

TAPE READER MANUAL

MODEL 424

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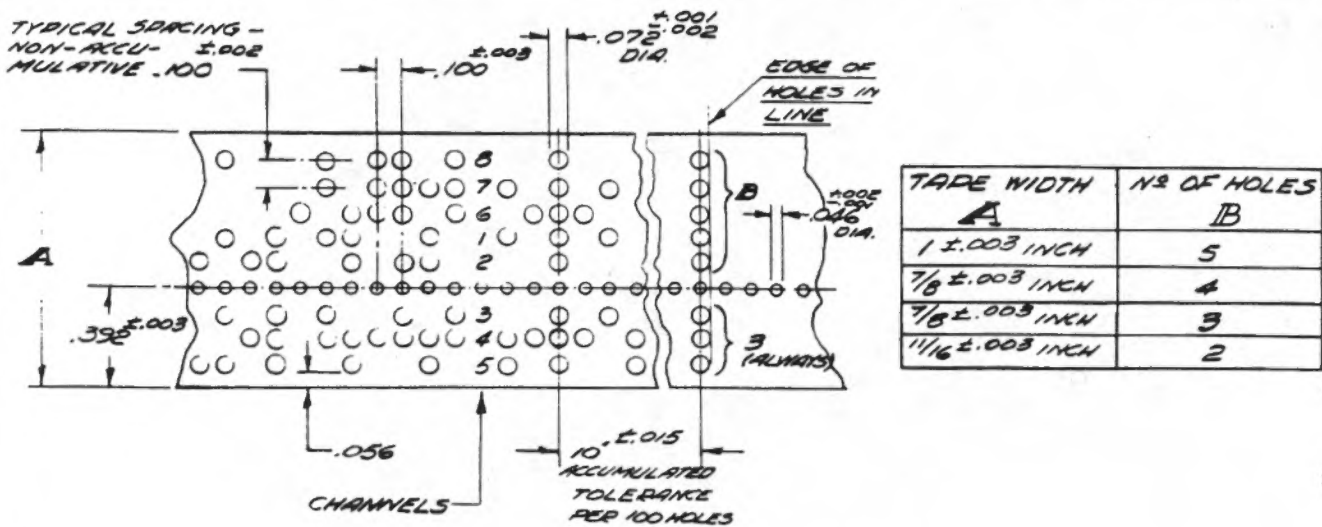


Figure 11. Standard Tape Dimensions

5.0 MAINTENANCE

5.1 Lubrication (See Figure 12)

After every 500 hours of operation, lubricate the following:

- (a) Escapement Clutch Assemblies. Lubricate both sides of each escapement clutch assembly between the friction washers and the spur gear with silicone oil, 350 centipoises.
- (b) Shaft Bearings. Lubricate shaft and idler gear bearings, using rust and oxidation inhibited oil, SAE 20 grade. If the reader is equipped with tape reeling equipment, the reel drive mechanism bearings should also be lubricated with the same oil.
- (c) Escapement Assembly. Clean, and then lubricate each escapement armature fulcrum with a light film of Tally pivot grease A. The adjacent armature pole face must be wiped clean of all lubricant.
- (d) Drive Motor. Lubricate drive motor bearings using rust and oxidation inhibited oil, SAE 20 grade.

5.2 Read Head Service

5.2.1 Trouble-Shooting Reading Errors

If erratic readings are detected, examine the contacts for dirt or pitting. If dirty, clean as outlined in Section 5.2.2. If pitted, they should be replaced and adjusted per Section 5.2.3. Check the star wheels and star wheel levers for free movement, and clean if necessary. Check switch timing and contact pressure per Section 5.2.3.

5.2.2 Cleaning Contacts

Access to the read head contacts may be gained by removing one screw on the front of the read head cover and withdrawing the cover away from the front panel. If the contacts are dirty or corroded, they should be cleaned with methyl ethyl ketone. Use a fine brush or pipe cleaner as the applicator, and dry with compressed air. Use caution not to bend the small movable contact wires with the brush or air blast.

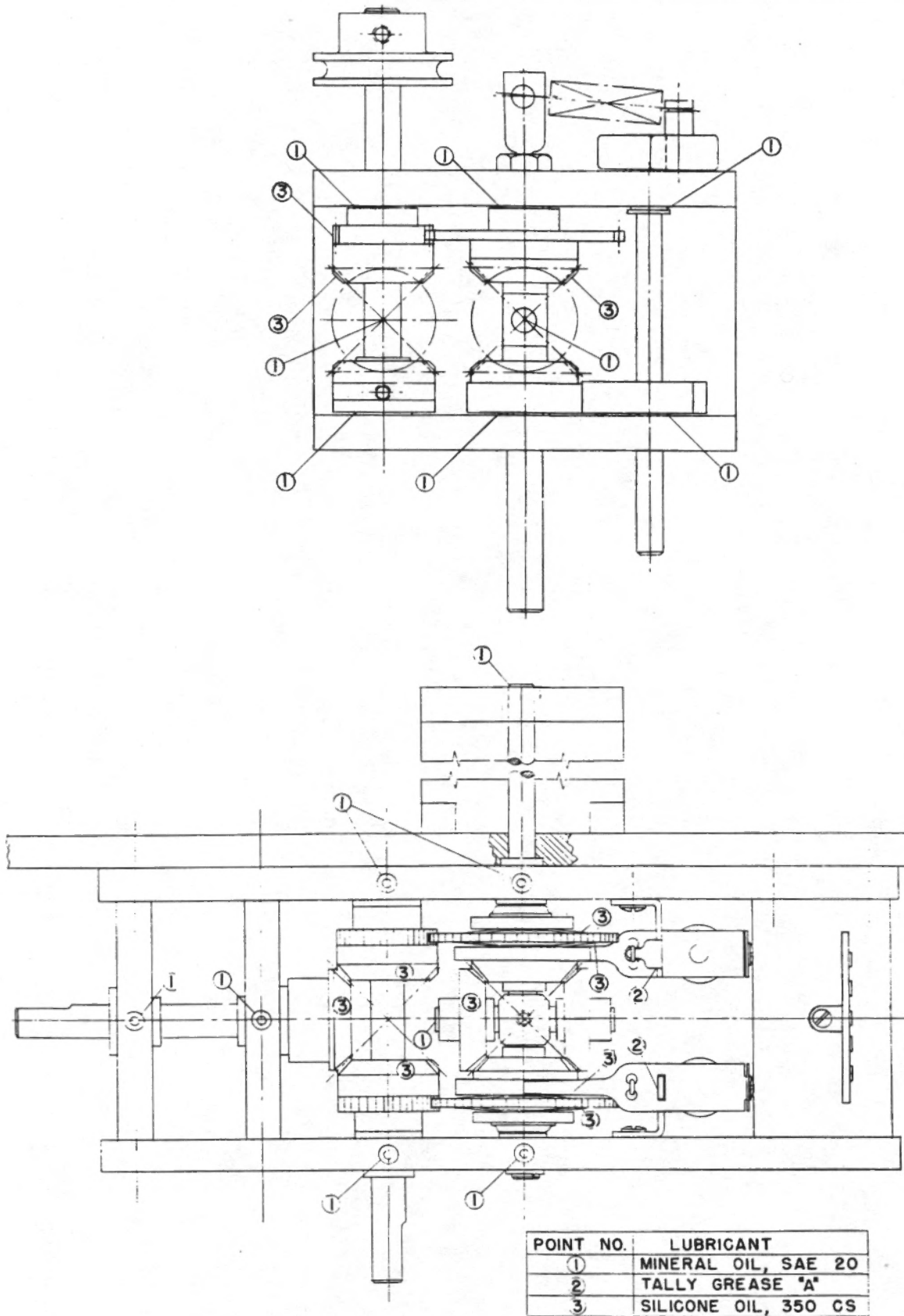


Figure 12. Lubrication Chart

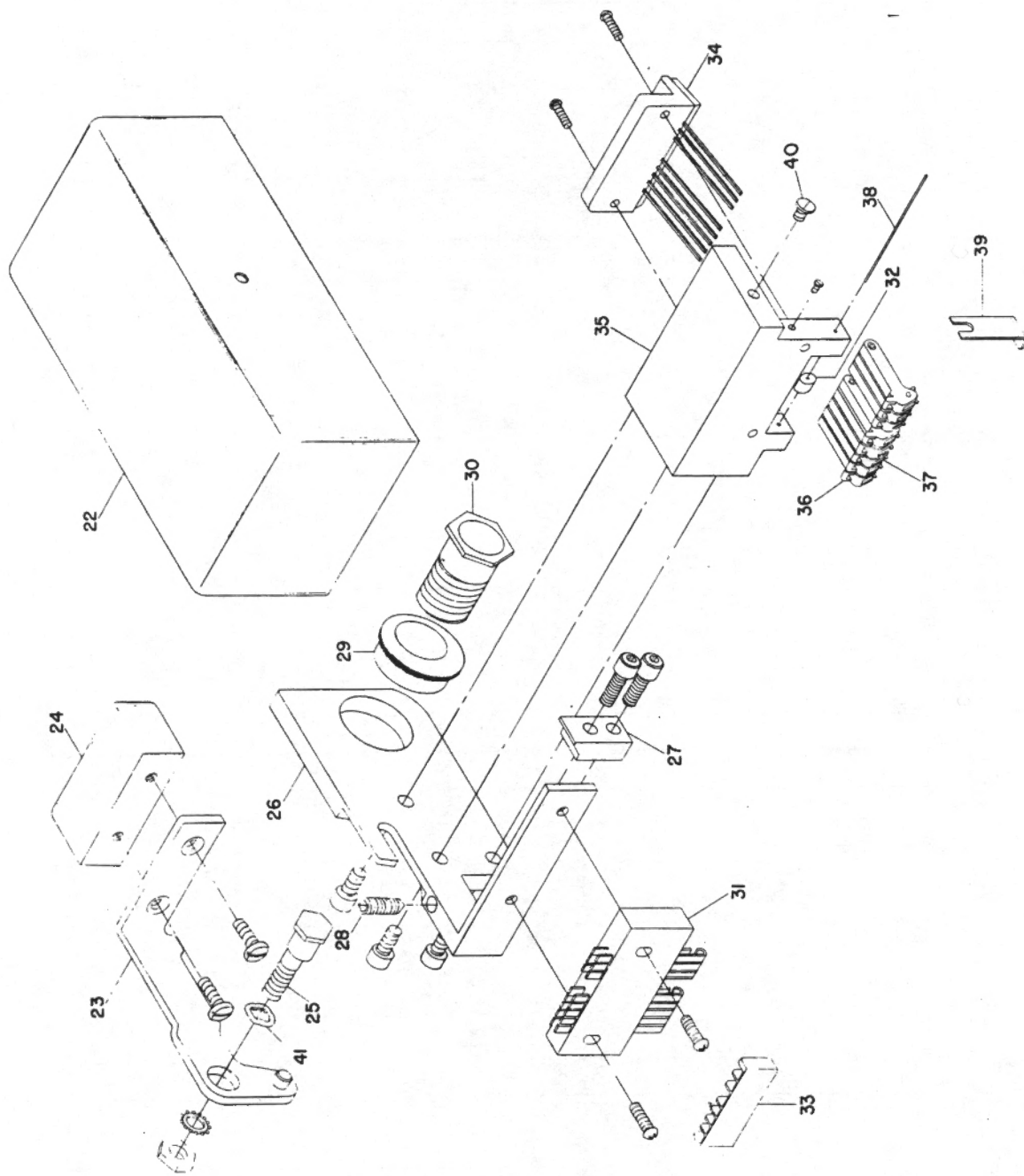


Figure 13. Tape Read Head, Exploded View

Keep the star wheels and star wheel levers free of lint and hair. They must have free movement to read tape without error. If lever movement becomes sticky, clean pivot bearings with methyl ethyl ketone and relubricate with SAE 20 oil.

5.2.3 Read Head and Contact Adjustments (See Figure 13)

Reading errors may be caused by incorrect adjustment of the read head assembly. The first step in adjustment is to verify that each of the eight star wheel levers (36) are free to move in a vertical direction without drag on the adjacent levers.

The star wheels (37) must also be centered over the capstan. The star wheel position with respect to the center of the capstan may be adjusted horizontally by loosening the pivot bushing (30) and moving the read head adjusting eccentric (29).

The movable contact wires (34) must be free to move up and down in the gap between the fixed contacts (31). Improper alignment may be corrected by carefully bending the movable contact wire at its base.

The fixed contact gap opening must be between .025 and .030 inches wide. Excessive gap may be corrected by bending the normally open (lower) contact.

Contact pressure should be 14-22 grams per pair of wires when in either the N/O or N/C position. Lower contact (N/O) pressure may be checked by applying upward force under the wires adjacent to the fixed contact, with a gram gage and wire tool as shown in Figure 14a. Observe the force required to lift the wires when switch contact is broken on the oscilloscope. Lower contact pressure is increased by moving the fixed contact block upward.

