

HIGH SPEED TAPE PUNCH

(BRPE TYPE)

DESCRIPTION AND PRINCIPLES OF OPERATION

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PERFORATING MECHANISM .....	7	2.02 The pulses are translated into mechanical motions that perforate corresponding code holes in the tape. Each parallel group of code pulses is accompanied by a feed pulse which causes tape to advance.
FEED MECHANISM .....	8	2.03 The tape punch operates at speeds up to 110 operations per second (1100 words per minute). Variations of the tape punch unit (1B, 2B, and special 2B), will permit perforation of 5-, 6-, 7-, or 8-level tape with normal or advanced feed holes.
UNIVERSAL TAPE PUNCH .....	8	2.04 In the high speed tape to tape systems, the tape punch is operated at speeds slightly faster than the transmitter to ensure synchronization. The punch mechanism runs continuously when turned on, but does not perforate or advance tape unless intelligence is received from the signal converter.
1. GENERAL		←
1.01 This section provides description and principles of operation for the high speed tape punch (BRPE). It is reissued to include the latest engineering information and corrections, and update the text. Marginal arrows indicate changes or additions.		←
1.02 The general description and principles of operation given in this section, apply to the 1B, 2B, and special 2B tape punches. The 1B tape punch unit is employed in tape receiver equipment for 5-level operation only; the 2B tape punch unit has adjustable components		←

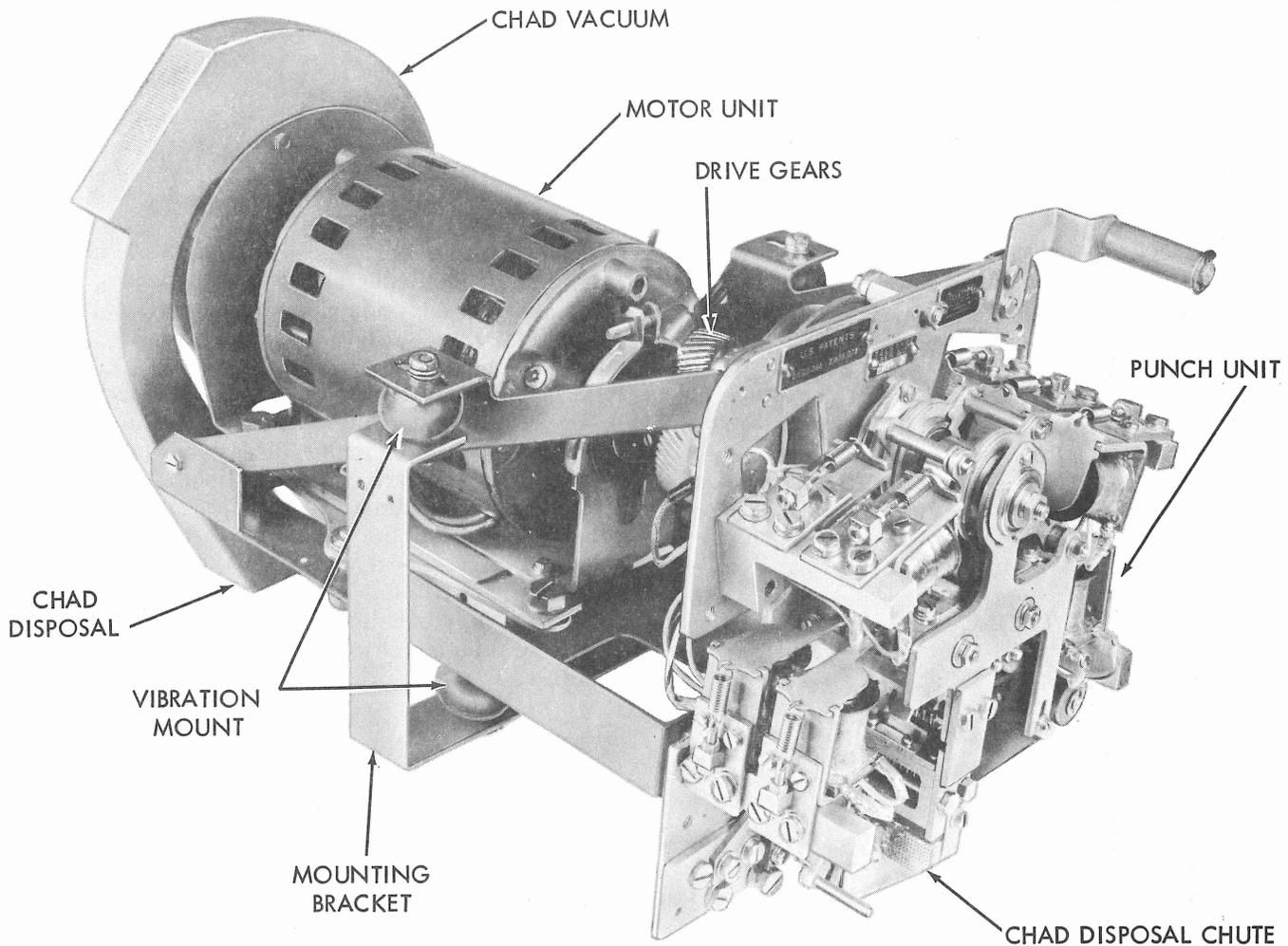


Figure 1 - Tape Punch Unit

**CAUTION:** THIS EQUIPMENT IS INTENDED TO BE OPERATED IN A ROOM ENVIRONMENT WITHIN THE TEMPERATURE RANGE OF 40°F TO 110°F. SERIOUS DAMAGE TO IT COULD RESULT IF THIS RANGE IS EXCEEDED. IN THIS CONNECTION, PARTICULAR CAUTION SHOULD BE EXERCISED IN USING ACOUSTICAL OR OTHER ENCLOSURES.

