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BULLETIN 215B

TECHNICAL MANUAL

HIGH SPEED TAPE PUNCH SET (BRPE)

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CORPORATION
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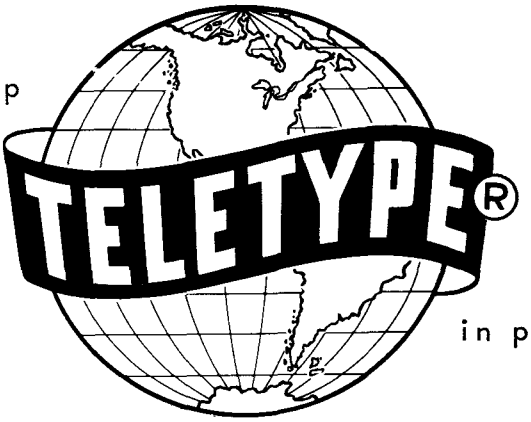

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BULLETIN 215B

TECHNICAL MANUAL

HIGH SPEED TAPE PUNCH SET (BRPE)

SECTIONS

TELETYPE®

SUBSIDIARY OF *Western Electric Company* INC.

SKOKIE, ILLINOIS, U. S. A.

Printed in U.S.A

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PAGE NUMBER	CHANGE IN EFFECT
A to E	Change 3
1-0 to 1-1	Change 2
1-2 to 1-7	Change 3
2-0	Change 2
2-1	Change 3
3-0 to 3-2	Change 3
3-3	Change 2
3-4 to 3-4a	Change 3
3-5	Change 2
3-6 to 3-7	Change 3
3-8	Change 2
3-9 to 3-13	Change 3
3-14	Change 2
3-15 to 3-15b	Change 3
3-16 to 3-18	Change 2
3-18a to 3-19	Change 3
3-20 to 3-29	Change 2
4-0 to 4-1	Change 2
5-0 to 5-6	Change 3
6-0 to 6-1	Change 2
6-2 to 6-7	Change 3
6-8 to 6-12	Change 2

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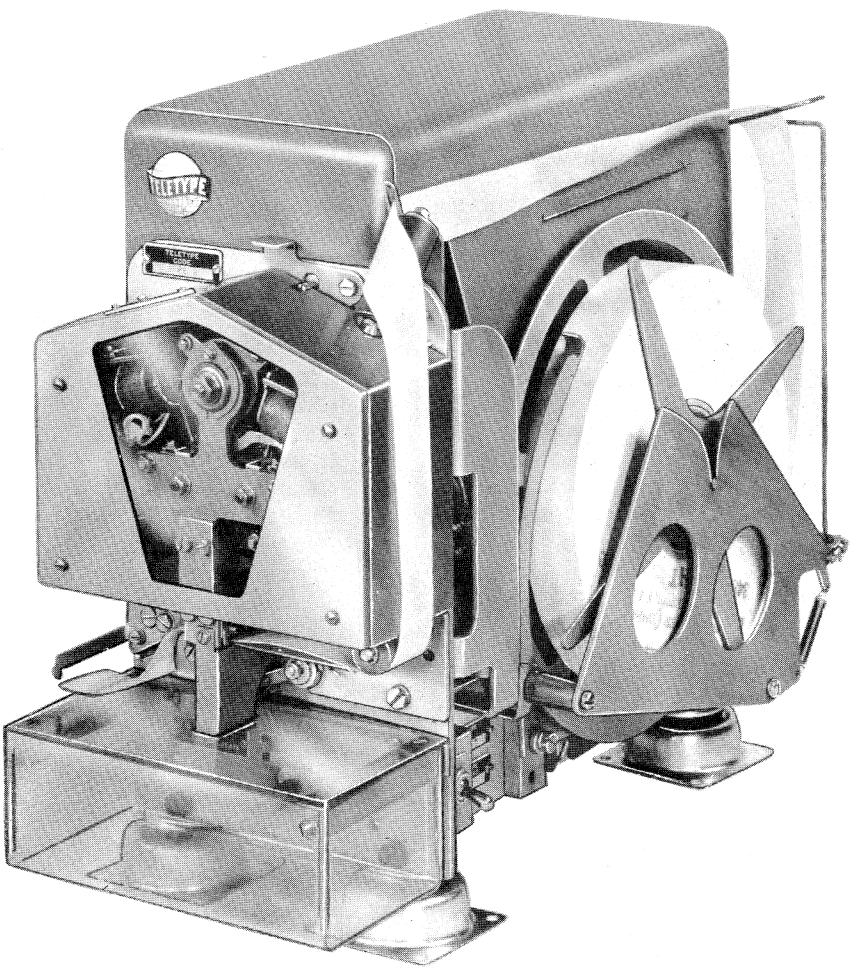
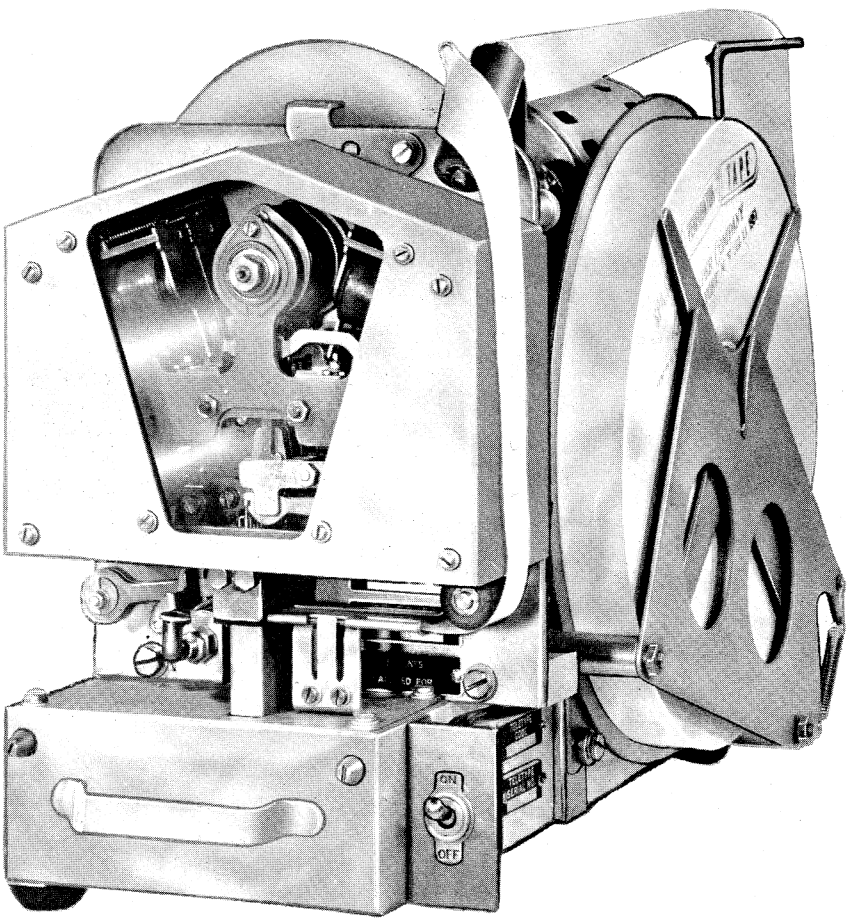


HIGH SPEED TAPE PUNCH SET (Late Design)

Consists of

Base (BRPEB), Punch Unit (BRPE)
Motor Unit (LMU) and Cover (BRPEC)



HIGH SPEED TAPE PUNCH SET (Early Design)
Consists of
Base (BRPEB), Punch Unit (BRPE) and Motor Unit (LMU)

TABLE OF CONTENTS

INTRODUCTION

This bulletin covers description, installation, maintenance and principles of operation for the Teletype High Speed Tape Punch Set, an equipment for the rapid perforation of intelligence in paper tape. Parts information will be found in Teletype Bulletin 1154B.

Unless specifically stated otherwise, the material in this publication applies to late-design Punches. The manufacture of late-design equipment began in 1959 and it includes the following coded units: Punch Units, BRPE7 and up; Bases, BRPEB6 and up; and Covers, BRPEC200 and up. Early-design equipment consists of BRPE1 through 5 and BRPEB1 through 5. Paragraphs that apply specifically to the early design are 3-5., 5-4. and 6-12.

Section 1 provides a brief physical and functional description of the equipment and a listing of its technical data. Installation instructions are contained in Section 2. Sections 3 through 5 cover maintenance including adjustments, disassembly and lubrication. General maintenance instructions appear in paragraph 3-1. Section 6 explains the operation of the Punch Set. The purpose of Section 6 is to provide background information and to serve as an aid to training personnel, applying and maintaining the equipment, and locating and correcting troubles. Of special interest to those applying the Punch and designing associated equipment is Figure 6-8 which indicates recommended electrical and mechanical timing. Figure 6-10 is a schematic wiring diagram of a typical Punch Set.

The six sections mentioned above are subdivided into numbered paragraphs. The first numeral indicates the section that the paragraph is in. For example, if a reference is to paragraph 5-1.b., it will be found in Section 5. Similar numbering is applied to the illustrations: For example, Figure 6-8 is in Section 6. References in the text to left or right indicates the viewer's left or right as he faces the front of the equipment. He is facing the front when the tape reel and tape rollers are on his right and the tape cutter is on his left (see Figure 1-1). In the illustrations, unless they are specifically labeled otherwise, it is assumed that the equipment is being viewed from the front. Pivot points are shown in the drawings by circles or ellipses which are solid black to indicate fixed points and cross-hatched to indicate floating points.

The terms defined below are used in a special sense throughout the bulletin:

Punch	This term designates the equipment when there is no need to differentiate between the Punch Set (see paragraph 1-1) and the Punch Unit (see paragraph 1-4).
Code	A binary permutation code expressed in electrical and tape form is used to convey and record the information handled by the Punch. It is explained in paragraph 6-2.
Character	Any unit of information (such as letters and numerals) represented by the code combinations described in paragraph 6-2.
Operation	The period measured in degrees of shaft rotation required by the Punch to perforate a character and advance the tape (see paragraph 6-3.d.).
Operating Speed	The constant speed at which the Punch runs. It is ordinarily given in operations per second (ops) and is equal to the revolutions per second of the main shaft. The Punch can perforate characters at various speeds up to the operating speed (see paragraph 6-1.c.).
Words per Minute (wpm)	A word is arbitrarily defined as six characters. Thus a Punch perforating 110 characters per second is operating at 60 x 110/6, or 1100 words per minute.
Self-Contained Set	A Punch Set (see paragraph 1-1) consisting of a Punch Unit, Base, Motor Unit, and drive parts.

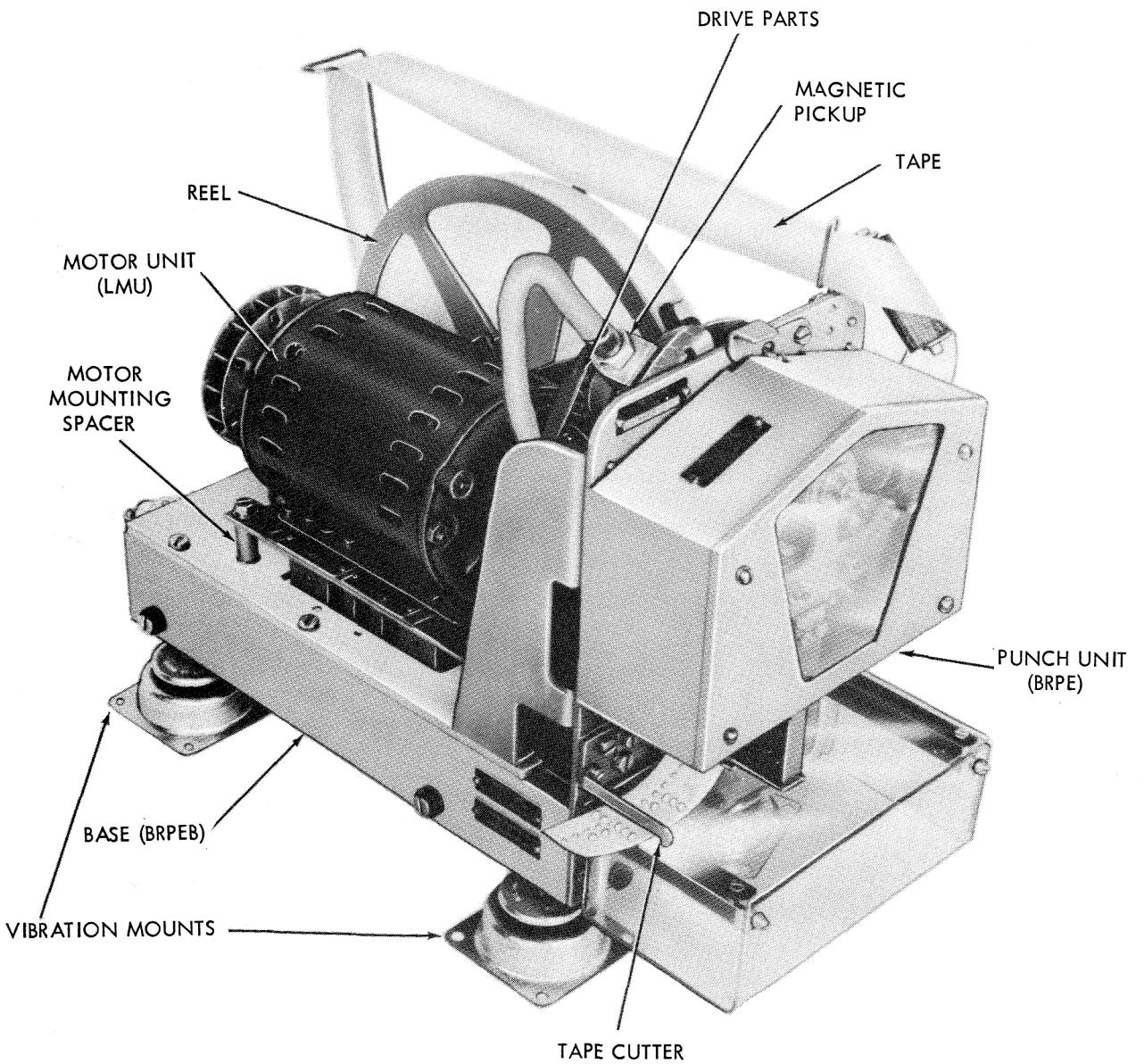


Figure 1-1. High Speed Tape Punch

SECTION 1

DESCRIPTION

1-1. GENERAL (Figure 1-1)

a. The High Speed Tape Punch Set is an electromechanical apparatus that perforates information in paper tape at speeds up to 110 characters per second (1100 words per minute). The information is received from external control circuits in the form of multi-wire electrical pulses which are translated into mechanical motions that feed the tape and perforate feed and code holes.

b. The basic components of the Set (Figure 1-1) are a Base (BRPEB), a Motor Unit (LMU) and a Punch Unit (BRPE). The Motor and Punch Units are mounted on the Base and are connected by a set of drive parts. The tape unwinds off a reel mounted on the side of the base and is fed and perforated at the front by the Punch Unit.

c. The Punch is a synchronous unit having a magnetic pickup that produces synchronizing (or clock) pulses which will trigger the control circuits at the proper time. Variations of the Set permit operation from either transistorized or vacuum-tube circuits, and will produce fully-perforated, standard teletypewriter, paper tape of either five, six, seven or eight levels. It is designed for surface or rack mounting and is provided with vibration mounts. Optional features are drive parts for different speeds and a protective Cover (BRPEC) which encloses the Motor Unit and part of the Base (See illustration on Page B.)

1-2. BASE (Figure 1-2)

The Base provides a foundation and certain accessories for the Set. It includes the following features:

a. Brackets for mounting the Punch Unit.
b. Motor mounting holes.
c. Power circuitry including a four-point terminal board, a motor switch and mating input connectors.
d. Control circuitry that includes 24-point mating input connectors and a similar

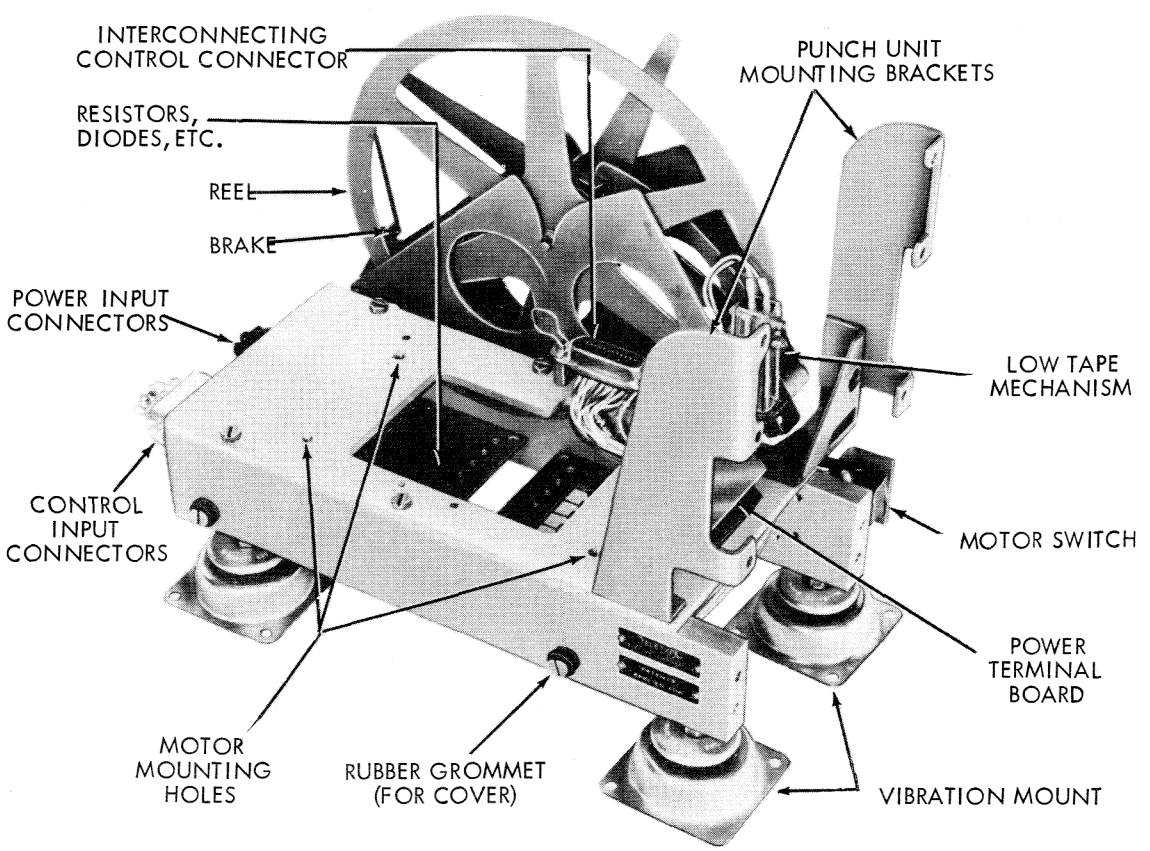


Figure 1-2. Tape Punch Base

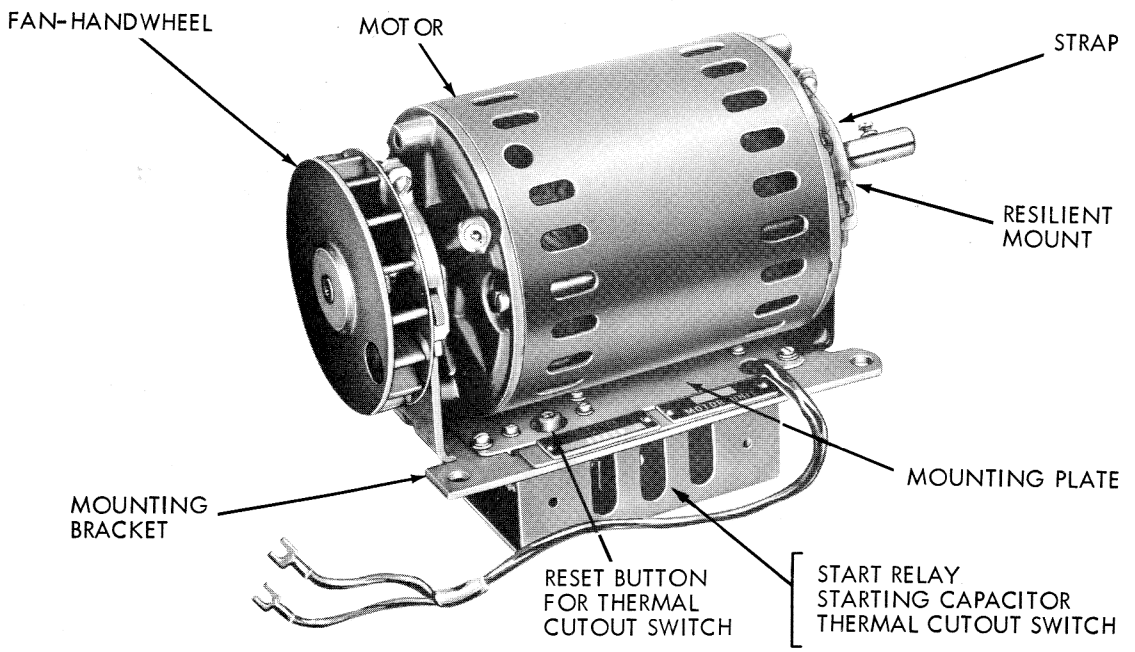


Figure 1-3. Motor Unit

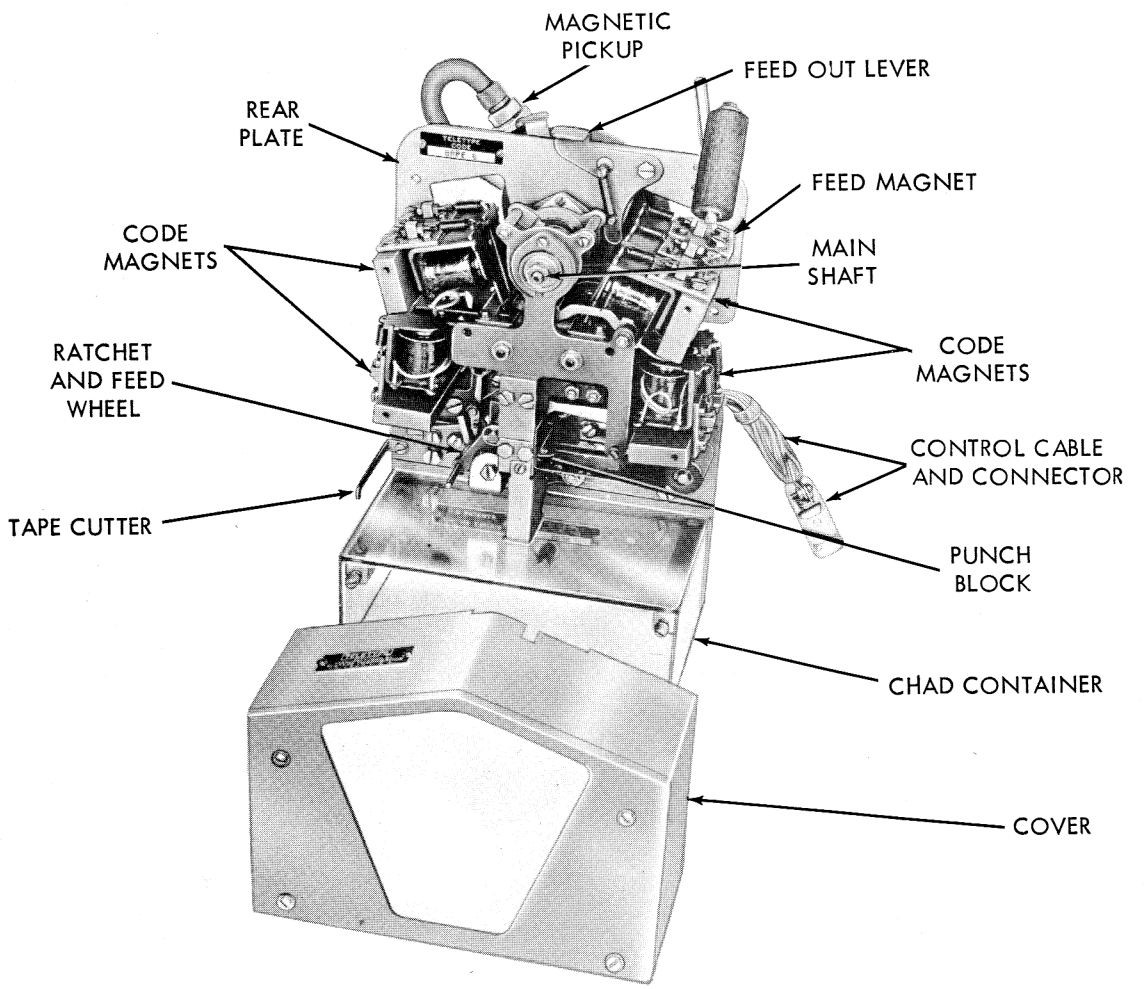


Figure 1-4. Tape Punch Unit

connector for interconnecting the Base and Punch Unit.

e. Provisions for mounting electrical components (resistors, diodes etc.) used in control circuits.

f. A reel and brake assembly which accommodates the tape roll and provides smooth acceleration and deceleration during starting and stopping.

g. A low-tape mechanism that may be used to actuate an external visual or audible alarm.

h. Vibration mounts which may be removed at the customers discretion.

i. Rubber grommets for supporting the Cover.

1-3. MOTOR UNIT (Figure 1-3)

a. Mechanical motion to operate the Set is produced by a two-pole, single-phase synchronous Motor Unit which develops 1/20 horsepower at 3600 revolutions per minute. The motor rests in the cradle of a mounting bracket and is held in place by a strap at each end. The cradle is isolated from the motor by resilient mounts which reduce vibration. A small fan is mounted at each end of a rotor within the end bells and a combination fan and handwheel rides on the rear end of the shaft. A start relay, a starting capacitor and a thermal-cutout switch are contained in a lower compartment. The Switch provides protection against an overload. The rotation of the shaft is counterclockwise as viewed from the handwheel end.

CAUTION

If motor becomes blocked for several seconds, thermal-cutout switch will break circuit. Allow motor to cool at least 5 minutes before depressing red reset button.

b. A. c. and d. c. governed motors are available for special applications.

1-4. TAPE PUNCH UNIT (Figure 1-4)

The Tape Punch Unit incorporates the electrical and mechanical elements necessary to translate electrical pulses into actions which feed and perforate the tape. It is mounted on the Base or other equipment by a rear plate. A main shaft mounted on bearings transfers motion from an external source to tape feeding and perforating mechanisms. Under the control of code magnets, the perforating mechanism punches code holes in the tape by means of pins in a punch block. A pin not under the control of a magnet is driven through the tape to punch a feed hole with every code combination. Each time a code combination is perforated, the feed mechanism, under the control of a feed magnet, advances the tape by means of a ratchet and feed wheel arrangement. The feed and code magnets are energized by electrical pulses fed to the unit on multiple wires. The following features are included on the Punch:

a. A magnetic pickup that produces a synchronizing pulse which will trigger the control circuits when the unit is ready to receive; the timing of the pulse is adjustable for varying conditions of operation.

b. A cable and connector for linking the Unit to the control circuits.

c. A feed out lever which will provide continuous blank tape feed out when manually depressed.

d. A transparent chad container.

e. A protective metal cover with a window.

f. A tape cutter.

Variations of the Unit are equipped with different magnets for operation with either transistorized or vacuum-tube control circuits, and with varying numbers of magnets to produce different levels (5, 6, 7 or 8) of tape. A manually operated two position punch block, which allows the operator to select between five level and eight level tape perforation, is standard equipment on Punch Units used in High Speed Communication Sets.

1-5. MOTOR MOUNTING AND DRIVE PARTS

a. General - The high speed Tape Punch Unit may be driven by one of two methods. When mounted in a self-contained set, the Punch Unit derives its power from a belt drive system. When part of a High Speed Communication Set, however, a gear drive system is utilized. A description of each follows.

b. Belt Drive System (Figures 1-1 and 6-2) - The drive parts consist of two sprockets and a timing belt (Figure 6-2), which transfer motion from the Motor Unit to the Punch Unit and determine the Set's operating speed. The Motor is mounted on four spacers (Figure 1-1). The tension of the timing belt is adjusted by adding or removing shims between the spacers and the motor mounting bracket. Standard motor mounting and drive parts are available for operating the Punch at speeds of 63.3 or 110 operations per second. These parts exist as modification kits which may be obtained to change the operating speed of the Punch in the field.

c. Gear Drive System (Figure 3-17b) - The drive parts consist of two gears which transfer motion from the Motor Unit to the Punch Unit and determine the sets operating speed. The Motor mounts on two spacers and an adjustable "T" plate. Adjustment between the gears is accomplished by means of an adjusting screw located below the "T" plate.

1-6. TECHNICAL DATA

a. GENERAL - The data given below is for typical Punches and may vary for individual coded units. A number of variables are associated with the values in paragraphs 1-6. c. and d. If additional information is needed, contact the Teletype Product Sales Department.

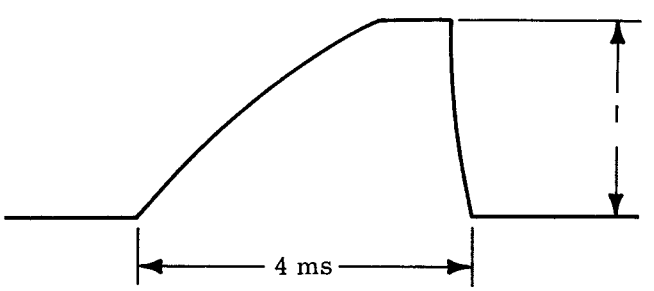
b. STANDARD SPEEDS

(1) 110 operations (or characters) per second (1100 words per minute).

(2) 63.3 operations (or characters) per second (633 words per minute).

c. MAGNET SPECIFICATIONS

	Transistor Operation	Vacuum-Tube Operation
Attract Time (Milliseconds)*	2	2
Release Time (Milleseconds)*	2	2
Magnet Coil Resistance (Ohms)	2.9	74-82
Magnet Coil Inductance (Milliheneries)	8	100
External Current Limiting Resistance (Ohms)**	25	686-694#
Code and Feed Pulse Requirements*		
Current (Amp.) (I)	1	0.150
Voltage (d.c.)	28	115
Length (Milliseconds)	4 ± 10%	4 ± 10%



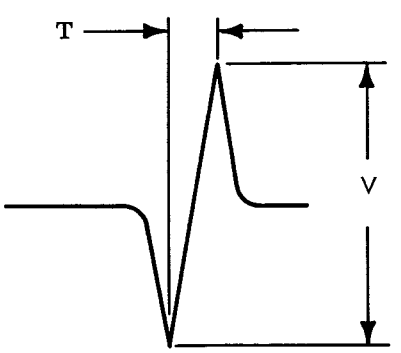
Must be supplied by customer.

** CAUTION

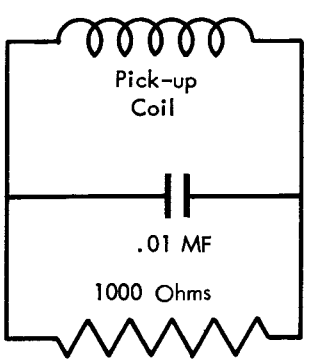
The 25 ohm resistors supplied on the base are designed for a duty cycle of 4 milliseconds ON, and 6 milliseconds OFF for one character operation. If duty cycle exceeds 5 milliseconds ON, it is necessary that the resistors be removed from the base and a special external mounting (or blower) be supplied to dissipate the head from the resistors.

*Since the operation of the magnets is largely dependent on the control circuitry, these values may be varied experimentally for specific applications.

d. MAGNETIC PICKUP SPECIFICATIONS



CIRCUIT FOR MEASUREMENT PURPOSES ONLY.



(1) Self-Contained Sets - Output pulse with clearance of 0.010 inch (see Figure 3-8) and pick-up connected across load equivalent to 0.01 MF and 1000 ohms in parallel.

Speed (operation per second)	63.3	110
Voltage (V)	4	6
Peak to Peak Time (microseconds) (T)	450	250

(2) High Speed Communication Sets - See Figures 1-5 and 1-6.

e. TAPE SPECIFICATIONS (See Figure 6-1.d.)

Levels	5, 6, 7 or 8 with in-line feed hole (For configurations
Widths	11/16 inch (5 level) see Figure 6-1-D)
	7/8 inch (6 & 7 level)
	1 inch (8 level)
Code Combinations per inch	10
Feed Hole Diameter (Inches)	0.0465
Code Hole Diameter (Inches)	0.071
Center of Feed Hole to Guiding Edge (Inches)	5-Level - 0.297; 6, 7, or 8-Level - 0.392

f. MOTOR UNIT

Type	Synchronous
Input Voltage	Singel Phase, 115 Volts $\pm$ 10%, 60 Cycles $\pm$ 1%
Input Current - Starting	9 Amp.
- Running	2 Amp.
Power Output	1/20 Horsepower at 3600 RPM
Power Consumption	65 Watts
Heat Dissipation	50 Watts
Protection	Thermal Cutout

g. WEIGHTS AND DIMENSIONS

	Depth (Inches)	Width (Inches)	Height (Inches)	Weight (Pounds)
Punch Unit	6-1/2	6-1/2	10-1/2	8-1/2
Base	13-1/2	8	10	7-1/2
Motor Unit	8	4	4-1/2	8
Set	16-1/2	8	12	24-1/2 (including drive parts)

Mounting Centers (Inches)*
Mounting Centers of Vibration Mounts (Inches)*
Mounting hole diameter (Inch)*

*See Figure 2-1.

