



TECHNICAL MANUAL  
MODEL 28  
UNIVERSAL TORN TAPE  
SYSTEM

SECTIONS

1. DESCRIPTION
2. INSTALLATION
3. OPERATOR'S SECTION
4. PRINCIPLES OF OPERATION
5. ADJUSTMENTS AND LUBRICATION
6. SERVICE AND REPAIR

**TELETYPE<sup>®</sup>**  
**CORPORATION**  
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CROSS REFERENCE  
AN NOMENCLATURE TO TELETYPE CODES

AN NOMENCLATURE		TELETYPE CODES	DISTRIBUTOR-TRANSMITTER SET, TELETYPEWRITER TT-333/UG	REPERFORATOR SET, TELETYPEWRITER TT-332/UG	REPERFORATOR SET, TELETYPEWRITER TT-331/UG
CABINET, ELECTRICAL EQUIPMENT	CY-3249/UG	LBAC229BR	X		
CABINET, ELECTRICAL EQUIPMENT	CY-3250/UG	LBAC230BR		X	
CABINET, ELECTRICAL EQUIPMENT	CY-3251/UG	LBAC231BR			X
DISTRIBUTOR-TRANSMITTER, TELETYPEWRITER	TT-334/UG	LBXD 9	X		
BASE UNIT, TELETYPEWRITER	MT-2600/UG	LMXB200BR	X		
BASE UNIT, TELETYPEWRITER	MT-2594/UG	LMRB204BZ		X	X
MOTOR, ALTERNATING CURRENT	PD-67/U	LMU12	X	X	X
REELING MACHINE, TAPE, MOTOR DRIVEN	RL-216/UG	TW15		X	
REPERFORATOR, TELETYPEWRITER	TT-315/UG	LPR35BWA			X
REPERFORATOR, TELETYPEWRITER	TT-317/UG	LPR37BWA		X	

CROSS REFERENCE  
TELETYPE CODES TO AN/FGC-59 TORN TAPE SYSTEM  
(7.42 UNIT CODE)

DESCRIPTION		TELETYPE CODES	AN/FGC-59 TORN TAPE SYSTEM				
			MODEL 28 UNIVERSAL TORN TAPE SYSTEM			MODEL 28 AUXILIARY GROUP	
			TRANSMITTER GROUP	TYPING REPERFORATOR MONITOR GROUP	TYPING REPERFORATOR RECEIVING GROUP	MONITOR TRANSMITTER GROUP-(PULL-BACK)	
CABINET		LBAC 229BR	X				
CABINET		LBAC 230BR		X			
CABINET		LBAC 231BR			X		
CABINET		LBAC 232BR				X	
TRANSMITTER DISTRIBUTOR		LBXD 9	X				
BASE, TRANSMITTER DISTRIBUTOR		LMXB 200BR	X			X	
MOTOR, SYNCHRONOUS		LMU 12	X	X	X	X	
TYPING REPERFORATOR		LPR 35BWA			X		
TYPING REPERFORATOR		LPR 37BWA		X		X	
BASE MULTIPLE REPERFORATOR		LMRB 204BZ		X	X	X	
TAPE WINDER, MULTIPLE		TW 15		X		X	
RELAY, LINE		33 RY		X	X	X	
END ENCLOSURES		161999BR	X	X	X	X	
GEAR SET NO.		WORDS PER MINUTE	TRANSMITTER BASE	TYPING REPERFORATOR BASE			
161530	60		LMRB 204BZ		X	X	X
161536	100		LMRB 204BZ		X	X	X
162035	60	LMXB 200BR		X			X
162041	100	LMXB 200BR		X			X

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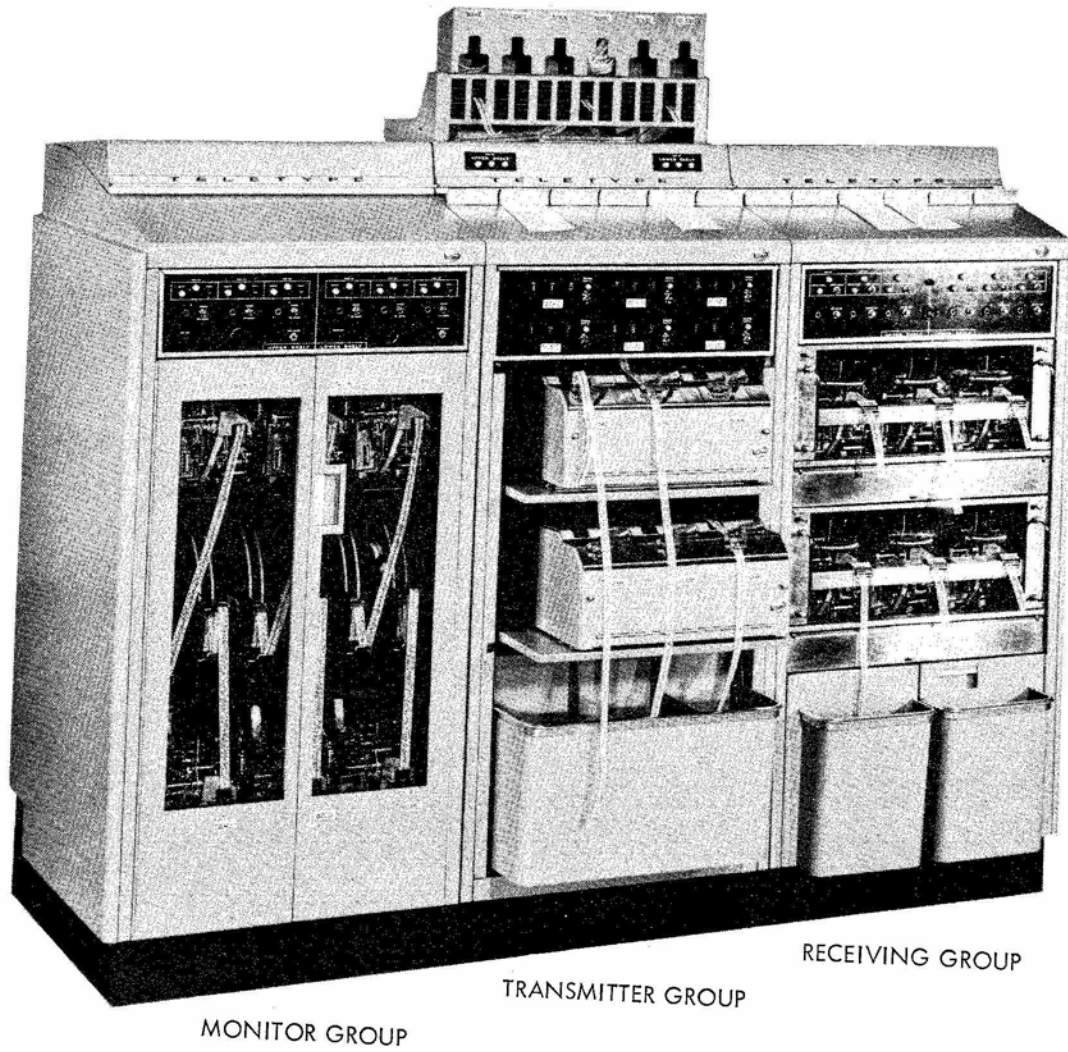


Figure 1-1. Model 28 Universal Torn Tape System (With Fully Perforated Tape Output)

SECTION 1  
DESCRIPTION

## 1-1. INTRODUCTION

a. This manual consists of two volumes containing all necessary information for the installation, operation, and maintenance of the following equipment groups in the Teletype Model 28 Universal Torn-Tape System (Figure 1-1, with fully perforated tape; and Figure 1-2, with chadless tape):

- (1) Model 28 Transmitter Group.
- (2) Model 28 Typing Reperforator Monitor Group.
- (3) Model 28 Typing Reperforator Receiving Group.

TABLE 1-1. MODEL 28 EQUIPMENT FOR UNIVERSAL TORN TAPE SYSTEM AND AUXILIARY GROUP

DESCRIPTION	TELETYPE CODES	MODEL 28 UNIVERSAL TORN TAPE SYSTEM			MODEL 28 AUXILIARY GROUP
		TRANSMITTER GROUP	TYPING REPERFORATOR MONITOR GROUP	TYPING REPERFORATOR RECEIVING GROUP	MONITOR TRANSMITTER GROUP - (PULL-BACK)
Cabinet	LBAC229BR	X			
Cabinet	LBAC230BR		X		
Cabinet	LBAC231BR			X	
Cabinet	LBAC232BR				X
Transmitter Distributor	LBXD9 (7.42 UNIT CODE)	X			X
Transmitter Distributor	LBXD18 (7.00 UNIT CODE)	X			
Transmitter Distributor	LBXD21 (7.50 UNIT CODE)	X			
Base, Transmitter Distributor	LMXB200BR	X			X
Base, Transmitter Distributor	LMXB204BR	X			
Motor, Synchronous	LMU12	X	X	X	X
Motor, Governed AC	LMU14	X	X	X	
Typing Reperforator	LPR35BWA			X	
Typing Reperforator	LPR37BWA		X		X
Typing Reperforator	LPR45AWA		X	X	
Base, Multiple Reperforator	LMRB201BZ		X	X	
Base, Multiple Reperforator	LMRB203BZ		X	X	
Base, Multiple Reperforator	LMRB204BZ		X	X	X
Base, Multiple Reperforator	LMRB205BZ		X	X	
Tape Winder, Multiple	TW15		X		X
Relay, Line	33RY		X	X	X
End Enclosures	161999BR	X	X	X	X
Power Factor, Mod. Kit, (LMRB201)	173484		X	X	

NOTE  
FOR APPLICABLE GEAR SETS REFER  
TO  
TABLE 1-2.

b. The Model 28 Monitor Transmitter Group (an auxiliary group) is also included in this manual. A group combination of the Monitor Transmitter Group with the Universal Torn-Tape System is shown in Figure 1-3.

c. The manual is divided into two volumes, Volume 1 and Volume 2. Volume 1 includes six sections as follows:

(1) Section 1, DESCRIPTION, presents a brief physical and functional description of the equipment.

(2) Section 2, INSTALLATION, contains installation instructions.

(3) Section 3, OPERATOR'S SECTION, contains information for proper equipment operation.

TABLE 1-2. GEAR SETS FOR MODEL 28 UNIVERSAL TORN TAPE SYSTEM AND AUXILIARY GROUP

GEAR SET NO.	SPEED			TELETYPE CODE NUMBERS FOR MULTIPLE BASES		MODEL 28 UNIVERSAL TORN TAPE SYSTEM			MODEL 28 AUXILIARY GROUP
						TRANSMITTER GROUP	TYPING REPERFORATOR MONITOR GROUP	TYPING REPERFORATOR RECEIVING GROUP	MONITOR TRANSMITTER GROUP - (PULL-BACK)
162035	7.42	60		LMXB200		X			X
172767	7.42	60		LMXB204		X			
178369	7.00	65		LMXB204		X			
162038	7.42	75		LMXB200		X			
162041	7.42	100		LMXB200		X			
172773	7.42	100		LMXB204		X			X
178366	7.00	106		LMXB204		X			
178821	7.50		45.5	LMXB204		X			
173592	7.00		45.5	LMXB200		X			
179212	7.00		50.	LMXB200		X			
178824	7.50		50.	LMXB204		X			
173589	7.00		75.	LMXB200		X			
172773	7.50		75.	LMXB204		X			
161530	7.42	60			LMRB204		X	X	
161680	7.42	60			LMRB201		X	X	
161533	7.42	75			LMRB204		X	X	
161536	7.42	100			LMRB204		X	X	
162217	7.42	100			LMRB201		X	X	X
173584	7.00		45.5		LMRB203		X	X	
178804	7.50		45.5		LMRB205		X	X	
164335	7.00		50.		LMRB203		X	X	
178801	7.50		50.		LMRB205		X	X	
178798	7.50		75.		LMRB205		X	X	
*164336	7.00		75.		LMRB203		X	X	

\*GEAR SET IS PART OF MULTIPLE REPERFORATOR BASE (LMRB203)

(4) Section 4, **PRINCIPLES OF OPERATION**, explains the principles of operation to aid in performing maintenance and in trouble shooting.

(5) Section 5, **ADJUSTMENTS AND LUBRICATION**, contains adjustment and lubrication information.

(6) Section 6, **SERVICE AND REPAIR**, covers information relating to preventive maintenance, trouble shooting, disassembly and re-assembly.

d. Volume 2 contains all associated actual and schematic wiring diagrams for the various groups.

e. Parts ordering information and exploded views of major assemblies with replaceable parts called out by part numbers will be covered in "PARTS BULLETIN 1180B."

f. Tables 1-1 and 1-2 contain a breakdown of components associated with each group.

g. Table 1-3 contains the approximate dimensions and weights of components associated with each group.

h. Various combinations of typical equipment groups are shown in the following figures:

(1) Two Typing Reperforator Monitor Groups with Monitor Transmitter Group (Figure 1-4).

(2) Two Transmitting Groups and Two Typing Reperforator Receiving Groups (Figure 1-5).

(3) Monitor Transmitter Group and Typing Reperforator Receiving Group (Figure 1-6).

(4) Two Typing Reperforator Monitor Groups with Transmitter Distributor Rerun Cart Group (Figure 1-7). For applicable Transmitter Distributor refer to standard Teletype Bulletins.

TABLE 1-3. DIMENSIONS AND WEIGHTS (APPROXIMATE) OF COMPONENTS FOR THE MODEL 28 UNIVERSAL TORN TAPE SYSTEM AND AUXILIARY GROUP

COMPONENT	HEIGHT	WIDTH	DEPTH	WEIGHT
CABINET (TRANSMITTER)	5' 5-3/4"	25-1/4"	26-1/4"	365 lbs.
CABINET (MONITOR)	4' 8-1/2"	25-1/4"	26-1/4"	270 lbs.
CABINET (RECEIVING)	4' 8-1/2"	25-1/4"	26-1/4"	270 lbs.
CABINET (MONITOR-TRANSMITTER)	4' 8-1/2"	25-1/4"	26-1/4"	315 lbs.
161999 (END ENCLOSURES)	3' 9-1/2"	1"	25-1/4"	50 lbs.
TRANSMITTER DISTRIBUTOR FIXED HEAD-MULTI-CONTACT	7"	5-1/2"	8-1/2"	8 lbs.
MULTIPLE TRANSMITTER DISTRIBUTOR BASE	7-1/2"	17-1/2"	15-1/2"	24 lbs.
MESSAGE IDENTIFICATION MODULE	2-3/4"	6-1/2"	13-3/4"	7 lbs.
MULTIPLE TYPING REPERFORATOR BASE	9-1/2"	22"	23"	27 lbs.
SYNCHRONOUS MOTOR	5-3/4"	8-1/2"	4"	9 lbs.
AC GOVERNED MOTOR	5-3/4"	10-1/2"	4"	10 lbs.
TYPING REPERFORATOR	7-1/2"	6-1/2"	8"	9 lbs.
TYPING REPERFORATOR WITH TAPE FEED-OUT MECHANISM	7-1/2"	6-1/2"	9"	10 lbs.
TW15	13-1/2"	9-1/2"	17"	19 lbs.
33RY	2-3/4"	2-3/4"	4"	1 lb.

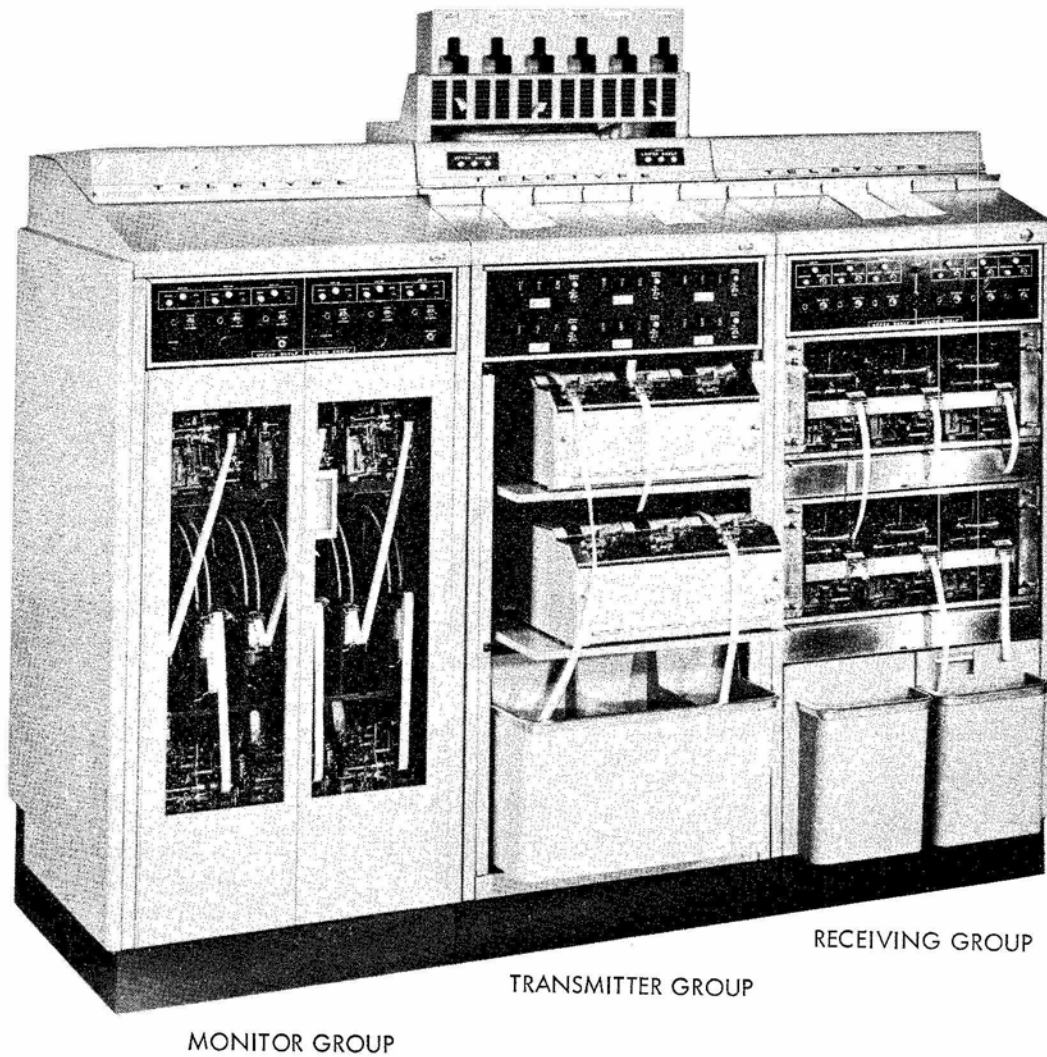


Figure 1-2. Model 28 Universal Torn Tape System (With Chadless Tape Output)

1-2. MODEL 28 UNIVERSAL TORN-TAPE SYSTEM (Figures 1-1 and 1-2) - The Model 28 Universal Torn-Tape System provides a means of:

- a. Receiving telegraphic baudot codes and converting them to perforated tape.
- b. Transmission and automatic identification of transmitted tapes.

c. Monitoring all outgoing transmission.

1-3. MODEL 28 TRANSMITTER GROUP (Figure 1-8)

- a. GENERAL - The Model 28 Transmitter Group provides facilities for the transmission of messages from perforated tape to the outgoing signal lines at predetermined and preset



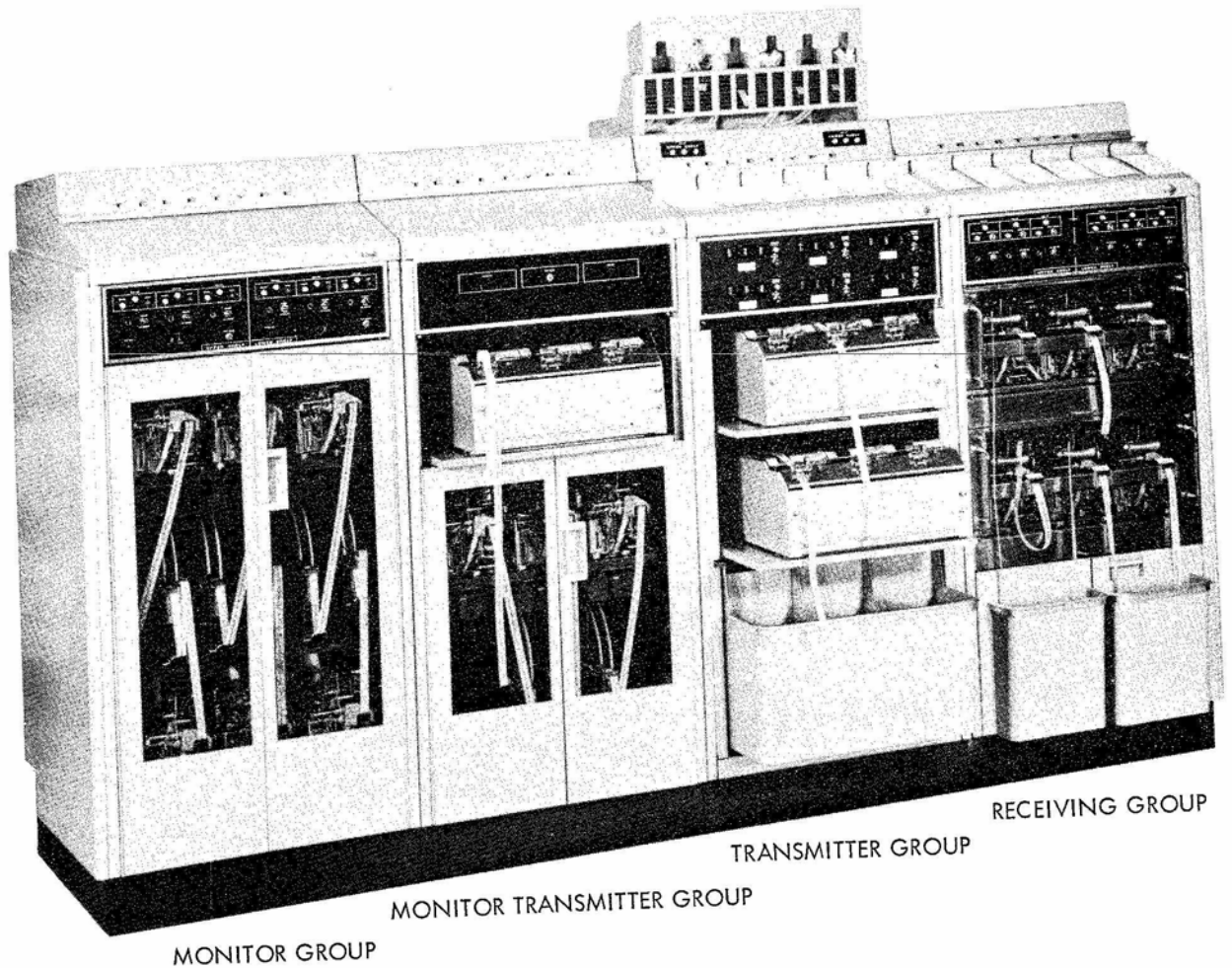


Figure 1-3. Model 28 Universal Torn Tape System With Monitor Transmitter Group

speeds. The message identification module provides the means of automatically identifying each message transmitted from a single transmitter distributor on a single channel, or from two transmitter distributors operating in tandem on a single channel.

b. The function of this module is to:

(1) Provide a means of automatically dispatching 12 identifying codes (either neutral

or polar) and 3 sequential numbers for 999 messages transmitted from a transmitter distributor.

(2) Provide tandem transmission between transmitter distributors.

(3) Provide a means of deleting the identifying code and number.

(4) Provide a means of stopping new

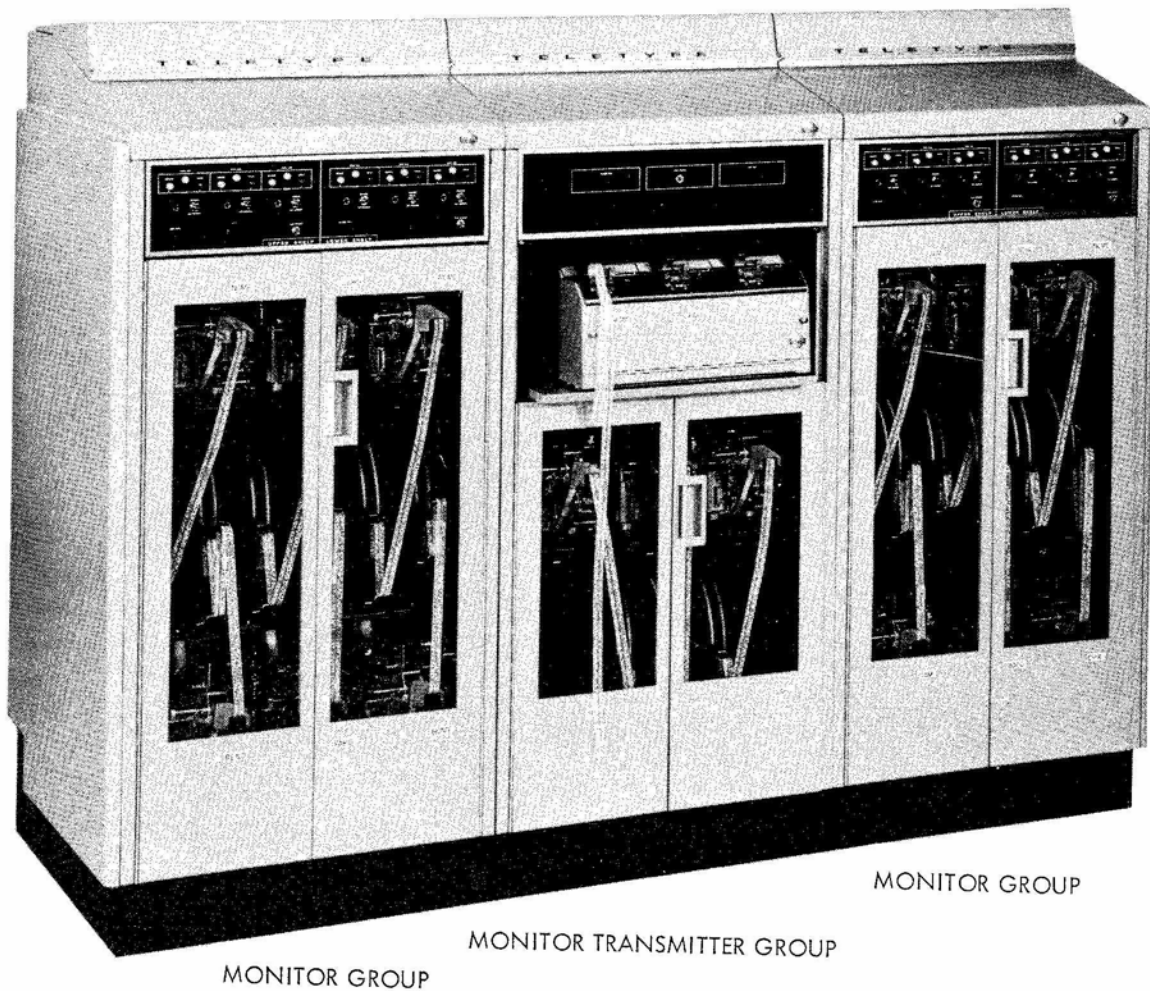


Figure 1-4. Two Model 28 Typing Reperforator Monitor Groups  
With Model 28 Monitor Transmitter Group

message tape transmission from the transmitters and to provide message identification from a remote location.

c. The module is of an electromechanical design and consists of the following:

(1) A mechanical counter capable of counting up to 999 and storing the telegraph baudot code associated with the numbers counted; in addition, providing a visual indication of the numbers counted.

(2) An electromechanical stepping switch that shall be capable of storing a minimum of 15 (five wire) baudot codes.

(3) Necessary relays, diodes, and capacitors for providing tandem operation of two transmitters and message identification deletion.

(4) Necessary relays and circuitry for line seizure and message identification from a monitor cabinet.

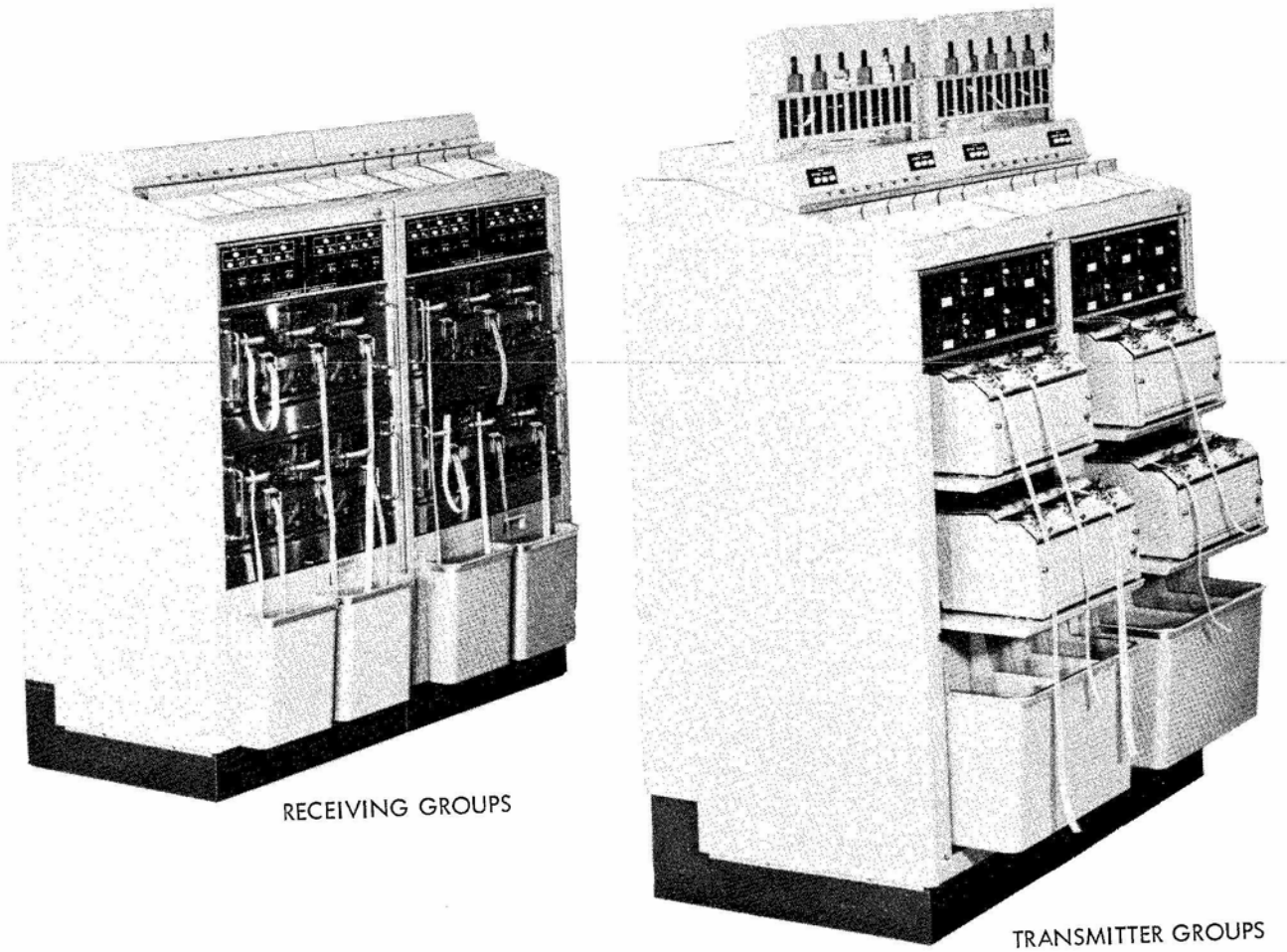


Figure 1-5. Two Model 28 Receiving Groups With Two Model 28 Transmitter Groups

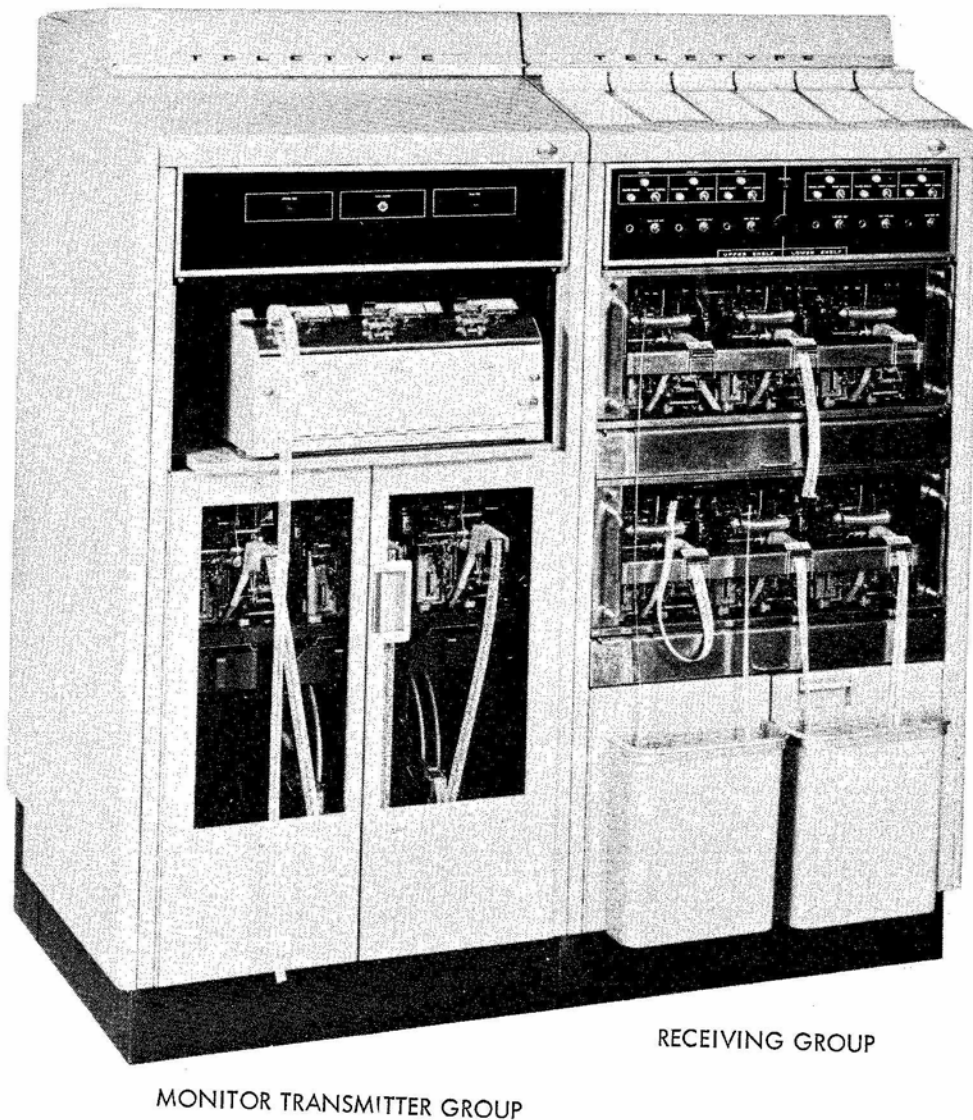


Figure 1-6. Model 28 Monitor Transmitter Group With Model 28 Receiving Group

d. Insertion of a tape in a transmitter distributor shall result in completing a flip-flop circuit between a stepping switch, the transmitter distributor's clutch magnet and auxiliary contact. The stepping switch stores a five wire baudot code and the distributor transmits the code sequentially. An electromechanical counter is actuated and registers the number of messages and stores the associated baudot code on three code reading contact assemblies. These

stored number codes will also be transmitted by the distributor. Upon completion of transmitting the identifying code (LTR) ZCZC ABCDE (FIG 123 (LTR), the upper transmitter will be permitted to read its message tape. A second lower transmitter, wired in series with the same carrier channel will be loaded with a message tape while the above transmitter is operating. Upon completion of the first transmitter operation, the second transmitter message tape will

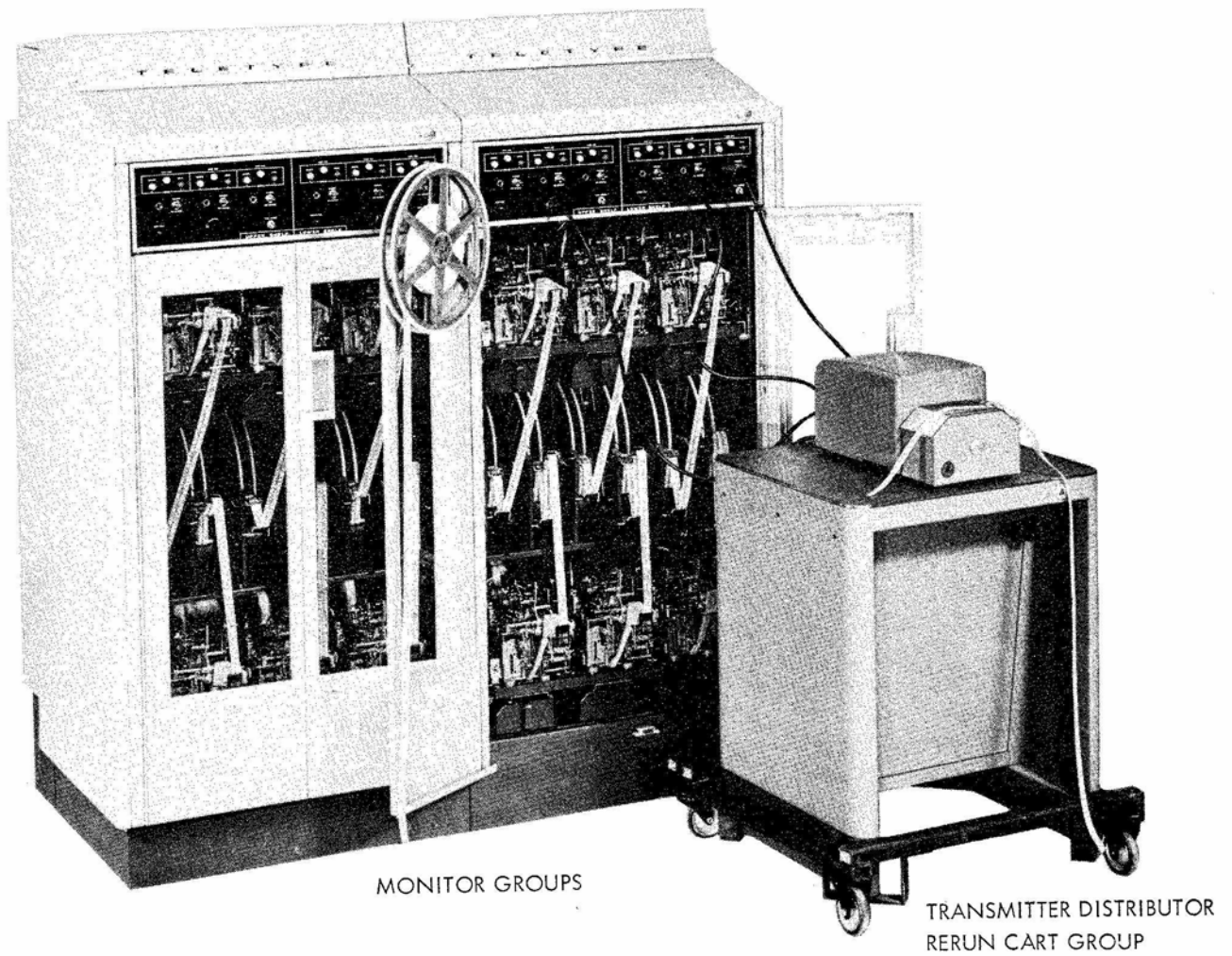


Figure 1-7. Two Model 28 Typing Reperforator Monitor Groups With Model 28 Transmitter Distributor Rerun Cart Group

automatically be preceded by an identifying code (LTR) ZCZC ABCDE (FIG) 124 (LTR) and be transmitted.

(1) The entire message identification sequence can be omitted from the transmitted text by operation of the message deletion switch.

(2) The above procedure may be reversed.

e. The transmitter group provides wiring and electrical control facilities to operate:

(1) Six single or three tandem transmitting channels.

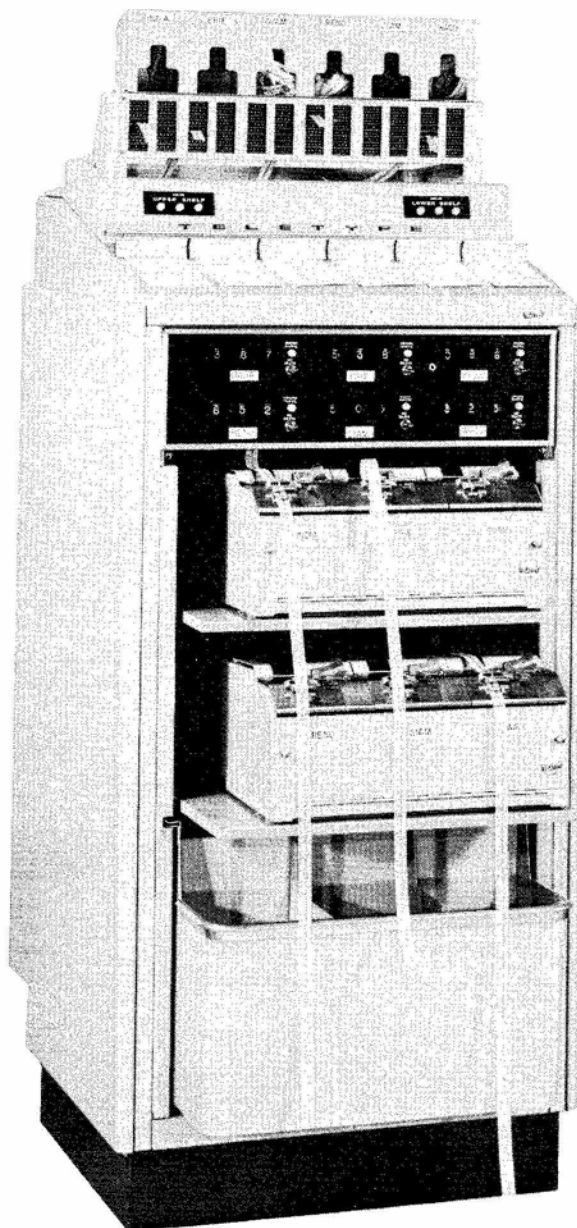


Figure 1-8. Model 28 Transmitter Group

(2) Six message numbering and identification modules for six channel operation, or three message numbering and identification modules for three channel tandem operation.

(3) One 6.5 amperes, 48 volts DC rectifier.

(4) Six amber LINE SEIZURE lamps (ABNORMAL TRAFFIC).

(5) Six white OPEN-LINE indicating lamps.

f. In addition, the Model 28 Transmitter Group features the following:

(1) Six transmitter distributors that accept chadless tape or fully perforated tape (11/16" or 7/8" wide).

(2) Manually operated message identification deletion switches.

(3) Tape grid to hold message tapes.

(4) Capable of polar or neutral channel operation.

(5) Signal line dropping resistors and potentiometers.

(6) Tape storage bin for ready, transmitted tapes.

(7) AC power on-off switch and fuses.

(8) AC convenience outlet.

(9) Power factor correctors.

(10) Channel identification card holders.

(11) Two multiple transmitter bases.

(12) Two motors (synchronous or governed).

(13) Six mechanical line shunts.

(14) Transmitter distributors that can be seized by means of line jacks or remote facility control center after completion of message.

(15) Prevention of accidental message identification sequence transmission with no tape in transmitters.

(16) Front, rear and top accessibility.

(17) Shielded AC power and signal cables.

(18) End enclosures for the cabinet.

g. The basic components of the group are the two Multiple Transmitter Distributor Sets. Each set consists of three transmitter distributors with tape deflectors, multiple transmitter distributor base, synchronous or governed motor, and drive parts. When a governed type motor is used, a speed indicator is necessary for setting the motor to the correct speed. The cabinet provides the necessary wiring and electrical control facilities to operate the two Multiple Transmitter Distributor Sets.

#### 1-4. MODEL 28 TYPING REPERFORATOR MONITOR GROUP (Figure 1-9)

a. GENERAL - The Model 28 Typing Reperforator Monitor Group has a monitor reperforator assigned to each transmitting channel. The reperforator records messages in the form of fully perforated code and feed holes with characters printed on the tape between the feed holes, or in the form of chadless code and feed holes, with characters printed on the inner edge of the tape. The tape from the reperforator is wound by the tape winders from which a full reel of tape can be conveniently removed for storage. A stud mounted on the inside portion of the left door provides facilities for unwinding tape from the reel for rerun purposes. The group provides wiring and electrical control facilities to operate:

(1) Six single channels.

(2) Six typing reperforators (fully perforated or chadless tape output).

(3) Six line relays.

(4) Six signal line rerun jacks.

(5) Six green LOCAL SEIZURE lamps.

(6) Six amber REMOTE LINE SEIZURE lamps.

(7) One red LOW TAPE alarm lamp.

(8) One red WINDER FULL alarm lamp.

(9) Six white OPEN-LINE indicating lamps.

b. In addition the Model 28 Typing Reperforator Monitor Group features the following:

(1) One signal line battery receptacle.

(2) One AC convenience receptacle.

(3) Six tape winding reels (two multiple tape winder sets).

(4) AC power ON-OFF switch.

(5) Two multiple reperforator bases with power factor correctors and six tape supply reels.

(6) Two 500 milliamperes 120 volts DC rectifiers.

(7) One 5.5 volt AC transformer.

(8) Capable of polar or neutral channel operation.

(9) Channel identification card holders.

(10) Facilities for unwinding tape reels.

(11) Provision for AC alarm circuitry.

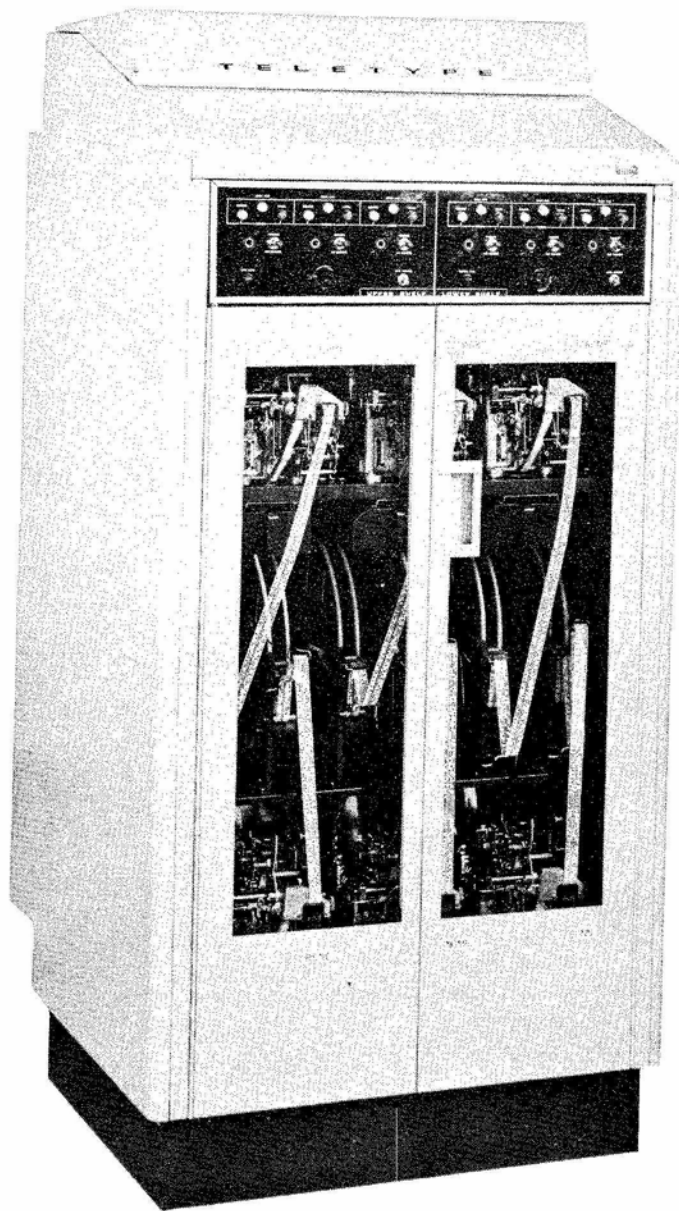


Figure 1-9. Model 28 Typing Reperforator Group



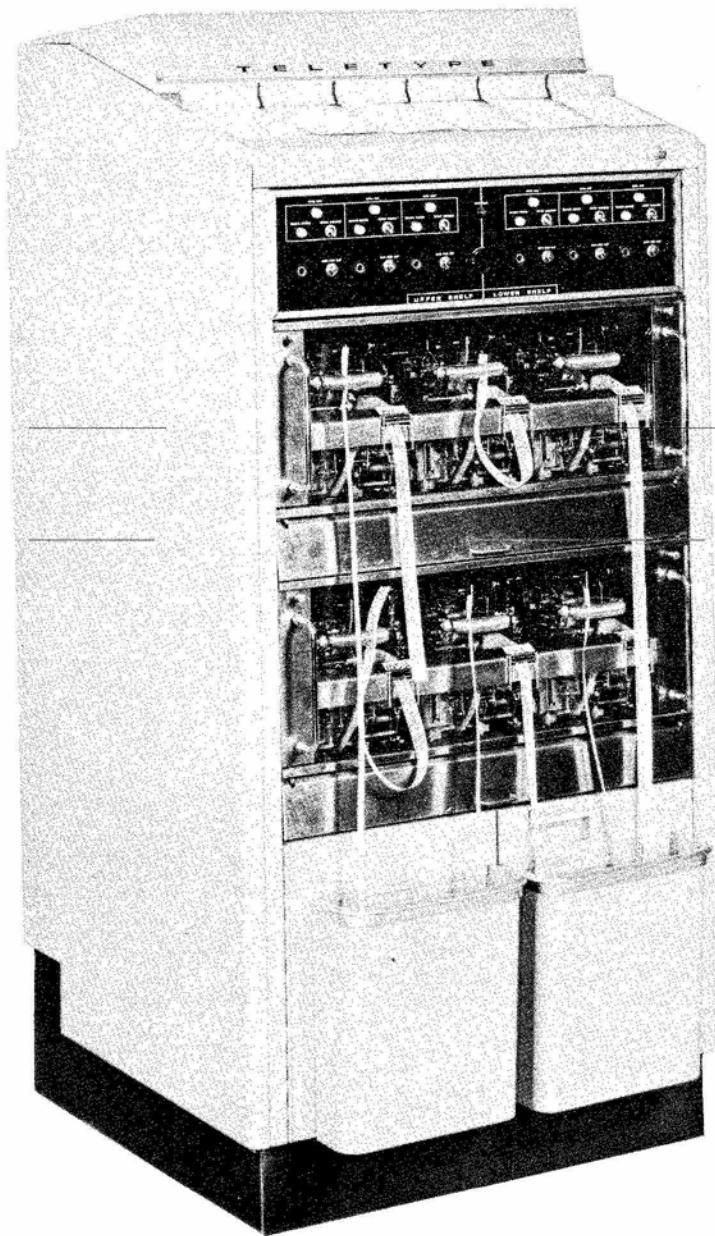


Figure 1-10. Model 28 Typing Reperforator Receiving Group

(12) Provision for remote indication of low tape and winder full alarms.

(13) Six line relay shunts (mechanical).

(14) Typing reperforators are electrically removed from the signal circuits when an open line condition exists.

(15) Front, rear and top accessibility.

(16) Shielded AC power and signal cables.

(17) End enclosures for the cabinet.

c. The basic components of the group are the two identical Multiple Reperforator Sets; one of the sets consists of three typing reperforators, multiple typing reperforator base, motor (either synchronous or governed) and drive parts. A

speed indicator is used for setting the correct governed motor speed. Included also are two multiple tape winder sets. The universal cabinet provides the necessary wiring and control facilities to operate the components of the group.

#### 1-5. MODEL 28 TYPING REPERFORATOR RECEIVING GROUP (Figure 1-10)

a. GENERAL - The Model 28 Typing Reperforator Receiving Group has a receiving reperforator assigned to each of the six separate incoming lines. The reperforators receive messages in the form of 5 level start-stop signals and convert them into fully perforated or chadless tape with characters printed on the tape. The group provides wiring and electrical control facilities to operate:

- (1) Six single channels.
- (2) Six typing reperforators (fully perforated or chadless tape output).
- (3) Six reperforator monitor jacks.
- (4) Six line relays.
- (5) Six white OPEN-LINE indicating lamps.
- (6) Six amber REMOTE SEIZURE lamps.
- (7) One red LOW TAPE lamp.
- (8) Six manual non-interfering letters tape feed-out switches. These switches are furnished on all Receiving Cabinets but are not operational in those cabinets which use typing reperforators equipped with an automatic non-interfering letters tape feed-out mechanism.

b. In addition the Model 28 Typing Reperforator Receiving Group features the following:

- (1) Pull-out drawers with plexi-glass windows for viewing reperforator operation.
- (2) Slots in the plexi-glass windows provide a convenient tearing edge for the tape at the end of message.
- (3) Six tape holders are mounted on the front of the plexi-glass windows.
- (4) Two tape storage bins are mounted on the front of cabinet.
- (5) Six message log holder clips are mounted on the top of cabinet.

(6) Two multiple reperforator bases with power factor correctors and six supply reels.

(7) Channel identification card holders.

(8) One 5.5 volt AC transformer.

(9) Two 500 milliamperes 120 volts DC rectifiers.

(10) Provision for AC power failure alarm.

(11) Provision for remote indication of low tape alarm.

(12) Six line relay shunts (mechanical).

(13) Typing reperforators are electrically removed from the signal circuit when an open-line condition exists.

(14) Front, rear and top accessibility.

(15) AC power and signal cables are shielded.

(16) End enclosures for the cabinet.

c. The basic components of the group are the two Multiple Typing Reperforator Sets. Each set consists of three typing reperforators (fully perforated or chadless tape), multiple typing reperforator base, motor (either synchronous or governed), and drive parts. A speed indicator is used for setting the correct governed motor speed. The universal cabinet provides the necessary wiring and control facilities to operate the components of the group.

#### 1-6. MODEL 28 MONITOR TRANSMITTER GROUP (Figure 1-11)

a. GENERAL - The Model 28 Monitor Transmitter Group (Pull-Back) provides facilities for the transmission of messages from fully perforated or chadless tape and simultaneously records these messages in the form of fully perforated or chadless tape with characters printed on the tape. The tape from the reperforator is wound by the tape winder from which a full reel of tape can be conveniently removed for storage. A stud mounted on the inside of the left door provides facilities for unwinding tape from the reel for rerun purposes. The group provides wiring and electrical control facilities to operate:

- (1) Three single transmitting channels in series with associated monitoring circuits.

- (2) One red LOW TAPE alarm lamp.
- (3) One red WINDER FULL alarm lamp.
- (4) Two 500 milliampere 120 volt DC rectifiers.

b. In addition the Model 28 Monitor Transmitter Group features the following:

- (1) Channel identification card holders.
- (2) Three transmitter distributors that

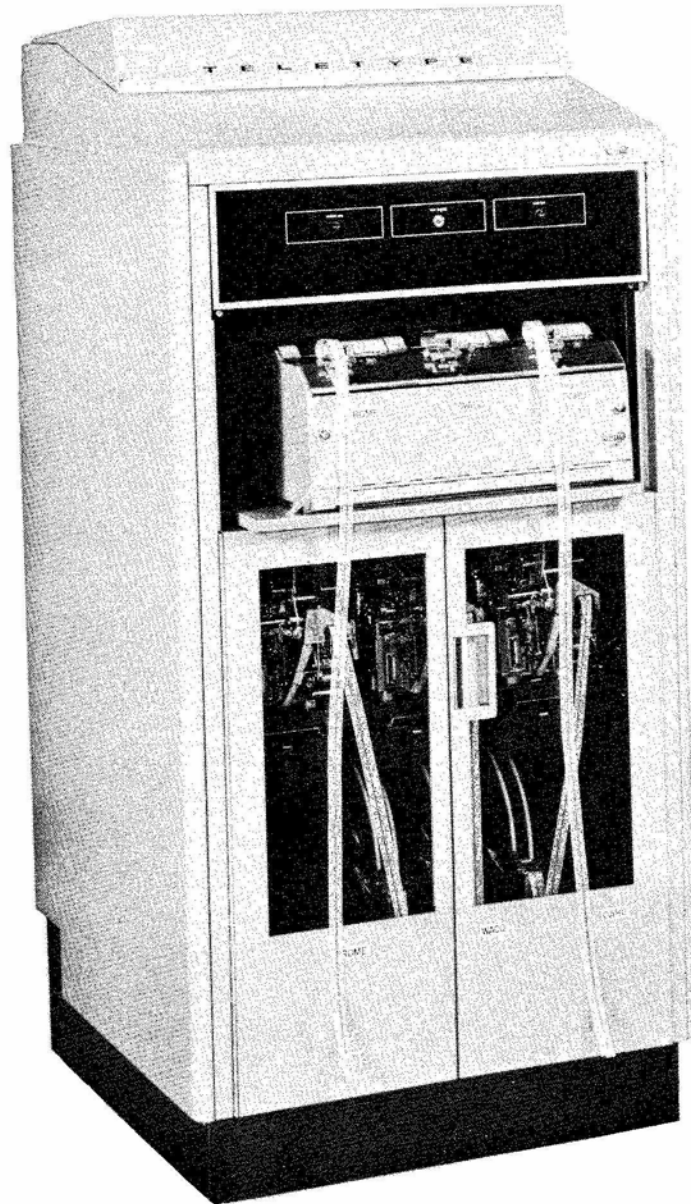


Figure 1-11. Model 28 Monitor Transmitter Group

accept chadless or fully perforated tape (11/16" or 7/8" wide).

- (3) Capable of polar or neutral channel operation.
- (4) Signal line dropping resistors and potentiometers.
- (5) AC power OFF-ON switch and fuses.
- (6) Power factor correctors.
- (7) One multiple transmitter base.
- (8) Three mechanical line shunts.
- (9) Three typing reperforators (fully perforated or chadless tape output).
- (10) Three line relays.
- (11) Three tape winding reels (one multiple tape winder set).
- (12) One multiple reperforator base with power factor correctors and three tape supply reels.
- (13) Provision for AC power alarm circuitry.
- (14) Three line relay shunts (mechanical).
- (15) Front, rear and top accessibility.
- (16) Shielded AC power and signal cables.
- (17) End enclosures for the cabinet.

c. The basic components of the group are the Multiple Reperforator Set, Multiple Transmitter Set, and Multiple Tape Winder Set. The multiple typing reperforator set consist of three typing reperforators, multiple typing reperforator base, motor (either synchronous or governed) and drive parts. The multiple transmitter set consists of three transmitter distributors with tape deflectors, multiple transmitter distributor base, motor (either synchronous or governed), and drive parts. A speed indicator is necessary for setting the governed motor to the correct speed.

#### 1-7. MODEL 28 TRANSMITTER DISTRIBUTOR RERUN CART GROUP (Figure 1-12)

a. GENERAL - This is a typical Model 28 Transmitter Distributor Rerun Cart Group which is portable and is used as an auxiliary means of

retransmitting messages. The signal line, AC, and DC power cords from this group plug into one of the six line jacks, AC and DC receptacles on the control panel of the Monitor Group. The message that is to be retransmitted is unreeled from the storage reel of the Monitor Group and placed into position on the transmitter distributor of the Rerun Group for retransmission to the distant station.

b. The basic components of a typical group are the transmitter (either single or multi-contact types), base, cover, motor (either synchronous or governed), table, dolly and drive parts.

#### 1-8. MODEL 28 RECEIVING TYPING REPERFORATOR CART GROUP

a. GENERAL - A typical portable Model 28 Typing Reperforator Receiving Cart Group is used as an auxiliary means of receiving messages. Red lamps indicate low tape supply for the upper and lower shelves of the receiving cabinet. In order to enable the operator to change tape supply, spare reperforator jacks, and reperforator marking battery switches are provided. The operator brings the portable cart group to the receiving cabinet to change tape, then plugs the AC power plug into the convenience AC receptacle and inserts the signal line plug into the desired signal line jack. The spare reperforator will now monitor the receiving reperforator. The operator (after assuring overlap of the received signal) operates the respective reperforator marking switch upward. This will shunt the signals to the cabinet reperforator causing the reperforator to come to a stop position. The operator may then insert a new tape supply. Upon completion of this operation the operator reverses the previous operating sequence. The operator removes the receiving cart group and will then splice the tapes together with any standard tape splicer.

b. The basic components of a typical group are the typing reperforator (either fully perforated or chadless tape output) receiving only base, cover, motor (either synchronous or governed) table, dolly, and drive parts.

c. For information concerning applicable components of this group refer to standard Teletype Bulletins.

#### 1-9. DESCRIPTION OF MAJOR COMPONENTS MODEL 28 TRANSMITTER DISTRIBUTOR GROUP

a. GENERAL - The basic components of the Group are the Universal Cabinet and the two Multiple Transmitter Distributor Sets (Figure

1-13). Each set consists of three transmitter distributors, multiple transmitter base, motor, and drive parts for predetermined speeds.

b. The Model 28 Fixed Head Multi-Contact Transmitter Distributor (Figure 1-14) mounts on the multiple transmitter distributor base. The transmitter distributor consists of two side

frames, held apart by separators, and two intermediate side plates onto which all the mechanisms mount, a top plate, and a tape guide plate. Mounted on the tape guide plate are the red tape lid release button and two adjustable tape guides. Each tape guide is scored with an index line six characters ahead of the sensing pins. Mounted on the tape guide plate but overhanging the top

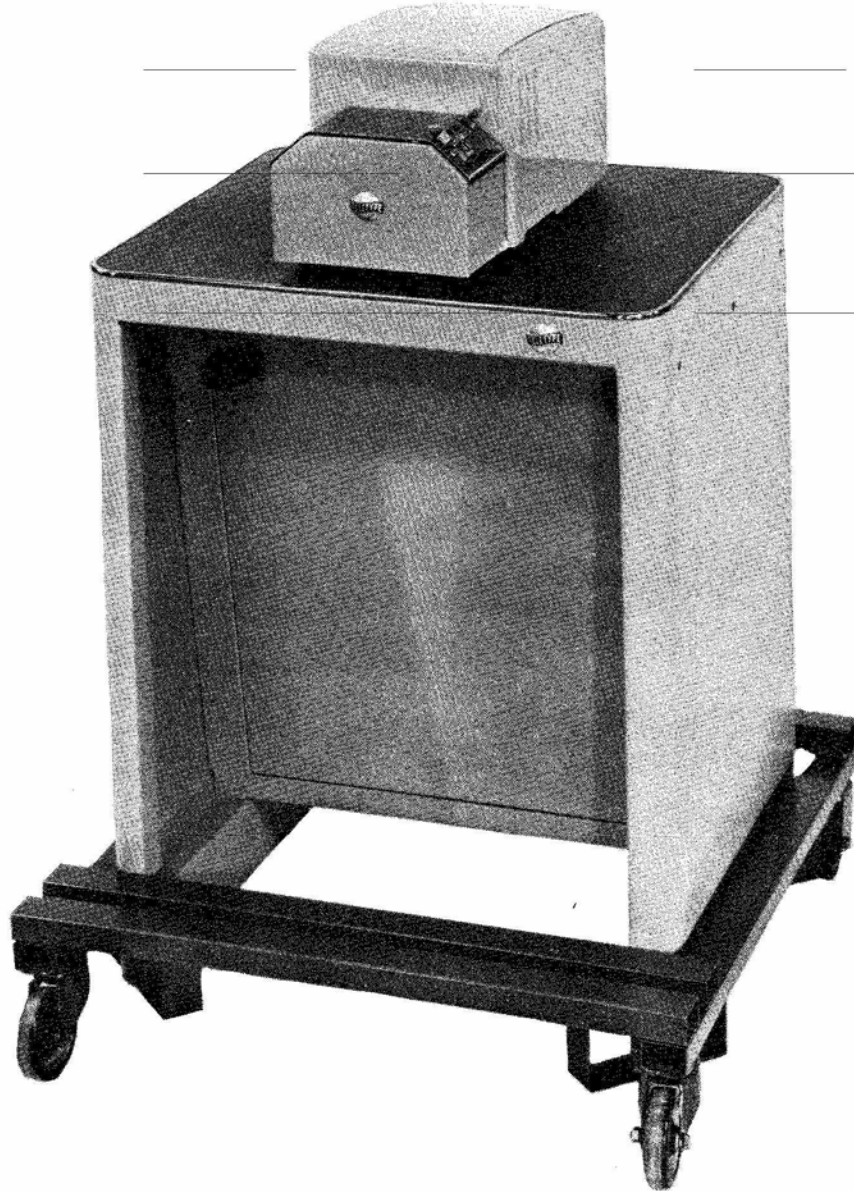


Figure 1-12. Model 28 Transmitter Distributor Rerun Cart Group

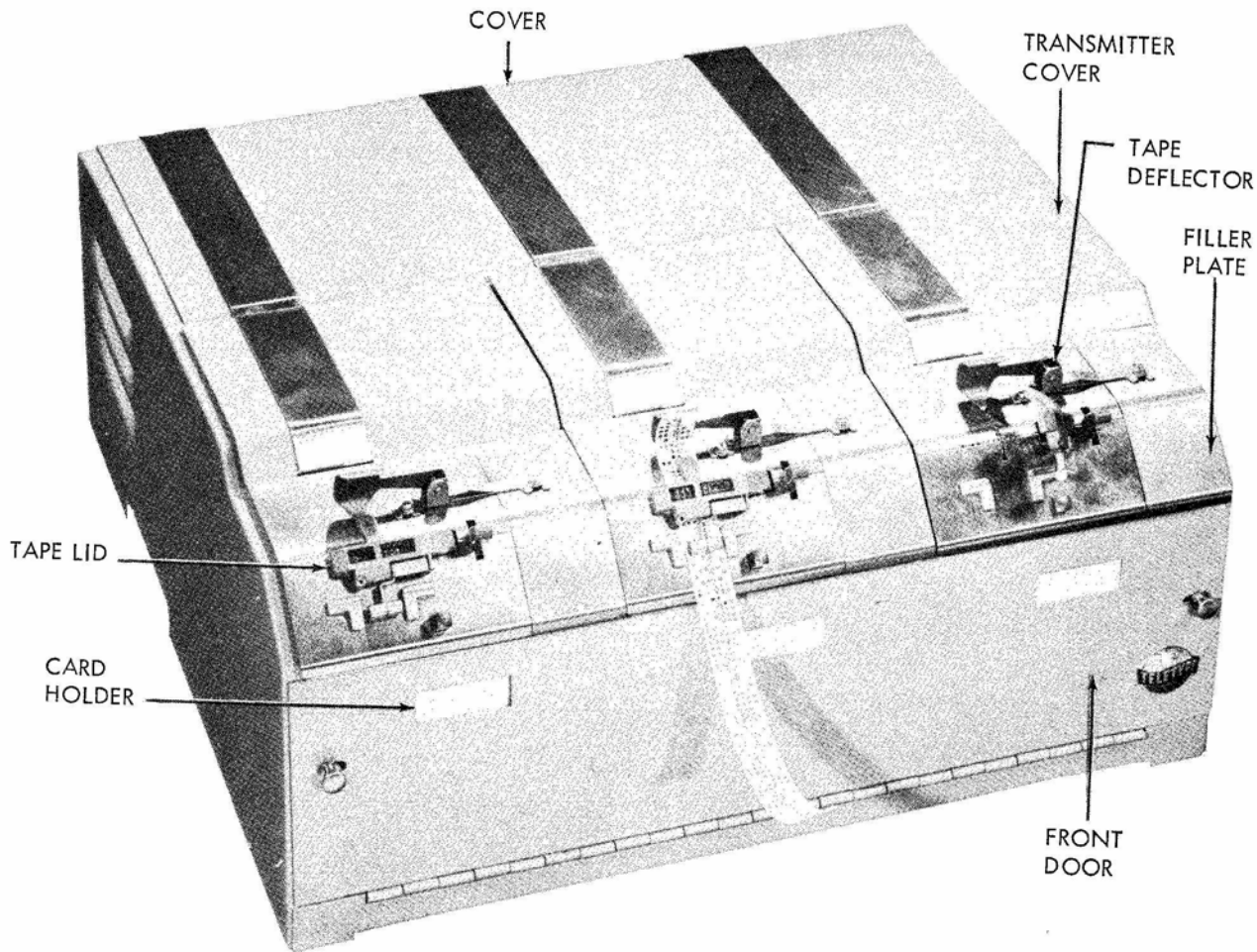


Figure 1-13. Model 28 Multiple Transmitter Distributor Set

plate and the tape guide plate is the tape lid. Mounted along side of the tape lid is a gray-green control lever. The tape sensing pins extend through slots in the top plate. The feed wheel pins extend through a slot in the top plate and a slot in the tape guide plate. The tape out pin also extends through the tape guide plate and tape lid. Two shafts are located within the unit; the sensing shaft and the distributor shaft. Each rotate at the same speed through an idler gear connected to the drive gears on the clutch. The distributor shaft includes an outboard gear which is connected through the intermediate gear assembly to the drive motor pinion (Figure 1-15).

(1) The sensing shaft auxiliary contact controls the distributor shaft clutch release magnet electrically when the unit is so operated. However, each shaft may be energized independently of the other by external means. A start-stop control lever, tape out pin and tight tape arm control the sensing clutch release magnet electrically. The unit is capable of "single

wire" or "multiple wire" output and multiple wire input to the distributor contacts for sequential distribution. Signal output is arranged for "neutral" or "polar" operation. The operation sequence is such that the reading cycle occurs after feeding and the code combinations for the last character sensed is sequentially distributed.

(2) The operating speed of the transmitter distributor is predetermined.

(3) The unit has a feed read sensing cycle, and sense distribute sequence.

(4) The distributor cam sleeve has a start cam lobe for use with polar operation.

(5) The auxiliary cams are designed to meet the specific requirements of the customer.

(6) An auxiliary "A" contact operated

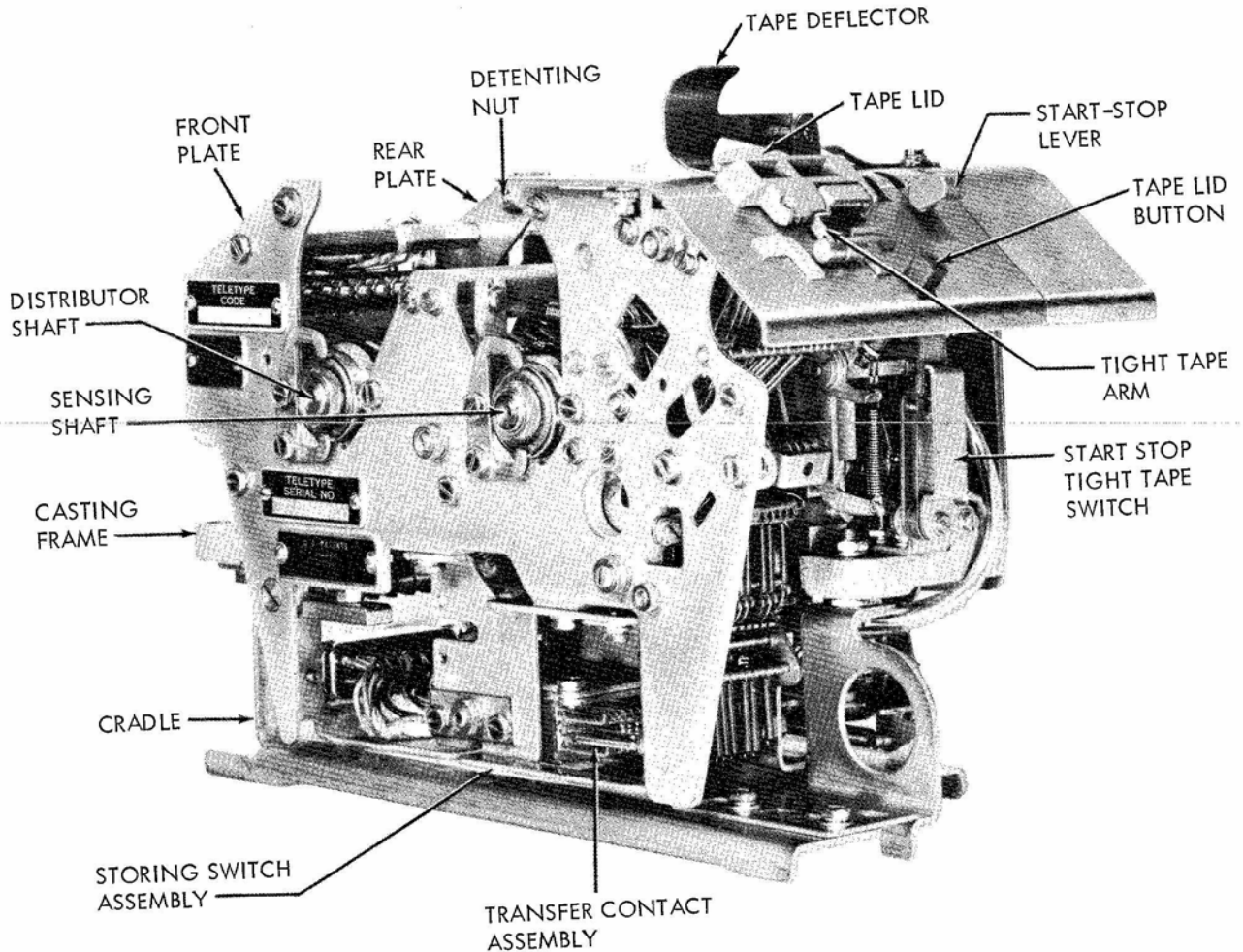


Figure 1-14. Model 28 Fixed Head Multi-Contact Transmitter Distributor (Front View)

from the sensing sleeve for controlling external circuits.

(7) An auxiliary "B" contact operated from the sensing cam sleeve for controlling the distributor clutch trip magnet.

(8) An auxiliary contact operated from the distributor cam sleeve for controlling external circuits.

(9) The distributor clutch trip magnets operate at .050 amperes, 110-120 volts DC or 45-55 volts DC.

(10) Transfer type code reading contacts are used in the reader portion of the transmitter distributor.

(11) Arc suppressors are connected across the distributor auxiliary contacts and across the signal line.

(12) A tape deflector is provided and may be positioned to deflect the tape back toward the operator.

(13) A quick disconnect 36 terminal connector plug, which aligns with its mate on the base, and facilitates making electrical connection as well as simplifying handling during servicing.

c. The Model 28 Multiple Transmitter Distributor Base (Figure 1-16) provides mounting facilities for three transmitter distributors, motor unit, and drive parts for predetermined speeds. A common driving shaft, intermediate

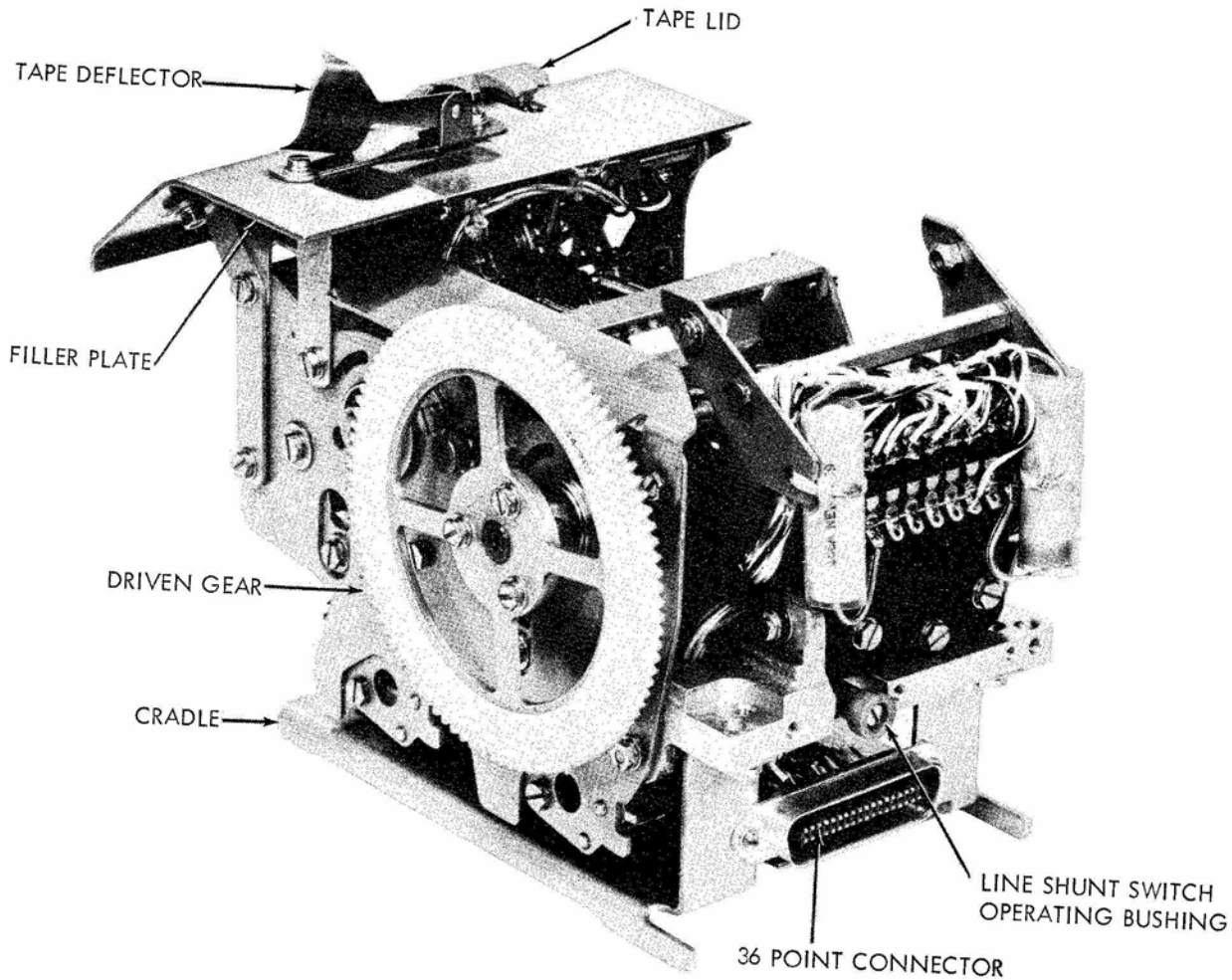


Figure 1-15. Model 28 Fixed Head Multi-Contact Transmitter Distributor (Side View)

gears, and motor unit provide the motion to the three transmitter distributors.

(1) The base is assembled to its sub-base (oil pan) by means of resilient mounts, which aid in preventing transmission of vibrations. The entire unit is enclosed in a cover having a front hinged panel for access to the transmitter distributor mounting screw and motor control switch. Three cover plates are provided for the transmitter distributor units.

(2) Three connector receptacles which are part of the cabinet cable assembly mount on the base and mate with the plugs of the transmitter distributors when they are mounted on the base. The individual transmitter distributors are mounted in place by a locating plate and

a single screw at the front. Power is brought to the base and connected to the terminal strip located on the base to the left of the motor.

(3) The line shunting switch is actuated automatically when the transmitter distributor unit is removed.

d. The Model 28 Synchronous Motor Unit (Figure 1-17) provides the motive force to operate the multiple typing reperforator set. The motor is a two pole, single phase synchronous motor unit which develops  $1/12$  horsepower at 3600 revolutions per minute. The motor rests in the cradle of a mounting bracket and is held in place by a strap at each end. The cradle is isolated from the motor by resilient mounts which reduce vibration. A small fan is mounted



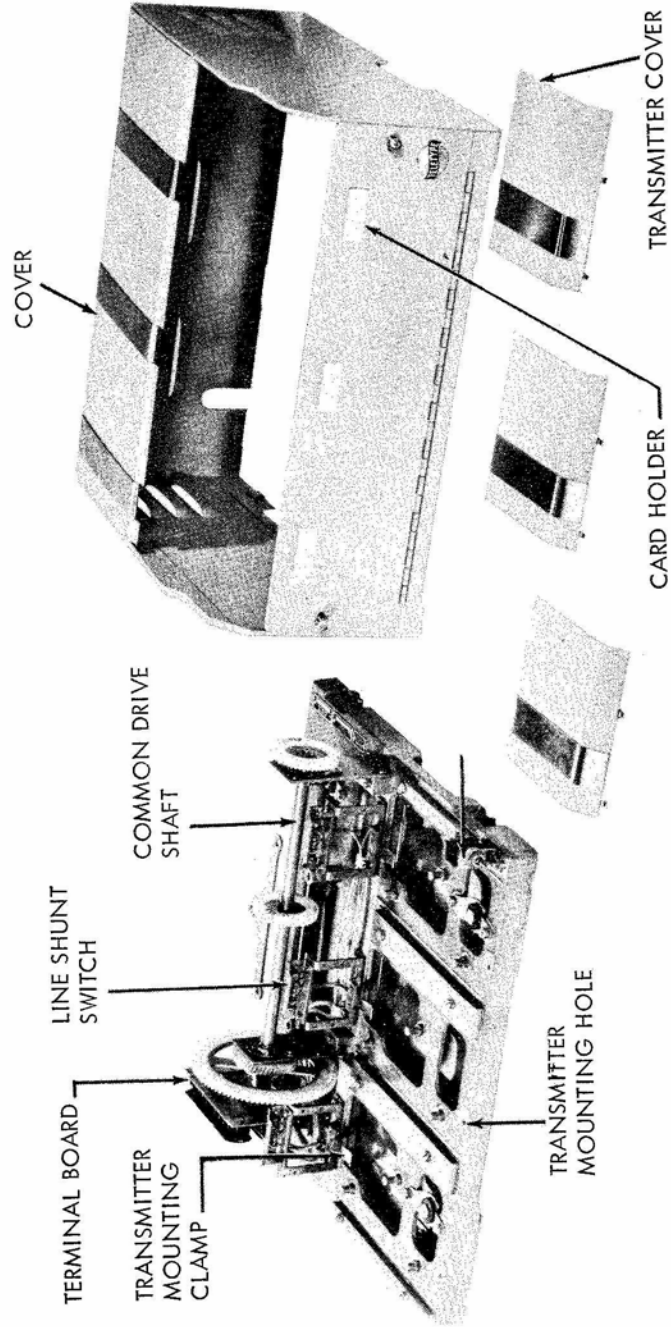


Figure 1-16. Model 28 Multiple Transmitter Distributor Cover and Base

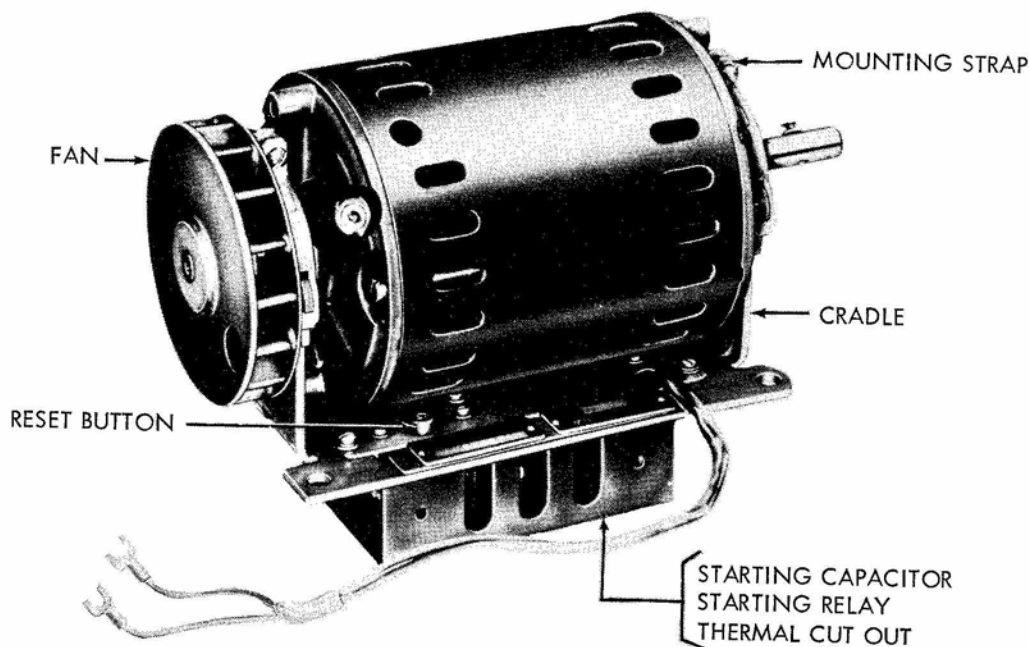


Figure 1-17. Model 28 Synchronous Motor Unit

at each end of a rotor within the end bells, and a combination fan and handwheel rides on the end of the shaft. A start relay, a starting capacitor, and a thermal cut out switch are contained in the upper compartment. The rotation of the shaft is counterclockwise as viewed from the handwheel end.

#### CAUTION

If the motor becomes blocked for several seconds, the thermal cut out switch will break the circuit. Allow the motor to cool at least five minutes before depressing red reset button.

e. The Model 28 AC Governed Motor Unit (Figure 1-18) can be used in place of the synchronous motor. The motor is a 1/15 hp, 115 volt, 50/60 cycle AC governed motor and runs at a governed 3600 rpm. A combined governor and fan are mounted on a motor shaft supported on ball bearings.

(1) An electromechanical governor is wired in series with the armature and two field

windings. Targets for speed checking are marked on the governor cover.

(2) The entire motor is shielded to minimize radio interference. A shielded compartment on the underside of the motor houses the governor resistor and capacitor, as well as an electrical noise suppressor across the power leads.

f. The Model 28 Universal Cabinet (Figure 1-19) accommodates two Multiple Transmitter Distributor Sets and allows front, rear and top accessibility to the associated apparatus and electrical components. The cabinet provides a tape grid, figure 8 tape container, tape bins, a pivoting type relay rack, control plate assembly, control panel drawer assembly, cable assemblies, terminal blocks, terminal strip for customer ground, capacitor mounting brackets, arc suppressors, tandem message identification modules and the necessary wiring and electrical control facilities. End enclosures are available for the cabinet.

(1) The Model 28 Message Identification Module (Figures 1-20, 1-21, and 1-22). Re-

ference Paragraph 1-3. a. through 1-3. f. since the same information concerning the universal cabinet and message numbering module applies.

#### 1-10. DESCRIPTION OF MAJOR COMPONENTS MODEL 28 TYPING REPERFORATOR MONITOR GROUP

a. **GENERAL** - The basic components of the Group are the Universal Cabinet, two Multiple Typing Reperforator Sets, and two Multiple Tape Winder Sets. One of the identical multiple typing reperforator sets (Figure 1-23) consists of three typing reperforators (with either fully perforated or chadless tape), multiple typing reperforator base, motor, and drive parts for predetermined speeds.

b. The Model 28 Typing Reperforator (Figures 1-24 and 1-25) is an electromechanical unit which records information on tape both as printed characters and as combinations of code perforations. The information is received from a signal line in the form of an electrical signalling code which is translated into the necessary mechanical motions to type and perforate the information. The code and feed holes are fully perforated or chadless. The printed characters simplify tape handling by eliminating the necessity of reading the code perforations. The characters perforated in the tape are six positions in advance of the printed characters. This should be considered when severing the tape or inserting it in a transmitter distributor. The end of the tape should include all the printed

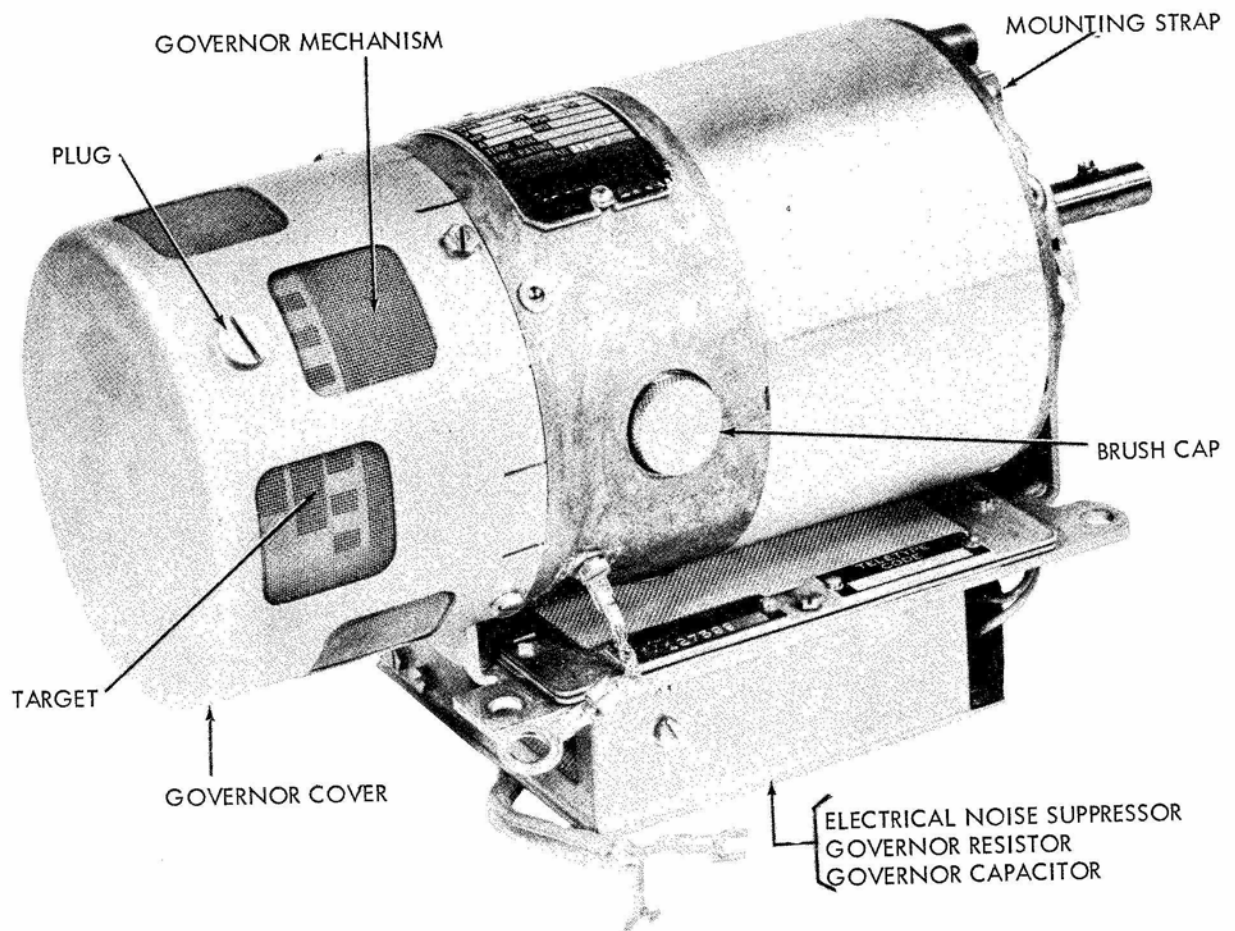


Figure 1-18. Model 28 AC Governed Motor Unit

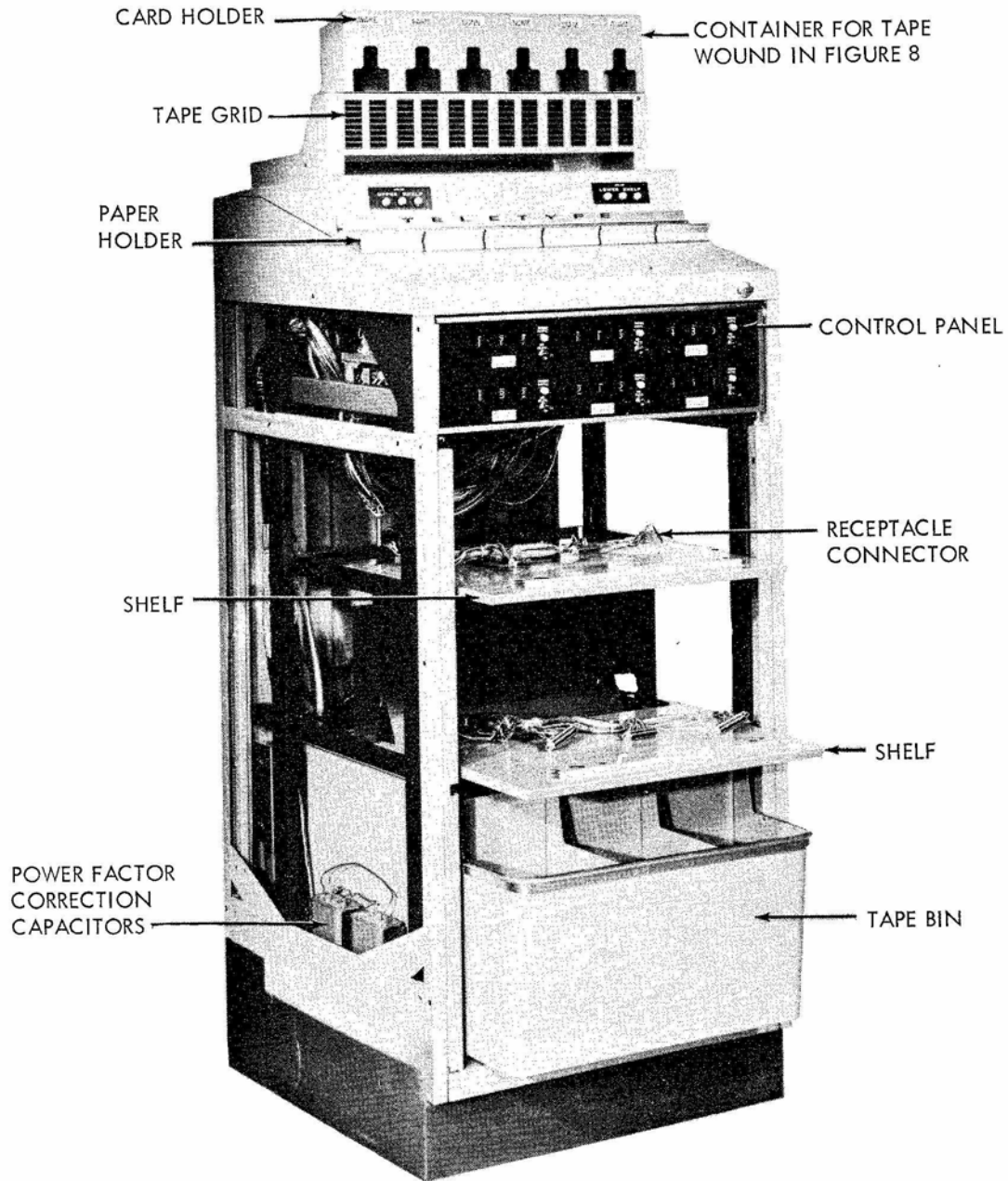


Figure 1-19. Model 28 Universal Cabinet (Transmitter Group)

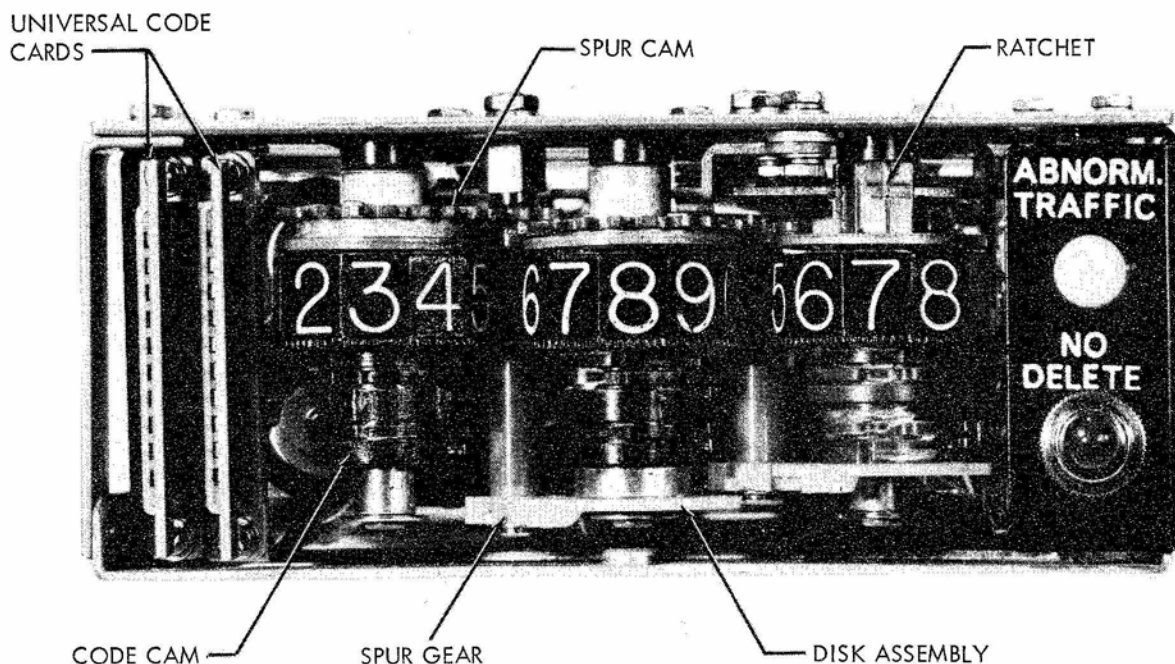


Figure 1-20. Model 28 Message Identification Module (Front View)

characters in the message, and the first printed character of the message must be preceded by at least six sets of code perforations in order to transmit the entire message.

(1) Code signals are applied to a magnet associated with a selector mechanism which interprets the signals and controls the motion involved in printing a character and perforating the tape. Means are provided for orienting the selector mechanism to the incoming signals. Motive power is provided by a motor unit and drive mechanism.

(2) A 36-point receptacle for connection of circuits is located at the upper rear section of reperforator unit.

c. The Teletype Model 28 Multiple Typing Reperforator Base (Figure 1-26) provides mounting facilities for three typing reperforators, motor unit, and drive parts. A common drive shaft, belt and sprocket drive parts, gear set, and motor unit provide the motions for the three typing reperforator units. The base is also equipped with tape containers, chad disposal facilities (for fully perforated tape) or without

chad disposal facilities (for chadless tape), motor power factor correction capacitors, electrical wiring and connector for operating the low tape alarm lamp and motor unit.

d. The Multiple Tape Winder (Figure 1-27 and 1-28) is a complete unit consisting of tape reels and a structure on which are mounted the power and driving mechanism, a tape tension device, a clutch engage and disengage device, rollers for tape reel engagement, and a contact arrangement to provide a full reel alarm. The unit is for general application with a capacity of 1,000 feet of fully perforated tape or 1,000 feet of chadless tape per reel and is adaptable for tape widths of 11/16, 7/8, or 1 inch.

(1) The tape winder has rubber vibration mounts, and mounts on the studs provided on the cabinet frame. The six terminal plug mates with the cabinet receptacle.

(2) A 115 volt AC 50/60 cycle, single phase, induction, 35 milli-horsepower motor (rotating at 1725 rpm), a gear set and a common driving shaft provide the motion to the three rim driven reels.

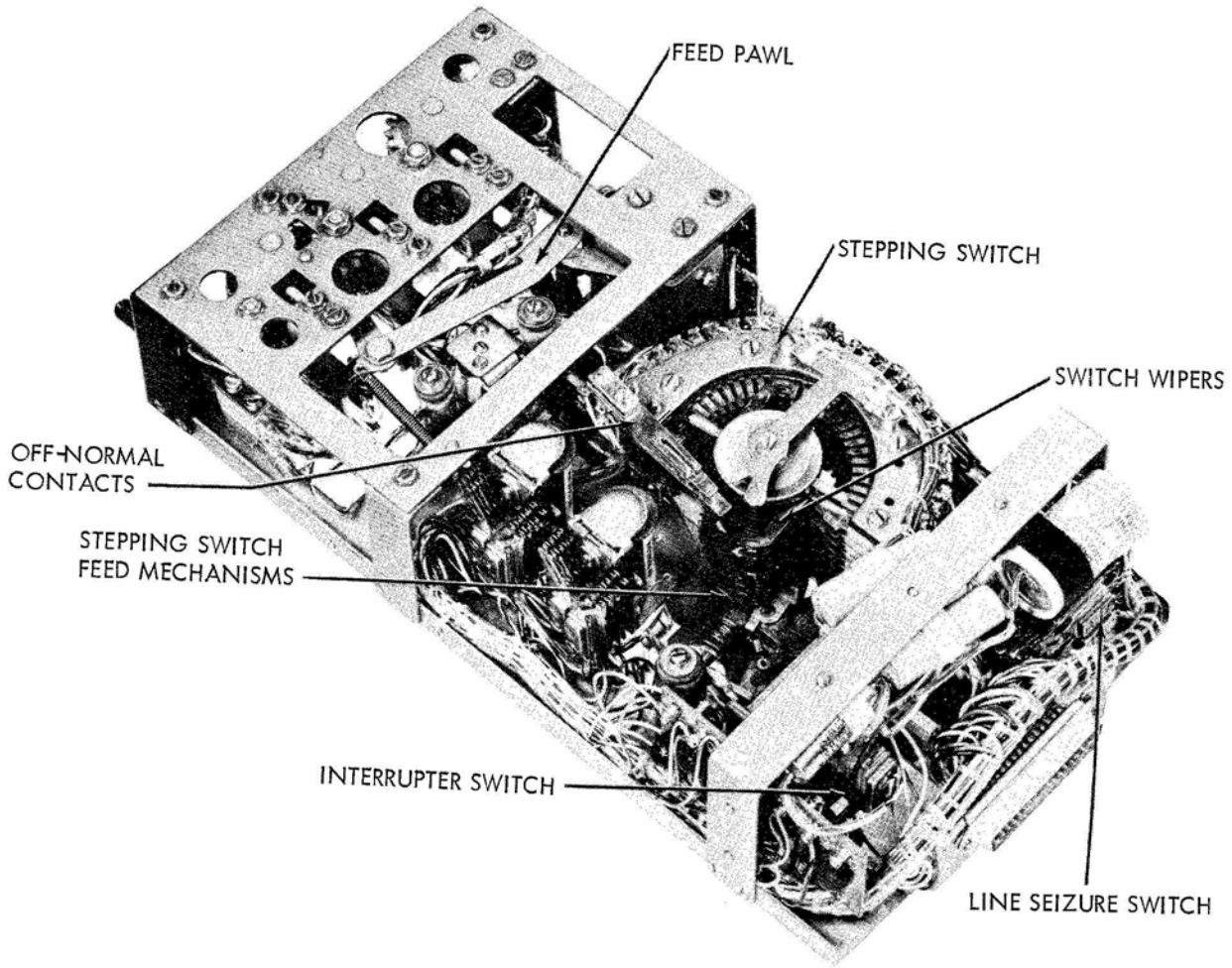


Figure 1-21. Model 28 Message Identification Module (Top View)

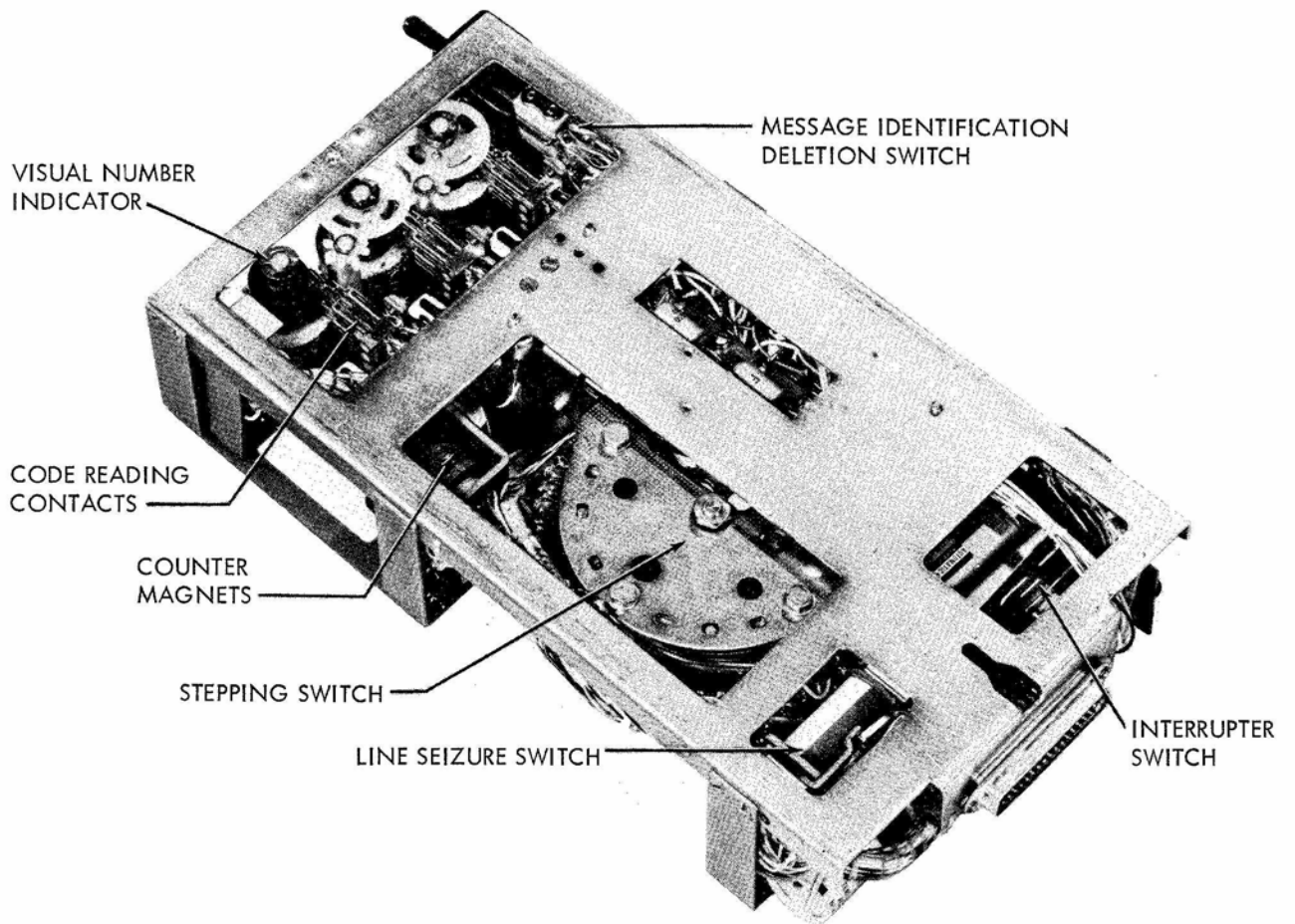


Figure 1-22. Model 28 Message Identification Module (Bottom View)

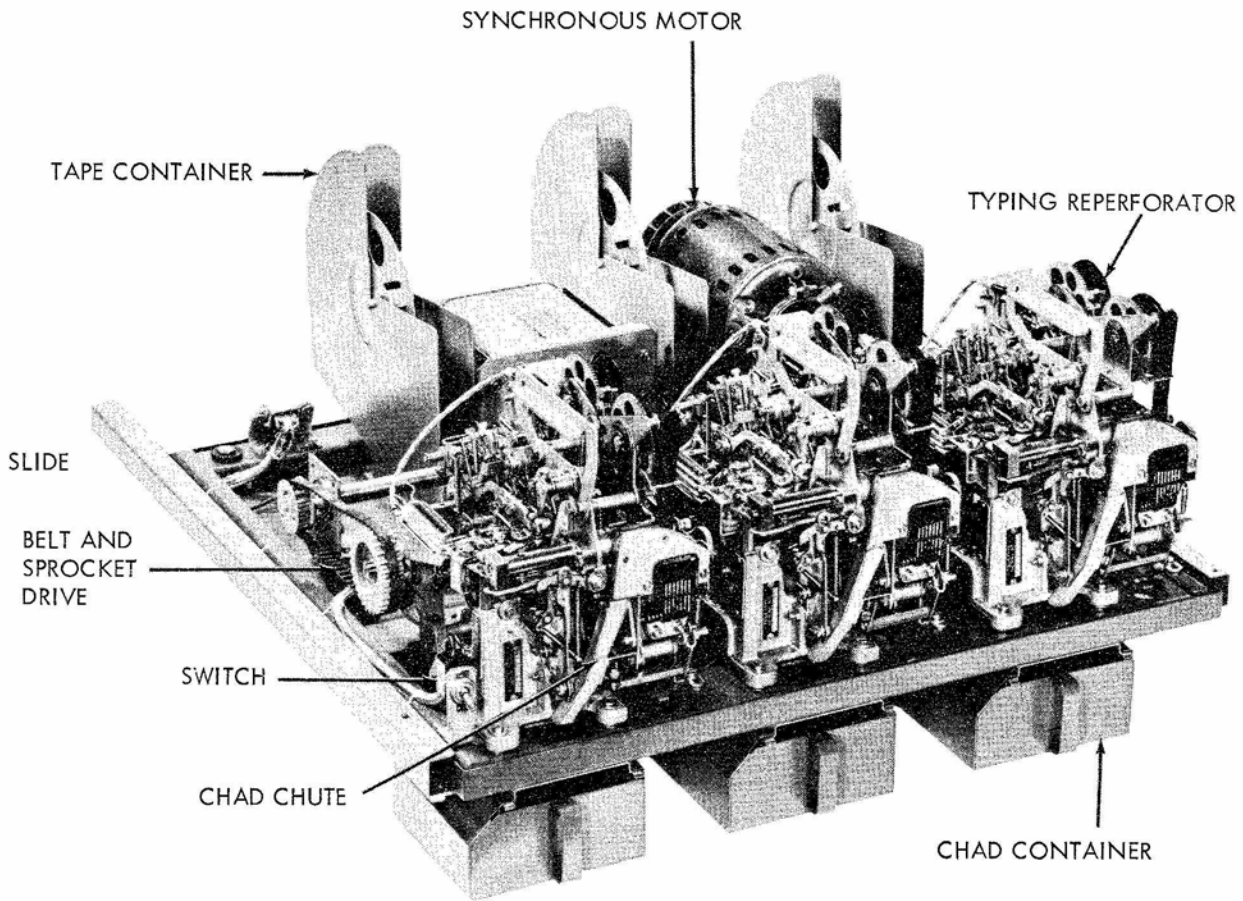


Figure 1-23. Model 28 Multiple Typing Reperforator Set



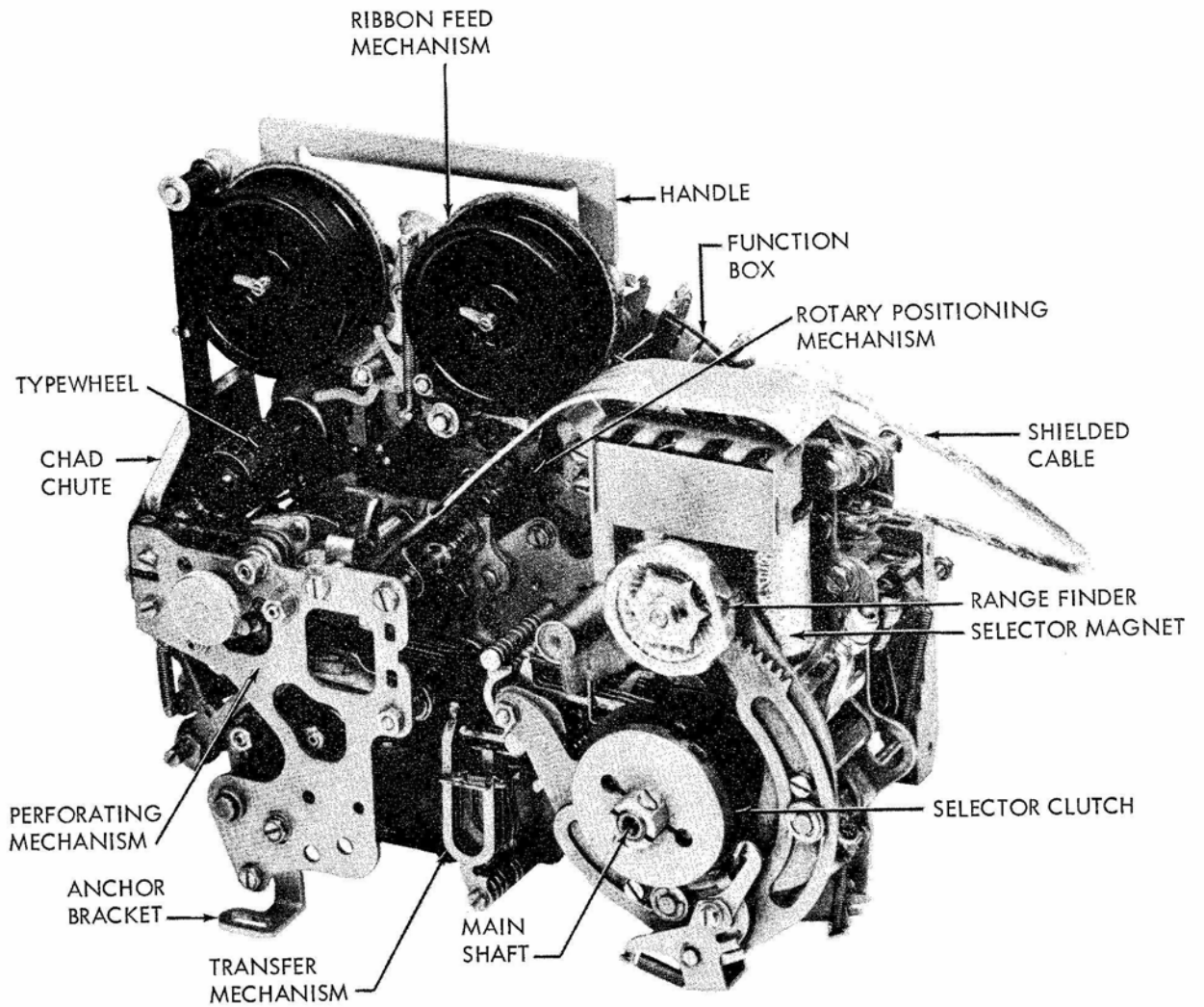


Figure 1-24. Model 28 Typing Reperforator Unit (Fully Perforated Tape Output) (Side View)

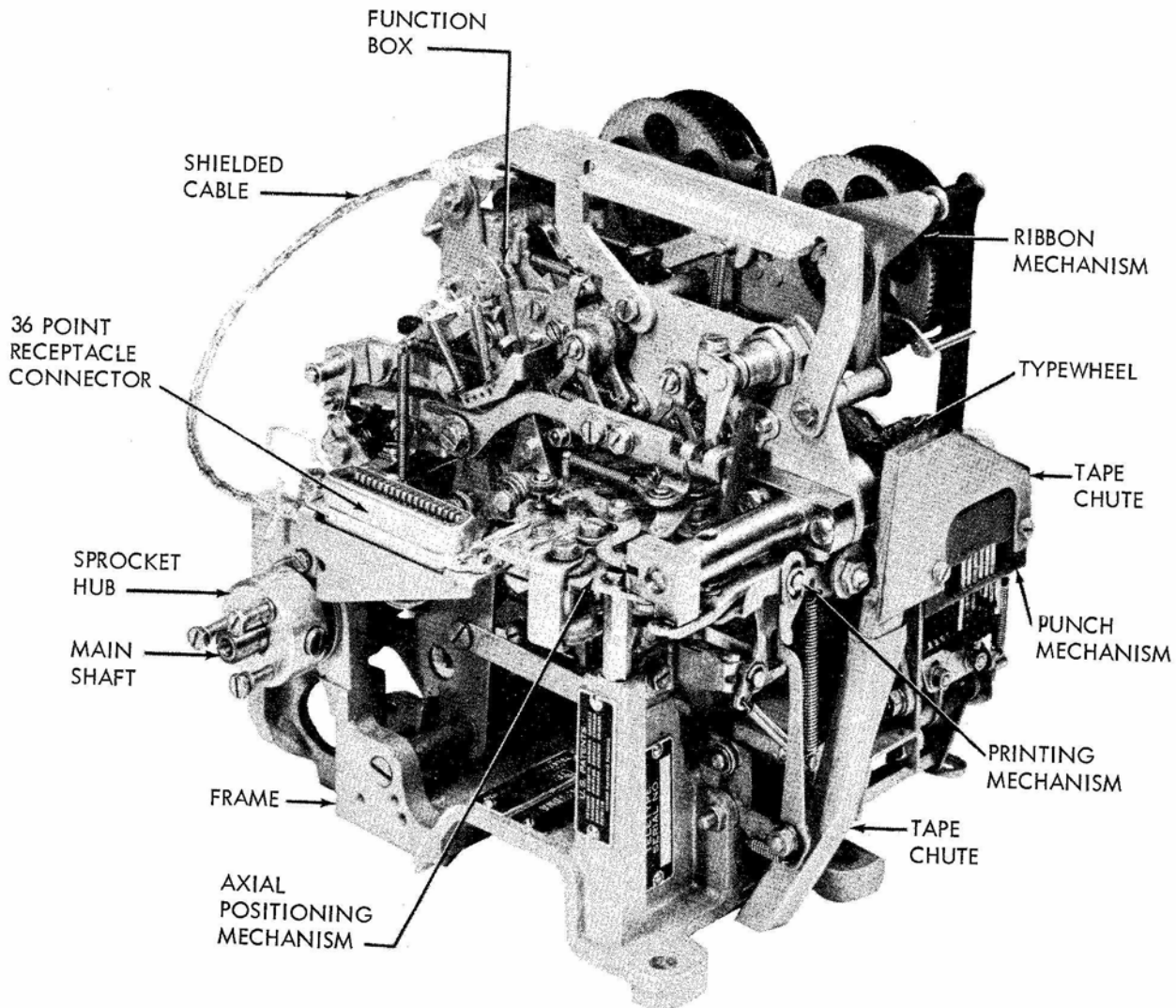


Figure 1-25. Model 28 Typing Reperforator Unit (Fully Perforated Tape Output) (Front View)

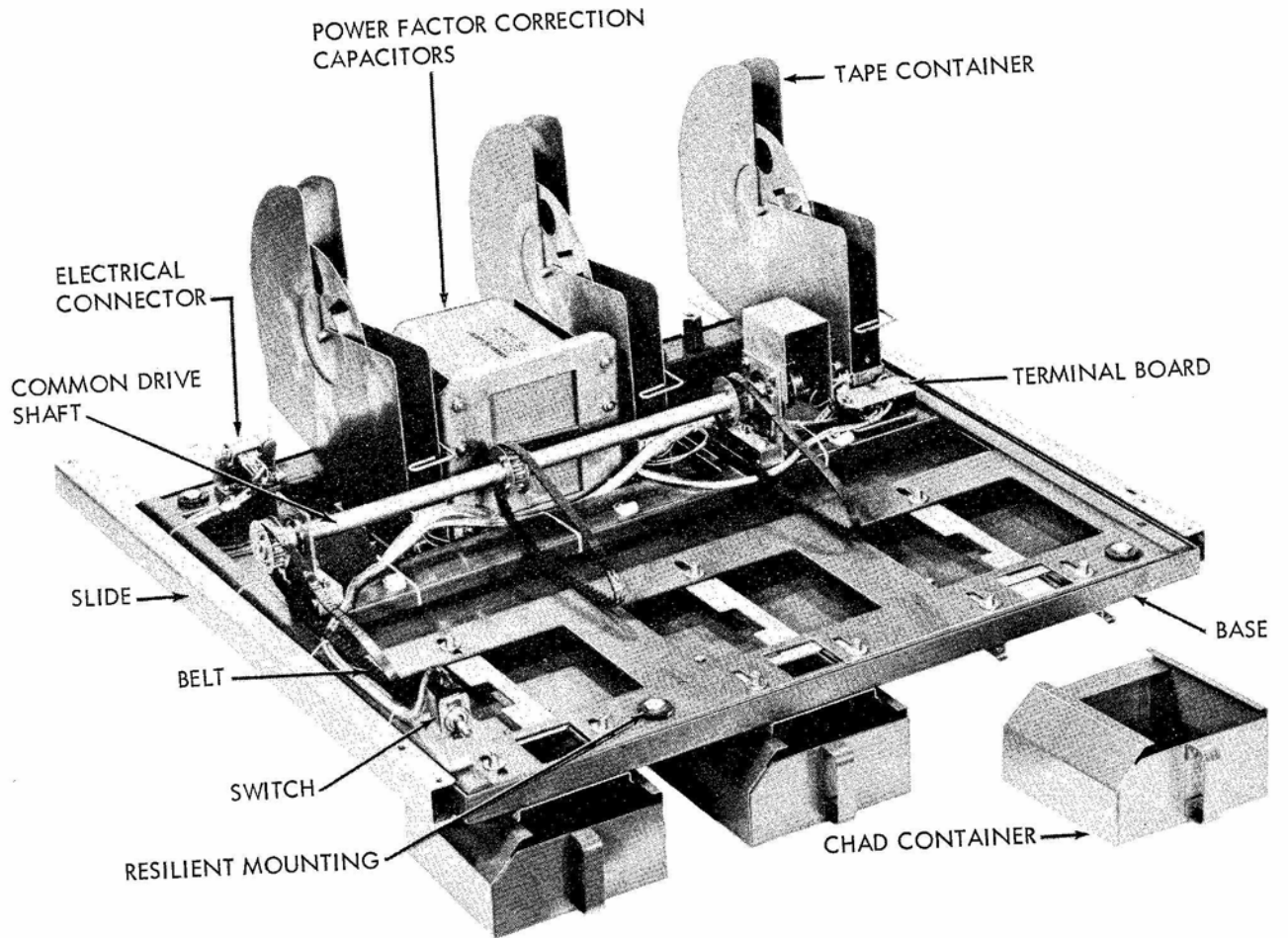


Figure 1-26. Model 28 Multiple Typing Reperforator Base (For Fully Perforated Tape Output)

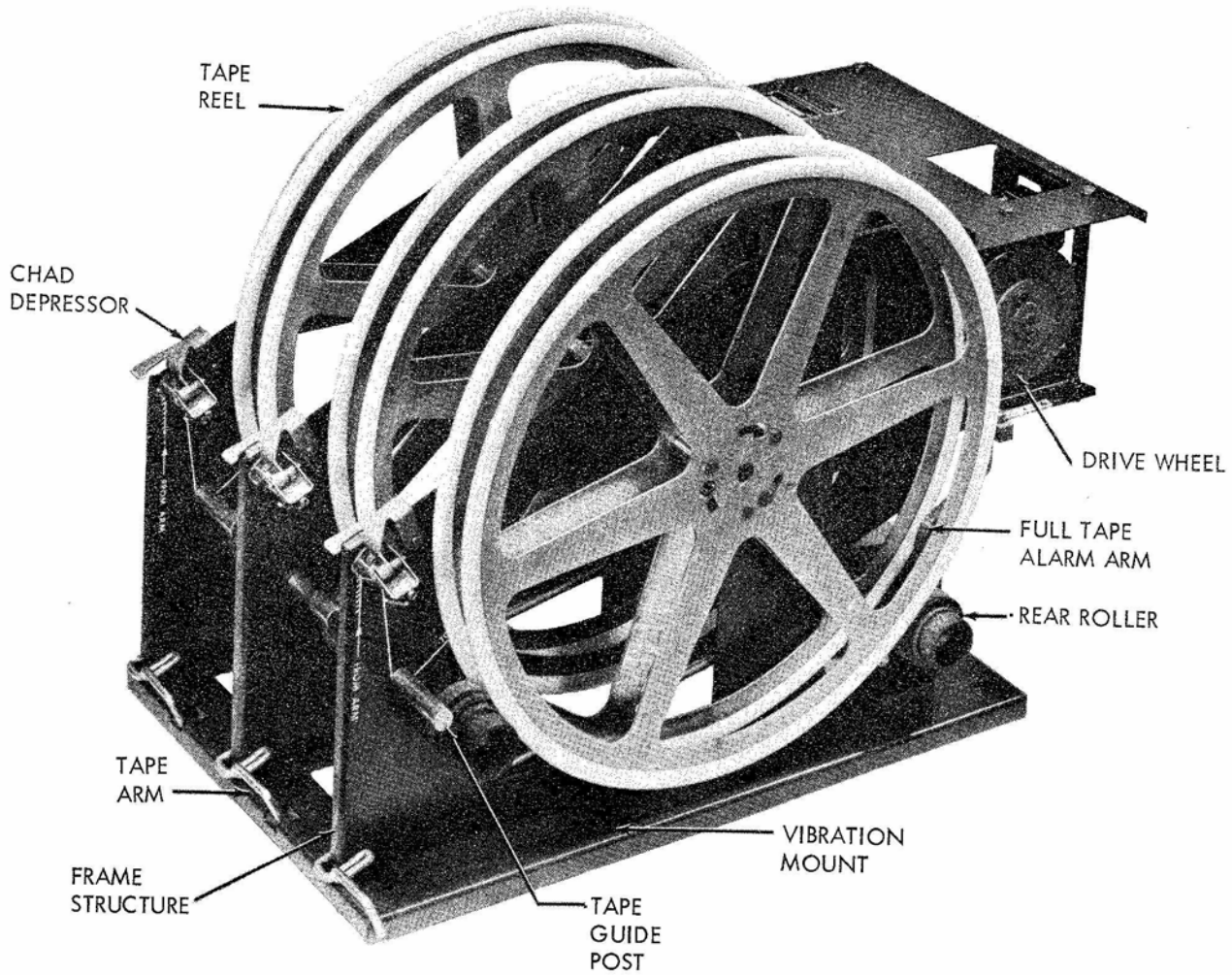


Figure 1-27. Model 28 Multiple Tape Winder Set (Front View)

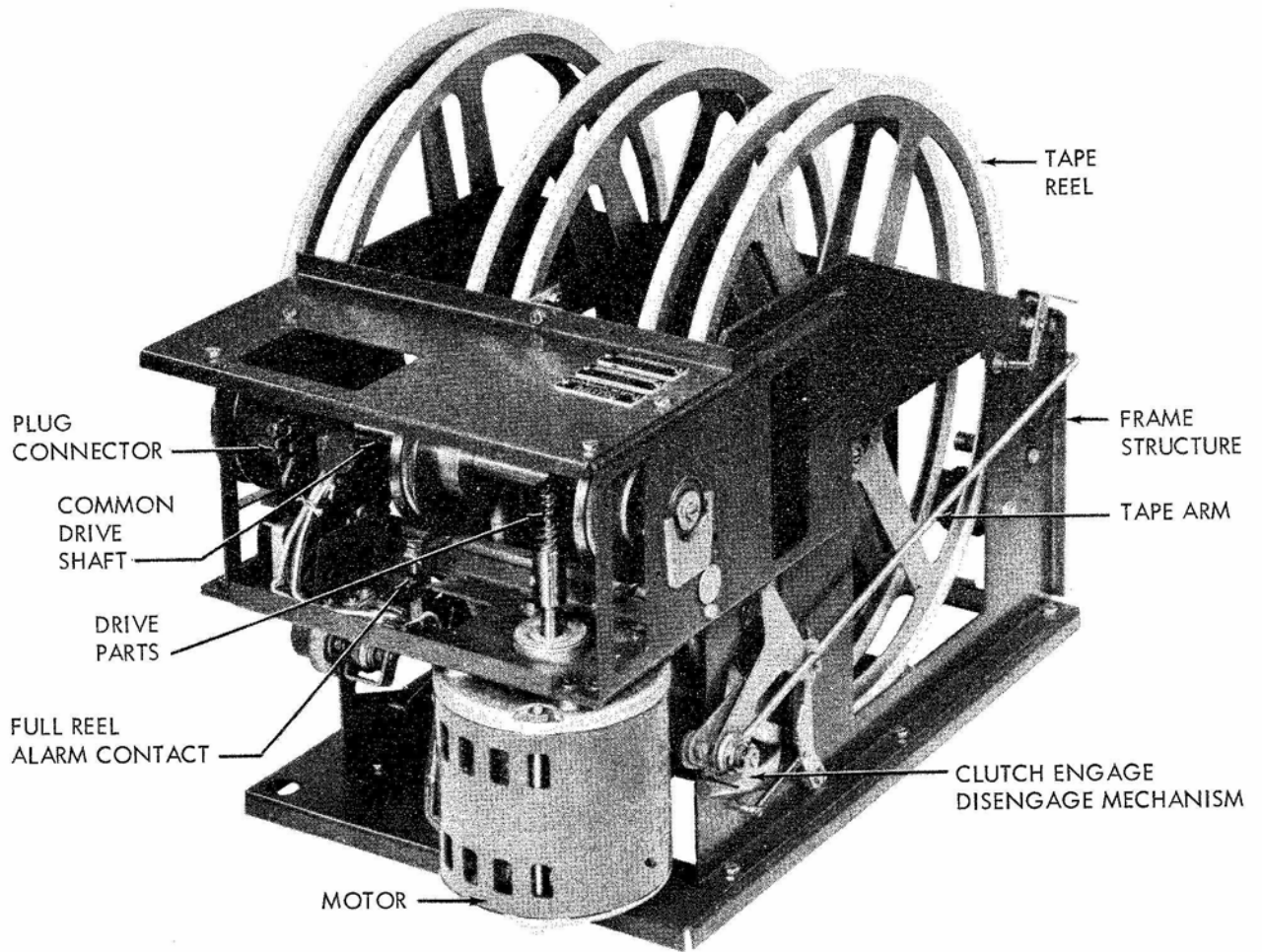


Figure 1-28. Model 28 Multiple Tape Winder Set (Rear View)

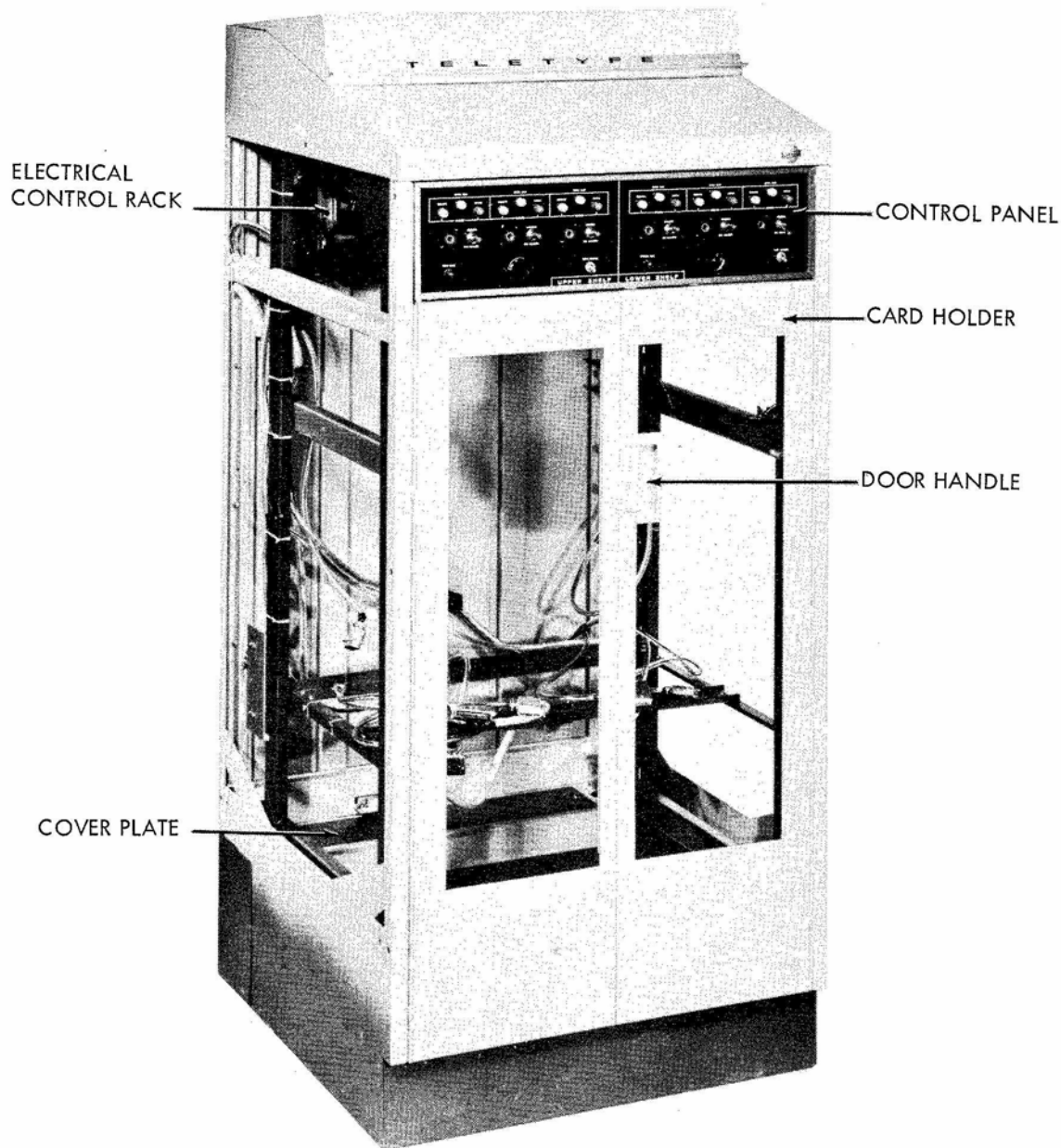


Figure 1-29. Model 28 Universal Cabinet (Monitor Group)

e. The Model 28 Universal Cabinet (Figure 1-29) accommodates two Multiple Reperforator Sets and two Multiple Tape Winder Sets. The cabinet design allows front, rear and top accessibility to the associated apparatus, wiring and electrical components. The control panel as-

sembly is part of the cabinet and mounts six white OPEN LINE indicating lamps, one red LOW TAPE alarm lamp, one red WINDER FULL alarm lamp, six green LOCAL SEIZURE lamps, six amber REMOTE LINE SEIZURE lamps, six signal line rerun jacks, one AC and one DC con-

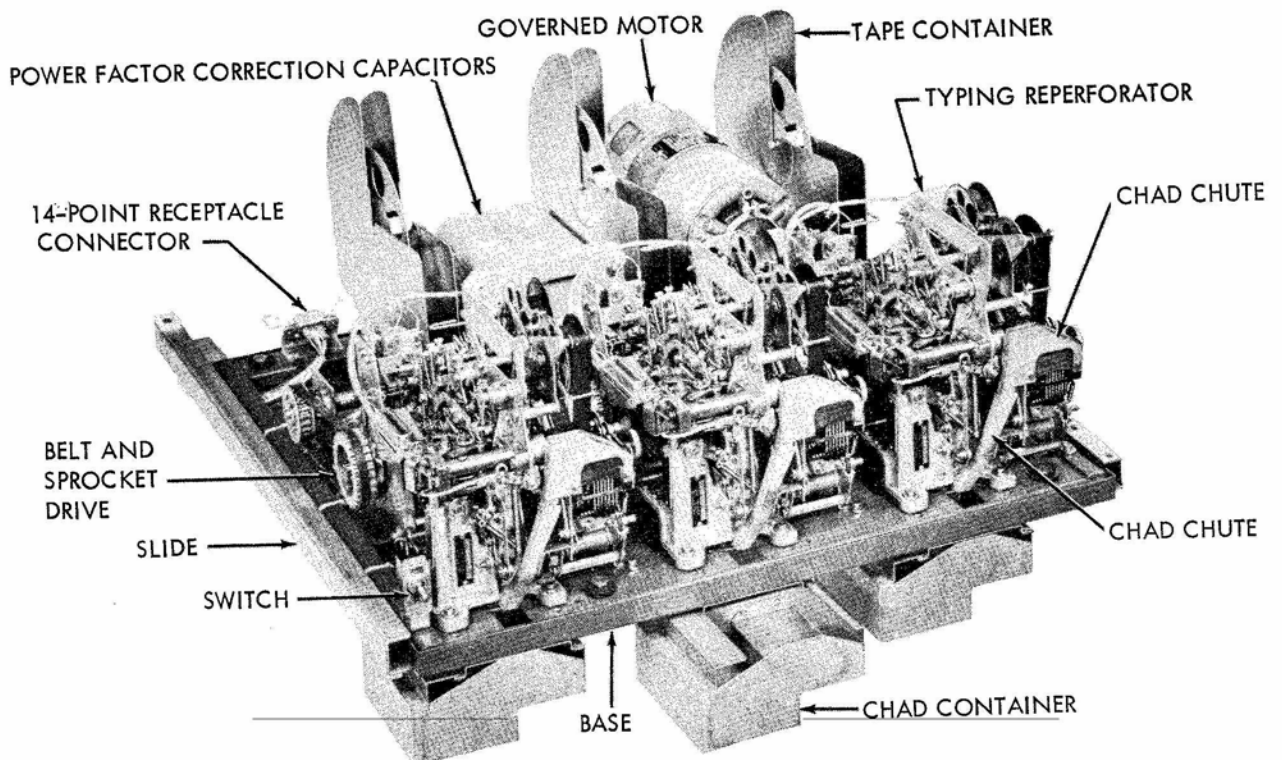


Figure 1-30. Model 28 Typing Reperforator Set With Remote Control Non-Interfering "Letters" Tape Feed-Out Mechanism (Early Design Chad Containers Shown; - For Later Design Chad Container Refer to Figure 1-23)

venience receptacle, a power switch for each tape winder, and six NUMBER-NO NUMBER line seizure switches. The control plate assembly mounts the DC power supply, transformers, rectifiers, AC power switch, AC convenience receptacle, fuses, and slow release relays for open line recognition. The AC power circuits are shielded and connected to the cabinet frame ground. The circuits are designed for 50/60 cycle AC operation. The line relays are wired for .060 ampere neutral operation with provision for .020 ampere neutral operation, or .035 ampere polar operation. Two vertically hinged doors at front and rear of the hinged dome provide access into cabinet. Magnetic door latches facilitate smooth opening and closing of the cabinet doors. The cabinet dome is equipped with six message log holder clips. The domes sloped design provides a convenient writing surface for the operator. With the cabinet dome open, the rack assembly can be raised and locked in position allowing convenient accessibility to the rack from the front of cabinet. Channel assemblies accept the slides which are part of the two multiple typing reperforator bases, and provide

mounting facilities for the two multiple tape winder sets. End enclosures are available for the cabinet.

#### 1-11. DESCRIPTION OF MAJOR COMPONENTS MODEL 28 TYPING REPERFORATOR RE- CEIVING GROUP

a. GENERAL - The basic components of the Group are the Universal Cabinet, and two Multiple Typing Reperforator Sets. One of the identical multiple typing reperforator sets (Figure 1-30) consists of three typing reperforators with fully perforated tape output and a remote control "letters" non-interfering tape feed-out mechanism, multiple typing reperforator base, motor (either synchronous or governed), and drive parts for predetermined speeds. Another type of multiple typing reperforator set used differs from the above set in that the typing reperforators have chadless tape output and automatic "letters" non-interfering tape feed-out mechanisms.

b. Typing Reperforators (With Remote Control "Letters" Non-Interfering Tape Feed-Out Mechanism, Figures 1-31, 1-32, and 1-33) - (With Automatic "Letters" Non-Interfering Tape Feed-Out Mechanism, Figures 1-34 and 1-35).

(1) Reference Paragraph 1-10. b.

(2) The Remote Control "Letters" Non-Interfering Tape Feed-Out Mechanism in-

sure that a predetermined length of "letters" tape is perforated at the end of each message. The operator actuates the feeding out of "letters" tape at the end of a message by operating the tape feed-out button which closes the circuit and energizes the mechanism start magnet. After feeding out a predetermined, but adjustable length of "letters" tape, the mechanism stops, re-cycles, and remains inoperative until the operator initiates another feed-out cycle. Should

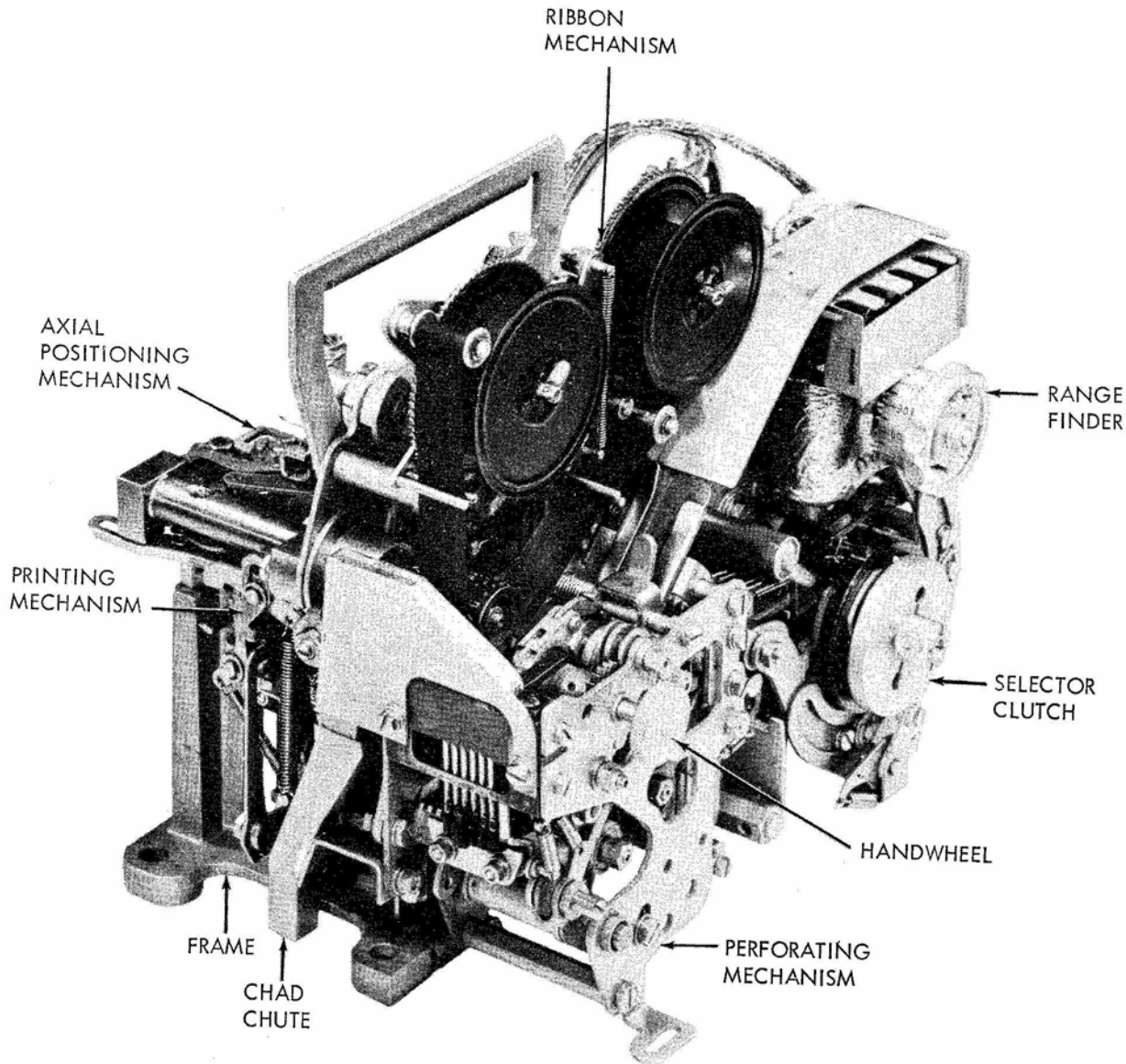


Figure 1-31. Model 28 Typing Reperforator Unit With Remote Control Non-Interfering "Letters" Tape Feed-Out Mechanism (Fully Perforated Tape Output) - (Front View)



a message be received during any part of the feed-out cycle, the mechanism stops and does not interfere with or cause loss of any portion of the incoming message. The length of "letters" tape feed-out is adjustable in increments of .600 inches up to a maximum of eighteen inches.

The mechanism has a non-repeat latch which allows it to be activated only once. This prevents possible interference with an incoming message, and also prevents starting a second feed-out cycle if the start magnet should be held energized throughout the feed-out cycle.

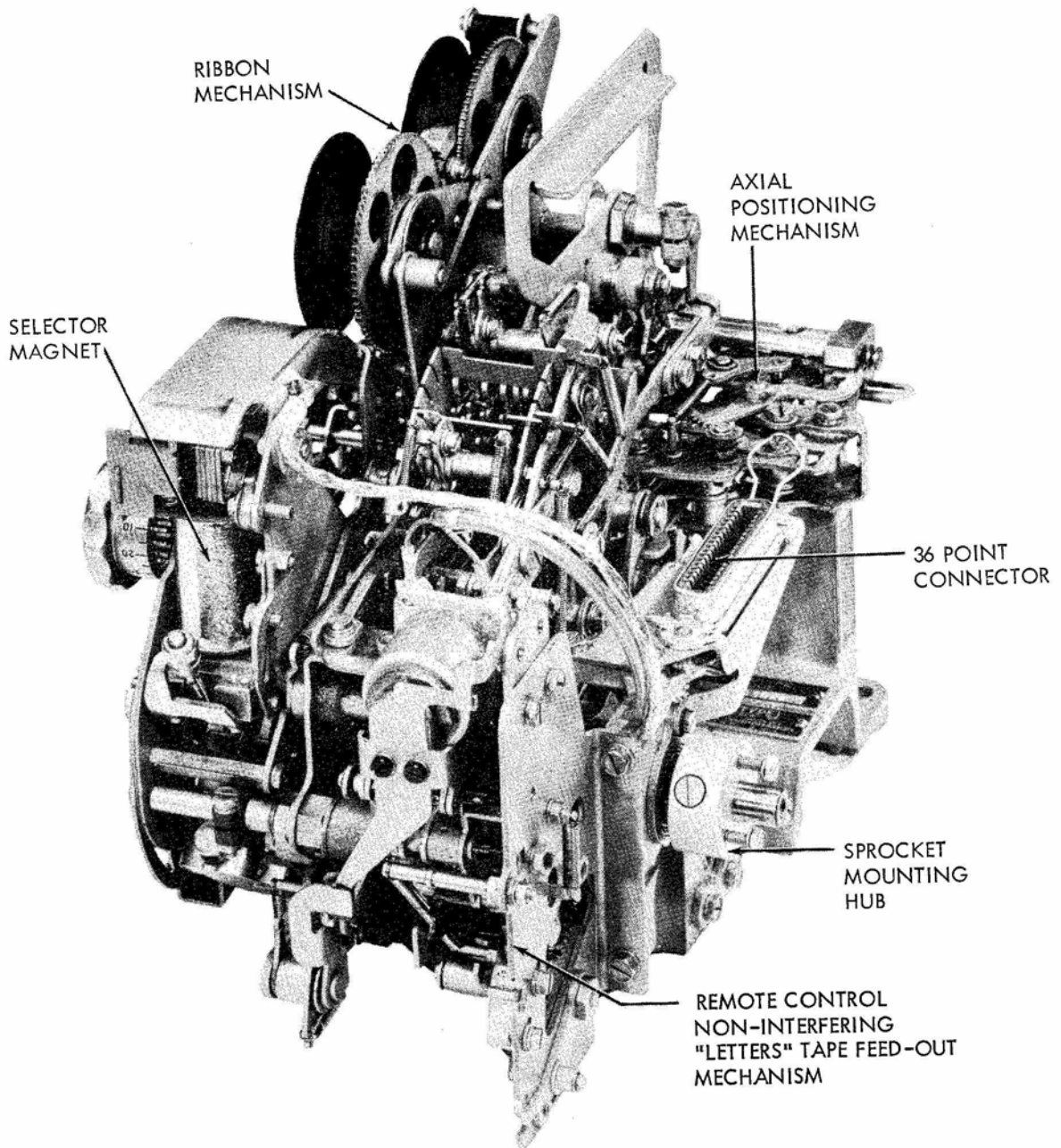


Figure 1-32. Model 28 Typing Reperforator Unit With Remote Control Non-Interfering "Letters" Tape Feed-Out Mechanism - (Rear View)

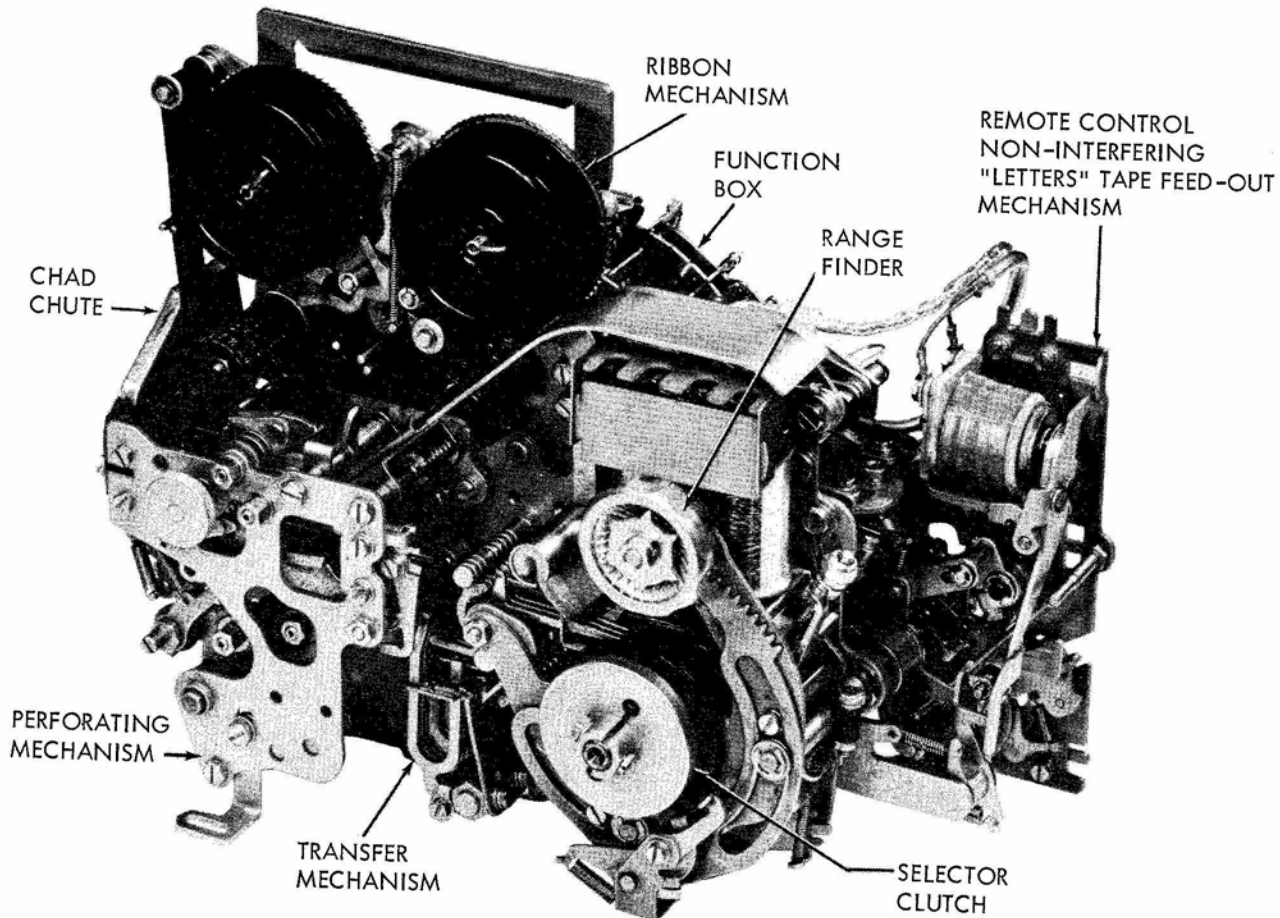


Figure 1-33. Model 28 Typing Reperforator Unit With Remote Control Non-Interfering "Letters" Tape Feed-Out Mechanism - (Side View)

(3) The start magnet shall operate on 115 volts AC plus or minus 10%, 120 volts DC plus or minus 10% with a 1350 ohms series resistance, and 48 volts DC plus or minus 10% with a 350 ohms series resistance.

(4) The Automatic "Letters" Non-Interfering Tape Feed-Out Mechanism differs from the above mechanism only in that it is automatically operated following a fixed period of idle signal line time. A start magnet is not used with this mechanism.

c. Model 28 Multiple Typing Reperforator Base (Figure 1-26) Reference Paragraph 1-10. c. since the same information applies except that the base used with typing reperforators equipped with chadless tape output does not have

the chad disposal openings, or the chad containers.

d. Model 28 Synchronous Motor - Reference Paragraph 1-9. d.

e. Model 28 AC Governed Motor - Reference Paragraph 1-9. e.

f. The Model 28 Universal Cabinet (Figure 1-36) accommodates two Multiple Typing Reperforator Sets (either fully perforated or chadless tape output). The cabinet design allows front, rear and top accessibility to the associated apparatus, wiring and electrical components, and pull-out drawers with plexi-glass windows for viewing reperforator operation. Three received tape holders and three channel identification

card holders are mounted on each front of the two plexi-glass windows. Six message log holder clips are mounted on the sloped portion of the dome. The sloped portion of the dome is also used as a convenient writing surface by the operator. With the cabinet dome open, the rack assembly can be raised and locked in position allowing convenient accessibility to the rack from the front of cabinet. Channel assemblies accept the slides which are part of the two multiple typing reperforator bases. Two tape storage bins are mounted on the hinged doors at the lower front of the cabinet. Magnetic door latches facilitate opening and closing of the cabinet doors. End

enclosures are available for the cabinet. The control panel assembly is part of the cabinet and mounts six white OPEN-LINE indicating lamps, six amber REMOTE SEIZURE lamps, six REPERFORATOR MARKING switches, one red LOW TAPE lamp, six reperforator monitor jacks, one AC convenience receptacle, and six TAPE FEED-OUT push switches for the remote "letters" non-interfering tape feed-out mechanisms. These switches are part of the cabinet, but are not used when typing reperforators are equipped with automatic "letters" non-interfering mechanism. The line relays are wired for .060 ampere neutral operation with provision

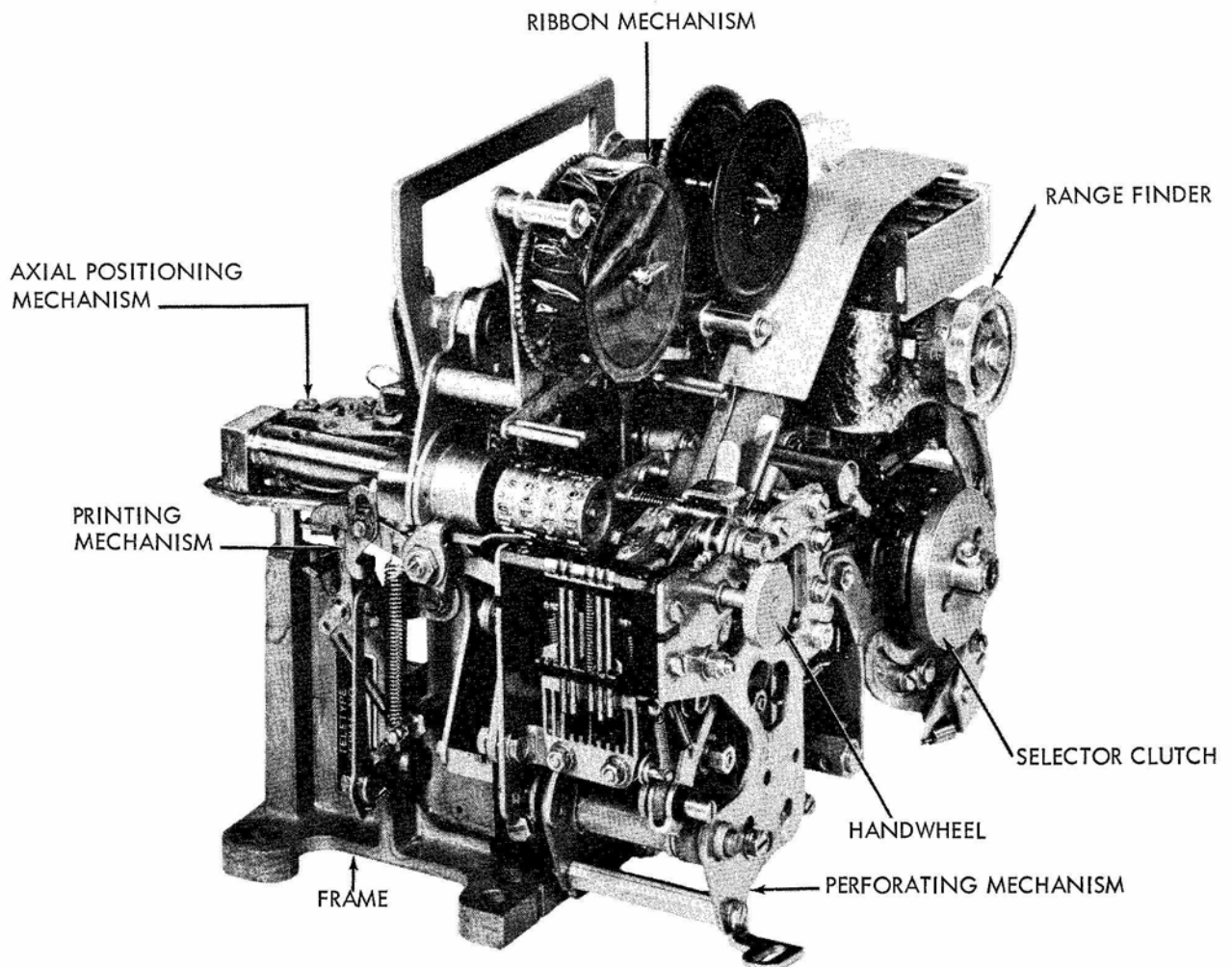


Figure 1-34. Model 28 Typing Reperforator Unit With Automatic Non Interfering "Letters" Tape Feed-Out Mechanism (Chadless Tape Output) - (Front View)

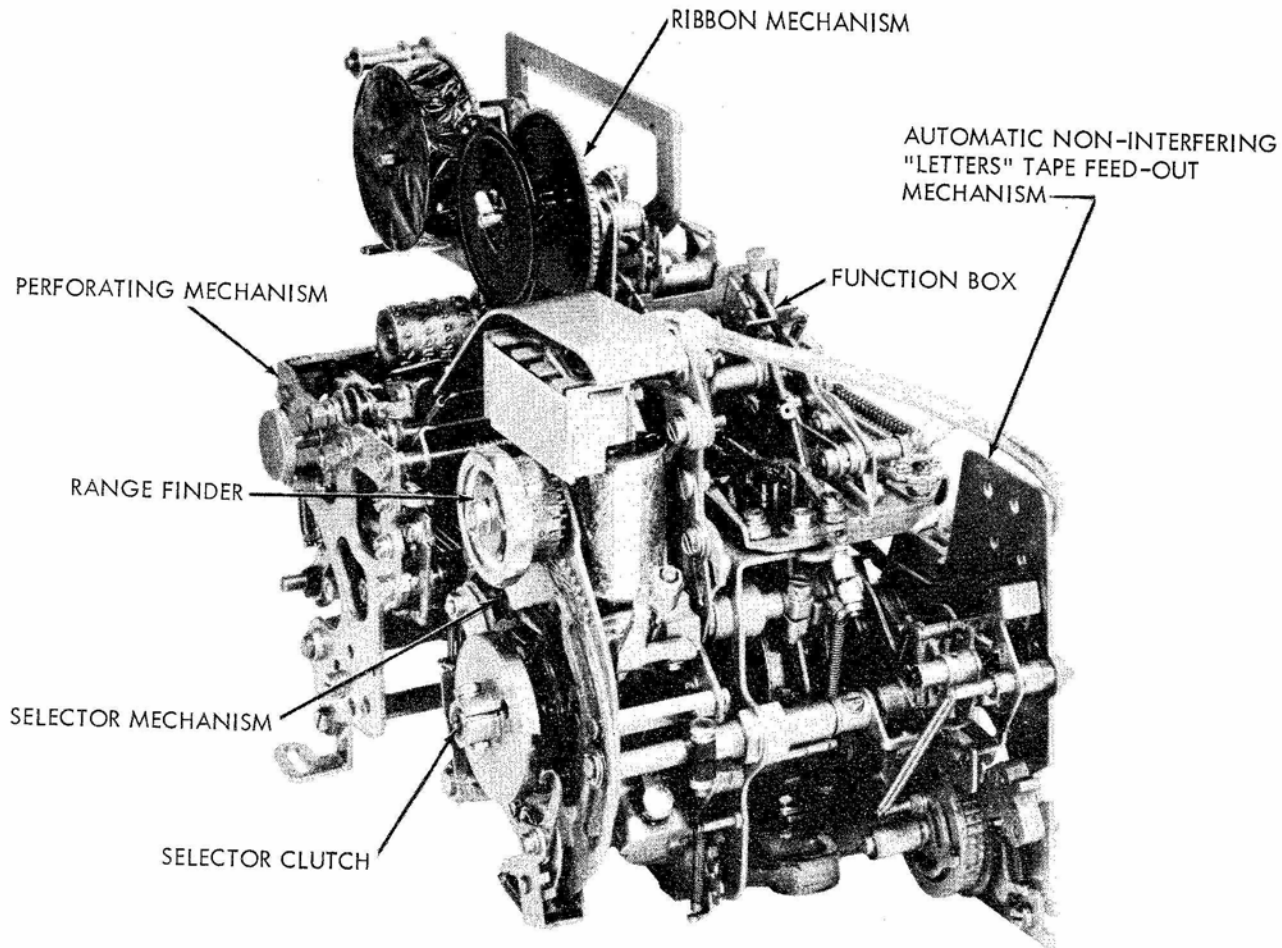


Figure 1-35. Model 28 Typing Reperforator Unit With Automatic Non-Interfering "Letters" Tape Feed-Out Mechanism (Chadless Tape Output) - (Rear View)

for .020 ampere neutral operation, or .035 ampere polar operation and are mounted on the line relay mounting plate assembly. The control plate assembly mounts the DC power supply, transformers, rectifiers, AC power switch, AC convenience receptacle, fuses, and slow release relays for open line recognition.

#### 1-12. DESCRIPTION OF MAJOR COMPONENTS MODEL 28 MONITOR TRANSMITTER GROUP (Pull-Back)

a. GENERAL - The basic components of the Group are the Universal Cabinet, Multiple

Typing Reperforator Set (fully perforated or chadless tape output), Multiple Tape Winder Set and Multiple Transmitter Distributor Set.

b. Multiple Typing Reperforator Set.

(1) Reference Paragraph 1-10. b. and 1-10. c. since the same information concerning typing reperforators with fully perforated tape output and associated base applies.

(2) Reference Paragraph 1-11. b., 1-11. c., since the same information concerning typing reperforators with chadless tape output and automatic "letters" non-interfering tape feed-out mechanism and associated base applies.

