

HIGH SPEED TAPE PUNCH UNIT

(DRPE TYPE)

DESCRIPTION AND PRINCIPLES OF OPERATION

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1. GENERAL

1.01 This section is reissued to make it a standard publication and to incorporate engineering changes, new 2400 wpm models, a photoelectric reader, and a universal punch block. Since this is a general revision, marginal arrows are omitted.

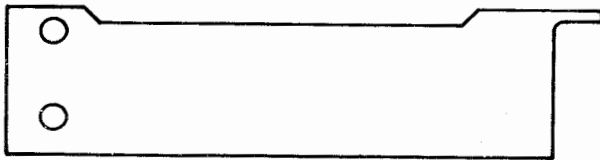
2. DESCRIPTION (Figures 1, 2 and 3)

2.01 The high speed tape punch unit (DRPE Type) is an electro-mechanical apparatus that perforates coded information in paper tape. The unit produces the code holes in paper tape in response to binary-parallel signals received from an electronic control unit. Early models operate at any speed up to 2000 words per minute (200 characters per second). Later models are available for operation up to 2400 words per minute (240 characters per second). These two types of units may be differentiated by the configuration of the reeds as shown in Figure 1. All units are capable of operating, without change or readjustment, at any speed up to their rated maximum speed.

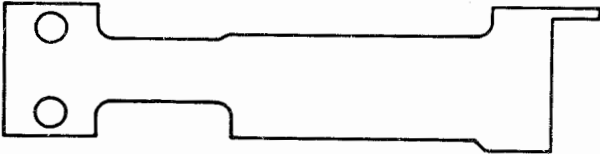
Note: Early 2400 wpm units may be equipped with solid reeds marked with an "X" on the fixed end. Inspect the reeds, and if they have an "X," do not use the punch at speeds over 850 words per minute. If higher speeds are required, replace the solid reeds with the laminated type (not marked with an "X").

USES

2.02 This punch unit serves for use in receive-transmit sets, high speed tape-to-tape receiving terminals and other applications. It is also used in computer type of applications and wherever its high speed capability or its ability to act as a slave in speed to the incoming signal may be required or useful.



REED FOR 2000 WPM PUNCH UNIT



REED FOR 2400 WPM PUNCH UNIT  
(850 WPM ONLY IF WITH X ON END)

Figure 1 - Reed Identification of 2000 wpm and 2400 wpm Punch Units

ASSOCIATED EQUIPMENT

2.03 An electronic control unit provides the circuitry that converts low level signals to controlled, shaped, power signals capable of operating the punch magnets and reed armatures at the required high speeds. Connecting cables should be provided in the base or cabinet mounting facility. The chad chute, output tape guide and tape handling vary from application to application and, therefore, should also be provided as part of the mounting facility.

SIGNAL INPUT (Figures 4, 5 and 6)

2.04 Signal code input to the punch is binary and parallel. Any code pulse combination and the control and tape feed pulse are simultaneous. These consist of shaped current pulses and a steady holding current. This input is provided by the electronic equipment mentioned in 2.03 above. Output from the unit consists of perforated paper tape. The strain energy that has been stored by electro-magnets in the steel tuned reed armatures, when released by a signal, is utilized to operate the punch pins and to trigger the escapement mechanism that feeds the tape.

TAPE (Figure 7)

2.05 With the appropriate punch block assembly and associated parts selected and installed, the unit will be capable of perforating either 11/16 inch, 7/8 inch or 1 inch tape. Tape guide channels can be provided to align any of these tapes.

CODE LEVELS

2.06 The punch will perforate, depending on the unit and punch block selected, either 5, 6, 7 or 8-level tapes according to the following arrangement:

5 Levels	6 Levels	7 Levels	8 Levels
	0 1	0 1	0 1
0 1	0 2	0 2	0 2
0 2	0 3	0 3	0 3
0 F	*0 0 F	0 F	0 F
0 3	0 4	0 4	0 4
0 4	0 5	0 5	0 5
0 5	0 6	0 6	0 6
		0 7	0 7
			0 8

- 0 = Tape Hole
- F = Feed
- \*0 = Advance Feed Hole (If so equipped)

SPEED AND TIMING (Figure 4)

2.07 This punch will operate at any speed up to 200 or 240 characters per second, depending on the model, entirely in response to its input signals; there are no timing restrictions on when the signals may be fed to the unit, except that they may not be at a higher rate than its maximum rated speed.

OPERATING POWER AND TEMPERATURE (Figure 3)

2.08 The unit has two shaded pole motors (Figure 3). The input to these motors is 115 v ac  $\pm 10\%$ , 60 cycle. Input to the motors is 150 (75 each) watts at nominal voltage and 70° F ambient temperature. Power input to the electronic control unit drive circuit may be found in its associated drawings and literature. The unit may be operated in an environment ranging from 0 to 90% relative humidity and at an ambient temperature of +40° to +110° F. (See Figures 5 and 6 for schematic wiring.)