2.05 The tape punch consists of three basic units: a base, a punch unit, and a motor unit. The motor and punch unit are connected through a set of gears. The base is supported by resilient mounts to reduce vibration. The ac power supply for the motor unit terminates in a terminal board located near the motor. An electrical connector is provided for connecting the tape punch unit to a module within the tape receiving set.

2.06 Information handled by the tape punch is represented by combinations of binary intelligence levels. Each level is defined as one bit and may be either a mark or a space. Each bit is transmitted electrically as current or no-current on the signal line, or is punched mechanically as hole or no-hole in paper tape. The code is conveyed in combinations of electrical pulses or is placed in storage on paper tape.

2.07 Fig. 2A represents a typical 6-level code combination in electrical form. The feed pulse accompanies the coded character to advance the tape. The electrical combination is shown in tape form in Fig. 2B. A marking pulse (current) is represented by a hole and a spacing pulse (no-current) by the absence of a hole. The various tapes for 5-, 6-, 7-, and 8-level codes with normal and advanced feed holes, are shown in Fig. 2C.

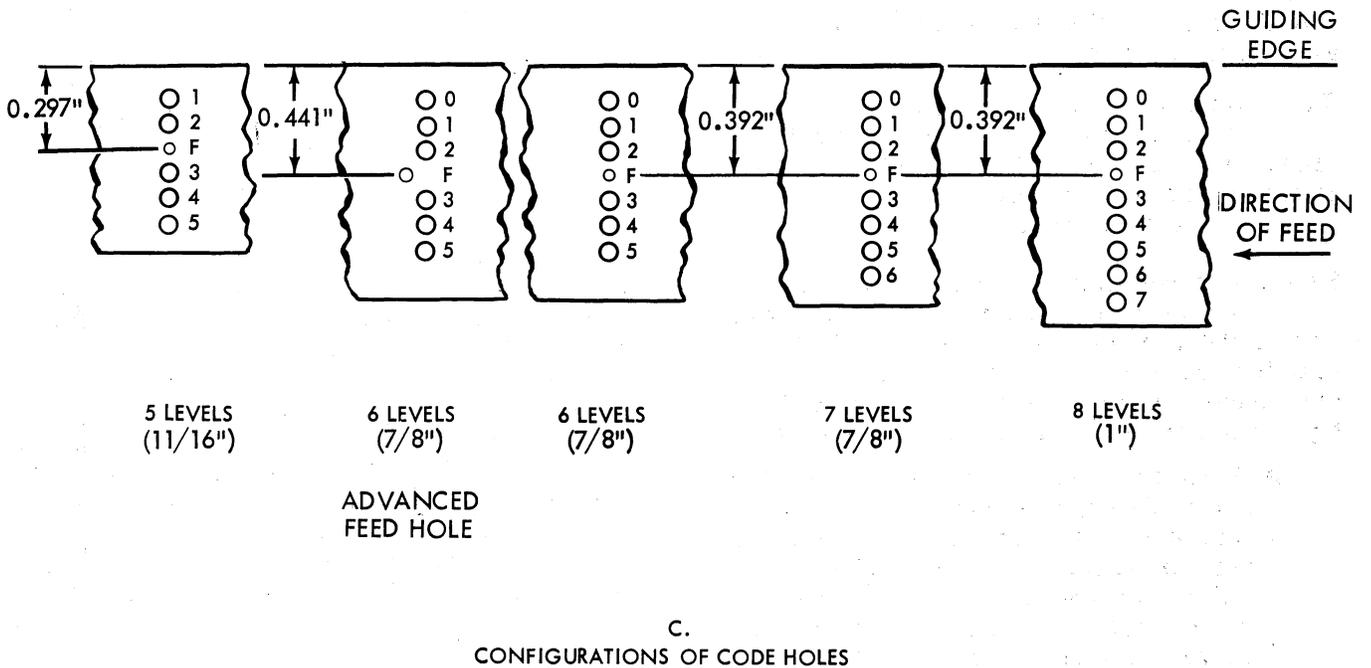
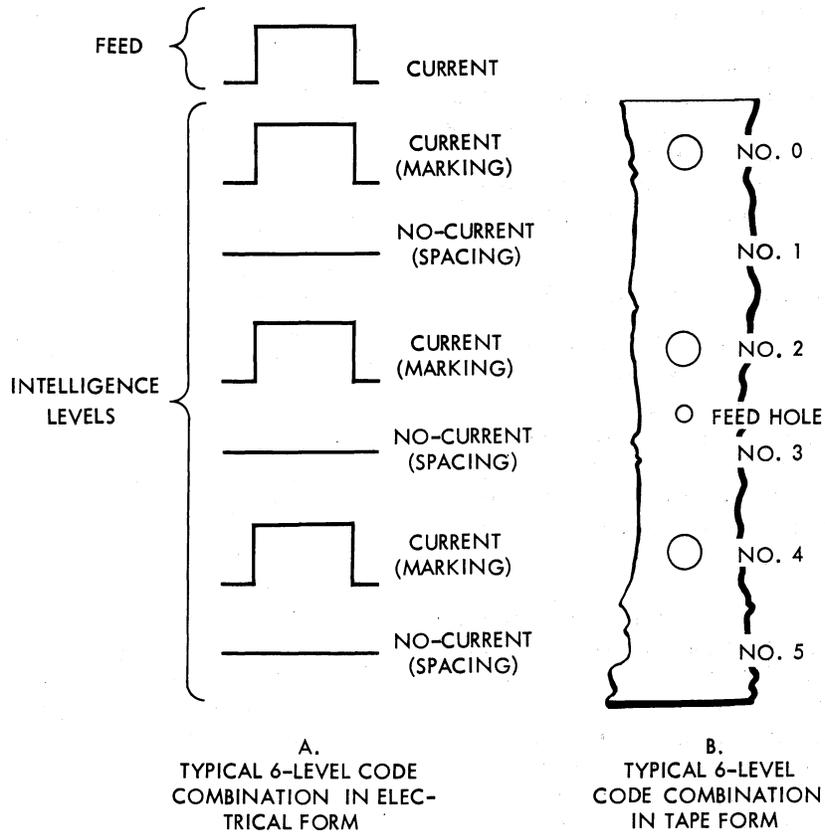