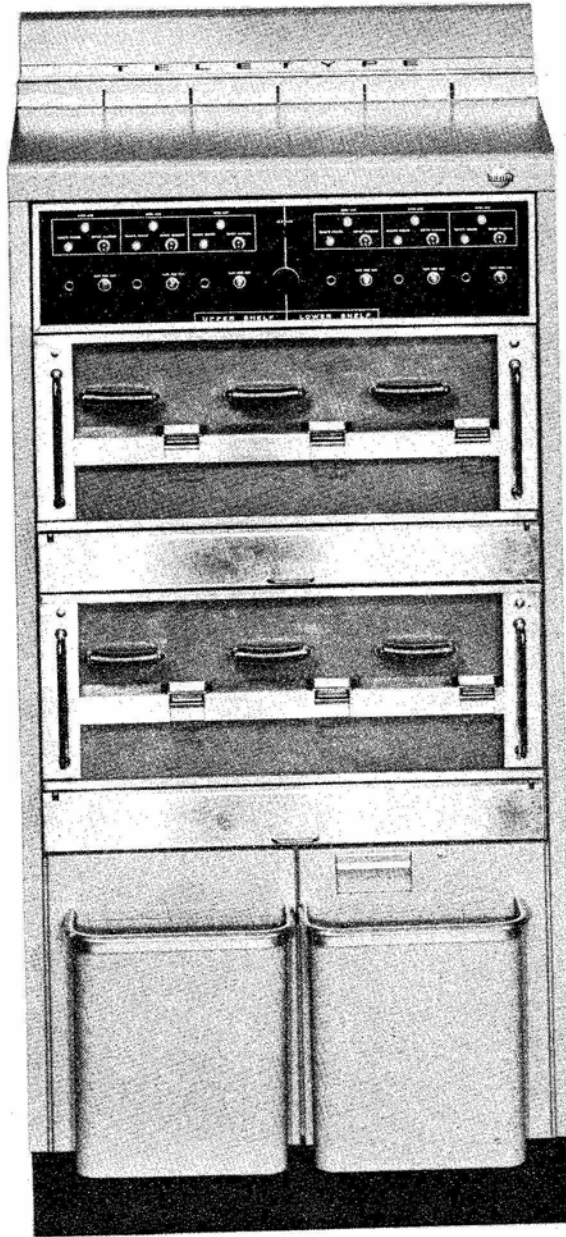


Figure 1-36. Model 28 Universal Cabinet (Receiving Group)

c. Model 28 Synchronous or AC Governed Motors. Reference Paragraphs 1-9. d. and 1-9. e. since the same information applies.

d. Model 28 Multiple Tape Winder Set. Reference Paragraph 1-10. d. since the same information applies.

e. Model 28 Multiple Transmitter Distributor Set. Reference Paragraphs 1-9. b. through

1-9. e. since the same information concerning transmitter distributors, associated base, and motor unit applies.

f. The Model 28 Universal Cabinet (Figure 1-37) accommodates one Multiple Typing Rep perforator Set, one Multiple Tape Winder Set and one Multiple Transmitter Distributor Set. The cabinet design allows front, rear and top accessibility to the associated apparatus, wiring

and electrical components. The control panel assembly is part of the cabinet and mounts one red WINDER FULL alarm, one red LOW TAPE alarm and one power switch for the tape winder. The control plate assembly mounts the DC power supply, transformer, signal line dropping resistors and potentiometers, AC power ON-OFF switch and fuses, power factor correctors, power failure alarm relays, and AC convenience receptacle. The line relays are wired for .060

ampere neutral operation with provision for .020 ampere neutral operation, or .035 ampere polar operation, and are mounted on the line relay mounting plate assembly. All signal line circuits are shielded and the shield wires are brought to a single cabinet terminal. The shield is insulated and kept separate from the cabinet frame ground. The AC power circuits are shielded and connected to the cabinet frame ground. The circuits are designed for 50/60 cycle AC operation.

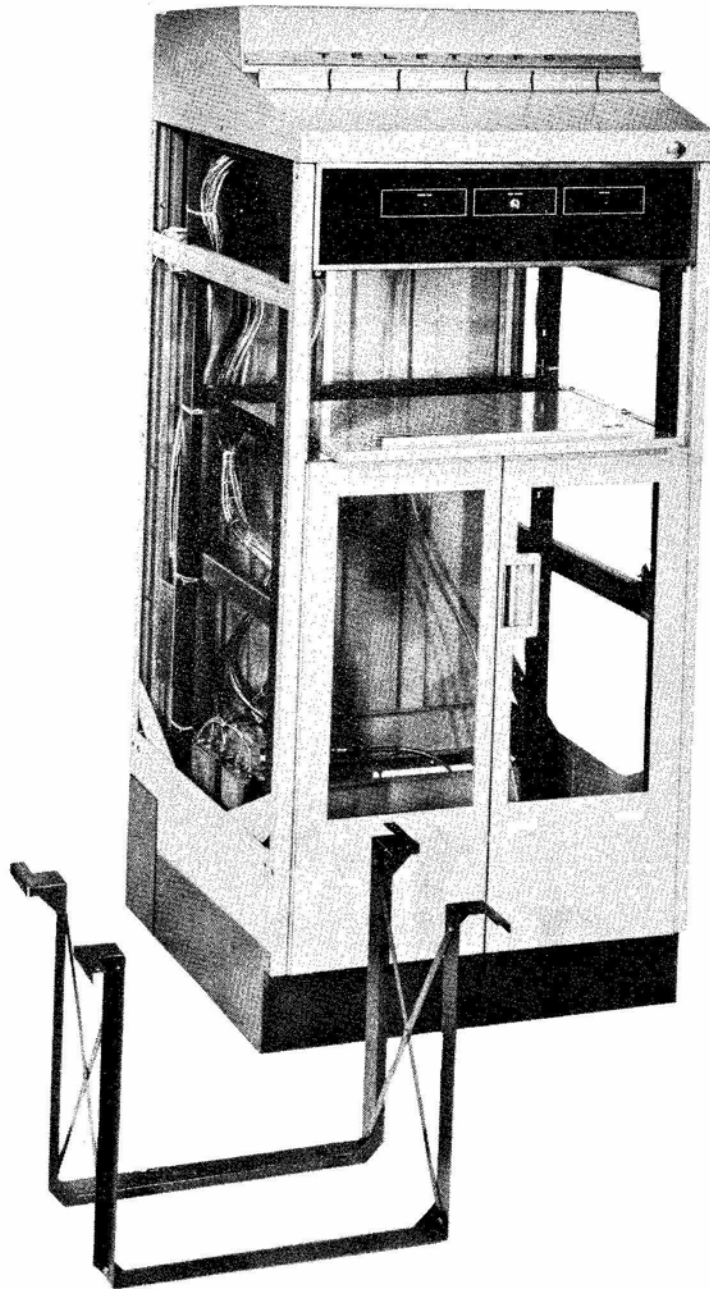


Figure 1-37. Model 28 Universal Cabinet (Monitor Transmitter Group)

## SECTION 2

### INSTALLATION

#### 2-1. INTRODUCTION

a. The purpose of this section is to provide instructions for installation of the equipment covered in this manual. The order of presentation of the equipment will be as follows:

- (1) Model 28 Transmitter Group (Figure 1-8).
- (2) Model 28 Typing Reperforator Monitor Group (Figure 1-9).
- (3) Model 28 Typing Reperforator Receiving Group (Figure 1-10).
- (4) Model 28 Monitor Transmitter Group (Figure 1-11).

b. The installation procedures in this section require the performance of several operations to install each component of the five groups. It is recommended that the components be installed in the order of presentation in this section.

c. The equipment is packed for maximum protection. However, due caution must be taken in unpacking and handling it to prevent damage and to ensure personal safety. All containers are clearly marked as to their contents. In unpacking, observe all caution labels and instructions. All small boxes, bags and loose parts should be kept with their associated apparatus until used in the installation.

#### 2-2. MODEL 28 TRANSMITTER GROUP

a. GENERAL - The Model 28 Transmitter Group consists of the following main component assemblies:

- (1) One Model 28 Universal Cabinet (Figure 1-19).
- (2) Two Model 28 Multiple Transmitter Distributor Sets (Figure 1-13).

The cabinet provides the necessary electrical control, wiring and mounting facilities for operation of the two Multiple Transmitter Distributor Sets.

#### b. CABINET INSTALLATION

- (1) There are two cardboard cartons and two muslin bags secured to the inner frame

of the cabinet. One carton contains the 161731 cover plate, 161752 duct channel, and 161987 duct plate which attach to the cabinet. The second carton contains the 173478 and 173479 Modification Kits which provide a tape grid and tape container for the cabinet. One bag contains mounting hardware for "bank" installation of cabinets, and the other bag contains cable clamps with mounting hardware.

- (2) Remove the cartons and bags from inside the cabinet, and set the cabinet in place. The cabinet assembly should rest firmly on all four of its metal pads to eliminate rocking motion. If one of the pads does not contact the floor, a shim (not provided) should be placed under the pad.

(3) Remove the four spacers and associated mounting hardware that secured the inner and outer structures during shipment (see Figure 2-1). Also, remove the stud which locks the right side of the pivoted-rack frame at the top rear of the cabinet. Inspect the previously removed cartons for identification of contents. Remove and install contents in the following order:

#### (a) COVER PLATE AND DUCT PARTS (Figure 2-1)

1. The 161731 cover plate is mounted on the bottom base section of the outer frame structure with the two 115594 speed nuts and 1253 screws.

2. Where rear access to the cabinet is anticipated, place the six 115594 speed nuts over the appropriate mounting holes in the outer frame and duct channel. Secure the plate and channel to the frame using the 1253 screws.

3. When the cabinet is to be flush mounted against a wall, place the six 115594 speed nuts over the appropriate mounting holes in the duct channel and duct plate. Working from inside the cabinet secure the duct plate and channel to the frame using the 1253 screws. The cabinet may now be removed from a "bank" without disturbing station cabling.

(b) INSTALLATION OF END ENCLOSURES (Figure 2-1) - The Model 28 Universal Cabinets may either be "bank" mounted, or mounted singly. When "bank" mounted, the cabinets are bolted together with the four 8185 screws and 174456 nut plates found in one of the muslin bags tied to the cabinet inner frame.

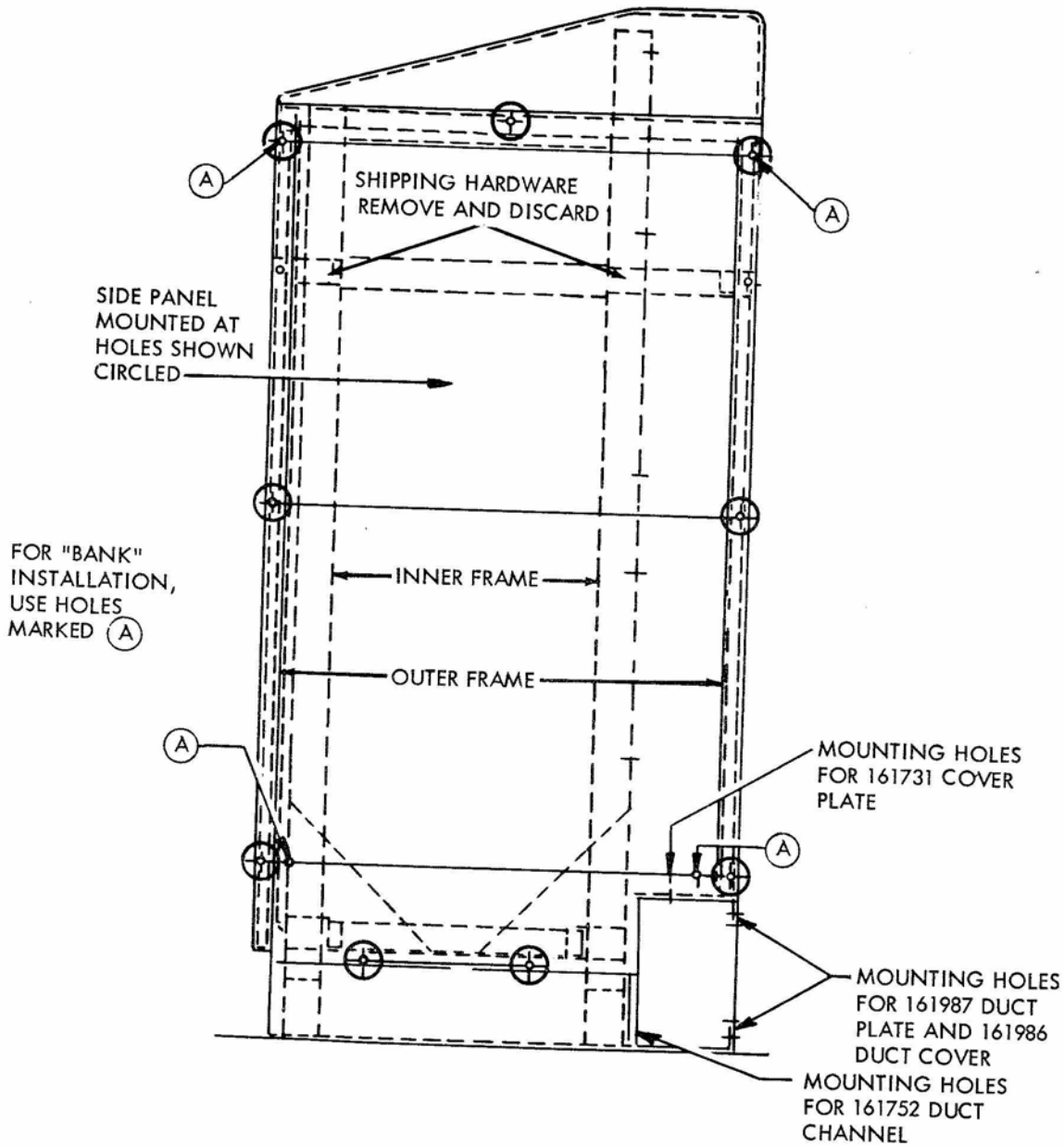


Figure 2-1. Universal Cabinet Installation

Whether mounted in "banks" or singly, end enclosure installation procedure is as follows:

plate as outlined in paragraphs 2-2. b. (3) (a) 1., 2., and 3.

1. Remove and discard the shipping hardware, and make sure the cabinet rests firmly on its metal pads (refer to paragraph 2-2. b. (2) and (3).)

3. Cabinets to be installed in "banks" should be bolted together using the four 8185 screws and 174456 nut plates (refer to Figure 2-1 for location of mounting holes).

2. Mount the 161731 cover plate, 161752 duct channel, and 161987 duct

4. Secure the 161753 Left-Side Panel and/or the 161754 Right-Side Panel



to the cabinet (use the holes indicated in Figure 2-1) with the 2449 lock washers, 92146 nuts, and 103081 screws as required.

5. Secure the 161936 duct cover (or covers) to the cabinet using the 1253 screws and 115594 speed nuts as required. See Figure 2-1.

(c) MODIFICATION KITS 173478 and 173479 (Refer to Figure 2-2)

1. Mount the 173423 Tape Grid Assembly and 173439 railing, respectively, to the dome of the cabinet with the seven 151631 screws, 2191 lock washers, and 3598 nuts.

2. On top of the 173423 Tape Grid Assembly mount the 173437 tape container using the two 151631 screws, 7002 flat washers, 2191 lock washers, and 3598 nuts.

#### c. MULTIPLE TRANSMITTER DISTRIBUTOR SET INSTALLATION

(1) The Multiple Transmitter Set consists of a "variable" speed or "non-variable" speed Multiple Base, three transmitter distributors, a synchronous or governed motor unit, and appropriate drive parts (see Table 4-1). The multiple base is shipped in one cardboard carton which contains the cover assembly and the base. The drive parts are packed in bags and tied to the base. The motor unit (Figures 1-17 and 1-18) and each transmitter distributor (Figure 1-14) are packed in separate cartons.

(2) Inspect each carton for identification of contents. Carefully remove the contents and install them in the following order (Refer to Figure 1-16):

#### (a) SYNCHRONOUS OR GOVERNED MOTOR UNIT

1. Remove the 156805 pinion retainer and two 156806 posts from the bag attached to the base. Remove the screw from the motor shaft and discard it. Secure the pinion to the motor shaft using the 156805 pinion retainer and the two 156806 posts.

2. Remove the 161569 plate, two 104124 screws and two 2449 lock washers from the bag attached to the base. Assemble the 161569 plate to the side of the motor on which the name plates are located (with the center hole of the plate toward the rear) using the screws and lock washers.

3. Remove the 156334 stud from the bag attached to the base and screw it into the single post at the rear of the base.

4. The incoming cable to the base should be installed prior to installation of the motor unit. For cable routing and clamping see Figure 2-6. Cable clamps, mounting screws, washers, and lock washers are found in a bag attached to the base.

5. Mount the motor unit on the base using the two 104124 screws and two

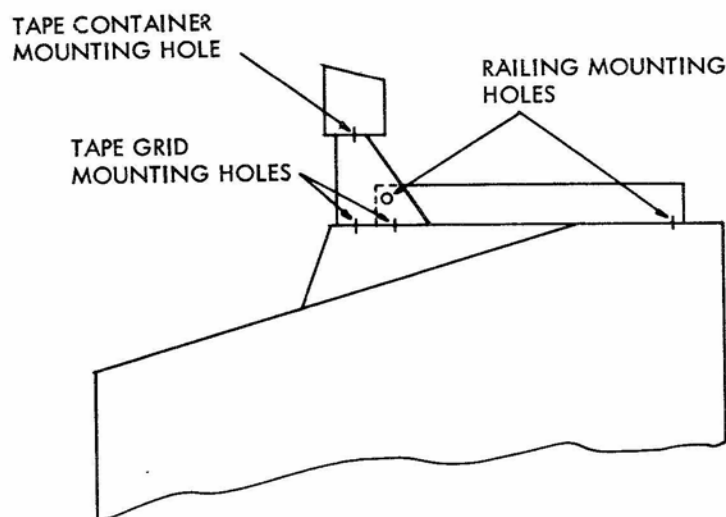


Figure 2-2. Tape Grid and Tape Container

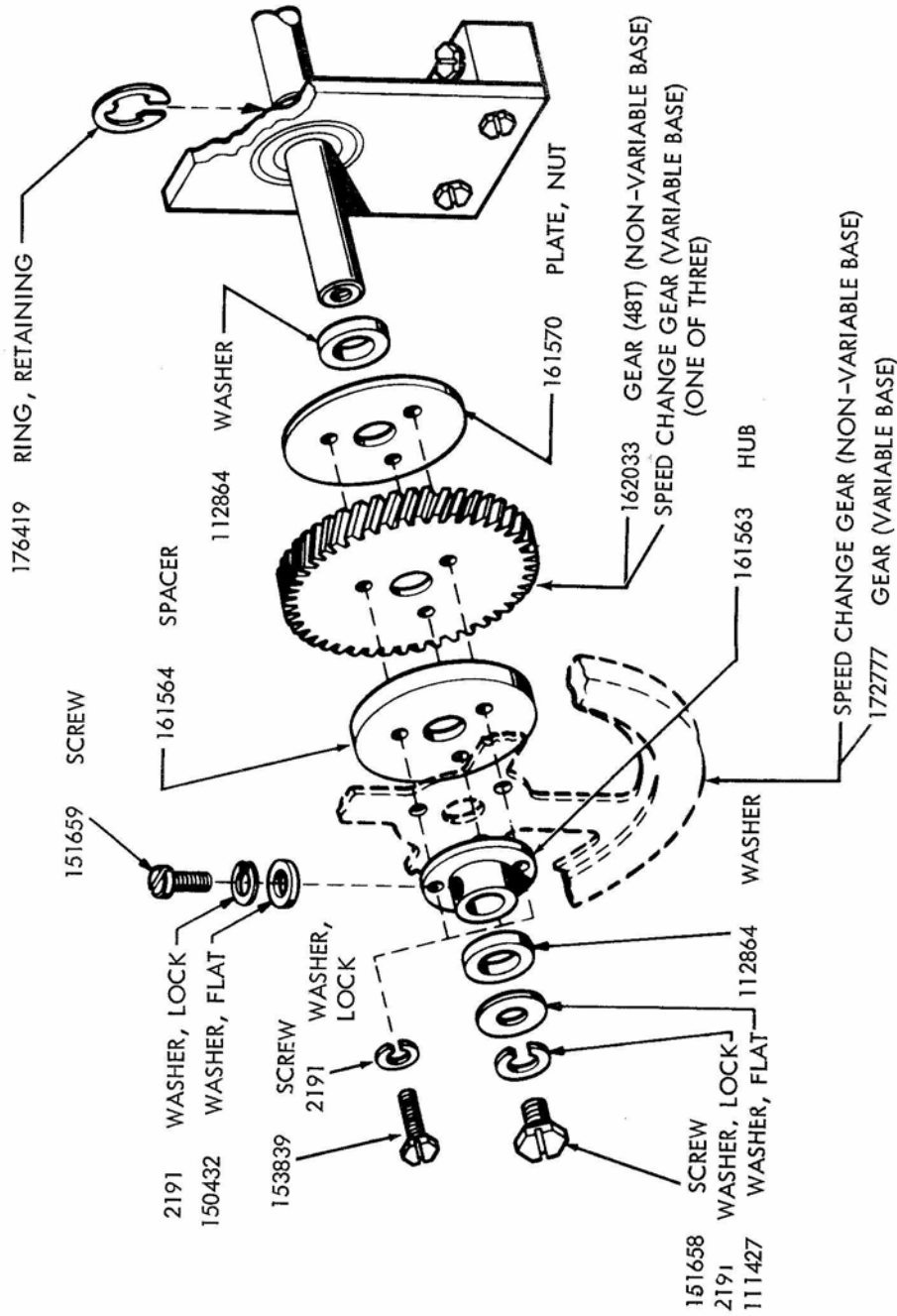


Figure 2-3. Multiple Transmitter Distributor Speed Change Gear Installation

2449 lock washers remaining in the bag. Use the 125224 nut and the third 2449 lock washer to fasten the motor unit to the 156334 stud.

(b) **TRANSMITTER DISTRIBUTOR POSITIONING** - Place a transmitter distributor unit in the left mounting position of the base. Loosen (friction tight) the two 151630 screws which hold the locating plate to the cradle and the 151724 screw which holds the transmitter distributor unit by placing a screw driver in the pry point. The gears should have a barely perceptible amount of backlash at their closest point. Remove the unit from the left mounting position, place it in the right mounting position, and check the gear mesh. If incorrect, loosen the four 85471 countershaft assembly mounting screws and position the countershaft until the unit gear mesh is correct in both mounting positions. Refine if necessary. Tighten the countershaft assembly mounting screws and check for binds. Adjust the gear mesh for each of the other transmitter distributor units to be used in one of the mounting positions.

(c) **SPEED CHANGE GEARS**

**1. NON-VARIABLE BASE** - Assemble the parts found in the bag attached to the shaft as follows (refer to Figures 2-3 and 2-4).

Place the 176419 retaining ring on the shaft (to the right of and adjacent to the left bearing). Place a 112864 washer on the left side of the bearing. Place the 161570 nut plate in the counterbore of the 162033 gear. On the other side of the gear, place the 161564 spacer, appropriate driven gear for the desired operating speed, and the 161563 gear hub. Secure these parts (friction tight) using the three 153839 screws and 2191 lock washers. Place the gear assembly on the shaft so that the 162033 gear is to the right of the driven gear; tighten the three screws. Secure the hub to the shaft (friction tight) using a 151659 screw, 2191 lock washer, and 150432 washer. Next to the 161563 hub, place a 112864 washer. Secure the pile-up of parts using the 151658 screw, 2191 lock washer, and 111427 washer. Tighten the gear hub mounting screw. This assembly procedure must be followed in order to insure clamping the inner race of the bearing.

**2. VARIABLE BASE** - Assemble the parts as for the non-variable base, except the appropriate change gears for the desired unit speeds must be placed on the countershaft (see Figures 2-3 and 2-5).

**3.** Adjust the gear mesh by running the stud in the motor unit mounting post up or down as required. The gears should have

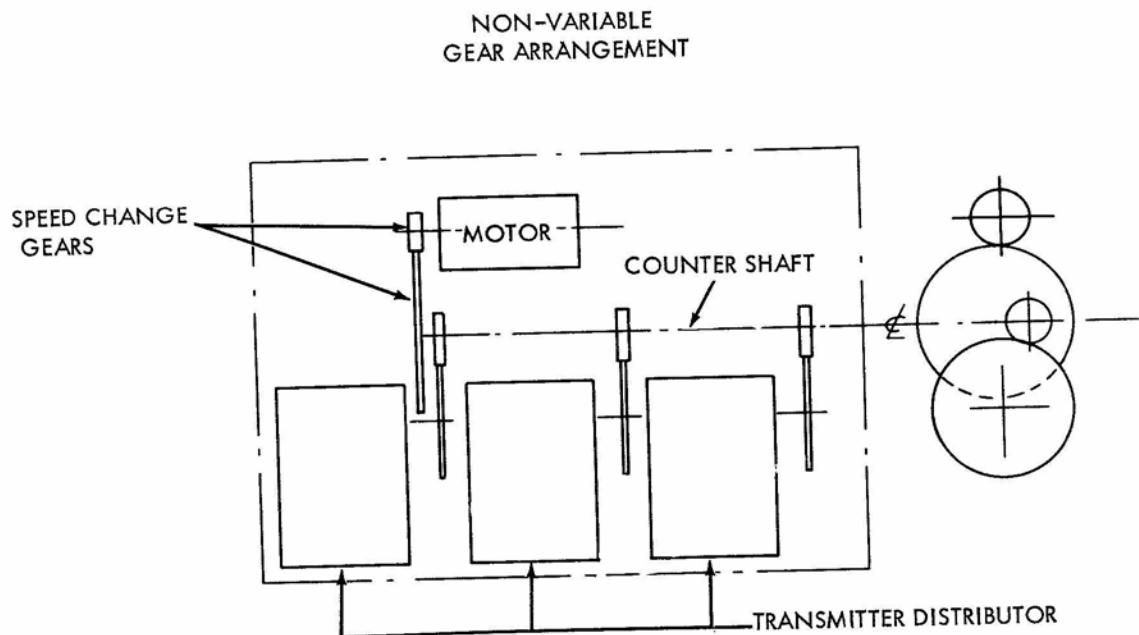


Figure 2-4. Multiple Transmitter Distributor Base Non-Variable Gear Arrangement

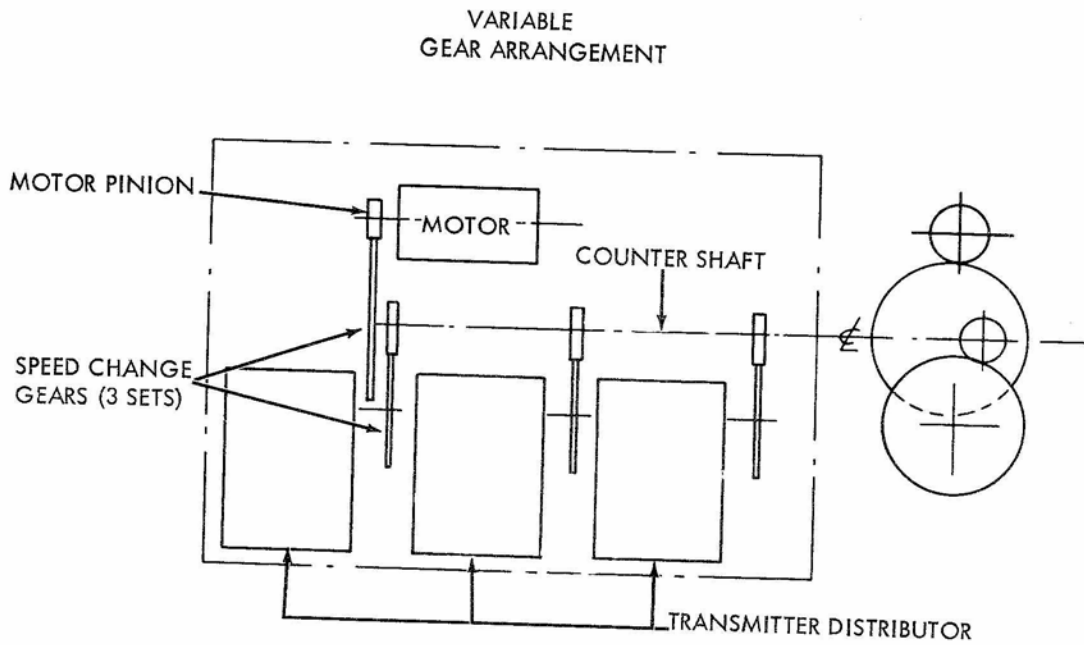


Figure 2-5. Multiple Transmitter Distributor Base Variable Gear Arrangement

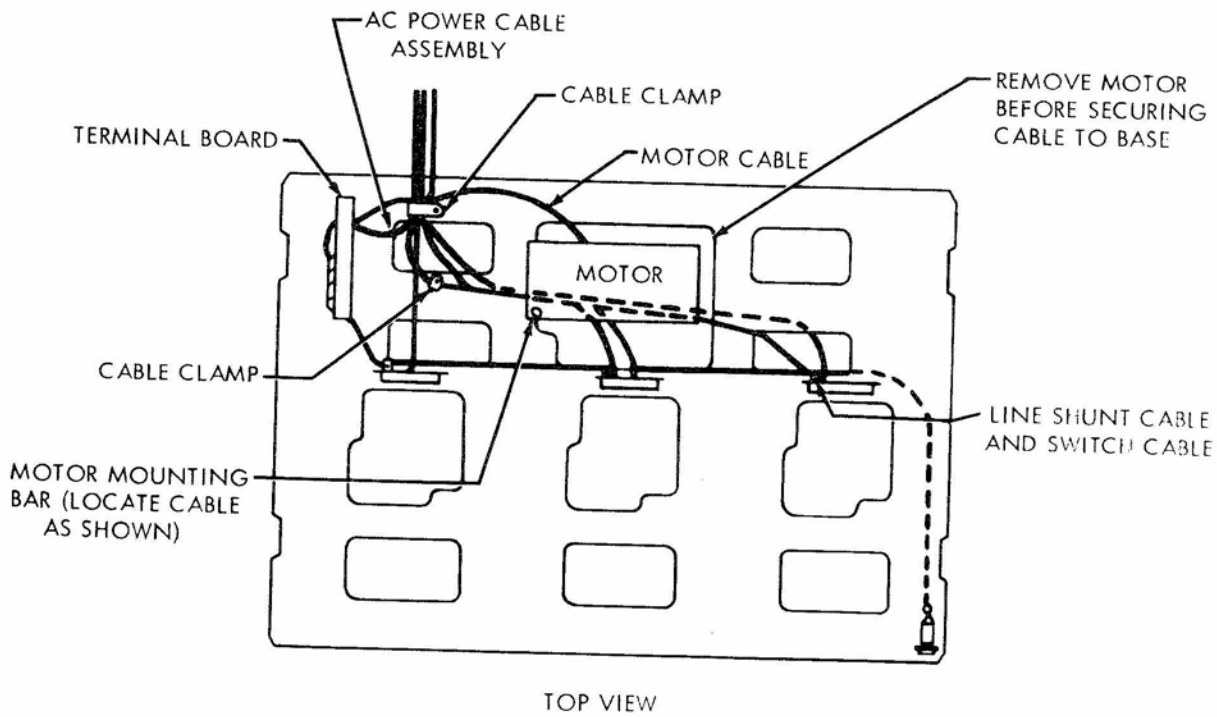


Figure 2-6. Multiple Transmitter Distributor Cable Routing

a barely perceptible amount of backlash at their closest point. Tighten the nut on the stud while holding the stud in position.

### (3) INSTALLING MULTIPLE SET INTO CABINET

(a) Place the multiple mounted set, without cover, on the lower (or upper) shelf of the cabinet (Figure 1-19).

(b) Wire in accordance with the applicable wiring diagram furnished with the equipment, or see Volume 2. Refer to Figure 2-6.

(4) DUST COVER - Remove the transmitter distributor units from the base. Place the dust cover over the base with the hinged panel to the front.

### (5) TO INSTALL TRANSMITTER DISTRIBUTORS

(a) The profile of the 162209 filler plate assembly should be matched to that of the tape guide and top plates so that the common edges bear against each other. Place a straight edge across the top and filler plates. Measure at two places (straight edge at front of plates and rear of plates). A 0.010 inch round wire gauge should not enter under the straight edge. Gauge within 1/8 inch on each side of the common edges. To adjust, loosen (friction tight) the three screws which secure the filler plate brackets and the two nuts securing the filler plate; position the plate and brackets to meet the requirements. Tighten the screws and nuts.

(b) Lower the hinged door on the dust cover and slide the transmitter distributor units on the base.

(c) The three cover plate assemblies (when installed on their respective transmitter distributor units on the base) should be mutually flush (horizontal), and the right edge of the cover plates should be held flush against their top plate edges by detent action. To adjust, loosen the 156782 nuts on the transmitter distributor unit side plates by means of their 151630 screws, and locate them to their extreme right position; tighten the screws. Refine if necessary.

(d) The left side of the cover plate assembly, when installed on the associated transmitter distributor unit, should be in line with the left side of the top plate. To adjust, loosen (friction tight) the four 3598 nuts on the cover plate assembly and position the cover plate. Remove the cover plate being careful not to disturb the adjustment; tighten the nuts.

(e) Secure the transmitter distributor onto the base by means of its locking screw.

## 2-3. MODEL 28 TYPING REPERFORATOR MONITOR GROUP

a. GENERAL - The Model 28 Typing Reperforator Monitor Group consists of the following main component assemblies:

(1) One Model 28 Universal Cabinet (Figure 1-29).

(2) Two Model 28 Multiple Typing Reperforator Sets (Figure 1-23) for fully perforated or chadless tape operation.

(3) Two Model 28 Multiple Tape Winder Sets (Figure 1-27).

The cabinet provides the necessary electrical control, wiring, and mounting facilities for operation of the Multiple Typing Reperforator and Tape Winder Sets.

### b. CABINET INSTALLATION

(1) There is one cardboard carton and three muslin bags secured to the inner frame of the cabinet. The carton contains the 161731 cover plate, 161752 duct channel, and 161987 duct plate which attach to the cabinet. One bag contains necessary electrical connectors, and the second bag contains three tape guides (with rollers) which mount on the tape winders. Mounting hardware for "bank" installation of the cabinets is contained in the final bag.

(2) Remove the carton and three bags from inside the cabinet and set the cabinet in place (refer to paragraph 2-2. b. (2)).

(3) Refer to paragraphs 2-2. b. (a) and (b) for installation of the cover plate, duct parts, and end enclosures.

### c. MULTIPLE TYPING REPERFORATOR SET INSTALLATION (Figures 1-23 and 1-26)

(1) The Multiple Typing Reperforator Set consists of a multiple base, power factor correction capacitors, three typing reperforators (chadless or fully-perforated), a synchronous or governed motor unit, and the necessary drive parts for the desired operating speed. The drive parts are placed in muslin bags and tied to the base. In addition, those bases which provide for fully-perforated tape operation are furnished with 176542 Chad Disposal Modification Kits. These kits are packed in muslin bags and tied to the base. The base, reperforators, and motor are packed in separate cartons.

(2) Inspect each carton for identification of contents. Carefully remove the contents and install in the following order:

(a) MOTOR UNITS AND GEAR SETS (Figure 1-26)

1. Remove the gear guard from the base. Retain the guard and its mounting parts.

2. Install the desired motor pinion on the motor shaft using the screw and lock washer in the motor shaft.

3. Remove the 156334 stud from the bag attached to the base. Screw the stud loosely into the motor mounting post immediately behind the driven gear location.

4. Remove the 156344 adjusting bracket, four 156936 screws and four 2449 lock washers from the bag attached to the base. Mount the adjusting bracket to the gear end of the motor unit (the center hole in the bracket should extend beyond the motor mounting plate) using two of the screws and lock washers. Place the motor unit and bracket over the three motor mounting posts (the hole in the adjusting bracket should pass over the 156334 stud). Secure the fan end of the motor unit using the two remaining screws and lock washers.

NOTE

It is important that the fan be removed from the synchronous motor unit mounted on the multiple typing reperforator base. This is necessary to avoid interference between the fan and the base cabling.

5. Remove the 125224 nut and 2449 lock washer from the bag attached to the base and put them on the stud holding the adjusting bracket (do not tighten).

6. Discard the spacer and install the gear using the mounting hardware furnished with the gear hub. With the gear hub mounting screw friction tight, tighten the screw at the right end of the shaft. Tighten the gear hub mounting screw.

(b) BELT AND SPROCKET DRIVE INSTALLATION (Figure 2-7)

1. The unit, as supplied, may be equipped for various operating speeds (see Table 4-1). To change operating speed, the appropriate 173584 drive parts must be installed

in place of the existing drive parts. Proceed as follows:

2. BELT AND SPROCKET DRIVE DISASSEMBLY

a. Remove the 161687 gear guard by removing the two 151630 screws and 2191 lock washers. Retain all of the removed parts.

b. Remove left timing belt.

c. Remove and retain screw, lock washer, and washer from the left end of the 161506 shaft.

d. Remove the 151721 screw, 2191 lock washer, 7002 flat washer, and 3598 nut from the existing sprocket hubs. Slide the left sprocket assembly to the left and off the 161506 shaft.

e. Remove the left 162216 retainer from the 161506 shaft.

f. Remove the two 151631 screws and 2191 lock washers that mount the 161513 clamp and 161514 plate to the 161507 bearing mounting plate. Retain parts removed.

g. Slide the 161520 or 161522 timing belts off the center and right sprockets.

h. Remove and retain the 151721 screw, 2191 lock washer, and 7002 flat washer from the center and right sprocket hubs.

i. Move the shaft assembly partly through the right 161507 bearing plate and then move the two timing belts and sprockets assemblies to the left until they slide off the left end of the 161506 shaft.

3. BELT AND SPROCKET ASSEMBLY

NOTE

Replace the removed sprocket assemblies with those for the desired speed. To reassemble the sprocket assemblies and timing belts, reverse the disassembly procedure.

a. Assemble the three sprocket assemblies (retainer, sprocket, and hub) with the three 150089 screws and 130683 lock washers. It will be easier to slide the

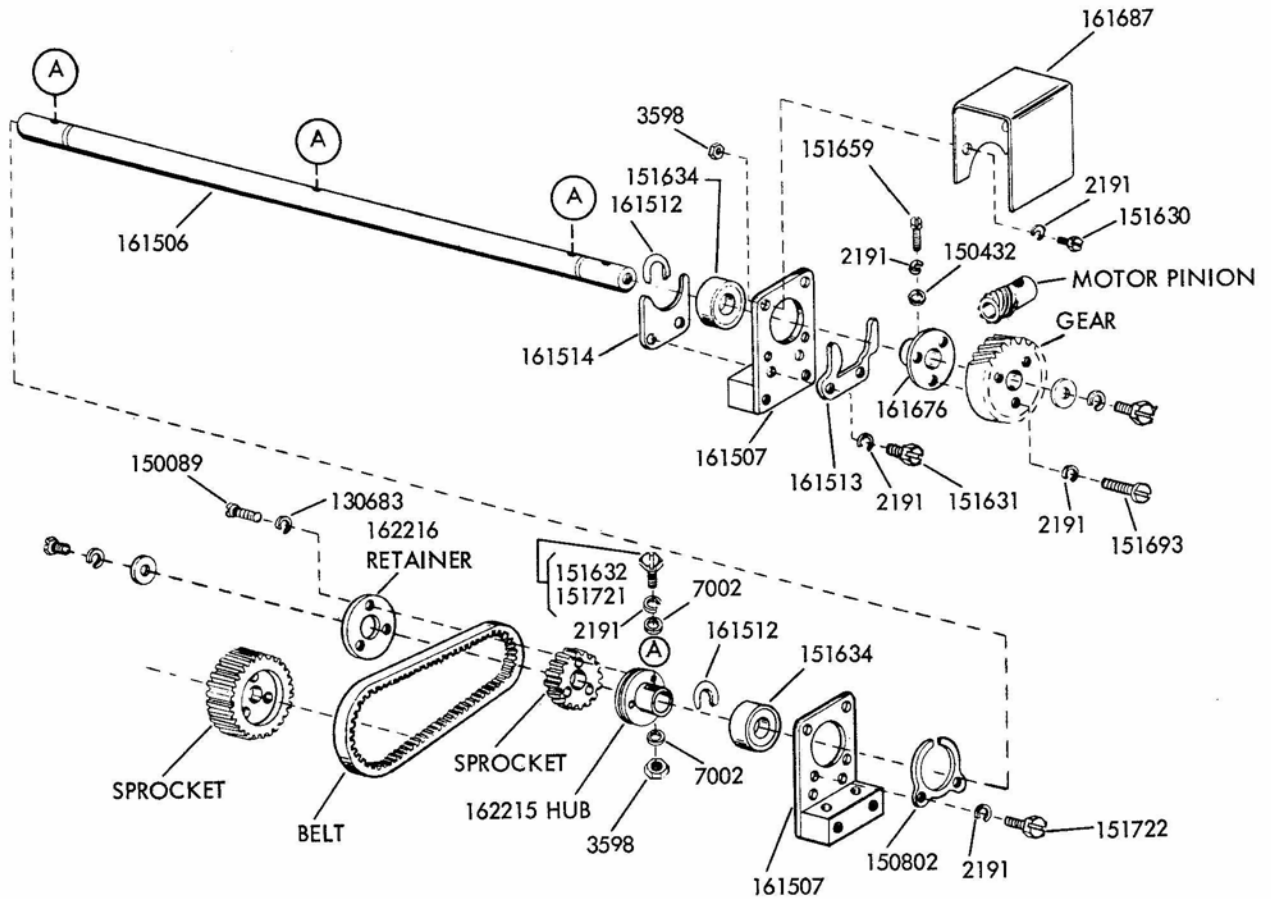


Figure 2-7. Belt and Sprocket Drive Installation

sprocket or gear assemblies onto the shaft if their three assembly screws are friction tight. Slide the right and center sprocket assemblies onto the shaft with the hub end to the right. Tighten the three sprocket assembly screws.

b. Secure each sprocket assembly to the 161506 shaft with the 151632 screw, 2191 lock washer, two 7002 flat washers, and 3598 nut.

c. Replace the right and center (161520 or 161522) timing belts.

d. Insert the 161506 shaft through the left 151634 bearing.

e. Replace the left 161512 retaining ring.

f. Replace the left sprocket assembly and timing belt.

g. Replace the 161513 clamp and 161514 plate to the right 161507 bearing mounting plate using the two retained 151631 screws and 2191 lock washers.

h. When replacing the screw, lock washer, and flat washer, at the left end of the 161506 shaft, leave the mounting screw that secures the adjacent sprocket assembly to the shaft friction tight. Tighten the screw at the left end of the shaft first. This will take up the end play of the 151634 bearing between the 161512 retaining ring and the sprocket hub at the left end of the shaft. Secure the left sprocket assembly to the shaft by tightening the mounting screw.

1. The 173583 sprocket is secured to the hub of the typing reperforator unit. The hub, sprocket mounting screw, and lock washers are part of the typing reperforator unit.

i. Refer to paragraph 2-3.c.(2)(d) for timing belt adjustment.

### (c) POWER FACTOR CORRECTION CAPACITORS

#### NOTE

The following installation instructions apply only to those multiple typing reperforator bases shipped without power factor correction capacitors factory installed.

1. Mount the two 158989 capacitors to the 173827 mounting plate using the four 158990 brackets, eight 153442 screws, eight 2669 lock washers, and eight 112626 nuts. Mount the capacitors so the terminals are on the upper side of the capacitor.

2. Cover the capacitor terminals and wire terminals with the insulating sleeving supplied as shown in Figure 2-8.

3. Solder the 173713 cable assembly to the lower capacitor terminals. Looking at the terminals solder the white color lead to right terminal and slate color lead to left terminal. Solder the wire straps between terminals as shown in Figure 2-8.

4. Loosen the two mounting screws that are used for mounting the center and left tape containers to the oil pan. Slide the tape containers to the rear to disengage them from the mounting screws. Remove and retain the tape container mounting screws.

5. Place the bracket assembly on the oil pan and place the tape containers on the 173827 mounting plate, aligning the mounting holes. The retained tape container mounting hardware will be used to secure the bracket assembly and tape containers to the oil pan as shown in Figure 2-8.

6. Route the cable to the terminal board on the base and connect the white color lead to terminal number 4 and the slate color lead to terminal number 3.

7. Center the 173827 mounting bracket by means of its elongated slots between the two tape containers. Check to see that

tape guide arm on the left container does not rub on the 173827 mounting bracket. Reposition either the tape guide arm or the 173827 mounting bracket and tighten the tape container mounting screws.

(d) REPERFORATOR UNITS (Figures 1-23, 1-25, 1-26)

### 1. FULLY PERFORATED TYPING REPERFORATOR

a. Mount a 164279 chad chute to the punch block of each of the reperforator units using two 151152 screws, 3640 lock washers and 104807 washers (if the punch block has a 0.012" offset on the chute mounting surface, place two 90560 washers between the chad chute and the punch block; discard the 90560 washers if the mounting surface is flat). See Figure 2-9. Position each chute (by means of its slotted mounting holes) so that it is flush with the top of the punch block; tighten the screws.

b. Secure a 172967 chad chute to the front plate of each of the reperforator units using a 151630 screw, 7002 washer, 2191 lock washer, and 3598 nut. See Figure 2-9. Position each chute (by means of its enlarged mounting hole) for maximum clearance between the chute and the reperforator unit casting; tighten the screw.

c. Slide each 176514 chad container onto its retaining rail bracket located under the multiple base. See Figure 2-9.

### 2. FULLY PERFORATED AND CHADLESS TYPING REPERFORATORS

a. Remove one 151632 screw, three 151631 screws, four 2191 lock washers, three 76461 washers, and one 125015 washer from the bag attached to the base.

b. Place the reperforator unit over its mounting studs on the base. Loosen (friction tight) the screw which secures the anchor bracket ("L" shaped) to the reperforator unit. Start the three 151631 screws (with 2191 lock washers and 76461 washers attached) into the proper tapped studs in the "T" plate; do not tighten. Start the 151632 screw (with 2191 lock washer and 125015 washer attached) through the "L" bracket into the proper tapped hole in the base; do not tighten.

(e) TIMING BELT ADJUSTMENT  
- A pressure of 7 to 9 ozs. applied at the center of the span should deflect the belt 3/32" to 5/32".



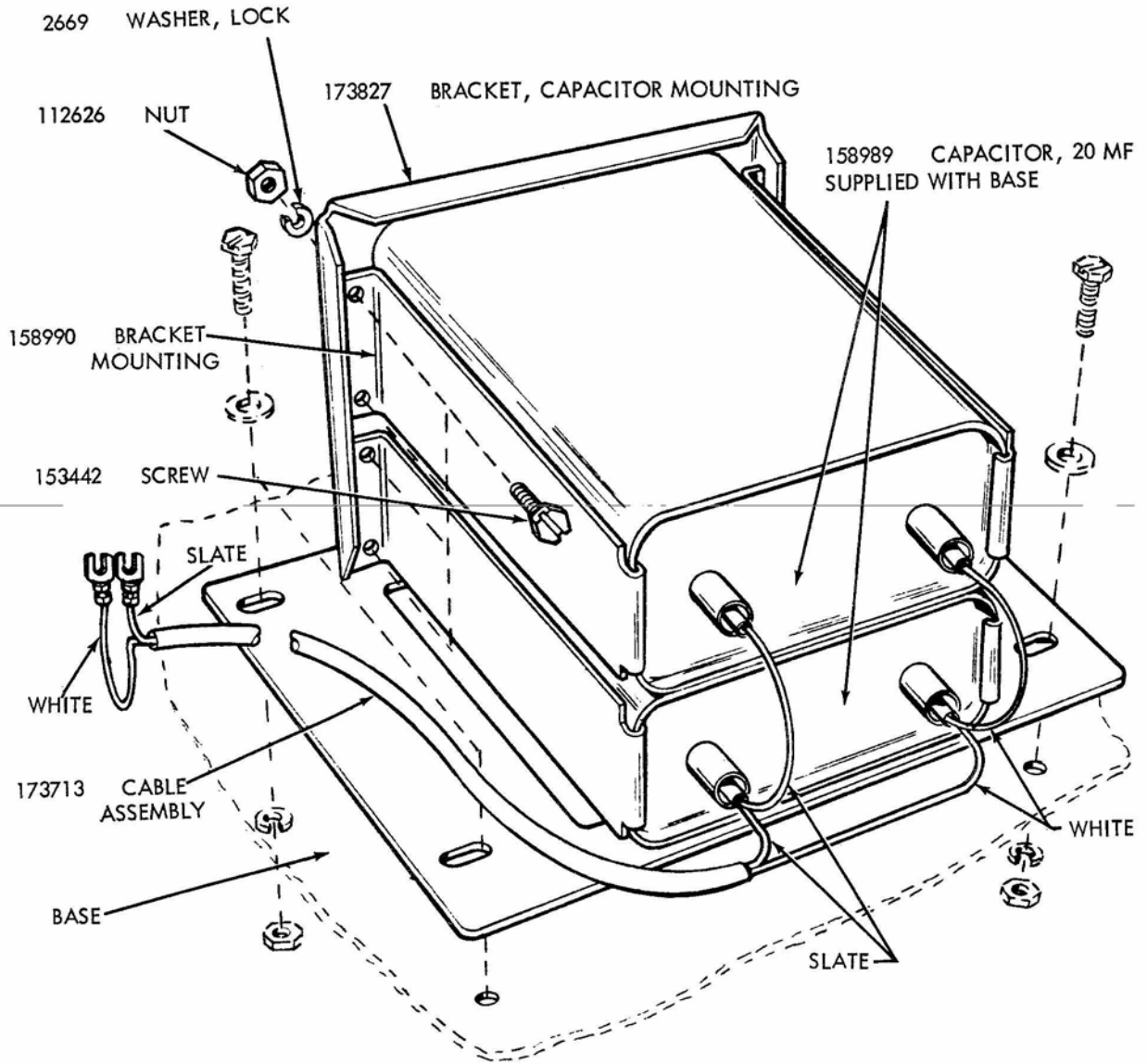


Figure 2-8. Power Factor Correction Capacitors Installation

#### CAUTION

Belt should not be tight. To adjust, position the reperfurator unit. Tighten the three mounting screws. Press the anchor bracket against the base plate and tighten the screw holding the bracket to reperfurator unit. Tighten the screw holding the bracket to the base. Do Not lubricate timing belt or sprockets.

(f) GEAR ADJUSTMENT - The gears should have a barely perceptible amount of backlash at their closest point. To adjust,

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position the stud in the motor mounting post; tighten the nut on the stud while holding the stud in position. Apply a light film of grease (use standardized lubricant) to the gears. Replace the gear guard removed in Paragraph 2-4.c.(2) (a).

(g) INSTALLING BASES INTO CABINET (Figure 3-7)

1. Apply light film of "Lubri-plate" grease to the mating rails and channels of the base and cabinet. Slide the base into the mating channels located in the cabinet.

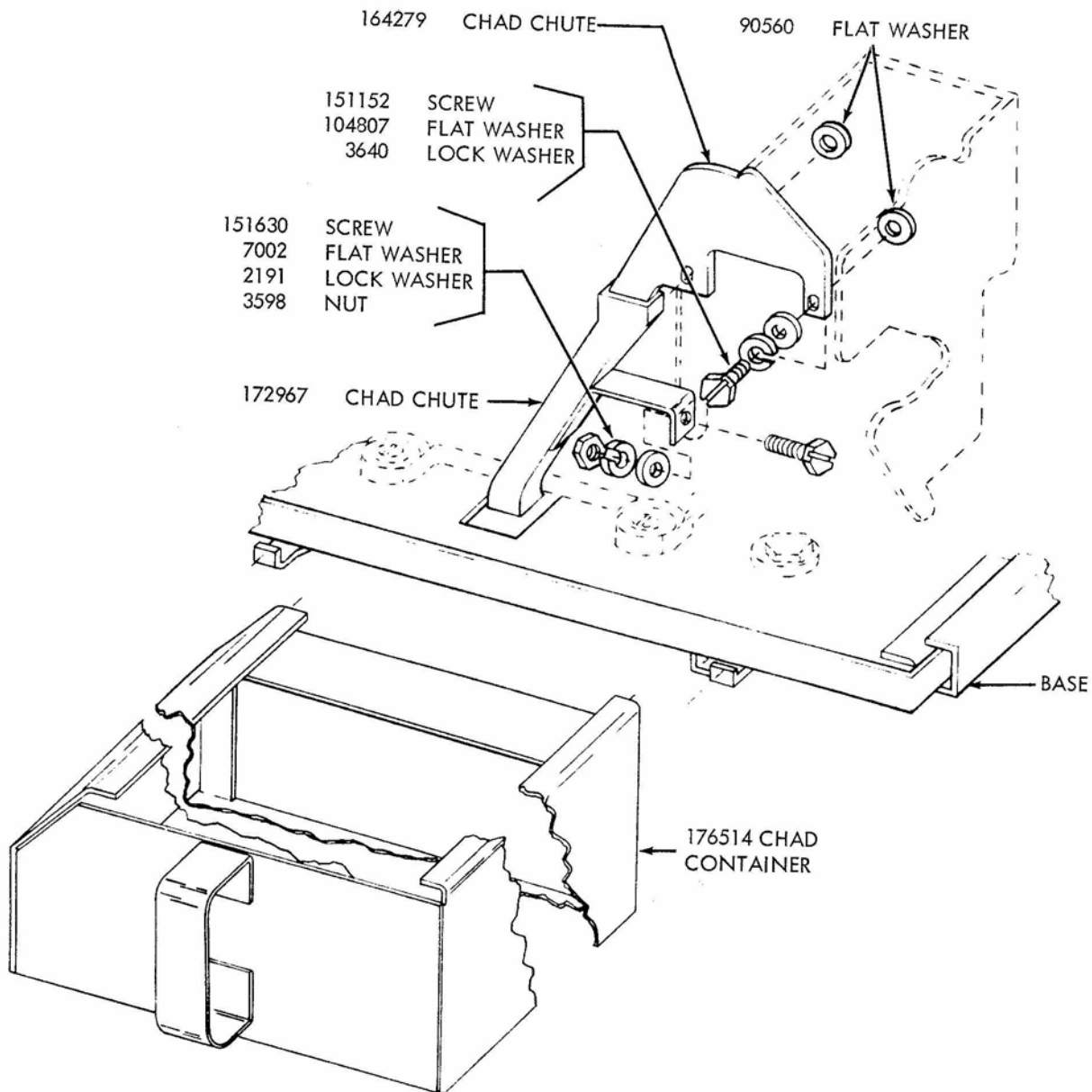


Figure 2-9. Chad Disposal Chutes and Containers

2. Route the cabinet cable to the base along the right side of the right tape container, and then to the left along the rear of each reperforator unit. Plug in the connectors. Secure the cable behind each reperforator unit using the cable clamps found in the bag attached to the cabinet frame and the 151631 screws, 2191 lock washers and 7002 washers furnished with the base. The cable should also be secured to the right tape container. Mount the appropriate size cable clamp under the upper tape guide mounting screw and position it so as to make the

cable rise up and backward from the base. Insert a 7002 washer between the cable clamp and the tape container.

d. TAPE WINDER INSTALLATION

(1) The tape winder is packed in two cartons; one carton contains the winder mechanism, and the other carton contains the three tape reels. Unpack by cutting the sealed edges being careful not to mar the finish. Observe all caution labels and instructions.

(2) When the two tape winders are installed, tape reel positions number 2, 4, and 6 require a 173953 guide w/roller (furnished with the cabinet). Install the guide w/roller under the spring post as shown in Figure 2-10. The lock washer for the spring post should remain on the left side of the tape winder frame. Tighten the nut.

(3) Install the rubber vibration mounts on the tape winders. Place the tape winders on the studs provided on the cabinet frame. Disregard the remaining mounting hardware furnished with the winders.

(4) **TAPE PATH** - Place the reel core into a roll of tape and place both into the tape container so that the tape comes off the top of the roll. Thread the tape through the tape guide and into the tape entry chute on the reperforator unit. Position and/or reform the tape guide as necessary, so that the tape flows freely; tighten the screws. See Figure 3-7 for applicable tape paths between the reperforator units and the tape winders.

#### 2-4. MODEL 28 TYPING REPERFORATOR RECEIVING GROUP

a. **GENERAL** - The Model 28 Typing Reperforator Receiving Group (Figure 1-10) con-

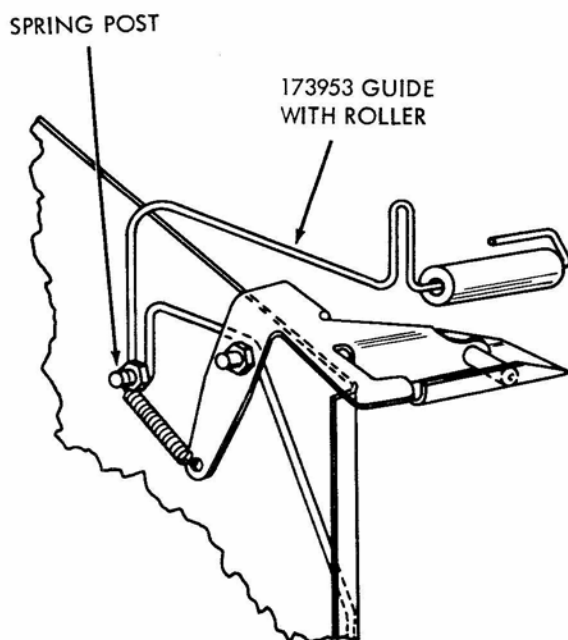


Figure 2-10. Tape Guide

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sists of the following main component assemblies:

(1) One Model 28 Universal Cabinet (Figure 1-36).

(2) Two Model 28 Multiple Typing Reperforator Sets (Figure 1-30).

The cabinet provides the necessary electrical control, wiring, and mounting facilities for operation of the two Multiple Typing Reperforator Sets.

#### b. CABINET INSTALLATION

(1) There are three cardboard cartons and one muslin bag secured to the inner frame of the cabinet. One carton contains the 161731 cover plate, 161752 duct channel, and 161987 duct plate which attach to the cabinet. The second carton contains two tape bins which mount on the front doors. The 176544 Front Enclosure Modification Kit is packaged in the final carton. The bag contains the necessary mounting hardware for "bank" installation of the cabinets.

(2) Remove the cartons and bags from the cabinet and set the cabinet in place according to instructions given in paragraph 2-2.b.(2).

(3) Refer to paragraphs 2-2.b.(2)(a) and (b) for installation of the cover plate, duct parts, and end enclosures.

(4) **FRONT ENCLOSURE INSTALLATION** (Figures 2-11 and 2-12).

(a) Assemble the 176504 right bracket, 176505 left bracket and 176506 strip using the four 98725 screws, 7002 flat washers, 2191 lock washers, and two 176579 nut plates.

(b) Mount this assembly to the multiple typing reperforator base rails using the four 151632 screws, 2191 lock washers, 7002 flat washers, and two 176519 nut plates (see Figure 2-12).

(c) Assemble the 176578 handle to the 176503 front plate with the two 3599 nuts and 110743 lock washers.

(d) Assemble the 176575 right bracket to the 176503 front plate using the two 7002 flat washers, 2191 lock washers, and 3598 nuts.

(e) Mount this assembly on the pivot of the 176504 right bracket, and then assemble the remaining 176576 left bracket to the 176505 left bracket by means of the two 7002 flat washers, 2191 lock washers, and 3598 nuts.

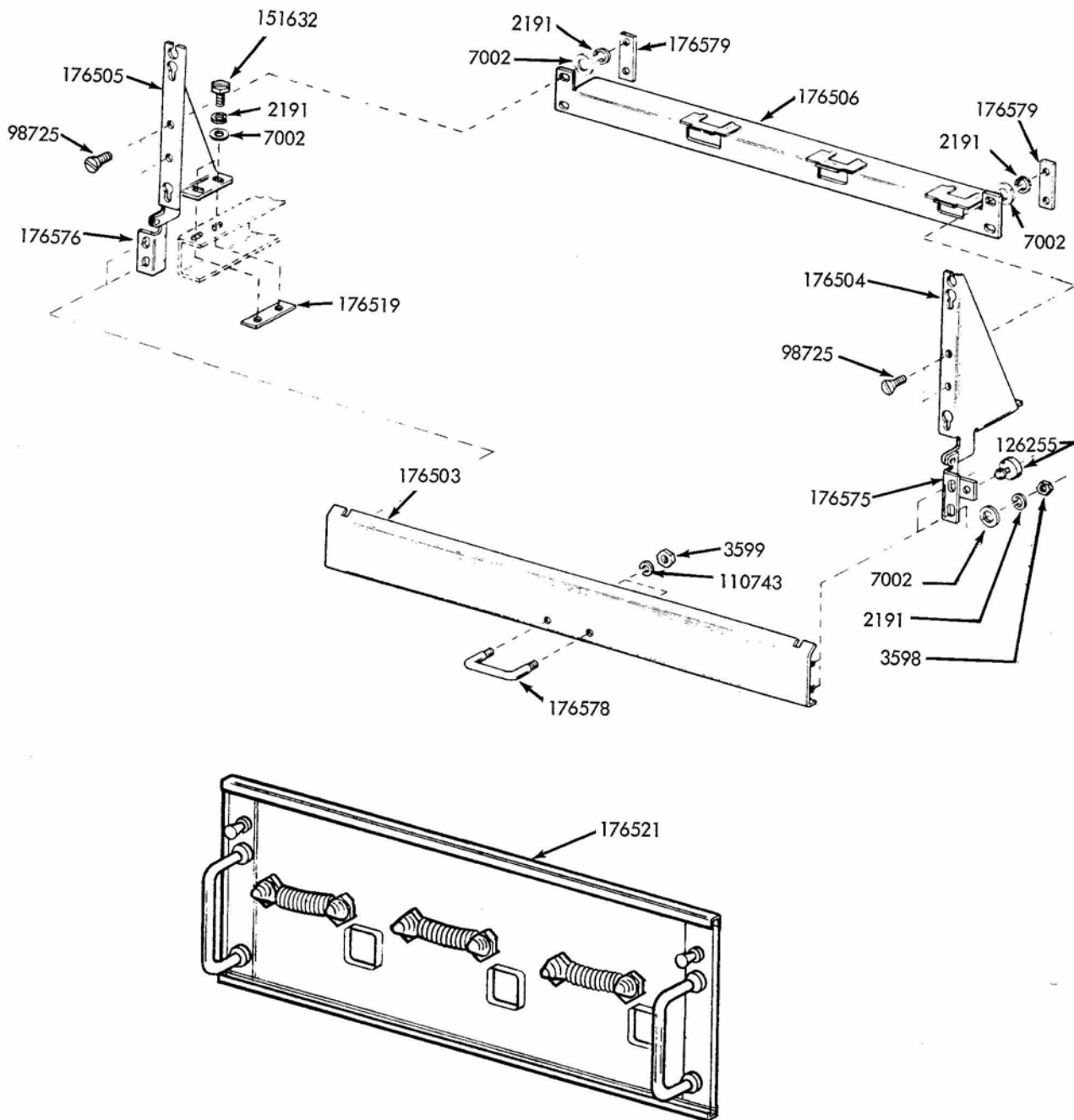


Figure 2-11. Front Enclosure Installation

(f) Mount the 126255 bumper to the 176575 and 176576 brackets.

(g) Install the 176521 panel assembly to the 176504 and 176505 brackets.

(h) Refer to Section 5, Adjustments and Lubrication, for adjustment procedure.

c. MULTIPLE TYPING REPERFORATOR SET INSTALLATION - Refer to Paragraph 2-3. c.

2-5. MODEL 28 MONITOR TRANSMITTER GROUP

a. GENERAL - The Model 28 Monitor

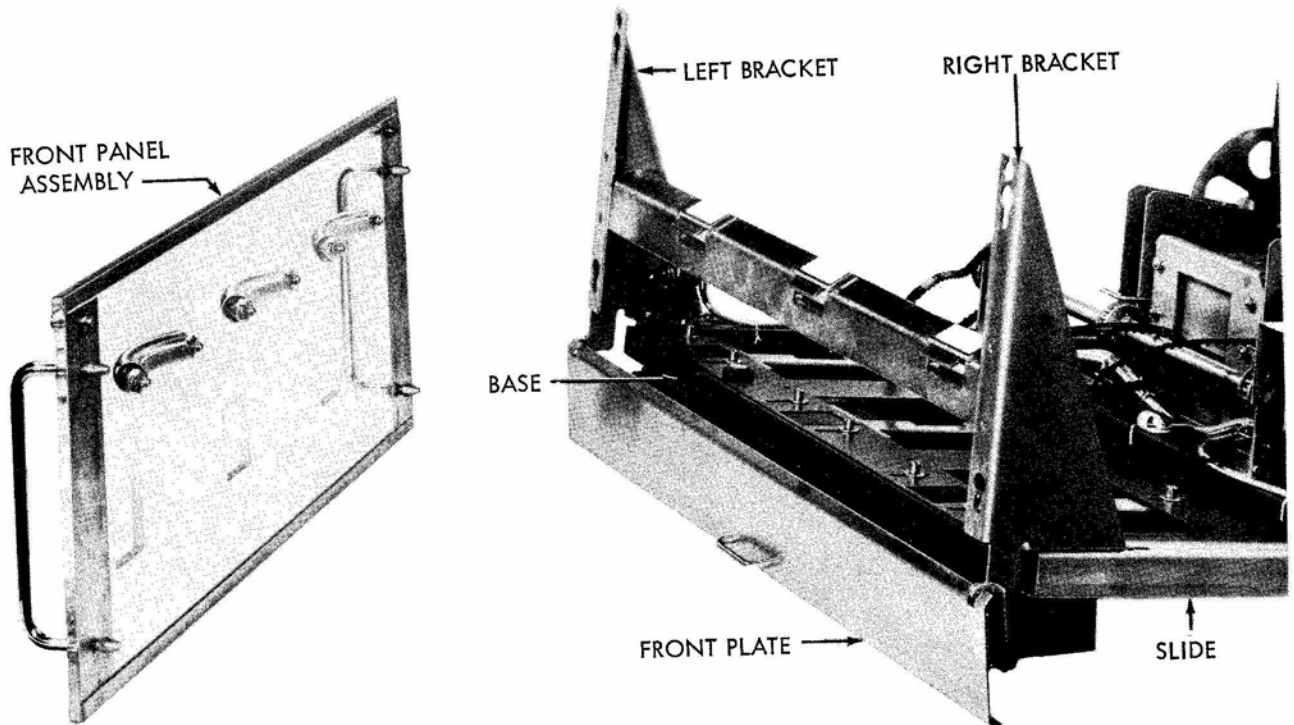


Figure 2-12. Front Enclosure Assembly

Transmitter Group consists of the following main component assemblies:

- (1) One Model 28 Universal Cabinet (Figure 1-37).
- (2) One Model 28 Multiple Typing Reperforator Set (Figure 1-23).
- (3) One Model 28 Multiple Transmitter Distributor Set (Figure 1-13).
- (4) One Model 28 Multiple Tape Winder Set (Figure 1-27).

The cabinet provides the necessary electrical control, wiring and mounting facilities for operation of the above sets.

#### b. CABINET INSTALLATION

(1) There are two cardboard cartons and one muslin bag secured to the inner frame of the cabinet. One carton contains the 161731 cover plate, 161752 duct channel, and 161987 duct plate which attach to the cabinet. The sec-

ond carton contains the tape winder mounting bracket which mounts under the multiple base. The muslin bag contains the mounting hardware for "bank" installation of the cabinets.

(2) Remove the cartons and bags from the cabinet and set the cabinet in place according to instructions given in Paragraph 2-2.b.(2).

(3) Refer to Paragraphs 2-2.b.(2)(a) and (b) for installation of the cover plate, duct parts, and end enclosures.

#### (4) TAPE WINDER MOUNTING BRACKET INSTALLATION (Figure 2-13).

(a) Mount the two 176499 brackets to the left and right slides of the multiple typing reperforator base. One of the brackets mounts on the front two mounting screws of each slide, and the other to the rear two mounting screws of each slide. The welded braces of each bracket face inward.

(b) Mount the four 176263 straps to the 176499 brackets with the eight 151723

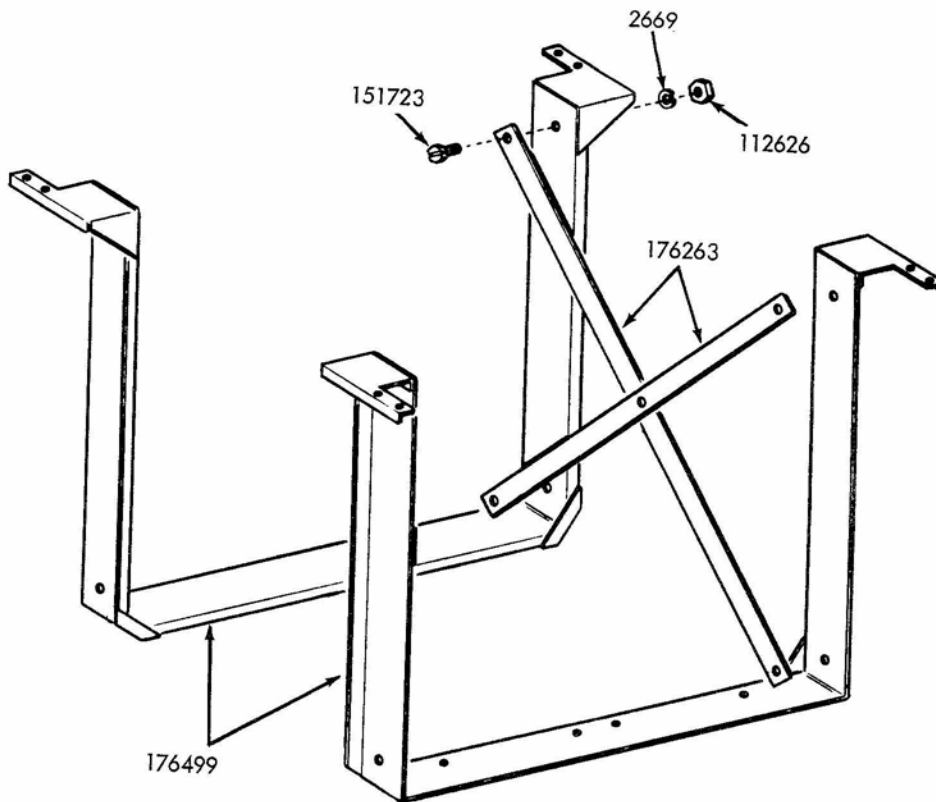


Figure 2-13. Tape Winder Mounting Bracket Installation

screws, 2669 lock washers, and 112626 nuts furnished.

c. MULTIPLE TYPING REPERFORATOR SET INSTALLATION - Refer to Paragraph 2-3. c.

d. MULTIPLE TRANSMITTER DISTRIBUTOR SET INSTALLATION - Refer to Paragraph 2-2. c.

e. TAPE WINDER SET INSTALLATION

(1) The tape winder is packed in two cartons. One carton contains the winder mechanism and the other carton contains the three tape reels. Unpack by cutting the sealed edges being careful not to mar the finish. Observe all caution labels and instructions.

(2) Install the four rubber vibration mounts on the tape winder. Using the furnished 161552 shoulder screws, mount the tape winder to its mounting bracket (Paragraph 2-5. b.(4)). Locate the tape winder as far to the right as possible (See Figure 3-12).

SECTION 3

OPERATOR'S SECTION

3-1. INTRODUCTION

a. GENERAL - The purpose of this section will be to provide the necessary information required to understand and operate the following equipment:

- (1) Model 28 Transmitter Group
- (2) Model 28 Typing Reperforator Monitor Group
- (3) Model 28 Typing Reperforator Receiving Group

- (4) Model 28 Monitor Transmitter Group

The first three groups of equipment make up a basic Model 28 Universal Torn Tape System. The fourth group is an auxiliary unit to the system. All of the above groups of equipment are electromechanical, and are designed to perform a specific function or group of functions as part of an overall system.

b. Model 28 UNIVERSAL TORN TAPE SYSTEM (Figures 1-1, 1-2, and 3-1)

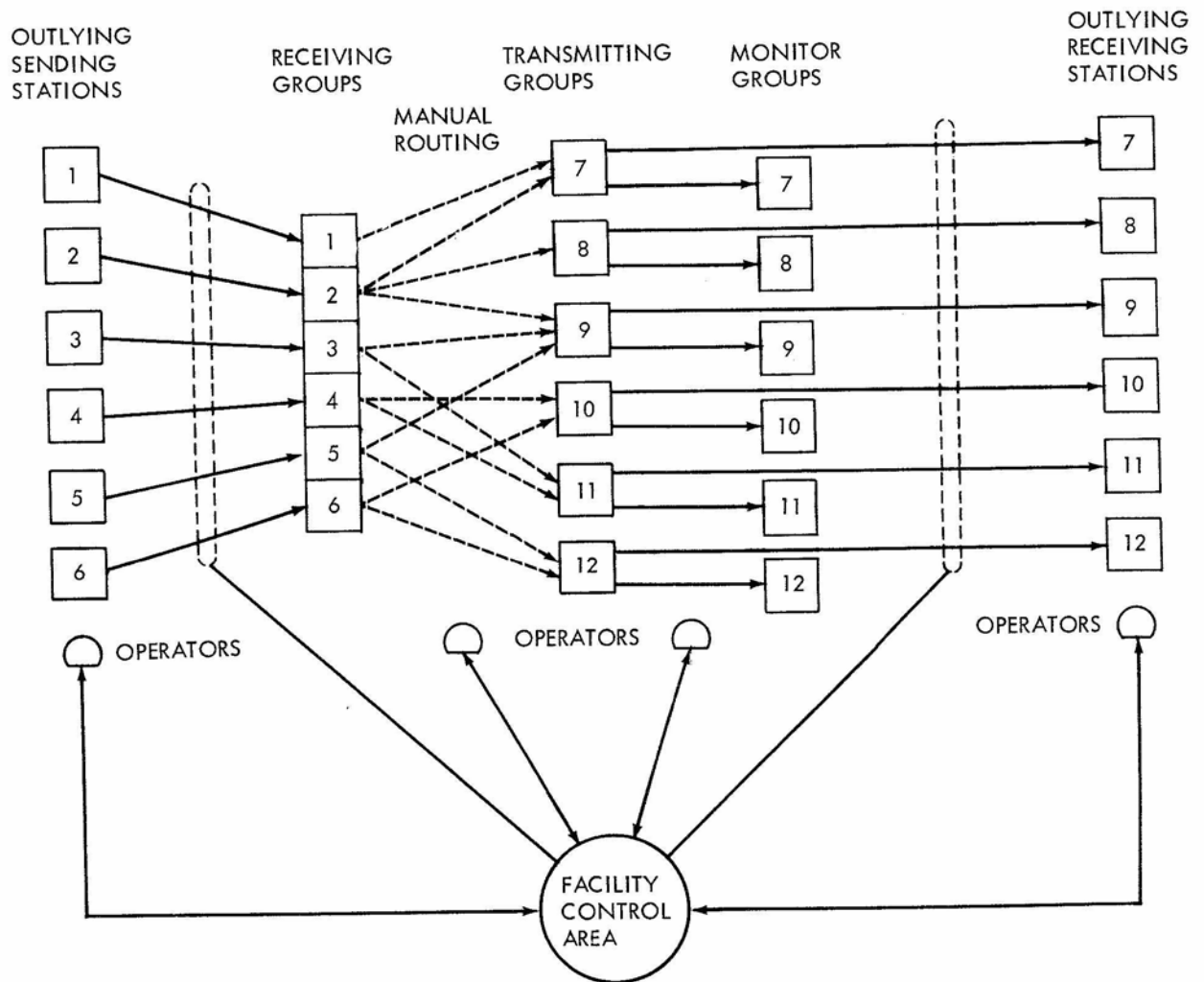


Figure 3-1. Model 28 Universal Torn Tape System Block Diagram

(1) The universal torn tape system is designed to receive messages (in the form of telegraphic baudot code) and convert them into perforated tape. The received message, besides being perforated in the tape, is also typed along the length of the tape.

(2) Received messages are manually routed (according to their address codes) to the proper message tape bin or grid on the transmitting cabinet. The operator(s) at the transmitting cabinet removes the tapes from the grid or bin above the dome and places them in the proper transmitter distributors for transmission to the distant stations. All transmitted messages are automatically numbered and identified (unless deleted by the operator) before transmission. Each transmitting channel has a typing reperforator assigned to it for monitoring purposes.

#### c. REMOTE FACILITIES CONTROL AREA

- The facilities control area is the communications center of the torn tape system. The area is provided by the customer, and may perform a variety of functions. The basic functions of a typical control area would be to receive trouble calls from outlying stations, initiate trouble shooting procedures, control message routing of signal lines, decide message priority transmission, and check transmission lines between stations. Figure 3-1 is a block diagram of a typical torn tape communications system setup.

#### NOTE

There are two important transmission line seizure features available for use by the facilities control area - an emergency seizure condition and an immediate seizure condition.

(1) The emergency seizure feature allows the control area to seize a transmission line during a message transmission, and release the line (when the emergency condition is over) without losing a character of the interrupted message.

(2) The immediate seizure feature allows the control area to seize a transmission line immediately, if the line is idle, or as soon as a numbering sequence has been transmitted by the numbering module in the transmitter cabinet.

(3) Refer to schematic wiring diagram 4361 WD, Volume 2 of this manual, for wiring instructions concerning the above features.

### 3-2. MODEL 28 TRANSMITTING GROUP (Figure 1-8)

a. GENERAL - The Model 28 Transmitting Group consists of two identical multiple transmitter distributor sets (Figure 1-13) and six message identification numbering modules mounted in a common cabinet (Figure 1-8). Each set consists of three transmitter distributors and one motor unit (synchronous or governed) mounted on a common base (Figure 1-18). The transmitter distributor sets are mounted, one above the other, on the cabinet shelves below the numbering modules. The cabinet provides the necessary electrical control apparatus for operation of the equipment and, in addition, also provides collection and storage facilities for tape transmitted - or to be transmitted - by the equipment.

#### b. OPERATING PROCEDURE

(1) CONTROLS AND ALARMS - Operating controls and alarm lamps are located at convenient positions on the transmitting cabinet to facilitate operation of the group. Refer to Table 3-1 for a listing of the operating controls and alarm lamps, and to Figure 3-2 for their locations.

(2) LOADING TRANSMITTERS WITH TAPE - All transmitter distributors are loaded in the same manner (Figure 3-3). Place the run-stop switch to the STOP position. Depress the red tape lid release button to raise the tape lid. Place the tape feed perforations on the teeth of the feed wheel with the first code to be transmitted directly over the sensing pins. When placed in the transmitter, the printed characters should be up, and three code holes should be to the left of the feed wheel. Hold the tape flat, and close the tape lid. If it is desired to utilize the tape deflector, make sure it is down before the tape is loaded and the tape lid is closed.

#### NOTE

When operating with one transmitter distributor per channel (single channel operation), tape may be loaded into the units when the run-stop lever is placed in the free wheeling position. With the lever in the FREE position, the start circuit is open. The lever mechanically disengages the tape feed mechanism and permits "free-wheeling" action in positioning or feeding tape into the reading head without raising the tape lid.

#### (3) STARTING OPERATION

(a) Place the main ON-OFF power switch to the ON position. The switch is accessible when the rear doors are opened, or by raising the dome and swinging the control relay rack to the horizontal position.



Table 3-1. Transmitting Group Operating Controls and Alarms

Item	Control or Alarm	Purpose	Remarks
①	Identification Card Holder	Provides mounting facilities for an identification card.	Provides means for transmitter channel identification.
②	Numbering Module	Provides visual indication of message number.	Number in view is same as number transmitted.
③	OPEN LINE alarm lamp (WHITE)	Informs the operator of trouble in the signal line circuit.	Controlled by operation of the open line time delay relay in the monitor cabinet.
④	ABNORMAL TRAFFIC alarm lamp (AMBER)	Indicates seizure of a transmission channel from a remote location.	Line may be seized from either the monitor cabinet or the facility control area.
⑤	NO-DELETE switch	Allows deletion of identification sequence from transmission.	Operated to "delete" position (down) only when both transmitters are in "idle" condition. Will prevent normal transmission if left in "delete" position.
6	Main ON-OFF power switch (not shown on Figure 3-2)	Supplies 115 volt AC power to all transmitting group circuits.	Located on electrical control rack panel. Accessible from rear of cabinet, or when dome is raised and rack is rotated to a horizontal position.
7	Base ON-OFF power switch (not shown on Figure 3-2)	Supplies 115 volt AC power to multiple transmitter distributor set motor unit.	Two switches, one mounted on each base and located at the right front corner of the base. Accessible when the base front door is opened.

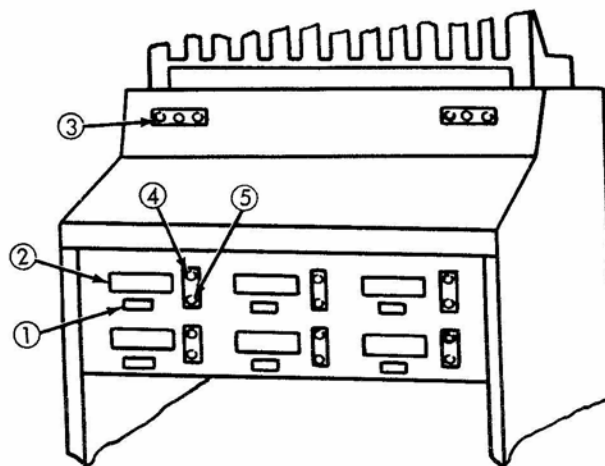


Figure 3-2. Location of Transmitter Group Controls and Alarms

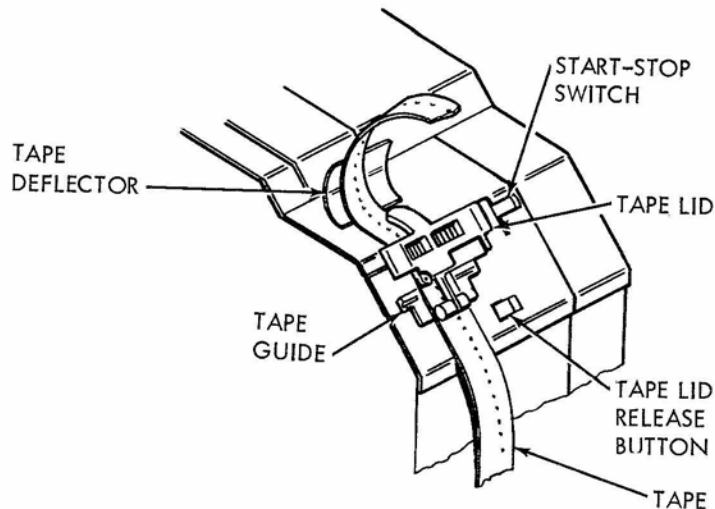


Figure 3-3. Path of Tape in Transmitter Distributor

(b) Place the base ON-OFF power switches to the ON position. The switches are located at the right front corner of the bases behind the hinged door.

(c) First load an upper transmitter distributor with tape, and place it in the RUN position. A lower transmitter distributor may then be loaded with tape and also placed in the RUN position. Messages will be transmitted in tandem fashion (assuming the control circuit is wired for tandem operation - see paragraph 4-3.f.) as long as tapes are loaded into the transmitters and power is supplied to the control circuit.

#### (4) CONTROL CIRCUIT - SUMMARY OF OPERATION

##### NOTE

In the following discussion the terms UPPER - TD and LOWER - TD will be used to distinguish between those transmitter distributor (TD) units mounted on the upper shelf, and those mounted on the lower shelf.

(a) The message identification control circuit and transmitter magnets are all de-energized when in an idle or stop position. When an operator loads a tape to be transmitted in an UPPER - TD unit and places it in RUN position, a relay type "flip-flop" control circuit is completed. The control circuit will then advance the message numbering mechanism one unit, and set up the system for "normal transmission" operation (message identification switch must be in NO DELETE position).

(b) The control circuit will then proceed to automatically transmit a fifteen character identification sequence -- (LTR) ZCZCAB CDE (FIG) 000 (LTR) -- for the message to be transmitted. After transmission of the identifying sequence, the UPPER-TD is allowed to read and transmit its message.

(c) The UPPER-TD and LOWER-TD are wired in series on the same signal line. If loaded with tape, the LOWER-TD will transmit its message tape after the associated UPPER-TD completes its transmission. Before actual transmission of the LOWER-TD message tape, a new fifteen character identifying sequence will be transmitted (the code is exactly the same as the previous sequence, except that the number portion of the sequence is increased by one unit).

(d) While the LOWER-TD is transmitting its message, the UPPER-TD may again be loaded with a message tape for transmission upon completion of the LOWER-TD transmission. Before transmission of the new message, the control circuit, again, automatically transmits another identification sequence and will allow the UPPER-TD to read and transmit its message. This tandem type operation will continue until interrupted (1) by the operator or (2) by a "line seized" condition.

(e) To operate the message identification deletion feature, both the UPPER and LOWER transmitters should be in an idle condition (i.e. no tape installed). Operating the deletion switch, located on the control panel below the ABNORMAL TRAFFIC lamp, to the down or

"delete" position conditions the control circuit to omit transmission of the normal identification sequence when a tape is inserted in a transmitter distributor. As soon as the tape begins to move, the switch should be returned to the NO DELETE (up) position in order to return the control circuit to a normal transmission condition.

(5) STOPPING OPERATION - To stop operation of the equipment, place the start-stop switches on the transmitter distributors in the STOP position. The transmitting group is now in "idle" condition, the control circuit being supplied with power. Operating the main ON-OFF power switch to the OFF position disconnects 115 volt AC from all power supply circuits and places the equipment in a stop condition.

### 3-3. MODEL 28 TYPING REPERFORATOR MONITOR GROUP (Figure 1-9)

a. GENERAL - The Model 28 Typing Reperforator Monitor Group consists of two multiple typing reperforator sets and two multiple tape winder sets mounted in a common cabinet. The cabinet, besides providing mounting facilities for the above equipment, also houses the necessary electrical control apparatus for its operation (Figure 3-4). Each multiple reperforator set is composed of three typing reperforators (chadless or fully perforated) and a motor unit (synchronous or governed), mounted on a common base. The two reperforator sets are located, one above and one below the tape winders, on the cabinet's UPPER SHELF and LOWER SHELF. The reperforator sets mount on sliding rails, and may be pulled forward for maintenance or servicing. Tape supply facilities and chad disposal facilities (fully perforated units only) are provided for each typing reperforator (Figure 1-23).

#### b. OPERATING PROCEDURE

(1) CONTROLS AND ALARMS - Operating controls and alarms are located at convenient positions on the monitor cabinet control panel. Refer to Table 3-2 for a listing of the operating controls and alarm lamps, and to Figure 3-5 for their locations.

#### (2) TAPE AND RIBBON ROUTING

##### (a) TAPE ROUTING

1. Tape routing for the UPPER and LOWER SHELF reperforator sets is basically the same. Tape feeds forward from off the top of a tape supply roll and through the tape guide fastened to the side of the supply reel container (Figure 1-26). From the tape guide the tape is fed into the tape chute of the reperforator,

through the tape feed mechanism, and through the block (Figure 3-6).

2. From the punch block the tape is fed down (UPPER SHELF reperforators) to the left and through a tape winder tape arm (Figure 3-7). The end of the tape is threaded about six inches through any one post on the center of the tape winder reel and wound two or more turns to secure it. The tape is then brought under the post and up between the back-stop and chad depressor (Figure 1-27).

3. The only variation for routing tape on the LOWER reperforators is that after passing through the punch block, the tape is directed up to the right and over a tape guide roller attached to a tape winder supporting frame (see Figures 2-10 and 3-7).

(b) RIBBON ROUTING - For routing of ribbon on the typing reperforator, refer to Figure 3-8. Open the ribbon spool toggles. Thread a new ribbon on an empty spool, and insert the spools on the shafts. The full spool should be on the front shaft (left shaft in Figure 3-8).

(3) CHAD DISPOSAL (FULLY PERFORATED TAPE TYPING REPERFORATORS ONLY). Each reperforator unit is supplied with disposal facilities for chad. When a fresh roll of tape is placed into the tape supply container for a reperforator, the chad container associated with the reperforator should be emptied.

#### CAUTION

Failure to empty the chad container can result in equipment failure due to chad backing up in the chad chutes and fouling the punch mechanism.

#### (4) STARTING OPERATION

(a) Place the main ON-OFF power switch to the ON position. The switch is accessible when the rear cabinet doors are opened, or by raising the dome and rotating the control rack to its horizontal position.

(b) Place the multiple reperforator set ON-OFF power switches to the ON position. The switches are located at the left corner of the bases, and are accessible when the front doors are opened.

(c) Place the TAPE WINDER switches to their ON position.

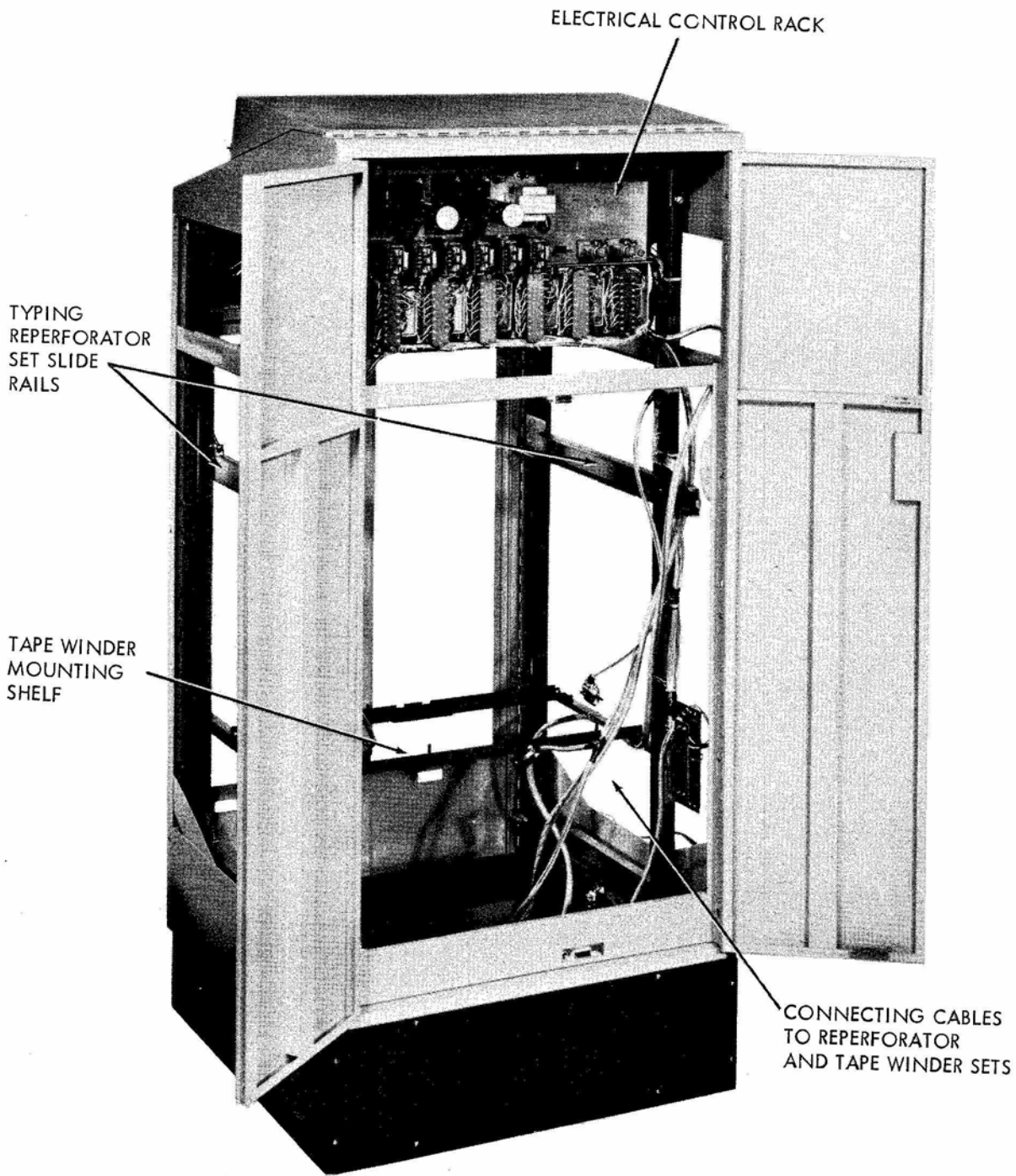


Figure 3-4. Monitor Cabinet (Rear View)

Table 3-2. Monitor Group Operating Controls and Alarms

Item	Control or Alarm	Purpose	Remarks
①	Identification Card Holders	Provide mounting facilities for an identification card.	Provides means for signal channel identification.
②	115 volt AC power receptacle	Provides 115 volt AC power for operation of Rerun Cart Group.	Refer to paragraph 1-7.
③	LOW TAPE alarm lamp (RED)	Indicates a low tape condition on one of the typing reperforator supply reels.	The exact unit running out of tape is identified by the red colored tape coming out of the reperforator.
④	ABNORMAL TRAFFIC rerun jacks	To make a signal line available to Rerun Cart Group.	For transmission of ABNORMAL TRAFFIC. See Table 3-1.
⑤	NUMBER-NO NUMBER switches	Provides a means of numbering messages sent from Rerun Cart Group.	Controls the numbering module in the transmitting cabinet, and allows seizure of a transmitting channel.
⑥	REMOTE SEIZURE alarm lamp (AMBER)	Informs operator of a remote seizure.	Initiated from the Facility Control Area.
⑦	OPEN LINE alarm lamp (WHITE)	Informs operator of trouble in the signal line circuit.	Controlled by operation of the open line time delay relay in the cabinet.
⑧	LOCAL SEIZURE alarm lamp (GREEN)	Informs operator when local seizure of transmitting line has been accomplished.	Operates in conjunction with NUMBER-NO NUMBER switch, Item 5.
⑨	TAPE WINDER switch	To supply 115 volt AC to the tape winder motors.	Switch on UPPER SHELF section controls left tape winder set, while that on LOWER SHELF section controls the right set.
⑩	WINDER FULL alarm lamp (RED)	Indicates full condition of one of the tape winder reels.	Specific reel becoming full is determined by a visual inspection of the reels.
⑪	115 volt DC power receptacle	Provides 115 volt DC power to operate clutch circuits on the Rerun Cart Group.	To be used with a suitable dropping resistor.
12	Base ON-OFF power switch (not shown on Figure 3-5)	Supplies 115 volt AC power to multiple typing reperforator set motor units.	Two switches, one mounted on each base and located at the left front corner of the base. Accessible when the front doors are opened.
13	Main ON-OFF power switch (not shown on Figure 3-5)	Supplies 115 volt AC power to all monitor group circuits.	Located on the electrical control rack panel. Accessible from rear of cabinet, or when dome is raised and rack rotated to a horizontal position.

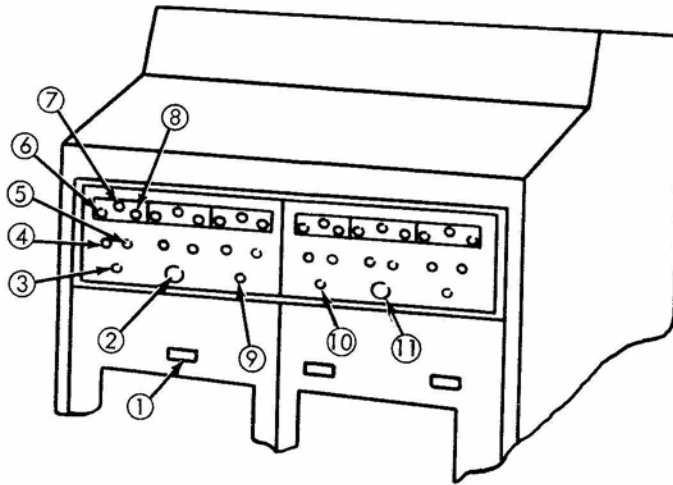


Figure 3-5. Location of Monitor Group Controls and Alarms

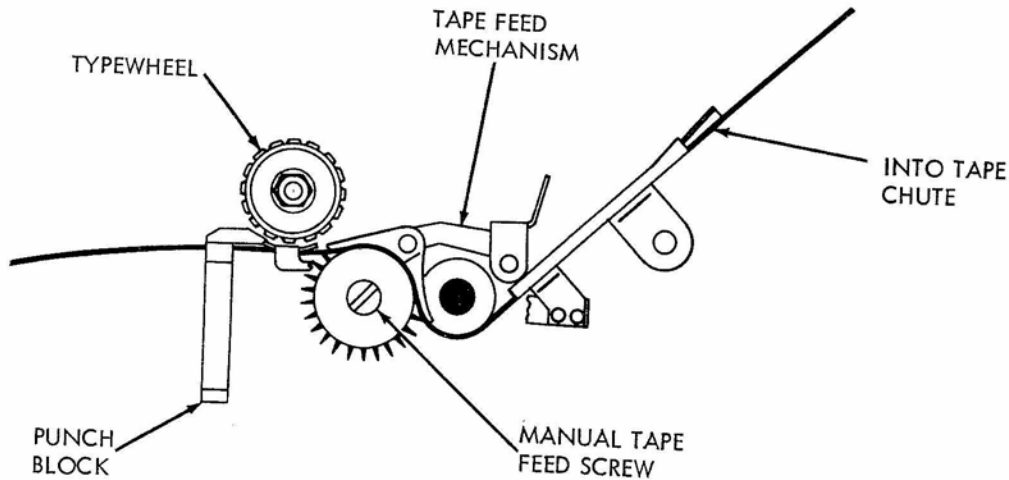


Figure 3-6. Path of Tape in Typing Reperforator

(5) ABNORMAL TRAFFIC OPERATION

(a) The monitor cabinet provides facilities for transmitting message tapes with the option of assigning a new message identification code to the message. This feature is provided so that the monitor operator may transmit from the monitor location any messages which were lost by the outlying stations but not by the monitor station.

(b) When the monitor operator is notified that a message (number 162 for example) has not been received, he brings a Rerun Cart

Group (See Figure 1-7) to the cabinet position. The operator then inserts the DC clutch magnet battery plug, the AC power plug, and the transmitting plug into their respective receptacles on the control panel (refer to Table 3-2 and Figure 3-5). Placing the tape reel which contains message number 162 on the unwinder stud, the operator unwinds the tape until he locates message 162. The message is removed from the reel, and the start of the message tape is inserted in the reading head of the transmitter distributor. The operator then places the line seizure NUMBER-NO NUMBER switch to the NUMBER position. This conditions the control circuit in the transmitting cabinet to stop transmission of

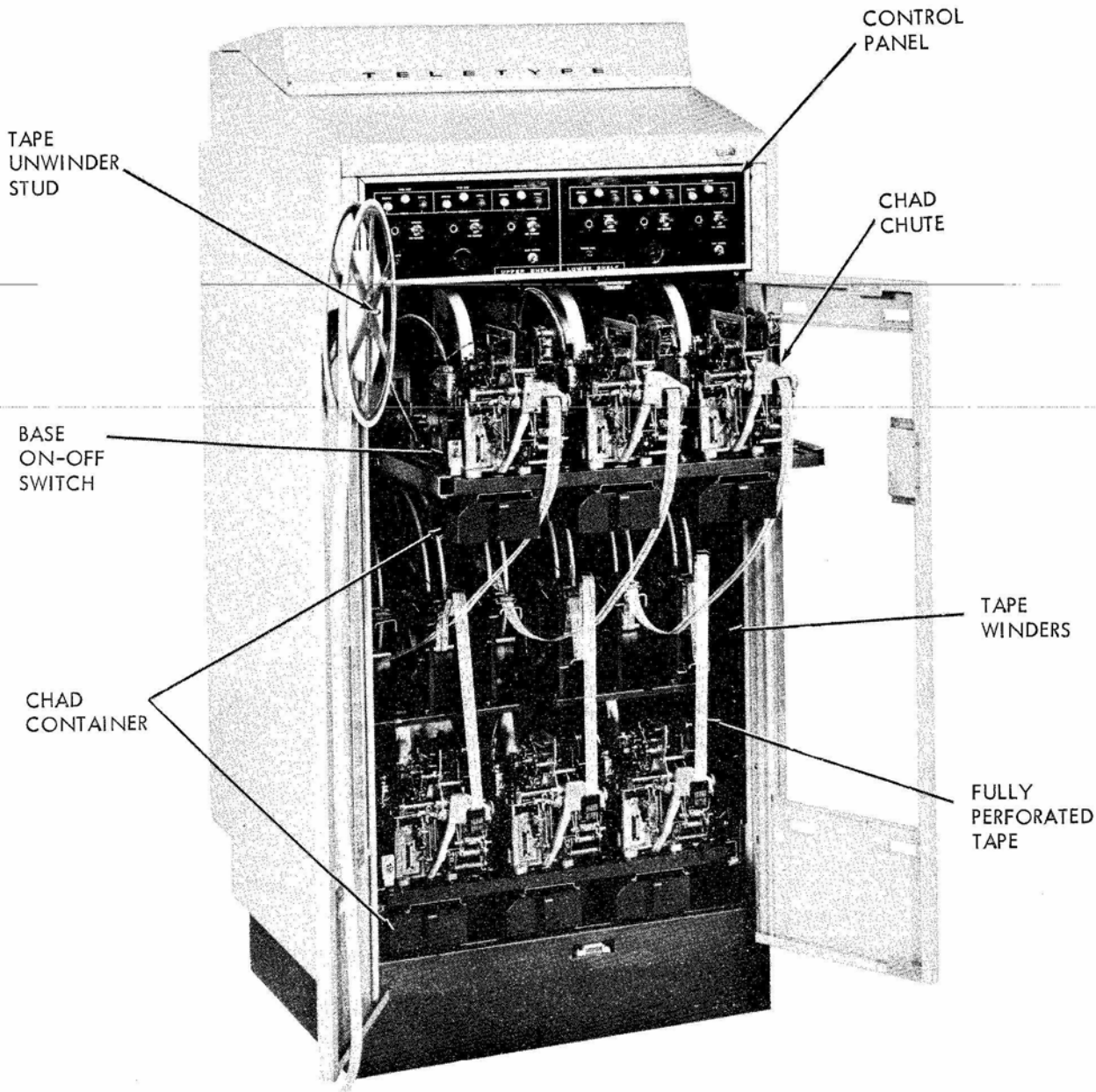


Figure 3-7. Model 28 Monitor Group (Typing Reperforators, With Fully Perforated Tape Output)

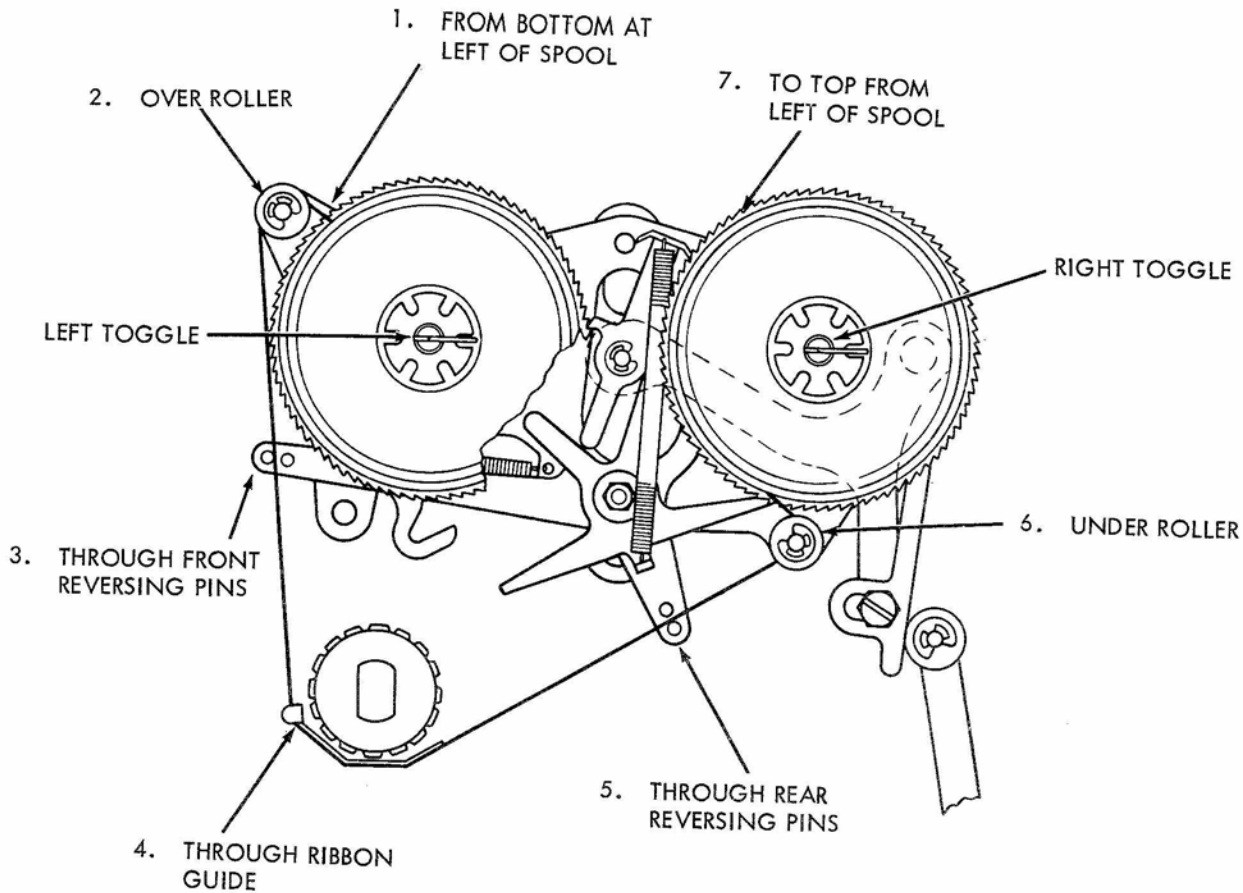


Figure 3-8. Path of Ribbon in Typing Reperforators

messages from the transmitter distributor - at that location - upon completion of any message which may already be in the process of transmission. When seizure is accomplished, a new identification number will be transmitted (for message 162) from the transmitting cabinet and the green LOCAL SEIZURE lamp at the monitor cabinet will light. The amber ABNORMAL TRAFFIC lamp, at the transmitter cabinet, will also light to notify the transmitter operator that a transmitting channel has been seized from a remote location.

(c) When the green LOCAL SEIZURE lamp lights, the monitor operator may place the run-stop lever on the rerun group transmitter to the RUN position. Upon completion of message transmission, the operator resets the NUMBER-NO NUMBER switch to its mid position, removes all connecting plugs from the rerun group, splices the message tape back onto the reel, rewinds the monitor tape, and finally replaces the tape reel. When the NUMBER-NO NUMBER switch is returned to the mid po-

sition, the line seizure circuit is broken, the alarm lamps extinguish, and the transmitting channel is released for normal operation.

(d) In addition to the above local seizure option, an amber REMOTE SEIZURE lamp is provided to inform the monitor operator of a line seizure from the Facility Control Area.

(6) LOW TAPE - FULL WINDER CONDITIONS - If a low tape supply or full winder condition occurs (red warning lamps on the control panel will light), two methods may be used to correct either condition.

(a) The first method would be to operate the NUMBER-NO NUMBER switch to the NO NUMBER position. This will cause a line seizure to occur at the transmitting cabinet as explained in paragraph (5) (b) above, except that no identification sequence will be transmitted. When the green LOCAL SEIZURE lamp lights, the operator may then proceed to correct the indicated condition.



**NOTE**

When using this method, the monitor operator must be sure that ample tape is available for reception of the last message being transmitted at the transmitting station before line seizure occurs.

(b) The second method which may be used, is for the monitor operator to contact the transmitting operator and request him to place the associated transmitter run-stop lever to the STOP position. The monitor operator may then correct the indicated condition.

(7) STOPPING OPERATION - To stop operation, return the ON-OFF power switches to their OFF position.

### 3-4. MODEL 28 TYPING REPERFORATOR RECEIVING GROUP (Figure 1-10)

a. GENERAL - The Model 28 Typing Reperforator Receiving Group consists of two multiple typing reperforator sets mounted in a common cabinet. The cabinet, besides providing mounting facilities for the above equipment, also houses the necessary electrical control apparatus for its operation (Figure 4-19). Each multiple reperforator set is composed of three typing reperforators (chadless or fully perforated) and a motor unit (synchronous or governed), mounted on a common base. The reperforator sets are located, one above the other, on the cabinet's UPPER SHELF and LOWER SHELF. Each set mounts in a drawer assembly, and may be pulled forward by the operator for tape and ribbon changing. Tape supply facilities and chad disposal facilities (fully perforated units only) are provided for each typing reperforator (Figure 1-23).

#### b. OPERATING PROCEDURE

(1) CONTROLS AND ALARMS - Operating controls and alarms are located at convenient positions on the monitor cabinet control panel. Refer to Table 3-3 for a listing of the operating controls and alarm lamps, and to Figure 3-9 for their locations.

#### (2) TAPE AND RIBBON ROUTING

(a) TAPE ROUTING - Tape routing for these reperforator sets is essentially the same as that of the monitor group (paragraph 3-3.b.(2)(a)). After coming through the punch block, the tape is directed through the appropriate slot in the drawer front (see Figure 1-10 and 2-11).

(b) RIBBON ROUTING - Ribbon routing for these reperforators is identical to that for the reperforators used in the monitor group. Refer to paragraph 3-3.b.(2)(b).

(3) CHAD DISPOSAL (FULLY PERFORATED TAPE TYPING REPERFORATORS ONLY) - Refer to paragraph 3-3.b.(3).

#### (4) STARTING OPERATION

(a) Place the main ON-OFF power switch to the ON position. The switch is accessible when the rear cabinet doors are opened, or by raising the dome and rotating the control rack to its horizontal position.

(b) Place the multiple reperforator set ON-OFF power switches to the ON position. The switches are located at the left corner of the bases, and are accessible when the front doors are opened.

(5) MESSAGE RECEPTION - The receiving operator tears the message tape from the reperforators, and records the number of the message and/or the time the message was received. The torn tape is then inserted on the tape holders assigned to the respective receiving reperforator (Figure 4-41). When a sufficient quantity of message tapes have accumulated, the operator removes all the tapes and distributes them (according to their address codes) into the ready to transmit tape grids or "figure 8" bins on the transmitting cabinets (refer to Figure 3-1).

#### (6) LOW TAPE CONDITION

(a) The red LOW TAPE lamp in the center of the control panel warns the receiving operator of a low tape condition on one of the reperforators. The operator can determine the exact unit running low by the red colored tape emerging from the reperforator. To enable the operator to change the tape supply without losing any incoming messages, spare reperforator jacks and reperforator marking battery switches are provided on the control panel (Table 3-3 and Figure 3-9).

(b) To change tape, the operator brings a spare reperforator to the receiving cabinet, and plugs the units AC power connector into the mating receptacle on the control panel. The operator then inserts the signal line plug into the proper jack on the control panel, and the spare reperforator will monitor the receiving reperforator. After assuring overlap of the signals, the operator places the REPERF MARKING switch into its up position. This shunts the signals to the receiving reperforator, and causes

Table 3-3. Receiving Group Operating Controls and Alarms

Item	Control or Alarm	Purpose	Remarks
①	115 volt AC power receptacle	Provides 115 volt AC power for operation of a spare reperforator.	Refer to paragraph 1-8.
②	TAPE FEED OUT button	Initiates remote controlled "letters" tape feed-out mechanism on the typing reperforators.	Feeds out a predetermined length of tape at the end of a message (when depressed) perforated with the "letters" code combination.
③	Spare reperforator jack	To provide a quick means of inserting a spare reperforator into the signal line.	Used when changing tape or ribbon, or replacing the reperforator in the set.
④	REMOTE SEIZURE alarm lamp (AMBER)	Inform operator of a remote seizure.	Initiated from the Facility Control Area.
⑤	OPEN LINE alarm lamp (WHITE)	Informs operator of trouble in a signal line circuit.	Controlled by operation of the open line time delay relay in the cabinet.
⑥	REPERF MARKING switch	Shunts signals to the cabinet reperforator.	Causes reperforator to come to the stop position for servicing purposes.
⑦	LOW TAPE alarm lamp (RED)	Indicates a low tape condition on one of the typing reperforator supply reels.	The exact unit running out of tape is identified by the red colored tape coming out of the reperforator.
8	Base ON-OFF power switch (not shown on Figure 3-9)	Supplies 115 volt AC to multiple typing reperforator set motor units.	Two switches, one mounted on each base and located at the left front corner of the base. Accessible when the drawers are opened, or the drawer front panel assembly is removed.
9	Main ON-OFF power switch (not shown on Figure 3-9)	Supplies 115 volt AC to all Receiving Group circuits.	Located on the electrical control rack panel. Accessible via rear doors, or when dome is raised and rack is swung to a horizontal position.

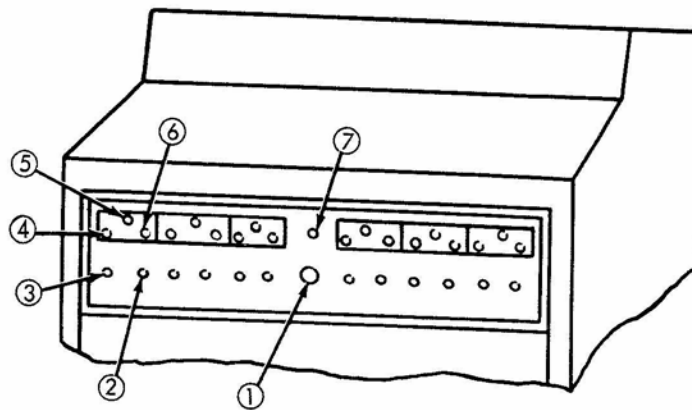


Figure 3-9. Location of Receiving Group Controls and Alarms

the reperforator to come to a stop. The operator may then replenish the reperforator tape supply, and place the unit back on the line. The message tape received by the two reperforators during the above change-over operation may be spliced together (if necessary) with any standard tape splicer.

(7) STOPPING OPERATION - To stop operation, return the ON-OFF power switches to their OFF position.

### 3-5. MODEL 28 MONITOR TRANSMITTER (PULL-BACK) GROUP (Figure 1-11)

#### a. GENERAL

(1) The Model 28 Monitor Transmitter Group consists of one multiple transmitter distributor set, one multiple typing reperforator set, and one multiple tape winder set. The cabinet, besides providing mounting facilities for the above equipment, also houses the necessary electrical control apparatus for its operation (Figure 3-11).

(2) The multiple transmitter distributor set consists of three transmitter distributors and a motor unit mounted on a common base (Figure 1-18). The set mounts on the cabinet shelf below the front control panel.

(3) The multiple typing reperforator set consists of three typing reperforators (fully perforated or chadless units) and a motor unit mounted on a common base (Figure 1-23). The set mounts on a sliding rail assembly below the multiple transmitter distributor set, and may be pulled forward for maintenance or servicing. Tape supply facilities and chad disposal faci-

ties (fully perforated units only) are provided for each typing reperforator.

(4) The multiple tape winder set consists of three tape reels, a motor unit, a drive mechanism, and a clutch mechanism mounted on a common frame assembly (Figures 1-27 and 1-28). The set is mounted on a bracket assembly attached to the bottom of the multiple typing reperforator set, and pulls forward with that unit (Figure 3-12).

#### b. OPERATING PROCEDURE

(1) CONTROLS AND ALARMS - Operating controls and alarms are located at convenient positions on the monitor-transmitter cabinet control panel. Refer to Table 3-4 for a listing of the operating controls and alarms, and to Figure 3-10 for their locations.

#### (2) TAPE AND RIBBON ROUTING

(a) TAPE ROUTING - Tape routing for the reperforators is essentially the same as that of the monitor group UPPER SHELF reperforators. Refer to paragraph 3-3.b.(2)(a)1 and 2, and Figure 3-12.

(b) RIBBON ROUTING - Ribbon routing for the reperforators is identical to that for the reperforators used in the monitor group. Refer to paragraph 3-3.b.(2)(b).

(3) LOADING TRANSMITTERS WITH TAPE - Refer to paragraph 3-2.b.(2) for loading instructions.

(4) CHAD DISPOSAL (FULLY PERFORATED TYPING REPERFORATORS ONLY) - Refer to paragraph 3-3.b.(3).

Table 3-4. Monitor-Transmitter Group Operating Controls and Alarms

Item	Control or Alarm	Purpose	Remarks
①	WINDER FULL alarm lamp (RED)	Indicates full condition of one of the tape winder reels.	Specific reel becoming full is determined by a visual inspection of the reels.
②	TAPE WINDER switch	To supply 115 volt AC to the tape winder motor.	
③	TAPE OUT alarm lamp (RED)	Indicates a low tape condition on one of the typing reperforator supply reels.	The exact unit running out of tape is identified by the red colored tape coming out of the reperforator.
4	Base ON-OFF power switch (not shown on Figure 3-10)	Supplies 115 volt AC power to the multiple typing reperforator set.	Located at the left front corner of the base, and accessible when front doors are opened.
5	Base ON-OFF power switch (not shown on Figure 3-10)	Supplies 115 volt AC power to the multiple transmitter distributor set.	Located at the right front corner of the base, and accessible when the base front door is opened.
6	Main ON-OFF power switch (not shown on Figure 3-10)	Supplies 115 volt AC power to all Monitor Transmitter Group circuits.	Located on the electrical control rack panel. Accessible via rear doors, or when dome is raised and rack is swung to a horizontal position.

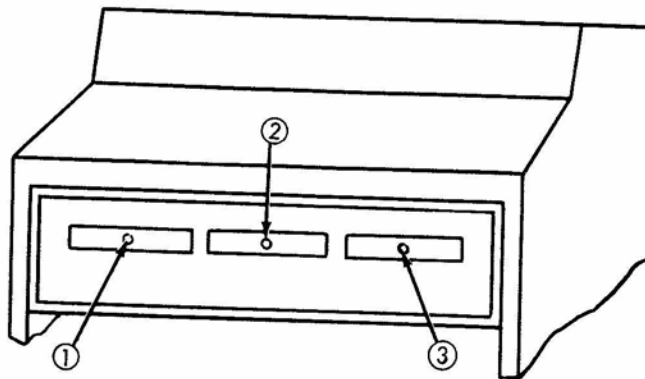


Figure 3-10. Location of Monitor - Transmitter Group Controls and Alarms

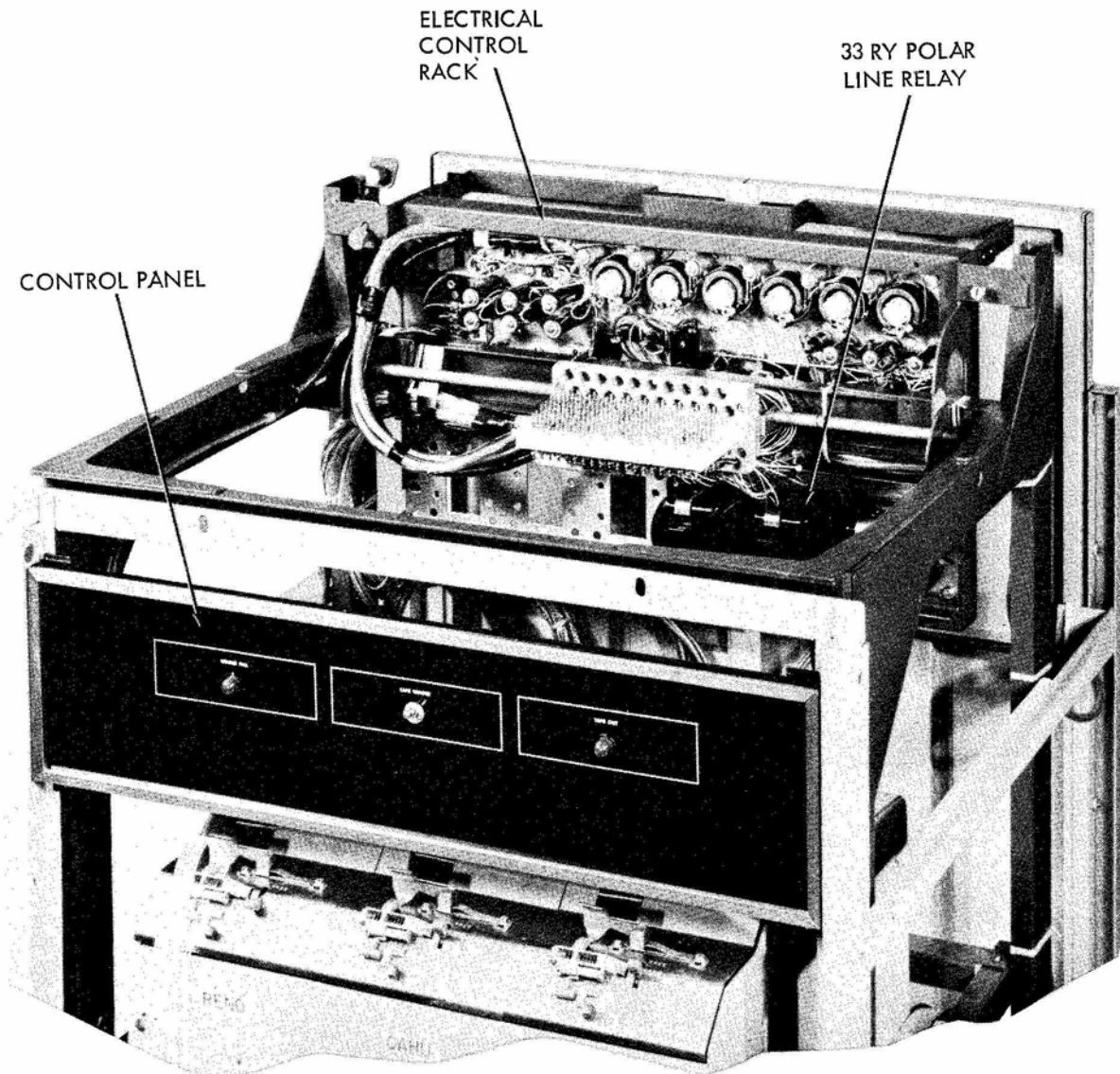


Figure 3-11. Monitor - Transmitter Cabinet (Dome Removed)

(5) STARTING OPERATION

(a) Place the main ON-OFF power switch to the ON position. The switch is accessible when the rear doors are opened, or by raising the dome and rotating the control rack to its horizontal position.

(b) Place the multiple typing reperforator set and transmitter distributor set ON-OFF power switch to the ON position. The switches are located respectively on the left and right front corner of the bases. Place the TAPE WINDER switch in its on position.

(6) MESSAGE RERUN - To rerun a

message from the monitor-transmitter group, the operator removes the tape reel containing the message from the tape winder and places it on the unwinding stud located inside the left front door. After locating the message to be rerun, the operator loads the message tape into the proper transmitter distributor and sends the message. When transmission is completed, the operator splices the message tape back onto the tape reel, rewinds the monitor tape, and replaces the reel.

(7) STOPPING OPERATION - To stop operation, return the ON-OFF power switches to their OFF positions.

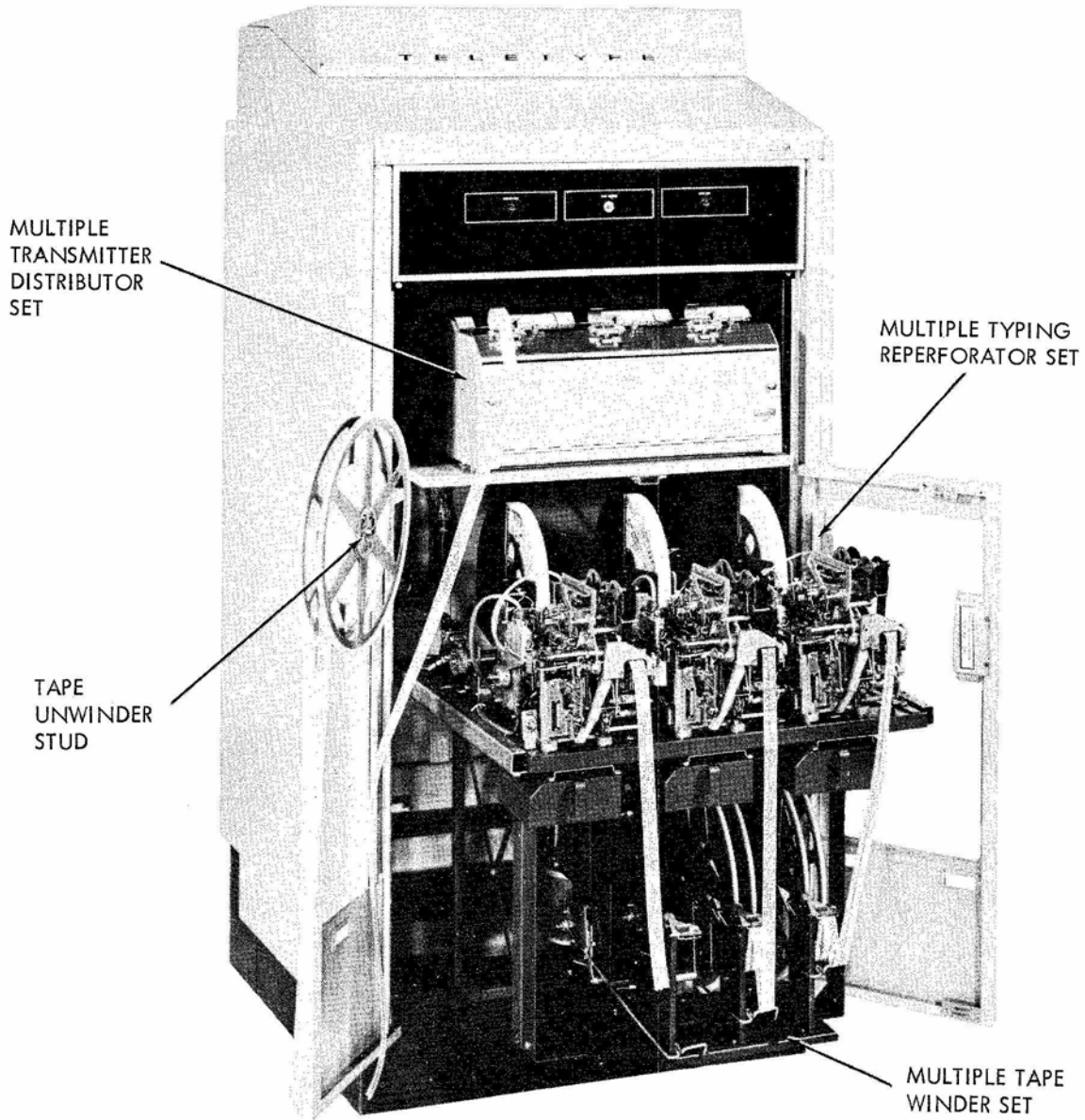


Figure 3-12. Model 28 Monitor Transmitter (Pull-Back) Group

SECTION 4  
PRINCIPLES OF OPERATION

4-1. GENERAL

a. This section covers the operating principles and circuit descriptions of the Model 28 Universal Torn Tape System and the auxiliary Monitor Transmitter (Pull-Back) Group. The Model 28 Universal Torn Tape System consists of three groups: a Model 28 Transmitting Group, Model 28 Typing Reperforator Monitor Group, and Model 28 Typing Reperforator Receiving Group. The groups provide complete facilities for the reception, storage, and transmission of messages over radio or wire channels connecting two or more stations equipped with compatible units.

b. Depending upon customer requirements, the equipment can be wired to transmit and receive polar or neutral direct current signals in a 7.00, 7.42, or 7.50 unit stop-start pattern. Operation at 0.020 or 0.060 ampere line current (neutral operation), or 0.030 ampere line current (polar operation) is possible. Gearing changes can adapt the equipment for various operating speeds (see Table 4-1). A transformer and rectifier supply furnishes current for operation of the selector unit magnets through plug-in type line relays. The selector magnet circuits are closed loops, and a separate line relay is required for each unit in the groups equipped

with a selector magnet. Wiring facilities provided allow a choice of "free-running" or "synchronous pulsed" transmission.

c. The sets are driven by synchronous or governed motors depending upon the source of power. Synchronous motors require a power supply of 115 volts (plus or minus 10 per cent) 60 cycles, single phase alternating current. To avoid loss in receiving margin with this type motor, the frequency regulation must be within plus or minus one-half cycle. Governed motors require a similar power supply, except that the line frequency may vary from 50 to 60 cycles.

4-2. SIGNALING CODE

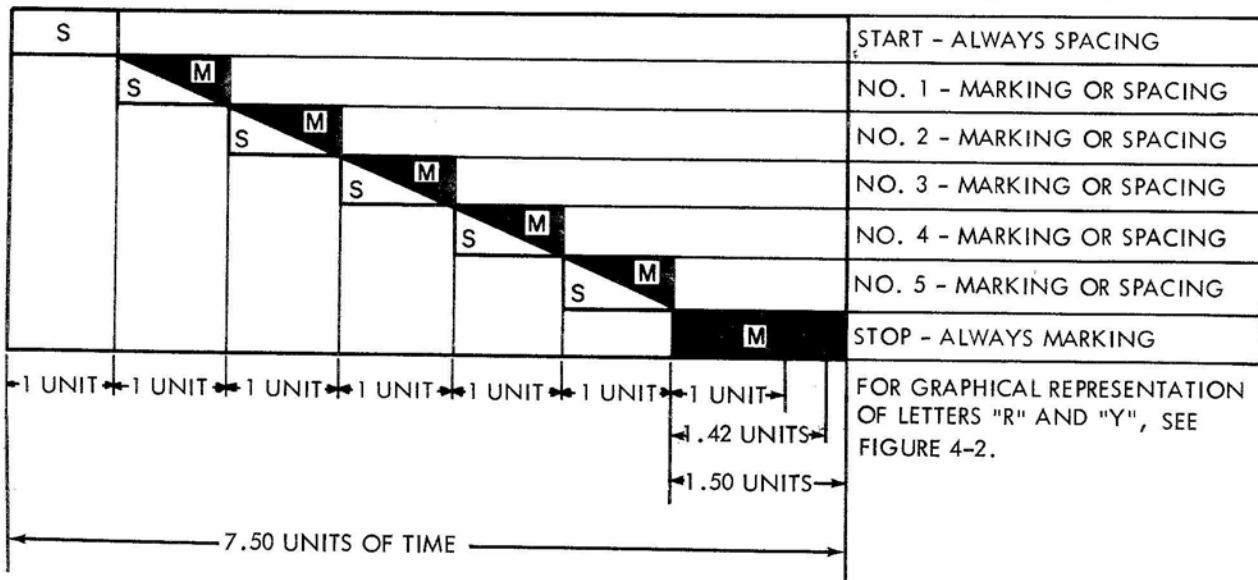
a. The various components of the teletypewriter operate on the principle of electro-mechanical conversion of message characters (see Figure 4-1) in terms of a signal code. Teletypewriter equipment utilizes the Baudot code, a five-unit start-stop signaling code, in which each character or function is 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

Table 4-1. Speed Chart

Unit Code	7.00	7.00	7.00	7.42	7.42	7.42	7.42	7.50	7.50	7.50
O.P.M.	390	428.6	636	368	404	460	600	364	400	600
Baud	45.5	50.0	74.2	45.5	50.0	56.9	74.2	45.5	50.0	75.0
Pulse Lgth.	0.022	0.020	0.0135	0.022	0.020	0.0175	0.0135	0.022	0.020	0.0133
Freq.	22.75	25.0	37.1	22.75	25.0	28.45	37.1	22.75	25.0	37.5
Char. Per Sec.	6.5	7.1	10.6	6.0	6.7	7.7	10.0	6.1	6.7	10.0
Words Per Min.	65	71.4	106	60	67.3	75	100	60.6	66.6	100

TRANSMISSION PATTERNS

TRANSMISSION SEQUENCE



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

Figure 4-1. Signal Code

flows in the opposite direction 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. Every code combination includes five elements that carry the intelligence, each of which may be either marking or spacing. The intelligence elements are preceded by a start element (always spacing) and are followed by a stop element (always marking). The start and stop elements provide for mechanical synchronization between the transmitting and receiving equipment. A graphic illustration of the marking and spacing element in each sequence may be found in Figure 4-2, Code Representation of

the Letters R and Y. All five elements are marked in the "letters" code. The "blank" code is comprised of five spacing elements.

c. 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. These sets employ a 7.00, 7.42, or 7.50 unit transmission pattern (see Figure 4-1). The signaling frequency is expressed in dot cycles per second, one cycle consisting of a positive current pulse followed by a negative current



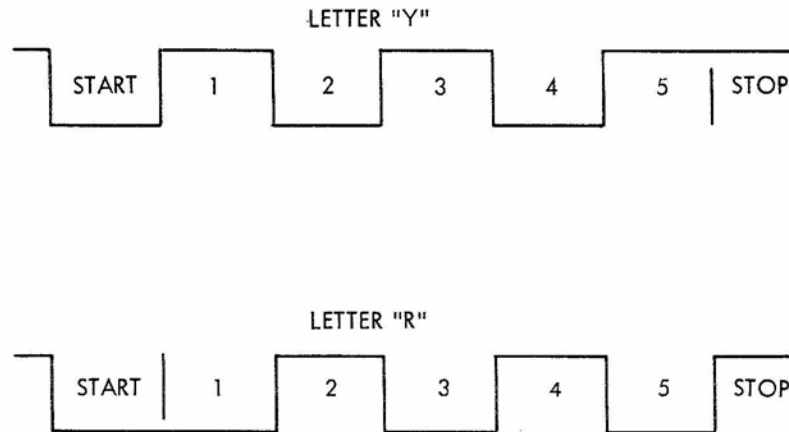


Figure 4-2. Code Representation of the Letters "R" and "Y"

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.

#### 4-3. MODEL 28 TRANSMITTER GROUP (Figure 1-8)

a. GENERAL - The Model 28 Transmitter Group consists of six transmitter distributors and two motor units (synchronous or governed) mounted on two multiple transmitter distributor bases (three transmitters and one motor on each base). The above units mount in a Model 28 Universal Cabinet which provides message numbering, wiring, and electrical control facilities for operation of the multiple transmitter distributor sets. The transmitter distributors may be operated at various speeds, depending on the gear set used (see Table 4-1).

#### b. TRANSMITTER DISTRIBUTOR OPERATION

##### (1) GENERAL

(a) The transmitter distributor used in the Model 28 Transmitter Group mounts on a multiple base. The unit is designed to sense code combinations perforated in a tape or received from an external multiwire input, convert them into electrical code pulses, and distribute them over a signal circuit. Arc suppressors are connected across the distributor auxiliary contacts and the signal line. All electrical wiring terminates in a 36 point female connector mounted on the rear of the unit (Figure 1-15).

(b) The transmitter distributor is ORIGINAL

a two-shaft unit. The sensing shaft auxiliary "B" contact controls the distributor shaft clutch release magnet electrically when the control system stepping switch is in its 16th position. However, each shaft may be operated independently of the other. Rotation of the sensing shaft is controlled via the stepping switch ("A" level) and the contacts of the transmitter distributor control relay in series with the transmitter distributor read magnet (Figure 4-19). A start-stop control lever, tape-out pin, and tight tape arm control the transmitter control relay electrically. The unit is capable of "single wire" output, and "multiple wire" input to the distributor contacts for sequential distribution. Signal out may be arranged for neutral or polar operation. The operation sequence is such that the reading cycle occurs after tape feeding, and the last character sensed is transmitted immediately.

(c) In the following description of the sequence of operation, the transmitter distributor is assumed to be operating under the following normal conditions:

1. Current applied to the sensing and distributor clutch trip magnet circuits and the motor power circuit at the base connector terminals.
2. Motor toggle switch in its "ON" position.
3. Tape inserted in the transmitter, tape lid closed, and the start-stop lever in its right, or "RUN", position.
4. Sensing clutch trip magnet and start-stop switch connected in series.

5. Distributor clutch trip magnet and auxiliary "B" contact connected in series.

6. Storing switch contacts and distributor contacts connected in series with the signal line.

## (2) SUMMARY OF OPERATION

(a) The sensing clutch trip magnet is energized via the 16th position on the "A" level of the stepping switch, the K202 control relay contacts, and the transmitter start-stop contacts.

(b) The sensing clutch and cam sleeve will start their rotation to advance the tape, sense the tape, store the sensed character in the storing switch, and operate the auxiliary "A" and "B" contacts.

(c) When operated, the auxiliary "B" contact completes an energizing path for the distributor clutch trip magnet. The distributor clutch trips and the distributor cam and clutch rotate to distribute the stored code pattern over the signal line.

(d) In continuous transmission, the sensing cam will have started its next cycle while the actions controlled by the distributor cam sleeve are taking place. These motions will continue until the sensing clutch trip magnet circuit is interrupted (by exhaustion of tape or by moving the start-stop lever to the stop position), and the sensing clutch disengages.

(3) GEARING - The distributor shaft assembly mounts two gears, a rear gear and a clutch drum gear. The rear gear meshes with the intermediate gear train on the base and is driven from the motor. The clutch drum gear, through the idler gear, drives the sensing clutch drum gear to rotate the sensing and the distributor shafts at the same speed.

## (4) SENSING SHAFT

(a) CLUTCH TRIP (Figure 4-3) - As the sensing clutch trip magnet is energized, its armature and armature extension bail are attracted to the magnet core releasing the latching extension of the lower trip lever. The lower trip lever and upper trip lever pivot on their shaft, and the upper trip lever releases the clutch shoe lever from the stop lug on the clutch cam disk.

(b) CLUTCH ENGAGEMENT (Figure 4-4) - Clutch engagement is accomplished by releasing the lower end of lever B. The upper end of lever B pivots about its ear C

(which bears against the upper end of the secondary shoe) and moves its ear D, and the upper end of the primary shoe, toward the left until the shoe makes contact with the drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward causing it to make 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 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 of the preceding steps, the final force developed at point I is very great. This force is applied to the lug J on the clutch-cam disk to cause it to turn in step with the drum.

## (c) CLUTCH RESET (Figure 4-3)

1. As the sensing cam sleeve starts its rotation, the reset extension of the lower trip lever rides to the peak of its cam, placing the upper trip lever in the path of the clutch shoe lever.

2. Should the magnet remain energized, the armature will remain attracted to the magnet core and the armature extension bail will be prevented from latching the lower trip lever. Then, as the cam continues to rotate, the reset extension of the lower trip lever will ride to the lower part of its cam and permit the upper trip lever to pivot out of the path of the clutch shoe lever. The cam will continue to rotate until the trip magnet is no longer energized.

3. When the clutch trip magnet circuit is interrupted, the armature and armature extension bail will be released. Then, as the reset extension of the lower trip lever rides to the high part of its cam, the latching extension will be latched by the armature extension bail to hold the upper trip lever in the path of the clutch shoe lever. As the clutch shoe lever strikes the upper trip lever, the inertia of the clutch will cause it to rotate a slight additional amount and permit the clutch latch lever to fall into the notch in the cam disk. In this position the clutch shoe is held in proximity to the stop lug on the clutch cam disk.

## (d) CLUTCH DISENGAGEMENT

(Figure 4-5) - Clutch disengagement is caused by bringing together lug A on the cam clutch disk and the lower end of 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.

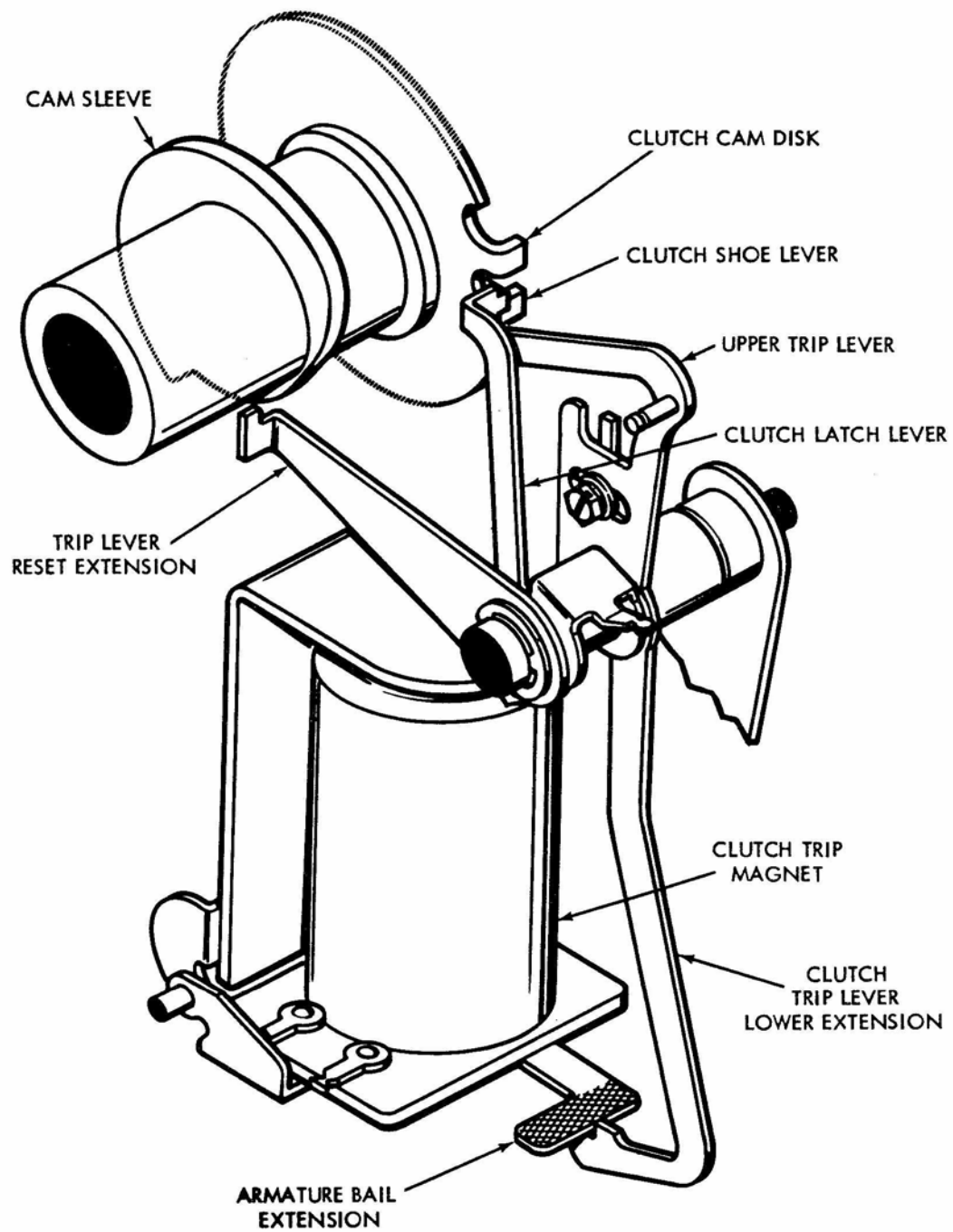


Figure 4-3. Clutch Trip Mechanism

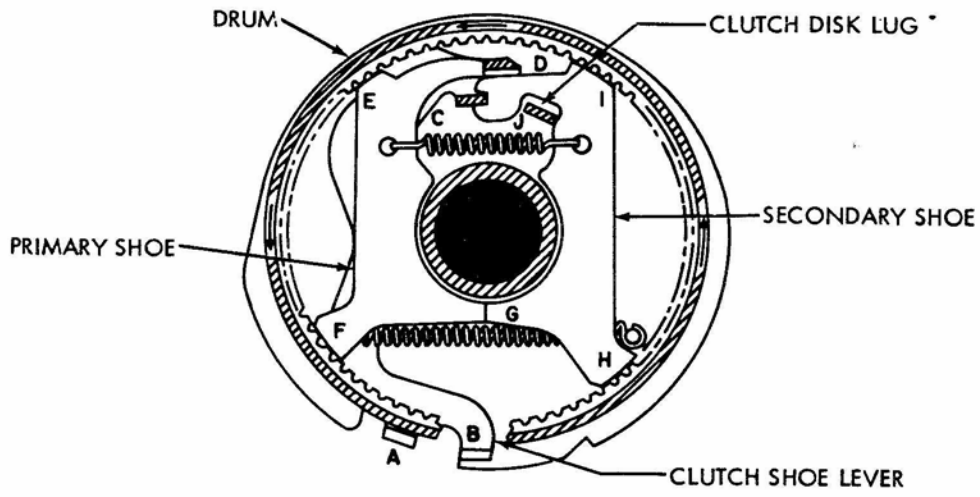


Figure 4-4. Clutch Engaged

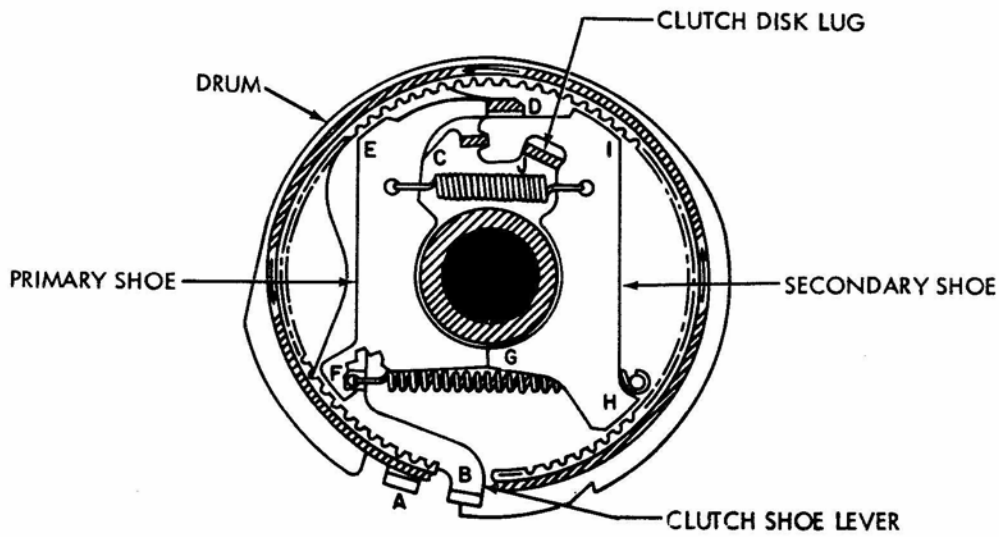


Figure 4-5. Clutch Disengaged

(e) **TAPE FEEDING** (Figure 4-6) - As the sensing cam sleeve rotates, a roller on the rear feed lever rides to the high part of its cam moving the lower extension of the front feed lever downward. The feed levers actuate a feed pawl assembly which engages a tooth on the feed wheel and rotates it one space. As the feed wheel rotates, the detent lever roller will rest in the hollow between two teeth to hold the feed wheel in position. With the continued rotation of the sensing cam sleeve, the feed lever roller rides to the low part of its cam and the feed pawl rises to move past the next tooth where it is in position for the next cycle.

(f) **TAPE SENSING** (figure 4-7) - At the start of the sensing cam sleeve rotation, the sensing pins are in their downward position (withdrawn from the tape), and the storing switch contacts are arranged in accordance with the code combination of the previous sensed character.

1. **PUSHER BAIL** (Figure 4-8) - As the pusher bail roller rides to the peak

of its cam, it moves the pusher levers to the right, stripping any previously selected pusher levers from the shoulders of their sensing pins. Then, as the pusher bail roller rides to the indent of its own cam, the pusher bail is withdrawn from the pusher levers to permit the levers to rest against their sensing pins.

2. **SENSING BAIL** (Figure 4-9) - As the sensing bail rollers move into the indent of their cams, the right end of the sensing bail rises to permit the sensing pins to rise and sense the code perforations in the tape. If the code level sensed by a pin is not perforated, travel of the pin is blocked by the tape and the pusher lever remains to the right of its sensing pin. If the code level is perforated, the pin is free to rise through the perforation sufficiently to permit the top of the pusher lever to drop under the shoulder of the sensing pin. Further rotation of the sensing cam sleeve will move the sensing bail rollers to the peak of their cams and start the right end of the sensing bail, the sensing pins, and the selected pusher levers moving downward.

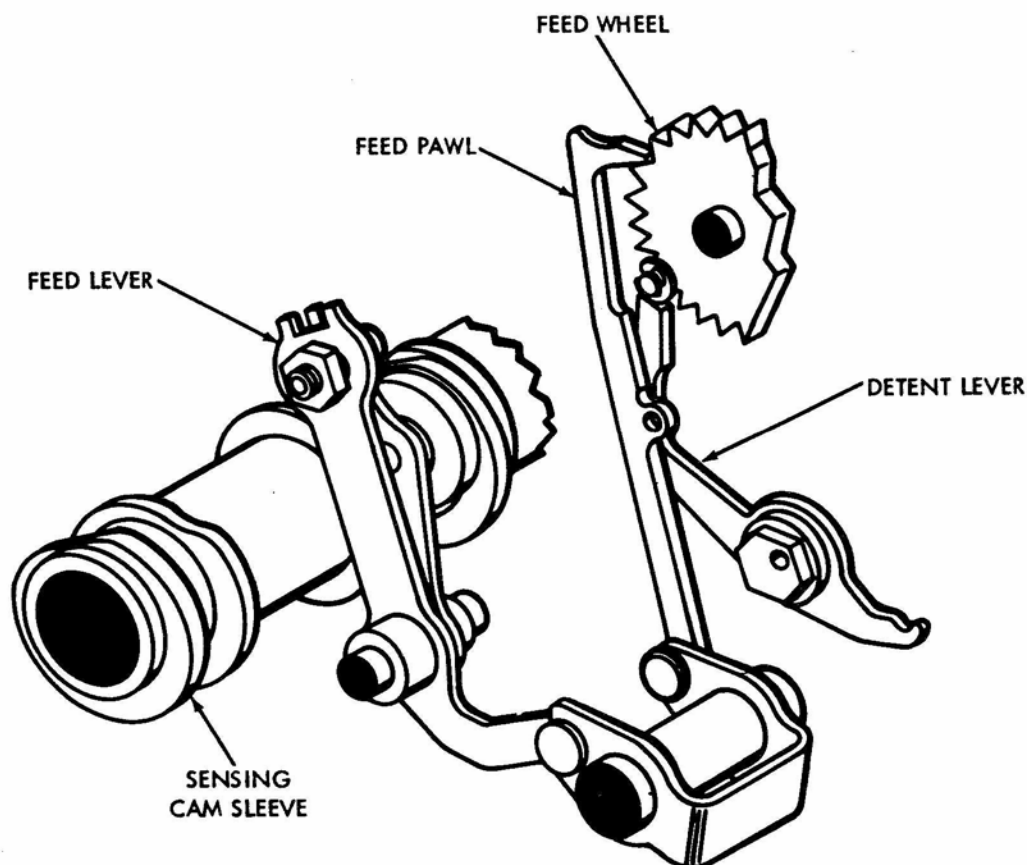


Figure 4-6. Tape Feed Mechanism

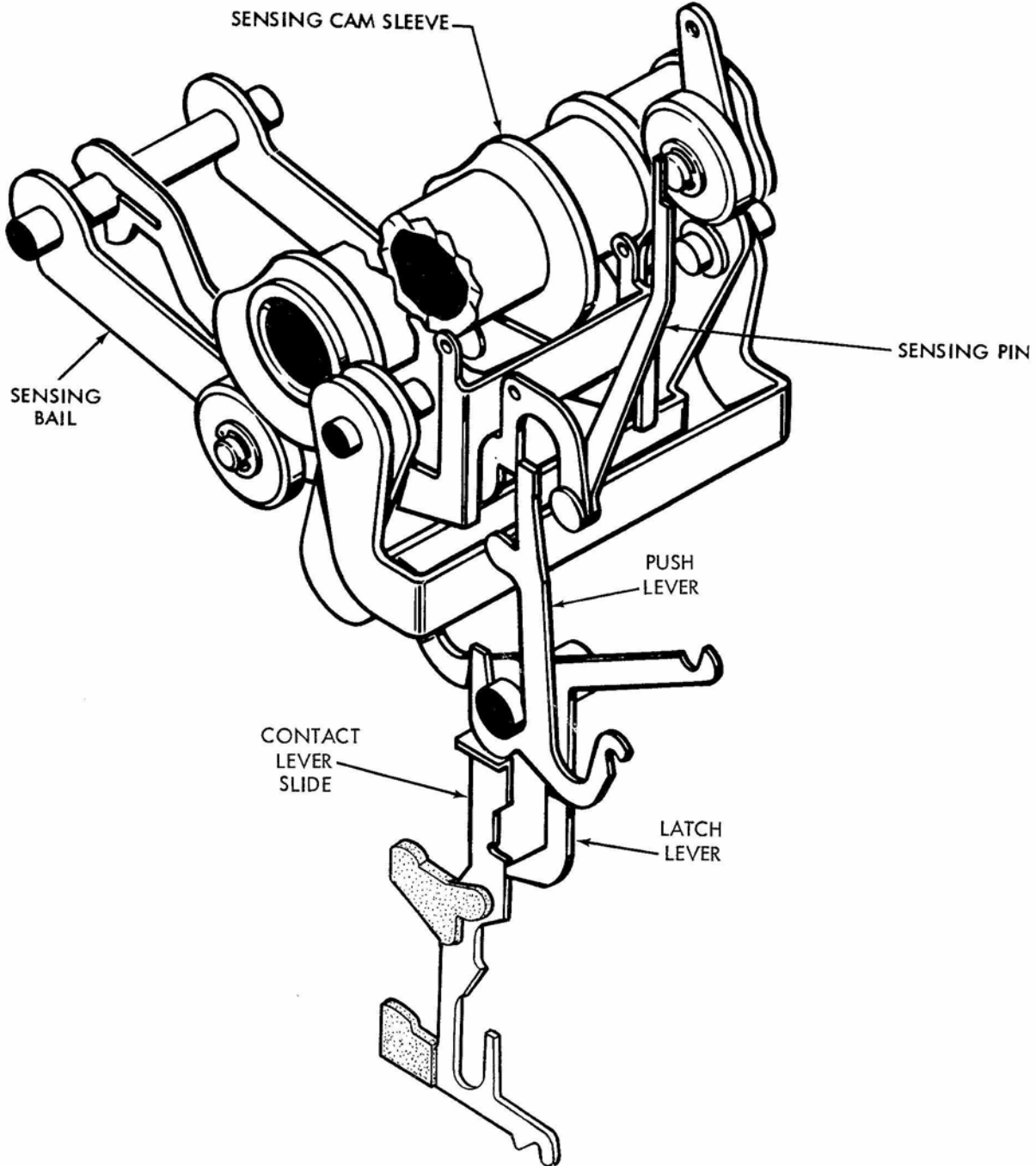


Figure 4-7. Tape Sensing

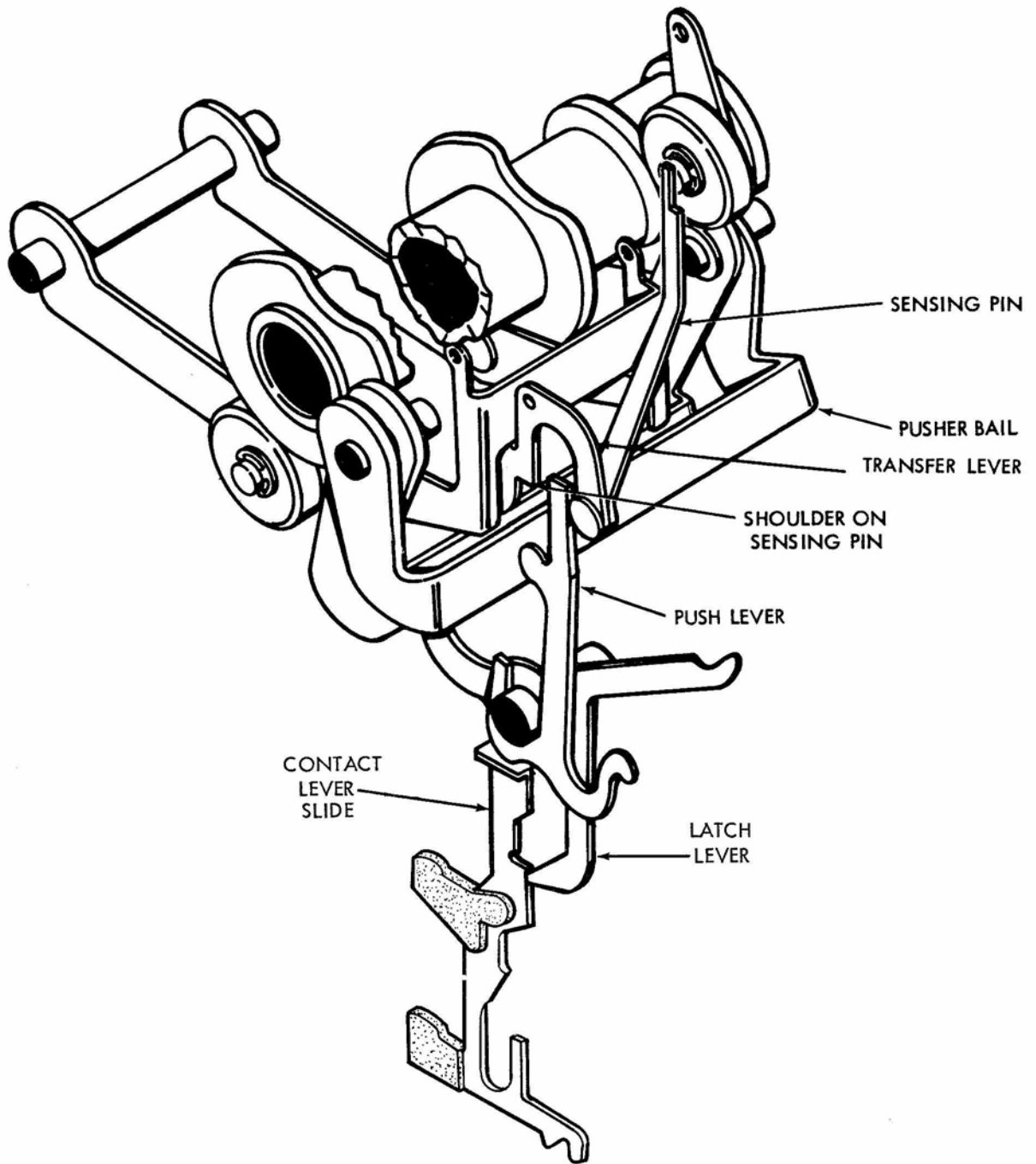


Figure 4-8. Pusher Bail

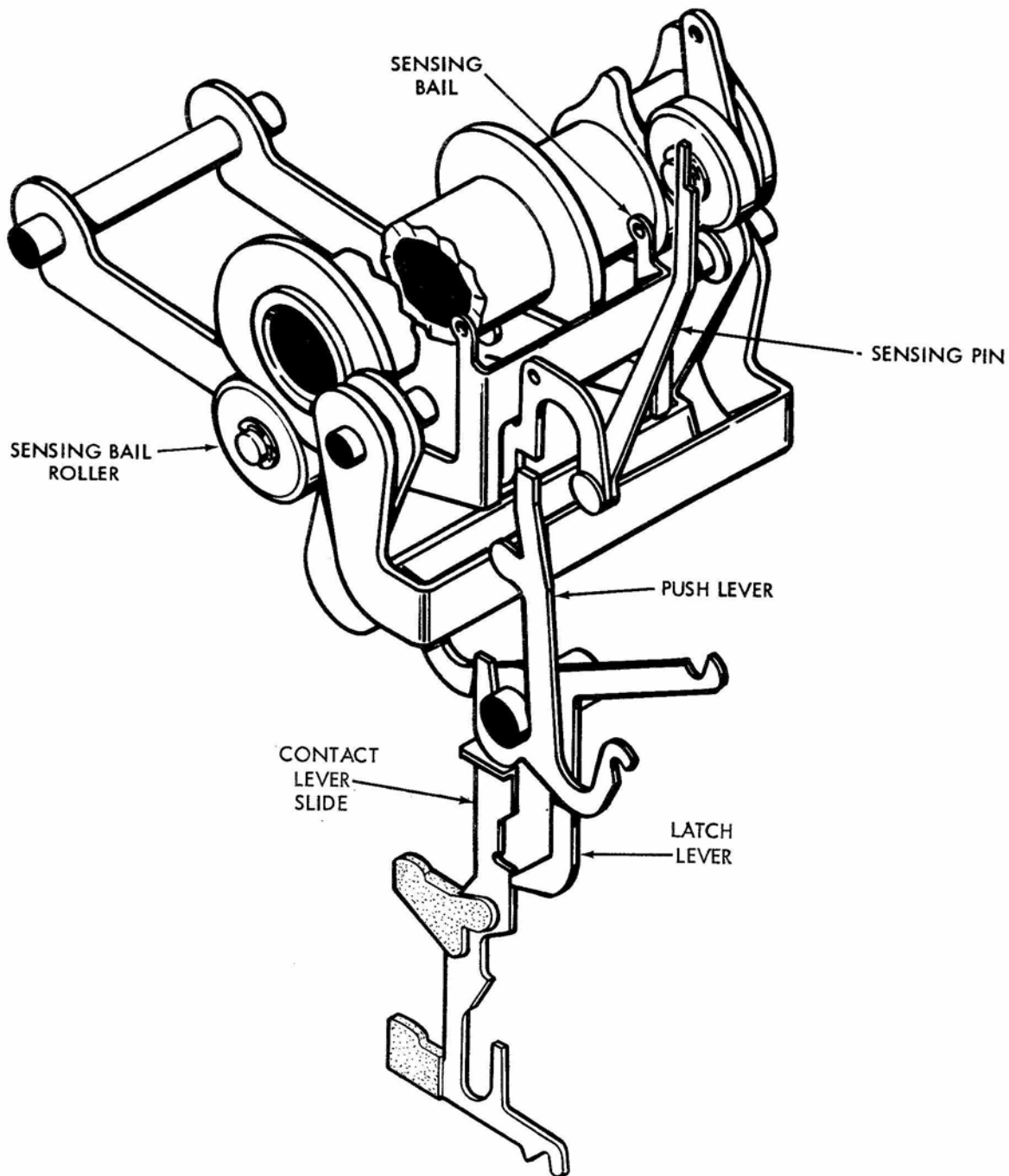


Figure 4-9. Sensing Bail



3. LATCH BAIL (Figure 4-10) - As the latchbail roller rides to the peak of its cam, the lower end of the latchbail moves to the left and actuates the latch levers. The lower end of the latch levers are moved to the right to release any previously latched slides, and the slides will start to rise under the tension of their springs. If its pusher lever has not been selected, the slide is free to rise to its unoperated position. If its pusher lever has been selected and moved downward by the sensing bail, the pusher lever will hold the slide down. Then, as the latch bail roller rides to the indent of its cam, the lower end of the latch bail will move to the right, permitting the latch levers to latch the slides in their operated position.

4. STORING SWITCH (Figure 4-11) - In its unselected or upward position, the storing switch slide lifts the swinger of the storing switch up, closing the normally open (spacing) contact. In the selected or downward position, the slide does not operate the swinger and the normally closed (marking) contact remains closed. Thus, the code combination of the sensed character is stored in an arrangement of the storing switch contacts and, upon rotation of the distributor cam sleeve, will be transmitted sequentially over the signal circuit.

(g) AUXILIARY CONTACTS - With the rotation of the sensing cam sleeve, auxiliary levers "A" and "B" follow their cams to actuate pusher levers, slides, and the contact swingers of the storing switch assembly (Figure 4-11). These contacts are operated for each cycle of the sensing cam sleeve as follows:

1. An auxiliary contact "A" shall open at 7 degrees (+5 degrees) and close at 353 degrees (+5 degrees).

2. An auxiliary contact "B" shall close at 247 degrees (+2.5 degrees) and open at 309 degrees (+4 degrees).

#### (5) DISTRIBUTOR SHAFT

(a) CLUTCH OPERATION - As the distributor clutch trip magnet is energized, the distributor clutch operates in a manner similar to that of the sensing clutch (refer to paragraph (4) (a) through (d) above) causing the distributor cam sleeve to rotate.