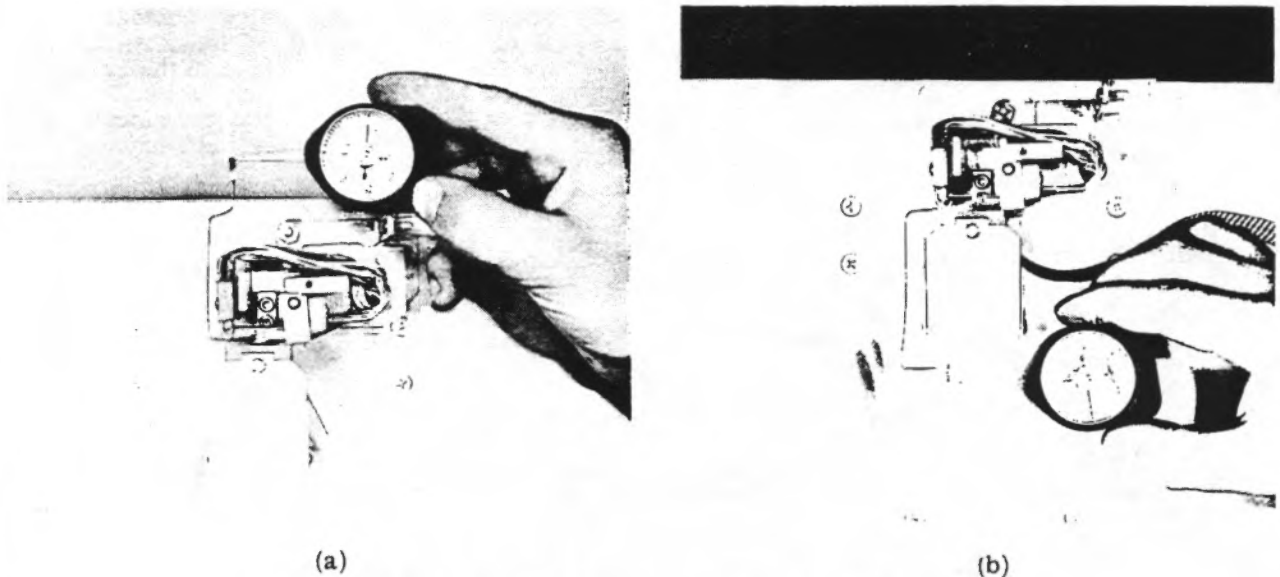


Figure 14. Checking Contact Pressure with a Gram Gage:

- (a) checking lower contact pressure;
- (b) checking upper contact pressure

Insert no-hole tape in the read head, and apply down force on the wires with the gram gage and wire tool to check upper contact pressure as shown in Figure 14b. Upper contact pressure is increased by lowering the read head through use of the depth adjusting screw (28) Figure 13, and the lever eccentric (25).

After contact pressure has been adjusted, switch timing should be verified with an oscilloscope per the timing diagram, Figure 8. Check the switch timing of #8 channel against #5 channel. If they do not coincide within the 7-14 millisecond range, slightly rotate the fixed contact block.

When alternate hole, no-hole tape is positioned so the star wheel is sensing a "no-hole" condition, the two points in contact with the paper must be equally spaced from the edges of the adjacent holes as shown in Figure 15.

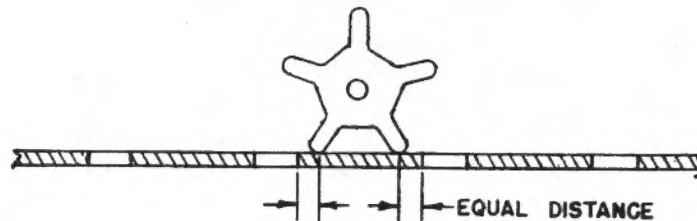


Figure 15. Correct Positioning for Star Wheels on Alternate Hole-No-Hole Tape

If the star wheel is not symmetrically located between tape holes, contact switching will occur early or late depending on direction of tape movement. Contact switching should be checked on an oscilloscope by stepping the tape first forward and then in the reverse direction. If the switching in both directions is not within the 7 - 14 millisecond zone, loosen the recessed head clamp screw and turn the adjusting screw (25, Figure 6) counter clockwise to advance the tape, clockwise to delay it. Tighten the clamp screw securely and recheck switching as above.

The lift lever should be adjusted so the lifting stud passes over center with the lever down firmly against the base plate. If adjustment is required, loosen the eccentric bolt, and turn the eccentric (25, Figure 13) so the lever locks over center.

CAUTION: Do not move the depth adjusting screw (28) for this screw adjusts upper contact (N/C) pressure.

5.3 Drive System Parts Replacement

To replace damaged gears or shafts, loosen all set screws clamping gears to the shaft. Slide the shaft through its bearings. Take care to preserve all the shim washers disassembled.

When re-assembling components, re-insert the shaft through its bearings, picking up shim washers, gears, or other components one at a time. Be sure to re-assemble all shim washers in their proper places. This will usually keep shaft end-play and gear backlash within the tolerances shown in Table 5.3-1. It may become necessary to add or take away shims when new gears are installed.

TABLE 5.3-1. CAPSTAN DRIVE SYSTEM TOLERANCES

<u>Part</u>	<u>Movement</u>	<u>Max.</u>	<u>Min.</u>
Motor Input Shaft	End Play	.010	.001
Auxiliary Drive Gear	End Play	.010	.001
Capstan Shaft	End Play	.005	.001
Spider Bevel Gear	End Play	.005	.001

5.3.1 Escapement Assembly Adjustment

If any parts of the escapement assembly have been repaired or replaced, adjust the assembly to provide the clearances shown in Figure 16.

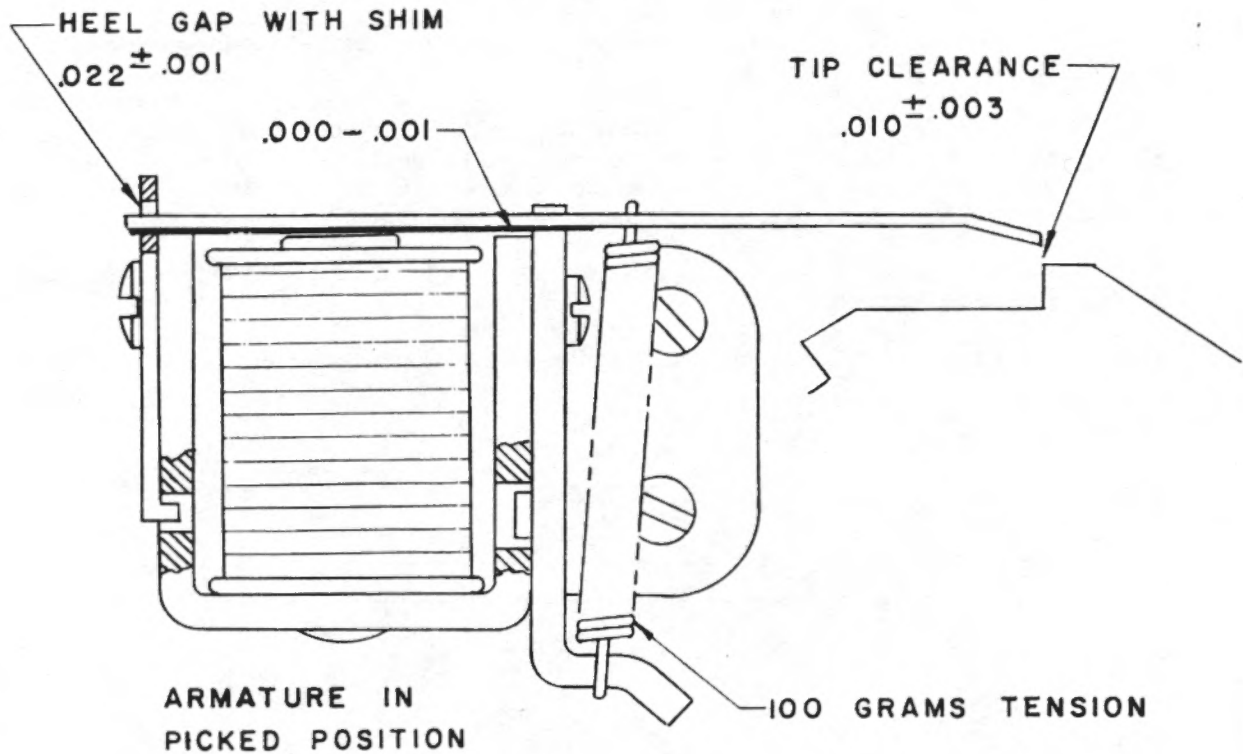


Figure 16. Escapement Adjustments

6.0 TAPE SPLICING

Care should be taken in splicing tapes to help prevent erroneous reading. If a rough joint is made, the leading edge of the tape catches the star wheel (when reading no-hole) so that it starts to roll over the splice. This action, represented in Figure 17a, does not produce an erroneous reading in itself, but if the joint is just forward of a perforation, the star wheel, after rolling over the rough edge, straddles the perforation as shown in Figure 17b, and the character will not be read.

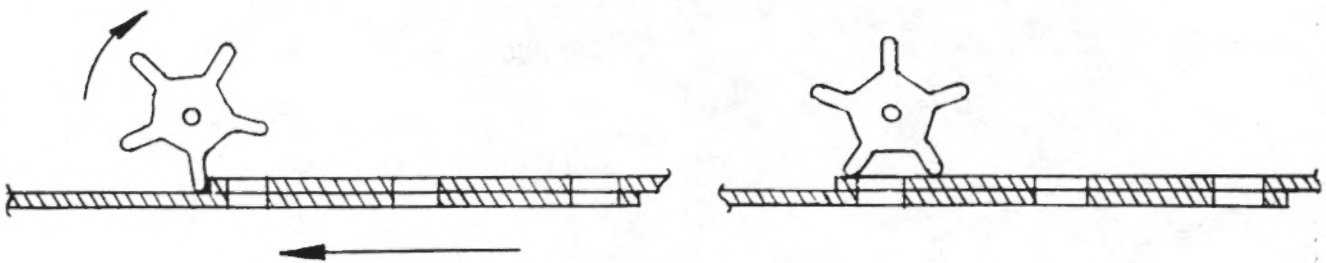


Figure 17. Bad splice showing star wheel (a) catching on edge of tape and starting to roll into position, (b) straddling the following perforation

Reading errors can be prevented by observing proper techniques in splicing the tape as follows:

a. The tape should be cut straight across through the center of the sprocket hole as shown in Figure 18. This permits the star wheel to slide into the perforation properly, or if no perforation exists, the star wheel will roll over the splice and yet be in position to read a character on the next step. Allow approximately 1/2 inch for splice overlap.

b. Taper the ends of the tape prior to cementing with sandpaper. A fingernail board is an excellent tool for this purpose.

c. Apply a light coat of contact cement to the tape ends, and after drying thoroughly, sand the joint smooth.

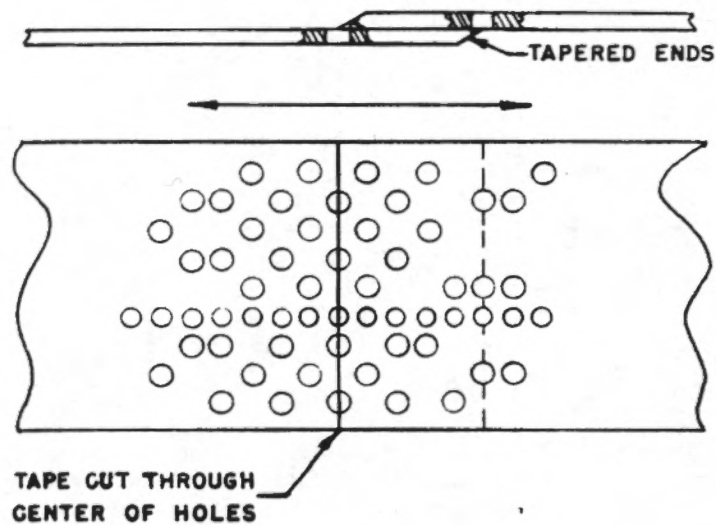


Figure 18. Bi-directional Tape Splice

7.0 SPECIAL ACCESSORY EQUIPMENT

7.1 End-of-Tape Sensing Switch

7.1.1 Description

The end-of-tape sensing switch is designed to provide a contact transfer to indicate the end of a tape regardless of its direction of movement. Either the "make" or "break" signal may be used depending upon the logic requirements of the system.

7.1.2 Mechanical Operation (See Figure 20)

A lever actuated sensing switch is mounted on the inside face of the read head stripper plate. The roller on the end of the switch actuator protrudes through a slot in both the stripper plate and tape pressure guide. When tape is under the tape guide, the switch contacts will be transferred to the normally open position due to tape pressure against the switch actuator. When no tape is present, the switch contacts will be in the normally closed position. One sensing switch is positioned on each side of the capstan so that end-of-tape is indicated whether tape is moving in either the forward or reverse direction.

7.1.3 Electrical Operation

The sensing switches use form "C" contacts, and as shown in Figure 19, contacts are in the normally closed (NC) position when no tape is under the pressure guide.

