BULLETIN 215B

TECHNICAL MANUAL

HIGH SPEED TAPE PUNCH SET
(BRPE)

TELETYPE®
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BULLETIN 2158

TECHNICAL MANUAL

HIGH SPEED TAPE PUNCH SET
(BRPE)

SECTIONS

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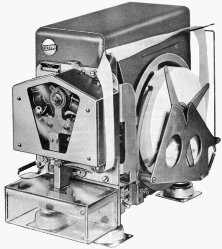
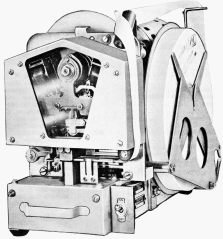


HIGH SPEED TAPE PUNCH SET (Late Design)
Consists of
Base (BRPEB), Punch Unit (BRPE)
Motor Unit (LMU) and Cover (BRPEC)



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

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SECTION 1

DESCRIPTION

1-1. INTRODUCTION

a. This manual presents information for the High Speed Tape Punch Set, an electro-mechanical apparatus designed to rapidly perforate intelligence into paper tape. Unless stated otherwise, the material in this publication applies to late-design Punch Sets, the manufacture of which began in 1959. Sets manufactured prior to 1959 are considered early-design Punch Sets, and are so designated.

b. Also included in this manual is certain adjustment information which pertains to Punch Units (see Paragraph 1-1.e) used in applications other than High Speed Tape Punch Sets. For further information concerning these Punch Units and their applications, contact the Teletype Product Sales Department.

c. Section 1 provides a brief physical and functional description of the equipment and a listing of the 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 6-4 which indicates recommended electrical and mechanical timing.

d. 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 1-1.b, it will be found in Section 1. Similar numbering is applied to the illustrations: For example, Figure 6-4 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 1-2), 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.

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

Self-Contained Set	A Punch Set (see Paragraph 1-2) consisting of a Punch Unit, Base, Motor Unit, and drive parts.
Punch	This term designates the equipment when there is no need to differentiate between the Punch Set (see Paragraph 1-2) and the Punch Unit (see Paragraph 1-5).
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 perform 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 perform operations 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 performing 110 characters per second is operating at 60 x 110/6, or 1100 words per minute.

1-2. GENERAL (Figure 1-2)

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 1-2) 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).

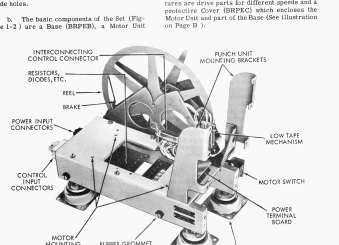


Figure 1-1. Tape Punch Base

1-3. BASE (Figure 1-1)

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 connector for interconnecting the Base and Punch Unit.

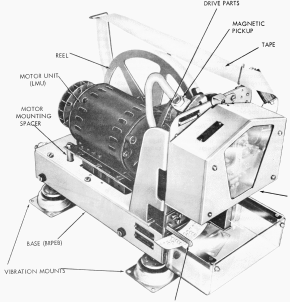


Figure 1-2. High Speed Tape Punch

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

f. A reel and brake assembly which accommodates the tape pull 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 customer's discretion.

i. Rubber grommets for supporting the Cover.

1-4. 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 insulated 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 in 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.

1-5. 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

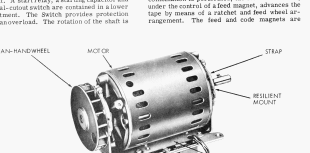


Figure 1-3. Motor Unit

energized by electrical pulses fed to the unit on multiple wires. For location of magnets on Punch, see Figure 1-5. 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 certain Punch Units.

1-6. MOTOR MOUNTING AND DRIVE PARTS

a. General - The high speed Tape Punch Unit may be driven by one of two methods, a belt drive system or a gear drive system. A description of each follows.

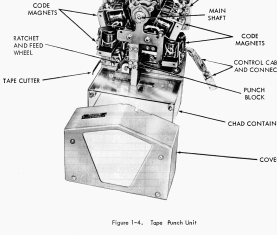
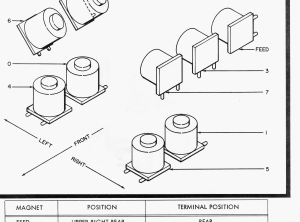


Figure 1-4. Tape Punch Unit

b. Belt Drive System (Figures 1-2 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 1-2). 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 3-26) - 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.



MAGNET	POSITION	TERMINAL POSITION
FEED	UPPER RIGHT REAR	REAR
0 - PULSE	LOWER LEFT REAR	REAR
1 - PULSE	LOWER RIGHT REAR	REAR
2 - PULSE	UPPER LEFT REAR	REAR
3 - PULSE	UPPER RIGHT MIDDLE	DOWN ON 8 LVL, FRONT ON 5 LVL.
4 - PULSE	LOWER LEFT FRONT	FRONT
5 - PULSE	LOWER RIGHT FRONT	FRONT
6 - PULSE	UPPER LEFT FRONT	DOWN
7 - PULSE	UPPER RIGHT FRONT	DOWN

Figure 1-5. Magnet Positions

1-7. TECHNICAL DATA

a. GENERAL - The data given below is for typical tape punches and may vary for individual coded units. A number of variables are associated with the values in Paragraph 1-7. 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) 105 operations (or characters) per second (1050 words per minute).

(3) 63.3 operations (or characters) per second (633 words per minute).

c. MAGNET SPECIFICATIONS

	Transistor Operation	Vacuum-Tube Operation
Attract Time (Milliseconds to fully attract)*	3-4	4-5
Release Time (Milliseconds to fully release)*	6-8	6-8
Magnet Coil Resistance (Ohms)	2, 9	74-82
Magnet Coil Inductance (Millihenries)	8	100
External Current Limiting Resistance (Ohms)*	25++	600#
Code and Feed Pulse Requirements*		
Current (Amp.) (I)	1	0.150
Voltage (dc)	28	115
Length (Milliseconds)**	4.5	4.5

Must be supplied by customer.

++CAUTION

If the 25 ohm resistors supplied on the base exceed 5 milliseconds on, for one character operation, it is necessary that the resistors be removed from the base and a special external mounting (or blower) be supplied to dissipate the heat from the resistors.

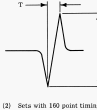
*Since the operation of the magnets is largely dependent on the control circuitry, these values may be varied experimentally for specific applications.

**Production tape punch units are adjusted to a standard optimum input signal of 4.5 ms pulse length with an expected operational tolerance requirement of approximately ±8% margin, ie, the unit will operate through an approximate range of 4.15 to 4.85 ms without readjustment of armature gap and/or spring tension. Field applications having control equipment generating signals other than that of an optimum 4.5 ms pulse length may therefore require refinement of the magnet armature adjustments and spring tensions to provide some operating margin of the pulse length being used.

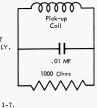
d. MAGNETIC PICKUP SPECIFICATIONS

(1) Sets with 60 point timing scale - Output pulse with clearance of 0.010 inch (see Figure 3-20) and pickup connected across load equivalent to 0.01 MF and 1000 ohms in parallel.

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



CIRCUIT FOR MEASUREMENT PURPOSES ONLY.



(2) Sets with 160 point timing scale - See Figures 1-6 and 1-7.

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

Levels	5, 6, 7 or 8 with in-line feed hole 6 with advanced feed hole
Widths	11/16 inch (5 level) 7/8 inch (6 & 7 level) 7/8 inch with advanced feed hole (6 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 6-Level (Advanced Feed Hole) - 0.441

f. MOTOR UNIT

Type	Synchronous
Input Voltage	Single Phase 115 Volts ± 10%, 60 Cycles ± 1%
Input Current - Starting	9 Amp.
- Running	2 Amp.
Power Output	1/20 Horsepower at 3600 RPM
Power Consumption	95 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

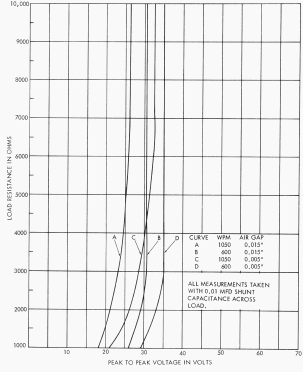


Figure 1-6. Magnetic Pickup Characteristics

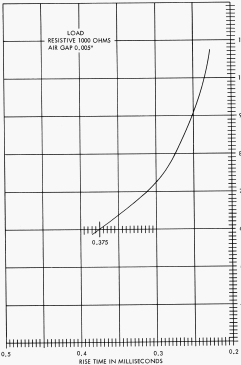


Figure 1-7. Magnetic Pickup Characteristics

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, not in a specification packed with the set of parts, Parts Bulletin 15448 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 is around the Punch Unit between the outer liner. Grasp the unit by the cover and the wooden tape puller 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 and caps, hold it in place and turn the carton upside down. Lift the carton off the Unit across 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 150768 screws with 93065 lock washers should pass through the rear bracket 142935 and 142936 mounting brackets on the Base into the upper part of the 143900 rear plate of the Punch Unit. The four 151724 screws with 3669 lock washers should pass from the front through the lower part of the rear plate into the 142936 and 142935 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 59448 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 2-2 . 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 2-2 .

2-5. ELECTRICAL CONNECTIONS

See Paragraph 1-7 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 3-7 .

(2) Orientation of the flywheel for synchronization purposes (see Paragraph 5-5) is pre-set at the factory. Refer to Figure 3-15 or 3-18 for the proper flywheel orientation procedure to follow if reorientation is necessary.