(b) CAM SLEEVE (Figure 4-12).

1. AUXILIARY "C" CONTACT - Shortly after the distributor cam sleeve starts to rotate, an auxiliary "C" cam follower lever will ride into its cam indent. In so doing, it will release its rocker to permit the auxiliary "C" contact to close. The "C" contact closes at

50 degrees (+10 degrees) and opens at 340 degrees (+5 degrees).

2. DISTRIBUTOR CONTACTS (Figure 4-13) - The contacts of the storing switch assembly are arranged to conform with the code combination of the character sensed by the sensing mechanism. Then, as the distributor cam sleeve rotates, the cam follower levers are actuated by their cams to open and close the distributor contacts for measured intervals of time. Operation of the distributor contacts (in series with the storing switch contacts) will generate a signal pattern corresponding to the code combination of the previously sensed character.

#### (6) CONTROLS

(a) RUN-STOP LEVER (Figure 1-14) - A toggle type on-off (RUN-STOP) lever is built into the tape guide plate of the transmitter distributor. The switch actuated by this lever also serves as a tight or tangled tape switch. Wired in series with the sensing clutch trip magnet, the switch is normally open. When the control lever is moved from the STOP to RUN position, it actuates a run-stop control bail, slide arm bail, and slide arm to close the run-stop switch contacts and energize the sensing clutch trip magnet. When the control lever is returned to the stop position, the switch will open to de-energize the sensing clutch trip magnet and stop rotation of the sensing cam.

(b) FREE WHEELING - When the run-stop control lever is moved to the FREE position, the lever cams the run-stop control bail an additional distance and an extension of the bail disengages the feed pawl and detent lever from the feed wheel to permit the wheel to rotate freely. In addition, an extension on the run-stop control bail depresses the tape-out pin allowing free passage of tape under the tape lid.

(c) TAPE OUT (Figure 1-14) - The normally open contacts of the tape out switch are wired in series with the transmitter distributor control relay. With tape in the transmitter, the tape-out pin is held depressed and the tape-out switch contacts are closed, allowing the control relay to energize. As the end of the tape passes over the tape-out pin, the pin rises to open the switch contacts and interrupt the control relay magnet circuit. Through operation of the control relays associated contacts, the energizing circuit to the sensing clutch magnet is opened, stopping transmission.

(d) TAPE LID (Figure 4-14) - When the tape lid button is depressed, the shaft portion of the button actuates the tape lid plunger bail and the latching post. The latching post,

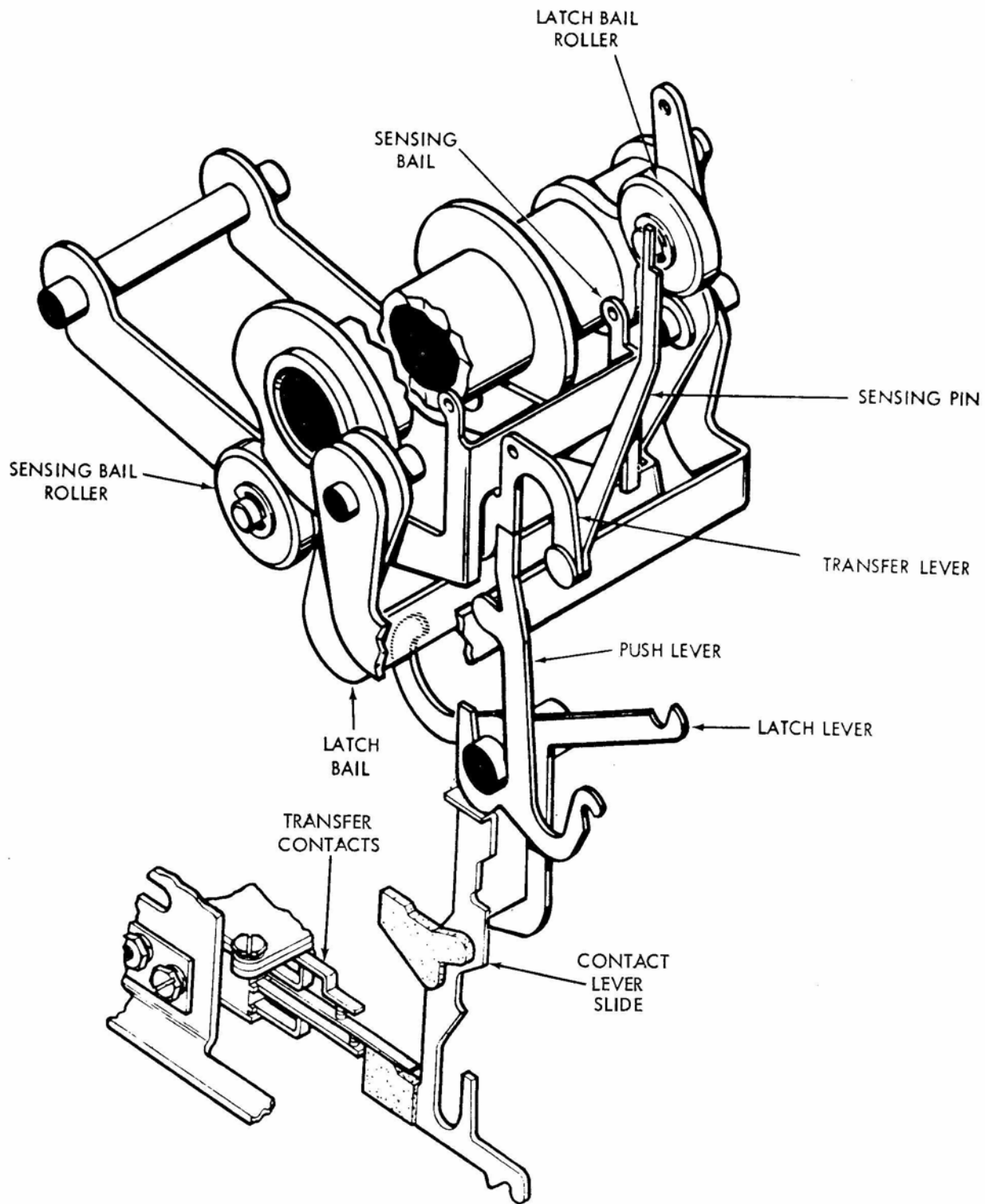


Figure 4-10. Storing Switch (with Transfer Contacts)

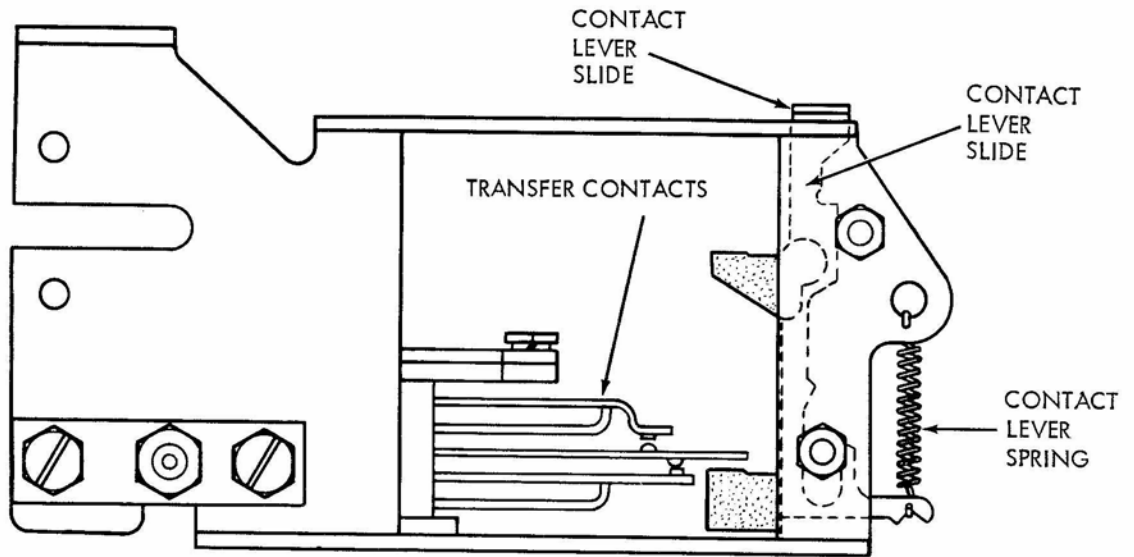


Figure 4-11. Storing Switch (with Transfer Contacts)

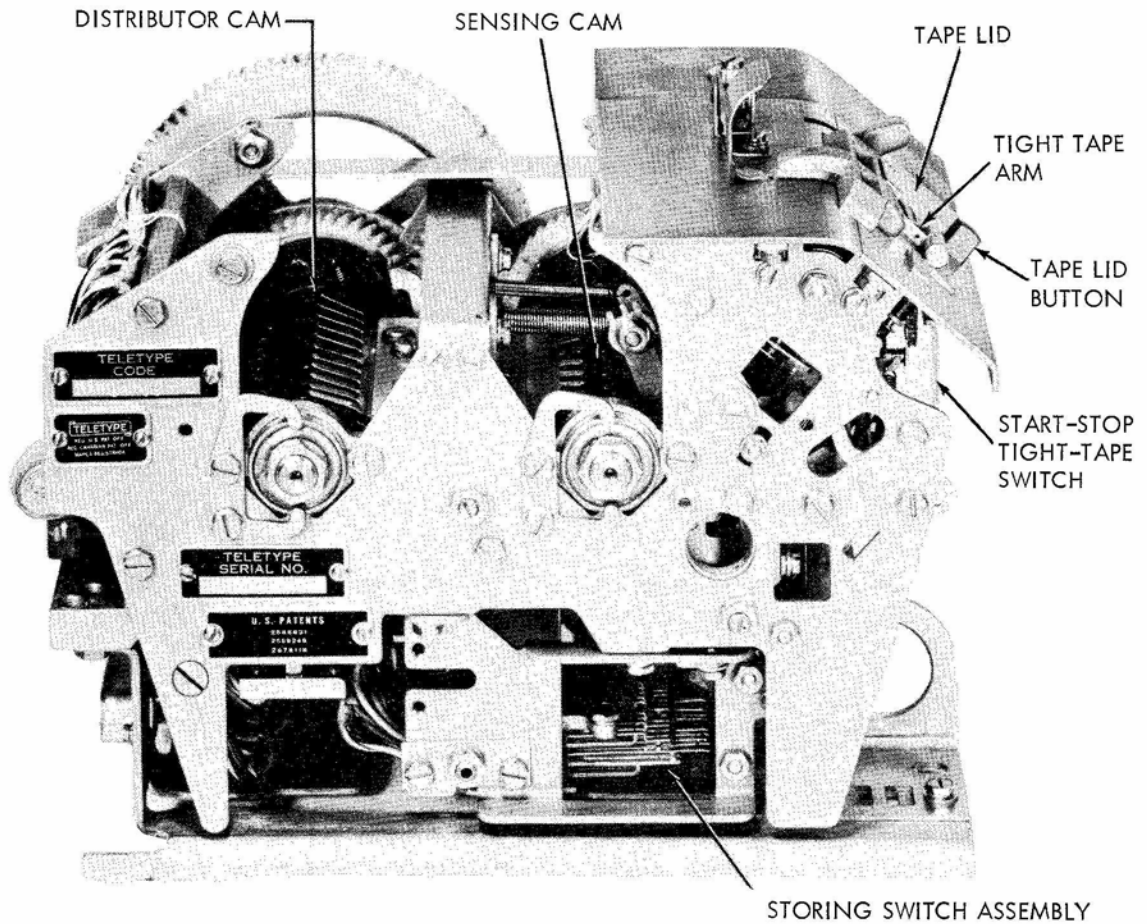


Figure 4-12. Model 28 Transmitter Distributor (Side View)

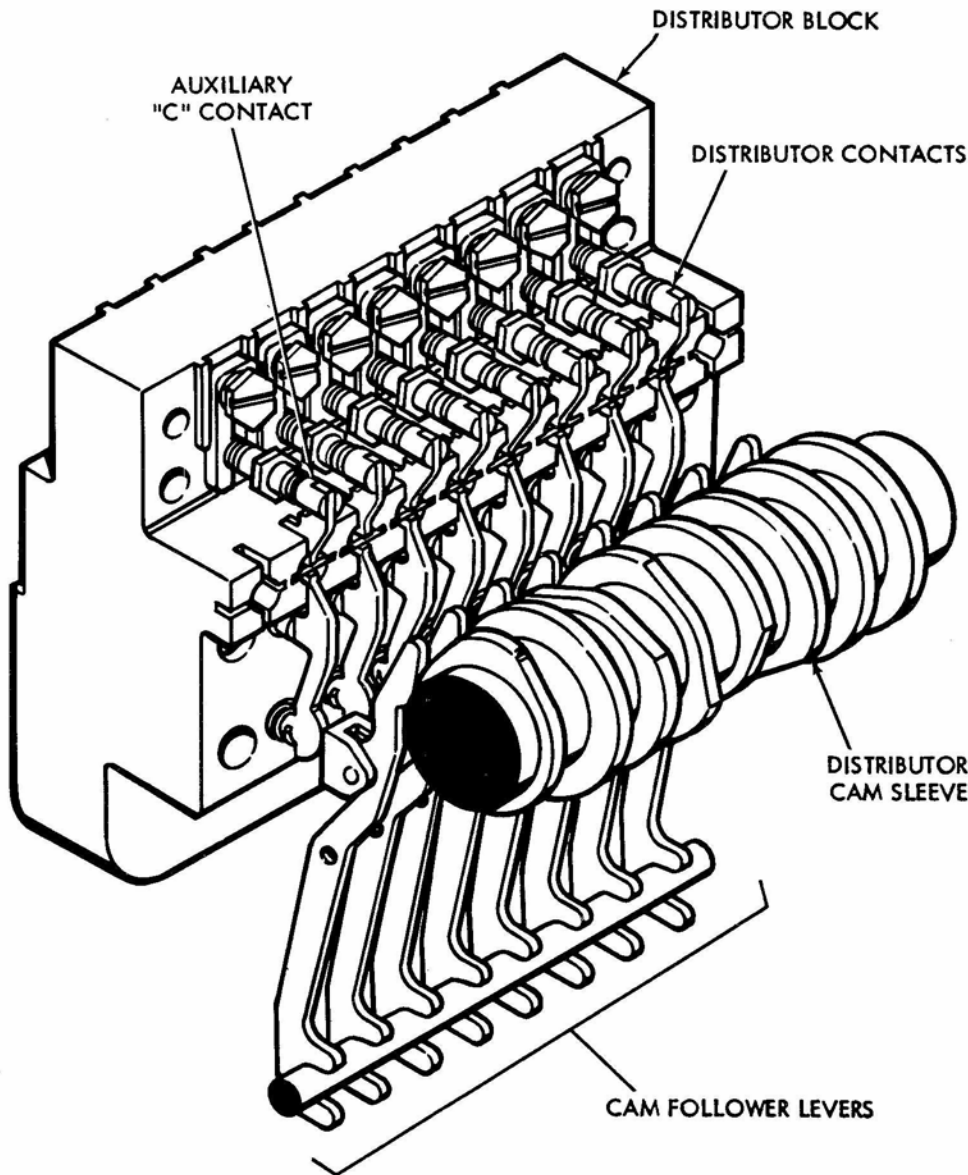


Figure 4-13. Distributor Mechanism

which is mounted to the tape lid below the tape guide plate, causes the main part of the tape lid to swing upward (open) when the post swings down. The tape lid is closed manually by pressing it against the tape guide plate. The lid is held closed by the plunger bail latching extension.

(e) **TIGHT TAPE ARM** (Figure 1-14) - The tight tape arm is a spring loaded mechanism attached to the tape lid, which senses a tight or tangled tape condition of the transmitted tape. When operated, the arm actuates an intermediate bail and slide arm assembly to open the run-stop-tight tape contacts and de-energize the sensing clutch trip magnet.

(f) **TAPE DEFLECTOR** (Figure 1-14) - A tape deflector, mounted immediately behind the tape lid, deflects the transmitted tape back toward the operator when in the down or operated position. To allow straight line tape travel, the deflector may be rotated to the right on its hinge so as not to interfere with tape travel.

#### c. **MULTIPLE TRANSMITTER DISTRIBUTOR BASE**

##### (1) **GENERAL**

(a) The multiple transmitter distributor base provides mounting and common

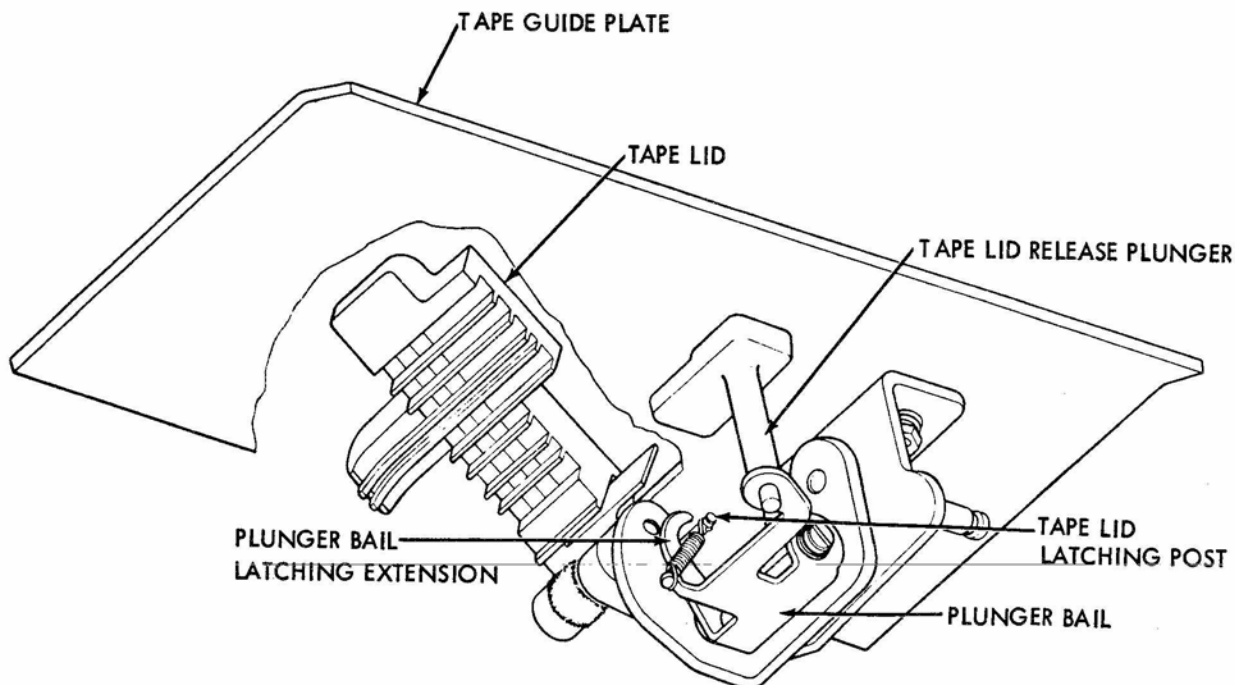


Figure 4-14. Tape Lid Mechanism (Bottom View)

drive facilities for three transmitter distributors and a synchronous or governed motor unit. The transmitter distributors are driven by a common cross-shaft from the motor unit mounted at the rear of the base. Power is transmitted to the cross-shaft via an intermediate gear set at the left end of the cross-shaft (Figure 1-16).

(b) There are two basic types of multiple transmitter distributor bases, a variable speed and a non-variable speed base. The bases are similar in appearance and operation, but have one major difference. On the variable speed base, each transmitter distributor may be operated at a different speed (see Table 4-1) depending on the gear sets mounted on the cross-shaft. However, the transmitter distributors on the non-variable base, all operate at the same speed. Therefore, when changing operating speed on the non-variable base, the three transmitter distributors are equally effected.

(2) **ELECTRICAL FACILITIES** - Three 36 point receptacles (furnished with the transmitter cabinet) are mounted on the base, one in each transmitter mounting position (Figures 1-16 and 1-19). The receptacles mate with the transmitter plugs (Figure 1-15), and furnish the units with control and signal line facilities. An AC power switch for motor operation is located at the front right corner of the base.

Three line shunt switches (one for each transmitter distributor) are located behind the transmitter distributors above the mounting clamps (Figure 1-16). The switches are operated by the line shunt switch operating bushing on the rear of the transmitter distributor above the connector (Figure 1-15). When a transmitter distributor is removed from the base, the line shunt switch closes placing a marking condition on the line (Figure 4-18) to energize the receiving selectors or line relays at the distant station.

(3) **ENCLOSURE** - The base is resiliently mounted on a sub-base (oil pan), and is enclosed with a dust cover (Figure 1-16). The cover consists of a front hinged panel (for removal of the transmitter units), transmitter covers, and tape wear strips. The enclosure and base, with transmitter distributors, mounts on the shelves of the transmitter cabinet immediately above the tape bins.

(4) **TRANSMITTER DISTRIBUTOR MOUNTING** - Mounting the transmitter distributors is accomplished by opening the hinged panel on the front of the base cover. The unit is guided onto and from the base by studs, posts, and bars mounted on the base (Figure 1-16). These guide and hold the transmitter cradle so that accurate gear engagement is insured, and the

electrical connectors on the base and transmitter distributor mate properly. The units are secured at the front by a clamp screw which extends through the cradle and threads into a tapped hole in the base (Figure 1-16).

#### d. MOTOR UNITS

##### (1) SYNCHRONOUS MOTOR UNIT (Figure 1-17)

(a) GENERAL - The synchronous motor unit is a 1/12 horsepower, 3600 RPM, two pole, wound stator ball bearing motor with a squirrel cage type rotor. The stator has two windings - a main operating winding and an auxiliary starting winding. The auxiliary winding is wired in series with a 170 MFD electrolytic capacitor and a current operated motor starting relay. Normal starting current is 12.0 amperes, running current 2.7 amperes, and rated torque 23.4 ounce inches. The motor operates on single phase, 115 volt (plus or minus 10 per cent) alternating current, at a frequency of 60 cycles per second (plus or minus 0.75 per cent).

##### (b) OPERATION

1. The initial starting current causes the relay to pull up, and its contacts to close the auxiliary winding circuit. As the rotor gains speed, the current flowing through the motor, and through the relay coil, decreases. When a predetermined current value is reached, the relay armature is released, the relay contacts are opened, and the auxiliary winding circuit is disconnected from the line. The rotor continues to accelerate until it reaches synchronous speed (3600 RPM). The motor is wired in such a manner that the rotor revolves counterclockwise when viewed from the fan end.

2. The starting relay and capacitor, together with a thermal cut-out switch, are mounted in a compartment above the motor. The thermal cut-out switch is in series with both the main and the auxiliary motor windings. If excessive current is drawn by the motor for any reason, the thermal cut-out switch will open the circuit preventing possible damage to the motor. The switch may be manually reset, if tripped, by depressing the red button which projects upward through the compartment mounting plate. Allow the motor to cool at least 5 minutes before manually depressing the red button.

3. There are two fans located within the motor housing, one at each end of the rotor. These draw cooling air through the slots in the end bells and exhaust it through the slots in the motor housing. The end bells have rubber vibration mounts by means of which the motor sets in the ends of its mounting bracket. The

rubber mounts are held in the bracket by mounting straps. The motor shaft has a tapped hole for use in fastening the intermediate shaft driving helical gear. All end play is taken up by a conical shaped spring, which bears against the outer race of one of the ball bearings.

##### (2) GOVERNED MOTOR UNIT (Figure 1-18)

(a) GENERAL - The governed motor unit is a 1/15 horsepower, 3600 RPM ball bearing motor, which depends on an electromechanical governor for its speed regulation. The armature is wired in series with two field windings and the governor contacts. A 250 ohm, 40 watt resistor and 0.5 MFD capacitor are connected in parallel with the governor contacts. When the contacts are closed, the resistor is shorted out. When the contacts are open, the resistor is in series with the motor to limit its operating current and reduce its speed. The capacitor serves as a spark suppressor for the governor contacts. Normal starting current is 4.0 amperes, running current 2.9 amperes, and rated torque 18.7 ounce inches. The motor operates on single phase, 115 volt alternating current (plus or minus 10 per cent) at a frequency of 50 to 60 cycles per second.

##### (b) OPERATION

1. The combination fan and governor is mounted on one end of the motor shaft. The fan draws cooling air through the motor housing, which also serves as a mounting plate for the governor slip rings and for the governor contact mechanism (mounted on opposite sides of the fan). Connections to the two slip rings, which are wired to the governor contacts, are made by means of two brushes mounted on the ends of the motor housing. Normally, the governor contact spring holds the governor contact against the contact screw. When the motor shaft exceeds a predetermined speed, the centrifugal force developed on the governor contact briefly overcomes the pull of the governor spring, and the governor contact leaves the contact screw until the motor slows down. The tension on the contact spring may be adjusted to maintain the motor speed at 3600 RPM.

2. Means are provided to compare the motor speed with a standard when making the contact spring tension adjustment. An aluminum cover fits against the side of the fan and encloses the governor contact mechanism. The outside of the cover is finished in white, with four black stripes equally spaced about its periphery. This serves as a target, and should appear to stand almost still at 3600 RPM, when viewed through the moving shutter of a 120 vibrations per second tuning fork.

## NOTE

The six spot and thirty-five spot rows serve as targets when using an 87.6 VPS tuning fork. The six spot target is used to approach an on-speed setting, and the thirty-five spot target is used to arrive at an accurate setting.

3. The motor brushes are protected by 0.5 MFD capacitors connected between the brushes and the grounded frame of the motor. These tend to by-pass any electrical noise created by the brushes as they make and break contact with the various segments of the armature commutator. The motor is wired in such a manner that the armature rotates counterclockwise when viewed from the governor end.

4. The method of mounting the series motor is similar to the method of mounting the synchronous motor (see paragraph 4-3.d.(1) (b) 3.). The housing provided on the underside of the mounting bracket contains both the 250 ohm resistor and 0.5 MFD capacitor in the governor circuit, as well as an electrical noise suppressor.

5. The purpose of the electrical noise suppressor in the motor input circuit is to prevent any radio interference (which may be generated by the motor) from being radiated by the motor power leads. To prevent this disturbance from being radiated directly from any of the motor components or wiring, the entire AC motor is enclosed by grounded metal housings with screened openings. The screening permits the circulation of cooling air through the motor and across the governor resistor. It also permits the target to be viewed when checking the motor speed. A threaded plug in the governor shield housing may be removed to permit the insertion of a screwdriver for adjustment of motor speed. Access to the compartment on the underside of the motor may be gained by removing a screw and lock washer, and sliding the bottom cover plate aside.

e. UNIVERSAL CABINET (TRANSMITTING GROUP)

(1) GENERAL - The transmitting cabinet provides mounting facilities for two multiple transmitter distributor sets and the necessary wiring and electrical control facilities for their operation (see Figures 1-19 and 4-15). The cabinet assembly consists of separate inner and outer structures to minimize mechanical transmission of noise to the outer shell. All equipment mounts to the inner structure, the outer shell serving as a dust and noise enclosure. A race-way is provided at the bottom rear of the

cabinet to contain station cabling. The race-way may be fastened in place from the inside of the cabinet for "against the wall" applications. Six tandem message identification modules are located above the multiple transmitter distributor sets.

(2) DOORS AND PANELS

(a) DOORS - Two full length doors are provided at the rear of the cabinet for accessibility to both apparatus and electrical wiring. A recessed handle is provided in the right hand door to facilitate opening. Two magnetic catches serve to hold the doors closed. (Figure 4-15).

(b) END ENCLOSURES - End enclosures (side panels) are not supplied with the cabinet, but can be ordered separately. Depending on the arrangement of equipment in a given location, end enclosures may or may not be used on an individual cabinet. If a cabinet is to stand alone, then end enclosures are necessary to complete the cabinet (Figures 1-8 and 1-19). However, if a number of cabinets are mounted side by side, then end enclosures are necessary only on the outside cabinets (Figure 1-3).

(c) FRONT CONTROL PANEL - Six message identification numbering modules, with their associated NO DELETE switches and amber ABNORMAL TRAFFIC lamps, are accessible through cutouts in the control panel. The panel itself provides mounting facilities for six station identification cards.

(3) DOME AND TAPE BIN

(a) DOME - Mounted immediately behind the inclined panel at the front of the cabinet is the cabinet dome. The dome is hinged across the full length of the cabinet back and opens to allow access to the electrical control rack. The dome is supported in the raised position by a sliding lock arm located at the left rear corner of the cabinet. Mounted on top of the cabinet dome (Figure 1-8) is a tape grid on which prepared torn tapes are placed prior to transmission. Above the tape grid is a tape container which provides storage space for long prepared torn tapes wound in a normal figure eight pattern. On the front surface of the dome are mounted six white OPEN LINE lamps, one for each typing reperforator signal line. Each lamp is controlled by a time delay relay to indicate trouble in the signal line circuit. When closed, the dome is secured by a captive screw located centrally in the inclined top panel in line with the front edge of the dome.

(b) TAPE BIN - A tape storage bin - to collect spent tape and to store tape to

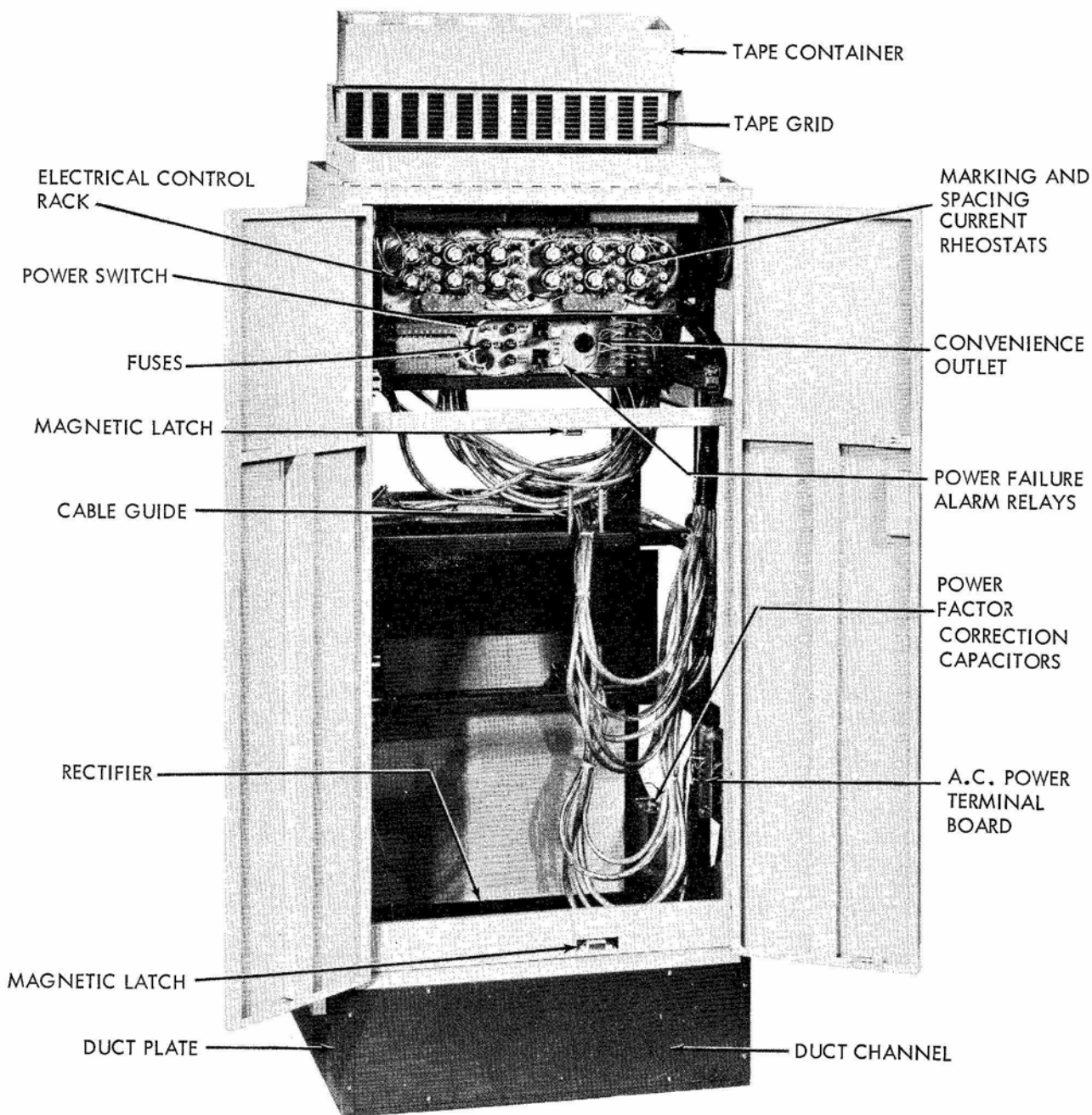


Figure 4-15. Model 28 Transmitter Group (Rear View)

be transmitted - is located at the bottom of the cabinet below the lower multiple transmitter distributor shelf (Figure 1-8). The bin is divided into six compartments, to facilitate locating of transmitted tape, and pulls forward for access to the rear bins.

(4) ELECTRICAL CONTROL FACILITIES

(a) Located at the rear of the cabinet on an electrical control rack are the electrical control facilities to operate the transmitter



contact. The stepping switch stores a 5 wire baudot code, and the distributor will transmit it sequentially. An electromechanical counter is actuated which registers the message number and stores the associated code on three code reading contact assemblies. The stored number codes are also transmitted by the distributor.

(b) Upon completion of transmitting the identifying code (LTR) ZCZCABCDE (FIG.) 000 (LTR), the transmitter is permitted to read its message tape. While the first transmitter is operating, a second transmitter - wired in series on the same channel - can be loaded with a message tape. When the first transmission ceases, the second message tape will be automatically transmitted after its identifying code, (LTR) ZCZCABCDE (FIG.) 001 (LTR), has been transmitted. If desired, the entire message identification sequence can be omitted from the transmission by operation of the M.I.D. switch.

#### NOTE

The identifying code transmitted will differ with each message as follows:

(LTR) ZCZCABCDE (FIG.) 000 (LTR)  
 (LTR) ZCZCABCDE (FIG.) 001 (LTR)  
 through  
 (LTR) ZCZCABCDE (FIG.) 999 (LTR)

The three number sequence following (FIG.) increases by one for each transmitted message when the message identification switch is in the NO DELETE position.

#### (2) SIGNAL LINE CIRCUIT (Figure 4-18)

(a) OUT - GOING SIGNAL LINE - Marking and spacing battery are routed through the transmitter distributor mark or space contacts, and the distributor stop contact to the distant station's selector or signal line relay to ground. Arc suppressors are connected across the distributor contacts and the signal line. All signal leads are shielded.

#### (b) STEPPING SWITCH LEVELS D, E, F, G, AND H.

1. The distributor contacts (1, 2, 3, 4, and 5) are connected directly to the SW206 stepping switch's D, E, F, G, and H levels, respectively. Mark and space signal line battery are connected to these levels so as to conform to the following code sequence.

STEP	CODE
1	LTR (customer option)
2	Z
3	C
4	Z
5	C
6	A (customer option)
7	B (customer option)
8	C (customer option)
9	D (customer option)
10	E (customer option)
11	FIG.
12	1 (any number 0 to 9)
13	2 (any number 0 to 9)
14	3 (any number 0 to 9)
15	LTR

As noted, the 1st, 6th, 7th, 8th, 9th, and 10th position codes are reserved for customer options. The 1st, 6th, 7th, and 8th position codes must be wired to SW206 by the customer; however, the 9th and 10th codes are established by use of universal code cards (Figure 4-17) and associated shorting type connector switches (SW204 and 205). The code cards are visually separated with a mark and space battery side. If mark battery for a particular code is desired, the mark tine is broken off; conversely if space battery is desired, a space tine is broken off.

2. The 12th, 13th, and 14th positions of the stepping switch are connected to the swingers of three, five unit transfer type code reading contact assemblies operated by counter drums on the numbering assembly. These transfer the baudot code of the number counted to the code reading contact swingers (see paragraph 4-3.g.(3)(a)4.b.). The normally open and closed contacts of the contact assemblies are wired, respectively, to space and mark signal line battery.

3. Due to the above electrical connections, the distributor contacts have mark or space battery applied to them from the 1st to 15th position of the stepping switch. The distributor will then transmit each position sequentially to the distant station upon rotation of the distributor cam.

(c) MESSAGE TAPE TRANSMISSION - The five levels (D, E, F, G, and H) on the 16th position of the stepping switch are connected to the swingers of the transmitter distributor code reading contacts. As in the case of the counter assemblies, the transmitter distributor code reading contacts are connected to

marking and spacing signal line battery, respectively. If the transmitter distributor is transmitting, the baudot codes on the tape are transferred through a mechanical linkage to the code reading contact swingers. The resultant voltages are applied to the distributor contacts, from which they will be sequentially transmitted to the distant station.

### (3) CONTROL CIRCUIT (Figure 4-19)

#### (a) TANDEM TRANSMITTER OPERATION

##### 1. START OPERATION -

The message identification control circuit relays and transmitter distributor clutch magnets are all de-energized when the transmitter distributors are in the STOP position, and the stepping switch (SW206) wipers are in the home position. When the operator inserts a tape in the transmitting head of the UPPER transmitter distributor, and places the bat handle in the START position, the TAPE OUT and START contacts are closed. Plus (+) 48 volts DC is then connected through the K202 control relay via the TAPE OUT contacts, the K203 (7R-8R) normally closed contacts, CR202, the normally closed OFF-NORMAL contacts, the upper START contacts, and the K201 normally closed contacts (5T-6T) to ground. This energizes the K202 control relay, and connects +48 volts DC through the M203 stepping magnet to ground via the magnets normally closed INTERRUPTER contacts, the normally open K202 (1F-2F) and (3F-4F) contacts, and the energizing circuit for the K202 control relay as explained above. Energizing the M203 stepping magnet results in opening its own normally closed INTERRUPTER contacts, breaking its energizing circuit and stepping SW206 to the first position. This initial stepping action opens the normally closed OFF - NORMAL contacts and breaks the initial control relay energizing circuit.

2. POSITION 1 - The K202 control relay is held energized by two holding circuits. One holding circuit applies ground to the control relay via the TAPE OUT contacts, the normally closed K203 (7R-8R) contacts, and the normally open K202 (5R-6R) contacts. This circuit is used for sensing "tape out" during message transmission. The second holding circuit assures circuit continuity during the numbering cycle. Ground is applied to the control relay via the normally open K202 (3R-4R) contacts, CR204, the 1st through 7th positions on level B of SW206, and then directly via the 8th through 15th positions on SW206 (B level).

##### 3. POSITION 2 THROUGH 15

- When SW206 steps to the first position, +48

volts DC is applied to the UPPER transmitter distributor distributor clutch magnet via the A level of SW206 and the M.I.D. (message identification deletion) switch's normally closed contacts (3-4) to ground. This causes the distributor clutch magnet to energize, the distributor cam to rotate, and the five level code, (LTR) permanently wired to the D, E, F, G, and H levels of SW206 (refer to paragraph 4-3.g.(2)(b) 1.) to be transmitted to the distant station selector magnets or line relays. As the distributor cam rotates, its auxiliary "C" contact closes and allows the stepping relay to energize via the C level of SW206 and the normally closed M.I.D. (5-6) contacts. After transmission of the fifth pulse, the auxiliary "C" contact opens causing the stepping switch magnet to de-energize, and SW206 to step to the second position prior to the distributor arriving at the first pulse of the next stored code combination (Z). The above stepping - transmission - stepping action continues through the 15th position of SW206 to complete transmission of the 15 character message identification sequence (that is (LTR) ZCZCABCDE (FIG.) 123 (LTR).

#### 4. MESSAGE NUMBERING

a. When SW206 stepped to the first position, an energizing circuit was completed for the K204 relay. The relay, when energized, provides an energizing path for the counter magnets via the K204 normally open (1L-1R) contacts. The counter magnet pulls the armature extension feed pawl forward so that the feed pawl leaves its backstop and engages a tooth on the 1 unit counter drum ratchet. The counter magnets remain energized from the 2nd through 7th position. When SW206 steps to the 8th position, the K204 energizing circuit is broken and the counter magnets de-energize. As the armature returns to its de-energized position, its feed pawl feeds the 1 unit counter drum ratchet one tooth (one digit) and locks the ratchet into position. When the 1 unit counter drum has made a complete revolution and moves again into the 0 position, the 1 unit counter disk notch (at the base of the counter drum) engages its mating spur gear tooth resulting in rotation of the 10 unit counter drum to its next position. An identical feeding takes place on the 100 unit drum when the 10 unit drum moves to the 0 position. All drums may be reset by simply turning the counting drums knurled disk to the left.

#### CAUTION

When resetting numbers, always change drums in the following order: One, ten, and one hundred units.

b. One leaf spring detent lever keeps the counting drum positioned on the counter drum shaft. The drums cannot be turned to the right due to the jamming action of the spring detent arm against the drum and the detent post. Five transfer type code reading contacts ride on each counter drum camming surface. The peaks of the cams represent a spacing code, and the valleys a marking code. These upper and lower dwells (space and mark) correspond to the baudot code of the numerical figure showing on the front of the drum face. The code is transferred to the D, E, F, G, and H levels of the stepping switch (SW206) via the swingers on the transfer type code reading contacts. The 12th position of SW206 is connected to the 100 unit code reading contact swingers, and the 13th and 14th positions are connected to the 10 and 1 unit drums, respectively. The stepping switch, when arriving at the 12th, 13th, and 14th positions, connects the respective contact swingers to the distributor contacts for transmission on the signal line.

#### 5. MESSAGE TRANSMISSION (POSITION 16)

a. During transmission of the 15th character of the message identification sequence, the auxiliary "C" contact opens. This causes the stepping switch magnet to de-energize (refer to paragraph 4-3.g.(3)a.3.), and SW206 to step to its 16th (message) position. In this position, +48 volts DC is applied to the UPPER transmitter distributor READ clutch magnet via the A level of SW206, the K202 normally open (1R-2R) contacts, CR4, the UPPER transmitter distributor start contacts, and K201 (5T-6T) to ground. The READ clutch magnet, when energized, trips the sensing shaft clutch allowing the shaft to rotate, read and store the sensed character, and feed the message tape.

b. As the sensing shaft rotates, momentary closure of the auxiliary "B" contact results in energizing the UPPER distributor clutch magnet. The distributor shaft will then rotate, and transmit the stored code combination to the distant stations selector or line relay. The distributor contacts are connected to the reader storage contacts via the 16th step on levels D, E, F, G, and H of SW206 (refer to paragraph 4-3.g.(2)(c)).

c. At the end of the taped message transmission, the TAPE OUT contact will open and break the K202 control relay energizing circuit. De-energization of K202 results in disconnecting the READ clutch magnet circuit, and completing a stepping circuit for the stepping relay via the K202 (6F-7F) normally closed contacts, the UPPER and LOWER transmitter distributor auxiliary "A" contacts,

the normally closed K203 (6F-7F) contacts, the 16th position (C level) of SW206, and the auxiliary "C" contacts. The reader auxiliary "A" contacts close as the sensing shaft comes to rest, after which the auxiliary "C" contacts close and energize the stepping magnet. As the distributor shaft comes to rest, the auxiliary "C" contact opens, the stepping magnet de-energizes, and SW206 steps to the 17th position.

#### 6. HOMING

a. When SW206 steps to the 17th position, a homing or zeroing circuit is completed. Plus (+) 48 volts DC is applied through the stepping switch relay (M203), its normally closed INTERRUPTER contacts, the normally closed M.I.D. (8-9) contacts, positions 17 and 18 (B level) of SW206, through the normally closed K201 (5B-6B) contacts, the 19th through 23rd steps of SW206, CR206, and 24th and 25th steps of SW206 to ground. SW206 automatically steps to the home or zero position through operation of the INTERRUPTER contacts.

b. When SW206 steps to the home (26th) position, the OFF-NORMAL contacts close and prepare the control circuit for numbering and transmission of another message. If the LOWER transmitter distributor has been loaded with a message tape (start lever in START position) prior to the end of transmission of the UPPER transmitter distributor message tape, the control circuit will automatically send out a new message identification sequence and allow transmission of the message. Tandem operation of the UPPER and LOWER transmitter distributors will continue as long as the transmitters are loaded with message tapes, and their start levers are placed in the START position. Only one message identification module is required to control operation of two transmitter distributors in tandem.

#### (b) MESSAGE IDENTIFICATION DELETION

##### CAUTION

To delete the message identification sequence, the operator must place the M.I.D. switch in the DELETE position before loading the desired transmitter distributor with tape. The M.I.D. switch should NOT be operated while the stepping switch is in the process of identifying a message.

#### 1. IDENTIFICATION DELETION SEQUENCE AND MESSAGE TRANSMISSION

a. Loading a message tape in a transmitter distributor and placing the start lever in the START position, will energize the associated control relay as described in paragraph 4-3.g.(3)(a)1. When the operator places the M.I.D. switch in the DELETE position, a continuous stepping circuit to the 16th (message) position of SW206 is completed. Plus (+) 48 volts DC is routed through the M203 stepping magnet, its normally closed SELF INTERRUPTER contacts, the normally open M.I.D. (7-8) contacts, the 1st through 15th steps of SW206 (C level), the normally open M.I.D. (10-11) contacts, through CR208 and CR209 (depending upon which transmitter distributor is loaded), and the K202 (5R-6R) or K203 (5R-6R) contacts to ground. Operation of the INTERRUPTER contacts steps SW206 to position 16.

b. During the above stepping sequence, the distributor magnet energizing circuit (via level A of SW206, positions 1 through 14) and the counter magnet energizing circuit are broken, respectively, by contacts (3-4) and (1-2) of the M.I.D. switch. Also, the zeroing (homing) circuit from the 16th position (level C) is broken by contacts (8-9) of the M.I.D. switch. This assures that the next message is not transmitted without identification, should the M.I.D. switch be left in the DELETE position after message transmission.

c. Normal operation of the transmitter distributor is then initiated as described in paragraph 4-3.g.(3)(a)5.a. and b.

#### NOTE

The M.I.D. switch may be returned to its normal position when the transmitter distributor begins to read the message tape.

2. HOMING - When "tape-out" occurs, the ground circuit on the C level of SW206 is broken due to K202 or K203 de-energizing (depending upon which transmitter distributor is in operation). This re-establishes the stepping circuit combination of the auxiliary "A" contacts and auxiliary "C" contacts (see paragraph 4-3.g.(3)(a)5.c.), allowing SW206 to step to the 17th position. If the M.I.D. switch is left in the DELETE position, the zeroing (homing) circuit (see paragraph 4-3.g.(3)(a)6.) is broken and will not operate until the switch is returned to its normal position.

#### (4) ABNORMAL TRAFFIC

(a) GENERAL - In this equipment, circuitry is provided which allows an operator at some remote location to "seize" one or more signal lines for transmission of ABNORMAL

TRAFFIC. The message identification module may be conditioned to either transmit or not transmit a message identification sequence, from the remote location. An amber ABNORMAL TRAFFIC warning lamp is provided at the transmitting group to warn the operator that a particular transmitter distributor is locked out or "seized".

#### (b) LINE SEIZURE OPERATION WITH MESSAGE IDENTIFICATION

1. LINE SEIZURE - While a message tape is in process of transmission, an operator at a remote location may place the line seizure NUMBER - NO NUMBER switch in the NUMBER position. This prepares the K201 line seizure relay energizing circuit for operation. Plus (+) 48 volts DC is applied through the K201 coil, the normally open contact at the remote control area (furnished by customer), CR210, and the 26th (home), 25th, and 24th positions (B level) of SW206 (via CR205). Note that the circuit is not completed to ground, and will not be, until SW206 steps to "home" after message "tape-out" occurs. The blocking action of CR206 prevents K201 from energizing before the 24th position.

#### 2. MESSAGE IDENTIFICATION TRANSMISSION

a. POSITIONS 1 THROUGH 15 - When "tape-out" occurs, and SW206 steps to "home", K201 will energize during positions 24, 25, and 26 (home). The normally closed contacts (5T-6T) of K201 will open, breaking the energizing circuits to the K202 and K203 control relays to prevent transmission of a new message tape. Since completion of the original energizing circuit to the stepping relay (M203) is dependent upon energization of either K202 or K203 (refer to paragraph 4-3.g.(3)(a)1.), another energizing circuit must be provided for ABNORMAL TRAFFIC operation. Plus (+) 48 volts DC is applied through M203, the SELF INTERRUPTING contacts, the normally closed M.I.D. (8-9) contacts, the normally open K201 (3T-4T) contacts, the normally open NUMBER switch, and the "home" position on the B level of SW206 to ground. This circuit will cause SW206 to step to position 1 and perform the normal message identification sequence operation. To assure circuit continuity during the numbering sequence, relay K201 is held operated by its own normally open (3B-4B) contacts, and the 1st through 15th position of SW206 (B level).

b. POSITIONS 16 THROUGH 19 - When SW206 steps to the 16th position, a stepping circuit is completed to M203 via the SELF INTERRUPTING contacts, the normally closed M.I.D. (8-9) contacts (to positions 17

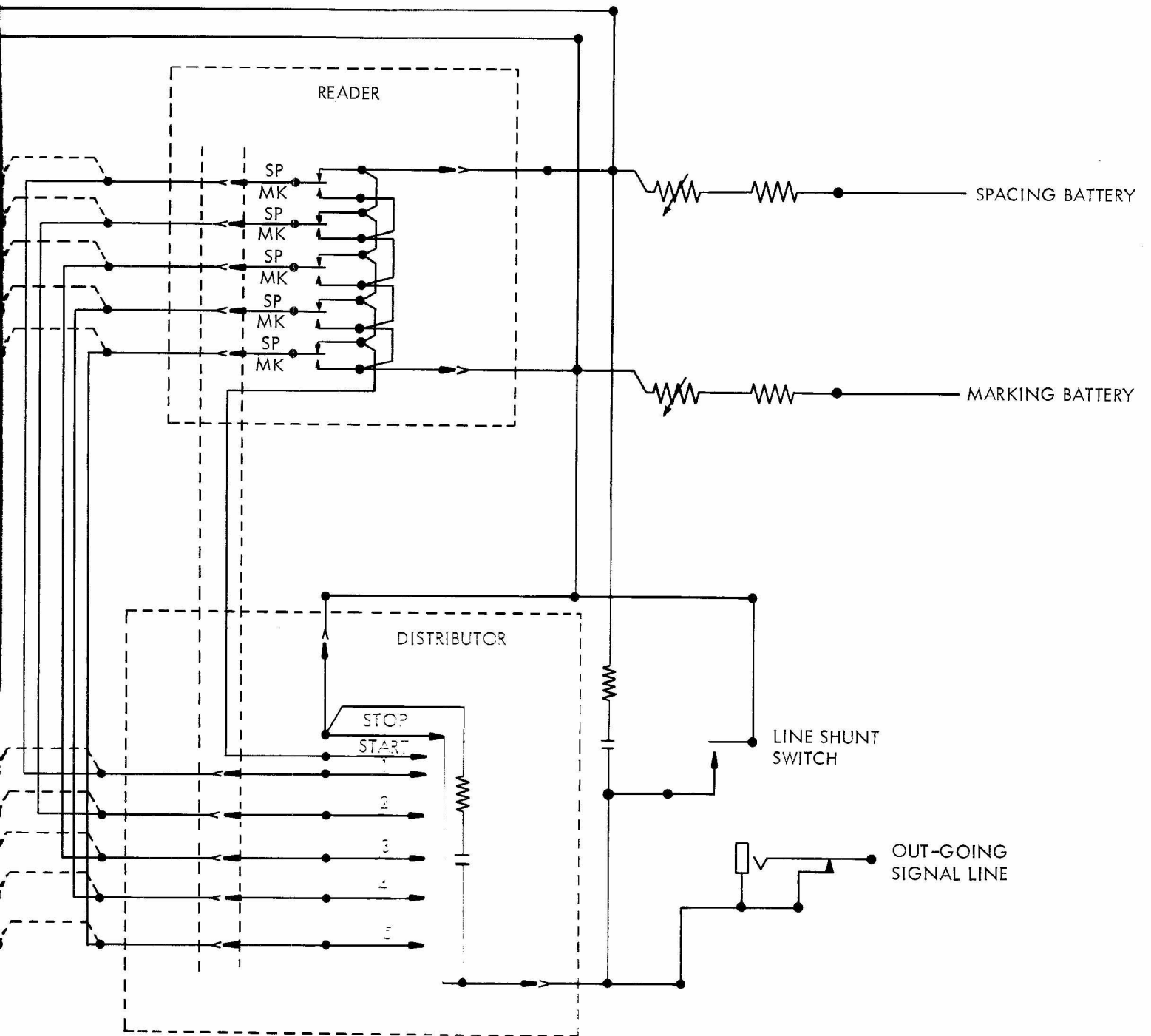
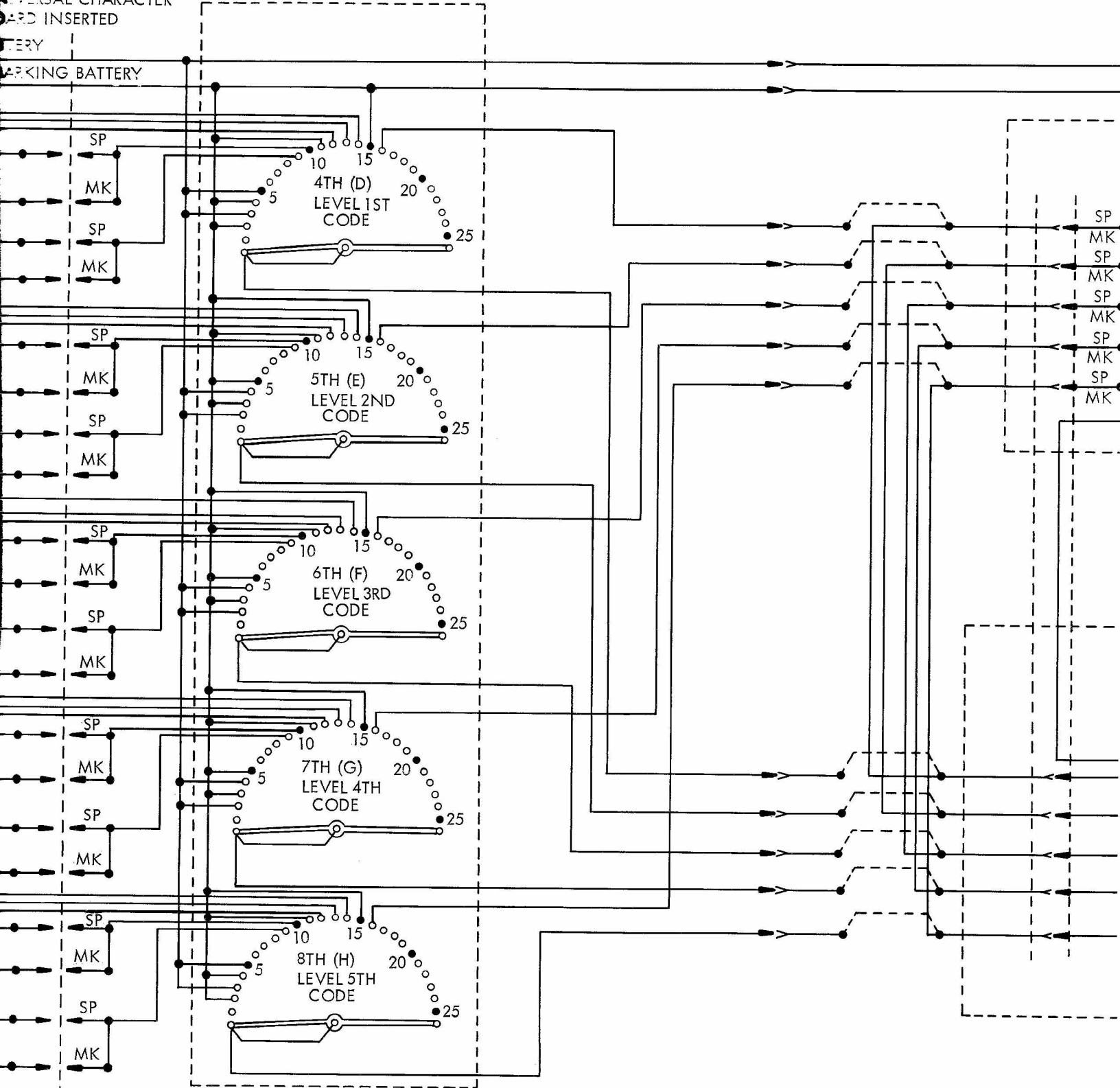


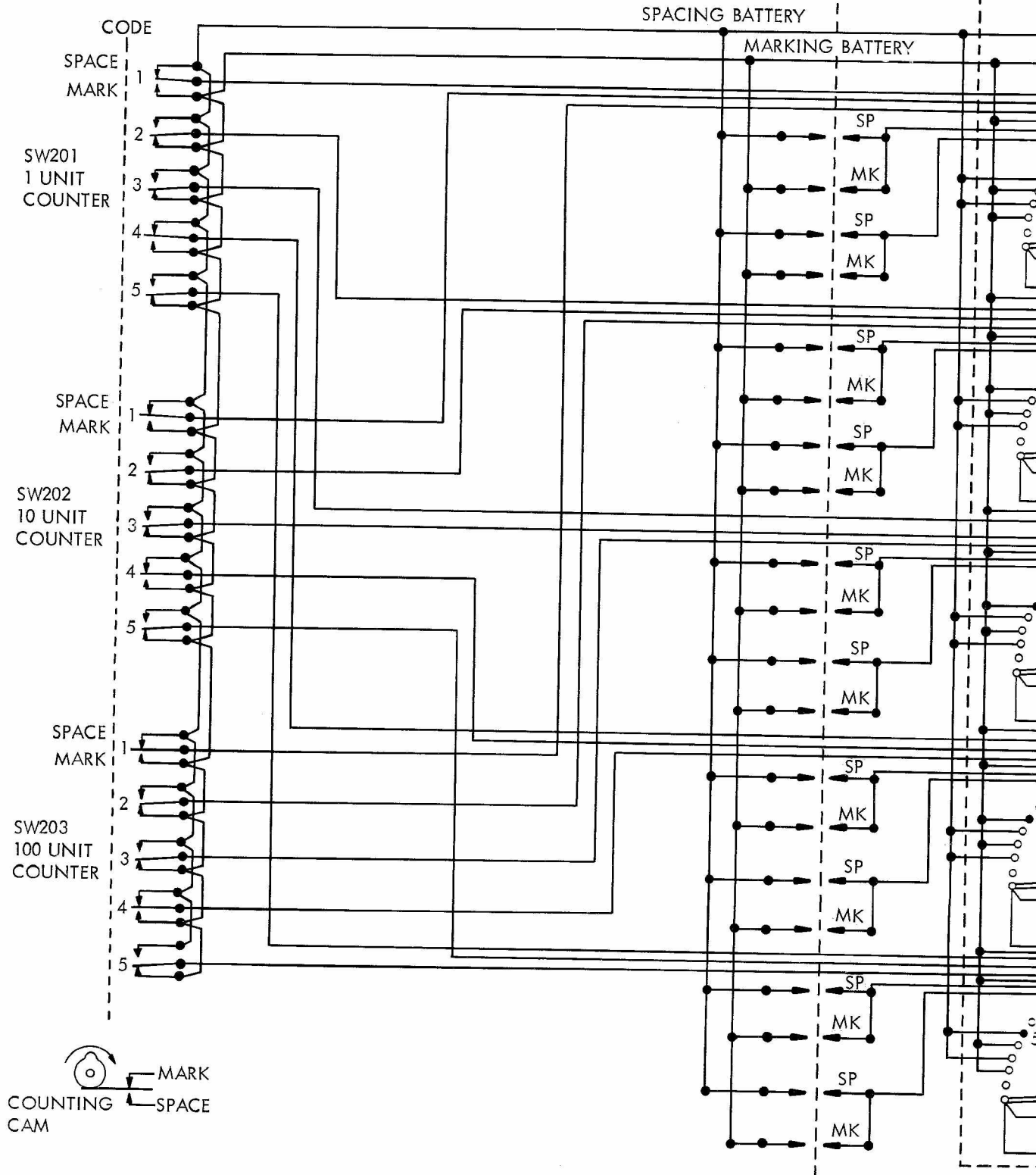
Figure 4-16. Transmitter Group Simplified Control System Schematic Wiring Diagram

204 AND SW205  
CAN WITH  
UNIVERSAL CHARACTER  
CARD INSERTED  
BATTERY  
MARKING BATTERY

SW206



SW204 AND SW205  
SHOWN WITH  
UNIVERSAL CHARACTER  
BOARD INSERTED



NOTES

1	SP - SPACE MK - MARK
2	FOR ACTUAL SCHEMATIC DRAWING, SEE APPROPRIATE WIRING DIAGRAM IN VOLUME 2 OF THIS MANUAL

SPAC  
MAR

SW201  
1 UNIT  
COUNTER

SPAC  
MAR

SW202  
10 UNIT  
COUNTER

SPACE  
MARK

SW203  
100 UNIT  
COUNTER

  
COUNTIN  
CAM



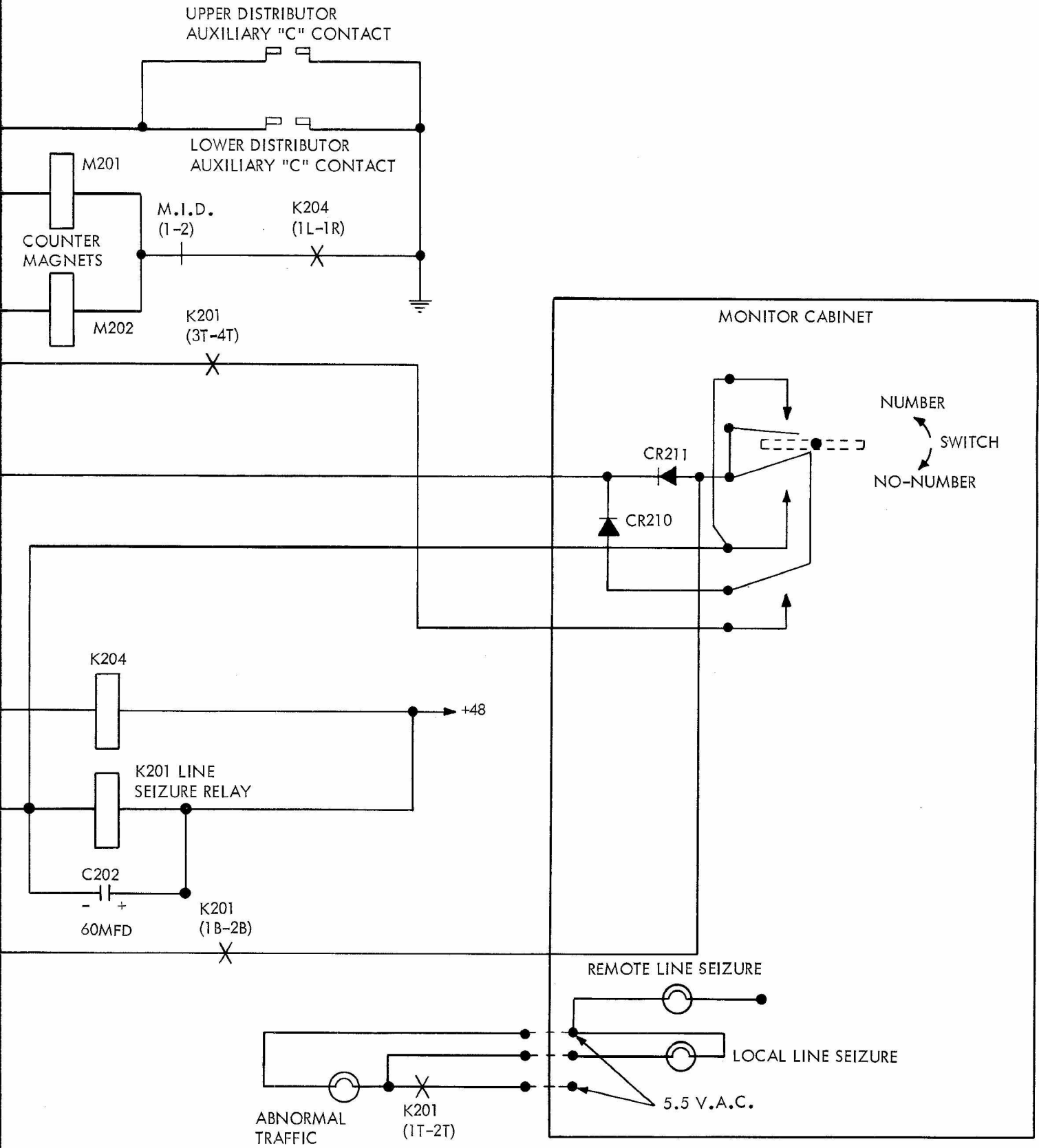
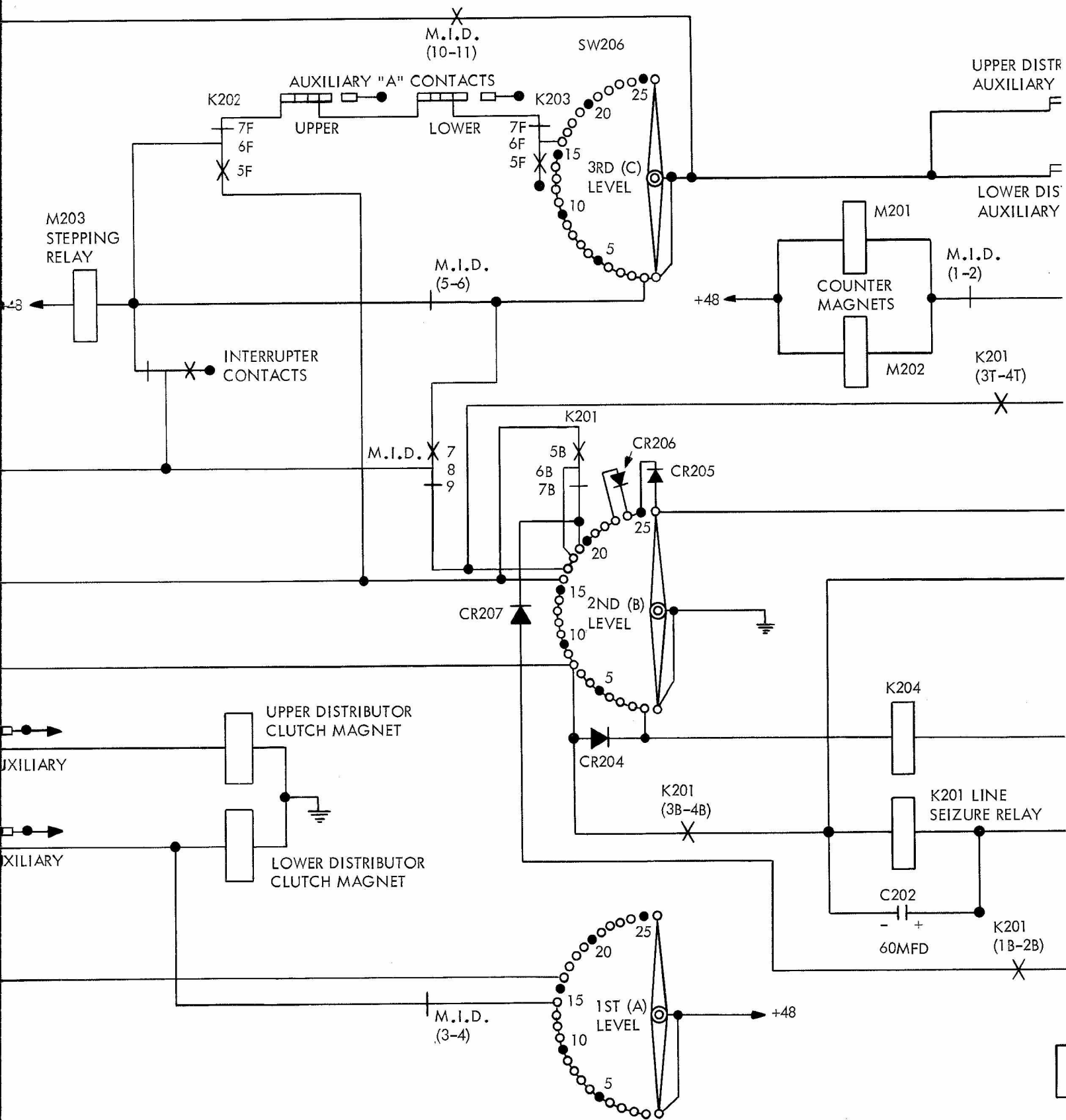
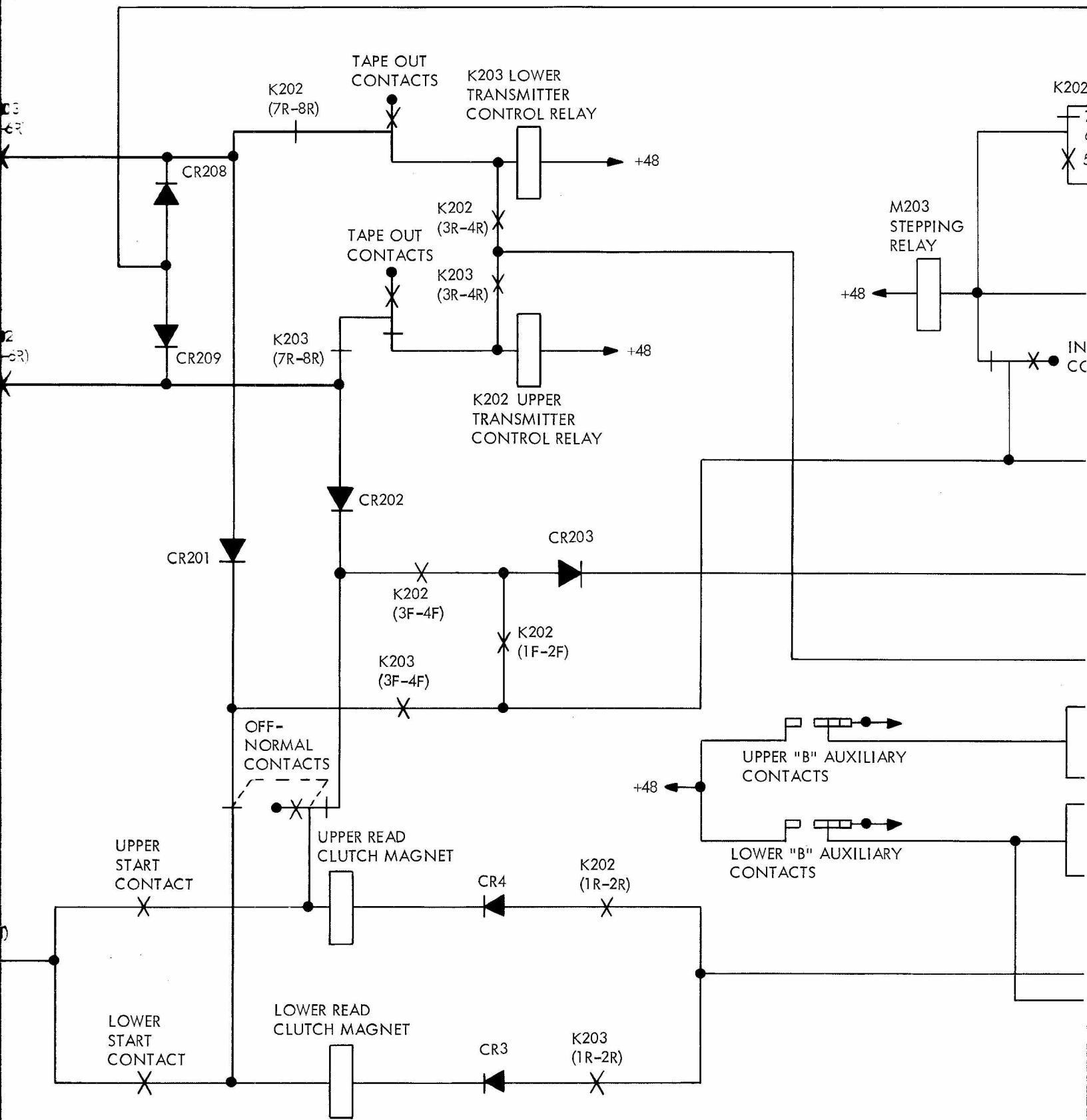


Figure 4-19. Transmitter Group Simplified Control System Schematic Wiring Diagram

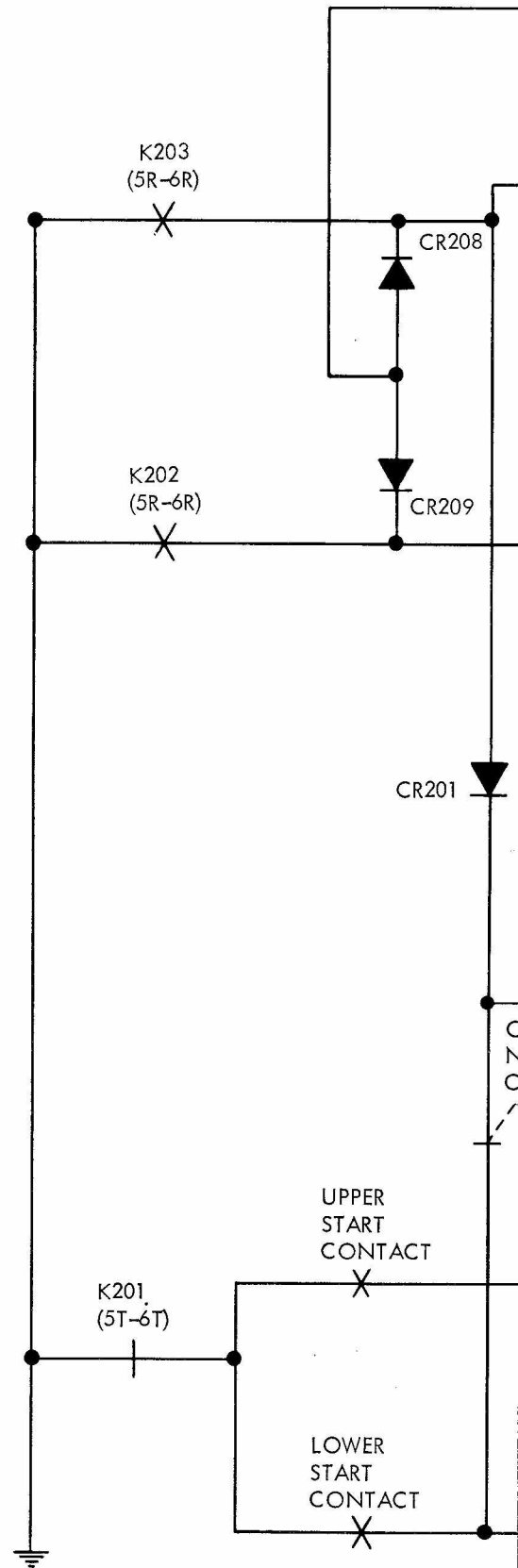


AB  
TR.

OR.



NOTES	
1.	⊕ NORMALLY CLOSED CONTACT
2.	⊗ NORMALLY OPEN CONTACT
3.	⊕ ⊗ — TRANSFER CONTACT
4.	ALL COMPONENTS SHOWN IN THEIR NORMAL POSITION WHEN SENDING APPARATUS IS IN IDLE, STOP, OR HOME POSITION.
5.	R - REAR CONTACTS F - FRONT CONTACTS T - TOP CONTACTS B - BOTTOM CONTACTS
6.	FOR ACTUAL SCHEMATIC SEE APPROPRIATE WIRING DIAGRAM IN VOLUME 2 OF THIS MANUAL
7.	FOR STRAPPING CHANGES TO CONVERT FROM TANDEM TO SINGLE TRANSMITTER OPERATION, SEE ACTUAL SCHEMATIC WIRING DIAGRAM.



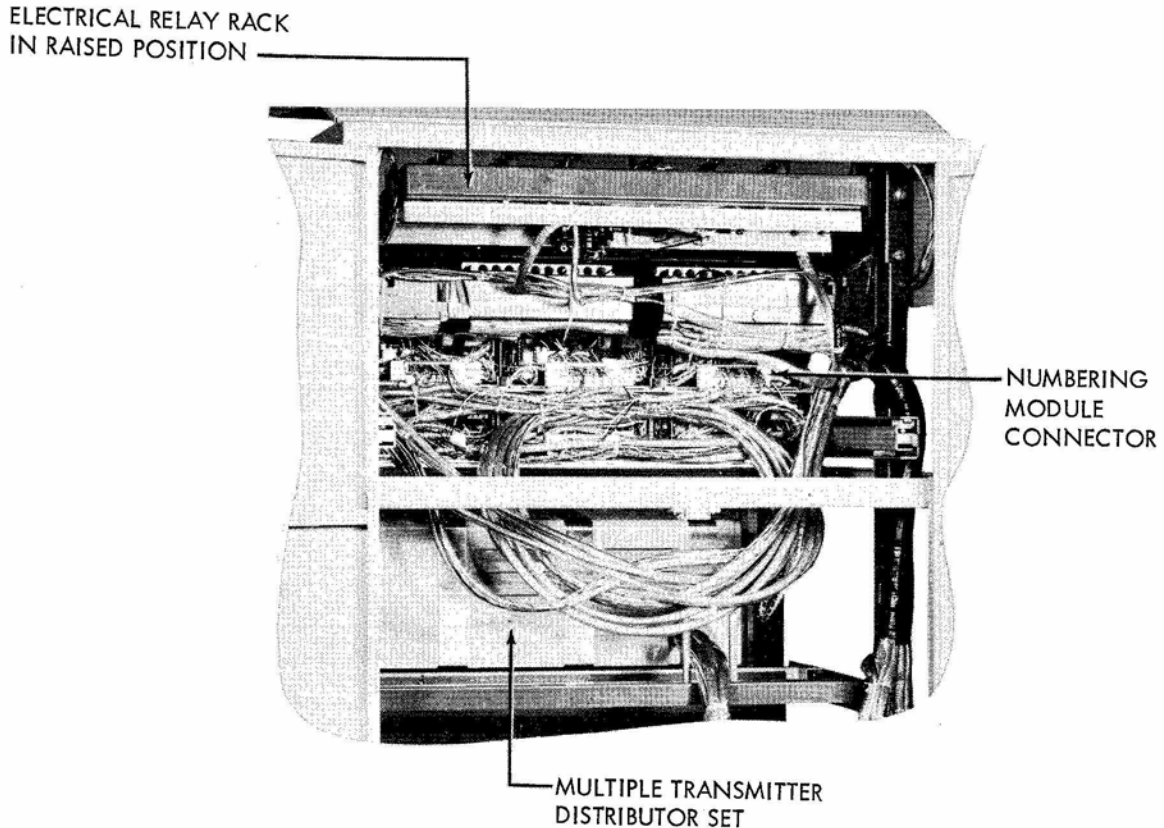


Figure 4-20. Model 28 Transmitter Group (Rear Doors Open)

and 18, B level of SW206), and the normally open K201 (5B-6B) contacts (to position 16, level B of SW206 to ground. The stepping switch (SW206) will continue to step, and stop at position No. 19 (contacts K201 (6B-7B) open. During the 16th, 17th, and 18th steps, K201 is held energized by the discharge of C202. When SW206 is in the 19th position, K201 is held energized via the normally open remote switch, the normally open K201 (1B-2B) contacts, and CR207 to ground.

c. **END OF TRANSMISSION** - After completion of the **ABNORMAL TRAFFIC** transmission, the operator at the remote location returns the line seizure switch to its mid position. This will break the K201 relay energizing circuit, allowing the stepping switch (SW206) to step to the "home" position. When SW206 reaches the "home" position, the control circuit will be conditioned to operate in the normal (tandem or single transmission) mode.

(c) **LINE SEIZURE OPERATION WITHOUT MESSAGE IDENTIFICATION** - While ORIGINAL

a message tape is in process of transmission, an operator may place the line seizure **NUMBER - NO NUMBER** switch to the **NO NUMBER** position. Plus (+) 48 volts DC is applied through the K201 line seizure relay, the normally open line seizure switch, CR210, and the home position of SW206 (B level) to ground, energizing K201. As explained in paragraph 4-3.g.(4)(b)2.a, the energizing circuits for the K202 and K203 control relays are broken. Since the message identification sequence is not required, no energizing circuit is completed to the M203 stepping relay.

(5) **SINGLE TRANSMITTER OPERATION** - The transmitter group cabinet can readily be converted from tandem transmitter operation (three signal channels) to single transmitter operation (six signal channels) with only simple strapping changes (refer to the applicable wiring diagram in Volume 2 of this manual). Operation of a transmitter distributor and numbering module wired for single transmitter operation is identical to the operation of one transmitter distributor wired in a tandem circuit (refer to paragraph 4-3.g.(3).

#### 4-4. MODEL 28 TYPING REPERFORATOR MONITOR GROUP (Figure 1-9)

a. **GENERAL** - The Model 28 Typing Reperforator Monitor Group consists of six typing reperforators and two motor units (synchronous or governed) mounted on two multiple typing reperforator bases (three reperforators and one motor on each base). Two multiple tape winder sets, mounted below the typing reperforator sets, serve to wind and store the tape punched by the reperforators. Either fully perforated or chadless tape may be prepared by the typing reperforators, depending on the unit used. In both cases, the monitored message is also typed by the reperforator along the length of the tape. The above units mount in a Model 28 Universal Cabinet which provides wiring and electrical control facilities for operation of the sets. The typing reperforators may be operated at various speeds (See Table 4-1) depending on the gear set used.

#### b. TYPING REPERFORATOR OPERATION (Figures 1-24, 1-25 and Figures 1-34, 1-35)

##### (1) GENERAL

(a) The typing reperforator, which mounts on a multiple base, operates from a sprocket and belt arrangement on the cross shaft, and is driven by an intermediate gear and a pinion on the motor unit. AC power is fed to the motor unit through a power switch located on the base.

(b) Two types of reperforators are available for use in a group depending on customer requirements - a fully perforated unit, and a chadless unit with an automatic "letters" tape feed-out mechanism. Operating theory for the units is almost identical.

##### (2) SUMMARY OF OPERATION

(a) The typing reperforator operates in response to a line signal. The signaling code combinations are applied to the selecting mechanism through a line relay located in the cabinet. The start pulse of each code combination causes the selector magnet armature to trip the selecting cam-clutch. Driven by the main shaft, the cam-clutch begins its cycle and imparts timed motion to the selector, which converts the code combinations into corresponding mechanical arrangements. Near the end of each selecting cycle, the selecting cam-clutch trips the function cam-clutch and permits the punch slides of the reperforator to receive the arrangements from the selector. The selecting cam-clutch is then disengaged by the stop pulse of the code and remains inoperative until the next start pulse is received.

(b) The punch slides distribute intelligence from the selector in the form of mechanical arrangements to the punch block and transfer mechanism. The transfer mechanism, in turn, carries the information to the function box and the axial and rotary positioning mechanisms. At the receipt of the letters or figures code combination, the function box causes the rotary mechanism to shift the type wheel so that the proper characters are selected. The ribbon feed mechanism supplies the ink, and the printing mechanism provides the impact to print the selected characters.

(c) The reperforator main bail assembly, driven by the rocker bail, imparts motion to the tape feed parts which advance the tape and position the punch slides. The punch slides, having received the intelligence from the selector, cause pins in the punch block to perforate combinations of holes corresponding to the code combinations.

### (3) SELECTING MECHANISM

(a) The selecting mechanism consists of the selector magnet coil and armature, a selector cam-clutch, and the associated levers, arms, bails, and slides necessary to convert the electrical elements of the start-stop code to the mechanical arrangements which govern the characters to be printed and the functions to be performed.

(b) The selector cam-clutch comprises, from right to left (Figure 4-21): the clutch, stop arm bail cam, the fifth, fourth, and third selector lever cams, the cam for the spacing and marking lock levers, the second and first selector lever cams, the push lever reset bail cam, and the function clutch trip cam.

(c) During the time in which a closed line circuit (marking) condition exists, the selector magnet coils are energized and hold the selector armature against the selector magnet pole pieces. In this stop position, the selector armature blocks the start lever (Figure 4-22). When the signal for any character or function is being received, the start (spacing) element releases the selector armature which, under the tension of its spring, moves away from the magnet cores and unlatches the start lever. The start lever turns clockwise under the tension of its spring, and moves the stop arm bail into the indent of its cam. As the stop arm bail rotates about its pivot point, the attached stop arm is moved out of engagement with the clutch shoe lever. The selector cam-clutch engages and begins to rotate. The stop arm bail immediately rides to the high point of its cam and holds the start lever away from the selector armature

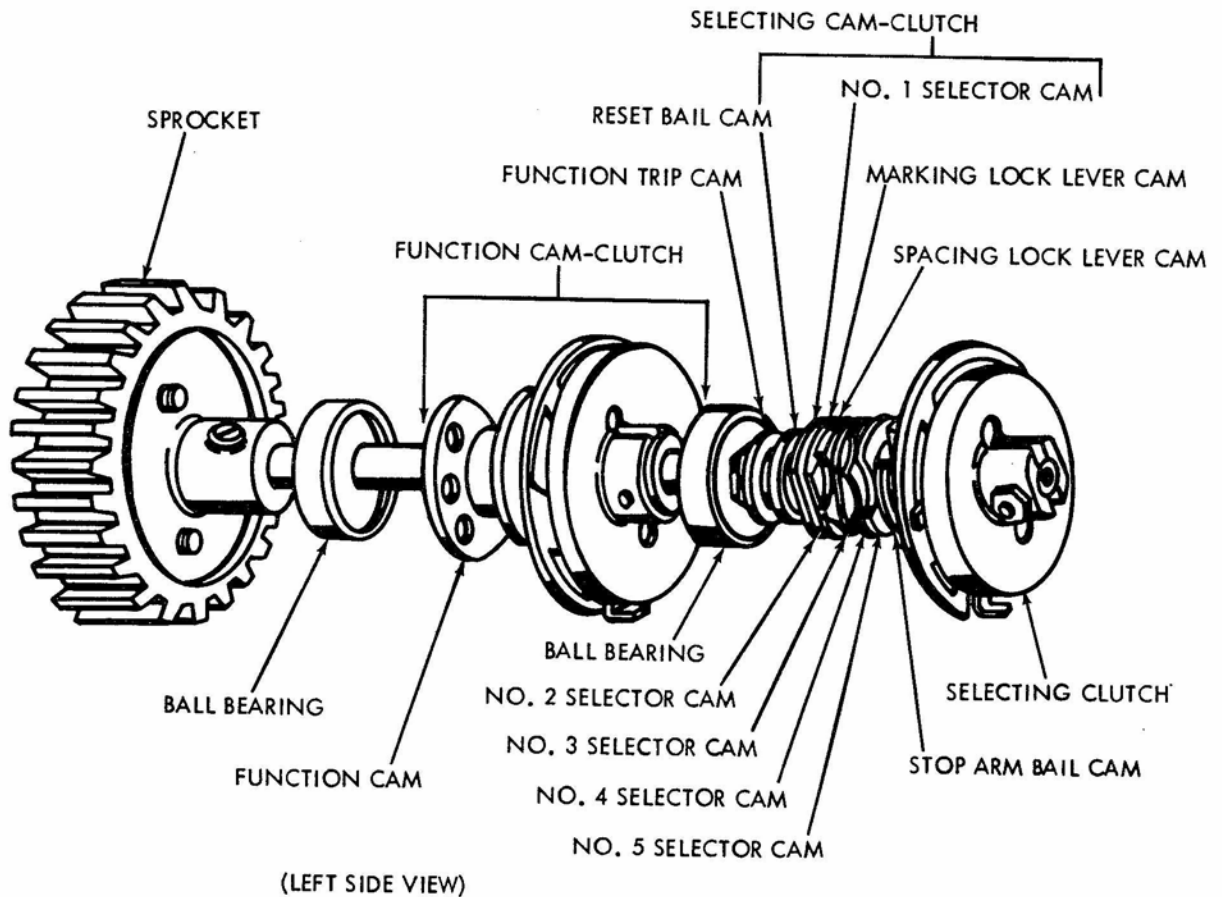


Figure 4-21. Typing Reperforator Main Shaft

during the signaling time. When the stop element at the end of signal is received, the selector armature is pulled up to block the start lever. Thus, the stop arm bail is prevented from dropping onto the low part of its cam (stop position of cam-clutch), and the attached stop arm is held so as to stop the clutch shoe lever. The selector clutch one-stop cam disk, upon which the latch lever rides, has an indent at its stop position. When the clutch shoe lever strikes the stop arm, the inertia of the cam disk assembly causes it to continue to turn until its lug makes contact with the lug on the clutch shoe lever. At this point, the latch lever drops into the indent in the cam disk, and the clutch is held disengaged until the next start element is received.

(d) The series of five selecting levers, a marking lock lever, and a spacing lock lever ride their respective cams on the selector cam-clutch. As the marking and spacing signal elements are applied to the selector magnet, the selector cam-clutch rotates and actuates the

selector levers. When a spacing impulse is received, the marking lock lever is blocked by the end of the armature and the spacing lock lever swings toward the right (right end view) above the armature and locks it in the spacing position until the next signal transition is due. Extensions on the marking lock lever prevent the selector levers from following their cams (Figure 4-23). When a marking element of the signal is received, the spacing lock lever is blocked by the end of the armature and the marking lock lever swings to the right below the armature to lock it in the marking position until the next signal transition is due. During this marking condition, the selector levers are not blocked by the marking lock lever extensions but are permitted to move against their respective cams. The selecting lever that is opposite the indent in its cam, while the armature maintains a marking condition, swings to the right or selected position momentarily. Each selecting lever has an associated push lever which drops into a notch on the top of the selecting lever when it falls into

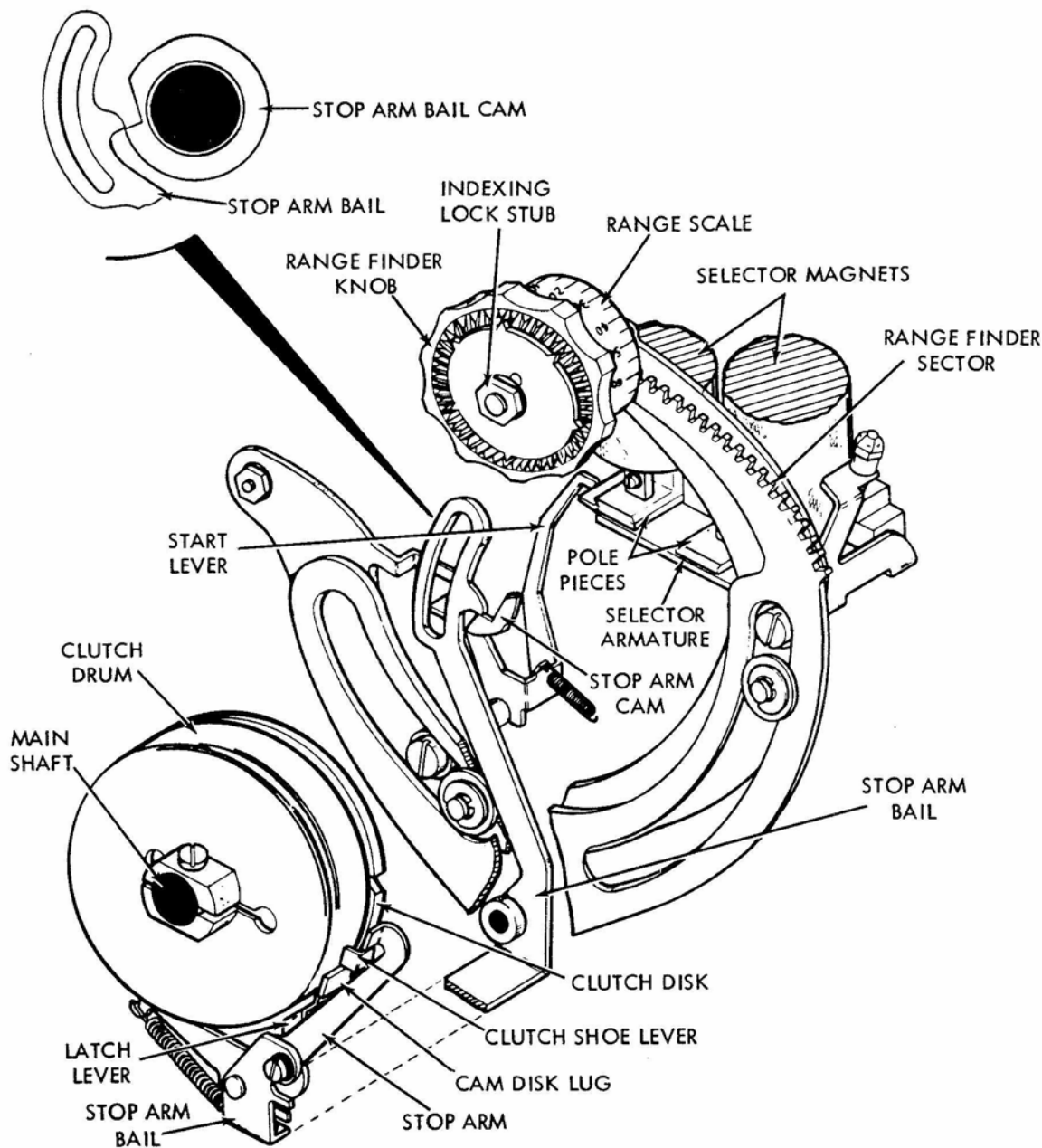


Figure 4-22. Range Finder and Selector Cam-Clutch Assembly

its cam indent. As the selector cam-clutch turns, each selecting lever together with its latched push lever is moved toward the left and held there until all five code impulses have been received. The selected push levers, in moving to the left, rotate associated punch slide latches counterclockwise (Figure 4-23). Just before the fifth push lever is selected, the selecting cam, through the function trip assembly, causes the reperforator 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 (paragraph 4-4.b.(8)(b)2). The latches, under spring tension, return to their unselected position when the selected push levers are repositioned at the beginning of the next cycle.



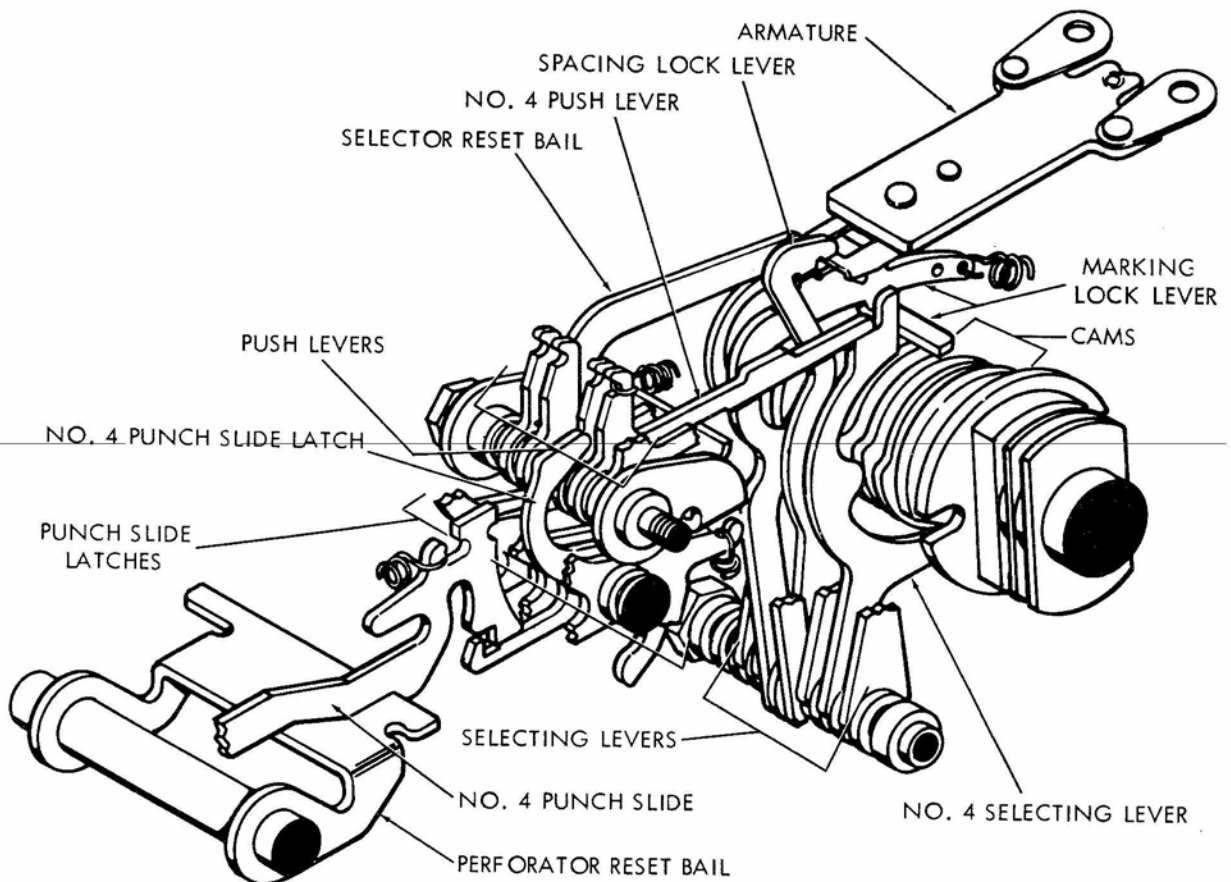


Figure 4-23. Selecting Mechanism

**(4) ORIENTATION**

(a) For optimum performance, the selecting mechanism should be adjusted to sample the signaling code elements at the most favorable time. To determine this adjustment, the operating margins are established through the range finder, which provides a means of varying the time of sampling.

(b) When the range finder knob (Figure 4-22) is pushed inward and rotated, its attached range gear moves the range finder sector (which mounts the stop arm bail, stop arm and latch lever), either clockwise or counterclockwise about the selector cam-clutch. This changes the angular position at which the selector cam-clutch stops with respect to the selecting levers. When an optimum setting is obtained, the range finder knob is released. Its inner teeth engage the teeth of the indexing lock stud to lock the range finder mechanism in posi-

tion. The setting may be read on the range scale opposite the fixed index mark.

**(5) MOTION FOR TYPING AND PERFORATING**

(a) **GENERAL** - The main shaft rotates at a constant speed in a fixed gear ratio which will accommodate an input at various operating speeds (see Table 4-1). The motion is distributed to the mechanisms concerned with typing and perforation by the function mechanism, which is comprised of a cam-clutch, a clutch trip assembly (Figure 4-24), and a rocker bail (Figure 4-25).

**(b) FUNCTION CAM-CLUTCH AND CLUTCH TRIP ASSEMBLY**

1. The main trip lever is rotated counterclockwise by the selector cam

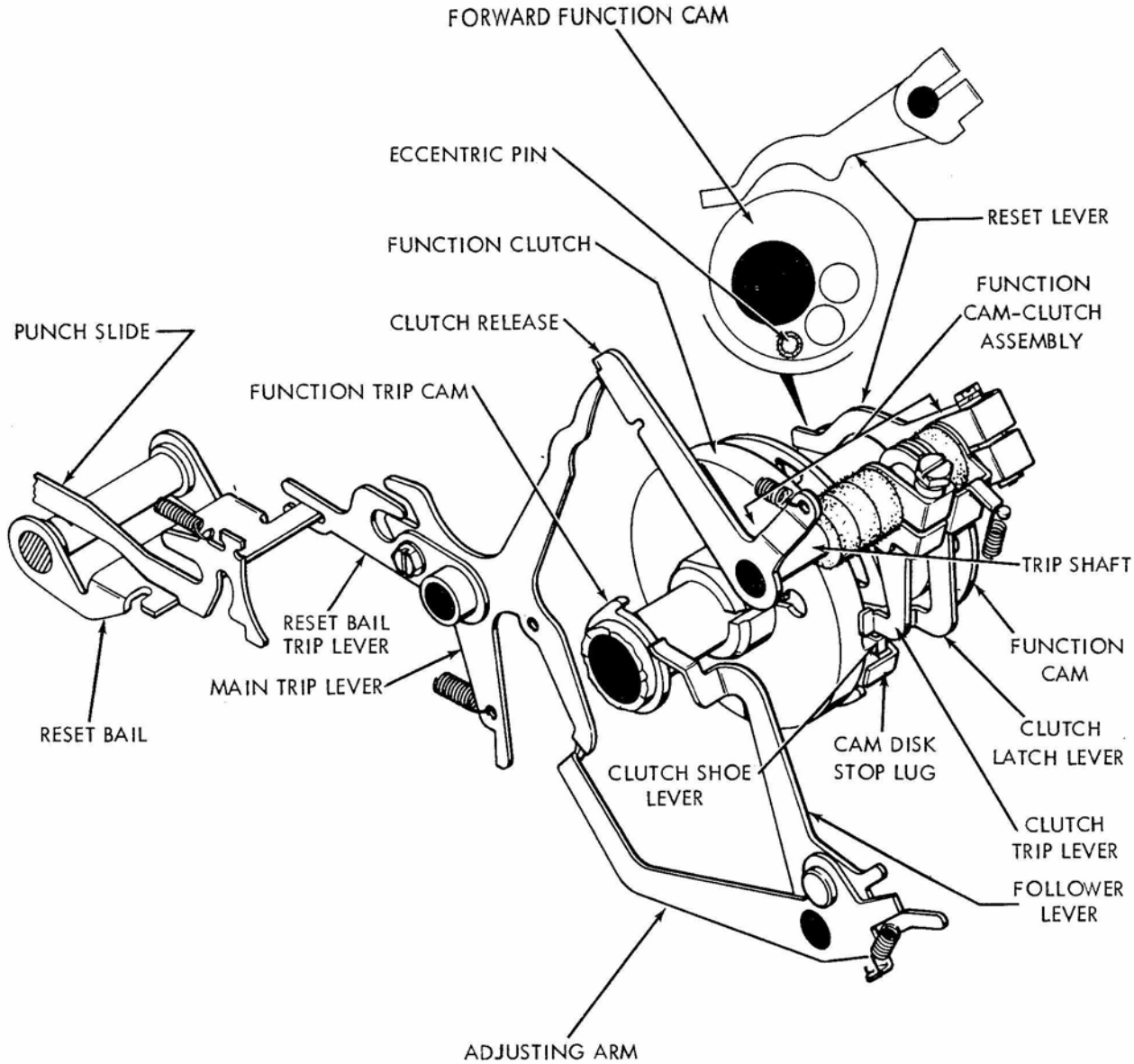


Figure 4-24. Typing Reperforator Function Cam-Clutch and Clutch Trip Assembly

clutch when the function trip cam raises the follower lever near the end of the selecting cycle. Immediately, the lower part of the function trip cam allows the follower lever to return to its unoperated position, and the main trip lever is free to move under the clutch release when the trip shaft raises the release. A reset bail trip lever attached to the main trip lever lowers the reperforator reset bail and releases the punch slides. An upper arm of the main trip lever moves out of the way of the clutch release, which falls against a downstop and rotates a trip shaft counterclockwise. Immediately the trip lever latch allows the main trip lever to return toward its unoperated position, the upper arm moving

down against the clutch release. When the trip shaft is rotated by the release, it moves the clutch trip lever out of engagement with the clutch shoe lever. The clutch engages to begin the function cycle.

2. About midway through the function cycle, an eccentric pin on the function cam lifts a reset arm, which rotates the trip shaft clockwise. The clutch release is moved upward, allowing the main trip lever to rotate fully clockwise, raising the reset bail. The eccentric pin then moves out from under the reset arm, and the clutch release is permitted to return to its unoperated position against the main

trip lever. When the cam-clutch assembly completes its cycle, the clutch shoe lever strikes the trip lever, and the clutch is disengaged.

(c) **THE ROCKER BAIL ASSEMBLY** (Figure 4-25) - The rocker bail distributes motion received from the function cam-clutch to the following:

1. Perforator mechanism.
2. Function Box mechanism.
3. Push bars of the axial and rotary positioning mechanisms.
4. Oscillating assembly.
5. Corrector mechanism.
6. Printing mechanism.
7. Ribbon feed mechanism.

The bail is shown in its home position. Each function cycle, the function cams bear against rollers and cause the bail to rock to the left (as viewed from the front of Figure 4-25) during the first part of the cycle and then back to the home position during the latter part of the cycle.

(6) **TRANSFER** (See Figure 4-26) - Near the end of each selecting cycle, the transfer mechanism moves the input intelligence in the form of a mechanical arrangement from the punch slides to the function box and positioning mechanisms. Included in the mechanism are five linkages, each of which is associated with a punch slide. A linkage consists of a transfer lever, a pulse beam, and a bell crank. Since the linkages are similar, the No. 4 linkage is shown in its entirety in Figure 4-26, and is typical.

(a) The linkages associated with the unselected punch slides remain in their unselected position as shown in Figure 4-23. However, the selected slides, in moving to the left,

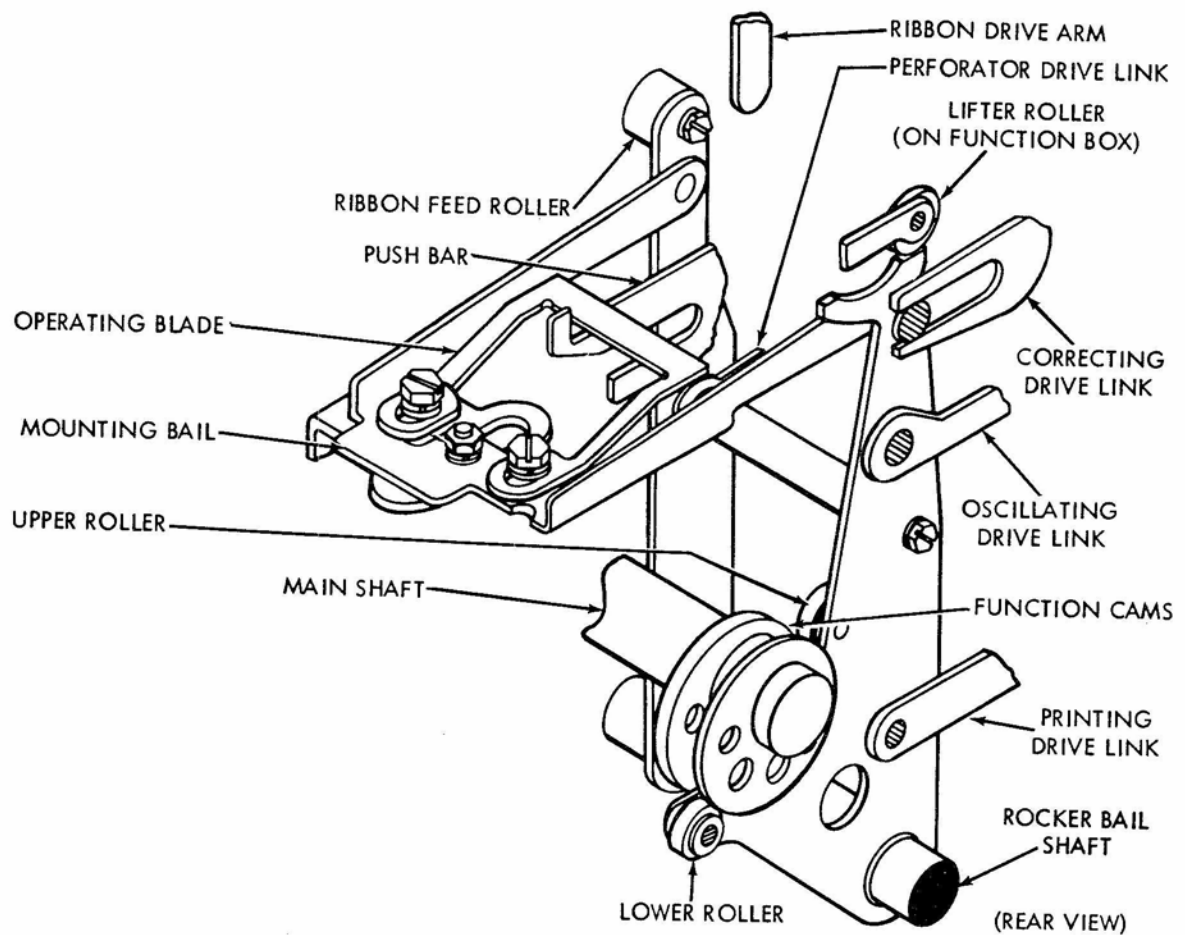


Figure 4-25. Rocker Bail Assembly

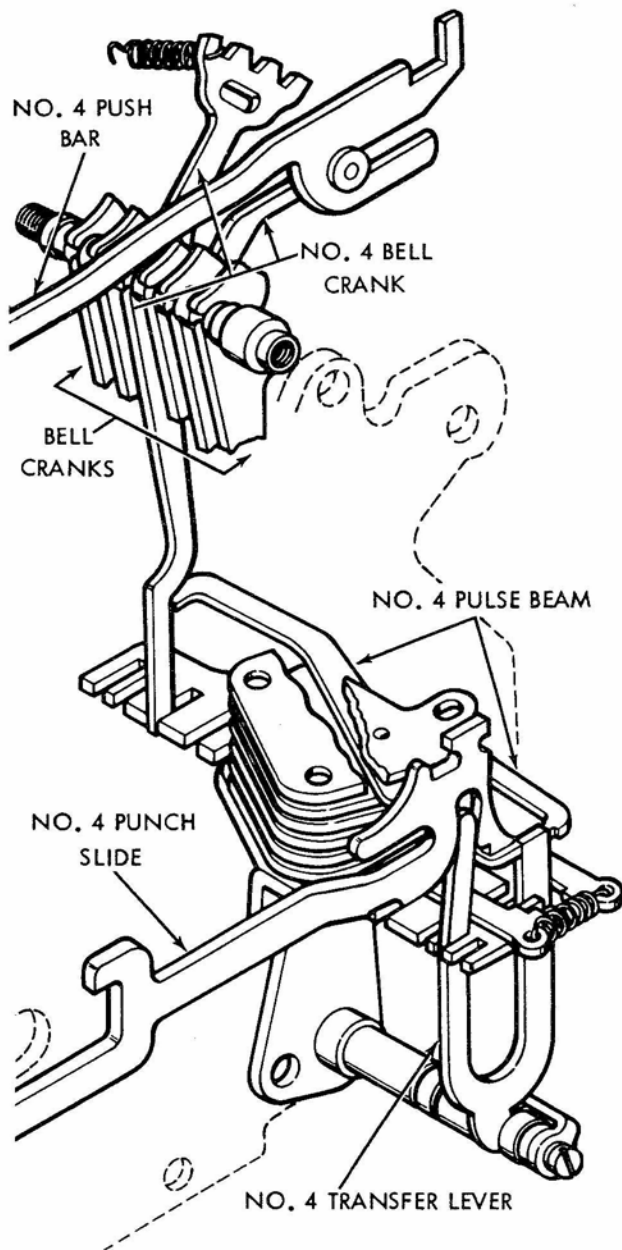


Figure 4-26. Transfer Mechanism

pivot the associated transfer levers, which in turn move corresponding pulse beams clockwise (as viewed from above). The selected beams allow associated bell cranks, under spring tension, to pivot counterclockwise and lift attached push bars. The push bars control the positioning mechanism. 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 positions.

(b) Slotted upper arms of the bell cranks extend up into the function box, but are not operative in the typing reperforator. An additional bell crank, not associated with a transfer linkage, is specifically concerned with the letters-figures shift.

#### (7) SELECTOR AND FUNCTION CLUTCH OPERATION

(a) When the selector clutch stop arm or the function clutch trip lever is tripped, the clutch shoes engage a serrated surface on the inside of the clutch drum. Since the clutch shoes are mounted on a plate that is part of the cam assembly (selector or function cam), the cam rotates upon engagement of the clutch.

(b) Figure 4-27 shows a clutch disengaged. Disengagement is caused by bringing together lug A on the cam clutch disk and the lower end of 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.

(c) Figure 4-28 shows the same clutch engaged. This is accomplished by releasing the lower end of lever B. The upper end of lever B pivots about its ear C (which bears against the upper end of the secondary shoe) and moves its ear D, and the upper end of the primary shoe, toward the left until the shoe makes contact with the drum at point E. As the drum turns counterclockwise, it drives the primary shoe downward, so that it again makes contact with the drum, this time at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point G. The lower end of the secondary shoe then bears against the drum at point H. The revolving drum acts to drive this shoe upward so that it again makes contact with the drum at point I. Since the forces involved are multiplied at each of the preceding steps, the final force developed at point I is very great. This force is applied to the lug J on the clutch-cam disk to cause it to turn in step with the drum. The cam disk is a part of the selector cam assembly, which rotates upon engagement of the clutch.

#### (8) TAPE PERFORATING AND FEEDING

(a) GENERAL - The perforator mechanism punches feed holes, advances the tape and perforates combinations of code holes corresponding to the code combinations received from the selector. Intelligence is received from the selector by the punch slides, which select proper pins in a punch block assembly (Figure 4-29). Motion from the rocker bail is distributed

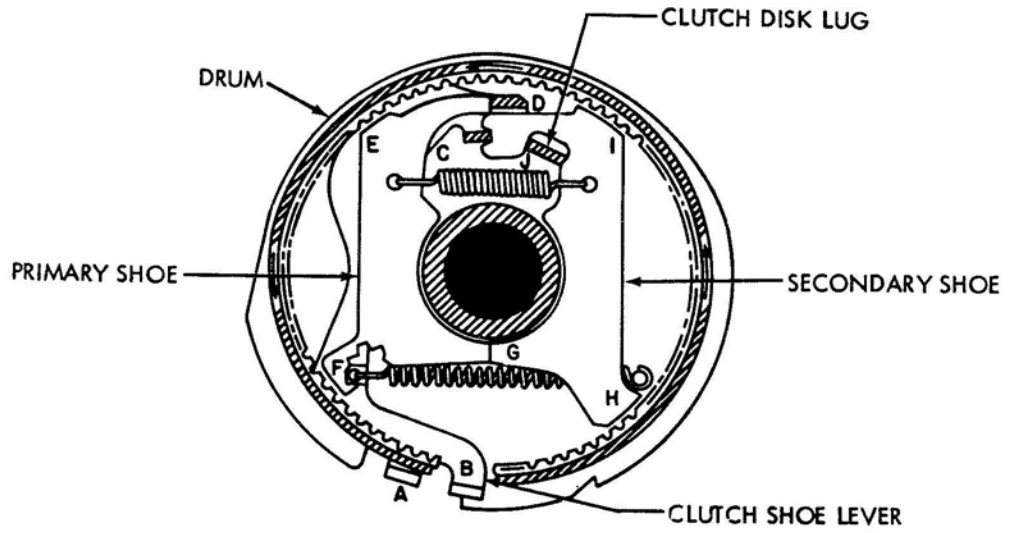


Figure 4-27. Clutch Disengaged

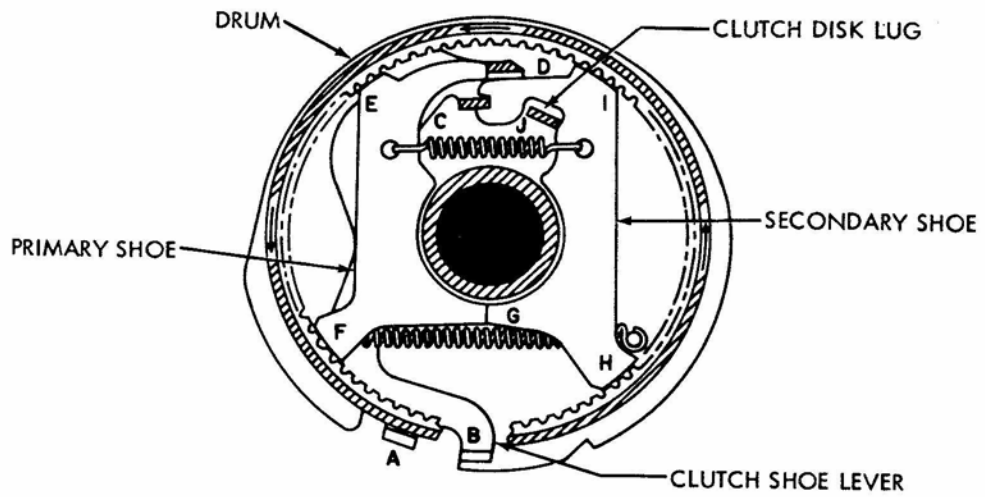


Figure 4-28. Clutch Engaged



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.

b. 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.

c. 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.

## 2. CHADLESS UNITS

a. As described in paragraph 4-4.(5)(b)1, near the end of the selecting cycle, the reset bail is lowered and releases the five punch slides (Figure 4-30). 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. 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 counter-clockwise. 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.

b. 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 down-stop for the pins, and thus hold them in the block. A compression spring is mounted on the No. 3 punch pin, and four 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 semi-circular, so that only the rear portion of the hole is severed.

(c) FEEDING - 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 4-29 and 4-30). 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 on 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 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.

## (9) TYPING

(a) GENERAL - The characters used to type the input intelligence (letters, figures and symbols representing various functions) are embossed on the cylindrical surface of the metal typewheel. The typewheel furnished with the typing reperforator will print standard communications symbols. During the function cycle, the rotary and axial positioning mechanisms (Figures 4-31 and 4-32), having received the intelligence from the transfer mechanism, position the wheel so that the character represented by the input code permutation is selected. Following typewheel positioning, the correcting mechanism accurately aligns the selected character. Then the printing mechanism (Figure

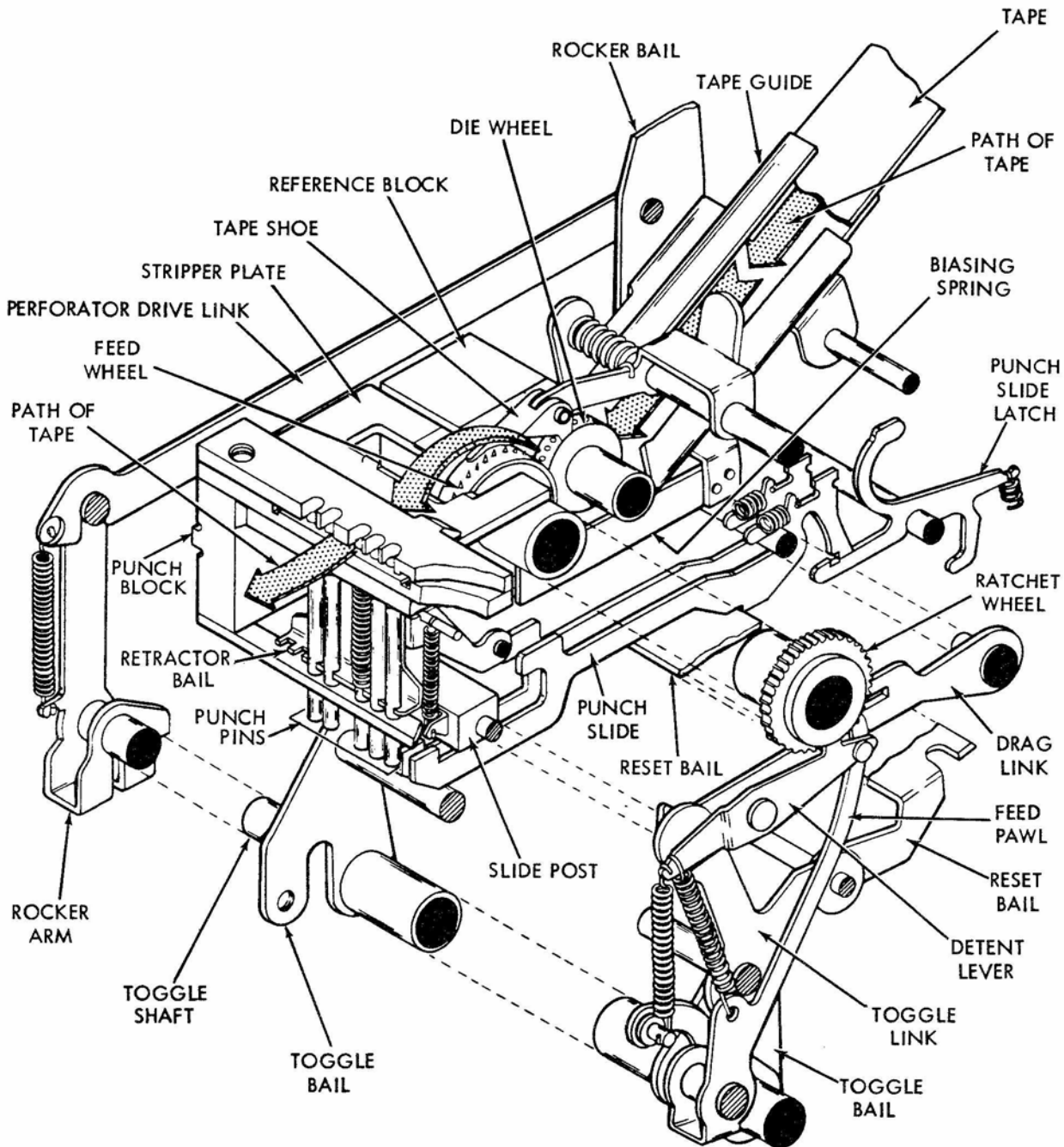


Figure 4-30. Perforator Mechanism (Chadless Tape)

4-33), by means of a printing hammer, drives the tape and inked ribbon against the wheel and prints the character. A ribbon feed mechanism (Figure 4-34) advances the ribbon and reverses its direction of feed when one of the two ribbon spools is depleted. Near the end of the function cycle, the axial positioning mechanism retracts

the typewheel and ribbon guide so that the last printed character is visible. The letters or figures code combination sets up an arrangement in the transfer mechanism which permits the function box (Figure 4-35) to operate and cause the rotary positioning mechanism to shift the typewheel through 180 degrees of rotation.



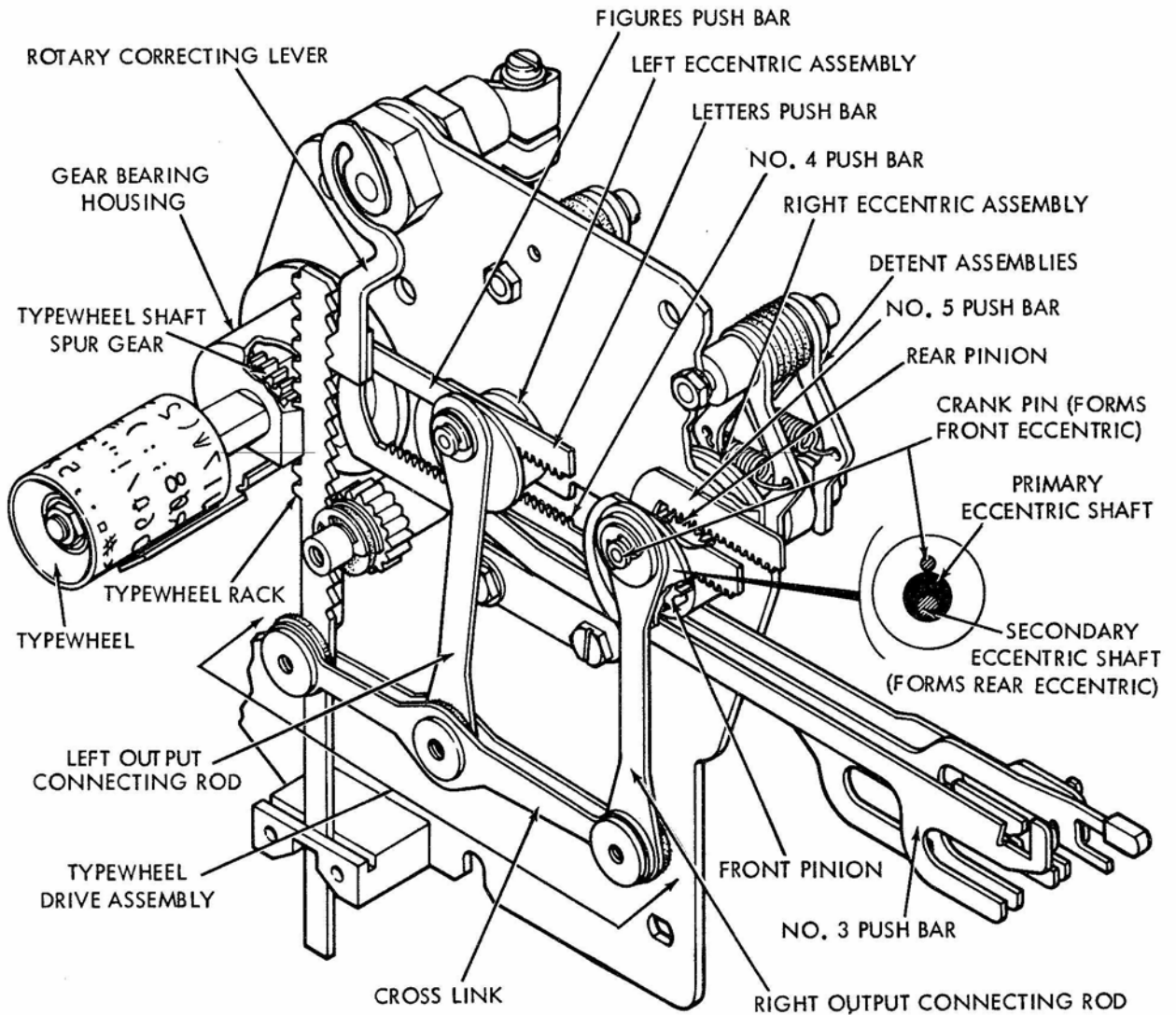


Figure 4-31. Rotary Positioning Mechanism

## (b) TYPEWHEEL POSITIONING

## 1. GENERAL

a. A typical typewheel character arrangement is shown in Figure 4-36, in which the wheel's cylindrical surface is shown rolled out into a plane. There are 16 longitudinal rows, each of which is made up of four characters numbered 0 to 4 from front to rear. The surface is divided into two sections, a letters and a figures section. Each section contains eight rows. The fifth row counterclockwise from the division line in both sections is numbered 0. There are four rows in one direction from 0 numbered 1 to 4 and designated as

ORIGINAL

counterclockwise rows, and three rows in the other direction numbered 1 to 3 and designated as clockwise rows. It should be noted that the clockwise and counterclockwise modifiers refer to the direction of rotation of the wheel to select the rows, and not to their position on the wheel.

b. Each printing operation (excluding those devoted to the letters-figures shift) begins and ends with the typewheel in the home position of the section containing the character to be printed. (For example, with the No. 0 character of the No. 0 row in the figures or letters section at the point of contact. Actually, inasmuch as the wheel is retracted to

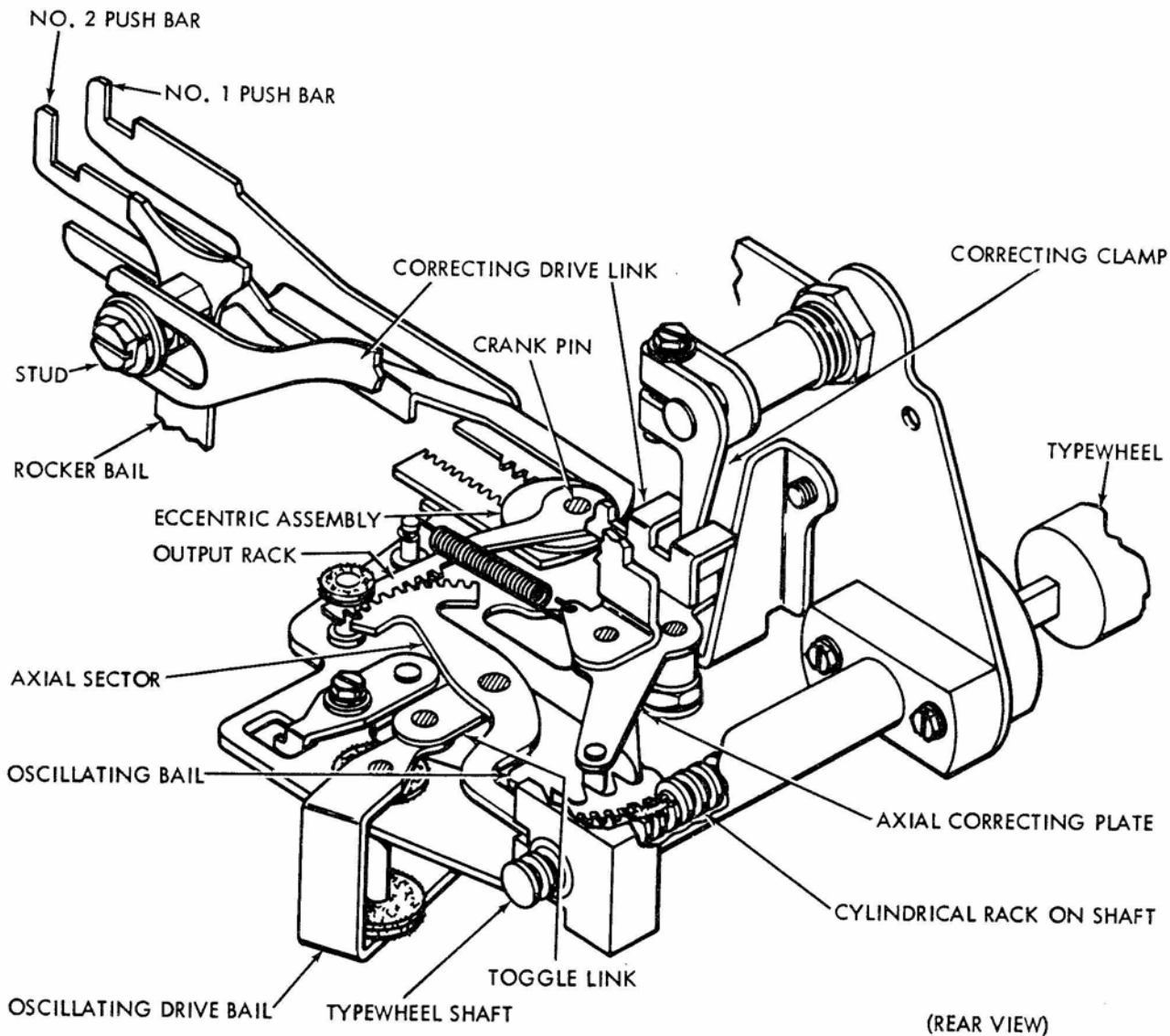


Figure 4-32. Axial Positioning Mechanism

show the last printed character, the No. 0 character is slightly to the rear. But, for this discussion, it will be assumed that it is at the point of contact.) During the printing operation, the axial and rotary positioning mechanisms, transferring separate but simultaneous motions to the wheel, position it so that the character represented by the input code combination is at the point of contact of the hammer at the time of printing. The rotary mechanism, which is controlled by the No. 3, 4, and 5 selecting elements of the code, revolves the wheel to select the proper row. The axial mechanism, which is governed by the No. 1 and 2 elements, moves it forward and rearward along its axis 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.

c. To illustrate the above, if the typewheel is in the figures conditions (as shown in Figure 4-36) 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. If, however, the letter "I" is to be printed, the keyboard code for letters must first be received to shift the typewheel eight rows to the letters home position. Then, during the next operation,

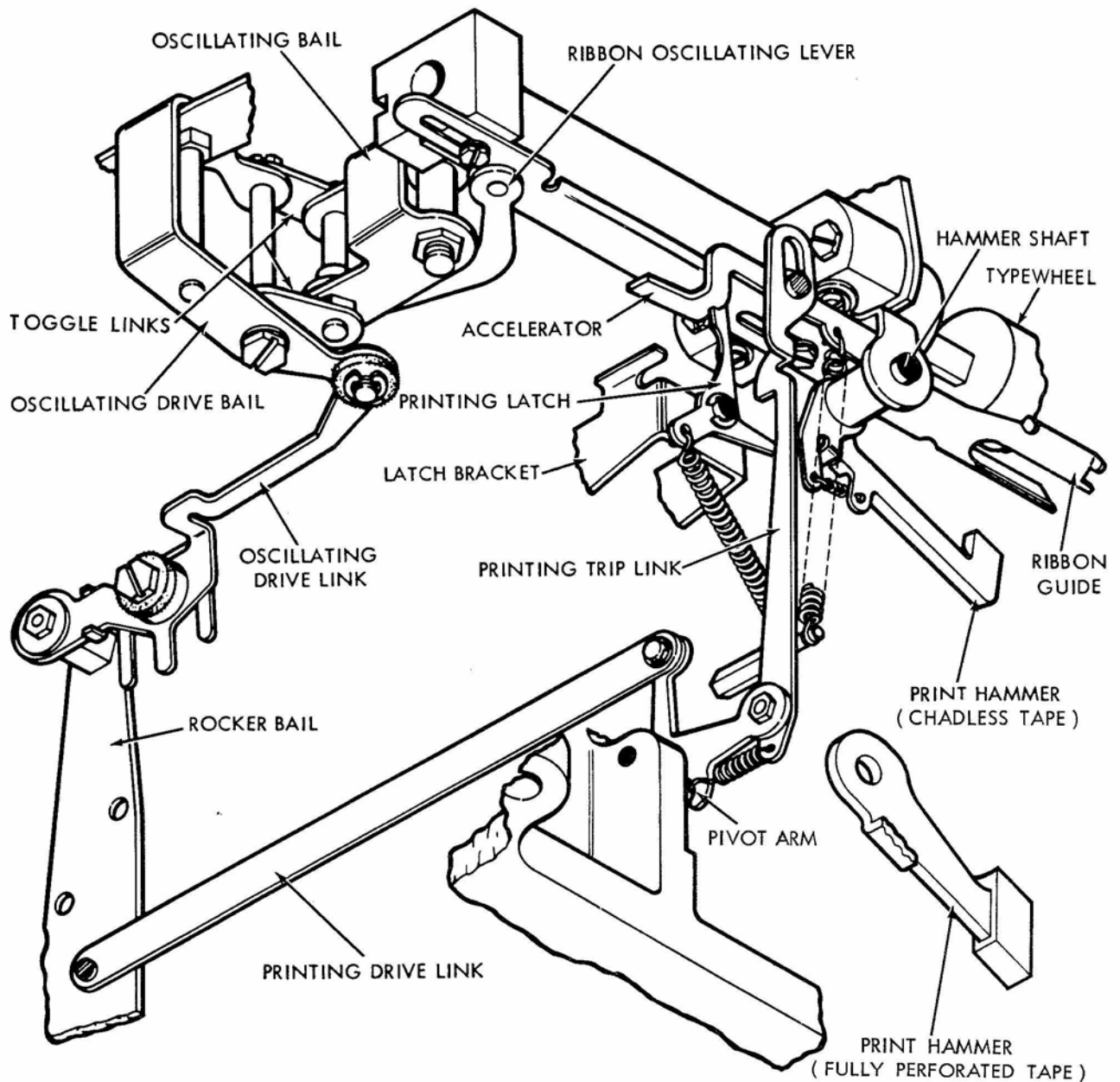


Figure 4-33. Printing Mechanism

the typewheel is rotated three rows counter-clockwise and moved forward two characters, so that "I" is at the point of contact with the hammer. Printing takes place, and the typewheel is then returned to the letters home position.

## 2. ROTARY POSITIONING

(See Figures 4-31 and 4-37) - The rotary positioning mechanism revolves the typewheel so that the row containing the character to be printed is aligned with the print hammer at the time of printing.

a. Mounted at the front plate, the rotary positioning mechanism includes two eccentric assemblies. Each assembly includes a primary shaft, a section of which is formed into a pinion. A secondary shaft mounted in the primary and offset from its center, forms an 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 push bar; the No. 3 bar engages the rear pinion, and the No. 5 engages the right pinion. The

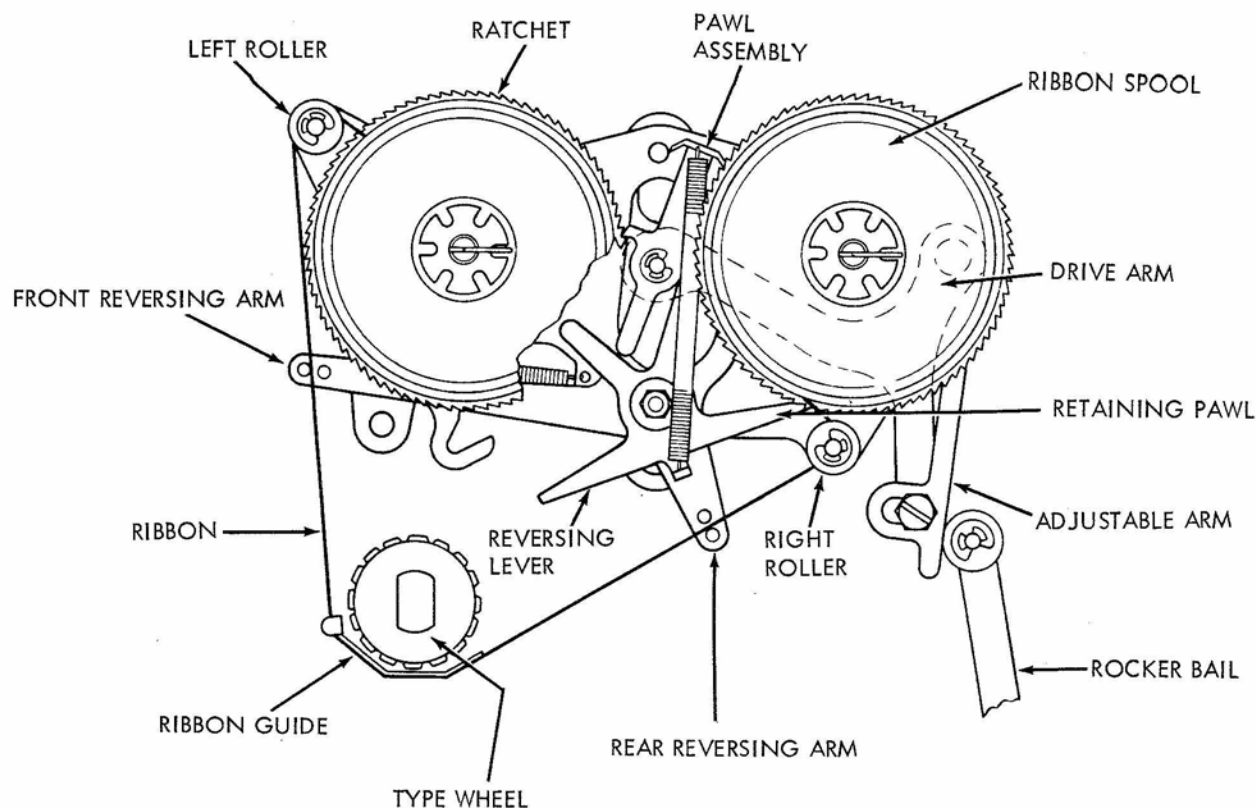


Figure 4-34. Ribbon Feed Mechanism

left front pinion is engaged by both the letters and figures push bar.

b. The eccentric assemblies are linked to a typewheel shaft by a drive assembly as shown in Figure 4-31. The typewheel is secured to the front of the shaft, which is supported by a bearing housing mounted at the left rear of the front plate (Figure 4-32). A spur gear, which meshes with the typewheel rack, rides on the shaft in a bearing housing. The shaft is free to move axially in the housing and through the spur gear. Flats in the shaft circumference, which bear against flats in the gear, insure its rotating when the gear rotates in response to movements of the typewheel rack.

c. When in response to a marking pulse a push bar is lifted by its bell crank (paragraph 4-4.b.(6)(a), the rocker bail operating blade (see Figure 4-25 and 4-37) 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 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 positions, where the eccentric is again detented. The preceding does not apply to the No. 5 push bar which is designed so that it is selected - moved to the left - on spacing rather than marking, nor to the left-front eccentric which affects the letters-figures shift, and whose operation is covered in paragraph 4-4.b.(9)(b)5. 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), and 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, taking the displacement of the front eccentric to be four units, the displacement of the rear eccentric is one unit. Four permutations are thus available: zero (neither eccentric displaced), one (rear eccentric displaced), four (front eccentric displaced), and three or

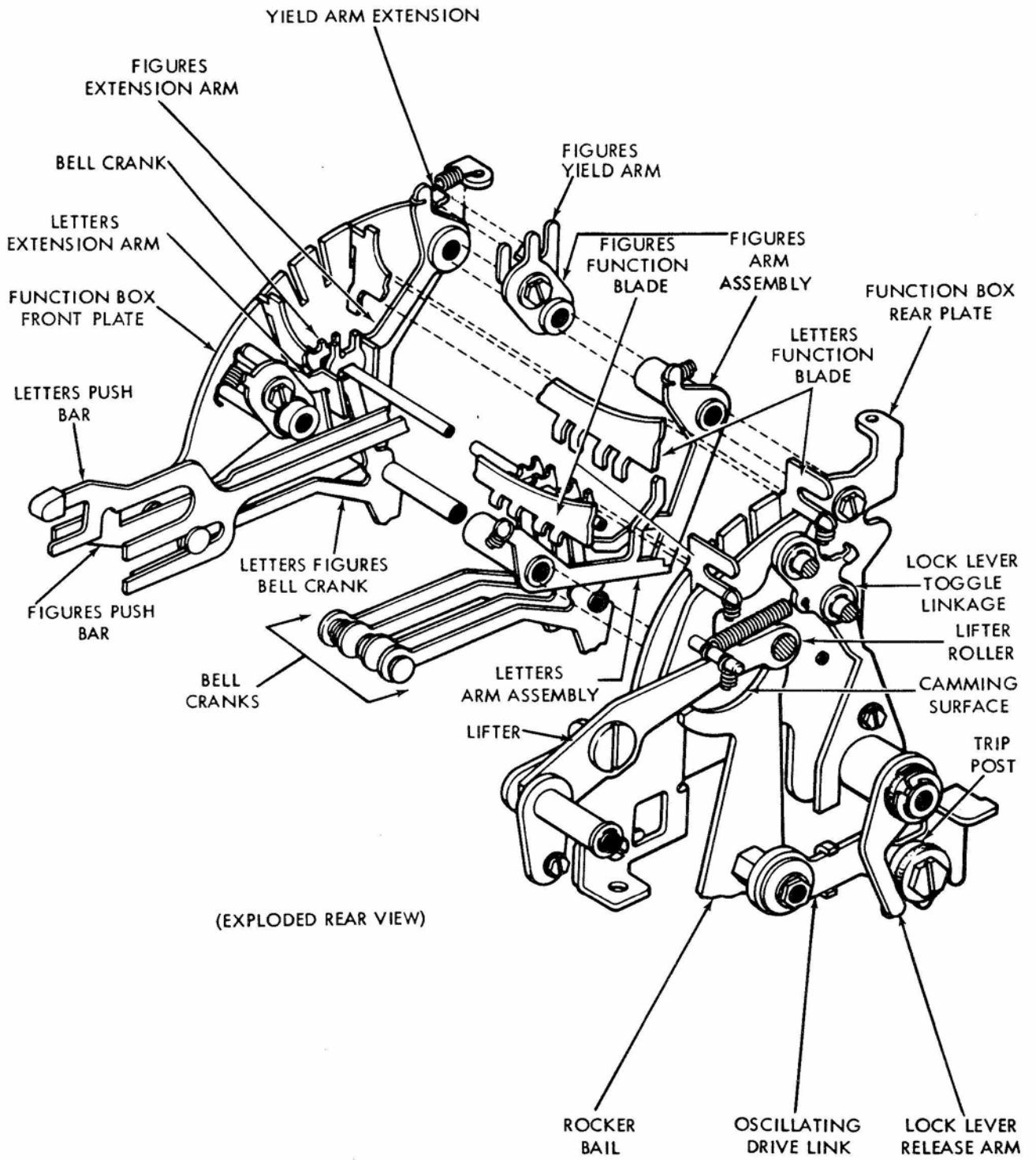


Figure 4-35. Function Box

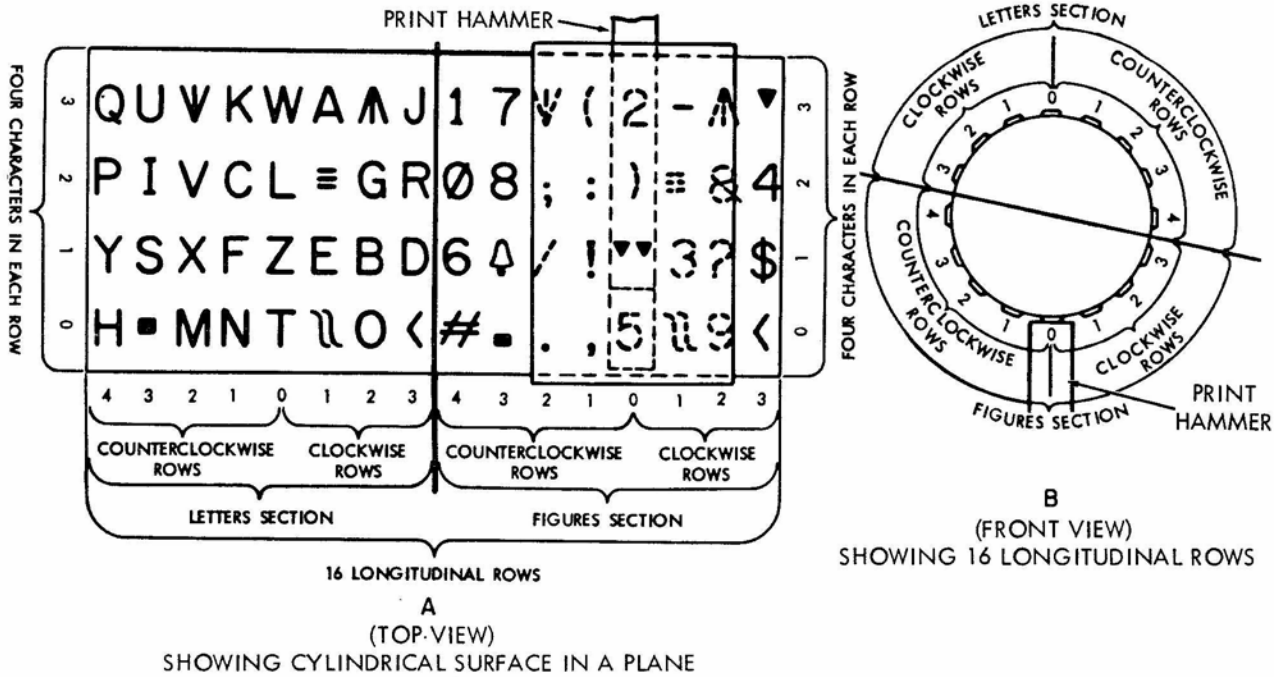


Figure 4-36. Typical Typewheel Character Arrangement

five units, depending on how the assembly is set up (both eccentrics displaced).

d. In the right assembly, the home position of the rear eccentric is down, and the home position of the front eccentric is up (Figure 4-37). Thus, their displacements are in opposite directions (up for the rear and down for the front), and their aggregate displacement is three units downward. Any displacement occurring in the right assembly is imparted to the typewheel rack in equal quantity, but opposite direction. For example, if the No. 5 push bar is selected, it causes the right rear eccentric to be displaced and one unit of upward motion to be transferred through a right output connecting rod to the right end of a cross link (Figure 4-31). The cross link pivots about a left output connecting rod, and at its left end imparts one unit of downward displacement to the typewheel rack. The rack rotates the spur gear, shaft, and typewheel one row of characters clockwise from the home position, and the No. 1 clockwise row (Figure 4-36) is presented to the print hammer at the time of printing. On its right stroke, the No. 5 push bar returns the eccentric and the typewheel to their home positions. In a similar manner, selection of the No. 3 push bar 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 typewheel.

e. The home position of the left rear eccentric is up, and any displacement appearing in the left assembly is transferred to the typewheel rack in double quantity in the same direction. When the No. 5 push bar 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 typewheel rack, which rotates the typewheel two rows clockwise from its home position.

f. When both eccentric assemblies are displaced, the motion occurring in the typewheel rack is equal to the algebraic sum of the motions resulting from each assembly. For example, 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 typewheel. If neither the No. 3, 4, nor 5 push bar is selected, the mechanism remains inactive and printing takes place in the No. 0 row. Excluding the left front

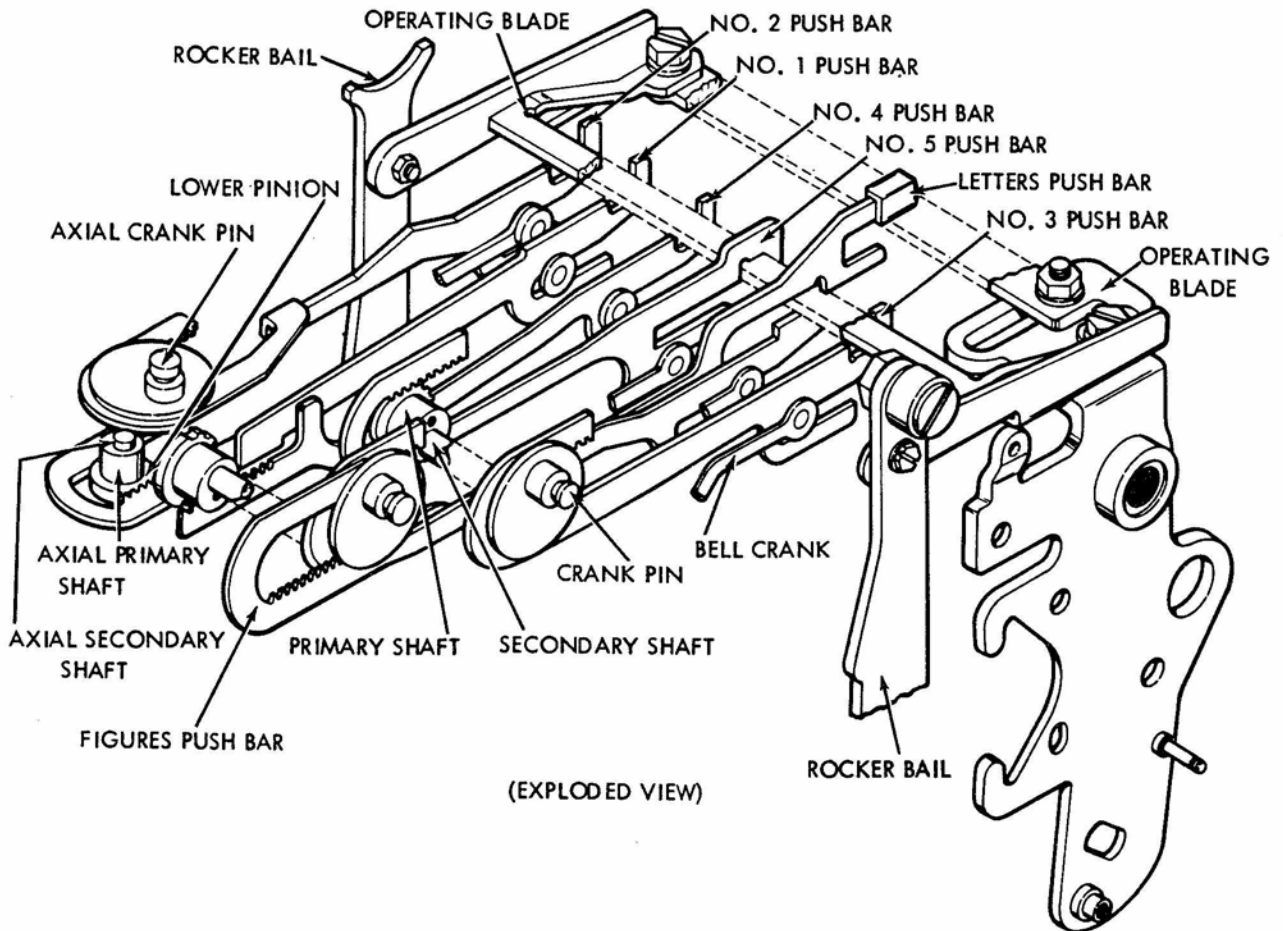


Figure 4-37. Push Bars and Eccentric Assemblies

eccentric, which is used only 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 4-36).

3. AXIAL POSITIONING (See Figures 4-32, 4-33, and 4-37). The function of the axial positioning mechanism is to position the typewheel so that the proper character in the selected row is aligned with the hammer at the time of printing, and to retract the typewheel and ribbon guide at the end of the function cycle so that the last typed character is visible.

a. The axial positioning mechanism mounts on an axial bracket supported by the frame and the front plate and includes an eccentric assembly similar to those of the rotary positioning mechanism (Figures 4-32 and 4-37). Two eccentrics -- a lower, whose pinion is driven by the No. 1 push bar, and an upper, whose pinion is driven by the No. 2 push bar --

rotate in a horizontal plane in bearing housings attached to the bracket. The eccentric assembly is linked to the typewheel shaft by an axial output rack and sector, as shown in Figure 4-32.

b. The selection of either the No. 1 or No. 2 push bar results in the maximum displacement toward the rear of the associated eccentric. The eccentrics are so designed that if the displacement of the lower is taken to be one unit, that of the upper is two units. Again, four permutations are available at the crank pin: zero (neither eccentric displaced), one (lower eccentric displaced), two (upper eccentric displaced) and three (both eccentrics displaced).

c. If during a function cycle neither push bar is selected, no motion occurs in the axial positioning mechanism, with the exception of that resulting from the oscillating assembly (paragraph 4-4.b.(9)(b)3.d. below), and the No. 0 character of the selected row is

aligned with the hammer at the time of printing (Figure 4-36). On the other hand, if the No. 1 push bar 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 typewheel shaft, moves the typewheel one character forward from its home position and the No. 1 character is printed. When the push bar returns to its unselected position, it moves the axial linkage and typewheel to their home positions. If the No. 2 push bar is selected, the No. 2 character is printed, and if both push bars are selected, the No. 3 character is printed. The cylindrical rack has no lead, and the shaft can thus be rotated while being moved axially.

d. 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 4-32 and 4-33). This movement is passed by toggle links to the oscillating bail and the sector pivot. The effect of this action is to introduce a separate motion to the sector, causing it to pivot about the teeth on the output rack. During the fore part of the function cycle, if no axial push bar is selected, the end of the sector is moved forward slightly and positions the No. 0 character for printing. At the end of the cycle, the sector retracts the typewheel slightly, so that the last printed character is visible. Together with the above operation, the ribbon oscillating lever is made to pivot about its left end and, with each cycle, project and retract the ribbon guide, which would otherwise obstruct the view of the printed character (Figure 4-33).

4. CORRECTION (See Figures 4-31 and 4-32).

a. After the typewheel has been positioned by the axial and rotary positioning mechanisms, the selected character is more accurately aligned for printing by the correcting mechanism, which compensates for any play and backlash in the positioning linkages. Each function cycle, the rocker bail transfers motion through a correcting drive link to a correcting clamp and shaft (Figure 4-32). The shaft pivots a rotary correcting lever (Figure 4-31), which is equipped with an idention that engages a tooth in a typewheel rack. There is a tooth in the rack for each row of characters (16 in all). They are so correlated with the typewheel that when a tooth is engaged by the corrector, its row is accurately aligned with the print hammer. Axial correction, which is accomplished simultaneously, is similar to rotary

correction. The drive link rotates an axial correcting plate counterclockwise (as viewed from the top), and a roller mounted on the plate engages a notch in the axial sector (Figure 4-32). Thus, the typewheel is accurately aligned in both fields of motion just before printing takes place. During the latter part of the function cycle, a correcting drive link spring returns the correcting mechanism to its home position.

b. Since the rocker bail is the source of motion for both the push bars and the positioning mechanisms, correction must take place at a point near enough to the extreme travel of the bail that it does not interfere with the movement of the typewheel 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.

5. LETTERS-FIGURES SHIFT (See Figures 4-31 and 4-35). The purpose of the letters-figures shift is to rotate the typewheel from the home position in one section to that of the other section (Figure 4-36). It is accomplished through a function box mechanism located at the upper rear of the typing reperfector (Figure 4-35).

a. When the unit is in the letters condition (Figures 4-31 and 4-35), and the figures code combination (1M, 2M, 3S, 4M, 5M) is received, the transfer mechanism sets up the figures arrangement in the bell cranks during the input 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 4-35). 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 bell cranks.

b. The slot arrangement of the No. 1, 2, 4, and 5 bell cranks are identical, and permit the entry of both function blades when all are selected. However, on receipt of the figures code combination, the No. 3 bell crank permits entry of the figures blade, while blocking the letters blade. In moving all the way down, the figures blade encounters a projection on the figures arm assembly, and shifts the mechanism from the letters to figures position. A yield arm extension attached to the figures arm assembly pivots a figures extension arm away



from the letters-figures bell crank. A letters extension arm, under spring tension, rotates the bell crank clockwise (Figure 4-35), and the bell crank lifts the letters and figures push bars. As the bail reaches its extreme position, the lifter is cammed up and raises the function blades.

c. While the letters-figures bell crank is being positioned by the function box, the No. 1, 2, and 4 push bars are selected, the typewheel 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 push bar (which was lifted as described above) and moves the bar to the right (see Figures 4-31 and 4-37). The common pinion moves the letters push bar to the left, and the left front eccentric shifts from its up to down position. Since the typewheel was displaced two rows clockwise during the first part of the cycle, it is now rotated six more rows to the figures home position (see paragraph 4-4.b.(9)(b)2.e.). As the bail returns to its home position during the last half of the cycle, a lock lever toggle linkage (Figure 4-35) prevents the lifter roller from following its camming surface. The lifter holds the function blades up, so they do not drop into the bell cranks. As the bail nears its home position, a trip post riding on the oscillating drive link strikes a lock release arm, buckles the toggle linkage and permits the lifter roller to again fall on the bail camming surface.

d. In a manner similar to that described above, when the letters code combination (1M, 2M, 3M, 4M, 5M) is received, the function box causes the letters-figures bell crank to lower the letters and figures push bars. The typewheel is rotated two rows counterclockwise during the first part of the cycle, six more rows to the letters home position during the last part of the cycle, and the letters push bar is moved to the right. The preliminary two-row rotation of the typewheel, which is made possible by selecting the No. 5 push bar on spacing rather than marking, provides less throw and smoother operation than would be possible if the complete eight-row displacement were made during the latter part of the cycle. Each operation the function blades will move down to feel for an opening. Except for the shift operations, they are blocked each time by the bell crank arms.

(c) PRINTING (See Figure 4-33)

1. After the typewheel has been positioned and corrected, the printing mechanism supplies the impact which drives the paper and ribbon against the selected character. This operation is accomplished by means of a

print hammer, which is mounted on a shaft supported by a bracket attached to the typewheel bearing housing. In its unoperated condition, (Figure 4-33), the hammer is held against an accelerator by a relatively weak spring. The accelerator is mounted on the hammer shaft, and is retained by a printing latch in its upper position, against the tension of a relatively strong spring.

2. The rocker bail, during the early part of the function cycle, moves a printing drive link to the right (Figure 4-33) and causes the pivot arm to rotate clockwise, lowering the trip link. Near the end of the rocker bail's travel, the trip link pivots the latch, which releases the accelerator. Under 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 typewheel and prints 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.

(d) RIBBON FEEDING (See Figure 4-34)

1. The ink to type the characters is supplied by an inked ribbon. The ribbon is held between the tape and the typewheel by a guide and advanced by the ribbon feed mechanism (Figure 4-34). The path of the ribbon is down to the left off the top of the right spool, under the right roller, to the left through pins on the rear reversing arm, through the ribbon guide, up through pins on the front reversing arm, over the left roller and down to the right on the bottom of the left spool.

2. 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 and ribbon spool one tooth. A retaining pawl, under spring tension, detents the ratchet while the feed pawl, during the latter part of the function cycle, is lowered so as to engage the next tooth. Each operation, the ribbon is advanced in this manner until the ribbon feed mechanism is reversed.

3. When a spool is almost depleted, an eyelet in the ribbon encounters pins on a reversing arm. 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 to the other ratchet. The pawl's rounded lower extension pivots a reversing lever, which shifts the retaining pawl, so that it engages in the opposite direction until again reversed.

(10) AUTOMATIC NON-INTERFERING "LETTERS" TAPE FEED-OUT (CHADLESS TAPE UNITS ONLY)

(a) INITIATION

1. The feed-out operation (Figure 4-38) is automatically initiated after a fixed period of idle signal line. Through the interaction of a drive link operated by the rocker bail and a follower activated by the reset bail cam in the selector, the mechanism recognizes the end of a message. The timing of the selector, while receiving a message, is such that the reset bail cam lobe raises its follower during the first part of the selector cycle. The follower, through a linkage, lowers a latch lever which permits a release lever to rotate clockwise. When the release lever is in its clockwise position the mechanism is in its unoperated condition (see paragraph (b)3. below). When the

rocker bail goes to its extreme left position, during the middle of the function cycle, the attached drive link rotates the release lever counterclockwise and places the mechanism in its operated condition (see paragraph (b)2. below). Each time a new character is received, the above sequence occurs.

2. End of message recognition is obtained when the release lever is rotated counterclockwise by the rocker bail and then not permitted to rotate clockwise by the follower.

(b) METERING AND FEED OUT

1. When the release lever rotates counterclockwise, it lowers a front check pawl and a metering feed pawl onto two metering ratchets. Every sixth tooth of the rear ratchet is deeper than the others. An eccentric riding on the main shaft transfers an oscillating motion to the metering feed pawl which advances the rear ratchet one tooth counterclockwise each revolution of the shaft. As long as it is engaging the shallow teeth of the rear ratchet, the feed pawl is prevented from engaging the front ratchet. However, when a deep tooth comes up,

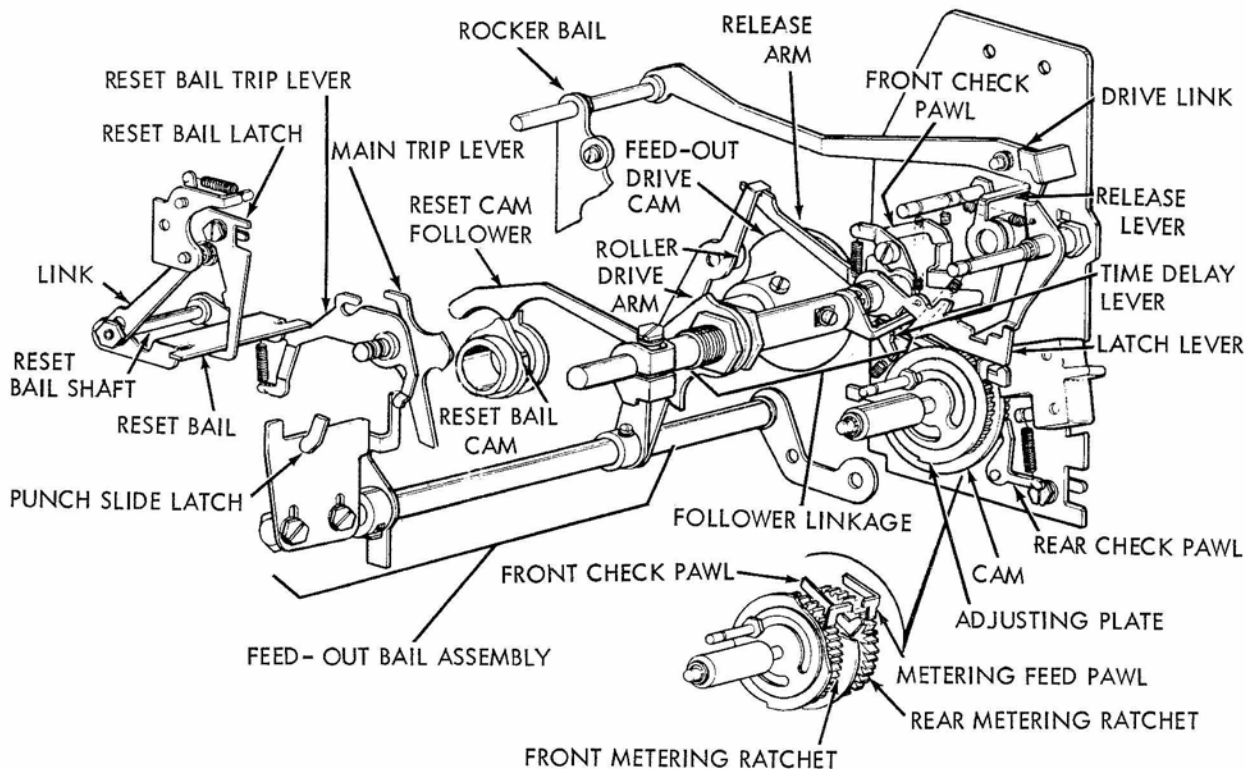


Figure 4-38. Automatic Non-Interfering "Letters" Tape Feed-Out Mechanism

the pawl engages and advances both ratchets. Check pawls prevent the ratchets from rotating clockwise.

