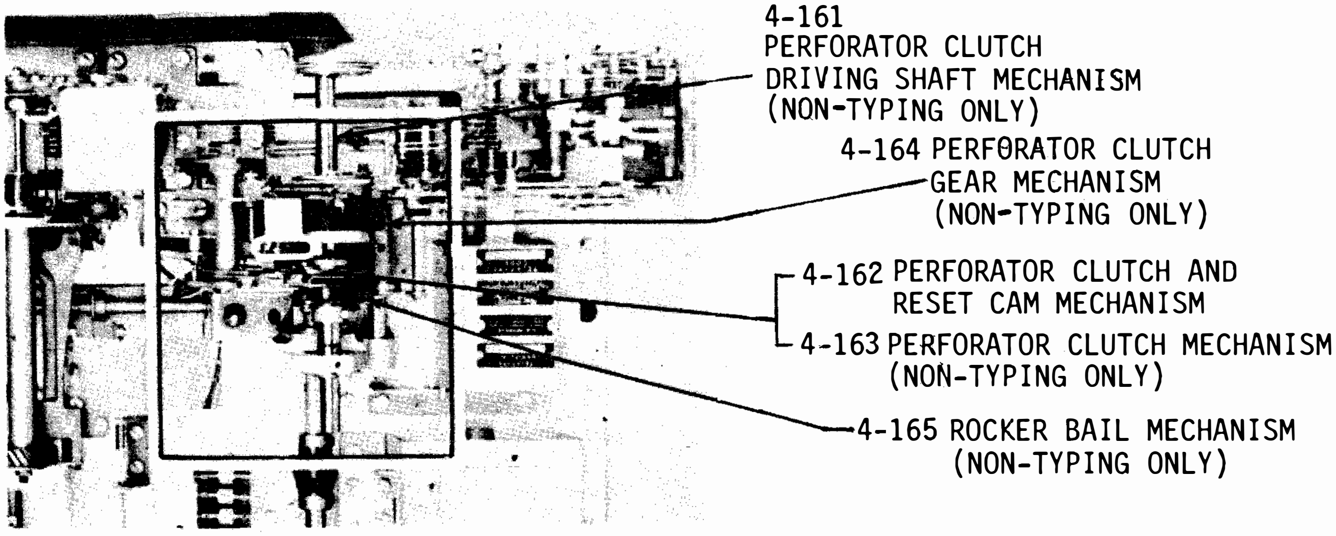


Figure 4-160. Perforator Mechanism, Top View

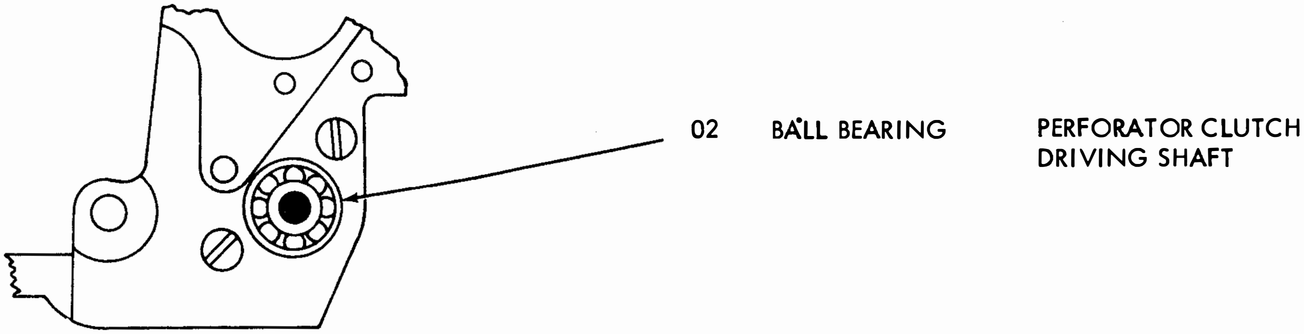


Figure 4-161. Perforator Clutch Driving Shaft Mechanism
(Non-Typing)

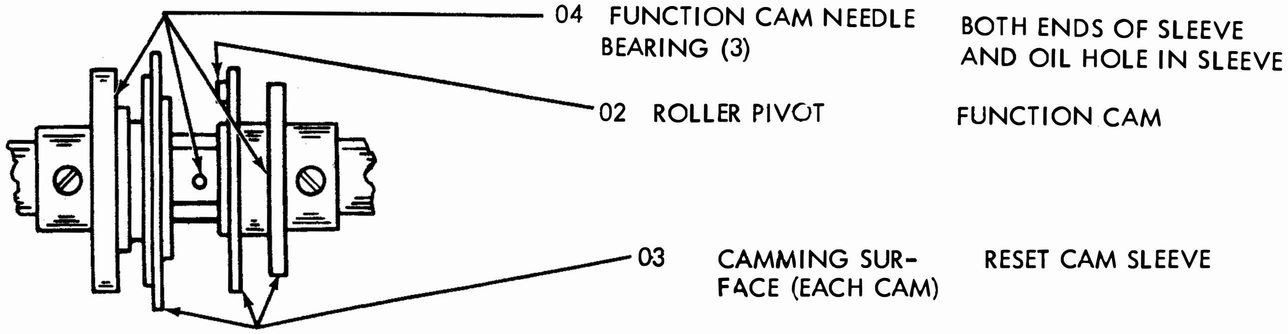
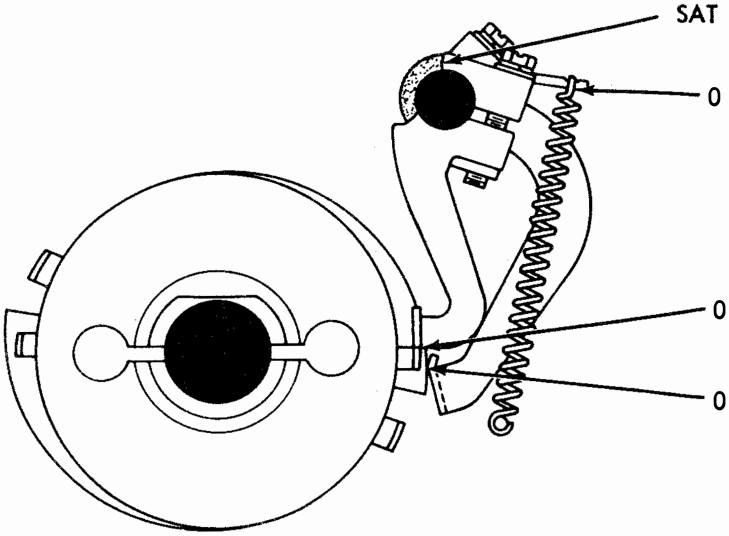
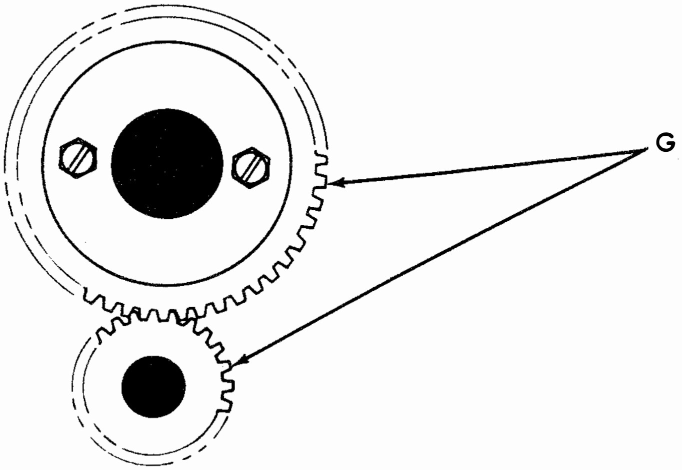


Figure 4-162. Perforator Clutch and Reset Cam Mechanism



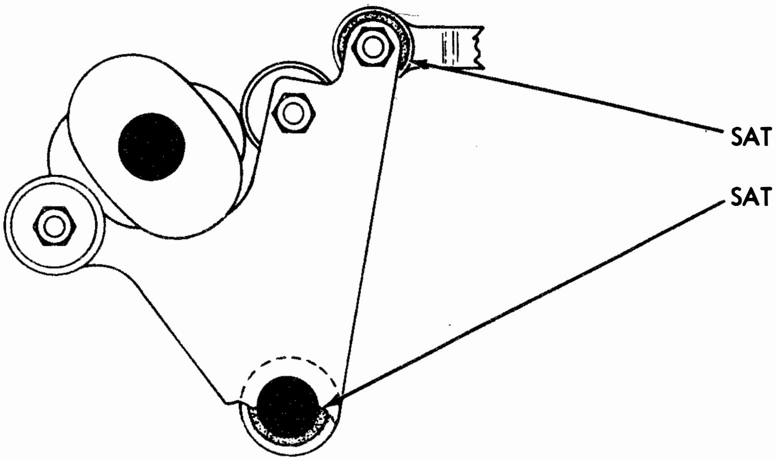
SAT	FELT WASHER	CLUTCH LATCH-LEVER
0	HOOKS-EACH END	SPRING
0	LATCHING SURFACE	CLUTCH TRIP LEVER
0	LATCHING SURFACE	CLUTCH LATCH-LEVER

Figure 4-163. Perforator Clutch Mechanism (Non-Typing)



G	GEAR TEETH	PERFORATOR CLUTCH DRIVE AND DRIVEN GEARS

Figure 4-164. Perforator Clutch Gear Mechanism (Non-Typing)



SAT	FELT WASHER	ROCKER BAIL
SAT	FELT WICK (USE OIL HOLE)	ROCKER BAIL

Figure 4-165. Rocker Bail Mechanism (Non-Typing)

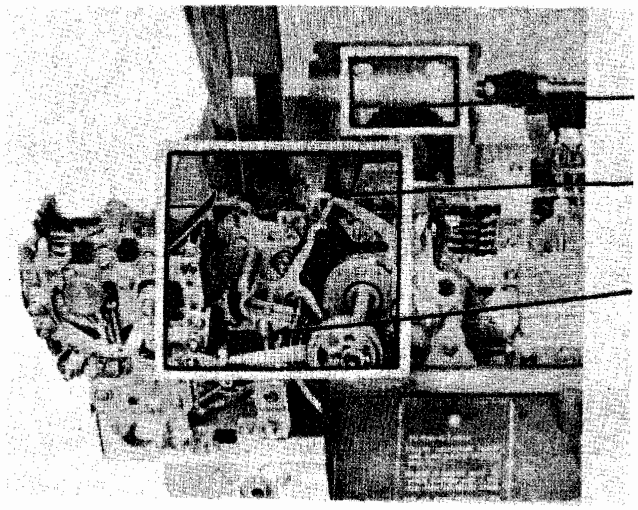
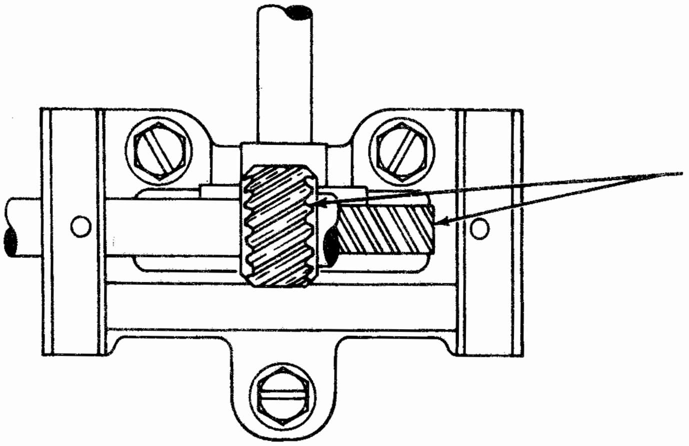
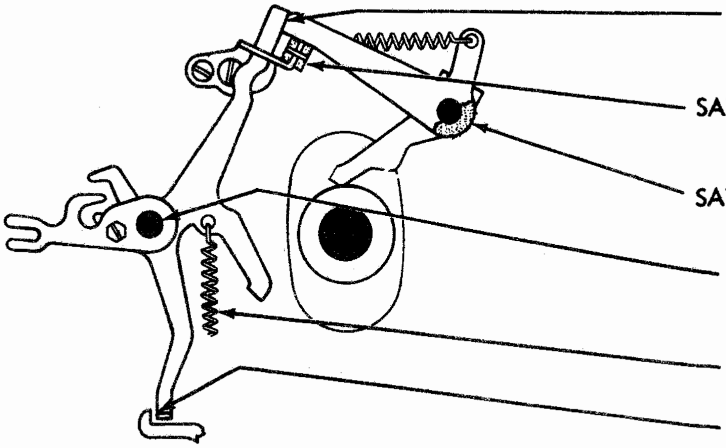


Figure 4-166. Perforator Transmitter, Front View



G	GEAR TEETH	REAR BEARING BRACKET GEAR

Figure 4-167. Rear Bearing Bracket Gear Mechanism



0	CONTACT SURFACE	PERFORATOR TRIP LEVER
SAT	FELT WICK	PERFORATOR TRIP LEVER
SAT	FELT WASHER	CLUTCH RELEASE
0	BEARING SURFACE	PERFORATOR TRIP LEVER
0	HOOKS-EACH END	SPRING
0	ENGAGING SURFACE	PERFORATOR TRIP LEVER LATCH

Figure 4-168. Perforator Trip Lever Mechanism (Non-Typing)

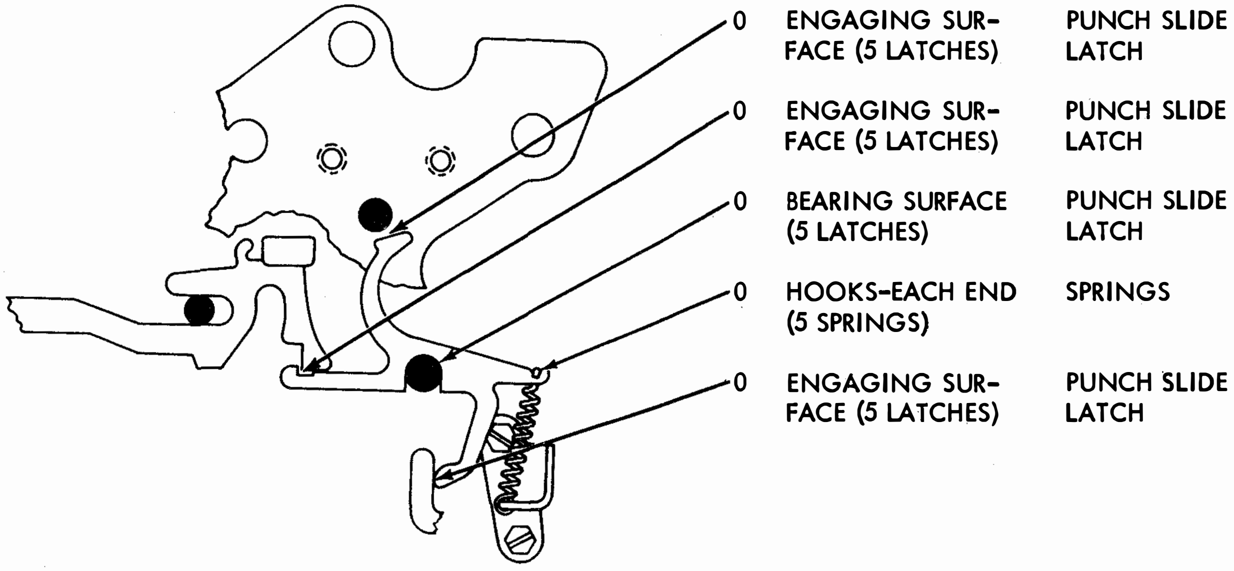


Figure 4-169. Punch Slide Latch Mechanism

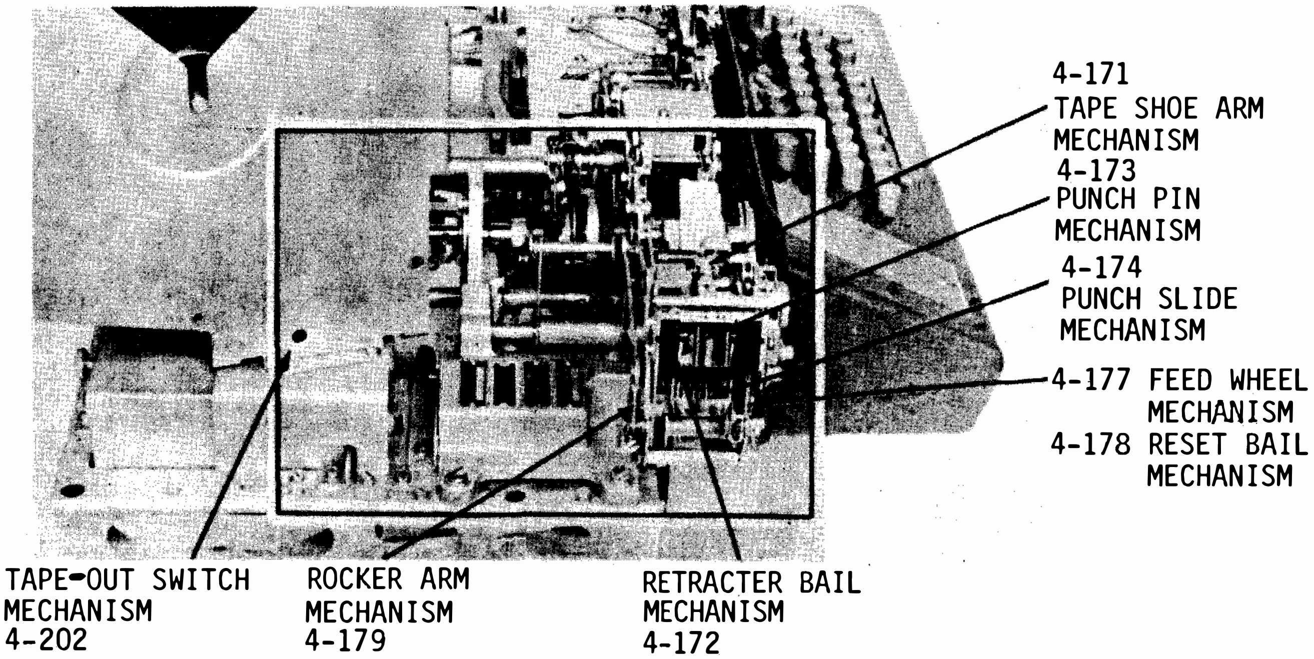
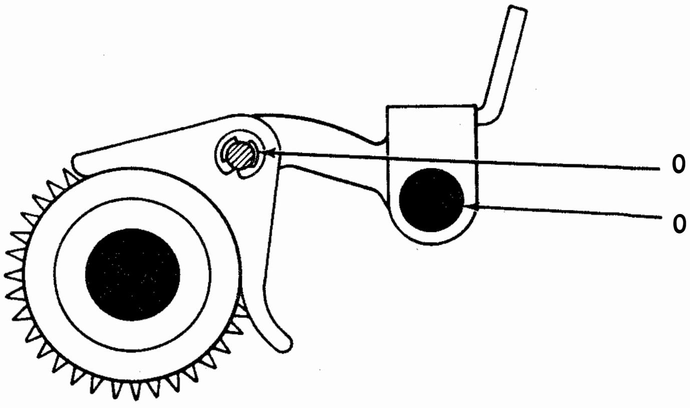
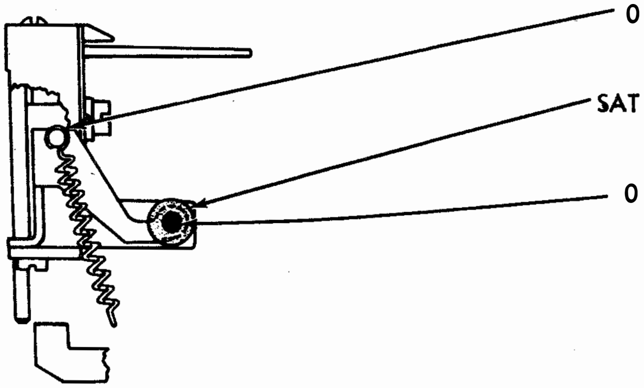


Figure 4-170. Punch Mechanism - Reset Perforator Transmitter, Left Side View



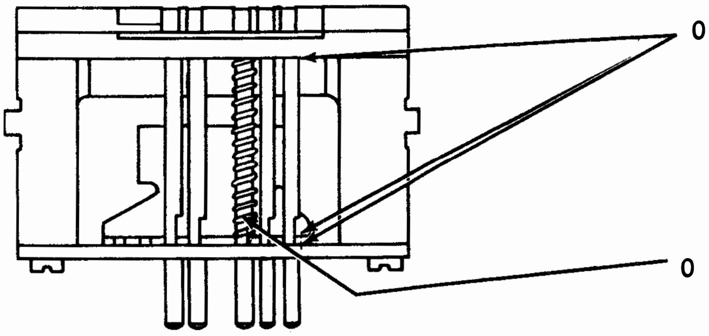
0	BEARING SURFACE	TAPE SHOE
0	BEARING SURFACE (2) (FRONT AND REAR)	TAPE SHOE ARM

Figure 4-171. Tape Shoe Arm Mechanism



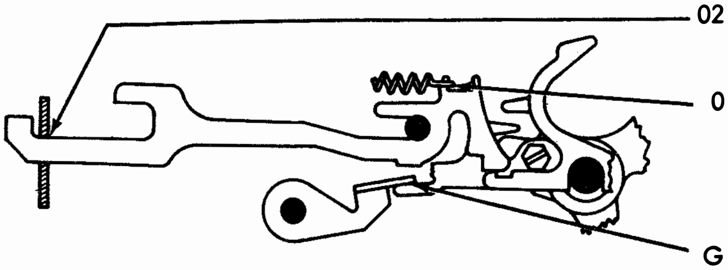
0	HOOKS-EACH END (4 SPRINGS)	ROCKER BAIL SPRING
SAT	FELT WASHERS (2-FRONT & REAR)	RETRACTOR BAIL
0	BEARING SURFACE (2-FRONT & REAR)	RETRACTOR BAIL

Figure 4-172. Retractor Bail Mechanism



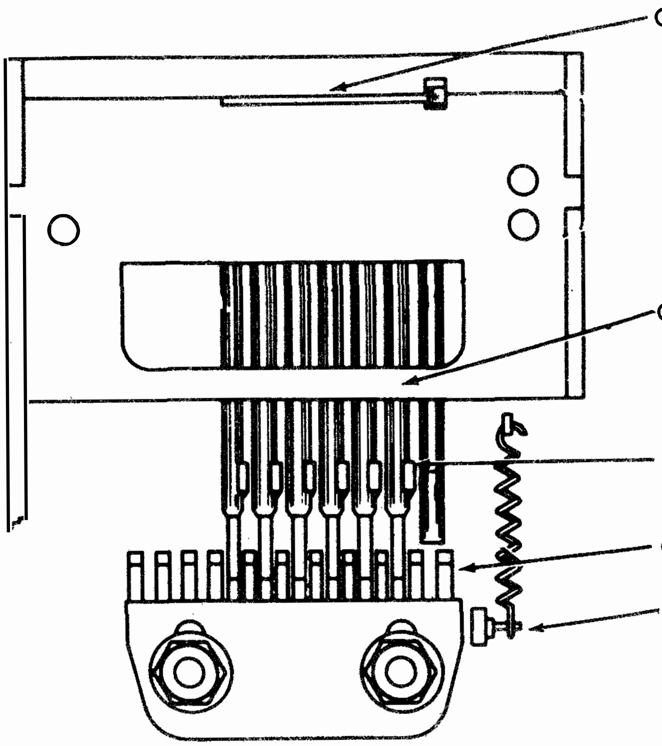
0	GUIDES AND NOTCHES (3 PLACES)	PUNCH PINS
0	SPRING	RETRACTOR SPRING

Figure 4-173. Punch Pin Mechanism



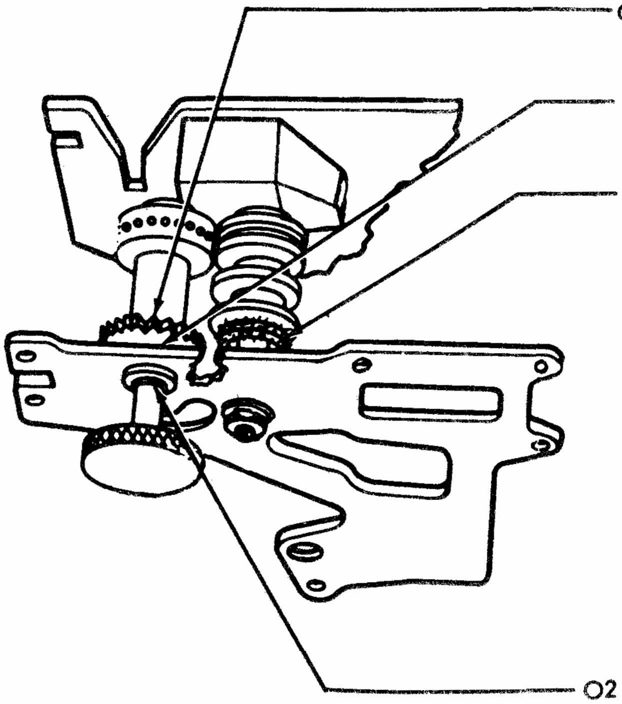
02	ENGAGING SURFACE	PUNCH SLIDE GUIDE
0	HOOKS-EACH END (5 SPRINGS)	SPRINGS
G	ENGAGING SURFACE (5)	RESET BAIL

Figure 4-174. Punch Slide Mechanism



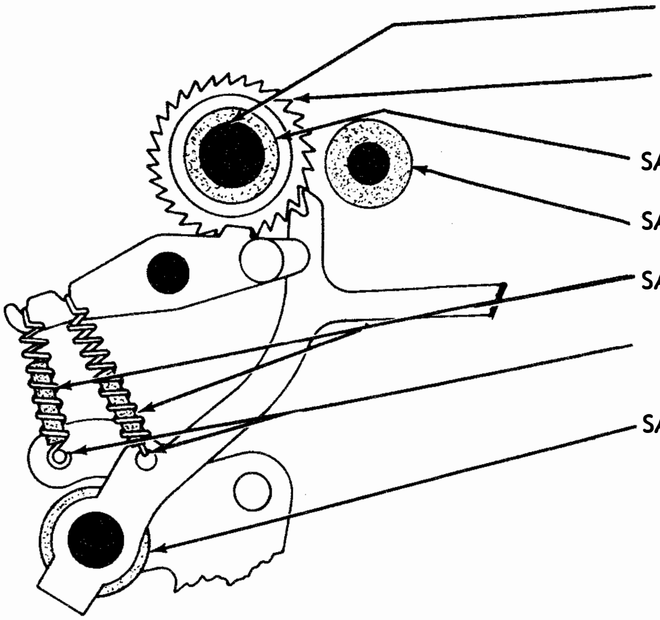
O	SLIDING SURFACE (6) (UPPER GUIDE)	PUNCH PIN
O	SLIDING SURFACE (6) (LOWER GUIDE)	PUNCH PIN
O	SLIDING SURFACE (6)	PUNCH PIN
O	SLIDING SURFACE (6)	PUNCH SLIDE GU
O	HOOKS-EACH END	SPRING

Figure 4-175. Perforator Mechanism for Fully Perforated Tape



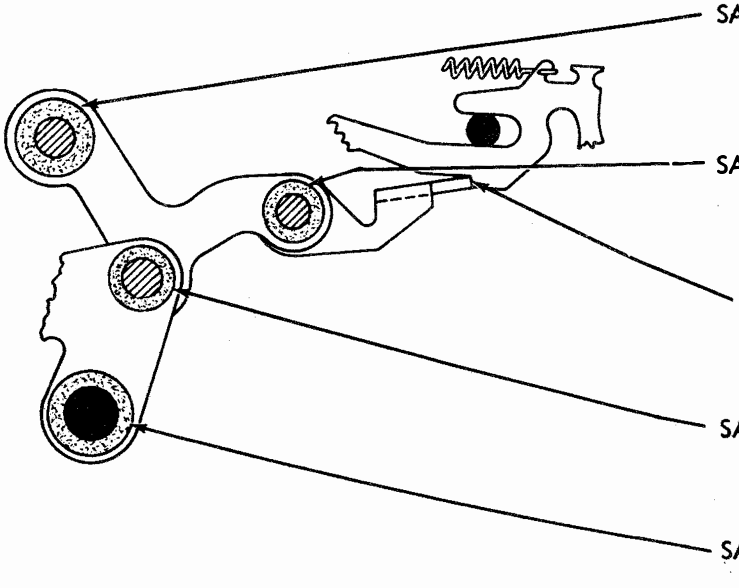
O	RATCHET TEETH (2)	FEED WHEEL
SAT	PIVOT POINT (FELT WASHER)	FEED WHEEL
SAT	PIVOT POINT (FELT WASHER)	DIE WHEEL
O2	PIVOT POINTS (2)	HANDWHEEL BEARIN

Figure 4-176. Perforator Mechanism



0	BEARING SURFACE	FEED WHEEL KNOB
0	RATCHET TEETH (2 PLACES)	FEED WHEEL
SAT	FELT WASHER	FEED WHEEL
SAT	FELT WASHER	DIE WHEEL
SAT	FELT WICKS (2)	SPRING WICKS
0	HOOKS-EACH END (2 SPRINGS)	SPRING
SAT	FELT WASHER	FEED PAWL

Figure 4-177. Feed Wheel Mechanism



SAT	FELT WASHER (2 WASHERS - FRONT & REAR)	TOGGLE LINKS
SAT	FELT WASHERS (2 WASHERS - FRONT & REAR)	RESET BAIL
0	ENGAGING SURFACE	RESET BAIL
SAT	FELT WASHERS (2 WASHERS - FRONT & REAR)	TOGGLE BAIL
SAT	FELT WASHERS (2 WASHERS - FRONT & REAR)	TOGGLE BAIL

Figure 4-178. Reset Bail Mechanism

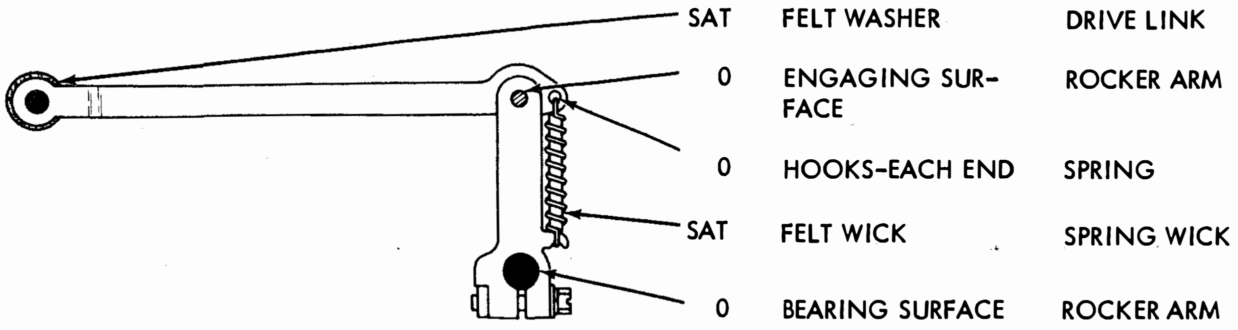


Figure 4-179. Rocker Arm Mechanism

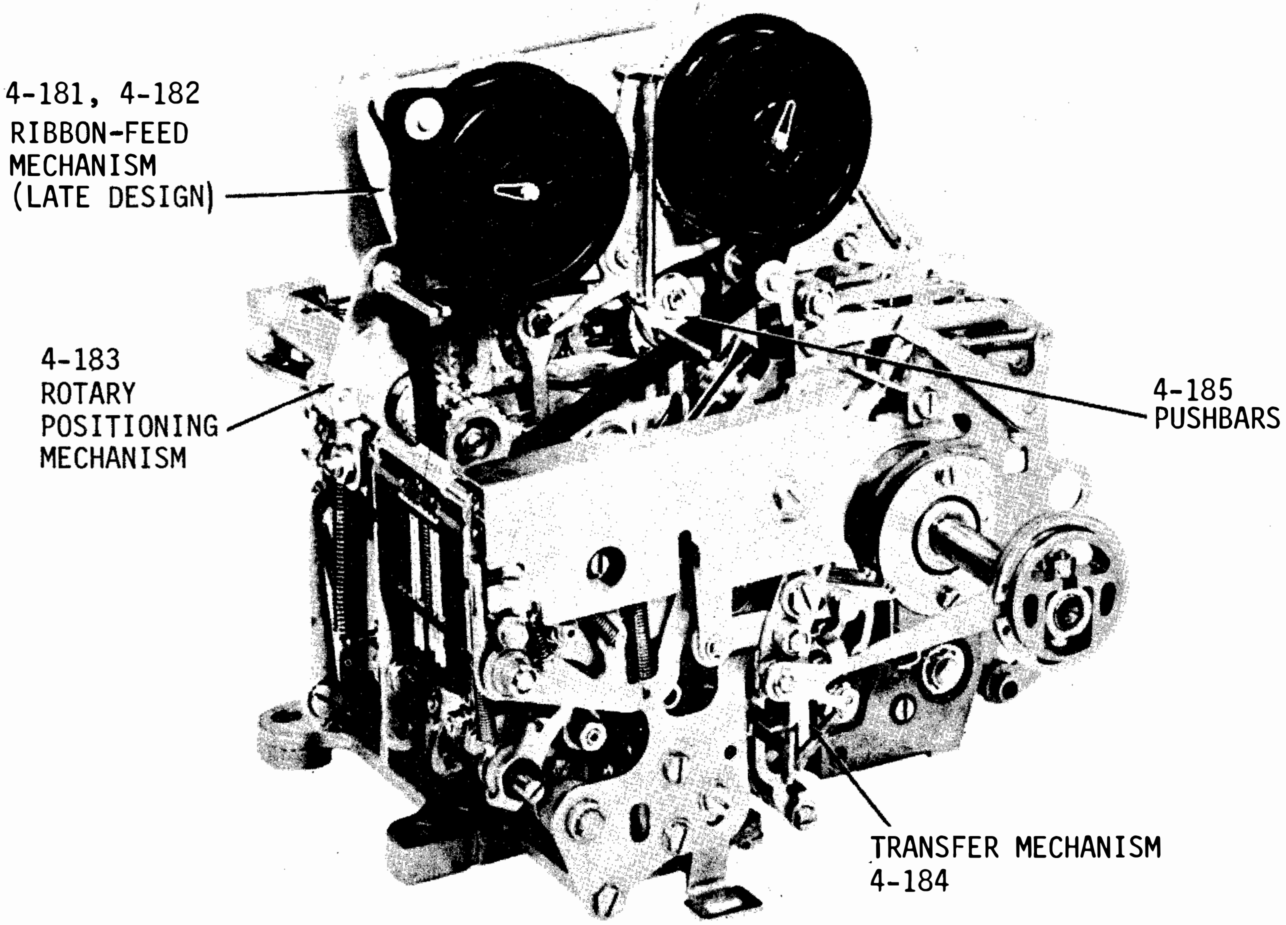
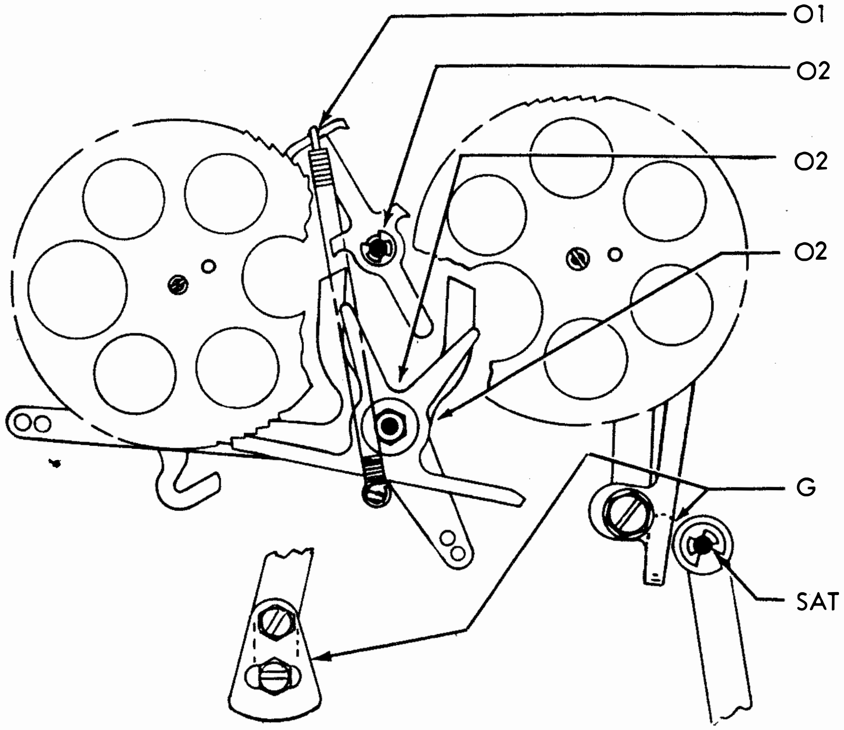
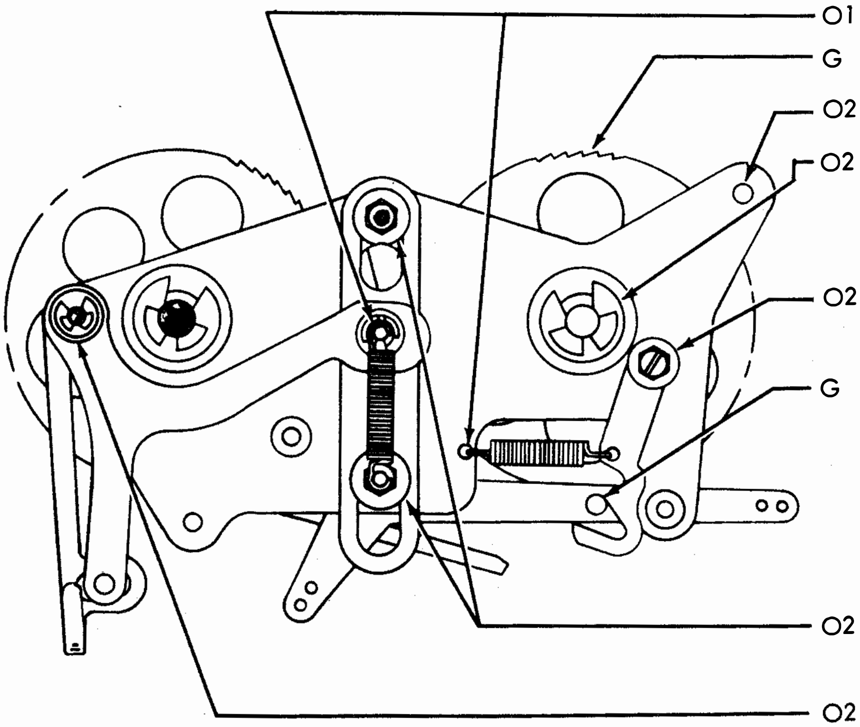


Figure 4-180. Typing Perforator



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

Figure 4-181. Ribbon-Feed Mechanism (Late Design), Front View



O1	HOOKS (2)	SPRINGS (2)
G	TEETH	RATCHET WHEEL
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

Figure 4-182. Ribbon-Feed Mechanism (Late Design), Rear View

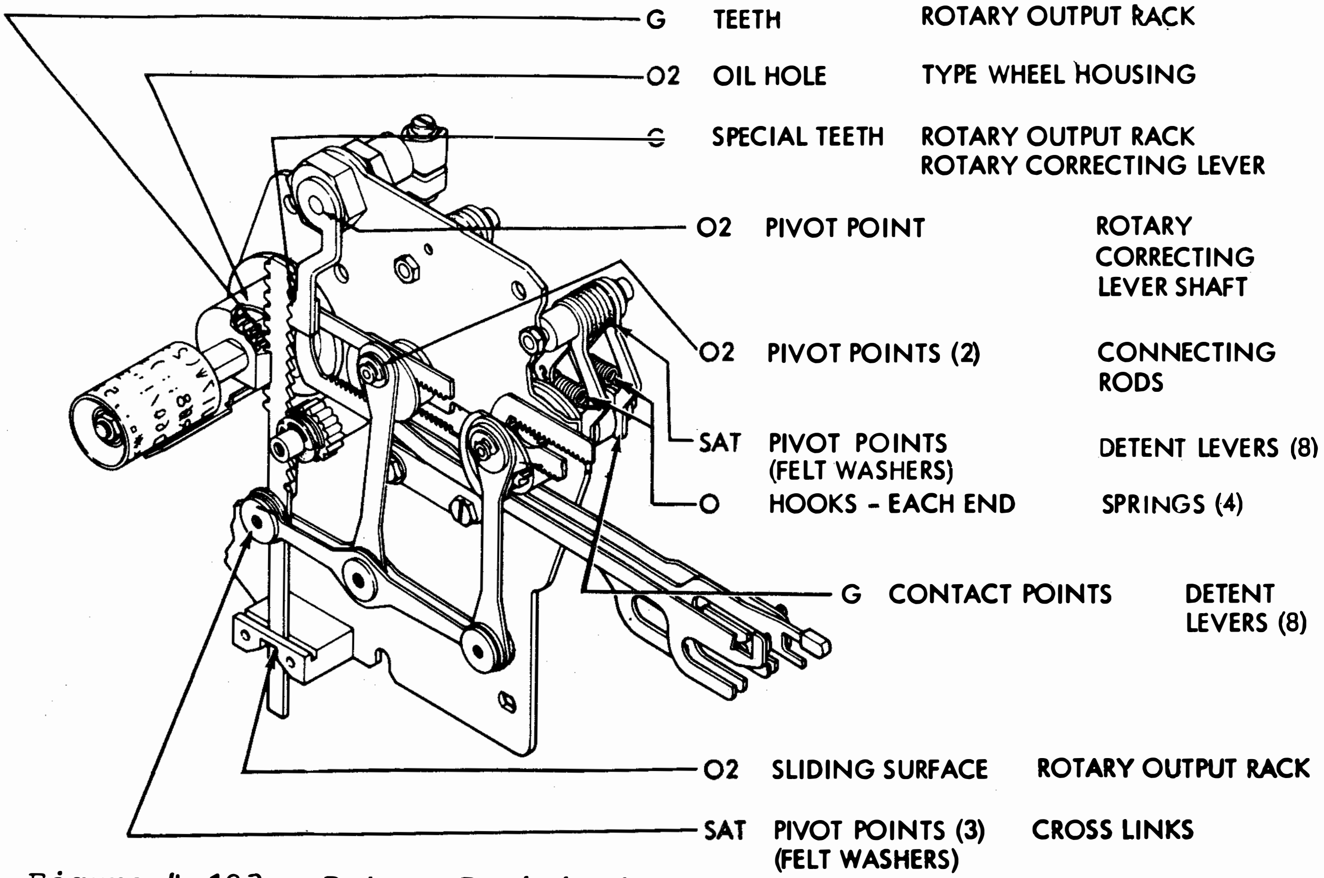


Figure 4-183. Rotary Positioning Mechanism (Typing Perforator Only)

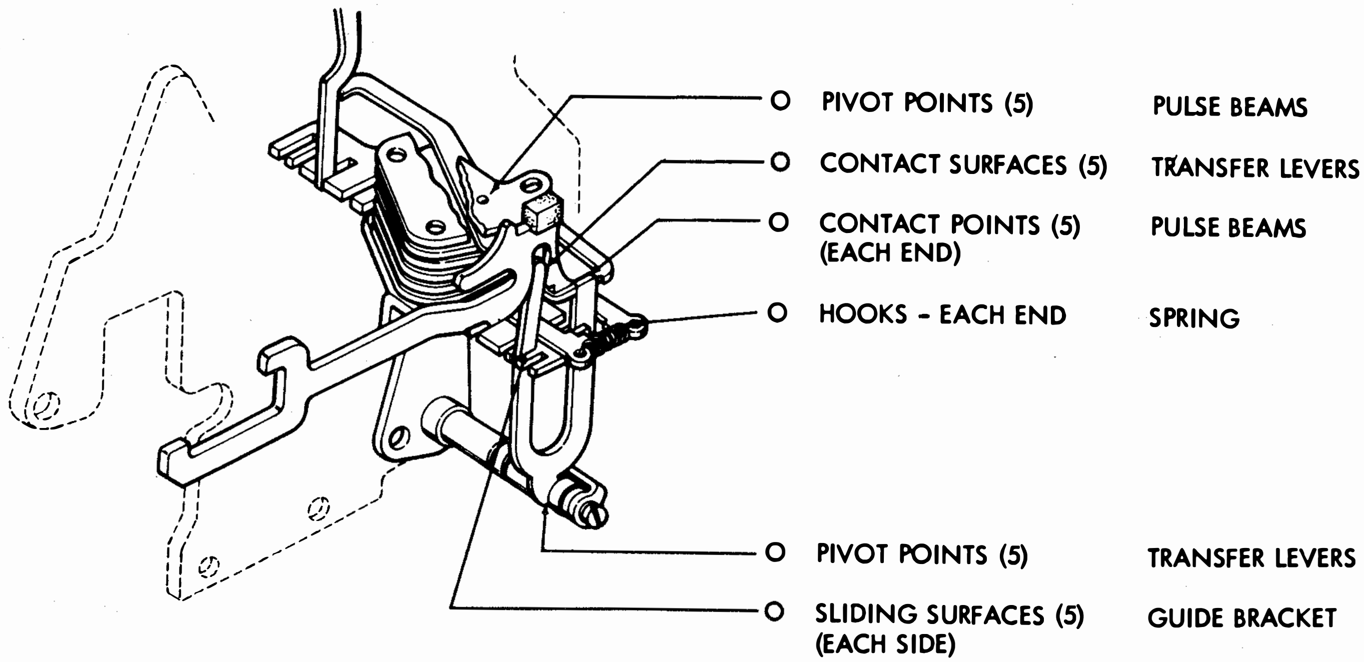


Figure 4-184. Transfer Mechanism (Typing Perforator Only)

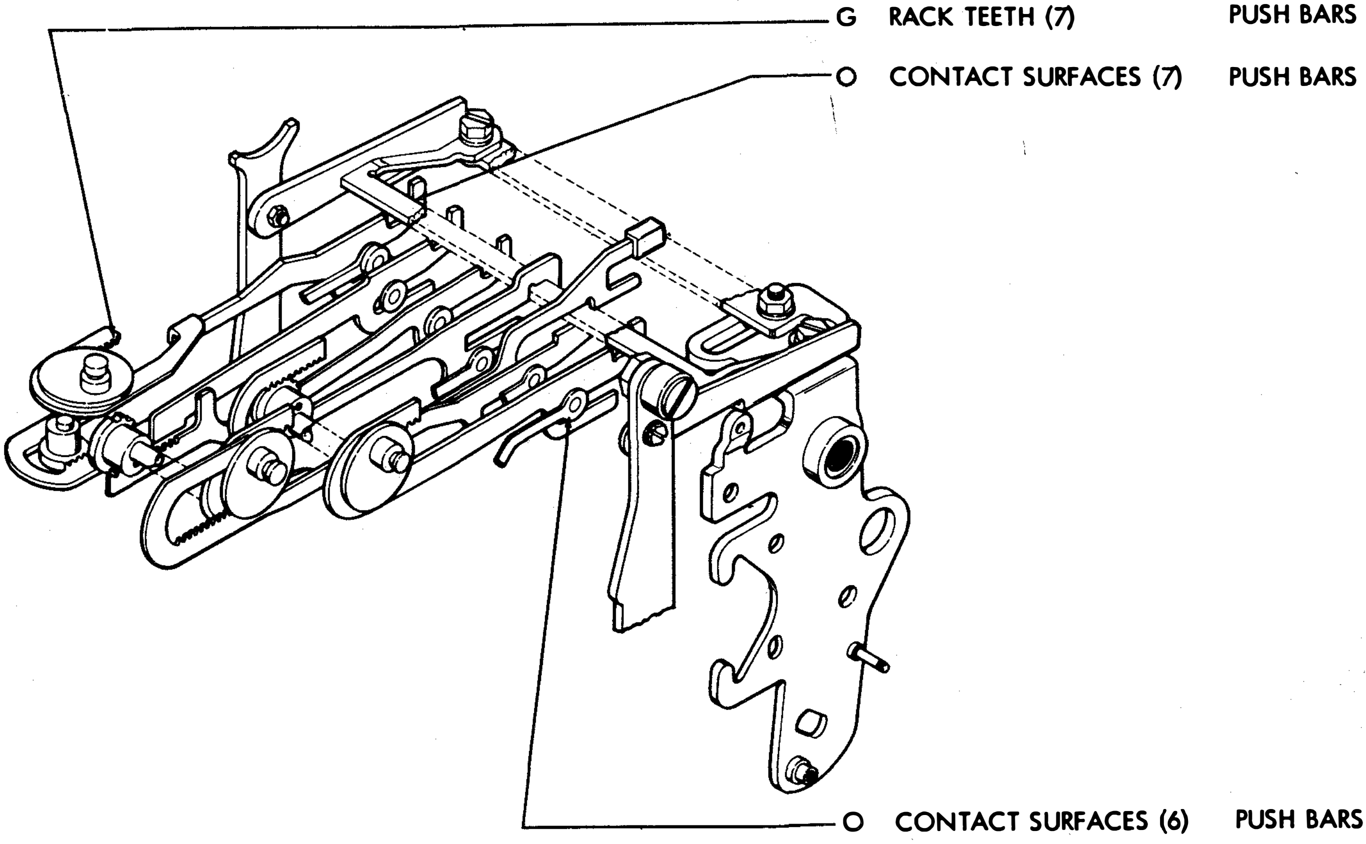


Figure 4-185. Pushbars (Typing Perforator Only)

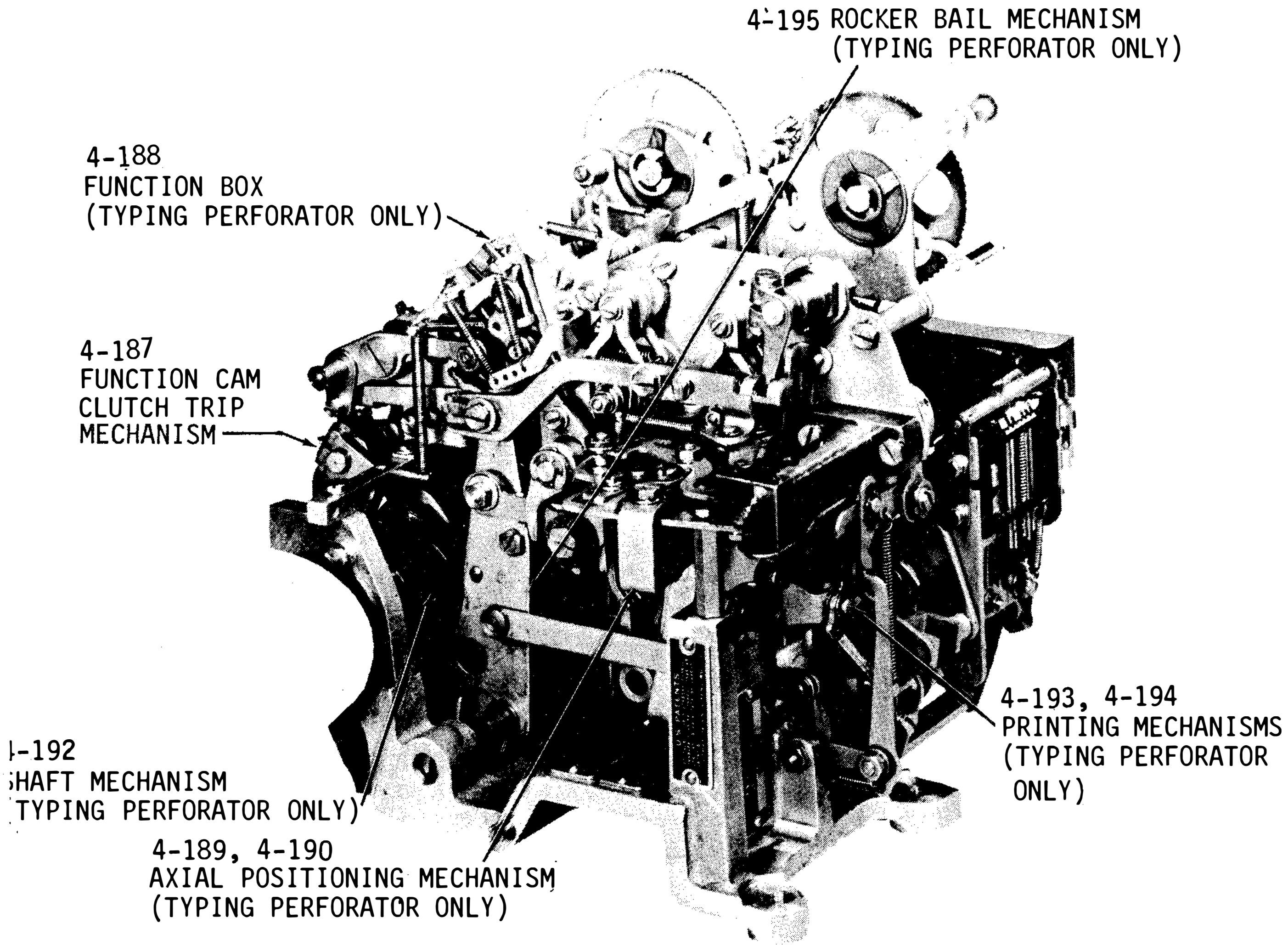


Figure 4-186. Typing Perforator

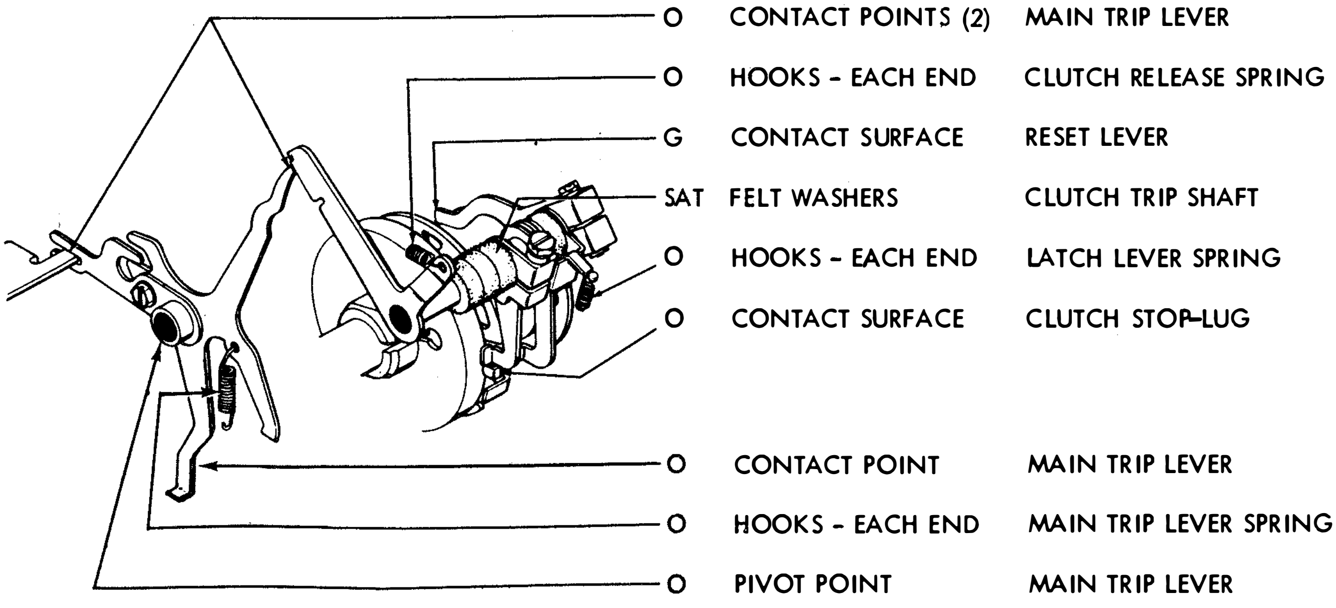


Figure 4-187. Function Cam-Clutch Trip Mechanism

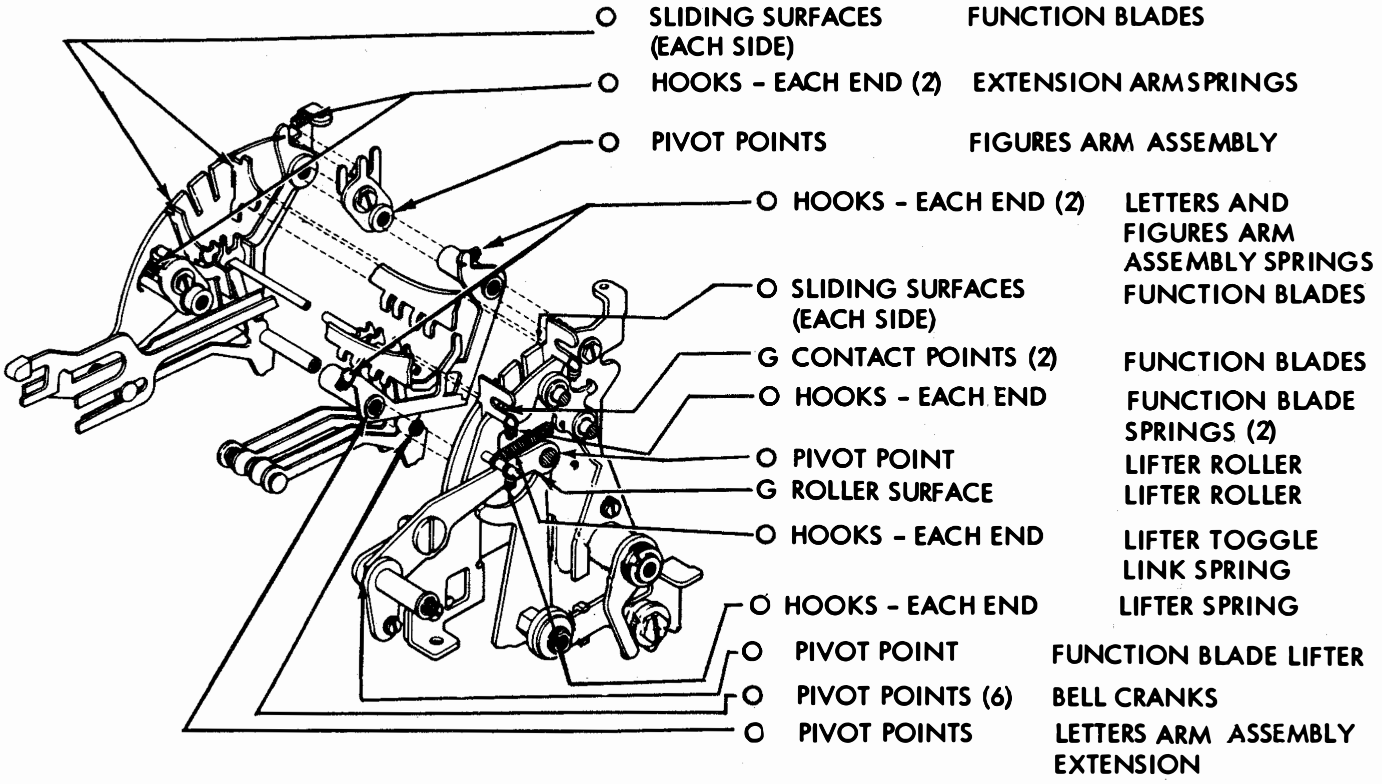


Figure 4-188. Function Box (Typing Perforator Only), Rear View

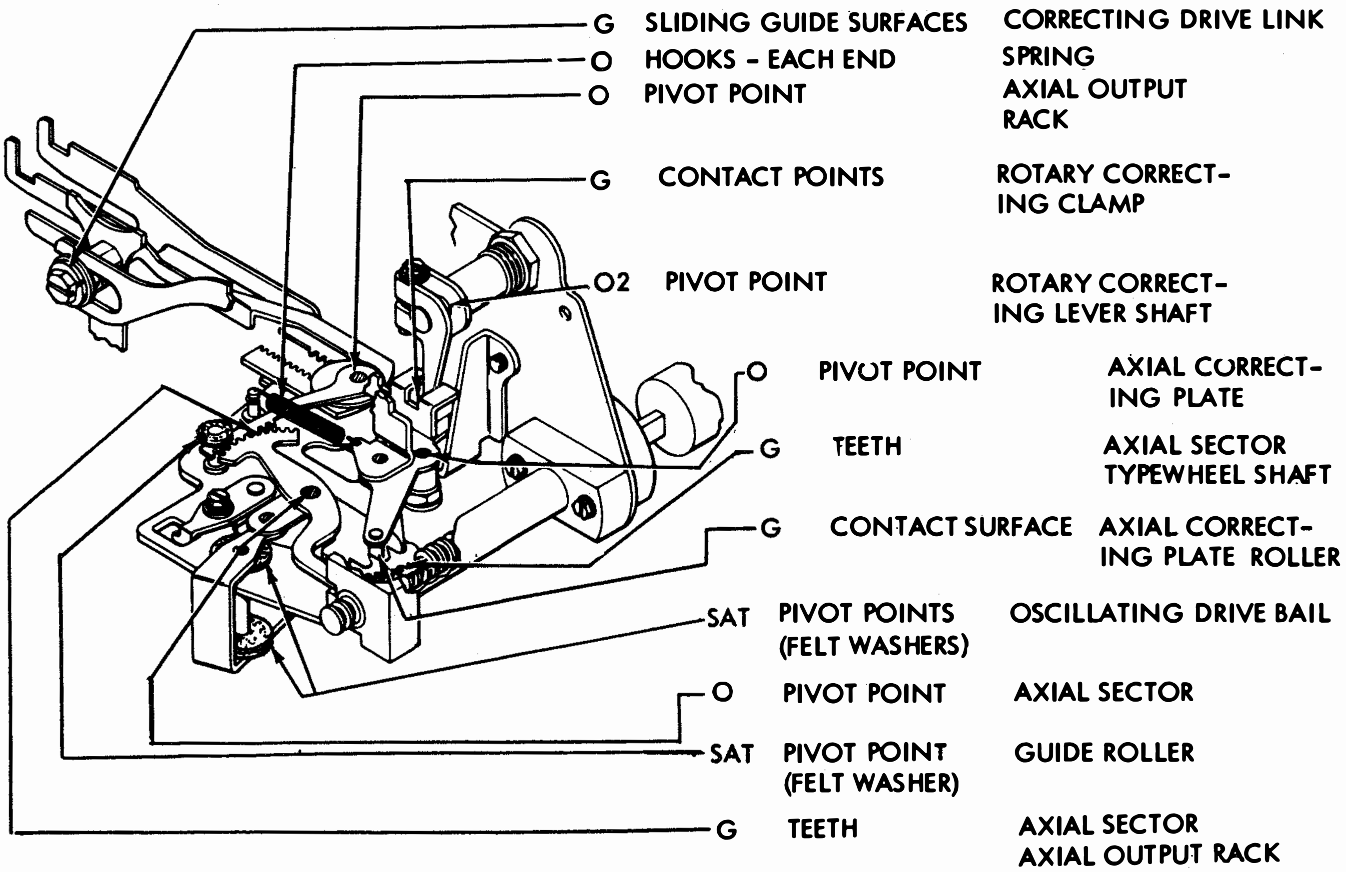
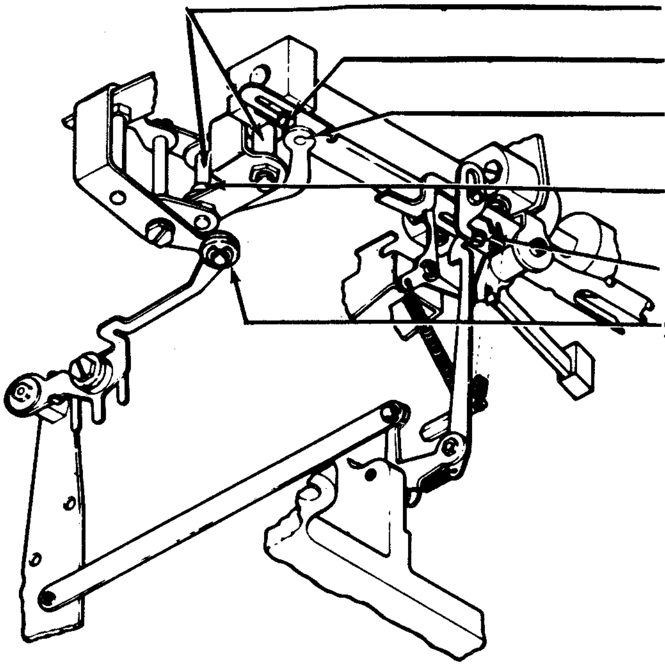
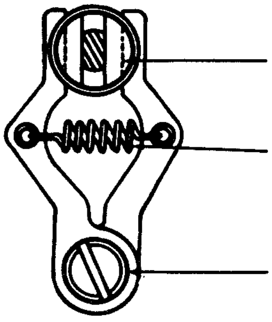


Figure 4-189. Axial Positioning Mechanism (Typing Perforator Only), Rear View



O	PIVOT POINT	OSCILLATING BAIL
O	CONTACT SURFACES	RIBBON CARRIER
O	PIVOT POINTS	RIBBON OSCILLATING LEVER
O	PIVOT POINT (FELT WASHER)	RIBBON OSCILLATING LEVER
O	CONTACT SURFACES	RIBBON CARRIER
SAT	PIVOT POINTS (2) (FELT WASHERS)	OSCILLATING DRIVE LINK

Figure 4-190. Axial Positioning Mechanism (Typing Perforator Only), Left Side View



O	DETENT POINTS	DETENT LEVERS (4)
O	HOOKS - EACH END	DETENT LEVER SPRINGS (2)
SAT	PIVOT POINTS (FELT WASHERS)	DETENT LEVERS (4)

Figure 4-191. Detent Assemblies, Bottom View

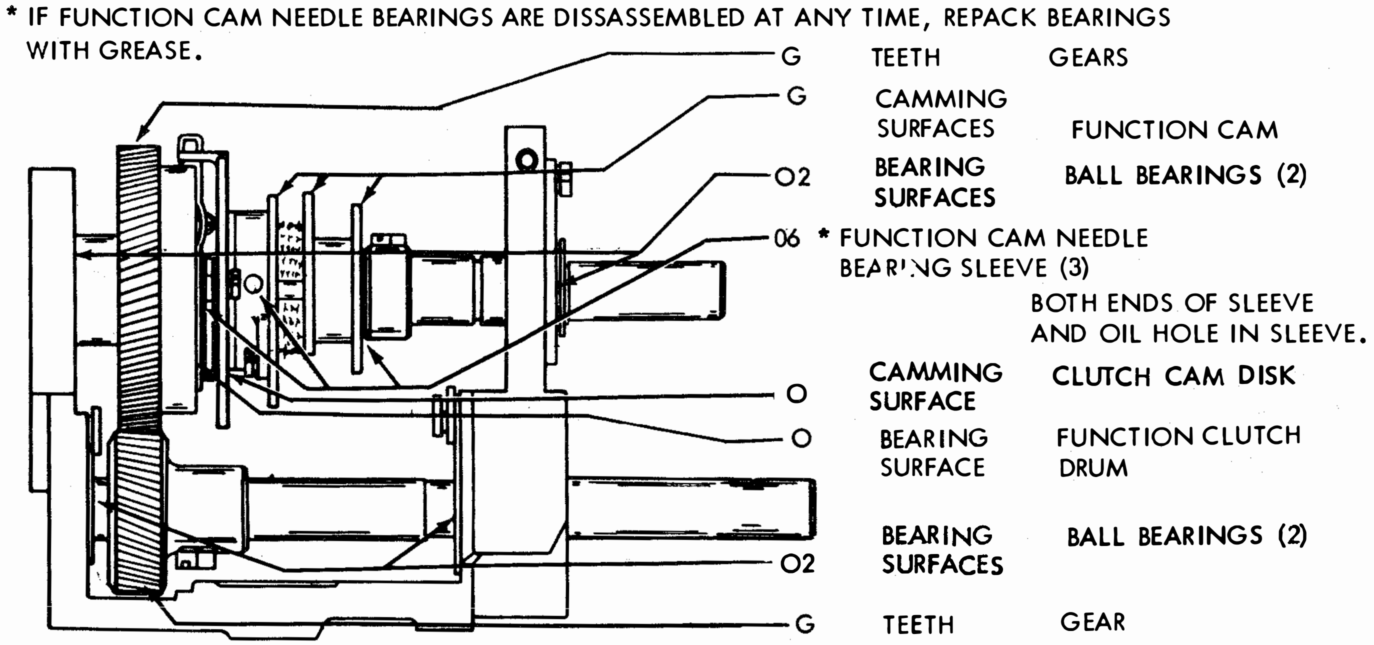


Figure 4-192. Shaft Mechanisms (Typing Perforator Only)

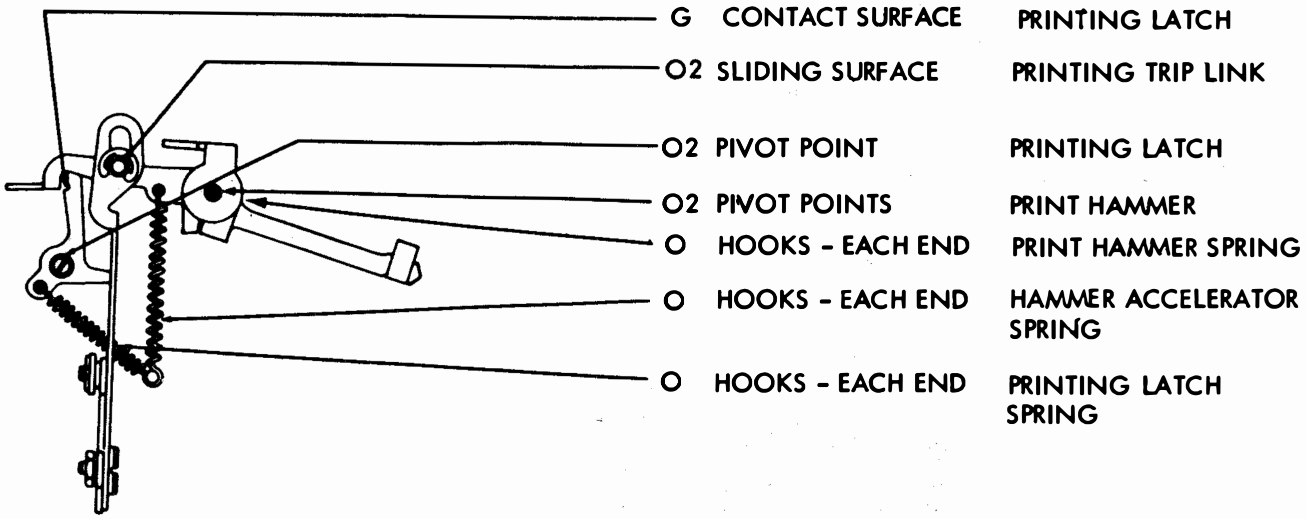


Figure 4-193. Printing Mechanism (Typing Perforator Only), Left Side View

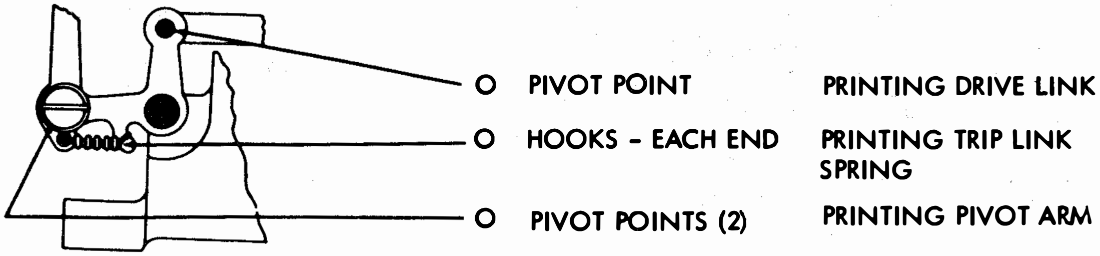


Figure 4-194. Printing Drive Link, Trip Link and Pivot Arm, Left Side View

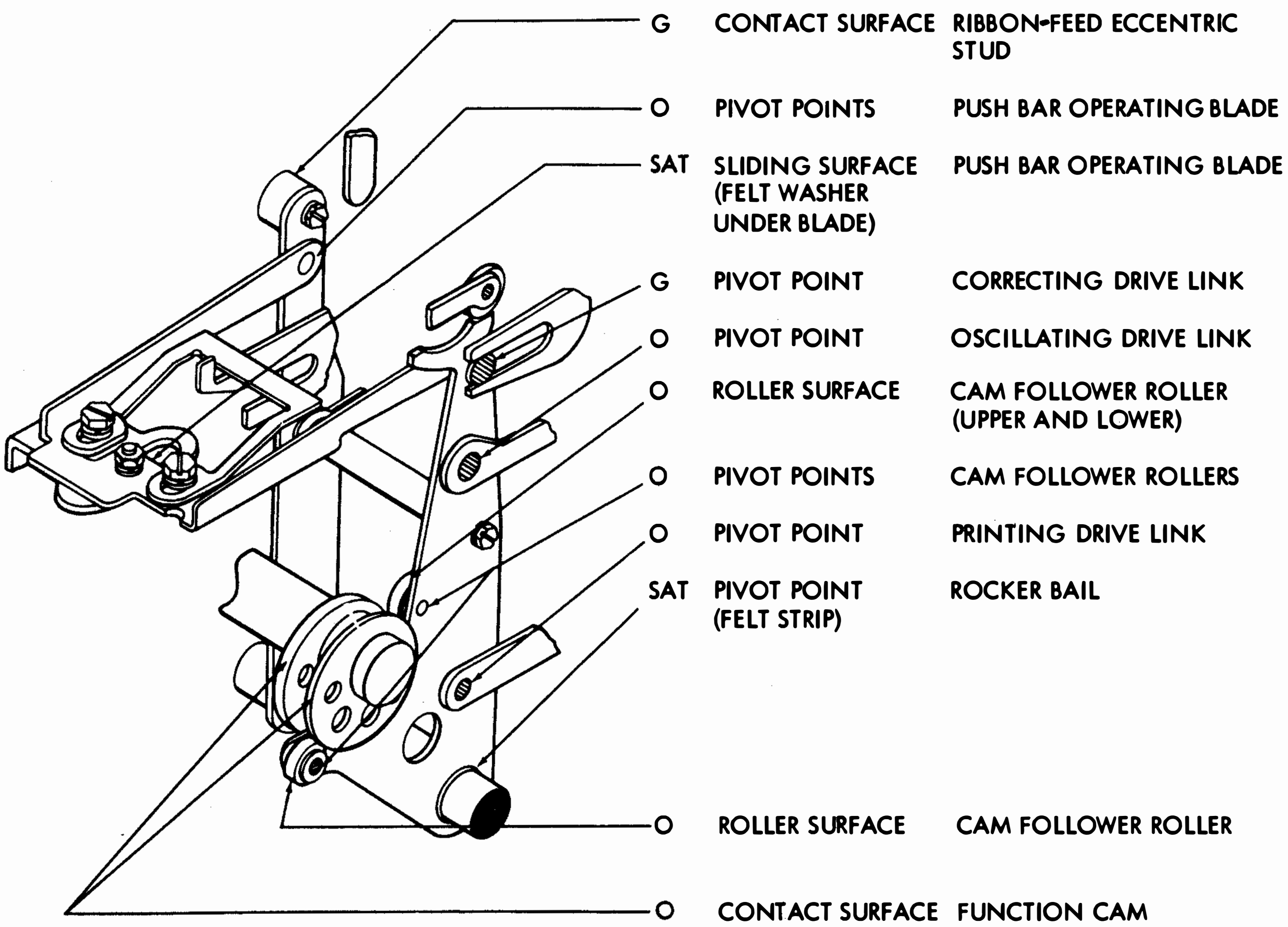


Figure 4-195. Rocker Bail Mechanism (Typing Perforator Only), Rear View

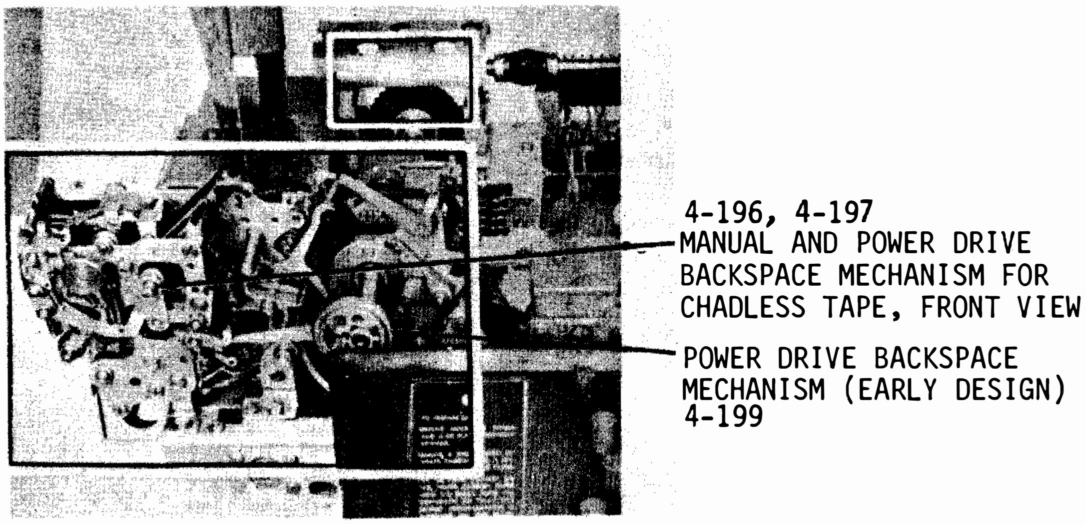


Figure 4-196. Manual and Power Drive Backspace Mechanism for Chadless Tape, Front View

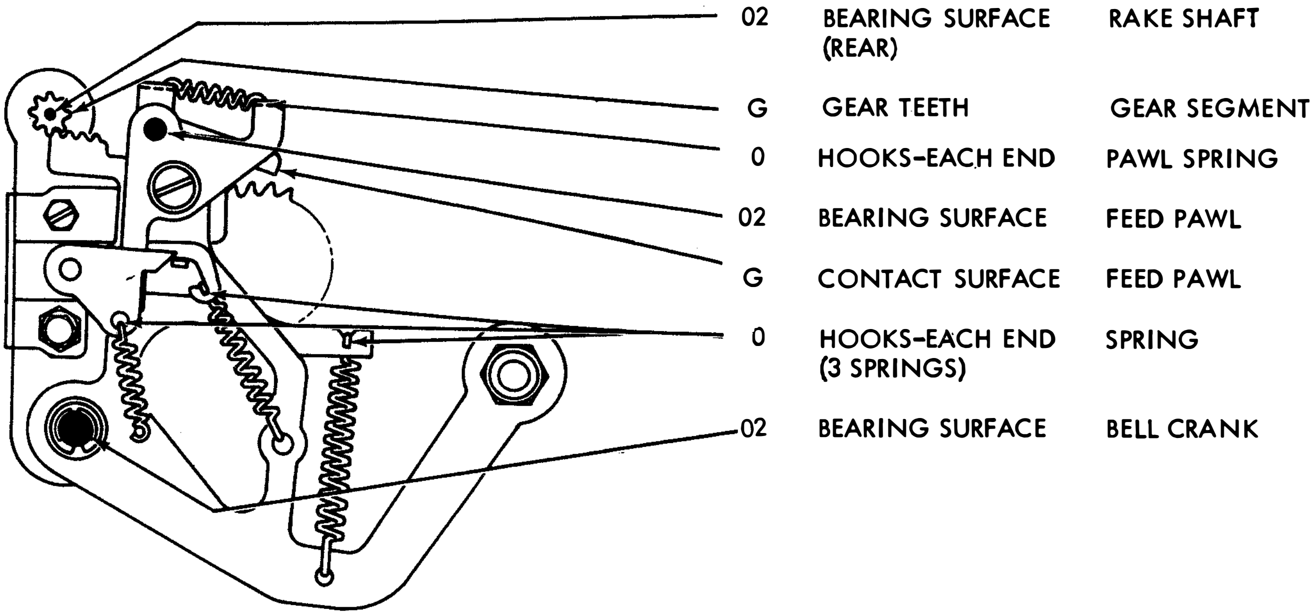


Figure 4-197. Manual and Power Drive Backspace Mechanism for Chadless Tape

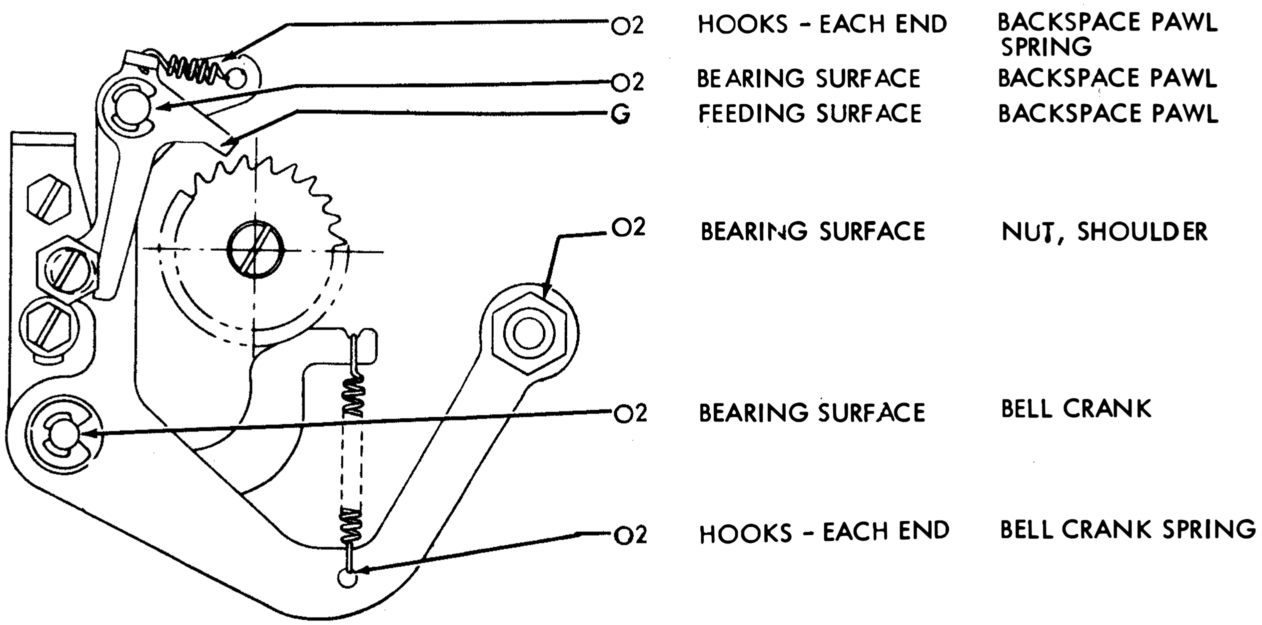


Figure 4-198. Manual and Power Drive Backspace Mechanism for Perforated Tape

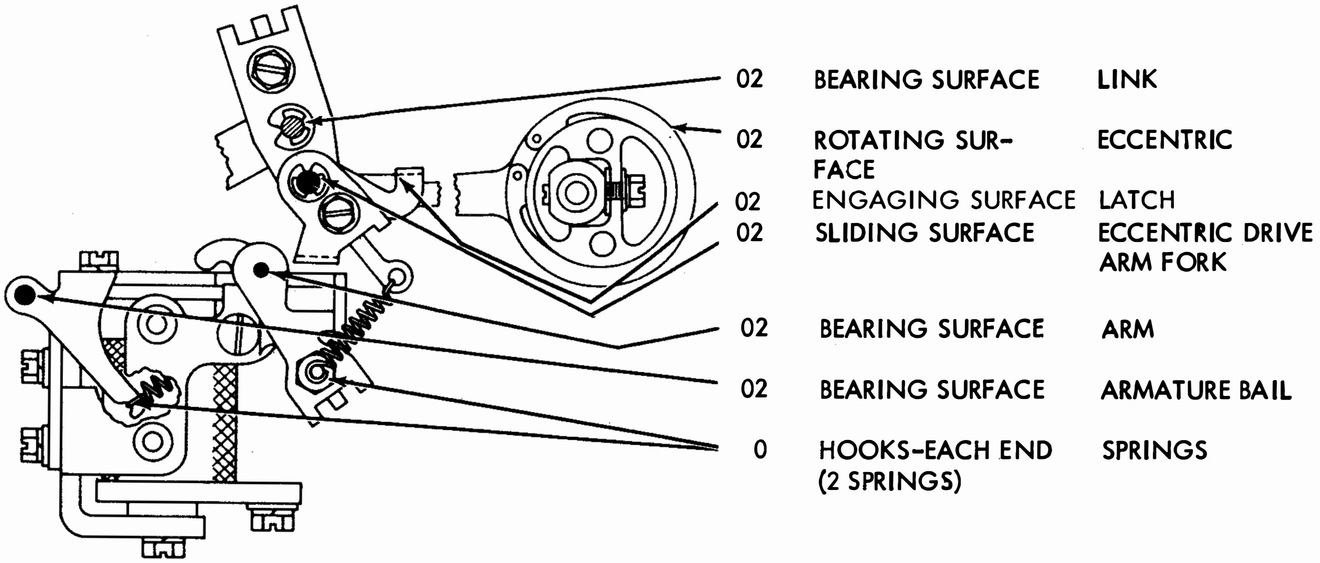


Figure 4-199. Power Drive Backspace Mechanism, Early Design

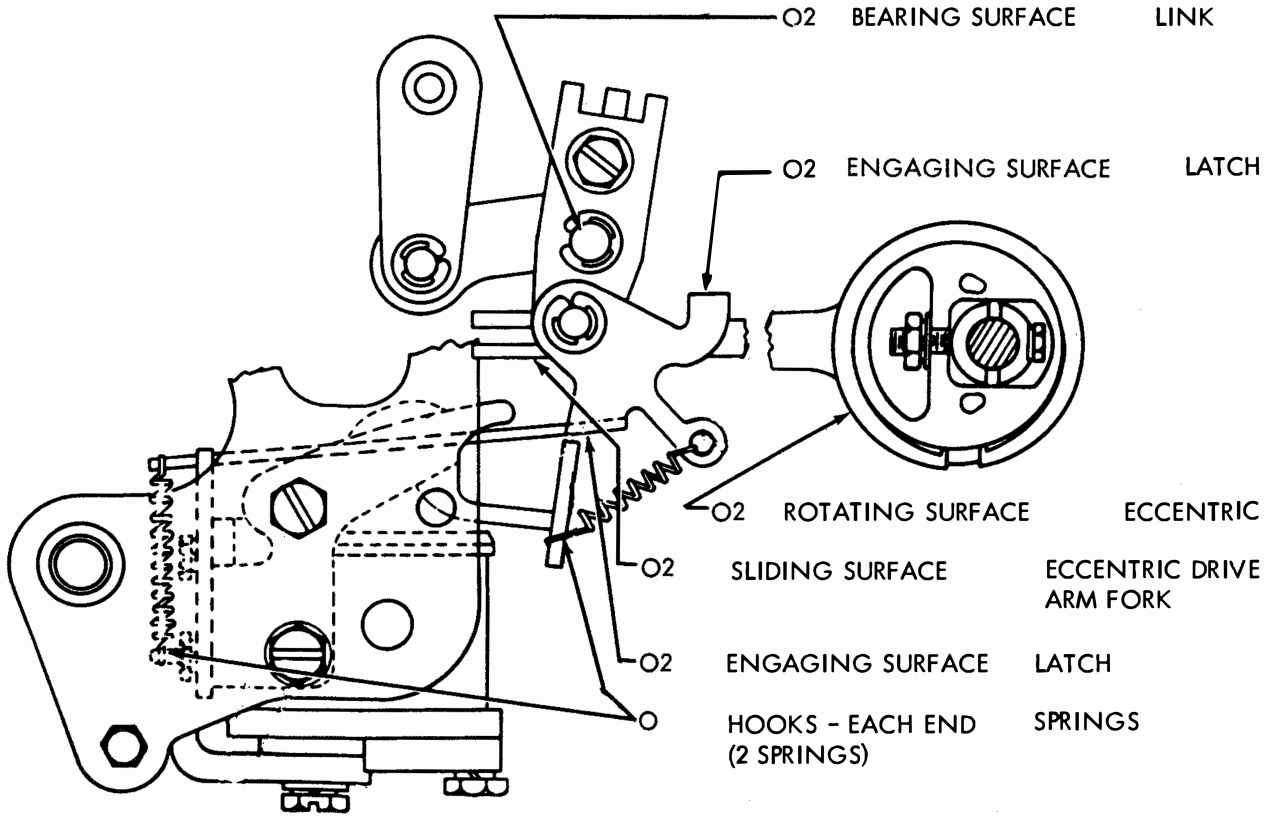


Figure 4-200. Power Drive Backspace Mechanism, Latest Design

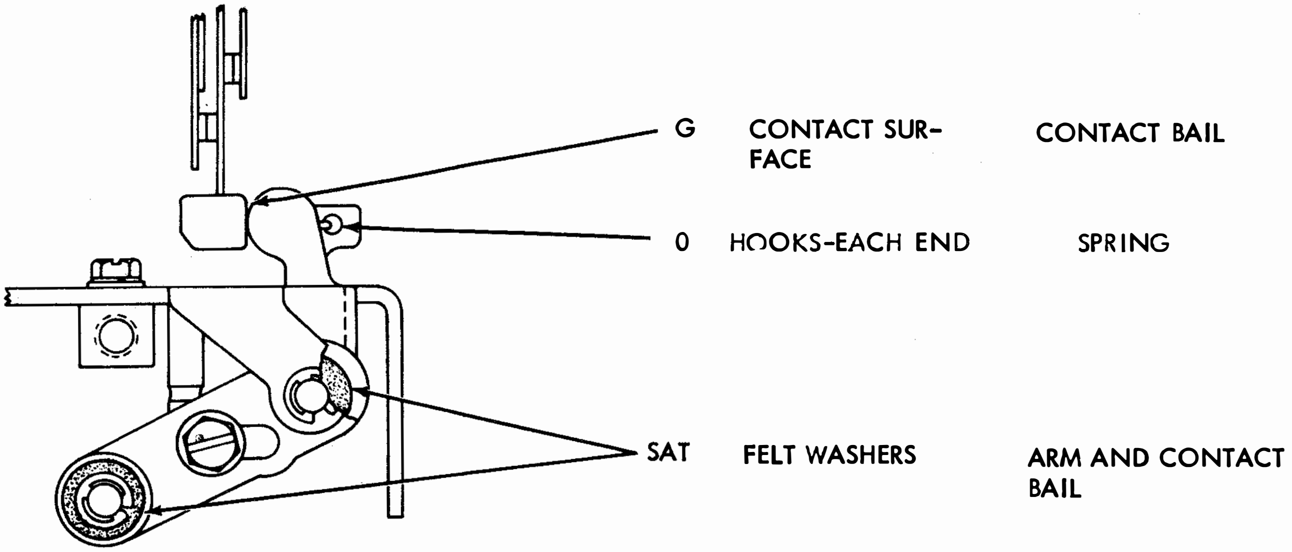


Figure 4-201. Single Auxiliary Timing Contacts Mechanism

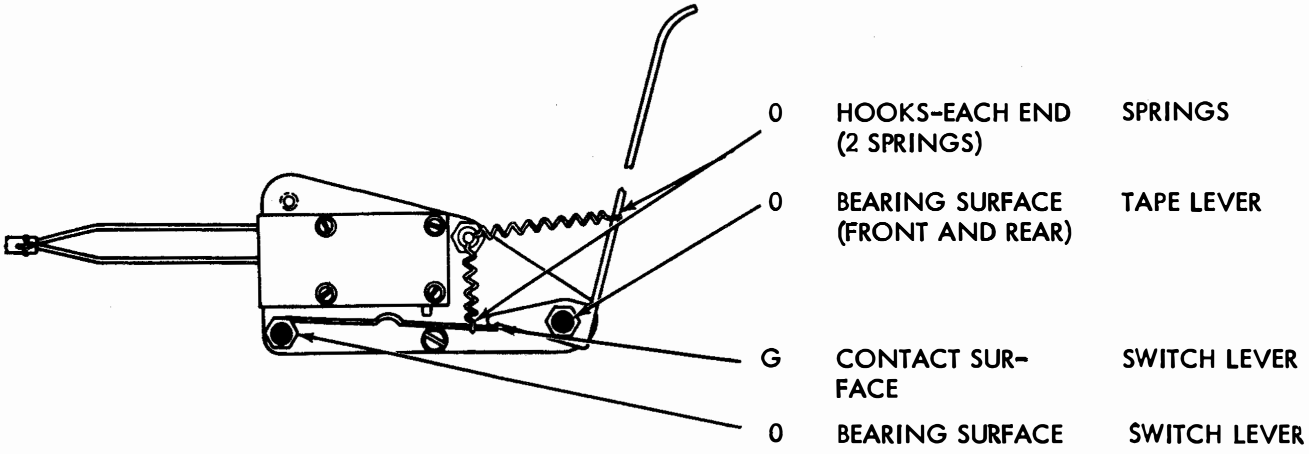


Figure 4-202. Tape-Out Switch Mechanism

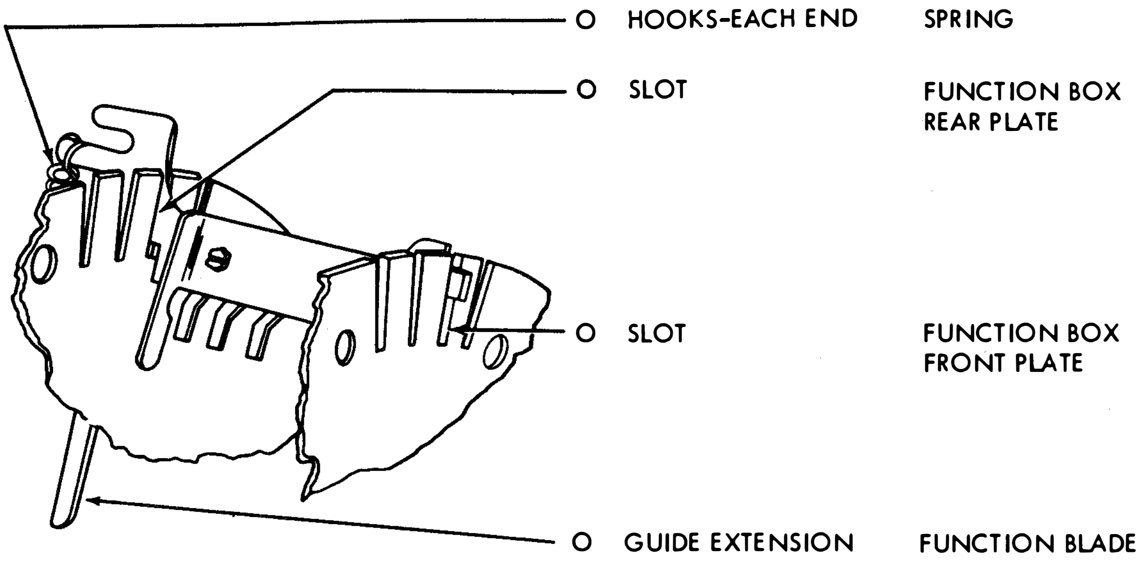


Figure 4-203. Unshift-on-Space Mechanism

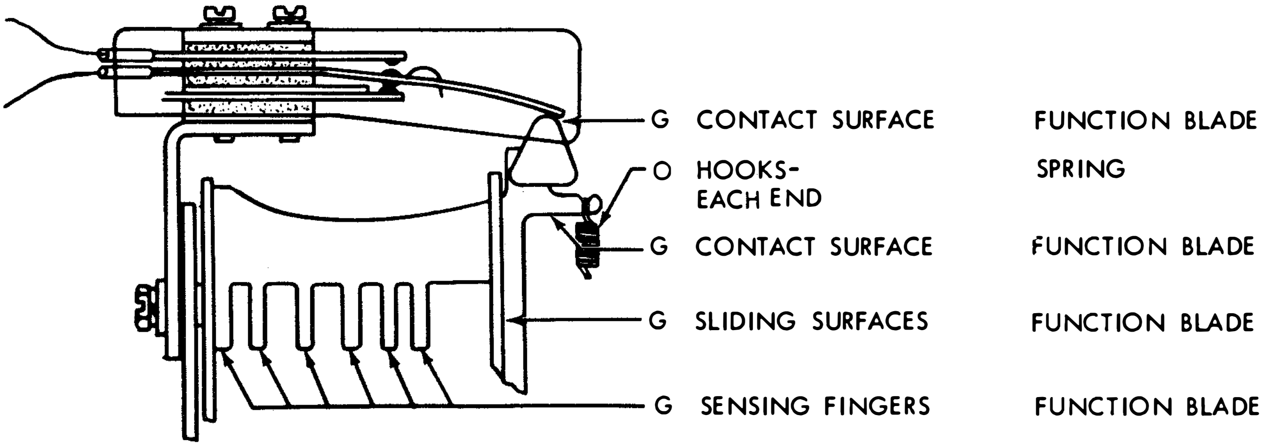


Figure 4-204. Signal Bell Contact Mechanism, Right Side View

charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the unit as viewed by the operator facing the unit.

b. Lubricate the unit just prior to placing it in service. After 300 to 500 operating hours, relubricate the unit. Recheck all clutch gaps; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Apply a thick film of grease to all gears. Apply oil to all cams, including the camming surfaces of each clutch disk. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

d. Whenever clutches are disassembled, apply a thin coat of grease to the shoe lever spring loops, and oil to the internal mechanisms. Fill lubricator reservoir at indicated intervals.

e. Lubricate the unit thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-11. TYPING REPERFORATOR LUBRICATION. The following paragraphs provide typing reperforator lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the typing reperforator are indexed in Table 4-7 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the unit as viewed by the operator facing the unit.

b. Lubricate the unit just prior to placing it in service. After 300 to 500 operating hours, relubricate the unit. Recheck all clutch gaps; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

Table 4-7. Typing Reperforator Lubrication Chart Index

Table 4-7. Typing Reperforator Lubrication Chart Index - Continued

Table 4-7. Typing Reperforator Lubrication Chart Index - Continued

Table 4-7. Typing Reperforator Lubrication Chart Index - Continued

Figure	Title	Page No.
4-255	Time Delay Motor Stop Mechanism	4-165
4-256	Ribbon-Feed Mechanism, Earlier Design	4-166

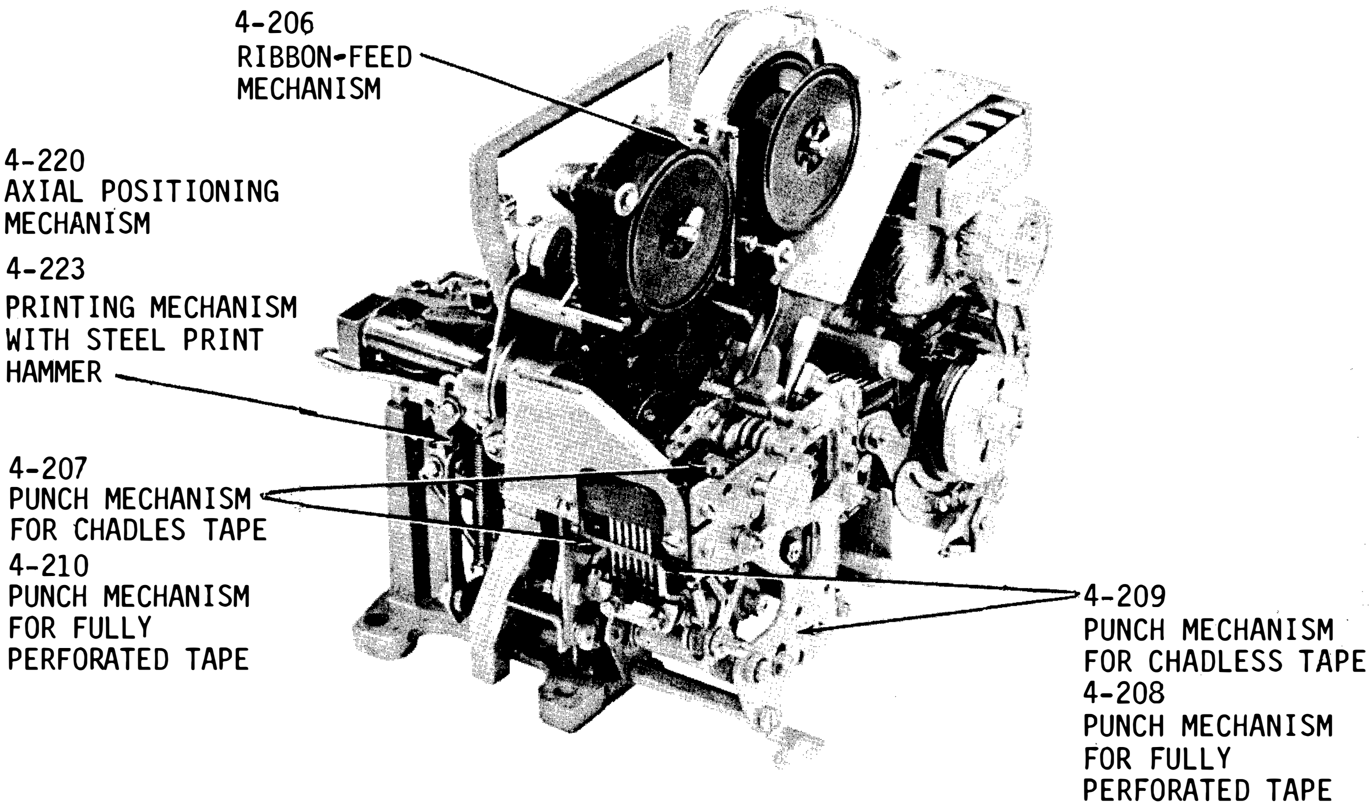
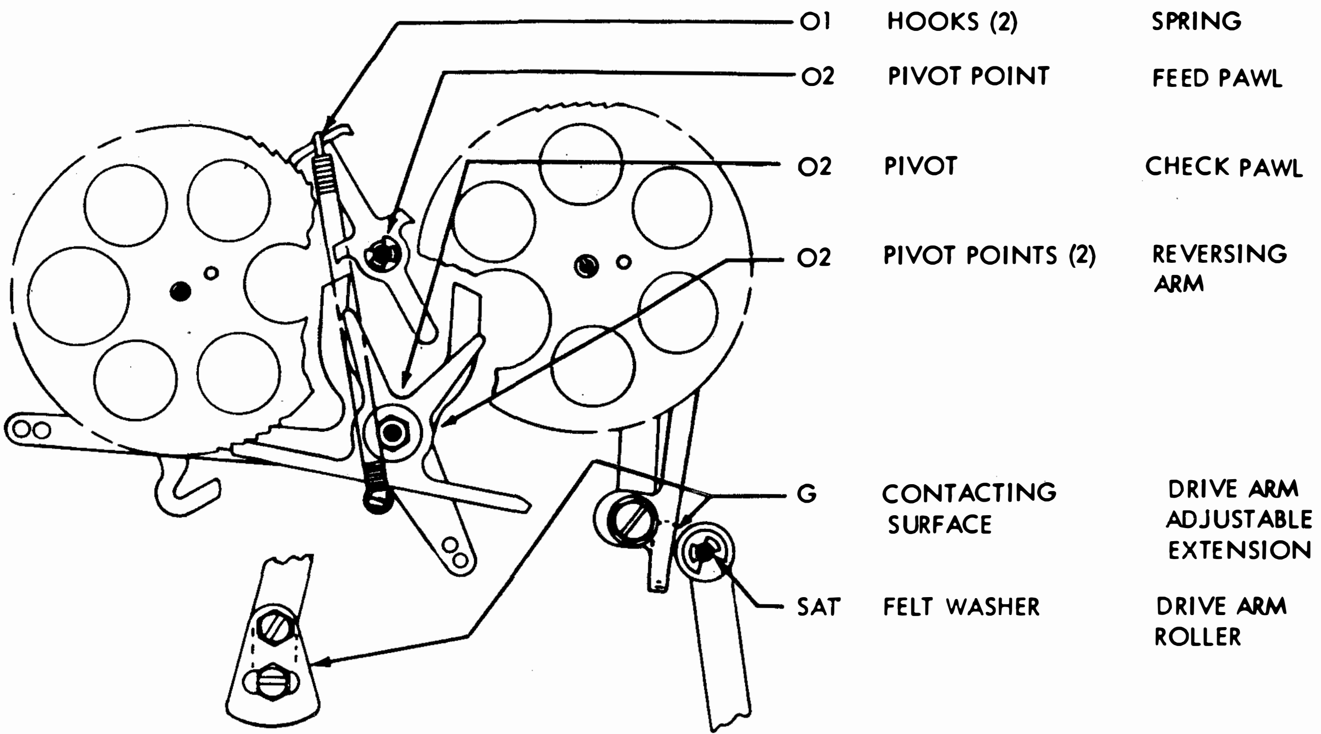
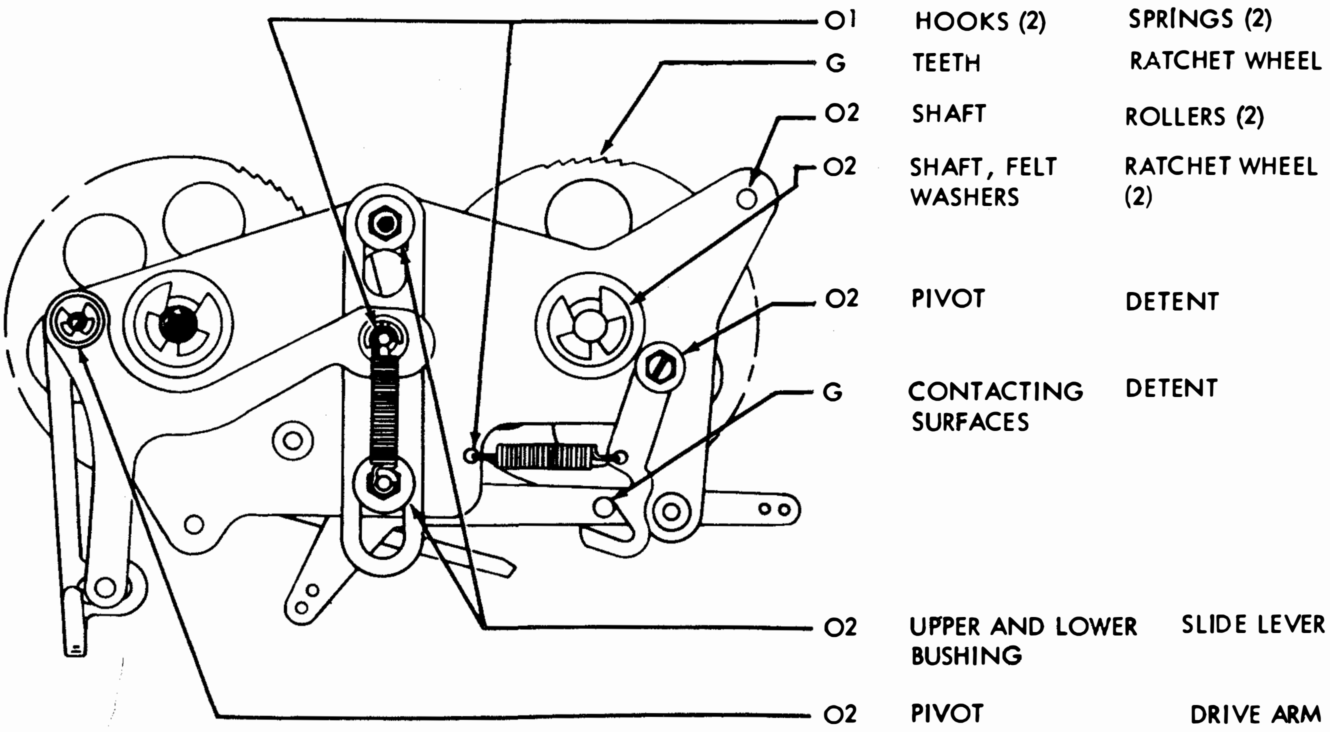


Figure 4-205. Typing Reperforator Unit

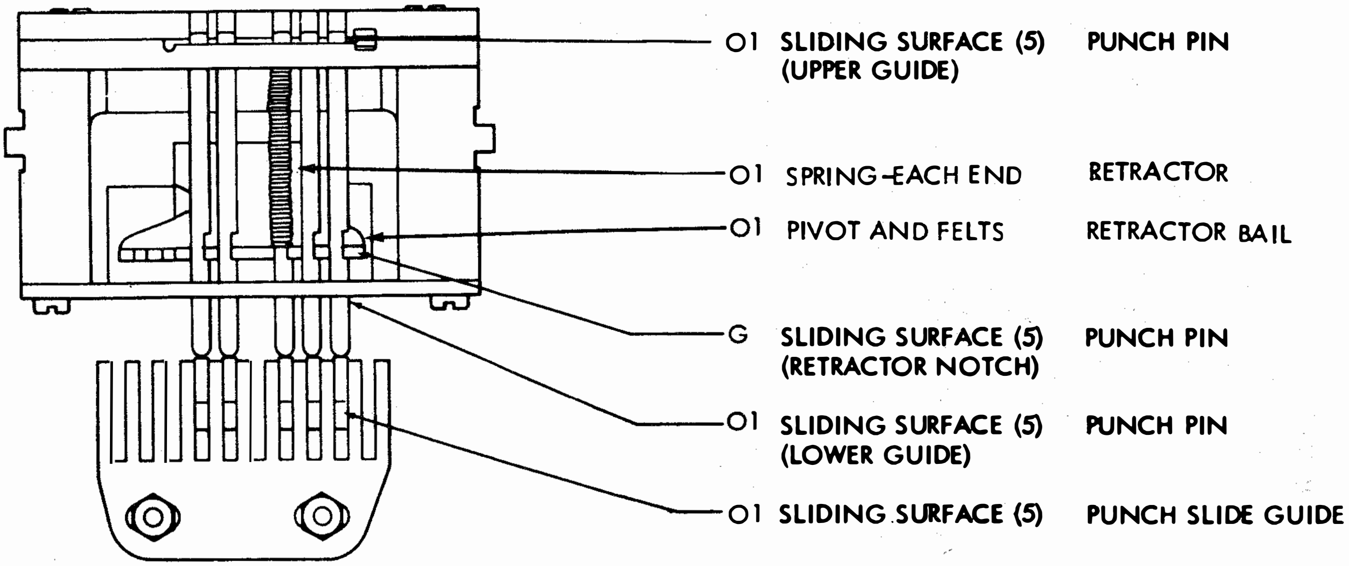


FRONT VIEW



REAR VIEW

Figure 4-206. Ribbon-Feed Mechanism, Late Design



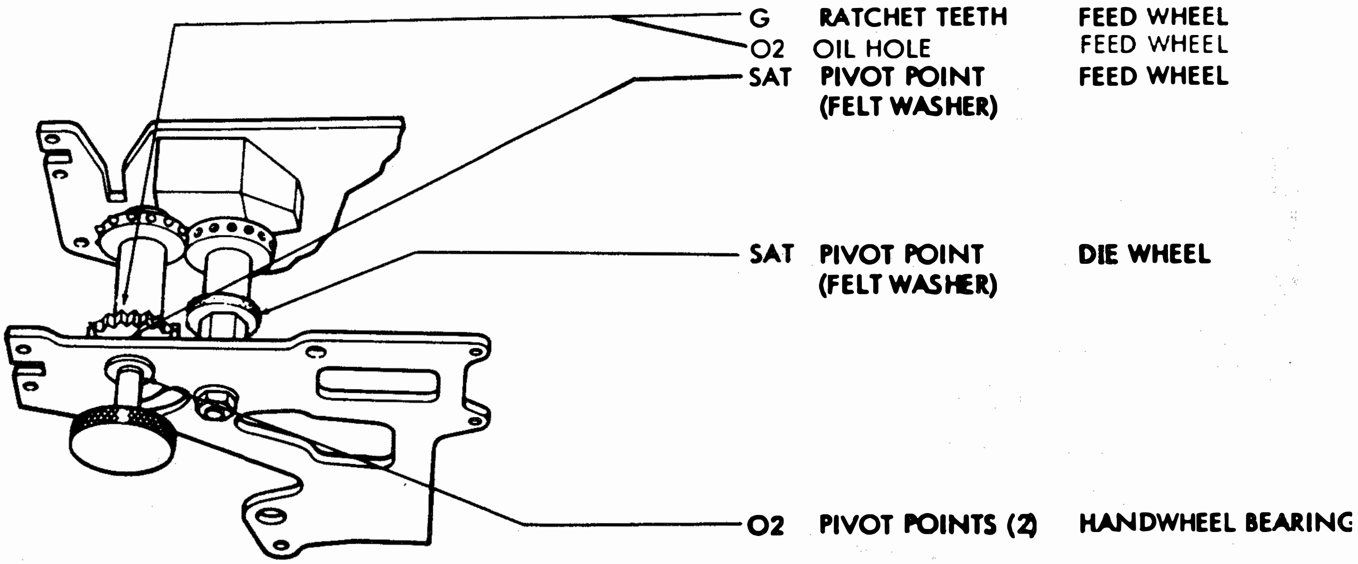


Figure 4-207. Punch, Pin, Retractor, and Punch Slide Guide for Chadless Tape Mechanism