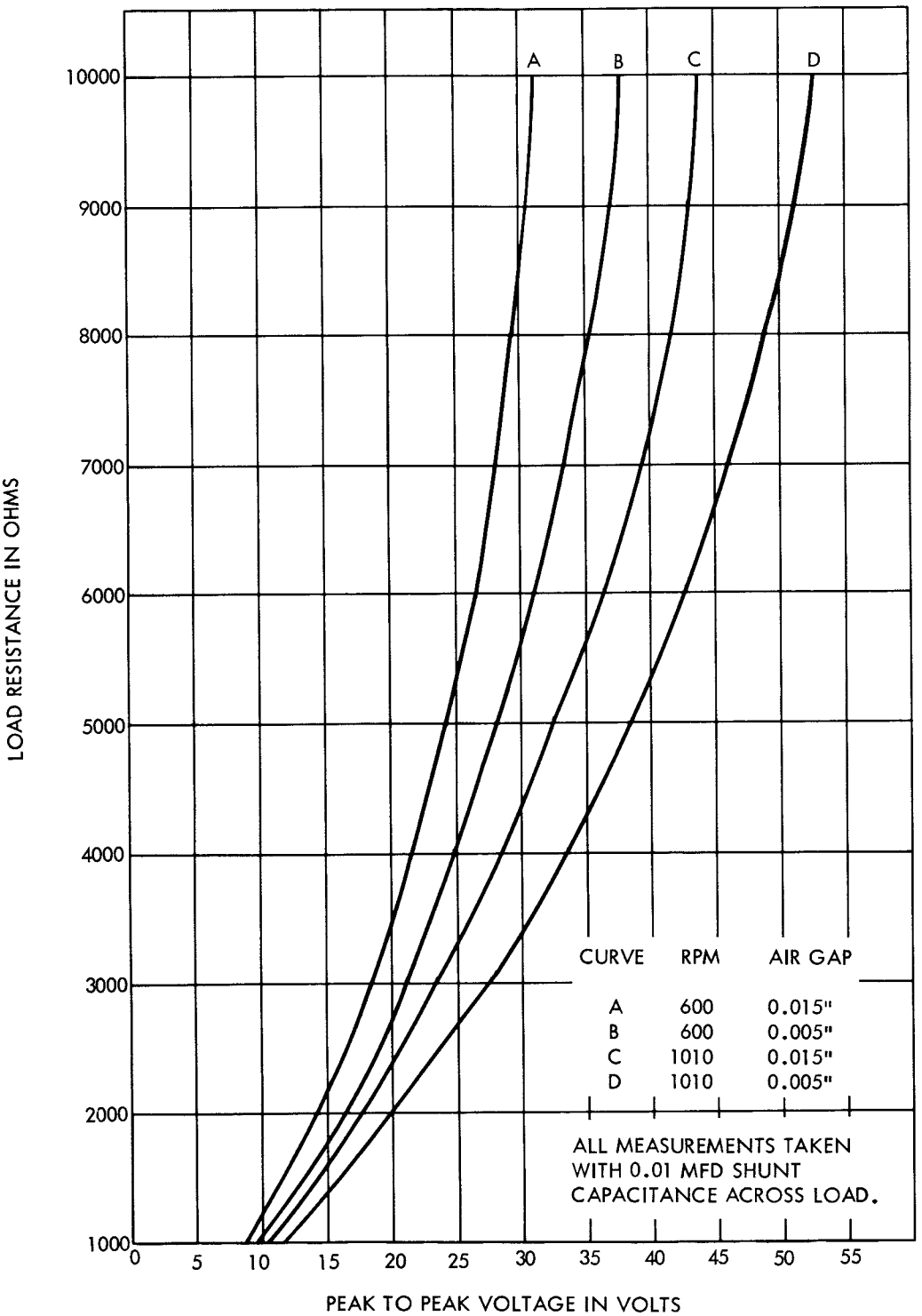


Figure 1-5. Magnetic Pickup Characteristics

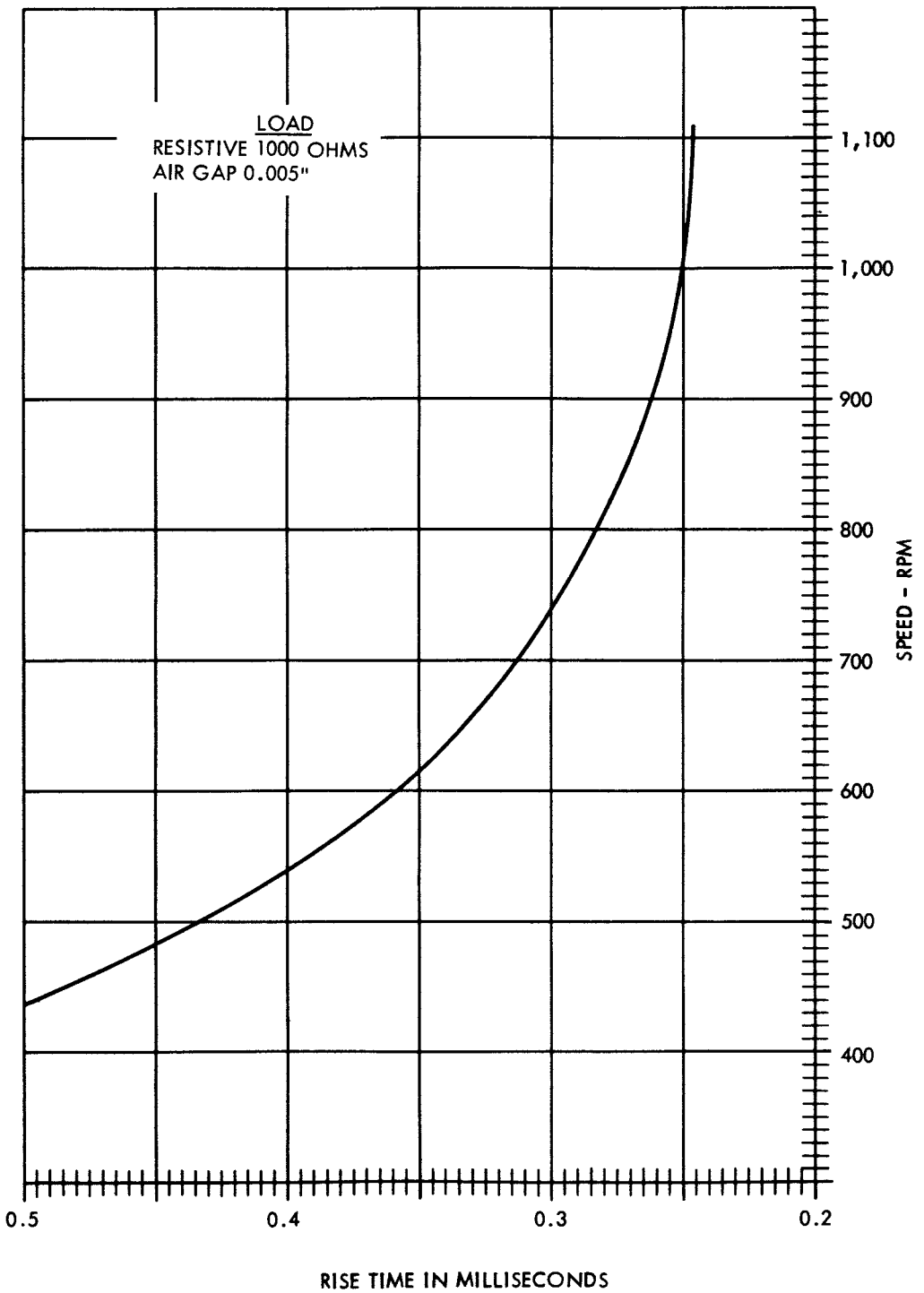


Figure 1-6. Magnetic Pickup Characteristics

SECTION 2

INSTALLATION

2-1. GENERAL

Certain variations in the following procedures may have to be made for individual coded equipment and specific applications. A Set consisting of a Base (BRPEB), Motor Unit (LMU), Punch Unit (BRPE) and motor mounting and drive parts for 110 ops operation is ordinarily packed assembled in one carton. However, for cases in which the components may be packed separately, paragraph 2-3. below covers unpacking and assembly. When individual units are obtained, see paragraph 2-3.a. below for unpacking instructions and paragraph 2-4. for mounting information. Instructions for installing different motor mounting and drive parts are in a specification packed with the set of parts. Parts Bulletin 1154B illustrates the parts mentioned below.

2-2. ASSEMBLED SET - UNPACKING

a. Cut the seal and open the top flaps of the cardboard carton. Remove the top corrugated detail. Cut the seal and open the top flaps of the inner carton. Remove the corrugated liner. Detach the chad container from the liner and remove the tissue wrapping. Remove the loose connectors from the container and remove the tissue wrapping.

b. Grasp the Set by the motor housing and carefully lift it out of the carton. Remove the pallet from the Set by removing the four mounting clamps. Remove the string and tape holding the tape reel and wire guide in position. Mount the chad container on the front of the Set by inserting the plastic post at the rear of the container into the provided hole in the Punch Unit's rear plate and inserting the two studs at the front of the mounting bars into the two holes in front of the container.

c. If a Cover (BRPEC) is included in the Set, cut the seal of its carton and open the top flaps. Lift the Cover out of the carton and remove the tissue wrapping. Hold the Cover over the Set, lower it carefully, and fit the four rubber grommets on the Base into the provided slots.

2-3. DISASSEMBLED SET

a. UNPACKING

(1) Base - Cut the seal and open the top flaps of the cardboard carton. Remove the cardboard detail on top of the equipment. Grasp the Base by the mounting plate and carefully lift it from the carton. Remove the string holding the tape reel and wire guide in position. Remove the two male connectors from the muslin bag attached to the base.

(2) Punch Unit - Cut the seal and open the top flaps of the cardboard carton. Remove any tissue at the top of the carton. Remove the chad container, which is wrapped in tissue, from the small cardboard liner and lay it aside. Remove the small liner. Remove the detail that fits around the Unit. Remove the large liner. Grasp the unit by the cover and the wooden tape roller and carefully lift it from the carton. Remove the string and tissue paper from the cable. When ready to mount the unit, take it off the wooden pallet by removing the two mounting screws.

(3) Motor Unit - Cut the seal and open the top flaps of the cardboard carton. If the Unit is packed in plastic end caps, hold it in place and turn the carton upside down. Lift the carton off the Unit and remove the end caps. If the Unit is not packed in plastic, remove the cardboard detail from the top of the carton. Grasp the Unit by the housing and lift it out of the carton.

b. ASSEMBLY

(1) Remove the Punch Unit from the wooden pallet. Mount it on the Base by means of the mounting hardware in the muslin bag attached to the Punch Unit (see Figure 4-1). The six 156768 screws with 93985 lock washers should pass from the rear through the 142955 and 142956 mounting brackets on the Base into the upper part of the 142800 rear plate of the Punch Unit. The four 151724 screws with 2669 lock washers should pass from the front through the lower part of the rear plate into the 142950 and 142951 side bars of the Base. Connect the male receptacle on the Punch Unit's cable into the female receptacle on the top of the Base. Mount the chad container on the Unit as instructed in paragraph 2-2.b. above.

(2) Mount the Motor Unit and drive parts as instructed in Specification 5944S which is packed with the motor mounting and drive parts. If a Cover is included in the Set, unpack and mount it as instructed in paragraph 2-2.c.

2-4. MOUNTING

The Set is designed for mounting with or without the provided shock mounts. There are four screw holes in each mount for securing the Set to the customer's table, shelf, cabinet track or other equipment. For pertinent dimensions, see Figure 2-1, Page 2-1. If the shock mounts are not to be used, they may be taken off by removing their mounting screws. Provisions must then be made by the customer for mounting the Set on specific equipment. Mounting dimensions for the Punch Unit are shown in Figure 2-2, Page 2-1.

2-5. ELECTRICAL CONNECTIONS

See paragraph 1-6 for pertinent electrical data. Wiring from the power supply and control circuits should be connected to the two loose connectors mentioned in paragraphs 2-2.a. and 2-3.a. (1) above. For specific connections, refer to the wiring diagrams packed with the equipment.

2-6. PREPARATION FOR OPERATION

a. ADJUSTMENTS

(1) Five-level Punches are adjusted at the factory for 11/16-inch tape and should need no further adjustment. Six-, seven- and eight-level equipment is adjusted for one-inch tape. If 7/8-inch tape (6- and 7-level) is to be used, see the Tape Biasing Spring Adjustment in Figure 3-9.

(2) The magnetic insert on the flywheel which controls the synchronizing pulse is ordinarily set in the factory at the 7 o'clock position. See Figures 3-1 and 3-2 to determine what orientation is needed for specific applications.

b. LUBRICATION - Lubricate the Punch as instructed in Section 5.

c. TAPE ROLL - Remove the tape reel from the tape container. Unscrew the tape retainer and remove it from the reel. Place the tape roll on the reel so that the tape will feed off the bottom-rear. Replace the retainer and place the reel back in the container.

d. TAPE THREADING - The tape path is illustrated in the photograph on page B. Thread the tape off the bottom-rear of the roll, up through the wire guide on the container, forward through the wire guide on the Punch Unit to the left of the upper roller, over and down to the right of the upper roller, to the right of and down under the lower roller, and to the left through the tape guide and punch block. Lift the tape lid and lead the tape between the lid and the feed wheel and then out to the left under the tape cutter.

e. STARTING TAPE - Turn on the motor switch. Depress the feed out lever, pull the tape to the left until it begins to feed and release the feed out lever. If the Set has been properly oriented with its control circuits, it should now be ready for operation.

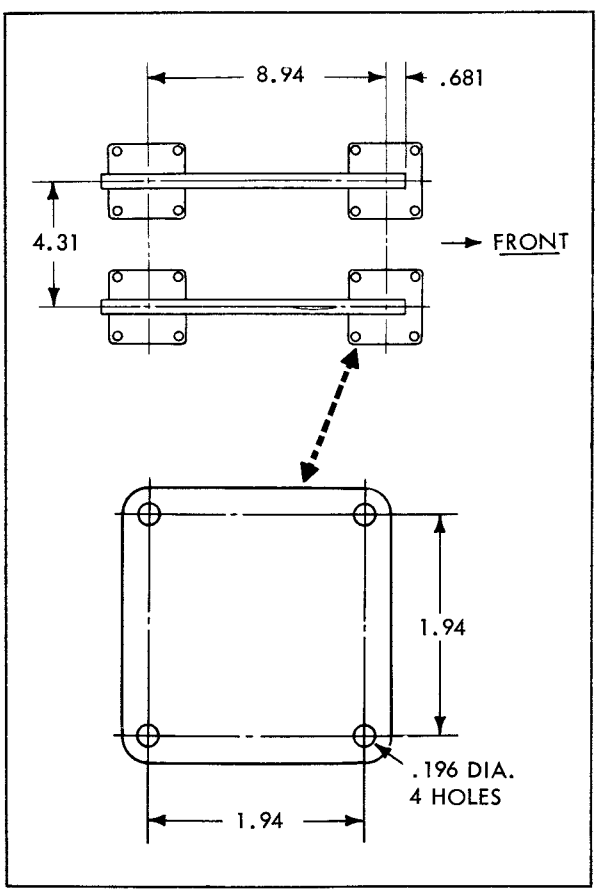


Figure 2-1. Set Mounting Dimensions.

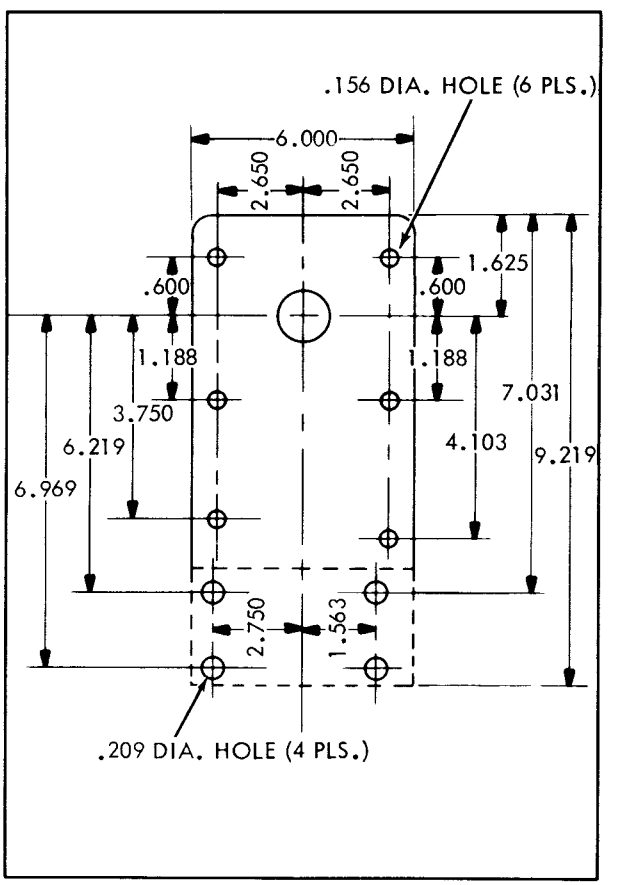


Figure 2-2. Punch Unit Mounting Dimensions.

SECTION 3

ADJUSTMENTS AND SPRING TENSIONS

3-1. GENERAL MAINTENANCE

a. The Punch will require less maintenance and provide more satisfactory service if it is used properly. Although it will perforate tape at speeds less than the operating speed (see Introduction and paragraph 6-1.c.), operating life will be increased if the lowest suitable speed is used. For example, if perforation is not to occur at a rate over 60 characters per second, then drive parts providing 63.3 ops should be employed rather than those providing 110 ops. The Punch will accommodate most paper tapes. However, standard teletypewriter paper tape is recommended because it is impregnated with oil which lubricates the punch pins. Since the equipment is subject to more wear when idling, i.e. running but not perforating tape, it should be turned off during idle periods either manually or by the control circuits.

b. The Punch should be cleaned periodically, but care should be taken to avoid damaging or distorting delicate springs, thus reducing their tension. Check the tightness of all wiring connections at terminal boards and connections. Make sure that the nuts and screws that lock the adjustments are tight. Inspect the equipment at intervals for conditions that might cause trouble later. Oxidized (red) metal dust near bearing surfaces may indicate insufficient clearance, a condition that should be rectified immediately. Manual operation as outlined in paragraph 3-2. f. below should accompany inspection.

NOTE

Certain parts of the Punch may require replacement at intervals determined by the speed and type of operation (i.e. idling or punching). The parts to be replaced are available in Maintenance Parts Kit 143076, and are illustrated in Teletype Bulletin 1154B. Examine the parts according to the following schedule:

Words Per Minute	Punching	Idling
600	550 Hrs.	3,000 Hrs.
857	400 Hrs.	1,500 Hrs.
1,100	300 Hrs.	1,000 Hrs.

Maintenance may require that the Punch be disassembled, see Section 4, to make certain adjustments and to replace parts. It is very important that the equipment be thoroughly lubricated at regular intervals in accordance with Section 5.

3-2. GENERAL ADJUSTING INFORMATION

a. Paragraph 3-4. (pages 3-2 through 3-19) covers adjustments and spring tensions for late-design Punches (BRPE7 and up), while Paragraph 3-5. (pages 3-20 through 3-29) covers this material for early-design equipment (BRPE 5 and lower).

b. In the adjustments and spring tensions covered in this section, location of clearances, position of parts and point and angle of scale applications are illustrated by drawings. Requirements and procedures are set forth in the texts that accompany the drawings. The sequence of the adjustments is that which should be followed when complete readjustment of the Set is undertaken. The letters of the alphabet in parenthesis which precede the texts indicate the sequence to be followed on the individual pages. A procedure should be read all the way through before making the adjustment or testing the spring tension. If any adjustment is changed, related adjustments should be checked.

c. Tools required to make the adjustments and test the spring tensions are contained in Tool Kit 171312. The tools are not supplied with the equipment, but are listed in Teletype Bulletin 1124B. If parts are removed, all adjustments which the removal of these parts might facilitate should be made before the parts are replaced. When a part mounted on shims is removed, the number of shims at each mounting screw should be noted so that identical pile ups can be made when the part is replaced. Unless it is specifically stated to the contrary, after an adjustment has been made, all nuts and screws that were loosened should be tightened.

d. The spring tensions given in this bulletin are indications, not exact values, and should be checked with Teletype scales in the positions shown in the drawings. Springs which do not meet the requirements and for which there are no adjusting procedures should be discarded and replaced by new springs.

e. All contact points should meet squarely. Samller points should fall wholly within the circumference of larger mating points. Points that are the same size should not be out of alignment more than 25 per cent of the point diameter. Avoid sharp kinks or bends in the contact springs.

f. Before proceeding with the adjustments, remove the Cover, (if present) by simply lifting

it from the Base, and take off the Punch Unit cover by removing its four mounting screws. Rotate the main shaft slowly in its normal direction (clockwise as viewed from the front) and activate all movable elements. Check for freedom of movement and eliminate any binds. The shaft should be rotated to set up the conditions required in the adjusting procedures.

CAUTION

Improperly adjusted equipment may be seriously damaged in a matter of seconds if operated under power.

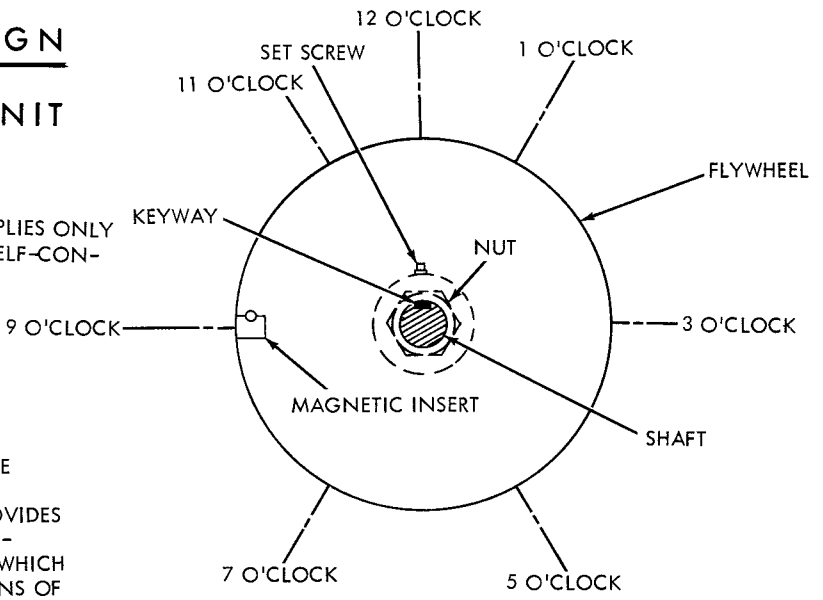
3-3. ALPHABETICAL INDEX: ADJUSTMENTS AND SPRING TENSIONS

3-4. LATE DESIGN

a. PUNCH UNIT

NOTE

FOLLOWING PROCEDURE APPLIES ONLY TO PUNCH UNITS USED IN SELF-CONTAINED SETS.



SYNCHRONIZING PULSE ORIENTATION

FLYWHEEL MAY BE ORIENTED IN 60-DEGREE STEPS WITH RESPECT TO MAIN SHAFT. THIS PROVIDES AN OPTION OF SIX INITIAL POSITIONS FROM WHICH VARIOUS COMBINATIONS OF OPERATING SPEEDS, MAGNETS, AND CONTROL-CIRCUIT DELAYS MAY BE ACCOMMODATED.

TO DETERMINE O'CLOCK POSITION

(A) COMBINE ATTRACT TIME OF MAGNETS (PAR. 1-6.c.) AND DELAY TIME OF CONTROL CIRCUITS TO OBTAIN TIME (T) IN MILLISECONDS (MS) AT WHICH ARMATURE ARE FULLY ATTRACTED AFTER PICKUP FIRES WHEN SET AT RANGE 30.

(B) LOCATE T ON TIME SCALE AT LOWER LEFT OF FIGURE 3-2. EXTEND A LINE HORIZONTALLY TO RIGHT UNTIL IT INTERSECTS LINE REPRESENTING OPERATING SPEED OF PUNCH UNIT IN OPERATIONS PER SECOND (OPS).

(C) EXTEND A LINE VERTICALLY UPWARD FROM THIS POINT UNTIL IT INTERSECTS ONE OF THE O'CLOCK LINES.

(D) EXTEND A LINE FROM THIS POINT HORIZONTALLY TO LEFT UNTIL IT INTERSECTS SCALE AT UPPER LEFT. THIS POINT REPRESENTS POSITION OF TOGGLE LINKAGES IN DEGREES (AS ILLUSTRATED IN FIG. 6-8) WHEN ARMATURES REACH FULLY ATTRACTED POSITION. IT SHOULD FALL WITHIN SELECTION INTERVAL. USE O'CLOCK POSITION REPRESENTED BY INTERSECTED LINE IN POSITIONING FLYWHEEL AS INSTRUCTED BELOW.

POSITIONING FLYWHEEL

(A) VIEW UNIT FROM FRONT. ROTATE FLYWHEEL UNTIL SET SCREW IS IN 12 O'CLOCK POSITION. IF MAGNETIC INSERT IS NOT AT O'CLOCK POSITION DETERMINED ABOVE, LOOSEN FLYWHEEL NUT AND REMOVE SET SCREW.

(B) POSITION SHAFT SO THAT KEYWAY IS IN 12 O'CLOCK POSITION. HOLD SHAFT IN THIS POSITION AND ROTATE FLYWHEEL SO THAT MAGNETIC INSERT IS AT O'CLOCK POSITION DETERMINED ABOVE.

(C) INSERT SET SCREW IN HOLE IN HUB AT 12 O'CLOCK POSITION AND TIGHTEN JUST ENOUGH TO HOLD FLYWHEEL IN POSITION. TIGHTEN NUT. TIGHTEN SET SCREW SECURELY.

EXAMPLE

(A) ASSUME THAT PUNCH UNIT IS TO OPERATE AT SPEED OF 110 OPS, THAT ATTRACT TIME OF MAGNETS IS 2 MS AND DELAY OF CONTROL CIRCUITS IS 1 MS. COMBINED TIME (T) IS THUS 3 MS.

(B) LOCATE 3 ON TIME SCALE IN FIGURE 3-2. EXTEND A LINE FROM 3 TO RIGHT UNTIL IT INTERSECTS 110 OPS LINE.

(C) EXTEND A LINE VERTICALLY UPWARD FROM THIS POINT. AS CAN BE SEEN IN FIGURE 3-2, LINE INTERSECTS 9 O'CLOCK LINE.

(D) WHEN A LINE IS EXTENDED TO LEFT FROM THIS POINT, IT INTERSECTS SCALE AT 339°. THUS TOGGLE LINKAGES ARE IN SELECTION INTERVAL WHEN MAGNETS REACH FULLY ATTRACTED POSITION.

(E) POSITION FLYWHEEL AT 9 O'CLOCK AS INSTRUCTED UNDER POSITIONING FLYWHEEL ABOVE.

Figure 3-1

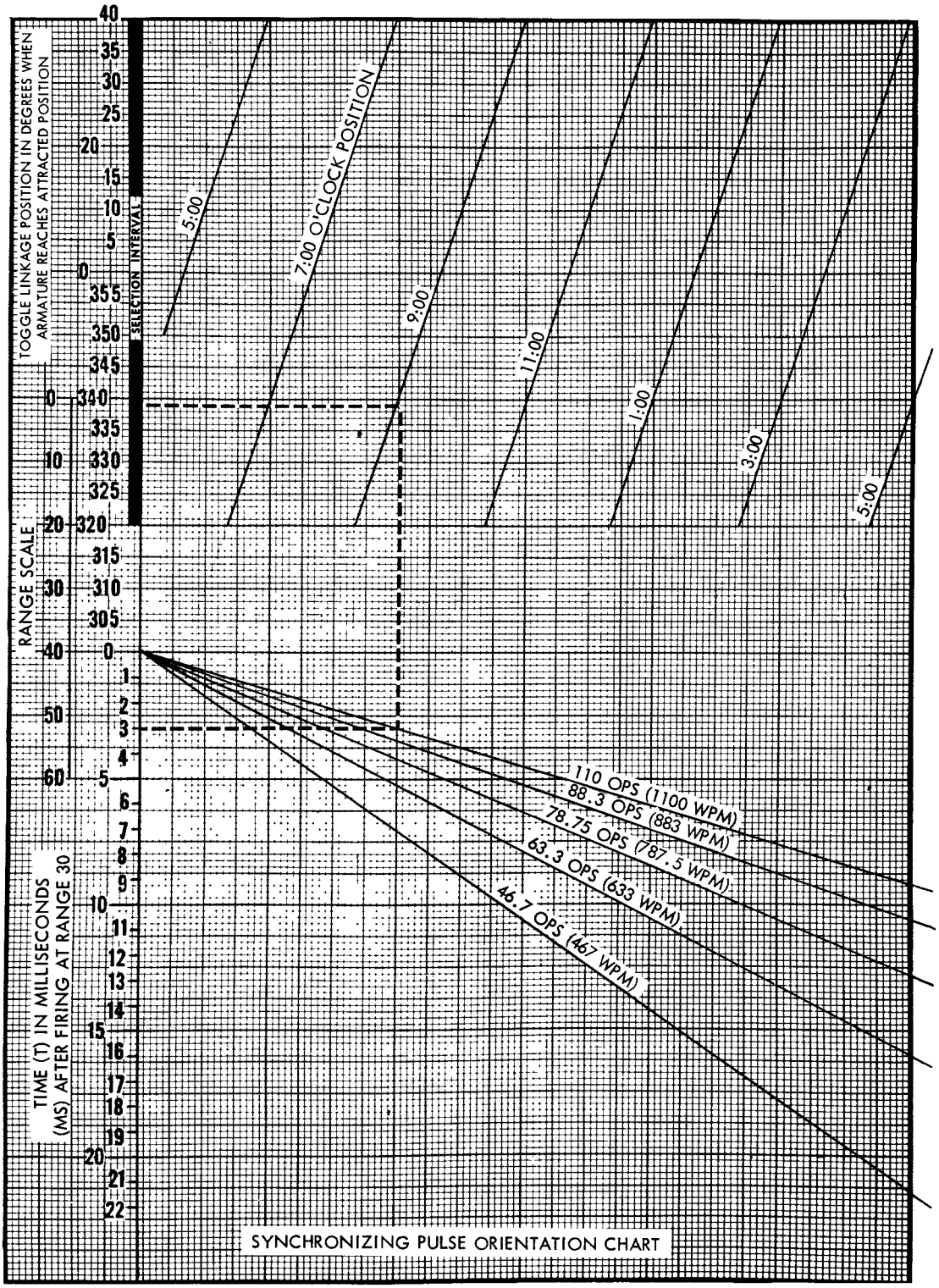
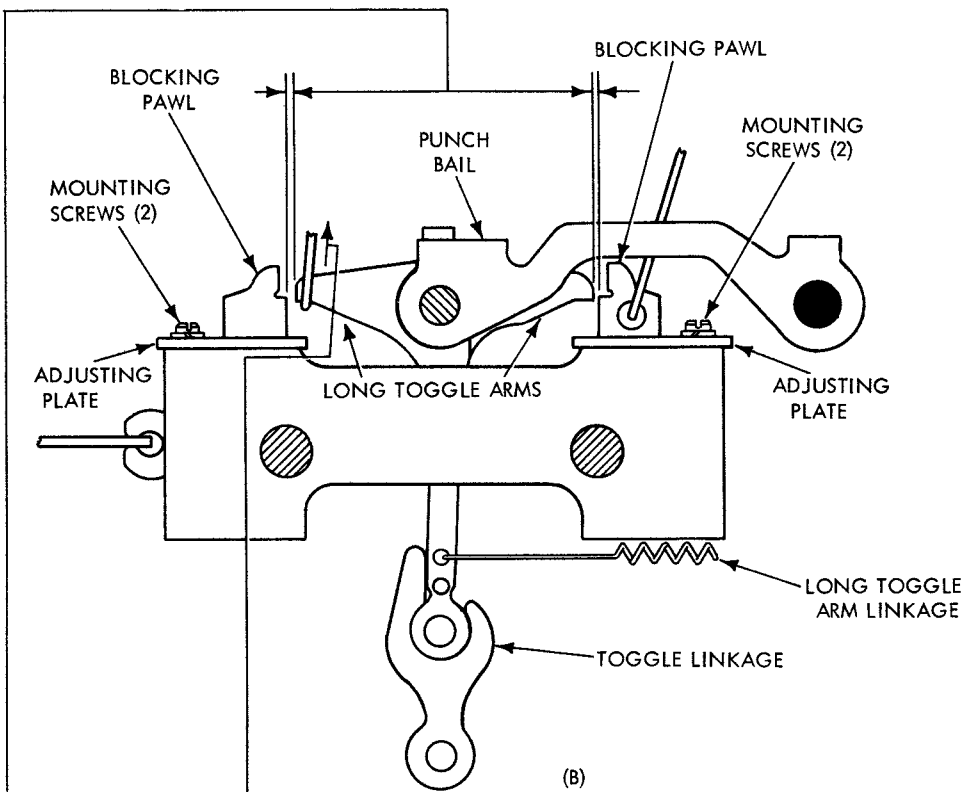

TOGGLE LINKAGE POSITION IN DEGREES WHEN ARMATURE REACHES ATTRACTED POSITION
SELECTION INTERVAL
RANGE SCALE
TIME (T) IN MILLISECONDS (MS) AFTER FIRING AT RANGE 30
5:00
7:00 O'CLOCK POSITION
9:00
11:00
1:00
3:00
5:00
110 OPS (1100 WPM)
88.3 OPS (883 WPM)
78.75 OPS (787.5 WPM)
63.3 OPS (633 WPM)
46.7 OPS (467 WPM)
SYNCHRONIZING PULSE ORIENTATION CHART

Figure 3-2



(B)
LONG TOGGLE ARM SPRINGS

REQUIREMENT (EACH SPRING)
WITH ARMATURE IN ATTRACTED POSITION AND PUNCH BAIL IN LOWEST POSITION:
MIN. 6 OZS. --- MAX. 9 OZS.
TO BUCKLE TOGGLE LINKAGE.

(A)
ADJUSTING PLATE

TO CHECK
HOLD BLOCKING PAWLS AWAY FROM TOGGLE ARMS AGAINST ADJUSTING PLATES. ROTATE MAIN SHAFT UNTIL LONG TOGGLE ARMS ARE BELOW ENGAGING SURFACES OF BLOCKING PAWLS.

REQUIREMENT
MIN. 0.002 INCH --- MAX. 0.008 INCH
BETWEEN LONG TOGGLE ARMS AND THEIR BLOCKING PAWLS.

TO ADJUST
POSITION ADJUSTING PLATES WITH MOUNTING SCREWS LOOSENED.

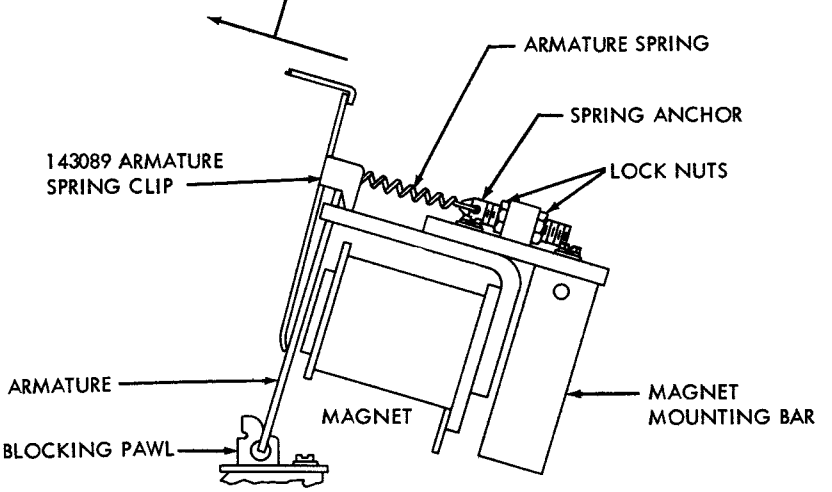
Figure 3-3

ARMATURE SPRING

REQUIREMENT (EACH SPRING)
WITH PUNCH BAIL IN HIGHEST POSITION:
MIN. 4-1/2 OZS. --- MAX. 5-1/2 OZS.
TO START ARMATURE MOVING.