Figure 2 - Illustrations of Codes

### 3. PRINCIPLES OF OPERATION

3.01 The functional operation of the tape punch unit is illustrated in Fig. 8. It represents the reception of a 5-level code, with levels 1-3-5 marking. The mechanical to electrical operations and the mechanical and electrical timing characteristics are described in the following paragraphs. Figures 8 and 9.

#### MECHANICAL TO ELECTRICAL OPERATIONS

3.02 Operation of the PUNCH button on the control panel applies AC power to the motor. The motor delivers rotational motion which is transmitted through a pinion and gear set to the drive mechanism. The drive mechanism translates rotary motion to oscillating motion and distributes it to the perforating and feed mechanism.

3.03 There are two sets of motions involved, those of the perforating, and those of the feed mechanisms. In Fig. 9, vertical motions of key parts of these mechanisms are plotted against the rotation of the main shaft in degrees. Top dead center (TDC) of the perforating mechanism has been designated as 0 degrees. The drive mechanism is so designed that the feed mechanism reaches TDC 45 degrees after the perforating mechanism.

3.04 An operation of the tape punch is defined as the period measured in degrees of shaft rotation from TDC of perforating mechanism to TDC of feed mechanism, a period of 405 degrees.

3.05 A synchronizing pulse is generated by the magnetic pickup with each revolution of the flywheel. (See Fig. 3.) This pulse initiates the transfer action of the code from the signal converter storage register in the tape receiver set to the reperforator magnets.

- When intelligence is present in the storage register, a combination of code and feed pulses is applied to the code and feed magnets. The perforating mechanism punches code holes in the tape corresponding to marking pulses received. A feed hole is automatically punched with each code combination. Perforation occurs about midway through the operation as indicated in Fig. 9.
- When intelligence is not present in the storage register of the signal converter, the tape punch undergoes an operation without perforating or feeding tape.

3.06 The feed pulse energizes the feed magnet and causes the feed mechanism to advance the tape. This occurs late in the operation, after perforation has been completed. (See Figs. 8 and 9.)

3.07 Mechanical motion is generated by a 1/20 horsepower synchronous motor. A thermal cutout switch is provided to prevent damage resulting from overload. This switch may be reset by depressing a RESET button which projects through the motor mounting plate.

Note: Allow motor to cool for at least 5 minutes before depressing RESET button.

3.08 A housing is mounted around the rear fan wheel of the motor. This fan, in addition to its cooling function, creates a vacuum to draw chad from the punch block. Chad travels from the block, through a plastic tube, and into a container located under the rear of the motor.

#### MECHANICAL TIMING

3.09 For each marking code pulse received, a punch magnet armature should reach its fully attracted position during the code magnet selection interval; between 40 degrees before and 40 degrees after TDC position of the punch bail.

3.10 For each marking feed pulse, the feed magnet armature should reach its fully attracted position during the feed magnet selection interval; between 0 degree and 90 degrees after TDC position of punch bail.

3.11 For each spacing code pulse received, the feed magnet armature should reach its fully released position between 0 degree and 70 degrees after TDC position of the punch bail. The punch magnet armature should reach its fully released position between 300 degrees before and 20 degrees after TDC position of the punch bail.

#### ELECTRICAL TIMING

3.12 Punch and feed magnet armatures are fully attracted approximately 3 milliseconds after being energized, and fully released approximately 8 milliseconds after opening the circuit. These nominal values vary with mechanical adjustments, length and amplitude of the current pulse.