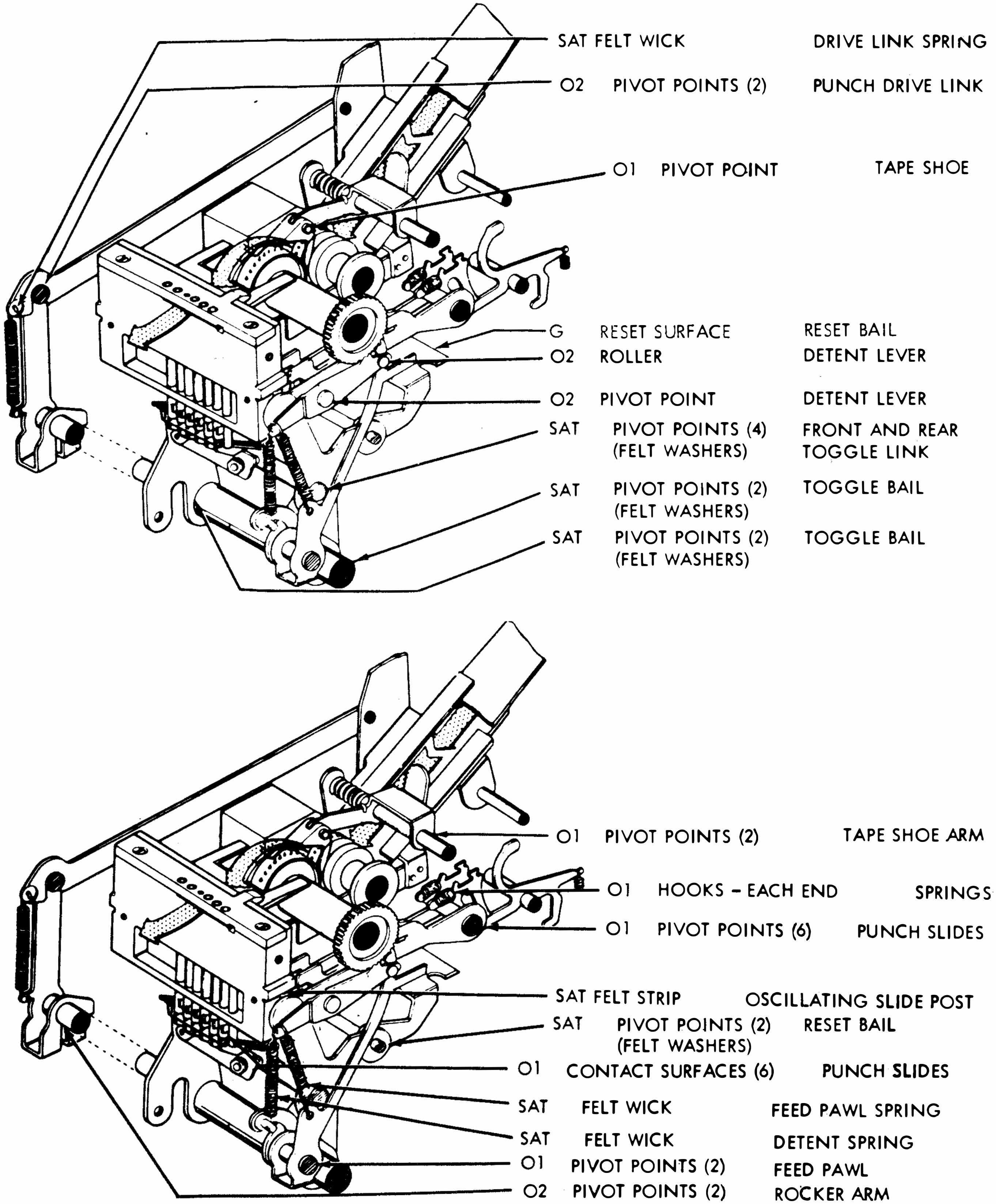
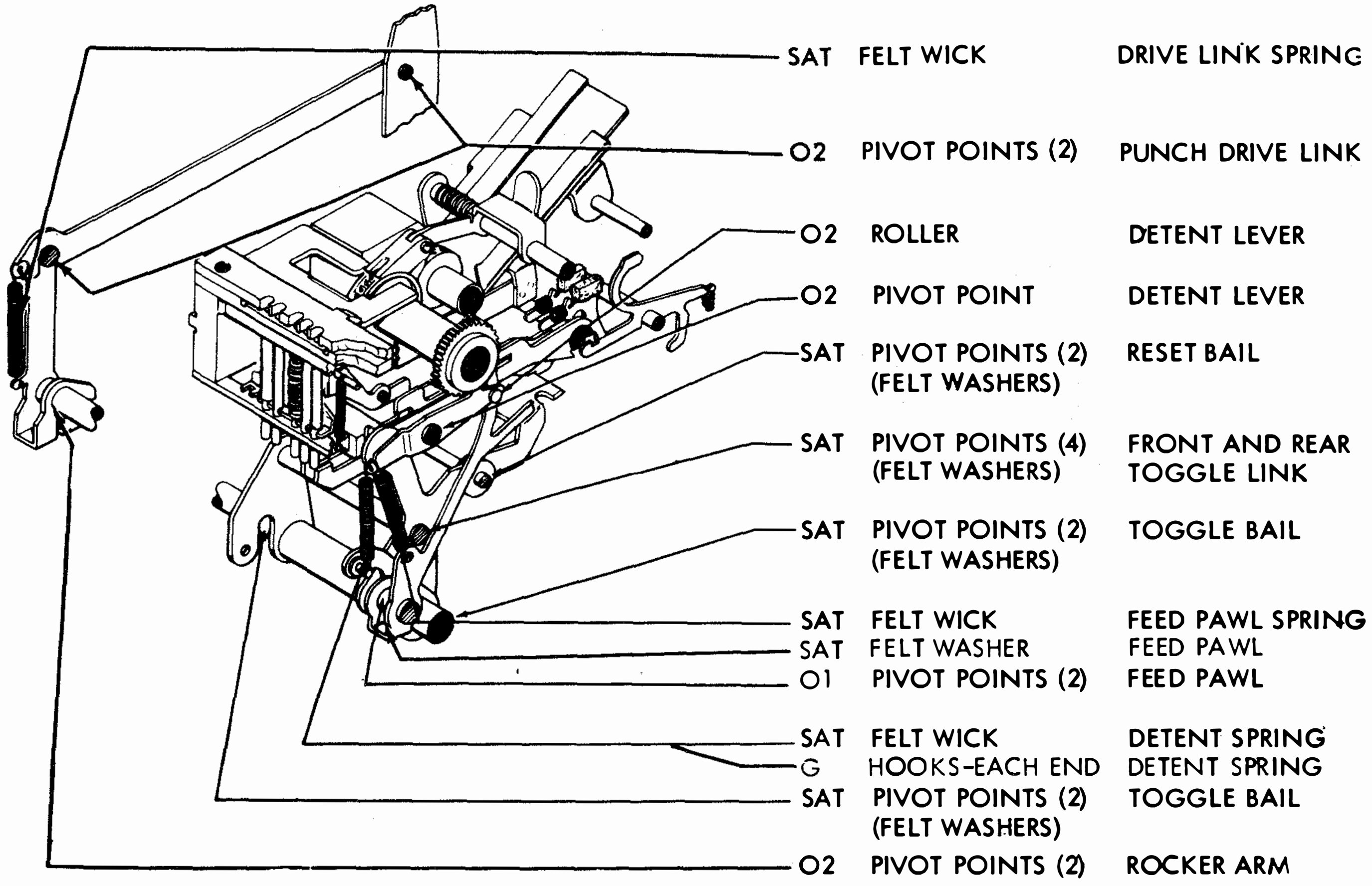


Figure 4-208. Punch Mechanism for Fully Perforated Tape



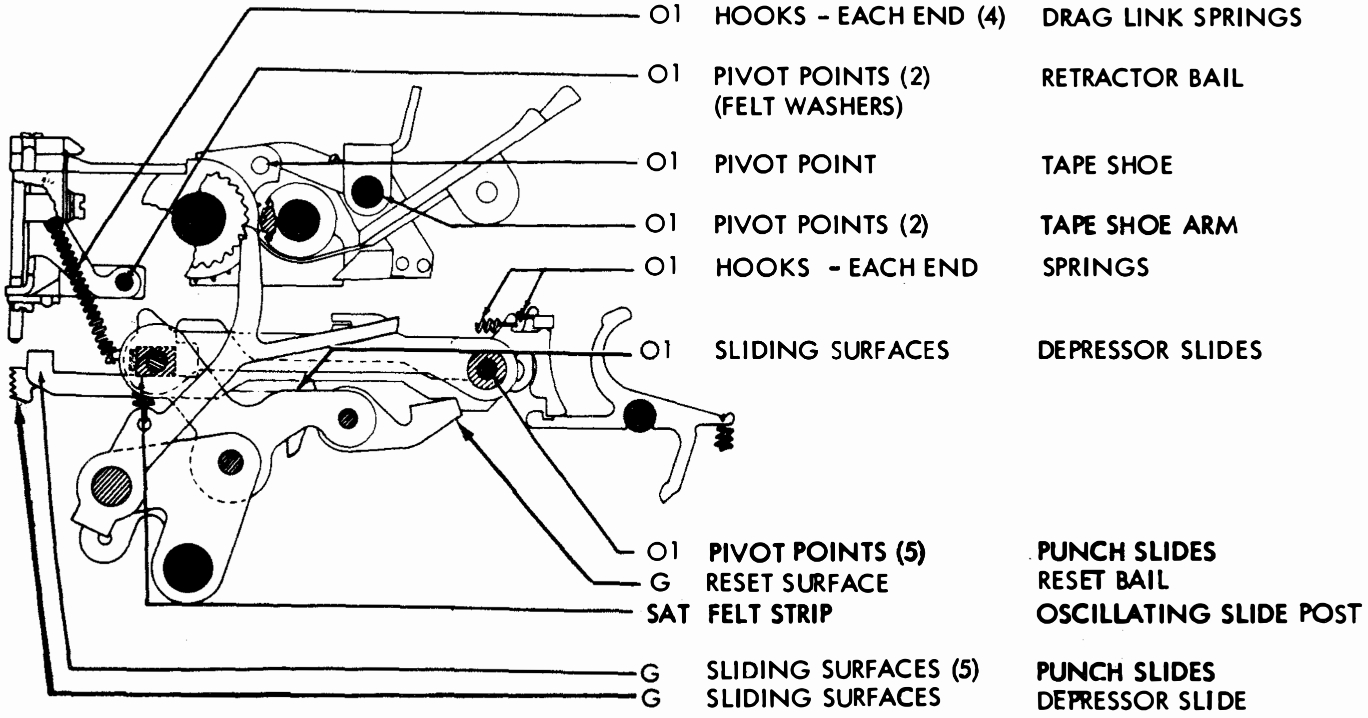


Figure 4-209. Punch Drive Link, Feed Pawl and Components for Chadless Tape Mechanism

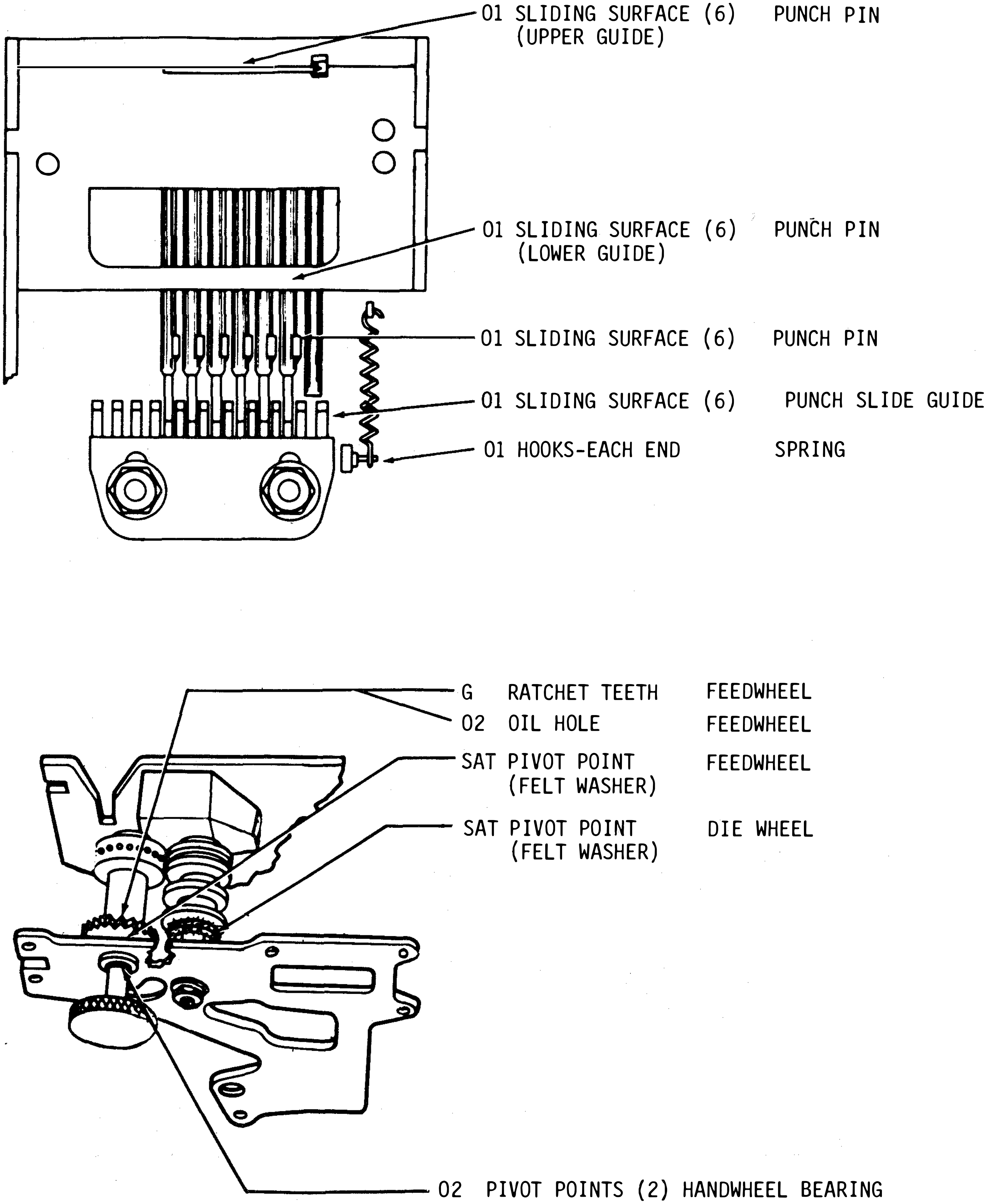


Figure 4-210. Sliding Surfaces, Feed Wheel and Components for Fully Perforated Tape

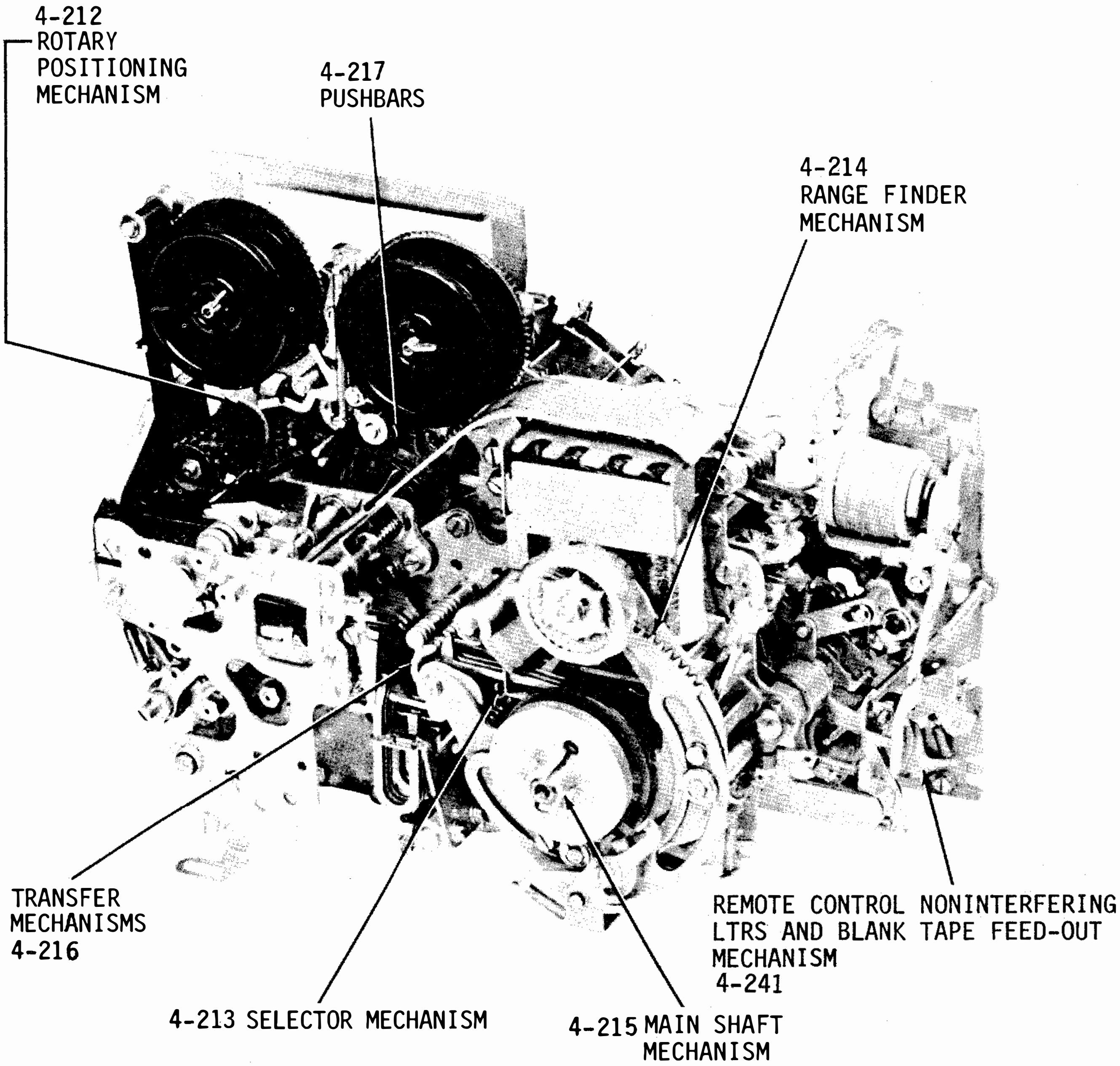
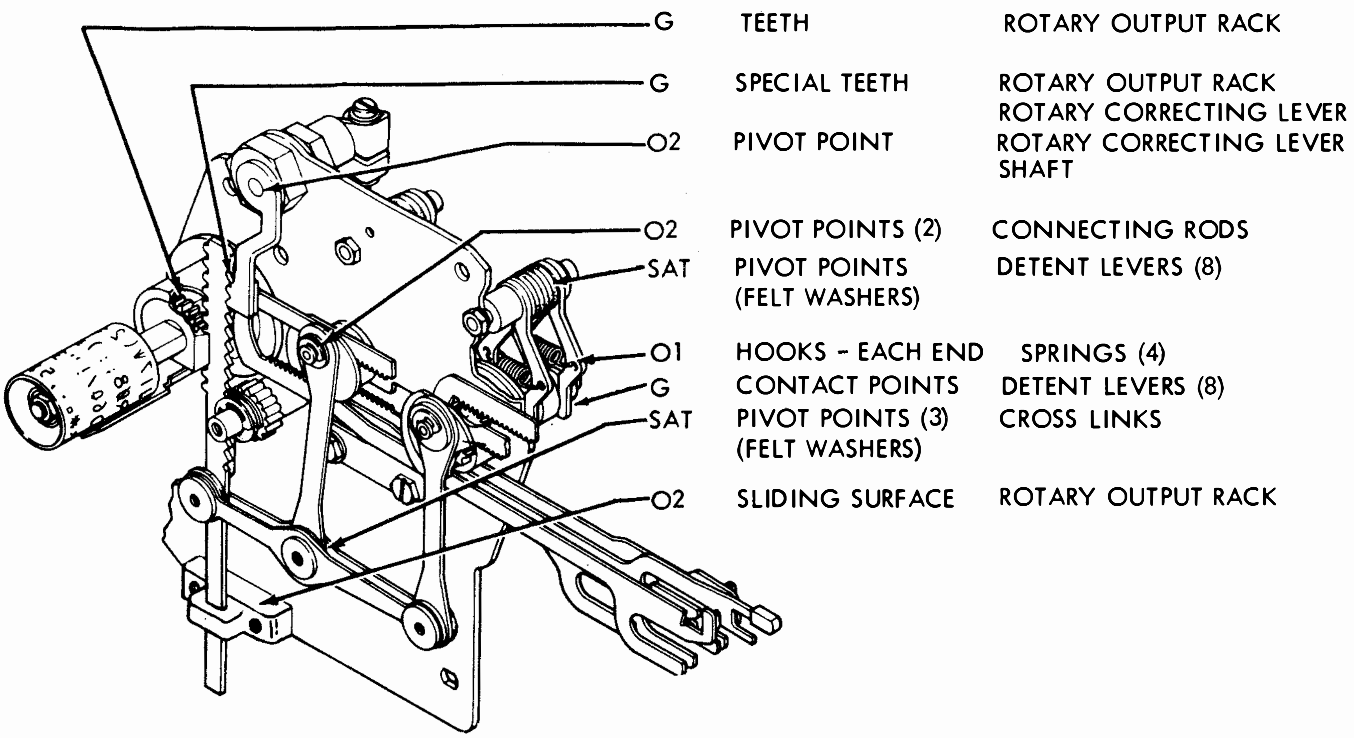
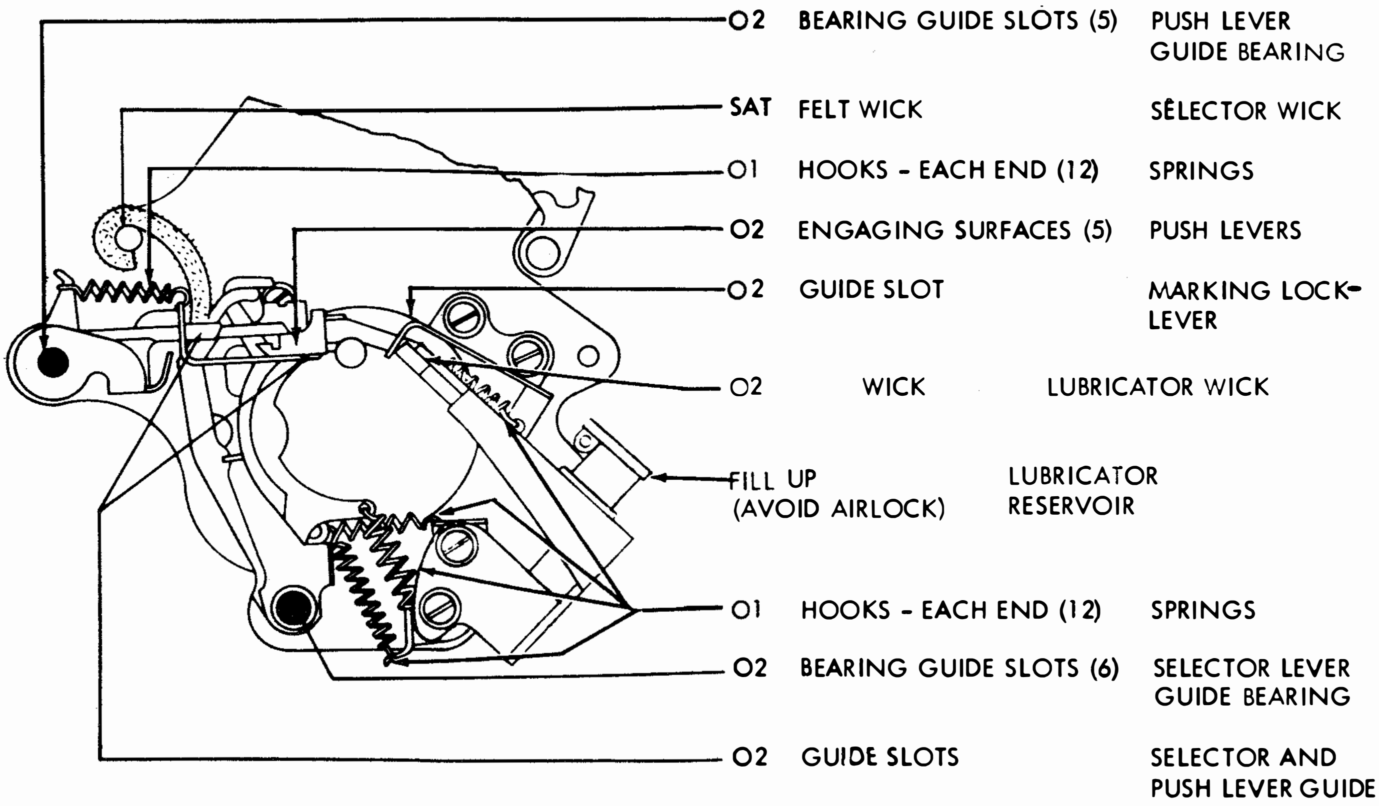


Figure 4-211. Typing Reperforator Unit Components



G	TEETH	ROTARY OUTPUT RACK
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

Figure 4-212. Rotary Positioning Mechanism



O2	BEARING GUIDE SLOTS (5)	PUSH LEVER GUIDE BEARING
SAT	FELT WICK	SELECTOR WICK
O1	HOOKS - EACH END (12)	SPRINGS
O2	ENGAGING SURFACES (5)	PUSH LEVERS
O2	GUIDE SLOT	MARKING LOCK-LEVER
O2	WICK	LUBRICATOR WICK
FILL UP (AVOID AIRLOCK)		LUBRICATOR RESERVOIR
O1	HOOKS - EACH END (12)	SPRINGS
O2	BEARING GUIDE SLOTS (6)	SELECTOR LEVER GUIDE BEARING
O2	GUIDE SLOTS	SELECTOR AND PUSH LEVER GUIDE

Figure 4-213. Selector Mechanism

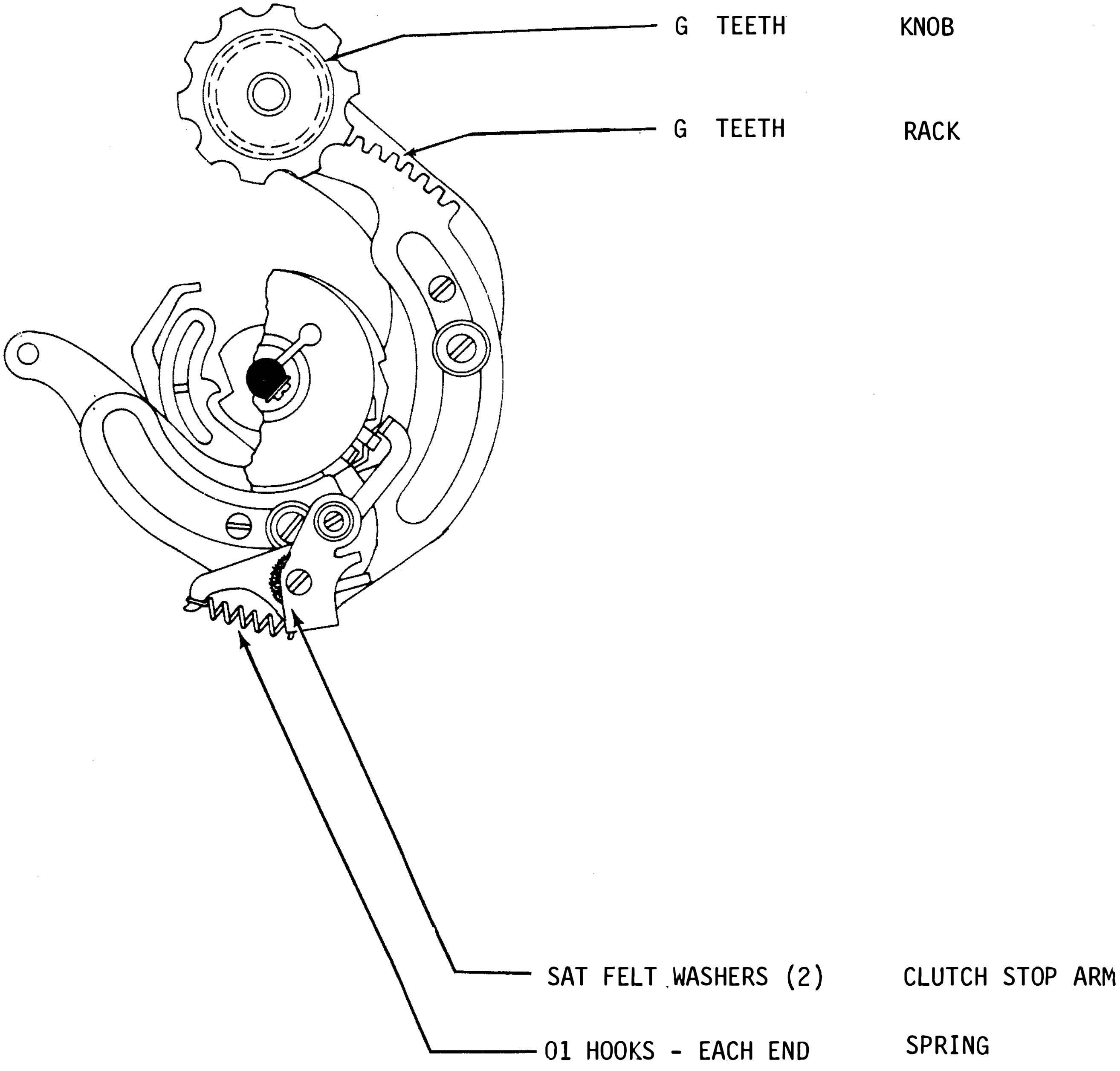


Figure 4-214. Range Finder Mechanism

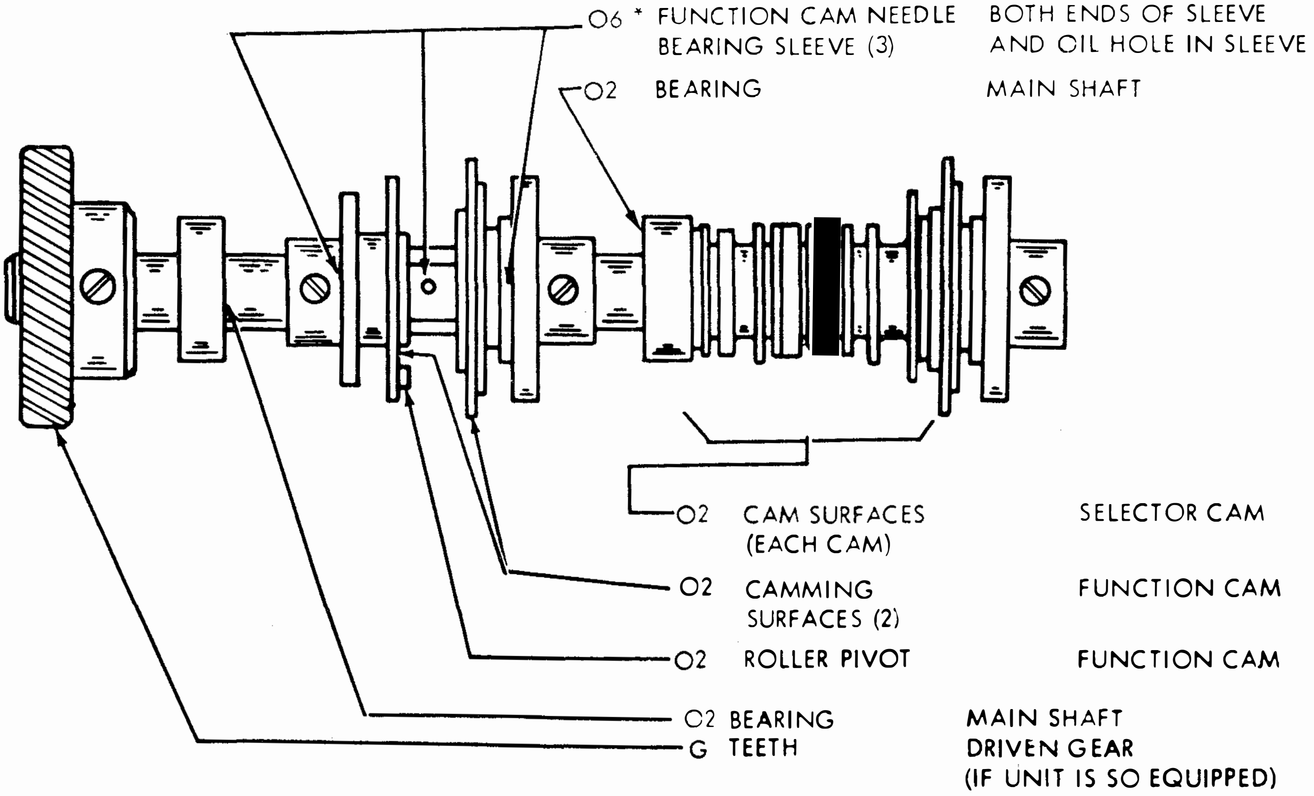


Figure 4-215. Main Shaft Mechanism

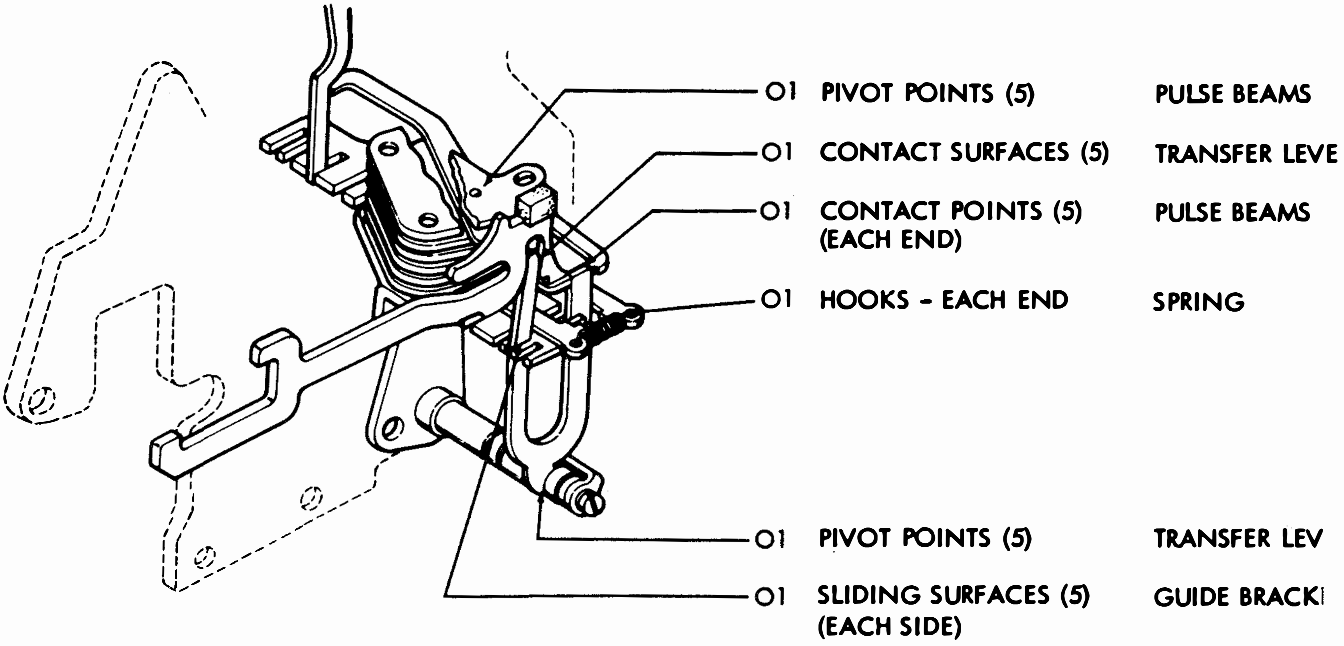


Figure 4-216. Transfer Mechanism

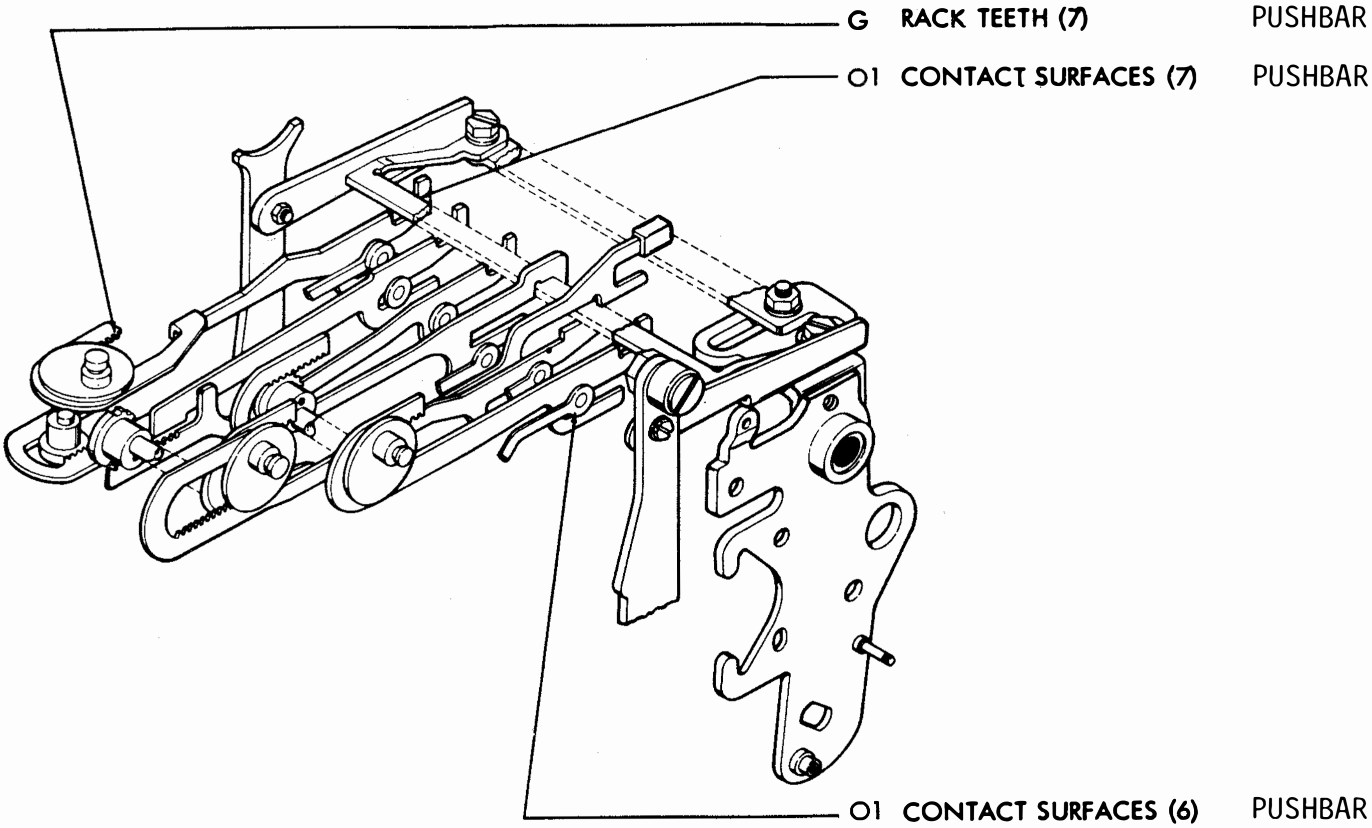


Figure 4-217. Pushbars

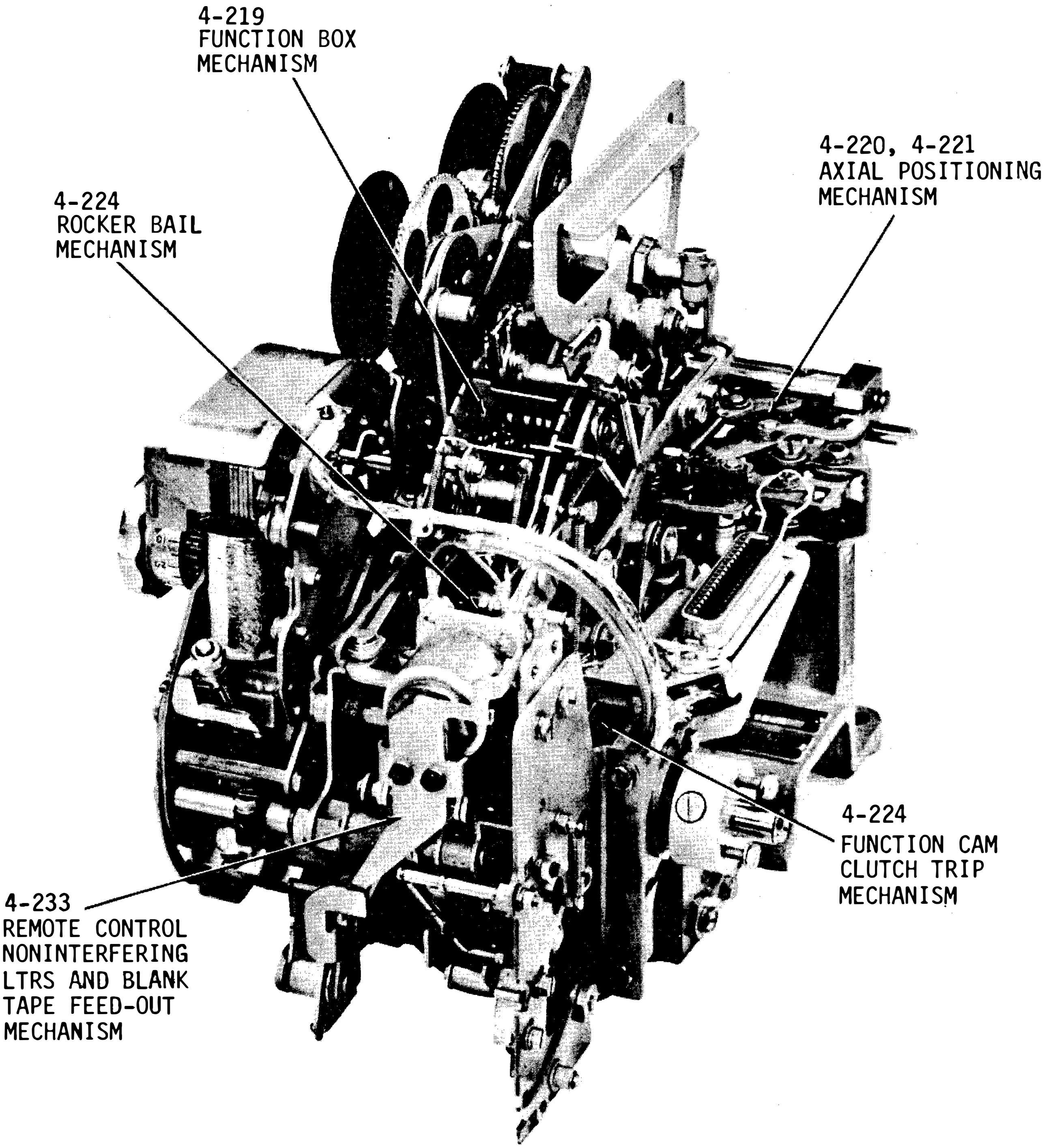


Figure 4-218. Location of Rocker Bail, Function Box, Axial Positioning and Function Cam Clutch Trip Mechanisms on Typing Reperforator Unit

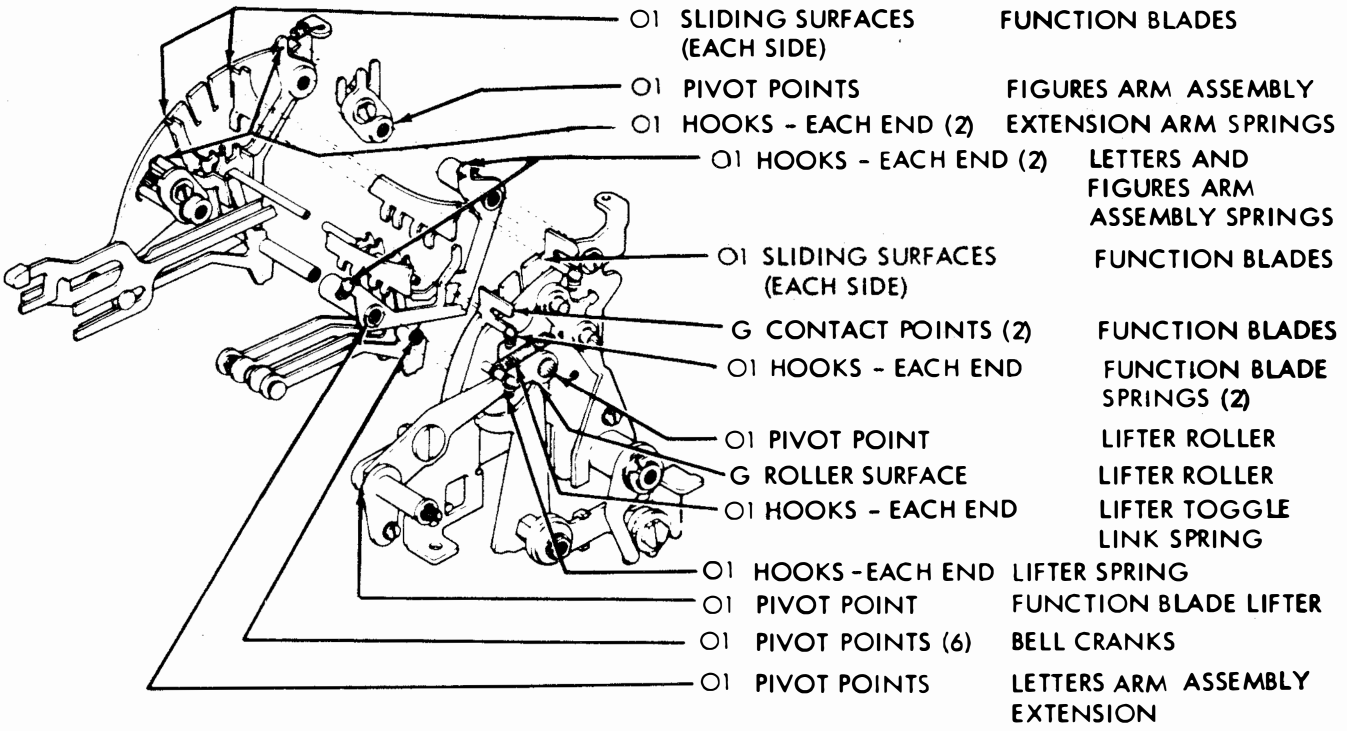


Figure 4-219. Function Box Mechanism

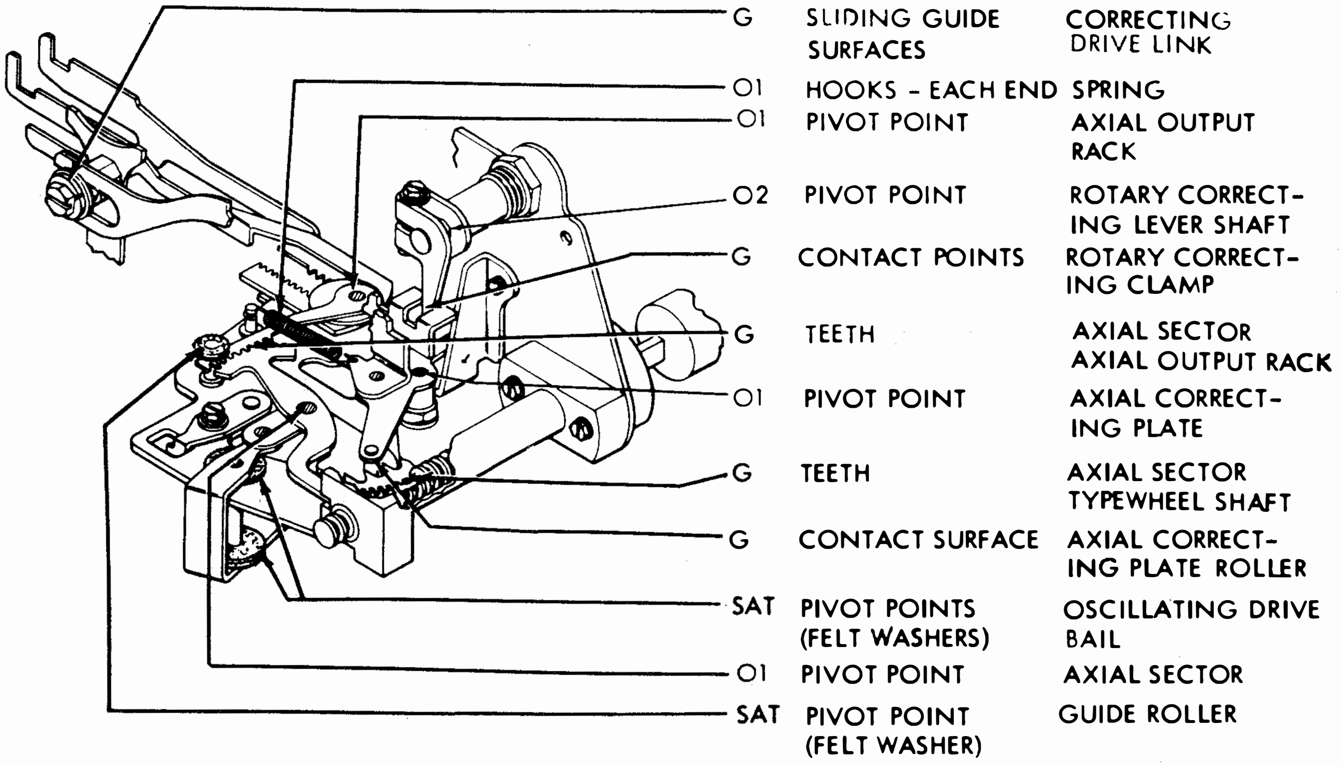


Figure 4-220. Axial Positioning Mechanism

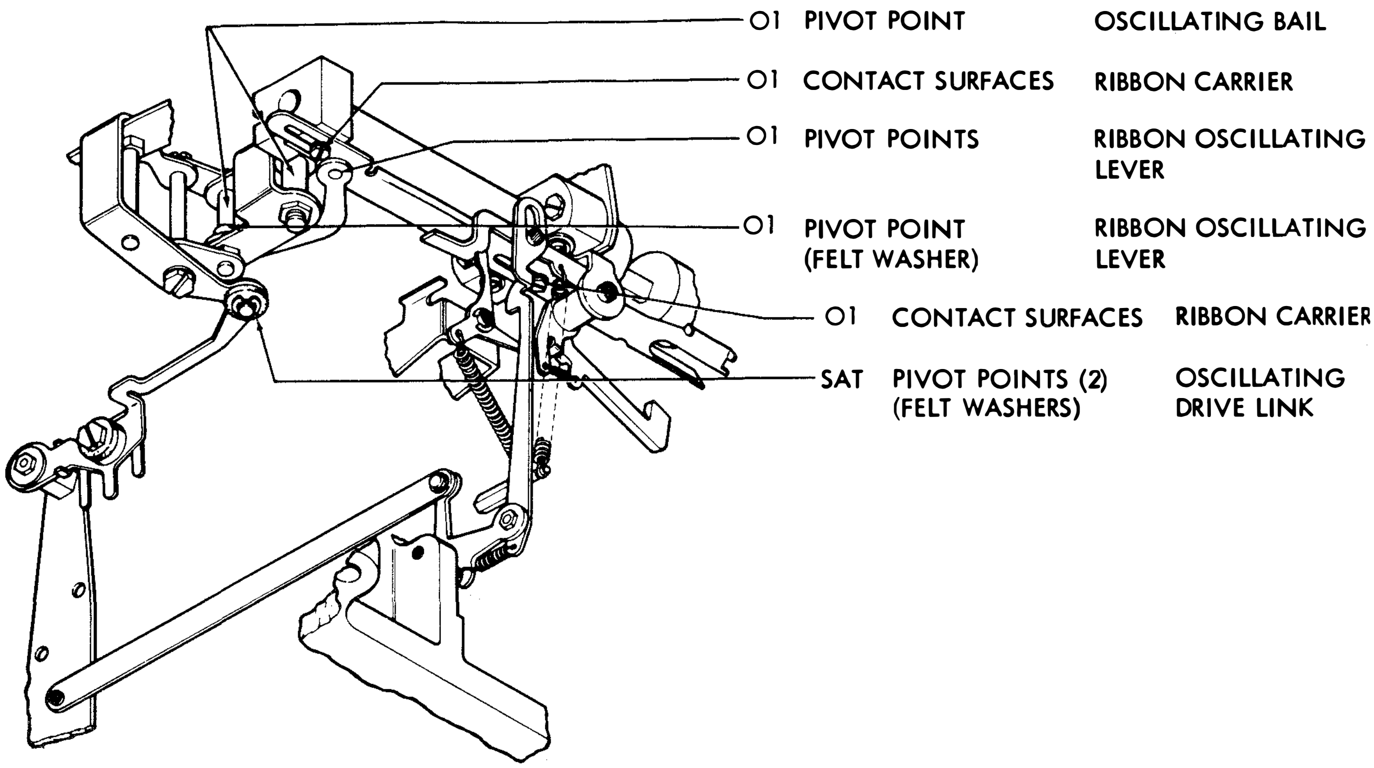


Figure 4-221. Axial Positioning Mechanism, Left Side View

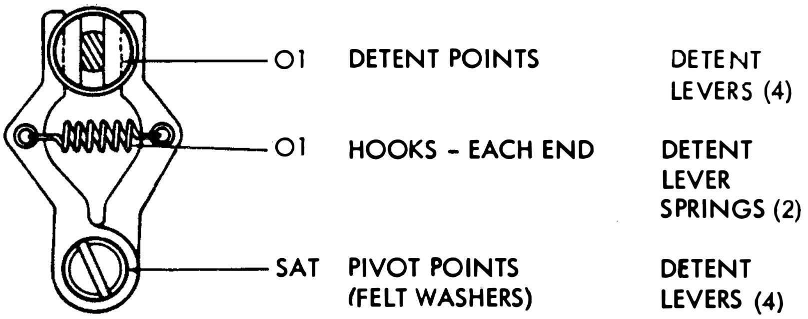


Figure 4-222. Detent Assemblies

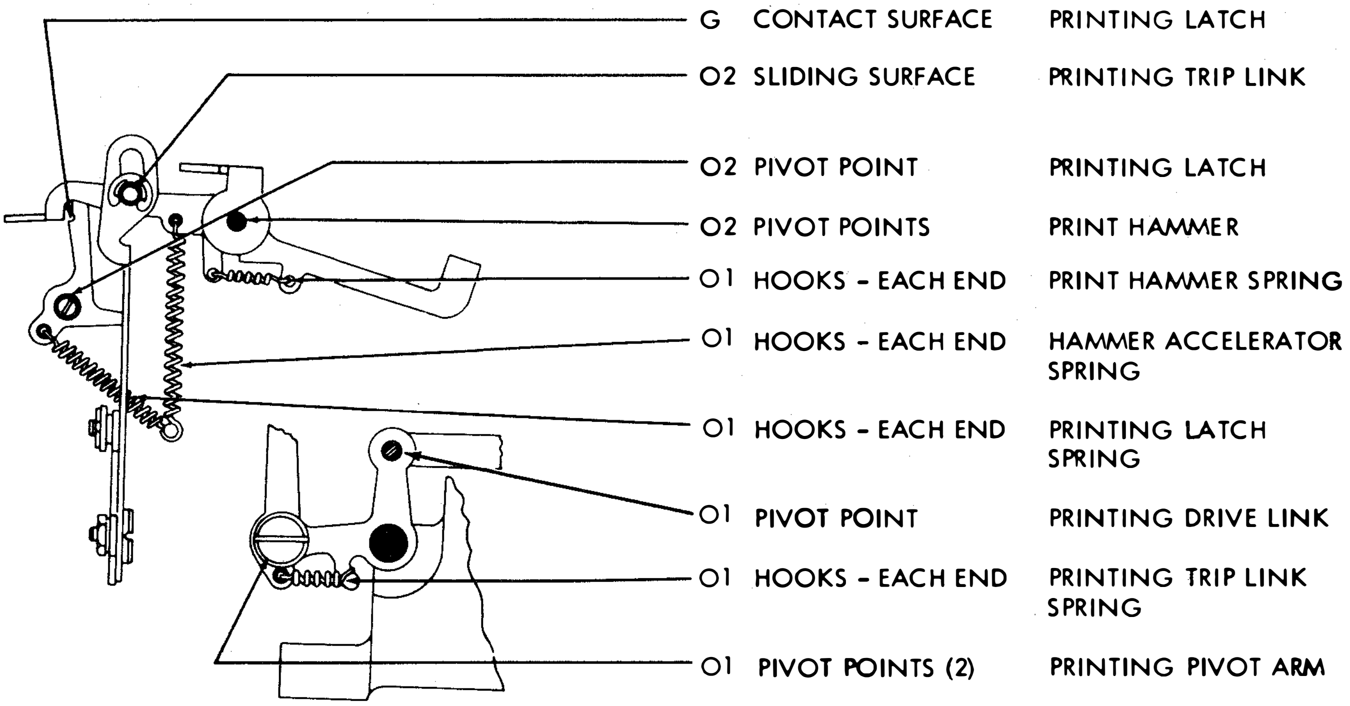


Figure 4-223. Printing Mechanism with Steel Print Hammer, Left Side View

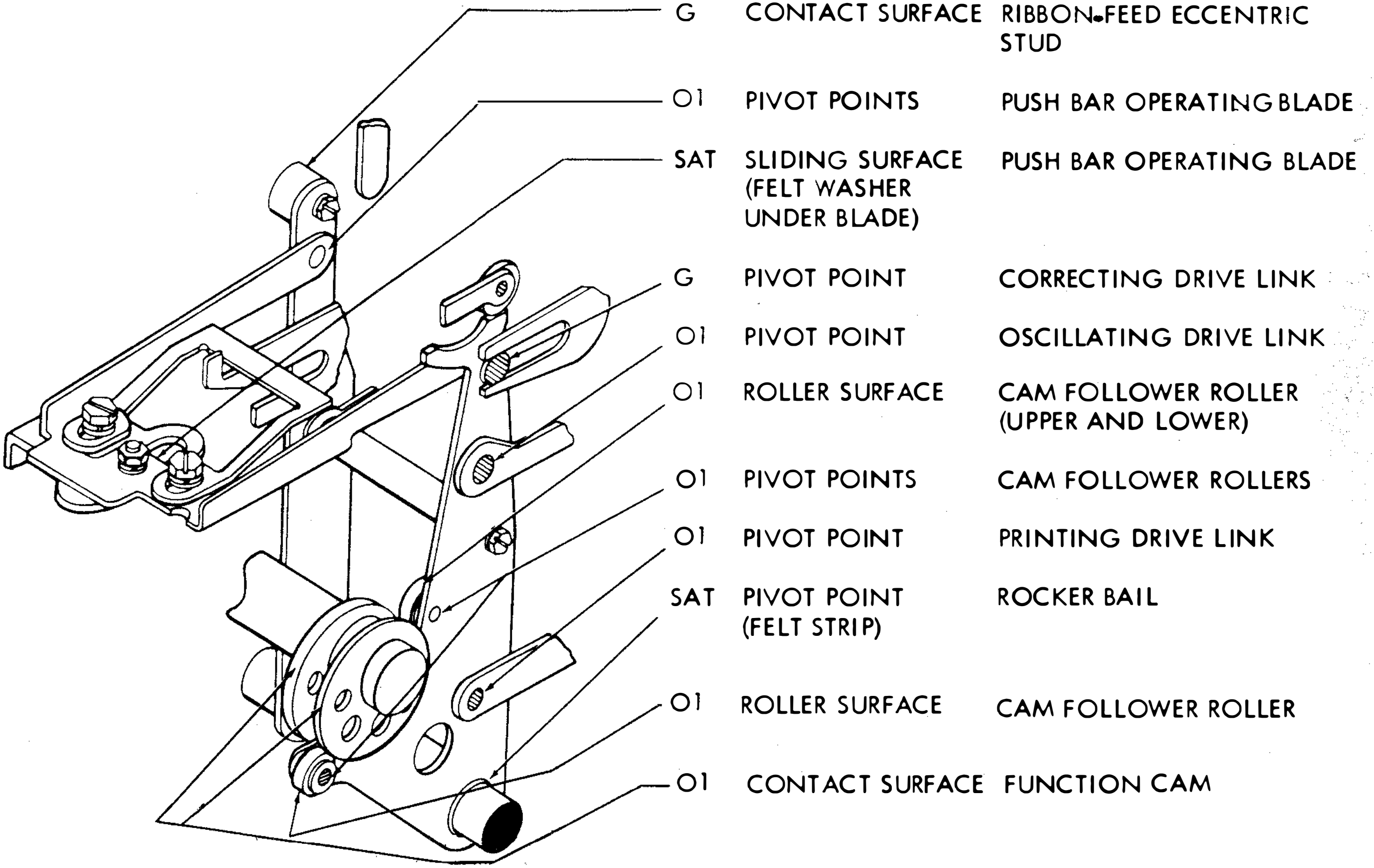


Figure 4-224. Rocker Bail Mechanism, Rear View

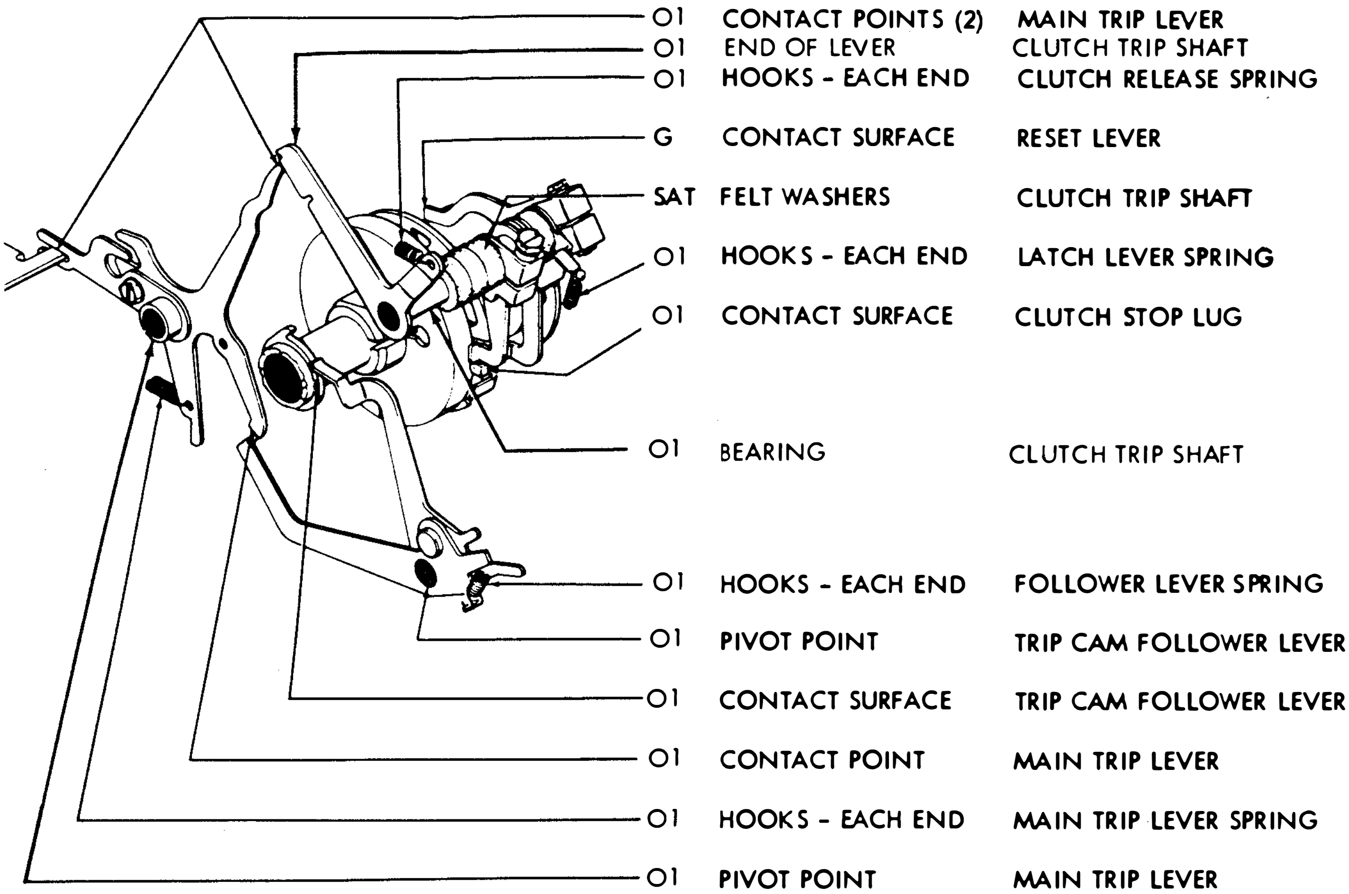


Figure 4-225. Function Cam Clutch Trip Mechanism

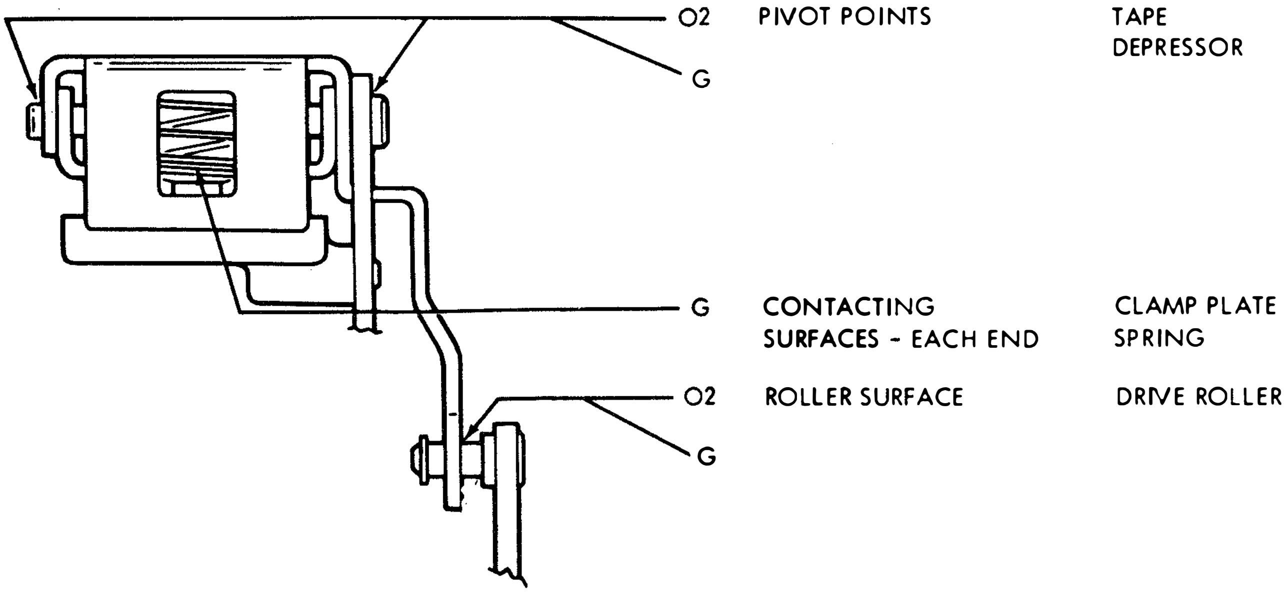


Figure 4-226. Slack Tape Mechanism

*IF FUNCTION CAM NEEDLE BEARINGS ARE DISASSEMBLED AT ANY TIME, REPACK BEARINGS WITH GREASE (BEACON 325) (TP195298) OR ITS EQUIVALENT

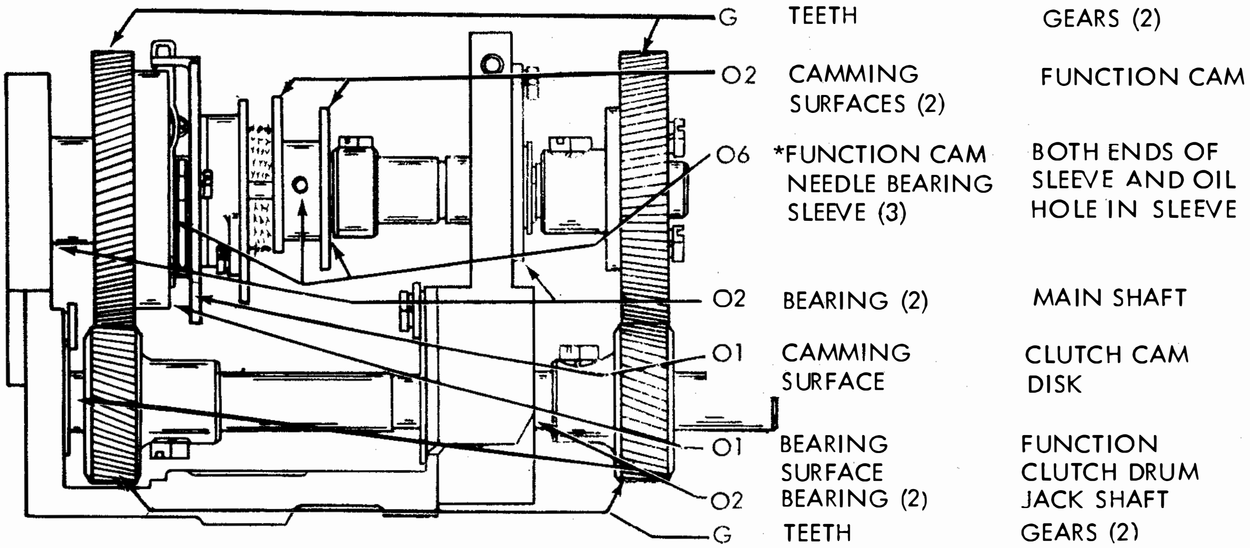


Figure 4-227. Main Shaft and Jack Shaft (Two-Shaft Unit)

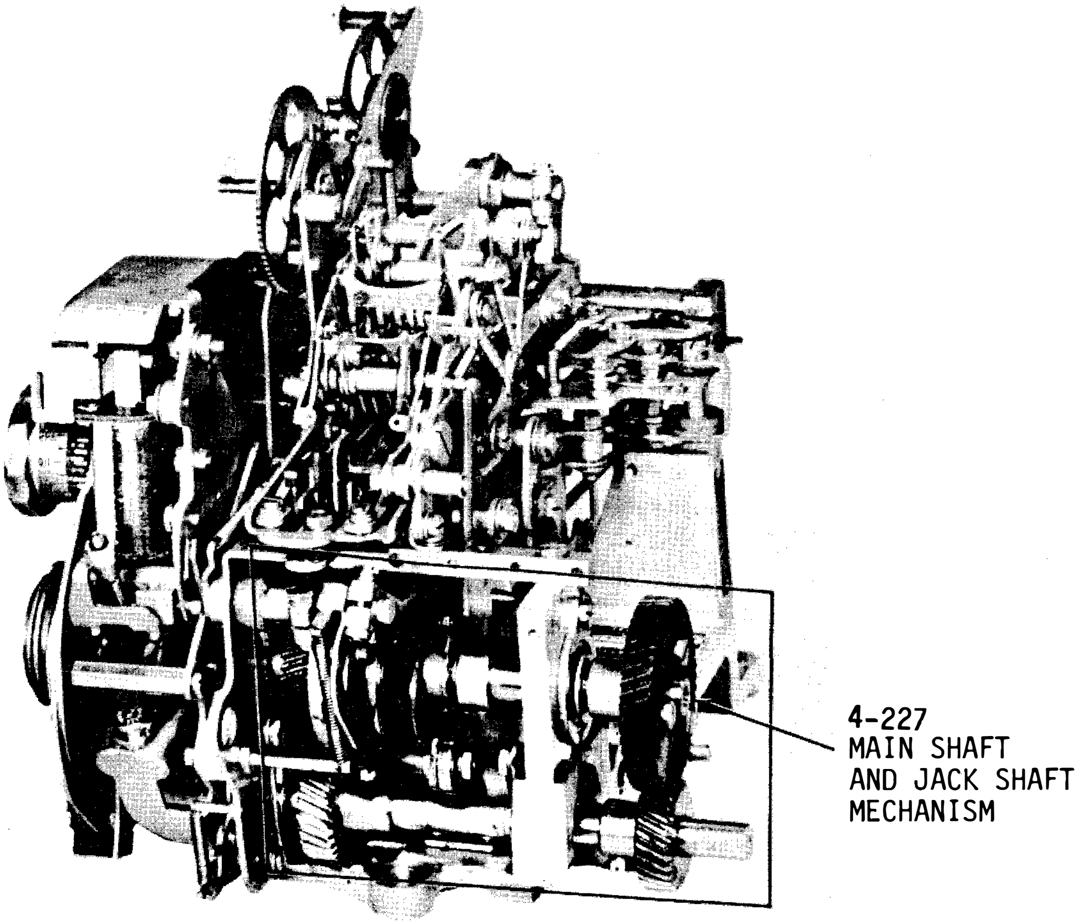


Figure 4-228. Main Shaft and Jack Shaft Location on ASR 28 Typing Reperforator Unit

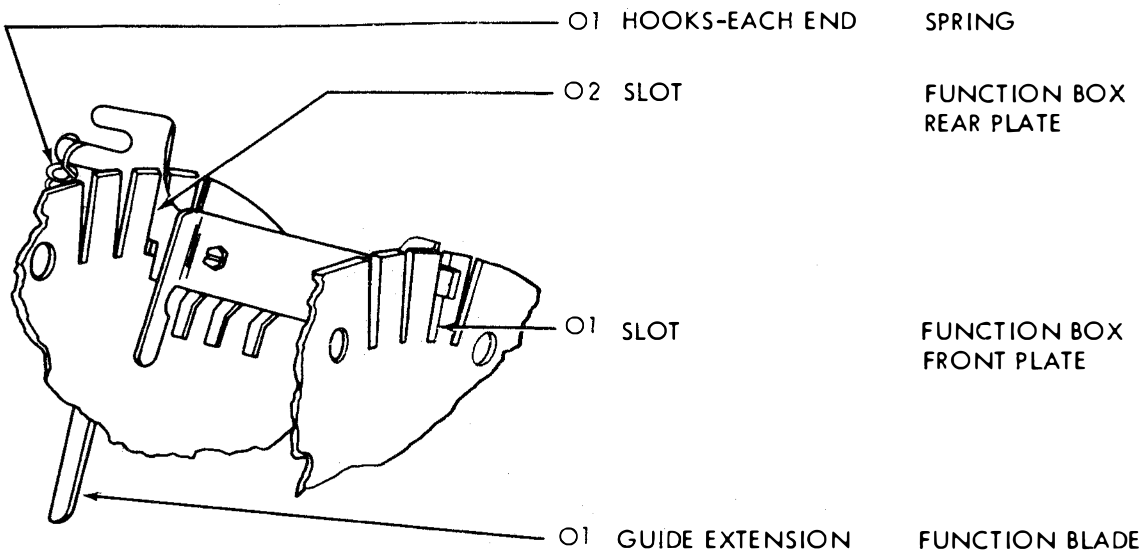


Figure 4-229. Unshift-on-Space Mechanism

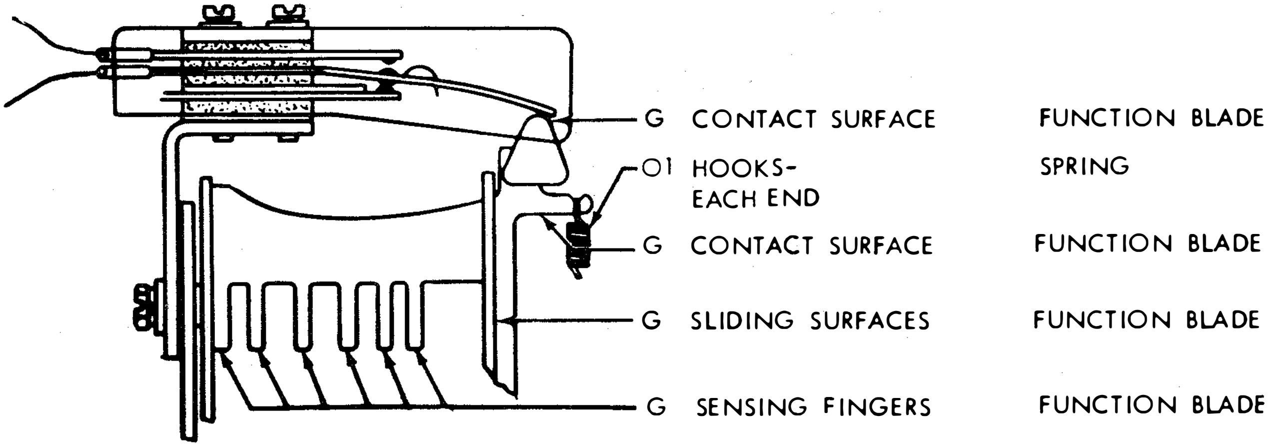


Figure 4-230. Signal Bell Contact Mechanism, Right Side View

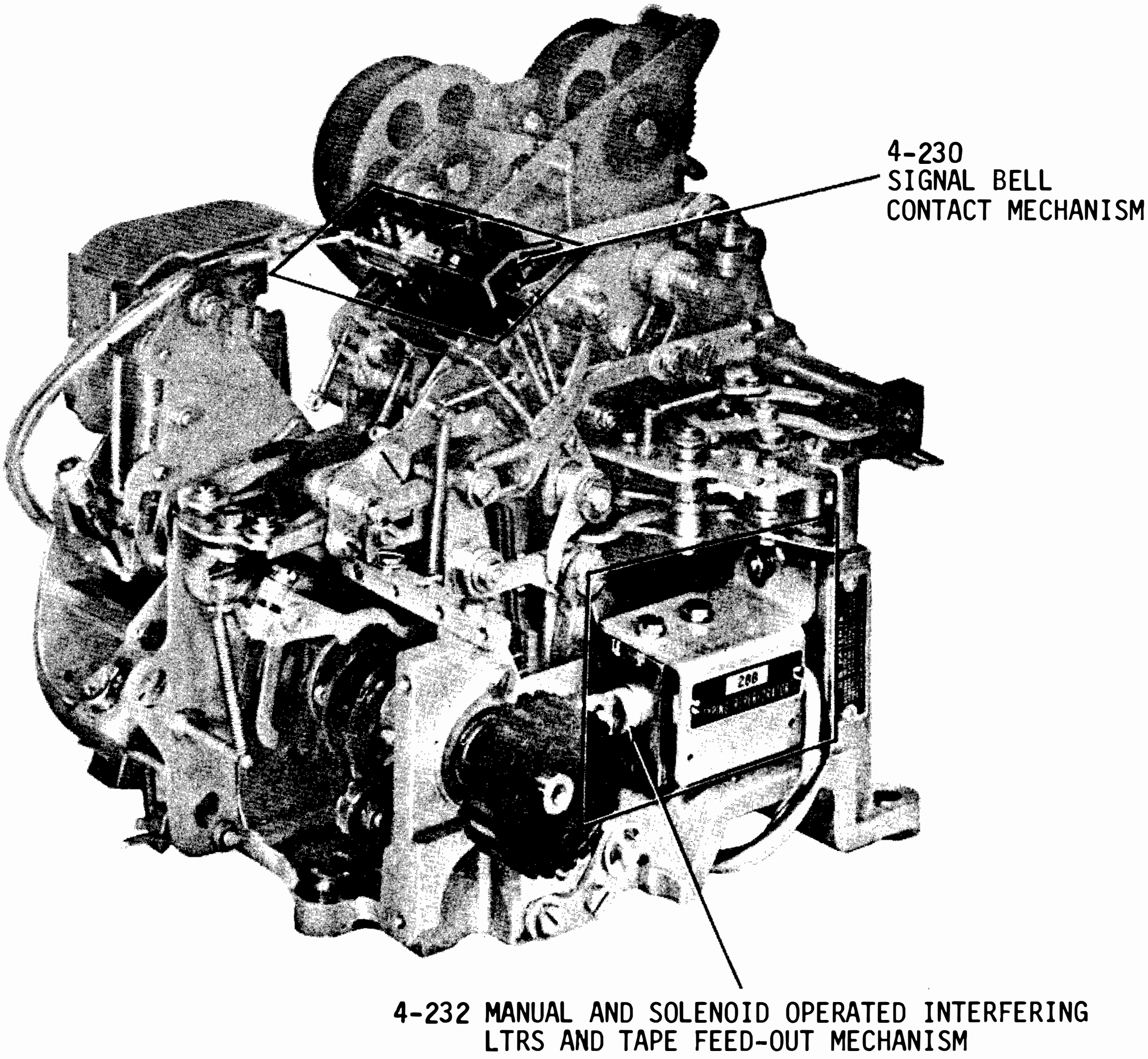


Figure 4-231. Manual and Solenoid Operated Interfering LTRS Tape Feed-Out Mechanism and Signal Bell Mechanism Area

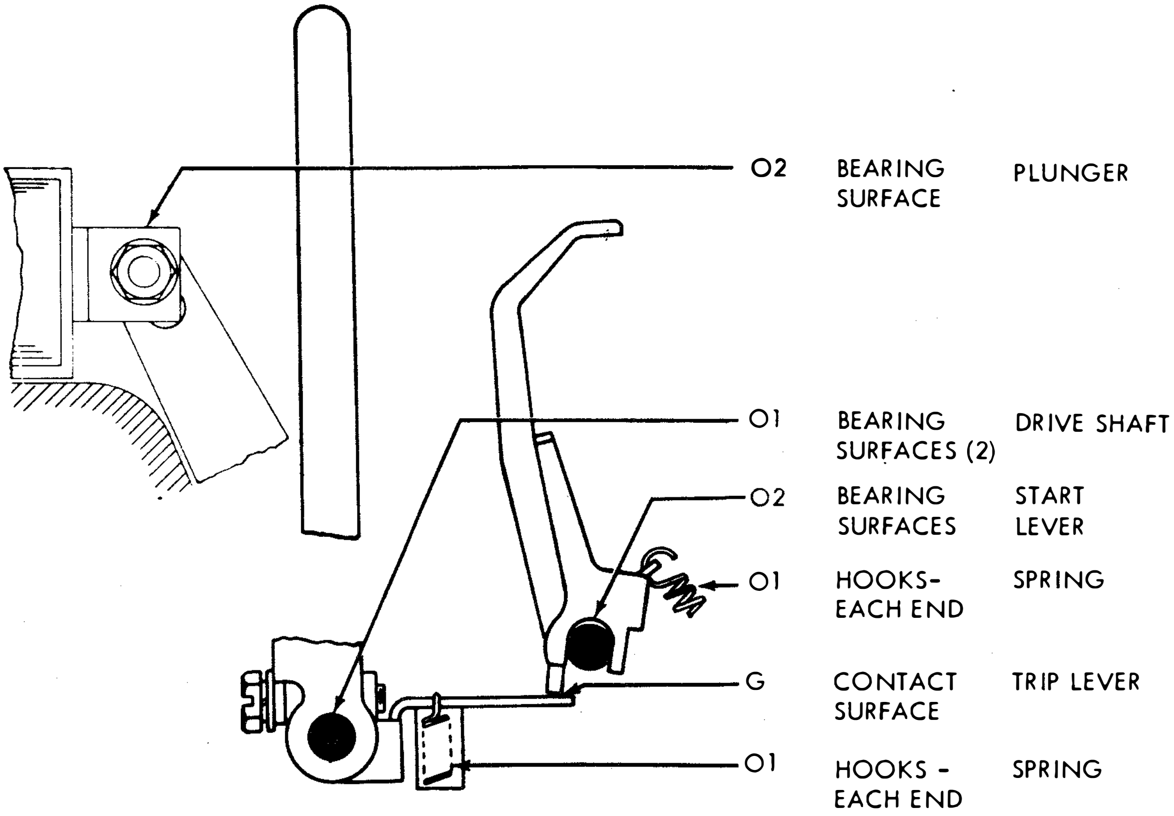


Figure 4-232. Manual and Solenoid Operated Interfering LTRS Tape Feed-Out Mechanism, Drive Shaft and Trip Lever Lubrication Points

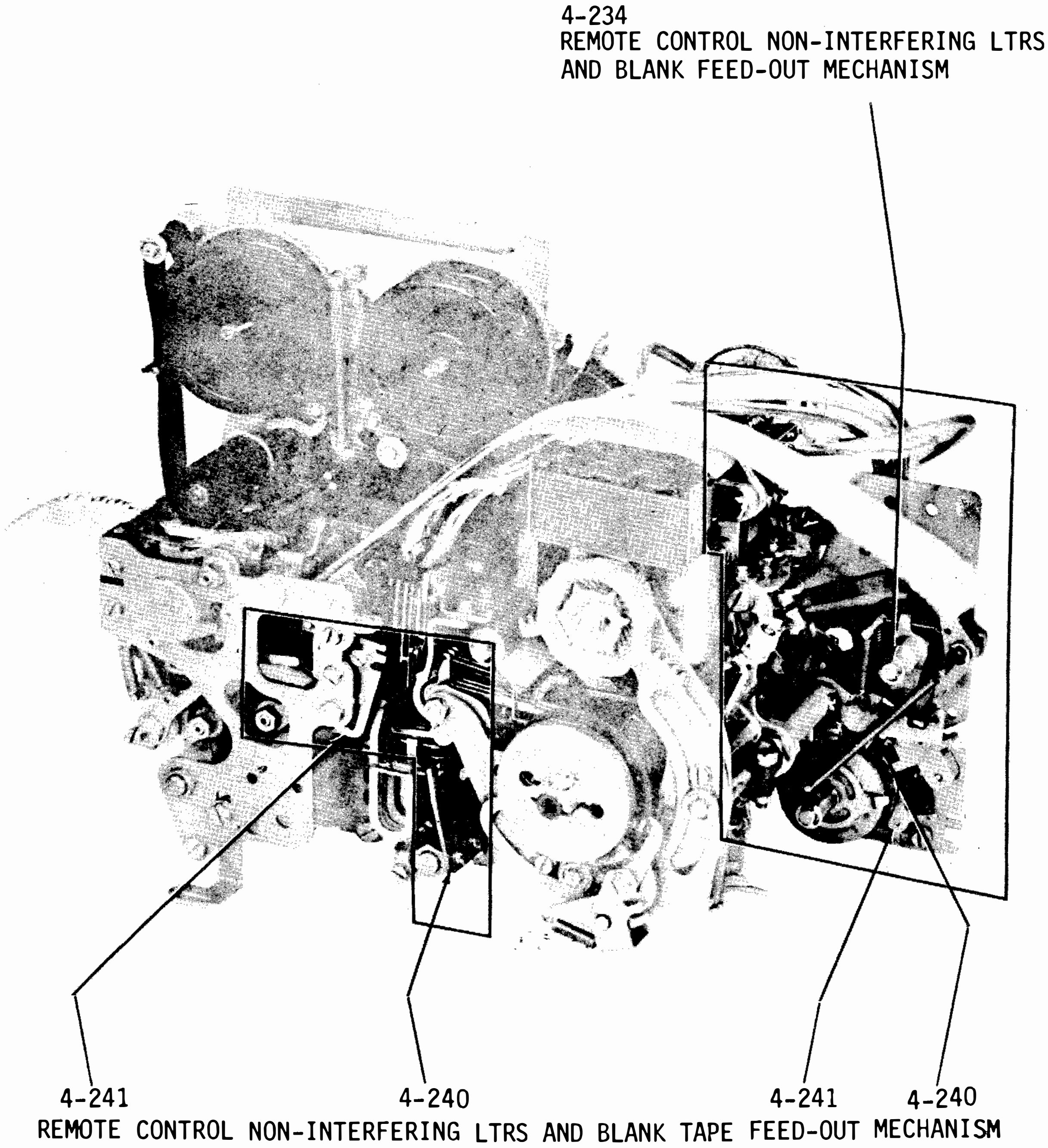


Figure 4-233. Remote Control Non-Interfering LTRS Tape Feed-Out Mechanism

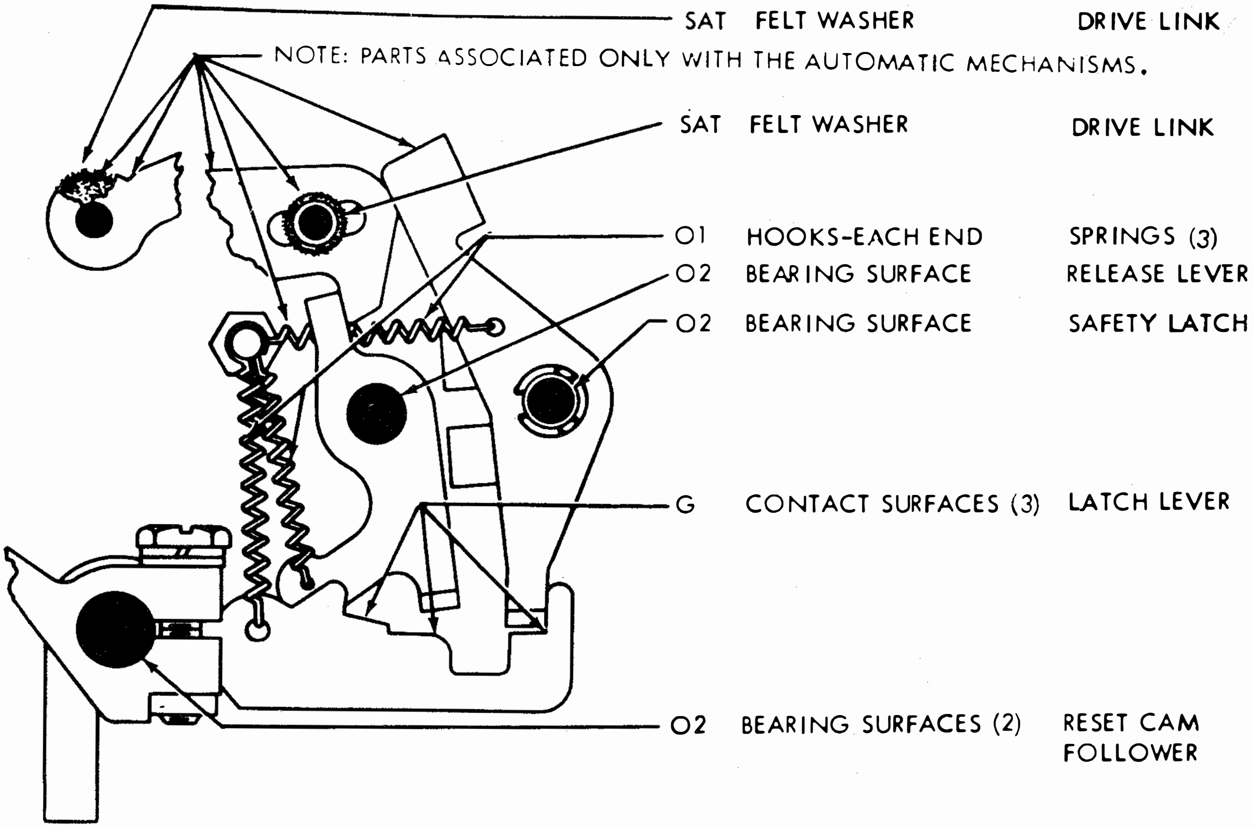
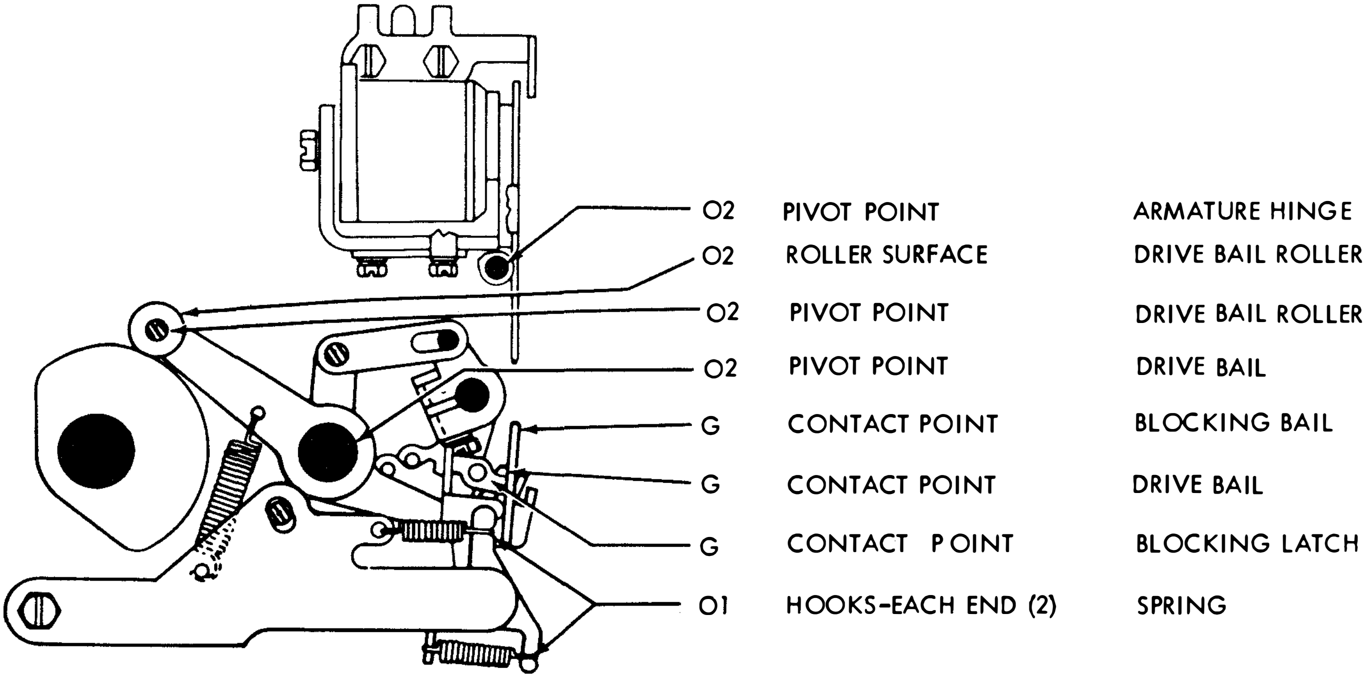


Figure 4-234. Remote Control Non-Interfering LTPS and BLANK Tape Feed-Out Mechanisms



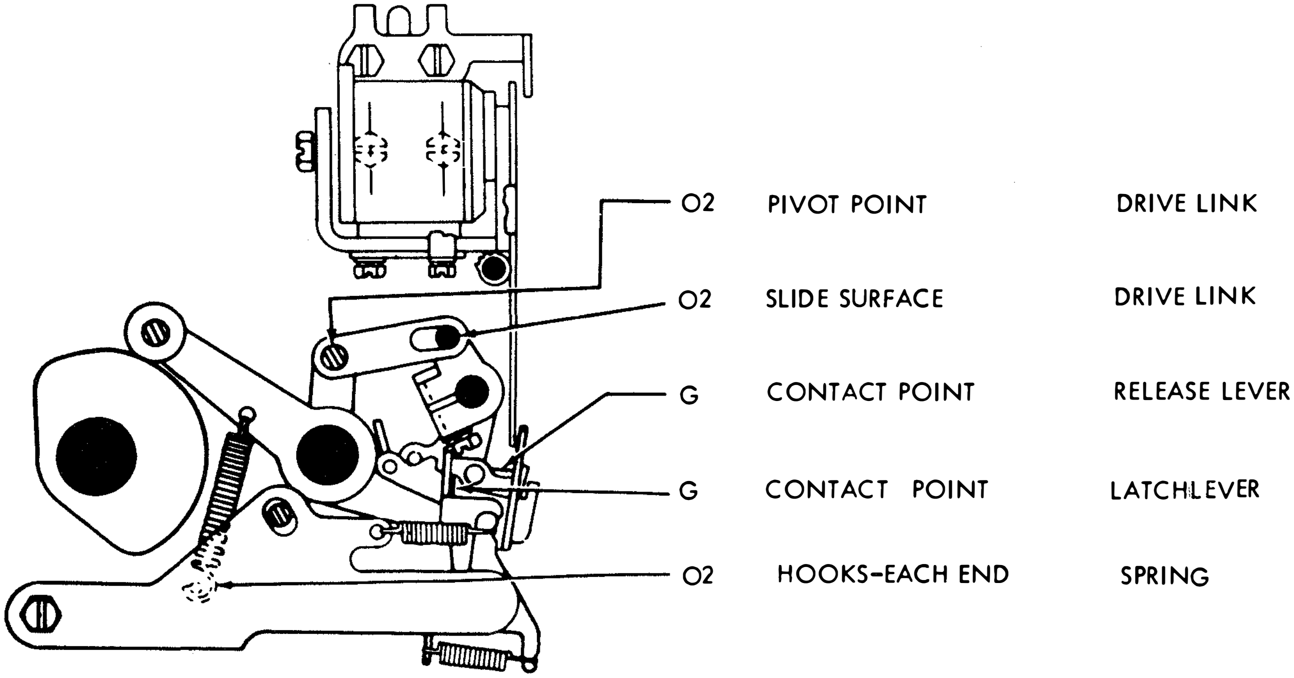


Figure 4-235. Remote Control Non-Interfering LTRS and BLANK Tape Feed-Out Mechanism, Points of Lubrication

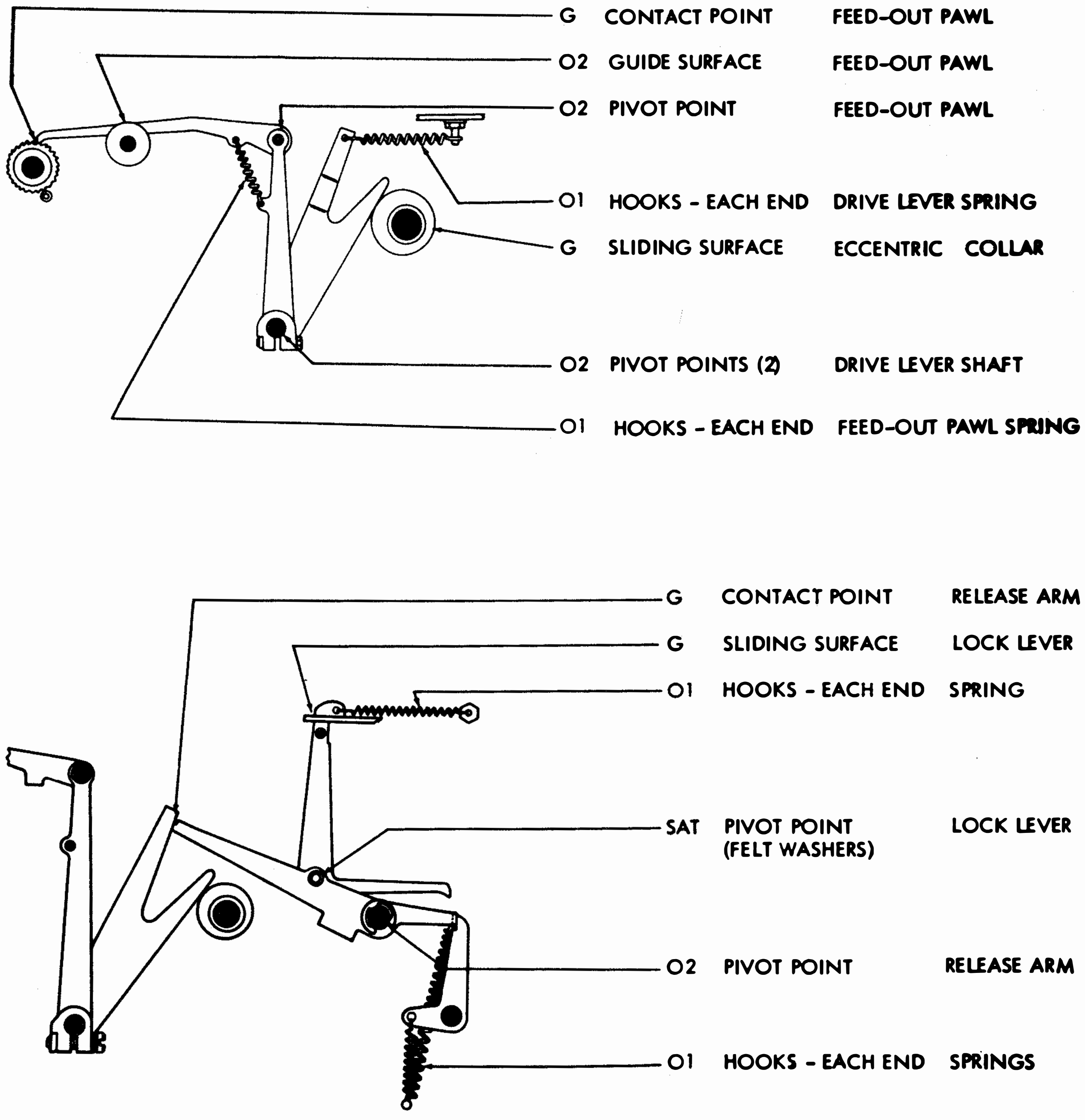


Figure 4-236. Feed-Out Pawl, Drive Lever, and Locklever on Remote Control Non-Interfering BLANK Tape Feed-Out Mechanism, Early Design

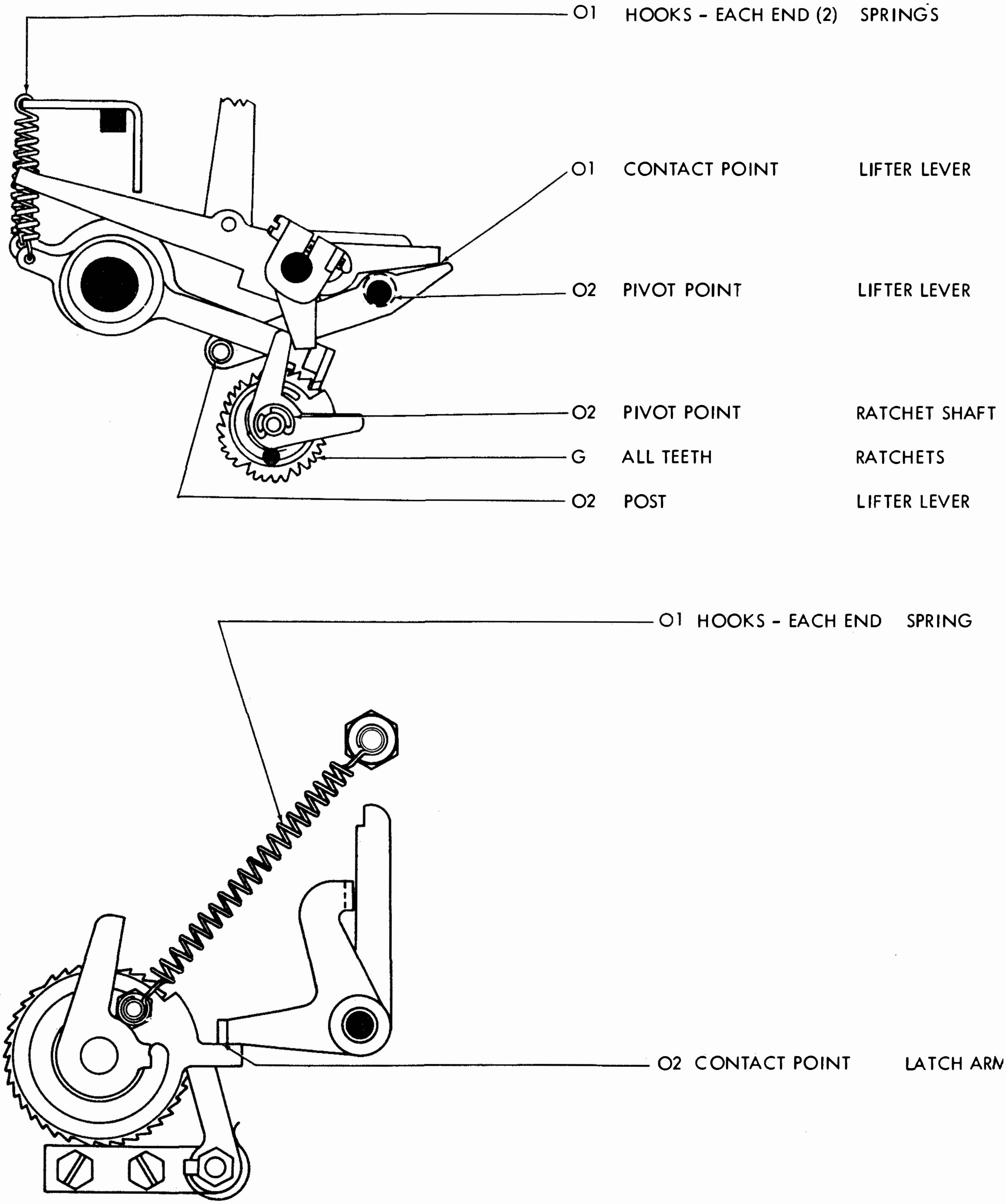


Figure 4-237. Lifter Lever, Ratchet Lever, and Latch Arm on Remote Control Non-Interfering BLANK Tape Feed-Out Mechanism, Early Design

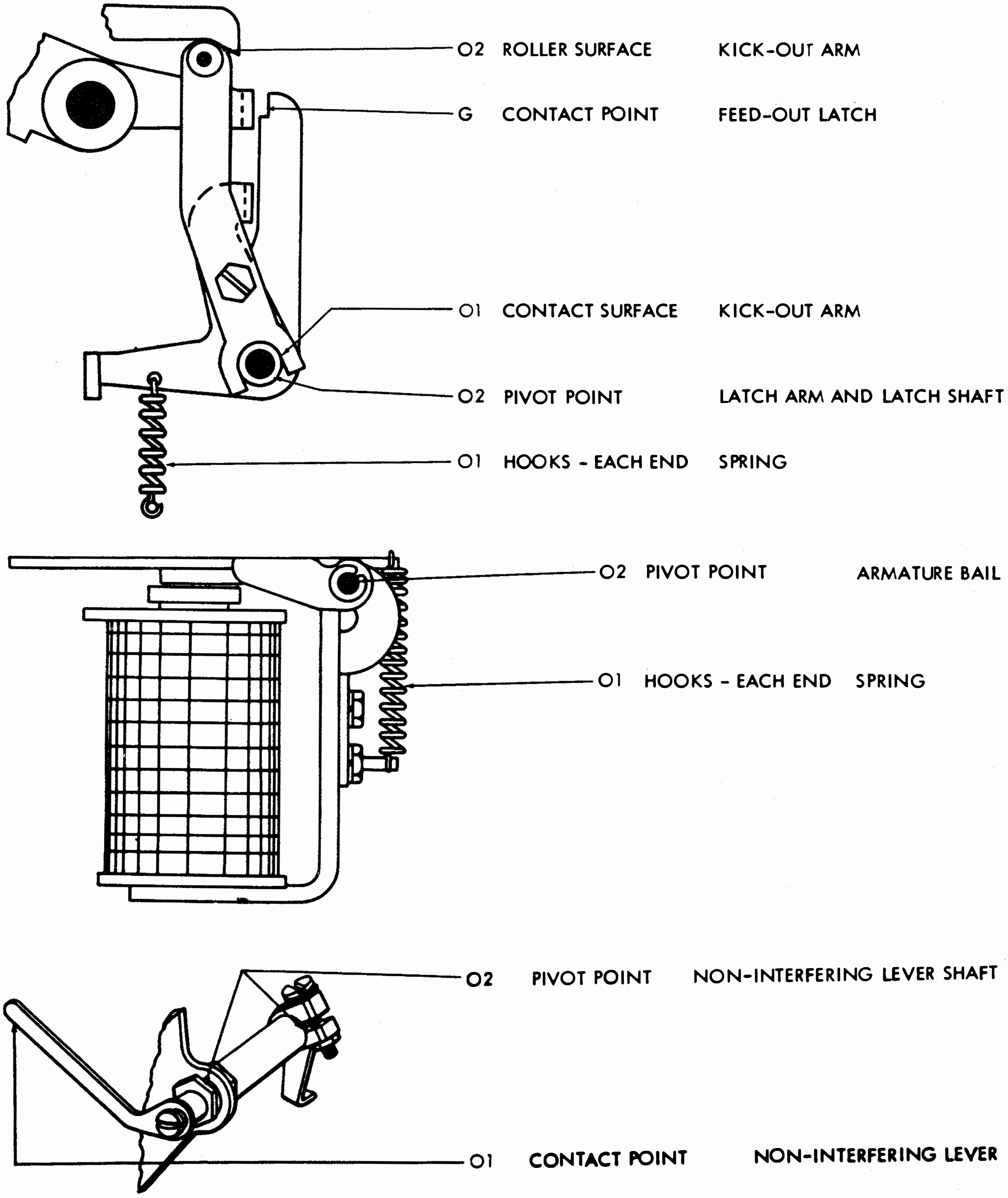


Figure 4-238. Kick-Out Arm, Armature Bail, and Lever Shaft on Remote Control Non-Interfering BLANK Tape Feed-Out Mechanism, Early Design

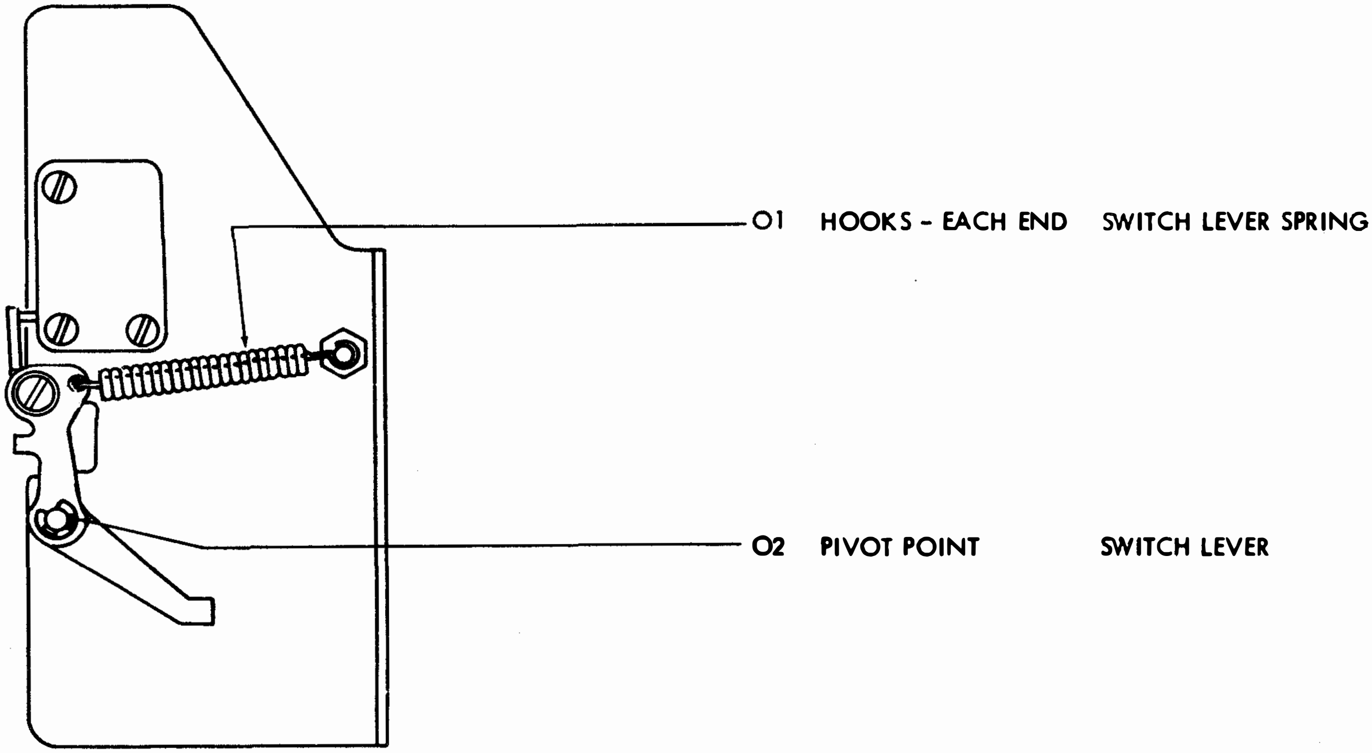


Figure 4-239. Switch Lever and Spring on Remote Non-Interfering BLANK Tape Feed-Out Mechanism, Early Design

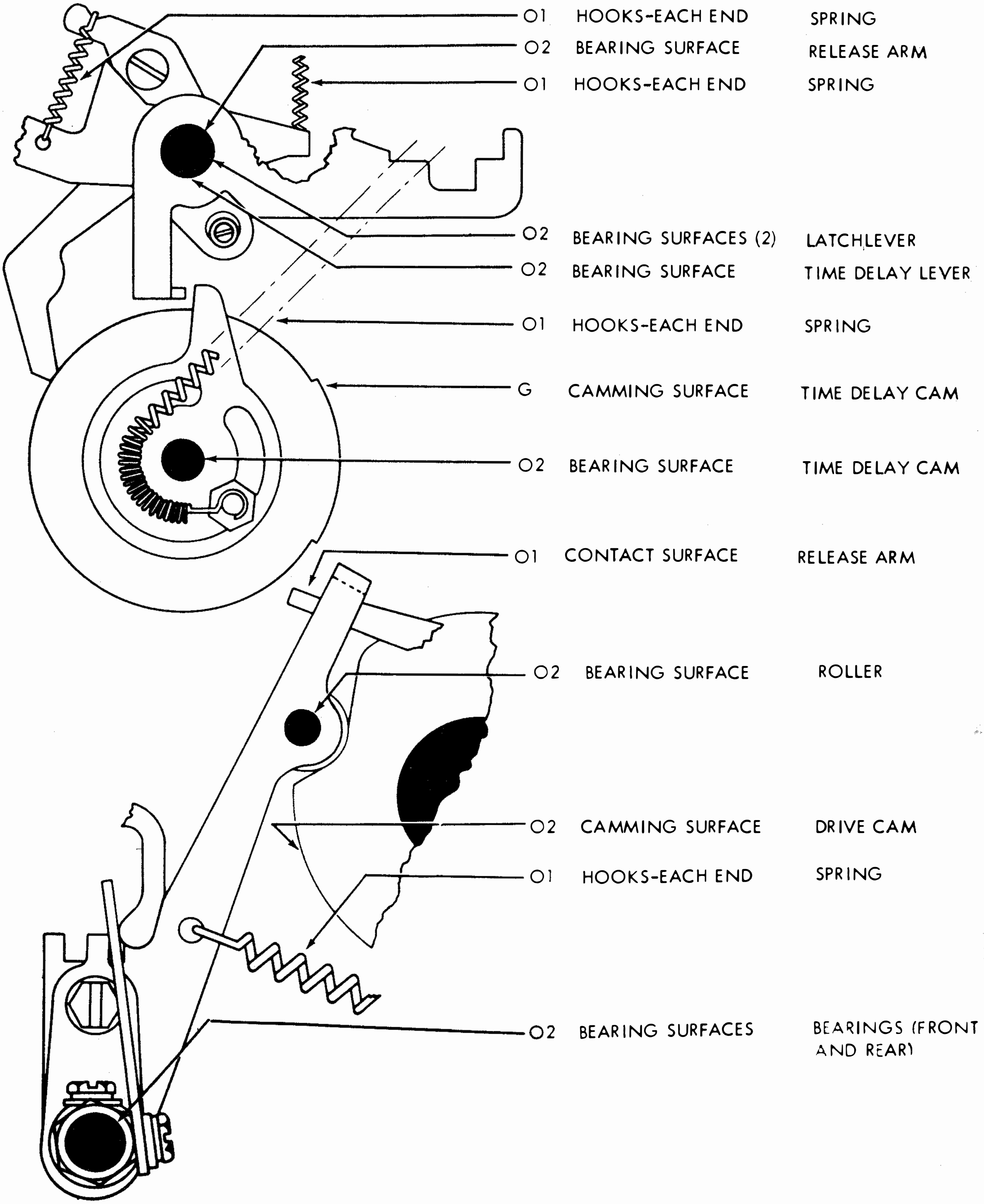


Figure 4-240. Remote Control Non-Interfering BLANK Tape Feed-Out Mechanisms, Later Design