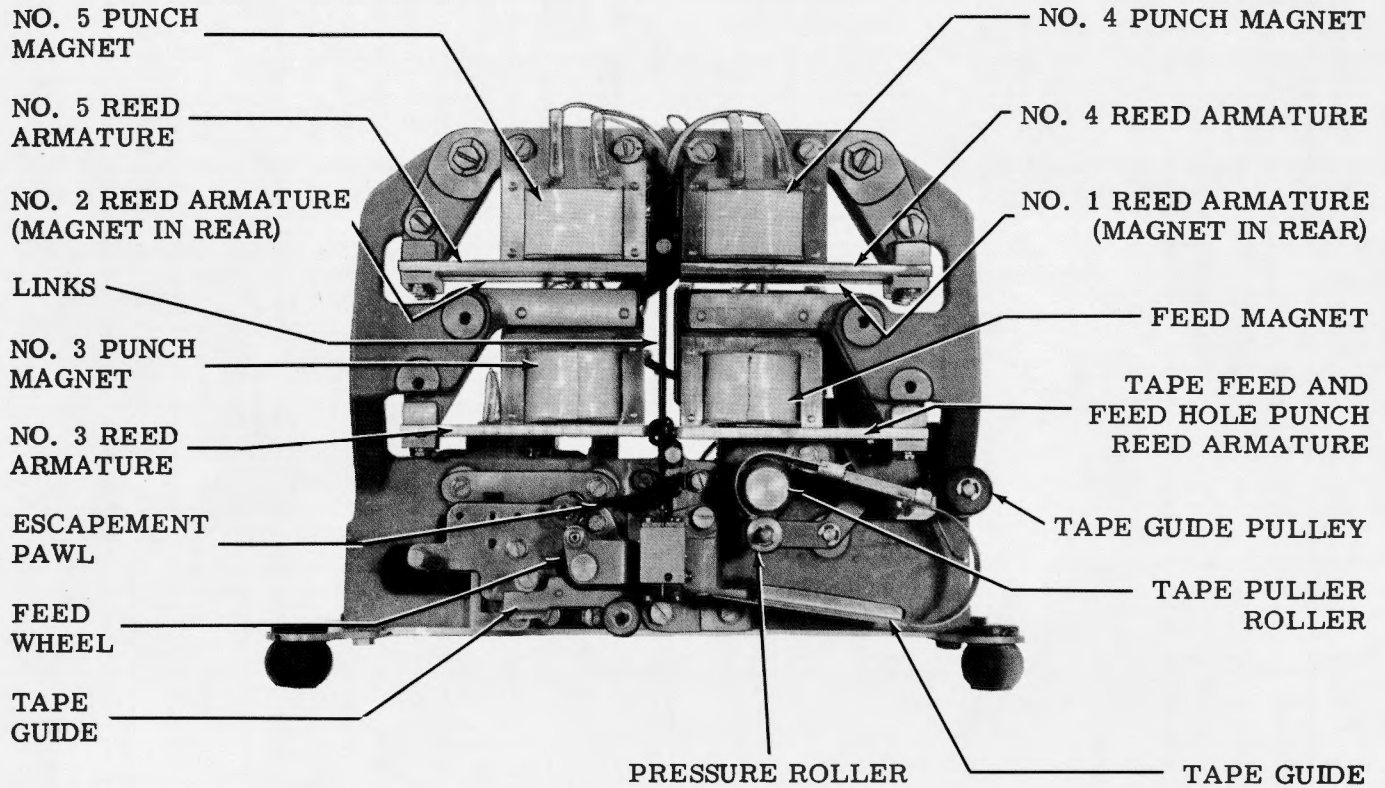


Figure 2 - Five-Level High Speed Tape Punch (Early Design), Front View

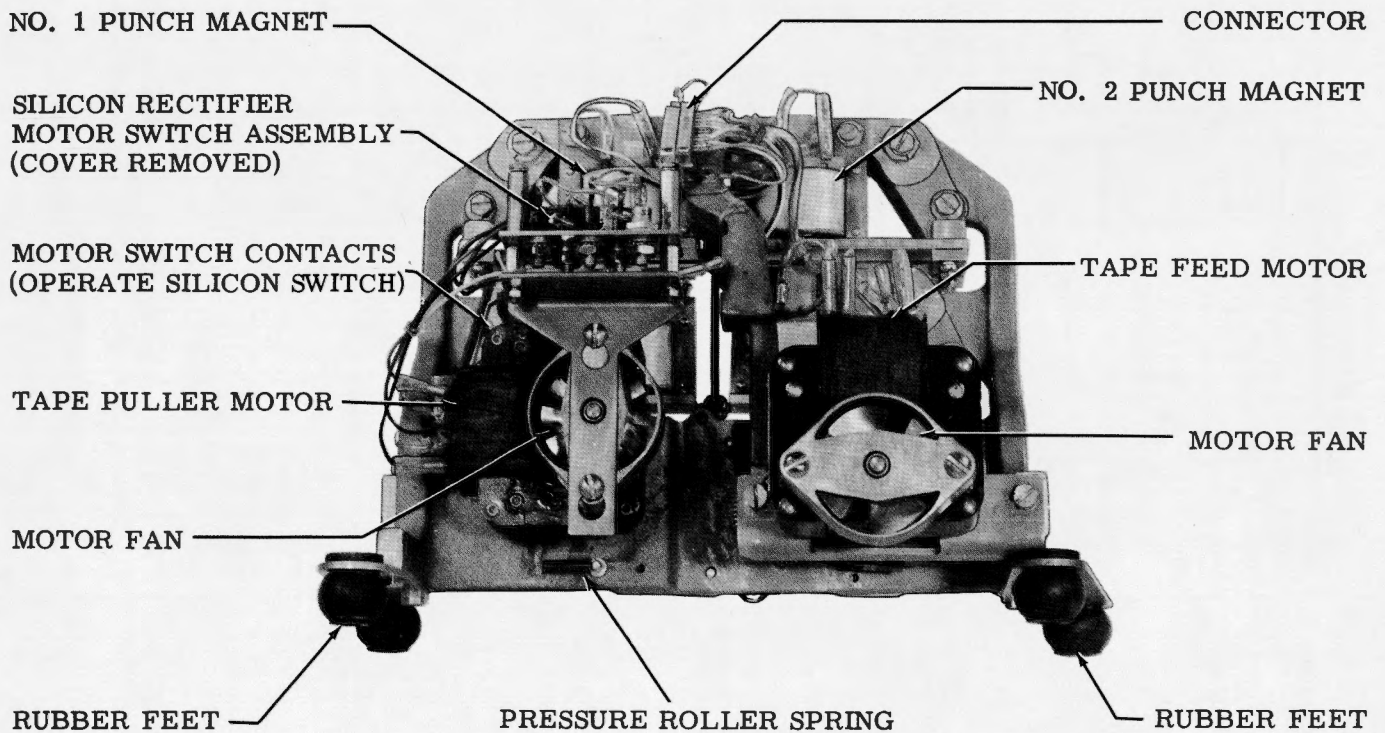
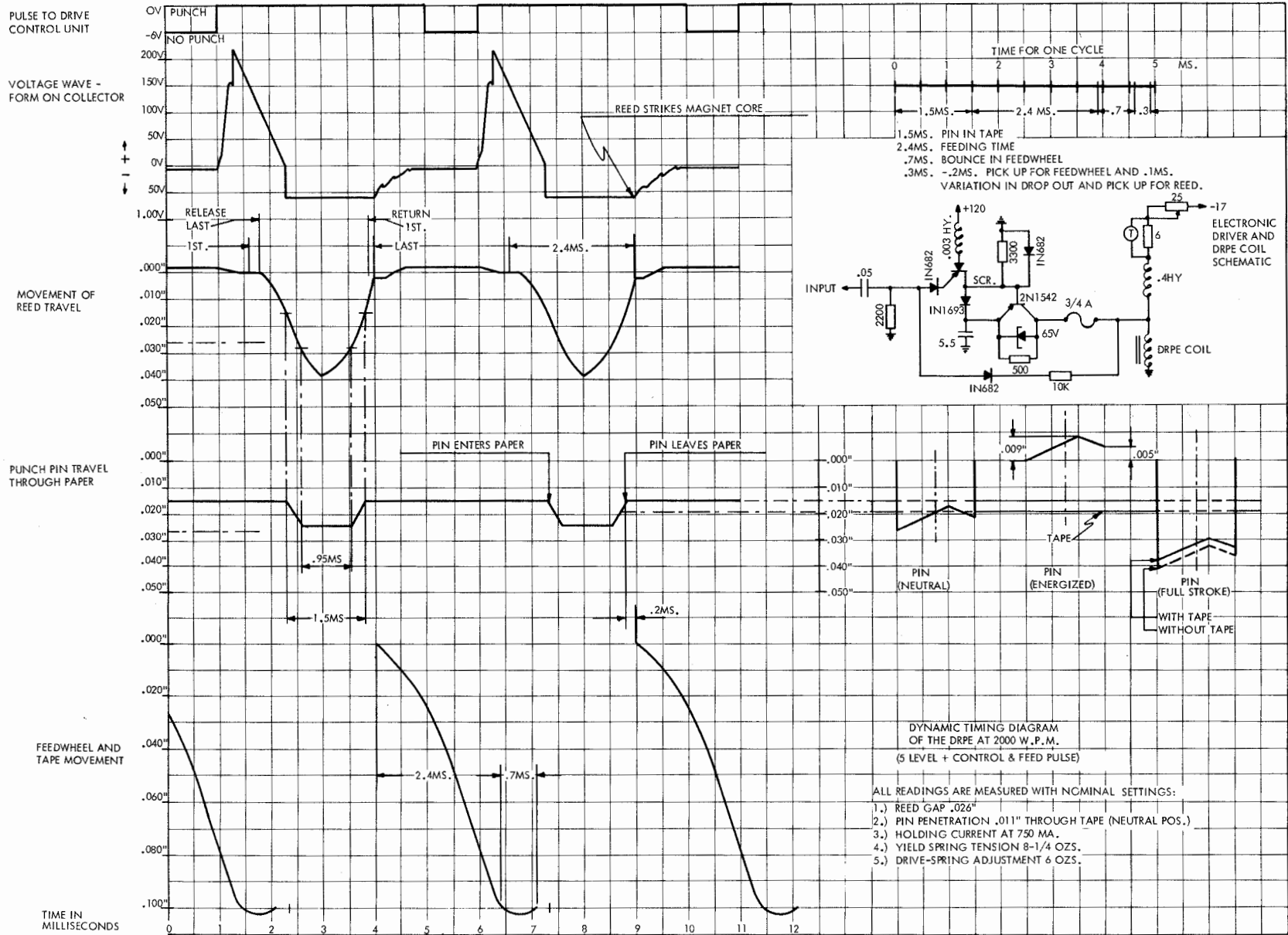