2. A time delay lever rides on a cam attached to the front ratchet. When the lever rides to the low part of the cam, it causes a release arm to release the drive arm of the feed out bail assembly. A roller on the drive arm then rides, under spring-pressure, on a feed out drive cam on the main shaft. Each time the roller rides to the low part of the cam, the feed out bail assembly does two things: (1) rotates the main trip lever counterclockwise (see Figure 4-24) tripping the function clutch, and (2) rotates the punch slide latches counterclockwise to set up the "letters" code combination. Thus the reperforator feeds out "letters" tape in the same manner as if the function clutch and punch slides had been actuated in the usual manner.

3. As the ratchets are rotated as described above, a tape length adjusting plate on the front ratchet reaches the position where it rotates the latch lever clockwise. The latch lever, in turn, performs two actions: (1) through the time delay lever it causes the release arm to latch the drive arm and terminate feed out, and (2) it permits the release lever to move to its clockwise position and lift the metering feed pawl and front check pawl off the ratchets. A spring returns the front ratchet to its start position. The mechanism remains in the unoperated condition until the next code combination is received.

#### (c) NON-INTERFERENCE

1. When the first character of an incoming message is received during feed out, the selector clutch is tripped and, as described in paragraph 4-4.b.(10)(a)1., the reset cam follower causes the release lever to rotate clockwise. Feed out is terminated as described in paragraph 4-4.b.(10)(b)3., and the incoming message is perforated.

2. When the first character is received during feed out, the relationship between the selector cam and function cam could be such that the reset bail would release the punch slides before the slides are fully reset (see paragraphs 4-4.b.(5)(b)1. and 2. and 4-4.b.(8)(b)2.a. and b.). In this case the first character of the incoming message would be lost. The purpose of the storage assembly is to prevent this. The storage assembly consists of a reset bail latch that is moved by a link attached to the reset bail shaft. During normal reception of messages, the link pushes the latch out of the way of the reset bail prior to the bail's being lowered by the main trip lever. Whenever the condition described above occurs, the latch

holds the bail in engagement with the slides until they are fully reset so that they may recognize the first character set up in the punch slide latches by the selector.

#### c. MULTIPLE TYPING REPERFORATOR BASE

(1) GENERAL - The multiple typing reperforator base provides mounting facilities for three typing reperforators and a motor unit. Power is transmitted from the motor unit to the typing reperforator by a pinion gear which drives an intermediate gear mounted to a cross shaft. Three sprockets and drivebelts, mounted on the cross shaft, line up with and drive an associated sprocket on a typing reperforator. Various operating speeds are available, depending on the gear and sprocket set used. On those bases designed to handle reperforators which punch fully perforated tape, three chad containers (one for each reperforator) mount on rail brackets located under the base near the front edge (see Figures 1-23 and 1-26).

#### CAUTION

When replenishing the tape supply on any of the fully perforated tape reperforators, be sure to empty the associated chad container. Failure to do so may result in equipment failure due to chad backing up in the chad chute and fouling the punch mechanism.

(2) ELECTRICAL FACILITIES - Located at the left front corner of the base is an ON-OFF power switch to control the motor operation. A four point terminal board located in front of the right tape supply container, and fourteen point connector at the left rear of the base (Figure 1-26) provide wiring facilities for the motor units AC power lines and for the low tape alarm switches on each of the tape supply containers. Power factor correction capacitors, where required, are mounted to a bracket located near the center of the base between the two tape supply containers (see Figure 1-26).

(3) REPERFORATOR MOUNTING - Each typing reperforator is located on the base by means of three tapped mounting studs in a "T" plate (see Figure 1-26). The "T" plate, which moves forward and back in guide slots, provides a means for adjusting the timing belt tension on each reperforator. The reperforator is secured by tightening the three mounting screws, and the screw holding the anchor bracket (Figure 1-23) to the base.

d. MOTOR UNITS - Refer to paragraph 4-3.d. for principles of operation of synchronous and governed motor units.

## e. TAPE WINDER

(1) **GENERAL** - Two tape winders mount side by side on two cross members in the monitor cabinet. They are located on the cross members by eight locating studs, four for each tape winder, and are held in position by their own weight on resilient rubber mounts. The tape winder is a self contained unit, consisting of a driving mechanism, tape tension device, clutch engage-disengage mechanism, rollers for tape reel engagement, and a full reel alarm switch to operate a WINDER FULL lamp on the control panel.

## (2) OPERATION

(a) A drive wheel, with two garter springs for added friction, mounts rigidly on the motor shaft and rotates continuously (there is one drive wheel associated with each tape reel, all drive wheels mounted on a common shaft as shown in Figure 1-28). Power is transmitted to the drive shaft through a gearing arrangement driven by a 35 milli-horse power induction motor mounted at the rear of the tape winder (Figure 1-28). Each tape reel is positioned on two fiber rollers (Figure 1-27) and rotates when its rim engages the drive wheel. The tape reel rim is placed in or out of engagement with the drive wheel by the position of the rear roller. The rear roller is mounted on an arm that is part of the clutch engage-disengage mechanism (Figure 1-28). The position of this arm (up or down) is determined indirectly from the flow of tape looped through the tape arm. When the tape arm is near the bottom of its travel or moving up, the tape reel rotates. When the tape arm is latched in the up position or moving down, the tape reel will not rotate.

(b) The end of the tape is threaded about six inches through any one or more posts at the center of the reel, and is then wound two or more turns manually to secure the tape to the reel. The tape is then brought under the posts, up between the backstop and chad depressor, and onto the tape arm (Figure 1-27). When mounted in the monitor cabinet, those reels servicing the lower three reperforators have an additional tape guide roller in the tape path. After passing the tape under the tape arm, it is then brought up and over the tape guide roller immediately above the chad depressor to complete the path to the reperforator (Figure 1-27). Lifting the tape arm manually to its latched position disengages the reel from the drive wheel and allows rapid unwinding of tape.

(c) Each tape winder assembly is furnished with a set of full reel contacts mounted on the rear shelf of the unit (Figure 1-27). The contacts may be operated by any one of the three

(one for each reel) full reel sensing arms. These arms are mounted on a common shaft, and have equal effect on the full reel contacts.

## f. UNIVERSAL CABINET (MONITOR)

(1) **GENERAL** - The monitor cabinet provides mounting facilities for two multiple typing reperforator sets, two multiple tape winder sets, and the electrical control facilities to operate the units. The cabinet consists of separate inner and outer structures to minimize the transmission of mechanical noise to the outer shell by the apparatus. All equipment mounts on the inner structure, the outer shell serving as a dust and noise enclosure. A raceway is provided at the bottom rear of the cabinet to contain station cabling. The raceway may be fastened in place from inside the cabinet for "against the wall" applications. Provisions for grounding the various units to the cabinet and for attaching an external ground to the cabinet are furnished.

## (2) DOORS AND PANELS

(a) **DOORS** - Four doors are provided on the cabinet, two at the rear and two in front. The rear doors are all metal, extend the full length of the cabinet, and allow access to the typing reperforators, tape winders, and electrical control rack. The front doors, also full length, are provided with glass windows to permit observation of the reperforators and of the amount of tape in the tape supply and winder reels. A stud is mounted on the inside of the left door to permit manual unwinding of the tape from a tape reel. A recessed handle is provided on each right hand door to facilitate opening. Two magnetic catches serve to hold each pair of doors closed.

(b) **END ENCLOSURES** - Refer to paragraph 4-3.e.(2)(b).

(c) **FRONT CONTROL PANEL** - The front control panel is divided into an UPPER SHELF and LOWER SHELF section. Mounted in each section are three white OPEN LINE lamps, three amber REMOTE SEIZURE lamps, three red LOCAL SEIZURE lamps, three rerun jacks, three NUMBER-NO NUMBER switches, and one TAPE WINDER power switch. An AC convenience receptacle and red LOW TAPE lamp are also mounted on the UPPER SHELF section, and a DC convenience receptacle and red WINDER FULL lamp on the LOWER SHELF section.

(d) **DOME** (Figure 1-9) - At the top rear of the cabinet, immediately behind the sloping panel, is a dome which provides access to the electrical control rack. The dome is

hinged across the full length of the cabinet back, and is held in the closed position by means of a captive screw located at the top center of the sloping panel. The screw is accessible when the front doors are opened. A locking slide support, located at the left rear corner of the cabinet, holds the dome opened.

### (3) ELECTRICAL CONTROL FACILITIES

(a) **GENERAL** - Located at the rear of the cabinet on an electrical control rack are the electrical control facilities to operate the typing reperforators and tape winders. The electrical control rack mounts on a swivel mechanism, and can be rotated to a horizontal position for maintenance purposes when the dome is opened. Captive screws are provided to secure the rack in the horizontal or vertical position. Mounted on the electrical control rack are five fuses, an AC power switch and convenience receptacle, two AC power failure alarm relays, six open line alarm relays (plus associated components) and six 33RY line relays for control of the reperforator signal circuits, and terminal board facilities for cabinet wiring.

(b) **SIGNAL CIRCUIT** (Figure 4-39) - The monitor typing reperforator signal circuit includes a 33RY line relay, OPEN LINE relay, and a 115 volt DC full wave power supply. The K101 OPEN LINE relay is a time delay relay which controls the operation of the associated OPEN LINE LAMPS mounted on the monitor, transmitting, and receiving cabinet control panels. When an open line condition occurs, the 33RY line relay will de-energize and its swinger will remain in the SPACE position. This completes a shunting circuit around the K101 relay which will cause the relay to de-energize after a specified length of time has elapsed (release time is: Min. 0.312 seconds - Max. 0.500 seconds). When the relay de-energizes, its contacts K101 (1-2) and (3-4) return to their normally closed position energizing the OPEN LINE lamps and the reperforator selector magnets. See Volume 2 of this manual for the actual schematic wiring diagram of the signal line and power circuits.

(c) **33RY POLAR RELAY** - There are six 33RY line relays mounted on the electrical control rack, one for each typing reperforator. The 33RY polar line relay is a two-winding, two position, permanent magnet relay. Each winding on the relay terminates at a separate pair of pins on the base. The relay has eight pin type terminals with four (two large and two small) mounting legs. The relay is equipped with long life tungsten carbide contacts which have a higher contact resistance, particularly at low pressures, than other commonly used contact materials. It is important, therefore, that a relatively high contact pressure be maintained. See Table 4-2 for coil characteristics.

### 4-5. MODEL 28 TYPING REPERFORATOR RECEIVING GROUP

a. **GENERAL** - The Model 28 typing reperforator receiving group is an electromechanical device designed to receive messages on six separate signal lines, and convert them into fully perforated or chadless tape (depending on the typing reperforator used) with the message printed on the tape. The group consists of two multiple typing reperforator sets mounted on drawers (Figure 4-40) which may be pulled forward for access to the reperforator sets. Each set consists of three typing reperforators (fully perforated or chadless) mounted on a multiple typing reperforator base, and driven by a motor unit (synchronous or governed).

### b. TYPING REPERFORATOR OPERATION

(1) **GENERAL** - The typing reperforators operate from a sprocket and belt arrangement mounted on the multiple base cross shaft. The cross shaft is driven by a motor unit via a pinion and intermediate gear arrangement. Various operating speeds are available, depending on the gear and sprocket set used (see Table 4-1). Operating theory for the receiving group reperforators is identical to that for the mon-

Table 4-2. 33RY Coil Characteristics

Winding	Total No. of Turns	DC Resistance	AC (60 CY.) Resistance	Inductance 60 Cycles
2-7	3160	136 Ohms	150 Ohms	0.65 Henry
3-6	3160	136 Ohms	150 Ohms	0.65 Henry

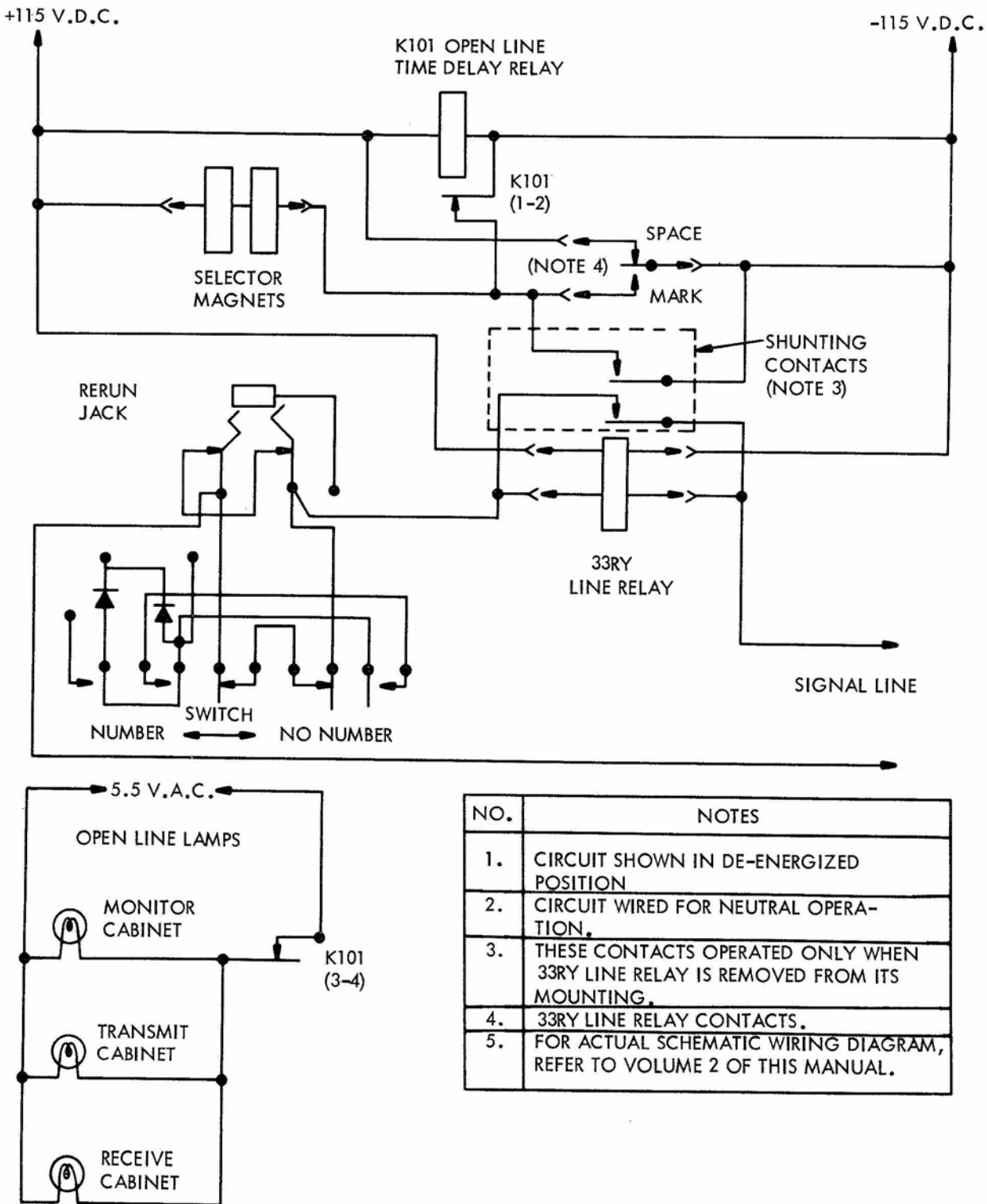


Figure 4-39. Monitor Group, Simplified Signal Circuit Wiring Diagram

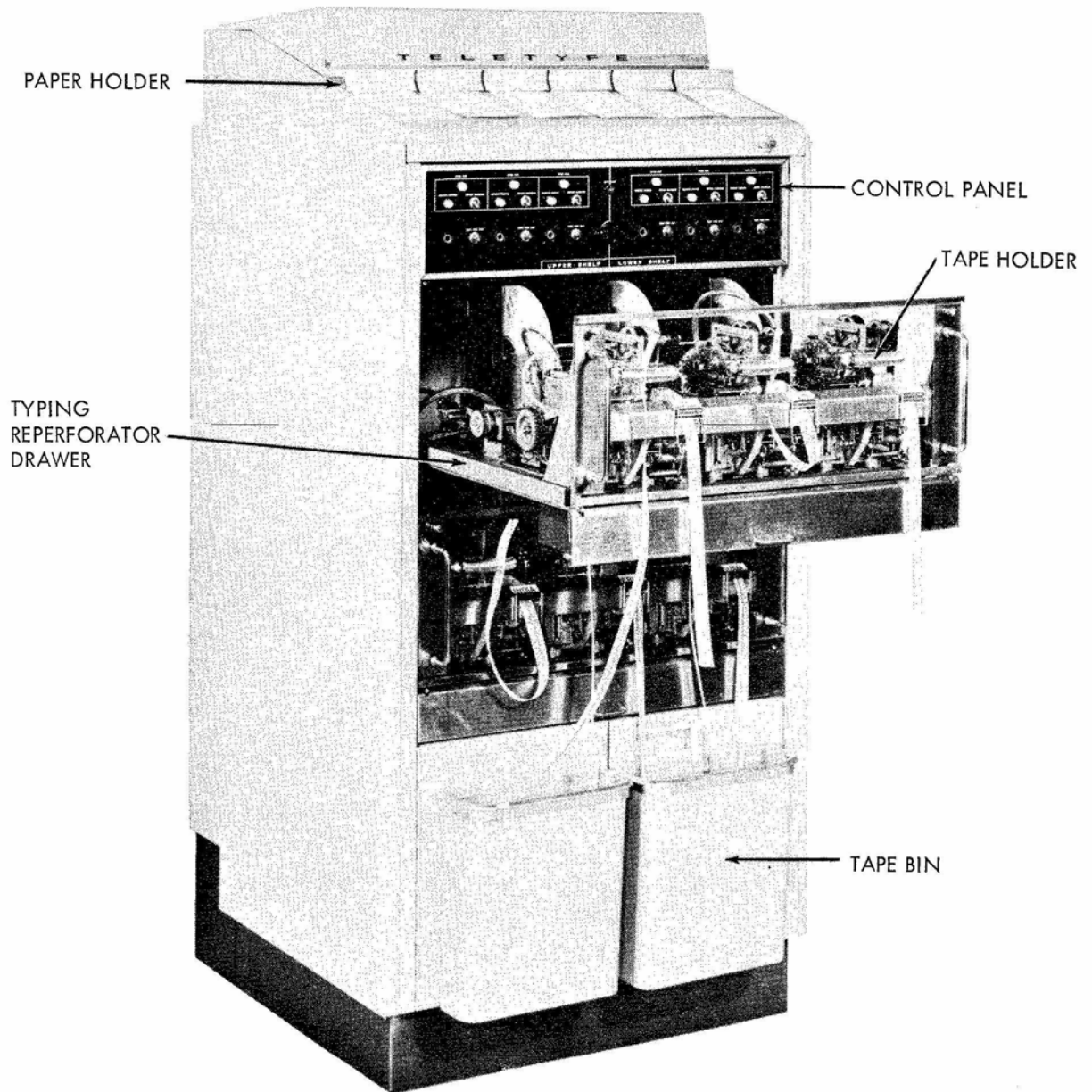


Figure 4-40. Model 28 Typing Reperforator Receiving Group (Drawer In Forward Position)

itor group reperforators covered in Paragraph 4-4.b. The receiving group fully perforated tape reperforator, however, has a remote control non-interfering "letters" tape feed out mechanism. This is an additional feature, and is not covered in paragraph 4-4.b. For operation of this mechanism, refer to paragraph (2) below.

(2) REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED OUT (Figure

ORIGINAL

4-41) - The remote control non-interfering "letters" tape feed-out mechanism provides a means of feeding a predetermined length (upto 18 inches) of "letters" perforated tape at the end of each message by remote control. The "letters" feed-out operation can be initiated by means of the TAPE FEED-OUT button on the control panel of the receiving cabinet following a one second time delay at the end of a message. The feed out is adjustable in steps of 0.6 inch. If a

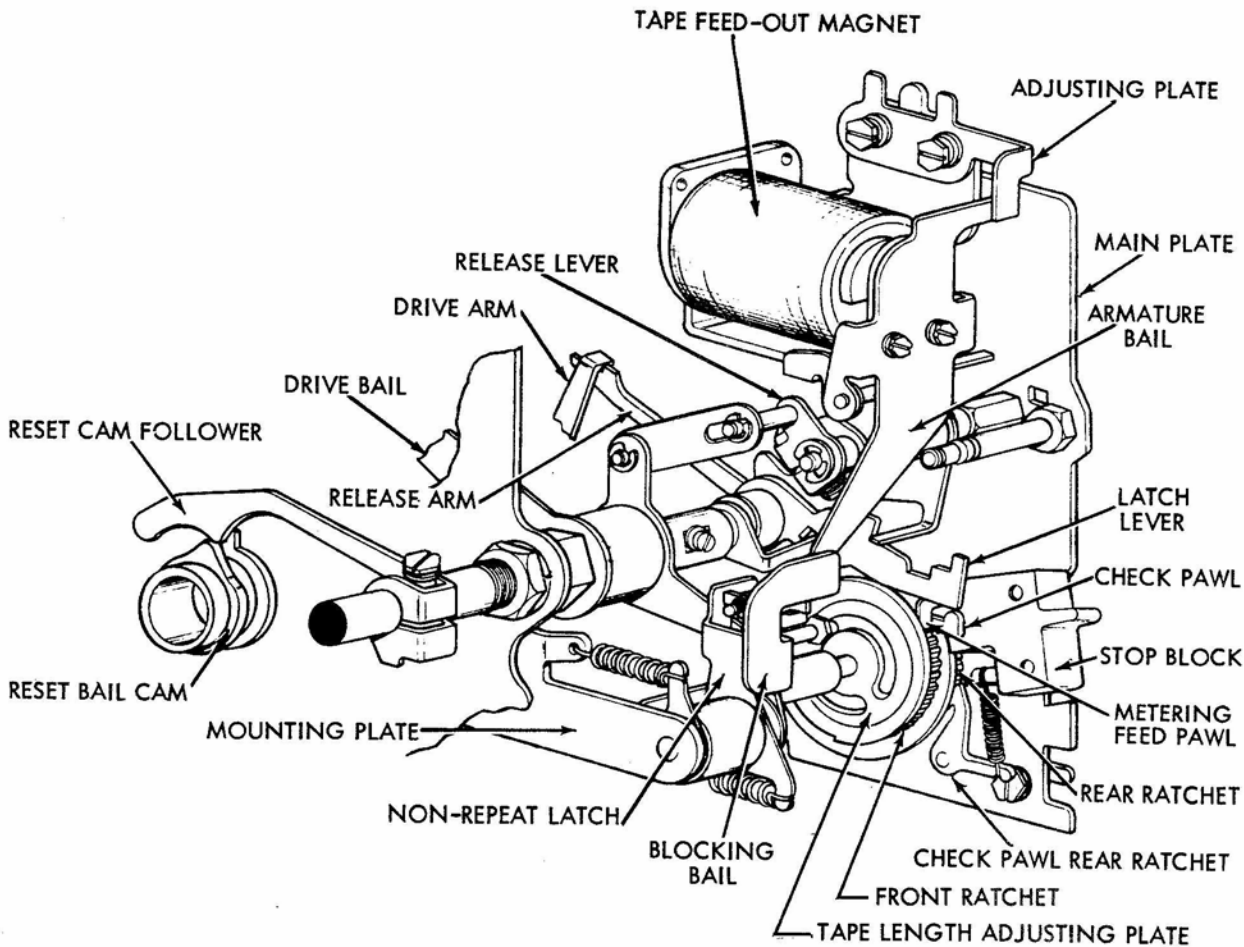


Figure 4-41. Remote Control Non-Interfering "Letters" Tape Feed-Out Mechanism

message is received during any part of a tape feed-out cycle, the mechanism will stop and the incoming message will be received without interference. 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 a feed-out cycle the mechanism stops and remains inactive until the operator starts another cycle.

(a) INITIATION MECHANISM -

The feed-out operation is initiated by a pulse (115 volt DC  $\pm$  10% with 600 ohms series resistance) from a tape feed-out button. The pulse is applied to a feed-out magnet when the typing reperforator is in an idling condition. When the magnet is energized, the armature bail moves the blocking bail out of engagement with the drive bail assembly. The drive bail, which is spring loaded, falls into the indent of its cam and the connecting link positions the release lever on the lower step of the latch lever. If the start magnet is held energized longer than one cycle,

the non-repeat latch prevents the drive bail from again falling into the indent of its cam. The non-repeat latch is delayed one cycle by the spring loaded blocking latch on the drive bail. As the drive bail reaches the indent 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.

(b) METERING MECHANISM -

When the drive bail positions the release levers on the lower step of the latch lever 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 feed 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 latch lever is actuated, as it would be by the selector cam on receipt of a message, and the tripping mechanism is blocked preventing further feeding. Simultaneously, the feed pawls are lifted off the ratchets and the ratchets return to their zero position.

(c) **TRIPPING MECHANISM** - A bail that follows a cam attached to the reperforator main shaft engages the clutch trip lever and punch slide latches. When the bail cam follower enters the detent of its cam, the bail operates the function clutch trip lever and punch slide latches initiating a "letters" cycle of the punch. Each time the reperforator main shaft rotates one revolution a "letter" cycle is initiated, provided the bail is not blocked by the latch lever. If an incoming message trips the latch lever, the "letters" punching cycle is immediately blocked from any further operation.

(d) **STORAGE MECHANISM** - The purpose of the storage mechanism is to hold the reset bail in engagement with the slides until the slides are fully reset so that they may recognize the first character set up in the punch slide latches by the selector. 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.

c. **MULTIPLE TYPING REPERFORATOR BASE** - The bases used in this group are identical to those used in the monitor group. For information concerning physical description, electrical facilities, and reperforator mounting refer to paragraph 4-4.c.

d. **MOTOR UNITS** - For information concerning operating theory of the synchronous and governed motor units, refer to paragraph 4-3.d.

e. **UNIVERSAL CABINET (RECEIVE)**

(1) **GENERAL** - The receiving cabinet provides mounting facilities for two multiple typing reperforator sets and the electrical control facilities to operate the sets (Figure 4-42). The cabinet consists of separate inner and outer structures to minimize the transmission of mechanical noise to the outer shell by the apparatus. All equipment mounts on the inner structure, the outer shell serving as a dust and noise enclosure. Each reperforator set is mounted on slide rails so that the sets may be withdrawn

from the front of the cabinet for servicing and maintenance. A raceway is provided at the bottom rear of the cabinet to contain station cabling. The raceway may be fastened in place from inside the cabinet for "against the wall" applications. Provisions for grounding the various units to the cabinet and for attaching an external ground to the cabinet are provided.

(2) **DOORS, PANELS, AND DRAWERS**

(a) **DOORS** - Four doors are provided on the cabinet, two at the rear and two in front. The rear doors are all metal, extend the full length of the cabinet, and allow access to the typing reperforators and electrical control rack. The front doors, located below the reperforator drawers, allow access to a storage area and provide a mounting surface for two tape bins. A recessed handle is provided on each right hand door to facilitate opening. Magnetic catches serve to hold each pair of doors closed.

(b) **END ENCLOSURES** - Refer to paragraph 4-3.e.(2)(b).

(c) **FRONT CONTROL PANEL** - The front control panel is divided into an UPPER SHELF and LOWER SHELF section. Mounted in each section are three white OPEN LINE lamps, three amber REMOTE SEIZURE lamps, three REPERF MARKING switches, three TAPE FEED OUT buttons, and three spare reperforator jacks. Located between the two sections is a red LOW TAPE lamp and an AC convenience receptacle.

(d) **DOME** - Refer to paragraph 4-4.f.(2)(d).

(e) **TYPING REPERFORATOR DRAWER FRONT ENCLOSURE** - Each typing reperforator set is mounted in a drawer assembly which pulls forward to permit access to the reperforators for servicing. To remove the front panel assembly from the drawer, grasp the two vertical handles near the top and push the spring loaded thumb screws above each handle in (use thumbs to push screws). Holding the thumb screws in, simultaneously pull forward and lift up on the handles to clear the four guides from their respective slots on the right and left brackets. When fully perforated tape typing reperforators are used, the hinged door below the front panel assembly provides access to the chad containers mounted below the multiple base.

(3) **ELECTRICAL CONTROL FACILITIES**

(a) **GENERAL** - Located at the rear of the cabinet on an electrical control rack are the electrical control facilities to operate the typing reperforators. The electrical control

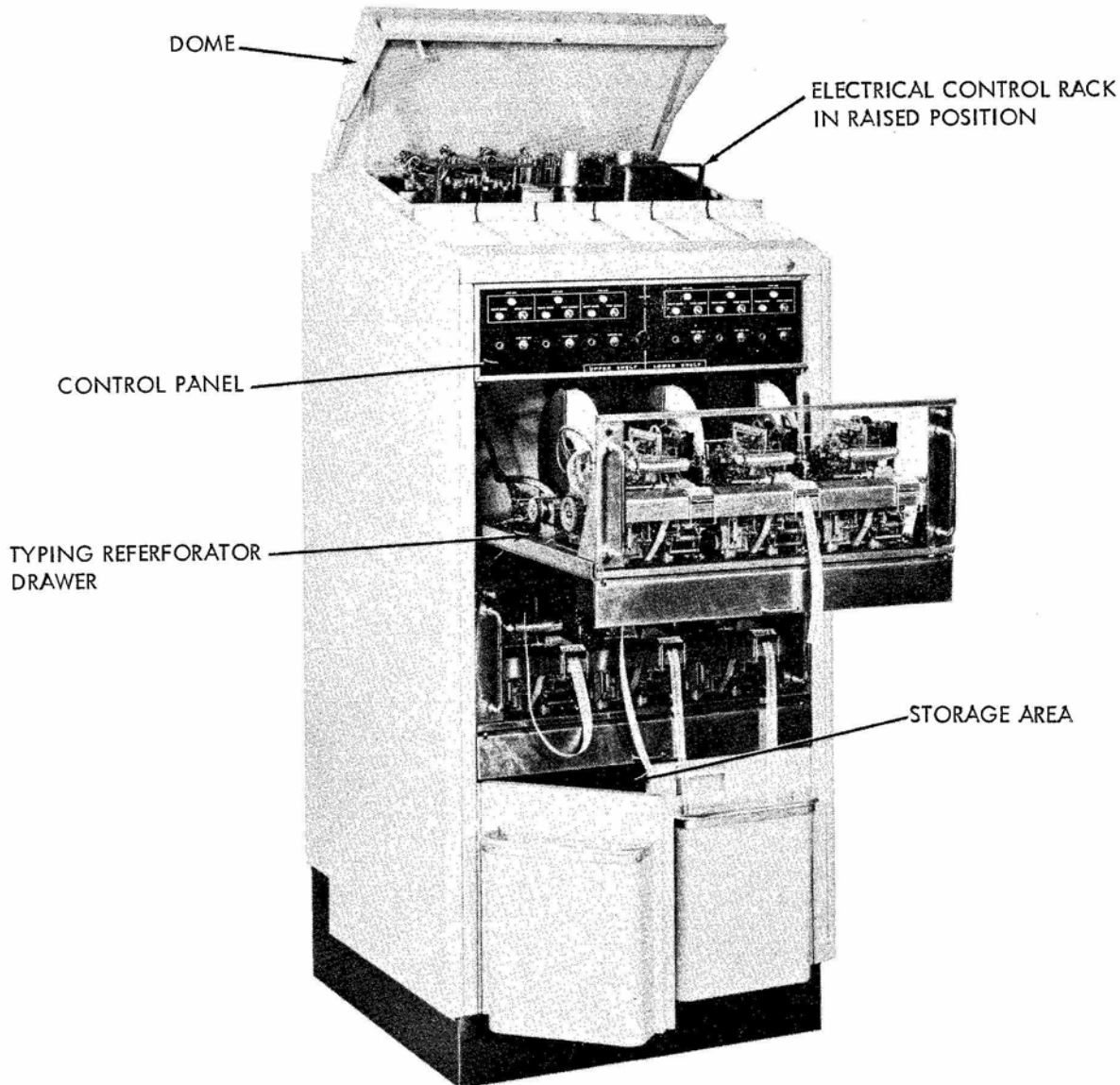


Figure 4-42. Model 28 Typing Reperforator Receiving Group (Front View)

rack mounts on a swivel mechanism, and can be rotated to a horizontal position for maintenance purposes when the dome is opened. Captive screws are provided to secure the rack in the horizontal or vertical position. Mounted on the control rack are five fuses, an AC power switch and convenience receptacle, two AC power failure alarm relays, six open line alarm relays (plus associated components) and six 33RY line relays for control of the reperforator signal circuits, and terminal board facilities for cabinet wiring.

(b) **SIGNAL CIRCUIT** - The receiving typing reperforator signal circuit includes a 33RY line relay, OPEN LINE RELAY, 115 volt DC full wave power supply, and a REPERF MARKING switch. The OPEN LINE relay is a time delay relay, and operates as explained in paragraph 4-4.f.(3)(b). The REPERF MARKING switch, when operated, shunts the signals to the cabinet reperforator causing the reperforator to come to the stop position. See Volume 2 of this manual for the actual schematic wiring diagram of the signal line and power circuits.

(c) 33RY POLAR RELAY - Refer to paragraph 4-4.f.(3)(c).

#### 4-6. MODEL 28 MONITOR TRANSMITTER (PULL BACK) GROUP (FIGURE 1-11)

a. GENERAL - The Model 28 Monitor Transmitter Group consists of one multiple transmitter distributor set, one multiple typing reperforator set, and one multiple tape winder set. The above units mount in a Model 28 Universal Cabinet which provides wiring and electrical control facilities for operation of the sets. The monitor transmitter group is an auxiliary piece of equipment, and is not considered as part of the Model 28 Universal Torn Tape System.

#### b. TRANSMITTER DISTRIBUTOR OPERATION

(1) The transmitter distributor used in the Model 28 Monitor Transmitter Group mounts on a multiple base. The unit is designed to sense code combinations perforated in a tape or received from an external multiwire input, convert them into electrical code pulses, and distribute them over a signal circuit. All electrical wiring terminates in a 36 point female connector mounted on the rear of the unit (Figure 1-15).

(2) The transmitter distributor is a two-shaft unit. The sensing shaft auxiliary "B" contact is wired in series with the distributor shaft clutch release magnet to control it electrically. However, each shaft may be operated independently of the other. Rotation of the sensing shaft is controlled via the tape out and start-stop contacts which are wired in series with the sensing shaft clutch release magnet. The unit is capable of "single wire" or "multiple wire" output, and "multiple wire" input to the distributor contacts for sequential distribution. Signal out may be arranged for neutral or polar operation. The operation sequence is such that the reading cycle occurs after tape feeding, and the last character sensed is transmitted immediately.

(3) For a detailed discussion of the sequence of operation for the transmitter distributor, refer to paragraphs 4-3.b.(1)(c) through (6). The actual schematic wiring diagram of the signal, power, and control circuits for the cabinet appears in Volume 2 of this manual.

c. MULTIPLE TRANSMITTER DISTRIBUTOR BASE - Refer to paragraph 4-3.c.

d. TYPING REPERFORATOR OPERATION - Refer to paragraph 4-4.b.

e. MULTIPLE TYPING REPERFORATOR BASE - Refer to paragraph 4-4.c.

f. MOTOR UNITS - Refer to paragraph 4-3.d.

g. UNIVERSAL CABINET (MONITOR - TRANSMITTER GROUP)

(1) GENERAL - The monitor transmitter cabinet provides mounting facilities for a multiple transmitter distributor set, multiple typing reperforator set, multiple tape winder set, and the necessary wiring and electrical control facilities for their operation (see Figures 1-11 and 4-43). The cabinet assembly consists of separate inner and outer structures to minimize mechanical transmission of noise to the outer shell. All equipment mounts to the inner structure, the outer shell serving as a dust and noise enclosure. A raceway is provided at the bottom rear of the cabinet to contain station cabling. The raceway may be fastened in place from the inside of the cabinet for "against the wall" applications.

#### (2) DOORS AND PANELS

(2) DOORS - Two full length all metal doors are provided at the rear of the cabinet for accessibility to the mechanical apparatus and the electrical control rack. The front doors, below the transmitter distributor shelf, provide access to the multiple typing reperforator and tape winder sets for changing of tape, emptying of chad containers (fully perforated tape), message re-transmission, and for servicing. The front doors are provided with glass windows to permit observation of the sets during operation. A stud is mounted on the inside of the left door to permit manual unwinding of the tape for message re-transmission.

(b) END ENCLOSURES - Refer to paragraph 4-3.e.(2)(b).

(c) FRONT CONTROL PANEL - The front control panel mounts a red WINDER FULL lamp, red TAPE OUT lamp, and a TAPE WINDER switch. The switch is located between the two red warning lamps.

(d) DOME - Refer to paragraph 4-4.f.(2)(d).

#### (3) ELECTRICAL CONTROL FACILITIES

(a) GENERAL - Located at the rear of the cabinet on an electrical control rack are the electrical control facilities to operate the sets mounted in the cabinet. The electrical control rack mounts on a swivel mechanism,

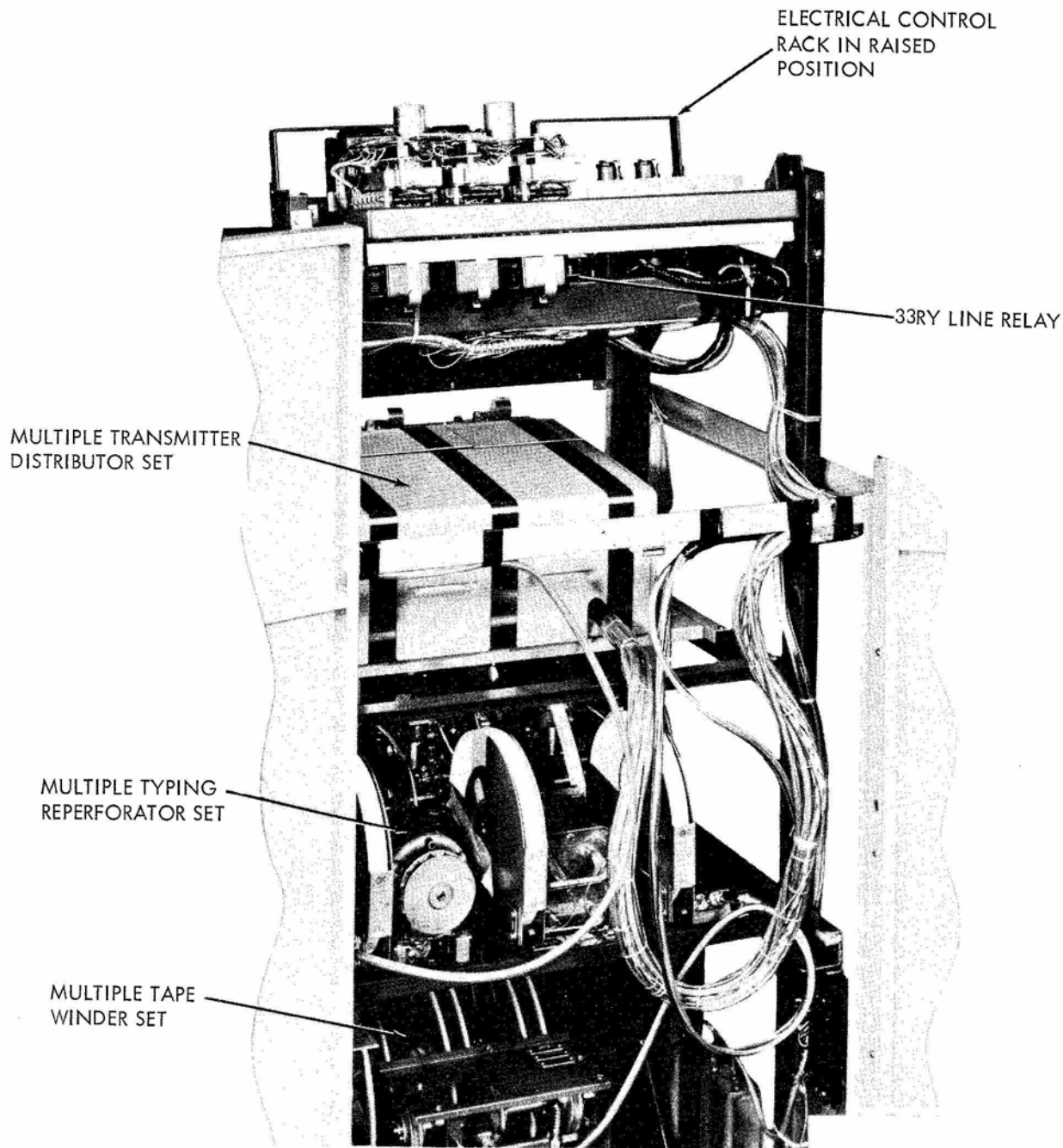


Figure 4-43. Model 28 Monitor Transmitter Group (Rear View, Dome Removed)

and can be rotated to a horizontal position for maintenance purposes when the dome is opened. Captive screws are provided to secure the rack in the horizontal or vertical position. Mounted on the electrical control rack are five fuses, an AC power switch and convenience receptacle, two AC power failure alarm relays, six rheostats (plus associated components) for control of marking and spacing current, three jacks (for

insertion of a milliammeter into the signal lines) to monitor signal current adjustment, three 33RY line relays, and terminal board facilities for cabinet wiring. See Volume 2 of this manual for the appropriate schematic and actual wiring diagrams.

(b) 33RY LINE RELAY - Refer to paragraph 4-4.f.(3)(c).

## SECTION 5

## ADJUSTMENTS AND LUBRICATION

## 5-1. INTRODUCTION

a. This section contains adjustments and lubrication information for the basic components of the four groups covered in this manual.

b. It is assumed that the elements depicted in the illustrations which appear throughout the bulletin are being viewed from a position in front of the equipment, unless the illustrations are specifically labeled otherwise. In the line drawings, pivot points are shown by circles or ellipses that are solid black to indicate fixed points and cross-hatched to indicate floating points. References in the text to "left" or "right" designate the viewers left or right as he faces the front of the equipment.

## CAUTION

Improperly adjusted equipment may be seriously damaged in a matter of seconds if operated under power.

## 5-2. ADJUSTMENTS

## a. GENERAL

(1) In the adjustments and spring tensions covered in this section, location of clearances, position of parts and point and angle of scale applications are illustrated by drawings. Requirements and procedures are set forth in the texts that accompany the drawings. The sequence of the adjustments is that which should be followed when complete readjustment of any of the components is undertaken. The letters of the alphabet in parenthesis which precede the texts indicate the sequence to be followed on the individual pages. A procedure should be read all the way through before making the adjustment or testing the spring tension.

(2) Tools required to make the adjustments and test the spring tensions are not supplied with the equipment, but are listed in Teletype Bulletin 1124B. If parts are removed, all adjustments which the removal of these parts might facilitate should be made before the parts are replaced. When a part mounted on shims is removed, the number of shims at each mounting screw should be noted so that identical pile ups can be made when the part is replaced. Unless it is specifically stated to the contrary, after an adjustment has been made, all nuts and screws that were loosened should be tightened.

(3) The spring tensions given in this bulletin are indications, not exact values, and should be checked with Teletype scales in the positions shown in the drawings. Springs which do not meet the requirements and for which there are no adjusting procedures should be discarded and replaced by new springs.

(4) All contact points should meet squarely. Smaller points should fall wholly within the circumference of larger mating points. Points that are the same size should not be out of alignment more than 25 percent of the point diameter. Avoid sharp kinks or bends in the contact springs.

## b. MANUAL SELECTION OF CHARACTERS OR FUNCTIONS

(1) The viewer is facing the front of the typing reperforator unit when the selecting mechanism is on his right and the perforator mechanism is on his left. The unit is in its unoperated, or stop, condition when it is not under power and both clutches are disengaged. It is in idling condition when it is under power and the clutches are disengaged (steady marking of signal line). The unit is in the letters condition when the typewheel rack is in its upper position, the numerals appear on the top half of the typewheel and the letters push bar is in its extreme right position. The unit is in the figures condition when the typewheel rack is in its lower position, the letters appear on the top half of the typewheel and the figures push bar is in its extreme right position. The unit can be placed in the letters or figures condition by selecting the letters or figures code combinations (see paragraph (3) below).

(2) When fully disengaged, either of the two steel clutches on the typing reperforator unit are latched in their stop position between a trip lever (or stop arm), which bears against a shoe lever, and a latch lever which seats in a notch in a clutch cam disk. The main shaft will then turn freely without the clutch shoes dragging. When the clutch is engaged, or tripped, the shoe lever and a cam disk stop lug are moved apart, and the clutch shoes are wedged against the drum so that the clutch turns in unison with the shaft.

## NOTE

If the shaft is turned by hand, the clutch will not fully disengage upon reaching its stop position. Where a procedure calls for disengagement, ro-

tate the clutch to its stop position, apply a screwdriver to the cam disk stop lug and turn the disk in the normal direction of shaft rotation until the latch lever seats in its notch in the disk.

(3) To Manually Operate the Typing Reperforator Unit. Attach an armature clip to the selecting mechanism as follows: carefully place the flat-formed portion of the clip over the armature between the pole pieces, lock the extruded projection under the armature and hook the clip's other end over the bakelite guard. The spring pressure of the clip will hold the armature in its marking (attracted) position. Rotate the main shaft counterclockwise until the clutches reach their stop position. Fully disengage the clutches as instructed in paragraph (2) above. Release the armature momentarily to allow the selecting clutch to engage. Turn the main shaft slowly until all push levers have fallen to the left of their selecting levers. Strip the push levers corresponding to the spacing elements of the code combination to be processed from their selecting levers and allow them to move to the right. The push levers and selecting levers are numbered in succession 1 to 5 from rear to front. The main shaft can then be rotated until the required condition is set up or the character or function to be selected is cleared through the unit.

(4) TRANSMITTER DISTRIBUTOR

(a) When rotating either the sen-

sing or distributor shaft by hand, the clutch does not fully disengage upon reaching its stop position. In order to relieve the drag on the clutch and permit the main shaft to rotate freely, apply pressure on a lug of the clutch disk with a screwdriver to cause it to engage its latch lever and thus disengage the internal expansion clutch shoes from dragging on the clutch drum.

(b) When the requirement calls for the clutch to be disengaged, the clutch shoe lever must be fully latched between its trip lever and latch lever so that the clutch shoes release their tension on the clutch drum. When engaged, the clutch shoe lever is unlatched and the clutch shoes are wedged firmly against the clutch drum.

(c) Covers may be removed for inspection and minor repair of the unit, however, when more extensive maintenance is to be undertaken, it is recommended that the unit be removed from its sub-base to disconnect the power and to permit the unit to be inverted.

(d) All contact points should meet squarely. Contacts with the same diameter should not be out of alignment more than 25% of the contact diameter. Avoid sharp kinks or bends in the contact springs.

c. ALPHABETICAL INDEX: ADJUSTMENTS AND SPRING TENSIONS

TYPING REPERFORATORS (PARAGRAPH 5-2.d.)

ADJUSTMENTS	FIGURE	ADJUSTMENTS	FIGURE
Clutch Shoe Lever	5-1	Punch Mechanism (Fully Perforated Tape Units Only)	
Follower Lever	5-11	Feed Hole Lateral Alignment	5-20
Function Box	5-32	Feed Hole Spacing	5-19
Function Clutch Drum End Play	5-1	Punch Slide Downstop Position	5-14
Function Clutch Trip Lever	5-10	Punch Slide Guide	5-14
Punch Mechanism		Rocker Arm	5-14
Feed Pawl	5-18	Release Downstop Bracket	5-29
Perforator Position - Final	5-16	Reset Arm	5-10
Punch Position - Preliminary	5-13	Rocker Bail	5-12
Punch Slide Reset Bail	5-18	Rocker Bail Guide Bracket	5-12
Reset Bail Trip Lever	5-17	Selector Mechanism	
Rocker Arm	5-13	Range Finder Knob Phasing	5-8
Punch Mechanism (Chadless Tape Units Only)		Selector Armature	5-3
Feed Hole Lateral Alignment	5-24	Selector Cam Lubricator	5-10
Feed Hole Spacing - Final	5-22	Selector Clutch Drum	5-6
Feed Hole Spacing - Preliminary	5-22	Selector Clutch Stop Arm	5-8
Punch Pin Penetration	5-15	Selector Magnet Bracket	5-4
Punch Slide Downstop Position	5-15	Selector Receiving Margin	5-9
Punch Slide Guide Position	5-15	Tape Guide	5-28

ADJUSTMENTS	FIGURE	ADJUSTMENTS	FIGURE
Typing Mechanism		AUTOMATIC NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM ONLY)	
Axial Output Rack Guide Roller	5-42	Adjusting Lever	5-63
Axial Sector Alignment	5-41	Follower Lever	5-63
Correcting Drive Link	5-43	Safety Latch	5-57
Detent (Chadless Tape Units Only)	5-23		
Drive Arm	5-52	SPRING TENSIONS	
Idler Gear Eccentric Shaft	5-43	Clutch Shoe	5-2
Letters and Figures Yield Arms	5-34	Clutch Shoe Lever	5-2
Lifter Arm	5-36	Function Clutch Latch Lever	5-31
Lifter Arm Eccentric Screw	5-36	Function Clutch Release	5-29
Lock Lever	5-37	Punch Mechanism	
Lock Lever Trip Post	5-38	Detent Lever	5-27
Oscillating Drive Bail	5-40	Feed Pawl	5-27
Oscillating Drive Link	5-40	Main Trip Lever	5-11
Printing Between Perforated Feed Holes (Fully Perforated Tape Units Only)	5-48	Perforator Drive Link	5-13
Printing Trip Link (Fully Perforated Tape Units Only)	5-47	Punch Slide Latch	5-11
Printing Trip Link (Chadless Tape Units Only)	5-51	Tape Shoe Torsion	5-28
Push Bar Guide Bracket	5-42	Punch Mechanism (Chadless Tape Units Only)	
Push Bar Operating Blade (Final)	5-30	Punch Slide	5-25
Push Bar Operating Blade (Preliminary)	5-30	Retractor Bail	5-25
Ribbon Carrier (Fully Perforated Tape Units Only)	5-46	Tape Guide (Punch Block)	5-26
Ribbon Carrier (Chadless Tape Units Only)	5-50	Tape Guide (Tape Chute)	5-26
Rocker Bail Pilot Stud	5-31	Punch Mechanism (Fully Perforated Tape Units Only)	
Rotary Correcting Lever	5-44	Punch Slide	5-21
Transfer Mounting Bracket	5-33	Tape Guide (Punch Block)	5-21
Typewheel	5-49	Tape Guide (Tape Chute)	5-21
		Selector Mechanism	
		Adjusting Arm	5-11
		Marking Lock Lever	5-5
		Push Lever Reset Bail	5-7
		Selector Armature	5-5
		Selector Clutch Latch Lever	5-7
		Selector Lever	5-6
		Selector Push Lever	5-6
		Spacing Lock Lever	5-7
		Start Lever	5-9
		Typing Mechanism	
		Bell Crank	5-30
		Correcting Drive Link	5-39
		Detent	5-53
		Drive Arm	5-53
		Eccentric Shaft Detent Lever	5-41
		Feed Pawl	5-52
		Figures Arm Assembly	5-34
		Figures Extension Arm	5-34
		Function Blade	5-39
		Letters Arm Assembly	5-35
		Letters Extension Arm	5-35
		Lifter	5-39
		Lifter Toggle Link	5-39
		No. 5 Pulse Beam	5-37
		Ratchet Wheel Torque	5-52
		Typing Mechanism (Chadless Tape Units Only)	
		Accelerator	5-51
		Print Hammer	5-51
		Printing Latch	5-51
		Printing Trip Link	5-51
REMOTE CONTROL AND AUTOMATIC NON- INTERFERING "LETTERS" TAPE FEED-OUT MECHANISMS			
Drive Arm Adjusting Plate	5-61		
Latch Lever	5-56		
Ratchet Stop Block	5-58		
Rear Check Pawl	5-58		
Release Arm	5-60		
Reset Bail Latch	5-66		
Reset Bail Trip Lever	5-64		
Tape Length Adjusting Plate	5-65		
Time Delay Lever	5-59		
REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM ONLY			
Adjusting Lever	5-62		
Armature Backstop	5-55		
Armature Hinge	5-54		
Follower Lever	5-62		
Magnet Assembly	5-54		
Mounting Plate	5-54		
Release Lever	5-55		
ORIGINAL			

SPRING TENSIONS	FIGURE	ADJUSTMENTS	FIGURE
Typing Mechanism (Fully Perforated Tape Units Only)		TRANSMITTER DISTRIBUTOR (PARAGRAPH 5-2.g.)	
Accelerator	5-47	Backstop	5-81
Print Hammer	5-48	Cam Follower Guide	5-78
Printing Latch	5-47	Cam Shaft Bearing Retainer	5-74
Printing Trip Link	5-47	Cam Sleeve End Play	5-74
		Clutch Shoe Lever	5-77
REMOTE CONTROL AND AUTOMATIC NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISMS		Clutch Trip Lever Upper Extension	5-77
Drive Arm	5-61	Clutch Trip Magnet Armature Hinge	5-75
Feed Pawl and Front Check Pawl	5-58	Contact Gap	5-81
Ratchet Return	5-59	Contact Lever Slide	5-93
Rear Check Pawl	5-58	Cover Plate	
Release Arm	5-60	Deflector Bracket	5-96
Release Lever	5-56	Distributor Contact Assembly	5-79
Reset Bail Latch	5-66	Distributor Contact Gap	5-79
Reset Bail Trip Lever	5-66	Feed Lever Set Collar	5-80
Time Delay Lever	5-59	Feed Pawl (Top Plate Removed)	5-95
		Feed Wheel Detent	5-92
REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM ONLY		Idler Gear Assembly	5-74
Blocking Bail	5-55	Initial Adjustment with Distributor Block Removed	5-79
Blocking Latch Torsion	5-55	Magnet Bracket	5-76
Drive Bail	5-54	Oil Reservoir	5-95
Non-Repeat Lever	5-55	Pusher Lever	5-94
		Removing Cover Plate	5-72
AUTOMATIC NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM ONLY		Removing Filler Plate	5-72
Latch Lever	5-57	Removing Tape Deflector	5-72
Safety Latch	5-57	Removing Tape Guide Plate	5-72
		Removing Top Plate	5-72
MULTIPLE REPERFORATOR BASE (PARAGRAPH 5-2.e.)		Removing Transmitter Distributor Assembly	5-72
ADJUSTMENTS		Removing Transmitter Distributor From Cradle	5-72
Motor Adjusting Stud	5-69	Replacing and Positioning Tape Guide Plate	5-85
Tape Out Switch Assembly	5-68	Replacing and Positioning Top Plate	5-86
Timing Belt	5-67	Sensing Pin	5-90
SPRING TENSIONS		Slide Lever	5-83
Tape Out Lever Spring	5-68	Start-Stop Switch Bracket	5-89
		Storing Switch Assembly	5-82
SYNCHRONOUS AND GOVERNED MOTORS (PARAGRAPH 5-2.f.)		Tape Guide	5-85
ADJUSTMENTS		Tape Lid	5-84
Governor Contact	5-70	Tape Lid Pin	5-91
Governor Contact Backstop	5-70	Tape Out and Tape Lid	
Governor Motor Positioning	5-70	Pin Downstop	5-91
Governor Motor Speed Adjustment	5-71	Tape-Out and Tape Lid Switch	5-88
Synchronous Motor Positioning	5-70	Tape-Out and Tape Lid Switch Bracket	5-91
		Tape-Out Pin	5-87
SPRING TENSIONS		Tape-Out Switch	5-87
Governor Brush Spring Tension	5-71	Tape-Out Switch Bracket (Run Position)	5-87
		Tight Tape Slide Arm	5-89
		Trip Assembly Mounting Plates	5-75
		SPRING TENSIONS	
		Armature Bail	5-75
		Auxilliary Lever	5-94
		Cam Follower Lever	5-78



SPRING TENSIONS	FIGURE	ADJUSTMENTS	FIGURE
Clutch Latch Lever	5-76	RELAY (33RY) (PARAGRAPH 5-2.j.)	
Clutch Shoe Lever	5-73	Bias (Magnetic Balance)	5-103
Clutch Shoe	5-73	Bias Test (Magnetic Balance)	5-104
Clutch Trip Lever Lower Extension	5-76	Calibration	5-104
Contact (Normally Closed)	5-81	Contact Gap	5-103
Contact (Normally Open)	5-81	Contact Test (% Break)	5-104
Contact Swinger	5-81	Evaluation of a Particular Test Set	5-104
Deflector	5-96		
Distributor Rocker	5-79	UNIVERSAL CABINETS (PARAGRAPH 5-2.k.)	
Distributor Rocker Compression	5-79	ADJUSTMENTS	
Feed Lever	5-80	Control Panel Assembly	5-107
Feed Pawl	5-95	Control Panel Magnet Adjustment	5-107
Feed Ratchet Detent	5-80	Front Door	5-105
Latch Lever	5-93	Front Door Catches	5-105
Latch Stripper Bail	5-94	Rear Door	5-106
Pusher Lever	5-93	Rear Door Catches	5-106
Pusher Stripper Bail	5-94	Numbering Module Adjustment	5-107
Sensing Bail	5-90		
Sensing Pin	5-90	TANDEM MESSAGE IDENTIFICATION MOD- ULE (PARAGRAPH 5-2.l.)	
Slide Lever	5-83	ADJUSTMENTS	
Start-Stop Bail	5-89	Armature Assembly Alignment	5-115
Start-Stop Lever Detent	5-92	Backstop - Normally Closed Contact	5-108
Tape Lid Pin	5-91	Bank Alignment	5-114
Tape Lid Release Plunger	5-92	Bracket	5-109
Tape-Out Bail Yield	5-86	Check Pawl	5-110
Tape-Out Extension Bail	5-86	Code Reading Contact Swinger Alignment	5-109
Tape-Out Pin	5-91	Feed Pawl Auxiliary Backstop	5-110
Tape-Out Sensing Pin	5-86	Feed Pawl Backstop	5-110
Tight-Tape and Start-Stop Contact	5-89	Intermediate Gear	5-111
Tight-Tape Bail Yield	5-89	Interrupter Contact Gap	5-116
		Interrupter Swinger and Contact Alignment	5-116
MULTIPLE TRANSMITTER DISTRIBUTOR BASE (PARAGRAPH 5-2.h.)		Magnet Assembly	5-112
ADJUSTMENTS		Normally Open Contact Gap	5-109
Cover Plate	5-99	Off-Normal Swinger Alignment	5-117
Filler Plate Assembly	5-99	Off-Normal Switch Break and Make Contact Gaps	5-118
Motor Pinion	5-97	Ratchet Stopping Spring Alignment	5-114
Transmitter Distributor Positioning	5-98	Wiper Spring Alignment and Tension	5-113
TAPE WINDER (PARAGRAPH 5-2.i.)		SPRING TENSIONS	
ADJUSTMENTS		Brush	5-113
Clutch Engage-Disengage	5-100	Check Pawl	5-110
Full Tape Reel Alarm	5-102	Feed Pawl	5-110
Motor Pinion	5-101	Interrupter Swinger	5-116
Tape Arm	5-100	Normally Closed Contact	5-108
SPRING TENSIONS		Normally Open Contact	5-109
Chad Depressor	5-101	Off-Normal Switch Break Contact	5-118
Clutch Release Arm	5-100	Off-Normal Switch Make Contact	5-118
Clutch Release Latch	5-100	Ratchet Stopping	5-114
Full Tape Reel Alarm	5-102	Swinger	5-108
Full Tape Reel Alarm Contact		Wiper Spring	5-113
Pressure	5-102		

d. TYPING REPERFORATOR UNIT

NOTE  
TO FACILITATE ADJUSTMENTS, REMOVE TYPING REPERFORATOR FROM BASE

NOTE  
THE FOLLOWING ADJUSTMENTS PERTAIN TO ALL TYPING REPERFORATORS UNLESS OTHERWISE SPECIFIED.

CLUTCH SHOE LEVER

TO CHECK

- (1) DISENGAGE CLUTCH. MEASURE CLEARANCE.
- (2) ALIGN HEAD OF CLUTCH DRUM MOUNTING SCREW WITH STOP LUG. ENGAGE CLUTCH. MANUALLY PRESS SHOE LEVER AND STOP LUG TOGETHER AND ALLOW TO SNAP APART. MEASURE CLEARANCE.

REQUIREMENT

CLEARANCE BETWEEN SHOE LEVER AND STOP LUG:  
MIN. 0.055 INCH----MAX. 0.085 INCH  
GREATER WHEN CLUTCH ENGAGED (2) THAN WHEN DISENGAGED (1).

TO ADJUST

ENGAGE WRENCH OR SCREWDRIVER WITH LUG ON ADJUSTING DISK. ROTATE DISK WITH CLAMP SCREWS LOOSENED.

NOTE:

AFTER MAKING ADJUSTMENT, DISENGAGE CLUTCH. REMOVE DRUM MOUNTING SCREW. ROTATE DRUM IN NORMAL DIRECTION AND CHECK TO SEE IF IT DRAGS ON SHOE. IF IT DOES REFINE ADJUSTMENT.

THIS ADJUSTMENT SHOULD BE MADE FOR BOTH SELECTING AND FUNCTION CLUTCHES.

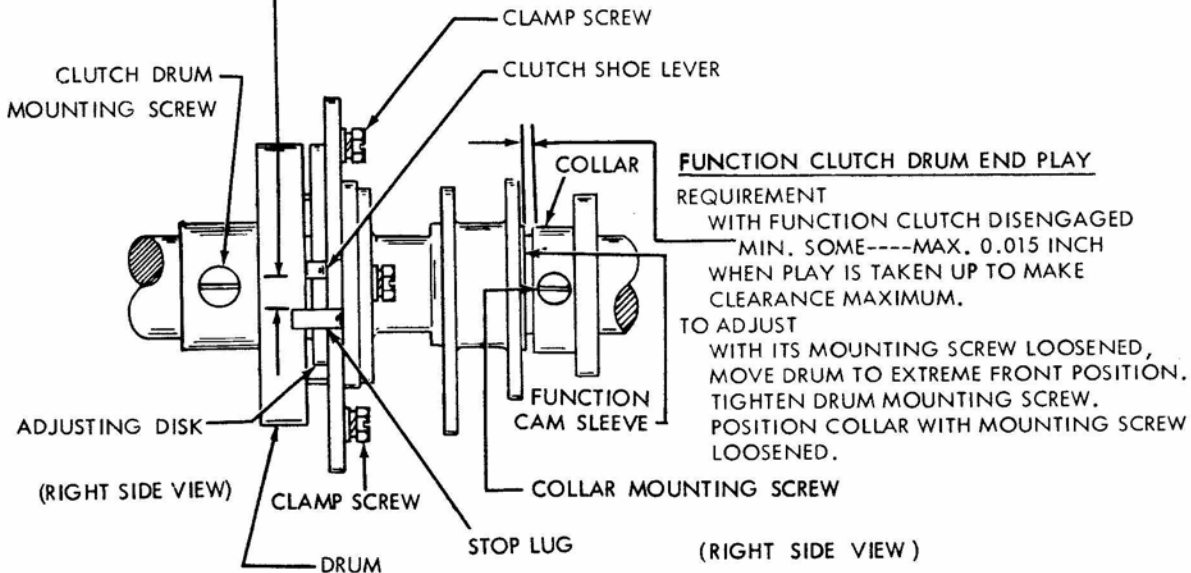


Figure 5-1. Typing Reperfector, Selecting and Function Clutch Mechanisms

NOTE:  
THESE SPRING TENSIONS APPLY TO BOTH CLUTCHES.

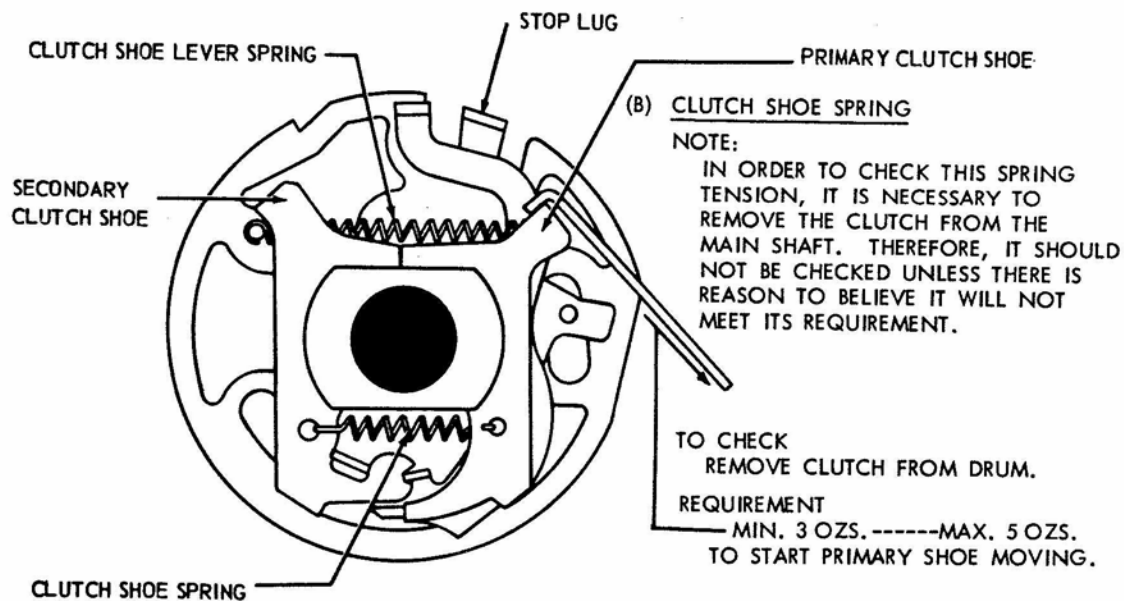
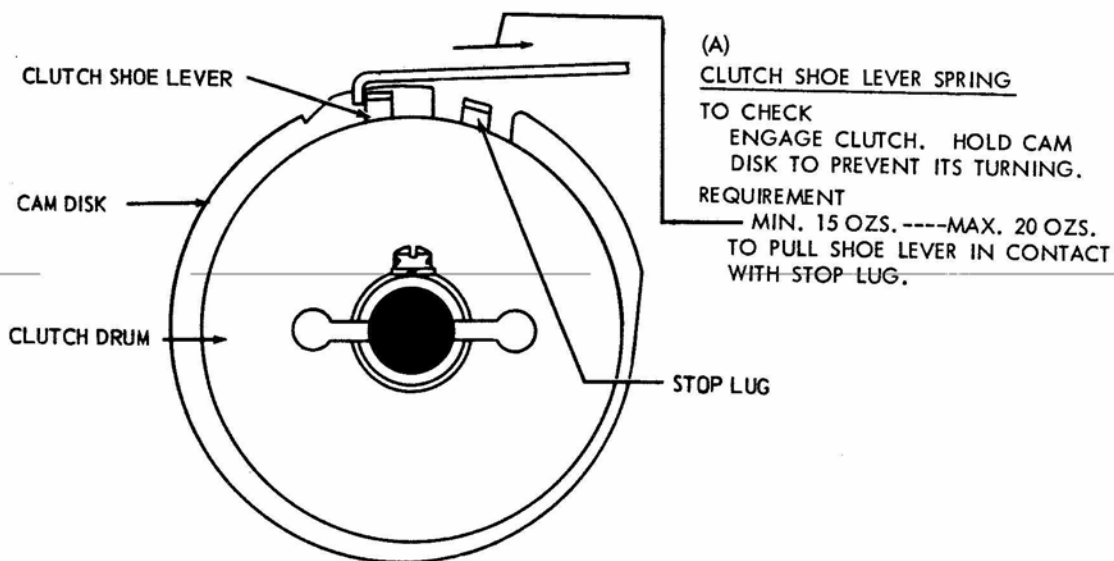
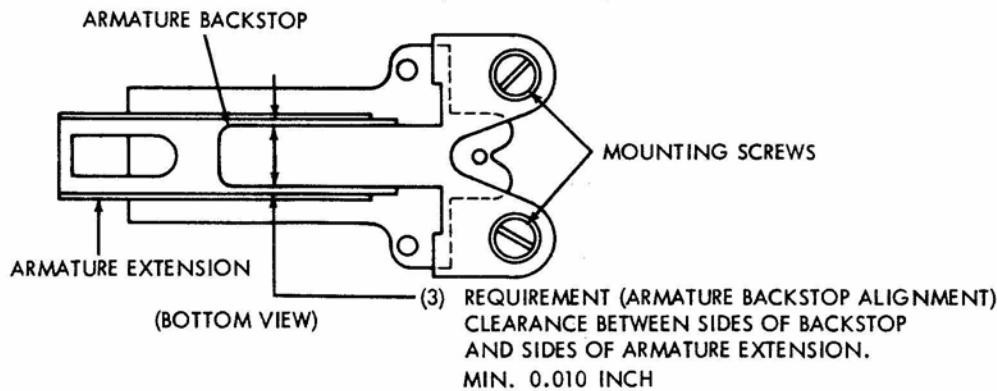
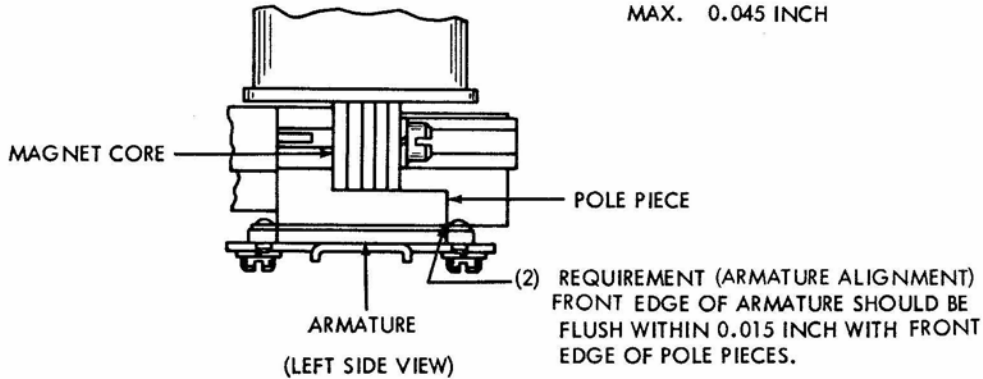
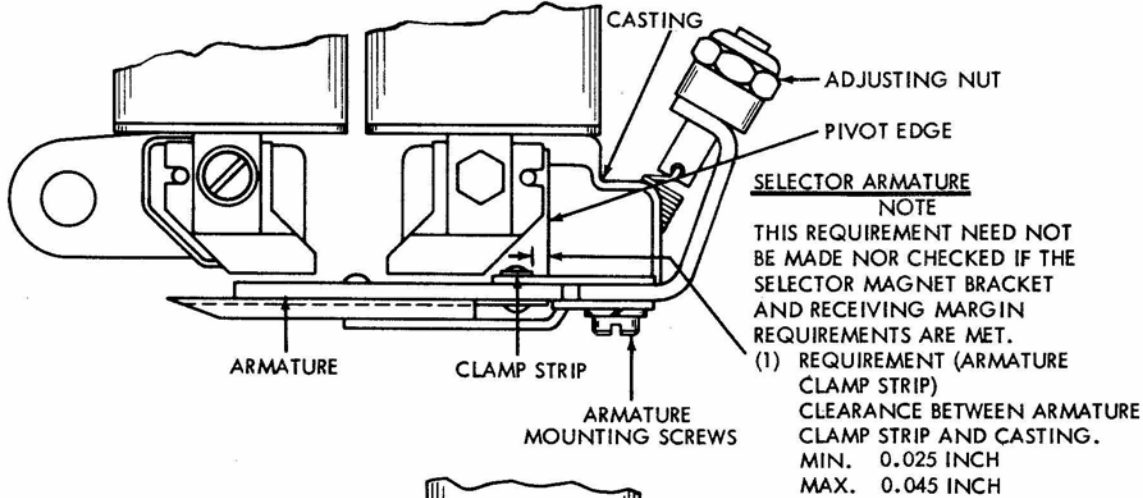


Figure 5-2. Typing Reperforator, Clutch Assemblies

NOTE

TO FACILITATE MAKING THE FOLLOWING ADJUSTMENTS, REMOVE THE RANGE FINDER AND SELECTOR MAGNET ASSEMBLIES. TO INSURE BETTER OPERATION, PULL A PIECE OF BOND PAPER BETWEEN THE ARMATURE AND THE POLE PIECES TO REMOVE ANY OIL OR FOREIGN MATTER THAT MAY BE PRESENT. MAKE CERTAIN THAT NO LINT OR PIECES OF PAPER REMAIN BETWEEN THE POLE PIECES AND ARMATURE.



TO ADJUST

1. POSITION ARMATURE SPRING ADJUSTING NUT TO HOLD ARMATURE FIRMLY AGAINST PIVOT EDGE OF CASTING.
2. POSITION ARMATURE AND BACKSTOP WITH MOUNTING SCREWS LOOSENED.

Figure 5-3. Typing Reperforator, Selector Armature

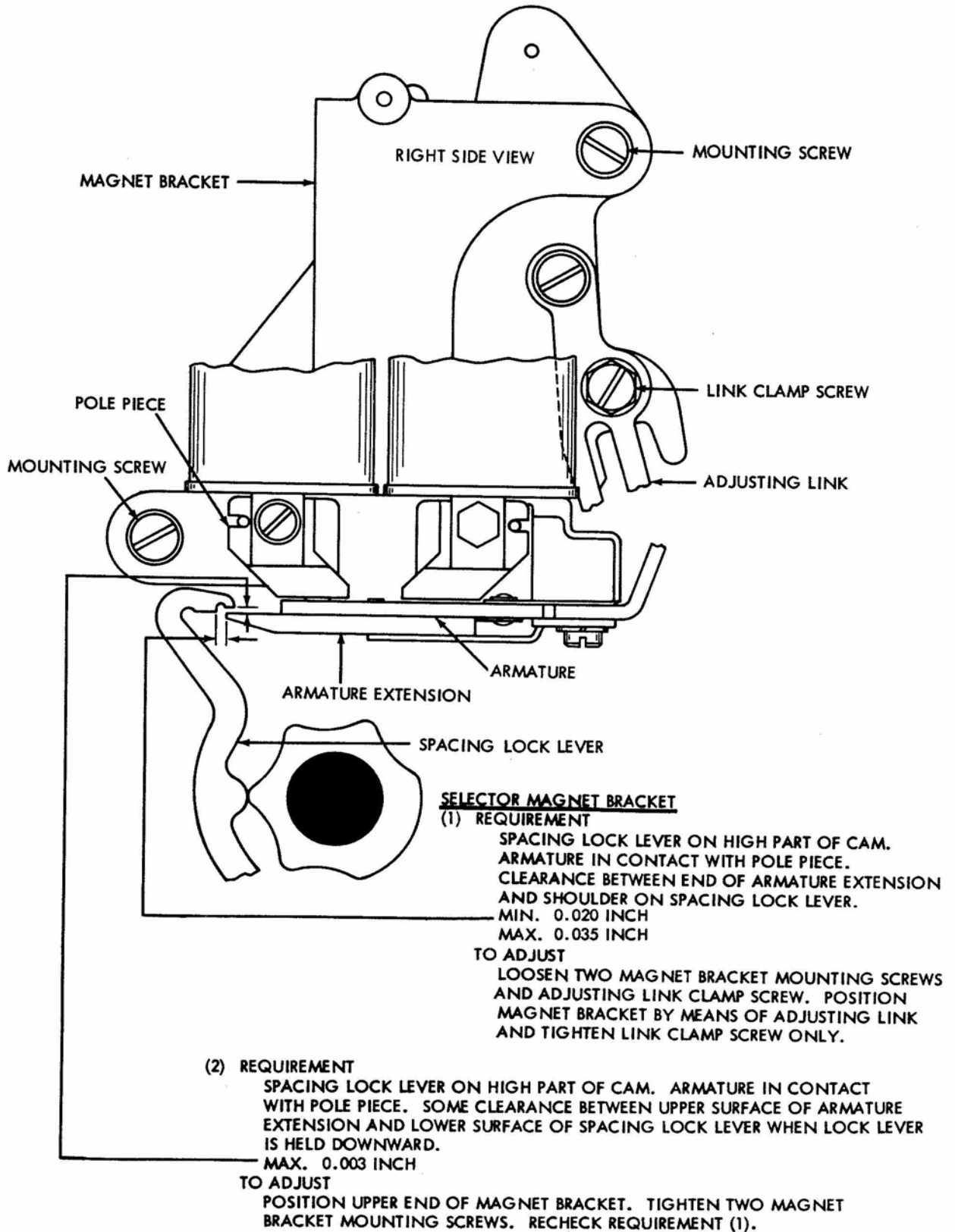


Figure 5-4. Typing Reperforator, Selector Magnet Bracket

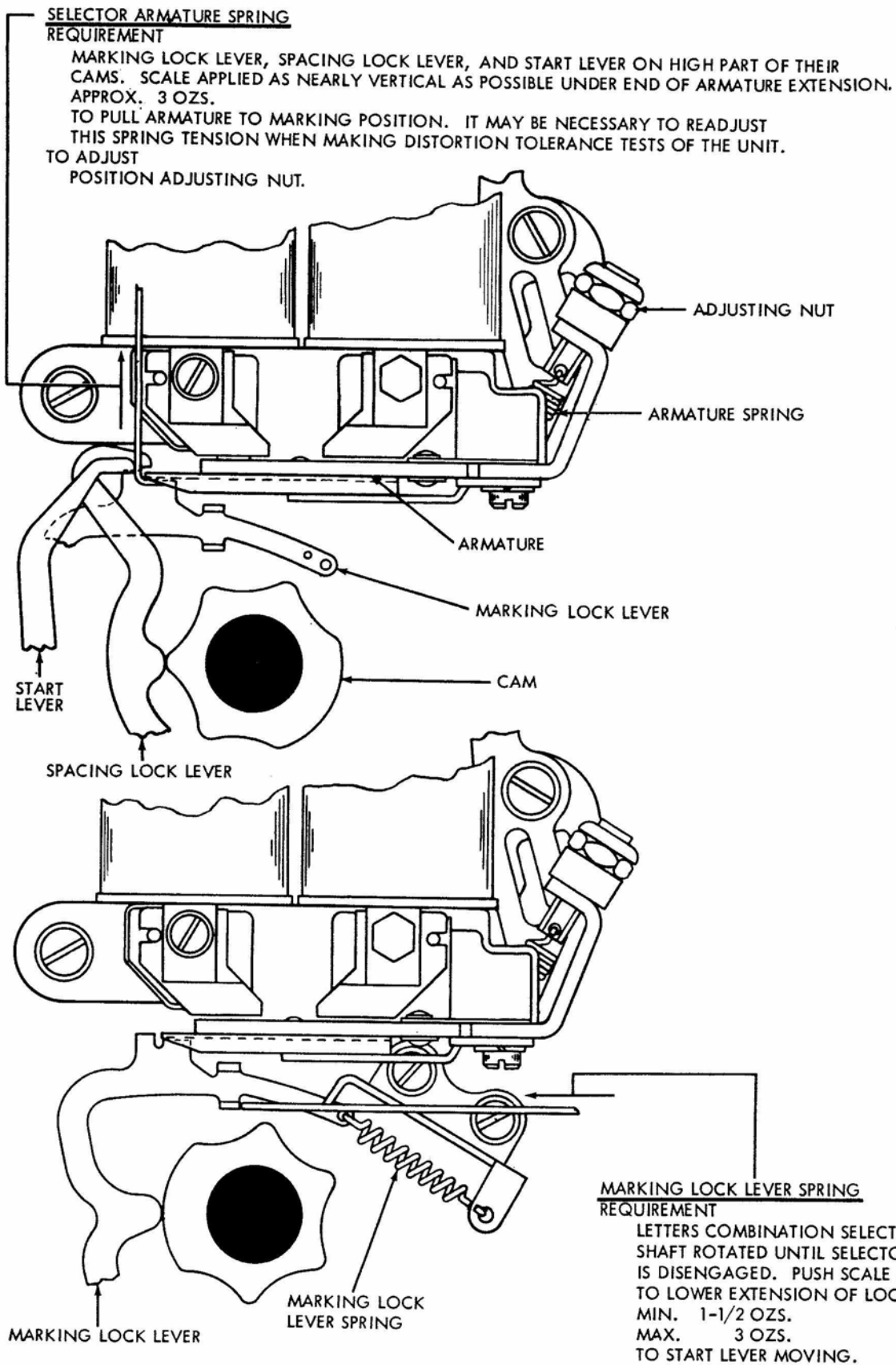
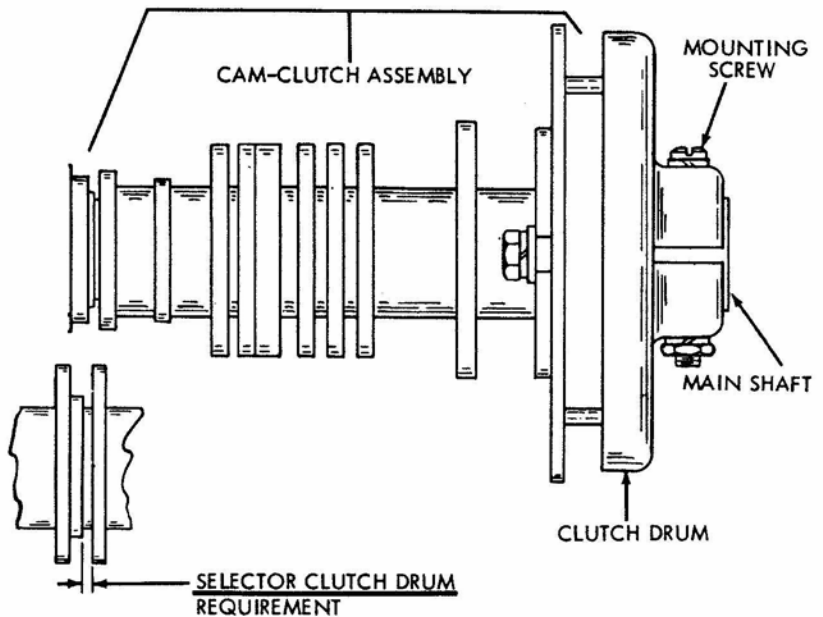
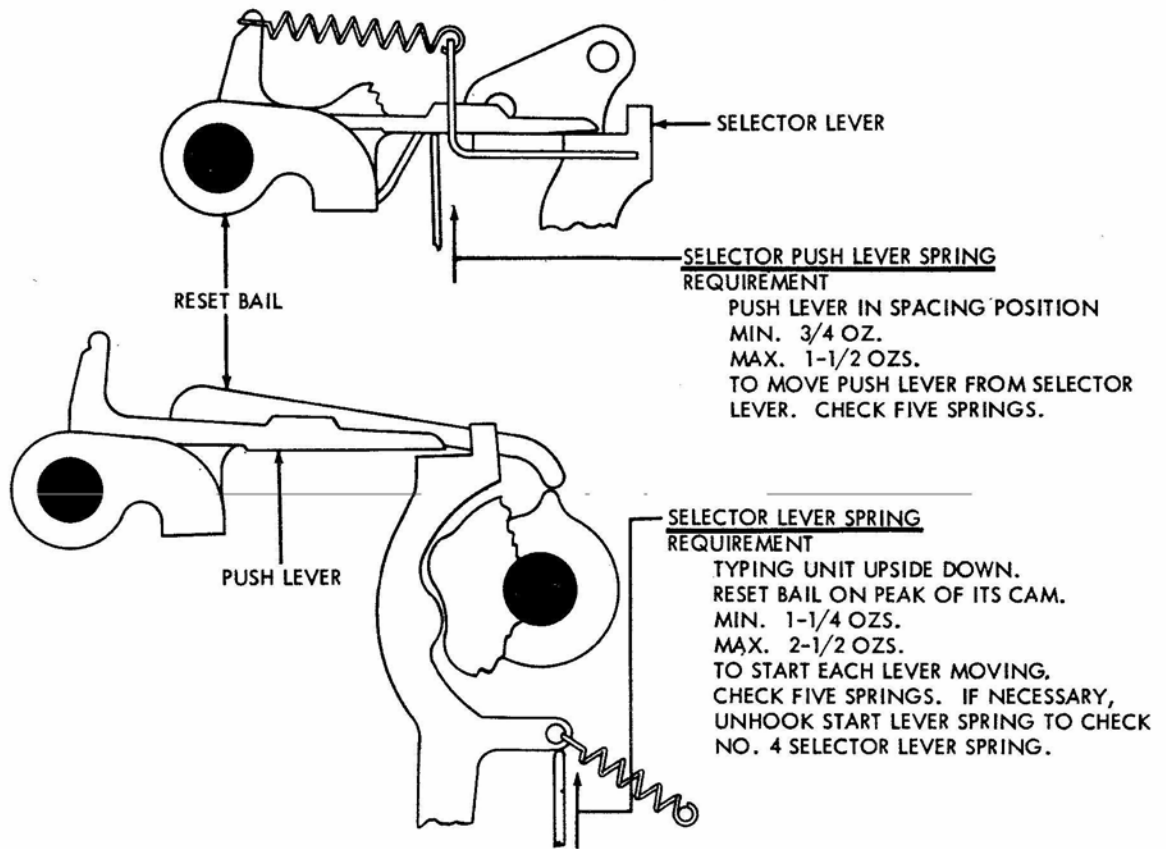


Figure 5-5. Typing Reperforator, Selector Spring Tensions



CLUTCH LATCHED IN STOP POSITION. CLUTCH DRUM AGAINST SHOULDER ON MAIN SHAFT. CAM-CLUTCH ASSEMBLY SHOULD HAVE SOME END PLAY  
 MAX. 0.010 INCH  
 TO ADJUST POSITION CLUTCH DRUM WITH MOUNTING SCREW LOOSENED.

Figure 5-6. Typing Reperforator, Selector Cam Clutch

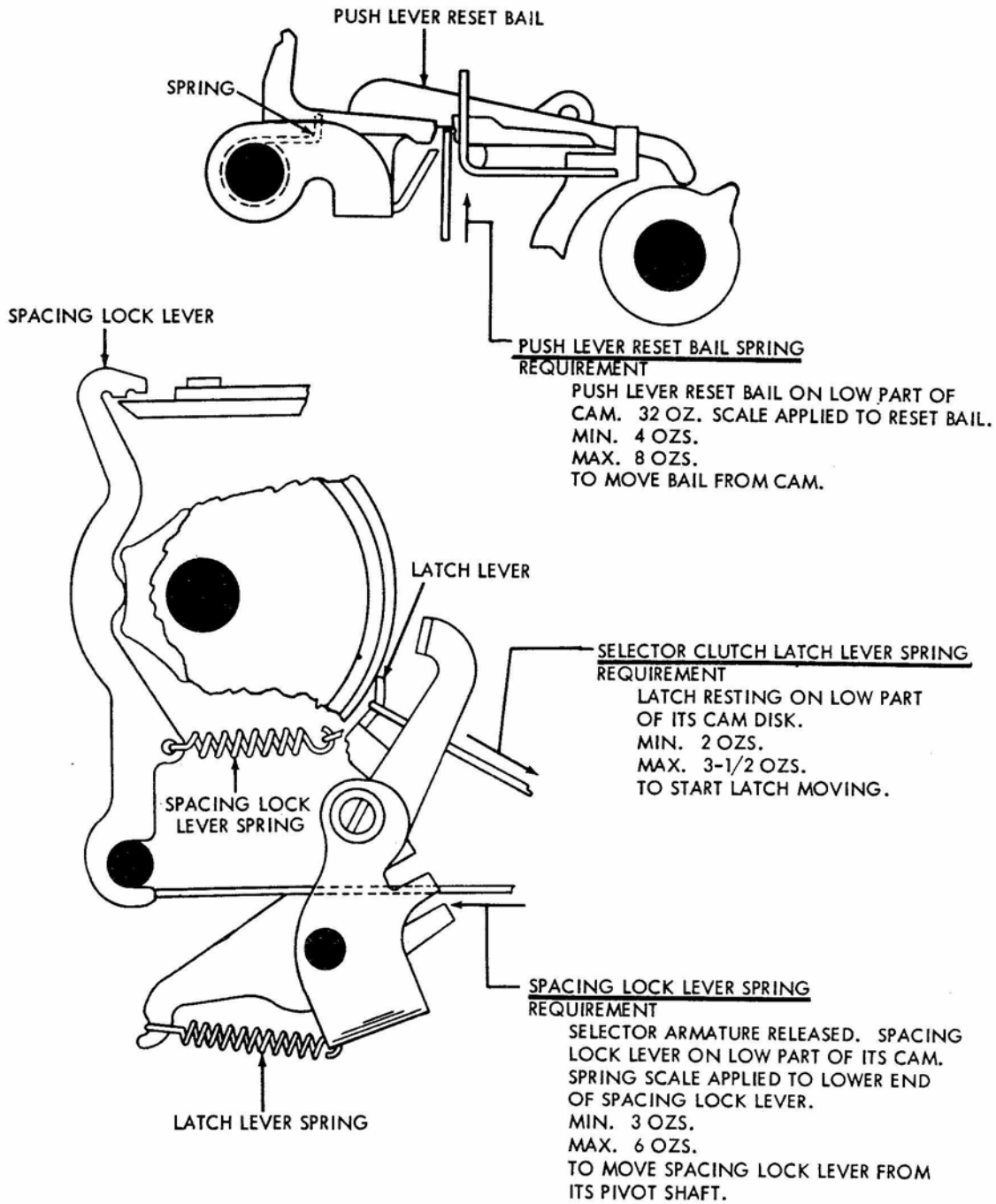


Figure 5-7. Typing Reperforator, Selector Clutch Spring Tensions



NOTE: REPLACE RANGE FINDER AND SELECTOR MAGNET ASSEMBLY.

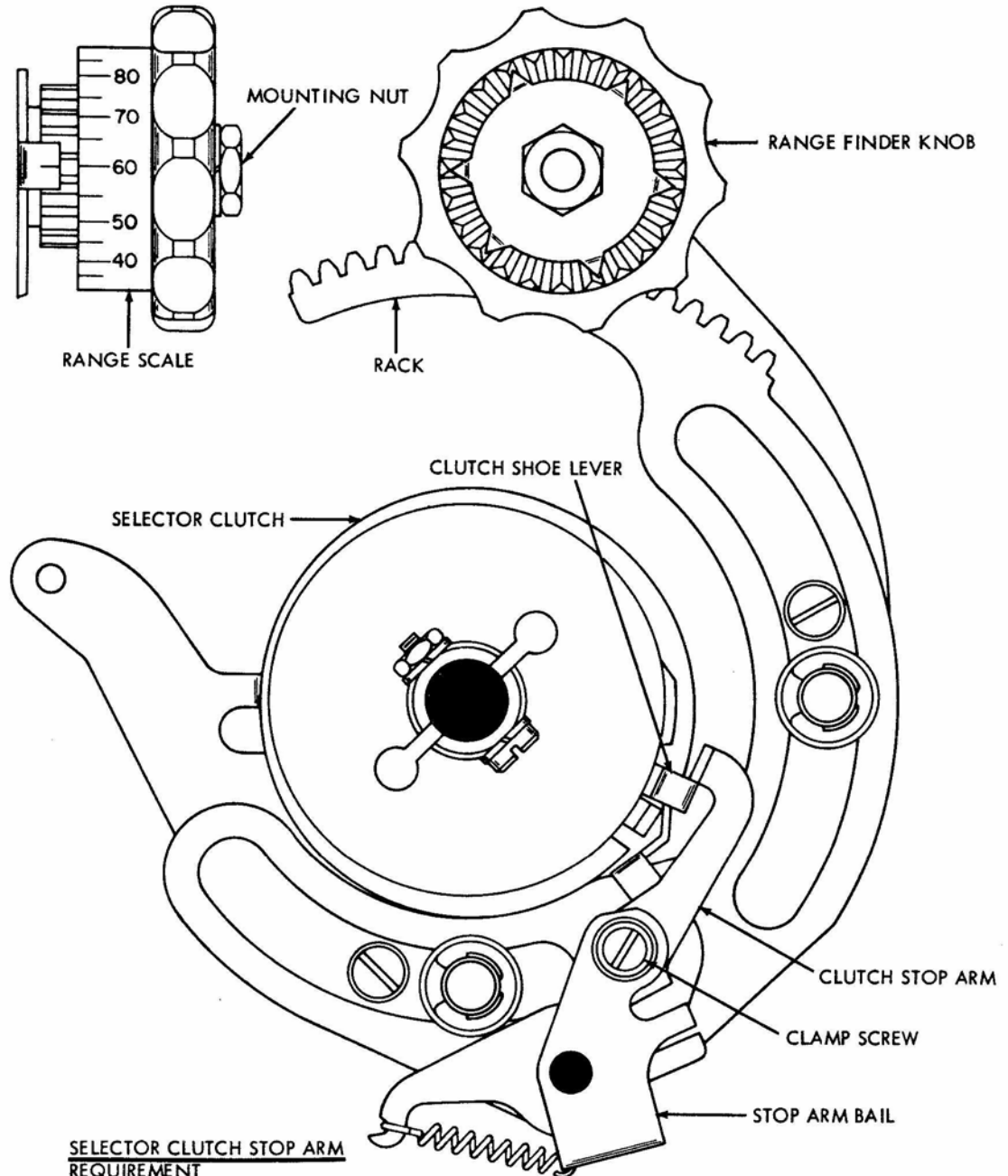
RANGE FINDER KNOB PHASING

REQUIREMENT

WITH RANGE FINDER KNOB TURNED TO EITHER END OF RACK, ZERO MARK ON SCALE SHOULD BE WITHIN 3 POINTS OF SCRIBED LINE ON RANGE FINDER PLATE.

TO ADJUST

REMOVE MOUNTING NUT, DISENGAGE KNOB FROM RACK AND POSITION KNOB. RE-ENGAGE KNOB WITH RACK AND REPLACE MOUNTING NUT.



SELECTOR CLUTCH STOP ARM

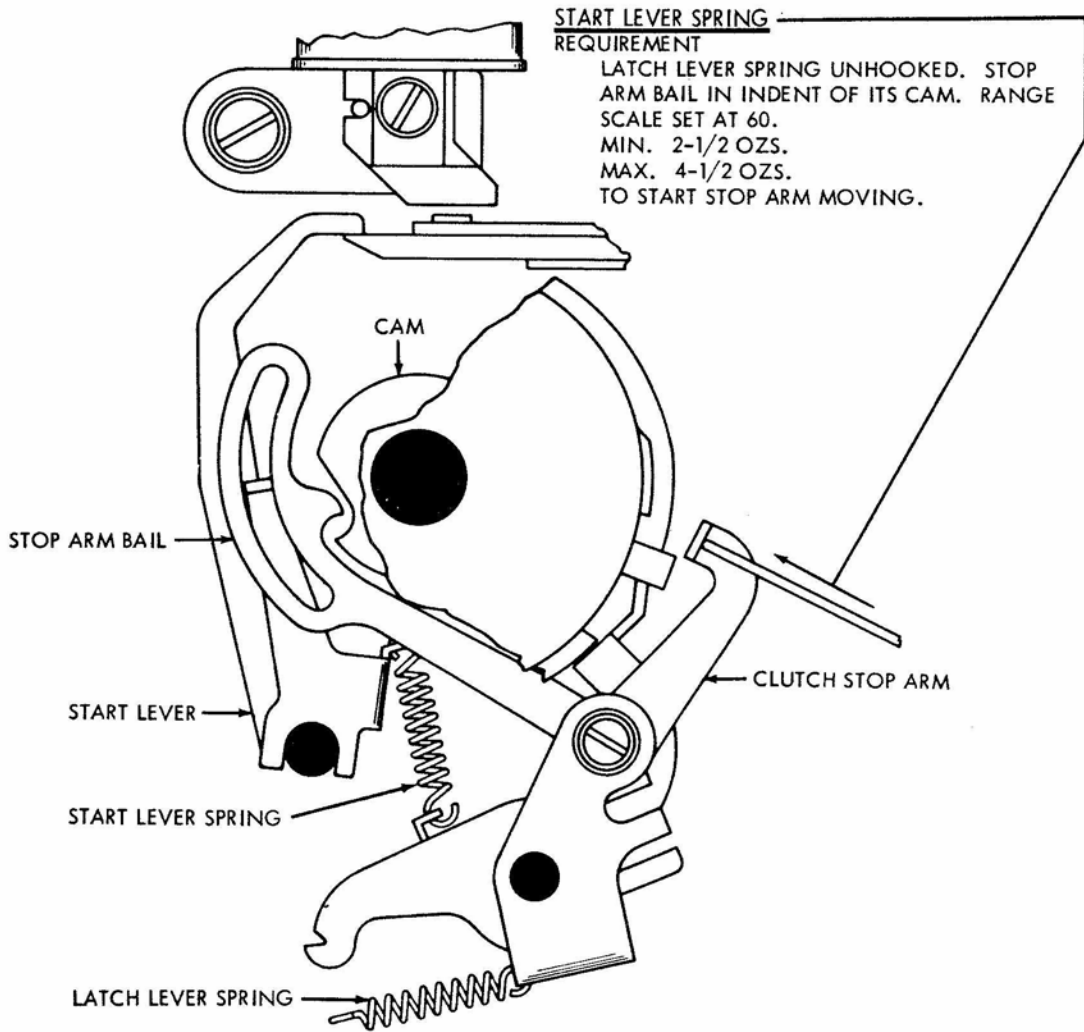
REQUIREMENT

RANGE SCALE SET AT 60. SELECTOR CLUTCH DISENGAGED. ARMATURE IN MARKING POSITION. CLUTCH STOP ARM SHOULD ENGAGE CLUTCH SHOE LEVER BY APPROXIMATELY FULL THICKNESS OF SHOE LEVER.

TO ADJUST

POSITION STOP ARM ON STOP ARM BAIL WITH CLAMP SCREW LOOSENED.

Figure 5-8. Typing Reperforator, Range Finder Mechanism



**SELECTOR RECEIVING MARGIN**

WHEN A SIGNAL DISTORTION TEST SET IS USED FOR DETERMINING THE RECEIVING MARGINS OF THE SELECTOR, AND WHERE THE CONDITION OF THE COMPONENTS IS EQUIVALENT TO THAT OF NEW EQUIPMENT, THE RANGE AND DISTORTION TOLERANCES BELOW SHOULD BE MET.

**SELECTOR RECEIVING MARGIN MINIMUM REQUIREMENTS**

POINTS RANGE WITH ZERO DISTORTION	PERCENTAGE OF MARKING AND SPACING BIAS TOLERATED	END DISTORTION TOLERATED WITH SCALE AT BIAS OPTIMUM SETTING
72	40	35

TO ADJUST: REFINE THE SELECTOR ARMATURE SPRING (FIGURE 5-5)

Figure 5-9. Typing Reperforator, Selector Clutch Mechanism

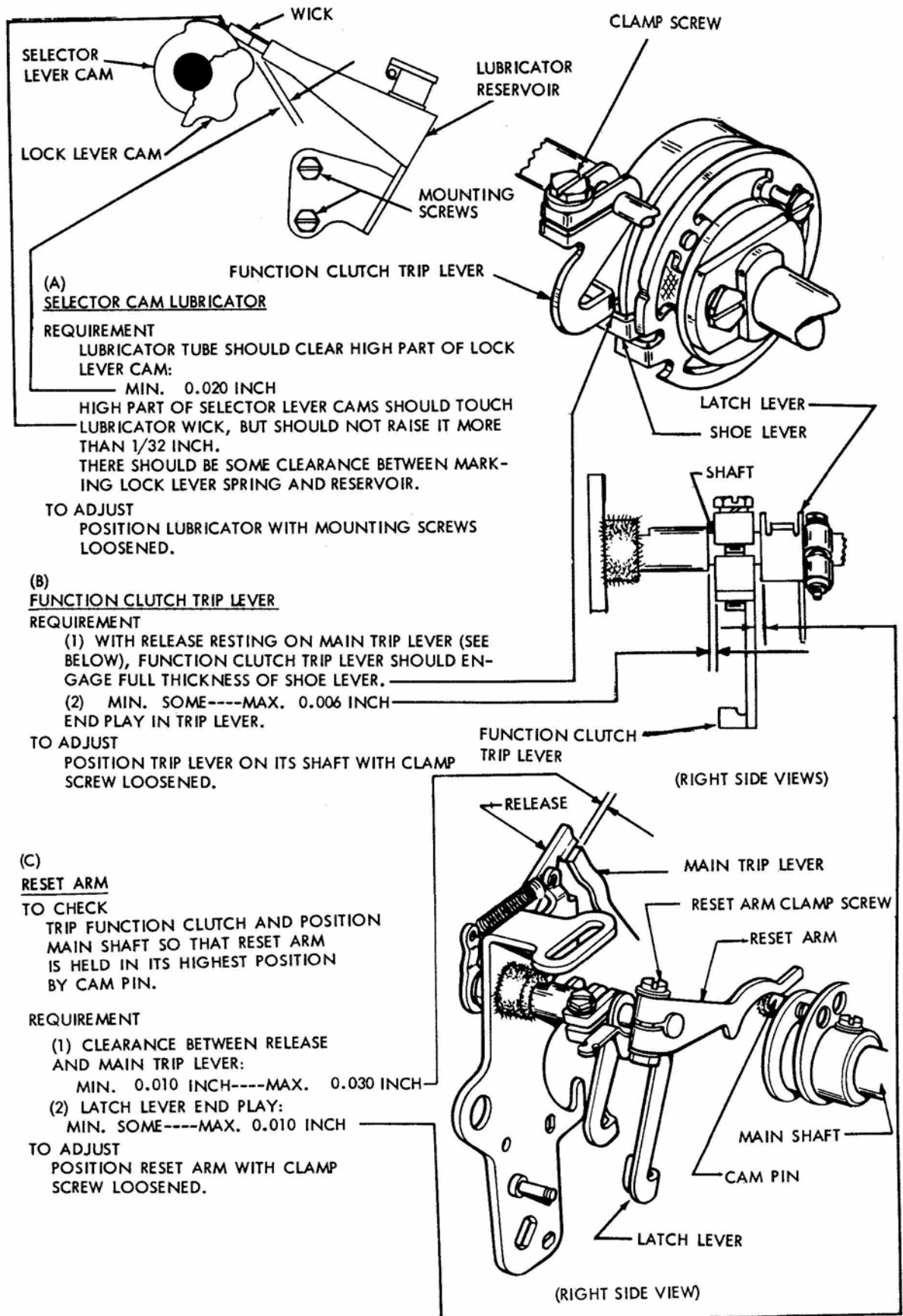


Figure 5-10. Typing Reperforator, Selecting and Function Mechanisms

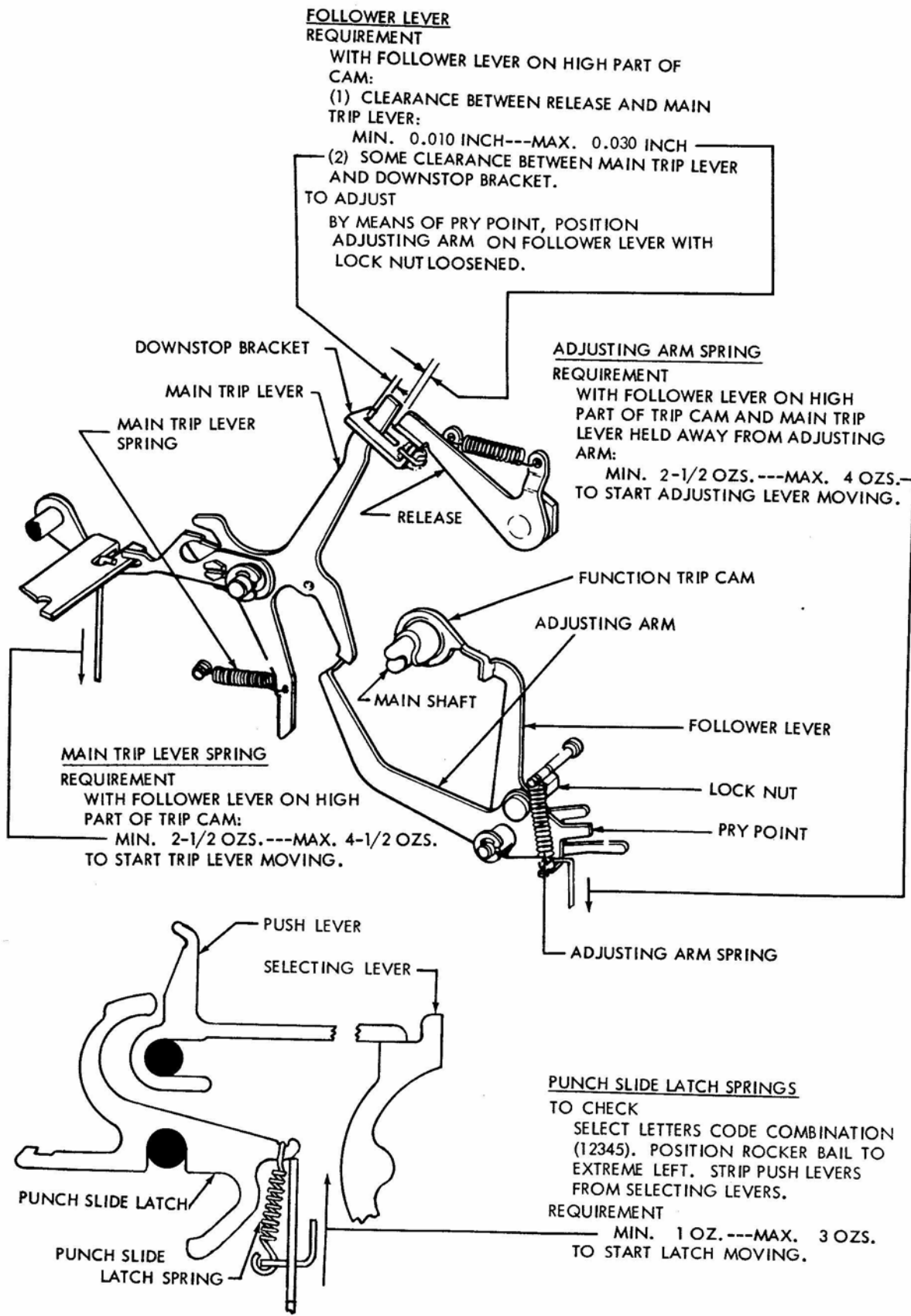


Figure 5-11. Typing Reperforator, Function and Selecting Mechanisms

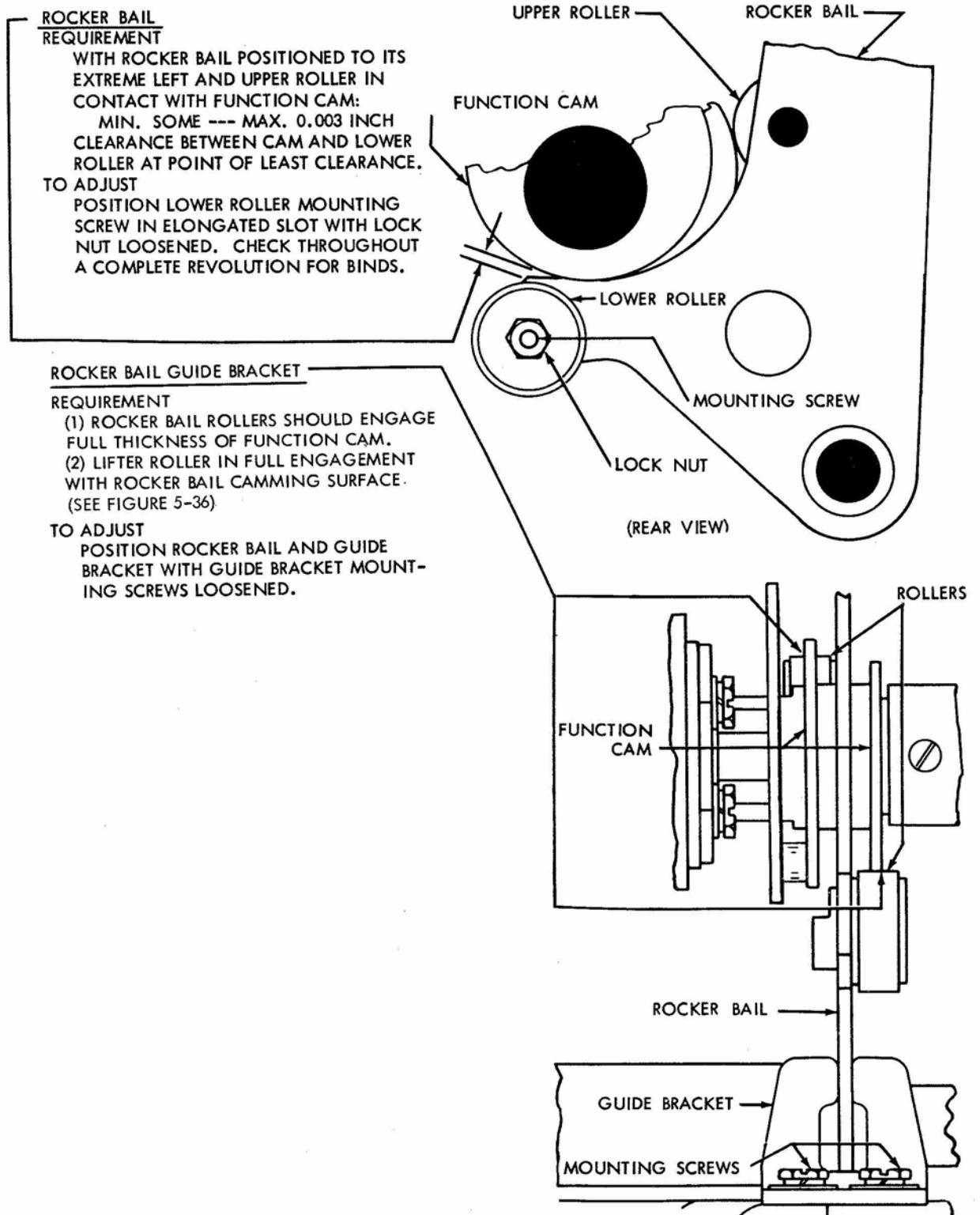


Figure 5-12. Typing Reperforator, Function Mechanism

PUNCH POSITION --- PRELIMINARY

REQUIREMENT

PUNCH MOUNTING SCREWS CENTRALLY LOCATED IN ELONGATED MOUNTING HOLES  
 PUNCH SLIDE LATCHES SHALL BE VISUALLY HORIZONTAL WHEN ENGAGED WITH THE PUNCH SLIDES.

TO ADJUST

REMOVE THE MOUNTING SCREW AT THE LOWER EDGE OF THE PUNCH MECHANISM BACK PLATE. REMAINING BACK PLATE MOUNTING SCREWS AND ANCHOR BRACKET MOUNTING SCREW FRICTION TIGHT. PUNCH SLIDES IN RESET CONDITION. MEET REQUIREMENT. TIGHTEN ALL SCREWS.

NOTE

BEFORE PROCEEDING WITH THE FOLLOWING ADJUSTMENTS. CHECK ROCKER BAIL LOWER ROLLER ADJUSTMENT.

ROCKER ARM

TO CHECK

TRIP FUNCTION CLUTCH AND ROTATE MAIN SHAFT UNTIL ROCKER BAIL UPPER ROLLER IS ON HIGH PART OF FUNCTION CAM PLACE 159926 GAUGE AS SHOWN. TAKE UP PLAY TO MAKE CLEARANCE BETWEEN GAUGE AND FEED PAWL STUD MINIMUM.

REQUIREMENT

- (1) CLEARANCE  
 MIN. 0.002 INCH --- MAX. 0.005 INCH
- (2) MIN. 0.002 INCH END PLAY IN ROCKER ARM SHAFT.
- (3) MAX. 0.015 INCH CLEARANCE BETWEEN ROCKER ARM AND BEARING HUB.

TO ADJUST

SELECT BLANK CODE COMBINATION. TRIP FUNCTION CLUTCH. REMOVE DOWNSTOP. LOOSEN PUNCH SLIDE GUIDE MOUNTING STUDS. ROTATE MAIN SHAFT UNTIL ROCKER BAIL UPPER ROLLER IS ON HIGH PART OF FUNCTION CAM. PLACE GAUGE AS SHOWN. WITH CLAMP SCREW LOOSENED, POSITION ROCKER ARM ON TOGGLE BAIL SHAFT TO MEET REQUIREMENT. TIGHTEN CLAMP SCREW. REPLACE PUNCH SLIDE GUIDE AND POSITION IT SO THAT ITS SLOTS ARE ALIGNED (AS GAUGED BY EYE) WITH CORRESPONDING PUNCH PINS TIGHTEN MOUNTING STUDS. REPLACE THE DOWNSTOP IN ITS LOWEST POSITION AND TIGHTEN MOUNTING NUTS.

NOTE

THE PUNCH SLIDES SHALL RETURN FREELY WHEN PUSHED IN NOT MORE THAN 1/16 OF AN INCH. UNIT IN STOP POSITION.

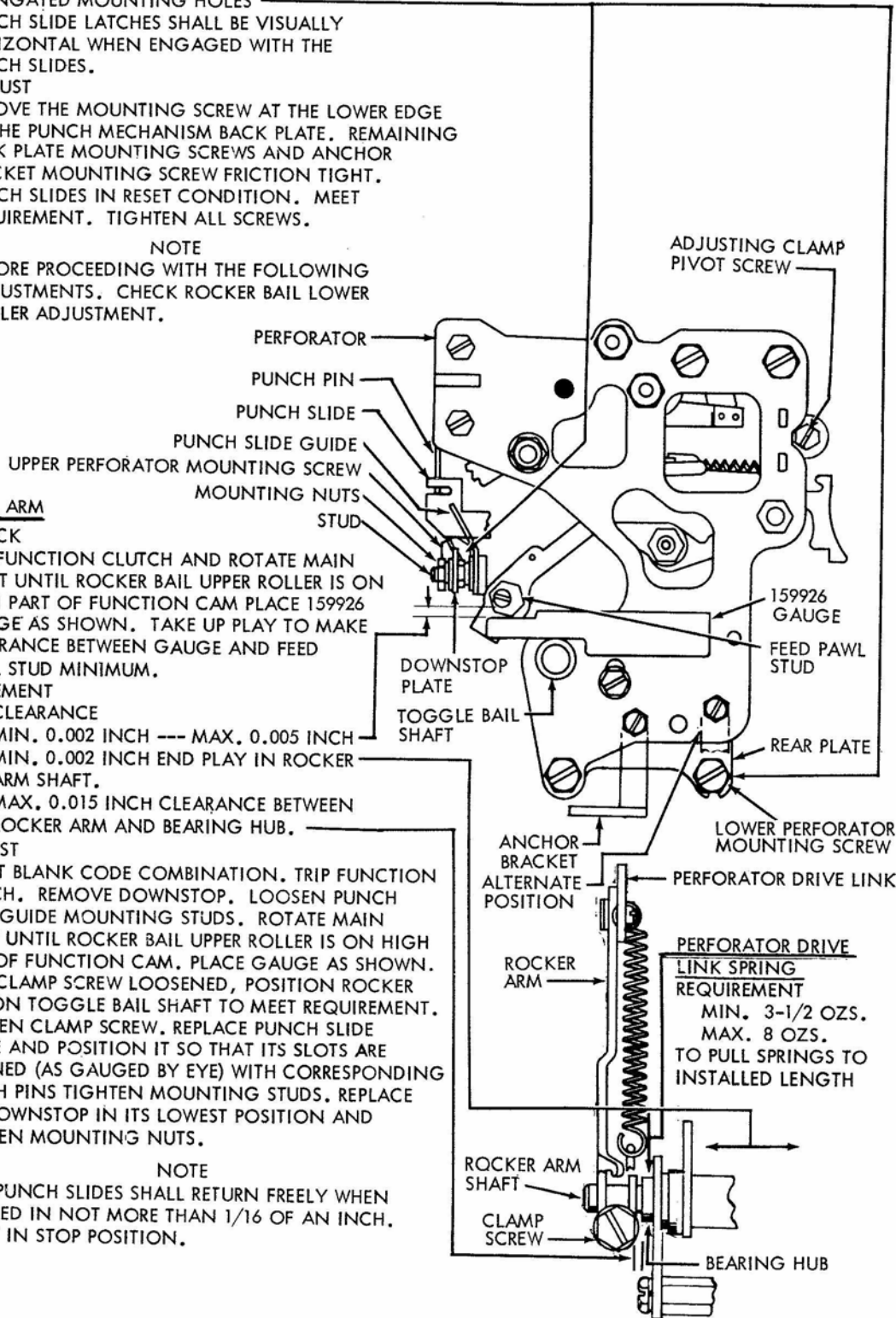


Figure 5-13. Typing Reperforator, Punch Mechanism For Fully Perforated Tape

NOTE: THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO FULLY PERFORATED TAPE MECHANISM. REFER TO FIGURE 5-15 FOR SIMILAR CHADLESS TAPE MECHANISM ADJUSTMENTS.

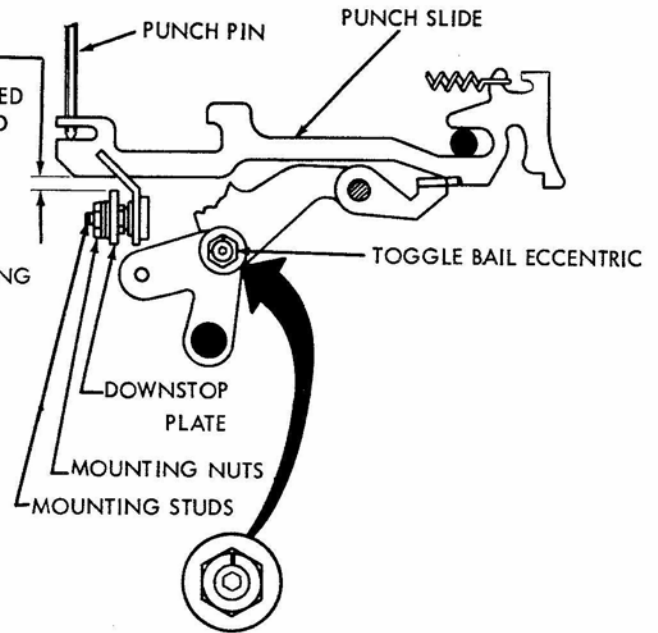
(C)

PUNCH SLIDE DOWNSTOP POSITION REQUIREMENT

FUNCTION CLUTCH DISENGAGED AND LATCHED  
PLAY IN THE PUNCH SLIDES TAKEN UP TOWARD THE TOP, CLEARANCE BETWEEN EACH PUNCH SLIDE AND THE DOWNSTOP PLATE  
MIN. SOME  
MAX. 0.008 INCH

TO ADJUST

POSITION DOWNSTOP PLATE WITH IT MOUNTING LOCK NUTS LOOSENED.



(B)

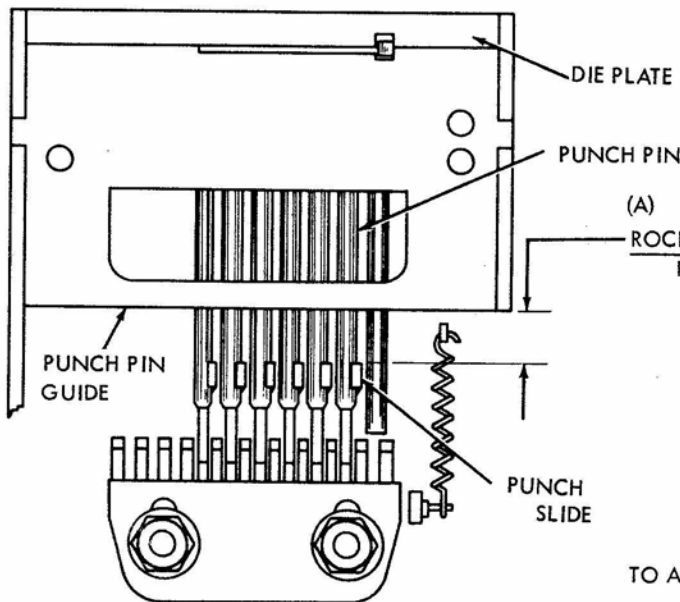
PUNCH SLIDE GUIDE REQUIREMENT

REQUIREMENT

THE PUNCH SLIDES SHOULD ALIGN WITH THEIR CORRESPONDING PUNCH PINS AND BE FREE OF BINDS AFTER TIGHTENING THE GUIDE MOUNTING STUDS. EACH PUNCH SLIDE SHOULD RETURN FREELY AFTER BEING PUSHED IN NOT MORE THAN 1/16 INCH.

TO ADJUST

POSITION THE GUIDE WITH ITS MOUNTING STUDS FRICTION TIGHT.



(A)

ROCKER ARM REQUIREMENT

WITH LETTERS SELECTED AND MAINSHAFT ROTATED UNTIL THE ROCKER BAIL IS IN THE EXTREME LEFT HAND POSITION. CLEARANCE BETWEEN TOP OF CLOSEST PUNCH SLIDE AND BOTTOM OF PUNCH PIN GUIDE  
MIN. 0.020 INCH  
MAX. 0.030 INCH

TO ADJUST

POSITION THE ROCKER ARM WITH ITS CLAMP SCREW FRICTION TIGHT. CHECK TO SEE THAT THE TOGGLE BAIL SHAFT HAS AT LEAST 0.002 INCH END PLAY

Figure 5-14. Typing Reperforator, Punch Mechanism For Fully Perforated Tape

NOTE: THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO CHADLESS TAPE MECHANISM. REFER TO FIGURE 5-14 FOR SIMILAR FULLY PERFORATED TAPE MECHANISM ADJUSTMENTS.

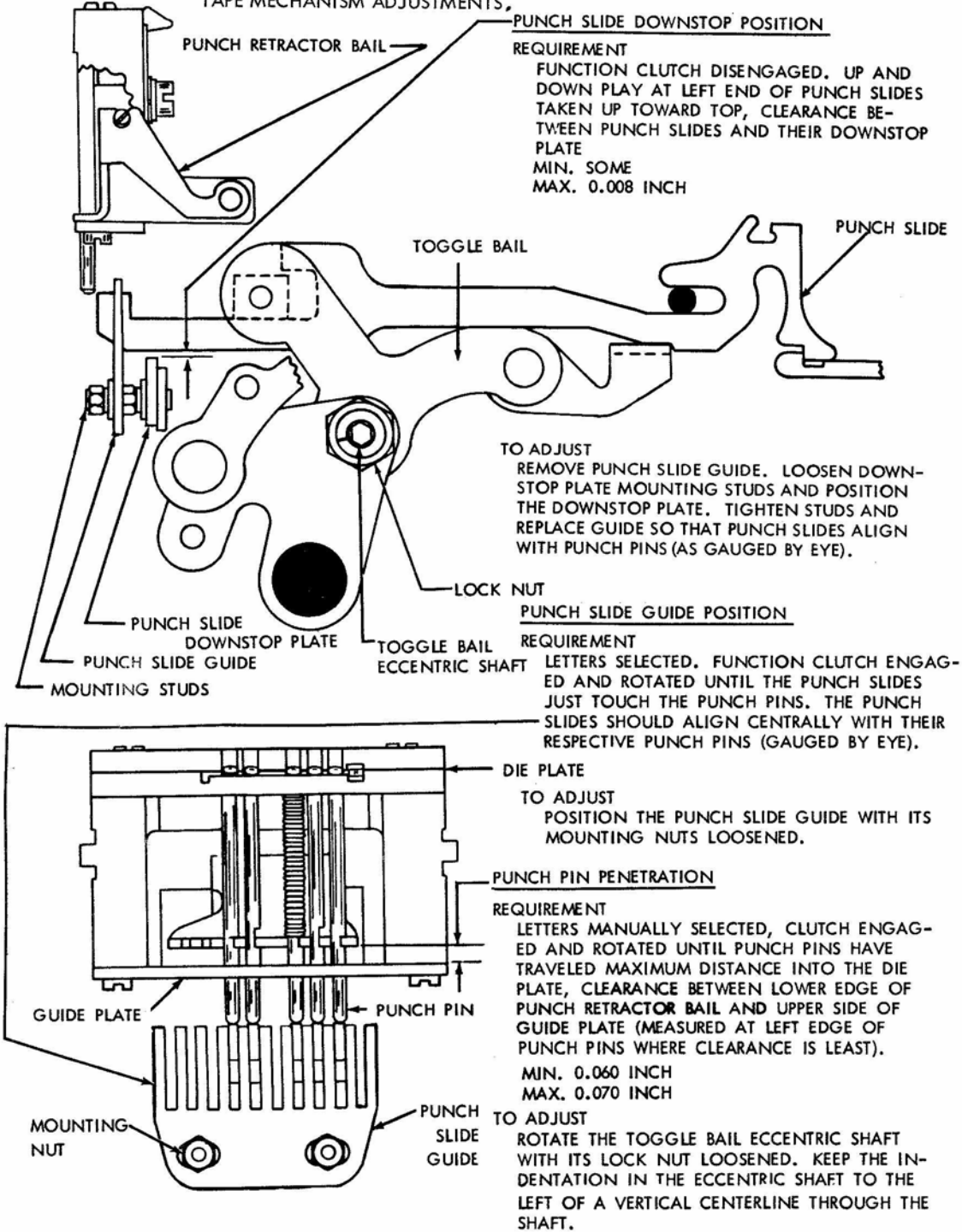


Figure 5-15. Typing Reperforator, Punch Mechanism for Chadless Tape



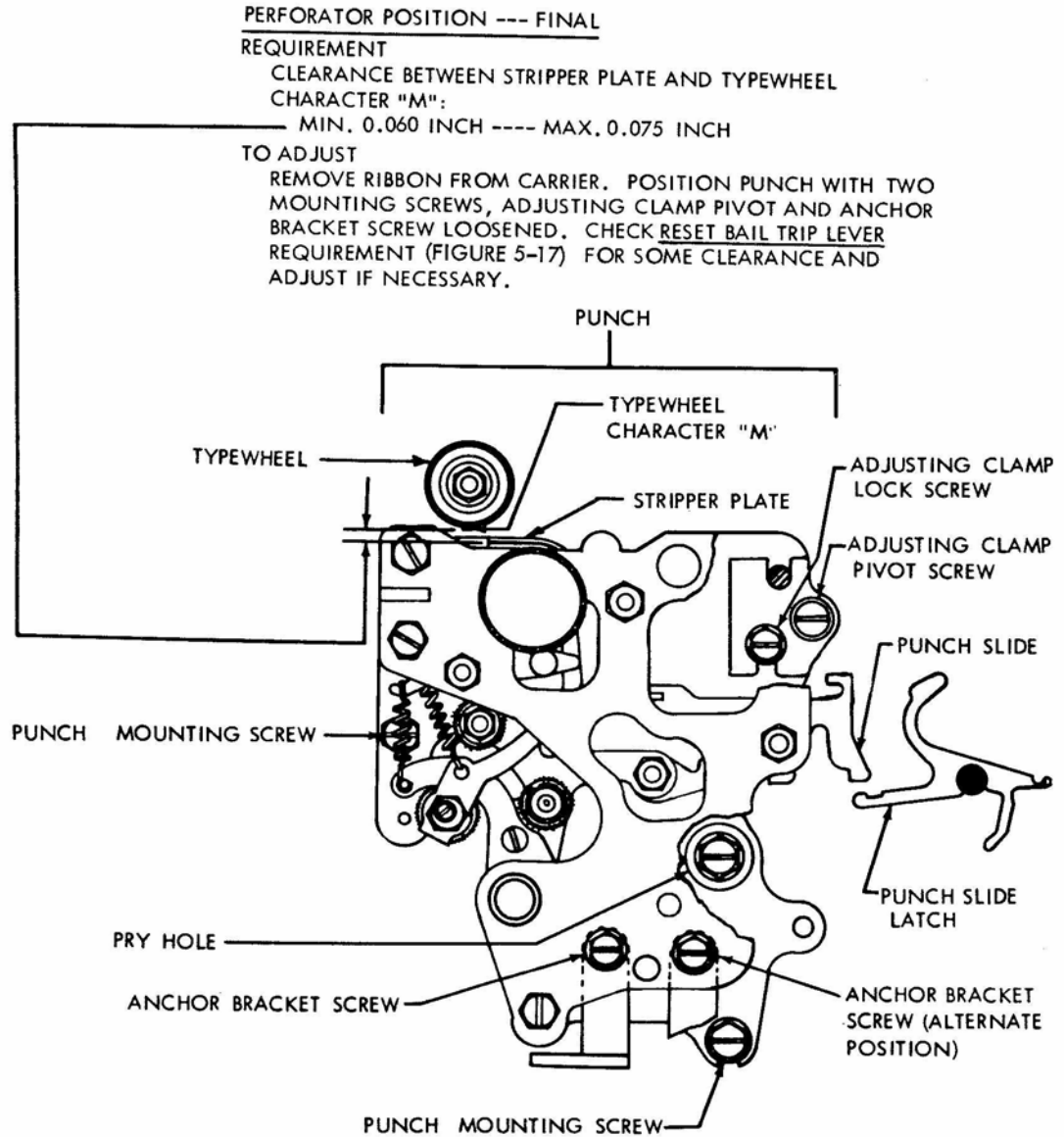


Figure 5-16. Typing Reperforator

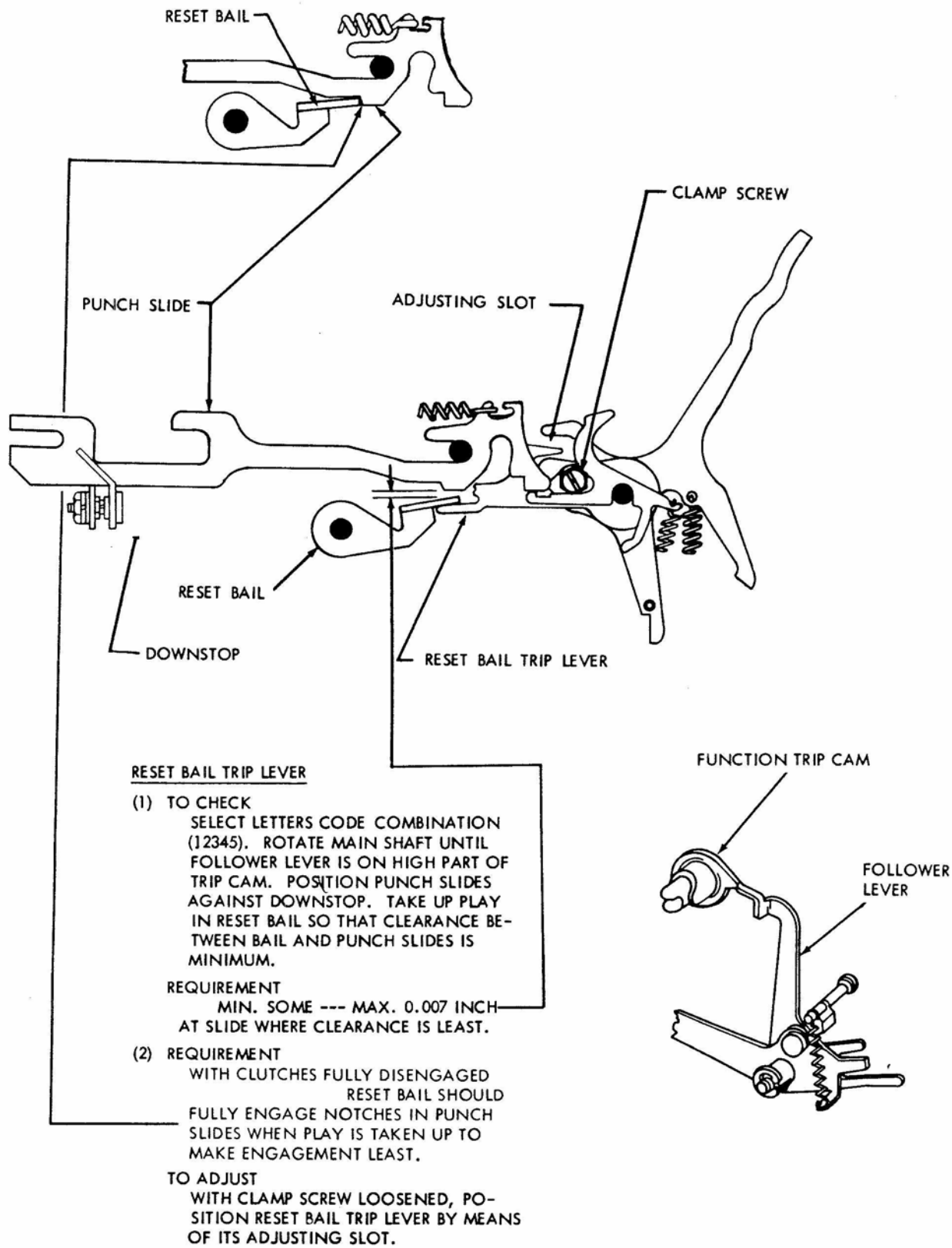
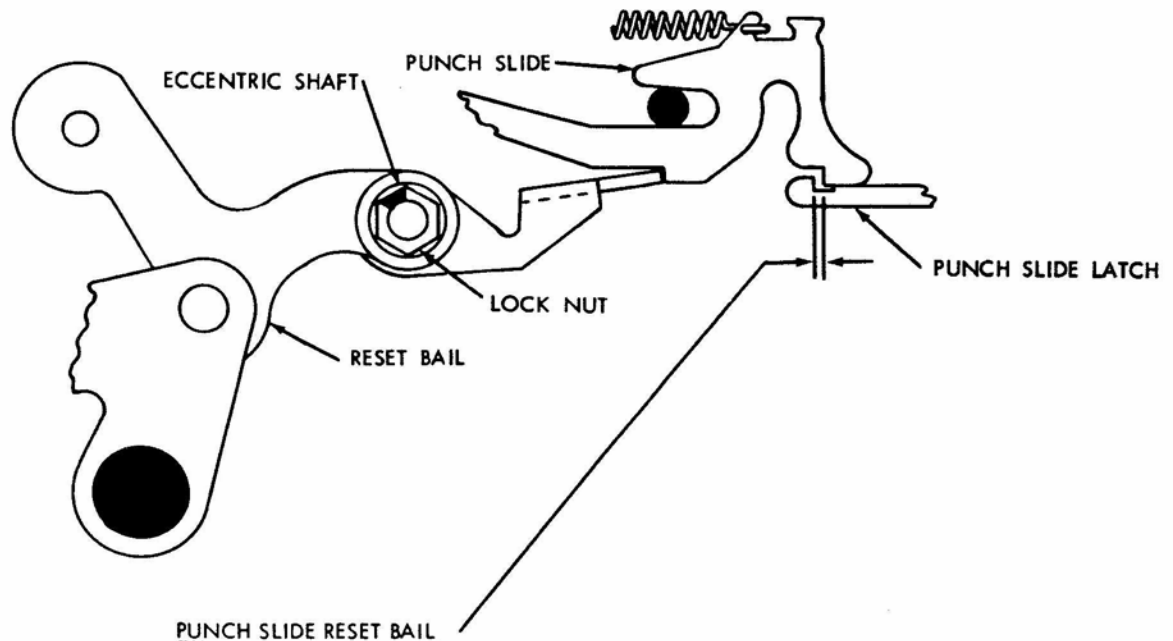


Figure 5-17. Typing Reperforator, Reset Bail Trip Lever



PUNCH SLIDE RESET BAIL

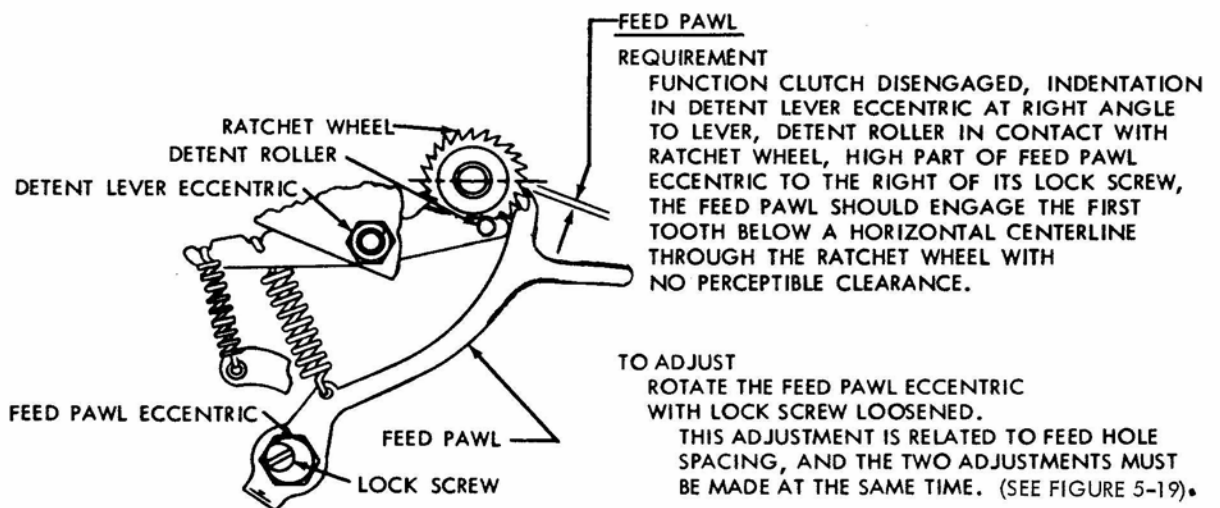
REQUIREMENT

FUNCTION CLUTCH DISENGAGED AND LATCHED. CLEARANCE AT PUNCH SLIDE LATCH CLOSEST TO PUNCH SLIDE:

MIN. 0.015 INCH --- MAX. 0.025 INCH

TO ADJUST

ROTATE THE RESET BAIL ECCENTRIC SHAFT WITH ITS LOCK NUT LOOSENED. KEEP THE INDENTATION IN THE ECCENTRIC SHAFT HIGH AND TO THE LEFT OF A VERTICAL CENTERLINE THROUGH THE SHAFT.



FEED PAWL

REQUIREMENT

FUNCTION CLUTCH DISENGAGED, INDENTATION IN DETENT LEVER ECCENTRIC AT RIGHT ANGLE TO LEVER, DETENT ROLLER IN CONTACT WITH RATCHET WHEEL, HIGH PART OF FEED PAWL ECCENTRIC TO THE RIGHT OF ITS LOCK SCREW, THE FEED PAWL SHOULD ENGAGE THE FIRST TOOTH BELOW A HORIZONTAL CENTERLINE THROUGH THE RATCHET WHEEL WITH NO PERCEPTIBLE CLEARANCE.

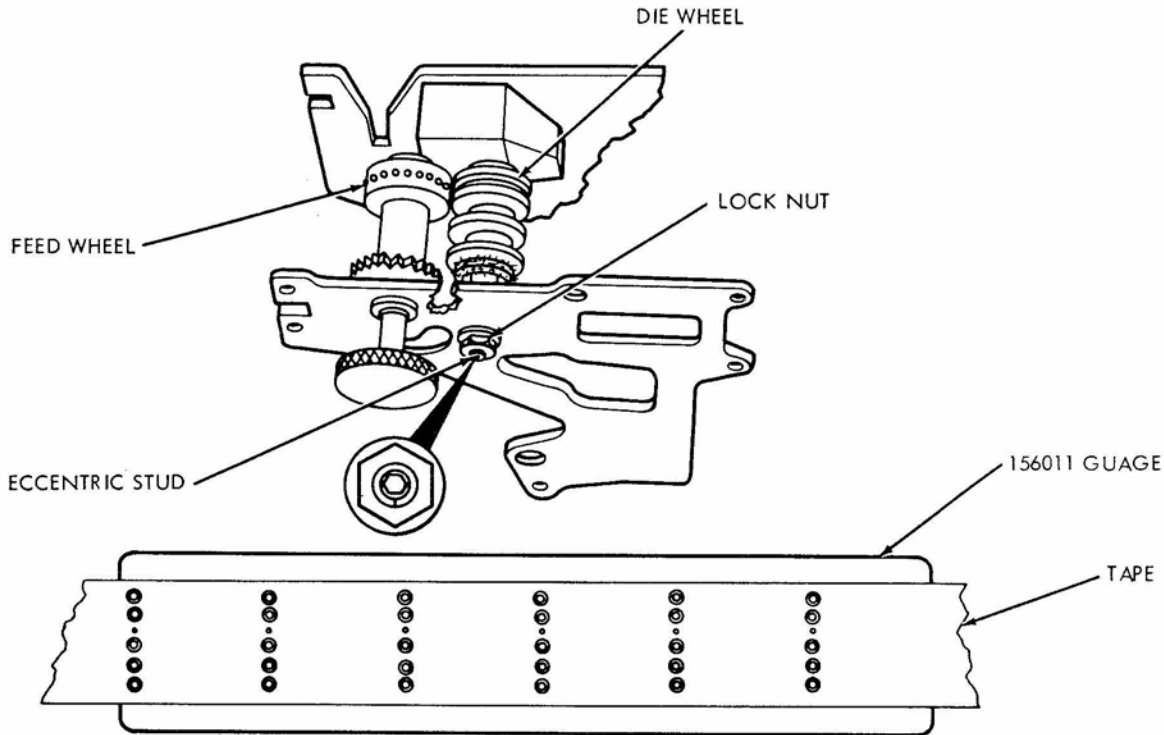
TO ADJUST

ROTATE THE FEED PAWL ECCENTRIC WITH LOCK SCREW LOOSENED.

THIS ADJUSTMENT IS RELATED TO FEED HOLE SPACING, AND THE TWO ADJUSTMENTS MUST BE MADE AT THE SAME TIME. (SEE FIGURE 5-19).

Figure 5-18. Typing Reperforator, Punch Slide Reset Bail and Feed Pawl

NOTE  
THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO FULLY PERFORATED TAPE MECHANISM. REFER TO FIGURE 5-22 FOR SIMILAR CHADLESS TAPE MECHANISM ADJUSTMENTS.



NOTE  
BEFORE PROCEEDING WITH THE FOLLOWING ADJUSTMENT CHECK BOTH TAPE GUIDE SPRING TENSIONS (FIGURE 5-21).

#### FEED HOLE SPACING

##### (1) REQUIREMENT

WITH A PIECE OF TAPE PERFORATED WITH SIX SERIES OF 9 BLANK CODE COMBINATIONS FOLLOWED BY A LETTERS COMBINATION PLACED OVER THE SMOOTH SIDE OF THE 156011 TAPE GAUGE SO THAT THE CIRCULAR PORTION OF THE FIRST NUMBER 2 CODE HOLE IN THE TAPE IS CONCENTRIC WITH THE FIRST HOLE OF THE TAPE GAUGE, THE NEXT FOUR HOLES IN THE TAPE GAUGE SHOULD BE VISIBLE THROUGH THE NUMBER 2 CODE HOLES IN THE TAPE AND THE CIRCULAR PORTION OF THE LAST (SIXTH) NUMBER 2 CODE HOLE IN THE TAPE SHALL BE ENTIRELY WITHIN THE 0.086 DIAMETER HOLE OF THE TAPE GAUGE.

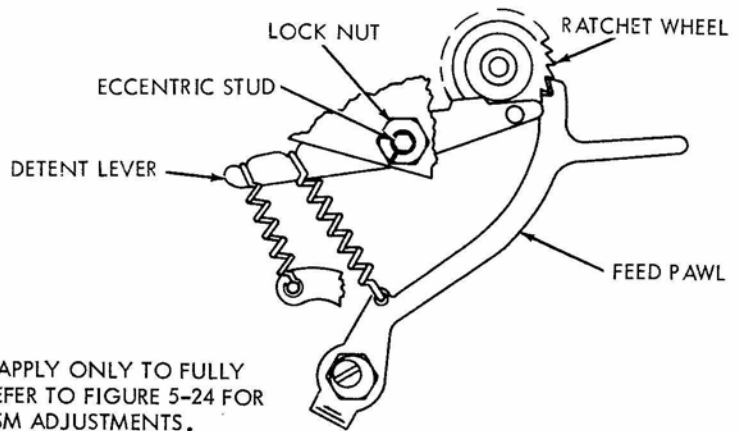
##### (2) REQUIREMENT

WITH TAPE SHOE HELD AWAY FROM FEED WHEEL, FEED PAWL AND DETENT DISENGAGED AND TAPE REMOVED, FEED WHEEL SHOULD ROTATE FREELY.

##### TO ADJUST

WITH TAPE REMOVED FROM THE PUNCH MECHANISM, LOOSEN THE ECCENTRIC LOCK NUT AND ROTATE THE DIE WHEEL ECCENTRIC SHAFT UNTIL IT BINDS AGAINST THE FEED WHEEL. BACK OFF THE ECCENTRIC UNTIL THE DIE WHEEL IS JUST FREE. KEEP THE INDENT OF THE ECCENTRIC BELOW THE HORIZONTAL CENTERLINE OF THE STUD. REFINE ADJUSTMENT FOR REQUIREMENT (1), IF NECESSARY, BY MOVING THE DIE WHEEL TOWARD THE FEED WHEEL TO DECREASE THE CHARACTER SPACING AND AWAY FROM THE FEED WHEEL TO INCREASE THE CHARACTER SPACING.

Figure 5-19. Typing Reperforator, Feed Hole Spacing, Fully Perforated Tape



NOTE  
THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO FULLY PERFORATED TAPE MECHANISM. REFER TO FIGURE 5-24 FOR SIMILAR CHADLESS TAPE MECHANISM ADJUSTMENTS.

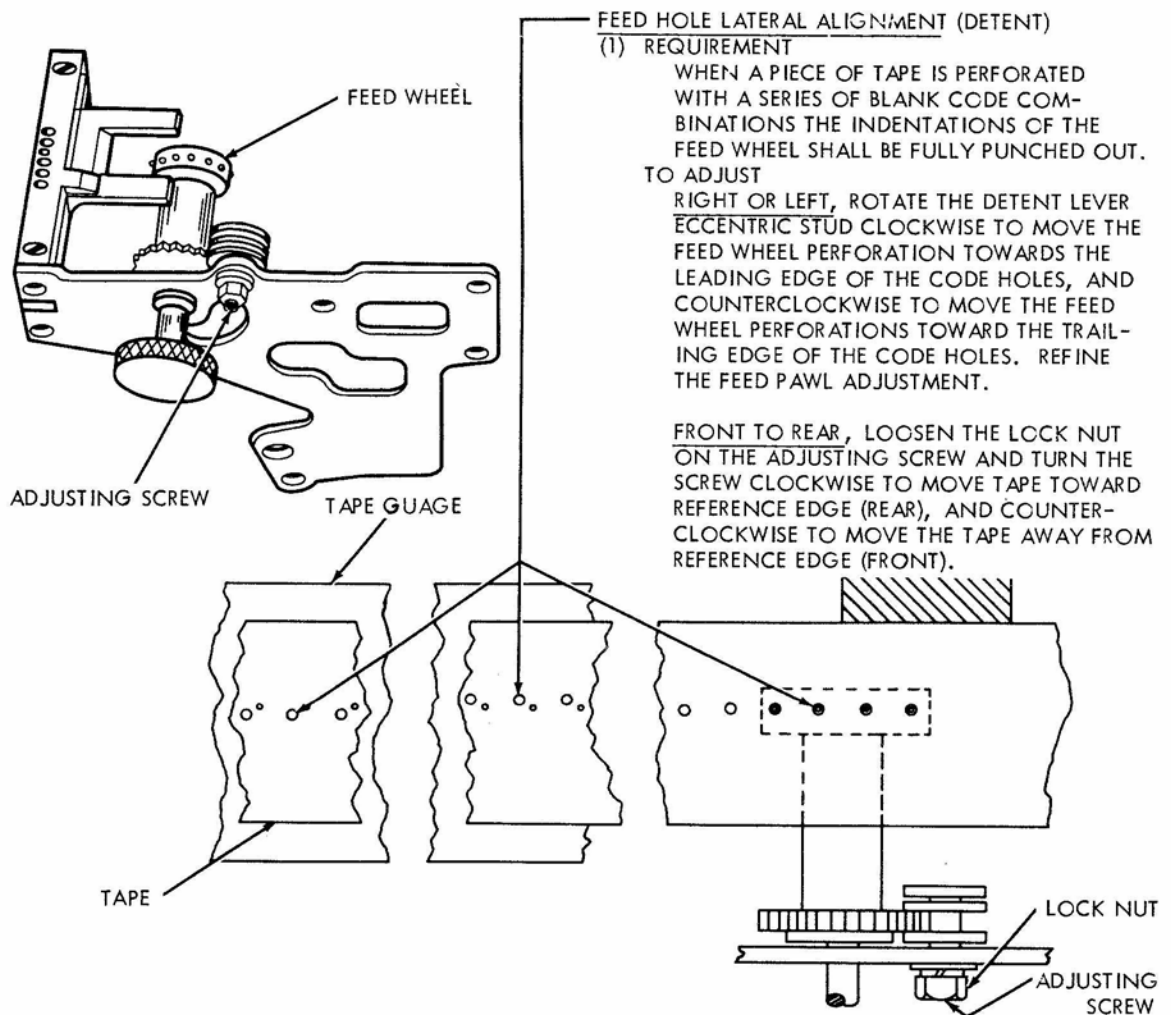


Figure 5-20. Typing Reperforator, Detent Lever and Feed Hole Lateral Alignment, Fully Perforated Tape

NOTE  
 THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO FULLY PERFORATED TAPE MECHANISM. REFER TO FIGURE 5-26 FOR SIMILAR CHADLESS TAPE MECHANISM ADJUSTMENTS.

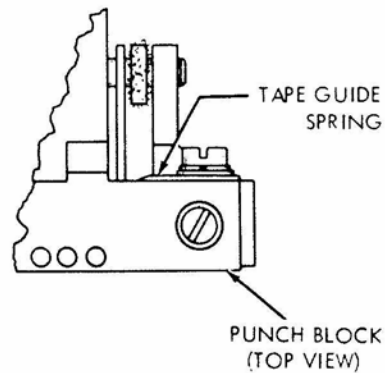
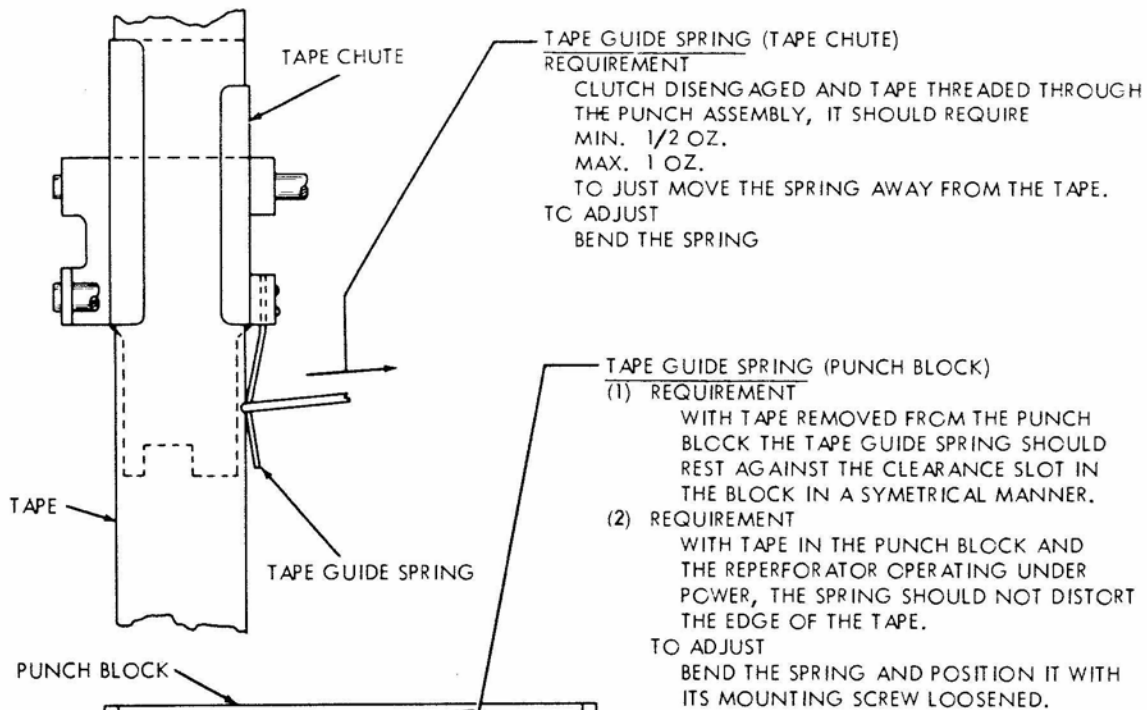
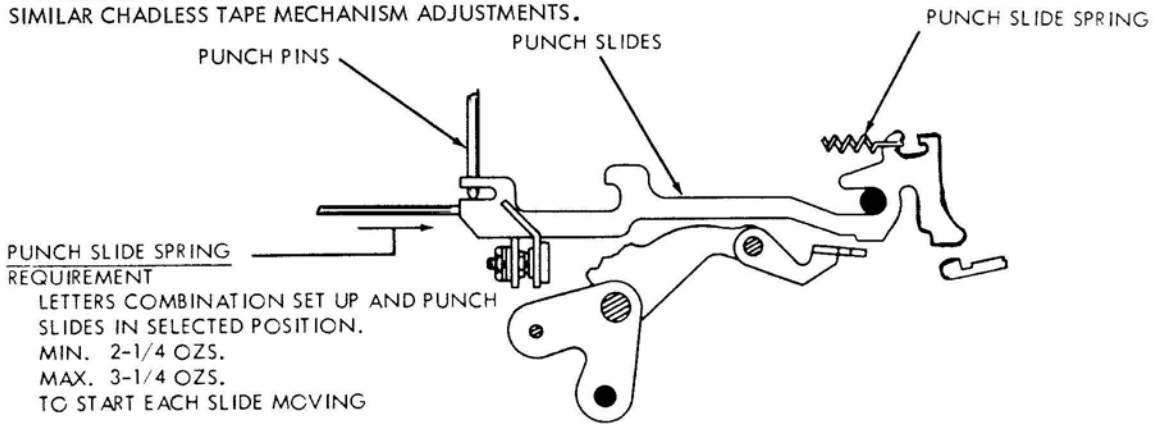


Figure 5-21. Typing Reperforator, Punch Mechanism, Fully Perforated Tape

## NOTE

THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO CHADLESS TAPE MECHANISM. REFER TO FIGURE 5-19 FOR SIMILAR FULLY PERFORATED TAPE MECHANISM ADJUSTMENTS.

FEED HOLE SPACING (PRELIMINARY)

## REQUIREMENT

WITH INDENT OF DIE WHEEL ECCENTRIC STUD POINTING DOWNWARD, CLEARANCE BETWEEN DIE WHEEL AND FEED WHEEL:

MIN. 0.002 INCH-----MAX. 0.004 INCH

TO ADJUST  
POSITION DIE WHEEL ECCENTRIC STUD WITH LOCK NUT LOOSENED.

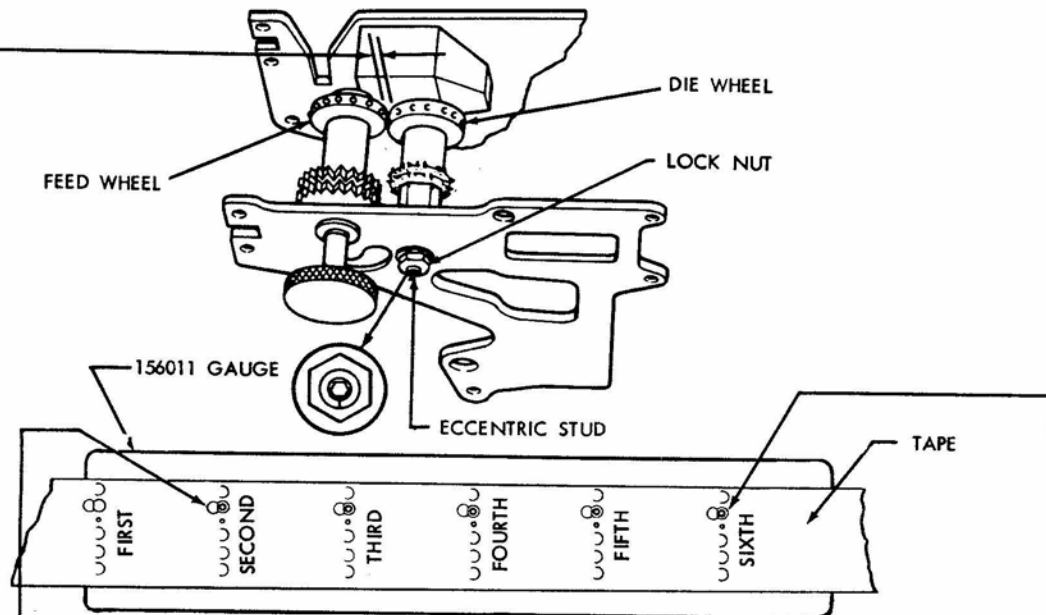
## NOTE:

BEFORE PROCEEDING WITH THE FOLLOWING ADJUSTMENTS, CHECK BOTH TAPE GUIDE SPRING TENSIONS.

FEED HOLE SPACING (FINAL)

## (1) REQUIREMENT

WITH TAPE REMOVED, MIN. OF 0.002 INCH CLEARANCE BETWEEN FEED WHEEL AND DIE WHEEL.



## (2) TO CHECK

PERFORATE IN ORDER SIX SEQUENCES MADE UP OF NINE BLANK CODE COMBINATIONS FOLLOWED BY A LETTERS COMBINATION. OPEN CHADS SO THAT CODE HOLES ARE VISIBLE. PLACE TAPE OVER SMOOTH SIDE OF 156011 TAPE GAUGE SO THAT FIRST NO. 2 CODE HOLE IS CONCENTRIC WITH FIRST (0.072 INCH) HOLE IN GAUGE (SEE NOTE BELOW).

## REQUIREMENT

SECOND THROUGH FIFTH HOLE IN GAUGE VISIBLE THROUGH NO. 2 CODE HOLES IN TAPE. CIRCULAR PORTION OF SIXTH NO. 2 CODE HOLE ENTIRELY WITHIN CORRESPONDING (0.086 INCH) HOLE IN GAUGE.

## (3) REQUIREMENT

WITH TAPE SHOE HELD AWAY FROM FEED WHEEL, FEED PAWL AND DETENT DISENGAGED AND TAPE REMOVED, FEED WHEEL SHOULD ROTATE FREELY.

## TO ADJUST

(1) WITH TAPE REMOVED, KEEPING INDENT BELOW CENTER OF STUD, POSITION DIE WHEEL ECCENTRIC STUD WITH LOCK NUT LOOSENED SO THAT CLEARANCE BETWEEN FEED WHEEL AND DIE WHEEL IS

MIN. 0.002 INCH-----MAX. 0.004 INCH.

(2) REFINE THE ABOVE ADJUSTMENT TO MEET REQUIREMENT (2). MOVE INDENT IN ECCENTRIC STUD TOWARD FEED WHEEL TO DECREASE AND AWAY FROM FEED WHEEL TO INCREASE FEED HOLE SPACING. CAUTION: WITH TAPE REMOVED, MAKE SURE FEED WHEEL-DIE WHEEL CLEARANCE IS A MIN. OF 0.002 INCH.

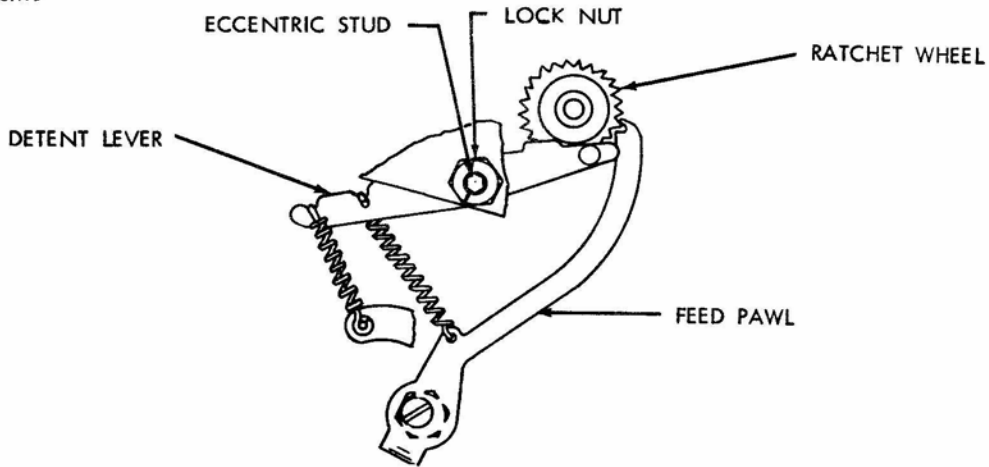
(3) FAILURE TO MEET REQUIREMENT (3) INDICATES DIE WHEEL ECCENTRIC STUD HAS BEEN OVER ADJUSTED. REFINES.

## NOTE:

FIRST THROUGH FIFTH HOLES IN GAUGE ARE SAME SIZE AS CODE HOLES IN TAPE (0.072 INCH DIAMETER). BUT SIXTH HOLE IN GAUGE IS LARGER (0.086 INCH). THIS ARRANGEMENT ALLOWS 0.007 INCH VARIATION IN 5 INCHES.

Figure 5-22. Typing Reperforator, Perforator Mechanism, Chadless Tape

NOTE  
THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO CHADLESS  
TAPE MECHANISM.



DETENT

REQUIREMENT

A PIECE OF TAPE CONTAINING NINE FEED HOLES FOLLOWED BY A LETTERS COMBINATION PERFORATED ON THE PERFORATOR MUST CONFORM TO THE 156011 TAPE GAUGE.

THE LATERAL CENTERLINE THROUGH THE CODE HOLES IN THE TAPE SHOULD COINCIDE WITH A LATERAL CENTERLINE THROUGH THE HOLES IN THE GAUGE.