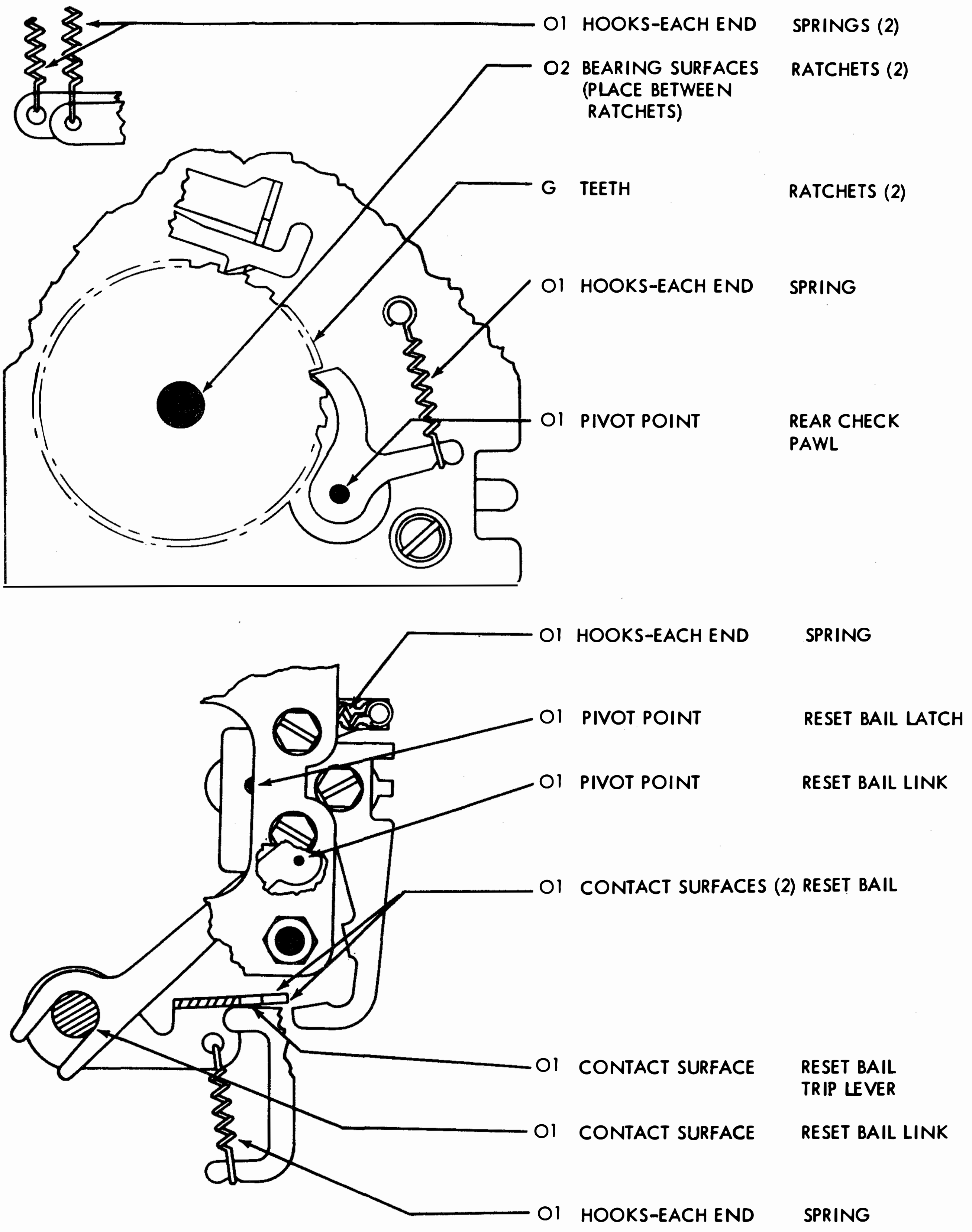


Figure 4-241. Remote Control Non-Interfering BLANK Tape Feed-Out Mechanisms, Component Lubrication Points

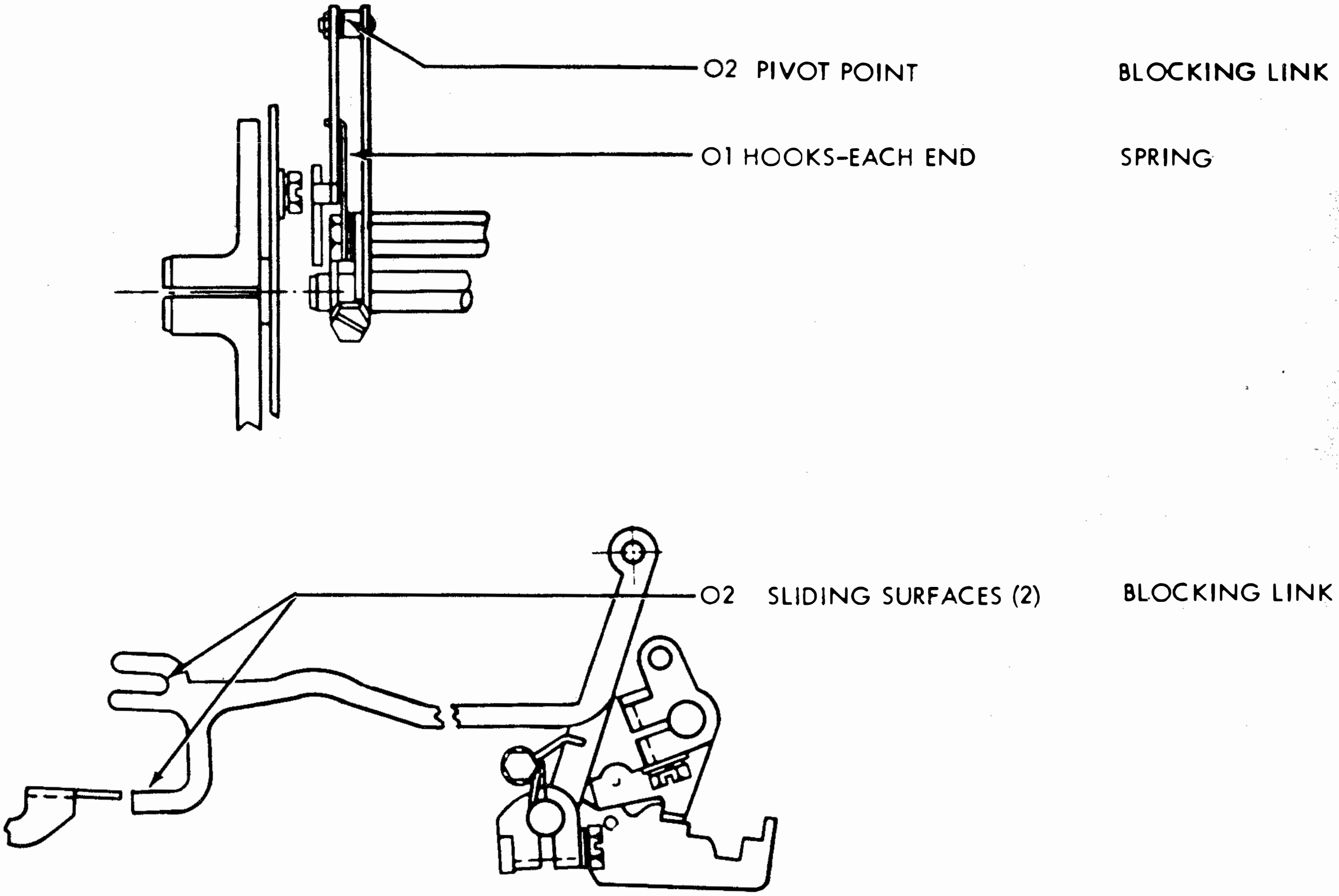


Figure 4-242. Blocking Link on Remote Control Non-Interfering BLANK Tape Feed-Out Mechanisms

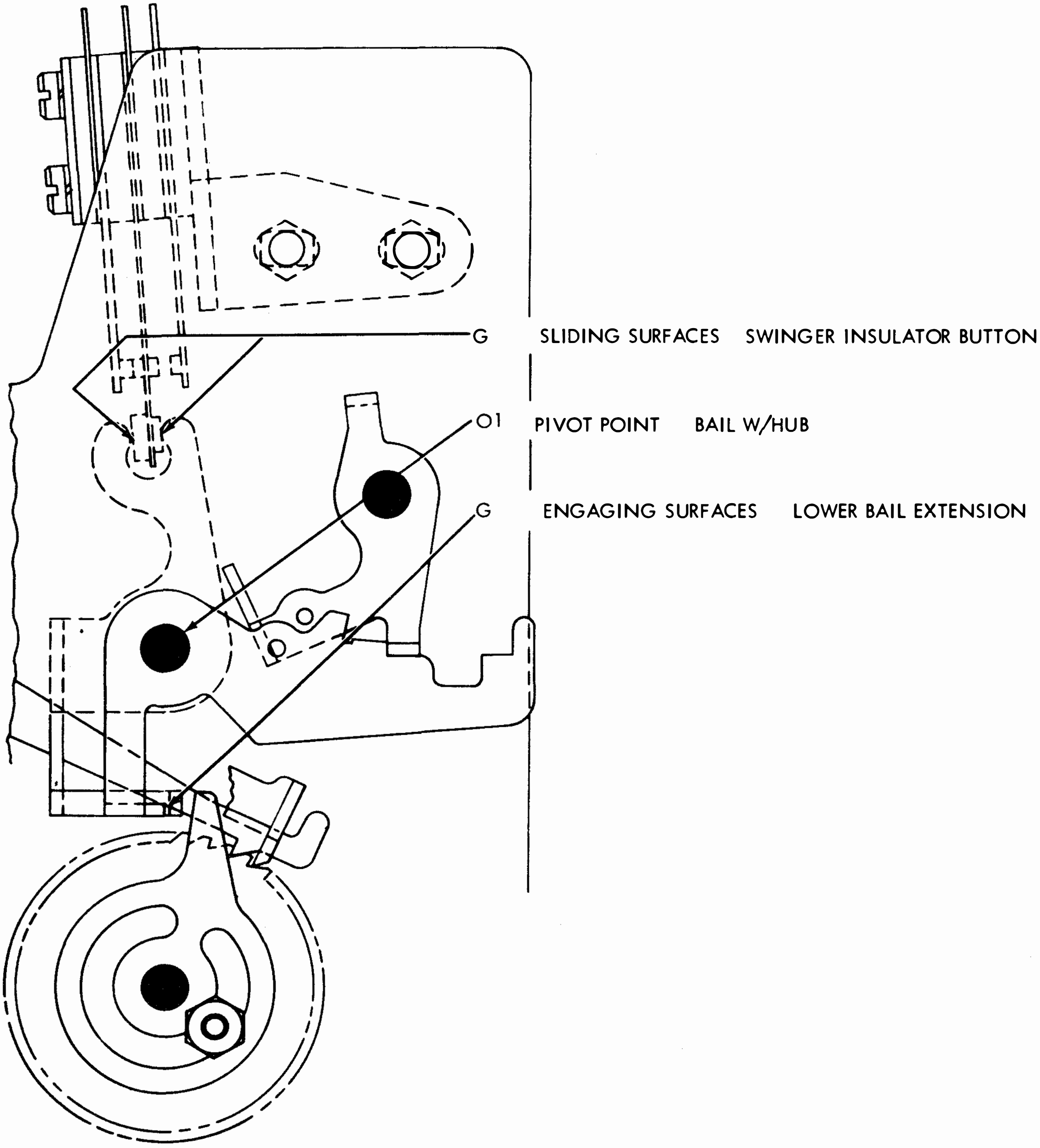


Figure 4-243. End of Tape Feed-Out Timing Contacts for Non-Interfering LTRS and BLANK Tape Feed-Out Mechanism

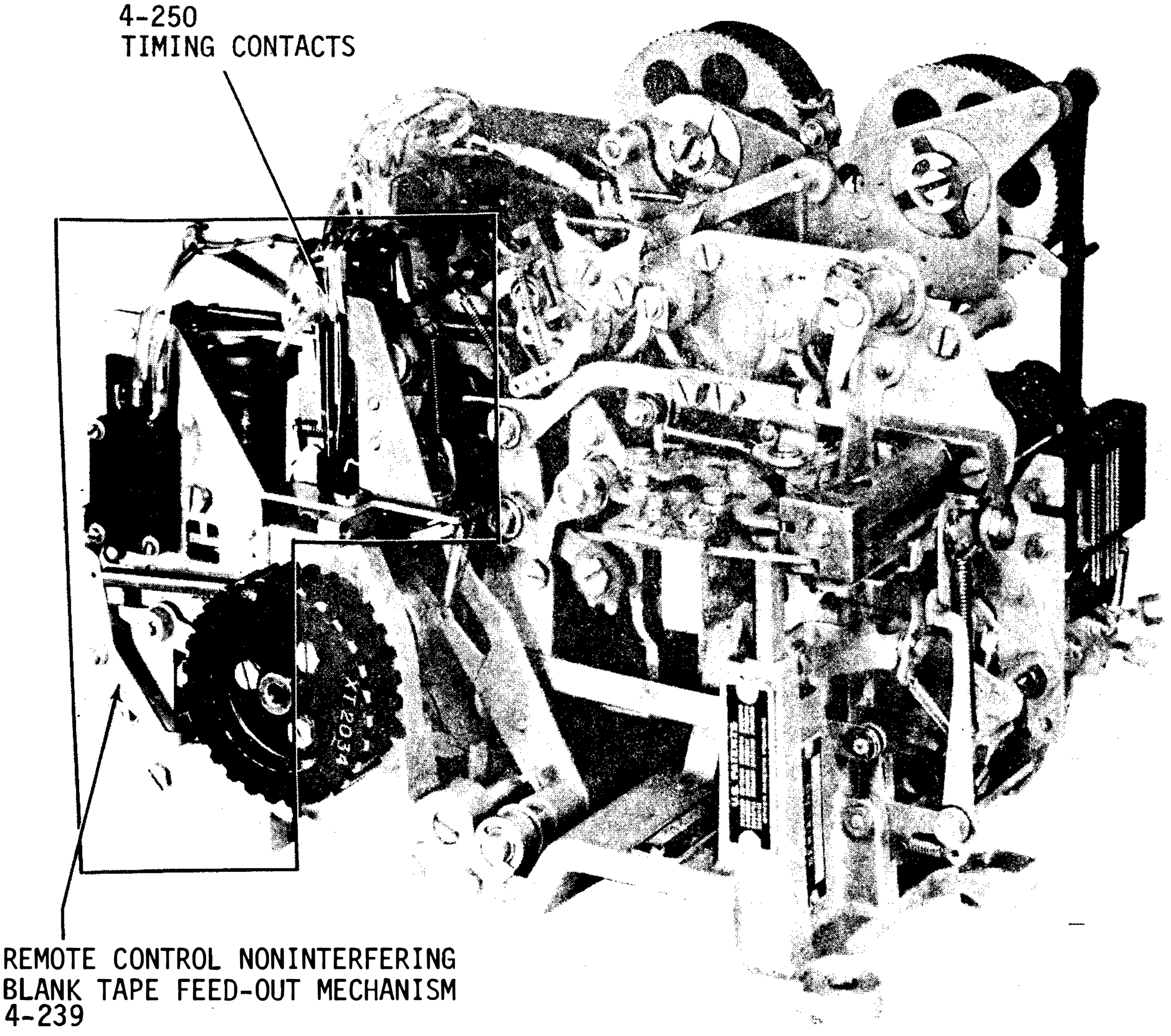
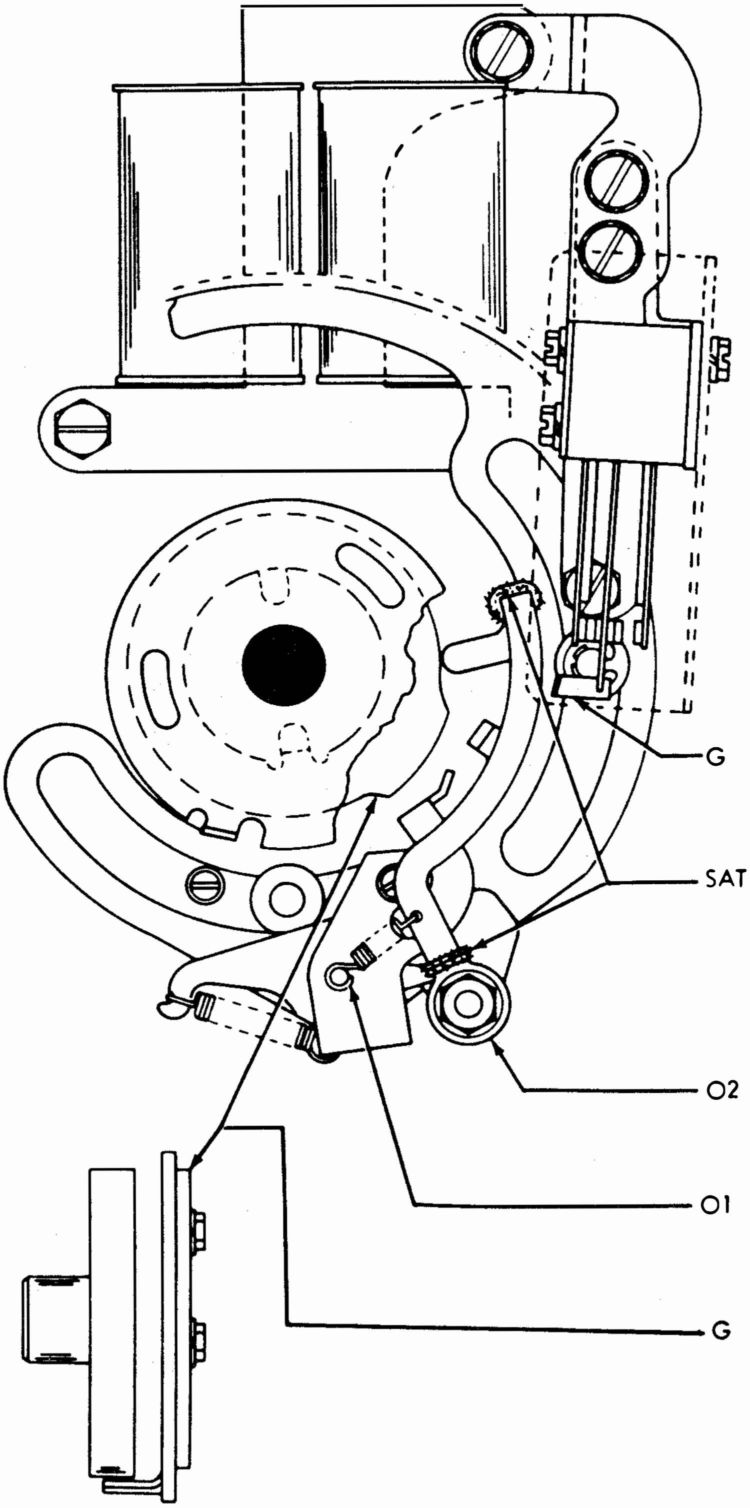


Figure 4-244. Remote Control Non-Interfering Tape Feed-Out Mechanism



G	METAL FACE TOWARD OPERATING ARM	SWINGER SPRING INSULATOR
SAT	FELT WASHERS (3)	OPERATING LEVER
O2	BEARING-EACH END	OPERATING LEVER
O1	HOOKS-EACH END	OPERATING LEVER COILED SPRINGS
G	OPERATING SURFACE	CAM

Figure 4-245. Timing Contact Mechanism (Selector Operated)

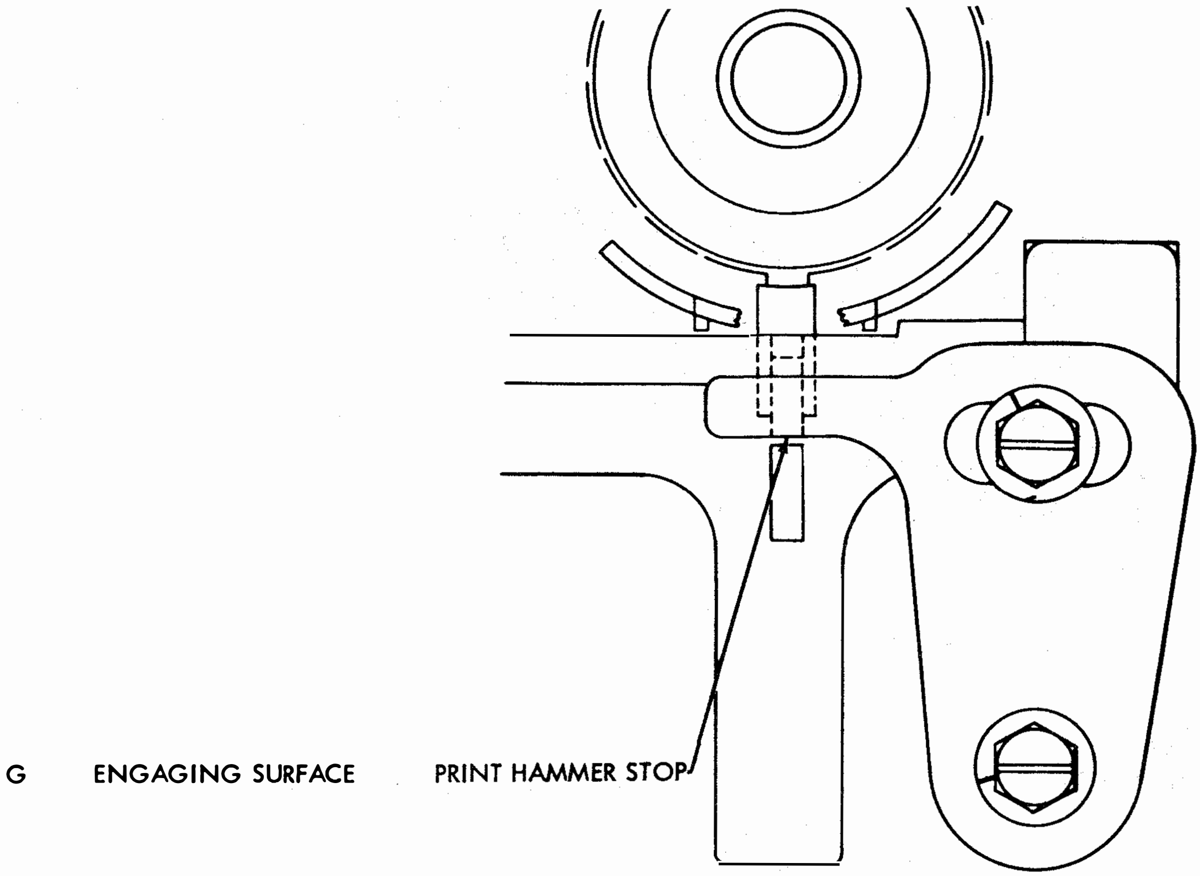


Figure 4-246. Print Suppression on Functions

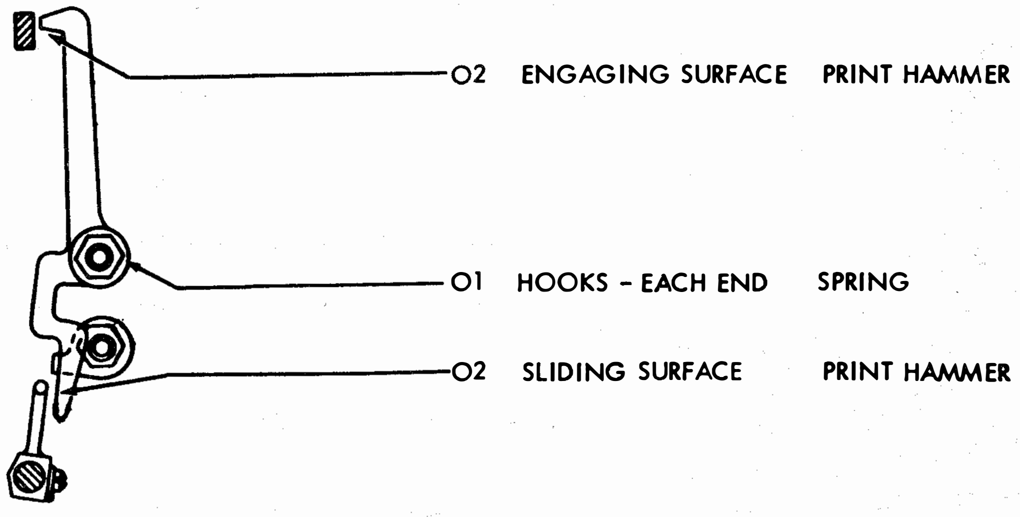


Figure 4-247. Print Hammer Sliding Surface and Function Blade on BLANK Delete Mechanism

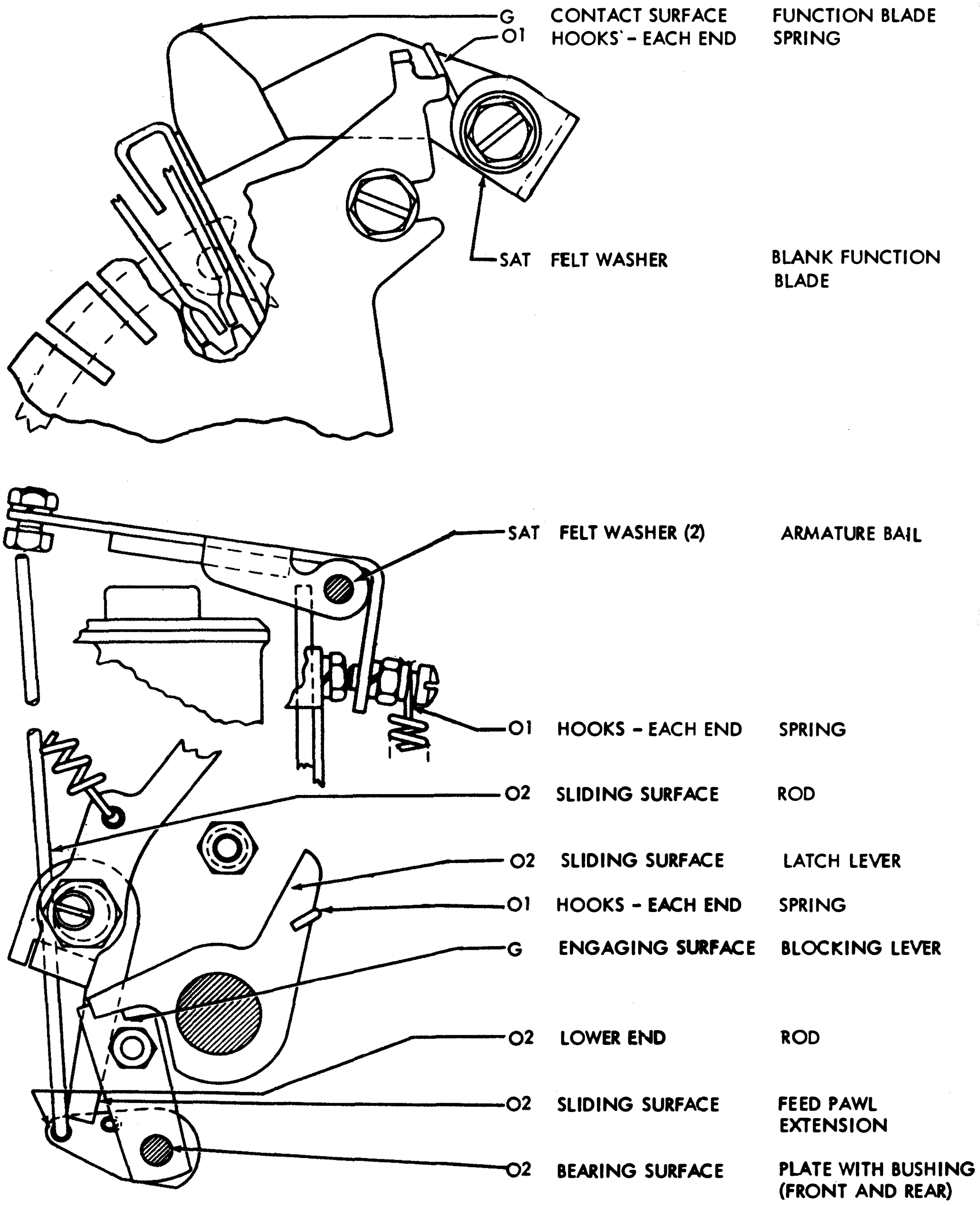


Figure 4-248. BLANK Delete Mechanism

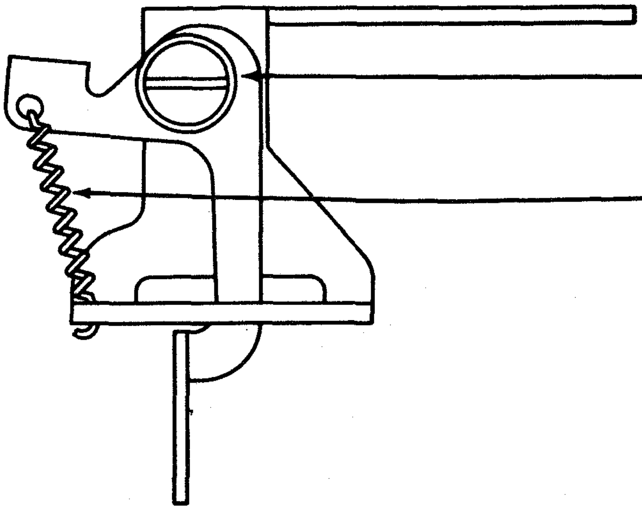


Figure 4-249. LETTERS-FIGURES Contact Mechanism, Late Design

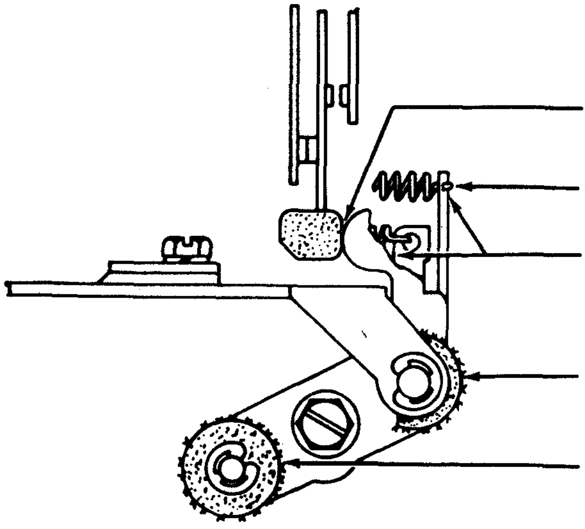


Figure 4-250. Timing Contacts

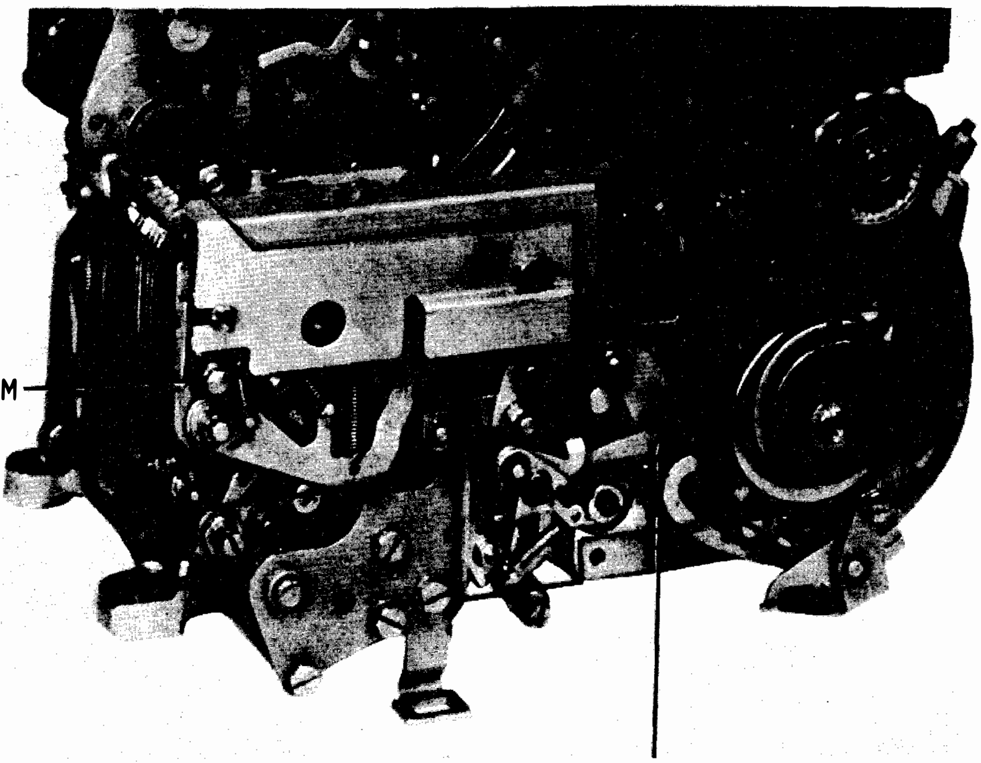
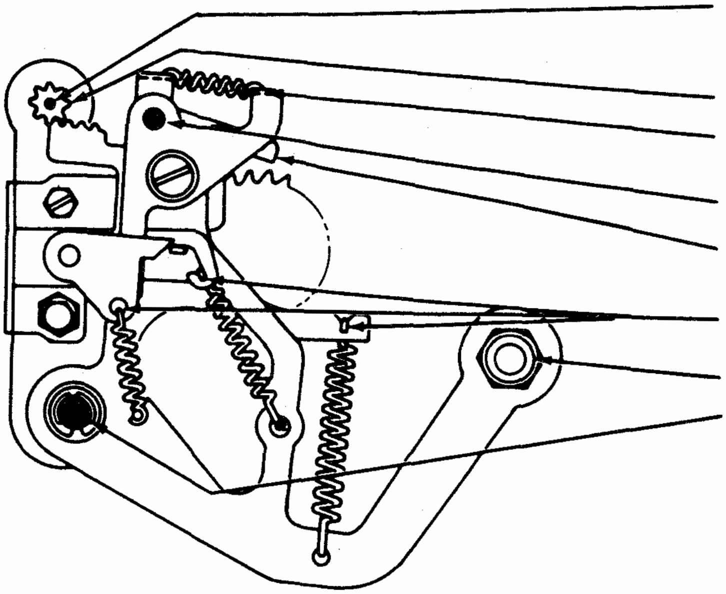
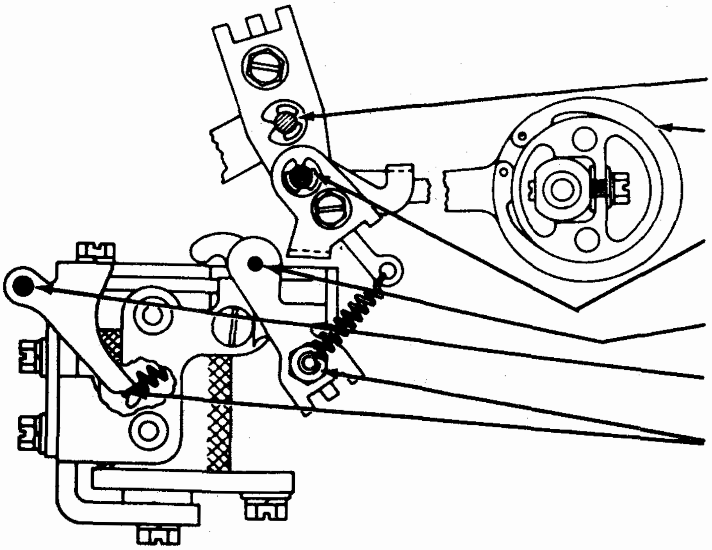


Figure 4-251. Manual and Power Drive Backspace Mechanisms for Chadless Tape



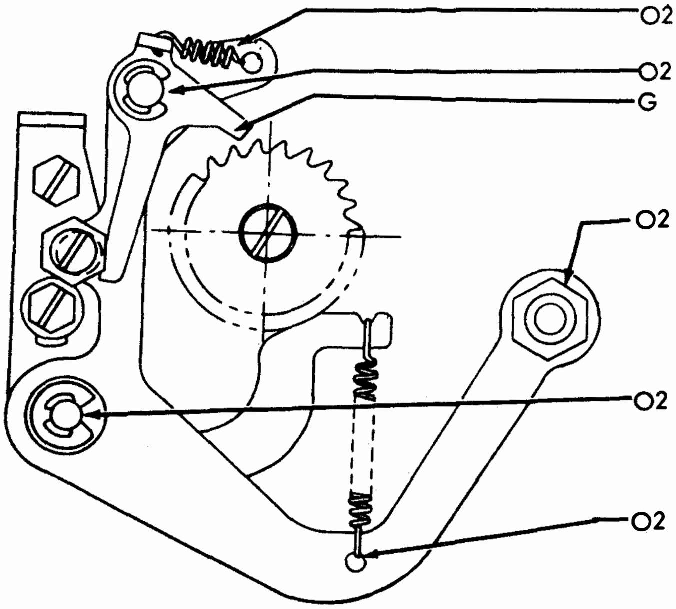
O2	BEARING SURFACE (REAR)	RAKE SHAFT
G	GEAR TEETH	GEAR SEGMENT
O2	HOOKS-EACH END	PAWL SPRING
O2	BEARING SURFACE	FEED PAWL
G	CONTACT SURFACE	FEED PAWL
O2	HOOKS-EACH END (3 SPRINGS)	SPRING
O2	BEARING SURFACE	NUT, SHOULDER
O2	BEARING SURFACE	BELL CRANK

Figure 4-252. Backspace Mechanism for Chadless Tape

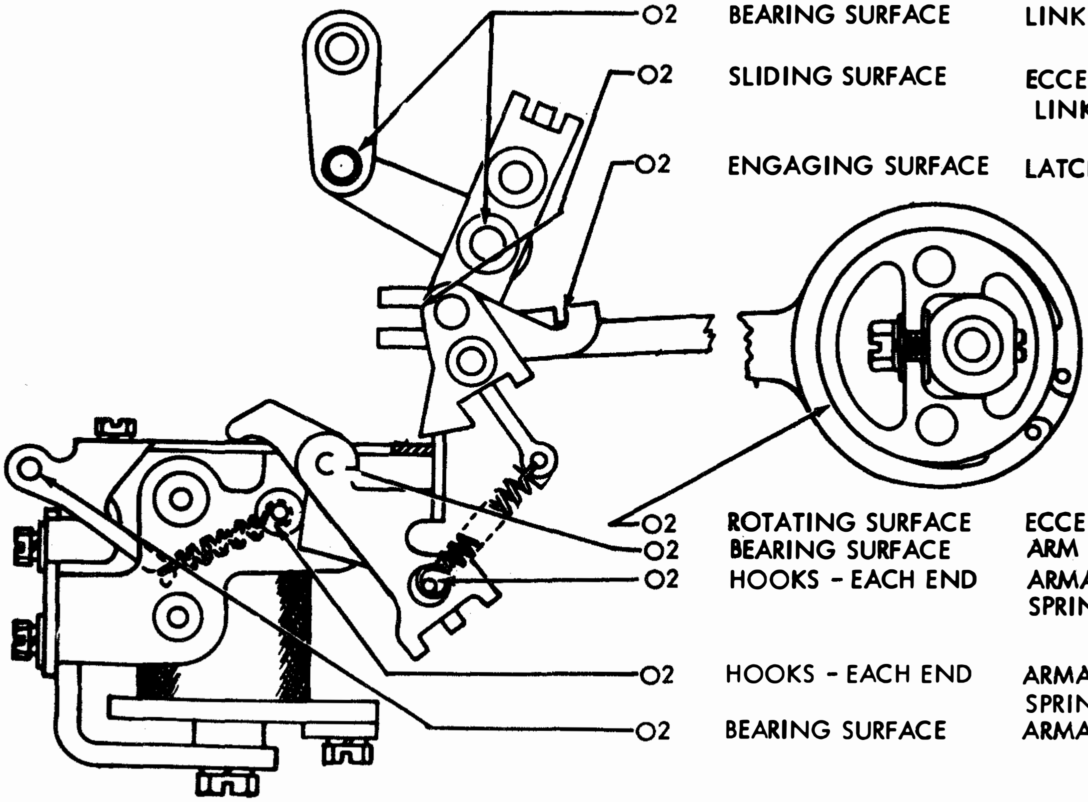


O2	BEARING SURFACE	LINK
O2	ROTATING SURFACE	ECCENTRIC
O2	SLIDING SURFACE	ECCENTRIC DRIVE ARM FORK
O2	BEARING SURFACE	ARM
O2	BEARING SURFACE	ARMATURE BAIL
O2	HOOKS-EACH END (2 SPRINGS)	SPRINGS

Figure 4-253. Backspace Mechanism for Chadless Tape (Power Drive)

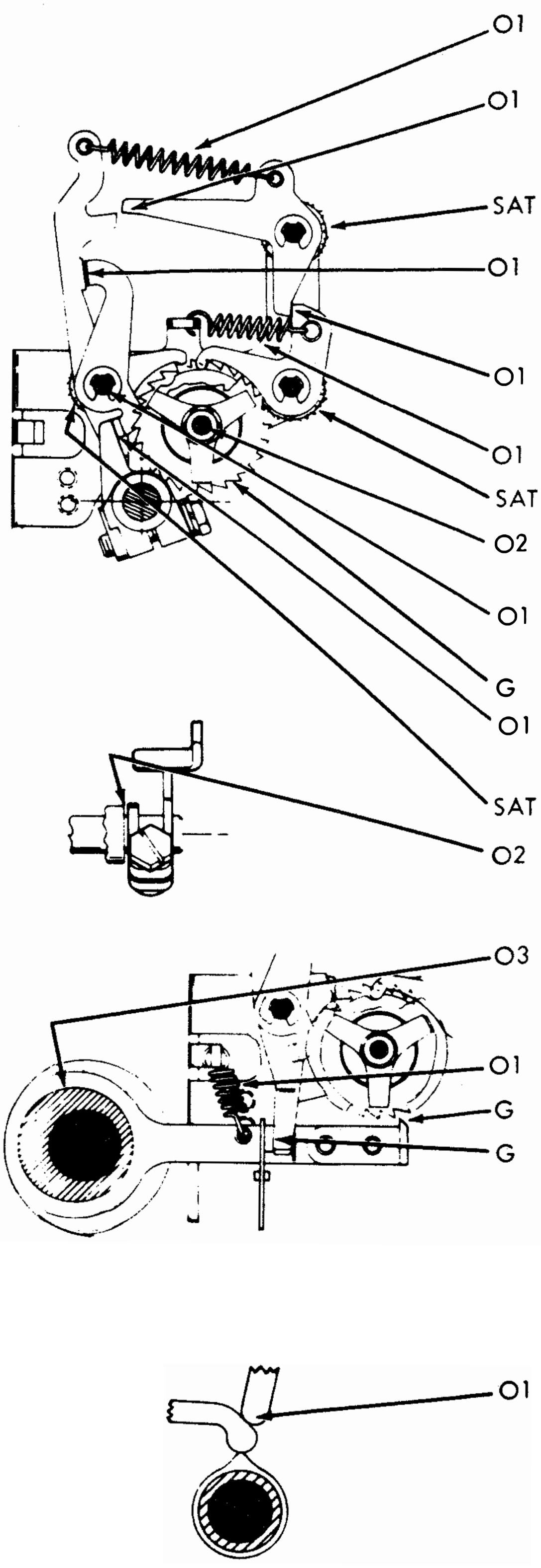


O2	HOOKS - EACH END	BACKSPACE PAWL SPRING
O2	BEARING SURFACE	BACKSPACE PAWL
G	FEEDING SURFACE	BACKSPACE PAWL
O2	BEARING SURFACE	NUT, SHOULDER
O2	BEARING SURFACE	BELL CRANK
O2	HOOKS - EACH END	BELL CRANK SPRING



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

Figure 4-254. Backspace Mechanism for Fully Perforated Tape (Power Drive)



O1	HOOKS-EACH END	SPRING
O1	ENGAGING SURFACE	CONTACT OPERATING PAWL AND LATCH LEVER
SAT	FELT WASHERS	LATCH LEVER
O1	ENGAGING SURFACE	BELL CRANK AND CONTACT OPERATING PAWL
O1	ENGAGING SURFACE	LATCH PAWL AND LATCH LEVER
O1	HOOKS-EACH END	SPRING
SAT	FELT WASHERS	LATCH PAWL
O2	BEARING SURFACE EACH END	RATCHET WHEEL SHAFT
O1	BEARING SURFACE EACH END	BELLCRANK AND SUPPORTING STUD
G	TEETH AND FLANGES	RATCHET WHEELS
O1	ENGAGING SURFACE	CLAMP ARM AND BELLCRANK
SAT	FELT WASHERS	CONTACT PAWL
O2	BEARING SURFACE (2)	TIME DELAY RESET SHAFT BUSHING
O3	BEARING SURFACE	ECCENTRIC FOLLOWER DRIVE ARM AND ECCENTRIC
O1	HOOKS-EACH END	SPRING
G	ENGAGING SURFACE	DRIVE ARM
G	ENGAGING SURFACE	CONTACT OPERATING PAWL AND CONTACT INSULATOR
O1	ENGAGING SURFACE	SELECTOR RESET BAIL TIME DELAY RESET LEVER

Figure 4-255. Time Delay Motor Stop Mechanism

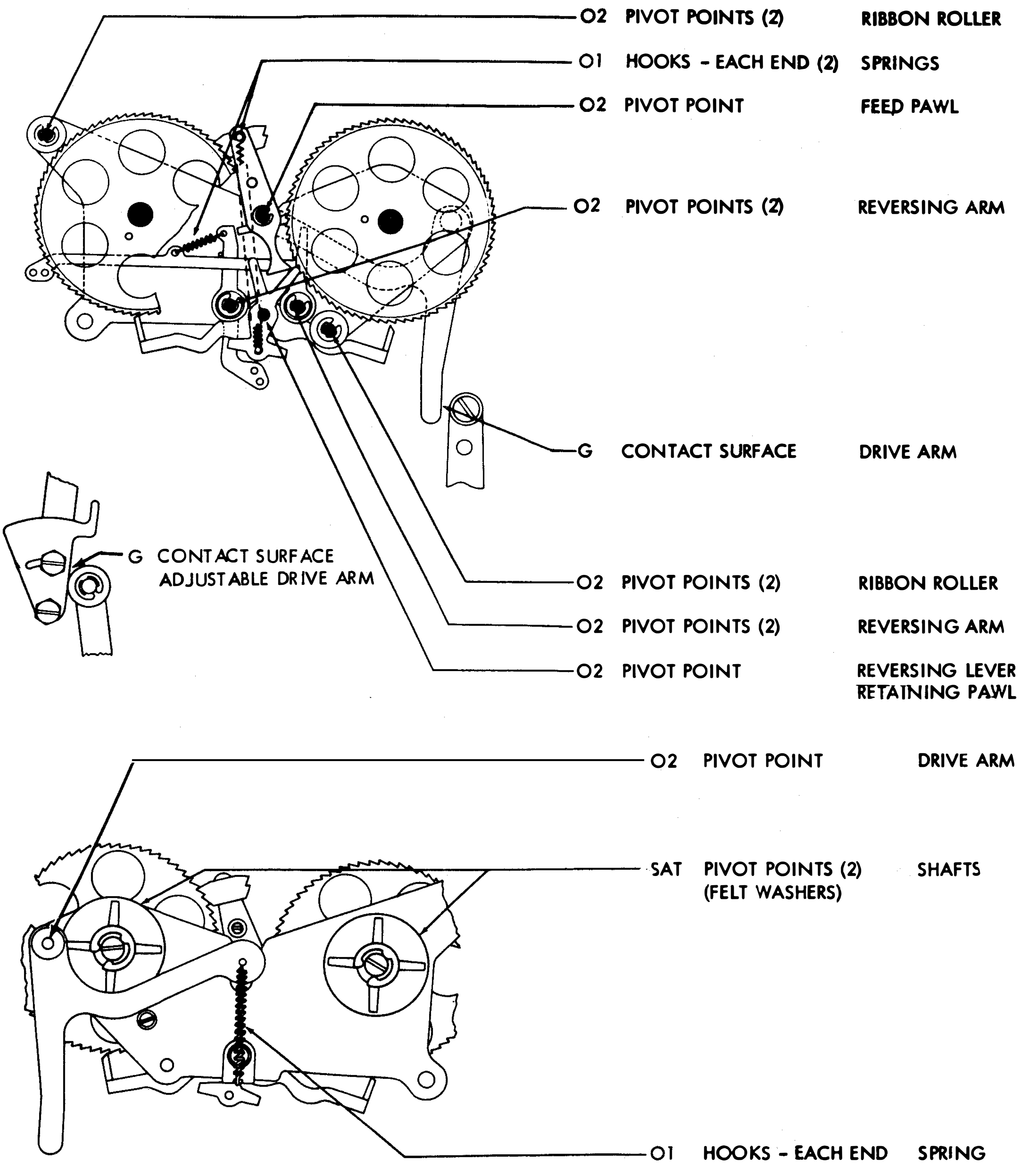


Figure 4-256. Ribbon-Feed Mechanism (Earlier Design)

c. Apply a thick film of grease to all gears and the spacing clutch trip cam plate. Apply oil to all cams, including the camming surfaces of each clutch disk. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

d. Lubricate the unit thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-12. TRANSMITTER DISTRIBUTOR UNIT (LXD) LUBRICATION. The following paragraphs provide transmitter distributor (TD) unit lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the transmitter distributor unit are indexed in Table 4-8 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the unit as viewed by the operator facing it.

b. To gain access to lubrication points of the TD assembly, follow the procedure as outlined in the following paragraphs.

(1) To remove the coverplate, lift the left end of the plate. This will release the detent fasteners. Then slide the coverplate toward the left.

(2) To remove the top plate, loosen the front and rear mounting screws. Lift the top plate upward.

(3) To remove the remaining tape guideplate, loosen the tape guideplate mounting screws. Lift the tape guideplate off.

(4) To remove the TD assembly, remove the screws that secure the unit to the base and lift unit up to disengage the gears. Disconnect the electrical plug.

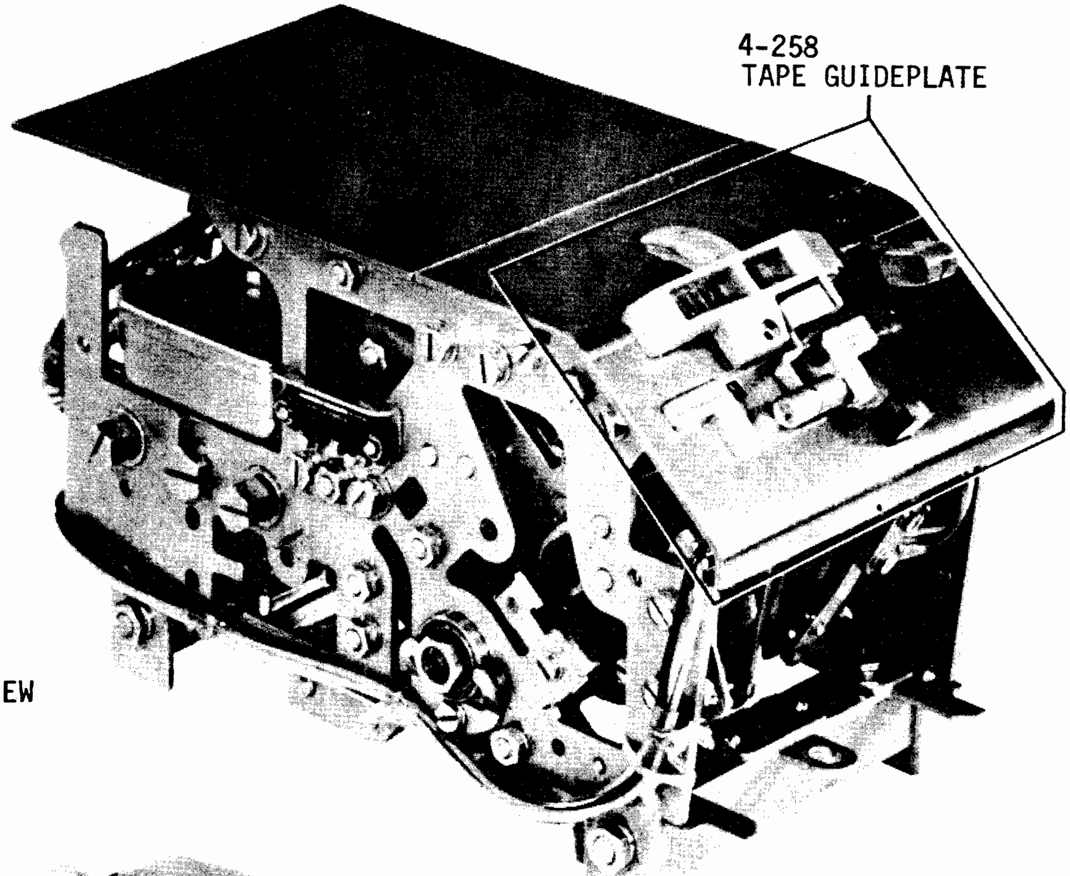
c. Lubricate the unit just prior to placing it in service. After 300 to 500 operating hours, relubricate the unit. Recheck all clutch gaps; reset if necessary. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

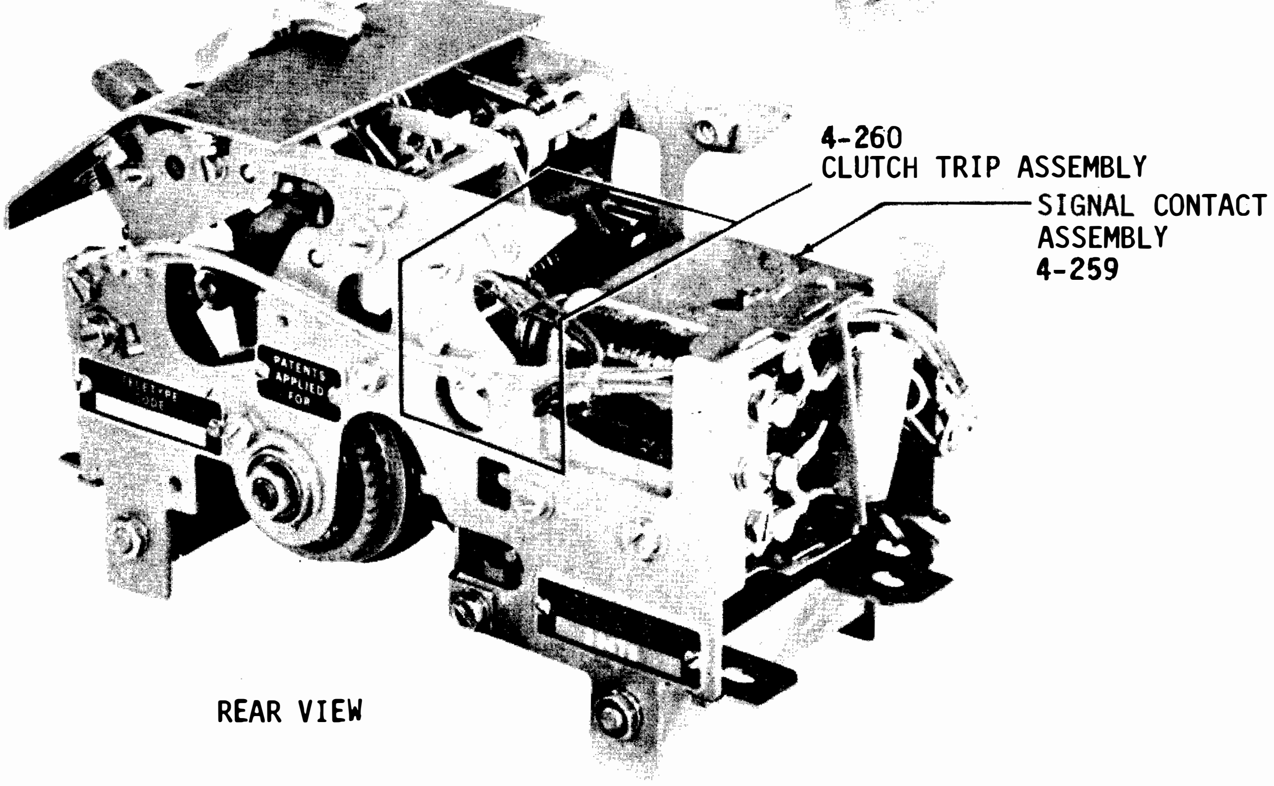
Disconnect power before applying any lubricant.

d. Apply a thick film of grease to all gears and the spacing clutch trip cam plate. Apply oil to all cams, including the camming surfaces of each clutch disk. Refer to paragraph 4-6c for symbols that apply to the specific lubrication

Table 4-8. Transmitter Distributor Unit (LXD) Lubrication Chart Index

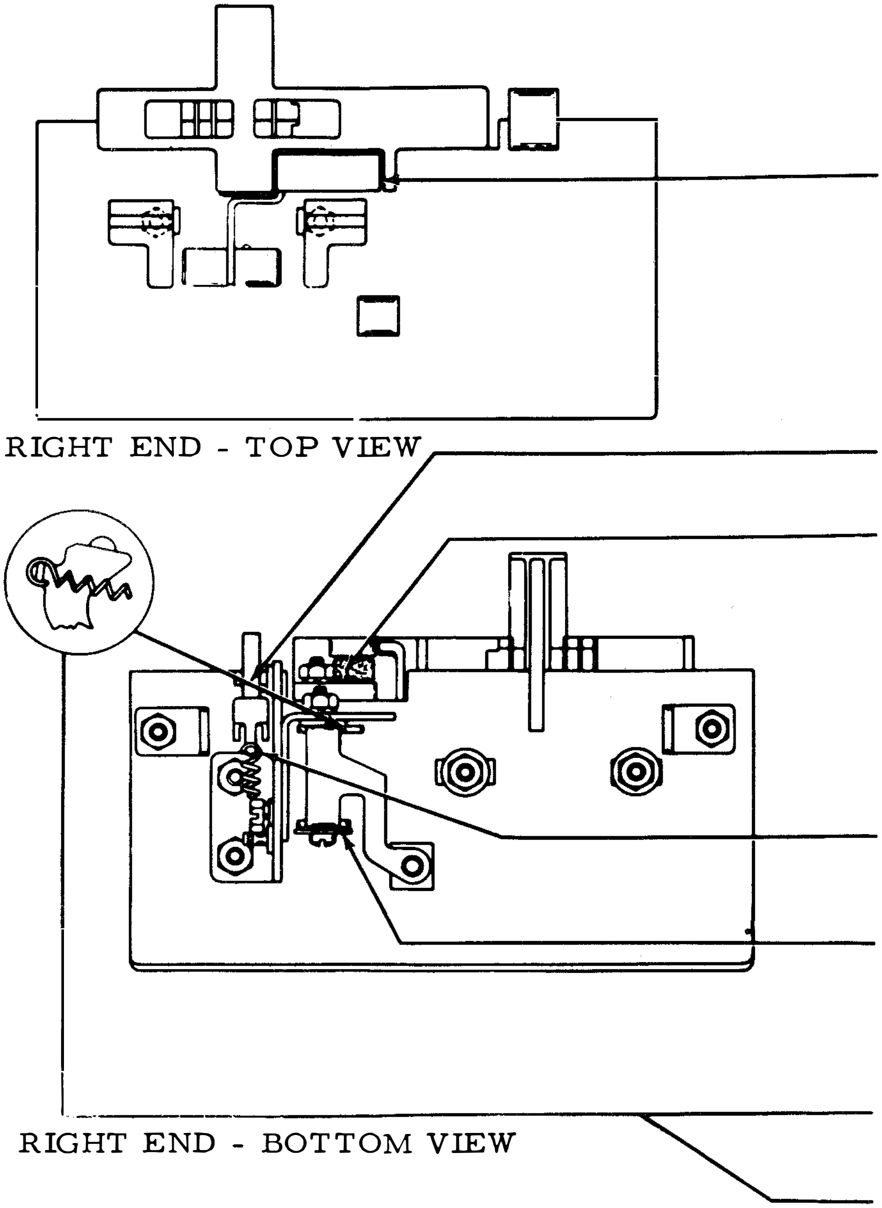


FRONT VIEW



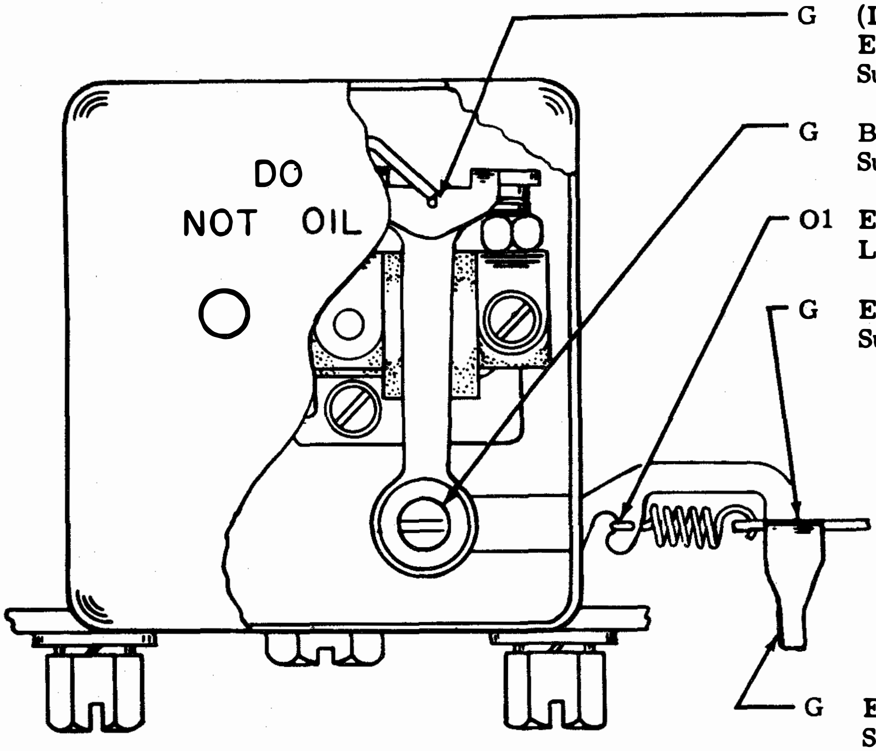
REAR VIEW

Figure 4-257. Transmitter Distributor



O1	Bearing Surface	Tight-Tape Bail
G	Detent Teeth	Control Lever
SAT	Felt Washer	Tape Lid Shaft
O1	Each Loop	Start-Stop Detent Bail
O1	Bearing Surface	Tape Lid Release Bail
G	Latching Surface	Tape Lid Latch
O1	Each Loop	Tape Lid Latch Spring

Figure 4-258. Tape Guideplate

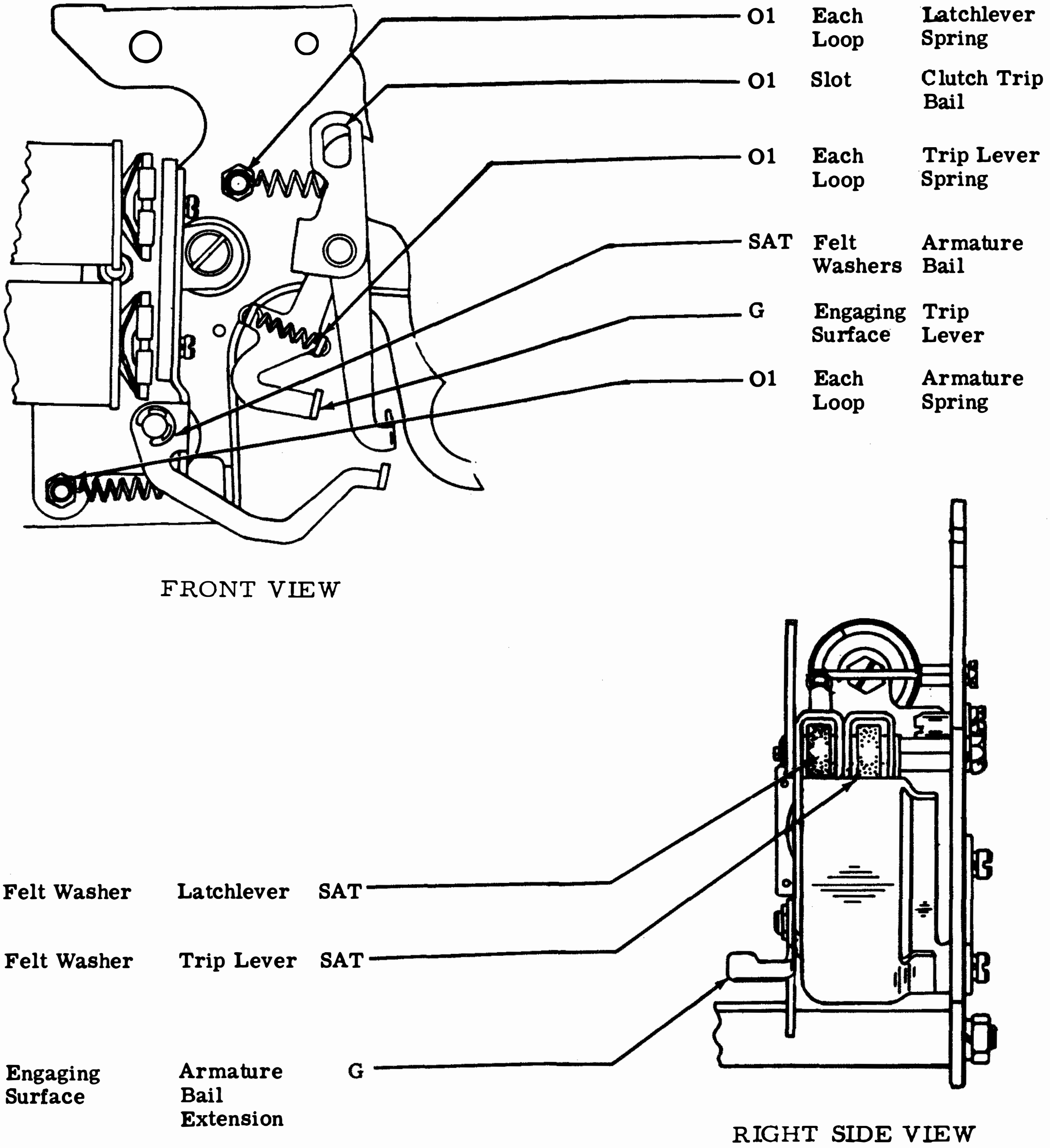


G	(Light Film) Engaging Surface	Toggle Link
G	Bearing Surface	Toggle (Metal) Bushing
O1	Each Loop	Drive Link Spring
G	Engaging Surface	Transfer Bail and Link
G	Engaging Surface	Transfer Bail Extension

COVERPLATE REMOVED

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.

Figure 4-259. Signal Contact Assembly, Top View



FRONT VIEW

RIGHT SIDE VIEW

Figure 4-260. Clutch Trip Mechanism

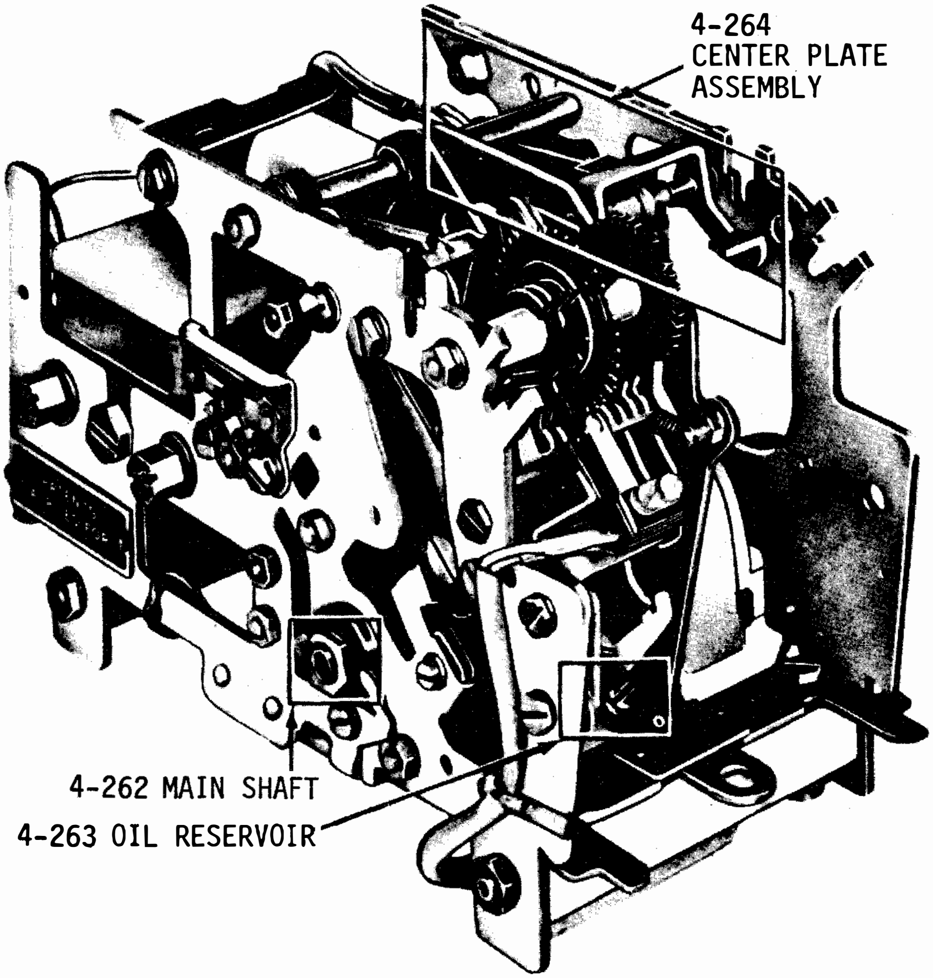


Figure 4-261. Main Shaft, Oil Reservoir, and Center Plate Assembly

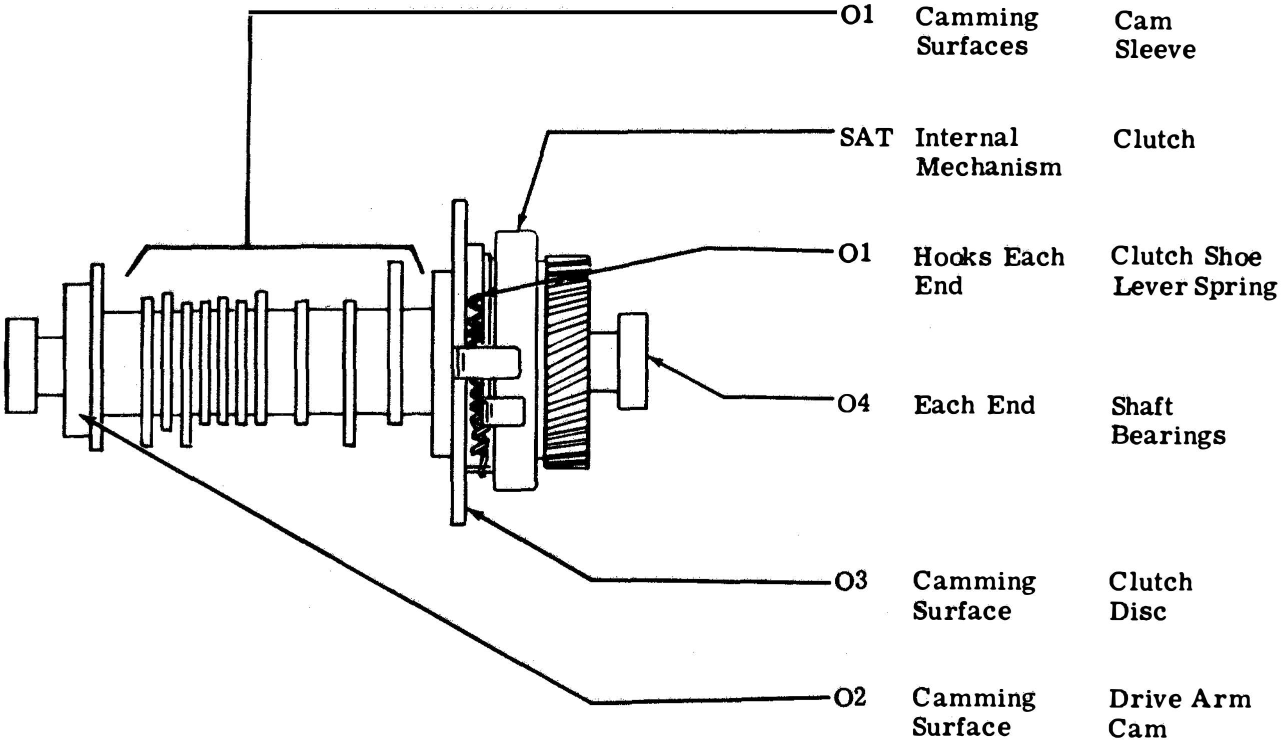


Figure 4-262. Main Shaft, Right Side View

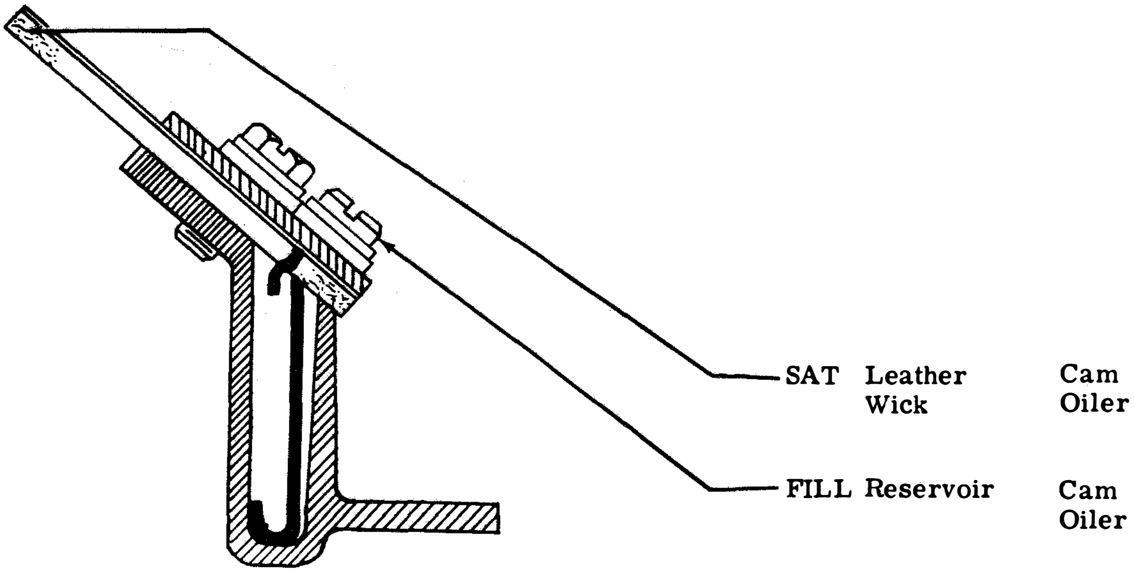
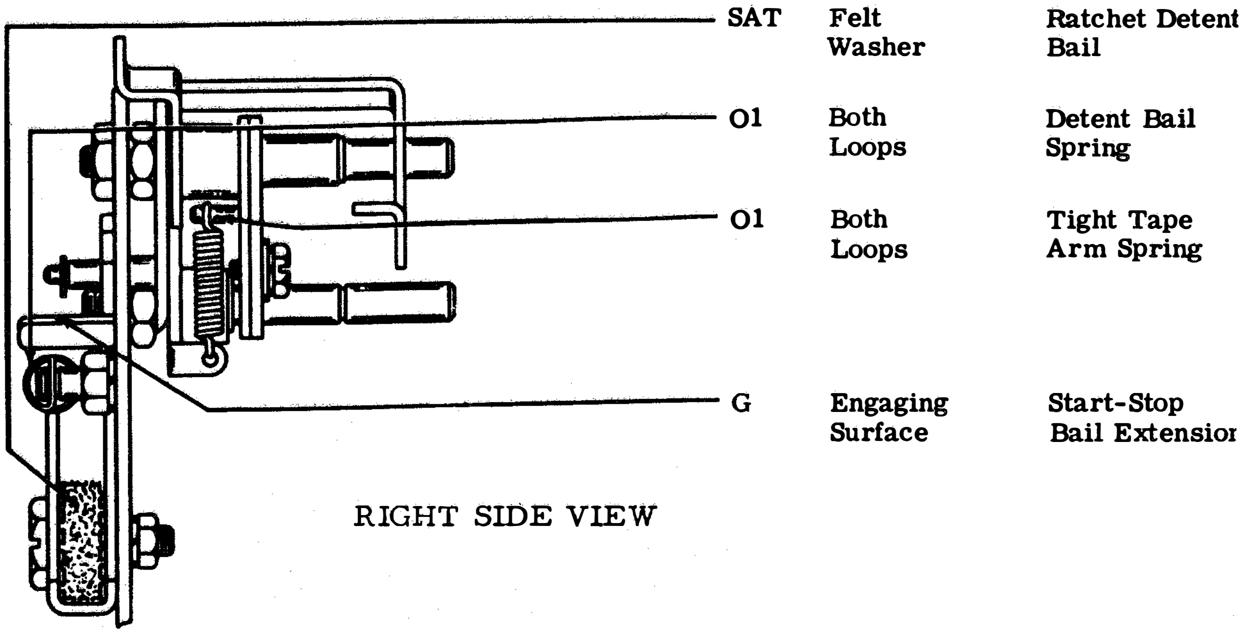


Figure 4-263. Oil Reservoir, Front View



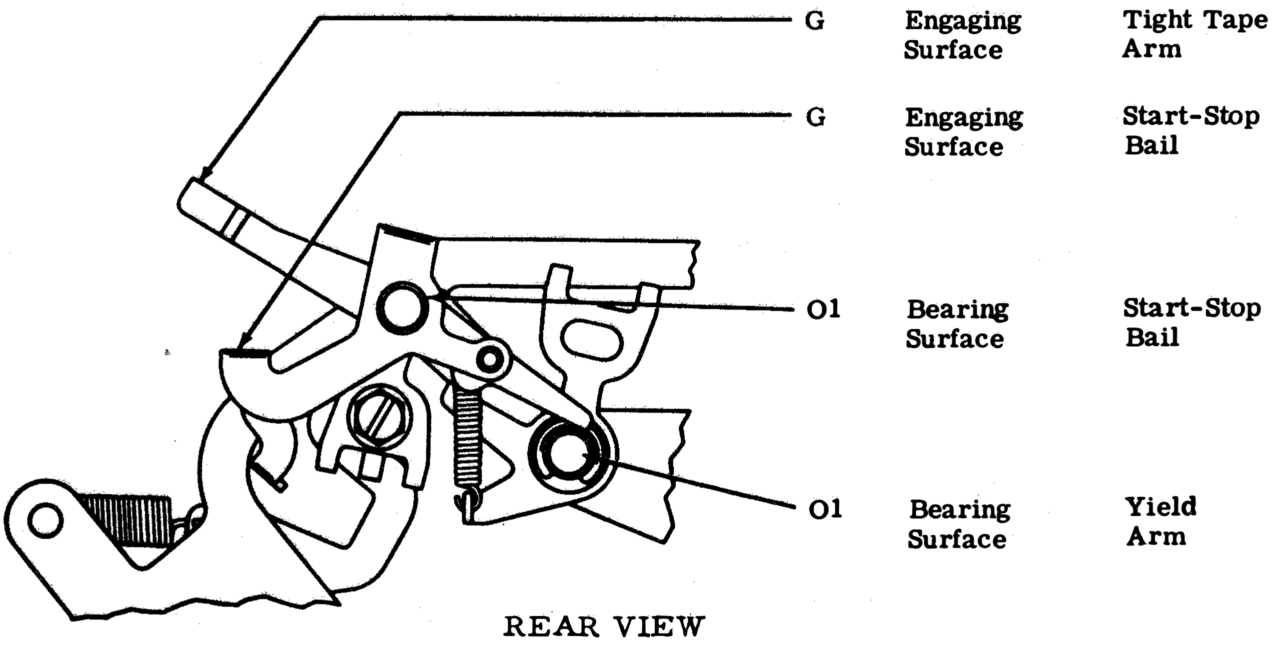


Figure 4-264. Center Plate Assembly

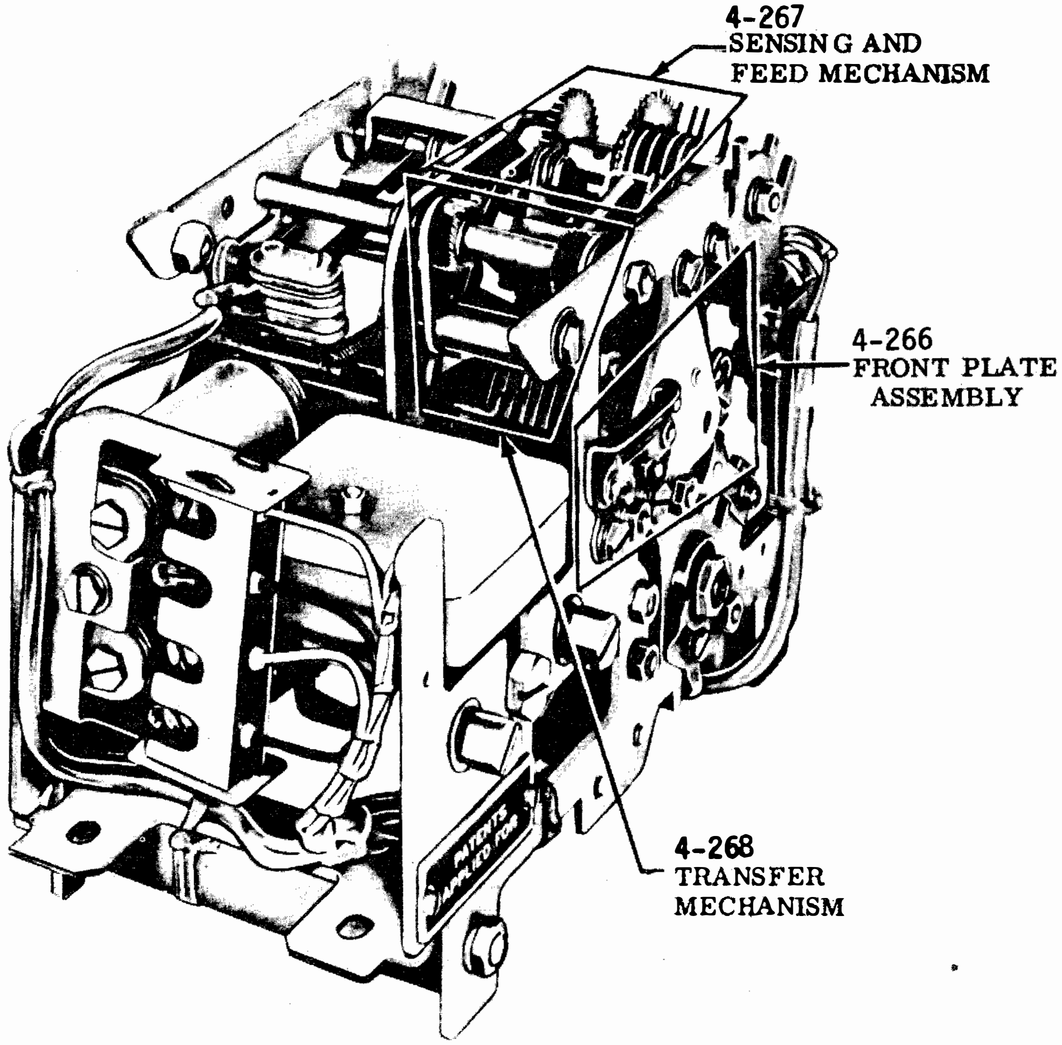
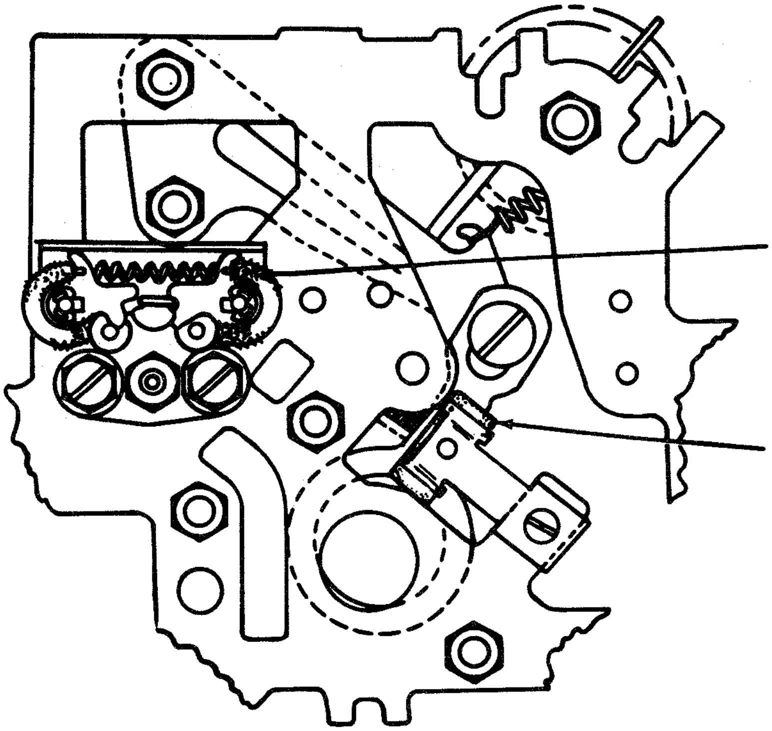
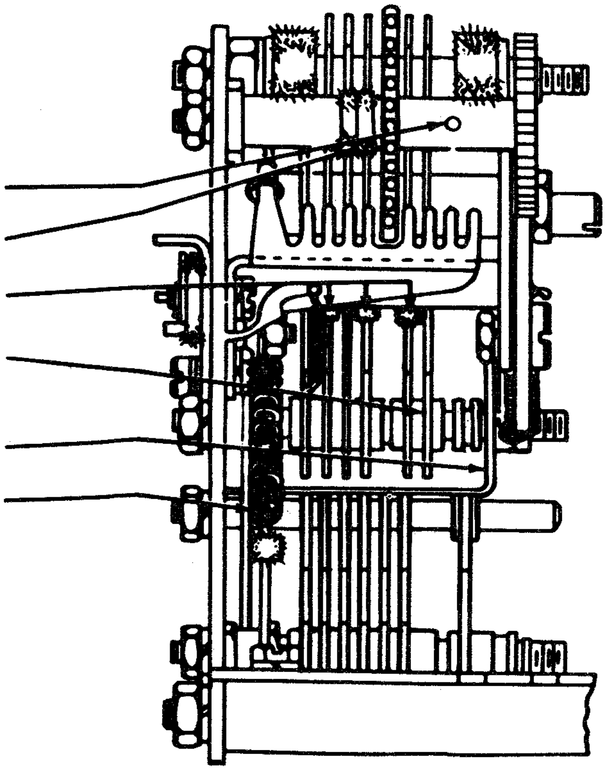


Figure 4-265. Front Plate Assembly, Sensing and Feed Mechanism, and Transfer Mechanism, Rear View



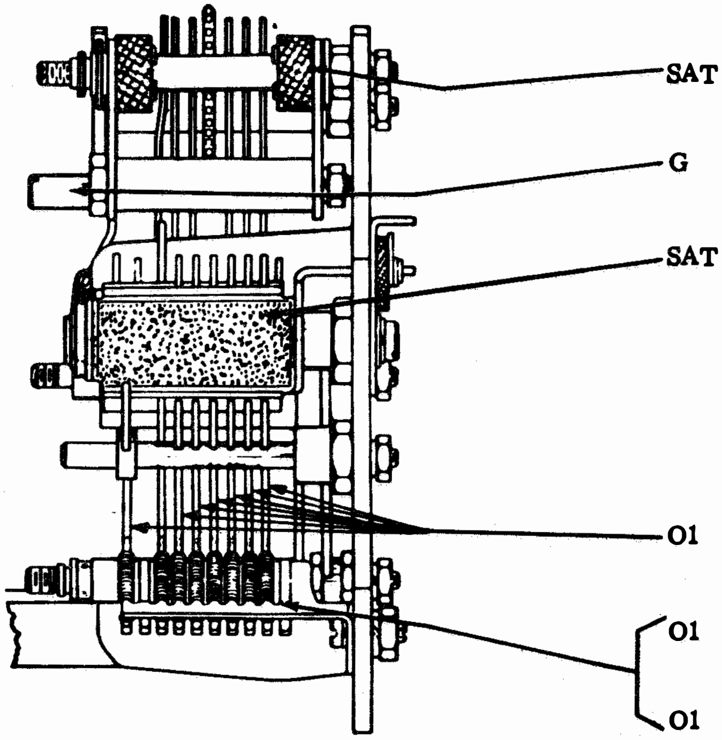
SAT	Felt Wick	Stabilizer Latch
SAT	Leather Wick	Drive Arm Oiler

Figure 4-266. Front Plate Assembly, Front View



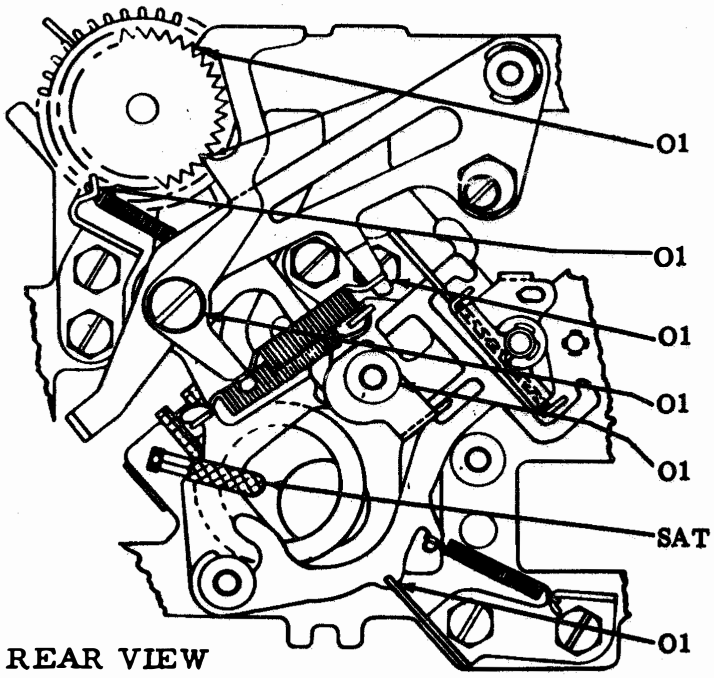
Shaft	Feedwheel	O3
Felt Wicks	Feedwheel Bearing	SAT
Felt Wicks	Sensing Pins	SAT
Sliding Surface	Sensing Pin Guide Post	O6
Sliding Surface	Locking Bail	O2
Both Loops	Locking Bail Spring	O2

Figure 4-267. Sensing and Feed Assembly, Bottom View



BOTTOM 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	Each Loop	Transfer Lever Springs
O1	Each Loop	Locking Bail Spring



REAR VIEW

O1	Teeth	Feed Pawl and Ratchet Wheel
O1	Each Loop	Transfer Lever Springs
O1	Each Loop	Feed Pawl Spring
O1	Sliding Surface	Feed Pawl Pivot
O1	Engaging Surface	Locking Bail
SAT	Felt Washer	Locking Bail
O1	Sliding Surface	Transfer Levers

Figure 4-268. Transfer Mechanism

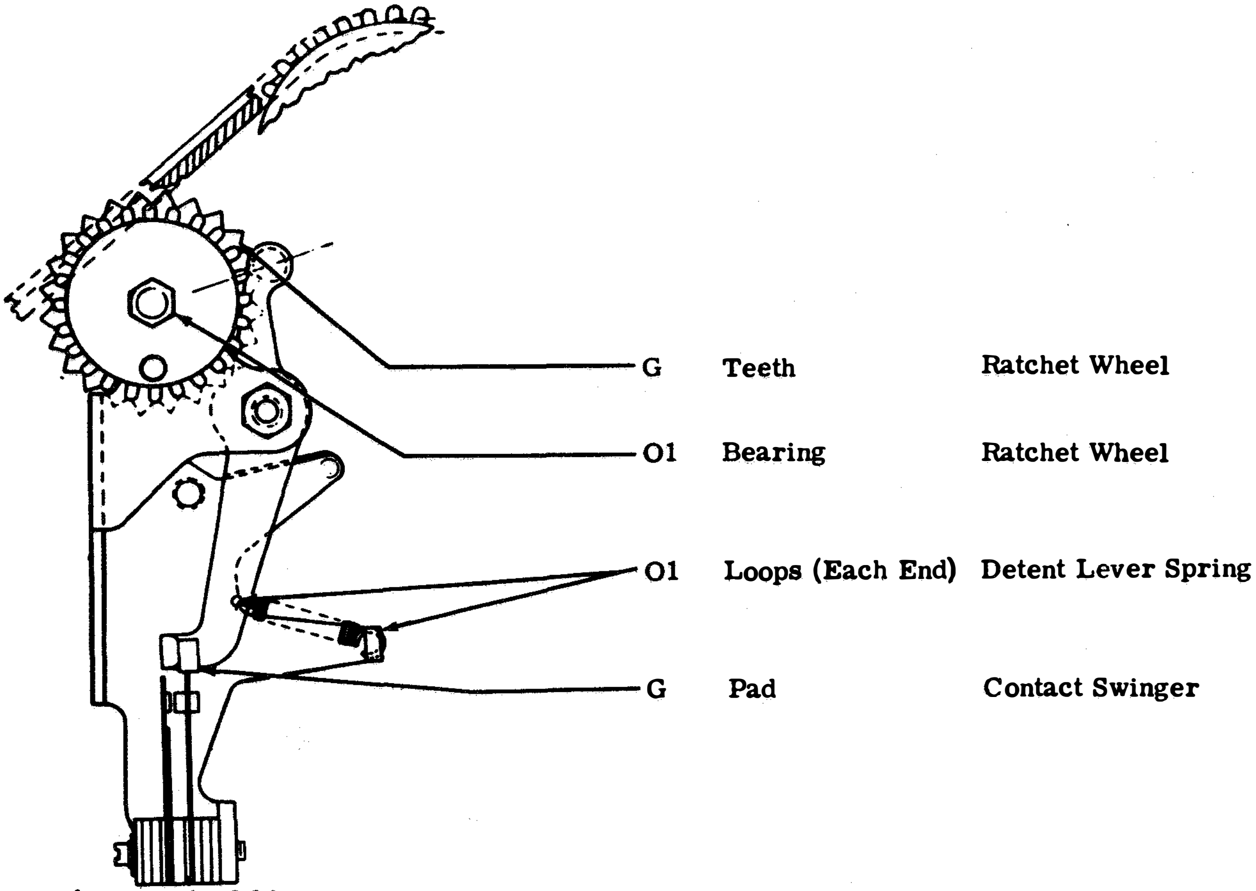


Figure 4-269. Tape Feed Assurance Mechanism, Rear View

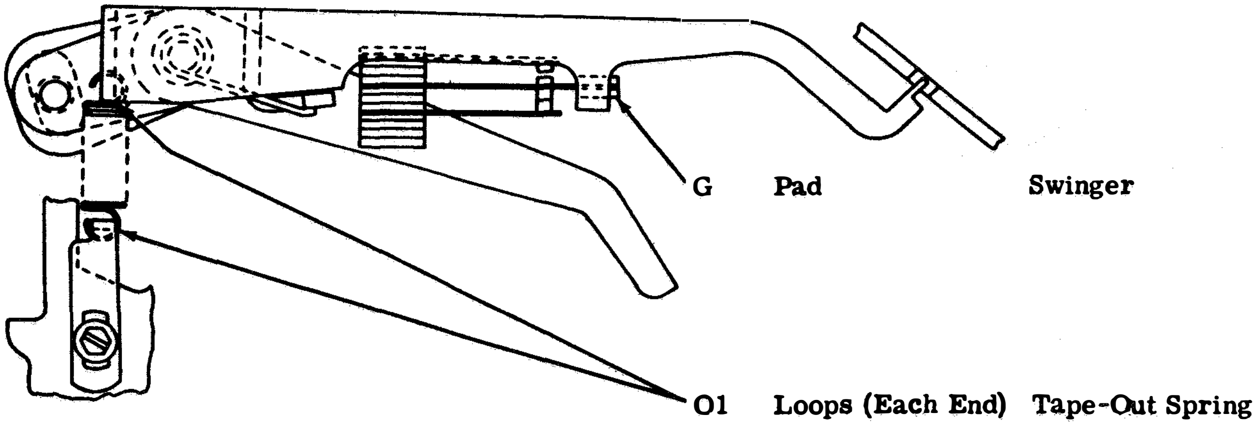
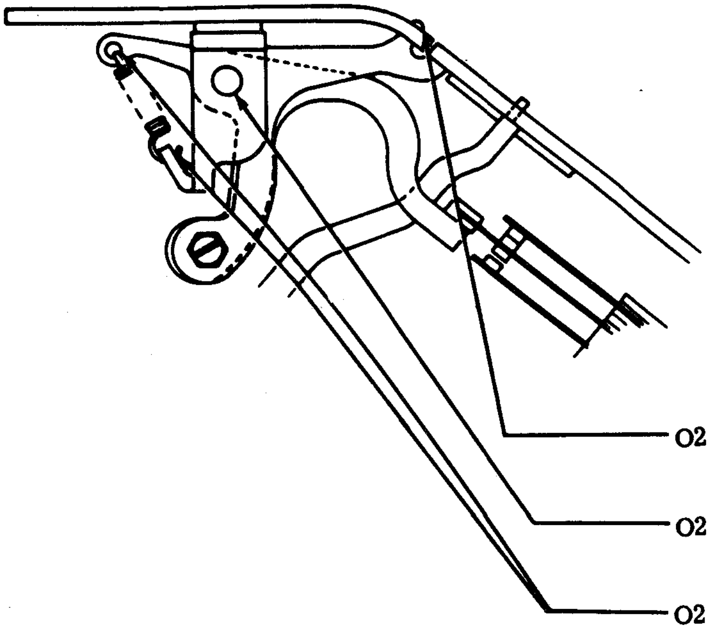
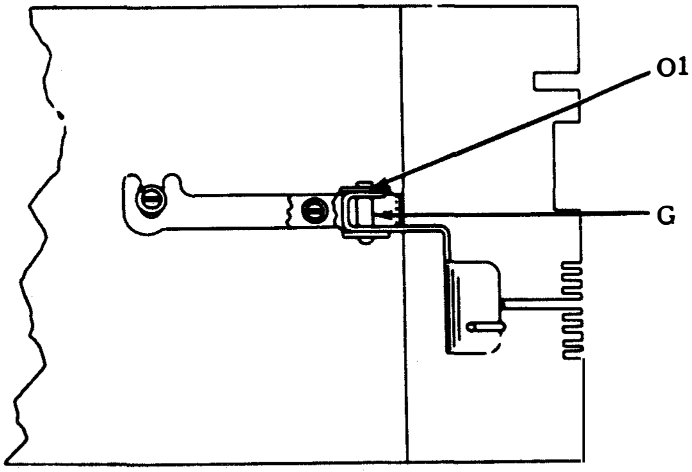


Figure 4-270. Tape-Out Sensing Mechanism, Front View



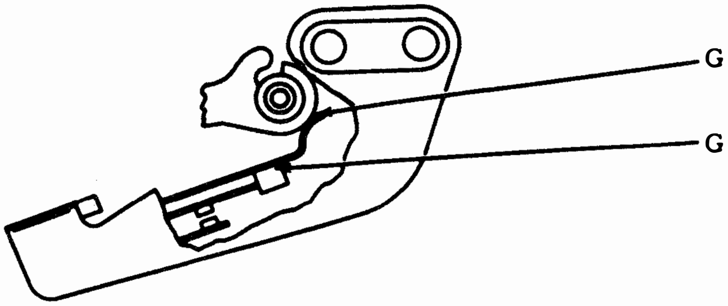
O2	Protrusion	Sensing Lever
O2	Pivot	Sensing Lever
O2	Loops (Each End)	Sensing Lever Spring

Figure 4-271. Tape Lid Sensing Lever, Front View



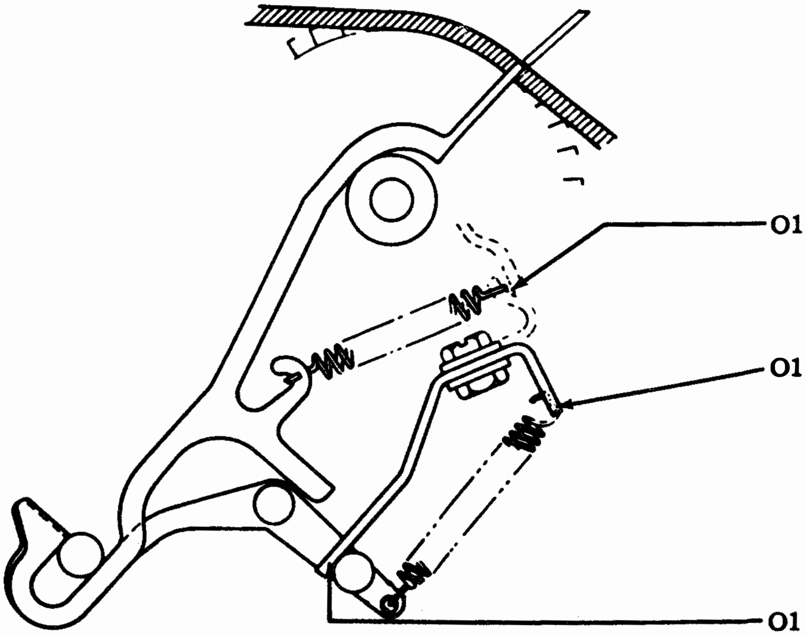
O1	Bearing Surface (Each End)	Tape Deflector
G	Thin Film Contact Surface	Deflector Spring

Figure 4-272. Tape Deflector, Top View



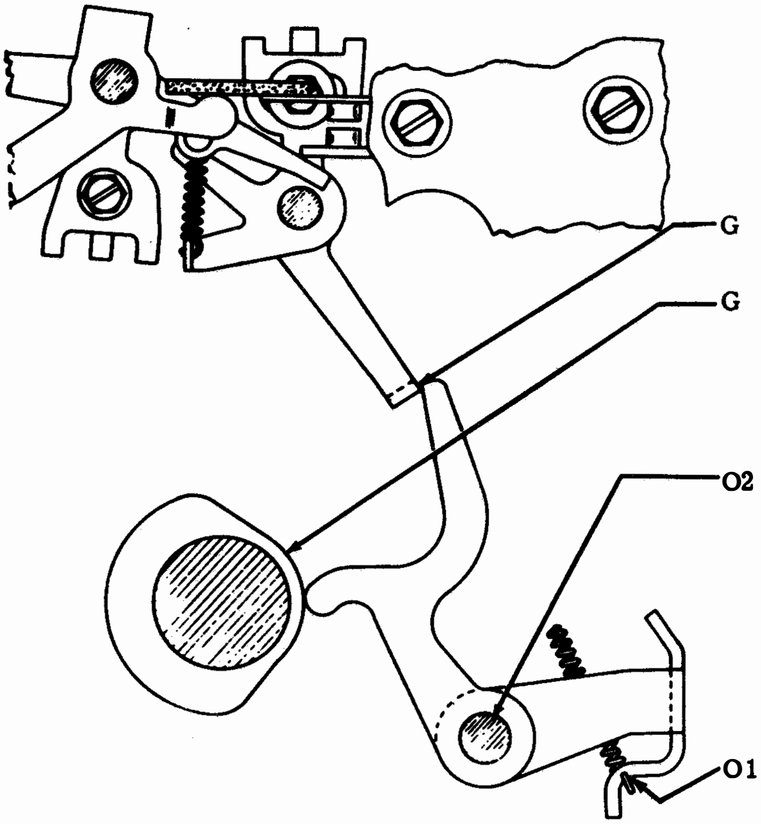
G	Engaging Surface	Contact Lever
G	Engaging Surface	Contact Insulator

Figure 4-273. Start-Stop Pulse Contact, Front View



O1	Each Loop	Spring
O1	Each Loop	Spring
O1	Engaging Surface	Deflector Bail Guide

Figure 4-274. Rub-Out Deleter, Front View



G	Engaging Surface	Timing Arm
G	Light Film	Timing Cam
O2	Bearing Surface	Timing Bail
O1	Each Loop	Spring

Figure 4-275. Transmitter Stop Mechanism, Rear View

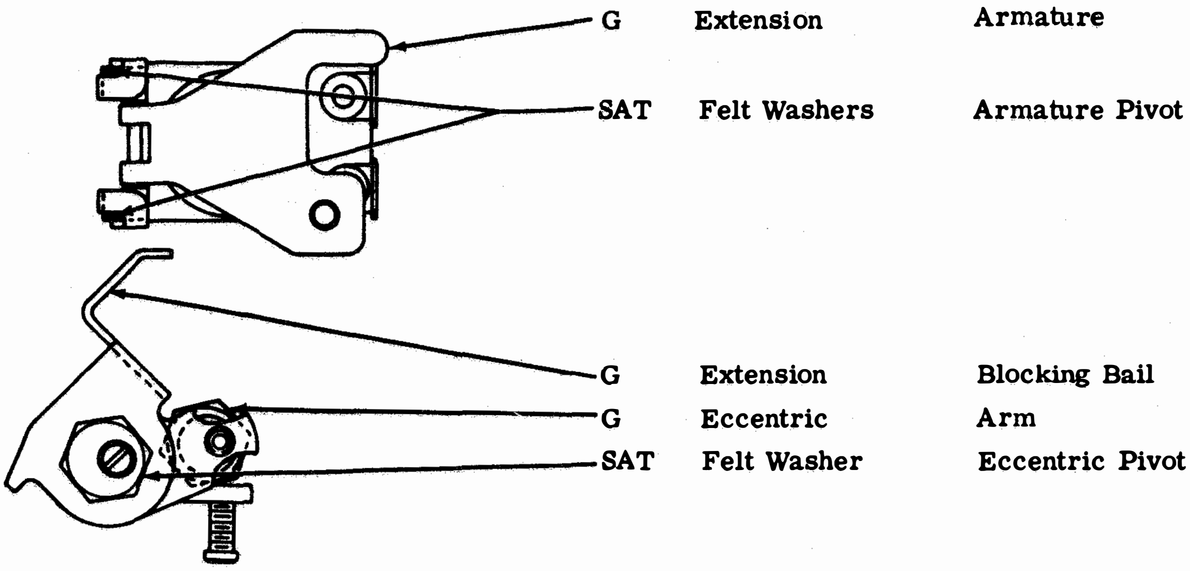


Figure 4-276. Tape Withhold Mechanism, Front View

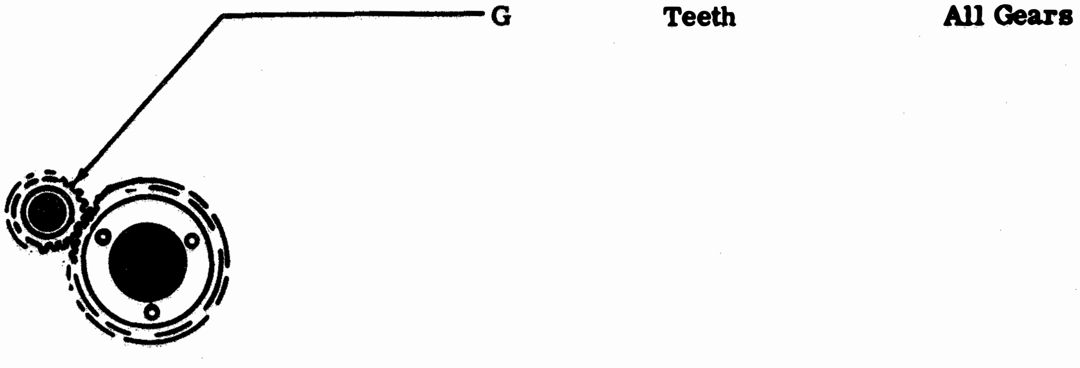


Figure 4-277. All Gears

instructions indicated in the line drawings.

e. Lubricate the unit thoroughly. Saturate all felt washers and oilers, and apply oil to each end of all springs. Apply oil to points where it will adhere and not run off. Avoid overlubrication. Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings, wicks, and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-13. MOTOR UNITS LUBRICATION. The following paragraphs provide motor units lubrication instructions and specify lubrication intervals in Table 4-2 which depend on the amount of daily operation and the speed of operation. Lubrication methods for the motor units are indexed in Table 4-9 and presented in lubrication charts. The lubrication charts consist of photographs and line drawings. Refer to Figures 4-278 through 4-280. Photographs show the general area to be lubricated. Callouts on the photographs refer to line drawings indicating each specific mechanism to be lubricated and method of lubrication.

a. References to front, rear, left, right, etc., in the lubrication charts, apply to the unit as viewed by the operator facing the unit.

b. Lubricate the unit just prior to placing it in service. After 300 to 500 operating hours, relubricate the unit. Thereafter, use the lubrication intervals specified in Table 4-2.

WARNING

Disconnect power before applying any lubricant.

c. Gear Train and Governor Lubrication. To lubricate gear train and governor assembly, proceed as follows:

(1) Refer to Figure 4-279.

(2) Remove end cap of governor housing with its four mounting screws loosened.

(3) Remove front and rear guideplates of brake shoe slide.

(4) Remove the retaining ring that secures the regulating lever link with brake shoe slide.

(5) Remove coverplate from top of governor housing.

(6) Remove governor mounting screw, and slide governor out of housing.

(7) Remove brake disks from center shaft by removing its retaining ring and sliding disk assembly outward. Apply grease to shaft and bearing shown in Figure 4-280.

d. Apply a thick film of grease to all gears. Refer to paragraph 4-6c for symbols that apply to the specific lubrication instructions indicated in the line drawings.

e. Lubricate the unit thoroughly. Apply oil to points where it will adhere and not run off. Avoid overlubrication.

