

S365-84

**HANDBOOK**

**MTS-120**

**-X41427**

**MAGNETIC TAPE SYSTEM**

PREPARED FOR

**UNIVAC - Division of Sperry Rand Corporation  
St. Paul, Minnesota**

PREPARED BY



**POTTER  
INSTRUMENT  
COMPANY, INC.**

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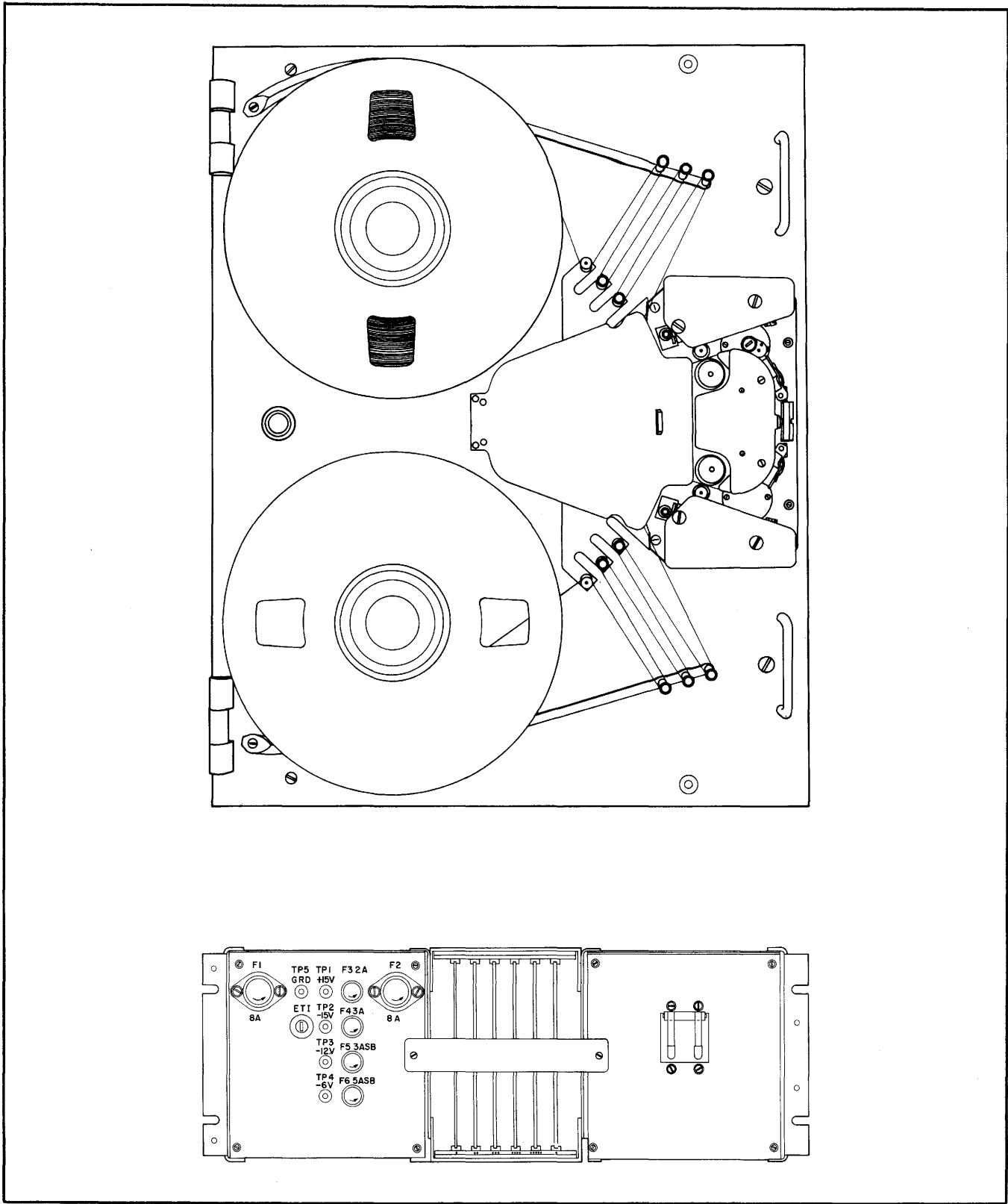


Figure 1-1. MT-120 Magnetic Tape Transport and EC-120 Electronic Chassis

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# SECTION I

## INTRODUCTION AND DESCRIPTION

### 1-1. SCOPE

This handbook has been prepared to orientate and assist operating and technical support personnel working with the transport unit. The information contained in this document is based on a standard MT-120 Magnetic Tape Transport and EC-120 Electronics Chassis, shown in figure 1-1. Operational characteristics are listed in the detailed specifications denoted in Table 1-1. Any supplemental material is included separately at the rear of this handbook.

This book provides description, installation, operating instructions, theory of operation, illustrated parts breakdown, preventive maintenance (preventive maintenance schedule, cleaning instructions) and maintenance (adjustments, and replacement parts procedures). In addition, drawings are included to aid in locating components and to clarify procedures.

### 1-2. INTRODUCTION

The MT-120 is a high-speed digital magnetic tape system, designed for use in data processing. The transport provides operating speeds of up to 120 inches per second without program restrictions.

### 1-3. DESCRIPTION

Each element of the tape system provides a distinctive function in the sequence of tape handling and control. The block diagram shown in figure 1-2 shows the arrangement of all components and their interrelationship. All commands to the tape transport are originated in or routed through the EC-120. These commands control appropriate circuits in the EC-120 to provide control of tape speed and direction.

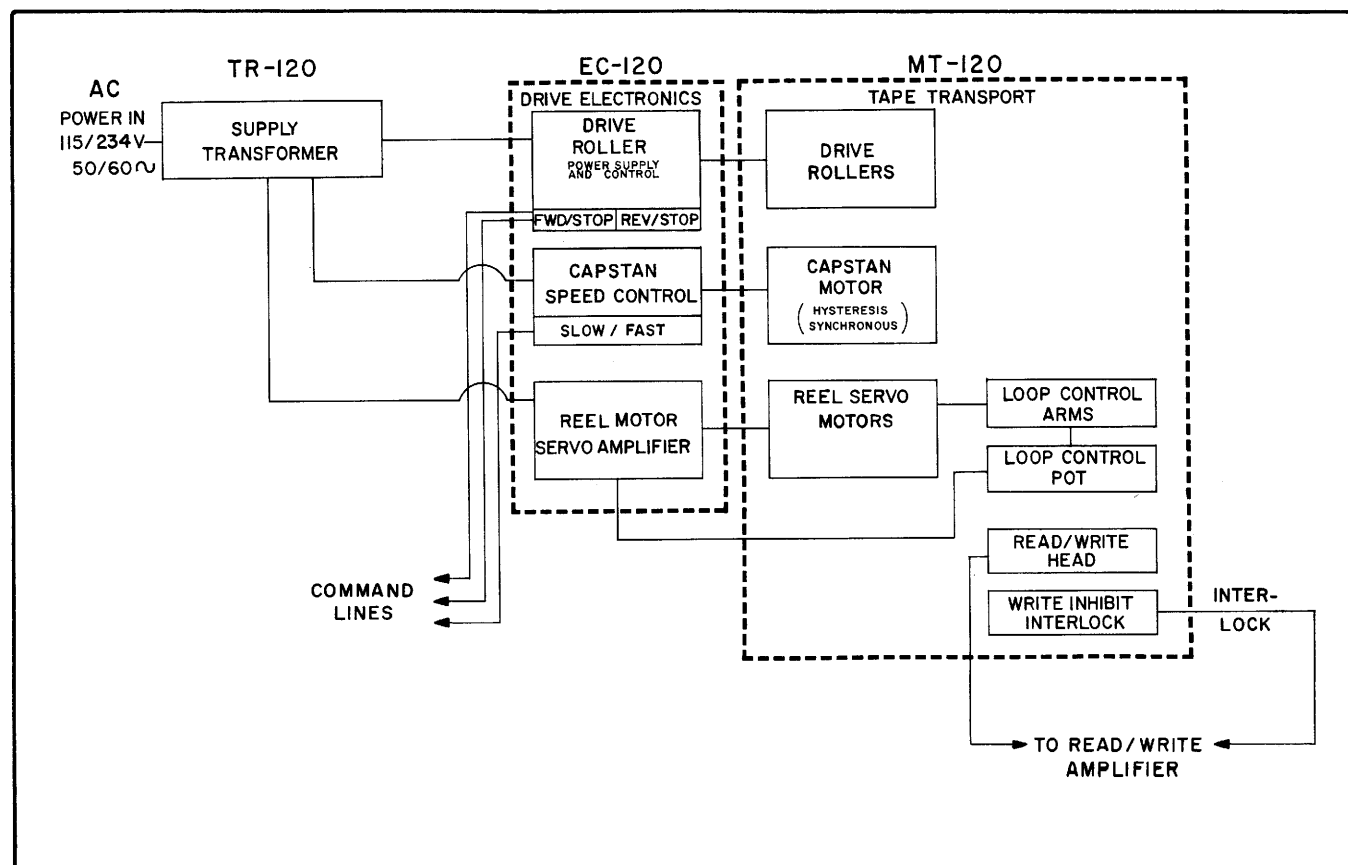


Figure 1-2. MT-120/EC-120 Functional Block Diagram

## SECTION I

## INTRODUCTION AND DESCRIPTION

TABLE I-1

## MT-120 SPECIFICATIONS

Characteristic	Specification
Tape Speed: (Forward and Reverse)	120 ips max, without program restrictions
Tape Speed Variations	±2%
Speed Combinations	75/225, 100/200, 112.5/225, 120/240. Both speeds may be used in forward and reverse directions. The lower speed is for Read/Write; the higher speed is for rewind.
Performance figures	at 120 ips with 1/2 inch, 1-1/2 mil Mylar
Start Time	Less than 2.0 ms from receipt of command to start of tape motion. Less than 3 ms from receipt of command to within ±10% of nominal tape speed.
Start Distance	Over a cycling range of 0-200 commands per second, tape travels less than 0.190 ± 0.050" at 3 ms after receipt of start command.
Stop Time	Less than 1.5 ms.
Stop Distance	Tape travel is 0.110 ± 0.03 inches max.
Command Repetition Rate	0 to 200 commands per second.
Wow and Flutter	Less than 2% rms at 120 ips (steady running).
Interchannel Time Displacement (at 120 ips, 1/2" tape)-	Static: Less than 3 microseconds between center channel and any other channel when measured at the head in the forward direction. Dynamic: Less than 2 microseconds between any two channels when measured at the head in the forward direction.
Tape Widths	1/2 or 1 inch.
Tape Type	1, 1-1/2 mil Mylar
Tape Reels	Potter precision NARTB or IBM 10-1/2" dia. reels.
Hubs	Potter NARTB-type "Quick-Lock" or IBM hubs.
Tape Threading	In line, quick, simple; push-button control of electrically operated retraction mechanism for loop and low tape sensor arms.
Remote Control Inputs	Three sets of control lines are available for remote control of the MT-120: Standard: 0 volts fwd; -5 volts @ 5 ma rev. 0 volts stop; -5 volts @ 5 ma run 0 volts low; -5 volts @ 5 ma high Optional: 0 volts stop; -5 volts @ 5 ma fwd. 0 volts stop; -5 volts @ 5 ma rev. 0 volts low; -5 volts @ 5 ma high

TABLE I-1 (Cont.)

## MT-120 SPECIFICATIONS

Characteristic		Specification			
Condition Indication		Low tape: N. O. contact - contact closes on low tape condition Write lockout: form C contact (optional)  End-of-tape and beginning-of-tape sensors (optional): a. split post b. photoreflective c. amplifiers for either photoreflective or split post -15 volts @ 5 ma; not sense; -0 volts @ 5 ma: sense Ready line: 0 volts not ready; -10 volts ready (monitors all power supplies)			
Circuits		All control circuits completely transistorized with modular construction mounted on glass epoxy plug-in cards.			
Power (Transport and Drive Electronics)		115 volts, 60 cycles; 9 amp. standby, 16 amp. peak (230 volts, 50 cycles optional)			
Ambient Temperature (Operating)		32° F. to 125° F.			
Physical Data					
Model No.	Component Description	Dimensions (in.)			Weight (lbs.)
		High	Wide	Deep	
MT-120	Tape Transport	24-1/2	19	11	160
EC-120	Drive Electronics	6-3/4	19	18	35
PBH-120	Manual Control	3-3/4	19	6-1/2	10
CT-120	Cabinet(horiz. mount.)	63	30-3/4	28-1/2	285
CAB-250	Cabinet(Vert. mount.)	69-15/16	27	31-1/2	290 (app.)
TR-120	Transformer	9	13-1/2	8	75

## 1-4. MT-120 TAPE TRANSPORT

The MT-120 Tape Transport consists of a hinged panel on which are mounted the mechanisms and components to provide the functions of tape storage and supply, tape drive and guidance, tape reading and writing and tape condition sensing.

These functions are discussed in the following paragraphs. The transport is illustrated in figure 1-3. Table 1-2 lists the references cited in figure 1-3 and their functions.

1-4-1. TAPE STORAGE AND SUPPLY. (Reference figure 1-3.) Tape storage is provided in two areas on the tape transport. Primary tape storage is on two hub mounted reels (16) which supply and take-up the magnetic tape. A secondary tape storage area is created by the length of tape threaded around two tension arms (3). A vacuum buffer (17) located on the drive plate assembly, isolates the tape in the storage area from the tape in the drive system. A retraction motor positions the tension arms to facilitate tape loading. The motor is energized by pressing the retraction button (18) on the transport panel. Power for driving tape reels is provided by a pair of series wound split field, servo motors.

TABLE 1-2  
MT-120 LEGEND

Figure No.	Index No.	Description	Function
1-3	1	Tension arm stop	Limits outward travel of tension arm.
1-3	2	Front panel locking screws	Locks front panel to cabinet.
1-3	3	Tension Arm	Provides tape storage between reel and vacuum buffer.
1-3	4	Left stationary guide post	Stationary post guides magnetic tape between file tape reel and tension arm.
1-3	5	Right stationary guide post	Stationary post guides magnetic tape between right tape reel and right tension arm.
1-3	6	BOT/EOT photoelectric sensor	Detects beginning-of-tape and end-of-tape in conjunction with reflective strips mounted on tape.
1-3	7	Roller assemblies	Guide magnetic tape between reel and vacuum buffer with minimum friction.
1-3	8	Pinch roller solenoid assembly	When energized, the solenoid clamps the tape to the rotating capstan and tape is pulled through trough guides and over read/write head.
1-3	9	Read/write head	Used to record information on or playback information from magnetic tape.
1-3	10	Head pad	Magnetic shield that isolates read/write heads and reduces inter-channel crosstalk. (Does not contact tape.)
1-3	11	FORWARD capstan	Drives tape forward when pinch-roller solenoid is energized. Capstan is continuously driven by a synchronous motor.
1-3	12	REVERSE capstan	Drives tape in a reverse direction when pinch roller solenoid is energized. Capstan is continuously driven by a synchronous motor.
1-3	13	Low tape sensor stop	Limits outward travel of low tape sensor arm.
1-3	14	Low tape sensor	Spring loaded arm that follows level of tape on tape reel and reduces speed near the end of a re-wind or unload cycle.
1-3	15	Reel hub	Quick-lock hubs which hold tape reel to servo motor shaft.

TABLE 1-2 (Cont.)

## MT-120 LEGEND

Figure No.	Index No.	Description	Function
1-3	16	Tape reel	Provides primary storage for magnetic tape.
1-3	17	Vacuum buffer	Isolates magnetic tape in tension arm and tape reel storage area from magnetic tape in capstan drive system.
1-3	18	Tension arm retraction button	When depressed, tension arm retraction motor is energized and tension arms are pulled toward bridge roller to facilitate tape threading.
1-3	19	Pinch roller	When pinch roller drive solenoid is energized, pinch roller presses tape against rotating capstan.

Each motor has two field windings to provide for clockwise and counterclockwise rotation of the tape reels. A reel brake is provided for each motor to stop the reel servo motors when power is removed. Operation of the reel servo motors is controlled by the tension arms (3). When these arms are displaced from their center or null position, they signal the servo amplifiers, and the servo motors are made to rotate in the proper direction to either pay out, or take up tape.

1-4-2. **TAPE DRIVE AND GUIDING.** (Reference figure 1-3). The tape drive and guiding components are responsible for the movement, stoppage and guidance of tape within the system. Tape is driven by one of two capstans which are belt coupled to a hysteresis synchronous capstan drive motor. The tape is threaded between each capstan (11) and (12), and associated pinch roller on the drive assemblies. Since both capstans are rotating when the unit is in operation, tape movement is initiated when a pinch roller presses the tape against one of the rotating capstans. The direction of tape movement is dependent upon which pinch roller is actuated. A pair of troughs guide the tape as it passes over the read/write head (9). Drag pads located at each trough guide provide drag to keep tape taut while it is passing over the read/write head. This added drag aids in bringing the tape to a rapid halt when the driving pinch roller is released.

1-4-3. **READ/WRITE HEAD.** (Reference figure 1-3). A major component of the transport is the read/write head (9) which is used to write information on, or read information from, a magnetic tape. Head connectors for the read/write head are mounted at the rear of the tape transport panel.

1-4-4. **TAPE CONDITION SENSING.** (Reference figure 1-3). Provisions for sensing tape breakage and tape load conditions are incorporated within the tension arm assembly of the tape transport.

1-4-4-1. The tension arm assembly includes tape-break switches which are actuated if tape breakage occurs. Tension arm protective switches also sense over-travel of tension arms in the area of the stationary rollers (7). Should a tape break occur, relay K1 will be deenergized which removes all power.

1-4-4-2. Low tape detection is accomplished by the low tape sensor (14) which rests on the tape. When this arm reaches a given point where the tape on the reel is low, a switch contact closes. This switch action may be used to slow the tape down from fast to slow speed or it may be used for the purpose of selecting a new command.

1-4-4-3. When an end-of-tape or beginning-of-tape condition is sensed, an indication is given and the pinch roller may be released automatically by connecting this signal to the pinch roller drive circuit. The EOT/BOT sensor is shown in figure 1-3, item (6). Sensing may be done photoelectrically or mechanically. When photoelectric sensing is used, the sensor or detecting device is a photocell and a light source. See figure 1-4.

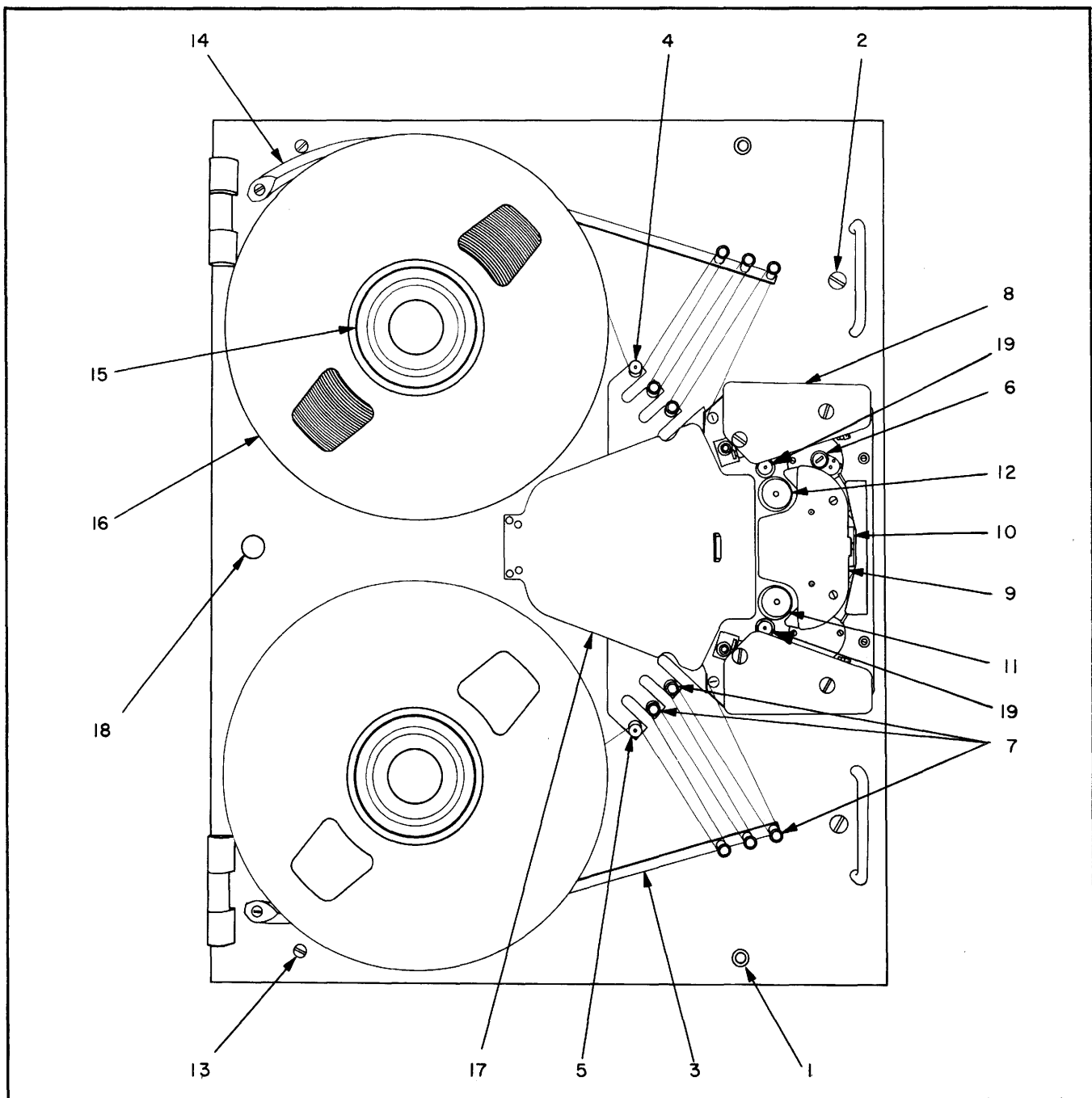


Figure 1-3. MT-120 Front Panel Components

The photocell is excited when a reflective strip located on the tape passes under the light source. Mechanical sensing is accomplished by utilizing a split post in place of one of the tape guide posts or rollers (4) and (5), figure 1-3. Metallic tape leaders are fastened to the ends of the tape for BOT and EOT sensing. When the leader reaches the split post, the two sections of the post are short circuited to provide a sensing signal.

1-4-4-4. An electro-mechanical "Write Lockout" switch is mechanically actuated by a write lockout protective ring which is inserted in the tape reel. The contacts of this switch can be used to inhibit the write function.

1-5. EC-120 ELECTRONICS CHASSIS

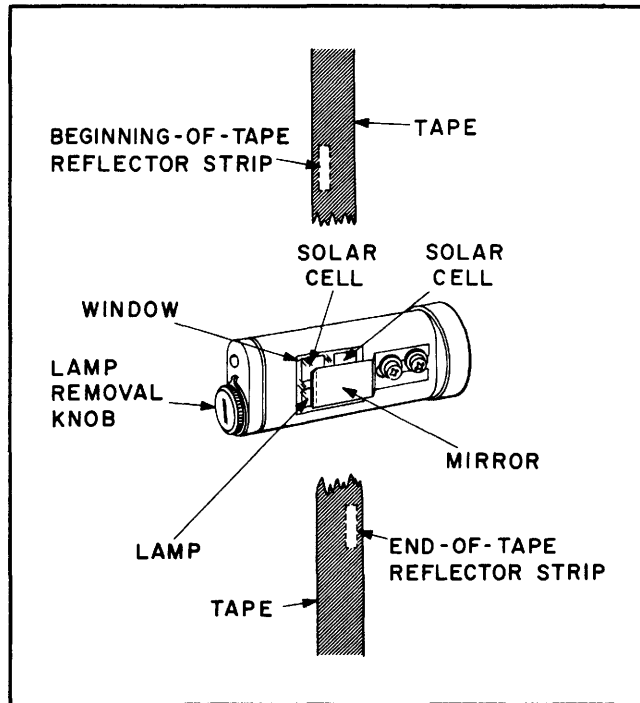


Figure 1-4. EOT/BOT Assembly

The EC-120 Electronics Chassis provides the drive, condition sensing electronics and power supplies for the transport. The majority of the electronic components are mounted on printed circuit plug-in cards and removable sub-assemblies. The left and right servo amplifier circuits control tape reel payout and take-up action of the servo reel motors. The pinch roller circuit actuates either the forward or reverse pinch roller solenoid causing the pinch roller to press the tape against a corresponding rotating capstan. The EOT/BOT amplifiers, speed change and ready circuits are contained on one card. The EOT/BOT sensor outputs provide inhibit/enabling action to prevent tape or transport damage. A plate on the left front side of the chassis contains fuseholders, an elapsed time indicator and test jacks. A plate at the right mounts the circuit breaker.

#### 1-6. MANUAL CONTROL UNIT

When a Potter manual control unit is employed, a supplement covering same is included at the rear of the manual.

#### 1-7. TR-120 TRANSFORMER

The TR-120 Transformer supplies all AC power for the system. A schematic diagram of the transformer is shown in Section VIII. A cable connector J4 from the transformer plugs into the EC-120 chassis to carry all AC lines for the power supplies.

#### 1-8. OPERATIONAL AND PHYSICAL CHARACTERISTICS

The operational and physical characteristics of the MT-120 Tape Transport and EC-120 Electronics Chassis are listed in Table 1-1.

#### 1-9. MAGNETIC TAPE

It is recommended that computer type mylar base tape as supplied by numerable reputable manufacturers be used on the MT-120 Magnetic Tape Transport

#### Note

The MT-120 tape transport is normally adjusted to operate with 1-1/2 mil tape unless otherwise specified. See pinch roller adjustments in Section VI for additional information.





## SECTION II INSTALLATION

### 2-1. GENERAL

This section contains information for unpacking, mounting, inter-connecting and cooling the MT-120 Magnetic Tape Transport and EC-120 Electronic Chassis.

#### CAUTION

When cabinets of light construction are used, it will be necessary to weight them at the base to prevent them from overturning when the transport panel is swung open.

### 2-2. CABINET AND RACK STRUCTURE

It is recommended that only cabinets and racks of substantial construction be used in mounting the tape transport. This equipment contains high powered motors of considerable weight, requiring rugged mechanical construction. Unstable racks or cabinets will not properly support the weight of the transport. Outline dimensions for the Potter cabinet, model CAB-250, are shown in figure 2-1. See Table 1-1 for physical characteristics of cabinet.

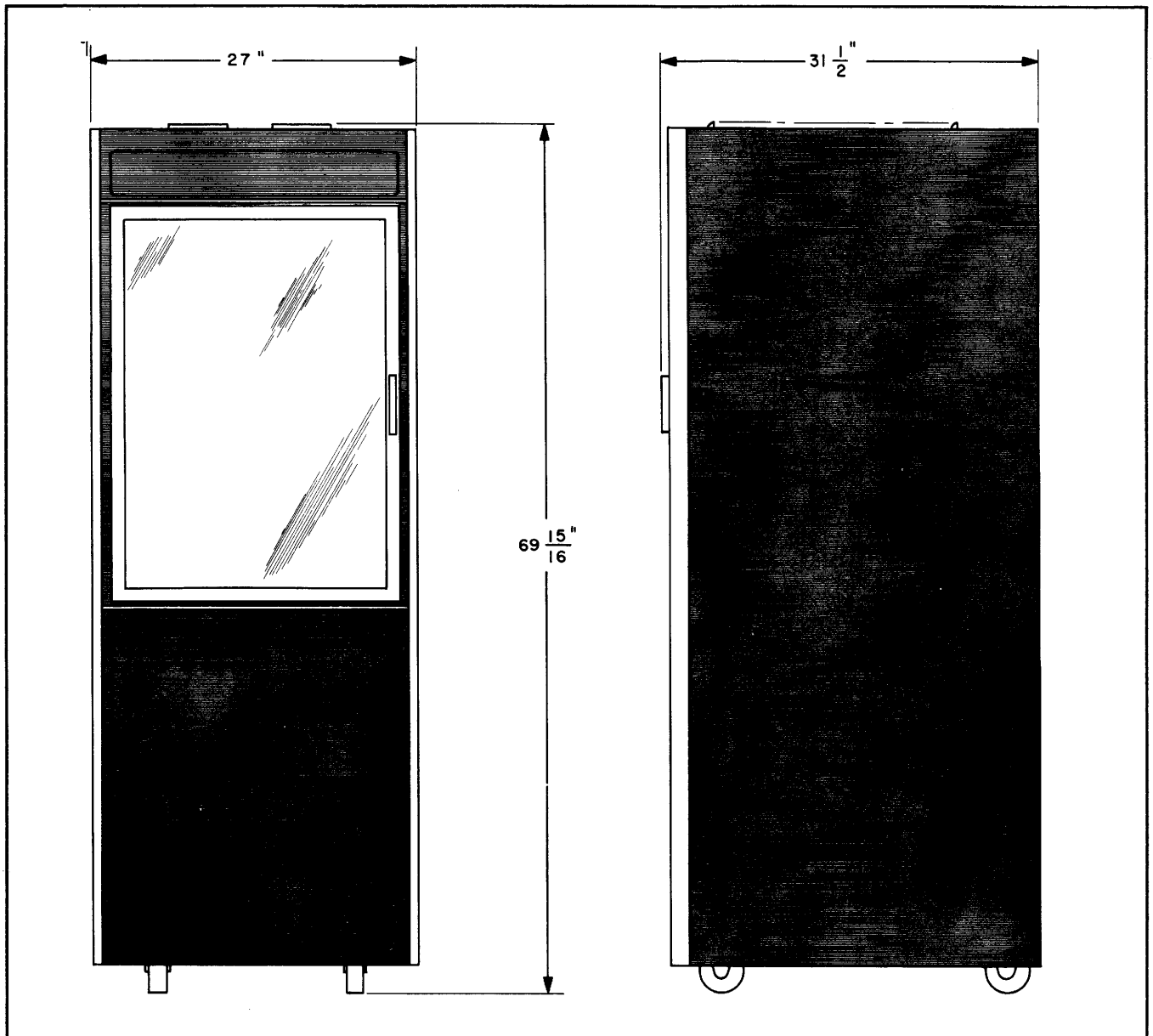


Figure 2-1. CAB-250 Cabinet, Outline Dimensions

SECTION II  
 INSTALLATION

2-3. ORIENTATION

The MT-120 Tape Transport will operate either vertically or horizontally. Typical mounting arrangements have the transport hinged at the left side. The electronic drive chassis is usually mounted directly below the tape transport. This arrangement of components is satisfactory for most

applications and allows ease of operation, cooling and servicing. When other arrangements are employed, careful consideration should be given to cooling and interconnections. Outline dimensions for the MT-120 Tape Transport are shown in figure 2-2. Figure 2-3 shows the outline dimensions for the EC-120.

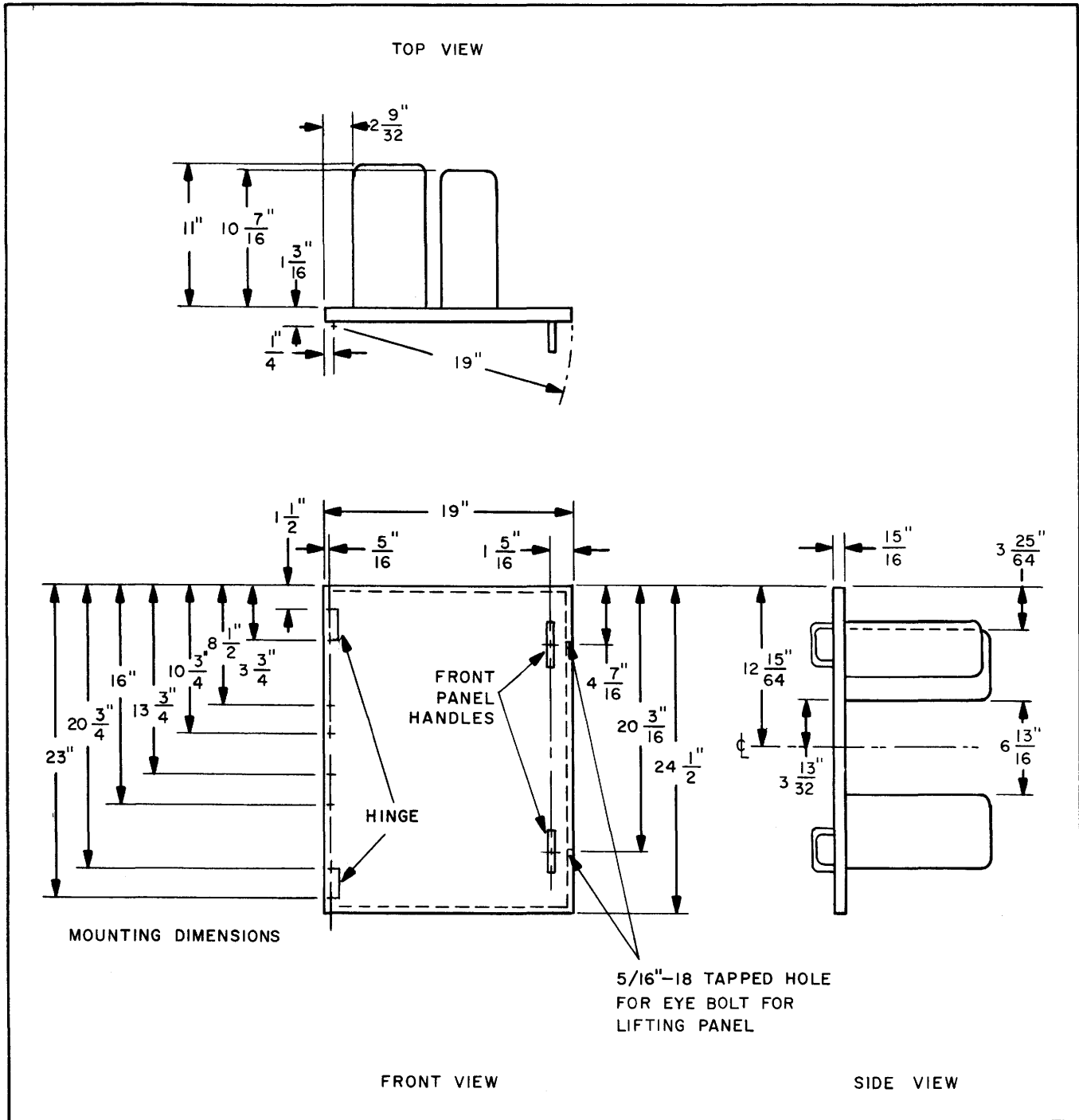


Figure 2-2. MT-120 Tape Transport, Outline Dimensions

2-4. COOLING

This equipment is designed to operate at ambient temperature up to +125°F. The limits of this range are governed by the operating characteristics of the transistor circuits in the electronic chassis and the allowable temperature rise of the motors. In any mounting configuration, consideration must be given to the ambient temperature of the area where this equipment is located.

The top and bottom covers of the electronics chassis are both made of perforated metal and provide the path for cooling air. When the electronics chassis and the tape transport are mounted together in a closed cabinet, a cooling flow of at least 400 CFM of filtered air is recommended. If other heat producing elements are housed in the same cabinet, a greater cooling air flow will be necessary. If the tape transport and electronics

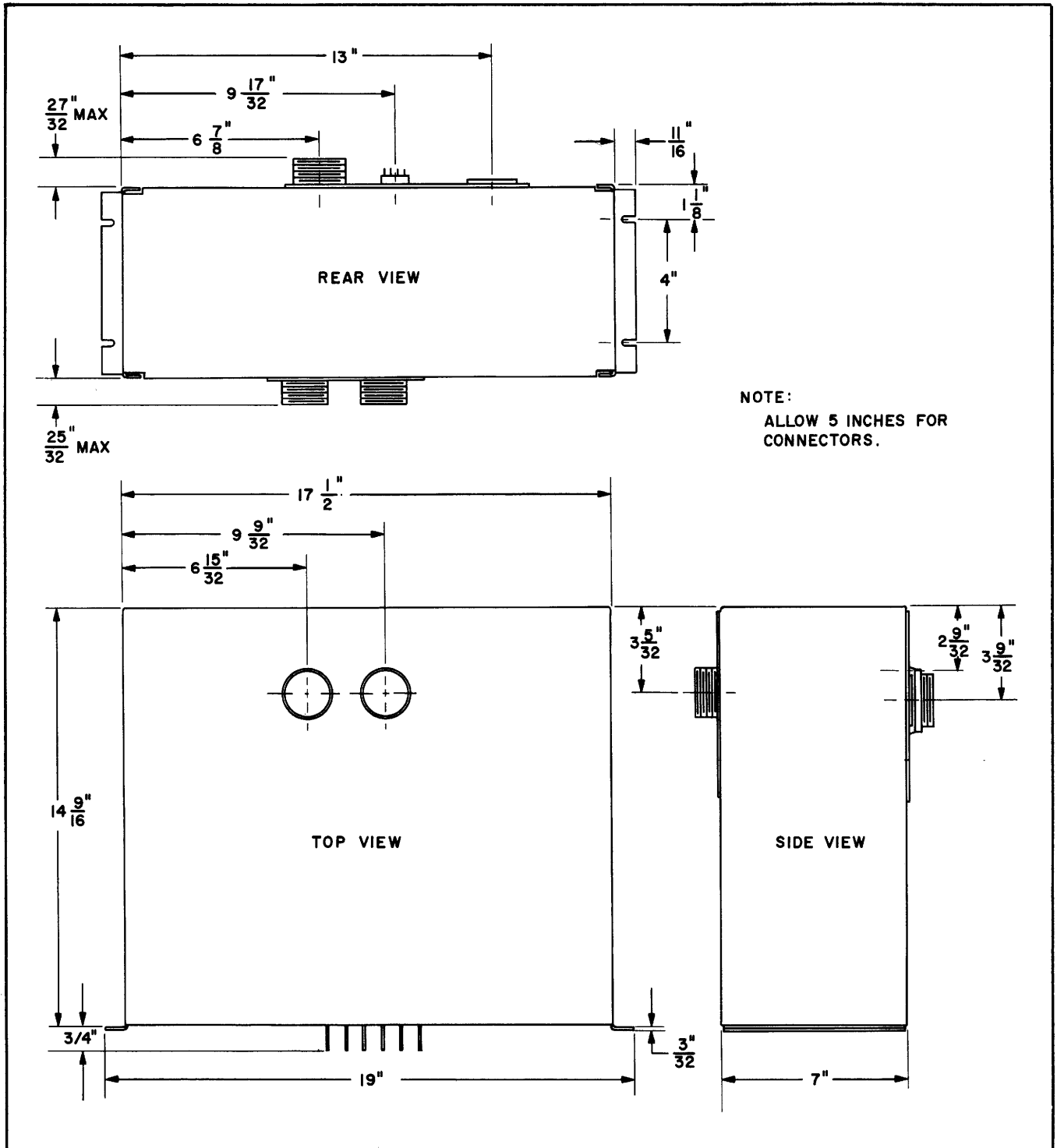


Figure 2-3. EC-120 Electronic Chassis, Outline Dimensions

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chassis are housed separately, without other heat producing elements, a cooling air flow of 100 CFM is recommended for the electronic chassis and 300 CFM for the tape transport.

