

TALLY

INSTRUCTION MANUAL

M O D E L

420

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CONTENTS

	<u>Page</u>
INTRODUCTION	1
ENVIRONMENT	1
PHYSICAL SPECIFICATIONS	1
INPUT REQUIREMENTS	1
TAPE HANDLING	1
OPERATING INSTRUCTIONS	2
CLUTCH PROTECTION	2
THREADING TAPE	2
MECHANICAL OPERATION	3
REEL DRIVE MECHANISM	3
CAPSTAN DRIVE	4
PERFORATOR MECHANISM	4
PUNCH HEAD ASSEMBLY	6
ELECTRICAL OPERATION	6
ESCAPEMENT OPERATION	6
BUZZ SWITCH	6
TAPE FEED SWITCH	6
TERMINATIONS	6
CYCLE LENGTH LIMITATIONS	6
SUPPRESSION	7
PREVENTIVE MAINTENANCE	7
DAILY MAINTENANCE	7
250 HOUR MAINTENANCE	7
500 HOUR MAINTENANCE	8
MAINTENANCE PROCEDURES	8
DIE BLOCK CLEANING	8
HOLE SPACING ADJUSTMENTS	8
ESCAPEMENT ADJUSTMENTS, CAPSTAN DRIVE MECHANISM	10
ESCAPEMENT ADJUSTMENTS, PERFORATOR MECHANISM	11
FRICTION CLUTCH TORQUE, CAPSTAN DRIVE MECHANISM	11
REELING ADJUSTMENT	12
WEAR POINTS, ESCAPEMENT ASSEMBLIES	12
LUBRICATION	13

CONTENTS (Continued)

	<u>Page</u>
PARTS REPLACEMENT	15
MOTOR	15
PERFORATOR MECHANISM	15
DIE PLATE REMOVAL	16
CAPSTAN DRIVE MECHANISM	16
OPTIONS	17
TAPE SUPPLY STATUS	17
END OF TAPE SWITCH	17
LOW TAPE SUPPLY SWITCH	18
TELETYPESETTER OPTION	18
CARBIDE PUNCH OPTION	19
5 CHANNEL OPTION	19
100/115 VAC, 50 HERTZ	19
230/50 HERTZ	19
MEASUREMENTS, TOLERANCES	20
TROUBLE SHOOTING	22
PARTS ORDERING PROCEDURE	26
RECOMMENDED TOOL LIST	26
RECOMMENDED SPARE PARTS	27
PARTS LISTS	28
NUMERIC PARTS LIST	43

ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1	MODEL 420 TAPE PERFORATOR	iv
2	UNLATCHED WIRE SPRING CLUTCH	2
3	THREADING TAPE	3
4	REEL DRIVE MECHANISM	3
5	CAPSTAN DRIVE MECHANISM	4
6	PERFORATOR MECHANISM	5
7	CLUTCH LINKAGE ASSEMBLY	5
8	SUPPRESSION COMPONENT VALUES	7
9	SUPPRESSION DIAGRAM	7
10	PAPER TAPE STANDARDS	9
11	HEEL GAP AND TIP CLEARANCE	10
12	TIP CLEARANCE ADJUSTMENT	10
13	ARMATURE SPRING TENSION	11
14	MEASURING FRICTION CLUTCH TORQUE	12
15	WEAR POINTS , ESCAPEMENT ASSEMBLIES	13
16	LUBRICATION POINTS	14
17	TYPICAL ACCESSORY BLOCK WIRING	17
18	END OF TAPE SWITCH	17
19	LOW TAPE SUPPLY SWITCH	18
20	CAPSTAN DRIVE MECHANISM, ESCAPEMENT ADJUSTMENTS	20
21	PERFORATOR MECHANISM, ESCAPEMENT ADJUSTMENTS	20
22	TIMING DIAGRAM	24
23	WIRING DIAGRAM	25
24	GENERAL ASSEMBLY (FRONT VIEW)	29
25	GENERAL ASSEMBLY (REAR VIEW)	31
26	PERFORATOR MECHANISM	33
27	CAPSTAN DRIVE MECHANISM, BALL BEARING	35
28	CAPSTAN DRIVE MECHANISM, BUSHINGS	35
29	REEL DRIVE MECHANISM, BUSHINGS	37
30	REEL DRIVE MECHANISM, BALL BEARINGS	37
31	TAPE GUIDE ASSEMBLY	39
32	IDLER MECHANISM ASSEMBLY	40
33	TENSION ARM ASSEMBLY	41
34	TAPE SUPPLY SLIDE ASSEMBLY	42

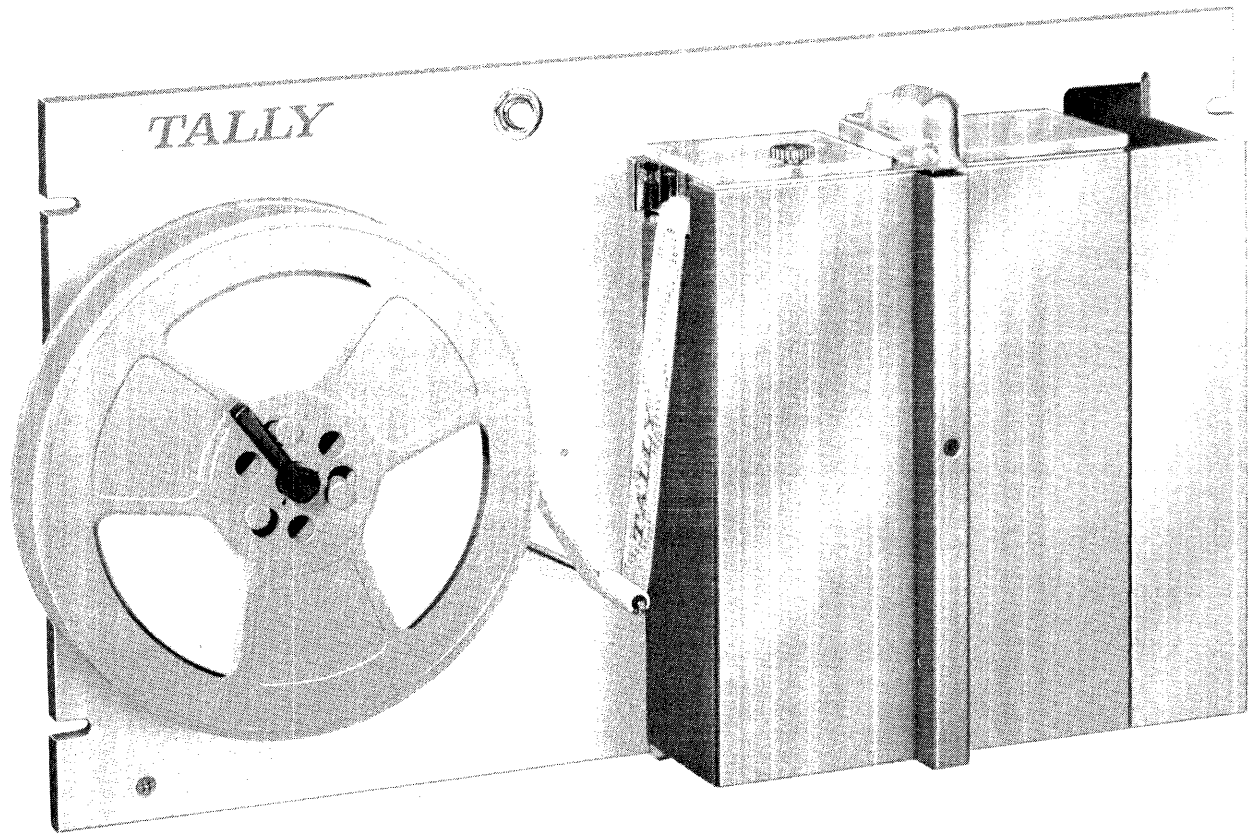


Figure 1
MODEL 420 TAPE PERFORATOR

INTRODUCTION

The Tally Model 420 Tape Perforator is designed to operate at speeds up to 60 characters per second. It is capable of perforating tapes of varying widths up to one inch maximum, eight channels. The unit is asynchronous and each character punched is initiated by a separate independent pulse. Therefore, it can be operated at any repetition rate below the maximum.

Many options are available for the Model 420 which make it readily adaptable for a variety of applications. The standard unit is bi-directional, and is designed for eight channel operation. It requires 115VAC, 60 Hz for motor operation, and 48VDC pulses to the advance and punch coils. All variations from this standard, though they are considered to be options, are discussed in applicable sections of the manual through use of footnotes and parentheses. Special features, such as Low Tape and End-of-Tape, are discussed under *Options*.

ENVIRONMENT

The unit is designed for continuous operation in a temperature range of 50 to 110 degrees Fahrenheit at 20 to 85 percent relative humidity, as long as no temperature/humidity combination produces condensation. Satisfactory cooling, particularly at high temperatures, requires that the unit be provided with adequate ventilation.

PHYSICAL SPECIFICATIONS

The unit is 19 inches wide, 10.5 inches high, extends 3.25 inches to the front of the panel, 9.5 inches to the rear of the panel, and weighs 28 pounds.

INPUT REQUIREMENTS

1. The drive motor requires a source of 115 or 230 VAC $\pm 10\%$ at 50 or 60 ± 1.5 Hz.

NOTE: The 230 volt and 50 Hz operations are options. Wiring to the drive motor differs with voltage change 115/230, see Wiring Diagram, Figure 23. Pulley ratios differ with Hertz change.

2. The eight data lines, the sprocket and tape feed pulse line, and the reverse escapement line require DC input pulses with the following characteristics.

CAUTION: A steady current of rated voltage will burn out the coils.

- A. Pulse duration of 4.5 ± 0.5 milliseconds.
 - B. Pulse amplitude of 48 or 24 volts $\pm 10\%$, according to customer specifications.
 - C. One pulse must be supplied for each movement of the tape and for each character to be punched.
 - D. The eight data pulses and the sprocket and feed pulses must be simultaneous within ± 0.5 milliseconds.
 - E. The minimum time between drive pulses (leading edge to leading edge) must be 16.7 milliseconds for the maximum speed of 60 characters per second. Refer to Timing Diagram, Figure 22, for time relationships of pulses during one cycle.
 - F. Where suppression is to be incorporated with associated equipment, the conditions specified under *Suppression*, Page 7, must be met.
3. A customer supplied source of drive pulses is required for use with the Buzz switch to provide tape leader. These pulses must meet the requirements specified above.

TAPE HANDLING

The unit is provided with a free-wheeling tape supply reel and braking system mounted behind the right side of the panel. It is magnetically latched, and can be pulled out from the front for refill. Tape is fed by the capstan, eliminating the need for a separate tape feed mechanism. Tape take-up is accomplished through a reel drive mechanism mounted on the left rear side of the panel. It consists essentially of a differential gear arrangement and a braking mechanism. A tape tension arm on the front of the panel controls the reel drive mechanism while preventing slack in the tape.

OPERATING INSTRUCTIONS

NOTE: Before operating, check oil in the perforator drive mechanism, and add oil if necessary. See Lubrication, Page 13. Be sure adequate provisions for clutch protection have been made (see Clutch Protection).

CLUTCH PROTECTION

Occasionally, when the unit has been subjected to shock or to noise pulses at shutdown, wire spring clutches become unlatched. These clutches are designed to grip the shaft on which they are mounted—but only on command. A clutch unlatched while the unit is off will be partially latched at start up, and will remain so until pulsed at full motor speed; the resulting friction produces intense heat.

Figure 2 shows an unlatched clutch. In this condition, its wire spring will be firmly gripping the shaft. When AC power is applied to the motor, the clutch will rotate with the shaft until the control sleeve contacts the armature. This contact must be made with enough force to unwind the spring and release the shaft. The rotation allowed in Figure 2 is not enough; neither is an additional 180 degrees allowed by pulsing the escapement before the shaft has reached full RPM. Pulsing the escapement after the motor has reached full speed will generate the necessary force.

Therefore, when AC power is turned on, pulse all escapements after the motor has reached full speed, which takes 500 milliseconds. Or, pulse continually (up to the maximum rated speed of the perforator) through the 0-500 millisecond period after start up. If a majority of the clutches are unlatched, they may cause enough total drag on the clutch shafts to

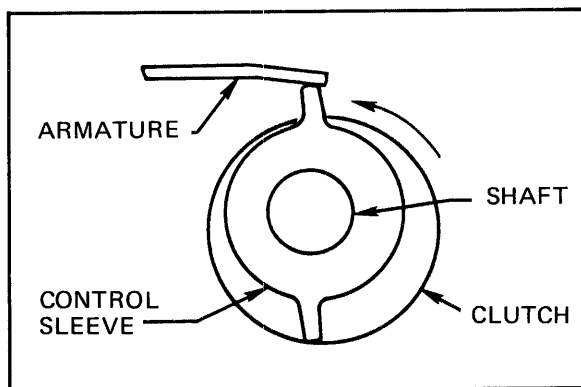


Figure 2
UNLATCHED WIRE SPRING CLUTCH

prohibit the motor from starting or reaching full speed. This may also cause the motor fuse to blow.

If this condition should occur, the coils should be pulsed continuously, while AC power is applied, until the motor has reached full speed. Failure to do so will cause partially latched clutches to overheat, resulting in their destruction and that of adjacent parts. Units operating on less than eight channels must have provisions made to pulse the unused channels. Factory modifications can be made for permanent disabling of unused clutches. Also, provisions must be made to shut off AC power when the perforator is not punching data for periods longer than ten minutes. Idling for long periods of time will cause excessive wear in the punch mechanisms.

THREADING TAPE

Move the three tape guide screws, if necessary, to accommodate the width of tape being used. Tape guide screws are not used for one-inch tape.

Referring to Figure 3, perform the following steps:

1. Before running a new roll of tape, always empty the chad box and brush all loose chad from the tape guide to avoid clogging the mechanism with overflow.
2. To insert a new roll of tape in the perforator, pull the tape supply slide out of the panel. It is held by a magnetic catch.

Separate the supply reel sections. Install a new roll of tape, placing it so the tape comes off the top of the reel. Put the side back on the reel.

Thread the tape from right to left—under the tape guide roller and back up to the top of the assembly. Hold the end of the tape, while sliding the tape back into place.
3. Twist the tape one-half turn clockwise and feed it into the tape guide assembly. Force the end of the tape against the capstan, and press the Buzz switch. The capstan will pull the tape through.
4. Loop the tape under the tension arm and onto the take-up reel, as shown. Fasten the tape to the hub of the take-up reel. Feed enough tape onto the reel to insure its staying on.
5. Before starting to record, provide several inches of sprocket tape. Check to see that the tape feeds smoothly, without binding or twisting. The perforator is now ready for operation.

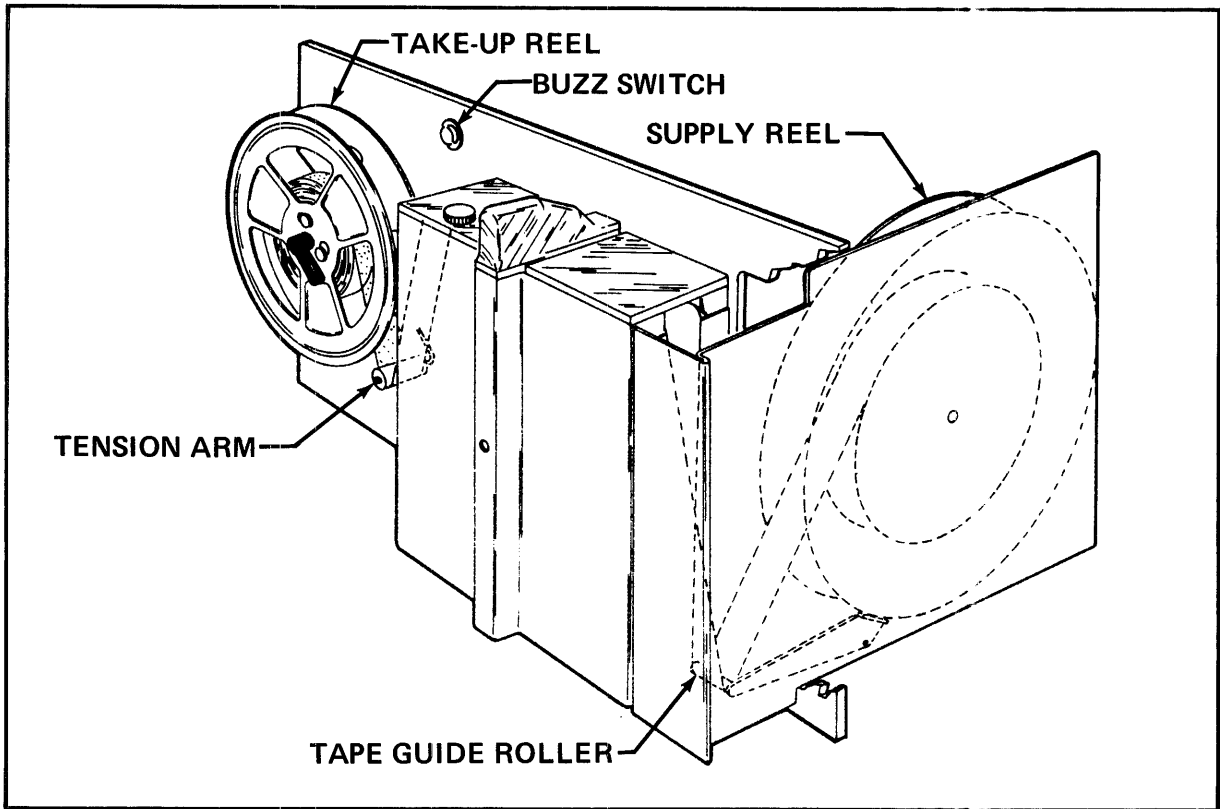


Figure 3
THREADING TAPE

MECHANICAL OPERATION

REEL DRIVE MECHANISM

The reel drive mechanism, mounted on the left rear side of the panel, consists essentially of a differential gear arrangement and a braking mechanism. See Figure 4.

Drive power to the reeling mechanism is supplied by the motor to the input shaft (1) through a drive belt and pulleys. The bevel gear (2), mounted on the input shaft, transfers the power to gear (5) through the spider gear (3) and bevel gear (4). Gear (5) rotates the differential gear (6), which is pinned to the reeling shaft (8). The differential gear is meshed with gear (7), which freewheels on the reeling shaft when the brake is off.

The tape tension arm on the front of the panel is positioned to rest on the tape between the capstan and the take-up reel, forming a loop. As tape is fed from the capstan, the loop lengthens, permitting the arm to drop. This applies the brake (9) to gear (7),

stopping its rotation. The differential gear then revolves around the reeling shaft, rotating the shaft to take up the tape.

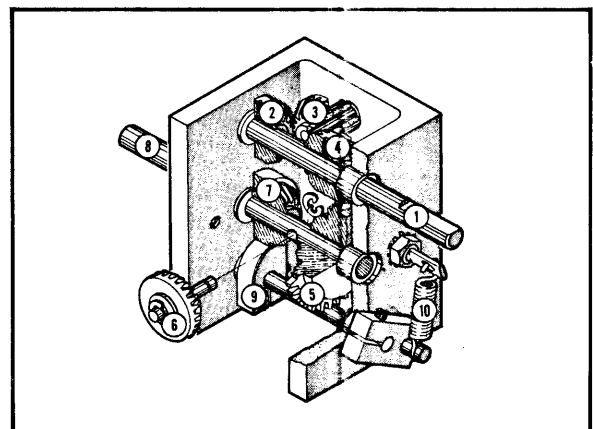


Figure 4
REEL DRIVE MECHANISM

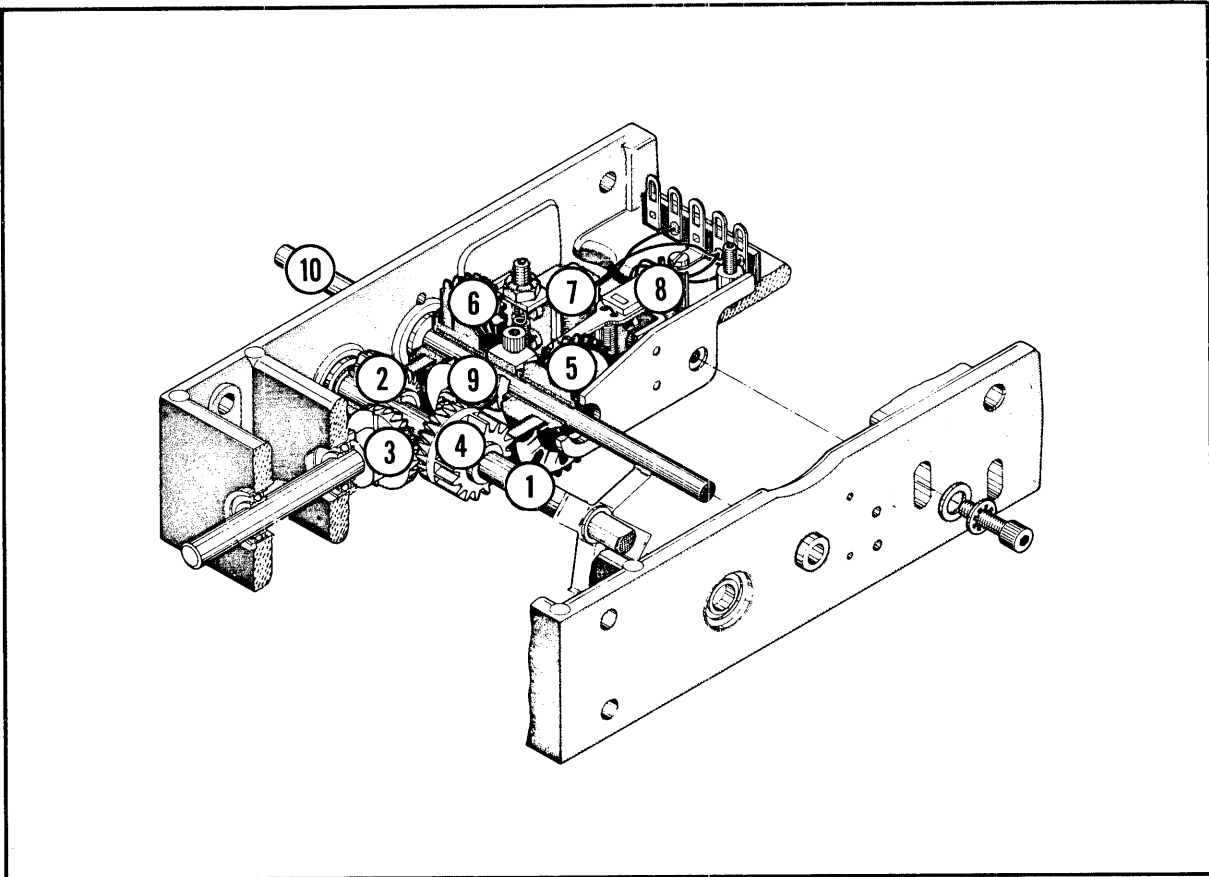


Figure 5
CAPSTAN DRIVE MECHANISM

CAPSTAN DRIVE

Refer to Figure 5.