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

c. TAPE ROLL - Remove the tape reel from the tape container. Unscrew the tape re-

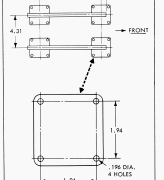


Figure 2-1. Set Mounting Dimensions

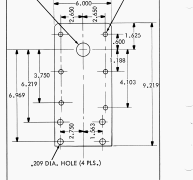


Figure 2-2. Punch Unit Mounting Dimensions

tainer 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.

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 Paragraph 1-1 and Paragraph 6-1.c), operating life will be increased if the lowest suitable speed is used. For example, if perforation is set to occur at a rate over 60 characters per second, then drive parts providing 63.3 cps should be employed rather than those providing 110 cps. 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.

NOTE

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 connectors. 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 and worn bearing surfaces may indicate insufficient clearance or improper lubrication, 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). These parts are available in the form of a Maintenance Parts Kit. For information concerning these kits, contact the Teletype Product Sales Department.

Words Per Minute	Punching	Idling
600	3,000 Hrs.	550 Hrs.
857	1,500 Hrs.	400 Hrs.
1,100	1,000 Hrs.	300 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 3-5 through 3-29) covers adjustments and spring tensions for late-design Punches (BRPET and up), while Paragraph 3-5 (Pages 3-30 through 3-37) covers this material for early-design equipment (BRPES and lower).

b. In the adjustments and spring tensions covered in this section, location of clearances, position of parts and point and angle of stake 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 disturb or 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. Smaller points should fall wholly within the circumference of larger mating points. Points that are the same size should be out of alignment more than 25 per cent of the point diameter. Avoid sharp ridges 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

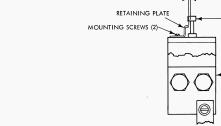
Improperly adjusted equipment may be seriously damaged in a matter of seconds if operated under power.

3-3. ALPHABETICAL INDEX: ADJUSTMENTS AND SPRING TENSIONS

3-4. LATE DESIGN

a. PUNCH UNIT

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.



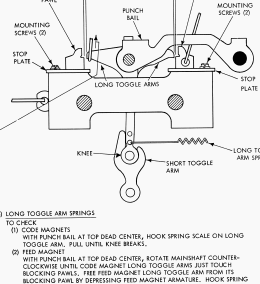
NOTE
IF PUNCH BLOCK IS REMOVED FROM UNIT FOR ANY REASON, MAKE PUNCH PIN ADJUSTMENT BEFORE REPLACING IT.

CAUTION
DO NOT ATTEMPT TO ADJUST PUNCH BLOCK DIE PLATE.

Figure 3-1.

(A) STOP PLATE
TO CHECK
HOLD BLOCKING PAWLS AGAINST STOP PLATES AWAY FROM TOGGLE ARMS. 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 STOP PLATES WITH MOUNTING SCREWS LOOSENED.



(B) LONG TOGGLE ARM SPRINGS
TO CHECK
(1) CODE MAGNETS
WITH PUNCH BAIL AT TOP DEAD CENTER, HOOK SPRING SCALE ON LONG TOGGLE ARM. PULL UNTIL KNEE BREAKS.
(2) FEED MAGNET
WITH PUNCH BAIL AT TOP DEAD CENTER, ROTATE MAINSHAFT COUNTER-CLOCKWISE UNTIL CODE MAGNET LONG TOGGLE ARMS JUST TOUCH BLOCKING PAWLS. FREE FEED MAGNET LONG TOGGLE ARM FROM ITS BLOCKING PAWL BY DEPRESSING FEED MAGNET ARMATURE. HOOK SPRING SCALE ON LONG TOGGLE ARM. PULL UNTIL KNEE BREAKS.
REQUIREMENT (EACH SPRING)
MIN., 6 OZS. — MAX., 9 OZS.
TO START SHORT TOGGLE ARM MOVING AWAY FROM LONG TOGGLE ARM.

Figure 3-2.

NOTE

IF A 143089 ARMATURE SPRING CLIP IS AVAILABLE, FOLLOW ARMATURE SPRING ADJUSTMENT. (FIGURE 3-4).

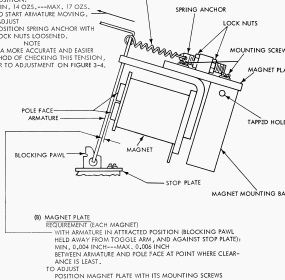
(A) ARMATURE SPRING

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.

NOTE

FOR A MORE ACCURATE AND EASIER METHOD OF CHECKING THIS TENSION, REFER TO ADJUSTMENT ON FIGURE 3-4.



(B) MAGNET PLATE

REQUIREMENT (EACH MAGNET)
WITH ARMATURE IN ATTRACTED POSITION (BLOCKING PAWL HELD AWAY FROM TOGGLE ARM, AND AGAINST STOP PLATE):
MIN., 0.004 INCH---MAX., 0.006 INCH
BETWEEN ARMATURE AND POLE FACE AT POINT WHERE CLEARANCE IS LEAST.

TO ADJUST
POSITION MAGNET PLATE WITH ITS MOUNTING SCREWS LOOSENED.

NOTE

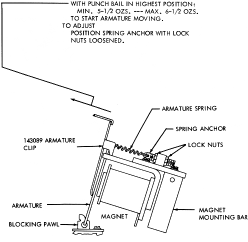
MAKE CERTAIN THAT TAPPED HOLES IN MAGNET MOUNTING BARS MATCH HOLES IN PUNCH UNIT COVER. IF NOT, POSITION BARS BY LOOSENING TWO MOUNTING SCREWS AT REAR.

Figure 3-3.

NOTE

THE FOLLOWING ADJUSTMENT PERTAINS ONLY TO CODE LEVEL SPRINGS. TO CHECK THE FEED LEVEL ARMATURE SPRING TENSION, USE ADJUSTMENT (e), FIGURE 3-3.

ARMATURE SPRING
TO CHECK
POSITION A 143089 ARMATURE CLIP OVER ARMATURE AS SHOWN. REQUIREMENT (EACH CODE LEVEL SPRING) WITH PUNCH BAIL IN HIGHEST POSITION: MIN. — 1-1/2 OZS. — MAX. 4-1/2 OZS.
TO START ARMATURE MOVING.
TO ADJUST
POSITION SPRING ANCHOR WITH LOCK NUTS LOOSENED.



NOTE

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

Figure 3-4.

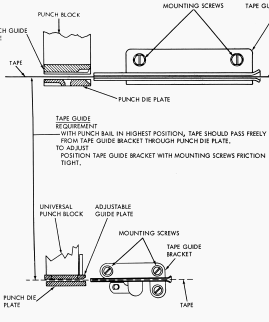
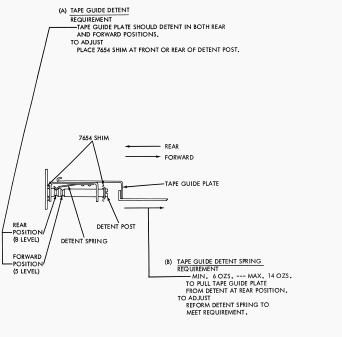

PUNCH BLOCK
MOUNTING SCREWS
TAPE GUIDE BRACKET
PUNCH GUIDE PLATE
TAPE
TAPE
PUNCH DIE PLATE
TAPE GUIDE REQUIREMENT
WITH PUNCH BAIL IN HIGHEST POSITION, TAPE SHOULD PASS FREELY FROM TAPE GUIDE BRACKET THROUGH PUNCH DIE PLATE.
TO ADJUST
POSITION TAPE GUIDE BRACKET WITH MOUNTING SCREWS FRICTION TIGHT.
UNIVERSAL PUNCH BLOCK
ADJUSTABLE GUIDE PLATE
MOUNTING SCREWS
TAPE GUIDE BRACKET
PUNCH DIE PLATE
TAPE

Figure 3-5.



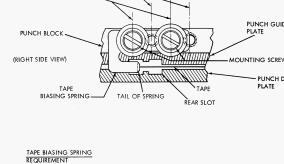
NOTE
ADJUSTMENTS (A) AND (B) ONLY REQUIRED ON PUNCH UNITS WITH UNIVERSAL PUNCH BLOCK CAPABLE OF PUNCHING EITHER 11/16" OR 1" TAPE.

Figure 3-6.

NOTE

THE CONFIGURATION OF TAPE BIASING SPRING AND PUNCH PLATES VARY, BUT THE TAPE BIASING SPRING ADJUSTMENT PROCEDURE REMAINS THE SAME.

CERTAIN PUNCH SETS HAVE PUNCH PLATES DESIGNED TO USE EITHER 1 INCH OR 7/8 INCH WIDTH TAPE. THESE PUNCH SETS 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.



TAPE BIASING SPRING REQUIREMENT

TAPE BIASING SPRING SHOULD SLANT TAPE TOWARD REAR OF PUNCH BLOCK WITHOUT CRIMPING OR CURLING FRONT EDGE OF TAPE.

TO ADJUST

POSITION SPRING WITH MOUNTING SCREWS) FRICTION TIGHT.

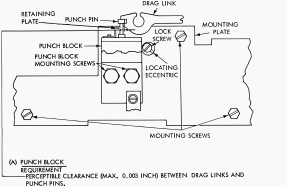
TO VERIFY

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 LINKS ADJUSTMENT (FIGURE 3-9) HAS BEEN COMPLETED.

NOTE

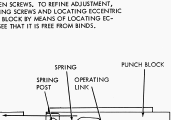
TAPE BIASING SPRING MUST NOT BIND AGAINST PUNCH GUIDE PLATE OR PUNCH DIE PLATE.

Figure 3-7.