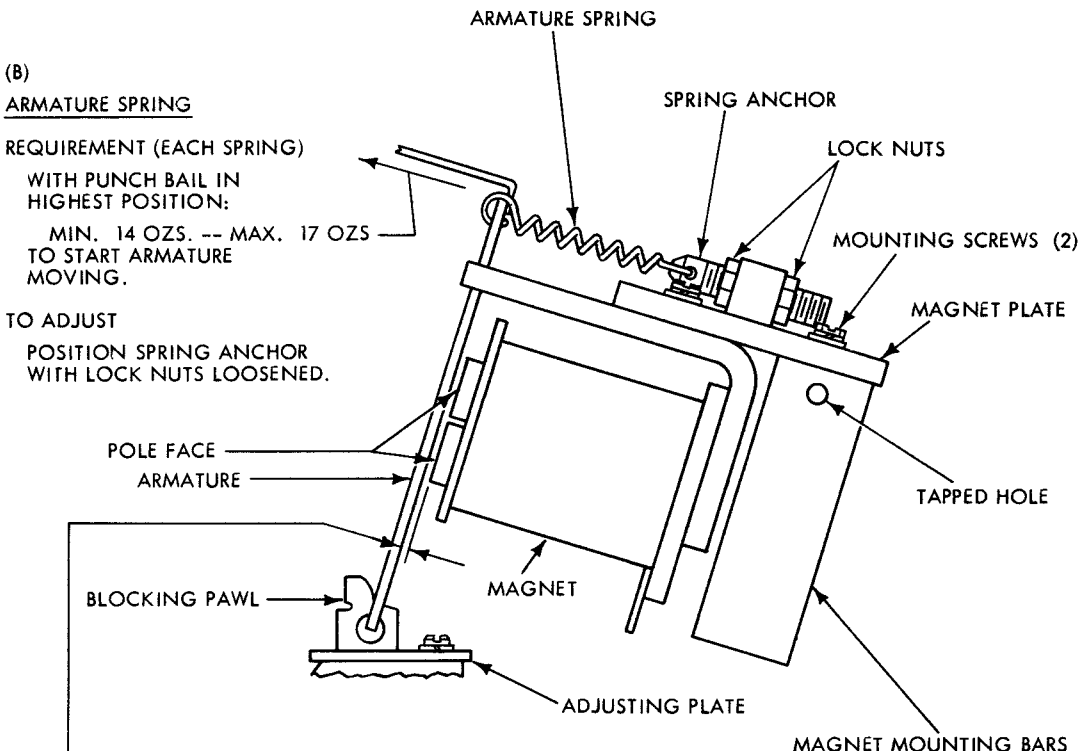
TO CHECK
POSITION A 143089 SPRING CLIP OVER ARMATURE AS SHOWN.

TO ADJUST
POSITION SPRING ANCHOR WITH LOCK NUTS LOOSENED.



NOTE
IF A 143089 ARMATURE SPRING CLIP IS NOT AVAILABLE, USE THE ARMATURE SPRING ADJUSTMENT PROCEDURE OUTLINED IN FIGURE 3-4.

Figure 3-3a



(B)

ARMATURE SPRING

REQUIREMENT (EACH SPRING)

WITH PUNCH BAIL IN HIGHEST POSITION:

MIN. 14 OZS. -- MAX. 17 OZS TO START ARMATURE MOVING.

TO ADJUST

POSITION SPRING ANCHOR WITH LOCK NUTS LOOSENED.

(A)

MAGNET PLATE

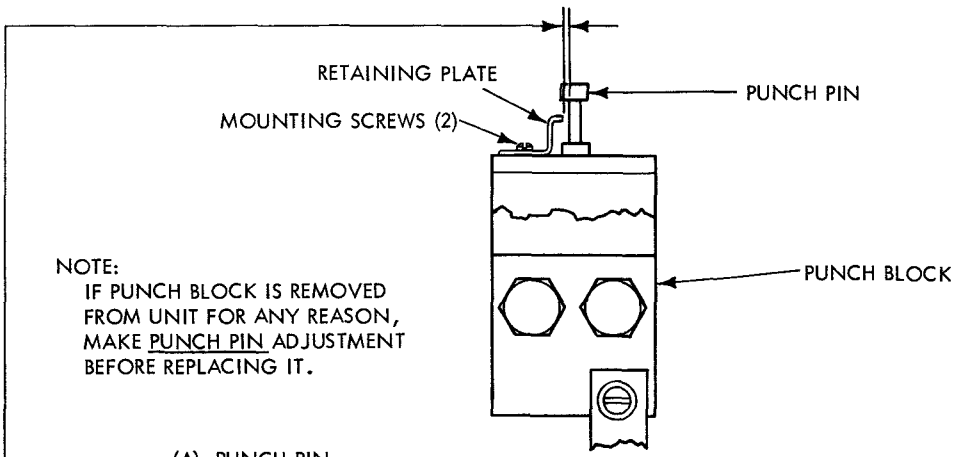
REQUIREMENT (EACH MAGNET)

WITH ARMATURE IN ATTRACTED POSITION (BLOCKING PAWL AWAY FROM TOGGLE ARM AGAINST ADJUSTING PLATE):
MIN. 0.003 INCH --- MAX. 0.006 INCH BETWEEN ARMATURE AND POLE FACE AT POINT WHERE CLEARANCE IS LEAST.

TO ADJUST

MAKE CERTAIN THAT TAPPED HOLES IN MOUNTING BARS MATCH HOLES IN PUNCH UNIT COVER. IF NOT, POSITION BARS BY LOOSENING TWO MOUNTING SCREWS AT REAR. HOLD ARMATURE IN ATTRACTED POSITION AND POSITION MAGNET PLATE WITH MOUNTING SCREWS LOOSENED. RECHECK REQUIREMENT.

Figure 3-4.



NOTE:
IF PUNCH BLOCK IS REMOVED FROM UNIT FOR ANY REASON, MAKE PUNCH PIN ADJUSTMENT BEFORE REPLACING IT.

(A) PUNCH PIN

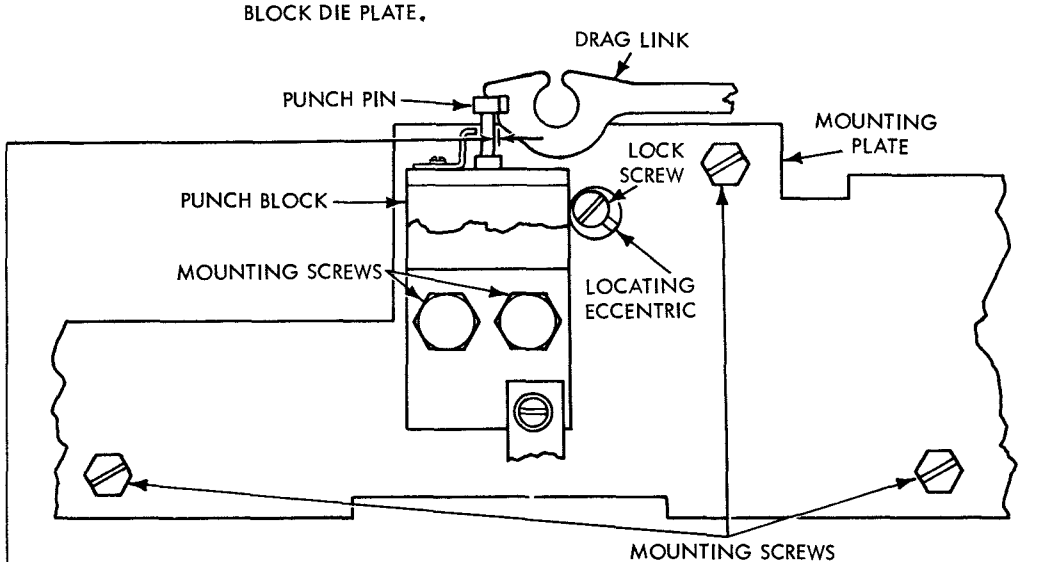
REQUIREMENT

PUNCH PINS SHOULD MOVE FREELY IN PUNCH BLOCK WITH MINIMUM CLEARANCE BETWEEN PUNCH PINS AND RETAINING PLATE.

TO ADJUST

POSITION RETAINING PLATE WITH MOUNTING SCREWS LOOSENED.

CAUTION: DO NOT ATTEMPT TO ADJUST PUNCH BLOCK DIE PLATE.



(B) PUNCH BLOCK

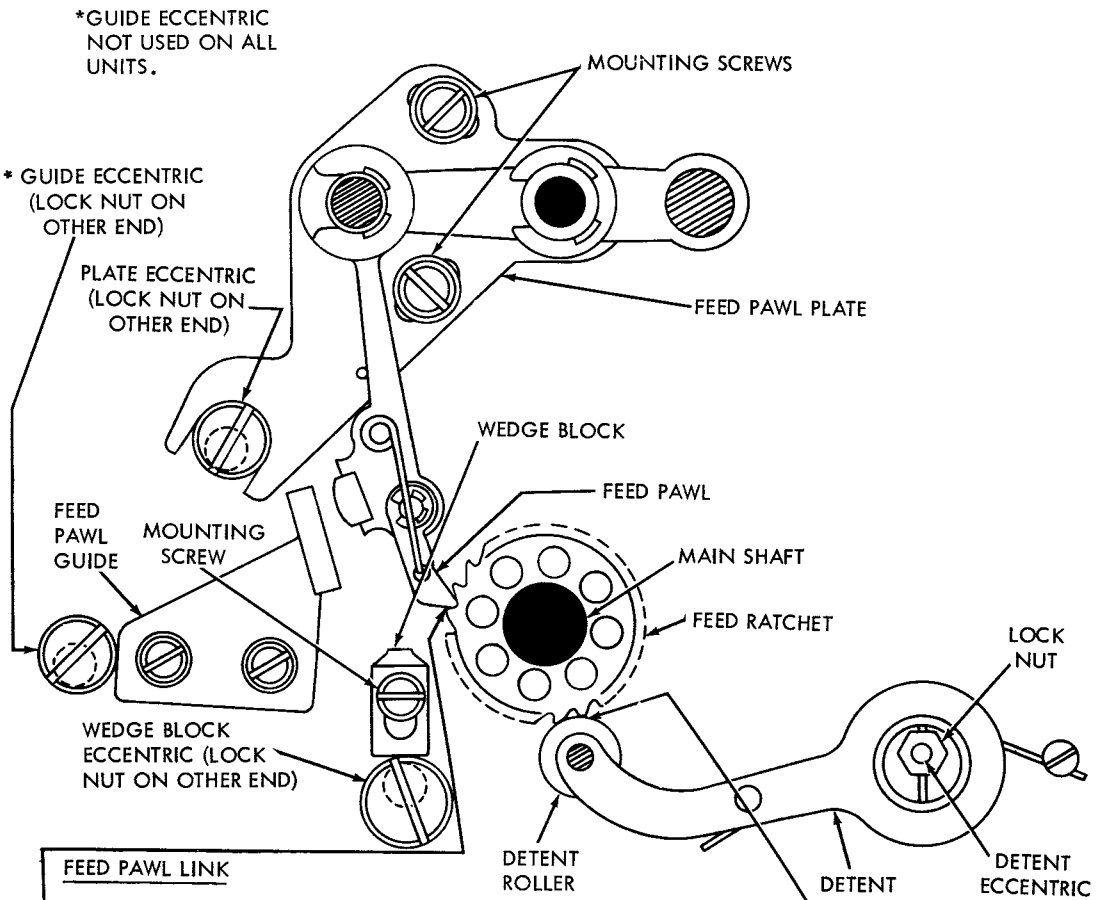
REQUIREMENT

PERCEPTIBLE CLEARANCE (MAX. 0.003 INCH) BETWEEN DRAG LINKS AND PUNCH PINS.

TO ADJUST

POSITION MOUNTING PLATE WITH MOUNTING SCREWS LOOSENED TO REFINE ADJUSTMENT, LOOSEN PUNCH BLOCK MOUNTING SCREWS AND POSITION PUNCH BLOCK LOCATING ECCENTRIC WITH ITS LOCK SCREW LOOSENED. CHECK EACH PIN TO SEE THAT IT IS FREE FROM BINDS.

Figure 3-5



FEED PAWL LINK

TO CHECK

HOLD FEED MAGNET ARMATURE IN ATTRACTED POSITION (FIGURE 3-4). ROTATE MAIN SHAFT THROUGH ONE COMPLETE REVOLUTION.

REQUIREMENT

(1) FEED PAWL SHOULD ADVANCE FEED RATCHET ONE TOOTH WITH NO PERCEPTIBLE UNDER OR OVER TRAVEL.

(2) DETENT ROLLER SHOULD FULLY DETENT FEED RATCHET.

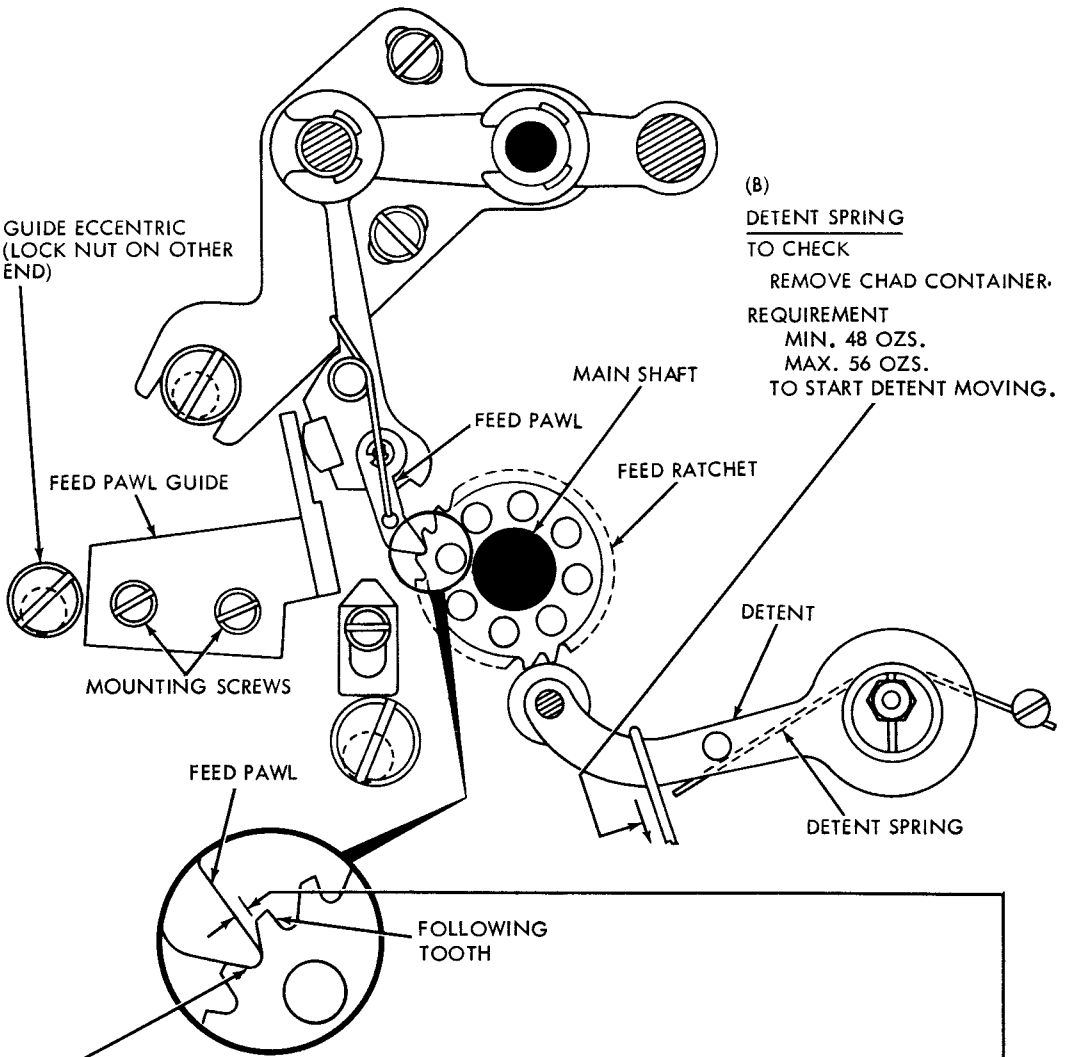
TO ADJUST

(1) LOOSEN WEDGE BLOCK MOUNTING SCREW. LOOSEN WEDGE BLOCK ECCENTRIC LOCK NUT. MOVE BLOCK TO ITS LOWEST POSITION.
(2) LOOSEN FEED PAWL GUIDE MOUNTING SCREWS. LOOSEN GUIDE ECCENTRIC LOCK NUT SO GUIDE IS FREE TO MOVE. (NOT NECESSARY IF NO GUIDE ECCENTRIC IS PRESENT ON UNIT).
(3) LOOSEN DETENT ECCENTRIC LOCK NUT. PLACE DETENT IN LOWEST POSITION. TIGHTEN DETENT LOCK NUT.
(4) LOOSEN FEED PAWL PLATE MOUNTING SCREWS. LOOSEN LOCK NUT ON PLATE ECCENTRIC. POSITION PLATE TO MEET REQUIREMENT BY ROTATING ECCENTRIC. TIGHTEN PLATE ECCENTRIC LOCK NUT AND PLATE MOUNTING SCREWS. RECHECK REQUIREMENTS.

NOTE

IF THIS ADJUSTMENT IS CHANGED, CHECK FEED PAWL GUIDE (FIGURE 3.7) WEDGE BLOCK (FIGURE 3-8), AND FEED RATCHET DETENT (FIGURE 3-10) ADJUSTMENTS.

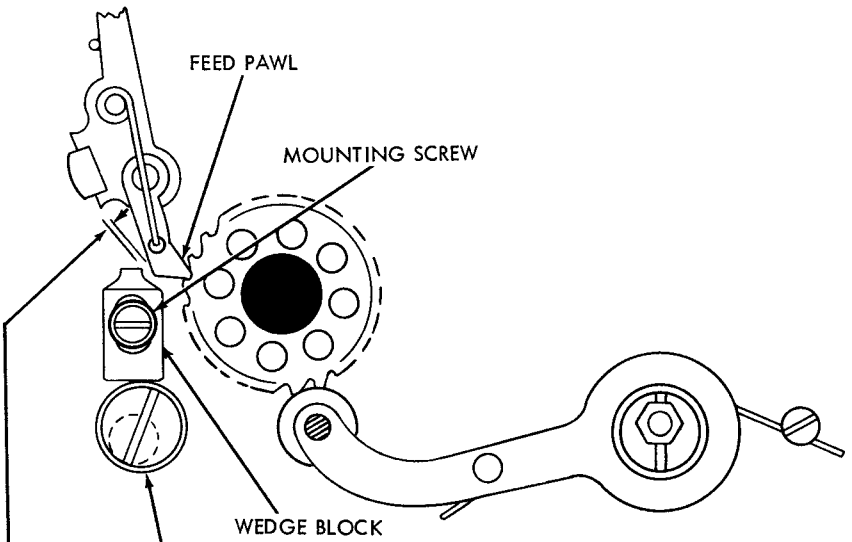
Figure 3-6



NOTE

IF THIS ADJUSTMENT IS CHANGED, CHECK FEED PAWL PLATE (FIGURE 3-6), WEDGE BLOCK (FIGURE 3-8) AND FEED RATCHET DETENT (FIGURE 3-10) ADJUSTMENTS.

Figure 3-7



WEDGE BLOCK

REQUIREMENT

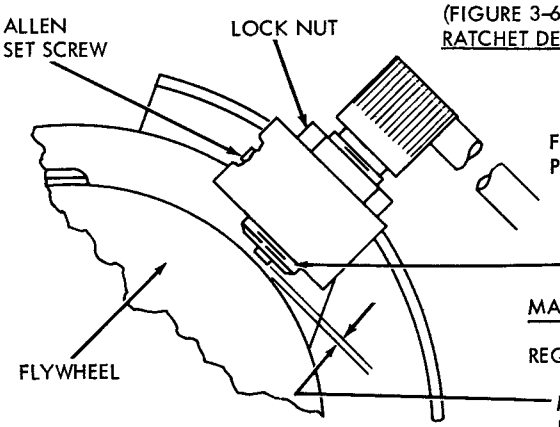
WITH FEED PAWL IN LOWEST POSITION:
MIN. 0.001 INCH --- MAX. 0.003 INCH
BETWEEN WEDGE BLOCK AND FEED PAWL

TO ADJUST

LOOSEN BLOCK MOUNTING SCREW AND ECCENTRIC LOCK NUT. POSITION WEDGE BLOCK BY MEANS OF ECCENTRIC. TIGHTEN MOUNTING SCREW AND LOCK NUT AND RECHECK REQUIREMENT.

NOTE

IF THIS ADJUSTMENT IS CHANGED, CHECK FEED PAWL LINK (FIGURE 3-6), FEED PAWL GUIDE (FIGURE 3-7, AND FEED RATCHET DETENT (FIGURE 3-10) ADJUSTMENTS.



NOTE

FOLLOWING ADJUSTMENT APPLIES ONLY TO PUNCH UNITS USED IN SELF-CONTAINED SETS.

MAGNETIC PICK-UP

REQUIREMENT

MIN. 0.005 INCH --- MAX. 0.010 INCH
BETWEEN FLYWHEEL AND MAGNETIC
PICK-UP WHERE CLEARANCE IS LEAST.

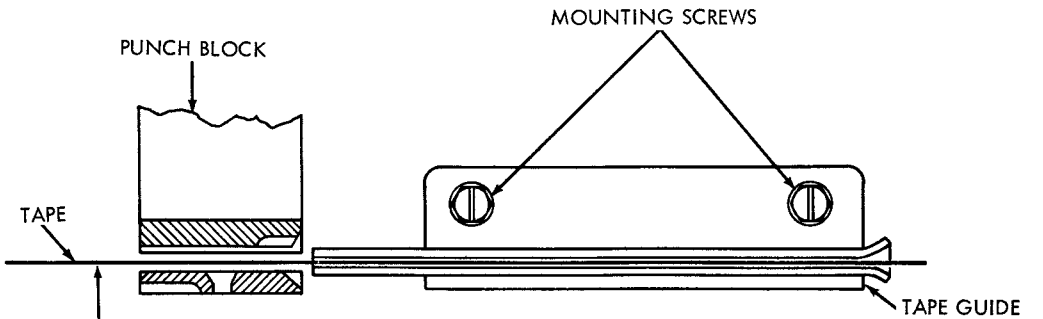
TO ADJUST

POSITION MAGNETIC PICK-UP WITH
LOCK NUT AND SET SCREW LOOSENED.

NOTE

FOR RANGE ADJUSTMENT SEE FIGURE 3-12.

Figure 3-8



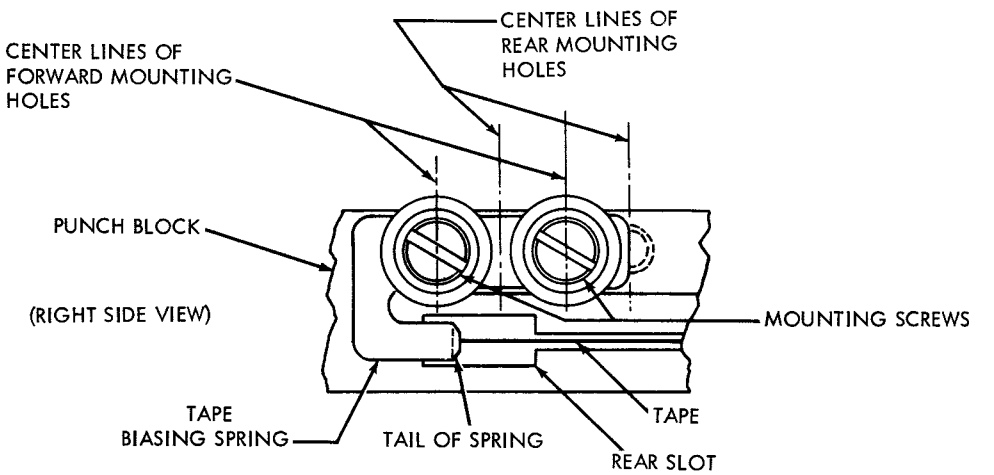
TAPE GUIDE

REQUIREMENT

WITH PUNCH BAIL IN HIGHEST POSITION, TAPE SHOULD PASS FREELY FROM TAPE GUIDE THROUGH PUNCH BLOCK.

TO ADJUST

POSITION TAPE GUIDE WITH MOUNTING SCREWS FRICTION TIGHT.



TAPE BIASING SPRING

ALL 6- TO 8-LEVEL PUNCHES ARE ADJUSTED AT FACTORY FOR 1-INCH WIDTH TAPE. IF 7/8 INCH TAPE (6- OR 7-LEVEL) IS TO BE USED, REMOVE BIASING SPRING BY REMOVING ITS MOUNTING SCREWS. INSERT TAIL OF SPRING IN REAR SLOT OF PUNCH BLOCK. INSERT SCREWS IN REAR MOUNTING HOLES AND MAKE FRICTION TIGHT.

REQUIREMENT

TAPE BIASING SPRING SHOULD HOLD TAPE AGAINST REAR OF PUNCH BLOCK WITHOUT CRIMPING OR CURLING FRONT EDGE.

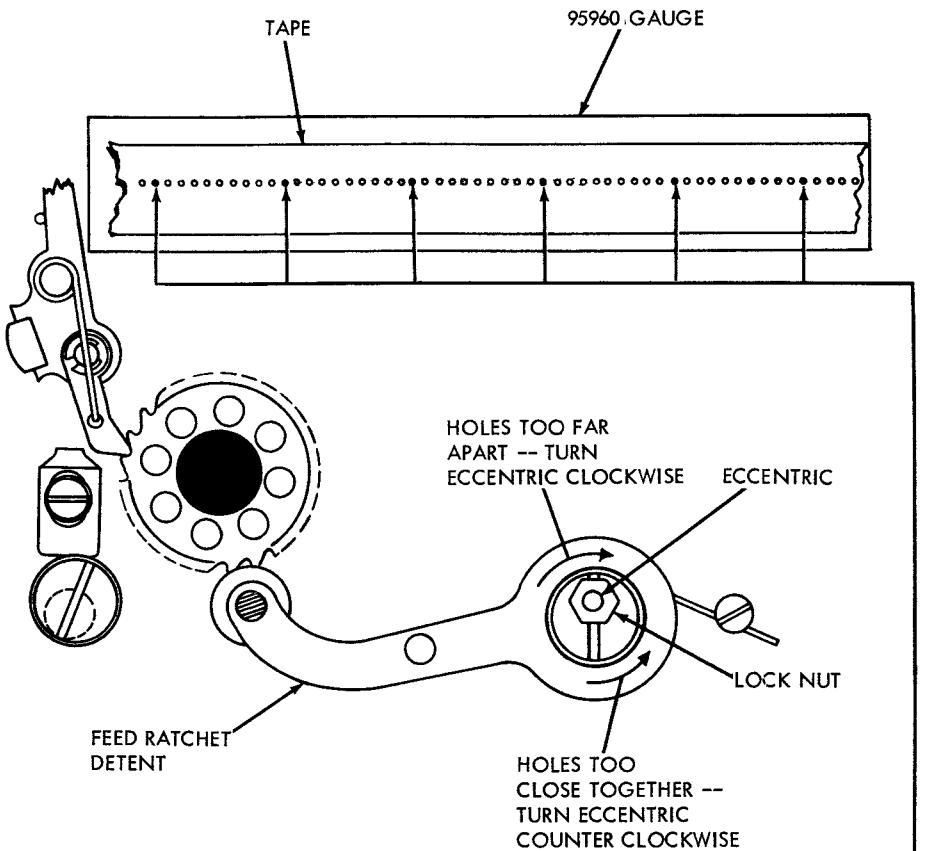
TO ADJUST

POSITION SPRING WITH MOUNTING SCREWS FRICTION TIGHT.

TO CHECK

PERFORATE A THREE OR FOUR FOOT SAMPLE OF TAPE, WITH ALL CODE LEVELS MARKING. HOLD ONE END OF THE TAPE SAMPLE AT EYE LEVEL, AND SIGHT DOWN THE TAPE. THERE SHOULD BE NO WAVERING IN THE ALIGNMENT OF THE PERFORATIONS WITH RESPECT TO THE TAPE EDGE. MAKE THIS CHECK AFTER DRAG LINK ADJUSTMENT (FIGURE 3-11) HAS BEEN COMPLETED.

Figure 3-9



FEED RATCHET DETENT

TO CHECK

WITH PUNCH UNIT UNDER POWER, FEED OUT A SHORT LENGTH OF BLANK TAPE. PLACE TAPE ON 95960 TAPE GAUGE.

REQUIREMENT

SPACING OF FEED HOLES SHOULD BE 10 TO INCH; I.E., EVERY TENTH FEED HOLE SHOULD CONFORM TO A HOLE IN GAUGE.

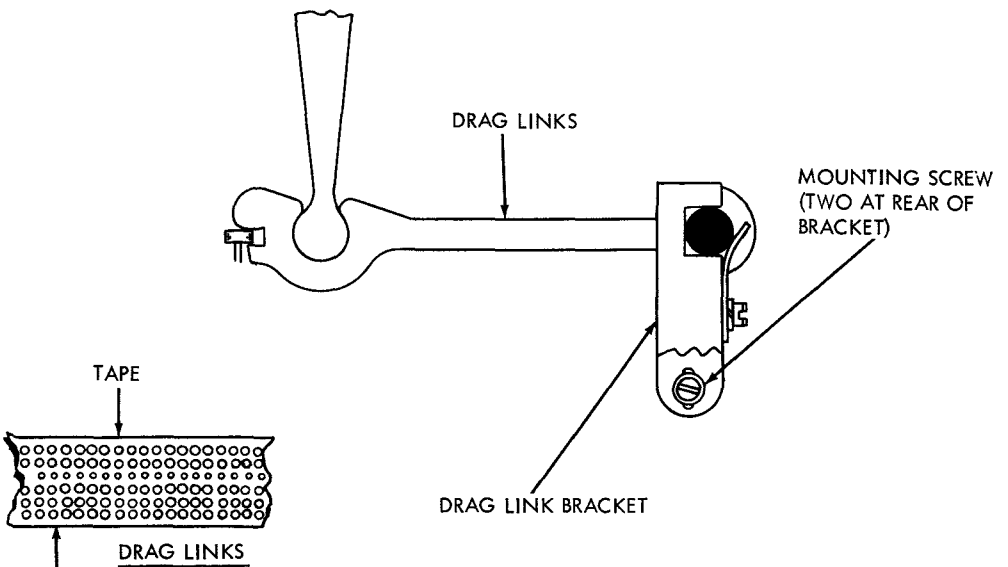
TO ADJUST

BY MEANS OF ITS ECCENTRIC, POSITION DETENT WITH LOCK NUT LOOSENED.

NOTE

IF THIS ADJUSTMENT CHANGES, CHECK FEED PAWL LINK (FIGURE 3-6), FEED PAWL GUIDE (FIGURE 3-7) AND WEDGE BLOCK (FIGURE 3-8) ADJUSTMENTS.

Figure 3-10



DRAG LINKS

(1) TO CHECK
PLACE THE PUNCH UNIT IN IDLE RUNNING CONDITION, AND INSERT TWO THICKNESSES OF TAPE IN THE PUNCH BLOCK

REQUIREMENT
AFTER TEN MINUTES IDLE RUNNING TIME, THERE SHOULD BE NO PUNCH PIN IMPRESSION ON THE UPPER SURFACE OF THE TOP THICKNESS OF TAPE.

(2) TO CHECK
PLACE ONE THICKNESS OF TAPE IN THE PUNCH BLOCK. WITH PUNCH UNIT UNDER POWER, PERFORATE A SERIES OF MARKING (HOLES) CODE COMBINATIONS.

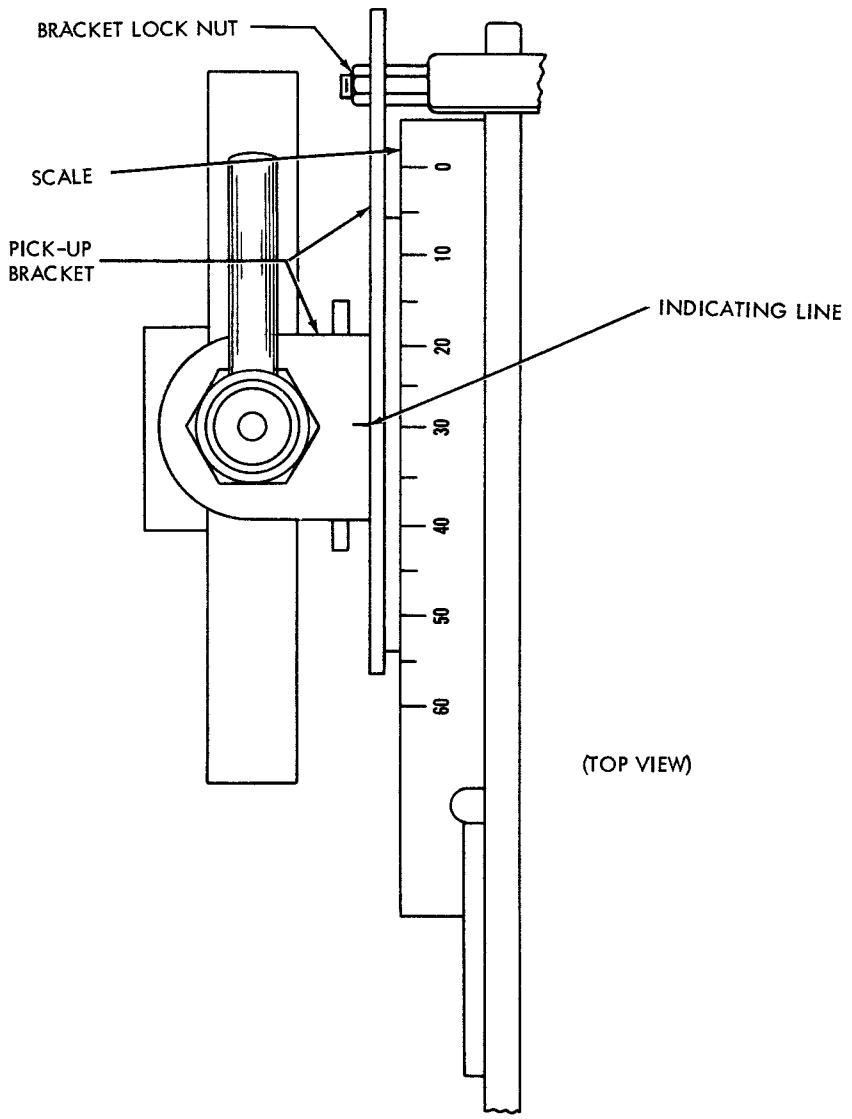
REQUIREMENT
EDGES OF ALL HOLES SHOULD BE CLEAN CUT.

