

# **TAPE PERFORATOR MANUAL**

**MODEL 420**

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## 1.0 INTRODUCTION

### 1.1 Description

The Tally Model 420 tape perforator, Figure 1, is a self-contained, electrically operated, high-speed unit capable of perforating paper recording tape of varying widths from five to eight channels, at rates up to 60 characters per second. The unit is asynchronous, and can be operated at any speed below the maximum, since each character is initiated by a separate, independent pulse. The individual character pulses may be fed to the perforator at any random timing, as long as the interval between characters is not less than  $16\frac{2}{3}$  milliseconds.

The 420 perforator consists essentially of a perforator mechanism, a capstan drive mechanism, and a  $\frac{1}{20}$ -HP drive motor, all mounted on a standard  $10\frac{1}{2}$  x 19-inch panel and a chassis, along with the particular tape handling mechanism required for the type of tape. The motor is mounted on the chassis, and drives the perforator and capstan drive mechanisms by means of two flat lug belts.

### 1.2 Input Requirements

The drive motor requires a source of 105 to 125 volts AC, 60 cycle, and a current of 1.7 amperes. A 2 ampere slow-blow fuse protects the motor.

The escapement assemblies for the capstan drive and punch drive mechanisms require DC pulses of  $4.5 \pm 0.5$  milliseconds duration of 48 or  $24 \pm 10\%$  volts (according to customer specifications) for correct operation. One pulse must be supplied for each movement of the tape and one pulse is required for each character to be punched. Punch pulses for all eight channels are normally derived from a common pulse, but if individual pulse sources are used for each channel, all pulses for any individual character must be simultaneous within  $\pm 0.5$ -millisecond. See Figure 9, Wiring Diagram, for other input requirements.

CAUTION: Steady state current of rated voltage will burn out the coils.

Where spark suppression is to be incorporated with the associated equipment, the conditions specified under Spark Suppression, Paragraph 3.5, must be met.

### 1.3 Tape Handling

The Model 420 perforator is available with two types of tape handling: Model 420PF is equipped with fan-fold tape handling equipment; Model 420PR is equipped for handling tape on reels.

The Model 420PF is fitted with a tape feed tray mounted behind the right side of the panel, and with a tape take-up tray on the left-front side of the panel. With this arrangement, tape is fed by the capstan, and no separate tape feed mechanism is required.

The Model 420PR has tape feed and take-up reels mounted in the same relative positions of the tape trays on Model 420PF. With reel tape handling, the take-up reel is rotated by a differential gear and clutch mechanism mounted on the left-rear side of the panel, and is driven by a belt from the capstan drive mechanism.

#### 1.4 Physical Specifications

Overall dimensions and weight of the unit as supplied are as follows:

Width . . . . .	19 in.
Height . . . . .	10-1/2 in.
Depth . . . . .	12-3/4 in.
Weight . . . . .	28 lbs.

#### 1.5 Environmental Limitations

The tape perforator will operate satisfactorily under a wider range of conditions than those usually found where personnel must work. Low temperature limit is approximately 40 degrees Fahrenheit, and the continuous high temperature limit should be approximately 120 degrees Fahrenheit, for long mechanism life. Satisfactory cooling, particularly at high temperatures, requires that the unit be provided with adequate ventilation.

### 2.0 MECHANICAL OPERATION

#### 2.1 Motor and Capstan Drive (See Figure 3)

Drive power is transmitted by a lug belt from motor pulley to pulley (20) mounted on input shaft (5). Input shaft cluster gear (3) drives an idler gear (4) through idler shaft and gear (2). Each cluster gear drives a friction clutch (25).

When tape is not being moved, an armature on each of two escapement assemblies (13 and 18) engages a tooth of escapement wheel on corresponding friction clutch, causing clutches to slip. When tape is to be advanced, a pulse from tape feed switch causes the forward escapement (13) to disengage its armature (12) from the escapement wheel, permitting forward friction clutch to rotate. Rotation of friction clutch transfers torque from clutch through differential (14 & 16) to capstan shaft (7). When escapement coil is de-energized, allowing armature to drop and engage the next tooth of the escapement wheel, capstan (17) is stopped in position for punching the next character.

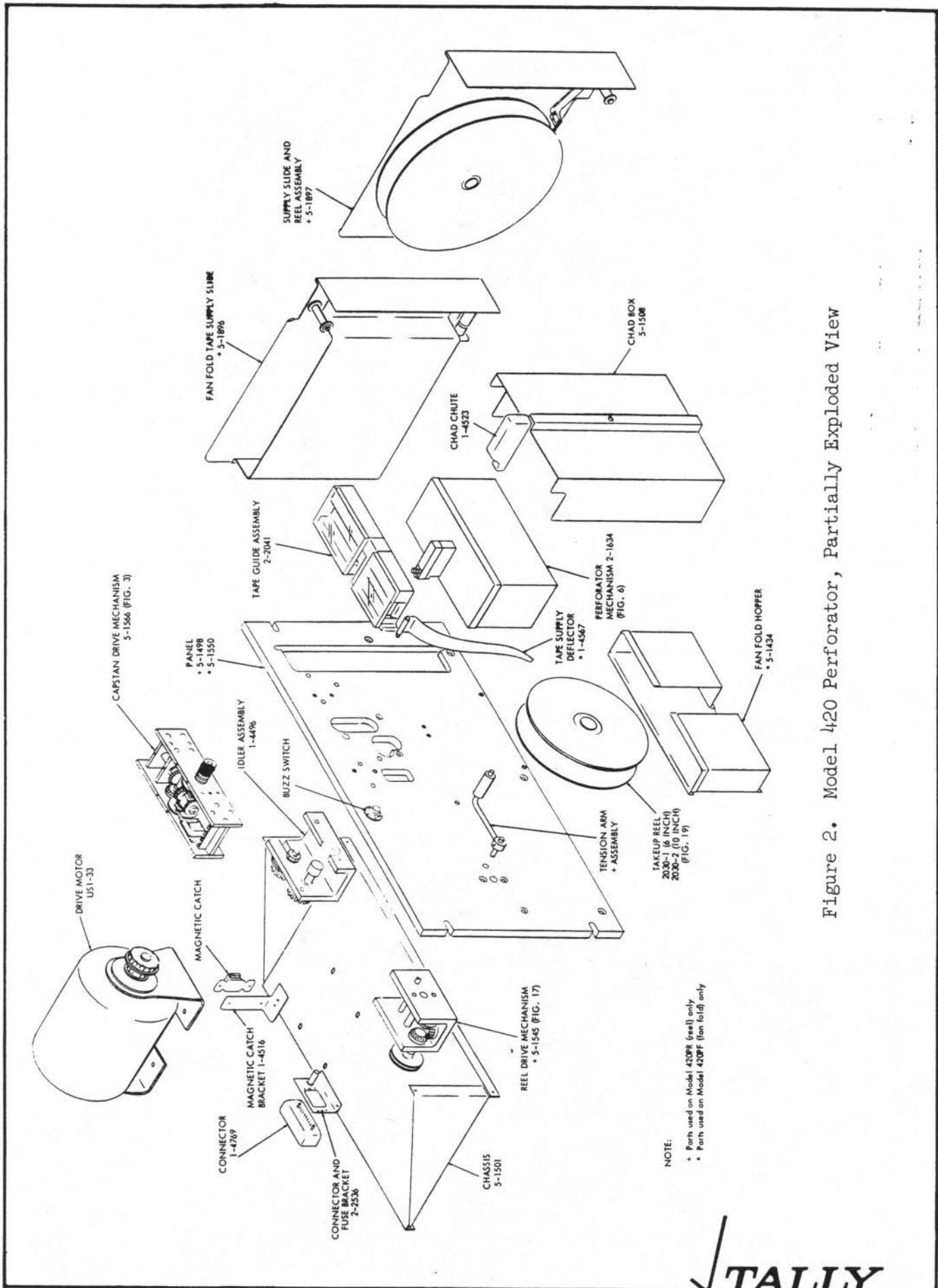


Figure 2. Model 420 Perforator, Partially Exploded View

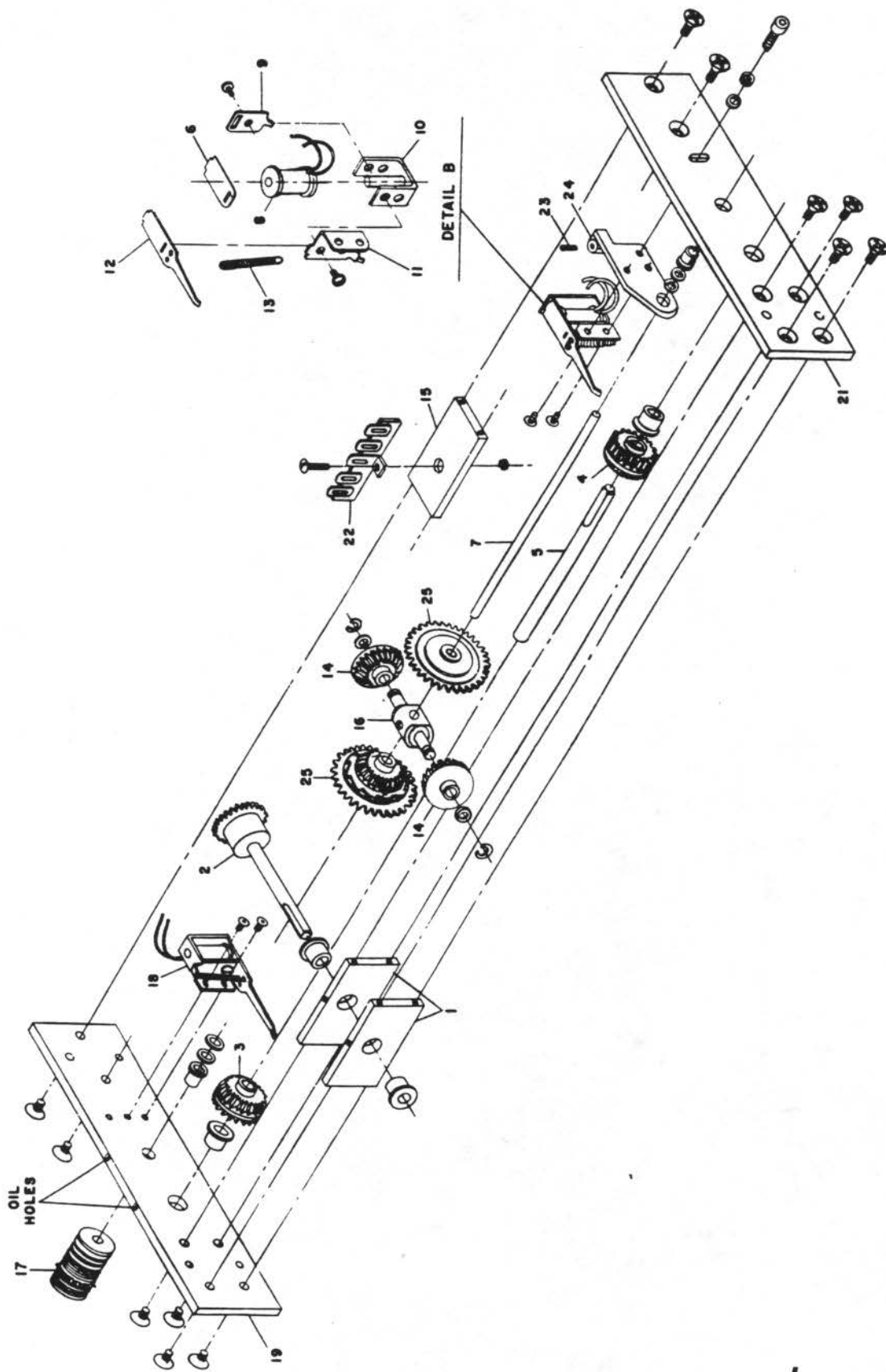


Figure 3. Capstan Drive Mechanism, Exploded View

Figure 3. Capstan Drive Mechanism, Exploded View

Index No.	Item	Part No.
1.	Vertical Spacer	2-2064
2.	Idler Shaft W/Bevel Gear	1-3551-1
3.	Bevel Gear W/Set Screw	1-3824
4.	Idler Bevel Gear	1-3554
5.	Drive Shaft	1-4764
6.	Anti-Residual Shim	2-2637
7.	Capstan Shaft	1-3553
8.	Coil 24V, 48V ( <b>Specify voltage</b> )	2-2053-M
9.	Armature Limit	2-2377
10.	Coil Frame	2-2376
11.	Escapement Bracket	2-1838
12.	Armature	2-1730-2
13.	Escapement Spring	1-4641
14.	Spider Bevel Gear (2 used)	2-2652
15.	Horizontal Spacer	2-2065
16.	Differential Spider	2-2848
17.	Capstan	2-1680-1
18.	Escapement Assembly (2 used)	2-1684
19.	Front Bearing Plate	2-1996
21.	Rear Bearing Plate	2-1997
22.	Terminal Strip	1-4456
23.	Adjusting Screw	
24.	Capstan Adjusting Plate	1-4578
25.	Friction Clutch	2-2443-1

Release of the reverse friction clutch will cause the capstan to be rotated in the opposite direction and move the tape in the reverse direction from normal feed. Reverse feed may be used with manual push-button control for purposes of backspacing the tape for editing.