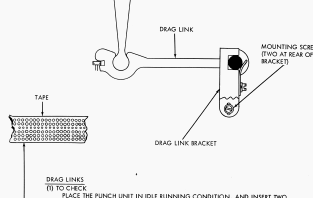
(A) PUNCH BLOCK REQUIREMENT
PERCEPTIBLE CLEARANCE (MAX. 0.003 INCH) BETWEEN DRAG LINKS AND PUNCH PINS.
TO ADJUST
POSITION PUNCH BLOCK BY MOVING MOUNTING PLATE WITH MOUNTING SCREWS LOOSENED. TIGHTEN SCREWS. TO REFINE ADJUSTMENT, LOOSEN PUNCH BLOCK MOUNTING SCREWS AND LOCATING ECCENTRIC LOCK SCREW. POSITION PUNCH BLOCK BY MEANS OF LOCATING ECCENTRIC. CHECK EACH PIN TO SEE THAT IT IS FREE FROM BINDS.

(B) OPERATING LINK SPRING
TO CHECK
OPERATING LINK IN "OUT" (1/16" TAPE) POSITION, SPRING REMOVED FROM POST.
REQUIREMENT
MIN. .6 OZS. --- MAX. 10 OZS.
TO PULL SPRING TO INSTALLED LENGTH.



NOTE
ADJUSTMENT (B) ONLY REQUIRED ON PUNCH UNITS WITH UNIVERSAL PUNCH BLOCK CAPABLE OF PUNCHING EITHER 11/16" or 1" TAPE.

Figure 3-8.



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 IMPRESSIONS (OR MARKS) 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

LOOSEN THREE MOUNTING SCREWS.

START WITH DRAG LINK BRACKET IN CENTER OF ITS ADJUSTMENT RANGE. IF TOP THICKNESS OF TAPE (SEE (1) ABOVE) SHOWS PUNCH PIN IMPRESSIONS (OR MARKS), 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 OR MARKS IN TOP THICKNESS OF TAPE WHEN DRAG LINK BRACKET IS IN ITS LOWERMOST POSITION (SEE (1) ABOVE). TO CORRECT, LOOSEN PUNCH BLOCK MOUNTING SCREWS AND PUSH PUNCH BLOCK DOWN. TIGHTEN MOUNTING SCREWS. REMAKE DRAG LINKS ADJUSTMENT. IN EXTREME CASES, IT MAY BE NECESSARY TO MOVE THE MOUNTING PLATE (SEE FIGURES 3-8) DOWN. AFTER MOVING MOUNTING PLATE, RECHECK THE FOLLOWING ADJUSTMENTS: PUNCH BLOCK (FIGURE 3-8) AND TAPE GUIDE (FIGURE 3-5).

Figure 3-9.

NOTE

THE FOLLOWING SEVEN ADJUSTMENTS - (1) TAPE LID SPRING (FIGURE 3-11), (2) FEED RATCHET DETENT ARM (FIGURE 3-12), (3) FEED RATCHET DETENT ARM SPRING (FIGURE 3-12), (4) FEED PAWL SPRING (FIGURE 3-13), (5) FEED PAWL LINK (FIGURE 3-13), (6) WEDGE BLOCK (FIGURE 3-14), AND (7) CHECK FOR TEN CHARACTER PER INCH (FIGURE 3-16) - MUST BE PERFORMED AS OUTLINED IN ORDER TO ACHIEVE PROPER CODE HOLE INTERVALS (TEN CHARACTERS PER INCH).

TEN CHARACTERS PER INCH

TO CHECK

WITH MAXIMUM TAPE SUPPLY LOAD (FULL ROLL), POWER PERFORATE SIX SERIES OF NINE "BLANK" COMBINATIONS FOLLOWED BY ONE "LETTERS" COMBINATION (ONLY "LETTERS" OR "BLANKS" ACCEPTABLE).

REQUIREMENT

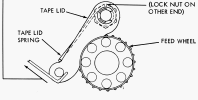
PLACE TAPE OVER SMOOTH SIDE OF 9590 TAPE GAUGE SO THAT FIRST P_2 CODE HOLE IN TAPE IS CONCENTRIC WITH FIRST (0.072") HOLE OF TAPE GAUGE (SEE NOTE BELOW). THE NEXT FOUR 0.072" HOLES IN TAPE GAUGE SHALL BE VISIBLE THROUGH P_2 CODE HOLES IN TAPE, AND LAST (SIXTH) P_2 CODE HOLE IN TAPE SHALL BE ENTIRELY WITHIN THE 0.086" DIAMETER HOLE OF THE TAPE GAUGE.

NOTE

THE FIRST FIVE HOLES IN GAUGE ARE SAME SIZE AS CODE HOLES IN TAPE (0.072" DIAMETER), BUT SIXTH HOLE IN GAUGE IS LARGER (0.086" DIAMETER). THIS ARRANGEMENT ALLOWS ± 0.007" VARIATION IN FIVE (5) INCHES.

Figure 3-10.

TEN CHARACTERS PER INCH (CON'T)
TO ADJUST
(1) TAPE LID SPRING REQUIREMENT
— MIN. 4 OZS. —MAX. 6 OZS. TO START TAPE LID MOVING.
TO ADJUST
LOOSEN TAPE LID POST AND ROTATE TO OBTAIN REQUIRED TENSION.



NOTE
SLOT IN HEXAGONAL HEAD OF TAPE LID POST SHALL BE IN UPPER POSITION. SPRING TENSION CAN BE HELD TO SPECIFIED LIMIT BY TURNING POST.

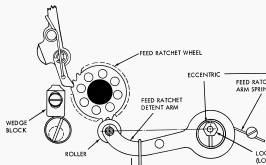
Figure 3-11.

TEN CHARACTERS PER INCH (CONT'D)

(2) FEED RATCHET DETENT ARM
REQUIREMENT
FEED RATCHET DETENT ARM SHALL BE POSITIONED SO THAT ECCENTRIC IS IN ITS LOWERMOST POSITION.
TO ADJUST
POSITION ECCENTRIC TO ITS LOWERMOST POSITION.

NOTE

REFINEMENT OF FEED RATCHET DETENT ARM ADJUSTMENT MAY BE NECESSARY AFTER COMPLETING WEDGE BLOCK ADJUSTMENT. SEE CHECK FOR TEN CHARACTERS PER INCH ADJUSTMENT (FIGURE 3-14).

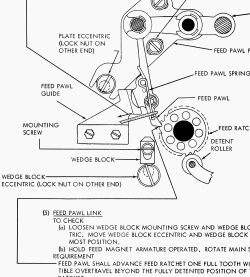


(3) FEED RATCHET DETENT ARM SPRING
REQUIREMENT
WITH ECCENTRIC APPROXIMATELY VERTICAL:
MIN. 36 OZS.,---MAX. 46 OZS.
TO MOVE FEED RATCHET DETENT ARM.
TO ADJUST
REFORM FEED RATCHET DETENT ARM SPRING.

Figure 3-12.

TEN CHARACTERS PER INCH (CONT)

(a) FEED PAWL SPRING REQUIREMENT
WITH FEED ARMATURE IN ATTRACTED POSITION AND FEED PAWL IN UPPERMOST POSITION:
MIN. .3 OZS. --- MAX. .5 OZS.
TO START FEED PAWL MOVING.



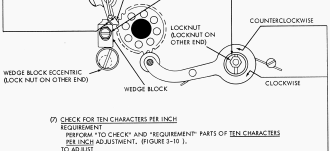
(b) FEED PAWL LINK
TO CHECK
(a) LOOSEN WEDGE BLOCK MOUNTING SCREW AND WEDGE BLOCK ECCENTRIC. MOVE WEDGE BLOCK ECCENTRIC AND WEDGE BLOCK TO LOWERMOST POSITION.
(b) HOLD FEED MAGNET ARMATURE OPERATED, ROTATE MAIN SHAFT.
REQUIREMENT
FEED PAWL SHALL ADVANCE FEED RATCHET ONE FULL TOOTH WITH PERCEPTIBLE OVERTRAVEL BEYOND THE FULLY DETENTED POSITION OF THE FEED RATCHET.
TO ADJUST
LOOSEN PLATE MOUNTING SCREWS AND PLATE ECCENTRIC, POSITION FEED LINK BY ROTATING PLATE ECCENTRIC, TIGHTEN PLATE MOUNTING SCREWS AND PLATE ECCENTRIC, RECHECK TO SEE THAT THE FEED PAWL PICKS UP THE NEXT TOOTH AT THE TOP OF THE NEXT FEEDING CYCLE, REFINE BY REDUCING THE AMOUNT OF OVERTRAVEL.

Figure 3-13.

TEN CHARACTERS PER INCH (CON'T)

(6) WEDGE BLOCK
REQUIREMENT
THERE SHALL BE NO CLEARANCE BETWEEN WEDGE BLOCK AND FEED PAWL WHEN FEED PAWL IS IN LOWERMOST POSITION.
TO ADJUST
MOVE WEDGE BLOCK TO ITS UPPERMOST POSITION AND TIGHTEN MOUNTING SCREW FRICTION TIGHT.
MOVE WEDGE BLOCK ECCENTRIC TO ITS LOWERMOST POSITION.
DEPRESS FEED MAGNET AND ROTATE MAINSHAFT BY HAND TO POSITION WEDGE BLOCK. TIGHTEN MOUNTING SCREW. MOVE WEDGE BLOCK ECCENTRIC UP TO TOUCH BOTTOM OF WEDGE BLOCK. RECHECK REQUIREMENT.

NOTE
THERE SHALL BE NO JAMMING WHEN TURNING MAINSHAFT BY HAND.