Figure 3 - Five-Level High Speed Tape Punch (Early Design), Rear View

Figure 4 - Five-Level Punch Unit (Early Design), Typical Dynamic Timing Diagram



**WEIGHTS AND DIMENSIONS**

2.09 The 5-level unit weighs 14 pounds and the 8-level unit weighs 17 pounds. Approximate overall dimensions, not including variable features, mounting facilities or covers, are 7-3/8 inches high by 9-3/8 inches wide by 9-1/4 inches deep.

**VARIABLE FEATURES**

A. Photoelectric Reader (Figures 12 and 13)

2.10 Late design models (2400 wpm) of the High Speed Tape Punch may be equipped with a photoelectric sensing assembly which

includes a light source, a collimating lens and a prism assembly to route the light to the tape (of any level, 5 through 8). The resultant parallel output current levels correspond to the hole or no hole condition of the tape and follow one character after the perforating position. This sensing assembly is intended for use in error detection systems or wherever it is necessary or desirable to regenerate a signal from the tape one character after perforation.

B. Universal Punch Block (Figure 14)

2.11 Late design models (2400 wpm) of the High Speed Tape Punch (either with or without the photoelectric reader) may be equipped

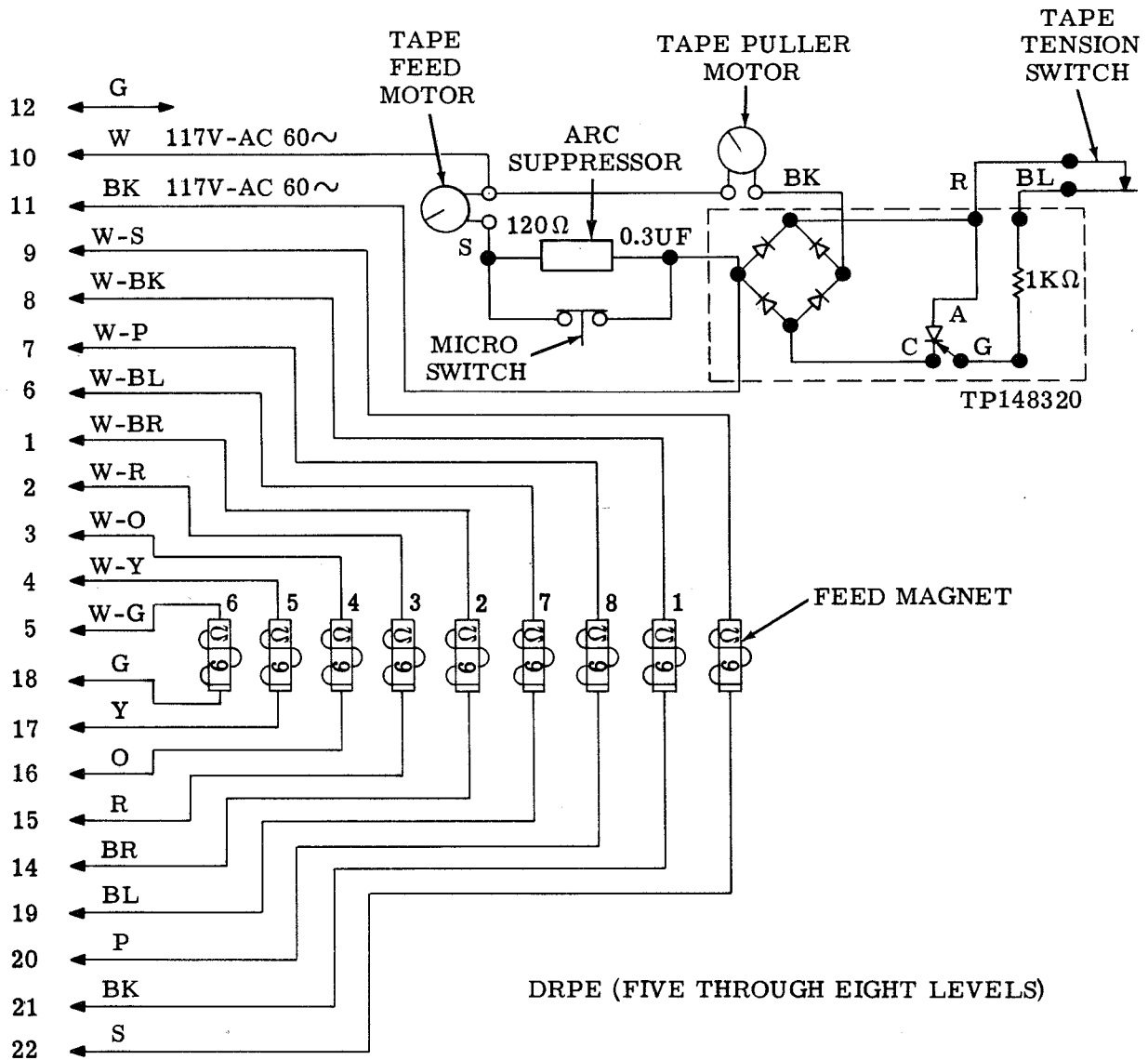


Figure 5 - High Speed Tape Punch, Typical Schematic Wiring (Early Design)