Table 4-9. Motor Units Lubrication Chart Index

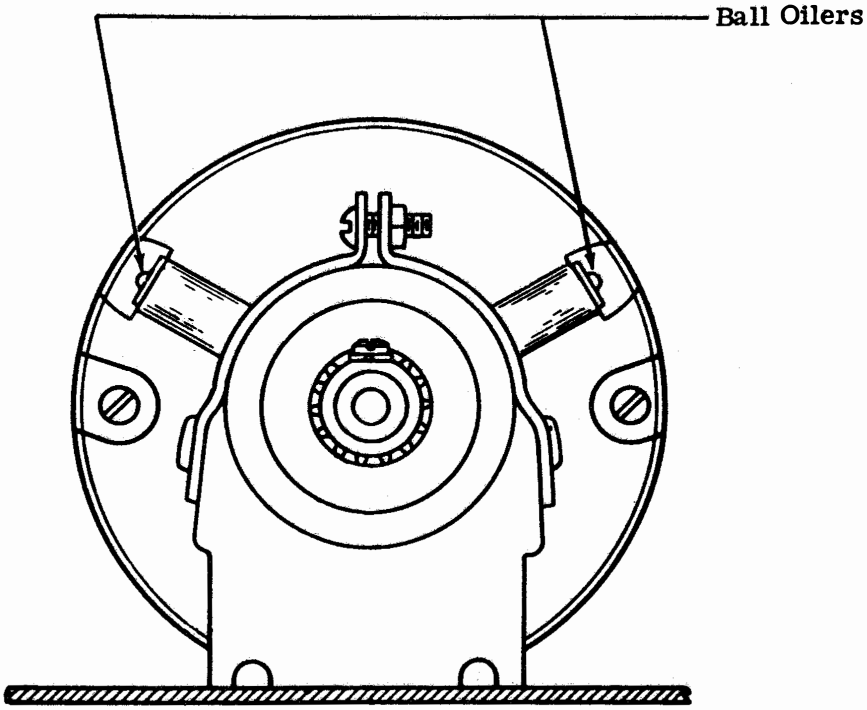


Figure 4-278. Motor Bearings - Standard Motors

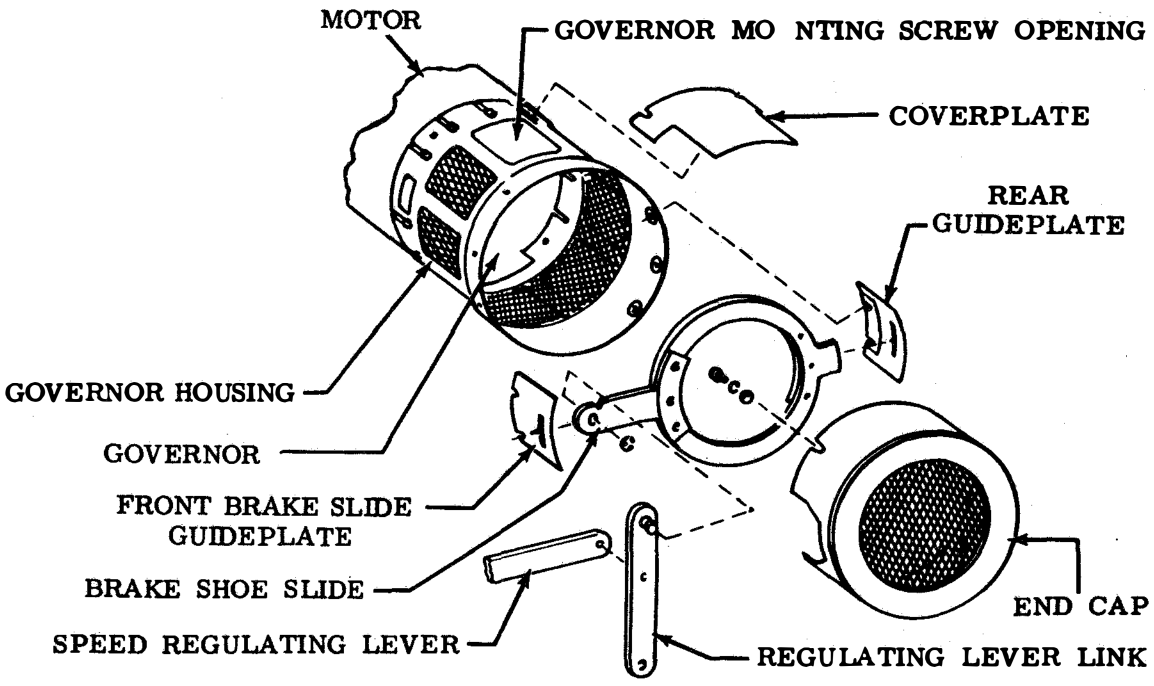
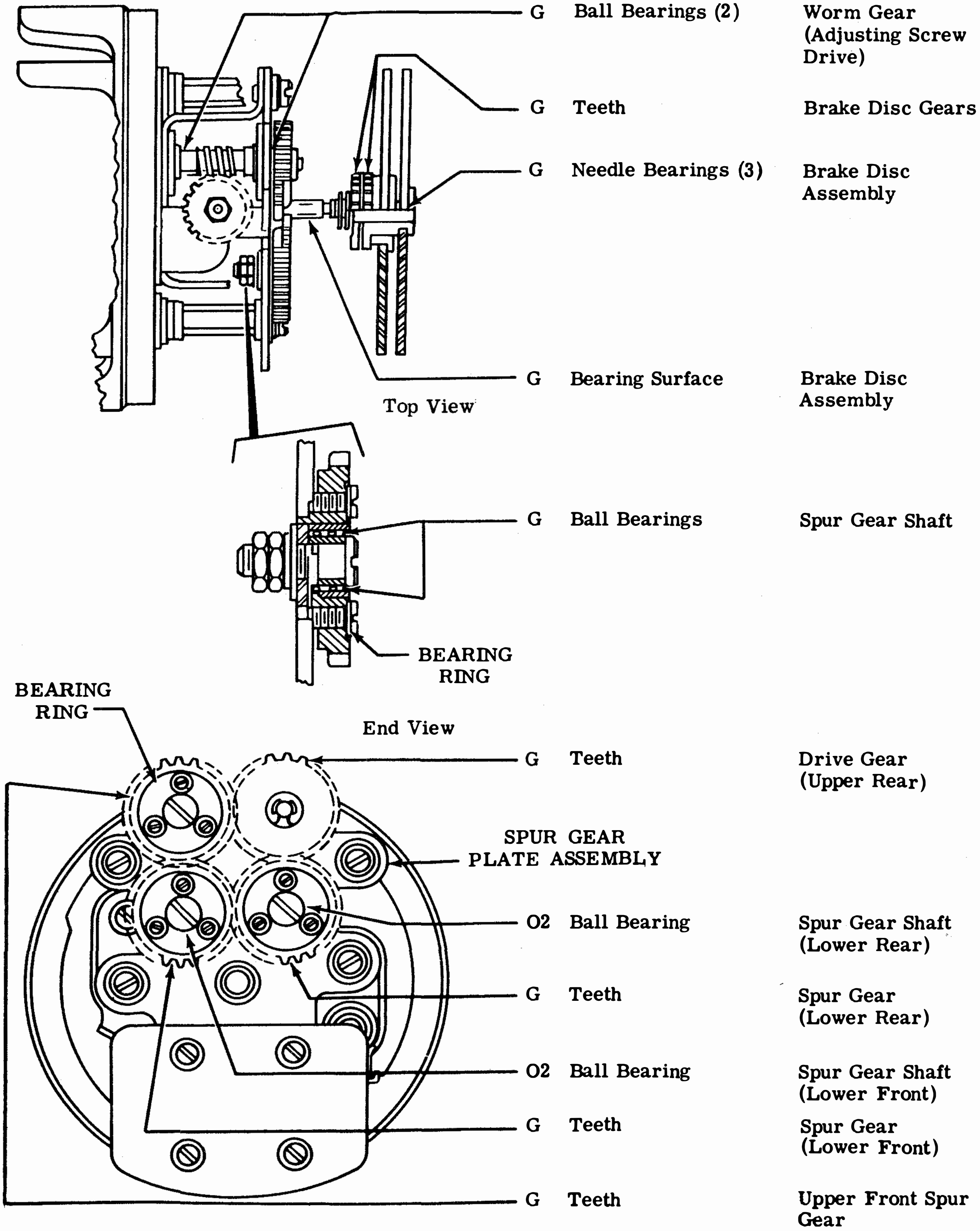


Figure 4-279. Access Instructions to Lubricate Gear Train and Governor, End View



G	Ball Bearings (2)	Worm Gear (Adjusting Screw Drive)
G	Teeth	Brake Disc Gears
G	Needle Bearings (3)	Brake Disc Assembly
G	Bearing Surface	Brake Disc Assembly
G	Ball Bearings	Spur Gear Shaft
G	Teeth	Drive Gear (Upper Rear)
O2	Ball Bearing	Spur Gear Shaft (Lower Rear)
G	Teeth	Spur Gear (Lower Rear)
O2	Ball Bearing	Spur Gear Shaft (Lower Front)
G	Teeth	Spur Gear (Lower Front)
G	Teeth	Upper Front Spur Gear

Figure 4-280. Gear Train and Governor

Keep electrical contacts and wire insulations free of lubricants. In general, apply oil to all bearings and locations where parts rub, slide, or move with respect to each other. Apply grease to gear teeth and points of heavy pressure.

4-14. SCHEDULED PERFORMANCE TESTS. Performance tests consist of mechanical adjustment checks, described in paragraphs 4-14b and 4-14c, and operational tests described in paragraph 4-14d.

a. Preliminary Instructions. Prior to performing mechanical adjustment checks, disassemble machine as follows:

WARNING

Disconnect power from unit. Failure to comply can cause serious injury.

(1) Open ASR top by depressing plungers on sides of dome.

(2) Remove typing unit.

(a) Disconnect P103 from J103 (for low-level).

(b) Remove R plug by pushing clips together at bottom.

(c) Remove four screws which mount typing unit on base.

(d) With left hand under rear frame and right hand on side of front plate above dashpot, lift typing unit from base.

b. Keyboard Unit Adjustment Checks. The following paragraphs describe procedures for checking keyboard unit adjustments.

NOTE

The following checks will begin with signal generator clutch disengaged and synchronous pulse armature lever held to front by lever clamp.

(1) Check signal generator clutch shoe lever as follows:

(a) Refer to Figure 6-108.

(b) Measure clearance between shoe lever and disk stop-lug.

(c) Engage clutch.

(d) Repeat step (b).

(e) Clearance in step (d) should be between 0.055 and 0.085 inch greater than clearance in step (b). If the difference is not within the specified limits, perform adjustment procedures described in paragraph 6-4b(1).

(2) Check signal generator clutch stop lever as follows:

(a) Refer to Figure 6-109.

(b) Engage signal generator clutch.

(c) Rotate through a full rotation and ensure stop lever does not touch drum at any point and engages shoe lever by a full thickness.

(d) If necessary, perform adjustment procedure described in paragraph 6-4b(2).

(3) Check code bar bail as follows:

(a) Refer to Figure 6-102.

(b) Depress LTRS key.

(c) Rotate signal generator shaft until bottom of code bar bail is in maximum left position.

(d) Measure clearance between right side of code bar bail roller and left side of code bar bail latch.

(e) There should be some clearance not exceeding 0.006 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-4a(12).

(4) Check code bar bail and non-repeat lever clearance as follows:

(a) Refer to Figure 6-103.

(b) Press any key.

(c) Measure clearance between left side of non-repeat roller and right edge of lip on non-repeat lever.

(d) Clearance should be between 0.010 and 0.020 inch. If clearance exceeds specified limits, perform adjustment procedure described in paragraph 6-4a(14).

(5) Check universal bail extension as follows:

(a) Refer to Figure 6-105.

(b) Press any key.

(c) Measure clearance between top of non-repeat lever and bottom of universal bail forward extension.

(d) Clearance should be between 0.050 and 0.080 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-4a(17).

(6) Check universal bail latchlever as follows:

(a) Refer to Figure 6-104.

(b) Depress bar slowly with 32 ounces force.

(c) While maintaining force, manually rotate universal bail backward and release quickly.

(d) Maintain force on bar and measure clearance between rear edge of latchlever and front edge of universal bail vertical extension roller.

(e) Clearance should be between 0.015 and 0.020 inch. If clearance exceeds specified limits, perform adjustment procedure described in paragraph 6-4a(15).

(7) Check intermediate gear bracket as follows:

(a) Refer to Figure 6-134.

(b) Place typing unit on keyboard.

(c) Rotate motor fan to ensure gears are meshed.

(d) Gently rotate intermediate driven gear back and forth.

(e) Ensure backlash between typing unit driving gear and driven gear is barely perceptible as gauged by feel. If backlash is not excessive, remove typing unit. If backlash is excessive, perform adjustment procedure described in paragraph 6-4d(16).

(f) While holding motor fan stationary, gently rotate intermediate driven gear back and forth.

(g) Ensure backlash between driving gear and driven gear is barely perceptible as gauged by eye and feel. If backlash is excessive, perform adjustment procedure described in paragraph 6-4d(16).

(8) Check synchronous pulse contact gap as follows:

(a) Refer to Figure 6-442.

(b) Disengage signal generator clutch.

(c) Measure gap between contacts.

(d) Gap should be between 0.020 and 0.035 inch. If gap exceeds specified limits, perform adjustment procedure described in paragraph 6-13h(5).

(9) Check synchronous pulse mounting bracket as follows:

(a) Refer to Figures 6-440 and 6-441.

(b) Remove clamp from synchronous pulse armature lever.

(c) Press any key.

(d) Rotate signal generator shaft until trip bar is in maximum left position.

(e) Measure clearance between right end of trip bar and left side of armature lever latching surface.

(f) Clearance should be between 0.005 and 0.015 inch. If clearance exceeds specified limits, perform adjustment procedure described in paragraphs 6-13h(1) and (3).

(g) Push synchronous pulse armature lever into contact with magnet pole face.

(h) Measure clearance between clutch trip bar and armature at closest point.

(i) Clearance should be between 0.005 and 0.015 inch. If clearance is within specified limits, replace armature and proceed to next step. If clearance exceeds specified limits, perform adjustment procedure described in paragraphs 6-13h(1) and (3).

c. Typing Unit Mechanical Adjustment Checks. The following paragraphs describe procedures for checking typing unit adjustments.

(1) Check range finder knob phasing as follows:

(a) Refer to Figure 6-14.

(b) Rotate range finder knob either clockwise or counterclockwise to the stop.

(c) Zero on range scale should be within 3 points of index mark. If zero is more than 3 points away from index, perform adjustment procedure described in paragraph 6-3.1a(15).

(2) Check selector clutch stop arm as follows:

(a) Refer to Figure 6-14.

(b) Set range scale at 60.

(c) With selector clutch disengaged and armature in marking position, clutch stop arm should engage clutch shoe lever by approximately the full thickness of shoe lever. If not, perform adjustment procedure described in paragraph 6-3.1a(16).

(3) Check selector clutch drum end play as follows:

(a) Refer to Figure 6-11.

(b) With clutch latched in stop position, measure cam-clutch assembly end play.

(c) Cam-clutch assembly should have some end play, but not to exceed 0.010 inch. If end play adjustment is necessary, perform procedure described in paragraph 6-3.1a(11).

(4) Check code bar clutch trip lever end play as follows:

(a) Refer to Figure 6-25.

(b) Disengage selector clutch and code bar clutch.

(c) Code bar clutch trip lever should engage clutch shoe lever by full thickness of clutch shoe lever, and trip shaft should have some end play, but not to exceed 0.006 inch.

(d) If either engagement or end play adjustment is necessary, perform procedure described in paragraph 6-3.1c(2).

(5) Check function clutch trip lever end play as follows:

(a) Refer to Figure 6-26.

(b) Disengage code bar clutch and function clutch.

(c) Function clutch trip lever should engage clutch shoe lever by full thickness of clutch shoe lever. (Check at lug with least bite on three-stop clutches.) Trip lever shaft should have some end play, but not to exceed 0.006 inch.

(d) If either engagement or end play adjustment is necessary, perform procedure described in paragraph 6-3.1c(4).

(6) Check clutch trip shaft set collars as follows:

(a) Refer to Figure 6-28 (earlier design - Figure 6-536).

(b) Measure spacing cutout lever end play.

(c) Lever should have some end play, not to exceed 0.008 inch.

(d) Measure line-feed clutch latchlever end play.

(e) Lever should have some side play, not to exceed 0.008 inch.

(f) If side play adjustment is required, perform procedure described in paragraph 6-3.1c(6) (earlier design - paragraph 6-17c(2)).

(7) Check type box clutch trip lever eccentric post as follows:

(a) Refer to Figure 6-31.

(b) Disengage type box clutch.

(c) Ensure that trip lever engages clutch shoe lever by full thickness of shoe lever.

(d) If full engagement does not exist, perform adjustment procedure described in paragraph 6-3.1c(9).

(8) Check spacing clutch trip lever as follows:

(a) Refer to Figure 6-29 (earlier design - Figure 6-538).

(b) Disengage clutch.

(c) Trip clutch trip lever and rotate main shaft until trip lever is over shoe lever. Take up play of shoe lever inward by snapping trip lever over shoe lever.

(d) Check clearance between shoe lever and drum at each of three-stop positions to determine which stop yields greatest clearance.

(e) With trip lever at stop position which yields greatest clearance, rotate main shaft slowly until trip lever just falls off stop lug. Check clearance between trip lever and drum. Clearance should be from 0.018 to 0.035 inch less than clearance between shoe lever and drum.

(f) If clearance adjustment is necessary, perform procedure described in paragraph 6-17c(4).

(9) Check line-feed clutch trip lever eccentric post as follows:

(a) Refer to Figure 6-32.

(b) Disengage clutch.

(c) Trip clutch trip lever and rotate main shaft until trip lever is over shoe lever. Take up play of shoe lever inward by snapping trip lever over shoe lever.

(d) Check clearance between shoe lever and drum of each of three-stop positions to determine which stop yields greatest clearance.

(e) With trip lever at stop position which yields greatest clearance, rotate main shaft slowly until trip lever just falls off stop lug. Check clearance between trip lever and drum. Clearance should be from 0.018 to 0.035 inch less than clearance between shoe lever and drum.

(f) If clearance adjustment is necessary, perform procedure described in paragraph 6-3.1c(10).

(10) Check line-feed clutch trip lever adjusting screw as follows:

(a) Refer to Figure 6-32.

(b) Set line-feed function slide arm in rear position and clutch trip lever against its eccentric post.

(c) Hold trip arm against the function slide arm and measure clearance between end of trip lever adjusting screw and trip arm. Clearance should not exceed 0.006 inch.

(d) If clearance adjustment is necessary, perform procedure described in paragraph 6-3.1c(11).

(11) Check line-feed clutch phasing as follows:

(a) Refer to Figure 6-82.

(b) Disengage line-feed clutch.

(c) Both line-feed bars should engage teeth of line-feed spur gear and be flush with each other.

(d) If adjustment is necessary, perform procedure described in paragraph 6-3.1h(1).

(12) Check line-feed spur gear detent eccentric as follows:

(a) Refer to Figure 6-83.

(b) Disengage line-feed clutch.

(c) Rotate platen until detent stud is seated between two teeth on line-feed spur gear.

(d) When hand-wheel is released, manually set the teeth on the feed bars into engagement with the teeth on the line-feed spur gear.

(e) The detent stud should contact one gear tooth and be not more than 0.010 inch from other tooth. If adjustment is necessary, perform procedure described in paragraph 6-3.1h(2).

(13) Check clutch shoe levers as follows:

(a) Refer to Figure 6-34.

(b) Disengage clutch and measure gap between clutch shoe lever and its stop-lug. Record measurement.

(c) Engage and rotate clutch until clutch shoe lever is towards bottom of unit.

(d) With clutch engaged, again measure gap between clutch shoe lever and its stop-lug. Measurement should be 0.055 inch to 0.085 inch greater than measurement obtained in step (b) above. If adjustment is necessary, perform procedure described in paragraph 6-3.1c(13).

(e) Repeat steps (a) through (d) for each clutch.

(14) Check spacing gear clearance as follows:

(a) Refer to Figure 6-37.

(b) With carriage fully returned, hold spacing driving gear stationary and gently rotate driven gear back and forth.

(c) Ensure backlash between gears is barely perceptible, without bind, at closest point in travel. If backlash adjustment is necessary, perform procedure described in paragraph 6-3.1d(2).

(15) Check spacing gear phasing as follows:

(a) Refer to Figure 6-37.

(b) Engage spacing clutch.

(c) Observe index line on spacing pawl is midway between the two lines on pawl retaining washer. If adjustment is necessary, perform procedure in paragraph 6-3.1d(1).

(16) Check rocker shaft bracket eccentric stud as follows:

(a) Refer to Figure 6-51.

(b) Disengage type box clutch and take up play on locking arm, toward front.

(c) Measure gap between lower side of locklever roller and top edge of shoulder on horizontal positioning locklever. Gap should be between 0.055 inch and 0.090 inch. If not, perform adjustment procedure described in paragraph 6-3.1e(2).

(17) Check code bar shift lever drive arm as follows:

(a) Refer to Figure 6-20 (earlier design - Figure 6-533).

(b) Engage and rotate code bar clutch until code bar shift lever link is in uppermost position.

(c) There should be some clearance, but not to exceed 0.025 inch, between top of code bar shift lever link roller and top of cam slots in top of code bar shift levers. If adjustment is necessary, perform procedure described in paragraph 6-3.1b(5).

(d) Code bar shift lever link shaft should have some end play but not to exceed 0.006 inch. If adjustment is necessary, perform procedure described in paragraph 6-3.1b(5) earlier design - paragraph 6-17b(1).

(18) Check transfer lever eccentric as follows:

(a) Refer to Figure 6-18.

(b) Set up a LETTERS (12345) code combination.

(c) Disengage selector clutch.

(d) Engage and rotate code bar clutch until code bar shift lever link is in uppermost position.

(e) With play of shiftbar taken up for maximum clearance, measure clearance between rear code bar shift lever and code bar shiftbar farthest from shift lever.

(f) Clearance should be 0.010 to 0.025 inch. If not, perform adjustment procedure described in paragraph 6-3.1b(3).

(19) Check intermediate arm backstop bracket as follows:

(a) See Figure 6-19.

(b) Set up a BLANK (-----) code combination.

(c) Disengage selector and code bar clutches.

(d) Take up play to obtain maximum clearance between front code bar shift lever and inner step of code bar shiftbar farthest from shift lever, then measure clearance.

(e) Clearance should be from 0.010 inch to 0.025 inch. If not, perform adjustment procedure described in paragraph 6-3.1b(4).

(20) Check code bar shift lever link brackets as follows:

(a) Refer to Figure 6-21 (earlier design link guide bracket - Figure 6-534).

(b) Set up a LETTERS (12345) code combination.

(c) Engage and rotate code bar clutch until code bar shift lever link is in uppermost position.

(d) Ensure code bars are detented.

(e) With play taken up for maximum clearance, measure clearance between right side of front code bar shift lever and shoulder of closest code bar shiftbar. Clearance should be between 0.002 inch and 0.025 inch.

(f) Set up a BLANK (-----) code combination.

(g) Repeat steps (c) and (d).

(h) With play taken up for maximum clearance, measure clearance between left side of rear code bar shift lever and shoulder of closest code bar shiftbar. Clearance should be between 0.002 inch and 0.025 inch.

(i) If clearance in either step (e) or (h) above is not within specified limits, perform adjustment procedure described in paragraph 6-3.1b(6) (earlier design link guide bracket - paragraph 6-17b(2)).

(21) Check type box clutch trip lever as follows:

(a) Refer to Figure 6-33 (variable feature - Figure 6-383).

(b) Engage and rotate code bar clutch until trip shaft cam follower roller is on lowest surface of code bar clutch cam.

(c) Align type box clutch disk stop lug with trip lever.

(d) Measure clearance between trip lever and stop-lug. Clearance should be from 0.025 inch to 0.045 inch.

(e) Measure type box clutch latchlever side play. There should be some side play but it should not exceed 0.008 inch.

(f) If clearance measured in step (d) or side play measured in step (f) exceeds specified limits, perform adjustment procedure described in paragraph 6-3.1c(12) (variable features - paragraphs 6-12c(1) and 6-12n(3)).

(22) Check carriage draw-wire rope as follows:

(a) Refer to Figure 6-40.

(b) Engage and rotate type box clutch 180 degrees.

(c) As gauged by feel, rear upper cable should have slightly greater tension then front cable.

(d) Measure clearance between lower draw-wire rope and carriage return latch bail post. Clearance should be 0.006 inch minimum.

(e) Measure clearance between lower draw-wire rope and left horizontal positioning drive linkage. Clearance should be 0.030 inch minimum.

(f) If either clearance is insufficient, perform adjustment procedure described in paragraph 6-3.1d(9).

(23) Check oscillating rail slide position as follows:

(a) Refer to Figure 6-38 (earlier design - Figure 6-539).

(b) Move type box carriage to right until feed pawl farthest advanced engages tooth immediately above cutaway section on spacing drum ratchet.

(c) Measure clearance between oscillating rail slide and right rear draw-wire pulley at point on pulley where clearance is minimal.

(d) Clearance should be between 0.025 inch and 0.050 inch. If clearance is not within the specified limits, perform adjustment procedure described in paragraph 6-3.1d(3) (earlier design - paragraph 6-17d(1)).

(24) Check printing carriage lower roller as follows:

(a) Refer to Figure 6-72.

(b) Move printing carriage to right.

(c) Operate manual carriage return while holding printing carriage to right. Allow carriage to slowly return.

(d) Observe play of carriage on track is minimal over full length of track.

(e) If adjustment of eccentric bushing or sliding screw is necessary, perform procedure described in paragraph 6-3.1g(1).

(25) Check function reset bail blade as follows:

(a) Refer to Figure 6-63 (earlier design - Figure 6-547).

(b) Engage and rotate code bar clutch until shoe lever just touches trip lever.

(c) Disengage all function pawls from function bars.

(d) Unlatch all function lever latches from function levers.

(e) Using spring pulley, pull each function bar to rear and measure clearance between each function bar and function reset bail blade.

(f) Clearance should be between 0.018 inch and 0.035 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-3.1f(1) (earlier design - paragraph 6-17e(2)).

(26) Check printing carriage position as follows:

(a) Refer to Figure 6-74.

(b) Set up M (--345) code combination.

(c) Position printing carriage at approximate midpoint of platen.

(d) Engage and rotate type box clutch 180 degrees.

(e) From top view, as gauged by eye, ensure that M type pallet is centered on printing hammer when hammer is touching pallet.

(f) If adjustment is necessary, perform procedure described in paragraph 6-3.1g(3).

(27) Check printing hammer bearing stud as follows:

(a) Refer to Figure 6-75.

(b) Set up a PERIOD (--345) code combination in upper case.

(c) Position printing carriage at approximate midpoint of platen.

(d) Engage and rotate type box clutch 180 degrees.

(e) From right view, as gauged by eye, ensure that period type pallet fully engages printing hammer when hammer is touching pallet.

(f) If adjustment is necessary, perform procedure described in paragraph 6-3.1g(4).

(28) Check spacing trip lever bail cam plate as follows:

(a) Refer to Figure 6-39.

(b) With spacing trip lever arm in upward position, engage and rotate type box clutch 180 degrees.

(c) Disengage all function pawls from function bars.

(d) Measure clearance between top surface of trip lever arm extension and spacing trip lever shoulder.

(e) Clearance should be between 0.010 inch and 0.040 inch. If clearance exceeds specified limits, perform adjustment procedure described in paragraph 6-3.1d(5).

(29) Check printing track as follows:

(a) Refer to Figure 6-76.

(b) Set up BLANK (-----) code combination in figures.

(c) Position printing arm slide alternately over each printing track mounting screw.

(d) Position printing hammer operating bail latching extension in line with left face of latch shoulder.

(e) Measure clearance between latching extension and latch shoulder.

(f) Clearance should be between 0.015 inch and 0.040 inch. If clearance exceeds specified limits, perform adjustment procedure described in paragraph 6-3.1g(5). Hold clearance to maximum.

NOTE

Cycle unit between each check.

(30) Check printing hammer stop bracket as follows:

(a) Refer to Figure 6-77 (earlier design - Figure 6-555).

(b) Set up M (--345) code combination.

(c) Engage and rotate type box clutch 180 degrees.

(d) Hold printing hammer stop bracket towards type pallet with 8 ounces of force.

(e) Measure clearance between printing hammer and M type pallet across entire length of pallet.

(f) Clearance should be between 0.035 inch and 0.050 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-3.1g(10) (earlier design - paragraph 6-17g(2)).

(31) Check printing arm as follows:

(a) Refer to Figure 6-77 (earlier design - Figure 6-555).

(b) Position printing track in its extreme downward position.

(c) Set printing hammer operating bail against its stop.

(d) Take up play for maximum by lightly pressing down on printing arm slide and measure clearance between secondary printing arm and forward extension of printing hammer operating bail.

(e) There should be some clearance, not to exceed 0.015 inch.

(f) Position printing track in its extreme upward position.

(g) Disengage type box clutch.

(h) Measure clearance between right face of operating bail latching extension and left face of latch surface. Check right and left positions.

(i) Clearance should be 0.006 inch minimum.

(j) If clearance measured in steps (d) or (i) is not within specified limits, perform adjustment procedure described in paragraph 6-3.1g(12) (earlier design - paragraph 6-17g(3)).

(32) Check carriage return latch bail as follows:

(a) Refer to Figure 6-42.

(b) Manually return carriage.

(c) Take up play in carriage return bail to right by holding right side against retainer.

(d) Measure clearance between carriage return lever and carriage return latch bail.

(e) Clearance should be between 0.004 inch and 0.040 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-3.1d(12).

(33) Check carriage return lever as follows:

(a) Refer to Figure 6-43.

(b) Set up CARRIAGE RETURN (---4-) code combination.

(c) Engage and rotate function clutch until stop-lug is toward bottom of unit.

(d) Rotate spacing drum clockwise until carriage return latch bail overtravels carriage return lever.

(e) Measure clearance between latching surface of carriage return latch bail and top of carriage return lever.

(f) Clearance should be between 0.006 inch and 0.035 inch. If clearance is not within specified limits, perform adjustment procedure described in paragraph 6-3.1d(14) (variable feature - paragraph 6-12g(5)).

(34) Check left margin as follows:

(a) Refer to Figure 6-45 (sprocket feed) or 6-84 (line-feed). (For earlier design line-feed, refer to Figure 6-541.)

(b) Manually return carriage.

(c) Shift type box to LETTERS condition.

(d) Ensure front feed pawl is farthest advanced.

(e) Measure clearance between left edge of platen and letters print indicator.

(f) Clearance should be between 15/16 inch and 1-1/16 inch. If clearance is not within the specified limits, perform adjustment procedure described in paragraph 6-3.1d(17).

(g) Take up play in spacing shaft by rotating driven gear clockwise from a front view.

(h) Measure clearance between feed pawl and shoulder of ratchet tooth immediately above pawl. There should be some clearance, not to exceed 0.008 inch.

(i) Engage and rotate spacing clutch until rear feed pawl is farthest advanced and clutch is disengaged.

(j) Manually return carriage.

(k) Observe rear feed pawl drops into indentation between ratchet wheel teeth, and bottoms firmly in notch. If adjustment is necessary, perform procedure described in paragraph 6-3.1h(13) (sprocket feed) or 6-3.1d(17) (line-feed). (For earlier design line-feed, refer to paragraph 6-17d(5)).

(35) Check shift linkage as follows:

(a) Refer to Figure 6-60.

(b) Position carriage near midpoint at platen.

(c) Set up O (not zero) (---45) code combination.

(d) Engage and rotate type box clutch 180 degrees.

(e) Note position of printing hammer in relation to O (not zero) type pallet when hammer is pushed in to touch pallet.

(f) Manually buckle right shift linkage.

(g) Position of printing hammer in relation to 9 type pallet should be same as it was in relation to O (not zero) type pallet in step (e).

(h) Repeat steps (b) through (g) using number 2 type pallet and W(12--5) code combination.

(i) If adjustment is necessary, perform procedure described in paragraph 6-3.1e(16).

(36) Check stripper blade drive cam position as follows:

(a) Refer to Figure 6-69.

(b) Note amount of overtravel between upper high of stripper blade drive cam and stripper blade drive arm.

(c) Engage and rotate function clutch 180 degrees.

(d) Note amount of overtravel between lower high of stripper blade drive cam and stripper blade drive arm.

(e) Amount of overtravel in steps (b) and (d) should be equal as gauged by eye. If adjustment is necessary perform procedure described in paragraph 6-3.1f(9).

d. Operational Tests. Operational tests for high-level ASR equipment are discussed below in paragraph 4-14d(1) and for low-level ASR equipment in paragraph 4-14d(2).

(1) Operational Tests (High-Level). Figure 4-281 shows test setup required to perform high-level ASR test procedures described in Table 4-10. If abnormal indications are encountered during a test, refer to Troubleshooting Index, Table 5-1, in Chapter 5. Prior to conducting the tests, perform the following initial control setting on the AN/UGM-8B(V) and TS-2616/UGM test sets shown in Figure 4-281.

AN/UGM-8B(V)

(1) POWER ON/OFF switch to OFF.

(2) DISTORTION SELECT switch to MARK BIAS.

(3) PERCENT DISTORTION switch to 0.

(4) STOP LENGTH SYNC-START/STOP switch to S/S 1.42.

(5) CHARACTER RELEASE switch to FREE RUN.

(6) SIGNAL PATTERN switch to STDY MK.

(7) RATE switch to 74.2.

(8) LOOP POLARITY switch to either + or - to cause meter to deflect to right.

(9) LOOP ADJ control fully counterclockwise.

(10) HIGH-LEVEL OUTPUT MODE switch to EXT NEUT.

(11) MARK SPACE switches to any position.

TS-2616/UGM

(1) AC POWER switch to OFF (down) position.

(2) PEAK RESET switch to AUTO.

(3) RATE-BAUDS switch to 74.2.

(4) CODE LEVEL switch to 5.

(5) DISTORTION SELECT switch to PEAK-TOTAL.

(6) TRANSITION SELECT switch to all.

(7) INPUT POLARITY switch to either + or - to cause meter to deflect to right.

(8) INPUT SELECT switch to NEUTRAL 60.

(9) INPUT FILTER switch to IN.

(2) Operational Tests (Low-Level). Figure 4-282 shows test setup required to perform low-level ASR procedures described in Table 4-11. If abnormal indications are encountered during a test, refer to Troubleshooting Index, Table 5-1, Chapter 5. Prior to conducting the tests, perform the initial control settings on the AN/UGM-8B(V) and TS-2616/UGM test sets as described in paragraph 4-8d(1).

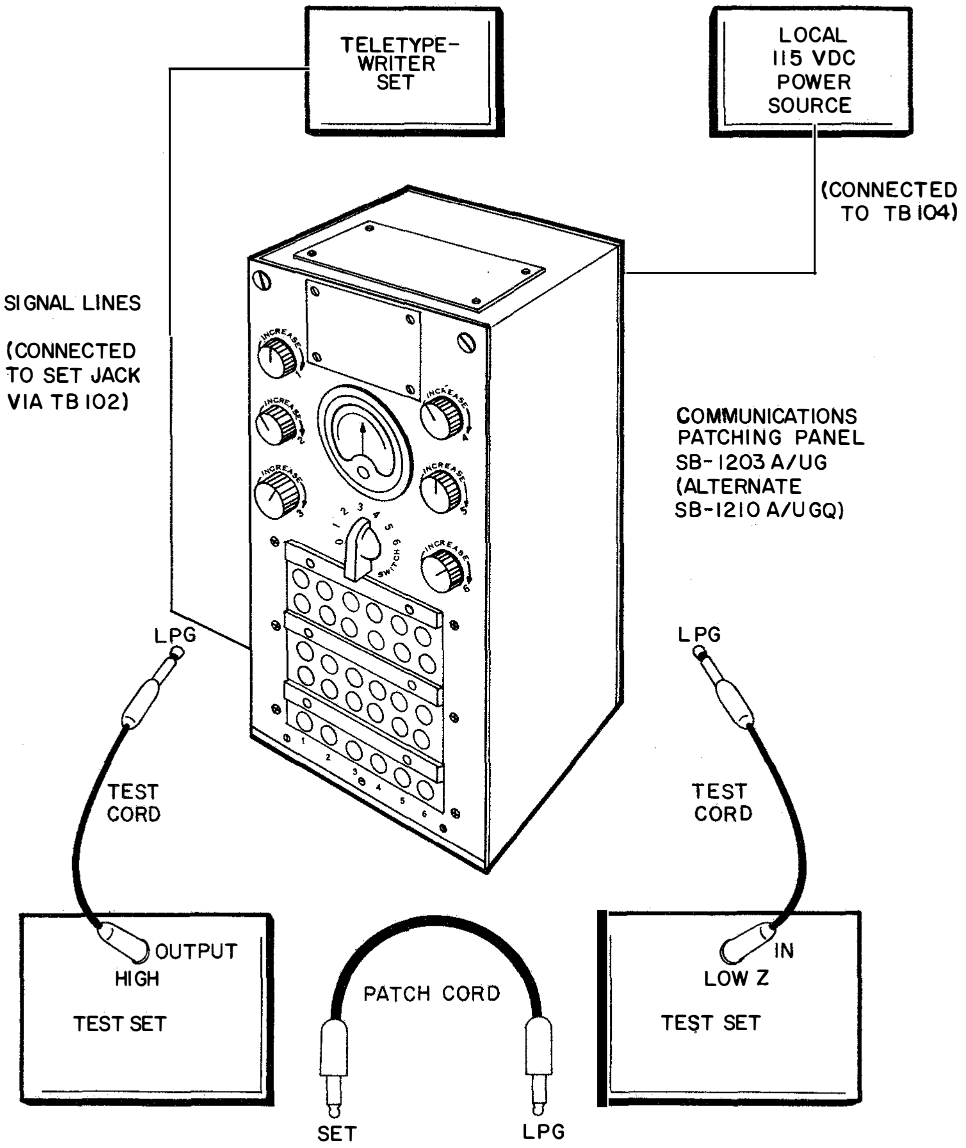


Figure 4-281. ASR Test Setup (High-Level)

Table 4-10. Operational Test Procedures

Step	Action	Normal Indication	Reference Table 5-1
1.	<u>Preliminary</u>		
a.	Ensure teletype test set controls are set as indicated in paragraph 4-14d.		
b.	ASR power switch must be OFF and control knob set to position K.		
c.	If optional DC power supply is used place power switch in the OFF position.		
d.	Using appropriate wiring diagrams, connect all ASR signal lines in series to test set input.		
e.	If optional DC power supply is used, connect its DC output into the signal line.		
f.	APPLY local 115 VAC power to ASR test set, and DC power supply.		
g.	Move teletype test set power switch to the ON position.		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
h.	If DC power supply is used, move the power switch to the ON position. Set the DC output to the proper value.		
i.	Set switch on either DC power supply or teletype test set for correct polarity.		
j.	Move LINE-TEST switch on ASR to LINE.		
k.	Turn power switch of ASR to the ON position.	Teletype runs closed.	Item 35 and 36
l.	Adjust signal line loop current to proper value.		
m.	Send repeated Y's from ASR keyboard.		
n.	Adjust keyboard signal generator contacts to less then 3 percent distortion.	Machines meets requirements for copying distorted messages.	Item 22
o.	Set switch on teletype test set to check MARK to SPACE transition of the code.		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
p.	Alternate transition selector switch of teletype test set and adjust contacts until there is less than 3 percent distortion in both switch positions.		
q.	Set switch on teletype test set to test total distortion.		
r.	Total distortion should be less then 5 percent. If it is not less then 5 percent, refine adjustments. Refer to n through q.		
s.	Set control knob to T position.	Character advances one unit for each character.	Item 63
t.	Send repeated Y's from transmitter distributor.		
u.	Repeat steps n through s adjusting transmitter distributor signal generator contacts.		
v.	Place teletype test set controls to positions indicated in paragraph 4-8d(2).		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
w.	Connect ASR signal line to test set output. (If test set must be changed or if hard wiring is necessary, remove AC power from equipment and make appropriate change.		
x.	Turn test set power switch to ON.		
2.	<u>Typing Unit Range Check</u>		
a.	Turn ASR control knob to the K position.		
b.	Turn power switch on ASR to the ON position.	Motor operates.	Item 28
c.	Adjust signal line loop current to proper level.		
d.	Set signal pattern switch on test set to output message.	(1) Typing unit types test message.	Item 11
		(2) LETTERS-FIGURES shift and FIGURES-LETTERS shift operate properly.	Item 48
		(3) Normal carriage return and line-feed operate properly.	Item 17

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
e.	Adjust range finder knob on selector assembly to determine minimum and maximum settings at which message is typed without error.		
f.	Note difference between minimum and maximum settings obtained in step e.	72 (minimum difference)	Item 1
g.	Place range finder on optimum setting as follows:		
	(1) Add low and high readings obtained in step e.		
	(2) Divide by 2.		
	(3) Resulting number is optimum setting.		
3.	Typing Unit Quality of Print Check.		
a.	While typing unit is receiving test message, observe quality of printed copy.	(1) Characters are positioned on straight vertical line.	Item 3
		(2) Uniform spacing between characters.	Item 1
		(3) Clear type.	Item 2

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
		(4) Proper, error-free test pattern typed.	Item 4
		(5) Proper ribbon-feed.	Item 5
b.	Manually operate ribbon lever inward, on side where ribbon is being unwound.	Ribbon reverses.	Item 6
c.	Repeat step b, using other ribbon lever.	Ribbon reverses.	Item 6
d.	Set SIG PATTERN switch on test set to STEADY MARK.		
4.	<u>Typing Unit Distorted Signal Check</u>. NOTE This test checks the ability of the typing unit to copy a distorted signal.		
a.	Ensure DISTORTION SELECT switch on test set is set to MARK BIAS.		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
b.	Set PERCENT DISTORTION switches to 40 percent. (1) TENS: 40 (2) UNITS: 0		
c.	Set SIGNAL PATTERN switch on test set to MESSAGE OUTPUT.	Must copy one line with not more then 3 percent distortion.	Item 22
d.	Set DISTORTION SELECT switch to SPACE BIAS.	Same as step c.	
e.	Set DISTORTION SELECT switch to MARK END.	Same as step c.	
f.	Set PERCENT DISTORTION switches to 35 percent. (1) TENS: 30 (2) UNITS: 5		
g.	Set DISTORTION SELECT switch to SPACE END.	Same as step c.	
h.	Set DISTORTION SELECT switch to SWITCH BIAS.	Same as step c.	
i.	Set POWER ON/OFF switch on test set to OFF.		
j.	Set power switch on ASR to OFF.		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
5.	<u>Typing Unit Proper Function Operation Check</u>.		
a.	Set signal pattern switch on test set to STEADY MARK.		
b.	Press FIGS key.	FIGS Shift should occur.	Item 48
c.	Press S key.	Signal bell rings.	Item 12
d.	Set single/double line-feed lever (inside) to number 1 position.	Line-feed should occur whe LINE FEED key is depressed.	Item 9
e.	Press LINE-FEED key.	Typing unit single line-feeds.	Item 14
f.	Set single/double line-feed lever to number 2 position.	Same as d.	Item 9
g.	Repeat step e.	Typing unit double line-feeds.	Item 14
h.	Press LOC CR key to return carriage.	Carriage should return to left margin.	Item 8

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
i.	Press M and REPT keys simultaneously until full line of Ms has been printed, carriage has returned, and printing has started on next line. Count characters.	(1) There shall be 72 clear characters.	Items 15 and 16
		(2) The 74th character shall strike over the 73rd character.	Items 15 and 16
		(3) The 75th character shall print approximately in center of page, beneath 32nd through 42nd character.	Items 15 and 16
		(4) The 76th character shall print exactly under 1st character.	Items 15 and 16
		(5) The 77th character shall print exactly under 2nd character.	Items 15 and 16
j.	Press RETURN key.	Carriage returns and line-feeds.	Items 17 and 20
k.	Press LINE-FEED key.	No line-feed occurs.	Items 17 and 20
l.	Repeat step k.	No line-feed occurs.	Items 17 and 20
m.	Repeat step k.	Line feed occurs.	Items 17 and 20

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
6.	<u>Local Functions Check</u>		
a.	Press LOC CR key.	Carriage returns.	Item 18
b.	Press and hold LOC LF key.	Line-feed occurs continuously until key is released.	Item 19
7.	<u>Keyboard Operation Check</u>		
a.	Turn the main power switch at the lower right side of the keyboard, to the upper position which is ON.	Keyboard motor starts.	Item 28
b.	Turn the keyboard control knob to the K position.		
c.	Move the LINE-TEST switch to the LINE position.		
d.	Manually depress each character key.	The proper character should be printed for each key depressed.	Item 4
e.	Depress the LOC LF key.	Paper should feed from the typing unit three times faster then when the LINE-FEED and REPT keys are depressed.	Item 9
f.	Depress the REC key.	This should prevent signal generation.	Item 27

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
g.	Depress the SEND key.	This should restore signal generation.	
h.	Depress the BREAK key, hold it depressed for about two seconds.	The electrical keyboard lock will be activated as in (f). Depress SEND key to resume keyboard transmission.	Item 44
i.	Depress and hold REPT key simultaneously with any other key except local function keys.	This should cause repeated transmission of the associated code combination.	Item 66
j.	Depress the LOC CR key.	Carriage should return to the left-hand margin.	Item 20
k.	Depress upper case S key.	Signal bell should ring once clearly each time the key is depressed.	Item 12
l.	Depress the BLANK key alternately with any key other then the local function keys.	Keyboard should not lock.	Item 62
m.	Depress the BLANK key twice in succession.	Keyboard should lock. Depress the SEND key to resume keyboard transmission.	Item 61

Table 4-10. Operational Test Procedures - Continued

Step	Action	.Normal Indication	Reference Table 5-1
n.	Depress the spacebar below the bottom row of keys.	This will initiate a mechanical allowance for a space, as between two words in the printed page message, or a symbol on the perforated tape.	Item 1
o.	Depress the FIGS key.	The symbols indicated on the upper part of the key should print, such as figures, punctuation marks, or other uppercase symbols.	Item 48
p.	Depress the LTRS key.	This should print characters indicated on the lower part of the keys.	Item 68
q.	Depress the TAPE B. SP. key.	This should reverse the direction of the tape feed in the perforator for the space required by a single character code.	Item 67
8.	<u>K-T Position, Operational Check</u>.		
a.	Place the keyboard control knob in the K-T position.		
b.	Place the LINE-TEST key (if available) in the LINE position.		

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
c.	Depress each key.	The correct character should be printed on the page-printer and perforated in the tape. If the perforator-transmitter base includes a typing perforator or reperforator, the correct character should also be printed on the tape.	Item 2
d.	Depress the BLANK and REPT keys simultaneously.	Tape should feed out uninterrupted.	Item 42
e.	Depress the E and REPT keys simultaneously.	The character counter should work without missing a count. The end-of-line indicator lamp should light when the preset count is reached.	Item 63
f.	Depress the CAR RET key.	The indicator of the character counter should return to zero.	Item 64
g.	Depress the E key once more.	The counter should count one character.	
h.	Depress the keys indicated in (7)e through q.	The same functions should be performed as indicated in (7)e through q.	
i.	Check the accuracy of the transmitter distributor; it should be operational.	Use a prepared tape and monitor the transmission on the typing unit.	

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
j.	Operate the LINE-TEST key to the TEST position.	Results obtained should be the same when performing the tests given in (7)e through q except operation should be on a local loop.	
9.	<u>T Position Operational Check</u>.		
a.	Place control knob in the T position.		
b.	Place the LINE-TEST key (if available) in the LINE position.		
c.	Depress the BLANK and REPT keys simultaneously.	Tape should feed out of the punch without interruption at high speed until the depressed keys are released.	Item 52
d.	Perform same tests as indicated in (8)e through h.	The margin indicator lamp at the right of the cabinet dome, should light six characters before the count end-of-line position in the T mode of operation.	Item 63
e.	Operate the LINE-TEST key to the TEST position.		
f.	Perform the tests outlined in in (7) and (8).	Results obtained should be the same as indicated in (7) and (8).	

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
10.	<u>Transmitter Distributor</u>.		
a.	Place the transmitter switch in the OFF position.		
b.	Depress the red button.	The spring loaded tape lid should open.	Item 58
c.	Place the tape feed perforations on the teeth of the tape feed wheel with the first code to be transmitted directly over the sensing pins. The two code perforations should be toward the back of the transmitter.		Item 56
d.	Hold the tape down flat and close the lid.		
e.	Move the selector to the T mode.		
f.	Depress the SEND key.	The tape feed will be responsive to the transmitter distributor switch (GREEN).	Item 52
g.	Move the selector to the K-T mode.	Character counter should advance one unit for each character.	Item 63

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
11.	<u>Lamp Checks</u>. Check for proper operation of lamps as follows:		
a.	Observe pilot lamp.	Pilot lamp is lighted.	Item 1
b.	Observe cabinet illumination lamp.	Illumination lamp is lighted.	Item 2
12.	<u>Motor Checks</u>. Check for proper operation of motor as follows:		
a.	Observe motor starting.	Motor starts.	Item 3
b.	Determine that motor is not running too slow or too fast.	Motor runs at correct speed.	Item 4
13.	<u>Main Shaft Drive Check</u>. Check for proper main shaft drive as follows:		
a.	Observe main shaft rotation.	Main shaft rotates.	Item 5
b.	Observe gears.	Gears do not howl or chatter.	Item 6
14.	<u>Signal Generator Shaft Drive Check</u>. Observe signal generator shaft rotation.	Signal generator shaft rotates.	Item 7

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
15.	<u>Typing Reperforator Checks</u>. Check typing reperforator as follows:		
a.	Apply signal to set from signal line (external) or signal test set.	Typing reperforator operates.	Item 8
b.	Apply alternate R and Y signal input.	R and Y are typed and perforated.	Item 9
c.	If distortion test set is used, apply FIGS and LTRS input.	Proper shift character is printed and corresponding code is perforated.	Item 10
d.	With signal line idle (marking) press TAPE F.O. key.	Tape is fed out to preset length.	Item 11
e.	While tape is feeding, interrupt feed-out with incoming signal.	Feed-out stops and first character of signal is typed and perforated.	Item 12
f.	Stop signal transmission.	Tape automatically feeds out to preset length, typed and perforated for letters.	Item 13
g.	Lift tape out of tape container.	TAPE-OUT lamp lights.	Item 14

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
h.	Replace tape roll (with at least one inch of tape on core).	TAPE-OUT lamp extinguishes.	Item 15
i.	Press BREAK key.	Typing reperforator runs open.	Item 16
j.	Press KYBD LOCK key.	Keys in lower three rows will not operate.	Item 17
k.	Press KYBD UNLK key.	Tape is perforated according to input message.	Item 18
l.	Operate keyboard.	Character counter indicator advances one unit for each character or space typed and END-OF-LINE lamp lights between 66th and 68th space.	Item 19
m.	Depress CAR RET key.	Character counter indicator returns to zero and END-OF-LINE lamp is extinguished.	Item 20
n.	Press REPT key and one character key (or space-bar) and hold.	Character (or space) is typed and perforated continuously until REPT key is released.	Item 21
o.	Press TAB B. SP. key.	Last perforated character is moved to right (in punch mechanism) in line with punch pins.	Item 22

Table 4-10. Operational Test Procedures - Continued

Step	Action	Normal Indication	Reference Table 5-1
p.	Press LTRS key.	LETTERS code perforation obliterates previously punched (erroneous) code.	Item 23
q.	Turn ASR main power switch to the OFF position.	Motor stops.	Item 24

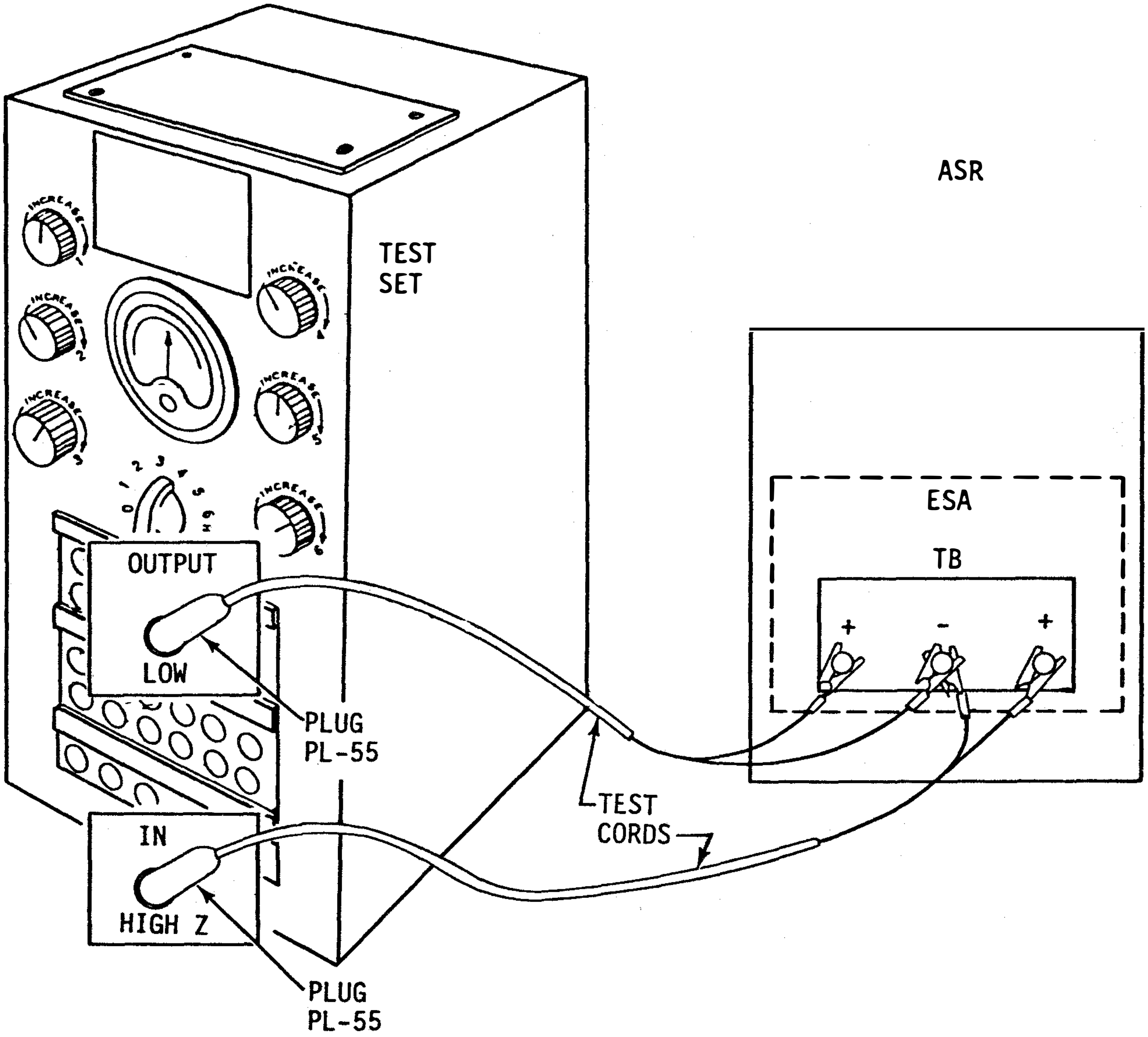


Figure 4-282. ASR Test Setup (Low-Level)

Table 4-11. Operational Test Procedures (Low-Level)

Step	Action	Normal Indication	Reference Table 5-1
1.	<u>Typing Reperforator Checks</u>. Check typing reperforator as follows:		
a.	Apply signal to set from line (external) or signal test set.	Typing reperforator operates.	Item 15
b.	Apply alternate R and Y signal input.	R and Y are typed and perforated.	Item 15
c.	If distortion test set is used, apply FIGS and LTRS input.	Proper shift character is printed and corresponding code is perforated.	Item 15
d.	With signal line idle (marking) press TAPE F.O. key.	Tape is fed out to preset length.	Item 15
e.	While tape is feeding, interrupt feed-out with incoming signal.	Feed-out stops and the first character of signal is typed and perforated.	Item 15
f.	Stop signal transmission.	Tape automatically feeds out to preset length, typed and perforated for letters.	Item 15
g.	Lift tape out of tape container.	TAPE OUT lamp lights.	Item 15

Table 4-11. Operational Test Procedures (Low-Level) - Continued

Step	Action	Normal Indication	Reference Table 5-1
h.	Replace tape roll (with at least one inch of tape on core).	TAPE OUT lamp extinguishes.	Item 15
i.	Press BREAK key.	Typing reperforator runs open.	Item 15
j.	Press KYBD LOCK key.	Keys in lower three rows will not operate.	Item 15
k.	Press KYBD UNLK key.	Tape is perforated according to input message.	Item 15
l.	Operate keyboard.	Character counter indicator advances one unit for each character or space typed and END-OF-LINE lamp lights between 66th and 68th space.	Item 15
m.	Depress CAR RET key.	Character counter indicator returns to zero and END-OF-LINE lamp is extinguished.	Item 15
n.	Press REPT key and one character key (or space bar) and hold.	Character (or space) is typed and perforated continuously until REPT key is released.	Item 15
o.	Press TAB B. SP key.	Last perforated character is moved to right (on punch mechanism) in line with punch pins.	Item 15

Table 4-11. Operational Test Procedures (Low-Level) - Continued

Step	Action	Normal Indication	Reference Table 5-1
p.	Press LTRS key.	LETTERS code perforation obliterates previously punched (erroneous) code.	Item 7
q.	Turn ASR main power switch to off position.	Motor stops.	Item 12

CHAPTER 5
TROUBLESHOOTING

5-1. INTRODUCTION. This chapter provides information required to isolate a malfunction in Automatic Send-Receive (ASR) Teletypewriter Sets Model 28 to a misadjusted mechanism or a defective component. Troubleshooting is based on the result of operational tests described in paragraph 4-7b of chapter 4. Wiring and schematic diagrams are presented at the end of this chapter for use in troubleshooting.

5-2. TROUBLESHOOTING PROCEDURES. Troubleshooting procedures for high and low-level ASR teletypewriter equipment are provided in paragraphs 5-2.1 and 5-2.2. The high-level procedures contained in paragraph 5-2.1, are also applicable to low-level equipment. The procedures contained in paragraph 5-2.2 are applicable to low-level equipment only.

5-2.1 HIGH-LEVEL TROUBLESHOOTING PROCEDURES. The following paragraphs provide procedures for use in troubleshooting high-level ASR teletypewriter equipment.

a. Troubleshooting Index. The troubleshooting index, Table 5-1, contains the items referenced in Tables 4-10 and 4-11, operational test procedures. If an abnormal indication is encountered, the technician is directed to a fault isolation paragraph.

b. Lamp and Fuse Index. Table 5-2 provides a list of lamps and fuses used in the high-level ASR sets. The above active components constitute the most probable cause of failure.

c. Fault Isolation Procedures. The following paragraphs provide fault isolation procedures referenced in Table 5-1.

(1) If unequal spacing between characters is observed, proceed as follows:

(a) Check horizontal positioning drive linkage adjustment, paragraph 6-3.1e(12).

(b) Check reversing slide brackets adjustment, paragraph 6-3.1e(11).

(c) If adjustments are required in both steps (a) and (b), check rocker shaft bracket eccentric stud adjustment, paragraph 6-3.1e(2).

(2) If type is not clear, proceed as follows:

(a) Check ribbon.

(b) Check type box.

(c) Check printing track adjustment, paragraph 6-3.1g(5).

(d) Check printing hammer stop bracket adjustment, paragraph 6-3.1g(10).

(e) Check printing arm adjustment, paragraph 6-3.1g(12).

Table 5-1. Typing Unit Troubleshooting Index

Item	Test/Step	Symptom	Fault Isolation Paragraph
1	3/a(2)	Unequal spacing between characters.	5-2.1c(1)
2	3/a(3)	Type printing not clear.	5-2.1c(2)
3	3/a(1)	Printing is unequal vertically.	5-2.1c(3)
4	3/a(4)	Garbled test pattern.	5-2.1c(4)
5	3/a(5)	Ribbon does not feed properly.	5-2.1c(5)
6	3/b,c	Ribbon fails to reverse.	5-2.1c(6)
7	7/i	Repeating characters are observed.	5-2.1c(7)
8	6/a	Local carriage return function inoperative.	5-2.1c(8)
9	6/b	Local line-feed function inoperative.	5-2.1c(9)
10	2/d(2)	If FIGURES-LETTERS shift function is inoperative.	5-2.1c(10)
11	2/d(2)	If LETTERS-FIGURES shift function is inoperative.	5-2.1c(11)
12	5/c	Signal bell inoperative.	5-2.1c(12)
13	5/e	Normal line-feed inoperative.	5-2.1c(13)
14	5/g	Single-double line-feed improper operation.	5-2.1c(14)
15	5/j	Automatic carriage return line-feed improper operation.	5-2.1c(15)
16	5/k	Automatic carriage return line-feed function operates improperly.	5-2.1c(16)

Table 5-1. Typing Unit Troubleshooting Index - Continued

Item	Test/Step	Symptom	Fault Isolation Paragraph
17	6/a,7/j	Normal carriage return is inoperative.	5-2.1c(17)
18	6/a	If automatic line-feed on selected carriage return function is inoperative.	5-2.1c(18)
19	6/b	If line-feed blocking after carriage return function is inoperative.	5-2.1(19)
20	6/a	Local carriage return function inoperative.	5-2.1c(8)
21	6/b	Local line-feed function inoperative.	5-2.1c(9)
22	4/e,f,g, i,j	Machine does not meet requirements for copying distorted signal.	5-2.1c(20)
23	2/g	Low range span.	5-2.1c(20)
24	4/a thru j, (1)	High percentage of distortion.	5-2.1c(21)
25	7/b,c	One or more keys hard to press.	5-2.1c(22)
26	7/b	Keyboard operates when P and Q keys are pressed simultaneously.	5-2.1c(23)
27	7/f,g	Typing unit operates when a character key is pressed after pressing and releasing REC key.	5-2.1c(24)
28	7/a	If the keyboard motor does not start when main power switch is ON.	5-2.1c(25)
29	7/a	If the cainbet lamps in ASR sets fail to illuminate.	5-2.1c(26)

Table 5-1. Typing Unit Troubleshooting Index - Continued

Item	Test/Step	Symptom	Fault Isolation Paragraph
30	7/a,c	If the auxiliary reperforator base motor does not start when main power switch is ON.	5-2.1c(27)
31	7/b,/ 12a.b.	If motor speed is incorrect.	5-2.1c(28)
32	13/a	If the auxiliary reperforator main shaft does not rotate when mechanical motion is transmitted to the ASR main shaft.	5-2.1c(29)
33	13/b	If the gears howl or chatter when in mechanical motion.	5-2.1c(30)
34	13/a,b/14	If the signal generator shaft does not rotate when mechanical motion is applied.	5-2.1c(31)
35	15/i	If the set runs open when external signal line or signal test is applied.	TABLE 5-2 5-2.1c(32) PAGE 5-14
36	1/k	If the set runs closed on verifiable signal input.	5-2.1c(33)
37	15/a,b	If the typing reperforator fails to function with alternate R and Y signal input.	5-2.1c(34)
38	15/a,b	If an error in typing and reperforating is intermittent with alternate R and Y signal input.	5-2.1c(35)
39	15/b	If the set gains or loses a pulse with alternate R and Y signal inputs.	5-21.c(36)
40	15/b	If the set fails to perforate during alternate R and Y signal input.	5-2.1c(37)

Table 5-1. Typing Unit Troubleshooting Index - Continued

Item	Test/Step	Symptom	Fault Isolation Paragraph
41	15/a,bb, e,f,	If the punch pins fail to penetrate the tape during alternate R and Y signal input.	5-2.1c(38)
42	15/f	If the tape fails to feed during alternate R and Y signal input.	5-2.1c(39)
43	15/b	If feed holes are incorrectly spaced during alternate R and Y signal input.	5-2.1c(40)
44	15/a	If typing reperforator or perforator does not print during alternate R and Y signal input.	5-2.1c(41)
45	3/b,c	If the typing reperforator or perforator ribbon fails to feed or reverse during alternate R and Y signal input.	5-2.1c(42)
46	15/a,b,c	If the reperforator or perforator fails to type during alternate R and Y signal input.	5-2.1c(43)
47	8/c	If the typing reperforator or perforator fails to perforate the tape during alternate Randy signal inputs.	5-2.1c(44)
48	7/o,p	When there is FIGS or LTRS shift failure of the typing reperforator or perforator.	5-2.1c(45)
49	8/c	If the typing reperforator or perforator type wheel characters are not positioned square for printing.	5-2.1c(46)
50	8/c	If only top or bottom of thee typing reperforator or perforator type wheel character prints.	5-2.1c(47)
51	8/c	If the typing reperforator or perforator characters are too light or smudged.	5-2.1c(48)

Table 5-1. Typing Unit Troubleshooting Index - Continued

Item	Test/Step	Symptom	Fault Isolation Paragraph
52	8/d	When the tape feed-out button key is pressed and the signal line is idle, the tape does not feed-out.	5-2.1c(49)
53	15/d,f	If an incorrect length of tape feeds out when the TAPE feed-out button key is pressed.	5-2.1c(50)
54	15/e	If tape continues to feed out.	5-2.1c(51)
55	15/e	When the first character of an incoming signal is lost.	5-2.1c(52)
56	15/d	If tape does not feed out to preset length.	52-.1c(53)
57	15/f	When transmission ends and an incorrect length of tape feeds out.	5-2.1c(54)
58	15/g	If the low-tape bell fails to ring when tape is lifted from the container.	5-2.1c(55)
59	15/h	If the low-tape bell continues to ring when the tape roll is replaced.	5-2.1c(56)
60	7.h	If a BREAK signal transmission failure occurs when the BREAK key is pressed.	5-2.1c(57)
61	7/m	If keyboard fails to lock when the KYBD LOCK key is pressed.	5-2.1c(58)
62	7/g	If keyboard transmission does not take place when the KYBD UNLK key is pressed.	5-2.1c(59)

Table 5-1. Typing Unit Troubleshooting Index - Continued

Item	Test/Step	Symptom	Fault Isolation Paragraph
63	7/a/,8/c/ 9a,b,c,d, e,f	If character counter fails to advance one unit for each character when operating in "K-T" or "T" control knob position.	5-2.1c(60)
64	8/f	If the character counter fails to return to zero when the CAR RET key is pressed.	5-2.1c(61)
65	8/i	If typing unit or typing reperforator runs open when signal line current is supplied.	5-2.1c(62)
66	5/i(1) - (5),7/i	If a repeat function fails when the REPT or the spacebar or character keys are pressed.	5-2.1c(63)
67	7/q	If tape fails to backspace when the TAPE B. SP. key is pressed.	5-2.1c(64)
68	7/q	If the backspace correction fails when the LTRS key is depressed.	5-2.1c(65)

Table 5-2. Lamp and Fuse Index

Qty	Name, Type, Part Number	Function, Location	Energizing Voltage
4	Lamps, Incandescent, 151982	Copylight, Cover	5.5 VAC
1	Fuse, 4 Amp, Slo-Blo, 129919	Electrical circuit protection auxiliary reperforator motor circuit	---
1	Fuse, 6-1/4 Amp, 161136	Electrical circuit protection, Keyboard motor and cabinet circuits.	---

(3) If printing is unequal vertically, proceed as follows:

(a) Check right and left vertical positioning lever eccentric stud adjustment, paragraphs 6-3.1e(5) and (7).

(b) Check right and left vertical positioning locklever adjustment, paragraph 6-3.1e(14).

(c) If adjustments are required in step (1), check rocker shaft bracket eccentric stud adjustment, paragraph 6-3.1e(2).

(4) If a garbled test message is typed, proceed as follows:

(a) Check range setting.

(b) Check selector magnet bracket adjustment, paragraph 6-3.1a(5).

(c) Check selector armature spring adjustment, paragraph 6-3.1a(4).

(5) If ribbon does not feed properly, proceed as follows:

(a) Check ribbon-feed lever bracket adjustment, paragraph 6-3.1g(17).

(b) Check ribbon-feed lever spring adjustment, paragraph 6-3.1g(18).

(6) If ribbon does not reverse properly, check ribbon reverse spur gear adjustment, paragraph 6-3.1g(14).

(7) If repeating characters are observed, proceed as follows:

(a) Check code bar clutch trip lever adjustment, paragraph 6-3.1c(2).

(b) Check type box clutch trip lever adjustment, paragraph 6-3.1c(12).

(8) If local carriage return function is inoperative, proceed as follows:

(a) Press LOC CR key; verify local carriage return function bail moves top to rear; if not, check train of parts (located on keyboard) from key to bail.

(b) Ensure bail is operating carriage return lever; if not, remount typing unit.

(9) If local line-feed function is inoperative, proceed as follows:

(a) Press LOC LF key; verify local line-feed trip key moves to rear; if not, check train of parts (located on keyboard) from key to trip link.

(b) Ensure trip link is operating clutch trip lever; if not, remount typing unit.

(10) If FIGURES-LETTERS shift function is inoperative, proceed as follows:

(a) Set up code combination for LETTERS (12345).

(b) Engage and rotate function clutch 180 degrees; observe the following:

1. LETTERS function lever should be top to rear; if not, check function bar through lever.

2. Right shift link breaker slide should be rotated clockwise over breaker slide bail; if not, check parts from function lever to breaker slide bail.

(c) Rotate main shaft 180 degrees while observing the following:

1. Right breaker slide bail moves shift link breaker slide up.

2. Breaker slide buckles right oscillating rail shift link.

3. Oscillating rail moves left until left oscillating rail shift link completely straightens.

(11) If LETTERS-FIGURES shift function is inoperative, proceed as follows:

(a) Set up code combination for FIGURES (12-45).

(b) Engage and rotate function clutch 180 degrees; observe the following:

1. FIGURES function lever should be top to rear; if not, check function bar through lever.

2. Left shift link breaker slide should be rotated counterclockwise over breaker slide bail; if not, check parts from function lever to slide bail.

(c) Rotate main shaft 180 degrees while observing the following:

1. Left breaker slide bail moves shift link breaker slide up.

2. Breaker slide buckles left oscillating rail shift link.

3. Oscillating rail moves right until right oscillating rail shift link completely straightens.

(12) If signal bell is inoperative, proceed as follows:

(a) Place typing unit in FIGURES position.

(b) Set up code combination for S (1-3--).

(c) Engage and rotate function clutch 180 degrees; signal bell function lever should be top to rear; if not, check function bar through lever.

(d) If signal bell function lever is properly positioned, trouble is electrical.

(13) If normal line-feed function is inoperative, proceed as follows:

(a) Set up code combination for LINE-FEED (-2---).

(b) Engage and rotate function clutch 180 degrees.

(c) Rotate main shaft 180 degrees; observe the following:

1. Line-feed function lever should be top to rear; if not, check function bar through lever.

2. Check that line-feed function pawl stripper is down and in proper engagement with stripper bail.

3. Check that clutch trip lever is out of path of shoe lever; if not, check bottom of function lever through trip lever.

4. Line-feed bars should be in engagement with spur gear; if not, check line-feed bar bellcrank spring.

5. Rotate main shaft while observing that one line-feed bar moves to rear and up while other line-feed bar is moving down and rotating spur gear.

(14) If single-double line-feed operates improperly, proceed as follows:

(a) Set single-double line-feed lever in position 1.

(b) Observe that stripper bail is rotated counterclockwise (top view) in engagement with slot in line-feed function pawl stripper; if not, check parts between lever and bail and stripper bail spring.

(c) Set single-double line-feed lever in position 2.

(d) Observe that stripper bail is rotated clockwise (top view) out of engagement with slot in line-feed function pawl stripper; if not, check parts between lever and bail.

(15) If automatic carriage return line-feed is inoperative, proceed as follows:

(a) Rotate spacing drum clockwise while observing the following:

1. Lug on spacing drum rear stop spring should strike and rotate automatic carriage return line-feed bellcrank clockwise; if not, check for broken or bent lug or bellcrank; check right margin adjustment, paragraph 6-3.1d(19).

2. 0 (zero) code bar should move right; if not, check engagement of bellcrank with code bar.

(b) Engage and rotate function clutch 180 degrees; observe the following:

1. Automatic carriage return and automatic line-feed function levers should be top to rear; if not, check function bar through levers.

2. Normal line-feed function lever should be top to rear; if not, check tab on automatic line-feed function pawl.

(c) Check engagement of bottom of automatic carriage return and normal line-feed function levers with respective slide arms.

(16) If automatic carriage return line-feed function operates improperly, proceed as follows:

(a) If carriage does not return when 74th character is printed, check right margin adjustment, paragraph 6-3.1d(19).

(b) If 75th character is not printed in center of page, increase tension on carriage return spring to move it to left, or decrease tension to move it to right.

(c) If carriage return spring tension was adjusted in step (b), above, readjust dashpot vent screw, paragraph 6-3.1d(15).

(d) If 76th and 77th characters are not positioned under 1st and 2nd, respectively, proceed as follows:

1. Check dashpot vent screw adjustment, paragraph 6-3.1d(15).

2. Check left margin adjustment, paragraph 6-3.1d(17).

(17) If normal carriage return is inoperative, proceed as follows:

(a) Set up code combination for CARRIAGE RETURN (---4-).

(b) Engage and rotate function clutch 180 degrees, observe the following:

1. Carriage return function lever should be top to rear; if not, check function bar through lever.

2. Carriage return feed pawl release link should be rotated counterclockwise holding feed pawls out of engagement with spacing drum, if not, check bottom of function lever through release link including carriage return lever adjustment, paragraph 6-3.1d(14).

3. Carriage should be to left; if not, check for bind in spacing drum, draw-wire rope, carriage return spring drum, and printing and type box carriages. Check tension on carriage return spring.

(18) If automatic line-feed on selected carriage return function is inoperative, proceed as follows:

(a) Set up code combination for CARRIAGE RETURN (---4-).

(b) Engage and rotate function clutch 180 degrees; observe the following:

1. Line-feed on carriage return function lever should be top to rear; if not, check function bar through lever.

2. Check engagement of bottom of function lever with slide arm.

(19) If line-feed blocking after CARRIAGE RETURN function is inoperative, proceed as follows:

(a) Set up code combination for CARRIAGE RETURN (---4-).

(b) Engage and rotate function clutch 180 degrees; observe the following:

1. Line-feed on carriage return blocking function lever should be top to rear; if not, check function bar through lever.

2. Blocking slide should be to right with extensions in front of function bars in slots 39 and 40; if not, check top of function lever thorugh blocking slide.

(c) Disengage function clutch.

(d) Set up code combination for LINE-FEED (-2---).

(e) Engage and rotate function clutch 180 degrees; observe the following:

1. Blocking function lever should be top to rear; if not, check blocking function lever latch.

2. Universal number 1 function lever should be top to rear; if not, check function bar through lever.

(f) Repeat steps (c) through (e); observe the following:

1. Universal number 1 and 2 function levers should be top to rear; if number 2 is not to rear, check function bar through lever.

2. Blocking slide should be to left; if not, check blocking function lever latch through blocking slide and shift plate post spring.

(20) If difference between range settings (range span) is too low or machine does not meet requirements for copying a distorted signal, proceed as follows:

(a) Check selector armature adjustment, paragraph 6-3.1a(1).

(b) Check selector magnet bracket adjustment, paragraph 6-3.1a(5).

(c) Check selector magnet bracket vertical adjustment, paragraph 6-3.1a(5).

(d) Check for wear on armature extension, marking and spacing locklever, and spring tensions.

(e) Check that range spans are centered on scale; if not, increase or decrease tension on selector armature spring to raise or lower range span.

(21) If percentage of distortion is too high, check transfer bail detent plate, paragraph 6-4b(7).

(22) If one or more keys are hard to press proceed as follows:

(a) Check code bar and code lever clearance, paragraph 6-4a(4).

(b) Check lock ball channel, paragraph 6-4c(1).

(c) Check ball wedgelock and ball track clearance, paragraph 6-4c(2).

(d) Check lock ball end play, paragraph 6-4c(3).

(23) If keyboard operates when P and Q keys are pressed simultaneously, proceed as follows:

(a) Check ball wedgelock and ball track clearance, paragraph 6-4c(2).

(b) Check lock ball end play, paragraph 6-4c(3).

(24) If typing unit operates when a character key is pressed after pressing and

releasing REC key, proceed as follows:

(a) Check the mechanical linkage of the REC key.

(b) Check the proper operation of the contacts in the SEND-REC switch.

(25) If the keyboard motor does not start when main power switch is ON, proceed as follows:

(a) Check the external power supply to verify 115-volts ac is present.

(b) Check the case for breaks or dents. Check the mating of the connector and receptacle and the operation of the latch locking the two in mated position.

(c) Check for an open thermal cutout switch at the rear of the motor mounting bracket. If the red switch button is raised, rotate the motor manually and check mechanical linkages to the motor shaft for an obstruction. Depress the switch button. If the cutout operates shortly after the motor switch has been reset, allow the motor to cool for five minutes and check further for the cause of overheating before resetting.

(d) Check motor connections. Leads are interchangeable. Refer to the wiring diagrams at the end of this chapter.

(e) Check the main power switch.

(26) If the cabinet lamps in ASR sets fail to illuminate, proceed as follows:

(a) Check the cabinet illumination lamps (4) and sockets.

(b) Check for a burned-out cabinet-mounted transformer, and base transformer leads on the terminal block.

(27) If the auxiliary reperforator base motor does not start when main power switch is ON, proceed as follows:

(a) Check the fuse. If open, check mechanical linkage from motor through typing reperforator manually for excessive load before replacing fuse. If a fuse burns out immediately upon installation, check for shorted wiring in the motor or the tape-out circuit.

(b) Check for an open thermal cutout switch at the rear of the motor mounting bracket. If the red switch button is raised, rotate the motor manually and check mechanical linkages to the motor shaft for an obstruction. Depress the switch button. If the cutout operates shortly after the motor switch has been reset, allow the motor to cool for five minutes and check further for the cause of overheating before resetting. Check the solder connections to terminals of 36-point connector and receptacle. Terminals 35 and 36 of the connector (attached to the typing reperforator) must be strapped on the soldered end, and the connector must be mated with the base receptacle to complete the ac power distribution circuit in the set. Check for loose or missing contacts within the case and for broken body moldings. Check the case for breaks or dents. Check the mating of the connector and receptacle and the operation of wire latches locking the two in mated position.

(c) Examine the motor brushes and replace a brush if its length is less than 3/8 of an inch. Wipe off and blow off accumulated carbon dust. Relationship of brush to slip rings should be maintained. Be sure brush springs are in place.

(28) If motor runs at incorrect speed, proceed as follows:

(a) If the synchronous motor operates at incorrect speed, check for 60 Hertz (plus or minus 0.5 Hertz) frequency in the external power supply.

(b) Check the governor adjustment. If the motor runs at incorrect speed, check for 115-volts ac power line supply. If line voltage is adequate and stable, use a 120-vps tuning fork to check the governor. Adjust if required.

(29) If the auxiliary reperforator main shaft does not rotate when mechanical motion is transmitted to ASR main shaft, proceed as follows:

(a) Check the mechanical linkage through the intermediate gear mechanism. Adjust mesh of pinion and drive gear for barely perceptible backlash when the drive gear is centered vertically and horizontally beneath pinion.

(b) Check the mechanical linkage through variable speed drive mechanism. Note that the gears are properly installed and securely fastened to their shaft or sleeve. Check for sheared gear mounting screws. Check condition of the gears and remove any foreign objects in the gear mechanism. Visually inspect gear mesh when the gear change lever is in each of its three positions.

(c) Check the condition and tension of the timing belt. The belt should not be too tight. If belt appears too loose (yields more than 1/16-inch in response to slight pressure midway between the two sprockets), check for loosened screws attaching either the reperforator or the intermediate gear mechanism or both to the base.

(30) If the gears howl or chatter when mechanical motion is transmitted to ASR main shaft, check the mechanical linkage through the intermediate gear mechanism. Adjust mesh of the pinion and drive gear for barely perceptible backlash when the drive gear is centered vertically and horizontally beneath pinion.

(31) If the signal generator shaft does not rotate when mechanical motion is applied, check mechanical linkage through the intermediate gear mechanism. Adjust mesh of the pinion and drive gear for barely perceptible backlash when drive gear is centered vertically and horizontally beneath pinion.

(32) If the set runs open when external signal line or signal test set signal is applied to the set, proceed as follows:

(a) Check for an open signal line external to the set. Check for 0.060-ampere 115-volts dc signal circuit (unless the selector magnets have been series wired for 0.020

or 0.030-ampere operation). If operating on 0.030-ampere circuit, check the external signal line relay.

(b) Check the solder connections to terminals of the 16-point connector and receptacle. Check for loose or missing contacts within the case and for broken body moldings. Check the case for breaks or dents. Check the mating of the connector and receptacle and the operation of the latch locking the two in mated position.

(c) Check the solder connections to terminals of the 36-point connector and receptacle. Terminals 35 and 36 of the connector (attached to the typing reperforator) must be strapped on the soldered end, and the connector must be mated with the base receptacle to complete the dc power distribution circuit in the set. Check for loose or missing contacts within the case and for broken body moldings. Check the case for breaks or dents. Check the mating of the connector and receptacle and the operation of wire latches locking the two in mated position.

(d) Check for loose connections on the terminal boards. Refer to the wiring diagrams at the end of this chapter for location of straps and jumpers on each set.

(e) Check for open selector magnets or faulty connections on the selector unit of the typing reperforator. Drag a thin piece of clean paper between the armature and the magnet cores to clean a dirty or oily armature. Be sure no lint is left beneath the magnet cores.

(f) Check for binding mechanisms in the selector unit. Check linkage for free operation. Check the clutch adjustment, (paragraphs 6-21b(1) and (3)), with particular attention to failure of the stop lever to latch or release.

(g) Check the selector mechanism adjustments, paragraphs 6-3.1h(9), (4), (6), (7), (8), (10), (15), (16), (17), and (20) in the order indicated.

(h) In ASR sets, check for an open signal break switch (normally closed) on the keyboard. Check signal break key linkage to the switch.

(i) In ASR sets, check the signal generator contacts and mechanical linkages.

(33) If the set runs closed on verifiable signal input, check for binding mechanisms in the selector unit. Check the linkage for free operation. Check the clutch adjustment (paragraphs 6-3.1b(1) and (2)).

(34) If the typing reperforator fails to function when signal input is alternate R and Y, check operation and mechanical linkage of the function clutch. Note that the clutch is tripped near the end of the operating cycle of the selector clutch.

(35) If an error in typing and reperforating is intermittent when signal input is alternate R and Y, proceed as follows:

(a) Check for an open signal line external to the set. Check for 0.060-ampere

115 volts dc signal circuit (unless the selector magnets have been series wired for 0.020 or 0.030-ampere operation). If operating on 0.030-ampere circuit, check the external signal line relay.

(b) Check the range finder knob phasing (paragraph 6-3.1h(18)).

(c) Check the selector mechanism adjustments (paragraphs 6-3.1h(9)) (12), (13), and (14)).

(36) If the set gains or loses a pulse when signal input is alternate R and Y, proceed as follows:

(a) Check for binds in the selector and transfer mechanisms. Note in particular free operation of the linkage involved in the particular pulse gained or lost, as determined by analyzing errors for a common (1, 2, 3, 4, or 5 pulse) addition or omission.

(b) Check the selector mechanism adjustments (paragraphs 6-3.1h(9), (12), (13), and (14)).

(37) If the set fails to perforate when signal input is alternate R and Y, proceed as follows:

(a) Check function clutch and cam mechanisms and rocker bail operation. Check the punch mounting plate (preliminary adjustment) (paragraph 6-3.1c(1)).

(b) Check the rocker bail and guide bracket adjustments. Check the function clutch trip lever adjustment (paragraph 6-3.1b(6)). Check the reset arm (paragraph 6-3.1b(7)) punch position, toggle operating arm (paragraph 6-3.1c(4) and punch mounting plate (final) adjustments (paragraph 6-3.1c(2)).

(38) If the punch pins fail to penetrate tape when the signal input is alternate R and Y, check punch slide downstop plate (paragraph 6-3.1d(3)), punch pin penetration (paragraph 6-3.1d(1)), and punch slide guide (paragraph 6-3.1d(2)).

(39) If the tape does not feed when signal input is alternate R and Y, proceed as follows:

(a) Check for binds or obstructions in the tape container on path of tape.

(b) Check perforator adjustments.

(40) If feed holes are incorrectly spaced when the signal input is alternate R and Y, check perforator adjustments.

(41) If the typing reperforator or perforator does not print when signal input is alternate R and Y, check proper installation of the ribbon, particularly through ribbon carrier beneath type wheel.

(42) If the typing reperforator or perforator ribbon fails to feed or fails to reverse when signal input is alternate R and Y, proceed as follows:

(a) Check the position of the eyelets on the ribbon above the ribbon reverse arms at both spools.

(b) Check the ribbon-feed mechanism and

operating arm adjustment (paragraphs 6-3.1g(1), (2), and (3)).

(43) If the typing reperforator or perforator fails to type when the signal input is alternate R and Y, proceed as follows:

(a) Check the ribbon carrier (paragraph 6-3.1m(1) or 6-3.1n(1))

(b) Check the print hammer (paragraph 6-3.1m(4) or 6-3.1n(4))

(44) If the typing reperforator or perforator fails to perforate tape when the signal input is alternate R and Y, proceed as follows:

(a) Check the selector magnet bracket (paragraph 6-3.1h).

(b) Check the selector armature (paragraph 6-3.1h(4))

(c) Check selector spring tensions (paragraph 6-3.1n(6), 6-3.1n(8), and 6-3.1h(10)).

(d) Check selector clutch spring tensions (paragraph 6-3.1h(16) and (17)).

(45) If there is FIGS or LTRS shift failure of the typing reperforator or perforator proceed as follows:

(a) Check the function mechanism (paragraphs 6-3.1e(1) and 6-3.1b(8)).

(b) Check the type wheel positioning mechanism.

(46) If the typing reperforator or perforator type wheel characters are not positioned square for printing, check the axial and rotary positioning mechanism linkage and adjustments.

(47) If only top or bottom of the typing reperforator or perforator type wheel character prints, proceed as follows:

(a) Check and adjust the axial and rotary correcting mechanism for firm positioning of the correcting plate roller (axial) or correcting lever lobes (rotary) simultaneously with activation of printing hammer.

(48) If the typing reperforator or perforator characters are too light or are smudged, check print hammer adjustment (paragraph 6-3.1m(4) for chadless tape or paragraph 6-3.1n(4) for fully perforated tape).

(49) If tape does not feed out when the TAPE feed-out button key is pressed while the signal line is idle (marking), proceed as follows:

(a) Check for an open feed-out magnet winding or loose leads at the magnet. Check the power supply lead common to both feed-out and backspace magnet at both terminal.

(b) Check the feed-out switch.

(c) Check the mechanical linkage through feed-out mechanism.

(d) Check the tape feed-out adjustments.

(50) If an incorrect length of tape feeds out, when

the TAPE feed-out button key is pressed while the signal line is idle (marking) check the remote control tape feed-out mechanism.

(51) If tape continues to feed out when feed-out is interrupted with an incoming signal, check feed-out adjustments.

(52) If the first character of an incoming signal is lost when feed-out is interrupted with incoming signal, proceed as follows.

(a) Check the feed-out adjustments.

(b) Check the mechanical linkage with selector mechanism and perforator.

(53) If the tape does not feed out to preset length, typed and perforated for letters when signal transmission ends, proceed as follows.

(a) Check the mechanical linkage with selector mechanism.

(b) Check the feed-out adjustments.

(54) If an incorrect length of tape feeds out when signal transmission ends, check feed-out adjustments.

(55) If the low-tape bell fails to ring when tape is lifted from tape container, check the mechanical linkage to the tape-out switch for bent or broken components or missing springs.

(a) Check the low tape bell.

(b) Check the wiring and the terminal boards for loose or burned connections.

(56) If the low-tape bell continues to ring when the tape roll is replaced, check the low-tape switch (paragraphs 6-5.2b(1), (2), and (3)).

(57) If a BREAK signal transmission failure occurs when the BREAK key is pressed, proceed as follows:

(a) Check for a short in the normally-closed BREAK switch.

(b) Check the mechanical linkage from the BREAK keylever to switch. Operation of the keylever should not affect the code bar mechanism.

(58) If the keyboard fails to lock when the KYBD LOCK key is pressed, check the mechanical linkage of the KYBD LOCK key through its code bar.

(59) If the keyboard transmission does not take place when the KYBD UNLK key is pressed, proceed as follows:

(a) Perform fault isolation procedures 5-2.1c(9) through 5-2.1c(25).

(b) Check the signal generator contacts and mechanical linkages.

(c) Check the operation and adjustment of the signal generator clutch mechanism (paragraph 6-4.2a(1), (2), (3), (4), and (5)).

(d) Check the signal generator and keyboard adjustments (paragraphs 6-4.2b(1) through (5) and 6-4.2c(2) through (4)).

(e) Check the synchronous pulse mechanism (paragraphs 6-6.2b(1) through (7)).

(60) If the character counter fails to advance one unit for each character or space typed when the keyboard is operating in the "K-T" or "T" control knob position, proceed as follows:

(a) Check the mechanical linkage to the code bar mechanism. Ensure that the character counter operating forks are positioned over the pins on the right end of their respective code bars.

(b) Check the character counter adjustments (paragraphs 6-4.1b(1) through (8)).

(c) Check for maladjusted or dirty switch contacts in the character counter mechanism.

(d) Adjust the END-OF-LINE switch bracket and cam (paragraph 6-4.1b(2)).

(61) If the character counter fails to return to zero position when the CAR RET key is pressed, proceed as follows:

(a) Check the mechanical linkage to the code bar mechanism. Ensure that the character counter operating forks are positioned over the pins on the right end of their respective code bars.

(b) Check the mechanical linkage of the character counter reset mechanism.

(62) If typing unit or typing reperforator runs open when signal line current is supplied, proceed as follows:

(a) Check signal line for proper current and voltage.

(b) Check selector magnets for open coil.

(c) Check that all signal line connectors are fully mated and locked.

(d) Check that keyboard and transmitter distributor signal generators are both in the MARK position.

(e) For low-level ASRs, check the following:

1. Check that the signal ESA is on.

2. Check for defective circuit boards in the signal ESA.

(f) Check for loose or burnt connections on the terminal boards.

(g) Check for dirty or oily selector magnet armature or magnet coils.

(h) Check for binding mechanisms in the selector unit. Check linkage for free operation. Check the clutch adjustment, paragraph 6-21b(1) and (3), paying particular attention to possible failure of the stop lever to latch.

(i) Check the selector mechanism adjustments, paragraphs 6-3.1h(9), (4), (6), (7), (8), (10), (15), (16), (17) and (20) in the order indicated.

(63) If a repeat function fails when the REPT keys and any of the character key or spacebar is pressed, check freedom of the linkage and mating of the repeat keylever

and code bar non-repeat lever (paragraphs 6-4.1c(10) through (14)).

(64) If tape fails to backspace when the TAPE B.SP. key is pressed, proceed as follows:

(a) Check for a defective backspace switch, located immediately beneath the TAPE B.SP. key. Check the switch at the keyboard motor terminal board.

(b) Check for an open magnet coil on the typing reperforator or perforator. Check for loose leads on the magnet and check both terminals of the common power supply lead between the backspace magnet and feed-out magnet (for typing reperforator).

(c) Check the mechanical linkages in the backspace mechanism (on typing reperforator). The mechanism should operate freely and without binding on downward movement of magnet armature. (paragraphs 6-21b(1) through (5), 6-21c(1) through (5), and 6-22(a) through (c)).

(65) If the backspace correction fails when the LTRS key is depressed, proceed as follows:

(a) Check the mechanical linkages in the back space mechanism (in typing reperforator) (paragraphs 6-22a(1) through (7), 6-22b(1) and (2), and 6-22c(1) through (7)).

(b) Check the rake adjustment (paragraph 6-6.1g(28)).

(66) If the motor continues to run when the main power switch is turned off, remove the main power source from the unit. Disconnect the lead from either terminal of the main power switch. Reapply main power. If the motor does not start, replace the main power switch.

d. Maintenance Schematic and Wiring Diagrams. Schematic and wiring diagrams are provided at the end of this chapter as aids to troubleshooting and maintenance of the typing reperforator sets. An index of the schematic and wiring diagrams for high-level equipment is provided in Table 5-3.

5-2.2 LOW-LEVEL TROUBLESHOOTING PROCEDURES. The following paragaphs provide troubleshooting procedures for checking some of the difficulties that may be encountered in the operation of electrical service assemblies (ESAs) and their associated components. For troubleshooting mechanical failures refer to the high-level equipment troubleshooting procedures in paragraph 5-2.1, which are also applicable to low-level equipment.

a. Wiring and Schematic Diagrams. Wiring and schematic diagrams for use in troubleshooting low-level equipment are shown in figures at the end of this chapter. An index of these diagrams is provided in Table 5-3.

b. Lamp, Fuse, and Semiconductor Indexes. Refer to Table 5-4 for a list of lamps and fuses used in both high-level and low-level TD sets. Additional fuses, found in low-level assemblies are included in figures at the end of this

Table 5-3. Index of Schematic and Wiring Diagrams for Troubleshooting

Table 5-3. Index of Schematic and Wiring Diagrams for Troubleshooting - Continued

Table 5-3. Index of Schematic and Wiring Diagrams for Troubleshooting - Continued

Table 5-3. Index of Schematic and Wiring Diagrams for Troubleshooting - Continued

Table 5-3. Index of Schematic and Wiring Diagrams for Troubleshooting - Continued

chapter. These active components are identified because they constitute the most probable cause of failure.

c. ESA General Troubleshooting Instructions. The following paragraphs provide general instructions for use when checking some of the difficulties that may be encountered in the operation of the electrical service assembly (ESA) and its associated components. A suggested procedure is also outlined in the event of field repair where adequate facilities are not readily available.

(1) Since the ESA encloses and is dependent upon other componnent circuits for its operation, the field troubleshooting and repair for these components are also included in the procedures. Refer to the applicable wiring diagrams which are referenced in Table 5-3 for circuit tracing and identification of components. The wiring diagrams can be found at the end of this chapter. The diagrams are identified with their associated assemblies in the equipment matrix provided in Table 1-2 of Chapter 1, which also indicates the figure number.

(2) Before attempting to repair a power supply failure, one should familiarize himself with the power supply card and ESA wiring. Refer to the circuit description in Chapter 3. A reference should also be made to the wiring diagrams for the ESA as identified in Table 1-2 of Chapter 1.

(a) Troubleshooting for an ESA is required only to repair the power supply or correct burnt, loose or otherwise faulty wiring. Using the appropriate wiring diagram the wiring can be checked from point to point, and compared with the actual equipment wiring.

d. Power Supply Troubleshooting Procedures. If trouble should develope, the problem may be found by performing the test outlined in the troubleshooting charts, Table 5-5.

(1) Colored test point jacks are provided on top of the power supply circuit card to accept standard meter probes.

(2) When a fault in the power supply is suspected but not obvious, disconnect all power from the ESA. Remove all keyer (LLK) selector magnet driver (SMD), and clutch magnet driver (CMD) circuit cards. Apply 100 to 130 volt ac power to the ESA and proceed with the troubleshooting procedure as outlined in Table 5-5.

(3) If the procedure is followed as outlined in the troubleshooting charts, perform step 1. If a normal response is received, proceed to step 2. If an abnormal response is received repair or replace power supply card. After this procedure, return to step 1. Next, perform step 2 and so on in the same manner. If this troubleshooting fails to reveal the problem, check for loose or cold solder connection, or a broken, burnt or misplaced wire in the ESA. Recheck all wiring and wiring connections.

(4) Continually blowing fuses indicates a shorted component(s). Disconnect power, remove the circuit card assembly and make continuity checks between

Table 5-5. Power Supply Troubleshooting Procedures (0.5 Ampere Card)

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
1	Check voltage from -7 test jack.	COM-7	Meter reading should be: -6.6 VDC to -7.8 VDC Max. If normal, proceed to Step 2.	RESPONSE: Meter reading of zero VDC. PROBABLE CAUSE: CR5 shorted or R5 open. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1. RESPONSE: Meter reading of +57 VDC to +90 VDC. PROBABLE CAUSE: CR5 open. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1.
2	Check voltage from +7 test jack.	CPM +7	Meter reading should be: +6.6 to +7.8 VDC Max. If normal, proceed to Step 3.	RESPONSE: Meter reading of zero VDC. PROBABLE CAUSE: CR6 shorted or R4 open. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1.

Table 5-5. Power Supply Troubleshooting Procedures (0.5 Ampere Card) - Continued

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
				RESPONSE: Meter reading of +57 VDC to +90 VDC. PROBABLE CAUSE: CR6 open. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1.
3	Check voltage from UNREG. test jack.	COM UNREG.	Meter reading should be: +57 VDC to +90 VDC Max.	RESPONSE: Meter reading of zero VDC. PROBABLE CAUSE: Loose or blown fuse.
			If normal, proceed to Step 4.	PROCEDURE: Remove power supply card and replace fuse. Proceed to Step 5.
				RESPONSE: Meter reading indicates voltage which is too low. PROBABLE CAUSE: CR1 and/or CR4 open or shorted. C8 defective. T1 and power line filter defective.

Table 5-5. Power Supply Troubleshooting Procedures (0.5 Ampere Card) - Continued

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
				PROCEDURE: Remove power supply card or defective parts and repair or replace. Recheck Step 1.
4	Check voltage from +50 test jack.	COM +5-	Meter reading should be: +47 VDC to +53 VDC Max. If normal, end test.	RESPONSE: Meter reading of zero VDC. PROBABLE CAUSE: Z1 and/or Q2 open. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1. RESPONSE: Meter reading of more than zero VDC but less than +47 VDC. PROBABLE CAUSE: Too many shorting straps across CR8, CR9, CR10, and CR11. PROCEDURE: Remove power supply card and remove straps, as necessary to increase voltage. Replace card. Recheck Step 1. RESPONSE: Meter reading of +57 VDC to +90 VDC.

Table 5-5. Power Supply Troubleshooting Procedures (0.5 Ampere Card) - Continued

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
				PROBABLE CAUSE: Q1 and/or Q2 shorted. PROCEDURE: Remove power supply card and repair or replace. Recheck Step 1.
5	Check voltage from UNREG. test jack.	COM UNREG.	Meter reading should be: +57 VDC to +90 VDC Max. Return to Step 4.	RESPONSE: Meter reading of zero VDC. PROBABLE CAUSE: Repeated fuse blowing. PROCEDURE: Disconnect power and remove power supply card. Make continuity checks between card terminals B and N, N and H, B and H. A zero or near zero reading on the one-ohm scale of a multimeter indicates a short. Check continuity between Q1 case and its heat sink (Q1 must be electrically isolated from heat sink with mica insulators). If the power supply card checks satisfactorily, check power line filter

Table 5-5. Power Supply Troubleshooting Procedures (0.5 Ampere Card) - Continued

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
				T1 and C8 for shorted condition. Repair or replace card. Recheck Step 1. <u>RESPONSE</u>: Meter reading indicates voltage which is too low. <u>PROBABLE CAUSE</u>: CR1 and/or CR4 open or shorted. C8 defective. T1 and power line filter defective. <u>PROCEDURE</u>: Remove power supply card or defective parts and repair or replace. Recheck Step 1.

circuit card connector terminals B and N, N and H, and B and H. A zero reading or near zero reading on the one ohm scale of a multimeter indicates a short, all other readings should be disreagarded. Check continuity between the power transistor case and its heat sink. The power transistor must be electrically isolated from the heat sink with mica insulators. If the board assembly checks satisfactorily, examine the power line filter, power transformer, and rectifier filter capacitor for a shorted condition. All of these components can be found within the ESA.

(5) Failure to detect the fault using the procedures outlined normally indicates a loose or cold solder connection, or a broken or misplaced wire in the ESA. Recheck the wiring referring to the appropriate wiring diagram.

e. Selector Magnet Driver. The TP323810 selector magnet driver (SMD) is a circuit card assembly that needs only to be plugged into a properly keyed (polarizing key between pins E and F) 15 pin receptacle which is wired into the electrical service assembly. It is recommended that any defective or damaged TP323810 selector magnet driver unit be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions. It is also recommended that the SMD be radio frequency interference (rfi) suppression tested after being serviced and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

(1) SMD Troubleshooting. The following procedures outlined in Table 5-6 may be used as a guide in troubleshooting the SMD.

(2) SMD Adjustments. No mechanical adjustments are required on the TP323810 SMD. The following procedures as outlined may be used as a guide to electrically adjust the SMD. Proceed as follows:

(a) Terminate the output of the SMD with a 28 selector wired for 60 ma operation (pins A or B, and H, J, K, L, or M).

(b) Apply +47 to +53 volts dc to the driver (pins C or D to H, J, K, L, or M).

(c) With input 2 (pins E, F) open circuited, short input 1 to common (pins N, P to H, J, K, L, or M).

(d) Adjust R3 until the selector magnet changes state. Take note of the position of the potentiometer.

(e) Rotate R3 until the selector returns to its initial state.

(f) Set the potentiometer midway between the two positions obtained in (d) and (e).

(g) Secure the adjustment by applying an appropriate cement to the potentiometer adjustment screw.

(h) Repeat (a) through (g), this time adjusting R15 with input 1 (pins N, P) open circuited and input 2 shorted to common (pins E, F to H, J. K. L, or M).

Table 5-6. Selector Magnet Driver (SMD) Troubleshooting Guide

	Symptom		Probable Cause
(a)	Switching Levels out of tolerance.	(1)	Improper adjustment of R3 and/or R15.
		(2)	Q1 and/or Q5 low gain.
		(3)	CR5 defective or out of tolerance.
(b)	Circuit always marking.	(1)	Q8 open.
		(2)	Q1, Q5, Q6, Q7, or Q9 collector-emitter shorted.
(c)	Circuit always spacing.	(1)	Q1, Q5, Q6, Q7, or Q9 collector-emitter open.
		(2)	Q8 collector-emitter shorted.
		(3)	CR13 open.
(d)	Output current too high.	R23	out of tolerance.
(e)	Output current too low.	R23	out of tolerance.
(f)	Transient suppressor network ineffective.	(1)	CR14 open.
		(2)	R24 open.
		(3)	C6 open.
(g)	Loss of receiving margin.	(1)	Q8 and Q9 improper gain.
		(2)	C4, C5, or C6 out of tolerance or defective.
		(3)	CR14 shorted.

f. Low-Level Keyer (TP303142). Table 5-7 provides information for use as a guide when troubleshooting the low-level keyer. The following recommendations also are applicable when troubleshooting the polar low-level keyer (LLK).

(1) It is recommended that any damaged keyer card be replace in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions.

(2) It is also recommended that the keyer and associated filter cards (321268) be radio frequency interference (rfi) suppression tested after servicing and prior to final insallation. Failures from this standpoint are not necessarily recognized by monitoring a typical communication operation.

(3) Adjustments for the TP303142 Keyer. No mechanical or electrical adjustments are required on the TP303142 LLK or its associated TP321268 filter card. The adjustments given in this section apply only to the contact box or signal generator and are for reference only. This adjustment is to be made with the contact box installed in the appropriate transmitter or keyboard and may be used in place of adjustment as outlined in the alternate adjustment procedures following this section. To adjust the keyer, proceed as follows:

(a) Remove the TP325951 nut and the TP320043 outer cover. Remove the TP325951 nut and the TP321273 inner cover. Without unsoldering the leads to the filter card, remove the TP321268 filter card assembly.

Table 5-7. Low-Level Keyer Troubleshooting Guide

	Symptom		Probable Cause
(a)	Circuit always marking.	(1)	Q1 and/or Q2 shorted.
		(2)	Excessive signal generator contact resistance.
(b)	Circuit always spacing.		Q1 and/or Q2 open.
(c)	Mark-space bits detectable but will not go positive on mark.		Q4 and/or Q6 open.
(d)	Mark-space bits detectable but will no- go negative on space.		Q3 and/or Q5 open.

(b) Loosen the contact box mounting braCket screw and make the screw friction tight. Position the box by means of the eccentric, so that the marking and spacing gaps are equal when there is maximum clearance between the contacts. This can be determined by engaging the clutch and rotating the main shaft. After completing the adjustment, tighten the mounting screws and recheck the adjustment.

(4) Signal Generator Adjustment. The following electromechanical adjustments pertain to the signal generator after installation of the TP303142 polar line keyer and associated signal generator assembly. It may be used in place of the adjustment previously outlined with the signal generator and the low-level keyer in place. To use the alternate adjustment proceed as follows:

(a) Using an oscilloscope to view the output of the polar keyer (transmitter sending repeated Y character), adjust the oscilloscope to trigger at zero volt on the keyer output waveform. Be sure to properly zero the vertical amplifier on the scope before beginning the adjustment.

(b) Adjust the scope sweep rate so as to display one complete mark-space portion of the signal.

(c) Adjust the position of the signal generator until the mark to space transition corsses zero volt at the center of the horizontal scale. When the signal generator is properly adjusted, the three points at which the waveform passes through zero volts will divide the horizontal axis into two equal segments.

(d) After the adjustment is made, tighten the signal generator bracket screws securely.

g. Clutch Magnet Driver (CMD) Troubleshooting Procedures. Table 5-8 provides information for use as a guide when troubleshooting the CMD. The following recommendations also are applicable when troubleshooting CMDs.

NOTE

The clutch magnet driver (CMD) is a circuit card assembly that needs only to be plugged into a properly keyed 15-pin receptacle which is wired into an appropriate electrical service assembly (ESA).

(1) It is recommended that any damaged clutch magnet driver (CMD) unit be replaced in the field and maintained in a repair center. The reepair center should have equipment capable of simulating normaly operating conditions.

(2) It is also recommended that the CMD be radio frequency interference (RFI) suppression tested after repair and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communication operation.

(3) Clutch Magnet Driver (CMD) Adjustment. No mechanical adjustments are required on the TP321991 CMD. If necessary, the CMD may be

Table 5-8. Clutch Magnet Driver Troubleshooting Guide

	Symptom		Probable Cause
(a)	Switching levels out of tolerance.	(1)	Improper adjustment of R7.
		(2)	Q1 low gain.
		(3)	CR7 defective or out of tolerance.
(b)	Circuit always marking.	(1)	Q3 open.
		(2)	Q1, Q2, or Q4 collector-emitter shorted.
(c)	Circuit always spacing.	(1)	Q1, Q2, or Q4 open.
		(2)	Q3 collector-emitter shorted.
		(3)	CR8 open.
(d)	Output current too high.	(1)	CR2 open.
		(2)	R17 out of tolerance.
(e)	Output current too low.	(1)	R2 improperly adjusted or defective.
		(2)	R17 out of tolerance.
(f)	Transient suppressor network ineffective.	(1)	CR9 open.
		(2)	R16 open.
		(3)	C4 open.

electrically adjusted. The following instruments are required for making TP321991 CMD electrical adjustments. Refer to the appropriate shcematic wiring diagram for location of circuit elements.

(a) Milliammeter that will measure 15 ma with an accuracy of ±10 percent.

(b) Plug 6-volts ±20 percent dc source. The required power is less than 6 milliwatts.

(c) Transmitter distributor with series connected 256M clutch coils. To adjust the CMD electrically proceed as follows:

(d) Terminate the output of the driver with a transmitter distributor clutch assembly utilizing two 256M coils in series (pins A or B and K, L, or M).

(e) Place a milliammeter in series, connecting the positive terminal of meter to test point T4 and with the zener regulator diode CR2 mounted on the heat sink.

(f) With normal power applied to the circuit, (+47 to +53 volts dc and -6-volts dc), andd a +6 volt input to pin N or P, adjust R2 for 15 ma of zener current. Secure the wiper of R2, by applying an appropriate cement to prevent accidental rotation. Remove the +6-volt input.

(g) Short the input to common. This would be pins N or P to K, L, or M. Adjust R7 until the CMD changes state. Note the position of the potentiometer.

(h) Rotate R7 back until the CMD returns to its initial state.

(i) Set the potentiometer midway between the two positions obtained in paragraph (g) and (h).

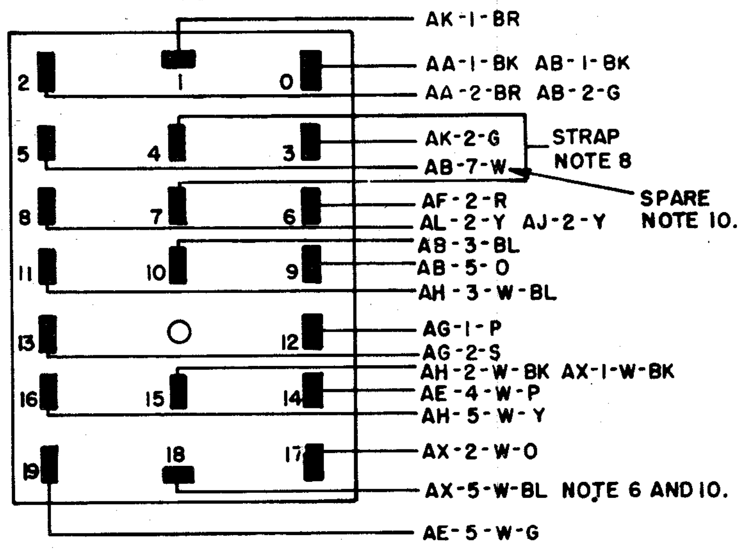
(j) Secure the adjustment by applying an appropriate cement to the potentiometer adjusting screw.

(k) Remove power and solder the zener diode lead to the cathode pin nearest the components side of the card.

NO	NOTES
1.	WIRING LEGEND A — I — W — BL DISTANT TERMINATING AREA DISTANT TERMINAL DESIGNATION WIRE COLOR CODE
2.	COLOR CODES. BK — BLACK BR — BROWN R — RED O — ORANGE Y — YELLOW G — GREEN BL — BLUE P — PURPLE W — WHITE S — SLATE W — BK — WHITE - BLACK W — BR — WHITE — BROWN W — R — WHITE — RED W — O — WHITE — ORANGE W — Y — WHITE — YELLOW W — G — WHITE — GREEN W — BL — WHITE — BLUE W — P — WHITE — PURPLE W — S — WHITE — SLATE
3.	UNIT WIRED FOR 115 VOLTS AC OR DC POWER INPUT.
4.	PLUGS VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION IN KEYBOARD.
6.	SPARE TERMINAL OF F-18 RESERVED FOR POLAR OPERATION OF KEYBOARD SIGNAL GENERATOR AND AL LAMP ON LAK 44.
7.	ASSOCIATED CABLES 158224 CABLE ASSEMBLY, AUXILIARY 158249 CABLE ASSEMBLY, KEYBOARD 155992 CABLE ASSEMBLY, BACK SPACE 159343 CABLE ASSEMBLY, BACK SPACE MAGNET 304613 CABLE ASSEMBLY, LAMP AND SWITCHES (LAK 44)
8.	BARE WIRE STRAP 39522 RM
9.	PART OF ASSOCIATED UNIT (LPE, LPR, LRPE OR LTPE)
10.	ON LAK 44 ONLY. REMOVE WHITE LEAD FROM F5 AND CUT OFF NEAR TUBING OF CABLE 158249.

F

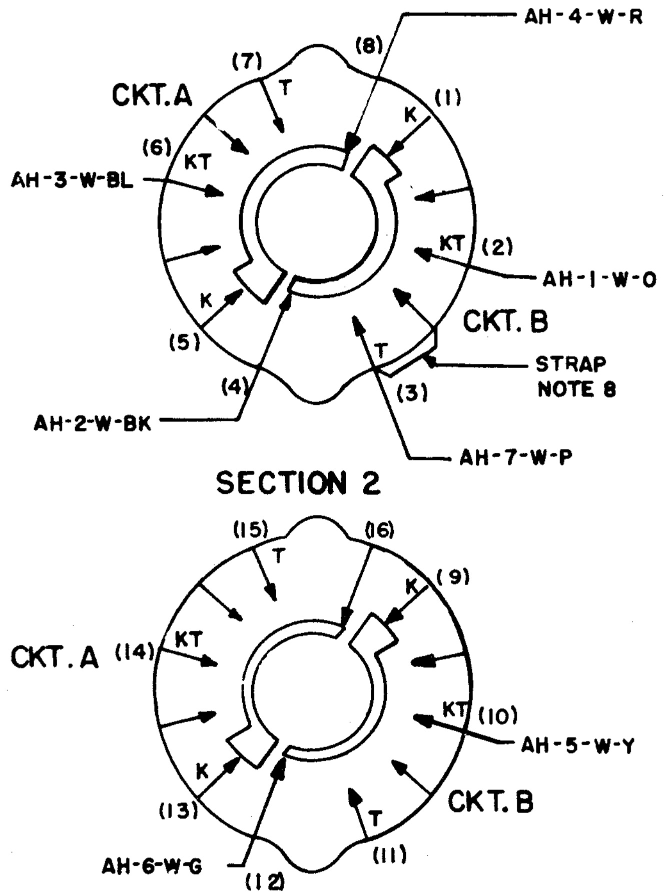
KEYBOARD CONNECTOR MALE



AC

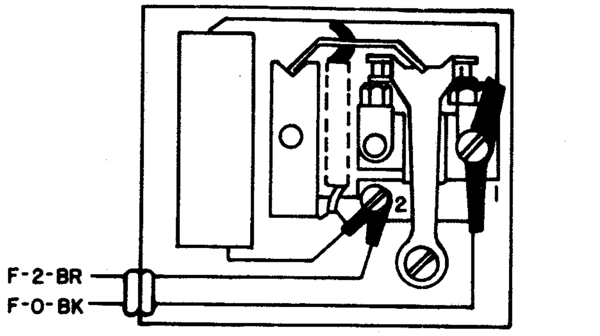
AUXILIARY SWITCH

SECTION 1



AA

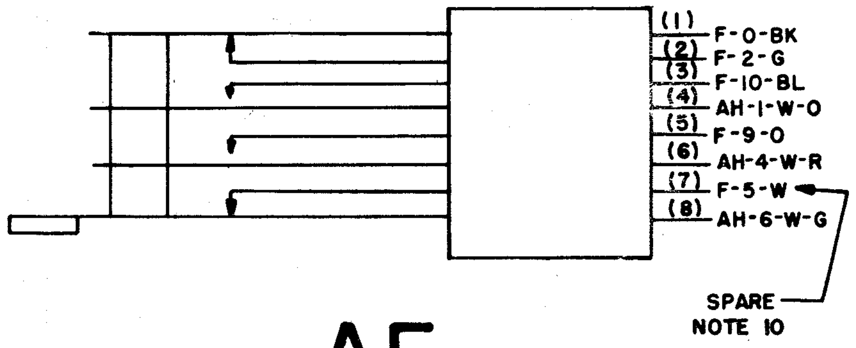
KEYBOARD SIGNAL GENERATOR



CONTACT BOX ASSEMBLY WITH ARC SUPPRESSION NETWORK ACCESSORY.