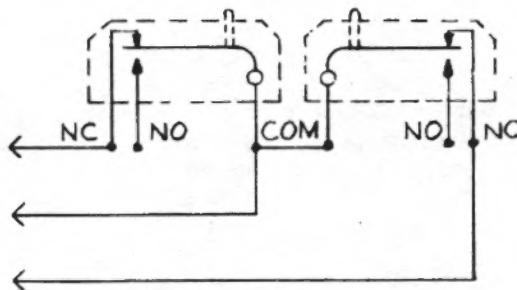


Figure 19. Schematic Showing Switches Indicating End of Tape

Alternate logic for "end-of-tape" switching may be easily arranged by removing the stripper plate, disconnecting the wires from the NC switch terminals, and reconnecting them to the NO terminals.

7.1.4 Adjustment

The roller on the switch actuator should protrude through the stripper plate 5/64 inch, so that when tape is moving under the tape pressure guide, the switch will be closed. This

adjustment can be made by loosening the two mounting screws (Figure 20) on the outside face of the stripper plate and moving the block assembly up or down. The tape pressure guide should be adjusted so that there is .015" - .020" clearance between the stripper plate and guide.

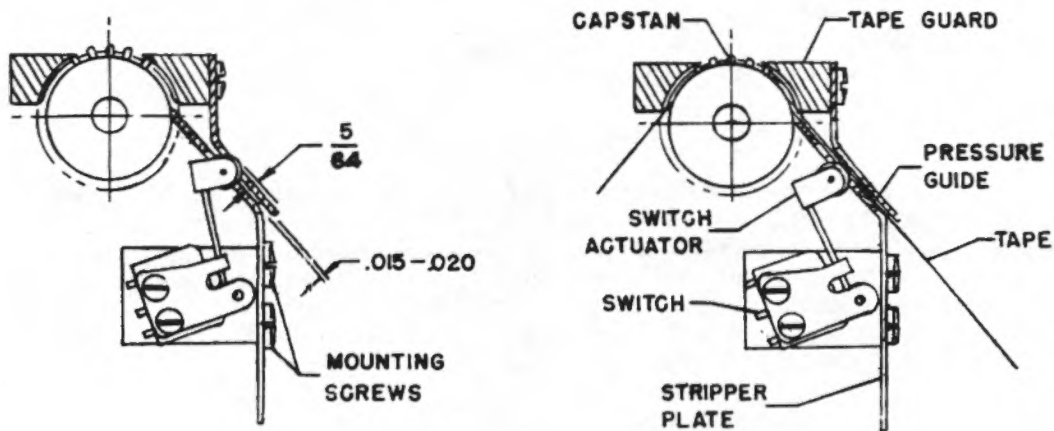


Figure 20. End-of-Tape Switch Adjustment:

- (a) switch sensing end of tape;
- (b) switch sensing tape

7.2 Capstan Shaft Commutator

7.2.1 Description

The commutator unit is designed to provide a "free-running" operational mode, and thus permit tape reading without using a tape reading pulse generator. The normal "tape-stepping" mode of the standard reader is retained as an optional operating mode. To obtain "free-running", an integral commutator generates a switch closure signal that has an adjustable duration which is discreetly related to the capstan velocity, and whose phase is adjustable and related to the tape hole and star wheel reading position. Switch closure and phase angle is adjusted to fulfill specific customers requirements.

7.2.2 Mechanical Operation (See Figure 21)

A commutator is directly driven by the read head 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 a set screw.

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

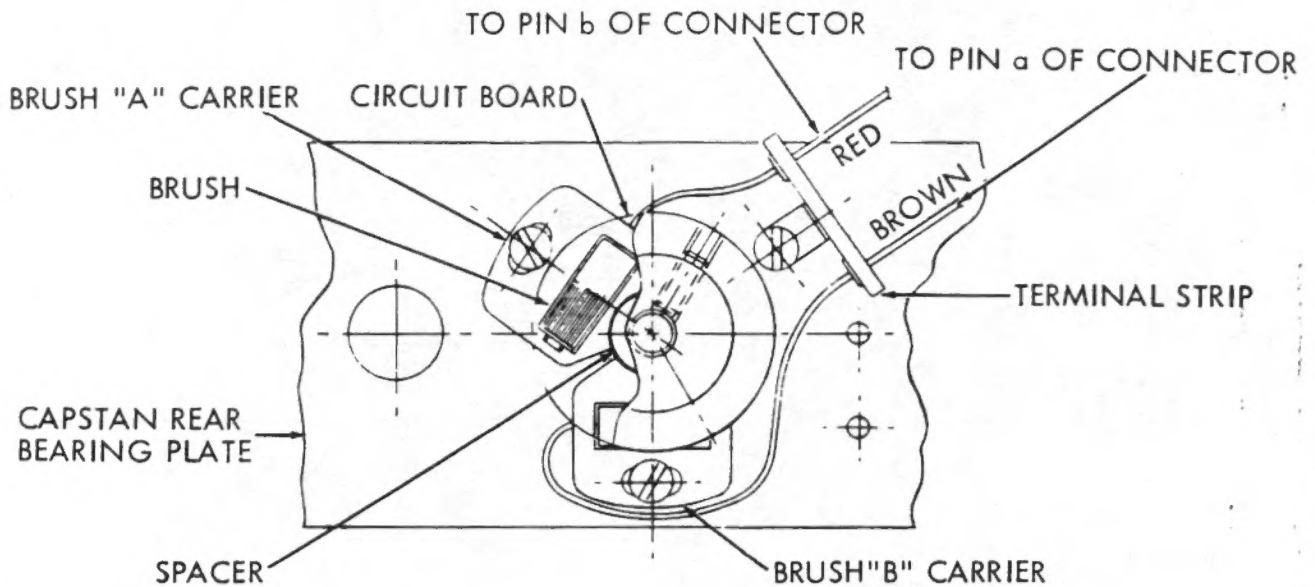


Figure 21. Capstan Commutator

7.2.3 Electrical Operation

With every revolution of the capstan drive shaft there are twenty series circuits completed through the two brushes and the twenty commutator 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. Current through the commutator must be limited to 10 milliamperes maximum.

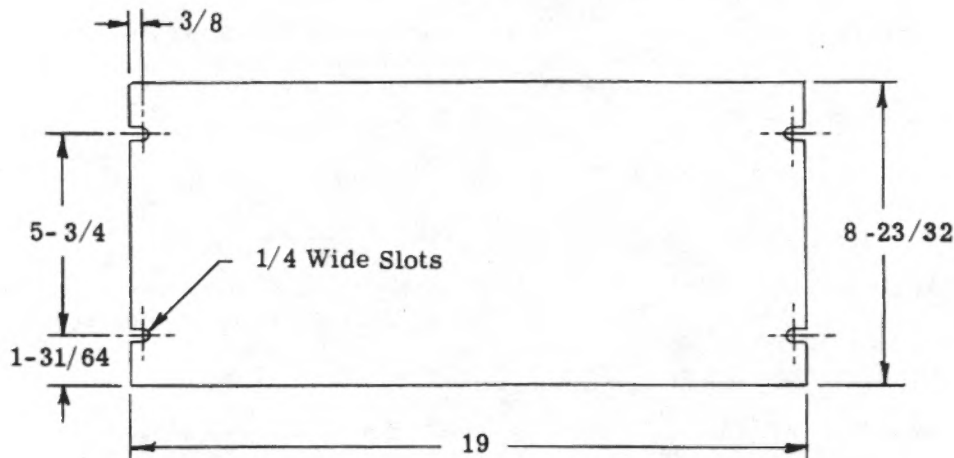
Because each brush holder can be independently adjusted, both switch closure duration and phase angle is adjusted to customer specifications. The timing diagram of Figure 22 illustrates the flexibility of these adjustments.

7.2.4 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 5 degree 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 width of the switch closure angle, 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.



Rack Mount Hole Pattern For Panel Model Reader
Dimensional tolerance $\pm .020$

1.2 Description

The Tally Model 424 Tape Readers, Figures 1, 3, and 4, are self-contained bi-directional, asynchronous devices for reading any standard perforated tape. Tapes having five to eight levels of information may be interchanged and read without reader adjustment. The reading rate is variable from 0 to 60 characters per second in either direction of tape feed. Tape wear is exceptionally low, and standard paper tape may be re-read hundreds of times.

Model types and associated tape handling facilities:

<u>Model</u>	<u>Type</u>	<u>Tape Handling Facility</u>
424 C	Console Model	No Tape Handling
424 CF	" "	Fan Fold Tape Handling
424 P	Panel Model	No Tape Handling
424 PF	" "	Fan Fold Tape Handling
424 PR	" "	Reel Tape Handling

The panel model series are mounted on an anodized aluminum panel $1/4" \times 8 - 23/32 \times 19"$. Refer to Section 1.1 for rack mounting dimensions.

Drive power is supplied to the capstan from an integrally mounted $1/30$ HP motor through a bevel gear and differential drive assembly. The use of special clutches in the drive assembly permits high speed response for bi-directional tape movement.

1.3 Input Requirements

The drive motor ($1/30$ HP) requires 105-125 volt AC, 60 cps, at 0.4 amperes. To move the tape, a 4.5 ± 0.5 millisecond DC pulse (rise time less than 0.5 millisecond) of 48 or $24 \pm 10\%$ volts (according to customer specification) is applied to either the forward or reverse escapement assembly. One pulse must be supplied for each movement of the tape.

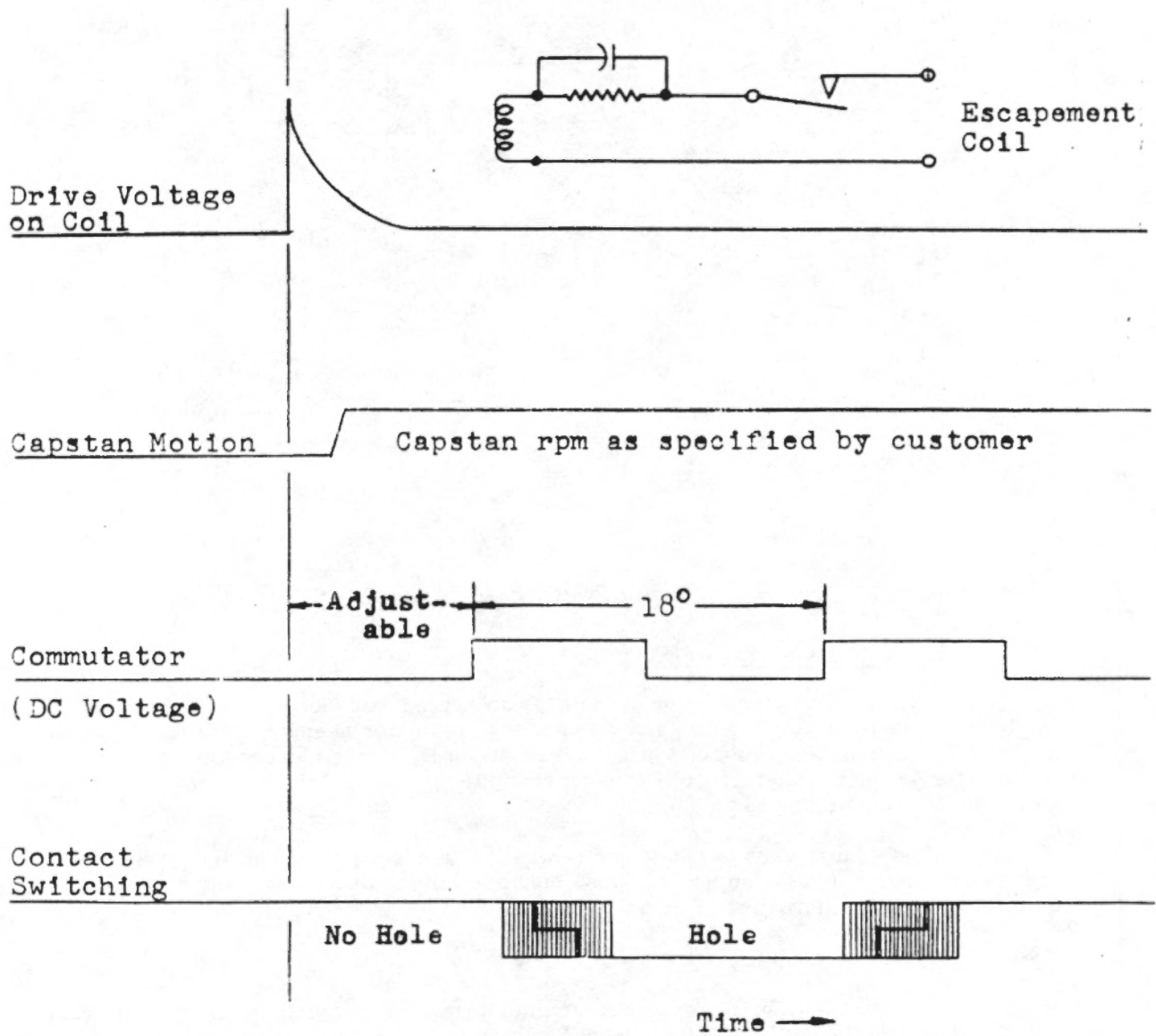


Figure 22. Commutator Timing Diagram

7.3 PLUGABLE READ HEAD

There is also available as optional equipment a read head in Modular Plug-in form. This permits rapid replacement of this entire unit, consisting of the fixed contacts, moving contacts, star wheels and star wheel levers. This approach is ideally suited for customers using several readers in one location; by stocking one spare read head, the spare parts on hand are then held to a minimum.