If it is desired to use reverse feed for any reason, the user must supply a series of standard feed pulses to the coil of the reverse escapement coil (pins C and H, 34 pin connector plug, Figure 9).

## 2.2 Perforator Mechanism

The perforator mechanism mounted on the front of the panel, consists essentially of ten linkage assemblies, four clutch shafts, four clutch shaft gears, a toggle shaft, an idler gear, an oil lead gear, ten escapement assemblies, inner and outer bearing plates, and a breaker switch, all of which, except the switch, are enclosed in an oil tight case. See Figures 4, 5, and 6. The front cover of the case is made of transparent plastic to provide visual inspection of the mechanism and the oil level; the cover is bonded to the oil can and is not removable.

A lug belt from the drive motor engages a drive pulley on the end of the upper-left clutch shaft (29). The clutch shaft gear drives an idler gear (40) which, in turn, drives the remaining three clutch shaft gears. An oil lead gear (21), meshed with the idler gear, is partially immersed in the lubricating oil so that it splashes the oil throughout the mechanism during operation. The ten linkage assemblies (13, 14, 15, and 16) are pivoted on the toggle shaft (27) and are connected to eccentric clutch units (45) on the clutch shafts. The upper end of each linkage engages a corresponding punch pin in the perforator assembly, except linkage (13), which operates the timing switch. Each clutch unit is secured against rotation by the armature of an escapement mechanism mounted on one of four escapement brackets (23, 36, 37, and 44).

## 2.3 Reel Drive

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

A tape tension arm is positioned to rest on the tape between the capstan and the take-up reel, forming a loop in the tape. When the tape is being fed from the capstan, the loop lengthens, permitting the arm to drop and brake one gear of the differential. This causes the differential



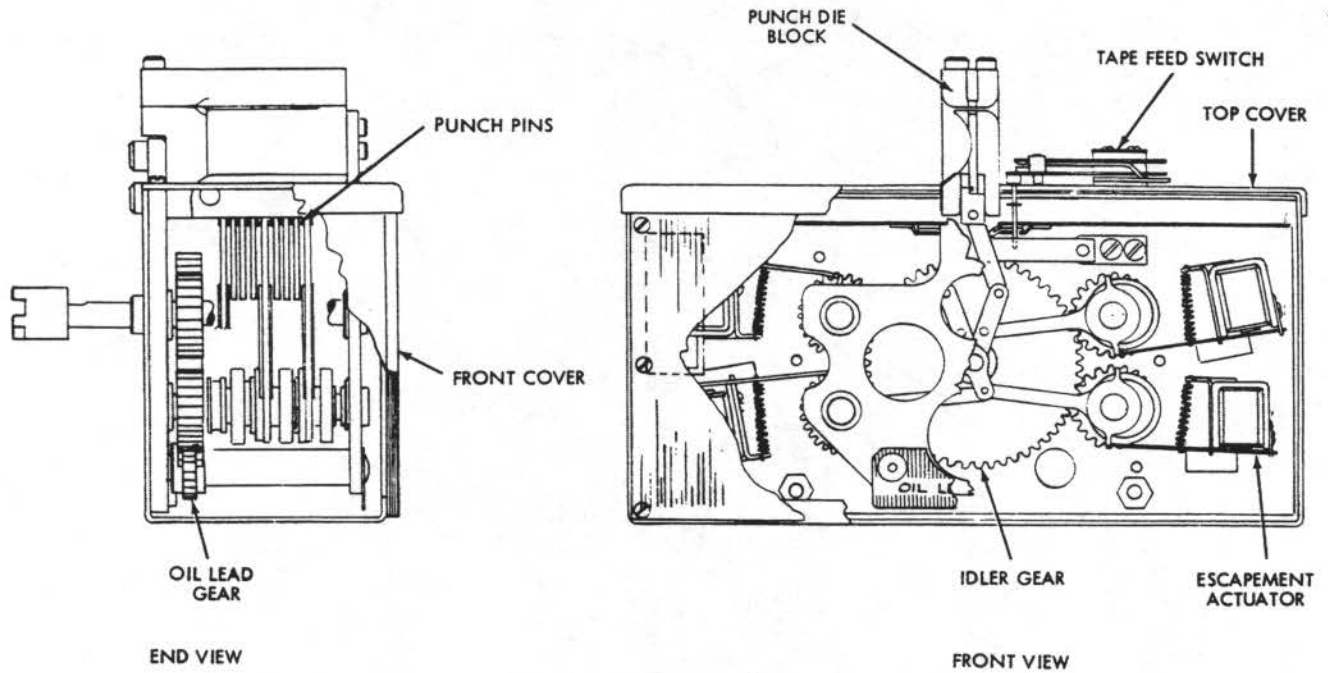


Figure 4. Perforator Assembly, Elevation Views

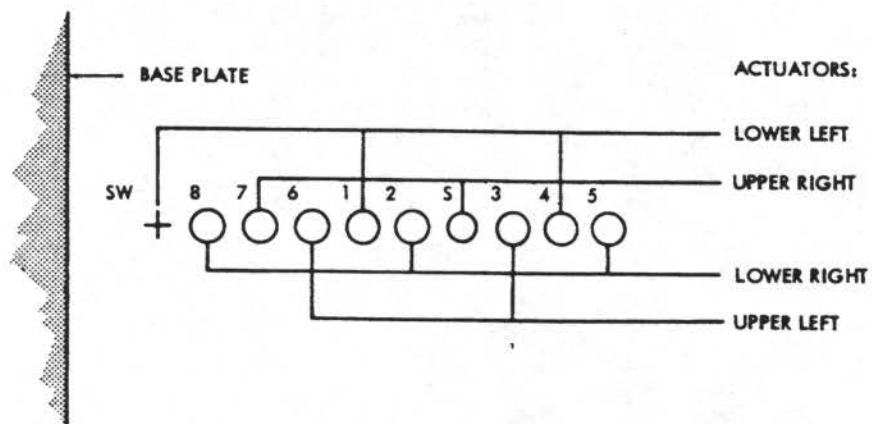


Figure 5. Punch and Clutch Orientation



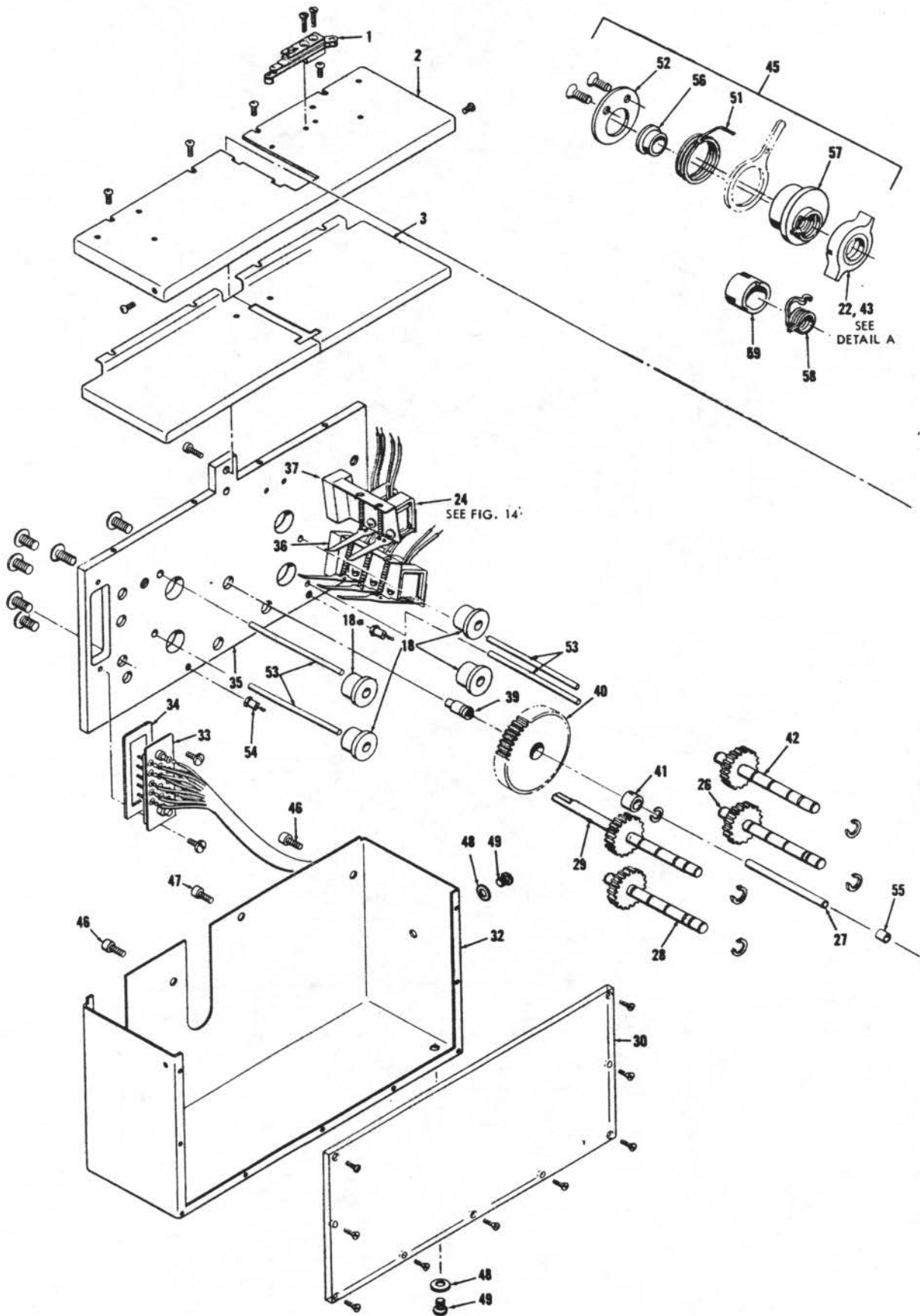


Figure 6. Punch Drive Mechanism, Exploded View  
(Sheet 1 of 2)

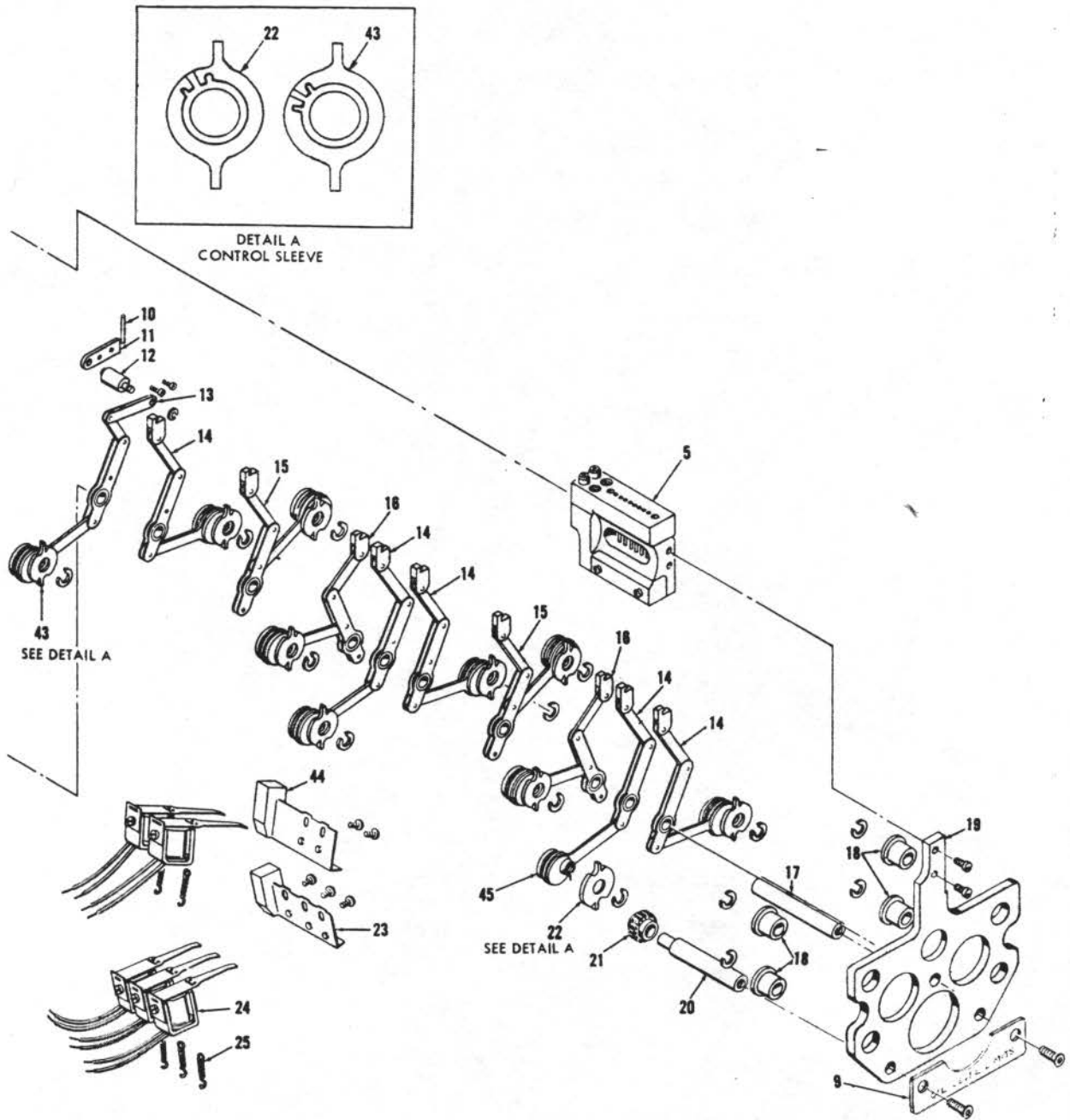


Figure 6. Punch Drive Mechanism, Exploded View (Sheet 2 of 2)