TO ADJUST
START WITH DRAG LINK BRACKET IN CENTER OF ITS ADJUSTMENT RANGE. IF TOP THICKNESS OF TAPE (SEE (1) ABOVE) SHOWS PUNCH PIN IMPRESSIONS, MOVE BRACKET DOWN. IF PUNCHED HOLES IN SINGLE TAPE THICKNESS (SEE (2) ABOVE) SHOW BURRS, MOVE BRACKET UP.

NOTE

IN SOME CASES, PUNCH PINS MAY CONTINUE TO MAKE IMPRESSIONS IN TOP THICKNESS OF TAPE WHEN DRAG LINK BRACKET IS IN ITS LOWERMOST POSITION. TO CORRECT, LOOSEN PUNCH BLOCK MOUNTING SCREWS AND PUSH PUNCH BLOCK DOWN. REMAKE DRAG LINK ADJUSTMENT. IN EXTREME CASES, IT MAY BE NECESSARY TO MOVE THE MOUNTING PLATE (SEE FIGURE 3-5) DOWN. AFTER MOVING MOUNTING PLATE, RECHECK THE FOLLOWING ADJUSTMENTS: PUNCH BLOCK (FIGURE 3-5), FEED PAWL LINK (FIGURE 3-6), WEDGE BLOCK (FIGURE 3-8), TAPE GUIDE (FIGURE 3-9) AND FEED RATCHET DETENT (FIGURE 3-10).

Figure 3-11



RANGE

TO CHECK

OPERATE PUNCH FROM CONTROL CIRCUITS, USING RECEIVING TEST TAPE XT 3380 OR EQUIVALENT. LOOSEN BRACKET LOCK NUT. TO DETERMINE OPERATING RANGE, ROTATE PICK-UP BRACKET IN ONE DIRECTION AND RECORD NUMBER ON SCALE OPPOSITE INDICATING LINE WHEN ERRORS BEGIN TO OCCUR. ROTATE BRACKET IN OTHER DIRECTION AND RECORD NUMBER WHERE ERRORS OCCUR.

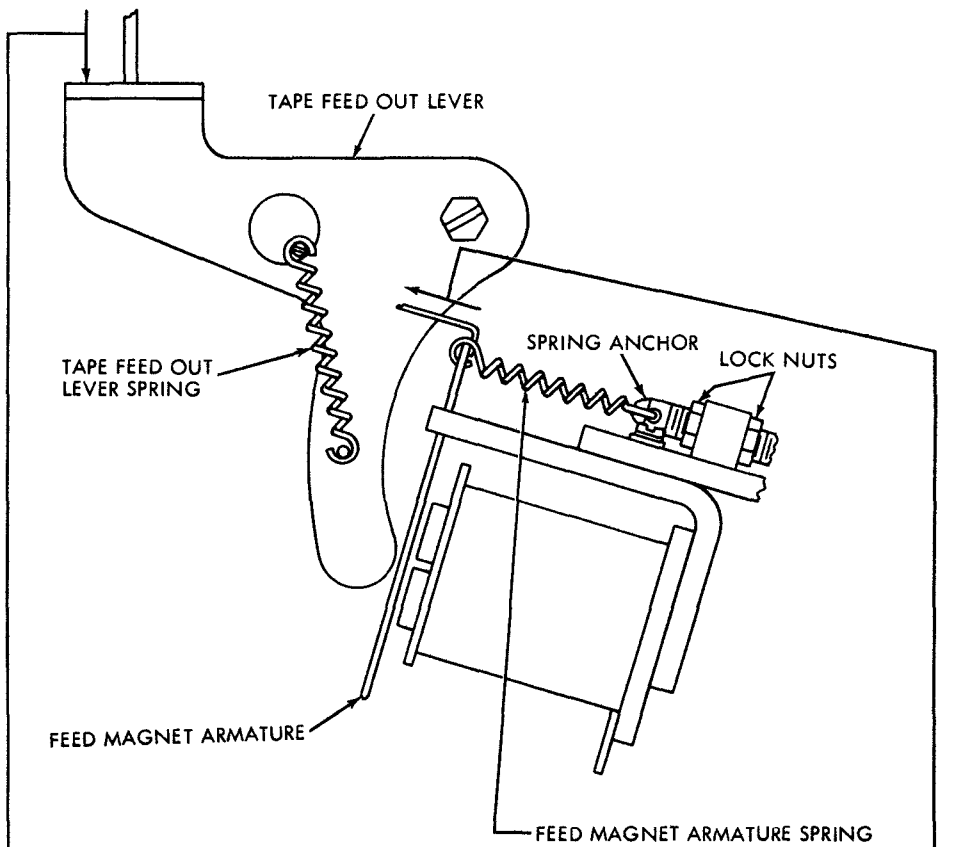
REQUIREMENT

MAGNETIC PICK-UP AT CENTER OF OPERATING RANGE.

TO ADJUST

POSITION BRACKET SO INDICATING LINE IS OPPOSITE NUMBER ON SCALE AT CENTER OF OPERATING RANGE.

Figure 3-12



(A)

TAPE FEED OUT LEVER SPRING

REQUIREMENT

MIN. 4 OZS.---MAX. 6 OZS.
TO START FEED OUT LEVER MOVING.

(B)

FEED MAGNET ARMATURE SPRING

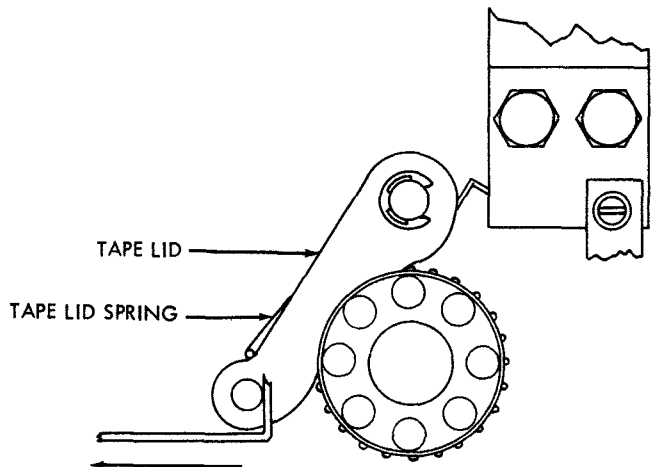
REQUIREMENT

WITH FEED DRIVE LEVER IN HIGHEST POSITION:
MIN. 14 OZS. --- MAX. 17 OZS. TO
START ARMATURE MOVING.

TO ADJUST

POSITION SPRING ANCHOR WITH
LOCK NUTS LOOSENED

Figure 3-13



(A)
TAPE LID SPRING

REQUIREMENT

MIN. 2-1/2 OZS. --- MAX. 3 OZS.
TO START LID MOVING.

(B)
FEED PAWL SPRING

REQUIREMENT

WITH FEED OUT LEVER
DEPRESSED AND FEED PAWL
IN ITS HIGHEST POSITION:
MIN. 3 OZS. --- MAX. 5 OZS.
TO START PAWL MOVING.

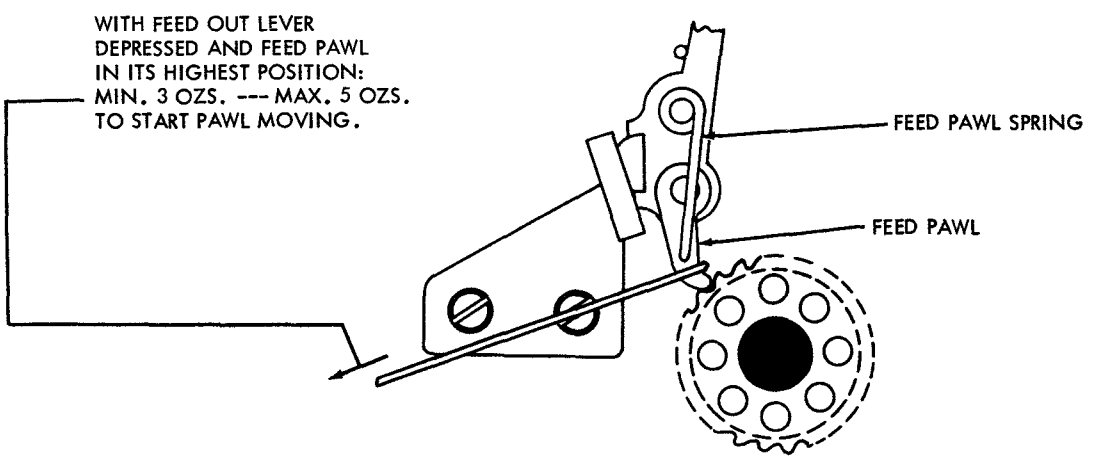
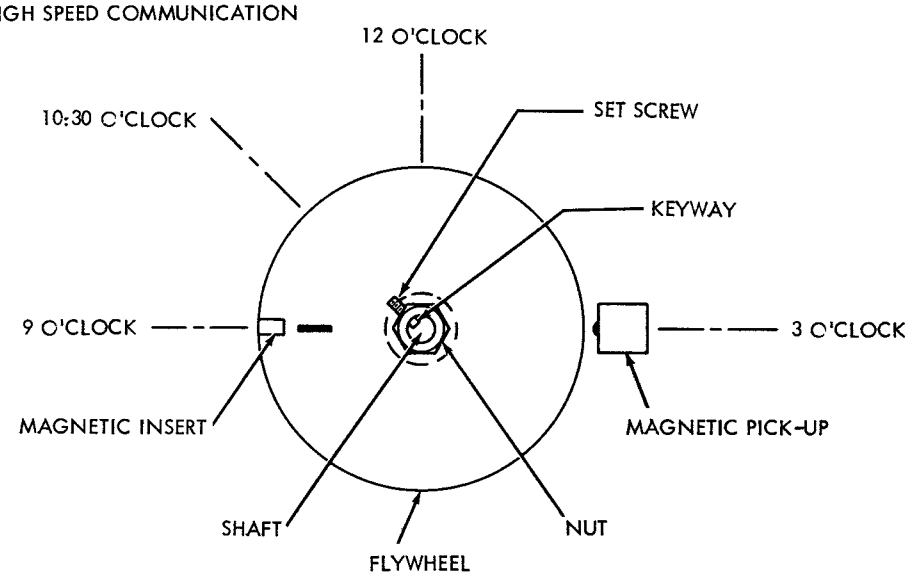


Figure 3-14

NOTE

FOLLOWING ADJUSTMENTS (FIGURES 3-14a AND 3-14b) APPLY ONLY TO PUNCH UNITS USED IN HIGH SPEED COMMUNICATION SETS.



SYNCHRONIZING PULSE ORIENTATION

(1) FLYWHEEL POSITION

WHEN VIEWED FROM REAR OF UNIT, FLYWHEEL SHOULD BE POSITIONED SO MAGNETIC INSERT IS AT 9 O'CLOCK POSITION WHEN MAIN SHAFT KEYWAY (AND SET SCREW) IS AT 10:30 O'CLOCK POSITION.

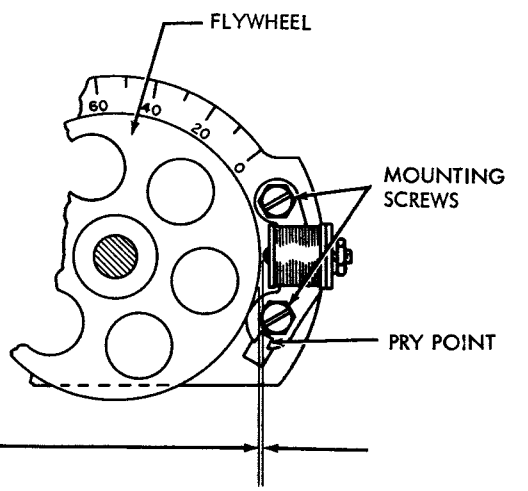
(2) MAGNETIC PICKUP AIR-GAP

REQUIREMENT

MIN. 0.005 INCH --- MAX. 0.015 INCH CLEARANCE BETWEEN FLYWHEEL AND MAGNETIC PICKUP. MEASURE AT POINT OF LEAST CLEARANCE.

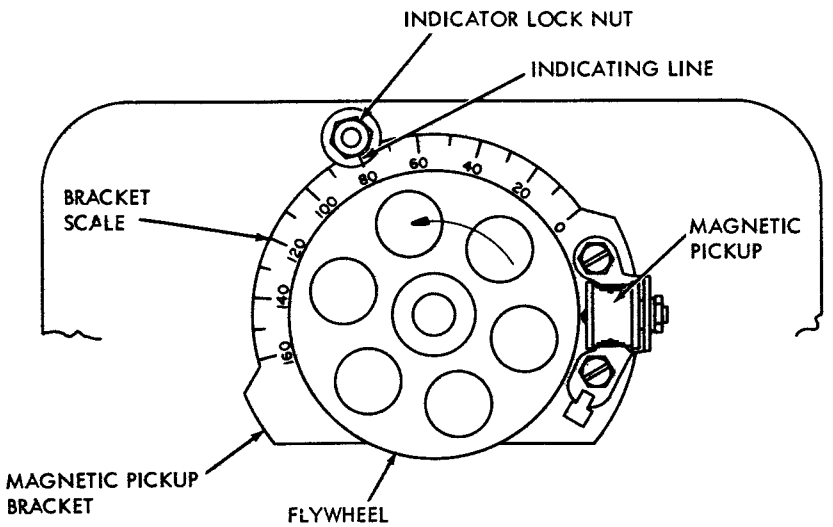
TO ADJUST

LOOSEN MAGNETIC PICK-UP BRACKET MOUNTING SCREWS FRICTION TIGHT. POSITION BRACKET BY MEANS OF PRY POINT TO MEET REQUIREMENT.



(REAR VIEW)

Figure 3-14a



(3) RANGE

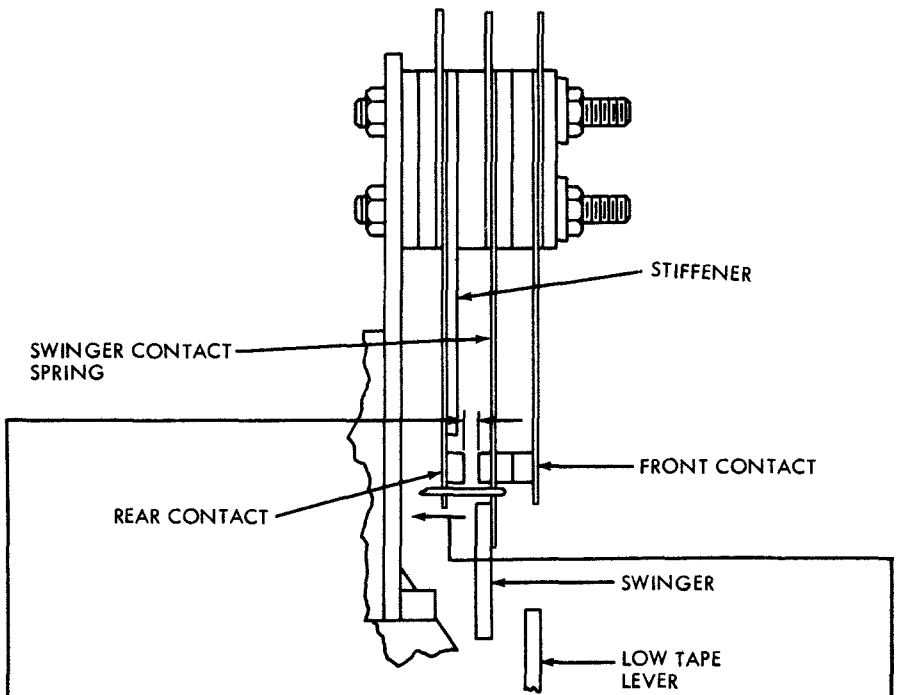
TO CHECK
OPERATE PUNCH FROM CONTROL CIRCUITS. LOOSEN INDICATOR LOCK NUT. TO DETERMINE OPERATING RANGE, ROTATE PICK-UP BRACKET IN ONE DIRECTION AND RECORD NUMBER ON SCALE OPPOSITE INDICATING LINE WHEN ERRORS BEGIN TO OCCUR; ROTATE BRACKET IN OPPOSITE DIRECTION AND RECORD NUMBER WHERE ERRORS OCCUR.

REQUIREMENT
MAGNETIC PICKUP AT CENTER OF OPERATING RANGE.

TO ADJUST
POSITION BRACKET SO THAT INDICATING LINE IS OPPOSITE NUMBER ON SCALE AT CENTER OF OPERATING RANGE.

Figure 3-14b

b. BASE



(LEFT SIDE VIEW)

LOW TAPE CONTACTS

REQUIREMENTS

WITH LOW-TAPE LEVER HELD AWAY FROM SWINGER:

(1) MIN. 0.025 INCH --- MAX. 0.035 INCH GAP AT REAR CONTACT.

(2) MIN. 4 OZS. --- MAX. 5 OZS. TO OPEN FRONT CONTACT.

TO ADJUST

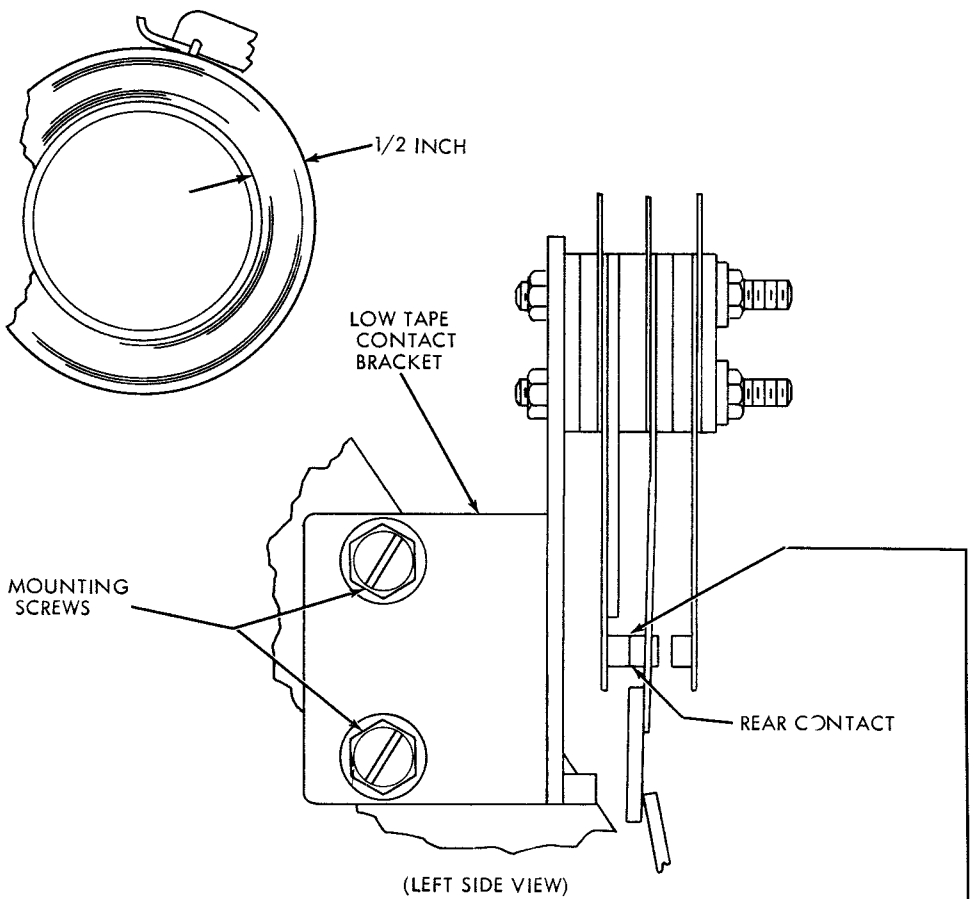
REMOVE TRANSPARENT COVER BY REMOVING ITS MOUNTING NUTS.

(1) BEND STIFFENER TO MEET (1) ABOVE.

(2) BEND SWINGER CONTACT SPRING TO MEET (2) ABOVE.

REPLACE COVER.

Figure 3-15.



LOW TAPE CONTACT BRACKET

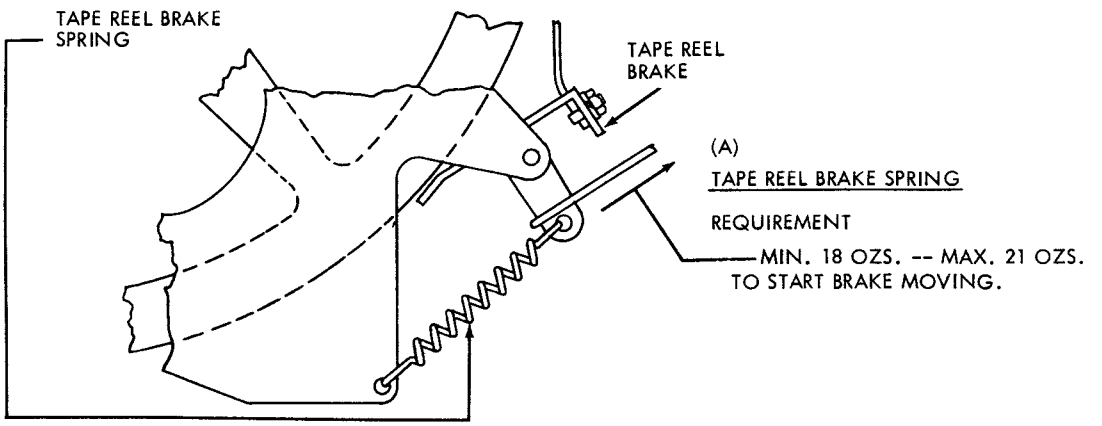
REQUIREMENT

WHEN THERE IS 1/2 INCH OF TAPE LEFT ON ROLL, REAR CONTACT SHOULD BE JUST CLOSED.

TO ADJUST

POSITION CONTACT BRACKET WITH MOUNTING SCREWS FRICTION TIGHT.

Figure 3-16


TAPE REEL BRAKE SPRING
TAPE REEL BRAKE
(A)
TAPE REEL BRAKE SPRING
REQUIREMENT
MIN. 18 OZS. -- MAX. 21 OZS.
TO START BRAKE MOVING.

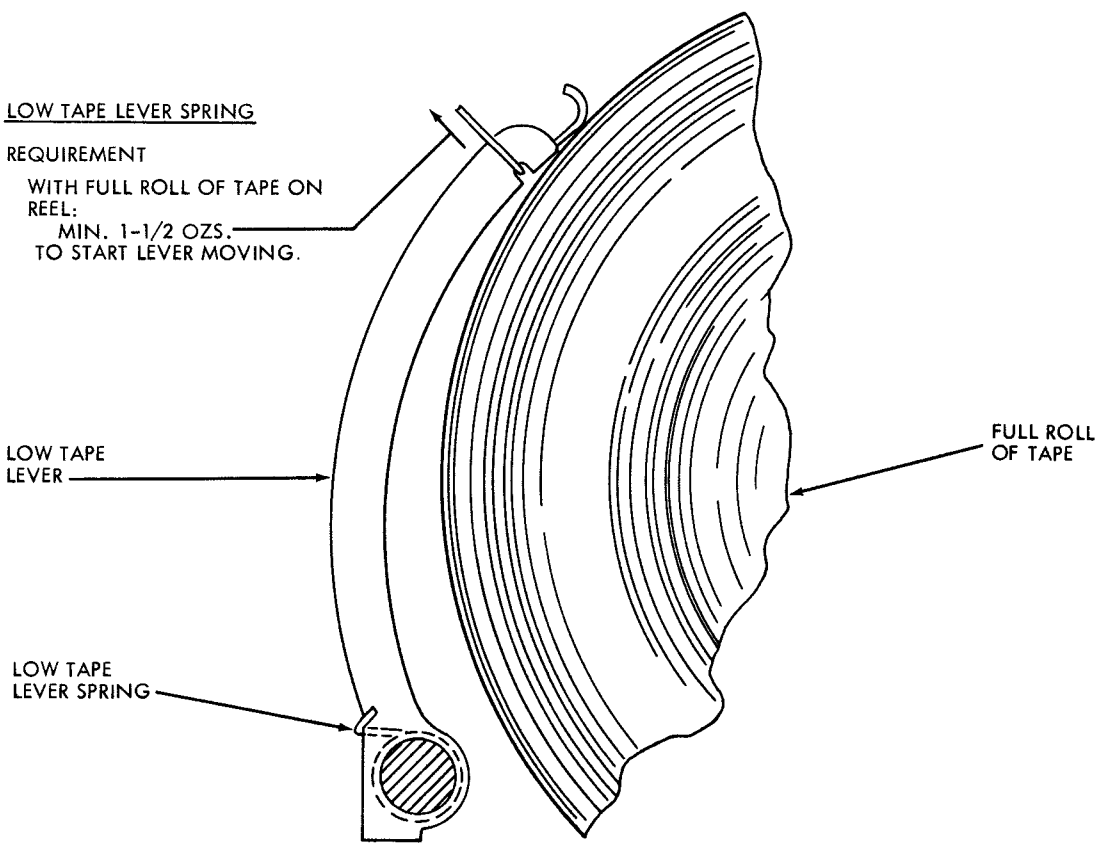

LOW TAPE LEVER SPRING
REQUIREMENT
WITH FULL ROLL OF TAPE ON REEL:
MIN. 1-1/2 OZS.
TO START LEVER MOVING.
LOW TAPE LEVER
LOW TAPE LEVER SPRING
FULL ROLL OF TAPE

Figure 3-17

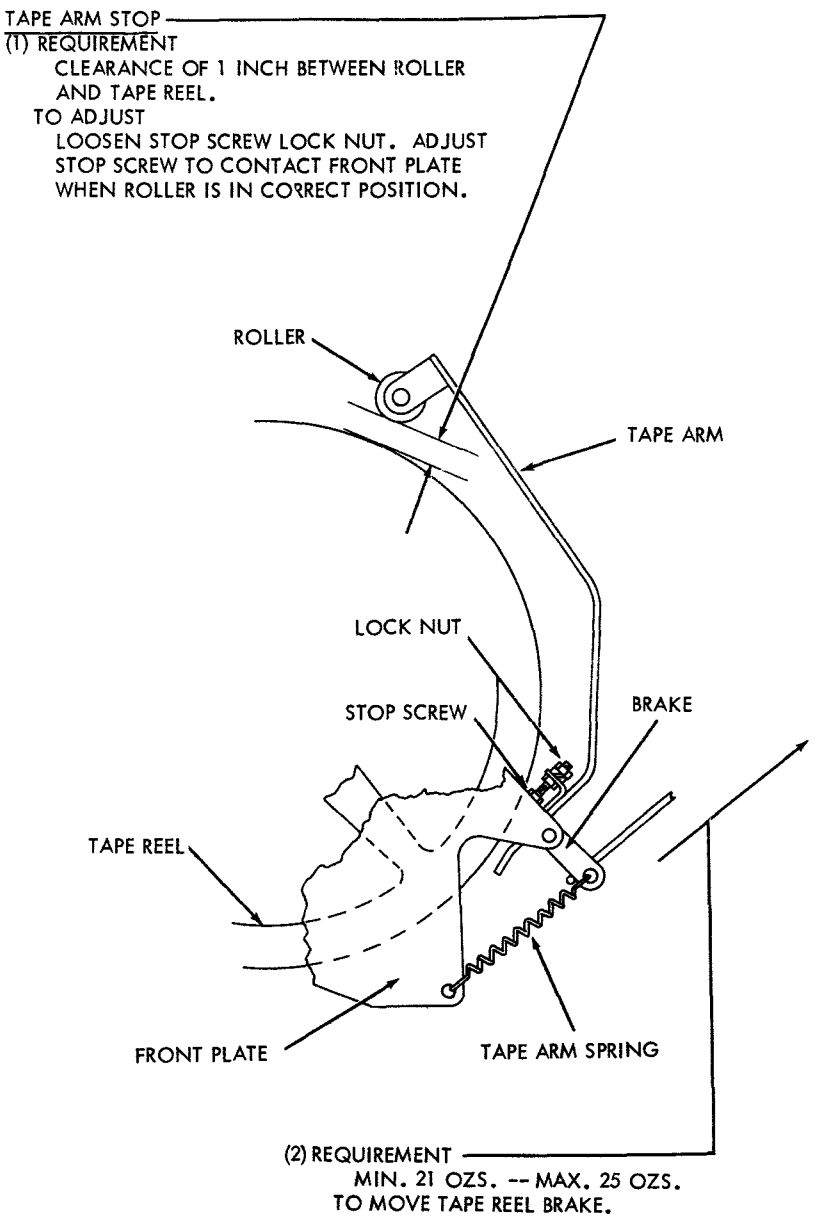
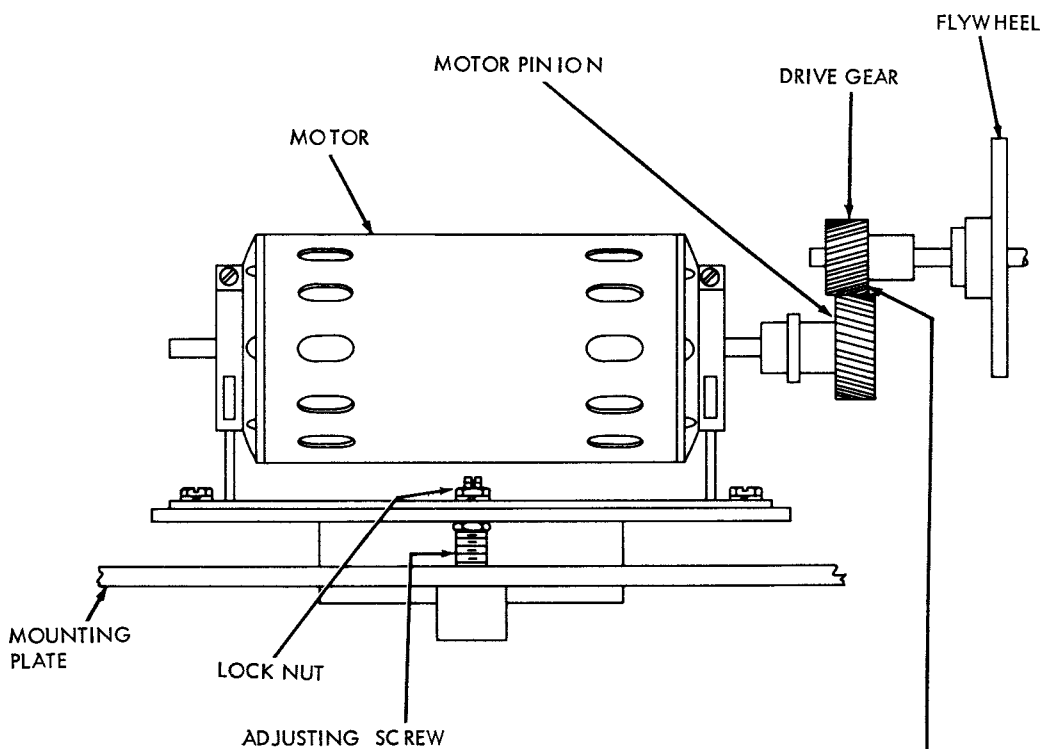

TAPE ARM STOP
(1) REQUIREMENT
CLEARANCE OF 1 INCH BETWEEN ROLLER AND TAPE REEL.
TO ADJUST
LOOSEN STOP SCREW LOCK NUT. ADJUST STOP SCREW TO CONTACT FRONT PLATE WHEN ROLLER IS IN CORRECT POSITION.
ROLLER
TAPE ARM
LOCK NUT
STOP SCREW
BRAKE
TAPE REEL
FRONT PLATE
TAPE ARM SPRING
(2) REQUIREMENT
MIN. 21 OZS. -- MAX. 25 OZS.
TO MOVE TAPE REEL BRAKE.

Figure 3-17a

c. MOTOR-MOUNTING AND DRIVE PARTS

NOTE

FOLLOWING ADJUSTMENT APPLIES ONLY TO HIGH SPEED COMMUNICATION SETS.



MOTOR PINION AND DRIVE GEAR MESH

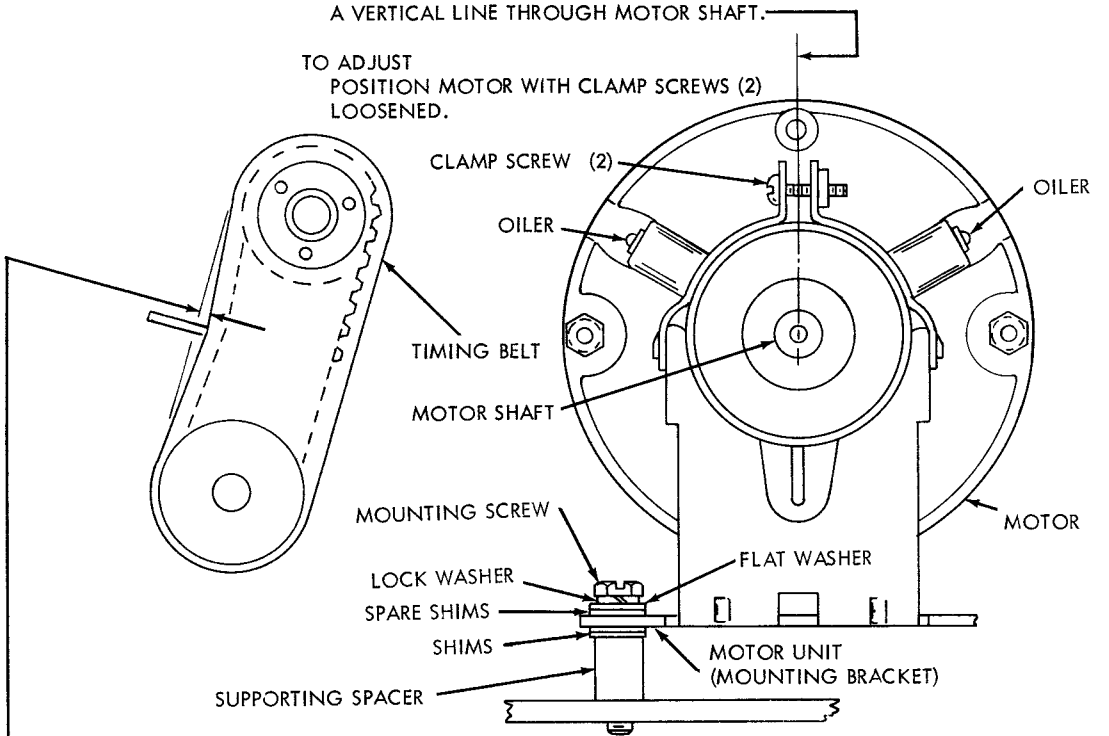
REQUIREMENT
BARELY PERCEPTIBLE AMOUNT OF BACKLASH AT POINT OF MINIMUM CLEARANCE.

TO ADJUST
WITH ADJUSTING SCREW LOCK NUT LOOSENED, ROTATE ADJUSTING SCREW TO MEET REQUIREMENT.

Figure 3-17b

MOTOR
REQUIREMENT
OILERS SHOULD BE UPWARD AND APPROXIMATELY EQUIDISTANT FROM A VERTICAL LINE THROUGH MOTOR SHAFT.