Drive power is transmitted from the motor by a lug belt and pulleys to the input shaft (1). The bevel gear (2), which is attached to the input shaft, transfers this power directly to the reverse friction clutch assembly (6), and to the forward friction clutch assembly (5), through the bevel gear (3), and bevel gear (4), which freewheels on the input shaft. When the tape is not being moved, the armature on each of the two escapement assemblies (7 and 8) engages a tooth of the corresponding clutch assembly, causing the clutch to slip. When the tape is to be advanced (capstan rotation counter-clockwise), a pulse energizes the electromagnet on the forward escapement assembly (8), disengaging the armature from the clutch tooth and permitting the forward clutch assembly to rotate. Rotation of the clutch assembly transfers torque from the clutch through the differential (9) to the capstan shaft (10). The escapement coil is de-energized, allow-

ing the armature to drop and engage the next tooth of the friction clutch assembly. This stops the capstan in position for the next character.

Release of the reverse clutch assembly will cause clockwise rotation of the capstan, moving the tape in the reverse direction.

PERFORATOR MECHANISM

The perforator mechanism, mounted on the front of the panel, consists essentially of ten linkage assemblies, four clutch shafts, four clutch shaft gear assemblies, a toggle shaft, an idler gear, an oil lead gear, ten escapement assemblies, inner and outer bearing plates and a breaker switch; all except the switch are enclosed in an oil tight case (see Figure 6). The front cover of the case is made of transparent plastic, to provide visual inspection of the mechanism and oil level checking.

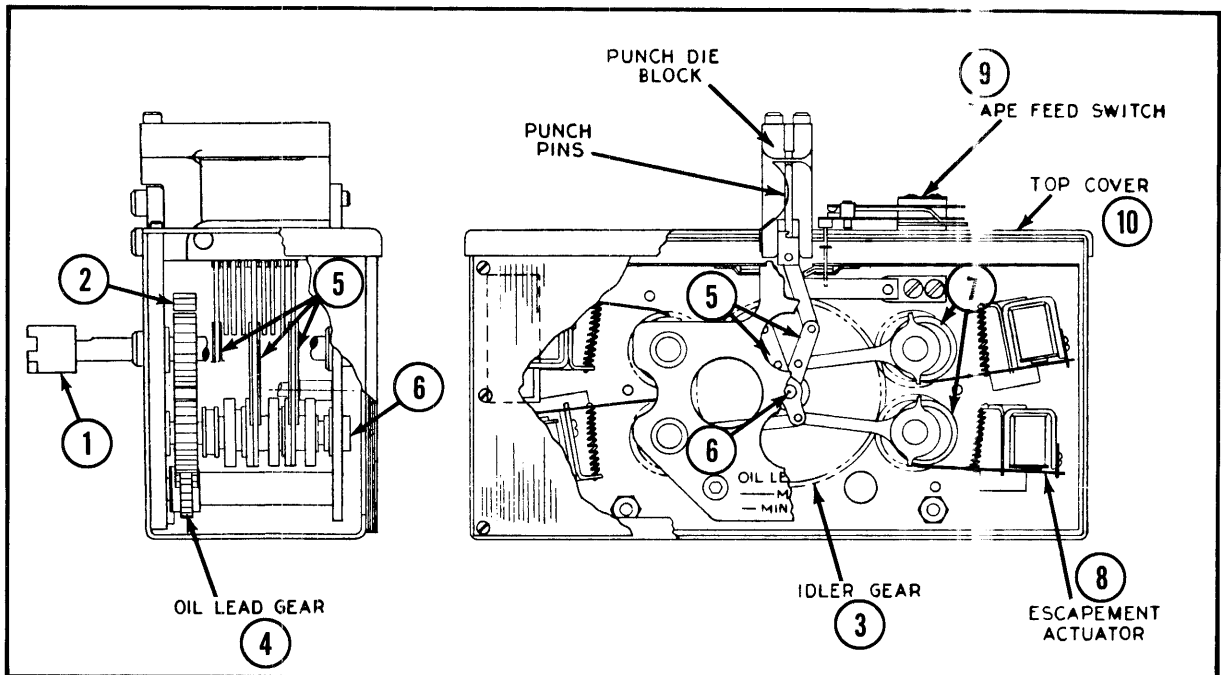


Figure 6
PERFORATOR MECHANISM

A lug belt from the drive motor engages a drive pulley (1, Figure 6) on the end of the upper-left clutch shaft. The clutch shaft gear (2) drives an idler gear (3), which in turn drives the remaining three clutch shaft gears. An oil lead gear (4) meshed with the idler gear, is partially immersed in the lubricating oil and during operation, it splashes oil throughout the mechanism. The ten linkage assemblies (5) are pivoted on the toggle shaft (6) and are connected to eccentric clutch units (7) on the clutch shafts. The upper end of each linkage engages a corresponding punch pin in the perforator assembly, except the switch linkage, which operates the tape feed switch. Each clutch unit is secured against rotation by the armature of an escapement mechanism mounted on one of the four escapement brackets (8).

Referring to Figure 7, when an escapement assembly is energized, the corresponding armature is momentarily disengaged from the clutch control sleeve, permitting the clutch assembly to rotate one-half turn and actuate the punch pin through one cycle to perforate the tape.

Before the clutch completes one-half revolution, the escapement armature has been released, thus engaging

the clutch control sleeve and stopping rotation of this sleeve. The hub of the clutch continues to rotate slightly beyond this point, releasing (unwinding) the clutch spring. The rebound spring around the hub prevents the hub from rebounding, to tighten the clutch spring, and the clutch is held in the released condition until another signal pulse disengages the armature.

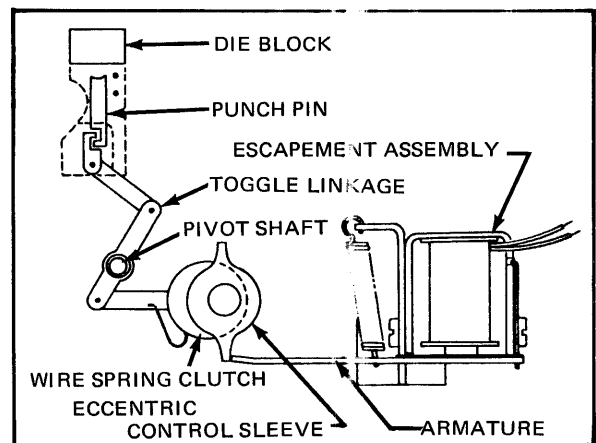


Figure 7
CLUTCH LINKAGE ASSEMBLY

During this punch cycle, the switch control clutch actuates the switch linkage to close the tape feed switch momentarily, which results in forward rotation of the capstan. A mechanical delay in the switch clutch control sleeve causes the switch contacts to close ten milliseconds after the start of the corresponding punch drive pulse. The delay assures that all punch pins are withdrawn from the tape before the tape is advanced.

PUNCH HEAD ASSEMBLY

The punch head assembly consists of eight data punch pins, a sprocket hole punch pin, a stripper, a punch

die block, a slide block clamp and an oil seal. The assembly is mounted on the perforator mechanism's base plate, where the punch pins engage the corresponding linkages. The assembly is positioned so that the pins normally rest in the stripper with the top ends of the pins slightly below the upper surface of the stripper. In this position, the tape can move freely between the stripper and the die block. The toggle action of the linkage withdraws the pin so the tape can advance to the next position.

ELECTRICAL OPERATION

ESCAPEMENT OPERATION

To perforate a character in the tape, an electric pulse is applied simultaneously to the electromagnets of the escapement assemblies which control the tape feed switch and the punches required for the particular character. When the electromagnets are energized, the corresponding armatures are momentarily disengaged from the clutch control sleeves, permitting the clutch assemblies to rotate one-half turn and actuate the punch pins through one cycle to perforate the tape. Before the clutch completes one-half revolution, the escapement armature has been released; thus, engaging the clutch control sleeve and stopping rotation of the sleeve.

During this punch cycle, the switch control clutch actuates the switch linkage to close the tape feed switch momentarily, which results in forward rotation of the capstan.

BUZZ SWITCH

The Buzz switch, mounted on the panel, is normally used to advance the tape manually. A customer-supplied source of drive pulses is required for use with the Buzz switch. These pulses must meet the requirements specified under *Input Requirements*.

TAPE FEED SWITCH

The tape feed switch (9, Figure 6), mounted on the top cover (10), is actuated by the switch linkage, as

described under *Escapement Operation*. When the switch is actuated, it supplies a pulse to the electromagnet of the forward escapement assembly, disengaging the escapement armature to permit the escapement wheel to advance one step. This advances the capstan, moving the tape to the next character position. A mechanical delay in the switch clutch control sleeve causes the switch contacts to close ten milliseconds after the start of the corresponding punch drive pulse, assuring that all punch pins withdraw from the tape before the tape is advanced. The switch is adjusted through an access hole, to provide the 4.5 millisecond pulse shown in the Timing Diagram, Figure 22.

TERMINATIONS

All power input, drive pulses and punch pulses are delivered to the perforator assembly through a 34-pin connector. Connections to the terminals and to the escapement coils are shown in Figure 23. The receptacle and mating plug are both supplied with the tape perforator.

CYCLE LENGTH LIMITATIONS

At a motor speed of 1725RPM, the clutch shaft speed is 2300RPM. This limits the minimum cycle time to 16.7 milliseconds between succeeding drive pulses (leading edge to leading edge). Refer to Figure 22, for time relationships of the pulses during one cycle.

SUPPRESSION

Suppression for contacts of the tape feed switch is provided by RC components shown in Figure 8 and 9. Suppression for customer's control contacts must be designed to protect the control without introducing excessive circulating currents in perforator coils. Diode or resistor-diode suppression is generally not satis-

factory because circulating current may flow long enough to prevent armatures from dropping out prior to the next cycle. Good suppression should allow current decay to ten percent within two milliseconds from the end of the drive pulse. The RC network shown in Figure 9 will provide suppression when the suppressor is connected, either across coils in parallel or across control contacts. The following table lists suitable circuit component values.

COIL RESISTANCE	DRIVE PULSE	RS	CS	PEAK INVERSE VOLTAGE (FOR 1 TO 10 COILS)
220 OHMS	48 VOLTS	10 OHMS	0.5MFD	65 TO 185 VOLTS
50 OHMS	24 VOLTS	5 OHMS	0.7MFD	60 TO 130 VOLTS

Figure 8
SUPPRESSION COMPONENT VALUES

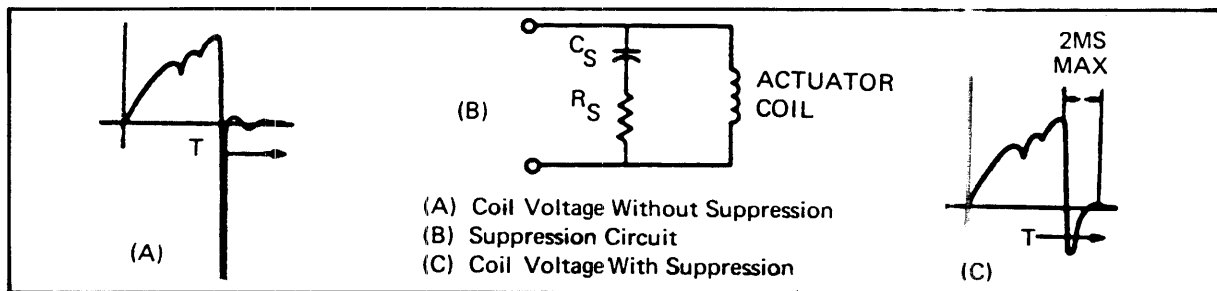


Figure 9
SUPPRESSION DIAGRAM

PREVENTIVE MAINTENANCE

This section is intended to serve as a checklist; it gives maintenance intervals and lists specific points for service. Detailed information on how to service these points may be found under *Maintenance Procedures*, Page 8.

DAILY MAINTENANCE

Perform the following maintenance daily, prior to operation:

1. Clean the die block, capstan and tape track, using light air blasts or brush. Loosen the chad chute and blow out the chad. Inspect the unit for overall cleanliness.

NOTE: The die block may, at times, become clogged with chad or bits of tape which cannot be removed with a brush or compressed air. See Die Block Cleaning, Page 8 .

2. Check general punch operation. Check for proper spacing, tape tearing, double punching, and bit deletion. Call for service if problems develop. An early call could prevent costly down time.
3. Check the oil level in the perforator mechanism. Keep this level between the MAX and MIN marks. See *Lubrication*, Page 13.

250-HOUR MAINTENANCE

CAUTION: The following maintenance requires special tools and should only be performed by Tally trained service personnel.

Perform the *Daily Maintenance* to ascertain that the unit is operating correctly before you begin the 250-Hour Maintenance.

Static Inspection

1. Inspect the capstan drive mechanism for excessively worn or damaged parts. Check for lug belt wear and alignment, and ensure that shaft end play is within the tolerance specified. See *Measurements, Tolerances*, Page 21.
2. Check escapement actuators for: Anti-residual shim wear, armature tip wear, clutch tooth wear, cleanliness, and clearances.
3. Inspect the reeling mechanism for worn or damaged parts. Check for belt wear and alignment. Check tension arm positioning, spring tension, and lug belt tension.
4. Inspect the idler assembly for worn or damaged parts. Check for belt wear and alignment.
5. Lubricate the unit according to *Lubrication*, Page 13.

Dynamic Inspection

1. Observe tip to clutch tooth operation in the capstan drive mechanism. See that the armature tips are contacting clutch teeth squarely and within the tolerance given in Figure 20.
2. Observe the tape tension arm for smooth operation.
3. Check punch operation for clean holes and proper spacing. Also, check for tape tearing, double punching, and bit deletion. Observe the data drive pulses on an oscilloscope.
4. Observe the reeling mechanism for smooth operation. See that the belts are not slipping.

500-HOUR MAINTENANCE

Perform the *250-Hour Maintenance*. Inspect the unit for overall wear. The factory service intervals vary widely, depending on (1) the volume and abrasive quality of the tape punched, and (2) environmental conditions.

MAINTENANCE PROCEDURES

DIE BLOCK CLEANING

The die block may become clogged with chad or bits of tape that cannot be removed with a brush or air blasts, as noted under *Daily Maintenance*. When this occurs, pass a .005 inch (.13mm) cleaning shim (Dust Cleaner, No. 329310) through the die block (right-side only) from right to left. A die block, too badly clogged to allow passage of a cleaning shim, may require removal for cleaning. See *Die Plate Removal*, Page 16.

HOLE SPACING ADJUSTMENTS

CAUTION: Hole spacing adjustments should only be made by qualified personnel.

The Model 420 is designed to operate within the hole spacing requirements of the ANSI Specifications, as shown in Figure 10. Hole spacing may be defined in two areas: edge-to-hole (centerline of sprocket hole to three hole edge of tape), and hole-to-hole (ten holes per inch).

Edge-to-Hole Spacing

For measurement and adjustment of the edge-to-hole space, perform the following steps:

1. Run a short length of test tape. Measure edge-to-hole spacing, using a tape hole gage (Tally Part Number 4043401) to see that the sprocket hole centers are $.392 \pm .004$ inch (9.9 ± 1 mm) from the three hole edge of tape, as shown in Figure 10.
2. If the measurement is outside the limits, adjust edge-to-hole spacing as follows:
 - a. Leaving the capstan secured to the shaft, loosen the screw (12, Figure 27) holding the Differential Assembly to the Capstan Shaft.
 - b. Move the shaft in the desired direction to reduce the spacing error; toward the front of the unit to reduce edge-to-hole spacing; toward the rear of the unit to increase it.
 - c. Retighten the Differential Spider Set Screw, and run another length of test tape. Recheck edge-to-hole spacing.

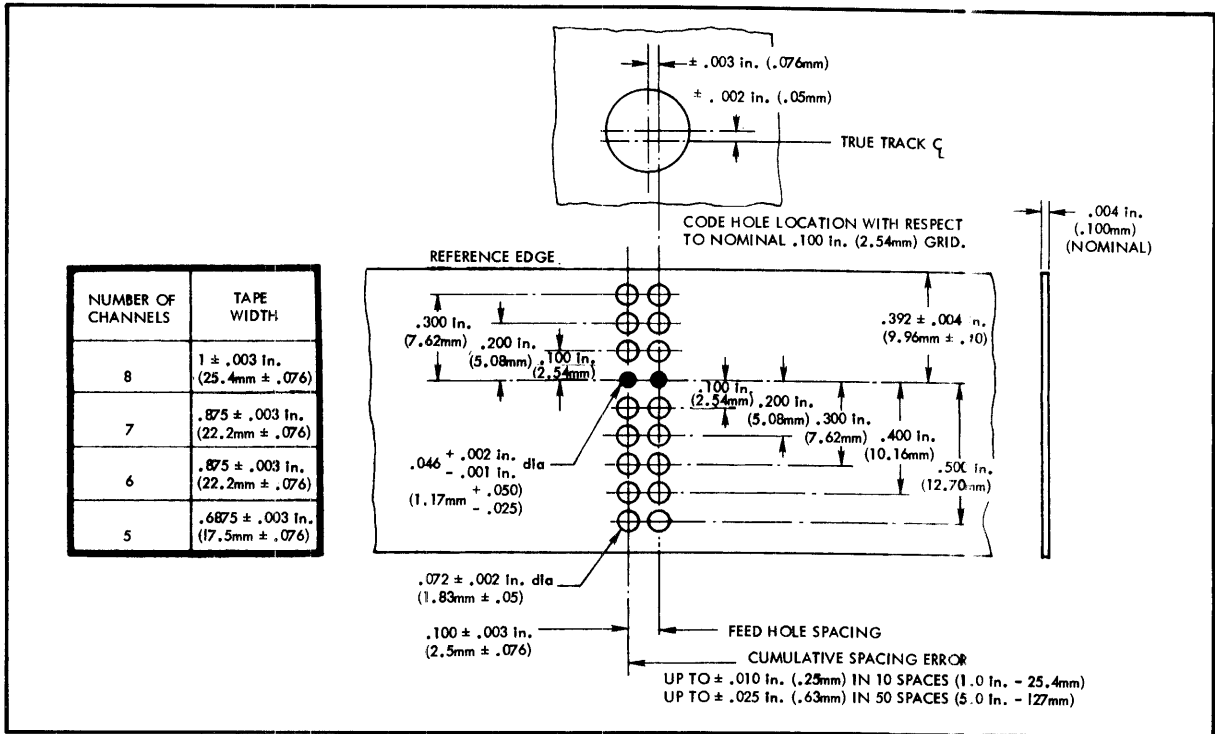


Figure 10
PAPER TAPE STANDARDS

Hole-to-Hole Spacing

The center-to-center hole spacing on the Model 420 must be maintained at $0.100 \pm .003$ inch ($2.54 \pm .08$ mm), and the accumulated spacing error over five inches of tape must be within $\pm .025$ inch (.64mm). Hole spacing is controlled by the Tape Stripper, Tape Hold Down and Capstan Drive Mechanism. Check and adjust as follows:

1. Check and adjust the tape stripper (4, Figure 31), using the two mounting screws, so that it does not interfere with the capstan.
2. Check and adjust the tape hold-down (plastic insert 10, Figure 31) on the left-hand lid assembly (12, Figure 31) as follows:
 - a. Produce a length of tape that can be pulled through the tape guide without interference from the capstan. To do so, loosen the thumb screw (15, Figure 31) and lift the left-hand lid assembly. Insert the tape through the die block and over the capstan. While the perforator is punching out a series of sprocket holes, pull on the tape in the forward direction so that it splits at the sprocket line. Run at least six inches of tape in this manner. Pull the split tape back through the tape guide. Close the left-hand lid assembly and tighten the thumb screw.
 - b. Loosen the right-hand mounting screw until the tape is pinched between the capstan rim and the Tape Hold Down.
 - c. Tighten the screw until the tape has no perceptible drag.
 - d. Check to see that the tape does not bind between the Stripper and the Tape Hold Down. If there is a bind, move the Stripper until the tape is free. Recheck for Capstan-Stripper interference.
3. Measure the spacing over a length of tape containing exactly fifty sprocket holes. The distance from hole 1 to hole 51 (leading edge to leading edge) should be between 4.975 and 5.025 inches. (12.64 and 12.76 centimeters) Tally Tape Gage, Number 4043401 may be used for approximate spacing check.
4. If the measurement is outside of the limits specified, loosen the socket head screw (19, Figure 27) on the Capstan Drive and turn the adjusting screw (18) to correct hole spacing. Turn the screw clockwise to shorten hole spacing; counter-clockwise to lengthen it.
5. Tighten the socket head screw securely, and run another length of test tape. Measure as in Step 3.