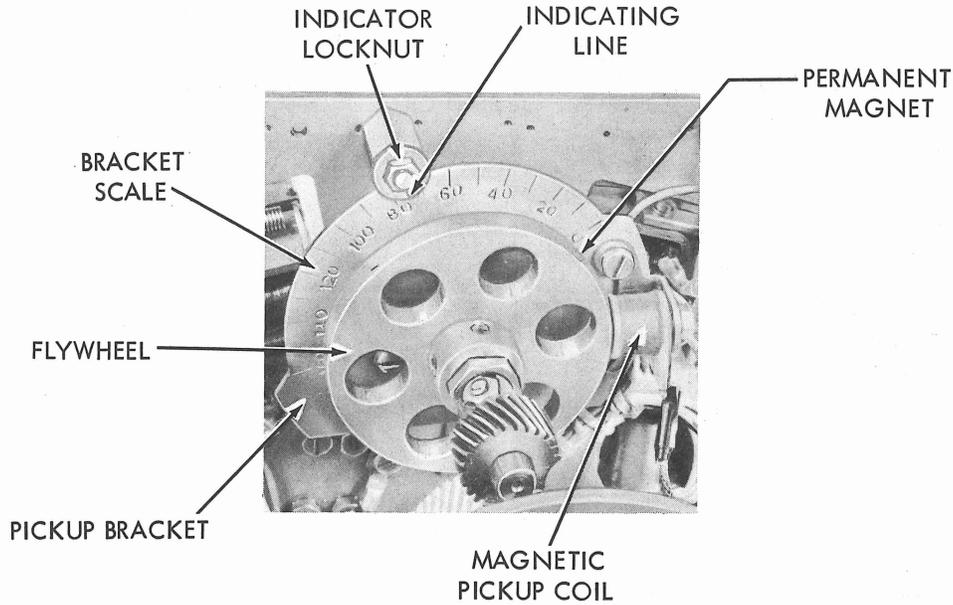


Figure 3 - Magnetic Pickup

3.13 Punch magnets pulsed from transistorized control units operate on 28 volts dc and require a 25 ohm resistor in series with each magnet to limit operating current. Punch and feed magnets are provided with a square wave pulse of 4-1/2 milliseconds.

pickup is connected to a circuit equivalent with a 0.01  $\mu$ F capacitor and a 1000 ohm resistor in parallel.

Note: Production units are adjusted to a standard optimum input signal of a 4-1/2 millisecond pulse length  $\pm$ 5 percent without readjustment of armature gap and/or spring tension. Field applications generating signals other than a 4-1/2 millisecond pulse may require refinement of the selector magnet armature adjustments and magnet armature spring tensions to provide an operating margin of the pulse length being used.

4. DETAILED DESCRIPTION OF MECHANISMS

SYNCHRONOUS PULSE

DRIVE MECHANISM

3.14 The magnetic pickup generates a timing pulse once during each cycle. The following operating values are obtained when the

4.01 The drive mechanism (Fig. 4) converts rotational motion into oscillating motion and applies it to the perforating and feed mechanisms. The conversion occurs through the integral cams on the main shaft. The forward cam, through a set of bearings and drive links, causes the transfer surface of the punch bail to oscillate. This motion is imparted directly to the perforating mechanism. The ver-

MAGNETIC PICKUP VALUES

CLEARANCE BETWEEN PICKUP COIL AND FLYWHEEL 0.010 INCH	OPS	PEAK TO PEAK VOLTAGE	PEAK TO PEAK TIME-MICROSECONDS
	63.33	30	450
110	40	250	