TO ADJUST

ROTATE THE DETENT ECCENTRIC CLOCKWISE TO MOVE THE FEED HOLES TOWARD THE HINGED EDGE OF THE CODE HOLES AND COUNTERCLOCKWISE TO MOVE THE FEED HOLES TOWARD THE TRAILING EDGE OF THE CODE HOLES. TIGHTEN THE ECCENTRIC LOCK NUT AND RE-FINE THE FEED PAWL ADJUSTMENT.

RECHECK FEED PAWL ADJUSTMENT

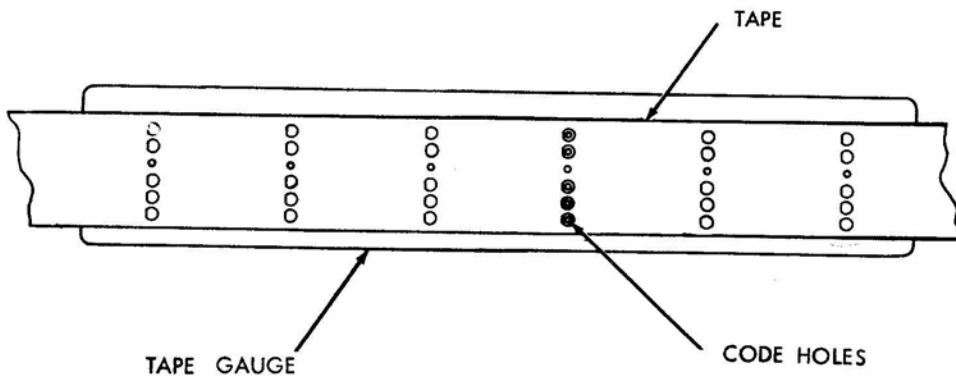
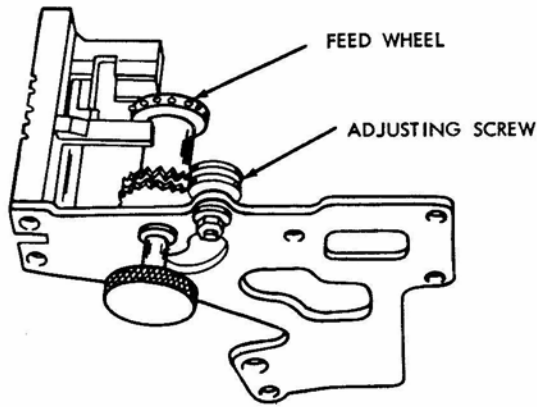


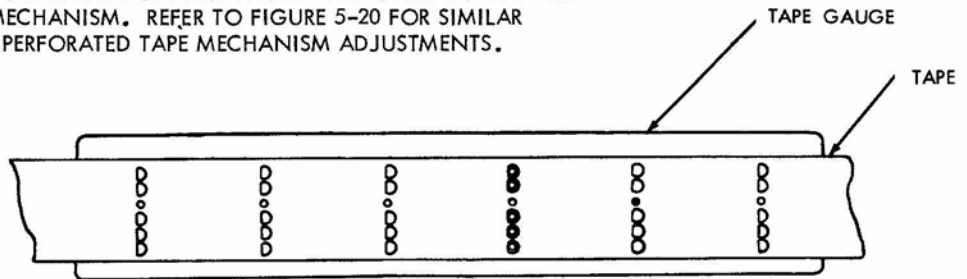
Figure 5-23. Typing Reperforator, Perforator Mechanism, Chadless Type





NOTE

THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO CHADLESS TAPE MECHANISM. REFER TO FIGURE 5-20 FOR SIMILAR FULLY PERFORATED TAPE MECHANISM ADJUSTMENTS.



FEED HOLE LATERAL ALIGNMENT

REQUIREMENT

WHEN A PIECE OF TAPE CONTAINING NINE FEED HOLES FOLLOWED BY A LETTERS COMBINATION ARE PERFORATED BY THE PERFORATOR AND CHECKED BY THE TAPE GAUGE, THE CODE HOLES IN THE TAPE SHOULD BE CONCENTRIC WITH THE HOLES IN THE GAUGE

TO ADJUST

TURN THE FEED WHEEL ADJUSTING SCREW IN OR OUT WITH ITS LOCK NUT LOOSENED.

REFINE DETENT LEVER ADJUSTMENT IF NECESSARY.

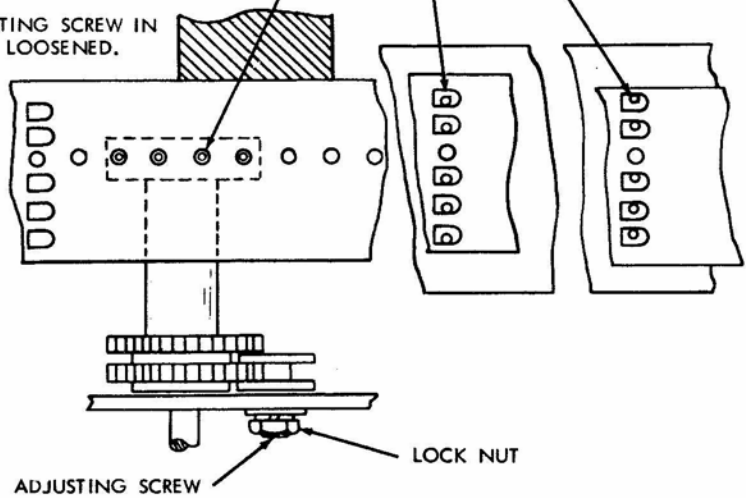
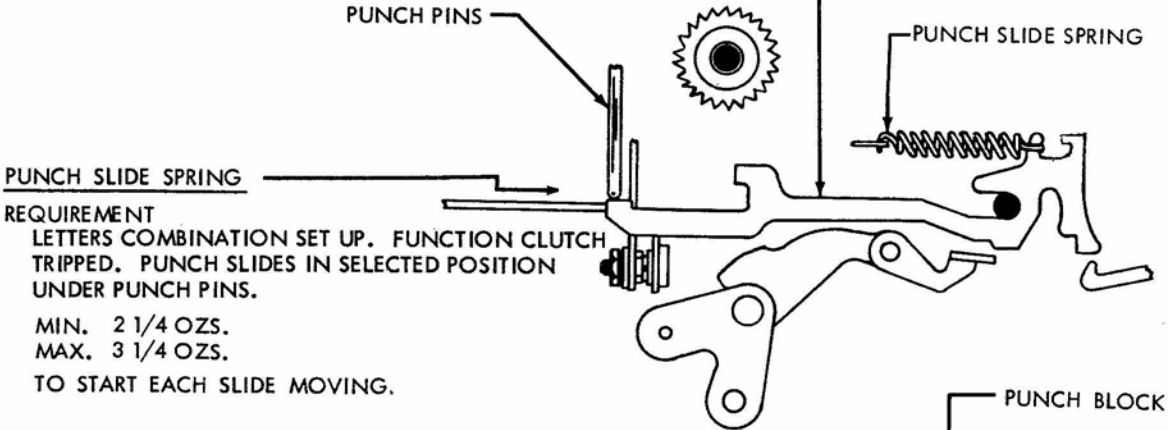
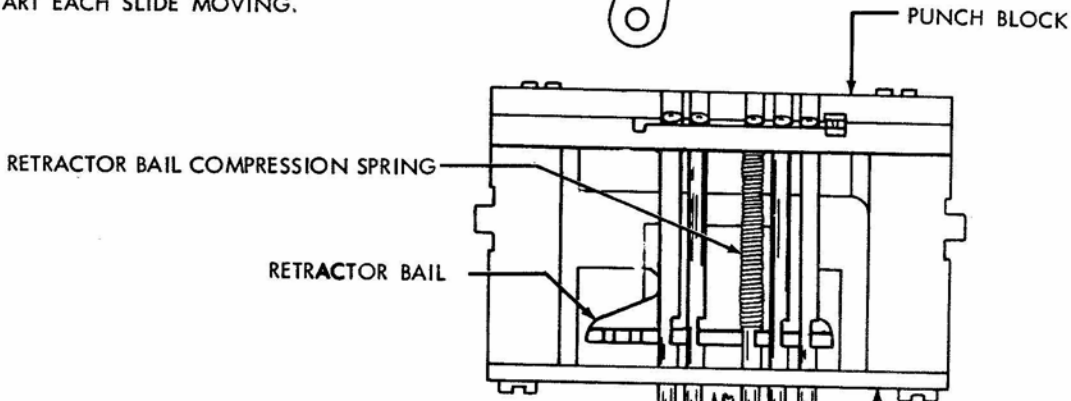


Figure 5-24. Typing Reperforator, Perforator Mechanism, Chadless Type

NOTE  
THE ADJUSTMENTS ON THIS PAGE APPLY ONLY TO  
CHADLESS TAPE MECHANISM ADJUSTMENTS.

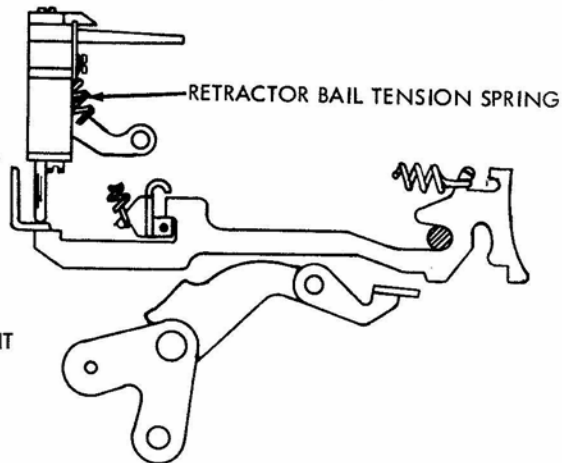
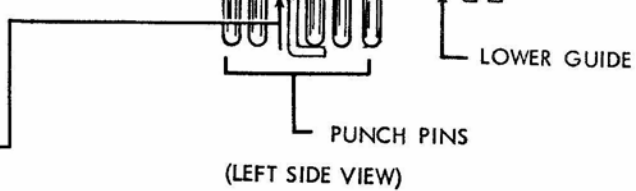


**REQUIREMENT**  
LETTERS COMBINATION SET UP. FUNCTION CLUTCH  
TRIPPED. PUNCH SLIDES IN SELECTED POSITION  
UNDER PUNCH PINS.  
MIN. 2 1/4 OZS.  
MAX. 3 1/4 OZS.  
TO START EACH SLIDE MOVING.



**RETRACTOR BAIL SPRINGS**

(1) REQUIREMENT (COMPRESSION SPRINGS ONLY)  
WITH FUNCTION CLUTCH DISENGAGED  
AND TENSION SPRINGS UNHOOKED:  
MIN. 15 OZS.  
MAX. 32 OZS.  
TO LIFT RETRACTOR BAIL AWAY FROM  
LOWER GUIDE OR PUNCH BLOCK.



(2) REQUIREMENT (COMBINED COMPRESSION AND  
TENSION SPRINGS)  
UNDER THE SAME CONDITIONS AS REQUIREMENT  
(1) ABOVE, EXCEPT WITH TENSION SPRINGS  
HOOKED\*

MIN. 4 LBS.  
MAX. 5 LBS.

\*TO FACILITATE REHOOKING TENSION SPRINGS, PLACE PUNCH PINS IN UPPERMOST POSITION.

Figure 5-25. Typing Reperforator, Perforator Mechanism, Chadless Tape

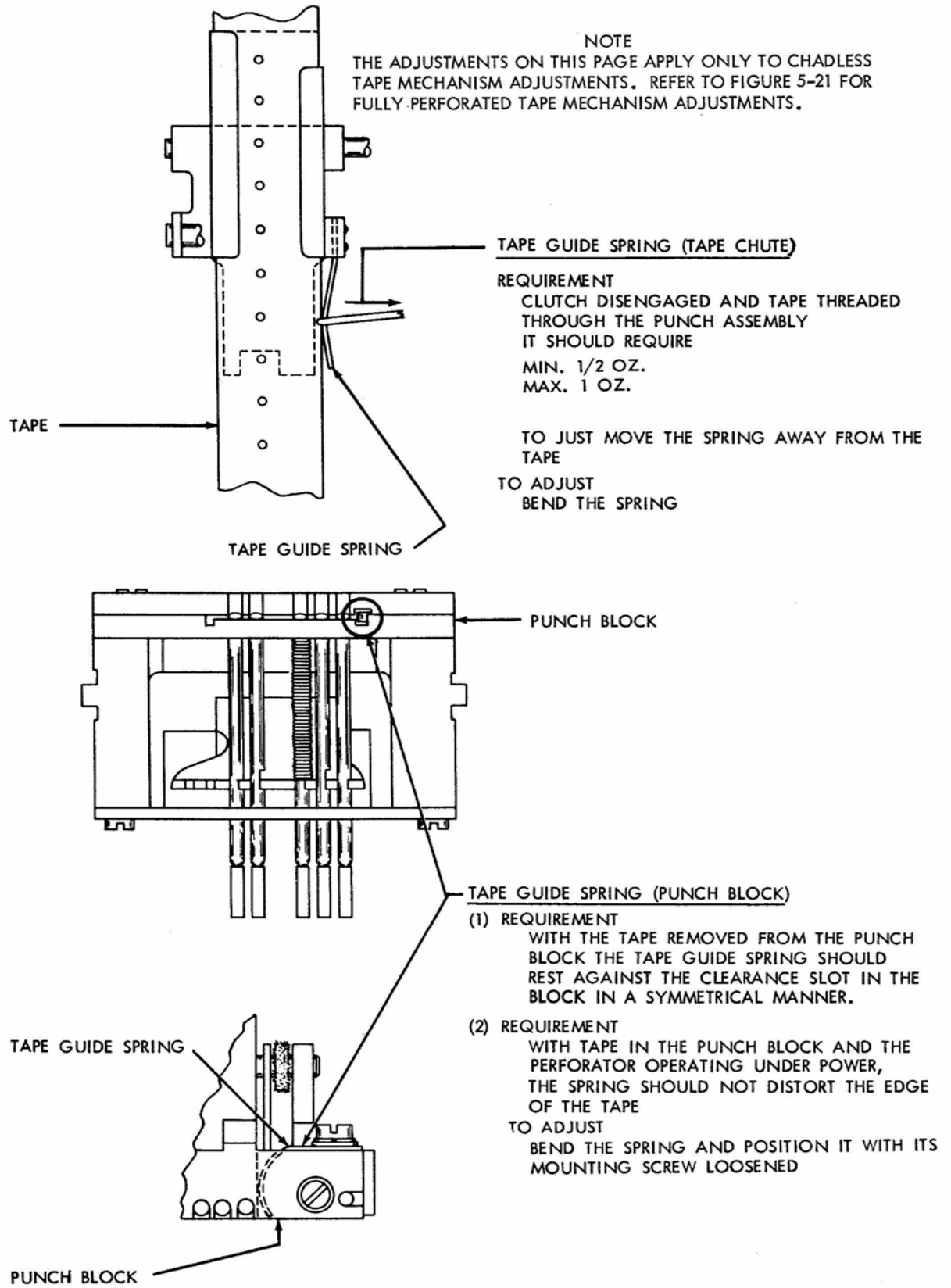


Figure 5-26. Typing Reperforator, Perforator Mechanism, Chadless Tape

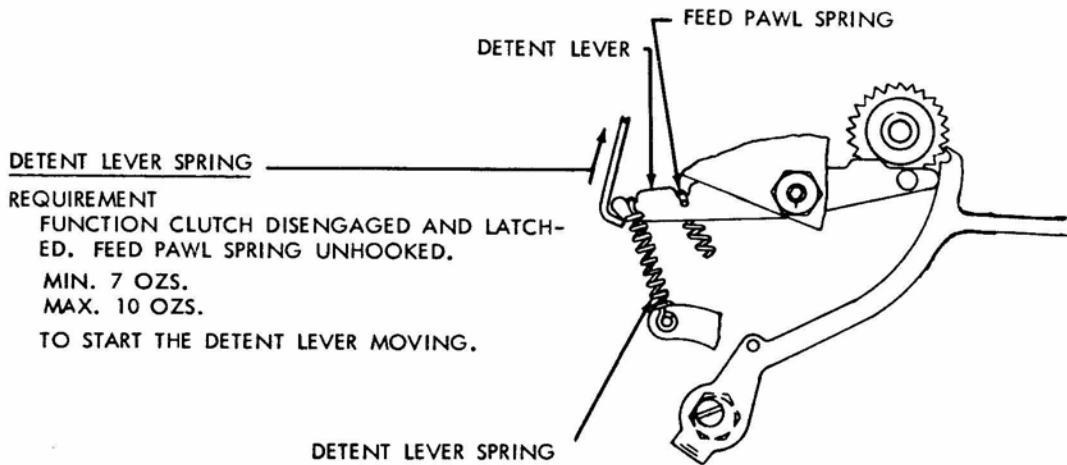
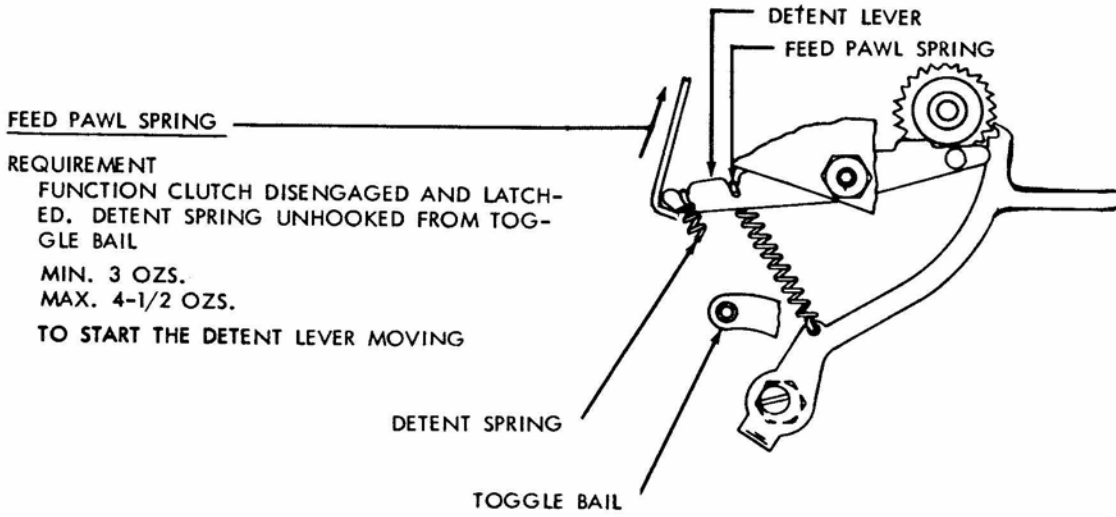


Figure 5-27. Typing Reperfector, Tape Feed Mechanism

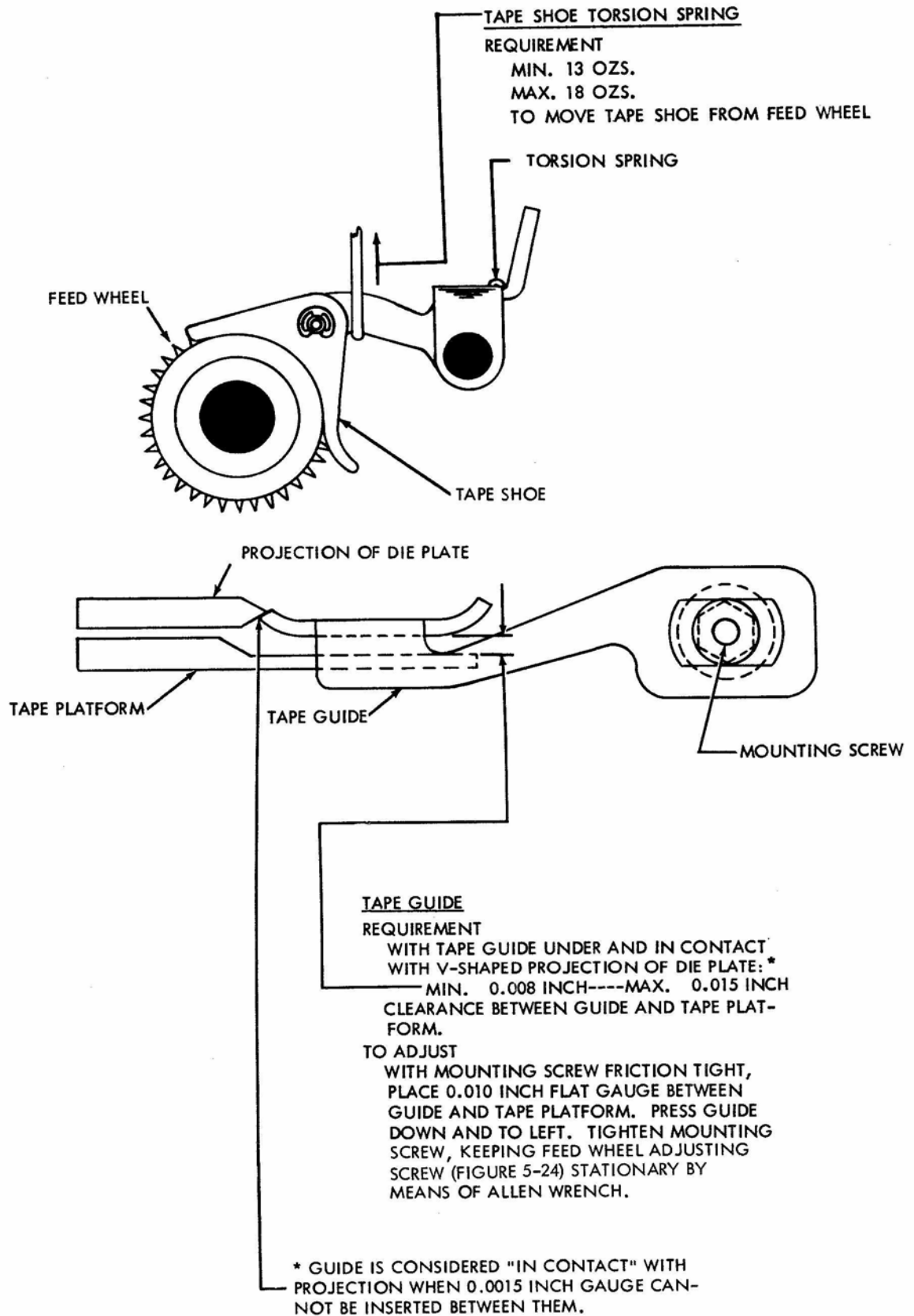


Figure 5-28. Typing Reperforator, Feed Wheel and Tape Guide

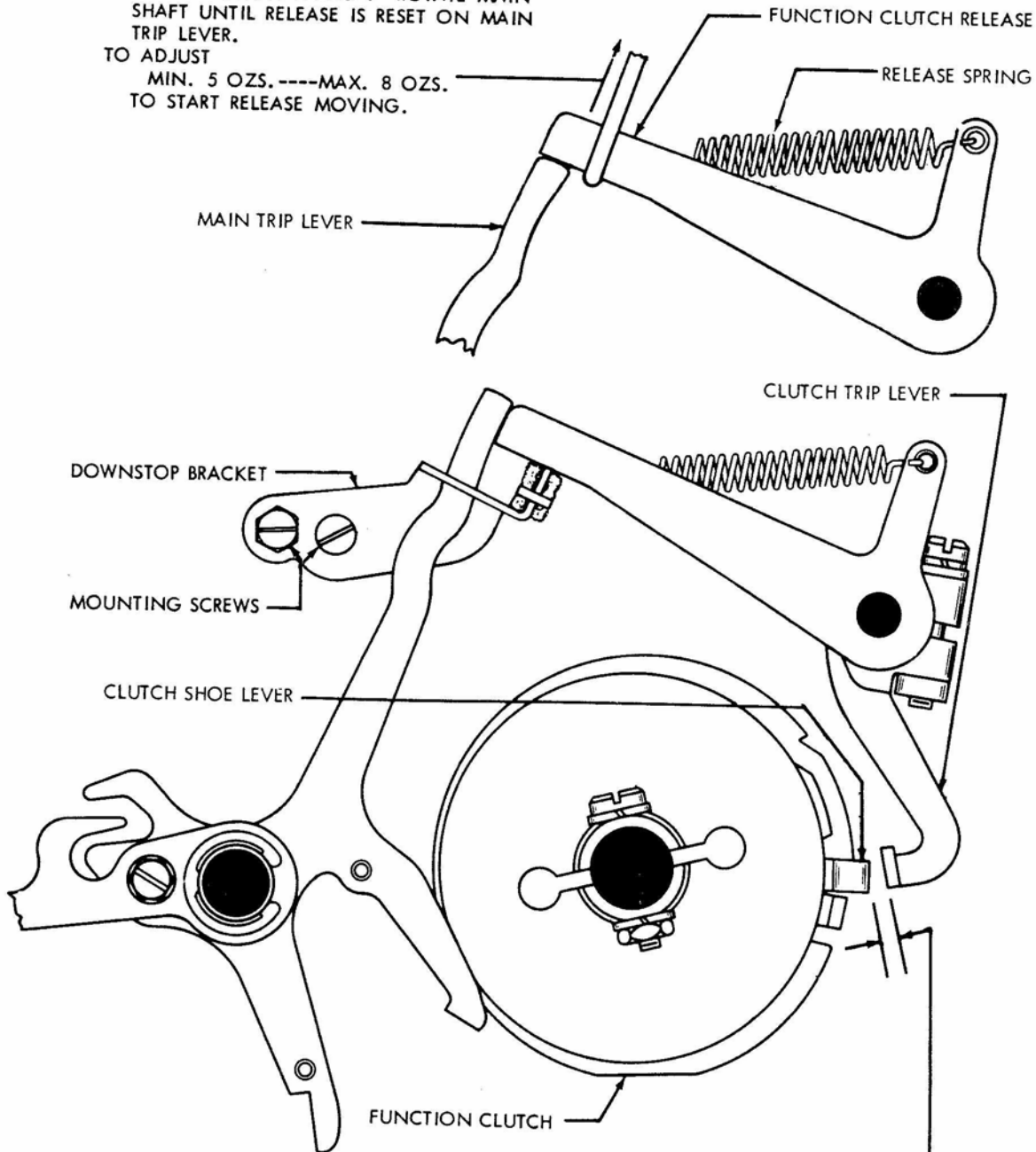
(A) FUNCTION CLUTCH RELEASE SPRING

TO CHECK

TRIP FUNCTION CLUTCH. ROTATE MAIN SHAFT UNTIL RELEASE IS RESET ON MAIN TRIP LEVER.

TO ADJUST

MIN. 5 OZS. ---- MAX. 8 OZS. TO START RELEASE MOVING.



(B) RELEASE DOWNSTOP BRACKET

REQUIREMENT

WITH FUNCTION CLUTCH TRIPPED, CLEARANCE BETWEEN TRIP LEVER AND CLUTCH SHOE LEVER:

MIN. 0.002 INCH ---- MAX. 0.045 INCH

AT POINT WHERE CLEARANCE IS LEAST.

TO ADJUST

REMOVE TAPE GUARD. POSITION DOWNSTOP BRACKET WITH MOUNTING SCREWS FRICTION TIGHT.

Figure 5-29. Typing Reperforator, Function Mechanism

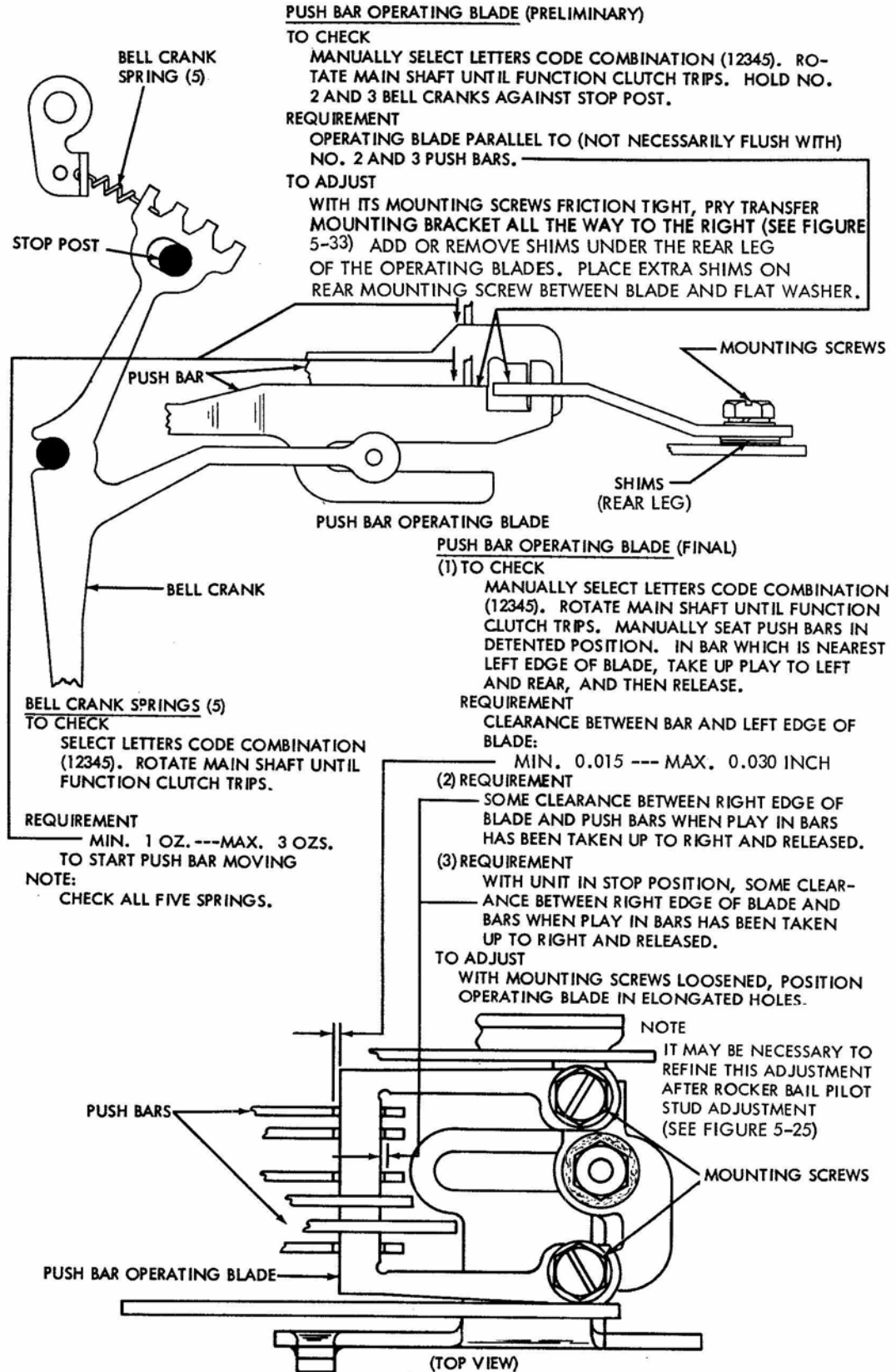
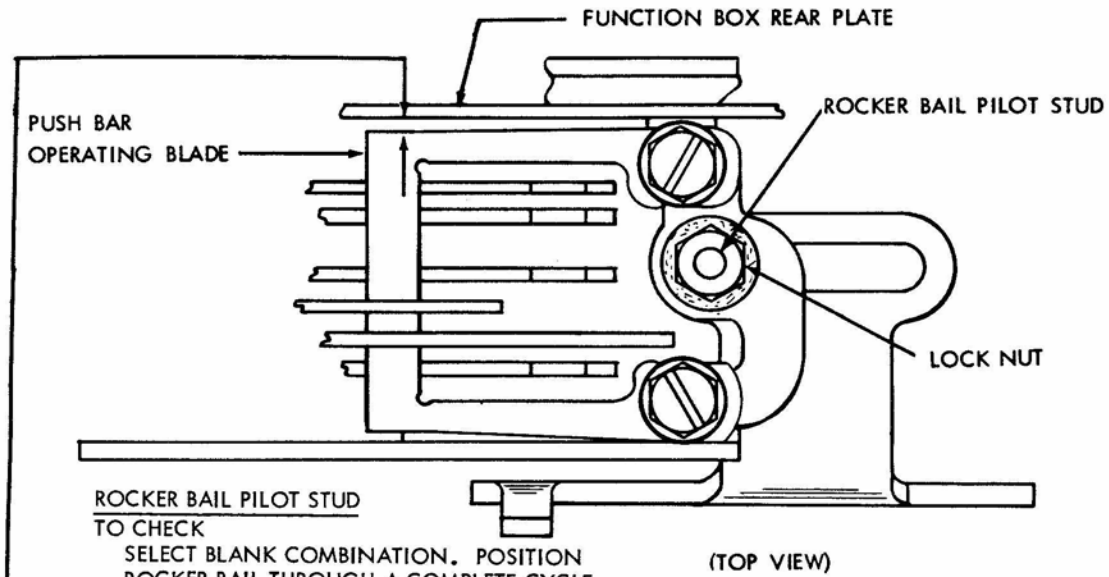
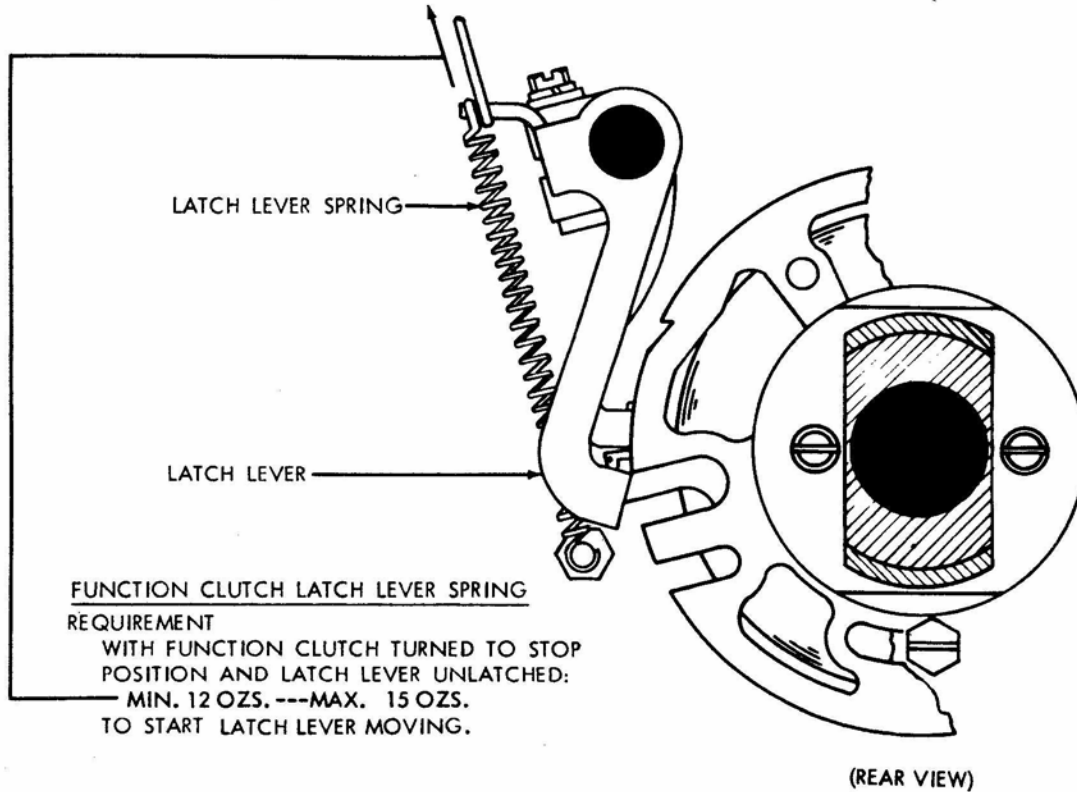


Figure 5-30. Typing Reperforator, Function Mechanism



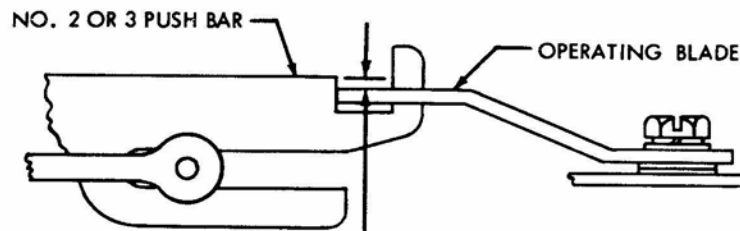
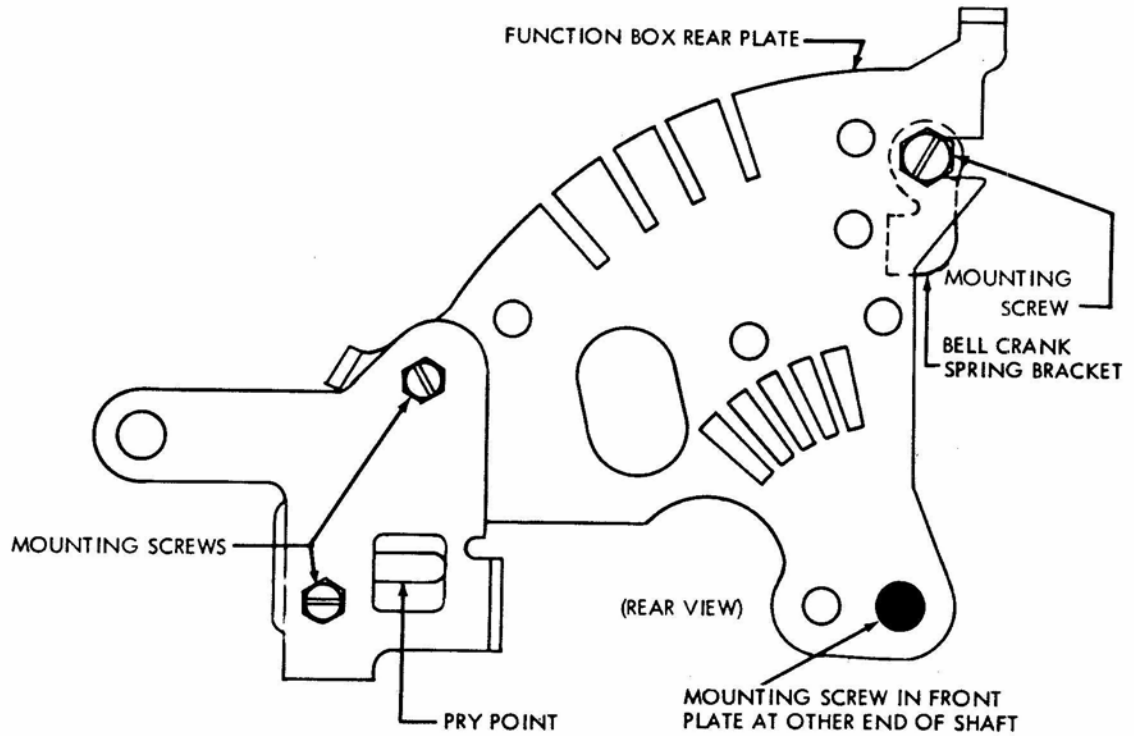
ROCKER BAIL PILOT STUD  
 TO CHECK  
 SELECT BLANK COMBINATION. POSITION  
 ROCKER BAIL THROUGH A COMPLETE CYCLE  
 TO INSURE THE CLEARANCE IS A MINIMUM.  
 REQUIREMENT  
 CLEARANCE BETWEEN FUNCTION BOX REAR  
 PLATE AND PUSH BAR OPERATING BLADE:  
 MIN. 0.005 INCH --- MAX. 0.020 INCH  
 AT A POINT IN THE CYCLE AND WHEN PLAY IS  
 TAKEN UP TO MAKE CLEARANCE MINIMUM.  
 TO ADJUST  
 POSITION ROCKER BAIL PILOT STUD IN  
 ELONGATED HOLE WITH LOCK NUT  
 LOOSENED.



FUNCTION CLUTCH LATCH LEVER SPRING  
 REQUIREMENT  
 WITH FUNCTION CLUTCH TURNED TO STOP  
 POSITION AND LATCH LEVER UNLATCHED:  
 MIN. 12 OZS. ---MAX. 15 OZS.  
 TO START LATCH LEVER MOVING.

Figure 5-31. Typing Reperforator, Function Mechanism





**FUNCTION BOX  
TO CHECK**

MANUALLY SELECT LETTERS CODE COMBINATION (12345). ROTATE MAIN SHAFT UNTIL FUNCTION CLUTCH TRIPS, PUNCH SLIDES ARE DISENGAGED FROM LATCHES AND BLADE JUST TOUCHES PUSH BARS. IN NO. 2 AND 3 PUSH BARS, TAKE UP PLAY DOWNWARD AND RELEASE.

**REQUIREMENT**

TOP SURFACE OF OPERATING BLADE  
FLUSH TO 0.020 INCH

BELOW TOP SURFACE OF NO. 2 AND 3 PUSH BARS.

**TO ADJUST**

USING PRY POINT, POSITION FUNCTION BOX WITH THREE MOUNTING SCREWS IN REAR PLATE AND ONE MOUNTING SCREW IN FRONT PLATE LOOSENED. CHECK POSITION OF BELL CRANK SPRING BRACKET.

Figure 5-32. Typing Reperforator, Function Box Mechanism

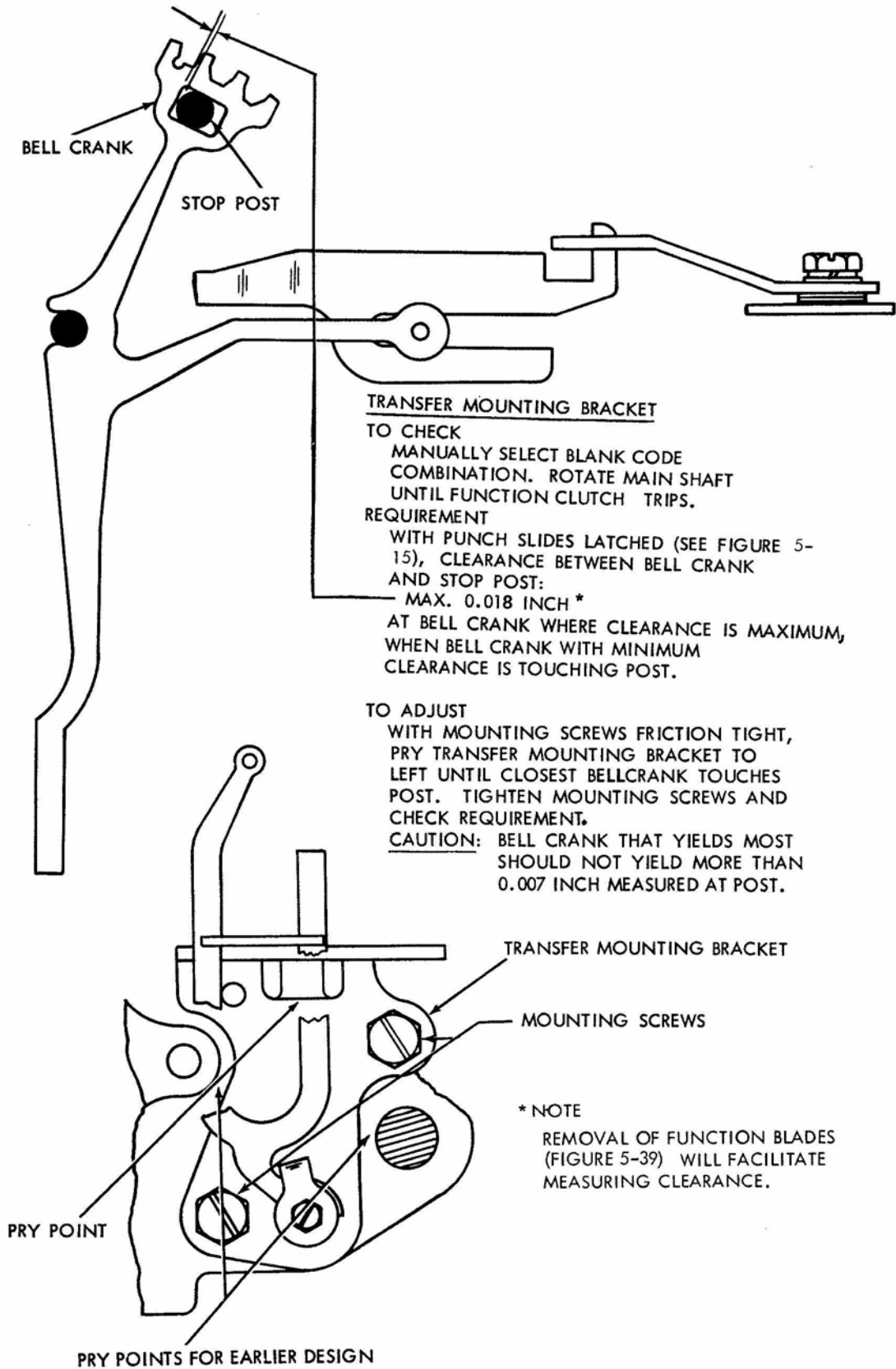


Figure 5-33. Typing Reperforator, Transfer Mechanism

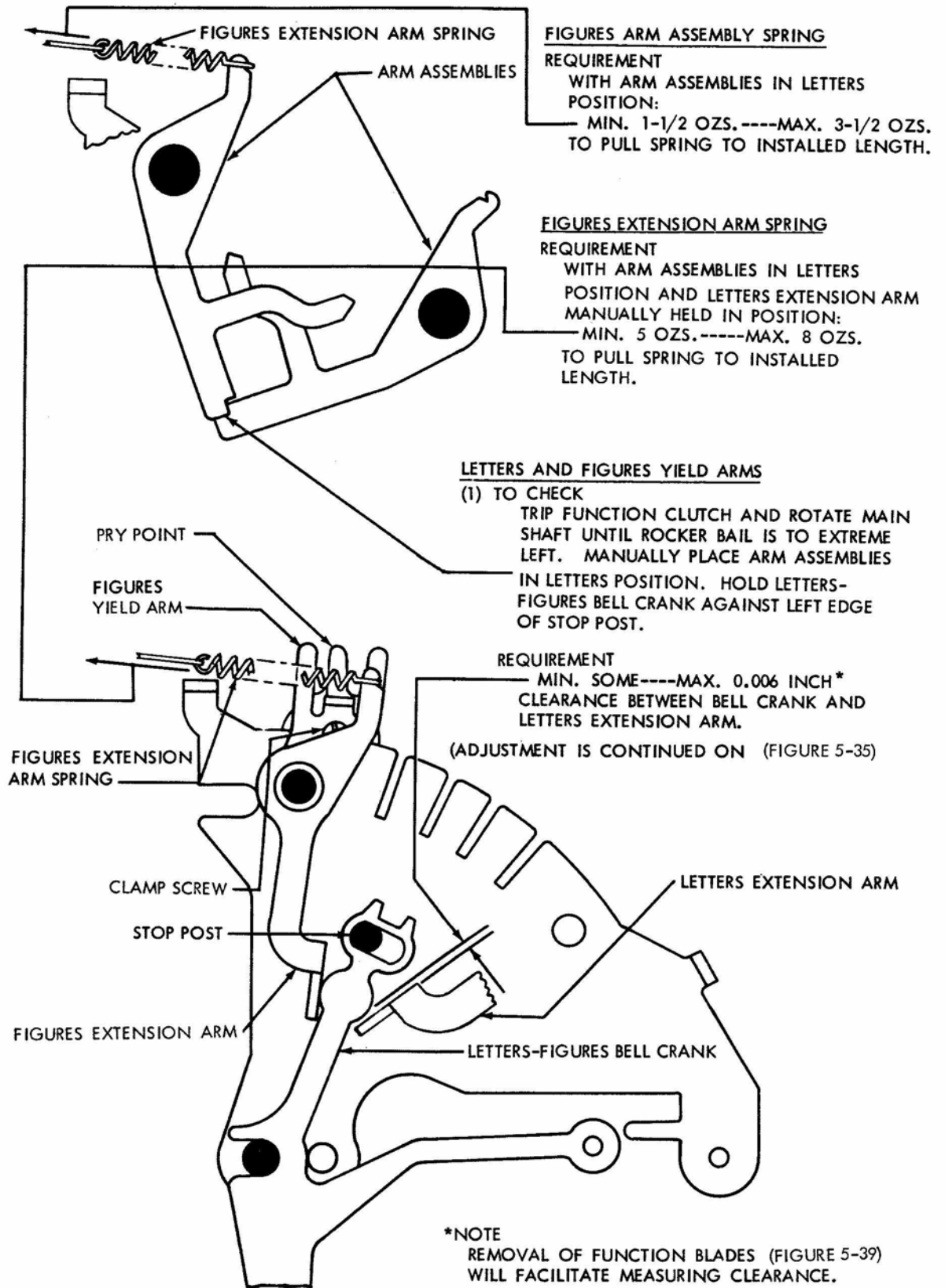


Figure 5-34. Typing Reperforator, Function Box Mechanism

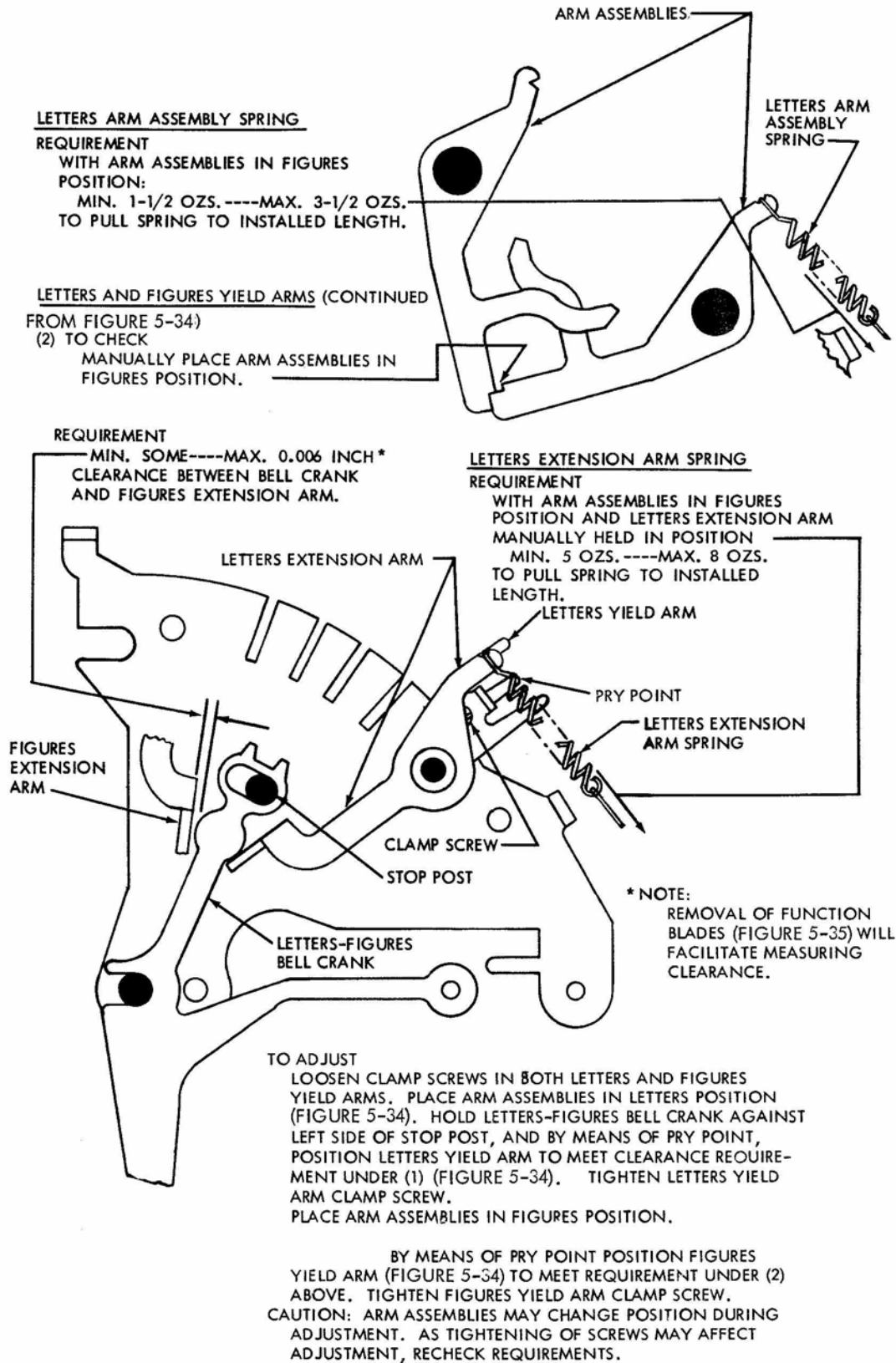
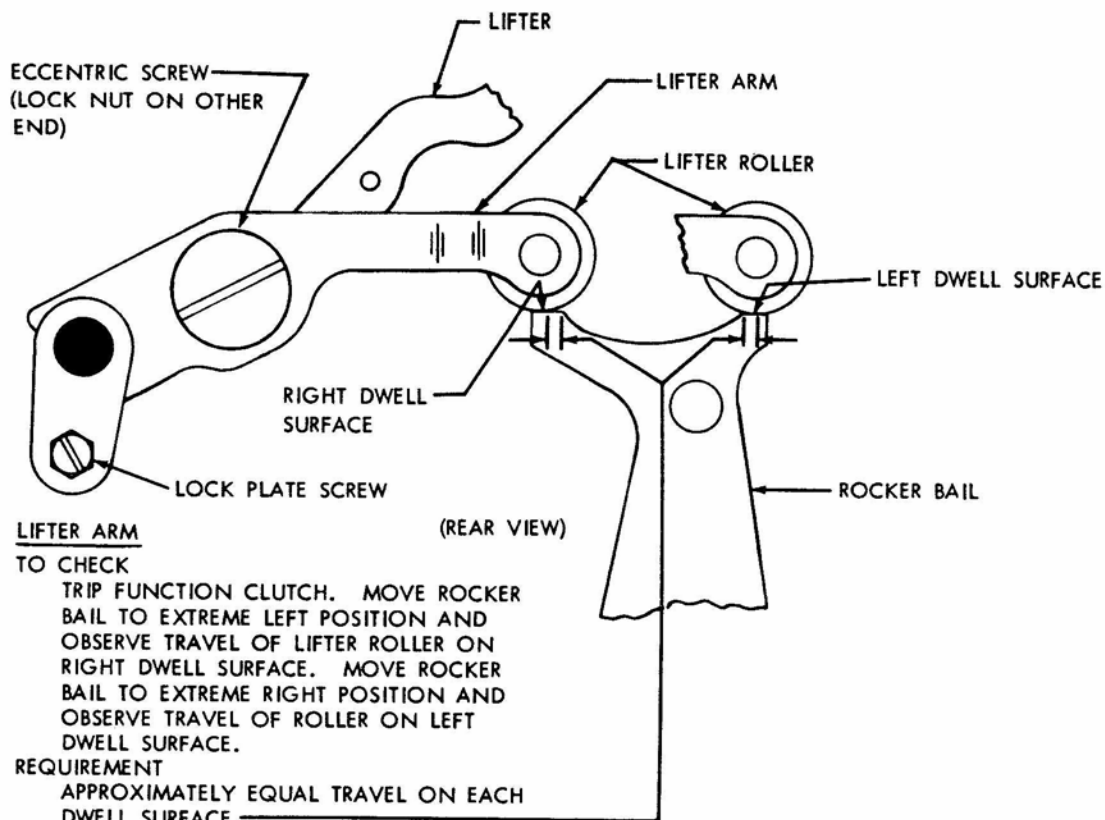


Figure 5-35. Typing Reperforator, Function Box Mechanism



#### LIFTER ARM ECCENTRIC SCREW

##### REQUIREMENT

WITH FUNCTION CLUTCH DISENGAGED;  
 CLEARANCE BETWEEN CLOSEST PROJECTION  
 OF BELL CRANKS AND ASSOCIATED LETTERS OR  
 FIGURES FUNCTION BLADE PROJECTION:  
 MIN. 0.008 INCH----MAX. 0.020 INCH

**TO ADJUST**  
 POSITION LIFTER ARM ECCENTRIC SCREW  
 WITH LOCK NUT LOOSENED.

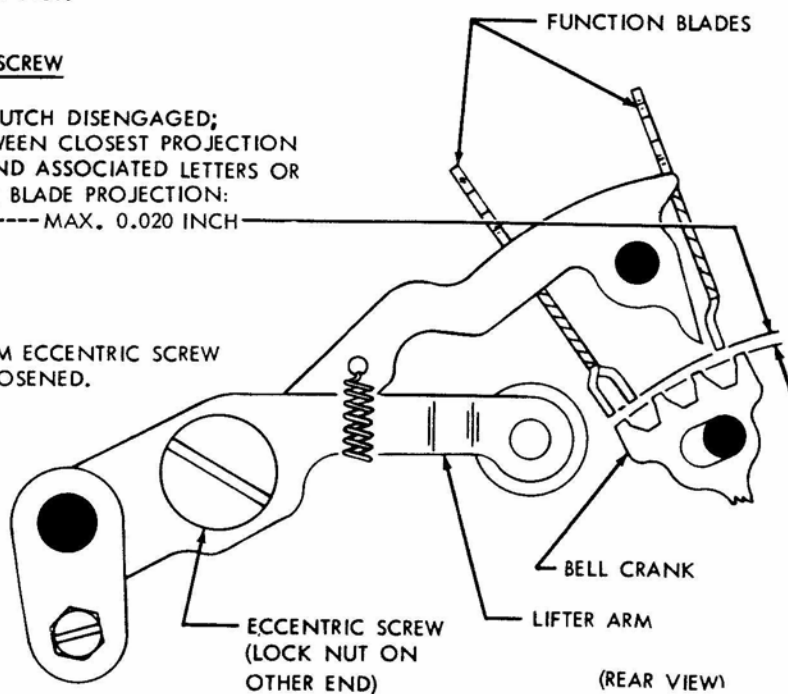
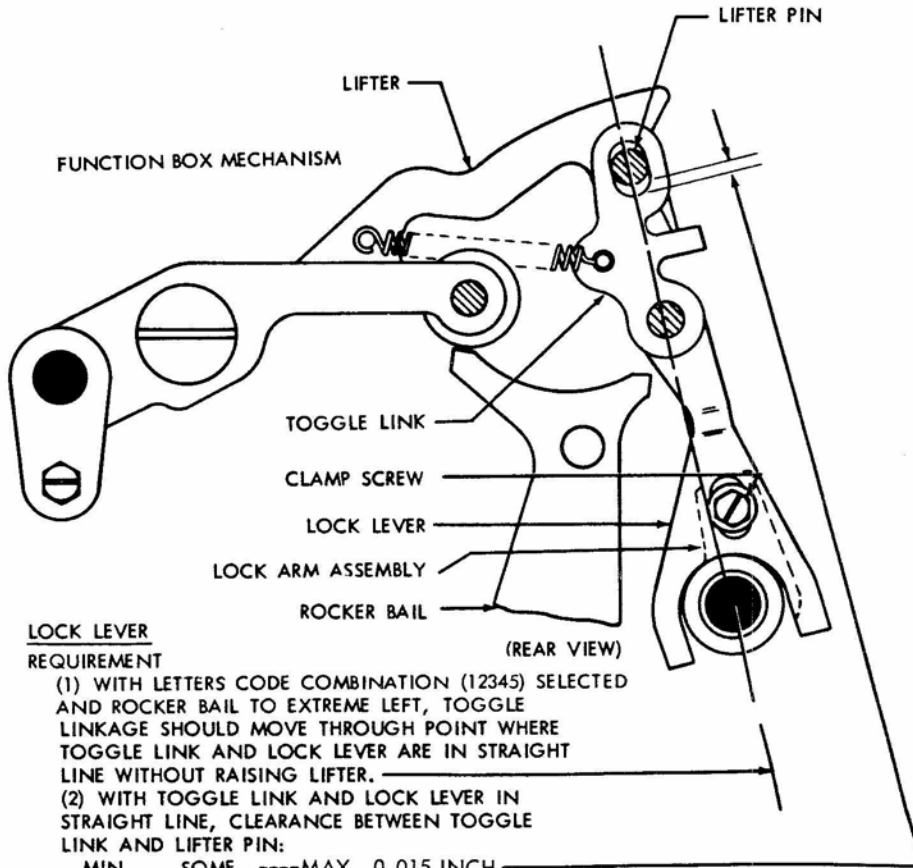


Figure 5-36. Typing Reperforator, Function Box Mechanism



**LOCK LEVER**

**REQUIREMENT**

(1) WITH LETTERS CODE COMBINATION (12345) SELECTED AND ROCKER BAIL TO EXTREME LEFT, TOGGLE LINKAGE SHOULD MOVE THROUGH POINT WHERE TOGGLE LINK AND LOCK LEVER ARE IN STRAIGHT LINE WITHOUT RAISING LIFTER.

(2) WITH TOGGLE LINK AND LOCK LEVER IN STRAIGHT LINE, CLEARANCE BETWEEN TOGGLE LINK AND LIFTER PIN:

MIN. SOME ---MAX. 0.015 INCH

**TO ADJUST**

POSITION LOCK LEVER ON LOCK ARM ASSEMBLY WITH CLAMP SCREW FRICTION TIGHT.

**NOTE:**

TO AVOID INTERFERENCE WITH LOCK LEVER, IT MAY BE NECESSARY TO MOVE HIGH PART OF CORRECTING DRIVE LINK ECCENTRIC BUSHING (SEE FIGURE 5-43) ABOVE HORIZONTAL CENTER LINE.

**NO. 5 PULSE BEAM SPRING**

**REQUIREMENT**

MIN. 10 OZS. ---MAX. 15 OZS.  
TO PULL SPRING TO LENGTH OF 7/16 INCH.

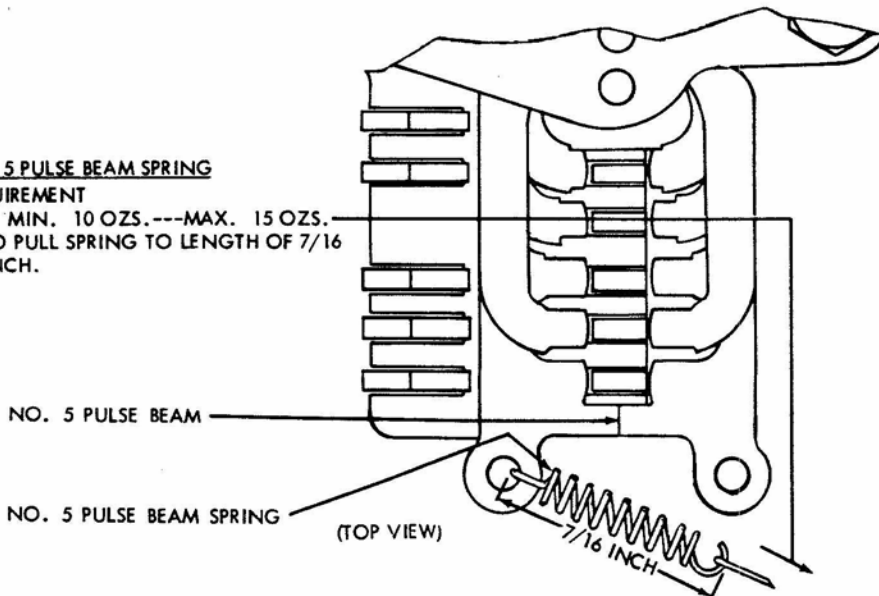


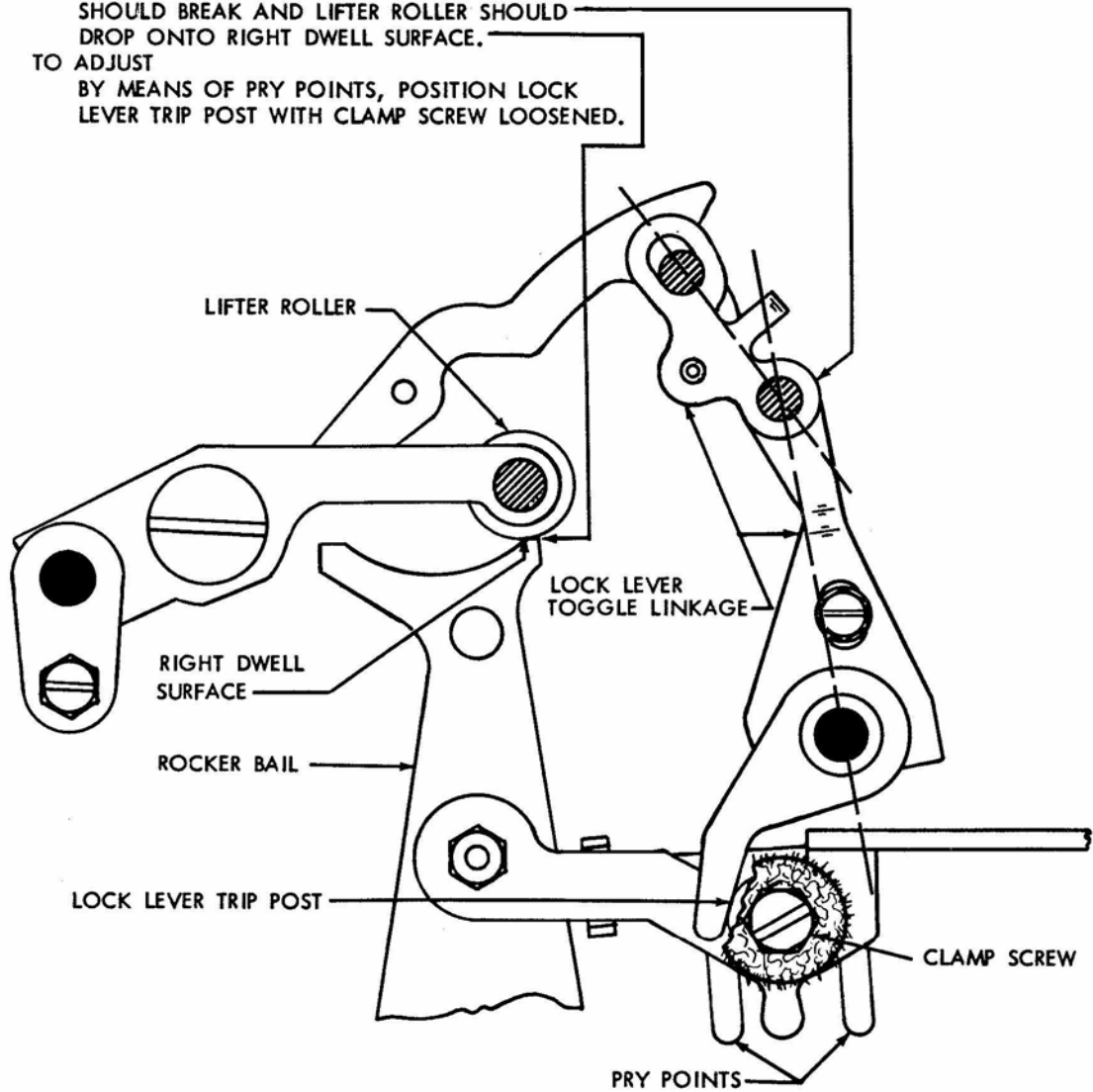
Figure 5-37. Typing Reperforator, Function Box and Transfer Mechanisms

**LOCK LEVER TRIP POST****REQUIREMENT**

AS ROCKER BAIL APPROACHES EXTREME RIGHT POSITION, LOCK LEVER TOGGLE LINKAGE SHOULD BREAK AND LIFTER ROLLER SHOULD DROP ONTO RIGHT DWELL SURFACE.

**TO ADJUST**

BY MEANS OF PRY POINTS, POSITION LOCK LEVER TRIP POST WITH CLAMP SCREW LOOSENED.



(REAR VIEW)

Figure 5-38. Typing Reperforator, Lock Lever Trip Post

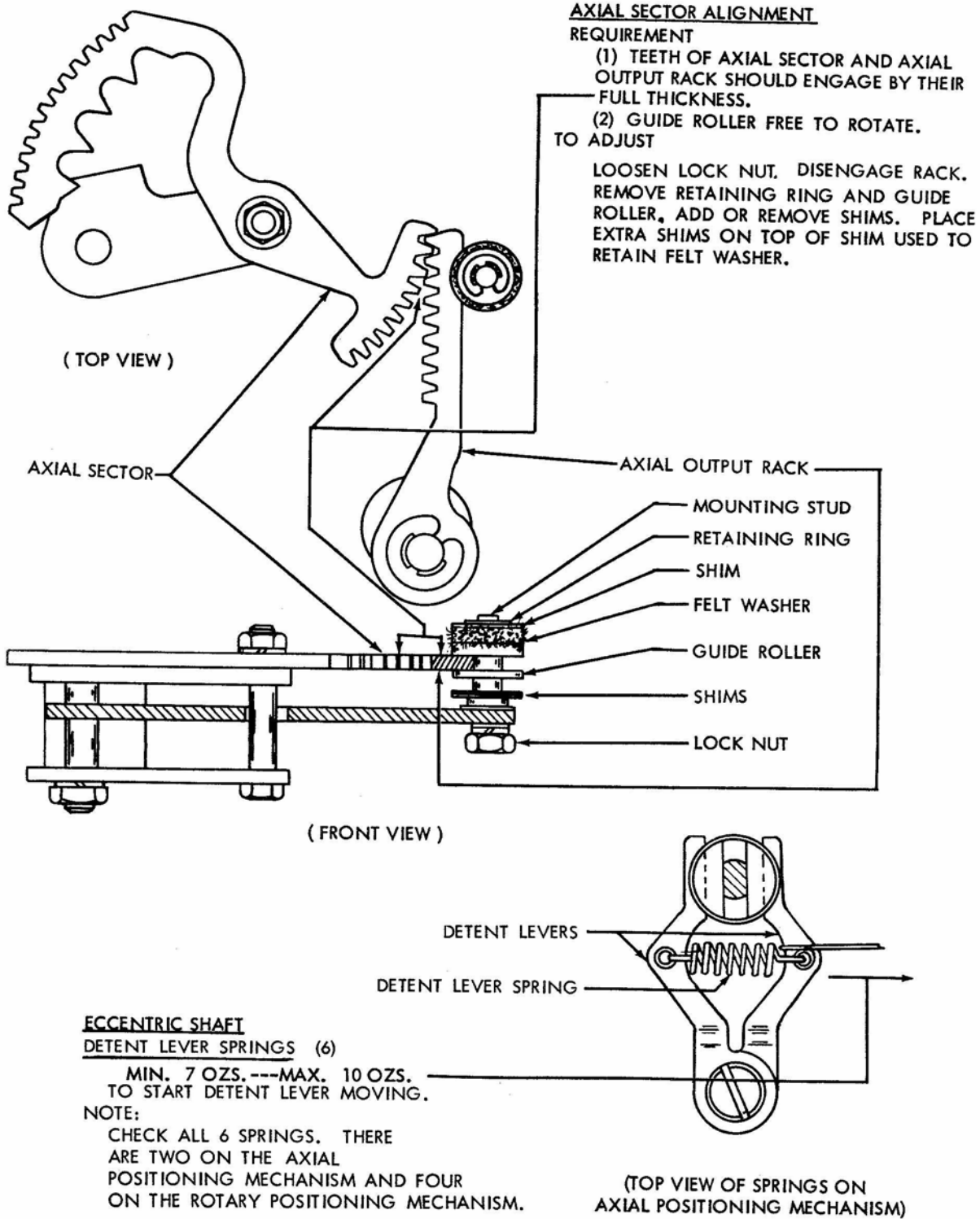


Figure 5-39. Typing Reperforator, Function Box and Correcting Mechanism



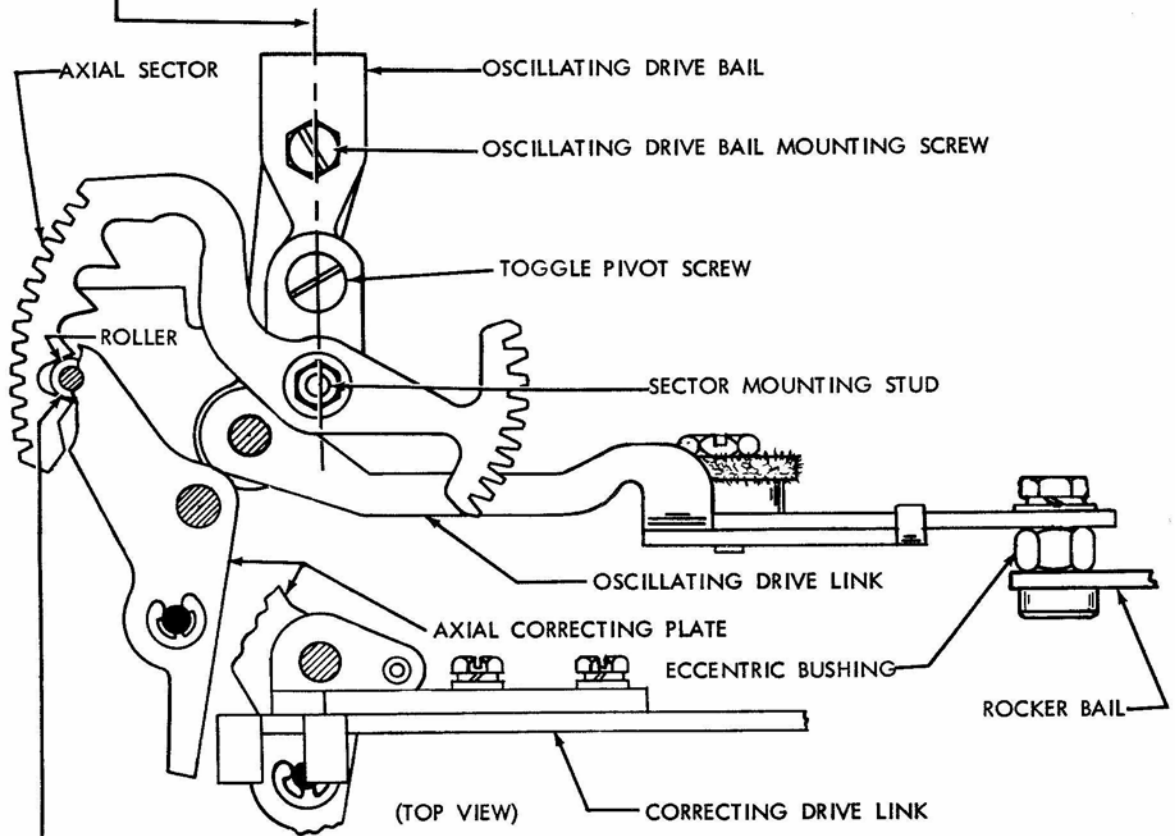
OSCILLATING DRIVE LINK

TO CHECK  
POSITION ROCKER BAIL TO ITS EXTREME LEFT.

## REQUIREMENT

SECTOR MOUNTING STUD, TOGGLE PIVOT SCREW AND OSCILLATING DRIVE BAIL MOUNTING SCREW SHOULD APPROXIMATELY LINE UP.

TO ADJUST  
POSITION OSCILLATING DRIVE LINK BY MEANS OF ITS  
ECCENTRIC BUSHING.

OSCILLATING DRIVE BAIL

TO CHECK  
MANUALLY SELECT BLANK CODE COMBINATION.  
ROTATE MAIN SHAFT UNTIL ROCKER BAIL IS TO  
EXTREME LEFT.

## REQUIREMENT

ROLLER ON AXIAL CORRECTING PLATE SEATED  
FIRMLY IN CENTER OF FIRST NOTCH OF AXIAL  
SECTOR.

## TO ADJUST

WITH OSCILLATING DRIVE BAIL MOUNTING SCREW  
LOOSENED, POSITION CORRECTING DRIVE LINK SO  
THAT ROLLER FITS SNUGLY IN FIRST NOTCH. ROLLER  
SHOULD RIDE CENTRALIZED IN NOTCH WITH NOTCH  
TOUCHING BOTH SIDES, AND DRIVE BAIL SHOULD BE  
LOOSE AND IN POSITION CORRESPONDING TO THAT  
OF CORRECTING PLATE.

Figure 5-40. Typing Reperforator, Axial Positioning Mechanism

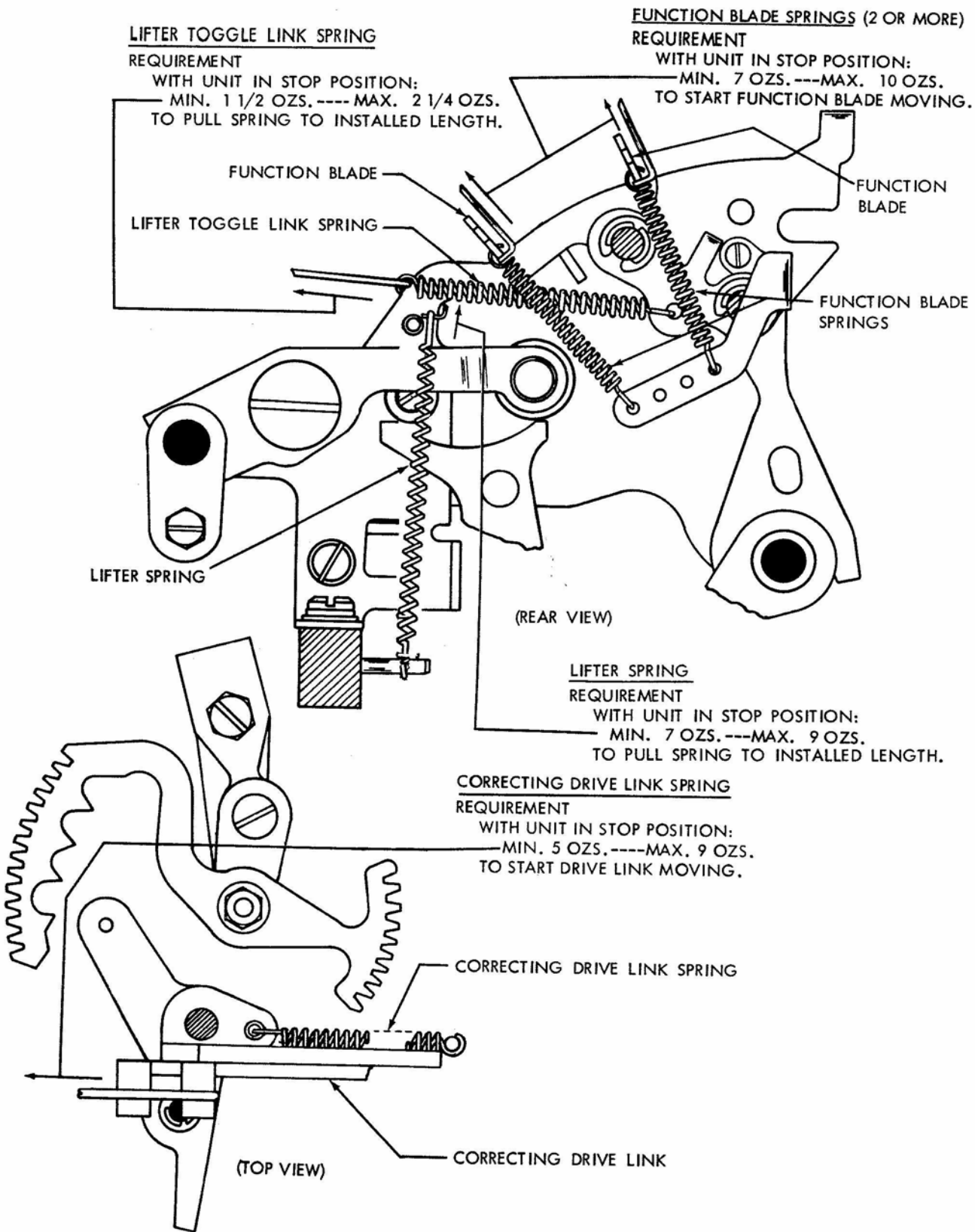


Figure 5-41. Typing Reperforator, Axial Positioning Mechanism

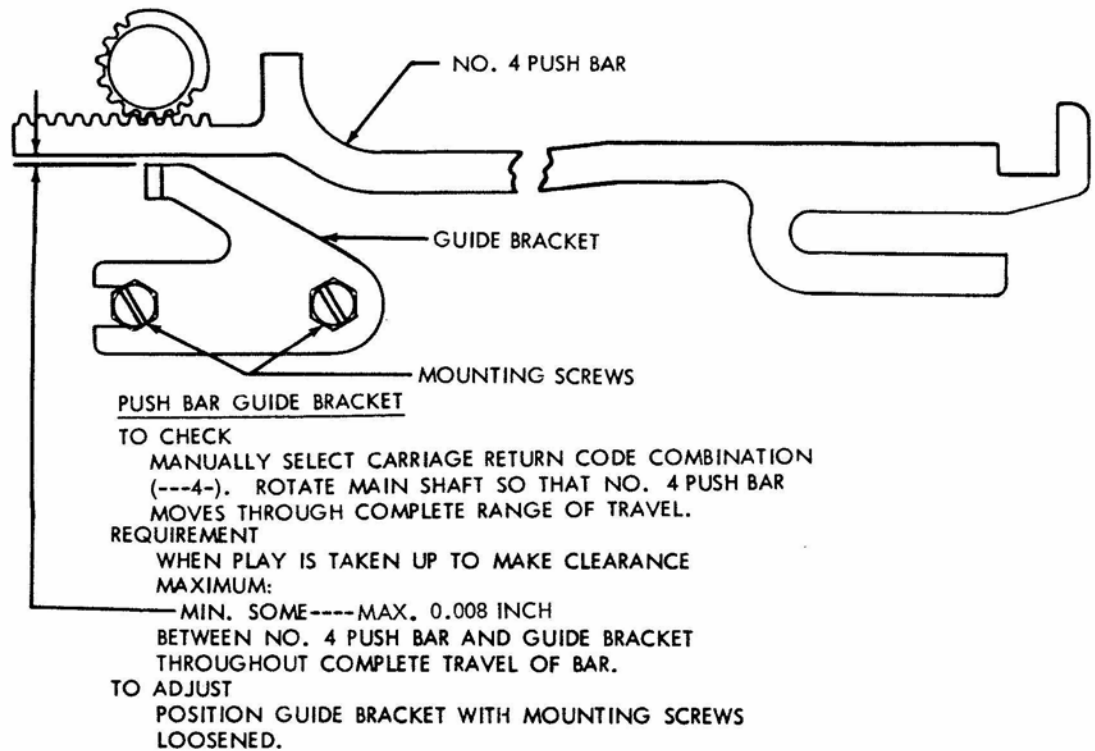
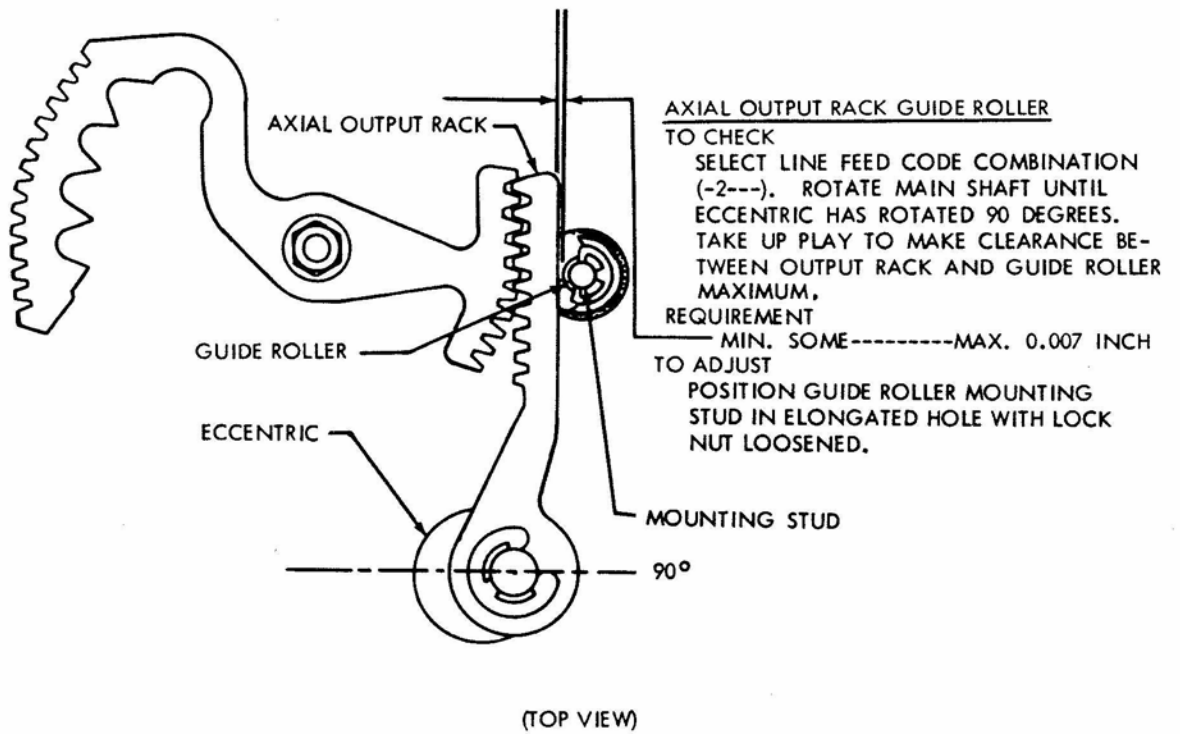


Figure 5-42. Typing Reperforator, Axial and Rotary Positioning Mechanisms

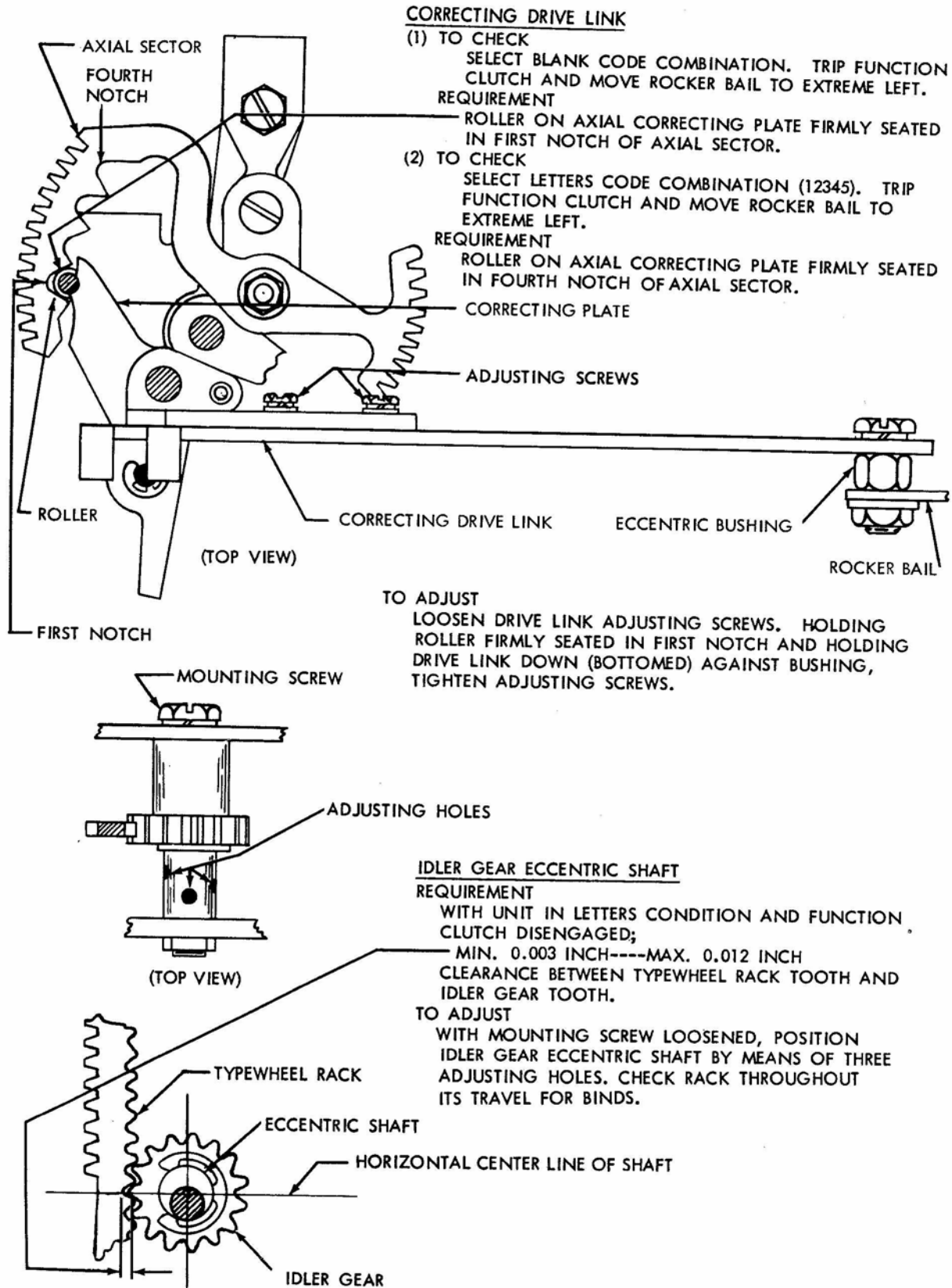


Figure 5-43. Typing Reperfector, Correcting Mechanism

ROTARY CORRECTING LEVER

## (1) TO CHECK

LOOSEN CORRECTING CLAMP ADJUSTING SCREW. WITH UNIT IN FIGURES CONDITION, SELECT NO. 9 CODE COMBINATION (---45). TRIP FUNCTION CLUTCH AND POSITION ROCKER BAIL TO EXTREME LEFT. MANUALLY SEAT ROTARY CORRECTING LEVER IN TYPE WHEEL RACK.

## REQUIREMENT

SECOND TOOTH FROM TOP OF RACK SEATED BETWEEN LOBES OF CORRECTING LEVER.

## TO ADJUST

LOOSEN ECCENTRIC BUSHING LOCK NUT. WITH CLAMP ADJUSTING SCREW LOOSENED AND CORRECTING LEVER PIVOT TO RIGHT OF CENTER LINE, POSITION CORRECTING LEVER. TIGHTEN BUSHING LOCK NUT DO NOT TIGHTEN CLAMP ADJUSTING SCREW AT THIS TIME.

## (2) TO CHECK

IN A MANNER SIMILAR TO THAT DESCRIBED ABOVE CHECK ENGAGEMENT OF FIFTH TOOTH (--34- CODE COMBINATION SELECTED IN FIGURES CONDITION), NINTH TOOTH (---4- CODE COMBINATION SELECTED IN LETTERS CONDITION) AND SIXTEENTH TOOTH (--3-5 CODE COMBINATION SELECTED IN LETTERS CONDITION).

## TO ADJUST

REFINE ADJUSTMENT UNDER (1) ABOVE.

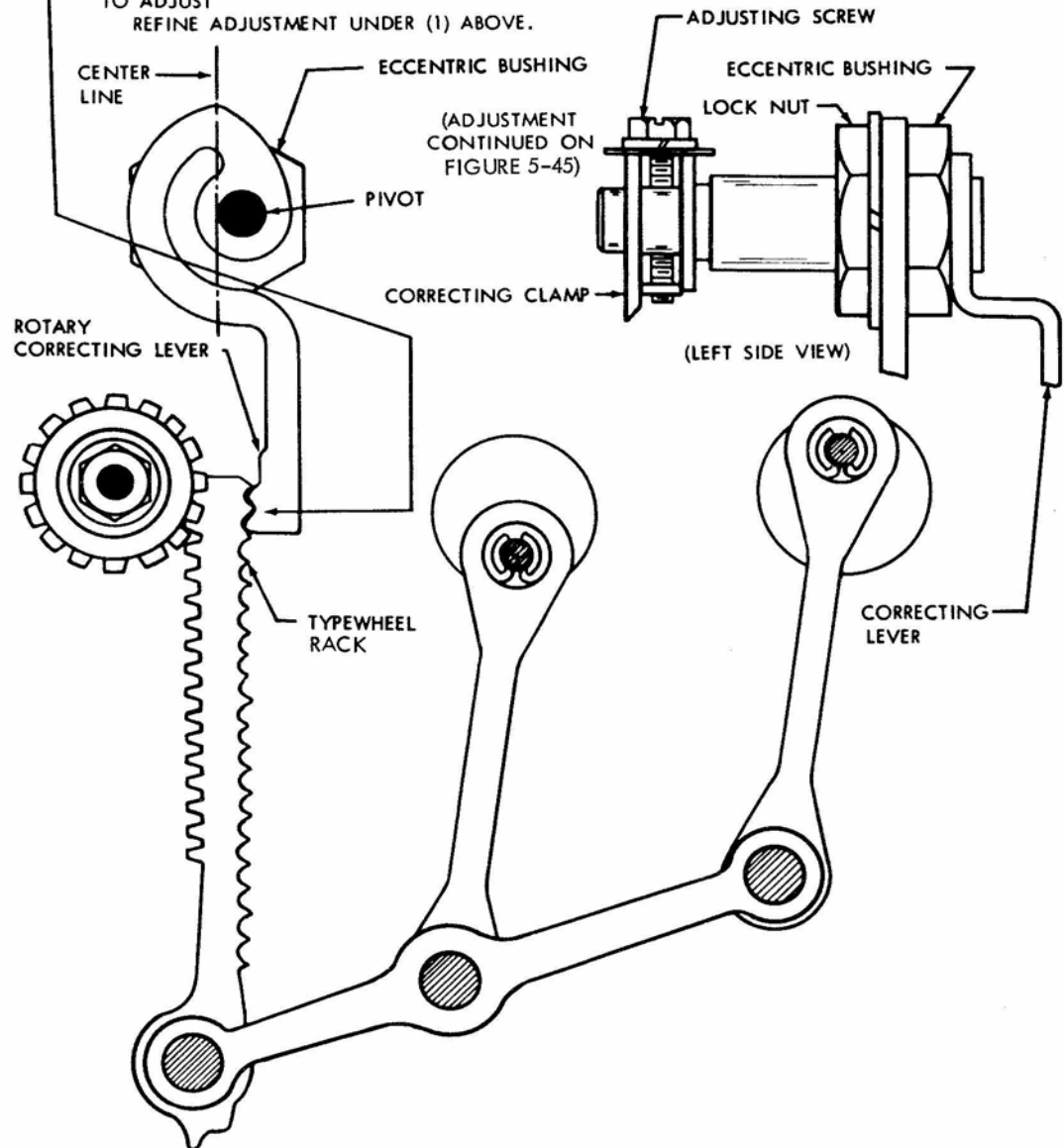


Figure 5-44. Typing Reperforator, Rotary Correcting Lever

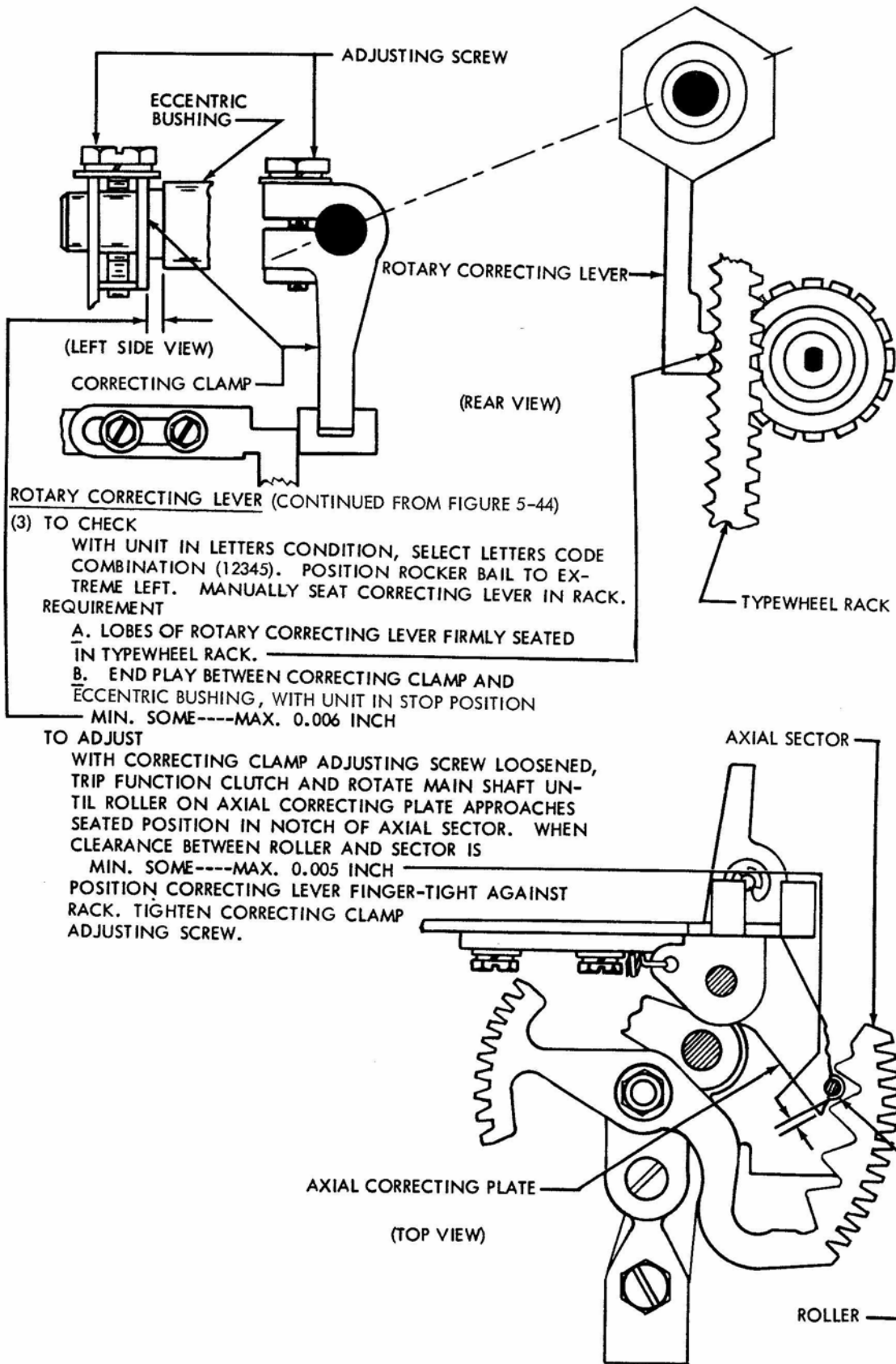


Figure 5-45. Typing Reperforator, Rotary Correcting Lever

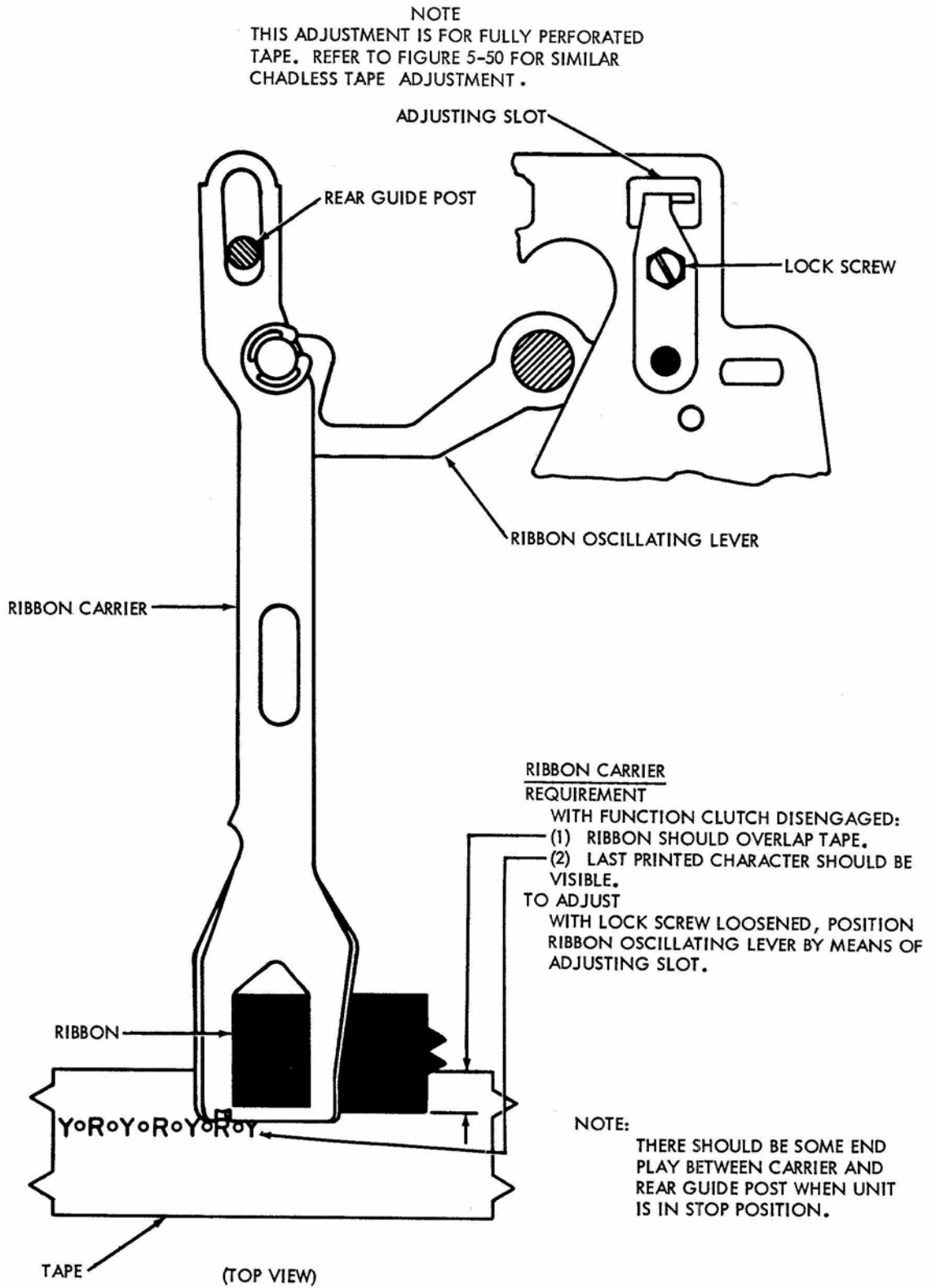


Figure 5-46. Typing Reperforator, Ribbon Oscillating Mechanism, Fully Perforated Tape

NOTE  
 THE ADJUSTMENTS ON THIS PAGE ARE FOR FULLY PERFORATED TAPE. REFER TO FIGURE 5-51 FOR SIMILAR CHADLESS TAPE ADJUSTMENTS.

PRINTING TRIP LINK TO CHECK

TRIP FUNCTION CLUTCH AND POSITION ROCKER BAIL TO EXTREME LEFT. MANUALLY LIFT ACCELERATOR SO THAT LATCHING SURFACES OF PRINTING LATCH AND ACCELERATOR ARE EVEN.

REQUIREMENT

MIN. 0.005 INCH ---- MAX. 0.015 INCH CLEARANCE BETWEEN ACCELERATOR AND LATCH.

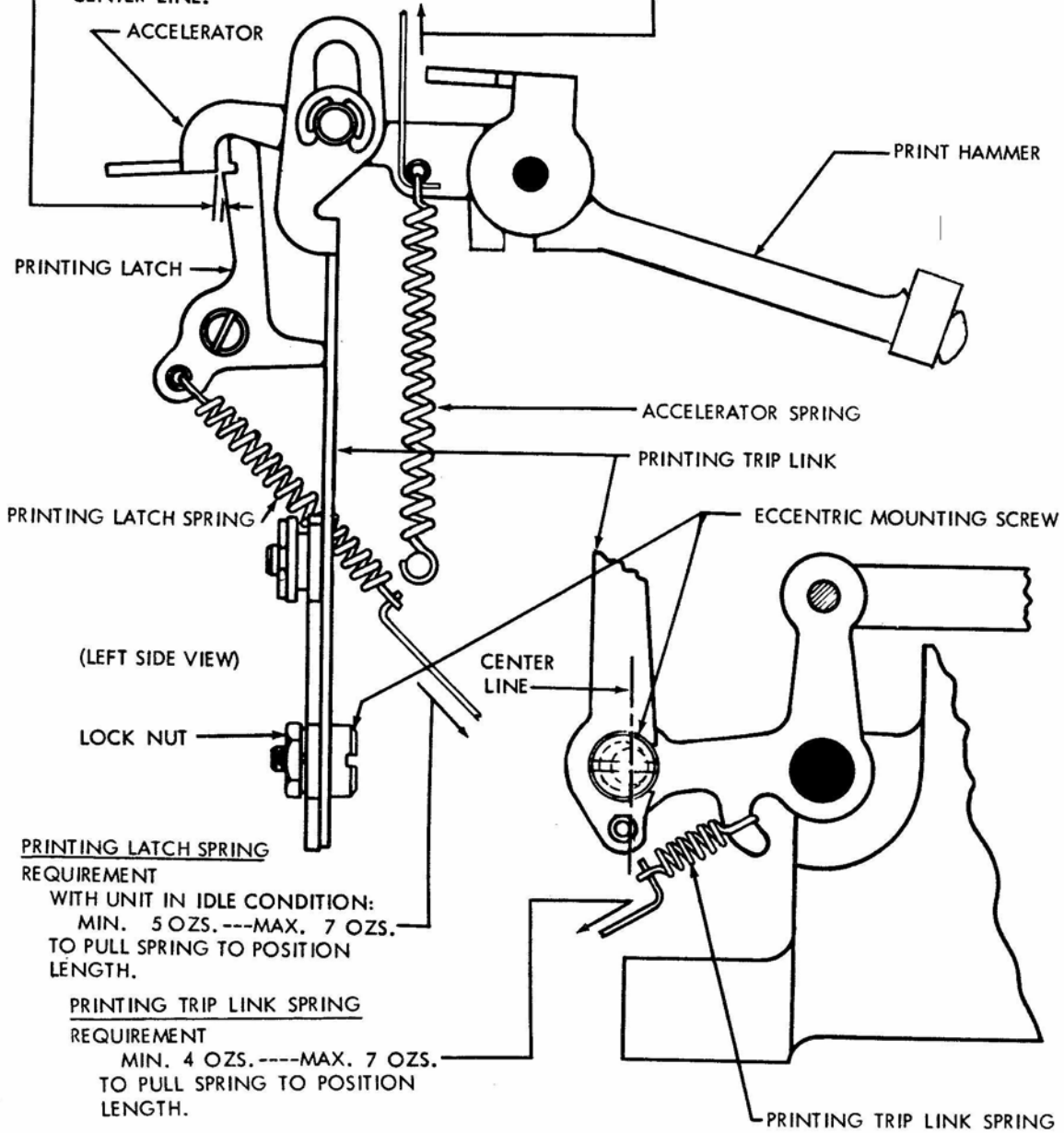
TO ADJUST

WITH LOCK NUT LOOSENED, POSITION PRINTING TRIP LINK BY MEANS OF ECCENTRIC MOUNTING SCREW. KEEP HIGH PART OF SCREW TO LEFT OF CENTER LINE.

ACCELERATOR SPRING REQUIREMENT

WITH UNIT IN IDLE CONDITION:

MIN. 20 OZS. ---- MAX. 26 OZS. TO PULL SPRING TO INSTALLED LENGTH.



PRINTING LATCH SPRING REQUIREMENT

WITH UNIT IN IDLE CONDITION:  
 MIN. 5 OZS. --- MAX. 7 OZS. TO PULL SPRING TO POSITION LENGTH.

PRINTING TRIP LINK SPRING REQUIREMENT

MIN. 4 OZS. ---- MAX. 7 OZS. TO PULL SPRING TO POSITION LENGTH.

Figure 5-47. Typing Reperforator, Printing Mechanism, Fully Perforated Tape



NOTE  
THE ADJUSTMENTS ON THIS PAGE ARE FOR FULLY PERFORATED TAPE. REFER TO FIGURE 5-51 FOR SIMILAR CHADLESS TAPE ADJUSTMENTS.

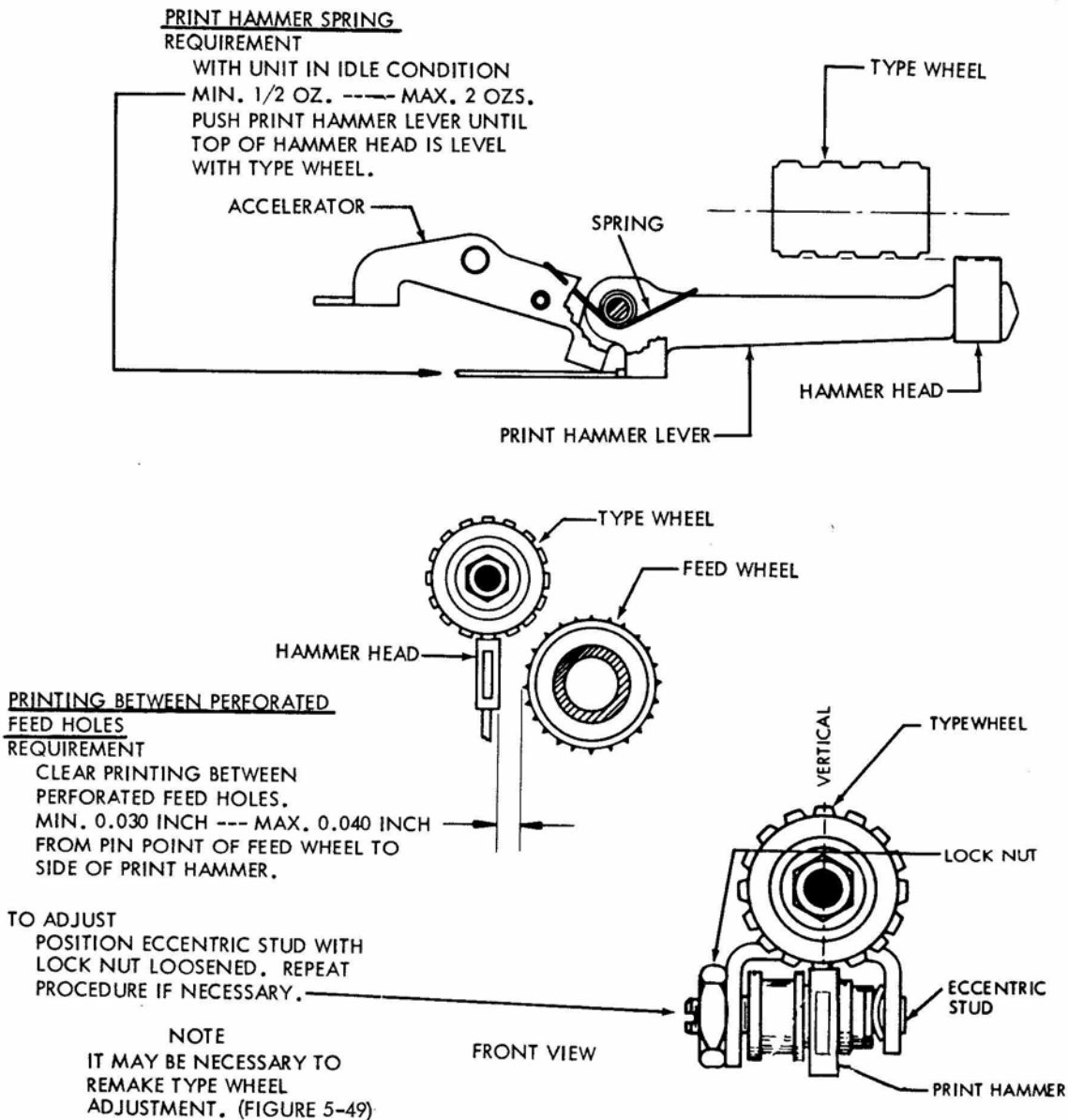
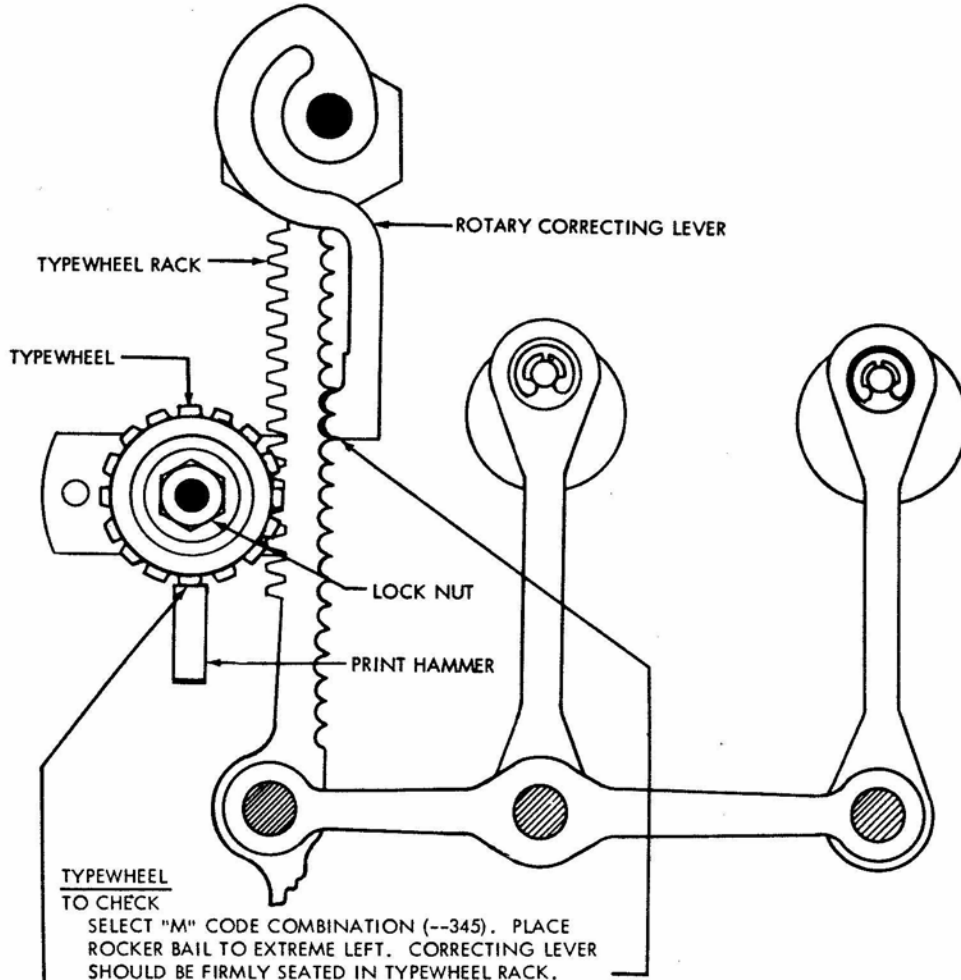


Figure 5-48. Typing Reperforator, Printing Mechanism, Fully Perforated Tape



**TYPEWHEEL TO CHECK**  
 SELECT "M" CODE COMBINATION (--345). PLACE ROCKER BAIL TO EXTREME LEFT. CORRECTING LEVER SHOULD BE FIRMLY SEATED IN TYPEWHEEL RACK.

**REQUIREMENT**  
 TYPEWHEEL ALIGNED SO THAT FULL CHARACTER IS PRINTED UNIFORMLY.

**TO ADJUST**  
 POSITION TYPEWHEEL WITH LOCK NUT LOOSENED. CHECK PRINTING BY MANUALLY LIFTING ACCELERATOR (FIGURE 5-47) TO LATCHED POSITION AND RELEASING IT.

**NOTE:** FOR BEST RESULTS IT MAY BE NECESSARY TO MAKE PRINT HAMMER ADJUSTMENT (FIGURE 5-48) AND THEN REFINE THIS ADJUSTMENT.

Figure 5-49. Typing Reperforator, Typewheel Mechanism, Fully Perforated Tape

NOTE  
THE ADJUSTMENTS ON THIS PAGE ARE FOR  
CHADLESS TAPE. REFER TO FIGURE 5-46 FOR  
SIMILAR FULLY PERFORATED TAPE ADJUSTMENTS.

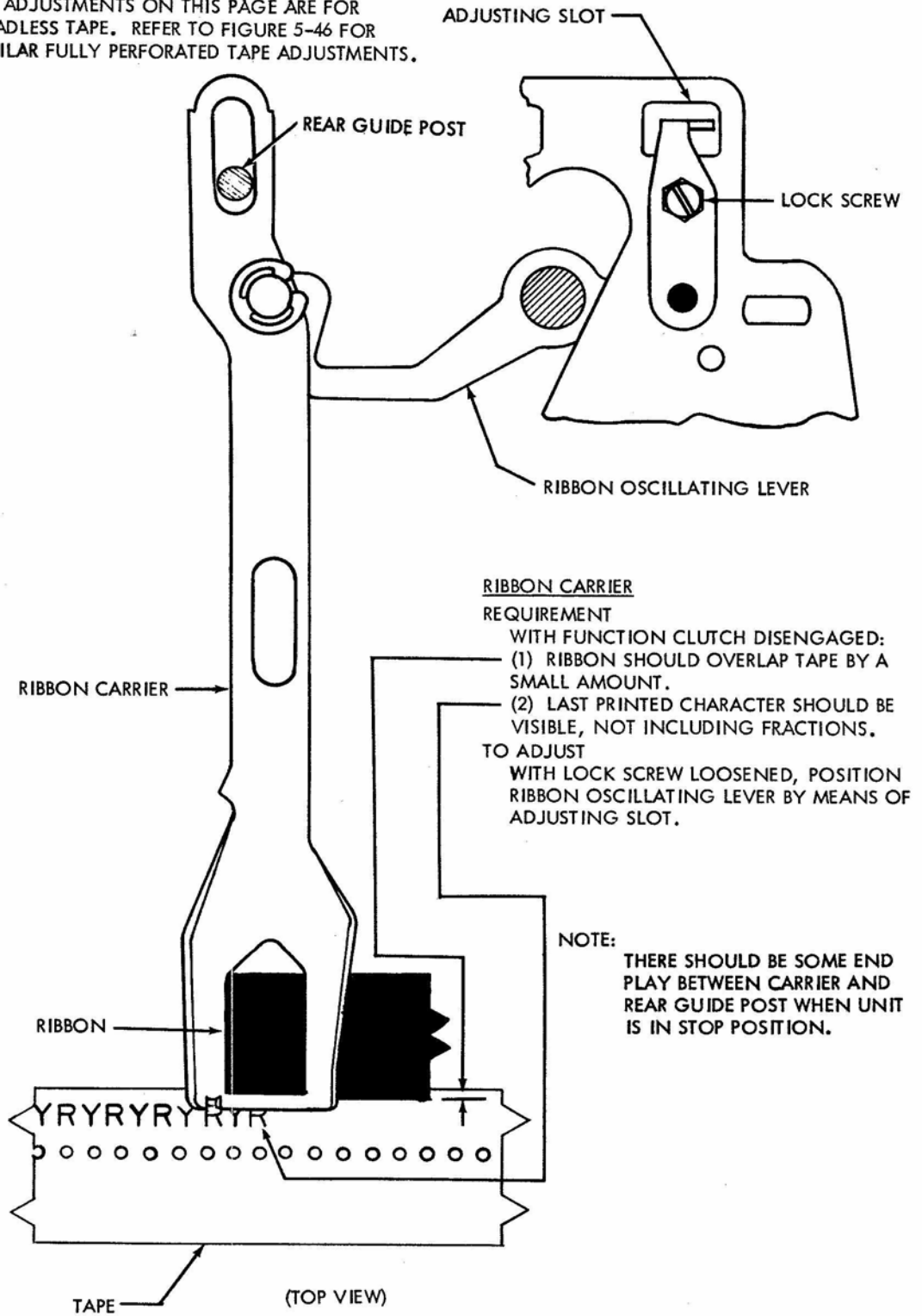


Figure 5-50. Typing Reperforator, Ribbon Oscillating Mechanism, Chadless Tape

NOTE  
 THE ADJUSTMENTS ON THIS PAGE ARE FOR  
 CHADLESS TAPE. REFER TO FIGURE 5-48 FOR  
 SIMILAR FULLY PERFORATED TAPE ADJUSTMENTS.

PRINTING TRIP LINK

TO CHECK

TRIP FUNCTION CLUTCH AND POSITION ROCKER  
 BAIL TO EXTREME LEFT. MANUALLY LIFT ACCELERATOR  
 SO THAT LATCHING SURFACES OF PRINTING LATCH  
 AND ACCELERATOR ARE EVEN.

REQUIREMENT

MIN. SOME ---- MAX. 0.015 INCH  
 CLEARANCE BETWEEN ACCELERATOR AND LATCH.

TO ADJUST

WITH LOCK NUT LOOSENED, POSITION PRINTING  
 TRIP LINK BY MEANS OF ECCENTRIC MOUNTING  
 SCREW. KEEP HIGH PART OF SCREW TO LEFT OF  
 CENTER LINE.

ACCELERATOR SPRING

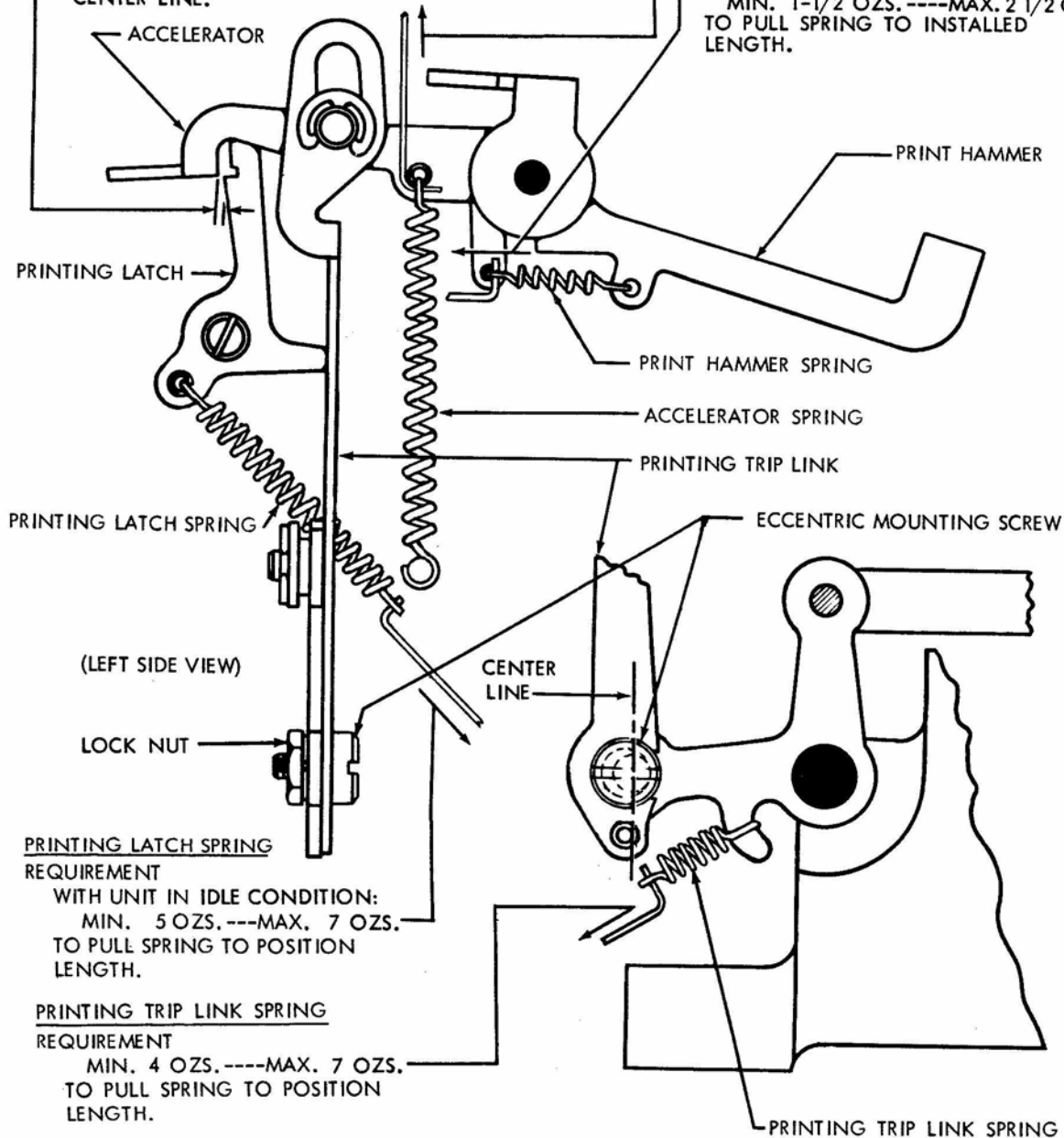
REQUIREMENT

WITH UNIT IN IDLE  
 CONDITION:  
 MIN. 20 OZS. ---- MAX. 26 OZS.  
 TO PULL SPRING TO INSTALLED  
 LENGTH.

PRINT HAMMER SPRING

REQUIREMENT

WITH UNIT IN IDLE CONDITION:  
 MIN. 1-1/2 OZS. ---- MAX. 2 1/2 OZS.  
 TO PULL SPRING TO INSTALLED  
 LENGTH.



PRINTING LATCH SPRING

REQUIREMENT

WITH UNIT IN IDLE CONDITION:  
 MIN. 5 OZS. --- MAX. 7 OZS.  
 TO PULL SPRING TO POSITION  
 LENGTH.

PRINTING TRIP LINK SPRING

REQUIREMENT

MIN. 4 OZS. ---- MAX. 7 OZS.  
 TO PULL SPRING TO POSITION  
 LENGTH.

Figure 5-51. Typing Reperforator, Printing Mechanism, Chadless Tape

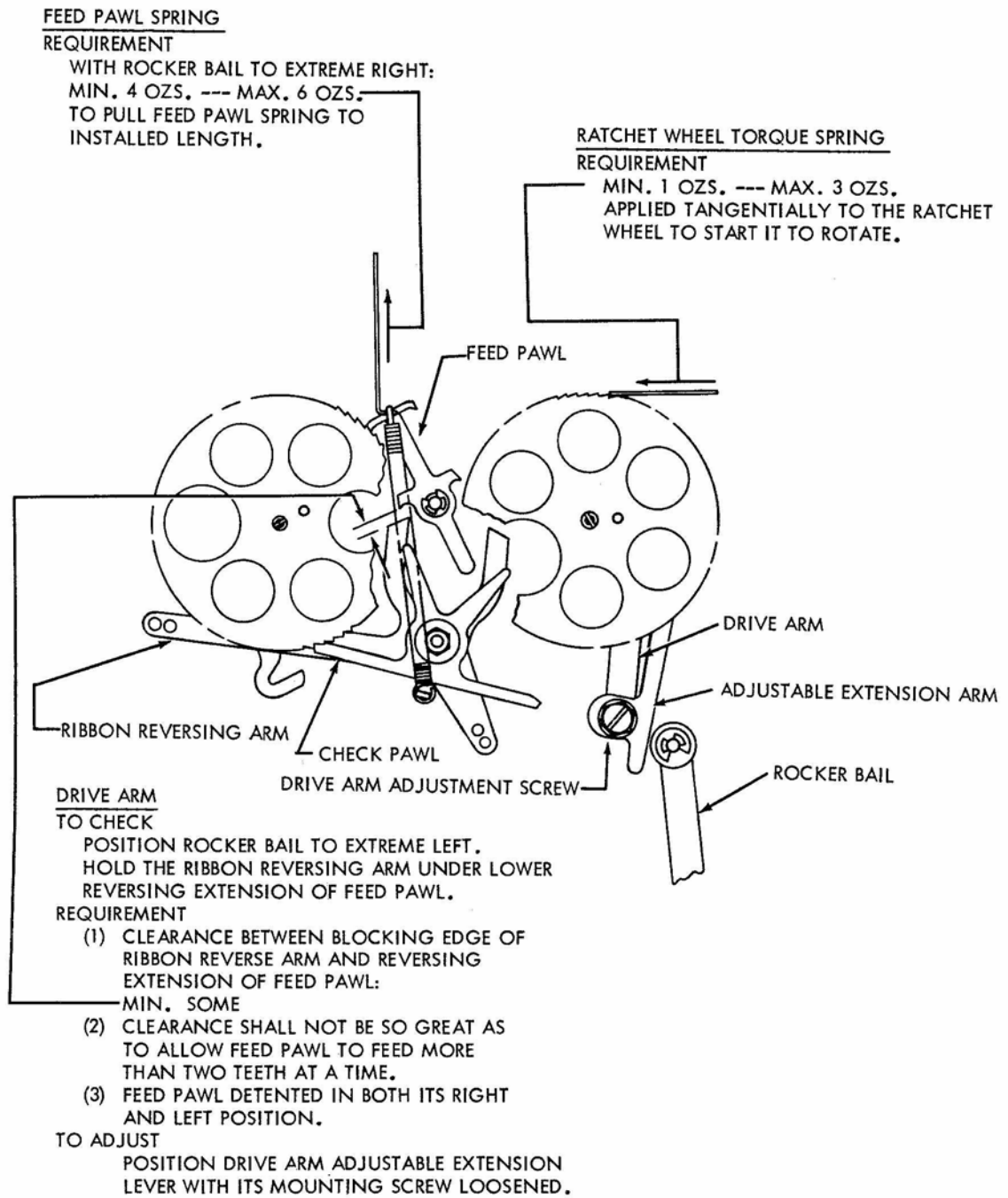
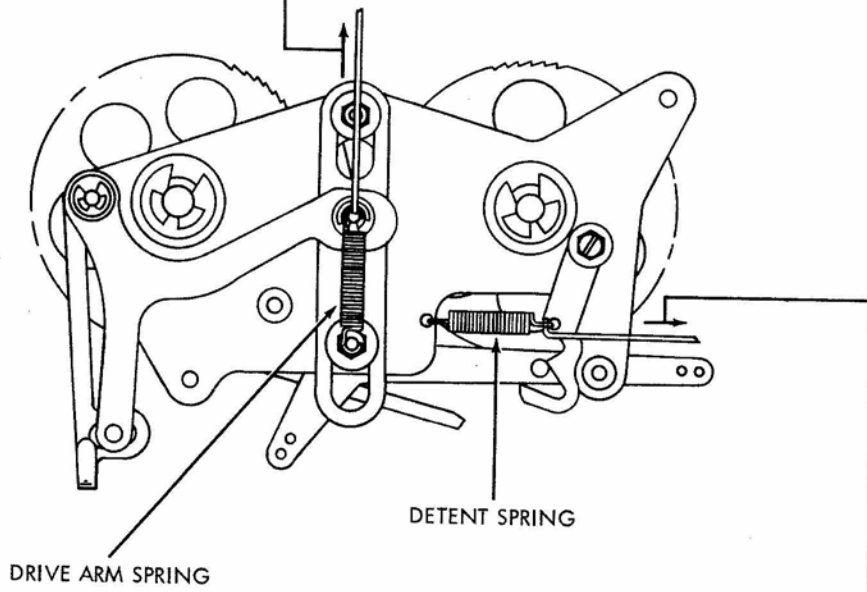


Figure 5-52. Typing Reperforator, Ribbon Feed Mechanism

DRIVE ARM SPRING  
REQUIREMENT

WITH ROCKER BAIL TO EXTREME RIGHT:  
MIN. 9 OZS. --- MAX. 14 OZS.  
TO PULL DRIVE ARM SPRING TO  
INSTALLED LENGTH.



DETENT SPRING  
REQUIREMENT

WITH REVERSING ARM IN ITS EXTREME  
RIGHT OR LEFT POSITION:  
MIN. 2 OZS. --- MAX. 4 OZS.  
TO PULL DETENT SPRING TO ITS  
INSTALLED LENGTH.

Figure 5-53. Typing Reperforator, Ribbon Feed Mechanism

## NOTE

THE FOLLOWING ADJUSTMENTS APPLY TO TYPING REPERFORATORS EQUIPPED WITH EITHER THE "REMOTE CONTROL" OR THE "AUTOMATIC" NON-INTERFERING LETTERS TAPE FEED-OUT MECHANISM AS INDICATED:

1. ONE ASTERISK (\*) APPLIES ONLY TO UNITS EQUIPPED WITH REMOTE CONTROL MECHANISM.
2. TWO ASTERISKS (\*\*) APPLIES ONLY TO UNITS EQUIPPED WITH THE AUTOMATIC MECHANISM.
3. ADJUSTMENTS WITHOUT THE ASTERISK INDICATION APPLY TO BOTH MECHANISMS.

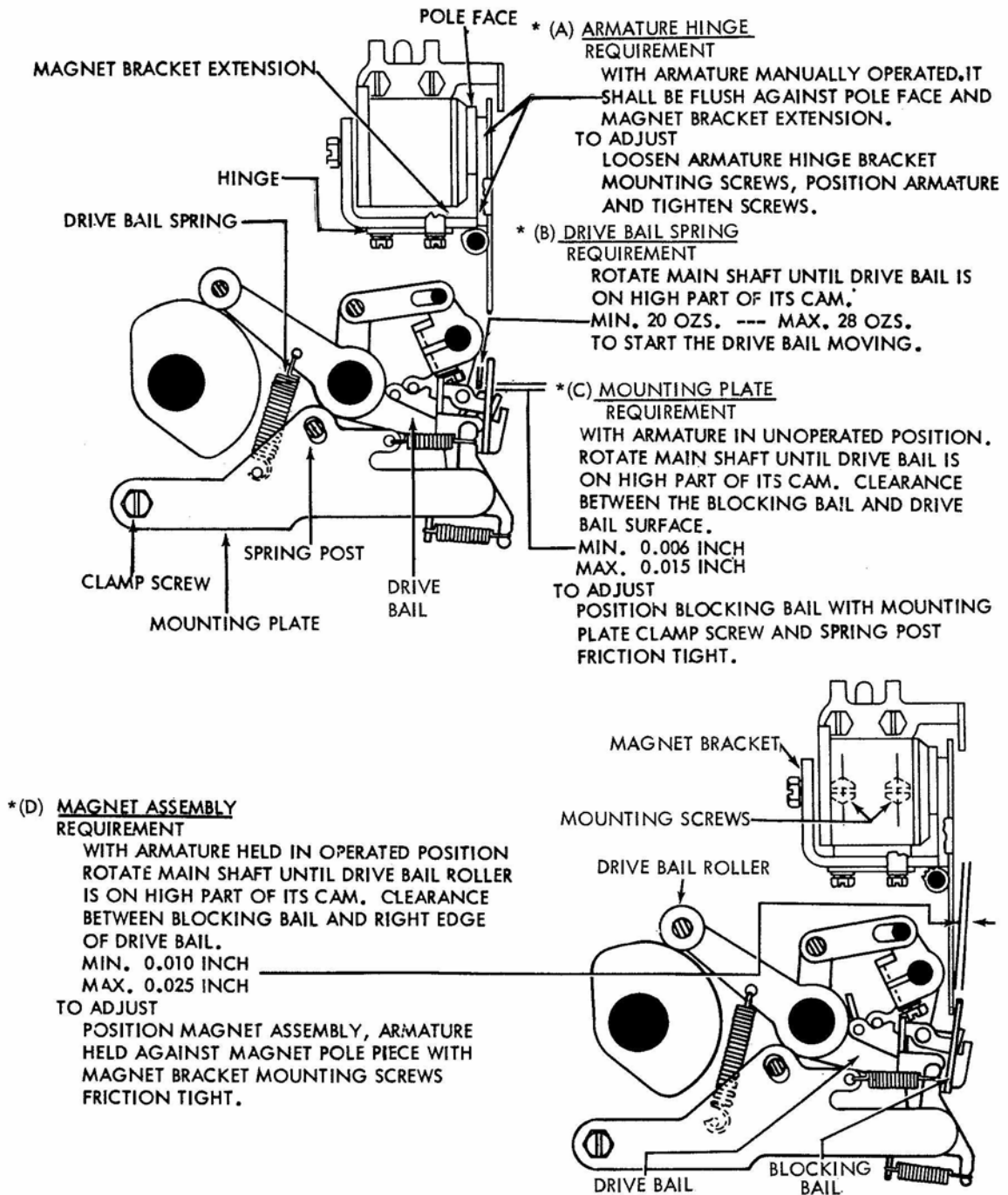


Figure 5-54. Typing Reperforator, Remote Control Non-Interfering Letters Tape Feed-Out Mechanism

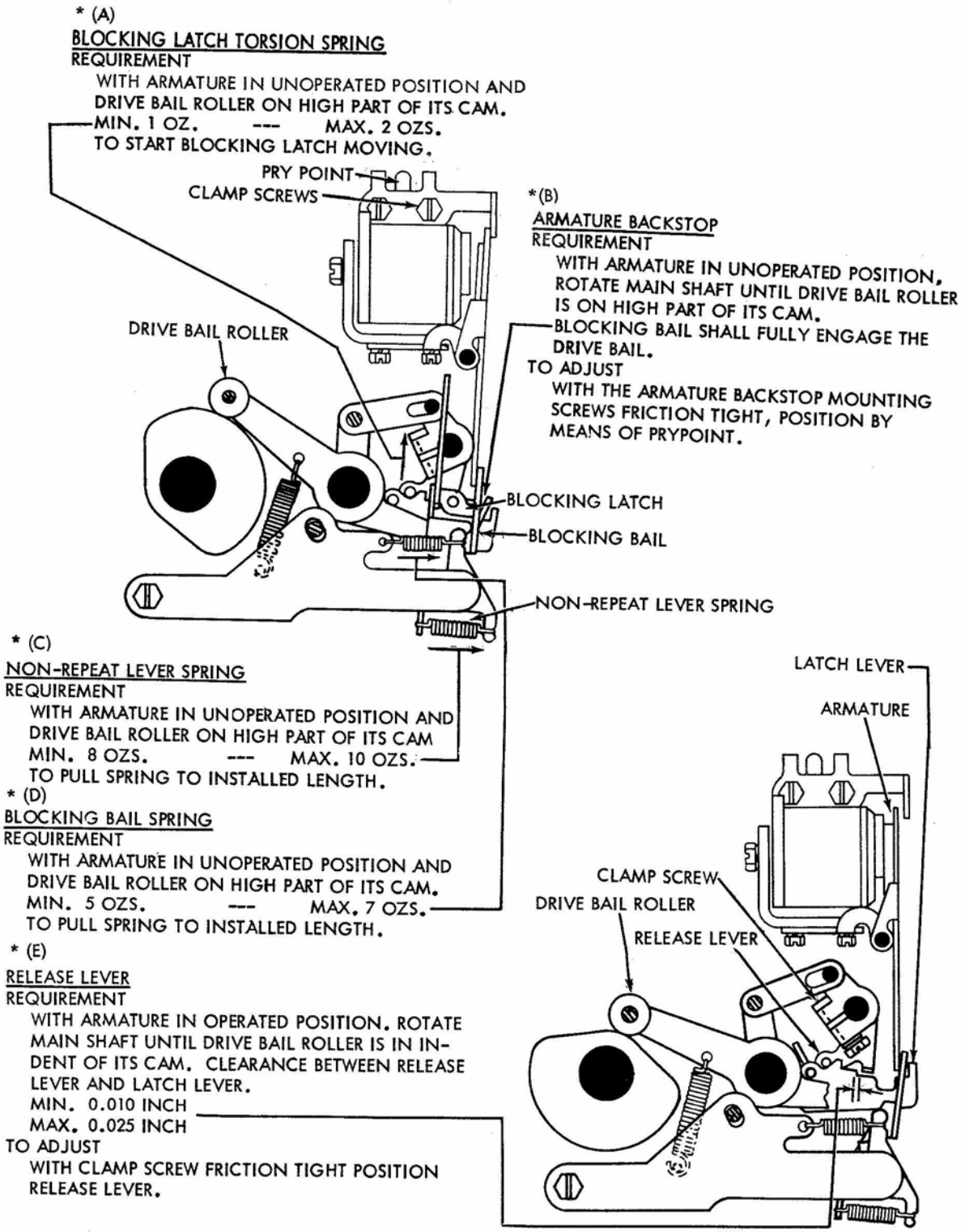


Figure 5-55. Typing Reperforator, Remote Control Non-Interfering Letters Tape Feed-Out Mechanism



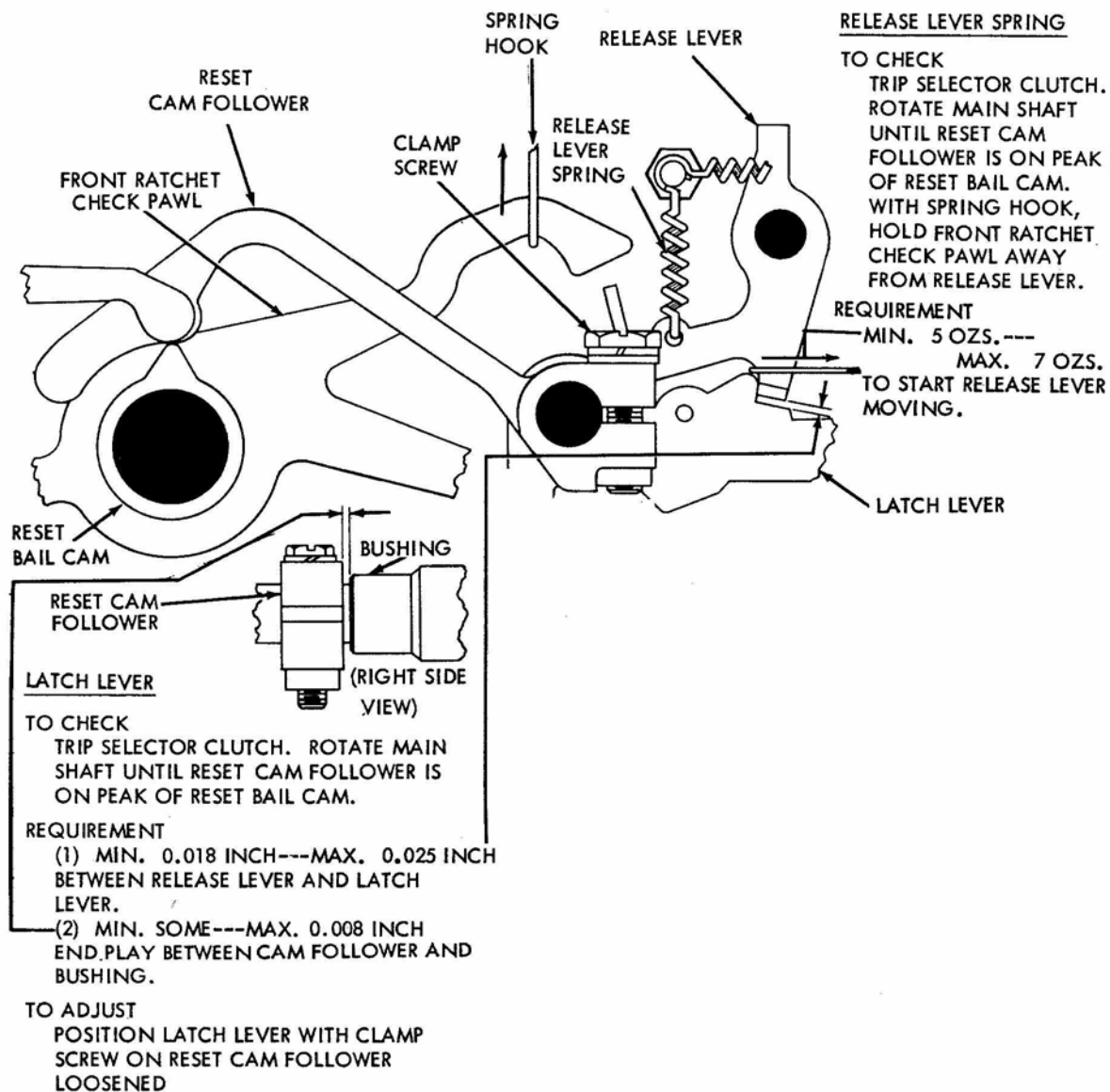


Figure 5-56. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

\*\* (A)

SAFETY LATCH

(1) TO CHECK: TRIP FUNCTION CLUTCH BY ROTATING MAIN TRIP LEVER COUNTERCLOCKWISE (SEE FIGURE 5-11), ROTATE MAIN SHAFT UNTIL DRIVE LINK IS TO EXTREME LEFT. TRIP SELECTOR CLUTCH AND ROTATE MAIN SHAFT UNTIL RESET CAM FOLLOWER IS ON PEAK OF CAM WHERE CLEARANCE BETWEEN SAFETY LATCH AND LATCH LEVER IS MIN. TAKE UP PLAY IN SAFETY LATCH TO MAKE CLEARANCE MIN. AND MEASURE CLEARANCE WHERE IT IS MIN.

REQUIREMENT

MIN. SOME---MAX. 0.003 INCH

TO ADJUST: WITH SMALL NUT LOOSE, POSITION SAFETY LATCH PIVOT BY MEANS OF PRY POINT.

(2) TO CHECK

TRIP SELECTOR CLUTCH. ROTATE MAIN SHAFT UNTIL RIGHT EDGE OF SAFETY LATCH AND CONTACTING EDGE OF LATCH LEVER ARE IN LINE.

REQUIREMENT

MAX. OF 0.030 INCH OF SAFETY LATCH NOT ENGAGED BY LATCH LEVER.

TO ADJUST

REFINE (1) ABOVE AND LATCH LEVER ADJUSTMENT.

NOTE  
TWO ASTERISKS (\*\*) INDICATE PARTS ASSOCIATED ONLY WITH THE AUTOMATIC MECHANISM.

\*\* (B)

SAFETY LATCH SPRING

TO CHECK

TRIP FUNCTION CLUTCH BY PIVOTING MAIN TRIP LEVER COUNTERCLOCKWISE (SEE FIGURE 5-11), ROTATE MAIN SHAFT UNTIL DRIVE LINK IS TO EXTREME LEFT. TRIP SELECTOR CLUTCH AND ROTATE MAIN SHAFT UNTIL RESET CAM FOLLOWER IS ON PEAK OF CAM.

REQUIREMENT

MIN. 1-1/2 OZS. ---MAX. 3 OZS.  
TO PULL SPRING TO INSTALLED LENGTH.

LATCH LEVER SPRING

TO CHECK

TRIP SELECTOR CLUTCH. ROTATE MAIN SHAFT UNTIL RESET CAM FOLLOWER IS ON PEAK OF RESET BAIL CAM.

REQUIREMENT

MIN. 2 OZS. ---MAX. 4 OZS.  
TO PULL SPRING TO INSTALLED LENGTH.

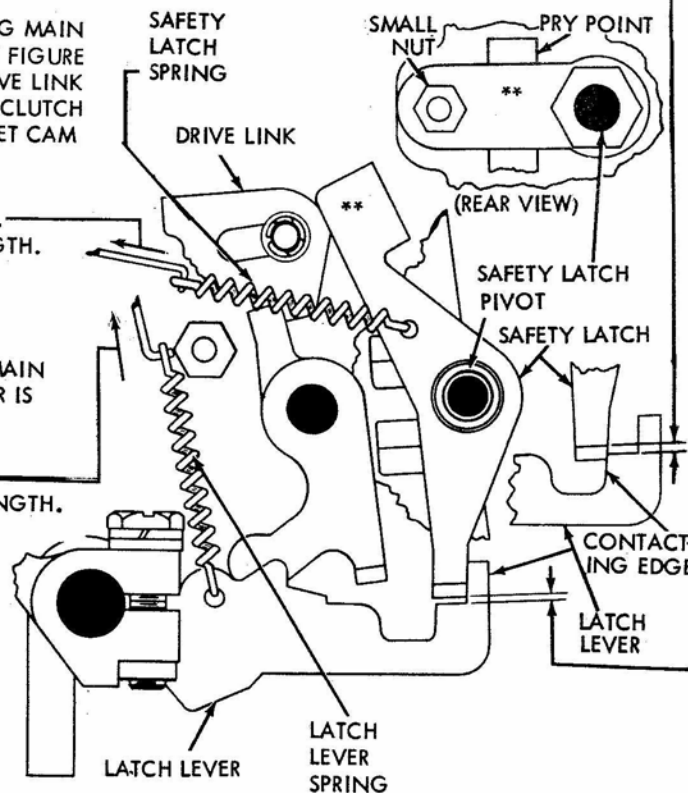


Figure 5-57. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

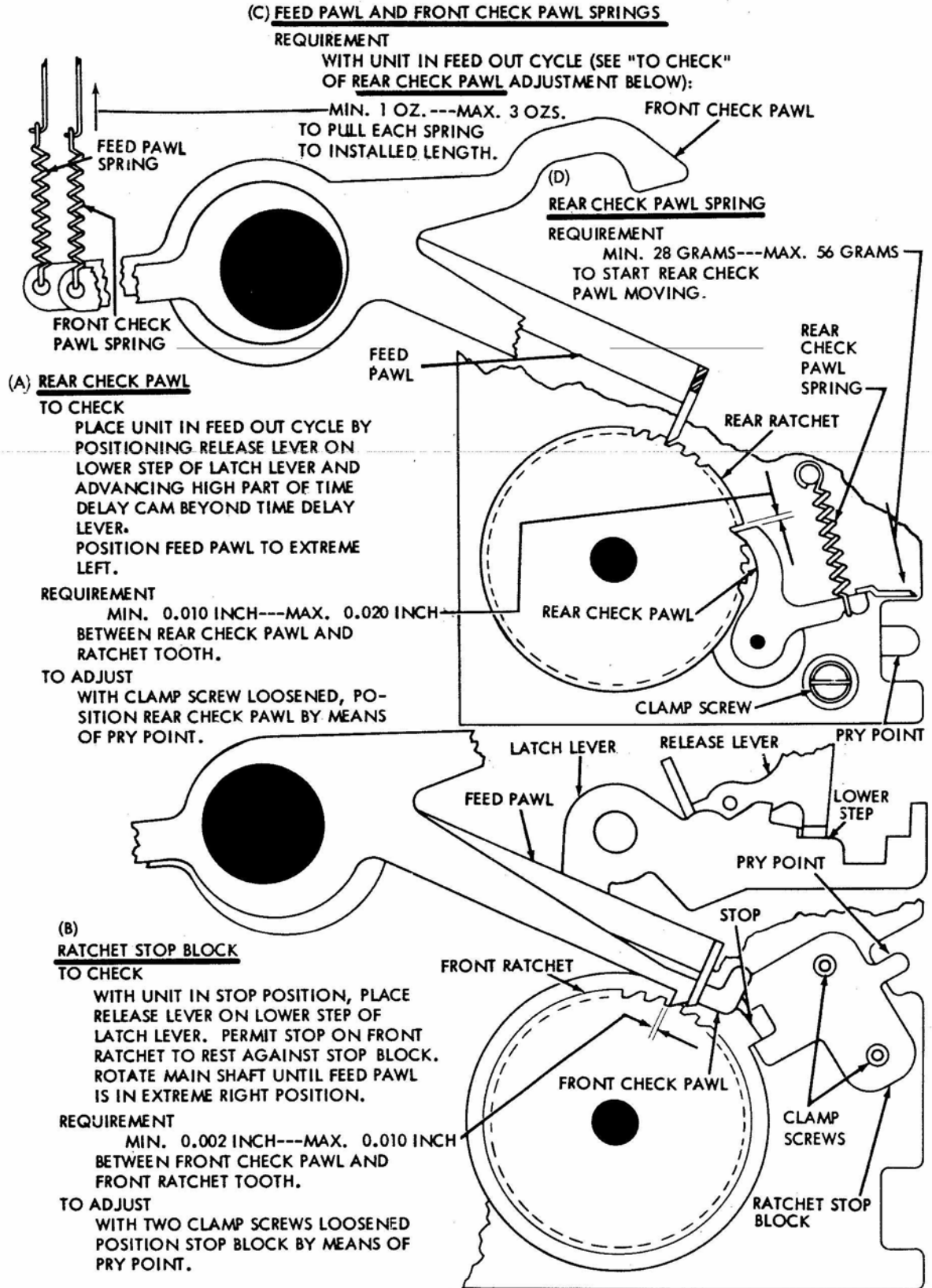


Figure 5-58. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

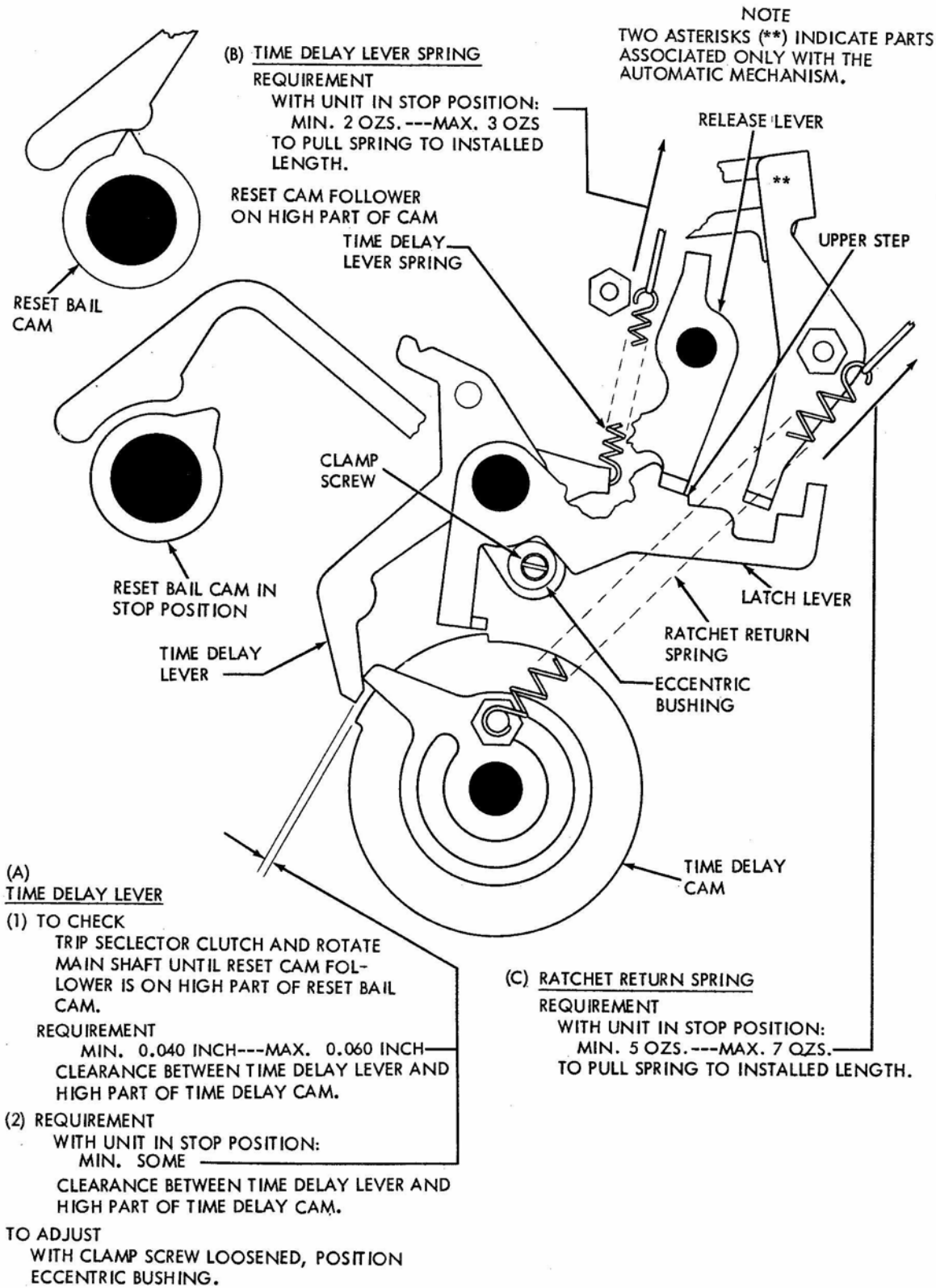


Figure 5-59. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

**(A) RELEASE ARM****TO CHECK**

PLACE UNIT IN FEED OUT CYCLE BY POSITIONING RELEASE LEVER ON LOWER STEP OF LATCH LEVER. ADVANCE RATCHETS BEYOND TIME DELAY (HIGH PART OF TIME DELAY CAM BEYOND TIME DELAY LEVER). POSITION FEED OUT CAM AS SHOWN.

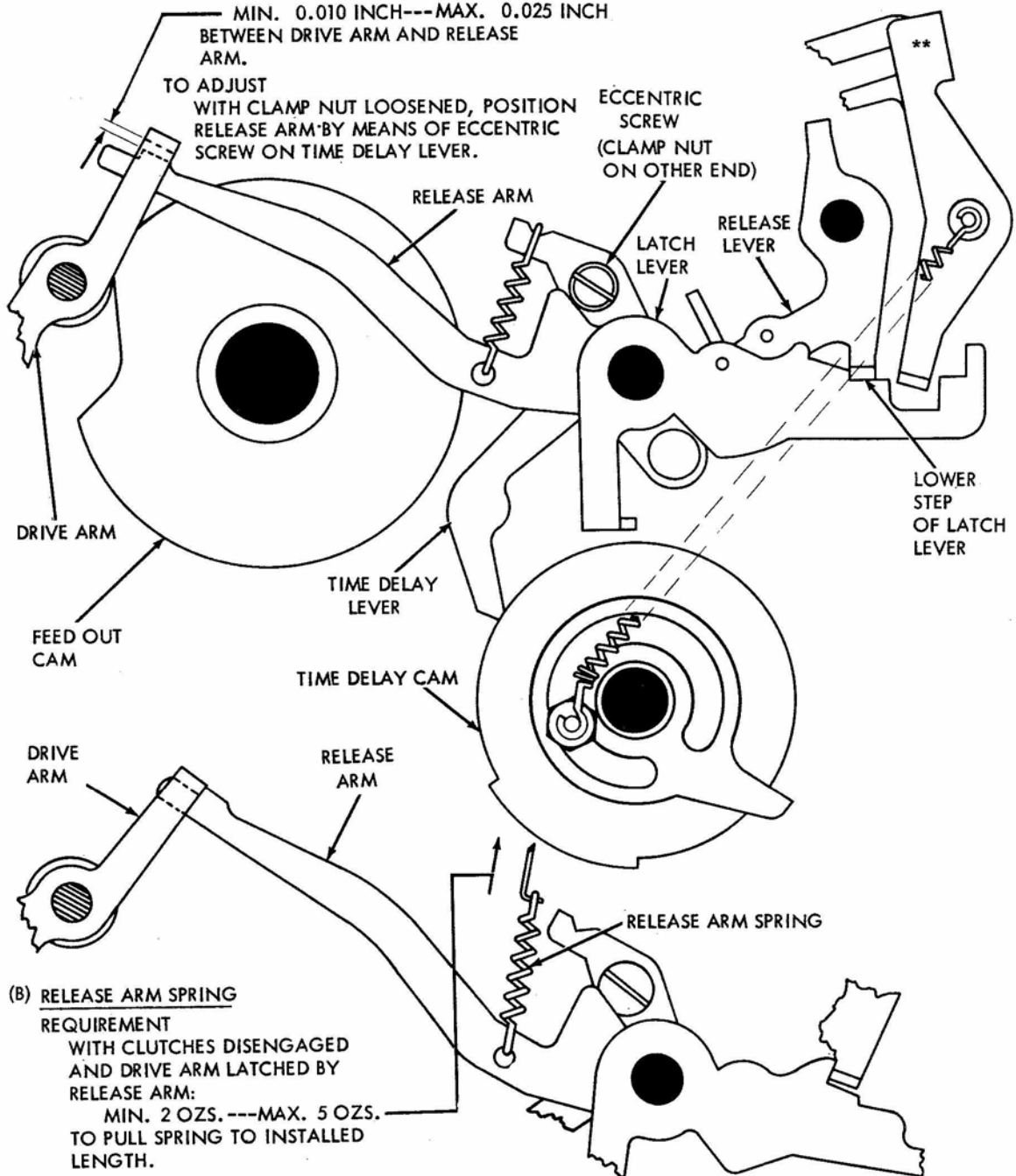
**NOTE**  
TWO ASTERISKS (\*\*) INDICATE PARTS ASSOCIATED ONLY WITH THE AUTOMATIC MECHANISM.

**REQUIREMENT**

MIN. 0.010 INCH---MAX. 0.025 INCH BETWEEN DRIVE ARM AND RELEASE ARM.

**TO ADJUST**

WITH CLAMP NUT LOOSENED, POSITION RELEASE ARM BY MEANS OF ECCENTRIC SCREW (CLAMP NUT ON OTHER END)

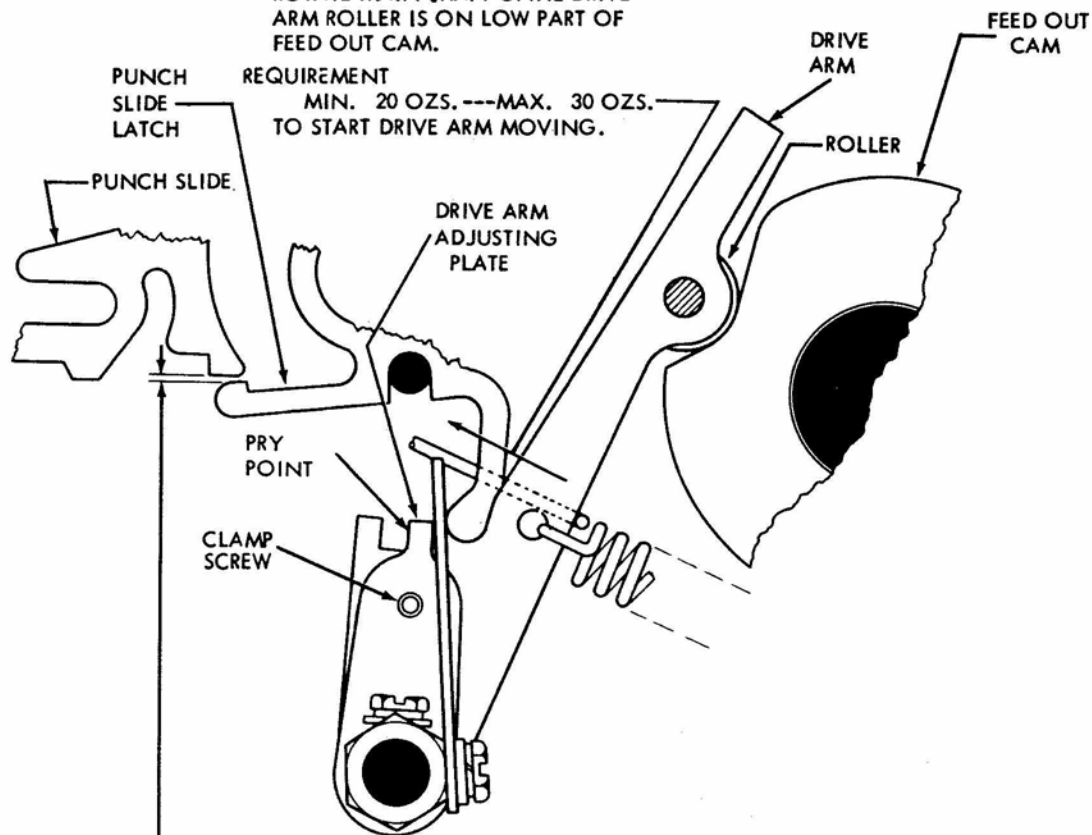


**Figure 5-60. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism**

**(A) DRIVE ARM SPRING**

PLACE UNIT IN FEED OUT CYCLE BY POSITIONING RELEASE LEVER ON LOWER STEP OF LATCH LEVER AND ADVANCING HIGH PART OF TIME DELAY CAM BEYOND TIME DELAY LEVER.