TO ADJUST
POSITION MOTOR WITH CLAMP SCREWS (2) LOOSENED.



CAUTION:
IF MOTOR BECOMES BLOCKED FOR SEVERAL SECONDS, THERMAL CUT-OUT SWITCH WILL BREAK CIRCUIT. SHOULD THIS HAPPEN, ALLOW MOTOR TO COOL AT LEAST 5 MINUTES BEFORE DEPRESSING RED RESET BUTTON.

TIMING BELT
REQUIREMENT
ONE POUND PRESSURE AT CENTER OF TIMING BELT SPAN SHOULD DEFLECT BELT APPROXIMATELY
1/16 INCH FOR 110 OPS OPERATION
3/16 INCH FOR 63.3 OPS OPERATION

TO ADJUST
REMOVE FOUR MOTOR MOUNTING SCREWS WITH LOCK WASHERS, FLAT WASHERS AND SPARE SHIMS. LIFT MOTOR UNIT FROM SUPPORTING SPACERS. ADD SHIMS TO, OR REMOVE THEM FROM SUPPORTING SPACERS. REPLACE MOTOR UNIT. REPLACE MOUNTING SCREWS WITH THEIR HARDWARE *AND MAKE FRICTION TIGHT. REFINE ADJUSTMENT BY SHIFTING MOTOR HORIXONTALLY. TIGHTEN MOUNTING SCREWS AND RECHECK REQUIREMENT.

*RETAIN SPARE SHIMS BY PLACING THEM ON MOUNTING SCREWS ABOVE MOUNTING BRACKET AS SHOWN IN DRAWING.

Figure 3-18

3-5. EARLY DESIGN

CHECK FOR BINDS BY ROTATING MAIN SHAFT AS INSTRUCTED IN PAR. 3-1.f.

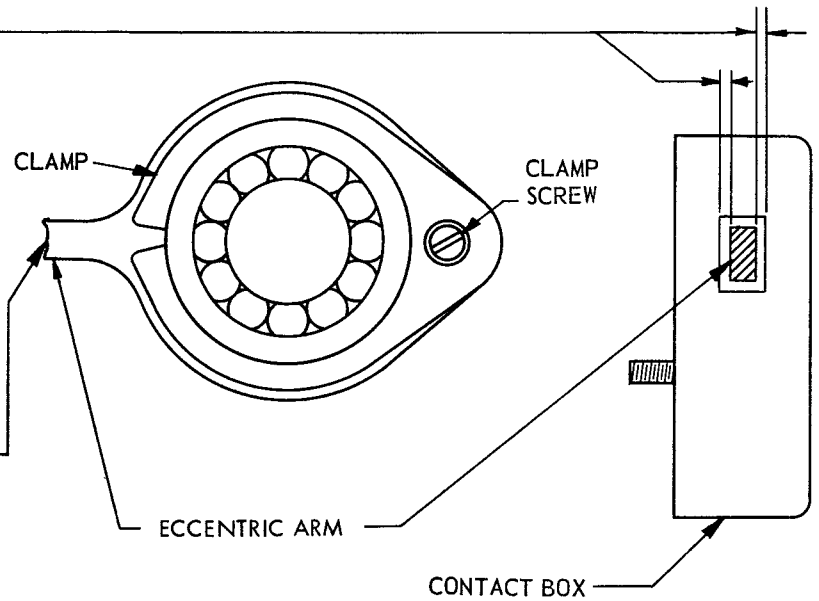
(A) ECCENTRIC ARMS

REQUIREMENT

SOME CLEARANCE BETWEEN SIDES OF ECCENTRIC ARMS AND CONTACT BOX OPENINGS

ADJUST

EACH ECCENTRIC ARM ON OUTER BEARING RACE WITH CLAMP SCREW LOOSENED.



(B) PUNCH BAIL ECCENTRIC STUD

REQUIREMENT

HOLD ARMATURES OPERATED (MARKING), BLOCKING PAWL AGAINST STOP PLATE. ROTATE THE MAIN SHAFT UNTIL THE ENGAGING SURFACES OF LONG TOGGLE ARMS ARE BELOW ENGAGING SURFACES OF THE BLOCKING PAWLS. CLEARANCE BETWEEN END OF LONG TOGGLE ARMS AND BLOCKING PAWLS MIN. .003 INCH MAX. .015 INCH.

ADJUST PUNCH BAIL ECCENTRIC STUD WITH ITS LOCK NUT LOOSENED.

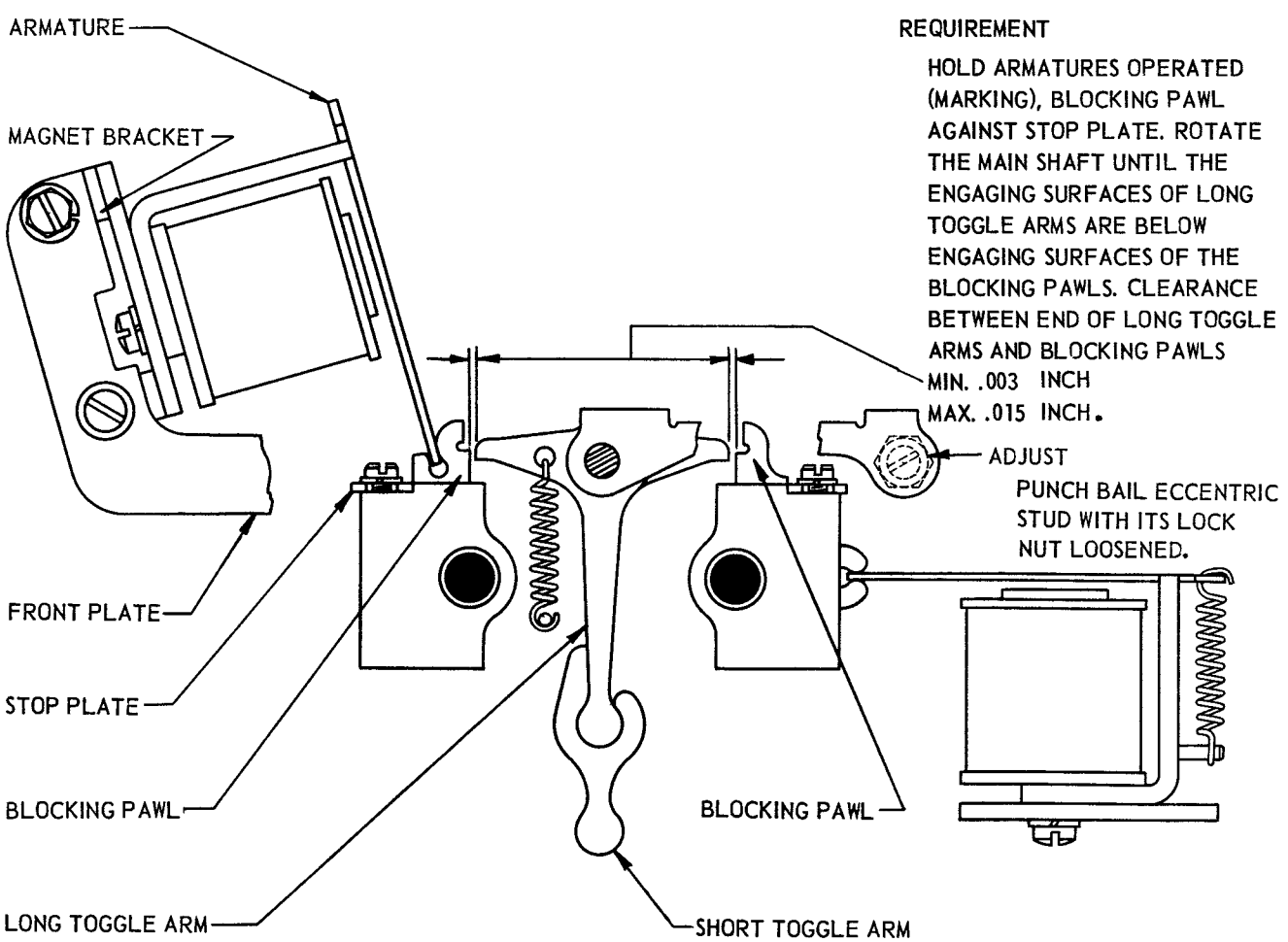


Figure 3-19

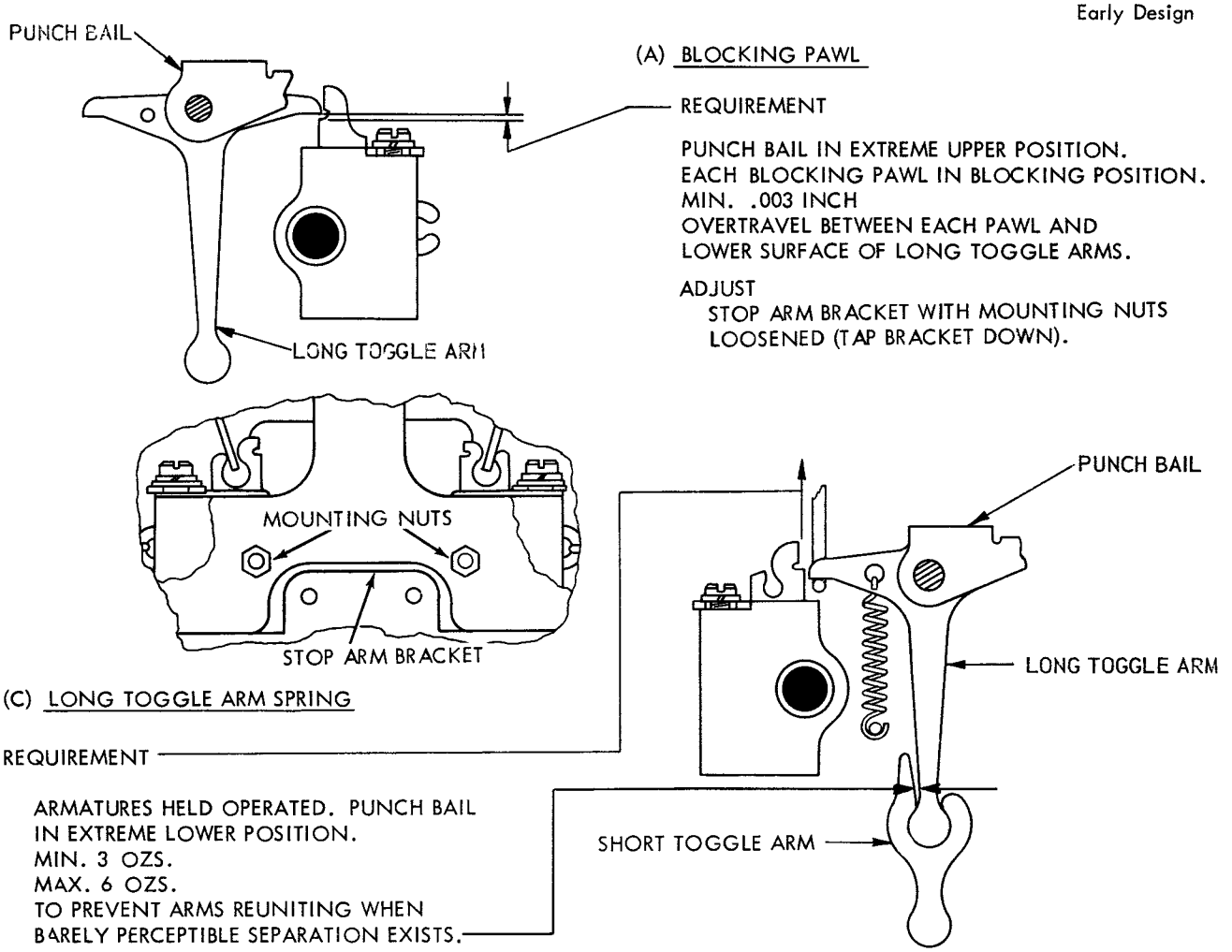
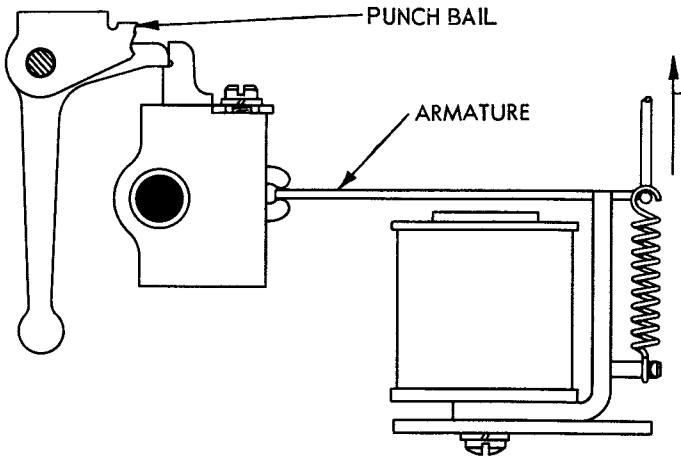

PUNCH BAIL
(A) BLOCKING PAWL
REQUIREMENT
PUNCH BAIL IN EXTREME UPPER POSITION.
EACH BLOCKING PAWL IN BLOCKING POSITION.
MIN. .003 INCH
OVERTRAVEL BETWEEN EACH PAWL AND
LOWER SURFACE OF LONG TOGGLE ARMS.
ADJUST
STOP ARM BRACKET WITH MOUNTING NUTS
LOOSENED (TAP BRACKET DOWN).
LONG TOGGLE ARM
MOUNTING NUTS
STOP ARM BRACKET
PUNCH BAIL
LONG TOGGLE ARM
(C) LONG TOGGLE ARM SPRING
REQUIREMENT
ARMATURES HELD OPERATED. PUNCH BAIL
IN EXTREME LOWER POSITION.
MIN. 3 OZS.
MAX. 6 OZS.
TO PREVENT ARMS REUNITING WHEN
BARELY PERCEPTIBLE SEPARATION EXISTS.
SHORT TOGGLE ARM
MOUNTING PLATE
SHIMS
YOKE
ARMATURE
CORE
(B) MAGNET BRACKET
REQUIREMENT
ARMATURES HELD OPERATED
CLEARANCE BETWEEN ARMATURE
AND CORE:
MIN. 0.003
MAX. 0.006
IF BRACKET HAS
ONE MAGNET
ONE AT MINIMUM (.003")
CLEARANCE AND THE OTHER NOT
MORE THAN .006" CLEARANCE IF
THE BRACKET HAS TWO MAGNETS.
ADJUST
EACH MAGNET BRACKET ON ITS PIVOT
SCREW LOCATED TO REAR OF STUD
MOUNTING SCREW, WITH ALL THREE
MOUNTING SCREWS LOOSENED. ADD
OR REMOVE SHIMS BETWEEN MAGNET
YOKE AND MOUNTING PLATE IF
NECESSARY.
STUD
MOUNTING SCREW

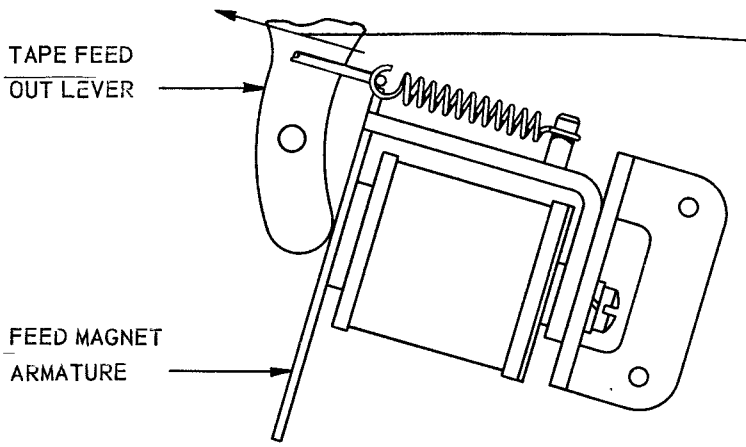
Figure 3-20



(A) PUNCH MAGNET ARMATURE SPRING

REQUIREMENT

PUNCH BAIL DRIVE LINK ASSEMBLY IN TOP CENTER POSITION.
MIN. 13 OZ.
MAX. 15 OZ.
TO MOVE ARMATURE.



(B) FEED MAGNET ARMATURE SPRING

REQUIREMENT

PUNCH BAIL DRIVE LINK ASSEMBLY IN TOP CENTER POSITION.
MIN. 13 OZS.
MAX. 15 OZS.
TO MOVE ARMATURE.

(C) PUNCH BLOCK

REQUIREMENT

PINS MOVE FREELY IN PUNCH BLOCK. MINIMUM CLEARANCE BETWEEN STEMS OF PUNCH PINS AND EDGES OF DRAG LINK SLOTS.

SOME CLEARANCE BETWEEN RETAINING PLATE AND PUNCH PINS.

ADJUST

FIRST THE RETAINING PLATE WITH ITS MOUNTING SCREWS LOOSENED; THEN POSITION PUNCH BLOCK, WITH MOUNTING SCREWS LOOSENED, BY MEANS OF ITS LOCATING ECCENTRIC.

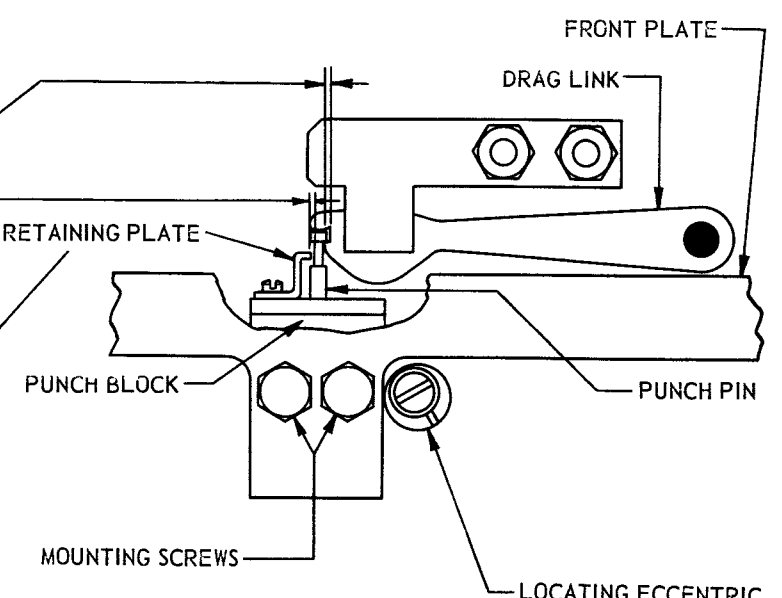


Figure 3-21

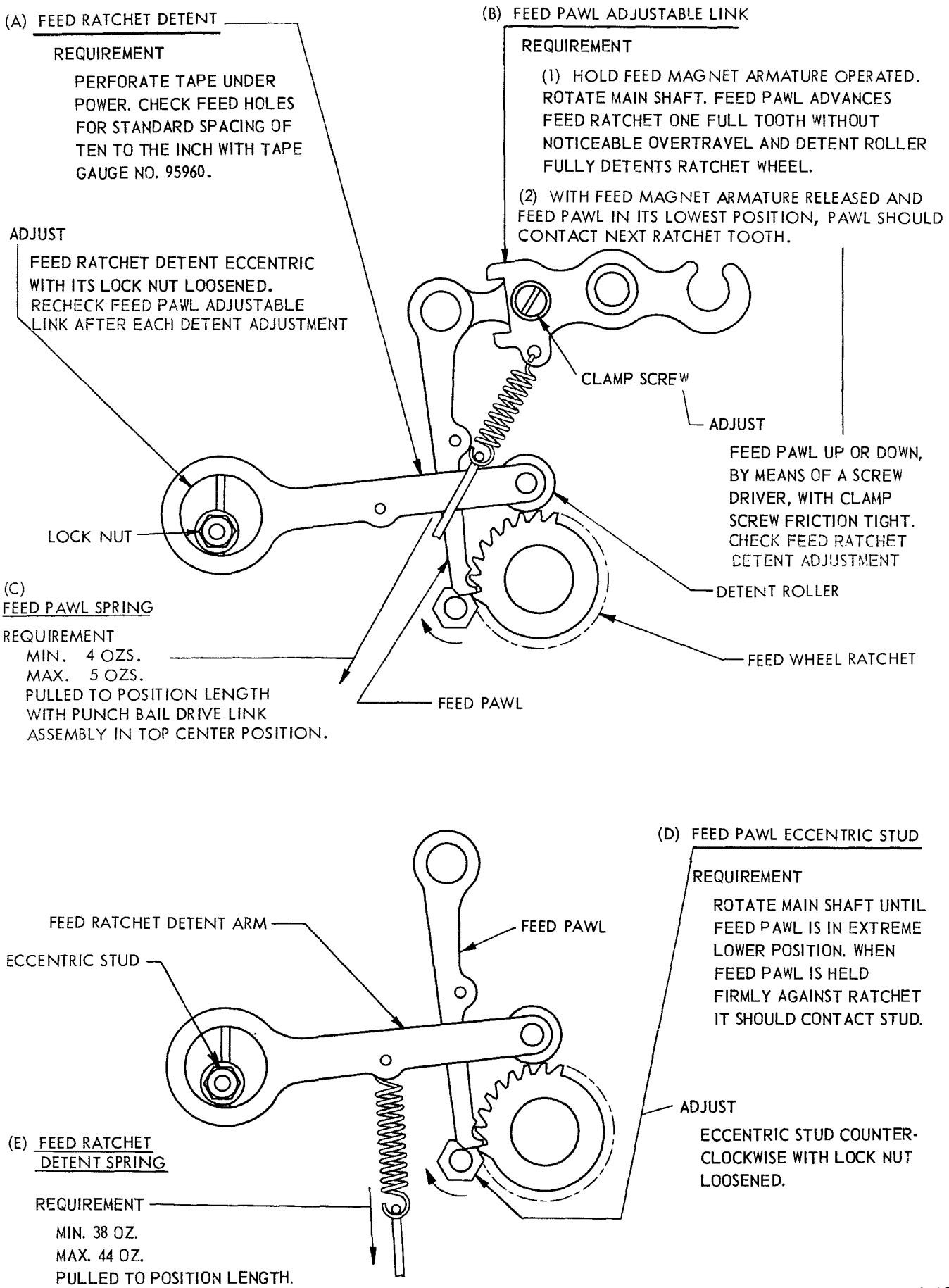
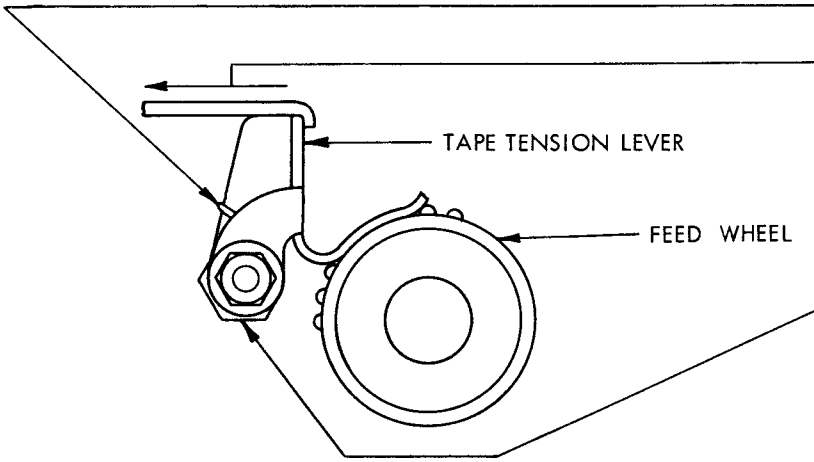

(A) FEED RATCHET DETENT
REQUIREMENT
PERFORATE TAPE UNDER POWER. CHECK FEED HOLES FOR STANDARD SPACING OF TEN TO THE INCH WITH TAPE GAUGE NO. 95960.
ADJUST
FEED RATCHET DETENT ECCENTRIC WITH ITS LOCK NUT LOOSENED. RECHECK FEED PAWL ADJUSTABLE LINK AFTER EACH DETENT ADJUSTMENT
(B) FEED PAWL ADJUSTABLE LINK
REQUIREMENT
(1) HOLD FEED MAGNET ARMATURE OPERATED. ROTATE MAIN SHAFT. FEED PAWL ADVANCES FEED RATCHET ONE FULL TOOTH WITHOUT NOTICEABLE OVERTRAVEL AND DETENT ROLLER FULLY DETENTS RATCHET WHEEL.
(2) WITH FEED MAGNET ARMATURE RELEASED AND FEED PAWL IN ITS LOWEST POSITION, PAWL SHOULD CONTACT NEXT RATCHET TOOTH.
CLAMP SCREW
ADJUST
FEED PAWL UP OR DOWN, BY MEANS OF A SCREW DRIVER, WITH CLAMP SCREW FRICTION TIGHT. CHECK FEED RATCHET DETENT ADJUSTMENT
LOCK NUT
DETENT ROLLER
(C)
FEED PAWL SPRING
REQUIREMENT
MIN. 4 OZS.
MAX. 5 OZS.
PULLED TO POSITION LENGTH WITH PUNCH BAIL DRIVE LINK ASSEMBLY IN TOP CENTER POSITION.
FEED WHEEL RATCHET
FEED PAWL
(D) FEED PAWL ECCENTRIC STUD
REQUIREMENT
ROTATE MAIN SHAFT UNTIL FEED PAWL IS IN EXTREME LOWER POSITION. WHEN FEED PAWL IS HELD FIRMLY AGAINST RATCHET IT SHOULD CONTACT STUD.
FEED RATCHET DETENT ARM
FEED PAWL
ECCENTRIC STUD
ADJUST
ECCENTRIC STUD COUNTER-CLOCKWISE WITH LOCK NUT LOOSENED.
(E) FEED RATCHET DETENT SPRING
REQUIREMENT
MIN. 38 OZ.
MAX. 44 OZ.
PULLED TO POSITION LENGTH.

Figure 3-22

(A) TAPE TENSION LEVER SPRING

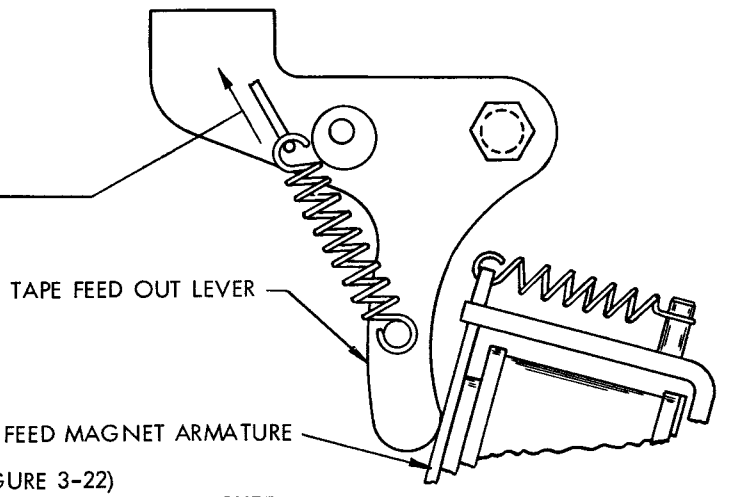
REQUIREMENT
MIN. 4-1/2 OZ.
MAX. 5-1/2 OZ.
TO START LEVER MOVING AWAY FROM FEED WHEEL.

ADJUST
TAPE TENSION LEVER STUD WITH LOCK NUT LOOSENED.



(B) TAPE FEED OUT LEVER SPRING TENSION

REQUIREMENT
MIN. 2-1/2 OZ.
MAX. 3-1/2 OZ.
PULLED TO POSITION LENGTH.



(C) FEED PAWL AND RATCHET ALIGNMENT (SEE FIGURE 3-22)
REQUIREMENT - FEED PAWL FULLY ALIGNED WITH FEED WHEEL RATCHET.
TO ADJUST - SHIM THE DETENT ARM ECCENTRIC STUD THAT IS FASTENED TO THE MOUNTING PLATE. USE 71074 WASHERS FOR SHIMS.

NOTE: THE FOLLOWING ADJUSTMENTS ARE ARRANGED TO PROVIDE CONTACTOR OPERATION. THE OPENING OR CLOSURE OF THE CONTACTS (OR CONTACT IN CASE OF SINGLE-CONTACT UNIT) MAY BE ADVANCED OR RETARDED IN THE PUNCHING CYCLE BY ROTATING THE CONTACTOR MOUNTING PLATES ABOUT THE MAIN SHAFT. ROTATING THE CONTACTORS IN THE DIRECTION OF SHAFT ROTATION WILL DELAY THE TIME AT WHICH THEY ARE ACTIVATED. ROTATING THE CONTACTORS AGAINST THE DIRECTION OF SHAFT ROTATION WILL ADVANCE THE TIME AT WHICH THEY ARE ACTIVATED. THE CONTACTORS (DOUBLE-CONTACT UNITS ONLY) MAY BE MOVED INDIVIDUALLY OR TOGETHER IN EITHER DIRECTION TO FACILITATE COUPLING OF THE PUNCH MECHANISM TO AUXILIARY CONTROL EQUIPMENT (REFER TO TIMING DIAGRAM, FIGURE 6-9).

(D) CONTACTS
REQUIREMENT
ECCENTRIC ARMS IN EXTREME RIGHT, THEN IN EXTREME LEFT POSITIONS.
ALL GAPS
MIN. .008 INCH
MAX. .012 INCH AND
EQUAL TO EACH OTHER WITHIN .002 INCH.

ADJUST
BOX HORIZONTALLY WITH SCREWS LOOSENED.

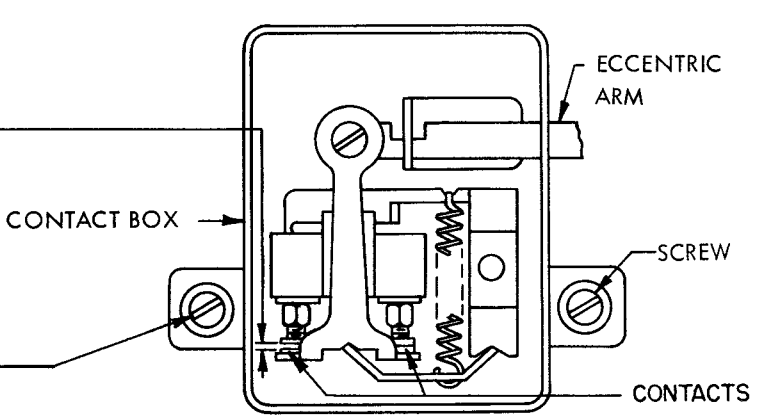


Figure 3-23

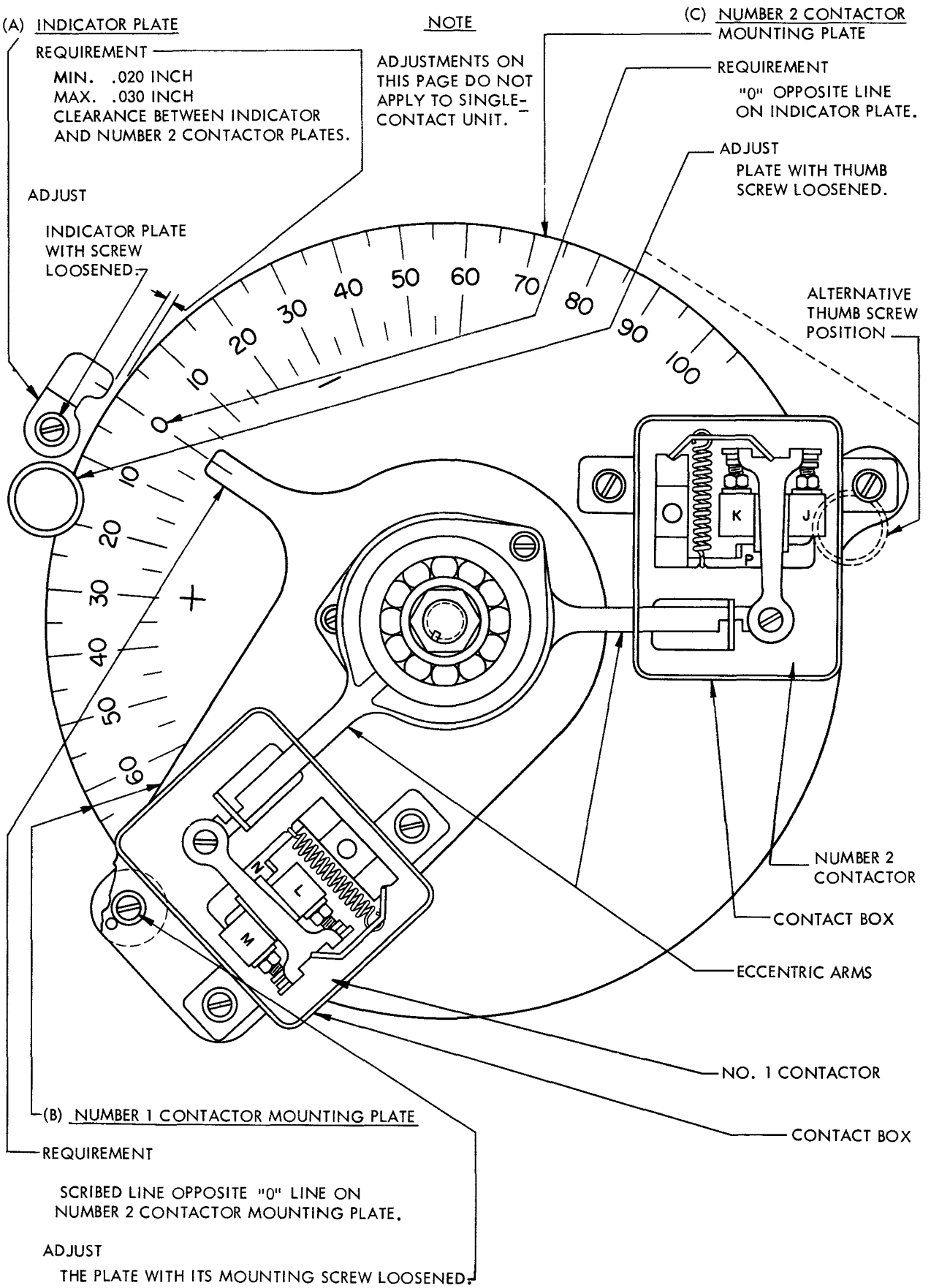
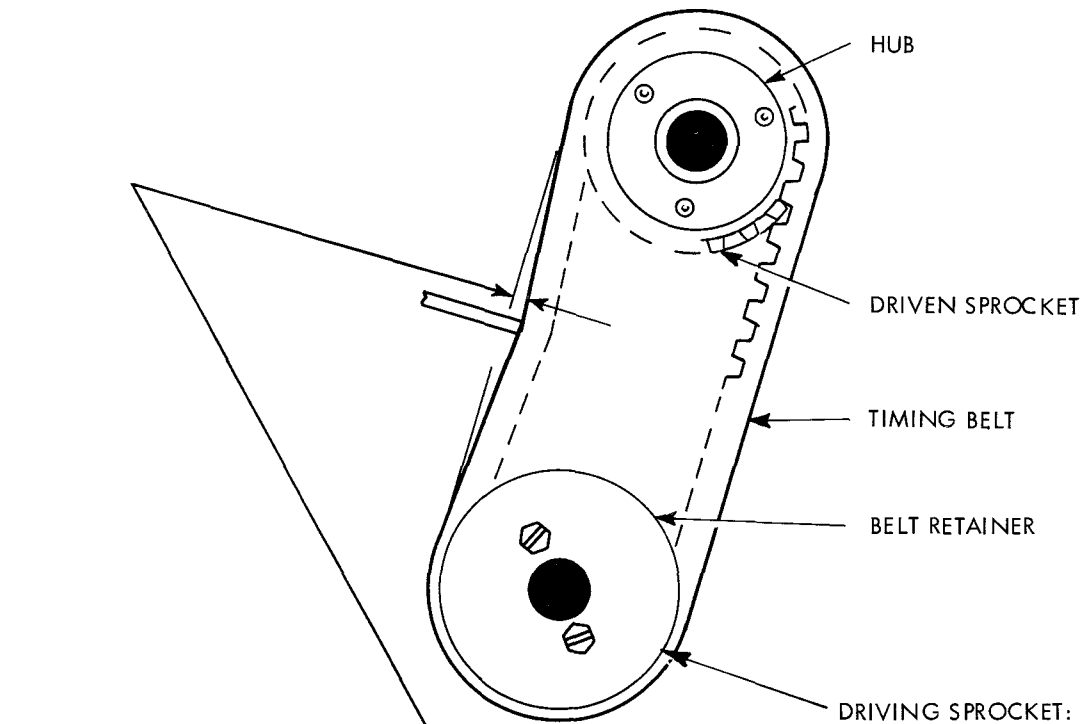

(A) INDICATOR PLATE
REQUIREMENT
MIN. .020 INCH
MAX. .030 INCH
CLEARANCE BETWEEN INDICATOR AND NUMBER 2 CONTACTOR PLATES.
ADJUST
INDICATOR PLATE WITH SCREW LOOSENED.
NOTE
ADJUSTMENTS ON THIS PAGE DO NOT APPLY TO SINGLE-CONTACT UNIT.
(C) NUMBER 2 CONTACTOR MOUNTING PLATE
REQUIREMENT
"0" OPPOSITE LINE ON INDICATOR PLATE.
ADJUST
PLATE WITH THUMB SCREW LOOSENED.
ALTERNATIVE THUMB SCREW POSITION
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60
K
J
P
N
L
M
NUMBER 2 CONTACTOR
CONTACT BOX
ECCENTRIC ARMS
NO. 1 CONTACTOR
CONTACT BOX
(B) NUMBER 1 CONTACTOR MOUNTING PLATE
REQUIREMENT
SCRIBED LINE OPPOSITE "0" LINE ON NUMBER 2 CONTACTOR MOUNTING PLATE.
ADJUST
THE PLATE WITH ITS MOUNTING SCREW LOOSENED.