AB

LOCK BAR SWITCH



AF

END-OF-LINE MARGIN INDICATOR SELECTOR SWITCH

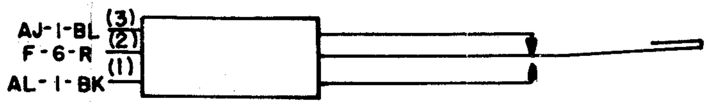


Figure 5-1. LAK 4, 25, 44 Keyboard Base Wiring Diagram (Sheet 1 of 2)

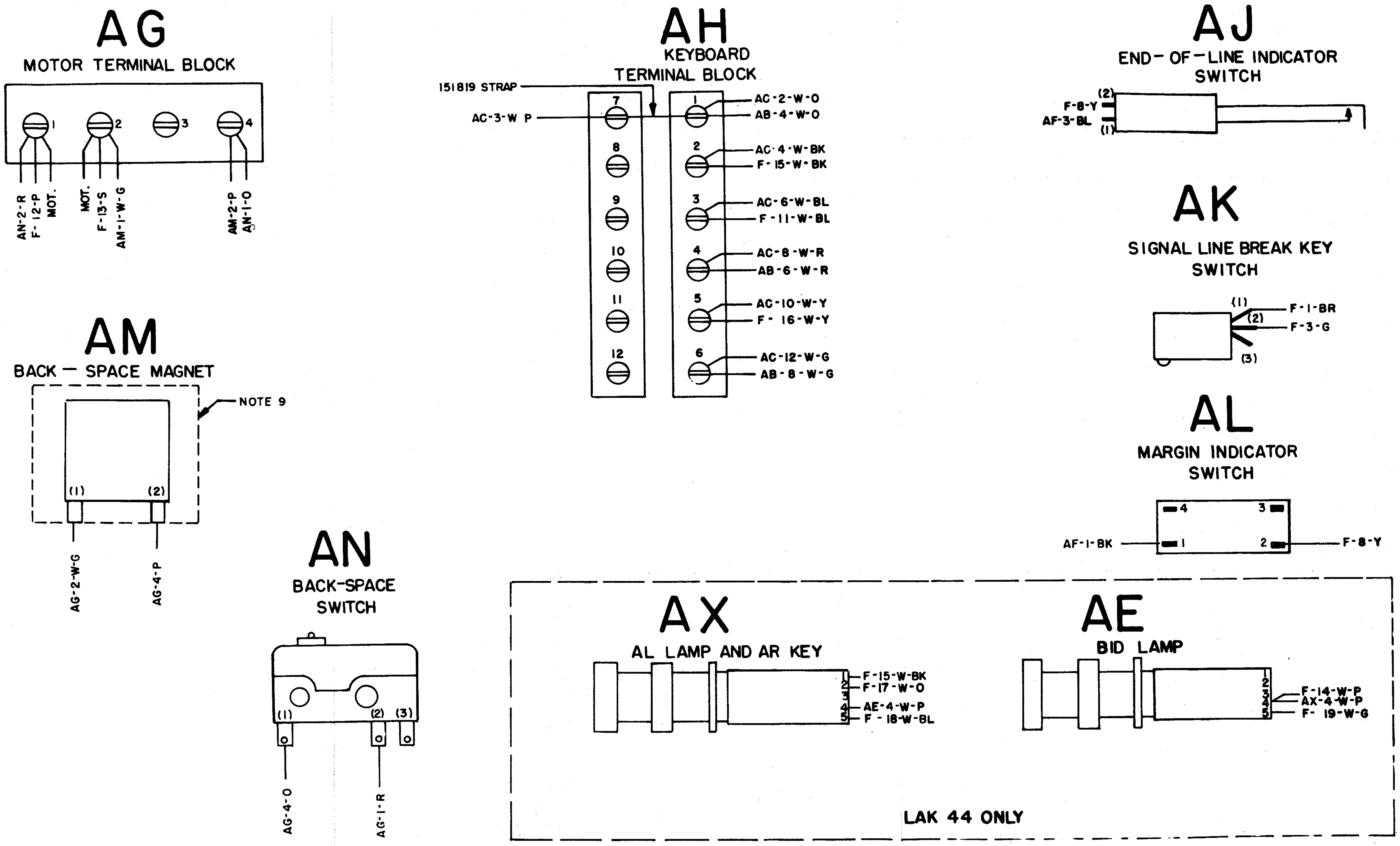


Figure 5-1. LAK 4, 25, 44 Keyboard Base Wiring Diagram
(Sheet 2 of 2)

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A-1-W-BL WIRE COLOR CODE
2.	COLOR CODE BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	UNIT WIRED FOR 115 VOLTS 50-60 CYCLE AC POWER INPUT.
4.	CONNECTORS VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION IN KEYBOARD.
6.	SPARE TERMINAL OF F-18 RESERVED FOR POLAR OPERATION OF KEYBOARD SIGNAL GENERATOR.
7.	ASSOCIATED CABLES: 158224 CABLE ASSEMBLY, AUXILIARY 158249 CABLE ASSEMBLY, KEYBOARD 155992 CABLE ASSEMBLY, BACKSPACE 159343 CABLE ASSEMBLY, BACKSPACE MAGNET 179362 CABLE ASSEMBLY, SYNC. PULSE
8.	BARE WIRE STRAP 39522RM
9.	PART OF ASSOCIATED UNIT (LPE, LPR, LRPE, OR LTPE)
10.	UNCOIL, ROUTE, AND CONNECT 179362 CABLE TO TWO OPEN CABINET TERMINALS, TYING UP ANY SLACK
11.	POLARITY MUST BE MAINTAINED ONLY WHEN 154190 FILTER IS USED. POLARITY MAY BE DISREGARDED WHEN 195923 FILTER IS USED.

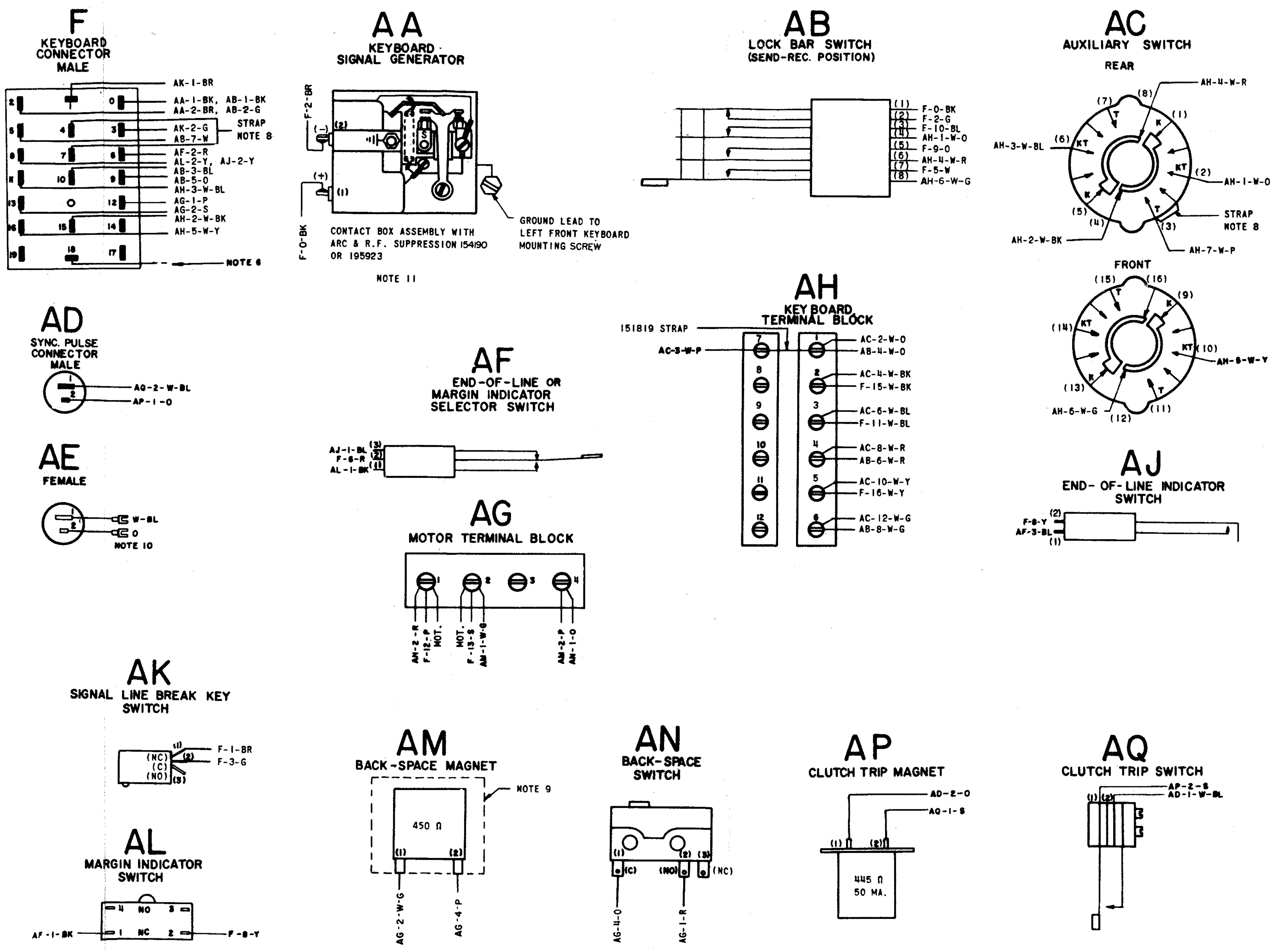


Figure 5-2. LAK 31 Keyboard Base Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A-1-W BL WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	UNIT WIRED FOR 115 VOLTS AC OR DC POWER INPUT.
4.	PLUGS VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION IN KEYBOARD.
6.	ASSOCIATED CABLES: 198353 CABLE ASSEMBLY, AUXILIARY 198352 CABLE ASSEMBLY, KEYBOARD 155992 CABLE ASSEMBLY, BACKSPACE 159343 CABLE ASSEMBLY, BACKSPACE MAGNET 198351 CABLE ASSEMBLY, SYNC. PULSE TRIP MAGNET
7.	BARE WIRE STRAP 39522RM
8.	PART OF ASSOCIATED UNIT (LPE, LPR, LRPE, OR LTPE)
9.	FOR SCHEMATIC SEE 6460WD AND 7016WD.
10.	TAPE AND TIE BACK BLUE AND WHITE LEADS TO THE OTHER END OF 196353 CABLE ASSEMBLY.

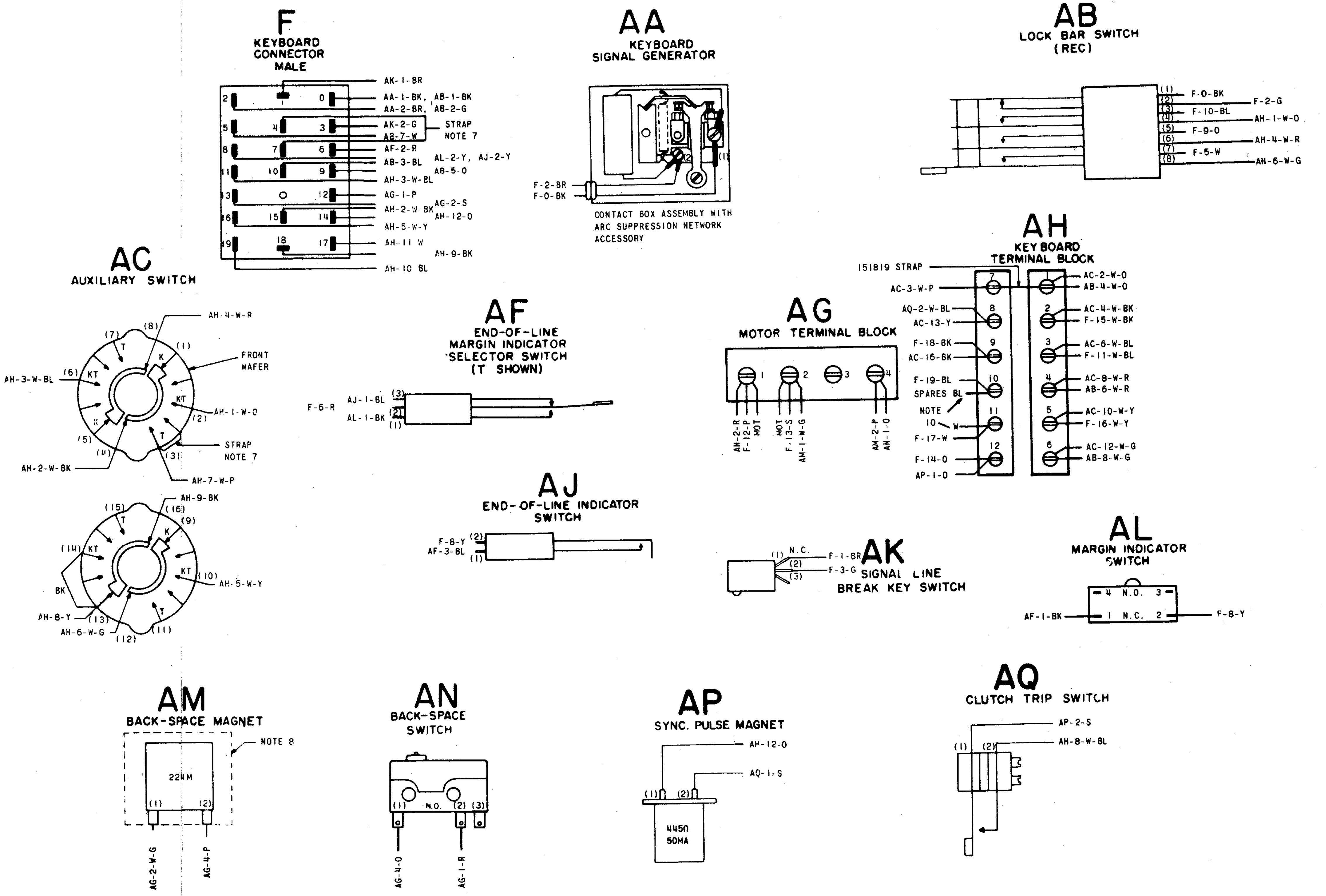
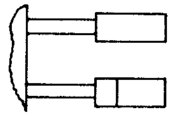
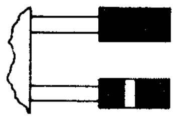


Figure 5-3. LAK 42, 46 Keyboard Base Wiring Diagram

NO	NOTES
1	WIRING CHANNEL DESIGNATED BY "R" DOES NOT REPRESENT CABLES, BUT ASSISTS IN TRACING CONNECTIONS.
2.	COLOR CODE: BK—BLACK BL—BLUE W —WHITE R —RED Y —YELLOW BR—BROWN P —PURPLE O —ORANGE S —SLATE G —GREEN
3.	COLOR LEGEND: R- 8- W CHANNEL IDENTIFICATION CHANNEL WIRE NUMBER WIRE COLOR CODE
4.	
5.	CONNECTOR VIEWED FROM SOLDERED TERMINAL ENDS.
6.	
7.	THESE LEADS FURNISHED WITH FUNCTION BOX.
8.	 NORMALLY OPEN CONTACTS NORMALLY CLOSED CONTACTS
9.	A COMPLETE LP UNIT USES ONLY ONE STUNT BOX. MAKE APPROXIMATE (____) CONNECTIONS TO COMPLETE CIRCUIT.
10.	 TRANSFER CONTACTS REAR CONTACTS NORMALLY OPEN REAR CONTACTS NORMALLY CLOSED
11.	THE FOLLOWING STUNT BOXES ARE WITHOUT SWITCH ASSEMBLIES: AX, ADL.
12.	THESE TWO TERMINALS ARE USED WHEN LP IS EQUIPPED WITH XD CONT. PAGE FEED OUT OR XD CONT. HORIZ. TAB. IF BOTH FEATURES ARE USED, THEY ARE WIRED IN SERIES TO THESE TERMINALS.
13.	USE 39522RM STRAP FOR LP 95,96,97,102,122
14.	THE 159611 SIGNAL BELL AND THE 195353 CABLE ASSEMBLY ARE CONTAINED ON THE LP111 ONLY.
15.	A. THE LP111 IS FACTORY WIRED FOR 60MA OPER.
	B. THE LP111 MAY BE CONVERTED FOR 20-30MA. OPERATION BY THE CUSTOMER.
16.	FOR AFY STUNT BOX, CONTACT IS OVER SLOT 30.
17.	195269 STRAP CONNECTED FROM TERMINAL 6 TO CONNECTOR BRACKET MOUNTING SCREW FOR 179613 AND 179644 R.F. SUPPRESSION MODIFICATION KITS.

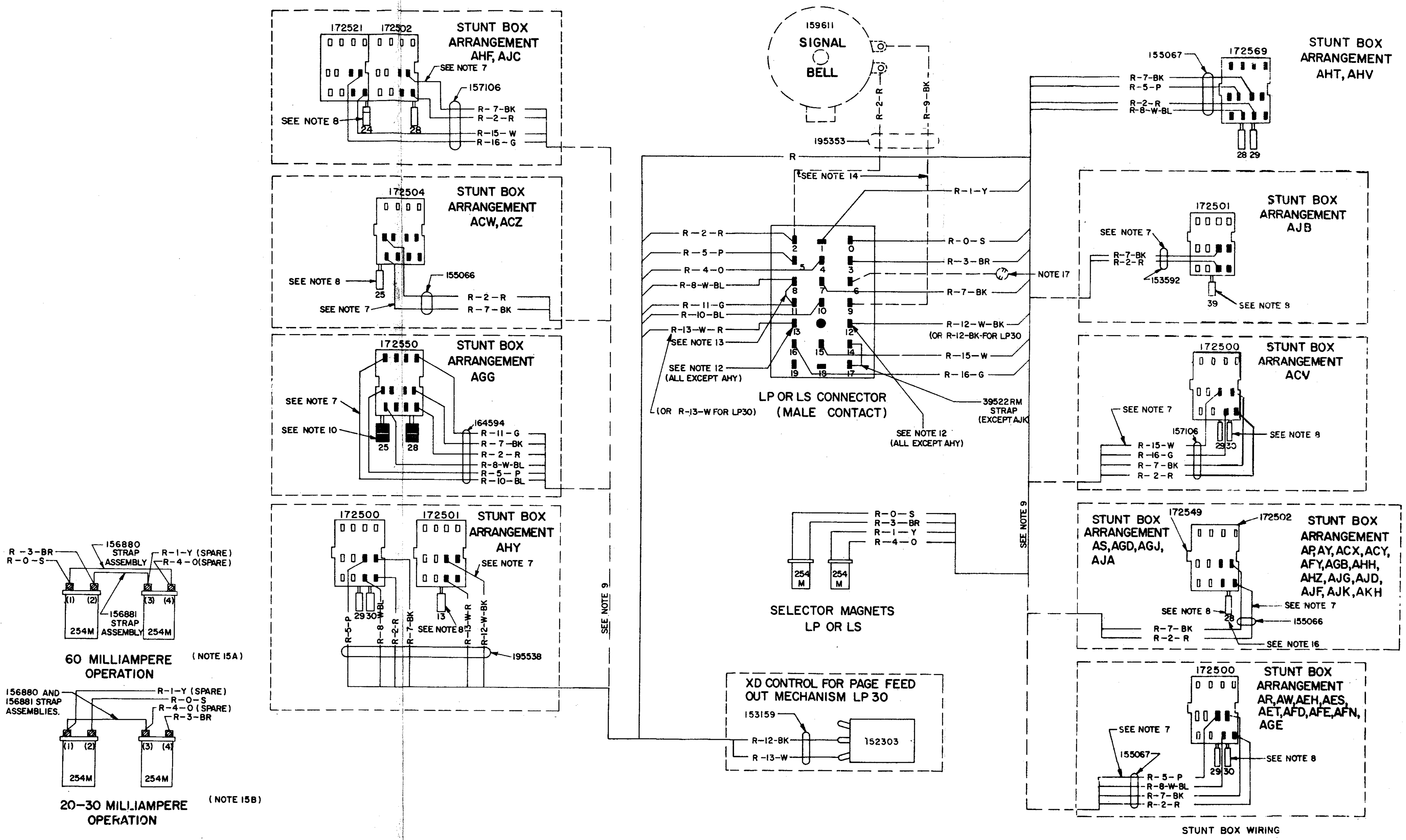


Figure 5-4. Model 28 ASR Typing Unit and Stunt Box Wiring Diagram

NO.	NOTES:
1.	WIRING CHANNEL DESIGNATED BY "C" DOES NOT REPRESENT CABLE BUT ASSISTS IN TRACING CONNECTIONS.
2.	CHANNEL LEGEND C – 8 – W CHANNEL IDENTIFICATION CHANNEL WIRE NUMBER WIRE COLOR CODE
3.	COLOR CODE: BK – BLACK R – RED W – WHITE G – GREEN O – ORANGE Y – YELLOW S – SLATE BR – BROWN
4.	CONNECTORS VIEWED FROM SOLDERED TERMINAL ENDS.
5.	THESE CABLES ARE FURNISHED WITH STUNT BOX.
6.	NORMALLY OPEN CONTACT NORMALLY CLOSED CONTACT

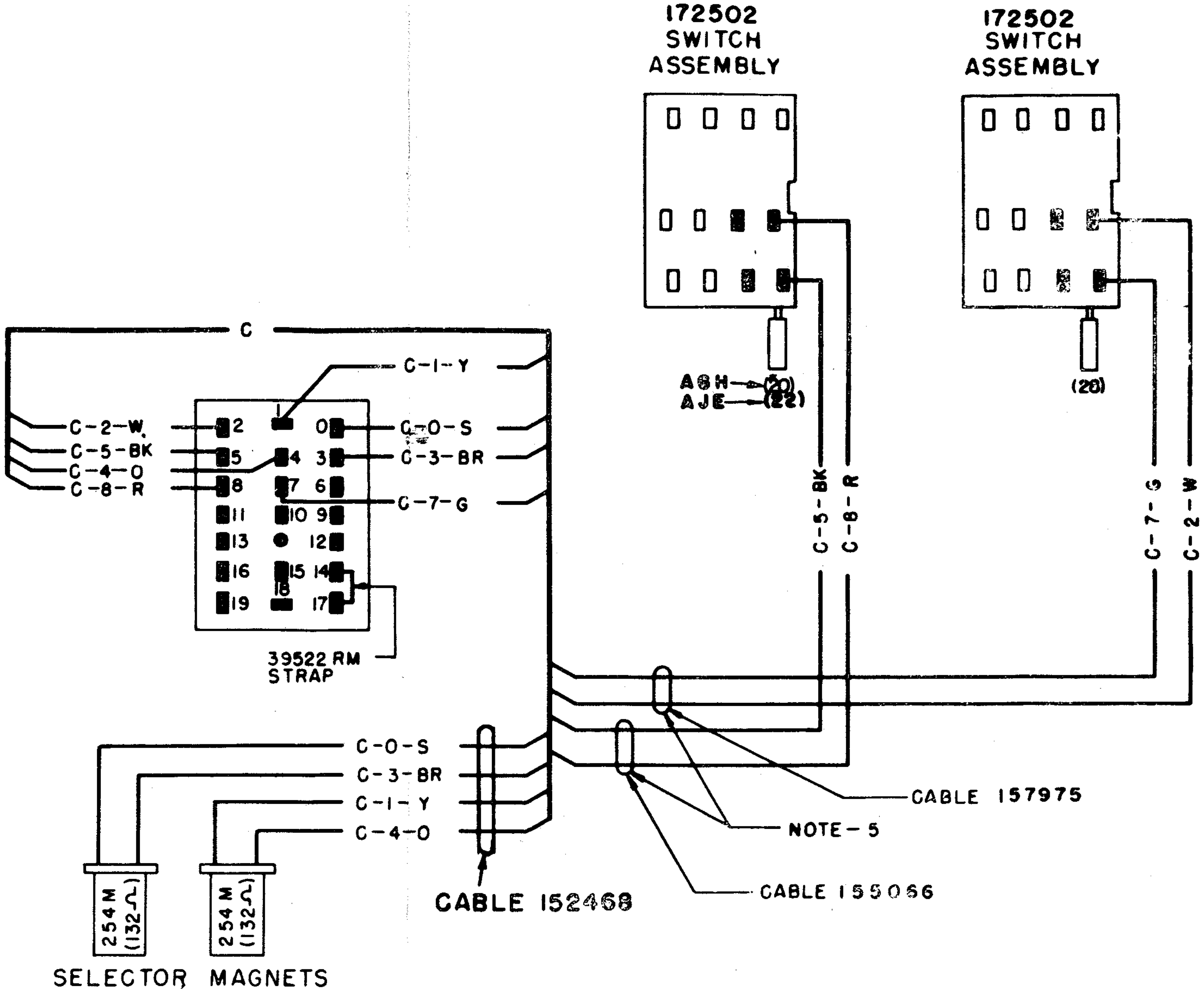


Figure 5-5. LP 14, 108, 109 Typing Unit Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION F-4-W-BL WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE S - SLATE Y - YELLOW W - WHITE
3.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESES ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENTS.
4.	TERMINALS ON CONNECTOR SHOWN AS VIEWED FROM SOLDER END.
5.	NORMALLY OPEN (NO) AND NORMALLY CLOSED (NC) CONTACTS ARE SHOWN WHEN THE REPERFORATOR IS IN THE STOP (IDLE) POSITION.
6.	THE SPACING (S) SIDE ON THE CODE READING CONTACTS ARE NORMALLY CLOSED. THE MARKING (M) SIDE OF THE CODE READING CONTACTS ARE NORMALLY OPEN.
7.	WHEN THE AUXILIARY CONTACTS ARE OPERATED FROM A SINGLE CYCLE FUNCTION CAM, THE CONTACTS NEAREST THE MOUNTING BRACKET ARE NORMALLY CLOSED. WHEN THE AUXILIARY CONTACTS ARE OPERATED FROM A DOUBLE CYCLE FUNCTION CAM, THE CONTACTS FARTHEST FROM THE MOUNTING BRACKET ARE NORMALLY CLOSED.
8.	GENERAL NOTE: WIRING OF INDIVIDUAL COMPONENTS IS DETERMINED BY REFERRING TO THE CABLE ASSEMBLIES SPECIFIED ON THE UNIT B/M.
9.	WHEN USING THE 162306 CABLE ASSEMBLY WITH THE LRPE8, CONNECT THE W-BL WIRE (NORMALLY CONNECTED TO G4) TO G6.
10.	
11.	WHEN COMMON CONNECTION IS USED, D.C. MUST BE PROVIDED FOR MAGNETS OTHER THAN 224M WHICH OPERATES ON A.C. OR D.C.
12.	FOR WIRING OF BACKSPACE MAGNET ON LAK KEYBOARD MOUNTED PERFORATORS, REFER TO ASSOCIATED LAK WIRING DIAGRAM.
13.	SELECTOR MAGNETS MUST BE STRAPPED FOR 60 MILLIAMPERE OPERATION WHEN 179615 AND 179616 R.F. SUPPRESSION MODIFICATION KITS ARE USED WITH REPERFORATOR SET.
10	ON UNITS EQUIPPED WITH THE 173850 SHIELDED CABLE, THE STRAP BETWEEN TERMINALS C-35 AND C-36 IS OMITTED AND THE "G" WIRE OF THE CABLE IS CONNECTED TO TERMINAL C-35. IF THE UNIT EQUIPPED WITH THE 173850 SHIELDED CABLE IS USED ON A BASE NOT CONTAINING PROVISIONS FOR R F SUPPRESSION (INCLUDING BELL SYSTEM) REMOVE THE "G" WIRE FROM TERMINAL C-35 AND ADD STRAP BETWEEN TERMINALS C-35 AND C-36.
14	THE LPR 66 SELECTOR MAGNET ASSEMBLY SHALL BE STRAPPED IN PARALLEL FOR 500 MA OPERATION

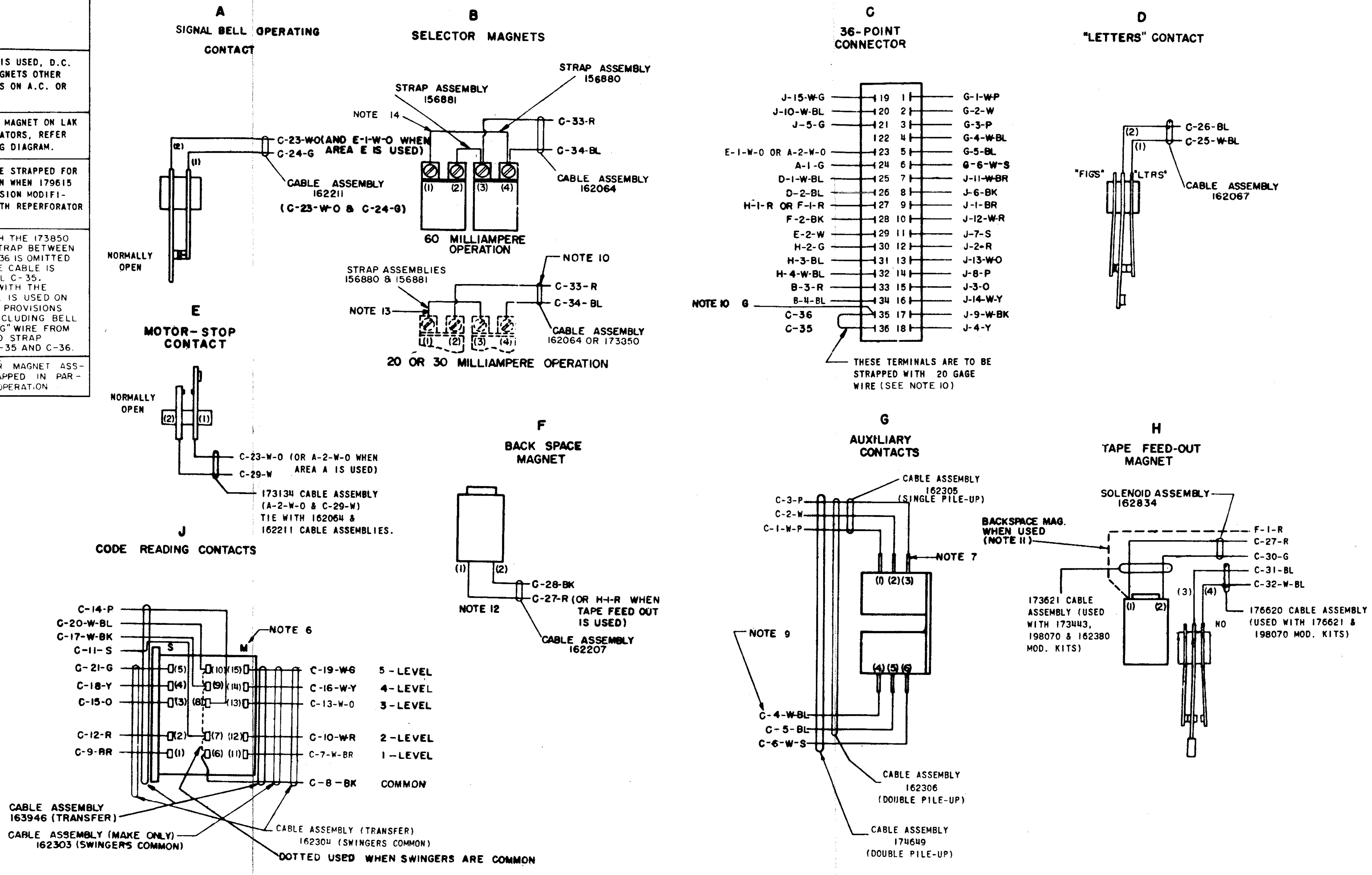


Figure 5-6. LPR, LPE, LRPE Typing and Non-Typing Reperforator Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION WIRE COLOR CODE AB—2—W
2.	COLOR CODE: BK—BLACK W—BK WHITE—BLACK BR—BROWN W—BR WHITE—BROWN R—RED W—R WHITE—RED O—ORANGE W—O WHITE—ORANGE Y—YELLOW W—Y WHITE—YELLOW G—GREEN W—G WHITE—GREEN BL—BLUE W—BL WHITE—BLUE S—SLATE W—S WHITE—SLATE P—PURPLE W—P WHITE—PURPLE W—WHITE
3.	ASSOCIATED CABLE ASSEMBLIES 161886, 161887 & 161888.
4	ALL CONNECTORS VIEWED FORM SOLDER END.
5.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE NOT MARKED ON COMPONENTS.
6.	FOR SCHEMATIC WIRING DIAGRAM SEE 3591 WD.

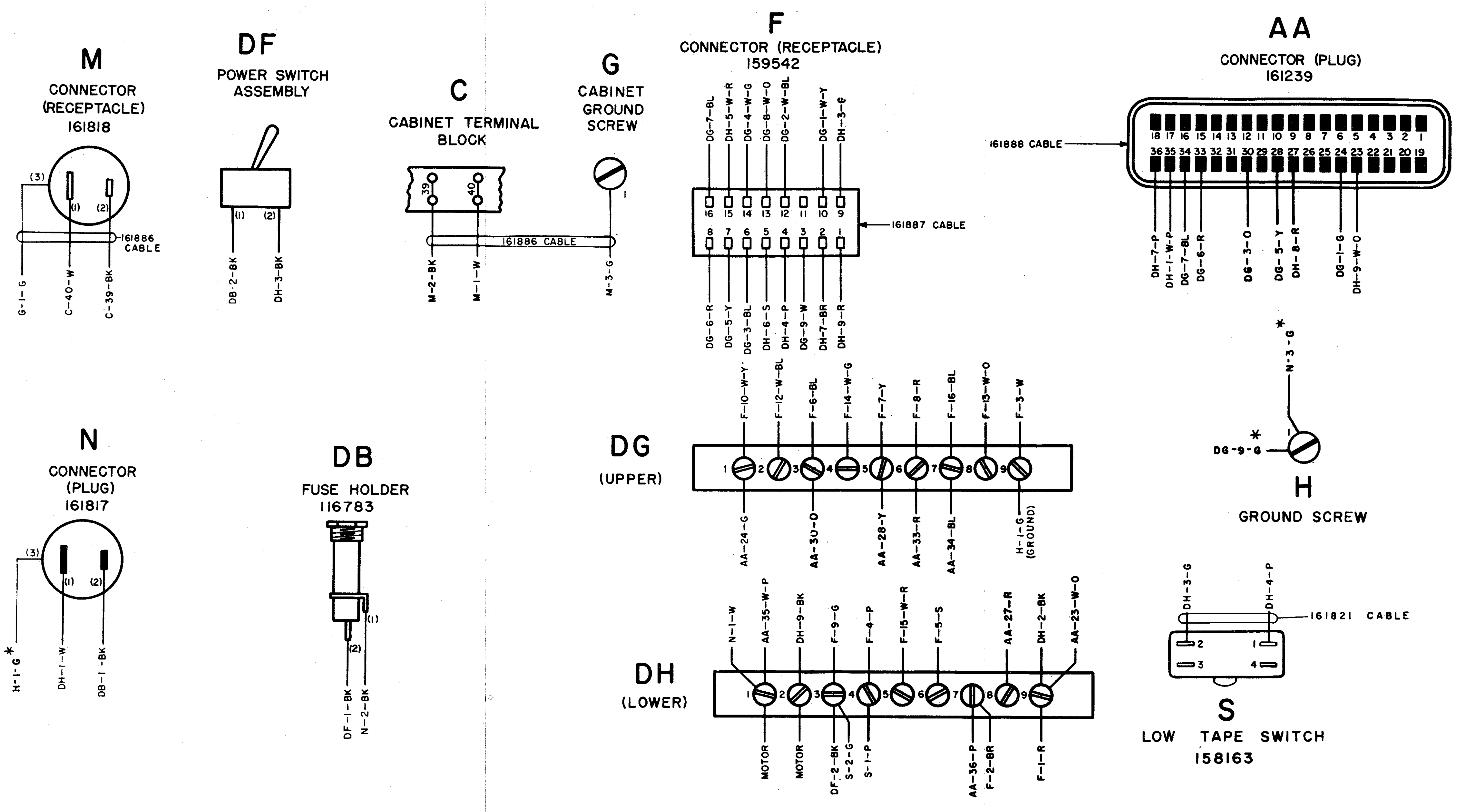


Figure 5-7. LRB 5, 6 Reperforator Base Wiring Diagram

NO	NOTES
1.	FOR ACTUAL WIRING DIAGRAMS OF INDIVIDUAL UNITS SEE WD NUMBER UNITS DIRECTLY OPERABLE WITH LESU 12 3344 WD ELECTRICAL SERVICE UNIT LESU 12 2900 WD MOTOR UNITS—LMU 3,4,6 3590 WD TYPING REPERFORATOR BASE LRB 5, LRB 6
2.	LEGEND ○ DG TERMINAL BLOCK (ON BASE) ○ DH TERMINAL BLOCK (ON BASE) << F 16-POINT CONNECTOR ○ A TERMINAL BLOCK (IN LESU) ○ B TERMINAL BLOCK (IN LESU) ○ D TERMINAL BLOCK (IN LESU) ○ E TERMINAL BLOCK (IN LESU) ○ J ① TERMINAL STRIP ON LINE RELAY (IN LESU) << J ② LINE RELAY CONNECTOR (IN LESU) ○ J ③ LINE RELAY FILTER (IN LESU) << AA 36 POINT CONNECTOR (ON BASE) C CABINET TERMINAL BLOCK << P CONTROL PANEL CONNECTOR << R CONTROL PANEL CONNECTOR
3.	DOT-DASH(-·-·-·-)LINES INDICATE FILTERING SHIELDING AND SUPPRESSION NETWORKS.
4.	ALL APPARATUS IS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITIONS.
5.	(Ω) RESISTANCE VALUES IN OHMS-(Ω) (δ) INDUCTANCE VALUES IN MICROHENRIES (MH) (c) CAPACITANCE VALUES IN MICROFARADS (MFD)
6.	CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP LINE CURRENT, ADD DASH LINE (----) CONNECTION AND OMIT CONNECTION MARKED (—✕—) IN LINE RELAY.
7.	USE SYNCHRONOUS MOTOR ON REGULATED 60 ~ (± 1%) AC. POWER ONLY. GOVERNED MOTORS AND OTHER POWER CIRCUITS OPERABLE ON 50 TO 60 ~ UNREGULATED A.C.
8.	LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING LINE RELAY COIL.
9	TAPE FEED OUT AND/OR BACKSPACE MAGNETS ARE AVAILABLE ONLY WITH SPECIFIC CODED LPR UNITS.
10	WHEN COMMON CONNECTION IS USED, D.C. MUST BE PROVIDED FOR MAGNETS OTHER THAN 224M WHICH OPERATES ON A.C. OR D.C.
11.	WIRING FOR LRB6 (EQUIPPED WITH 178838 MOD. KIT) OR LRB36, LRB51

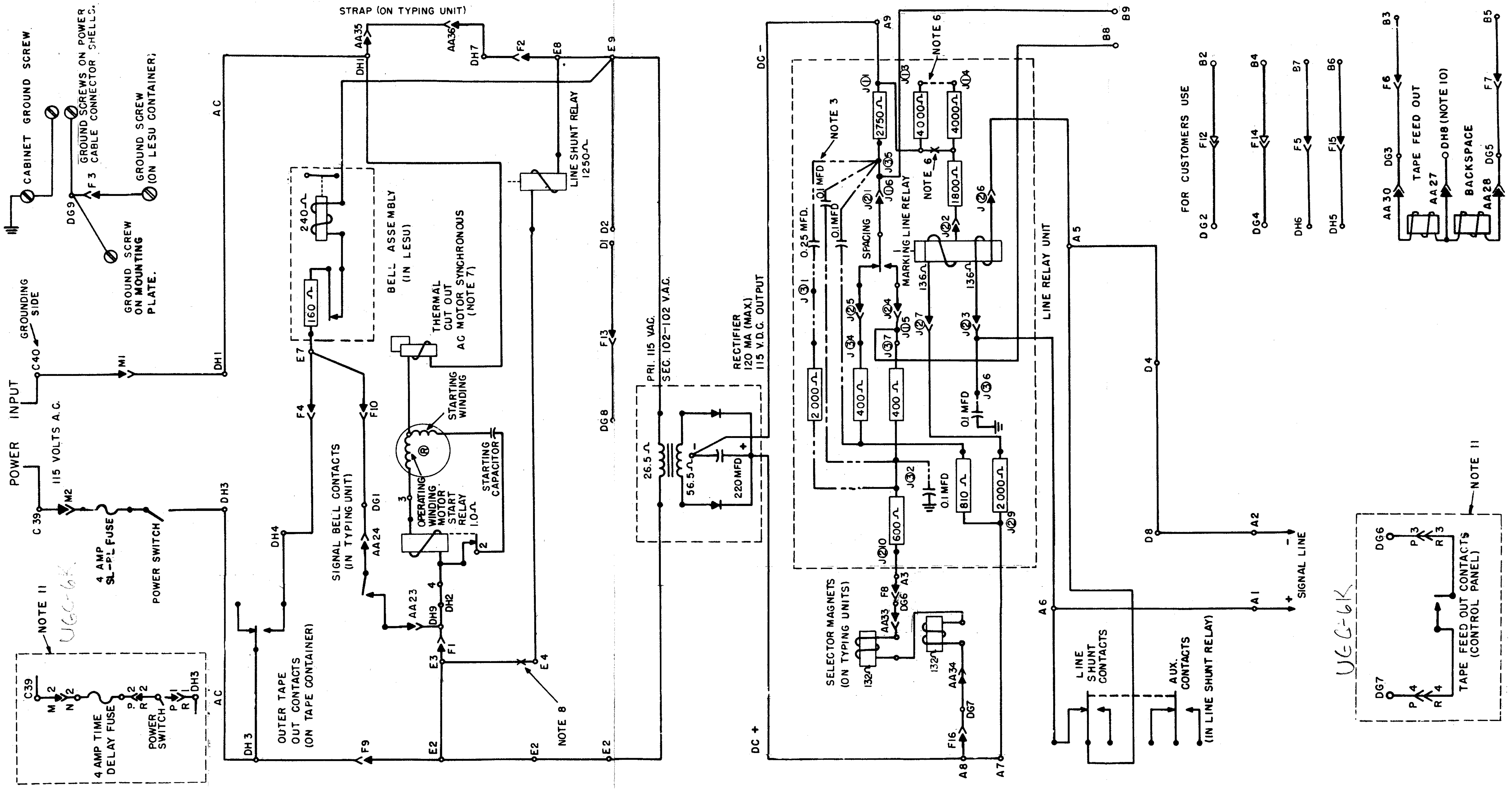


Figure 5-8. LRB 5, 6, 36, 42, 51 Reperforator Base Schematic Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: AB—2—W DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION WIRE COLOR CODE
2.	COLOR CODE: BK—BLACK W—BK WHITE—BLACK BR—BROWN W—BR WHITE—BROWN R—RED W—R WHITE—RED O—ORANGE W—O WHITE—ORANGE Y—YELLOW W—Y WHITE—YELLOW G—GREEN W—G WHITE—GREEN BL—BLUE W—BL WHITE—BLUE S—SLATE W—S WHITE—SLATE P—PURPLE W—P WHITE—PURPLE W—WHITE
3.	ALL CONNECTORS VIEWED FROM SOLDER END.
4.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE NOT MARKED ON COMPONENTS.
5.	FOR SCHEMATIC WIRING DIAGRAM SEE 3591 WD.
6	ASSOCIATED CABLE ASSEMBLIES 161886, 161887, 161888, 312475 AND 312476
7.	MAKE THIS CONNECTION BY (SPLICE, SOLDER, AND TAPE) BLACK LEAD FROM 161887 CABLE ASSEMBLY AND BLUE LEAD FROM 312476 CABLE ASSEMBLY.
8.	TIE BLACK JUMPER WIRE BACK IN CABLE.
9.	COVER TERMINAL T-6 WITH A 155753 INSULATING SLEEVE.

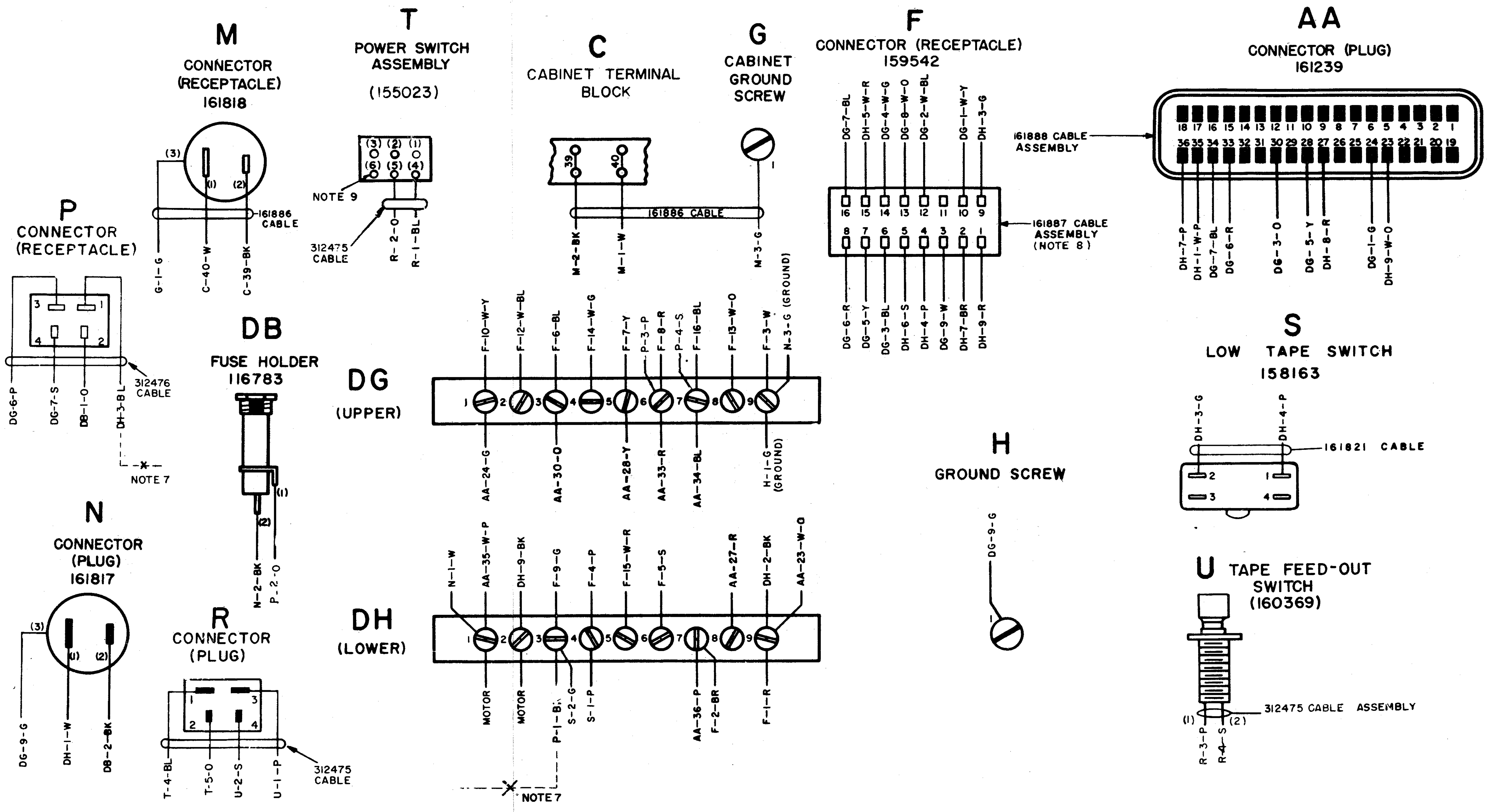


Figure 5-9. LRB 36, 42 and 51 Reperforator Base Wiring Diagram

NO	NOTES
1.	WIRING LEGEND: A—1—W—BL DISTANT TERMINATING AREA DISTANT TERMINAL DESIGNATION WIRE COLOR CODE
2.	COLOR CODE: BK— BLACK BR— BROWN R— RED O— ORANGE Y— YELLOW G— GREEN BL— BLUE P— PURPLE W— WHITE S— SLATE W—BK—WHITE-BLACK W—BR—WHITE-BROWN W— R—WHITE-RED W— O—WHITE-ORANGE W—Y—WHITE-YELLOW W—G—WHITE-GREEN W—BL—WHITE-BLUE W— P— WHITE-PURPLE W—S— WHITE-SLATE
4.	CONNECTOR VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION.
6.	SPARE TERMINAL OF U-18 RESERVED FOR POLAR OPERATION OF TRANSMITTER DISTRIBUTOR SIGNAL GENERATOR.
7.	DISCONNECT ONE TERMINAL WHEN TESTING SIGNAL GENERATOR.
8.	*THE NUMBERS ENCASED BY PARENTHESES ARE USED FOR REFERENCE AND ARE NOT NECESSARILY SHOWN ON THE PARTS.*
9.	A. 115 V ±10% AC POWER TO BE USED ON CLUTCH TRIP MAGNET ASSEMBLY CIRCUIT. (256M COIL ASSEMBLIES, 74Ω EACH) FOR DC OPERATION ADD SUFFICIENT EXTERNAL RESISTANCE TO LIMIT CURRENT TO 100 M.A. B. LXD27 EQUIPPED WITH 262M COIL ASSEMBLIES (RESISTANCE, 210Ω EACH) THE OPERATING CURRENT MUST BE 50MA, 115VDC WIRED AS SHOWN. FOR AC OPERATION CONNECT IN PARALLEL.
10.	GROUND STRAP 117366 OF LCXB SHOULD BE SECURED TO RIGHT REAR MTG. STUD OF LAAC RAIL (SEE SPEC. 5941S).

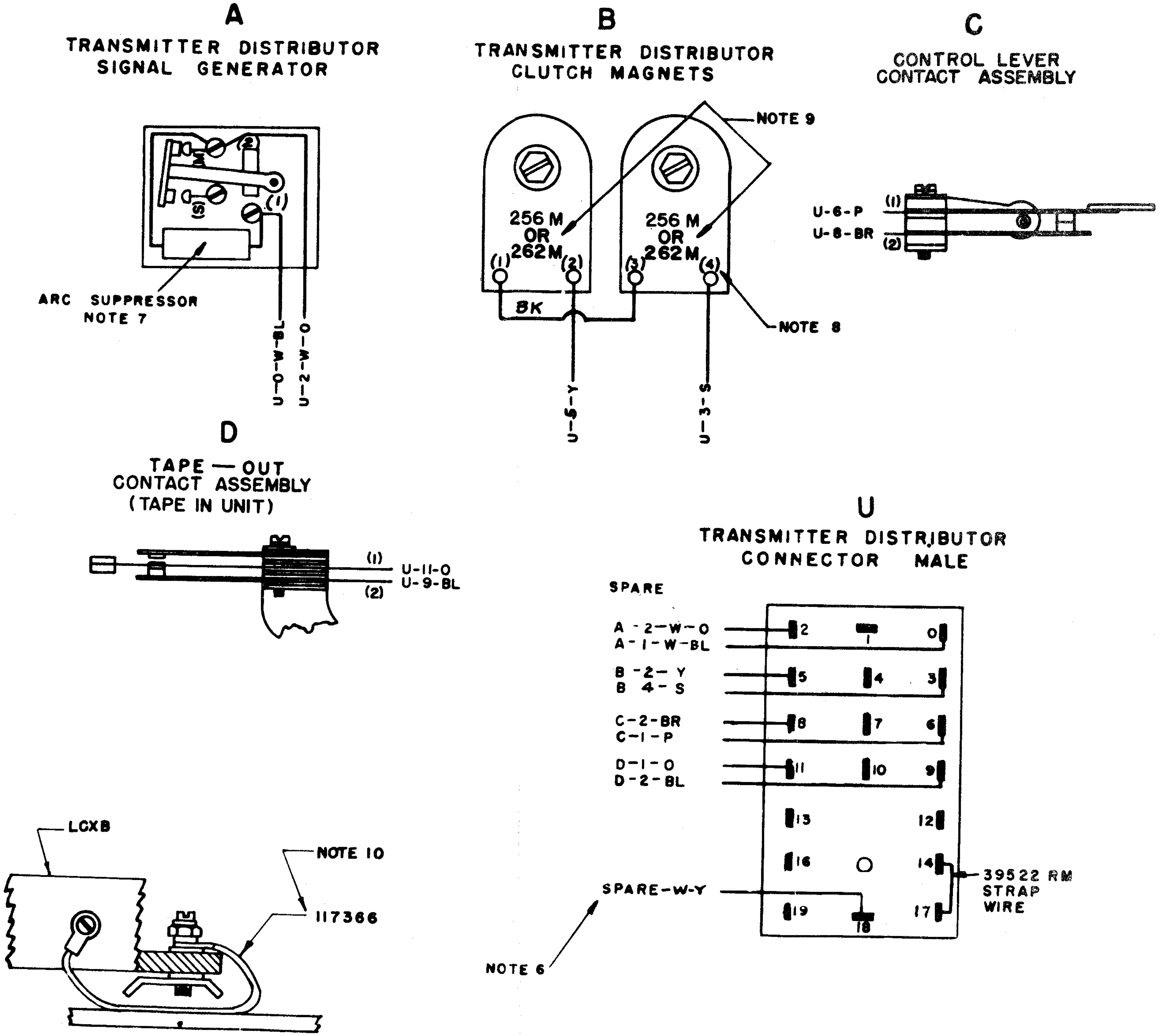


Figure 5-10. LXD 3, 27 Transmitter Distributor Wiring Diagram

<table>
<tr><th>NO.</th><th>NOTES</th></tr>
<tr><td>1.</td><td>WIRING LEGEND:
A-1-W-BL
DISTANT TERMINATING AREA
DISTANT TERMINATING DESIGNATION
WIRE COLOR CODE</td></tr>
<tr><td>2.</td><td>COLOR CODE:
BK - BLACK   G - GREEN
BR - BROWN   BL - BLUE
R - RED   P - PURPLE
O - ORANGE   W - WHITE
Y - YELLOW   S - SLATE</td></tr>
<tr><td>3.</td><td>UNIT WIRED FOR 115 VOLTS, 50 TO 60 CYCLE A.C. POWER INPUT ONLY.</td></tr>
<tr><td>4.</td><td>CONNECTORS VIEWED FROM SOLDER TERMINAL ENDS.</td></tr>
<tr><td>5.</td><td>CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP. OPERATION, REMOVE AND ADD CONNECTIONS AS TABULATED BELOW:
<table>
<tr><th>SIGNAL LINE CURRENT</th><th>CONNECTIONS REMOVED</th><th>CONNECTIONS ADDED</th></tr>
<tr><td>.020 AMP.</td><td>K1-K2,
J① 1-J① 2</td><td>J① 3-J① 4</td></tr>
</table></td></tr>
<tr><td>6.</td><td>RECTIFIER SHOWN CONTROLLED BY POWER SWITCH.
A. FOR CONTINUOUS OPERATION, REMOVE LEAD L-2-BK FROM TERMINAL E-2 AND CONNECT TO TERMINAL E-1.
B. FOR OPERATION FROM MOTOR CONTROL, REMOVE LEAD L-2-BK FROM TERMINAL E-2 AND CONNECT TO TERMINAL E-3.</td></tr>
<tr><td>7.</td><td>LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING LINE RELAY COIL AND KEYBOARD AND TRANSMITTER DISTRIBUTOR SIGNAL GENERATOR.
A. IF KEYBOARD SHUNTING IS NOT DESIRED, OR WHEN SIGNAL LINE BREAK SWITCH IS PRESENT, REMOVE THE BLACK STRAP CONNECTED BETWEEN TERMINALS C-10 AND C-13 AND CONNECT TERMINALS C-9 AND C-13.
B. FOR DIRECT CONTROL OF THE LINE SHUNT RELAY FROM THE POWER SWITCH, REMOVE STRAP BETWEEN TERMINALS C-34 AND C-37 AND CONNECT TERMINALS C-34 AND C-35. TERMINAL C-13 MAY THEN BE CONNECTED TO EITHER TERMINALS C-9, C-10, C-11 OR C-15 TO OBTAIN THE DESIRED SHUNTING OF THE SIGNAL LINE CIRCUIT.</td></tr>
<tr><td>8.</td><td>THE SPARE LEADS FROM THE KEYBOARD AND TRANSMITTER DISTRIBUTOR UNITS CONNECTORS ARE TERMINATED IN THE RIGHT END OF THE ELECTRICAL SERVICE UNIT. THE SPARE LEADS FROM THE TYPING UNIT CONNECTORS ARE TERMINATED IN THE LEFT END OF THE ELECTRICAL SERVICE UNIT.</td></tr>
<tr><td>9.</td><td>ADD STRAP BETWEEN C-10 AND C-11, IF SIGNAL LINE BREAK SWITCH IS NOT USED.</td></tr>
<tr><td>10.</td><td>SPARE LEADS FROM F-18 AND U-18 ARE RESERVED FOR POLAR OPERATION OF KEYBOARD AND TRANSMITTER DISTRIBUTOR SIGNAL GENERATORS.</td></tr>
<tr><td>11.</td><td>TERMINALS C-143 TO C-148 ARE RESERVED FOR CABINET LAMP OPERATION.</td></tr>
<tr><td>12.</td><td>TERMINALS C1-C3 RESERVED FOR CUSTOMER USE.</td></tr>
<tr><td>13.</td><td>TERMINALS C-121 - C-122 RESERVED FOR PERFORATOR LOW-TAPE SWITCH.</td></tr>
<tr><td>14.</td><td>CONTACTS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITION.</td></tr>
<tr><td>15.</td><td>WHEN LBXD IS USED IN PLACE OF LXD, MAKE THE FOLLOWING CHANGES:
OMIT CONNECTIONS   ADD CONNECTIONS
C-142 TO C-150
C-131 TO C-132</td></tr>
<tr><td>16.</td><td>WHEN LXD5 IS USED, REMOVE THE STRAP BETWEEN TERMINALS C-135 - C-136. ADD TWO STRAPS, ONE BETWEEN TERMINALS C-23 - C-135 AND ONE BETWEEN C-24 -C-136</td></tr>
<tr><td>17.</td><td>WHEN THE LXD II IS USED DO NOT INSTALL STRAPS BETWEEN TERMINALS C141 AND C142 OR C131 AND C132. THE INTERNAL CLUTCH MAGNET INPUT SHOULD BE CONNECTED TO TERMINALS C132 & C141. RESISTANCE PER COIL 210 OHMS.</td></tr>
</table>

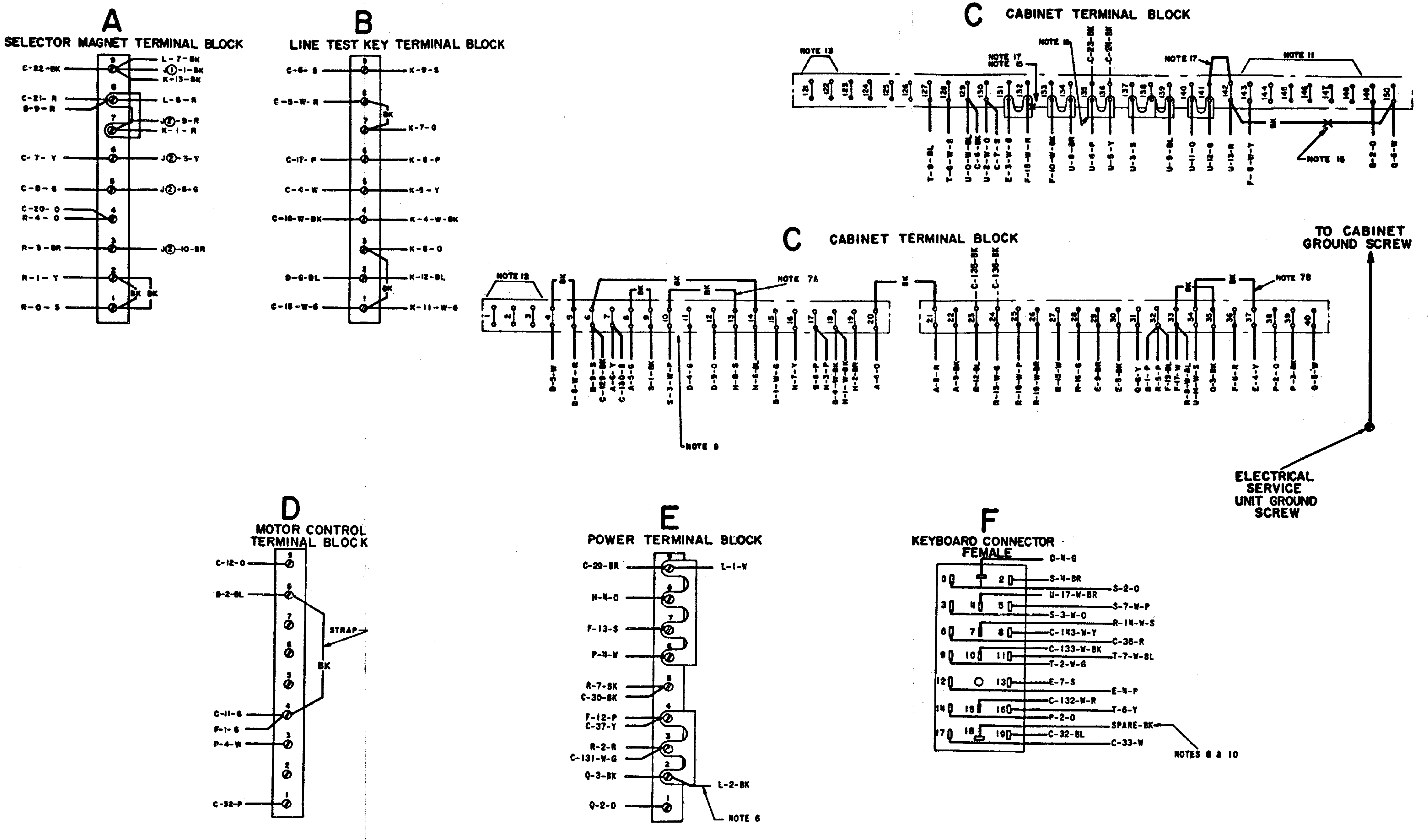


Figure 5-11. LESU 13 Electrical Service Unit Wiring Diagram (Sheet 1 of 2)

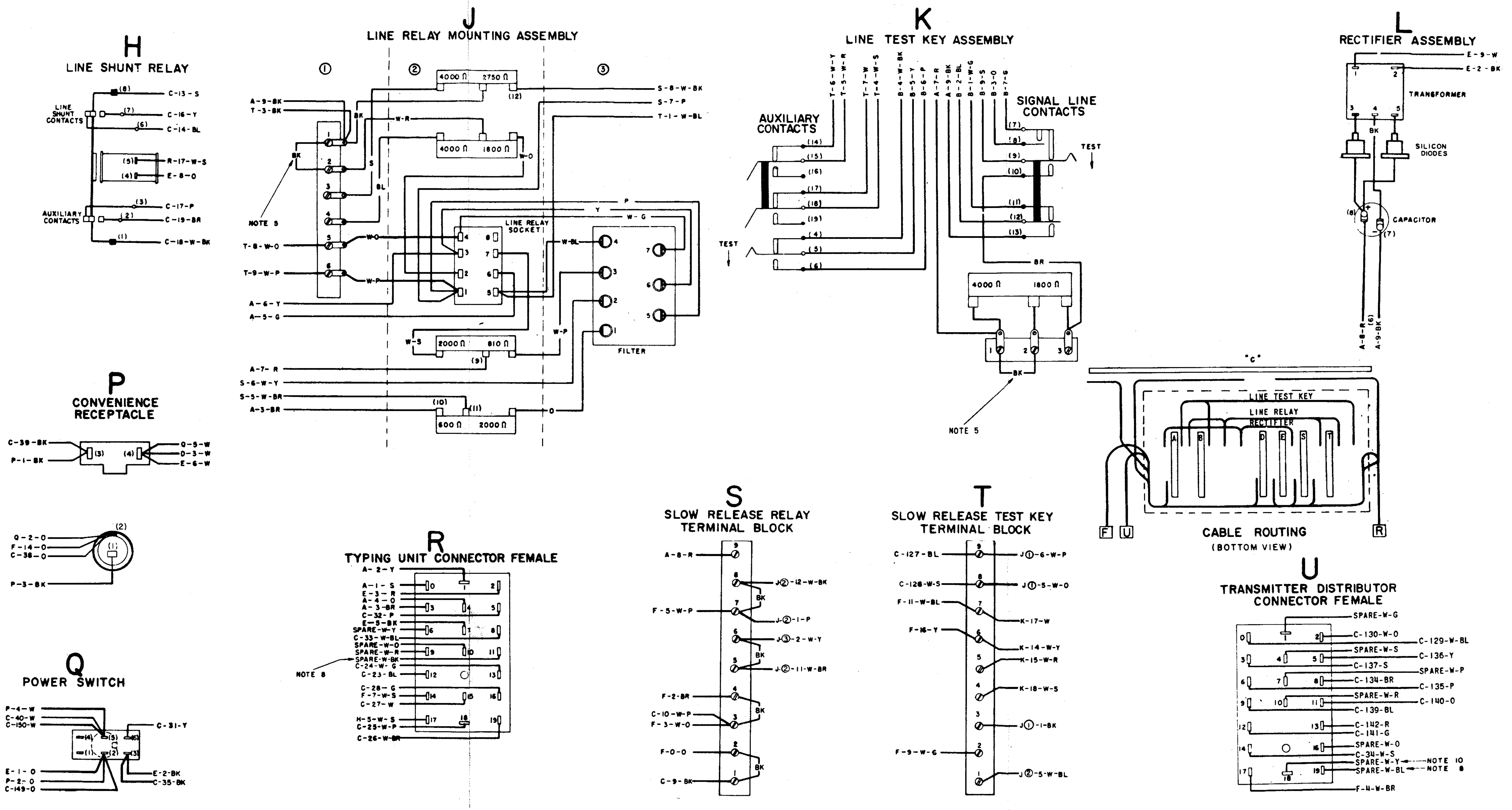


Figure 5-11. LESU 13 Electrical Service Unit Wiring Diagram (Sheet 2 of 2)

NO.	NOTES
1.	FOR ACTUAL WIRING DIAGRAMS OF INDIVIDUAL UNITS SEE:

WD NO.	UNITS DIRECTLY OPERABLE WITH LESU
3264WD	CABINETS-LAAC209,210
3292WD	ELECTRICAL SERVICE UNIT LESU13
3302WD	KEYBOARDS-LAK4
2900WD	MOTOR UNITS-LMU12 OR 14.
2864WD	PAGE TYPING UNITS-LP
3300WD	TRANSMITTER DISTRIBUTOR-LXD3
3288WD	TRANSMITTER DISTRIBUTOR-LAXD 3 & LCXD1
3251WD	TRANSMITTER DISTRIBUTOR-LBXD5
3452WD	TRANSMITTER DISTRIBUTOR BASE -LCXB7

2. LEGEND:
- ○ A SELECTOR MAGNET TERMINAL BLOCK (IN LESU)
- ○ B LINE TEST KEY TERMINAL BLOCK (IN LESU)
- ○ C CABINET TERMINAL BLOCK
- ○ D MOTOR CONTROL TERMINAL BLOCK (IN LESU)
- ○ E POWER TERMINAL BLOCK (IN LESU)
- ≪ F KEYBOARD CONNECTOR
- ○ J 1 TERMINAL STRIP (ON LINE RELAY ASSEMBLY IN LESU)
- ≪ J 2 LINE RELAY CONNECTOR (IN LESU)
- ● J 3 LINE RELAY FILTER(IN LESU)
- ○ K TERMINAL STRIP (ON LINE TEST KEY IN LESU)
- ≪ R TYPING UNIT CONNECTOR
- ○ S SLOW RELEASE RELAY TERMINAL BOARD(IN LESU)
- ○ T TEST SWITCH TERMINAL BOARD (IN LESU)
- ≪ U TRANSMITTER DISTRIBUTOR CONNECTOR
- ○ AG MOTOR TERMINAL BLOCK(ON LAK)
- ○ AH AUXILIARY SWITCH TERMINAL BLOCK (ON LAK)
- ≪ Z TRANSMITTER DISTRIBUTOR CONN (LBXD).

3. DOT DASH(---) LINES INDICATE FILTERING, SHIELDING AND SUPPRESSION NETWORKS.

4. ALL APPARATUS IS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITION.

5. A. RESISTANCE IN OHMS (Ω)
B. INDUCTANCE VALUES IN MICROHENRIES(MH)
C CAPACITANCE VALUES IN MICROFARADS(MF)

6. CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP. LINE CURRENT, ADD DASHED (——) CONNECTIONS AND OMIT CONNECTIONS MARKED (✱) IN LINE TEST KEY, AND LINE RELAY CIRCUITS.

7. USE POWER & SIGNAL LINE SUPPRESSOR AND SYNC.OR GOV.-FILT. MOTOR FOR INSTALLATIONS REQUIRING MINIMUM R.F. INTERFERENCE.
FOR OTHER INSTALLATIONS OMIT SUPPRESSORS AND CONNECT INPUTS AND GOV.MOTOR DIRECTLY TO TERMINALS SHOWN.

8. USE SYNCHRONOUS MOTOR ON REGULATED 60~ (± 1%) AC POWER ONLY. GOVERNED MOTORS AND OTHER POWER CIRCUITS OPERABLE ON 50 TO 60~ UNREGULATED AC.

9. RECTIFIER SHOWN CONTROLLED BY POWER SWITCH.
FOR CONTINUOUS OPERATION, MOVE RECTIFIER LEAD L2 FROM E2 TO E1.

10. A. TO OPERATE MOTOR CONTROL, SET MUST BE EQUIPPED WITH EITHER
1. TIME DELAY MECH. OR
2. MOTOR STOP CONTACTS
B IF TAPE POSITION IS TO BE USED IN THE ASR SET THE TIME DELAY MECHANISM MUST BE EITHER ELECTRICALLY OR MECHANICALLY DISABLED.

11. A. LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHOWN SHUNTING LINE RELAY COIL, TRANS.DIST.SIG. GENERATOR AND KEYBOARD SIG.GEN.
B. IF KEYBOARD SHUNTING IS NOT DESIRED MOVE STRAP FROM C10 TO C9.
C. FOR DIRECT CONTROL OF LINE SHUNT RELAY FROM POWER SWITCH, ADD DASHED (———) CONNECTIONS AND OMIT CONN. MARKED (✱) AT CABINET TERMINALS C34,C35.C37. CUSTOMER MAY THEN SELECT PORTION OF SIG.LINE CKT.TO BE SHUNTED BY CONNECTING TERM.C13 TO EITHER C9,C10,C11,C15.

12. CIRCUIT SHOWS BOTH HORIZONTAL TABULATOR AND FORM START CONTROL USED ON TYPING UNIT. WHEN ONLY ONE CONTROL IS USED, OMIT CONNECTION MARKED (—✱—) AND ADD PROPER DASHED (----) CONNECTION IN TYPING UNIT CIRCUITS.

13. FORM PAPER OUT ALARM CONTACTS MAY BE MOUNTED ON EITHER THE TYPING UNIT OR EXTERNAL TO THE CABINET. IN LATTER EVENT, CONNECTIONS ARE MADE DIRECTLY TO TERMINALS C25 AND C26.

14. WHEN PAPER FEED OUT SWITCH IS NOT USED DISCONNECT MOTOR LEAD FROM AG3 AND CONNECT TO AG1.

15. WHEN SIGNAL LINE BREAK SWITCH IS NOT USED IN KEYBOARD ADD DASHED (----) CONNECTION AT CABINET TERMINAL BLOCK BETWEEN C10 AND C11.

16. IN ALL TRANS.DIST.U14 MUST BE CONNECTED TO U17 EXCEPT FOR LXD4 AND UP.(SEE NOTE 25)

17. IN ALL KEYBOARDS F4 MUST BE CONNECTED TO F7.
IN ALL TYPING UNITS R14 MUST BE CONNECTED TO R17.

18 SPARE LEADS FROM U18 AND F18 ARE RESERVED FOR POLAR OPERATION OF SIGNAL GENERATOR.

19. CIRCUIT SHOWN FOR 115V DC POWER INPUT TO TRANS.DIST.CLUTCH MAGNETS. FOR 48V DC POWER INPUT MOVE WIRE CONNECTIONS AS FOLLOWS:

UNIT	WIRE INVOLVED	MOVE CONN.FROM	TO
LAXD+ LCXD	C81 TO V6 C142 TO V3	V6 V3	V5 V2
LBXD	A13 10 V6 A6 TO V3	V6 V3	V5 V2

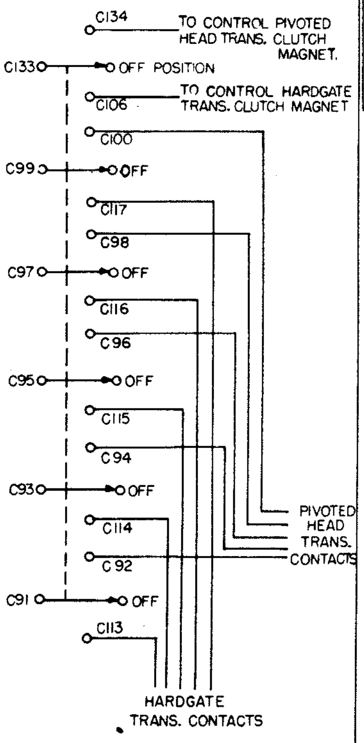
POWER SUPPLY MUST DELIVER 300MA € 48V DC OR 200MA € 115V DC.

20. USE APPROPRIATELY LABELED LXD.LAXD, LBXD OR LCXD CIRCUITRY AND MAKE CONN. AS SHOWN.

21. CUSTOMER MUST SUPPLY EXTERNAL SWITCHING AS FOLLOWS:
LXD - NONE
LAXD - BETWEEN C133 AND C134 TO CONTROL TRANS.CLUTCH MAGNET
LBXD - NONE

(CONTINUED)

LCXD AS PER DIAGRAM BELOW LEVER KEY SWITCH
6 NORMAL OPEN CONTACTS ON EACH SIDE

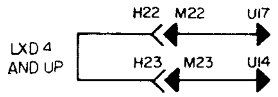


22. WHEN A SEPARATE TIGHT SWITCH IS USED IN LBXD THIS SWITCH BECOMES A MANUAL ON-OFF SWITCH ONLY.

23. WHEN LXD5 IS USED, REMOVE THE STRAP BETWEEN TERMINALS C135-C136. ADD TWO 176162 STRAPS, ONE BETWEEN TERMINALS C23-C135 AND ONE BETWEEN C24-C136.

24. TO CONTROL PIVOTED READER FROM ITS TAPE-OUT CONTACTS, REMOVE THE STRAP FROM TERMINALS 137 TO 141 AND PROVIDE SUIT-CIRCUITRY. THE TAPE OUT C NTACTS MAY NOT BE USED DIRECTLY SINCE THEY OPEN MOMENTARILY.

25. U14 IS CONNECTED TO U17 THROUGH THE TRANS.DIST.

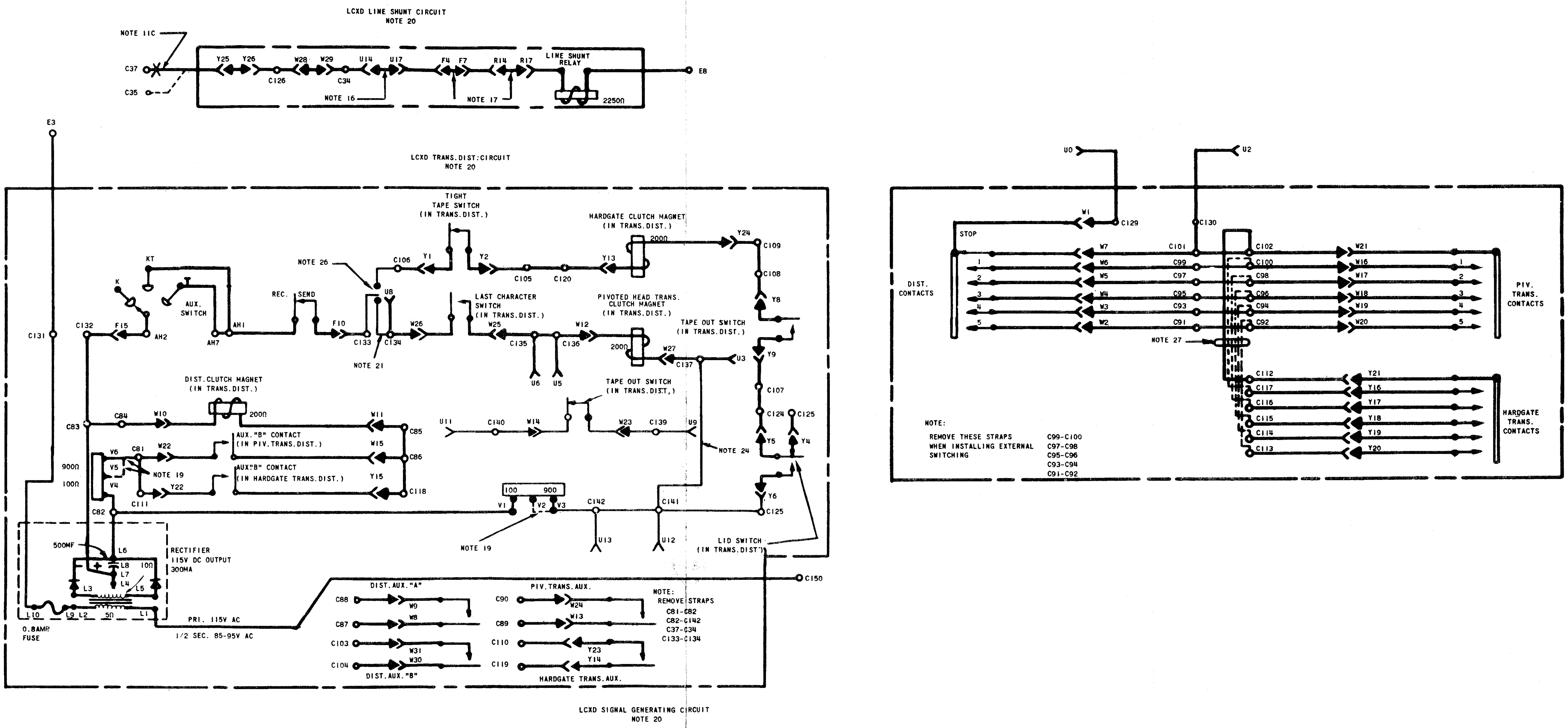


26. CUSTOMER MUST SUPPLY THIS SWITCH WHEN EXTERNAL SWITCHING IS NOT USED.

27. CUSTOMER MUST SUPPLY THESE STRAPS WHEN EXTERNAL SWITCHING IS NOT USED.

28. WHEN THE LXD11 IS USED DO NOT INSTALL STRAPS BETWEEN TERMINAL C141 AND C142, OR C131 AND C132. THE INTERNAL CLUTCH MAGNET INPUT SHOULD BE CONNECTED TO TERMINALS C132 AND C141. RESISTANCE PER COIL 210 OHMS.

Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 1 of 6)



NOTE:
REMOVE STRAPS
C81-C82
C82-C142
C37-C34
C133-C134

NOTE:
REMOVE THESE STRAPS WHEN INSTALLING EXTERNAL SWITCHING
C99-C100
C97-C98
C95-C96
C93-C94
C91-C92

Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 2 of 6)

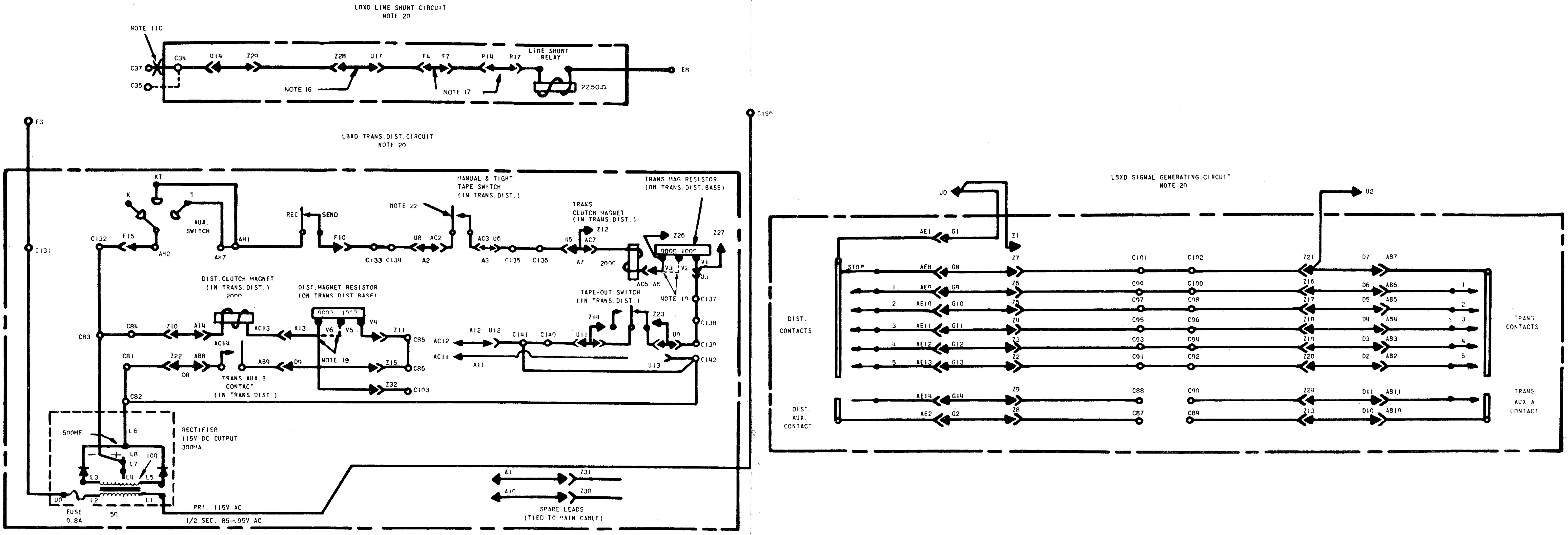


Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 3 of 6)

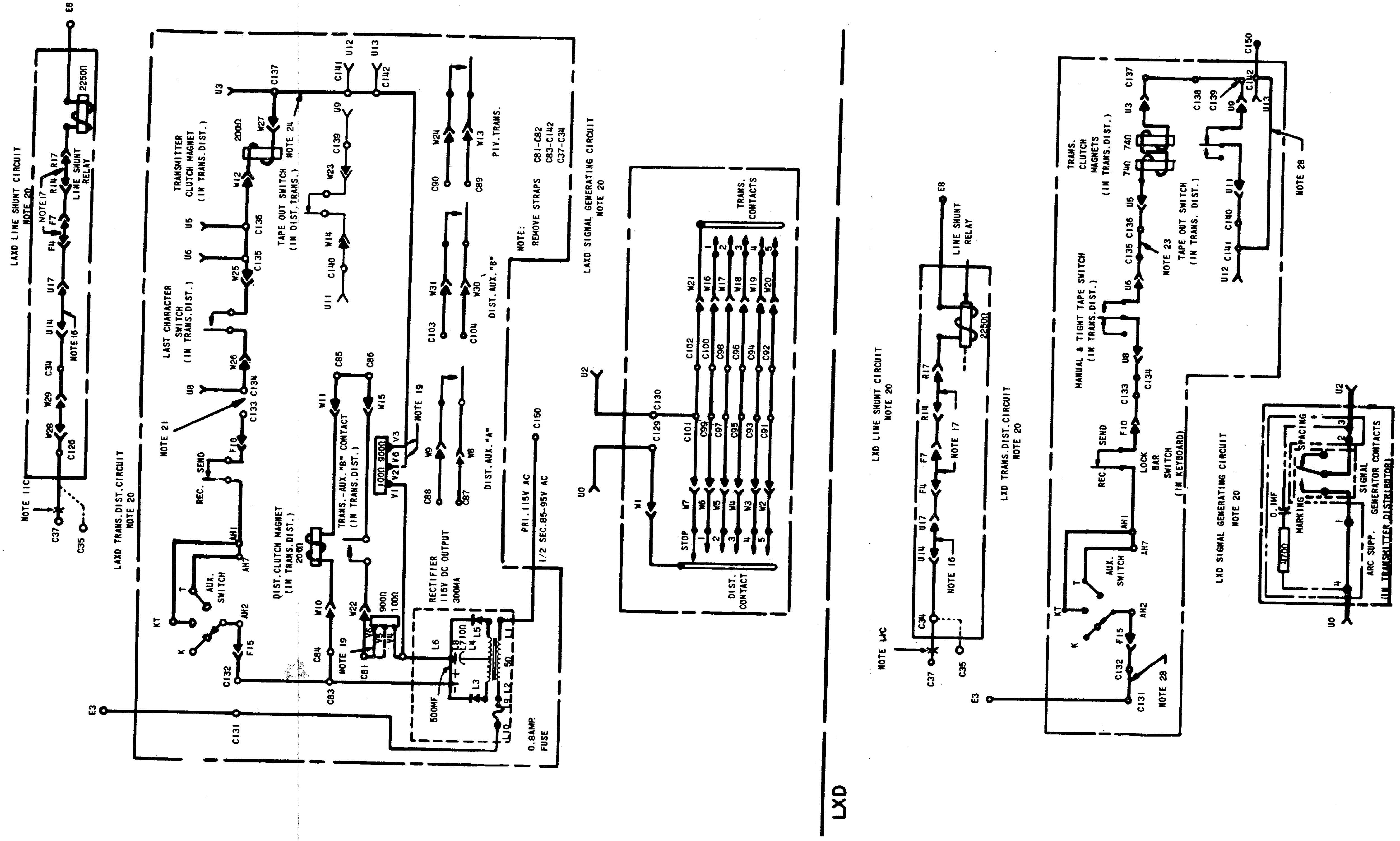


Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 4 of 6)

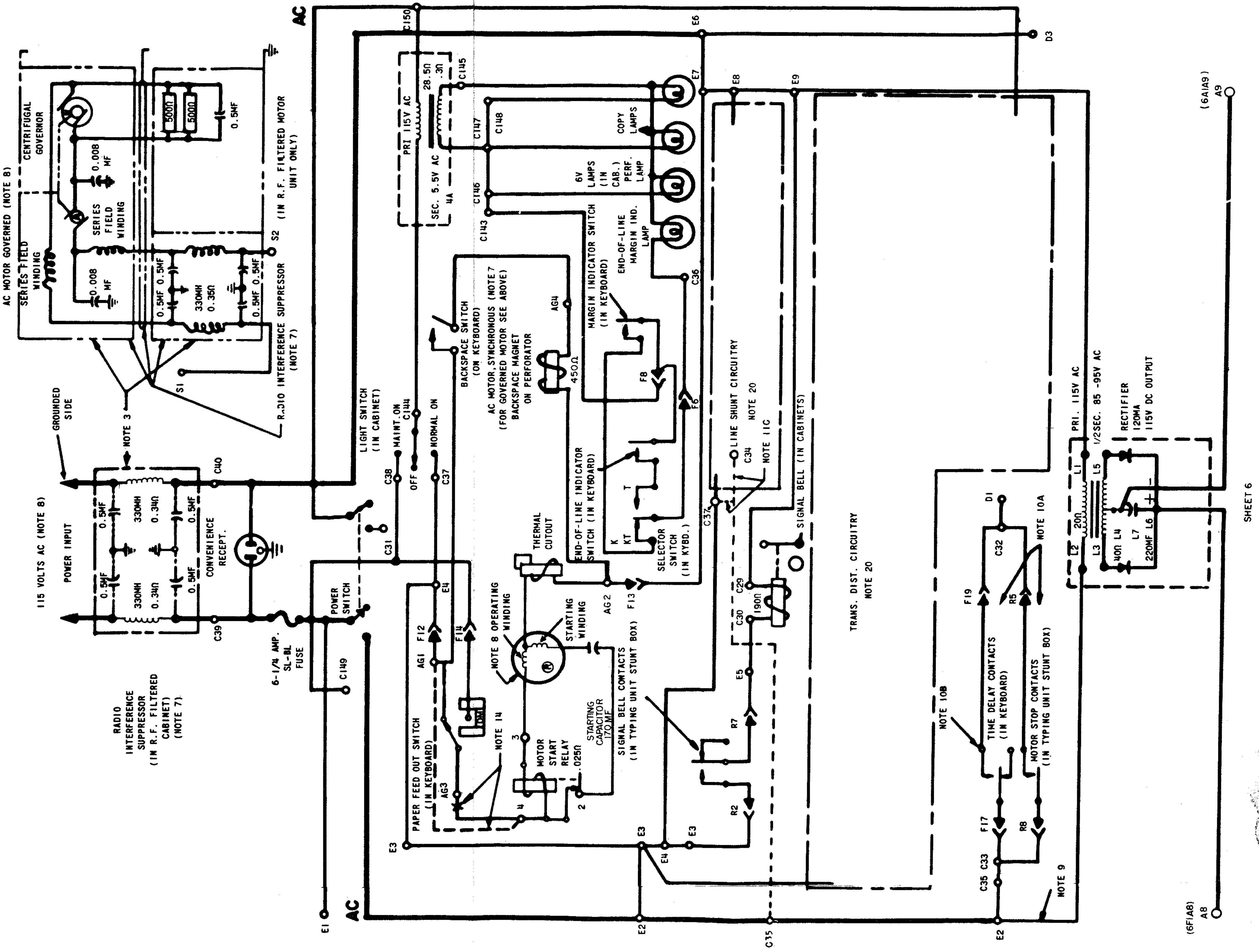


Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 5 of 6)

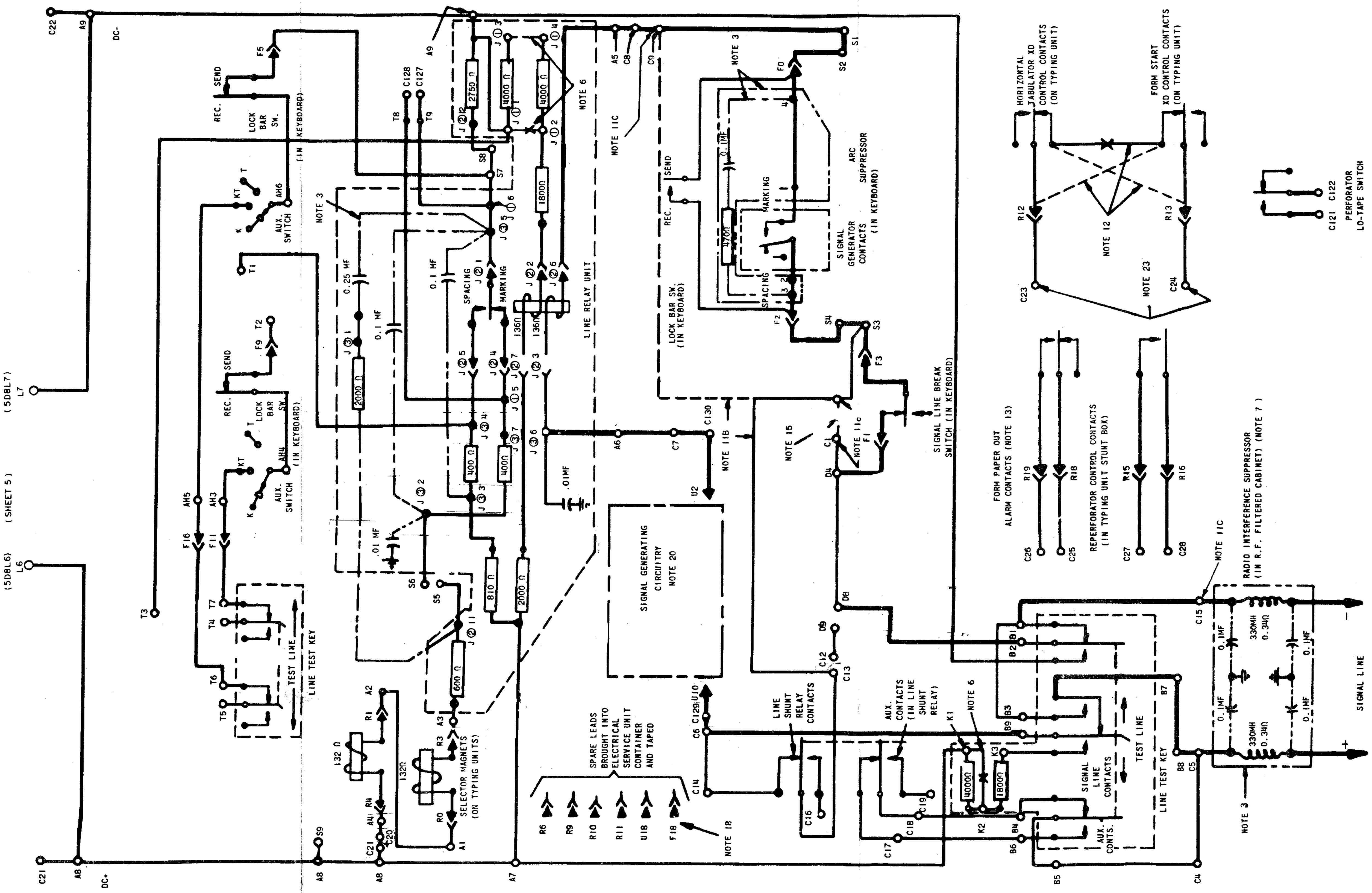


Figure 5-12. LESU 13 Schematic Wiring Diagram (Sheet 6 of 6)

<table>
<tr><th>NO</th><th>NOTES</th></tr>
<tr><td>1.</td><td>WIRING' LEGEND:
A-1-W-BL
DISTANT TERMINATING AREA
DISTANT TERMINAL DESIGNATION
WIRE COLOR CODE</td></tr>
<tr><td>2.</td><td>COLOR CODE
BK - BLACK
BR - BROWN
R - RED
O - ORANGE
Y - YELLOW
G - GREEN
BL - BLUE
P - PURPLE
W - WHITE
S - SLATE
W-BK - WHITE - BLACK
W-BR - WHITE - BROWN
W-R - WHITE - RED
W-O - WHITE - ORANGE
W-Y - WHITE - YELLOW
W-G - WHITE - GREEN
W-BL - WHITE - BLUE
W-S - WHITE - SLATE</td></tr>
<tr><td>3.</td><td>UNIT WIRED FOR 115 VOLTS 50 TO 60 CYCLE A.C. POWER INPUT ONLY.</td></tr>
<tr><td>4.</td><td>CONNECTOR VIEWED FROM SOLDER TERMINAL END.</td></tr>
<tr><td>5.</td><td>CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP OPERATION REMOVE AND ADD CONNECTIONS AS TABULATED BELOW.
<table>
<tr><th>SIGNAL LINE CURRENT</th><th>CONNECTION REMOVED</th><th>CONNECTION ADDED</th></tr>
<tr><td>.020 AMP.</td><td>J①1 - J①2,</td><td>J①3 - J①4</td></tr>
</table></td></tr>
<tr><td>6</td><td>RECTIFIER SHOWN CONTROLLED BY POWER SWITCH. FOR CONTINUOUS OPERATION REMOVE LEAD L-2-BK FROM TERMINAL E-2 AND CONNECT TO TERMINAL E-1.</td></tr>
<tr><td>7.</td><td>LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING LINE RELAY COIL.</td></tr>
<tr><td>8</td><td>SELECTOR MAGNETS ARE TO BE WIRED AS SHOWN FOR 30 MILLIAMPERE OPERATION WHEN THE LINE RELAY IS USED.</td></tr>
<tr><td>9.</td><td>ASSOC. CABLE NUMBERS
159939 CABLE ASSEM., LESU 12
153477 CABLE ASSEM., RECTIFIER
164030 CABLE ASSEM., LINE RELAY MTG. ASSEM.</td></tr>
<tr><td>10.</td><td>SELECTOR MAGNETS CAN BE CONNECTED DIRECTLY IN THE SIGNAL LINE CIRCUIT FOR NEUTRAL OPERATION AS FOLLOWS:
REMOVE LINE RELAY
20 MILLIAMPERE, 60 & 75 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A STRAP A5 TO A3.
B. MOVE BLUE LEAD FROM TERMINAL A8 TO TERMINAL A6
60 MILLIAMPERE, 60, 75 & 100 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A & B SAME AS ABOVE.
C CHANGE WIRING ON SELECTOR MAGNETS FOR 60 MILLIAMPERE OPERATION.</td></tr>
</table>

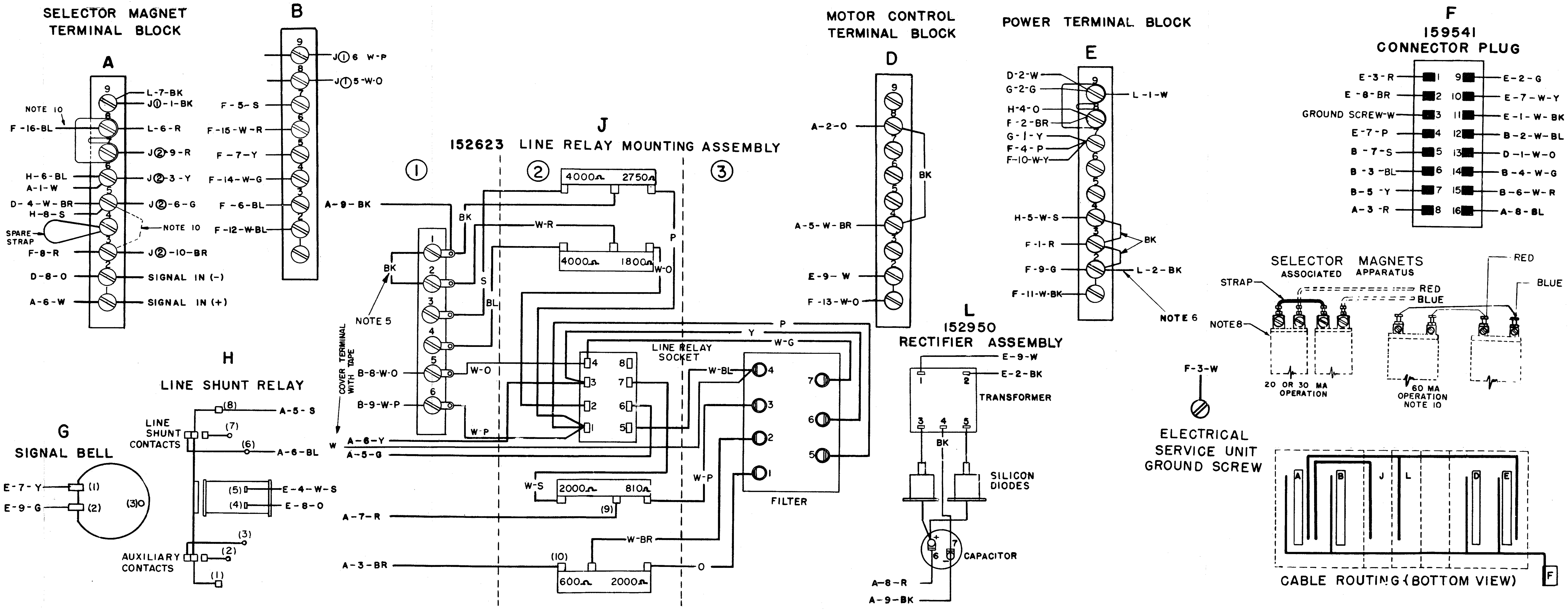


Figure 5-13. LESU 12 Electrical Service Assembly Wiring Diagram

NO.	NOTES
1.	FOR ACTUAL WIRING DIAGRAMS OF INDIVIDUAL UNITS SEE WD NUMBER — UNITS DIRECTLY OPERABLE WITH LESU 12 3344 WD — ELECTRICAL SERVICE UNIT LESU 12 2900 WD — MOTOR UNITS - LMU 3,4,6. 3319 WD — TYPING REPERFORATOR BASE LRB 3,11
2.	LEGEND O G 3-POINT CONNECTOR (ON BASE) O DG TERMINAL BLOCK (ON BASE) O DH TERMINAL BLOCK (ON BASE) ≪ F 16-POINT CONNECTOR O A TERMINAL BLOCK (IN LESU) O B TERMINAL BLOCK (IN LESU) O D TERMINAL BLOCK (IN LESU) O E TERMINAL BLOCK (IN LESU) O J ① TERMINAL STRIP ON LINE RELAY (IN LESU) ≪ J ② LINE RELAY CONNECTOR (IN LESU) O J ③ LINE RELAY FILTER (IN LESU)
3.	DOT-DASH (------ -) LINES INDICATE FILTERING, SHIELDING AND SUPPRESSION NETWORKS.
4.	ALL APPARATUS IS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITIONS.
5.	(A) RESISTANCE VALUES IN OHMS -(~) (B) INDUCTANCE VALUES IN MICROHENRIES (MH) (C) CAPACITANCE VALUES IN MICROFARADS (MFD)
6.	CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP LINE CURRENT, ADD DASH LINE (----) CONNECTION AND OMIT CONNECTION MARKED (-✕-) IN LINE RELAY.
7.	USE SYNCHRONOUS MOTOR ON REGULATED 60 ~ (±1%) A.C. POWER ONLY GOVERNED MOTORS AND OTHER POWER CIRCUITS OPERABLE ON 50 TO 60 ~ UNREGULATED A.C
8.	RECTIFIER SHOWN CONTROLLED BY POWER SWITCH A FOR CONTINOUS OPERATION MOVE PRIMARY (INPUT) LEAD FROM TERMINAL E2 TO TERMINAL E1
9.	LINE SHUNT RELAY SHOWN CONTROLLED BY POWER. SWITCH AND SHUNTING LINE RELAY COIL.
10.	FOR SPECIAL APPLICATIONS WHEN LESU 12 IS USED WITH LRB 20, THE FOLLOWING NOTE APPLIES ; SELECTOR MAGNETS CAN BE OPERATED DIRECTLY IN A NEUTRAL SIGNAL LINE AS FOLLOWS REMOVE LINE RELAY FOR 20 MILLIAMPERE, 60 AND 75 WPM OPERATION (OR ANY INTERMEDIATE SPEED.) 1 STRAP A5 TO A3 2. MOVE BLUE LEAD FROM TERMINAL A8 TO A6. FOR 60 MILLIAMPERE, 60,75 & 100 WPM OPERATION (OR ANY INTERMEDIATE SPEED.) 1 AND 2 SAME AS ABOVE 3. ADD DASHED (---) LEAD, OMIT ✕ LEAD ON SELECTOR MAGNETS (REFER TO 3342 WD)

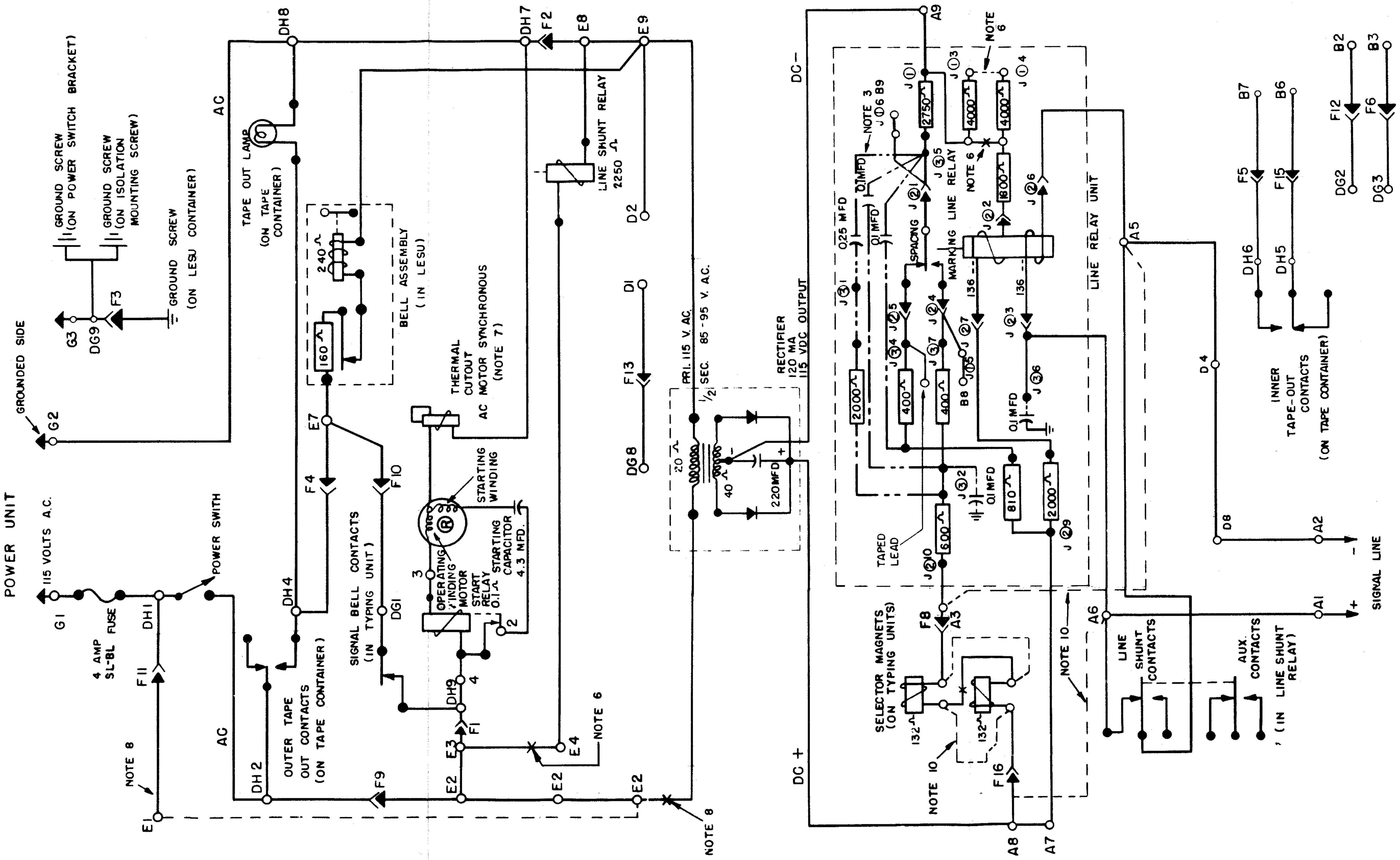


Figure 5-14. LRB 3 and 11 - LESU 12 Electrical Service Assembly Schematic Wiring Diagram

NOTES

LEGEND:

A-1-W-BL
DISTANT TERMINATING AREA
DISTANT TERMINAL DESIGNATION
WIRE COLOR CODE

ODE

BLACK	W-BK - WHITE - BLACK
BROWN	W-BR - WHITE - BROWN
RED	W-R - WHITE - RED
ORANGE	W-O - WHITE - ORANGE
YELLOW	W-Y - WHITE - YELLOW
GREEN	W-G - WHITE - GREEN
BLUE	W-BL - WHITE - BLUE
PURPLE	
WHITE	W-S - WHITE - SLATE
SLATE	

RED FOR 115 VOLTS 50 TO 60 CYCLE A C POWER ONLY.

TOR VIEWED FROM SOLDER TERMINAL END.

S SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE TION. FOR .020 AMP OPERATION REMOVE AND NNECTIONS AS TABULATED BELOW.

LINE CURRENT	CONNECTION REMOVED	CONNECTION ADDED
0 AMP.	J①1 - J①2	J①3 - J①4

R SHOWN CONTROLLED BY POWER SWITCH. NTINUOUS OPERATION REMOVE LEAD L-2-BK FROM AL E-2 AND CONNECT TO TERMINAL E-1.

HUNT RELAY SHOWN CONTROLLED BY POWER AND MOTOR CONTROL RELAY.

OR MAGNETS ARE TO BE WIRED AS SHOWN 0 MILLIAMPERE OPERATION WHEN THE RELAY IS USED

CABLE NUMBERS.

447 CABLE ASSEM., MOTOR CONTROL.
939 CABLE ASSEM., LESU 73
477 CABLE ASSEM., RECTIFIER
030 CABLE ASSEM., LINE RELAY MTG. ASSEM.

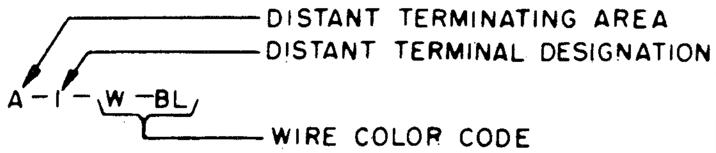
10. SELECTOR MAGNETS CAN BE CONNECTED DIRECTLY IN THE SIGNAL LINE CIRCUIT FOR NEUTRAL OPERATION AS FOLLOWS:

REMOVE LINE RELAY
20 MILLIAMPERE, 60 & 75 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A STRAP A5 TO A3
B MOVE BLUE LEAD FROM TERMINAL A8 TO TERMINAL A6.
60 MILLIAMPERE, 60, 75 & 100 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A & B SAME AS ABOVE
C CHANGE WIRING ON SELECTOR MAGNETS FOR 60 MILLIAMPERE OPERATION.

Figure 5-15. LESU 73 Electrical Service Unit Wiring Diagram

Figure 5-15 Part 1 of 2

NO	NOTES
1	WIRING LEGEND:



2 COLOR CODE

BK - BLACK	W-BK - WHITE-BLACK
BR - BROWN	W-BR - WHITE-BROWN
R - RED	W-R - WHITE-RED
O - ORANGE	W-O - WHITE-ORANGE
Y - YELLOW	W-Y - WHITE-YELLOW
G - GREEN	W-G - WHITE-GREEN
BL - BLUE	W-BL - WHITE-BLUE
P - PURPLE	
W - WHITE	W-S - WHITE-SLATE
S - SLATE	

3 UNIT WIRED FOR 115 VOLTS 50 TO 60 CYCLE A C POWER INPUT ONLY.

4 CONNECTOR VIEWED FROM SOLDER TERMINAL END.

5 CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP OPERATION REMOVE AND ADD CONNECTIONS AS TABULATED BELOW.

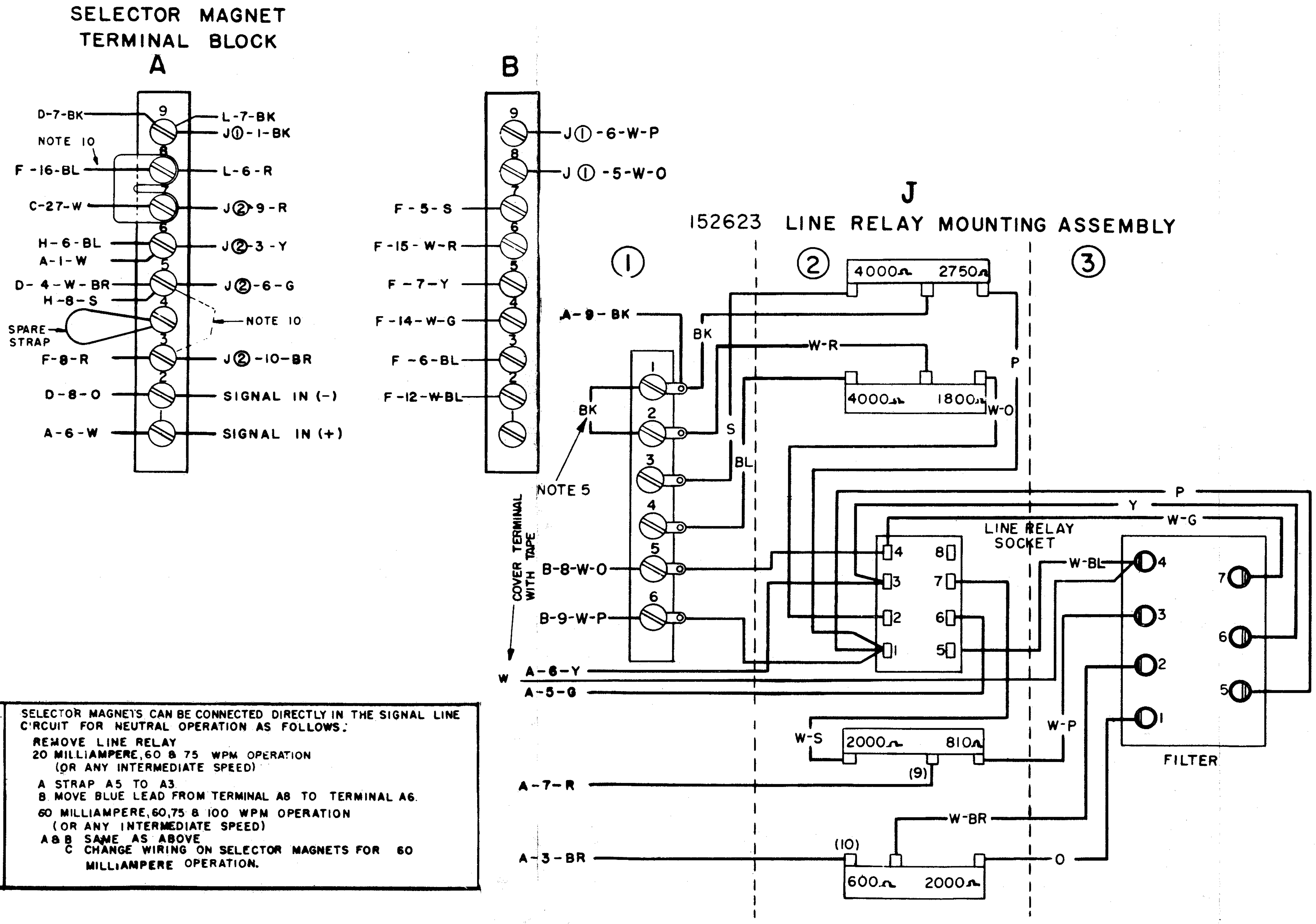
SIGNAL LINE CURRENT	CONNECTION REMOVED	CONNECTION ADDED
.020 AMP.	J①1 - J①2	J①3 - J①4

6 RECTIFIER SHOWN CONTROLLED BY POWER SWITCH. FOR CONTINUOUS OPERATION REMOVE LEAD L-2-BK FROM TERMINAL E-2 AND CONNECT TO TERMINAL E-1.

7 LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND MOTOR CONTROL RELAY.

8 SELECTOR MAGNETS ARE TO BE WIRED AS SHOWN FOR 30 MILLIAMPERE OPERATION WHEN THE LINE RELAY IS USED

9 ASSOC. CABLE NUMBERS.
176447 CABLE ASSEM., MOTOR CONTROL.
159939 CABLE ASSEM., LESU 73
153477 CABLE ASSEM., RECTIFIER
164030 CABLE ASSEM., LINE RELAY MTG. ASSEM.



10. SELECTOR MAGNETS CAN BE CONNECTED DIRECTLY IN THE SIGNAL LINE CIRCUIT FOR NEUTRAL OPERATION AS FOLLOWS:
REMOVE LINE RELAY
20 MILLIAMPERE, 60 & 75 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A STRAP A5 TO A3.
B MOVE BLUE LEAD FROM TERMINAL A8 TO TERMINAL A6.
60 MILLIAMPERE, 60, 75 & 100 WPM OPERATION
(OR ANY INTERMEDIATE SPEED)
A & B SAME AS ABOVE
C CHANGE WIRING ON SELECTOR MAGNETS FOR 60 MILLIAMPERE OPERATION.

Figure 5-15 part 2 of 2

NO	NOTES
1.	FOR ACTUAL WIRING DIAGRAMS OF INDIVIDUAL UNITS SEE WD NUMBER UNITS DIRECTLY OPERABLE WITH LESU 73 4385 WD ELECTRICAL SERVICE UNIT LESU 73 2900 WD MOTOR UNITS—LMU 3,4,6 3590 WD TYPING REPERFORATOR BASE LRB 5, LRB 6
2.	LEGEND ○ DG TERMINAL BLOCK (ON BASE) ○ DH TERMINAL BLOCK (ON BASE) << F 16-POINT CONNECTOR ○ A TERMINAL BLOCK (IN LESU) ○ B TERMINAL BLOCK (IN LESU) ○ D TERMINAL BLOCK (IN LESU) ○ E TERMINAL BLOCK (IN LESU) ○ J ① TERMINAL STRIP ON LINE RELAY (IN LESU) << J ② LINE RELAY CONNECTOR (IN LESU) ○ J ③ LINE RELAY FILTER (IN LESU) << AA 36 POINT CONNECTOR (ON BASE) C CABINET TERMINAL BLOCK ○ M MOTOR CONTROL RELAY (IN LESU)
3.	DOT-DASH(-·-·-·-)LINES INDICATE FILTERING SHIELDING AND SUPPRESSION NETWORKS.
4.	ALL APPARATUS IS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITIONS.
5.	(a) RESISTANCE VALUES IN OHMS-(Ω) (b) INDUCTANCE VALUES IN MICROHENRIES (MH) (c) CAPACITANCE VALUES IN MICROFARADS (MFD)
6.	CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP LINE CURRENT, ADD DASH LINE (----) CONNECTION AND OMIT CONNECTION MARKED (—✕—) IN LINE RELAY.
7.	USE SYNCHRONOUS MOTOR ON REGULATED 60 ~ (± 1%) A.C. POWER ONLY. GOVERNED MOTORS AND OTHER POWER CIRCUITS OPERABLE ON 50 TO 60 ~ UNREGULATED A.C.
8.	LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND MOTOR CONTROL RELAY. FOR CONTROL OF LINE SHUNT BY POWER SWITCH ONLY REMOVE CONNECTION MARKED (—✕—) AND ADD DASH LINE (---) CONNECTION.
9.	TAPE FEED OUT AND/OR BACKSPACE MAGNETS ARE AVAILABLE ONLY WITH SPECIFIC CODED LPR UNITS.