ROTATE MAIN SHAFT UNTIL DRIVE ARM ROLLER IS ON LOW PART OF FEED OUT CAM.

**(B) DRIVE ARM ADJUSTING PLATE**

TO CHECK

SET UP BLANK CODE COMBINATION (-----) IN SELECTOR. PLACE UNIT IN FEED OUT CYCLE BY POSITIONING RELEASE LEVER ON LOWER STEP OF LATCH LEVER AND ADVANCING HIGH PART OF TIME DELAY CAM BEYOND TIME DELAY LEVER. ROTATE MAIN SHAFT UNTIL DRIVE ARM ROLLER IS ON LOW PART OF FEED OUT CAM. MAKE SURE THAT RESET BAIL IS IN LOWER POSITION.

REQUIREMENT

MIN. 0.010 INCH---MAX. 0.030 INCH BETWEEN PUNCH SLIDE AND PUNCH SLIDE LATCH AT SLIDE WHERE CLEARANCE IS LEAST.

TO ADJUST

WITH CLAMP SCREW LOOSENED, POSITION DRIVE ARM ADJUSTING PLATE BY MEANS OF PRY POINT.

Figure 5-61. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

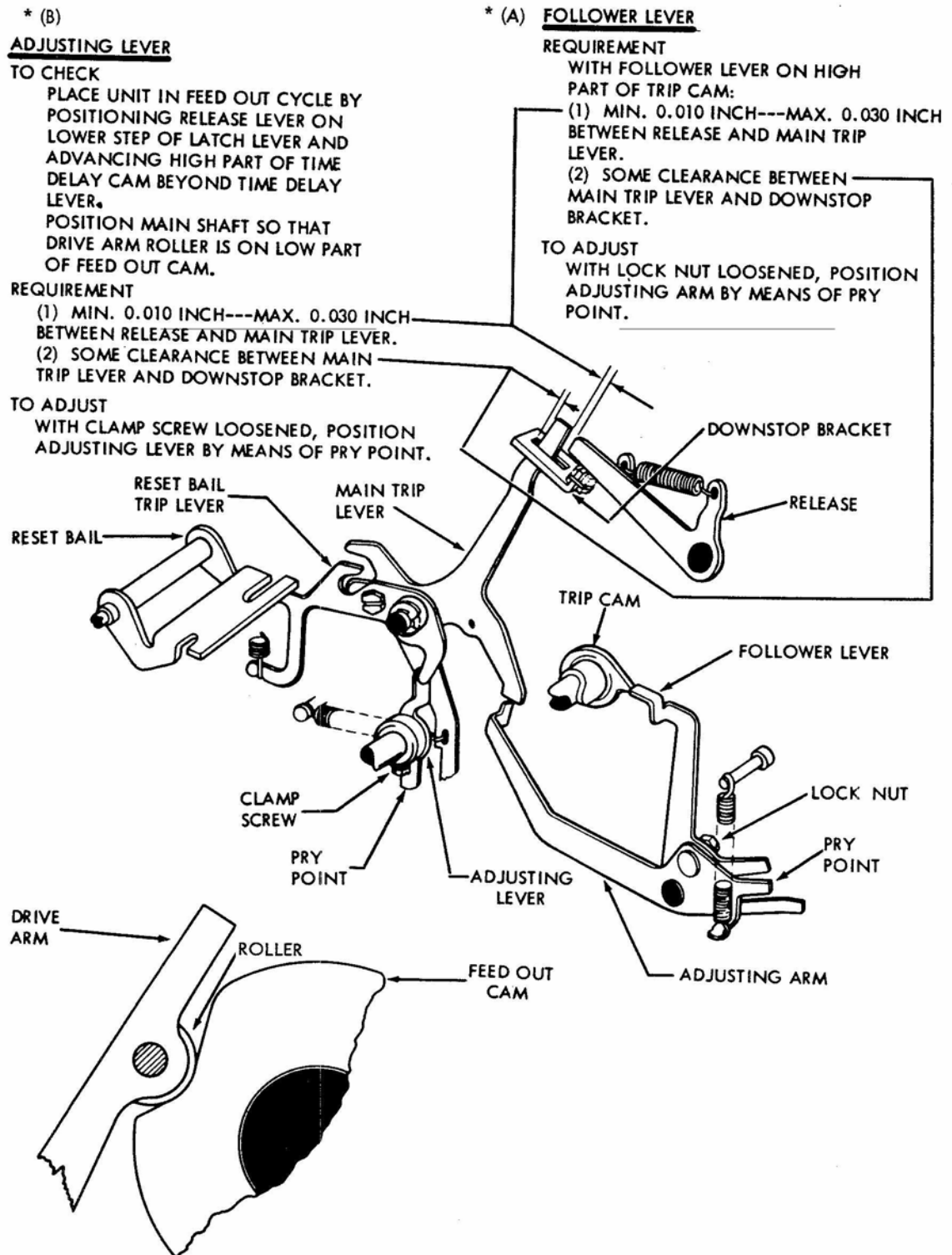


Figure 5-62. Typing Reperforator, Remote Control Non-Interference Letters Tape Feed-Out Mechanism

**\*\* (B)**  
**ADJUSTING LEVER**

**TO CHECK**

PLACE UNIT IN FEED OUT CYCLE BY POSITIONING RELEASE LEVER ON LOWER STEP OF LATCH LEVER AND ADVANCING HIGH PART OF TIME DELAY CAM BEYOND TIME DELAY LEVER.  
POSITION MAIN SHAFT SO THAT DRIVE ARM ROLLER IS ON LOW PART OF FEED OUT CAM.

**REQUIREMENT**

- (1) MIN. 0.010 INCH---MAX. 0.030 INCH BETWEEN RELEASE AND MAIN TRIP LEVER.
- (2) SOME CLEARANCE BETWEEN MAIN TRIP LEVER AND DOWNSTOP BRACKET.

**TO ADJUST**

WITH CLAMP SCREW LOOSENED, POSITION ADJUSTING LEVER MAKING SURE IT RIDES FULLY ON SLIDE TRIP LEVER.

**\*\* (A) FOLLOWER LEVER**

**REQUIREMENT**

WITH FOLLOWER LEVER ON HIGH PART OF TRIP CAM:

- (1) MIN. 0.010 INCH---MAX. 0.030 INCH BETWEEN RELEASE AND MAIN TRIP LEVER.
- (2) SOME CLEARANCE BETWEEN MAIN TRIP LEVER AND DOWNSTOP BRACKET.

**TO ADJUST**

WITH LOCK NUT LOOSENED, POSITION ADJUSTING ARM BY MEANS OF PRY POINT.

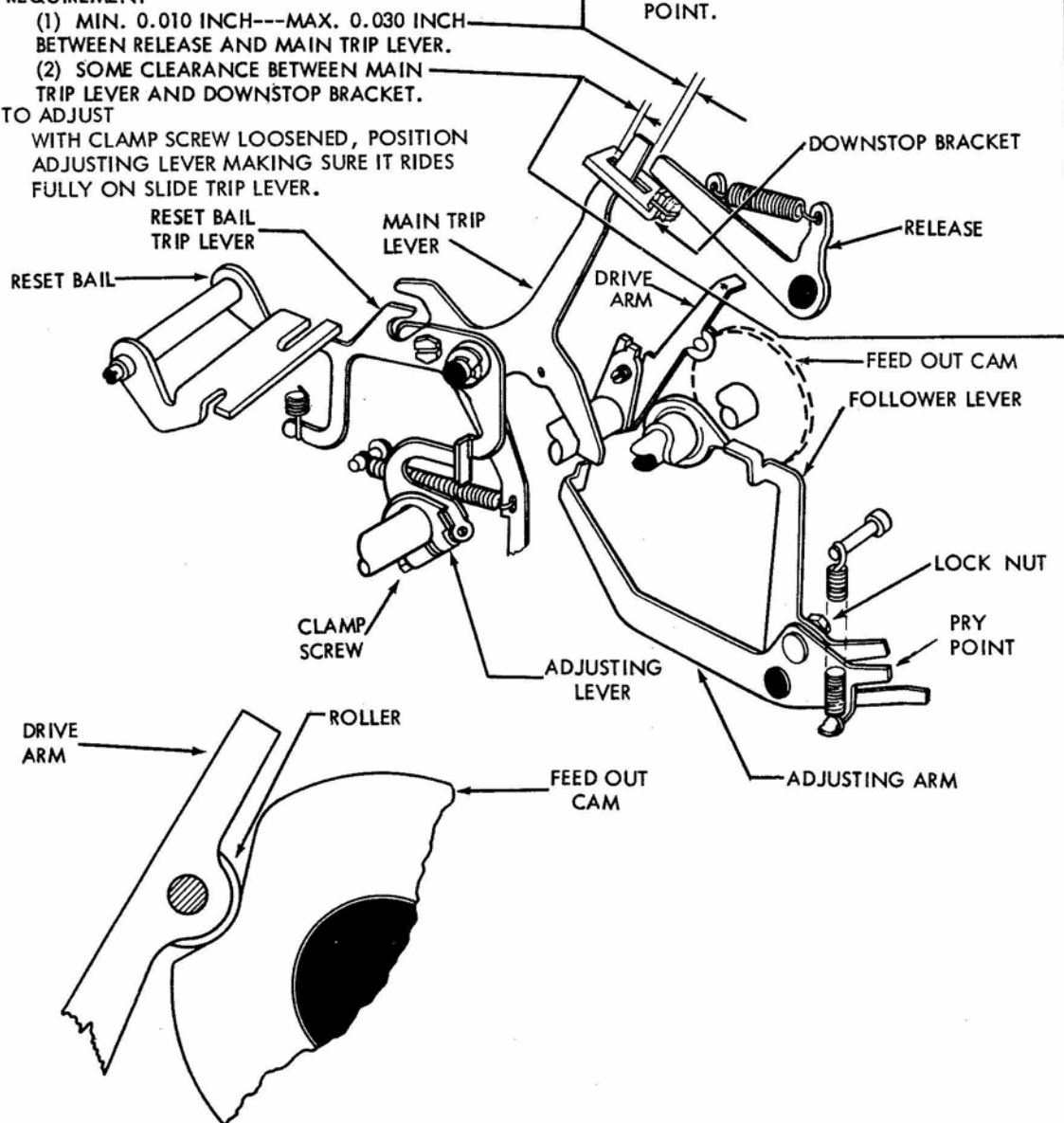
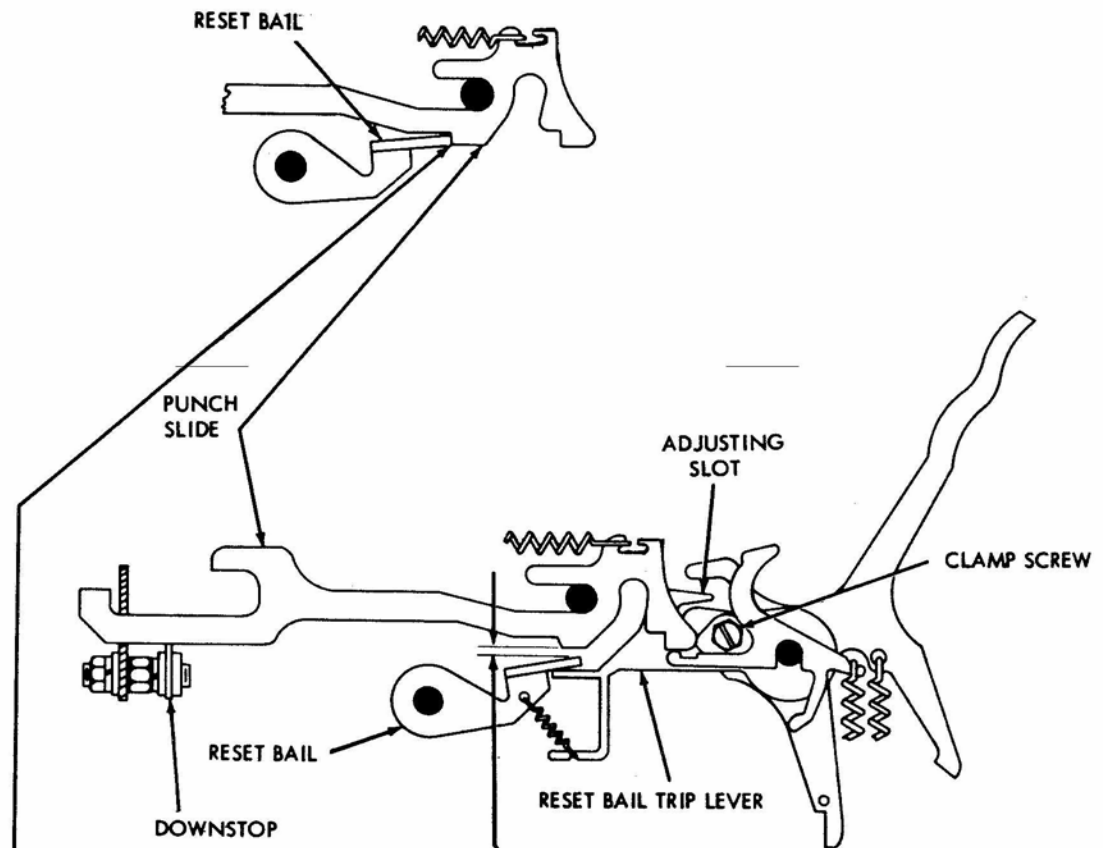


Figure 5-63. Typing Reperforator, Automatic Non-Interfering Letters Tape Feed-Out Mechanism





**RESET BAIL TRIP LEVER**

- (1) TO CHECK  
 SELECT LETTERS CODE COMBINATION  
 (12345). ROTATE MAIN SHAFT UNTIL  
 FUNCTION CLUTCH TRIPS. POSITION  
 PUNCH SLIDES AGAINST DOWNSTOP.

**REQUIREMENT**

MIN. 0.008 INCH --- MAX. 0.020 INCH  
 BETWEEN PUNCH SLIDE AND RESET BAIL.

- (2) REQUIREMENT  
 WITH CLUTCHES FULLY DISENGAGED  
 RESET BAIL SHOULD  
 FULLY ENGAGE NOTCHES IN PUNCH SLIDES.

**TO ADJUST**

WITH CLAMP SCREW LOOSENED, POSITION  
 RESET BAIL TRIP LEVER BY MEANS OF ADJUST-  
 ING SLOT.

Figure 5-64. Typing Reperforator, Remote Control Or Automatic  
 Non-Interfering Letters Tape Feed-Out Mechanism

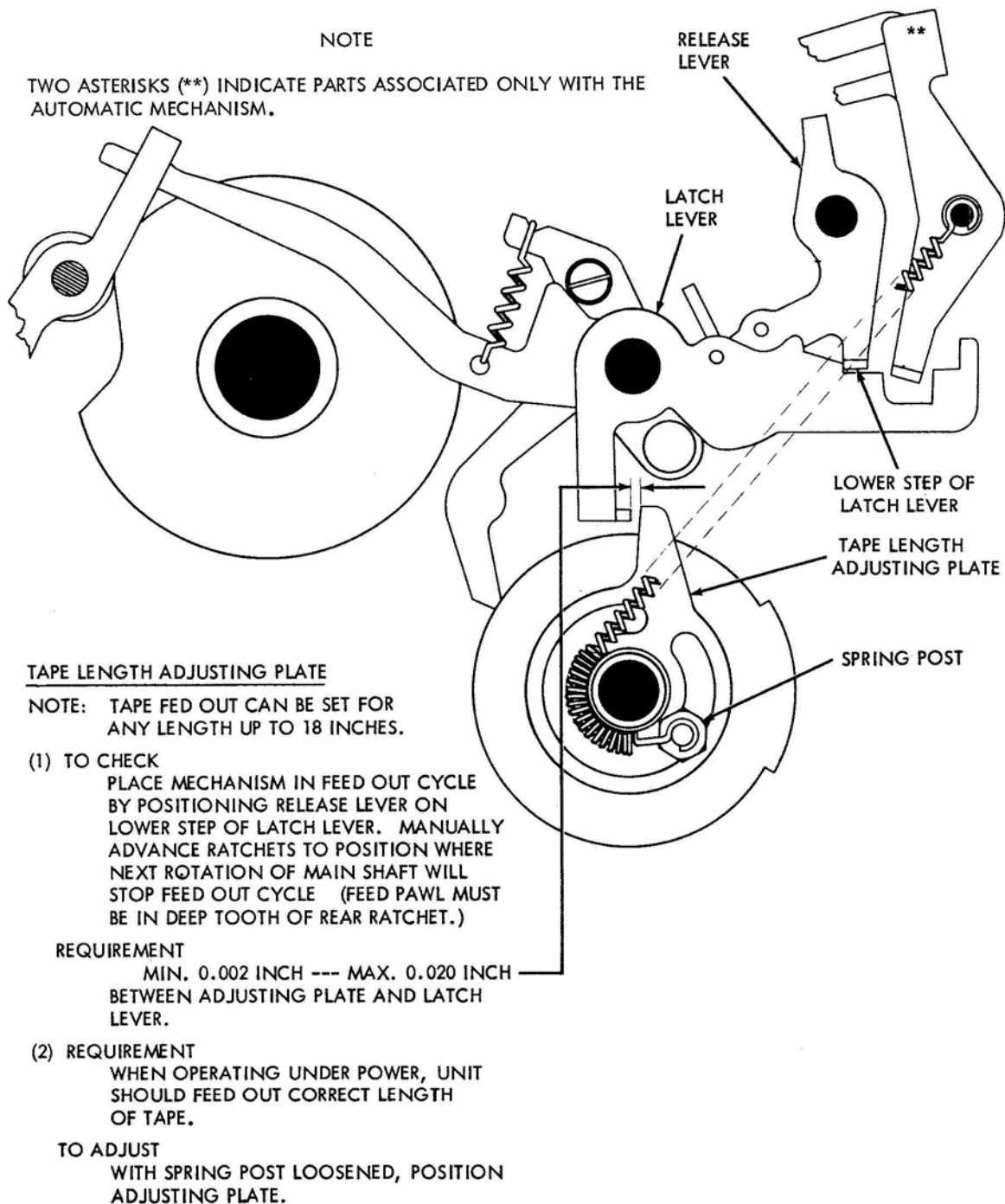


Figure 5-65. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

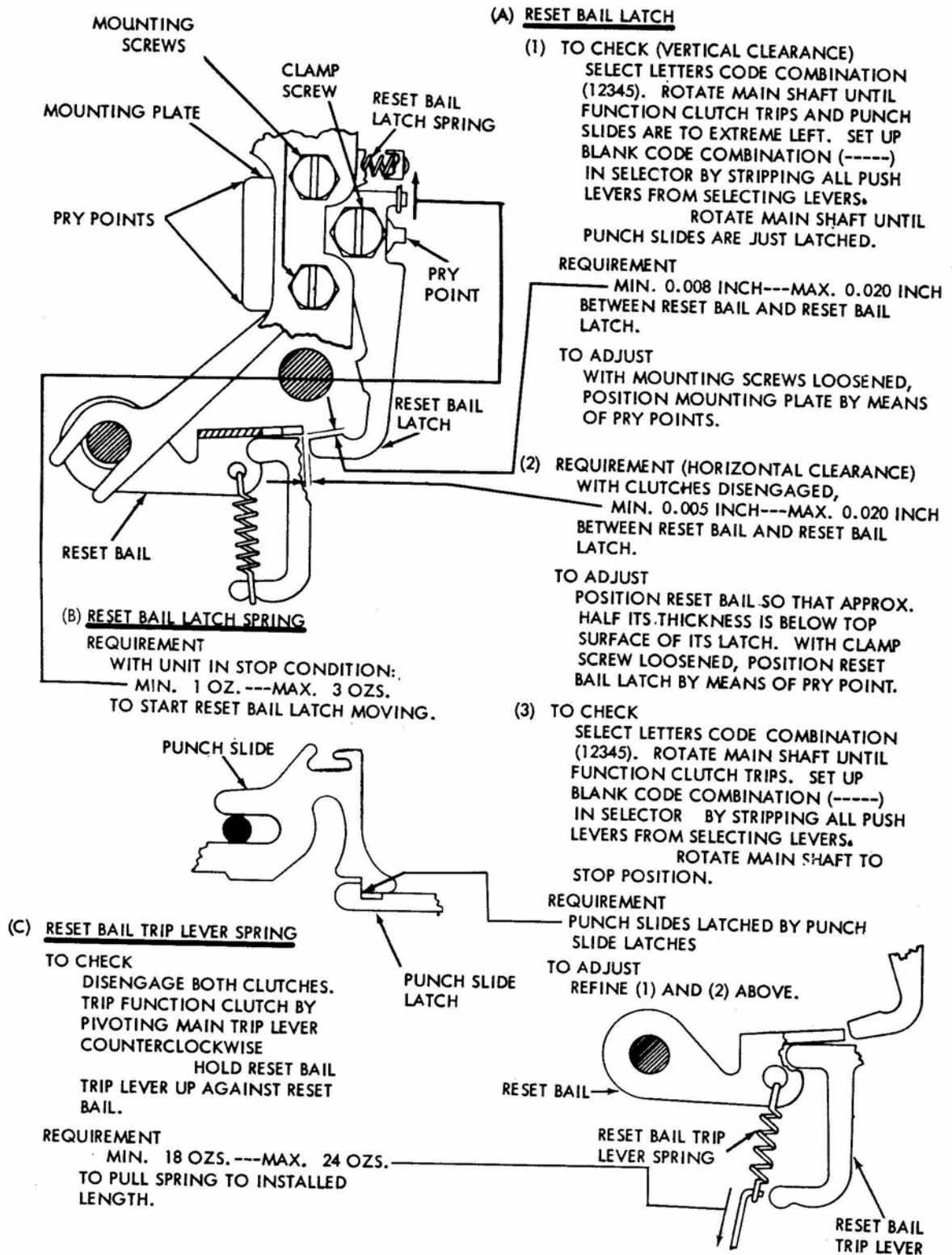


Figure 5-66. Typing Reperforator, Remote Control Or Automatic Non-Interfering Letters Tape Feed-Out Mechanism

e. MULTIPLE REPERFORATOR BASE

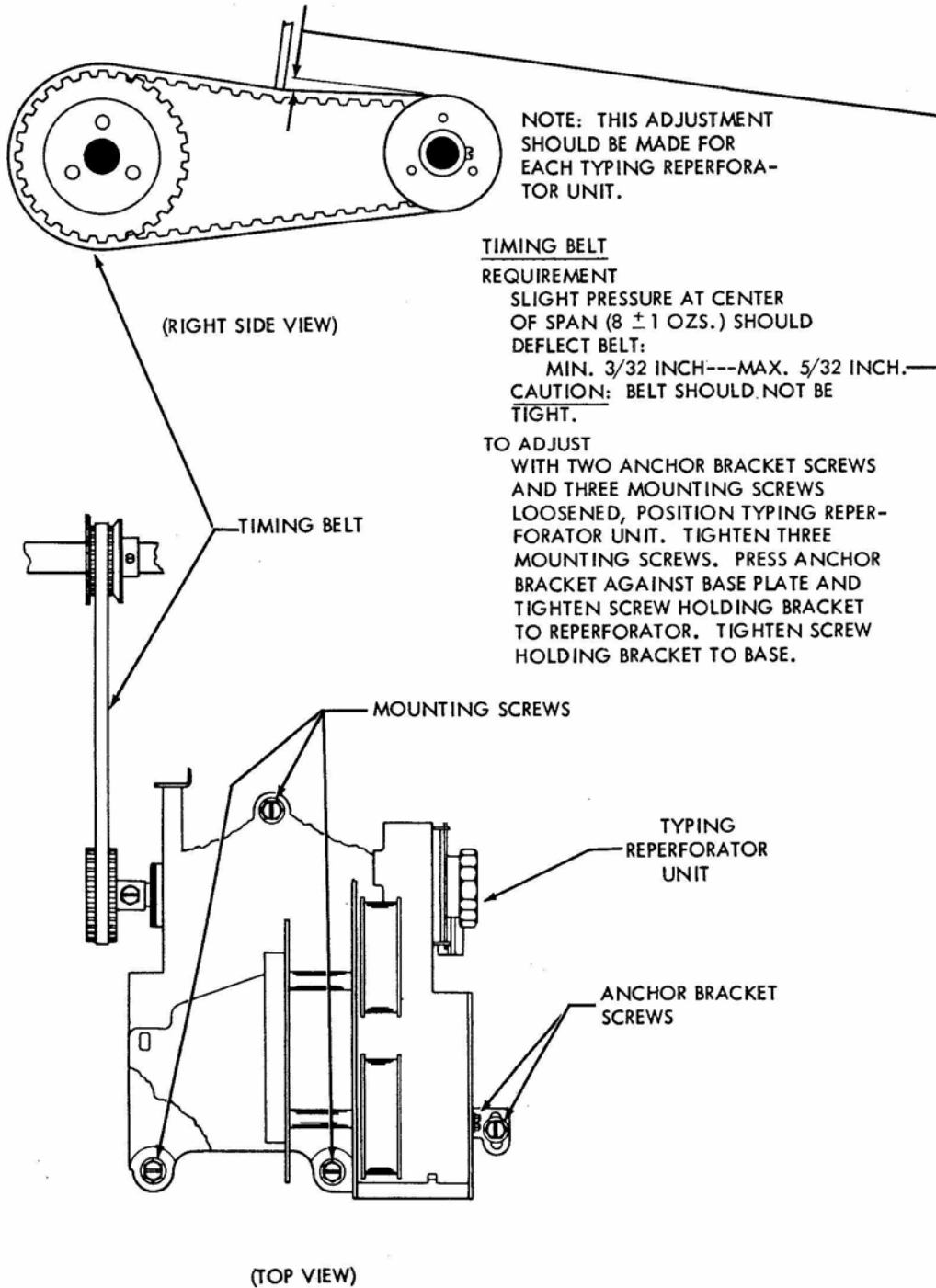


Figure 5-67. Multiple Reperforator Base, Drive Mechanism

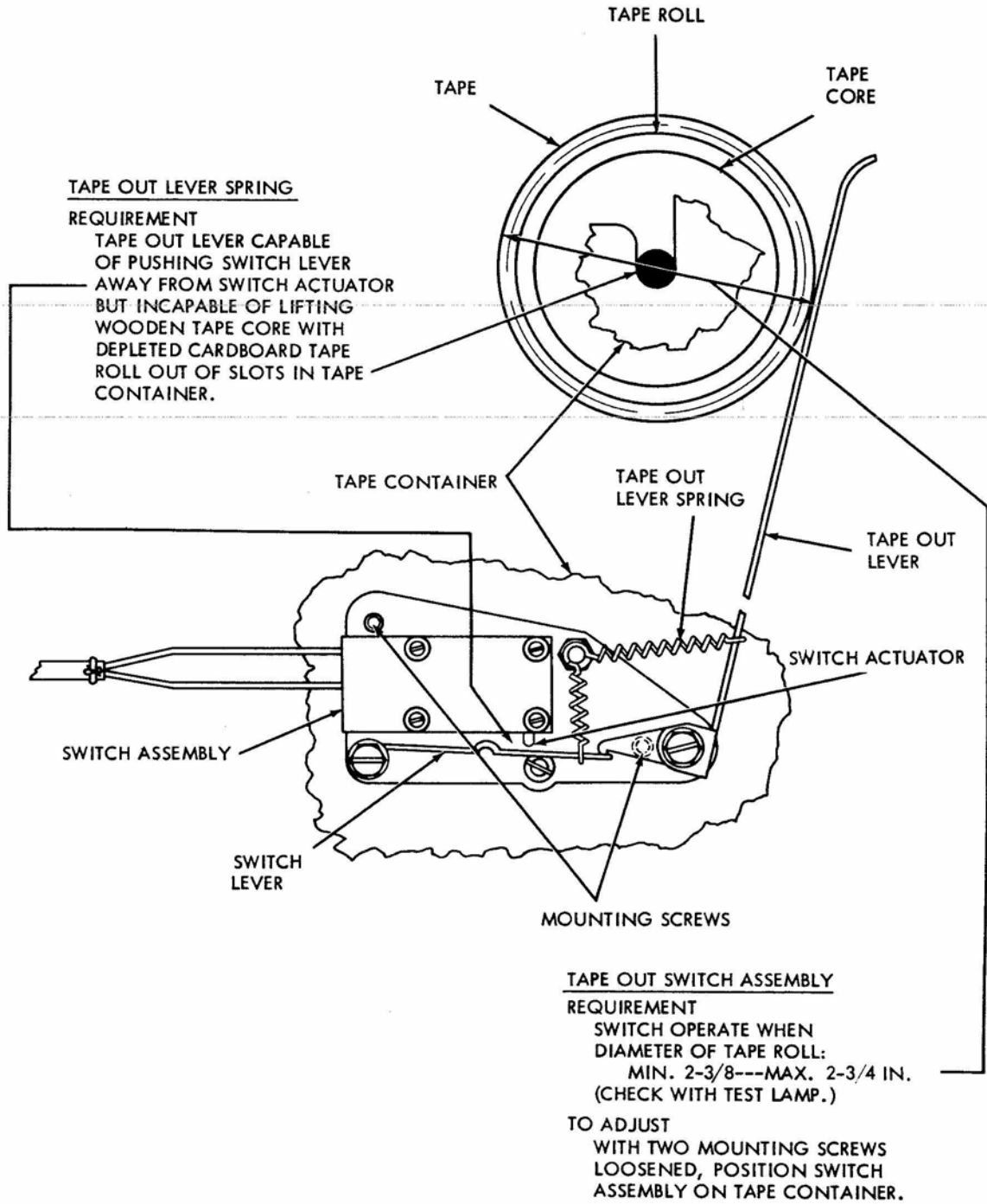


Figure 5-68. Multiple Reperforator Base, Low Tape Switch

(A)  
MOTOR ADJUSTING STUD

REQUIREMENT  
BARELY PERCEPTIBLE BACKLASH  
BETWEEN DRIVE GEAR AND  
DRIVEN GEAR AT POINT WHERE  
BACKLASH IS LEAST.

TO ADJUST  
WITH LOCK NUT LOOSENED,  
POSITION ADJUSTING STUD.  
TIGHTEN NUT WHILE HOLDING  
STUD IN POSITION.

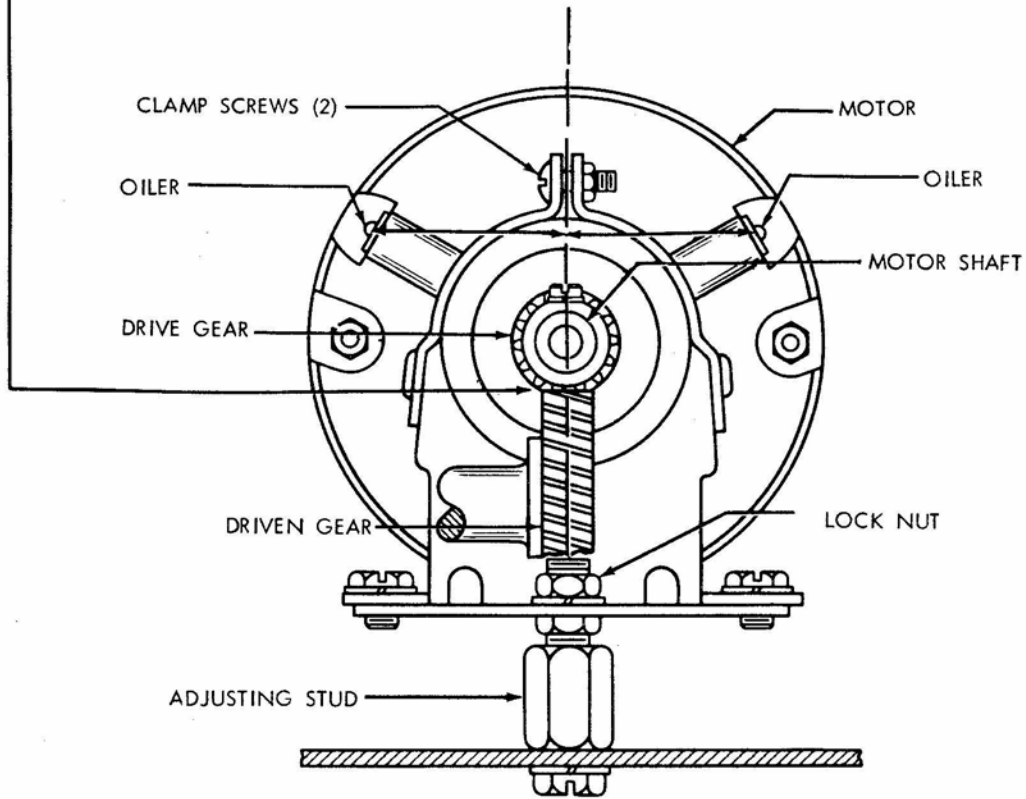


Figure 5-69. Multiple Reperforator Base, Motor Unit Adjusting Stud

f. SYNCHRONOUS AND GOVERNED MOTORS.

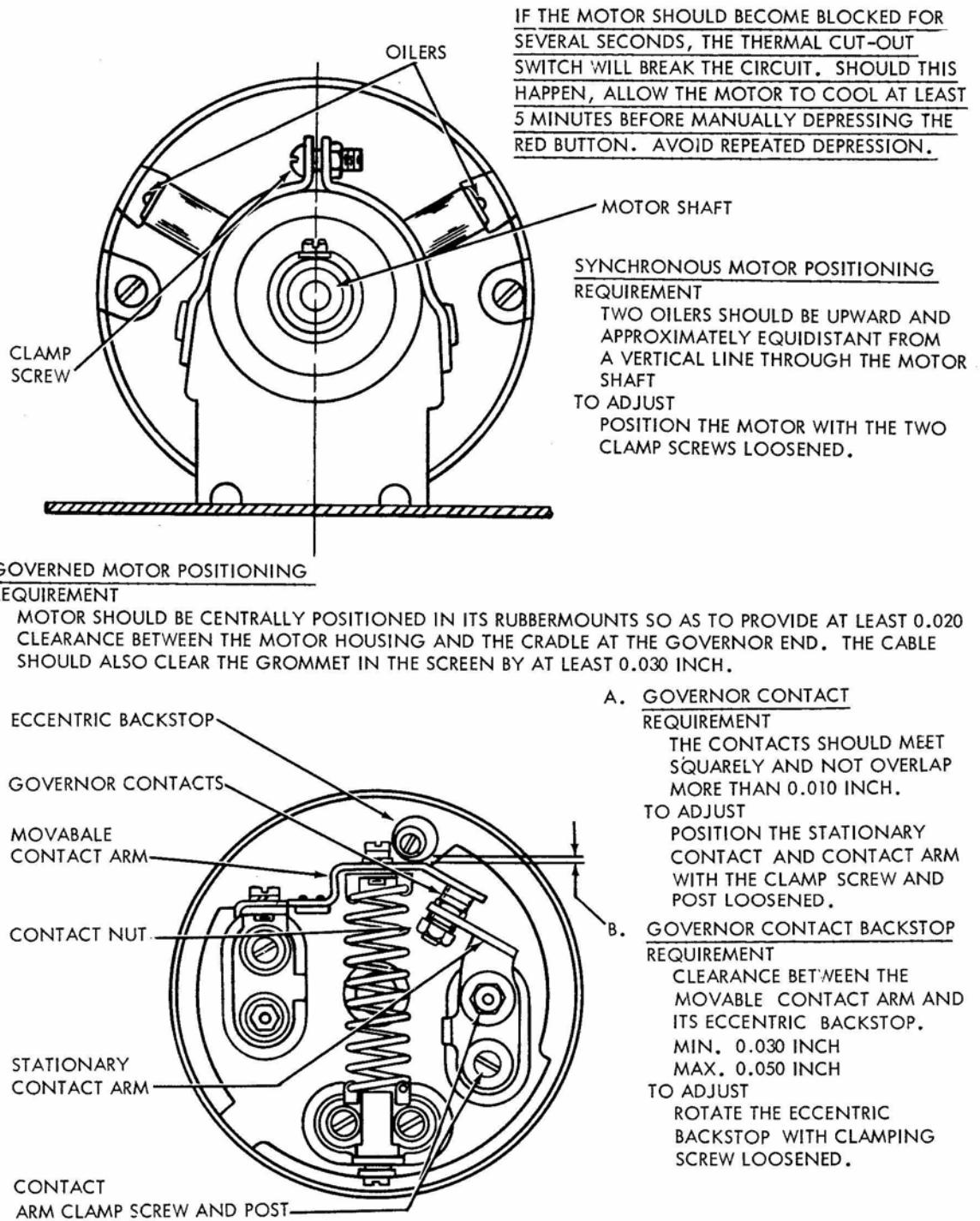
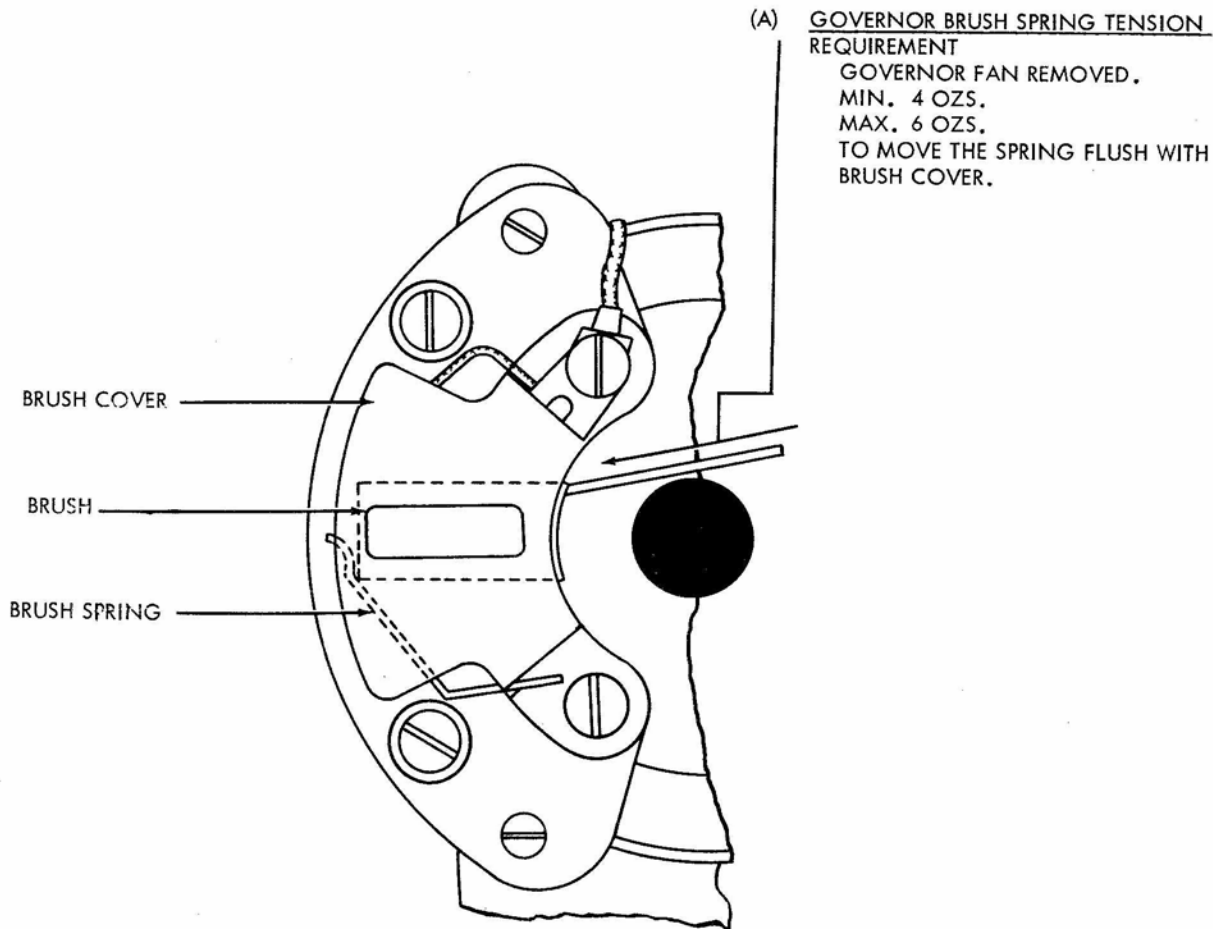


Figure 5-70. Synchronous and Governed Motors Positioning



(B) GOVERNED MOTOR SPEED ADJUSTMENT  
REQUIREMENT ---

WITH THE TARGET ILLUMINATED AND VIEWED THROUGH THE VIBRATING SHUTTERS OF A 120 VPS TUNING FORK, THE SPOTS SHOULD APPEAR STATIONARY WHILE THE MOTOR IS ROTATING.

TO ADJUST ---

STOP THE MOTOR AND TURN THE ADJUSTING SCREW AS INDICATED ON THE GOVERNOR COVER.

NOTE

IT IS POSSIBLE TO ADJUST THE MOTOR AT SOME MULTIPLE OF THE CORRECT SPEED. TO CHECK FOR CORRECT SPEED WITH A MONITOR PRINTER, HAVE THE TYPE BOX CARRIAGE AT THE LEFT MARGIN, INSERT A PERFORATED TAPE IN THE TRANSMITTER DISTRIBUTOR TO OPERATE THE PRINTER. IF THE UNIT IS EQUIPPED WITH GEARS FOR 60 SPEED OPERATION, IT SHOULD PRINT 70 CHARACTERS IN 10 SECONDS: WITH 75 SPEED GEARS - 44 CHARACTERS IN 5 SECONDS: WITH 100 SPEED GEARS - 57 CHARACTERS IN 5 SECONDS.

Figure 5-71. Governed Motor Speed and Brush Spring Tension



9. TRANSMITTER DISTRIBUTOR (LBXD)

INSTRUCTION FOR:

- (A) REMOVING COVER PLATE --- LIFT LEFT END OF COVER PLATE (WHEN VIEWED FROM FRONT OF INDIVIDUAL TRANSMITTER DISTRIBUTOR UNIT) TO DISENGAGE DETENTS. THEN SLIDE PLATE TOWARD THE LEFT TO DISENGAGE SPRING PLATE
- (B) REMOVING TRANSMITTER DISTRIBUTOR ASSEMBLY --- WITH HINGED FRONT PANEL OF COVER OPEN, REMOVE COVER PLATE AND CLAMP SCREW. THEN LIFT UPWARD AND PULL FORWARD TO DISENGAGE THE UNIT.
- (C) REMOVING TAPE DEFLECTOR - LOOSEN TWO SCREWS WHICH SECURE DEFLECTOR TO COVER AND FILLER PLATES. REMOVE DEFLECTOR.
- (D) REMOVING FILLER PLATE - REMOVE TWO NUTS WHICH SECURE FILLER PLATE TO ITS SUPPORT BRACKETS.
- (E) REMOVING TOP PLATE --- WITH FRONT AND REAR MOUNTING SCREWS LOOSENED, LIFT PLATE UPWARD. REFER TO FIGURE 5-86 WHEN REPLACING THE PLATE.
- (F) REMOVING TAPE GUIDE PLATE --- WITH FRONT AND REAR MOUNTING SCREWS LOOSENED, LIFT PLATE UPWARD. REFER TO FIGURE 5-85 WHEN REPLACING THE PLATE.
- (G) REMOVING TRANSMITTER DISTRIBUTOR FROM CRADLE --- REMOVE CONNECTOR FROM CRADLE BY REMOVING (2) MOUNTING SCREWS. (WHEN REPLACING SCREWS MAKE SURE THAT THE HEAD OF EACH SCREW IS ON THE OUTSIDE OF THE CRADLE). THEN REMOVE THE (3) MOUNTING SCREWS WHICH SECURE THE CASTING TO THE CRADLE. LIFT CASTING OFF OF CRADLE.

TOP VIEW OF MULTIPLE MOUNTING TRANSMITTER DISTRIBUTOR

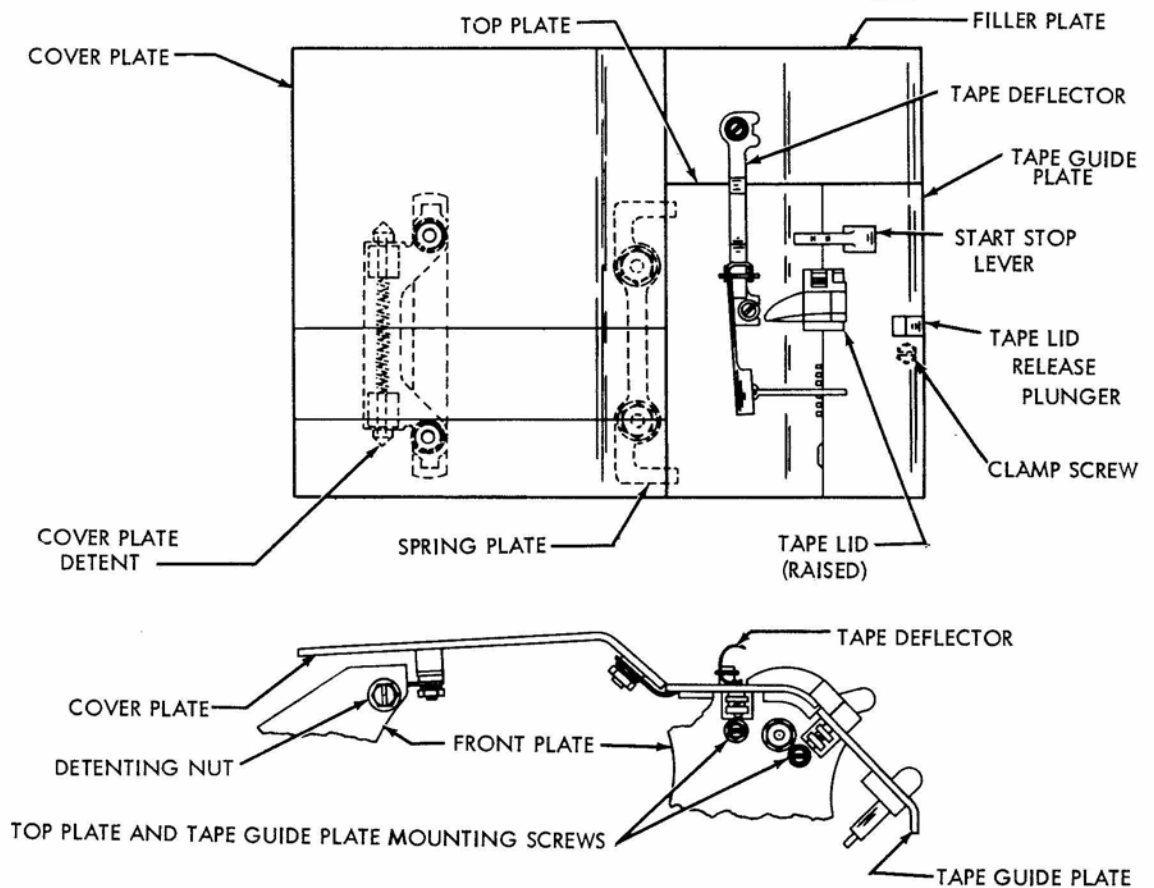
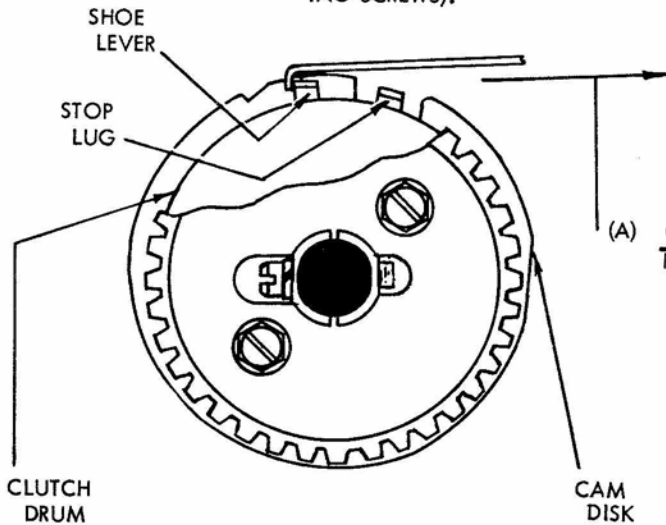


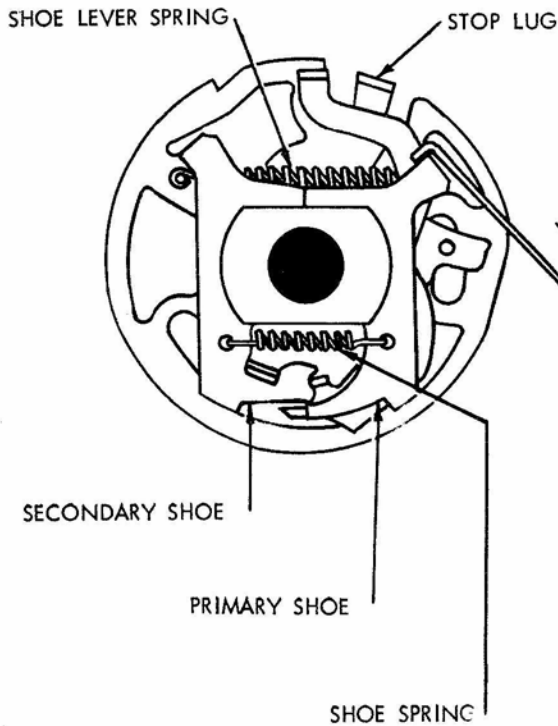
Figure 5-72. Transmitter Distributor, Removal of Transmitter Distributor From Base

NOTE----REQUIREMENTS "A & B" ARE ADJUSTED AT THE FACTORY AND SHOULD NOT BE DISTURBED UNLESS ASSOCIATED MECHANISMS HAVE BEEN REMOVED FOR SERVICING OR THERE IS REASON TO BELIEVE THAT THE REQUIREMENTS ARE NOT MET. THE FOLLOWING REQUIREMENTS APPLY TO BOTH THE SENSING CLUTCH AND THE DISTRIBUTOR CLUTCH.

REMOVE DEFLECTOR TO PROVIDE ACCESSIBILITY TO GEARS ETC. (TWO MOUNTING SCREWS).



(A) CLUTCH SHOE LEVER SPRING  
 REQUIREMENT----WITH CLUTCH ENGAGED, HOLD CAM DISK TO PREVENT TURNING. SPRING SCALE PULLED AT TANGENT TO CLUTCH MIN. 15 OZS. — MAX. 20 OZS. TO MOVE SHOE(RELEASE)LEVER IN CONTACT WITH STOP LUG.



NOTE--- IT IS NECESSARY TO REMOVE THE CLUTCH FROM THE MAIN SHAFT TO FACILITATE THIS CHECK

(B) CLUTCH SHOE SPRING  
 REQUIREMENT----WITH CLUTCH DRUM REMOVED, HOOK SPRING SCALE TO PRIMARY SHOE AT A TANGENT TO THE FRICTION SURFACE. MIN. 3 OZS. — MAX. 5 OZS. TO START PRIMARY SHOE MOVING AWAY FROM SECONDARY SHOE AT POINT OF CONTACT.

Figure 5-73. Transmitter Distributor, Clutch Mechanism

**NOTE 1**---THE FOLLOWING REQUIREMENTS APPLY TO BOTH THE DISTRIBUTOR AND SENSING CAM SLEEVES. THESE MECHANISMS SHOULD NOT BE DISTURBED UNLESS THERE IS REASON TO BELIEVE REQUIREMENTS ARE NOT MET.

**NOTE 2** --- ADJUSTMENT (A) IS TO BE MADE PRIOR TO ASSEMBLING GEAR.

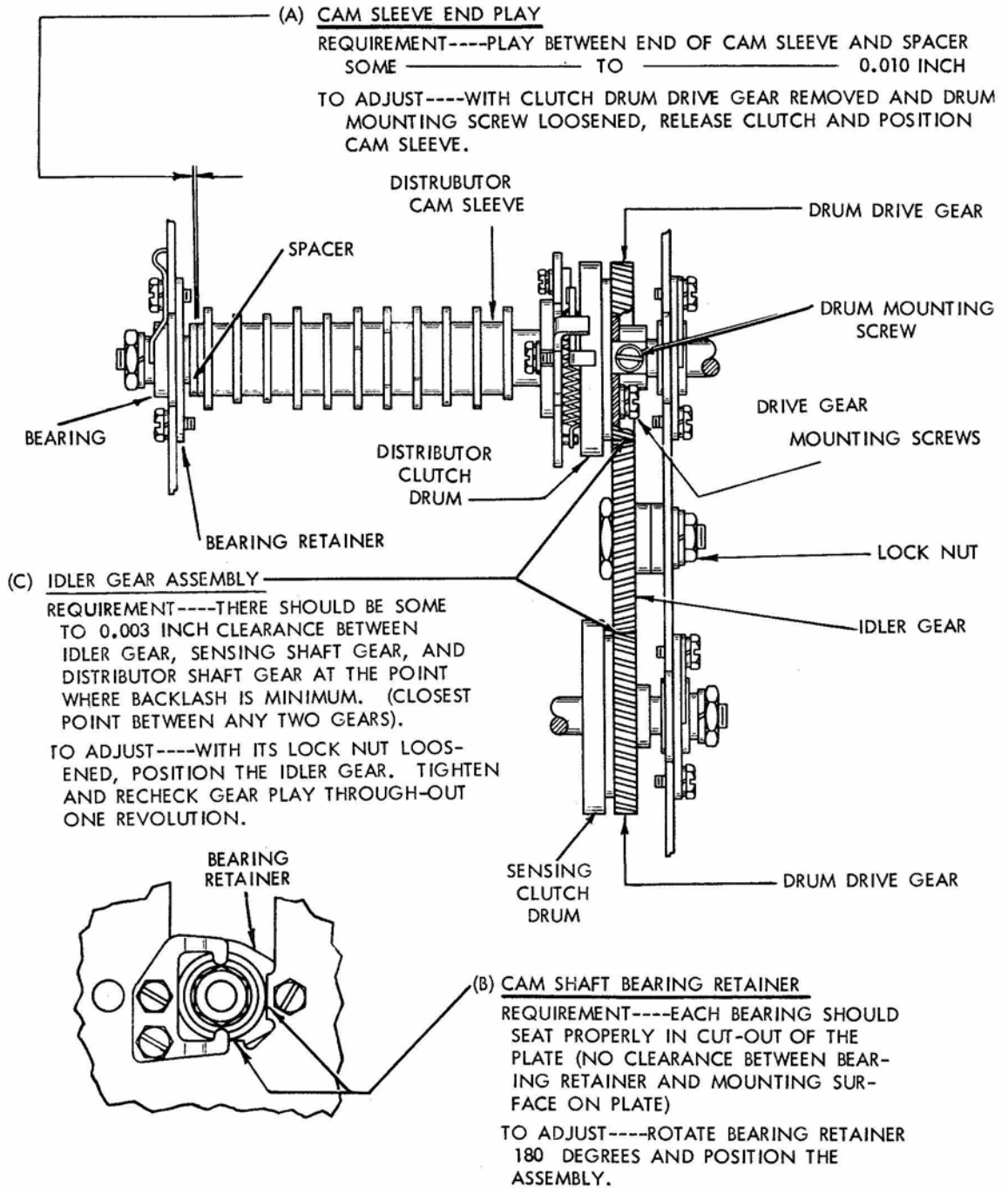
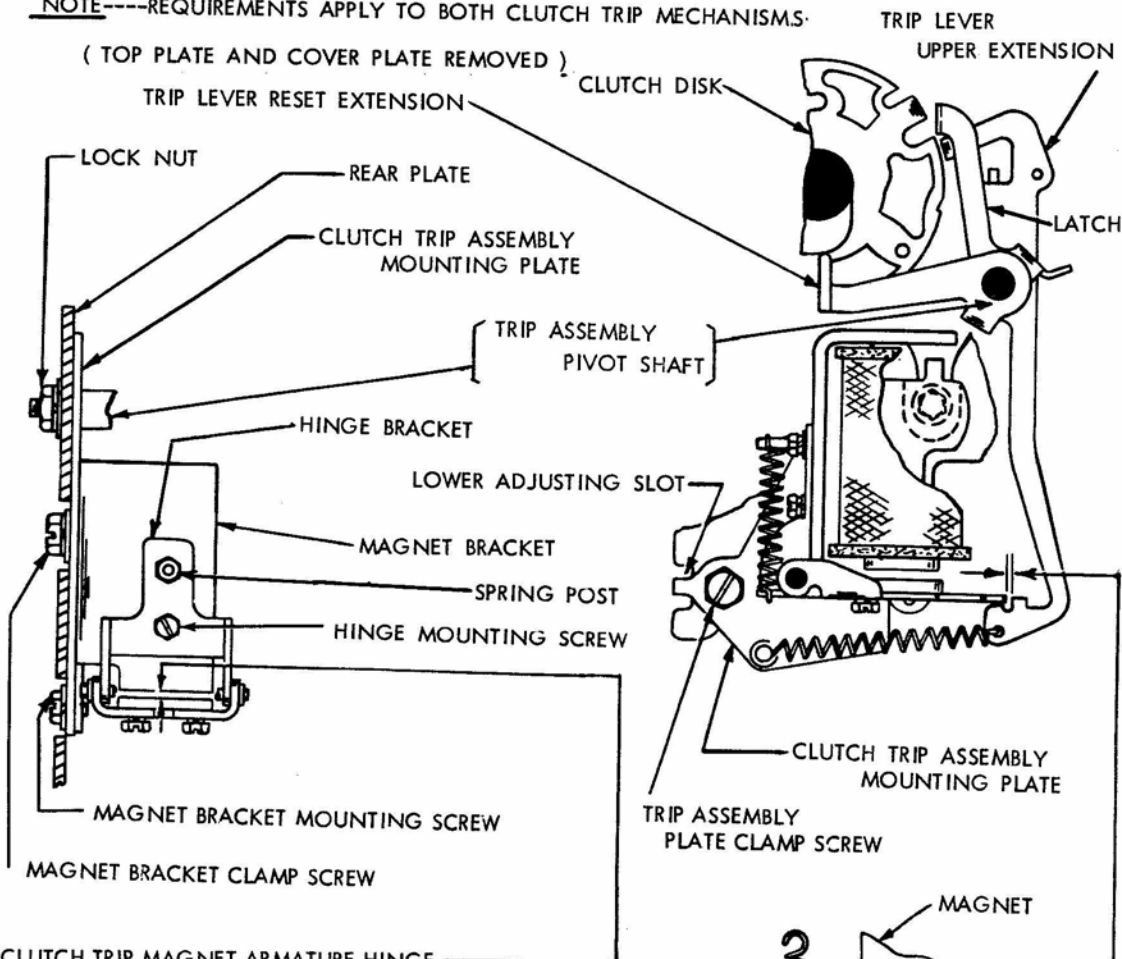


Figure 5-74. Transmitter Distributor, Cam Shafts

**NOTE**---REQUIREMENTS APPLY TO BOTH CLUTCH TRIP MECHANISMS.

( TOP PLATE AND COVER PLATE REMOVED )



**(A) CLUTCH TRIP MAGNET ARMATURE HINGE**

REQUIREMENT --- WITH ARMATURE HELD AGAINST ITS CORE, CLEARANCE BETWEEN ARMATURE AND MAGNET BRACKET  
 MIN. 0.004 INCH ——— MAX. 0.008 INCH  
 TO ADJUST --- REMOVE ARMATURE EXTENSION SPRING. WITH ARMATURE HINGE MOUNTING SCREW AND SPRING POST CLAMP SCREW LOOSENED, POSITION THE HINGE.

**(C) ARMATURE BAIL SPRING**

REQUIREMENT --- WITH UNIT INVERTED, TRIP CLUTCH MAGNET AND ROTATE SHAFT MANUALLY UNTIL TRIP LEVER RESET EXTENSION IS ON HIGH PART OF ITS CAM. (#160455 SPRING).  
 MIN. 3 OZS. ——— MAX. 4-1/2 OZS TO START ARMATURE BAIL MOVING.

**(B) TRIP ASSEMBLY MOUNTING PLATES**

REQUIREMENT---WITH TRIP LEVER RESET EXTENSION ON HIGH PART OF CAM, CLEARANCE BETWEEN LATCHING SURFACE OF TRIP LEVER LOWER EXTENSION AND END OF ARMATURE BAIL. (PLAY TAKEN UP BY SPRING).  
 MIN. 0.020 INCH ——— MAX. 0.030 INCH  
 TO ADJUST---WITH (TRIP ASSEM.) MOUNTING PLATE LOCK NUT AND PLATE CLAMP SCREW FRICTION TIGHT, POSITION PLATE WITH SCREW DRIVER IN LOWER ADJUSTING SLOT.

Figure 5-75. Transmitter Distributor, Clutch Trip Mechanism

NOTE---REFER TO REQUIREMENTS ON PRECEDING PAGE. (TAPE GUIDE PLATE REMOVED)

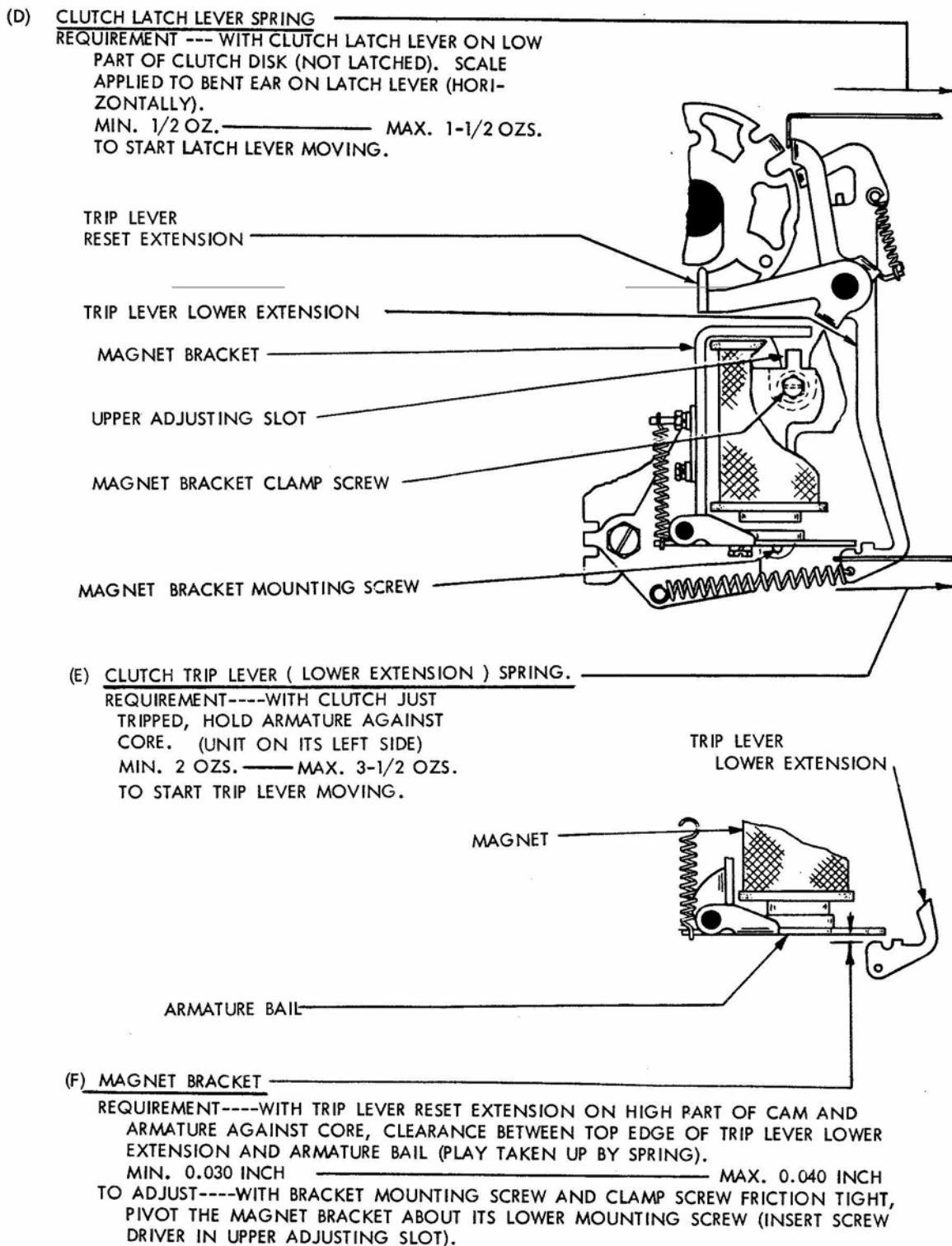
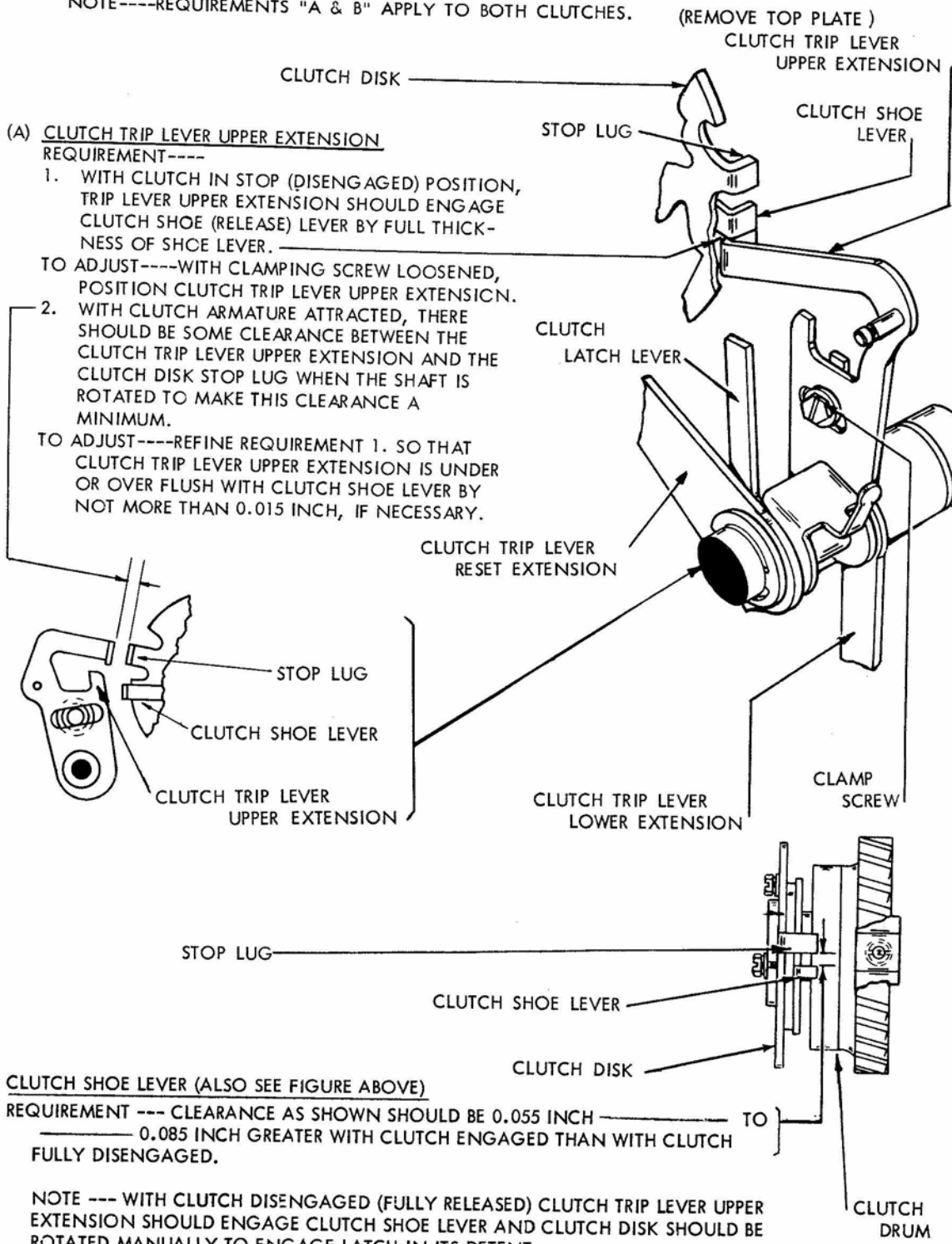


Figure 5-76. Transmitter Distributor, Clutch Trip Mechanism

NOTE----REQUIREMENTS "A & B" APPLY TO BOTH CLUTCHES.



- (A) CLUTCH TRIP LEVER UPPER EXTENSION REQUIREMENT----
1. WITH CLUTCH IN STOP (DISENGAGED) POSITION, TRIP LEVER UPPER EXTENSION SHOULD ENGAGE CLUTCH SHOE (RELEASE) LEVER BY FULL THICKNESS OF SHOE LEVER.
  2. TO ADJUST----WITH CLAMPING SCREW LOOSENED, POSITION CLUTCH TRIP LEVER UPPER EXTENSION. WITH CLUTCH ARMATURE ATTRACTED, THERE SHOULD BE SOME CLEARANCE BETWEEN THE CLUTCH TRIP LEVER UPPER EXTENSION AND THE CLUTCH DISK STOP LUG WHEN THE SHAFT IS ROTATED TO MAKE THIS CLEARANCE A MINIMUM.
- TO ADJUST----REFINE REQUIREMENT 1. SO THAT CLUTCH TRIP LEVER UPPER EXTENSION IS UNDER OR OVER FLUSH WITH CLUTCH SHOE LEVER BY NOT MORE THAN 0.015 INCH, IF NECESSARY.

- (B) CLUTCH SHOE LEVER (ALSO SEE FIGURE ABOVE) REQUIREMENT --- CLEARANCE AS SHOWN SHOULD BE 0.055 INCH TO 0.085 INCH GREATER WITH CLUTCH ENGAGED THAN WITH CLUTCH FULLY DISENGAGED.

NOTE --- WITH CLUTCH DISENGAGED (FULLY RELEASED) CLUTCH TRIP LEVER UPPER EXTENSION SHOULD ENGAGE CLUTCH SHOE LEVER AND CLUTCH DISK SHOULD BE ROTATED MANUALLY TO ENGAGE LATCH IN ITS DETENT. TO ADJUST --- WITH CLUTCH DISK CLAMPING SCREWS LOOSENED, PLACE WRENCH OVER ADJUSTING LUG AND POSITION ADJUSTING DISK.

CAUTION --- MAKE SURE THAT DRUM DOES NOT DRAG ON SHOES. REMOVE DRUM MOUNTING SCREW, DISENGAGE CLUTCH AND ROTATE DRUM IN ITS NORMAL DIRECTION. IF DRUM DRAGS, REFINE ADJUSTMENT.

Figure 5-77. Transmitter Distributor, Clutch Trip Mechanism

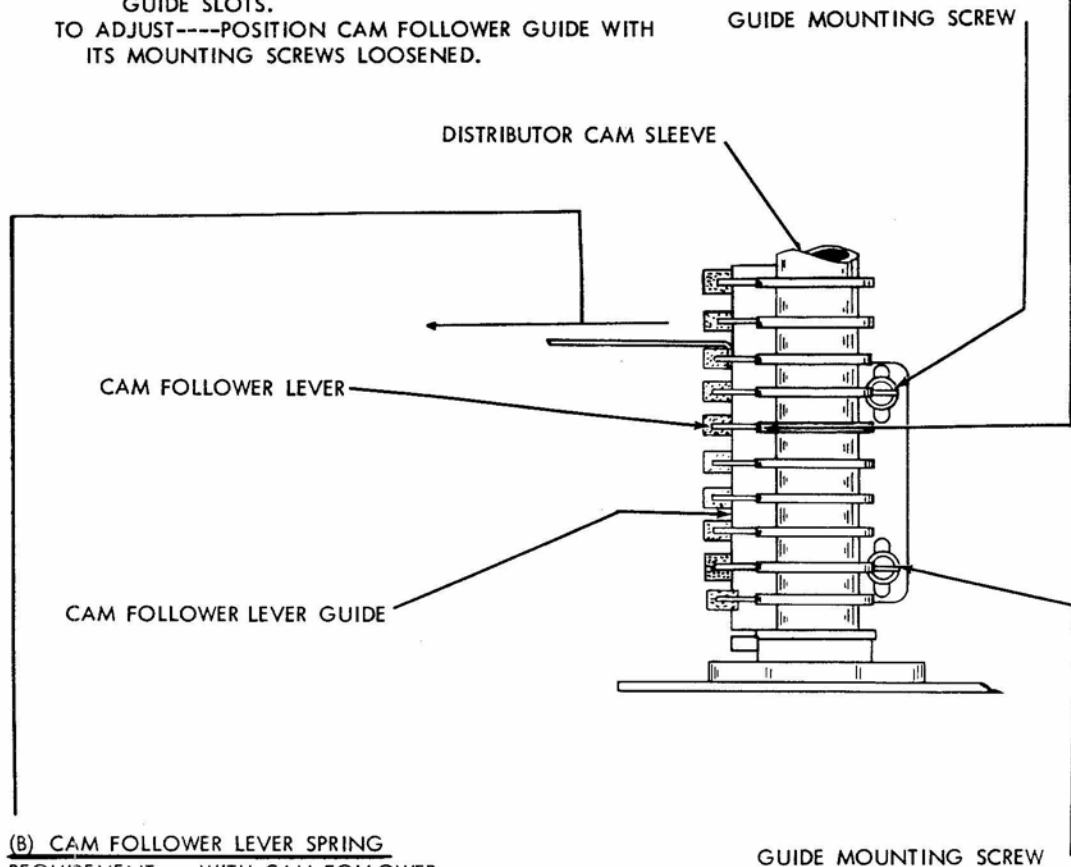
NOTE----REMOVE OIL RESERVOIR AND DISTRIBUTOR BLOCK ASSEMBLY TO FACILITATE ADJUSTMENT.

(A) CAM FOLLOWER GUIDE

REQUIREMENT----

1. CENTER CAM FOLLOWER LEVER SHOULD ENGAGE CAM BY FULL THICKNESS OF THE FOLLOWER WHEN MOVED FROM SIDE TO SIDE IN ITS GUIDE SLOT.
2. IN SIMILAR MANNER, THE OTHER FOLLOWERS SHOULD ENGAGE CAM BY AT LEAST 75% OF FOLLOWER THICKNESS.
3. ALL FOLLOWERS SHOULD MOVE FREELY IN THEIR GUIDE SLOTS.

TO ADJUST----POSITION CAM FOLLOWER GUIDE WITH ITS MOUNTING SCREWS LOOSENED.



(B) CAM FOLLOWER LEVER SPRING

REQUIREMENT----WITH CAM FOLLOWER LEVER ON HIGH PART OF ITS CAM AND SPRING SCALE HOOKED JUST BELOW SLIDING SURFACE OF LEVER, PULL HORIZONTALLY

MIN. 1/2 OZ. — MAX. 1-1/2 OZS.  
TO START EACH LEVER MOVING.

Figure 5-78. Transmitter Distributor, Distributor Cam Follower Guide

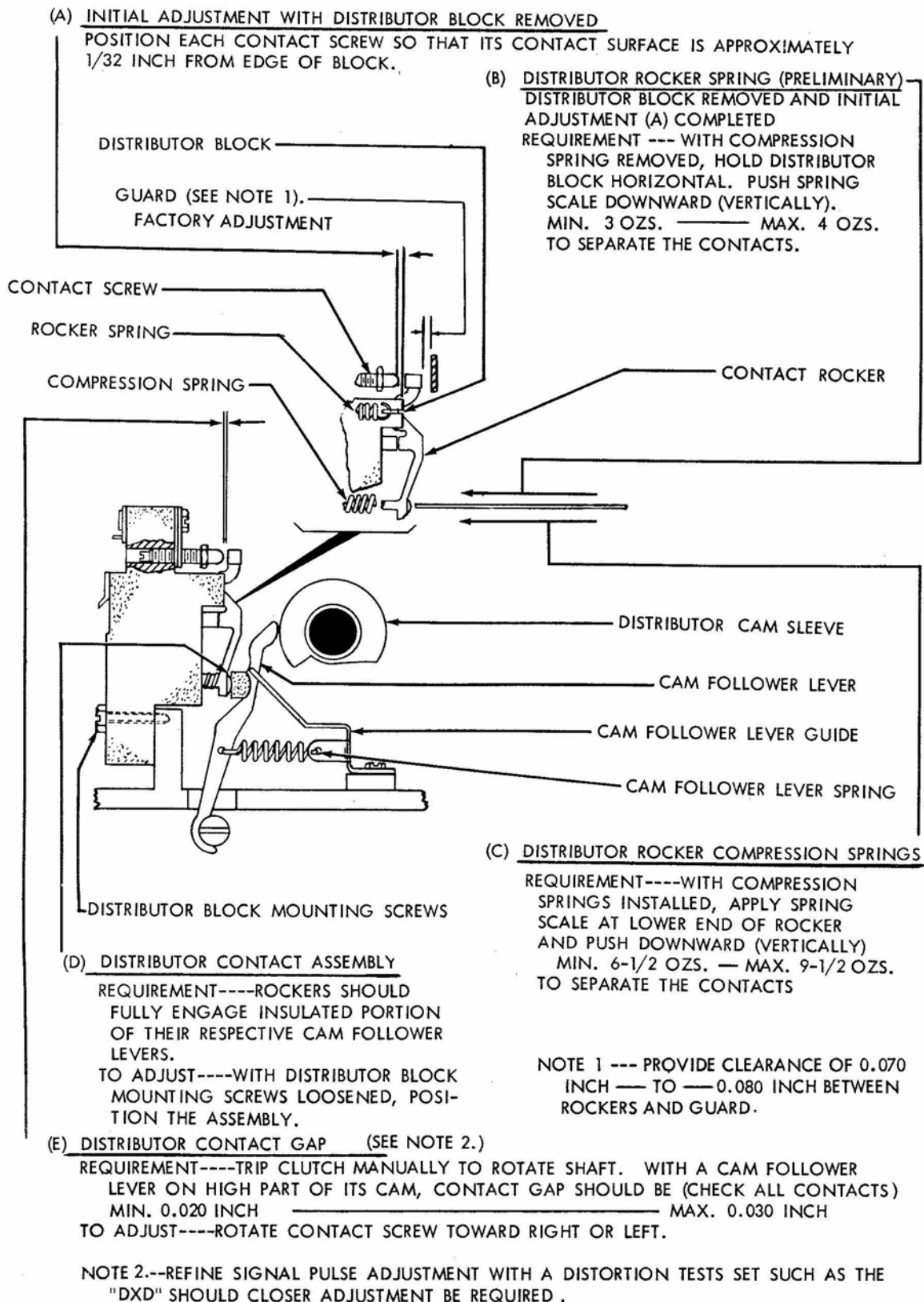


Figure 5-79. Transmitter Distributor, Distributor Contact Assembly



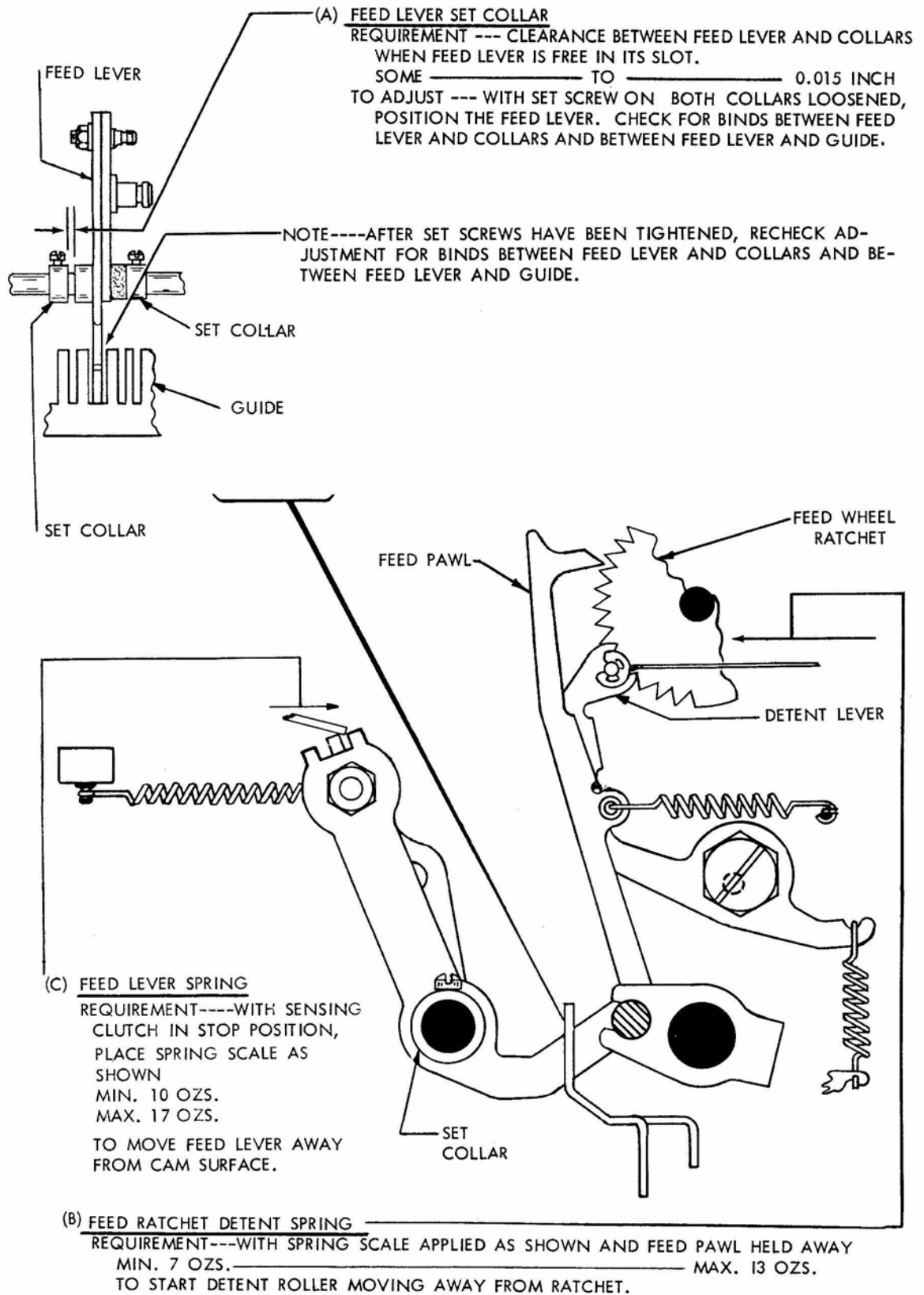
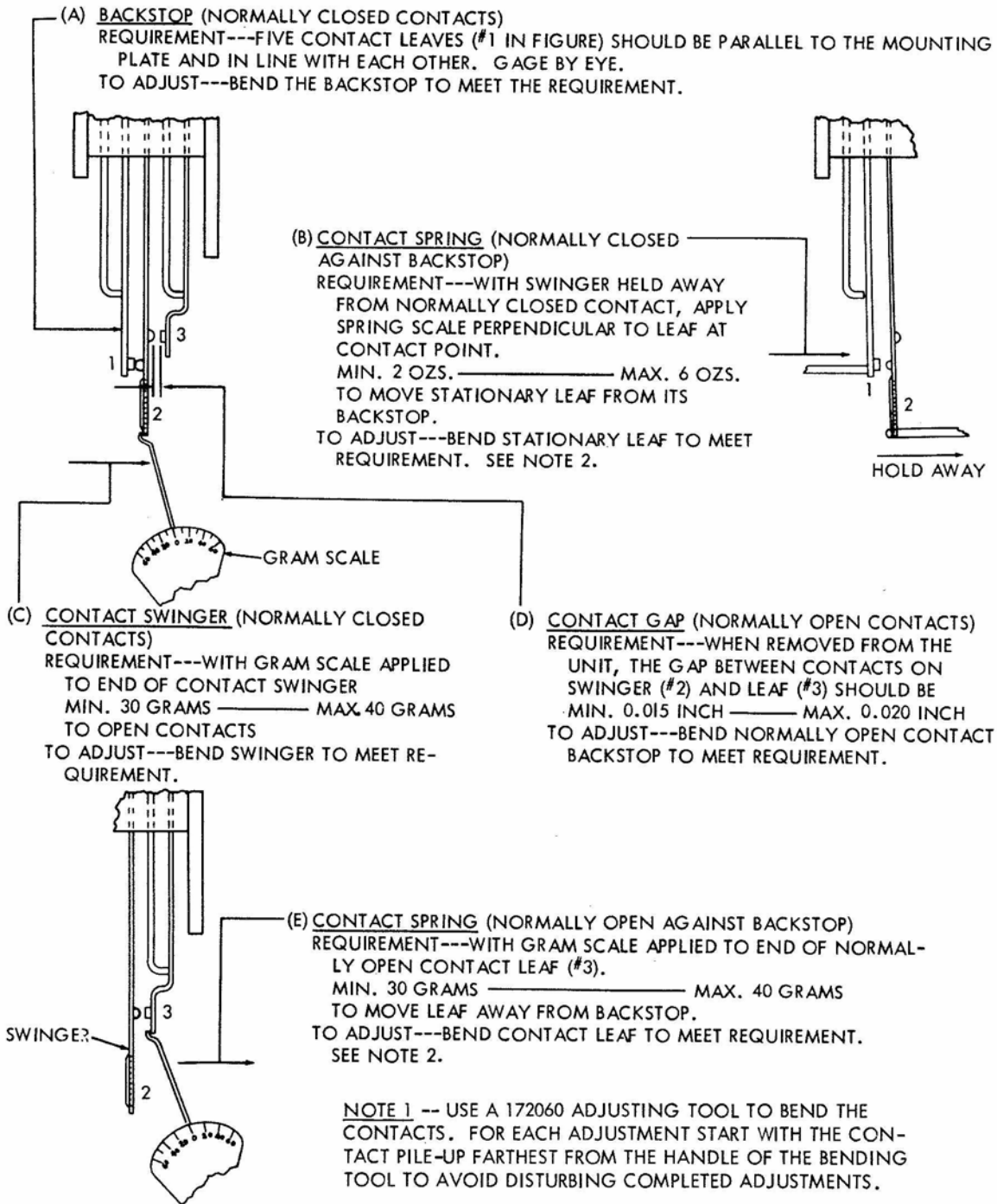


Figure 5-80. Transmitter Distributor, Feed Pawl

**INSTRUCTION FOR REMOVING STORING SWITCH ASSEMBLY:**

WITH THE UNIT INVERTED REMOVE THE TWO SCREWS WHICH MOUNT THE CABLE CONNECTORS TO THE BASE, REMOVE THE TWO MOUNTING SCREWS THAT SECURE THE STORING CONTACT ASSEMBLY TO THE MAIN CASTING AND LIFT THE SWITCH UPWARDS, EXERCISE CARE IN HANDLING TO PREVENT DAMAGE TO SLIDES OR MATING PARTS. THE FOLLOWING FIVE ADJUSTMENTS ARE PRELIMINARY.



**NOTE 2**---TO INCREASE TENSION OF THE LEAF AGAINST ITS BACKSTOP, BEND BACK STOP AWAY FROM THE LEAF, THEN FORM THE LEAF TO INCREASE THE TENSION. REPOSITION BACKSTOP TO MEET REQUIREMENT OF B OR E. RECHECK A, C, AND D.

Figure 5-81. Transmitter Distributor, Storing Switch Assembly

INSTRUCTIONS FOR REPLACING & POSITIONING STORING SWITCH ASSEMBLY

PLACE SWITCH ASSEMBLY  
ON LOWER SURFACE OF MAIN CASTING EXERCISING CARE IN SEATING SLIDE LEVERS  
AGAINST PUSHER LEVERS AND LATCH LEVERS IN APPROPRIATE SLOT OF SLIDE LEVER GUIDE.

(A) STORING SWITCH ASSEMBLY

REQUIREMENT----WITH TOP PLATE IN PLACE, SELECT A LETTERS, BLANK, LETTERS  
COMBINATION AND OBSERVE LATCH AND PUSHER LEVER ACTION. STORING  
SWITCH SHOULD ALIGN WITH LATCH LEVER SO THAT LATCH LEVERS AND SLIDES  
FUNCTION WITHOUT BINDING.

TO ADJUST----WITH SWITCH ASSEMBLY MOUNTING SCREWS LOOSENED, POSITION THE  
ASSEMBLY TO ALIGN LEVERS. RECHECK WHEN SCREWS ARE TIGHTENED.

NOTE----A MINOR ADJUSTMENT OF THE SENSING PIN AND PUSHER LEVER GUIDE  
MAY BE NECESSARY.

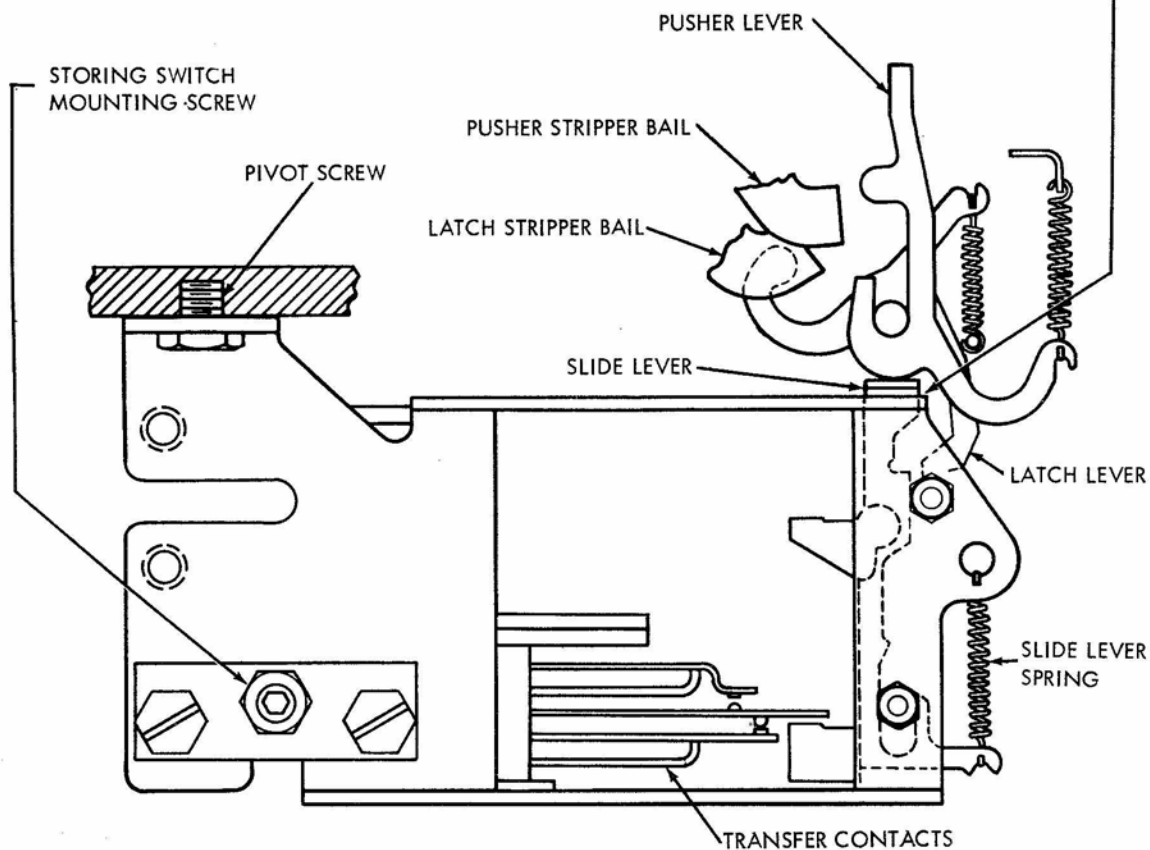


Figure 5-82. Transmitter Distributor, Storing Switch Assembly

SEE FIGURE 5-82 FOR INSTRUCTIONS IN REPLACING STORAGE SWITCH ASSEMBLY.

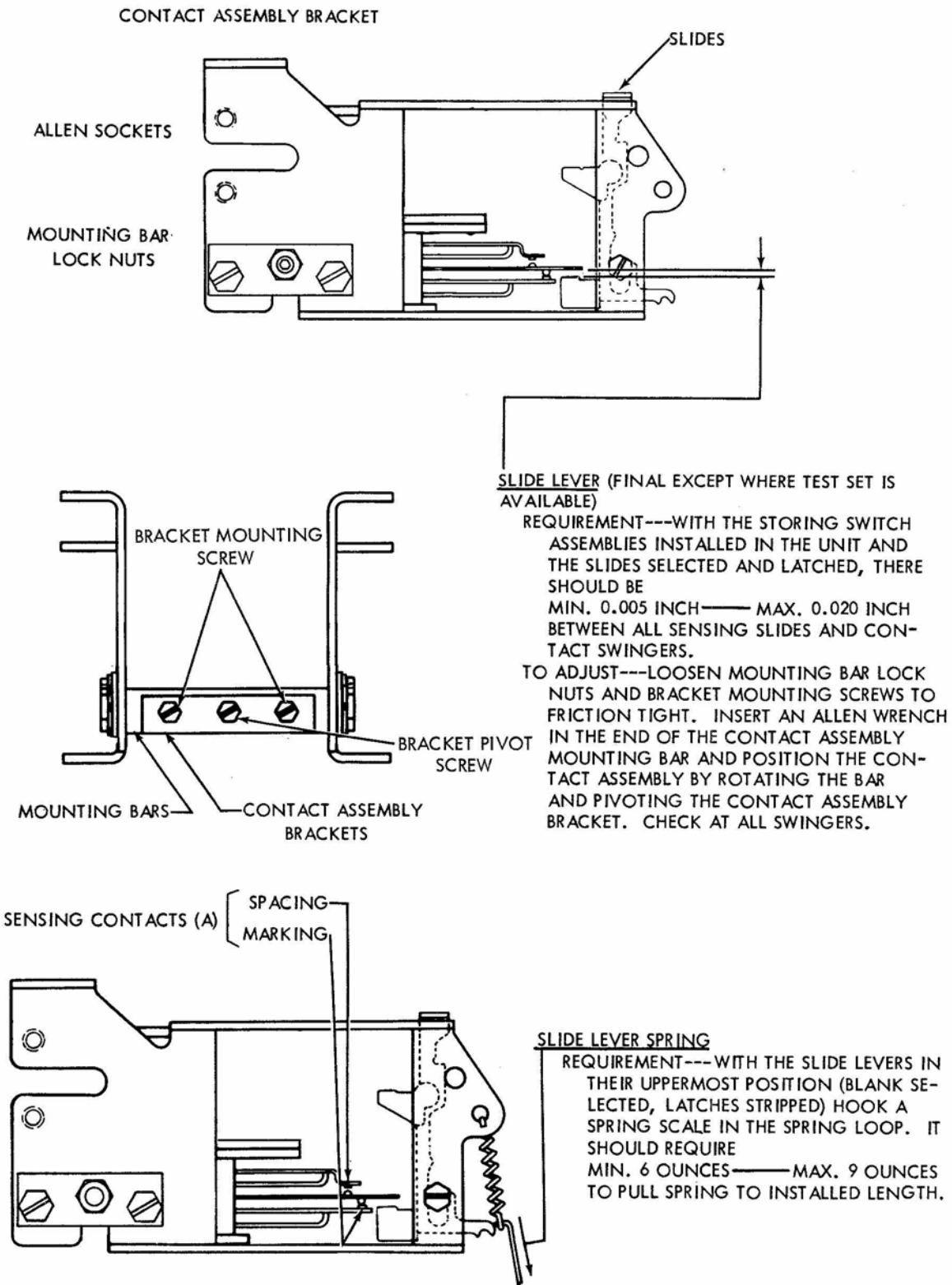


Figure 5-83. Transmitter Distributor, Storing Switch Assembly

(A) TAPE LID

REQUIREMENTS----(REMOVE TOP & TAPE GUIDE PLATES; LUBRICATE PRIOR TO ADJUSTMENT).

## (1) PRELIMINARY:

WITH TAPE LID HELD AGAINST NOTCH IN TAPE GUIDE PLATE  
A FEED WHEEL GROOVE IN TAPE LID SHOULD ALIGN WITH  
 SLOT IN PLATE.

B HOLE IN TAPE LID FOR TAPE-OUT PIN SHOULD ALIGN  
 WITH HOLE IN PLATE. (GAUGE BY EYE)

C CLEARANCE BETWEEN PIVOT SHOULDER AND TAPE LID  
 SOME \_\_\_\_\_ TO \_\_\_\_\_ 0.010 INCH MAX.

TO ADJUST----WITH TAPE LID BRACKET MOUNTING NUTS (2)  
 LOOSENED (INSERT TIP OF #156743 GAUGE THROUGH  
 SLOT AND INTO GROOVE OF LID), POSITION TAPE LID  
 BRACKET — RE-TIGHTEN NUTS.

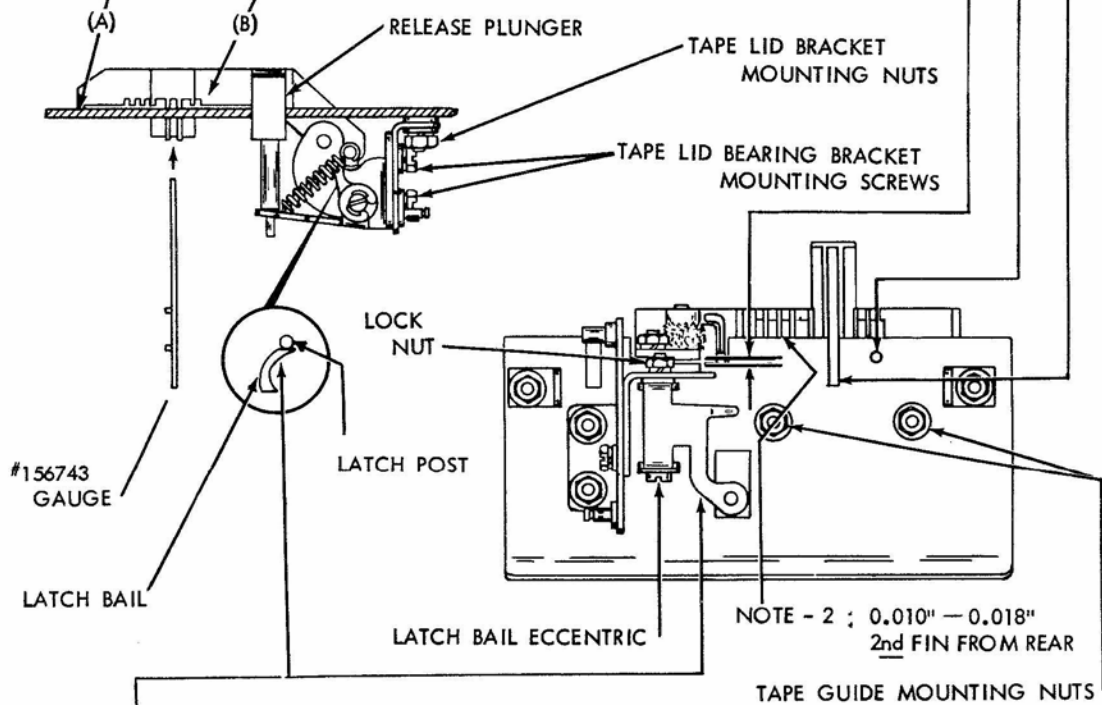
(2) TAPE LID FRONT BEARING SURFACE (A) SHOULD TOUCH TAPE  
 GUIDE PLATE. CLEARANCE (B) MEASURED AT FIN OF TAPE LID  
 WHICH IS IN LINE WITH REAR TAPE GUIDE (SEE NOTE 2)

MIN. 0.010 INCH \_\_\_\_\_ MAX. 0.018 INCH.

NOTE 1 -- WHEN BOTH PLATES ARE ASSEMBLED ON UNIT, LEFT  
 EDGE OF LID MAY TOUCH TOP PLATE AND SOME CHANGE IN  
 THIS CLEARANCE MAY BE EXPECTED.

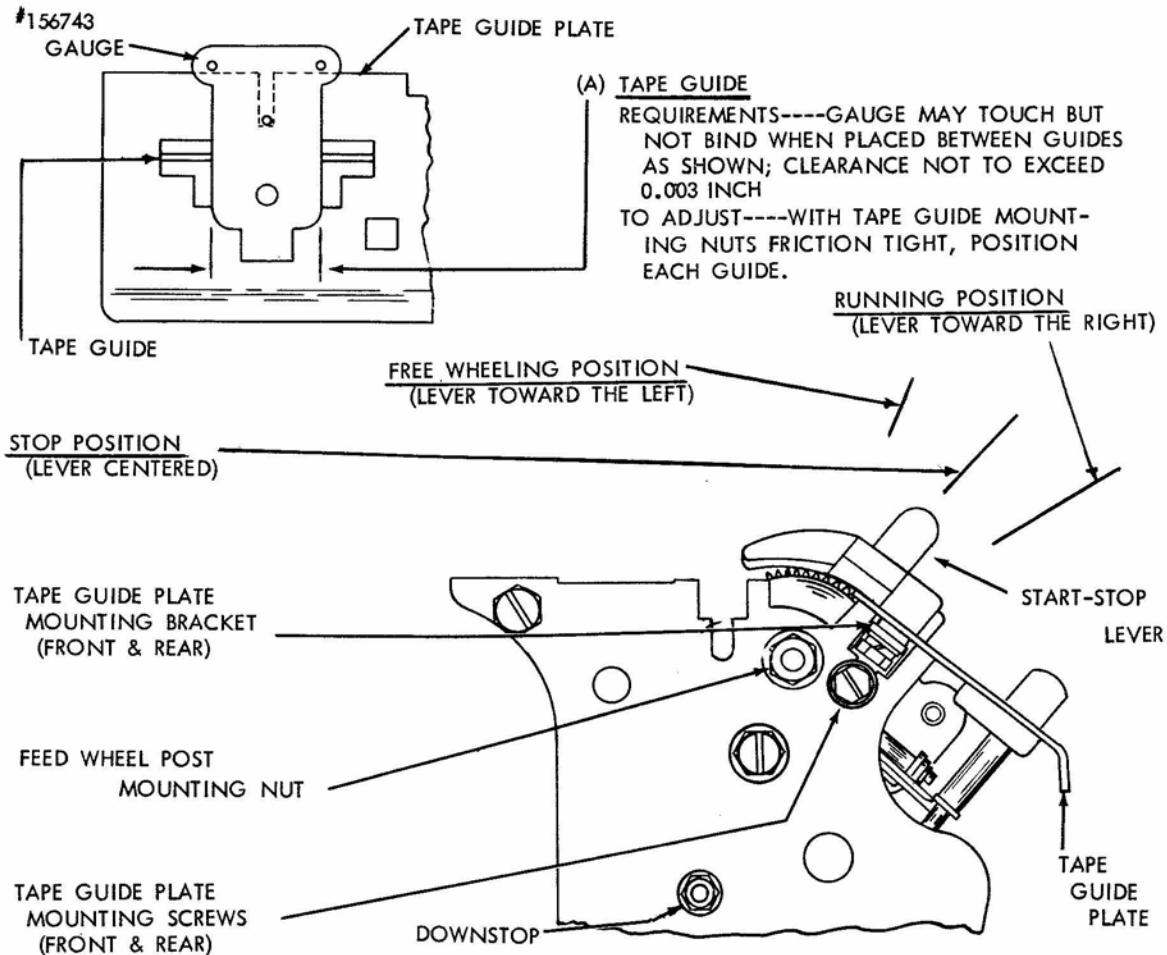
TO ADJUST -- WITH TAPE LID BEARING BRACKET MOUNTING  
 SCREWS FRICTION TIGHT AND TAPE LID PRESSED AGAINST TAPE  
 GUIDE PLATE, POSITION BEARING BRACKET. RECHECK REQUIRE-  
 MENT #1.

SEE SPRING REQUIREMENTS



- (3) RELEASE PLUNGER SHOULD HAVE SOME END PLAY WHEN LID IS  
 LATCHED AGAINST TAPE GUIDE PLATE.  
 TO ADJUST----WITH ECCENTRIC MOUNTING POST LOCK NUT  
 FRICTION TIGHT AND TAPE LID RAISED, ROTATE HIGH PART  
 OF ECCENTRIC TOWARD TAPE GUIDE PLATE. CLOSE LID AND  
 ROTATE ECCENTRIC TOWARD BRACKET UNTIL LATCH JUST FALLS  
 UNDER FLAT ON POST. RE-CHECK BY DEPRESSING PLUNGER —  
 WITH LID HELD DOWN, TIP OF LATCH SHOULD CLEAR POST AS  
 PLUNGER IS OPERATED.

Figure 5-84. Transmitter Distributor, Tape Lid Assembly

INSTRUCTIONS FORREPLACING AND POSITIONING TAPE GUIDE PLATE  
REQUIREMENTS ---

- (1) SHOULDER OF FEED WHEEL POST SHOULD NOT INTERFERE WITH TOP PLATE OR TAPE GUIDE PLATE MOUNTING BRACKETS.  
TO ADJUST --- WITH FEED WHEEL POST MOUNTING NUT LOOSENED, ROTATE THE POST.
- (2) TAPE GUIDE PLATE SHOULD REST FIRMLY AGAINST AT LEAST THREE PROJECTIONS OF FRONT AND REAR PLATE.  
TO ADJUST --- WITH TAPE-OUT DOWNSTOP IN ITS LOWERMOST POSITION AND LOCK NUT THAT SECURES TAPE GUIDE PLATE MOUNTING BRACKET (FRONT & REAR) FRICTION TIGHT, TRIP CLUTCH AND ROTATE SHAFT UNTIL SENSING PINS ARE IN THEIR UPPERMOST POSITION. WITH TAPE LID RAISED AND START-STOP LEVER IN RUN POSITION, PRESS TAPE GUIDE PLATE INTO POSITION WHILE GUIDING MOUNTING SCREWS INTO NOTCH OF FRONT AND REAR PLATE AND PLACING SENSING PINS ADJACENT TO LEFT EDGE OF GUIDE PLATE. ALSO PLACE TAPE-OUT PIN INTO ITS HOLE. TIGHTEN EACH BRACKET MOUNTING SCREW.
- (3) OUTER EDGES OF MOUNTING BRACKETS AND OUTER EDGES OF (MOUNTING STUD) SHOULDERS SHOULD ALIGN AND PROJECT EQUALLY ON FRONT AND REAR BRACKETS.  
TO ADJUST --- MOVE TAPE GUIDE PLATE TOWARD THE FRONT OR REAR. TIGHTEN NUTS ONLY AFTER TOP PLATE IS ADJUSTED.

Figure 5-85. Transmitter Distributor, Tape Guide Plate Assembly

## INSTRUCTIONS FOR

REPLACING AND POSITIONING TOP PLATE----LOOSEN NUTS (FRICTION TIGHT) THAT SECURE MOUNTING BRACKETS. PRESS TOP PLATE INTO POSITION WHILE GUIDING BRACKET MOUNTING SCREWS INTO NOTCH OF FRONT AND REAR PLATE. MAKE SURE THAT TOP PLATE SEATS FIRMLY AGAINST PROJECTIONS OF FRONT AND REAR PLATE (3 PROJECTION SHOULD ENGAGE) AND TIGHT-TAPE ARM EXTENSION IS UNDER TOP PLATE.

## REQUIREMENT----

1. MATING EDGE OF TOP PLATE SHOULD BE FLUSH TO 0.003 INCH UNDER FLUSH WITH EDGE OF TAPE GUIDE PLATE (WITHIN AREA OF TAPE LID) WHEN PLATE ENGAGES AT LEAST 3 PROJECTIONS.
2. FEED WHEEL SLOT SHOULD ALIGN WITH SLOT IN TAPE GUIDE PLATE.
3. CLEARANCE BETWEEN PROJECTION OF TAPE LID AND TOP PLATE. (SEE NOTE 1.)  
MIN. 0.010 INCH ——— MAX. 0.020 INCH. (PLAY TAKEN UP TOWARD TAPE GUIDE PLATE)

## TO ADJUST REQUIREMENT NUMBER----

1. POSITION TOP PLATE AND TAPE GUIDE PLATE BY MEANS OF THEIR OVERSIZED MOUNTING HOLES. TIGHTEN MOUNTING SCREWS.
2. POSITION PLATES SO THAT FEED WHEEL ROTATES FREELY WHEN ITS DETENT AND FEED PAWL ARE DISENGAGED. TIGHTEN NUTS THAT SECURE MOUNTING BRACKETS TO TOP PLATE AND TAPE GUIDE PLATE. (DO NOT DISTURB REQUIREMENT 2 FIGURE)
3. IF NECESSARY, LOOSEN TAPE LID BEARING BRACKET MOUNTING SCREWS AND POSITION TAPE LID. TIGHTEN SCREWS AND RECHECK REQUIREMENT (1) AND (2) FIGURE

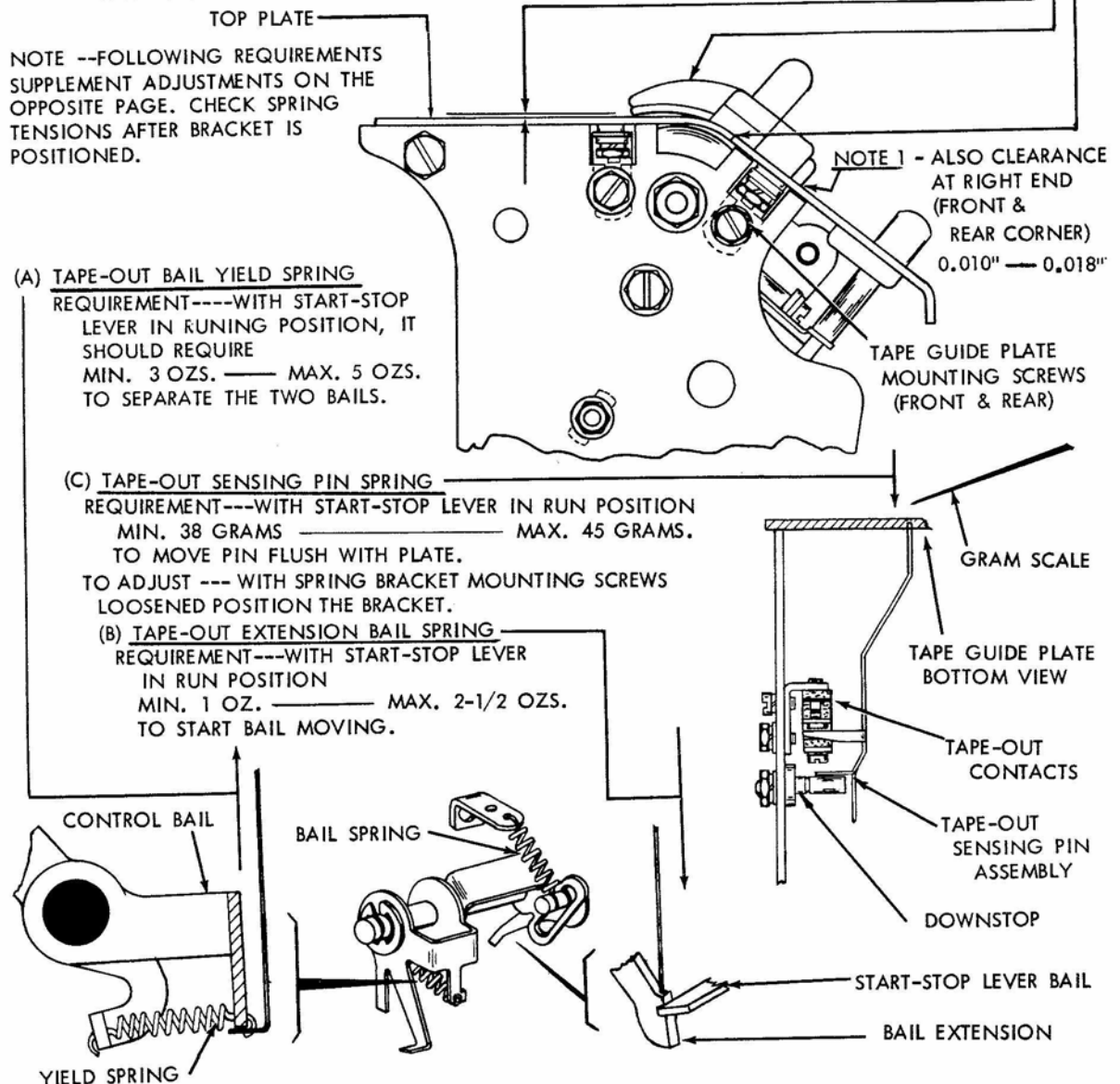


Figure 5-86. Transmitter Distributor, Top Plate Assembly

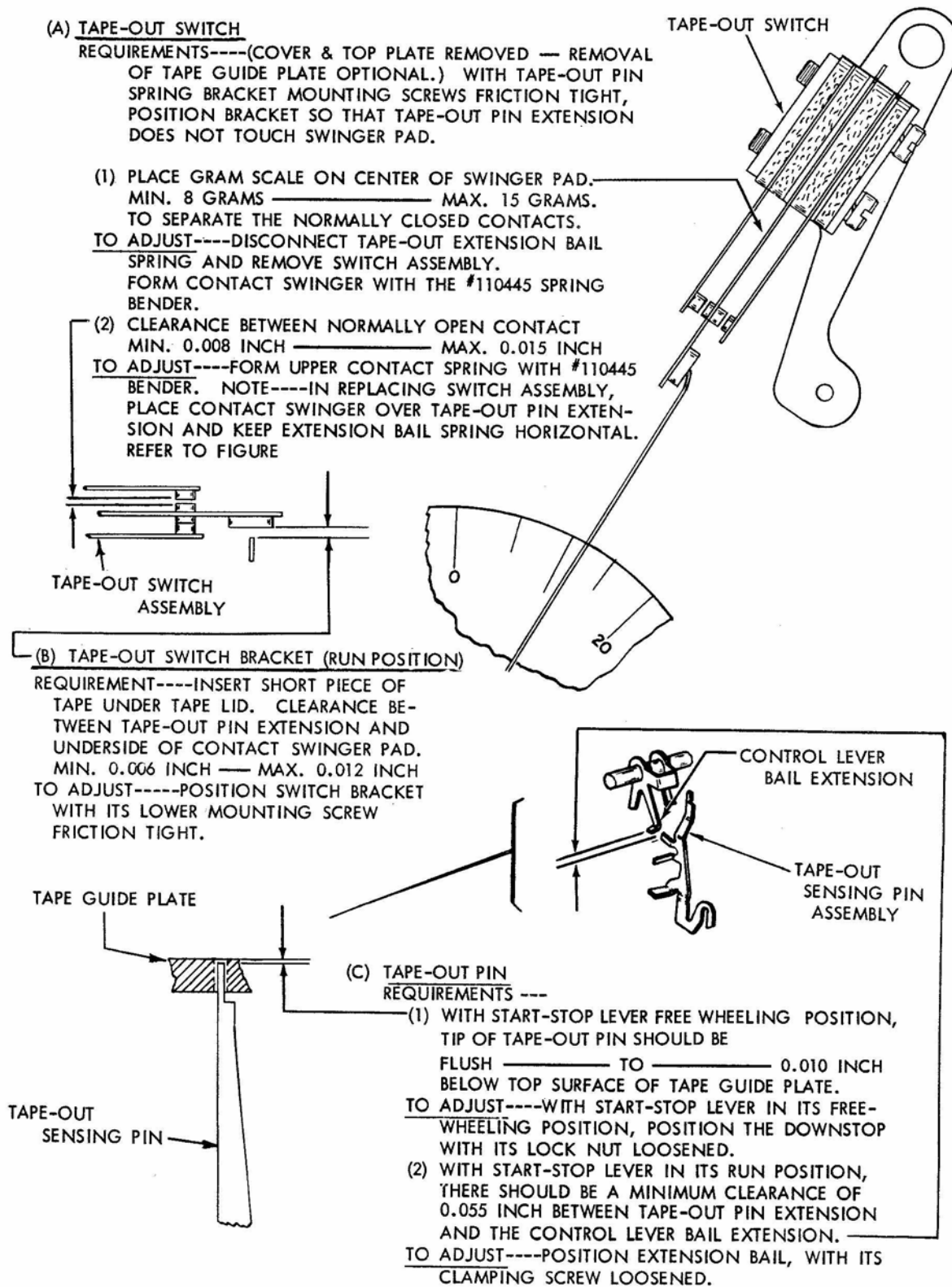
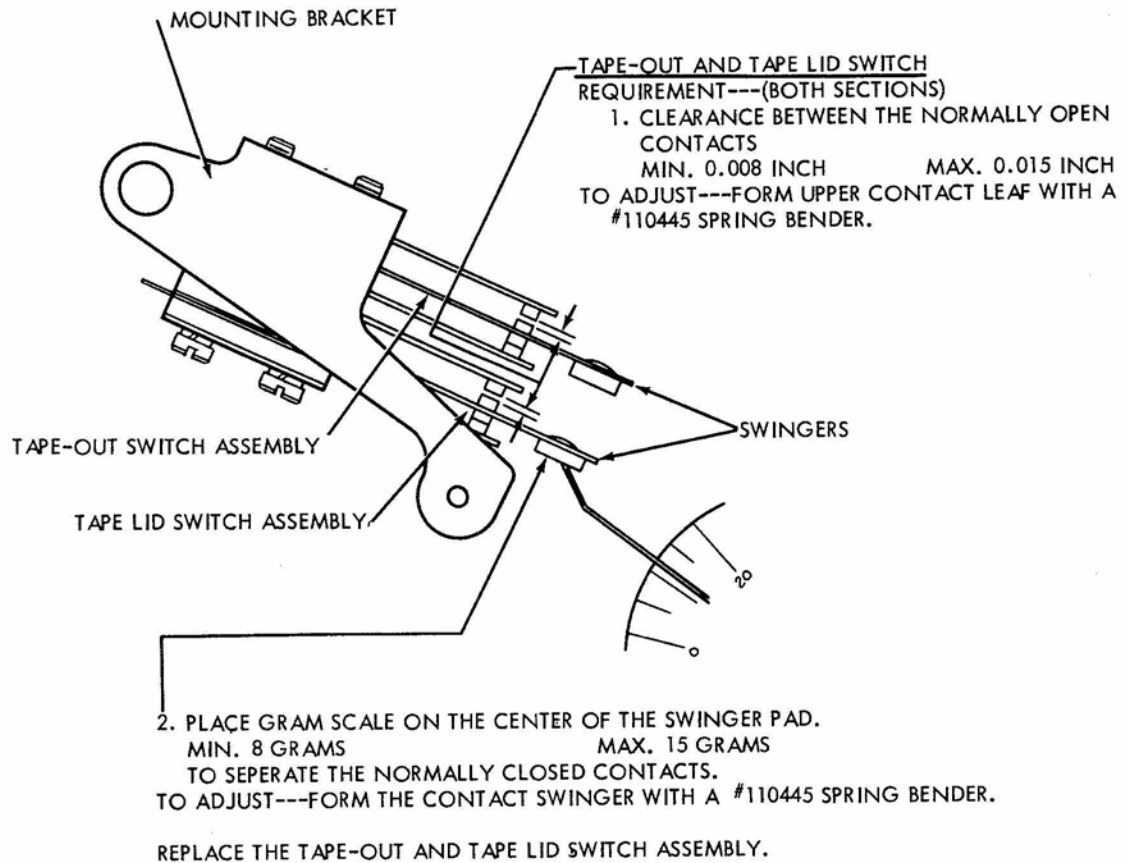


Figure 5-87. Transmitter Distributor, Tape Out Switch Assembly



NOTE: THE FOLLOWING ADJUSTMENTS SHOULD BE PERFORMED WITH THE TAPE-OUT AND TAPE LID SWITCH ASSEMBLY REMOVED FROM THE UNIT. SEE INSTRUCTIONS BELOW.



TO REMOVE TAPE-OUT AND TAPE LID SWITCH ASSEMBLY: WITH THE COVER AND TOP PLATE REMOVED TAKE OUT THE GUIDE POST AT THE TOP ON WHICH THE SWITCH ASSEMBLY PIVOTS. THIS IS ACCOMPLISHED BY REMOVING THE 111342 SPRING AND PARTIALLY REMOVING THE SCREW THAT SECURES THE POST TO THE REAR PLATE. REMOVE THE 110334 NUT WITH WASHER #2191 FROM THE FRONT END OF THE POST. THE POST CAN NOW BE REMOVED FAR ENOUGH TO RELEASE THE SWITCH ASSEMBLY. REMOVE THE ADJUSTING SCREW FROM THE LOWER END OF SWITCH BRACKET. WITHDRAW SWITCH ASSEMBLY USING CARE NOT TO DISTORT THE SWITCH MEMBERS.

TO REPLACE TAPE-OUT AND TAPE LID SWITCH ASSEMBLY REVERSE THE PROCEDURE USED IN REMOVING IT. USE CARE SO AS NOT TO DISTURB THE ADJUSTMENTS.

Figure 5-88. Transmitter Distributor, Tape Out and Tape Lid Switch Assembly

**(A) START STOP SWITCH BRACKET**

**REQUIREMENT----**

(1) WITH START-STOP LEVER IN RUN POSITION, CLEARANCE BETWEEN TIP END OF START-STOP SLIDE ARM AND BAKELITE PORTION OF CONTACT SWINGER. (SEE NOTE).  
MIN. 0.006 INCH ——— MAX. 0.015 INCH

(2) START-STOP AND TIGHT TAPE SLIDE ARMS SHOULD ENGAGE BAKELITE PORTION OF SWINGER BY FULL THICKNESS OF RESPECTIVE ARM.

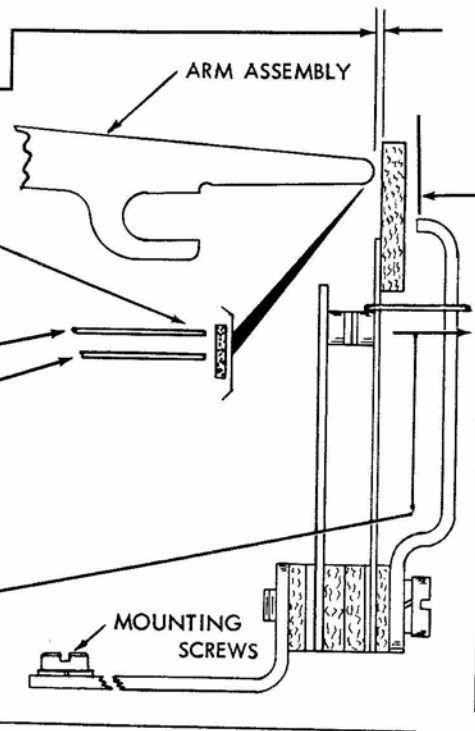
TO ADJUST----WITH SWITCH BRACKET MOUNTING SCREWS LOOSENED, POSITION THE BRACKET

NOTE----IF TIGHT TAPE SLIDE ARM RESTS AGAINST BAKELITE, HOLD THE ARM AWAY.

START-STOP SLIDE ARM

TIGHT-TAPE SLIDE ARM

**START-STOP ; TIGHT-TAPE SWITCH**



**(C) TIGHT-TAPE AND START-STOP CONTACT SPRING**

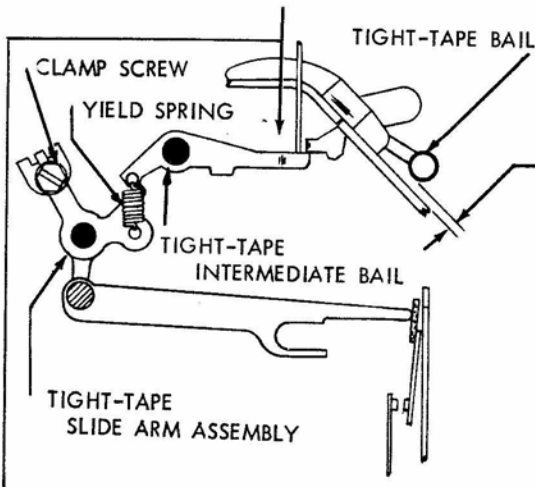
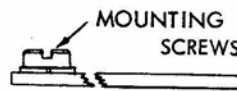
**REQUIREMENT----**

(1) WITH SPRING SCALE HOOKED AS SHOWN, PULL TO RIGHT  
MIN. 3 OZS. ——— MAX. 4 OZS.  
TO SEPARATE THE CONTACTS

(2) CLEARANCE BETWEEN SWITCH BACKSTOP AND BAKELITE PORTION OF SWINGER WITH CONTACTS CLOSED.

MIN. 0.050 INCH ——— MAX. 0.070 INCH

TO ADJUST----FORM THE SWINGER USING 110445 SPRING BENDER. RECHECK REQUIREMENTS "A" & " B " .



**(B) TIGHT TAPE SLIDE ARM (TOP PLATE REMOVED)**

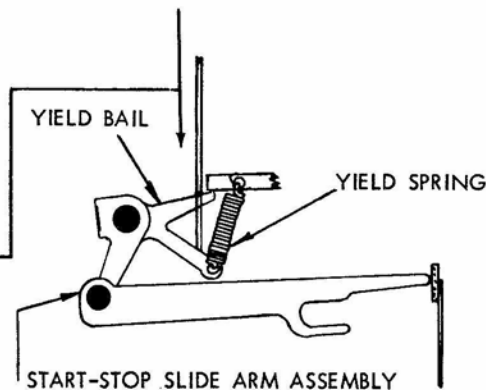
**REQUIREMENT----**TIGHT TAPE CONTACTS SHOULD OPEN WHEN TIGHT TAPE BAIL IS RAISED

MIN. 0.045 INCH ——— MAX. 0.075 INCH  
AWAY FROM TAPE GUIDE PLATE.

TO ADJUST----WITH START-STOP LEVER IN RUN POSITION AND ADJUSTING SLOT CLAMP SCREW LOOSENED, POSITION ARM ASSEMBLY SO THAT CONTACTS ARE CLOSED WITH A 0.045 INCH GAUGE PLACED UNDER TIGHT TAPE BAIL. HOWEVER, CONTACTS SHOULD OPEN WHEN A 0.075 INCH GAUGE IS USED.

**(D) TIGHT-TAPE BAIL YIELD SPRING**

**REQUIREMENT----**WITH TAPE LID OPEN, START-STOP LEVER IN FREE WHEELING POSITION  
MIN. 2 OZS. ——— MAX. 3-1/2 OZS.  
TO SEPARATE BAILS.



**(E) START -STOP BAIL YIELD SPRING**

**REQUIREMENT--**WITH START-STOP LEVER IN RUN POSITION (TOP PLATE REMOVED)  
MIN. 4 OZS. ——— MAX. 6 OZS.  
TO START BAIL MOVING.

Figure 5-89. Transmitter Distributor, Start-Stop, Tight Tape Switch Assembly

**(C) SENSING PIN**

REQUIREMENT----(TOP PLATE REPLACED) WITH SENSING CLUTCH DISENGAGED AND SENSING BAIL ECCENTRIC INDENT (MARKING) TOWARD THE RIGHT, TIP OF HIGHEST SENSING PIN SHOULD BE FLUSH TO 0.005 INCH BELOW TOP SURFACE OF TAPE GUIDE PLATE. TO ADJUST----LOOSEN ECCENTRIC SHAFT LOCK NUT AND POSITION THE ECCENTRIC. RECHECK REQUIREMENT AFTER LOCK NUT IS TIGHTENED.

RECHECK AND REFINE IF NECESSARY

**(B) SENSING PIN SPRING**

REQUIREMENT----TRIP SENSING CLUTCH MANUALLY AND ROTATE SHAFT UNTIL SENSING PINS ARE AT PEAK OF THEIR UPWARD TRAVEL. WITH PUSHER LEVERS HELD AWAY MIN. 2 OZS. MAX. 3 OZS. TO MOVE EACH PIN FLUSH WITH TOP SURFACE OF TAPE GUIDE PLATE.

**(A) SENSING BAIL SPRING (TOP PLATE REMOVED)**

REQUIREMENT --- WITH TAPE LID RAISED, TRIP SENSING CLUTCH AND MANUALLY ROTATE SHAFT UNTIL SENSING BAIL IS IN ITS UPPERMOST POSITION. DEPRESS SENSING PINS (MANUALLY) UNTIL THEY ARE FREE OF SENSING BAIL. MIN. 1/4 OZS. MAX. 2 OZS. TO START SENSING BAIL MOVING.

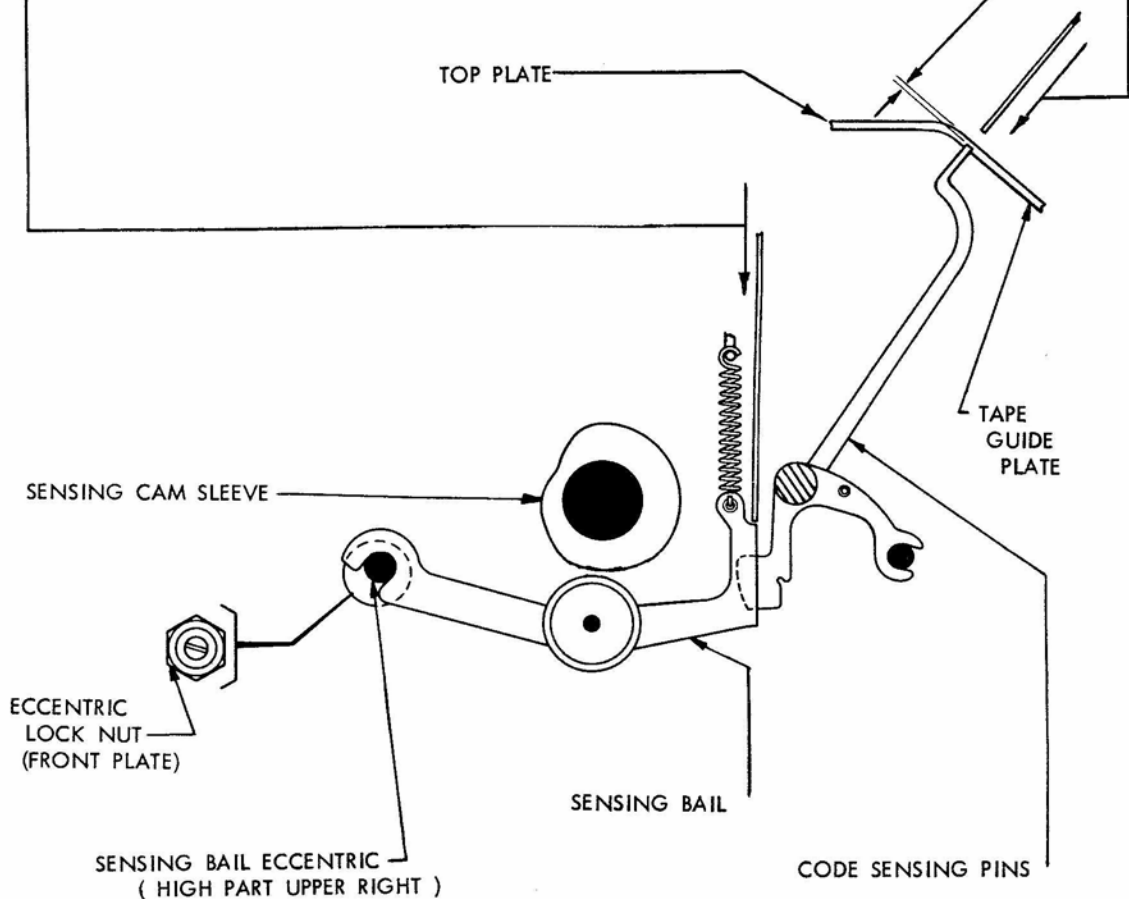


Figure 5-90. Transmitter Distributor, Sensing Pin Assembly

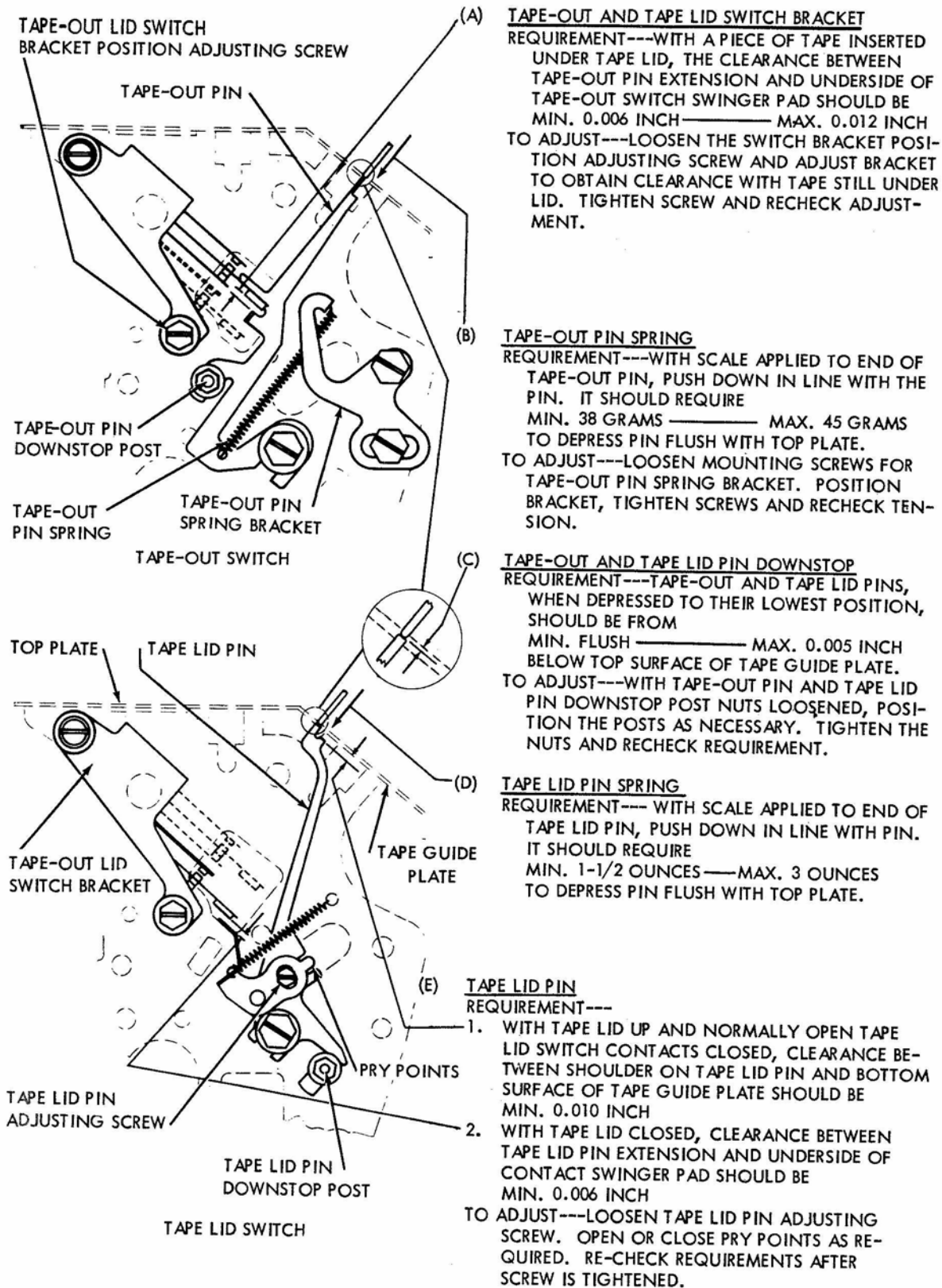


Figure 5-91. Transmitter Distributor, Tape Out and Tape Lid Switch Assembly

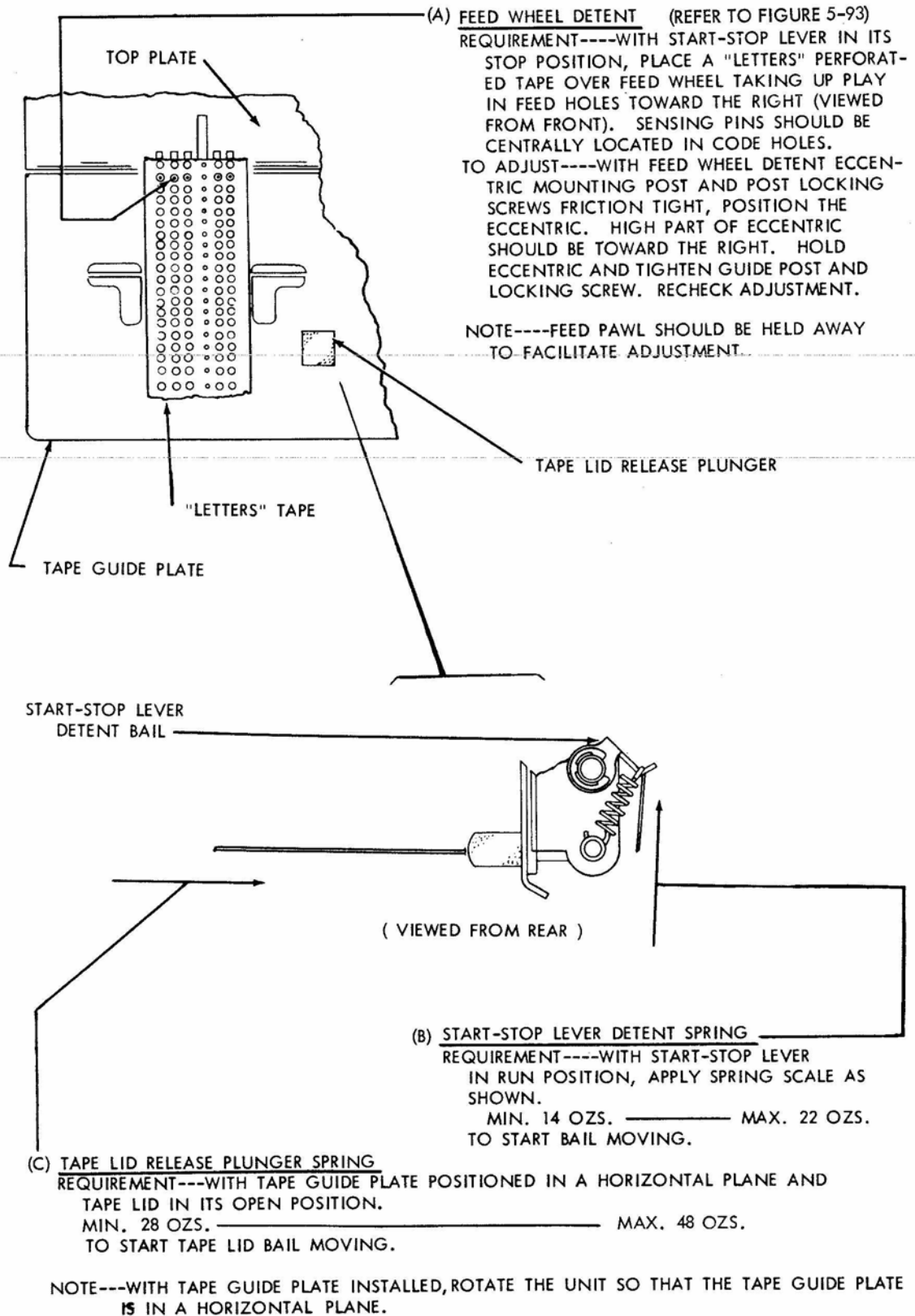


Figure 5-92. Transmitter Distributor, Feed Wheel Detent

(A) CONTACT LEVER SLIDE

REQUIREMENT----(CHECK CLOSEST SLIDE) WITH SENSING SHAFT ROTATED UNTIL SENSING PINS ARE AT PEAK OF THEIR UPWARD TRAVEL AND PUSHER LEVERS SELECTED, TRIP LATCH LEVERS MANUALLY, CLEARANCE BETWEEN LOWER SURFACE OF PUSHER LEVER AND TOP OF SLIDE.  
 MIN. 0.005 INCH — MAX. 0.012 INCH  
 TO ADJUST----LOOSEN ECCENTRIC SHAFT LOCK NUT. WITH HIGH PART OF ECCENTRIC IN UPPER RIGHT QUADRANT, ROTATE THE ECCENTRIC TOWARD THE RIGHT.

NOTE----RECHECK STORING SWITCH GUIDE ADJUSTMENT.

SENSING CAM

SENSING BAIL

TOP PLATE

SENSING PIN

TAPE GUIDE PLATE

PUSHER LEVER

LATCH LEVER

SLIDE

SLIDE ECCENTRIC

(B) LATCH LEVER SPRING (TAPE GUIDE & TOP PLATE REPLACED)

REQUIREMENT --- SELECT BLANKS COMBINATION, TRIP CLUTCH AND ROTATE SENSING SHAFT TO STOP POSITION UNTIL SLIDE LEVERS RETURN TO PEAK OF THEIR UPWARD TRAVEL.  
 MIN. 1 OZ. — MAX. 3 OZS.  
 TO START EACH LATCH LEVER MOVING.

PUSHER LEVER

LATCH LEVER

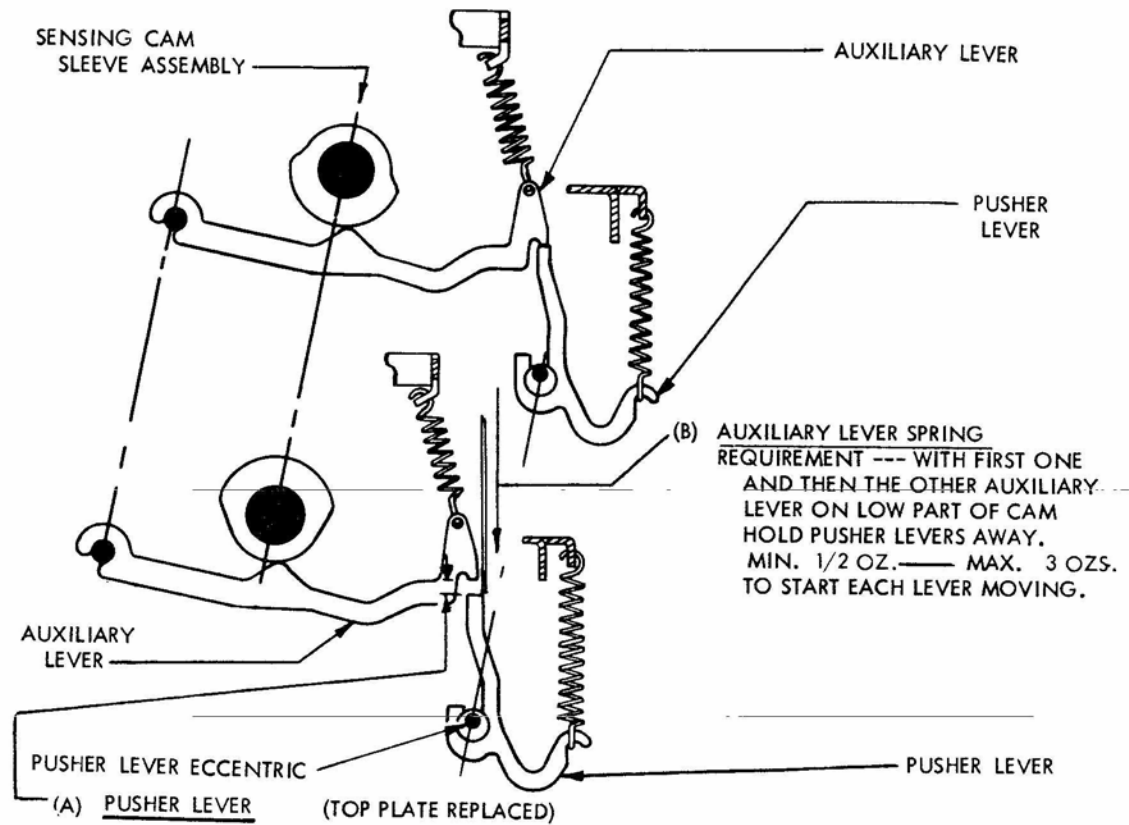
(C) PUSHER LEVER SPRING

REQUIREMENT----WITH UNIT ON ITS LEFT SIDE, SELECT A LETTERS COMBINATION AND LATCH CLUTCH. TRIP CLUTCH AND ROTATE SHAFT UNTIL PUSHER LEVERS ARE STRIPPED.  
 MIN. 1/4 OZ. — MAX. 1-1/2 OZS.  
 TO START EACH PUSHER LEVER MOVING.

NOTE----TO CHECK EITHER AUXILIARY PUSHER LEVER, ROTATE SHAFT UNTIL RESPECTIVE AUXILIARY LEVER IS ON LOW PART OF ITS CAM.

CAUTION --- EXERCISE CARE WHEN INSERTING SCALE BETWEEN PUSHER LEVER SPRINGS.

Figure 5-93. Transmitter Distributor, Sensing Bail Mechanism



REQUIREMENT----WITH FIRST ONE AND THEN THE OTHER AUXILIARY LEVER ON LOW PART OF CAM, THE AUXILIARY LEVER WITH THE LEAST CLEARANCE SHOULD CLEAR THE TIP OF ITS PUSHER LEVER BY  
 MIN. 0.025 INCH \_\_\_\_\_ MAX. 0.040 INCH

TO ADJUST----WITH PUSHER LEVER ECCENTRIC SHAFT LOCK NUT (FRONT PLATE) LOOSENED AND HIGH PART OF ECCENTRIC LOCATED TOWARD THE UPPER RIGHT, ROTATE ECCENTRIC TOWARD THE RIGHT OR LEFT.

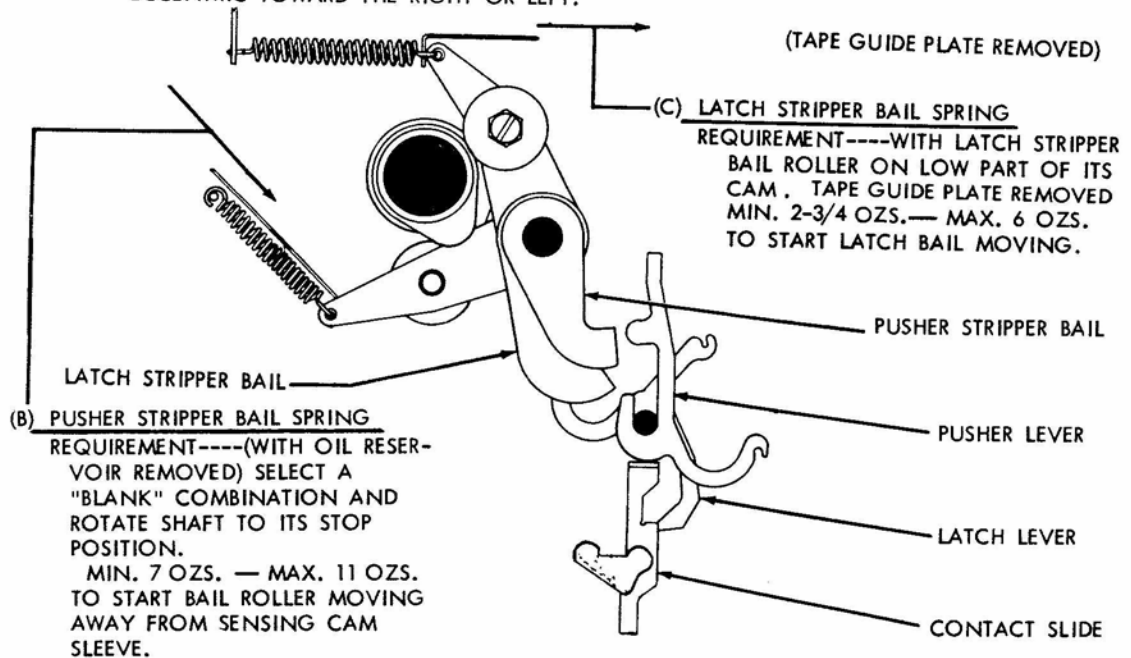


Figure 5-94. Transmitter Distributor, Auxiliary Lever Mechanism

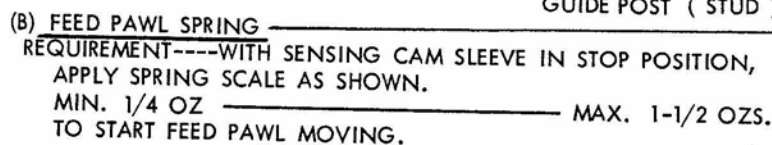
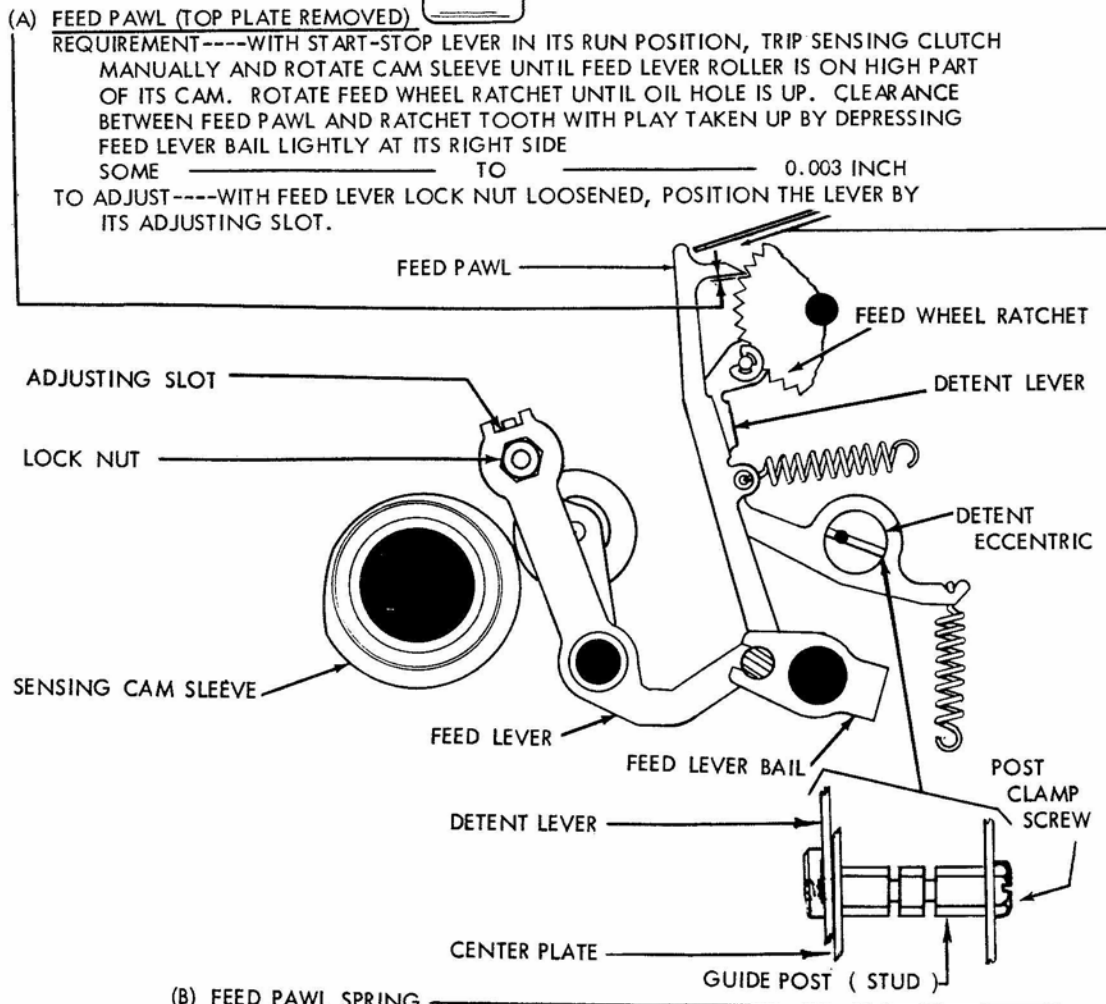
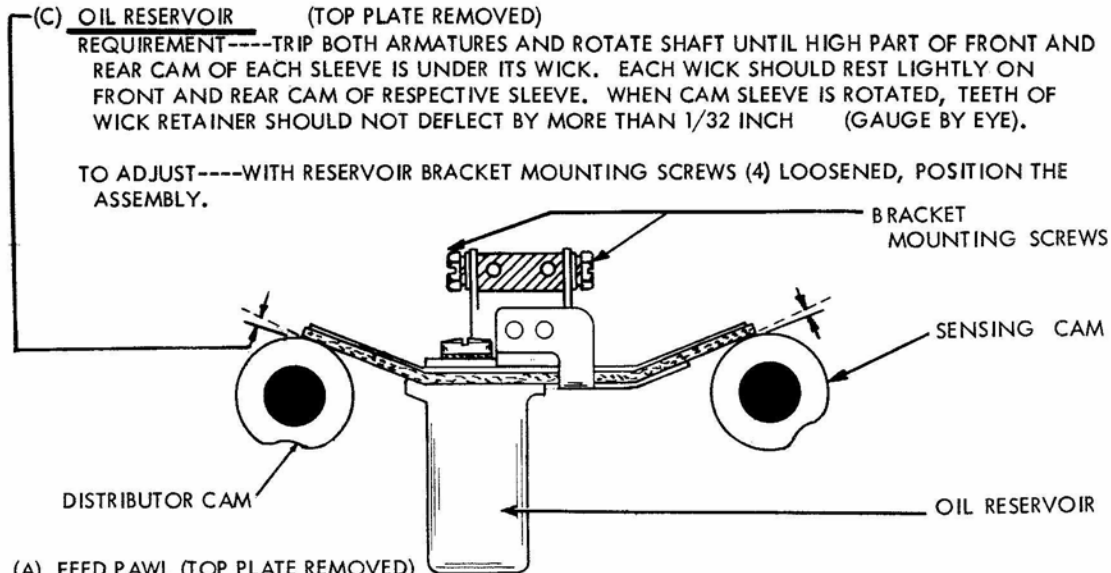


Figure 5-95. Transmitter Distributor, Feed Pawl Mechanism



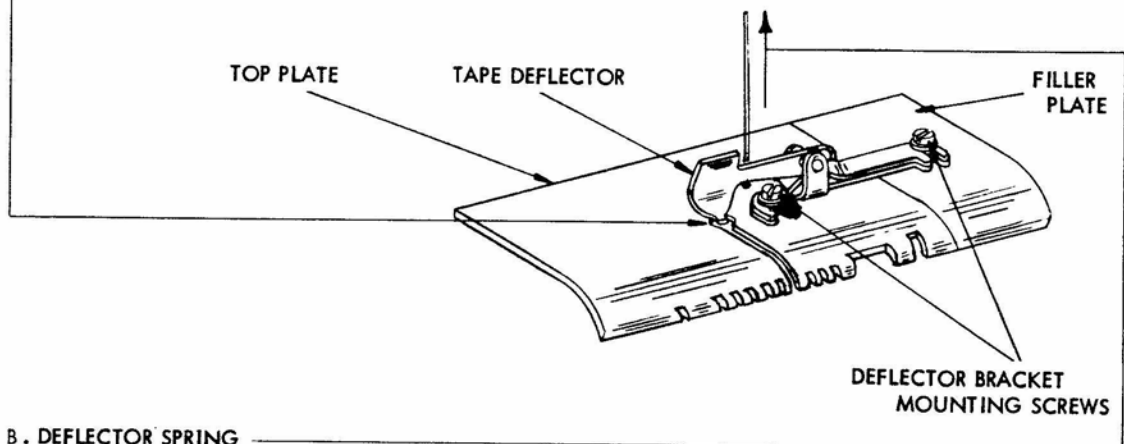
TAPE DEFLECTOR

NOTE---DEFLECTOR IS HINGED TO SWING IN EITHER OF TWO POSITIONS.

1. OPERATING POSITION - (LEFT SIDE) --- DEFLECTS TAPE BACK TO OPERATOR.
2. NON-OPERATING POSITION - (RIGHT SIDE) --- TAPE ALLOWED TO FOLLOW NATURAL PATH TO REAR OF UNIT.

A. DEFLECTOR BRACKET

REQUIREMENT --- WITH DEFLECTOR IN ITS OPERATING POSITION, TANG OF DEFLECTOR SHOULD BE CENTRALLY LOCATED IN HOLE OF TOP PLATE  
 TO ADJUST --- WITH BRACKET MOUNTING SCREWS LOOSENED, POSITION THE BRACKET.

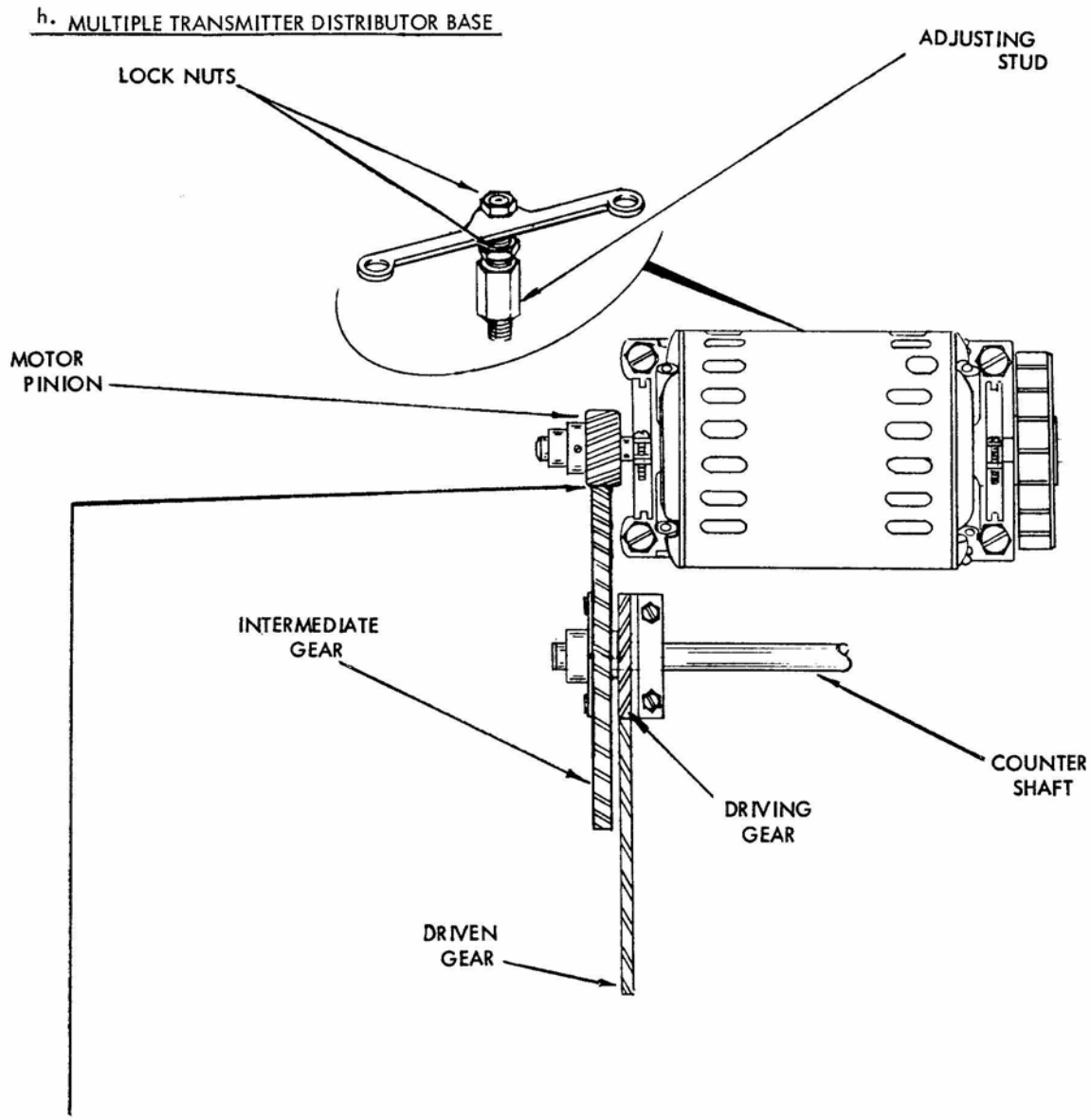
B. DEFLECTOR SPRING

REQUIREMENT --- WITH DEFLECTOR IN ITS OPERATING POSITION, HOOK SPRING SCALE UNDER NARROW SECTION.

MIN. 1-1/2 OZS. \_\_\_\_\_ MAX. 4 OZS.

TO ADJUST --- WITH SCREW THAT ANCHORS SPRING TO FILLER PLATE LOOSENED, POSITION SPRING IN ITS ELONGATED MOUNTING SLOT. IF NECESSARY, FORM THE SPRING.

Figure 5-96. Transmitter Distributor, Tape Deflector



(A) MOTOR PINION  
 REQUIREMENT --- PINION AND INTERMEDIATE GEAR  
 SHOULD HAVE A BARELY PERCEPTIBLE AMOUNT  
 OF BACKLASH AT POINT OF MINIMUM CLEARANCE  
 (CHECK FOR ONE REVOLUTION OF INTERMEDIATE GEAR).  
 TO ADJUST --- WITH ITS LOCK NUTS LOOSENED,  
 POSITION THE ADJUSTING STUD UP OR DOWN.

Figure 5-97. Multiple Transmitter Distributor Base, Motor Pinion

NOTE --- FOR ADJUSTMENT OF BACKLASH BETWEEN MOTOR PINION AND INTERMEDIATE DRIVEN GEAR AND ADJUSTMENT OF THE COUNTERSHAFT, SEE FIGURE 5-97.

- (A) TRANSMITTER DISTRIBUTOR POSITIONING  
 REQUIREMENT --- THERE SHOULD BE ONLY A PERCEPTIBLE AMOUNT OF BACKLASH BETWEEN TEETH OF COUNTER SHAFT DRIVING GEAR AND MAIN SHAFT DRIVEN GEAR AT POINT WHERE BACKLASH IS LEAST. CHECK FOR ALL THREE TRANSMITTER DISTRIBUTOR POSITIONS.  
 TO ADJUST --- POSITION LOCATING PLATE WITH ITS MOUNTING SCREWS LOOSENED.