Figure 6. Punch Drive Mechanism, Exploded View - Legend

Index No.	Item	Part No.
1.	Tape Feed Switch	1-4065
2.	Oil Pan Top Cover	2-1948
3.	Baffle	2-1949
5.	Punch Die Block Assembly	2-2454
9.	Decal	1-4749
10.	Pushrod	1-4339
11.	Bracket	1-4047
12.	Stud	1-4155
13.	Switch Linkage	2-1826
14.	Punch Linkage - Channel 1-2-4-5-8	2-1642-1
15.	Punch Linkage - Channel 7-8	2-1642-2
16.	Punch Linkage - Channel 3-6	2-1642-3
17.	Stand Off Pin	2-1709-1
18.	Clutch Shaft Bushing	2-2538
18a.	Upper Left Shaft Bushing	1-4974
19.	Outer Bearing Plate	2-1657
20.	Stand Off Shaft	2-1709-2
21.	Oil Lead Gear	1-4048
22.	Punch Control Sleeve	2-1960-1
23.	Lower Left Escapement Bracket	1-4236-2
24.	Escapement Assembly	2-1659-2
25.	Escapement Spring	1-4502
26.	Lower Right Clutch Shaft	2-2102-1
27.	Toggle Shaft	1-4066
28.	Lower Left Clutch Shaft	2-2102-4
29.	Upper Left Clutch Shaft	2-2102-3
30.	Oil Pan Front Cover	1-4043
32.	Oil Pan Frame	2-1818
33.	Connector	Continental H14-20P

Figure 6. Punch Drive Mechanism, Exploded View - Legend (Continued)

Index No.	Item	Part No.
34.	Connector Seal	1-4606
35.	Base Plate	5-1492
36.	Lower Right Escapement Bracket	1-4236-1
37.	Upper Right Escapement Bracket	1-4236-4
39.	Idler Gear Stud	1-4042
40.	Idler Gear	1-4668
41.	Idler Bearing	1-4338
42.	Upper Right Clutch Shaft	2-2102-2
43.	Switch Control Sleeve	2-1960-2
44.	Upper Left Escapement Bracket	1-4236-3
45.	Clutch Unit	2-1768
46.	Mounting Screw	
47.	Mounting Screw	
48.	Gasket	
49.	Oil Plug (#8-32 x 1/4)	
50.	Anti-Residual Shim (See Figure 14)	2-2637
51.	Rebound Spring	2-1640-2
52.	Retainer Plate	1-3949
53.	Keeper Pin-Actuator	2-2527
54.	Terminal "USECO"	1417
55.	Spacer-Toggle Shaft	1-4604
56.	Bushing	1-4053
57.	Eccentric Element	2-1768
58.	Clutch Spring	2-2173
59.	Hub Liner	2-1841
	Switch Pushrod Washer	1-4626
	Switch Insulator, Fishpaper	1-4632

to rotate the tape reel and take up the tape. When the tape stops feeding, the loop shortens, raising the tension arm and releasing the differential braked gear, and the differential turns freely without driving the take-up reel.

#### 2.4 Punch Head Assembly (See Figure 6)

The punch head assembly consists of eight channel punch pins (8), a sprocket hole punch pin (9), a stripper (5), a punch die block (4), a slide block clamp (6), and an oil seal (7). The assembly is mounted on the perforator base plate (35), 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. Whenever an escapement is actuated, the linkage swings through top-center, at which position the corresponding punch pin extends through the tape and into the die block. The remaining toggle action of the linkage withdraws the pin so the tape can advance to the next position.

### 3.0 ELECTRICAL OPERATION

#### 3.1 Escapement Operation

To record 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 punches through one up-and-down 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. The hub of the clutch continues to rotate slightly beyond this point, releasing (unwinding) the clutch spring. A rebound spring (Figure 6, detail B) 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. 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.

#### 3.2 Tape Feed Switch (See Figure 6)

The tape feed switch (1), mounted on the top cover (2), is actuated by the switch linkage, as described under Escapement Operation. When the switch is actuated, it supplies a pulse to the electro-magnet of the forward escapement assembly, disengaging the escapement armature to permit the escapement wheel to advance one step. This advances the capstan to move the tape to the next character position. A mechanical delay in the switch clutch control sleeve causes the switch contacts to

close  $9\frac{3}{4}$  milliseconds after the start of the corresponding punch drive pulse, assuring that all punch pins are withdrawn from the tape before the tape is advanced. The switch is adjusted through the access hole, Figure 1, to provide the 4-1/2-millisecond pulse shown in Figure 7.

### 3.3 Cycle Length Limitations

At a motor speed of approximately 1725 rpm, the clutch shaft speed is 2300 rpm. This limits the minimum cycle time to 16.7 milliseconds between succeeding drive pulses (leading edge to leading edge). Refer to Figure 7 for time relationships of the pulses during one cycle.

### 3.4 Terminations

All power input, drive pulses, and punch pulses are delivered to the perforator assembly through a Continental 250 series 34-pin connector. Connections to the terminals and to the escape coils are shown in the wiring diagram, Figure 9. The receptacle and mating plug are both supplied with the tape perforator.

### 3.5 Spark Suppression

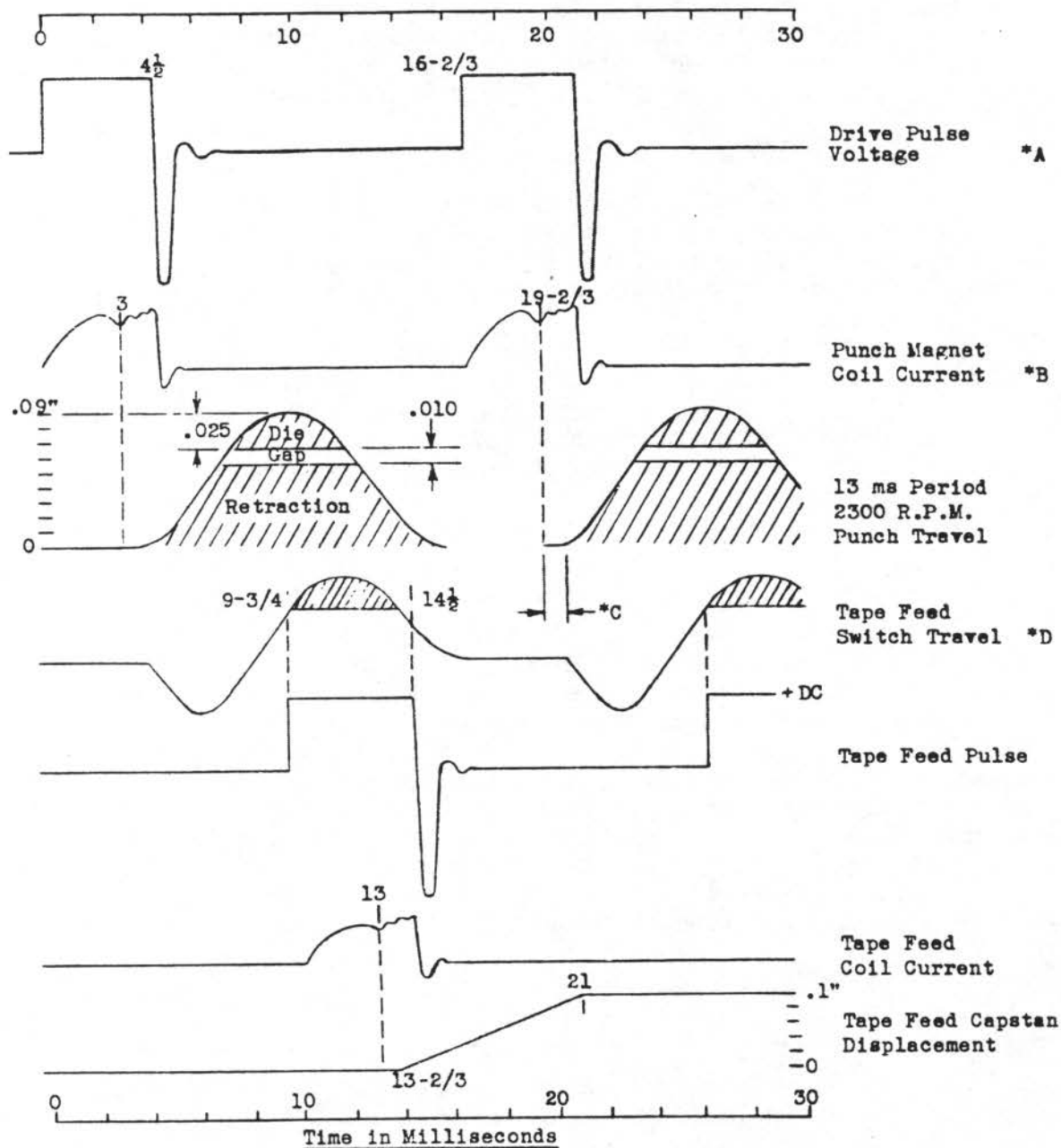
Spark suppression for contacts of the tape feed switch is provided by R-C components shown in Figure 9. Spark suppression for customer contacts or gates must be designed to protect the control without introducing excessive circulating currents in perforator coils. Diode or resistor-diode suppression is generally not satisfactory because circulating current may flow long enough to prevent armatures from dropping out prior to the next cycle. Good suppression should allow current to decay to 10% within 2 milliseconds from the end of the drive pulse. The R-C network shown in Figure 8 will provide spark suppression when suppressor is connected either across coils in parallel or across control contacts. The following table lists some suitable circuit component values.

<u>Resistance of Coil</u>	<u>Drive Pulse</u>	<u>R<sub>s</sub></u>	<u>C<sub>s</sub></u>	<u>Peak Inverse Voltage (For 1 to 10 Coils)</u>
220 ohms	48 volts	10 ohms	0.5 mfd	65 to 185
50 ohms	24 volts	5 ohms	0.7 mfd	60 to 130

### 3.6 Buzz Switch

The buzz switch, mounted on the panel, is a momentary-contact, two-circuit switch used to advance the tape manually, if desired. This is normally done to produce a leader on a new tape, or to provide several inches of tail leader when the tape is to be torn off at the completion of recording. Depressing the buzz switch causes a series of pulses to be fed to the sprocket punch and tape feed escapement actuators, resulting in a series of sprocket holes being punched in the tape. A customer-supplied source of drive pulses is required for use with the buzz switch. These pulses must meet the requirements specified in paragraph 1.2.





