SELECTRIC TYPEWRITER

3192

TRAINING MANUAL

SECOND EDITION

CONTROL DATA INSTITUTE

CONTROL DATA CORPORATION

SELECTRIC TYPEWRITER/3192

CONTROL DATA
CORPORATION

FOR TRAINING PURPOSES ONLY

This manual was compiled and
written by members of the
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SECTION I

SELECTRIC TYPEWRITER MECHANICAL OPERATION

INTRODUCTION

General Characteristics

The IBM Selectric Typewriter can be used as a standard office typewriter or as an input/output typewriter. The office machine is known as the 72 Series and the input/output machine is known as the 73 Series. It is capable of a print speed of 15 characters per second when under computer control. When under operator control, its speed is limited to that of the operator. The typewriter referred to in this manual is the Model 731 - which has an eleven inch carriage with an 8½ inch writing line. The 731 is available in two versions: BCD (Binary Coded Decimal) and Correspondence. The BCD version is limited to computer usage only as it utilizes non-standard print symbols. The Correspondence version can be used as an office typewriter or as an input/output machine as it utilizes standard print symbols. Because of its versatility, the Correspondence version is more widely used.

Comparison of Selectric to Standard Typewriter

Basically, the Selectric Typewriter performs the same functions as do all other typewriters. However, the method used to perform these functions differs greatly in most aspects. Three major areas in which the Selectric differs from other typewriters are:

1. Method of Printing - Standard typewriters utilize typebars to imprint a character. The Selectric utilizes a spherical typehead to imprint a character.

2. Method of Shifting - Standard typewriters raise and lower the typebar assembly to shift to lower or upper case characters. The Selectric rotates the typehead 180° to shift to either case.

3. Method of Escapement (Character Spacing) - Standard typewriters accomplish escapement by moving the entire carriage to the left. The Selectric accomplishes escapement by moving the typehead to the right.

Keyboard Characteristics

Located on the keyboard of the Correspondence Selectric are 55 keybuttons and switches. These are separated into the following categories:

1. Print Functions: 44 keybuttons representing 88 print characters. Each print keybutton can type any of two characters dependent upon the shift case of the machine (upper or lower)

2. Operational Functions: Eight keybuttons representing six operational functions.

   a. Spacebar - Moves the typehead one character space to the right.

   b. Carrier Return - Moves the typehead, quickly, to the left margin stop.

   c. Tabulator - Moves the typehead, quickly, to the right, usually several character spaces, until a preset stop is contacted.

   d. Backspace - Moves the typehead one character space to the left.

   e. Index - Line spaces the paper, vertically, one or two lines dependent upon the setting of the Index Selector Lever which is not located on the keyboard.

   f. Shift (three keybuttons) - Two shift buttons are located at either side of the keyboard and are interconnected by means of a bail. Depressing either button rotates the typehead 180° counter-clockwise to position the lower case characters on the typehead in the print zone. The third keybutton is the shift lock which locks the shift buttons down, keeping the typehead in the upper case position.

3. Power On/Off: A two-position switch which applies 110 volts A.C. to the typewriter motor when the "On" portion of the switch is depressed. The 110 volts A.C. is removed when the "Off" portion of the switch is depressed.

4. Tab Set/Clear: A two-position switch which sets or clears the tab stops which are necessary to stop the typehead at preset areas along the print line on a tabulator operation.

5. Margin Release: When depressed, causes the rear of the margin rack to be raised to enable the typehead to move, laterally, past the left or right margin stops.

MOTOR AND DRIVE

Two types of motors are used in the Selectric I/O Printer. One is a 3" induction motor known as the shaded pole motor and the other is known as the capacitor start motor. Both are 60 cycle A.C. motors, rated at 1/35 horsepower, and operate at 115 volts. The most common of the two is the shaded pole. (Figure 1-1) The motors are mounted at the left rear corner of the printer and have a pulley mounted to the right on their rotor shafts.

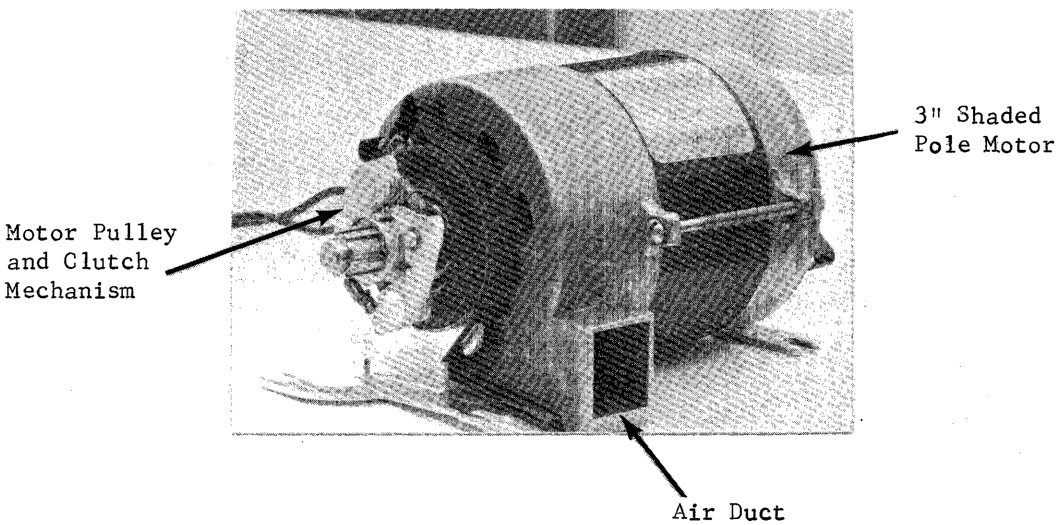


Figure 1-1. Shaded Pole Motor

The starting torque of the shaded pole motor is low, compared to that of the capacitor start and therefore, utilizes a centrifugal clutch assembly. The starting torque on the capacitor start motor, supplied by the capacitor, is high and therefore does not use a clutch assembly. The capacitor is mounted to the right of the motor. Internal circuit breakers in both motors are utilized to prevent the burning up of windings in case breakage of parts or maladjustments cause machine lockup. The circuit breaker will alternately open and close as long as the power switch is left on and the motor is stalled. The shaded pole motor normally runs very hot and care should be taken to prevent being burned. A cooling system is incorporated in the motor to prevent over-heating but the motor still can cause painful burns if not handled properly. The on-off switch (Figure 1-2) located on the front right side of the printer, controls power on and off as well as the keyboard lock mechanism covered later in the Keyboard Section.

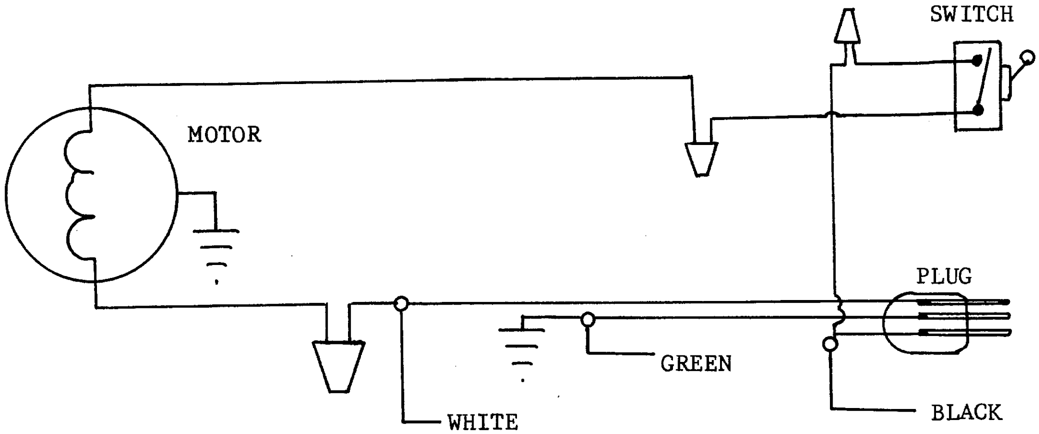


Figure 1-2. Diagram - Shaded Pole Motor

Drive is supplied by the motor to the printer via a belt running from an eight-toothed motor pulley to the cycle clutch pulley with a reduction in speed of 3 5/8 to 1. The motor pulley on the capacitor start motor is set-screwed to the rotor shaft and drives the cycle clutch pulley as soon as the motor begins to turn. On the shaded pole motor however, the motor pulley rides freely on the rotor shaft and is held in place by a grip ring on the end of the shaft. It has three ratchet teeth protruding radially from its left side. Set-screwed to the rotor shaft, just left of the pulley, is a clutch plate hub assembly (Figure 1-3) which has two clutch pawls pivoting on the plate. The pawls are spring loaded against stop lugs on

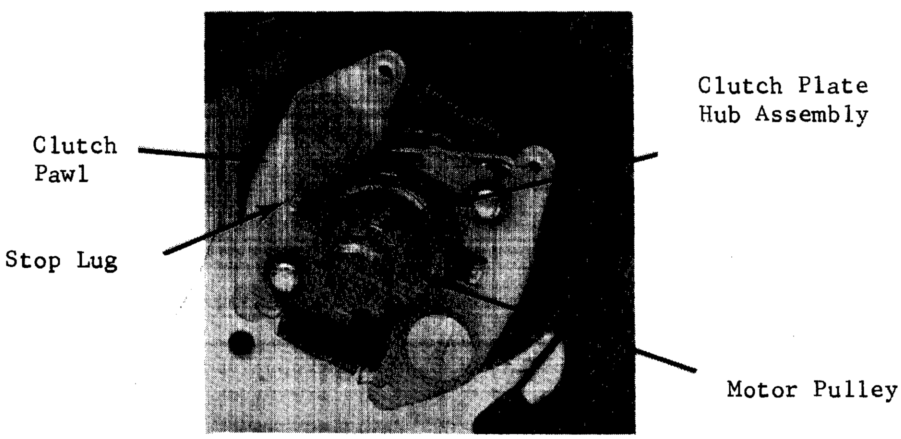


Figure 1-3. Motor Pulley Clutch

the clutch plate with the motor turned off. As the motor begins to rotate, centrifugal force begins to make the clutch pawls pivot on the studs of the clutch plate, pivoting the tips of the pawls into the three teeth of the still motionless pulley. As the motor approaches full speed, the tip of one of the pawls engages one of the three teeth of the motor pulley driving it and through the belt, the cycle clutch pulley. This supplies drive to the rest of the printer.

The cycle clutch pulley is mounted in the center of the power frame to a hub, which is supported by a bronze bearing and rotates with the pulley. The cycle clutch pulley hub (Figure 1-4) supports two shafts on either side, which extend into it.

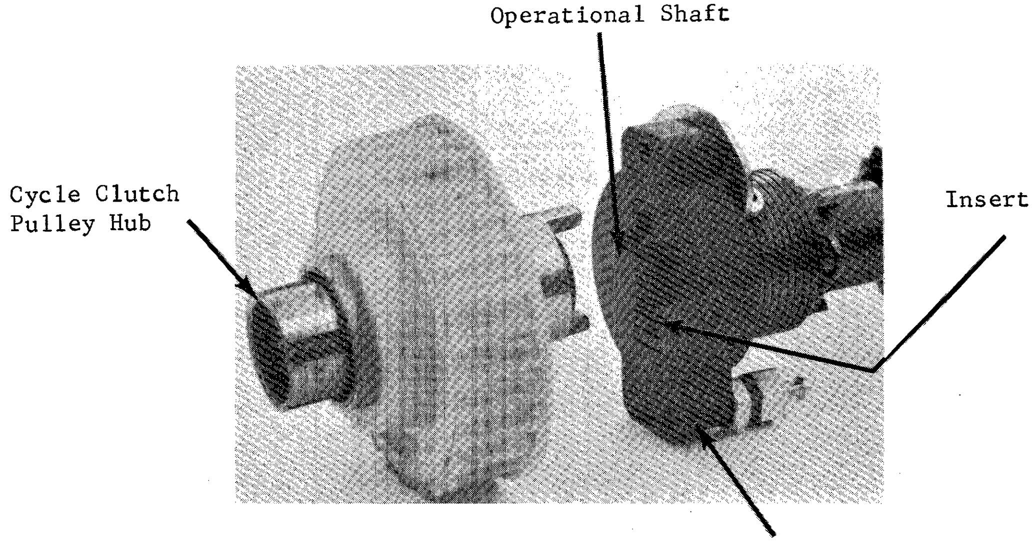


Figure 1-4. Drive Connection

The shaft to the right (Figure 1-5) is the operational cam shaft which rotates continuously, top to the front, when the motor is running. This shaft drives the following six operational functions: Space, Backspace, Tabulator, Shift, Carrier Return, and Index. It also regulates the speed of the carrier during a tab operation. The left end of the operational cam shaft, which extends into the cycle clutch pulley hub, is supported by a vinyl sleeve which supplies a tight connection for the shaft in the hub and eliminates any vibrational noises. The torque limiter hub, set-screwed to the left end of the operational shaft, has two cutouts in its left side which two extensions of the clutch pulley hub fit into. This supplies the drive connection between the hub and the operational shaft. Two nylon inserts, which fit into the cutouts

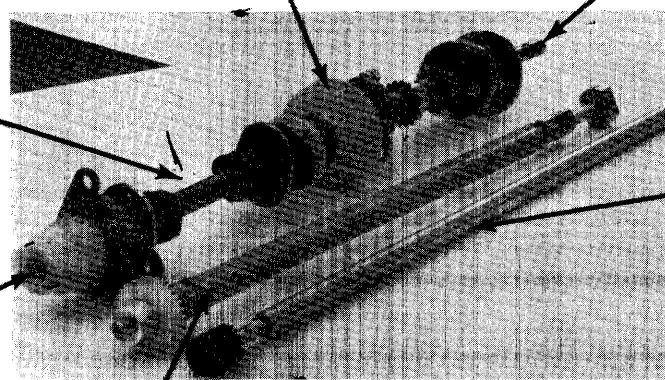


Figure 1-5. Drive Mechanism

around the hub extensions, permit a noise-free drive connection. To the right of the torque limiter hub are three spring clutches, two small pinion gears and two cams. These are used in the drive and/or control of all of the operational functions. The shaft to the left of the cycle clutch pulley hub is the cycle shaft (Figure 1-5) which, unlike the operational shaft, is not in continuous rotation. It is driven by means of a spring clutch which is permitted to tighten about a hub on the rotating pulley hub causing the cycle shaft to rotate, whenever a character is to be printed (depression of a character key-lever or selection of print magnets by the computer). To type a given character, the typehead must be in the correct position and is powered to that position by the cycle shaft. The cycle shaft rotates 180° (a complete print cycle), top to the front, for each character to be printed. At the end of 180° rotation the spring clutch disengages from the rotating pulley hub and the cycle shaft stops rotating. The cycle shaft directly drives two other shafts (Figure 1-5), each time it rotates, through a series of idler gears at the left of the printer. These two shafts are the print shaft, which operates the print mechanism, ribbon feed and lift mechanisms, and the type aligning mechanisms; the print shaft rotates 360°, top to the rear, for each print cycle; and the filter shaft, which operates the character selection mechanisms, the shift interlock, print escapement, and a spacebar lockout device. The filter shaft rotates 180°, top to the front, for each print cycle.

TYPE HEAD

Carrier Assembly

The typehead, or print element, contains eighty-eight characters and is supported by the carrier. The carrier (Figure 1-6) is box-shaped and moves just in front of and laterally to the platen. The carrier carries the typehead along the writing line and contains almost all of the print mechanisms. It also supports the ribbon, ribbon lift and feed mechanisms and a margin bracket. The print sleeve, which contains the ribbon feed and lift cams, the dentent cam and the print cam, is located at the front of the carrier and moves with the carrier left or right, on the print shaft.

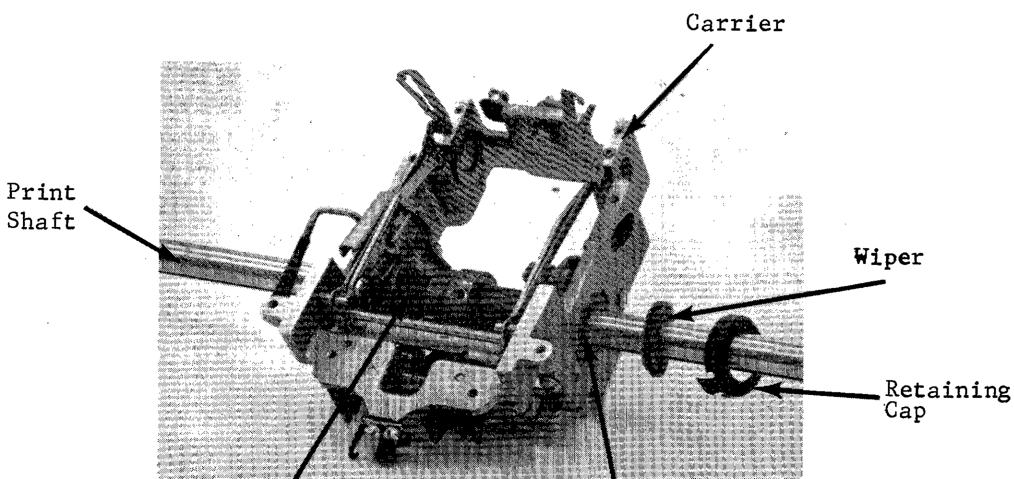


Figure 1-6. Front Carrier Support

The print sleeve (Figure 1-6), which fits into two bronze bearings within the carrier, must rotate within the carrier and also support the carrier in the front. Two felt rings, called the print shaft wipers, enclose the print shaft and are held in place to each side of the carrier by a retaining cup. The wipers are kept oil-soaked and supply a light film of oil to the print shaft as the print sleeve slides. They also keep the bearings lubricated to aid the rotation of the print sleeve.

Carrier Support

The carrier is supported in the rear (Figure 1-7) on the escapement rack by means of a nylatron block called the lower shoe which is mounted to a plate on the rear of the carrier and the upper carrier shoe which is mounted on an eccentric stud and is spring loaded against the top surface of the escapement rack. The left end of the leaf spring is anchored by a stud mounted on the plate. The free end of the spring presses against the bottom of the escapement bracket.

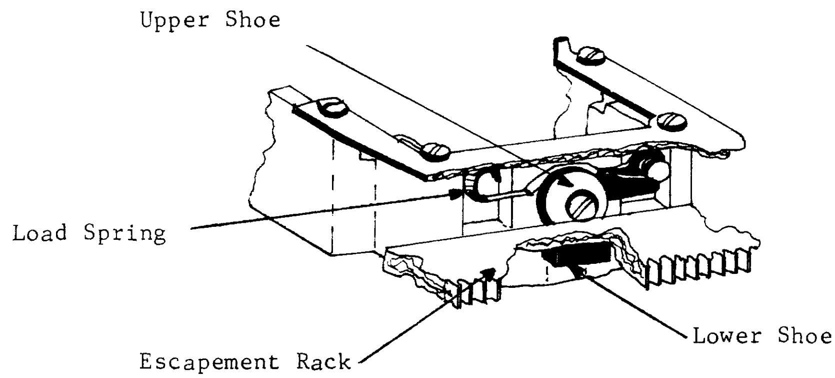


Figure 1-7. Rear Carrier Support

Rocker

The rocker is a platform located within, and pivoting at the rear of, the carrier on the rocker shaft. (Figure 1-8) Two bushings within the rocker ends are used as a bearing surface between the rocker and the rocker shaft. The rocker carries the typehead to and from the platen to allow printing to occur. The yoke, which acts as a pivot for the tilt ring is attached solidly to the top of the rocker. The upper ball socket, to which the typehead is attached, is mounted at the top of the tilt ring. As the rocker is pivoted toward the rear, it drives the typehead toward the platen.