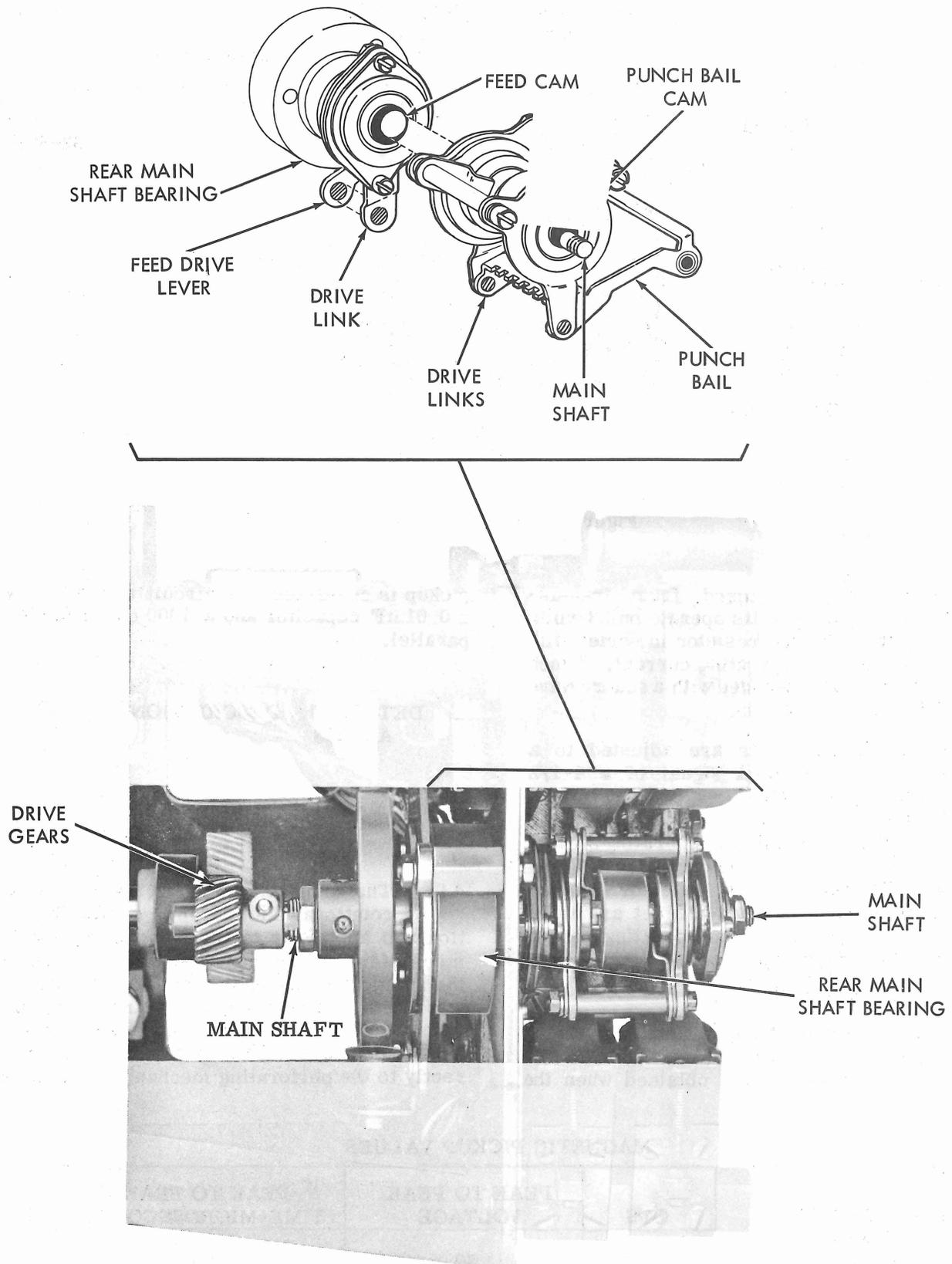


Figure 4 - Drive Mechanism

tical travel of the punch bail as a function of the main shaft rotation is represented by a heavy solid line in Fig. 9. A second cam on the main shaft causes the feed drive lever of the feed mechanism to oscillate as represented by the light solid line in Fig. 9. The throws or angular displacement of the two cams are so related that the feed drive link reaches TDC 45 degrees after the punch bail does. The drive mechanism cycles continuously and transfers motion to the feed and perforating mechanisms as long as the motor switch is on.

4.02 Since the tape punch cycles continuously, the feed and code pulses must be introduced at a specific time to be properly processed. A magnetic pickup is provided to synchronize delivery of code pulses with the mechanical timing of the reperforator. The pickup consists of a coil with an iron core. With each rotation of the main shaft a permanent magnet inserted in the flywheel periphery passes by the coil. The magnetic field of the insert cuts across the coil windings and in-

duces a voltage in the coil. This voltage is used to trigger the storage register circuit and initiates the transfer of intelligence.

#### PERFORATING MECHANISM

4.03 The perforating mechanism is shown in Fig. 5. For each level of the code there is a code magnet, armature, blocking pawl, toggle linkage, drag link, and punch pin. In the idling condition (motor running and no intelligence being received), the armatures are held away from the magnet pole faces by their springs. This is referred to as their released (or spacing) position, and they, in turn, hold associated blocking pawls in their spacing position. As the drive mechanism cycles, it causes the punch bail and toggle linkages to oscillate.

4.04 When the toggle linkages move down at the beginning of each idling condition, toggle extensions engage the blocking pawls and cause the linkages to buckle at 51 degrees of

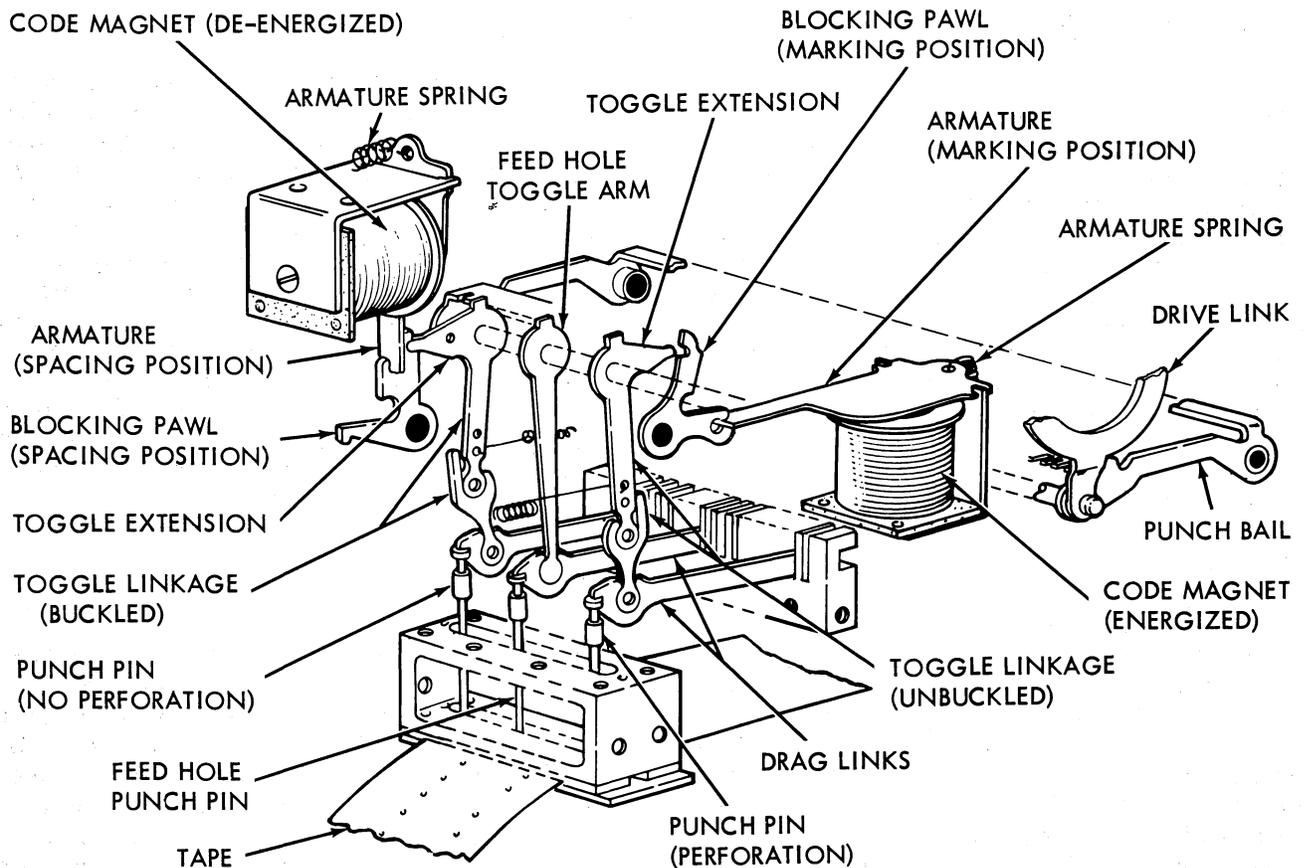


Figure 5 - Perforating Mechanism

shaft rotation. Vertical motion is imparted to the punch pins through the drag links. Since the toggle linkages are buckled, the vertical displacement of the pins is not enough to pass through the tape. Thus, the code holes are not perforated. The travel of the pins for spacing is represented by the heavy dotted line in Fig. 9. Each operation of the drive mechanism causes a feed hole toggle arm and drag link (having no associated magnet or buckling knee) to drive a feed hole punch pin through the tape. In the idling condition this pin moves up and down in the same hole.