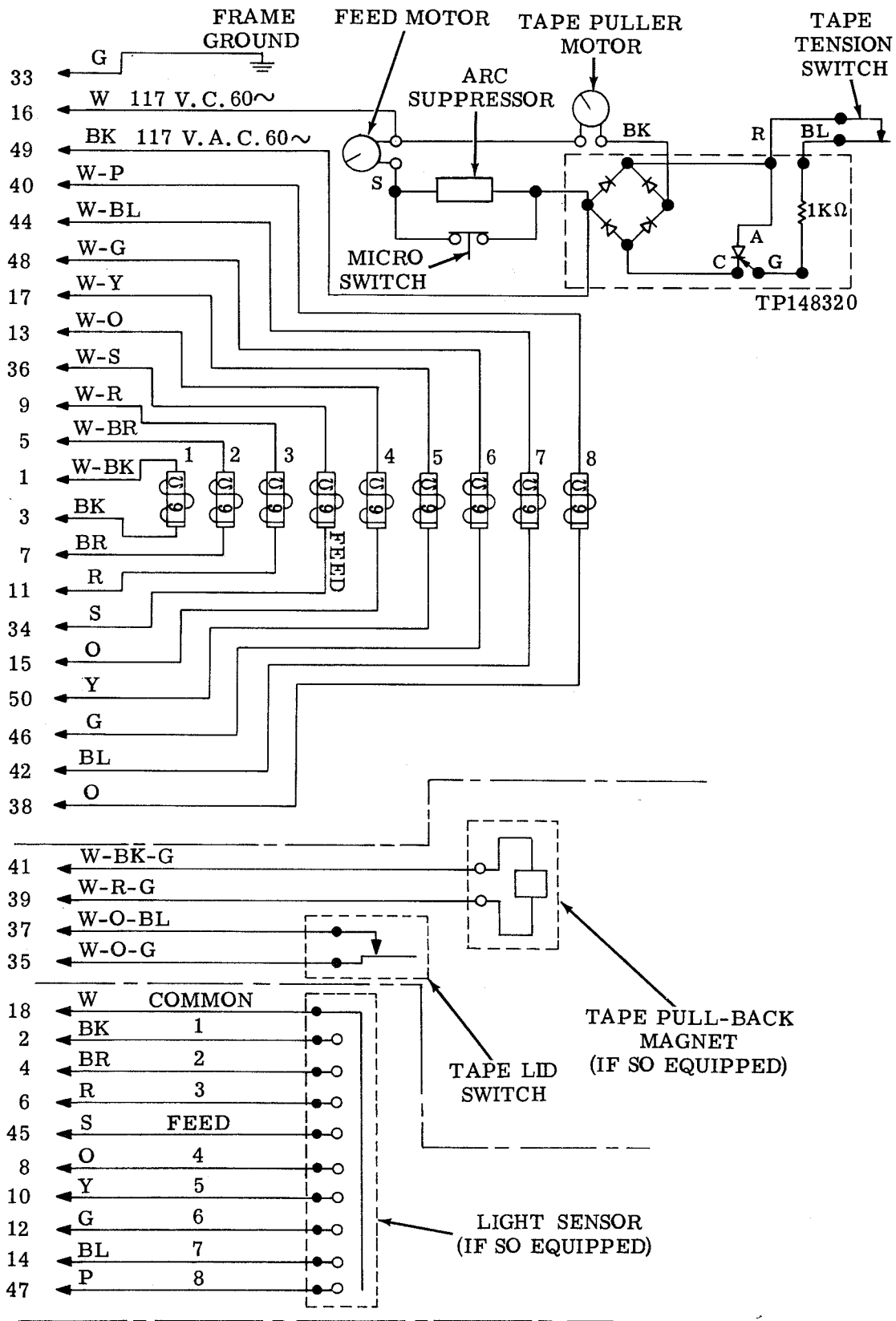


Figure 6 - High Speed Tape Punch, Typical Schematic Wiring (Late Design, Five through Eight Levels)

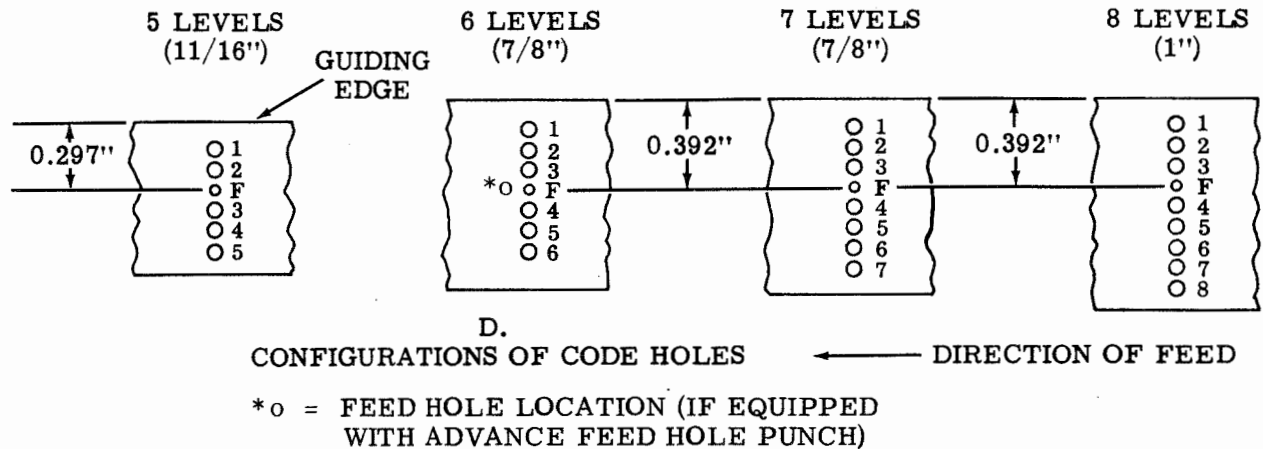


Figure 7 - Binary Permutation Code

with the adjustable universal punch block assembly which includes an adjustable tape guide. An operating lever on the universal punch block and the adjustable tape guide may be positioned to accommodate any of the available four different levels and three widths of tape.

### 3. PRINCIPLES OF OPERATION

#### RECEIVING SIGNALS (Figures 4, 5 and 6)

3.01 The binary code pulse combination and simultaneous binary control and tape feed pulse, which are required input from the electronic control unit to operate the punch unit, consist of the following: a steady holding current through all magnet coils during the standby (ready) period and through the coils of those code punch magnets that are to remain in a space (no-punch) state during the interval that a character code signal is being received. The tape feed hole for each character and any character marking code hole is punched in the tape through the release of a tuned reed armature during its no current interval of this character code signal. The no current interval, with its transition from holding current and back to the current state, is timed and spaced to match one-half of the natural resonant frequency cycle of a tuned reed combination that includes reed, linkage, punch and, in the case of the feed punch, the escapement and tape feed mechanism. Except for this wave shape-timing requirement, the high speed tape punch will accept the parallel wire binary signals at any speed from zero to its maximum rated number of words per minute without any changes or readjustments of the unit.

#### MAGNET AND REED ASSEMBLY (Figure 8)

3.02 Mark (Punch) Code Pulse: The tuned reed armature, through its rigid vertical link to the punch pin, punches the tape when it is released from its magnet by a no current interval (mark code signal, or any signal in the case of a feed punch). A rapid reduction to the no current state is obtained by momentary application of a reverse voltage of approximately +250 volts by the external control unit to the punch magnet coil, thereby overcoming the holding current through the inductances of the control unit and the punch magnet coils. Near the end of this cycle, a negative pulse (approximately -50 volts) is applied, through a variable resistance in the control unit, to the punch magnet coil in time to quickly re-establish a holding current (approximately 750 ma at -17 v dc) that catches the tuned reed armature on its rebound and holds it against its magnet until the next punch pulse is received. Later model units are equipped with reed silencing bumpers.