6. Repeat these steps as necessary to secure correct hole spacing.
7. If the above adjustment proves insufficient, carefully remove the retaining ring (6, Figure 27) from the spider bevel gear (9, Figure 27). Pull the spider bevel gear far enough out on the shaft that its teeth clear those of the friction clutch. Looking at the unit from the front bearing plate, move the differential spider gear clockwise to shorten hole spacing; counter-clockwise to lengthen it. Movement (the width of one tooth) should be enough to allow the adjustment previously described to be effective. Reseat the spider bevel gear and replace the retaining ring. Repeat Steps 3 through 6.

ESCAPEMENT ADJUSTMENTS, CAPSTAN DRIVE MECHANISM

Figure 20 shows the tolerances required for the escapement assembly in the capstan drive mechanism. Note that units contain two such escapements. Adjustment procedures are identical for both forward and reverse escapements.

Heel Gap

Select a gage equal to the Heel Gap lower tolerance (see Figure 20). Insert this gage into the slot of the armature limit (see Figure 11). It must slip in easily. Repeat with a gage equal to the higher tolerance. This gage must slip in with perceptible drag. To adjust, loosen screw "A" and re-insert the smaller gage. Press the armature limit firmly against the gage and re-tighten screw "A". Be sure the coil frame does not pivot on the bracket at point "B".

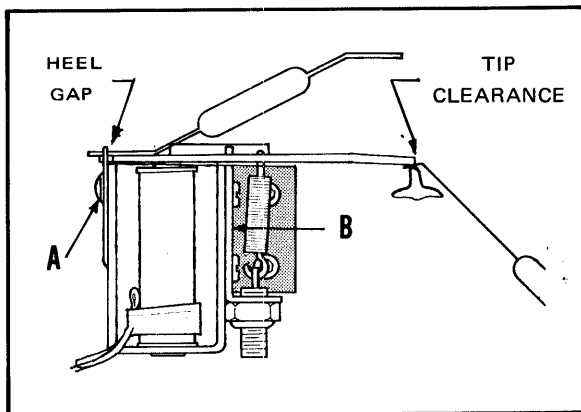


Figure 11
HEEL GAP AND TIP CLEARANCE

Armature Tip Clearance

Insert the smaller of two gages used in the Heel Gap Adjustment into the armature limit (see Figure 11). Turn the clutch so the high edge of a tooth rests under the armature tip.

Select a gage equal to the lower tip clearance specification shown in Figure 20, and push it from clutch toward coil as shown in Figure 11. It should slip easily through the gap between the armature tip and the clutch tooth. Repeat with a gage equal to the high tolerance of the tip clearance specification. This gage should slip through with perceptible drag.

To adjust tip clearance, loosen the assembly mounting screws shown in Figure 12. Place a small screw driver or awl between the mounting screws and bracket, and rotate the assembly in the desired direction. Retighten the mounting screws. An alternate method is to tap the assembly in the desired direction; Point "B" to reduce clearance, and Point "A" to increase it.

CAUTION: Extreme care must be taken to avoid distorting the coil frame or bracket.

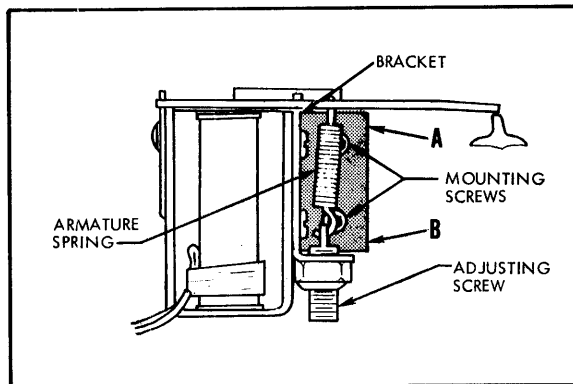


Figure 12
TIP CLEARANCE ADJUSTMENT

Armature Spring Tension

To measure armature spring tension, place the appropriate gram gage and spring hook as shown in Figure 13. Lift with a force of 90 degrees to the armature until the first movement of the armature tip is seen. Take the measurement at this point. For units with an adjustment screw (13k, Figure 27) on the coil, spring tension force must be within the range of 190 to 220 grams. If the force is out of this range, adjust by holding the adjustment screw with an allen wrench while turning the stop nut (13l, Figure 27) until the proper force is attained. For units without an adjustment screw on the coil, spring tension force must be within the required limits of 105 to 150 grams. If the force is not within these limits, replace the spring.

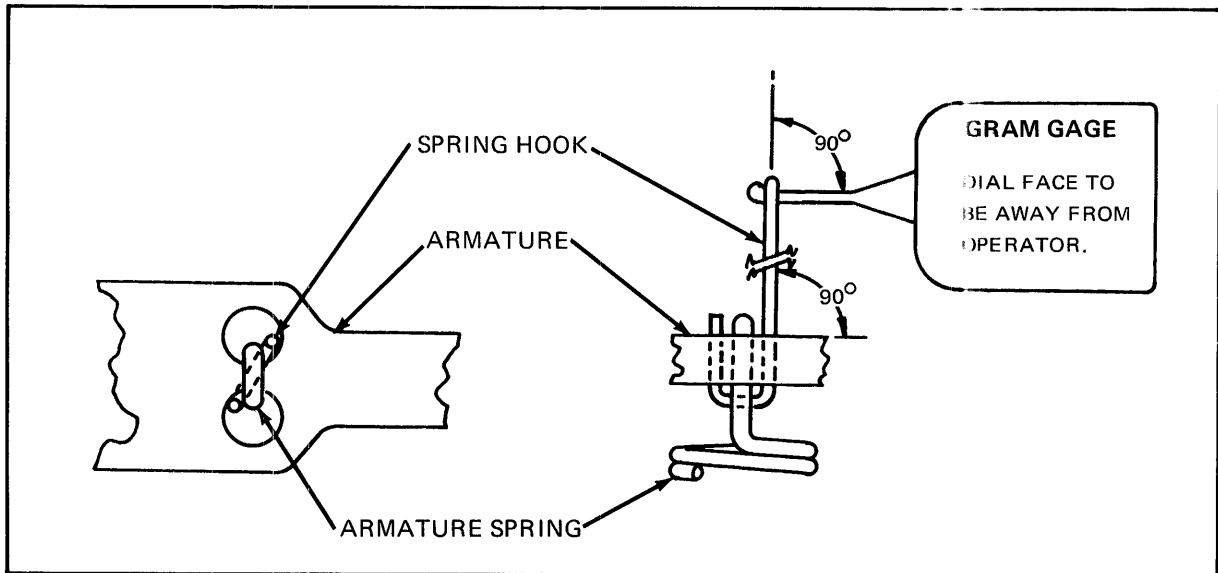


Figure 13
ARMATURE SPRING TENSION

An optional method of measuring spring tension force is to measure at the armature tip. If this method is preferred, place the gram gage and suitable spring hook at the tip of the armature. Measure as described in the previous paragraph. Spring tension force at the armature tip for those units with an adjustment screw must be within 36 to 41 grams. For those units without the adjustment screw, it is 20 to 28 grams.

ESCAPEMENT ADJUSTMENTS, PERFORATOR MECHANISM

The following adjustments can only be made with the perforator mechanism removed from the oil can. Only qualified personnel should perform this operation. See *Perforator Mechanism*, Page 15, for removal procedures.

Heel Gap

Select a gage equal to the Heel Gap lower tolerance (see Figure 21). Insert this gage into the slot of the armature limit (see Figure 11). It must slip in easily. Repeat with a gage equal to the higher tolerance. This gage must slip in with perceptible drag. To adjust, loosen screw "A" and re-insert the smaller gage. Press the armature limit firmly against the gage and re-tighten screw "A". Be sure the coil frame does not pivot on the bracket at Point "B".

Armature Tip Clearance

Insert the smaller of two gages used in the Heel Gap adjustment into the armature limit (see Figure 11). Turn the clutch assembly so that the leading edge of

the control sleeve tooth is parallel or in line with the tip of the armature.

Select a gage equal to the lower tip clearance specification shown in Figure 21, and push it from clutch toward coil as shown in Figure 11. It should slip easily through the gap between the armature tip and the clutch tooth. Repeat with a gage equal to the high tolerance of the tip clearance specification. This gage should slip through with perceptible drag.

CAUTION: Extreme care must be taken while making the following armature tip adjustment to avoid breaking the armature tip.

To adjust tip clearance, bend the armature tip with an armature forming tool (Part Number 309940) until the desired clearance has been obtained.

Armature Spring Tension

To measure armature spring tension in the perforator, place the gram gage (Part Number 4043404) and spring hook as shown in Figure 13. Lift with a force of 90 degrees to the armature. Measure the spring tension force at the first movement of the armature tip. Spring tension force must be within 110 to 140 grams. If the force is not within the required limits, replace the spring.

FRICITION CLUTCH TORQUE, CAPSTAN DRIVE MECHANISM

Operate the unit for at least 30 minutes before measuring the torque to assure reliable measurement.

Attach the torque arm clamp (Part Number 226620) to the capstan shaft, as shown in Figure 14. Check the torque with a gram gage, according to the following procedures:

1. Energize the motor, but *do not* pulse the unit.
2. Hook the gram gage to the torque arm clamp, as shown.

NOTE: Observe the position of the armature's actuator tip in relation to the gear escapement tooth it engages.

3. Pull gently on the gram gage against the torque arm, and record the measured force as the tooth moves away from the actuator tip.
4. At this point, allow the torque arm clamp to return with the torque. Record the gage reading during the null period, which occurs just before the escapement tooth re-engages the actuator tip.
5. Add the two readings obtained in procedures 3 and 4.

If the friction clutch torque does not meet the specifications, refer to Page 16, and replace the defective clutch.

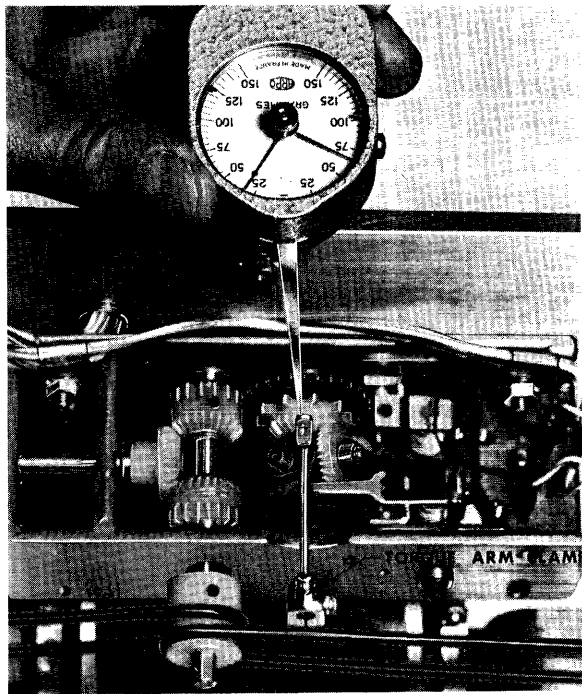


Figure 14
MEASURING FRICTION CLUTCH TORQUE

REELING ADJUSTMENT

Tension Arm Adjustment

Adjust the tape tension arm so that when the tension arm is at the rest position (brake on), the center of the roller must be $3.5 \pm .2$ inches from the bottom of the panel. The arm must hold in the up position with the reel in place.

Tension Arm Force

With the tension arm in the down position, and the centerline of the roller at $3.5 \pm .2$ inches from the bottom of the panel, adjust the spring tension to provide a pull of 150 ± 30 grams at the point of brake release.

WEAR POINTS, ESCAPEMENT ASSEMBLIES

Most parts in the Model 420, which are subject to wear, will show wear in an obvious manner. A worn wave washer may result in excessive end play. Some parts—particularly in escapement assemblies—are less direct in calling attention to themselves. This section will identify these parts and define wear in terms of replacement need. The worn parts shown in Figure 15, are representative of what to look for.

Clutch Teeth

Wear on the Clutch Teeth occurs where the armature tip strikes the tooth, and shows an indentation in the leading edge of the tooth, as shown in Figure 15A.

Anti-residual Shims

Anti-residual Shims show wear in three areas: The slot where the shim fits over the bracket; the area where the shim strikes the pole of the coil; and the edge. Figure 15B shows a badly worn shim. Note the impact scars, the uneven tip, and the jagged edge. This indicates the need for replacement.

NOTE: A worn shim is often accompanied by a worn armature bracket or limit. Check these items.

Bracket

Wear on the bracket occurs where the anti-residual shim strikes its bottom edge, as shown in Figure 15C.

Armature

Wear points on armatures are similar to those on anti-residual shims. Figure 15D shows a capstan drive armature. This is of a different design from those in the perforator mechanism but wear points are the same.

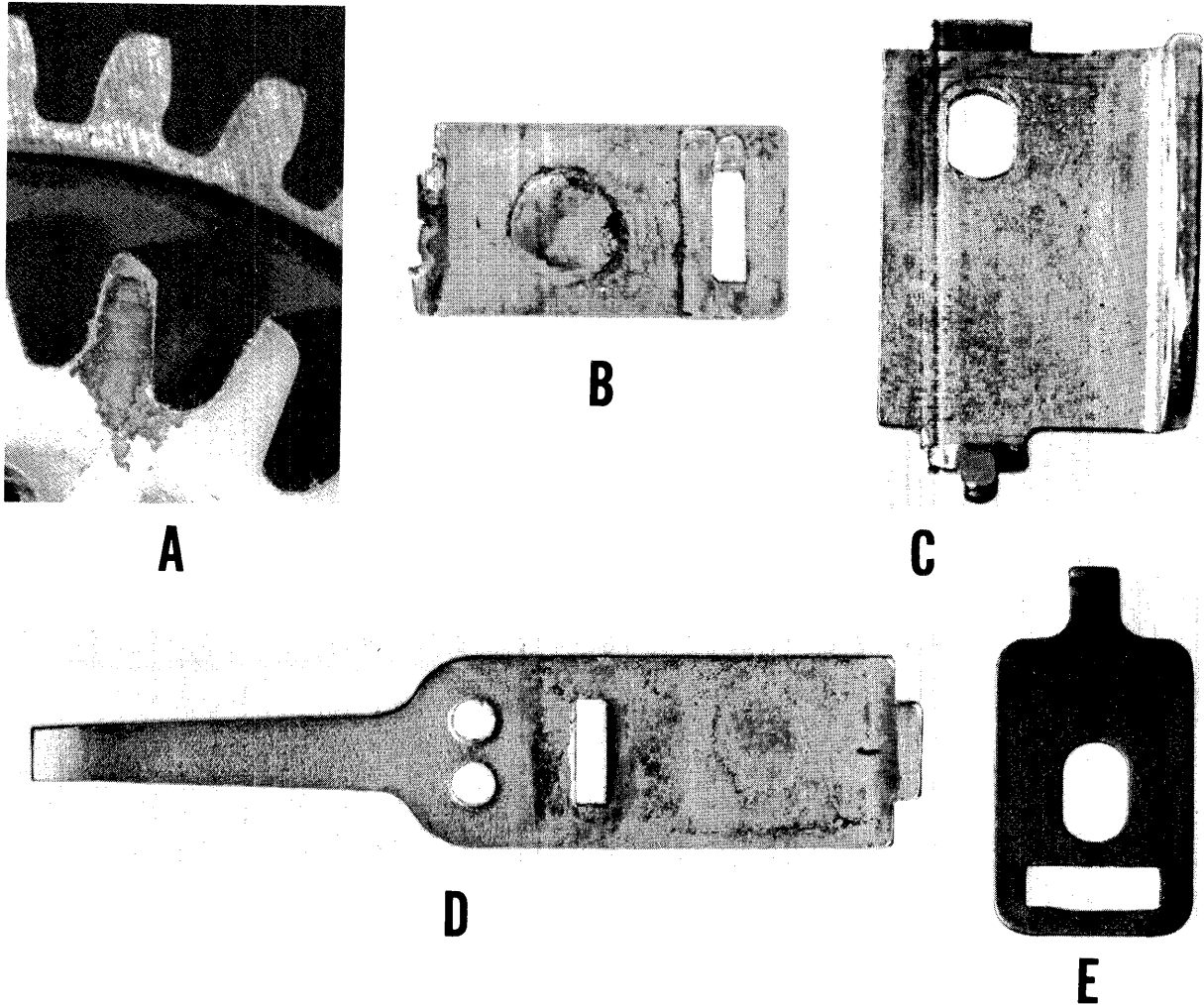


Figure 15
WEAR POINTS, ESCAPEMENT ASSEMBLIES

Armature Limit

Wear on the armature limit is evident in deformation of the slot that receives the heel of the armature. See Figure 15E.

LUBRICATION

Perforator Mechanism

The perforator mechanism is enclosed in an oil pan. Oil is distributed as a mist throughout the mechanism by an oil lead gear partially submerged in the oil pan. Check the oil level in the mechanism daily. Keep the oil level between the MAX and MIN marks on the face of the oil pan.

To add oil, remove the plug (65, Figure 26) from the access hole in the upper right side of the oil pan. Insert the tip of a container that allows spill-free pouring, and fill to the desired depth.

To drain the mechanism, remove the drain plug (66, Figure 26) on the right front corner of the bottom.

Check for dirty oil every 250 hours of operation, as the change period varies with environmental conditions. Change the oil when dirty.

LUBRICANT: Tally Mechanism Oil, Part Number 311270.

Capstan Drive and Reel Mechanisms

See Figure 16.

Point 1 For Bushing units, see Point 4. After every 500 hours of operation, lubricate bushings, shafts, and teeth of each gear with one or two drops of lubricant.

LUBRICANT: Tally Oil, Part Number 600491-1.

NOTE: Ball bearings require no lubrication to the bearings as they are sealed and lubricated for life.

Point 2 After every 500 hours of operation, wipe each escapement armature and the adjacent pole face. Then add one or two drops of lubricant to the armature's felt pad. Do not over-lubricate.

LUBRICANT: Tally Oil, Part Number 600491-4.

CAUTION: Avoid spilling lubricant onto the friction clutches, as this will cause permanent damage to the clutches.

Point 3 After every 500 hours of operation, clean all lubricants from the friction clutch escapement teeth. Relubricate the teeth with a light coat of Tally Silicone grease, Part Number 400005-01.

Point 4 Applies to Bushing units only. Apply lubricant, as stated in Point 1, to points 1 and 4.

LUBRICANT: Tally Oil (Part Number 600491-1).

NOTE: Ball bearings require no lubrication to the bearings as they are sealed and lubricated for life.

LUBRICATION OF MOTOR BEARINGS

Lubricate the drive motor bearings every 500 hours of operation.

LUBRICANT: Tally Oil, Part Number 600491-1.

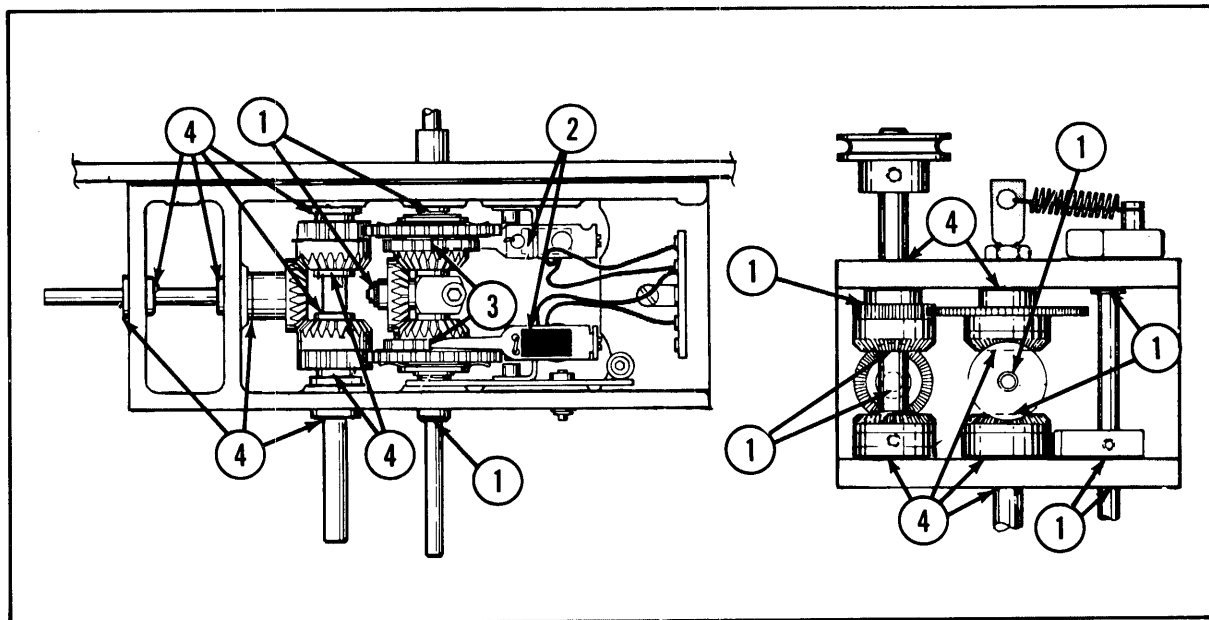


Figure 16
LUBRICATION POINTS

PARTS REPLACEMENT

CAUTION: The following procedures require special tools and are technician level responsibilities.