(7) CHECK FOR TEN CHARACTERS PER INCH
REQUIREMENT
PERFORM "TO CHECK" AND "REQUIREMENT" PARTS OF TEN CHARACTERS PER INCH ADJUSTMENT, (FIGURE 3-10).
TO ADJUST
PERFORATED HOLES TOO FAR APART:
LOOSEN LOCK NUT AND MOVE ECCENTRIC A VERY SMALL AMOUNT CLOCKWISE. TIGHTEN LOCK NUT.
PERFORATED HOLES TOO CLOSE TOGETHER:
LOOSEN LOCK NUT AND MOVE ECCENTRIC A VERY SMALL AMOUNT COUNTERCLOCKWISE . TIGHTEN LOCK NUT.
RECHECK FEED PAWL LINK (FIGURE 3-13), WEDGE BLOCK (FIGURE 3-14), AND TAPE BIASING SPRING (FIGURE 3-7) ADJUSTMENTS.

Figure 3-14.

NOTE

FOLLOWING ADJUSTMENT PROCEDURE, FIGURES 3-15 THRU 17, PERTAINS TO PUNCH UNITS WITH A 160 POINT TIMING SCALE. SEE FIGURES 3-18 THRU 21 FOR ADJUSTMENTS PERTAINING TO PUNCH UNITS WITH A 60 POINT TIMING SCALE. ADJUSTMENTS MUST BE MADE IN INDICATED ORDER.

FLYWHEEL ORIENTATION

(1) VIEWING UNIT FROM THE REAR, POSITION TIMING SCALE UNTIL NUMBER 80 IS LINED UP WITH INDICATOR. SECURE TIMING SCALE. ROTATE MAIN SHAFT UNTIL KEY-WAY IS AT 12 O'CLOCK POSITION. HOLD SHAFT IN THIS POSITION.

(2) PLACE FLYWHEEL ON SHAFT WITH FLYWHEEL HUB TO REAR. ROTATE FLYWHEEL UNTIL MAGNETIC INSERT LOCATING MARK ON FLYWHEEL IS ADJACENT TO ZERO ON TIMING SCALE.

(3) INSERT SET SCREW IN TAPPED HOLE OF FLYWHEEL HUB AT 12 O'CLOCK POSITION. ADVANCE SET SCREW JUST ENOUGH TO RETAIN LOCATION OF FLYWHEEL WITH RESPECT TO KEY-WAY. DO NOT TIGHTEN SET SCREW.

NOTE

SET SCREW MUST LINE UP WITH KEY-WAY. ALIGNMENT MAY NECESSITATE MOVING FLYWHEEL SO THAT LOCATING MARK NO LONGER LINES UP WITH ZERO MARK ON TIMING SCALE.

(4) ASSEMBLE WASHER, LOCK WASHER, AND FLYWHEEL RETAINING NUT ON MAIN SHAFT AND TIGHTEN SECURELY.

(5) TIGHTEN FLYWHEEL SET SCREW.

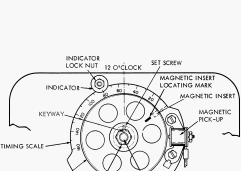


Figure 3-15.

MAGNETIC PICK-UP

TO CHECK

TIMING SCALE POSITIONED SO THAT INDICATOR IS OPPOSITE 80. TIGHTEN INDICATOR LOCK NUT.

TAKE UP PLAY BETWEEN FLYWHEEL AND MAGNETIC PICK-UP SO THAT CLEARANCE IS A MINIMUM.

REQUIREMENT

MIN. 0.010 INCH --- MAX. 0.015 INCH

BETWEEN FLYWHEEL AND MAGNETIC PICK-UP COIL AT POINT OF LEAST CLEARANCE.

TO ADJUST

LOOSEN MOUNTING SCREWS FRICTION TIGHT. POSITION BRACKET AT PRY-POINT TO MEET REQUIREMENT. TIGHTEN MOUNTING SCREWS.

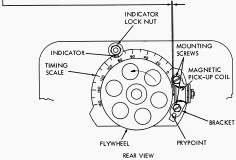


Figure 3-16.

NOTE

TIMING IS ADJUSTED TO OBTAIN PROPER SYNCHRONIZATION BETWEEN THE CODE PULSE DELIVERY FROM THE MAGNET DRIVERS AND THE MECHANICAL TIMING OF THE PUNCH.

(A) TIMING QUALITY
TO CHECK
OPERATE PUNCH FROM CONTROL CIRCUITS USING RECEIVING TEST TAPE 146605 OR EQUIVALENT. LOOSEN INDICATOR LOCK NUT. TO DETERMINE OPERATING MARGIN, ROTATE TIMING SCALE IN ONE DIRECTION AND RECORD NUMBER ON SCALE OPPOSITE INDICATING LINE WHERE ERRORS BEGIN TO OCCUR. ROTATE TIMING SCALE IN OPPOSITE DIRECTION AND RECORD NUMBER WHERE ERRORS OCCUR.
REQUIREMENT
MIN. 90 POINTS OF CONTINUOUS OPERATING MARGIN WHILE RECEIVING 110 CPS AT 28 VDC 1A.
TO ADJUST
CHECK AND CORRECT MAGNET PLATE ADJUSTMENT (FIGURE 3-31 AND ARMATURE SPRING ADJUSTMENT (FIGURES 3-3, 3-4). AN ADDITIONAL FACTOR RELATED TO THE AMOUNT OF MARGIN OBTAINABLE IS THE LENGTH OF CURRENT PULSE TO THE MAGNETS.

NOTE

WELL ADJUSTED EQUIPMENT WILL PROVIDE AT LEAST 90 POINTS OF OPERATING MARGIN. THE EQUIPMENT WILL OPERATE WITH LESS, BUT AN OPERATING MARGIN OF LESS THAN 90 POINTS INDICATES THAT THE RELATED ADJUSTMENTS ARE OF POOR QUALITY.

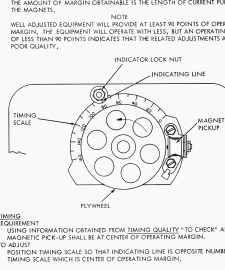


Figure 3-17.

(B) TIMING
REQUIREMENT
USING INFORMATION OBTAINED FROM TIMING QUALITY "TO CHECK" ABOVE, MAGNETIC PICK-UP SHALL BE AT CENTER OF OPERATING MARGIN.
TO ADJUST
POSITION TIMING SCALE SO THAT INDICATING LINE IS OPPOSITE NUMBER ON TIMING SCALE WHICH IS CENTER OF OPERATING MARGIN.

Fig. 3-18.

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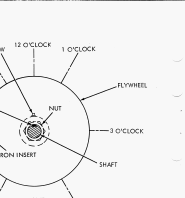
NOTE

FOLLOWING ADJUSTMENT PROCEDURE, FIGURES 3-18 THRU 21, PERTAINS TO PUNCH UNITS WITH A 60 POINT TIMING SCALE. SEE FIGURES 3-13 THRU 17 FOR ADJUSTMENTS PERTAINING TO PUNCH UNITS WITH A 160 POINT TIMING SCALE, ADJUSTMENTS MUST BE MADE IN INDICATED ORDER.



FLYWHEEL ORIENTATION

(1) GENERAL

THE 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.

(2) DETERMINE O'CLOCK POSITION

COMBINE ATTRACT TIME OF MAGNETS (PAR. 1-7.2) AND DELAY TIME OF CONTROL CIRCUITS TO OBTAIN TIME (T) IN MILLISECONDS (MS) AT WHICH ARMATURES ARE FULLY ATTRACTED AFTER PICKUP FIRES.

LOCATE T ON TIME SCALE AT LOWER LEFT OF FIGURE 3-19, EXTEND A LINE HORIZONTALLY TO RIGHT UNTIL IT INTERSECTS LINE REPRESENTING OPERATING SPEED OF PUNCH UNIT IN OPERATIONS PER SECOND (OPS).

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

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.

(3) EXAMPLE

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.

LOCATE 3 ON TIME SCALE IN FIGURE 3-19. EXTEND A LINE FROM 3 TO RIGHT UNTIL IT INTERSECTS 110 OPS LINE.

EXTEND A LINE VERTICALLY UPWARD FROM THIS POINT, AS CAN BE SEEN IN FIGURE 3-19 , LINE INTERSECTS 9 O'CLOCK LINE.

WHEN A LINE IS EXTENDED TO LEFT FROM THIS POINT, IT INTERSECTS SCALE AT 228°. THUS TOGGLE LINKAGES ARE IN SELECTION INTERVAL WHEN MAGNETS REACH FULLY ATTRACTED POSITION. POSITION FLYWHEEL AT 9 O'CLOCK AS INSTRUCTED BELOW.

(4) POSITION FLYWHEEL

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

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

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.

NOTE

SET SCREW MUST LINE UP WITH KEYWAY ON MAINSHAFT.

Figure 3-18.

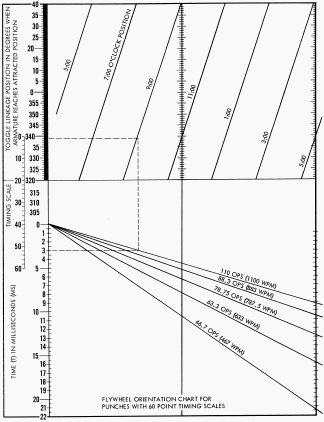
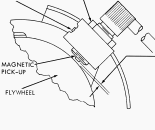

TOGGLE LINKAGE POSITION IN DEGREES WHEN PUNCH IS AT BOTTOM OF STROKE
TIMING SCALE
TIME (T) IN MILLISECONDS (MS)
300
700 O'CLOCK POSITION
500
11:00
100
200
1:00
110 OPS (1100 WPM)
98.3 OPS (983 WPM)
88.75 OPS (887.5 WPM)
82.7 OPS (827 WPM)
46.7 OPS (467 WPM)
FLYWHEEL ORIENTATION CHART FOR PUNCHES WITH 60 POINT TIMING SCALES

Figure 3-19.