**2-5. INTERCONNECTIONS**

Each component of the system is interconnected by cables for ease of maintenance and installation. In devising suitable mounting arrangements, special attention should be given to cable lengths and shielding. Intercabling between components is shown in figure 2-4 and interface signals are listed in Section III.

**2-6. READ/WRITE HEAD CONNECTIONS**

All connections to and from the magnetic read/write head are made through connectors located on the head connector bracket at the rear of the tape transport panel. See figure 8-8.

**Note**

It is essential that interconnections to and from the read/write head be kept as short as possible, preferably no longer than eight feet. Greater cable lengths can cause serious deterioration to the head signals.

**2-7. SHIELDING**

It is recommended that each channel of the read/write head be shielded individually with the shields returned to circuit ground at the amplifier end. It is further recommended that an outer shield be used to encase all the individual shields and that this shield be returned to chassis ground.

**2-8. GROUNDING**

Circuit ground is isolated from the chassis ground and may be connected together as required by the external system.

**2-9. UNPACKING AND MOUNTING**

The MT-120 Tape Transport and EC-120 Electronics Chassis may be purchased with or without a cabinet. The following instructions cover unpacking procedures for both types.

**2-9-1. CAB-250 CABINET, UNPACKING.** When the unit is purchased already mounted in a cabinet, the carton should be laid down in such a position so that the shipping labels face up. The following steps should be followed:

- a. Break the three or four bands around the carton.

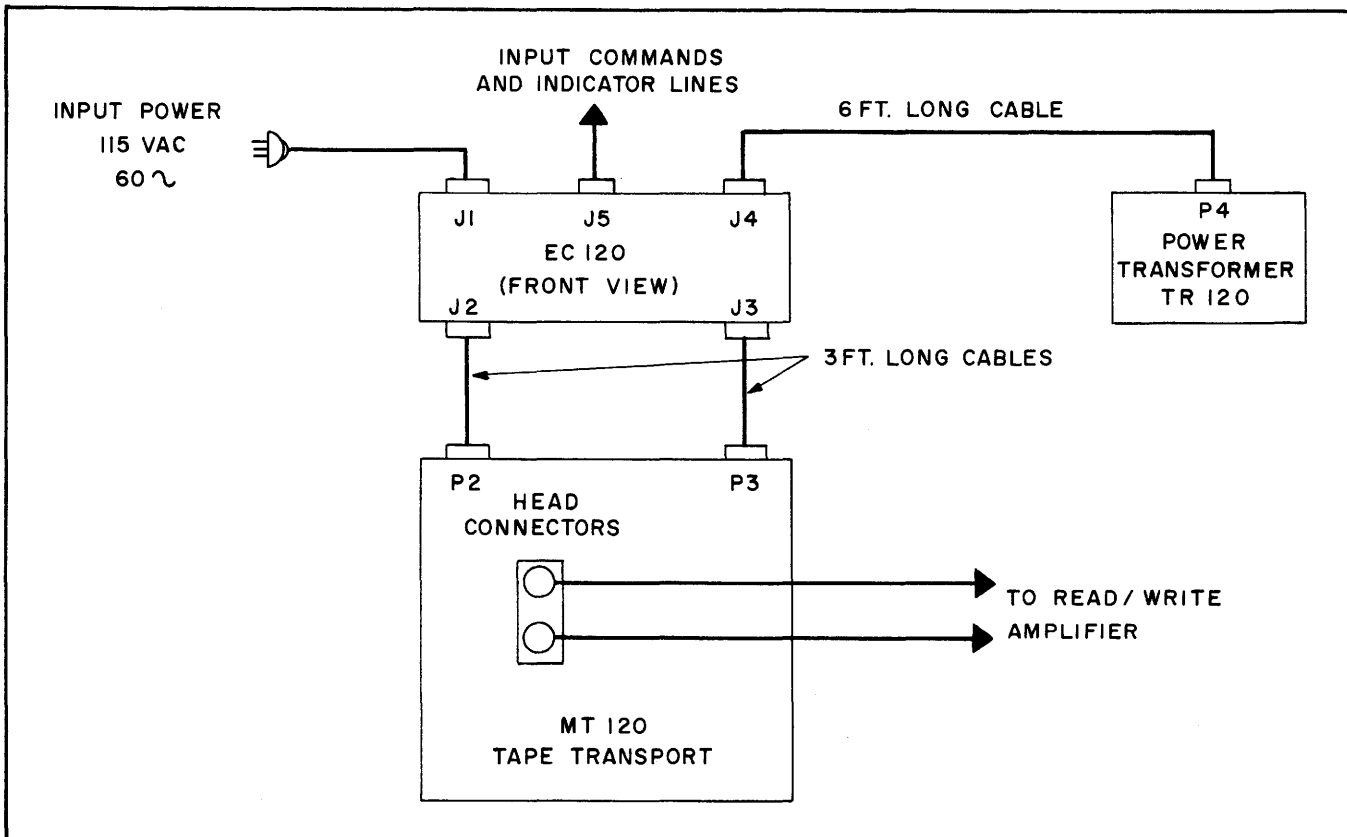


Figure 2-4. Interconnecting Diagram

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- b. Slit the tape on the carton, and along one side.
- c. Remove outer cardboard carton which is nailed at the base of wooden skid.
- d. Remove top packing material and filler.
- e. Break band around cabinet and stand cabinet upright off wooden skid.
- f. Remove all bracing material from inside of cabinet.

**CAUTION**

Do not swing out tape transport panel until cabinet is properly secured at base. The supply transformer which is fastened to the base of the cabinet will serve as the counter-balance required to prevent over-turning of the cabinet.

2-9-2. MT-120, UNPACKING. When the unit is purchased separately, without a cabinet, the transport, electronics unit and supply transformer are packed separately. The tape transport is packed in a wooden crate with steel banding and in turn placed into a cardboard carton which is also steel banded. Position the carton so that the shipping labels are facing up. Break the steel bands around the carton and remove the top cover. Remove the four corners and top packing material. Lift wooden crate from carton and break two steel bands around it. Lift top cover off crate. Transport may be lifted out. For mounting procedures, refer to paragraph 2-9-5.

2-9-3. EC-120, UNPACKING. The Electronic Chassis is shipped in a dual carton with no steel bands around it. Place the carton in position with the shipping labels facing up. Slit the taped seam and open the carton. Remove four corner braces and lift carton out. Slit the taped seam with a key or similar object.

**CAUTION**

When slitting the taped seam do not penetrate the carton deeply to avoid damaging the equipment.

Open the carton and remove end sections. For mounting procedures, refer to paragraph 2-9-6.

2-9-4. TR-120 TRANSFORMER, UNPACKING. The transformer is packed in a wooden crate and the top of the crate is held down with screws. Remove the screws and top cover, and lift the transformer out of the crate.

**CAUTION**

When mounting the transport in an upright rack, the transformer should be fastened to the rear base of the rack to serve as a counter-balance when the transport panel is swung open.

Outline dimensions for the TR-120 transformer are shown in figure 2-5.

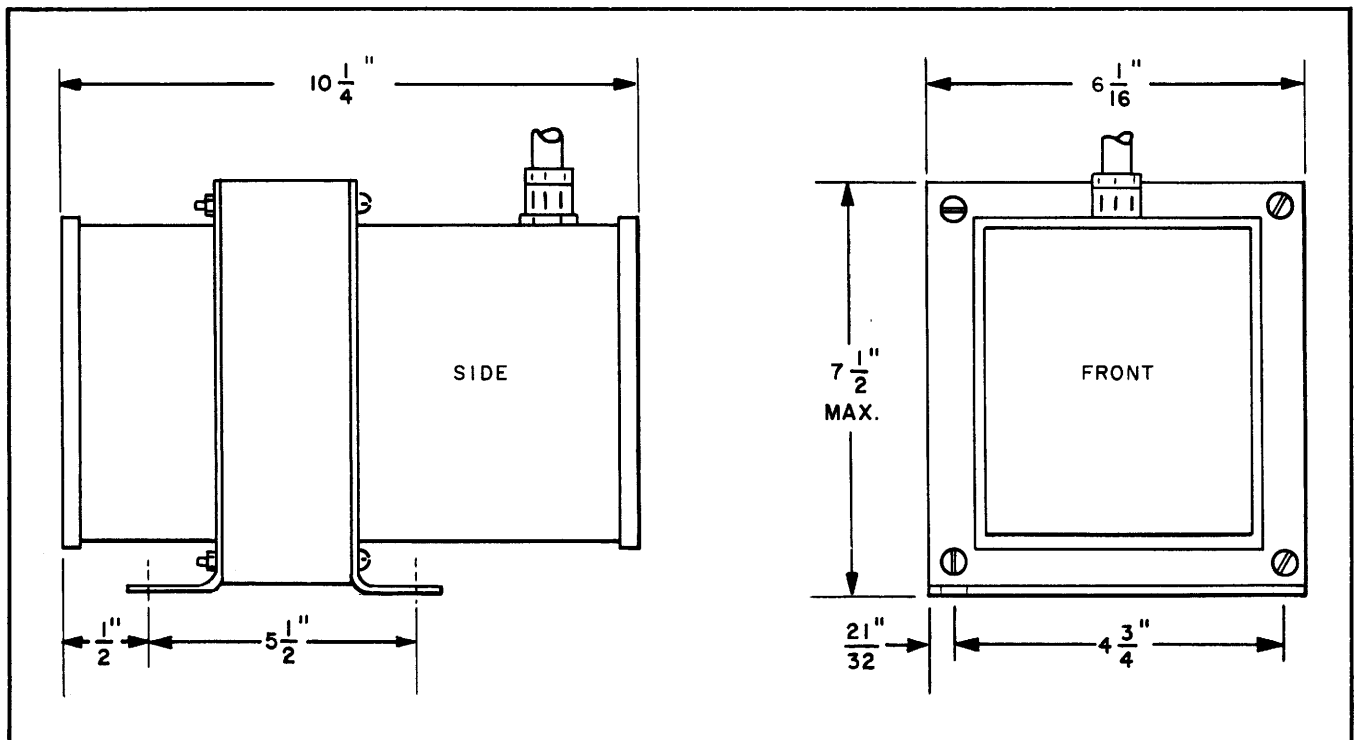


Figure 2-5. TR-120 Power Transformer, Outline Dimensions

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2-9-5. MT-120 MOUNTING. The tape transport and major components can be mounted vertically or horizontally. The following procedures are applicable to vertical mounting.

**CAUTION**

It is recommended that the transformer, TR-120, be mounted first at the cabinet base diagonally from the transport hinge. This transformer is bolted to the base with hardware appropriate to the cabinet structure. The weight of the transformer serves to counter-balance the cabinet when the transport panel is opened.

2-9-5-1. Remove the hinge casting from its wrapper and attach it to the rack as shown in figure 2-6. Square the hinge with the rack and secure it with eight No. 10-32 x 3/4" long oval head machine screws.

**Note**

The center of the end mounting hole must be a minimum of 1-9/16 inches from the surface of the left cross member of the rack.

a. Loosen two bolt-locking setscrews(5), on tape transport panel hinge and remove hinge dowels (3), and thrust washers (2).

b. Lift transport from crate by panel casting and position it against hinge on the rack so that hinge block (12) mates with hinge (13).

**Note**

To facilitate lifting panel into place, a chain hoist may be used with two 5/16-18 threaded eye-bolts. These eye-bolts are screwed into the panel edge, top or side, and the hoist hook slipped through them.

c. To relieve the weight of the transport, push a 4" long by 3/16" diameter steel pin into hole in upper hinge member.

d. Slip a thrust washer into place over hole in lower hinge member as illustrated.

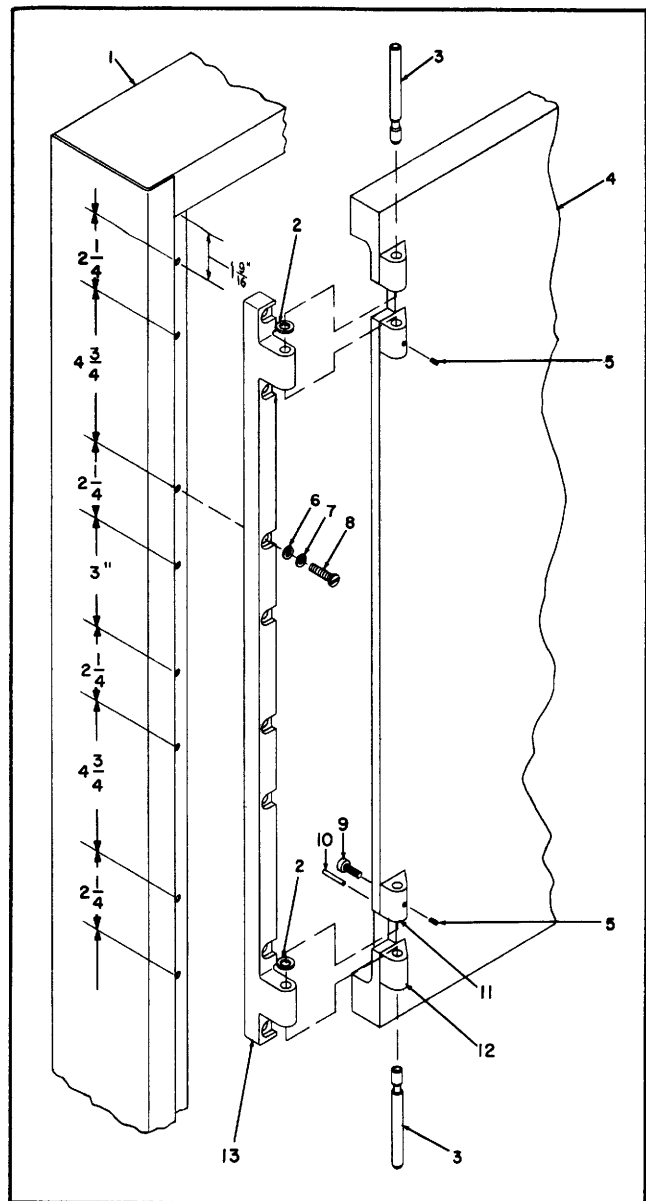


Figure 2-6. MT-120 Hinge Mounting

e. Insert dowel (3), with its grooved end facing upward into lower hinge member.

**Note**

If any difficulty is encountered when inserting hinge dowels, a gentle tap with a hammer and 1/8" diameter drift punch may be used.

f. The dowel is in place when its groove is in line with setscrew (5). Tighten setscrews.

g. Hold panel in place and remove steel pin called for in step (c). Repeat steps d, e and f for other hinge member.

h. Swing tape transport panel against rack and secure panel to rack with locking screws shown in figure 1-3, item (2).

2-9-6. EC-120, MOUNTING. (Refer to figure 2-7). When the unit employs a front cover, follow steps (a) through (d). If no front cover door is employed, follow step (e) only.

a. Open swing-out cover and remove hinge screws (1). Remove cover.

b. Remove nuts from screw (2) which secure hinge block (3).

c. Place unit into rack and line up hinge block with mounting holes in unit and rack; secure with 10-32 x 3/4" long binding head machine screws (2).

d. Position cover in place and secure hinges to the block with screws removed in step a. Close cover.

e. Place unit into rack and line up mounting holes in unit with holes in rack. Secure with 10-32 x 3/4" lg. binding head machine screws.

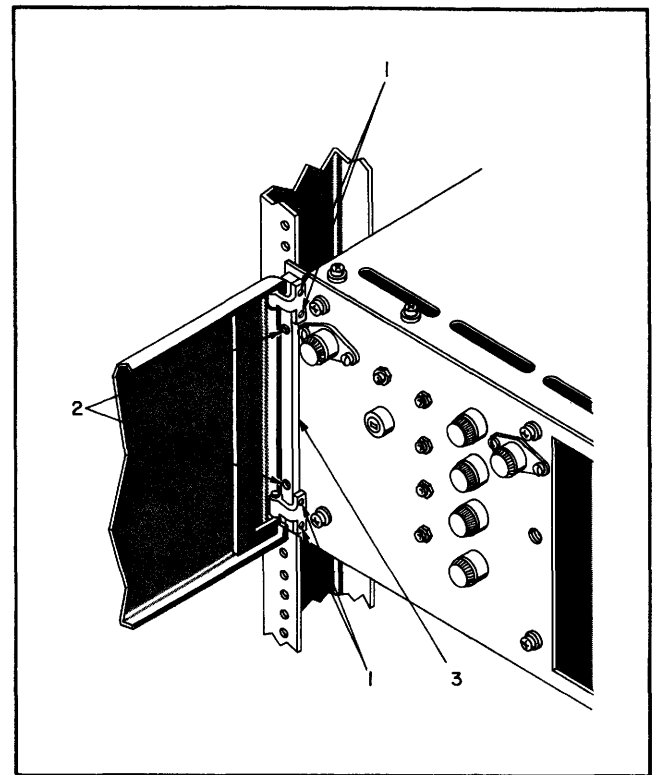


Figure 2-7. EC-120 Electronic Chassis, Mounting





## SECTION III OPERATION

### 3-1. GENERAL

This section contains operating instructions for the MT-120 Tape Transport and EC-120 Electronic Chassis.

### 3-2. CONTROL SOURCE

All functions are controlled by the remote source except POWER ON and tape threading.

### 3-3. TURNING POWER ON/OFF

Power for the MT-120 and EC-120 is controlled internally in the EC-120 by an AC operated relay KL. In order to energize KL it is necessary to connect a remote ON/OFF, two position switch between pins EE and CC of J5. Turning this switch on, followed by turning the circuit breaker on powers the arm retraction mechanism to facilitate tape threading. To turn transport off, turn remote ON/OFF switch off.

**3-3-1. THREADING TAPE.** When threading tape, it is recommended that only the very end of the tape be handled. Avoid touching the tape at any other point. To thread tape, proceed as follows:

- a. Turn remote ON/OFF switch to ON
- b. Mount a full reel of tape on the upper (pay out) hub, then press retraction button on MT-120. Tension arms will pull in and stop automatically.
- c. Open the vacuum buffer cover and raise the head cover away from the read/write head. Raising the head cover will also lift the drag pads off trough guides.
- d. Unreel approximately three feet of tape and thread through drive mechanism as shown in figure 3-1. Hold free end of the tape against core of take-up reel with finger and wind around core.

#### CAUTION

To prevent tape break at end of run, do NOT slip free end of tape into slot in take-up reel core, or in any way fasten free end to the take-up reel.

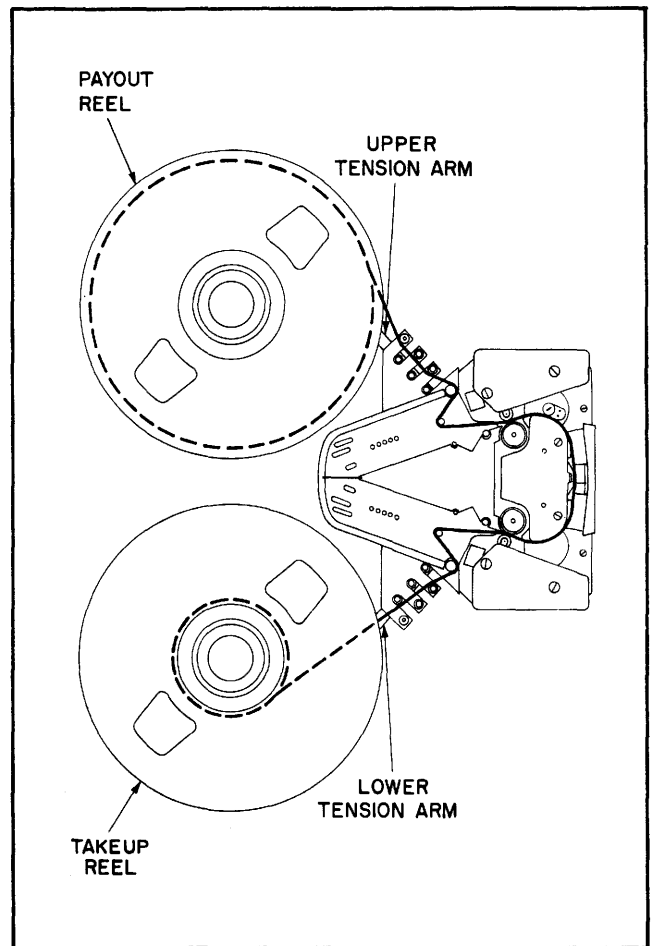


Figure 3-1. Tape Threading Outline

- e. Press retraction button and wait for tension arms to stop. Rotate both reels by hand until the tape loops around the tension arms extend to approximately mid-range. Close head cover and vacuum buffer cover.

**3-3-2. EOT/BOT MARKER.** If it is desired to begin operation at the BOT marker, apply a FORWARD command until the BOT marker reaches the sensor, then apply a STOP command. Unit is now in a ready or standby condition.

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3-3-2-1. Proper placement of the EOT/BOT markers is shown in figure 3-2. To place the markers on the tape it is recommended that one lift the head cover and adhere the marker on the portion of tape which covers the read/write head. The markers are always placed on the plastic or glossy side of the tape.

3-3-3. TAPE REMOVAL. When reflective EOT/BOT markers are used, the tape will stop on these markers when they reach the sensor and the driving pinch roller will be released. The transport will be inhibited from driving tape once it has been stopped by this marker.

**CAUTION**

When tape is stopped from a fast mode of operation, it is necessary to wait a minimum of three seconds for the capstan to slow down before selecting another fast mode. HIGH SPEED and RUN commands may be applied simultaneously. However, a RUN command should never be applied while the capstan is in high speed.

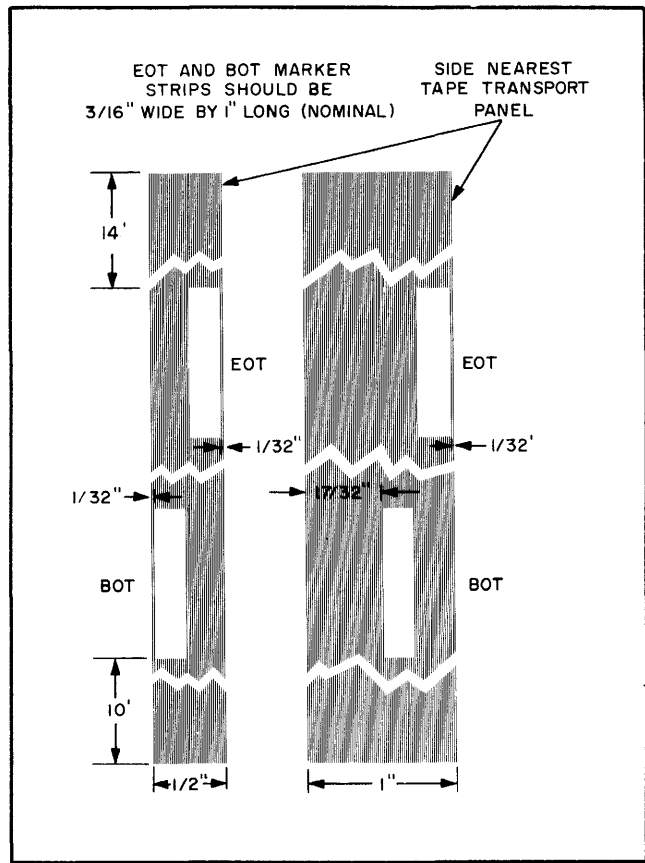


Figure 3-2. EOT/BOT Marker Strip Location

3-3-3-1. To remove tape, apply a HIGH SPEED and REVERSE command. When tape reaches BOT marker, remove HIGH SPEED and RUN command. If no marker is used, stop the transport when approximately ten feet of tape remains on the take-up reel.

- a. Open remote power ON/OFF switch connected to EE and CC of J5.
- b. Rotate reels by hand until tension arm rollers just pass the stationary rollers.
- c. Open read/write head cover, vacuum buffer cover and press arm retraction button.

d. When tension arms stop, wind the remaining tape onto the payout reel while turning the take up reel to avoid stretching tape.

e. Close read/write head cover, vacuum buffer cover and remove full tape reel.

3-4. INTERFACE SIGNALS (J5)

Command and indicator lines are listed in Table 3-1. AC power is connected to J4.

TABLE 3-1

INTERFACE CONNECTIONS (J5)

Pin Connection	Function
u	Write Lockout (no)
x	Write Lockout (com)
w	Write Lockout (NC)
Y	Low Tape (Take up reel)

TABLE 3-1 (Cont.)  
INTERFACE CONNECTIONS (J5)

Pin Connection	Function
V	Low Tape (com)
a	Low Tape (com)
X	Low Tape (com)
T	BOT On marker .0 V Off marker -15 V
N	EOT On marker .0 V $\pm 0.5$ V Off marker -15 V $\pm 2.5$ V
AA	Circuit ground
DD	Chassis ground
*CC	Power On
*EE	Power On
b	BOT/EOT lamp failure Lamp out 0 V Lamps ok -5V $\pm 1$ V
P	Ready Ready -15 $\pm 1$ V Not Ready 0V
D	Reverse ON 0V $\pm 0.5$ V OFF -4.5V $\pm 10\%$
E	Forward ON 0V $\pm 0.5$ V OFF -4.5V $\pm 10\%$
A	SpeedSelect ON 0V $\pm 0.5$ V OFF -4.5V $\pm 10\%$

\*Pins CC and EE must be connected together with a power ON/OFF switch.  
See paragraph 3-3.



## SECTION IV

### PRINCIPLES OF OPERATION

#### 4-1. GENERAL

This section contains a description of the Principles of Operation for the MT-120 Magnetic Tape Transport and the EC-120 Drive Electronics.

4-2. **MT-120 TAPE TRANSPORT.** All components for magnetic tape handling are mounted on the swingout panel casting. Major assemblies consist of the drive mechanism, vacuum buffer, servo motors and sensing devices. These items are discussed in the paragraphs that follow.

4-2-1. **REEL SERVOS.** Assume that tape is threaded and the transport is in the STANDBY condition. (See figure 4-1.) The tension arms are shown in a null position in which power is not applied to the servo motors. When a FORWARD command is applied to the transport, the forward pinch roller will press the tape against the corresponding capstan and tape will move in a forward direction (from upper to lower reel). The tape motion will cause both tension arms to begin moving in a clockwise direction. When the tension arms are centered, each secondary storage area (tape threaded around tension arm and bridge rollers) contains approximately 30 inches of tape. With the tension arms against the tension arm stops, the tape storage area contains approximately 60 inches of tape.

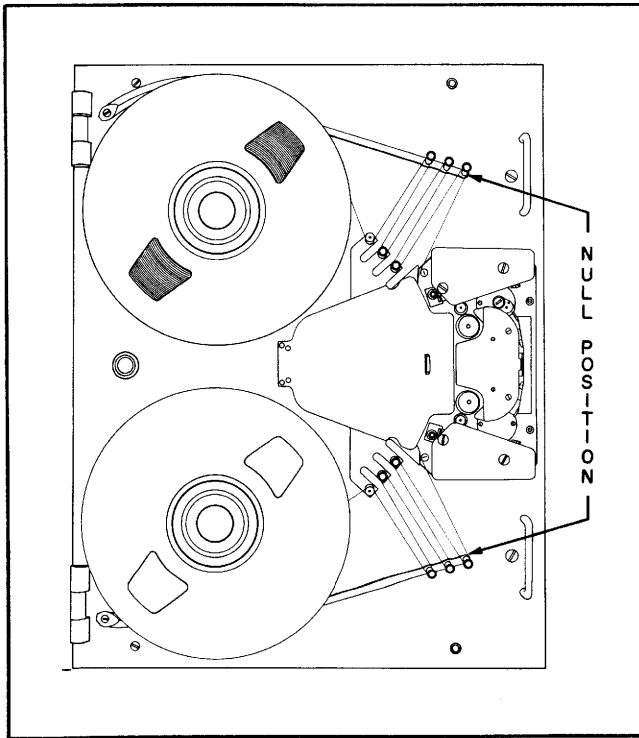


Figure 4-1. MT-120 (Null Position)

Moving the tape forward at 120 inches per second will empty the supply storage area in 0.25 seconds. It takes the same time to fill the take-up storage area since it only contained 30 inches of tape and can accommodate 30 inches more. Therefore, when transporting tape at 120 inches per second, the reel drive motors have a maximum time of 0.25 seconds after tape starts in which to accelerate the reels. In practice only about 12 inches of tape are withdrawn from or supplied to any one storage area (at 120 inches per second) before the reel has accelerated to the required speed. As tape is driven from the supply storage area to the take-up area, the upper and lower tension arms move in a CW direction. Each tension arm is coupled to a potentiometer located on a tension arm shaft assembly. The potentiometer provides an error signal which is proportional to the magnitude of the tension arm movement. The error signal originated by the potentiometer is fed to the servo amplifier (see paragraph 4-3-5). The servo amplifier output is proportional to the amplitude of the error signal and drives the servo motors. The speed and direction of each servo motor is a function of how far and in what direction its associated tension arm moves from the null or centered position. In this manner, the tape-drive system can supply tape to, or withdraw tape from the storage areas as required. The tape-drive system is isolated from the inertia of the reels by the tension arms and vacuum buffer. Tape tension between the reels and the tape-drive mechanism is maintained constant by the tension arms, regardless of direction of reel rotation or tape motion.

4-2-2. **VACUUM BUFFER.** The vacuum buffer is a device that serves to isolate the tape in the storage area from the tape in the drive system. The buffer is a dual chambered device, each chamber having a roller and several vacuum ports. The buffer is fitted with a hinged cover to provide ease of access for cleaning and tape threading. When the transport is in operation, a partial vacuum is created within each half of the chamber by the vacuum blower.

4-2-2-1. When the transport is initially turned on, each chamber will pull a tape loop into itself. Vacuum buffer pressure is such that the tape tension created by the tension arms is balanced at a point where the bottom of the tape loop in each vacuum buffer chamber is approximately centered in the chamber. When a FORWARD command is applied to the system, the left chamber is the supply chamber and the right, the take-up chamber. REVERSE commands create the opposite condition. When the tape is pulled from a supply chamber, the loop is pulled from its balanced position until the vacuum pressure reaches the point where the inertial load of the tension arm is overcome. Since the inertial load is momentary, the loop quickly returns to its balance point.

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4-2-2-2. The amount of vacuum pressure acting on the tape is dependent upon the relative position of the tape in the buffer. When the tape is in the balanced position, the total amount of vacuum pressure will not be applied since a portion of it is vented to atmosphere. When, as during the initiation of a FORWARD command, the tape loop is positioned so that no vacuum pressure is vented, the maximum pressure is applied to the loop, drawing it back into the chamber. The tape loop serves as a valve moving over the ports. When tape is fed into a chamber, it is drawn into the chamber until a larger area is uncovered, reducing the pressure. This area, from the balance point to the full chamber conditions, provides more than enough time for the tension arms to accelerate. When the tension arm is accelerated and assumes its new position the loop returns to the balance point.

4-2-2-3. Tape friction within each chamber is negligible, so that a minimum of vacuum pressure is required to retain the tape loop within the chamber at all times. At a tape movement command, the supply chamber will dampen the inherent pendulum action of the spring-loaded tension arm, resulting in a smooth start profile at the Read/Write Head. The tape friction created in the upper portion of the vacuum chamber and trough guide system is greater than the vacuum pressure can overcome. Therefore,

when a STOP command is applied, the take-up reel will empty the take-up chamber as it decelerates before it can affect the tape passing over the head. Since the chamber stores more than enough tape to provide adequate time for the take-up reel to decelerate, the stop time is only dependent upon the release time of the pinch roller solenoid assembly, plus the decelerate time of the tape within the drive system.

4-2-2-4. The vacuum blower is a two stage blower driven by a universal motor. A capacitor in the blower housing serves as an RF filter across the brushes. An RF shield is also provided for the motor.

4-2-3. REEL BRAKES. Each servo-motor assembly has a brake which stops and releases the servo motors in response to the removal and application of power to the tape transport. The brake assembly is shown in figure 4-2. Brake solenoids are energized when power is applied to the tape transport, pulling the brake arm away from the brake drum on the servo-motor shaft. When power is removed, a spring returns the arm so that it engages the drum and stops the motor.

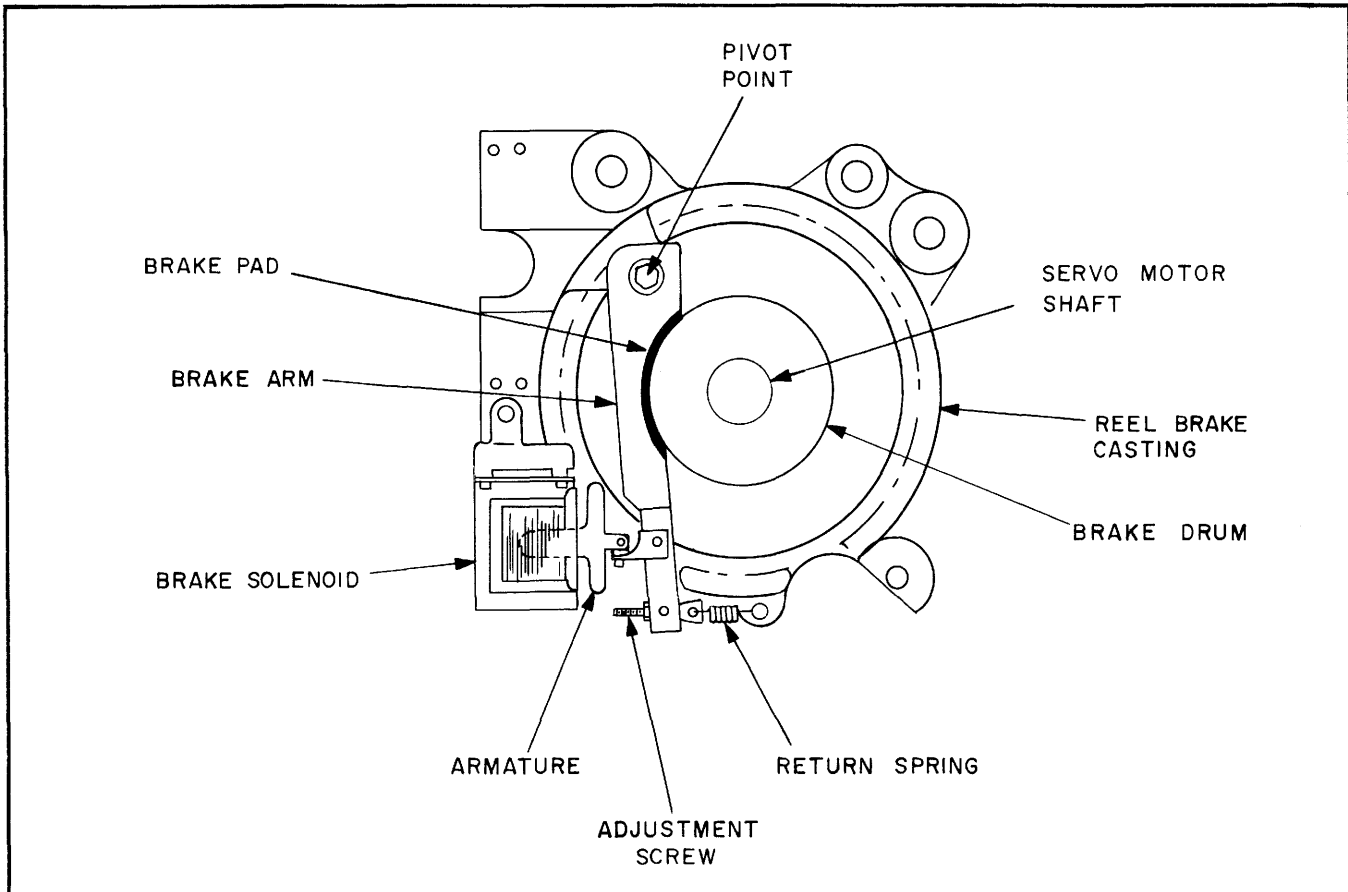


Figure 4-2. Servo Motor Reel Brake

**4-2-4. DASHPOT PISTON.** The dashpots prevent the tension arms from striking their stops with excessive force. Each tension arm shaft assembly has a free turning arm that is connected to the dashpot piston. A second arm, fixed to the tension arm shaft, rotates with the tension arm. As the arm moves towards its stop, the fixed arm will strike the free arm and cause the dashpot piston to be pushed into the dashpot cylinder, compressing the air in the cylinder. The slow escape of this air, through a small adjustable orifice in the cylinder, provides a cushion for the tension arm. Cushioning only occurs over the outermost 20 to 30 percent of tension arm travel and is ineffective during relatively slow tension arm movements so that normal tension arm movement is unrestricted. A compression spring locates the piston in the cylinder during slow tension arm movements.

**4-2-5. TAPE DRIVE.** The capstan motor is the prime source of drive for tape motion. It drives the capstan on the drive plate assembly by means of a belt and pulley arrangement. A single belt from the capstan motor pulley to the reverse capstan shaft is employed. The reverse capstan shaft always has two pulleys, one to receive the motion from the cap-

stan motor and another to pass this motion on to the forward capstan shaft. Dual speeds are achieved by using a dual speed motor and a speed select relay. A simplified arrangement is shown in figure 4-3.

**4-2-5-1.** Speed selection is accomplished by energizing or de-energizing the motor speed change relay which is mounted in the EC-120 Electronics Chassis.

**4-2-5-2.** Tape motion is initiated by pressing the tape against one of the rotating capstans. This action is performed by the pinch roller solenoid assemblies. Since the capstans rotate in opposite directions, pressing the tape against the forward capstan roller results in tape motion from the supply to take-up reel. Tape motion in the opposite direction is initiated by the reverse pinch roller solenoid assembly. The solenoid consists of a coil housing, frame armature assembly, backstop, pinch roller and return spring. The basic principle of operation is illustrated in figure 4-4. When current is applied to the solenoid coil, the armature is attracted to the pole tips and the entire frame armature assembly is pulled down toward the capstan.