8.0 PARTS ORDERING AND PARTS LIST

To order a replacement part, refer to Figures 23, 24, 25, 26, 27, 28, 29 and 30. Find the part required, and order by part number and name listed. Give the model and serial number of the reader on which it is to be used.

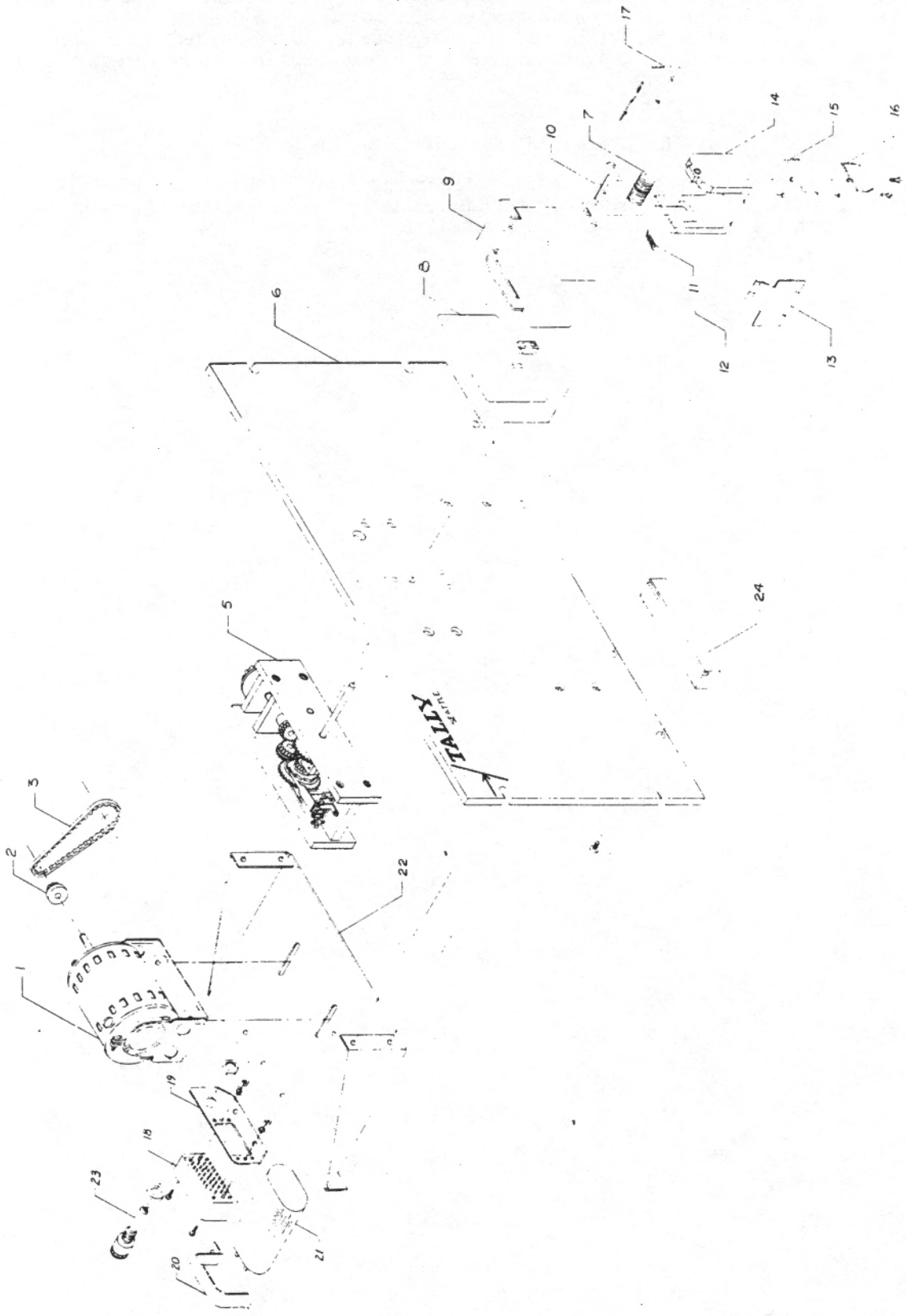


Figure 23. Model 424P Tape Reader

Figure 23. Model 424A Tape Reader Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Motor, 1/30 hp 1725 rpm	2-2400
2.	Pulley, 8 tooth	2-2044-31
3.	Drive Belt	XLB-38
4.	Pulley, 16 tooth	2-2044-3
5.	Capstan Drive Mechanism (See Fig. 25)	5-1566
6.	Panel, Fanfold	5-1965-1
	Panel, Combination Fanfold & 6" Reeling	5-1965-2
	Panel, 6" Reeling	5-1965-3
	Panel, 10" Reeling	5-1965-4
	Panel, No Accessories	5-1965-5
	Panel, Combination Fanfold & 10" Reeling	5-1965-6
7.	Capstan	2-1680-1
8.	Rubbing Plate	1-4162
9.	Read Head Assembly (See Fig. 26)	5-1343
10.	Tape Guard	2-1773
11.	Torsion Spring	1-3954
12.	Hinge Pin	1-3953
13.	Stripper Plate, L. H.	2-1724-1
14.	Outboard Bearing Bracket	5-1384
17.	Stripper Plate, R. H.	2-1724-2
18.	Connector	1-4769-1
19.	Bracket — Connector & Fuse	2-2536
20.	Capacitor Clamp	G. E. #9827065
21.	Capacitor	G. E. #49F1751
22.	Motor Chassis	5-1964
23.	Fuse Holder, Bussman	HKP
24.	Fuse, Slow Blow 1/2 amp Bussman	MDL
	Maintenance Kit	1-5099-1

Additional Parts:

Fanfold type units:	
Fanfold Hopper	5-1434
Fanfold Hopper Bracket	1-4223-2
Fanfold Hopper Hook	1-4060
Spring Clip	1-4209

Reel Type Units:
See Reel Drive Mechanism Page 30-31

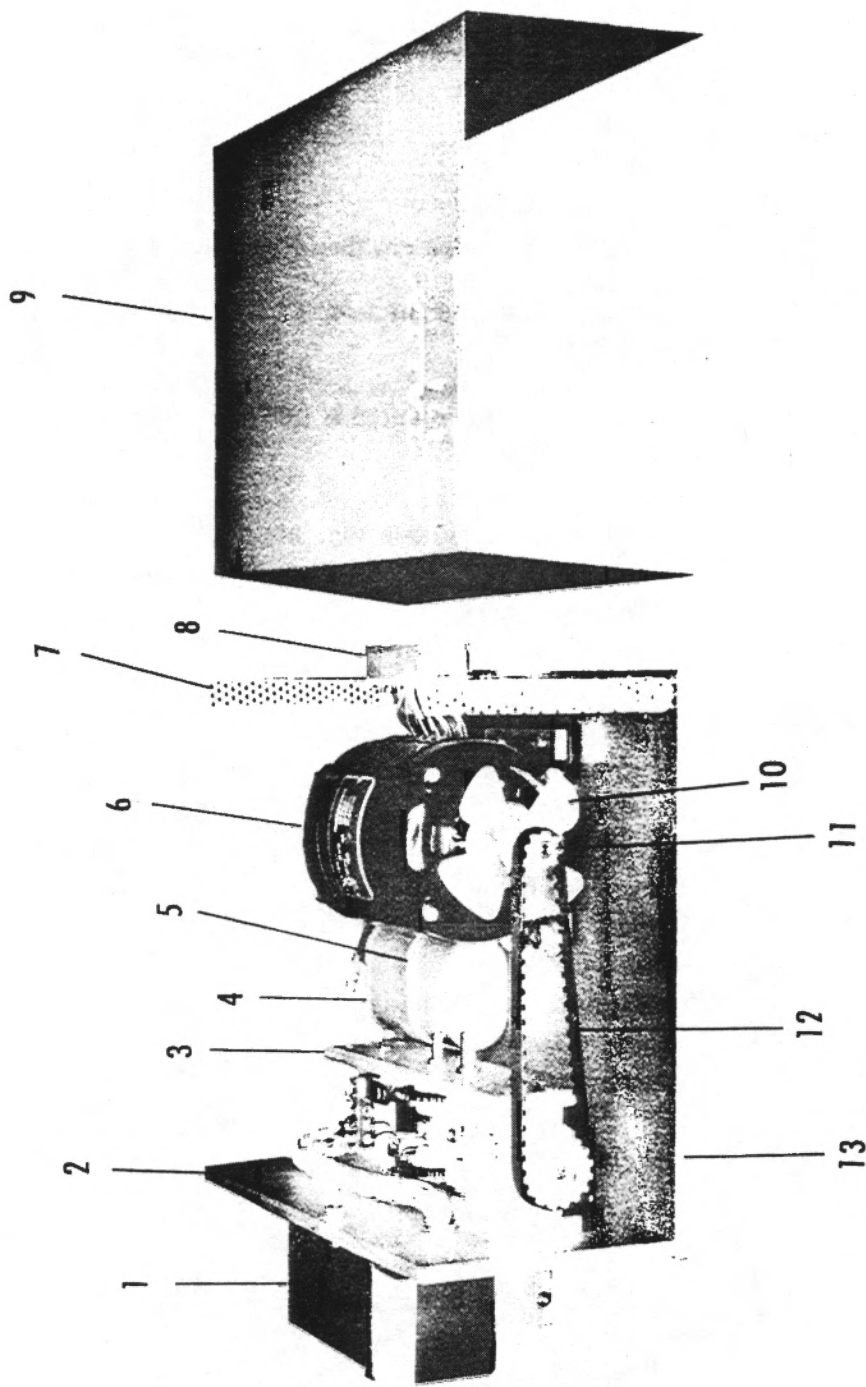


Figure 24. Model 424C Tape Reader

Figure 24. Model 424C Tape Reader, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Read Head Assembly (See Fig. 26)	5-1343
2.	Front Plate	2-1843
3.	Capstan Drive Mechanism (See Fig. 25)	5-1333
4.	Capacitor, 4 Mfd, 300 VAC, 600 VDC	
5.	Capacitor Clamp	
6.	Motor, 1/30 hp, 1725 rpm	2-2400
7.	Rear Cover	2-1845
8.	Connector Assembly	1-4769
9.	Cover	2-1844
10.	Fan, Cooling	
11.	Pulley, 8 tooth	2-2044-31
12.	Drive Belt	XLB-55
13.	Base Plate	5-1410
14.	Pulley 16 T	2-2044-3
 <u>Not Shown</u>		
	Base Extension Bracket (Fanfold models only)	2-2021
	Fanfold Box Bracket (2 used)	1-4223-2
	Fanfold Hopper	5-1434
	Fuse Holder, Bussman	HKP
	See Figure 23 for outboard bearing parts	
	Rubbing Plate	1-4162