**\*NOTE:**

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

Figure 7. Perforator Timing Diagram



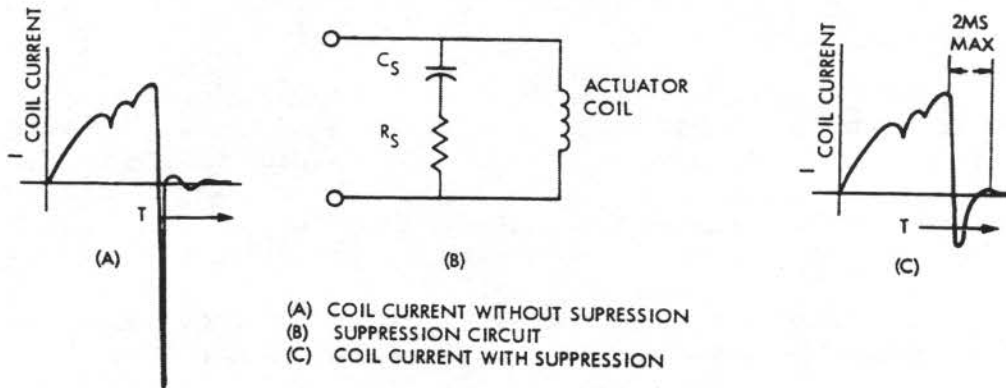


Figure 8. Spark Suppression Diagram

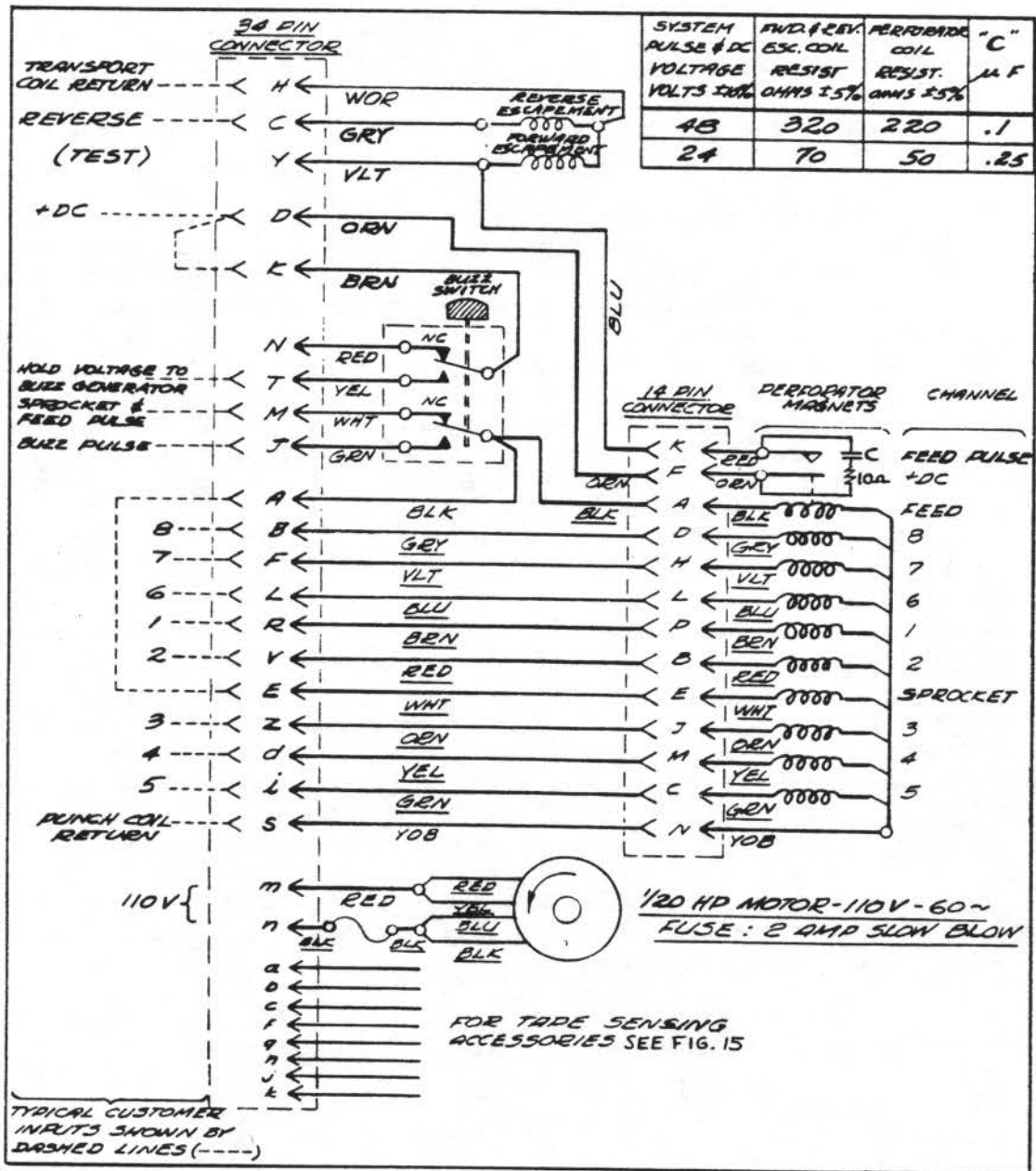


Figure 9. Wiring Diagram

### 3.7 Wiring

All electrical connections within the perforator assembly are shown in Figure 9. Wires carrying the 115-volt current to the drive motor are 20 gauge; all other wires are 22 gauge. Color coding is shown on the wiring diagram. Color names underlined indicate a solid color insulation. Color names not underlined indicate a colored tracer on a solid white background. Wires indicated YOB have a yellow tracer on a black background.

When any wiring connections must be changed, use rosin-core, tin/lead solder. Do not use acid-core solder or corrosive soldering fluxes.

## 4.0 INSTRUCTIONS FOR USE

### 4.1 Threading Tape

Clean the perforator mechanism, as described in Section 5.2, before threading in a new tape.

Move the three tape guide screws, Figure 11, if necessary, to accommodate the width of the tape being used. Thread the tape into the perforator as shown in Figure 10. With fan-fold tape handling, take the tape from the tape supply tray, feed it in the same manner as for reeled tape through the perforator, and lay the end of the tape in the tape take-up tray so that it will fold properly as it is fed.

If the buzz switch is connected with a pulse source, depress the buzz switch momentarily, before starting to record, to provide several inches of sprocket holes, and check to see that the tape pulls smoothly through the perforator without binding or twisting.

### 4.2 Operation

**CAUTION:** Energize all electromagnets at least once after motor reaches full speed, if they have been energized while the motor was off, or when motor is started for the first time after shipment or service operations. This will assure that any clutches which have become tripped accidentally will be reset to the released condition. Failure to do so may result in excessive wear to the clutch springs.

Before operating, be sure the tape is correctly threaded, and that all electrical connections are completed. Check oil level in the punch drive, and add oil, if necessary.

After recording is started, check the tape to see that it is being perforated correctly and cleanly.