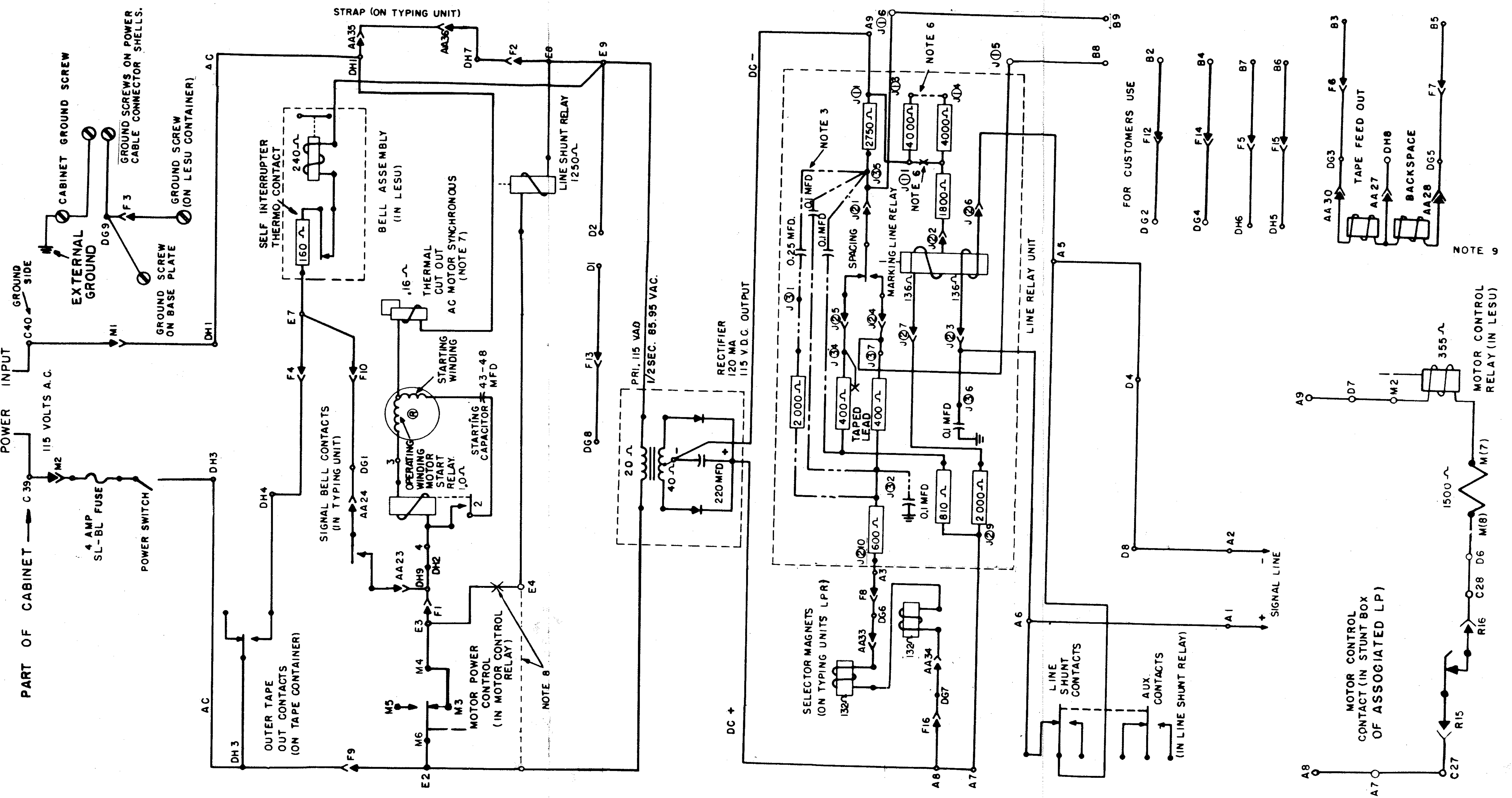


Figure 5-16. LESU 73 Electrical Service Unit Schematic Diagram

NOTES

1. WIRING LEGEND:

2. COLOR CODE
   - BK - BLACK
   - BR - BROWN
   - R - RED
   - O - ORANGE
   - Y - YELLOW
   - G - GREEN
   - BL - BLUE
   - P - PURPLE
   - W - WHITE
   - S - SLATE

3 UNIT WIRED FOR 115 VOLTS 50 TO 60 CYCLE A.C. POWER INPUT ONLY.

4. CONNECTOR VIEWED FROM SOLDER TERMINAL END.

5. CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP NEUTRAL OPERATION REMOVE CONNECTIONS AS TABULATED BELOW.

SIGNAL LINE CURRENT	CONNECTION REMOVED	
020 AMP.	J1 TO J2	

6. LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING SELECTOR MAGNET DRIVER.

7. SELECTOR MAGNETS ARE TO BE WIRED IN PARALLEL FOR 60 MILLIAMPERE OPERATION

8. ASSOC. CABLE NUMBERS

   159939 CABLE ASSEM., LESU

9. SELECTORS MAGNETS CAN BE CONNECTED DIRECTLY IN THE SIGNAL LINE CIRCUIT FOR NEUTRAL OPERATION AS FOLLOWS: DISCONNECT AND TAPE ALL SELECTOR MAGNET DRIVER LEADS SHOWN (—✕—). 20 MILLIAMPERE, 60 & 75 WPM OPERATION (OR ANY INTERMEDIATE SPEED).
   - A STRAP A5 TO A3
   - B. MOVE BLUE LEAD FROM TERMINAL A8 TO A6.

   60 MILLIAMPERE, 60, 75 & 100 WPM OPERATION (OR ANY INTERMEDIATE SPEED)
   - A. STRAP A5 TO A3
   - B. MOVE BLUE LEAD FROM TERMINAL A8 TO A6
   - C. CHANGE WIRING ON SELECTOR MAGNETS FOR 60 MILLIAMPERE OPERATION.

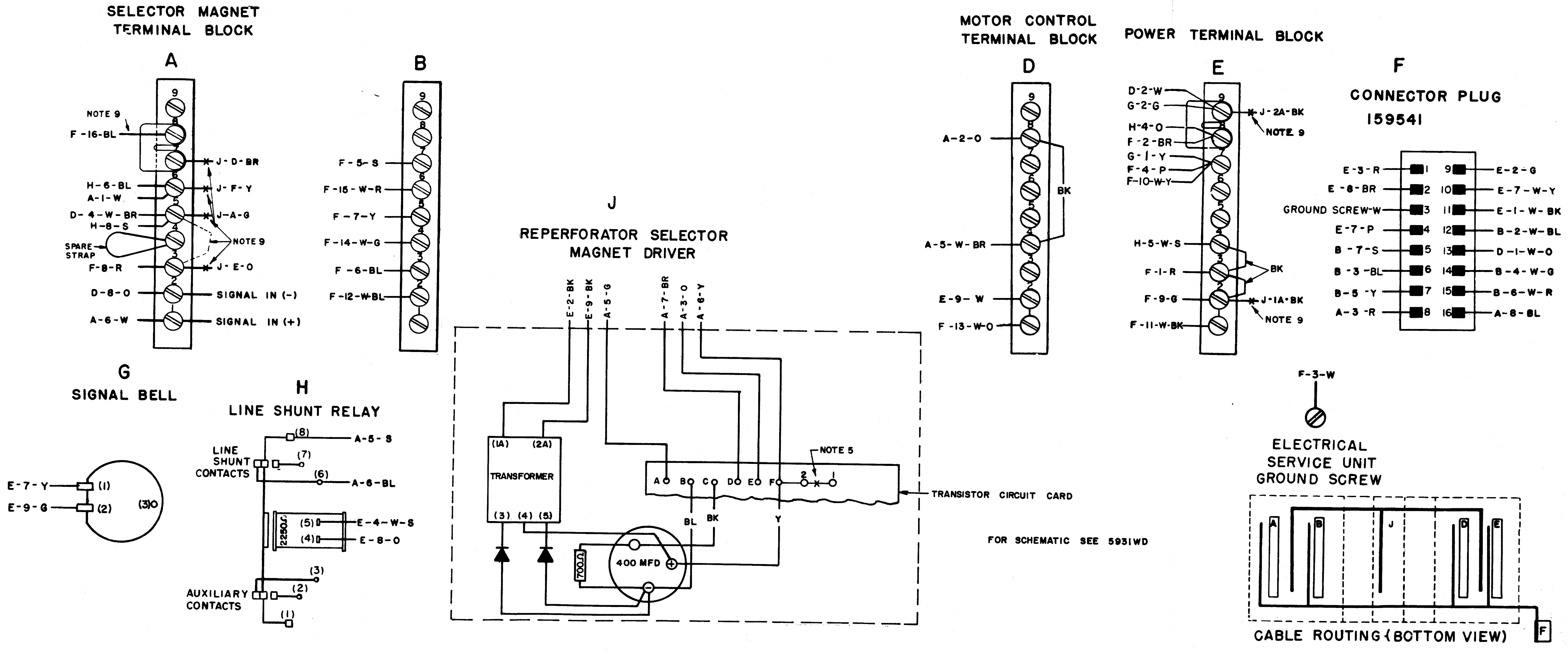


Figure 5-17. LESU 96 Electrical Service Unit Wiring Diagram

NO.	NOTES
1.	WIRING DIAGRAMS OF INDIVIDUAL UNITS UNITS DIRECTLY OPERABLE WITH LESU96 4445WD SELECTOR MAGNET DRIVER- 177010 5930 WD ELECTRICAL SERVICE UNIT LESU96 2900 WD MOTOR UNITS - LMU 3,4,6. 3736 WD TYPING REPERFORATOR BASE LRB 21,30 3628 WD TYPING AND NON-TYPING REPERFORATOR
2.	LEGEND C 36 POINT CONNECTOR G 3-POINT CONNECTOR (ON BASE) O DG TERMINAL BLOCK (ON BASE) O DH TERMINAL BLOCK (ON BASE) F 16-POINT CONNECTOR O A TERMINAL BLOCK (IN LESU) O B TERMINAL BLOCK (IN LESU) O D TERMINAL BLOCK (IN LESU) O E TERMINAL BLOCK (IN LESU) —+— N.C. CONTACT —✕— N.O. CONTACT
3.	DOT-DASH (-·——-) LINES INDICATE FILTERING, SHIELDING AND SUPPRESSION NETWORKS.
4.	ALL APPARATUS IS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITIONS.
5.	(A) RESISTANCE VALUES IN OHMS -(Ω) (B) INDUCTANCE VALUES IN MICROHENRIES (MH) (C) CAPACITANCE VALUES IN MICROFARADS (MFD)
6.	CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE OPERATION. FOR .020 AMP LINE CURRENT, OMIT CONNECTION MARKED (-●—) IN SELECTOR MAGNET DRIVER.
7.	USE SYNCHRONOUS MOTOR ON REGULATED 60 ∿ (±1%) A.C. POWER ONLY. GOVERNED MOTORS AND OTHER POWER CIRCUITS OPERABLE ON 50 TO 60 ∿ UNREGULATED A.C.
8.	LINE SHUNT RELAY WHICH SHUNTS SELECTOR MAGNET DRIVER INPUT IS SHOWN CONTROLLED BY POWER SWITCH.
9.	FOR SPECIAL APPLICATIONS SELECTOR MAGNETS CAN BE OPERATED DIRECTLY IN A NEUTRAL SIGNAL LINE AS FOLLOWS: COMPLETELY DISCONNECT SELECTOR MAGNET DRIVER, FOR 20 MILLIAMPERE, 60 AND 75 WPM OPERATION (OR ANY INTERMEDIATE SPEED.) 1. STRAP A5 TO A3 2. MOVE LEAD FROM TERMINAL A8 TO A6 3. ADD DASHED (---) LEAD, OMIT ⊗— LEADS ON SELECTOR MAGNETS FOR 60 MILLIAMPERE, 60, 75 & 100 WPM OPERATION (OR ANY INTERMEDIATE SPEED.) 1. STRAP A5 TO A3 2. MOVE LEAD FROM TERMINAL A8 TO A6
10.	FOR OPERATION WITH SELECTOR MAGNET DRIVER, SELECTOR MAGNETS MUST BE CONNECTED IN PARALLEL.

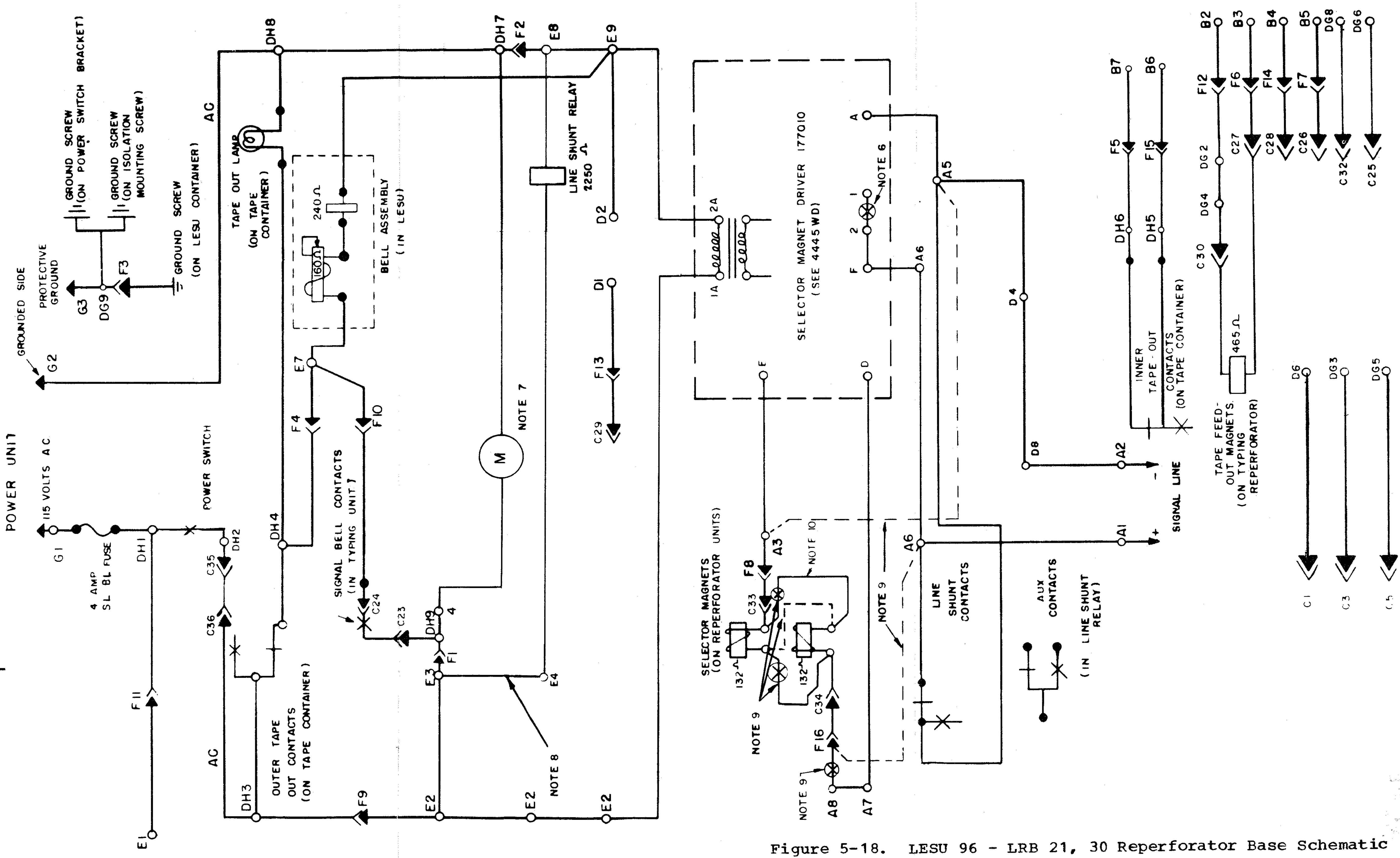


Figure 5-18. LESU 96 - LRB 21, 30 Reperforator Base Schematic Wiring Diagram

<table>
<tr><th>NO.</th><th>NOTES</th></tr>
<tr><td>1.</td><td>WIRING LEGEND:
DISTANT TERMINATING AREA
DISTANT TERMINATING DESIGNATION
A-1-W-BL
WIRE COLOR CODE</td></tr>
<tr><td>2.</td><td>COLOR CODE:
BK - BLACK
BL - BLUE
Y - YELLOW
W - WHITE
O - ORANGE
BR - BROWN
R - RED
P - PURPLE
S - SLATE
G - GREEN</td></tr>
<tr><td>3.</td><td>UNIT WIRED FOR 117 VOLTS. 50 TO 60 CYCLE AC POWER INPUT ONLY.</td></tr>
<tr><td>4.</td><td>CONNECTORS VIEWED FROM SOLDERED TERMINAL ENDS.</td></tr>
<tr><td>5.</td><td>CIRCUITS SHOWN FOR .060 AMP.NEUTRAL SIGNAL LINE OPERATION.FOR .020 AMP. OPERATION REMOVE AND ADD CONNECTIONS AS TABULATED BELOW.
<table>
<tr><th>SIG. LINE CURRENT</th><th>CONNECTION REMOVED</th><th>CONNECTIONS ADDED</th></tr>
<tr><td>.020 AMP.</td><td>K1-K2</td><td></td></tr>
</table>
FOR .020 AMP. OPERATION OF SELECTOR MAGNET DRIVER, REFER TO 4445WD.</td></tr>
<tr><td>6.</td><td>RECTIFIER SHOWN CONTROLLED BY POWER SWITCH.
FOR CONTINUOUS OPERATION, REMOVE LEADL-10-BKFROM TERMINAL E-2 AND CONNECT TO TERMINAL E-1.</td></tr>
<tr><td>7.</td><td>LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING LINE RELAY COIL AND KEYBOARD AND TRANSMITTER DISTRIBUTOR SIGNAL GENERATOR.</td></tr>
<tr><td>8.</td><td>THE SPARE LEADS FROM THE TRANSMITTER DISTRIBUTOR UNIT CONNECTOR PLUG ARE TERMINATED IN THE RIGHT END OF THE ELECTRICAL SERVICE UNIT. THE SPARE LEADS FROM THE TYPING UNIT PLUG ARE TERMINATED IN THE LEFT END OF THE ELECTRICAL SERVICE UNIT.</td></tr>
<tr><td>9.</td><td>ADD STRAP BETWEEN C10 & C11 IF SIGNAL LINE BREAK SWITCH IS NOT USED.</td></tr>
<tr><td>10.</td><td>SPARE LEAD FROM U18 IS RESERVED FOR POLAR OPERATION OF KEYBOARD AND TRANSMITTER DISTRIBUTOR SIGNAL GENERATORS.</td></tr>
<tr><td>11.</td><td>TERMINALS C143 TO C148 RESERVED FOR CABINET LAMP OPERATION.</td></tr>
<tr><td>12.</td><td>TERMINALS C1 TO C3 RESERVED FOR CUSTOMER USE.</td></tr>
<tr><td>13.</td><td>TERMINALS C121 - C122 RESERVED FOR PERFORATOR LO-TAPE SWITCH.</td></tr>
<tr><td>14.</td><td>CONTACTS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITION.</td></tr>
<tr><td>15.</td><td>SYNC.PULSE CURRENT SHOWN SUPPLIED FROM SET RECTIFIER,TO PULSE SET EXTERNALLY REMOVE STRAPS AND CONNECT EXTERNAL SOURCE IN ACCORDANCE WITH INSTALLATION REQUIREMENTS:
C124 - C131 C21 - C131
C125 - C142 C22 - C142</td></tr>
<tr><td>16.</td><td>FOR SCHEMATIC WIRING DIAGRAM SEE 7016WD.</td></tr>
</table>

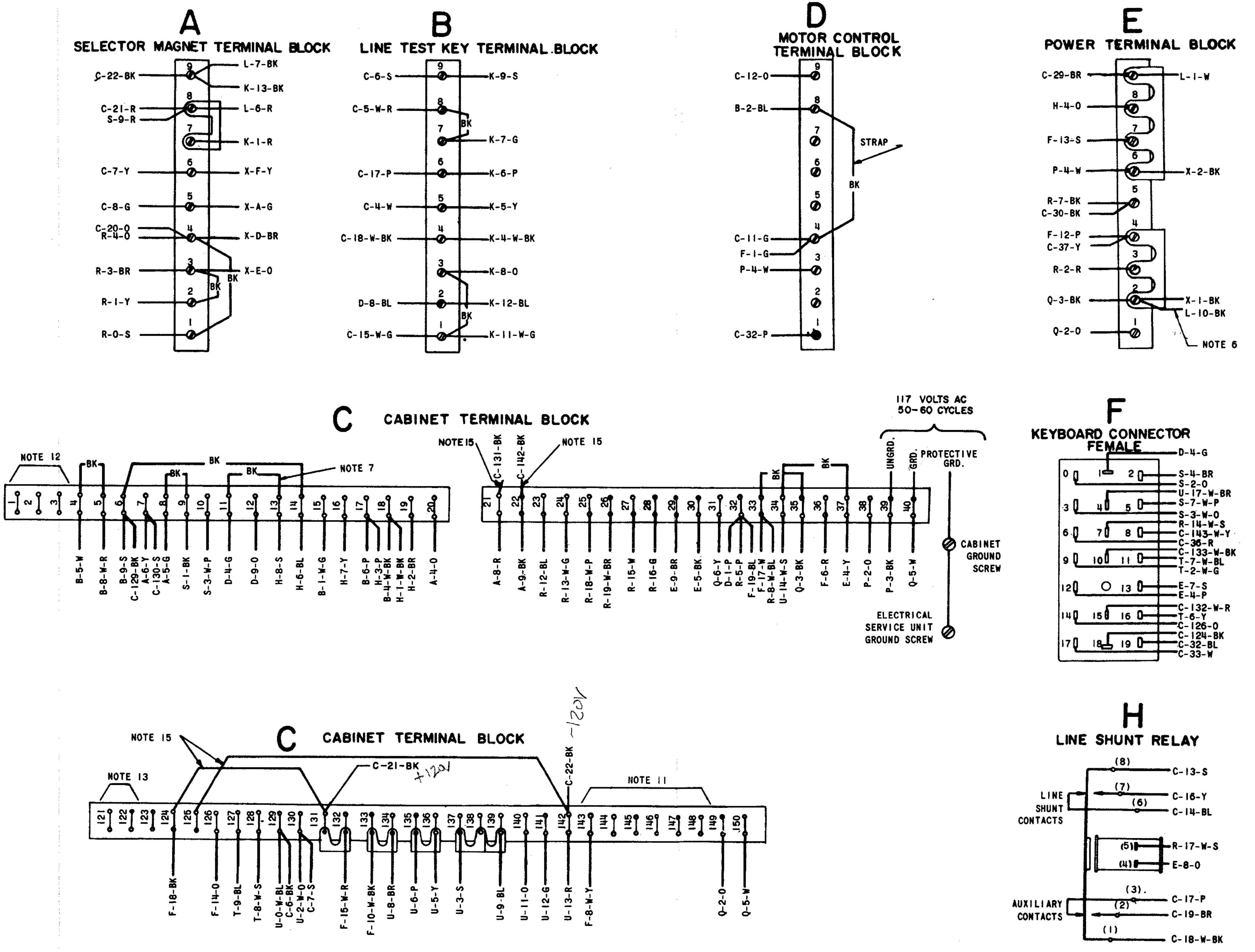


Figure 5-19. LESU III Electrical Service Unit Wiring Diagram (Sheet 1 of 2)

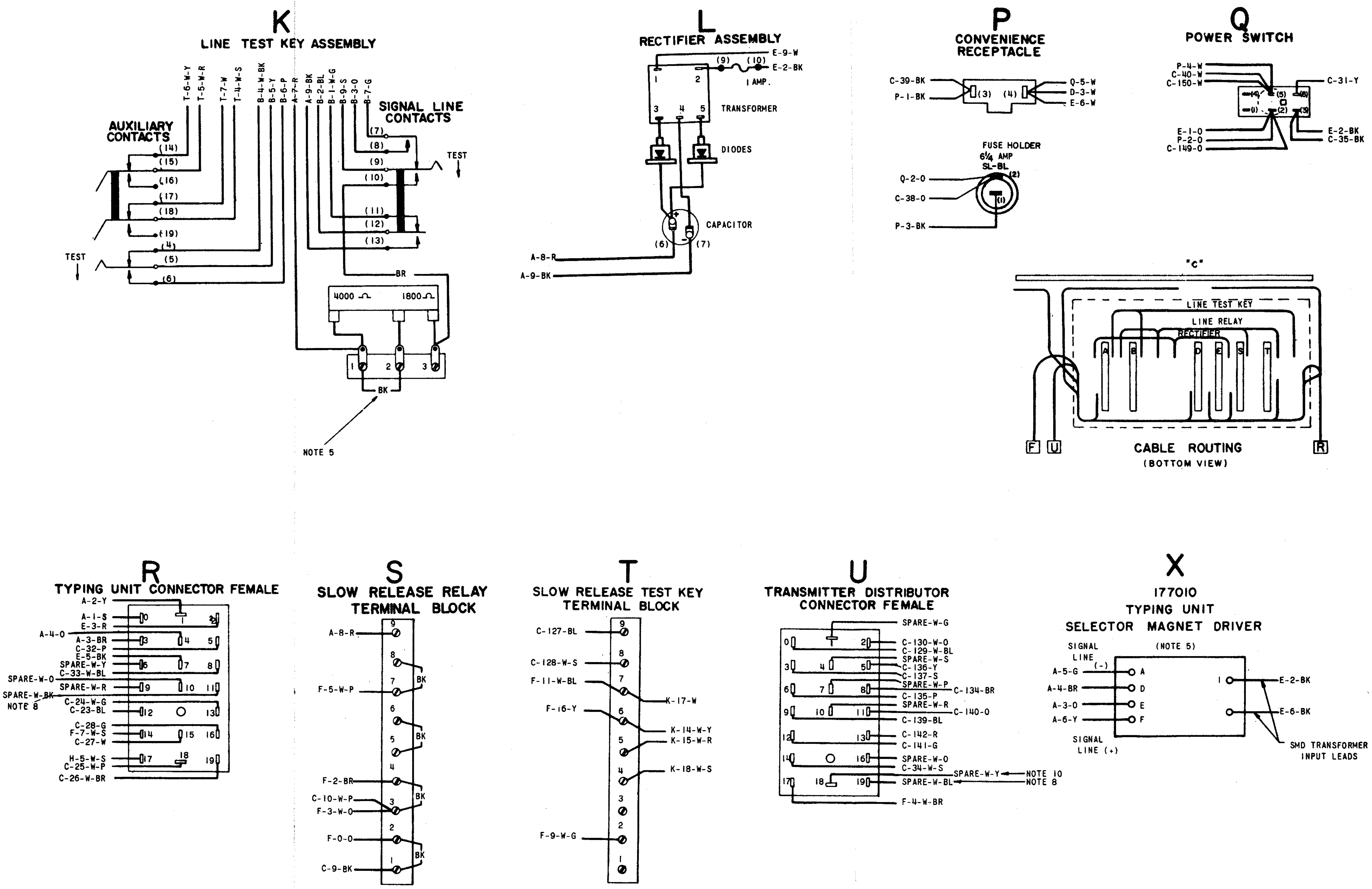


Figure 5-19. LESU III Electrical Service Unit Wiring Diagram (Sheet 2 of 2)

NOTES

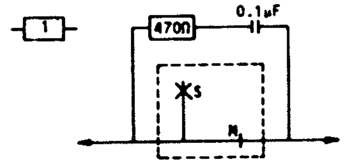
1. FOR ACTUAL WIRING DIAGRAMS OF INDIVIDUAL UNITS SEE:

WD.NO.	UNIT
3264WD	CABINET-LAAC200
7015WD	ELECT. SERVICE UNIT-LESU111
6456WD	KEYBOARD-LAK42
2900WD	MOTOR UNIT-LMU12
3214WD	PAGE TYPING UNIT-LP14
3300WD	TRANS. DIST.-LXD3

2. LEGEND:

- ○ A SEL. MAG. TERM. BLOCK (IN LESU)
- ○ B LINE TEST KEY TERM.BLOCK(IN LESU)
- ○ C CABINET TERMINAL BLOCK
- ○ D MOTOR CONTROL TERM.BLOCK(LESU)
- ○ E POWER TERM. BLOCK (IN LESU)
- ≪ F KEYBOARD CONNECTOR
- ● H LINE SHUNT RELAY (IN LESU)
- ○ X SELECTOR MAGNET DRIVER

- ○ K LINE TEST KEY TERM.STRIP(IN LESU)
- ● K LINE TEST KEY CONTACTS (IN LESU)
- ● L RECTIFIER (IN LESU)
- ● P CONVEN. RECEPT.& FUSE (IN LESU)
- ● Q POWER SWITCH (IN LESU)
- ≪ R TYPING UNIT CONNECTOR
- ○ S SLOW REL.RLY.TERM.BLOCK(IN LESU)
- ○ T TEST SWITCH TERM.BLOCK (IN LESU)
- ≪ U TRANS.DIST.CONNECTOR
- ● AB LOCK BAR SWITCH (IN LAK)
- ● AC AUXILIARY SWITCH (IN LAK)
- ○ AF SELECTOR SWITCH (IN LAK)
- ○ AH KEYBOARD TERM.BLOCK (IN LAK)
- ○ AJ E.O.L. INDICATOR SWITCH (IN LAK)
- ○ AL MARGIN INDICATOR SWITCH (IN LAK)
- ● AP SYNC. PULSE MAGNET (IN LAK)
- ● AQ CODE BAR CONTACT (IN LAK)
- —(M)— INDICATES MOTOR UNIT. REFER TO 2900WD.
- —✕— INDICATES N.O. CONTACT
- —+— INDICATES N.C. CONTACT
- —▭— / - - - - INDICATES FILTERING, SHIELDING AND SUPPRESSION NETWORKS



3. ALL APPARATUS SHOWN IN UNOPERATED OR DE-ENERGIZED POSITIONS.(TAPE IN UNIT)
4. A. RESISTANCE IN OHMS (Ω)
   B. INDUCTANCE IN MICROHENRIES (μH)
   C. CAPACITANCE IN MICROFARADS (μF)
5. CIRCUITS SHOWN FOR .060 AMP. NEUTRAL SIGNAL LINE. FOR .020 AMP.LINE CURRENT OMIT CONNECTION K1-K2

   REFER TO 4445WD FOR SELECTOR MAGNET DRIVER WIRING.
6. RECTIFIER SHOWN CONTROLLED BY POWER SWITCH. FOR CONTINUOUS OPERATION, MOVE L-10 FROM E-2 TO E-1.
7. LINE SHUNT RELAY SHOWN CONTROLLED BY POWER SWITCH AND SHUNTING TRANSMITTER DISTRIBUTOR AND KEYBOARD SIGNAL GENERATORS AND SELECTOR MAGNET DRIVER.

NOTES (CONT.)

8. SYNC. PULSE CURRENT SHOWN SUPPLIED FROM SET RECTIFIER. TO PULSE SET EXTERNALLY, REMOVE STRAPS AS FOLLOWS AND CONNECT EXTERNAL SOURCE IN ACCORDANCE WITH INSTALLATION REQUIREMENTS:

   C142 - C125 C21 - C131
   C131 - C124 C22 - C142
9. USE POWER AND SIGNAL LINE SUPPRESSORS AND SYNCHRONOUS OR GOVERNED FILTERED MOTOR UNIT FOR INSTALLATION REQUIRING MINIMUM R.F. INTERFERENCE. FOR OTHER INSTALLATIONS, OMIT SUPPRESSORS AND CONNECT INPUTS AND GOVERNED MOTOR DIRECTLY TO TERMINALS SHOWN.
10. (X) INDICATES SPARE LEADS WHICH ARE TAPED AND TIED BACK TO CABLE.
11. FOR SCHEMATIC OF AUXILIARY REPERFORATOR AND ASSOCIATED APPARATUS, SEE 3343WD.

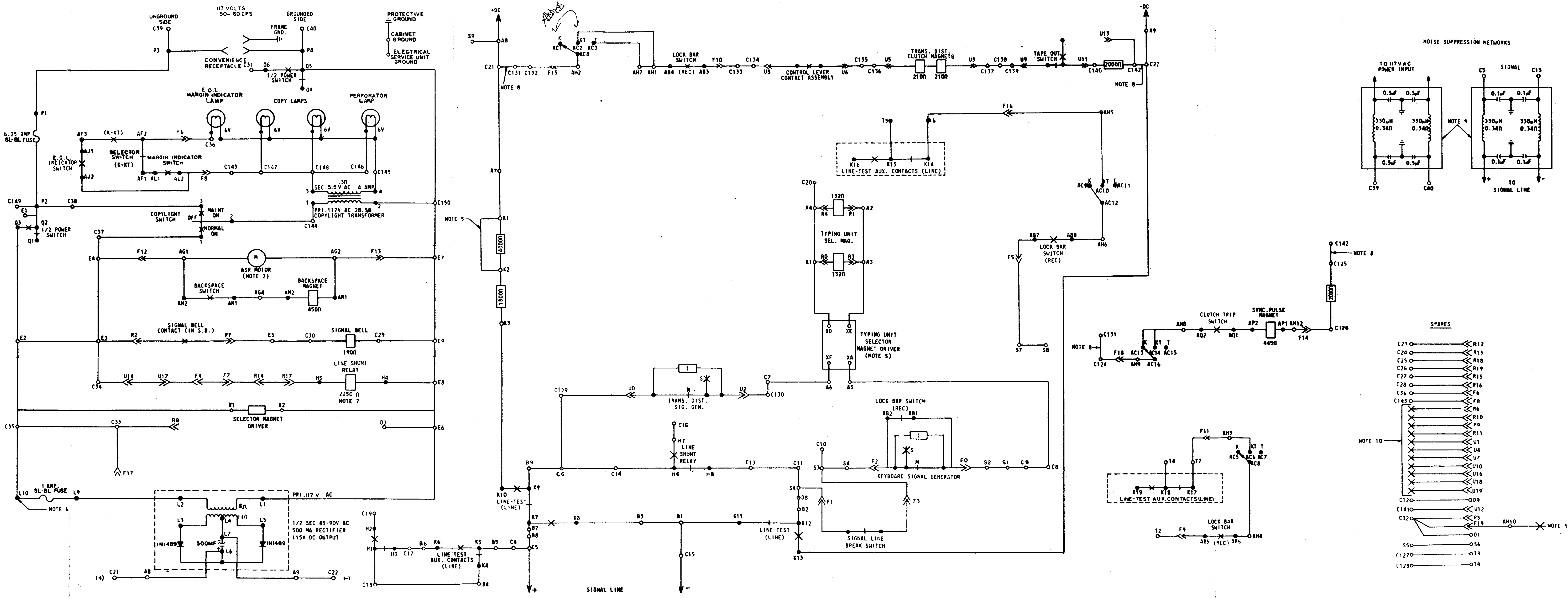
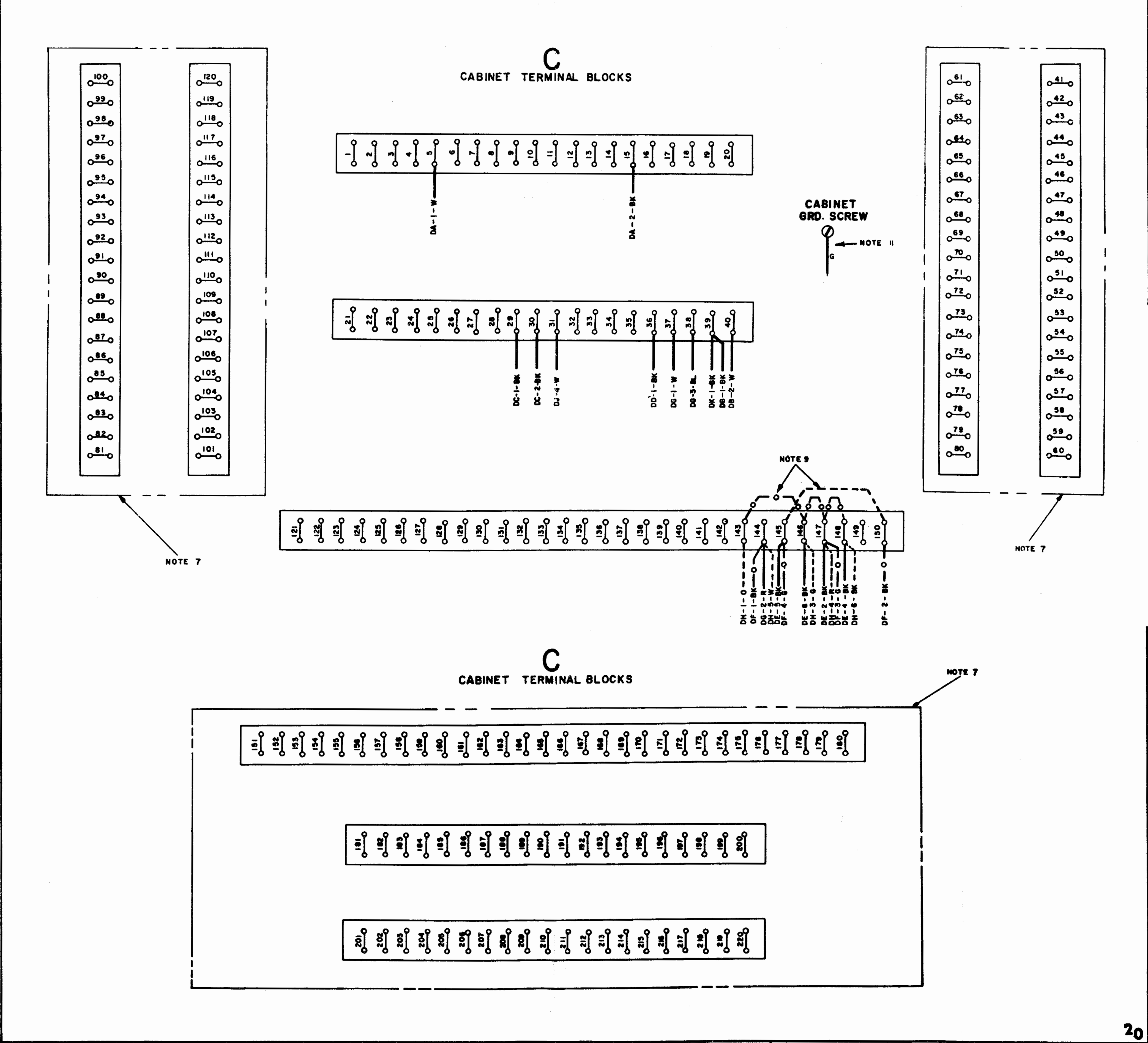


Figure 5-20. LESU III ASR Schematic Wiring Diagram

NO	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A 1-W WIRE COLOR CODE
2.	COLOR CODE: BK-BLACK BR-BROWN BL-BLUE R-RED P-PURPLE G-GREEN S-SLATE Y-YELLOW W-WHITE O-ORANGE
3.	-X- DENOTES SPLICED AND TAPED WIRES.
4.	USE POWER AND SIGNAL LINE INTERFERENCE SUPPRESSORS FOR INSTALLATIONS REQUIRING MINIMUM R.F. INTERFERENCE. FOR OTHER INSTALLATIONS, OMIT SUPPRESSORS AND CONNECT POSITIVE AND NEGATIVE LEADS OF THE INCOMING SIGNAL LINE TO CABINET TERMINALS C5 & C15 RESPECTIVELY. CONNECT THE INCOMING GROUNDED AND UNGROUNDED POWER LEADS TO CABINET TERMINALS C40 & C39 RESPECTIVELY.
5.	USE PROPER COPYLIGHT SYSTEM FOR THE TYPE OF CURRENT USED.
6.	CABINET RECEPTACLES REQUIRED WHEN TAPE WINDER OR TAPE STUFFER IS USED.
7.	OPTIONAL FEATURES, REFER TO APPLICABLE WD.
8.	CABINET POWER MUST BE 115V, 50-60~AC WHEN THIS ACCESSORY IS USED.
9.	------ FOR DC APPLICATION — — FOR AC APPLICATION ——— NORMAL WIRING
10.	ASSOCIATED CABLES: 158267 TRANSFORMER AND CABLE 159329 TAPE WINDER CABLE 154440 CABINET LIGHTS, SWITCH CABLE 159330 RESISTOR PACK CABLE
11.	GROUND WIRE MAY BE ATTACHED TO THE RIGHT 154412 TERMINAL BLOCK ASSEMBLY MOUNTING STUD BY MEANS OF THE TERMINAL BLOCK COVER MOUNTING SCREW AND LOCK WASHER.



3264 WD

REVISIONS		
ISSUE	DATE	AUTH. NO.
A	7-9-57	TP-2027
B	9-16-57	TP-2399
C	2-24-58	28-8517
~~D~~ 5	5-27-58	28-9036
~~E~~ 6	9-17-58	28-9902
~~F~~ 7	10-7-58	28-9996
8	11-28-58	28-10256
9	4-9-59	28-10928
10	5-22-59	28-11108
11	8-4-59	28-11508
12	9-22-61	71027
13	2-14-62	72426
14	3-23-62	72707
15	4-11-62	73068
16	12-10-62	75290
17	2-19-63	75725
18	3-14-63	75290-1
19	10-3-63	77579
20	10-17-63	78376

SHEET 1 OF 2

ACTUAL
WIRING DIAGRAM FOR
MODEL 28 AUTOMATIC
SEND-RECEIVE
CABINETS
LAAC200, 201, 202,
205, 209, 210, 213,
214, 219, 235, 236
AC-DC APPLICATION
225, 237

APPROVALS	
D AND R	E OF M
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E-NUMBER

PROD. NO. 3264WD

DATE 4-16-57

P.D. FILE NO. 24-A65AA

DRAWN R.W.D.	CHKD. R.D.
ENGD. J.M.	APPD. J.A.

TELETYPE
CORPORATION

20

3264 WD

Figure 5-21 sheet 1 of 2

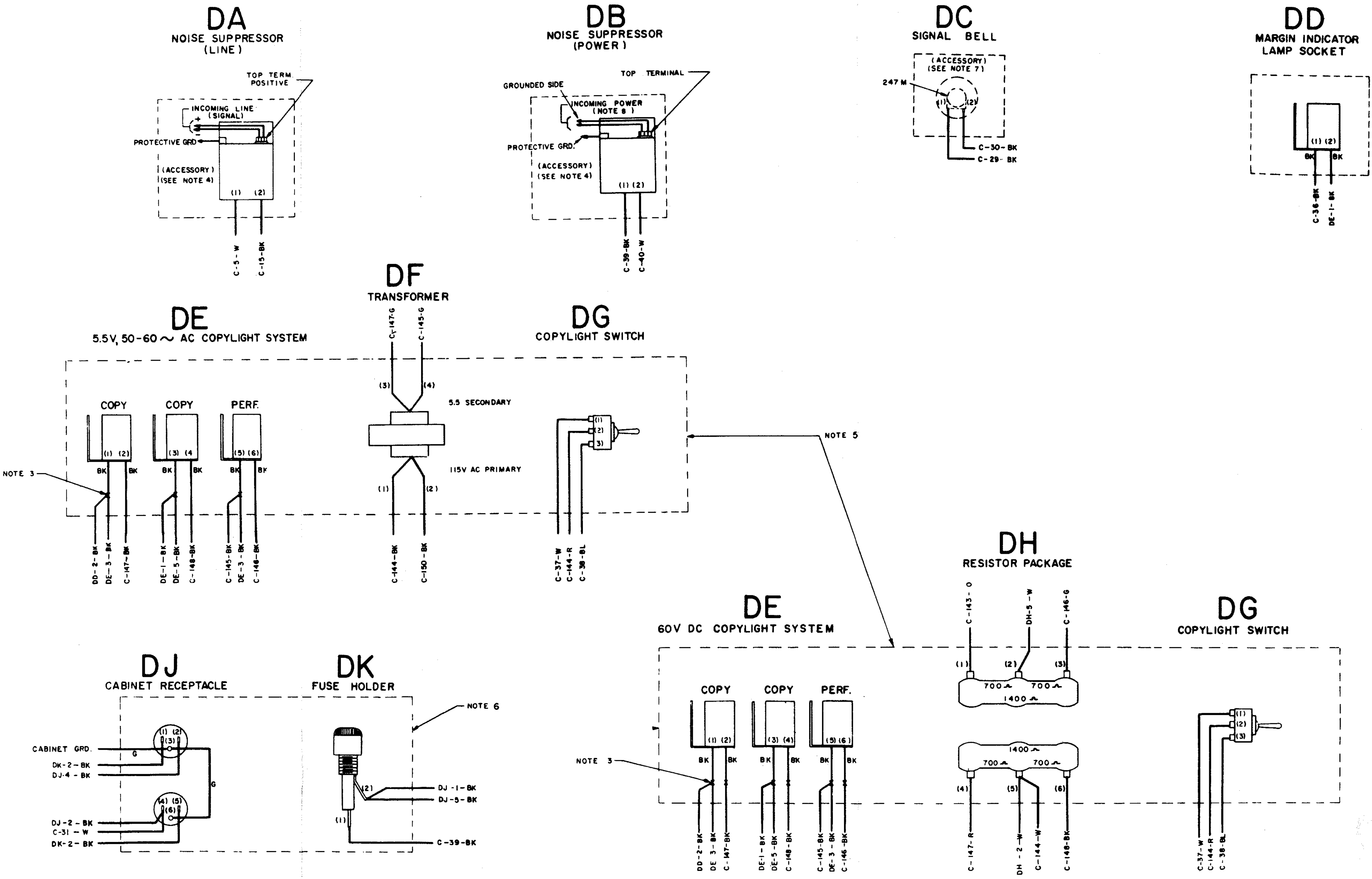
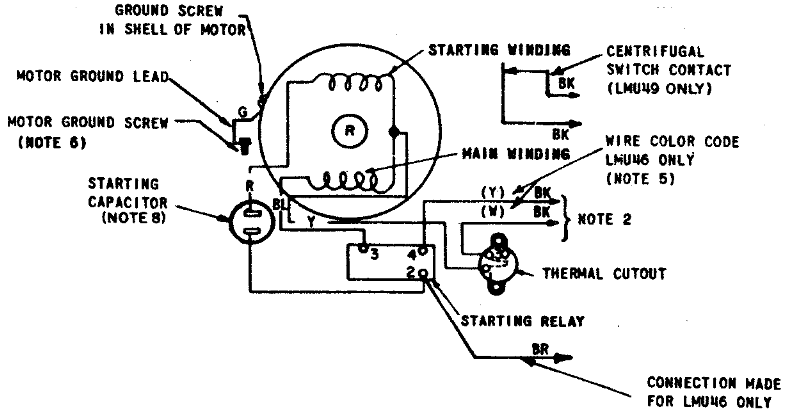


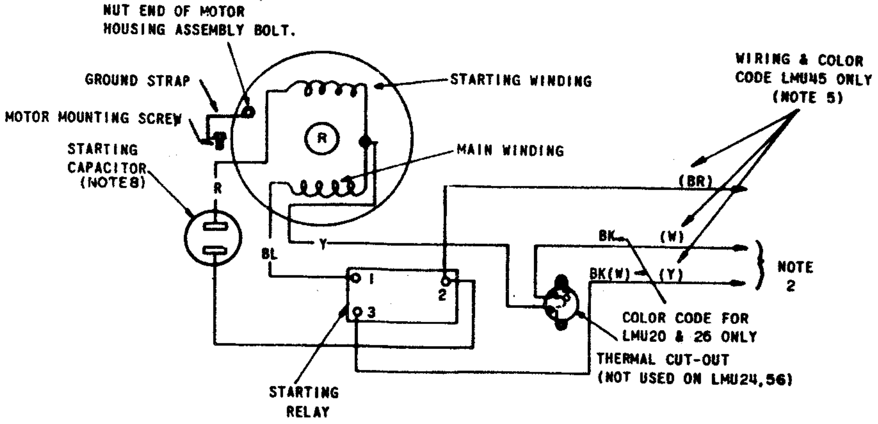
Figure 5-21. LAAC 200, 201, 202, 204, 209, 210, 213, 214, 219, 235, 236 ASR Cabinet Wiring Diagram (Sheet 2 of 2)

SYNCHRONOUS MOTOR UNITS

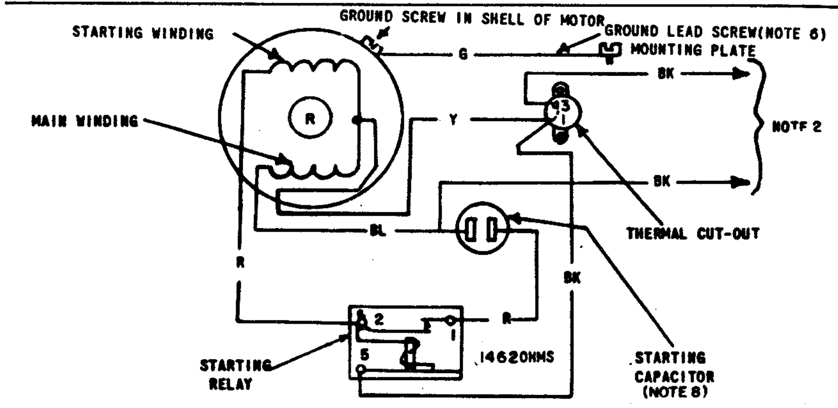
<table>
<tr><th>NO.</th><th colspan="2">NOTES</th></tr>
<tr><td>1.</td><td colspan="2">SYNCHRONOUS MOTOR OPERATES ON REGULATED FREQUENCY (± 0.75%) MAXIMUM AC ONLY.</td></tr>
<tr><td>2.</td><td colspan="2">CONNECT EITHER WIRE TO DESIGNATED TERMINALS OF UNIT TERMINAL BLOCK, PER WIRING DIAGRAM OF ASSOCIATED UNIT</td></tr>
<tr><td>3.</td><td colspan="2">MOTOR LEADS OF SAME COLOR ARE INTERCHANGEABLE.</td></tr>
<tr><td>4.</td><td colspan="2">EXTERNAL NOISE SUPPRESSION NETWORK CONSISTING OF 100 OHM, 1/2 WATT RESISTOR IN SERIES WITH 0.25 MFD IK V CAPACITOR CONNECTED ACROSS YELLOW AND BROWN WIRES. (FOR LMU45, 46)</td></tr>
<tr><td>5</td><td colspan="2">MOTOR GROUND LEAD (GREEN) TERMINAL MUST BE FASTENED TO MOUNTING CRADLE OF MOTOR UNDER A SEPARATE GROUND SCREW ONLY. A SCREW USED FOR ANOTHER PURPOSE CANNOT BE USED FOR GROUNDING (UNDERWRITERS LABORATORIES REQUIREMENT).</td></tr>
<tr><td>6</td><td colspan="2">WIRE COLOR CODE:
BK - BLACK
BL - BLUE
BR - BROWN
P - PURPLE
W - WHITE
R - RED
O - ORANGE
Y - YELLOW
S - SLATE
G - GREEN</td></tr>
<tr><td rowspan="7">7</td><td>LMU</td><td>STARTING CAPACITOR VALUE</td></tr>
<tr><td>3,15,21,30,33, 36,37,38,42, 46,49,51,52</td><td>43 – 48 MFD</td></tr>
<tr><td>11,12</td><td>170 – 226 MFD</td></tr>
<tr><td>35</td><td>64-77 MFD</td></tr>
<tr><td>55</td><td>15–18 MFD</td></tr>
<tr><td>19,20,24,26, 31,45,56</td><td>88 – 108 MFD</td></tr>
<tr><td>50,</td><td>161 – 193 MFD</td></tr>
</table>



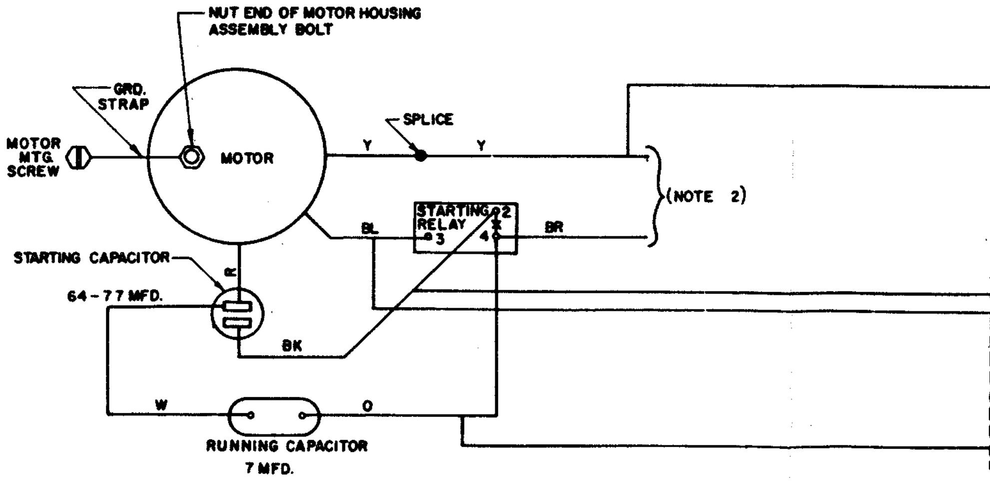
LMU 3,11,12,15,21,30,37,42,46,49
FOR USE WITH 115V.A.C. 60~POWER SUPPLY
LMU 33, 36,38, 51,52
FOR 115V.AC 50~POWER SUPPLY.
LMU 55
FOR 230 V.A.C. 50~POWER SUPPLY



LMU 19,20,24,26,31,45,56
FOR USE WITH 115V AC 60~POWER SUPPLY ONLY



LMU 50,
FOR USE WITH 115V AC 50~POWER SUPPLY ONLY



LMU 35

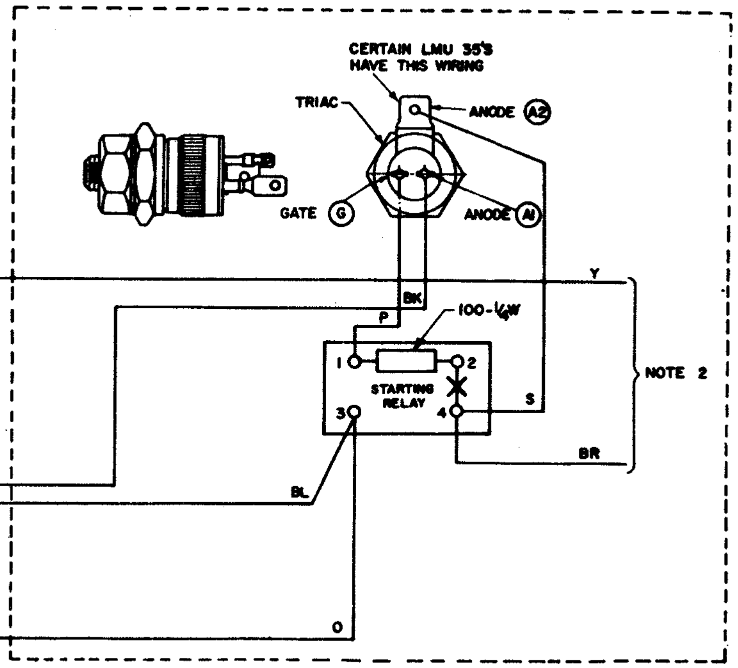
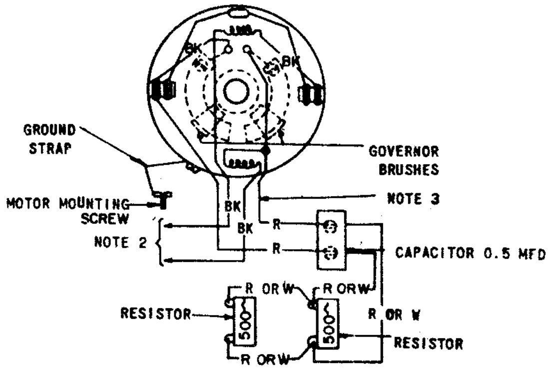


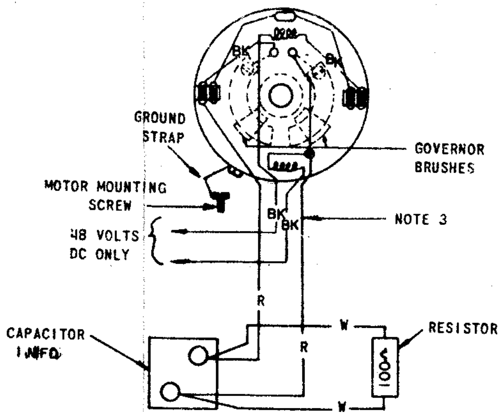
Figure 5-22. LMU3, 41, 12, 39, 38, 50 Wiring Diagrams
(Sheet 1 of 2)

NO.	NOTES
1.	A. AC SERIES MOTOR UNITS OPERATE ON UN-REGULATED AC POWER. B. ASSOCIATED LESU MUST BE EQUIPPED WITH CAPACITOR-RESISTOR ASSEMBLY FOR DC OPERATION OF GOVERNED MOTORS.
2.	CONNECT EITHER WIRE TO DESIGNATED TERMINALS OF UNIT TERMINAL BLOCK, PER WIRING DIAGRAM OF ASSOCIATED UNIT.
3.	MOTOR LEADS OF SAME COLOR ARE INTERCHANGEABLE.
4.	MOTOR LEADS ARE ENCLOSED IN APPROXIMATLY 10" LONG COPPER SHIELDING & FASTENED TO MOTOR AND CONTROL PARTS COMPARTMENT. (FOR LMU28).
5.	LMU4, 10, AND 14 MOTOR UNITS (UNIVERSAL SERIES GOVERNED) CONTAIN TWO 500 OHM RESISTORS WIRED IN PARALLEL EQUIVALENT TO 250 OHMS. LMU4 MOTOR UNIT SUPERSEDED BY LMU41 MOTOR UNIT. LMU10 MOTOR UNIT SUPERSEDED BY LMU47 MOTOR UNIT. LMU14 MOTOR UNIT SUPERSEDED BY LMU39 MOTOR UNIT.
6.	WIRE COLOR CODE: BK - BLACK R - RED BL - BLUE O - ORANGE BR - BROWN Y - YELLOW P - PURPLE S - SLATE W - WHITE G - GREEN

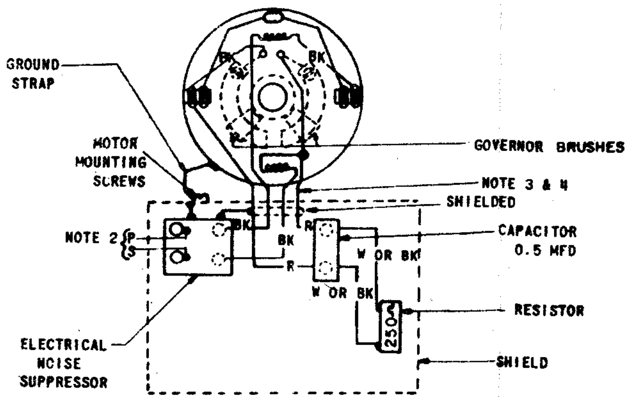
SERIES GOVERNED MOTOR UNITS



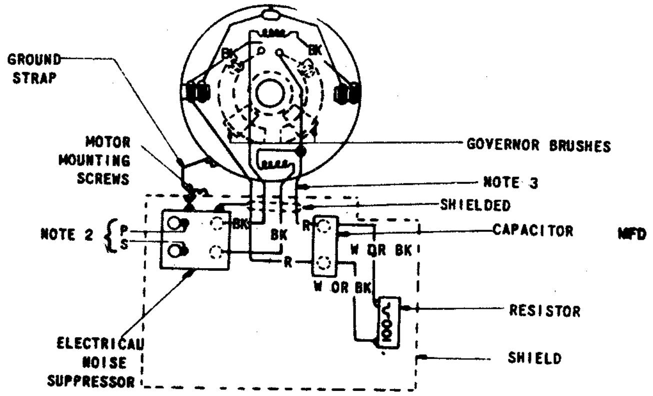
LMU 6,13 (UNIVERSAL)
WITHOUT RADIO FREQUENCY SUPPRESSORS
FOR USE WITH EITHER 115V AC 50-60~OR 115V DC POWER SUPPLY (NOTE 1B).



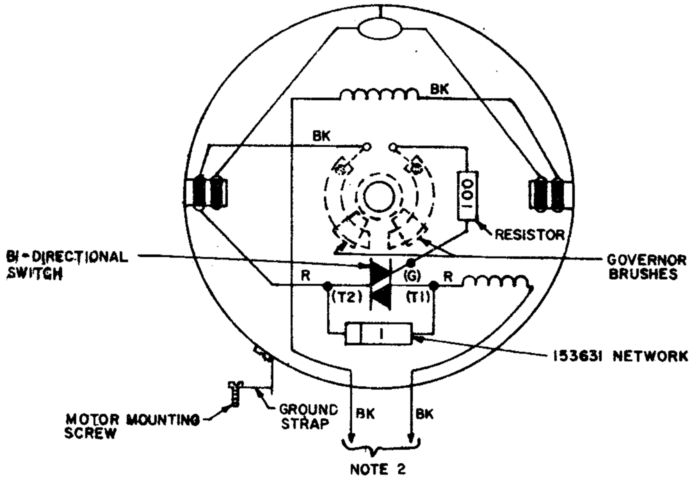
LMU 23 (48 VOLTS)
WITHOUT RADIO FREQUENCY SUPPRESSORS
FOR USE ON 48 V.D.C. POWER SUPPLY ONLY



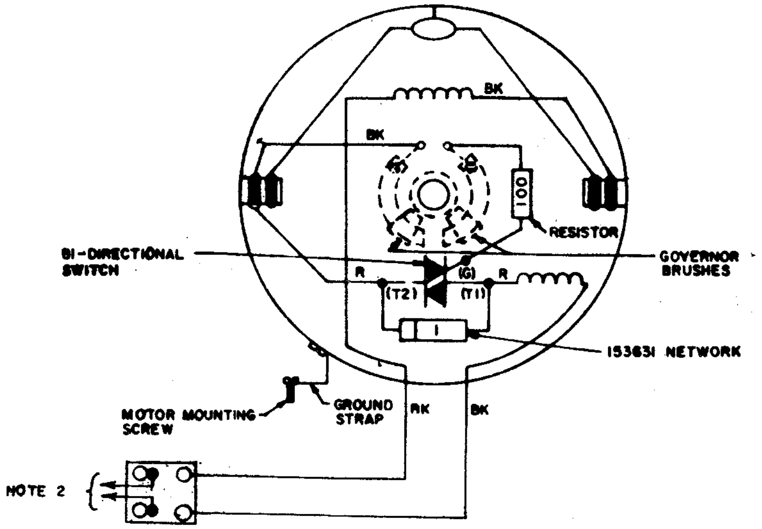
LMU 28,32,39,41,47 (UNIVERSAL)
WITH RADIO FREQUENCY SUPPRESSORS
FOR USE WITH EITHER 115V AC 50-60~115 V DC POWER SUPPLY (NOTE 1B)



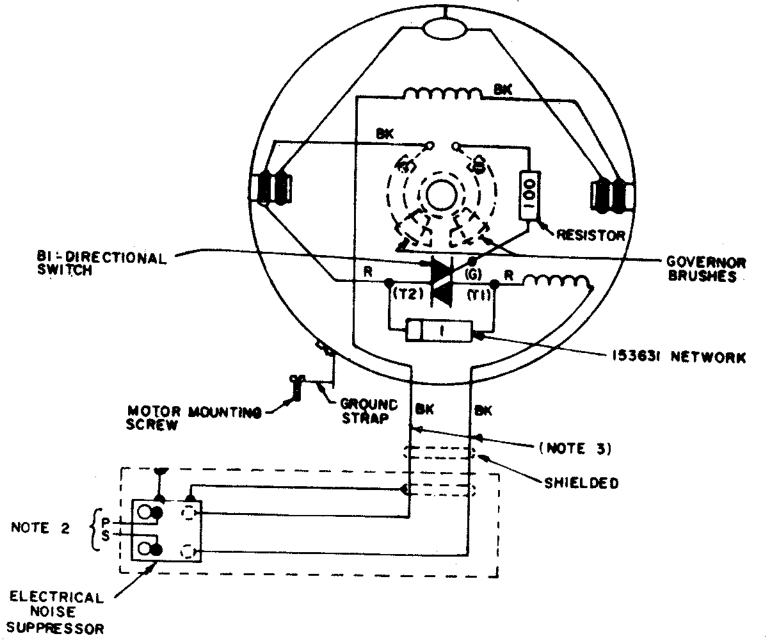
LMU 29 (48 VOLTS)
WITH RADIO FREQUENCY SUPPRESSORS
FOR USE ON 48 VOLT DC POWER SUPPLY ONLY



LMU 57, (115 VOLTS AC)
WITHOUT RADIO FREQUENCY SUPPRESSORS
FOR USE ON 115 VOLTS AC ONLY

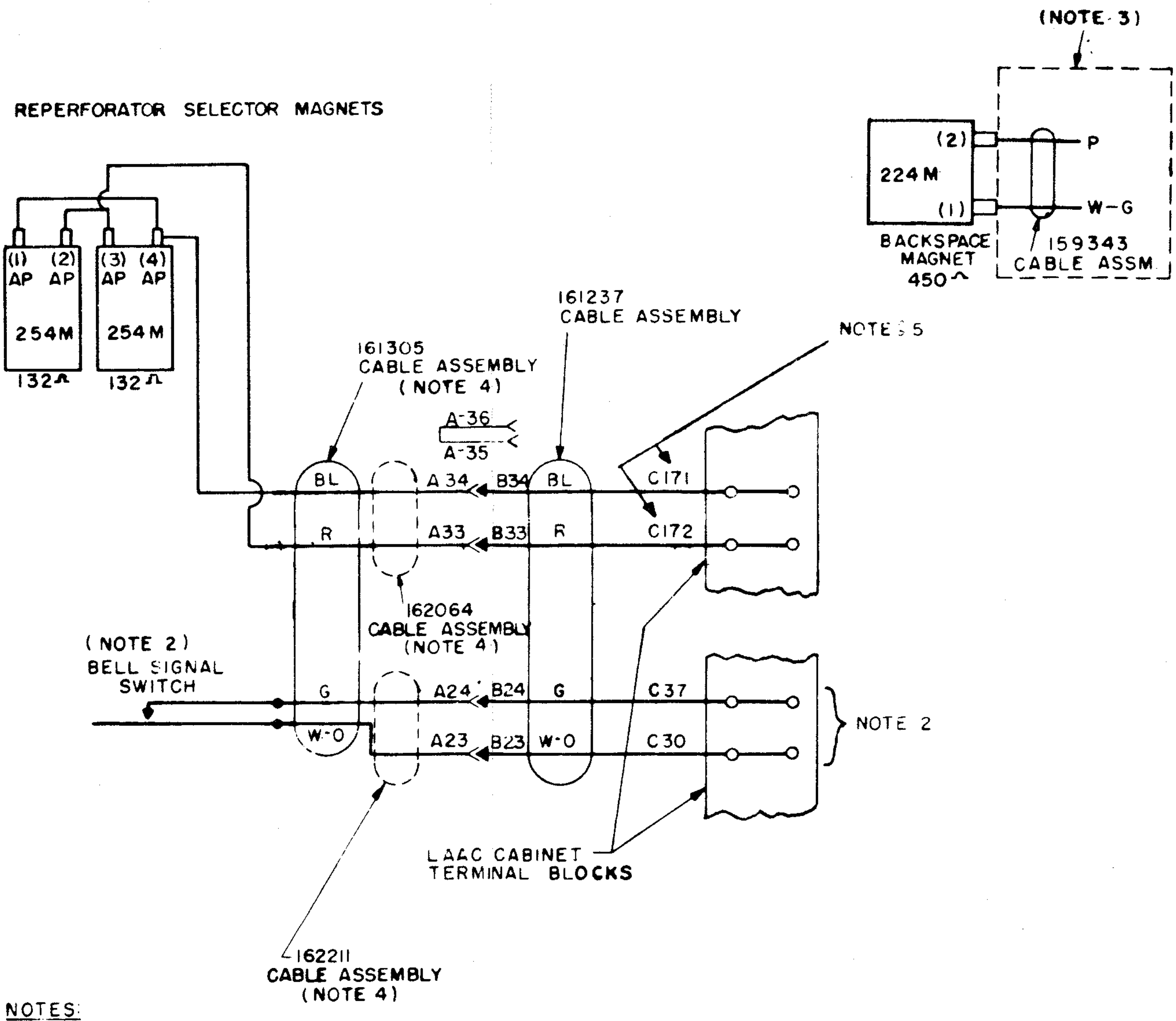


LMU 60,61,64 (115 VOLTS AC)
WITH RADIO FREQUENCY SUPPRESSORS
FOR USE ON 115 VOLTS AC ONLY



LMU 63 (115 VOLTS A.C.)
WITH RADIO FREQUENCY SUPPRESSORS
FOR USE ON 115 VOLTS AC ONLY.

Figure 5-22. LMU3, 41, 12, 39, 38, 50 Wiring Diagram (Sheet 2 of 2)



NOTES:

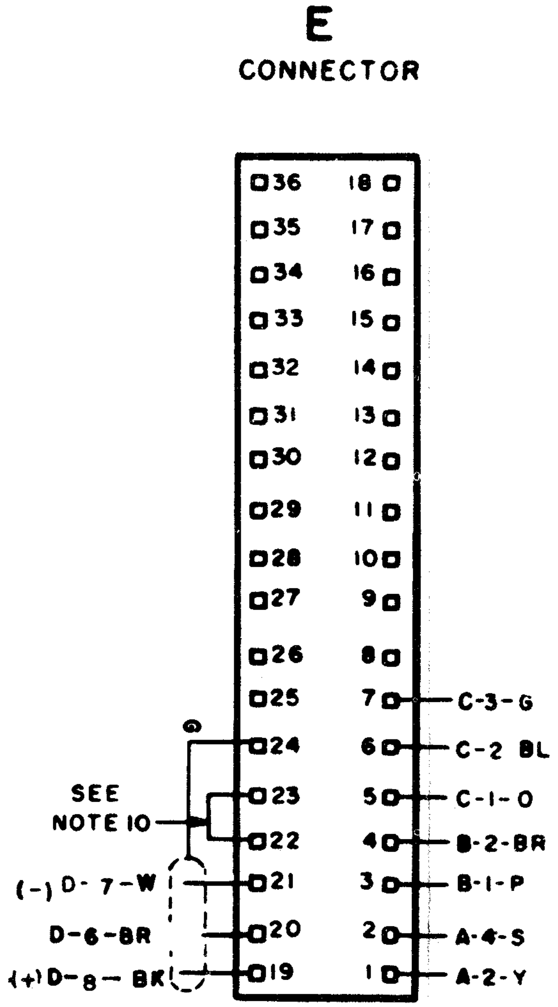
REPERFORATOR SELECTOR MAGNETS SHOWN FOR .060 AMP OPERATION. FOR .020 AMP OPERATION REMOVE AND ADD CONNECTIONS AS TABULATED BELOW

	CONNECTION REMOVED	CONNECTION ADDED
.020 AMPS.	A33- AP3	A33- AP2
	AP2 - AP3	AP1- AP3
	AP1 - AP4	

2. BELL SIGNAL SWITCH NOT USED ON LRPE6. TIE BACK W-O AND G WIRES ALONG CABLE 161237 WHEN USED WITH LRPE 6
3. PART OF LAK 4 & LAK 18
4. LPR 51 & 56 USE 162064 & 162211 CABLE ASSEMBLIES. LRPE 6 USES 162064 CABLE ASSEMBLY LPR 77 USES 162064 CABLE ASSEMBLY.
5. WHEN THESE TERMINALS ARE NOT AVAILABLE, THE 159396 MODIFICATION KIT TO ADD TERMINALS C-151 TO C-180, MAY BE ORDERED.

Figure 5-23. LPR 10, 33, 56, 51, 77, and LRPE 6 Schematic Wiring Diagram

	NOTES:
1.	WIRING LEGEND: A - 1 - W A — DISTANT TERMINATING AREA 1 — DISTANT TERMINAL DESIGNATION W — WIRING COLOR CODE
2.	COLOR CODE: BK - BLACK · W-BK - WHITE-BLACK BR - BROWN · W-BR - WHITE-BROWN R - RED · W-R — WHITE-RED O - ORANGE · W-O — WHITE-ORANGE Y - YELLOW · W-Y — WHITE-YELLOW G - GREEN · W-G — WHITE-GREEN BL - BLUE · W-BL - WHITE-BLUE P - PURPLE · W-P — WHITE-PURPLE S - SLATE · W-S — WHITE-SLATE W - WHITE
3.	CONNECTORS VIEWED FROM SOLDER TERMINAL ENDS
4.	ALL CONTACTS SHOWN IN UNOPERATED POSITION.
5.	ASSOCIATED CABLES: 173440 CABLE ASSEMBLY (LXD 11) 307288 CABLE ASSEMBLY (LXD 29,35)
6.	THE NUMBERS ENCLOSED BY PARENTHESES ARE USED FOR REFERENCE AND ARE NOT MARKED ON THE PARTS.
7.	UNIT EQUIPPED WITH 262 COIL ASSEMBLY (RESISTANCE 210Ω EACH). THE OPERATING CURRENT MUST BE 50 MA. 120 V·DC FOR EXTERNAL PULSING. FOR 110V AC. NON-PULSING OPERATION, RELOCATE STRAP ON TERMINAL (1) TO TERMINAL (2). ADD STRAP BETWEEN TERMINALS (1) AND (4) FOR PARALLEL OPERATION OF MAGNETS.
8.	178535 SPARK SUPPRESSOR ASSEMBLY (153631 NETWORK) USED ON LXD 29 ONLY.
9	TERMINAL NO. 21 ON CONNECTOR E IS RESERVED FOR POLAR SIGNAL.
10.	STRAP WITH 22 GAUGE WIRE AS INDICATED.
11.	FOR PROPER R.F. FILTERING POLARITY OF FILTERS MUST BE MAINTAINED WHEN 174422 FILTER IS USED. UNIT AS FURNISHED IS WIRED FOR "MARKING" CONTACT POSITIVE (+) "SPACING" CONTACT NEGATIVE (-). TO REVERSE POLARITY OF CONTACTS SO THAT THE "MARKING" CONTACT IS NEGATIVE (-) AND "SPACING" POSITIVE (+) MAKE THE FOLLOWING CONNECTIONS IN CONTACT BOX ASSEMBLY. 1. MOVE BLACK LEAD OF BOTTOM FILTER FROM "MARKING" CONTACT TO "SPACING" CONTACT. 2. MOVE GREEN LEAD OF TOP FILTER FROM "SPACING" CONTACT TO "MARKING" CONTACT. POLARITY MAY BE DISREGARDED WHEN UNITS ARE FURNISHED WITH 174421 FILTER. COLOR CODING OF FILTER LEADS DOES NOT APPLY TO 174421 FILTER.



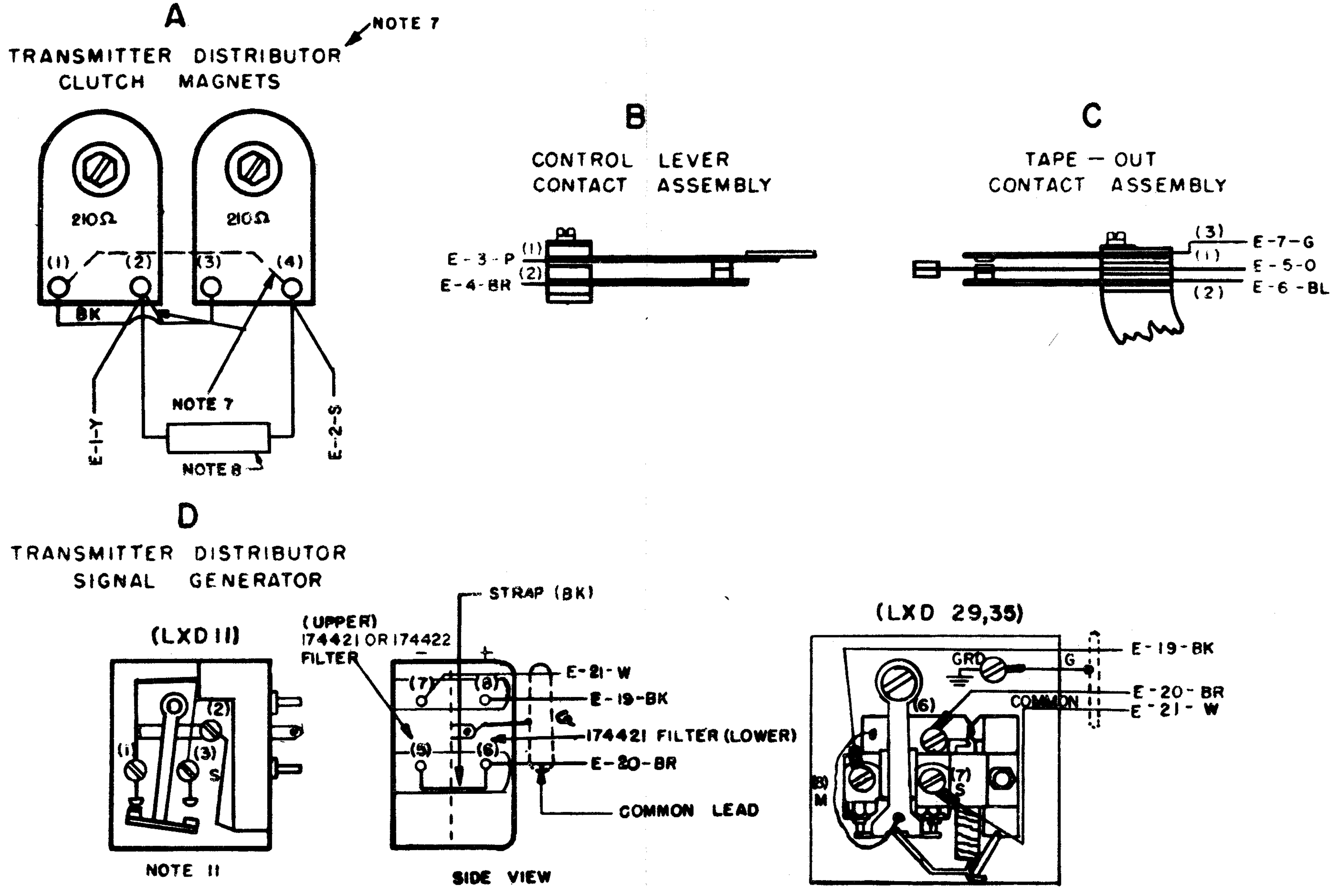


Figure 5-24. LXD 11, 29, 35 Transmitter Distributor Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND DISTANT TERMINAL AREA DISTANT TERMINAL DESIGNATED A-1-W WIRE COLOR
2.	COLOR CODE: BK BLACK BR BROWN Y YELLOW S SLATE P PURPLE O ORANGE BL BLUE W WHITE
3.	CONNECTIONS VIEWED FROM SOLDER TERMINAL ENDS.
4.	ASSOCIATED CABLE 173448
5.	ASSOCIATED SCHEMATIC WIRING DIAGRAM 4275WD
6.	(*) ASTERISK INDICATES 3 WIRE SHIELDED CABLE.

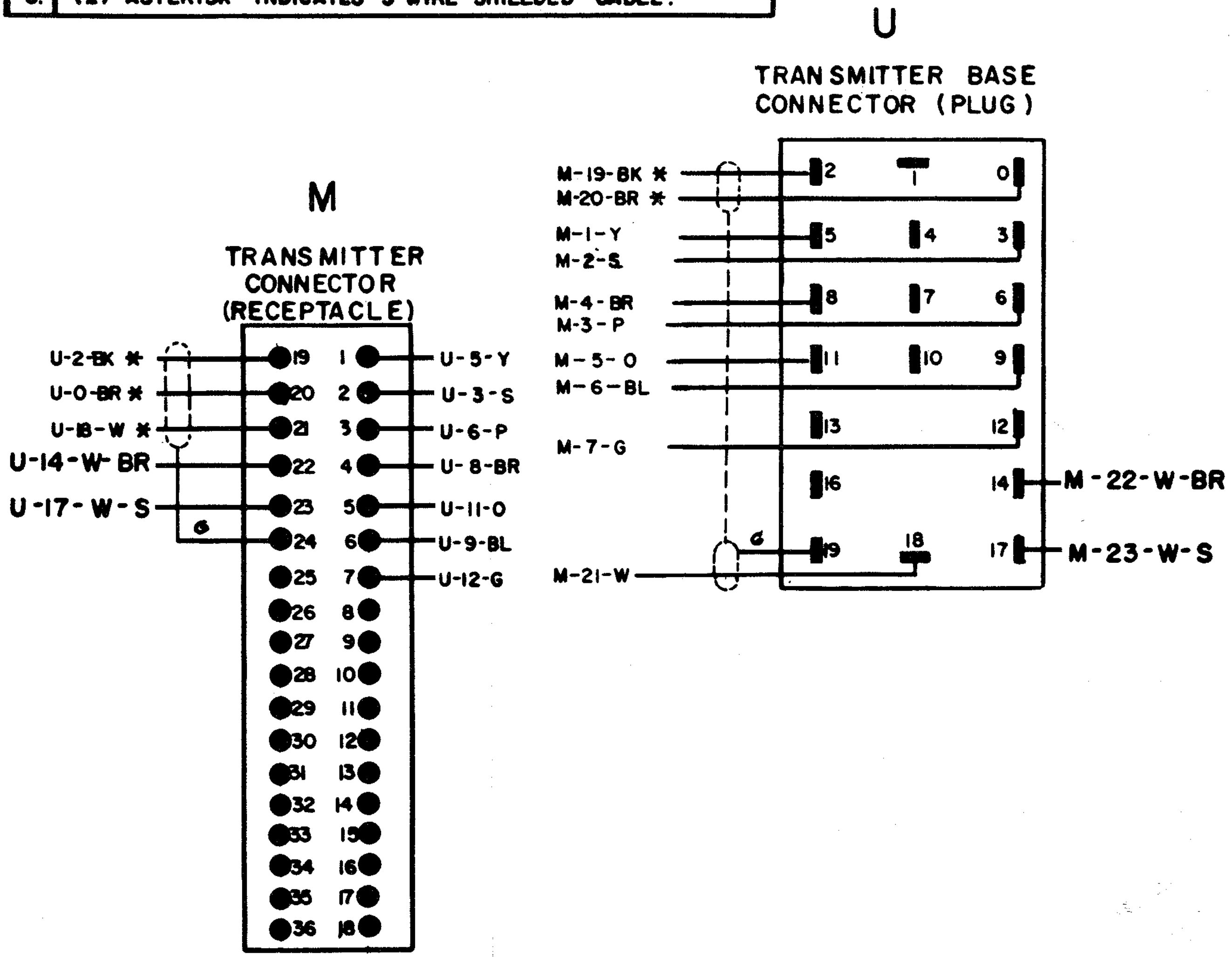


Figure 5-25. LCXB 13 Wiring Diagram

NO	NOTES
1.	WIRING LEGEND: A-I-W DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION WIRE COLOR CODE
2.	COLOR CODE: BK-BLACK BR-BROWN BL-BLUE R-RED P-PURPLE G-GREEN S-SLATE Y-YELLOW W-WHITE O-ORANGE
3.	—✕— DENOTES SPLICED AND TAPED WIRES.
4.	CABINET POWER 100 - 130V AC 45 - 66 HZ
5.	ASSOCIATED CABLES: 158267 TRANSFORMER AND CABLE 154440 CABINET LIGHTS, SWITCH CABLE 324157 T-D BASE CABLE 324158 REPERFORATOR BASE CABLE 324159 KEYBOARD BASE CABLE 324695 TYPING UNIT CABLE
6.	THE CABINET GROUND SCREW IS ON THE 158682 BRACKET AT THE RIGHT OF THE CABINET TERMINAL BLOCKS.
7.	DENOTES SHIELD LEADS DENOTES TAPED SHIELD ENDS
8.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND APE NOT MARKED ON COMPONENT.
9.	REFER TO , 8405, AND 8141WD FOR SCHEMATIC WIRING DIAGRAMS.
10.	DR INDICATES DRAIN
11.	FUSE NUMBER 118510 1/4 AMP.

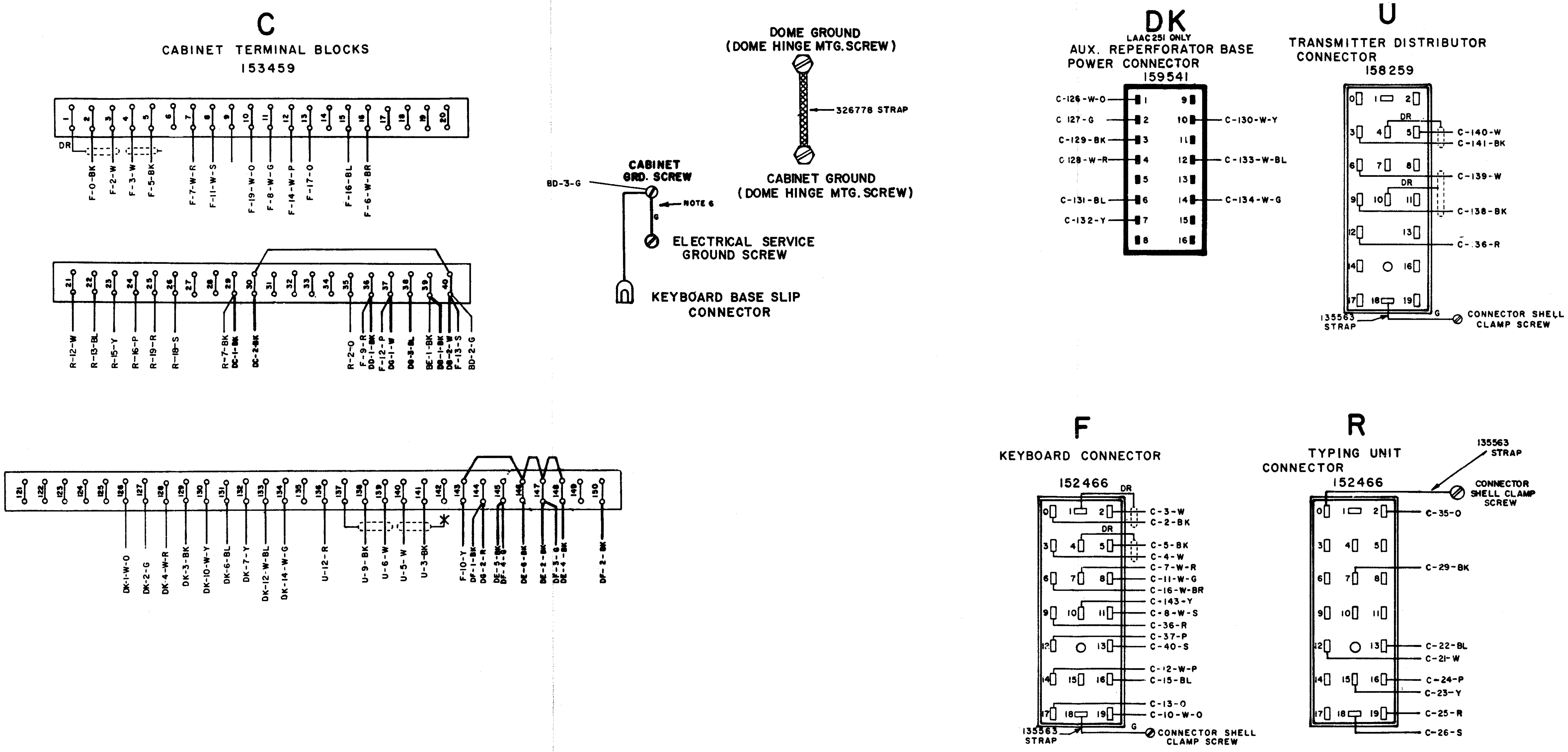


Figure 5-26. LAAC 251, 256, 255 ASR Cabinet Wiring Diagram (Sheet 1 of 2)

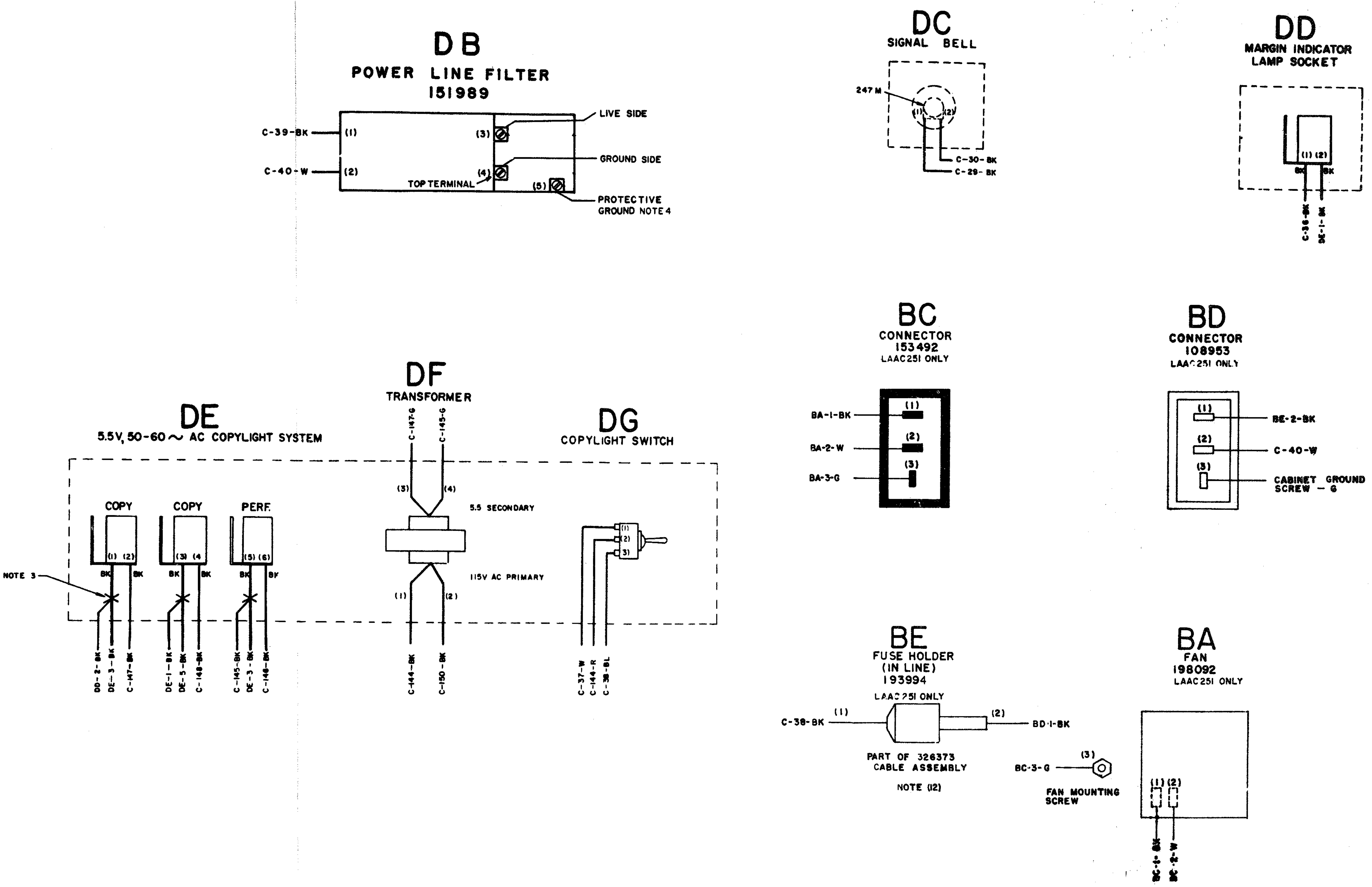


Figure 5-26. LAAC 251, 256, 255 ASR Cabinet Wiring Diagram Sheet 2 of 2)

NO.	NOTES
1.	WIRING LEGEND: A-1-W DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	ASSOCIATED CABLES: 159279 TRANSFORMER CABLE 154440 CABINET LIGHTS, SWITCH CABLE 324159 KEYBOARD CABLE 324156 PAGE PRINTER CABLE 324157 TRANSMITTER DISTRIBUTOR BASE CABLE 324158 AUXILIARY TYPING REPERFORATOR BASE CABLE 326373 FAN CABLE ASSEMBLY.
4.	THE CABINET GROUND SCREW IS ON THE 158682 BRACKET AT THE RIGHT OF THE CABINET TERMINAL BLOCKS.
5.	ACCESSORY PART OF 173778 CONTROL PANEL ASSEMBLY.
6.	—✕— DENOTES SPLICED AND TAPED WIRES. DENOTES SHIELDED CABLE
7.	CABINET WIRED FOR 100-130VAC, 45-66HZ AS IS ASSOCIATED LESU123. THE MOTORS MUST BE CHOSEN IN ACCORDANCE WITH AVAILABLE LINE FREQUENCY AND REGULATION.
8.	CONNECT POWER LINE SHIELDS TO H4 AND J3. UNIT AS SHIPPED IS WIRED FOR SEPARATE MOTOR POWER AND SIGNAL POWER. IF A SINGLE POWER CIRCUIT IS BROUGHT IN, REMOVE KNOCK OUT IN POWER CONNECTOR BOX AND STRAP J1 TO H1. J2 TO H3, J4 TO H5 AND H4 TO J3.
9.	REFER TO 8313 WD FOR SCHEMATIC WIRING DIAGRAM
10.	FUSE NUMBER 118510 1/4 AMP.

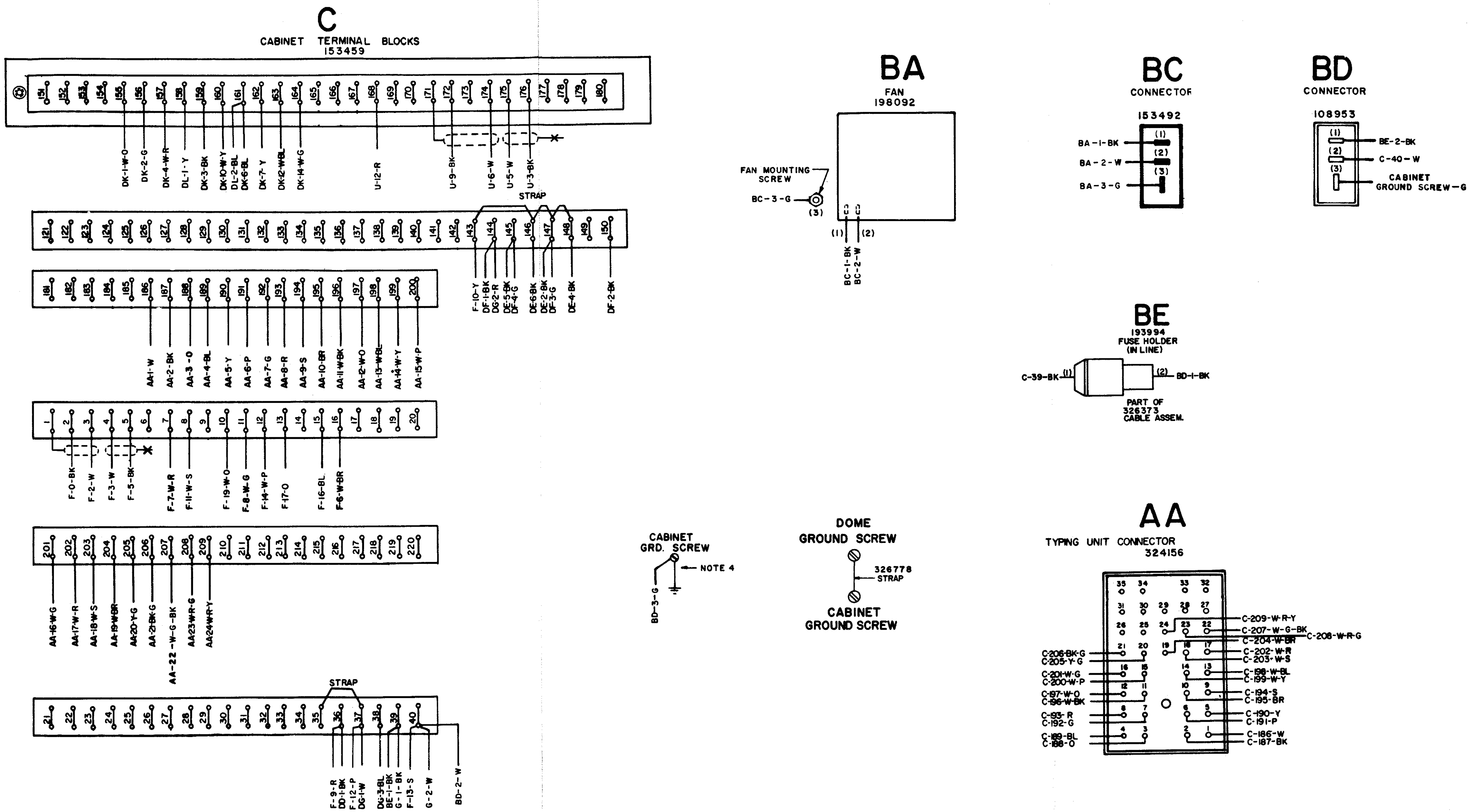


Figure 5-27. LAAC 252 Cabinet Wiring Diagram (Sheet 1 of 3)

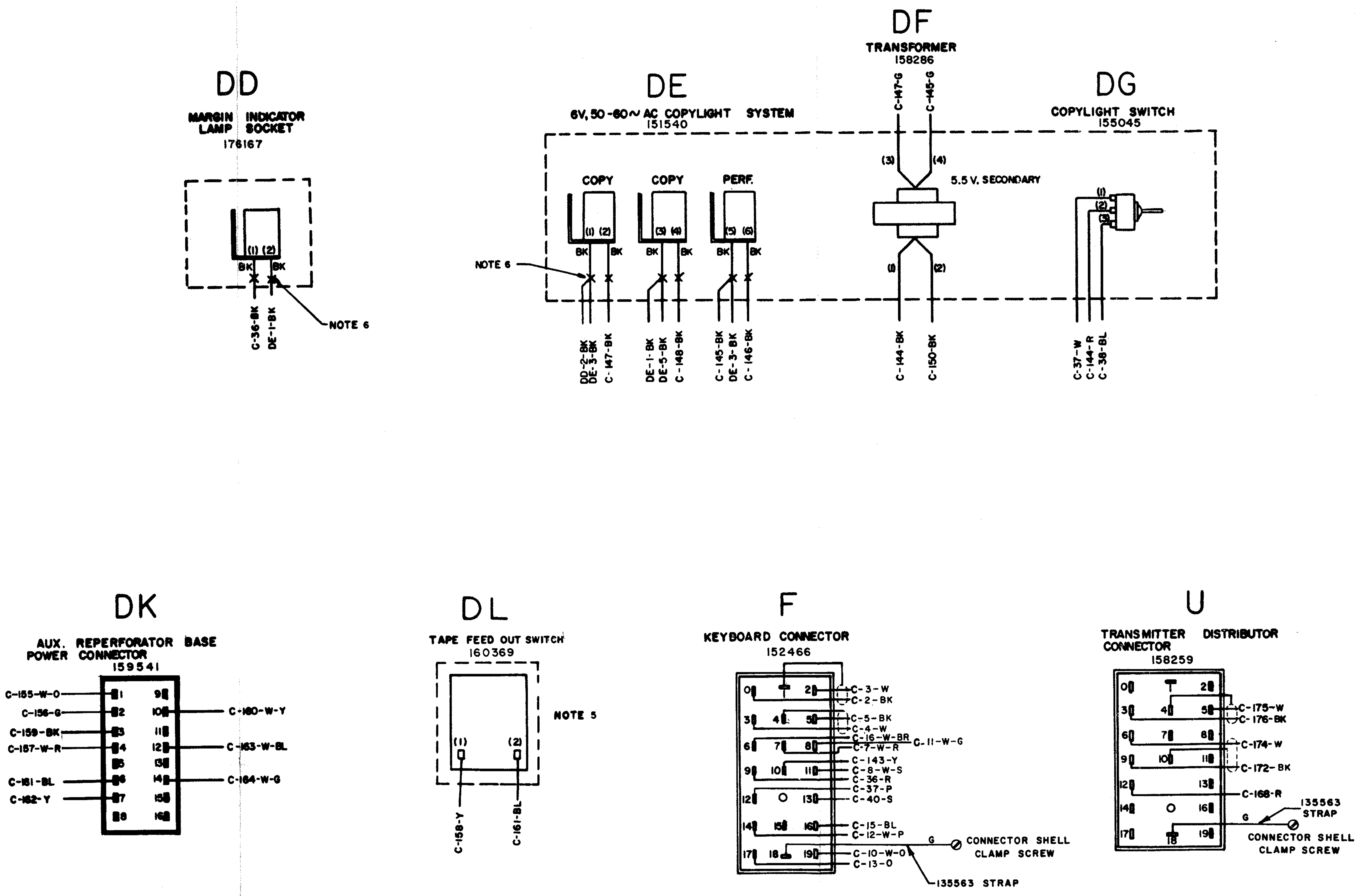


Figure 5-27. LAAC 252 Cabinet Wiring Diagram (Sheet 2 of 3)

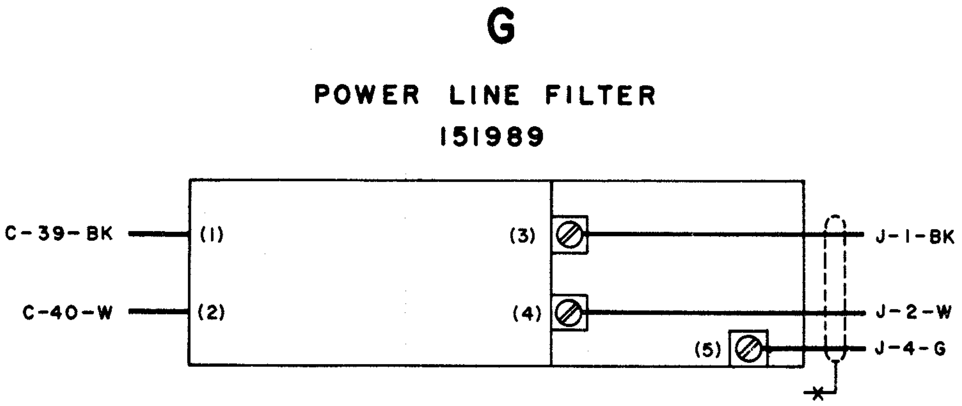


Figure 5-27. LAAC 252 Cabient Wiring Diagram (Sheet 3 of 3)

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A-1-W WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	ASSOCIATED CABLES: 159279 TRANSFORMER CABLE 154440 CABINET LIGHTS, SWITCH CABLE 324159 KEYBOARD CABLE 324156 PAGE PRINTER CABLE 324158 AUXILIARY TYPING REPERFORATOR BASE CABLE 326373 FAN CABLE ASSEMBLY.
4.	THE CABINET GROUND SCREW IS ON THE 158682 BRACKET AT THE RIGHT OF THE CABINET TERMINAL BLOCKS.
5.	ACCESSORY PART OF 173778 CONTROL PANEL ASSEMBLY.
6.	—X— DENOTES SPLICED AND TAPED WIRES. DENOTES SHIELDED CABLE
7.	CABINET WIRED FOR 100-130VAC, 45-66HZ AS IS ASSOCIATED LESU123. THE MOTORS MUST BE CHOSEN IN ACCORDANCE WITH AVAILABLE LINE FREQUENCY AND REGULATION.
8.	CONNECT POWER LINE SHIELDS TO H4 AND J3. UNIT AS SHIPPED IS WIRED FOR SEPARATE MOTOR POWER AND SIGNAL POWER. IF A SINGLE POWER CIRCUIT IS BROUGHT IN, REMOVE KNOCK OUT IN POWER CONNECTOR BOX AND STRAP J1 TO H1, J2 TO H3, J4 TO H5 AND H4 TO J3.
9.	REFER TO 8910 WD FOR SCHEMATIC WIRING DIAGRAM
10.	FUSE NUMBER 118510 1/4-AMP.