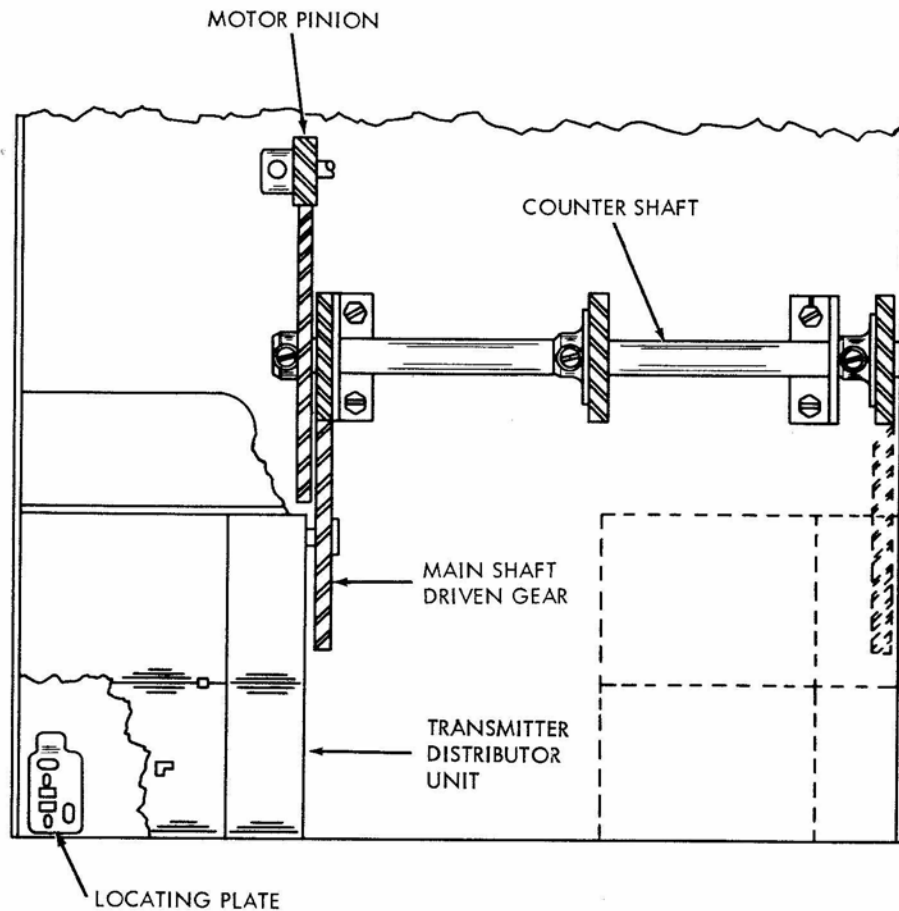


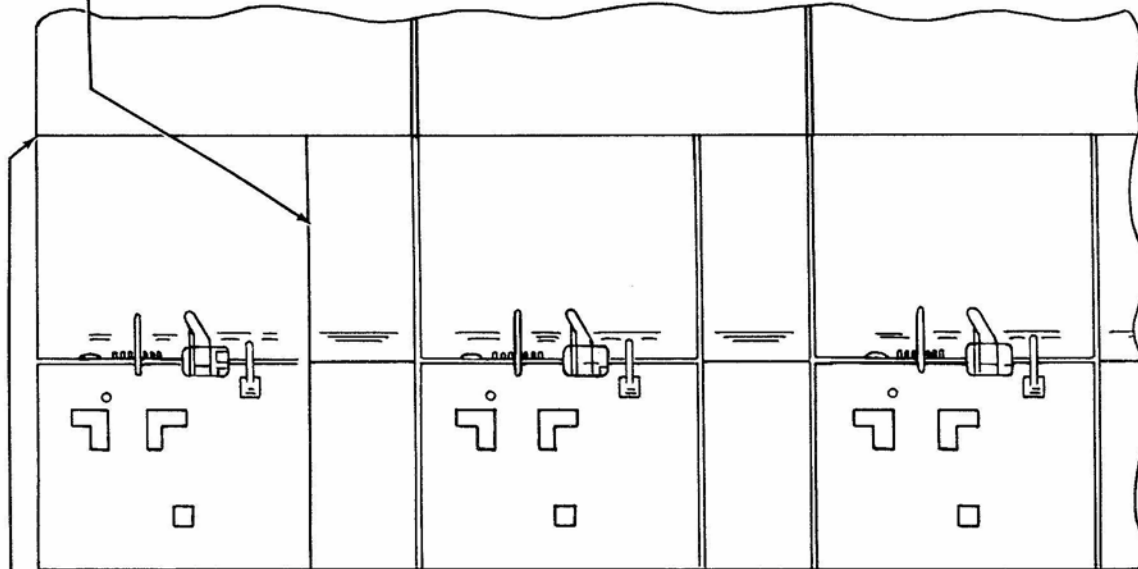
Figure 5-98. Multiple Transmitter Base, Transmitter Distributor Positioning

(A) FILLER PLATE ASSEMBLY

REQUIREMENT --- TOP SURFACE OF FILLER PLATE SHOULD ALIGN WITH TOP SURFACE OF BOTH THE TOP PLATE AND THE TAPE GUIDE PLATE. THE COMMON EDGES SHOULD BEAR AGAINST EACH OTHER.

- (1) LAY A STRAIGHTEDGE ACROSS THE TOP PLATES AND FILLER PLATES AT A DISTANCE OF 1/4" FROM COVER PLATE. MEASURE GAP BETWEEN EACH PLATE AND STRAIGHTEDGE, AT A DISTANCE OF 1/8 INCH ON EACH SIDE OF EDGE BETWEEN TOP PLATE AND FILLER PLATE FOR ALL (5) SUCH EDGES  
FLUSH \_\_\_\_\_ TO \_\_\_\_\_ 0.010 INCH

- (2) LAY A STRAIGHTEDGE ACROSS THE TAPE GUIDE PLATES AND FILLER PLATES AT A DISTANCE OF 1/8 INCH FROM THE LOWER EDGE OF THE TAPE GUIDE PLATES. MEASURE GAP BETWEEN THE STRAIGHTEDGE AND THE TAPE GUIDE PLATE AT A DISTANCE OF 1/8 INCH ON EACH SIDE OF THE EDGE BETWEEN TAPE GUIDE PLATES AND FILLER PLATES AT ALL (5) SUCH EDGES  
FLUSH \_\_\_\_\_ TO \_\_\_\_\_ .010 INCH



## NOTE

WHEN LESS THAN THREE TRANSMITTER DISTRIBUTOR UNITS ARE USED ON THE BASE, THE UNUSED COMPARTMENTS CONTAIN A DUMMY UNIT. POSITION THE TOP PLATE AND COVER PLATE IN A MANNER SIMILAR TO REQUIREMENT B.

(B) COVER PLATE

REQUIREMENTS ---

- (1) WITH (THREE) UNITS IN THEIR OPERATING POSITION ON THE BASE, COVER PLATES SHOULD ALIGN HORIZONTALLY AND MATING EDGE OF COVER AND RESPECTIVE TOP PLATE SHOULD BE FLUSH. TO ADJUST --- WITH DETENTING NUTS LOOSENED, POSITION THE COVER.  
(2) EDGE OF COVER PLATE OPPOSITE DRIVING GEAR SHOULD ALIGN WITH EDGE OF TOP PLATE. TO ADJUST --- WITH COVER PLATE DETENT MOUNTING NUTS (2) AND SPRING PLATE MOUNTING NUTS (2) FRICTION TIGHT, POSITION COVER PLATE.

Figure 5-99. Multiple Transmitter Distributor Base, Cover Plate and Filler Plate

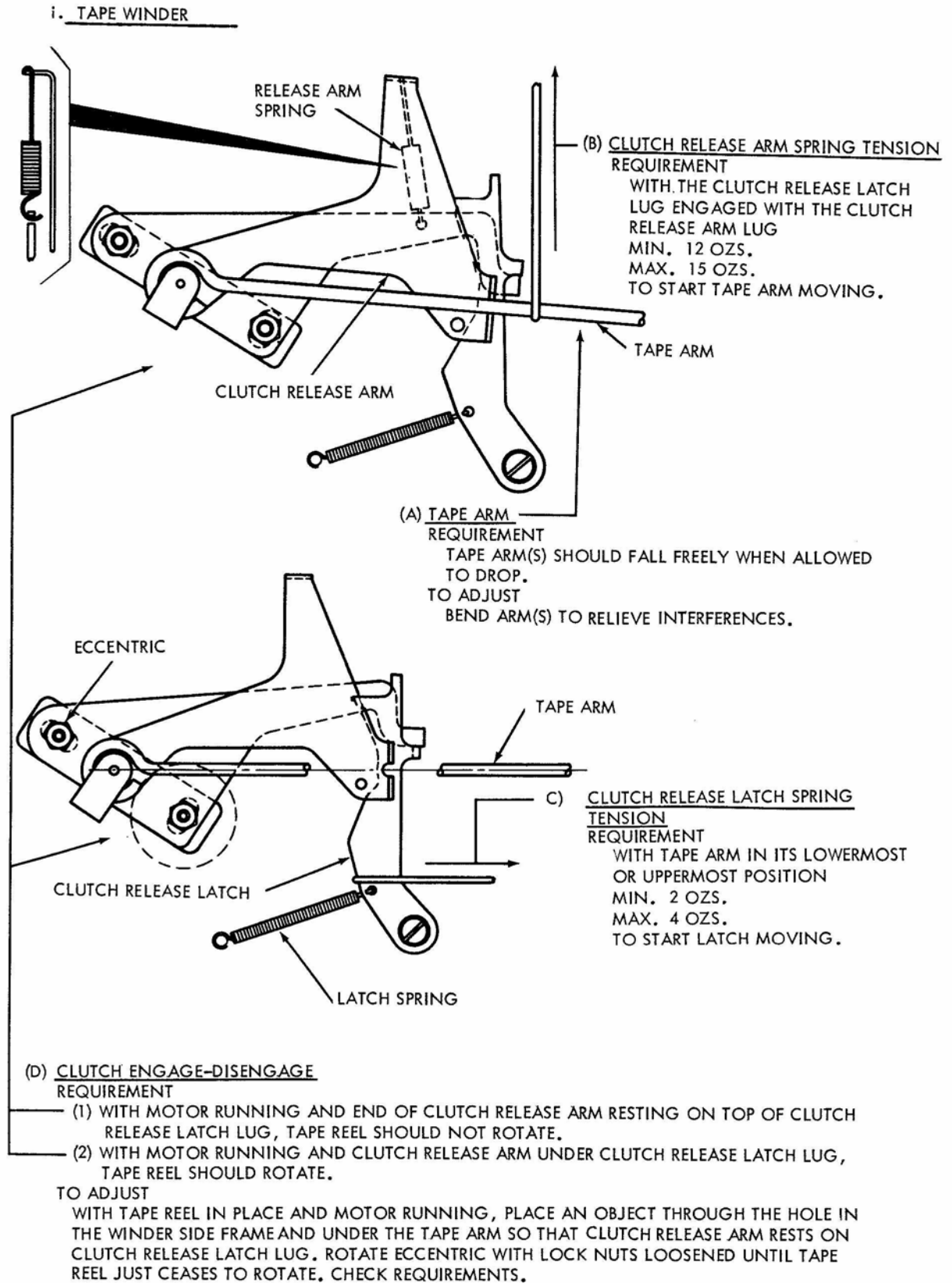
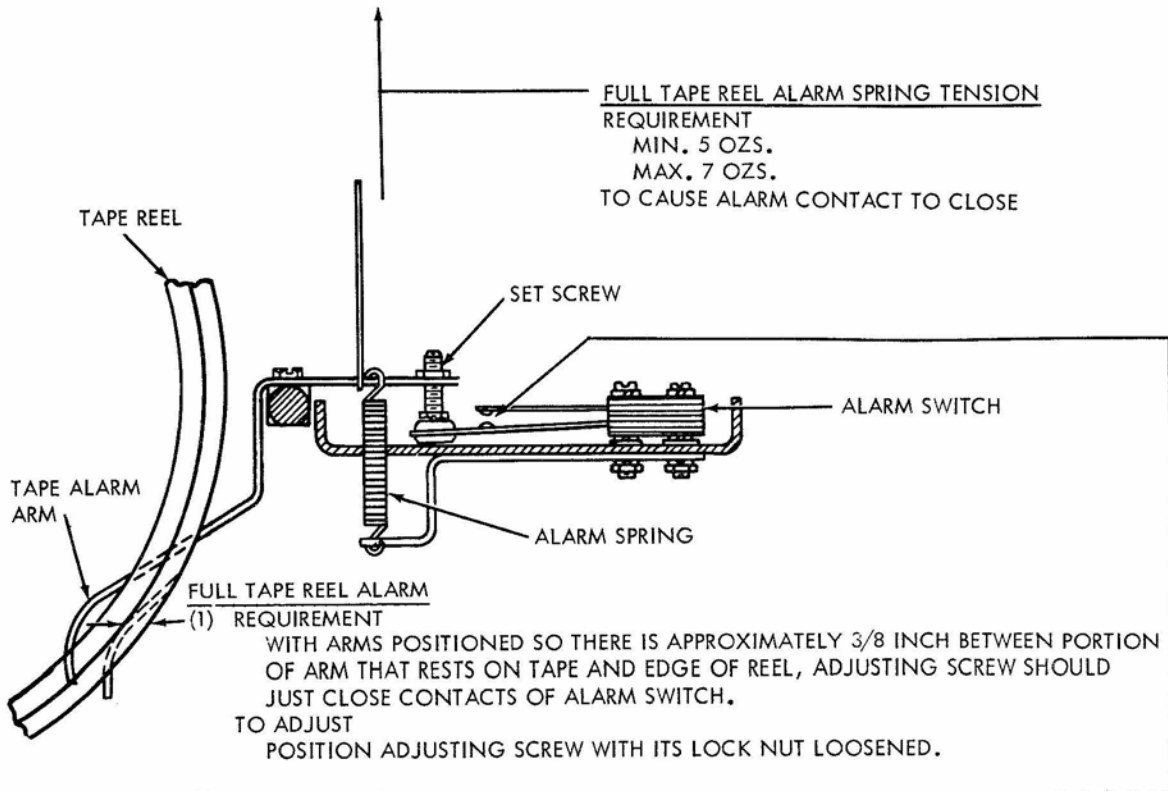


Figure 5-100. Tape Winder, Clutch Mechanism



- (2) REQUIREMENT  
WITH AN EMPTY REEL, THE SET SCREW SHOULD HOLD THE SWINGER AWAY FROM THE CONTACT WITH A MINIMUM CONTACT GAP OF .020 INCHES.  
TO ADJUST REFINE ADJUSTMENT 1.

NOTE  
THE CONTACT CLOSURE POINT CAN BE MODIFIED TO PROVIDE EITHER AN EARLIER OR LATER TAPE REEL ALARM INDICATION.

FULL TAPE REEL ALARM CONTACT PRESSURE REQUIREMENT  
WITH ADJUSTING SCREW HELD AWAY FROM CONTACT SWINGER  
MIN. 1 OZ.  
MAX. 3 OZS.  
TO SEPARATE CONTACTS.

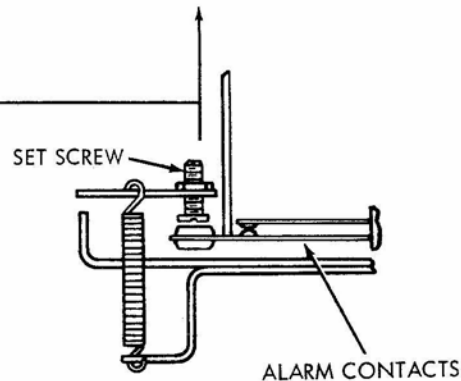
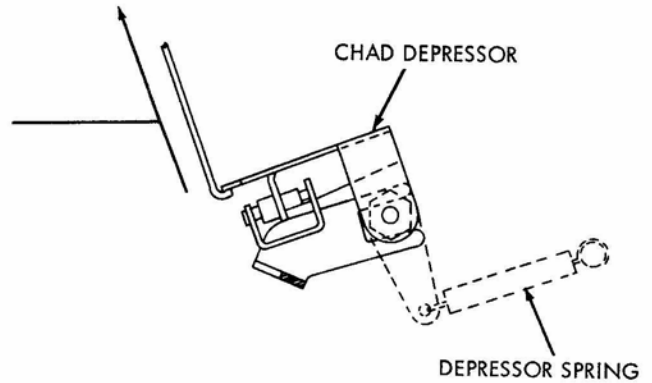


Figure 5-101. Tape Winder, Chad Depressor and Motor Pinion

CHAD DEPRESSOR SPRING TENSION  
REQUIREMENT  
 MIN. 7 OZS.  
 MAX. 9 OZS.  
 TO PULL THE DEPRESSOR AWAY FROM ITS  
 BACKSTOP.



MOTOR PINION  
REQUIREMENT  
 THERE SHOULD BE ONLY A BARELY PERCEPTIBLE AMOUNT OF BACKLASH  
 BETWEEN THE MOTOR PINION AND THE DRIVEN GEAR AT THE POINT WHERE  
 THE CLEARANCE IS THE LEAST.  
 TO ADJUST  
 WITH THE (4) MOUNTING SCREWS WHICH SECURE THE MOTOR MOUNTING  
 PLATE TO THE SIDE FRAME'S LOOSENED, POSITION THE PLATE TO MEET  
 REQUIREMENT.

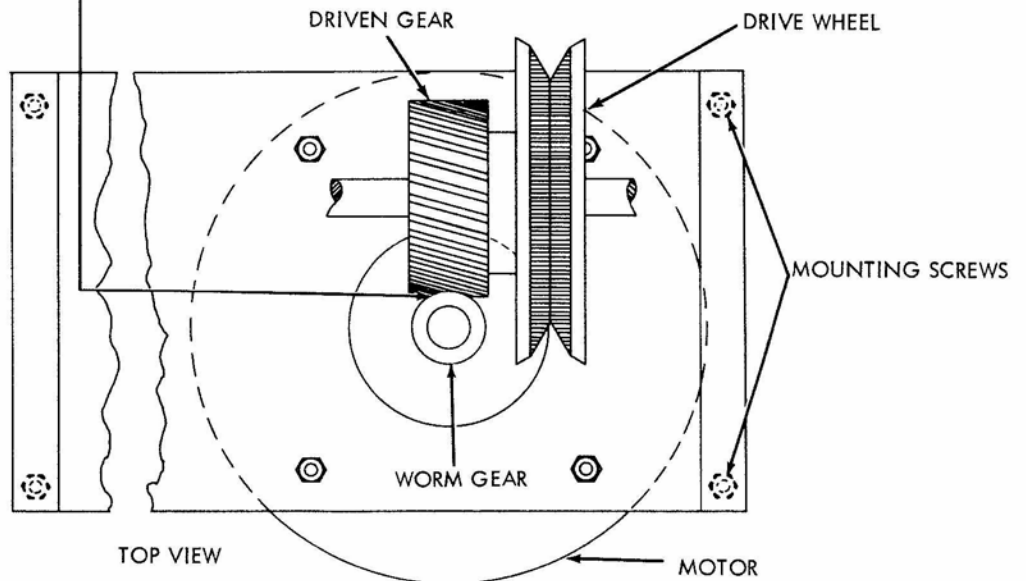


Figure 5-102. Tape Winder, Full Tape Alarm

j. RELAY (33RY)

CAUTION-----THE POSITION AND ALIGNMENT OF THE ARMATURE ASSEMBLY SHOULD NOT BE DISTURBED

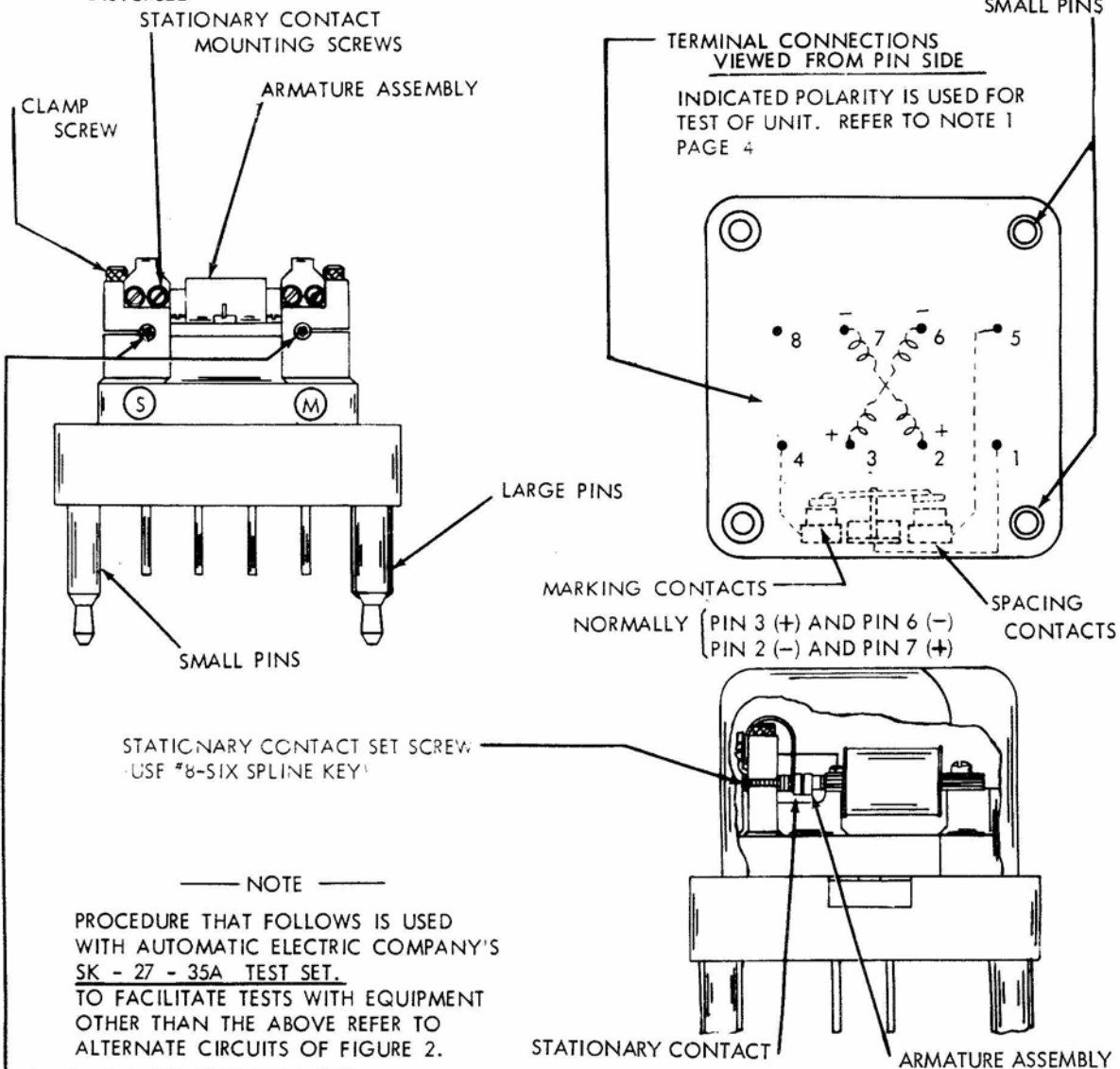
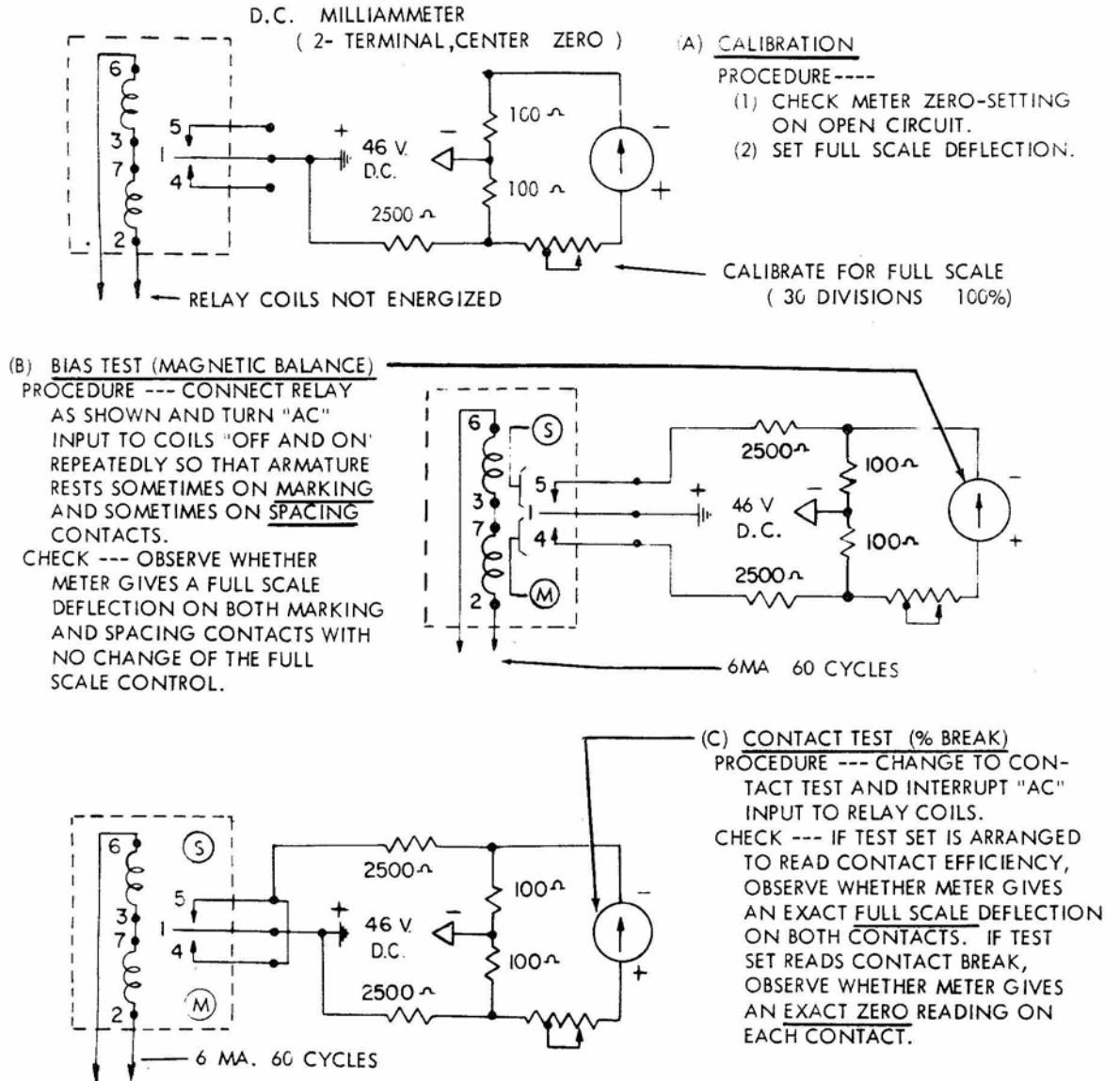


Figure 5-103. Relay, Contact Adjustments



NOTE 1 ---IF MAGNET COILS ARE ENERGIZED WITH A POLARITY AS SHOWN IN FIGURE 1, THE RELAY SHOULD CLOSE ITS #1 & #4 CONTACTS.

THE FOLLOWING PROCEDURE IS RECOMMENDED BEFORE USING ANY TEST SET TO DETERMINE WHETHER THE SET IS SUITABLE TO CHECK TUNGSTEN-CARBIDE CONTACTS.



#### EVALUATION OF A PARTICULAR TEST SET

REPEAT (B) AND (C) WITH TWO MORE RELAYS (33RY). IF METER READS AN EXACT FULL SCALE OR ZERO WHEN THE A.C. IS TURNED OFF, THE TEST SET IS SUITABLE FOR TUNGSTEN-CARBIDE CONTACTS. A FAILURE OF ONE RELAY MAY BE CAUSED BY A DIRTY CONTACT. FAILURE OF SEVERAL CONTACTS IS A GOOD INDICATION THAT THE TEST SET IS NOT SUITABLE FOR TUNGSTEN-CARBIDE CONTACTS.

Figure 5-104. Relay Test Circuits

k. UNIVERSAL CABINETS

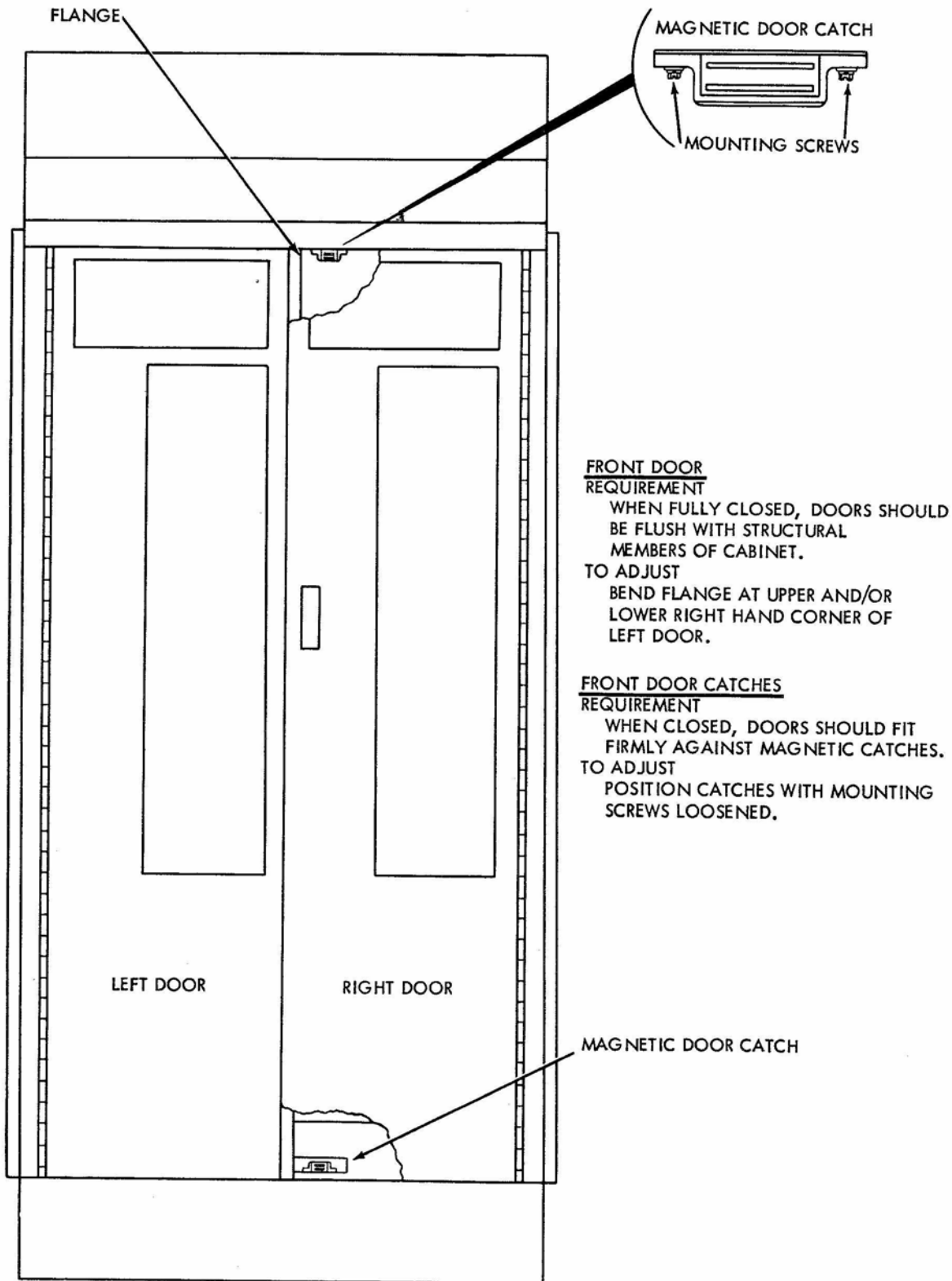


Figure 5-105. Universal Cabinet, Front Doors and Magnetic Door Catches

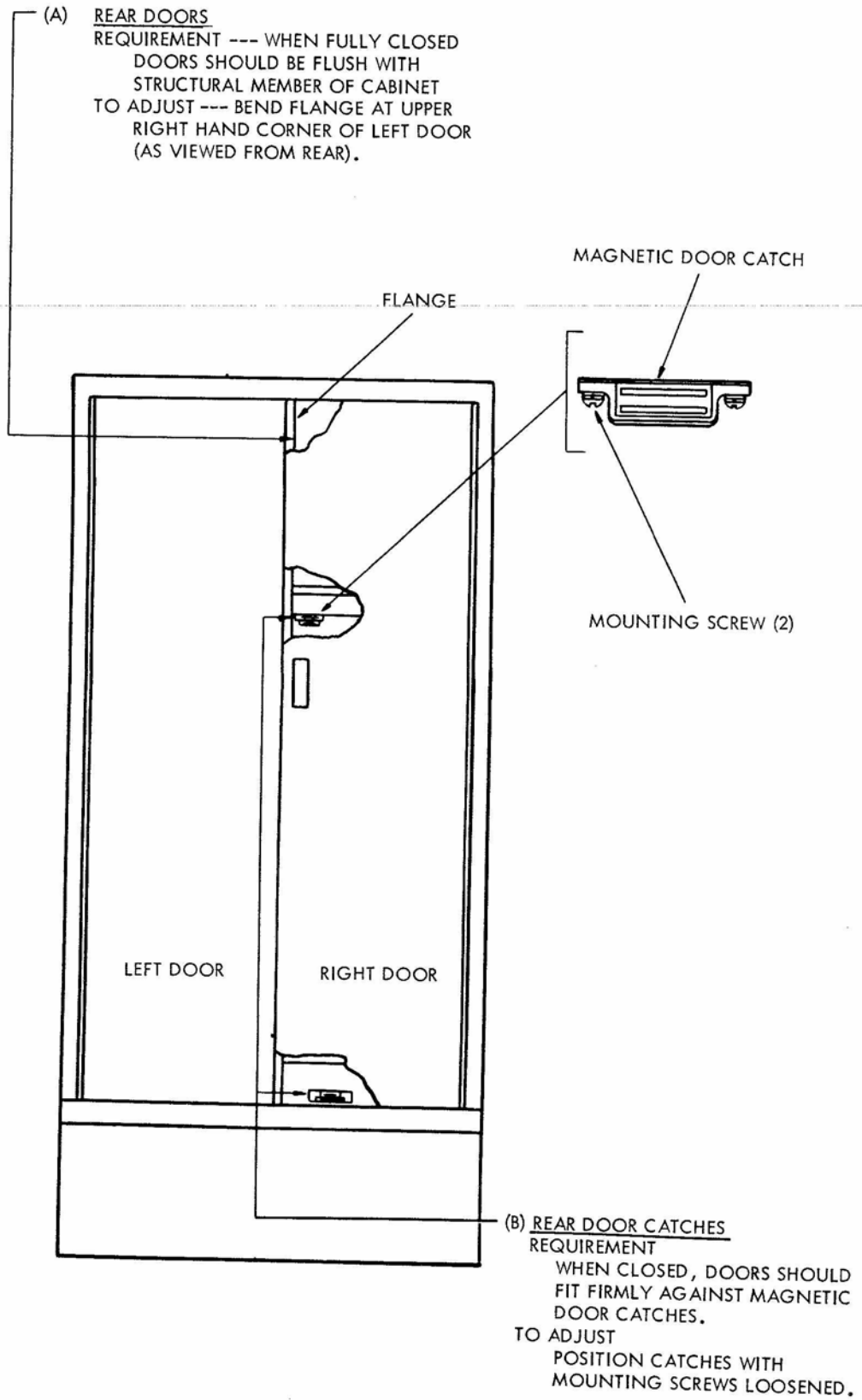
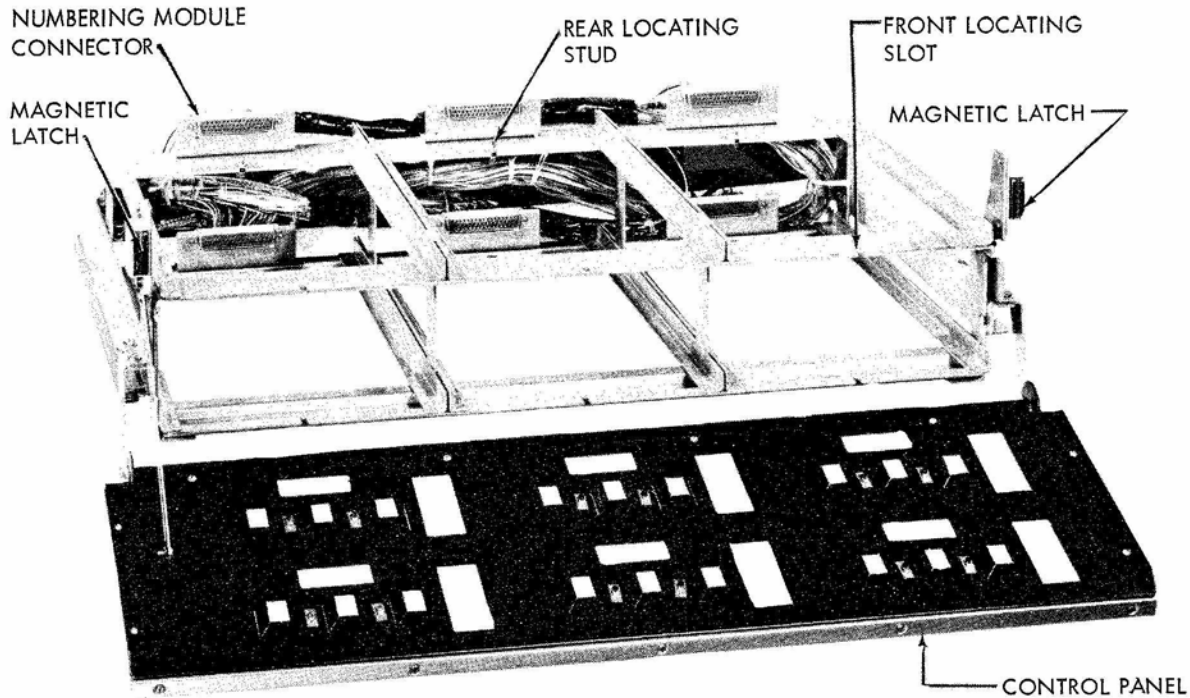


Figure 5-106. Universal Cabinet, Rear Doors and Magnetic Door Catches

**(A) NUMBERING MODULE ADJUSTMENT****(1) REQUIREMENT**

EACH MODULE CENTERED ON ITS TRACK

**(2) REQUIREMENT**

CONNECTOR PLUG ON EACH MODULE ENGAGES ITS ASSOCIATED RECEPTACLE TO PERMIT QUICK CONNECT-DISCONNECT WITH LEAST INTERFERENCE.

**TO ADJUST**

- (1) REMOVE DRAWER ASSEMBLY FROM CABINET. LOOSEN SHOULDER SCREW THAT GUIDES MODULE AT REAR OF DRAWER. LOOSEN SCREWS THAT MOUNT THE CONNECTOR RECEPTACLE, AND THE SCREWS THAT SECURE THE CONNECTOR BRACKET TO THE DRAWER. MOVE BRACKET TO REAR MOST POSITION. INSERT AND CENTER MODULE. MAKE FRONT EDGE OF MODULE PARALLEL AND FLUSH WITH FRONT EDGE OF DRAWER CHANNEL. REMOVE MODULE AND TIGHTEN SHOULDER SCREW. CHECK AND REFINE.
- (2) WITH MODULE REINSERTED AND SECURED, POSITION CONNECTOR BRACKET AND CONNECTOR SO RECEPTACLE FULLY ENGAGES PLUG. TIGHTEN BRACKET SCREWS AND THEN RECEPTACLE MOUNTING SCREWS.

**(B) CONTROL PANEL ASSEMBLY****REQUIREMENT**

CONTROL PANEL ON DRAWER ASSEMBLY POSITIONED SO NUMERALS ON MODULES ARE CENTRALLY LOCATED WITH RESPECT TO CONTROL PANEL WINDOWS.

**TO ADJUST**

- (1) POSITION PANEL HORIZONTALLY WITH RIGHT AND LEFT BRACKET MOUNTING SCREWS LOOSENED.
- (2) POSITION PANEL VERTICALLY WITH MAGNET BRACKET EXTENSION SHOULDER SCREW LOOSENED.

**(C) CONTROL PANEL MAGNET ADJUSTMENT****REQUIREMENT**

WHEN CLOSED, CONTROL PANEL EDGES SHOULD BE PARALLEL TO CABINET UPRIGHTS.

**TO ADJUST**

POSITION MAGNET LATCH ASSEMBLY WITH MOUNTING SCREWS LOOSENED.

Figure 5-107. Universal Cabinet, Control Panel Assembly

I. TANDEM MESSAGE IDENTIFICATION MODULE

## (A) CODE READING CONTACT ASSEMBLY ADJUSTMENT

## NOTE

FOLLOWING ADJUSTMENTS TO BE MADE WITH CONTACT ASSEMBLIES REMOVED FROM MODULE. WHEN USING CONTACT SPRING BENDER, START WITH THE CONTACT PILE-UP FARTHEST FROM HANDLE OF TOOL AND WORK TOWARD CONTACT NEAREST TOOL HANDLE.

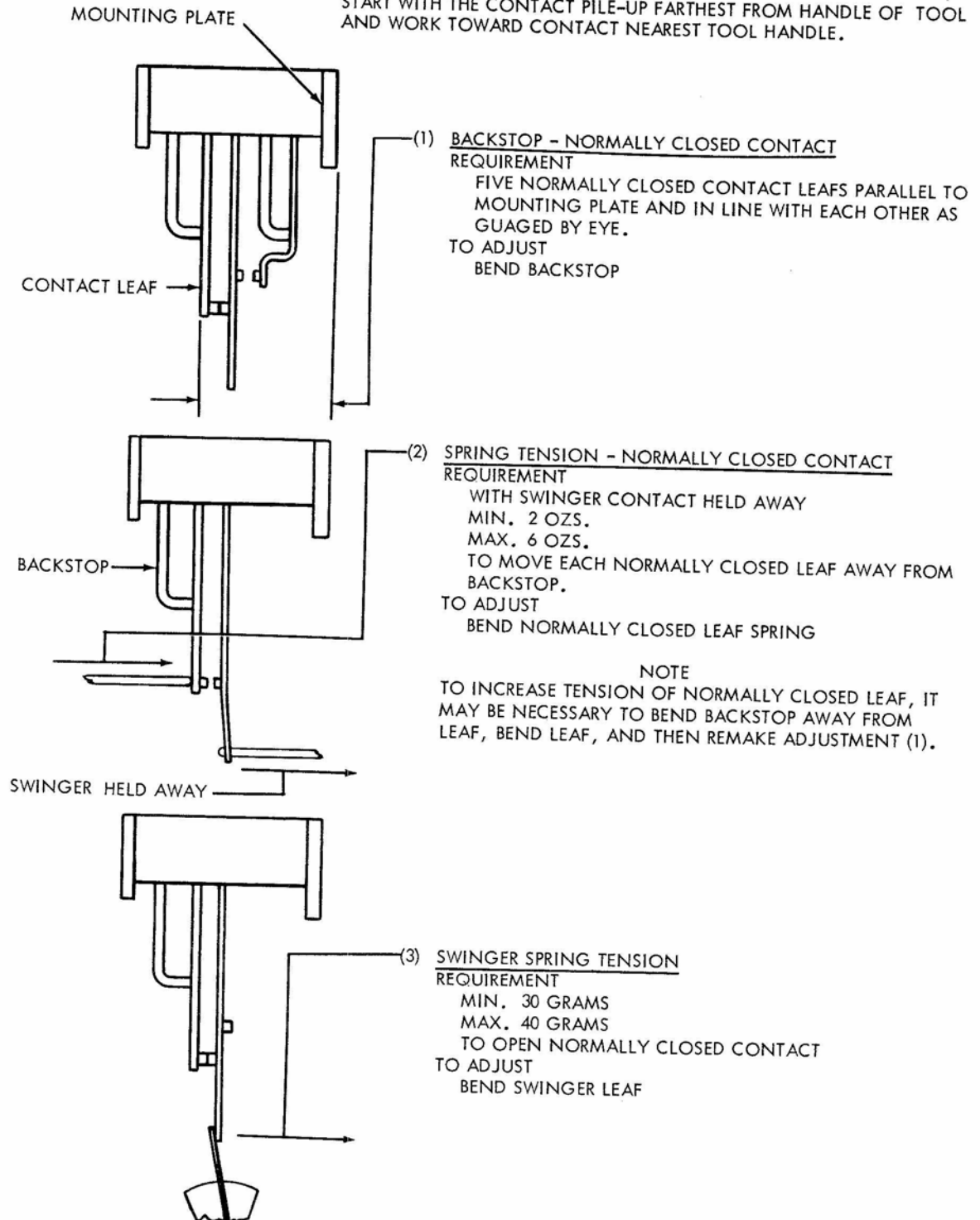
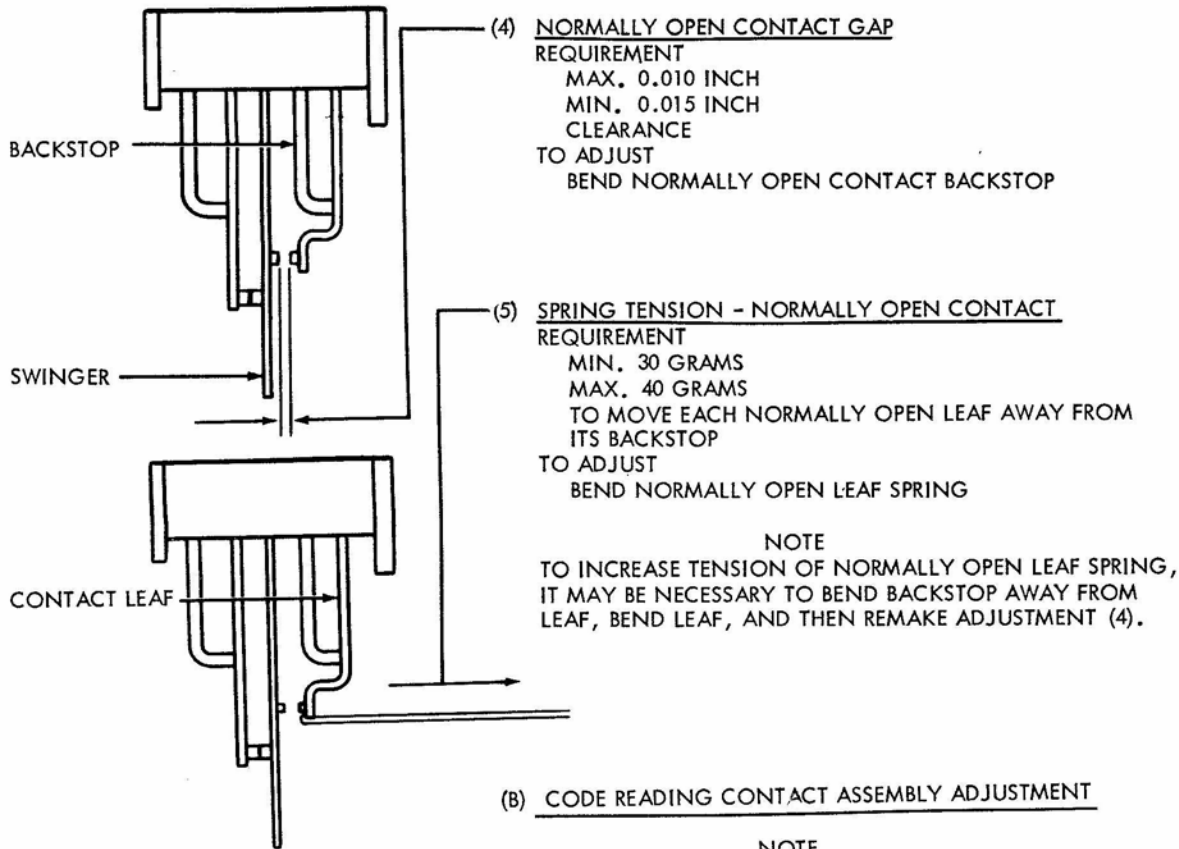


Figure 5-108. Tandem Message Identification Module, Code Reading Contact Assembly



NOTE  
 FOLLOWING ADJUSTMENTS TO BE MADE WITH CONTACT ASSEMBLIES  
 MOUNTED ON THEIR BRACKETS, AND PLACED IN THE NUMBERING  
 MODULE. BRACKET SHOULD BE APPROXIMATELY CENTERED IN ITS  
 ADJUSTMENT RANGE.

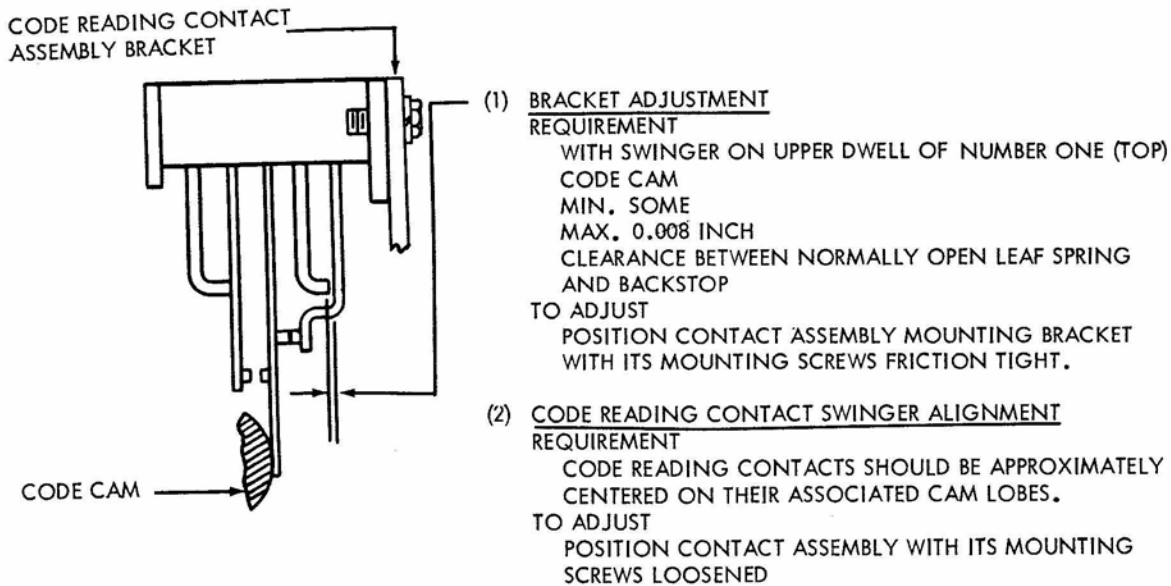


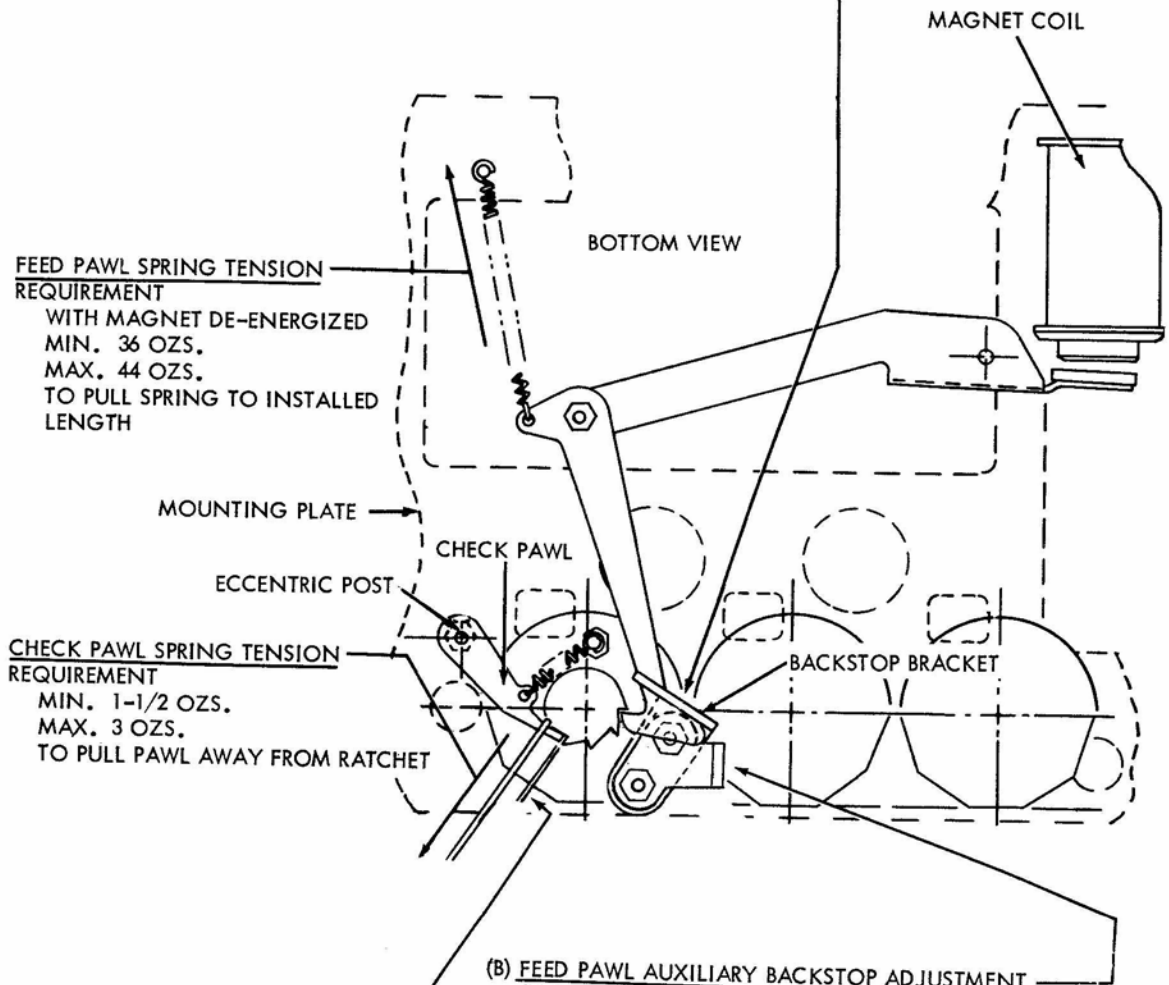
Figure 5-109. Tandem Message Identification Module, Code Reading Contact Assembly

**(A) FEED PAWL BACKSTOP ADJUSTMENT****REQUIREMENT**

FLAT OF THE UNITS NUMBER DRUM TO BE PARALLEL TO FRONT EDGE OF TOP PLATE AS GAUGED BY EYE.

**TO ADJUST**

- (1) LOOSEN SCREW SECURING CHECK PAWL ECCENTRIC POST SO THAT CLEARANCE BETWEEN CHECK PAWL AND RATCHET TOOTH IS MAXIMUM.
- (2) LOOSEN SCREWS SECURING BACKSTOP BRACKET TO ASSEMBLY MOUNTING PLATE. WITH MAGNET DE-ENERGIZED, ADJUST BRACKET TO MEET REQUIREMENT.

**FEED PAWL SPRING TENSION**

**REQUIREMENT**  
WITH MAGNET DE-ENERGIZED  
MIN. 36 OZS.  
MAX. 44 OZS.  
TO PULL SPRING TO INSTALLED LENGTH

**CHECK PAWL SPRING TENSION**  
**REQUIREMENT**  
MIN. 1-1/2 OZS.  
MAX. 3 OZS.  
TO PULL PAWL AWAY FROM RATCHET

**(B) FEED PAWL AUXILIARY BACKSTOP ADJUSTMENT****(1) REQUIREMENT**

CLEARANCE BETWEEN FEED PAWL AND AUXILIARY STOP BRACKET TO BE  
MIN. 0.020 INCH  
MAX. 0.025 INCH  
WHEN FEED PAWL IS AGAINST RATCHET TOOTH ALLOWING LEAST CLEARANCE.

- (2) WHEN MANUALLY OPERATED, FEED PAWL SHOULD NOT TOUCH AUXILIARY BACKSTOP

**TO ADJUST**

POSITION THE AUXILIARY BACKSTOP WITH ITS MOUNTING SCREWS LOOSENED.

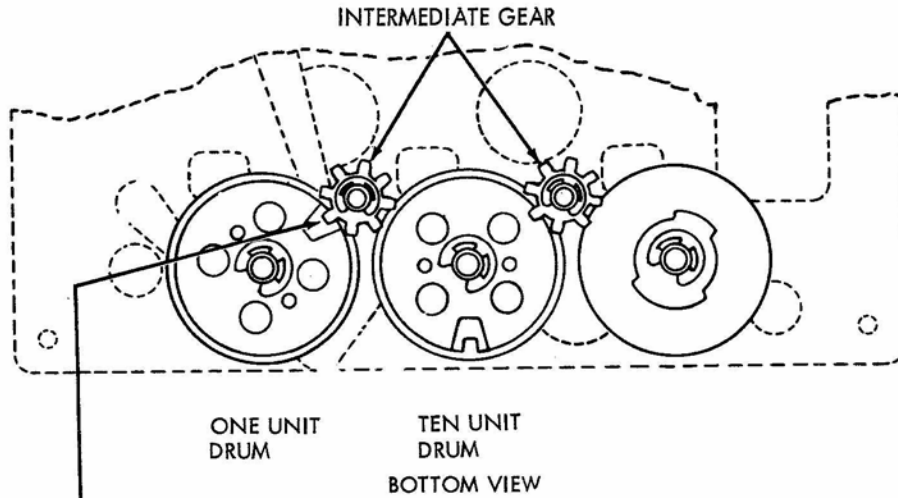
**(C) CHECK PAWL ADJUSTMENT****REQUIREMENT**

CLEARANCE BETWEEN END OF CHECK PAWL AND RATCHET TOOTH TO BE  
MIN. SOME  
MAX. 0.010 INCH  
WHEN PLAY IN RATCHET IS TAKEN UP TO MAKE CLEARANCE LEAST.

**TO ADJUST**

POSITION CHECK PAWL ECCENTRIC POST. CHECK AT SEVERAL PLACES AROUND RATCHET.

Figure 5-110. Tandem Message Identification Module, Feed and Check Pawls



INTERMEDIATE GEAR ADJUSTMENT

(1) REQUIREMENT

BARELY PERCEPTIBLE BACKLASH BETWEEN INTERMEDIATE GEAR TOOTH AND DISK ASSEMBLY TOOTH WHEN DISK IS HELD IN MIDDLE OF STEP. CHECK "UNIT" AND "TEN" DRUMS.

(2) REQUIREMENT

BARELY PERCEPTIBLE BACKLASH BETWEEN SPUR GEAR AND 20 TEETH GEAR AT POSITION OF MINIMUM CLEARANCE.

TO ADJUST POSITION SPUR GEAR WITH ITS MOUNTING NUT LOOSENED.

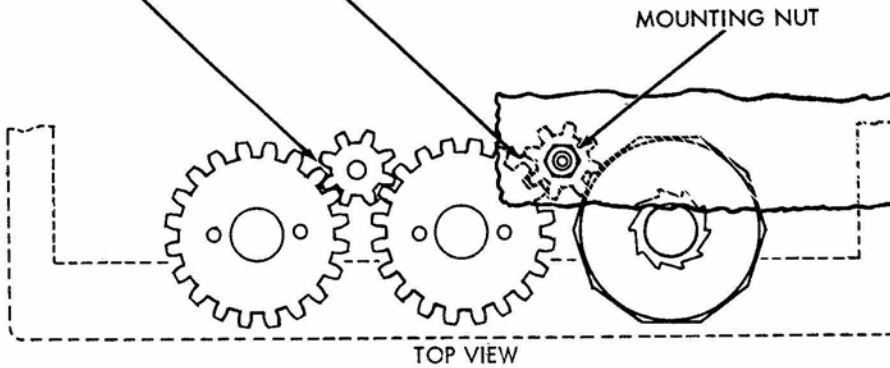


Figure 5-111. Tandem Message Identification Module, Intermediate Gear



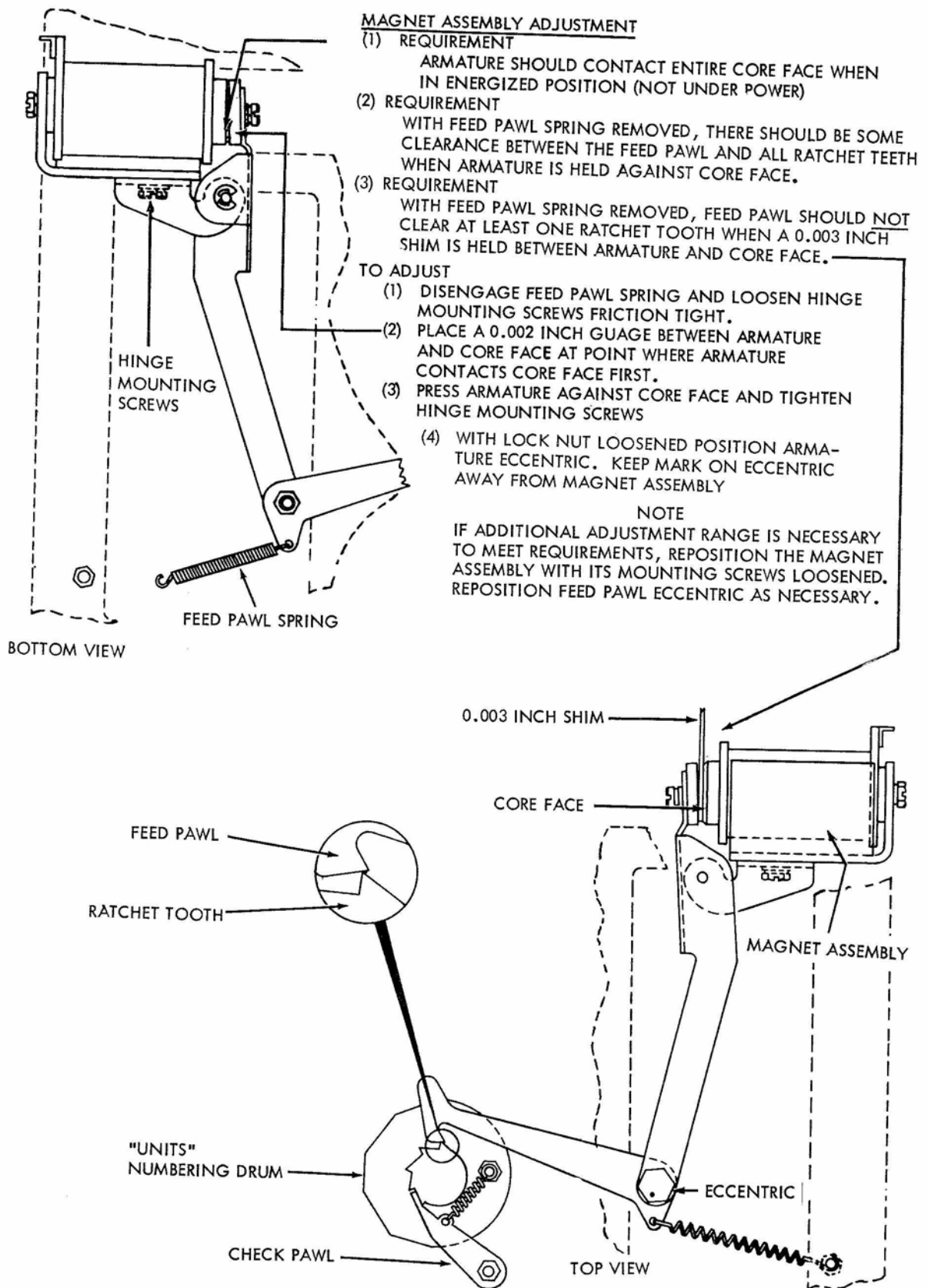


Figure 5-112. Tandem Message Identification Module, Magnet Assembly

NOTE  
ADJUSTMENTS ON THE RELAYS AND THE STEPPING SWITCH WILL NOT BE REQUIRED UNDER NORMAL CONDITIONS. IN EMERGENCY CASES, WHEN A REPLACEMENT IS NOT AVAILABLE OR DURING A MAJOR OVERHAUL, ADJUSTMENTS SHOULD BE MADE ONLY BY QUALIFIED PERSONNEL.

BRUSH SPRING TENSION

(1) REQUIREMENT

BRUSH SPRINGS SHOULD REST AGAINST THE INNER HUB OF WIPER CONTACTS WITH ENOUGH TENSION TO INSURE GOOD ELECTRICAL CONTACT.

NOTE

UNDER NORMAL CONDITIONS THE BRUSH SPRINGS WILL NOT REQUIRE ADJUSTMENT DURING THE LIFE OF THE SWITCH. IF ADJUSTMENT IS NECESSARY, PROCEED AS FOLLOWS:

(2) REQUIREMENT

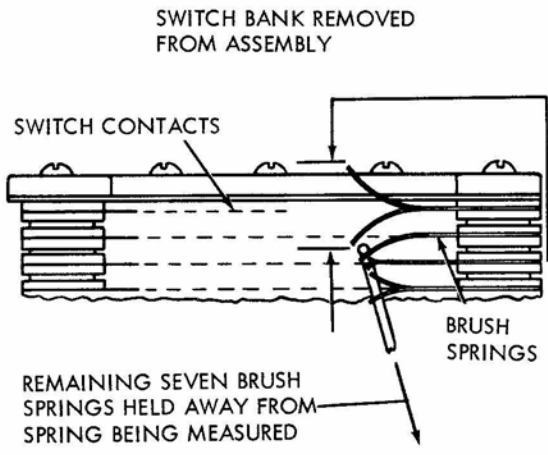
WITH SWITCH ASSEMBLY REMOVED FROM BANK, TENSION AND CURVE BRUSH SPRINGS TO OBTAIN A MINIMUM 1/2 INCH SEPARATION OF THE ENDS.

TO ADJUST

LOOSEN TWO BANK MOUNTING SCREWS AND REMOVE SWITCH ASSEMBLY. BEND BRUSH SPRINGS AS REQUIRED. REPLACE SWITCH ASSEMBLY.

CAUTION

USE EXTREME CARE WHEN REASSEMBLING THE SWITCH TO AVOID DAMAGE TO THE BRUSHES AND WIPERS.



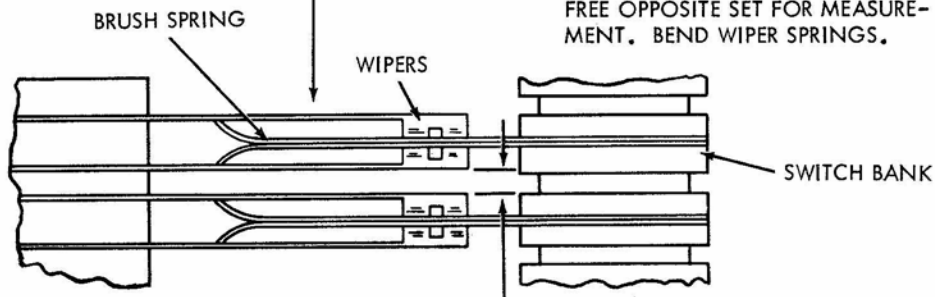
WIPER SPRING ALIGNMENT AND TENSION

(1) REQUIREMENT

WIPERS SHOULD HAVE SUFFICIENT TENSION TO INSURE GOOD ELECTRICAL CONTACT WITH SWITCH BANK CONTACTS.  
TO ADJUST  
BEND WIPER SPRINGS

(2) REQUIREMENT

EACH SPRING OF A WIPER PAIR SHOULD HAVE SUFFICIENT TENSION TO FOLLOW ITS OPPOSING SPRING 0.094 INCH WHEN ITS OPPOSING SPRING IS DEFLECTED.  
TO ADJUST  
POSITION ONE SET OF WIPERS ON FIFTH SWITCH CONTACTS TO FREE OPPOSITE SET FOR MEASUREMENT. BEND WIPER SPRINGS.



(3) REQUIREMENT

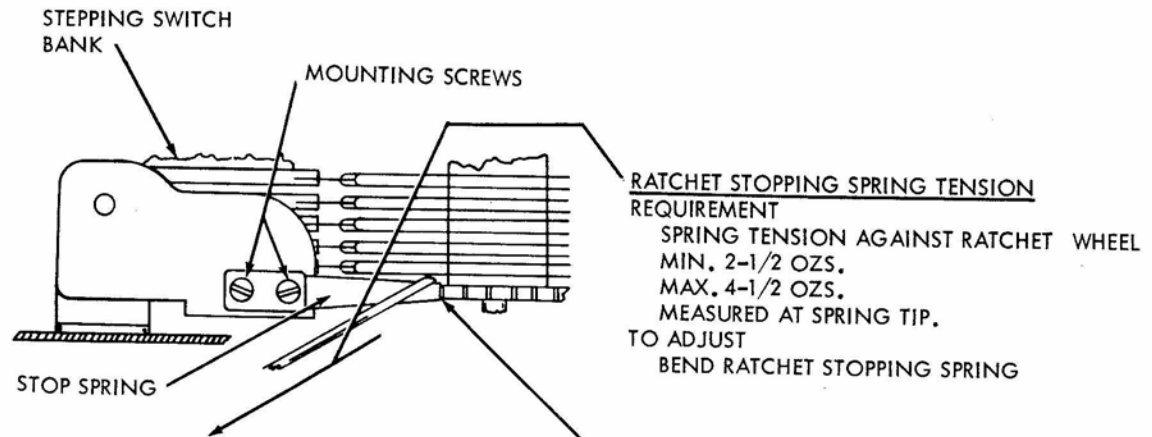
ALIGN WIPER PAIRS SO THEY PASS ONTO BASE OF BRUSH SPRINGS WITHOUT EXCESSIVE MOVEMENT (0.015 INCH) TO ONE SIDE OR THE OTHER.

(4) REQUIREMENT

CLEARANCE BETWEEN WIPER SPRINGS OF ADJACENT WIPER PAIRS  
MINIMUM 0.062 INCH  
WITH WIPERS RESTING ON BANK CONTACTS  
TO ADJUST  
BEND WIPER SPRINGS

VIEWED FROM RIGHT SIDE OF MODULE

Figure 5-113. Tandem Message Identification Module, Stepping Switch Assembly



**RATCHET STOPPING SPRING ALIGNMENT REQUIREMENT**

WITH PLAY BETWEEN FEED PAWL AND RATCHET WHEEL TAKEN UP IN CLOCKWISE DIRECTION  
 MIN. SOME  
 MAX. 0.003 INCH  
 CLEARANCE BETWEEN SPRING TIP AND RADIAL SURFACE OF RATCHET TOOTH.  
 TO ADJUST  
 POSITION SPRING WITH MOUNTING SCREWS LOOSENED.

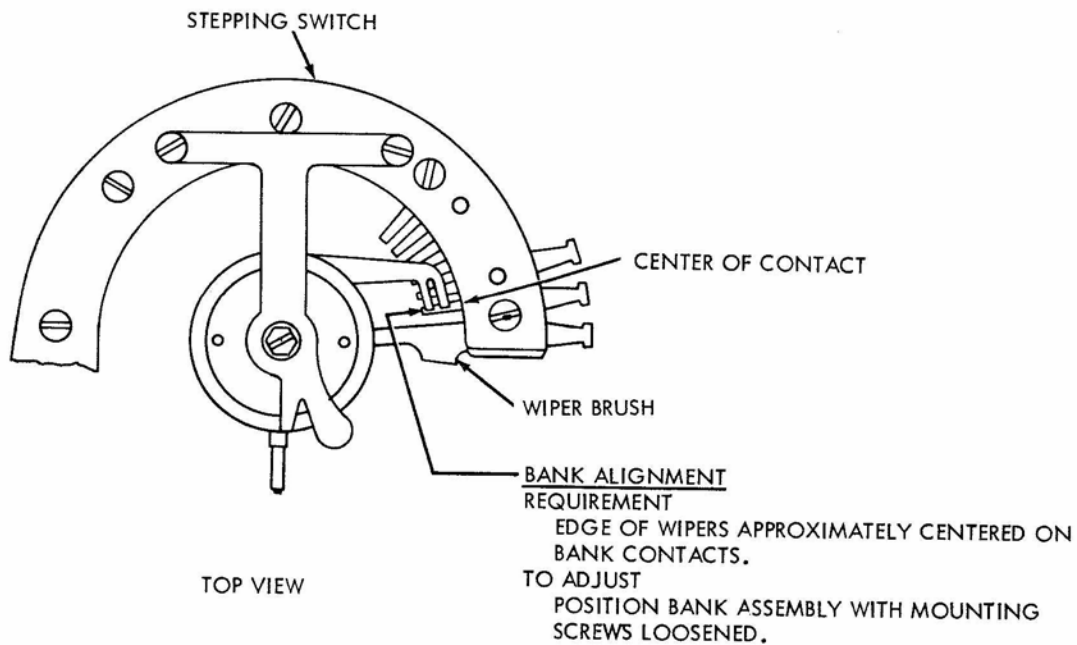
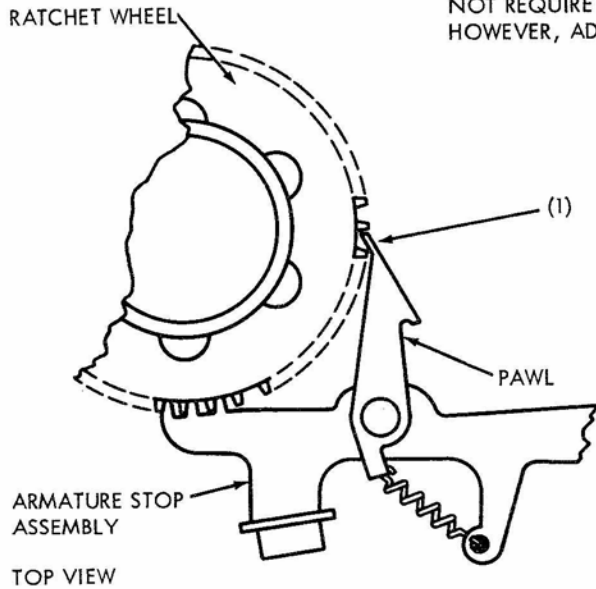


Figure 5-114. Tandem Message Identification Module, Stepping Switch Assembly

(A) ARMATURE ASSEMBLY ALIGNMENT

NOTE

UNDER NORMAL CONDITIONS THE ARMATURE ASSEMBLY SHOULD NOT REQUIRE ADJUSTMENT DURING THE LIFE OF THE SWITCH. IF, HOWEVER, ADJUSTMENT IS NECESSARY PROCEED AS FOLLOWS:



(1) REQUIREMENT  
 EDGES OF FEED PAWL SHOULD BE PARALLEL TO RATCHET WHEEL SIDE AND TOP OF FEED PAWL SHOULD BE PARALLEL TO EDGE OF RATCHET TEETH. GAUGE BY EYE.

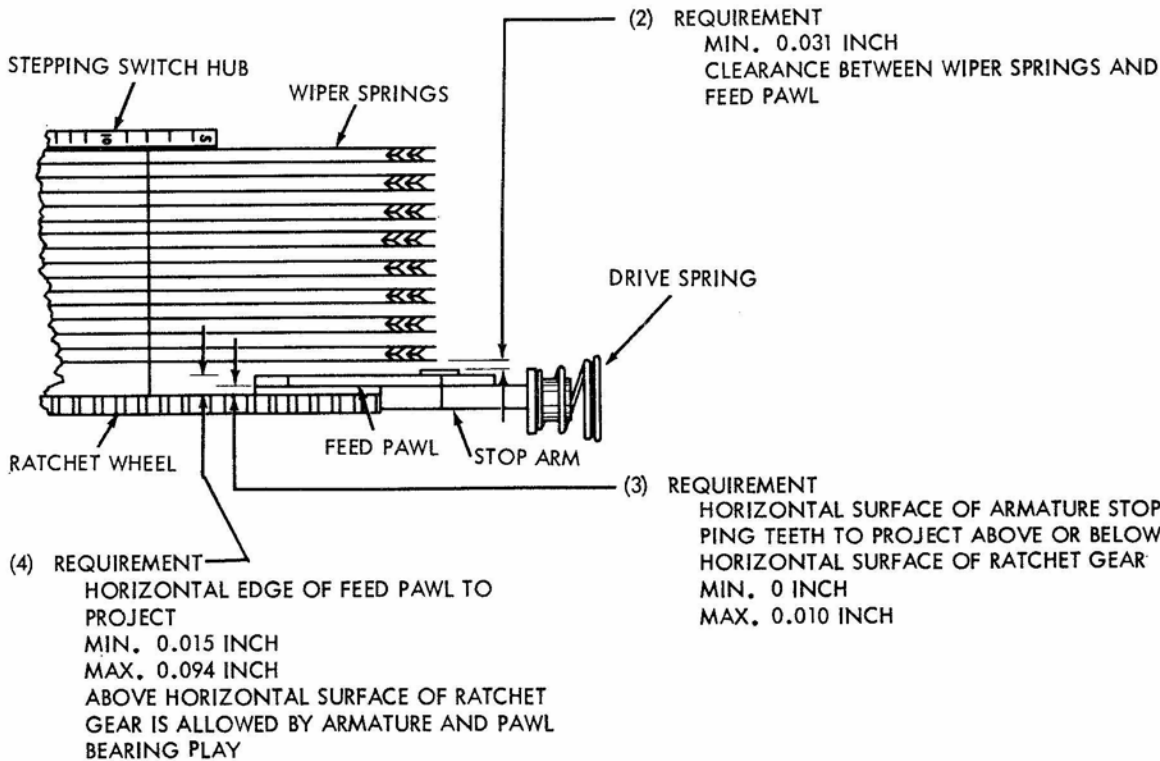


Figure 5-115. Tandem Message Identification Module, Stepping Switch Assembly

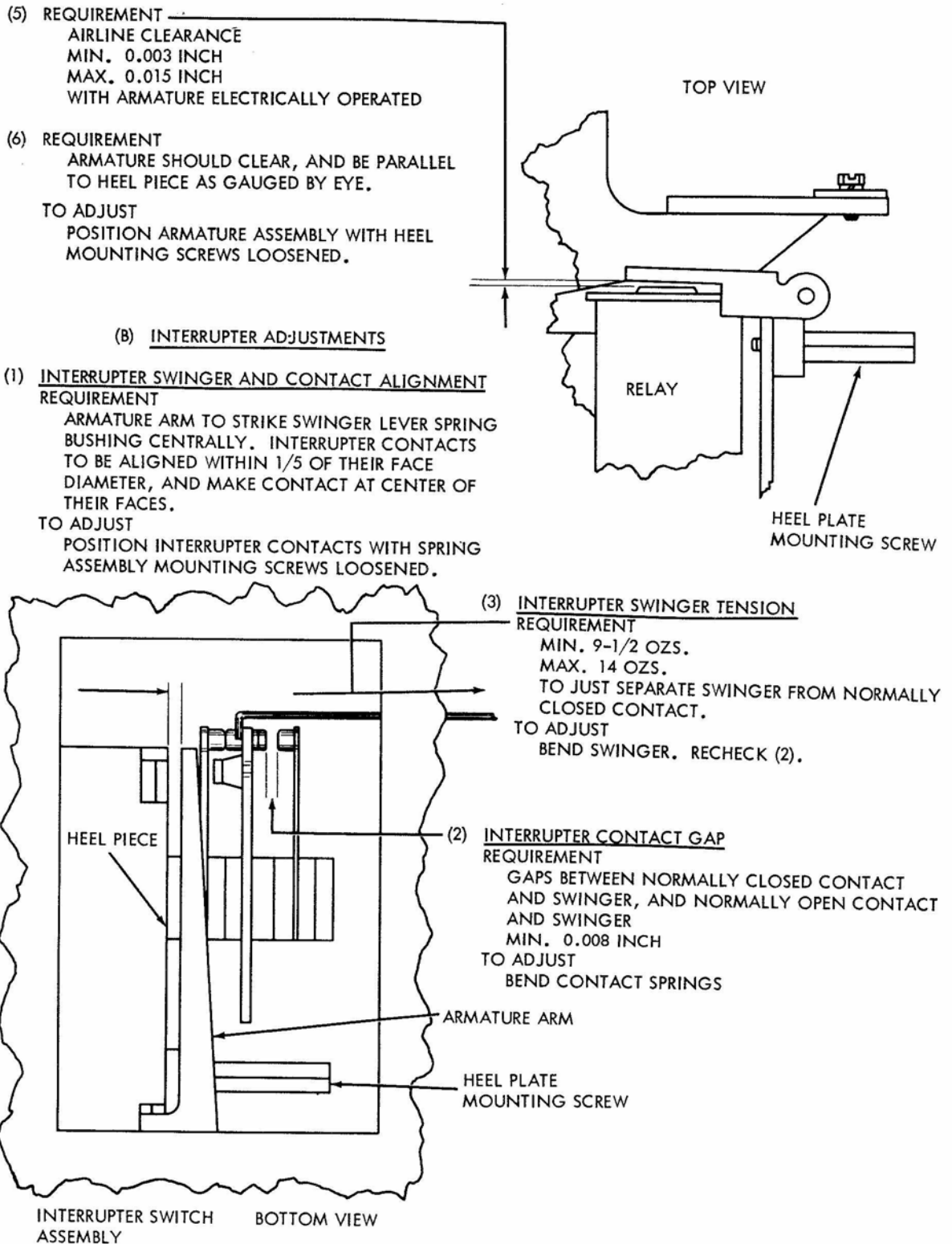


Figure 5-116. Tandem Message Identification Module, Stepping Switch Assembly

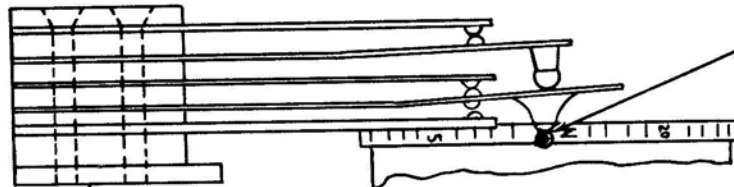
(A) OFF-NORMAL SWINGER ALIGNMENT

(1) REQUIREMENT

APEX OF "V" FORM ON LOWER SWINGER APPROXIMATELY CENTERED ON OFF-NORMAL ARM ACTUATING BUSHING WHEN SWITCH IS ON 26TH STEP.

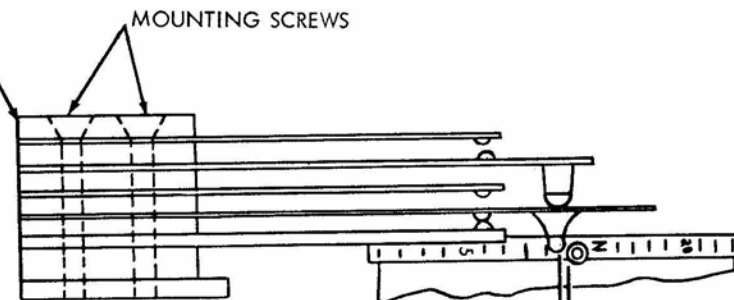
(2) REQUIREMENT

EITHER EDGE OF "V" FORM MIN. 1/32 INCH FROM EDGES OF ACTUATING BUSHING



HOME POSITION (26TH STEP)

OFF-NORMAL CONTACT ASSEMBLY



1ST POSITION

(3) REQUIREMENT

CLEARANCE BETWEEN "V" FORM AND ACTUATING BUSHING MIN. 0.010 INCH WHEN SWITCH IS ON 25TH OR 1ST STEP AND WIPER ASSEMBLY PLAY IS TAKEN UP IN THE CLOCKWISE DIRECTION.

TO ADJUST

POSITION OFF-NORMAL SWITCH ASSEMBLY WITH MOUNTING SCREWS LOOSENED.

Figure 5-117. Tandem Message Identification Module, Stepping Switch Assembly

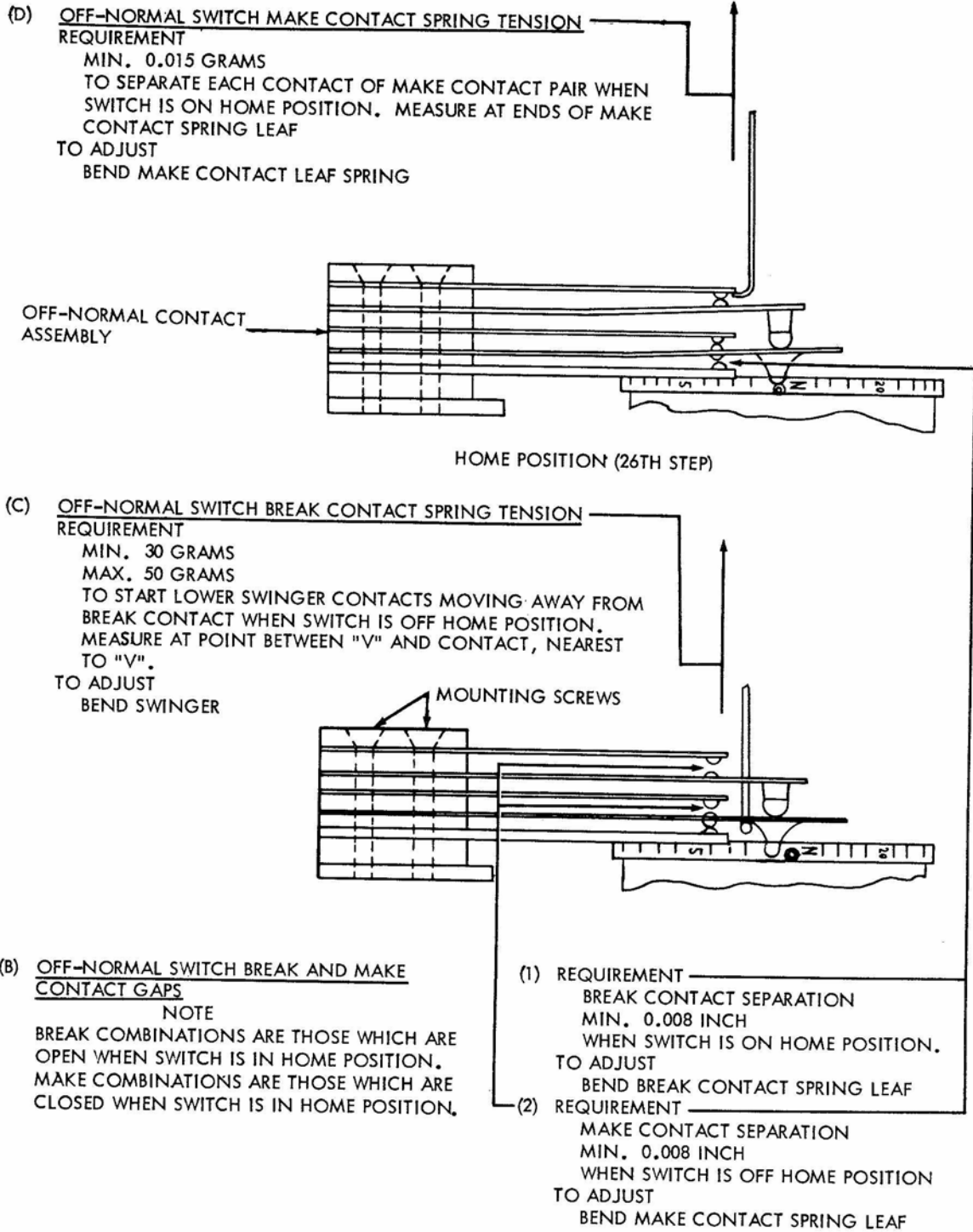


Figure 5-118. Tandem Message Identification Module, Stepping Switch Assembly

5-3. LUBRICATION

a. GENERAL

(1) This section provides lubrication information for the Model 28 Teletype equipment contained in this manual. On the following pages the general areas of the equipment are shown by photographs. The specific points to receive lubricant are indicated by line drawings and descriptive text. The symbols in the text indicate the following directions:

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

Teletype KS7470 oil and KS7471 grease should be used.

(2) The equipment should be thoroughly lubricated, but over-lubrication which might allow oil to drop or grease to be thrown on other parts should be avoided. Special care

should be exercised to prevent lubricant from getting between armatures and pole faces or between electrical contact points. The following general instructions supplement the specific lubricating points illustrated on subsequent pages:

- Apply one drop of oil to all springs hooks.
- Apply a light film of oil to all cam surfaces.
- Apply a thick coat of grease to all gears.
- Saturate all felt washers, oilers, etc.
- Apply oil to all pivot points.
- Apply oil to all sliding surfaces.

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

<u>Operating Speed</u>	<u>Lubrication Interval</u>
60 WPM	3000 hours or 1 year*
100 WPM	1500 hours or 6 months*

\* Whichever occurs first.



b. TYPING REPERFORATORS

NOTE

FOLLOWING LUBRICATION INSTRUCTIONS PERTAIN TO ALL TYPING REPERFORATORS UNLESS OTHERWISE SPECIFIED.

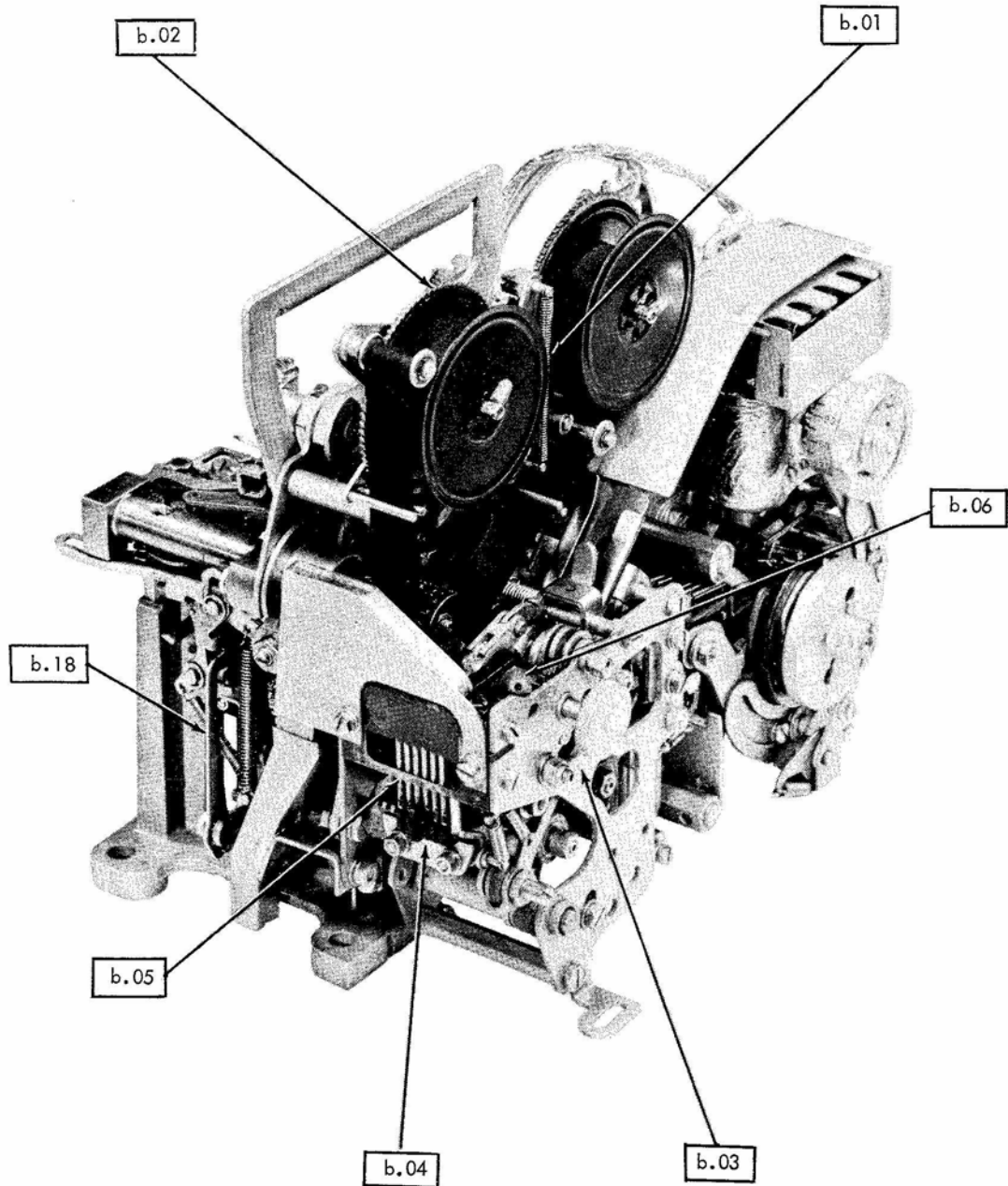


Figure 5-119. Typing Reperforators

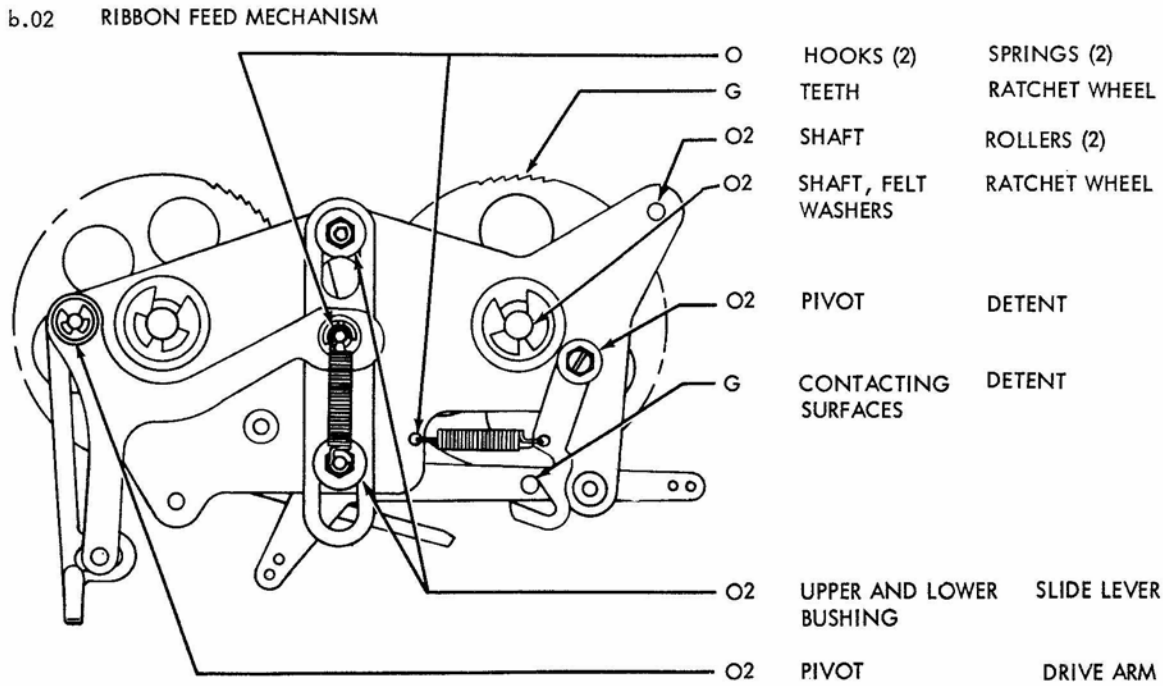
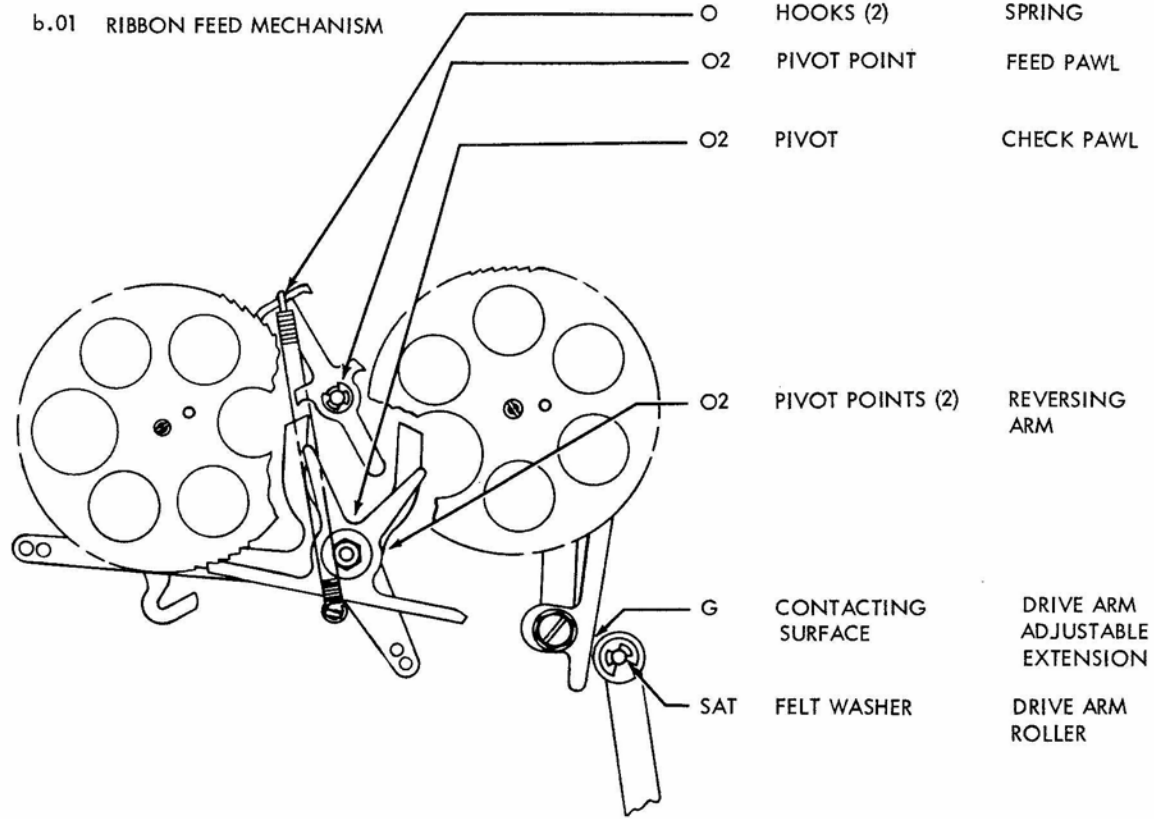
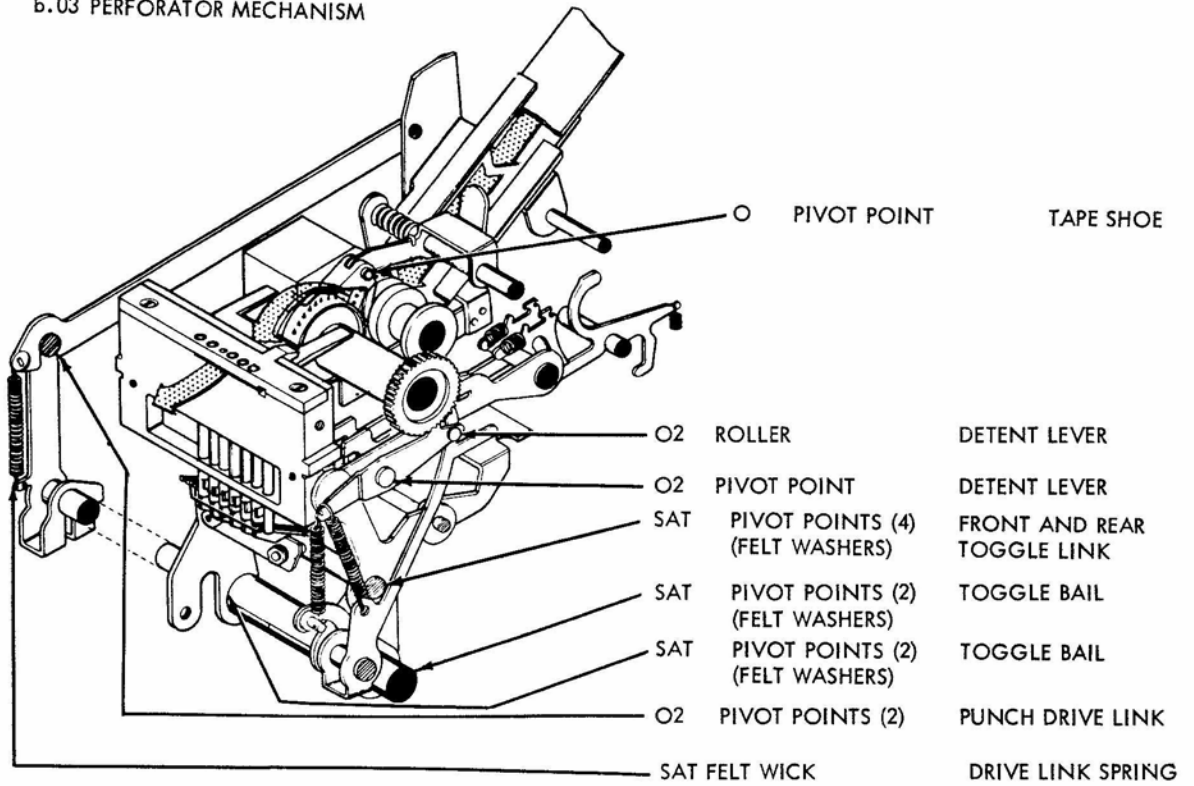


Figure 5-120. Typing Reperforators, (Fully Perforated Tape)

b.03 PERFORATOR MECHANISM



b.04 PERFORATOR MECHANISM

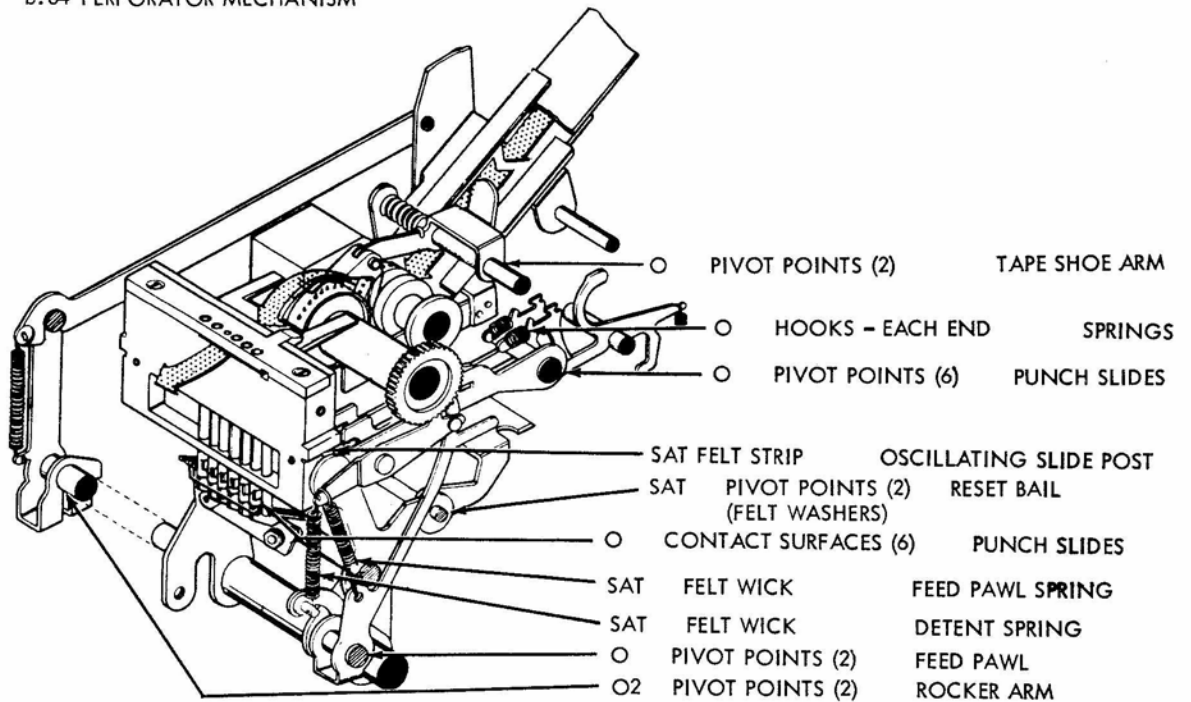
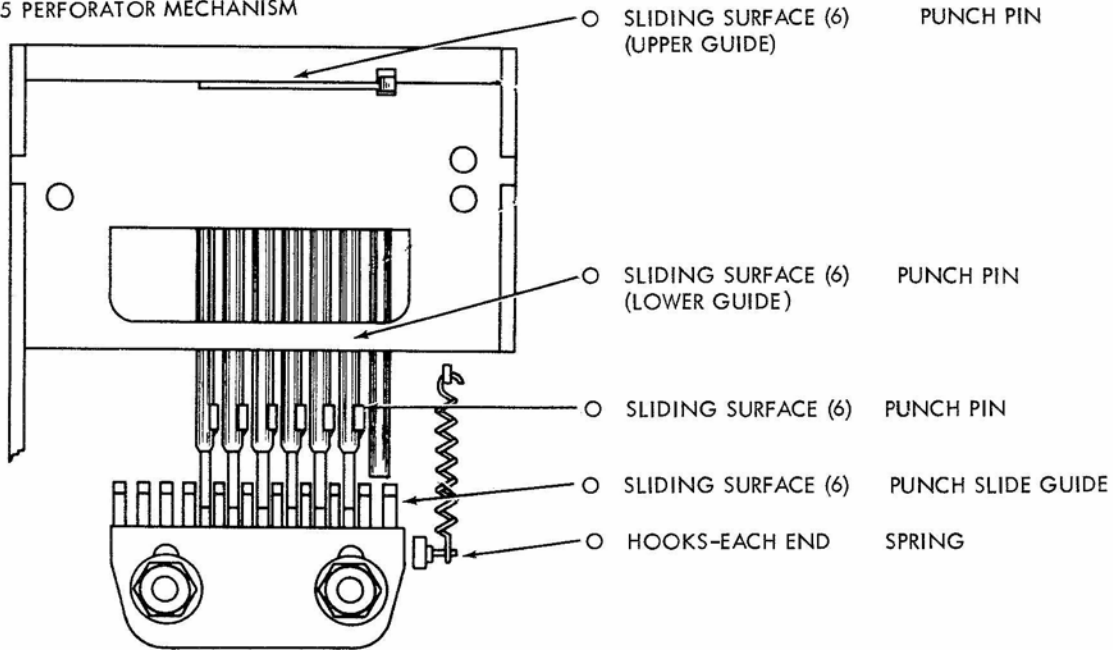


Figure 5-121. Typing Reperforators

b.05 PERFORATOR MECHANISM



b.06 PERFORATOR MECHANISM

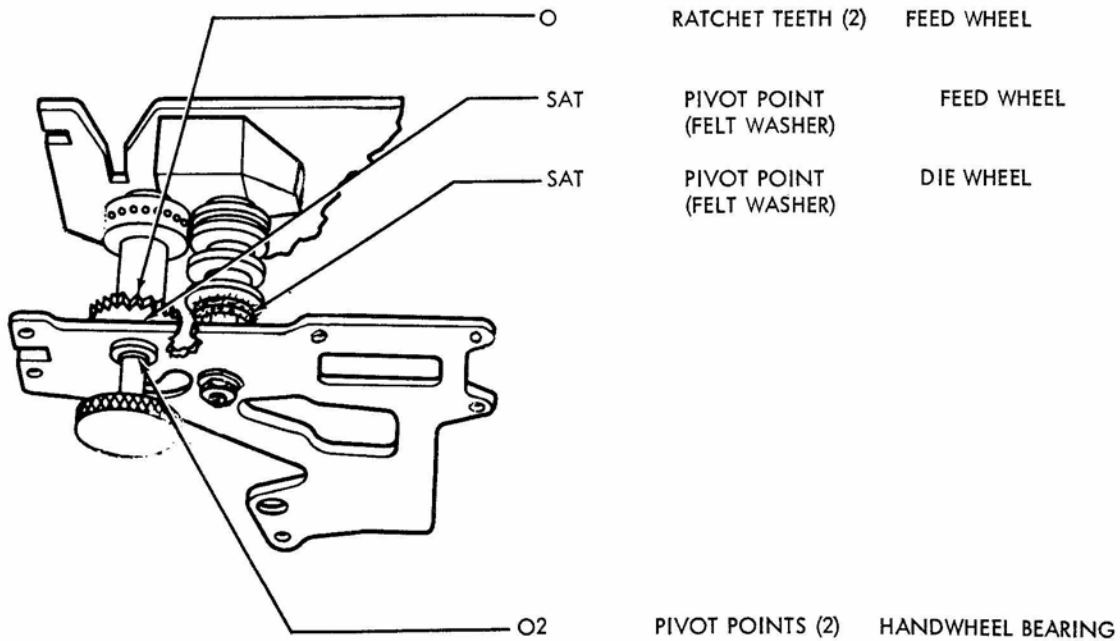
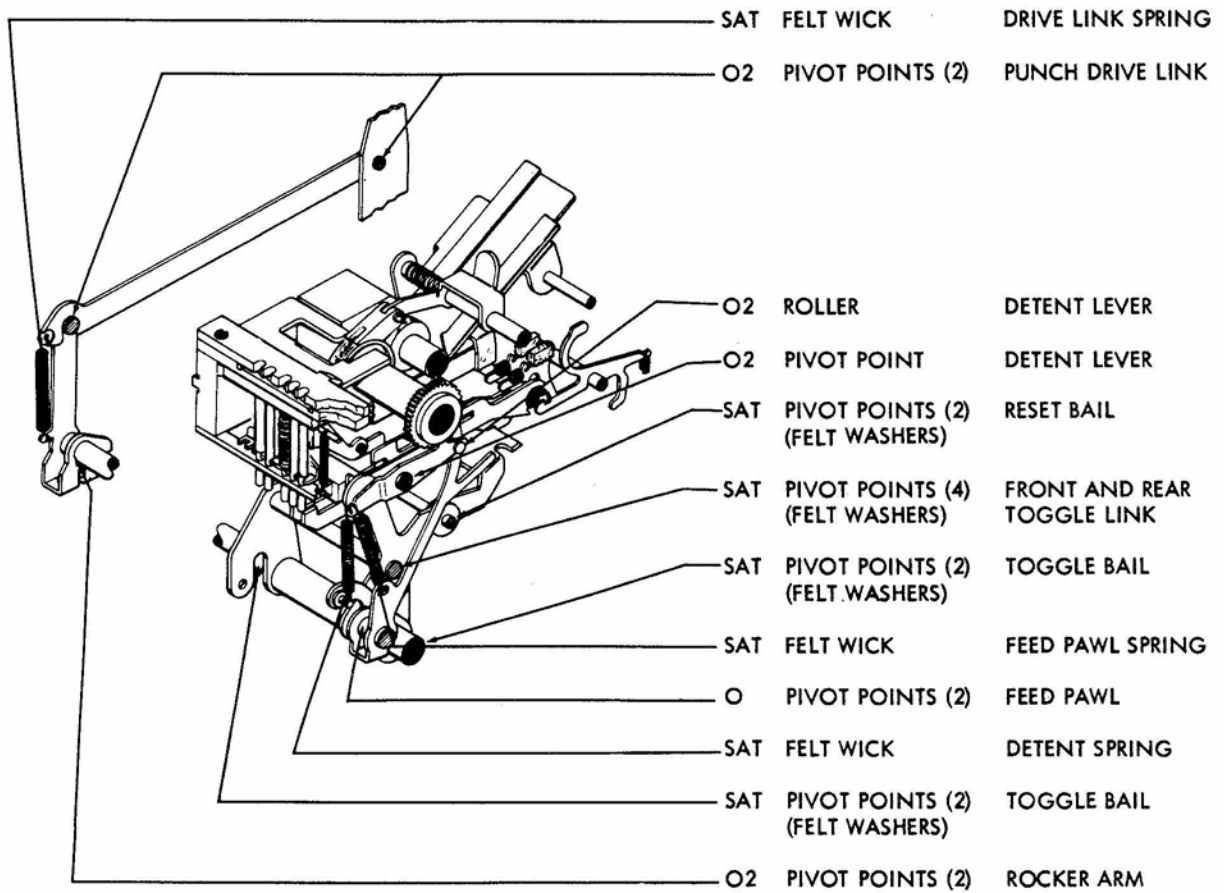


Figure 5-122. Typing Reperforators, (Chadless Tape)

b.07 PERFORATOR MECHANISM



b.08 PERFORATOR MECHANISM

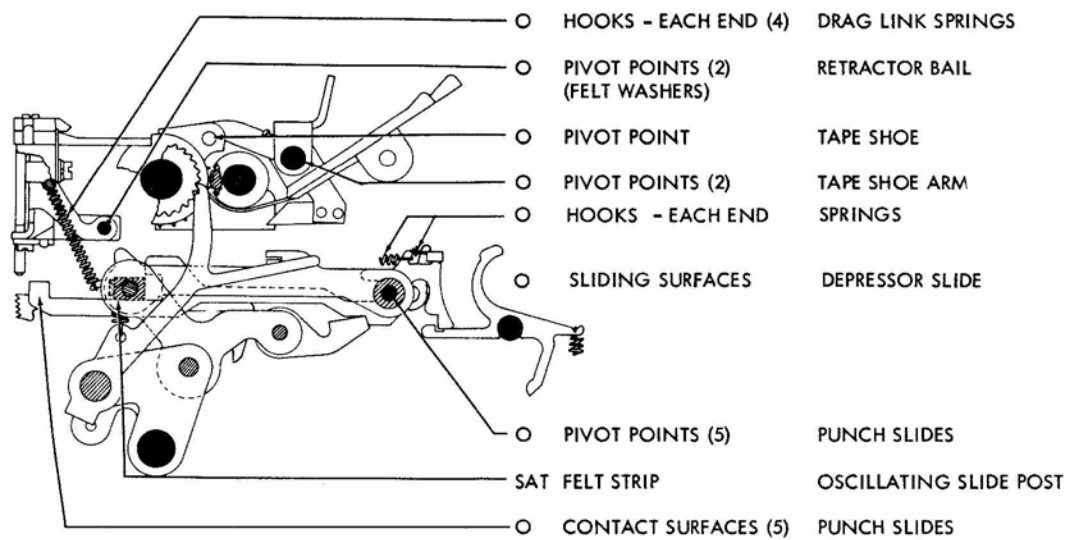


Figure 5-123. Typing Reperforators

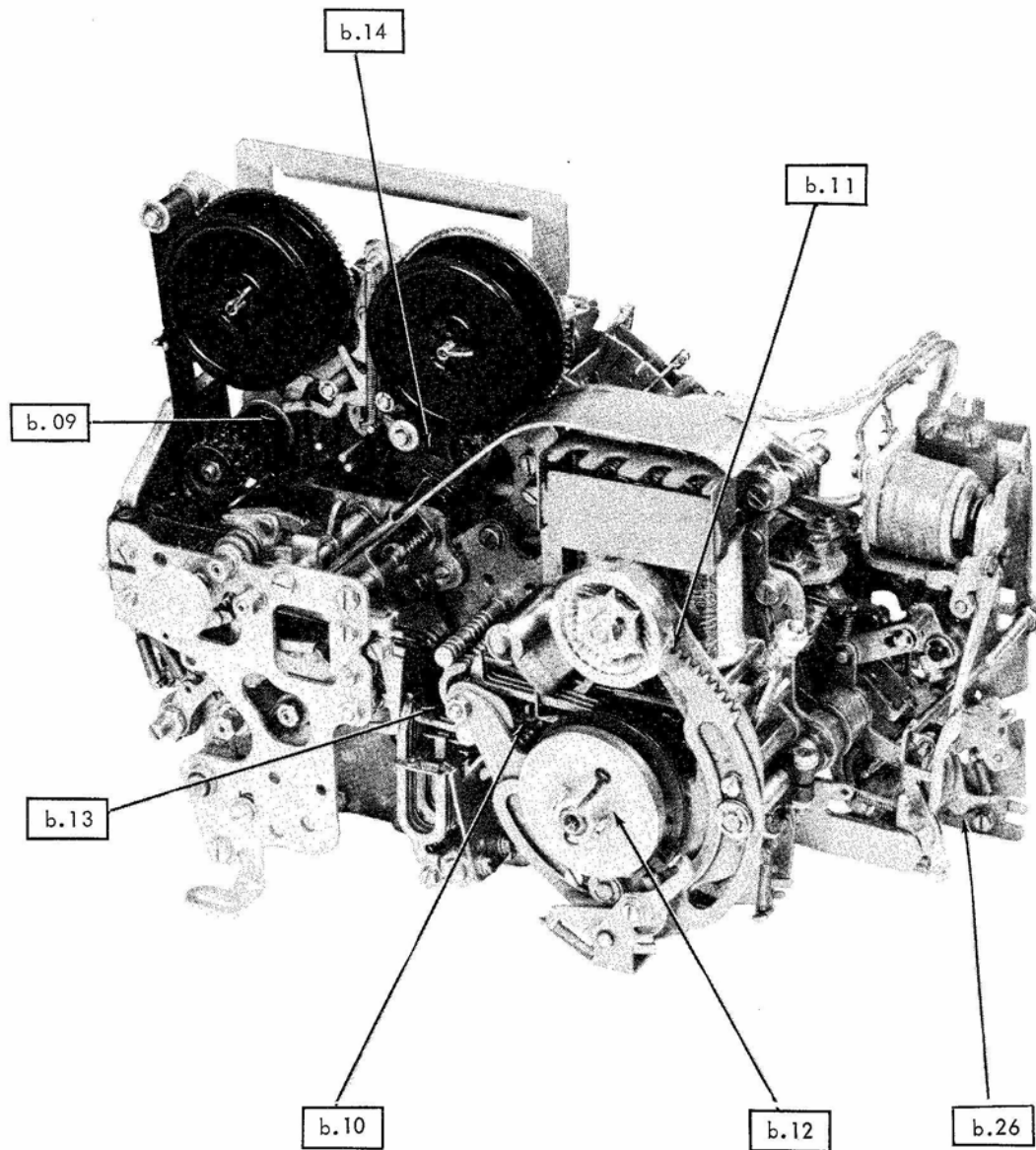
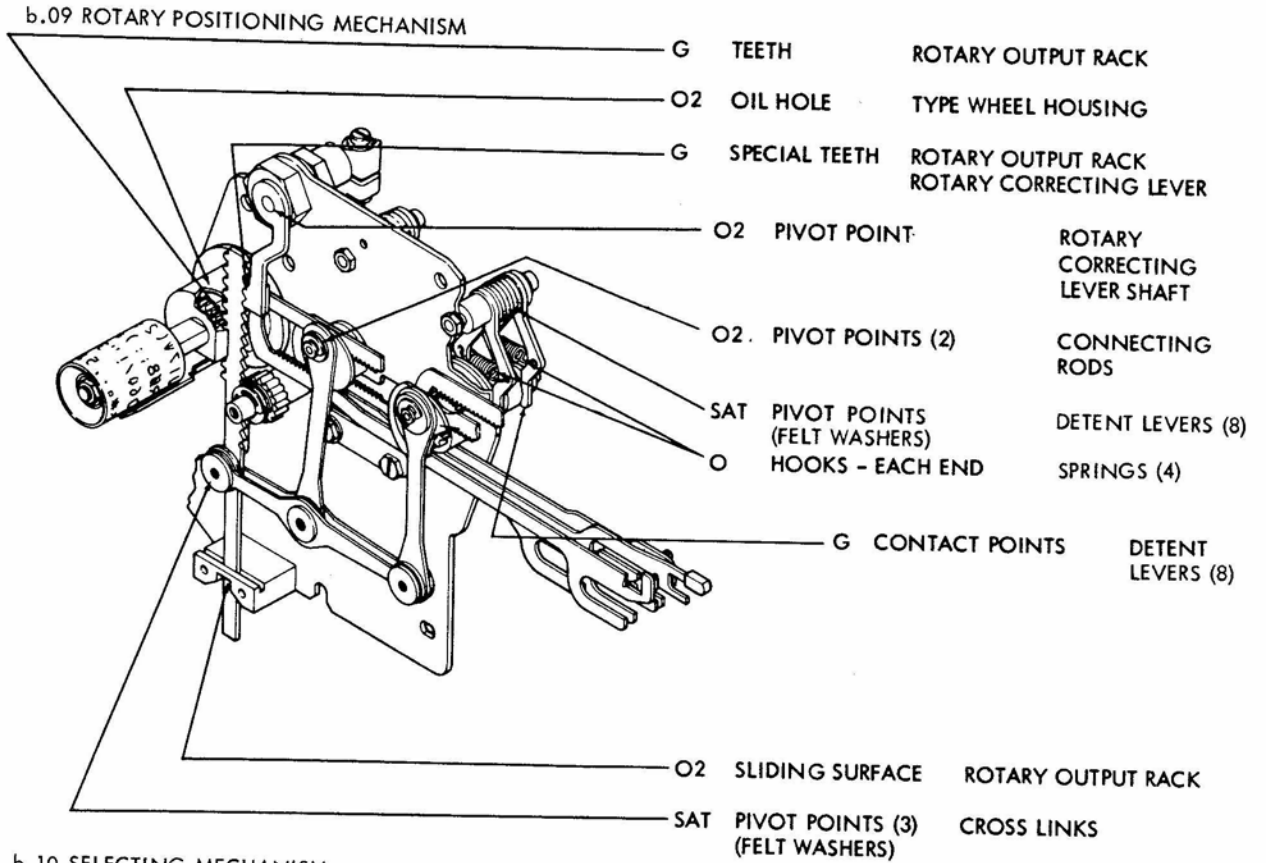


Figure 5-124. Typing Reperforators



b.10 SELECTING MECHANISM

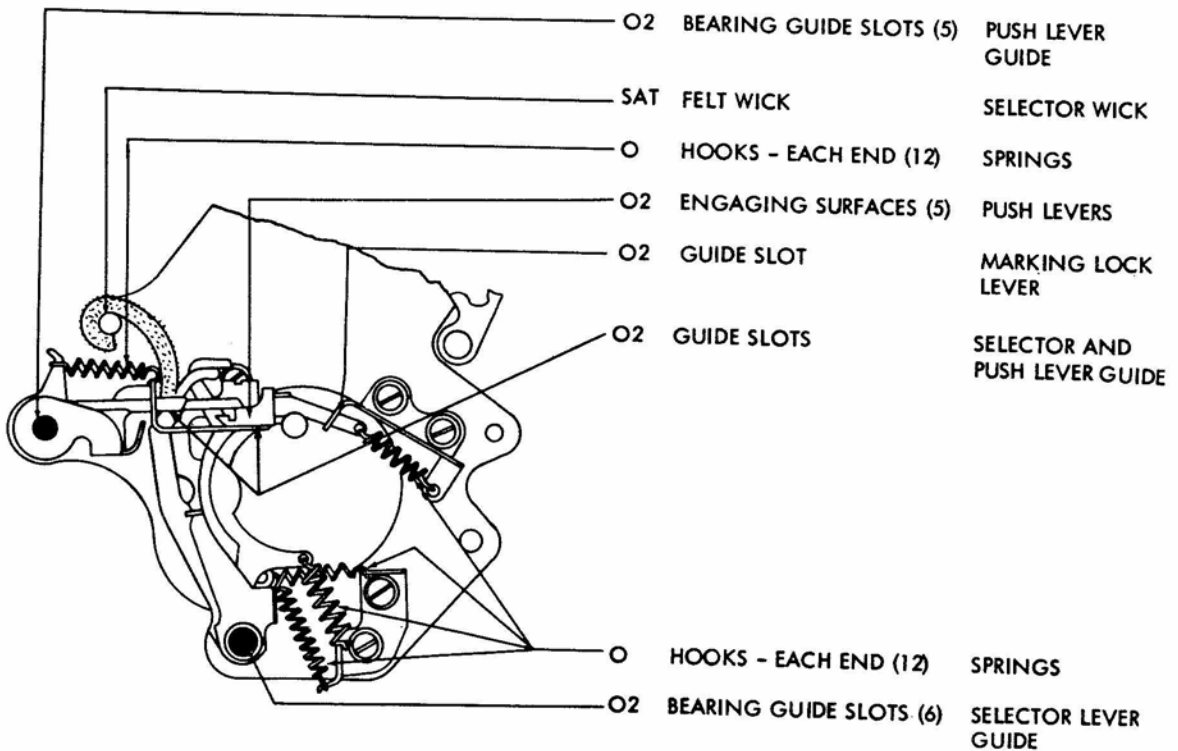
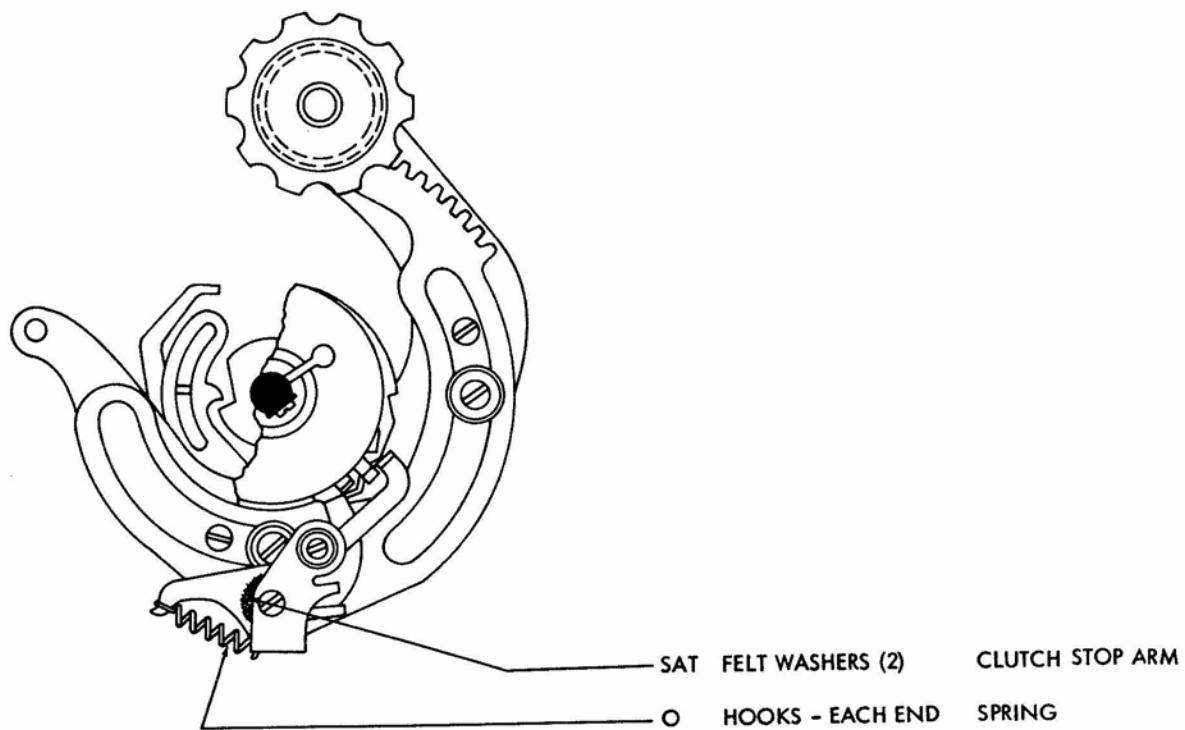


Figure 5-125. Typing Reperforators

b.11 RANGE FINDER MECHANISM



b.12 MAIN SHAFT MECHANISM

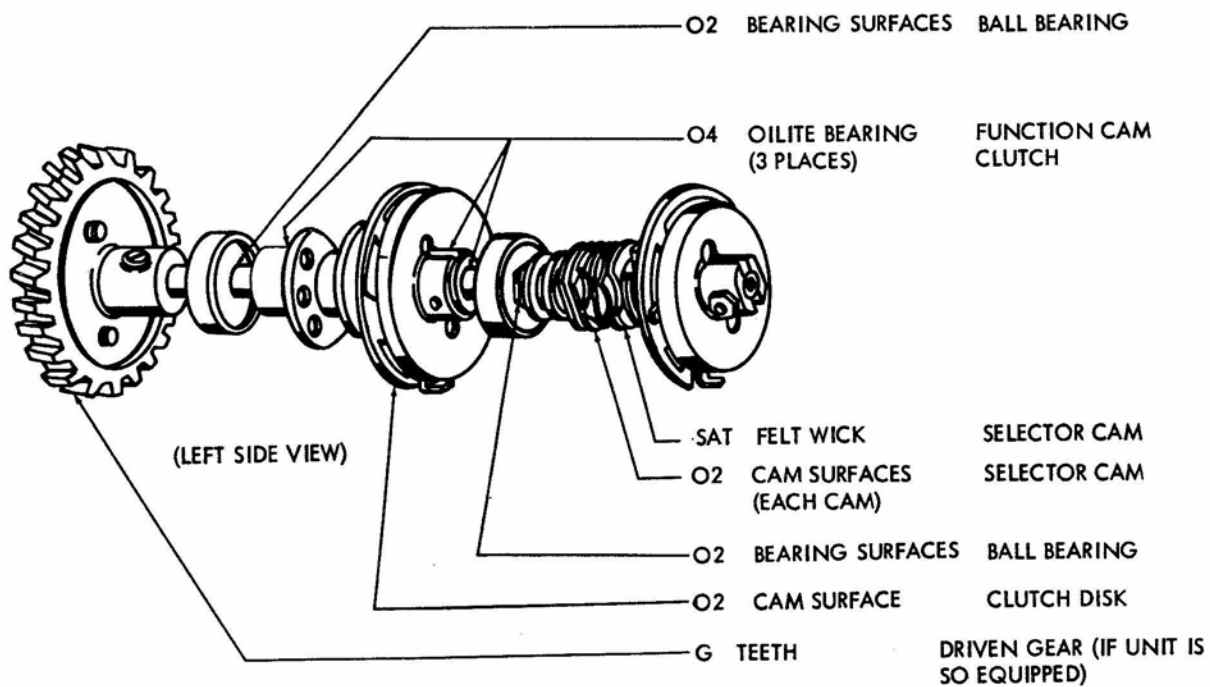
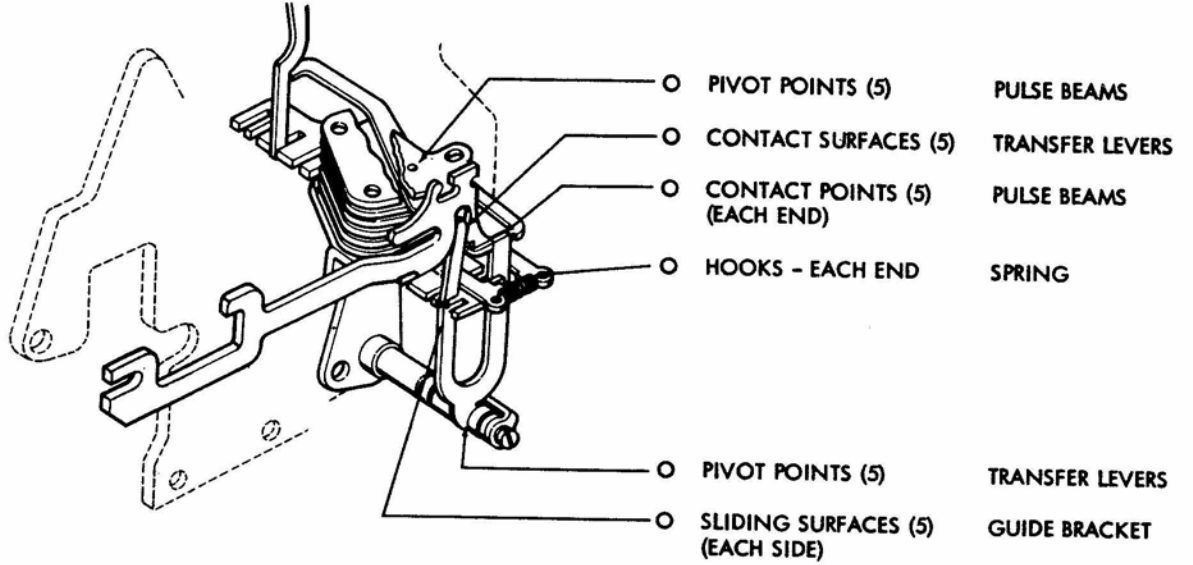


Figure 5-126. Typing Reperforators



b.13 TRANSFER MECHANISM



b.14 PUSH BARS

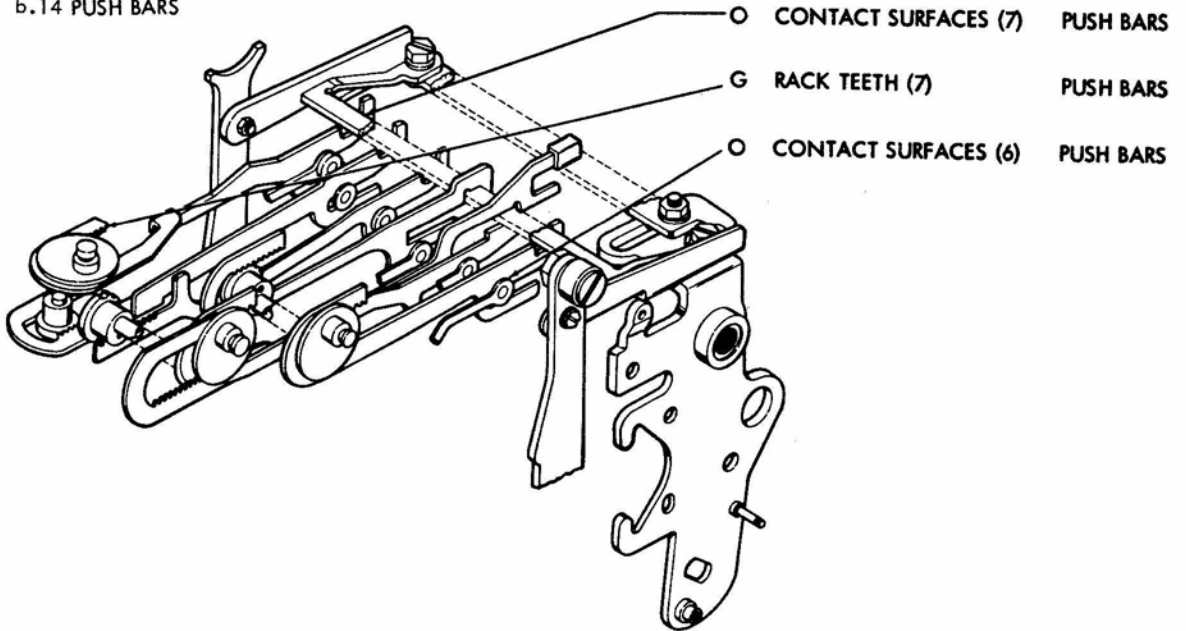


Figure 5-127. Typing Reperforators

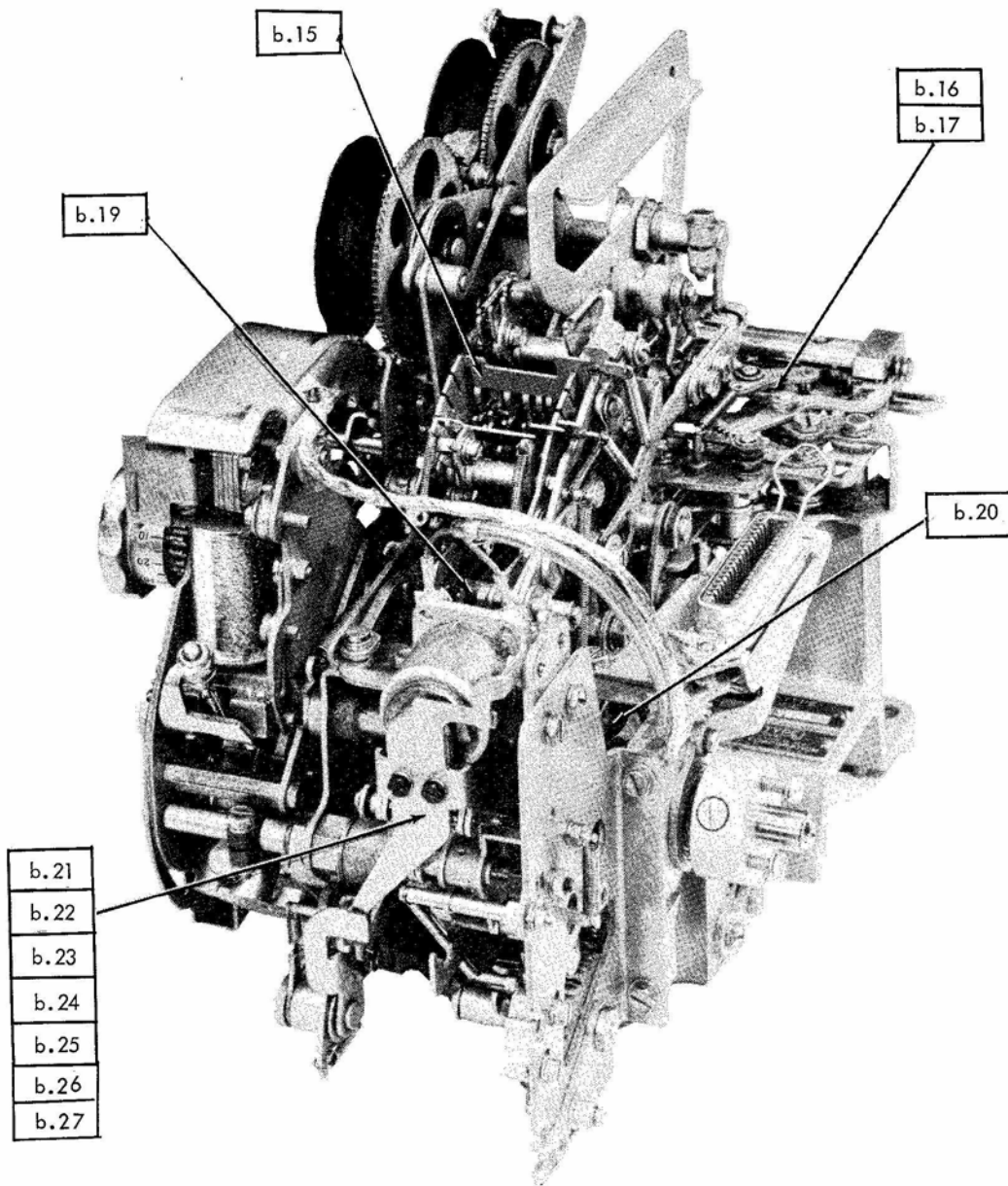
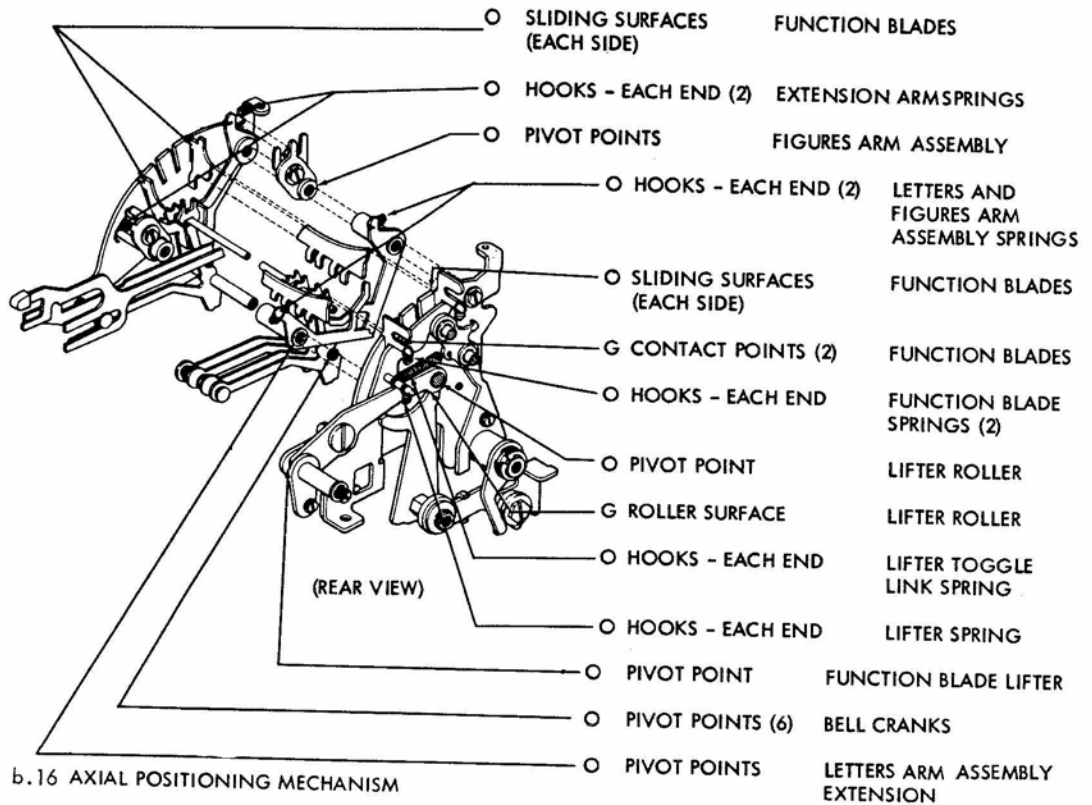


Figure 5-128. Typing Reperforators

b.15 FUNCTION BOX



b.16 AXIAL POSITIONING MECHANISM

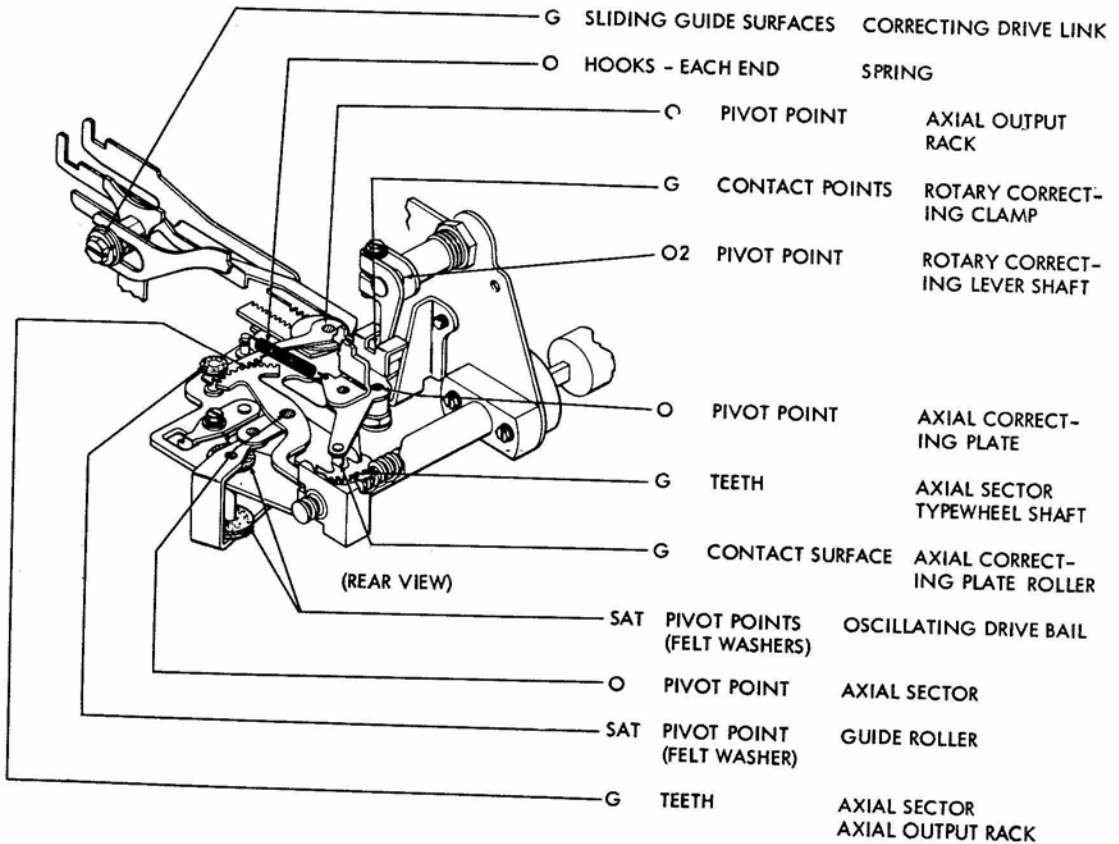
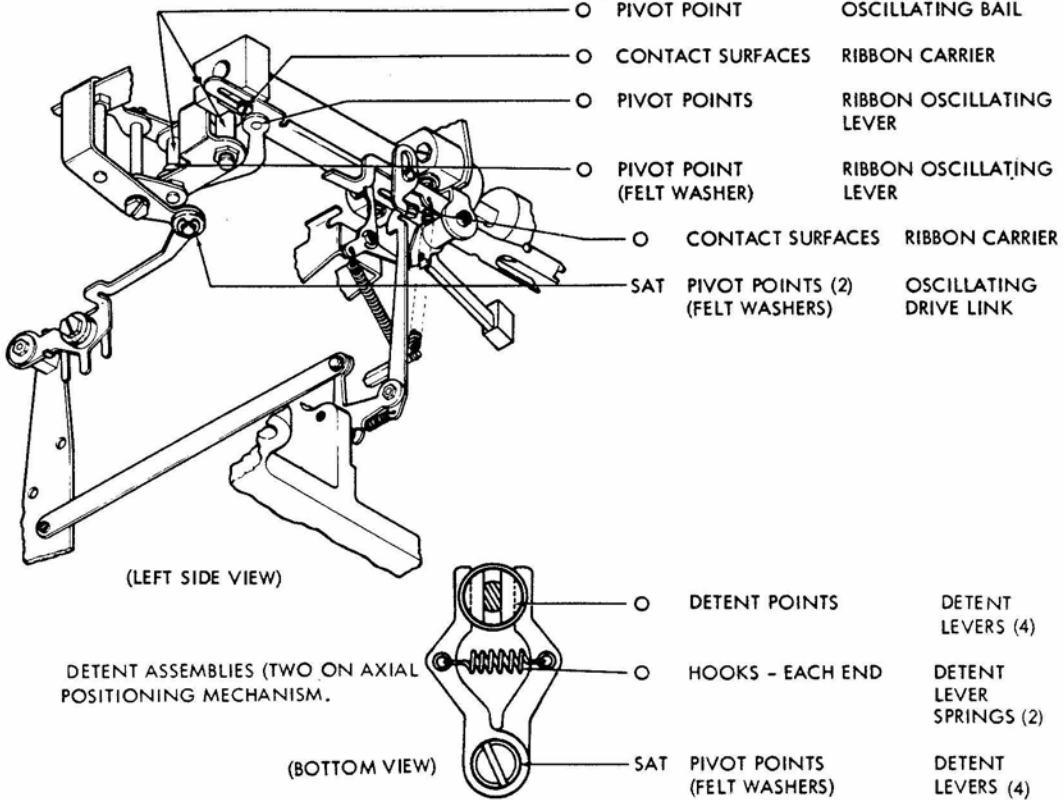


Figure 5-129. Typing Reperforators

b.17 AXIAL POSITIONING MECHANISM



b.18 PRINTING MECHANISM

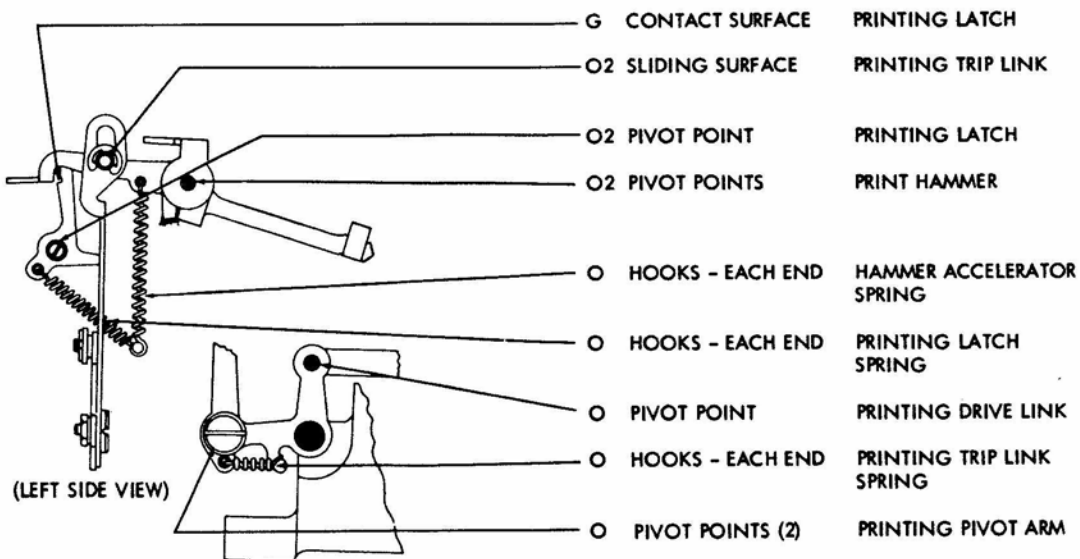
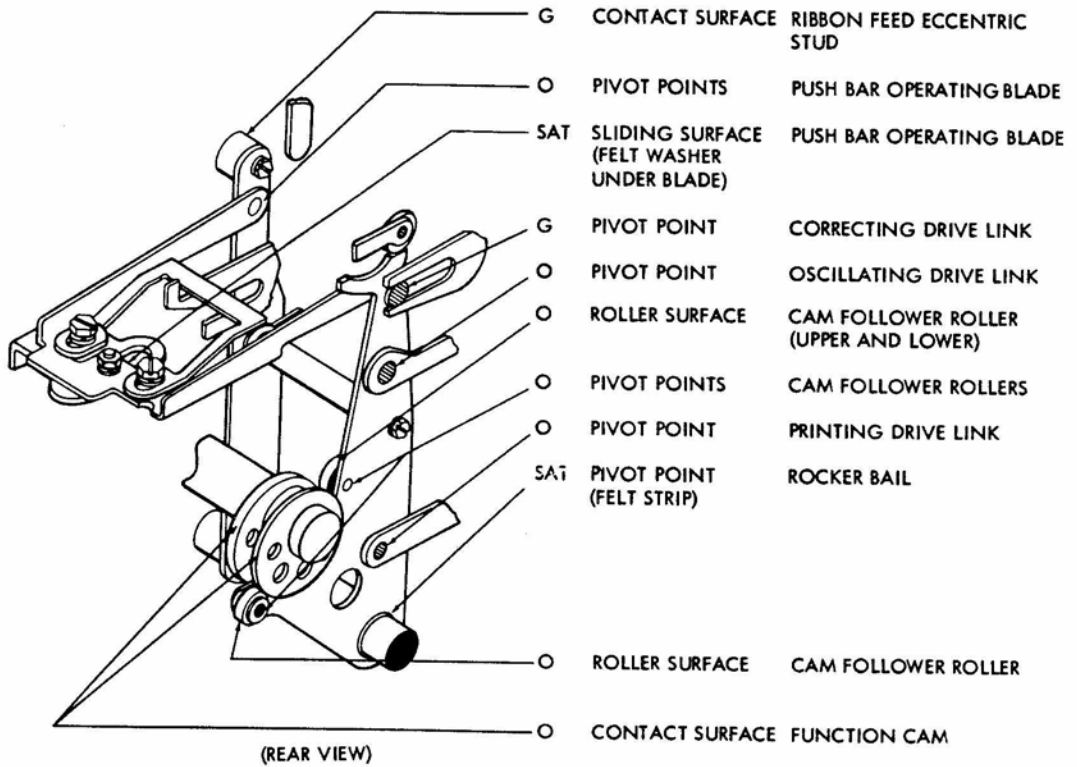


Figure 5-130. Typing Reperforators

b.19 ROCKER BAIL MECHANISM



b.20 FUNCTION CAM - CLUTCH TRIP MECHANISM

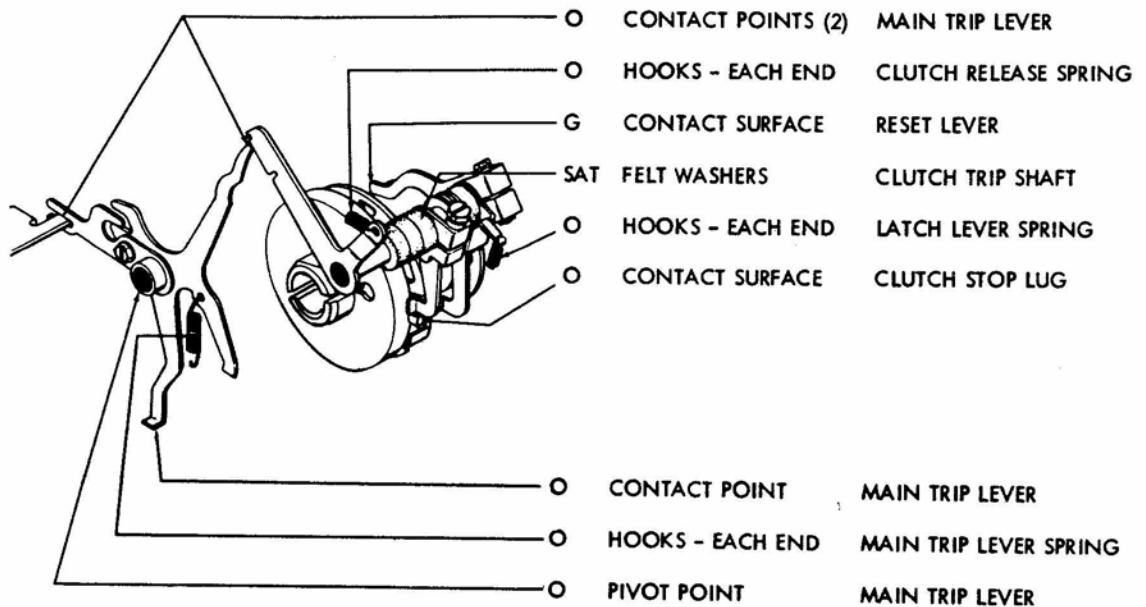


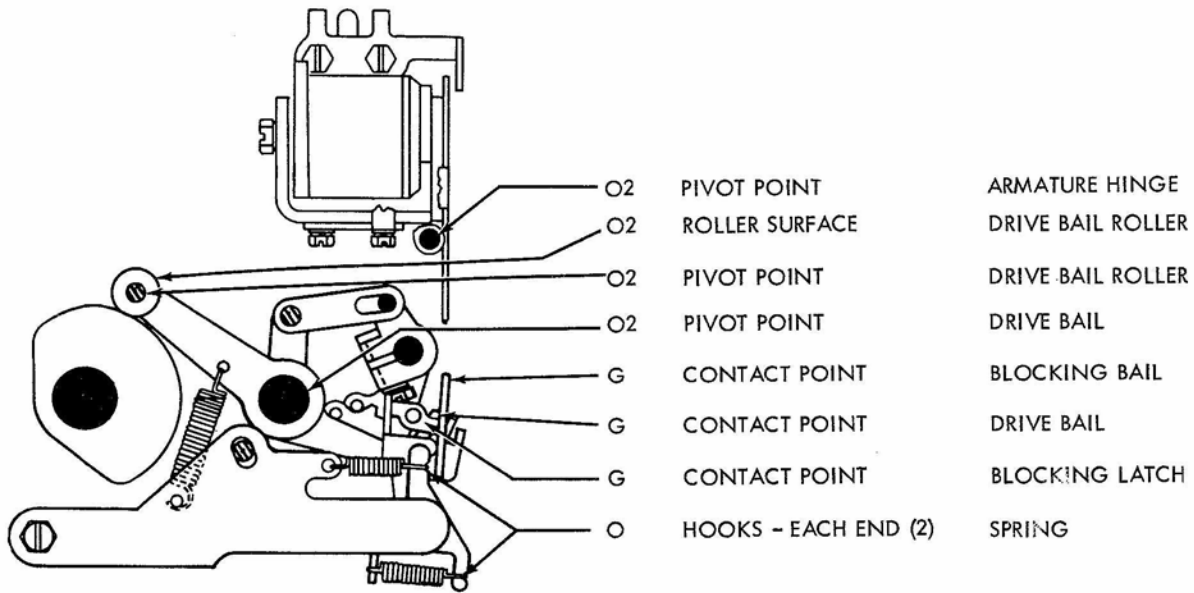
Figure 5-131. Typing Reperforators

NOTE

THE FOLLOWING LUBRICATION INSTRUCTIONS APPLY TO TYPING REPERFORATORS EQUIPPED WITH EITHER THE "REMOTE CONTROL" OR THE "AUTOMATIC" NON-INTERFERING LETTERS TAPE FEED-OUT MECHANISM AS INDICATED:

1. ONE ASTERISK (\*) APPLIES ONLY TO UNITS EQUIPPED WITH REMOTE CONTROL MECHANISM.
2. TWO ASTERISKS (\*\*) APPLY ONLY TO UNITS EQUIPPED WITH THE AUTOMATIC MECHANISM.
3. LUBRICATION INSTRUCTIONS WITHOUT THE ASTERISK INDICATION APPLY TO BOTH MECHANISMS.