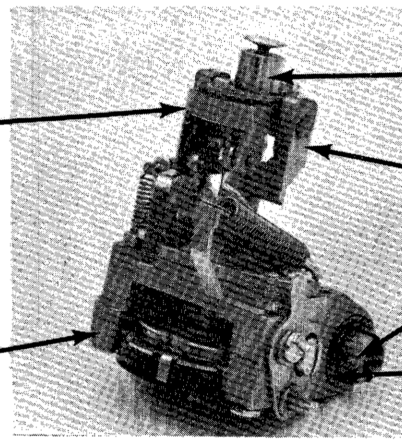


Figure 1-8. Rocker Assembly

Typehead

The eighty-eight character typehead (Figure 1-9) is divided into two hemispheres of forty-four characters each: upper case and lower case. It is divided into four circular bands of twenty-two characters. Each band has eleven lower case and eleven upper case characters. At rest, the middle character of the upper band (the letter Z in most cases) is in position to strike the platen. This is referred to as the home position. To print any character other than the Z, the typehead must be tilted up to three positions from the home position and/or rotated up to five positions clockwise or counterclockwise from the home position. The tilting or rotating of the typehead operates the same in lower or upper case. The typehead always restores to the home position after any character has printed and before another character will print.

To position the typehead into upper case, it must be rotated 180° counter-clockwise. To position the typehead into lower case it must be rotated 180° clockwise. Any given character on the typehead (i.e. the letter Z) is exactly 180° apart from its upper case counterpart and vice-versa. A spring clip on the top of the typehead is used to mount the typehead to a groove in the upper ball socket. The inside of the typehead is keyed to fit a pin at the base of the upper ball socket. The typehead cannot be locked into place unless the key fits over the pin. This allows the typehead to be installed in only one position. The typehead is removed or installed by pressing the two ears of the spring clip together. The ears of the spring clip always face toward the front when the typewriter is in lower case. As the typehead faces the platen, the 20 characters to the right of the home position are called positive characters. A counterclockwise rotation of the typehead is required to bring a positive character to the print position. The 20 characters to the left of home are called negative characters and require clockwise rotation of the typehead to bring them into the print position.

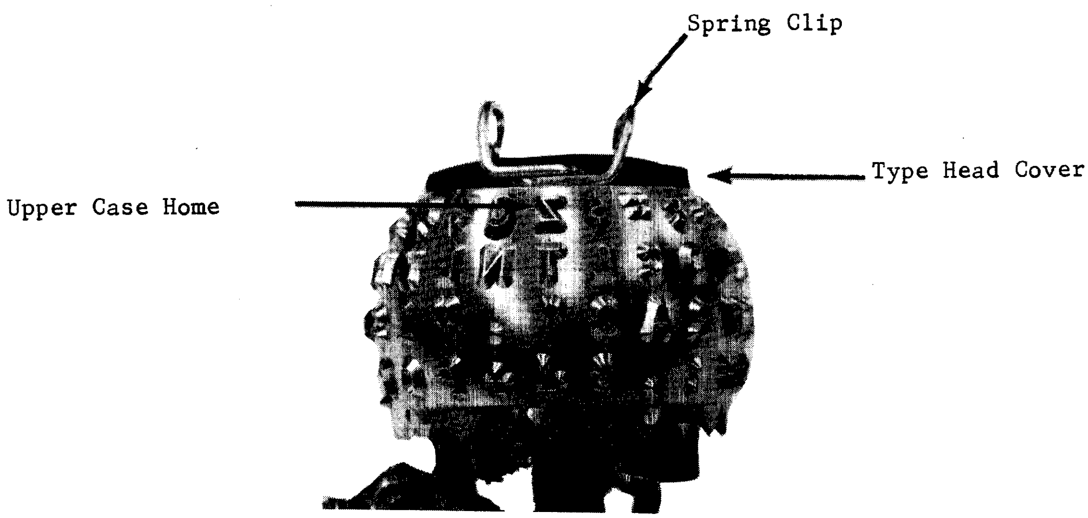


Figure 1-9. Typehead

Figure 1-9a illustrates the tilt and rotate positioning of the 88 characters on the typehead.

Upper Case

Rotate	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Tilt 0	±	#	&	*	$	Z	@	%	¢	)	(
Tilt 1	X	U	D	C	L	T	N	E	K	H	B
Tilt 2	M	V	R	A	O	°	.	"	I	S	W
Tilt 3	G	F	:	,	?	J	+	P	Q	Y	_
						HOME					

Lower Case

Rotate	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Tilt 0	1	3	7	8	4	Z	2	5	6	0	9
Tilt 1	X	U	D	C	L	T	N	E	K	H	B
Tilt 2	M	V	R	A	O	!	.	'	I	S	W
Tilt 3	G	F	;	,	/	J	=	P	Q	Y	-
						HOME					

Figure 1-9a. Typehead Character Positioning

CYCLE CLUTCH

The cycle clutch is the "heart" of the printer and a rotation will occur for each character printing. The cycle shaft (Figure 1-10) powers all print operations. It extends from a bearing in the left side of the powerframe to the cycle clutch pulley hub in the center. A wrap spring (Figure 1-10) called the cycle clutch spring, provides the means of engaging the cycle shaft with the continuously rotating pulley hub.

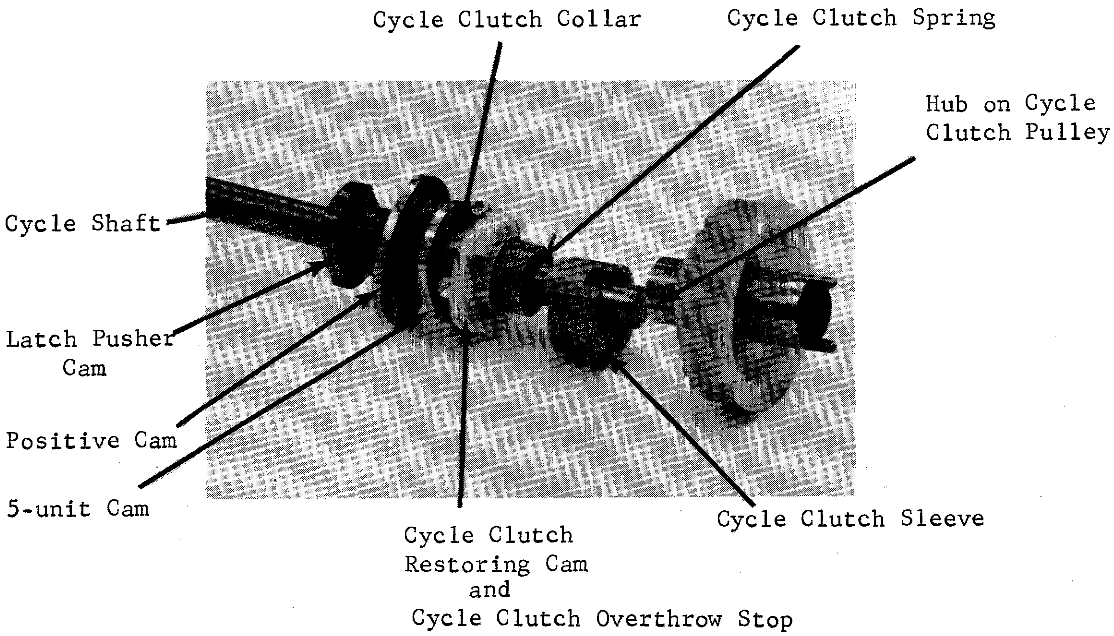
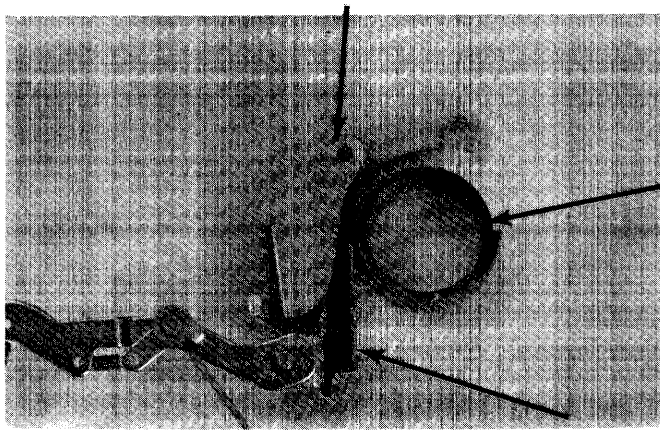


Figure 1-10. Cycle Clutch

The left end of the spring fits around the hub of the cycle shaft and is clamped to the hub by the cycle clutch collar. The tip of the spring fits into a slot in the collar. The right end of the spring fits around the hub on the pulley and a tip of the spring fits into a slot in the cycle clutch sleeve. The inside diameter of the spring is less than that of the pulley hub and the spring will collapse tightly around the hub unless it is held unwound. Holding the spring unwound is accomplished by the cycle clutch latch (Figure 1-11) which holds the cycle clutch sleeve. The sleeve prevents the spring from tightening around the rotating pulley hub. This allows rotation of the cycle clutch pulley without rotating the cycle shaft. Located on the cycle clutch sleeve are two lips 180° apart. As the cycle shaft rotates, one of the lips, or sleeves, will be stopped by the cycle clutch latch. This allows just 180° of rotation. To cause rotation, the cycle clutch latch is pivoted to the front, out of the path of the cycle clutch sleeve. It is then pivoted back into the path of the next lip on the sleeve. The latch stops the right end of the spring but the left end of the spring must be allowed to rotate slightly farther to unwind the spring and disengage the clutch from the hub on the cycle clutch pulley. This extra rotation is accomplished by momentum of the cycle shaft.

Cycle Clutch Latch Bracket



Cycle Clutch Sleeve

Cycle Clutch Latch

Figure 1-11. Cycle Clutch Latch

The cycle clutch restoring cam/overthrow stop has two lugs which project into notches on the left side of the cycle clutch sleeve (Figure 1-12). As the sleeve is stopped by the latch, the cycle shaft with the restoring cam/overthrow stop attached to it, continues to rotate until the lugs on the overthrow stop contact the extensions of the sleeve . At this time, forward motion of the cycle shaft is stopped but the shock created by the force of the stopping action causes the cycle shaft to attempt to bounce backwards. This is prevented by the cycle clutch check pawl (Figure 1-71) which drops into a notch on the cycle clutch check ratchet. Both are located inside the powerframe at the left of the printer. The overthrow stop plus the check pawl assures that the cycle shaft always restores to the exact same position upon each 180° rotation.

Cycle Clutch Collar

Cycle Clutch Restoring Cam/Over-throw Stop

Cycle Clutch Sleeve

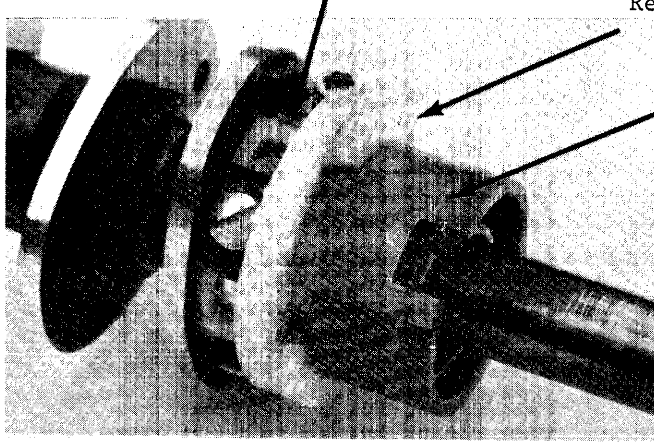
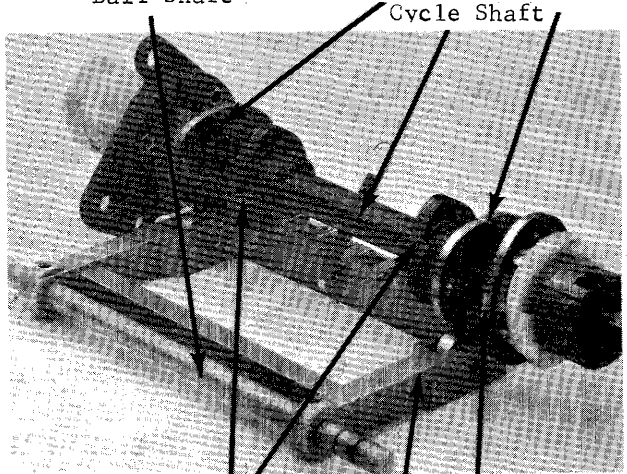


Figure 1-12. Cycle Clutch Stop

LATCH BAIL

The purpose of the latch bail (Figure 1-13) is to supply the motion needed to cause the typehead to tilt and/or rotate to the needed position to print a selected character. It is a square-shaped frame located just under the cycle shaft and pivoting on the bail shaft mounted toward the front of the printer. The rear of the latch bail is held upward by an extension spring which connects to the power frame. A roller is located in each side of the latch bail and both rollers are held in contact with two cams, called the positive cams, on the cycle shaft. Each time the cycle shaft rotates 180° the latch bail is forced down in the rear. Six selector latches sit



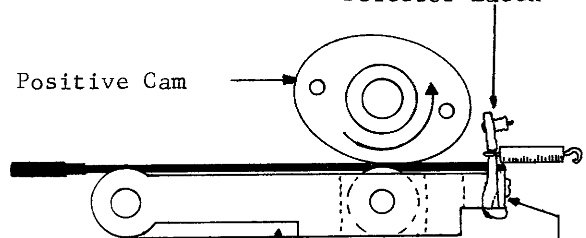


Figure 1-13. Latch Bail and Cycle Shaft   Figure 1-14. Latch Bail - Side View

in six recessed points at the rear of the latch bail. A plate runs across the rear of the latch bail. Each selector latch has a lip formed to the rear which fits under this plate. Each latch is held to the rear (under the latch bail plate) by an extension spring (Figure 1-14). If they are left to the rear when the latch bail is forced downward they will be pulled down. Any latches pulled forward (unlatched) as the latch bail begins its downward motion will not be pulled down. The first and third latches are used in the tilt differential mechanism. The fourth, fifth and sixth latches are used in the rotate differential mechanism. The differential mechanisms determine the amount of tilt and rotate the typehead is to receive. The second latch is used for parity checking purposes and will be discussed later.

TILT MECHANISM

The purpose of the tilt mechanism is to raise the rear of the typehead to allow the desired character band to be in position to permit a selected character in that band to strike the platen. The tilt ring is used to tilt the typehead upward from the rest position (Figure 1-15). Movement of the tilt ring is accomplished by a pull from a link on the front right lower part of the tilt ring. The other end of the link is connected to the tilt pulley which is held upward by the tilt pulley spring (Figure 1-15). A narrow steel tape is connected from the tilt pulley through a cutout section of the rocker shaft out the left side of the carrier, around the left hand tilt pulley, across the printer, around the right hand tilt pulley, and is anchored to a pin in the right side of the carrier.

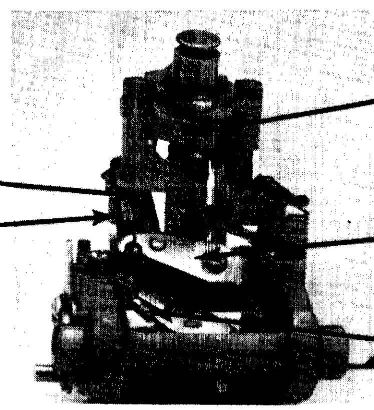


Figure 1-15. Tilt

The right hand pulley is anchored to the frame. A pull on the tape (which pulls the tilt pulley, then the link, then pulls the front of the tilt ring down, pivoting the rear up) is accomplished by moving the left hand tilt pulley away from the side frame of the printer. Relaxing the pull on the tape allows the tilt pulley spring to restore the tilt ring to the rest position.

Tilt Differential

Figure 1-16 shows the tilt differential mechanism at rest. The two tilt latches are connected at each end of a horizontal arm by means of ball shouldered rivets, which permit free movement of the latches. A vertical link attaches to the horizontal arm one-third the distance from the left of the arm and two-thirds from the right. This allows the leverage of one tilt latch to be greater than the other. The top of the vertical link connects to the tilt bellcrank. The bellcrank is connected to the tilt arm by means of a horizontal link. To the top of the tilt arm is connected the tilt pulley. The pulley is mounted on the tilt arm by means of a ball shouldered screw. This arrangement permits the pulley to remain horizontal despite movement by the tilt arm. Thus the tilt tape cannot jump off of the pulley. When either or both of the tilt latches is pulled downward the tilt bellcrank rotates forcing the tilt arm away from the powerframe causing the typehead to tilt.

When the right hand tilt latch (Tilt 1) is left under the latch bail with the left hand latch (Tilt 2) pulled forward, the top of the Tilt 2 latch acts as a pivot point. Since the vertical link is connected one-third the distance from this pivot point it will only have a downward motion equal to that of one-third of the Tilt 1 latch being pulled by the latch bail. This causes a sufficient amount of rotation of the bellcrank and a subsequent push on the tilt arm to bring the second band of characters on the typehead to the print position. This is a Tilt 1 operation (Figure 1-17).

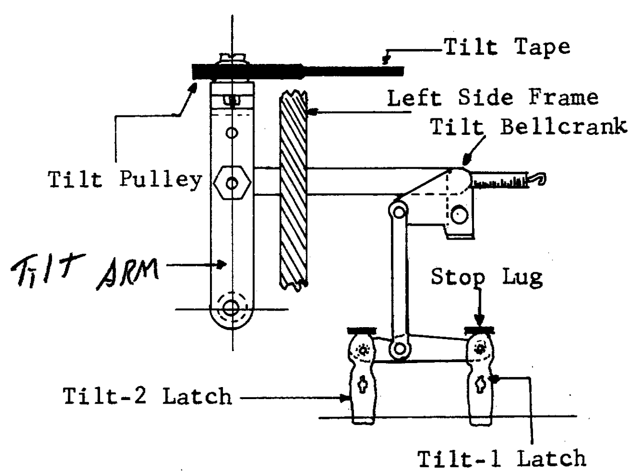


Figure 1-16. Tilt Differential at Rest

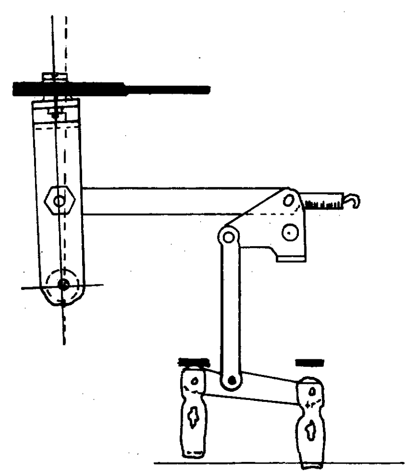


Figure 1-17. Tilt-1 Operation

Leaving the Tilt 2 latch under the bail and pulling the Tilt 1 latch forward creates a pull on the vertical link equal to that of two-thirds the downward motion of the Tilt 2 latch. This is due to the link being two-thirds the distance from the top of the Tilt 1 latch which is now acting as a pivot point. This causes sufficient pull on the bellcrank to tilt the typehead to the third band of characters. This is a Tilt 2 operation (Figure 1-18).

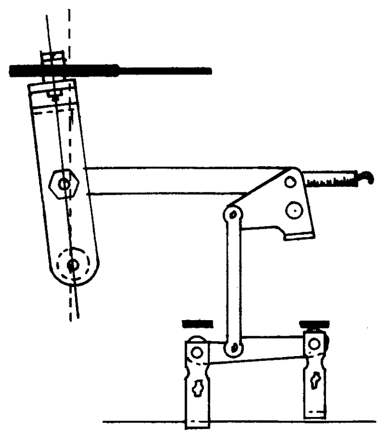


Figure 1-18. Tilt-2 Operation

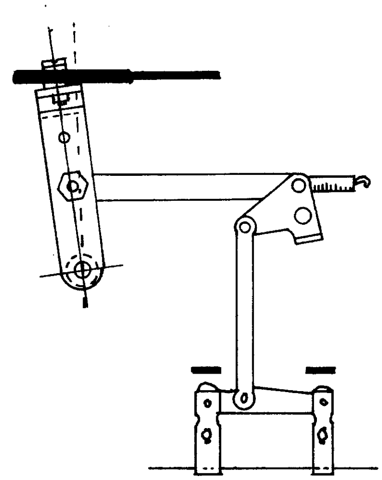


Figure 1-19. Tilt-3 Operation

Allowing both latches to be left under the latch bail transfers the same amount of motion to the vertical link as that of the latches due to the absence of a pivot point. This rotates the bellcrank enough to tilt the typehead to the fourth band of characters. This is a Tilt 3 operation (Figure 1-19).