3.03 Space (No Punch) Code Interval: Any tuned reed armature, except for one released by a control pulse and associated with the feed punch mechanism, is held against its magnet during the character space code interval by the same holding current that passes through the magnet coil in the standby (ready) condition. The feed punch armature is released upon receipt of any code signals by a control pulse to punch and feed tape as described for the mark code pulse in 3.02.



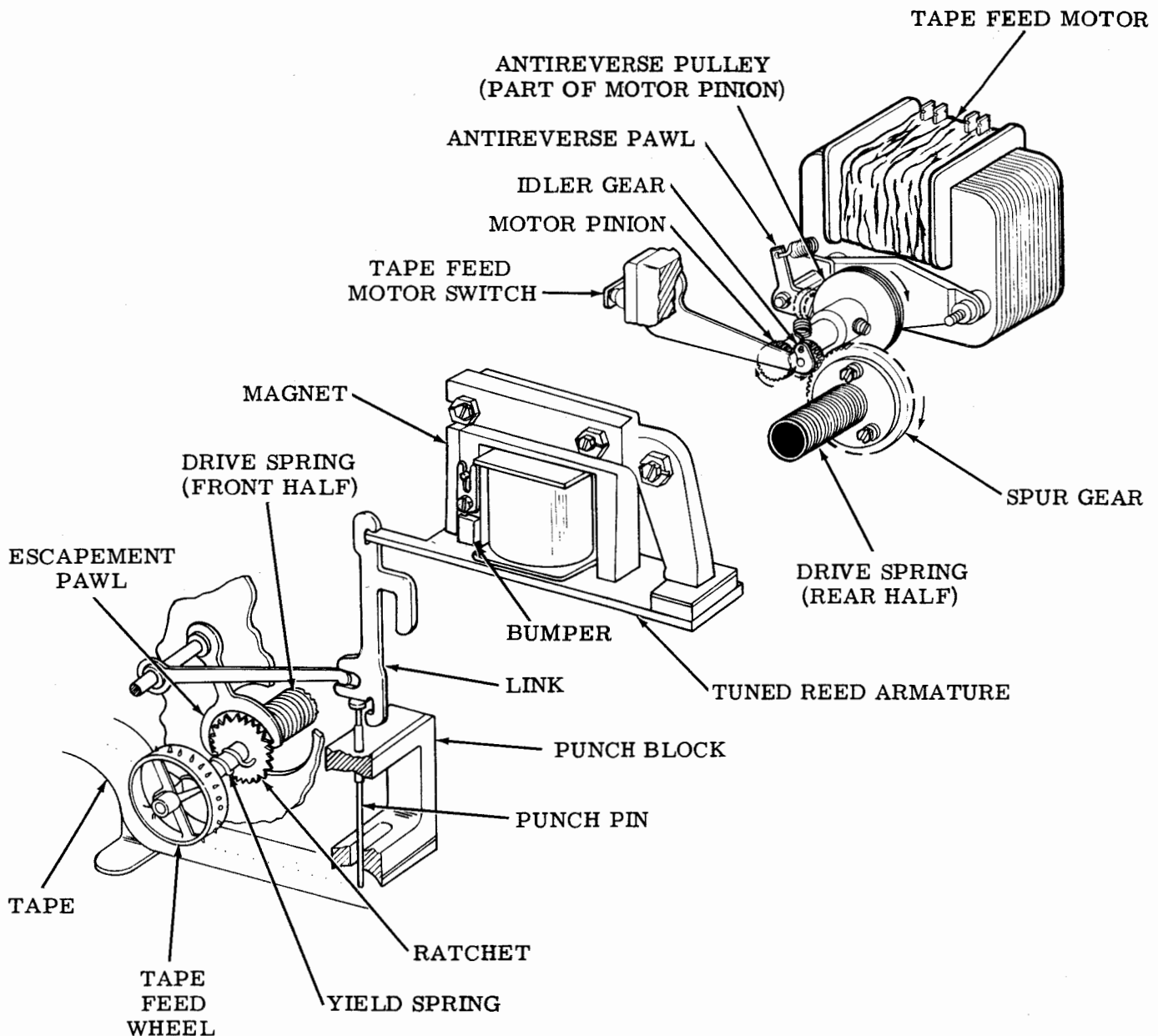


Figure 8 - Tape Punch and Feed Mechanisms

3.04 The high speed punch comprises one magnet-punch mechanism to punch and feed tape plus one for each code level to be punched. This provides six for a 5-level punch unit, or nine for an 8-level punch unit.

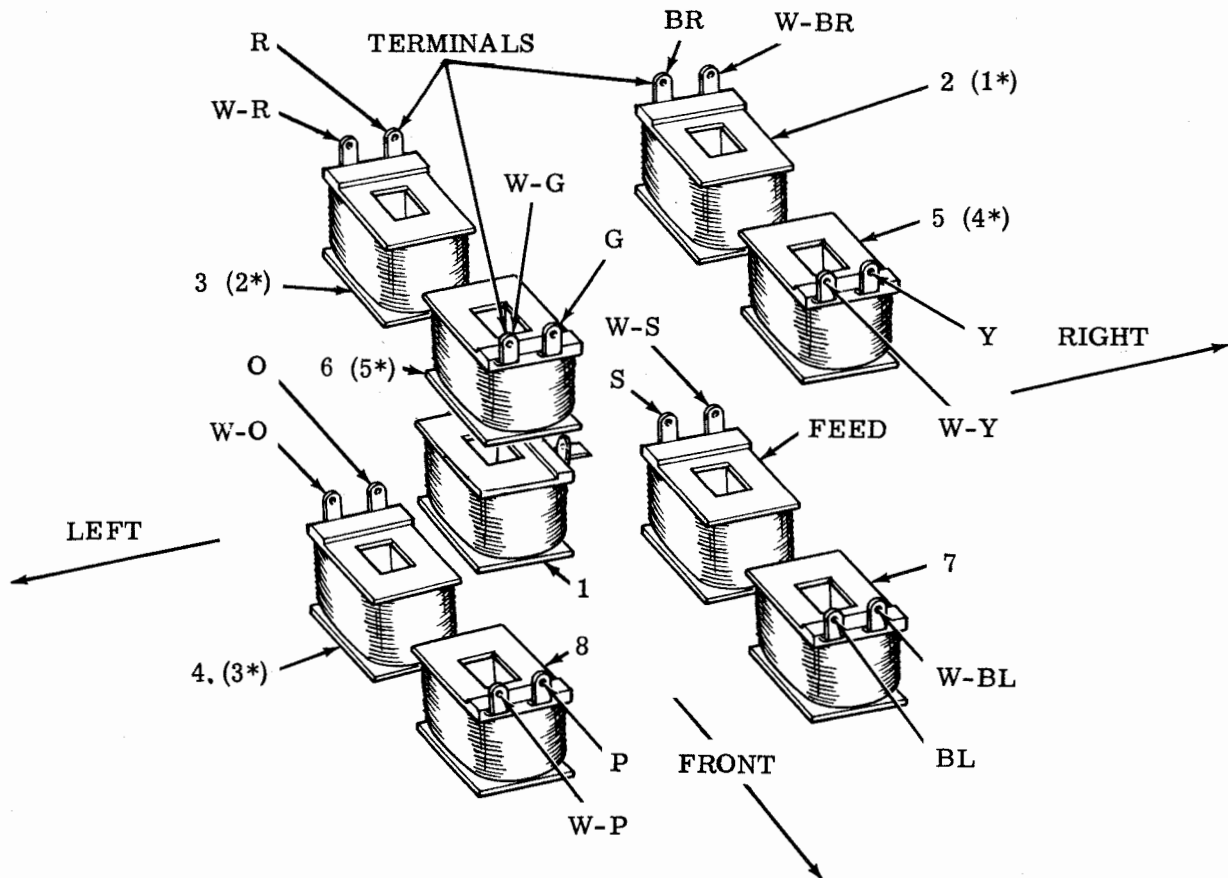
#### REED, LINK AND PUNCH MECHANISM (Figure 8)

3.05 Each tuned reed armature has an extended tip that is arranged to align with and fit into the upper notch of its associated

link. The reed is adjustable within its clamp and is mounted to an adjustable magnet bracket which also mounts an adjustable magnet. This combination is adjusted for proper alignment, air gap and height, so that the punch pin just penetrates the tape with the reed in its neutral (unoperated) position.