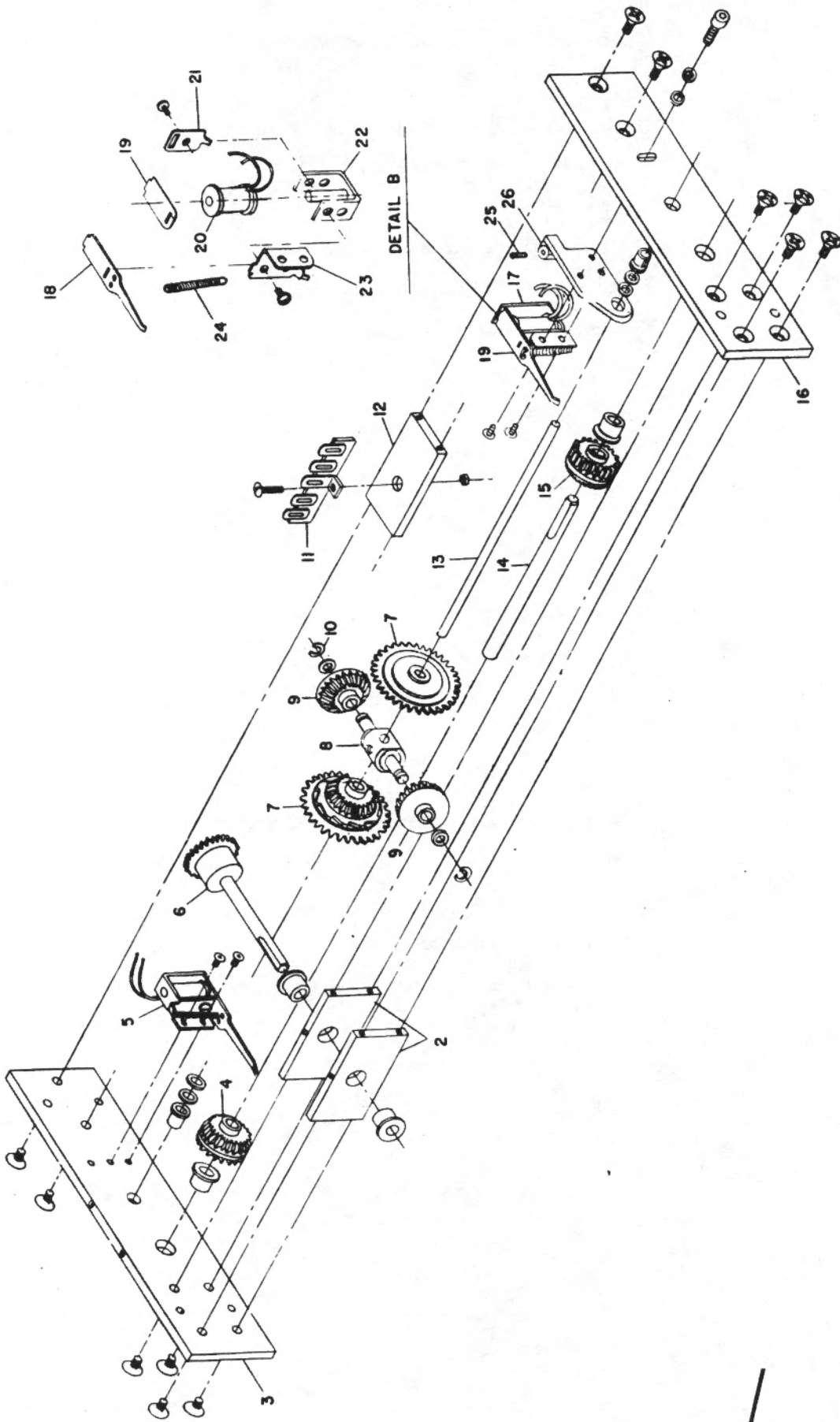


Figure 25. Capstan Drive

Figure 25. Capstan Drive Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.		
2.	Vertical Spacer (2 used)	2-2064
3.	Front Bearing Plate	2-1996
4.	Bevel Gear w/Set Screw	1-3824
5.	Reverse Escapement Assembly	2-1684
6.	Idler Shaft w/Bevel Gear	1-4764
7.	Friction Clutch (2 used)	2-2443-2
8.	Differential Spider	2-2593
9.	Spider Bevel Gear (2 used)	2-2652
10.	Retaining Ring (2 used)	5103-18
11.	Terminal Strip	1-4456
12.	Horizontal Spacer	2-2065
13.	Capstan Shaft	1-3553
14.	Secondary Drive Shaft	1-3551-1
15.	Idler Bevel Gear	1-3554
16.	Rear Bearing Plate	2-1997
17.	Forward Escapement Assembly	2-1684
18.	Armature	2-1730-2
19.	Anti-Risidual Shim	2-2637
20.	Electromagnet Coil - 48V Electromagnet Coil - 24V	2-2053-1 2-2053-4
21.	Armature Limit	2-2377
22.	Coil Frame	2-2376
23.	Escapement Bracket	2-1838
24.	Escapement Spring	1-4641
25.	Adjusting Screw	
26.	Capstan Adjusting Plate	1-4578

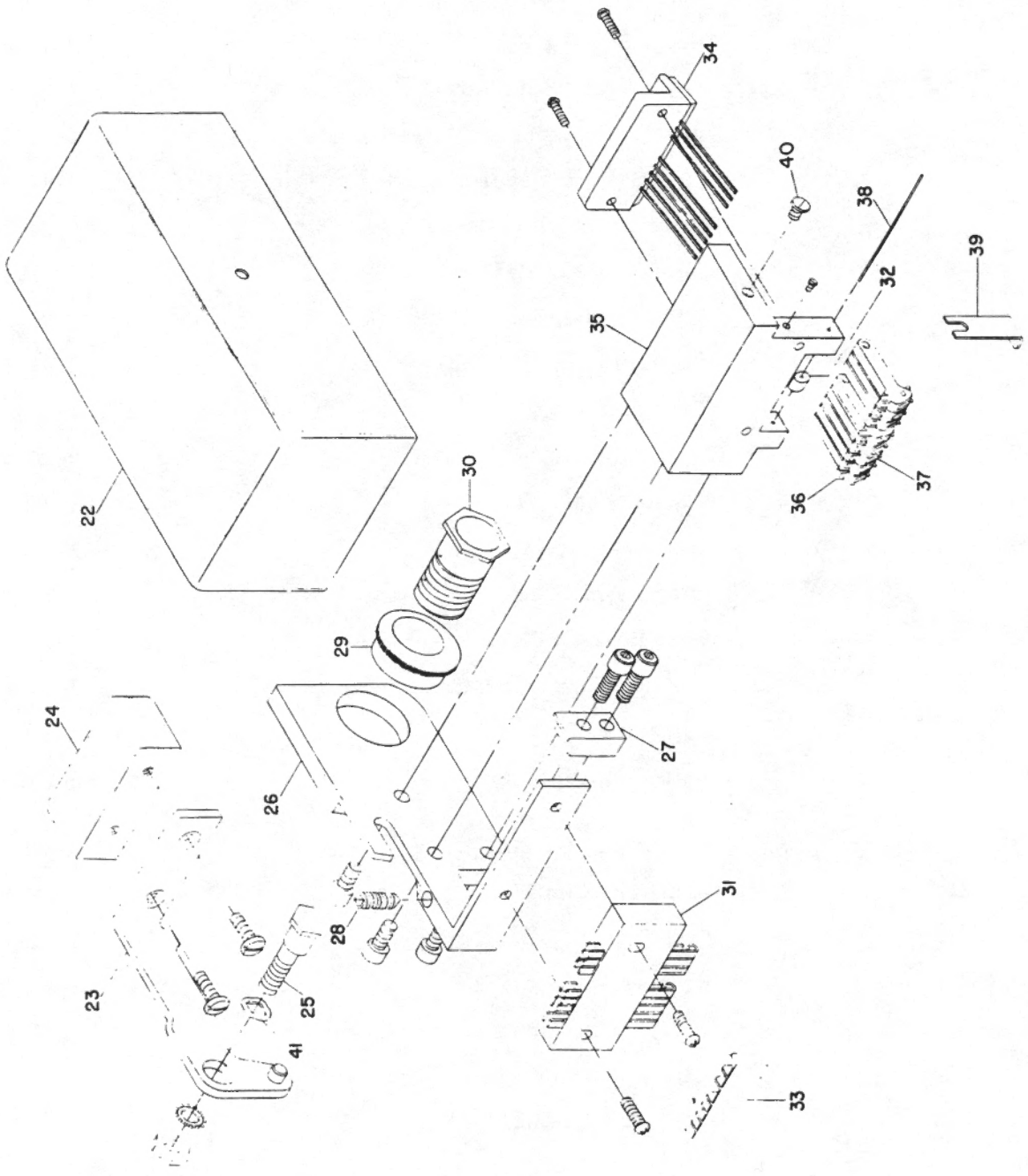


Figure 26. Tape Read Head

Figure 26. Tape Read Head, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
22.	Cover	5-1358
23.	Lift Lever	2-2616
24.	Lift Handle	1-3889
25.	Lift Lever Adjusting Eccentric	2-2513
26.	Arm & Base Plate Assembly	2-1811
27.	Block - Latch	1-3754
28.	Depth Adjusting Screw 10-32 x 3/8	
29.	Bushing - Pivot Pin	1-3755
30.	Pivot Clamp	1-3756
31.	Fixed Contact Assembly	2-1686
32.	Starwheel Lever Spacer	1-5090
33.	Read Head Contact Insulator	1-3752
34.	Movable Contact Assembly	2-1687
35.	Star Wheel Bracket	2-1685
36.	Star Wheel Levers	1-3537
37.	Star Wheels	1-3719
38.	Lever Pivot Pin	1-3663
39.	Lever Retaining Plate	2-2612
40.	Cover Hold Down Screw 6-32 x 1/4	
41.	Preload Spring	R-2

Any of the several modes of controlling tape movement and reading may be adopted. For example, tape movement and reading can be controlled by separate pulses, or different bit levels can be read by separate pulses. Normally, the same pulse that advances the tape also interrogates the read contacts. If individual pulse sources are used for tape movement and reading, all pulses must be simultaneous within ± 0.5 millisecond. At maximum reading rate of 60 characters per second, the drive pulses are 16.7 milliseconds apart (leading edge to leading edge).

1.4 Outputs

The functional output of the system consists of three leads to each of the eight form C switches. A read pulse at the movable wire contact of the switch will be delivered to the lower fixed contact when a tape hole is sensed, and to the upper fixed contact when no holes are present. Sensing of a particular character code, such as a stop code, can be used by external equipment to interrupt the drive pulses and stop the reader. Whenever drive pulses are stopped, the reader will come to rest in position to read the next character.

1.5 Tape Handling

The Model 424 Tape Reader is available with two types of tape handling equipment: fanfold, and reeling. The 424 CF and 424 PF Models (Figure 3) are fitted with fanfold tape trays mounted on either side of the read head. The tape is fed by the capstan from one tray into the other, neatly folding itself in either direction without additional handling equipment.

The 424 PR Model (Figures 4 and 5) is supplied with bi-directional tape reeling equipment mounted on either side of the read head. The tape reels are rotated by a differential gear and brake mechanism actuated by tape tension arms. Both mechanisms are driven by belts from the capstan drive assembly. Since the units are bi-directional, either reel can be the take-up or supply side depending upon direction of tape movement. No tape threading change is required when reversing the direction of tape movement. All slack on the supply reel is taken up through the action of the tension arms.

The 424 PR Model can be supplied with either 6" or 10" reels. The reels (Figures 2 and 4) have a demountable front flange and only a light pressure need be applied to the flange to release the ball detent lock; thus tape may be easily removed or placed on the reel.

1.6 Environmental Conditions

The unit is designed for continuous operation in a temperature range between 40 and 120 degrees Fahrenheit.

2.0 MECHANICAL OPERATION

2.1 Motor and Capstan Drive (See Figure 6)

Drive power is transmitted from the motor by a lug belt and pulleys (1) to the input shaft with bevel gear (6) through the two idler bevel gears (4 and 15) and to the two clutch assemblies (7). When the tape is not being moved, an armature (19) on each of two escapement assemblies (5 and 18) engages a tooth of the escapement wheel on the corresponding clutch assembly, causing the clutches to slip. When the tape is to be advanced (capstan rotation counter-clockwise), an electric pulse energizes the electromagnet on the forward escapement assembly (18) disengaging the armature from the escapement wheel and permitting the forward clutch assembly to rotate. Rotation of the clutch assembly transfers torque from the clutch through the differential (8 and 9) to the capstan shaft (13). When the escapement coil is de-energized, allowing the armature to drop and engage the next tooth of the escapement wheel, the capstan (17) is stopped in position to read the next character.

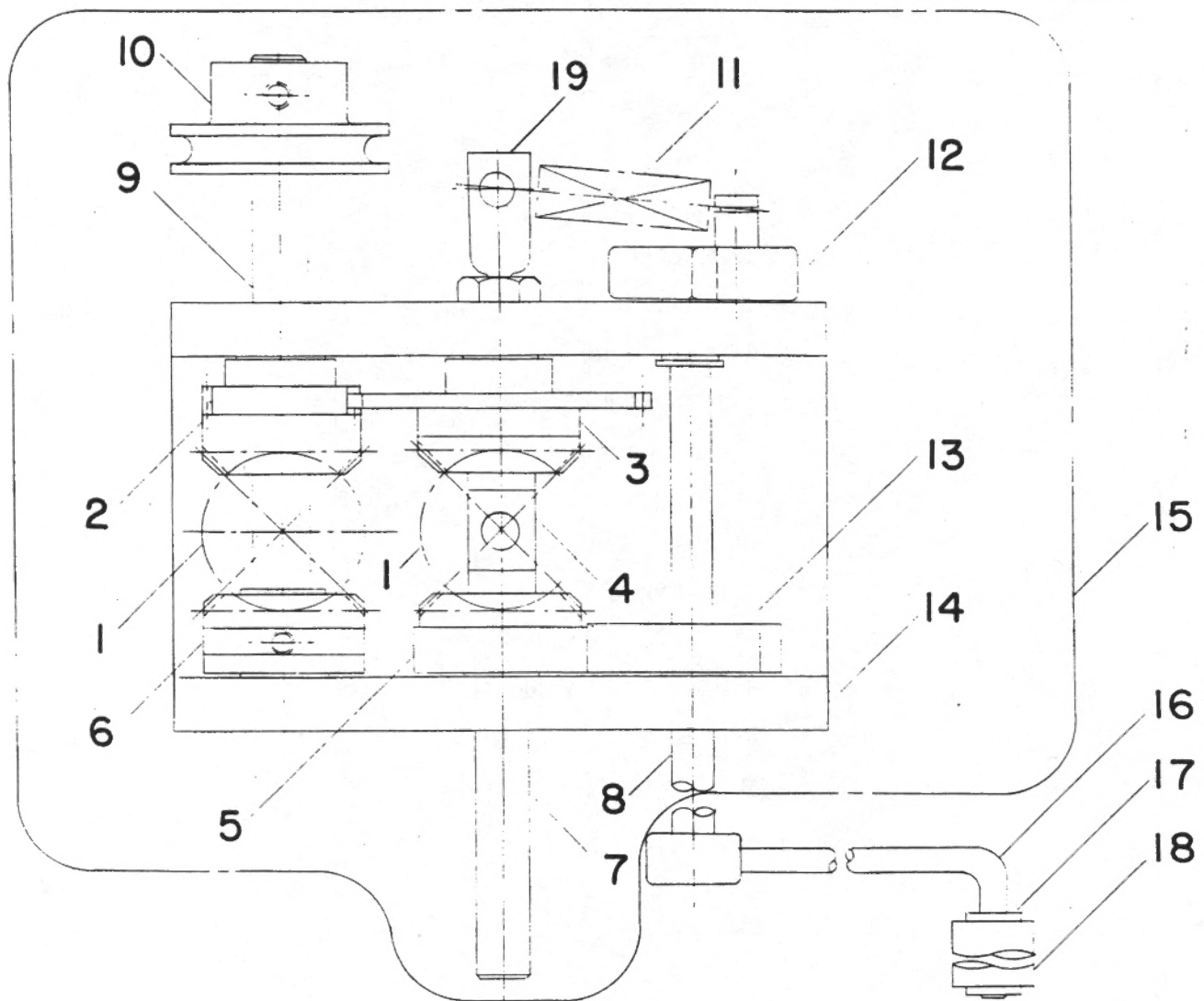


Figure 27. Reel Drive Mechanism, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Spider Bevel Gear (2 used on L. H.)	2-2652
	Bevel Gear Spacer (L. H. only)	1-4663
2.	Bevel Gear (L. H. only)	1-3554
	Bevel Gear w/Set Screw (R. H. only)	1-3824
3.	Bevel Spur Gear	2-2106
4.	Differential Spider	1-3555
	Retaining Ring	5103-18
5.	Brake Gear	1-4667