If both latches are pulled from under the bail then neither will move downward. Therefore, there is no downward motion of the vertical link and no rotation of the bellcrank. Thus the typehead does not tilt and the first band of characters stays in the print position. This is a Tilt 0 operation.

ROTATE MECHANISM

The purpose of the rotate mechanism (Figure 1-20) is to rotate the type-head clockwise or counterclockwise to the selected character within one of the four tilt bands.

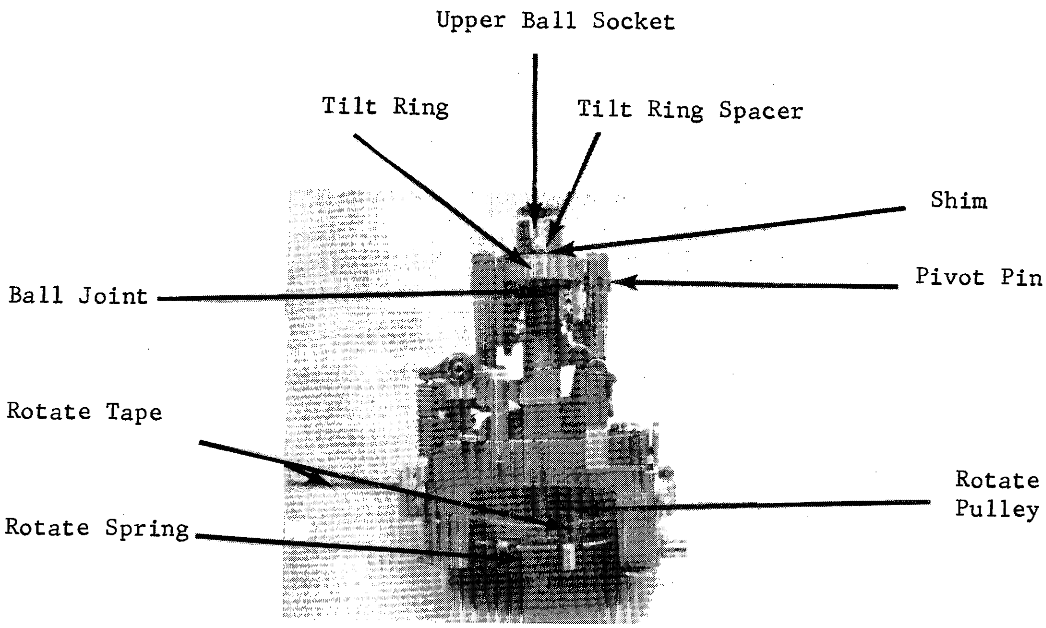


Figure 1-20. Rotate Mechanism

The typehead is attached to the upper ball socket. The shoulder at the bottom of the upper ball socket fits closely into a hole in the tilt ring with just enough freedom to rotate freely. The tilt ring spacer, which is attached to the tilt ring, holds the upper ball socket in place. Shims are used to insure complete rotary movement of the upper ball socket but no up and down play.

A ball joint connection, called the dog-bone (Figure 1-21), fits into a hollow position in the underside of the upper ball socket. Each end of the dog-bone is slotted. The dog-bone fits over a pin in the upper ball socket. The other side of the dog-bone fits the same way in the lower ball socket which is also hollow. This type of connection acts as a universal joint and permits the typehead to be tilted and rotated at the same time.

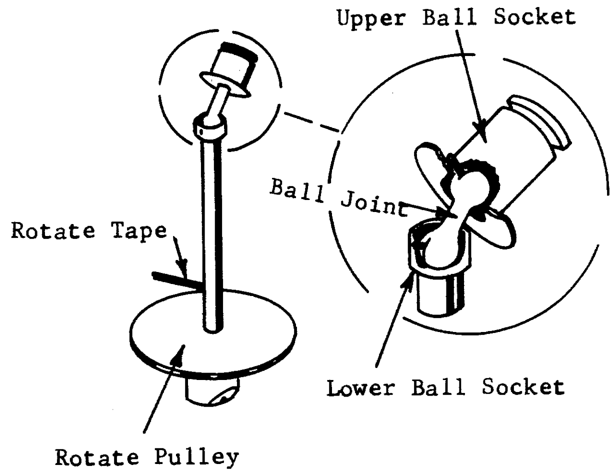


Figure 1-21. Rotate Mechanism-Rocker Portion

The lower ball socket is part of the rotate shaft (Figure 1-21) which is held tightly within a hole in the rotate pulley by means of a set screw and wedging block arrangement. The rotate pulley is operated by a steel tape called the rotate tape, which is similar to the tilt tape. One end of the tape has a "T" connector while the other has an eyelet. The "T" end of the tape connects to the rotate pulley (Figure 1-22) passes around a guide in the rocker, and out the left side of the carrier. As the tape leaves the left side of the carrier its edges are perpendicular to the ground. It is given a half twist, top toward the front, so that its edges are now parallel to the ground. It then passes around the rotate arm pulley and across the printer to pass around the shift arm pulley. It is then anchored to the right side of the carrier. A pull outward on either of the pulleys causes the rotate pulley, and thus the typehead, to rotate in a counterclockwise (positive) direction. An inward movement of either of the pulleys allows the typehead to rotate clockwise (negative) by tension of the rotate spring. The rotate spring, which is a mainspring, is enclosed in a cage located immediately below the rotate pulley. The outer end of the spring is connected to the cage which is held stationary while the inner end of the spring is connected to a slot on the bottom of the rotate pulley. The inner part of the spring always trys to unwind in the clockwise direction. Thus, the rotate pulley always has tension on it in the clockwise or negative direction and takes up tape if either of the pulleys moves toward the sideframe. The left hand pulley, called the rotate pulley, governs the rotation of the typehead for all print selections. The right hand pulley, called the shift arm pulley, always rotates the typehead 180° and only moves during a shift operation. All other times, it is stationary.

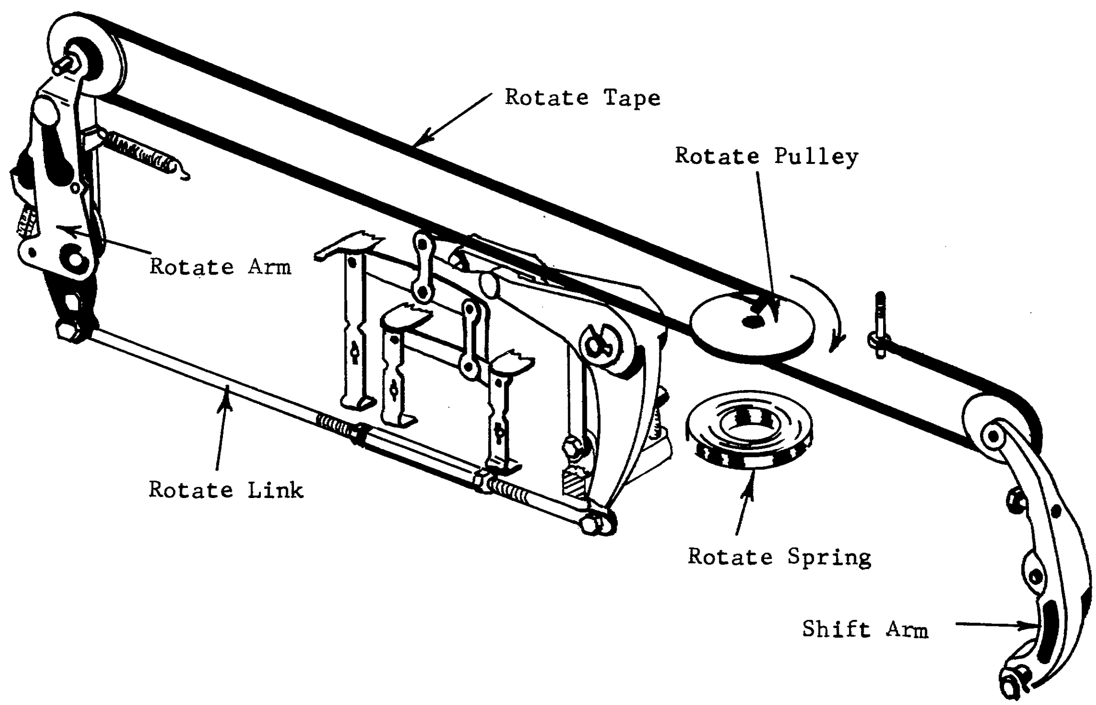


Figure 1-22. Rotate Tape System

Positive Rotate Differential

The operation of the rotate differential is basically the same as that of the tilt differential. The latches are operated if left under the latch bail. However, the typehead must sometimes be rotated up to five characters in either direction of home. This calls for more latches and levers. Positive (counterclockwise) rotation will be covered first.
There are three latches in the rotate differential (Figure 1-23) farthest to the right in the bail. From the left, they are labeled R2A, R1 and R2. The R1 and R2 latches are mounted to a lever by means of ball shouldered rivets. A vertical link is attached to the lever one-third the distance from the right (R2 side) of the lever. At the left end of the lever the R2A latch is connected by means of a ball-shouldered rivet. This latch is longer than the others to allow it to be under the bail.
A second vertical link is connected two-fifths the distance from the right side of the second lever. This link is connected to the left side of an adjustable lever, the balance lever. Is is adjustable to permit equal balance between a positive and negative rotation. The balance lever is connected, at approximately its mid-section, to the left end of the rotate bell crank. The right end of the balance lever is connected to a vertical link, called the R5 or 5-unit link. For all positive rotations, the R5 link will be stationary. A positive rotation is created by downward motion of any of the latches. This causes a downward motion on the left end of the balance lever, pulling down on the left side of the rotate bellcrank. The bottom of the rotate bellcrank then moves to the right (counterclockwise) creating a pull on the rotate link, which is adjustable. The left end of the rotate link is connected to the bottom of the rotate arm and a pull at this point causes the rotate arm to move away from the power frame creating a counterclockwise pull on the typehead.

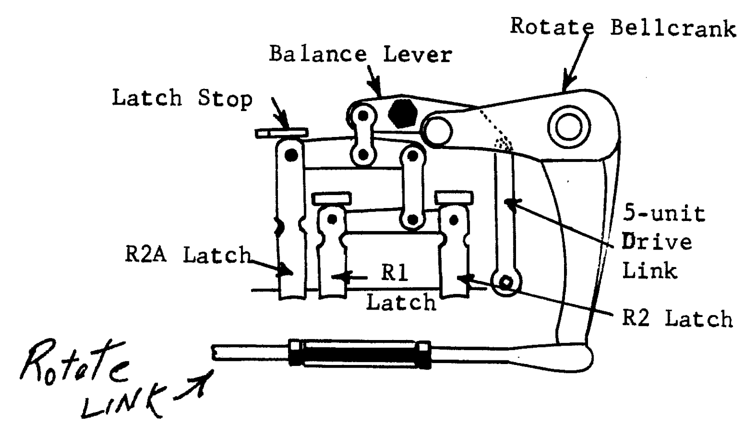


Figure 1-23. Rotate Differential at Rest

For a rotate one operation, the R1 latch is left under the bail while the R2 and R2A latches are unlatched. A rotate two calls for the R2 latch under the bail; a rotate three, the R1 and R2 latches; a rotate four, the R2 and R2A latches; and a rotate five, all three latches must be under the bail. The R2A latch is never used without the R2 latch in a print operation initiated from the keyboard. For a zero rotate operation, none of the latches is left under the bail. This permits one of the four characters in the home position to print. This is called a positive zero and is the only way to cause the printing of a home character from the keyboard.
To perform a rotate one operation (Figure 1-24) the R1 latch is left under the bail. The top of the R2 latch acts as a pivot point up against its stop. Since the vertical link is connected one-third the distance from this pivot point, it is pulled down one-third as far as the R1 latch. The second lever pivots at its left side due to the R2A latch not being used. Since the second link is connected to this lever three-fifths from this pivot point it will be pulled down only three-fifths as much as the first vertical link which was one-third as far as the latch. Multiplying the two together gives a total pull on the balance lever of one-fifth the pull of the latch. This is sufficient to rotate the typehead one character counterclockwise.

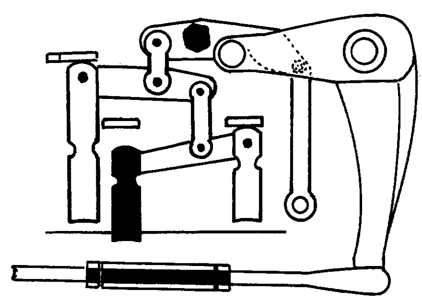


Figure 1-24. Positive-One Rotate Operation

For a plus three (Figure 1-25) leaving the R1 and R2 latches under the bail causes a full pull on the first vertical link of three-thirds or a unit of one. The second lever still pivots at the top of the R2A latch meaning the balance lever is pulled down a total distance of three-fifths times one or three-fifths as far as the latches. This is sufficient to cause a

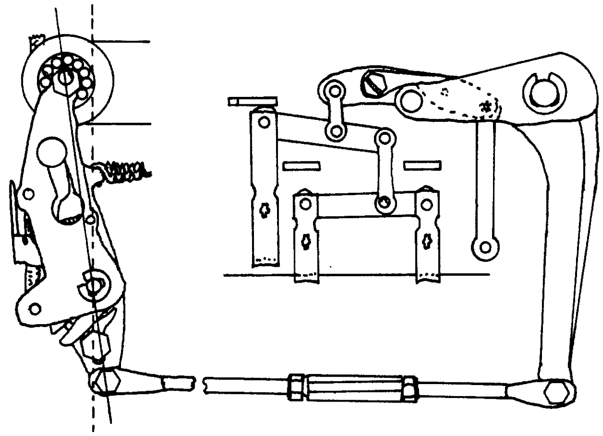


Figure 1-25. Positive-Three Rotate Operation

counterclockwise rotation of three characters. A plus five operation (Figure 1-26) requires all latches under the bail. Since the second lever does not pivot, the balance lever is pulled down five-fifths times three-thirds or as far as the three latches were pulled down. This will create a counterclockwise rotation of five characters.

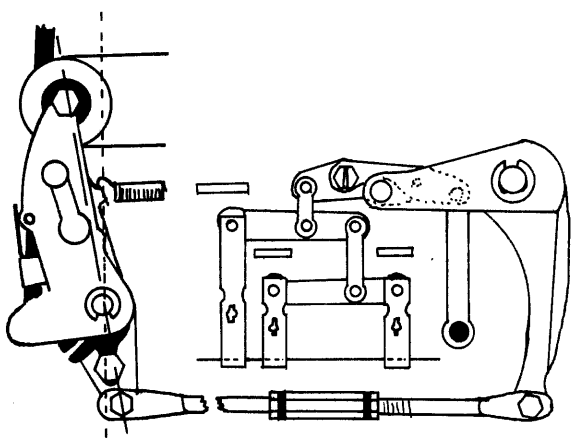


Figure 1-26. Positive-Five Rotate Operation

Negative Rotation

Negative rotation is caused by operating the rotate bellcrank clockwise. This allows the rotate spring to rotate the typehead in a clockwise direction. Rotation of the bellcrank is governed by the balance lever. If the right side of the balance lever is forced to rise, the bellcrank must rotate clockwise. This action is accomplished by the 5-Unit Link. The bottom side of the link is attached to the five-unit bail (Figure 1-27) which is normally held in a downward position. The five-unit bail is a single arm located under the cycle shaft and to the right of the latch bail. Like the latch bail, it pivots on the bail shaft. In the rest position, it is held downward by the five-unit cam which is mounted to the right of, and 90° out of phase with, the right hand positive cam on the cycle shaft. However, since the cycle shaft will rotate each time any character is to be printed, positive or negative, the five-unit bail will try to rise.

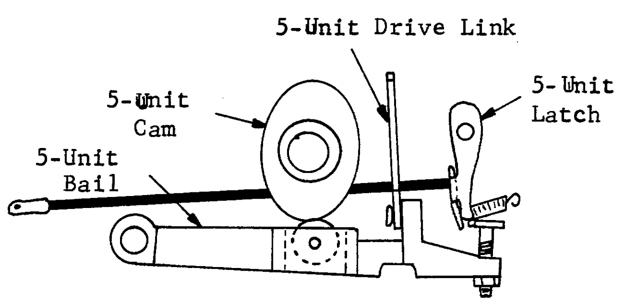


Figure 1-27. Five-Unit Bail at Rest

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This is prevented, on a positive operation, by the five-unit latch which is spring loaded to the rear and over an adjustable screw on the top rear of the five-unit bail (Figure 1-28). Unless the five-unit latch is pulled to the front, the five-unit bail cannot rise.

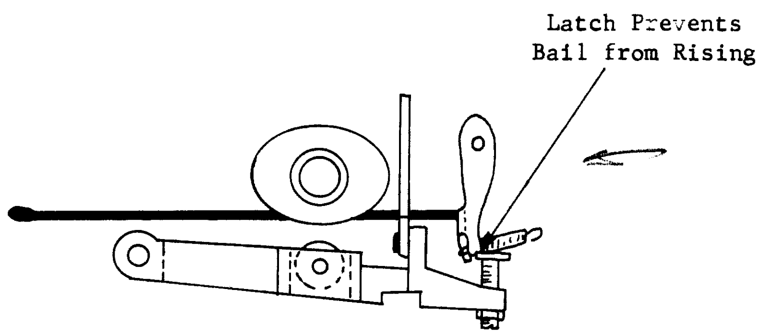


Figure 1-28. Five-Unit Bail During Positive Rotate Cycle

To print a negative character, the five unit latch is pulled to the front. As the five-unit cam now beings to rotate to a low point, the five-unit bail is forced to rise (Figure 1-29) by pressure from the rotate spring and the spring attached to the rotate arm. These springs are applying a constant clockwise force on the rotate bellcrank. When the five-unit bail rises, the five-unit link will rise, allowing the bellcrank to rotate clockwise. If none of the positive latches has been left under the bail, then the bellcrank will be allowed to rotate far enough to permit

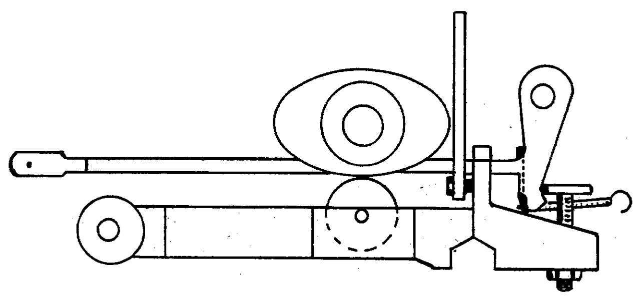


Figure 1-29. Five-Unit Bail During Negative Rotate Cycle

a negative five character to print (Figure 1-30). To obtain another negative character, other than negative five, some of the positive latches must be left under the bail. This will subtract from the total permissable clockwise rotation of the bellcrank and cause a less than negative five typehead rotation.

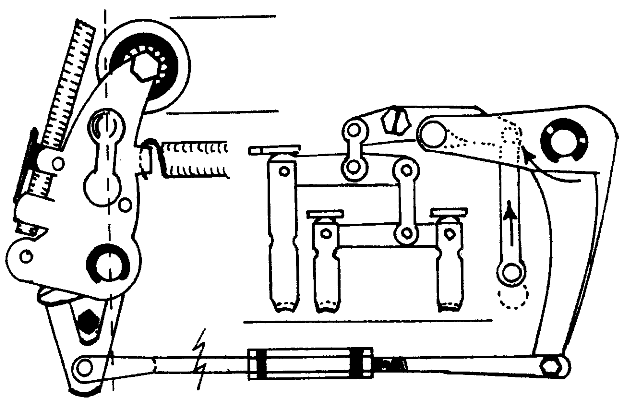


Figure 1-30. Negative-Five Rotate Operation

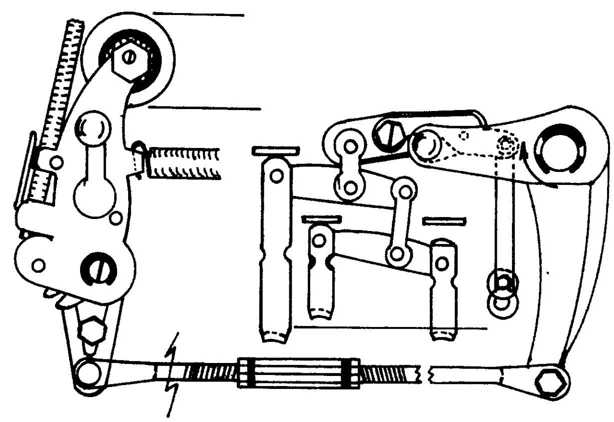


Figure 1-31. Negative-One Rotate Operation

To print a negative one character (Figure 1-31) the +2 and +2A latches are left under the bail while the +1 and -5 latches are pulled (-5 must be pulled for any negative character). The +4 subtracted from -5 leaves -1 or one-fifth total negative rotation of the bellcrank and, thus, the typehead.