MOTOR

Remove the motor according to the following steps:

1. Disconnect the motor wiring.
2. Remove the two lug belts from the motor pulleys.
3. Remove the two retaining clips holding the motor to the motor mounting and lift the motor off.
4. Remove the pulleys from the motor shaft.
5. Install the motor by reversing the above order, being sure to align the motor pulleys with those on the idler assembly. Lubricate the motor in accordance with the *Lubrication Instructions*, Page 14.

PERFORATOR MECHANISM

If repairs to the perforator mechanism are necessary, it is recommended that the entire unit be replaced or a Tally trained service man be contacted.

To replace the perforator mechanism, proceed with the following steps:

1. Disconnect power from the unit.
2. Disconnect the mechanism input cable.
3. Loosen the chad chute and blow out the chad.
4. Remove the chad box and clip.
5. Separate the drive coupling (under the capstan drive mechanism) by loosening the set screw.
6. While supporting the mechanism with one hand, remove the two allen socket head screws holding the mechanism in place (index 23, Figure 25).

Do not remove the screws holding the tape guide assembly. It is adjusted at the factory, and cannot be properly installed without special alignment tools. Ease the mechanism down and away from the panel.

7. Install the perforator mechanism by reversing the above order. Add oil to the new unit as specified under *Lubrication*, Page 13.

If repairs or adjustments are to be made within the perforator mechanism, remove the two side screws (19, Figure 26) and loosen the four back screws (15, Figure 26), securing the top cover and baffle (13 and 14, Figure 26). Remove the cover and baffle. Remove the fill plug from the upper right side of the oil pan frame. Remove the bottom mounting screw (2, Figure 26) holding the die block to the oil can.

CAUTION: Screw (2) is the lower of two screws at the back of the perforator mechanism. Do not loosen the upper screw unless die block replacement is required, for this will affect punch pin overtravel.

Lift the mechanism out of the oil can.

Escapement Assembly Replacement

If individual escapement assemblies (57, Figure 26) are to be removed from their brackets (20, 21, 55 and 58, Figure 26), remove retaining pins (22, Figure 26) as necessary. Remove the screw immediately beneath the armature pivot point. Do not remove or loosen the escapement brackets unless total readjustment of the escapement assemblies is required. To be certain that the armature of escapement actuators working in the oil spray will release promptly, the shim at the top of the escapement coil is curved upward to act as a booster spring in releasing the armature. Be sure the escapement actuators installed in the perforator mechanism have this curved anti-residual shim.

Linkage Assembly Replacement

If clutches or linkage assemblies are to be replaced, remove retaining pins (22, Figure 26) as necessary. Remove the slide block clamp from the die block to release the linkages from the punch pins. Noting all shims, remove the outer bearing plate (48, Figure 26), the toggle shaft (60, Figure 26) and the four clutch shafts with the linkage assemblies. Progressively, remove clutches, unwinding the clutch spring by rotating the control sleeve clockwise and linkage assemblies from front to back until the assembly to be replaced is reached. Mark all components to assure proper position at time of reassembly. Punch pins and linkage assemblies are matched to provide correct clearance in the perforator head. Be sure the punch pins are replaced in the same position, and with the same linkage from which they were removed.

Perforator Mechanism Reassembly

Reassemble the perforator mechanism in the reverse order of disassembly. Be sure all retaining rings and shim washers are installed to position the clutch units on their shafts (27, 28, 61 and 64, Figure 26). Check that tolerances of the escapement actuators are as shown in Figure 21. Be sure the switch clutch is fitted with a switch control sleeve (Detail C, Figure 26), not one of the punch control sleeves. Failure to do so will result in faulty operation of the perforator. The configuration of the two types of control sleeves is shown in Detail C. When replacing the slide block clamp on the die block, caution should be used in tightening the screws. Screws should be only finger tight. Overtightened screws will cause punch head damage.

Before installing the mechanism in the oil pan, remove the old oil and fill the pan with new oil, as specified under *Lubrication*, Page 13.

When punch pins become dull, return the die block to the factory for regrinding or replacement with a rebuilt die block.

Die Plate Removal

If removal of the die plate is necessary for cleaning chad, the following steps are required:

1. Loosen the chad chute and blow out the chad.
2. Remove the chad chute.
3. Remove the three mounting screws on top of the die plate.
4. Gently insert a screwdriver into the die gap on the right side (tape side) of the die block ONLY. Gently pry upward until the die plate becomes loose and can be removed.

When replacing the die upon the stripper block, be sure that the punch pins are fully retracted to facilitate alignment before the screws are inserted. After the die block has been replaced, adjust punch pin overtravel by loosening the three screws holding the stripper. Make sure the channel punch pins and sprocket pins protrude above the surface of the stripper to the tolerance given on Page 21.

CAPSTAN DRIVE MECHANISM

Parts replacement in the capstan drive consists of replacing friction clutches, ball bearings, escapements, and damaged gears.

Friction clutches are factory adjusted assemblies, and need only to be installed. Escapement assemblies are

also stocked as assemblies but require adjustment on installation. Individual escapement parts are also available.

The capstan drive mechanism must be removed as a unit for access to these assemblies. This is done in the following procedure:

1. Loosen the chad chute (6, Figure 24) and blow out the chad; remove the chad chute.
2. Remove the tape stripper (4, Figure 31) from the tape guide assembly.
3. Loosen the set screw holding the capstan (5, Figure 24) to the shaft.
4. Remove all belts from the capstan drive mechanism.
5. Remove the four screws (19, Figure 25) holding the capstan drive mechanism to the panel.
6. Remove the capstan drive mechanism, allowing the capstan to slide off the shaft onto the tape guide assembly.

Clutch/Shaft Assembly

To replace the friction clutches, loosen the socket head screw (12, Figure 27) in the differential spider. Slide the capstan shaft out, allowing removal of the clutches and the differential spider gear assembly. Install the new clutches, reversing the above procedure. Be sure to re-install all shims.

NOTE: Adjustments must now be made. See Escapement Adjustments, Capstan Drive Mechanism, Page 10.

Drive Shaft Assembly

To replace damaged gears of shafts in the capstan drive mechanism, loosen all set screws securing the gears to the shaft, and slide the shaft axially through its bearings. Note the position of all shims and washers and replace in the same position from which they were removed. Check gear and shaft backlash and end play. Values must be within tolerances shown on Page 21.

Escapement Assembly Replacement

Replacing the escapement assembly involves removing the two mounting screws, unsoldering the coil leads and removing the assembly. Replace new assembly by reversing this procedure. Adjust according to *Escapement Adjustments, Capstan Drive Mechanism*, Page 10.

Capstan Drive Mechanism Re-installation

Reverse the removal procedure for the *Capstan Drive Mechanism*.

OPTIONS

TAPE SUPPLY STATUS OPTIONS

Two Form "C" switches are available as optional equipment to determine the status of the tape supply. They are the Low Tape and End-of-Tape switches. Each switch is connected to the 34 Pin connector through the accessory terminal block, as shown in Figure 17. Two additional options, not discussed in this manual, also use this block and are shown connected in series with the End-of-Tape (EOT) switch. The terminal block is jumpered to connect the EOT switch directly to the output whenever these switches (TT and THD) are omitted.

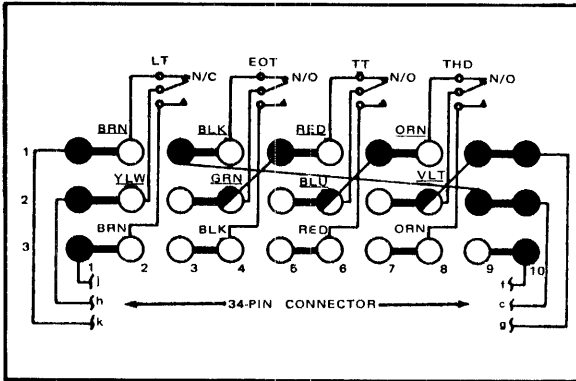


Figure 17
TYPICAL ACCESSORY BLOCK WIRING

END-OF-TAPE (EOT) SWITCH

(Reference No. 337580-1)

This switch is located on the right half of the tape guide, in the center of the tape groove (see Figure 18). It detects the presence of tape in the tape guide, and operates at the end of the tape or when the hold down cover is raised. The switch's normally open (N/O) contacts are closed with tape in the tape guide and the hold down cover closed. Access for maintenance or adjustment is gained by removing the perforator mechanism.

To incorporate the End-of-Tape Option, DELETE the following part, see Figure 24.

Index	Part Number	Description
9	220411	Assembly, Tape Guide

ADD the following parts

600291	* Assembly, Accessory Block
220412	** Assembly, Tape Guide with EOT Switch
- -	Cable Clamps as required See <i>Note</i> , below.

*Wire Switch and Accessory Block as shown in Figure 17.

**Removal of the Tape Guide Assembly affects hole spacing. The Hole Spacing Adjustments on Page 8, must be accomplished.

NOTE: When cable clamps are required with an option, two are needed. Cable clamp sizes vary, depending upon the type and/or number of options used. Cable clamps are selected from the following:

4097900	Cable Clamp, 1/8 in. I.D.
4097910	Cable Clamp, 1/4 in. I.D.
4097920	Cable Clamp, 5/16 in. I.D.
4097930	Cable Clamp, 3/8 in. I.D.

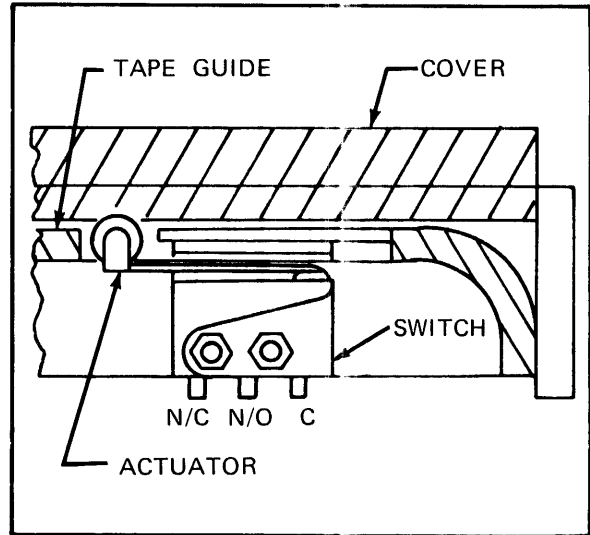


Figure 18
END-OF-TAPE SWITCH

CARBIDE PUNCH OPTION

(Reference No. 382630-1, -2, -7, and -8)

The Carbide Punch Option provides a heavy duty punch and die for punching mylar tapes and extra long life when punching paper tapes. Options are available for 5 or 8 channels, 48 or 24 volts.

To incorporate the Carbide Punch Option, DELETE the following parts, see Figure 24.

Index	Part Number	Description
11	600463-1	Punch Mechanism Assembly (8 Channel, 48V) <i>or</i>
11	600463-2	Punch Mechanism Assembly (8 Channel, 24V)

ADD the following parts for 8 Channel operation (382630-1, -2).

600463-11	Punch Mechanism Assembly (8 Channel, 48V) <i>or</i>
600463-12	Punch Mechanism Assembly (8 Channel, 24V)

ADD the following parts for 5 Channel operation (382630-7, -8)

600463-17	Punch Mechanism Assembly (5 Channel, 48V) <i>or</i>
600463-18	Punch Mechanism Assembly (5 Channel, 24V)
313780	Screw, Guide (see 2, Figure 31)
145540	Screw, Guide (2) (see 23, Figure 31)

5 CHANNEL OPTION

(Reference No. 600551-5, -6)

Punch Channels 6, 7, and 8 are mechanically disabled by this option.

To incorporate the 5 Channel Option, DELETE the following parts, see Figure 24.

Index	Part Number	Description
11	600463-1	Punch Mechanism Assembly (8 Channel, 48V) <i>or</i>
11	600463-2	Punch Mechanism Assembly (8 Channel, 24V)

ADD the following parts:

600463-7	Punch Mechanism Assembly (5 Channel, 48V) <i>or</i>
600463-8	Punch Mechanism Assembly (5 Channel, 24V)
313780	Screw, Guide (see 2, Figure 31)
145540	Screw, Guide (2) (see 23, Figure 31)

100/115VAC, 50 HERTZ OPTION

(Reference No. 600459-1)

This option allows the user to operate the perforator at 100/115VAC, 50 Hertz. Pulley ratios are changed.

To incorporate this option, DELETE the following part, see Figure 25.

Index	Part Number	Description
18	600613-1	Pulley Assembly, 12 Tooth 1/4 I.D. (2)
28		

ADD the following part:

600613-5	Pulley Assembly, 10 Tooth 1/4 I.D. (2)
----------	--

230/50 HERTZ OPTION

(Reference No. 337650)

To incorporate this option, DELETE the following parts, see Figure 25.

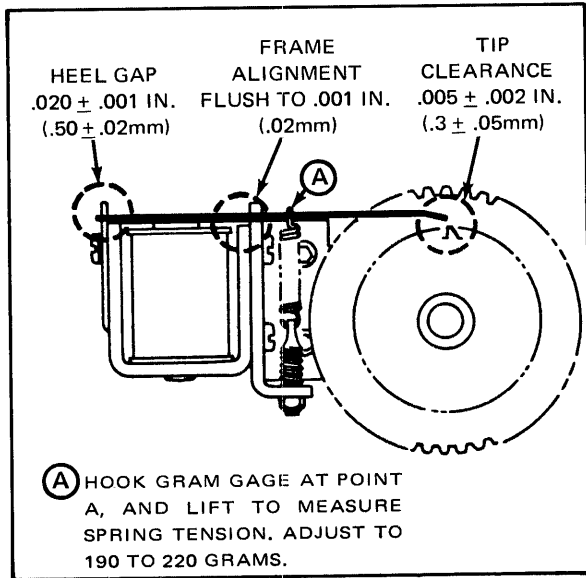
Index	Part Number	Description
18	600613-1	Pulley Assembly, 12 Tooth 1/4 I.D. (2)
28		
4	400031-28	Fuse, 2A

ADD the following parts:

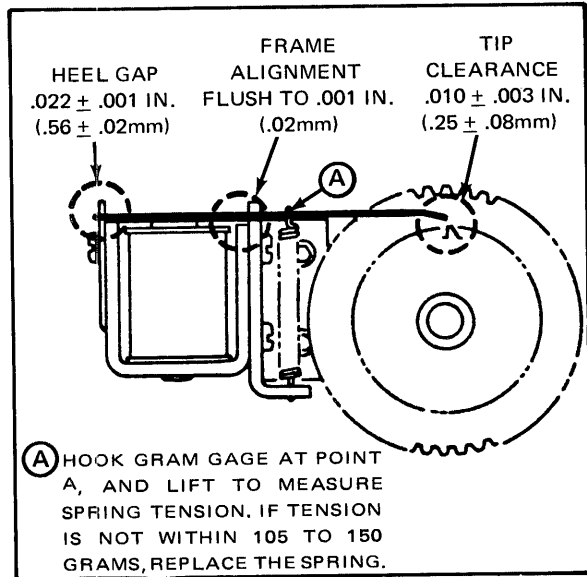
600613-5	Pulley Assembly, 10 Tooth 1/4 I.D. (2)
400031-20	Fuse, 1-1/4A

NOTE: The motor must be wired for 230VAC operation. See Figure 23.

MEASUREMENTS, TOLERANCES



(Adjustable Spring)



(Non-Adjustable Spring)

Figure 20

CAPSTAN DRIVE MECHANISM—ESCAPEMENT ADJUSTMENTS

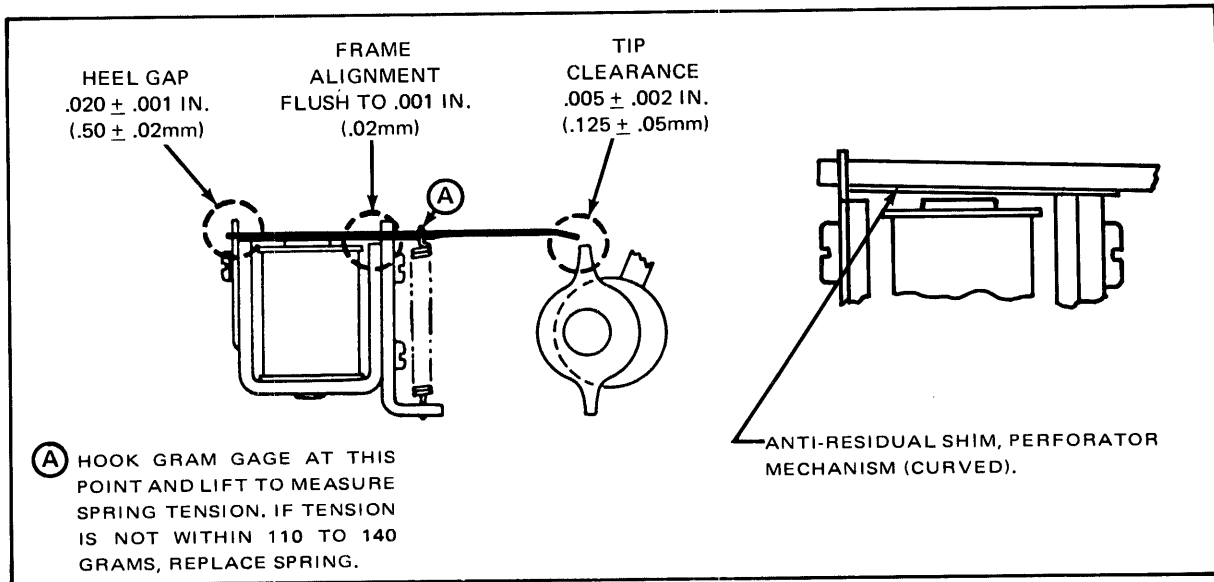


Figure 21

PERFORATOR MECHANISM—ESCAPEMENT ADJUSTMENTS

CAPSTAN DRIVE MECHANISM

	INDEX	FIGURE	TOLERANCE	
<i>UNITS WITH BALL BEARINGS</i>				
Capstan Shaft End Play	5	27	.005 - .010 in.	(.13 - .25mm)
Friction Clutch Torque	10	27	140 - 225 gram in.	

UNITS WITH BUSHINGS

Drive Shaft End Play	26	28	.005 - .015 in.	(.13 - .38mm)
Idler with Bevel Gear Shaft End Play	30	28	.001 - .010 in.	(.02 - .25mm)
Spider Bevel Gear End Play	27	28	.005 - .015 in.	(.13 - .38mm)
Capstan Shaft End Play	5	28	.005 - .010 in.	(.13 - .25mm)
Friction Clutch Torque	10	28	140 - 225 gram in.	

REELING MECHANISM

UNITS WITH BALL BEARINGS

Tension Shaft End Play	19	30	.002 - .015 in.	(.05 - .38mm)
Bevel Gear End Play	1, 10, 20	30	.002 - .012 in.	(.05 - .3mm)

UNITS WITH BUSHINGS

Drive Shaft End Play	12	29	.002 - .012 in.	(.05 - .3mm)
Tension Shaft End Play	19	29	.002 - .025 in.	(.05 - .635mm)
Reeling Shaft End Play	5	29	.010 - .020 in.	(.25 - .5mm)
Bevel Gear End Play	10	29		

PERFORATOR MECHANISM

Sprocket Punch Pin Overtravel	42	26	.026 - .040 in.	(.66 - 1.0mm)
Data Punch Pin Overtravel	42	26	.030 - .040 in.	(.76 - 1.0mm)
Clutch Assembly End Play	Detail B	26	.005 - .010 in.	(.13 - .25mm)
Clutch Shaft End Play	27, 28, 61, 64	26	.005 - .010 in.	(.13 - .25mm)

TENSION ARM ASSEMBLY

Tension Arm Position	14	24	3.5 ± 3/16 in. (8.9 ± .45 CM) above bottom edge of panel in rest position.	
Tension Arm Force	14	24	120 to 180 grams force at brake release.	