(A) MAGNETIC PICK-UP
TO CHECK
POSITION INDICATING LINE OPPOSITE 20 ON TIMING SCALE. (SEE FIGURE 3-21) TAKE UP PLAY BETWEEN FLYWHEEL AND MAGNETIC PICK-UP SO THAT CLEARANCE IS A MINIMUM.
REQUIREMENT
MIN. .0.005 INCH ---- MAX. 0.010 INCH BETWEEN FLYWHEEL AND MAGNETIC PICK-UP AT POINT OF LEAST CLEARANCE.
TO ADJUST
LOOSEN LOCK NUT AND SET SCREW, POSITION MAGNETIC PICK-UP TO MEET REQUIREMENT.

NOTE

TIMING IS ADJUSTED TO OBTAIN PROPER SYNCHRONIZATION BETWEEN THE CODE PULSE DELIVERY FROM THE MAGNET DRIVERS AND THE MECHANICAL TIMING OF THE PUNCH.

(B) TIMING QUALITY
TO CHECK
OPERATE PUNCH FROM CONTROL CIRCUITS, USING RECEIVING TEST TAPE 166605 OR EQUIVALENT. LOOSEN BRACKET LOCK NUT. TO DETERMINE OPERATING MARGIN, 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
MIN. 90 POINTS OF CONTINUOUS OPERATING MARGIN WHILE RECEIVING 110 OPS AT 28 VDC 1A.

NOTE

TO CHECK FOR 90 POINTS OF OPERATING MARGIN IT IS NECESSARY TO ROTATE THE FLYWHEEL A 60 DEGREE STEP TO ONE SIDE THEN/OR TO THE OTHER SIDE OF THE FLYWHEEL ORIENTATION (FIGURE 3-18) WHERE SOME ERROR FREE OPERATION IS OBTAINED.

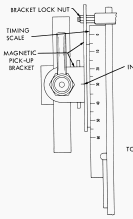
TO ADJUST
CHECK AND CORRECT MAGNET PLATE ADJUSTMENT (FIGURE 3-3) AND ARMATURE SPRING ADJUSTMENT (FIGURES 3-5, 3-6). AN ADDITIONAL FACTOR RELATED TO THE AMOUNT OF MARGIN OBTAINABLE IS THE LENGTH OF CURRENT PULSE TO THE MAGNETS.

NOTE

WELL ADJUSTED EQUIPMENT WILL PROVIDE AT LEAST 90 POINTS OF OPERATING MARGIN. THE EQUIPMENT WILL OPERATE WITH LESS, BUT AN OPERATING MARGIN OF LESS THAN 90 POINTS INDICATES THAT THE RELATED ADJUSTMENTS ARE OF POOR QUALITY.

Figure 3-20.

(A) TIMING
REQUIREMENT
USING INFORMATION OBTAINED FROM TIMING QUALITY "TO CHECK" TYPO LIST 3-28, MAGNETIC PICK-UP BRACKET SHALL BE POSITIONED AT CENTER OF OPERATING MARGIN.
TO ADJUST
POSITION MAGNETIC PICK-UP BRACKET SO INDICATING LINE IS OPPOSITE NUMBER ON SCALE AT CENTER OF OPERATING MARGIN.



(B) TAPE FEED OUT LEVER SPRING
REQUIREMENT
MIN. 4 OZS. --- MAX. 6 OZS. TO START TAPE FEED OUT LEVER MOVING.

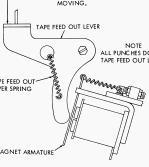
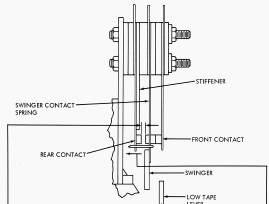


Figure 3-21.

b. BASE



LOW TAPE CONTACTS REQUIREMENTS
WITH LOW-TAPE LEVER HELD AWAY FROM SWINGER:
(1) MIN., 0.002 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 175 MOUNTING NUTS.
(1) BEND STIFFENER TO MEET (1) ABOVE.
(2) BEND SWINGER CONTACT SPRING TO MEET (2) ABOVE.
REPLACE COVER.

Figure 3-22.

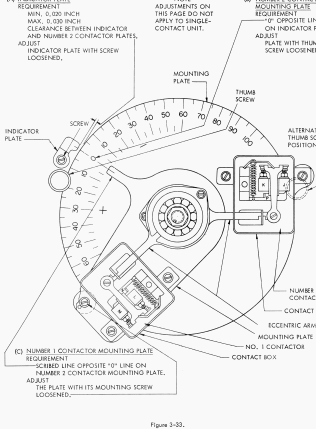
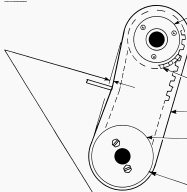

(A) INDICATOR PLATE REQUIREMENT
MIN. 0.020 INCH
MAX. 0.030 INCH
CLEARANCE BETWEEN INDICATOR AND NUMBER 2 CONTACTOR PLATES.
ADJUST
INDICATOR PLATE WITH SCREW LOOSENED.
NOTE
ADJUSTMENTS ON THIS PAGE DO NOT APPLY TO SINGLE-CONTACT UNIT.
(B) NUMBER 2 CONTACTOR MOUNTING PLATE REQUIREMENT
"0" OPPOSITE LINE ON INDICATOR PLATE.
ADJUST
PLATE WITH THUMB SCREW LOOSENED.
MOUNTING PLATE
THUMB SCREW
SCREW
INDICATOR PLATE
ALTERNATIVE THUMB SCREW POSITION
NUMBER 2 CONTACTOR
CONTACT BOX
ECCENTRIC ARMS
MOUNTING PLATE
NO. 1 CONTACTOR
CONTACT BOX
(C) 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 3-33.

NOTE
MAKE MOTOR ADJUSTMENT IN FIGURE 3-27.

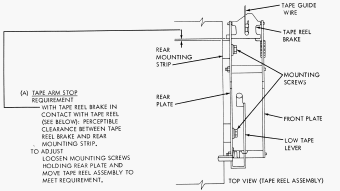


CAUTION:
IF MOTOR BECOMES BLOCKED FOR SEVERAL SECONDS, THERMAL CUT-OUT SWITCH WILL BREAK CIRCUIT. SHOULD THIS HAPPEN, ALLOW MOTOR TO COOL AT LEAST 5 MINUTES BEFORE DEPRESSING RED RESET BUTTON.

TIMING BELT
REQUIREMENT
BY MEANS OF A SCALE, APPLY ONE POUND PUSH TO CENTER OF THE BELT SPAN. THE BELT SHOULD YIELD 3/16 INCH. SPROCKETS ALIGNED. SHAFTS PARALLEL.
ADJUST
MOTOR WITH FOUR MOUNTING SCREWS LOOSENED.

Figure 3-34.

Fig. 3-25.



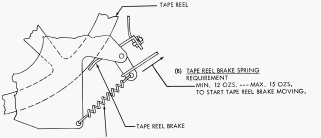


Figure 3-25.

e. MOTOR-MOUNTING AND DRIVE PARTS

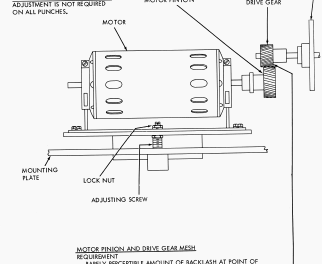


Figure 3-26.

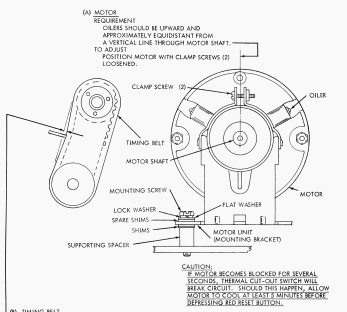
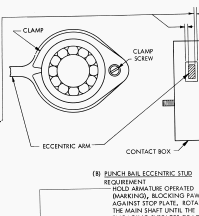

(A) MOTOR REQUIREMENT
OILERS SHOULD BE UPWARD AND APPROXIMATELY EQUIDISTANT FROM A VERTICAL LINE THROUGH MOTOR SHAFT.
TO ADJUST
POSITION MOTOR WITH CLAMP SCREWS (2) LOOSENED.
CLAMP SCREW (2)
OILER
TIMING BELT
MOTOR SHAFT
MOUNTING SCREW
LOCK WASHER
SPARE SHIMS
SHIMS
SUPPORTING SPACER
FLAT WASHER
MOTOR UNIT (MOUNTING BRACKET)
MOTOR
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.
(B) TIMING BELT REQUIREMENT
ONE POUND PRESSURE AT CENTER OF TIMING BELT SPAN SHOULD DEFLECT BELT APPROXIMATELY.
1/16-INCH FOR 110 CPS OPERATION.
2/16-INCH FOR 60.3 CPS 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 HORIZONTALLY. TIGHTEN MOUNTING SCREWS AND RECHECK REQUIREMENT.
*RETAIN SPARE SHIMS BY PLACING THEM ON MOUNTING SCREWS ABOVE MOUNTING BRACKET AS SHOWN IN DRAWING.

Figure 3-27.

3-5. EARLY DESIGN

CHECK FOR BINDS BY ROTATING MAIN SHAFT AS INSTRUCTED IN PAR. 3-2.7.

(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 ARMATURE 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. 0.003 INCH MAX. 0.015 INCH.
ADJUST
PUNCH BAIL ECCENTRIC STUD WITH ITS LOCK NUT LOOSENED.

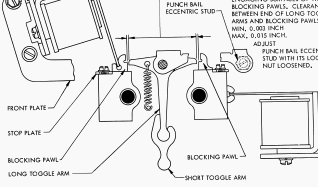


Figure 3-28.