Figure 27. Reel Drive Mechanism. Parts List (Continued)

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
6.	Bevel Gear w/Set Screw (L. H. only)	1-4644
7.	Reel Shaft	1-4486-2
	Reel Shaft (Comb. fanfold & reeling)	1-4486-3
	Reel Shaft Extension (Comb. fanfold & reeling)	1-4863
8.	Tension Shaft	1-4484
9.	Drive Shaft	1-4485
	Retaining Ring (R. H. only)	5555-25
10.	Driven Pulley w/Set Screw	1-4488
11.	Brake Spring	1-4494
12.	Tension Link	1-4483
13.	Brake	1-4493
14.	Frame Assembly w/Bearings, Stub Shaft & Spring Lug	5-1594
15.	Reel Drive Mechanism, L. H. , Complete	5-1545-1
	Reel Drive Mechanism, R. H. , Complete	5-1545-2
16.	Tension Arm (6" Reels)	2-1864-4
	Tension Arm (10" Reels)	2-1864-5
17.	Retaining Ring (2 used)	5555-12
18.	Tension Arm Roller	1-4128
19.	Post, Spring	1-4670-1
 <u>Not Shown</u>		
	Washer	2-2517
	Drive Pulley, Double Groove	1-4491
	Drive Belt - L. H. (6" Reels)	Parker 2-248
	Drive Belt - R. H. (6" Reels)	Parker 2-240
	Drive Belt - L. H. (10" Reels)	Parker 2-257
	Drive Belt - R. H. (10" Reels)	Parker 2-248
	Belt Idler Bracket & Pulley Assy (10" Reels only)	2-2167
	Tape Reel Assembly - Complete (6" Reels)	2-2030-1
	Tape Reel Assembly - Complete (10" Reels)	2-2030-2

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

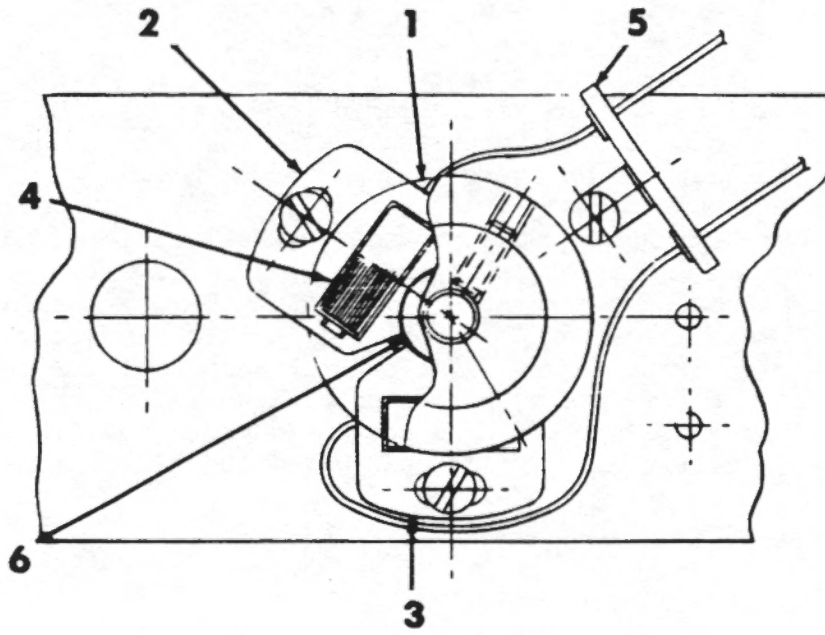


Figure 29. Commutator Unit, Parts List

<u>Index No.</u>	<u>Part Name</u>	<u>Part No.</u>
1.	Commutator Assembly	2-2639
1.	Circuit Board	2-2189
2.	Brush Holder	2-2148
3.	Brush Holder	2-2149
4.	Brush (2 used)	2-2455
5.	Terminal Strip	HHS #1064
6.	Screw #4-40 x 1/4 Fillister Head (3)	

TAPE READER MANUAL

MODEL 424

ADDENDUM SHEET

<u>Page</u>	<u>Section</u>	<u>Correction</u>						
1	1.1	1/50 hp should read 1/35 hp.						
2	1.2	1/30 hp should read 1/35 hp.						
	1.3	1/30 hp should read 1/35 hp.						
5	2.2	Five point star wheel changed to four point.						
6	3.4 (b)	1725 rpm should read 1650 rpm.						
6	3.6	Coil specification for 24V drive pulse to read: <table border="1"><thead><tr><th><u>Coil Resistance</u></th><th><u>Peak Inverse Voltage</u></th><th><u>Coil Inductance</u></th></tr></thead><tbody><tr><td>50 ohms</td><td>80 volts</td><td>60 mh.</td></tr></tbody></table>	<u>Coil Resistance</u>	<u>Peak Inverse Voltage</u>	<u>Coil Inductance</u>	50 ohms	80 volts	60 mh.
<u>Coil Resistance</u>	<u>Peak Inverse Voltage</u>	<u>Coil Inductance</u>						
50 ohms	80 volts	60 mh.						
9	Fig.10	Escapement coils: 50 ohms or 220 ohms						
13	5.2.3	Contact pressure should be 10-20 grams (instead of 14-22)						
23	Fig.23	Add index No.25, Pulley-16 tooth Part No. 2-2044-3.						
23	Parts List	Index No. 1 - Motor 1/35 hp, 1650 rpm Index No.23 - Fuse, Slow Blow 6/10 amp						
25	Fig.24	Index No. 6 - Motor 1/35 hp, 1650 rpm. Index No. 4 - Capacitor, 3 Mfd. 370 VAC						
27	Fig.25	Index No. 6 - Part No. 1-3551-1 Index No. 8 - Part No. 1-3555 Index No. 9 - Part No. 1-3556, one used. Index No.14 - Part No. 1-4764 Index No.20 - Electromagnetic Coil 48 volts - Part No. 2-2053-2						
29	Fig.26	Index No.37 - Part No. 2-2657						
33	Fig.29	Index No. 2 - 2 used Index No. 3 - delete						

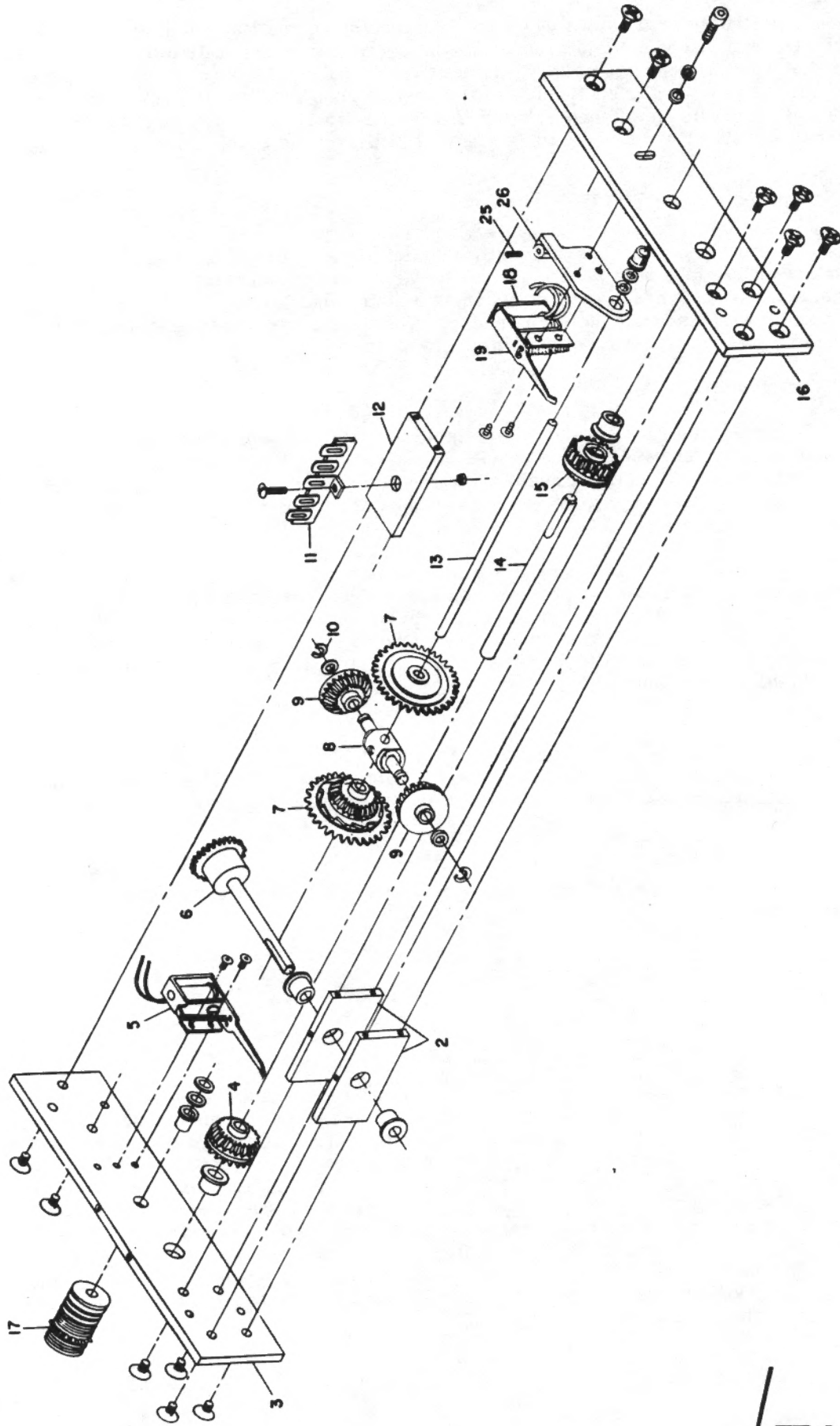


Figure 6. Capstan Drive, Exploded View

Release of the reverse clutch assembly will cause the capstan to be rotated clockwise and move the tape in the reverse direction.

2.2 Tape Read Head

As the capstan moves the tape through the read head, the tape is fed and taken up so as to provide approximately 120 degrees wrap on the capstan (see Figure 7). This retards elongation of sprocket holes in tapes that must be read hundreds of times. The strippers on either side of the capstan prevent the tape from wrapping around the capstan.

Perforations (holes) in the tape are sensed by the five point star wheels. Spring pressure applied to the star wheel lever by each pair of movable contacts, Figure 7a, holds the star wheel lightly against the tape.

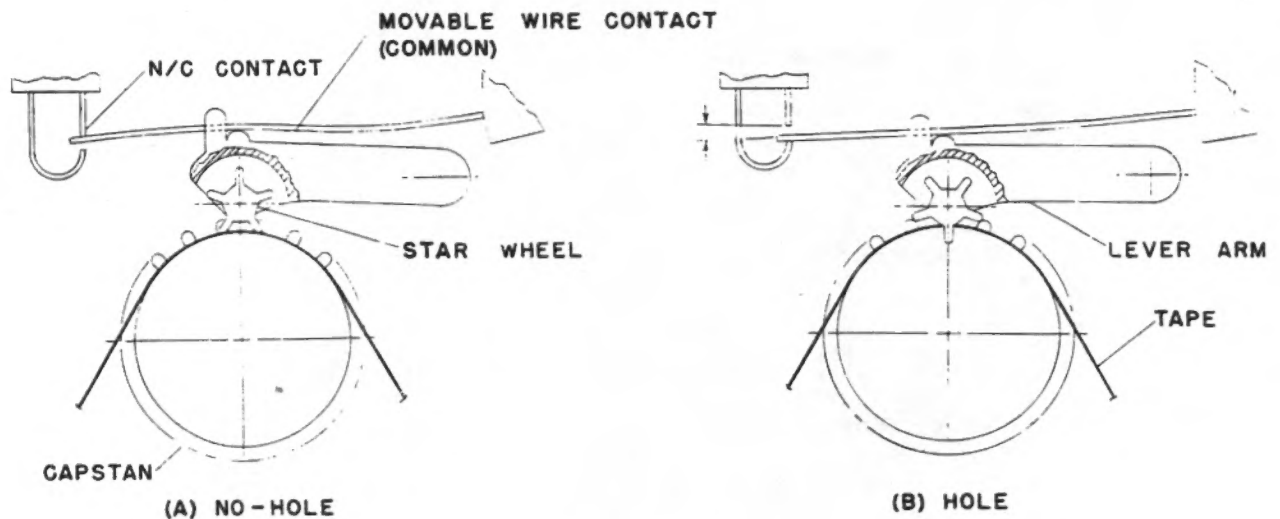


Figure 7. Starwheels Reading Perforated Tape

As shown in Figure 7a, when a no-hole condition is sensed, the star wheel rides the tape on two of its points, and the movable contact is switched to the upper, normally closed (N/C) position. When a hole is sensed (with the tape moving in either direction), one of the star wheel points drops through the hole as shown in Figure 7b, and the movable contact is switched downward to the normally open (N/O) position. Therefore, an electric pulse delivered to the movable contact wire (common) will be conducted to the N/C terminal if a no-hole is sensed or to the N/O terminal if a hole is sensed.