3.06 Each long and short link is notched at the top for the reed and at the bottom for the punch pin, thereby enabling the reed to punch the tape on its down stroke after release,





5-LEVEL MAGNETS	OTHER MAGNETS	MAGNET POSITION	TERMINAL LOCATION
FEED	FEED	LOWER RIGHT REAR	REAR
1*	1-LEVEL	REAR CENTER	RIGHT SIDE
2*	2-LEVEL	UPPER RIGHT REAR	REAR
3*	3-LEVEL	UPPER LEFT REAR	REAR
4*	4-LEVEL	LOWER LEFT REAR	REAR
5*	5-LEVEL	UPPER RIGHT FRONT	FRONT
	6-LEVEL	UPPER LEFT FRONT	FRONT
	7-LEVEL	LOWER RIGHT FRONT	FRONT
	8-LEVEL	LOWER LEFT FRONT	FRONT

Figure 9 - Punch Magnet and Terminal Positions

and to retract the punch pins on its return (rebound) stroke. The long links are guided by a fixed guide at the top plus an adjustable guide affecting both long and short links near the bottom. The link for the tape feed hole punch has an additional notch on its left side to operate the tape feed escapement pawl.

3.07 A head at the top of each punch pin fits into the notch of the link at its right, to punch the tape on a down stroke of the link and to retract the pin from the die plate on the up

stroke. An adjustable retaining plate, mounted at the top left side of the punch block assembly, holds the pins in position in case of punch block adjustment or removal.

**TAPE FEED AND FEED HOLE PUNCH**  
(Figures 8, 9 and 10)

3.08 Upon receipt of the binary control signal pulse at the tape feed hole punch magnet, the armature reed is released. These punch and feed mechanisms then operate in the following sequence:

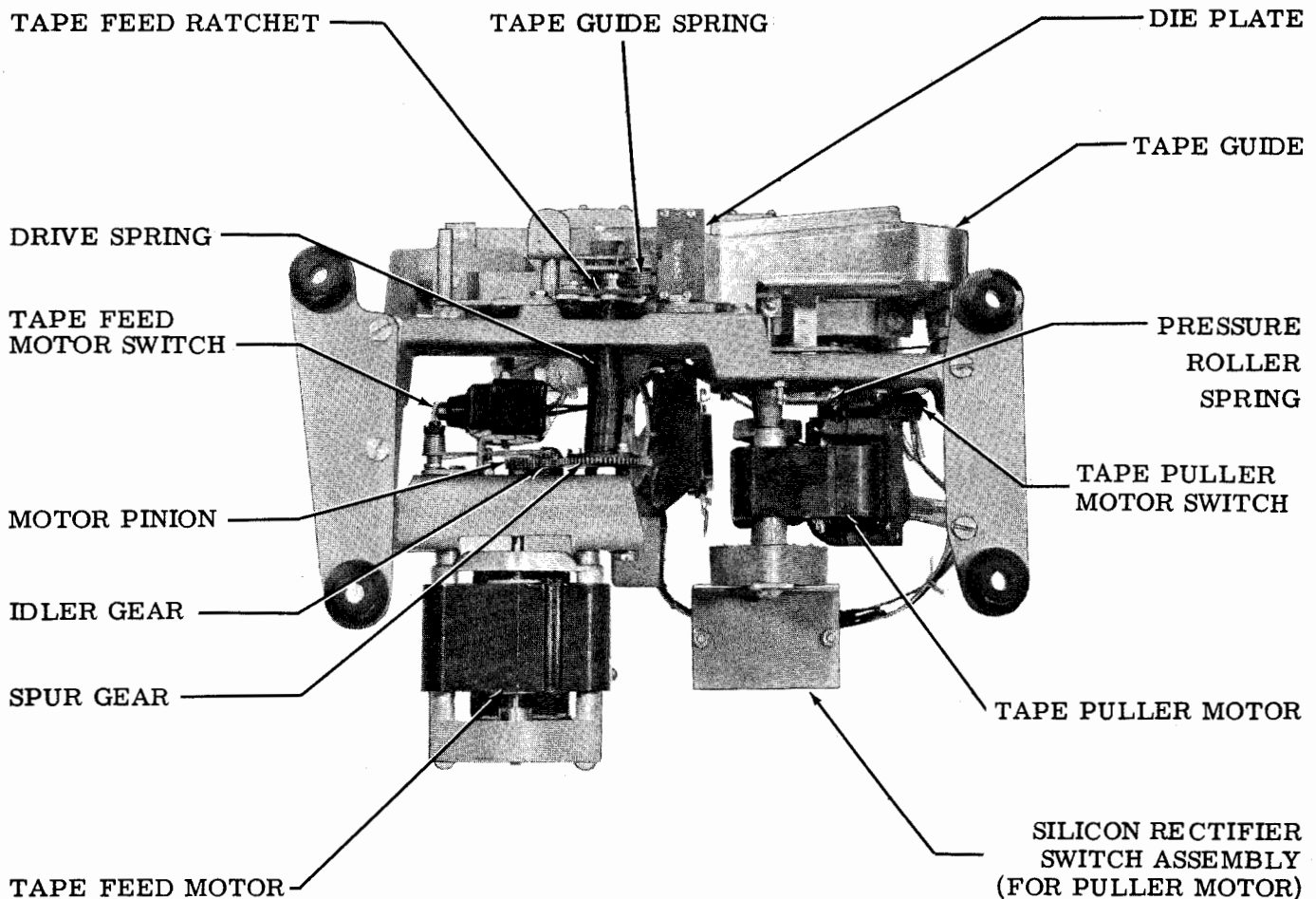


Figure 10 - High Speed Tape Punch, Bottom View

(a) The reed to punch pin link first drives the pin into the tape far enough to hold the tape and prevent feeding.

(b) As the link continues downward it pivots the escapement pawl, thereby allowing the ratchet to escape by one tooth under torque of the drive spring. An extended stop lug on the ratchet rotates with the ratchet. This releases the tape feed wheel to rotate, under torque of the yield spring between the ratchet and feed wheel, when the feed wheel is later released by the tape and the punch pins are holding the tape.

(1) The drive spring is wound to its correct tension by a shaded pole motor through its pinion gear, a spring loaded idler gear with motor, control switch and a spur gear. (See Figures 5 and 6 for typical schematic wiring.)