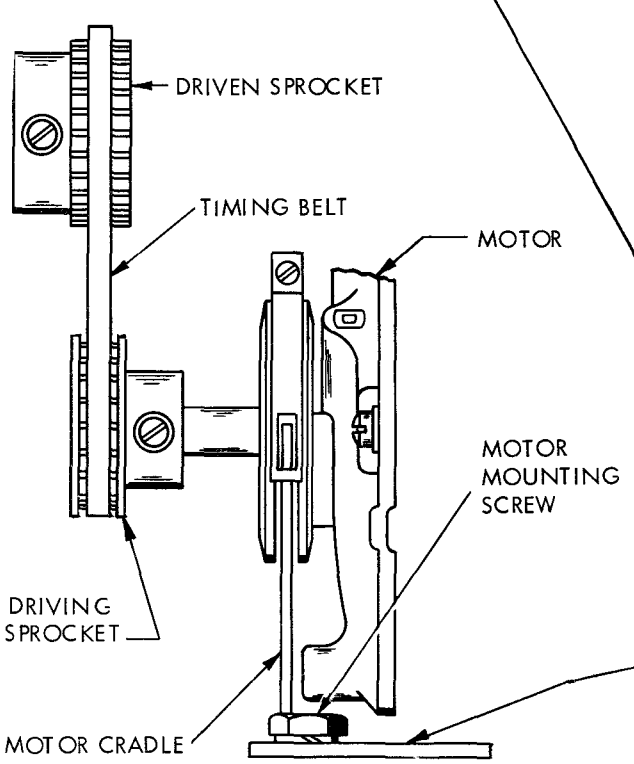
Figure 3-24

NOTE
MAKE MOTOR ADJUSTMENT IN FIGURE 3-18.



(FRONT VIEW)

CAUTION:
IF MOTOR BECOMES BLOCKED FOR SEVERAL SECONDS, THERMAL CUT-OUT SWITCH WILL BREAK CIRCUIT. SHOULD THIS HAPPEN, ALLOW MOTOR TO COOL AT LEAST 5 MINUTES BEFORE DEPRESSING RED RESET BUTTON.



TIMING BELT

REQUIREMENT
BY MEANS OF A SCALE, APPLY A ONE POUND PUSH TO THE CENTER OF THE BELT SPAN. THE BELT SHOULD YIELD 3/16". SPROCKETS ALIGNED. SHAFTS PARALLEL.

ADJUST
MOTOR WITH FOUR MOUNTING SCREWS LOOSENED.

Figure 3-25

SINGLE UNIT BASE ADJUSTMENTS NOTE:
TO MOUNT THE PUNCH UNIT ON ITS BASE, REMOVE THE FLEXIBLE COUPLING LOCK SCREWS AND SLIDE THE COUPLING BACK ON THE MOTOR SHAFT. MOUNT THE PUNCH UNIT TO ITS BASE WITH THE FOUR MOUNTING SCREWS PROVIDED. AT THE REAR OF THE BASE, REMOVE THE PLATE THAT CONTAINS PROVISIONS FOR THE CONNECTORS AND ON THIS PLATE MOUNT THE PUNCH CABLE CONNECTOR PLUG WITH FOUR SCREWS AND LOCKWASHERS. DIRECT THE PUNCH CABLE THROUGH ITS OPENING IN THE BASE PLATE AND REPLACE THE CONNECTOR PLATE. PASS THE CABLE THROUGH THE CABLE CLAMPS.

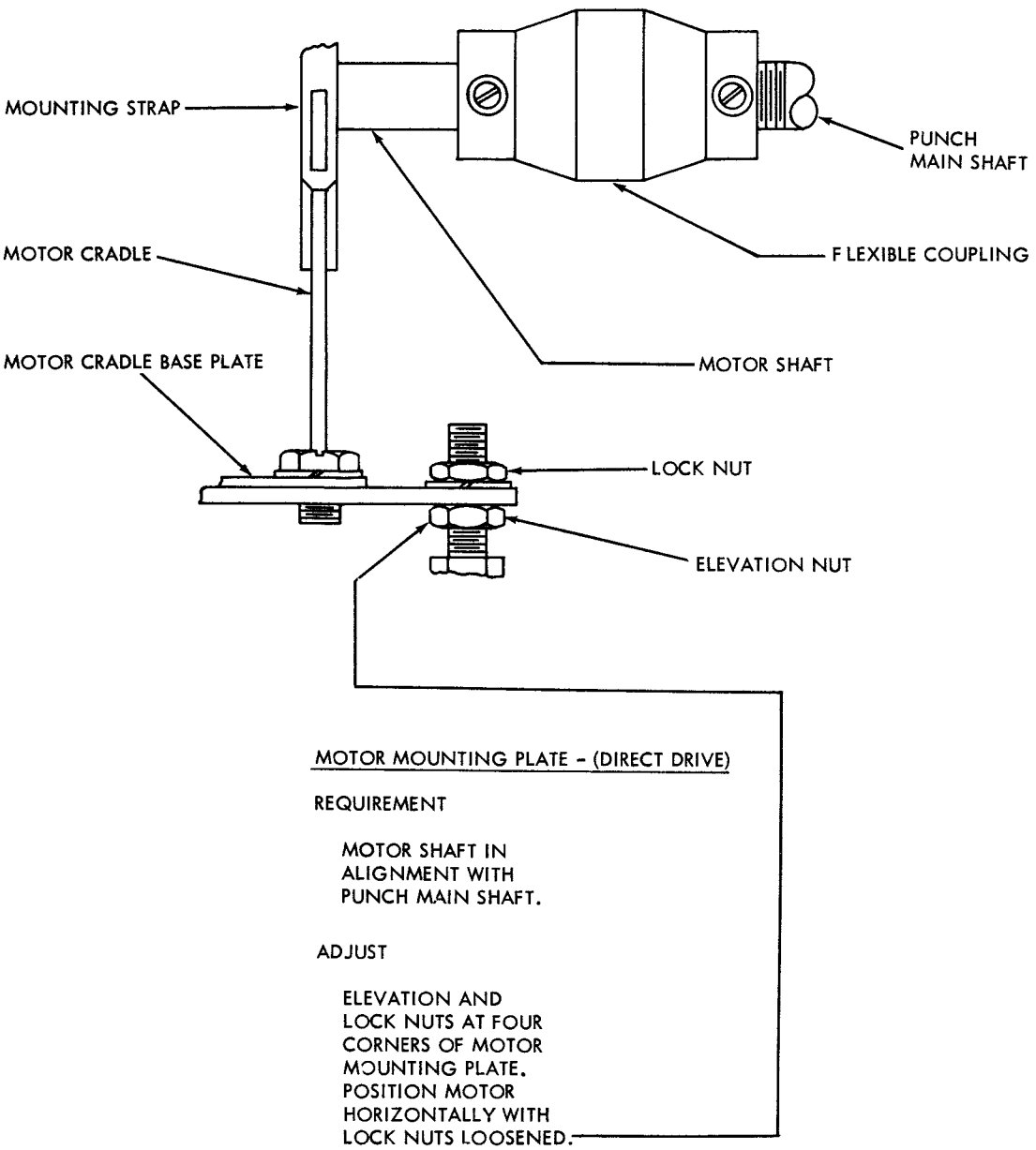


Figure 3-26

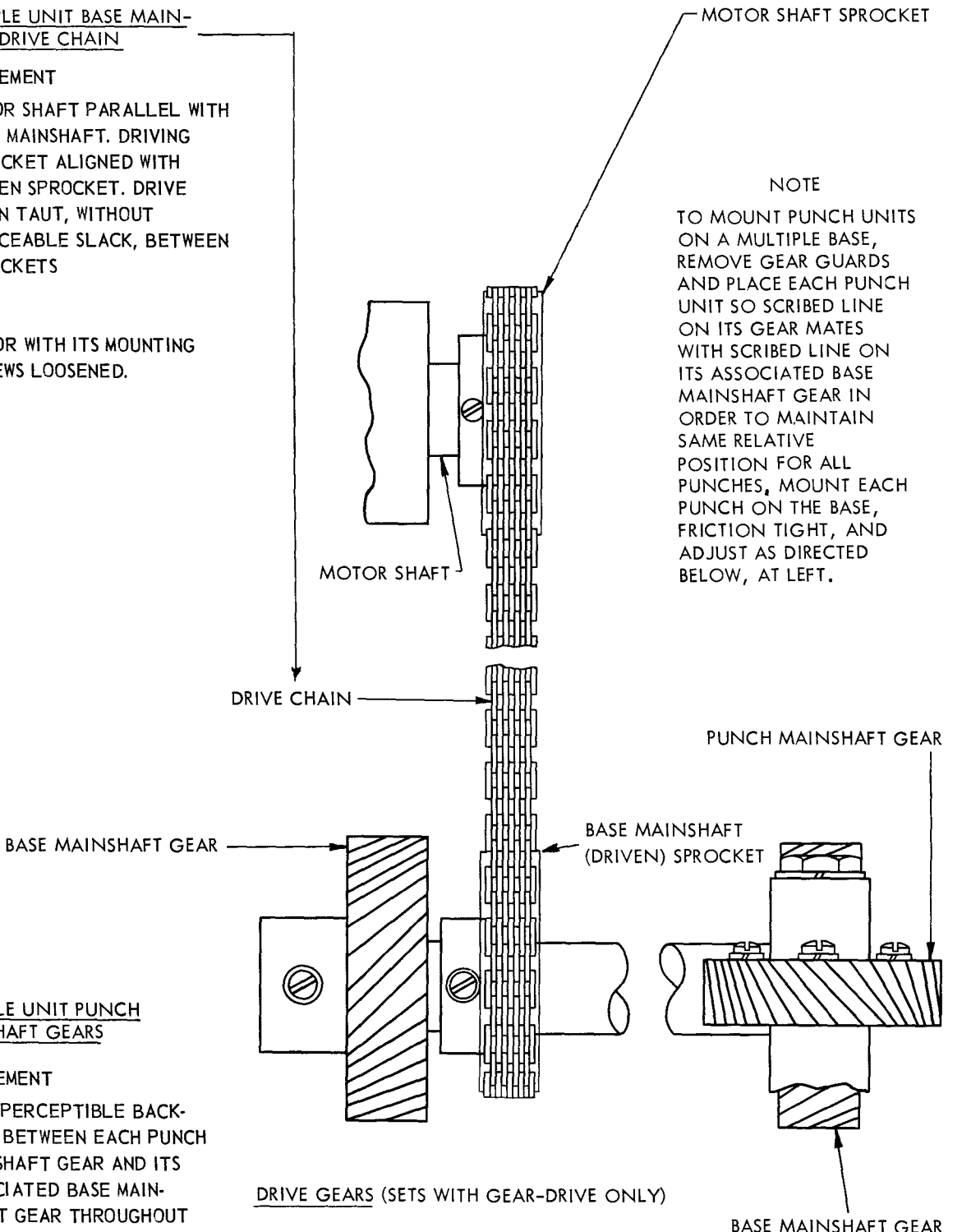
(A) MULTIPLE UNIT BASE MAINSHAFT DRIVE CHAIN

REQUIREMENT

MOTOR SHAFT PARALLEL WITH BASE MAINSHAFT. DRIVING SPROCKET ALIGNED WITH DRIVEN SPROCKET. DRIVE CHAIN TAUT, WITHOUT NOTICEABLE SLACK, BETWEEN SPROCKETS

ADJUST

MOTOR WITH ITS MOUNTING SCREWS LOOSENED.



NOTE

TO MOUNT PUNCH UNITS ON A MULTIPLE BASE, REMOVE GEAR GUARDS AND PLACE EACH PUNCH UNIT SO SCRIBED LINE ON ITS GEAR MATES WITH SCRIBED LINE ON ITS ASSOCIATED BASE MAINSHAFT GEAR IN ORDER TO MAINTAIN SAME RELATIVE POSITION FOR ALL PUNCHES, MOUNT EACH PUNCH ON THE BASE, FRICTION TIGHT, AND ADJUST AS DIRECTED BELOW, AT LEFT.

(B) MULTIPLE UNIT PUNCH MAINSHAFT GEARS

REQUIREMENT

JUST PERCEPTIBLE BACKLASH BETWEEN EACH PUNCH MAINSHAFT GEAR AND ITS ASSOCIATED BASE MAINSHAFT GEAR THROUGHOUT COMPLETE REVOLUTION OF GEARS.

ADJUST

EACH PUNCH UNIT UP OR DOWN WITH GEAR GUARDS REMOVED AND ITS MOUNTING SCREWS LOOSENED FRICTION TIGHT.

DRIVE GEARS (SETS WITH GEAR-DRIVE ONLY)

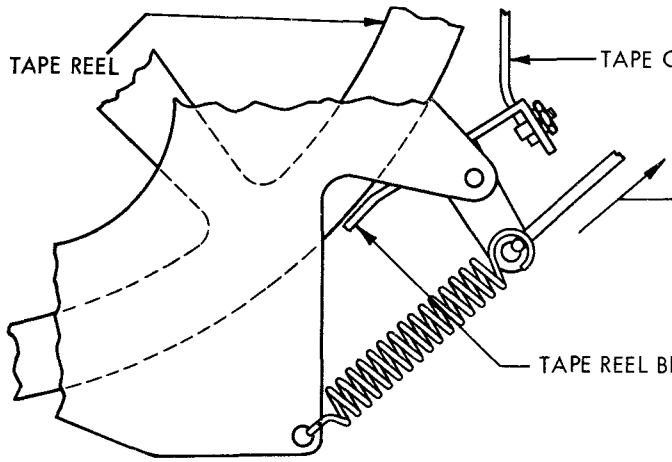
REQUIREMENT

GEARS ALIGNED, WITH MINIMUM BACKLASH AND NO BIND

ADJUST

MOTOR ON MOUNTING POSTS WITH MOUNTING SCREWS LOOSENED

Figure 3-27



(A) TAPE REEL BRAKE SPRING

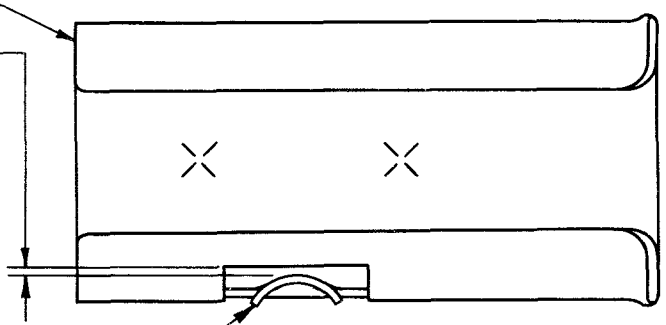
REQUIREMENT

MIN. 18 OZ.
MAX. 21 OZ.
PULLED TO POSITION LENGTH.

(B)
TAPE GUIDE SPRING

REQUIREMENT

TOP, CURVED EDGE OF SPRING PARALLEL TO TOP EDGE OF TAPE GUIDE. CLEARANCE BETWEEN SPRING AND CUT-OUT PORTION OF GUIDE IS GREATER WITH A TAPE IN GUIDE THAN WHEN GUIDE IS EMPTY BY A
MIN. .005 INCH
MAX. .010 INCH.

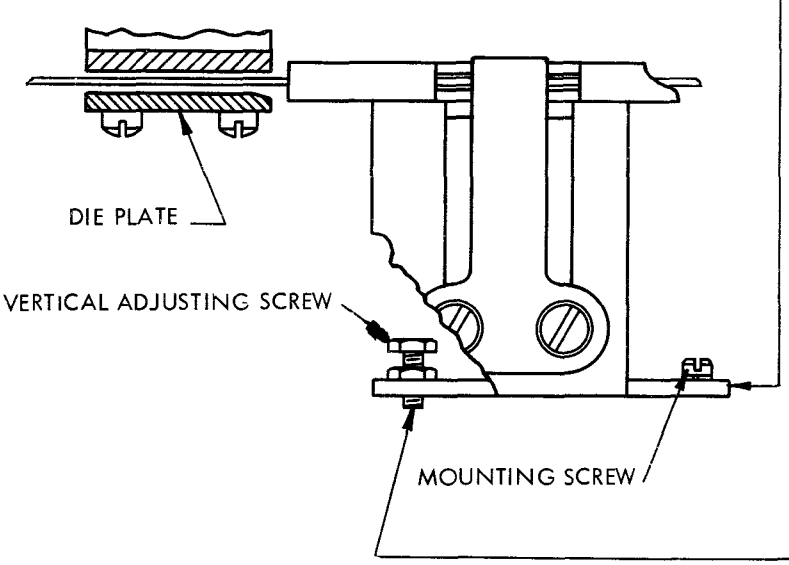


ADJUST
SPRING, WITH MOUNTING SCREWS LOOSENED, FOR ALIGNMENT. BEND SPRING FOR CLEARANCE.

(C)
TAPE GUIDE BRACKET

REQUIREMENT

WITH PUNCH BAIL IN EXTREME UPPER POSITION THE TAPE PASSES FREELY FROM THE TAPE GUIDE THROUGH PUNCH BLOCK DIE PLATES. CLEARANCE BETWEEN TAPE GUIDE AND DIE PLATES SHOULD BE
MIN. .010 INCH
MAX. .040 INCH.



ADJUST

VERTICALLY BY MEANS OF ADJUSTING SCREW WITH ITS LOCK NUT LOOSENED AND WITH MOUNTING SCREW TIGHT. CHECK WITH UNDERSIZE (ONE HALF) TAPE. POSITION HORIZONTALLY WITH MOUNTING SCREWS LOOSENED FRICTION TIGHT. REFINE VERTICAL POSITION IF NECESSARY.

Figure 3-28

SECTION 4

DISASSEMBLY

4-1. GENERAL

a. The disassembly procedure covered in this section will break the Punch down into its major subassemblies. Teletype Parts Bulletin 1154B illustrates the complete disassembly and includes drawings of the parts referred to below.

b. If a part that is mounted on shims is to be removed, the number of shims used at each of its mounting screws should be noted so that the same shim pile-up can be replaced when the part is remounted. Retaining rings are made of spring steel and therefore have a tendency to release suddenly. Loss of these rings can be minimized as follows:

> Hold the retaining ring to prevent it from rotating. Place the blade of a screwdriver in one of the slots. Rotate the screwdriver in a direction to increase the diameter, and the ring will come off easily without flying.

4-2. COVER

a. To remove the cover, lift it from the Set.

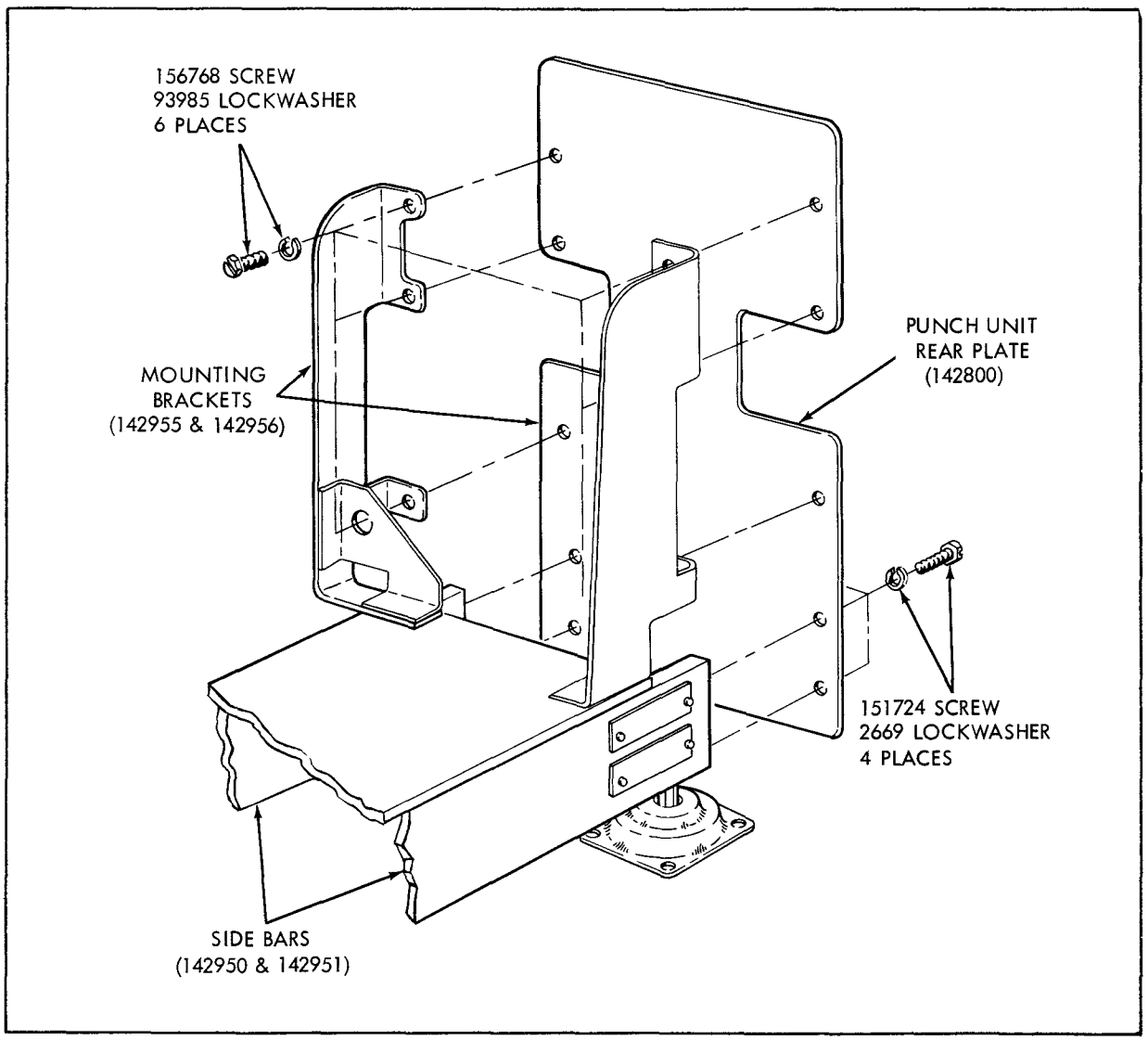


Figure 4-1

b. To replace the cover, hold it over the Set, lower it carefully and fit the four rubber grommets on the Base into the provided slots.

4-3. MOTOR UNIT

a. To remove the Motor Unit, remove the timing belt from the sprockets. Disconnect the motor cable leads from the terminal board on the Base. Note the position of the hardware on the four motor mounting screws and then remove them. Lift the motor from the Base.

b. To replace the Motor Unit, place the four mounting spacers over the screw holes in the base plate and reverse the removal procedure. Check the Timing Belt adjustment (Figure 3-18).

4-4. PUNCH UNIT

a. REMOVAL FROM BASE (Figure 4-1)

(1) Remove the timing belt from the sprockets. Remove the Punch Unit's cable connector from the connector on the base. Remove the Punch Unit by removing the six mounting screws that pass through the 142955 and 142956 brackets on the Base into the 142800 rear plate of the Punch Unit and the four mounting screws that pass through the rear plate into the 142950 and 142951 side bars on the base.

(2) Replace the Punch Unit by reversing the procedure used to remove it.

b. PUNCH BLOCK MOUNTING PLATE ASSEMBLY

(1) To take off the assembly first remove the chad container. Then remove the Punch Unit cover by removing its four mounting screws. Remove the retaining ring from the stud at the left end of the 143014 feed link. Remove the 142917 tape cutter by removing its mounting screw. Remove the two screws that pass through the 142911 plate on the punch block into the 142880 front plate. Remove the three 151606 mounting screws from the 142901 mounting plate. Move the mounting plate slightly to left to disconnect the punch pins from the drag links. Pull the assembly forward slowly and disconnect the 143045 feed pawl link from the stud on the 143014 feed link.

(2) To replace the assembly, place it back into position and connect the 143045 feed pawl link onto the stud of the 143014 feed link. Make sure that the drag links properly engage the punch pins. Then reverse the procedure used to remove the assembly.

c. FEED AND PUNCH MAGNETS

(1) To remove any group of magnets, remove the two 153442 mounting screws and lockwashers from the magnet bar.

(2) To remove any individual magnet assembly, remove the two 156632 mounting screws with hardware from the 142992 mounting plate.

SECTION 5

LUBRICATION

5-1. GENERAL

a. The Punch should be thoroughly lubricated, but over-lubrication which might allow oil to drop or grease to be thrown on other parts should be avoided. Teletype KS7470 oil, or 145867 grease, should be used as indicated in the specific instructions in this section.

b. Lubricate the equipment before putting it in service or prior to storage. After a short period of service, repeat the procedure to make sure that all specified points have received lubricant. Thereafter, lubricate at regular intervals as needed. The lubrication interval should not be more than 160 hours or one month of service, whichever occurs first.

c. Make certain that no oil or grease accumulates between the armatures and magnet pole faces or between contact points. Wire off the excess lubricant from the armatures and yoke pivot points.

d. Paragraph 5-4. applies to early-design punches.

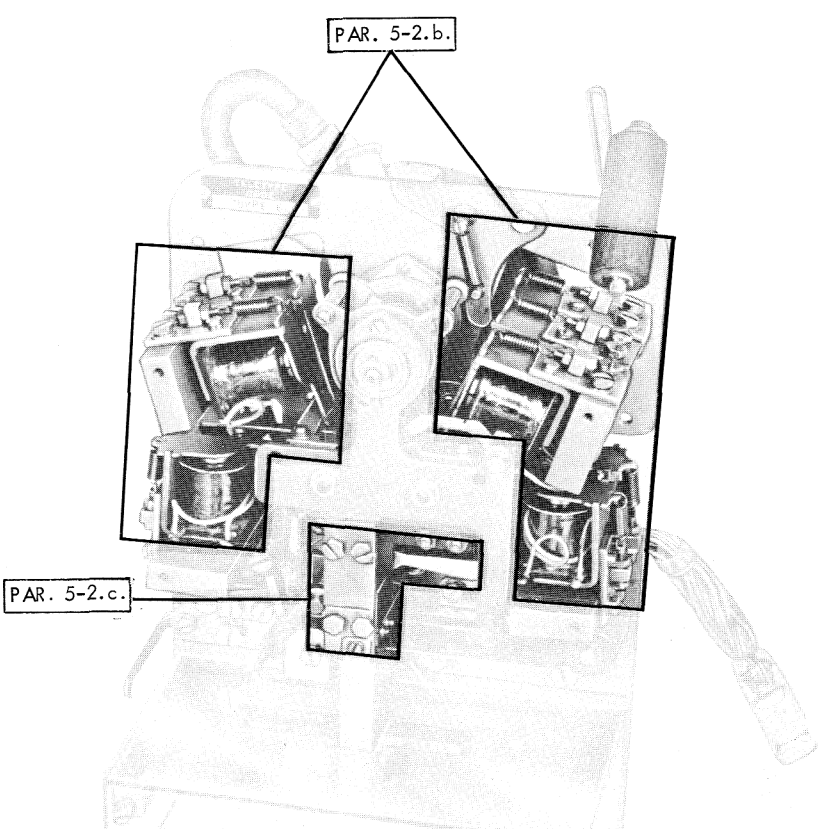
e. Paragraphs 5-2. and 5-3. cover late design equipment. In these paragraphs general lubricating areas are shown by photographs. Specific areas to receive lubricant are indicated by line drawings with text. The drawings are keyed to the photographs by paragraph numbers.

The symbols in the text indicate the following:

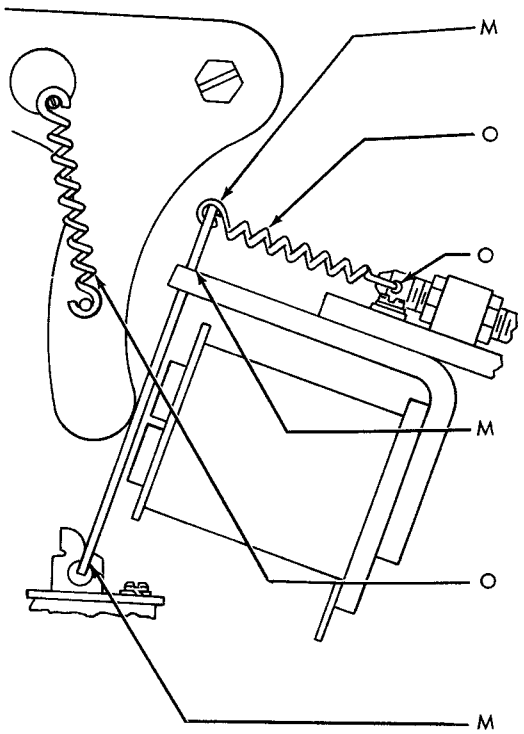
O	Apply one drop of KS7470 oil.
O2	Apply two drops of KS7470 oil, etc.
SAT	Saturate with KS7470 oil (felt washers, oilite bearings, etc.)
FILL	Fill with KS7470 oil (oil holes, oil cups, etc.)
M	Apply 1/64 inch coating of 143484 or 145867 grease.