TROUBLE SHOOTING

CAPSTAN DRIVE MECHANISM

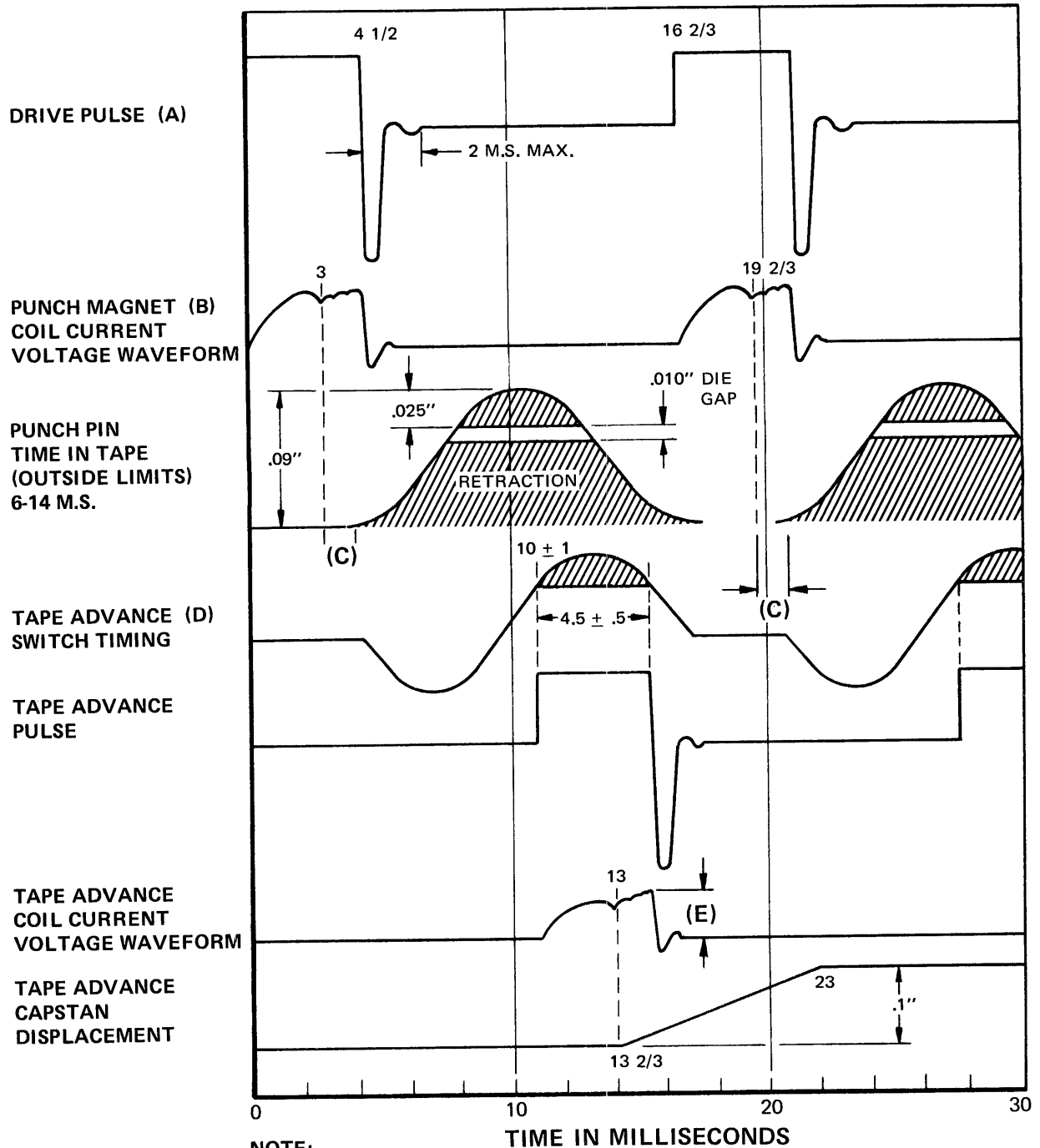
MALFUNCTION	POSSIBLE CAUSE	
	MECHANICAL	ELECTRICAL
Erratic hole spacing (low speed) <i>Also refer to Perforator Mechanism</i>	Hole-to-hole spacing misadjusted Tape retainer too tight or too loose Tape stripper too tight or too loose Tape retainer too loose	Improper tape feed pulse <i>or</i> defective suppression.
Erratic hole spacing (high speed) <i>Also refer to Perforator Mechanism</i>	Sluggish capstan Bent Shaft Insufficient capstan end play Insufficient clutch torque Tape retainer and tape stripper too tight Tape supply feeding improperly	Improper tape feed pulse <i>or</i> defective suppression
Hole spacing changes when running at con- stant speed	Capstan loose on shaft	
Fails to advance tape <i>Also refer to Perforator Mechanism</i>	Insufficient tip clearance Excessive heel gap Excessive spring tension Mechanical bind on capstan shaft Dirty die block	No tape feed pulse Insufficient duration of tape feed pulse Insufficient amplitude of tape feed pulse Burned out coil Broken connection
Fails to reverse step	Defective reverse clutch <i>See Fails to advance tape.</i>	Improper wiring <i>See Fails to advance tape</i>
Skip—advances two or more steps on one pulse <i>Also refer to Perforator Mechanism</i>	Excessive tip clearance Insufficient spring tension	Excessive pulse duration Excessive pulse amplitude
Skip—in repetitive fashion (every 20 spaces) <i>Also refer to Perforator Mechanism</i>	Broken or nipped escapement tooth	

PERFORATOR MECHANISM

MALFUNCTION	POSSIBLE CAUSE	
	MECHANICAL	ELECTRICAL
Fails to punch (punch linkage assemblies)	Insufficient tip clearance Excessive heel gap Excessive spring tension Armature interference Defective coil Stuck punch pin Broken clutch anchor Defective linkage Worn anti-residual shim	Improper pulse duration or amplitude Motor not running Burned out coil Broken connections Faulty suppression network
Erratic hole spacing (low and high speed) Fails to advance tape Skip—advances two or more steps on one pulse	Defective switch linkage assembly Insufficient tip clearance Excessive air gap. Excessive spring tension Armature interference Defective coil Worn anti-residual shim Broken clutch anchor Defective linkage	Improper pulse duration or amplitude Motor not running Burned out coil Broken connections Faulty series capacitor
Skip—in repetitive fashion (every 20 spaces)	Stuck punch pin	
Double punch	Excessive tip clearance Insufficient spring tension Armature interference Broken control sleeve	Improper pulse duration Excessive pulse amplitude

REEL DRIVE MECHANISM

MALFUNCTION	POSSIBLE CAUSE	
	MECHANICAL	ELECTRICAL
Reeling failures	Tension arm out of adjustment Reel drive brake not releasing within tolerances Spring tension incorrect	Motor not running



NOTE:

- A. Drive pulse rise time less than 0.5ms, with suppression to limit transient duration to less than 2.0ms after end of $4 \frac{1}{2} \pm \frac{1}{2}$ ms drive pulses.
- B. Dip in coil current curve marks the magnet armature striking the pole piece.
- C. Punch-clutch grab time is about 1.0ms.
- D. Switch motion similar to punch motion, but shifted in phase.
- E. 48V Units - 0.5 AMP. 24V Units - 1.0 AMP.

Figure 22
TIMING DIAGRAM
(Reference 338140)

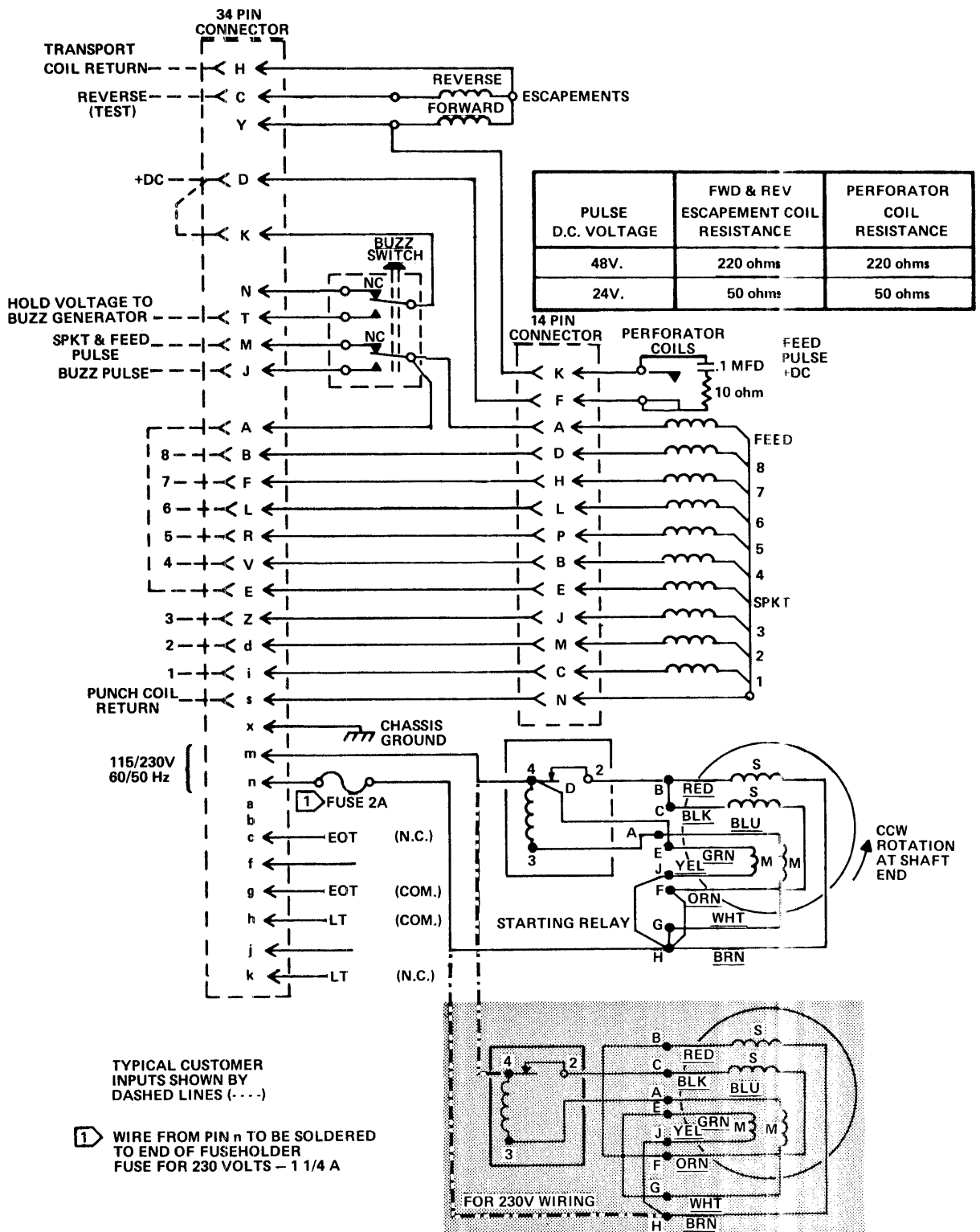


Figure 23
WIRING DIAGRAM
(Reference 146592)

PARTS ORDERING PROCEDURE

Spare parts should be ordered from Tally Corporation, 8301 South 180th, Kent, Washington 98031. A major inventory of replacement parts is maintained at the factory for prompt service.

To order a replacement part, find the part required and order by the part number and name. Include the

model and serial number of the unit on which it is to be used.

Contact Tally Corporation, Kent, Washington, for assistance in matters concerning prices or unlisted parts. The telephone number is Area Code: 206 251-5680.

NOTE: Minimum order: \$25.00. Terms: NET 30 days, F.O.B. Kent.

RECOMMENDED TOOL LIST

The following list indicates items necessary to make on-the-spot repairs of simple breakdown. This list is subject to change.

Part Number	Description
600702	Pull Hook
4043403	Gram Gage, 3-30 grams
4043404	Gram Gage, 15-150 grams
4043402	Gram Gage, 100 to 500 grams
4043401	Tape Gage
4042850	Wrench, Snap-Ring, No. 2
4042950	Wrench, Snap-Ring, No. 2, 90 degrees
4043400	Wrench, Snap-Ring (CR25-025)
4042650	Allen Driver Set
4143120	Allen Driver with Handle, 7/64 in.
4143130	Allen Driver with Handle, 9/64 in.
226620	Torque Arm
309940	Armature Forming Tool
378440	Lubrication Kit
4043150	Steel Rule, 6 in., with graduations of .01 and .1
4043600	Feeler Gage Set (.006-.025 in.)
4042820	Pin Punch Set
4042860	Screw Driver, 1/8 in. bit, 6 in.
4042960	Screw Driver, Phillips
4043450	Wrench, Adjustable, 6 in.
329310	Paper Dust Cleaner
228860	Gage, Tip Clearance (.007-.013 in.)
316440-6	Gage, Tip Clearance (.003 in.)
229470	Gage, Heel Gap (.021-.023 in.)
309860-3	Gage, Heel Gap (.019)
304610	Gage, End Play (.005/.010, 3/16 in. I.D.)
304612	Gage, End Play (.005/.010, 1/4 in. I.D.)
304614	Gage, End Play (.002/.010, 1/4 in. I.D.)
304618	Gage, End Play (.005/.015, 1/4 in. I.D.)
335511	Gage, End Play (.001/.002, 3/16 in. I.D.)
335513	Gage, End Play (.001/.020, 1/4 in. I.D.)

RECOMMENDED SPARE PARTS

The following list denotes items on which wear or failure is most likely to occur. These parts should be kept on hand if on-the-spot repair of simple breakdown is necessary.

Quantities are suggested on the basis of one to five units. The Recommended Spare Parts List for the Model 420 is 337980. This list is subject to change.

Quantity	Part Number	Description
1	600039	Assembly, Breaker Switch
1	143390	Push Rod
6	145020	Spring, Armature
6	300371	Spring, Armature
4	216400	Spring, Rebound
1	318460	Assembly, Armature with Felt Pad
5	217303	Armature, Perforator Mechanism
5	217680	Assembly, Spring Clutch
5	219601	Assembly, Control Sleeve, Punches
1	219602	Assembly, Control Sleeve, Switch
2	220532	Assembly, Coil, 48V, 220 Ohm <i>or</i>
2	220535	Assembly, Coil, 24V, 50 Ohm
2	601580-1	Assembly, Coil, 24V, 28 Ohm
1	389990	Assembly, Friction Clutch
2	226372	Shim, Anti-residual, 48V, CDM
2	276373	Shim, Anti-residual, 48V, CDM <i>or</i>
2	226374	Shim, Anti-residual, 24V, CDM
2	225371	Shim, Capstan Shaft, .003 - 3/16 I.D.
2	225372	Shim, Capstan Shaft, .005 - 3/16 I.D.
2	225373	Shim, Capstan Shaft, .010 - 3/16 I.D.
2	225374	Shim, Input Shaft, .003 - 1/4 I.D.
2	225375	Shim, Input Shaft, .005 - 1/4 I.D.
2	225376	Shim, Input Shaft, .010 - 1/4 I.D.
2	225377	Shim, Input Shaft, .005 - 3/16 I.D.
1	305083	Belt, Lug
2	305094	Belt, O-Ring
5	4095500	Ring, Retaining
5	4095600	Ring, Retaining
5	4095700	Ring, Retaining
2	4151100	Screw, 1-72 x 3/16 in., Flat Head Slotted
2	400013-03	Screw, 4-40 x 3/16 in., Pan Head Slotted
2	400013-51	Screw, 4-48 x 1/8 in., Pan Head Slotted
2	400017-03	Screw, 8-32 x 1/4 in., Pan Head Slotted
2	400031-28	Fuse, 2A, 115V <i>or</i>
2	400031-20	Fuse, 1.25A, 230V

PARTS LIST

GENERAL ASSEMBLY –FRONT VIEW Reference Numbers: 515520-1 (48V), 515520-2 (24V)

NOTE: This Parts List assumes a unit operating at 115V/60 Hz with either a 48 volt or 24 volt DC pulse input requirement. For variations of this list, see OPTIONS.

Index	Part Number	Description
1	601701-1	Panel
2	4165500	Screw, 8-32 x 1/2 in., Flat Head Phillips (4)
3	145150	Clip, Chad Box
4	400013-03	Screw, 4-40 x 3/16 in., Pan Head Slotted (2)
4	4179300	Washer, No. 4, Internal Star (2)
4	400216-07	Washer, No. 4, Flat (2)
5	226240	Capstan
	4153900	Screw, 4-40 x 1/8 in., Socket Set, Cup Point
6	229720-1	Assembly, Chad Chute
7	400013-03	Screw, 4-40 x 3/16 in., Pan Head Slotted (2)
8	518970	Assembly, Tape Supply Slide
9	220411	Assembly, Tape Guide
9	226741	Shim, .010 in. thick } as required
9	226742	
9	226743	
10	515080	Chad Box
11	600463-1	Assembly, Perforator Mechanism (115V/60 Hz/48V) <i>or</i>
11	600463-2	Assembly, Perforator Mechanism (115V/60 Hz/24V)
12	145140	Bracket, Chad Box
13	400258-02	Screw, 4-40 x 3/8 in., Flat Head Phillips (2)
14	337880-1	Assembly, Tension Arm (note next item and see Fig 33) <i>or</i>
--	303130-3	Assembly, Tension Arm (see Fig 33)
*15	519950	Reel, 7-1/2 inch Lexan <i>or</i>
*15	388195	Reel, 6 inch Lexan (option) <i>or</i>
**15	310622	Reel, 6-1/2 inch NAB, Metal (option) <i>or</i>
***15	519951	Reel, 8-1/2 inch Lexan (option)
16	229490	Reel Adapter <i>or</i>
16	318600	Reel Adapter
17	4161200	Screw, 6-32 x 1/2 in., Flat Head Phillips (5)
17	4172850	Nut, 6-32, Hex Keps (5) (not shown)

- * Requires No. 229490 Reel Adapter
- ** Requires No. 318600 Reel Adapter
- *** Requires No. 303130-3 Tension Arm Assembly

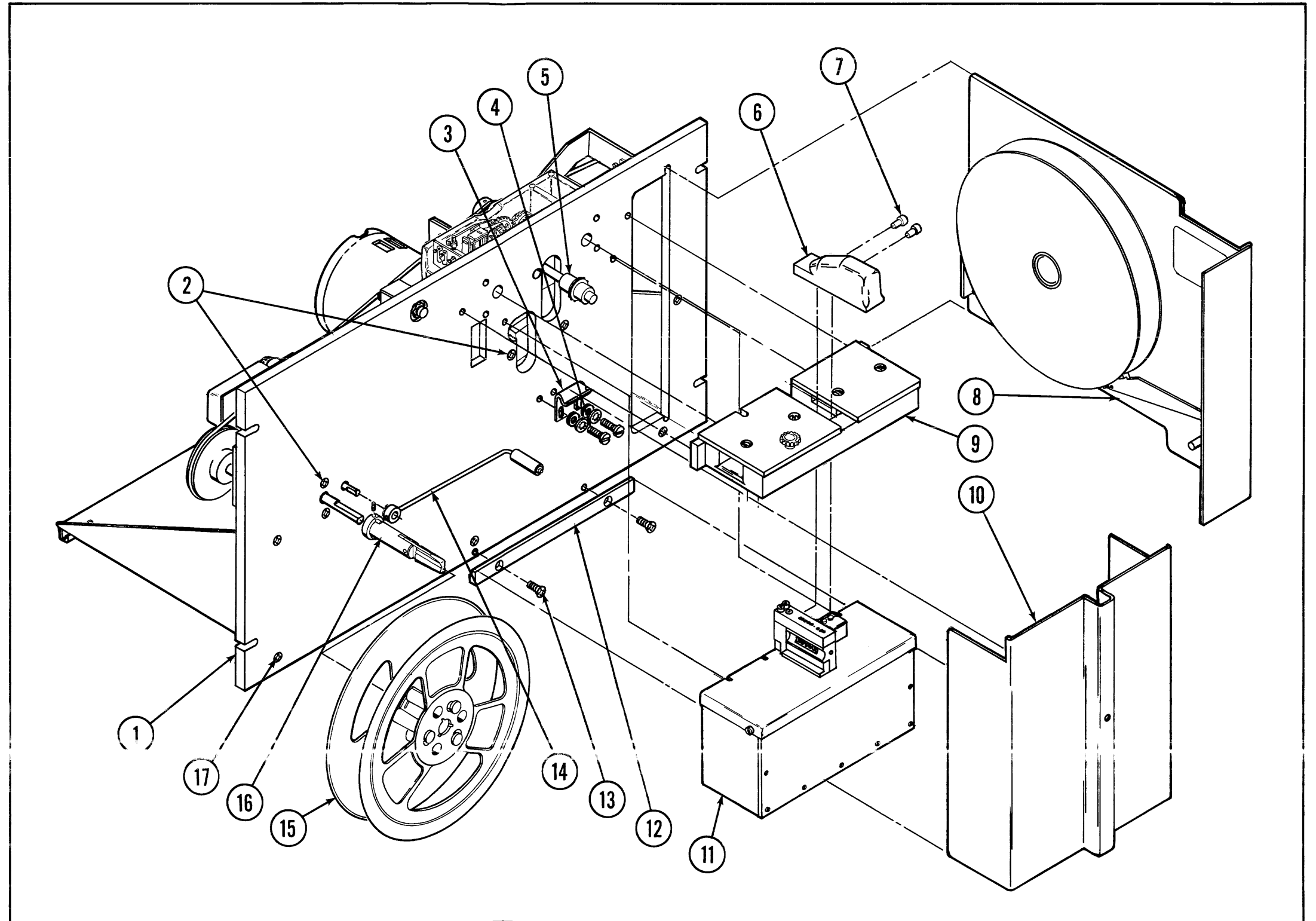


Figure 24
GENERAL ASSEMBLY (FRONT VIEW)

PARTS LIST

GENERAL ASSEMBLY –REAR VIEW

(Reference Numbers: 515520-1 (48V); 515520-2 (24V))

NOTE: This parts list assumes a unit operating at 115V/60 Hz with either a 48 volt or 24 volt DC pulse

input requirement. For variations of this list, see OPTIONS.