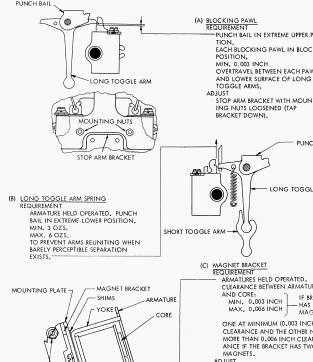

PUNCH BAIL
LONG TOGGLE ARM
MOUNTING NUTS
STOP ARM BRACKET
(A) BLOCKING PAWL REQUIREMENT
PUNCH BAIL IN EXTREME UPPER POSITION.
EACH BLOCKING PAWL IN BLOCKING POSITION,
MIN. 0.003 INCH OVERTRAVEL BETWEEN EACH PAWL AND LOWER SURFACE OF LONG TOGGLE ARM.
ADJUST STOP ARM BRACKET WITH MOUNTING NUTS LOOSENED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

Figure 3-29

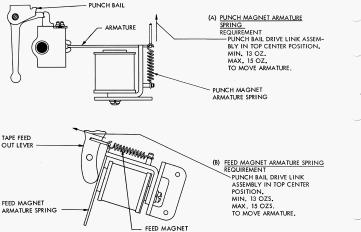

PUNCH BAIL
ARMATURE
(A) PUNCH MAGNET ARMATURE SPRING REQUIREMENT
PUNCH BAIL DRIVE LINK ASSEMBLY IN TOP CENTER POSITION, MIN., 13 OZ., MAX., 15 OZ., TO MOVE ARMATURE.
PUNCH MAGNET ARMATURE SPRING
TAPE FEED OUT LEVER
(B) FEED MAGNET ARMATURE SPRING REQUIREMENT
PUNCH BAIL DRIVE LINK ASSEMBLY IN TOP CENTER POSITION, MIN. 13 OZS, MAX. 15 OZS. TO MOVE ARMATURE.
FEED MAGNET ARMATURE SPRING
FEED MAGNET ARMATURE
(C) PUNCH BLOCK REQUIREMENT
(1) PINS MOVE FREELY IN PUNCH BLOCK. MINIMUM CLEARANCE BETWEEN STEMS OF PUNCH PINS AND EDGES OF DRAG LINK SLOTS.
(2) 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.
FRONT PLATE
DRAG LINK
RETAINING PLATE
PUNCH BLOCK
PUNCH PIN
MOUNTING SCREWS
LOCATING ECCENTRIC

Figure 3-30.

(A) FEED RATCHET DETENT REQUIREMENT
PERFORATE TAPE UNDER POWER, CHECK FEED HOLES FOR STANDARD SPACING OF TEN TO THE INCH WITH TAPE GAUGE NO. 9986D.
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.
ADJUST
FEED PAWL UP OR DOWN, BY MEANS OF A SCREWDRIVER, WITH CLAMP SCREW FRICTION TIGHT. CHECK FEED RATCHET DETENT ADJUSTMENT.
FEED PAWL ADJUSTABLE LINK
FEED RATCHET DETENT ARM
CLAMP SCREW
FEED RATCHET DETENT ECCENTRIC
FEED PAWL SPRING
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 PAWL
FEED WHEEL RATCHET
FEED PAWL
FEED RATCHET DETENT ARM
ECCENTRIC STUD
(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.
ADJUST
ECCENTRIC STUD COUNTERCLOCKWISE WITH LOCK NUT LOOSENED.
LOCK NUT
FEED RATCHET DETENT SPRING
(E) FEED RATCHET DETENT SPRING REQUIREMENT
MIN. 38 OZ.,
MAX. 44 OZ.
PULLED TO POSITION LENGTH.
FEED PAWL ECCENTRIC STUD

Figure 3-31.

(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.
TAPE TENSION LEVER
FEED WHEEL
TAPE TENSION LEVER STUD
(B) TAPE FEED OUT LEVER SPRING
REQUIREMENT
MIN. 2-1/2 OZ.,
MAX. 5-1/2 OZ.,
PULLED TO POSITION LENGTH.
(C) FEED PAWL AND RATCHET ALIGNMENT SEE FIGURE 3-31.)
REQUIREMENT
FEED PAWL FULLY ALIGNED WITH FEED WHEEL RATCHET.
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.).
TAPE FEED OUT LEVER SPRING
TAPE FEED OUT LEVER
FEED MAGNET ARMATURE
(D) CONTACTS
REQUIREMENT
ECCENTRIC ARMS IN EXTREME RIGHT, THEN IN EXTREME LEFT POSITIONS.
ALL GAPS
MIN. 0.008 INCH
MAX. 0.012 INCH AND
EQUAL TO EACH OTHER WITHIN 0.002 INCH.
ADJUST
BOX HORIZONTALLY WITH SCREWS LOOSENED.
ECCENTRIC ARM
CONTACT BOX
SCREW
SCREW
CONTACTS

Figure 3-32.

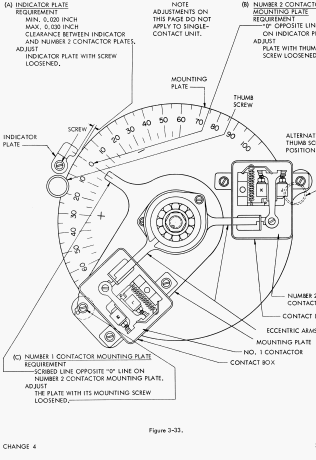

(A) INDICATOR PLATE REQUIREMENT
MIN. 0.020 INCH
MAX. 0.030 INCH
CLEARANCE BETWEEN INDICATOR AND NUMBER 2 CONTACTOR PLATES.
ADJUST
INDICATOR PLATE WITH SCREW LOOSENED.
NOTE
ADJUSTMENTS ON THIS PAGE DO NOT APPLY TO SINGLE-CONTACT UNIT.
(B) NUMBER 2 CONTACTOR MOUNTING PLATE REQUIREMENT
"0" OPPOSITE LINE ON INDICATOR PLATE.
ADJUST
PLATE WITH THUMB SCREW LOOSENED.
MOUNTING PLATE
THUMB SCREW
SCREW
INDICATOR PLATE
ALTERNATIVE THUMB SCREW POSITION
NUMBER 2 CONTACTOR
CONTACT BOX
ECCENTRIC ARMS
MOUNTING PLATE
NO. 1 CONTACTOR
CONTACT BOX
(C) 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 3-33.

NOTE
MAKE MOTOR ADJUSTMENT IN FIGURE 3-27.

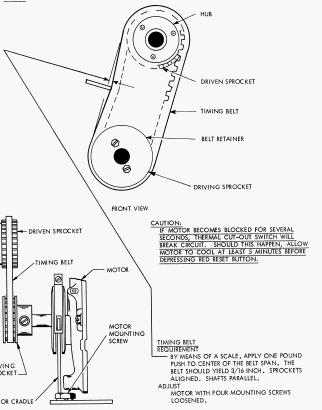
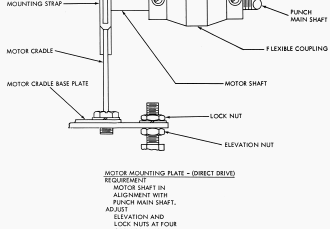


Figure 3-34.

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.



MOTOR MOUNTING PLATE – (DIRECT DRIVE)
REQUIREMENT
MOTOR SHAFT IN ALIGNMENT WITH PUNCH MAIN SHAFT.
ADJUST
ELEVATION AND LOCK NUTS AT FOUR CORNERS OF MOTOR MOUNTING PLATE. POSITION MOTOR HORIZONTALLY WITH LOCK NUTS LOOSENED.

Figure 3-35.

(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.

MOTOR SHAFT SPROCKET

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.

MOTOR SHAFT

DRIVE CHAIN

PUNCH MAINSHAFT GEAR

BASE MAINSHAFT (DRIVEN) SPROCKET

BASE MAINSHAFT GEAR

(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.

(C) DRIVE GEARS (SETS WITH GEAR-DRIVE ONLY)
REQUIREMENT
GEAR ALIGNED, WITH MINIMUM BACKLASH AND NO BIND.
ADJUST
MOTOR ON MOUNTING POSTS WITH MOUNTING SCREWS LOOSENED.

BASE MAINSHAFT GEAR

Figure 3-36.

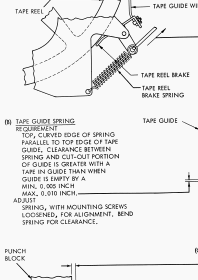

TAPE REEL
TAPE GUIDE WIRE
(A) TAPE REEL BRAKE SPRING REQUIREMENT
MIN., 18 OZ.,
MAX., 21 OZ.,
PULLED TO POSITION LENGTH.
TAPE REEL BRAKE
TAPE REEL BRAKE SPRING
(B) TAPE GUIDE SPRING REQUIREMENT
TOP, CURVED EDGE OF SPRING PARALLEL TO TOP EDGE OF TAPE GUIDE. CLEARANCE BETWEEN SPRING AND CUT-OUT PORTION OF GUIDE IS GREATER WITH A TAPE IN GUIDE THAN WHEN GUIDE IS EMPTY BY A MIN. 0.005 INCH MAX., 0.010 INCH.
ADJUST SPRING, WITH MOUNTING SCREWS LOOSENED, FOR ALIGNMENT, BEND SPRING FOR CLEARANCE.
TAPE GUIDE
SPRING
PUNCH BLOCK
TAPE
DIE PLATE
TAPE GUIDE
VERTICAL ADJUSTING SCREW
MOUNTING SCREW
TAPE GUIDE BRACKET
(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., 0.010 INCH MAX., 0.040 INCH.
ADJUST VERTICALLY BY MEANS OF ADJUSTING SCREW WITH ITS LOCK NUT LOOSENED AND WITH MOUNTING SCREW TIGHT. CHECK WITH UNDER-SIZE (ONE HALF) TAPE. POSITION HORIZONTALLY WITH MOUNTING SCREWS LOOSENED FRICTION TIGHT. REFINE VERTICAL POSITION IF NECESSARY.