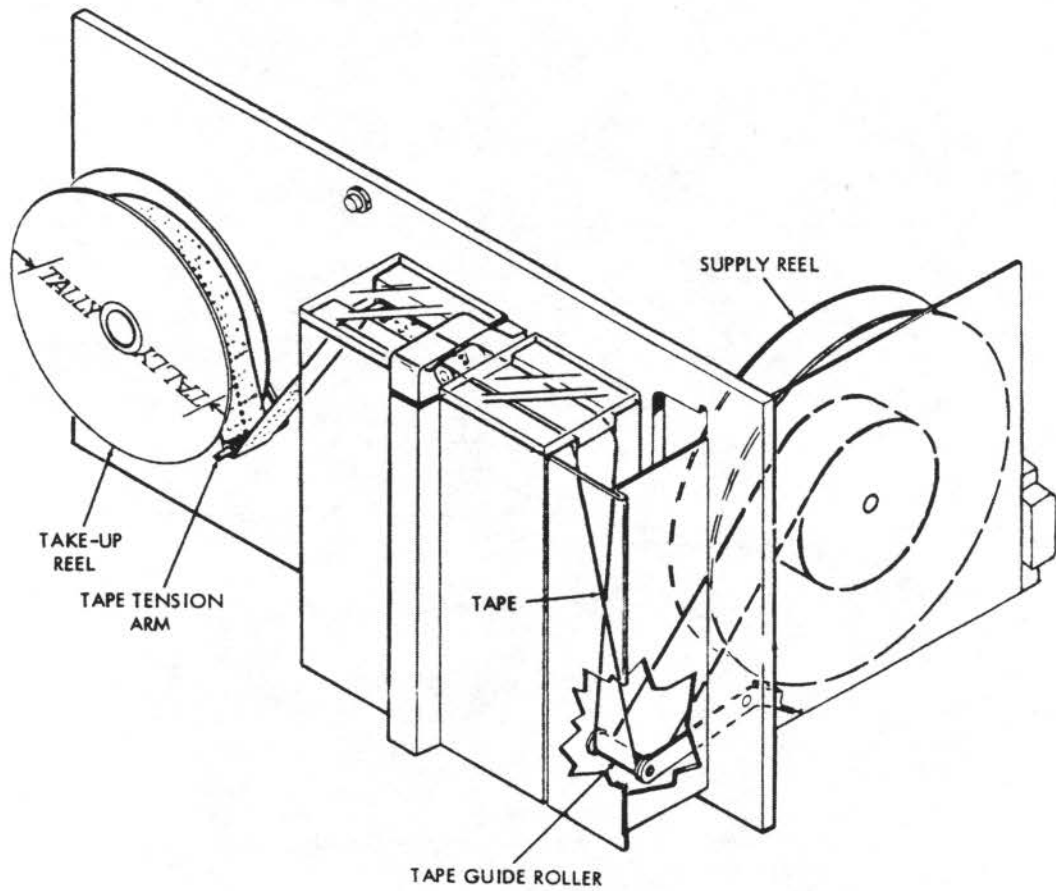


Figure 10. Threading Tape into Perforator

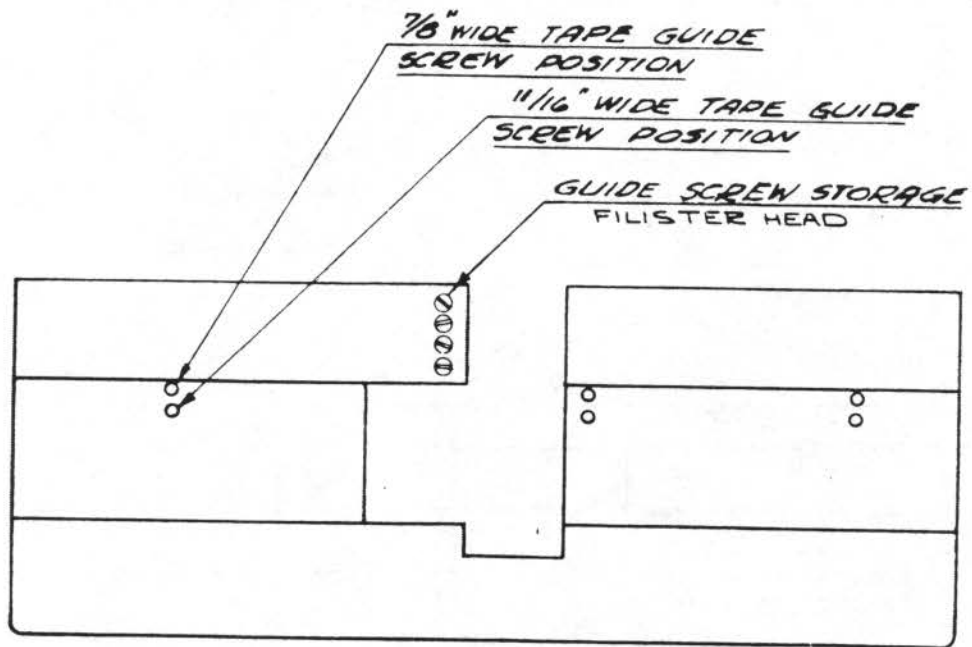


Figure 11. Tape Guide Adjustment



POINT NO	LUBRICANT
①	MINERAL OIL, SAE 60
②	TALLY GREASE "A"
③	SILICONE OIL, 350 CS

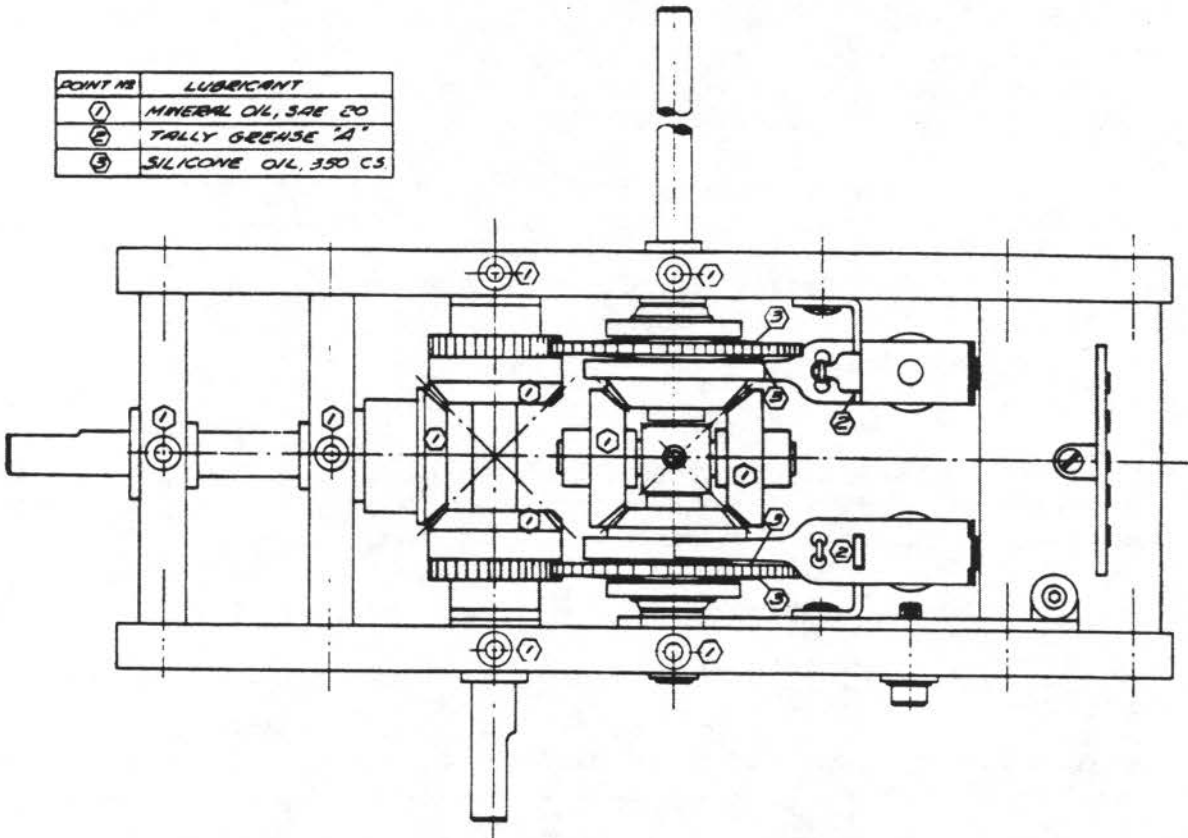


Figure 13. Lubrication Points (Sheet 2 of 2)

## 5.0 MAINTENANCE

### 5.1 Lubrication (See Figure 13)

The tape punch drive gearing and escapement mechanism are enclosed in a rectangular case consisting of an oil pan frame and front and top covers. A supply of oil in the oil pan is distributed as a mist throughout the mechanism by an oil lead gear partially submerged in the oil. The remainder of the tape punch mechanism is oiled at specific points, as noted below. Lubricate the unit as follows:

a. Punch Drive Mechanism (8). Keep the oil pan filled to a level between the two oil level marks on the outer bearing plate (19, Figure 6) with light turbine oil, viscosity 160 SSU, Texaco Regal A R&O, or equivalent. Remove the oil filler plug (49, Figure 6) to add oil. The turbine oil should be changed when dirty; check every 200 hours of operation, as the change period varies with environmental dirt, temperature and perforator duty cycle. Oil level should be checked daily.

b. Capstan Drive (5). Under extremely dry or dusty conditions, lubricate both sides of each friction clutch (3) with silicone oil (DC200, 350CS), inserting the tip of the oiling syringe in 1/4 inch between the fiber friction washer and the black nylatron gear. No lubrication required on friction clutches under normal conditions.

Lubricate initially at 200 hours, then each 500 hours thereafter.

Lubricate the escapement armature lever fulcrum every 200 hours, using Tally pivot grease A, supplied in the lubrication kit. Wipe the mechanism clean of all excess lubricant.

c. Drive Motor. Lubricate the drive motor bearings twice yearly, using a good grade, rust and oxidation inhibited oil, SAE20 grade.

d. Reel Drive. Lubricate the reel drive shaft bearings (1, 2, and 3) twice yearly with SAE20 oil.

## 5.2 Cleaning

After each roll of tape has been punched, empty the chad box and brush all loose chads from the tape guide. Failure to empty the chad box may result in jamming the transparent chad chute.

## 5.3 Parts Replacement

### 5.3.1 Inspection

If the tape perforator operates erratically, or with unusual noise or vibration, check carefully for the cause of trouble. Inspect all screws and nuts visually for looseness or missing items.

Visually inspect operation of the punch drive through the transparent front cover while the mechanism is operating. Watch to see that all parts are wet with oil from the oil-mist lubrication system.

Check for loose, worn, or damaged lug belts, and for pulleys loose on their shafts.

### 5.3.2 Disassembly and Reassembly (See Figure 6)

If components of the perforator assembly are to be replaced, proceed as follows:

a. Disconnect electrical power from the unit, and remove the chad chute, chad box and clip, and drive coupling.

b. Remove the two screws (46) securing the perforator mechanism to the panel, and remove it from below the tape guide. Do not remove the tape guide from the panel; it is adjusted to correct position at the factory, and cannot be properly installed without special alignment tools. Remove the six screws securing the top cover (2) to the oil pan frame (32), and remove the cover and baffle (3). Remove the screw (47) securing the mechanism to the pan, and remove the mechanism.

c. If individual escapement assemblies (24) are to be removed from their brackets (23, 36, 37, and 44), 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 armatures 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 (Figure 14, detail A). The curved shim is not required on actuators used in the capstan drive.

d. If clutches or linkage assemblies are to be replaced, remove the slide block clamp (6) from the perforator head to release the linkages from the punch pins. Remove the outer bearing plate (19) and the "C" shaped snap rings, and 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. Punches and linkage assemblies are matched to provide correct clearance in the perforator head. Be sure the punches are replaced in the same position, and with the same linkage, from which they were removed.

e. Reassemble the perforator mechanism in the reverse order of disassembly shown above. Be sure all retaining rings are installed to position the clutch units (45) on their shafts (26, 28, 29, and 42). Check adjustment of the escapement actuators as described in Paragraph 5.4. Be sure the switch clutch is fitted with a switch control sleeve (43), not one of the punch control sleeves (22). Failure to do so will result in faulty operation of the perforator. The correct configuration of the two types of control sleeves is shown in detail A of Figure 6.

f. Before installing the mechanism in the oil pan, pour out the old oil and fill the pan with new oil as specified in Paragraph 5.1.a.

g. When replacing the die upon the stripper block, the punch pins should be fully extended to facilitate alignment before the screws are inserted. Replacement of the punch pins will improve punching when the original pins become dull. When dull again the die-set should be returned to the factory for resharpener. (Specify die-set number, which is stamped on the right-hand side, when ordering replacement punch pins.)

After the punch pins, linkages, slide block clamp, and stripper block have been replaced, adjust punch pin over-travel by loosening the four screws holding the stripper. The channel punch pins protrude .035 inch, the sprocket pins protrude .031 inch (both plus or minus .005 inch) above the surface of the stripper when fully extended.

h. To replace damaged gears or shafts in the capstan drive mechanism, loosen all set screws securing the gears to the shaft, and slide the shaft axially through its bearings. See Figure 2. Note position of all shims and washers, and replace in the same position from which they were removed when the mechanism is reassembled. Do not disassemble the frame members. After reassembly, check the adjustment of the escapement actuators, as described in Paragraph 5.4. Check gear and shaft backlash and end play. Values must be within tolerances shown in Table 5-1.



Table 5-1. CAPSTAN DRIVE SYSTEM TOLERANCES

<u>Part</u>	<u>Movement</u>	<u>Max.</u>	<u>Min.</u>
Motor Input Shaft	End Play	0.010	0.004
Capstan Shaft	End Play	0.007	0.004
Spider Bevel Gear	End Play	0.003	0.001

#### 5.4 Escapement Actuator Adjustment

If any parts of the escapement mechanism have been repaired or replaced, adjust the escapement actuators to provide the clearances shown in Figure 14.

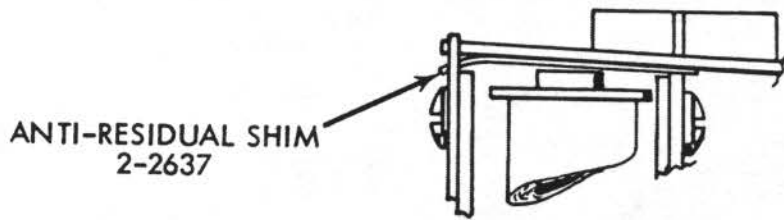
#### 5.5 Capstan Adjustment

To meet industry standards (figure 12) for hole spacing on perforated tape, the center-to-center hole spacing must be maintained at 0.100  $\pm$  0.003-inch, and the accumulated spacing error over 10 inches of tape should be within  $\pm$ 0.015-inch. To check spacing and adjust as required, proceed as follows:

- a. Measure the spacing over a length of tape containing exactly 100 sprocket holes. The distance from hole 1 to hole 101 (leading edge to leading edge) should be between 9.985 and 10.015 inches.
- b. If the measurement is outside of the limits specified, loosen the recessed-head clamping screw, and turn the adjusting screw (23, Figure 2) to correct the hole spacing. Turn the adjusting screw clockwise to decrease hole spacing; turn the screw counterclockwise to increase spacing.
- c. Tighten the clamping screw securely, and run another length of test tape.
- d. Repeat steps a, b, and c as necessary to secure correct hole spacing.
- e. If all the adjustment in adjustment screw (24) is used without achieving satisfactory spacing, loosen differential spider (16, Figure 2) and rotate capstan as required; tighten screw very securely. Proceed as above.

#### 5.6 Parts Ordering

If replacement parts are needed, order each part by part number and name. Give the model and serial number of the equipment on which it is to be used. Part numbers are shown in the legends for the exploded views.



DETAIL A  
ARM RELEASED

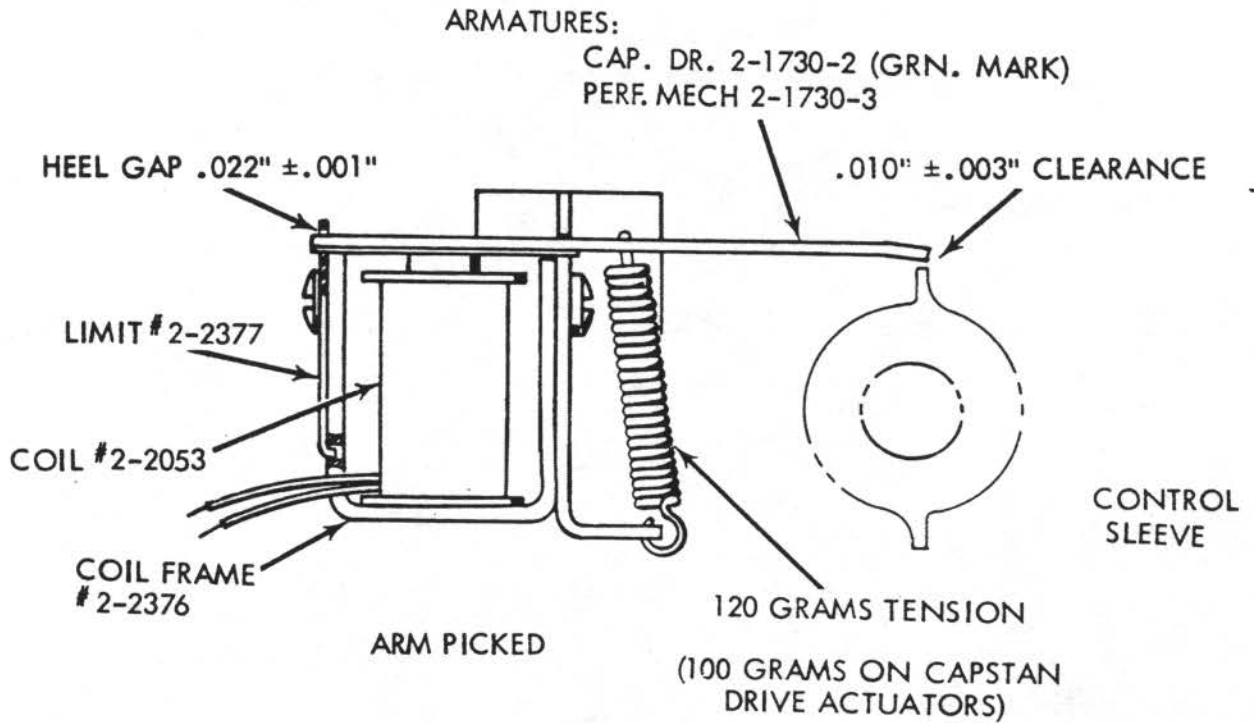
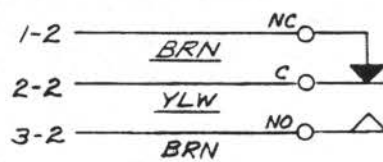
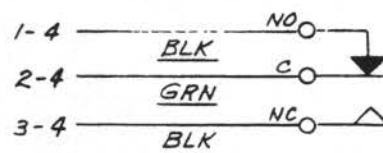