4.05 When a code combination is received, the magnets and associated parts corresponding to spacing levels operate as described in the two previous paragraphs. For marking levels in the code combination, the magnets are energized and pull their armatures to their operated (or marking) position. The armatures, in turn, hold the blocking pawls in their marking position. The timing is such that the armatures reach their marking position before the end of the selection interval (320 degrees to 40 degrees of shaft rotation) illustrated in Fig. 9.

4.06 As the toggle linkages move down, the toggle extensions associated with marking levels clear their blocking pawls, and the unbuckled linkages drive their pins through the tape and punch code holes. The motion of the pins for marking is represented by the solid black line in Fig. 9. As can be seen, perforation occurs about midway through the operation between 140 degrees and 220 degrees of shaft rotation. Each time tape is advanced, the feed hole punch pin perforates a feed hole.

#### FEED MECHANISM

4.07 The tape feed mechanism is shown in Fig. 6. It includes a magnet and toggle linkage similar to those of the perforating mechanism. In the idling condition the magnet is de-energized, and the armature and blocking pawl are held under spring tension in their spacing position. The drive mechanism, through the feed drive lever, causes the toggle linkage to oscillate. As the linkage moves down during the early part of each idling operation, it is buckled by the blocking pawl at 85 degrees of shaft rotation (Fig. 9). The linkage rotates a pivot arm which, in turn, lifts the feed pawl, but not enough to raise it above

the next tooth on the feed wheel ratchet. The motion of the feed pawl for idling (or spacing) is represented by the light dotted line in Fig. 9. In this condition the feed wheel is not rotated and the tape is not advanced.

4.08 When a code combination is received, a feed pulse is applied to the feed magnet which pulls the armature and blocking pawl into their marking position. The timing is such that the armature does not reach its fully released position before the end of the feed selection interval (Fig. 9). As the toggle linkage moves down during the early part of the operation, the toggle extension clears the blocking pawl; the linkage remains in its unbuckled condition, and the feed pawl is lifted above the next tooth on the ratchet. When the linkage moves up during the latter part of the operation, it causes the pawl to act on the ratchet and rotate the feed wheel one tooth. Pins on the periphery of the wheel engage the feed holes and advance the tape one character. As shown in Fig. 9, feeding occurs between 293 degrees and 44 degrees of shaft rotation.

4.09 Near the end of its downward travel, the pawl is engaged by a wedge block which prevents over travel. Consistent spacing of the code perforations is ensured by a detent with a roller that is held under spring pressure against the ratchet. The detent secures the feed wheel and tape in position between feeding operations. Consistent spacing of the perforations in relation to the edge of the tape is maintained by a biasing spring which holds the tape against a reference surface on the block. The tape is fed into the punch block through a tape guide and is held on the feed wheel by a spring-biased tape lid which may be raised to initially insert the tape.

#### UNIVERSAL TAPE PUNCH

4.10 The punch units with the universal tape punch (Fig. 7) are capable of perforating 11/16 inch tape with 5-level code, or 1 inch tape with 5-, 6-, 7- or 8-level codes. To accomplish this, a manually operated mechanism is provided to mechanically vary the size of the punch block tape path to accept either 11/16 inch or 1 inch tapes. Associated with this mechanism is a variable tape guide mechanism, and three switches which electrically control the 0, 6, and 7 code levels.