KEYBOARD AND CHARACTER SELECTION

Keylevers

The keylevers pivot at the rear of the machine on a fulcrum rod (Figure 1-32). Tension is supplied by a set of flat springs, with cupped tips, under the front of the keylevers. Due to the difference in leverage between the four rows of keys, auxiliary leaf springs of different sizes are utilized to supply a uniform force on all of the keylevers. Just to the rear of the keybutton are two adjustable lugs which are used to adjust the height of the keylever pawl. The keylever pawl is fastened to the keylever by means of a shoulder rivet. It is located just rear of the adjustable lugs and is spring loaded forward. It extends below the keylever and immediately above the keylever pawl contact surface of the selector interposer.

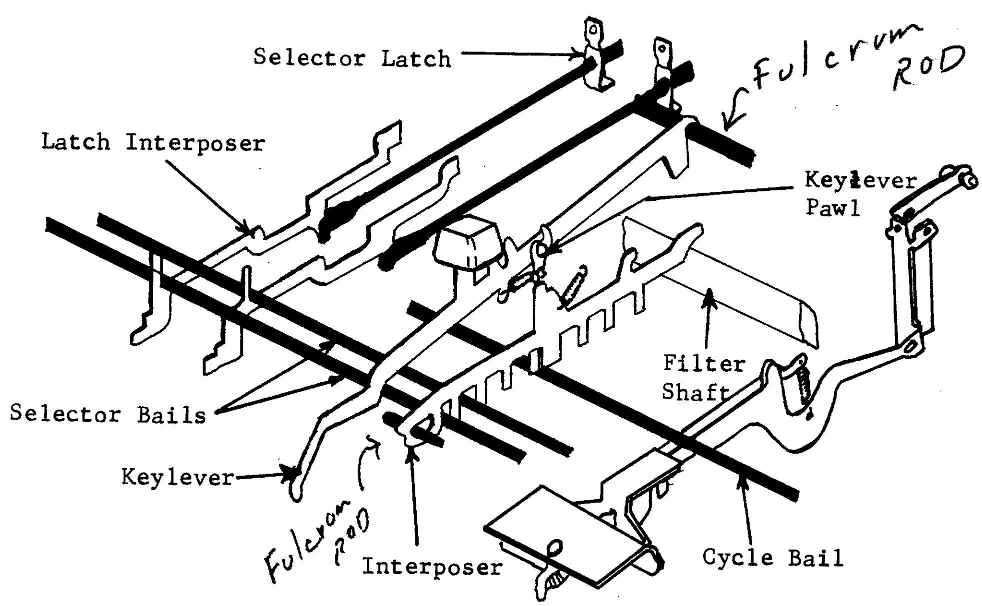


Figure 1-32. Keyboard Section and Character Selection

Selector Interposers

Each keylever has an interposer immediately below it (Figure 1-33). The purpose of the interposers is to cause the selector latches that are not needed for a given character to be pulled from under the latch bail. The negative five latch will also be pulled if a negative rotate is selected. Each interposer has an elongated hole in the front through which passes a large fulcrum rod. This supports the front of the interposer as well as allowing free sliding and pivoting of the interposer. The interposers are

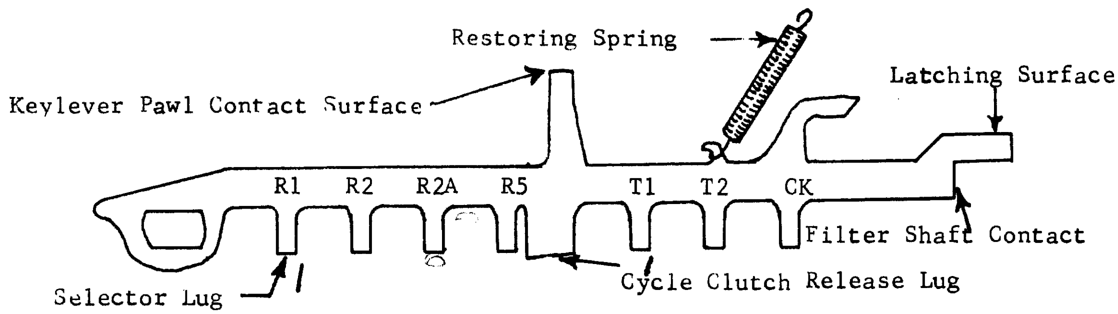


Figure 1-33. Selector Interposer

separated from each other by guide combs at the front and rear which allow the interposers to move front to rear as well as up and down. The interposers are spring loaded up and to the rear. This is their rest position. Extending from each interposer are several lugs. Three lugs on each interposer are common to each other. The top middle lug is contacted by the keylever pawl which allows the interposer to be pushed downward. Another lug on the top but toward the rear of the interposer is hooked-shaped and fits into the selector compensator tube which will be discussed shortly. The third common lug is located on the bottom of the interposer just beneath the keylever pawl lug. This lug is called the cycle clutch release lug. Its purpose is to release the cycle clutch causing it to rotate each time a character keylever is depressed. Directly below the cycle clutch release lugs is the cycle bail (Figure 1-32) which pivots up and down. Any interposer being pushed down will push the cycle bail down. This will release the cycle clutch latch and allow the cycle shaft to turn. The bottom of the lug is cut at an angle to the rear. This prevents interference between the interposer and the cycle bail when the interposer restores to the rest position, above the cycle bail. There can be up to seven lugs, in addition to the cycle clutch release lug, on the bottom of an interposer. The absence or presence of these lugs will determine which selector latches are to be left under the bail and which ones are to be pulled. No two interposers are alike.

Filter Shaft

As the cycle shaft rotates 180° a gear train at the left of the printer will cause the filter shaft to rotate 180°. When an interposer is pushed down it is brought into the path of the filter shaft. As the filter shaft (Figure 1-32) rotates it drives the interposer to the front of the machine which operates the characater selection mechanism.

Selector Bails and Links

There are seven selector bails (Figure 1-32) mounted between the two sideframes. Their movement is rear to front. Each bail fits in front of a selector lug position on the interposers. Each selector lug that is present on any given interposer will push its associated selector bail forward. Seven latch interposers (Figure 1-32), located at the left of the printer under the selector bails, are controlled by the selector bails--one interposer for each bail. Each interposer has a lug at the top which fits in front of its selector bail. As the bail or bails is pushed forward by the selector interposer, the associated latch interposer or interposers will be pulled forward. Attached to the rear of the latch interposers are adjustable links which are attached to the seven latches. Thus, the end result of latching a selector interposer is the unlatching of a combination of selector latches.

Interposer Latch Springs

From the time the interposer is pushed down by the keylever pawl, to the moment of impact between the interposer and the filter shaft, enough time could elapse to allow the interposer to restore up before it is struck by the filter shaft. To prevent this from occurring, the latch spring is utilized (Figure 1-34). The latch spring is a spring finger which is held slightly deflected to the rear when the interposer is at rest. When an interposer is pushed down, its latch spring snaps forward over the top of the interposer and holds it down until the filter shaft drives the interposer forward. The interposer can now be restored by its extension spring. This arrangement also allows an interposer to be latched while another is being operated. Thus, when the first interposer has restored, the second will then be immediately operated. This is called character storage and compensates for erratic typing rhythm.

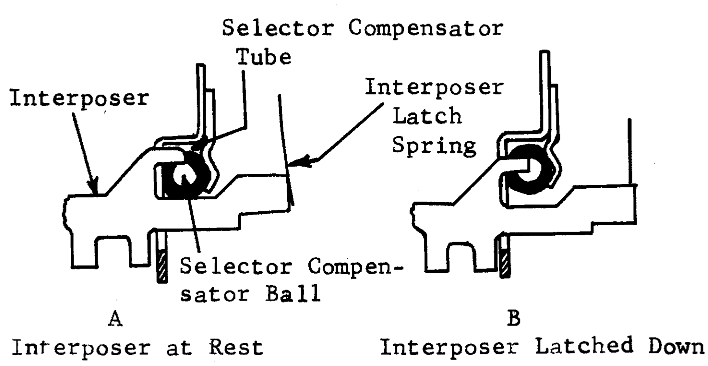


Figure 1-34. Interposer Latch and Selector

Selector Compensator

The purpose of the selector compensator is to prevent the depression of two keylevers simultaneously, which would cause a selection error. The compensator contains steel balls which are packed very close together. The hooked shaped lugs on top of all the interposers fit into slots in the selector compensator tube but, in the rest position, do not extend into the steel balls. The steel balls are adjusted, by means of adjusting screws at either end of the compensator tube, just loose enough for one interposer lug to fit between the balls (Figure 1-34). Latching one interposer down shifts the balls in the tube tightly against one another to prevent another interposer from being latched down. Depressing two keylevers simultaneously (Figure 1-35) will prevent either interposer from latching. When the interposer is driven forward by the filter shaft, its lug will be pushed from between the steel balls and another interposer can now be latched down.

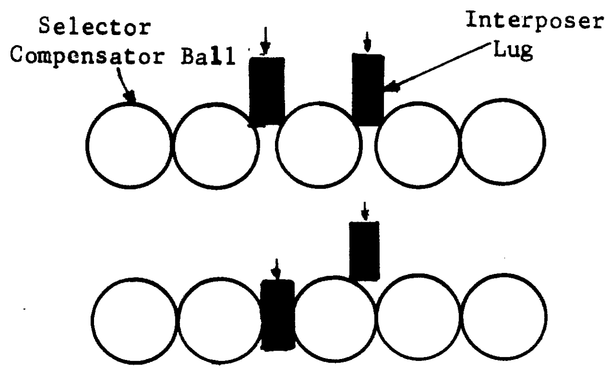


Figure 1-35. Selector Compensator Action

Cycle Clutch Latch

The cycle clutch latch (Figure 1-36) must be tripped upon depression of a keylever or no printing will occur due to the cycle shaft not rotating. A thin metal plate mounted to a rubber backing on the latch prevents the cycle clutch sleeve from rotating. Holding the sleeve stationary prevents the

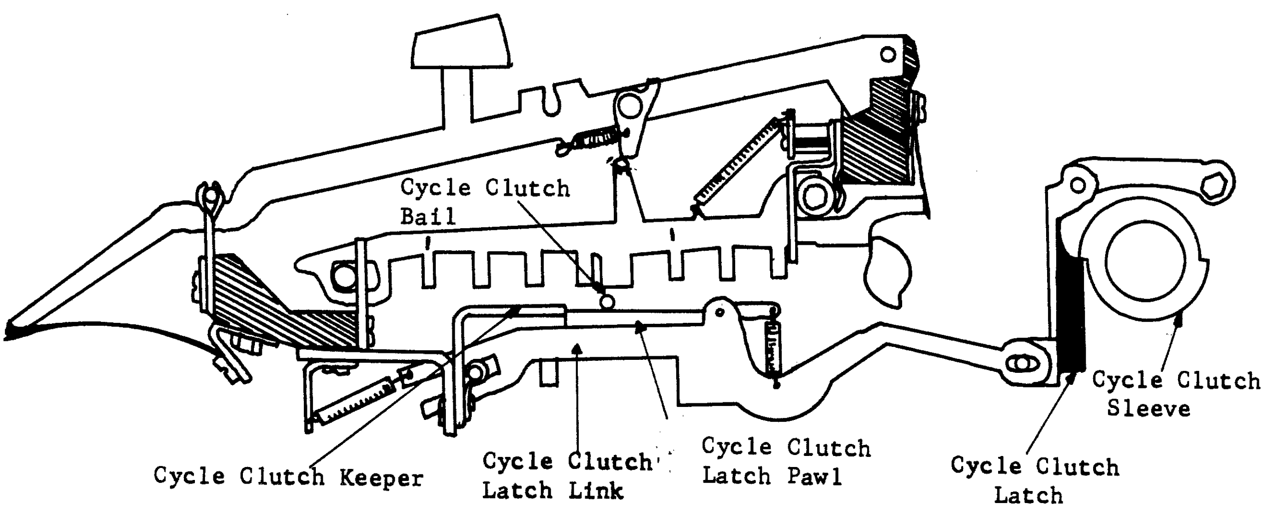


Figure 1-36. Cycle Clutch Latch Mechanism

clutch spring from winding around the rotating pulley hub. The latch pivots from the top, on a bracket toward the front of the printer, in a vertical position. It is held to the rear, under the lip of the cycle clutch sleeve, by the cycle clutch latch link and cycle clutch latch pawl. The latch pawl pivots on the link and the front of the pawl is spring loaded upward and into the cycle clutch keeper (Figure 1-36). The latch link is spring-loaded to the front by an extension spring but it cannot move as long as the latch pawl is held by the keeper. When an interposer is latched down it exerts a downward push on the bail which, in turn, pushes down on the latch pawl. As soon as the latch pawl is pushed past the keeper, the latch link will be pulled to the front by its extension spring. The bottom of the latch, being connected to the latch link, will now be pulled toward the front of the machine away from the cycle clutch sleeve which will now be allowed to rotate and bring the cycle clutch into operation.
The cycle bail damper (Figure 1-37) is a series of three levers, two on each end of the power frame and one in the middle, which are used to lightly slow down the upward movement of the cycle bail when it restores. This prevents bouncing which could cause the bail to trip the latch pawl inadvertantly. A downward extension of the damper rests against the front of the bail. An extension spring, connected between each damper and the cycle bail acts to both spring-load the bail upward and hold the damper arm against the cycle bail to provide the dampening affect.

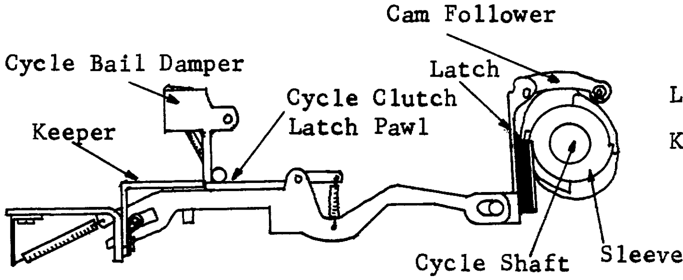


Figure 1-37. Cycle Clutch Latch Restoring Operation

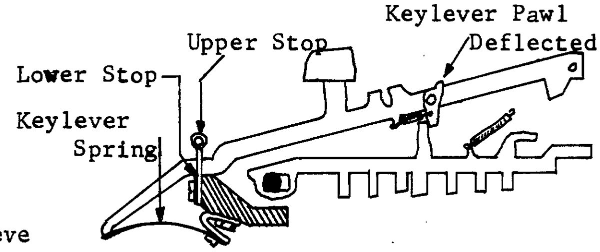


Figure 1-38. Keylever Held Depressed

Restoring Mechanism

The clutch latch restoring mechanism (Figure 1-37) consists of a cam, mounted to the cycle shaft, and a cam follower arm which is an extension of the cycle clutch latch. The cam follower arm has an adjustable steel roller mounted on it which rides on the cam during a rotation of the cycle shaft. At rest, the roller is directly above the low spot on the restoring cam but not in contact with it. When an interposer is latched down the cycle clutch latch will be pivoted forward from the cycle clutch sleeve. As this occurs the cam follower roller will drop onto the restoring cam. As the cam rotates with the cycle shaft, a high point of the cam will begin pushing the cam follower arm roller upward. As this occurs, the latch will be pivoted back into the path of the next lip of the sleeve and will stop the rotation of the sleeve. As the latch is pivoted toward the rear, it will pull the latch link back far enough to permit the latch pawl to seat behind the keeper. The low point of the restoring cam will now be beneath the cam follower arm roller again and a restoring operation will have taken place.

Summary of a Print Operation

1. Depress print character keylever
2. Latch selector interposer down
3. Push down cycle bail
4. Trip cycle clutch latch pawl from keeper
5. Trip cycle clutch latch from sleeve
6. Begin rotation of cycle shaft
7. Begin rotation of filter shaft
8. Drive selector interposer forward
9. Push selector bail(s) forward
10. Pull selector interposer forward
11. Pull selector latches forward
12. Begin downward motion of latch bail (the dwell of the cams is such that the latch bail will not start downward at the same time that the cycle shaft begins to rotate -- this allows time to unlatch the latches.
13. Selector interposer restores
14. Restore cycle bail
15. Selector bail(s) and latch interposer(s) restore
16. Latches restore (by now the latch bail will have started downward and the latches will only ride on the side of the bail)
17. Cycle clutch cam follower arm begins to rise on the cam
18. Cycle clutch latch pawl restores on keeper
19. Cycle clutch latch stops rotation of cycle clutch sleeve after 180°
20. Latch bail restores upward (five-unit bail downward if it was used)
21. End of operation

Holding the keylever down throughout the operation will cause the upper lug of the restoring interposer (Figure 1-38) to contact the keylever pawl and hold it to the rear. The interposer cannot again be latched down until the keylever is released permitting the pawl to restore over the lug of the interposer. This insures a single operation for each depression of a keylever.

PRINT SELECTION UNIT

The purpose of the print selection unit is to allow a computer or other output device to select the printer for a print operation. When printing occurs in this manner, most of the keyboard mechanism is by-passed. Seven magnets are used in the print selection unit (Figure 1-39), one for each rotate and tilt latch and one for parity, or, code check.

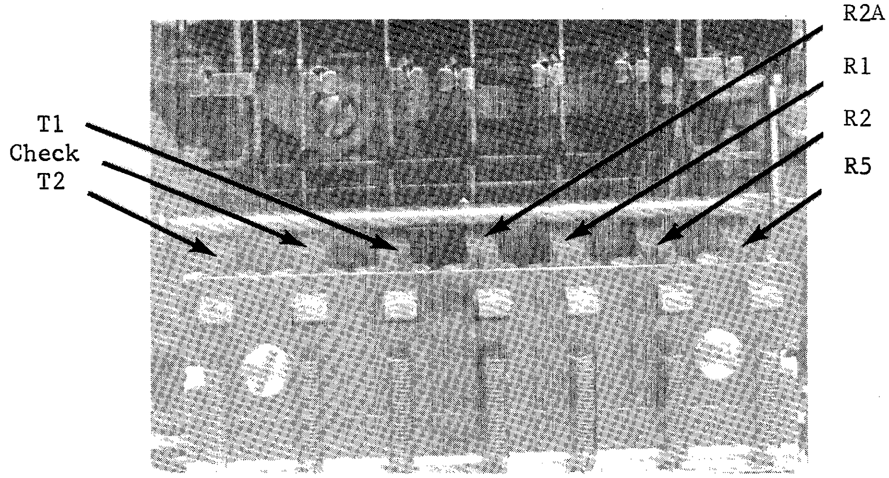


Figure 1-39. Selector Magnets

To print, two basic things must occur:

1. Trip the cycle clutch
2. Unlatch the proper combination of latches.

Cycle Clutch Trip Mechanism

Attracting any of the armatures to their magnets will cause the operating end of the armature to push the trip bail to the rear. (Figure 1-40) A link, connected to the bail, will also be pulled to the rear. The other end of the link connects to the latch lever. A hook on the front of the latch lever will pivot downward and disengage from a lug on the trip lever. The trip lever is spring loaded to the front and will then pivot toward the cycle clutch latch tripping it free of the cycle clutch sleeve. At the same time, the inhibitor trip lever will pivot through an arc and push the inhibitor pawl, which is spring-loaded upward, out of the path of the cycle clutch latch. The cycle shaft can now rotate. As the restoring cam restores the cycle clutch latch to the rear, the latch will push the trip lever to the rear. The tip of the latch lever, being restored by means of the magnets de-energizing, plus a small extension spring, will now latch in front of the lug on the trip lever while the inhibitor pawl will then be allowed to restore upward and in front of the cycle clutch latch.