\*  
b.21 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM



\*  
b. 22 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM

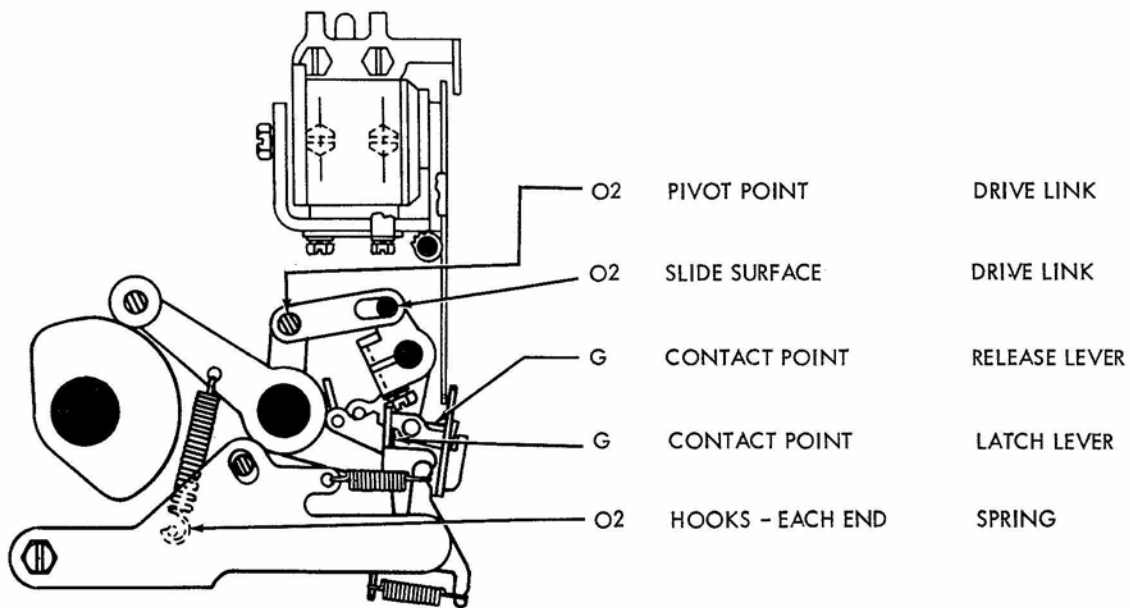
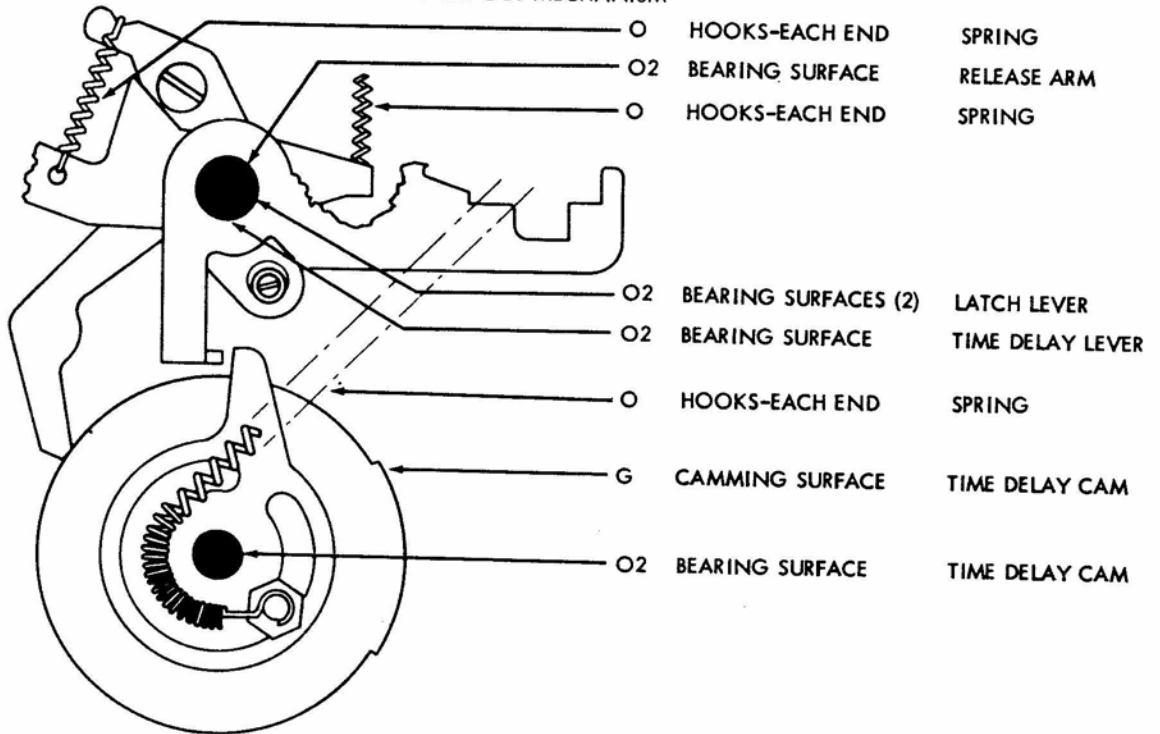


Figure 5-132 Typing Reperforators

b.23 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM



b.24

NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM

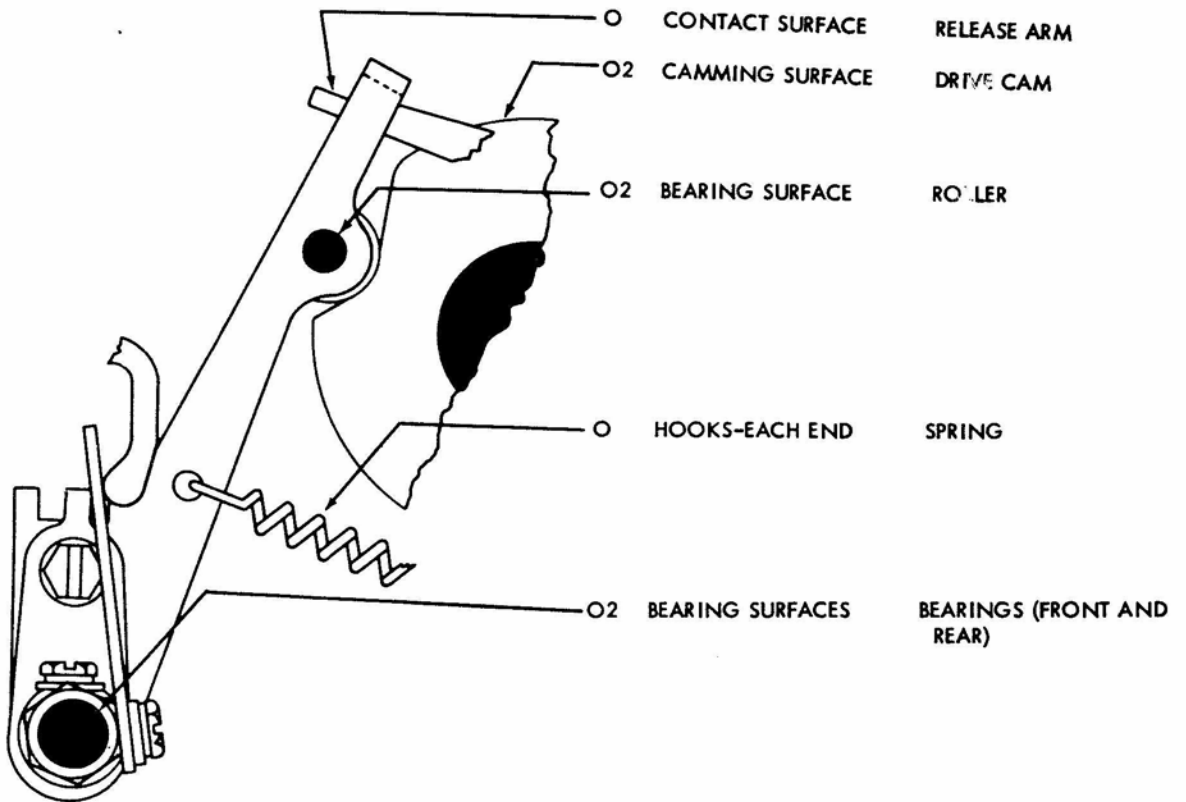
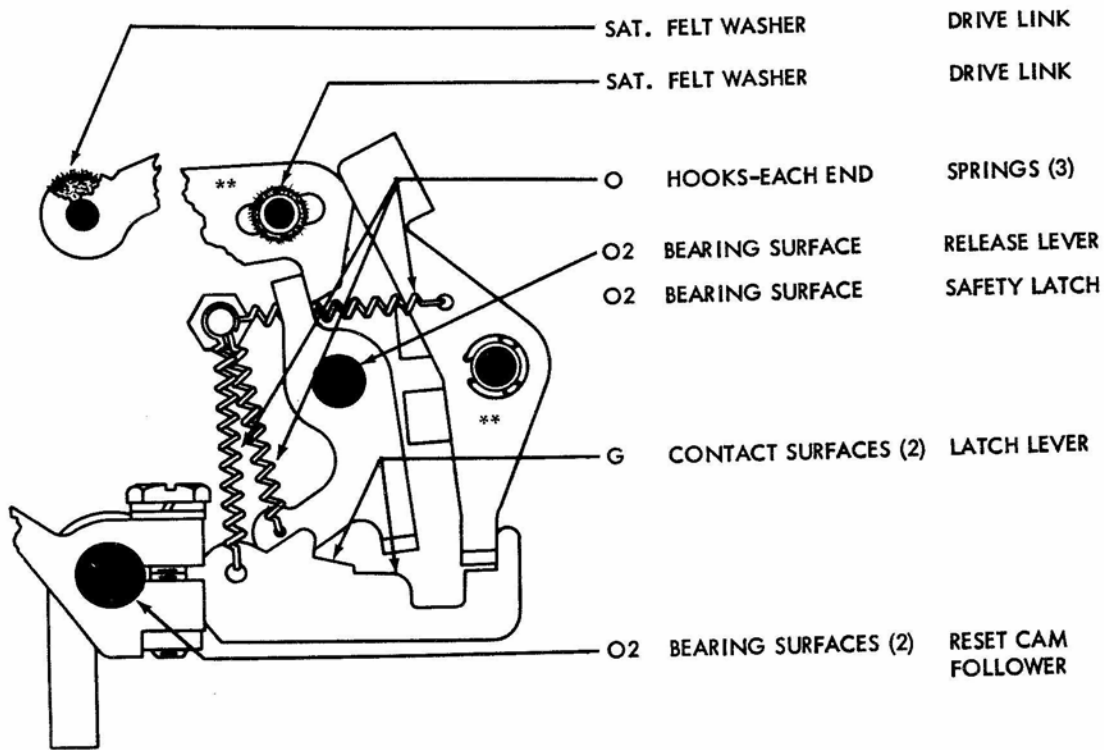


Figure 5-133. Typing Reperforators

NOTE  
TWO ASTERISKS (\*\*) INDICATE PARTS ASSOCIATED ONLY WITH THE AUTOMATIC MECHANISM.

b.25 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM



b.26 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM

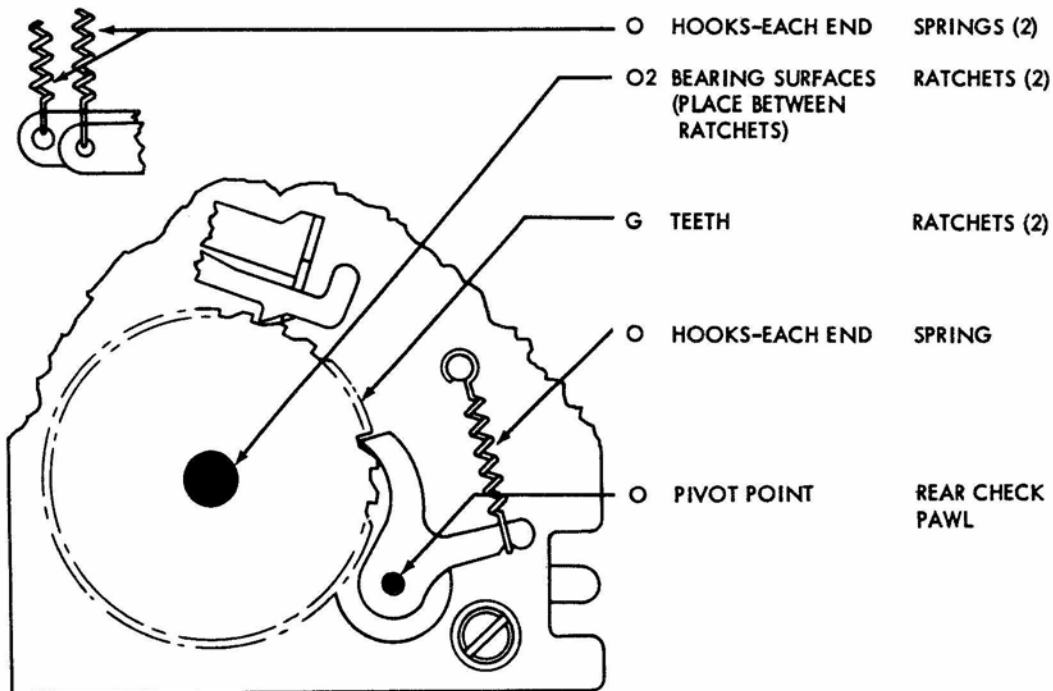


Figure 5-134. Typing Reperforators



b.27 NON-INTERFERING LETTERS TAPE FEED OUT MECHANISM

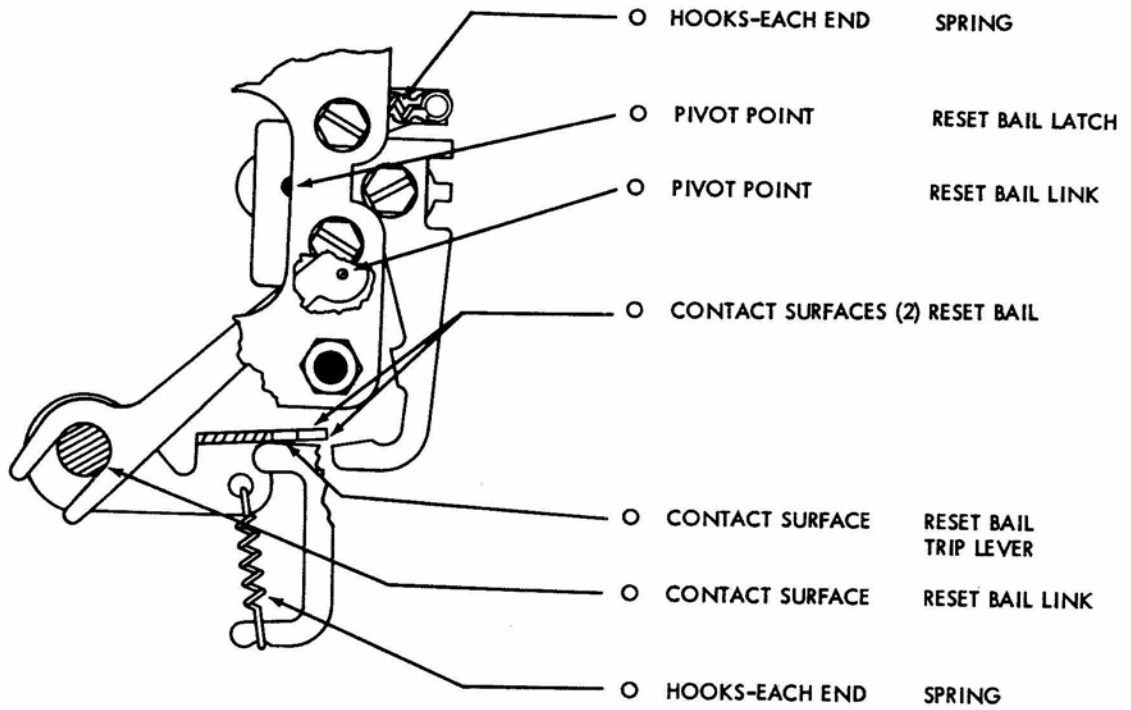


Figure 5-135. Typing Reperforators

c. TRANSMITTER DISTRIBUTOR

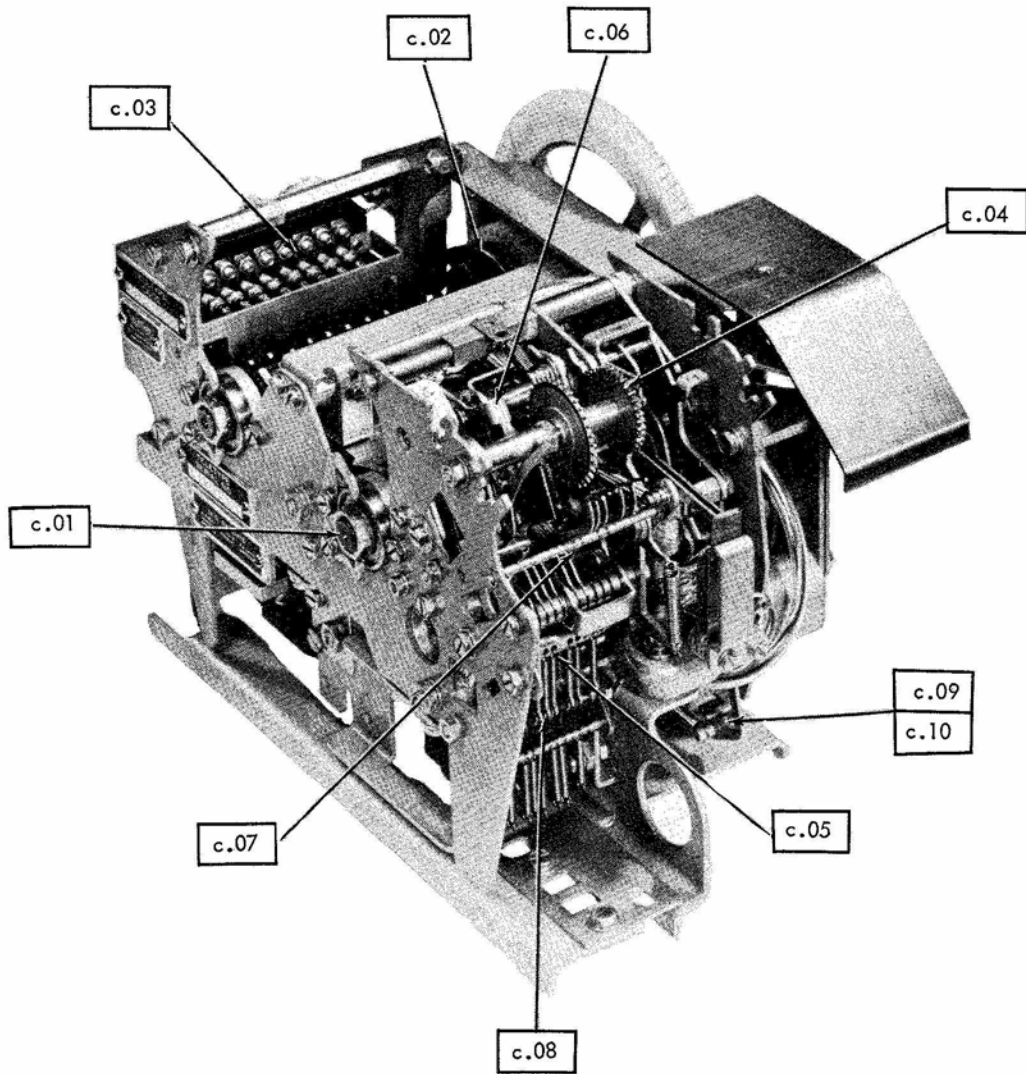
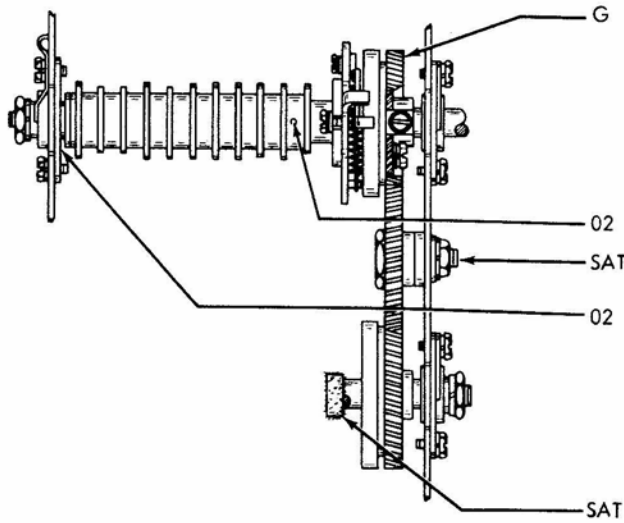


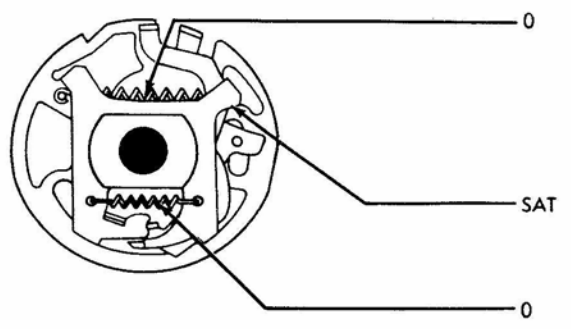
Figure 5-136. Transmitter Distributors

c. 01 DISTRIBUTOR AND SENSING SHAFT ASSEMBLIES



- G GEARS (2) CLUTCH
- 02 OIL HOLES (2) CAM SLEEVE
- SAT FELT WICKS 'DLER GEAR SHAFT
- 02 BEARINGS (4)
- SAT FELT WICKS (4) CAM SLEEVE

c. 02 CLUTCH ASSEMBLY



- 0 HOOKS EACH END CLUTCH SHOE LEVER SPRING
- SAT FELT WICK 2 PLACES CLUTCH SHOE
- 0 HOOKS EACH END CLUTCH SHOE SPRING

Figure 5-137. Transmitter Distributors

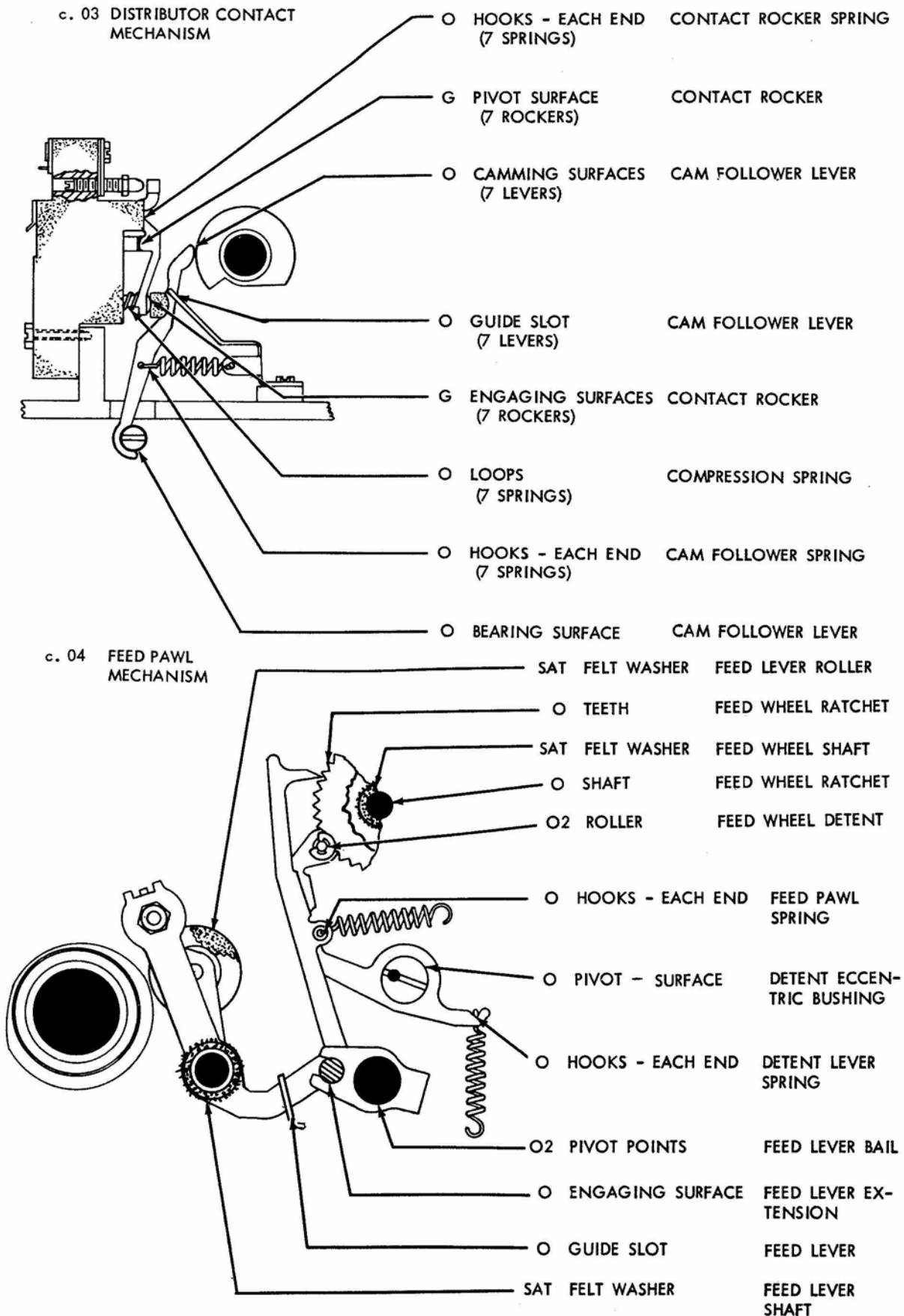
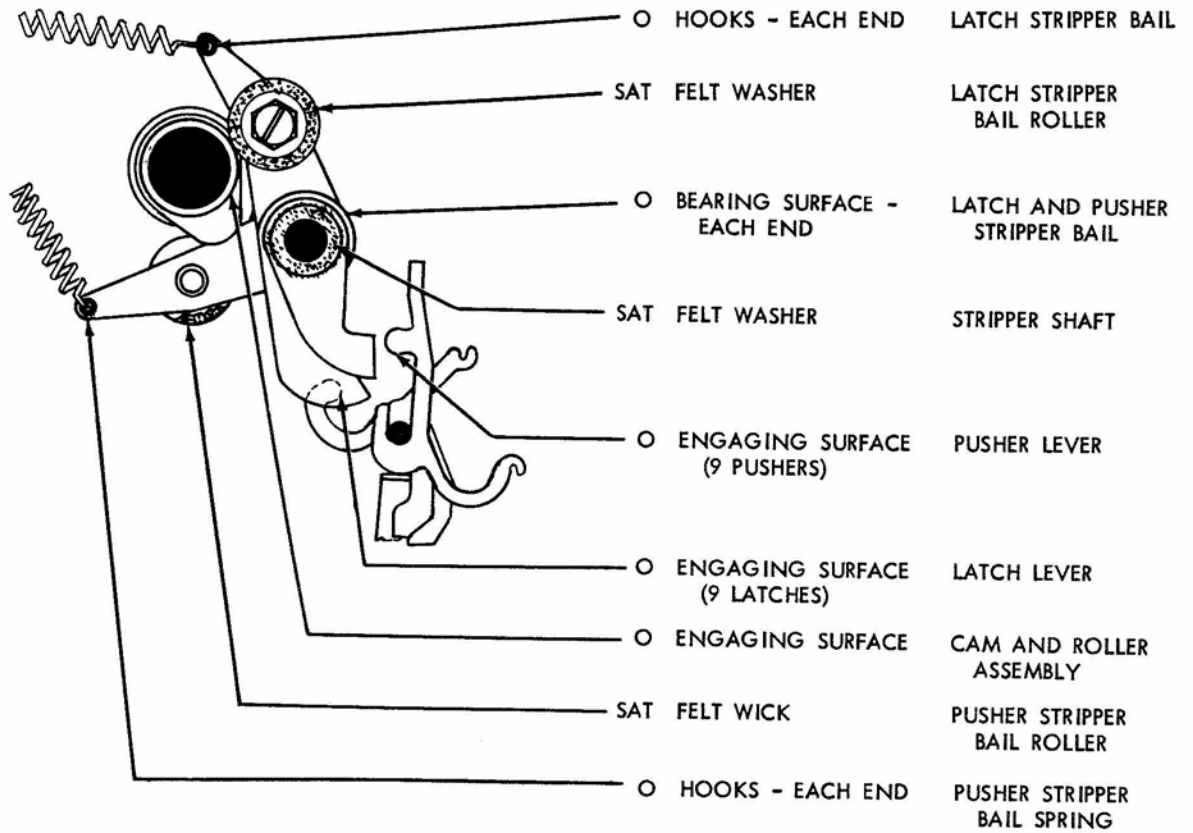


Figure 5-138. Transmitter Distributors

c. 05 LATCH AND PUSHER BAIL STRIPPER



c. 06 TAPE OUT AND CONTROL MECHANISM

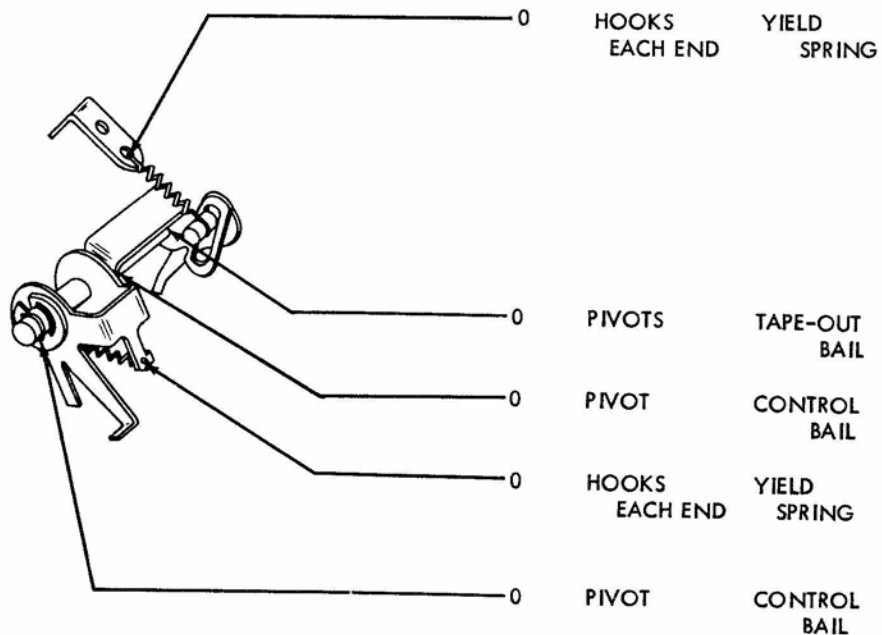
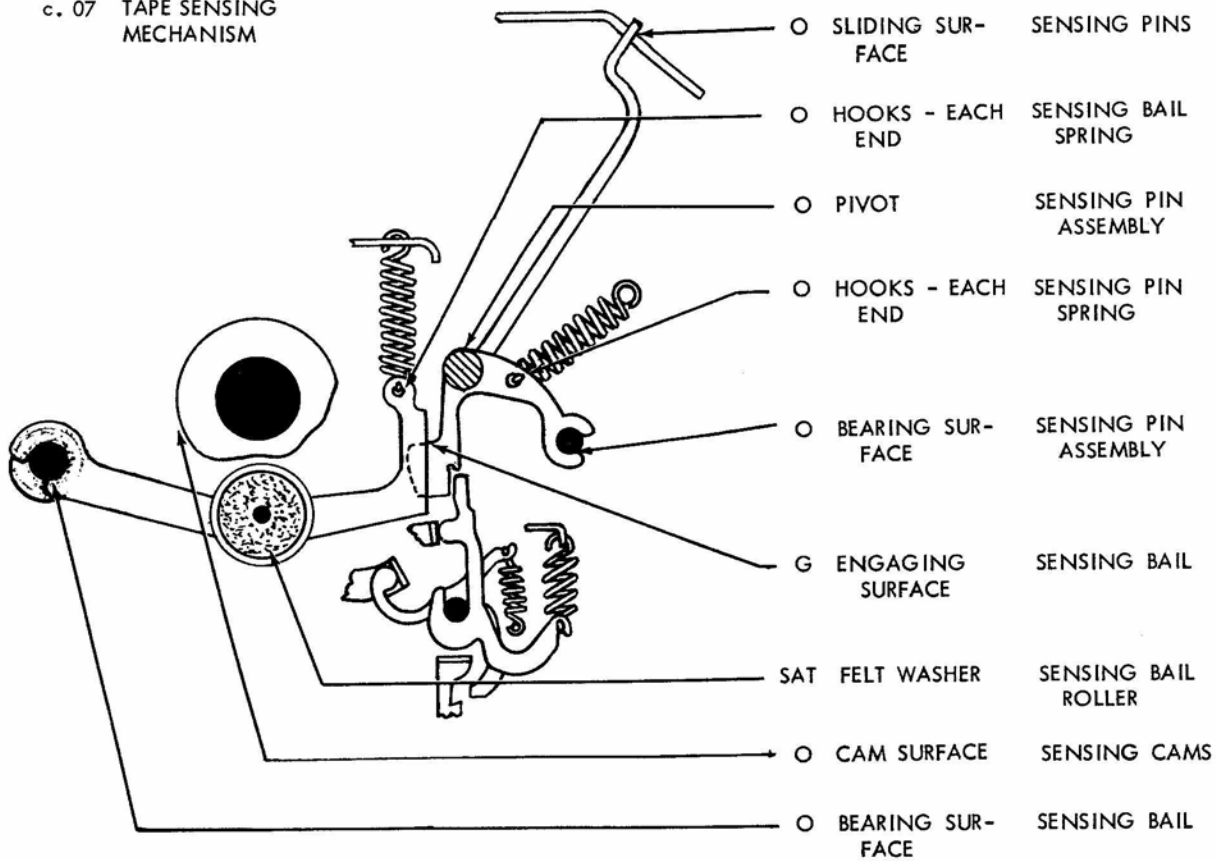


Figure 5-139. Transmitter Distributors

c. 07 TAPE SENSING MECHANISM



c. 08 PUSHER LEVERS

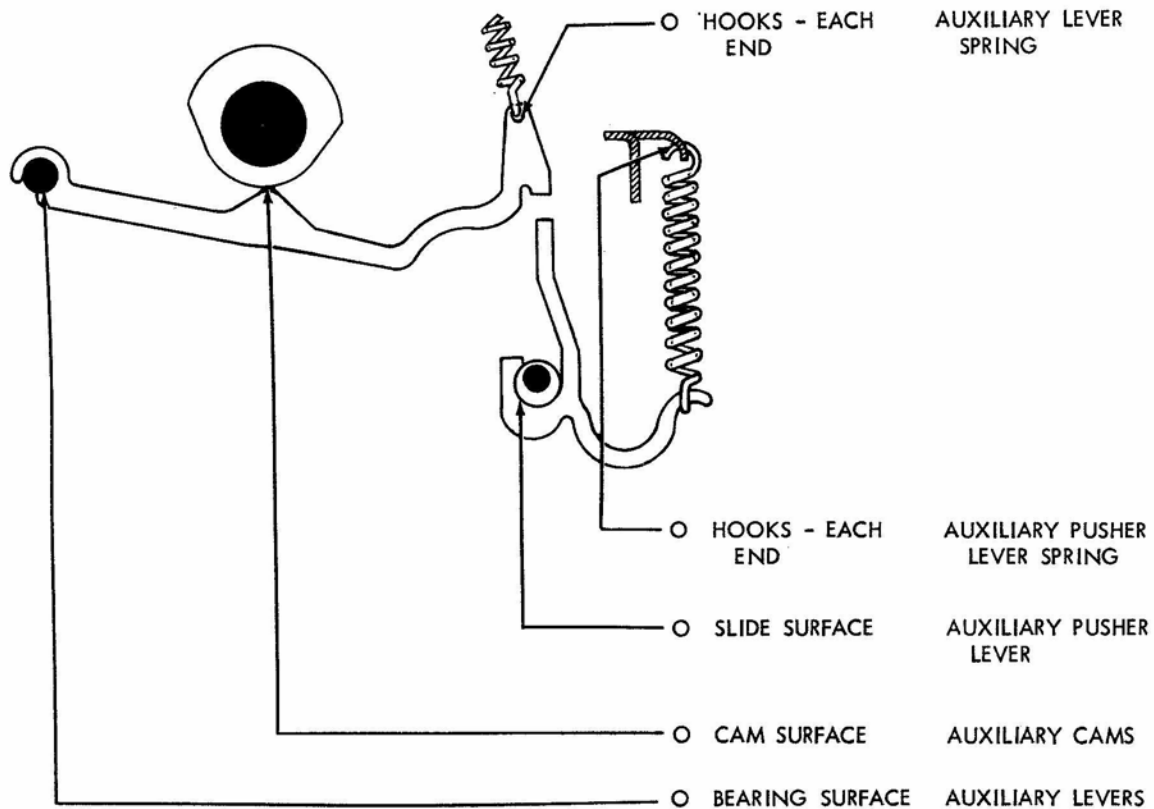
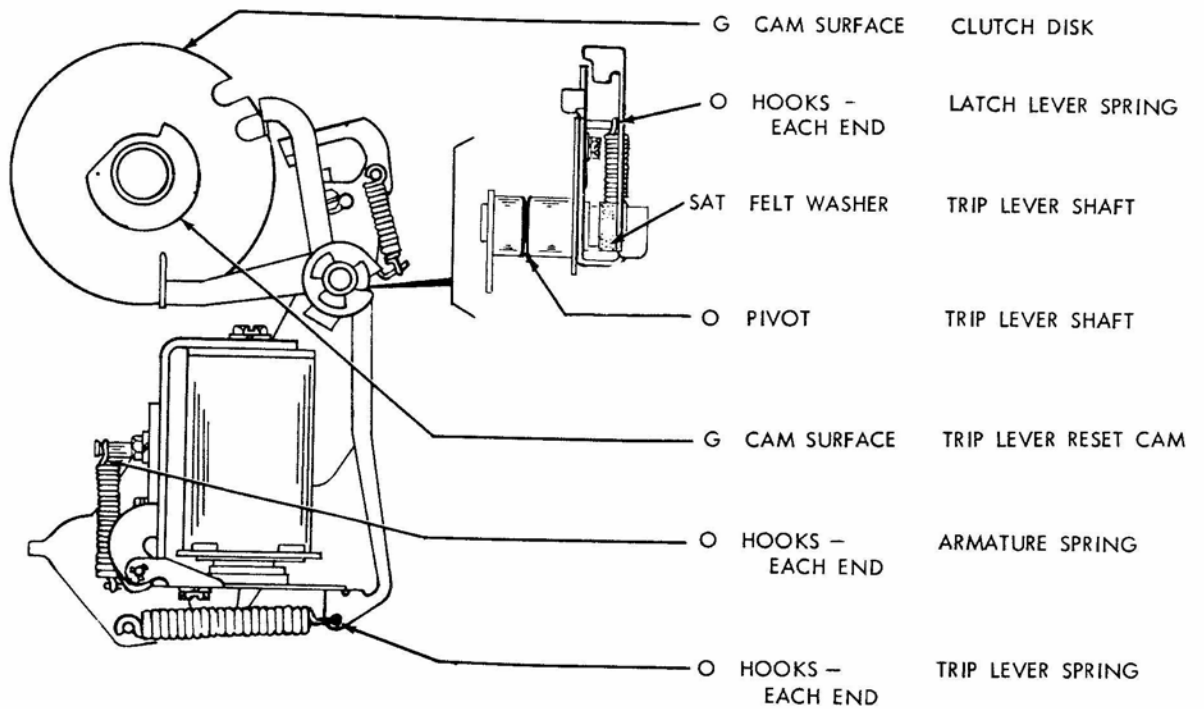


Figure 5-140. Transmitter Distributors

c. 09 DISTRIBUTOR AND SENSING SHAFT TRIP MECHANISMS



c. 10 MAGNET ARMATURE HINGES

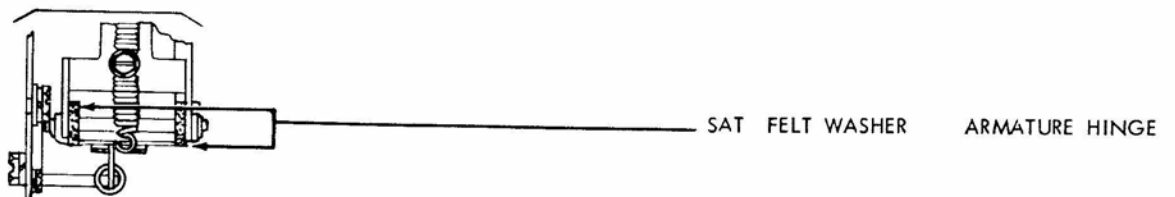


Figure 5-141. Transmitter Distributors

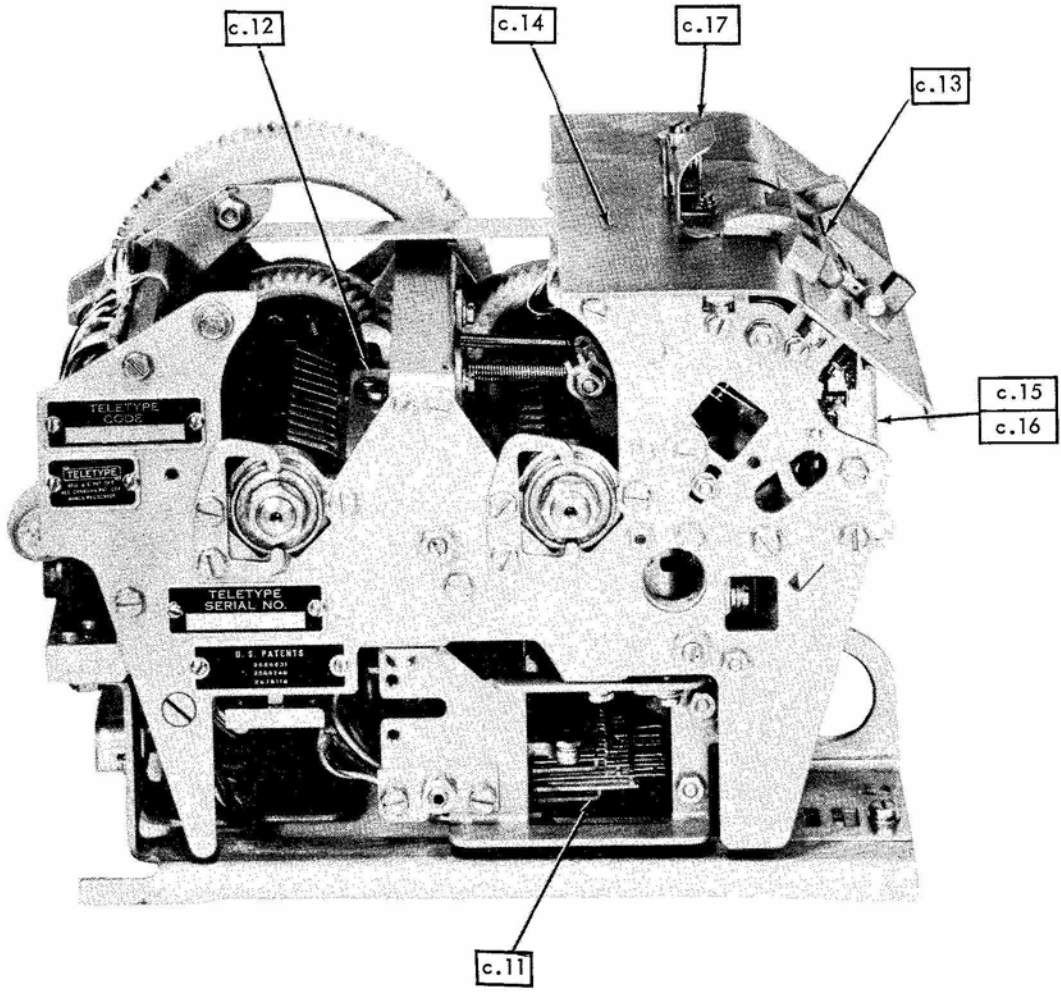
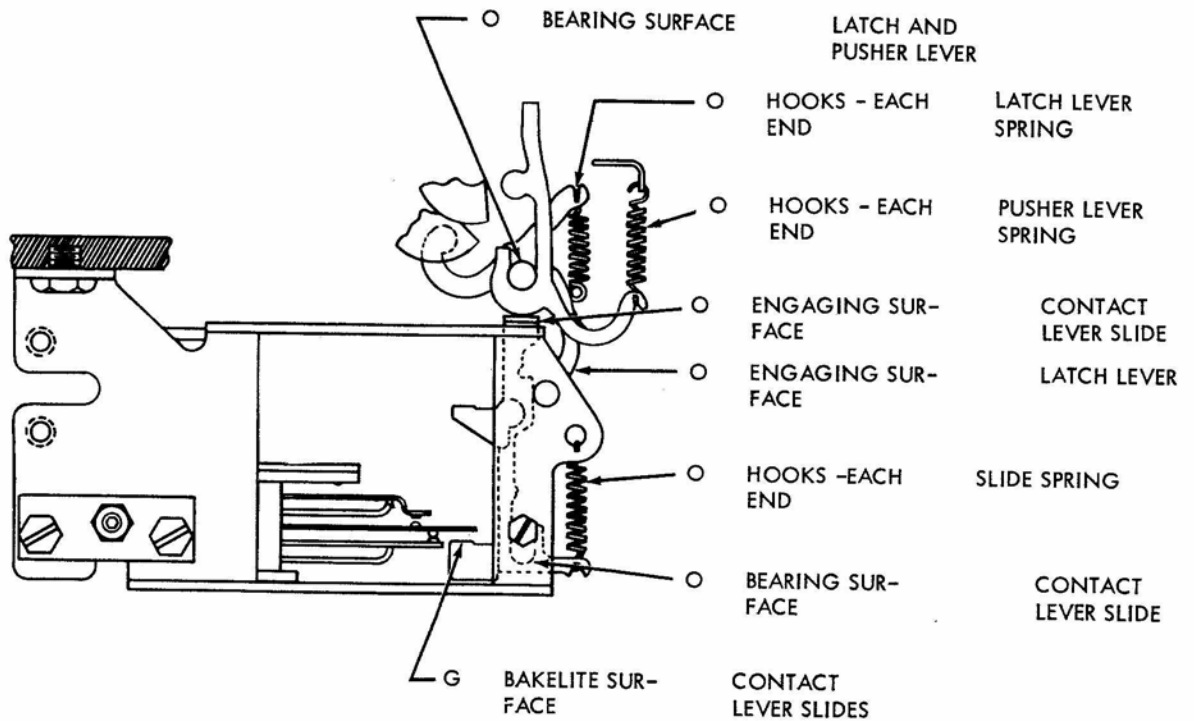


Figure 5-142. Transmitter Distributors



c. 11 STORING SWITCH MECHANISM



NOTE: KEEP CONTACTS FREE OF GREASE

c. 12 OIL RESERVOIR

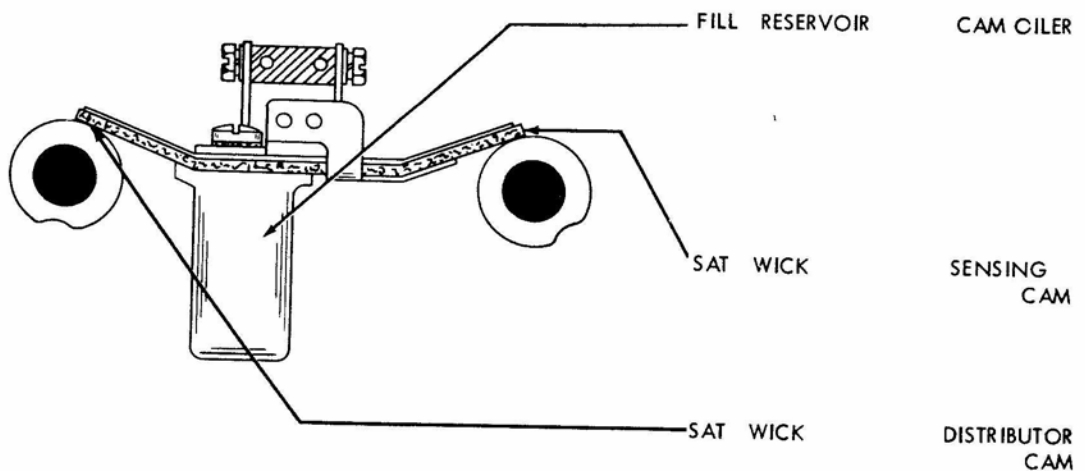
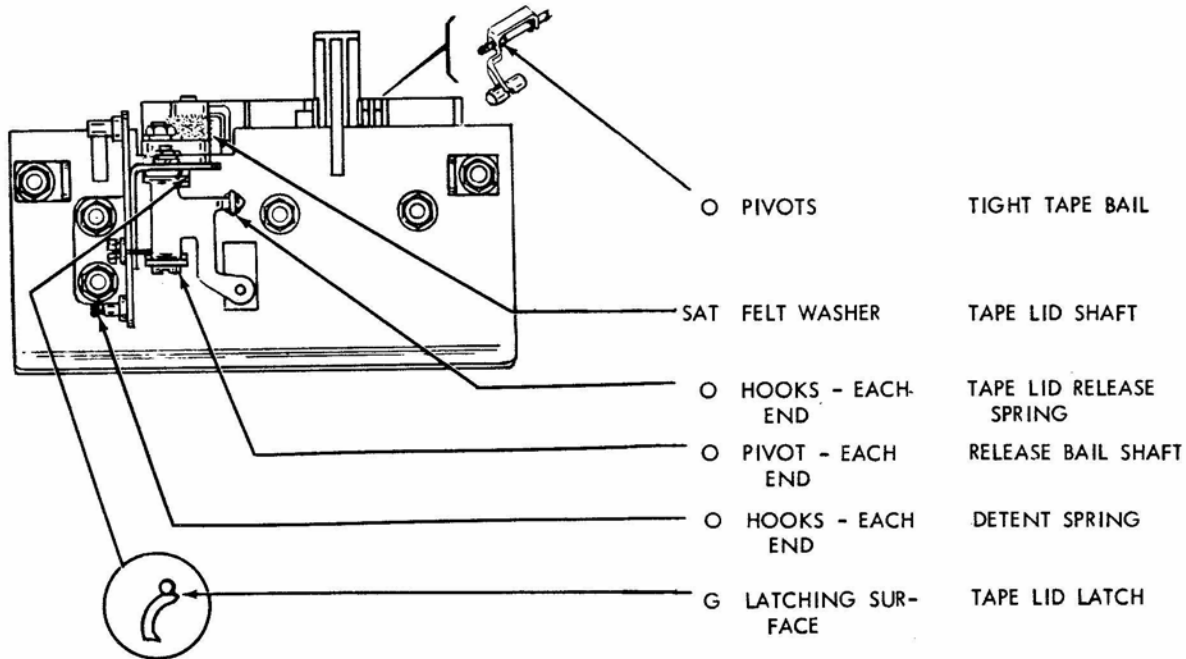


Figure 5-143. Transmitter Distributors

c. 13 TAPE GUIDE PLATE



c. 14 COVER PLATE

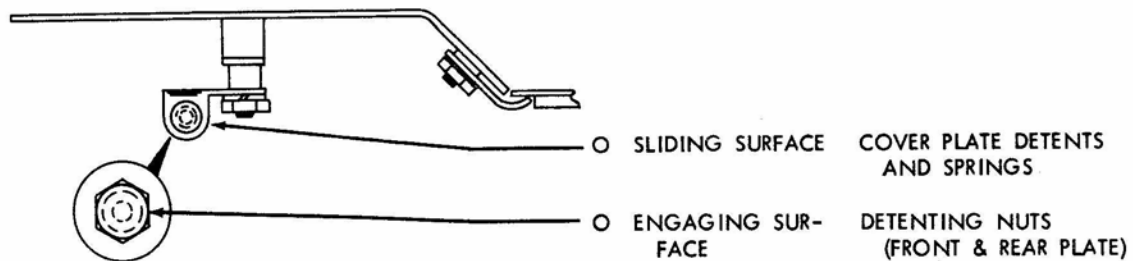
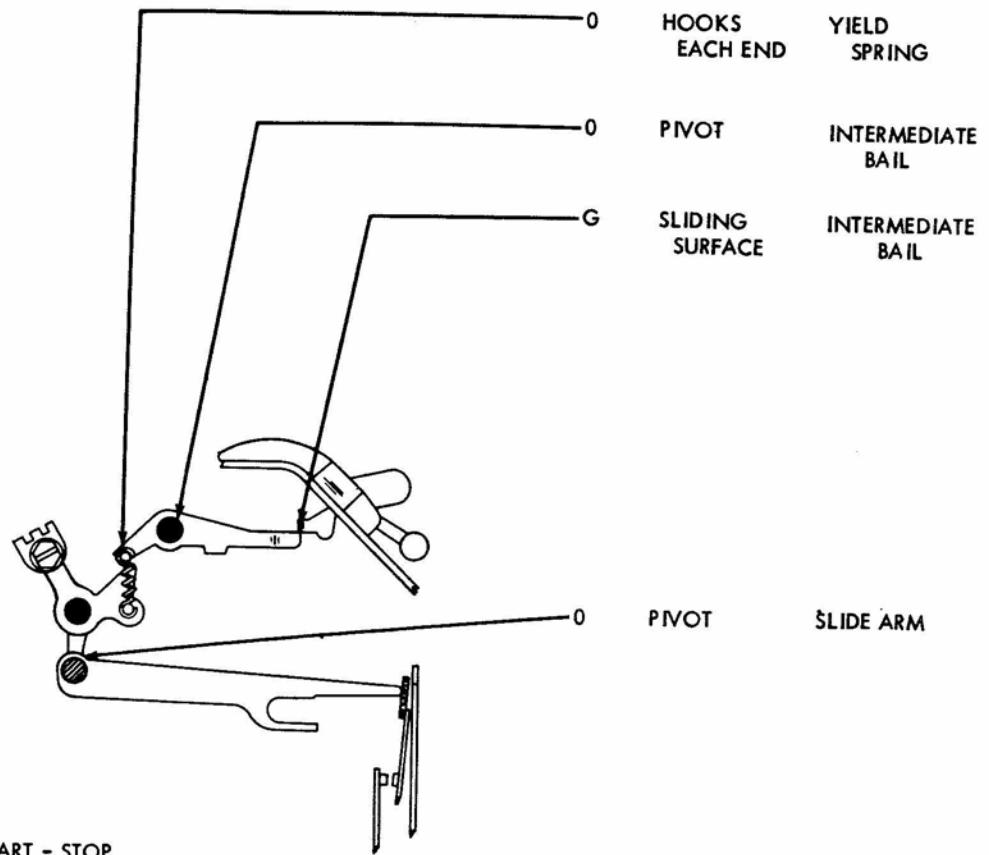


Figure 5-144. Transmitter Distributors

c. 15 TIGHT TAPE  
SLIDE ARM ASSEMBLY



c. 16 START - STOP  
SLIDE ARM ASSEMBLY

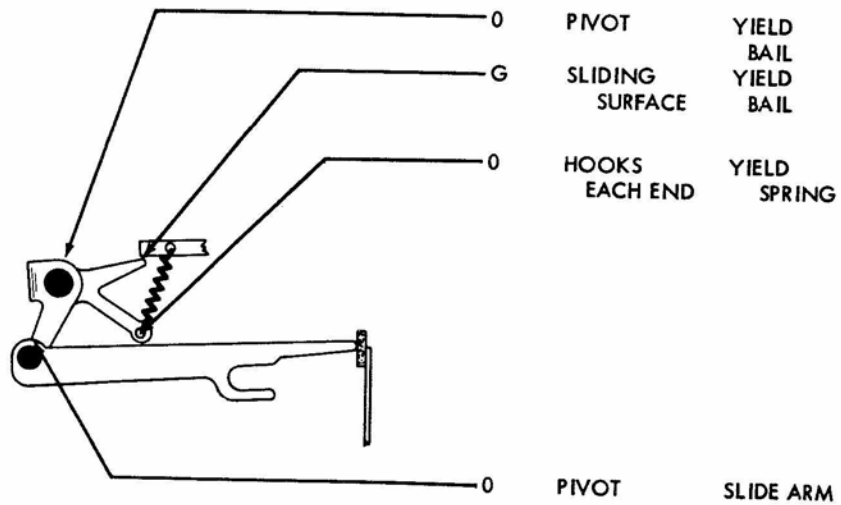


Figure 5-145. Transmitter Distributors

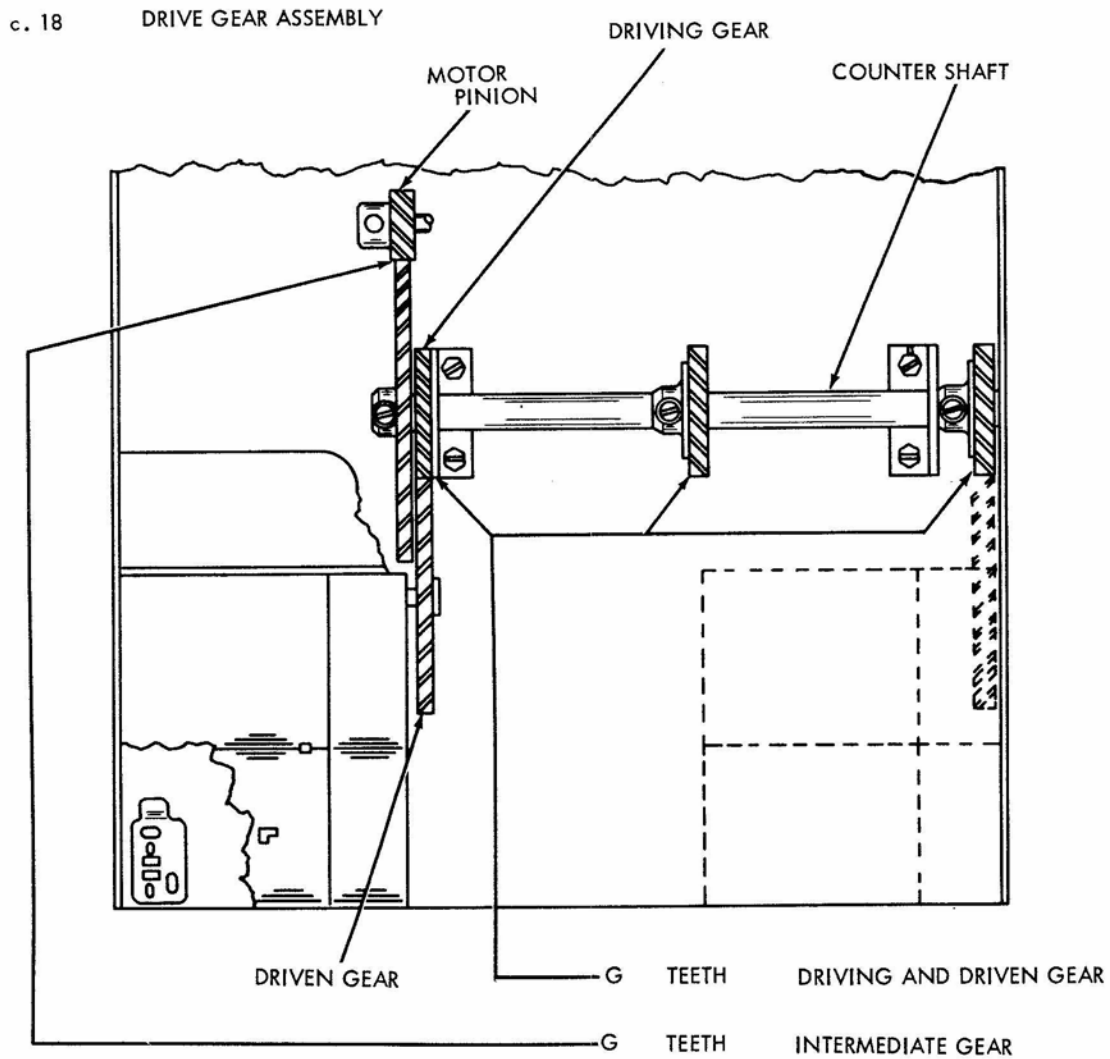
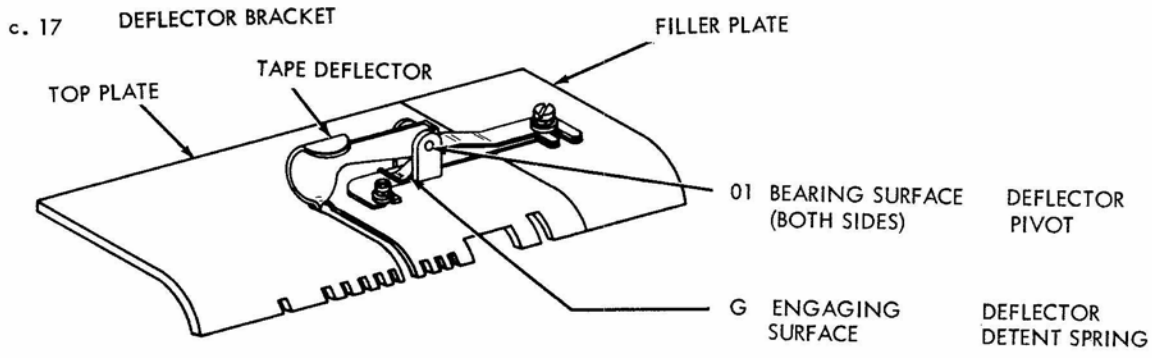


Figure 5-146. Transmitter Distributor and Base

d. UNIVERSAL CABINETS

d.01 CABINET HINGES AND SLIDES

NOTE  
FOLLOWING LUBRICATION INSTRUCTIONS PERTAIN  
TO ALL CABINETS.

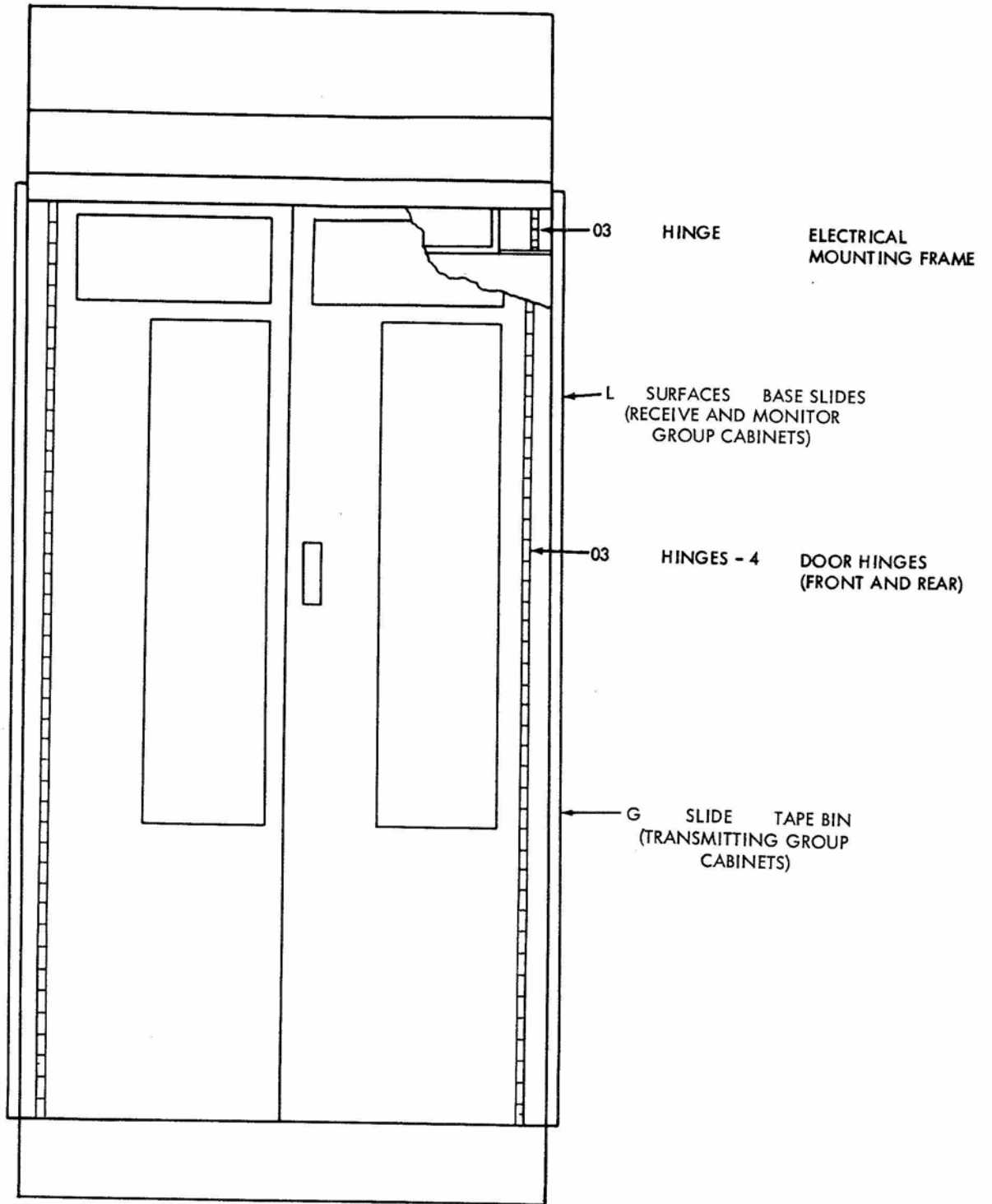


Figure 5-147. Universal Cabinet (Front View)

d.02

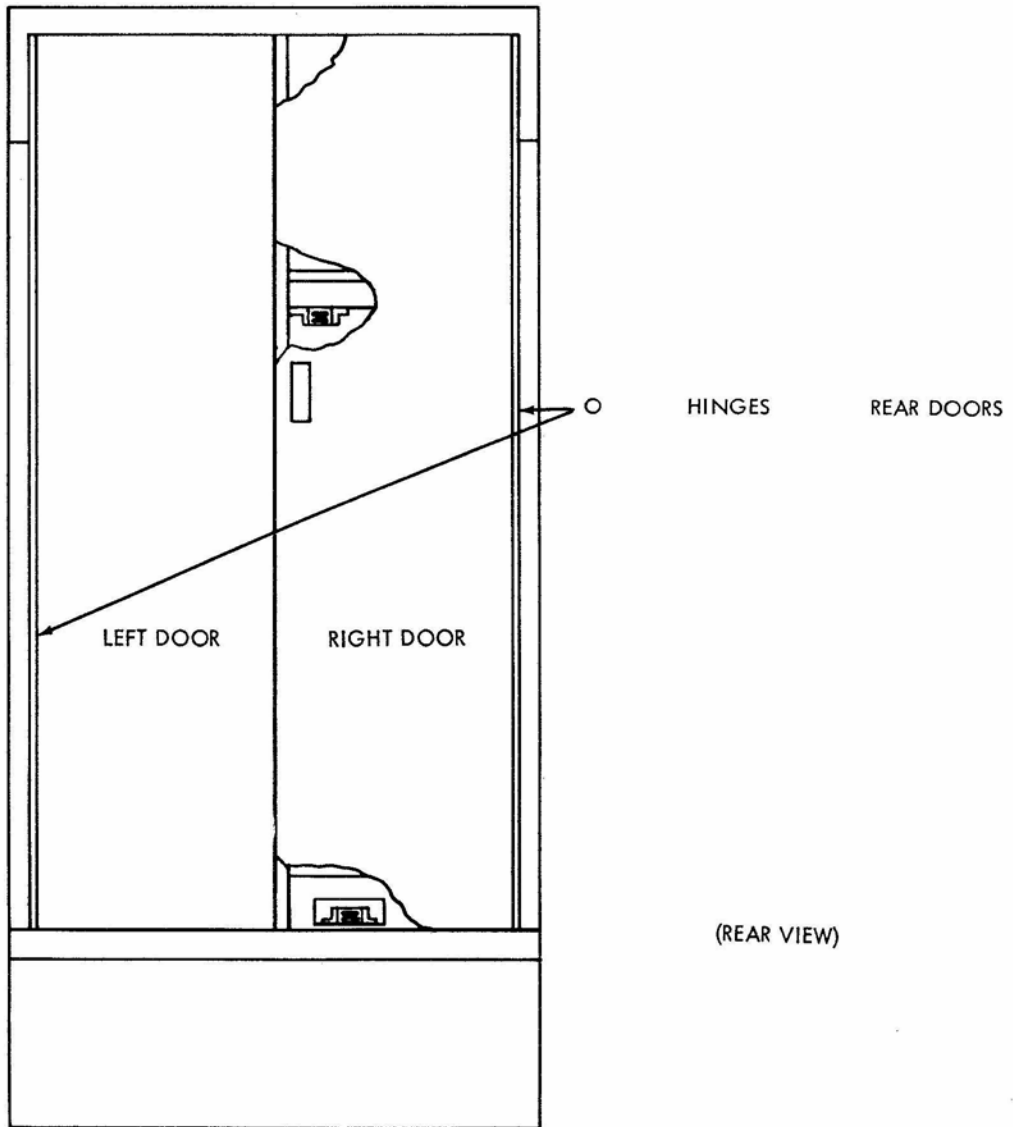


Figure 5-148. Universal Cabinet (Rear View)

e. TANDEM MESSAGE IDENTIFICATION MODULE

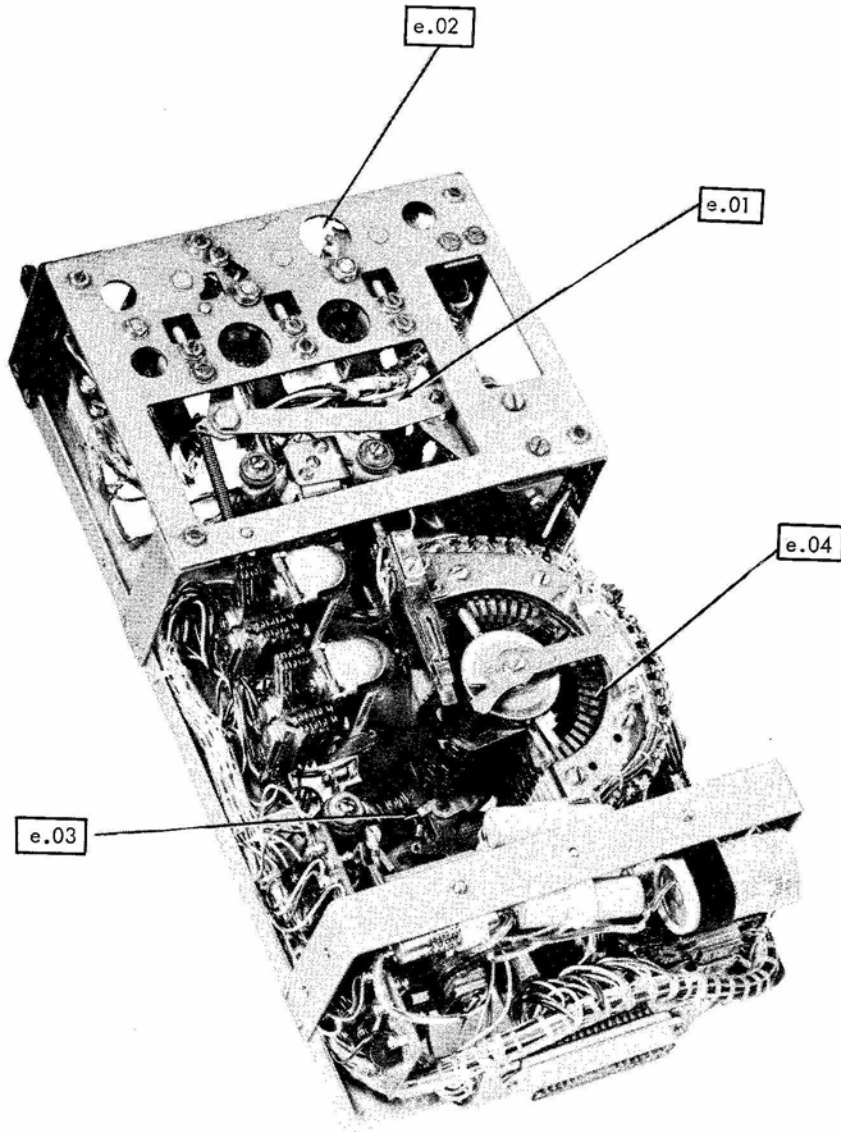
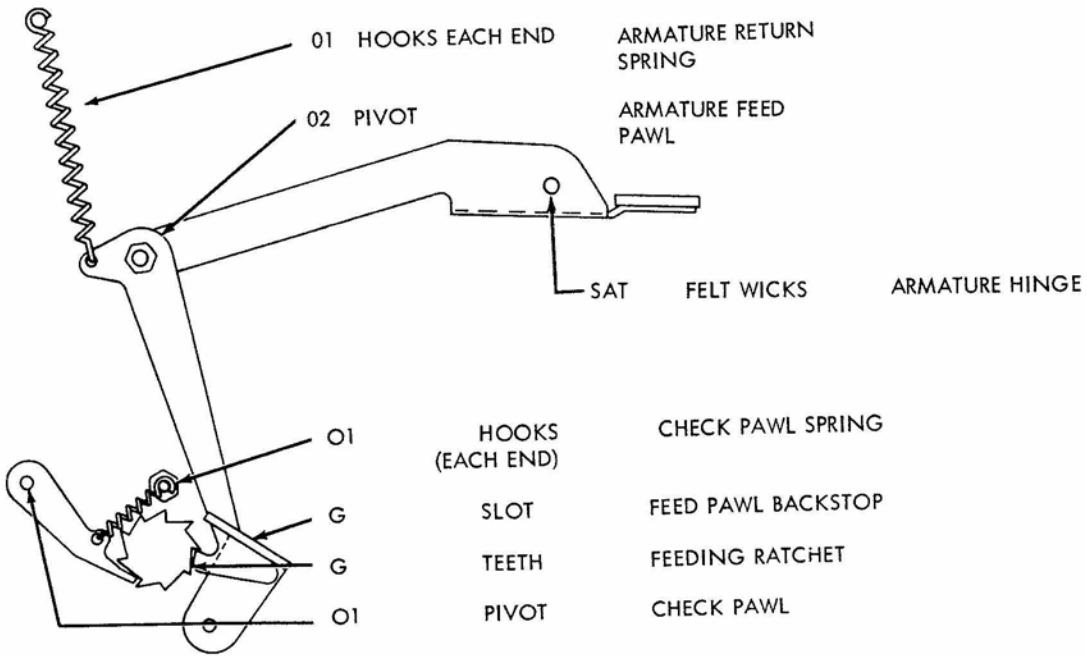


Figure 5-149. Tandem Message Identification Module

e.01 NUMBER ADVANCE MECHANISM



e.02 COUNTER DRUM ASSEMBLY

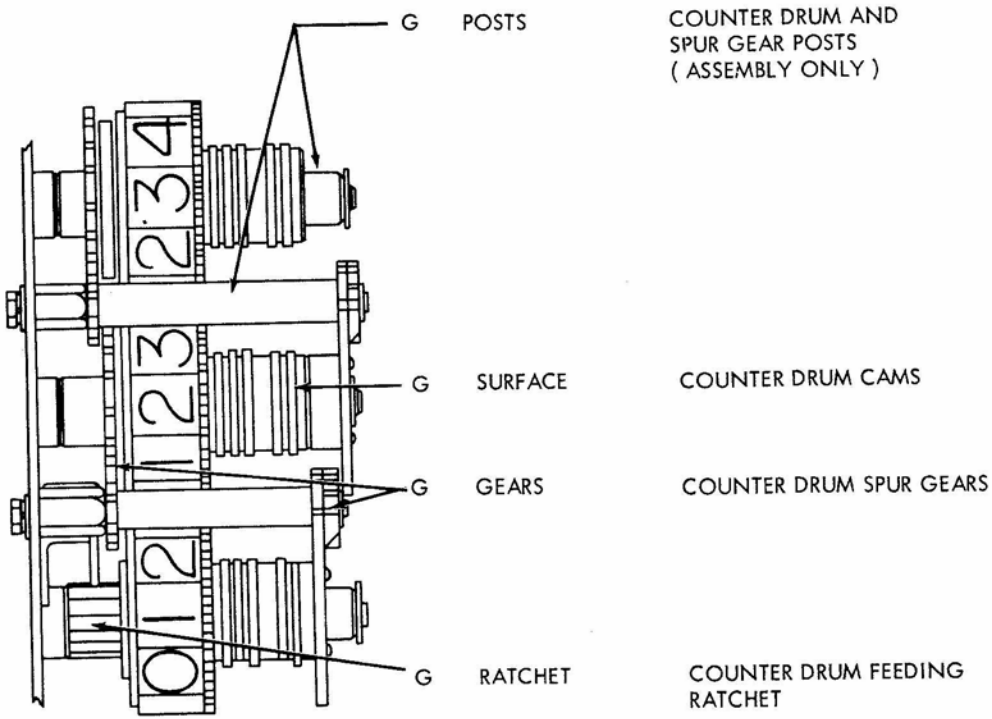
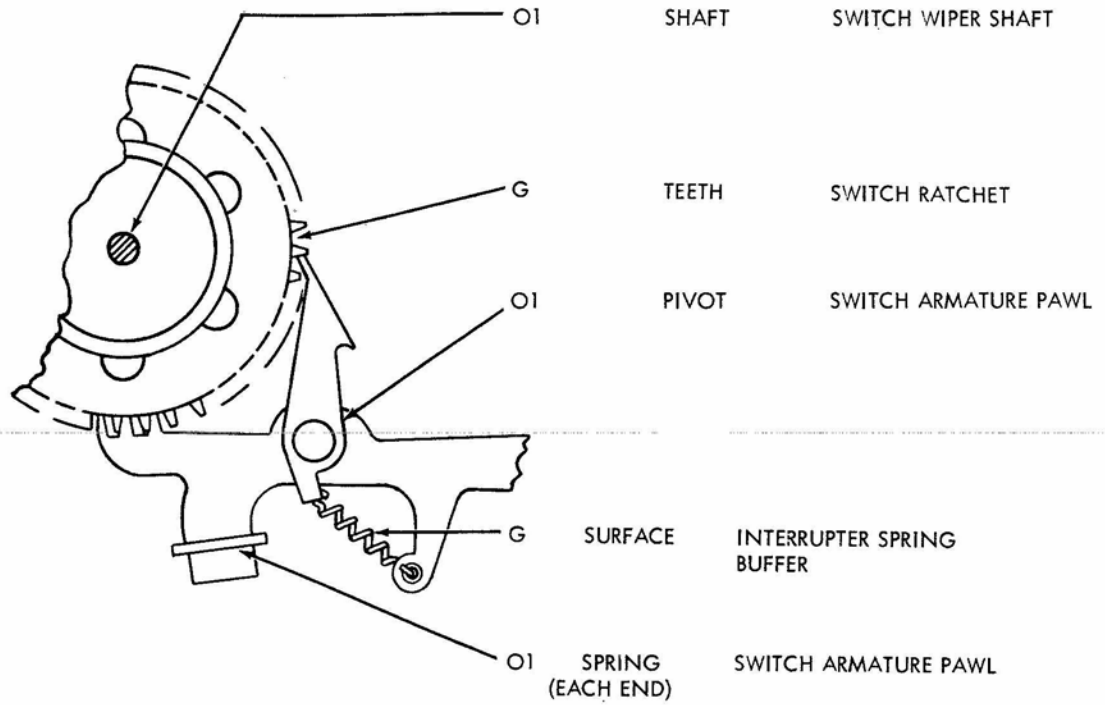


Figure 5-150. Tandem Message Identification Module



e.03 STEPPING SWITCH FEED MECHANISM



e.04 STEPPING SWITCH ELECTRICAL CONTACTS

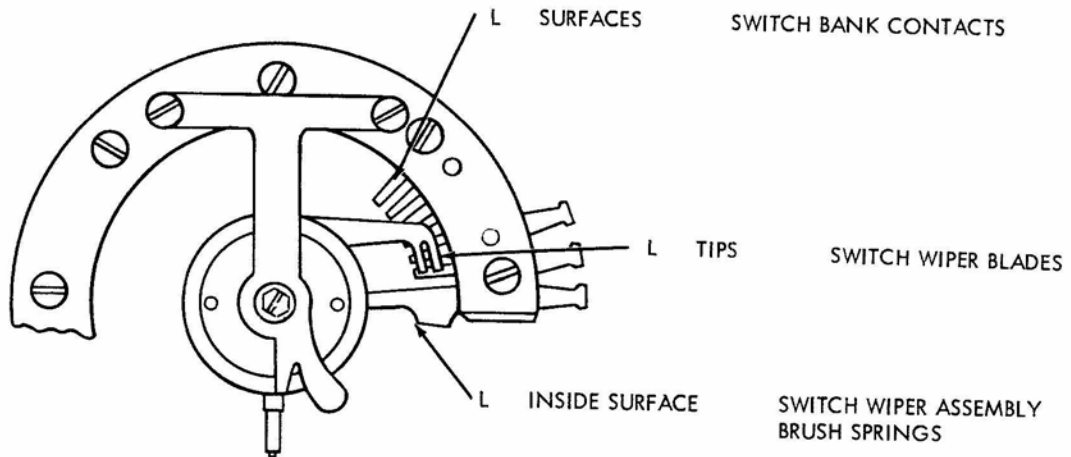


Figure 5-151. Tandem Message Identification Module

f. MULTIPLE TAPE WINDER

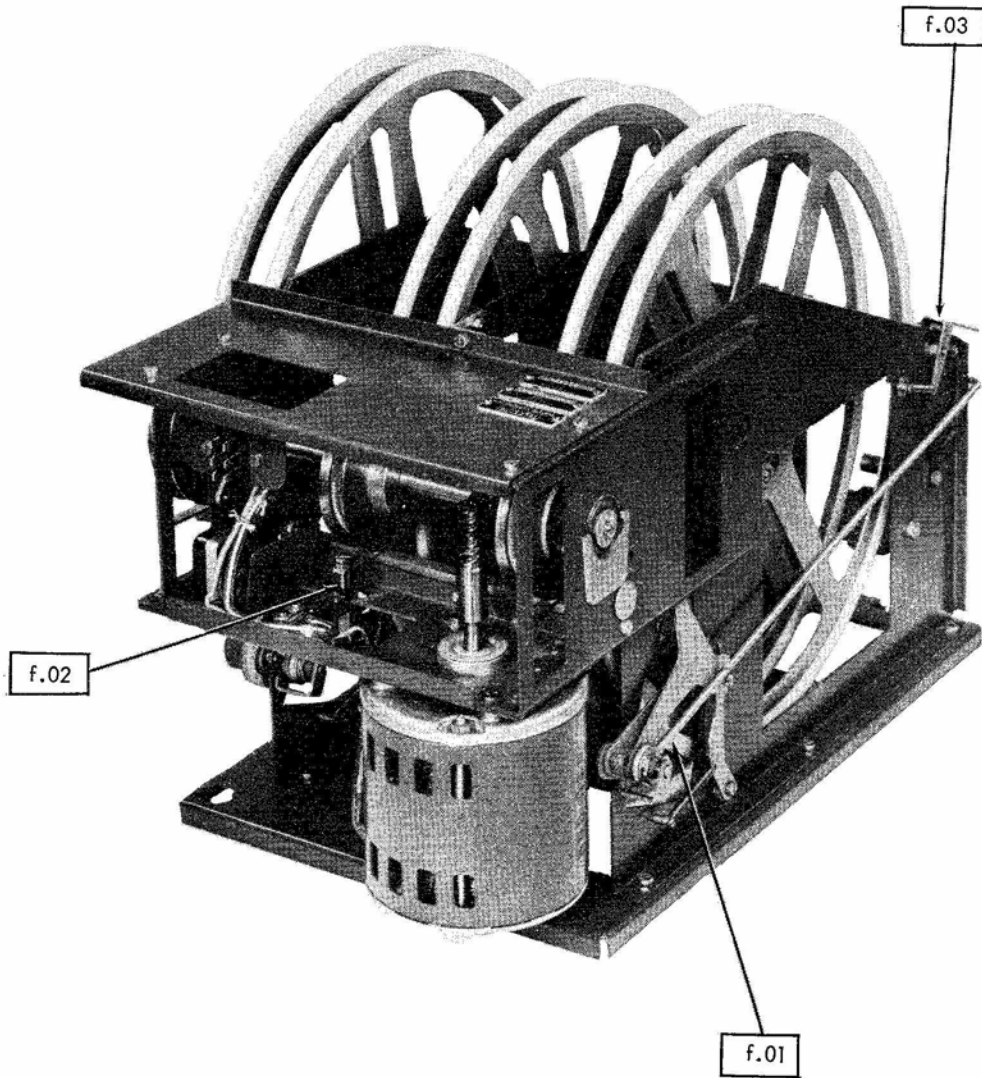
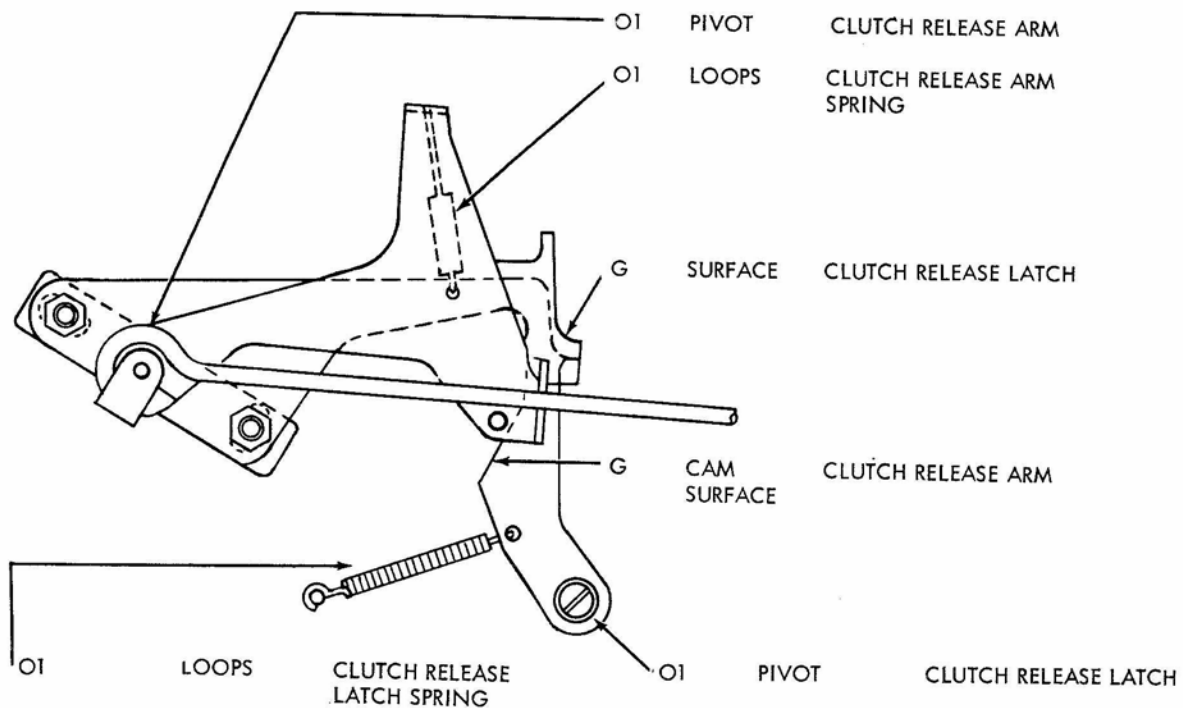
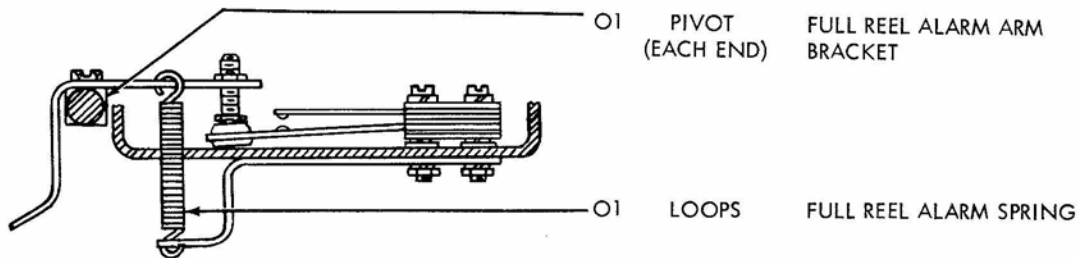


Figure 5-152. Multiple Tape Winder

f.01 CLUTCH ENGAGE-DISENGAGE MECHANISM



f.02 FULL REEL TAPE ALARM MECHANISM



f.03 CHAD DEPRESSOR ASSEMBLY

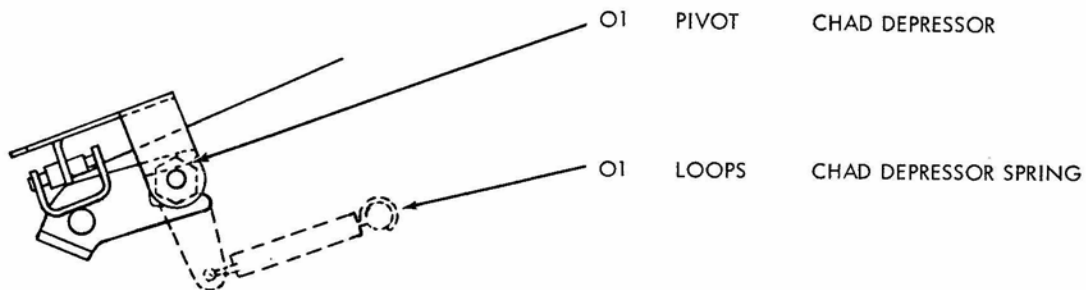


Figure 5-153. Multiple Tape Winder



## SECTION 6

## SERVICE AND REPAIR

## 6-1. GENERAL

a. This section provides instructions for PREVENTATIVE MAINTENANCE, TROUBLE SHOOTING, DISASSEMBLY and REASSEMBLY.

b. Refer to other volumes and sections of this manual as the need arises. Lubrication- a definite requirement in preventative maintenance- and adjustments- required for any repair and correction of troubles- will be found in Section 5. For aid in trouble shooting the equipment, refer to Section 4, PRINCIPLES OF OPERATION, and to Volume 2, WIRING DIAGRAMS. Section 3, OPERATOR'S SECTION, will aid in acquainting the maintenance personnel with operation of the equipment groups. Parts ordering information, with exploded views of parts and assemblies illustrating the detailed arrangement of parts to supplement the assembly and disassembly information, may be found in Teletype Bulletin 1180B (NAVSHIPS 94158, Vol. 3 of 3). Refer to Section 2, INSTALLATION, and to paragraph 6-9, DISASSEMBLY AND REASSEMBLY, as required.

## 6-2. COMPONENTS COVERED

a. The equipment covered by this technical manual is divided into four groups as described in Section 1. The preventive maintenance instructions in this section are either general or refer to specific components and should be used with all groups as applicable.

b. Illustrations covering each of the above groups and their components may be found in Section 1.

c. The four groups are referenced throughout the technical manual in the following order:

- (1) Model 28 Transmitter Group.
- (2) Model 28 Typing Reperforator Monitor Group.
- (3) Model 28 Typing Reperforator Receiving Group.
- (4) Model 28 Monitor Transmitter (Pull-Back) Group.

ORIGINAL

## 6-3. GENERAL PREVENTIVE MAINTENANCE INSTRUCTION

a. The preventive maintenance listed in this paragraph is a systematic series of operations to be performed at regular intervals on equipment, when the equipment is not in the operating circuit, in order to prevent major breakdowns and unwanted interruptions in service and to keep the equipment operating at top efficiency.

b. Most of the operating mechanical and electrical parts used in teletypewriter equipment require some type of routine preventive maintenance. Definite and specific work schedules are needed. This section contains specific instructions and serves as a guide for personnel assigned to perform the following maintenance operations.

(1) FEEL - The feel operation is used most often to check rotating machinery, such as the motor, cams, and shafts, and to determine if electrical connections, bushings, etc., are loose or overheated. Feeling indicates the need for lubrication and the existence of other types of defects requiring correction. Many motors used in teletypewriter equipment operate at relatively high temperatures. The maintenance man must be familiar with normal operating temperatures of the equipment in order to be able to properly recognize signs of overheating.

## NOTE

It is important that the feel operation be performed as soon as possible after shutdown and always before any other maintenance is done.

(2) INSPECT - Inspection is the most important operation in the preventive maintenance program. The inspector must know what and how to check for required clearances, tensions, and adjustments of the various assemblies, without overlooking the evidence of minor trouble. Although these minor defects may not immediately interfere with performance of the equipment, valuable in-service time and correction effort can be saved if they are corrected before they lead to major breakdowns. Make every effort to become thoroughly familiar with the indications of normal functioning in order to be able to recognize the signs of defective equipment. Inspection includes carefully observing and checking with tools, gauges, etc.

(when they are required), all parts of the equipment. Notice state of cleanliness, lubrication, amount of wear, adjustment and placement, tightness, clearance, tension, overheating, bind, drag, noise, moisture accumulation and foreign matter; inspect for these conditions as follows:

(a) Cleanliness, by carefully examining all surfaces of the units for accumulation of dust, dirt, and excessive oil or grease. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth, mildew, and moisture accumulation.

(b) Inadequate or excessive lubrication.

(c) Excessive wear, as indicated by loose fittings, bearings, etc.

(d) Adjustment and placement, by determining that all mechanical and electrical parts are properly adjusted and in their original positions.

(e) Tightness, by testing any connection, assembly, or mounting that is normally fastened in a rigid position.

#### CAUTION

Before tightening any screws, bolts, or nuts, determine whether or not they are part of some adjustment. If so, tighten in accordance with detailed requirements and adjustment procedures given in Section 5 and check all related adjustments.

(f) Clearance between specified points, by feeling, sighting, or inserting gauges as specified for item inspected.

(g) Spring tensions, by using the appropriate special spring scale in the exact manner illustrated for each spring tension requirement. (See Section 5).

(h) Overheating, as indicated by discoloration, blistering, odor or bulging of the parts or surface of the container; by leakage of insulating compounds; and by oxidation of metal contact surfaces.

(3) **TIGHTEN** - This operation applies to soldered connections, bolts, screws, and fasteners holding items rigidly in place. Solder loose or broken soldered connections. Correct tightening procedure requires the careful use of

the proper type and size of tools. Do not over-tighten screws, bolts and nuts. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

#### CAUTION

Do not tighten parts or apparatus requiring clearance or tension adjustment.

(4) **CLEAN** - This operation as applied to external surfaces of boxes, covers, panels, frames, etc. is the normal cleaning process.

(a) Cleaning equipment interiors, including delicate electrical and mechanical parts, requires detailed specific procedures. This cleaning is normally performed as part of the preventive maintenance routine.

(b) Items scheduled for cleaning in the check list need not be cleaned each time they are inspected. Under some conditions, however, it may be necessary to complete the cleaning of a unit before starting the other operations. Clean all parts only when inspection shows that it is necessary.

(5) **ADJUST** - Adjustments are made only when they are necessary to restore normal operating conditions. Use extreme care in selecting the proper tools and gages before making adjustments. Many adjustments must be made in a particular sequence. EACH adjustment must meet ALL requirements for clearance, spring tension, speed, and other tolerance limits. If ONE adjustment is changed, ALL related adjustments must be checked. This check may involve a certain amount of duplication, but there are no practical short cuts when making overlapping functional adjustments. Detailed instructions for specific requirements and adjustments are given in Section 5.

(6) **LUBRICATE** - Lubrication refers to the application of oil or grease to all rotating shafts, bearings, cam rollers, sliding surfaces, and other moving parts. It may include the application of oil to metal surfaces or parts of the equipment. All lubrication should be performed as directed in Section 5. Section 5 indicates the normal preventive maintenance-lubrication interval, the points to be lubricated, and the type and quantity of lubricant to be used.

6-4. **PREVENTIVE MAINTENANCE CLEANING** - The majority of preventive maintenance techniques pertain to specific areas of preventive maintenance. However, the following general instructions should be helpful.

a. Use crocus cloth of No. 0000 sandpaper to remove rust or corrosion, where there is no danger of sand or grit lodging in moving parts.

b. Use a clean, dry, lint-free cloth and/or a dry brush for cleaning purposes.

(1) Use a cloth, moistened with solvent if necessary, to clean metallic parts (except electrical contacts). Wipe solvent and dirt from the part with a clean, dry, lint-free cloth.

(2) Flushing, or burnishing followed by a flushing action, normally is best when cleaning electrical contacts; recheck clearances after filing or burnishing. Dip an orange stick in cleaning compound and allow the liquid to drip from the stick through the contacts only. Remove all cleaning compound carefully with a clean lint-free cloth, and/or bond paper. Protect other parts against cleaning compound.

#### WARNING

Prolonged breathing of cleaning compounds is dangerous. Be sure that adequate ventilation is provided. In addition, some cleaning compounds are flammable. Do not use near a flame.

c. If available, use vacuum cleaning equipment for removing loose dust, paper lint, and dirt from the teletypewriter equipment.

#### CAUTION

Never use compressed air for cleaning operations in assemblies of small parts since it may dislodge springs or other delicate parts. Use a vacuum cleaner with care; do not break or loosen wiring and connections.

d. **OIL-IMPREGNATED BRONZE PARTS** - Do not immerse oil-impregnated bronze (oilite) bearings and other oil-impregnated parts in solvent, because the impregnated oils will dissolve. To clean these parts, use a stiff brush or wipe with an oil-soaked cloth.

e. **BALL BEARINGS** - Most ball bearings, except motor bearings, used on the teletypewriter sets are grease sealed. Do not attempt to clean or lubricate these, other than to wipe them with a clean, dry cloth. Lubricate other bearings as directed in Section 5. Replace any bearings that do not spin freely.

f. **MOTORS** - Clean the motors as follows:

(1) Use a clean, dry sash brush to remove dust and dirt from the exterior of the motor. Remove all oil and gummy deposits with a clean, lint-free cloth, dampened if necessary with a suitable solvent.

(2) To clean the internal parts of the motors, disassemble the motor (refer to paragraph 6-9 and to Bulletin 1180B (NAVSHIPS 94158, Vol. 3 of 3). Remove all dust and dirt from the motor with a clean dry, sash brush.

#### CAUTION

When cleaning, take care not to damage the motor windings.

(3) When necessary, clean all parts made entirely of metal by immersing in a container of solvent.

g. **SELECTOR-MAGNET** - Clean the coils of the selector-magnet with a cloth, dampened in solvent if necessary. Clean rust off the pole pieces with crocus cloth or with No. 0000 sandpaper; refer to Section 5 for adjustments.

h. **FELT WASHERS** - Discard any dirty or gritty felt washers or oilers. Do not clean by immersing in solvent. When overhauling the equipment, replace all nonmetallic washers, mechanically preformed felts, and felt washers with new ones regardless of condition.

#### 6-5. ROUTINE MAINTENANCE CHECK CHARTS AND PROCEDURE

a. **GENERAL** - Time intervals for routine preventive maintenance will usually vary with operating conditions, importance of continuous operation, and available personnel. Normal operation is based on operating conditions which prevail when the temperature is moderate and the air is relatively free of foreign matter and excessive moisture. When equipment is being operated in localities where there are extreme temperatures, excess moisture, dust, dirt, sand, or other adverse conditions, establish the routine schedules at whatever intervals necessary to keep the equipment in satisfactory operating condition.

b. **TIME INTERVALS** - Time intervals are recommended under lubrication in Section 5 for equipment operating under normal conditions.

#### WARNING

Disconnect the power before starting to remove or replace any of the components.

## NOTE

Wherever applicable, check or perform the preventive maintenance on the same and similar related parts of a component associated with the component referenced (i. e., drive and driven gears, cables, cords, connectors, etc.).

c. **PREVENTIVE MAINTENANCE PROCEDURE** - Preventive maintenance procedure can be divided into two classes, work which can be completed while the teletypewriter set (group) remains in service, and work which requires that the teletypewriter set be taken out of service.

(1) The first class of work is limited to the operations performed on the teletypewriter set exterior which is accessible while the teletypewriter is in service.

(2) The second class of work includes the operations which require that the teletypewriter set be removed from service before the preventive maintenance work is started.

(3) Detailed information on the different individual test requirements and adjustments of complicated parts and mechanisms are given in Section 5.

(4) After all preventive maintenance work including lubrication has been completed and the teletypewriters have been assembled, make the following tests and adjustments.

(a) Motor speed (governed motors only).

(b) Rangefinder setting (all typing reperforators).

(c) Operating and monitoring tests.

## NOTE

Always check related adjustments when any adjustment is made.

## CAUTION

Do not attempt to pick up units by clip-on top plates or small protruding parts.

(5) **DISASSEMBLY AND REASSEMBLY.**

(a) Disconnect the power and line cords. Place the components (units) on a bench or other suitable work-place.

(b) Refer to paragraph 6-9 for disassembly and reassembly instructions, and to Bulletin 1180B (NAVSHIPS 94158, Vol. 3 of 3) for parts diagrams as required.

(c) Refer to installation instructions in Section 2 for assembly of complete sets or groups.

(6) **LUBRICATION** - Lubricate the equipment as shown in the figures of Section 5. Section 5 indicates the lubrication interval, the points to be lubricated, and the quantity and type of lubricants to be used.

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
1. Exterior of Teletypewriter Cabinets	Check for dirt, rust, corrosion, cracked or chipped enamel; loose or missing bolts, nuts, screws, etc.; bent, rusted, or damaged door latches and hinges, rollers, and sliding surfaces on shelves; broken, cracked, or damaged windows. Rotate the tape reels to see that they move freely. Tighten all loose screws on the exterior of the cabinet; replace any missing parts. Tighten all switch mountings and knobs. Wipe off excess oil, dirt, moisture, etc., with a clean, dry, cloth. Lubricate rollers and sliding surfaces of the shelves (see Section 5).	Do not over-tighten screws, nuts, bolts, etc. Wipe off all excessive lubricant. Refer to Section 5 for detailed instructions for making any necessary adjustments.



Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
2. Electrical Facilities and Cabinet Interiors	Clean all dirt, dust, etc., from the interior using a brush and clean cloth. Inspect the interior for loose, damaged or missing parts. Check and perform applicable preventive maintenance listed in 3 through 14 below. Refer to wiring diagrams shipped with the equipment or to Volume 2 as needed.	Make sure all power is disconnected before cleaning. Protect the various units housed in the cabinets from dirt, etc., falling off the interior.
3. Cords, Cables and Connectors	Inspect cords and cables for cracked or deteriorated insulation, frayed or cut insulation at connecting points, excessive strains on the wires or connections. Inspect the connector plugs and sockets for dirt, rust, oil, corrosion, and cracked or damaged shells. Remove the connector shells and tighten any loose connections or clamps. Tighten the connections on the power cords. Check all connections on terminal boards for tightness. Clean grease, oil, and moisture from cords, plugs and sockets with a clean, dry cloth, or if necessary clean outer insulation with clean cloth moistened in water. Clean corrosion or stains from plugs with metal polish. Be sure to remove all residue of the polish after cleaning.	Disconnect all power before cleaning. Protect units in cabinets from dirt, etc., which is removed from the wiring.
4. Fuses	Inspect the fuses and fuse holders for dirt, dust, and corrosion. Check for burned out fuses. Clean the fuses and fuse holders with a sash brush. Remove corrosion on the fuse or fuse holder with crocus cloth or #0000 sandpaper and wipe clean with a dry cloth.	Make sure all power is disconnected before cleaning. Protect units in cabinets from dirt, etc., falling off the fuses and holders.
5. Equipment Shelves	Inspect for excessive dirt, cracks, missing or broken parts, bent, rusted, or damaged sliding surfaces, worn or damaged mountings. Tighten all loose screws, bolts and nuts. Clean the surfaces, if necessary, with a clean rag dampened with a suitable dry cleaning solvent. Oil may be used to remove rust spots from the metal surfaces. Lubricate moving parts in accordance with lubrication diagrams of Section 5.	Protect units which may be exposed to dirt, etc., falling from the shelf. Maintain adequate ventilation of cleaning solvent and avoid exposure to fire or sparks. Avoid prolonged breathing of fumes.

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
6. Terminal Boards	<p>Inspect terminal boards for loose connections and mounting screws, cracks, breaks, oil, moisture and dirt. Carefully examine the connections for mechanical defects, dirt, and corrosion. Tighten loose screws, bolts, and mounting lugs. Remove and clean dirty or corroded connections before tightening. Clean terminal board with a dry brush. Use a suitable dry cleaning solvent if necessary and then wipe with a clean, dry cloth followed by a brush to remove all lint.</p>	<p>Disconnect all power before performing maintenance operations. Protect any units which might be exposed to dirt, etc., brushed from the terminal blocks. Prevent solvent from coming into contact with insulation.</p>
7. Wiring	<p>Inspect for cracked, frayed or torn insulation. Check for loose clamps, loose or dirty connections and faulty lacing. Check for wires which may be bearing on moving parts. Be sure the ground connections are clean and tight. Tighten all loose screw connections. Resolder loose or broken solder connections. Place all wiring in the proper place and retie if necessary. (Soldering must be done by an experienced repairman.) Clean all moisture, oil, grease, etc., from wiring with a clean dry cloth. Clean all connections before reconnecting.</p>	<p>Disconnect all power before performing the maintenance operation.</p>
8. Rectifiers and Transformers	<p>Inspect for dirt, dust, and gummy deposits. Check fuses, terminals, and leads on the control panels, or terminal boards. Investigate any odor or discoloration of burning insulation or excessive heating of parts. Remove any strap, wire or other device used to strap, a blown fuse. Tighten any loose mounting screws and bolts. Solder any loose or broken connections. Clean the exterior of the unit with a clean cloth and if necessary, a suitable dry cleaning solvent. Remove any foreign material from between the rectifier connections and diodes; use a small touch-up brush about one inch wide. Clean foreign matter from all other parts with a stiff brush. Test the rectifier for output voltage. Before changing the diodes or transformers, or trouble shooting to provide the proper output voltage; check the AC line voltage to be sure it is not temporarily higher or lower than normal. (See wiring diagrams or Volume 2.)</p>	<p>Disconnect all power before performing maintenance operations. Refer to wiring diagrams shipped with equipment or in Volume 2.</p>

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
9. Switches, Relays and Contacts	<p>Operate and check the mechanical action and spring tension of each switch; also check for corrosion, dirt, oil, and moisture on all exposed parts. Clean with brush and clean cloth, remove corrosion with crocus cloth and, if necessary, remove grease or oil deposits with a solvent of known, suitable characteristics.</p> <p>a. Remove any pits, build ups and corrosion from contacts with a file or crocus cloth and finish with a burnisher. Replace contacts if insufficient metal remains. Remove corrosion from armatures and magnet pole pieces with crocus cloth. Recheck adjustments per Section 5.</p> <p>b. Remove last traces of oil or cleaning compound by pulling a strip of bond paper through contacts while pressing them together against the paper; for armature and pole piece use thin, preferably non-magnetic, flat piece of metal, if required, with the bond paper.</p> <p>c. Remove any filings or small particles sticking to pole pieces, armature or contacts by pressing, <u>without rubbing</u>, fresh pieces of friction tape against them until clean. Wrap the tape around a thin piece of metal as in b. above.</p>	<p>Disconnect all power. Keep oil and solvent from insulation and contacts to greatest extent possible; remove all traces before returning equipment to service. Make certain that grit and fillings do not lodge in moving parts.</p>
10. Loose or Defective Parts	<p>Tighten or replace all loose, missing or damaged parts; if part of, or affecting any adjustment, make the adjustment and check all related adjustments in accordance with Section 5. Check all components for breaks, cracks, kinks, corrosion, excessive wear etc. Manually check rotating and moving parts of all units against bind or drag. Check all clutches for complete engagement and disengagement.</p>	<p>Disconnect power before working on a component.</p>
11. Accumulation of Dust and Dirt	<p>Check for dust from paper beneath its path through punch and typewheel mechanisms and for dust and dirt on other parts of the equipment. Clean by wiping with a soft lint-free cloth. Cleaning with an air hose should be avoided.</p>	<p>Be sure that springs are not disengaged or other parts disturbed in cleaning. Avoid getting dust or dirt into bearings or other moving parts.</p>

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
<p>12. Selector Response (Typing Reperforator)</p>	<p>If the selector responds to distorted signals in the manner specified in Section 5, no maintenance is required. If the requirements are not met, the following routine should be observed:</p> <ul style="list-style-type: none"> <li>a. Clean the magnet pole faces by running a clean piece of paper between them and the armature. If corroded, see 9 above.</li> <li>b. Examine selector parts for wear and replace if worn.</li> <li>c. Check adjustment of selector mechanism in Section 5.</li> <li>d. Check selector mechanism springs and replace if necessary. (See Section 5.)</li> </ul>	
<p>13. Adjustments</p>	<p>Most adjustments will remain within specification limits for the life of the equipment and, therefore, do not require checking unless trouble occurs. Refer to individual items for adjustments to be checked.</p>	<p>Exercise extreme precaution to guard against overtightening screws which might result in stripping.</p>
<p>14. Lubrication</p>	<p>For disassembly prior to lubrication see detailed instructions at end of this section, then refer to Section 5. Remove the units from the cabinets. Examine all mechanism for signs of lubrication failure, frequently evidenced by the presence of red, powdery substance at point of failure. If failure is observed, parts should be examined and if damaged they should be replaced. Lubricate the equipment in accordance with Section 5 and wipe off excessive lubricant with a clean cloth.</p>	<p>Be sure that springs are not disengaged and that other parts are not disturbed during examination and lubrication.</p>
<p>Note: Check all components, wherever applicable, in accordance with above instructions numbered 1 through 14, regardless of specific checks called out in the chart for any component.</p>		
<p>15. Tape Winders</p>	<p>Inspect the housing for excess dirt and missing or broken parts. Tighten all mounting screws on the exterior of the unit, replace any missing parts. Clean excessive oil, dirt, moisture, etc., with a clean, dry cloth. Adjust the tape winders as instructed in Section 5. Lubricate the unit in accordance with the lubrication diagrams of Section 5.</p>	<p>Disconnect power source while performing maintenance operations.</p>

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
16. Tape Winder Motors	Check for cracks or other damage to the motor. Check for loose, broken or missing mounting screws. Feel the motor to make sure it is not overheating. Clean the outside of the motor with a clean, dry cloth. Do not remove the motor from the tape winder. Lubricate in accordance with the lubrication diagrams of Section 5.	Disconnect the power source before performing maintenance operations. Motor normally runs hot.
17. Motor Units	<p>Preventive maintenance may be performed on the unit or on the motor, bracket and base assemblies separately after removal.</p> <p>a. Shaft should turn freely, smoothly and quietly by hand and under power.</p> <p>b. Check for overheating by feel, discoloration, odor of burned insulation or operation of thermal cut-out safety switch.</p> <p>c. Check motor position on mounting bracket assembly and tighten mounting strap screws that secure the motor.</p> <p>d. Clean the motor as instructed in Paragraph 6-4.f.</p> <p>e. Check for breaks and loose or missing screws.</p> <p>f. Check items listed under "cords, cables and connectors", "Fuses", "Terminal Boards", "Wiring", "Switches and Relays" above.</p> <p>g. Lubricate and, if necessary, adjust in accordance with Section 5.</p>	Disconnect all power before removing or replacing any components.
18. Motor Brushes (Governed Motor only)	Remove and replace if length is less than 3/8 inch. Wipe and blow off the accumulation carbon dust.	Relationship of brush to armature should be maintained.
19. Motor Governor Brushes	Examine length and replace if less than 3/8 inch remains. Wipe and blow off accumulation of carbon dust.	Be sure brush springs are in place.
20. Motor Governor Contacts	Replace if badly burned.	Be sure that contacts are properly aligned.

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
21. Motor Governor Speed	See Section 5.	Applies to governed motor only. Motor may be considered on-speed if not more than 12 target spots pass a given point in ten seconds.
22. Bases and Motor Unit Brackets	<p>Check for deposits of oil, grease and dirt. If necessary, scrape or use solvent to remove hardened grease or oil from metal parts; otherwise use clean cloth and brush. Use oily cloth to remove rust and to clean non-metallic gears. Clean with dry cloth and keep oil from belts, sprocket belts, sprockets, V pulleys and friction drive parts. Check all gears and belts for reasonable play and tension. Lubricate and, if necessary, adjust in accordance with Section 5. Perform applicable preventive maintenance listed under "Cords, Cables and Connectors", "Terminal Boards" and "Wiring".</p>	
23. Typing Reperforators	<p>Remove the unit and examine all operating assemblies for wear, lubrication, dirt and loose or missing parts.</p> <ol style="list-style-type: none"> <li>a. Check manually against bind of all moving parts.</li> <li>b. Check for broken or weak springs and missing or loose parts.</li> <li>c. Clean and remove any excess lubricant. (See paragraph 6-4.)</li> <li>d. Check condition of ribbon and replace if necessary. If one edge is frayed, check ribbon guide alignment.</li> <li>e. Blow or brush out dirt and paper lint accumulated around printing and punching mechanism.</li> <li>f. If typewheel has dirt deposits, remove ribbon from guides, insert paper under typewheel and brush dirt out toward front of unit while rotating typewheel, then wipe with clean cloth.</li> <li>g. Check the selector as instructed in 12 above.</li> </ol>	Disconnect all power. Avoid over-lubrication.

Table 6-1. Routine Maintenance Check Chart

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
<p>23. Typing Reperforators (Cont)</p> <p>24. Transmitter Distributors</p>	<p>h. Check contacts and tape feed-out magnet (see 9, above).</p> <p>i. Lubricate (see Section 5).</p> <p>Remove the unit and examine all operating assemblies for wear, lubrication, dirt and loose or missing parts.</p> <p>a. Check manually against bind of all moving parts.</p> <p>b. Check for broken or weak springs and missing or loose parts.</p> <p>c. Clean and remove any excess lubricant (see paragraph 6-4).</p> <p>d. Check clutch trip magnet armatures and pole pieces (see 9, and 12 above).</p> <p>e. Spot check, at least, visible contacts. If any are found dirty, oily, pitted, out of adjustment or otherwise defective, recheck all contacts in accordance with 9 above and Section 5.</p> <p>f. Lubricate (see Section 5).</p>	<p>Disconnect all power. Avoid over-lubrication.</p>

## 6-6. TROUBLE SHOOTING

a. **GENERAL** - Failures of the equipment can be traced functionally with the aid of the Trouble Shooting Charts, Tables 6-2 through 6-5. A step-by-step analysis of the behavior of the equipment in response to the tabulated checks will help indicate the area of trouble in which to apply remedial measures outlined below and referenced in the chart. Since, in most cases, each check step is conditioned by the procedure in preceding steps, examine the condition of all controls, and switches before rechecking any step or otherwise performing any trouble shooting check out of sequence. An eliminative process relative to probable troubles indicated should greatly facilitate clearing faulty operation at any point in the equipment.

(1) When check of an adjustment is indicated, care should be exercised not to disturb the adjustment or related adjustments. Ref-

erence is made to adjustment illustrations in Section 5 as required. If adjustment is found to be needed, check applicable sequence of paragraphs in Section 5 to determine if related adjustments may be required.

(2) For removal and disassembly procedures, when indicated, refer to paragraph 6-9, and to the exploded views of the equipment contained in Bulletin 1180B (NAVSHIPS 94158, Vol. 3 of 3).

(3) Comprehensive electrical analysis of the equipment is not generally required in trouble shooting. Reference to an "open" condition represents a normally closed circuit through which current will not flow, due either to a break, a poor connection, or a poor or dirty contact mechanism. Reference to a "closed" condition represents a normally or intermittently open circuit through which current will flow, either due to a short or to a sticky, dirty or poorly adjusted contact mechanism.

(4) "Running open" is a condition created by an open signal circuit, resulting in operation of typing and printing mechanisms because of the absence of a stop signal to latch the function clutches.

(5) "Running closed" is a condition created by a closed signal circuit, resulting in failure of typing and printing mechanisms to respond to a signal, due to the absence of the start and spacing elements in the signal, or to mechanical failure.

(6) "Garbling" is a condition in which the response of the typing and printing mechanisms does not correspond to the mechanical or signal input.

#### NOTE

If trouble shooting checks indicate abnormal conditions, refer to paragraph 6-8, in this section. If lubrication is indicated, refer back to Section 5.

b. **PROCEDURE** - The trouble shooting information presented in this section consists of operational, electrical, and mechanical checks designed to lead maintenance personnel to the specific part, adjustment, or electrical component that is causing the trouble in the equipment. A thorough knowledge of the sequence of operation for each functioning element is of fundamental importance. Refer to Section 3 and to Section 4 of this manual to clarify the operation and function of all teletypewriter parts. Because the teletypewriter groups and sets are an assemblage of components, the first step in trouble shooting, if the trouble is not obvious, is to sectionalize the trouble to a particular component, then determine what specific mechanism or electrical part is faulty.

(1) Make a visual inspection of the equipment to determine if the trouble is caused by loose line or power connections, improperly set switches, erratic motor speed, or improper rangefinder setting.

(2) Arrange an operating test of the equipment. Refer to Section 2, Installation, and to Section 3 Operator's Section, if required, to sectionalize the trouble. These procedures are primarily performed after initial installation of new or repaired equipment and may be used to locate troubles when they occur.

(3) **LOCALIZING ELECTRICAL TROUBLES** - Most electrical troubles are found at the various contacts in the equipment, which include,

switch contacts, plug-in connector and pin contacts, terminal board contacts, soldered contacts, (including spliced wires), and chassis ground contacts. Electrical circuits in the teletypewriter set have jack or terminal board connections at the points where most tests must be made. Do not disturb the wiring more than necessary when testing or inspecting. Maintenance personnel must be thoroughly familiar with the schematic and wiring diagrams to be found with the equipment or in Volume 2, and use them while making point-to-point checks of the circuits. Schematic wiring diagrams of external equipment to which the teletypewriter set is connected furnish information helpful for testing and localizing trouble.

#### (a) POWER SUPPLY CHECKS -

To be sure that proper operating conditions exist, check the input power, AC circuits, and DC circuits in turn before making other tests. These checks will, of necessity, include normal operation of the parts in these circuits and the requirements of all adjustments which would affect the indicated trouble as related to the parts. When check of an adjustment is indicated, care should be exercised not to disturb the adjustment or related adjustments.

#### (b) CONTINUITY, RESISTANCE, AND CAPACITOR CHECKS

1. **CONTINUITY.** The continuity check is used to locate suspected open circuits. In making continuity checks, be sure that parallel current paths are disconnected. Make the tests by checking the continuity through the circuit suspected to be faulty by connecting the tests leads so that the current can go only through the suspected circuit. Be sure no other part of the circuit is shunting the circuit being tested. If necessary, disconnect certain leads. Check all likely circuits, in this manner. If, after checking all possible causes, the fault cannot be located, make a continuity test of the entire circuit. Test from one terminal to a half-way point in the circuit. If continuity is indicated, test the other half of the circuit. Continue subdividing the circuit until the open point is definitely located.

2. **RESISTANCE.** The resistance check is used to locate suspected open or shorted coil windings, transformer windings, motor windings, fixed resistors and inductors. In making resistance checks, follow the same general procedures as those described for continuity checks (1. above).

3. **CAPACITOR.** The capacitor check is used to locate shorted or leaking elements. To test, discharge the suspected capacitor with an insulated shorting jumper. Then



disconnect one lead and connect the capacitor to an ohmmeter. Use the highest reading scale. A good capacitor will be indicated by the ohmmeter pointer first moving up the scale rapidly, then returning more slowly to the infinity mark. A capacitor which is open will give a reading of infinite ohms. A shorted capacitor will give a reading of constant value between zero and infinity, depending upon the resistance of the short.

#### WARNING

Be extremely careful when handling charged capacitors. A severe electrical shock may be received from the capacitor or leads connected to a power supply in operation.

#### (c) ELECTRICAL CHECKS

1. Check for external interruptions to the 115 volt AC power supply at the cabinet terminal boards.

2. Check for open fuses located on the equipment control panels or electrical service assembly facilities. If open, rotate the motor by hand and check for excessive mechanical load before replacing the fuse. If a replaced fuse burns out immediately upon installation, check for shorted wiring in the motor, selector magnets, or the rectifier transformers.

3. Proceed to the applicable trouble shooting chart (paragraph 6-7), for a more complete tabulation.

(4) LOCALIZING MECHANICAL TROUBLES - Although many mechanical troubles can occur in the teletypewriter sets, no difficulty should be experienced in locating the fault if the sequence of operation is checked through its various steps. When a mechanical function fails to operate, or operates in a faulty manner, the trouble may be in a particular adjustment, or series of adjustments, or it may be in a particular assembly. One method for checking troubles involves checking the indi-

vidual requirement for all adjustments in the faulty subassembly or mechanism. Use the related data, found in the detailed adjustment procedures of Section 5, to determine the sequence to be followed. A second method involves setting up by hand the selecting mechanism and completing the operation by manually rotating the motor, shaft, gear, or cam that normally drive the assembly. This second method is usually quicker when only one adjustment is faulty and the remainder of the mechanism is in good condition. In such cases only the related adjustments need be checked. In some instances, faulty operation may be observed only when the mechanism is power-driven. The experience of the maintenance personnel and the over-all condition of the equipment will indicate which of the two methods is the better approach to various troubles. As with electrical troubles, additional aid in locating mechanical troubles may be secured from records of previous troubles and adjustments. The procedure for localizing mechanical trouble is divided into the effects of the trouble observed. Proceed to the applicable trouble shooting chart.

#### 6-7. TROUBLE SHOOTING CHARTS

The following tables, 6-2 through 6-5, are arranged by group to help in locating a probable faulty component.

a. Any trouble listed in the trouble column is assumed to be the only trouble. Multiple simultaneous troubles would probably require some degree of special service engineering analysis while using the schematic wiring diagram applicable to the equipment along with Section 4, PRINCIPLES OF OPERATION, of this manual.

b. When a type of trouble has been located in the trouble column of a chart, refer back to the preceding steps in the first column and, if necessary, to Section 3, OPERATOR'S SECTION, in order to verify proper control and switch settings as well as otherwise normal operation of the overall group.

Table 6-2. Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
1.	Transmitter cabinet for each of 3 (or 6) channels, as required by operating conditions; control relay, step relay, sensing clutch release magnet, distributor clutch release magnet and counter magnet operate from 48 volt DC source <b>ABNORMAL TRAFFIC LAMPS</b> light on line seizure condition.	No relays or clutches will operate.	Check 48 volt DC source at bottom of cabinet.	6-8.a.(2)(a)
		One relay or magnet operated mechanism does not operate properly.	a. Check connections and wiring. b. Check adjustment of defective part (refer to affected unit in steps below).	6-8.a.(2)(b)
		<b>ABNORMAL TRAFFIC LAMPS</b> will not light.	a. Check bulb and socket. b. Check connections and wiring at cabinet. c. Check connections and wiring at remote area.	6-8.a.(1)
2.	Cabinet main power switch and both motor switches ON: motors (synchronous) run normally.  NOTE: If governed motors are used, refer to STEP 3.	No motor runs.	a. Check AC power to cabinet terminal connection. b. Check convenience receptacle and connections for short.	6-8.a.(3)
		Motor will not start.	a. Check 4 amp. slow-blow fuse. b. Check motor switch. c. Check power factor corrector (esp. if second fuse blows). d. Check, and, if required, reset thermal cut-out switch. e. Check motor-start relay. f. Check connections and wiring. g. Check motor-start capacitor. h. Check start winding.	

Table 6-2. Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
2. Cont		<p>Motor will not run.</p> <p>Motor speed incorrect.</p> <p>Motor overheats, noise and/or vibration.</p>	<p>Check operating winding.</p> <p>Check power line frequency and voltage.</p> <p>a. Disconnect power.</p> <p>b. Check for lubrication.</p> <p>c. Check manually for binding or loose mechanical parts.</p> <p>d. If more than 1 motor overheats, check power.</p>	6-8.a.(3)(d)
3.	<p>Governed Motor: Switches ON: both motors run normally, as in STEP 2 above.</p> <p>NOTE: Use this step only where a governed motor is used in place of synchronous motor.</p>	<p>Motor will not start.</p> <p>Motor runs at incorrect speed.</p> <p>Motor speed uncontrollable.</p>	<p>a. Check fuse and power connections.</p> <p>b. Check motor brushes.</p> <p>c. Check governor brushes.</p> <p>d. Check governor adjustment.</p> <p>a. Check 115 volt AC power line voltage.</p> <p>b. Check motor and governor brushes.</p> <p>c. Check governor adjustment.</p> <p>d. Check governor resistor.</p> <p>a. Check governor capacitor and resistor.</p> <p>b. Check for sticking governor contacts.</p>	<p>6-8.a.(4)</p> <p>6-8.a.(4)(d)</p>

Table 6-2. Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
4.	Tandem Message Identification Module: Deletion switch in "NO DELETE" position; preceding each message, the module automatically transmits the message identification sequence and message number with local visual indication of number. As tape runs out of one transmitter distributor, module switches transmission to the other loaded transmitter distributor in series on the same channel.	<p>Will not start transmission.</p> <p>Will not properly transmit complete code sequence.</p> <p>Will not transfer transmission to other loaded transmitter distributor at end of tape.</p>	<p>a. Check delete switch.</p> <p>b. Check transmitter distributor tape out contact through the control relay to +48 volt DC.</p> <p>c. Check from the tape out contact, through the normally closed control relay contacts, diode, off-normal contacts, start contacts, and K201 contacts (5T-6T) to ground.</p> <p>a. Check a. through c. above and associated contacts.</p> <p>b. Check interrupter contacts, step relay, auxiliary contacts and stepping switches.</p> <p>c. Check counter mechanism.</p> <p>d. Check transmitter distributor contacts.</p> <p>e. Check all components of affected circuit per schematic wiring diagram 4361 WD.</p> <p>a. Check tape-out contacts.</p> <p>b. Check control relays.</p> <p>c. Check stepping switches.</p> <p>d. See e. above.</p> <p>NOTE: The overlap of most functions may require careful study of wiring diagrams to clear troubles.</p>	<p>6-8.a.(5)(a)</p> <p>6-8.a.(5)(b)</p> <p>6-8. a. (5)(c)</p>

Table 6-2. Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
5.	Transmitter Distributor: Loaded with tape and RUN-STOP lever in RUN position; starts from "flip-flop" control circuit of numbering module. Transmits message to out-going signal line after transmission of identification code and message number from numbering module.	<p>Will not start.</p> <p>Will not transmit, or transmits garbled signal.</p> <p>Will not run, or stops during normal message transmission.</p> <p>Does not feed or sense tape.</p>	<p>a. Check tape-out contacts and start or tight tape contacts.</p> <p>b. Check 48 volt DC source.</p> <p>c. Refer to STEP 4, above.</p> <p>a. Check 48 volt DC supply and signal line current.</p> <p>b. Check reader and distributor contacts.</p> <p>c. Check circuit back through code and stepping switches (refer to STEP 4. above).</p> <p>d. Check sensing pins and linkage.</p> <p>a. Check start (tight tape) and tape-out contacts.</p> <p>b. Check control relays and 48 volt DC source.</p> <p>c. Check mechanical linkages, clutches and magnets.</p> <p>d. Check all auxiliary and stepping switch contacts in circuit.</p> <p>e. Check step relay (refer to STEP 4. above).</p> <p>a. Check mechanical linkages.</p> <p>b. Check for defective clutch, release magnet and coil.</p>	<p>6-8.a.(6)(a)</p> <p>6-8.a.(6)(b)</p> <p>6-8.a.(6)(c)</p>

Table 6-2. Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
5. Cont		Tape lid does not open when re-released.	<ul style="list-style-type: none"> <li>a. Check latch.</li> <li>b. Check for damaged or missing springs.</li> </ul>	6-8.a.(6)(d)
		Feed wheel does not engage tape feed holes.	<ul style="list-style-type: none"> <li>a. Check adjustment.</li> <li>b. Check alignment of feed and code holes. (If not correct, check original perforator of tape.)</li> </ul>	
		Transmitter Distributor does not stop when tape runs out.	<ul style="list-style-type: none"> <li>a. Check tape lid.</li> <li>b. Check tape-out pin.</li> <li>c. Check tape-out contacts.</li> </ul>	6-8.a.(6)(e)
6.	Multiple Transmitter Distributor Bases	Overheating, noise and/or vibration.	<ul style="list-style-type: none"> <li>a. Check for lubrication.</li> <li>b. Check for tightness of screws and nuts.</li> <li>c. Check for proper alignment and mesh of all gears and timing belts.</li> <li>d. Check for loose or binding gears, bearings and other moving parts.</li> </ul>	6-8.a.(7)

Table 6-3. Typing Reperforator Monitor Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
1.	Monitor Cabinet: Main power switch ON; control panel LOW TAPE lamp and WINDER-FULL lamp light and extinguish for either of 2 multiple typing reperforator sets, and SEIZURE and OPEN LINE lamps light from external source for each of the 6 typing reperforators, as required by operating conditions. AC power is available at two cabinet receptacles. 115 volt DC power is available at control panel DC outlet.	<p>No power.</p> <p>Neither the LOW TAPE or WINDER FULL control panel lamp will light.</p> <p>One of above alarm lamps will not light.</p> <p>SEIZURE and OPEN LINE lamps will not light.</p> <p>No 115 volt DC at cabinet receptacle.</p>	<p>a. Check AC to cabinet and connections.</p> <p>b. Check main power switch.</p> <p>c. Check AC receptacle connections and wiring.</p> <p>Check connections and wiring back to AC power source.</p> <p>a. Check bulb, socket and connections.</p> <p>b. Check specific operating contacts on reperforator tape supply reel or on tape winder mechanism.</p> <p>Check bulb, socket, connections and external control voltage source.</p> <p>Check cabinet power source and connections.</p>	<p>6-8.b.(1)</p> <p>6-8.b.(2)</p>
2.	Both tape winder switches and both typing reperforator set motor switches ON: All motors run normally.	Motor will not start.	<p>Check main AC power source, connections and wiring.</p> <p>a. Check 4 amp. fuses (one tape winder motor and typing reperforator set motor wired in parallel with one fuse for both).</p> <p>b. Check power factor corrector (esp. if new fuse blows).</p> <p>c. Check motor switch and, if required, reset thermal cut-out switch.</p>	<p>6-8.b.(3) and 6-8.b.(7)</p>

Table 6-3. Typing Reperforator Monitor Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
2. Cont		<p>Motor will not run.</p> <p>Motor speed incorrect.</p> <p>Motor overheats, noise and/or vibration.</p>	<p>d. Check motor start relay.</p> <p>e. Check connections and wiring.</p> <p>f. Check motor start capacitor.</p> <p>g. Check motor start winding.</p> <p>Check operating winding.</p> <p>Check power line frequency and voltage.</p> <p>a. Disconnect power.</p> <p>b. Check lubrication.</p> <p>c. Check manually for loose or binding parts (if more than one motor overheats, check power).</p>	
3.	Typing Reperforator receives incoming message; perforates and prints tape.	<p>Will not run: runs open on mark signal; runs closed on space signal.</p> <p>Poor selector receiving range.</p>	<p>a. Check drive parts through motor end base.</p> <p>b. Check incoming signal line current.</p> <p>c. Check 33RY polar line relay.</p> <p>d. Check local DC power.</p> <p>e. Check selector magnet, armature and linkage.</p> <p>a. Check incoming signal voltage, current and marking and spacing bias.</p> <p>b. Check selector magnet armature and pole pieces for oil and dirt.</p> <p>c. Check selector adjustments.</p>	6-8.b.(4)(a)



Table 6-3. Typing Reperforator Monitor Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
3. Cont		Intermittent errors in printing and perforating (same errors).	a. Check range finder adjustment to incoming signal. b. Check line current. c. Check selector magnet armature adjustment. d. Check selector adjustments.	6-8.b.(4)(b)
		Tape does not feed properly.	a. Check tape loading. b. Check tape feed mechanism adjustments. c. Check for excess chad packed in punch block (fully perforated units only).	6-8.b.(4)(c)
		Tape is not printed.	a. Check ribbon installation. b. Check printing mechanism adjustments.	6-8.b.(4)(d)
		Punch pins do not penetrate tape.	a. Check adjustments. b. Check for worn pins.	6-8.b.(4)(e)
		Garbled copy and perforations; gaining or losing a pulse.	a. Check as for "intermittent errors" above. b. Check for damaged or missing springs on punch slides or punch slide latches. c. Check positioning mechanism adjustments. d. Check punch mechanism adjustments.	6-8.b.(4)(f)

Table 6-3. Typing Reperforator Monitor Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
3. Cont		Typewheel does not shift.	<ul style="list-style-type: none"> <li>a. Check function blade adjustments.</li> <li>b. Check positioning mechanism adjustments.</li> </ul>	6-8.b.(4)(g)
4.	Automatic non-interfering "letters" tape feed-out mechanism: Similar in operation to remote controlled mechanisms, except that operation is initiated after a fixed period of idle line time.		Make mechanical checks as outlined in Table 6-4, STEP 4.	6-8.b.(4)(i)
5.	Multiple Typing Reperforator Base.	Overheating, noise and/or vibration.	<ul style="list-style-type: none"> <li>a. Check lubrication.</li> <li>b. Check for tightness of screws and nuts.</li> <li>c. Check adjustment of motor pinion to driven gear.</li> <li>d. Check alignment and tension of sprockets and timing belts.</li> <li>e. Check for loose or binding gears, bearings and other moving parts.</li> </ul>	6-8.b.(5)
6.	Tape Winder	Tape breaks, tangles or does not wind properly.	<ul style="list-style-type: none"> <li>a. Check tape tension mechanism.</li> <li>b. Check disengage clutch.</li> <li>c. Check friction drive roller and reel engagement.</li> </ul>	6-8.b.(6)

Table 6-4. Typing Reperforator Receiving Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
1.	Receiving Cabinet: Main power switch ON; LOW TAPE lamp, 6 REMOTE SEIZURE lamps and 6 OPEN LINE lamps light and extinguish as required by operating conditions. Power is available at AC convenience receptacle.	No power.	<ul style="list-style-type: none"> <li>a. Check AC to cabinet and connections.</li> <li>b. Check main power switch.</li> <li>c. Check AC receptacle, power, connections and wiring.</li> </ul>	6-8.c.(1)
2.	Main power switch and two motor power switches are ON; both motors run normally.	LOW TAPE lamp will not light.	<ul style="list-style-type: none"> <li>a. Check applicable contacts at tape reel, wiring and connection back to AC supply.</li> <li>b. Check bulb, socket and connections.</li> </ul>	6-8.c.(2)
		REMOTE SEIZURE or OPEN LINE lamps will not light.	Check bulb, socket, connections and wiring back to external voltage and control source.	
		No motor runs.	Check main AC power source, connections and wiring.	6-8.c.(3)
		Motor will not start.	<ul style="list-style-type: none"> <li>a. Check 4 amp. slow-blow fuse.</li> <li>b. Check motor switch.</li> <li>c. Check power factor corrector (esp. if new fuse blows).</li> <li>d. Check and, if required, reset thermal cut-off switch.</li> <li>e. Check motor start relay.</li> </ul>	NOTE: If a governed motor is used, refer to STEP 3, of Table 6-3.

Table 6-4. Typing Reperforator Receiving Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
2. Cont		<p>Motor will not run.</p> <p>Motor speed incorrect.</p> <p>Motor overheats, noise and/or vibration.</p>	<p>f. Check motor start capacitor.</p> <p>g. Check motor start winding.</p> <p>Check operating winding.</p> <p>Check power line frequency and voltage.</p> <p>a. Disconnect power.</p> <p>b. Check lubrication.</p> <p>c. Check manually for loose or binding parts (if more than one motor overheats, check power).</p>	
3.	Typing Reperforator		Check according to instructions as outlined in Table 6-3, STEP 3.	6-8.c.(4)
4.	Remote controlled non-interfering "letters" tape feed-out mechanism: Feeds out predetermined length (adjustable up to 18 inches in 0.6 inch steps) of tape punched with letters combination after 1 second time delay following end of message (if associated TAPE FEED OUT button is depressed).	<p>None will feed tape.</p> <p>One unit will not feed tape.</p>	<p>a. Check 115 volt DC source.</p> <p>b. Check terminal connections and wiring.</p> <p>a. Check tape feed-out magnet and armature.</p> <p>b. Check drive bail, release lever and latch lever.</p> <p>c. Check non-repeat latch and blocking latch.</p> <p>d. Check reperforator clutch trip mechanism.</p> <p>e. Check series resistor.</p>	<p>6-8.b.(4)(h)</p> <p>NOTE: If an adjustment required checking, check all related adjustments.</p>

Table 6-4. Typing Reperforator Receiving Group Trouble Shooting Charts

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
4. Cont	Feed-out stops, without interfering, upon receipt of incoming message or at end of its cycle.	Will not feed correct length.	a. Check tape length adjusting plate.	
		Starts feeding before elapse of 1 second time delay.	b. Check release and latch levers. c. Check feed and check pawls. d. Check ratchet cam follower. e. Check tripping and unblocking mechanism.  Check time delay lever adjustment and related adjustments.	
		Will not stop feeding or interferes with message.	a. Check non-repeat latch. b. Check tripping mechanism and blocking c. Check storage mechanism and reset bail toggle linkage.	
		Will not punch letters combination in tape.	a. Check reperforator clutch trip lever and bail. b. Check punch slide latches. c. Check storage mechanism.	
5.	Multiple Typing Reperforator Base.		Refer to STEP 5 of Table 6-3.	6-8.c.(5)



Table 6-5. Monitor Transmitter Group Trouble Shooting Chart

STEP	PROCEDURE AND NORMAL INDICATION	TROUBLE	NEXT STEP	CORRECTION (REFERENCE PARAGRAPH)
3. Cont		<p>Does not feed or sense tape.</p> <p>Tape lid does not open when released.</p> <p>Feed wheel does not engage tape feed holes.</p> <p>Does not stop when tape runs out.</p>	<p>d. Check reader auxiliary "B" contact.</p> <p>e. Check series resistor.</p> <p>Refer to Table 6-2, STEP 5 for this and following troubles.</p>	
4.	Multiple Transmitter Distributor Base.	Troubles are the same as those listed under STEP 6 of Table 6-2.	Refer to Table 6-2, STEP 6.	6-8.d.(4)
5.	Typing Reperforator.		Refer to Table 6-3, STEP 3.	6-8.d.(5)
6.	Multiple Typing Reperforator Base.		Refer to Table 6-3, STEP 5.	6-8.d.(6)
7.	Tape Winder.		Refer to Table 6-3, STEP 6.	6-8.d.(7)

## 6-8. ELIMINATION OF TROUBLE INDICATIONS

### a. TRANSMITTER GROUP (See Table 6-2)

#### (1) ALARM LAMP FAILURES

(a) Check main power fuse.

(b) Check bulb, socket, connections, and wiring. Refer to Volume 2 of this manual. See Table 6-1(7).

#### (2) RELAY AND CLUTCH RELEASE MAGNET FAILURES

(a) Check 48 volt DC sources. Refer to Table 6-1(9).

(b) Check connections to relays, wiring, and relay contacts (Table 6-1(9)).

#### (3) MOTOR FAILURE (SYNCHRONOUS MOTOR)

(a) Check fuses in motor circuit. Fuses are located on electrical control relay rack and are accessible when rear doors are opened.

(b) Check for open thermal cutout switch on motor mounting bracket. If the red button is raised, rotate motor by hand and check for binds or obstructions. Depress switch button. If the cut-out 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. Refer to Table 6-1(17) and paragraph 4-3.d.(1).

(c) Check motor ON-OFF switch on set base (see Table 3-1) for loose connections or defective operation.

(d) If motor operates at incorrect speed, check for 60 cycle ( $\pm 0.5$  cycle) frequency in power supply.

#### (4) MOTOR FAILURE (GOVERNED MOTOR)

(a) Check AC power to cabinet terminal board. Check convenience receptacles on multiple bases for loose connections.

(b) Check fuse in motor circuit.

(c) Examine motor brushes and replace if length is less than  $\frac{3}{8}$  of an inch. Wipe and brush off accumulated carbon dust. Relationship of brush to armature should be maintained. Similarly, examine governor brushes, and be sure brush springs are in place.

(d) Check governor adjustment, Figure 5-71. If motor runs at incorrect speed, check 115 volt AC power line supply. If line voltage is stable, use a tuning fork and check motor speed (see paragraph 4-3.d.(2)).

(e) If motor speed is uncontrollable, check for short in governor capacitor. To readjust, refer to Figure 5-70 and 5-71.

(f) If motor overheats check for binding and lack of lubrication.

#### (5) TANDEM MESSAGE IDENTIFICATION MODULE FAILURE

##### (a) NO TRANSMISSION

1. Check delete switch.

2. Check energizing circuit for transmitter distributor clutch release magnet. Refer to paragraph 4-3.g.(3)(a)1. See appropriate wiring diagram in Volume 2 of this manual.

(b) IMPROPER TRANSMISSION OF FIFTEEN CHARACTER CODE SEQUENCE - Refer to paragraph 4-3.g.(3)(a) for operation sequence.

1. Check operation of stepping relay.

2. Check stepping switch contacts and connections to stepping switch.

3. Check code reading contacts on numbering drums. For adjustments see Figures 5-108 and 5-109.

4. Check interrupter contacts on stepping switch assembly. Adjust according to Figure 5-116.

5. Check distributor contacts (see Table 6-1(9)).

##### (c) TANDEM TRANSMISSION FAILURE

1. Check control circuit and numbering module as outlined above. Refer to paragraph 4-3.g.(3)(a) for operation sequence.

2. Check tape-out contacts and start contacts on tandem transmitters.

#### (6) TRANSMITTER DISTRIBUTOR FAILURE

##### (a) IMPROPER TRANSMISSION



1. Check mark and space current.

2. Check reader and distributor contacts (see Table 6-1(9)). For operation sequence, see paragraph 4-3.b. Adjust contacts as shown in Figures 5-79 and 5-82.

3. Check control relay circuit as explained above.

(b) STOPS DURING NORMAL TRANSMISSION

1. Check transmitter distributor clutch assembly. Refer to adjustment Figure 5-74 through 5-76.

2. Check mechanical linkages and drive parts. Refer to paragraph 4-3.b. for operating theory.

3. Check operation of control circuit. Refer to appropriate wiring diagram in Volume 2 of this manual.

(c) TAPE FEED FAILURE - Check tape feed mechanism. Refer to paragraph 4-3.b. and Figure 5-80.

(d) TAPE LID FAILURE - Check tape lid release mechanism. Refer to paragraph 4-3.b. and Figure 5-84.

(e) TAPE-OUT FAILURE

1. Check tape lid (see paragraph (d) above).

2. Check tape out pin and contacts. Refer to paragraph 4-3.b. For adjustment procedure refer to Figure 5-86, 5-87 and 5-91.

(7) TRANSMITTER DISTRIBUTOR BASE FAILURE

(a) Check for lubrication of gears.

(b) Check for proper alignment of units on base. Refer to paragraph 2-2.c.(5) for positioning of transmitter distributor. See Figure 5-98.

b. TYPING REPERFORATOR MONITOR GROUP (See Table 6-3)

(1) POWER FAILURE

(a) Check for external interruptions of 115 volt AC power supply to cabinet terminal boards.

(b) Check main power fuse located at rear of cabinet on electrical relay control rack. Fuse is accessible when rear doors are opened, or control rack is tilted forward.

(2) ALARM LAMP FAILURE

(a) Check bulb, socket, connections, and wiring to lamp (see Table 6-1(3) and (7)). Refer to applicable wiring diagram in Volume 2 of this manual.

(b) Check tape out and winder full switches on units. Refer to Figures 5-68 and 5-102.

(3) MOTOR FAILURE - For synchronous motors refer to paragraph 6-8.a.(3). For governed motors refer to paragraph 6-8.b.(4).

(4) TYPING REPERFORATOR FAILURE

(a) RUNS OPEN OR CLOSED

1. Check connections of cabinet terminal boards, and receptacle to reperformer transmitter set.

2. Check for open magnets or faulty connections in selector mechanism on reperformer unit. See Table 6-1(12) and (23).

3. Check for defective 33RY polar line relay for unit involved.

4. Check incoming signal at cabinet terminals. Check equipment independently of line signal.

5. Check for binding mechanism in selector unit and transfer mechanisms.

(b) INTERMITTENT ERRORS

1. Check for inadequate or excessive line current.

2. Check range finder setting beyond range of incoming signal. For operating theory refer to paragraph 4-4.b.(3). For adjustment see Figure 5-8.

3. Check selector mechanism adjustments, Figures 5-3 and 5-9.

(c) IMPROPER TAPE FEED

1. Check tape loading (refer to paragraph 3-3.b.(2)(a)).

2. Check tape feed mechanism (refer to paragraph 4-4.b.(8)(c)). See Figures 5-18 through 5-21 for adjustments.

3. Check for fouled punch mechanism due to excessive chad (fully perforated tape units only). Refer to paragraph 3-3.b.(3).

(d) PRINTING FAILURE

1. Check ribbon installation (paragraph 3-3.b.(2)(b)).

2. Check printing mechanism. For operating theory see paragraph 4-4.b.(9). See adjustment Figures 5-46 through 5-53.

(e) PUNCH FAILURE - Check adjustment Figures 5-13 through 5-21. Refer to paragraph 4-4.b.(8) for operating theory.

(f) GARBLING

1. Check free movement of linkages around eccentrics in linkage from code bar extension through transfer mechanism and bell cranks to push bars. Check the particular linkage for the code or code element most frequently involved in the incorrect interpretation of the input signal.

2. Check and adjust axial and rotary correcting mechanisms for firm positioning of correcting plate roller (axial) or correcting lever lobes (rotary) simultaneously with activation of the printing hammer. See adjustment Figures 5-40 through 5-45.

3. Check oscillating drive link and bail if only the tops of characters are printing. Mechanism may be withdrawing the type wheel prior to printing hammer stroke. See adjustment Figure 5-40.

(g) LETTERS - FIGURES SHIFT FAILURE

1. Check mechanical linkage from push lever extensions through punch slide latches and punch slides to punch pins for binding on erroneous code hole perforating sequence. Refer to paragraph 4-4.b.(9)(b)5.

(h) REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM FAILURE

1. Check external 115 volt DC supply to tape feed-out mechanism magnets. Check wiring, connections, and series dropping resistor. Refer to Table 6-1(3), (6), and (7).

2. Check for dirty or poorly adjusted switch contacts in the tape feed-out circuit involved. Check for an open tape feed-

out magnet, or dirty magnet armature. Clear armature and magnet pole piece by drawing a thin piece of paper between them while applying slight pressure to the armature. See Table 6-1(9).

3. Check tape feed-out mechanism adjustments, Figures 5-54 through 5-66. Refer to paragraph 4-5b.(2) for operating theory.

4. Check reperforator clutch trip mechanism adjustments, Figures 5-1 through 5-10.

5. Check tape length adjusting plate (Figure 5-65) and adjust to desired length of tape feed-out.

6. Check remaining tape feed-out mechanism adjustments, Figures 5-58 through 5-66, and correct if necessary.

(i) AUTOMATIC NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM FAILURE - Make mechanical checks as outlined in paragraph (h)3. through 6. above. Refer to paragraph 4-4.b.(10) for operating theory.

(5) TYPING REPERFORATOR BASE FAILURE

(a) Check for lubrication of gears.

(b) Check for proper belt tensions. Refer to paragraphs 4-4.c. and adjustment Figure 5-67.

(c) Check for proper alignment of motors and typing reperforators. See paragraph 2-3.c.(2)(a), (d), and (e) and adjustment Figures 5-68 through 5-71.

(6) TAPE WINDER FAILURE (TAPE BREAKAGE OR FOULING)

(a) Refer to paragraph 4-4.e. for operation theory. Check tape tension mechanism.

(b) Check clutch engage - disengage mechanism, and friction drive roller and reel engagement. See adjustment Figures 5-100 and 5-101.

(7) MOTOR FAILURE (TAPE WINDER)

(a) Check fuse in motor circuit. See appropriate wiring diagram in Volume 2 of this manual.

(b) Check tape winder power switches on cabinet.

(c) Check motor for damage or loose, broken, or missing parts. Refer to Table 6-1(16) and (17). See paragraph 4-4.e. for operating theory.

**c. TYPING REPERFORATOR RECEIVING GROUP (See Table 6-4)**

**(1) POWER FAILURE**

(a) Check for external interruptions to 115 volt AC power supply to cabinet terminal boards.

(b) Check main power fuse located at rear of cabinet on electrical control rack. Fuse is accessible when rear doors are opened, or control rack is pivoted forward.

**(2) ALARM LAMP FAILURE**

(a) Check alarm switch on appropriate tape supply reel. Refer to paragraph 4-5.c, and Table 6-1(7) and (9).

(b) Check bulb, socket, connections, and wiring to lamp (see Table 6-1(3) and (7). Refer to applicable wiring diagram in Volume 2 of this manual.

(3) **MOTOR FAILURE** - For synchronous motors refer to paragraph 6-8.a.(3). For governed motors refer to paragraph 6-8.a.(4).

(4) **TYPING REPERFORATOR FAILURE** - Refer to paragraph 6-8.b.(4).

(5) **TYPING REPERFORATOR BASE FAILURE** - Refer to paragraph 6-8.b.(5).

**d. MONITOR TRANSMITTER GROUP (See Table 6-5)**

**(1) POWER FAILURE**

(a) Check for external interruptions to 115 volt AC power supply to the cabinet terminal boards.

(b) Check main power fuse located at rear of cabinet on electrical relay control rack. Fuse is accessible when rear doors are opened, or rack is pivoted forward.

**(2) ALARM LAMP FAILURE**

(a) Check main power fuse.

(b) Check for burned out step-down transformer, or loose transformer connections.

(c) Check for defective alarm switches on individual units. Refer to Table 6-1(9).

(d) Check for loose or broken socket connections, broken or burned out bulbs.

(e) Check wiring and terminal board connections (Table 6-1(6) and (7)).

(3) **TRANSMITTER DISTRIBUTOR FAILURE** - Refer to paragraph 6-8.a.(6). See paragraph 4-6.b for operating theory.

(4) **TRANSMITTER DISTRIBUTOR BASE FAILURE** - Refer to paragraph 6-8.a.(7).

(5) **TYPING REPERFORATOR FAILURE** - Refer to paragraph 6-8.b.(4).

(6) **TYPING REPERFORATOR BASE FAILURE** - Refer to paragraph 6-8.b.(5).

(7) **TAPE WINDER FAILURE** - Refer to paragraphs 6-8.b.(6) and (7).

**6-9. DISASSEMBLY AND REASSEMBLY**

**a. GENERAL**

(1) Refer to the installation instructions in Section 2, and reverse the procedure when the major components are to be removed from their respective cabinets. The power leads should be disconnected first as a safety precaution. On cabinets equipped with power factor capacitors, make sure that the capacitors are discharged before handling the associated circuit connectors, or before placing a meter in the circuit. The list of tools referenced in the adjusting procedure will be applicable for the disassembly or reassembly procedure.

(2) The disassembly procedure that follows breaks the respective unit down into its major subassembly. Further disassembly of each mechanism is fully explained by the exploded illustrations shown in Teletype Bulletin 1180B (NAVSHIPS 94158, Vol. 3 of 3). The illustrations are arranged on a functional basis insofar as possible, with a part number adjacent to each piece part. The pages following the illustrations lists the part number with its nomenclature. Frequent use of the part number is made in the disassembly procedure.

(3) Exercise care when removing or replacing gear guards, covers, and units so as not to damage cables or wiring. Route the connecting cables away from moving parts.

## NOTE

Retaining rings (tru-arc) are of spring steel and have a tendency to release suddenly. Loss of these can be minimized as follows: Hold the ring with your left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the ring. Rotate the screwdriver in a direction to increase the diameter of the ring. The retaining ring will come off easily without flying.

## b. TRANSMITTER GROUP

## (1) MESSAGE IDENTIFICATION MODULE

(a) To remove the 176540 module, loosen its front mounting screw and pull the unit forward. For further disassembly of the module, see paragraph 6-9.a.(2).

(b) To reassemble the unit, reverse the disassembly procedure.

## (2) TRANSMITTER DISTRIBUTORS

## (a) REMOVAL OF TRANSMITTER DISTRIBUTORS FROM BASE

1. Open the hinged front panel of the dust cover to provide access to each transmitter distributor and its attached cradle assembly. Lift the rear end of each cover plate to disengage its rear detents; then slide the cover toward the rear. Remove the clamp screw that secures each unit to the common base. Lift the respective transmitter upward and pull forward to disengage the unit.

2. To replace the unit, reverse the procedure, refer to paragraph 2-2.c.(5); make sure that the cover plate, top plate, tape guide plate, and filler plate are aligned, and that the gear play requirement is met. See Section 5.

## (b) TOP PLATE

1. To remove the 158521 top plate, loosen the side mounting screws and lift the plate upward.

2. To replace the top plate, guide the mounting screws into the notches of the side plates. Align the sensing pins and feed wheel with their respective slots. Refer to the adjusting procedure in Section 5 if the plates do not align.

## (c) TAPE GUIDE PLATE

1. To remove the 158627 or 158518 top plate, loosen the side mounting screws and slide the plate upward.

2. To replace the tape guide plate, guide the mounting screws into the respective notches of the side plates while guiding the tape-out pin into its hole and place the sensing pins against the left edge of the tape guide plate.

(d) FILLER PLATE - Refer to appropriate parts illustration.

## (e) CRADLE

1. Remove the two 42827 screws and the lock washers which secure the 161594 connector to the cradle. When the screws are replaced make sure that the head of each screw is on the outside of the cradle. For further disassembly of the cradle, see paragraph 6-9.a.(2).

2. Replace in the reverse order.

## (f) OIL RESERVOIR

1. To remove the oil reservoir, remove the four screws that secure the 158860 cross bar to the front and rear plate. Unhook the springs attached to the under side of the cross bar and lift the assembly upward.

2. Replace in the reverse order.

## (g) DISTRIBUTOR BLOCK ASSEMBLY

1. To remove the distributor contact assembly, remove the nuts that secure the cable connector to the rear plate if the unit is so equipped. Remove the three screws that secure the assembly. Lift the assembly out far enough for servicing.

2. To replace the distributor contact assembly, reverse the procedure. Refer to Section 5 for alignment and adjustment requirements.

## (h) IDLER GEAR ASSEMBLY

1. To remove the idler gear, remove the lock nut that secures the shaft to the side plate. Remove this assembly before removing the sensing and distributor shaft assemblies.

2. To replace the idler gear, reverse the procedure.

## (i) DISTRIBUTOR SHAFT ASSEMBLY

1. To remove the distributor shaft, remove the mounting screws (2) that secure each bearing clamp to the side plates.

2. To replace the shaft, reverse the procedure and check the requirements for adjustment in Section 5.

## (j) SENSING SHAFT ASSEMBLY

1. To remove the sensing shaft, remove the mounting screws (2) that secure each bearing clamp to the side plates.

2. To replace the shaft, reverse the procedure and observe the alignment and adjusting procedures in Section 5.

## (k) FEED WHEEL

1. To remove the feed wheel, back off the nut that secures the cantilever post sufficiently to raise the post and slide the wheel off.

2. To replace the feed wheel, reverse the procedure. Align the shoulder of the 158539 shaft with the notch for the tape guide and top plate mounting.

## (l) STORING SWITCH ASSEMBLY

1. To remove the transfer contact type storing switch assembly, remove the mounting screws (4) that secure the storing switch assembly to the main casting. Exercise care in handling not to damage the contact and slide projections. Withdraw switch assembly far enough to permit servicing.

2. To replace storing switch assembly, reverse the procedure. Replace the left front screw first and position the assembly about this pivot point to align the slides. Refer to Section 5.

## (m) PUSHER AND LATCH LEVERS

1. Remove storing switch, spring post, etc. to aid disassembly.

2. To remove the pusher and latch levers, remove both sets of springs and slide the 158849 and the 158848 pusher levers down. Slide and rotate the 158834 latch levers to left and out.

3. To replace the pusher and latch levers, reverse the procedure.

ORIGINAL

## (n) SENSING PINS

1. Remove tape guide plate, spring bracket, and sensing finger guide.

2. To remove the sensing pins, remove all springs at the lower end. Rotate the bell cranks downward and remove each 158522 sensing pin assembly.

## NOTE

The 158522 sensing bail eccentric shaft may be positioned to the side to facilitate disassembly.

3. To replace the sensing pins, reverse the procedure.

## (o) SWITCH ACTUATING MECHANISM (START-STOP AND/OR TIGHT TAPE SWITCH).

1. To remove the switch slide arm assembly, remove the 158560 intermediate plate by removing the three mounting screws and its spacer. Rotate the intermediate plate and remove the bail and slide arm mounting nut.

2. To replace the switch mechanism, reverse the procedure.

3. To remove the tape-out switch, remove the mounting screws that secure the 160590 bracket to the side plate.

4. To replace the tape-out switch, reverse the procedure.

## (p) CENTER PLATE ASSEMBLY

1. To remove the center plate assembly, remove the 110334 screw and lock washer from the 158535 post and the 151630 screw with lock and flat washer from the 158531 shaft that secures the plate assembly to the side plate. Lift the projection of the center plate that is hooked over the stripper bail pivot shaft, then pull the plate away.

2. To replace the center plate assembly, reverse the procedure.

## (q) SENSING ASSEMBLY

1. To remove the sensing mechanism, remove the 161328 pivot shaft by loosening the nut, set collars and the two retaining rings. Slide the shaft out and remove the 161325 latch bail, 161326 pusher bail and the 158526 feed lever. Remove the 158831 sensing bail.

2. To replace the assembly, reverse the procedure.

(r) CLUTCH TRIP MECHANISM

1. To remove either clutch trip mechanism, it will not be necessary to unsolder the leads to the magnet coil. Remove the screws that secure the 158751 mounting plate.

2. Replace the mechanism in the reverse order. Refer to Section 5 for adjustments.

(s) FRAME ASSEMBLY

1. Remove all screws and/or nuts that secure eccentric shaft to side frame and/or casting. Remove all screws that secure the side plates to the castings.

2. To replace the frame assembly, reverse the procedure.

(3) MOTOR UNIT

(a) Remove the motor mounting screws. The motor height adjustment should not be disturbed.

(b) To replace reverse the procedure.

(4) MULTIPLE TRANSMITTER BASE DRIVE MECHANISM

(a) To remove the counter shaft, refer to paragraph 6-9.a.(2).

(b) To replace the assembly, reverse the procedure noting the adjusting procedure in Section 5. Refer to paragraph 2-2.c.(2)(c).

CAUTION

Make sure that the screw in the right as well as the left end of the cross shaft is tightened before the respective gear hub is secured to the cross shaft by its mounting screw.

c. TYPING REPERFORATOR MONITOR GROUP

(1) TYPING REPERFORATORS

(a) REMOVAL OF TYPING REPERFORATORS FROM BASE

1. Remove multiple base from cabinet.

2. Remove typing reperforator unit from base by removing the three 151631 mounting screws holding the reperforator to the "T" plate and anchor bracket mounting screw.

3. To replace typing reperforator, reverse disassembly procedure. Refer to paragraph 2-3.c.(2)(d)2.

(b) SELECTING MECHANISM

1. Remove the screw, lock washer and nut from the 150001 selector clutch drum. Place the 152410 reset bail in its raised position. Holding the 152432 stop arm and 152405 marking lock lever to the left, grasp the cam-clutch by the cam disk (not by the drum) and pull forward rotating the cam-clutch slowly. The cam-clutch should come off easily; it should not be forced.

2. Unhook the spring on the 150355 function clutch latch lever. Remove the 156472 spring post by removing its nut and lock washer. Remove the 151442 screw (with lock washer) that passes through the frame and 152400 selector mounting plate into the 152402 selector lever guide. Remove the 152457 oil wick, 153538 screw, 2191 lock washer and 159467 wick holder. Remove the selecting mechanism. See paragraph 6-9.a.(2) for further disassembly instructions.

3. To replace the selecting mechanism, reverse the disassembly procedure.

(c) RIBBON FEED MECHANISM

1. Remove the ribbon. Remove the two 151632 mounting screws (with lock washers) from the 156414 ribbon feed mounting plate. Remove the ribbon feed mechanism.

2. To replace the ribbon feed mechanism, reverse the procedure used to remove it.

(d) PERFORATOR MECHANISM

1. Remove the 90573 spring and disconnect the 156412 perforator drive link from the 156884 rocker arm.

2. Remove the 159621 pivot screw, with lock washer, from the 159622 perforator adjusting clamp. Remove the 151631 and 151632 mounting screws (with lock washers and flat washers) that fasten the 156024 rear plate to the 159472 main plate. Remove the perforator mechanism.

3. To remount the perforator mechanism, reverse the procedure used to re-

move it. Make certain that the 162763 reset bail fits in the fork of the 159430 reset bail trip lever and that the print hammer fits in its slot in the perforator mechanism.

(e) TRANSFER MECHANISM

1. Remove the 49084 main tripl lever spring. Remove the 151631 and 151632 mounting screws (with lock washers and flat washers) from the 159488 transfer mounting bracket. Remove the transfer mechanism.

2. To remount the transfer mechanism, reverse the procedure used to remove it.

(f) TYPING MECHANISM

1. Remove the 156872 operating blade from the rocker bail assembly by removing its two mounting screws with lock washers, flat washers, and shims. Remove the 119651 retaining ring and disconnect the 159512 printing trip link. Remove the nut, lock washer and flat washer from the 156396 eccentric on the 162350 rocker ball, and disconnect the 159526 oscillating drive link. Remove 33828 spring from the 173981 accelerator and the 90606 spring from the 156252 lifter.

2. Remove screw with lock washer that fastens the 159434 lifter plate to the 162862 bar on the frame. Remove the screw with lock washer that secures the 159525 axial bracket to the 159404 post on the frame. Remove the 151631 screw (with lock washer and flat washer) that fastens the 159487 function box front plate to the 159472 main plate. Remove the 119653 retaining ring from the 159659 idler gear eccentric shaft. Remove the eccentric shaft, 159536 idler gear, 151629 special nut, and lock washer by removing the 159658 mounting screw. Remove the three 151631 screws (with lock washers and flat washers) that secure the 159535 front plate to the frame. Remove the typing mechanism from the frame.

3. To remount the typing mechanism, reverse the procedure used to remove it.

(g) FUNCTION BOX MECHANISM

1. Remove the 151631 mounting screw (with lock washer and two flat washers) that passes through the 156316 function box rear plate and 159483 spring bracket into the 159535 front plate. Remove the function box from the typing mechanism.

2. To remount the function box, reverse the procedure used to remove it.

ORIGINAL

(h) AXIAL PLATE ASSEMBLY

1. Remove the 3870 correcting drive link spring. Remove the 156413 correcting drive link by removing the retaining ring from the 156378 axial correcting plate. Remove the retaining ring and disconnect the 156870 ribbon oscillating lever.

2. Remove the three mounting screws and lock washers from the 159525 axial plate. Remove the axial plate assembly.

3. To remount the axial plate assembly, reverse the procedure used to remove it. The rearmost tooth of the rack on the 173775 typewheel shaft must mesh with the rearmost tooth space in the 156294 axial sector, and the forward tooth on the sector must mesh with the second tooth space on the shaft; there is an extra tooth space on the forward portion of the shaft's rack.

(i) After the function box mechanism and axial plate assembly have been removed, the remainder of the typing mechanism is the front plate assembly.

(j) PUSHBARS

1. Remove the typing mechanism. Remove the function box mechanism from the typing mechanism. Remove the pushbar by disengaging the pushbar rack from its associated pinion.

2. Correct gear tooth engagement of racks.

a. Pushbar #1 - #5 inclusive - in assembling the pushbars to the various eccentric assemblies, great care must be exercised to assure the correct rack-pinion gear mesh. The correct mesh is such that the first tooth on the pinion and the first tooth space on the rack are meshed. The last tooth on the pinion and the last tooth on the rack should therefore also mesh. Misalignment of the mesh by as little as one tooth will produce a jam in the machine and cause part breakage if the machine is put under power while this condition exists.

b. "Letters" and "Figures" Pushbar - the assembly of these two pushbars to the left eccentric assembly must follow the assembly of the detents on the same eccentric. Starting with the left eccentric in the lower detented position, locate the gear tooth of the pinion which is at top dead center. (Using the oil hole in the eccentric housing as a reference may help since it also is located at top dead center.) The first tooth space of the rack of the

"letters" pushbar must engage the tooth located directly below. This requirement is met when the indicating mark on the pushbar and eccentric shaft are in line. Pull the "letters" pushbar all the way on the pinion. The eccentric shaft should now be in the upper detented position. Now locate the tooth at bottom dead center. The first tooth space of the rack on the "figures" pushbar should engage the tooth just located. The full travel of either pushbar should result in the eccentric shaft being rotated from one detented position to the other without jamming. As before, a misalignment of the mesh by one tooth will cause a jam and parts breakage if the machine is put under power while this condition exists.

#### (k) ROCKER BAIL ASSEMBLY

1. Disconnect the 156937 printing drive link by removing the retaining ring at its left end. Remove the 3598 nut, lock washer, flat washer, felt washer, bushing, and 151632 screw from the 156871 operating blade mounting bail.

2. Remove the nut, lock washer and 156921 adjusting lever guide, and remove the 156366 rocker bail shaft. Remove the rocker bail.

3. To replace the rocker bail assembly, reverse the procedure used to remove it.

#### (l) MAIN SHAFT ASSEMBLY

1. Remove the 87401 spring from the function clutch latch lever. Remove the retaining ring spring washer and flat washers from the forward end of the 154397 main shaft.

2. Remove the screw and lock washer (if present) from the 150000 function clutch drum. Remove the screw and lock washer from the 173340 collar. Remove the screw and lock washer from the 158745 bearing clamp.

3. Pull main shaft out of rear of unit, removing the cam-clutch and 173340 collar.

#### CAUTION

Note the location of the main shaft needle roller bearings as shown in Teletype Bulletin 1180B. Move the main shaft toward the rear of the unit a small amount at a time and exercise care not to drop or contaminate the 20 needle rollers in each race. A 125252 spring (as used on the ribbon feed pawl) may be stretched around the shaft

and rollers with the ends of the spring hooked together. The garter spring, in conjunction with the KS7471 grease, will hold the rollers in place.

4. To replace the main shaft assembly, reverse the procedure used to remove it. Make sure the rollers are clean, then lubricate the race only with KS7471 grease. Apply a liberal amount of KS7470 oil at each end of the bearing sleeve.

#### NOTE

When the main shaft is inserted into the cam-clutch, hold the latter firmly so that the drum is not pushed off the clutch. Compress the drum and cam disk together so that holes in drum and clutch bearings are aligned.

#### (m) REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM DISASSEMBLY

1. Remove two 119652 tru-arc retaining rings holding the 162791 shaft.

2. Remove the 162798 roller, 172795 ratchet assembly, and 172793 ratchet from the 162791 shaft.

3. Remove the two 119652 tru-arcs holding the 173614 link (with stud) to the 173605 bail assembly and 164888 lever.

4. Remove the two 151631 screws, 2191 lock washers, and 8330 flat washers which mount the 162773 main plate to the typing reperforator casting.

5. For further disassembly to mechanism refer to paragraph 6-9.a.(2).

#### (n) REMOTE CONTROL NON-INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM REASSEMBLY

1. Reassembly mechanism according to the appropriate figure in Teletype Bulletin 1180B.

2. When re-mounting mechanism to typing reperforator, make certain the following conditions are met:

a. The 162786 blocking arm must engage the 162745 drive arm.

b. Fit the 163326 lever into the rectangular opening of the 162760 latch lever.



c. Position the 173620 armature bail so that it moves the 173618 bail away from the 173605 bail assembly.

3. Follow the disassembly procedure (steps 4. through 1.), in reverse. Make sure all levers properly engage their respective latches before assembly is tightened down.

(o) AUTOMATIC NON - INTERFERING "LETTERS" TAPE FEED-OUT MECHANISM - Disassembly and reassembly of this mechanism is similar to that for the remote controlled mechanism (paragraph (m) and (n) above) with minor part differences. Refer to the appropriate parts illustration in Teletype Bulletin 1180B.

## (2) MULTIPLE REPERFORATOR BASE DRIVE MECHANISM

(a) To remove cross-shaft, refer to appropriate figure in Teletype Bulletin 1180B.

(b) To reassemble, reverse disassembly procedure. See Section 5 for any necessary adjustments.

## (3) TAPE WINDER

(a) Remove Tape Winder from cabinet.

### (b) MOTOR

1. Disconnect wiring.
2. Remove 151631 screw and 2191 washer which mount 162722 worm drive gear to motor shaft. Remove worm gear.
3. Remove four 151723 screws and 2669 lock washers which secure motor to the mounting plate.
4. To remount motor reverse disassembly procedure.

### (c) DRIVE SHAFT

- (1) Remove 162704 cover plate by removing four 151630 screws and 2191 lock washers, and the 151631 screw, 3598 nut, 2191 lock washer, and 7002 flat washer.
2. Loosen the 151631 screw which mounts the worm drive gear to the motor shaft. Remove the gear.
3. Remove 151631 screw and 2191 lock washer from left end of drive shaft (viewed from rear of unit). Remove 151642 screw and 2191 lock washer which secure 173377 drive wheel to shaft. Remove drive wheel.

4. Remove 152537 bearing retainer from left 162700 bracket extension by removing its two 151630 mounting screws.

5. Remove two 151630 screws and 2191 lock washers which secure the right bearing plate and clamp to the right 162700 bracket extension.

6. Slide drive shaft out. If necessary remove 151642 screw which secures right drive wheel and drive gear to shaft.

7. To reassemble shaft reverse disassembly procedure.

## (d) CLUTCH LATCH MECHANISM REMOVAL

1. Remove 119655 retainer from 163527 arm stud. Remove 162999 roller from stud.

2. Remove 74807 nut and 2669 washer which secure the 162715 stud to the 162700 bracket. Remove latch mechanism.

3. Remove 49645 spring from 163528 latch. Remove 73276 shoulder screw which secures 163528 latch to 162700 bracket. Remove latch.

4. To reassemble latch mechanism reverse disassembly procedure.

## d. TYPING REPERFORATOR RECEIVING GROUP

(1) TYPING REPERFORATORS - Refer to paragraph 6-9.c.(1).

(2) MULTIPLE REPERFORATOR BASE DRIVE MECHANISM - Refer to paragraph 6-9.c.(2).

## e. MONITOR TRANSMITTER GROUP

(1) TRANSMITTER DISTRIBUTORS - Refer to paragraph 6-9.b.(2).

(2) MOTOR UNIT - Refer to paragraph 6-9.b.(3).

(3) MULTIPLE TRANSMITTER DISTRIBUTOR BASE DRIVE MECHANISM - Refer to paragraph 6-9.b.(4).

(4) TYPING REPERFORATORS - Refer to paragraph 6-9.c.(1).

(5) MULTIPLE REPERFORATOR BASE DRIVE MECHANISM - Refer to paragraph 6-9.c.(2).

(6) TAPE WINDER - Refer to paragraph 6-9.c.(3).