Index	Part Number	Description
1	400016-04	Screw, 6-32 x 5/16 in., Pan Head Slotted (2)
1	4172850	Nut, No. 6, Hex Keps (2)
2	600484-1	Assembly, Cable
	147691	Connector, 34-Pin, Male
	147692	Connector, 34-Pin, Female (not shown)
	225360	Bracket, Connector
	4068570	Connector, 14-Pin (not shown)
	4068670	Hood
	4089270	Fuse Holder
3	400324-09	Screw, 1/4 - 20 x 3/4 in., Hex Head (4)
4	400031-28	Fuse, 2.0 amperes
5	230650	Bracket, Motor Mounting
6	228223	Spacer, .030 in. } as required
6	228224	Spacer, .125 in. }
6	228225	Spacer, .060 in. }
7	515010-1	Chassis
8	145160	Bracket, Magnetic Catch
9	400013-07	Screw, 4-40 x 5/16 in., Pan Head Slotted (2)
9	4171900	Nut, No. 4, Hex Keps (2)
10	305110	Catch, Magnetic
11	400013-01	Screw, 4-40 x 1/8 in., Pan Head Slotted (2)
11	4179300	Washer, No. 4, Internal Star (2)
11	400216-07	Washer, No. 4, Flat (2)
12	321750	Guide Strip, Tape Supply Slide
12	4114370	Rivet (3)
13	302990	Motor, 1/12HP, 115V/230V, 50/60 Hz
14	4070400	Relay
14	4158520	Screw, 6-32 x 3/16 in., Round Head Brass (3)
15	400016-03	Screw, 6-32 x 1/4 in., Pan Head Slotted (2)
15	4179400	Washer, No. 6, Internal Star (2)
16	312090-5	Pulley, 3/4 in. diameter
17	305083	Belt, Lug
18	600613-1	Pulley, 12 Tooth, 1/4 in. I.D.
19	4165100	Screw, 8-32 x 1/2 in., Socket Head Cap (4)
19	4179500	Washer, No. 8, Internal Star (4)
19	400216-10	Washer, No. 8, Flat (4)
20	600773-14	Assembly, Capstan Drive, 48V (Models with Ball Bearings only) or
20	600773-15	Assembly, Capstan Drive, 24V (Models with Ball Bearings only) or
20	352260-11	Assembly, Capstan Drive, 48V (Models with Bushings only) or
20	352260-10	Assembly, Capstan Drive, 24V (Models with Bushings only)

PARTS LIST

GENERAL ASSEMBLY—REAR VIEW (Continued)

Index	Part Number	Description
21	4165100	Screw, 8-32 x 1/2 in., Socket Head Cap (2)
21	4179500	Washer, No. 8, Internal Star (2)
21	400216-10	Washer, No. 8, Flat
22	400017-05	Screw, 8-32 x 3/8 in., Pan Head Slotted
23	4165100	Screw, 8-32 x 1/2 in., Socket Head Cap (2)
23	4179500	Washer, No. 8, Internal Star (2)
23	400216-10	Washer, No. 8, Flat (2)
*24	4078550	Switch, Buzz
25	4097920	Clamp, Cable, 5/16 in.
25	400016-05	Screw, 6-32 x 3/8 in.
25	4179400	Washer, No. 6, Internal Star
25	400216-09	Washer, No. 6, Flat
26	600789-1	Assembly, Reeling Mechanism (Models with Ball Bearings)
26	515451	Assembly, Reeling Mechanism (Models with Bushings)
27	144960	Assembly, Idler Mechanism
28	600613-1	Pulley, 12 Tooth, 1/4 in. I.D.
29	305083	Belt, Lug
30	600613-22	Pulley, 16 Tooth, 5/16 in. I.D.
31	600613-20	Pulley, 12 Tooth, 5/16 in. I.D.
32	4097920	Clamp, Cable, 5/16 in. (2)
32	400016-05	Screw, 6-32 x 3/8 in., Pan Head Slotted (2)
32	4179400	Washer, No. 6, Internal Star (2)
32	400216-09	Washer, No. 6, Flat (2)
32	4172850	Nut, No. 6, Hex Keps (2)
33	305097	Belt, O-Ring
34	312090-3	Pulley, 2 inch diameter
35	400324-06	Screw, 1/4 - 20 x 7/16 in., Hex Head (2)
35	4179000	Washer, 1/4 I.D., Split (2)
35	4175650	Washer, 1/4 I.D., Flat (2)
36	400017-05	Screw, 8-32 x 3/8 in., Pan Head Slotted
36	4173250	Nut, No. 8, Hex Keps
37	223900	Stiffner Chassis
38	4175650	Washer, 1/4 I.D., Flat (4)
38	4173700	Nut, No. 1/4 - 20, Nylon Self Locking (4)

* Part of Cable Assembly, 600484-1.

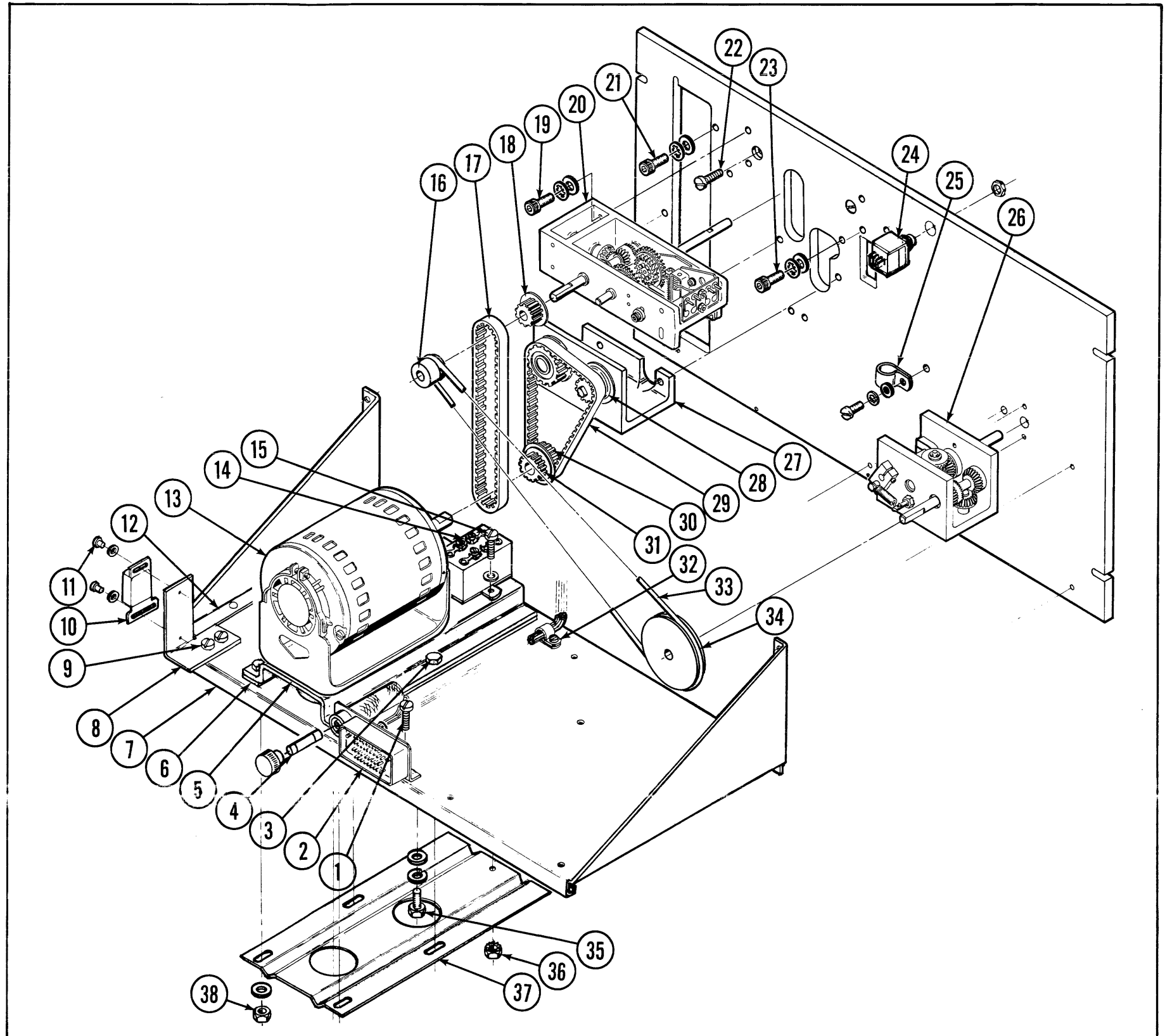


Figure 25
GENERAL ASSEMBLY (REAR VIEW)

PARTS LIST

PERFORATOR MECHANISM Reference No. 600463-1 (48V); 600463-2 (24V)

Index	Part Number	Description
*1	218180	Frame, Oil Pan
2	4164701	Screw, 8-32 x 3/8 in., Socket Head Cap
3	4155100	Screw, 4-40 x 1/4 in., Pan Head Slotted with Washer, No. 4, Flat (2)
**4	4068240	Connector, 14-Pin
5	146060	Gasket, Connector
6	4091000	Terminal, Insulated (2)
7	514920	Plate, Base
8	400017-07	Screw, 8-32 x 1/2 in., Pan Head Slotted (8)
9	400017-07	Screw, 8-32 x 1/2 in., Pan Head Slotted (2)
10	4176100	Gasket
11	144430	Assembly, Coupling
12	4164701	Screw, 8-32 x 3/8 in., Socket Head Cap
13	219491	Assembly, Baffle, Left Side
13	219492	Assembly, Baffle, Right Side
14	219480	Cover, Oil Pan
15	4155100	Screw, 4-40 x 1/4 in., Pan Head Slotted with Washer, No. 4, Flat (4)
16	228751	Assembly, Switch, Breakers with Suppression Network
17	4153650	Screw, 3-48 x 1/2 in., Round Head Slotted (2)
18	146320	Insulator, Switch
19	4155100	Screw, 4-40 x 1/4 in., Pan Head Slotted (2)
20	142364	Assembly, Bracket, Escapement, Upper Right
21	142361	Assembly, Bracket, Escapement, Lower Right
22	225271	Pin, Retaining (4)
23	149740	Bushing, Drive Shaft
24	225380	Bushing, Base Plate (3)
25	140420	Stud, Idler
26	146680	Gear, Drive
27	221022	Assembly, Gear and Clutch Shaft, Upper Right
28	221021	Assembly, Gear and Clutch Shaft, Lower Right
29	227930	Guard, Oil Splash
30	140470	Bracket, Switch Linkage
31	146260	Washer, Pushrod
32	143390	Pushrod
33	141550	Pivot, Stud-Switch Linkage
34	4155000	Screw, 4-40 x 1/4 in., Socket Head Cap (2)
35	4095500	Ring, Retaining
36	4151100	Screw, 1-72 x 3/16 in., Flat Head Slotted
37	139490	Plate, Retainer
38	216400	Spring, Rebound
39	217680	Clutch, Spring, Wire
40	219601	Assembly, Punch Control Sleeve <i>or</i>
40	219602	Assembly, Switch Control Sleeve
41	216421	Assembly, Linkage, Channels 1, 2, 4, 5, 8

PARTS LIST

PERFORATOR MECHANISM (Continued)

Index	Part Number	Description
42	602021-1	Assembly, Die Block, Punch
	216540	Clamp, Block
43	4095700	Ring, Retaining (17)
44	217091	Standoff
45	225380	Bushing, Plate (4)
46	4155000	Screw, 4-40 x 1/4 in., Socket Head Cap
46	4178700	Washer, No. 4, Split
47	400017-05	Screw, 8-32 x 3/8 in., Pan Head Slotted (2)
48	521400	Plate, Outer Bearing
49	217092	Shaft, Standoff
50	140480	Gear, Oil Lead
51	216423	Assembly, Linkage, Channels 3 and 6
52	216422	Assembly, Linkage, Sprocket, Channel 7
53	218260	Assembly, Linkage, Switch
54	400013-51	Screw, 4-48 x 1/8 in., Pan Head Slotted (10)
55	142362	Assembly, Bracket, Lower Left
56	145020	Spring, Armature (Perforator Mechanism (10)
57	216592	Escapement Assembly, 48V, 220 Ohm Coil (10) <i>or</i>
57	216595	Escapement Assembly, 24V, 50 Ohm Coil (10)
a	223760	Frame, Coil Assembly
b	220532	Coil, 48V, 220 Ohm <i>or</i>
b	220535	Coil, 24V, 50 Ohm
c	601202-1	Shim, Anti-residual
d	217303	Armature, Escapement
e	378510	Limit, Escapement
f	400013-51	Screw, 4-48 x 1/8 in., Pan Head Slotted
g	4178700	Washer, No. 4, Split
58	142363	Bracket, Escapement, Upper Left
59	146041	Spacer, Toggle
60	140660	Shaft, Toggle
61	221024	Assembly, Gear and Clutch Shaft, Lower Left
62	4095800	Ring, Retaining
63	143380	Bearing, Idler
64	221023	Assembly, Gear and Clutch Shaft, Upper Left
65	400017-02	Screw, 8-32 x 3/16 in., Pan Head Slotted with Gasket, Oil Plug
66	400017-02	Screw, 8-32 x 3/16 in., Pan Head Slotted (Drain Plug)
67	4090205	Gasket, Oil Plug
*68	4151700	Screw, 2-56 x 3/16 in., Flat Head Slotted (9)
*69	140430	Cover, Front, Plexiglass

* Items 1, 68 and 69, must be ordered together as a unit (Part Number 517350).

** 4068570 Connector (mates with item 4)
4068670 Hood for Connector, above.

NOTE: Shim each Clutch Assembly (see detail B) as required when placed on the shaft, using the following Shims:

225374	.003 x 1/4 in. I.D.
225375	.005 x 1/4 in. I.D.
225376	.010 x 1/4 in. I.D.

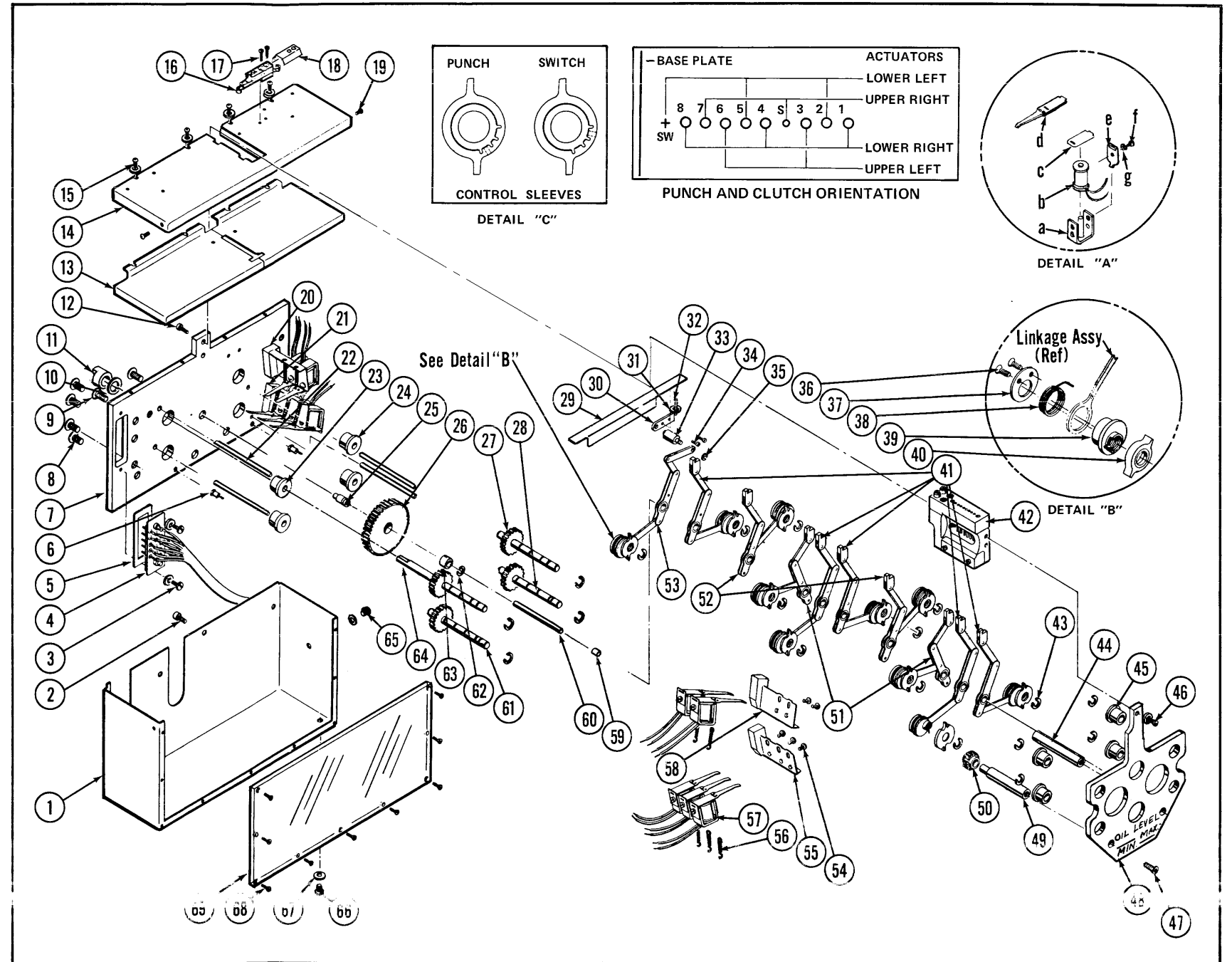


Figure 26
PERFORATOR MECHANISM

PARTS LIST

CAPSTAN DRIVE MECHANISM

Reference Numbers: Models with Ball Bearings

600773-14 (48V)
600773-15 (24V)

Reference Numbers: Models with Bushings

352260-11 (48V)
352260-10 (24V)

Index	Part Number	Description
*1	600764-1	Assembly, Capstan Frame (Models with Ball Bearings)
	386241	Frame
	4000700	Ball Bearing (4) (see items 3, 23 and 29)
	349842	Bushing (index 8)
	349843	Bushing (index 22)
	335610	Frame, Capstan (Models with Bushings only)
*2	225376	Shim, .010 in.
2	225374	Shim, .003 in. (Models with Bushings only) <i>or</i>
2	225375	Shim, .005 in. (Models with Bushings only) <i>or</i>
2	225376	Shim, .010 in. (Models with Bushings only) as required
3	349840	Bushing
*3	4000700	Ball Bearing
4	138240	Gear, Bevel, with Set Screw
5	135530	Shaft, Capstan
**6	4095600	Ring, Retaining
**7	225377	Shim, .005 in.
8	349842	Bushing
**9	135560	Gear, Spider Bevel
10	389990	Assembly, Friction Clutch (2)
**11	135550	Spider, Differential
**12	304181	Screw, 6-32 x 3/8 in., Socket Head Cap
13	3138210	Assembly, Magnetic Actuator, 48V Coil (2)
		(Models with Bushings only) <i>or</i>
13	313829	Assembly, Magnetic Actuator, 24V Coil (2)
		(Models with Bushings only)
a	223760	Assembly, Coil Frame
b	400013-51	Screw, 4-48 x 1/8 in., Pan Head Slotted
c	4178700	Washer, No. 4, Split
d	223770	Limit, Escapement
e	226372	Shim, Anti-residual, .004 in.
f	220532	Assembly, Coil, 48V, 220 Ohm <i>or</i>
f	220535	Assembly, Coil, 24V, 50 Ohm
g	318460	Assembly, Armature
h	145020	Spring, Actuator
i	4155050	Screw, 4-40 x 1/4 in., Socket Head Cap (2)
j	313740	Bracket, Latch Actuator
*13	601071-3	Assembly, Magnetic Actuator, 48V Coil (2)
*13	601071-4	Assembly, Magnetic Actuator, 24V Coil (2)
		(Models with Ball Bearings only)
a	223760	Assembly, Coil Frame

PARTS LIST

CAPSTAN DRIVE MECHANISM (Continued)

Index	Part Number	Description
b	400013-51	Screw, 4-48 x 1/8 in., Pan Head Slotted
c	4178700	Washer, No. 4, Split
d	223770	Limit, Escapement
e	226373	Shim, Anti-residual, .003 in., Flat (for 48V Coil) <i>or</i>
e	226374	Shim, Anti-residual, .004 in., Flat (for 24V Coil)
f	220532	Assembly, Coil, 48V, 220 Ohm
f	601580-1	Assembly, Coil, 24V, 28 Ohm
g	318460	Assembly, Armature
h	300371	Spring, Actuator
i	4155050	Screw, 4-40 x 1/4 in., Socket Head Cap (2)
j	313740	Bracket, Latch Actuator
k	304370	Screw, Spring Tension Adjust
l	4172400	Nut, 6-32, Hex, Self Locking Stop
14	4154100	Screw, 4-40 x 1/4 in., Socket Head Cap (2)
15	144560	Strip, Terminal
16	4155100	Screw, 4-40 x 1/4 in., Pan Head Slotted
17	145780	Assembly, Plate, Capstan Adjusting
18	4161770	Screw, 6-32 x 5/8 in., Set, Socket Head
19	304183	Screw, 6-32 x 9/16 in., Socket Head
20	4179400	Washer, No. 6, Internal Star
21	353690	Washer, No. 6, Flat
22	349843	Bushing
23	349841	Bushing (Models with Bushings only)
*23	4000700	Ball Bearing
24	400009-05	Washer, Thrust
*24	397920	Spring, Preload (Models with Ball Bearings only)
25	225374	Shim, .003 in. (Models with Bushings only) <i>or</i>
25	225375	Shim, .005 in. (Models with Bushings only) <i>or</i>
25	225376	Shim, .010 in. (Models with Bushings only) as required
26	147640	Shaft, Drive
*26	386320	Shaft, Drive
27	135540	Gear, Bevel
*27	225376	Shim, .010 in. (Models with Ball Bearings only)
28	349841	Bushing (2)
29	4000700	Ball Bearing (2)
*29	135511	Shaft, Idler, with Bevel Gear
*30	386300	Shaft, Idler, with Bevel Gear
** -	304282	Washer, Wave (assemble between index 7 and index 9)
** -	304282	Washer, Wave (assemble between index 22 and index 10 for Models with Bushings only)

* Models with Ball Bearings only.