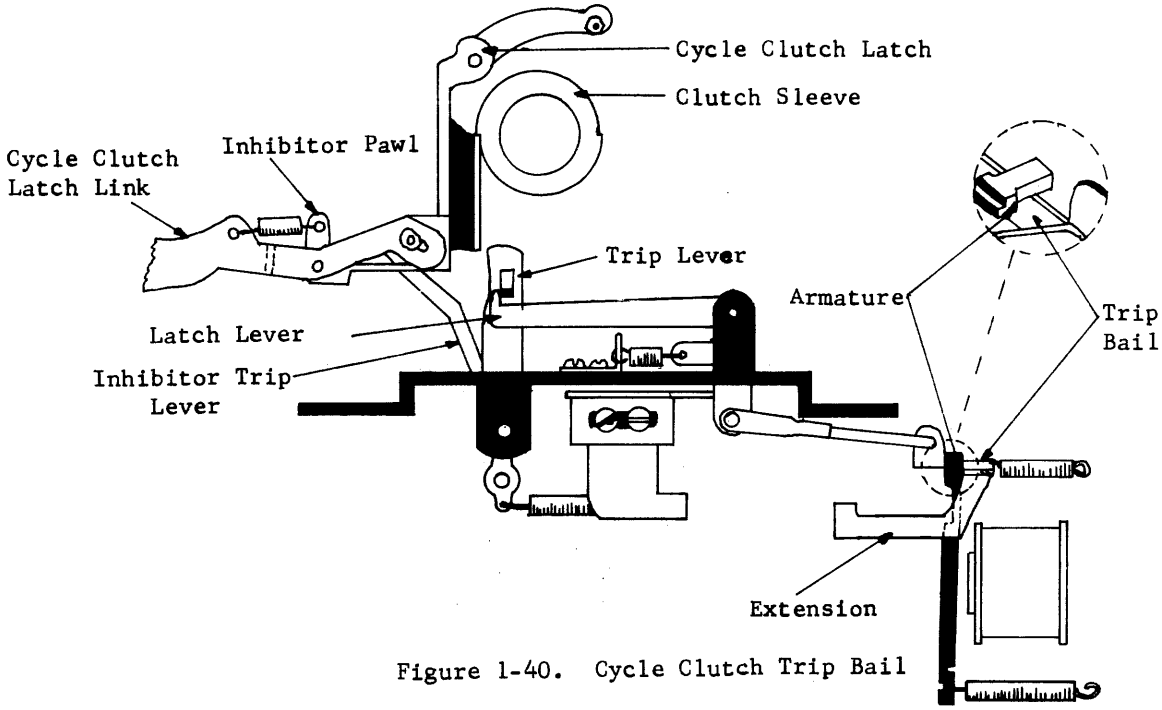


Figure 1-40. Cycle Clutch Trip Bail

Latch Pusher Cams

The latch pusher cams are located on the cycle shaft between the positive cams. The purpose of the cams is to operate the latch pusher bail (Figure 1-41) which allows the latch pushers to operate. As the cams

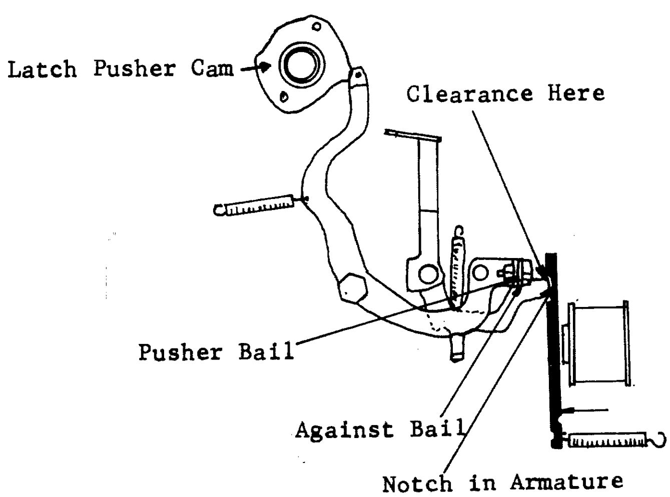


Figure 1-41. Latch Pusher at Rest

begin to rotate with the cycle shaft, the bail is immediately allowed to rise because the cam follower arms will have entered the low dwell of the cams. Further rotation forces the pusher bail downward to a restored position at the end of the cycle shaft rotation (Figures 1-42, 1-43).

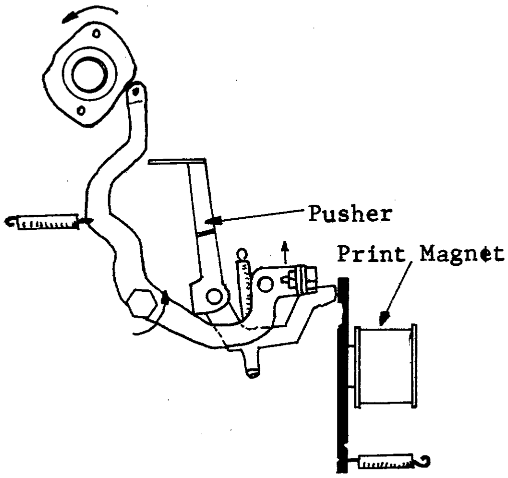


Figure 1-42

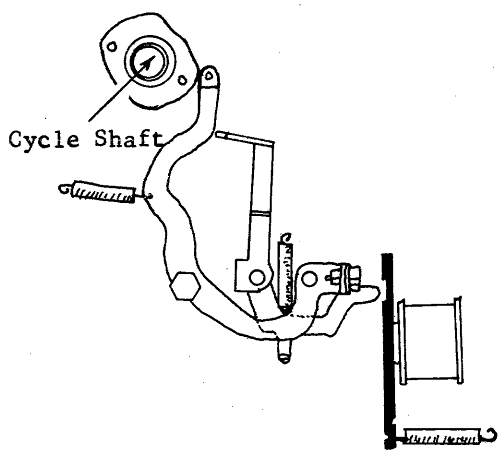


Figure 1-43

Latch Pusher Bail Operation

Selector Latch Pusher

There are seven latch pushers (Figure 1-44) which pivot about the pivot shaft. They are spring-loaded, at the rear, against the latch pusher bail.

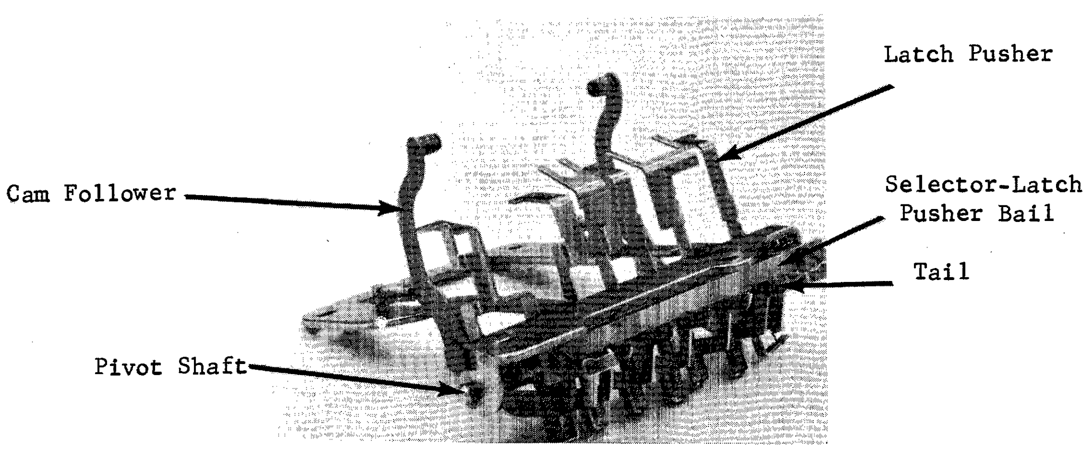


Figure 1-44. Selector-Latch Pusher

The tail of the latch pushers fits into a notch in the operating end of the magnet armatures. The front end of the latch pusher, called the pusher, rests against the latch extension (Figure 1-44) of the selector latches. Any magnets which are pulsed will pull their armatures away from the tails of their latch pushers. As the latch pusher bail now begins to rise, through the rotation of the cams, the freed latch pusher tails will rise due to their extension springs. This causes the pusher to push the latch to the front and out from under the cycle bail which will now begin to drop. The notches in the armatures of the magnets which were not pulsed will prevent their respective latch pusher tails from rising when the latch pusher bail rises. Thus, their latches will not be pushed from under the cycle bail and will be operated downward. As the latch pusher bail now is forced down, it pushes the tails of the latch pushers downward allowing them to seat inside the notches of the magnet armatures.

<u>Selector Armature Knock-off</u>

The cycle clutch trip bail is utilized to insure that the magnet armatures knock-off from the magnets at restoration time. This overcomes any residual magnetism which could develop and insures quick armature restoration.

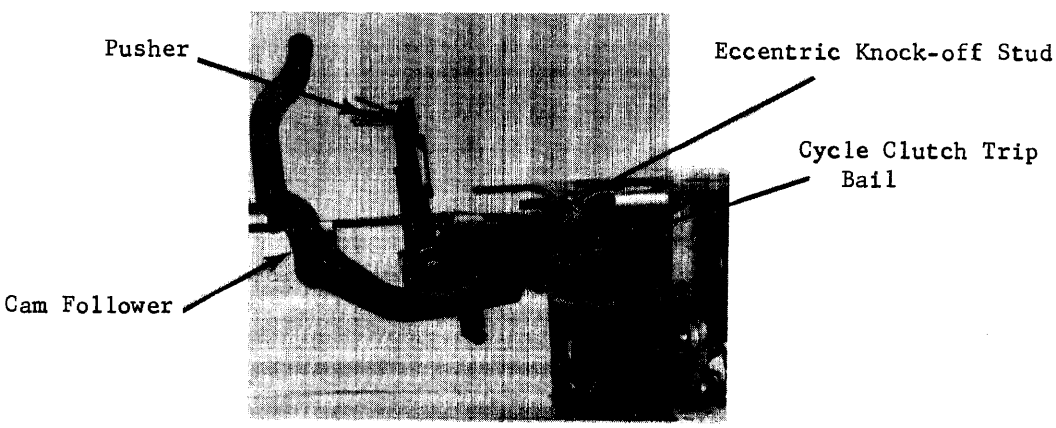


Figure 1-45. Selector Armature Knock-off

An eccentric stud (Figure 1-45) on the latch pusher-bail arm pushes the trip bail downward which knocks-off the armatures.

SELECTION CONTACT ASSEMBLY

Contact Actuator Assembly

Figure 1-46 shows the contact actuator assembly. The extension of any selector latch left under the bail will operate a contact actuator (Figure 1-47). The actuator will be pushed down in its guide and transfer two sets of contacts by means of two cross bars mounted on the actuators near the bottom. The spring tension of the contacts will allow the actuator to rise when the latches restore.

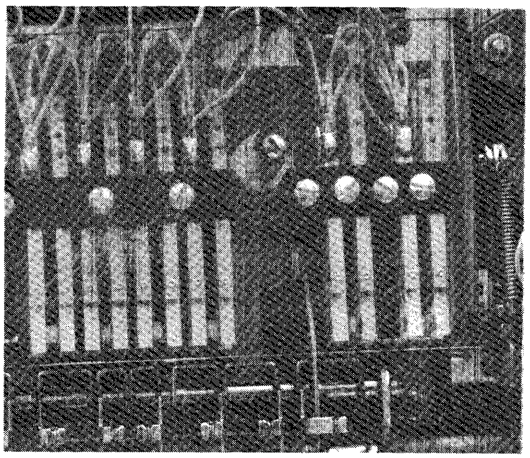


Figure 1-46. Print Selection Contact Assembly

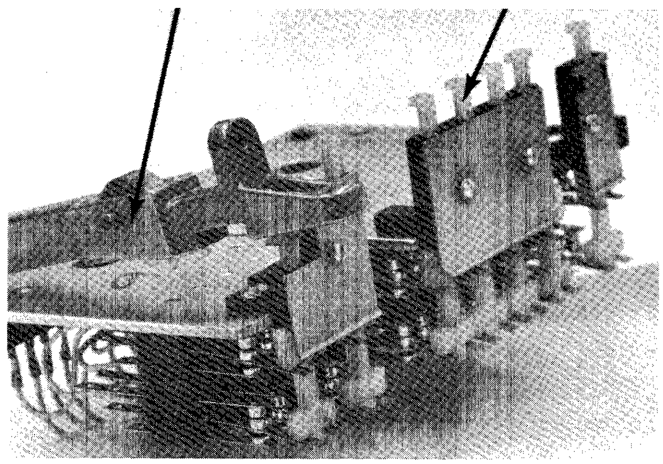


Figure 1-47. Contact Actuators

The five unit actuator is operated by the five-unit bail and is held downward during positive rotations. When the bail rises, the spring tension of the contacts will allow the actuator to rise.
The seven sets of contacts will cause a seven-bit code to be transmitted to the computer--one bit for each of the three rotate latches, one for the five-unit bail, one for each of the two tilt latches and one bit for the check latch which is parity.

Parity Check

The parity check insures that an odd number of latches is operated during any print cycle. Thus, an error created by a latch sticking under the bail, or a latch popping out from under the bail, can be immediately recognized.

This assembly requires an extra latch, a selector bail, a latch interposer, latch pusher and magnet. The extra latch, called the check latch, does nothing but operate its associated actuator if the latch is left under the latch bail. When an output operation is initiated to the printer, if just the check latch magnet is pulsed, a +5 rotate, tilt 3 operation will occur.

Extra Cycles

If, for any reason, the cycle clutch rotates without having a selector interposer latched down or a print magnet energized, a rotate +5, tilt 3 print operation will occur. On the Correspondence machine the resultant character which prints will be a dash or underscore. This is a malfunction known as "Extra Cycles".

KEYBOARD LOCK

The keyboard lock mechanisms are needed, and utilized, on three separate occasions:

1. Power Off condition
2. Output Mode condition (selection by an output device)
3. Line Lock condition (carrier has reached right hand margin)

In the first case, a print operation is generally undesirable when power is first turned on.
In the second case, printing is undesirable from the keyboard when an output device, such as a computer, is outputting to the printer.
In the third case, printing is undesirable when the carrier has reached the right hand margin.

Power Off Keyboard Lock

Power Off keyboard lock is accomplished by the link (Figure 1-48) which is attached to the top part of the power on/off switch. The other end of the link is attached to a bellcrank which is attached to the lockout bail extending across the printer beneath the keyboard. With the switch in the off position, the bail is pivoted forward against the cycle clutch pawl stop which is located beheath the cycle clutch latch pawl extension. The pawl stop, when pushed forward, will prevent the latch pawl from tripping thereby preventing a cycle clutch operation.
In addition, a special bellcrank at the left side of the keyboard will be rotated into the selector compensator by means of a link attached to the lockout bail. This will prevent the latching down of an interposer.

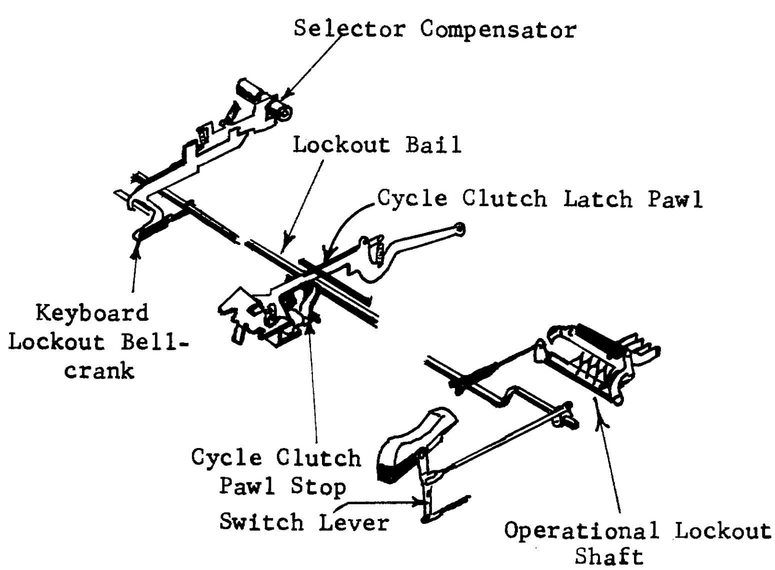


Figure 1-48. Power Off Keyboard Lock

A link at the right side of the lockout bail rotates a D-shaped shaft, beneath the operational mechanism, to prevent the backspace, spacebar, tab, carrier return and indexing operational interposers from being unlatched.

Output Mode Keyboard Lock

Output Mode keyboard lock (Figure 1-49) is accomplished by means of the keyboard lock solenoid which is held bolted to the underside of the frame by means of a bracket. The lockout lever is fastened to the bracket by a pivot screw and is positioned fron to rear. The front, sloped, surface of the lockout lever is spring loaded upward except when the solenoid is energized. Energizing the solenoid pulls the lockout lever down. The sloped edge rides on the bail roller (Figure 1-50) and forces the lock bail forward. The lock bail is not the same as the lockout bail.

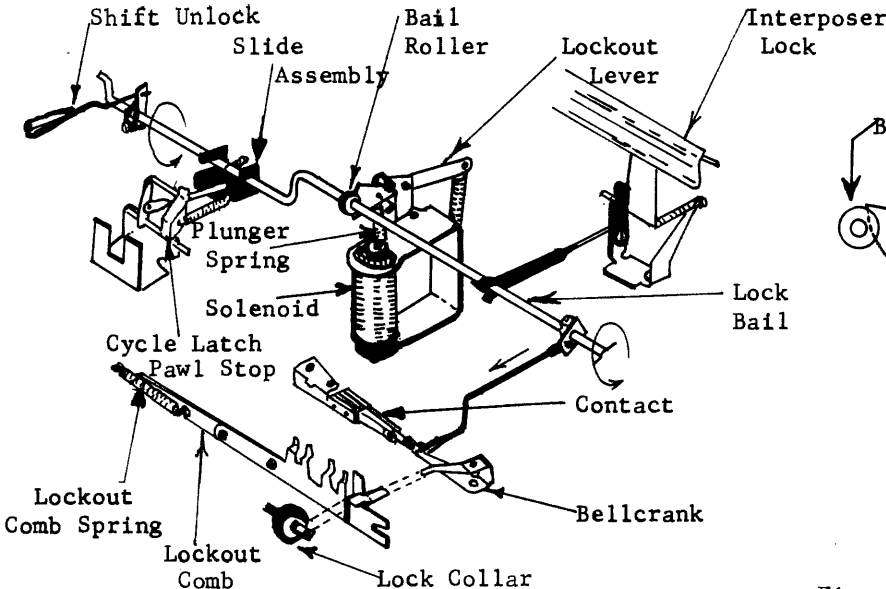


Figure 1-49. Output Mode Keyboard Lock

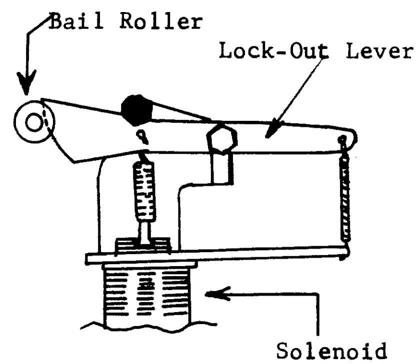


Figure 1-50. Lockout Lever

Attached to the lock bail are three links and a slide assembly. (Figure 1-49) They accomplish the following:

1. Lock the functional keylevers and spacebar
2. Operate keyboard lock contact
3. Lock all 44 character interposers
4. Return the machine to lower case if in upper case
5. Lock the cycle clutch check pawl

One link, at the far right of the bail, locks the functional keylevers. It is fastened to a bellcrank, the front end of which is in contact with the lockout comb. A push on the link by the lock bail will cause the front of the bellcrank to move to the right allowing the lockout comb to spring-load to the right. The teeth of the lockout comb will now be under the functional keylevers and block them from being pushed down. The spacebar, however, cannot be locked in this fashion as it has no keylever. Therefore, a lock collar is fastened to the space bar shaft. As the bellcrank moves to the right, the tip of it will slide under a step in the collar. This prevents the spacebar from being depressed (Figure 1-51). The other end of the bellcrank will transfer contacts on the keyboard lock contact. The second link from the right is connected to the bottom of the interposer lock which is a wide bail running the width of the printer. The bottom edge of the bail protrudes beneath the rear extensions of the interposers and when pulled forward, will prevent the interposers from being pushed down.