Figure 3-37.

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 11548 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.

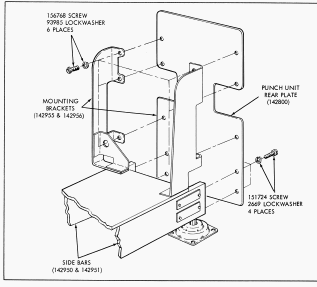


Figure 4-1. Rear Plate Mounting

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 3-27).

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 142951 plate on the punch block into the 142800 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 136632 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 165 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.

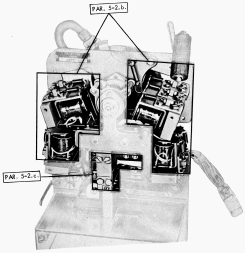
e. Paragraphs 5-2 and 5-3 cover late design equipment. In these paragraphs general lubricating areas are shown by photographs. Specific areas to receive lubricant are indicated by line drawings with text. The drawings are keyed to the photographs by paragraph numbers.

The symbols in the text indicate the following:

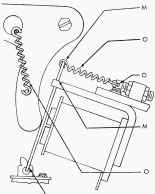
O	Apply one drop of KS7470 oil.
OZ	Apply two drops of KS7470 oil, etc.
SAT	Saturate with KS7470 oil (felt washers, oilite bearings, etc.)
FILL	Fill with KS7470 oil (oil holes, oil cups, etc.)
M	Apply 1/64 inch coating of 143464 or 145867 grease.

5-2. PUNCH UNIT (LATE DESIGN)

a. GENERAL AREAS

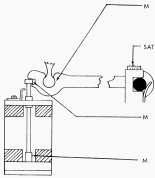


b. FEED AND CODE MAGNETS



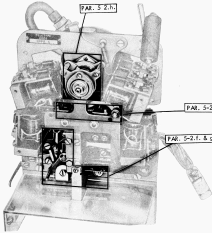
M	HOOKS	CODE AND FEED MAGNET SPRINGS
O	COILS	CODE AND FEED MAGNET SPRINGS
O	HOOKS	CODE AND FEED MAGNET SPRINGS
M	CONTACTING SURFACES (APPLY SPARINGLY)	CODE AND FEED MAGNET ARMATURES
O	HOOKS - EACH END	SPRING
M	CONTACTING SURFACES	BLOCKING PAWLS AND ARMATURES

c. PERFORATING MECHANISM

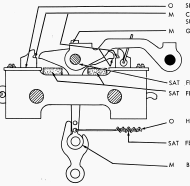


M	BEARING SURFACES	DRAG LINKS AND LONG TOGGLE ARMS
SAT	FELT WICK	DRAG LINK BRACKET
M	CONTACTING SURFACES	DRAG LINKS AND PUNCH PINS
M	SLIDING SURFACES	PUNCH PINS

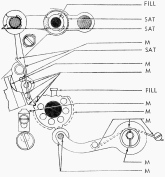
d. GENERAL AREAS



e. PERFORATING MECHANISM

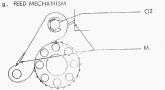


f. FEED MECHANISM



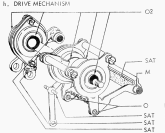
FILL	OIL HOLE	PIVOT ARM PIVOT
SAT	FELT WASHER	PIVOT ARM PIVOT
SAT	OILITE BEARING	PIVOT ARM
M	CONTACTING SURFACES	SPRING
SAT	OIL WICK	FEED PAWL GUIDE LINK
M	GUIDE SURFACE	FEED PAWL GUIDE
M	PIVOT AND CONTACTING SURFACES	FEED PAWL
FILL	OIL CUP	FEED WHEEL BEARING
M	GUIDE SURFACE	WEDGE BLOCK
M	TEETH	FEED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

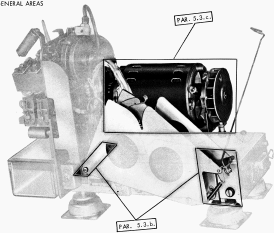
h. DRIVE MECHANISM



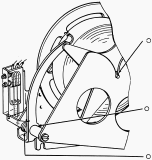
O2	BEARING SURFACES	BEARINGS (2) ON MAIN SHAFT
SAT	FELT WASHERS (2)	PUNCH BAIL SHAFT
M	BEARING & CONTACTING SURFACES	PUNCH BAIL SPACER
O	BEARING SURFACES	DRIVE LINKS
SAT	FELT WICK	TOGGLE ARM
SAT	FELT WICK (RING)	FEED BEARING
SAT	FELT WASHER	FEED DRIVE LEVER

5-3. BASE AND MOTOR UNIT

a. GENERAL AREAS



b. TAPE REEL AND BRAKE MECHANISM



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 19029B 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 14586T 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, the operation of which 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 perform 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 paragraph 1-1e. Being a synchronous unit which produces synchronizing (or clock) pulses, the Punch does not necessarily have to receive and to perform a character each time it undergoes an operation. For example, operating at 110 cps, it might over a period of one minute (6600 total operations) perforate 100 intermittent 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 performing 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 usually run at speeds slightly greater 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 graphic representation of a six-level code combination with alternate marking and spacing levels (1-2-4-L). In addition to the intelligence pulses, each combination is accompanied by a feed pulse which initiates 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 in 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 the perforation in tape. It also illustrates the relative timing of the process. The operation as represented by the figure is described below.

b. A. 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 mechanisms in 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 6-7 the vertical motions of key parts of these mechanisms are plotted against the rotation of the cam shaft in degrees. Top dead center (TDC) of the perforating mechanism

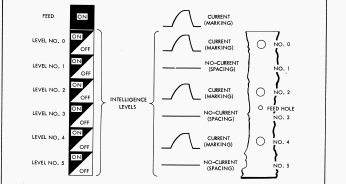


Figure 6-1. Binary Permutation Code

has been designated as 0°. As can be seen, the drive mechanism is so designed that the feed mechanism reaches TDC 45° after the perforating mechanism.

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 Paragraph 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. Simultaneously, 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.

g. The feed magnet, energized by the feed pulse, caused 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 periodically takes another cam 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, 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 to the set if caused by excessive load. 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 1-4).

(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 train to the speed of the Motor Unit by a rotary motion and transfer it to the main shaft of the Punch Unit. The drive parts are described in Paragraph 1-6 .

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. The function cam drive links, the forward cam causes the punch bail of the perforating mechanism to oscillate in a simple harmonic motion as represented by the heavy curve line in Figure 6-6 . The other cam causes a feed driver lever of the feed mechanism to oscillate as represented by the light solid line in Figure 6-6 . The curves of these arcs are so timed that as the feed drive link reaches top dead center 45° after the punch bail does. Thus, the perforating 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 pulses delivery and mechanical timing of the Punch, a flywheel and magnetic pickup system as 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 with a 60 cycle motor timing scale differs from that used in the set with a 50 cycle motor timing. Although the systems are similar in appearance and operation, they will be discussed separately.

(1) Sixty Point Timing Scale (Figures 6-3 and 3-21) - In this arrangement, 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

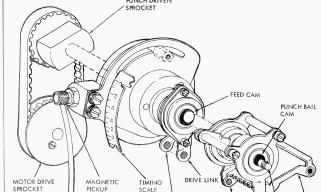


Figure 6-2. Drive Mechanism

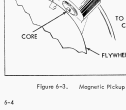


Figure 6-3. Magnetic Pickup

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 timing scale, which is adjustable 60 degrees.

(2) One Hundred Sixty Point Timing Scale (Figures 3-15 and 3-17) - The pick-up consists of a coil with an iron core, in this arrangement. 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 timing scale, which is adjustable 160 degrees.

(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 1-7. 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.

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 210° 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 backing lever) 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

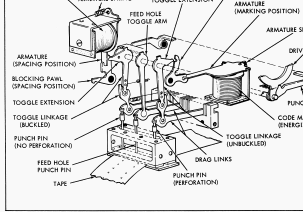


Figure 6-4. Perforating Mechanism

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 6-4 .

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

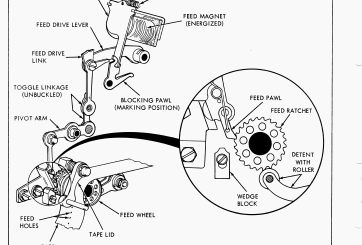


Figure 6-5. Tape Feeding Mechanism

to oscillate. As the linkage moves down during the early part of each idling operation, it is latched by the blocking pawl at 90° 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 during the early part of the operation, the blocking extension clears the blocking pawl, the linkage remains in its unlatched 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. Then 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 270° and 90° of shaft rotation.

c. Near the end of its downward travel, the pawl is engaged by a wedge block which prevents overthrow. 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 backup spring which holds the tape back against a reference surface on the block (Figure 3-7). The tape is fed into the punch block through a tape guide (Figure 3-5) and is held on the feed wheel by a spring-biased tape idle which may be raised to initially insert the tape.