** Comprise Differential Spider Assembly, Part Number 216830.

NOTE: Use shims, as required, between items 22 and 10 (Bushing and Ball Bearing Units) and between items 8 and 10 (Ball Bearing Units only). Shims used are:

225371	.003 in. x 3/16 in. I.D.
225372	.005 in. x 3/16 in. I.D.
225373	.010 in. x 3/16 in. I.D.

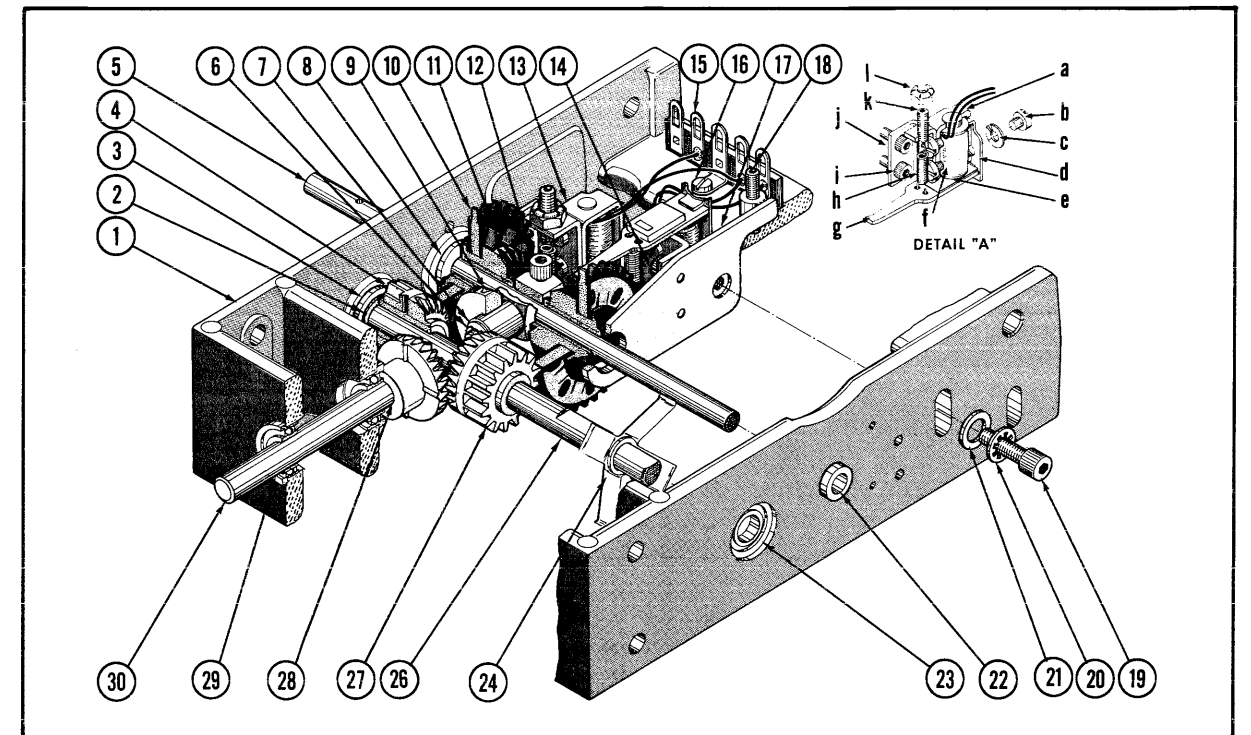


Figure 27
CAPSTAN DRIVE MECHANISM—BALL BEARING UNITS

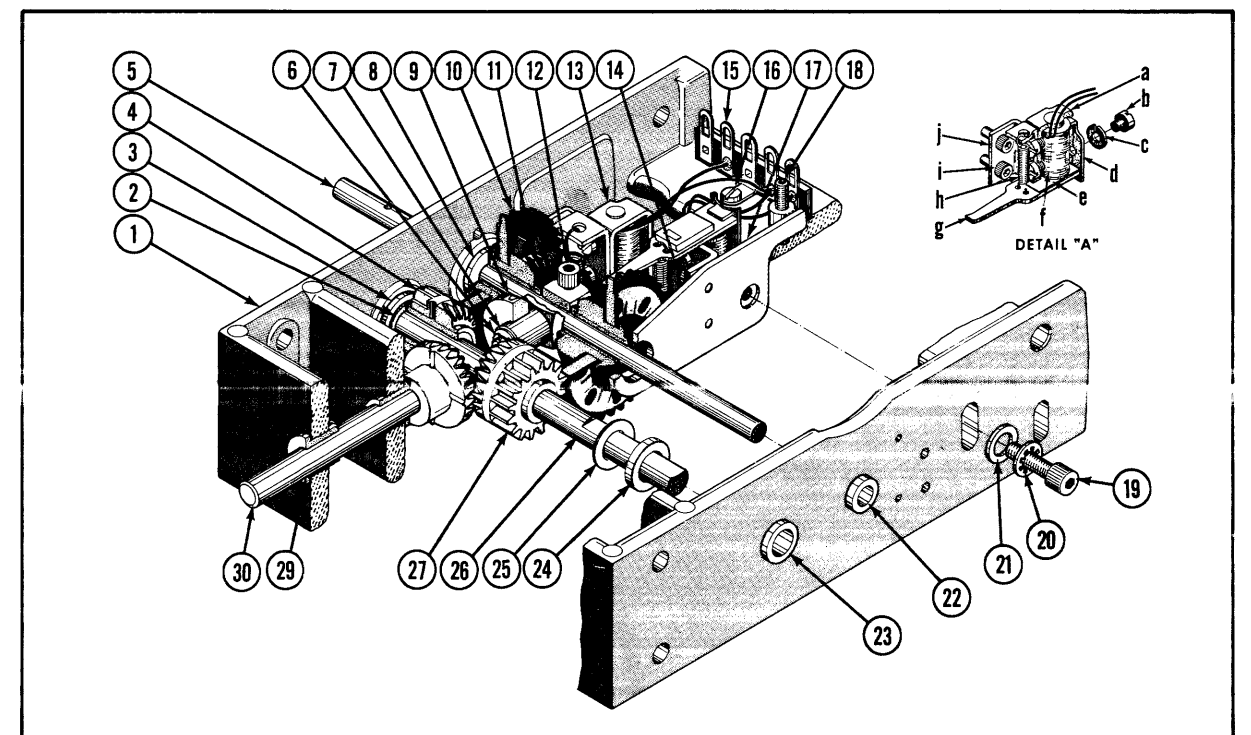


Figure 28
CAPSTAN DRIVE MECHANISM—UNITS WITH BUSHINGS

PARTS LIST

REEL DRIVE MECHANISM

Reference Numbers: 600789-1—Ball Bearing Units
515451 —Bushing Units

Index	Part Number	Description
1	226520	Gear, Spider Bevel
2	4096400	Ring, Retaining
3	228880	Pin, Differential
*4	386260	Assembly, Frame, Reel Drive Mechanism (Models with Ball Bearings only)
	386250	Frame
	304197	Bushing (2) (use on item 19, Tension Shaft)
4	515940	Assembly, Frame, Reel Drive Mechanism (Models with Bushings only)
	515941	Frame
	304197	Bushings (2) (use on item 19, Tension Shaft)
	304201	Bushings (4) (see index 11)
5	362960	Shaft, Reeling
6	146440	Gear, Bevel with Set Screw, 4-40, Socket Set, Cup Point
7	135560	Gear, Spider Bevel
8	146630	Spacer
9	4106800	Pin, Dowel, 3/16 in. diameter x 7/8 in. long
10	135540	Gear, Bevel
*11	305071	Ball Bearing (4)
*11	4097050	Ring, Grip (4)
11	304201	Bushing (4)
12	144850	Shaft, Drive
*12	386350	Shaft, Drive
13	4173250	Nut, 8-32, Hex Keps
14	4170700	Bolt, Spade, 8-32
15	600641-1	Spring, Brake
16	600798-1	Assembly, Tension Link
17	4161100	Screw, 6-32 x 1/2 in., Socket Head Cap
18	4096700	Ring, Retaining
19	144840	Shaft, Tension
20	228870	Gear, Combination Bevel/Spur
21	4165100	Screw, 8-32 x 1/2 in., Socket Head Cap
21	4178900	Washer, No. 8, Split
22	600786-1	Assembly, Brake
23	4096400	Ring, Retaining
24	228910	Gear, Brake Drum

* Models with Ball Bearings only

NOTE: Use Shims, as required, on items 1, 10, 20 and 24. Shims used are:

305651	.003 in. x 1/8 in. I.D.
305652	.005 in. x 1/8 in. I.D.
305653	.010 in. x 1/8 in. I.D.
225374	.003 in. x 1/4 in. I.D.
225375	.005 in. x 1/4 in. I.D.
225376	.010 in. x 1/4 in. I.D.

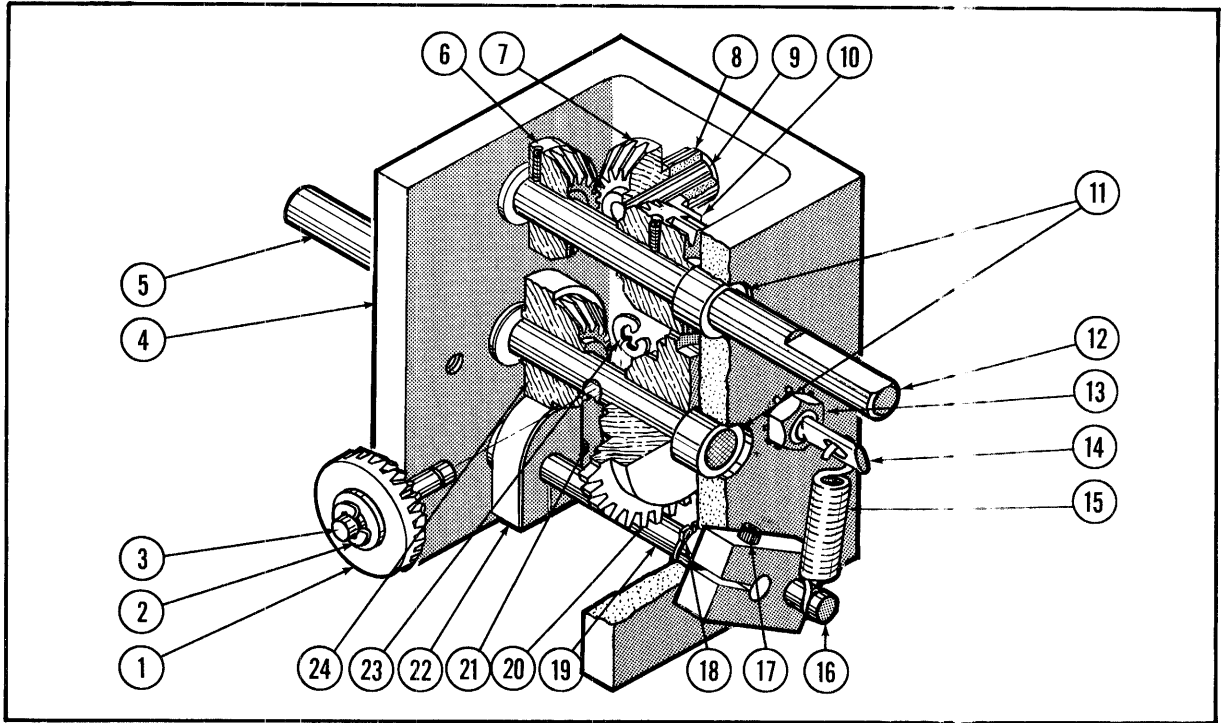


Figure 29
REEL DRIVE MECHANISM—UNITS WITH BUSHINGS

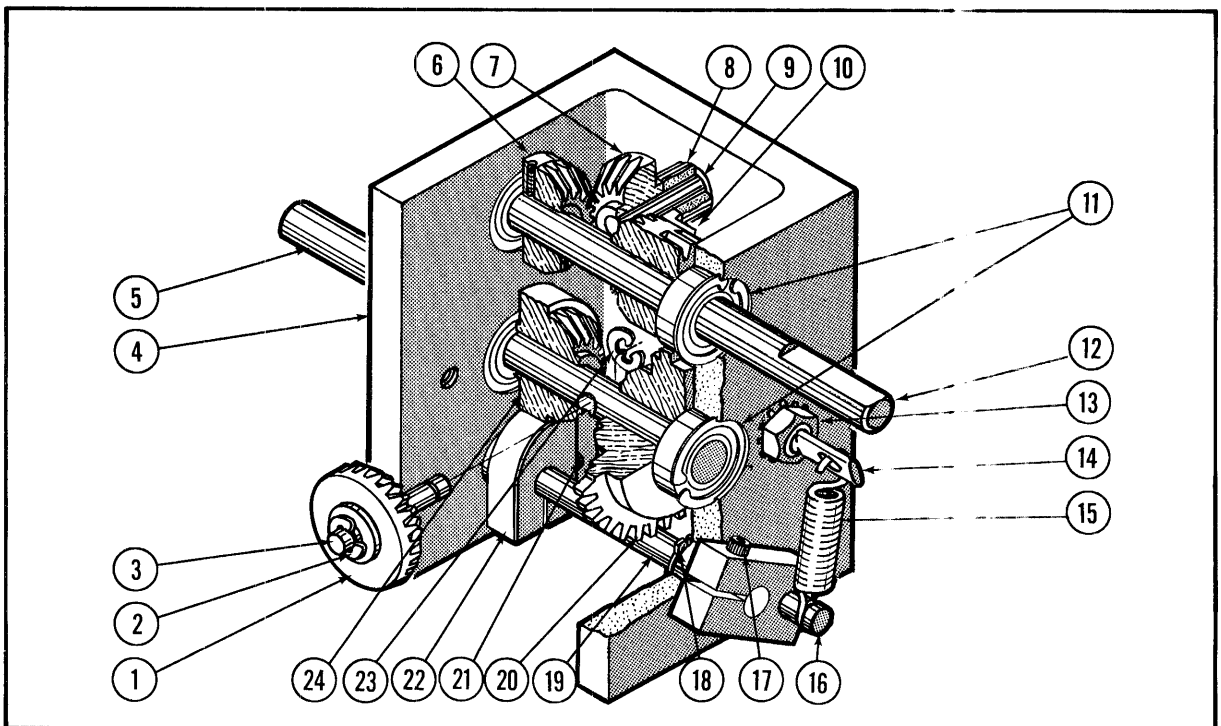


Figure 30
REEL DRIVE MECHANISM—BALL BEARING UNITS

PARTS LIST

TAPE GUIDE ASSEMBLY (Reference No. 220411)

<u>Index</u>	<u>Part Number</u>	<u>Description</u>
1	220420	Tape Guide, Standard
2	313780	Screw, Guide (1 needed for 5 and 6 channel operation)
3	147290	Screw, Lid Locating
4	303030	Stripper, Tape
5	400013-05	Screw, 4-40 x 1/4 in., Pan Head Slotted (2)
5	4178700	Washer, No. 4, Split (2) <i>and</i>
5	400216-07	Washer, No. 4, Flat (2)
--	307100	Assembly, Lid, Left Hand
6	144590	Spring, Pivot (2)
7	144530	Pivot, Spring-loaded Tape Lid (2)
8	4108950	Pin, .039 ± .003 (2)
9	303020	Plate, Nut
10	303040	Hold-down, Tape
11	4096600	Ring, Grip
12	144421	Lid, Tape Guide, Left Hand
13	4108950	Pin, .039 ± .003 in. (2)
14	400013-07	Screw, 4-40 x 5/16 in., Pan Head Slotted (2)
15	4164450	Screw, 8-32 x 3/8 in., Thumb
--	307090	Assembly, Lid, Right Hand
16	400013-05	Screw, 4-40 x 1/4 in., Pan Head Slotted (2)
17	4108950	Pin, .039 ± .003 (2)
18	144422	Lid, Tape Guide, Right Hand
19	145511	Spacer, Lid, Tape Guide
20	144530	Pivot, Spring-loaded Tape Lid (2)
21	4108950	Pin, .039 ± .003 (2)
22	144590	Spring, Pivot (2)
23	145540	Screw, Guide (2 needed for 5 and 6 channel operation)

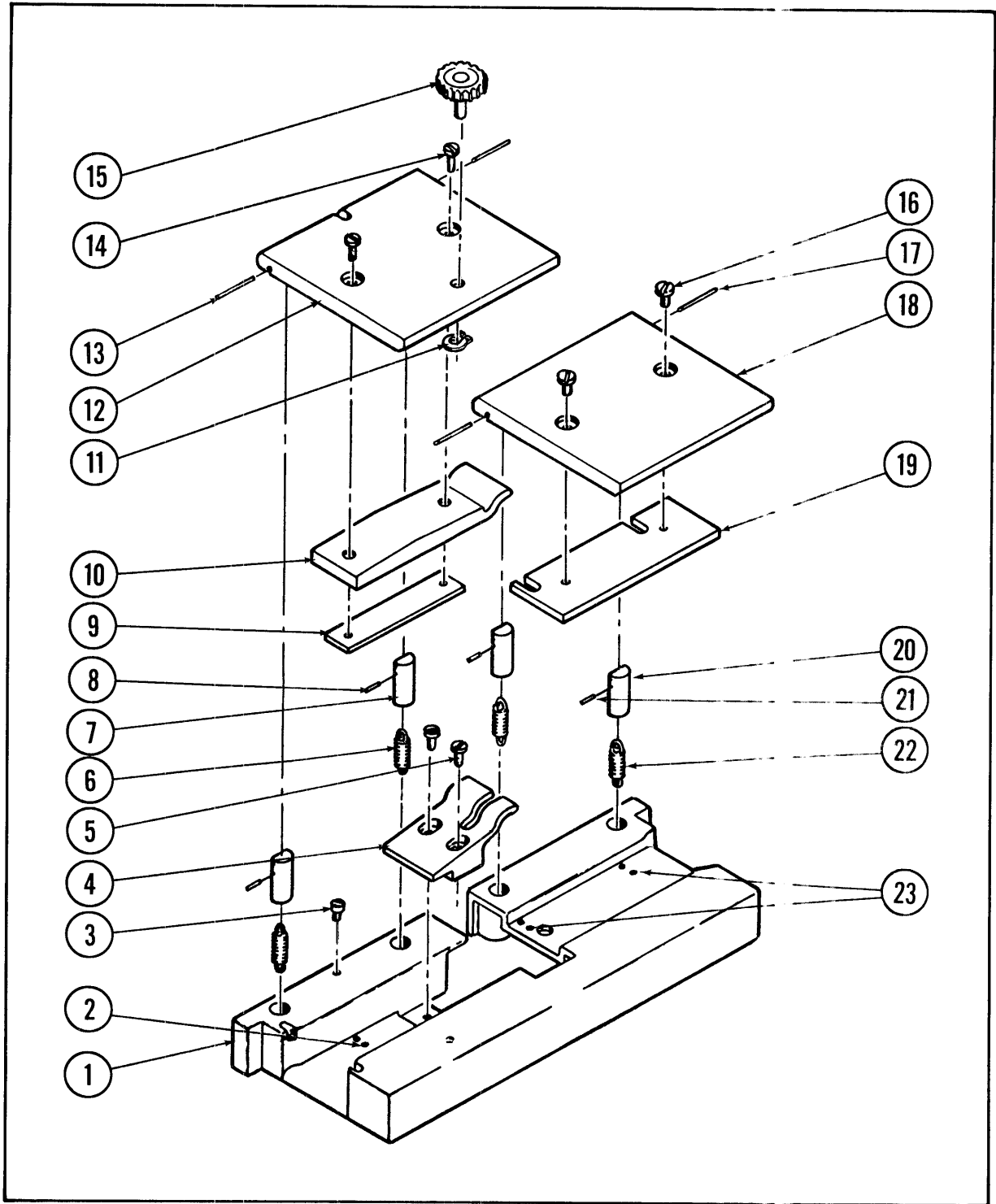


Figure 31
TAPE GUIDE ASSEMBLY

PARTS LIST

IDLER MECHANISM ASSEMBLY (Reference No. 144960)