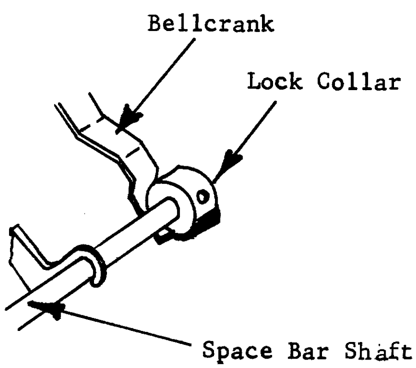


Figure 1-51. Spacebar Lock Collar

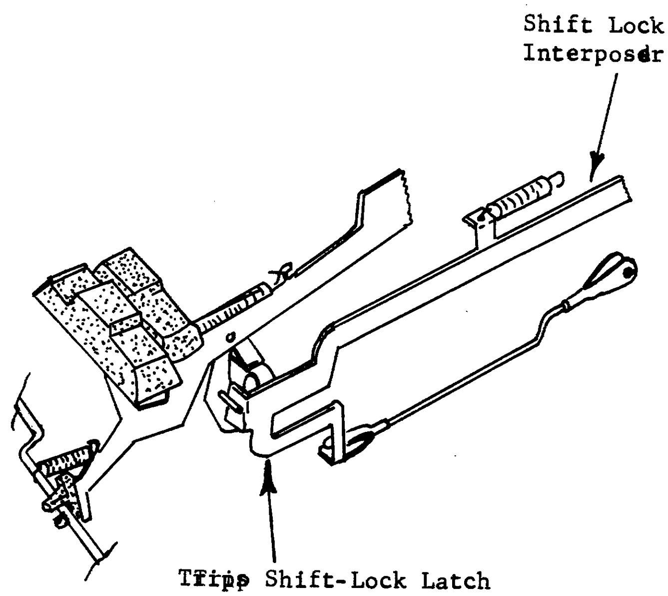


Figure 1-52. Shift Lock Interposer

The third link, at the far left of the lock bail, operates the shift-lock interposer (Figure 1-52). A push on the link, to the front, pushes the interposer to the front where it comes in contact with a stud on the lock arm. The lock will be pushed away from the shift stop, freeing the shift key, and allowing the printer to return to lower case.

The slide assembly, by means of a link, will cause the cycle clutch pawl stop to pivot underneath the cycle clutch pawl preventing the cycle clutch from unlatching.

Line Lock Keyboard Lock

The Line Lock keyboard lock (Figure 1-53) is accomplished by the bell ringer bail. As the carrier comes in line with the right hand margin stop, a raised surface of the line lock bracket, which is mounted to the carrier, will come in contact with the bellringer bellcrank, causing it to rotate clockwise. The other end of the bellcrank will force the bellringer bail

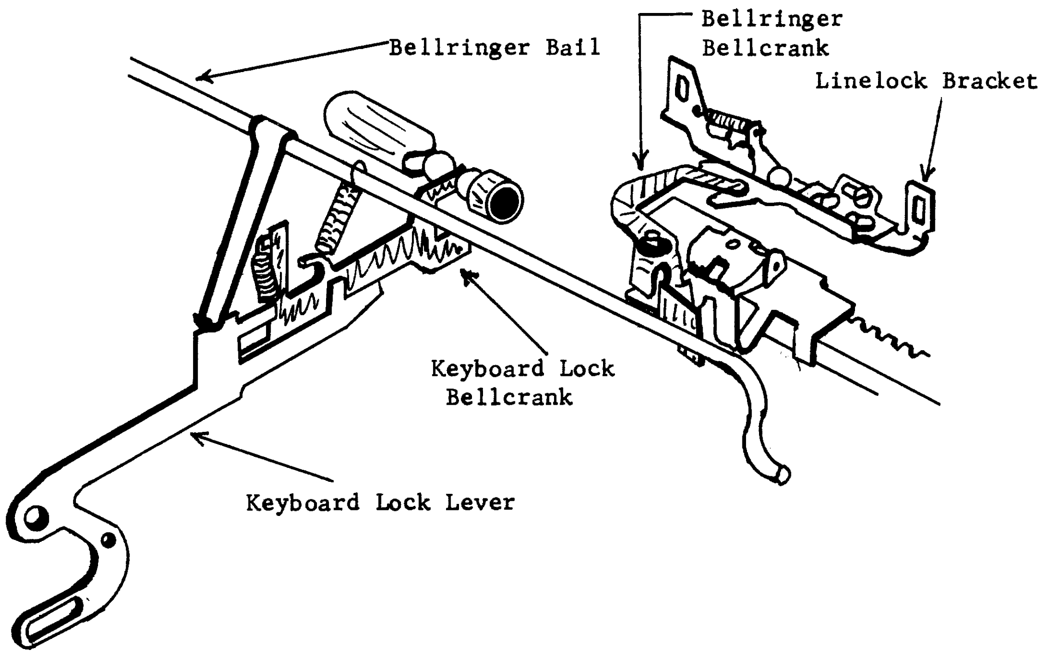


Figure 1-53. Line Lock Keyboard Lock

forward. Welded to the left side of the bail is an arm which extends downward. Its tip is just above the keyboard lock lever. (Figure 1-53) As the bail is pushed forward, the arm is forced down, pushing the keyboard lock lever down. An extension spring connects the lock lever to the keyboard lock bellcrank and the bellcrank, which, at rest, sits in the selector compensator, will now be pulled into the steel balls. This prevents a character interposer from being latched down until a carrier return, a margin release, a spacebar, or a tab operation have been initiated.

SHIFT

The purpose of the shift mechanism is to rotate the typehead to position either the upper case hemisphere or the lower case hemisphere in front of the platen. Depressing either of the two shift buttons or the lock button will rotate the typehead 180° counterclockwise placing it in the upper case hemisphere. Releasing either of the shift buttons will allow the typehead to rotate 180° clockwise and place the lower case hemisphere of the typehead toward the platen. The shift mechanism is made up of the shift arm, shift cam, wrap spring clutch and clutch control, and interlocks. The mechanism is driven by the right end of the operational shaft and is located on the outside of the power frame.

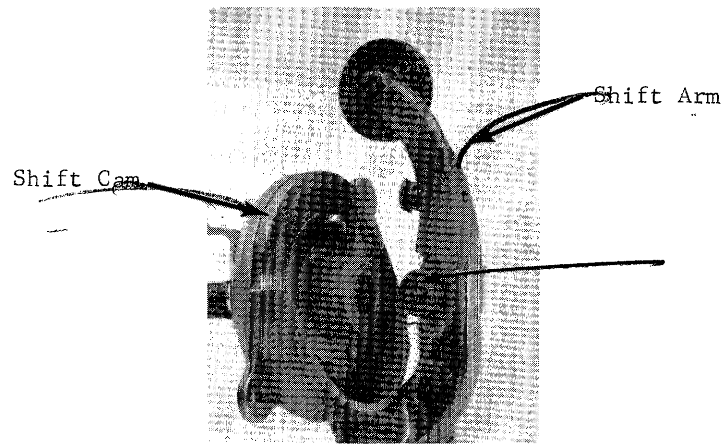


Figure 1-54. Shift Cam and Shift Arm

Moving the right hand rotate pulley (Figure 1-54) away from or toward the powerframe will cause the typehead to rotate because of pressure on the rotate tape.

The shift buttons are located at the front corners of the printer and are linked together by the shift bail (Figure 1-55). Depressing either button will also cause the other to drop. The shift lock is mounted on the left shift keylever and, when depressed, will lock the shift keylevers down keeping the printer in upper case. Depressing either of the shift buttons will free the keylevers from the locking mechanism. Depressing either shift button will cause the shift release link, at the right of the printer, to be pushed to the rear. The right hand rotate pulley is attached to the shift arm which pivots left to right at the bottom, and is prevented from moving front to rear by the shift arm brace, which is connected from the pivot pin to the shift arm. An adjusting screw near the top of the shift arm rests against a mounting screw in the frame while

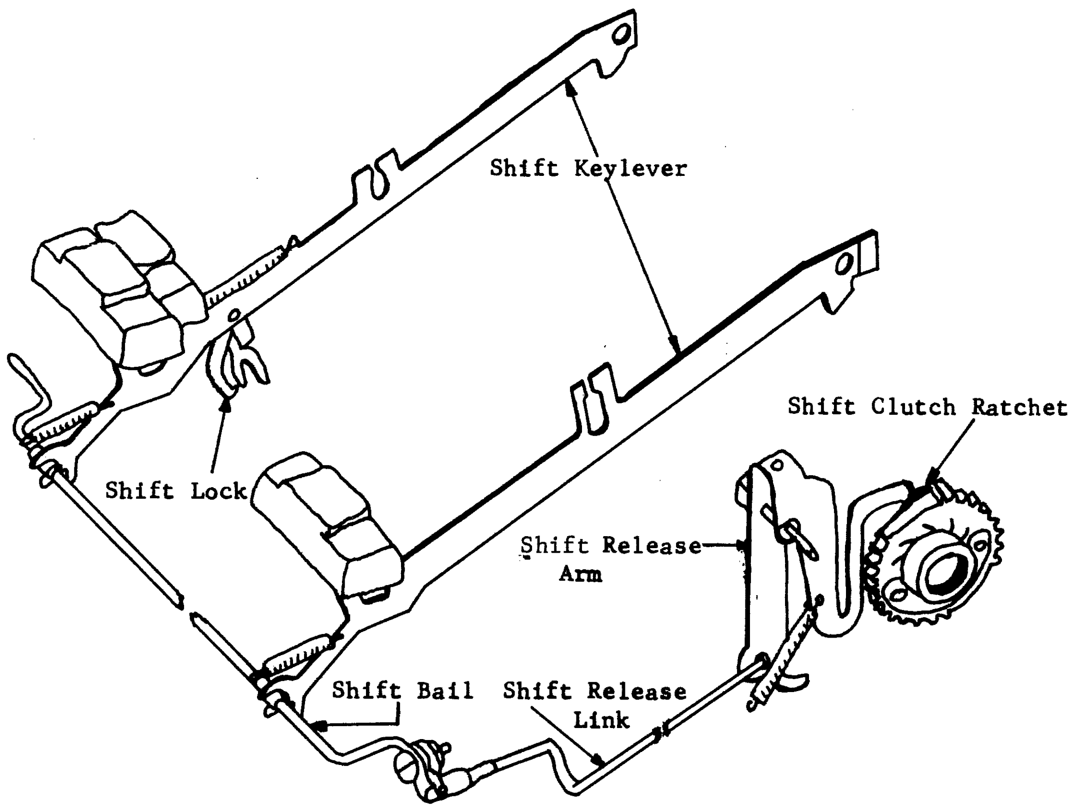
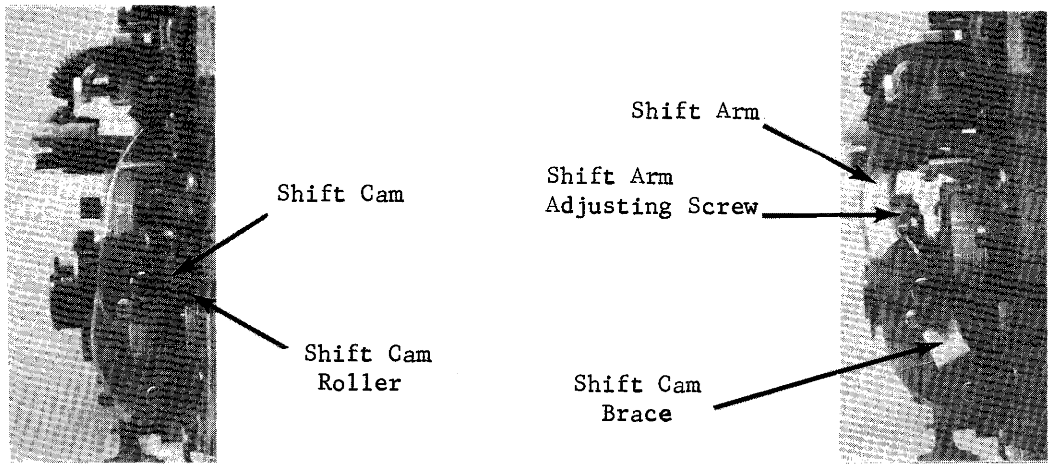


Figure 1-55. Shift Release Mechanism

the printer is in lower case. Forcing the shift arm away from the side-frame will cause the typehead to rotate to upper case. This is accomplished by the shift cam.

The shift cam has a high point and a low point -- 180° apart. It is round and fits about the operational shaft bearing extension on the outside of the powerframe. It rotates between two rollers -- a fixed roller mounted to the sideframe and the shift arm roller, which will ride the camming surface of the shift cam. The camming surface is not on the perimeter of the cam (it is round) but rather on the right side and the tension on the rotate pulley at the top of the shift arm holds the cam tightly between the two rollers. When the cam's low point is between the two rollers, the printer will be in lower case (Figure 1-56). Consequently, allowing the high point of the cam to ride between the two rollers will place the printer in upper case (Figure 1-56). The shift cam rotates only when a shift operation is called for and, with the operational shaft turning continuously,



a. Lower Case Position   b. Upper Case Position

Figure 1-56. Shift Operation-Rear View

a spring clutch, of the type used in the cycle clutch, is utilized. Set screwed to the operational shaft, just to the right of the shift cam, is the shift clutch arbor. It rotates continuously with the operational shaft (Figure 1-57). A wrap spring fits around the clutch arbor. An extension on the left side of the spring fits into a notch of an adjustable plate which is held tightly to the right side of the cam by two screws. The right extension of the spring fits into one of several notches in the left side of the shift clutch ratchet (Figure 1-57). The inside of the spring

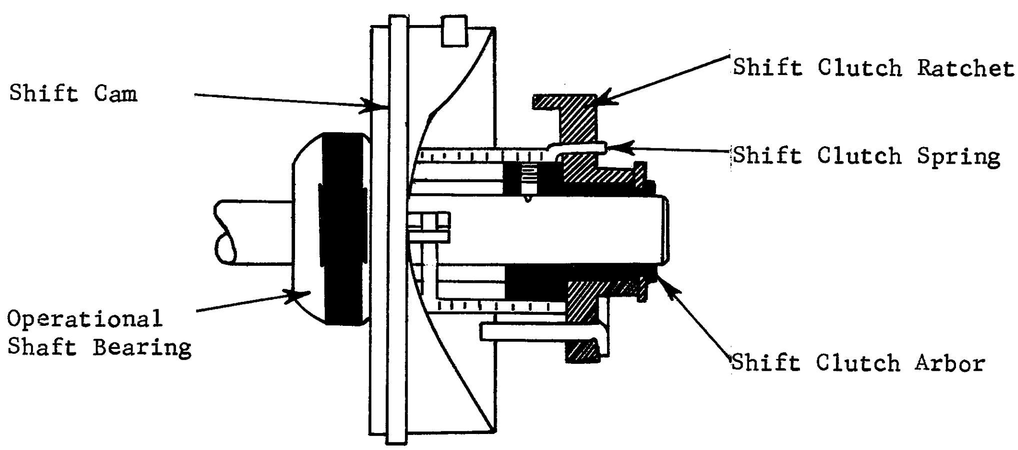
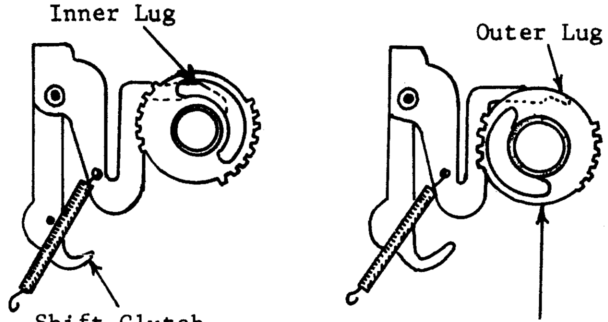


Figure 1-57. Shift Clutch

is smaller, in diameter, than the arbor and if it is not held relaxed, it will collapse about the arbor tightly, causing it, the cam, and the ratchet to rotate 180°. As the cam rotates, the high or low point will either force the shift arm away from or toward the sideframe causing the typehead to rotate 180°.



a. Lower Case Position b. Upper Case Position

Figure 1-58. Shift Clutch Release Arm

Holding the spring relaxed when a shift operation is not called for is the function of the shift release arm which is connected to the other end of the shift release link. The rear extension of the shift release arm has a flange formed to the right and this flange comes in contact with one of two lugs on the left side of the shift clutch ratchet (Figure 1-58). While this contact is made, the ratchet will prevent the clutch spring from wrapping around the rotating arbor. The two lugs on the ratchet are called the inner lug, (which is metallic), and the outer lug. In the lower case position, the tip of the shift release arm will be in contact with the inner lug due to an extension spring on the shift arm (Figure 1-58) pulling it downward.

As a shift key is depressed, the shift release link will be pushed to the rear, pushing the bottom of the shift release arm to the rear. This will cause the formed tip of the shift release arm to raise. When this occurs, the arm will no longer be in contact with the inner lug of the ratchet and the spring will now be allowed to collapse about the turning arbor. As the cam now rotates, it will force the shift arm away from the sideframe. When the mechanism has rotated 180°, the outer lug of the ratchet will then contact the raised tip of the shift release arm. This will unwind the spring and stop rotation of the shift mechanism which will then stay in the upper case position until the shift button is released.

Upon releasing the shift button, the shift release arm will drop down and out of the path of the outer lug of the ratchet. 180° of rotation will then occur at the end of which time the inner lug of the ratchet will contact the shift release arm, unwinding the spring and stopping all rotation of the shift mechanism.

A shift cam stop, mounted to the adjustable plate of the cam, is used to prevent the cam from overthrowing the rest position. It operates against

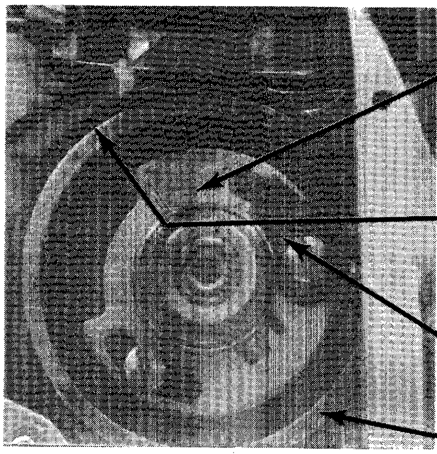


Figure 1-59. Shift Cam Stop and Brake

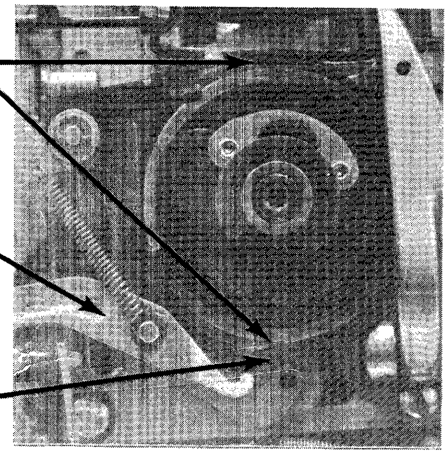


Figure 1-60. Shift Arm and Detent

the rear side of the inner lug. As rotation occurs, the shift cam stop (Figure 1-59) will follow behind the inner lug of the ratchet. When the ratchet is stopped by the shift release arm, the cam, due to momentum, will keep moving but only until the shift cam stop contacts the inner lug at which time cam rotation ceases also.

Mounted below the cam is the shift detent arm which pivots up and down. A nylon roller, mounted on the detent arm, is spring-loaded upward and rides on the outer perimeter of the cam. It will seat into one of two notches, called detents, when the cam is at rest either in upper case or lower case. This helps to insure that the cam returns to the exact position in either case (Figure 1-60).