5-2. PUNCH UNIT (LATE DESIGN)

a. GENERAL AREAS

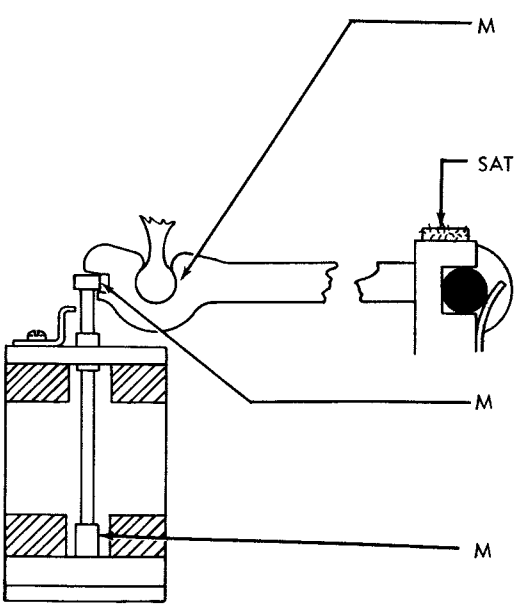


b. FEED AND CODE MAGNETS



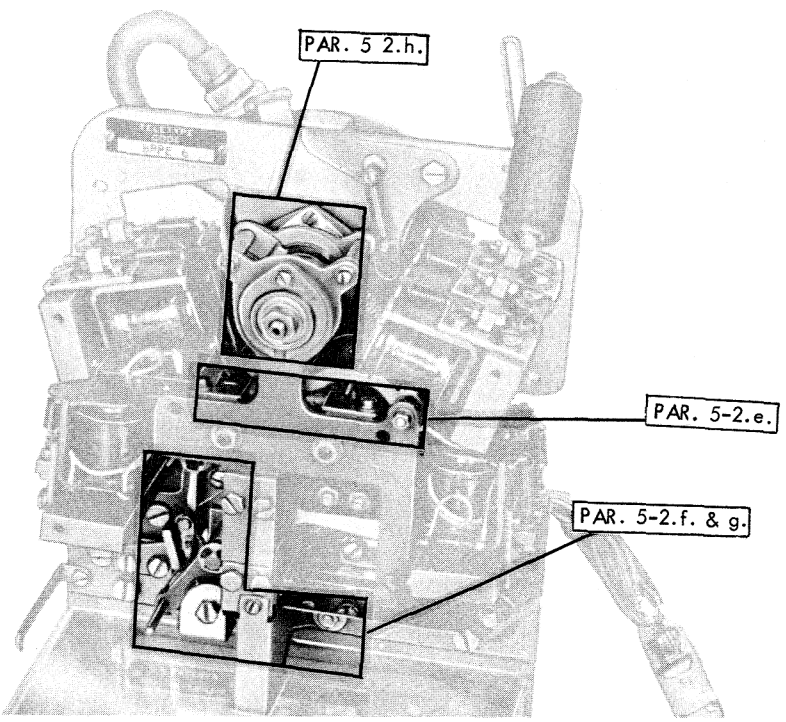
M	HOOKS	CODE AND FEED MAGNET SPRINGS
O	COILS	CODE AND FEED MAGNET SPRINGS
O	HOOKS	CODE AND FEED MAGNET SPRINGS
M	CONTACTING SURFACES (APPLY SPARINGLY)	CODE AND FEED MAGNET ARMATURES
O	HOOKS - EACH END	SPRING
M	CONTACTING SURFACES	BLOCKING PAWLS AND ARMATURES

c. PERFORATING MECHANISM

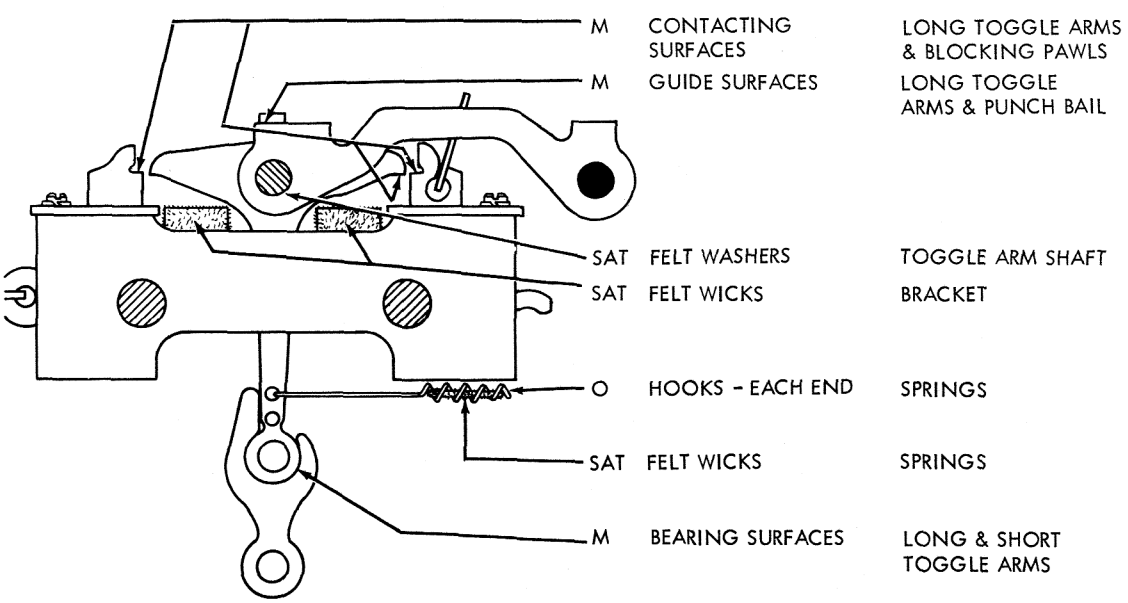


M	BEARING SURFACES	DRAG LINKS AND LONG TOGGLE ARMS
SAT	FELT WICK	DRAG LINK BRACKET
M	CONTACTING SURFACES	DRAG LINKS AND PUNCH PINS
M	SLIDING SURFACES	PUNCH PINS

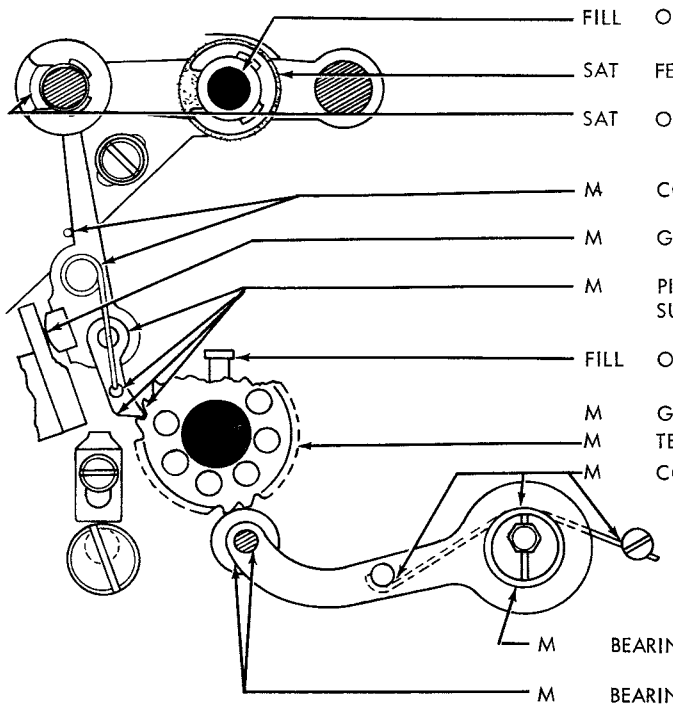
d. GENERAL AREAS



e. PERFORATING MECHANISM

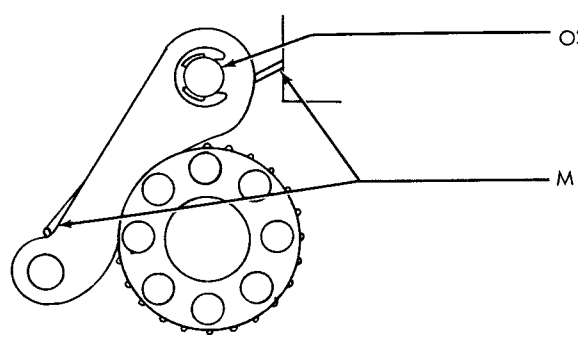


f. FEED MECHANISM



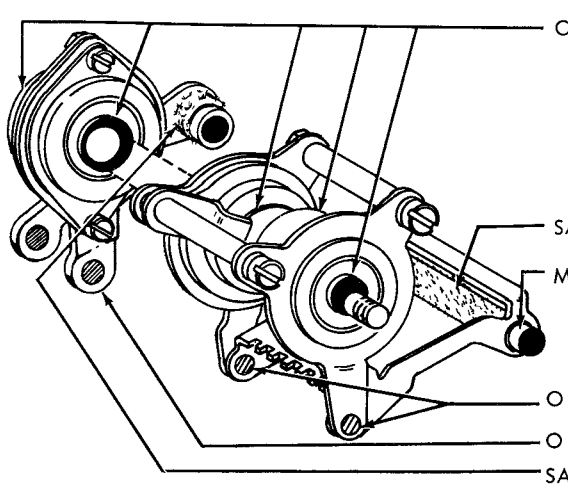
FILL	OIL HOLE	PIVOT ARM PIVOT
SAT	FELT WASHER	PIVOT ARM PIVOT
SAT	OILITE BEARING	PIVOT ARM
M	CONTACTING SURFACES	SPRING
M	GUIDE SURFACE	FEED PAWL GUIDE
M	PIVOT AND CONTACTING SURFACES	FEED PAWL
FILL	OIL CUP	FEED WHEEL BEARING
M	GUIDE SURFACE	WEDGE BLOCK
M	TEETH	FEED RATCHET
M	CONTACTING SURFACES	SPRING
M	BEARING SURFACE	DETENT ECCENTRIC
M	BEARING AND CONTACTING SURFACES	DETENT ROLLER

g. FEED MECHANISM



O2	COILS	SPRING
M	CONTACTING SURFACES	SPRING

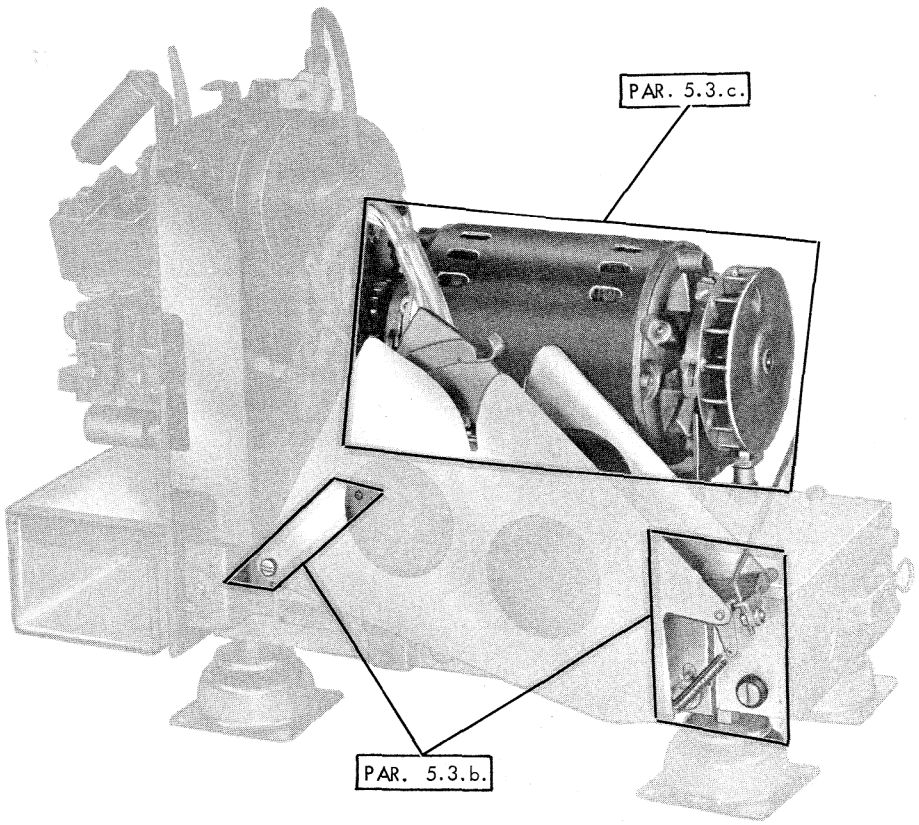
h. DRIVE MECHANISM



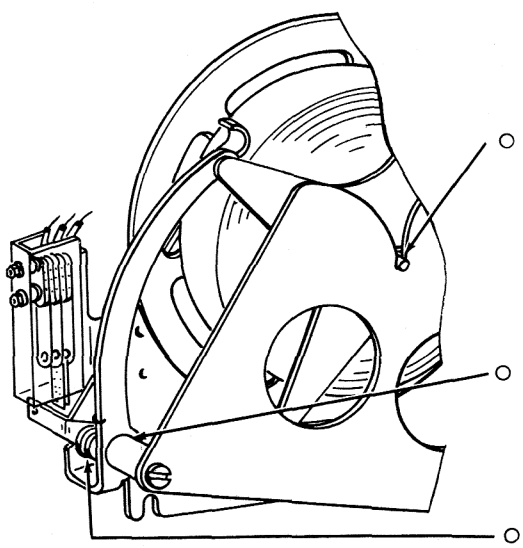
O2	BEARING SURFACES	BEARINGS (5) ON MAIN SHAFT
SAT	FELT WASHERS (2)	PUNCH BAIL SHAFT
M	BEARING & CONTACTING SURFACES	PUNCH BAIL SPACER
O	BEARING SURFACES	DRIVE LINKS
O	BEARING SURFACES	DRIVE LINK
SAT	FELT WASHER	FEED DRIVE LEVER

5-3. BASE AND MOTOR UNIT

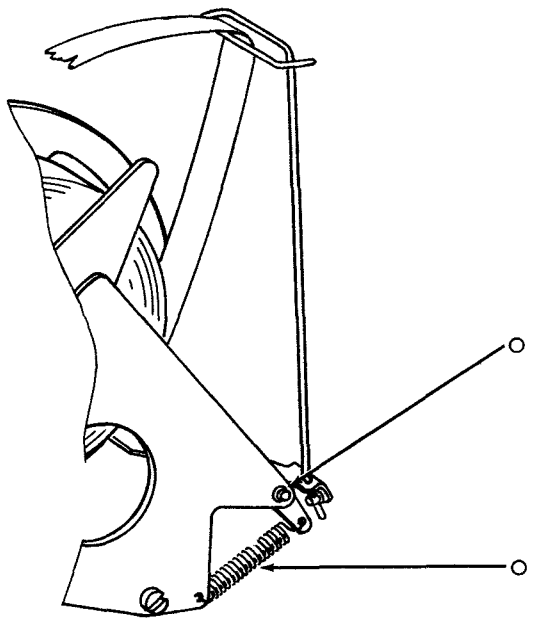
a. GENERAL AREAS



b. TAPE REEL AND BRAKE MECHANISM

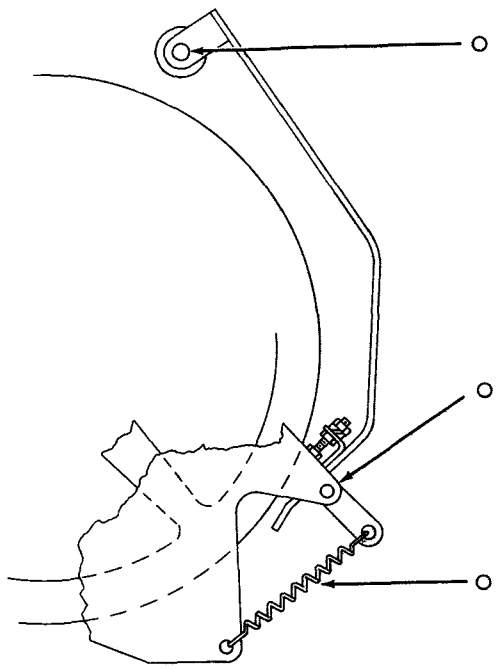


O	BEARING SURFACES (2 PLACES)	TAPE REEL SHAFT
O	PIVOTS (2)	LOW TAPE LEVER
O	HOOKS - EACH END	SPRING



O PIVOTS (2) BRAKE

O HOOKS - EACH END SPRING

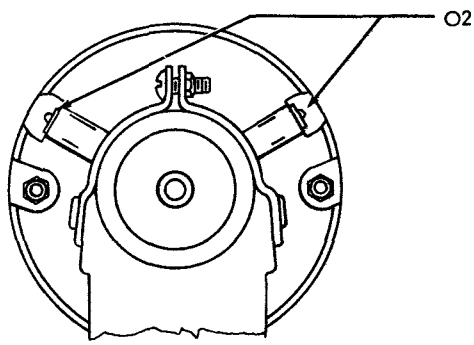


O SHAFT ROLLER

O PIVOTS (2) BRAKE

O HOOKS - EACH END SPRING

c. MOTOR UNIT



O2 OILER* (4) --- (DEPRESS OILER WITH METAL OBJECT.) MOTOR SHAFT

NOTE: DO NOT LUBRICATE SPROCKETS.

*APPLY OIL EVERY FOUR MONTHS. IF MOTOR IS DISASSEMBLED AT ANY TIME, REPACK BEARINGS WITH KS7471 GREASE. DO NOT REPACK BEARINGS OTHERWISE.

5-4. EARLY DESIGN

a. GENERAL - Paragraphs 5-1. a. through c. apply to the early-design Punch. 1/32 inch coating of 145867 grease should be applied to the places listed below unless other instructions are given. Oil both loops of all helical springs that exert a nominal tension of less than 2-1/2 pounds. Grease both loops of all helical springs that exert a nominal tension of 2-1/2 pounds or more.

b. PUNCH UNIT

MAIN SHAFT - grease all unshielded ball bearings.

FEED LINK & LONG TOGGLE ARM JOINT.

TOGGLE JOINT OF LONG TOGGLE ARM FEED PAWL EXTENSION.

BLOCKING PAWL PIVOTS - 1 drop of oil.

TOGGLE ARM SHAFT - saturate felt washers with oil.

TOGGLE JOINT OF LONG AND SHORT TOGGLE ARMS.

SOCKET JOINT OF SHORT TOGGLE ARMS AND DRAG LINKS.

DRAG LINK PIVOT POINTS - 1 drop of oil.

DRAG LINK AND PUNCH PIN JOINTS.

PUNCH AND FEED PIN HOLES.

DETENT ARM ROLLER.

DETENT ARM PIVOT - 2 drops of oil.

FEED LINK BEARING - fill oil holes with oil.

FEED PAWL PIVOT - 1 drop of oil.

FEED WHEEL BEARING - fill oil cup with oil.

FEED PAWL RATCHET.

BLOCKING PAWL - point of contact between blocking pawl and armature - wipe off excess grease.

CONTACTOR MOUNTING PLATES - light film of grease between plates and bearing housing.

c. SINGLE UNIT BASE

MOTOR - two drops of oil at infrequent intervals in oilers at each end of motor.

TAPE REEL SHAFT - light film of grease at both bearings.

BRAKE SHAFT.

d. MULTIPLE UNIT BASE

MOTOR - five to ten drops of oil at infrequent intervals in the oilers at each end of the motor housing.

DRIVE CHAIN - oil frequently and adequately to provide a noticeable film of oil on the chain links at all times.

GEARS - medium film of grease, visible at all times.

MAIN SHAFT BEARINGS - grease center bearing.

e. BASE WITH GEAR DRIVE

GEARS - light coat of grease visible at all times.

SECTION 6

PRINCIPLES OF OPERATION

6-1. GENERAL

a. Paragraphs 6-2. through 6-11. below treat the Late-Design Punch. Paragraph 6-12. covers the Early-Design whose operation is similar to the Late-Design except for the method of producing synchronizing pulses.

b. The function of the Punch is to record information in paper tape at speeds up to 110 characters per second. The information is received from control circuits as combinations of electrical code pulses. These pulses are translated into mechanical motions that perforate corresponding combinations of code holes. The code pulses are accompanied by a feed pulse which causes the equipment to advance the tape. A feed hole is automatically punched with each code combination.

c. The terms character, operation and operating speed are defined in the INTRODUCTION on page E. Being a synchronous unit which produces synchronizing (or clock) pulses, the Punch does not necessarily have to receive and perforate a character each time it undergoes an operation. For example, operating at 110 ops, it might over a period of one minute (6600 total operations) perforate 100 intermittant bursts of twenty characters (2000 in all) which arrive at the rate of 110 per second. During the remaining operations (4600) it would run idle perforating no characters. Thus it may be used to perforate characters at various speeds up to the operating speed. For this type of operation, provisions must be made in the control circuits to correlate the Punch's timing with the character source. In tape-to-tape telegraph systems, the Punch is usually run at speeds slightly faster than the transmitter to ensure synchronization.

6-2. CODE (Figure 6-1)

a. The information handled by the Punch is in the form of a binary permutation code. The units of the information---characters, numerals etc.---are represented by combinations of binary intelligence levels (bits), each of which may be in one of two states, i.e., on or off, yes or no etc. Different versions of the equipment will accommodate codes whose combinations consist of either five, six, seven or eight levels. Figure 6-1-A. illustrates a six-level code. In addition to the intelligence levels, a feed level is indicated which is explained below. The total number of permutations available in a given code is equal to two to the n power where n is the number of levels. For example, the permutations that can be expressed by a six-level code is equal to two to the sixth power, or 64.

b. The code is expressed in either electrical or tape form. In electrical form, each level of the code combinations consists of either a current condition (referred to as a marking pulse) or no-current condition (spacing pulse). Figure 6-1-B. is a graphical representation of a six-level code combination with alternate marking and spacing levels (0-2-4-). In addition to the intelligence pulses, each combination is accompanied by a feed pulse which actuates the feed mechanism of the Punch. The feed and code pulses of each combination are fed to the equipment on individual wires. In tape form the characters are represented by combinations of code holes. Each intelligence level consists of either a hole (corresponding to a marking pulse) or the absence of a hole (corresponding to a spacing pulse). The electrical combination of Figure 6-1-B. is shown in tape form in Figure 6-1-C. Code and feed hole configurations for the different levels of tape are illustrated in Figure 6-1-D.

6-3. GENERAL OPERATION (Figure 6-7)

a. Figure 6-7 is a schematic diagram of the operation of the Punch Set. It illustrates the reception of five-level, electrical code combination 1-3-5 and its perforation in tape. It also illustrates the relative timing of the process. The operation as represented by the figure is described below.

b. A.c. power is fed to the Motor Unit through the motor switch. When the switch is On, the motor converts the electrical power into rotary mechanical motion which is delivered by the drive parts to the drive mechanism on the Punch Unit. The drive mechanism translates the motion from rotary to oscillating and distributes it to the perforating and feed mechanisms.

c. The basic motion of the Punch is oscillating, or simple harmonic. There are actually two sets of motions involved, those of the perforating mechanism and those of the feed mechanism. In Figure 6-8 the 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^{o}. As can be seen, the drive mechanism is so designed that the feed mechanism reaches TDC 45^{o} after the perforating mechanism.

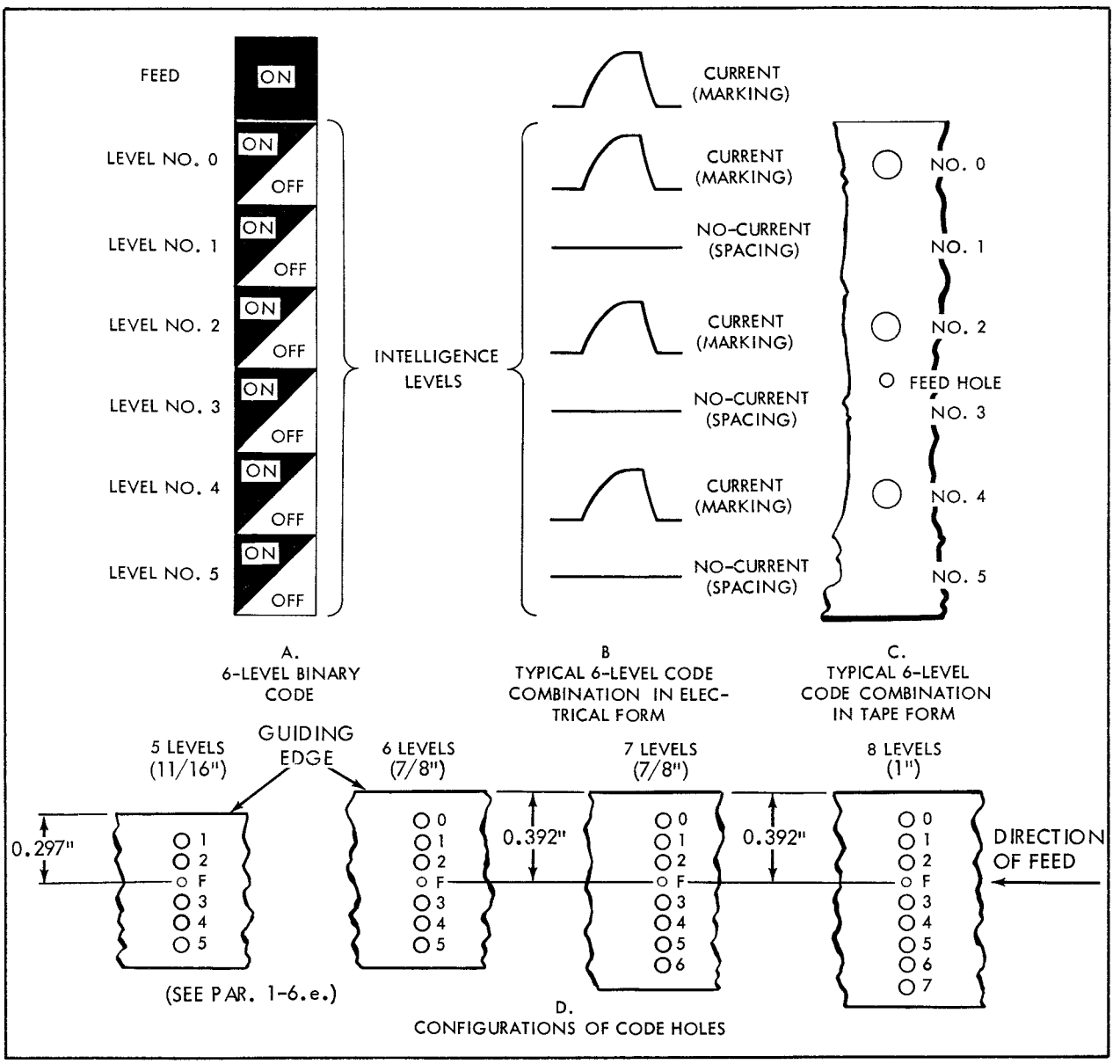


Figure 6-1. Binary Permutation Code

d. An operation of the Punch may be thought of as measured from TDC of the perforating mechanism to TDC of the feed mechanism, a period of 405° (Figures 6-7 and 6-8). This is the period required by the equipment to perforate a character and advance the tape if an electrical code combination has been received. As shown in the figures, the operations overlap each other by 45°.

e. Each operation the magnetic pickup, actuated by an iron insert in the fly wheel, sends out a synchronizing pulse whose function is to actuate the control circuits. The timing of this pulse is adjustable to a number of factors explained in Subdivision 6-5. below. If no intelligence is ready in the control circuits, no feed or code pulses are sent to the magnets, and the Punch undergoes an operation without perforating or feeding the tape.

f. On the other hand, if there is intelligence ready in the control circuits, a combination of code pulses and a feed pulse are applied to the code magnets and feed magnet respectively. Under the control of the code magnets, the perforating mechanism punches code holes in the tape corresponding to the marking pulses received. In addition, the perforating mechanism automatically punches a feed hole with each code combination. As indicated in Figures 6-7 and 6-8, perforation occurs about midway through the operation following reception of the pulses.

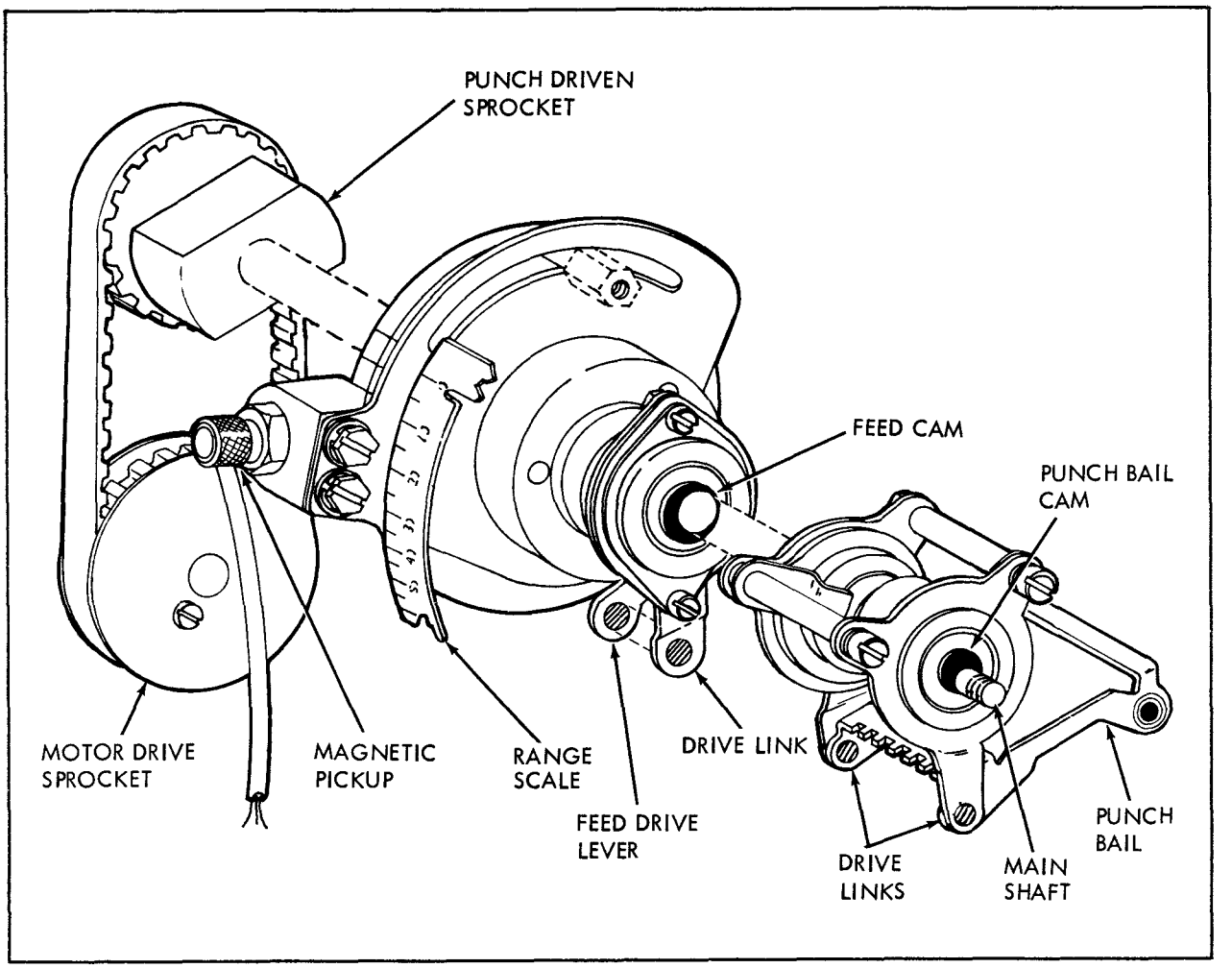


Figure 6-2. Drive Mechanism

g. The feed magnet, energized by the feed pulse, causes the feed mechanism to advance the tape late in the operation after perforation has been completed (Figures 6-7 and 6-8). As the Punch continues to cycle, it perforates a character each operation that the control circuits has one ready.

6-4. MOTION

a. MOTOR UNIT (Figure 6-10)

(1) Mechanical motion to operate the Set is ordinarily supplied by a synchronous Motor Unit. The motor is comprised of a two-pole, wound stator and a squirrel-cage rotor. The stator includes a main operating winding and a start winding connected in parallel (Figure 6-10). A 43-microfarad, electrolytic starting capacitor and the switch of a start relay are in series with the start winding, and the coil of the start relay and a thermal cutout switch are in series with the main operating winding.

(2) When the motor switch is closed, the initial surge of current energizes the start relay coil which closes the relay contacts. The magnetic flux produced by the main-operating and start windings causes the rotor to turn. As the rotor accelerates the current through the motor-start relay, main operating winding and thermal-cutout switch decreases; and at approximately 5.7 amperes the relay coil permits its contact to open and remove the start winding from the circuit. The rotor continues to accelerate until it reaches synchronous speed. The thermal-cutout switch is placed in the circuit to prevent damage that might be caused by an overload. Should the unit draw excessive current--because of a blocked rotor, for example--heat generated in the coils will cause the switch to open and remove power from the motor. The switch can be closed by pressing the red reset button that projects through the motor mounting

plate (see caution note in paragraph 1-3).

(3) A fan mounted at each end of the rotor within the frame draws cooling air through slots in the end bell and exhausts it through slots in the stator frame. Additional cooling is provided by a combination fan-handwheel mounted at the rear end of the shaft.

b. DRIVE PARTS (Figure 6-2) - The drive parts gear up the speed of the Motor Unit's rotary motion and transfer it to the main shaft of the Punch Unit. The drive parts are described in paragraph 1-5.

c. DRIVE MECHANISM (Figure 6-2) - The drive mechanism translates the rotary motion of the drive parts to oscillating motion and distributes it to the perforating and feed mechanisms. Two portions of the main shaft are formed into cams. Through bearings and drive links, the forward cam causes the punch bail of the perforating mechanism to oscillate in simple harmonic motion as represented by the heavy solid line in Figure 6-8. The other cam causes a feed drive lever of the feed mechanism to oscillate as represented by the light solid line in Figure 6-8. The throws of the two cams are so related that the feed drive link reaches top dead center 45^{0} after the punch bail does. The drive mechanism cycles and transfers motion to the feed and perforating mechanisms as long as the motor switch is On.

6-5. SYNCHRONIZATION

a. GENERAL - Since the Punch cycles continuously, the feed and code pulses must be introduced at a specific time (within certain limits) to be properly processed by the Punch. To achieve synchronization between code pulse delivery and mechanical timing of the Punch, a flywheel and magnetic pickup system is utilized. Timing requirements are discussed in paragraph 6-11, and illustrated in Figure 6-8.

b. FLYWHEEL AND MAGNETIC PICKUP SYSTEM - The flywheel and magnetic pickup arrangement used in the High Speed Tape Punch Set (self-contained set) differs from that used in the High Speed Communications Set. Although the systems are similar in appearance and operation, they will be discussed separately.

(1) Self-Contained Set (Figures 6-3 and 3-12) - In this set, the pick-up consists of a permanent magnet and coil (with an iron core), so arranged to create a permanent magnetic field about the pick-up. Each rotation of the main shaft, the iron insert on the periphery of the flywheel passes through and disturbs the field, inducing a voltage in the coil. The flywheel may be oriented in 60-degree steps with respect to the main shaft. This provides an option of six initial positions from which various combinations of operating speed, magnets, and control-circuit delays may be accommodated. Fine adjustment of the pickup is made by means of the range scale, which is adjustable 60 degrees.

(2) High Speed Communication Set (Figures 3-14a and 3-14b) - The pick-up consists of a coil with an iron core, in this set. Each rotation of the main shaft, a permanent magnet insert on the flywheel periphery passes by the coil. The magnetic field of the insert cuts across the coil windings and induces a voltage in the coil. The flywheel may be oriented in 90-degree steps with respect to the main shaft, allowing an option of four initial positions from which various combinations of operating speed, magnets, and control-circuit delays may be accommodated. Fine adjustment of the pickup is made by means of the range scale, which is adjustable 160 degrees.

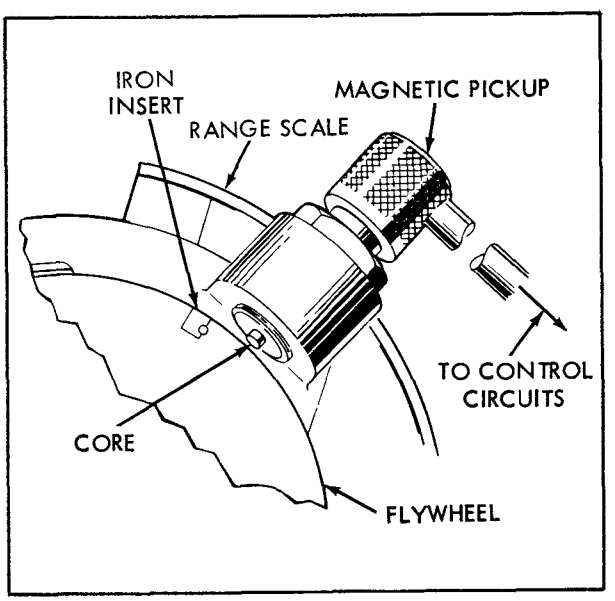


Figure 6-3. Magnetic Pickup

(3) Output Pulse - The voltage induced in the coil, due to the rapidly rotating insert, produces a pulse which is applied to the control circuits (see paragraph 1-6.d.). The design of the control circuits must be such that the pulse will cause them to apply a feed pulse and release any code combination they have ready in storage.