(2) An antireverse pawl engages the groove in a pulley at the rear of motor pinion to prevent unwinding of the drive spring through the motor when power is removed by operation of the idler gear arm switch. This also prevents the idler gear spring and drive spring mechanisms from hunting for their balance positions.

(c) With the feed wheel still held against its yield spring torque by the tape; the armature, link and punch pin start their upward, rebound, movement. The escapement pawl is again pivoted and the ratchet escapes another tooth at approximately the same time that the feed punch pin (with other pins, if any) is withdrawn from the tape. The tape is now moved by the feed wheel, under torque of its yield spring,

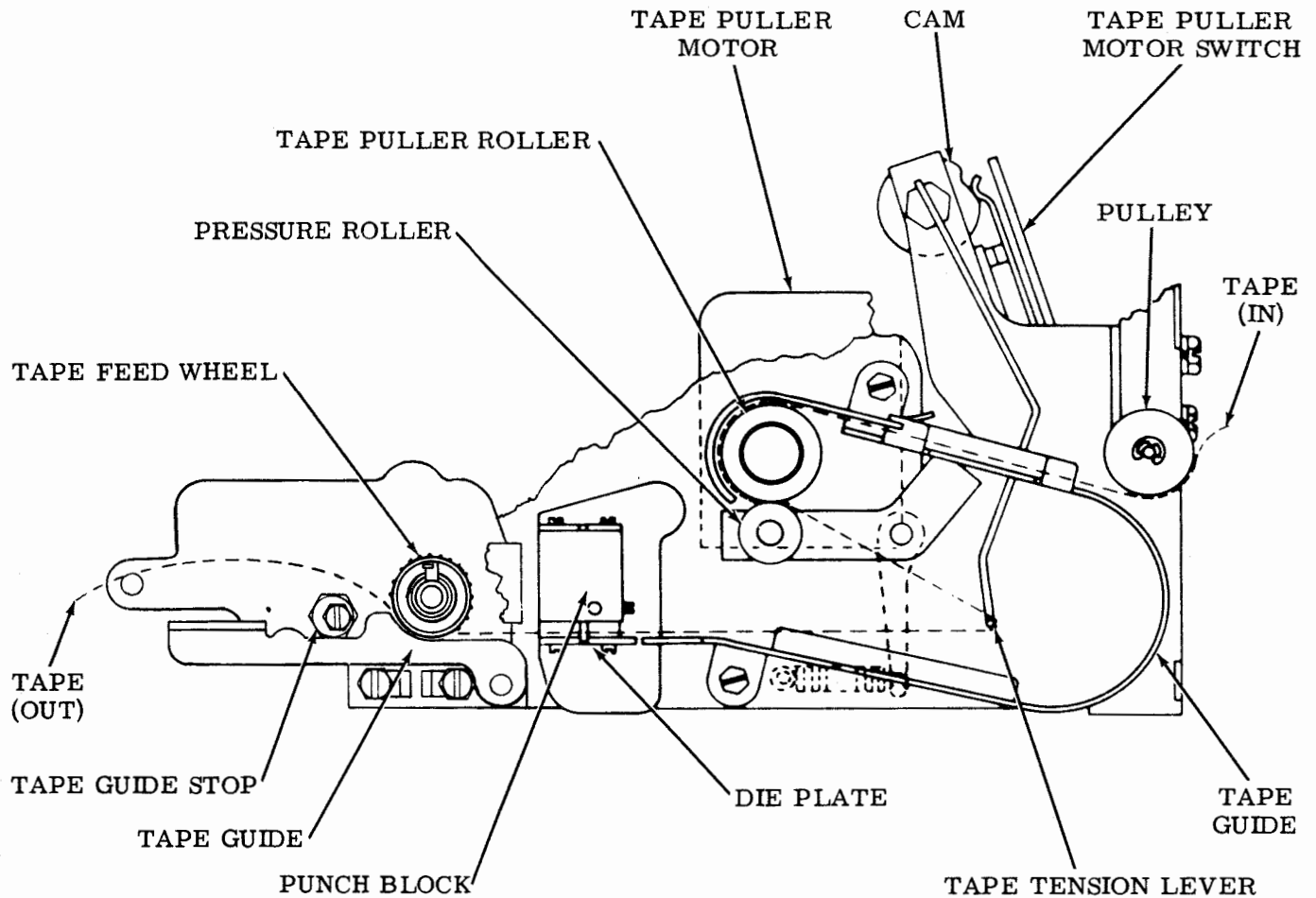


Figure 11 - Tape Puller and Guides

until the feed wheel is blocked by the extended stop on the ratchet (0.1 inch tape movement).

- (1) The tape feed wheel revolves (moves)  $\frac{1}{10}$  of an inch at its periphery, where the tape rides, for each punch and feed cycle.
- (2) To maintain the ten feed holes to the inch spacing, the distance between the point where the feed-wheel punch pin enters the tape must be an exact multiple of 0.1 inch, so that the feed hole is presented to the feed pin at the right point to avoid strain, distortion and relative motion between tape and feed wheel.
- (3) The multiple of 0.1 inch distance may be adjusted, if necessary, by the TEN TO THE INCH adjustment given in the adjustment section.

(d) The armature reed, with its link and punch pin, continues upward (rebounds) to its latched position against the magnet where it is held by the holding current until the start of the next character or tape feedout cycle.

#### TAPE PULLER AND GUIDES (Figure 11)

3.09 The unpunched tape will, normally, be stored on a tape reel that is mounted on associated apparatus. From there it will be pulled, by the drive roller and shaded pole motor, into the high speed punch from the upper right side of the unit as follows (see Figure 11):

- (a) The tape travels to the left under pulley at extreme right of unit.
- (b) Continues to the left, over top of guide and through shielded slot to under surface of tape guide.