Figure 14. Escapement Adjustments

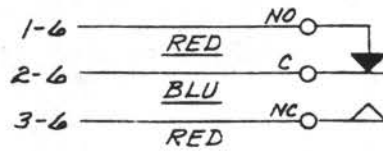
A. REEL LOW TAPE SWITCH  
SHOWN WITH TAPE ON REEL



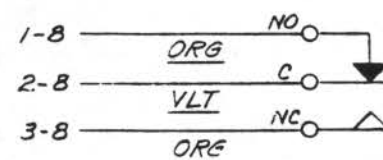
B. TAPE GUIDE END-OF-TAPE SWITCH  
SHOWN WITH TAPE IN GUIDE



C. TAPE TENSION SWITCH  
SHOWN WITH NORMAL TENSION



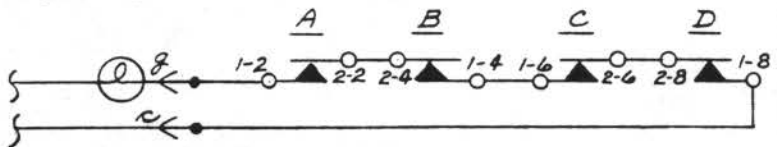
D. TAPE HOLD-DOWN SWITCH  
SHOWN WITH COVER DOWN



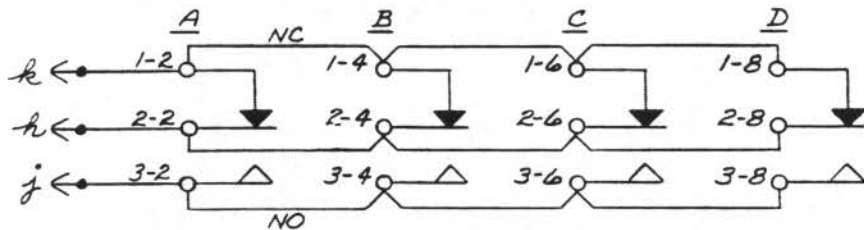
TO AMP  
TERMINAL  
BLOCK

TYPICAL APPLICATION OF SWITCHES :

E. NORMALLY CLOSED SERIES CIRCUIT  
"READY LAMP" OR RELAY



F. PARALLEL CIRCUIT



G. TERMINAL BLOCK (AMP)

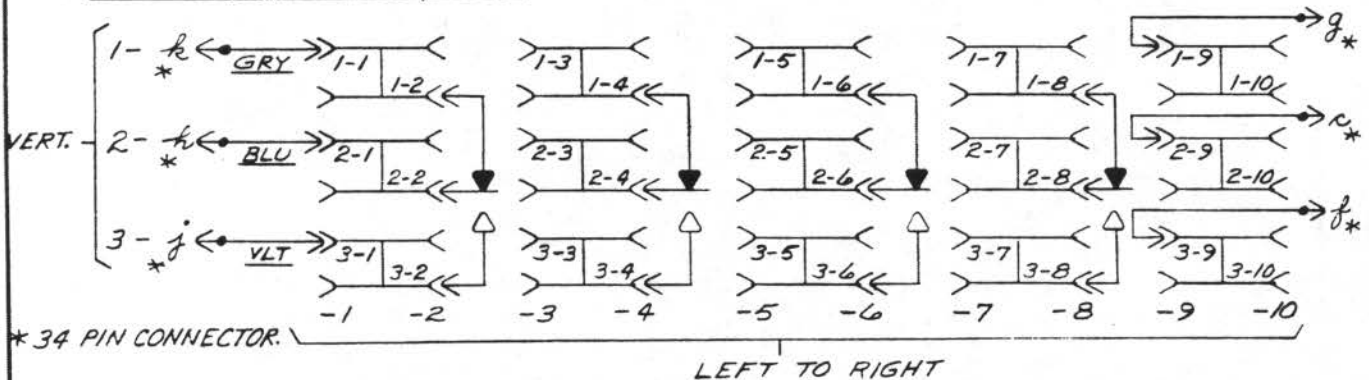


Figure 15. Switch Accessories for 420 Perforator

## 6.0 OPTIONAL ACCESSORIES

### 6.1 Tape Sensing and Alarm Switches

#### 6.1.1 Location, Operation and Adjustments

Four different switches are available as optional equipment to determine the status of the tape supply and/or the position of the tape hold downs. The four form C switches, available in any combination, are as follows:

##### A. Reel Low Tape Switch (Figure 15A)

This switch is mounted on a bracket alongside the tape supply reel and operates when approximately fifty feet of tape remains on the supply reel. It may be adjusted to indicate any amount of tape by merely bending the long follower arm. The switch N/C contacts are closed with more than fifty feet of tape remaining on the roll. This switch is not available on fanfold models.

##### B. Tape Guide End-Of-Tape Switch (Figure 15B)

This switch is located on the right half of the tape guide in the center of the tape groove. The switch detects the presence of tape in the tape guide and operates at the end of tape or when the hold down cover is raised. The switch N/O contacts are closed with tape in the tape guide. Access to the switch for maintenance or adjustment is gained by removing the perforator mechanism.

##### C. Tape Tension Switch (Figure 15C)

The sensing arm and roller of the tape tension switch is positioned at the right hand side of the tape guide, with the switch located inside the tape guide casting. Excessive tape tension operates the switch. Switch sensitivity may be adjusted to operate between 50 and 300 grams pull on the tape by turning a flat phillips head screw on the top edge of the tape guide. Turn screw clockwise to increase pull, counter-clockwise to decrease pull. Unless otherwise specified, tape pull is adjusted at the factory for approximately 175 grams, and the switch N/O contacts are closed with tape pull less than 175 grams. The perforator mechanism must be removed for switch access.

##### D. Tape Hold-Down Switch (Figure 15D)

The switch is positioned on the left half of the tape guide near the outer edge. The switch operates when the tape hold down is lifted from the normal operating position, thus detecting when tape is not held down on the capstan. The switch is adjusted to operate at the factory, and the N/O contacts are closed when the tape hold down is seated. Access to the switch for maintenance is gained by removing the perforator mechanism.

### 6.1.2 Electrical Wiring

All switches are wired to a terminal block per the accessory switch wiring diagram, Figure 15. Since wires from all three switch terminals (N/C, C, N/O) on each switch are brought out to the dual lug terminal block, either the normally open or normally closed contacts may be selected to control the external circuits. Six pins (k, h, j, g, c, f) on the 34 pin connector plug are wired to the Amp Terminal Block as shown in Figure 15G. Switch rating, 4 amps, at 28 V DC, inductive load.

Any combination of the above switches in series (Figure 15E) and/or parallel (Figure 15F) to form a two-terminal circuit can be easily wired by the customer from the terminal block. A switch "Ready" lamp circuit, (Figure 15E), utilizing a neon indicator lamp can also be installed by the customer. Connections are made to the Terminal Block by short jumper-wires with AMP Taper Tips at each end.

## 6.2 Capstan Shaft Commutator

### 6.2.1 Description

The commutator accessory is designed to provide an "echo pulse" representing tape movement. The echo pulse may be used to initiate the command to punch following data insertion. The echo pulse may be adjusted to occur between 14 and 21 milliseconds after the leading edge of the punch drive pulse with an adjustable duration of 3.5 milliseconds maximum.

### 6.2.2 Mechanical Operation (See Figure 16)

A commutator is directly driven by the perforator capstan shaft and is mounted just to the rear of the capstan bearing support plate. Two adjustable brushes are located on either side of the commutator and are supported by the capstan bearing plate. The commutator is composed of 20 angular segments, each 5 degrees wide. Segments are equally spaced, center to center, every 18 degrees of arc. The commutator segments are printed circuits retained on an aluminum hub. The commutator is locked in position on the capstan shaft with two set screws.

The two sets of brushes are made of multiple wires retained in a nylon brush holder. The brush holders are held in position with a screw. The upper brush (A) may be moved for adjustment of the phase angle of the commutator switch closure.

### 6.2.3 Electrical Operation

With every revolution of the capstan drive shaft there are twenty series circuits completed through the two brushes and the twenty com-

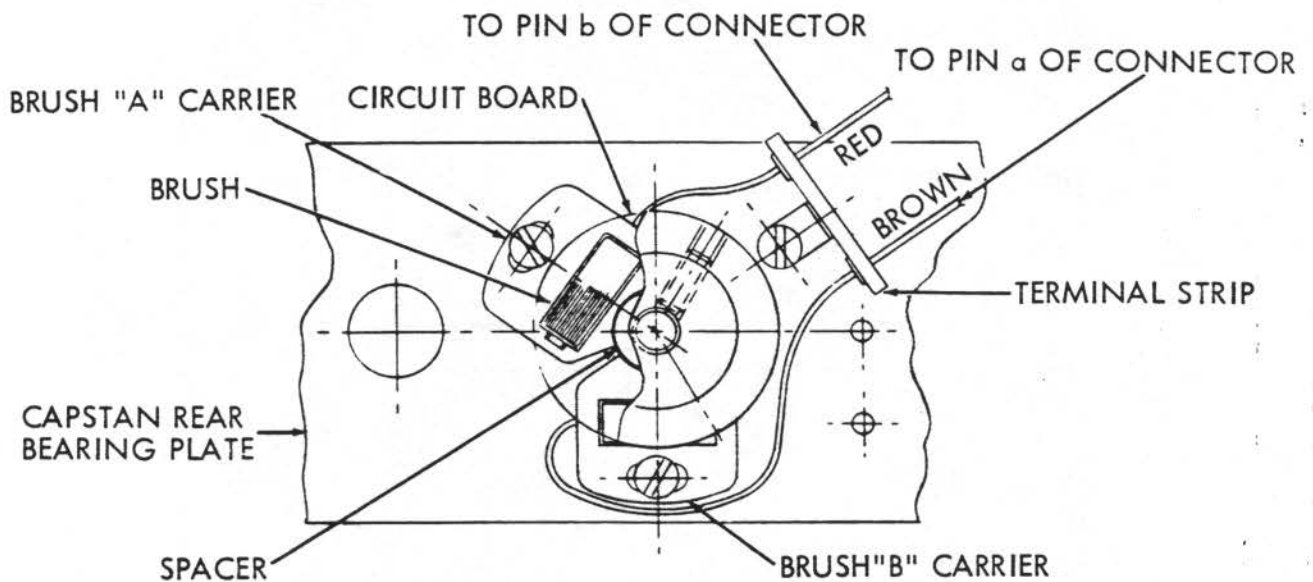


Figure 16. Capstan Commutator

mutator segments. Through these series circuits from Brush A to commutator and out to Brush B, switch closures are generated during each angular 18 degree increment of capstan revolution.

**CAUTION:** Current switched by the commutator must be limited to 10 milliamperes maximum. Use resistive load only. Do not use inductive load.

#### 6.2.4 Adjustment

When both brushes are set so as to engage their commutator segment contacts at exactly the same moment, the switch closure angle will be at its maximum duration. The phase relationship between the switch closure angle and capstan increment may be altered, maintaining the same switch closure angle, by moving both brushes an equal distance in the same direction of travel.

In order to change the switch closure duration, one brush holder, or both if desired, may be moved so that the brushes do not engage their respective commutator segments at the same time. It is possible to diminish the closure angle to zero by this adjustment.

**IMPORTANT:** When making any brush adjustments, always keep finger pressure on the brush holder toward the capstan drive shaft. This is necessary in order to insure proper brush radial alignment.