Index	Part Number	Description
1	220400	Support, Drive Shaft
2	4175550	Washer, Plain, 5/16 in.
3	4179850	Washer, Internal Star, 5/16 in.
4	4173800	Nut, 5/16-18, Hex
5	144430	Coupling
6	4096210	Ring, Retaining
7	225376	Shim, .010 x 1/4 in. I.D.
8	305070	Ball Bearing
9	145860	Retainer, Bearing
10	4155100	Screw, 4-40 x 1/4 in., Pan Head (2)
11	145460	Shaft, Extension
12	4096700	Ring, Retaining
13	600613-8	Pulley, 18 Tooth, 3/16 in. I.D.
14	4106800	Pin, Dowel, 3/16 x 7/8 in.
15	145450	Stud, Idler

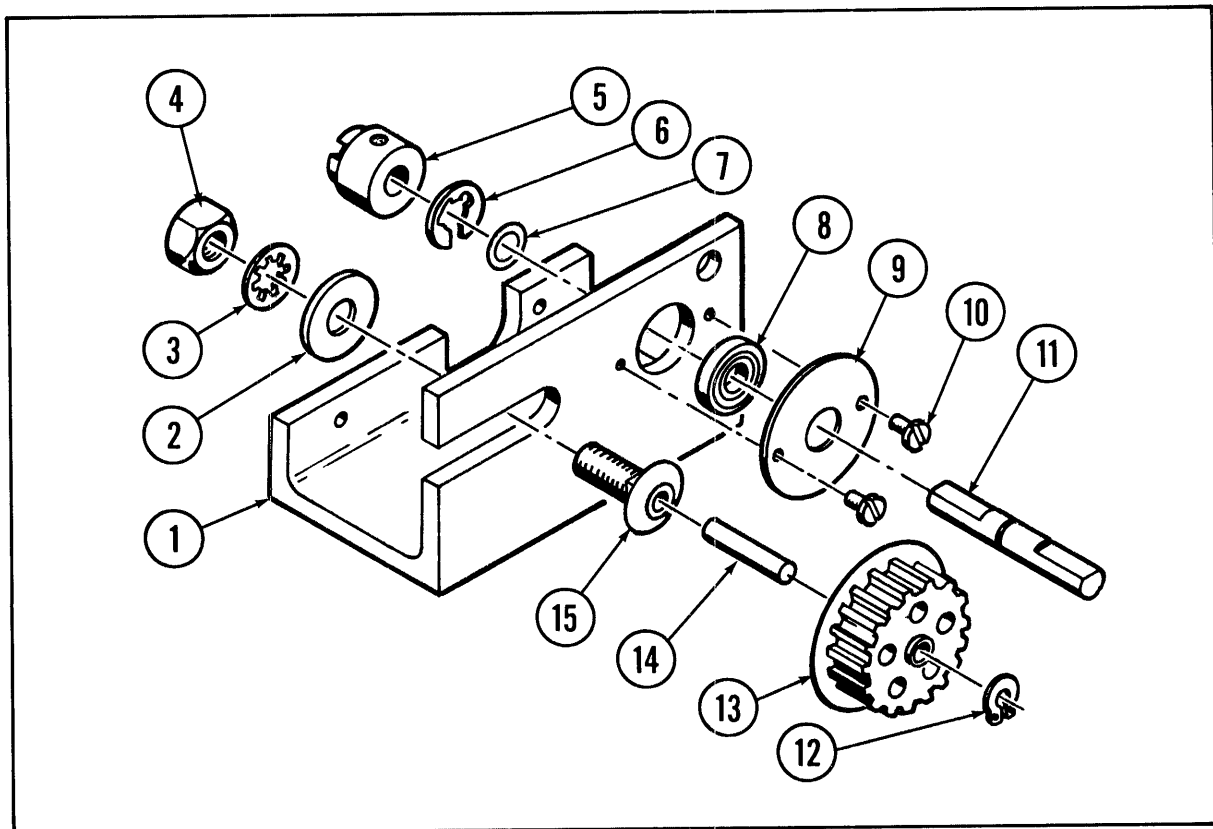


Figure 32
IDLER MECHANISM ASSEMBLY

PARTS LIST

TENSION ARM ASSEMBLY A (Reference No. 337880-1)

<u>Index</u>	<u>Part Number</u>	<u>Description</u>
1	4162850	Screw, 8-32 x 1/8 in., Socket Head Set, Cup Point
2	306080	Arm, Sensing
3	345520	Roller
4	4096500	Ring, Retaining (2)

NOTE: Tension Arm "A" is used with the 7-1/2 inch Standard Reel, and the 6, 6-1/2 and 8 inch Reel Options.

TENSION ARM ASSEMBLY B (Reference No. 303130-3)

<u>Index</u>	<u>Part Number</u>	<u>Description</u>
1	4162850	Screw, 8-32 x 1/8 in., Socket Head Set, Cup Point
2	218643	Arm, Sensing
3	356570	Roller
4	4096500	Ring, Retaining (2)

NOTE: Tension Arm "B" is used with the 8-1/2 inch Reel Option.

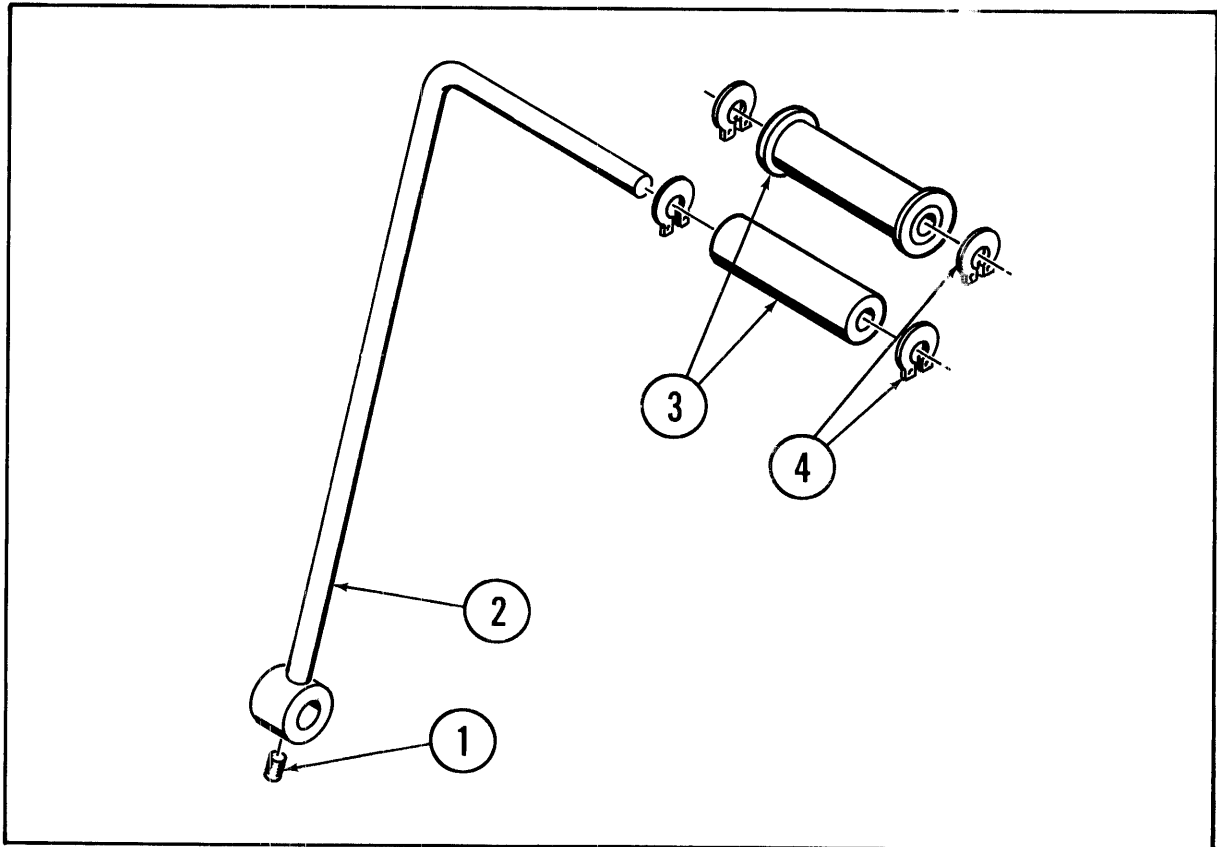


Figure 33
TENSION ARM ASSEMBLY

PARTS LIST

TAPE SUPPLY SLIDE ASSEMBLY (Reference No. 518970)

Index	Part Number	Description
1	220170	Reel, Tape Supply (disassembled to show grip ring location)
2	4095300	Ring, Grip
3	4172100	Nut, 4-40, Keps (2)
4	145280	Angle, Stop
5	515002	Slide, Tape Supply
6	144260	Shaft, Bearing
7	4155100	Screw, 4-40 x 1/4 in., Pan Head Slotted (2)
8	4144310	Rivet, Flat Head, Semi-tubular
9	228780	Assembly, Brake
10	145190	Stud, Brake Spring
11	4175325	Washer, No. 6, Plain
12	145180	Spring, Tension Brake

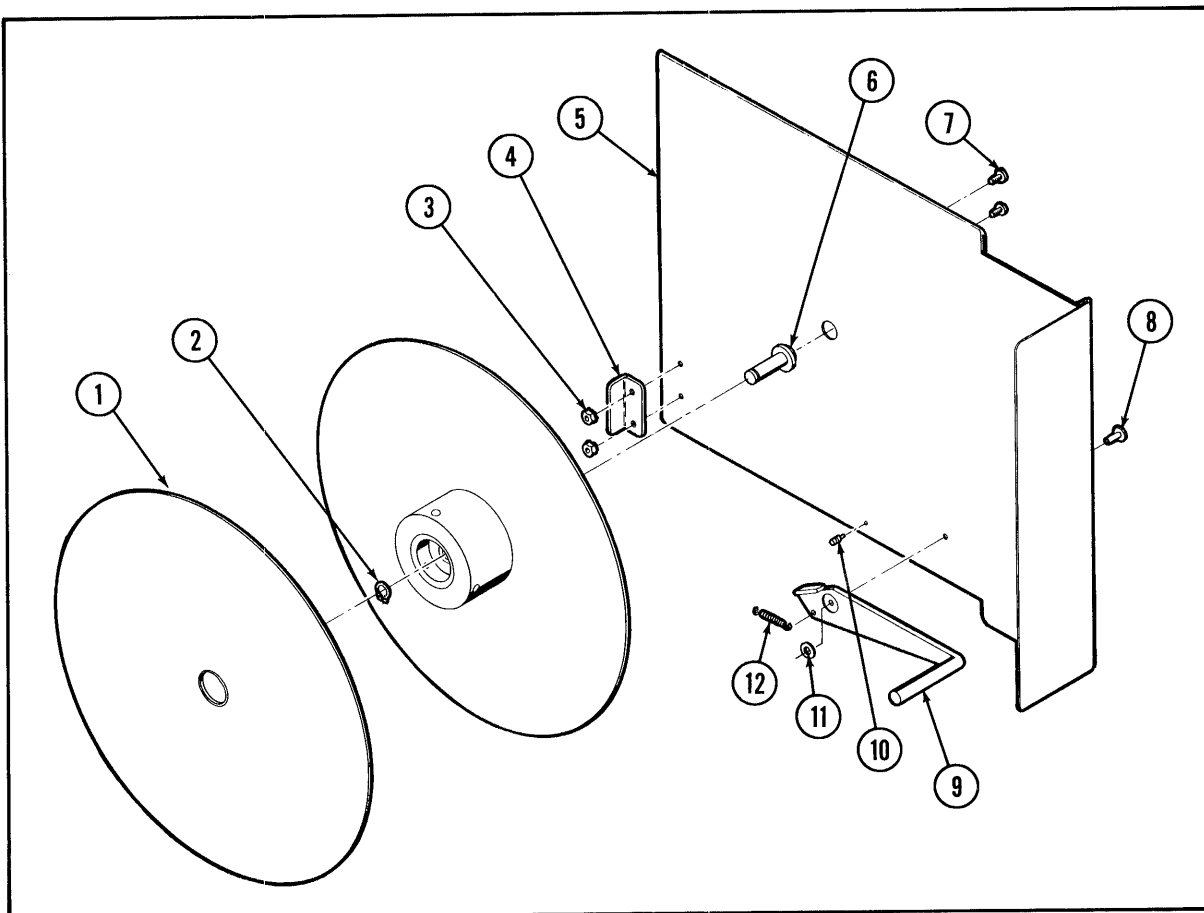


Figure 34
TAPE SUPPLY SLIDE ASSEMBLY

NUMERIC PARTS INDEX

Part Number	Figure Number	Index	Part Number	Figure Number	Index	Part Number	Figure Number	Index
135511	27	30	145020	28	13	219491	26	13
135511	28	30	145140	24	12	219492	26	13
135530	27	5	145150	24	3	219601	26	40
135530	28	5	145160	25	8	219602	26	40
135540	27	27	145180	34	12	220170	34	1
135540	28	27	145190	34	10	220400	32	1
135540	29	10	145280	34	4	220411	24	9
135540	30	10	145450	32	15	220420	31	1
135550	27	11	145460	32	11	220532	26	57
135550	28	11	145511	31	19	220532	27	13
135560	27	9	145540	31	23	220532	28	13
135560	28	9	145780	27	17	220535	26	57
135560	29	7	145780	28	17	220535	28	13
135560	30	7	145860	32	9	221021	26	28
138240	27	4	146041	26	59	221022	26	27
138240	28	4	146060	26	5	221023	26	64
139490	26	37	146260	26	31	221024	26	61
140420	26	25	146320	26	18	223760	26	57
140230	26	69	146440	29	6	223760	27	13
140470	26	30	146440	30	6	223760	28	13
140480	26	50	146630	29	8	223770	27	13
140660	26	60	146630	30	8	223770	28	13
141550	26	33	146680	26	26	223900	25	37
142361	26	21	147290	31	3	225271	26	22
142362	26	55	147640	28	26	225360	25	2
142363	26	58	147691	25	2	225371	27	--
142364	26	20	147692	25	2	225371	28	--
143380	26	63	149740	26	23	225372	27	--
143390	26	32	216400	26	38	225372	28	--
144260	34	6	216421	26	41	225373	27	--
144421	31	12	216422	26	52	225373	28	--
144422	31	18	216423	26	51	225374	26	--
144430	26	11	216540	26	42	225374	28	2
144430	32	5	216592	26	57	225374	28	25
144530	31	7	216595	26	57	225374	29	--
144530	31	20	216830	27	**	225374	30	--
144560	27	15	216830	28	**	225375	26	--
144560	28	15	217091	26	44	225375	28	2
144590	31	6	217092	26	49	225375	28	25
144590	31	22	217303	26	57	225375	29	--
144840	29	19	217680	26	39	225375	30	--
144840	30	19	218180	26	1	225376	26	--
144850	29	12	218260	26	53	225376	27	2
144960	25	27	218643	33	2	225376	27	28
145020	26	56	219480	26	14	225376	28	2

NUMERIC PARTS INDEX (Continued)

Part Number	Figure Number	Index	Part Number	Figure Number	Index	Part Number	Figure Number	Index
225376	28	25	304201	29	11	353690	27	21
225376	29	--	304282	27	--	353690	28	21
225376	30	--	304282	28	--	356570	33	4
225376	32	7	304370	27	13	362960	29	5
225377	27	7	305070	32	8	362960	30	5
225377	28	7	305071	30	11	378510	26	57
225380	26	24	305083	25	17	386241	27	1
225380	26	45	305083	25	29	386250	30	4
226240	24	5	305097	25	33	386260	30	4
226372	28	13	305110	25	10	386300	27	30
226373	27	13	305651	29	--	386320	27	26
226374	27	13	305651	30	--	386350	30	12
226520	29	1	305652	29	--	388195	24	15
226520	30	1	305652	30	--	389990	27	10
226741	24	9	305653	29	--	389990	28	10
226742	24	9	305653	30	--	397920	27	24
226743	24	9	306080	33	2	400009-05	28	24
227930	26	29	307090	31	--	400013-01	25	11
228223	25	6	307100	31	--	400013-03	24	4
228224	25	6	310622	24	15	400013-03	24	7
228225	25	6	312090-3	25	34	400013-05	31	5
228751	26	16	312090-5	25	16	400013-05	31	16
228780	34	9	313740	27	13	400013-07	25	9
228870	29	20	313740	28	13	400013-07	31	14
228870	30	20	313780	31	2	400013-51	26	54
228880	29	3	3138210	28	13	400013-51	26	57
228880	30	3	313829	28	13	400013-51	27	13
228910	29	24	318460	27	13	400013-51	28	13
228910	30	24	318460	28	13	400016-03	25	15
229490	24	16	318600	24	16	400016-04	25	1
229720-1	24	6	321750	25	12	400016-05	25	25
230650	25	5	335610	27	1	400016-05	25	32
300371	27	13	337880-1	24	14	400017-02	26	65
302990	25	13	345520	33	3	400017-02	26	66
303020	31	9	349840	28	3	400017-05	25	22
303030	31	4	349841	28	23	400017-05	25	36
303040	31	10	349841	28	29	400017-05	26	47
303130-3	24	14	349842	27	1	400017-07	26	8
304181	27	12	349842	27	8	400017-07	26	9
304181	28	12	349842	28	8	400031-28	25	4
304183	27	19	349843	27	1	4000700	27	1
304183	28	19	349843	27	22	4000700	27	3
304197	29	4	349843	28	22	4000700	27	23
304197	30	4	352260-10	25	20	4000700	27	29
304201	29	4	352260-11	25	20	400216-07	24	4

NUMERIC PARTS INDEX (Continued)

Part Number	Figure Number	Index	Part Number	Figure Number	Index	Part Number	Figure Number	Index
400216-07	24	11	4108950	31	21	4173250	29	13
400216-07	31	5	4114370	25	12	4173250	30	13
400216-09	25	25	4144310	34	8	4173700	25	38
400216-09	25	32	4151100	26	36	4173800	32	4
400216-10	25	19	4151700	26	68	4175325	34	11
400216-10	25	21	4153650	26	17	4175550	32	2
400216-10	25	23	4153900	24	5	4175650	25	35
400258-02	24	13	4154100	27	14	4175650	25	38
400324-06	25	35	4154100	28	14	4176100	26	10
400324-09	25	3	4155000	26	34	4178700	26	46
4068240	26	4	4155000	26	46	4178700	26	57
4068570	25	2	4155050	27	13	4178700	27	13
4068570	26	**	4155050	28	13	4178700	28	13
4068670	26	**	4155100	26	3	4178700	31	5
4068670	25	2	4155100	26	15	4178900	29	21
4070400	25	14	4155100	26	19	4178900	30	21
4078550	25	24	4155100	27	16	4179000	25	35
4089270	25	2	4155100	28	16	4179300	24	4
4090205	26	67	4155100	32	10	4179300	25	11
4091000	26	6	4155100	34	7	4179400	25	15
4095300	34	2	4158520	25	14	4179400	25	25
4095500	26	35	4161100	29	17	4179400	25	32
4095600	27	6	4161100	30	17	4179400	27	20
4095600	28	6	4161200	24	17	4179400	28	20
4095700	26	43	4161770	27	18	4179500	25	19
4095700	26	62	4161770	28	18	4179500	25	21
4096210	32	6	4162850	33	1	4179500	25	23
4096400	29	2	4164450	31	15	4179850	32	3
4096400	29	23	4164701	26	2	514920	26	7
4096400	30	2	4164701	26	12	515002	34	5
4096400	30	23	4165100	25	19	515010-1	25	7
4096500	33	4	4165100	25	21	515080	24	10
4096600	31	11	4165100	25	23	515451	25	26
4096700	29	18	4165100	29	21	515940	29	4
4096700	30	18	4165100	30	21	515941	29	4
4096700	32	12	4165500	24	2	517350	26	*
4097050	30	11	4170700	29	14	518970	24	8
4097920	25	25	4170700	30	14	519950	24	15
4097920	25	32	4171900	25	9	519951	24	15
4106800	29	9	4172100	34	3	521400	26	48
4106800	30	9	4172400	27	13	600463-1	24	11
4106800	32	14	4172850	24	17	600463-2	24	11
4108950	31	8	4172850	25	1	600484-1	25	2
4108950	31	13	4172850	25	32	600€ 13-1	25	18
4108950	31	17	4173250	25	36	600€ 13-1	25	28

NUMERIC PARTS INDEX (Continued)

<u>Part Number</u>	<u>Figure Number</u>	<u>Index</u>
600613-20	25	31
600613-22	25	30
600613-8	32	13
600641-1	29	15
600641-1	30	15
600764-1	27	1
600773-14	25	20
600773-15	25	20
600786-1	29	22
600786-1	30	22
600789-1	25	26
600798-1	29	16
600798-1	30	16
601071-3	27	13
601071-4	27	13
601202-1	26	57
601580-1	27	13
601701-1	24	1
602021-1	26	42