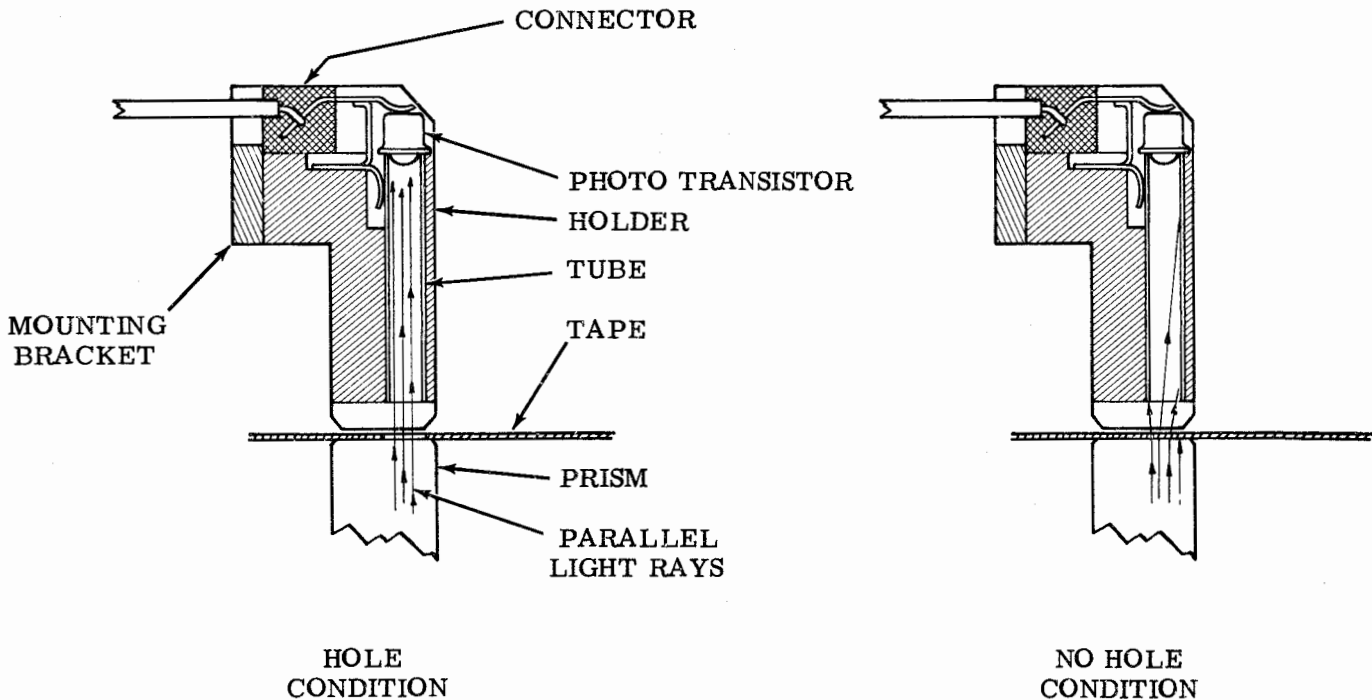


Figure 12 - Photo Transistor Assembly

(c) Tape is pulled over and around drive roller on motor shaft, returning to the right between this roller and the spring loaded pressure roller directly under the drive roller.

(d) Continues to the right, over and around tape tension lever.

(1) The tape tension lever maintains a predetermined, constant, low tension on the tape where it is presented to the punch block and tape feed wheel.

(2) This is accomplished by control of the tape puller motor through a torsion spring, double acting cam, and a switch at the opposite end of the tape tension lever. The motor power is thereby removed when the tape becomes too tight or too loose.

(e) From under the tension lever, the tape returns to the left and passes along the tape guide, then between the die plate and punch block. All punches must be in their retracted positions (reed armatures pulled up) before a new tape can be inserted at this point.

(f) The tape is then fed by the tape feed wheel and feed motor between the feed wheel and a manually releasable, spring-loaded tape guide directly under the feed wheel. From the left of the feed wheel, it arches over and clear of the adjustable guide stop post, then over the tape guide post at the extreme left.

(1) An additional tape cover guide may be added, after the feed wheel, as part of associated apparatus, to guide the tape to a tape winder.

(2) A chad chute, also part of associated apparatus, may be added under the punch die plate in order to dispose of the chad.

#### VARIABLE FEATURES

##### A. Photoelectric Reader (Figures 12 and 13)

###### General

3.10 Light supplied by a quartz iodine lamp is directed onto a prism. The prism re-directs the light onto the tape and illuminates the tape one character after the perforating

position. Any hole in the tape allows light to pass through the tape and cover glass to a photo transistor lens.

**Light Source**

3.11 The light source consists of a quartz iodine lamp, collimating lens and hardware to mount them. The lamp filament is positioned at the focal point of the lens, which then produces parallel light rays (collimated light).

**Prism Assembly**

3.12 A right angle prism is cemented to a holder, which in turn is mounted on the punch main frame casting. The prism is so positioned that the tape rides over its surface, thereby keeping it clear. Light from the source assembly strikes one side of the prism, proceeds to the 45 degree face and is bent 90° so that it illuminates the tape.

**Photo Transistor Assembly (Figures 12 and 13)**

3.13 **Hole Condition:** When a hole in the tape is in position over the prism assembly, light passes from the light source, through the prism, through the hole in the tape and through a tube to a photo transistor, which responds to the light and switches the photo transistor and amplifier to the "hole" (mark) condition.

3.14 **No Hole Condition:** When blank tape is in position over the prism assembly, the light is diffused and lowered in intensity suffi-

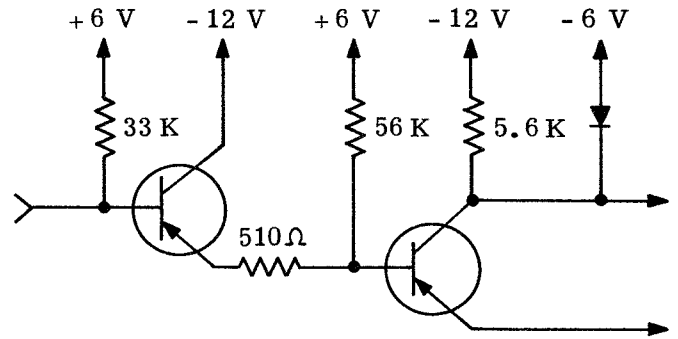


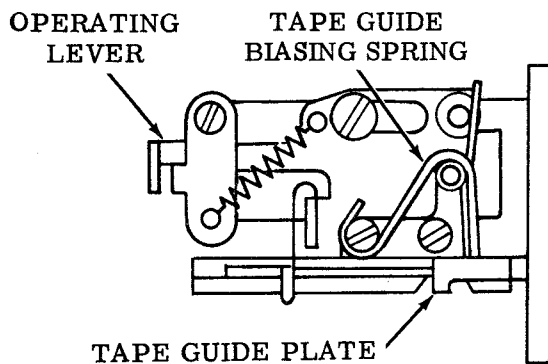
Figure 13 - Typical Photo Transistor Amplifier Circuit

ciently to prevent triggering of the photo transistor circuit. This results in a "no-hole (space) condition.

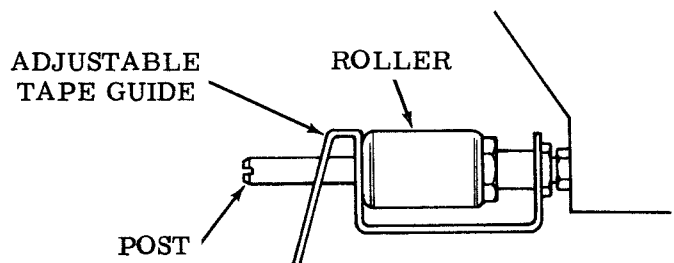
3.15 **Feed Hole:** The code hole sensor tubes have an inside diameter of 0.062 inch (0.010 inch smaller than the code hole). In the case of the feed hole, the sensor tube is 0.054 inch. The reason for this is so that the web in the tape between feed holes will completely shut off the light. In this way an output is available from the feed hole when each character is advanced. This output can be used for detecting tape motion, as an input to a counter, or for anything that requires an output with each character advance.

3.16 **Amplifier Circuit:** Refer to Figures 6 and 13 for circuits.

**B. Universal Punch Block (Figure 14)**



PUNCH BLOCK



TAPE ROLLER GUIDE

Figure 14 - Universal Punch Block and Guides

SECTION 592-803-100

3.17 The universal punch block is an 8-level punch with a tape guide plate, tape guide biasing spring and operating lever that are adjustable to accommodate either 8-lever 1-inch

tape, 6 or 7-level 7/8-inch tape or 5-level 11/16-inch tape. Units with this punch block are also equipped with an adjustable tape input roller guide.