By definition, the normally closed contact (N/C) is that contact which is closed when the star wheel reads a no-hole condition on the tape. Similarly, the normally open (N/O) contact is closed when the star wheel reads a hole in the tape.

3.0 ELECTRICAL OPERATION

3.1 Escapement Operation

To advance the tape (capstan rotation counter-clockwise), a drive pulse is applied to the forward escapement assembly. The energized electromagnet disengages the armature from the escapement wheel allowing the clutch assembly to rotate. Similarly, the tape may be moved in a

reverse direction by pulsing the reverse escapement assembly. The escapement coils are either 24 or 48 volts, according to customer specifications. Refer to Section 3.6 for coil resistance and inductance.

3.2 Switching Action

Switches in each of the 8 channels may be "read" by introducing a pulse to the common (movable) contact. If a pulse is transmitted through the normally closed (N/C) contacts to the output, the tape does not have a hole in that particular read position. On the other hand, if the pulse is transmitted to the output through the normally open (N/O) contacts, a hole is sensed.

3.3 Timing

Figure 8 shows the timing relationships and pulse duration requirements of the Model 424 Tape Reader. To start a cycle, a 24 or 48 volt pulse (as applicable) 4.5 milliseconds long is applied to either electromagnet which momentarily disengages the armature from the escapement wheel in the clutch assembly. The clutch assembly responds immediately, and the torque transmitted through the differential rotates the read head capstan.

As the tape is moved over the capstan, it is read by the star wheels. If no holes are read, the movable contacts will be switched to the normally closed position. When a hole in the tape is read, the movable wire contacts for that particular channel are transferred from the normally closed to the normally open position. However, due to the mechanical delay designed into the reader, contact switching occurs between 7 and 14 milliseconds after the drive pulse has been applied. This permits "dry" or current-free switching which gives long contact life.

3.4 Cycle Length Limitations

All the above discussion and the timing diagram is based on:

- (a) Maximum reading rate of 60 characters per second.
- (b) Drive motor speed of 1725 rpm.
- (c) Drive pulse of 24 or 48 volt amplitude and 4.5 milliseconds duration.

Under these conditions, the minimum time duration of one cycle is 16.7 milliseconds, i.e., drive pulses must be at least 16.7 milliseconds apart (leading edge to leading edge).

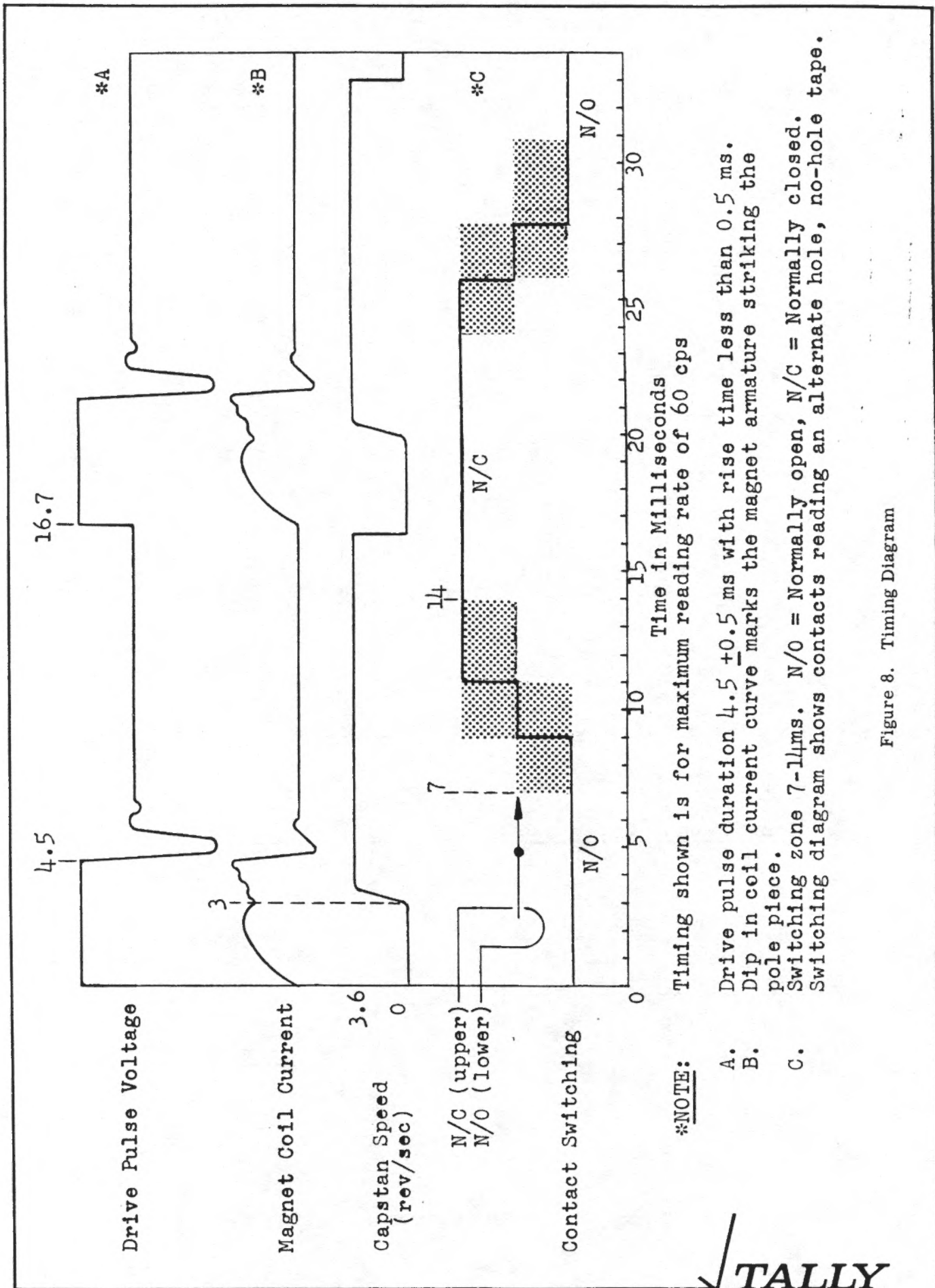
3.5 Terminations

All power input, escape pulses, and read pulses are delivered to the Model 424 Tape Reader through a Continental #250-34-16PDSP, 34 pin plug. Connections to each terminal are shown on the wiring diagram of Figure 9. The mating receptacle for the plug is also supplied with the reader.

3.6 Spark Suppression

Spark suppression, if provided to protect control contacts, must be designed so that the coil current transient becomes zero within two milliseconds after opening the control contacts. See Figure 10. Optimum spark suppression is effected with the following RC networks:

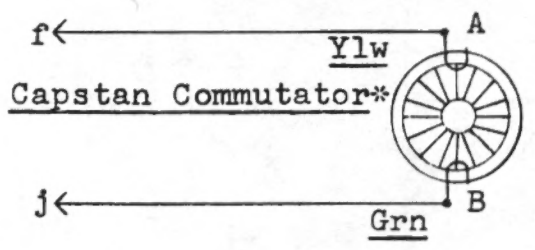
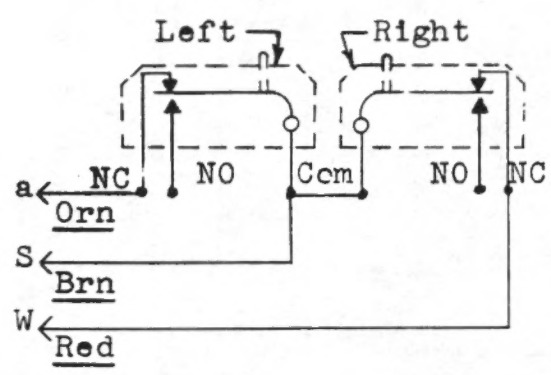
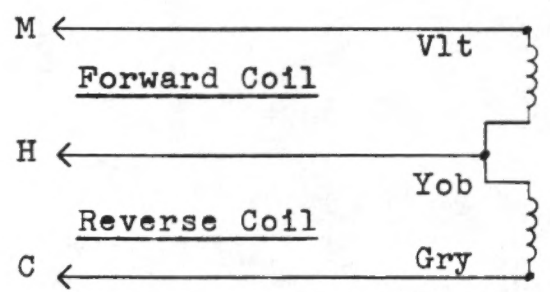
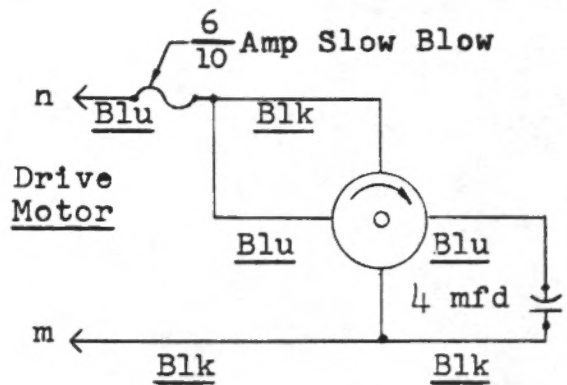
<u>Coil Resistance</u>	<u>Drive Pulse</u>	<u>Rs</u>	<u>Cs</u>	<u>Peak Inverse Voltage</u>	<u>Coil Inductance</u>
220 ohms	48 volts	10 ohms	.25 mfd	130 volts	200 mh
70 ohms	24 volts	10 ohms	.25 mfd	90 volts	80 mh



***NOTE:** Timing shown is for maximum reading rate of 60 cps

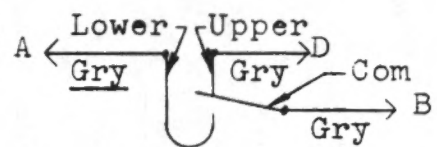
- A. Drive pulse duration 4.5 +0.5 ms with rise time less than 0.5 ms.
- B. Dip in coil current curve marks the magnet armature striking the pole piece.
- C. Switching zone 7-14ms. N/O = Normally open, N/C = Normally closed. Switching diagram shows contacts reading an alternate hole, no-hole tape.

Figure 8. Timing Diagram



Tape Channel

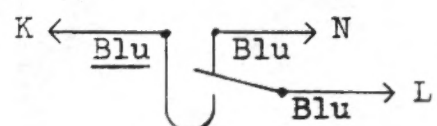
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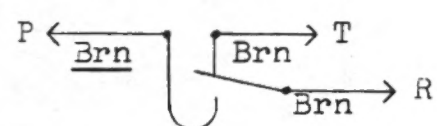
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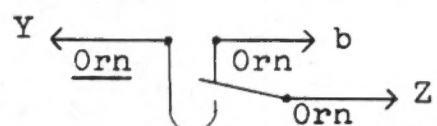
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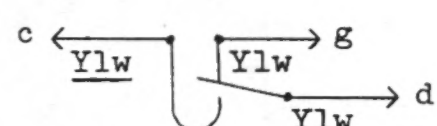
2



3



4



5



Contact position with no-hole tape

Wire Color Coding:

- Gry = Solid Gray
- Gry = Gray tracer on white
- Yob = Yellow on black

Figure 9. Wiring Diagram For 34 Pin Connector Model 424 Tape Reader

TALLY
SEATTLE

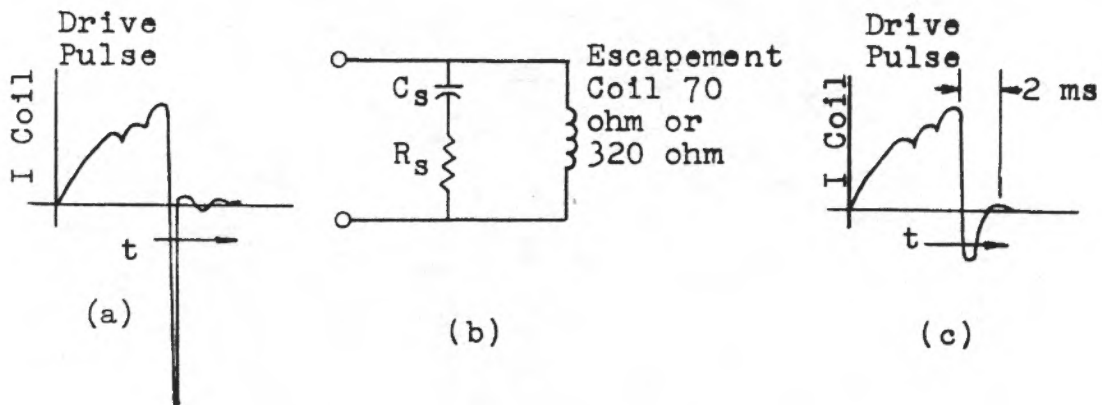


Figure 10. Spark Suppression Waveforms:

- (a) Coil current without suppression
- (b) Suppression Circuit
- (c) Coil current with suppression

3.7 Contact Ratings

In normal usage, the same pulse that advances the tape is used to interrogate the contacts. As shown on the timing diagram, Figure 8, contact make or break always occurs after the expiration of the drive-interrogate pulse. Consequently, the contacts are rated for a pulse-carrying capacity of 2 amperes, 48 volts DC.