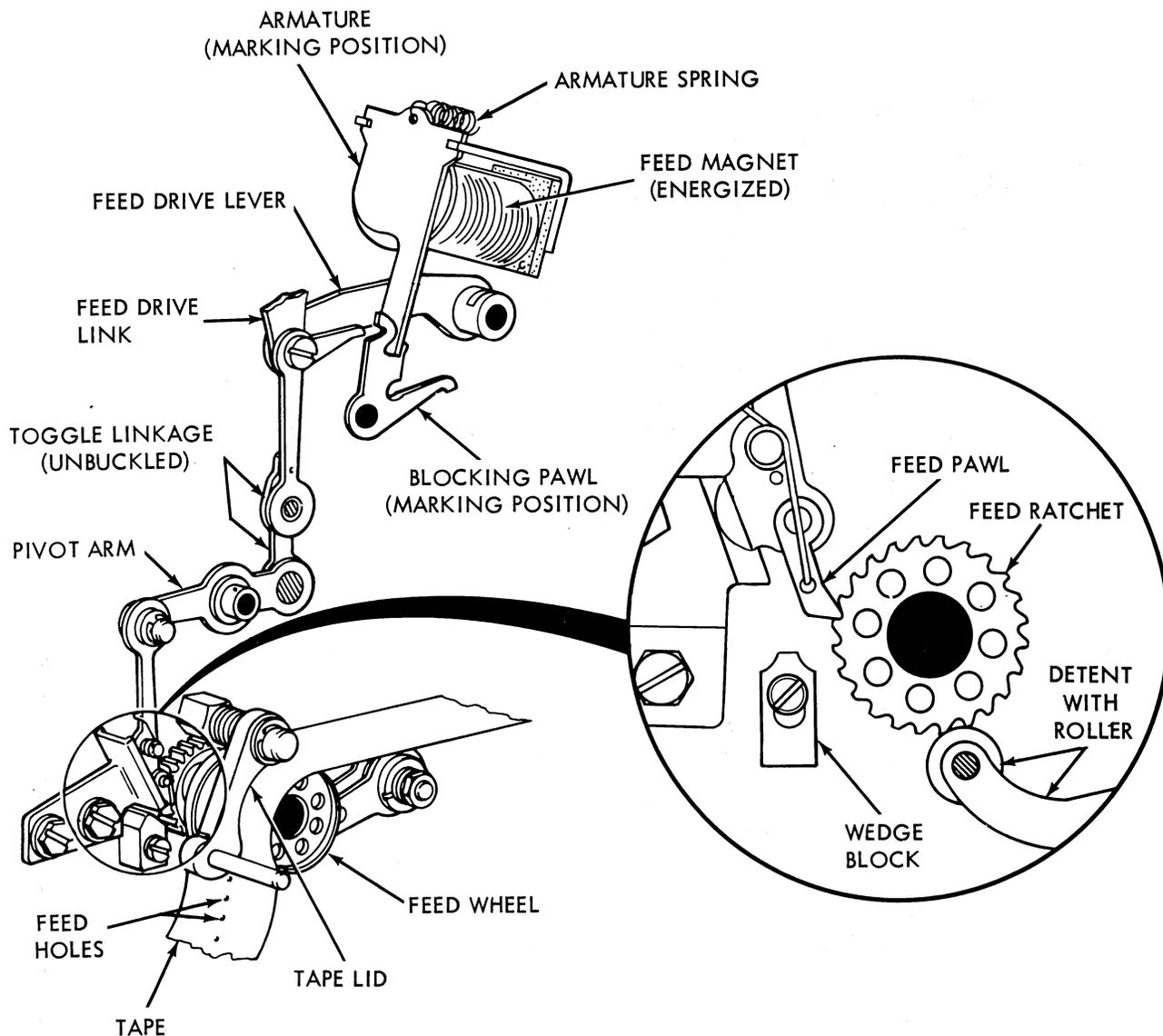


Figure 6 - Tape Feeding Mechanism

4.11 The production of 5-level, 11/16 inch tape is accomplished by lifting up on the control lever (located at the right side of the punch block), and allowing it to move forward under its own spring tension. This permits the rear edge of the punch block tape path to move forward, and simultaneously lowers a tape guide bias spring to form the front edge of the tape path. The switches for the 0-, 6-, and 7-levels should be operated to their OFF positions, and the tape guide plate should be moved to its forward detented position.

4.12 The production of 5-, 6-, 7-, or 8-level 1 inch tape is accomplished by pushing the control lever to the rear, while applying a slight downward pressure, until the control lever reaches its rear detent position. In this position, the rear edge of the tape path is moved back and the tape guide bias spring is retracted to clear the tape path for 1 inch tape. The switch for the 0, 6, or 7 level codes should be operated to their respective ON positions, depending upon the level of operation desired, and the tape guide plate should be operated to its rear detented position.