6-8. MANUAL FEED OUT (Figure 3-21)

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-out 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 supply of tape, 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 the friction surface away from the periphery of the reel. The "spring" 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 coordination outlined below and illustrated in Figure 6-8 are those recommended for normal operation and may be varied or supplemented in specific applications. Additional information may be obtained by consulting the Teletype Product Sales Department. The timing of the Punch is based on the 90 degree center position (1/2) of the perforating mechanism (or the punch bail) which is designated as 0 degrees of shaft rotation and 0 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 preforming 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

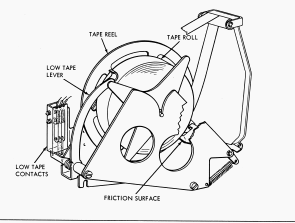


Figure 6-6. Tape Reel and Brake Assembly

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 6-9). The feed selection interval extends from 0° to 90° 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.

c. ELECTRICAL

(1) To meet the mechanical requirements in Paragraph 6-11.b.(2) above for operating speed of 110 cps, 4.5-millisecond feed and code pulses should start between 390.0° (9.75 ms) and 390.0° (2.50 ms) before TDC of the perforating mechanism (bar (c)). A typical 4.5 ms feed or code pulse for 110 cps is represented by the shaded portion of bar (d). It begins at 120.0° (3.00 ms) before and ends at 60.0° (1.50 ms) after TDC of the perforating mechanism. Since the armature fully attracted time is 3.00 ms (120.0°), the armature is fully attracted at 0.0° (0.00 ms) TDC. The armature fully released time is 8.00 ms (320.0°) and is fully released at 380.0° (9.50 ms) after TDC of the perforating mechanism.

(2) To meet the mechanical requirements for operating speed of 63.3 cps, 4.5-millisecond feed and code pulses should start between 180.0° (7.62 ms) and 30.0° (2.17 ms) before TDC of the punch bail (bar (e)). A typical 4.5 ms feed or code pulse for 63.3 cps is depicted by the shaded portion of bar (f). It begins at 80.0° (3.48 ms) before and ends at 25.0° (1.02 ms) after TDC of the perforating mech-

anism. Since the armature fully attracted time is 3.00 ms (09.1°), the armature is fully-attracted at 10.9° (0.47 ms) before TDC. The armature fully released time is 8.00 ms (184.2°) and is fully released 207.8° (9.02 ms) after TDC of the perforating mechanism.

(3) Instructions for orienting the flywheel of Punches for various speeds are given in Figures 3-15, 3-18, and 3-19.

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 ball. The feed magnet armature should reach the fully attracted position between 45° before and 70° after TDC of the punch ball. The code magnet armature should be held in the fully attracted position until 60° after TDC of the punch ball. The feed magnet armature should be held in the fully attracted position until 110° after TDC of the punch ball.

(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 ball. The code magnet armatures should reach the fully released position between 300° before and 20° after TDC of the punch ball.

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.

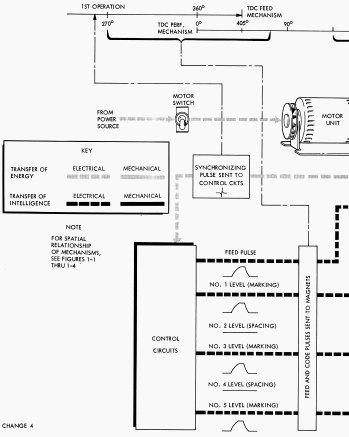
d. The feed magnet fully attracts its armature between 8 and 10 milliseconds after being energized from a 115 volt d.c. power supply with series resistors limiting the operating current to 25 milliamperes. The feed magnet armature is fully released within 4 milliseconds after opening this circuit.

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 rpm, 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 280°) of the operating cycle. The magnets should be de-energized between 140° and 260° (8 ms before 160°) 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 revolutions.

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 3-32 and 3-33).


1ST OPERATION
360°
TDC FEED MECHANISM
270°
TDC PERF. MECHANISM
0°
405°
90°
MOTOR SWITCH
FROM POWER SOURCE
MOTOR UNIT
KEY
TRANSFER OF ENERGY
ELECTRICAL
MECHANICAL
TRANSFER OF INTELLIGENCE
ELECTRICAL
MECHANICAL
SYNCHRONIZING PULSE SENT TO CONTROL CKTS
NOTE
FOR SPATIAL RELATIONSHIP OF MECHANISMS, SEE FIGURES 1-1 THRU 1-4
FEED PULSE
NO. 1 LEVEL (MARKING)
NO. 2 LEVEL (SPACING)
NO. 3 LEVEL (MARKING)
NO. 4 LEVEL (SPACING)
NO. 5 LEVEL (MARKING)
CONTROL CIRCUITS
FEED AND CODE PULSES SENT TO MAGNETS

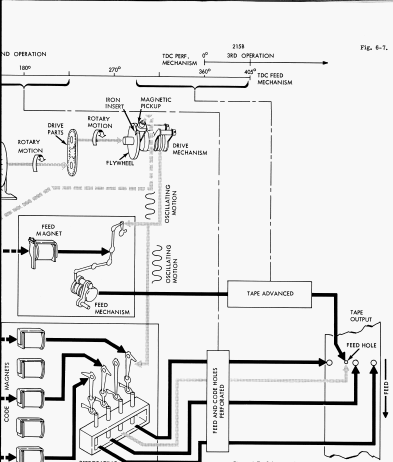


Fig. 6-7.

Figure 6-7. Schematic Diagram of Punch Operation

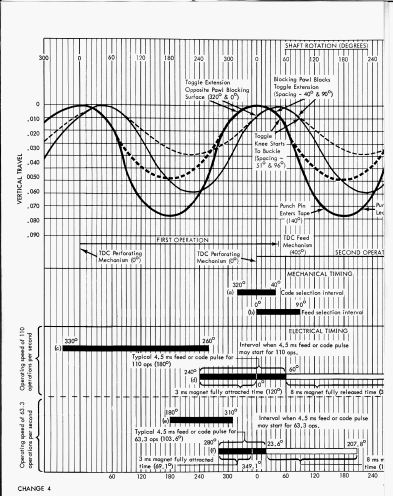

SHAFT ROTATION (DEGREES)
VERTICAL TRAVEL
Toggle Extension Opposite Pawl Blocking Surface (320° & 0°)
Blocking Pawl Blocks Toggle Extension (Spacing – 40° & 90°)
Toggle Knee Starts To Buckle (Spacing – 31° & 94°)
Punch Pin Enters Tape (140°)
TDC Feed Mechanism (40°)
FIRST OPERATION
TDC Perforating Mechanism (0°)
TDC Perforating Mechanism (0°)
SECOND OPERA
MECHANICAL TIMING
320°
40°
Code selection interval
0°
90°
Feed selection interval
ELECTRICAL TIMING
330°
266°
Interval when 4,5 ms feed or code pulse may start for 110 ops.
Typical 4,5 ms feed or code pulse for 110 ops (180°)
240°
60°
60
120°
3 ms magnet fully attracted time (120°)
8 ms magnet fully released time (1
Operating speed of 110 operations per second
Operating speed of 63,3 operations per second
380°
310°
Interval when 4,5 ms feed or code pulse may start for 63,3 ops.
Typical 4,5 ms feed or code pulse for 63,3 ops (105,6°)
280°
207,6°
23,4°
1 ms magnet fully attracted time (69,1°)
349,1°
8 ms r time (1
60
120
180
240
300
0
60
120
180
240

Figure 6-8. Timing Diagram (Late Design)

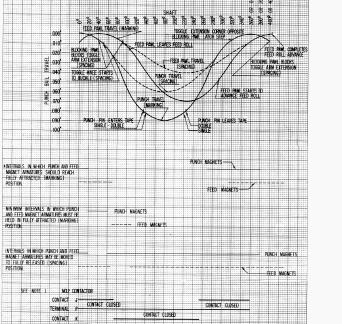
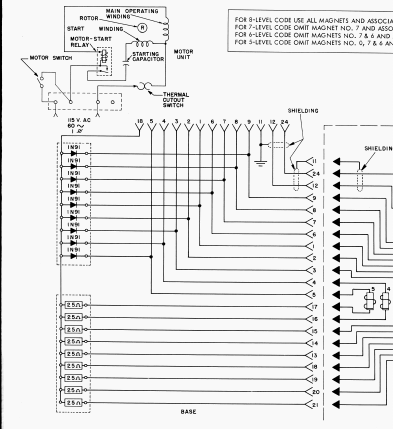


Figure 6-9. Timing Diagram (Early Design)


MAIN OPERATING WINDING
ROTOR
START WINDING
R
MOTOR-START RELAY
STARTING CAPACITOR
MOTOR UNIT
MOTOR SWITCH
THERMAL PROTECTOR SWITCH
115 V AC 60 ~ 1 Ø
SHIELDING
SHIELDIN
BASE
FOR 8-LEVEL CODE USE ALL MAGNETS AND ASSOCIA
FOR 7-LEVEL CODE OMIT MAGNET NO. 7 AND ASSO
FOR 6-LEVEL CODE OMIT MAGNETS NO. 7 & 6 AND
FOR 5-LEVEL CODE OMIT MAGNETS NO. 6, 7 & 6 AN

Figur

FOR 8-LEVEL CODE USE ALL MAGNETS AND ASSOCIATED RESISTORS AND DIODES.
FOR 7-LEVEL CODE OMIT MAGNET NO. 7 AND ASSOCIATED RESISTOR AND DIODE.
FOR 6-LEVEL CODE OMIT MAGNETS NO. 7 & 6 AND ASSOCIATED RESISTORS AND DIODES.
FOR 5-LEVEL CODE OMIT MAGNETS NO. 0, 7 & 6 AND ASSOCIATED RESISTORS AND DIODES.

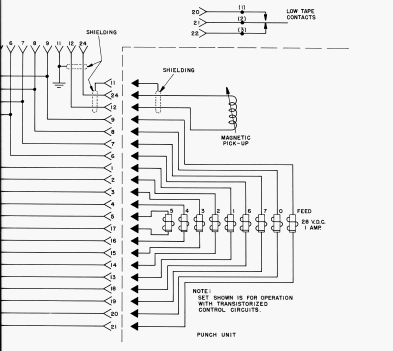


Figure 6-10. Schematic Wiring Diagram; Typical Tape Punch Set