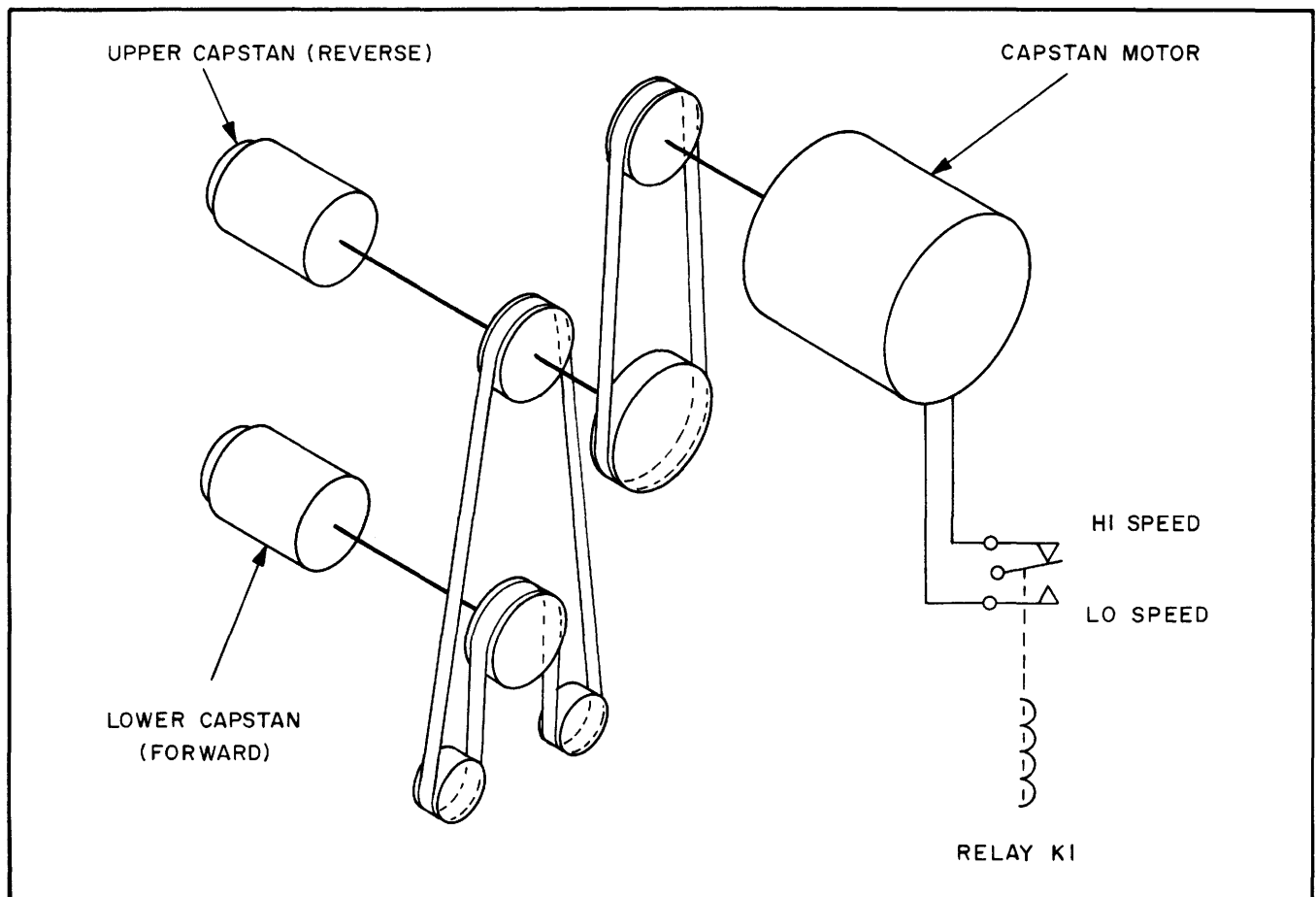


Figure 4-3. Capstan Speed Change Arrangement (Simplified)

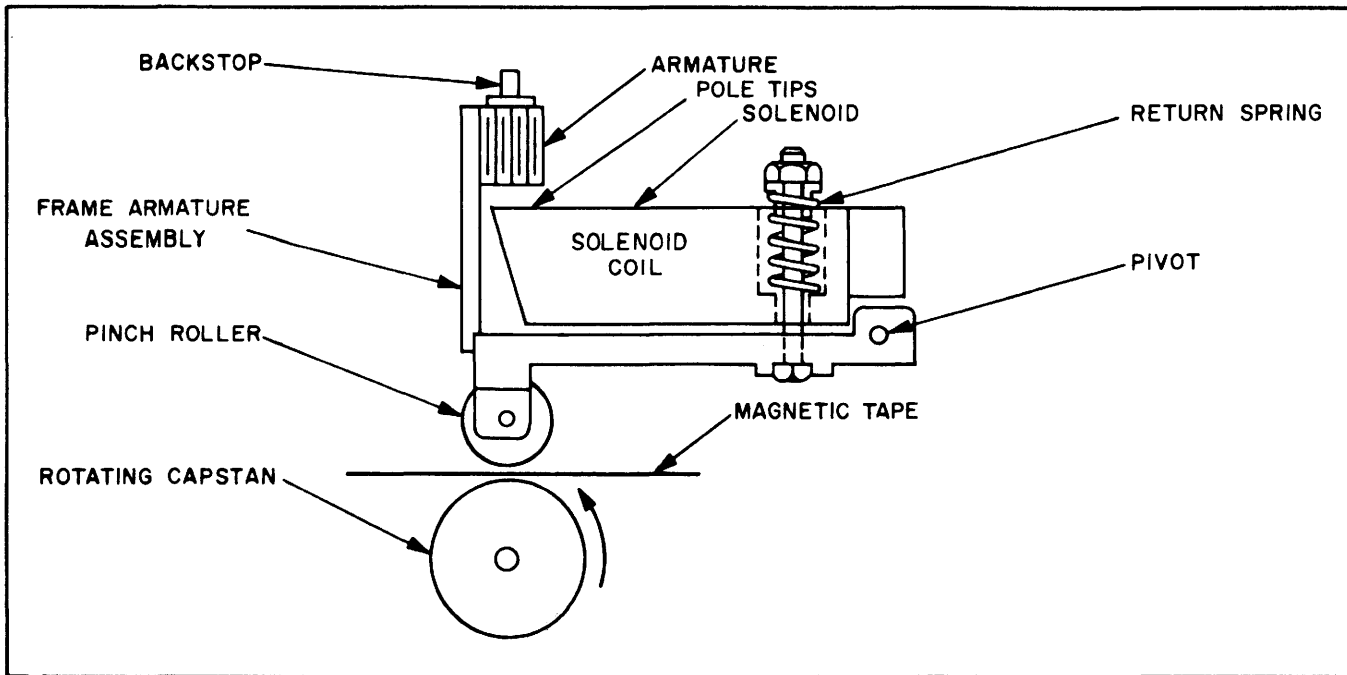


Figure 4-4. Pinch Roller Solenoid (Simplified)

The tape which lies between the pinch roller and capstan is then driven at the speed of the capstan. When current is removed, the spring in the body of the solenoid housing returns the frame armature to its resting position against the backstop.

**4-2-6. TAPE BREAK AND TAPE LOAD SWITCHES.** The tape break and tape load switches are connected in a series circuit with switch S10. Should any of these switches be open circuited, power to the transport is removed. The tape break switch is activated (opened) when the tension arm is 1/4" away from its outer limit (end nearest panel edge) while the tape load switch is opened when the tension arm rollers are in line with the bridge rollers. Switch S10 is open circuited only when the tension arms are being controlled by the arm retraction push button on the tape transport. The first time the button is pressed, a motor driven cam opens S10. The cam holds the switch open for 180 degrees of the cam rotation and at the same time, via a pulley and cable arrangement, retracts the tension arms past the bridge rollers to facilitate tape threading. When the cam stops, the tape load switch is closed as explained above. Once tape is threaded and the button pressed a second time, the arms returned to their original position, and tape load switch S10 is again closed when the cam stops at the next 180 degrees of its rotation.

**4-2-6-1.** The tape load and tape break switches are located in the tension arm potentiometer casting shown in figure 4-5. Note the adjusting screw which presses the spring actuator against the plunger on the switch when the tension arm is at either end of its range. The drawing illustrates the position of the cam when the tension arm is between its range limit (neither switch being actuated).

**4-2-6-2.** Switch S10 operates by a motor driven cam. Two set screws 180 degrees apart and along the cam outer edge activate the switch to disable the transport whenever the tension arms are being driven by the arm retraction motor. In this way the transport is inhibited until the retraction mechanism has come to a halt. The pushbutton on the transport is a momentary type and once depressed, starts the motor which opens S10 and closes another switch on itself until the motor is stopped at 180 degrees.

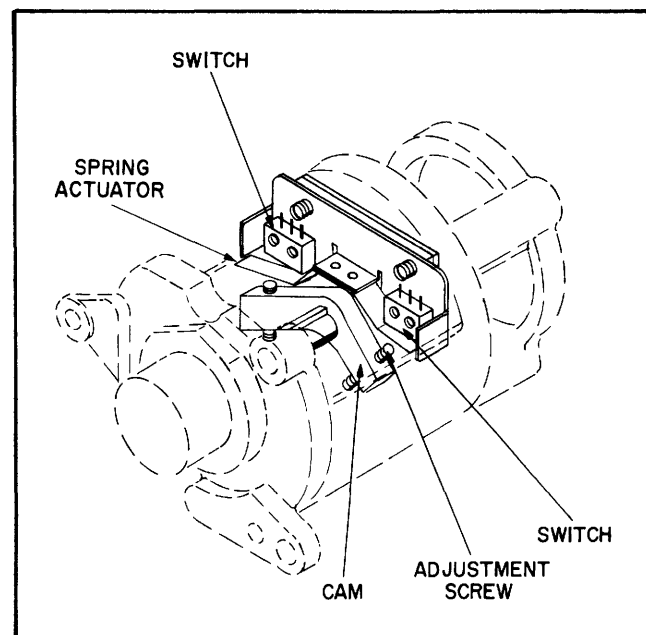


Figure 4-5. Tape Load and Tape Break Limit Switches



4-2-7. **LOW TAPE SENSING.** To detect a condition of low tape on either reel, the level of tape is monitored by a follower arm. When approximately 100 feet of tape remains on the reel, the follower arm activates a switch which is located at the pivot point of the arm and behind the front panel. The arm is adjustable for different levels of tape. (See Section VI.) When the switch is activated it may be used to signal the transport to slow down the tape from a fast tape speed such as rewind to a normal operating tape speed.

4-2-8. **WRITE LOCKOUT SWITCH.** The write lockout switch shown in figure 4-6 is used to disable external record circuits should a pre-recorded tape be used. In this manner accidental recording or erasure of pre-recorded information is avoided.

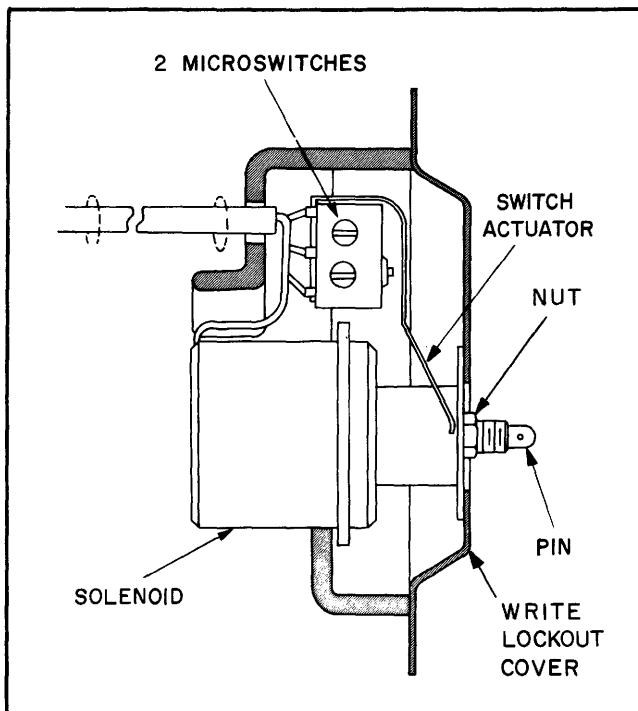


Figure 4-6. Write Lockout Switch

4-2-8-1. The flange insert (write lockout ring) which is placed inside a groove in the tape reel, pushes the switch plunger when the reel is placed on the hub. The plunger activates a switch to complete a current path to the plunger solenoid and the plunger is drawn in by the solenoid. In this manner, the plunger is completely out of contact with the write lockout insert thus preventing wear. As the plunger is drawn in, a switch operates which disables the record circuits.

4-2-8-2. In order to return the plunger to its normal position (not activated), power to the transport must be removed.

4-2-9. **PHOTOELECTRIC END-OF-TAPE SENSING.** An IBM photoelectric end-of-tape sensor is mounted on the tape transport drive plate. It operates in conjunction with reflective markers near either end of the tape. Marker strips are normally located on the glossy side of the tape at a minimum of 8-10 feet away from the tape ends. Figure 3-2 shows the proper location for these strips. End-of-tape sensing is accomplished by having the light from a lamp in the sensor strike the marker and reflect back onto a photo-electric silicon solar cell in the assembly. A lamp and a pair of solar cells are encased in the sensor. One cell is used for the beginning-of-tape function and the other for the end-of-tape function. The tape distance from the center line of the read/write head to the assembly is approximately  $2.33'' \pm .1''$ . The solar cell output increases from 20 microamperes to 500 microamperes as a marker passes under the light source. These outputs are applied to the BOT/EOT READY card. A description of this card is contained in paragraph 4-3-6.

#### 4-3. EC-120 AND TR-120 OPERATION

The drive electronics for the tape transport is in the EC-120 chassis. Plug-in printed circuit cards and removable heat sink assemblies are used to facilitate replacement. The schematic diagrams in Section VIII show the heat sink, plug-in card, and power supply components. Relays for controlling reel brakes, AC power, speed change, and time delay are mounted on the chassis.

4-3-1. **LINE POWER CIRCUIT.** The source for AC power is supplied by the TR-120 transformer which is usually mounted at the base of the cabinet or rack being used. This transformer is the source of AC for all power supplies. Connections for the transformer windings are shown in Section VIII. The transformer leads are routed to the drive electronics via a cable which terminates at J5 on the EC-120 chassis. The transformer may be connected to taps ranging from 107.5 to 245 VAC.

4-3-1-1. The following paragraph describes the primary flow of AC within the system (see figure 8-1). When the circuit breaker is turned on, AC is applied via K1 normally closed contacts on to the tension arm retraction motor and the motor in turn is controlled by the retraction button on the MT-120 Transport. To energize K1, pin CC and EE on J5 are connected by an external power ON/FF switch. K1 shifts AC from the arm retraction motor to the tape transport and the primary of the supply transformer, TR-120, through connector J4. Once the transformer is powered, the DC supply voltages exist and one of these voltages, -12 VDC, is applied to the Time Delay Relay K5. The purpose of K5 is to delay K2 (Ready Relay) from coming on and in this manner, the pinch rollers and servo systems are inhibited until all DC supplies are stable.

## SECTION IV

### PRINCIPLES OF OPERATION

When K2 is activated, it enables the servo amplifier cards and removes the inhibit signal from the pinch roller solenoid card. In order to energize relay K1 all transport interlocks must be closed and the external power ON/OFF switch must be in the ON position. If all circuits in the EC-120 are ready, K2 will then be energized when K5 contacts close.

**4-3-2. EOT/BOT FUNCTION.** After tape is initially loaded and it is desired to begin operating at the BOT marker, a forward command must be applied until the tape passes the BOT marker. Once tape has passed the marker, a STOP command is applied and the driving pinch roller will be released. A reverse command then returns the tape to the BOT marker.

**4-3-2-1.** The transport may be slowed down from rewind speed by remote means. When it is desired to stop on the BOT or EOT marker, the low tape sensor may be used to slow the transport down to normal speed prior to the marker reaching the EOT/BOT Sensor on the transport.

**4-3-3. CONVERTER CIRCUIT.** This card is an optional feature and is used to convert all logic levels to those necessary to operate the drive circuits in the EC-120. Three converter stages are used for converting such signals as the FWD/STOP, REV/STOP and SPEED SELECT commands. The card plugs into a space provided for in the card cage on the EC-120 Unit.

**4-3-4. POWER SUPPLY.** (Refer to EC-120 schematic figure 8-1.) Power supply circuits are contained on the EC-120 chassis. These supplies are fused on the front left plate of the unit and voltage test points are located next to the fuses. An elapsed time indicator on the plate shows the amount of time that the unit has been in operation. This indicator is effective up to 1000 hours. The majority of components for the DC power supplies are contained on a removable heat sink and also on the main chassis.

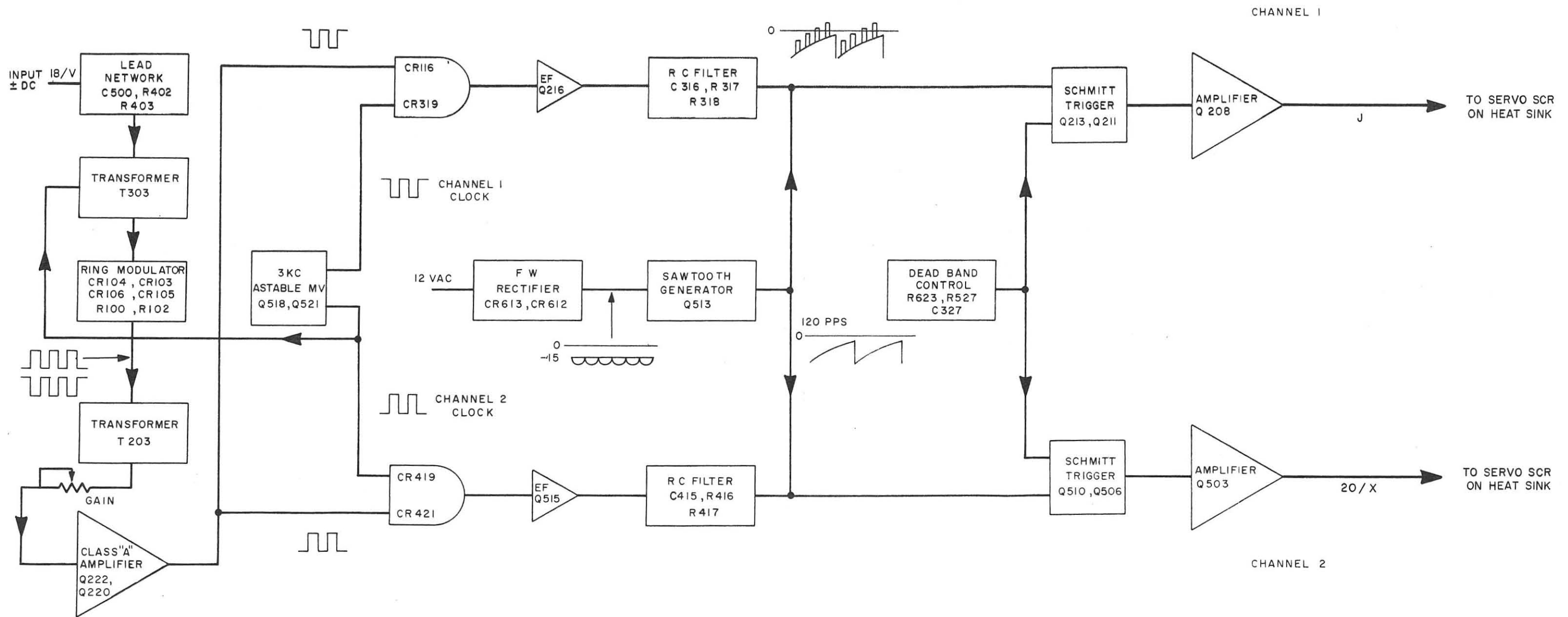
**4-3-4-1.** The -15 VDC supply is derived from a full wave rectifier, CR1 and CR2, (TB1). (See figure 8-1.) The input to the rectifier is supplied by the TR-120 transformer with 42 VAC center tapped. The output of the rectifier is fused between TB1-1 and 7 and fed to a series type regulator circuit Q1, Q2 and Q3. VR4 is a Zener diode used to generate a -10 volt supply at TB1-5. The primary voltage for the +15 VDC is supplied by the same transformer with 42 VAC. Diodes CR5 and CR6 rectify the 42 volts and the supply fused between TB1-10 and 12. Filtering is accomplished with capacitors C2 for the plus supply and C1 for the minus supply.

**4-3-4-2.** The -12 and -6 VDC supplies are not regulated. Rectifiers CR11 and CR12 are mounted on the chassis and produce the -12 volts which is unfiltered. The -6 volts is filtered by C3 connected to TB1-19 on the chassis. L1 is used as a slave choke which speeds up the operation of the pinch roller solenoids (inductive load), therefore producing a rapid start of tape motion. The -6 volts is used to supply the pinch roller drivers Q1, Q2 and Q3 (TB4-9) mounted on a heat sink. Zener diodes VR7, VR8, and VR9, which are connected to the collectors of these transistors, serve to protect the transistors when the pinch roller solenoid current is removed (self induced emf).

**4-3-5. SERVO AMPLIFIER CIRCUIT.** (Reference figure 4-7.) Two servo amplifiers are used in the EC-120 unit, one for the payout reel and the other for the take-up reel servo. The Servo Amplifier is comprised of a lead network, ring modulator, class "A" amplifier, 3KC astable multivibrator, sawtooth generator, full-wave rectifier, and two identical output channels. Each output channel consists of an AND gate, emitter follower, RC filter, Schmitt trigger, amplifier and silicon controlled rectifier (SCR). The servo amplifier input is a DC voltage derived from the tension arm potentiometer and is variable in polarity and magnitude. This voltage is changed to a square wave, the magnitude of which is directly proportional to the input signal. However, depending on the sign of the input signal, this square wave is either in-phase or out-of-phase with the internal 3 KC clock. The square wave which is generated drives one of the output channels, depending upon the polarity of the input signal. The output of the driven channel fires its SCR to provide power to the motor, proportional to the magnitude of the input.

**4-3-5-1.** The positive or negative DC voltage input to the amplifier is coupled to the ring modulator through the lead network. The ring modulator consists of a diode bridge (CR103 through CR106) and balance potentiometers R100 and R102. The 3 KC clock from the astable multivibrator is applied across the primary of transformer T303 through capacitor C418, and the lead network output is applied to the center-tap of the secondary winding. The ring modulator essentially chops the applied DC input into a 3 KC square wave.

**4-3-5-2.** The output of T203 (ring modulator output) is then amplified in class "A" amplifier Q222, Q220 and applied to the channel 1 input AND gate (CR116, CR319) and the channel 2 input AND gate (CR421, CR419). The second input leg of each AND gate is conditioned by one side of the internal clock multivibrator (channel 1 clock and channel 2 clock).



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Figure 4-7. Servo Amplifier, Logic Diagram

Therefore, the AND gates are conditioned 180 degrees out of phase with each other. If the input signal is a positive voltage, the class "A" amplifier output is in phase with the channel 1 clock and out of phase with the channel 2 clock. Therefore, the channel 1 AND gate is satisfied and channel 1 is driven. Conversely, if the input signal is a negative voltage, the amplifier output is out-of-phase with the channel 1 clock and in-phase with the channel 2 clock, satisfying channel 2 AND gate, thus driving channel 2.

4-3-5-3. Since both output channels are identical, only one will be discussed. Assume that channel 1 is the driven channel. Then the 3 KC square wave is applied to the RC filter (C316, R317, R318) via emitter follower Q216. The purpose of the filter is to remove any spurious pulses which may be present. A 12-volt, 60-cycle supply is rectified by full-wave rectifier CR613, CR612 and a negative 120 CPS pulsating DC voltage is applied to sawtooth generator Q513. A 120 PPS sawtooth waveform, slowly rising positive from -15 volts to ground is generated and applied to Schmitt trigger Q211 and Q213. The 3 KC square-wave output of the RC filter is also applied to the Schmitt trigger. The 3 KC square wave rides on the positive going excursion of the 120 PPS sawtooth. Therefore, there are approximately twenty-five 3 KC square wave pulses riding on each positive going sawtooth excursion. The firing point of the Schmitt trigger is set by the dead-band control circuit (R623, R527, C327). As the sawtooth rises from -15 to 0 volts, the first 3 KC pulse which exceeds the firing point will fire the Schmitt trigger. Since the RC filter output amplitude is directly proportional to the magnitude of the input signal, it can be seen that input voltages of a higher magnitude will cause the Schmitt trigger to be fired sooner during the sawtooth excursion than those input signals of a lower magnitude. The trigger output is amplified in amplifier Q208 and applied to the SCR gate by the channel 1 output line.

4-3-5-4. The reel drive servo system responds quickly to sudden changes in input signals. By themselves, the servo systems are incapable of accelerating a full reel of tape within the required time. It is the secondary storage system that provides the additional time for the servo to respond. Assume that tape is threaded on the transport, tension arms are in the null positions, and all power to the reel servo motors is disconnected, a forward command would cause the tension arms to move in a CW direction. During this time, the reels would not have to turn, since the tape stored between the upper tension arms and roller bridge is supplying the system. The lower storage area, since it is only half full, is taking up tape. The time lapse between the start of tape motion and the tension arms reaching their limits, is available to the servo systems to accelerate the reels. The time duration is a function of the amount of tape available in the storage area and the tape speed.

When the tension arms are centered, each storage area contains approximately 30 inches of tape. Moving the tape forward at 120 ips would empty the upper storage area in approximately 0.2 seconds. It would take just as long to fill the lower storage area since it only contained 30 inches of tape and could accommodate 30 inches more. Thus the reel drive servo systems have a maximum of 0.2 seconds to accelerate the reels after tape starts. This time is greater than actually required. In practice only about 12 inches of tape is withdrawn from any one storage area before the reel has accelerated to the required speed.

4-3-5-5. However, since the servo systems have to respond not only to tape starts but to tape stops, tape rewind, and direction reversals as well, a tension arm offset system is employed that extends the recovery time of the servos. While tape is moving, this offset system by means of electrical signals from the solenoid drive module to the reel servo amplifiers, positions the tension arm tips about two inches away from their null positions. In this manner, the amount of tape in each storage area is altered to add to the amount of recovery time available to the servo systems when a reverse command is given. The tension arms are offset in the direction of tape travel. For example, if tape is moving in a forward direction the tension arms will be offset in a CW direction. This allows more time for both servo systems to recover from a STOP or REVERSE command. Upon receipt of a STOP command, the upper reel, since it had been paying out tape, will continue to do so until the upper servo has had time to stop. This will cause the upper tension arm to move CCW. The lower reel will cause the lower tension arm to move CCW since it had been taking up tape.

4-3-6. EOT/BOT, READY LINE AND SPEED CHANGE CIRCUITS. These circuits are all contained on this card. Each function is described separately in the paragraphs which follow. Refer to the block diagram of figure 4-8.

4-3-6-1. Both the EOT and BOT amplifier circuits are identical; therefore only one, the EOT, will be discussed. When a reflective marker falls under the EOT sensor on the tape transport, the photo cell output increases. The cell output amplified by Q214 is fed to Schmitt trigger Q212 and Q210. The input to the Schmitt trigger is adjusted by a trim-pot so that the circuit will only respond when a reflective marker is under the sensor. Section VI covers adjustment procedures for this circuit.

SECTION IV  
 PRINCIPLES OF OPERATION

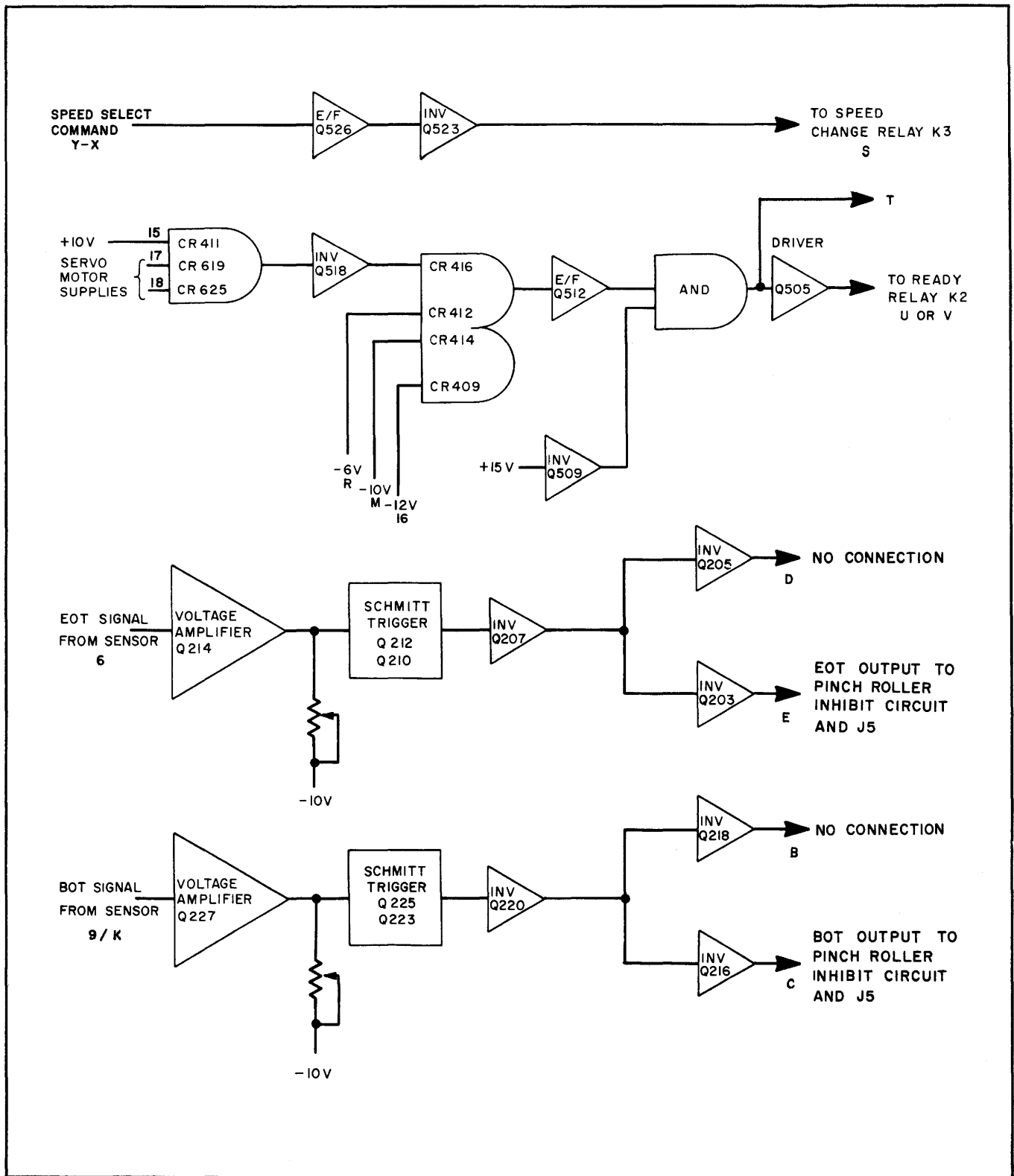


Figure 4-8. EOT/BOT Ready Line and Speed Change, Logic Diagram

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The output of the Schmitt trigger turns Inverter Q207 off. In going off, a negative swing at the collector of Q207 is DC coupled to Q203 and Q205. Inverter Q205, when turned on, supplies a ground indication to pin N of J5 which is utilized by the external equipment. Inverter Q203, when turned on, produces a swing from -15 VDC to ground. This positive going signal is connected to the pinch roller drive card, pin W. This connection, however, is routed through a jumper wire in the pinch roller circuit card and by this method can be made to inhibit the forward-drive circuit. Inhibiting this circuit will release the forward pinch roller solenoid if it has been energized. This arrangement produces automatic stopping of tape on the EOT marker.

4-3-6-2. For speed change, an emitter follower Q526 and Inverter Q523 are used. The output of the Inverter drives relay K3 on the EC-120 chassis. Relay K3, when energized, switches AC from the low-speed windings to the high-speed windings of the capstan motor.

4-3-6-3. A positive and negative AND gate is used in the ready circuit. Refer to figure 4-8. When enabled, the gates will cause the Ready relay K2 on the EC-120 chassis to be energized. The ready relay will not be energized when the AND gates do not have an input, thus inhibiting the pinch roller drive card and servo amplifiers. The positive AND gate comprised of CR411, CR619, and CR625 requires that all inputs be of a positive value. Once all inputs are satisfied, the positive AND gate output cuts off Inverter Q518. Q518, in going off, applies -10 volts to the anode of CR416, part of the negative AND gate comprised of CR416, CR414, CR412 and CR409. CR414, CR412, and CR409 have their anodes connected to the negative DC power supplies. If all negative supplies are present, a negative voltage appears at the input of Emitter Follower Q512. The negative output of Q512 turns Driver Q505 on. Driver Q505, when turned on, completes the relay coil circuit for K2 on the EC-120 chassis. Once K2 is energized, the positive inhibit signal to the pinch roller circuit card is removed, and the +15 volt supply for the SCRs is delivered to the servo amplifiers. A Ready indication (-15V) appears at terminal P on J5 when K2 is on.

4-3-6-4. A clamping transistor Q509 serves as a safety device. It prevents Q505 from turning on when the +15 volt supply fails. A voltage divider at the input of Q509 will swing negative, turning the transistor on. The collector of Q509 is then essentially shorted to ground. The base of Q505 which is connected to this point will also be at ground. This action prevents relay K2 (Ready relay) from coming on.

4-3-7. PINCH ROLLER DRIVE CIRCUIT. The pinch roller solenoids on the tape transport are energized by the pinch roller drive circuit. The block diagram of figure 4-9 illustrates the FWD/STOP, REV/STOP logic configuration. To initiate a forward mode, it is necessary to apply 0 VDC to the FWD/STOP line, pin E of J5. This signal is converted in the Logic Converter Card to a negative value which is connected to pin S on the Pinch Roller Drive Card. See figure 4-9. An AND gate consisting of CR611, CR608, CR409 and CR602 turns Q514 on when all inputs are negative or open-circuited. CR611 is negative as long as no EOT marker is under the sensor. CR608 is open circuited by relay K2 (Ready Relay) and CR602 is fed from the converter card with a negative level when the forward command was applied. Pins V, R, and N are not used with this circuit. All inputs being negative, will cause Q514 to conduct, turning Q519 off. The negative output of Q519 turns Emitter Follower Q521 on, producing a negative signal at pin U/17. A driving transistor, Q1, connected to U/17 via TB4-1 on the EC-120 chassis, is turned on by the output at pin U/17 of the Pinch Roller card and the forward pinch roller solenoid connected to pin A

4-3-7-1. When no run command is applied, and the tape transport is in a standby condition, AND gate CR112 and CR113 receives a zero signal from Q217 and Q519. The positive output of this gate cuts Inverter Q211 off. Q211, in going off, drives transistor Q208 on. The negative output of Q208 turns on Q2 located on the EC-120 heat sink. Choke L1 acts as a slave choke to speed up operation of the pinch roller solenoids (inductive load).

SECTION IV  
 PRINCIPLES OF OPERATION

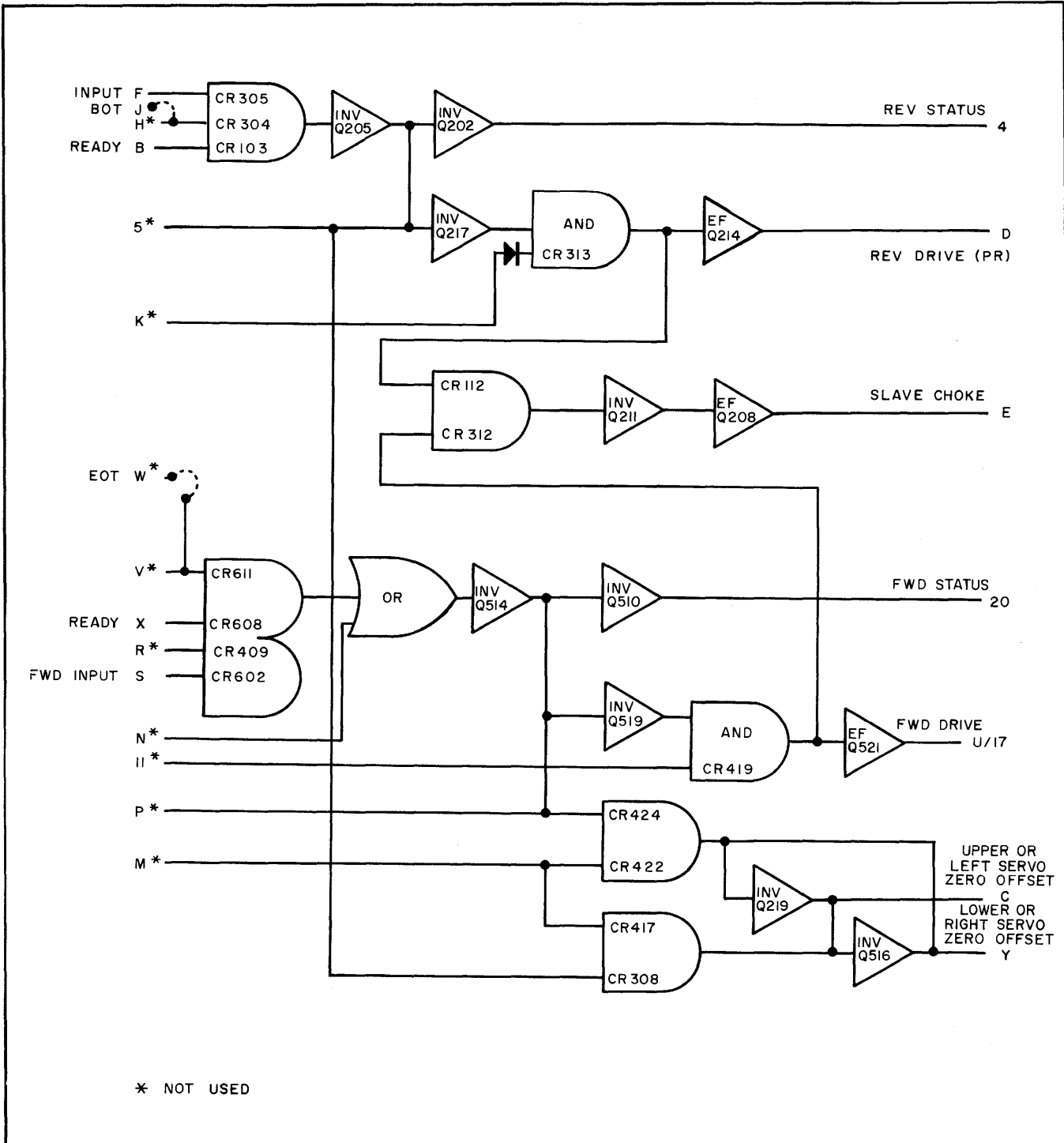


Figure 4-9. Pinch Roller Drive, Logic Diagram

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## SECTION V PREVENTIVE MAINTENANCE

### 5-1. GENERAL

This section contains instructions for cleaning the MT-120 Tape Transport together with a preventive maintenance schedule, Table 5-1. Close adherence to the preventive maintenance schedule will enhance equipment performance and increase tape life. Table 5-1 lists all the items to be checked, adjusted and replaced as required. This schedule is based on one eight hour shift per day, five days per week at a 20 percent duty cycle. Procedures for checking, adjusting and replacing components are outlined in Section VI, Maintenance.