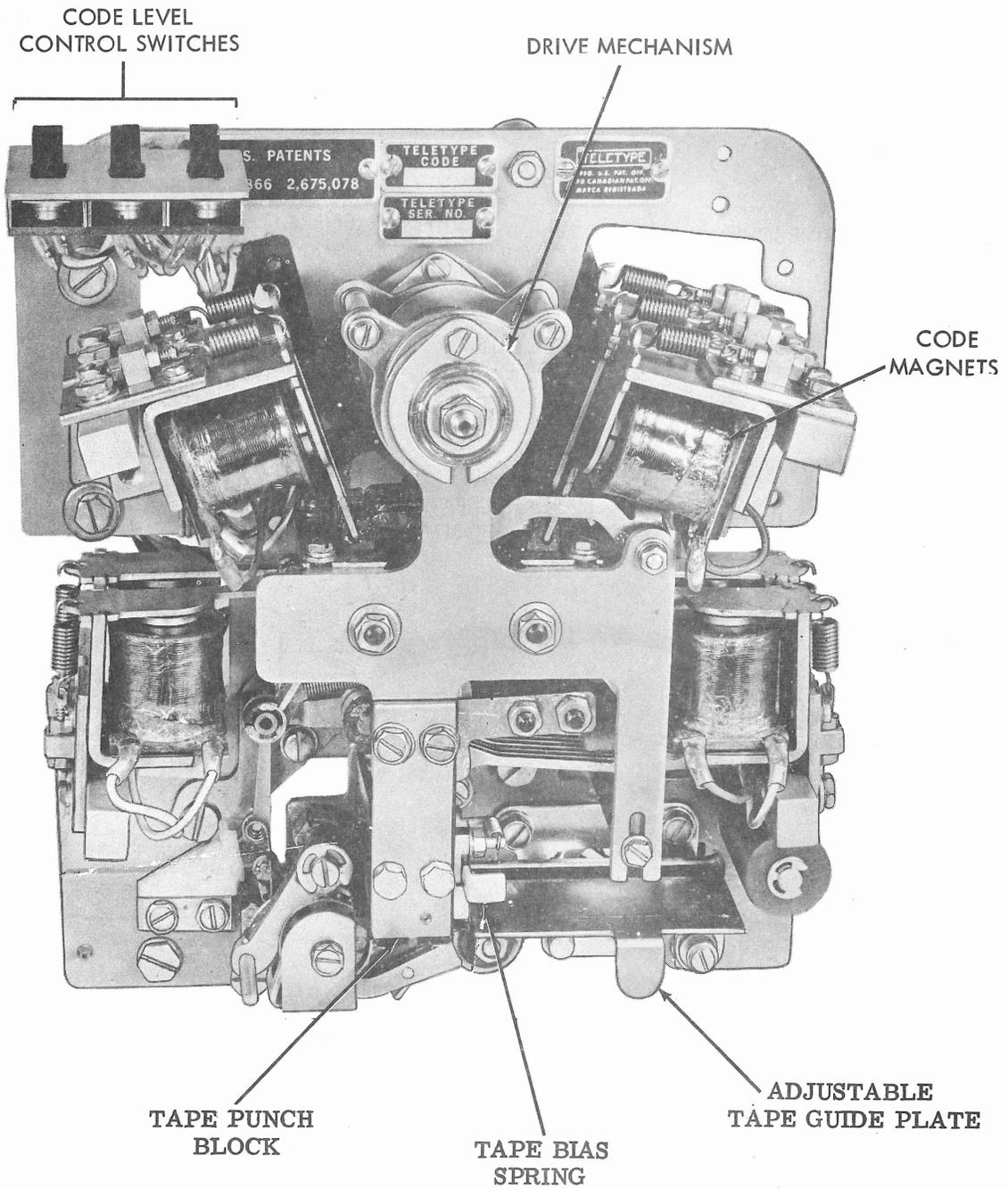


Figure 7 - Universal Tape Punch Unit



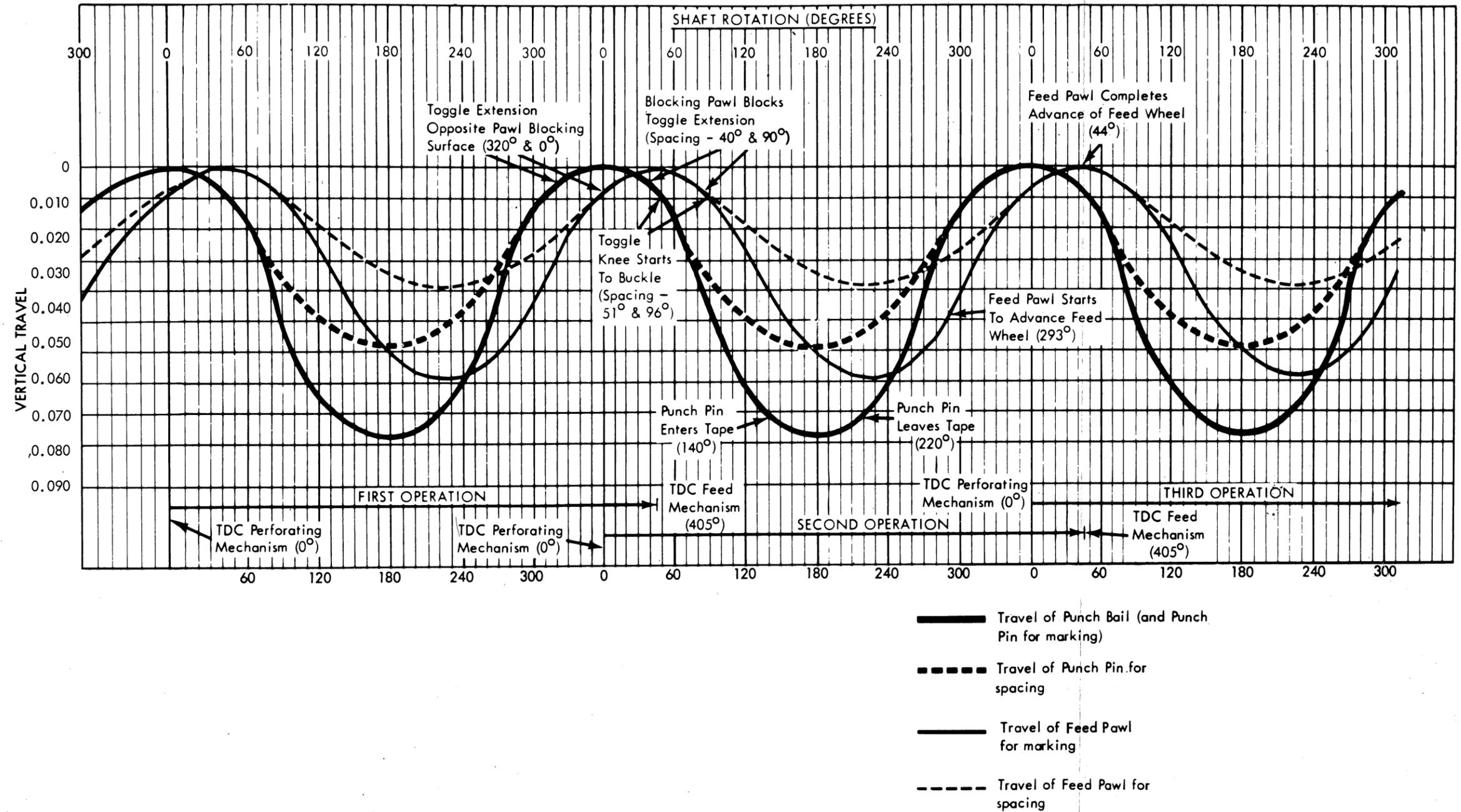


Figure 9 - Timing Diagram