In applications requiring the contacts to make or break a live circuit, a current of more than 5 milliamps will begin to deteriorate contact life. However, contacts are replaceable.

4.0 INSTRUCTIONS FOR USE

4.1 Paper Tape Standards and Channel Identification

The Model 424 Reader is designed to read any perforated tape that conforms to industry standards. For standard dimensions and channel designations, refer to Figure 11.

4.2 Threading Tape

To thread a tape through the read head, raise the lift lever handle (24, Figure 13). This raises the read head so the capstan is clear. Lay the tape across the capstan so that the pins project through the sprocket holes. Be sure the tape is positioned so that the pins do not project through the holes of a data channel. Also be certain that the tape is threaded with channel 5 nearest the operator. While holding the tape in position on the capstan, push the lift lever down until the lever locks in a slightly over center position. The tape is now properly threaded, and the reader is ready for use.

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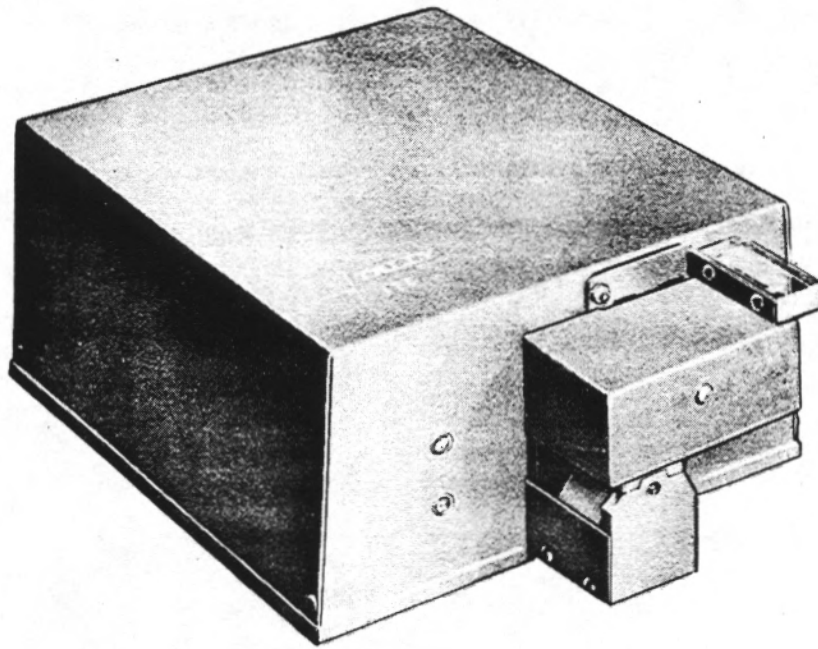


Figure 1. Model 424C Console Reader

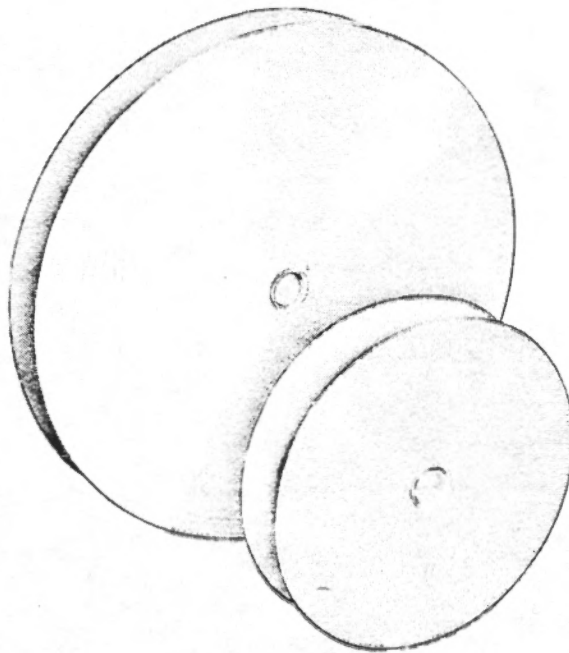


Figure 2. 6" and 10" Tape Reels

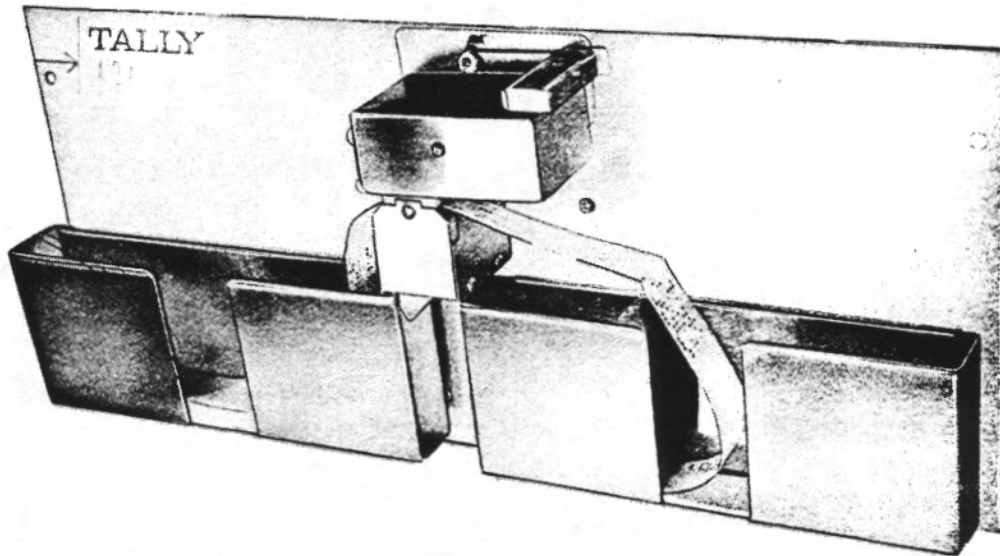


Figure 3. Model 424PF Reader With Fanfold Tape Handling.

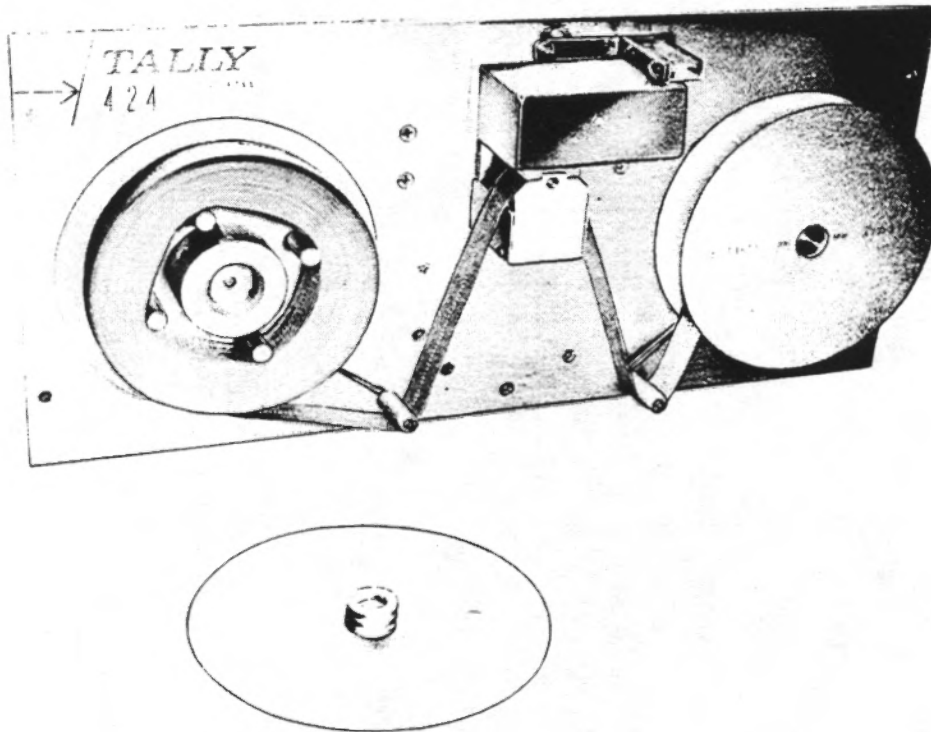


Figure 4. Model 424 PR Reader With 6" Tape Reels

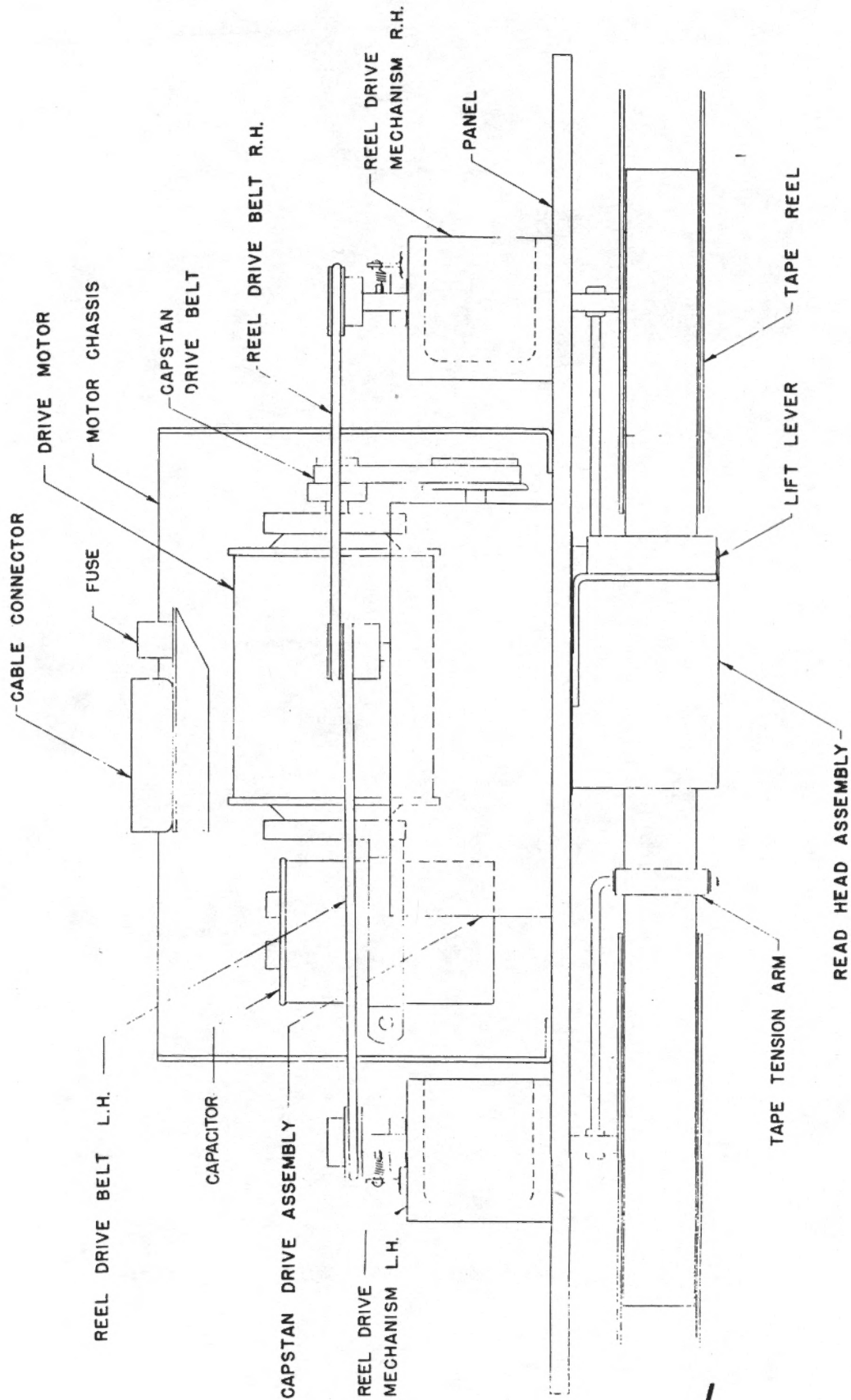


Figure 5. Model 424PR Reader With 6" Reels, Plan View