### 5-2. CLEANING

The following procedures should be performed after every eight hours of operation.

#### Note

A cleaning kit containing a prepared solvent, bristle brush, tissues and an instruction booklet is available. This kit contains all necessary items for performing the following cleaning procedures and may be purchased from the Potter Instrument Company, Inc.

5-2-1. TENSION ARM ROLLERS. (Reference figure 1-3.) Tension arm rollers (7) and stationary rollers are cleaned in the same manner. Clean all rollers with a tissue dampened in cleaning solvent, paying particular attention to the inside flanges.

5-2-2. DRAG PADS. Drag pads may be removed by removing two screws which attach the pad to the assembly. However, once removed, tape drag should be checked and adjusted if necessary. (See paragraph 6-3-7.) Drag pads may be cleaned by stroking the felt with a bristle brush or by blowing clean compressed air over the pad surface. If pads are removed, it is recommended that the trough guides also be cleaned at this time. The following paragraph describes this procedure.

5-2-3. TROUGH GUIDES. To clean the surfaces of the trough guide, open the head cover to raise the drag pad bracket away from the trough guide. Soak a tissue with cleaning solvent and clean all surfaces of the trough guides. Particular attention should be given to the side walls and corners of these guides. To gain access to the trough guide which is located under the EOT assembly, push the retractable EOT assembly into the front panel.

5-2-4. READ/WRITE MAGNETIC HEAD. Open the head pad cover away from the Read/Write head. Using a tissue soaked with cleaning solvent, rub the tissue across the Read/Write head in all directions with a final stroke in the direction of tape travel.

5-2-5. PINCH ROLLER AND CAPSTAN. Open the vacuum chamber door. Using a tissue soaked with cleaning solvent, rub clean both the pinch roller and capstan. The retractable EOT assembly may be pushed into the panel to gain access to the reverse pinch roller.

5-2-6. VACUUM CHAMBER. Open the vacuum chamber door and remove the divider which isolates both halves of the chamber. With a bristle brush soaked in cleaning solvent, clean all corners of the chamber. After cleaning the corners with the bristle brush, use a tissue dampened in solvent to wipe the entire chamber clean. Be sure to replace the chamber divider after completing this operation.

5-2-7. LOW TAPE SENSOR SHOE. Clean the surface of the low-tape sensor shoe by wiping with a clean dry cloth.



TABLE 5-1  
PREVENTIVE MAINTENANCE SCHEDULE

Nomenclature	Elapsed time in hours		
	Check	Adjust	Replace
Rollers (all except pinch rollers)	40		5,000
Pinch rollers	400	400	2,000
End-of-tape sensor lamp			6,000
End-of-tape sensor amplifier	400		
Tension arms	170		
Drag pads	170	170	400
Start-stop time	170		
Low tape sensor arm	400	400	
Low tape sensor shoe			1,000
Write lockout	400		
Capstan belts	400		7,500
Magnetic head wear	400		see note*
Reel brakes	400		
Ferrite head shield	1,000		
Tension arm potentiometer			5,000
Blower motor			5,000
Servo and Capstan motor			15,000
Voltages	1,000		
Limit switches	1,000		

\*NOTE: The actual life of a magnetic head will depend on duty cycle, tape speed and abrasiveness of tape. Head wear greater than .007" requires that the head be returned to the factory for re-crowning.

## SECTION VI MAINTENANCE

### 6-1. GENERAL

This section contains recommended procedures for performing adjustments and replacing major components on the MT-120 and EC-120.

### 6-2. TOOLS REQUIRED

The following tools are required to perform the adjustments described herein.

- a. Variac (Powerstat 0-120 volts, 20 amps)
- b. Tektronix M533A oscilloscope with type D pre-amplifier or equivalent
- c. Square wave generator, 1 to 200 cps.
- d. Chatillon spring scales:
  - No. 516-1000 (2 pound)
  - No. 719-5 (5 pound)
  - No. 719-10 (10 pound)
  - No. 719-20 (20 pound)
- e. Flat plate fixture
- f. Height gauges
- g. Set of Allen wrenches
- h. Reel of tape with a length of recording containing all ONES
- i. D. C. power supply (3 amp max)
- j. Three foot length of magnetic tape with a one inch loop at each end (use scotch tape to form loops)
- k. Lubri-plate Type 110 grease

### 6-3. ADJUSTMENTS

6-3-1. PINCH ROLLER DRIVE SOLENOID. Basic principles of operation are described in Section IV, paragraph 4-2-5-2.

#### Note

The solenoid should not be disassembled unless it is definitely established that it is the cause of the malfunctioning.

Under normal conditions, the only component requiring replacement is the rubber pinch roller described in paragraph 6-4-8. Accommodations for adjusting spring return force, breakaway force and

pinch roller to capstan clearance are incorporated on the assembly and may be performed on the transport. Pinch roller parallelism is a setting performed during assembly of the unit and should not require attention. Disassembly and reassembly instructions are discussed in paragraphs 6-4-9 and 6-4-10.

a. Prior to energizing the solenoid, check that a gap exists between pinch roller (3), figure 6-1 and capstan (4). If not, loosen setscrew (7) and back off return stop screw (5), and if necessary, adjusting screw (6), while pushing the coil housing (8) away from the capstan by hand. Tighten socket head screws (1) and (2).

#### Note

Whenever turning adjustment screw (6) counter-clockwise, it is necessary to push the coil housing (8) away from the capstan since it is not threaded and therefore will not follow the screw.

b. Load a reel of tape on the transport and turn power on. Energize the solenoid under test with a forward or reverse command depending on which solenoid is being adjusted. If pinch roller does not engage, pull down on armature frame assembly (9). If armature does not engage, loosen socket head screw (1) and turn adjustment screw (6) counter-clockwise approximately 1/2 turn.

c. Tighten socket head screw (1). Energize solenoid. Repeat until pinch roller drives tape.

6-3-1-1. Breakaway Force. This is the force required to pull the pinch roller away from the capstan to stop tape motion.

a. Adjustments are made with tape moving at normal operating speed (not rewind). While tape is being driven, hook a ten pound scale under the frame armature casting at (10), being careful not to strike tip of scale against rubber roller (3). Pull on scale until roller stops driving tape and observe reading. Force should be 8 lbs.  $\pm$  1/2 lb.

b. If the above reading is not within the specified range, adjust as follows:

1. Stop transport, loosen both socket head screws (1) and (2) 1/4 turn and adjust screw (6) in the correct direction; clockwise for less force and counter-clockwise for greater force.

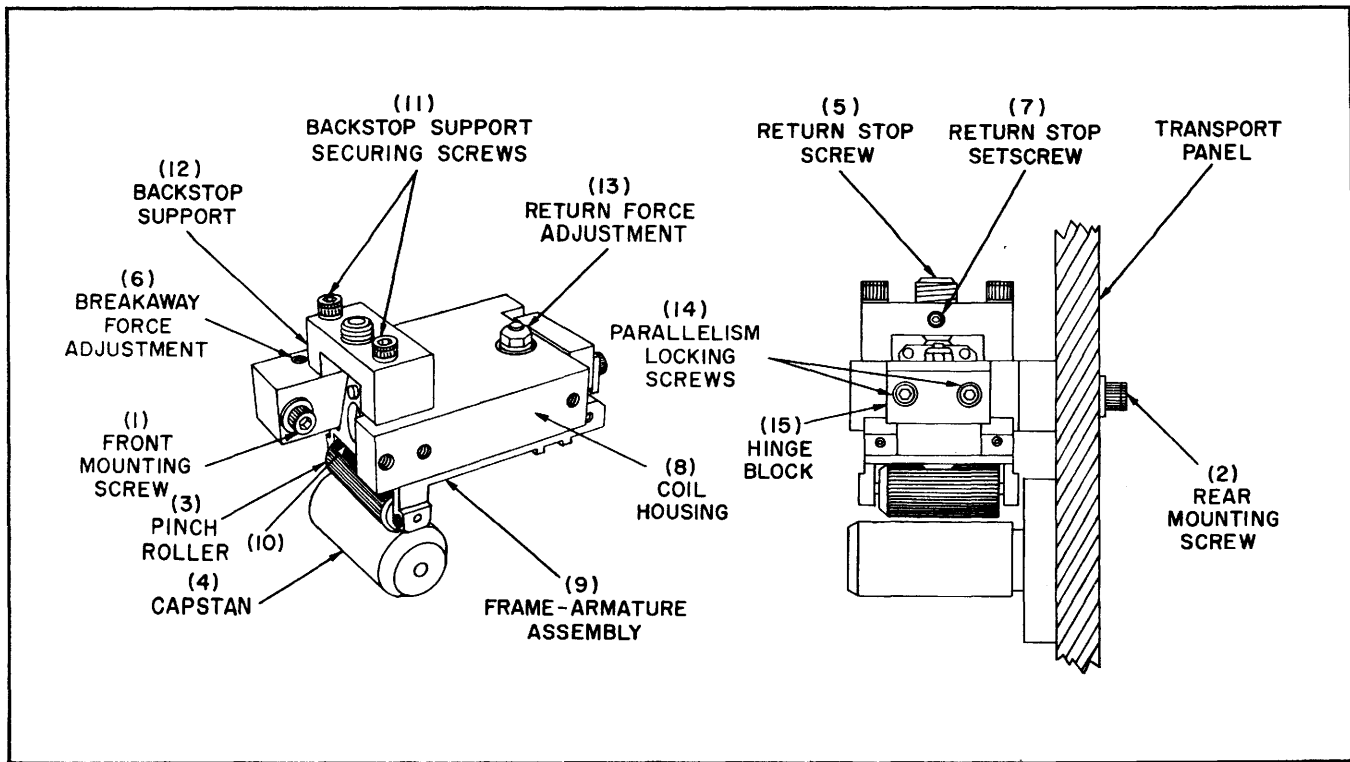


Figure 6-1. Pinch Roller Solenoid Adjustments

2. Lock solenoid in place each time with socket head screws (1) and (2).
3. Repeat steps 1 and 2 until required force is reached. When adjustment is completed, check both socket head screws for tightness and re-check breakaway force.

6-3-1-2. Start Time. Adjustment for start of tape motion is made with return stop screw (5). To adjust, it is necessary that the transport be loaded with a length of tape recorded with "ones", a square wave generator be coupled to the command input line and an oscilloscope having a vertical sensitivity of 5 mv/cm be connected to the Read Head. Proceed as follows:

- a. Operate transport in a start/stop mode and adjust square wave generator to run at approximately 30 milliseconds per command. Synchronize oscilloscope on the start command.

- b. Loosen Allen screw (7) and return stop screw (5) to give required start time. Then tighten locking screw (7).

6-3-1-3. Return Force. Return force is the spring force which pushes the pinch roller off the capstan when power is removed from the solenoid. This force should be 3 pounds +0/-2 ounces.

**Note**

Remove backstop screws (11) and backstop support (12) to expose armature for the following test.

The force is measured by pushing the armature with a scale until the pinch roller just begins to move. Do not take reading when pinch roller is touching capstan. Since the spring force is essentially rateless, the reading will be the same throughout the range of the armature travel. Adjustment is performed by turning nut (13); clockwise to increase tension and counter-clockwise for less tension.

6-3-1-4. Stop Time. Stopping of tape is a function of release time of the pinch roller and the amount of tape drag in the system. To check stop time, follow steps in paragraph 6-3-1-2, triggering oscilloscope from stop command. If a signal is seen (bounce) after the required stop time, tape drag pads should be adjusted for maximum drag as described in paragraph 6-3-7. If bounce remains, loosen the backstop locking screw (7) and turn the backstop (5) counter-clockwise slowly until bounce no longer appears. Tighten locking screw. Re-check start time to make certain that backstop was not turned too far counter-clockwise.

6-3-2. FERRITE SHIELD (See figure 6-2). Crosstalk in the read/write magnetic head is held to a minimum by a ferrite shield attached to the head door and located at the face of the magnetic head. This ferrite shield is designed to be adjusted in both the vertical and lateral plane. To check for maximum efficiency, proceed as follows:

- a. Connect high-gain oscilloscope to either of the outside channels of the magnetic head, at the connector.

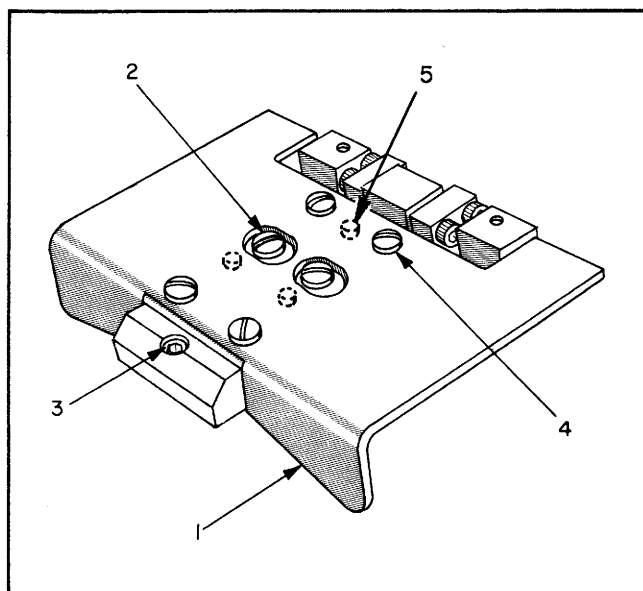


Figure 6-2. Ferrite Shield Adjustments

b. Observe and make note of the playback signal amplitude while recording.

c. Stop tape but continue passing record current. Make certain that all connections to the oscilloscope have been properly shielded to avoid spurious signals. Crosstalk should not exceed 1MV when the ferrite shield is adjusted in accordance with the following paragraph. Always adjust for minimum crosstalk.

6-3-2-1. To adjust the ferrite shield, proceed as follows:

a. Close head door (1) and loosen two securing screws (2).

b. Slide ferrite assembly up and down while observing crosstalk.

c. Secure adjustment screws (2) at the point of minimum crosstalk amplitude.

d. Lateral adjustment is accomplished by turning setscrew (3). Minimum clearance between the magnetic read/write head and ferrite shield is .005". If ferrite is not parallel to head surface, adjust three small Allen screws (5) until parallelism is achieved. To gain access to screws (5), remove cover (1). See note below.

**Note**

In units employing a spring clip which covers item (3), the cover (1) must be removed first. This is accomplished by removing screws (4).

6-3-3. ERASE HEAD. The erase head is mounted on top of the read/write head. Two screws secure the erase head in place. To adjust, loosen screws and with tape threaded, move erase head

so that gap line on head is .005" + .002/- .000 out of contact with the tape surface.

6-3-4. WRITE LOCKOUT SWITCH. The plunger (pin) on the write lockout switch shown in figure 4-6 is adjusted by first loosening the nut around it and turning the pin. For IBM reels, the pin is adjusted to extend 1/2-inch from the crown of the write lockout cover.

6-3-5. END-OF-TAPE SENSOR (EOTS). The photoelectric end-of-tape sensor works in conjunction with a reflective strip that is placed on the glossy side of the tape. See figure 1-4. The strip is located on edge-of-tape nearest the panel and at a predetermined distance from the end-of-tape. To adjust the EOT amplifier, proceed as follows:

a. Reduce gain by turning the EOTS amplifier trimpot (lower) on the EOT circuit card counter-clockwise until clicks are heard.

b. With power on and tape threaded, place transport in a standby condition and locate reflective strip directly under the EOT sensor.

c. Monitor pin N and DD on J5 with a voltmeter.

d. Slowly increase gain of EOT trimpot by turning clockwise until voltage swings from -15 VDC to ground.

e. Turn trimpot four more turns in clockwise direction.

6-3-5-1. Beginning-of-Tape Sensor (BOTS). The BOTS and EOTS circuits are identical and are adjusted in the same manner. The reflective strip (BOT), is placed on the outer edge on the tape, (edge furthest away from the panel). For adjustments use upper trimpot and follow paragraph 6-3-5.

6-3-6. SERVO AMPLIFIER ADJUSTMENT. (Refer to Schematic diagram in Section VIII.) There are four trimpots on each servo amplifier card. Trimpots R100 and R102 are used for adjusting the bridge balance and are located at the plug-in end of the card. Adjustment of these two trimpots must be done with the card on an extender. The servo amplifier gain is adjusted with trimpot R227 (upper trimpot) located at the front of the equipment. Trimpot R527 adjusts the dead ban width (lower trimpot).

6-3-6-1. Disconnect BLACK wire from each servo motor.

6-3-6-2. Thread tape on machine, and position tension arms in null area.

6-3-6-3. Apply power and monitor pin V on servo amplifier card with a d-c voltmeter. This point is connected to the wiper arm of the tension arm potentiometer. If this point is not at zero volts, loosen three dogs that secure potentiometer to casting (see paragraph 6-3-12) and rotate potentiometer until zero reading is obtained. Tighten three dogs which secure potentiometer. Ground pin V.

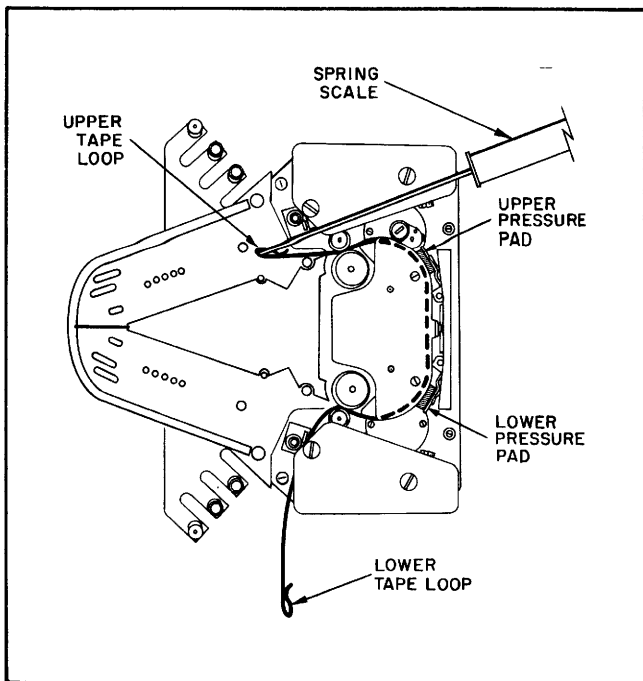


Figure 6-3. Checking Drag Pads

**CAUTION**

Do not move tension arms while pin V is grounded as damage to pot will result.

6-3-6-4. Set potentiometer R227 to mid-range and balance the ring modulator with potentiometers R100 and R102 by turning both potentiometers to mid-range (12.5 turns from either end). Alternately adjust potentiometers until the null voltage across R320 is a minimum (200 millivolts max.). Remove ground from pin V.

6-3-6-5. Connect voltmeter across C327 and adjust deadband potentiometer R527 for -0.07 volts.

6-3-6-6. Connect voltmeter between pin V and ground. Connect oscilloscope between junction of R407 and R408 and ground.

6-3-6-7. Adjust input to  $+1.1 \pm 0.1$  volt by rotating tension arm. Adjust R227 for one gate pulse at junction of R407 and R408. Adjust input to  $-1.1 \pm 0.1$  volt by rotating tension arm in opposite direction while checking for one pulse at junction of R305 and R311.

6-3-6-8. Determine input voltage necessary to give full conduction at outputs. If greater than  $\pm 3.8$  volts, re-adjust R227.

6-3-6-9. Remove power from machine and replace BLACK wires to each servo motor.

6-3-6-10. Adjust zero offset potentiometers R628 (upper trimpot) and R625 (lower trimpot) which are located on the Pinch Roller Card, as follows:

a. Set R628 so that voltage measured at junction of R412 and R421 is  $\pm 0.9$  volts as machine is run forward and reverse.

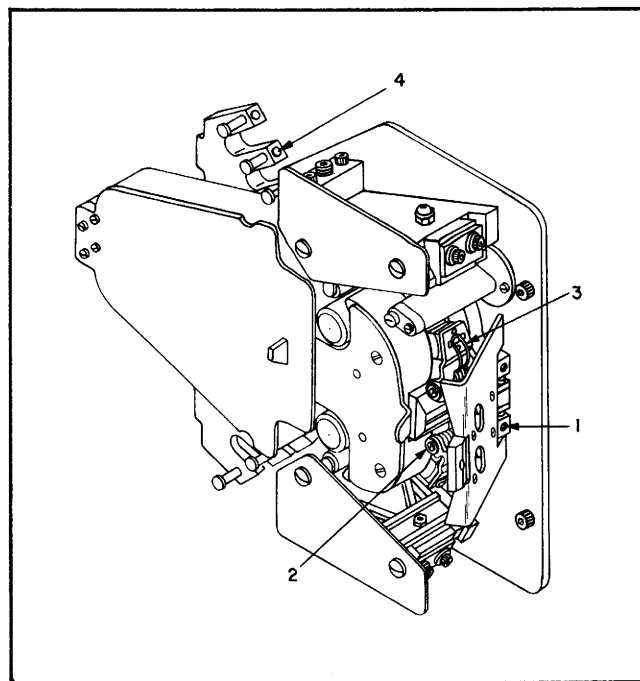


Figure 6-4. Adjusting Drag Pads

b. Set R625 so that voltage measured at junction of R318 and R317 is  $\pm 0.9$  volts as machine is run forward and reverse.

c. Do not exceed  $\pm 0.9$  volts in either direction.

6-3-7. DRAG PADS. The basic function of the drag pads is to maintain a constant tension on the area of tape that passes across the face of the magnetic head and to hold the tape in the trough guides. It also aids in bringing the tape to a rapid halt when a stop command is applied. All adjustments of the pads are accomplished with power off. To adjust drag pads, proceed as follows:

a. Thread three foot strip of tape through the drive mechanism and hook spring scale to loop as shown in figure 6-3.

b. Hold one pad off tape and push on scale. Read scale while pulling tape. Reading should be 3 to 3-1/2 oz. for each pad (6 to 7 oz. total).

6-3-7-1. To increase drag, proceed as follows: (Reference figure 6-4.)

a. Loosen small setscrew (1) and rotate slotted shaft (2) counter-clockwise to adjust upper pad and clockwise when adjusting lower pad.

b. Lock setscrew (1) while holding slotted shaft (2) in position with screwdriver.

**Note**

If screwdriver is removed from slotted shaft (2) before setscrew (1) is secured, spring (3) will not unwind itself, but merely release spring tension on the pad.

6-3-8. TENSION ARMS. To check for proper tension, proceed as follows:

- a. Remove tape and turn power off
- b. Place push type spring scale Chatillon #719-5 (0 to 5 pounds) or equivalent, on middle roller stud and push arm down to mid-range. Scale should read 16 oz.  $\pm$  1 oz.

6-3-8-1. To adjust proceed as follows: (Reference figure 6-5.)

- a. Turn adjustment screw located at top and bottom right edge of the front panel for 16 oz.  $\pm$  1 oz., scale reading.

6-3-9. LOW TAPE SENSORS. (Reference figure 6-6.) The low tape sensor arms follow the level of tape on each reel. As the amount of tape increases or decreases, the sensor arm changes position. When approximately 1/4 inch of tape remains on the reel, the sensor arm actuates a switch. The switch is located on the rear of the main panel at the sensor arm pivot point. The switching indication is cabled to J3 and connects to J5 on the EC-120. It may be used for a number of functions, such as slowing down the transport from rewind speed to operating speed, or as a low tape indicator. In either application, the use of this indication is utilized by the external equipment.

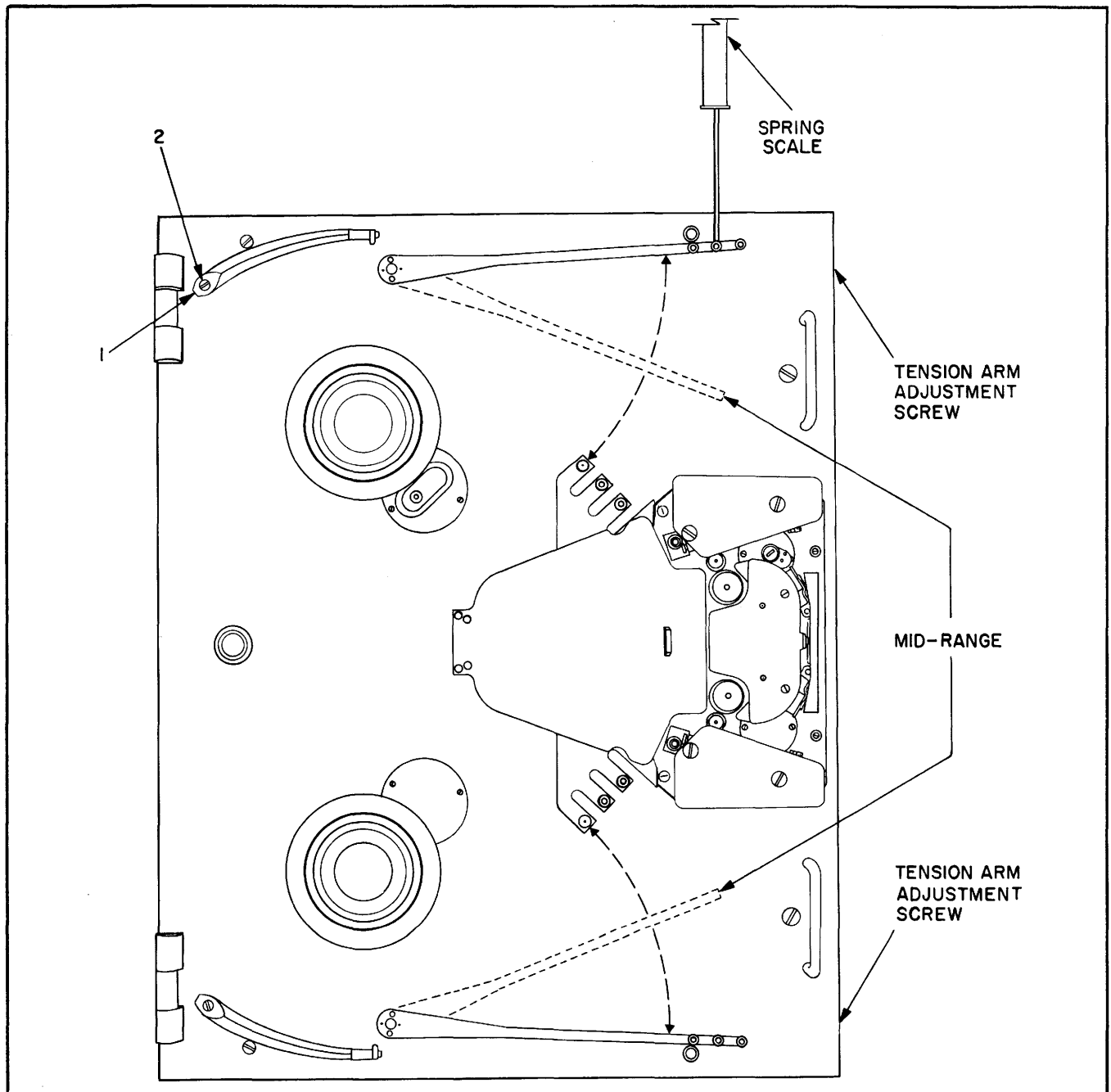


Figure 6-5. Tension Arm Adjustment

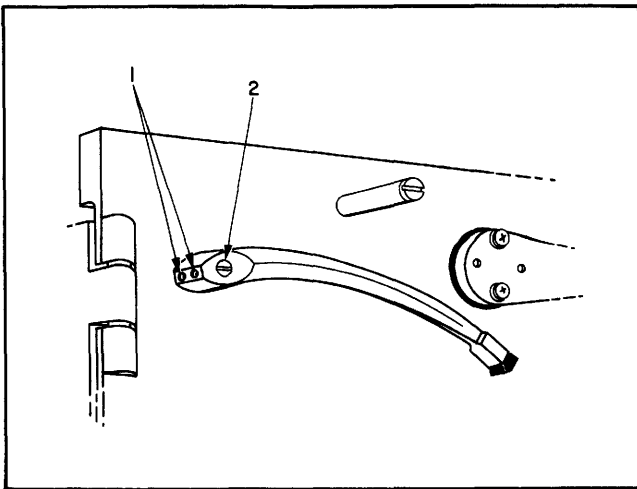


Figure 6-6. Low Tape Sensor Arm

6-3-9-1. To adjust low tape sensors, proceed as follows:

- a. Turn circuit breaker to "ON".
- b. Press arm retraction button.
- c. Place a reel on the hub associated with the low tape sensor arm being adjusted. The reel should be filled with the amount of tape it is desired to detect.
- d. Loosen two securing setscrews (1), at pivot end, and turn slotted shaft (2) until switch contacts just close. With an ohmmeter, monitor this switch action at J5, pins V, Y and X. See EC-120 diagram in Section VIII.
- e. Secure setscrews (1) and re-check.

6-3-10. GUIDE ROLLERS. (Reference figure 6-4.) Eight guide rollers on the tape system are adjustable. All others are fixed and require no adjusting. To adjust, proceed as follows:

- a. Loosen setscrews (4) which secure roller shaft to receptacle.
- b. If tape is riding on side flanges of rollers, move roller assembly in desired direction until tape is centered on roller.
- c. Tighten setscrew (4).

6-3-11. AIR DAMPER. The function of the air damper piston is to cushion the tension arm near its outer limit.

6-3-11-1. To check, pull tension arm to mid-range and release it, allowing the arm to strike the bumper stop. The arm should strike the stop gently, indicating that the air damper is properly adjusted. If it strikes forcefully, adjustment is necessary.

6-3-11-2. To adjust, turn the adjustment screw which is centrally located at the base of the air damper piston to regulate the opening of the air port. An insufficient opening will exhibit skip in arm travel from mid-range position to bumper stop. Proper adjustment will insure smooth travel of the tension arm.

6-3-12. POTENTIOMETER. (Reference figure 6-7.) The precision potentiometer (1) is held in a casting (2) by three dogs (3). The potentiometer shaft is attached to the tension arm shaft by a coupling (4). The angular setting of the potentiometer determines the location of the tension arm during the null period (transport in standby).

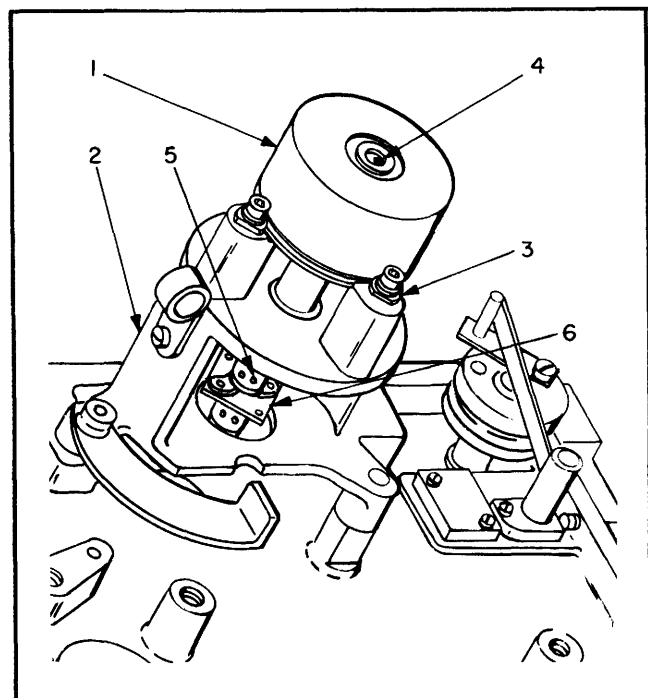


Figure 6-7. Potentiometer Removal

6-3-12-1. When installing a new potentiometer, position the shaft so that when the tension arm is at the null or mid-range point, no reel rotation occurs. To obtain this null point, loosen setscrew (5) and place an empty reel on the left hub while holding tension arm at mid-range. The other tension arm must be a minimum of 1/4" away from its bumper stop in order to defeat the tape break interlock switch. Apply power and hold tension arm being adjusted at mid-range. Rotate shaft (6) with thumb until reel motor comes to a halt (null).

Turn power off while still holding tension arm at mid-range and tighten coupling screw (5). Apply power and move tension arm through its entire range to determine proper reel rotation. For upper tension arm, the reel will turn CCW when the arm is between the null position and its outer limit, and CW when positioned between the null point and its inner limit (towards the drive assembly). The opposite rotation takes place for the other reel motor when that tension arm is moved through its range. After the above conditions have been satisfied, proceed to the following paragraph for adjustment.

6-3-12-2. To adjust, reference figure 6-7.

- a. Load tape on transport
- b. Turn power on (Standby)
- c. Hold potentiometer (1) in place while loosening three dogs (3).
- d. Slowly rotate potentiometer body (1) until voltage between pin V (on servo amplifier card) and ground is zero volts
- e. Secure three dogs (3).

6-3-13. TENSION ARM LIMIT SWITCHES. A cam on the tension arm shaft assembly actuates the tape break limit switches when the tension arm is 1/4 inch from the bumper stop, or in line with the bridge rollers. When either switch is actuated, the tape transport will be inhibited. Both switches are actuated by the same cam and are adjusted independently.

6-3-13-1. To check, proceed as follows:

- a. Turn power off and remove tape from transport
- b. Place "empty" reels on both hubs
- c. Hold tension arms off their bumper stops
- d. Turn circuit breaker on and jumper pins CC to EE on J5
- e. Slowly move one arm toward its bumper stop. Transport should turn off when arm is approximately 1/4" away from its bumper stop. Repeat this procedure for other tension arm.

6-3-13-2. To adjust, proceed as follows: (Reference figure 4-5). Turn adjustment screw clockwise to actuate the switch when the tension arm is 1/4" away from its bumper stop. An adjusting screw on the opposite end of the same cam actuates the switch when the tension arm is in line with the stationary rollers.

## 6-4. PARTS REPLACEMENT

6-4-1. GENERAL. The information in this section contains removal procedures intended for use by field maintenance personnel in the replacement of major components on the MT-120 Magnetic Tape Transport. Before removing components, disconnect all power from transport. Use standard procedures for soldering and unsoldering wires. When unsoldering wires, identify each wire and terminal to which it is connected to facilitate replacement. Exercise care to avoid dropping solder on any components. Replacement procedures are the reverse of removal procedures unless otherwise stated. All procedures are referenced to figure 6-8 while figure 6-9 is used to locate terminal boards and switches.

6-4-2. TENSION ARM ASSEMBLIES. To remove the tension arms, proceed as follows:

- a. Remove two screws (1) on potentiometer shaft (2)
- b. Remove tension arm (3).

6-4-3. END-OF-TAPE SENSOR (EOTS)LAMP. To remove EOTS Lamp, proceed as follows:

- a. Remove cover screw (4)
- b. Lamp (5), which is spring loaded in the EOTS assembly (6), will eject itself.

6-4-4. TROUGH GUIDE ASSEMBLIES. The upper and lower trough guide assemblies are removed as follows:

- a. Remove two screws (7) and washers (8) that secure trough guide cover (9) to the assembly
- b. Remove cover (9)
- c. Remove two long shank screws (10), securing three sections of the trough guide (11) to the trough guide mount (12)
- d. Remove three sections of the trough guide (11) by slowly rocking from side to side while pulling apart. These sections are held in place by dowel pins (13).

6-4-5. READ/WRITE HEAD ASSEMBLY.

### Note

DO NOT remove the head assembly (14) from the trough guide mount (12). Replacement of a head assembly should be done at the factory.