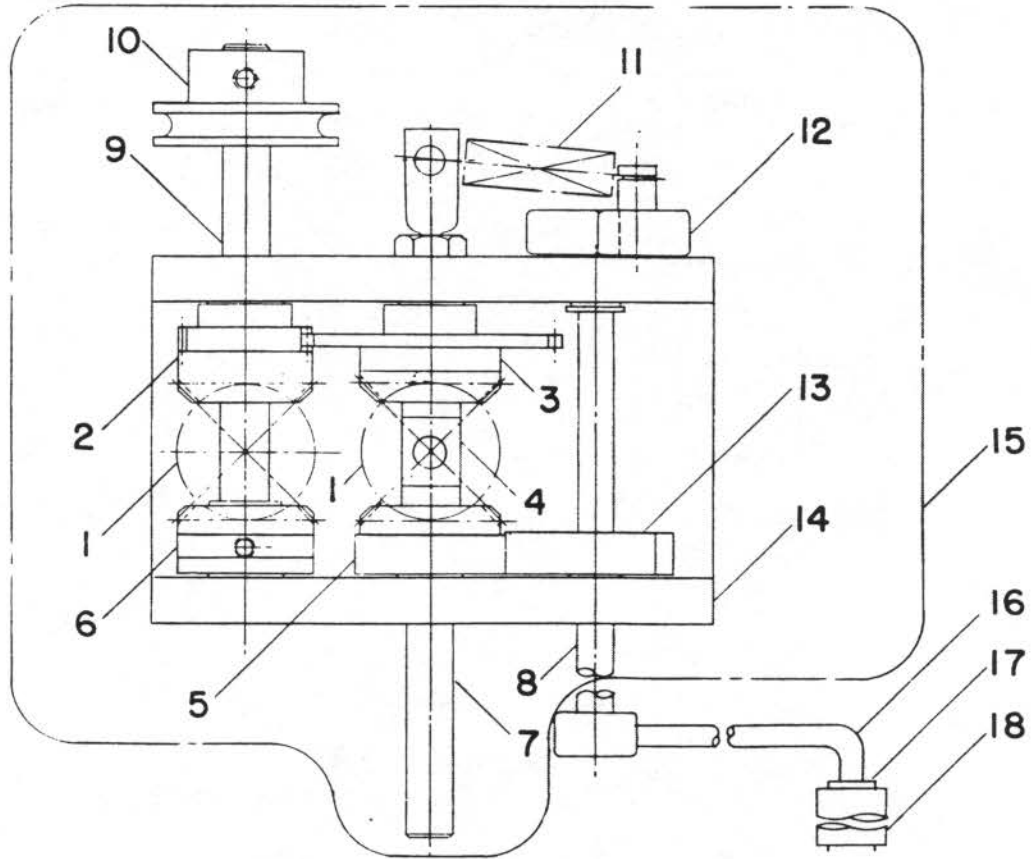


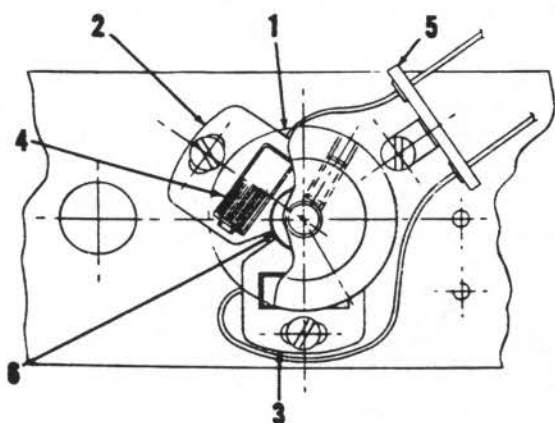
Figure 17. Reel Drive Mechanism, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Spider Bevel Gear (2 used)	1-3556
	Bevel Gear Spacer	1-4663
2.	Bevel Gear	1-3554
3.	Bevel Spur Gear	2-2106
4.	Differential Spider	1-3555
	Retaining Ring	5103-18
5.	Brake Gear	1-4667



Figure 17. Reel Drive Mechanism, Parts List (Continued)

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
6.	Bevel Gear w/Set Screw	1-4644
7.	Reel Shaft	1-4486-2
	Reel Shaft (Comb. fanfold & reeling)	1-4486-3
8.	Tension Shaft	1-4484
9.	Drive Shaft	1-4485
10.	Driven Pulley w/Set Screw	2-2856
11.	Brake Spring	1-4494
12.	Tension Link	1-4483
13.	Brake	1-4493
14.	Frame Assembly w/Bearings, Stub Shaft, and Spring Lug	5-1594
15.	Reel Drive Mechanism, L.H., Complete	5-1545-1
16.	Tension Arm (6" Reels)	2-1864-2
	Tension Arm (10" Reels)	2-1864-3
17.	Retaining Ring (2 used)	5555-12
18.	Tension Arm Roller	1-4128



<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Circuit Board	2-2189
2.	Brush "A" Carrier	2-2148
3.	Brush "B" Carrier	2-2149
4.	Brush (2 used)	2-2455
5.	Terminal Strip	2-2641
6.	Spacer	2-2642

Figure 18. Commutator Unit, Parts List

SUPPLEMENTAL PARTS LIST

The following parts of the 420 Perforator are in addition to those previously illustrated. Please order by part name and number and always include the serial number of the perforator.

Tape Guide Assembly 2-2041

Tape Guide Die Casting	2-2042
Guide Screw, Tape	1-4554
Tape Hold Down Assy, Left, w/o Guide	2-2041L
Tape Hold Down Assy, Right, w/o Guide	2-2041R
Chad Chute	1-4523
Tape Stripper	1-4552

Front Panel Assembly

Chad Box	5-1508
Chad Box Clip	1-4515
Chad Box Bracket	1-4514
Buzz Switch, Licon	70-223
Panel, Reel Type	5-1498
Panel, Fanfold Type	5-1550

Idler Assembly 1-4496

Bracket (Aluminum Channel)	2-2040
Idler Stud and Nut	1-4545
Grip Ring, Truarc	5555-18
Extension Shaft	1-4546
Coupling, Nylon	1-4443
Ball Bearing, New Departure	77-R4
Snap Ring, Truarc	5133-25
Shim Washer (.010x1/4x3/8)	
Bearing Retainer Plate	1-4586

Pulleys, Belts, Motor

Motor, Bodine 1/20 HP	9004
Spacer, Motor Mounting, (Specify thickness)	1-4671
Pulley, Idler, 18 Tooth	2-2044-11
Pulley, Perf. Shaft, 12 Tooth	2-2044-1
Pulley, Perf. Driver, 16 Tooth	2-2044-23
Pulley, Transport Driver, 12 Tooth	2-2044-21
Pulley, Transport Driven, 12 Tooth	2-2044-1
Belt, Lug, Gilmer	XLB-55
Pulley, O Ring, 3/4 Inch	2-2855
Belt, Reeling O Ring, Parker	2-267

SUPPLEMENTAL PARTS LIST (Continued)

Chassis Parts

Connector and Fuseholder Bracket	2-2536
Fuseholder, Bussman	HKP
Magnetic Catch Bracket	1-4516
34 Pin Connector Plug/Receptacle	1-4769
Chassis (8-1/2 x 16-1/2)	5-1501

Tape Reeling Type Parts

Supply Slide & Reel Assy	5-1897
Brake Lever Assy	1-4367-1
Brake Shoe & Pad	1-4542/1-4368
Brake Arm Roller	1-4104
Brake Mounting Collar	1-4369
Brake Spring	1-4518
Supply Reel Assembly	2-2017
Take up Reel Assembly 6"	2-2030-1
Take up Reel Assembly 10"	2-2030-2

Fanfold Parts

Tape Supply Slide, Fanfold Assy	5-1896
Upper Roller	1-4561
Pin, Upper Roller	1-4562
Lower Roller	1-4101
Bracket, Lower Roller	1-4546
Pin, Lower Roller	1-4647
Guide Pin, Tape	1-4523-3
Snap Ring, Truarc	5555-18
Fanfold Hopper	5-1434
Hopper Holder (top)	1-4107
Hopper Bracket (bottom)	1-4564
Tape Deflector	1-4567
Tape Deflector Pin	1-4556

Perforator Mechanism

2-1634

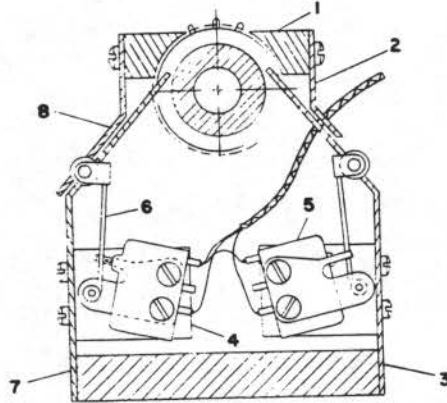


Figure 28. Outboard Bearing Block With End-of-Tape Switch, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Tape Guard	2-2068
2.	Tape Pressure Guide, R. H.	2-2062-2
3.	Stripper Plate, R. H.	2-2063-2
4.	Switch Block (2 used)	1-4612
5.	Switch (2 used)	1SX1-T
6.	Switch Actuator (2 used)	JX-25
7.	Stripper Plate, L. H.	2-2063-1
8.	Tape Pressure Guide, L. H.	2-2062-1

Please make the following part number changes to the manual:

Page 5

Index No.	Item	Part No.
17	Capstan	2-2624

Page 14

Change the times on tape feed switch contact and break from  $9 \frac{3}{4}$  and  $14 \frac{1}{2}$  to make at  $11 \pm 1.0$  with a pulse duration of 4.5 ms.

Page 15

The values for the table on Figure 9 are as follows:

48v	220 ohms	220 ohms	0.25 mf
24v	50 ohms	50 ohms	0.25 mf

Page 30

Tape Guide Assembly

Tape Stripper

ED1-0027

Chad Chute

2-2972

Prepared by: *[Signature]*

Approved by: *[Signature]*

20 Mar 63

A-420

1

TALLY

## ADDENDUM

TAPE PERFORATOR  
PARTS PRICE LIST

A-420

PART NO.	PART NAME	PRICE
REEL DRIVE MECHANISM		
1-3556	Spider Bevel Gear (2 Used)	1.66
1-4663	Bevel Gear Spacer	.45
1-3554	Bevel Gear	1.53
2-2106	Bevel Spur Gear	2.56
1-3555	Differential Spider	2.00
5103-18	Retaining Ring	.05
1-4667	Brake Gear	2.00
1-4644	Bevel Gear w/Set Screw	1.44
1-4486-2	Reel Shaft	2.40
1-4486-3	Reel Shaft (Comb. Fanfold & Reeling)	N/A
1-4484	Tension Shaft	1.17
1-4485	Drive Shaft	2.07
2-2856	Driven Pulley w/Set Screw	4.48
1-4494	Brake Spring	.65
1-4483	Tension Link	2.02
1-4493	Brake	3.96
5-1594-1	Frame Assembly w/Bearings, Stub Shaft, and Spring Lug	7.60
5-1545-1	Reel Drive Mechanism, L. H. Complete	48.83
2-1864-2	Tension Arm (6" Reels)	2.08
2-1864-3	Tension Arm (10" Reels)	2.08
5555-12	Retaining Ring (2 Used)	.05
1-4128	Tension Arm Roller	.80

## COMMUTATOR UNIT

2-2189	Circuit Board	50.80
2-2148	Brush "A" Carrier	2.00
2-2149	Brush "B" Carrier	N/A
2-2455	Brush (2 Used)	4.00
1-4456	Terminal Strip	.25

## TAPE GUIDE ASSEMBLY

2-2042	Tape Guide Die Casting	8.60
1-4442-1	Tape Hold Down Assy, Left, W/O Guide	5.52
1-4442-2	Tape Hold Down Assy, Right, W/O Guide	4.98
1-4523	Chad Chute	3.60
1-4552	Tape Stripper	1.44
1-4550	Guide (Left Hand)	1.93
1-4551-1	Guide (Right Hand)	2.80

## FRONT PANEL ASSEMBLY

5-1508	Chad Box	35.68
1-4515	Chad Box Clip	2.80
1-4514	Chad Box Bracket	1.44
70-223	Buzz Switch, Licon	7.38
5-1498	Panel, Reel Type	38.06
5-1550	Panel, Fanfold Type	38.00