The shift cam brake (Figure 1-59) is an adjustable spring steel arm which has a nylon shoe mounted to the end of it. Its purpose is to prevent cam overthrow when shifting from upper case to lower case. As the shift begins to take place, the shift arm roller will ride from the high point of the cam to the low point. Because the arm is spring-loaded inward it will tend to accelerate the speed of the cam which could cause excessive noise or parts breakage. A raised portion of the cam, however, will contact the nylon shoe creating friction and causing the cam to slow down to normal speed. This will allow the shift speed to be the same for both cases.

Character Interrupter

A character cannot be allowed to print while the shift is in progress because an erroneous character would print due to the typehead being in other than the home position as the rotate mechanism begins operation. The print operation will be delayed, until the shift operation has been completed, by blocking the release of the cycle clutch.

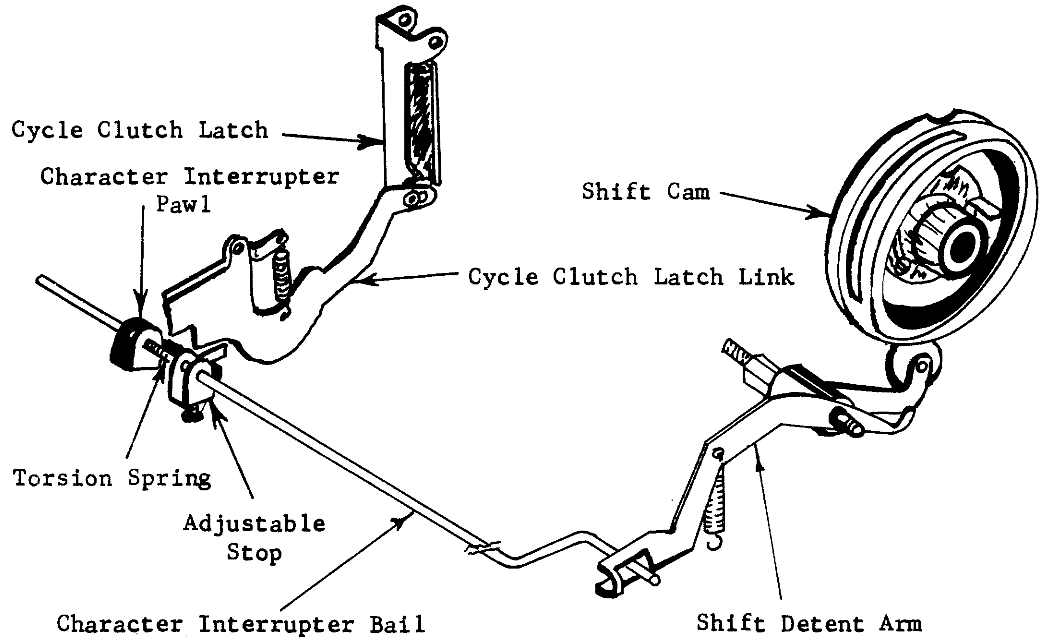


Figure 61. Character Interrupter

This is the primary purpose of the shift detent arm. The front end of the arm is slotted (Figure 1-61) and fitted into this slot is the character interrupter bail. Attached to the left end of the bail, underneath the printer, is the character interrupter pawl which is in line with the cycle clutch latch link but slightly beneath it. As the shift cam begins to rotate, the detent roller must ride out of the detent. This pivots the front of the detent arm upward causing the character interrupter bail to pivot counterclockwise (Figure 1-61). The character interrupter pawl will pivot into the path of the cycle clutch latch link and not allow it to come forward far enough to trip the cycle clutch latch from the sleeve. When the shift has been completed, the detent roller will seat in a detent notch of the cam. This will bring the front end of the detent arm down and pivot the character interrupter pawl out of the path of the latch link. A print operation can now be completed as the interposer was not blocked from being latched.

The character interrupter pawl is spring loaded to an adjustable stop on the interrupter bail (Figure 1-61). The purpose of this spring-loading is to allow the pawl to give way to the latch link in the event of a collision. A collision will occur between the pawl and the link if a character keylever and the shift key are depressed simultaneously. To prevent parts breakage, the pawl will yield to the link by overcoming the torsion spring as the bail rotates.

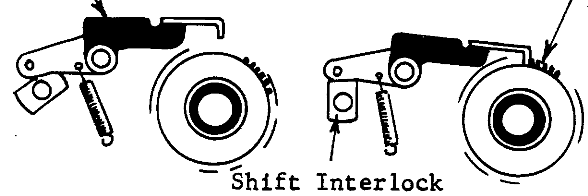


Figure 1-62. Shift Interlock

Shift Interlock

When a print operation is in progress, a shift must be inhibited. As the typehead is ready to strike the platen, it is locked in place by the tilt and rotate detents. A pull, at this time, by the shift arm would cause parts breakage.

The purpose, then, of the shift interlock is to prevent a shift from occurring if a print operation is already in progress. The shift interlock arm (Figure 1-62) is pivot-mounted on the right side of the frame. The rear portion of the shift interlock arm extends downward toward the top of the shift clutch ratchet. The front part of the interlock arm has a roller mounted to it and is spring-loaded onto the shift interlock cam (Figure 1-62). The cam is mounted to the right end of the filter shaft by two set screws. It has already been shown that the shift mechanism will not be allowed to rotate until the ratchet is released. In the rest position, the shift interlock cam follower roller will be in the low dwell of the cam and the rear tip of the shift interlock will be above the shift clutch ratchet. When a keylever is depressed, however, the rotation of the filter shaft will cause the high point of the interlock cam to force the front of the shift interlock arm upward, pivoting the rear down and into the teeth on the top of the ratchet. This will prevent the ratchet from turning even though the shift release arm may be raised by depressing the shift key. The shift will then be locked out until the cam on the filter shaft rotates to its low point at which time the interlock arm will pivot away from the ratchet, allowing the ratchet to rotate.

Beating the Shift

Depressing the shift key immediately after depressing a character key could cause the shift arm to move, somewhat, before the filter shaft can actuate the shift interlock. This can cause erroneous characters to print because the typehead would not be in the home position when the print cycle begins. This is known as beating the shift and occurs mostly when shifting from upper to lower case. It is no problem in lower case because the shift arm roller is not in contact with the low point of the cam (the adjustable screw is contacting the side frame). In order to cause the shift arm to move, the cam must rotate somewhat before it will actually begin forcing the shift arm outward. This is enough time to allow the filter shaft to activate the shift interlock. However, in upper case, the shift arm roller is pressing directly against the raised portion of the cam and any rotation of the cam could allow the shift arm to move inward from the high point toward the low point. This problem, however, is mostly eliminated by allowing a long high dwell on the cam. Thus, even though the cam begins to rotate, the shift arm cannot move until a lower dwell comes under the roller. This is, generally, sufficient time for the filter shaft to activate the shift interlock.

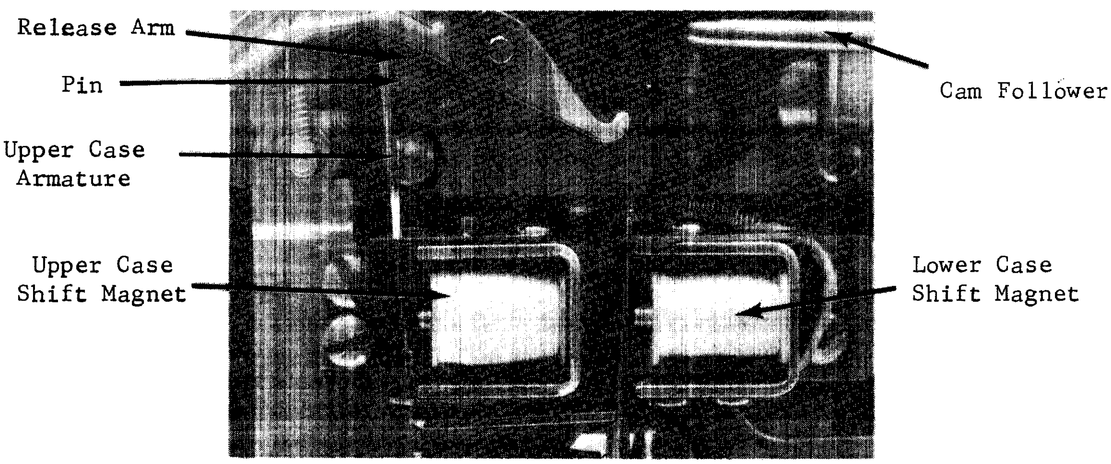


Figure 1-63. Shift Magnet Assembly

Shift Magnets

The purpose of the shift magnets (Figure 1-63) is to allow the printer to be shifted from the computer. The two shift magnets are mounted on the right side of the powerframe beneath the shift cam. The magnet toward the front is the upper case magnet. Its armature is long and comes in contact with a pin on the shift release arm (Figure 1-63). When the armature is attracted to the magnet the shift release arm will be pushed to the rear, causing a normal shift operation. As the armature moves to the rear, a formed bottom extension of the armature will pivot downward. The lower case armature, which is spring-loaded to the front, will now slide into the formed end of the upper case armature and prevent it from moving back up. This locks the shift in upper case. When the lower case magnet is pulsed, its armature will move to the rear, out of the formed end of the upper case armature. This allows the upper case armature to snap forward, releasing the shift release arm, and allowing it to move forward through the action of its extension spring. The shift will now return to lower case.

Figure 1-65. Shift Cam Detented Upper Case

Figure 1-66. Shift Cam Detented Lower Case

<u>Shift Contact and Cam Follower Assembly</u>

The shift contact and cam follower assembly is located on the right side of the frame and to the rear and above the shift magnets (Figure 1-67). It consists of a cam follower and two contact assemblies.

The cam follower is spring loaded onto the right side of the cam and leads the shift arm by 90° (Figure 1-65). When shifting to upper case, the high dwell of the cam will pass under the cam follower roller forcing it outward. (Figure 1-65) When the high point of the cam is under the shift arm roller the cam follower arm will move back inward and come to rest at a point midway between the high and low dwell. When shifting to lower case, (Figure 1-66) the low dwell of the cam will pass under the cam follower roller allowing it to move inward. As the low dwell continues toward the shift arm roller the cam follower arm will move back out to another rest position halfway between the high and low dwells. The two rest positions are 180° apart from each other and both are approximately midway between the high and low dwells. This arrangement permits the cam follower arm to move outward for an upper case shift and inward for a lower case shift but always return to a rest position.

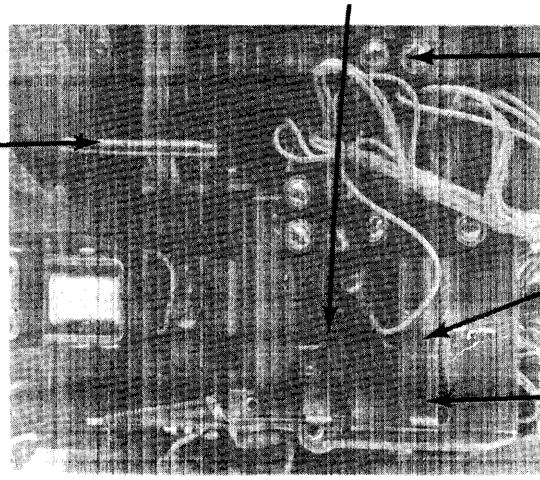


Figure 1-67. Shift Contact Assembly

Contact Actuating Arm

The contact actuating arm (Figure 1-67) is set-screwed to the bottom of the cam follower arm and controls the feedback and transmitting contacts. As the cam follower moves outward (upper case) the actuating arm will move inward, transferring the two inner sets of contacts. Moving the cam follower arm inward (lower case) pivots the actuator arm outward and transfers the two outer sets of contacts. In both cases, the actuator arm will return to the rest position.

Shift Contact Assemblies

The contact assemblies nearest the front are known as feedback (busy) contacts. The ones to the rear are transmitting contacts (Figure 1-67).

Shift Mode Contacts

The purpose of the shift mode contacts is to indicate whether the printer is in upper or lower case. They are mounted just above the feedback and transmitting contact assemblies (Figure 1-67). One or the other of these two contacts will always be held transferred by the shift arm tab (Figure 1-67) which is bolted to the rear of the shift arm.

ALIGNMENT

Alignment is the process of positioning the typehead to an exact point, both vertically and horizontally, before printing. Several factors, including changing spring loads, and system elasticity can adversely affect alignment. This is undesirable as the print quality will be affected.

The methods of aligning the tilt and rotate mechanisms are basically the same although there is much more to the rotate mechanism.

Tilt Alignment

Proper alignment of the tilt mechanism insures that the typehead will be aligned vertically. It also insures that the proper tilt band will be in the print position. The tilt latches are used to position the tilt ring coarsely and the tilt detent mechanism refines and locks the tilt ring to the exact desired position. A specific amount of play is present in the tilt ring and is located in the tilt pulley link. The play is utilized to overcome any tendency of the tilt mechanism to supply too much or too little motion to the tilt ring. Four V-shaped notches are located on the left side of the tilt ring--one for each of the four tilt positions. Left to right: Tilt 0 through Tilt 3. The tilt detent is an arm which fits into a slot in the left side of the yoke and operates in the notches. The tilt detent is spring loaded upward into the notches. As the latches operate the tilt ring to the approximate position the tilt detent will then enter the correct notch and, because of the play, will seat the tilt ring in the exact print position (Figure 1-68) by locking into the tip of the notch. It stands to reason, then, that if the tilt mechanism cannot coarse align the tilt ring within the limits of the tilt ring play, the tilt

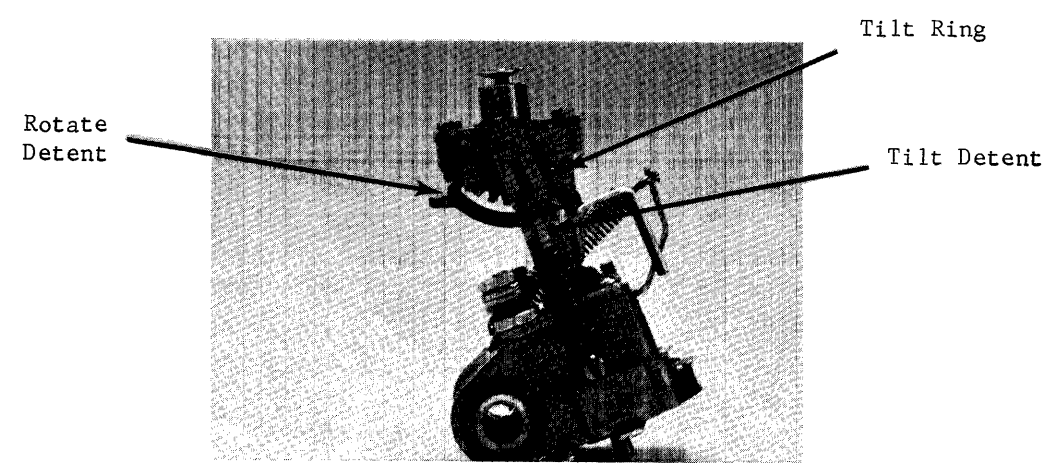


Figure 1-68. Tilt Ring Detenting

detent will not be able to lock into the center of the notch and a print failure will occur (cutting off characters, etc.) or the detent might enter the wrong notch. The largest variation in coarse alignment between any two of the tilt positions cannot exceed the tilt ring play. This variation is known as bandwidth (Figure 1-69) and can be observed by half-cycling, in turn, a Tilt 0 through Tilt 3 character and observing the exact spot that the tilt detent enters the notch.

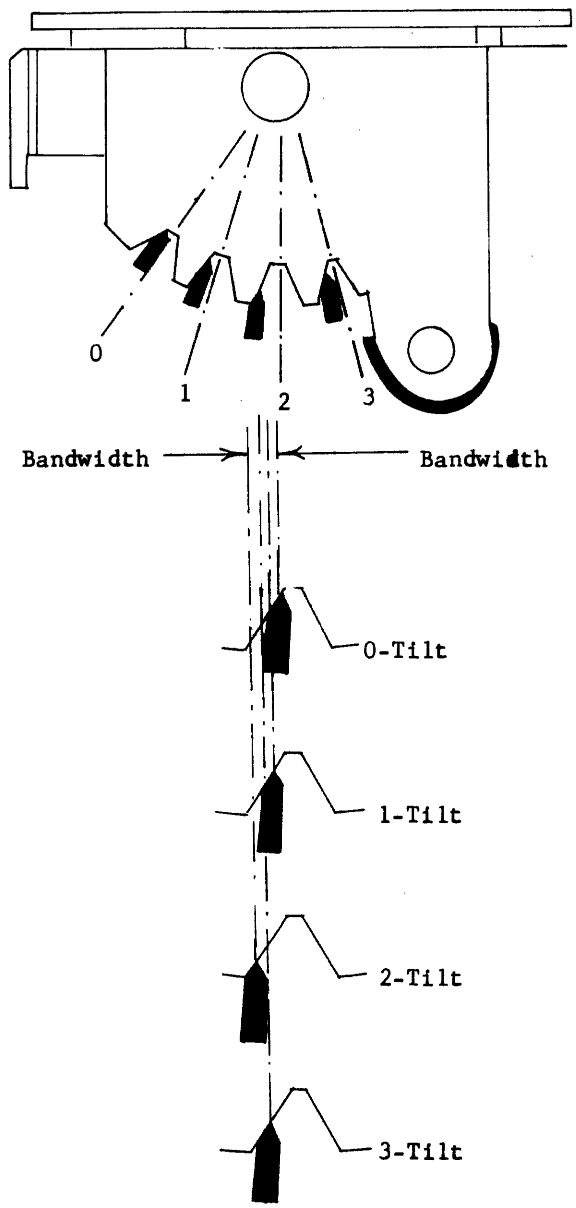


Figure 1-69. Bandwidth

The procedure is as follows:

a. Power half-cycle the printer by placing the hooverometer handle (or the blade of a large screwdriver) on top of, and touching, the cycle clutch sleeve with the edge of it resting against the latch pivot pin (Figure 1-70). Strike any character. The

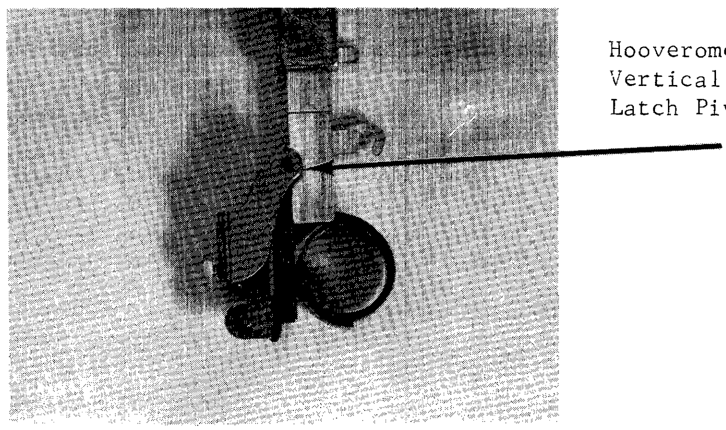


Figure 1-70. Powered Half Cycling Operation

handle will catch the lip of the sleeve after 90° of rotation. Now turn power off. Observe the position of the check pawl to be certain that it is seated in the ratchet (Figure 1-71). A power half cycle is used to allow for all the stresses in the system.

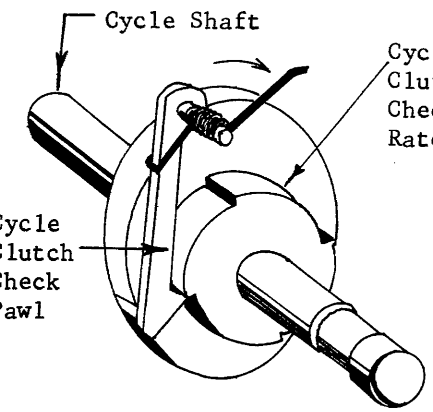


Figure 1-71. Cycle Clutch Check Pawl and Ratchet

b. Manually withdraw the detent from the notch and remove the tilt ring play by applying gentle pressure on the upper ball socket toward the rear.

c. Observe the point where the detent first touches the notch while allowing it to re-enter.