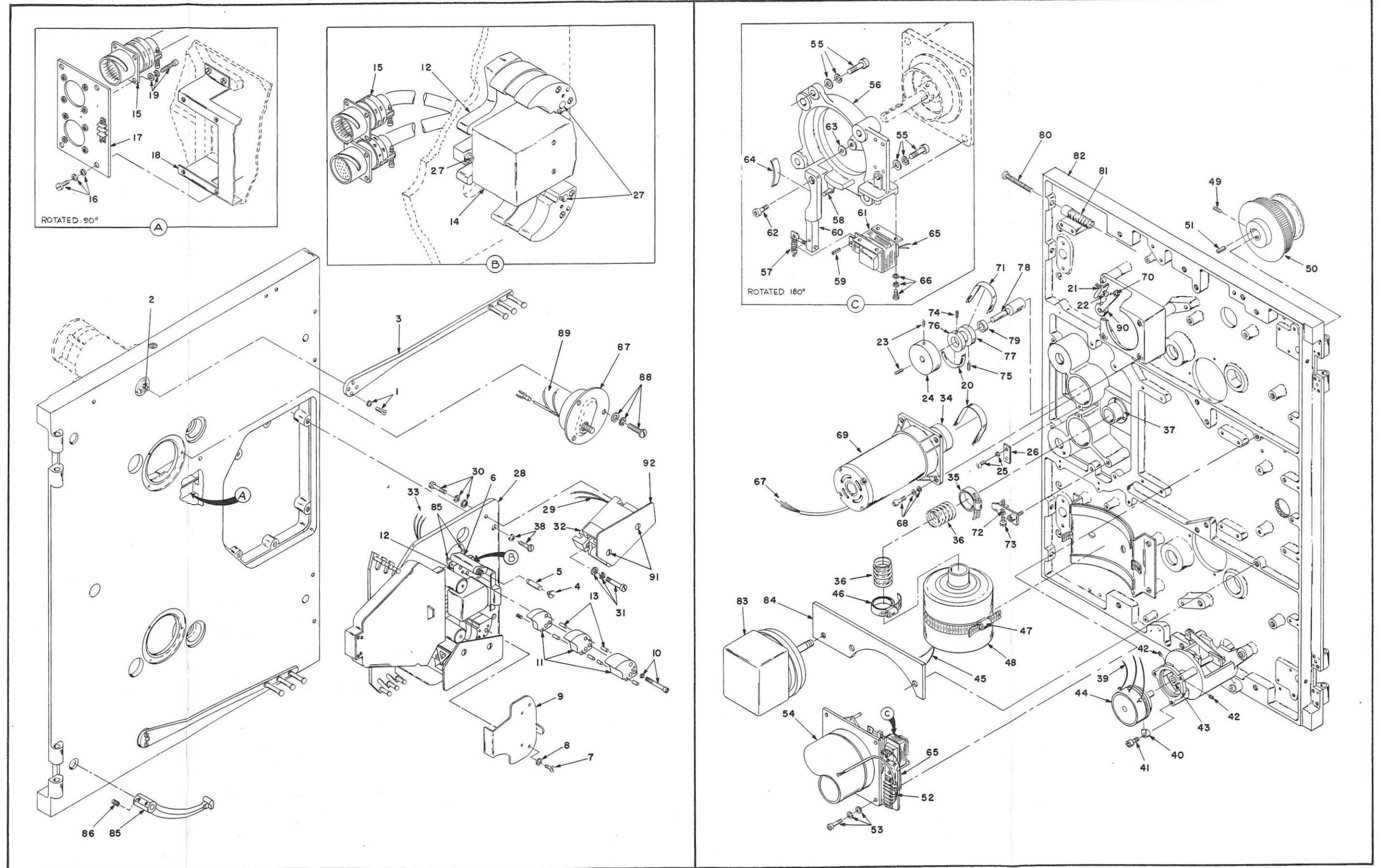


Figure 6-8. MT-120 Front and Rear Panel Components



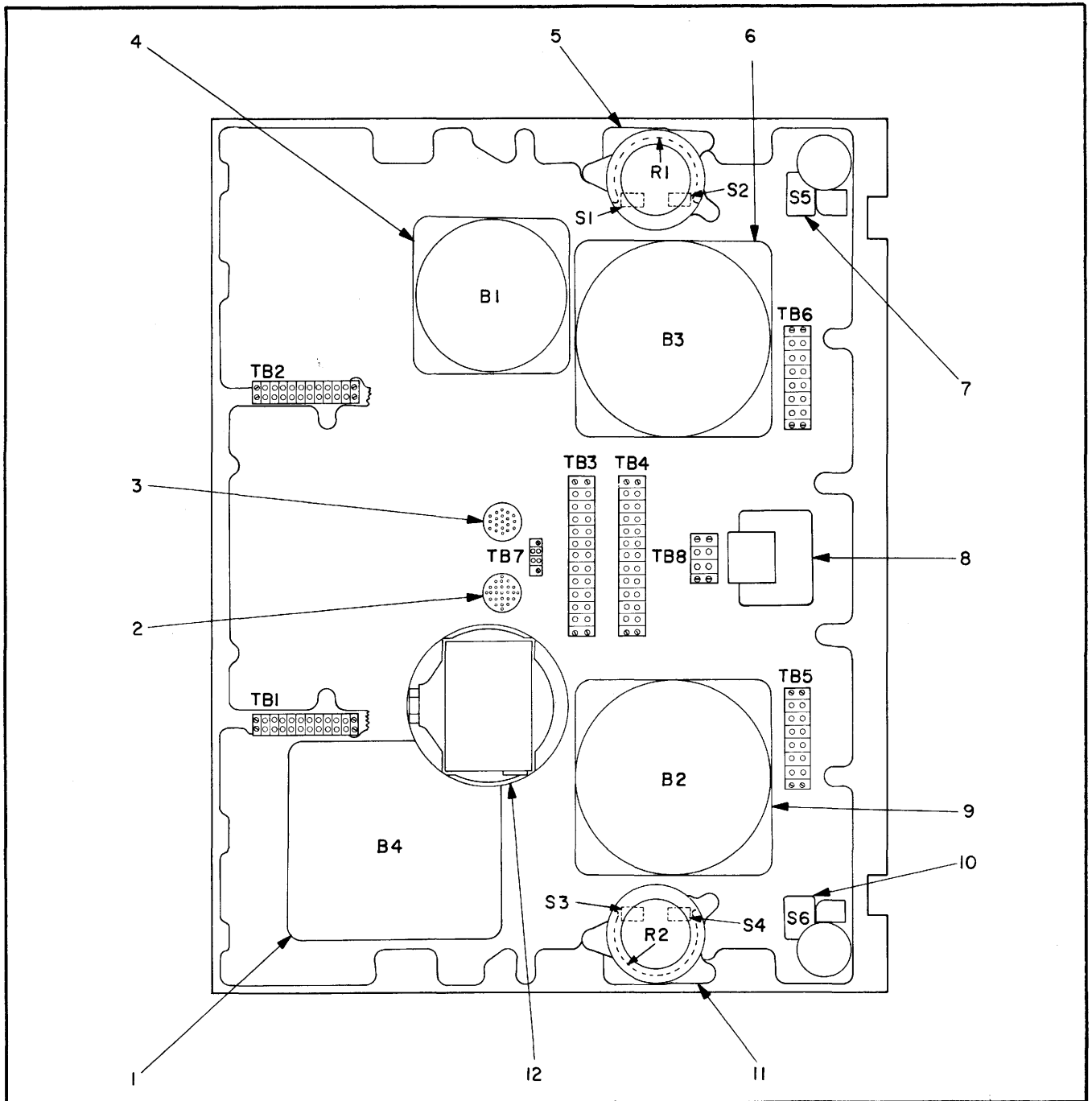


Figure 6-9. Terminal Board and Switch Location

SECTION VI  
MAINTENANCE

To remove the trough guide mount (12) and head assembly proceed as follows:

- a. Disconnect two connector "quick disconnect" ground lugs and any cable clamps
- b. Remove four mounting screws and washers (16), securing connector plate (17) to bracket (18)
- c. Disconnect two magnetic head cable connectors (15)
- d. Remove mounting screws and washers (19), securing connectors (15) to connector plate (17)
- e. Release tension on belt (20) by loosening lock nut (21) and turning adjustment screw (22) CCW
- f. Loosen two setscrews (23) in left fly wheel (24)
- g. Remove left flywheel (24)
- h. Remove two screws and washers (25) securing plate (26)
- i. Remove plate (26)
- j. Remove three mounting screws and washers (27)
- k. Remove trough guide mount (12) from drive plate (28).

6-4-6. REEL MOTOR. (See figure 6-8, item 54.)

- a. Remove two set screws (49) which secure reel hub (50) to motor shaft and retain key (51). See paragraph 6-4-14 for replacement.
- b. Disconnect reel brake leads. (Terminals 5 and 6 of TB6 for upper motor and terminals 5 and 6 of TB5 for lower motor.)
- c. Disconnect motor leads. (Terminals 1 through 4 on TB6 for upper motor and terminals 1 through 4 on TB5 for lower motor.)
- d. Remove cap screws (53)
- e. Remove reel motor (54).

**Note**

To remove reel brake, refer to paragraph 6-4-15.

6-4-7. IDLER ROLLER. (See figure 6-8, item 90.)

- a. Remove capstan belt as per paragraph 6-4-17, steps a and b

- b. Remove screw (70) and idler arm assembly
- c. Remove retaining ring inside idler and slide idler off idler arm shaft.

6-4-8. PINCH ROLLER (See figure 6-10, item 14.)

**Note**

To remove pinch roller from upper (reverse) solenoid assembly, remove the assembly first as per paragraph 6-4-9.

- a. Loosen setscrews (figure 6-10, item 11) at both ends of pinch roller
- b. Remove shaft (12)
- c. Remove spacers (13), (bushings)
- d. Remove pinch roller (14).

6-4-9. PINCH ROLLER SOLENOID ASSEMBLY. (See figure 6-8, item 32.)

- a. Remove screws (91) which hold front cover (92) to solenoid assembly
- b. Remove cover (92)
- c. Disconnect leads from terminals 1 and 2 of TB1 for forward pinch roller and terminals 1 and 2 of TB2 for reverse pinch roller
- d. Remove two mounting screws (30) and (31).

**Note**

One screw (30) secures the assembly from the rear of the panel.

6-4-10. SOLENOID RE-ASSEMBLY AND SETTINGS.

**Note**

It is recommended that the drive solenoid assembly not be disassembled unless it has been definitely established that is the cause of the malfunctioning.

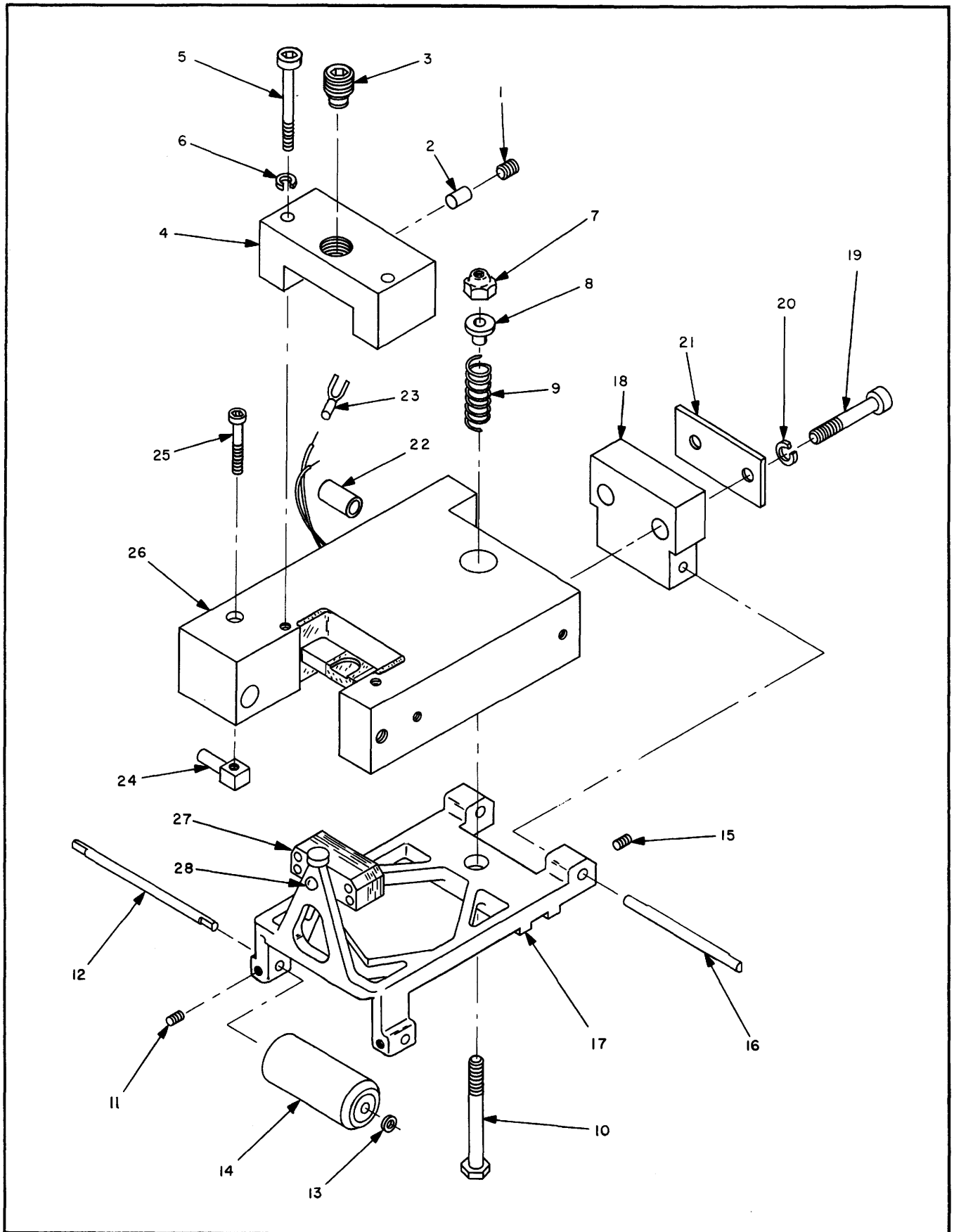


Figure 6-10. Drive Solenoid Assembly (Exploded View)

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Adjustments are described in paragraph 6-3-1. The paragraphs which follow are complete re-assembly and setting procedures used to perform overhaul of the drive solenoid. In figure 6-10, the solenoid is shown in an exploded view. It is assumed that a technician capable of using common shop tools will dismantle the drive solenoid as shown in the illustration.

**Note**

When overhauling a drive solenoid, the hinge block (18) and shaft (16) should be replaced if the solenoid has been operated for two years or more at an 8 hour per day duty cycle.

6-4-10-1. While the unit is disassembled, check that the armature is parallel with the pinch roller shaft. If found not to be parallel within the prescribed tolerance as outlined below, the frame and armature must be replaced. The armature (27) is made parallel to the pinch roller shaft (12) during assembly at the factory and is locked in place by rivet (28). A fixture is used during this assembly which holds the shaft parallel to a flat surface. See figure 6-11. The armature is made parallel to within a total indicator reading (TIR) of 0.001" with respect to the shaft and locked in place by the armature rivet.

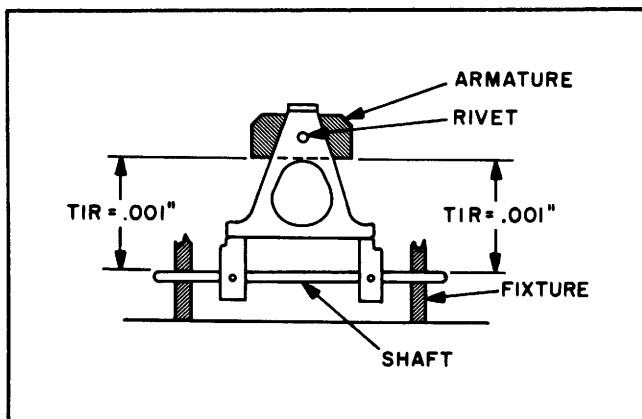


Figure 6-11. Parallelism Settings

a. Apply light film of Lubri-plate Type 110 Grease to inside of .125 diameter in hinge block (18), figure 6-10. Assemble shaft (16) in frame (17) and through hinge block (18). Tighten set screws (15) on flats of shaft. Check for free rotation of frame (17). Remove excess grease.

b. Attach above assembly to housing (26) with hardware (19) (20) (21), but do not tighten screws.

c. Connect solenoid terminals to D. C. power supply and adjust for 3.0 amps. Permit armature to set squarely on pole tips. (See figure 6-12.) Using fixture, establish .423" dimension as shown. Tighten screws (19), figure 6-10 while power is applied.

d. Measure force required to separate armature from pole tips. With 1.5 amps current, force should be between 17 and 20 pounds. Measure breakaway force at point shown in figure 6-12.

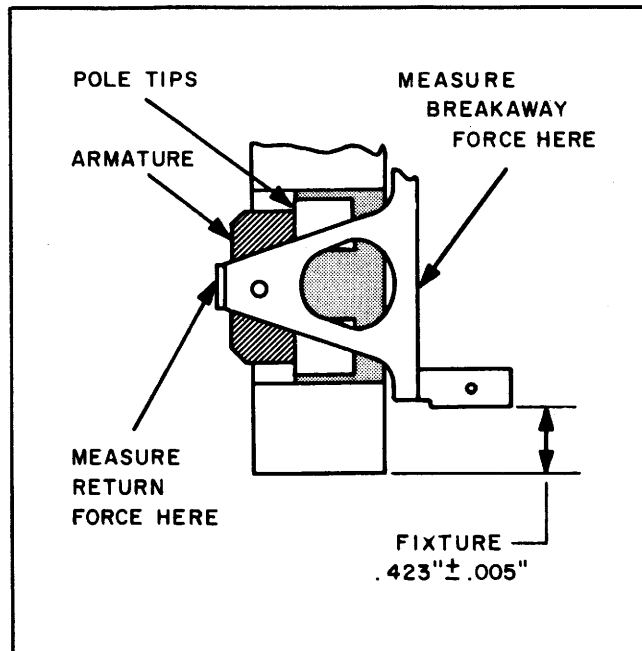


Figure 6-12. Measuring Return and Breakaway Force

e. Disconnect power. Install screw (10), figure 6-10, return spring (9), collar (8), and nut (7). Tighten nut until a force of 3 pounds  $\pm$  0/-2 ounces is required to seat armature on pole tips. Apply force at position shown in figure 6-12.

f. Assemble back stop (3), figure 6-10, in support (4). Align slug (2) with axis of #6 tapped hole and insert screw (1). Do not tighten fully.

g. Assemble roller assembly (14) and shaft (12) into frame assembly (17). Play of .004 to .014" between roller assembly and frame opening to be obtained by shimming at top of roller assembly only. (See figure 6-13.) Tighten set screws.

h. Install remaining components as shown in figure 6-10.

6-4-11. DRIVE PLATE ASSEMBLY. Assuming that unit is completely intact, all connecting parts located on the back of the drive plate assembly must first be disconnected. These consist of the capstan motor belt, drive block assembly, wire leads, EOTS assembly wire leads, magnetic head connectors, ground wires, and the vacuum block flexible hose. To remove the drive plate assembly, proceed as follows:

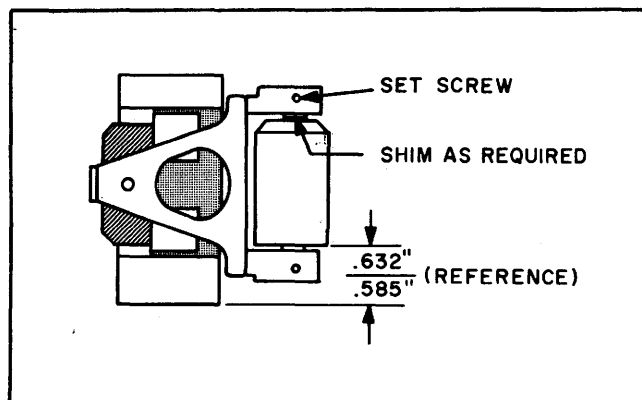


Figure 6-13. Pinch Roller Alignment

a. Disconnect EOTS assembly wire leads (33), figure 6-8, and drive block assembly wire leads (29).

b. Loosen lock nut (21) and adjustment screw (22) to reduce tension on belt (20).

c. Remove belt (20) from capstan motor pulley (34).

d. Loosen hose clamp (35) and remove flexible hose (36) from vacuum block fitting (37).

e. To disconnect magnetic head components, see paragraph 6-4-5 and follow procedures a through e.

f. Remove four mounting screws and lockwashers (38).

g. Remove drive plate assembly (28).

6-4-12. POTENTIOMETER, TENSION ARM. Remove potentiometer as follows:

a. Unsolder three wire leads (39).

b. Rotate three holding dogs (40) one-half turn after three screws (41) have been loosened.

c. Loosen two setscrews (42) located on the shaft coupling (43).

d. Remove potentiometer (44).

6-4-12-1. To install potentiometer, proceed as follows:

a. Secure potentiometer (44) to casting with three holding dogs (40).

b. Resolder three wire leads.

**CAUTION**

After potentiometer has been mounted in the casting, it must be properly positioned before servo power can be applied. To properly position the potentiometer, refer to paragraph 6-3-12.

6-4-13. VACUUM BLOWER MOTOR. (Refer to figure 6-8.) To remove vacuum blower, proceed as follows:

a. Disconnect vacuum blower wire leads

b. Loosen hose clamp (46) and remove flexible hose (36)

c. Loosen vacuum blower mounting clamp (47)

d. Remove vacuum blower motor (48).

6-4-14. REEL HUBS. The upper and lower reel hubs are both removed in the same manner. Remove hub as follows:

a. Loosen two setscrews (49) on back side of the reel hub

b. Remove reel hub (50) and key (51).

**Note**

Prevailing clearance between hub and panel must be maintained when reassembled to insure proper tape tracking. See figure 6-14.

6-4-15. REEL BRAKE ASSEMBLY. With continuous use, the reel brake arm pad (64) may require replacement. This cork pad is glued in place at the factory with Minnesota Mining and Manufacturing Company's 3M #EC776 glue. To gain access to the servo motor mount assembly, which contains the reel brake assembly, the procedure described in paragraph 6-4-6, Servo Motors, must first be performed. To remove the servo motor mount after completing steps in paragraph 6-4-6, proceed as follows:

a. Remove two mounting screws, lockwashers and flat washers (55)

b. Remove servo motor mount (56).

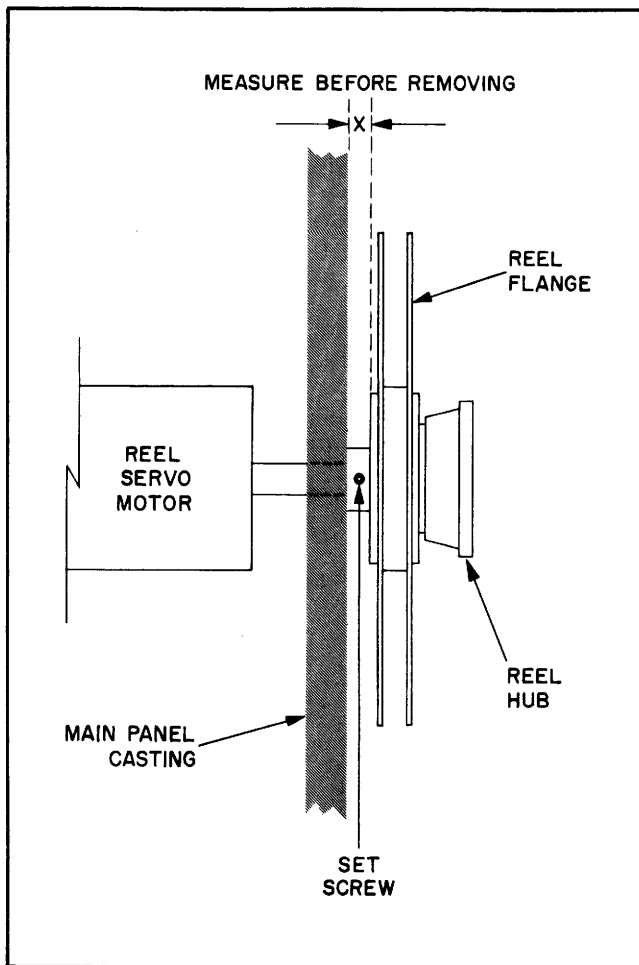


Figure 6-14. Reel Hub Removal

6-4-15-1. Disassemble reel brake assembly as follows:

- a. Remove return spring (57) from groove pin (58)
- b. Remove roll pin (59) which secures brake arm (60) to solenoid assembly (61)
- c. Remove screw (62) and spacer (63) which secures brake arm (60) to servo motor mount (56)
- d. Remove brake arm (60)
- e. A worn brake pad (64) can best be removed by scraping and cleaning excess material off with a good paint thinner
- f. Disconnect two solenoid wire leads (65)
- g. Remove four mounting screws, lock-washers, and flat washers (66) which secure solenoid assembly (61) to servo motor mount (56)
- h. Remove solenoid assembly (61).

6-4-16. CAPSTAN MOTOR ASSEMBLY. To remove capstan motor assembly, proceed as follows:

- a. Disconnect motor lead wires (67)
- b. Loosen lock nut (21) and adjustment screw (22) to release tension on capstan motor belt (20)
- c. Remove mounting screws, lock-washers and flat washers (68)
- d. Remove capstan motor (69).

6-4-17. CAPSTAN SHAFT ASSEMBLIES

There are two different capstan shaft assemblies. The disassembly procedure for both is similar, except that the upper or reverse assembly contains an extra pulley. The disassembly procedure below is for the upper capstan shaft assembly. To remove the capstan shaft, proceed as follows:

- a. Loosen lock nut (21) and adjustment screw (22) to release tension on capstan motor belt (20)
- b. Slide capstan motor belt (20) off end of capstan motor pulley shaft (34)
- c. Release tension on belt (71) by loosening lock nut (72) and adjustment screw (73)
- d. Loosen two setscrews (23) in upper flywheel (24)
- e. Remove upper flywheel (24)
- f. Loosen two setscrews (74) and (75)
- g. Remove two pulleys (76) and (77)
- h. Tap lightly with a plastic head mallet on the rear of upper capstan shaft (78)
- i. Remove front panel bearing (79) from upper capstan shaft (78).

6-4-18. BELTS. To remove the two belts, follow steps a through c in paragraph 6-4-17.

6-4-19. EOT/BOT SENSOR ASSEMBLY. To remove sensor assembly (6), proceed as follows:

- a. Disconnect wires (33)
- b. Remove two screws (85)
- c. Remove three screws (27) and pull sensor assembly from panel.

6-4-20. WRITE LOCKOUT SWITCH. (See figure 6-8, item 87.)

- a. Disconnect leads (89) from terminals 1 through 5 on TB8
- b. Remove reel hub. Refer to paragraph 6-4-14
- c. Remove screws (88)
- d. Remove cover (87).



**SECTION VII**  
**IPB**

**7-1. GENERAL**

This section contains an Illustrated Parts Breakdown for the MT-120 Magnetic Tape Transport.



Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	1 2 3 4 5 6 7	DESCRIPTION	MFR. CODE	UNITS PER ASSY	USABLE ON CODE
MAGNETIC TAPE TRANSPORT						
2-	MT120X41427		TRANSPORT, Magnetic Tape . . . . .		1	
-1	188-5816		· HANDLE . . . . .		2	
			(ATTACHING PARTS)			
-2	160-38		· SCREW . . . . .		4	
-3	147-4		· WASHER, Lock . . . . .		4	
-4	146-3		· WASHER, Flat . . . . .		4	
			----*----			
-5	428235		· DRIVE PLATE ASSY (see fig. 3 for breakdown) . . . . .		1	
			(ATTACHING PARTS)			
-6	162-33		· SCREW . . . . .		4	
-7	147-4		· WASHER, Lock . . . . .		4	
-8	195-35		· PIN, Dowel . . . . .		2	
			----*----			
-9	403168		· BUMPER . . . . .		2	
-10	403169		· STUD . . . . .		2	
-11	430139-2		· ARM ASSY, Tape Sensor . . . . .		1	
2-	165-11		· SETSCREW . . . . .		2	
2-	429944-2		· FOLLOWER ASSY . . . . .		1	
			(ATTACHING PARTS)			
2-	430490		· SCREW, Shoulder . . . . .		1	
			----*----			
2-	431854		· WASHER, Felt . . . . .		1	
2-	431857-2		· FOLLOWER . . . . .		1	
2-	429947-2		· ARM, Tape Sensor . . . . .		1	
2-	430138-2		· ARM ASSY, Tape Sensor . . . . .		1	
-12	165-11		· SETSCREW . . . . .		2	
2-	429944-2		· FOLLOWER ASSY . . . . .		1	
			(ATTACHING PARTS)			
-13	430490		· SCREW . . . . .		1	
			----*----			
-14	431854		· WASHER, Felt . . . . .		1	
-15	431857-2		· FOLLOWER . . . . .		1	
-16	429947-1		· ARM, Tape Sensor . . . . .		1	
-17	427718		· BUMPER . . . . .		2	
			(ATTACHING PARTS)			
-18	166-513		· SCREW, Shoulder . . . . .		2	
			----*----			
-19	433172		· DISC, Univac . . . . .		2	
-20	429907-3		· HUB, Quicklock, IBM (see fig. 7 for breakdown) . . . . .		1	
			(ATTACHING PARTS)			
-21	165-26		· SETSCREW . . . . .		1	
-22	165-38		· SETSCREW . . . . .		1	
-23	414640-31		· KEY . . . . .		1	
			----*----			
-24	421602-8		· REEL, Precision . . . . .		1	
-25	429781-3		· KNOB, Stationary, IBM (see fig. 8 for breakdown) . . . . .		1	
			(ATTACHING PARTS)			
-26	165-26		· SETSCREW . . . . .		1	
-27	165-38		· SETSCREW . . . . .		1	
-28	414640-20		· KEY . . . . .		1	
			----*----			
-29	300041		· LOCKOUT ASSY, Write (see fig. 9 for breakdown) . . . . .		1	
			(ATTACHING PARTS)			
-30	154-83		· SCREW . . . . .		3	
-31	147-15		· WASHER, Lock . . . . .		3	
-32	146-29		· WASHER, Flat . . . . .		3	
			----*----			
-33	177-6247		· TERMINAL, Lug . . . . .		5	
-34	427876		· COVER . . . . .		1	
			(ATTACHING PARTS)			
-35	153-28		· SCREW . . . . .		3	
-36	147-15		· WASHER, Lock . . . . .		3	
-37	146-29		· WASHER, Flat . . . . .		3	
			----*----			
2-	372104		· PUSHBUTTON ASSY . . . . .		1	
-38	204-6253		· LAMP . . . . .		1	
-39	177-6247		· TERMINAL, Lug . . . . .		3	
-40	61-1751		· SWITCH . . . . .		1	

Section VII  
Group Assembly Parts List

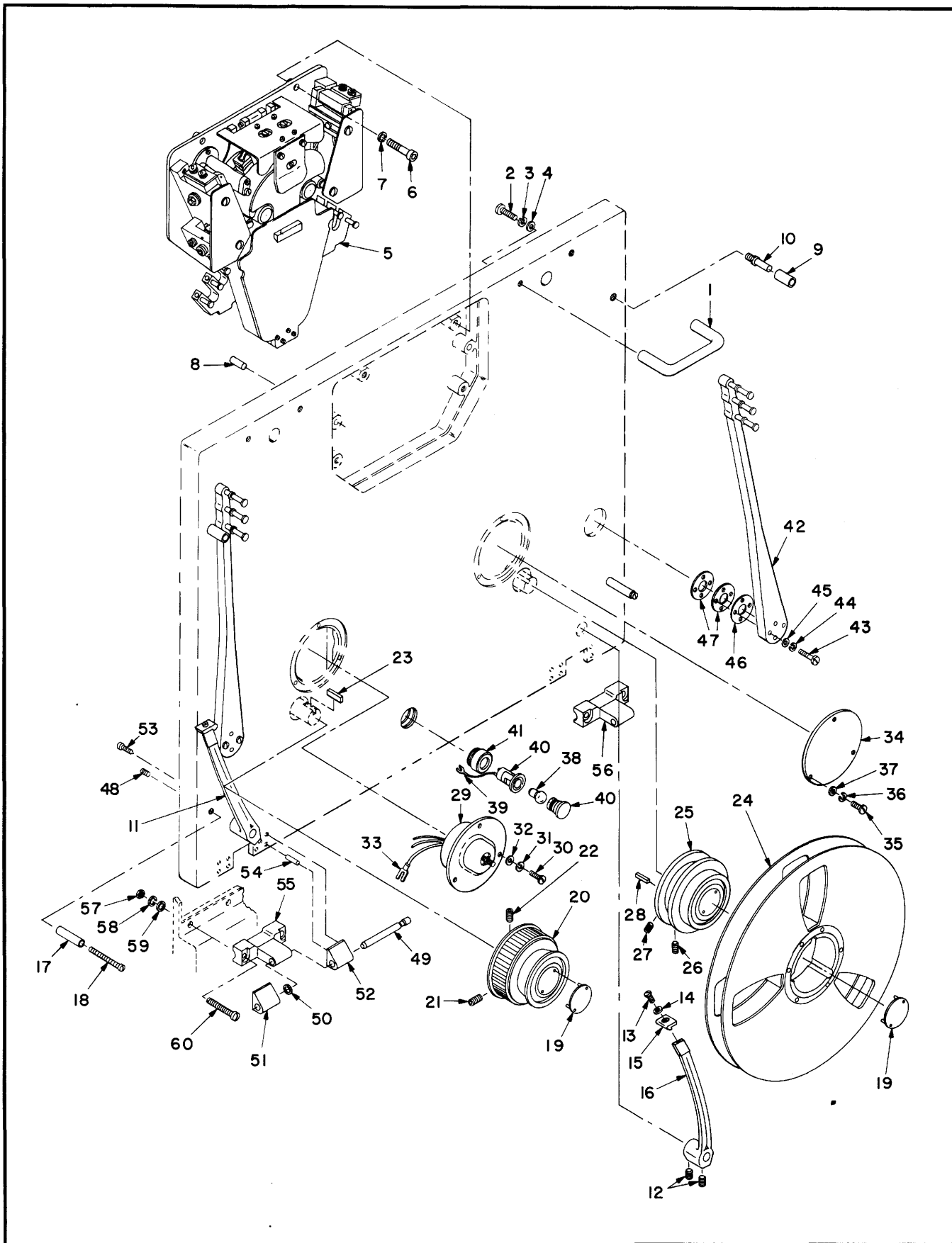


Figure 2. (Sheet 1 of 3) (Index nos. 1 thru 60)

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
MAGNETIC TAPE TRANSPORT (Cont.)											
2-41	426196	.									1
-42	428256-2	.									2
-43	154-35	.									4
-44	147-1	.									4
-45	146-20	.									4
-46	428687-1	.									2
-47	428687-2	.									4
-48	165-11	.									2
-49	414844	.									2
-50	149-7319	.									2
-51	414808-1	.									2
-52	414808-2	.									2
-53	162-17	.									8
-54	195-10	.									8
-55	431947-1	.									1
-56	431947-2	.									1
-57	171-5	.									4
-58	147-4	.									4
-59	146-4	.									4
-60	154-19	.									4
-61	179-18	.									2
-62	131-7055	.									1
-63	372288-2	.									1
-64	179-27	.									1
-65	426170-2	.									1
-66	179-11	.									2
-67	160-19	.									2
-68	147-2	.									2
-69	146-1	.									2
-70	426105	.									1
-71	154-22	.									4
2-	147-4	.									4
2-	146-3	.									4
-72	300045-2	.									1
-73	300044-2	.									1
-74	162-37	.									6
-75	162-39	.									2
-76	179-11	.									3
2-	154-4	.									3
-77	73-1918	.									2
-78	154-31	.									8
-79	143-44	.									2
-80	154-12	.									4
2-	147-3	.									4
2-	146-19	.									4



Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
MAGNETIC TAPE TRANSPORT (Cont.)											
2-81	233-6608	.	.	.	.	.	.	.	.	1	
-82	428176	.	.	.	.	.	.	.	.	1	
-83	73-1937	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
2-	153-5	.	.	.	.	.	.	.	.	2	
		---	*	---							
-84	431044	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-85	154-5	.	.	.	.	.	.	.	.	4	
2-	147-2	.	.	.	.	.	.	.	.	4	
2-	146-1	.	.	.	.	.	.	.	.	4	
		---	*	---							
-86	432424	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-87	162-17	.	.	.	.	.	.	.	.	8	
2-	147-2	.	.	.	.	.	.	.	.	8	
2-	146-1	.	.	.	.	.	.	.	.	8	
		---	*	---							
-88	210-31	.	.	.	.	.	.	.	.	1	
-89	410846-40	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-90	165-23	.	.	.	.	.	.	.	.	1	
-91	165-24	.	.	.	.	.	.	.	.	1	
		---	*	---							
2-	372280	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-92	162-8	.	.	.	.	.	.	.	.	4	
-93	147-5	.	.	.	.	.	.	.	.	4	
-94	146-13	.	.	.	.	.	.	.	.	4	
		---	*	---							
-95	177-6247	.	.	.	.	.	.	.	.	7	
-96	140-9	.	.	.	.	.	.	.	.	1	
-97	202-6349	.	.	.	.	.	.	.	.	1	
-98	154-16	.	.	.	.	.	.	.	.	1	
-99	171-4	.	.	.	.	.	.	.	.	1	
2-	426194	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-100	154-66	.	.	.	.	.	.	.	.	1	
-101	147-4	.	.	.	.	.	.	.	.	1	
-102	146-4	.	.	.	.	.	.	.	.	1	
		---	*	---							
-103	144-14	.	.	.	.	.	.	.	.	1	
2-	408088-2	.	.	.	.	.	.	.	.	1	
-104	144-26	.	.	.	.	.	.	.	.	1	
-105	206-5279	.	.	.	.	.	.	.	.	1	
-106	407688-2	.	.	.	.	.	.	.	.	1	
-107	407690	.	.	.	.	.	.	.	.	1	
-108	429717	.	.	.	.	.	.	.	.	1	
-109	179-5	.	.	.	.	.	.	.	.	2	
		.	.	.	.	.	.	.	.		
-110	154-4	.	.	.	.	.	.	.	.	2	
		---	*	---							
-111	427711	.	.	.	.	.	.	.	.	1	
		.	.	.	.	.	.	.	.		
-112	162-23	.	.	.	.	.	.	.	.	3	
-113	147-5	.	.	.	.	.	.	.	.	3	
-114	146-13	.	.	.	.	.	.	.	.	3	
		---	*	---							
2-115	426881	.	.	.	.	.	.	.	.	2	
-116	426879	.	.	.	.	.	.	.	.	2	
-117	415944	.	.	.	.	.	.	.	.	2	
-118	429090	.	.	.	.	.	.	.	.	2	
-119	179-11	.	.	.	.	.	.	.	.	2	
		.	.	.	.	.	.	.	.		
2-	154-12	.	.	.	.	.	.	.	.	2	
		---	*	---							

Section VII  
Group Assembly Parts List

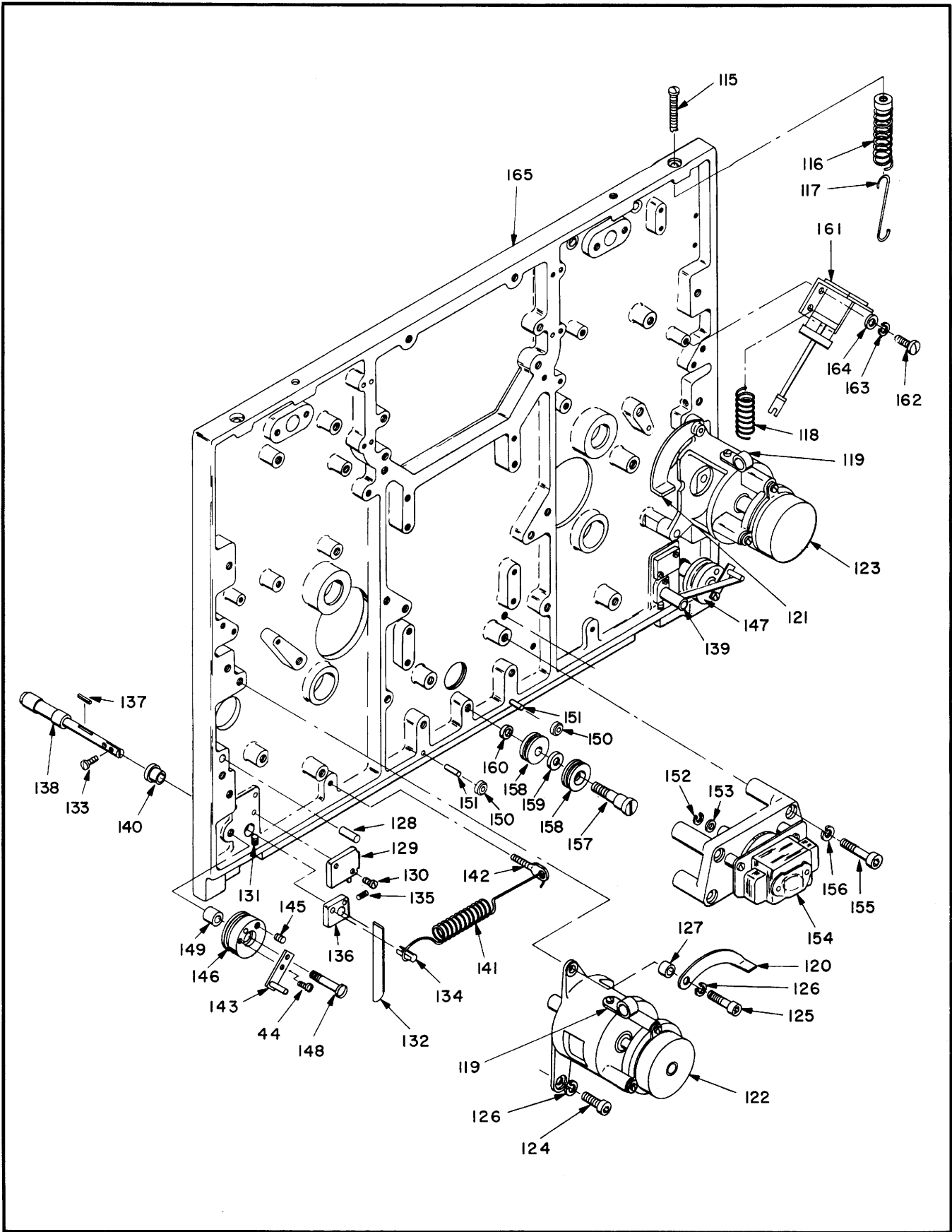


Figure 2. (Sheet 3 of 3) (Index nos. 115 thru 165)



Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
MAGNETIC TAPE TRANSPORT (Cont.)											
2-120	427553-2	.	.	.	.	.	.	.	.	1	
-121	427553-1	.	.	.	.	.	.	.	.	1	
-122	427595-1	.	.	.	.	.	.	.	.	1	
-123	427595-2	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-124	162-8	.	.	.	.	.	.	.	.	4	
-125	162-36	.	.	.	.	.	.	.	.	2	
-126	147-5	.	.	.	.	.	.	.	.	6	
-127	176-38	.	.	.	.	.	.	.	.	2	
-128	195-35	.	.	.	.	.	.	.	.	2	
		---*---									
-129	61-1623	.	.	.	.	.	.	.	.	2	
		(ATTACHING PARTS)									
-130	154-83	.	.	.	.	.	.	.	.	4	
		---*---									
-131	165-60	.	.	.	.	.	.	.	.	2	
-132	428677	.	.	.	.	.	.	.	.	2	
		(ATTACHING PARTS)									
-133	153-28	.	.	.	.	.	.	.	.	4	
		---*---									
-134	196-1	.	.	.	.	.	.	.	.	2	
-135	165-3	.	.	.	.	.	.	.	.	2	
-136	429942	.	.	.	.	.	.	.	.	2	
-137	414640-20	.	.	.	.	.	.	.	.	2	
-138	427864-2	.	.	.	.	.	.	.	.	1	
-139	426176-2	.	.	.	.	.	.	.	.	1	
-140	215-12	.	.	.	.	.	.	.	.	2	
-141	418057	.	.	.	.	.	.	.	.	2	
-142	166-9	.	.	.	.	.	.	.	.	2	
-143	428678	.	.	.	.	.	.	.	.	2	
		(ATTACHING PARTS)									
-144	154-83	.	.	.	.	.	.	.	.	4	
		---*---									
-145	165-38	.	.	.	.	.	.	.	.	2	
-146	426179-1	.	.	.	.	.	.	.	.	1	
-147	426179-2	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-148	155-21	.	.	.	.	.	.	.	.	2	
-149	426183	.	.	.	.	.	.	.	.	2	
		---*---									
-150	432432	.	.	.	.	.	.	.	.	2	
-151	193-2	.	.	.	.	.	.	.	.	2	
-152	144-13	.	.	.	.	.	.	.	.	1	
-153	146-13	.	.	.	.	.	.	.	.	3	
-154	428098-1	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-155	162-52	.	.	.	.	.	.	.	.	4	
-156	147-4	.	.	.	.	.	.	.	.	4	
		---*---									
-157	166-511	.	.	.	.	.	.	.	.	1	
-158	428772	.	.	.	.	.	.	.	.	2	
-159	149-7319	.	.	.	.	.	.	.	.	1	
-160	149-7317	.	.	.	.	.	.	.	.	1	
-161	417504	.	.	.	.	.	.	.	.	2	
		(ATTACHING PARTS)									
-162	154-5	.	.	.	.	.	.	.	.	6	
-163	147-2	.	.	.	.	.	.	.	.	6	
-164	146-1	.	.	.	.	.	.	.	.	6	
		---*---									
-165	431946	.	.	.	.	.	.	.	.	1	

Section VII  
Group Assembly Parts List

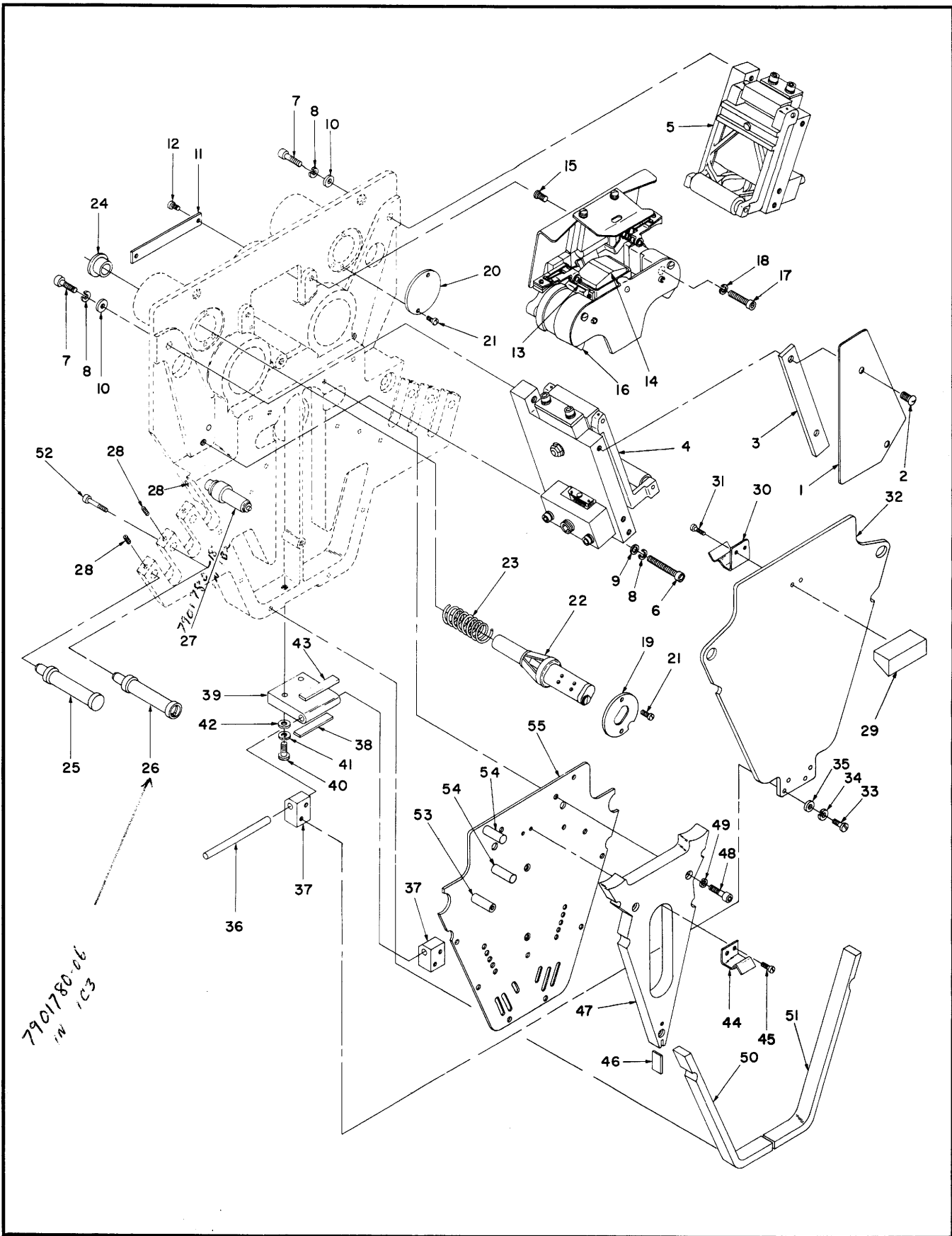


Figure 3. (Sheet 1 of 2) (Index nos. 1 thru 55)

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
DRIVE PLATE ASSY											
3-	428235	PLATE ASSEMBLY, Drive (see fig.2-5 for nha).								Ref	
-1	426141	. PLATE, Cover								2	
		(ATTACHING PARTS)									
-2	155-22	. SCREW								4	
		----*----									
-3	428891-2	. SPACER								2	
-4	430729	. DRIVE SOLENOID (see fig.4 for breakdown)								1	
-5	430730	. DRIVE SOLENOID (see fig.4 for breakdown)								1	
		(ATTACHING PARTS)									
-6	162-76	. SCREW								2	
-7	162-33	. SCREW								2	
-8	147-4	. WASHER, Lock								4	
-9	149-7325	. WASHER, Flat								2	
-10	146-16	. WASHER, Flat								2	
		----*----									
-11	428197	. BAR, Clamp								1	
		(ATTACHING PARTS)									
-12	154-47	. SCREW								2	
		----*----									
-13	EH2A	. ERASE HEAD								1	
		(ATTACHING PARTS)									
3-	162-72	. SCREW								2	
		----*----									
-14	18501-7	. HEAD, Read/Write, magnetic								1	
		(ATTACHING PARTS)									
-15	153-108	. SCREW								2	
		----*----									
-16	13513X41427	. TROUGH GUIDE ASSY (see fig.5 for breakdown)								1	
		(ATTACHING PARTS)									
-17	162-2	. SCREW								3	
-18	147-3	. WASHER, Lock								3	
		----*----									
-19	426101-1	. DISC								1	
-20	426101-2	. DISC								1	
		(ATTACHING PARTS)									
-21	154-47	. SCREW								4	
		----*----									
-22	300047	. SENSOR ASSY, Tape (see fig.6 for breakdown)								1	
-23	418042	. SPRING								1	
-24	427573	. BUSHING								1	
-25	426148-2	. POST, Guide								2	
-26	300052-2	. ROLLER ASSY								4	
-27	428139-2	. ROLLER ASSY								2	
		(ATTACHING PARTS)									
-28	165-3	. SETSCREW								8	
		----*----									
-29	431387	. HANDLE								1	
-30	426149	. LATCH								1	
		(ATTACHING PARTS)									
-31	154-48	. SCREW								2	
		----*----									
-32	428811	. COVER								1	
		(ATTACHING PARTS)									
-33	154-31	. SCREW								4	
-34	147-1	. WASHER, Lock								4	
-35	146-7	. WASHER, Flat								4	
		----*----									
-36	196-25	. PIN								1	
-37	426134	. BLOCK								2	
-38	428199-1	. STRIP, Rubber								1	
-39	426119-2	. BRACKET								1	
		(ATTACHING PARTS)									
-40	154-6	. SCREW								2	
-41	147-2	. WASHER, Lock								2	
-42	146-1	. WASHER, Flat								2	
		----*----									

Section VII  
Group Assembly Parts List

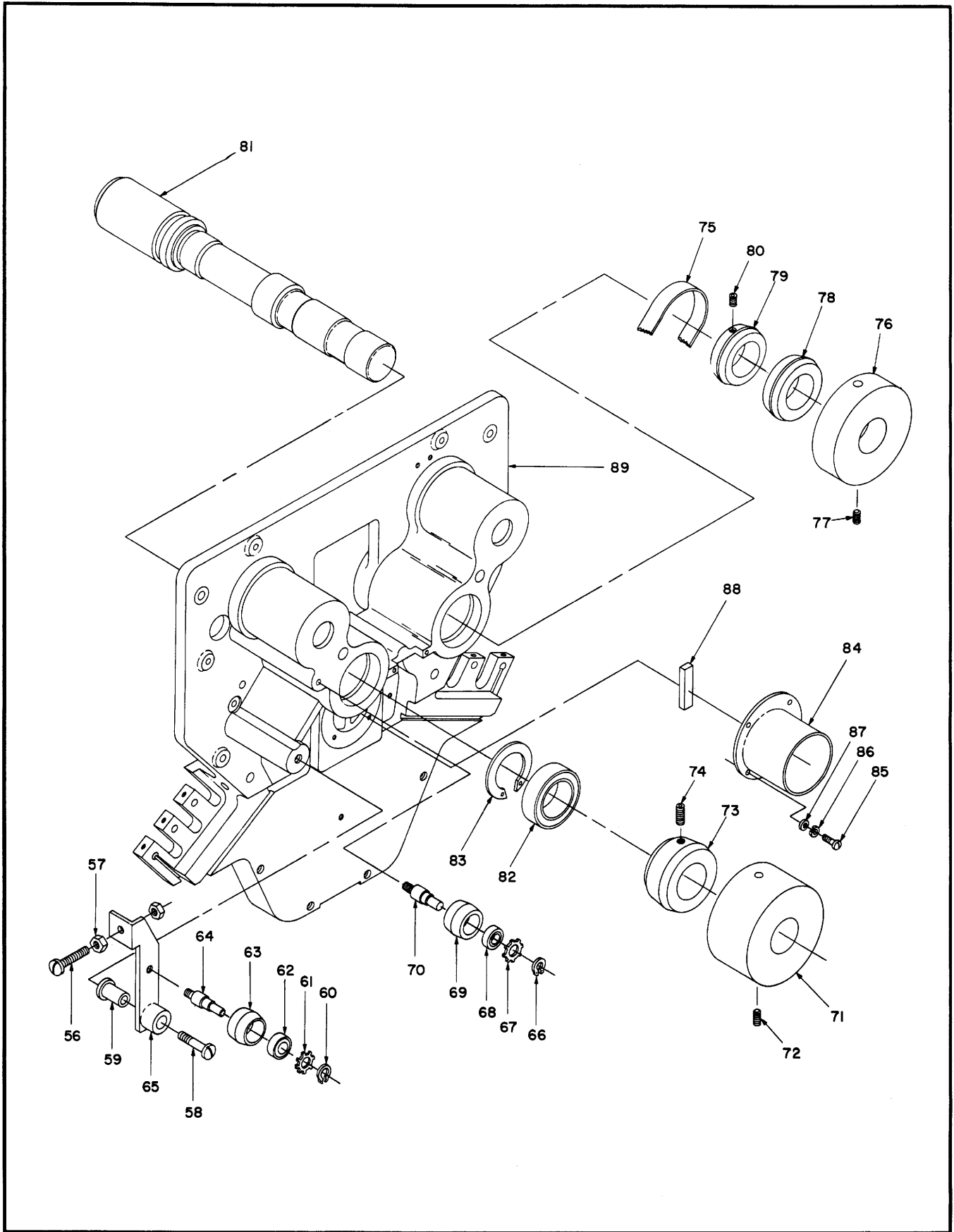


Figure 3. (Sheet 2 of 2) (Index nos. 56 thru 89)

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
DRIVE PLATE ASSY (Cont.)											
3-43	428199-2	.	.	.	.	.	.	.	.	1	
-44	426150	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-45	154-32	.	.	.	.	.	.	.	.	2	
		---*---									
-46	426143-2	.	.	.	.	.	.	.	.	1	
-47	427596-2	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-48	162-2	.	.	.	.	.	.	.	.	3	
-49	147-3	.	.	.	.	.	.	.	.	3	
		---*---									
-50	426108-20	.	.	.	.	.	.	.	.	1	
-51	426108-2	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-52	162-22	.	.	.	.	.	.	.	.	6	
		---*---									
-53	426144-2	.	.	.	.	.	.	.	.	2	
		(ATTACHING PARTS)									
3-	153-52	.	.	.	.	.	.	.	.	2	
		---*---									
-54	428180-2	.	.	.	.	.	.	.	.	4	
-55	430530	.	.	.	.	.	.	.	.	1	
-56	154-100	.	.	.	.	.	.	.	.	1	
-57	171-5	.	.	.	.	.	.	.	.	2	
3-	426165	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-58	154-66	.	.	.	.	.	.	.	.	1	
-59	426174	.	.	.	.	.	.	.	.	1	
		---*---									
-60	144-14	.	.	.	.	.	.	.	.	1	
3-	408088-1	.	.	.	.	.	.	.	.	1	
-61	144-26	.	.	.	.	.	.	.	.	1	
-62	206-5279	.	.	.	.	.	.	.	.	1	
-63	407688-1	.	.	.	.	.	.	.	.	1	
-64	407359-1	.	.	.	.	.	.	.	.	1	
-65	426164	.	.	.	.	.	.	.	.	1	
-66	144-14	.	.	.	.	.	.	.	.	1	
3-	408088-1	.	.	.	.	.	.	.	.	1	
-67	144-26	.	.	.	.	.	.	.	.	1	
-68	206-5279	.	.	.	.	.	.	.	.	1	
-69	407688-1	.	.	.	.	.	.	.	.	1	
-70	426175	.	.	.	.	.	.	.	.	1	
-71	426155	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-72	165-64	.	.	.	.	.	.	.	.	2	
		---*---									
-73	428810	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-74	165-70	.	.	.	.	.	.	.	.	1	
		---*---									
-75	210-30	.	.	.	.	.	.	.	.	1	
-76	427558	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-77	165-64	.	.	.	.	.	.	.	.	2	
		---*---									
-78	426159-1	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
3-	No Number	.	.	.	.	.	.	.	.	1	
		---*---									
-79	428810	.	.	.	.	.	.	.	.	1	
		(ATTACHING PARTS)									
-80	165-70	.	.	.	.	.	.	.	.	1	
		---*---									
-81	427599	.	.	.	.	.	.	.	.	2	
-82	206-5308	.	.	.	.	.	.	.	.	4	
-83	144-37	.	.	.	.	.	.	.	.	4	

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	MFR. CODE	UNITS PER ASSY	USABLE ON CODE
DRIVE PLATE ASSY (Cont.)					
3-84	417710	. COUPLING . . . . .		1	
(ATTACHING PARTS)					
-85	154-47	. SCREW . . . . .		3	
-86	147-1	. WASHER, Lock . . . . .		3	
-87	146-1	. WASHER, Flat . . . . .		3	
----*----					
-88	428198	. BARRIER . . . . .		1	
-89	427597	. PLATE, Drive . . . . .		1	

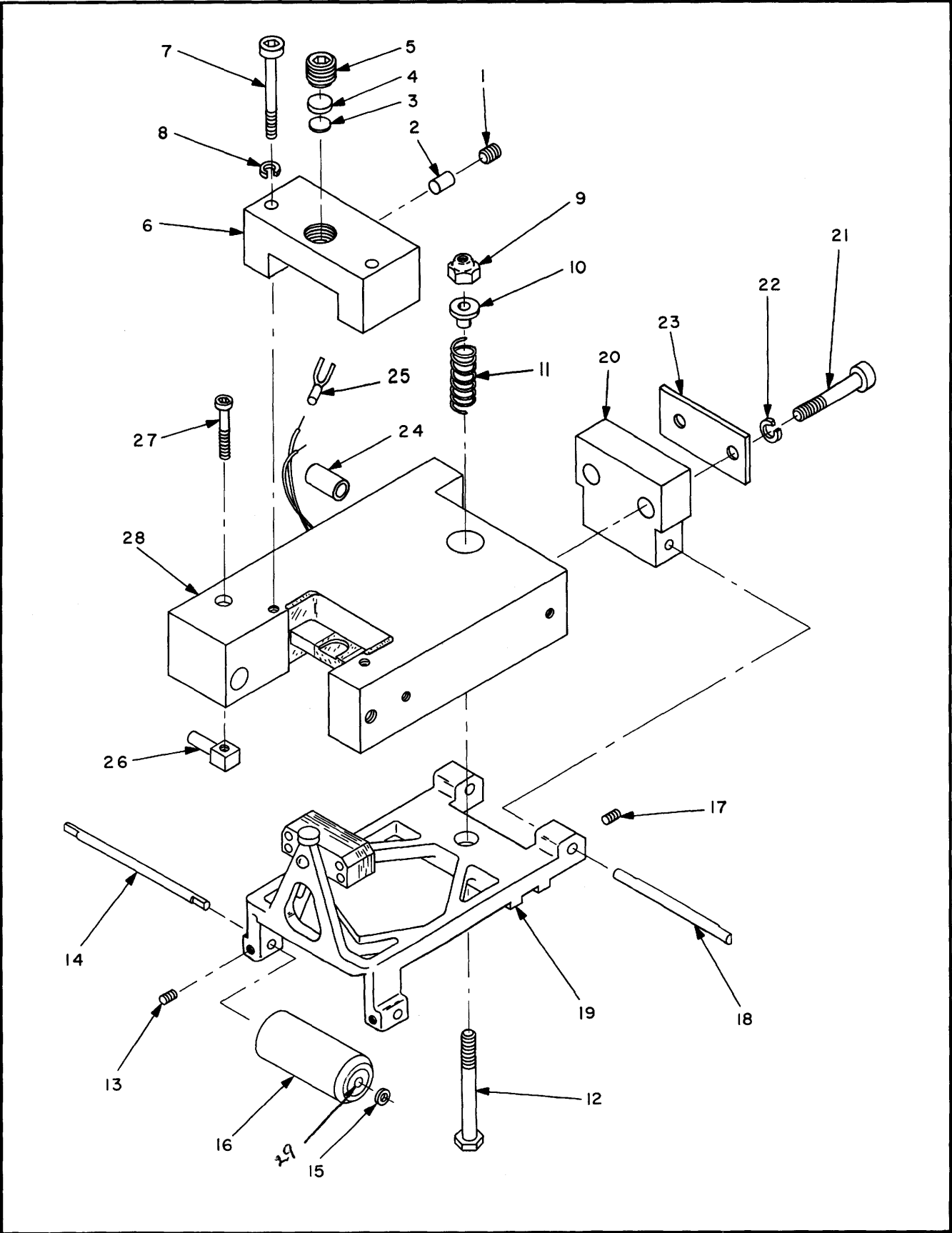


Figure 4. Drive Solenoid Assys





Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION	MFR. CODE	UNITS PER ASSY	USABLE ON CODE
DRIVE SOLENOID ASSYS					
USABLE ON CODE					
		1 2 3 4 5 6 7			
		Part No.      Code			
		430729          A			
		430730          B			
4-	430729	SOLENOID ASSY, Drive (upper) (see fig. 3-4 for nha)			Ref
4-	430730	SOLENOID ASSY, Drive (lower) (see fig. 3-5 for nha)			Ref
-1	165-104	. SETSCREW . . . . .		1	
-2	430471	. SLUG . . . . .		1	
4-	430470	. BACKSTOP ASSY . . . . .		1	
-3	430459	. . CAP . . . . .		1	
-4	429293	. . PAD . . . . .		1	
-5	430466	. . SCREW . . . . .		1	
-6	429295	. SUPPORT . . . . .		1	
		(ATTACHING PARTS)			
-7	162-71	. SCREW . . . . .		2	
-8	147-3	. WASHER, Lock . . . . .		2	
		----*----			
-9	171-34	. NUT . . . . .		1	
-10	429292	. ANCHOR . . . . .		1	
-11	418059	. SPRING . . . . .		1	
-12	166-798	. BOLT . . . . .		1	
-13	164-29	. SETSCREW . . . . .		2	
-14	429296	. SHAFT . . . . .		1	
-15	176-53	. SPACER . . . . .		AR	
-16	430468	. ROLLER . . . . .		1	
-17	165-5	. SETSCREW . . . . .		2	
-18	429297	. SHAFT . . . . .		1	
-19	429610	. FRAME . . . . .		1	
-20	429294	. BLOCK, Hinge . . . . .		1	
		(ATTACHING PARTS)			
-21	162-18	. SCREW . . . . .		2	
-22	147-3	. WASHER, Lock . . . . .		2	
-23	431074	. STRAP . . . . .		1	
		----*----			
-24	410155	. SPACER, Sleeve . . . . .		1	
-25	177-6250	. TERMINAL, Lug . . . . .		2	
-26	430469	. SPACER . . . . .		1	
		(ATTACHING PARTS)			
-27	162-22	. SCREW . . . . .		1	
		----*----			
-28	429299	. COIL-HOUSING . . . . .		1	A
-28	429300	. COIL-HOUSING . . . . .		1	B
-29	<i>Ref only</i>	<i>Bearing, Ball, Shielded SFRL-SPPEE</i>			

Section VII  
Group Assembly Parts List

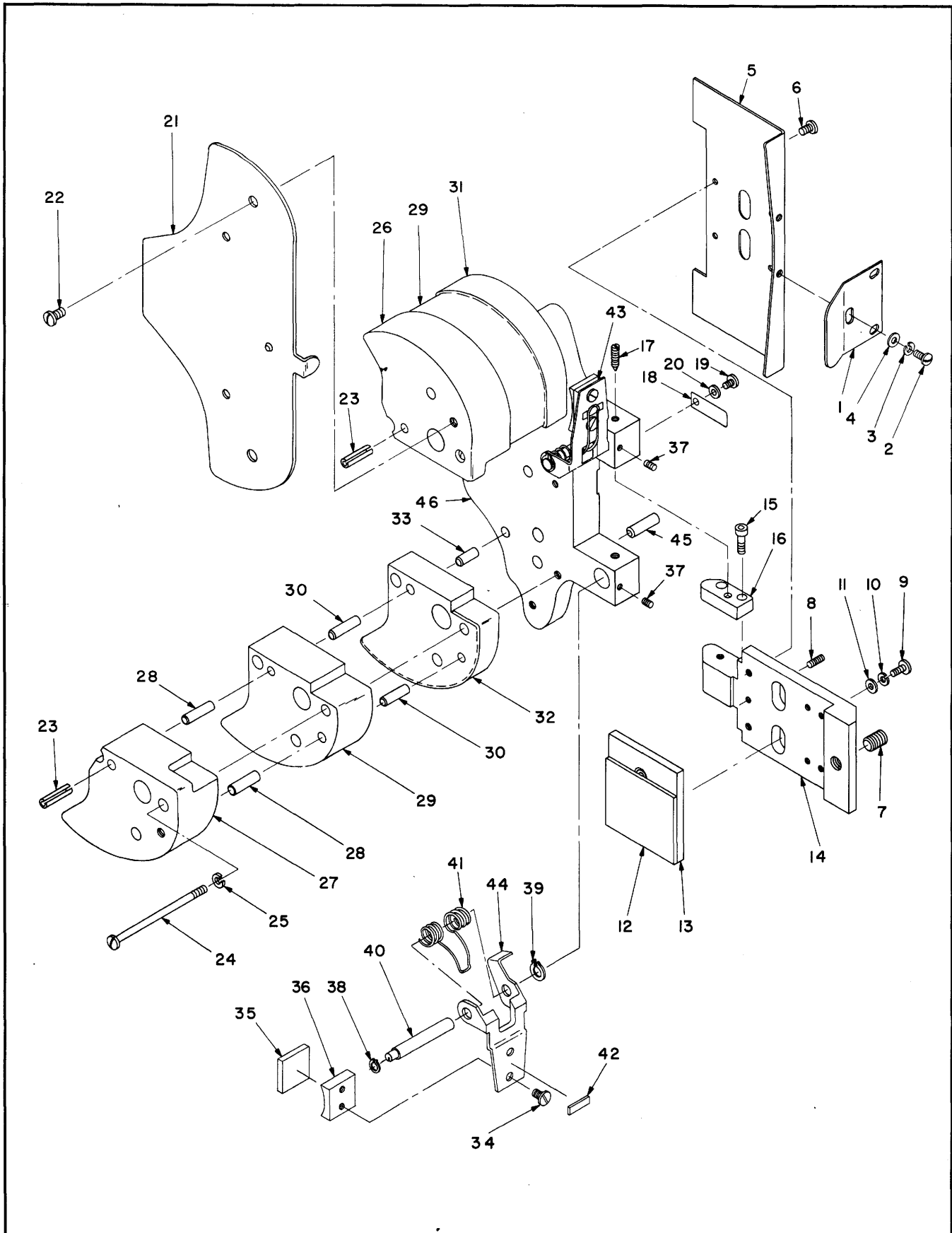


Figure 5. Trough Guide Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
TROUGH GUIDE ASSY											
5-	13513X41427	TROUGH GUIDE ASSY (see fig. 3-16 for nha) . . . . .								Ref	
-1	433352	. LATCH . . . . .								1	
		. (ATTACHING PARTS)									
-2	160-20	. SCREW . . . . .								2	
-3	147-4	. WASHER, Lock . . . . .								2	
-4	146-7	. WASHER, Flat . . . . .								2	
		. ---*---									
-5	433353	. COVER . . . . .								1	
		. (ATTACHING PARTS)									
-6	154-47	. SCREW . . . . .								4	
		. ---*---									
-7	165-135	. SETSCREW . . . . .								1	
-8	165-29	. SETSCREW . . . . .								3	
5-	423249-3	. PLATE ASSY, Ferrite adjustment. . . . .								1	
		. (ATTACHING PARTS)									
-9	154-84	. SCREW . . . . .								2	
-10	147-2	. WASHER, Lock . . . . .								2	
-11	146-50	. WASHER, Flat . . . . .								2	
		. ---*---									
-12	423252-3	. . PLATE, Ferrite . . . . .								1	
-13	423250-3	. . PLATE . . . . .								1	
-14	423247	. PAD, Head . . . . .								1	
		. (ATTACHING PARTS)									
-15	162-54	. SCREW . . . . .								4	
		. ---*---									
-16	418597	. BLOCK, Pivot . . . . .								2	
-17	165-89	. SETSCREW . . . . .								2	
-18	<del>420128</del> 428211	. SPRING . . . . .								1	
		. (ATTACHING PARTS)									
-19	154-4	. SCREW . . . . .								1	
-20	145-16	. WASHER, Fiber . . . . .								1	
		. ---*---									
-21	432439	. COVER, Trough guide . . . . .								1	
		. (ATTACHING PARTS)									
-22	155-4	. SCREW . . . . .								2	
		. ---*---									
-23	193-27	. PIN, Spring . . . . .								2	
-24	153-64	. SCREW . . . . .								4	
-25	147-2	. WASHER, Lock . . . . .								4	
-26	426173-2	. TOP . . . . .								1	
-27	426173-20	. TOP . . . . .								1	
-28	195-19	. PIN . . . . .								4	
-29	426172-2	. BODY . . . . .								2	
-30	195-19	. PIN . . . . .								4	
-31	426171-1	. BASE . . . . .								1	
-32	426171-2	. BASE . . . . .								1	
-33	195-10	. PIN . . . . .								2	
5-	419056-2	. PAD ASSY, Drag . . . . .								2	
		. (ATTACHING PARTS)									
-34	154-84	. SCREW . . . . .								4	
		. ---*---									
-35	417677-2	. . PAD, Felt . . . . .								1	
-36	418562-2	. . PAD, Drag. . . . .								1	
5-	419058-2	. BRACKET ASSY, Pad . . . . .								1	
5-	419057-2	. BRACKET ASSY, Pad . . . . .								1	
		. (ATTACHING PARTS)									
-37	165-29	. SCREW . . . . .								2	
		. ---*---									
-38	144-72	. . RING, Retaining. . . . .								1	
-39	144-68	. . RING, Retaining. . . . .								1	
-40	418556-2	. . SHAFT . . . . .								1	
-41	418005	. . SPRING . . . . .								1	
-42	418596	. . PAD . . . . .								1	
-43	418762-2	. . BRACKET (used on 419058-2). . . . .								1	
-44	418555-2	. . BRACKET (used on 419057-2). . . . .								1	
-45	195-19	. . PIN DOWEL . . . . .								1	
-46	426133	. . MOUNT . . . . .								1	

Section VII  
Group Assembly Parts List

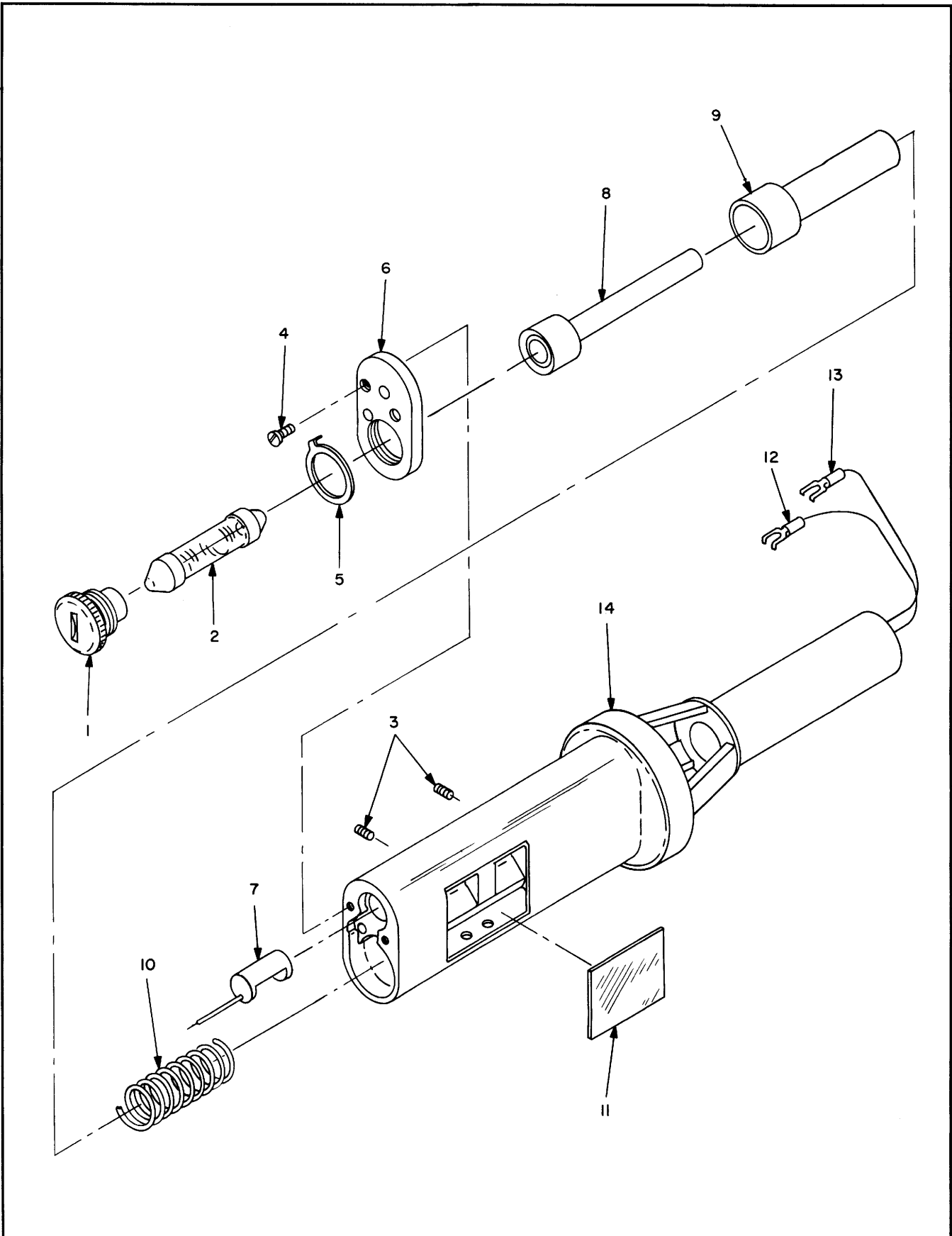


Figure 6. Photo Electric Tape Sensor Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
PHOTO ELECTRIC TAPE SENSOR ASSY											
6-	300047	SENSOR ASSY, Tape, photo electric (see fig. 3-22 for nha) . . . .								Ref	
-1	427067	. KNOB . . . . .								1	
-2	204-6266	. LAMP . . . . .								1	
-3	165-76	. SETSCREW . . . . .								1	
6-	432648	. SOLAR CELL AND CAP (ATTACHING PARTS)								1	
-4	151-34	. SCREW . . . . .								2	
		----*----									
-5	427065	. LUG . . . . .								1	
-6	427066	. CAP . . . . .								1	
-7	432647	. CELL, Solar . . . . .								1	
6-	432650	. SPRING - PLUNGER ASSY . . . . .								1	
-8	427064	. PLUNGER . . . . .								1	
-9	432649	. BUSHING . . . . .								1	
-10	418043	. SPRING . . . . .								1	
-11	426158	. WINDOW . . . . .								1	
-12	177-6250	. TERMINAL, Lug . . . . .								2	
-13	177-6292	. TERMINAL, Lug . . . . .								4	
-14	426104	. BLOCK . . . . .								1	

Section VII  
Group Assembly Parts List

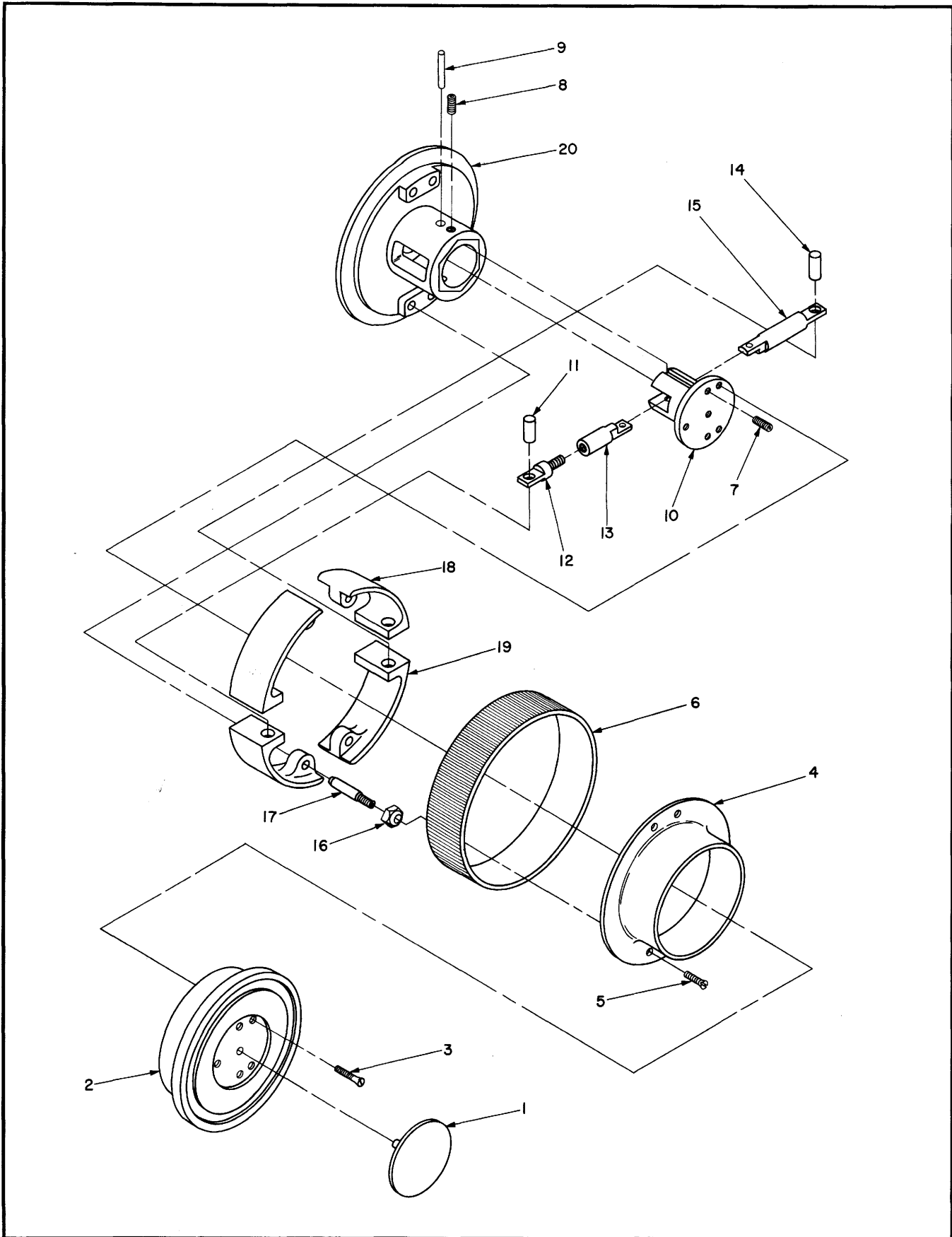


Figure 7. IBM Quick Lock Knob Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
IBM QUICK LOCK KNOB ASSY											
7-	429907-3	KNOB ASSY, Quick Lock, IBM (see fig. 2-20 for nha) . . . . .									Ref
-1	430545	. DISC . . . . .									1
-2	429644	. KNOB . . . . .									1
		(ATTACHING PARTS)									
-3	150-3	. SCREW . . . . .									3
		---*---									
-4	429647	. SKIRT . . . . .									1
		(ATTACHING PARTS)									
-5	152-3	. SCREW . . . . .									4
		---*---									
-6	235-3	. RING, Rubber . . . . .									1
-7	165-69	. SETSCREW. . . . .									2
-8	165-113	. SETSCREW. . . . .									1
-9	195-9	. PIN, Straight, headless . . . . .									1
-10	430019	. STUD . . . . .									1
7-	430026-1	. LINK ASSY. . . . .									1
-11	195-44	. . PIN . . . . .									1
-12	431959	. . LINK . . . . .									1
-13	431960	. . LINK . . . . .									1
7-	430026-2	. LINK ASSY. . . . .									1
-14	195-44	. . PIN, Straight, headless . . . . .									1
-15	431963	. . LINK . . . . .									1
7-	429955	. PIVOT ASSY . . . . .									4
-16	174-24	. . NUT . . . . .									1
-17	429648	. . PIN . . . . .									1
-18	430006	. LOCKSHOE. . . . .									1
-19	430007	. LOCKSHOE. . . . .									1
-20	429912	. HUB . . . . .									1