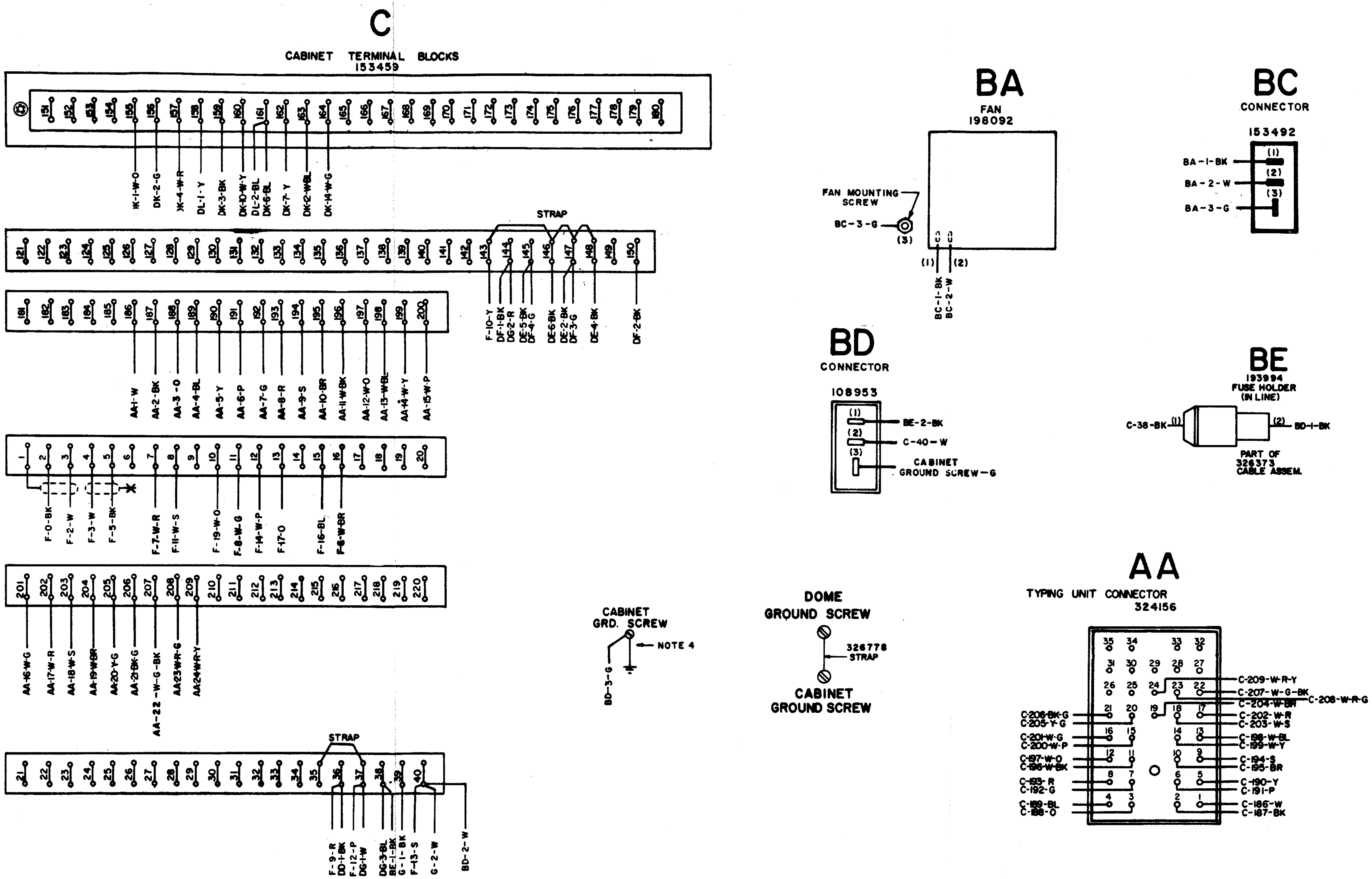


Figure 5-28. LAAC 259 Cabinet Wiring Diagram (Sheet 1 of 3)

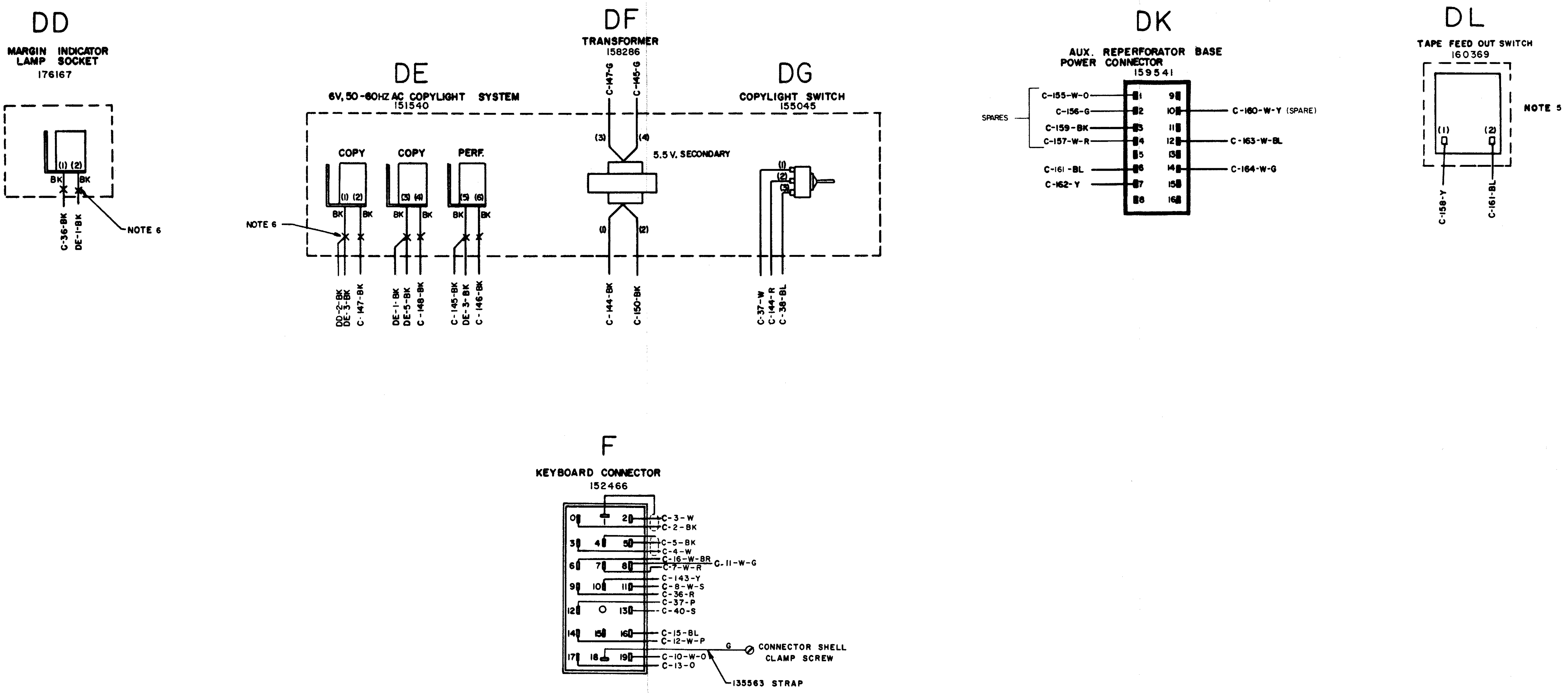


Figure 5-28. LAAC 259 Cabinet Wiring Diagram (Sheet 2 of 3)

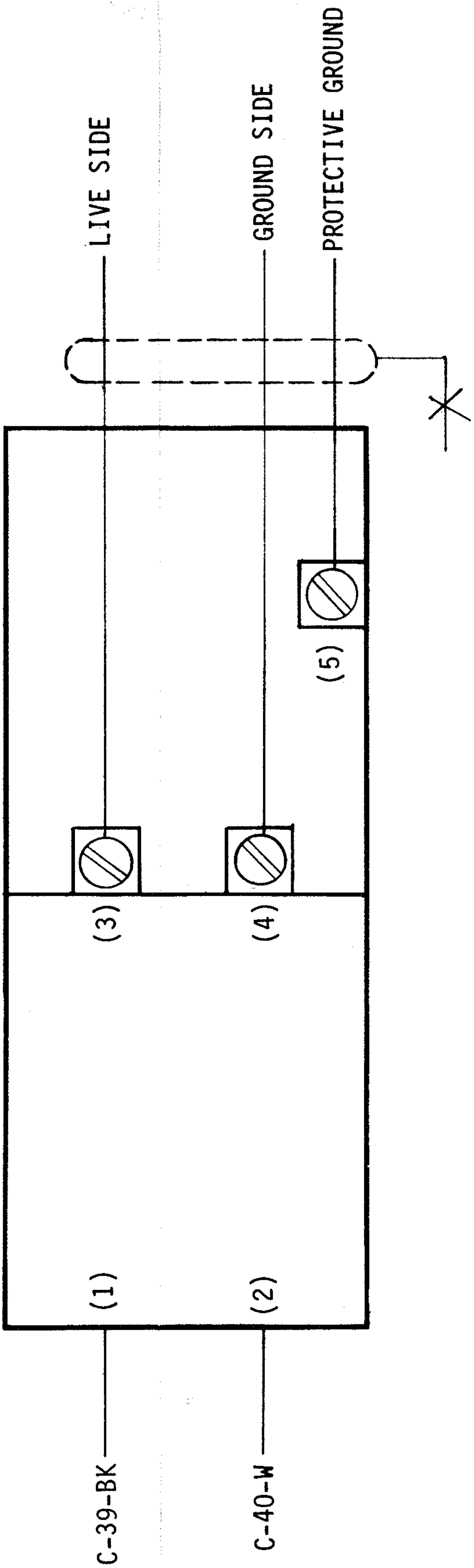


Figure 5-28. LAAC 259 Cabinet Wiring Diagram (Sheet 3 of 3)

	NOTES
1.	WIRING LEGEND A-1-R DISTANT TERM. AREA DISTANT TERM. DESIG. WIRE COLOR CODE
2.	COLOR CODE: R-RED W-WHITE BK-BLACK
3.	MATING CONNECTOR 114466 IS FURNISHED WITH UNIT. WIRING BETWEEN A.C. POWER AND 114466 IS TO BE PROVIDED IN FIELD AT INSTALLATION TIME.
4.	REMOVE AND TAPE RESISTOR LEADS WHEN LPW300 IS OPERATED WITH MODEL 32 AND 33 PAGE PRINTERS.
5.	MOTOR OPERATES ON 50-60 CYCLE 110 V.A.C.
6.	THE NUMBERS ENCLOSED BY PARENTHESES ARE USED FOR REFERENCE AND ARE NOT SHOWN ON THE PART.
7.	THE 195298 CABLE IS REPLACED BY 337963 CABLE ON DAPW 3

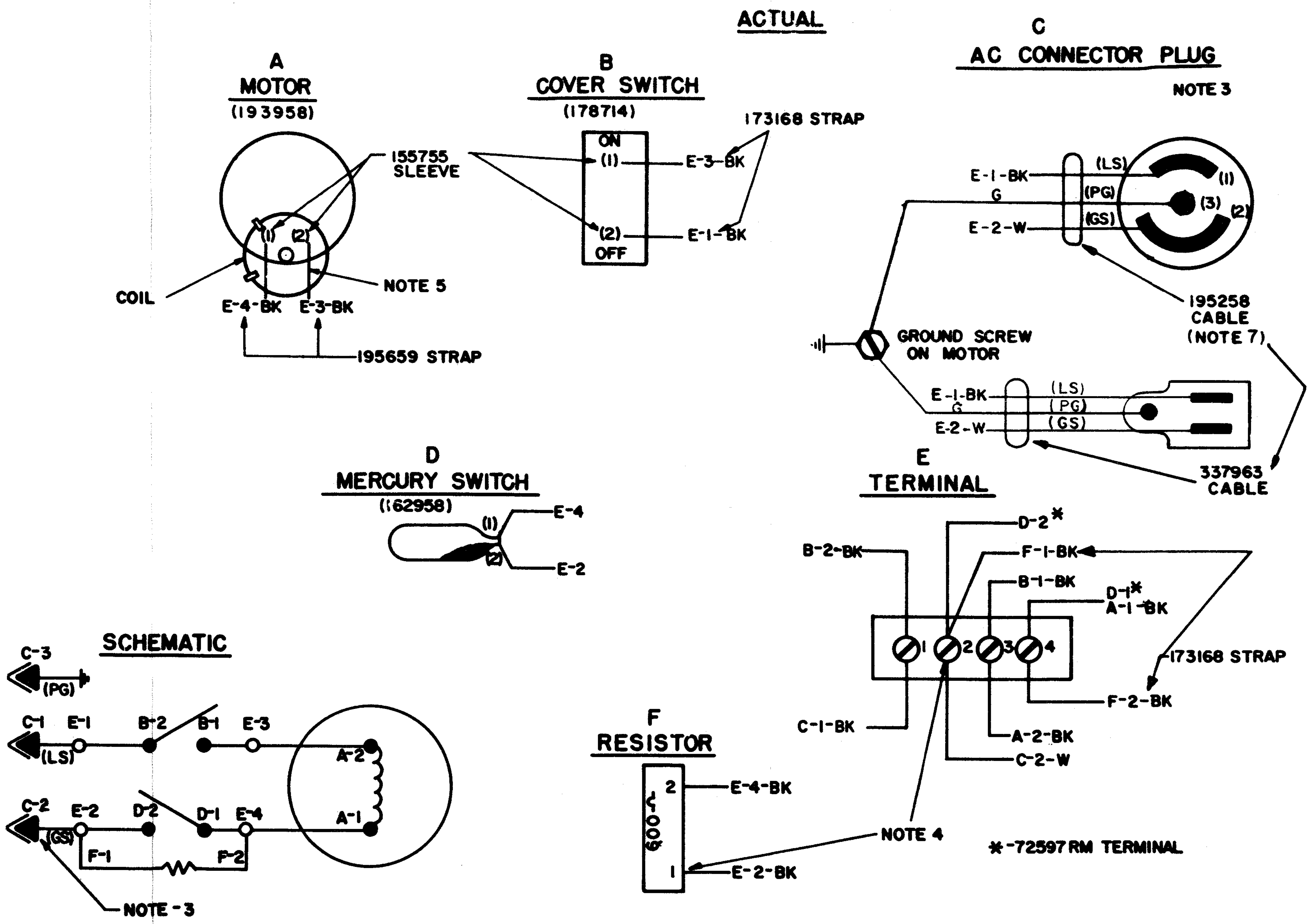


Figure 5-29. LPW 300 Paper Winder

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A-1-W-BL WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	UNIT WIRED FOR 115 VOLTS AC OR DC POWER INPUT.
4.	PLUGS VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION IN KEYBOARD.
6.	ASSOCIATED CABLES: 326355 CABLE ASSEMBLY, CLUTCH TRIP 324683 CABLE ASSEMBLY, KEYBOARD BASE 174314 CABLE ASSEMBLY, AUX. SWITCH 324684 CABLE ASSEMBLY, MARGIN INDICATOR
7.	BARE WIRE STRAP 39522RM.
8.	—*— TAPED END
9.	REFERENCE SPEC. FOR TELETYPE CORPORATION EMPLOYEES ONLY 6155 S
10	FOR SCHEMATIC WIRING REFER TO 8413WD-8405WD
11.	COVER DIODE LEADS WITH TWO LENGTHS (APPROX. 1 INCH) OF INSULATING TUBING (60019 RM).
12	DR INDICATES DRAIN
13	* DENOTES 18 AWG

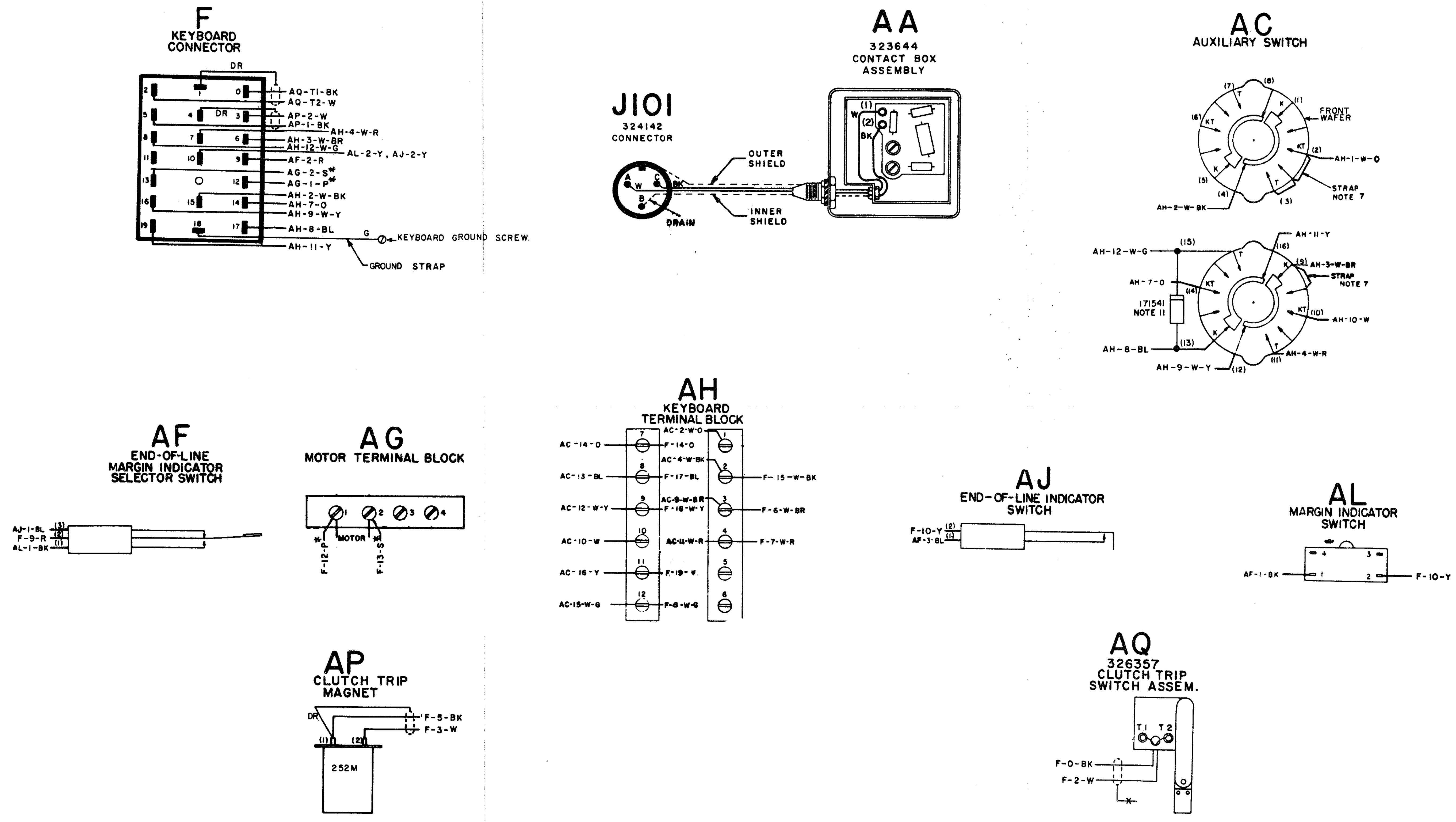


Figure 5-30. LAK 50 Keyboard Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A- 1-W-BL WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK G - GREEN BR - BROWN BL - BLUE R - RED P - PURPLE O - ORANGE W - WHITE Y - YELLOW S - SLATE
3.	UNIT WIRED FOR 115 VOLTS AC OR DC POWER INPUT.
4.	PLUGS VIEWED FROM SOLDER TERMINAL ENDS.
5.	ALL CONTACTS SHOWN IN UNOPERATED POSITION IN KEYBOARD.
6.	ASSOCIATED CABLES: 324684 CABLE ASSEMBLY, MARGIN INDICATOR 174314 CABLE ASSEMBLY, AUXILIARY 324683 CABLE ASSEMBLY, KEYBOARD 155992 CABLE ASSEMBLY, BACKSPACE 159343 CABLE ASSEMBLY, BACKSPACE MAGNET 326355 CABLE ASSEMBLY, CLUTCH TRIP MAGNET
7.	-X- DENOTES TAPED SHIELD END. DENOTES SHIELDED CABLE
8.	FOR SCHEMATIC SEE 8313 WD
9.	REFERENCE SPEC. FOR TELETYPE CORPORATION EMPLOYEES ONLY 6155S
10.	COVER DIODE LEADS WITH TWO LENGTHS (APPROX. 1 INCH) OF INSULATING TUBING (60019 RM).
11.	PART OF ASSOCIATED UNIT (LPE, LPR, LRPE, OR LTPE)
12.	TERMINAL DESIGNATION ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED COMPONENTS
13.	DR INDICATES DRAIN
14.	BARE WIRE STRAP 39522 RM.
15.	* DENOTES 18 AWG

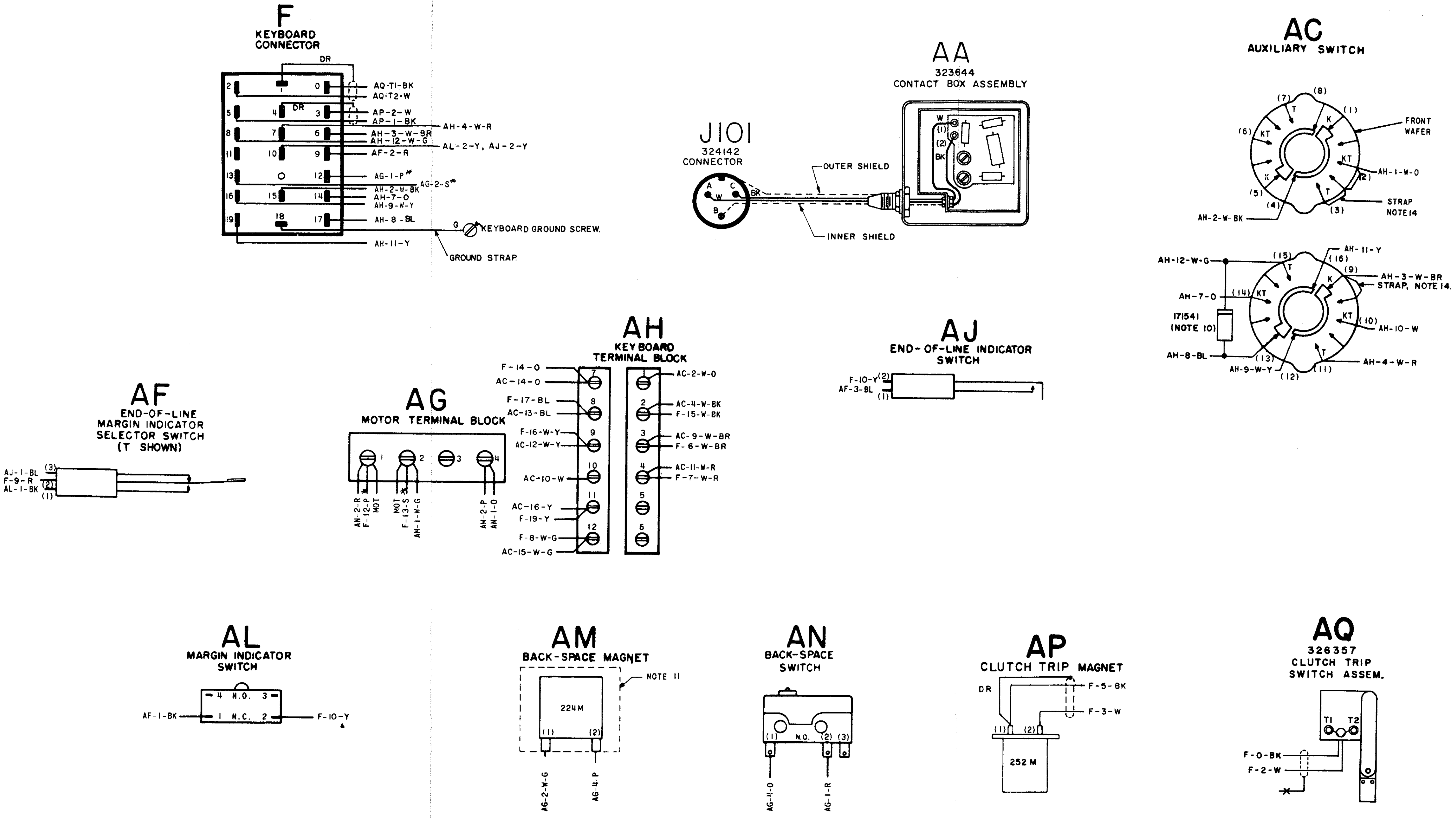
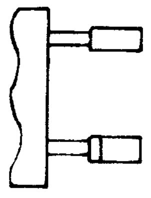


Figure 5-31. LAK 51 and 55 Keyboard Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION A-1-BK COLOR CODE
2.	COLOR CODE: BK-BLACK BL-BLUE W-WHITE BR-BROWN Y-YELLOW O-ORANGE P-PURPLE G-GREEN S-SLATE R-RED
3.	CONNECTORS VIEWED FROM SOLDERED TERMINAL END.
4.	THESE LEADS FURNISHED WITH STUNT BOX.
5.	 NORMALLY OPEN CONTACTS NORMALLY CLOSED CONTACTS
6.	135563 STRAP CONNECTED TO TERMINAL TO BE CONNECTED TO CONNECTOR BRACKET MOUNTING SCREW ON LP 134, LP 138, LP 149, LP150.
7.	LEGEND: DR-DRAIN LEAD CL-CLEAR INSULATION
9.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
10.	TAPE ENDS AND TIE BACK 152468 CABLE IF NECESSARY.
11.	337989 CABLE ASSEMBLY IS REQ'D ONLY WHEN THE LP 134 IS USED WITH THE LAAC 252.

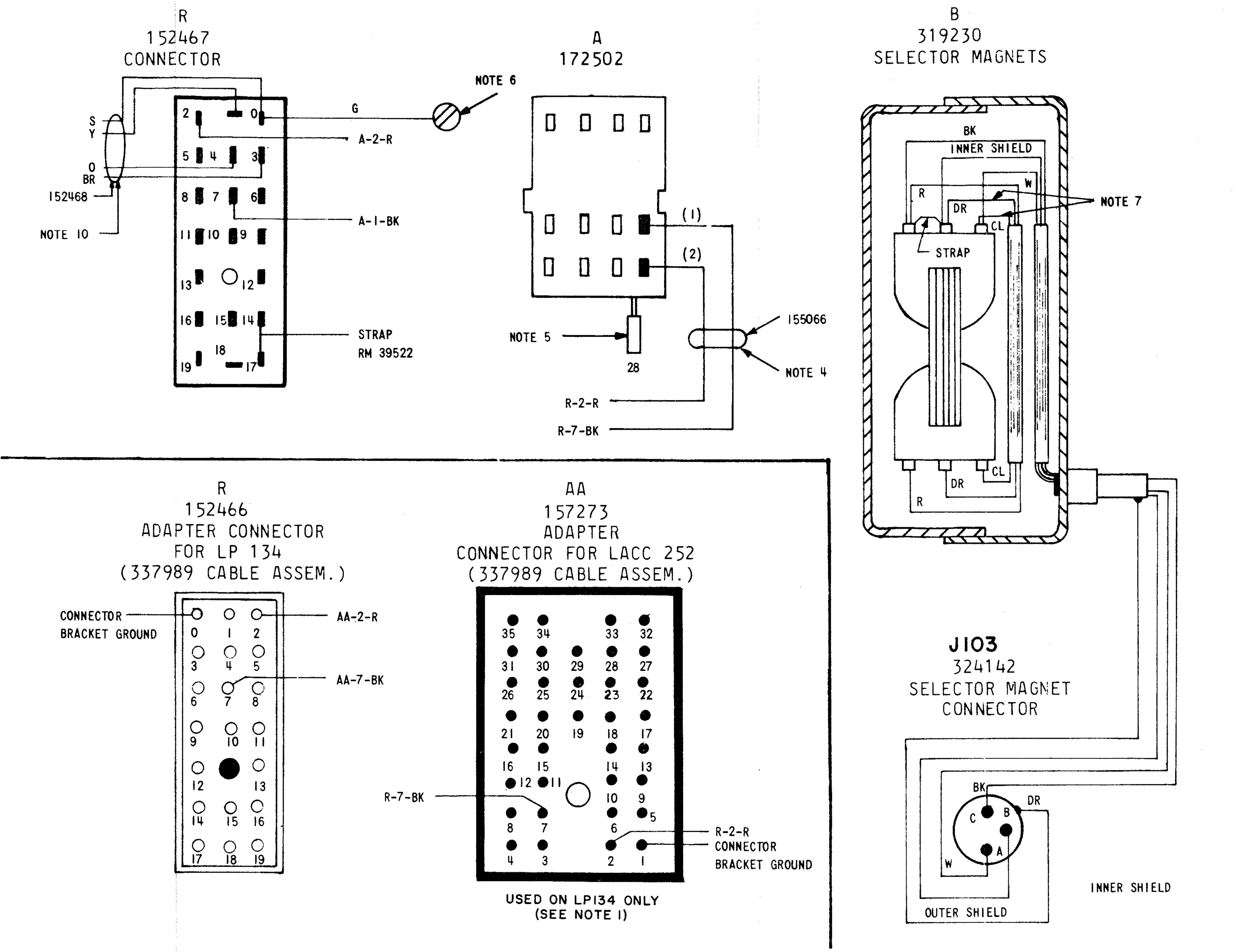


Figure 5-32. LP 134, 138, 149 and 150 Page Printer Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION AA-8-R WIRE COLOR CODE
2.	COLOR CODE: W - WHITE R - RED O - ORANGE BL - BLUE P - PURPLE S - SLATE Y - YELLOW G - GREEN BR - BROWN BK - BLACK
3.	CONNECTORS VIEWED FROM WIRING SIDE.
4.	NORMALLY OPEN CONTACT NORMALLY CLOSED CONTACT
5.	INDICATED SLOT LOCATION.
6.	LEGEND: DR - SHIELD DRAIN CL - CLEAR INSULATION
7.	SELECTOR MAGNET WIRED FOR 60 MA OPERATION.
8.	REFER TO 8331 WD & 8332 WD FOR SCHEMATIC DIAGRAM.
9.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENTS.
10	A UNIT OR STUNT BOX MAY BE EQUIPPED WITH A 173450 CABLE ASSEMBLY. IF PRESENT, TAPE TERMINALS AND TIE BACK CABLE ASSEMBLY.

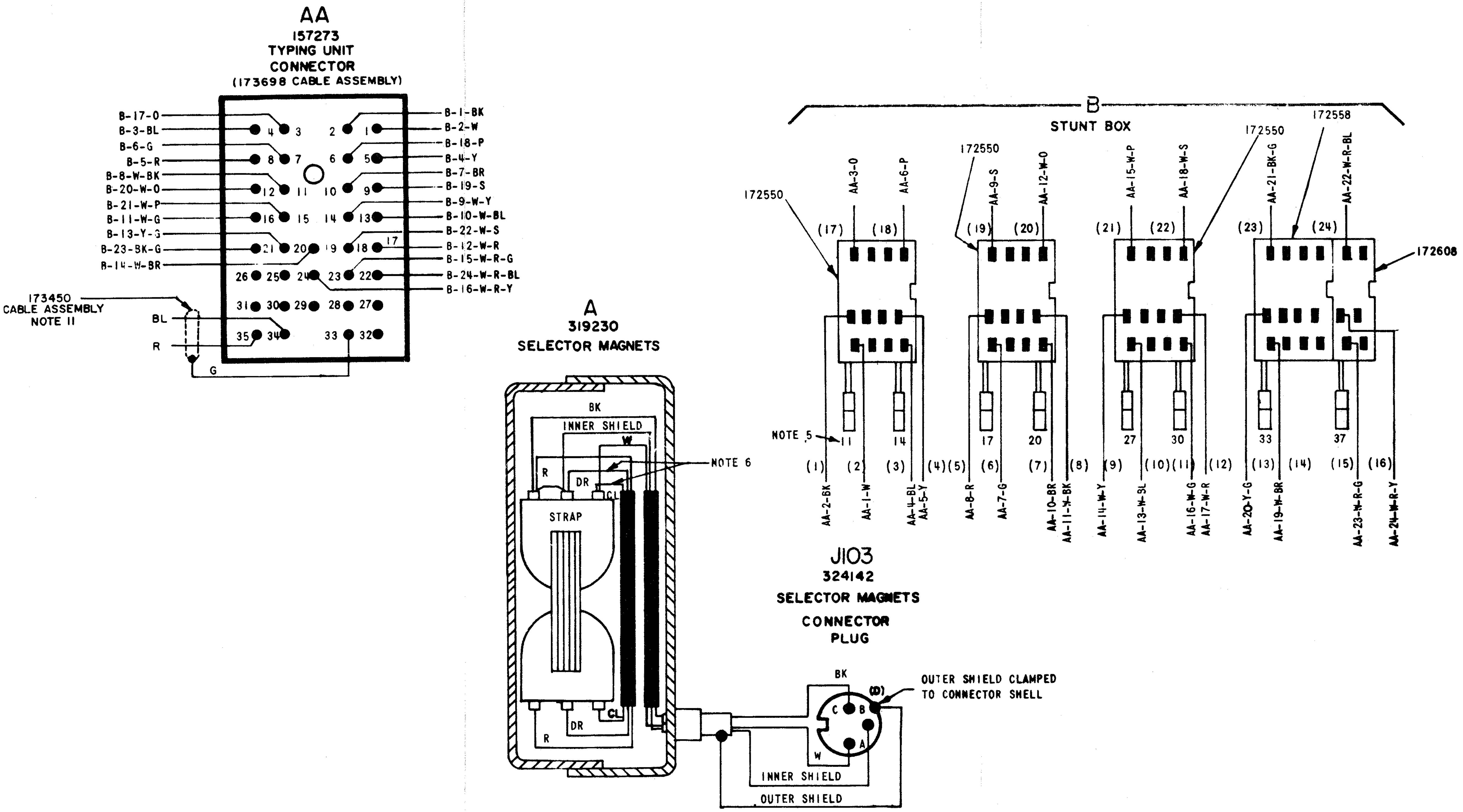


Figure 5-33. LP 135 Stunt Box Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: DISTANT TERMINATING AREA DISTANT TERMINATING DESIGNATION WIRE COLOR CODE AA-2-W
2.	COLOR CODE: BK - BLACK BR - BROWN R - RED O - ORANGE Y - YELLOW G - GREEN BL - BLUE S - SLATE P - PURPLE W - WHITE
3.	ASSOCIATED CABLE ASSEMBLIES: 161886, 173441, 324155, 326396, 312475, 312476,
4.	ALL CONNECTORS VIEWED FROM SOLDER END.
5.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE NOT MARKED ON COMPONENTS.
6.	FOR SCHEMATIC WIRING DIAGRAM SEE 8313WD.
7.	ON LRB60 SPLICE, SOLDER AND TAPE BLACK LEAD FROM DH-2 IN THE 173441 CABLE ASSEMBLY, TO THE BLUE LEAD OF THE 312476 CABLE ASSEMBLY. TAPE AND TIE THE BLACK LEAD THAT RUNS FROM DB1 TO DF1 OF THE 173441 CABLE.
8.	LRB 59 - CONNECT BLACK LEAD DB-1 TO DF-1. LRB60 - CONNECT ORANGE LEAD FROM 312476 TO DB-1

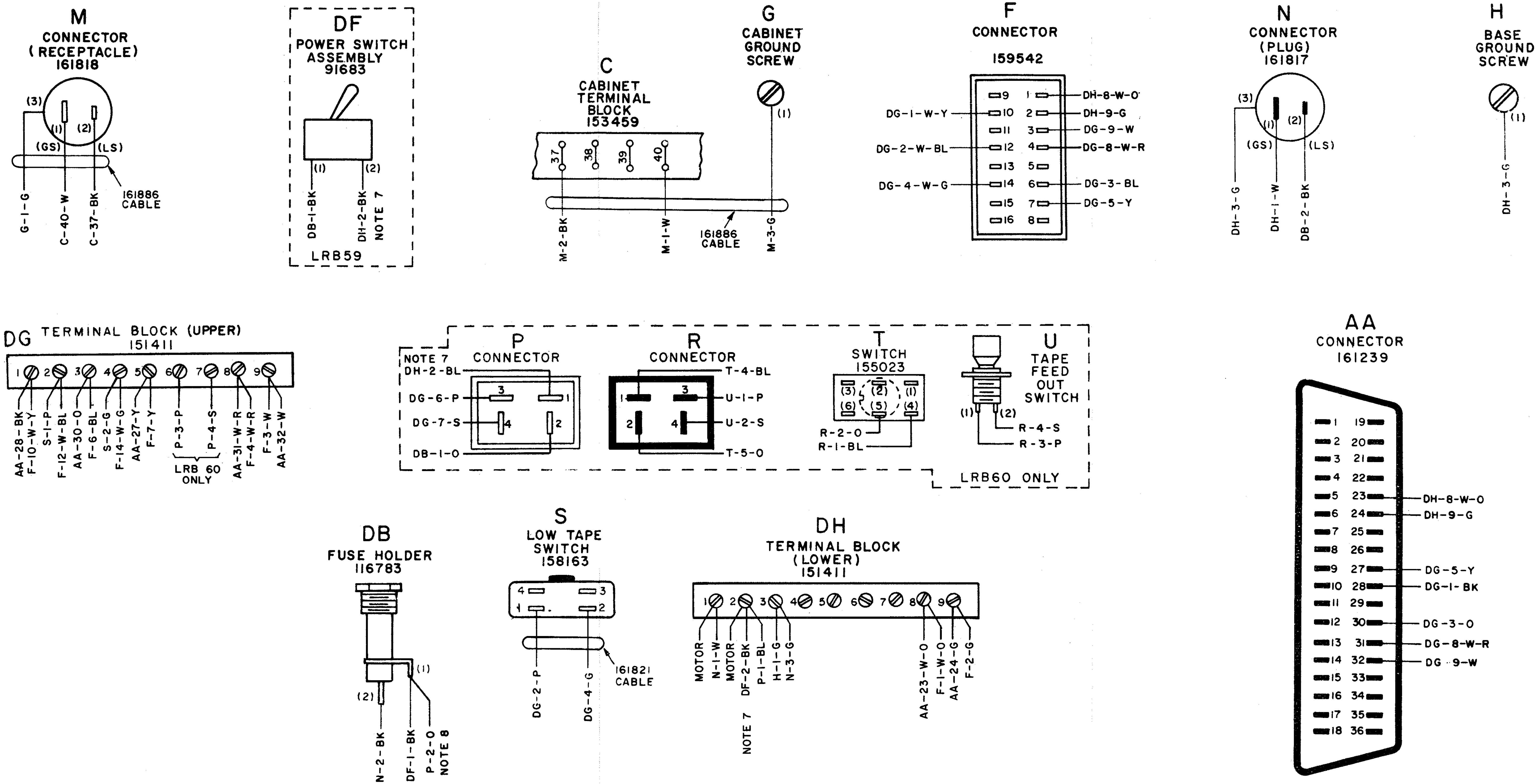


Figure 5-34. LRB 59 and 60 Reperforator Base Wiring Diagram

NOTES:	
1.	WIRING LEGEND: A - 1 - W DISTANT TERMINATING AREA (A) DISTANT TERMINAL DESIGNATION (1) WIRING COLOR CODE (W)
2.	COLOR CODE: BK-BLACK W-BK-WHITE-BLACK BR-BROWN W-BR-WHITE-BROWN R-RED W-R — WHITE-RED O-ORANGE W-O — WHITE-ORANGE Y-YELLOW W-Y — WHITE-YELLOW G-GREEN W-G — WHITE-GREEN BL-BLUE W-BL- WHITE-BLUE P-PURPLE W-P — WHITE-PURPLE S-SLATE W-S — WHITE-SLATE W-WHITE
3.	CONNECTORS VIEWED FROM SOLDER TERMINAL ENDS
4.	ALL CONTACTS SHOWN IN UNOPERATED POSITION.
5.	ASSOCIATED CABLES: 324681 CABLE ASSEMBLY TRANS.-DIST.
6.	THE NUMBERS ENCLOSED BY PARENTHESES ARE USED FOR REFERENCE AND ARE NOT MARKED ON THE PARTS.
7	STRAP WITH 22GAUGE WIRE AS INDICATED.
8.	FOR SCHEMATIC WIRING REFER TO 8313 WD WIRING DIAGRAM.

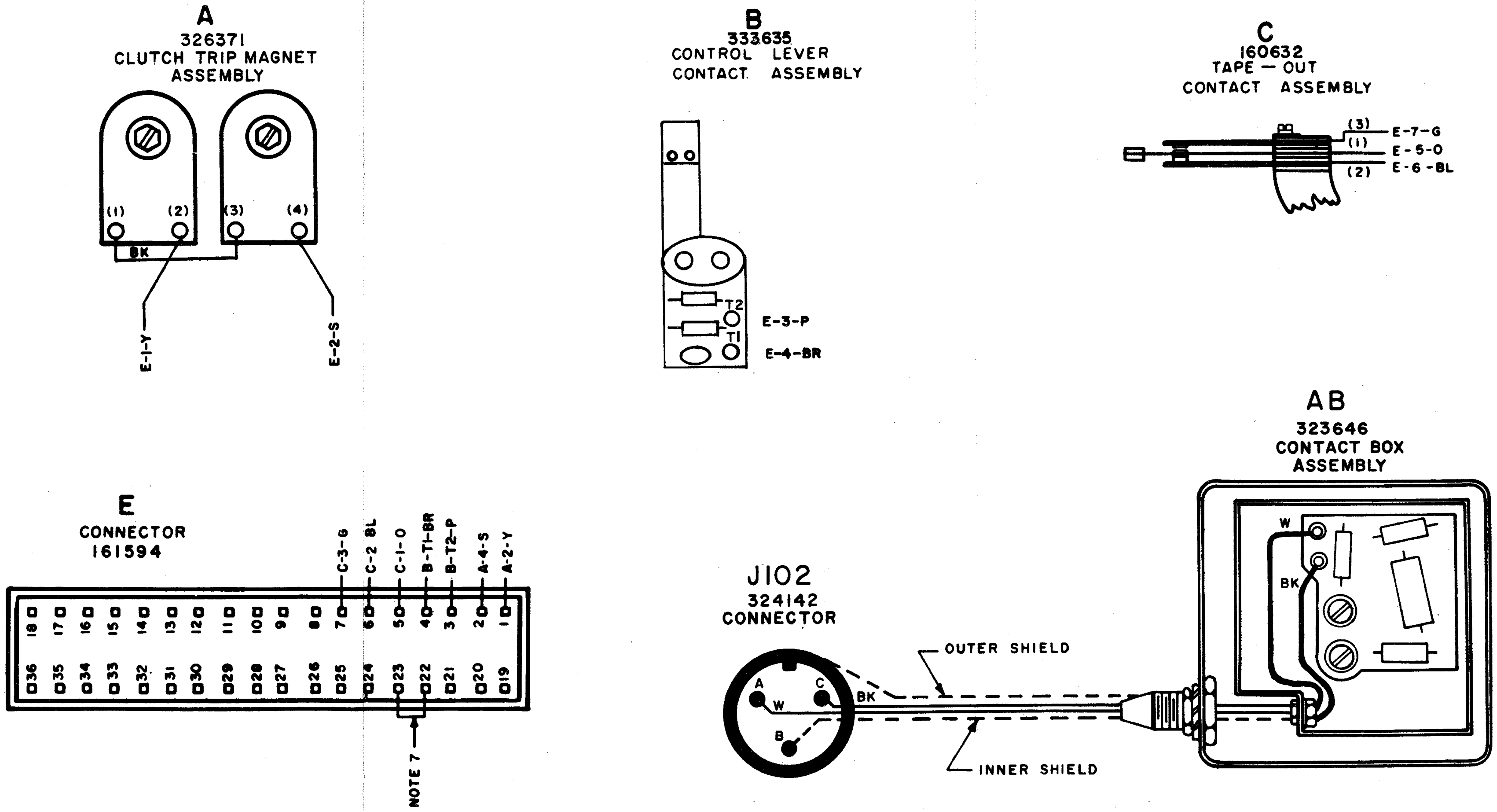


Figure 5-35. LXD 37 and 38 Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND DISTANT TERMINAL AREA DISTANT TERMINAL DESIGNATION A-1 W WIRE COLOR
2.	COLOR CODE: BK BLACK BR BROWN Y YELLOW S SLATE P PURPLE O ORANGE BL BLUE W WHITE
3.	CONNECTIONS VIEWED FROM SOLDER TERMINAL ENDS.
4.	ASSOCIATED CABLE 324682
5.	ASSOCIATED SCHEMATIC WIRING DIAGRAM 8313 WD.
6.	STRAP WITH 22 GAUGE WIRE AS INDICATED.
7.	DR INDICATES DRAIN WIRE
8.	INDICATES SINGLE SHIELDING
9.	GROUND STRAP 117366 OF LCXB SHOULD BE SECURED TO RIGHT REAR MTG. STUD OF LAAC RAIL (SEE SPEC. 5941S).

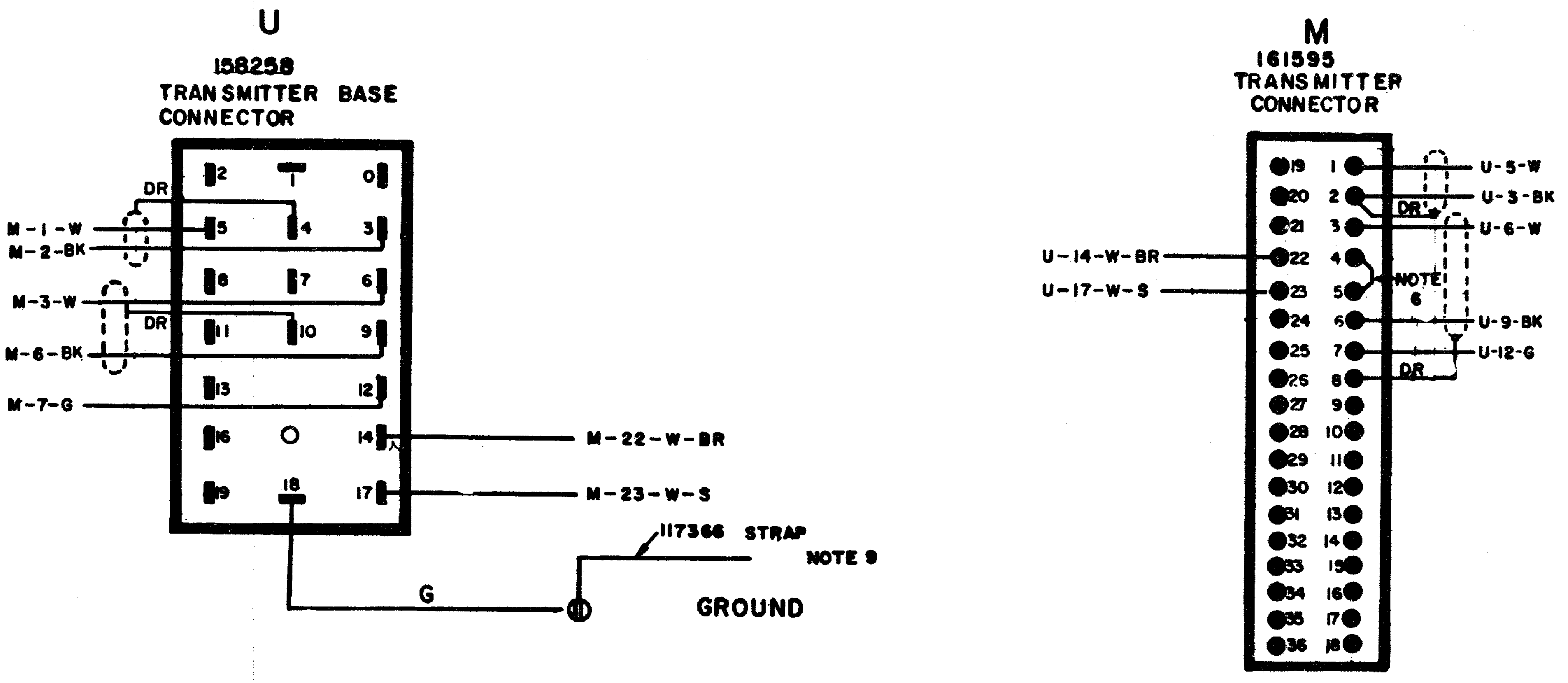


Figure 5-36. LCXB 24 Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND DISTANT TERMINATING AREA DISTANT TERMINATING DESIG. WIRE COLOR CODE A-I-BK
2.	WIRE COLOR CODE BK-BLACK G-GREEN BR-BROWN BL-BLUE R-RED W-WHITE O-ORANGE S-SLATE Y-YELLOW P-PURPLE
3.	INDICATES SHIELDED CABLE
4.	ALL WIRE 24AWG. UNLESS OTHERWISE SPECIFIED.
5.	ASSOCIATED CABLE ASSEMBLY 333632
6.	FOR SCHEMATIC WIRING REFER TO 8910 WD. OR 8913 WD

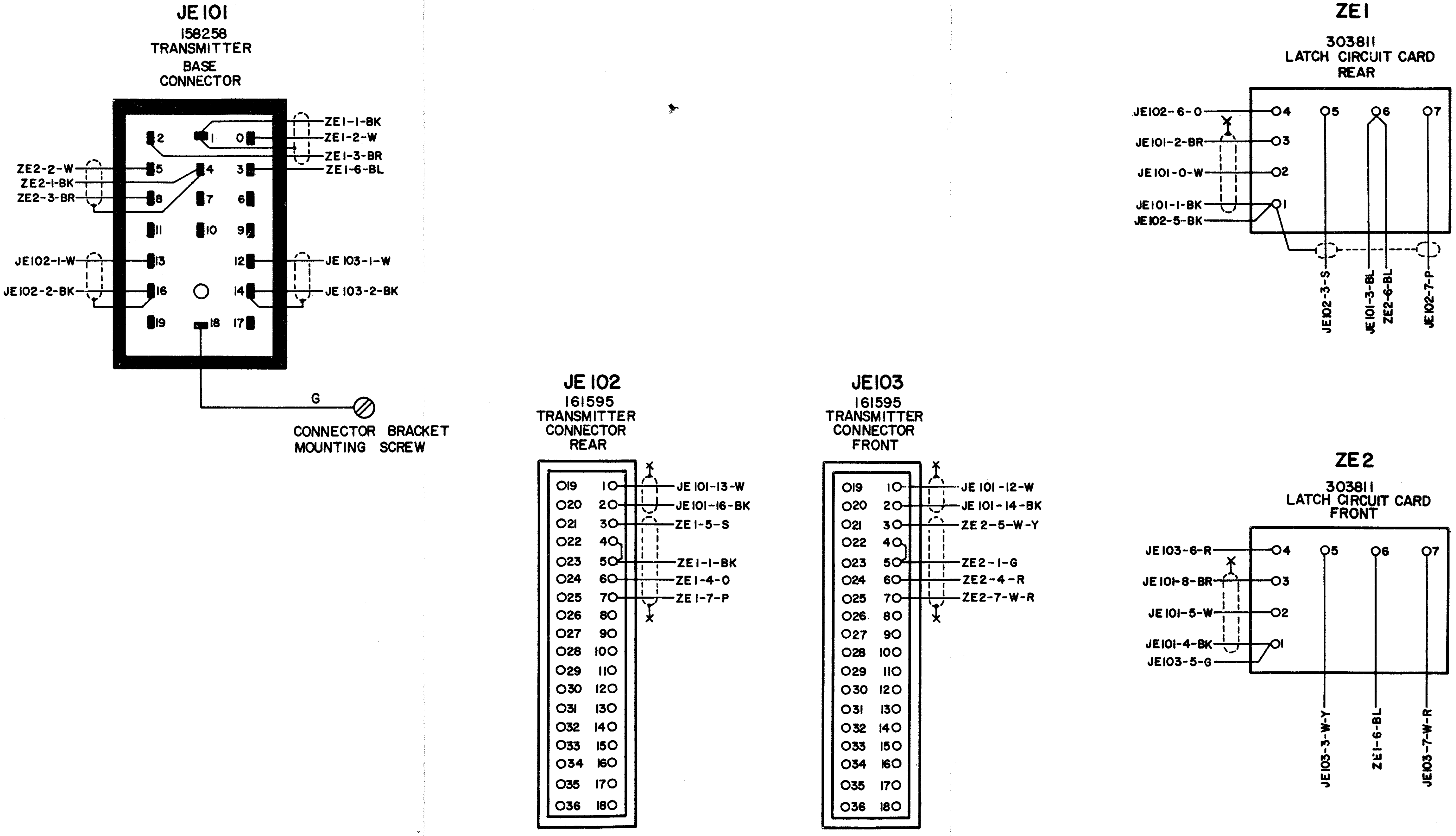


Figure 5-37. LCXB 27 Dual Transmitter Distributor Base Wiring Diagram

NO.	NOTES
1.	WIRING LEGEND: A-1-BK: A = DISTANT TERMINATING AREA; 1 = DISTANT TERMINATING DESIGNATION; BK = WIRE COLOR CODE
2.	COLOR CODE: BK - BLACK BL - BLUE BR - BROWN Y - YELLOW W - WHITE O - ORANGE R - RED P - PURPLE S - SLATE G - GREEN
3.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
4.	FUSE NUMBER: 161136 6 1/4 AMP SLOW-BLOWING
5	REFER TO 8313 WD FOR SCHEMATIC WIRING DIAGRAM.
6.	REFERENCE SPEC FOR TELETYPE CORPORATION EMPLOYEES ONLY. 61397S
7.	305143 ASSEMBLY IS STRAPPED BETWEEN TERMINALS 3 AND 4. REMOVE STRAP FOR THIS APPLICATION.
8.	ASSOCIATED CABLE ASSEMBLY 324685

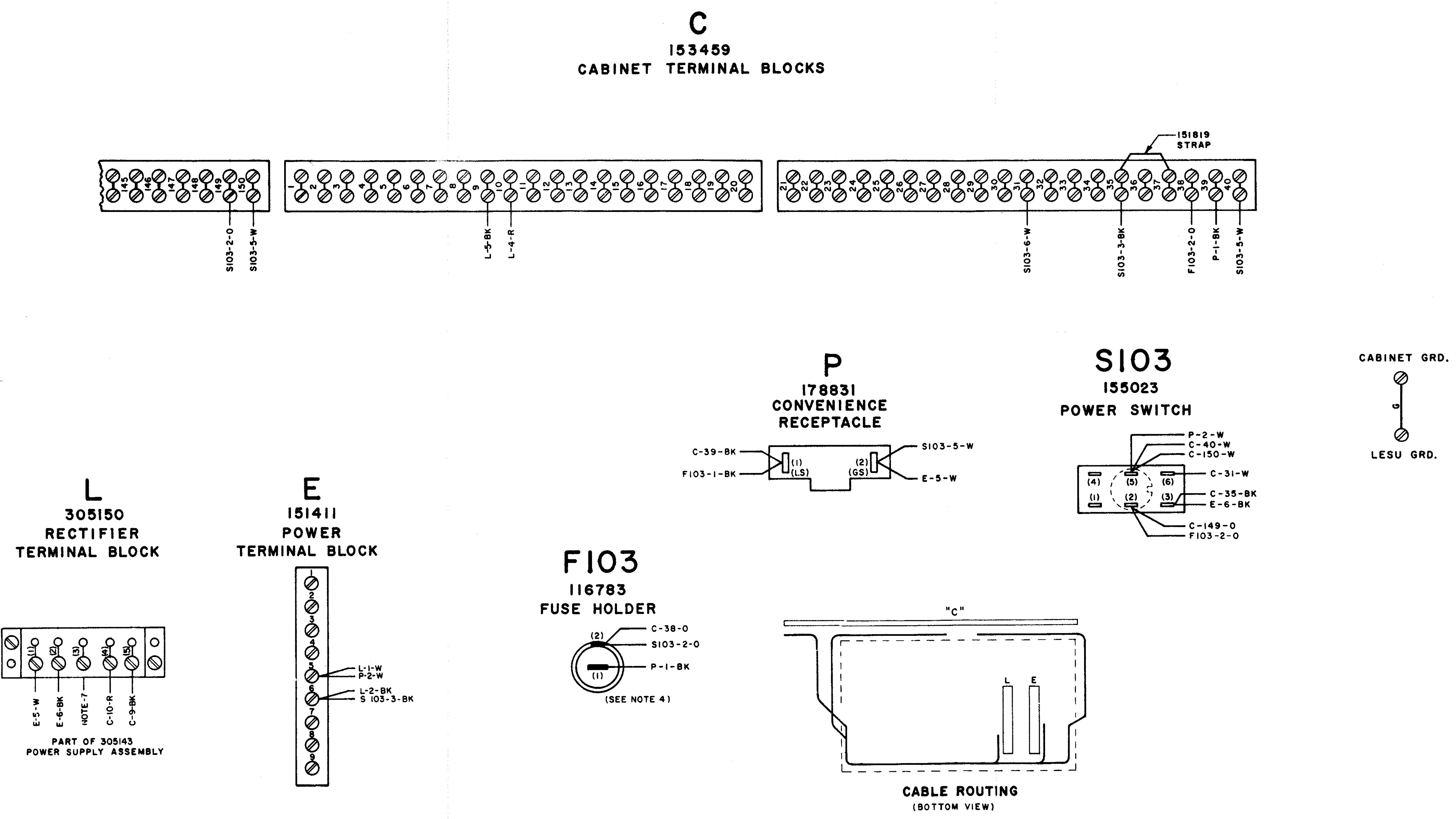


Figure 5-38. LESU 123 Electrical Service Unit Wiring Diagram

NO.	NOTES
1.	ALL SURFACE WIRING 24 AWG SOLID GREEN 31784PL UNLESS OTHERWISE SPECIFIED.
2.	WIRING CODE — PART OF 328011 ASSEMBLY — PART OF 328025 ASSEMBLY — PART OF 328024 ASSEMBLY — 20 AWG SOLID BARE
3.	TIE POWER SUPPLY COMMON TO CHASSIS AT CONNECTOR WITH STRAP.
4.	ALL VOLTAGES DC UNLESS OTHERWISE SPECIFIED.
5.	REFER TO 8580WD FOR SCHEMATIC WIRING DIAGRAM.
6.	COLOR CODE BK – BLACK G – GREEN BR – BROWN O – ORANGE BL – BLUE P – PURPLE R – RED Y – YELLOW S – SLATE W – WHITE
7.	C1 THRU C7 0.01 MFD CAPACITOR, 319999. PART OF CABLE ASSEMBLY 328025.
8.	ALL SOLID GREEN SURFACE WIRING SHALL TAKE THE SHORTEST ROUTE BETWEEN CONNECTOR TERMINALS.
9.	REFERENCE SPECIFICATION FOR TELETYPE CORPORATION EMPLOYEES ONLY: 61,527S.
10.	L1, 22 uH CHOC
10.	L1, 22 uH CHOKE, 329078. PLACE 60391 RM TUBING ON BOTH LEADS AND MOUNT L1 UNDER XZ4 ON TERMS. 16 & 23.
11.	18 GA. GREEN 2-1/4" MAX. WITH 72711RM TERMINAL.

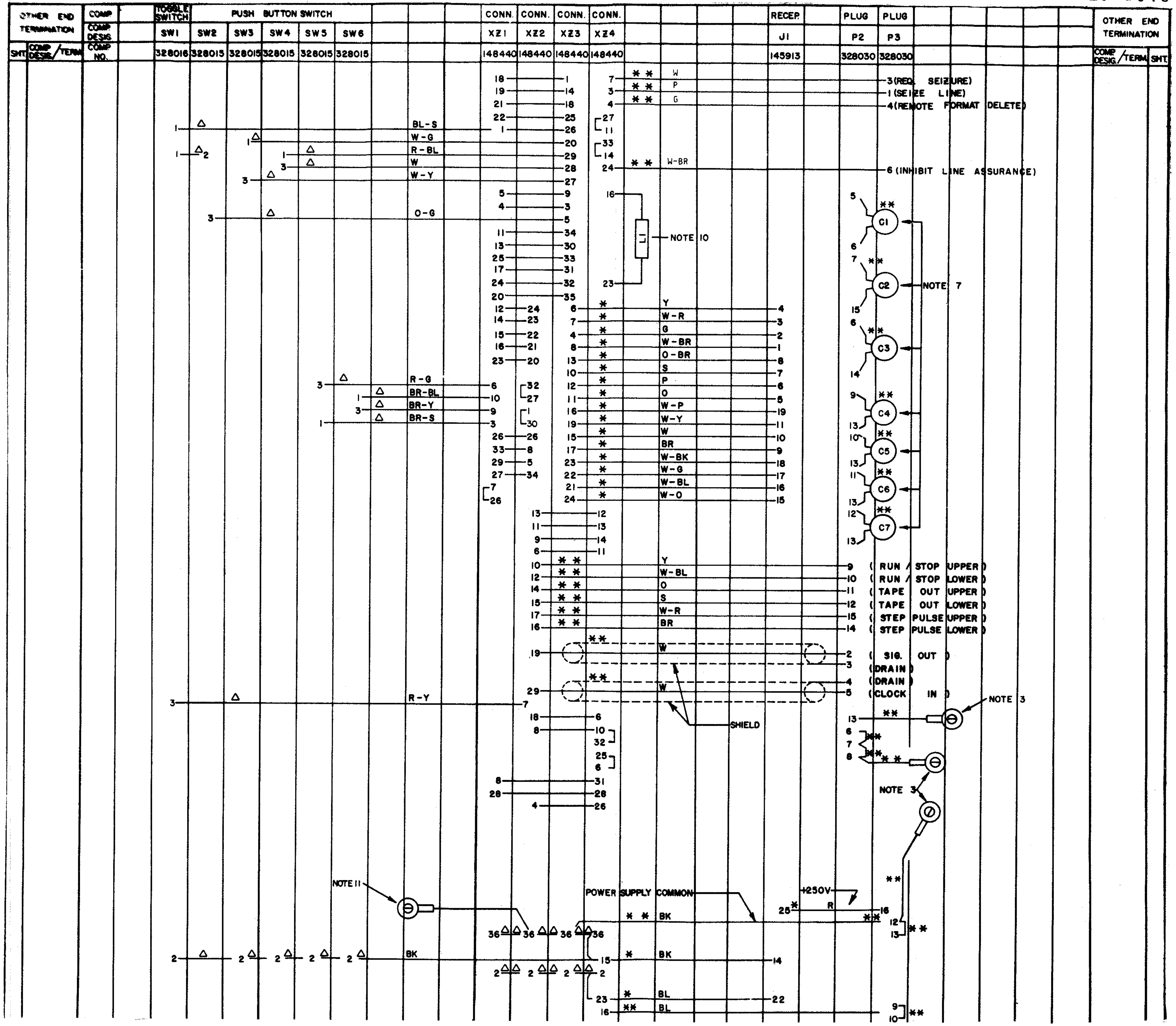


Figure 5-39. 328010 and 328000 Electronic Message Numbering Module Wiring Diagram (Sheet 1 of 2)

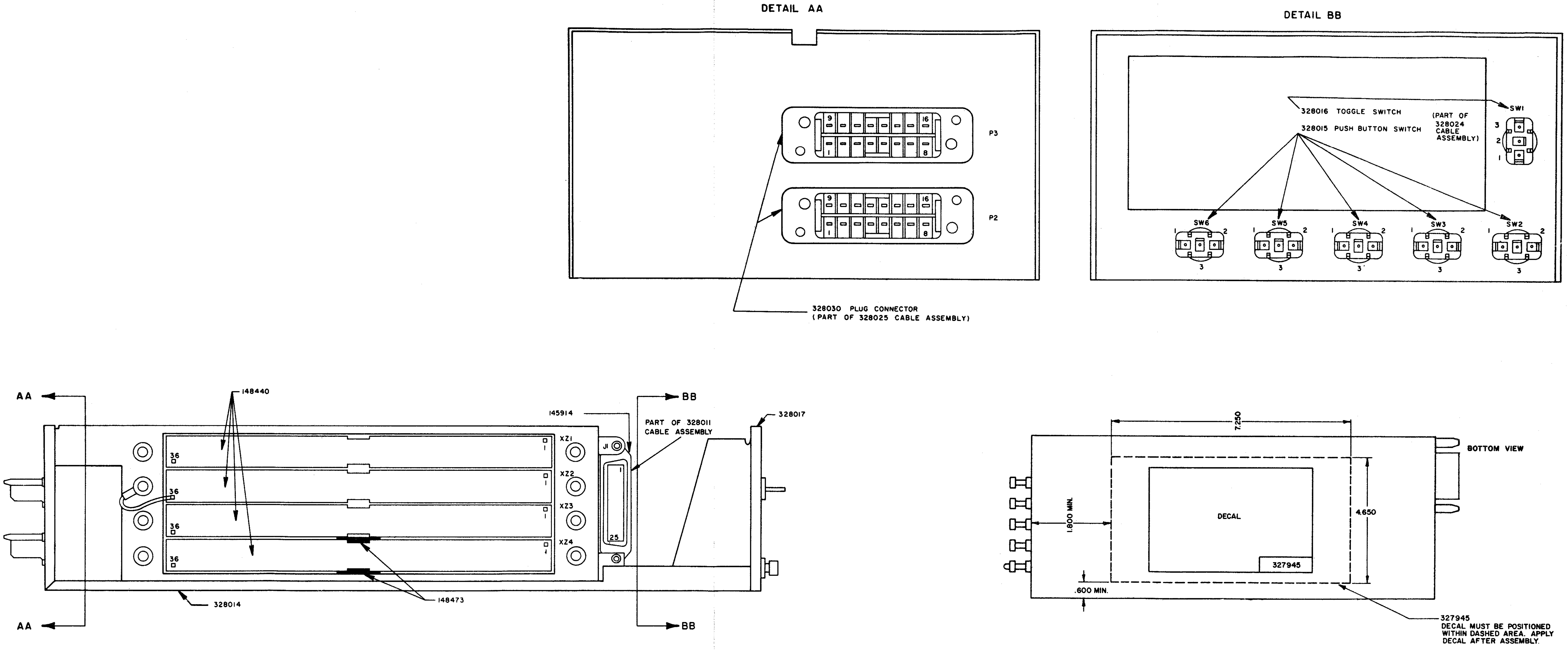


Figure 5-39. 328010 and 328000 Electronic Message Numbering Module Wiring Diagram (Sheet 2 of 2)

NO.	NOTES
1.	ALL VOLTAGES DC, UNLESS OTHERWISE SPECIFIED.
2.	◌ INDICATES SHIELDED WIRE.
3.	≻— INDICATES FEMALE AND → INDICATES MALE TERMINALS.
4.	▽ INDICATES POWER SUPPLY COMMON.
5.	FOR ACTUAL WIRING REFER TO 6579WD
6.	CIRCUIT CARD 322025 IS USED ONLY WITH THE 328000 ELECTRONIC MESSAGE NUMBERING MODULE TO PROVIDE LINE SEIZURE AND TANDEM DELAY LOGIC.
7.	CIRCUIT CARD 322080 IS USED TO PROVIDE A PLUG IN LINE ASSURANCE FEATURE NOT INCLUDED WITH 328000 OR 328010.
8.	REFERENCE SPECIFICATION FOR TELETYPE CORPORATION EMPLOYEES ONLY 61,527S

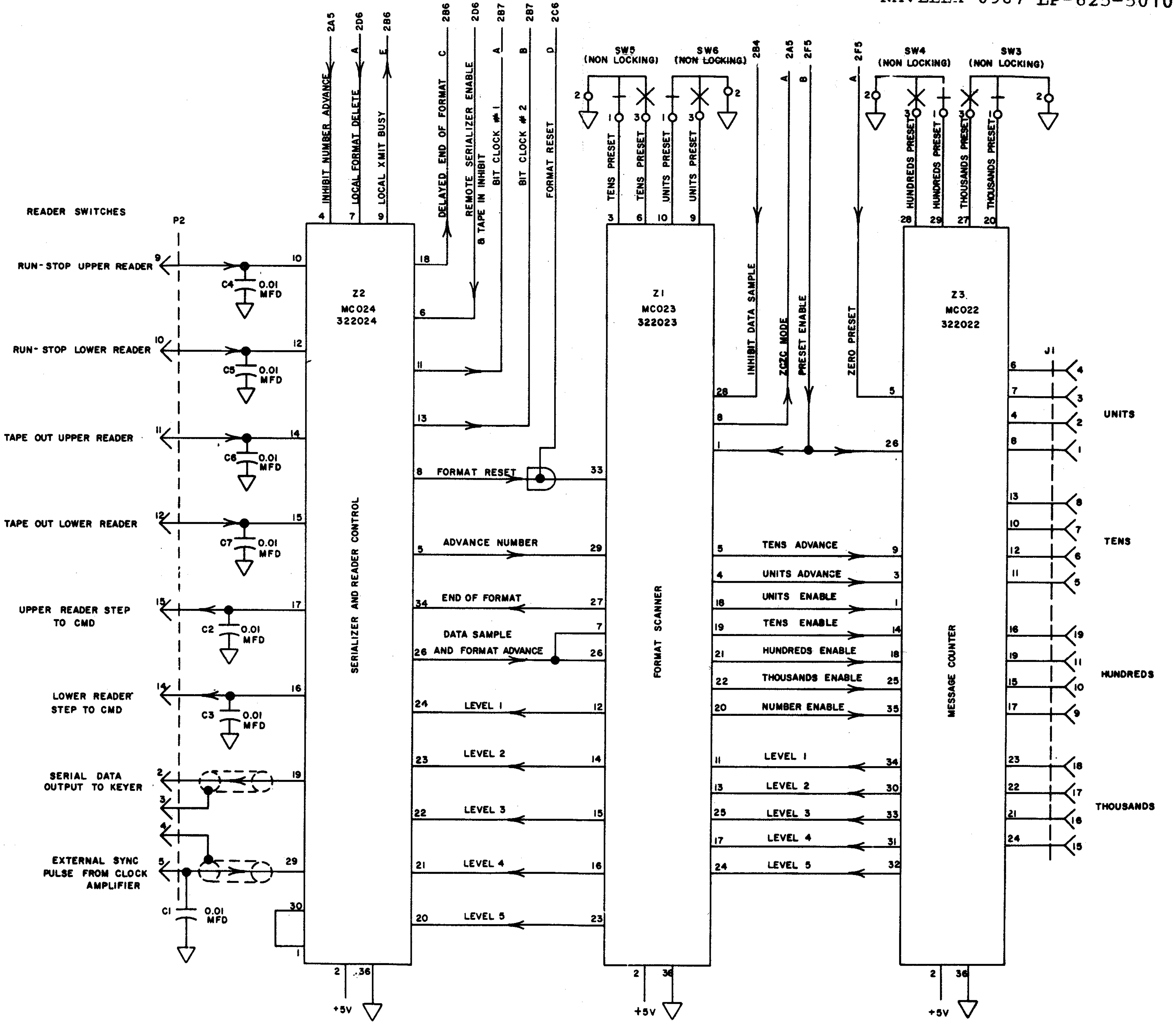


Figure 5-40. 328010 and 328000 Electronic Message Numbering Module Schematic Wiring Diagram (Sheet 1 of 2)

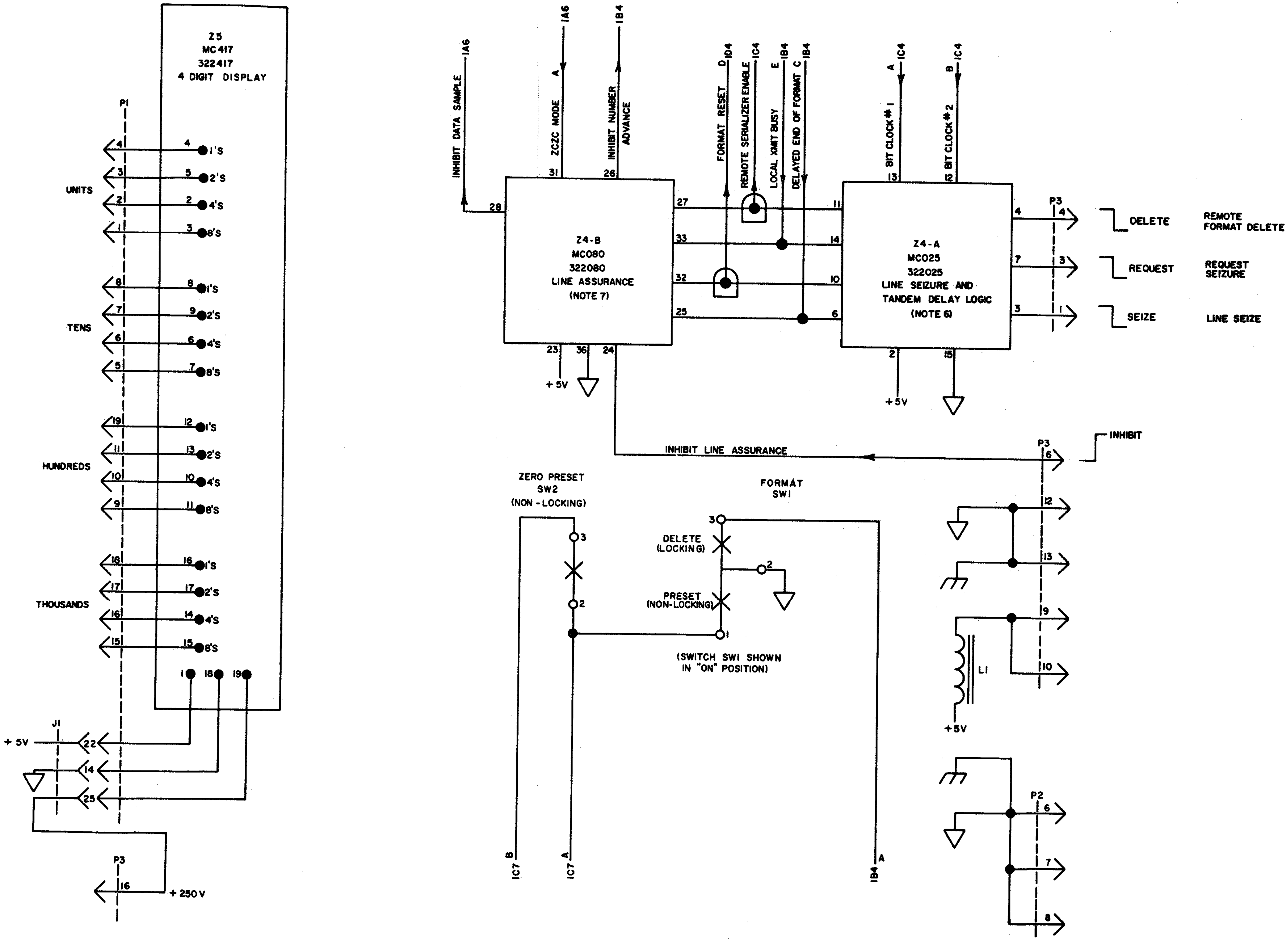


Figure 5-40. 328010 and 328000 Electronic Message Numbering Module Schematic Wiring Diagram (Sheet 2 of 2)

NO.	NOTES
1	ALL RESISTORS 1/2 WATT, RESISTANCE VALUES IN OHMS, CAPACITANCE VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
3	SL-BL INDICATES SLOW BLOWING
4	≻—— INDICATES FEMALE TERMINAL ——→ INDICATES MALE TERMINAL
5.	REFERENCE SPEC FOR TELETYPE CORPORATION EMPLOYEES ONLY: 61,267S
6	T1 SECONDARY 50V AC TO CENTER TAP WITH 115V AC INPUT; 8 OHMS (MAX) PRIMARY RESISTANCE; 10 OHMS (MAX) SECONDARY RESISTANCE TO CENTER TAP)
7	▽ INDICATES CIRCUIT COMMON.
8	
9	REFER TO 8322WD FOR ACTUAL WIRING DIAGRAM.
10	REFER TO RELATED SET DIAGRAMS FOR EXTERNAL CIRCUITS
11	INDICATES SINGLE SHIELDING INDICATES DOUBLE SHIELDING
12	TERMINAL TC-5 IS AN AUXILIARY KEYER OUTPUT TERMINAL TC-6, AN AUXILIARY SELECTOR MAGNET DRIVER INPUT AS SHIPPED. THESE TERMINALS ARE STRAPPED SO THE PAGE PRINTER WILL MONITOR ALL TRANSMISSIONS FROM THE KEYER
13	TERMINAL TD-5 AND TD-6 PROVIDE AUXILIARY INPUTS TO EACH OF THE TWO KEYERS CARDS AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THAT BOTH THE LXD AND LAK CAN USE A SINGLE KEYER CARD FOR NON-SIMULTANEOUS OPERATION WITH THIS ARRANGEMENT DO NOT PUT A 303142 KEYER CARD IN KB CONNECTOR.
14.	KEYER OUTPUTS + 6V MARK − 6V SPACE
15.	— — — — — INDICATES INNER SHIELD ——— ——— INDICATES OUTER SHIELD
16.	IF EXTERNAL BATTERY IS SUPPLIED FOR POLAR LINE KEYER, REMOVE STRAPS BETWEEN TD-1, TD-2 AND TD-3, TD-4. APPLY + BATTERY (6.6 TO 7.8V) TO TD-2, AND − BATTERY (6.6 TO 7.8V) TO TD-4. IF ±6V IS SUPPLIED, THE KEYER OUTPUT WILL DROP TO ±4.5V.

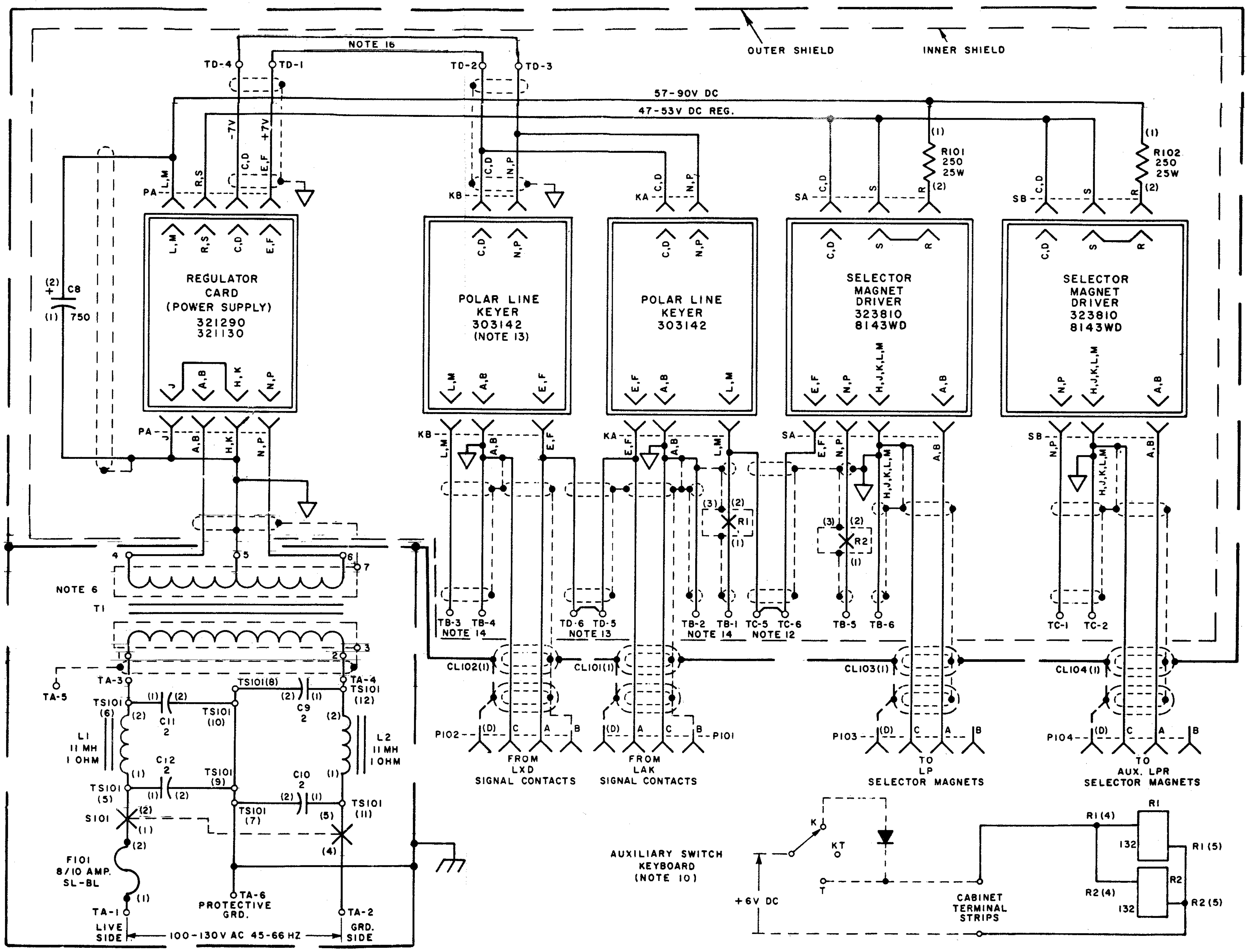
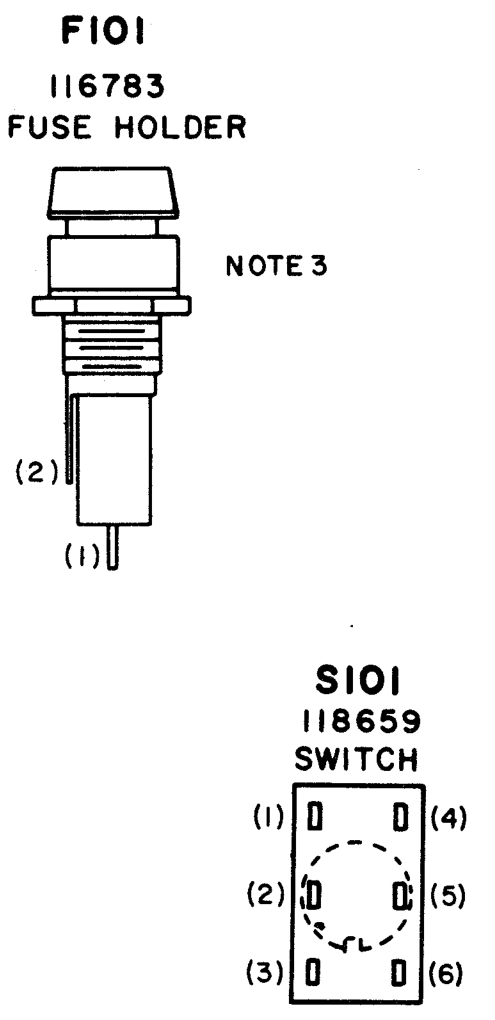


Figure 5-41. 323811 Electrical Service Assembly (Signal) Schematic Wiring Diagram

NO.	NOTES
1.	ALL VOLTAGES DC UNLESS OTHERWISE SPECIFIED.
2.	TERMINAL DESIGNATION ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
3.	FUSE NUMBER 162360 8/10 AMP SLOW BLOWING.
4.	TERMINAL NUMBERS APPEAR ON ASSOCIATED MARKING STRIP.
5.	✱ INDICATES TO TAPE END TERMINATING POINT.
6.	INDICATES SINGLE SHIELDING
7.	INDICATES DOUBLE SHIELDING
8.	ALL STRAPPING WIRE 24 AWG BARE, 39603RM. USE SLEEVING WHERE REQUIRED. ① INDICATES 18 AWG STRANDED WIRE. ② INDICATES 24 AWG STRANDED WIRE. ③ INDICATES 24 AWG 2 LEAD SINGLE SHIELDED CABLE. ALL SURFACE WIRE 24 AWG GREEN, 31784RM UNLESS OTHERWISE SPECIFIED.
9.	REFER TO 8141WD FOR SCHEMATIC WIRING DIAGRAM.
10.	COLOR CODE: BK-BLACK P-PURPLE BL-BLUE R-RED BR-BROWN S-SLATE G-GREEN W-WHITE O-ORANGE Y-YELLOW
11	TERMINAL TC-5 IS AN AUXILIARY KEYER OUTPUT. TERMINAL TC-6, AN AUXILIARY SELECTOR MAGNET DRIVER INPUT. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THE PAGE PRINTER WILL MONITOR ALL TRANSMISSIONS FROM THE KEYER.
	NOTES CONTINUED ON SHEET 2



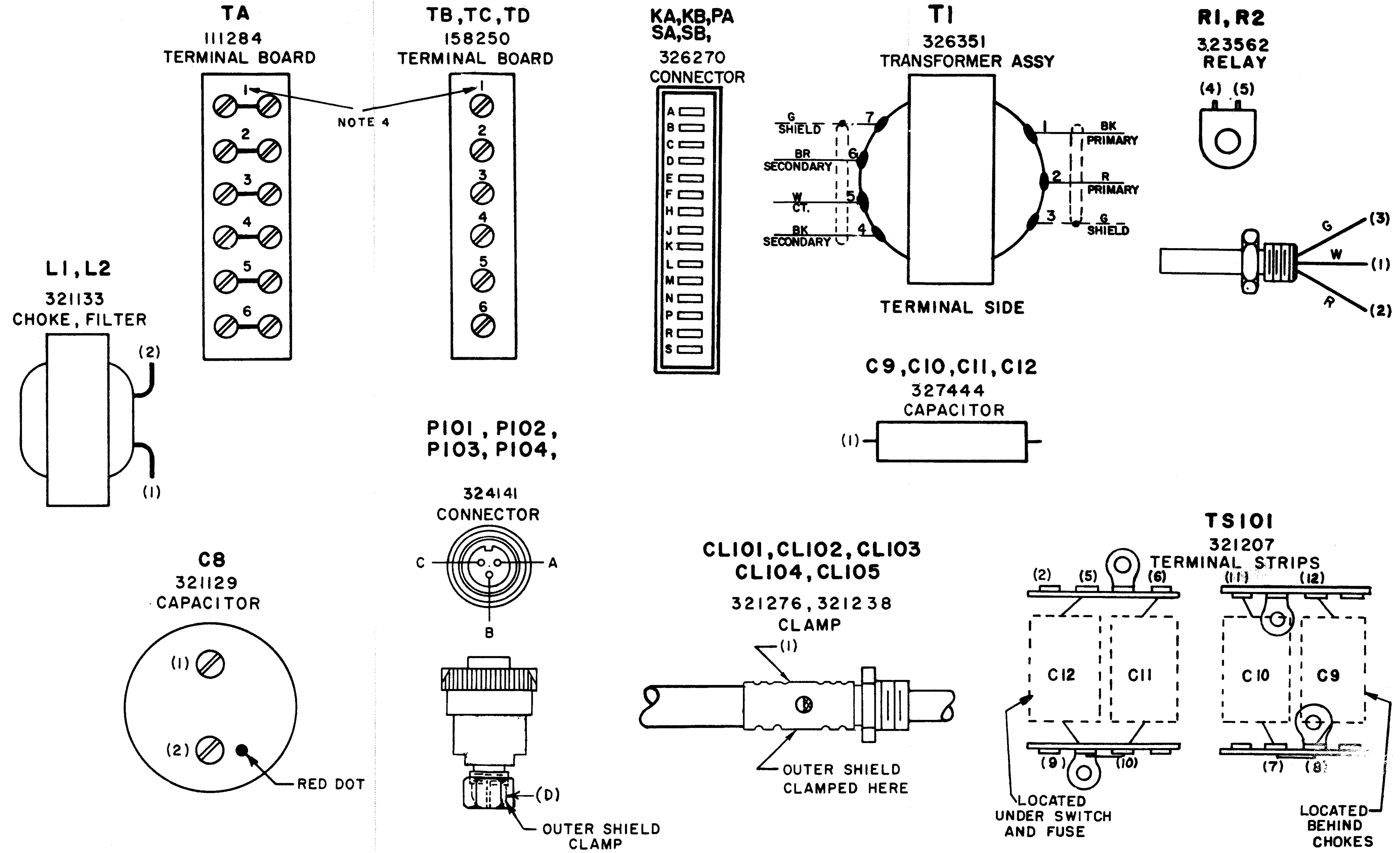
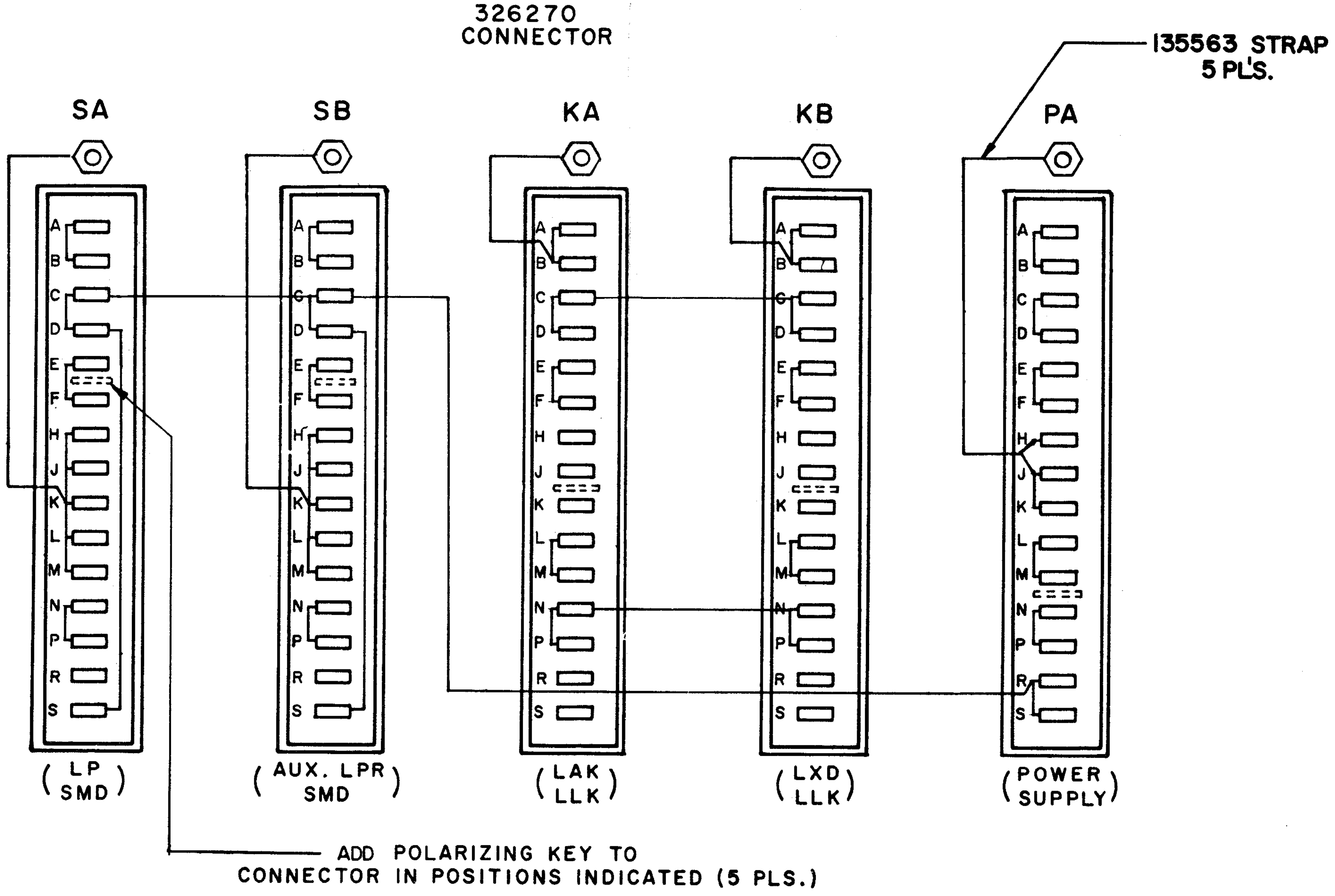
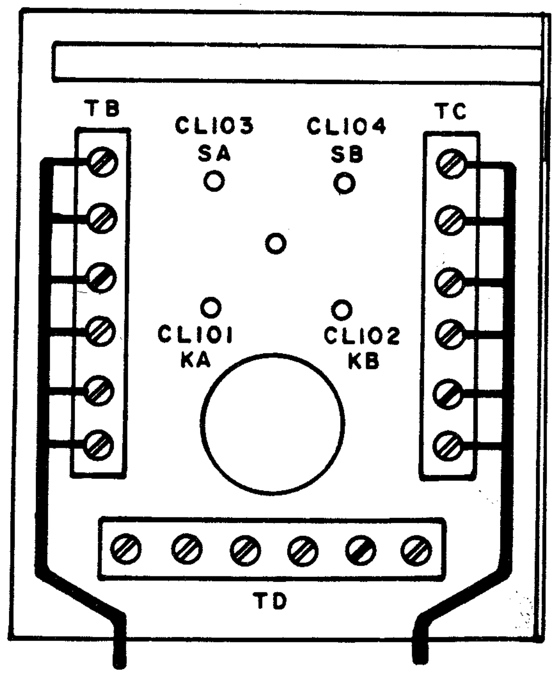


Figure 5-42. 323811 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 1 of 5)

NO.	NOTES
12.	IF EXTERNAL BATTERY IS SUPPLIED FOR POLAR LINE KEYER, REMOVE STRAPS BETWEEN TD 1, TD 2 & TD 3, TD 4. APPLY+ BATTERY (6.6 TO 7.80V) TO TD 2 AND— BATTERY (6.6 TO 7.80V) TO TD 4. IF ± 6V IS SUPPLIED, KEYER OUTPUT WILL DROP TO ± 4.5V.
13.	TERMINAL TD 5 & TD 6 PROVIDE AUXILIRY INPUTS TO EACH OF THE TWO KEYER CARDS. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THAT BOTH THE LXD & LAK CAN USE A SINGELE KEYER CARD FOR NONSIMULTANEOUS OPERATION. WITH THIS ARRANGEMENT DO NOT PUT A303142 KEYER IN KB CARD CONNECTOR
14.	REFER TO RELATED SET DIAGRAMS FOR EXTERNAL CIRCUITRY.





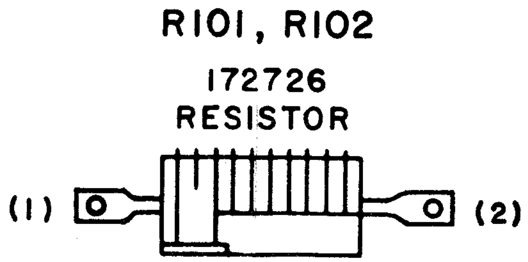


Figure 5-42. 323811 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 2 of 5)

NO.	NOTES
1	REFER TO SHEET 1 AND 2 FOR NOTES.

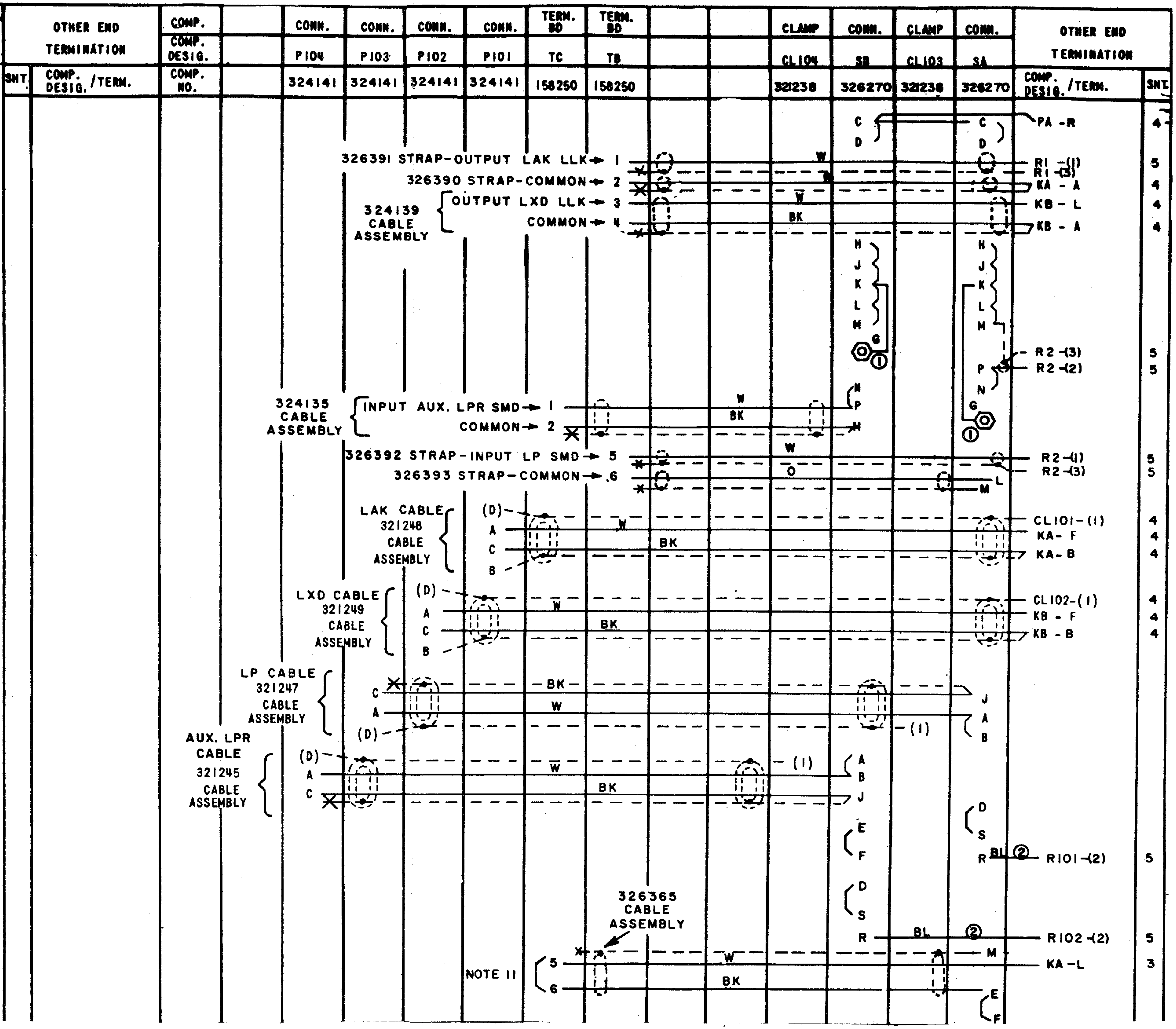


Figure 5-42. 323811 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 3 of 5)

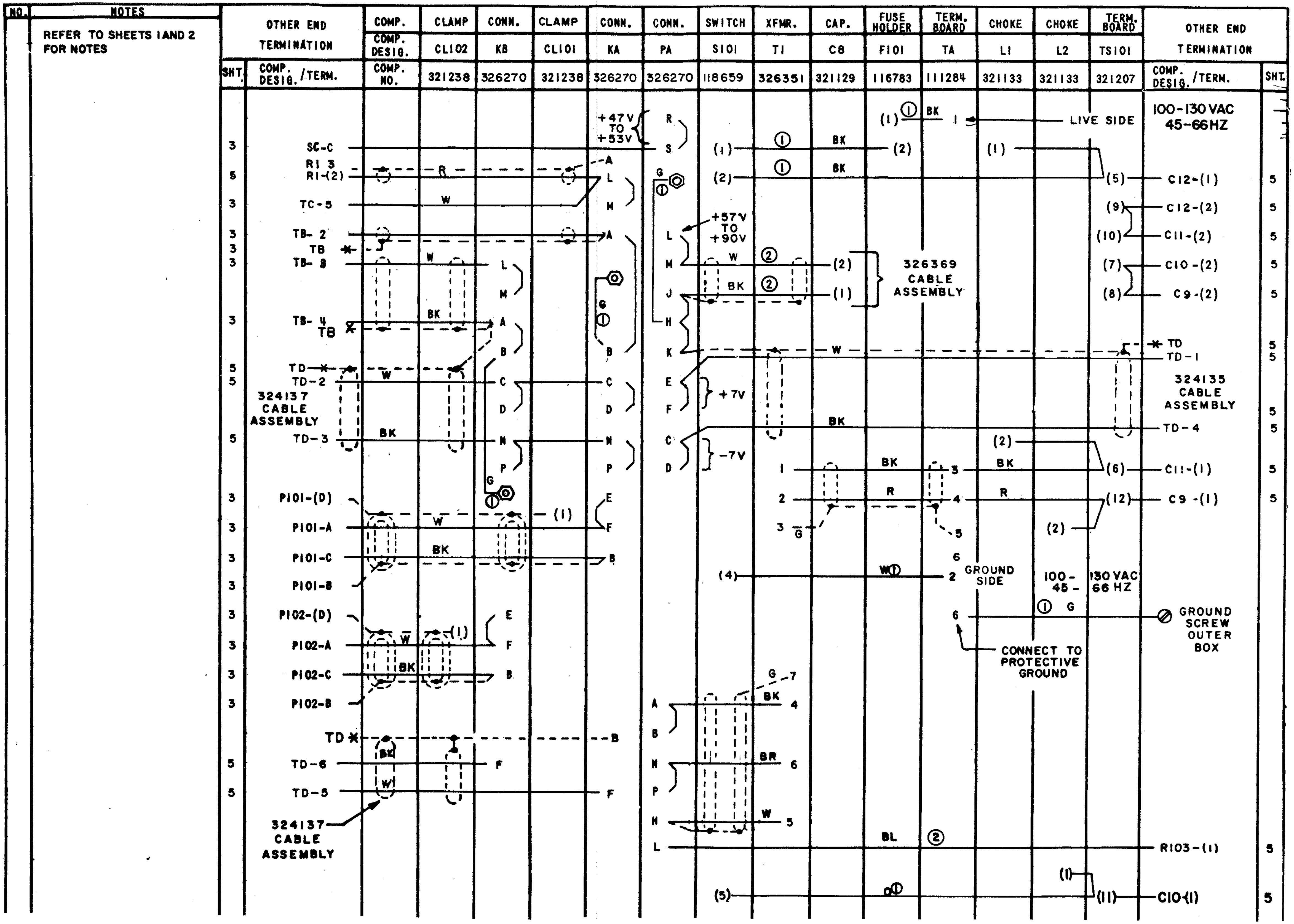


Figure 5-42. 323811 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 4 of 5)

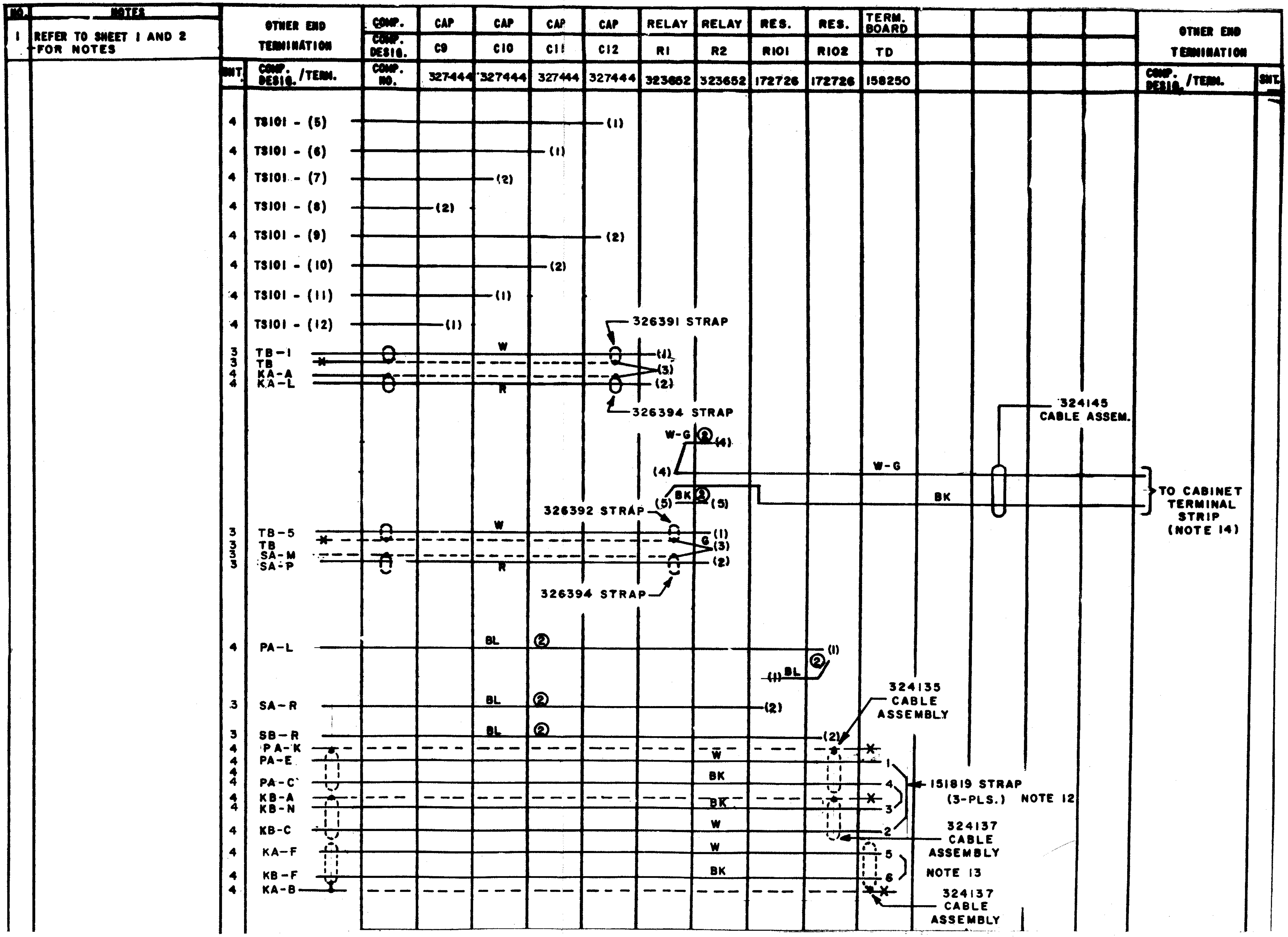


Figure 5-42. 323811 Electrical Service Assembly (Signal), Wiring Diagram (Sheet 5 of 5)

NO.	NOTES
1.	ALL RESISTORS 1/2 WATT. RESISTANCE VALUES IN OHMS. CAPACITANCE VALUES IN MICROFARDS UNLESS OTHERWISE SPECIFIED.
2.	≻—— INDICATES FEMALE TERMINAL ——> INDICATES MALE TERMINAL
3.	▽ INDICATES CIRCUIT COMMON
4.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
5.	SL-BL INDICATES SLOW-BLOWING.
6.	REFER TO 8316WD FOR ACTUAL WIRING DIAGRAM.
7.	REFERENCE SPEC. FOR TELETYPE CORPORATION EMPLOYEES ONLY: 61,267S
8.	INDICATES SINGLE SHIELDING INDICATES DOUBLE SHIELDING
9.	T1 SECONDARY 50V AC TO CENTER TAP WITH 115V AC INPUT. 8 OHMS (MAX.) PRIMARY RESISTANCE 10 OHMS (MAX.) SECONDARY RESISTANCE TO CENTER TAP.
10.	REFER TO RELATED SET DIAGRAMS FOR EXTERNAL CIRCUITS.
11.	ALL VOLTAGES GIVEN WITH RESPECT TO CIRCUIT COMMON.
12	+6 VOLT INPUT CLUTCH MAGNETS ENERGIZED -6 VOLT INPUT (OR OPEN LINE) CLUTCH MAGNETS DE-ENERGIZED.

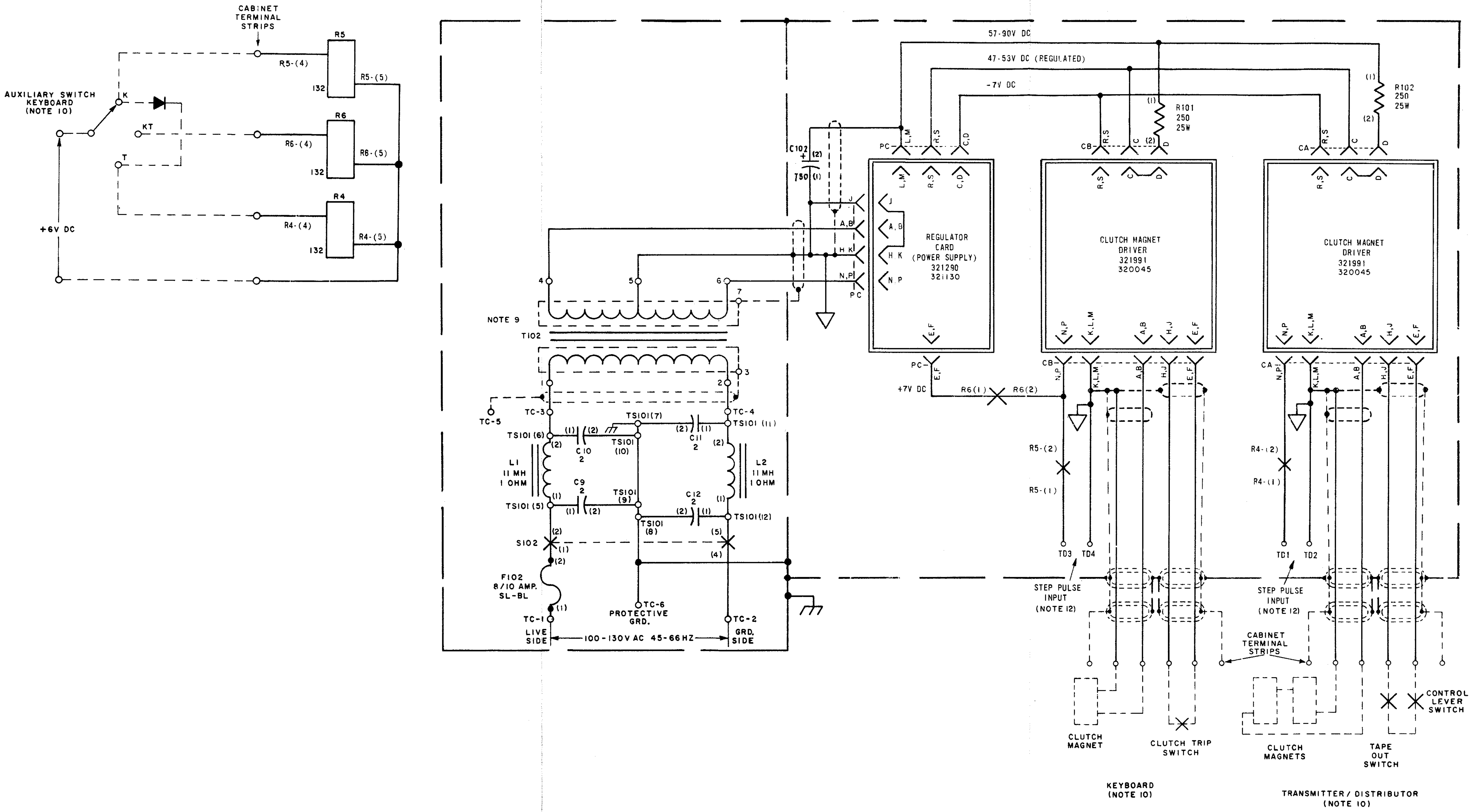


Figure 5-43. 323812 Electrical Service Assembly (Clutch) Schematic Wiring Diagram

NO.	NOTES
1.	ALL VOLTAGES DC UNLESS OTHERWISE SPECIFIED.
2.	TERMINAL DESIGNATION ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
3.	FUSE NUMBER: 162360 8/10 AMP. SLOW BLOWING.
4.	TERMINAL NUMBERS APPEAR ON ASSOCIATED MARKING STRIP.
5.	✱ INDICATES TO TAPE END TERMINATING POINT.
6.	 INDICATES SINGLE SHIELDING
7.	 INDICATES DOUBLE SHIELDING
8.	ALL STRAPPING WIRE 24 AWG BARE, 39603RM. USE SLEEVING WHERE REQUIRED. ① INDICATES 18 AWG STRANDED WIRE. ② INDICATES 24 AWG STRANDED WIRE. ③ INDICATES 24 AWG 2 LEAD SINGLE SHIELDED CABLE. ALL SURFACE WIRE 24 AWG GREEN, 31784 RM, UNLESS OTHERWISE SPECIFIED
9.	REFER TO 8405WD FOR SCHEMATIC WIRING DIAGRAM.
10.	COLOR CODE: BK-BLACK P-PURPLE BL-BLUE R-RED BR-BROWN S-SLATE G-GREEN W-WHITE O-ORANGE Y-YELLOW
11.	OUTER SHIELD CONNECTED TO BOX AT CONNECTOR.

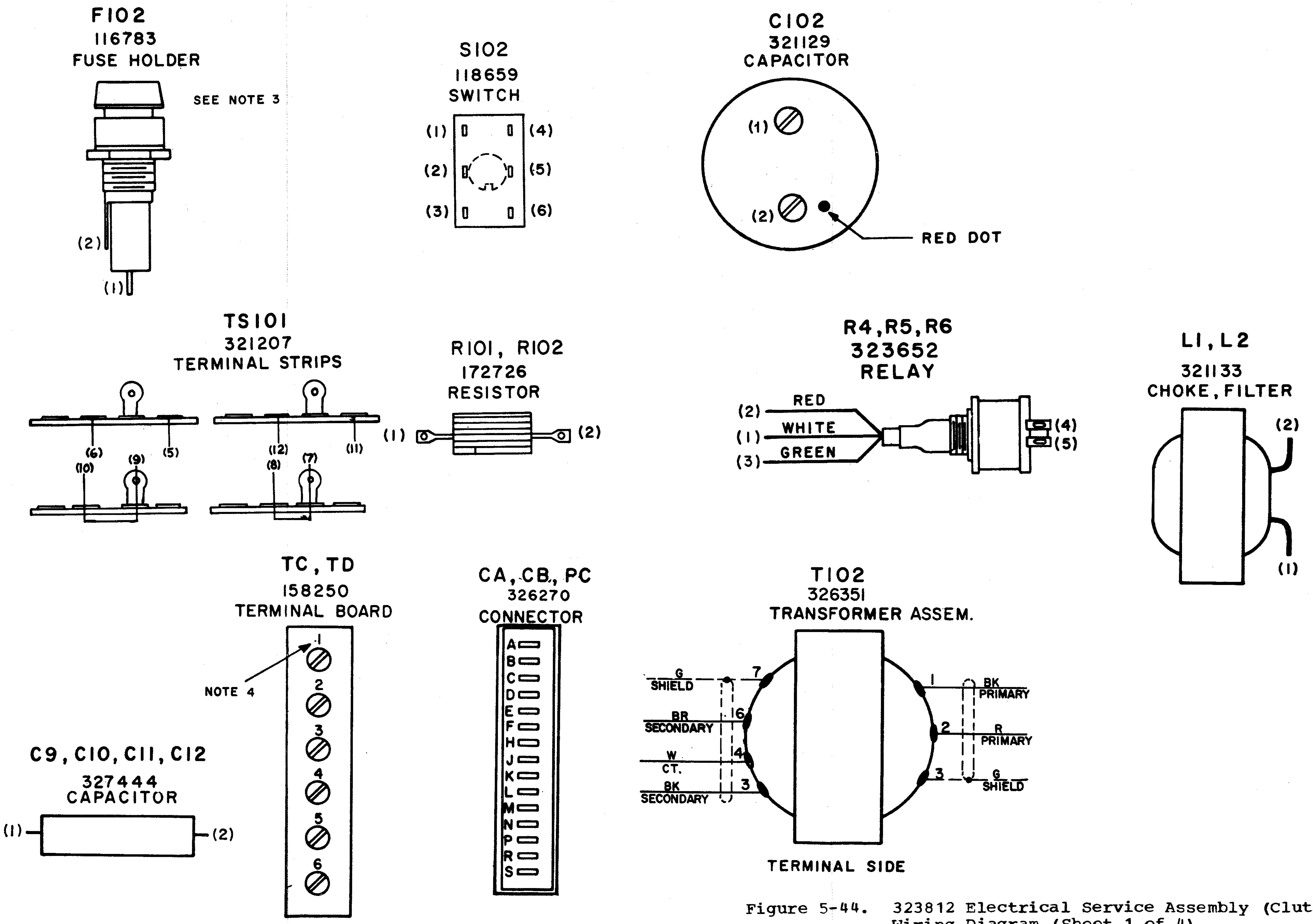
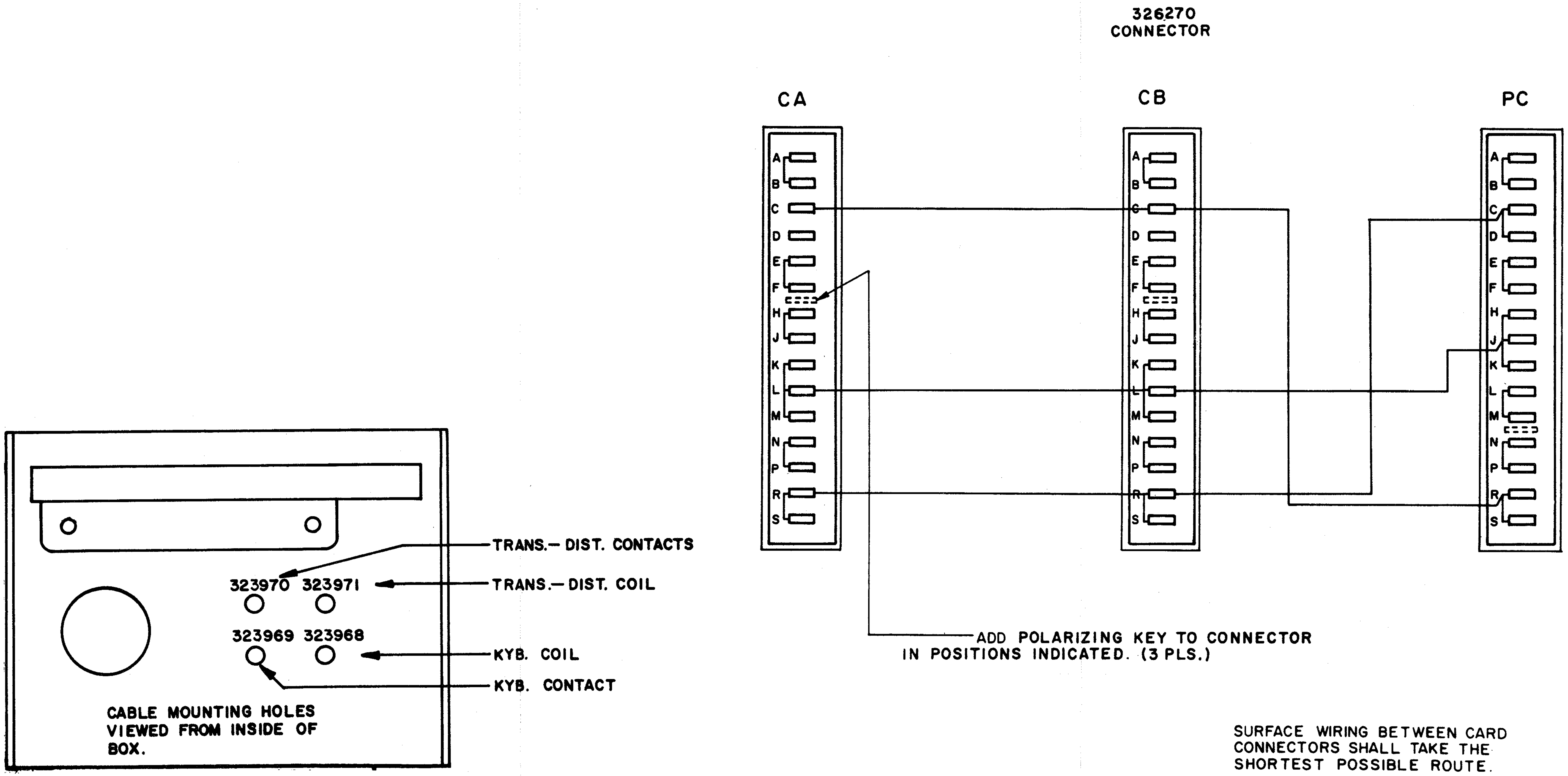


Figure 5-44. 323812 Electrical Service Assembly (Clutch) Wiring Diagram (Sheet 1 of 4)



SURFACE WIRING BETWEEN CARD CONNECTORS SHALL TAKE THE SHORTEST POSSIBLE ROUTE.