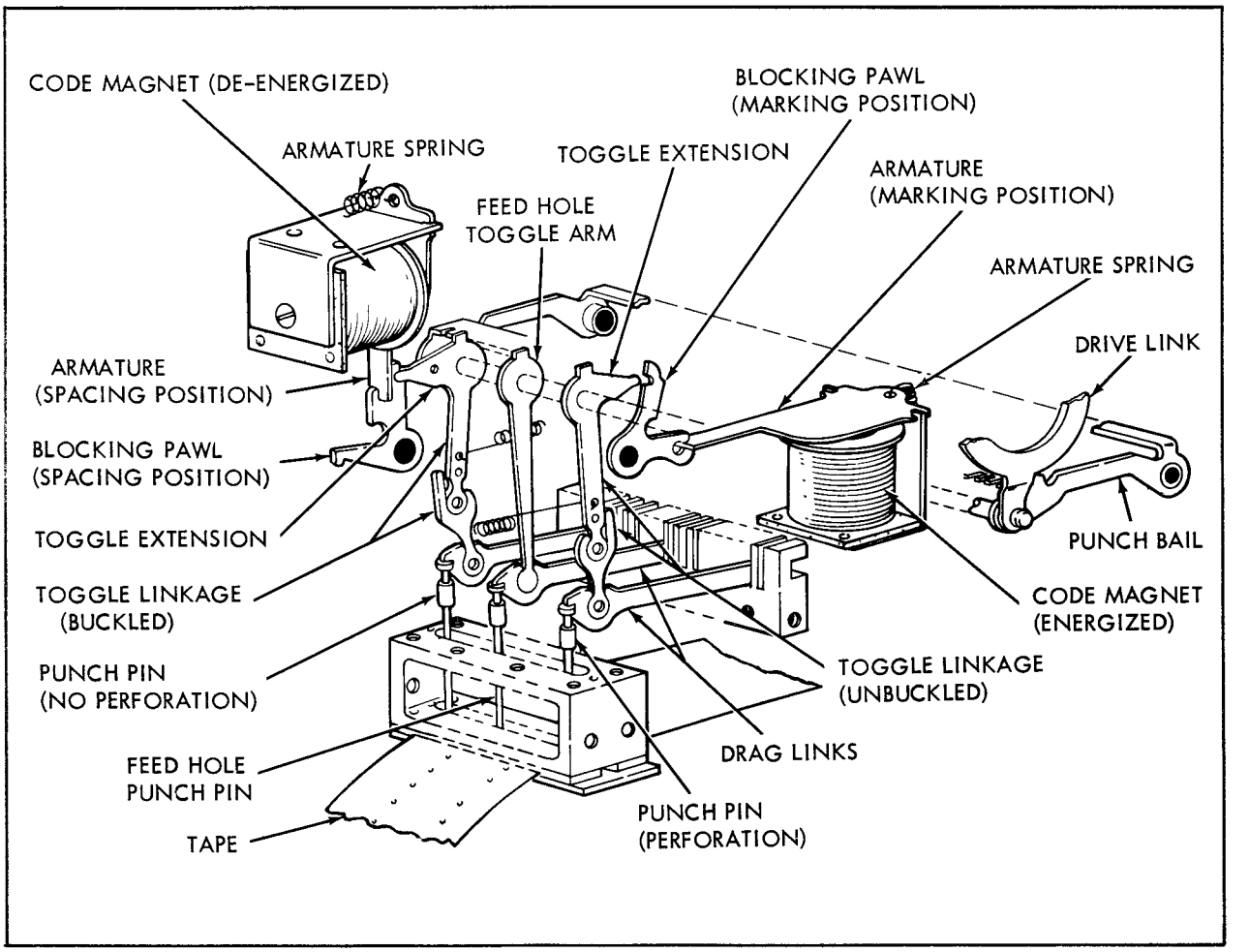


Figure 6-4. Perforating Mechanism

6-6. TAPE PERFORATION (Figure 6-4)

a. The perforating mechanism is shown in Figure 6-4. For each level of the code there is a code magnet, armature, blocking pawl, toggle linkage, drive link and punch pin. In the idling condition --- i.e., motor running and no intelligence being received --- the armatures are held by their springs away from the magnet pole faces. 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 as represented in Figure 6-8.

b. When the toggle linkages move down at the beginning of each idling operation, toggle extensions encounter the blocking pawls and cause the linkages to buckle at 51° of shaft rotation. Motion is imparted to the punch pins through the drag links, but not enough motion to drive them through the tape. Thus no code holes are perforated. The travel of the pins for spacing is represented by the heavy dotted line in Figure 6-8. Each operation the drive mechanism causes a feed hole toggle arm and drive 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.

c. When a code combination is received, the magnets and associated parts corresponding to the spacing levels of the code operate the same as described in the two previous paragraphs. For the marking levels of the combination, the magnets are energized and pull their armatures to their attracted (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° to 40° of shaft rotation) illustrated in Figure 6-8.

d. As the toggle linkages move down at the beginning of the operation, the toggle extensions associated with the 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 heavy line in Figure 6-8. As can be seen, perforation occurs about midway through the operation between 140° and 220° of shaft rotation. Each time the tape is advanced (described in paragraph 6-7 below), the feed hole punch pin perforates a feed hole with the combination of code holes.

6-7. TAPE FEEDING (Figure 6-5)

a. The tape feed mechanism is shown in Figure 6-5. 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° of shaft rotation (Figure 6-8). 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 Figure 6-8. In this condition the feed wheel is not rotated and the tape is not advanced.

b. 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. (Figure 6-8). As the toggle linkage moves down

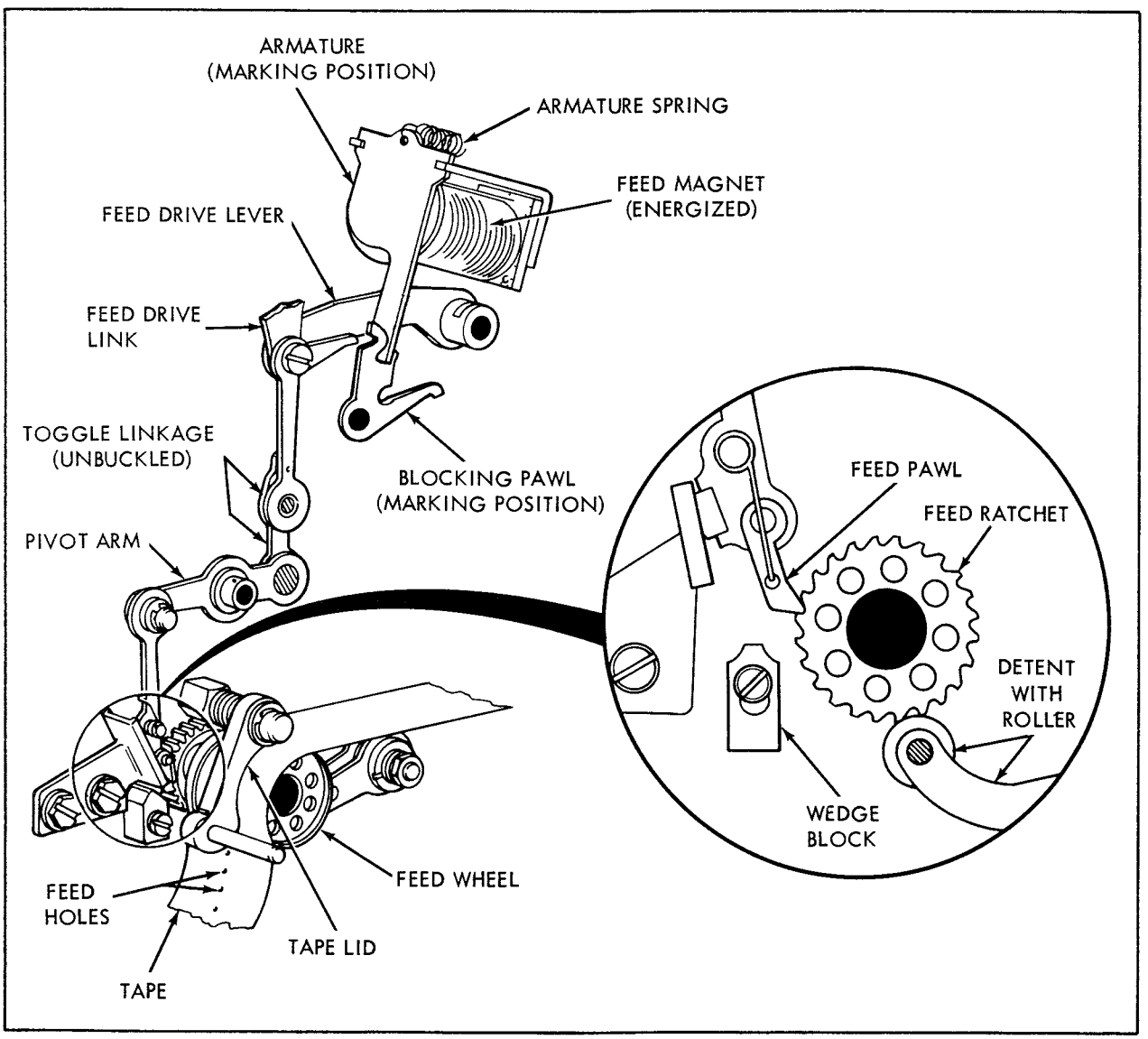


Figure 6-5. Tape Feeding Mechanism

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 Figure 6-8, feeding occurs between 293° and 44° of shaft rotation.

c. Near the end of its downward travel, the pawl is engaged by a wedge block which prevents overtravel. Constant spacing of the code perforations is ensured by a detent with a roller that is held under spring pressure against the ratchet and secures the feed wheel and tape in position between feeding operations. Constant spacing of the perforations in relation to the edge of the tape is maintained by a biasing spring which holds the tape back against a reference surface on the block (Figure 3-9). The tape is fed into the punch block through a tape guide (Figure 3-9) and is held on the feed wheel by a spring-biased tape lid which may be raised to initially insert the tape.

6-8. MANUAL FEED OUT (Figure 3-13)

When the feed-out lever is manually depressed, it moves the feed-magnet armature and its blocking pawl to their marking position. As the Punch cycles, the feed mechanism operates as if the feed magnet were energized and tape is fed out continuously until the lever is released. The code magnets are de-energized and thus no code holes are perforated. Since the feed hole punch pin is driven through the tape every operation, a feed hole is perforated each time the tape is advanced.

6-9. TAPE REEL AND BRAKE MECHANISM (Figure 6-6)

The tape reel and brake mechanism on the Base provides a rotating reel for the tape roll and controls its rapid acceleration and deceleration during starting and stopping. When feeding starts, the abrupt pull of the tape on the tape guide pivots a brake and moves its friction surface away from the periphery of the reel. The "giving" action of the tape guide serves to dissipate the inertia of the stationary tape roll. During feeding the tape guide and brake keep the tape taut by alternately braking and releasing the reel. When feeding stops, the tape's pressure on the tape guide is released, and the reel is quickly braked to a stop to prevent excess tape from unwinding.

6-10. LOW TAPE MECHANISM (Figure 6-6)

The low-tape mechanism may be connected so as to actuate an external audible or visual alarm when the tape roll is near depletion. A low tape lever under spring tension rides on the tape roll. When the roll reaches a predetermined diameter, the lever closes the low tape contacts which will complete an alarm circuit. The lever serves a secondary purpose by holding any loose loops on the roll until they are taken up by the feeding operation.

6-11. TIMING (Figure 6-8)

a. GENERAL. The mechanical and electrical conditions outlined below and illustrated in Figure 6-8 are those recommended for normal operation and may be varied experimentally in specific applications. Additional information may be obtained by contacting the Teletype Product Sales Department. The timing of the Punch is based on the top dead center position (TDC) of the perforating mechanism (or the punch bail) which is designated as 0 degrees of shaft rotation and 0 time in milliseconds.

b. MECHANICAL

(1) The feed and code selection intervals are represented by bars (a) and (b) in Figure 6-8. As illustrated by the insert in Figure 6-8, the selection interval is that period during any operation when the feed or code toggle extension is above the blocking surface of the blocking pawl. When a feed or code pulse is applied to a magnet, the associated blocking pawl (operated by the armature) must be in its marking position (i.e., out of the way of the toggle extension) at the end of the selection interval for the tape to be advanced or perforated. The feed mechanism operates 45° after the perforating mechanism to allow perforation to be completed before the tape is advanced.

(2) The code selection interval for any given operation (e.g., the second operation in Figure 6-8) extends from 40° before to 40° after TDC of the perforating mechanism (bar (a) of Figure 6-8). The feed selection interval extends from 5° to 85° after TDC of the perforating mechanism (bar (b)). For simultaneous feed and code pulses -- i.e., the feed and all code pulses start and end at the same time -- the feed and code magnet armatures should reach their fully attracted position before the end of the code selection interval, and should not reach their fully-released position until after the end of the feed selection interval.

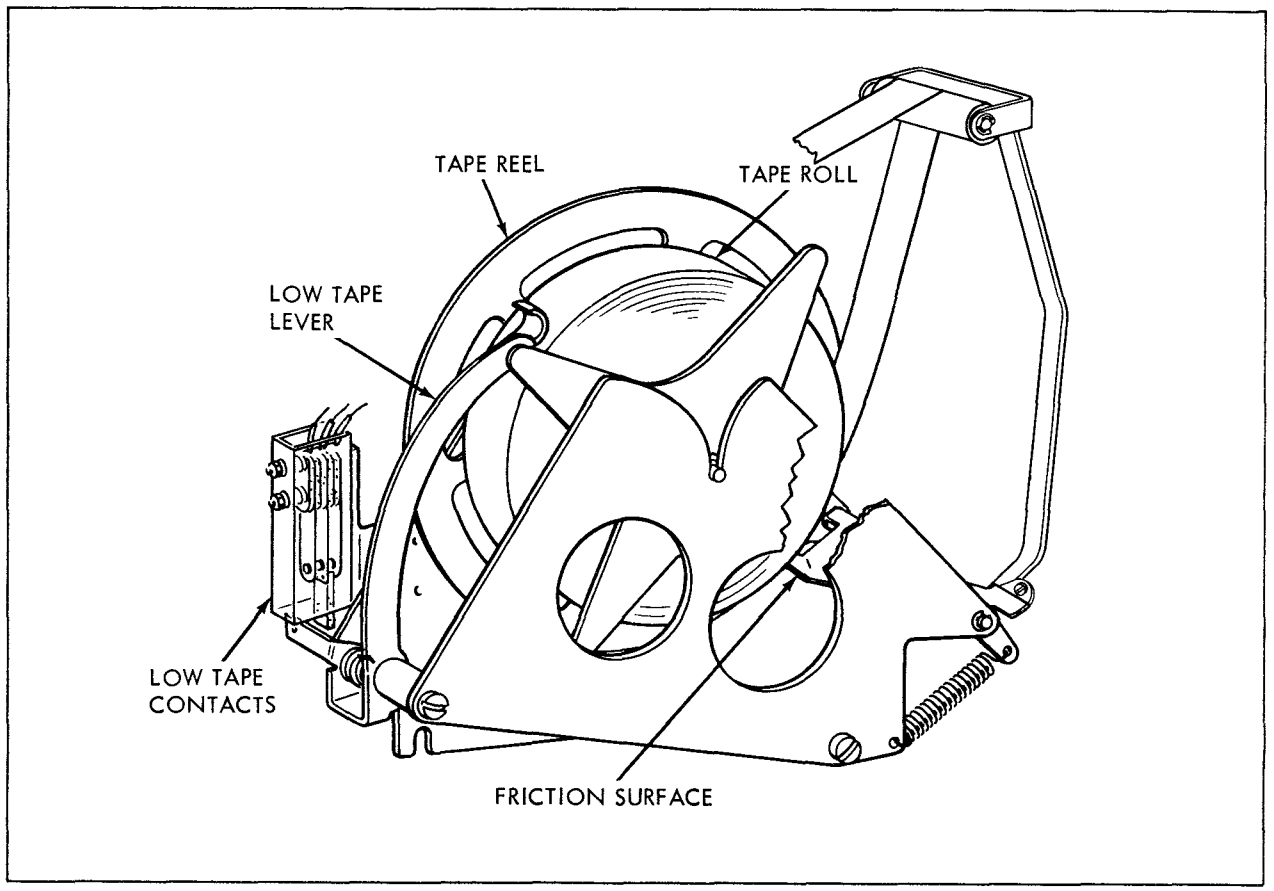


Figure 6-6. Tape Reel and Brake Assembly

c. ELECTRICAL

(1) To meet the mechanical requirements in paragraph 6-11. b. (2) above for operating speed of 110 ops, 4-millisecond feed and code pulses should start between 133° (3.37 ms) and 60° (1.52 ms) before TDC of the perforating mechanism (bar (c)). A typical 4 ms feed or code pulse for 110 ops is represented by the shaded portion of bar (d). It begins at 75° (1.90 ms) before and ends at 83.4° (2.10 ms) after TDC of the perforating mechanism. Since the armature release and attract times are both 2 ms (79.2°), the armature is fully attracted at 4.2° (0.10 ms) after TDC and fully released at 162.6° (4.10 ms) after TDC of the perforating mechanism.

(2) To meet the mechanical requirements for operating speed of 63.3 ops, 4-millisecond feed and code pulses should start between 42° (1.84 ms) and 16° (0.70 ms) before TDC of the punch bail (bar (e)). A typical 4 ms feed or code pulse for 63.3 ops is depicted by the shaded portion of bar (f). It begins at 25° (1.10 ms) before and ends at 66.2° (2.90 ms) after TDC of the perforating mechanism. Since the armature attract and release times are both 2 ms (45.6°), the armature is fully-attracted at 20.6° (0.90 ms) after TDC and fully released 111.8° (4.88 ms) after TDC of the perforating mechanism.

(3) Instructions for orienting the synchronizing pulse for various combinations of speed, magnet-attract times and control-circuit delays are given in Figures 3-1 and 3-2.

6-12. EARLY-DESIGN PUNCHES (Figure 6-9)

a. The early-design Punch operates on 115 volts d.c. with sufficient series resistance to maintain a magnet operating current of 25 milliamperes d.c.

b. It should operate normally under the following conditions:

(1) For each marking code pulse received, a code magnet armature should reach the fully attracted position between 90° before and 20° after the top dead center position (TDC) of the punch bail. The feed magnet armature should reach the fully attracted position between 47° before and 70° after TDC of the punch bail. The code magnet armature should be held in the fully attracted position until 60° after

TDC of the punch bail. The feed magnet armature should be held in the fully attracted position until 110° after TDC of the punch bail.

(2) For each spacing code pulse received, the feed magnet armature should reach the fully released position between 250° before and 70° after TDC of the punch bail. The code magnet armatures should reach the fully released position between 300° before and 20° after TDC of the punch bail.

c. The code magnets fully attract their armatures between 6 and 8 milliseconds after being energized from a 115 volt d.c. power supply with series resistors limiting the operating current to 25 milliamperes. The code magnet armatures are fully released within 6 milliseconds after opening this circuit.

d. The feed magnet fully attracts its armature between 8 and 10 milliseconds after being energized from a 115 volt d.c. power supply with series resistors limiting the operating current to 25 milliamperes. The feed magnet armature is fully released within 4 milliseconds after opening this circuit.

NOTE

The operation of all magnet armatures is largely dependent upon the circuitry of the auxiliary apparatus: The values in paragraphs c. and d. above can be varied experimentally for specific applications.

e. When operating the Punch under the conditions described in paragraphs c. and d. at 3600 opm, and applying voltage simultaneously to (energizing) the feed magnet and any or all code magnets, the code and feed magnets should be energized between 140° (8 ms before 313°) and 207° (8 ms before 380°) of the operating cycle. The magnets should be de-energized between 110° and 250° (6 ms before 380°) of the operating cycle. The 110° applies to all punch speeds. The values given in milliseconds apply to all punch speeds if the voltage and current conditions remain the same as indicated in subparagraphs c. and d. above. See Figure 6-9 for the timing diagram of required mechanical results.

f. The synchronizing pulses are provided by two contactors, each having a set of (make before break) two pairs of contacts. The timing of the make-break point of one contact set (No. 2 contactor) is adjustable throughout a range of 225° of the operating cycle. The timing of the make-break point of the other contact set (No. 1 contactor) is adjustable throughout a range of 170° with respect to a fixed position of the No. 2 contactor set (Figures 3-23) and 3-24).

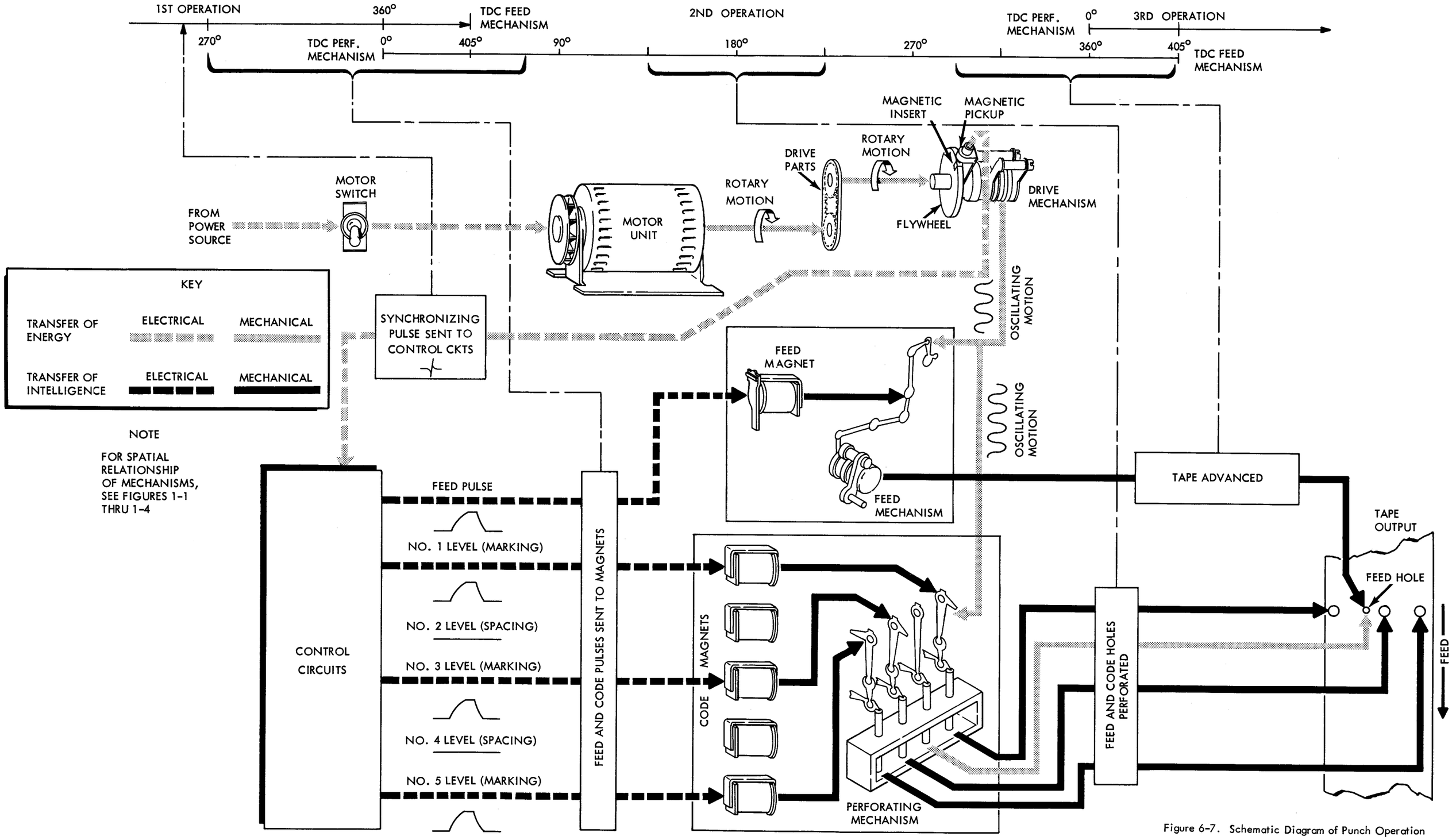


Figure 6-7. Schematic Diagram of Punch Operation

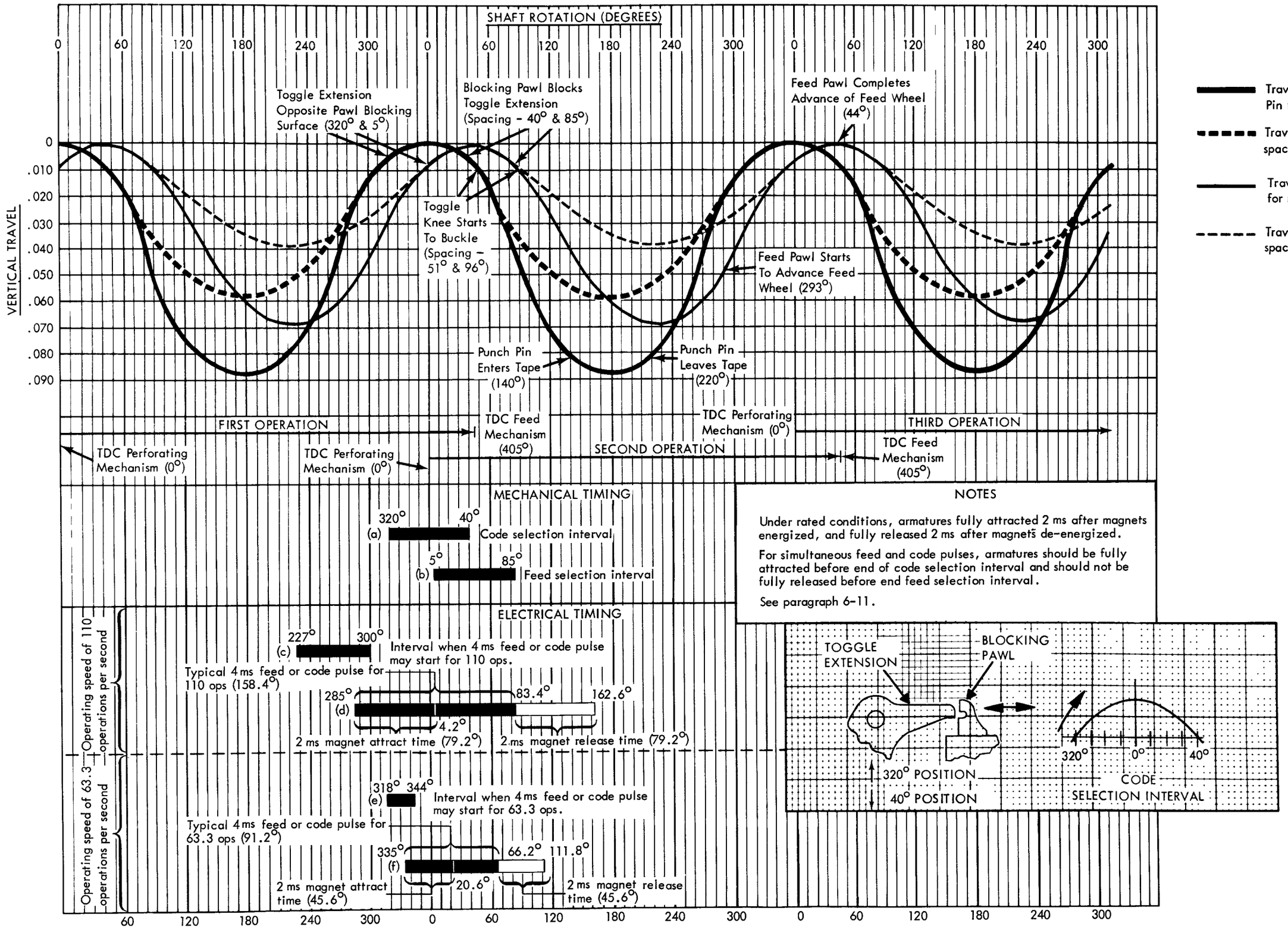


Figure 6-8 Timing Diagram (Late Design)

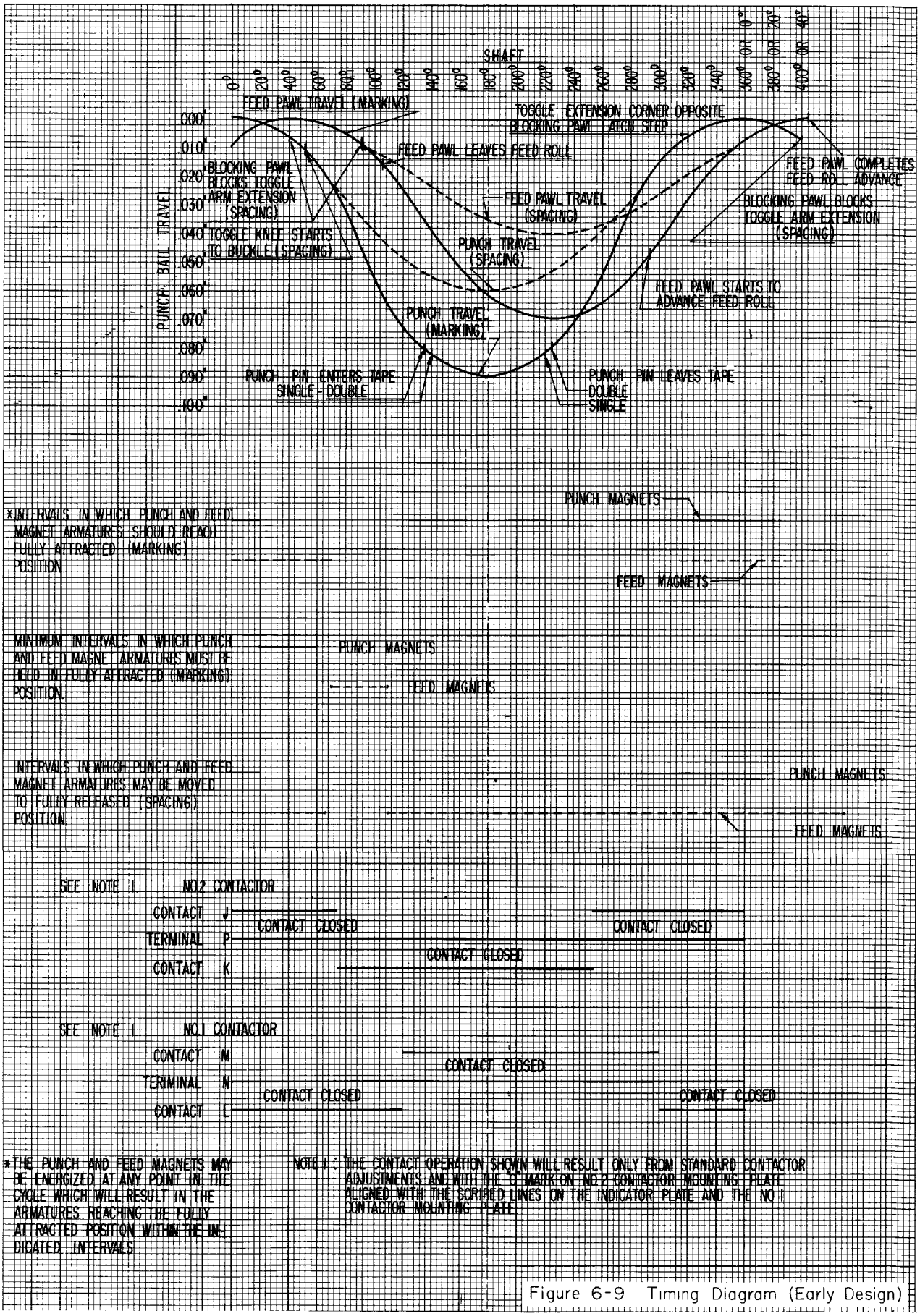


Figure 6-9 Timing Diagram (Early Design)

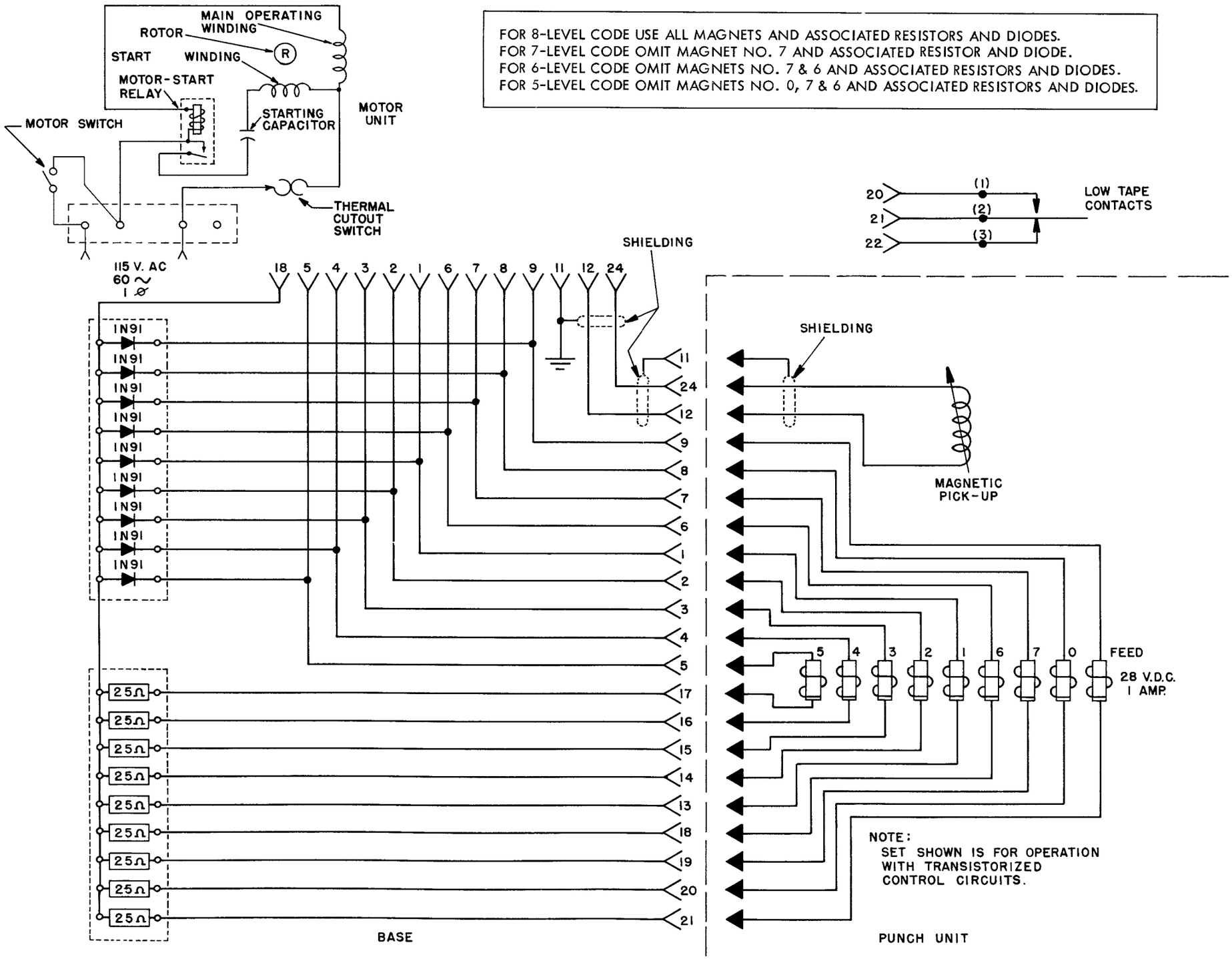


Figure 6-10. Schematic Wiring Diagram: Typical Tape Punch Set