**Section VII**  
**Group Assembly Parts List**

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
<b>IBM STATIONARY KNOB ASSY</b>											
8-	429781-3	KNOB ASSY, Stationary, IBM (see fig. 2-25 for nha). . . . .								Ref	
-1	433172	. DISC . . . . .								Ref	
-2	429783-2	. KNOB . . . . .								1	
(ATTACHING PARTS)											
-3	162-12	. SCREW . . . . .								3	
-4	147-4	. WASHER, Lock. . . . .								3	
---*---											
-5	195-42	. PIN . . . . .								1	
-6	352490-1	. GASKET . . . . .								1	
-7	429782	. HUB . . . . .								1	

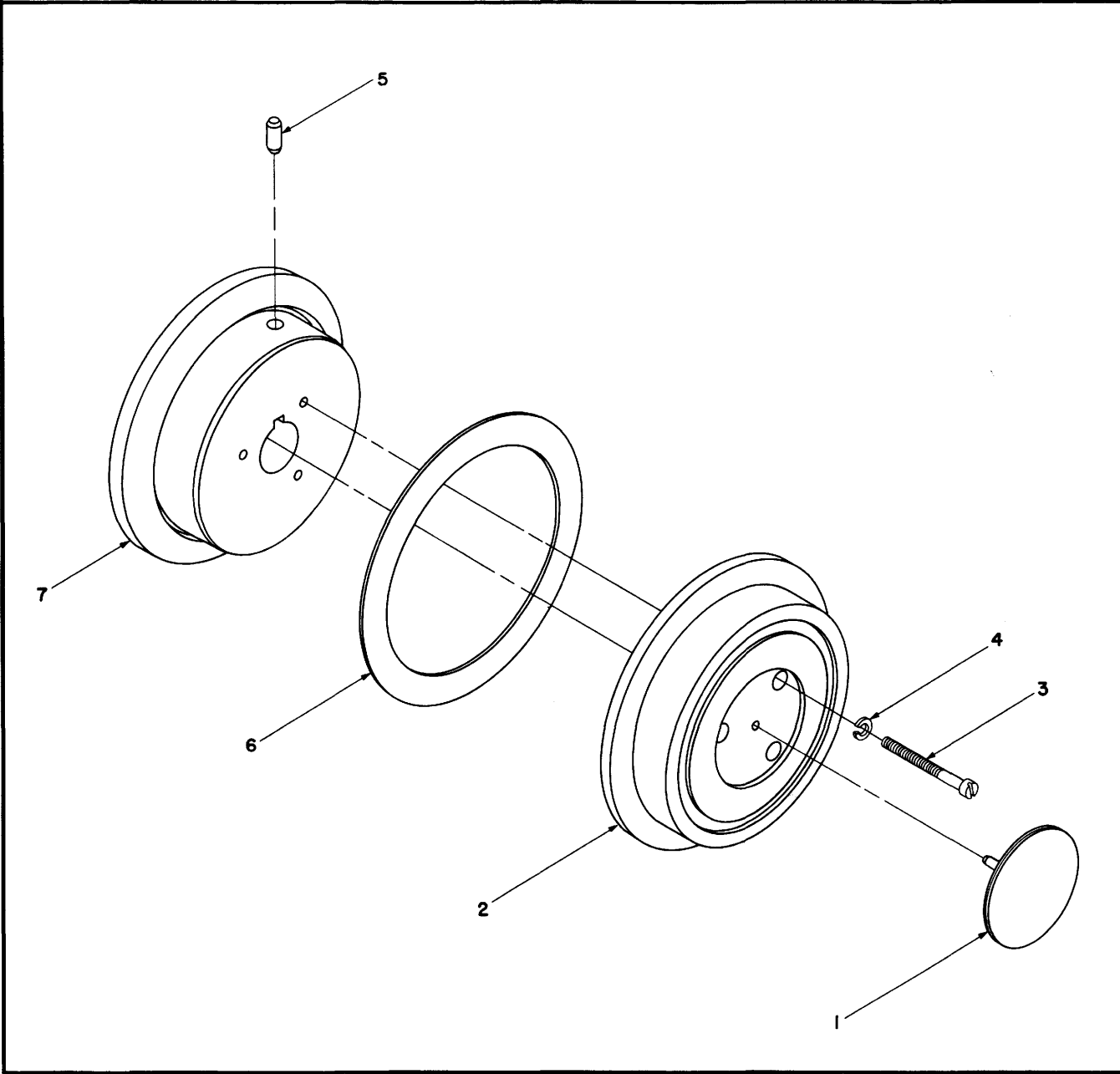


Figure 8. IBM Stationary Knob Assy



Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
<b>MAGNETIC TYPE WRITE LOCKOUT ASSY</b>											
9-	300041	LOCKOUT ASSY, Magnetic type write (see fig. 2-29 for nha) . . . . .								Ref	
-1	427738	. COVER . . . . .								1	
		. (ATTACHING PARTS)									
-2	153-28	. SCREW . . . . .								3	
-3	147-15	. WASHER, Lock . . . . .								3	
-4	146-29	. WASHER, Flat . . . . .								3	
		. ----*----									
-5	61-1686	. SWITCH . . . . .								1	
		. (ATTACHING PARTS)									
-6	153-15	. SCREW . . . . .								2	
-7	147-15	. WASHER, Lock . . . . .								2	
		. ----*----									
-8	427027	. ACTUATOR . . . . .								1	
-9	427047	. BRACKET . . . . .								1	
		. (ATTACHING PARTS)									
-10	154-68	. SCREW . . . . .								2	
-11	147-1	. WASHER, Lock . . . . .								2	
-12	146-20	. WASHER, Flat . . . . .								2	
		. ----*----									
-13	174-13	. NUT . . . . .								1	
-14	427049	. WASHER . . . . .								1	
-15	427048	. PIN . . . . .								1	
-16	427737	. SOLENOID . . . . .								1	
		. (ATTACHING PARTS)									
-17	154-68	. SCREW . . . . .								2	
-18	147-1	. WASHER, Lock . . . . .								2	
-19	146-20	. WASHER, Flat . . . . .								2	
		. ----*----									
-20	427046	. HOUSING . . . . .								1	

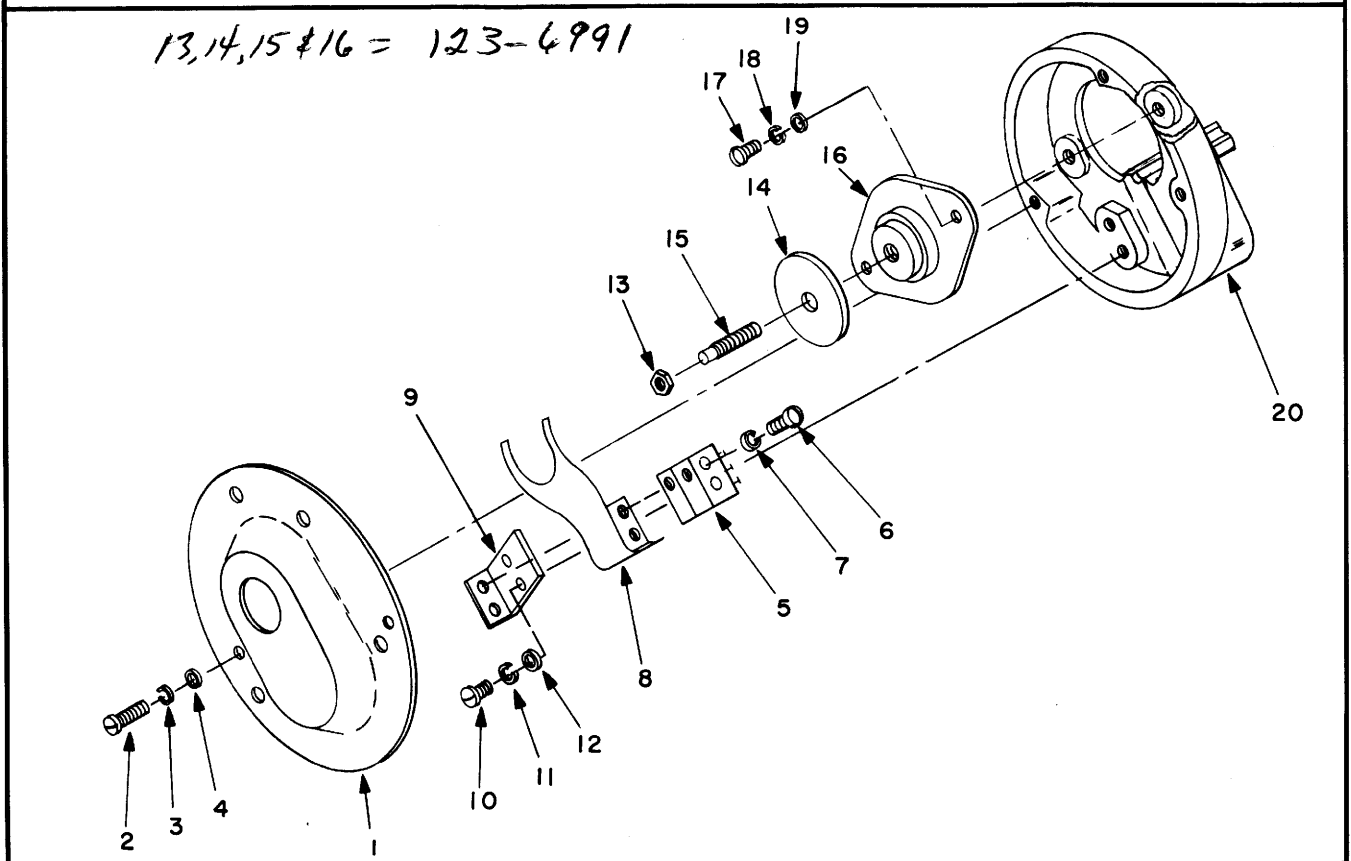


Figure 9. Magnetic Type Write Lockout Assy

**Section VII**  
**Group Assembly Parts List**

FIG. AND INDEX NO.	PART NUMBER								MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
<b>TENSION ARM AND ROLLER ASSY</b>											
10-	428256-2	ARM AND ROLLER ASSY, Tension (see fig. 2-42 for nha) . . . . .								Ref	
-1	144-35	. RING, Retaining . . . . .								3	
-2	408424	. SPACER . . . . .								3	
-3	408423-2	. BUSHING . . . . .								3	
-4	425631	. PIN . . . . .								3	
-5	206-5276	. BEARING, Ball. . . . .								3	
-6	408461-2	. ROLLER . . . . .								3	
-7	426161-2	. STUD . . . . .								3	
-8	428233	. ARM, Tension . . . . .								1	

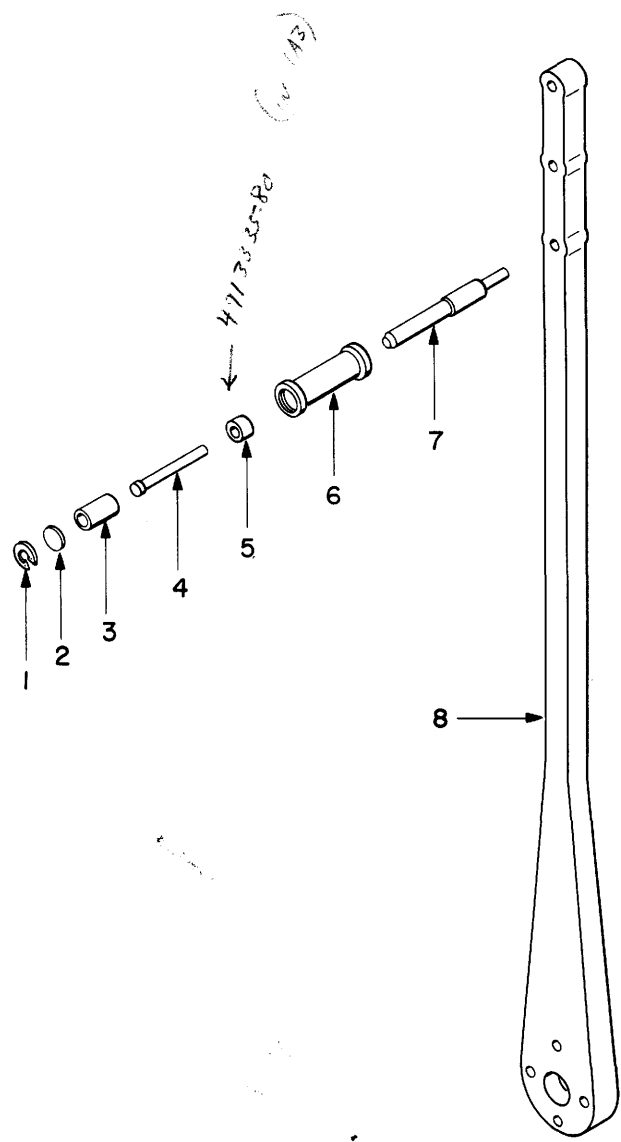


Figure 10. Tension Arm and Roller Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
VACUUM MOTOR ASSY											
11-	372288-2	MOTOR ASSY, Vacuum (see fig. 2-63 for nha) . . . . .								Ref	
-1	185-5741	. BUSHING . . . . .								1	
-2	177-56	. TERMINAL, lug . . . . .								3	
		(ATTACHING PARTS)									
-3	171-3	. NUT . . . . .								2	
-4	147-9	. WASHER, Lock. . . . .								1	
-5	154-5	. SCREW . . . . .								1	
		---*---									
-6	29-1177	. CAPACITOR . . . . .								1	
		(ATTACHING PARTS)									
-7	171-4	. NUT . . . . .								1	
-8	147-3	. WASHER, Lock. . . . .								1	
		---*---									
-9	202-105	. BRUSH . . . . .								2	
-10	209-5298	. MOTOR . . . . .								1	

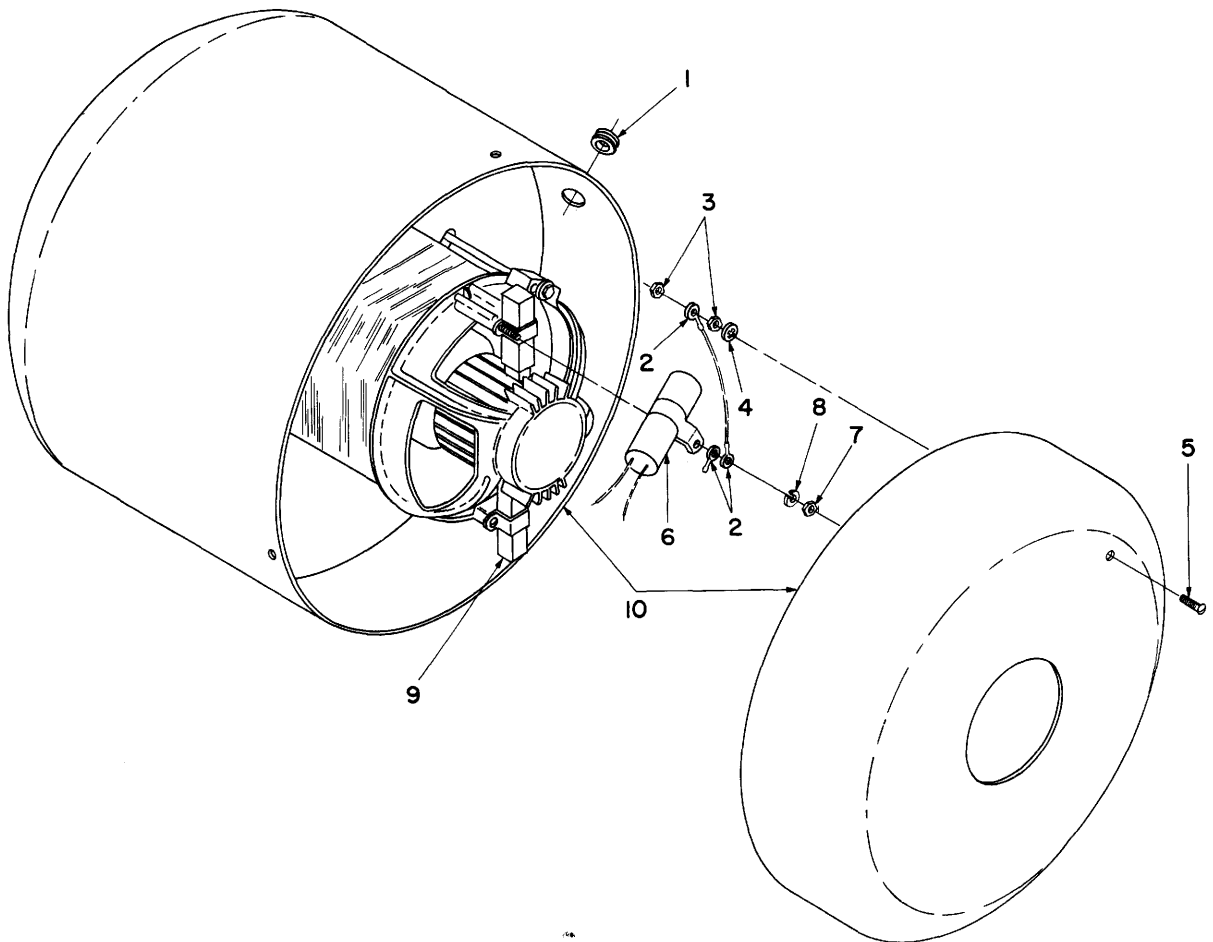


Figure 11. Vacuum Motor Assy

Section VII  
Group Assembly Parts List

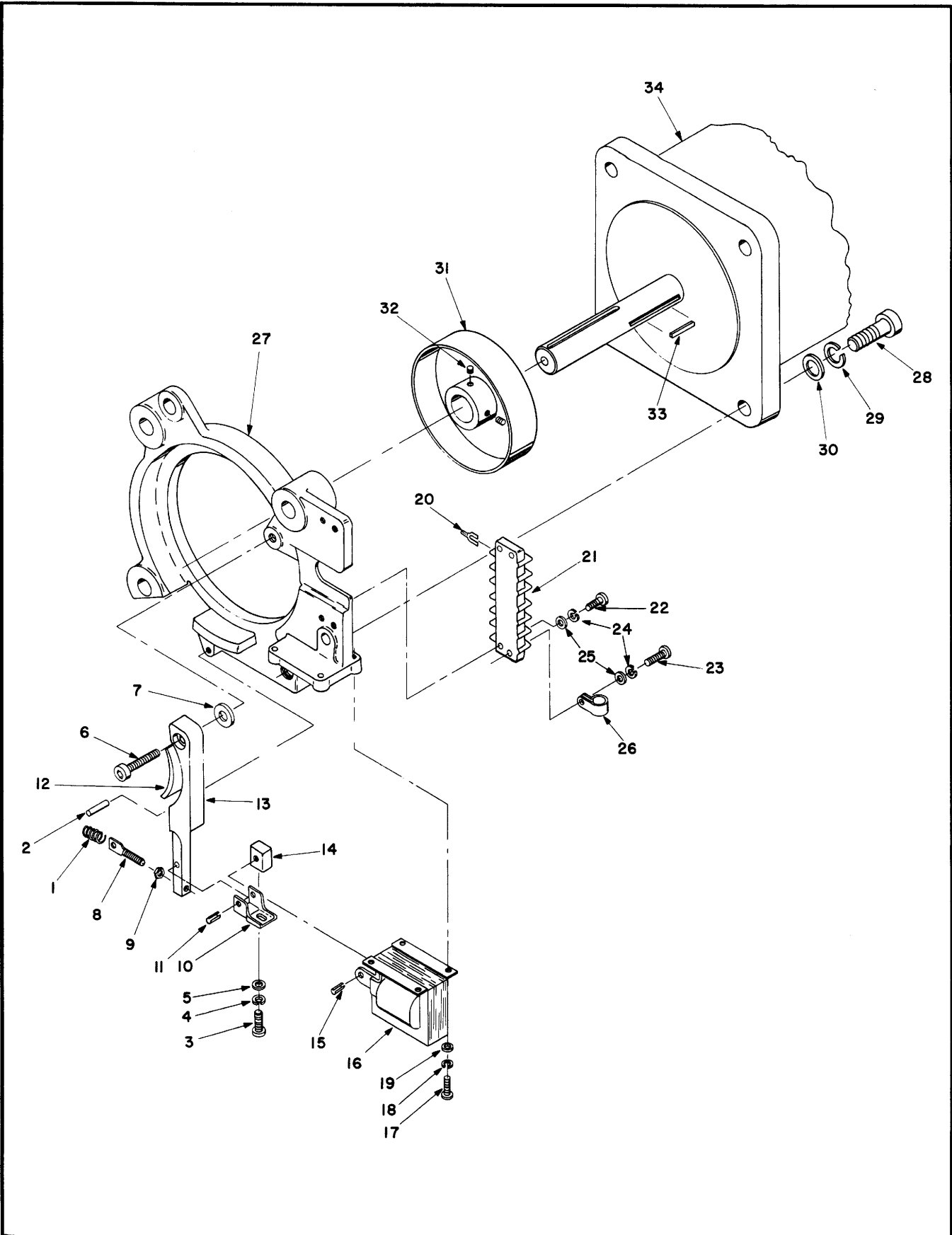


Figure 12. Servo Motor Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
SERVO MOTOR ASSYS											
USABLE ON CODE											
		Part No.	Code								
		300044-2	A								
		300045-2	B								
12-	300044-2	MOTOR ASSY, Servo (see fig. 2-72 for nha) . . . . .							Ref	1	A
12-	300045-2	MOTOR ASSY, Servo (see fig. 2-73 for nha) . . . . .							Ref	1	B
-1	408558	. SPRING . . . . .							1		
-2	195-2	. PIN, Groove . . . . .							1		
12-	428082-1	. ARM ASSY, Brake. . . . .							1		A
12-	428082-2	. ARM ASSY, Brake. . . . .							1		B
		(ATTACHING PARTS)									
-3	154-26	. SCREW . . . . .							1		
-4	147-2	. WASHER, Lock. . . . .							1		
-5	146-1	. WASHER, Flat . . . . .							1		
-6	166-502	. SCREW . . . . .							1		
-7	149-7319	. WASHER, Thrust . . . . .							1		
		---*---									
-8	166-9	. . BOLT, Eye . . . . .							1		
-9	171-3	. . NUT . . . . .							1		
-10	417283	. . YOKE . . . . .							1		
		(ATTACHING PARTS)									
-11	193-5	. . PIN . . . . .							1		
		---*---									
-12	352719	. . PAD . . . . .							1		
-13	352457-1	. . ARM . . . . .							1		A
-13	352457-2	. . ARM . . . . .							1		B
-14	417284	. BLOCK . . . . .							1		
		(ATTACHING PARTS)									
-15	193-5	. PIN . . . . .							1		
		---*---									
-16	123-6965	. RELAY . . . . .							1		A
-16	123-6966	. RELAY . . . . .							1		B
		(ATTACHING PARTS)									
-17	153-6	. SCREW . . . . .							4		
-18	147-2	. WASHER, Lock. . . . .							4		
-19	146-1	. WASHER, Flat . . . . .							4		
		---*---									
-20	177-6247	. TERMINAL, Lug . . . . .							1		
-21	73-1907	. TERMINAL BOARD . . . . .							1		
		(ATTACHING PARTS)									
-22	153-25	. SCREW . . . . .							3		
-23	153-33	. SCREW . . . . .							1		
-24	147-2	. WASHER, Lock. . . . .							4		
-25	146-1	. WASHER, Flat . . . . .							4		
		---*---									
-26	179-5	. CLAMP, Loop . . . . .							1		
-27	414224-2	. MOUNT . . . . .							1		A
-27	414224-1	. MOUNT . . . . .							1		B
		(ATTACHING PARTS)									
-28	162-38	. SCREW . . . . .							1		
-29	147-17	. WASHER, Lock. . . . .							1		
-30	146-22	. WASHER, Flat . . . . .							1		
		---*---									
-31	414598	. DRUM . . . . .							1		
		(ATTACHING PARTS)									
-32	165-25	. SETSCREW . . . . .							2		
		---*---									
-33	414640-10	. KEY . . . . .							1		
-34	414949	. MOTOR . . . . .							1		

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Group Assembly Parts List

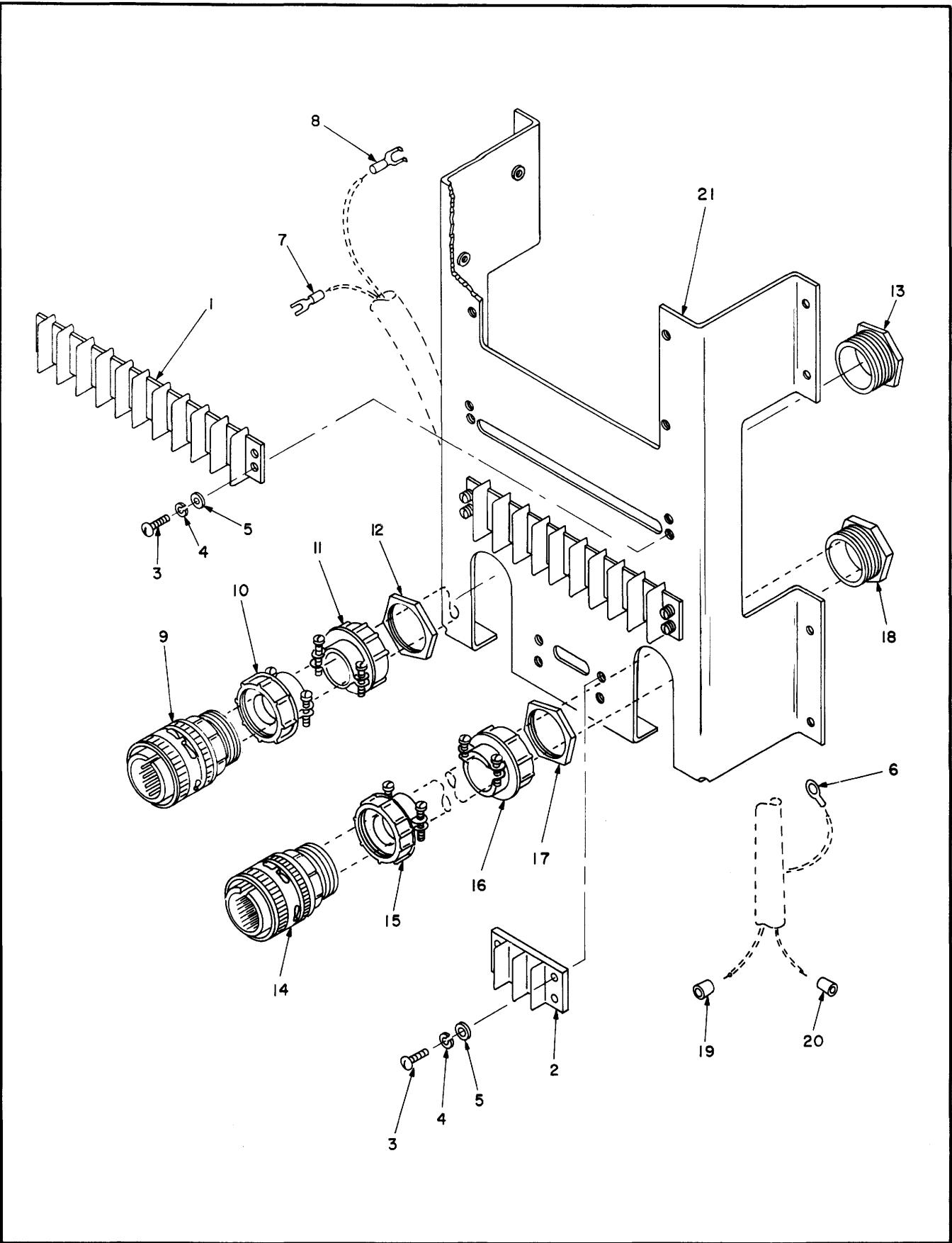


Figure 13. Harness Bracket Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
HARNES BRACKET ASSY											
13-	432424	BRACKET ASSY, Harness (see fig. 2-86 for nha) . . . . .								Ref	
-1	73-1921	. TERMINAL BOARD . . . . .								2	
-2	73-2001	. TERMINAL BOARD . . . . .								1	
		(ATTACHING PARTS)									
-3	154-6	. SCREW . . . . .								12	
-4	147-2	. WASHER, Lock . . . . .								12	
-5	146-30	. WASHER, Flat . . . . .								12	
		---*---									
-6	177-57	. TERMINAL, Lug . . . . .								1	
13-	372092-4	. WIRING HARNESS . . . . .								1	
-7	177-6247	. . . TERMINAL, Lug . . . . .								13	
-8	177-6250	. . . TERMINAL, Lug . . . . .								10	
13-	432423-1	. . . CABLE ASSY . . . . .								1	
-9	71-5056	. . . CONNECTOR . . . . .								1	
-10	243-5307	. . . CLAMP . . . . .								1	
-11	243-5305	. . . CLAMP . . . . .								1	
-12	71-5054	. . . NUT . . . . .								1	
-13	71-5053	. . . BOX . . . . .								1	
13-	185-5268	. . . BUSHING . . . . .								2	
13-	185-5269	. . . BUSHING . . . . .								1	
13-	432423-2	. . . CABLE ASSY . . . . .								1	
-14	71-5058	. . . CONNECTOR . . . . .								1	
-15	243-5307	. . . CLAMP . . . . .								1	
-16	243-5305	. . . CLAMP . . . . .								1	
-17	71-5054	. . . NUT . . . . .								1	
-18	71-5053	. . . BOX . . . . .								1	
-19	177-33	. . . FERRULE . . . . .								2	
-20	177-38	. . . FERRULE . . . . .								2	
13-	185-5268	. . . BUSHING . . . . .								2	
13-	185-5269	. . . BUSHING . . . . .								1	
-21	426191	. BRACKET . . . . .								1	

Section VII  
Group Assembly Parts List

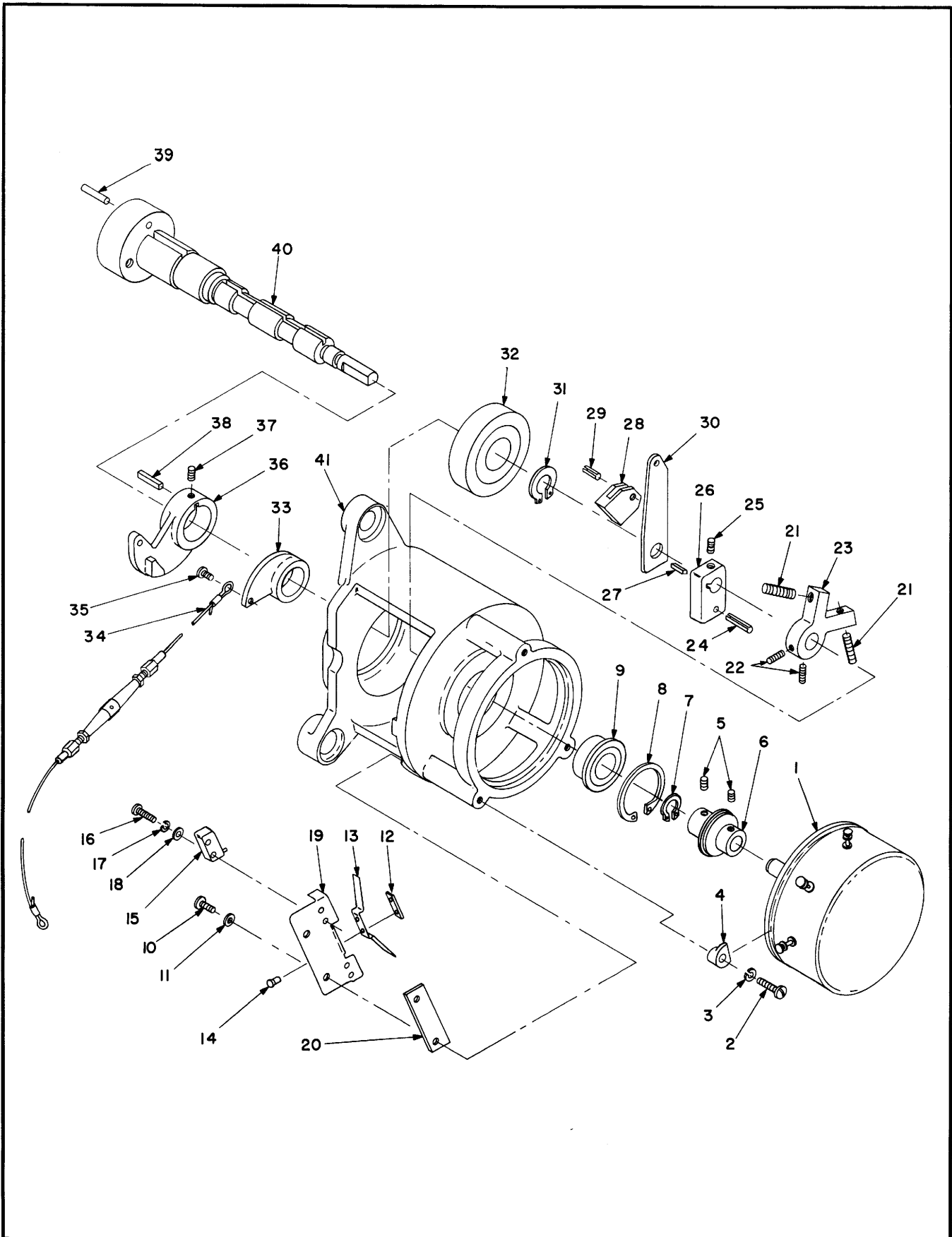


Figure 14. Shaft - Pot. Assys



Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION						MFR. CODE	UNITS PER ASSY	USABLE ON CODE	
		1	2	3	4	5	6				7
SHAFT - POT. ASSYS											
USABLE ON CODE											
		Part No.						Code			
		427595-1						A			
		427595-2						B			
14-	427595-1	SHAFT-POT. ASSY (see fig. 2-122)							Ref	A	
14-	427595-2	SHAFT-POT. ASSY (see fig. 2-123)							Ref	B	
-1	12-3	. RESISTOR							1		
(ATTACHING PARTS)											
-2	162-4	. SCREW							3		
-3	147-1	. WASHER, Lock							3		
-4	232-6319	. CLEAT							3		
---*---											
-5	165-33	. SETSCREW							2		
-6	228-5380	. COUPLING							1		
-7	144-13	. RING, Retaining.							1		
-8	144-62	. RING, Retaining.							1		
-9	206-5231	. BEARING, Ball							1		
14-	426066	. PLATE AND SWITCH ASSY							1		
(ATTACHING PARTS)											
-10	154-4	. SCREW							2		
-11	146-11	. WASHER							2		
---*---											
-12	426053	. . PAD							1		
-13	426054	. . SPRING							1		
(ATTACHING PARTS)											
-14	139-42	. . RIVET							2		
---*---											
-15	61-1686	. . SWITCH							2		
(ATTACHING PARTS)											
-16	154-48	. . SCREW							2		
-17	147-15	. . WASHER, Lock							2		
-18	146-10	. . WASHER, Flat							2		
---*---											
-19	426051	. . PLATE							1		
-20	426570	. SPACER							1		
-21	165-46	. SETSCREW							2		
-22	165-94	. SETSCREW							2		
-23	428628	. ACTUATOR							1		
14-	417760-2	. ARM ASSY							1	A	
14-	417760-1	. ARM ASSY							1	B	
-24	193-5	. . SETSCREW							1		
-25	165-25	. . SETSCREW							2		
-26	414417	. . ARM							1		
-27	414640-8	. KEY							1		
-28	415923	. YOKE							1		
(ATTACHING PARTS)											
-29	193-24	. PIN							1		
---*---											
-30	407652	. ARM							1		
-31	144-5	. RING, Retaining.							1		
-32	206-5226	. BEARING, Ball							1		
-33	414311-1	. ARM							1	A	
-33	414311-2	. ARM							1	B	
-34	427666	. CABLE							1		
(ATTACHING PARTS)											
-35	166-509	. SCREW							1		
---*---											
-36	414309-1	. ARM							1	A	
-36	414309-2	. ARM							1	B	
(ATTACHING PARTS)											
-37	165-25	. SCREW							1		
---*---											
-38	414640-9	. KEY							1		
-39	195-33	. PIN							2		
-40	428234	. SHAFT							1		
-41	427552-1	. MOUNT							1	A	
-41	427552-2	. MOUNT							1	B	

Section VII  
Group Assembly Parts List

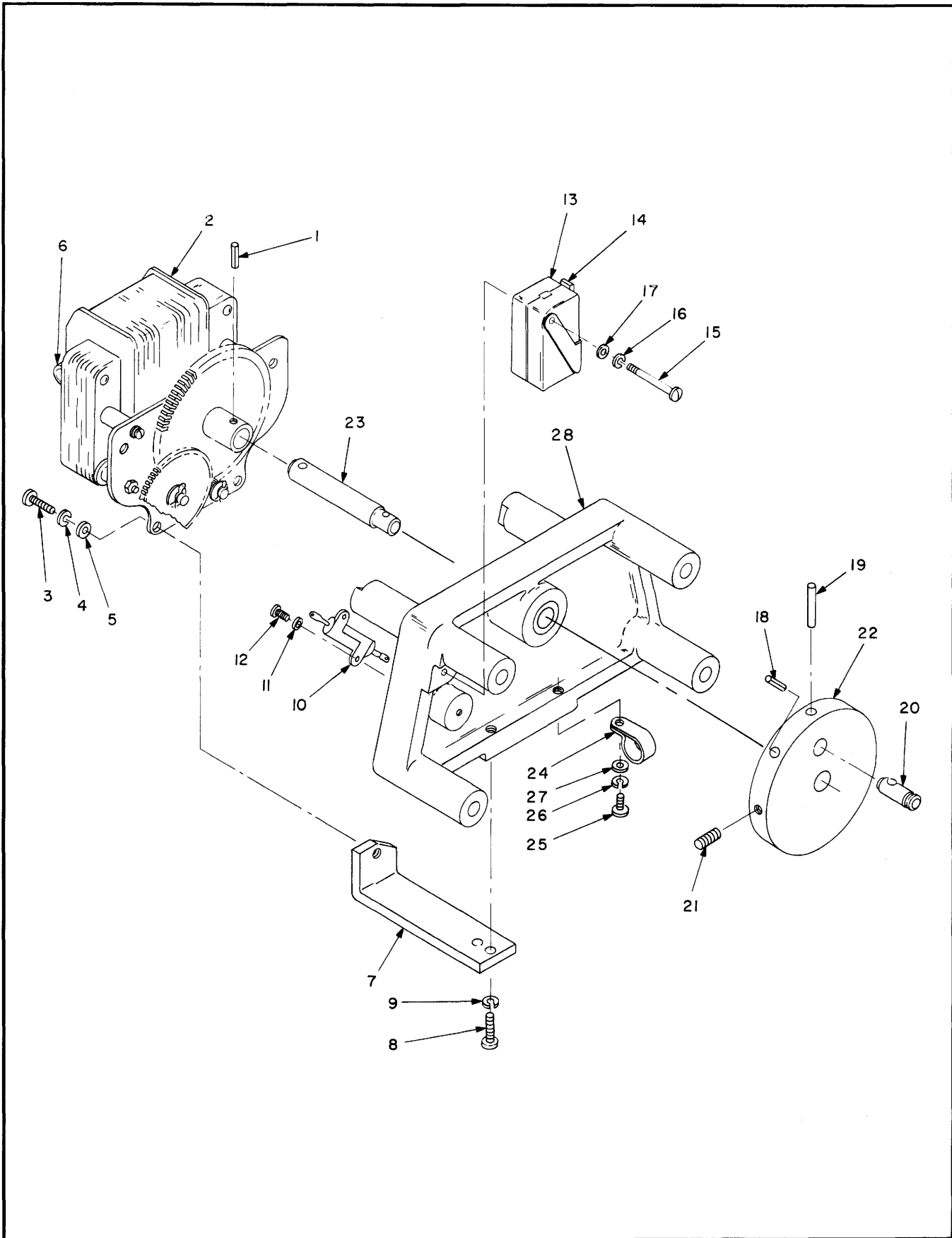


Figure 15. Cable Retraction Assy

Section VII  
Group Assembly Parts List

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION							MFR. CODE	UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7			
CABLE RETRACTION ASSY											
15-	428098-1	RETRACTION ASSY, Cable (see fig. 2-154 for nha).									Ref
-1	193-25	. PIN									1
-2	202-6443	. MOTOR									1
		. . (ATTACHING PARTS)									
-3	154-31	. SCREW									3
-4	147-1	. WASHER, Lock									3
-5	146-20	. WASHER									3
		----*----									
-6	179-4	. CLAMP									1
-7	427555	. BRACKET									1
		. . (ATTACHING PARTS)									
-8	154-91	. SCREW									2
-9	147-2	. WASHER, Lock									2
		----*----									
-10	10-40	. RESISTOR									1
		. . (ATTACHING PARTS)									
-11	154-37	. SCREW									2
-12	147-15	. WASHER, Flat									2
		----*----									
-13	61-1731	. SWITCH									1
-14	61-1765	. ACTUATOR									1
		. . (ATTACHING PARTS)									
-15	154-120	. SCREW									2
-16	147-15	. WASHER, Lock									2
-17	146-20	. WASHER, Flat									2
		----*----									
-18	193-7	. PIN									1
-19	193-9	. PIN									1
-20	426198	. PIN									1
-21	165-58	. SETSCREW									1
-22	427557	. CAM									1
-23	427556	. SHAFT									1
-24	179-11	. CLAMP									1
		. . (ATTACHING PARTS)									
-25	154-91	. SCREW									1
-26	147-2	. WASHER, Lock									1
-27	146-1	. WASHER, Flat									1
		----*----									
-28	426199	. MOUNT									1



## SECTION VIII SCHEMATIC DIAGRAMS

### 8-1. GENERAL

This section contains schematic diagrams for the MT-120 Magnetic Tape Transport and EC-120 Electronic Chassis.