Figure 5-44. 323812 Electrical Service Assembly (Clutch) Wiring Diagram (Sheet 2 of 4)

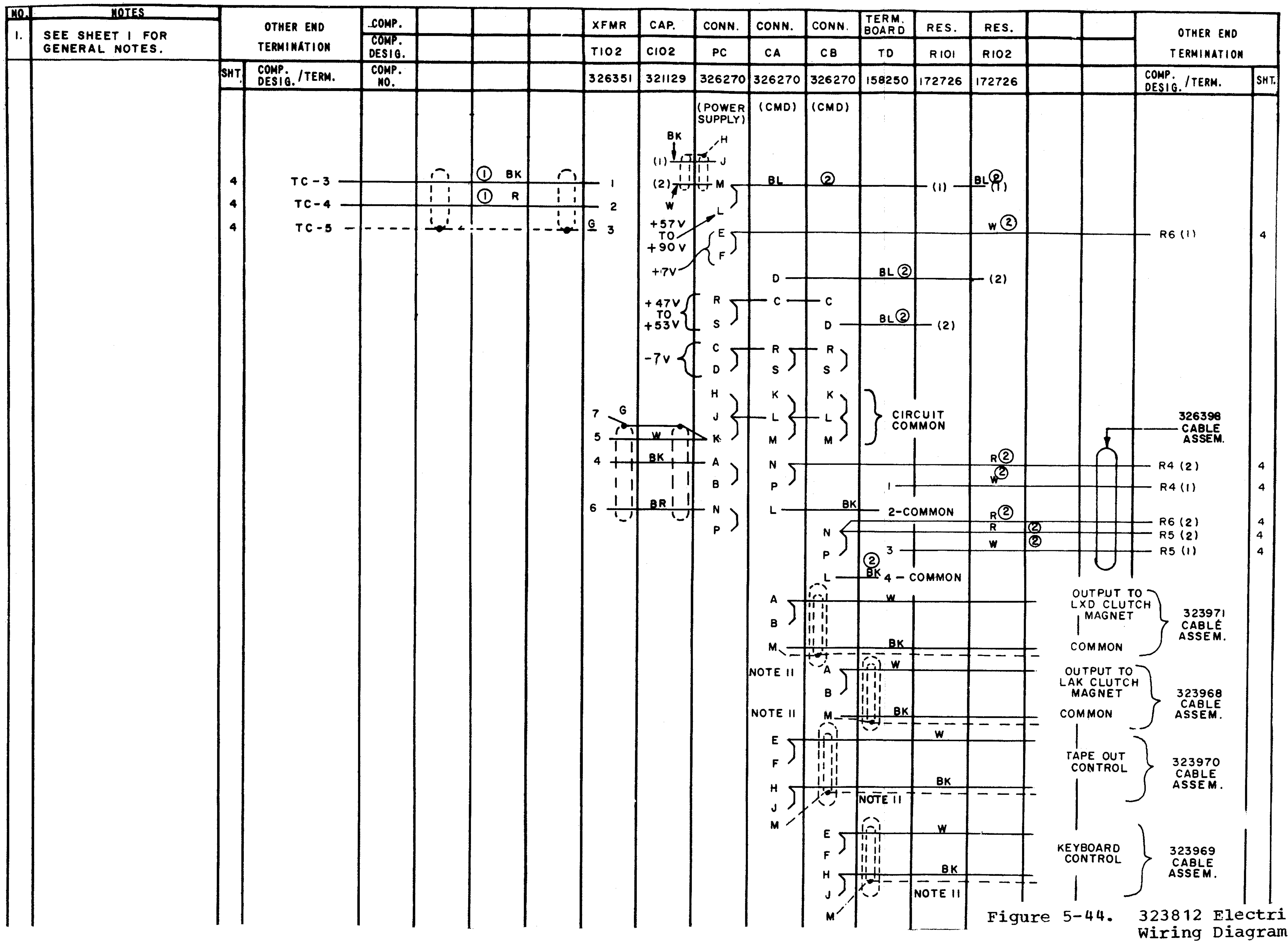


Figure 5-44. 323812 Electrical Service Assembly (Clutch) Wiring Diagram (Sheet 3 of 4)

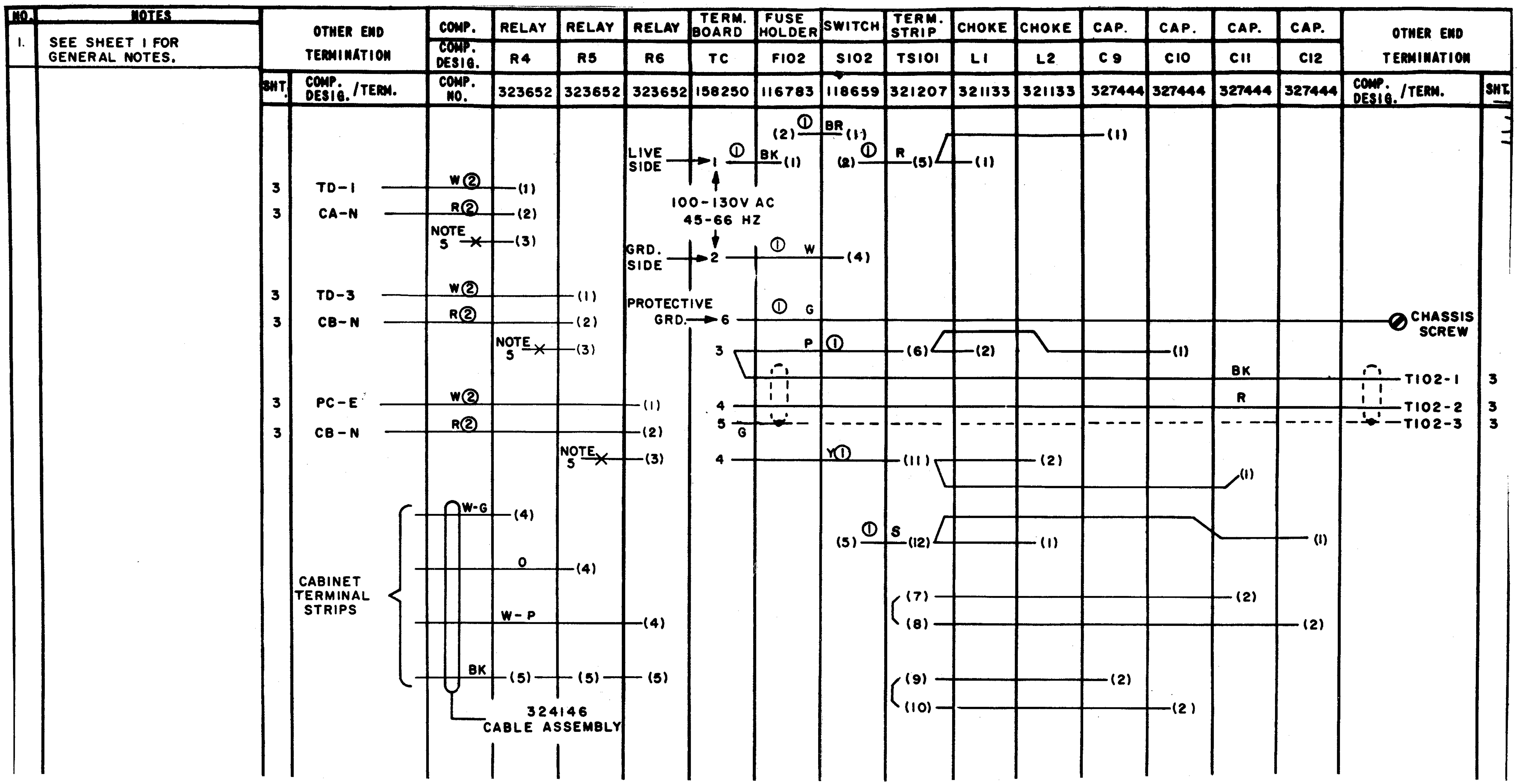


Figure 5-44. 323812 Electrical Service Assembly (Clutch) Wiring Diagram (Sheet 4 of 4)

NO.	NOTES
1.	ALL RESISTORS 1/2 WATT, RESISTANCE VALUES IN OHMS, CAPACITANCE VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2.	TERMINAL DESIGNATIONS ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
3.	SL-BL INDICATES SLOW BLOWING.
4.	>— INDICATES FEMALE TERMINAL → INDICATES MALE TERMINAL
5.	REFERENCE SPEC. FOR TELETYPE CORPORATION EMPLOYEES ONLY 61267S
6.	T1 SECONDARY 50V AC TO CENTER TAP WITH 115V AC INPUT; 8 OHMS (MAX.) PRIMARY RESISTANCE; 10 OHMS (MAX.) SECONDARY RESISTANCE TO CENTER TAP.
7.	▽ INDICATES CIRCUIT COMMON.
8.	IF EXTERNAL BATTERY IS SUPPLIED FOR POLAR LINE KEYER REMOVE STRAPS BETWEEN TD-1, TD-2 & TD-3, TD-4. APPLY + BATTERY (6.6-7.80V) TO TD-2 AND − BATTERY (6.6-7.80V) TO TD-4. IF ±6V IS SUPPLIED, KEYER OUTPUT WILL DROP ± 4.5 V.
9.	REFER TO 8315WD FOR ACTUAL WIRING DIAGRAM.
10.	REFER TO RELATED SET DIAGRAMS FOR EXTERNAL CIRCUITS.
11.	INDICATES SINGLE SHIELDING INDICATES DOUBLE SHIELDING
12	TERMINAL TC-5 IS AN AUXILIARY KEYER OUTPUT. TERMINAL TC-6, AN AUXILIARY SELECTOR MAGNET DRIVER INPUT. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THE PAGE PRINTER WILL MONITOR ALL TRANSMISSIONS FROM THE KEYER.
13	TERMINAL TD-5 AND TD-6 PROVIDE AUXILIARY INPUTS TO EACH OF THE TWO KEYER CARDS. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THAT BOTH THE LXD AND LAK CAN USE A SINGLE KEYER CARD FOR NON-SIMULTANEOUS OPERATION. WITH THIS ARRANGEMENT DO NOT PUT A 303142 KEYER CARD IN KB CARD CONNECTOR.
14	KEYER OUTPUTS + 6V MARK − 6V SPACE
15	– – – INNER SHIELD — — — OUTER SHIELD

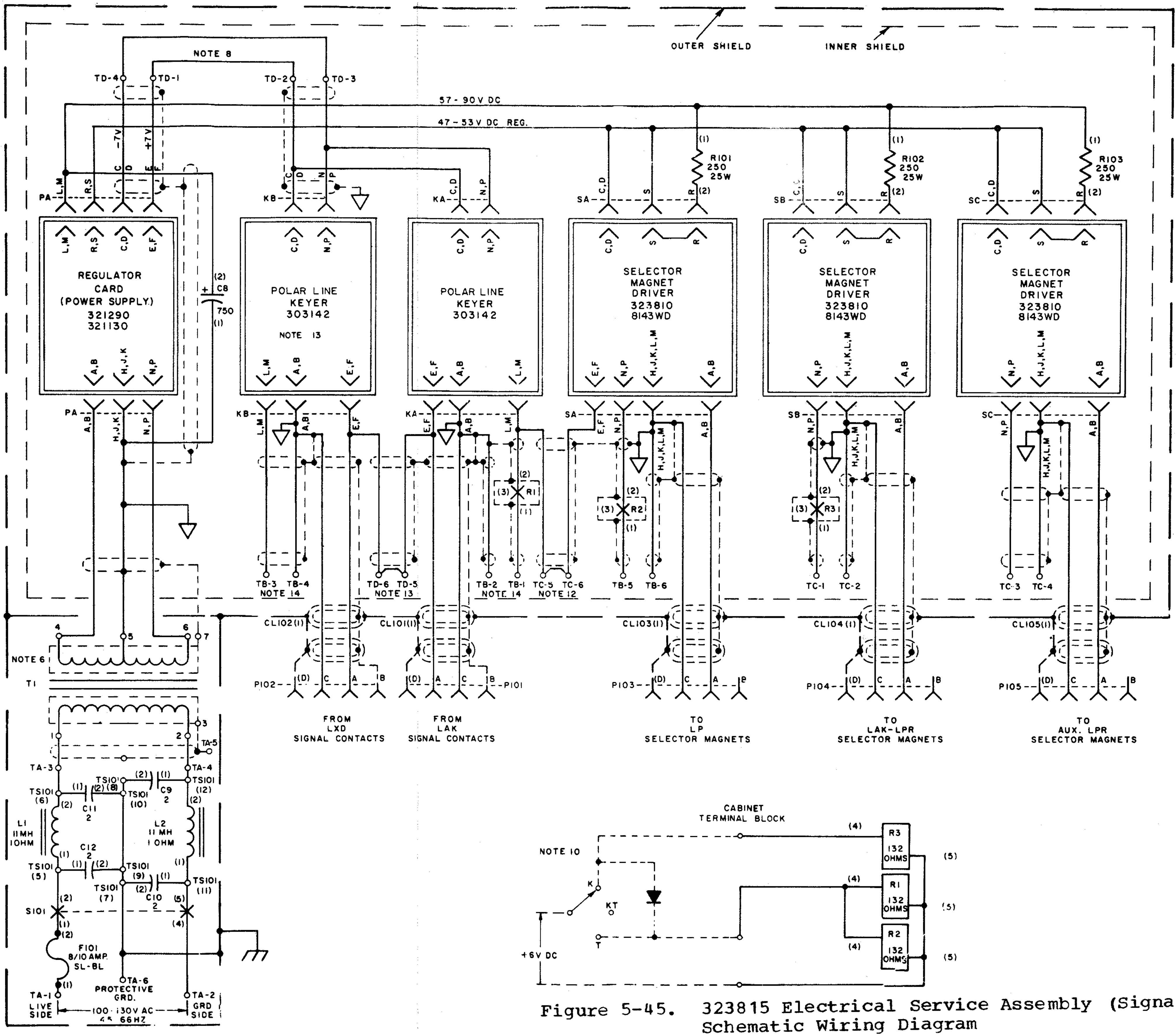
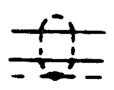
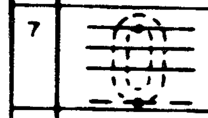
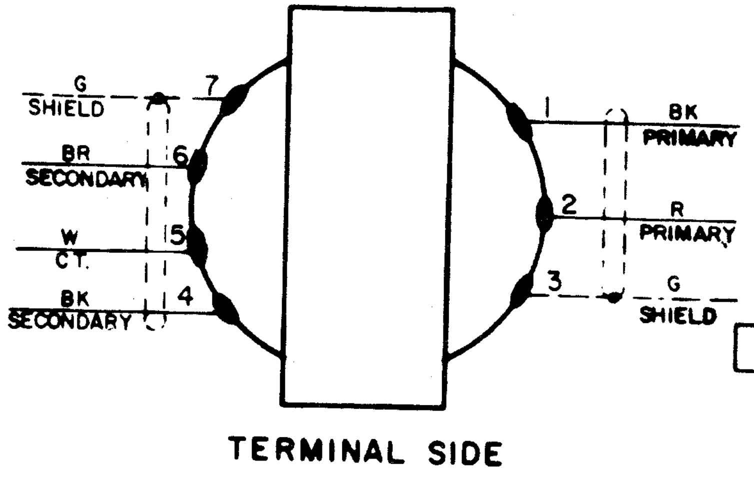


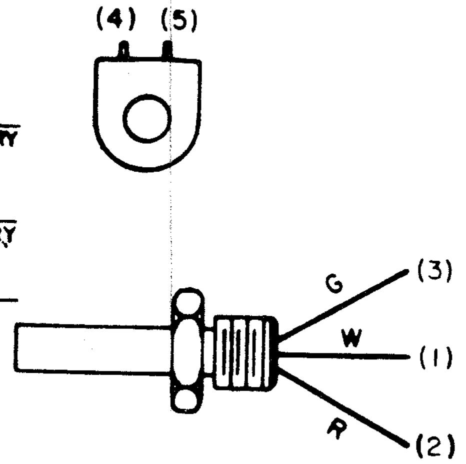
Figure 5-45. 323815 Electrical Service Assembly (Signal) Schematic Wiring Diagram

NO.	NOTES
1.	ALL VOLTAGES DC UNLESS OTHERWISE SPECIFIED.
2.	TERMINAL DESIGNATION ENCLOSED IN PARENTHESIS ARE FOR REFERENCE AND ARE NOT MARKED ON COMPONENT.
3.	FUSE NUMBER - 162360 8/10 AMP SLOW BLOWING
4.	TERMINAL NUMBERS APPEAR ON ASSOCIATED MARKING STRIP
5.	-✱- INDICATES TO TAPE END TERMINATING POINT.
6.	 INDICATES SINGLE SHIELDING
7	 INDICATES DOUBLE SHIELDING
8.	ALL STRAPPING WIRE 24 AWG BARE, 39603RM. USE SLEEVING WHERE REQUIRED. ① INDICATES 18 AWG STRANDED WIRE. ② INDICATES 24 AWG STRANDED WIRE. ③ INDICATES 24 AWG 2 LEAD SINGLE SHIELDED CABLE. ALL SURFACE WIRE 24 AWG GREEN, 31784RM UNLESS OTHERWISE SPECIFIED.
9.	IF EXTERNAL BATTERY IS SUPPLIED FOR POLAR LINE KEYER, REMOVE STRAPS BETWEEN TD-1, TD-2 AND TD-3, TD-4. APPLY + BATTERY (6.6 TO 7.8V) TO TD-2, AND, -BATTERY (6.6 TO 7.8V) TO TD-4. IF ±6V IS SUPPLIED,. THE KEYER OUTPUT WILL DROP TO ± 4.5V.
10.	REFER TO 8413 WD FOR SCHEMATIC WIRING DIAGRAM
11.	TERMINAL TC-5 IS AN AUXILIARY KEYER OUTPUT. TERMINAL TC-6 IS AN AUXILIARY SELECTOR MAGNET DRIVER INPUT. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THE PAGE PRINTER WILL MONITOR ALL TRANSMISSIONS FROM THE KEYER.
12.	TERMINAL TD-5 AND TD-6 PROVIDE AUXILIARY INPUTS TO EACH OF THE TWO KEYER CARDS. AS SHIPPED, THESE TERMINALS ARE STRAPPED SO THAT BOTH THE LXD AND LAK CAN USE A SINGLE KEYER CARD FOR NON—SIMULTANEOUS OPERATION. WITH THIS ARRANGEMENT DO NOT PUT A 303142 KEYER CARD IN KB CARD CONNECTOR.
13.	COLOR CODE: BK - BLACK BL - BLUE BR - BROWN G - GREEN O - ORANGE P - PURPLE R - RED S - SLATE W - WHITE Y - YELLOW

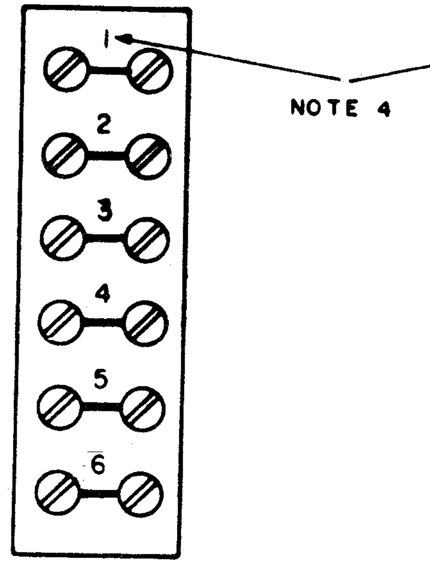
T1
326351
TRANSFORMER ASSEM.



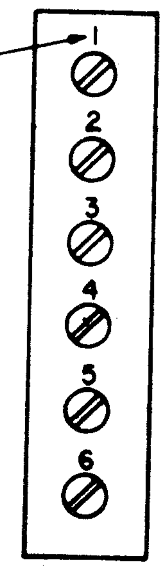
R1, R2, R3
323652
RELAY



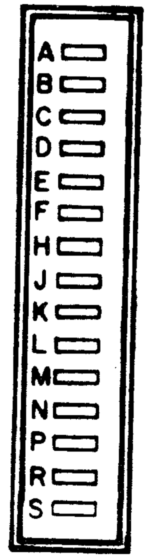
TA
111284
TERMINAL BOARD



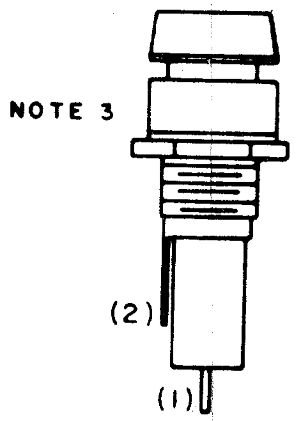
TB, TC, TD
158250
TERMINAL BOARD



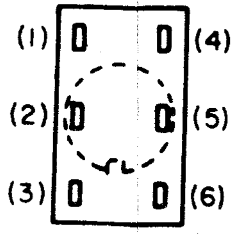
KA, KB, PA, SA, SB, SC
326270
CONNECTOR



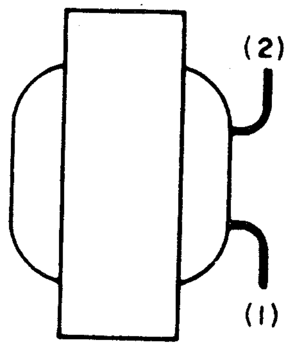
F101
116783
FUSE HOLDER



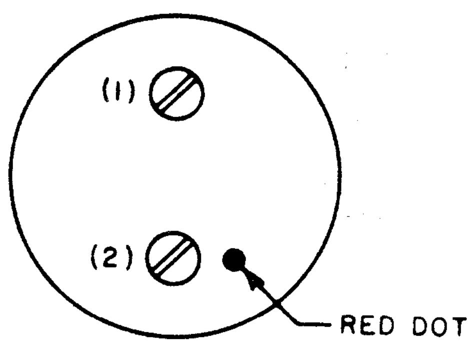
S101
118659
SWITCH



L1, L2
321133
CHOKE, FILTER

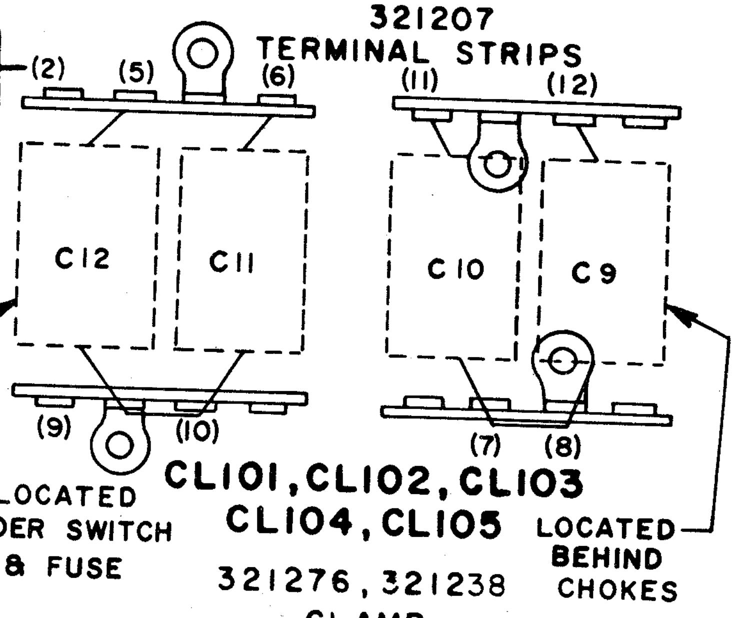


C8
321129
CAPACITOR

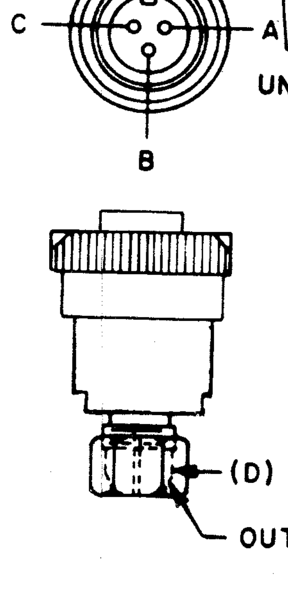


C9, C10, C11, C12
327444
CAPACITOR

TS101
321207
TERMINAL STRIPS



P101, P102, P103, P104, P105
324141
CONNECTOR



CL101, CL102, CL103 CL104, CL105
321276, 321238
CLAMP

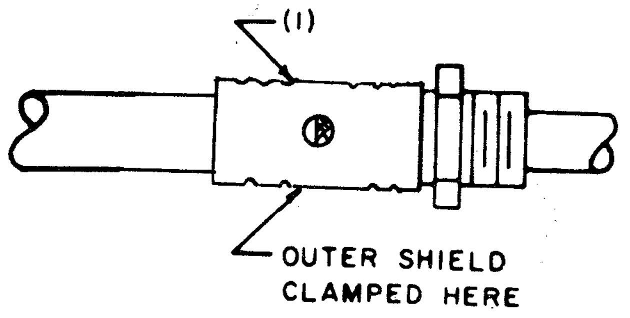


Figure 5-46. 323815 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 1 of 5)

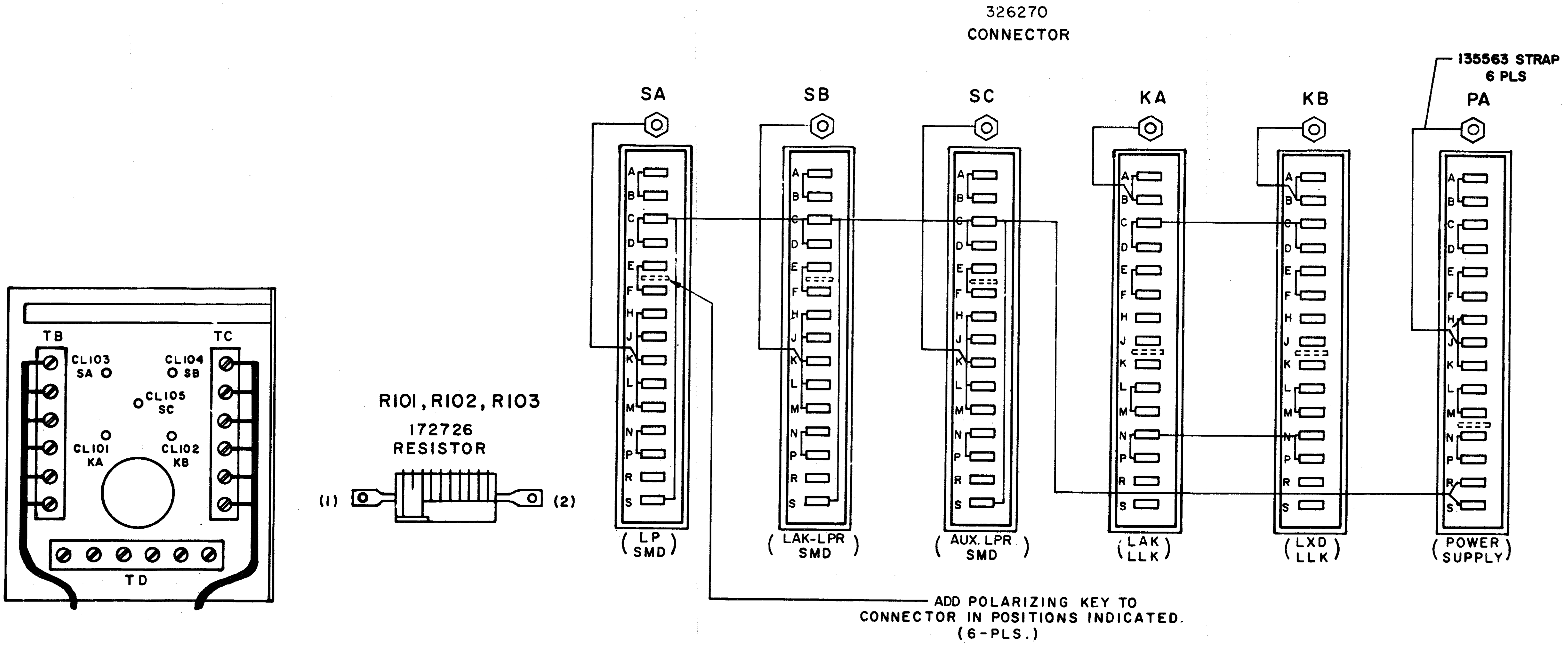


Figure 5-46. 323815 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 2 of 5)

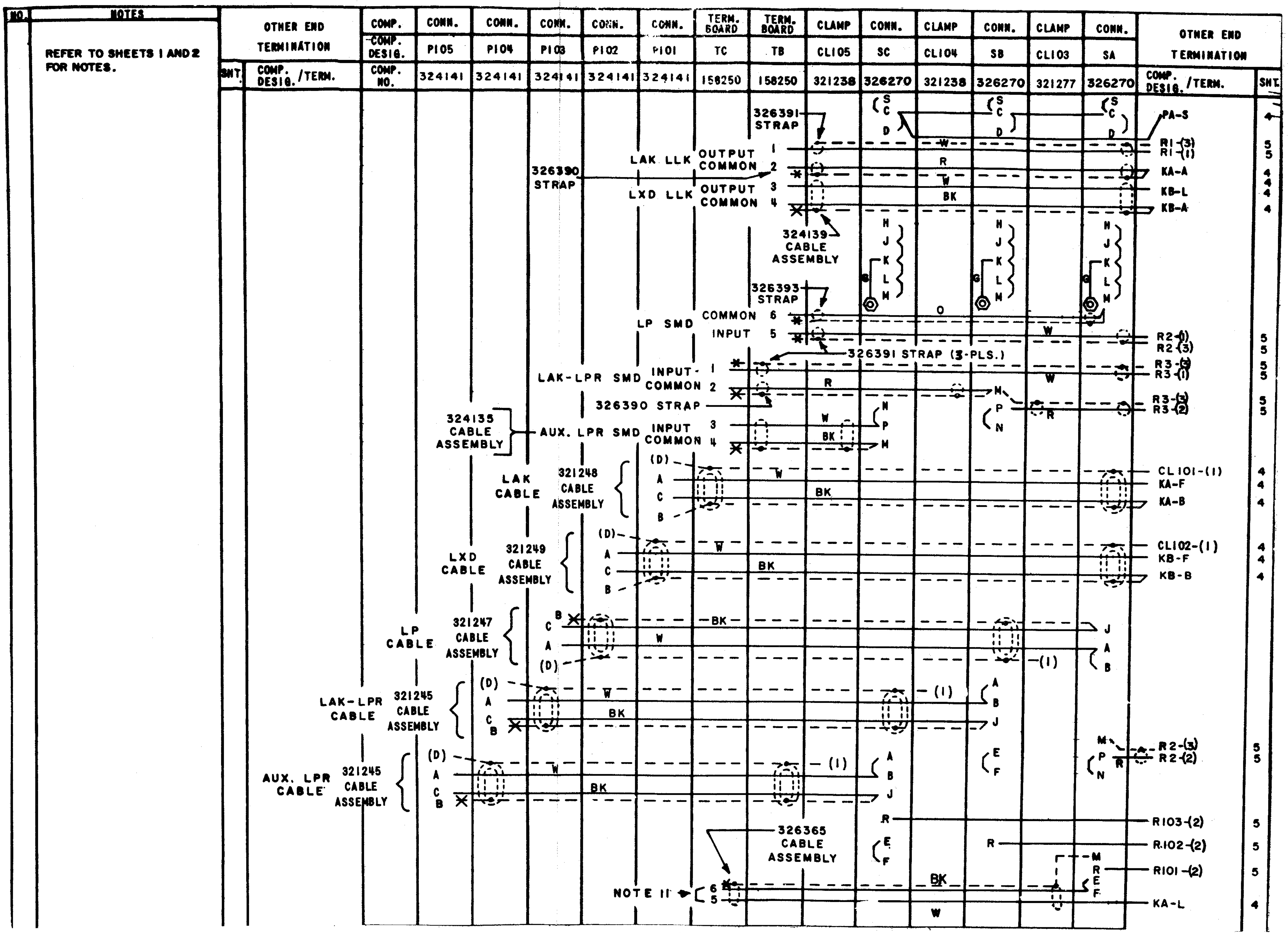


Figure 5-46. 323815 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 3 of 5)

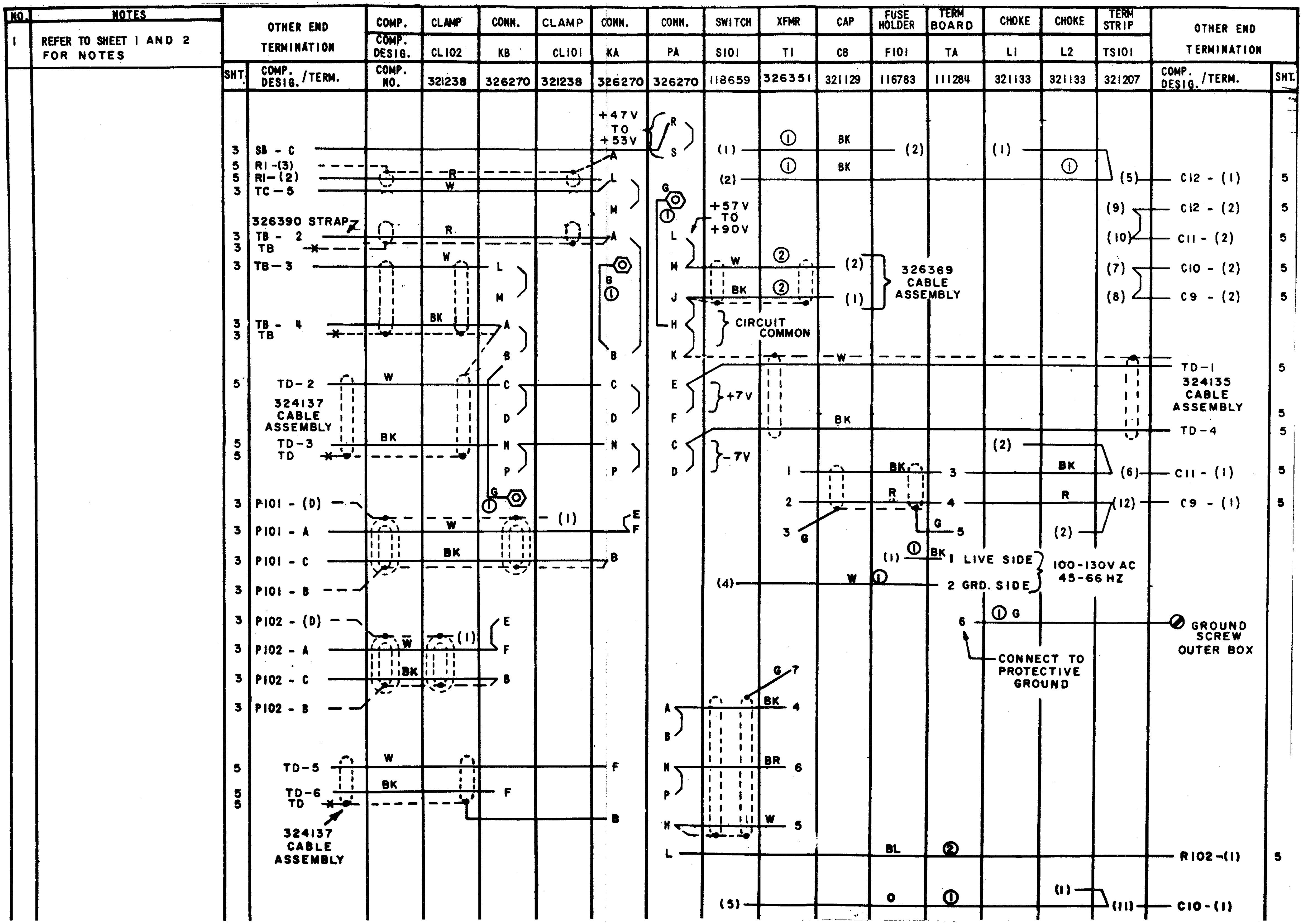


Figure 5-46. 323815 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 4 of 5)

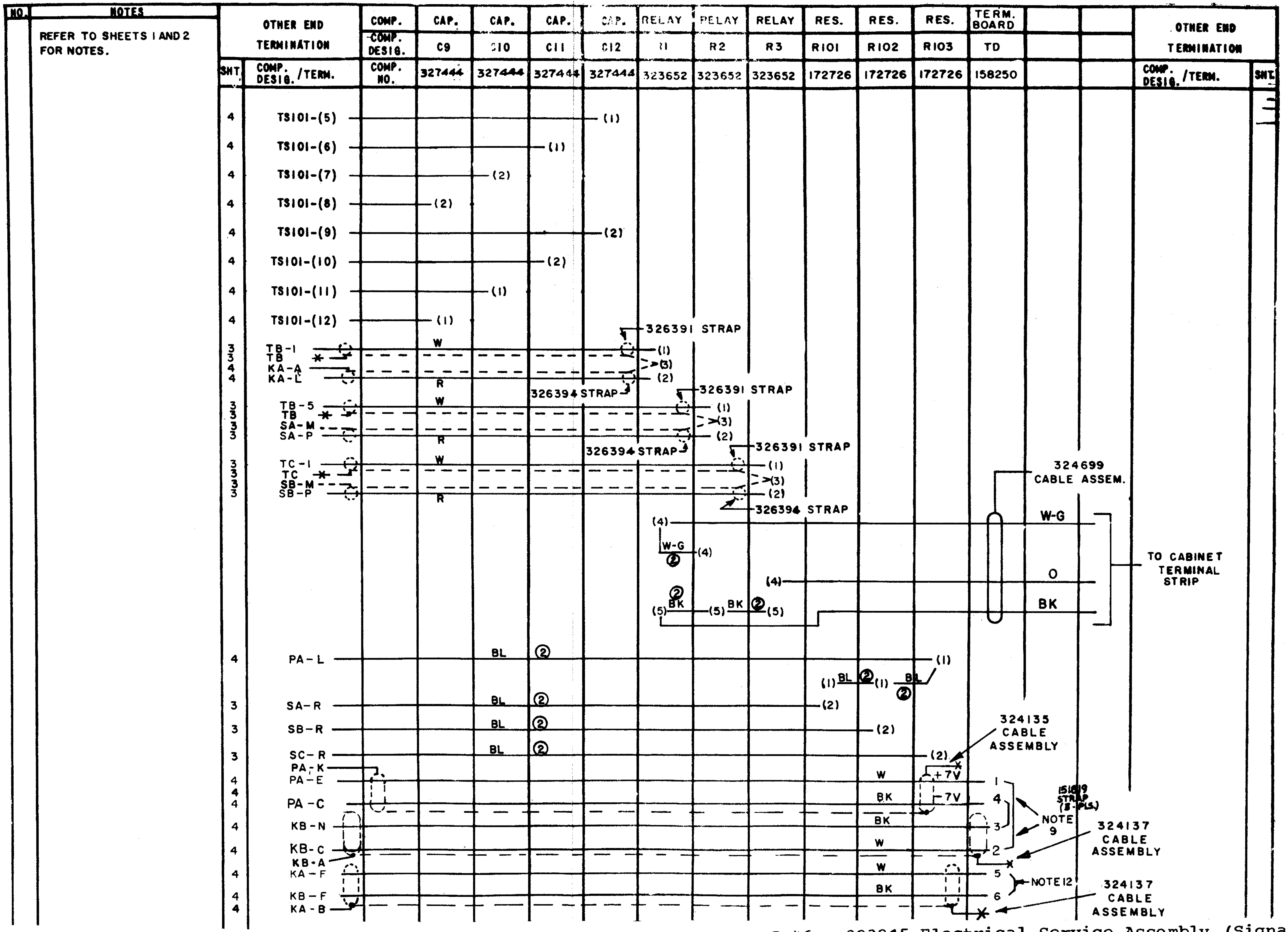


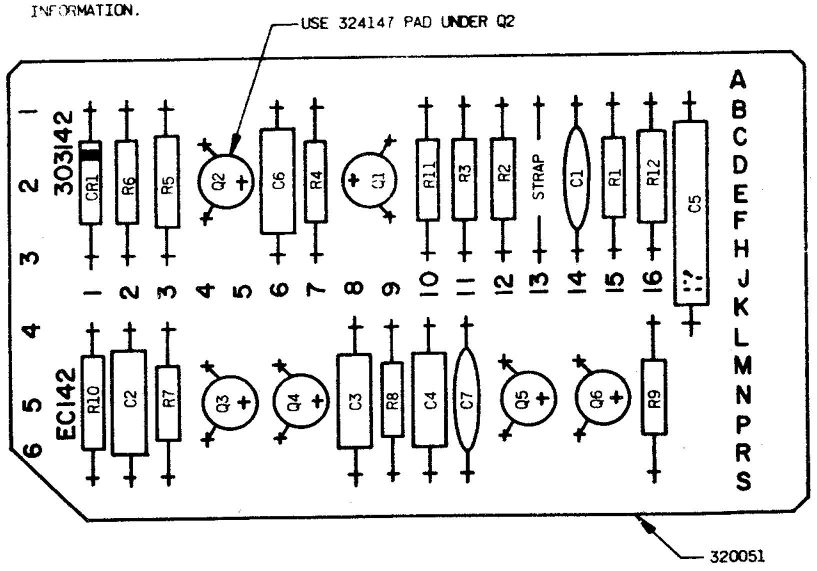
Figure 5-46. 323815 Electrical Service Assembly (Signal) Wiring Diagram (Sheet 5 of 5)

ALPHA NUMERIC CONVERSION CHART

STAMPING ON CIRCUIT BOARD	NUMERICAL CONVERSION FOR 15 PT. CARDS WHEN USED WITH 36 PT. CONNECTOR	
	WHEN INSERTED IN UPPER HALF OF CONNECTOR	WHEN INSERTED IN LOWER HALF OF CONNECTOR
A	1	22
B	2	23
C	3	24
D	4	25
E	5	26
F	6	27
H	7	28
J	8	29
K	9	30
L	10	31
M	11	32
N	12	33
P	13	34
R	14	35
S	15	36

REF DESIG.	PAR. NO REQ.	QTY	DESCRIPTION	FUNCTION
R1	118720	2	RESISTOR 100K 5% 1/2W	RC FILTER
R2	118178	1	RESISTOR 220K 5% 1/2W	Q1 BASE BIAS
R3			RESISTOR SAME AS R1	Q1 EMITTER BIAS
R4	129854	2	RESISTOR 10K 5% 1/2W	Q1 COLLECTOR BIAS
R5	321204	2	RESISTOR 13K 1% 1/2W	Q2 COLLECTOR BIAS
R6			RESISTOR SAME AS R5	RC BIAS EQUALIZER
R7	118147	2	RESISTOR 6.8K 5% 1/2W	Q3,4 BASE BIAS
R8			RESISTOR SAME AS R4	Q5,6 BASE BIAS
R9	137438	1	RESISTOR 100 Ω 5% 1/2W	RC FILTER
R10			RESISTOR SAME AS R7	Q3,4 BASE BIAS
R11	118146	2	RESISTOR 4.7K 5% 1/2W	Q1 EMITTER BIAS
R12			RESISTOR SAME AS R11	OUTPUT LOAD
CR1	181619	1	DIODE 1N482	R6 SHUNT SWITCH
C1	321157	2	CAPACITOR 500 PFD	INPUT FILTER
C2	320048	1	CAPACITOR .5 MFD.	ACTIVE FILTER FEEDBACK
C3	320049	2	CAPACITOR .15 MFD.	ACTIVE FILTER INTEGRATOR
C4			CAPACITOR SAME AS C3	RC FILTER INTEGRATOR
C5	320047	1	CAPACITOR 2 MFD	RC FILTER INTEGRATOR
Q1	315930	3	TRANSISTOR, 2N3568	1st AMPLIFIER
Q2	324144	1	TRANSISTOR 2N4121	2nd AMPLIFIER
Q3	315931	2	TRANSISTOR 2N3638	ACTIVE COMPLIMENTARY FILTER
Q4			TRANSISTOR SAME AS Q1	ACTIVE COMPLIMENTARY FILTER
Q5			TRANSISTOR SAME AS Q3	COMPLIMENTARY SYMMETRY
				EMITTER
Q6			TRANSISTOR SAME AS Q1	FOLLOWER AMPLIFIER
C6	181618	1	CAPACITOR .01MFD	RC FILTER
C7			CAPACITOR SAME AS C1	RF BY PASS
EC	320051	1	BOARD, ETCHED CIRCUIT	
		1	STRAP, BARE 24 AWG.	
	324147	1	PAD, TRANSISTOR	
	144495	5	PAD, TRANSISTOR	

NOTE: MANUFACTURE PER MR2001
REFER TO 5016WD FOR MARKING INFORMATION.



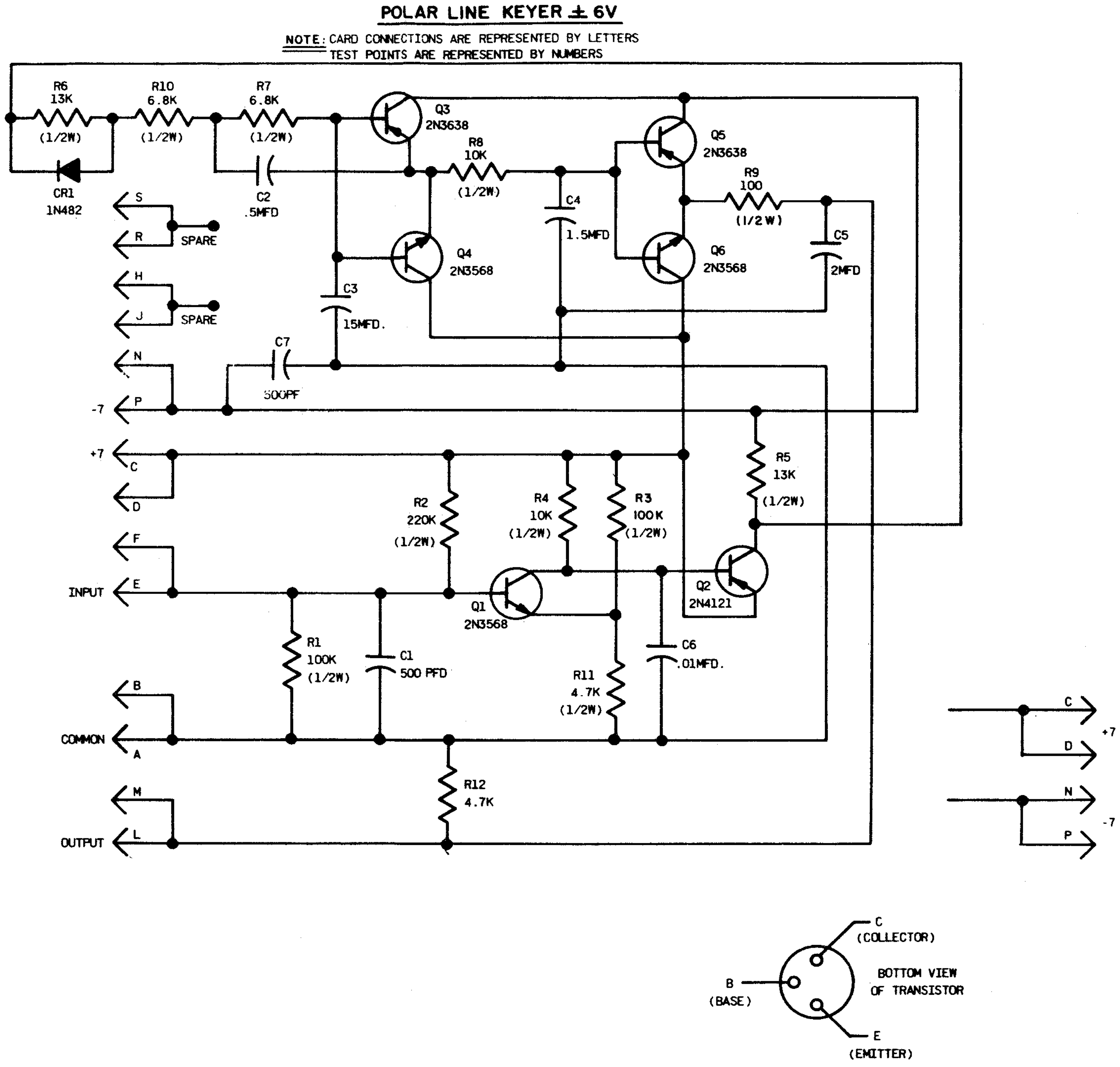
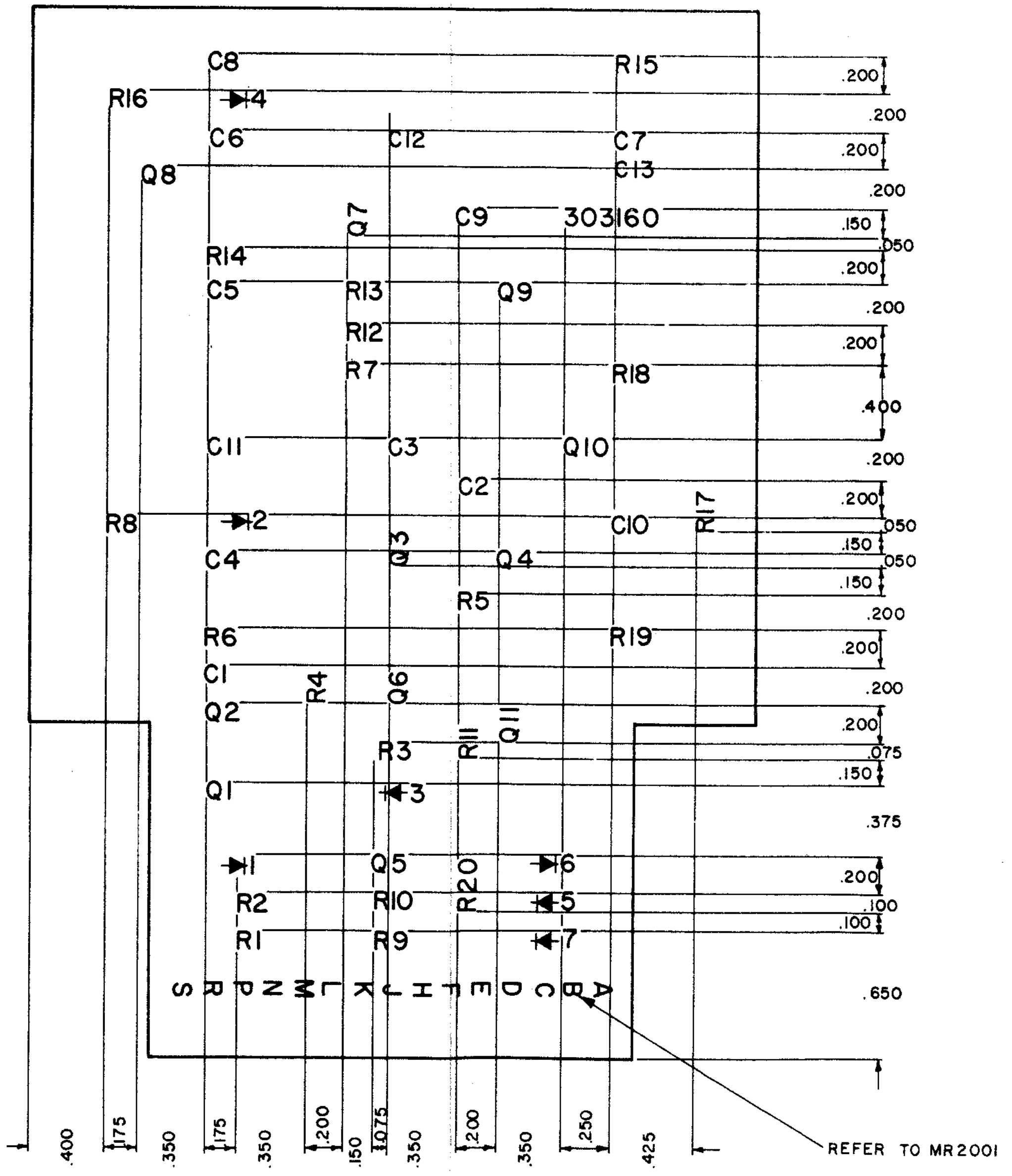


Figure 5-47. LLK Polar Line Keyer 303142 Circuit Card Wiring Diagram

NO.	NOTES
1.	ALL RESISTANCE VALUES IN OHMS, 1/4 WATT UNLESS OTHERWISE SPECIFIED.
2.	ALL CAPACITANCE VALUES IN MFD UNLESS OTHERWISE SPECIFIED.
3.	PINS A,B - CIRCUIT 2 OUTPUT, 100MA TO CLUTCH COIL. PINS C,D - +50 VOLTS DC POWER INPUT PINS E,F - CIRCUIT 1 OUTPUT, 100MA TO CLUTCH COIL. PINS H,J - CIRCUIT 2 SIGNAL INPUT, REF. A,B OUTPUT. PINS L,M - CIRCUIT COMMON. PINS N,P - CIRCUIT 1 SIGNAL INPUT REF. E,F OUTPUT.
4.	▽ DENOTES CIRCUIT COMMON.
5.	REFERENCE SPEC. FOR TELETYPE CORPORATION EMPLOYEES 61530 S
6.	TRANSISTOR Q9 HAS 323847 HEAT SINK PRESSED ON.
7.	POWER REQTS: +47 TO +53 V.D.C 0.2 AMPS. INPUT REQTS: +3.2 TO +6.6 V.D.C. TO ENERGIZE CLUTCH COILS. 0 TO +.5 V.D.C. TO DEENERGIZE COILS. OUTPUT REQTS: .088 TO .115 AMPS ENERGIZED CURRENT TO TWO SERIES 256 M COILS. 0 AMPS CURRENT TO DEENERGIZE COILS.
8.	FOR SCREEN PRINTING INFORMATION REFER TO MR 2001.
9.	MAINTAIN 1/8 IN. CLEARANCE BETWEEN C3, C11 AND R7, AND C7, C12 AND R15.
10.	MOUNT C9 FLAT AGAINST CIRCUIT BOARD TO ALLOW CLEARANCE FOR 323847 HEAT SINK.
11.	BEND LEFT LEAD OF R7 SHARPLY AT TERMINAL AND MOUNT R7 AS SHOWN.

CIRCUIT DESCRIPTION

THIS BOARD ASSEMBLY HAS TWO IDENTICAL LXD CLUTCH MAGNET DRIVERS, INTENDED FOR TANDEM OPERATION. EACH CIRCUIT HAS FOUR CASCADED TRANSISTOR STAGES; THE FIRST INTERFACES WITH IC LOGIC OUTPUTS AND THE LAST DRIVES LXD CLUTCH COILS AT 0.1 AMPS, WITH OPEN OR ZERO INPUTS, THE OUTPUT CURRENT IS ZERO. WITH A POSITIVE INPUT THE ASSOCIATED CLUTCH COILS WILL BE ENERGIZED.
THE CIRCUIT AND CLUTCH CURRENT IS SUPPLIED BY A CONSTANT CURRENT AMPLIFER Q11, Q9 AND Q10 SAMPLE THE CHANGING Q11 COLLECTOR VOLTAGE AND CHANGE CONDUCTION LEVEL THE AMOUNT REQUIRED TO KEEP THE SUPPLY CURRENT CONSTANT.

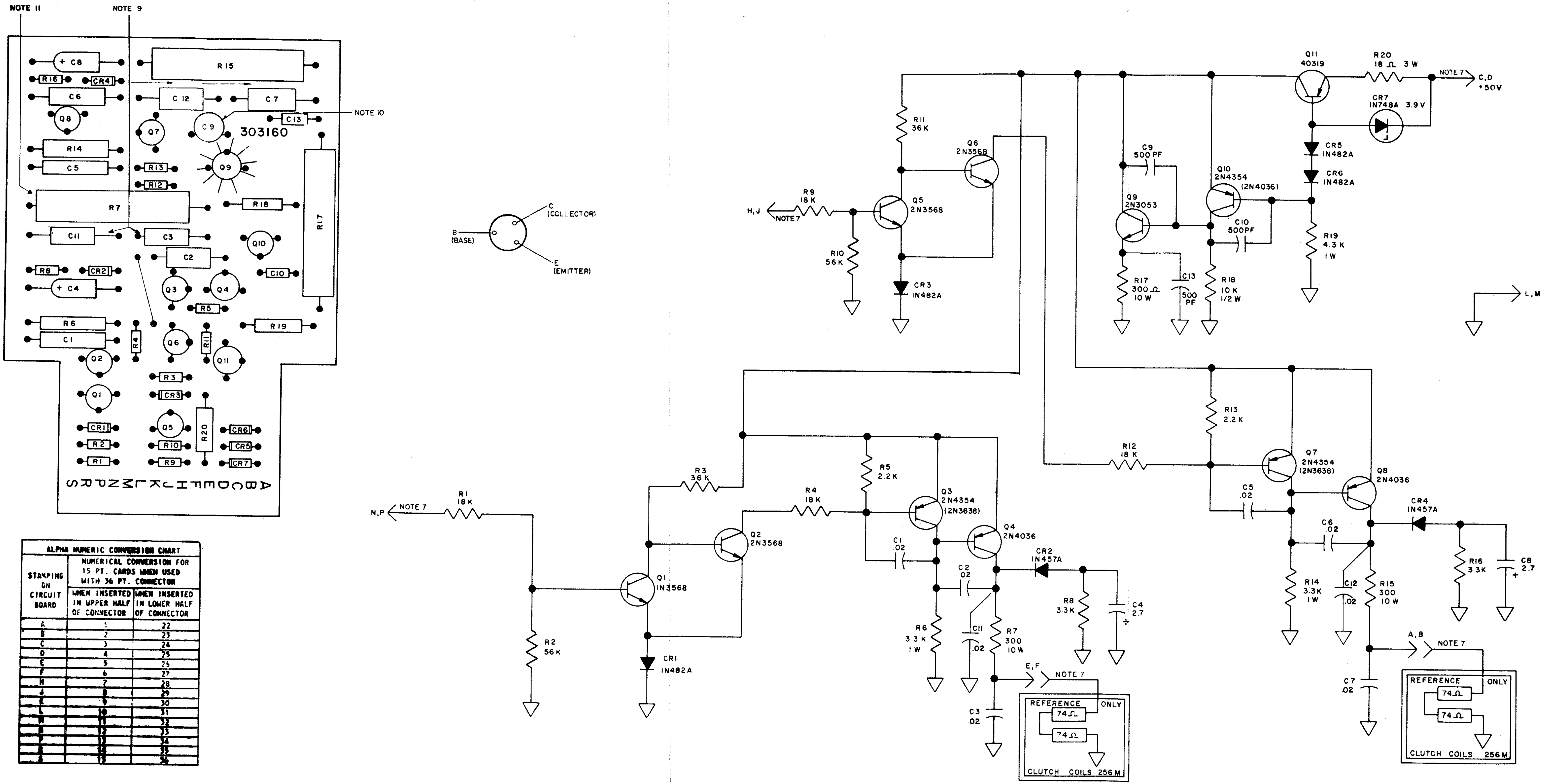


CIRCUIT BOARD EC 160					
	REF. DESIG.	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
	R1	323148	4	RESISTOR 18K	INPUT RESISTOR
	R4			SAME AS R1	Q2 LOAD
	R9			SAME AS R1	INPUT RESISTOR
	R12			SAME AS R1	Q6 LOAD
	R2	330643	2	RESISTOR 56 K	Q1 BIAS
	R10			SAME AS R2	Q5 BIAS
	R3	323147	2	RESISTOR 36 K	Q1 LOAD
	R11			SAME AS R3	Q5 LOAD
	R5	315955	2	RESISTOR 2.2 K	Q3 BIAS
	R13			SAME AS R5	Q7 BIAS
	R6	178863	2	RESISTOR 3.3K	Q3 LOAD
	R14			SAME AS R6	Q7 LOAD
	R7	193229	3	RESISTOR 300 Ω	COIL CURRENT LIMIT
	R15			SAME AS R7	COIL CURRENT LIMIT
	R17			SAME AS R7	Q9 EMITTER LOAD
	R8	315957	2	RESISTOR 3.3 K	C4 BLEEDER
	R16			SAME AS R8	C8 BLEEDER
	R18	118180	1	RESISTOR 10 K	Q10 LOAD
	R19	120424	1	RESISTOR 4.3 K	REG. REF. LIMIT
	R20	327793	1	RESISTOR 18 Ω	REG. LIMITER
	C1	330593	8	CAPACITOR .02 MFD	Q3 FEED BACK
	C5			SAME AS C1	Q7 FEED BACK
	C2			SAME AS C1	Q4 FEED BACK
	C6			SAME AS C1	Q8 FEED BACK
	C3			SAME AS C1	R.F. BY-PASS
	C7			SAME AS C1	R.F. BY-PASS
	C4	321264	2	CAPACITOR 2.7 MFD	TRANSIENT SUPPRES.
	C8			SAME AS C4	TRANSIENT SUPPRES.
	C9	321157	3	CAPACITOR 500 PF	Q9 FEED BACK
	C10			SAME AS C9	Q10 FEED BACK
	CR1	321156	4	DIODE 1N482A	Q1 EMITTER REF.
	CR3			SAME AS CR1	Q5 EMITTER REF.
	CR5			SAME AS CR1	VOLTAGE REF.
	CR6			SAME AS CR1	VOLTAGE REF.
	CR2	321154	2	DIODE 1N457A	TRANSIENT SUPPRES.
	CR4			SAME AS CR2	TRANSIENT SUPPRES.
	CR7	321161	1	DIODE 1N748 A	VOLTAGE REF.
	Q1	315930	4	TRANSISTOR 2N3568	D.C. AMP.
	Q2			SAME AS Q1	D.C. AMP.
	Q5			SAME AS Q1	D.C. AMP.
	Q6			SAME AS Q1	D.C. AMP.
*	Q3	302865	3	TRANSISTOR 2N4354	D.C. AMP.
*	Q7			SAME AS Q3	D.C. AMP.
**	Q10			SAME AS Q3	SHUNT REG. AMP.
	Q4	321261	2	TRANSISTOR 2N4036	D.C. AMP.
	Q8			SAME AS Q4	D.C. AMP.
	Q9	323844	1	TRANSISTOR 2N3053	SHUNT REGULATOR
	Q11	323845	1	TRANSISTOR 40319	SERIES REG.
		144495	11	PAD, TRANSISTOR	
		323847	1	HEAT SINK	
		328066	1	CIRCUIT BOARD, ETCHED	
		39603 RM	1	STRAP, 24 AWG. BARE	
	C11			SAME AS C1	R.F. BY-PASS
	C12			SAME AS C1	R.F. BY-PASS
	C13			SAME AS C9	R.F. BY-PASS

* TELETYPE PART NO. 315931, 2N3638 MAY BE SUBSTITUTED FOR Q3 OR Q7.

* * Q10 MAY BE THE SAME AS Q4.

Figure 5-48. 303160 Dual - Circuit CMD Schematic Wiring Diagram (Sheet 1 of 2)



ALPHA NUMERIC CONVERSION CHART		
STAMPING ON CIRCUIT BOARD	NUMERICAL CONVERSION FOR 15 PT. CARDS WHEN USED WITH 36 PT. CONNECTOR	
	WHEN INSERTED IN UPPER HALF OF CONNECTOR	WHEN INSERTED IN LOWER HALF OF CONNECTOR
A	1	22
B	2	23
C	3	24
D	4	25
E	5	26
F	6	27
H	7	28
J	8	29
K	9	30
L	10	31
M	11	32
N	12	33
P	13	34
R	14	35
S	15	36

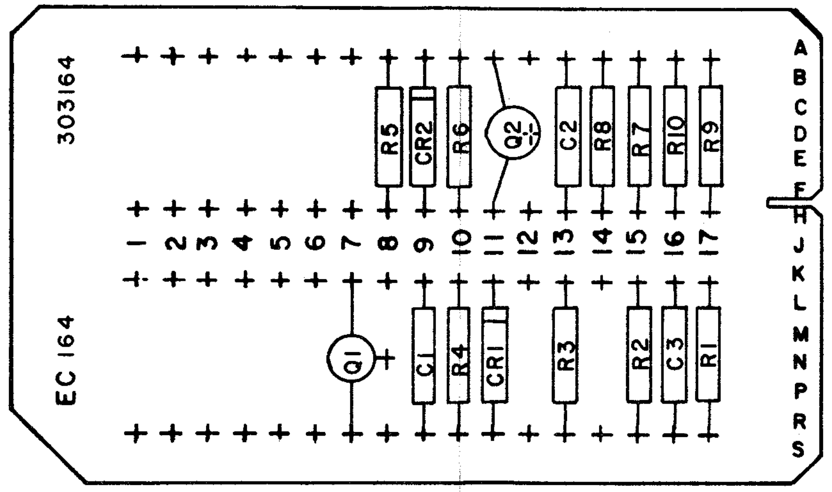
Figure 5-48. 303160 Dual - Circuit CMD Schematic Wiring Diagram (Sheet 2 of 2)

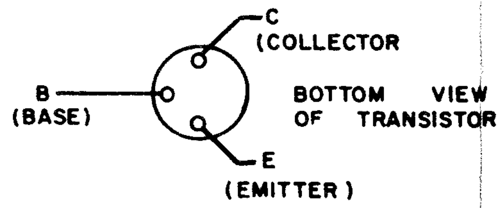
CLOCK AMPLIFIER

CIRCUIT DESCRIPTION

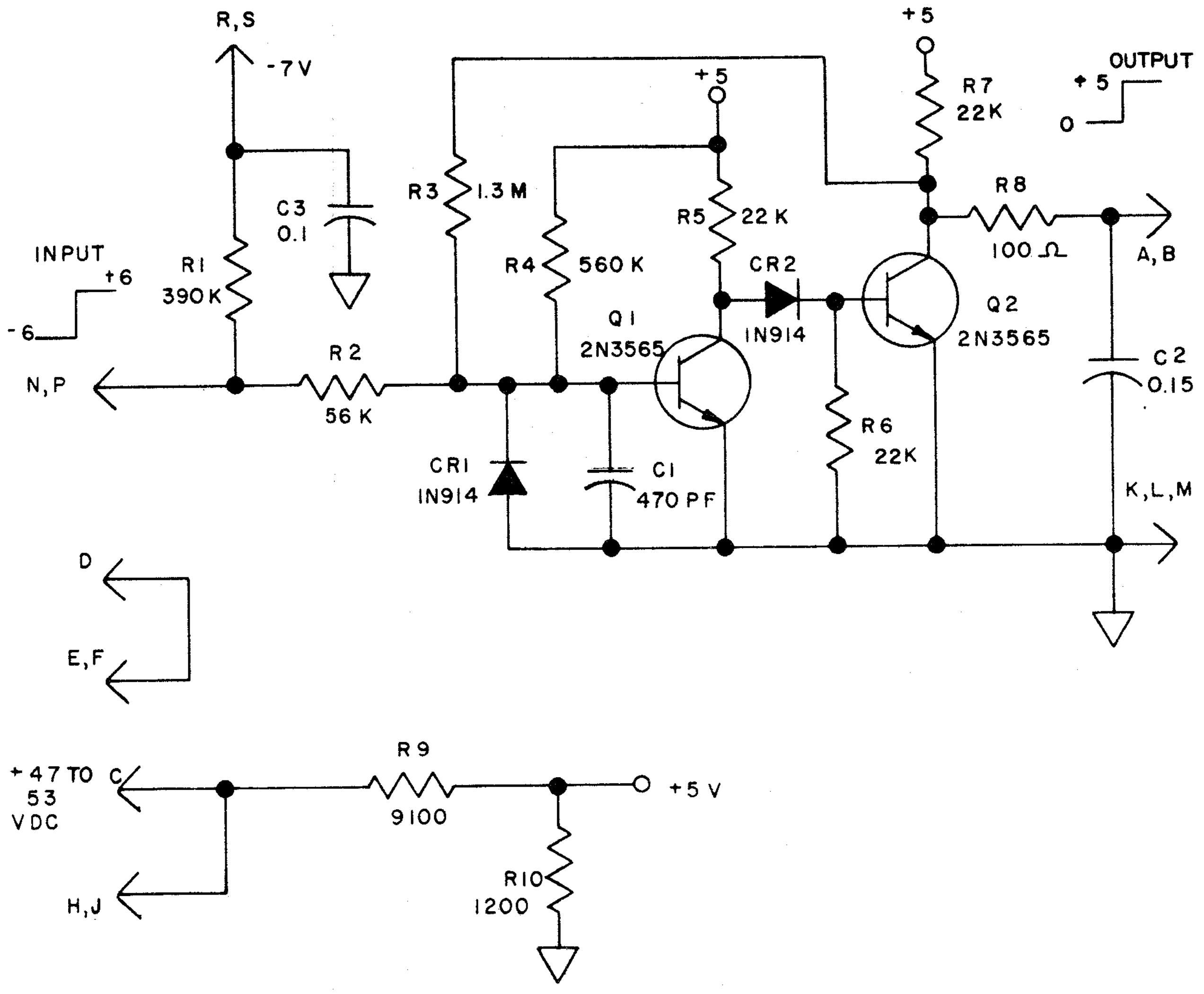
THIS AMPLIFIER PROVIDES A MIL 188B INTERFACE WITH LOGIC CIRCUITS. A MIL 188B POLAR INPUT AT PIN N,P WILL PRODUCE A NEUTRAL OUTPUT AT PIN A,B . THE RANGE OF INPUT SIGNALS CAN BE FROM ± 5V TO ±7V. THE TYPICAL HYSTERESIS IS 0.20V. WHEN THE INPUT AT PIN N,P IS POSITIVE +0.5V, Q1 IS FORWARD BIASED AND ITS COLLECTOR GOES TO 0 VOLTS. THIS ACTION ZERO BIASES Q2 AND ITS COLLECTOR GOES TO +5 VOLTS. A NEGATIVE INPUT -0.5V CAUSES A 0 VOLT OUTPUT. A SPACE HOLD FEATURE **KEEPS** THE OUTPUT AT 0 VOLTS IF THE INPUT IS DISCONNECTED. OUTPUT PIN A, B CAN SINK UP TO 5 MA TO POWER SUPPLY COMMON.

REF. DESIGN.	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
R1	330644	1	RESISTOR 390K 1/4 W.	PULL UP
R2	118156	1	RESISTOR 56K	BIAS
R3	330642	1	RESISTOR 1.3M 1/4 W.	FEEDBACK
R4	118166	1	RESISTOR 560K	BIAS
R5	118177	3	RESISTOR 22K	COLLECTOR LOAD
R6			SAME AS R5	BIAS
R7			SAME AS R5	COLLECTOR LOAD
R8	137438	1	RESISTOR 100 OHMS	OUTOUT
R9	165072	1	RESISTOR 9100 OHMS	VOLTAGE DIVIDER
R10	137441	1	RESISTOR 1200 OHMS	VOLTAGE DIVIDER
C1	315976	1	CAPACITOR 470 PF	INTERGATING
C2	310926	1	CAPACITOR 0.15 MFD	FILTER
C3	312385	1	CAPACITOR 0.1 MFD	FILTER
CR1	197464	2	DIODE 1N914	CLAMP
CR2			SAME AS CR1	GATE
Q1	323934	2	TRANSISTOR 2N3565	SWITCH
Q2			SAME AS Q1	
EC	333603	1	BOARD, ETCHED CIRCUIT	
	324147	2	PAD, TRANSISTOR	





NOTE:
REFER TO MR2001 TYPE I FOR MARKING INFORMATION.



NOTE: THE +5V OUTPUT MUST RANGE BETWEEN +3.3 AND +5.5V.

NOTE:
CARD CONNECTIONS ARE REPRESENTED BY LETTERS
TEST POINTS ARE REPRESENTED BY NUMBERS.

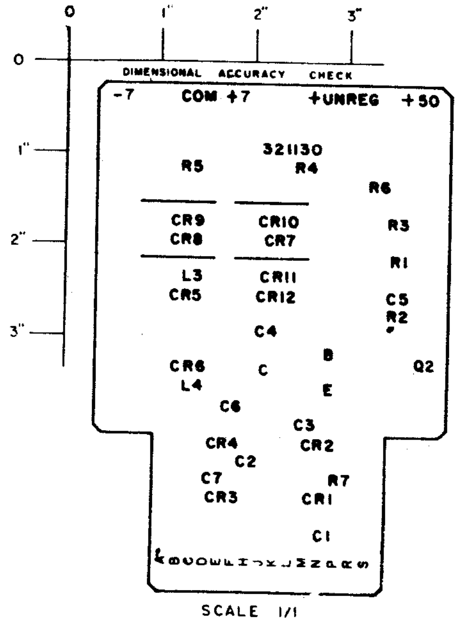
Figure 5-49. 303164 Clock Amplifier, Circuit Board EC 164

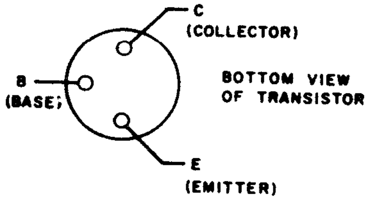
CIRCUIT BOARD ASSEMBLY, POWER SUPPLY (47-53V.D.C. .5AMP. MAX.)

REF. DESIGN.	PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	FUNCTION
C1	312284	1	CAPACITOR, 1.5 MFD 400V	RF FILTER
C2,3	171585	2	CAPACITOR, .22MFD 200V	RF FILTER
C4	171831	1	CAPACITOR, 10MFD 150V	RECTIFIER FILTER
C5	178860	1	CAPACITOR, .022MFD 100V	RF FILTER
C6,7	312385	2	CAPACITOR, .1MFD 10V	RF FILTER
R1	198937	1	RESISTOR, 2.7K 2W	
R2	182180	2	RESISTOR, 200 OHM 1/2W	
R3	171533	1	RESISTOR 4 OHM 5W	
R4,5	311664	2	RESISTOR, 2.5K 8W	DROPPING
R6			SAME AS R2	RF FILTER
R7	305298	1	RESISTOR, 3.3K 3W	BLEEDER
CR1-4	182520	4	DIODE (1N4383)	RECTIFIER
CR5,6	327794	2	DIODE, ZENER (7.2V)	REFERENCE
CR7	321286	2	DIODE, ZENER (1N4749A)	REFERENCE
CR8-11	178844	4	VARISTOR (W.E. 100A)	REFERENCE
CR12			SAME AS CR7	REFERENCE
L3,4	321159	2	INDUCTOR 39 uH	RF FILTER
Q2	321145	1	TRANSISTOR (2N2270)	GAIN
FC1,2	311068	2	FUSE CLIP	
F102	131807	1	FUSE .5 AMP.	
TP1	320042	1	JACK, TEST (SLATE)	
TP2	320041	1	JACK, TEST (GREEN)	
TP3	320039	1	JACK, TEST (BLACK)	
TP4	320040	1	JACK, TEST (ORANGE)	
TP5	320038	1	JACK, TEST (RED)	
P1-3	137471	3	TERMINAL POST	CONNECTOR
	321140	1	CIRCUIT CARD	
S1-S4	336470	4		
1	151637	2	SCREW 4-40	
2	151880	2	NUT 4-40	
3	110743	2	LOCK WASHER	
4	125011	2	FLAT WASHER	

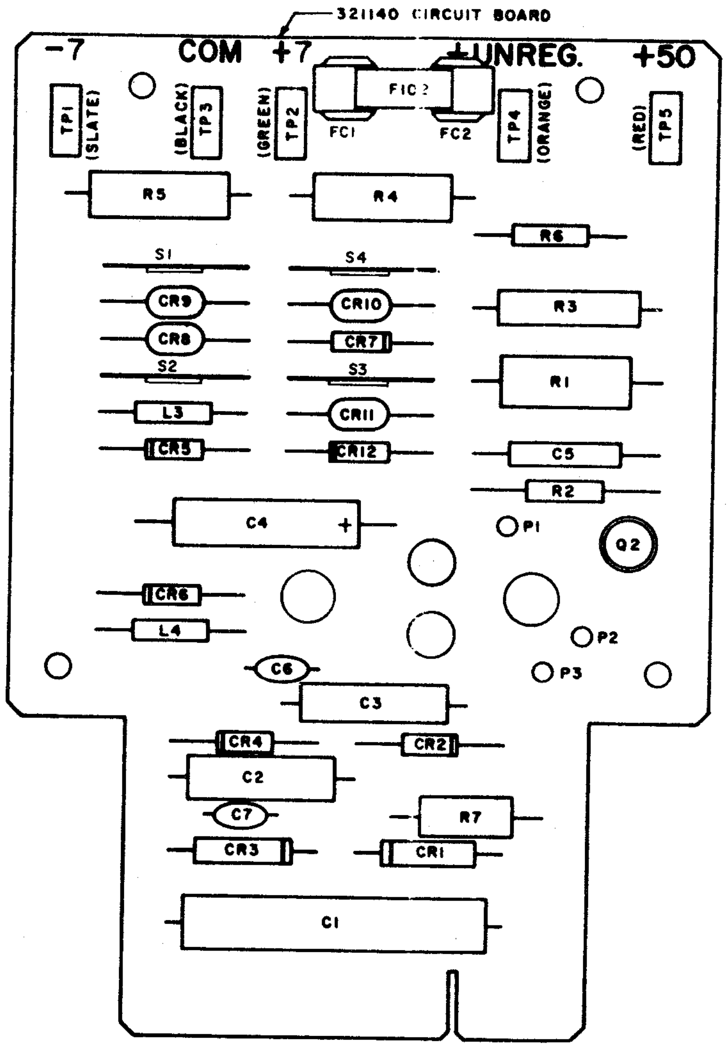
CIRCUIT DESCRIPTION (SEE SHEET 2)

DIODES CR1 AND CR3 FORM A RECTIFIER WITH ASSOCIATED TRANSFORMER (321123) T1 AND CAPACITOR C8 (321129) TO OBTAIN A MINIMUM +58V DC UNREGULATED. Q1 IS AN EMITTER FOLLOWER VOLTAGE REGULATING ELEMENT WHICH ABSORBS THE VOLTAGE DIFFERENCE BETWEEN THE UNREGULATED DC AND THE CONSTANT +50V DC REFERENCE ESTABLISHED BY DIODES CR7-CR12. Q2 PROVIDES GAIN FOR Q1. DIODES CR3.CR4. TRANSFORMER T1 AND CAPACITOR C4 FORM A FULL WAVE RECTIFIER TO OBTAIN NEGATIVE UNREGULATED DC. R4 AND CR6. R5 AND CR5 FORM BASIC SHUNT REGULATORS TO OBTAIN +7 AND -7V DC.





1) TELETYPE REFERENCE ONLY: SPECIFICATION 61,267S
2) SEE SHEET2 FOR SCHEMATIC WIRING
3) ALL CHARACTERS TO BE .125 HIGH AND PRINTED WITH WHITE ENAMAL.
4) ALL PRINTED CHARACTERS TO BE LOCATED ±.031 FROM NOMINAL POSITION.



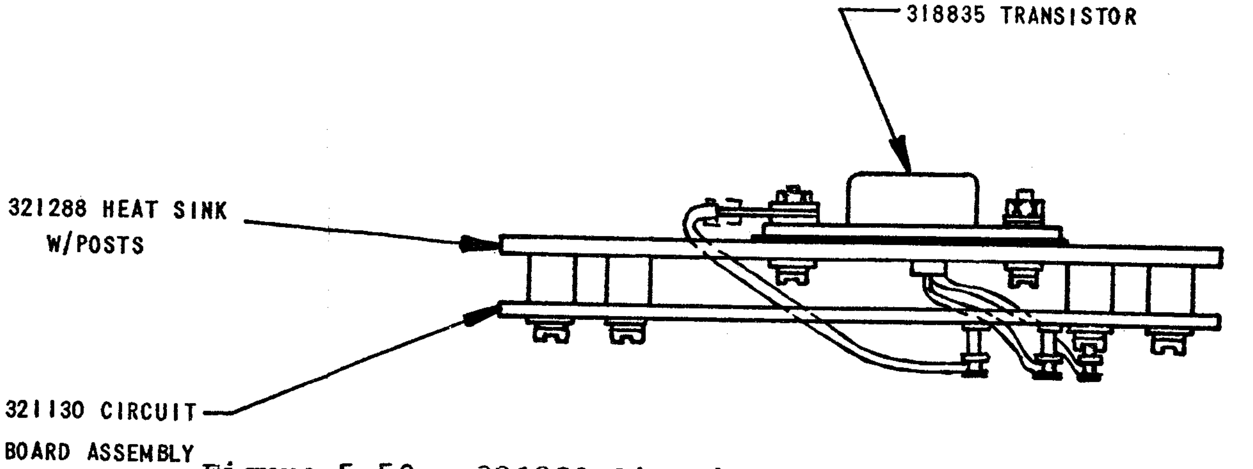


Figure 5-50. 321290 Circuit Board Assembly w/Heat Sink (Sheet 1 of 2)

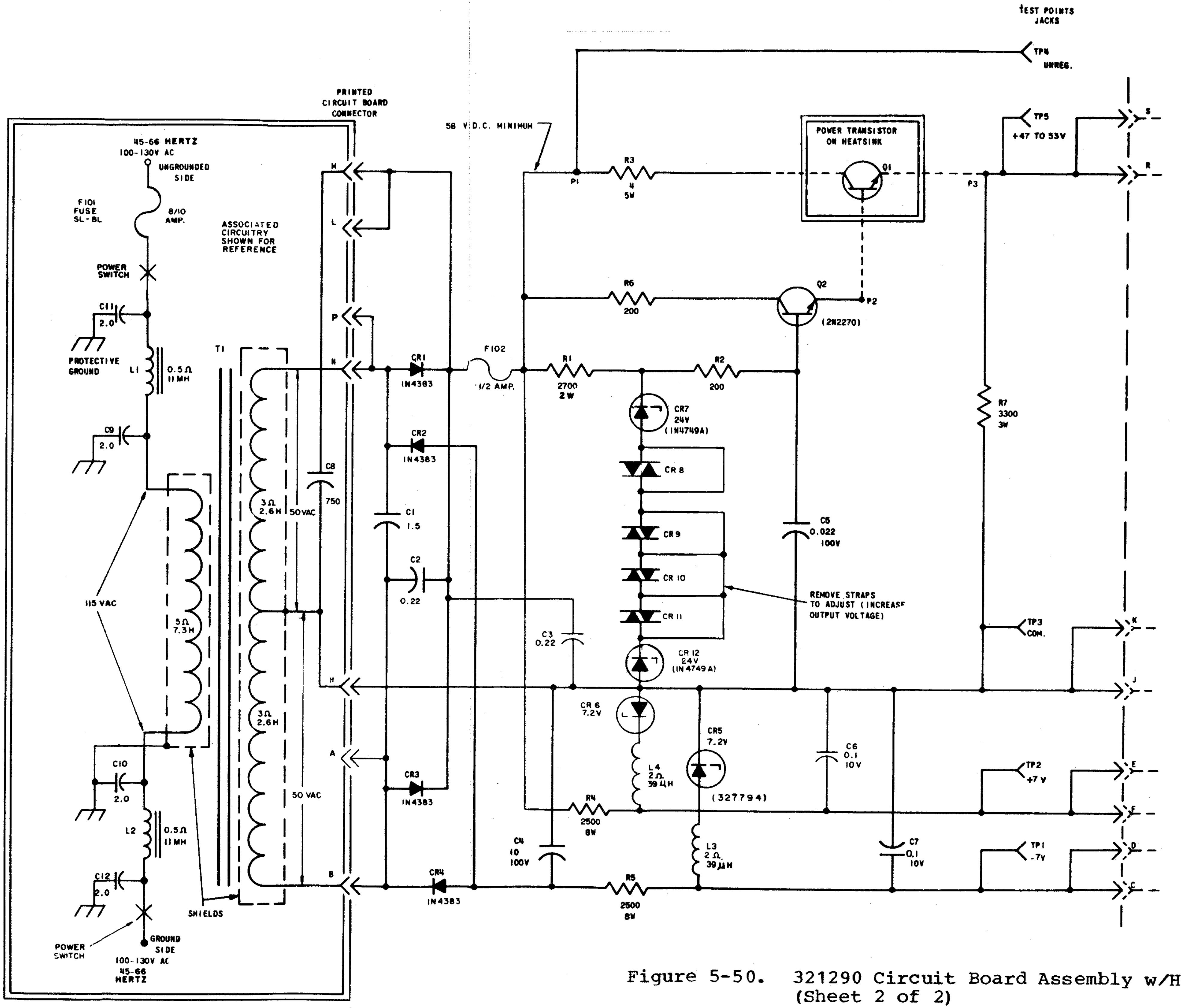


Figure 5-50. 321290 Circuit Board Assembly w/Heat Sink (Sheet 2 of 2)

NO	NOTES
1.	R3 AND R15 ARE ADJUSTED FOR SYMMETRICAL SWITCHING ABOUT ZERO VOLTS FOR INPUT 1 AND 2 RESPECTIVELY.
2.	PINS A,B - 60MA TO COILS PINS C,D - 47 TO 53V DC POWER INPUT PINS N,P - MS 1888 SIGNAL INPUT 1 PINS E,F - MS 188B SIGNAL INPUT 2 PINS H,J,K,L,M, - CIRCUIT COMMON (ALL INPUTS AND OUTPUTS REFERRED TO CIRCUIT COMMON).
3.	REFERENCE SPEC. FOR TELETYPE CORP. EMPLOYEES ONLY: 61,264S.
4.	ALL RESISTORS ARE 5%, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
'5.	ALL CAPACITANCE VALUES IN PICOFARADS UNLESS OTHERWISE SPECIFIED.
6.	▽ DENOTES CIRCUIT COMMON.

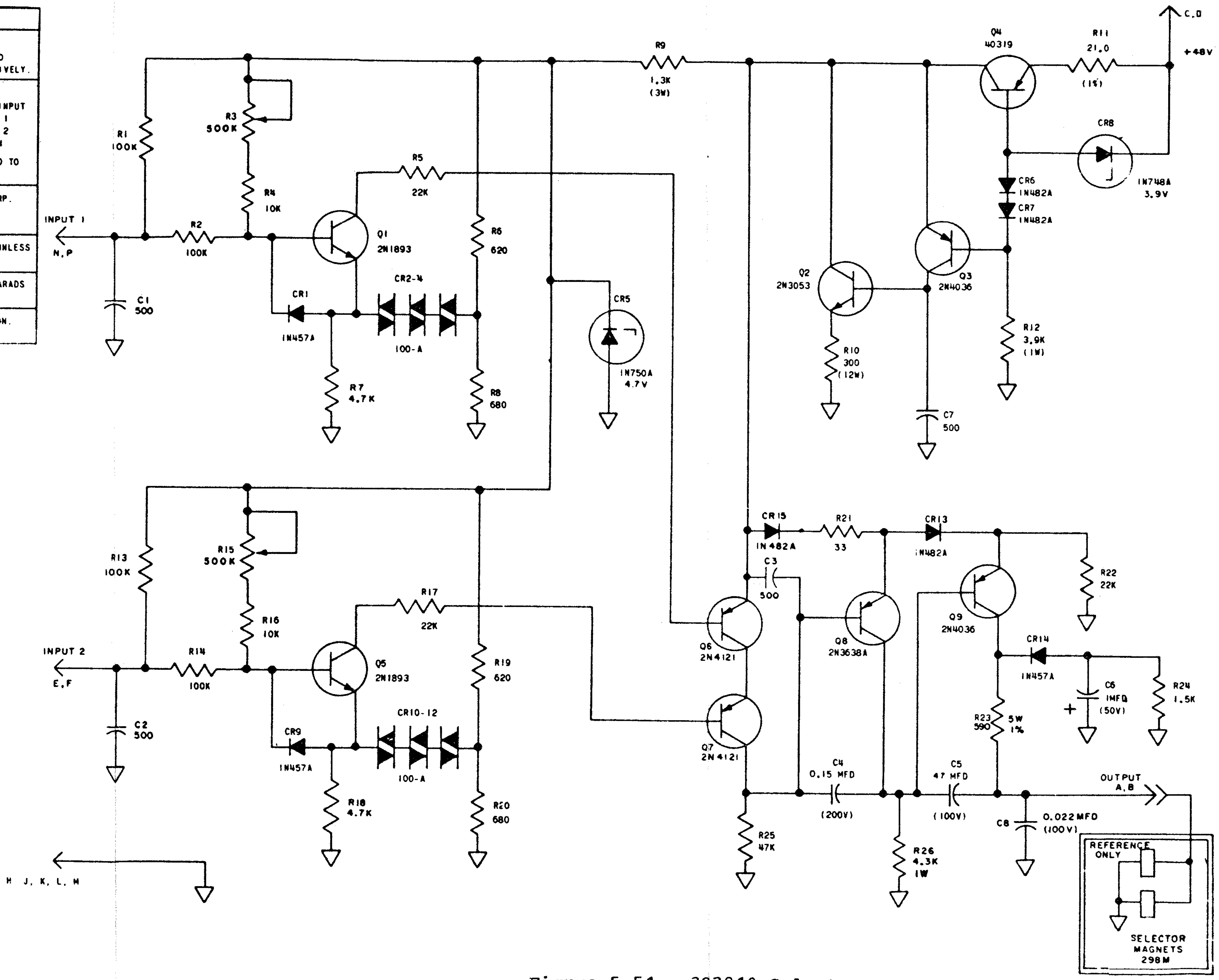
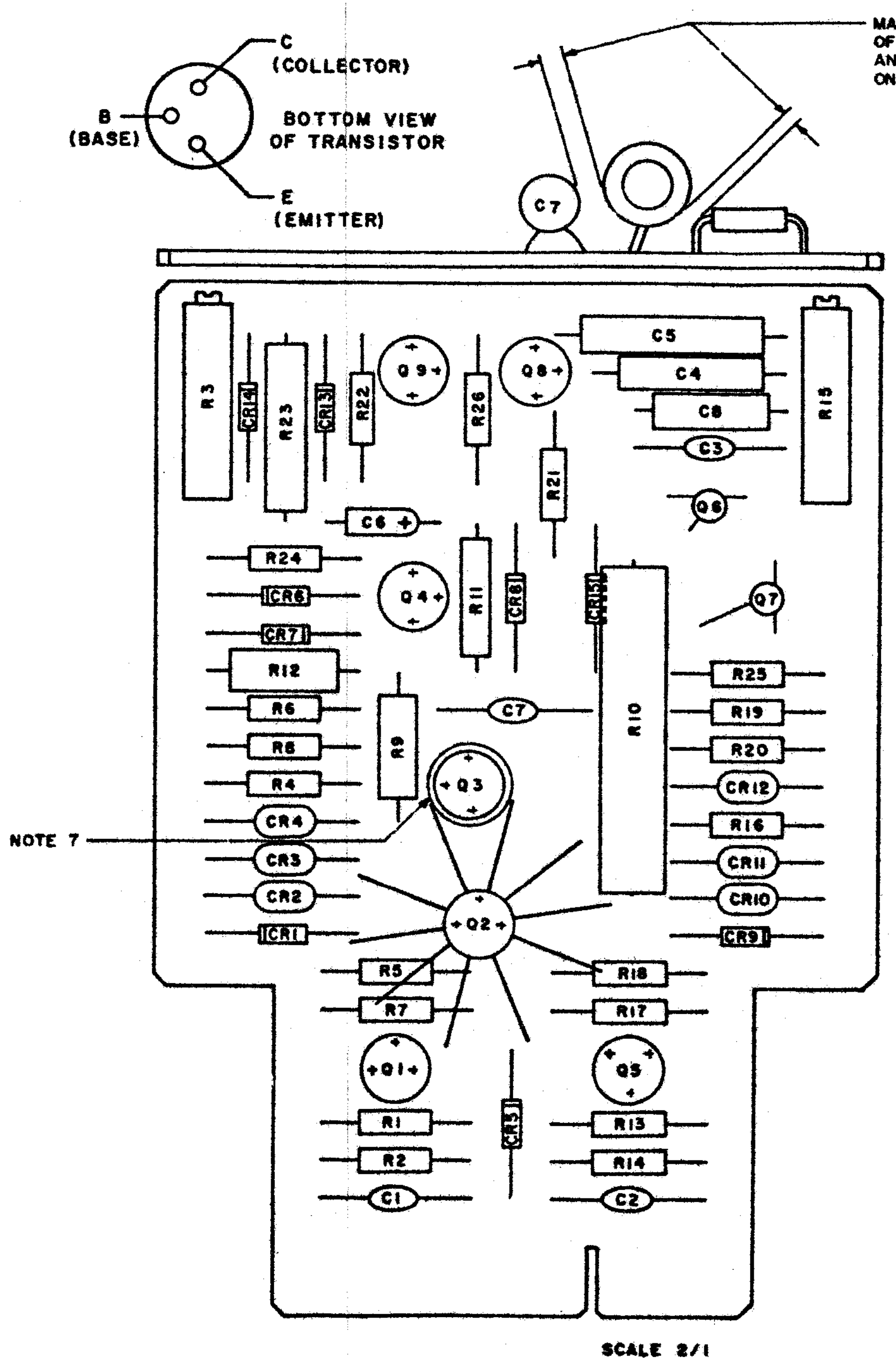
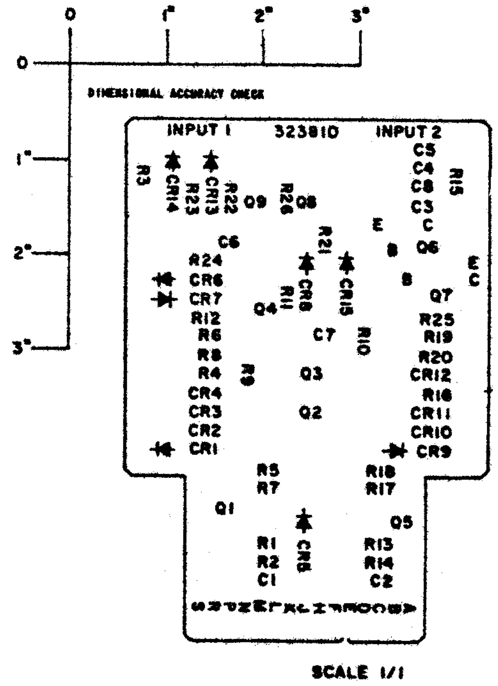


Figure 5-51. 323810 Selector Magnet Driver (SMD) With Siganl Combiner Schematic Wiring Diagram (Sheet 1 of 2)

REF. DESIG.	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
C1	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C2	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C3	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C4	171829	1	CAPACITOR, .15 MFD	Q8 FEEDBACK CAP.
C5	326776	1	CAPACITOR, .47 MFD	Q9 FEEDBACK CAP.
C6	321260	1	CAPACITOR, 1 MFD 50V	TRANSIENT SUPP.
C7	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C8	178880	1	CAPACITOR, .022 MFD	R.F. BY-PASS CAP.
R1	118720	1	RESISTOR, 100K, 1/2W	Q1 OPEN LINE BIAS
R2	118720	1	RESISTOR, 100K, 1/2W	INPUT 1 RES
R3	323964	1	POTENTIOMETER 500K	Q1 BIAS
R4	129854	1	RESISTOR, 10K, 1/2W	Q1 BIAS
R5	118177	1	RESISTOR, 22K, 1/2W	Q1 LOAD RES.
R6	137604	1	RESISTOR, 620, 1/2W	VOLTAGE DIVIDER
R7	118146	1	RESISTOR, 4.7K, 1/2W	Q1 EMITTER RES.
R8	129850	1	RESISTOR, 680, 1/2W	VOLTAGE DIVIDER
R9	309868	1	RESISTOR, 1.3K, 3W	CR5 CURRENT LIMITER
R10	323841	1	RESISTOR, 300, 12 W	Q2 LOAD RES.
R11	323842	1	RESISTOR, 21, 1/2W, 1%	REG. CURRENT SET
R12	178864	1	RESISTOR, 3.9K, 1W	CR8 CURRENT LIMITER
R13	118720	1	RESISTOR, 100K 1/2W	Q5 OPENLINE BIAS
R14	118720	1	RESISTOR, 100K, 1/2W	INPUT 2 RES.
R15	323964	1	POTENTIOMETER 500K	Q5 BIAS
R16	129854	1	RESISTOR, 10K, 1/2W	Q5 BIAS
R17	118177	1	RESISTOR, 22K, 1/2W	Q5 LOAD RES.
R18	118146	1	RESISTOR, 4.7K, 1/2W	Q5 EMITTER RES.
R19	137604	1	RESISTOR, 620, 1/2W	VOLTAGE DIVIDER
R20	129850	1	RESISTOR, 680, 1/2W	VOLTAGE DIVIDER
R21	321975	1	RESISTOR, 33, 1/2W	Q6 EMITTER RES.
R22	118177	1	RESISTOR, 22K, 1/2W	CR13 BIAS RES.
R23	323843	1	RESISTOR, 590, 5W, 1%	COIL CURRENT LIMITER
R24	137442	1	RESISTOR, 1.5K, 1/2W	C6 BLEEDER RES.
R25	118154	1	RESISTOR 47K, 1/2W	Q6,Q7 LOAD RES.
R26	120424	1	RESISTOR 4.3K, 1W	Q8 LOAD RES.
CR1	321154	1	DIODE, 1N457A	Q1 BASE PROT.
CR2	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR3	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR4	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR5	181667	1	DIODE, 1N750A	TEMP. COMP. REF.
CR6	321156	1	DIODE, 1N482A	Q4 COLLECTOR CLAMP
CR7	321156	1	DIODE, 1N482A	Q4 COLLECTOR CLAMP
CR8	321161	1	DIODE, 1N748A	REG. VOLT REF.
CR9	321154	1	DIODE, 1N457A	Q5 BASE PROT.
CR10	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR11	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR12	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR13	321156	1	DIODE, 1N482A	Q9 EMITTER DIODE
CR14	321154	1	DIODE, 1N457A	TRANSIENT SUPP.
CR15	321156	1	DIODE, 1N482A	Q8 EMITTER DIODE
Q1	321166	1	TRANSISTOR, 2N1893	DC AMP.
Q2	323844	1	TRANSISTOR, 2N3055	SHUNT REG
Q3	321261	1	TRANSISTOR, 2N4036	SHUNT REG. AMP.
Q4	323845	1	TRANSISTOR, 40319	SERIES REG.
Q5	321166	1	TRANSISTOR, 2N1893	DC AMP
Q6	324144	2	TRANSISTOR, 2N4121	DC AMP.
Q7			SAME AS Q6	
Q8	321165	1	TRANSISTOR, 2N3638A	DC AMP.
Q9	321261	1	TRANSISTOR, 2N4036	DC AMP.
	324157	2	PAD, TRANSISTOR	
	144495	6	PAD, TRANSISTOR	
	323846	1	PAD, TRANSISTOR	
	323847	1	HEAT SINK	
	323835	1	CIRCUIT BOARD, ETCHED	
	300116	1	COVER, INSULATING	

ASSEMBLY, CIRCUIT (SMD WITH SIGNAL COMBINER)

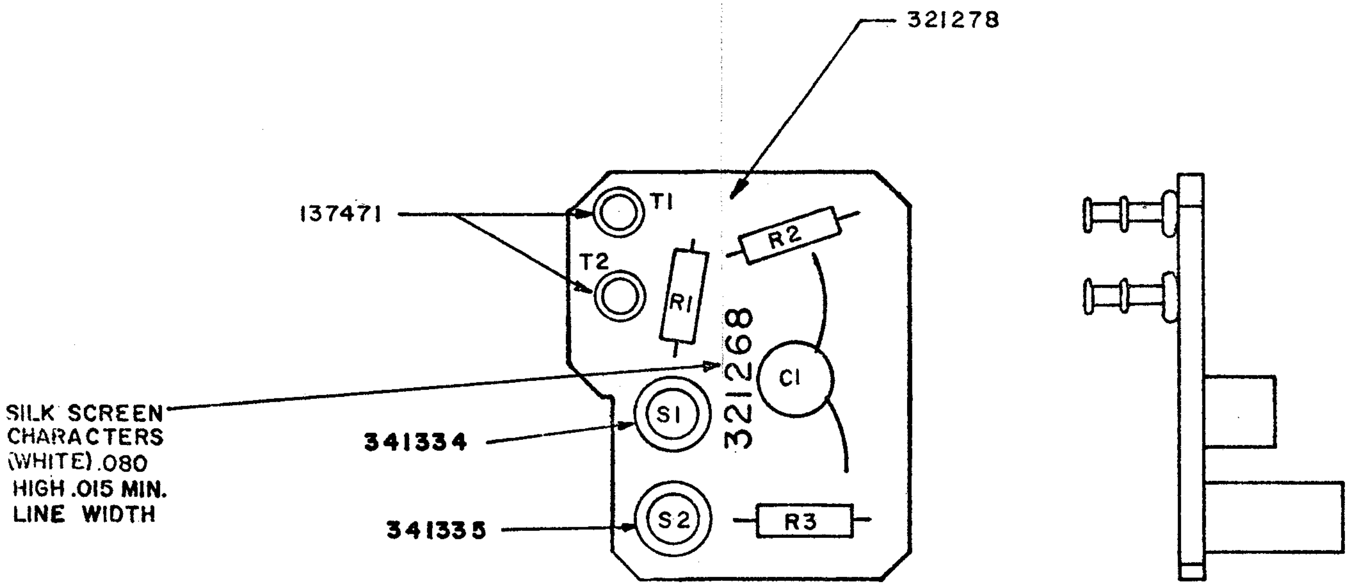


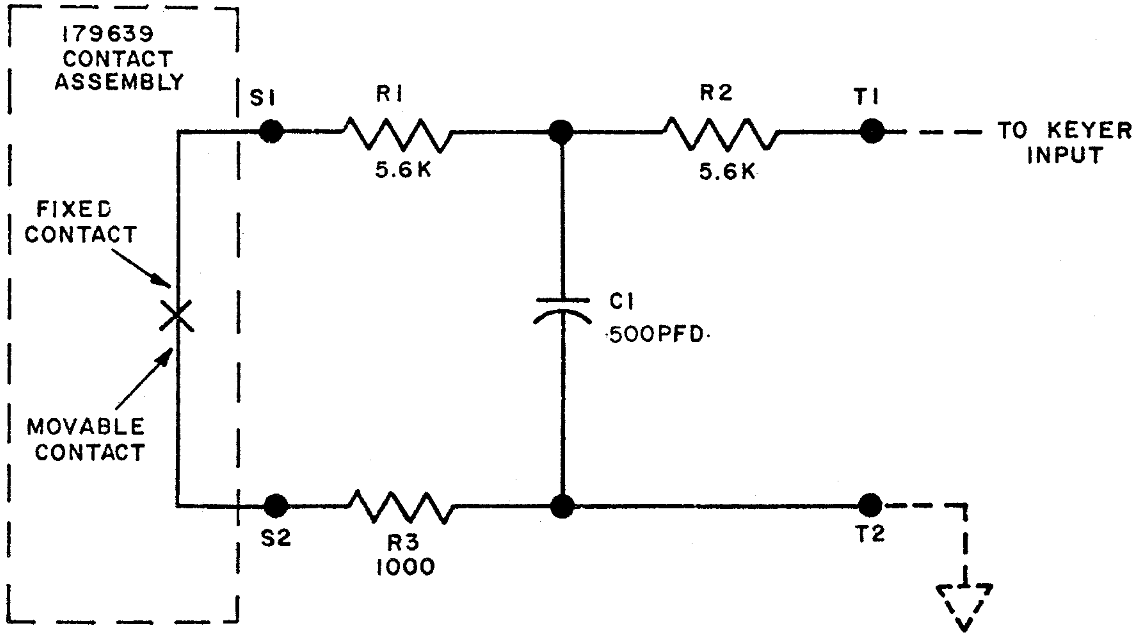


NOTES:

1. TRANSISTOR Q2 HAS 323847 HEAT SINK PRESSED ON.
2. USE 323846 TRANSISTOR PAD UNDER TRANSISTOR Q3.
3. REFERENCE SPECIFICATION FOR TELETYPE CORP. EMPLOYEES ONLY: 61,264S
4. REFER TO 8143WD FOR SCHEMATIC WIRING DIAGRAM.
5. ALL CHARACTERS TO BE .125 HIGH AND PRINTED WITH WHITE ENAMEL.
6. ALL PRINTED CHARACTERS TO BE LOCATED +.031 FROM NOMINAL.
7. Q3 HAS 300116 INSULATING COVER. POSITION Q3 (WITH COVER) SO THAT 323847 HEAT SINK MAY BE FULLY SEATED ON Q2.
8. 144495 TRANSISTOR PAD REQUIRED ON Q1, Q4, Q5, Q8 AND Q9, AND Q2.

Figure 5-51. 323810 Selector Magnet Driver (SMD) With Signal Combiner Schematic Wiring Diagram (Sheet 2 of 2)





REF. DESIGN	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
R1	315960	2	RESISTOR, 5.6K 1/4 WATT	RC FILTER
R2	"		SAME AS R1	"
R3	321213	1	RESISTOR, 1000 Ω 1/4 WATT	"
C1	321157	1	CAPACITOR, 500 PFD	"
T1	137471	2	TERMINAL, SOLDER	
T2	"		"	
S1	341334	1	STUD, CONNECTOR	
S2	341335	1	"	
321278	321278	1	BOARD, ETCHED CIRCUIT	

NOTE:

DASHED LINES INDICATE EXTERNAL CIRCUITRY.

Figure 5-52. 321268 Filter Card Assembly

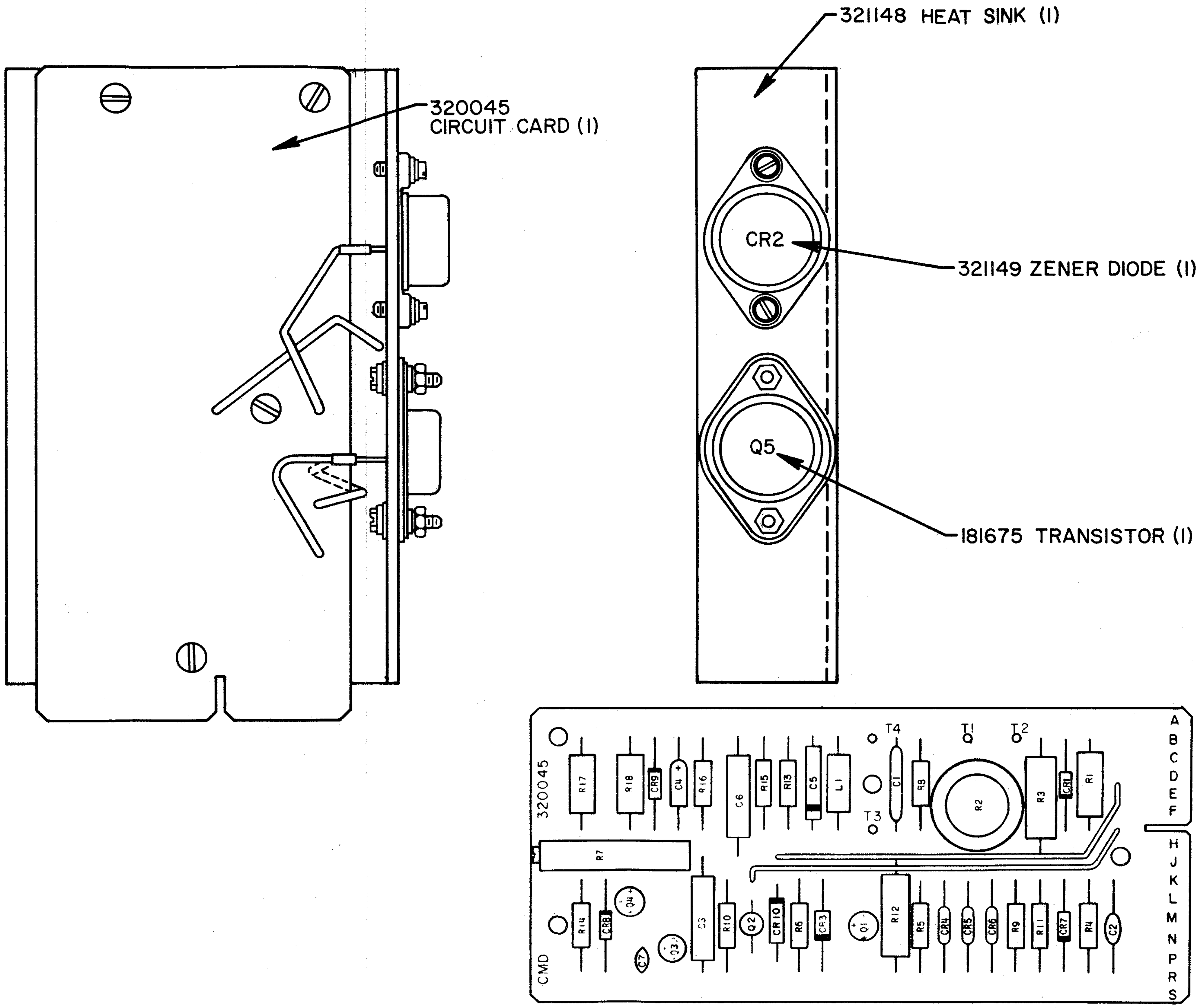


Figure 5-53 Clutch Magnet Driver 321991 (Sheet 1 of 2)

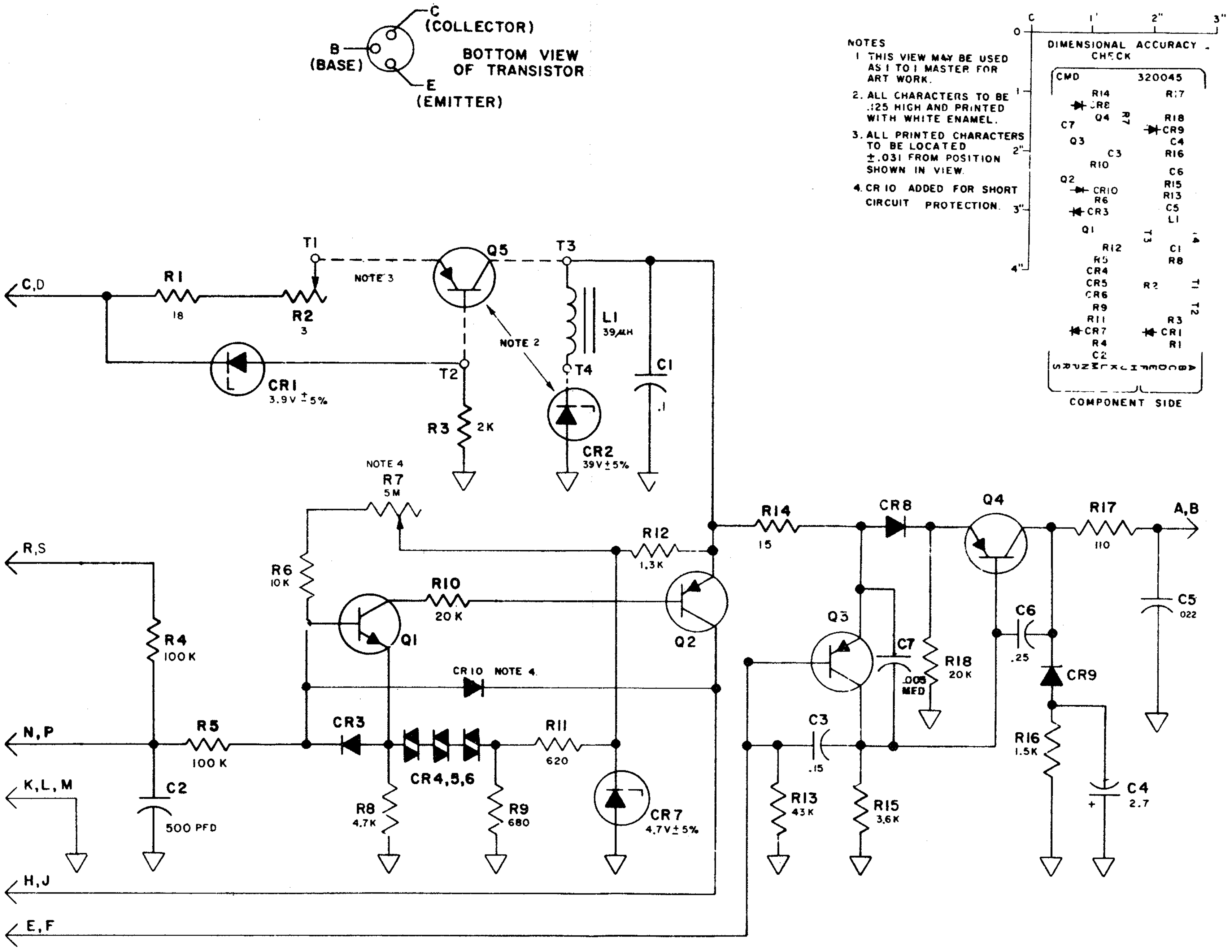
USED ON 321991

NO B/M

NOTE 4

ASSEMBLY, CIRUIT CARD (CMD)				
REF. DESIG.	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
R1	327793	1	RESISTOR, 18 OHM 3 W, ±1%	REG. CURRENT LIMITER
R2	182773	1	POTENTIOMETER, 3 OHM, 2.5W	REG. CURRENT ADJ.
R3	321155	1	RESISTOR, 2K, 2W, 5%	CR1 CURRENT LIMITER
R4	118720	1	RESISTOR, 100K, 1/2 W, 5%	Q1 OPEN LINE BIAS
R5	118720	1	RESISTOR, 100K, 1 2W, 5%	INPUT RESISTOR
R6	129854	1	RESISTOR, 10K, 1 2W	Q1 BIAS
R7	321160	1	POTENTIOMETER, 5M	Q1 BIAS
R8	118146	1	RESISTOR, 4.7K, 1 2W, 5%	**Q1 EMITTER RES**
R9	129850	1	RESISTOR, 680 OHM, 1 2W, 5%	VOLTAGE DIVIDER
R10	321258	1	RESISTOR, 20K, 1/2W, 5%	**Q1 LOAD RES**
R11	137604	1	RESISTOR, 620 OHM, 1 2W, 5%	VOLTAGE DIVIDER
R12	321292	1	RESISTOR, 1.3K, 2W, 5%	CR7 CURRENT LIMITE
R13	139143	1	RESISTOR, 43K, 1 2W, 5%	Q2 LOAD RES.
R14	321259	1	RESISTOR, 15 OHM, 1 2W, 5%	Q3 EMITTER RES.
R15	165178	1	RESISTOR, 3.6K, 1 W, 5%	Q3 LOAD RES.
R16	137442	1	RESISTOR, 1 5K, 1/2W, 5%	C4 BLEEDER RES
R17	321151	1	RESISTOR, 110 OHM, 3W, 1%	COIL CURRENT LIMITER
R18	321258	1	RESISTOR, 20K, 1/2W, 5%	CR8 BIAS RES.
C1	321158	1	CAPACITOR, .1 MFD.	R.F. BY-PASS CAP
C2	321157	1	CAPACITOR, 500 PFD.	R.F. BY-PASS CAP
C3	171829	1	CAPACITOR, .15 MFD.	Q3 FEEDBACK CAP
C4	321264	1	CAPACITOR, 50V, 2.7 MFD.	TRANSIENT SUPP.
C5	178860	1	CAPACITOR, 100V, .022 MFD.	R.F. BY-PASS
C6	171587	1	CAPACITOR, 200V, .25 MFD.	Q4 FEEDBACK CAP.
C7	171583	1	CAPACITOR, .003 MFD	R F BY-PASS CAP.
L1	321159	1	CHOKE, 390 µH	R.F. CHOKE
CR1	321161	1	DIODE, 1N748A, 3.9V ± 5%	REG. VOLT. REF.
CR3	321154	1	DIODE, 1N457A	Q1 BASE PROT.
CR4	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR5	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR6	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR7	181667	1	DIODE, 1N750A, 4.7V ±5%	TEMP COMP. REF.
CR8	177611	1	DIODE, 1N382	Q4 EMITTER DIODE
CR9	321154	1	DIODE, 1N457A	TRANSIENT SUPP.
CR10	321154	1	DIODE, 1N457A	SHORT PROT.
Q1	321166	1	TRANSISTOR, 2N1893	D.C. AMP.
Q2	324144	1	TRANSISTOR, 2N4121	D.C. AMP.
Q3	321165	1	TRANSISTOR,	D.C. AMP.
Q4	321261	1	TRANSISTOR, 2N4036	D.C. AMP.
	324147	1	PAD, TRANSISTOR	Q2
	144495	3	PAD, TRANSISTOR	Q1, Q3, Q4
	321299	1	CIRCUIT BOARD, ETCHED	
	321171	2	LEAD (BK)	
T1-T4	137471	4	LUG, TERMINAL	

NO.	NOTES
1.	ALL RESISTORS 1/2 WATT, ALL RESISTANCE VALUES IN OHMS AND ALL CAPACITANCE VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
2	Q5 (181675) AND CR2 (321149) ARE MOUNTED TO 321148 HEAT SINK. SEE CMD ASSEMBLY 321991.
3.	R2 IS ADJUSTED FOR 15 MA IN CR2 WITH INPUT MARKING (+6) AND OUTPUT CONNECTED TO A 150 OHM RESISTOR (5W)
4.	R7 IS ADJUSTED FOR SYMMETRICAL SWITCHING ABOUT ZERO.
5.	PINS A,B 140 MA TO COILS PINS R,S -6V DC PINS C,D +47 TO 53V DC POWER PINS E,F,H,J CONTROL CONTACT PROVISION. PINS N,P MS 188B SIGNAL INPUT PINS K,L,M COMMON (ALL INPUTS AND OUTPUTS REFERRED TO COMMON)
6.	S-NUMBER 61,263 S



NOTES
1 THIS VIEW MAY BE USED AS 1 TO 1 MASTER FOR ART WORK.
2. ALL CHARACTERS TO BE .125 HIGH AND PRINTED WITH WHITE ENAMEL.
3. ALL PRINTED CHARACTERS TO BE LOCATED ±.031 FROM POSITION SHOWN IN VIEW.
4. CR 10 ADDED FOR SHORT CIRCUIT PROTECTION.

Figure 5-53 Clutch Magnet Driver 321991 (Sheet 2 of 2)