## IDLER ASSEMBLY 1 4496

2-2040	Bracket (Aluminum Channel)	1.08
1-4545	Idler Stud and Nut	.06

2

TALLY

ADDENDUM	TAPE PERFORATOR PARTS PRICE LIST	A-420
5555-18	Grip Ring, Truarc	.05
1-4546	Extension Shaft	1.12
1-4443	Coupling, Nylon	2.68
77-R4	Ball Bearing, New Departure	11.30
5133-25	Snap Ring, Truarc	.05
	Shim Washer (.010 x 1/4 x 3/8)	
1-4586	Bearing Retainer Plate	.30
PULLEYS, BELTS, MOTOR		
9004	Motor, Bodine 1/20 HP	30.06
1-4671	Spacer, Motor Mounting (Specify Thickness)	.70
2-2044-11	Pulley, Idler, 18 Tooth	2.16
2-2044-1	Pulley, Perf. Shaft, 12 Tooth	2.16
2-2044-23	Pulley, Perf. Driver, 16 Tooth	2.16
2-2044-21	Pulley, Transport Driver, 12 Tooth	2.16
2-2044-1	Pulley, Transport Driven, 12 Tooth	2.16
XLB-55	Belt, Lug, Gilmer	1.00
2-2855	Pulley, O Ring, 3/4 Inch	1.71
2-267	Belt, Reeling O Ring, Parker	1.38
CHASSIS PARTS		
2-2536	Connector and Fuseholder Bracket	1.17
HKP	Fuseholder, Bussman	.32
1-4516	Magnetic Catch Bracket	1.17
1-4769	34 Pin Connector Plug/Receptacle	14.80
5-1501	Chassis (8 $\frac{1}{2}$ x 16 $\frac{1}{2}$ )	15.40
TAPE REELING TYPE PARTS		
5-1500-2	Supply Slide & Reel Assy	18.00
1-4367	Brake Lever Assy	.88
1-4542/1-4368	Brake Shoe & Pad	1.57
1-4104	Brake Arm Roller	.75
1-4369	Brake Mounting Collar	.88
1-4518	Brake Spring	1.26
2-2017	Supply Reel Assembly	18.00
2-2030-1	Take Up Reel Assembly 6"	12.00
2-2030-2	Take Up Reel Assembly 10"	18.00
FANFOLD PARTS		
5-1896	Tape Supply Slide, Fanfold Assy	N/A
1-4561	Upper Roller	1.71
1-4562	Pin, Upper Roller	1.63
1-4101	Lower Roller	N/A
1-4546	Bracket, Lower Roller	1.12
1-4647	Pin, Lower Roller	2.02
1-4523-3	Guide Pin, Tape	N/A
5555-18	Snap Ring, Truarc	.05
5-1434	Fanfold Hopper	25.27
1-4107	Hopper Holder (Top)	2.16
1-4564	Hopper Bracket (Bottom)	5.00
1-4567	Tape Deflector	3.84
1-4556	Tape Deflector Pin	1.98
2-1634	Perforator Mechanism	N/A



## W A R R A N T Y

Tally Register Corporation warrants its equipment to be free from defect in materials and workmanship for a period of one year from date of delivery and to perform in accordance with applicable specifications for a period of 90 days from date of delivery.

Tally Register Corporation will provide free service, including parts and labor, for any malfunction appearing as a failure to perform in accordance with applicable specifications during the 90 day period. Any repairs made to equipment after the 90 day period shall be in accordance with the In-Plant Service Price Schedule (which represents a labor charge only for equipment under one year old) on the price list in effect at that date. Purchased components, such as AC motors and semiconductors which are warranted for a longer period, will be accorded the manufacturer's warranty.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, or improper installation or application.

Obligation under this warranty is limited to servicing or adjusting any instrument or parts thereof which, upon authorization from the Company, are returned to the factory, transportation charges prepaid. The Company will repair or replace such equipment which, upon factory examination, shall prove to be defective.

If any fault develops, the following steps should be taken:

- 1) Notify Tally Register giving full details of difficulty, including model numbers and serial numbers where applicable.
- 2) Upon receipt of this information, Tally Register will give service data or shipping instructions.

If requested, an estimate of charges will be furnished before work begins, providing the equipment is not covered by the warranty or is not listed under the In-Plant Service Price Schedule then in effect.

October 2, 1961



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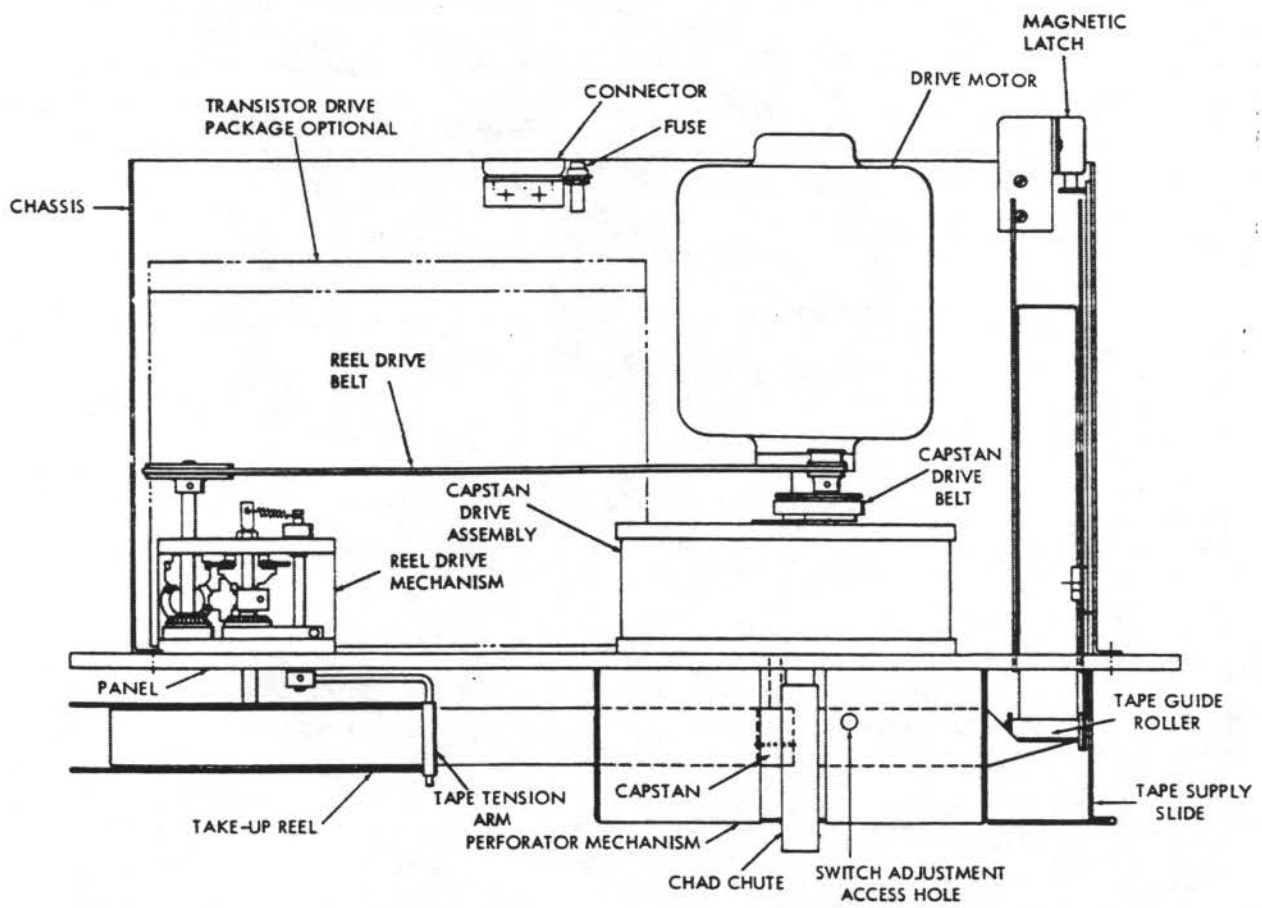
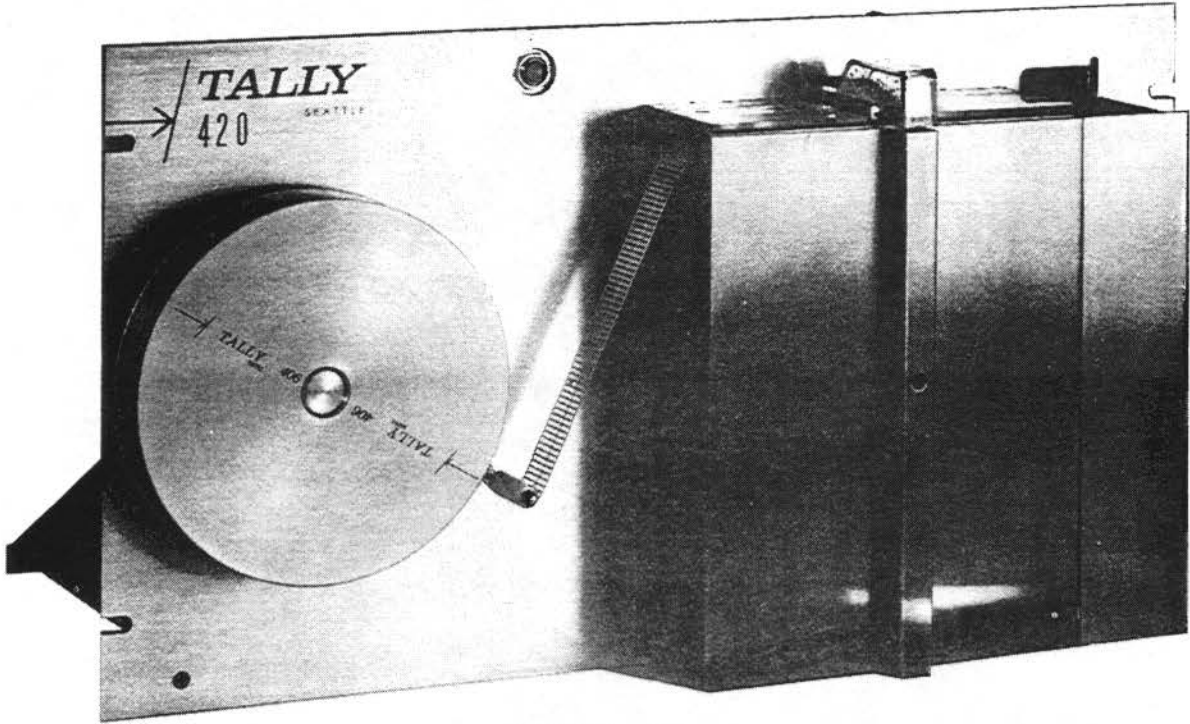
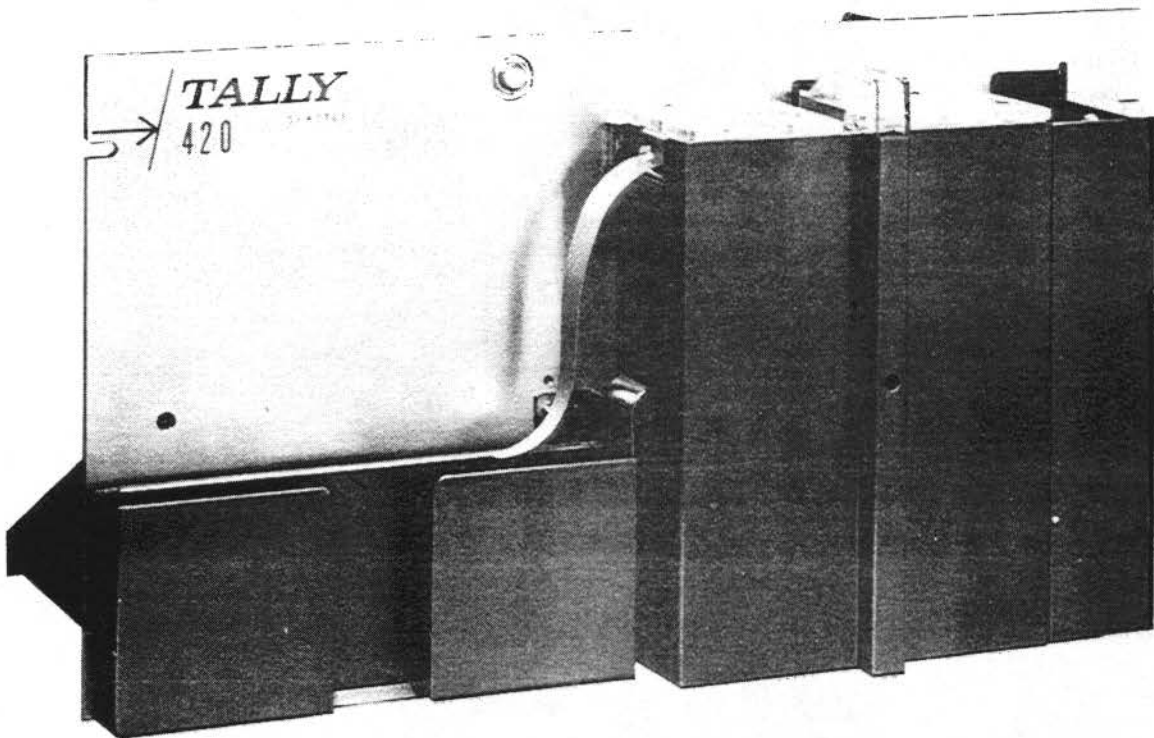


Figure 1. Tape Perforator, Plan View  
(Sheet 1 of 2)



MODEL 420 PR



MODEL 420 PF

Figure 1. Tape Perforators Models 420PR and 420PF, Left-Front View (Sheet 2 of 2)