### 8-2. SCHEMATIC DIAGRAMS

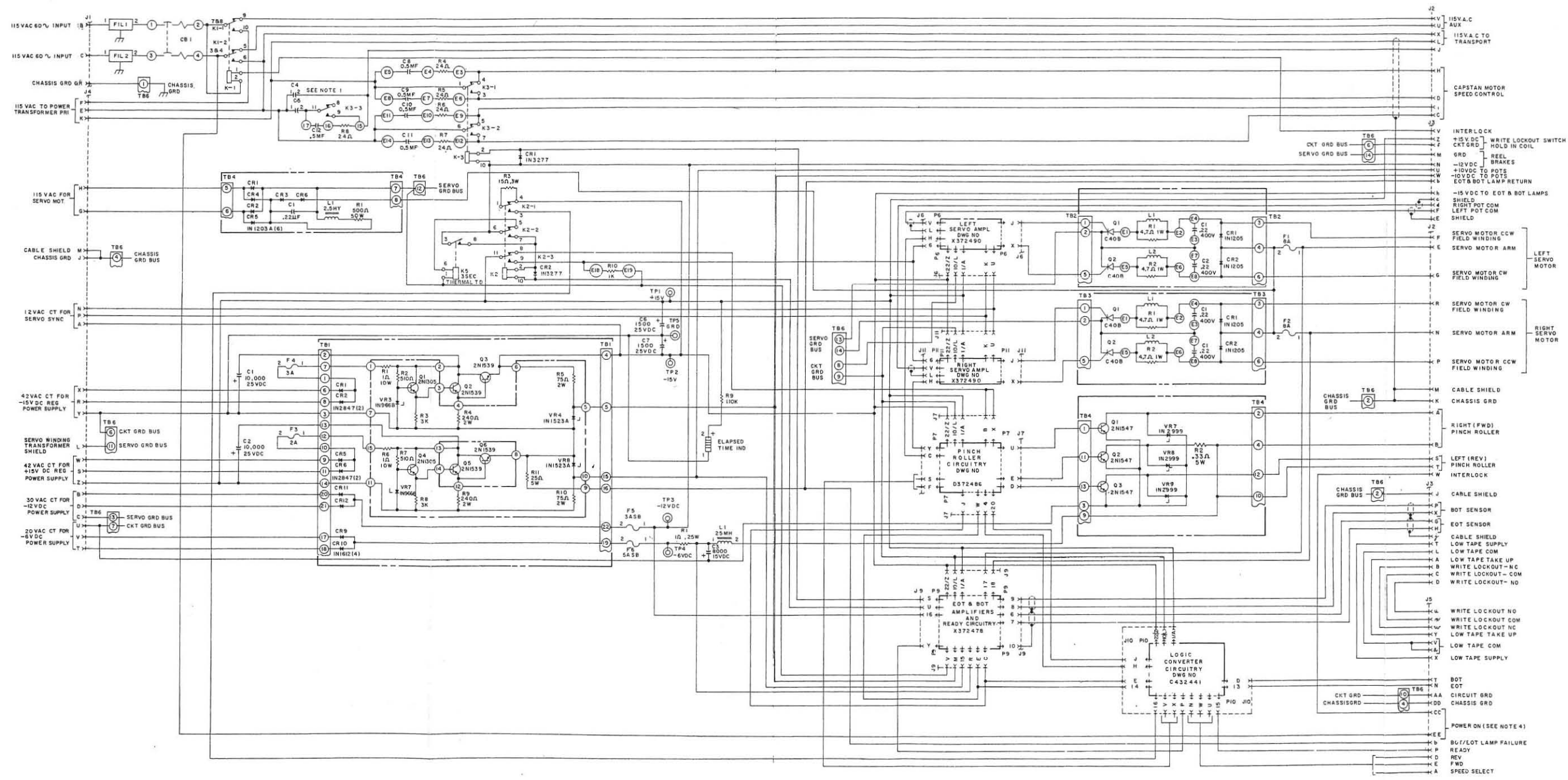
Table 8-1 lists the schematic diagrams referenced to the Potter Instrument Company, Inc. drawing numbers where applicable.

TABLE 8-1  
SCHEMATIC DIAGRAMS

Figure No.	Title	Potter Drawing No.	Revision Letter
8-1	EC-120 Electronic Chassis	J432385	F
8-2	MT-120 Tape Transport	D372496	E <sub>1</sub>
8-3	Pinch Roller Drive Card	D372486	H
8-4	Logic Converter Card	C432441	A
8-5	Servo Amplifier Card	X372490	D
8-6	EOT/BOT, And Ready Card	X372478	H
8-7	Transformer, Schematic	C430072	A



REV	DATE	DESCRIPTION	BY	APPROVED
A	10/25/57	REL FOR PROD	FH/...	KAC
B	11/22/57	ADDED R2	FH/...	KAC
C	12/17/57	R3, WINDS 24.1W	FH/...	KAC
D	1/14/58	REVERSE 24.1W	FH/...	KAC
E	2/11/58	NOTE 4 WAS PINS C4 & C5 MUST BE SHIPPED TOGETHER SW. C4, 1 INTERLOCK SW. C4, 1 BEFORE THE POWER CAN BE TURNED ON.	FH/...	KAC
F	7/21/58		FH/...	KAC



NOTES:  
1. C4 AND C5 VALUES PER MT-120 CAPSTAN MOTOR REQUIREMENTS AS FOLLOWS:

MOTOR NO.	C4	C5
S202-6348	8	
S202-6349	8	
S202-6351	8	
S202-6401	8	
S202-6409	10	
S202-6410	8	12
S202-6418	10	
S202-6422	10	
S202-6427	10	
S202-6384	10	
S202-6423	10	2
S202-6414	10	
S202-6419	10	
S202-6447	10	2

2. UNLESS OTHERWISE INDICATED: CAPACITOR VALUES ARE IN  $\mu$ F; RESISTORS ARE 1/2W 5%.

3. SPARE PINS:  
 J1 - NO SPARES  
 J2 - NO SPARES  
 J3 - K, R, S, Q, E, G, M, N, P, R, X  
 J4 - NO SPARES  
 J5 - B, C, F, H, L, M, R, S, U, W, Z, C, D, E, J, K, N, P, T, V, Y  
 J6 - 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21  
 B, C, D, E, F, M, N, P, R, S, T, W, Y  
 J7 - 2, 3, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, K, M, N, P, R, T, V  
 J8 - NOT USED  
 J9 - 2, 3, 4, 5, 11, 12, 13, 14, 15, 20, 21, B, D, F, H, J, K, N, P, T, W, X  
 J10 - 2, 3, 4, 5, 6, 7, 8, 9, 12, 17, 18, 19, 20, 21, B, C, F, M, R, S, T, Y  
 J11 - SAME AS J6  
 J12 - SAME AS J6

4. PINS C & E MUST BE CONNECTED TOGETHER THRU A TWO POSITION SWITCH IN ORDER TO PROPERLY CONTROL THE APPLICATION OF POWER.

WIRING R/L	HARNESS R/L
A 432388	A 432387

FIGURE 8-1

QTY	QTY	ITEM	DESCRIPTION	PART OR	NOMENCLATURE OR
REQD	REQD	NO.	(SIZE)	IDENTIFYING NO.	DESCRIPTION

UNLESS OTHERWISE SPECIFIED:  
 DIMENSIONS ARE IN INCHES  
 DIMENSIONS IN PARENTHESES ARE FOR REFERENCE ONLY  
 ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED  
 1. REMOVE ALL BURRS FROM PARTS  
 2. BRASS ALL SURFACES UNLESS OTHERWISE SPECIFIED

DATE: 12-15-57  
 DRAWN: J. J. JENSEN  
 CHECKED: J. J. JENSEN  
 APPROVED: J. J. JENSEN

SCALE: 1" = 1"

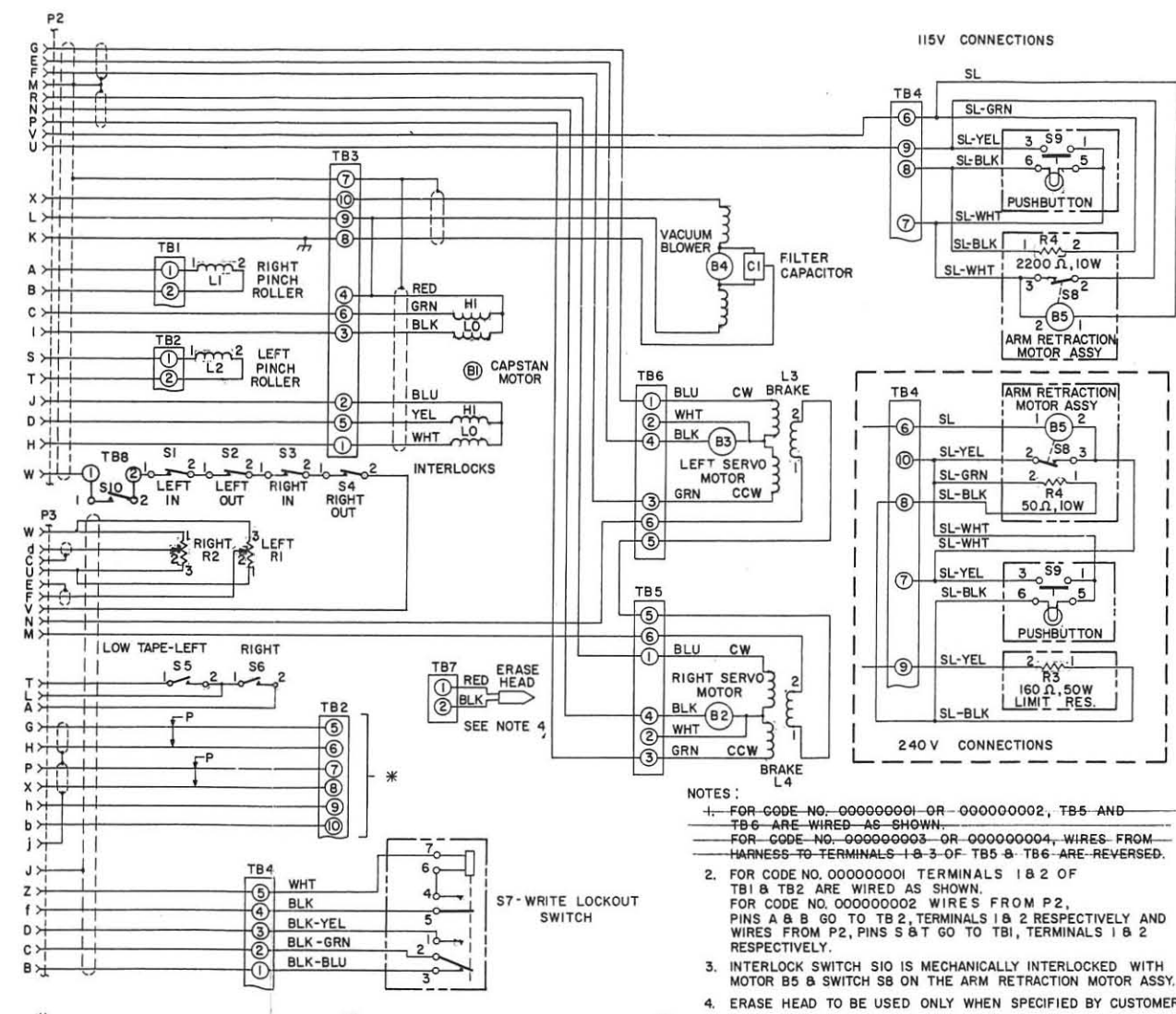
EC120-  
 X41427  
 NEXT ASSY: USED ON  
 APPLICATION:

POTTER INSTRUMENT CO., INC.  
 PLANVIEW, L.I., N.Y.

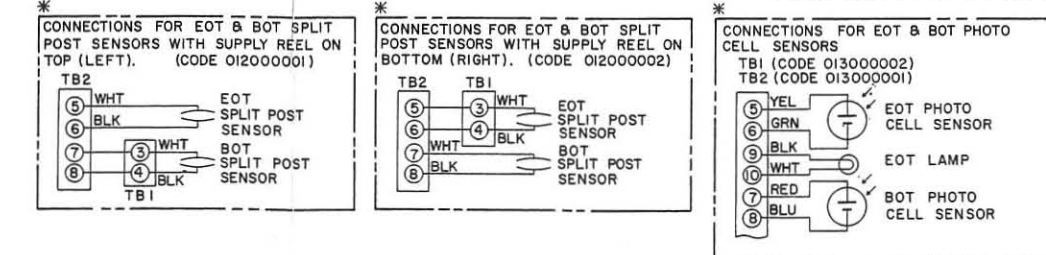
SCHEMATIC  
 ELECTRONIC CHASSIS

BOOK IDENT NO. 48294  
 SHEET NO. J  
 PART NO. 432385

REVISIONS						
SYM	ECN	ZONE	DFT	DESCRIPTION	DATE	APPROVAL
A			AC	REL FOR PROD		
B				...		
C				...		
D				...		
E				...		
F				...		
G				...		



- NOTES:
- FOR CODE NO. 00000001 OR 00000002, TB5 AND TB6 ARE WIRED AS SHOWN. FOR CODE NO. 00000003 OR 00000004, WIRES FROM HARNESS TO TERMINALS 1 & 3 OF TB5 & TB6 ARE REVERSED.
  - FOR CODE NO. 00000001 TERMINALS 1 & 2 OF TB1 & TB2 ARE WIRED AS SHOWN. FOR CODE NO. 00000002 WIRES FROM P2, PINS A & B GO TO TB2, TERMINALS 1 & 2 RESPECTIVELY AND WIRES FROM P2, PINS S & T GO TO TB1, TERMINALS 1 & 2 RESPECTIVELY.
  - INTERLOCK SWITCH S10 IS MECHANICALLY INTERLOCKED WITH MOTOR B5 & SWITCH S8 ON THE ARM RETRACTION MOTOR ASSY.
  - ERASE HEAD TO BE USED ONLY WHEN SPECIFIED BY CUSTOMER.



MODEL NO.	RUNNING LIST
MT 120	A 37249B
MT 120-X 41427	A 43242B

FIGURE 8-2

QTY. REQD.	QTY. REQD.	QTY. REQD.	ITEM NO.	DWG. NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES  
 FRACTIONS ±.015  
 DECIMALS ±.005  
 ALL DIMENSIONS BEFORE PROTECTIVE FINISH  
 1. REMOVE ALL BURRS  
 2. BREAK ALL SHARP EDGES .010R APPROX.

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POTTER INSTRUMENT CO., INC.  
PLAINVIEW, L.I., N.Y.

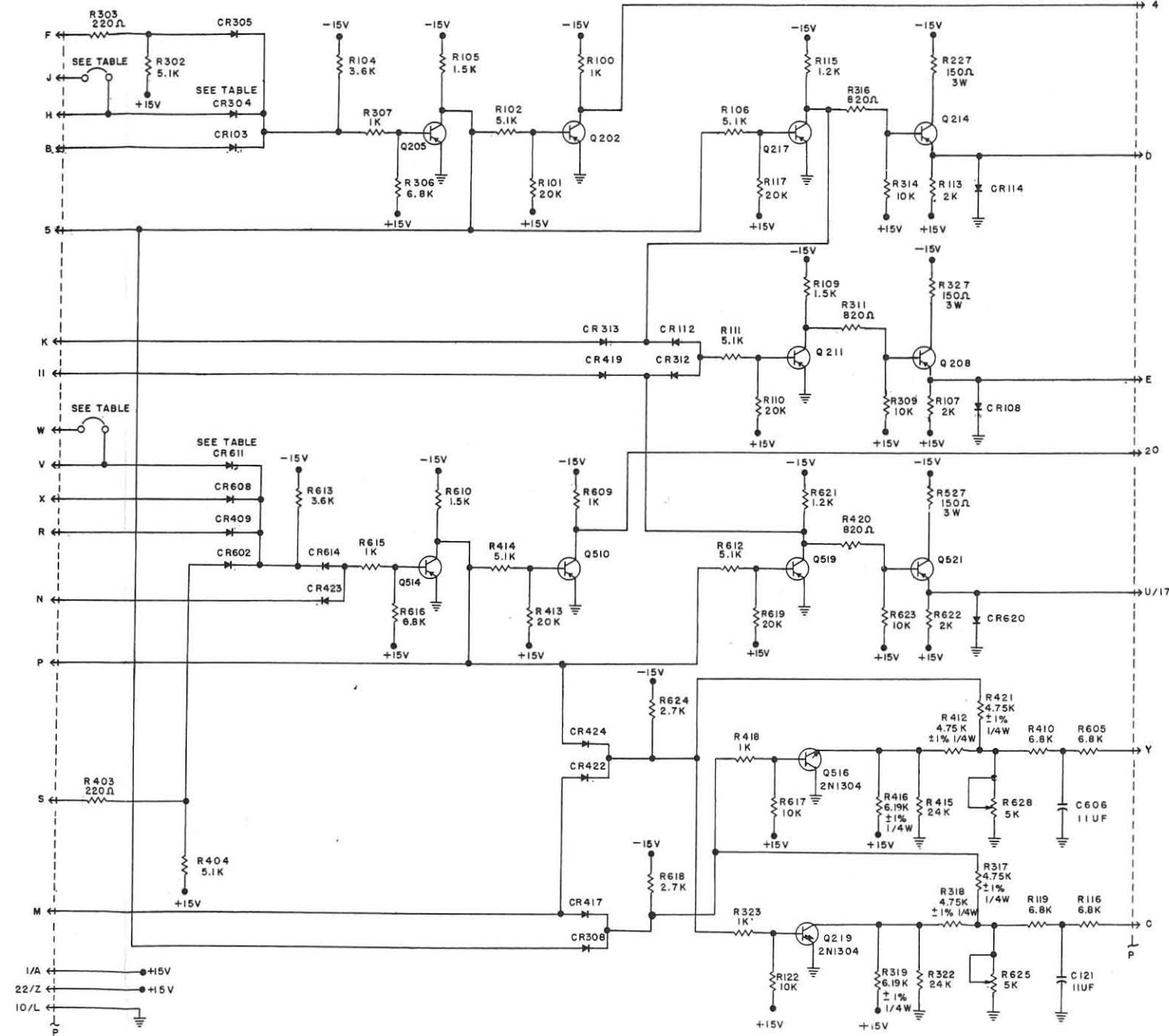
SCHEMATIC FOR TRANSPORT WIRING

CODE IDENT NO. 48294 SIZE D 372496

SCALE SHEET



REVISIONS					
SYM	ECN	ZONE	DESCRIPTION	DATE	APPROVAL
G	1604E		COMPLETELY REDESIGNED	12-11-64	R2H / JH
H	162-0	B-6	R403 WAS 1K	1-5-65	R2H / JH



NOTES: UNLESS OTHERWISE SPECIFIED  
 1. ALL RESISTORS ARE IN OHMS 1/2W ± 5%  
 2. ALL DIODES ARE IN 270.  
 3. ALL TRANSISTORS ARE 2N1305.

MODULE ASSY NO.	COMP SELECTION	
	WIRE JUMPERS	CR304 CR611
D372485-1	X	X
D372485-2		X
D372485-3		

MODULE ASSY  
D372485-1,2,3

FIGURE 8-3

QTY. REQD.	QTY.	QTY. REQD.	ITEM NO.	DWG. NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED  
 DIMENSIONS ARE IN INCHES  
 TOLERANCES  
 FRACTIONS: ±.015  
 DECIMALS: ±.005  
 ANGLES: ±1/2°  
 ALL DIMENSIONS BEFORE PROTECTIVE FINISH  
 1. REMOVE ALL BURRS  
 2. BREAK ALL SHARP EDGES .010R APPROX.

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PLAINVIEW, L.I., N.Y.

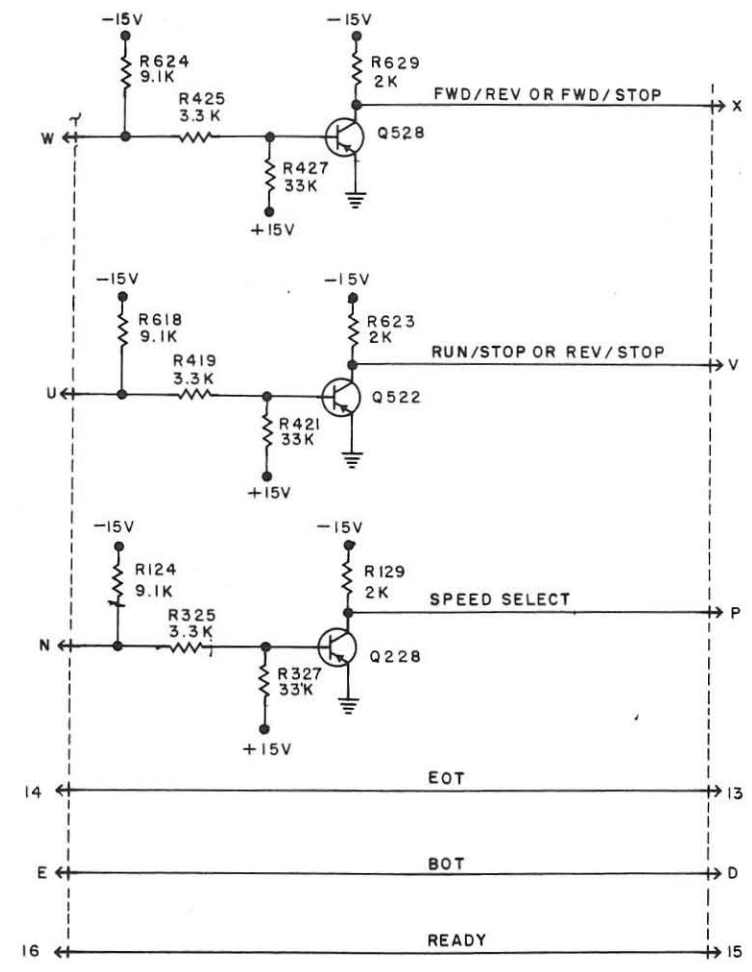
**SCHEMATIC  
PINCH ROLLER  
FWD/STOP REV/STOP**

CODE IDENT NO. 48294 SIZE D 372486

SCALE 1/4" = 1"

SHEET

REVISIONS						
SYM	ECN	ZONE	DFT	DESCRIPTION	DATE	APPROVAL
A	40967		RF	REL FOR PROD	7/12/65	CRM / 1971



NOTES: UNLESS OTHERWISE SPECIFIED  
 1 ALL RESISTORS ARE IN OHMS 1/2 W  $\pm$  5%  
 2 ALL TRANSISTORS ARE 2N1305.

MODEL NO	MOD ASSY
LCV 120 CODE 222911199	D432440

FIGURE 8-4

QTY. REQD.	QTY. REQD.	QTY. REQD.	ITEM NO.	DWG. SIZE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
------------	------------	------------	----------	-----------	-------------------------	-----------------------------

LIST OF MATERIAL  
**POTTER INSTRUMENT CO., INC.**  
 PLAINVIEW, L.I., N.Y.

UNLESS OTHERWISE SPECIFIED  
 DIMENSIONS ARE IN INCHES  
 TOLERANCES  
 FRACTIONS  $\pm$ .015  
 DECIMALS  $\pm$ .005  
 ANGLES  $\pm$  1/2°  
 ALL DIMENSIONS BEFORE  AFTER   
 PROTECTIVE FINISH  
 1. REMOVE ALL BURRS  
 2. BREAK ALL SHARP EDGES .010R APPROX.  
 MATERIAL

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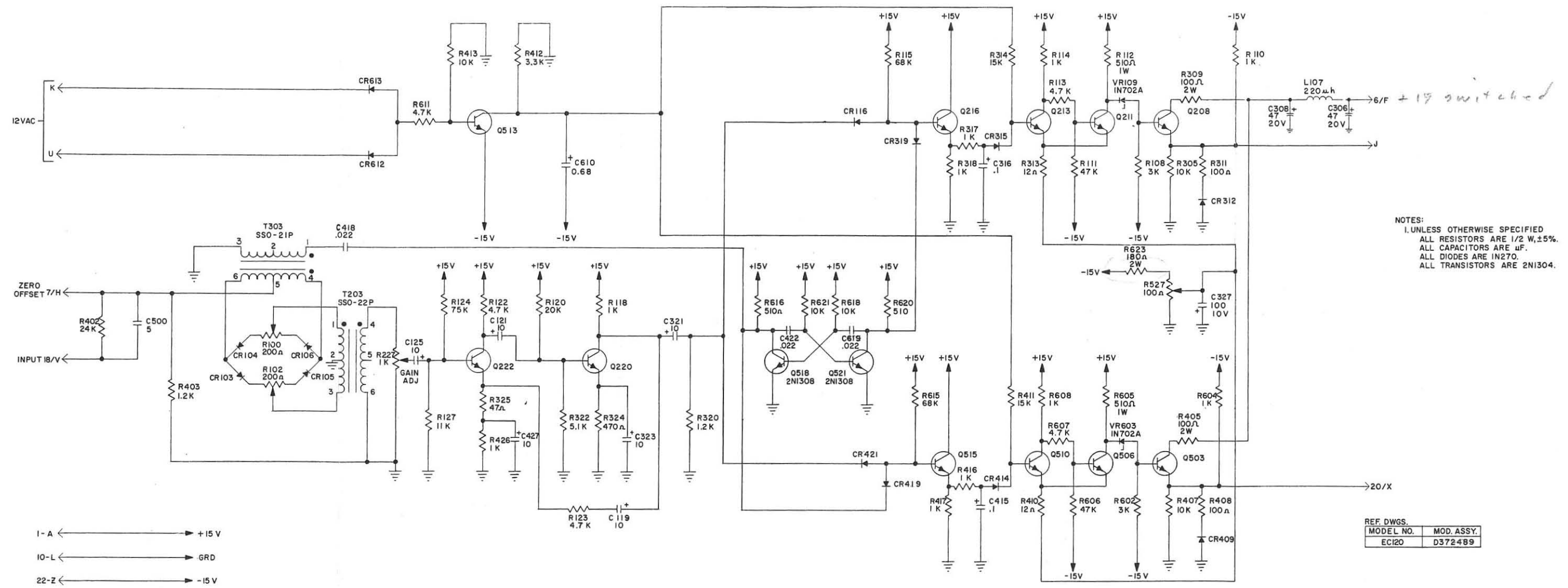
NAME	DATE
W. J. ...	2/10/65
M. J. ...	2/12/65
ENG. ...	2/12/65

**SCHEMATIC LOGIC CONVERTER**

EC120
EC120-X41427
NEXT ASSY USED ON
APPLICATION

CODE IDENT NO.	SIZE	
48294	C	432441
SCALE	SHEET	

REV	DATE	DESCRIPTION	APPROVAL
A	10/21/54	REL FOR PROD	
B	11/1/54	REVISED FOR PROD	
C	11/1/54	REVISED FOR PROD	
D	11/1/54	REVISED FOR PROD	



NOTES:  
1. UNLESS OTHERWISE SPECIFIED  
ALL RESISTORS ARE 1/2 W, ±5%.  
ALL CAPACITORS ARE μF.  
ALL DIODES ARE IN270.  
ALL TRANSISTORS ARE 2N1304.

REF DWGS.	MOD. ASSY.
EC120	D372489

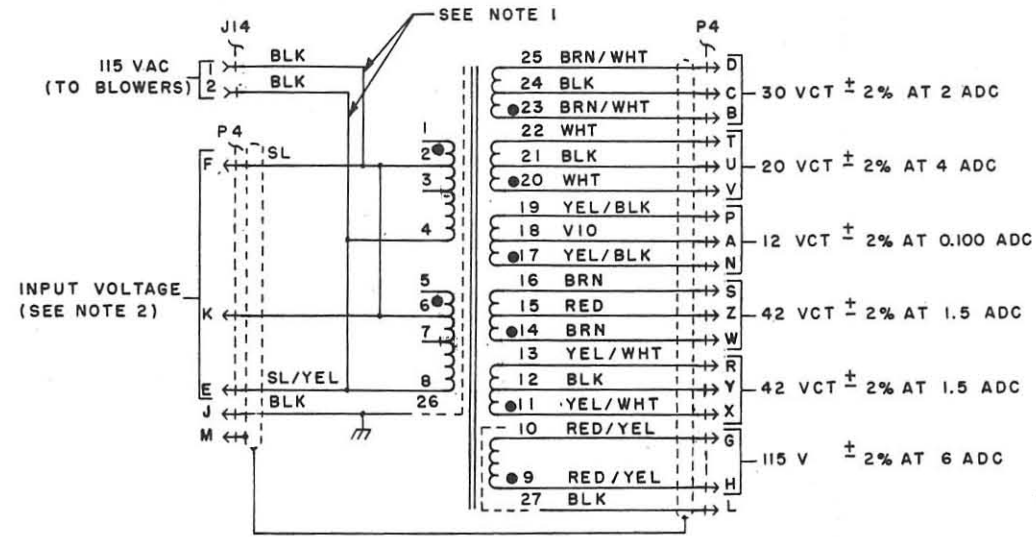
1-A ← → +15 V  
10-L ← → GRD  
22-Z ← → -15 V

FIGURE 8-5

QTY	QTY	QTY	ITEM	SIZE	PART OR	NOMENCLATURE OR
REQD	REQD	REQD	NO	IDENTIFYING	NO	DESCRIPTION
LIST OF MATERIAL						
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES						
FRACTIONS: 1/16, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 1/2, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 1/2, 2 3/4, 3, 3 1/8, 3 1/4, 3 1/2, 3 3/4, 4, 4 1/8, 4 1/4, 4 1/2, 4 3/4, 5, 5 1/8, 5 1/4, 5 1/2, 5 3/4, 6, 6 1/8, 6 1/4, 6 1/2, 6 3/4, 7, 7 1/8, 7 1/4, 7 1/2, 7 3/4, 8, 8 1/8, 8 1/4, 8 1/2, 8 3/4, 9, 9 1/8, 9 1/4, 9 1/2, 9 3/4, 10, 10 1/8, 10 1/4, 10 1/2, 10 3/4, 11, 11 1/8, 11 1/4, 11 1/2, 11 3/4, 12, 12 1/8, 12 1/4, 12 1/2, 12 3/4, 13, 13 1/8, 13 1/4, 13 1/2, 13 3/4, 14, 14 1/8, 14 1/4, 14 1/2, 14 3/4, 15, 15 1/8, 15 1/4, 15 1/2, 15 3/4, 16, 16 1/8, 16 1/4, 16 1/2, 16 3/4, 17, 17 1/8, 17 1/4, 17 1/2, 17 3/4, 18, 18 1/8, 18 1/4, 18 1/2, 18 3/4, 19, 19 1/8, 19 1/4, 19 1/2, 19 3/4, 20, 20 1/8, 20 1/4, 20 1/2, 20 3/4, 21, 21 1/8, 21 1/4, 21 1/2, 21 3/4, 22, 22 1/8, 22 1/4, 22 1/2, 22 3/4, 23, 23 1/8, 23 1/4, 23 1/2, 23 3/4, 24, 24 1/8, 24 1/4, 24 1/2, 24 3/4, 25, 25 1/8, 25 1/4, 25 1/2, 25 3/4, 26, 26 1/8, 26 1/4, 26 1/2, 26 3/4, 27, 27 1/8, 27 1/4, 27 1/2, 27 3/4, 28, 28 1/8, 28 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280						



REVISIONS						
SYM	ECN	ZONE	DESCRIPTION	DFT.	DATE	APPROVAL
A	40502	-	REL. FOR FKOD.	CG	2/4/64	[Signature]



INPUT VOLTAGE	P4-E TO	P4-F TO	JUMP TERMINALS
107.5 V	8	3	3 & 7, 4 & 8
115 V	8	2	2 & 6, 4 & 8
122.5 V	8	1	1 & 5, 4 & 8
215 V	8	3	4 & 7
230 V	8	2	4 & 6
245 V	8	1	4 & 5

- NOTES:
- J14 AND ASSOCIATED WIRES USED ONLY WHEN MTS-120 IS USED WITH PICO CABINET CT120 OR M3340.
  - TRANSFORMER PRIMARY SHOWN WIRED FOR 115 V INPUT. FOR OTHER INPUT VOLTAGES, REFER TO TABLE.

RUNNING LIST WIRING	RUNNING LIST HARNESS	TRANSFORMER ASSEMBLY
A430096	A430095	C430099

FIGURE 8-7

QTY. REQD.	QTY. REQD.	QTY. REQD.	ITEM NO.	DWG. SIZE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
LIST OF MATERIAL						

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES  
TOLERANCES  
FRACTIONS ±.015  
DECIMALS ±.005  
ANGLES ± 1/2°  
ALL DIMENSIONS BEFORE PROTECTIVE FINISH  
AFTER PROTECTIVE FINISH  
1. REMOVE ALL BURRS  
2. BREAK ALL SHARP EDGES .010R APPROX.  
MATERIAL  
FINISH

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NAME	DATE
DRAWN C. Guano	1-30-64
CHECKED [Signature]	2-4-64
ENGR N. Lipore	2-4-64

**POTTER INSTRUMENT CO., INC.**  
PLAINVIEW, L.I., N.Y.

## SCHEMATIC, TRANSFORMER

CODE IDENT NO.	SIZE	
48294	C	430072

SCALE ~ SHEET

TR-120	USED ON
APPLICATION	