If the bandwidth is bad, it can be corrected by moving the tilt link (Figure 1-72) up or down in the elongated slot in the tilt arm as this supplys less or more motion to the tilt ring for the given amount of motion produced by the tilt differential.

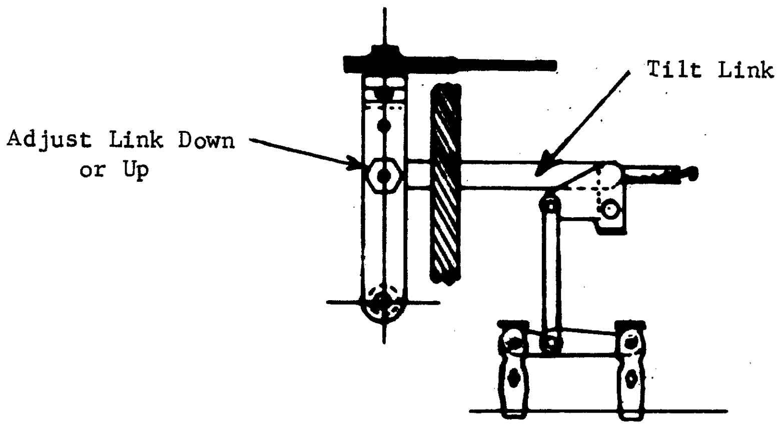


Figure 1-72. Tilt Differential

Vertical misalignment problems cannot be caused by the coarse alignment adjustments once the detent fully seats in the correct notch.

The problem will, then, in all probability, be one of the following:

a. Side play in the tilt detent
b. Side play in the tilt ring
c. Excessive upper ball socket play
d. Loose typehead mounting
e. Detent timing bad (not entering notch at correct time)
f. Vertical play in rear of carrier
g. Worn rocker shaft bearings

Rotate Alignment

As in tilt alignment, a detent is used tc lock the typehead in the correct horizontal position. This detent, called the rotate detent (Figure 1-73), will lock into V-shaped notches in the typehead skirt. Specific head play is present and is created by the backlash between the pins in the upper and lower ballsockets and the ball joint (dog bone). Bandwidth is

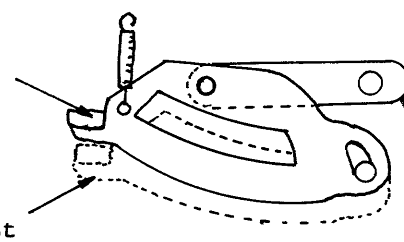


Figure 1-73. Rotate Detent

again utilized to permit proper adjustment of the rotate mechanism. The tilt detent is perpendicular to, and fits into a notch in the center of, the rotate detent. The rotate detent is spring loaded upward against the tilt detent.

Once the rotate detent has fully seated in the correct notch horizontal misalignment cannot be attributed to coarse alignment. The problem, then, will probably be one of the following:

a. Detent timing bad
b. Rotate detent sideplay
c. Rocker sideplay
d. Escapement (spacing) problems

Detenting

When the tilt and rotate detents are engaged, the typehead is locked. They must not be permitted to engage until the typehead has been both vertically and horizontally coarsely positioned. They must then be engaged to prevent the typehead from moving while it strikes the platen.

Preventing the tilt detent from rising also stops the rotate detent because of their mounting. An arm, called the detent actuating lever, is pivot mounted on the left side of the rocker and comes in contact with an extension or leg of the tilt detent (Figure 1-74). The front part of the detent actuating lever is in contact with a roller which rides freely on a pin connected to the detent cam follower. The detent cam follower, which pivots at the bottom left to right, rides against the edge of the detent cam which is set-screwed to the print sleeve (Figure 1-74). In the rest position, the high point of the cam forces the cam follower to the left which, in turn, holds the detent actuating lever to the left and this holds the leg of the tilt detent to the left. This will keep both detents down and prevent them from engaging. As a print operation occurs, the detent cam will rotate with the print sleeve. When the

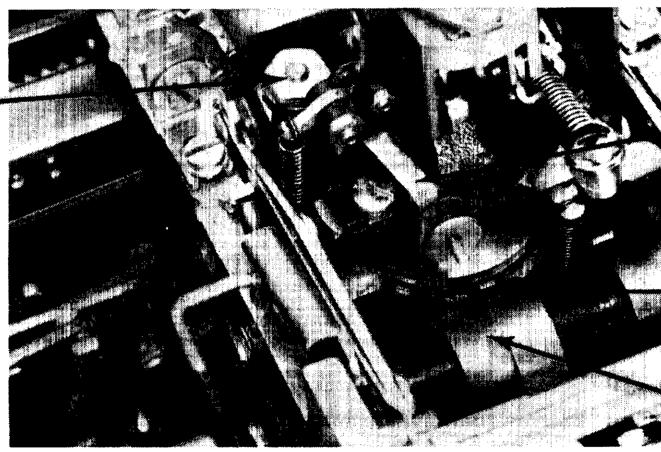


Figure 1-74. Detent Mechanism

typehead becomes coarsely positioned by the differential mechanisms, a low dwell of the detent cam will allow the cam follower arm, the detent actuating lever and the detent leg to move to the right because of the extension spring on the rear of the tilt detent. When this occurs, both detents will move upward and lock in the notches in the tilt ring and typehead.

The rotate detent (Figure 1-73) contains an elongated slot at the front and slides into place rather than pivot as does the tilt detent. The purpose of this sliding arrangement is to allow the rotate detent to seat at approximately the same angle in the typehead skirt for any of the four tilt positions.

As the typehead travels, locked by the detents, toward the platen, the detent cam continues to rotate but will maintain the low dwell to keep the detents in place. Once a character has been printed, however, it is then necessary to allow the typehead to return to the home position. A high dwell on the detent cam will force the detenting mechanisms to the left causing both detents to pivot out of the notches which allows the typehead to restore to the home position.

Detent timing is critical and must be such that the detents will engage just as the typehead becomes positioned and disengage just as the typehead begins to tilt and/or rotate back to the rest position. Faulty detent timing can result in parts breakage--especially the typehead skirt teeth.

Detent Timing

Detent timing is very critical and can cause parts breakage if not adjusted correctly. If the rotate detent is allowed to enter the typehead too soon, it could enter the wrong notch. If this occurred on a positive rotation, the tape or typehead could break due to continued pull on the rotate tape. If it happened on a negative rotation, the tape would become relaxed and possibly jump off of the pulleys. This would probably cause tape breakage.

Detent timing is controlled by the timing of the print shaft with respect to the cycle shaft. It should be set as late as possible, without restricting the restoration of the typehead, to insure that the detents do not leave the typehead, before printing occurs. This would affect print alignment.

Some of the factors affecting detent timing are:

a. Typehead Homing
b. Rotate and Tilt adjustments
c. Print shaft to cycle shaft timing
d. Detent actuating lever and cam adjustments

Head Play

Headplay is the distance the typehead will move horizontally with the rotate detent removed. It should be approximately .045" (Figure 1-79).

Rotate Bandwidth

Bandwidth is the difference in detenting between the character which detents the farthest in the negative direction and the character which detents the closest to the center of the notch (least negative). To make this check, headplay must be removed in the negative (clockwise) direction (Figure 1-85).

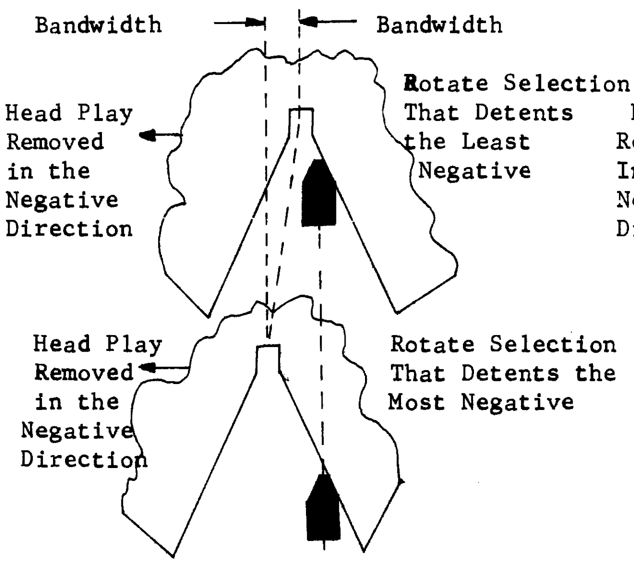


Figure 1-85. Bandwidth

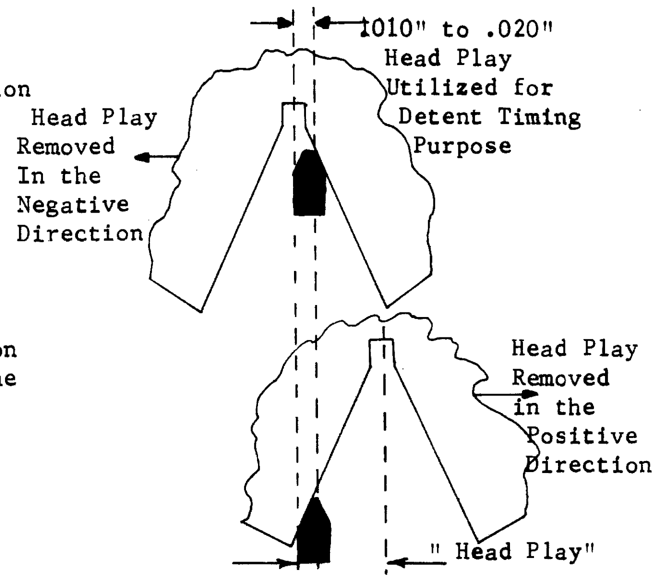


Figure 1-86. Typehead Homing

Typehead Homing

Typehead homing is the alignment of the typehead to the character that will detent the least negative (most positive) and still be on the negative (right) side of the center of the notch. It should detent .010" to .20" from the center of the notch with the headplay removed in the negative direction (Figure 1-86).

Wear Compensator

The purpose of the wear compensator is to prevent head drift created by wear in the rotate system. The wear compensator is an integral part of the rotate arm and is able to sense a change in position of the rotate arm caused by wear and compensate for that change.

The rotate pulley spring and the compensating arm spring apply a constant pressure on the rotate system in the negative direction. When wear occurs at pivot points, bearings, or any place that opposes the combined tension of these springs, the play developed will immediately be taken up by these springs, causing the rotate arm to move toward the sideframe slightly and the typehead to rotate slightly in the negative direction. This is known as drift. Excessive drift will cause incorrect character selection and possible parts breakage if it is not compensated for. Some amount of wear will always be present because of metal against metal and although the wear compensator cannot prevent wear, it can prevent head drift caused by wear. The wear compensator (Figure 1-75) consists of three basic parts:

a. Rotate arm
b. Compensating Arm
c. Nylon Roller

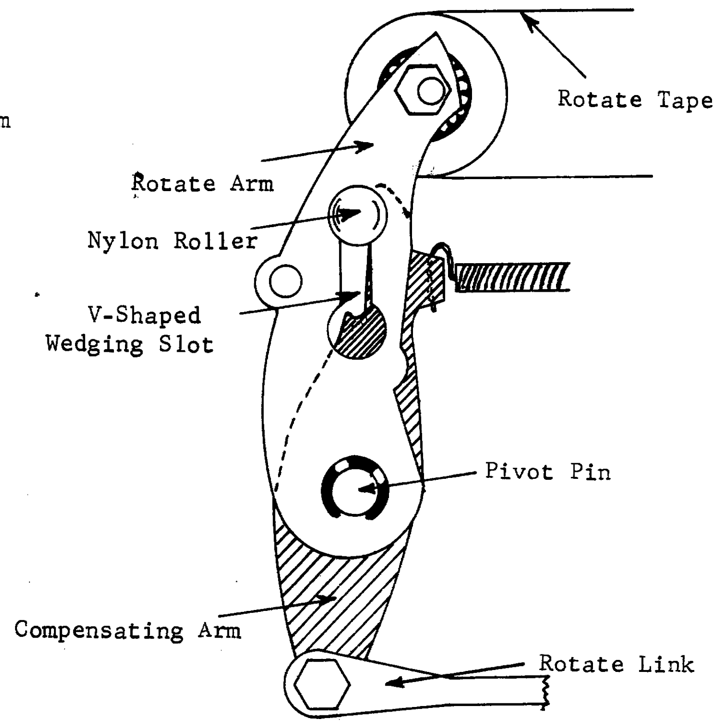


Figure 1-75. Basic Components of the Wear Compensator

The rotate arm pivots on a large pin in a bracket on the left outside of the frame. Mounted on the top of the rotate arm is the left hand rotate pulley.

The compensating arm pivots at the same point as does the rotate arm. The rotate link is connected to the lower extension of the compensating arm. The upper section fits between two sections of the rotate arm and is spring-loaded to the right by the compensating arm spring.

The nylon roller sits in a vertical slot in the rotate arm. This slot and the top of the compensating arm are at an angle to each other and form a V-shaped slot which holds the nylon roller in place.

The following four figures will demonstrate the basic action of the wear compensator:

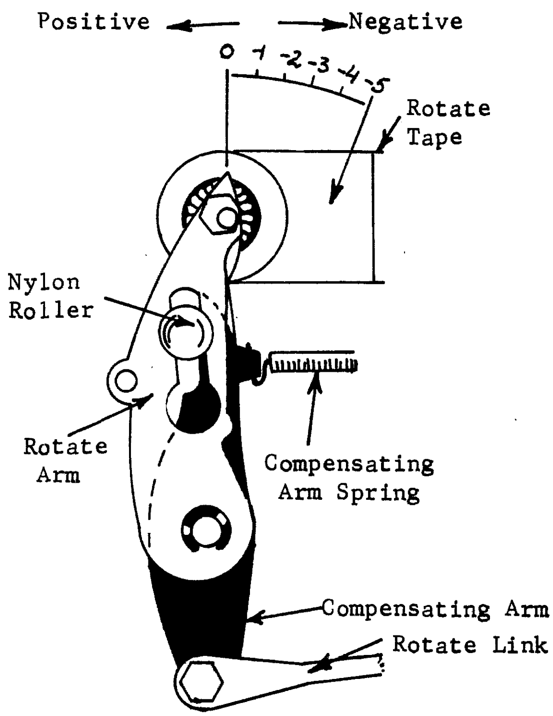


Figure 1-76. Zero Rotate Position

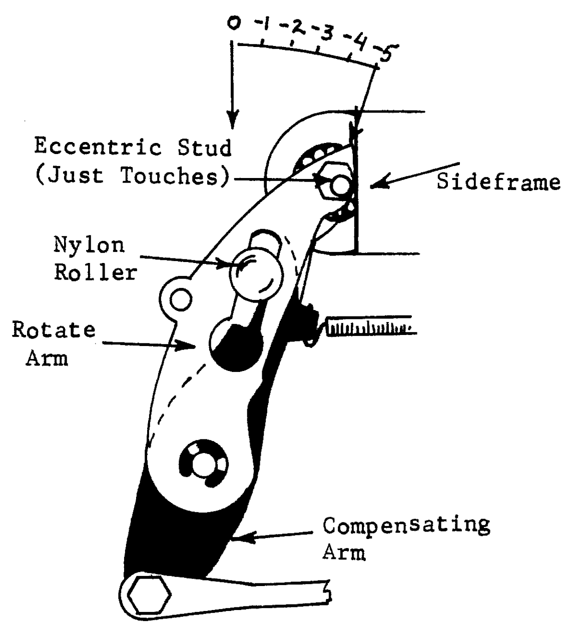


Figure 1-77. Negative-5 Position

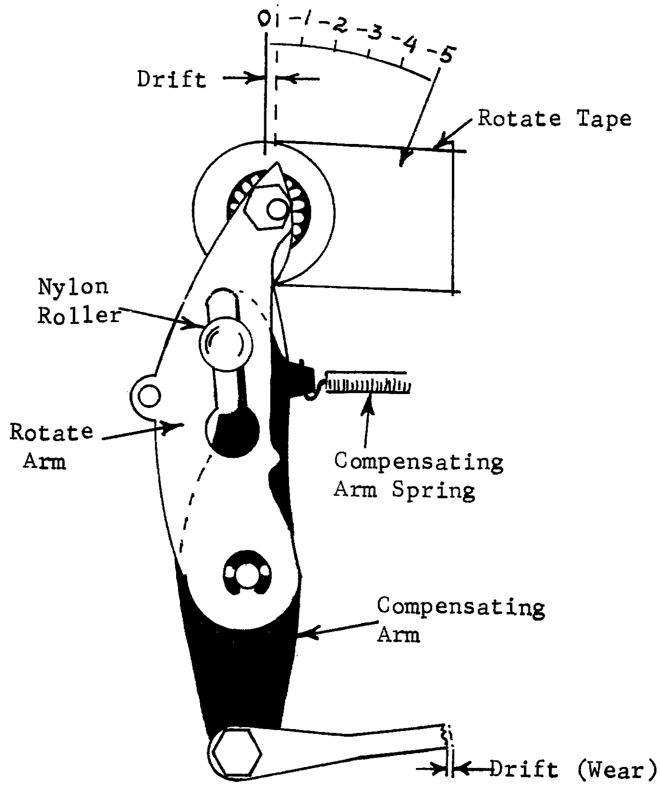


Figure 1-78. Zero Rotate Position With Drift

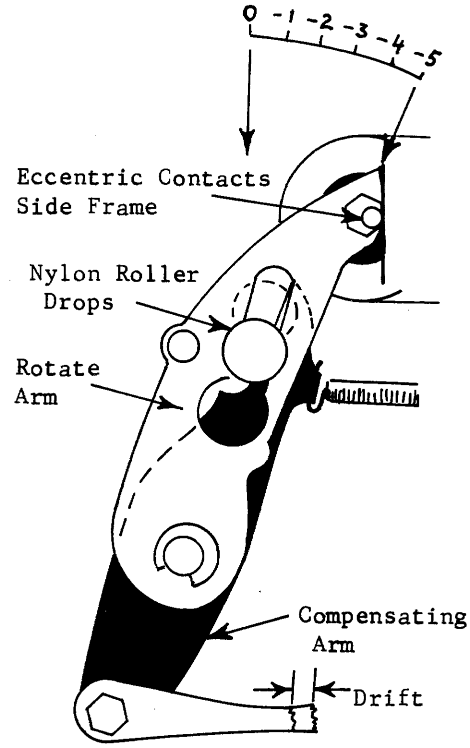


Figure 1-79. Negative-5 Position With Drift

Figure 1-76 shows the wear compensator at rest (zero rotate) with no wear introduced in the system. The combined tension of the rotate tape (from the rotate pulley spring) and the compensating arm are acting together to pull the arm to the right, in the negative direction. The rotate link is acting to overcome this tension. The nylon roller is positioned near the top of the slot.

Figure 1-77 shows the wear compensator in the negative five position, still with no wear in the system. In this position, the eccentric stud on the top of the rotate arm is just barely touching the sideframe of the printer. The nylon roller is still at the top of the slot.

Figure 1-78 shows the wear compensator in the rest position but with wear introduced in the system. Note that the pointer of the rotate arm is no longer vertical but has moved to the right. Wear has been taken up on the negative direction and drift has resulted. The nylon roller is still at the top of the slot.

Figure 1-79 shows the wear compensator in the negative five position with wear in the system. As the arm moves toward the sideframe, the rotate differential system is attempting to supply exactly five units of negative motion to the rotate arm but, because it started at a point to the right of zero, the rotate arm will contact the sideframe, by means of the eccentric stud, before the full five units of motion has been expended.

The differential system will continue supplying the rest of the motion but only the compensating arm will keep moving, as nothing blocks its inward travel. As this occurs, the V-slot opens up and the nylon roller will drop. Wear has been compensated for and drift has been eliminated as the rotate arm will then return to the zero position.

This, basically, is how the wear compensator works. However, all of the parts in the system which are opposing the combined spring tension of the rotate pulley spring and the compensating arm spring are being flexed, somewhat. Steel parts do have a measureable amount of flex when placed under stress.

When wear is introduced into the system it could be possible for the nylon roller not to drop on a negative five operation, and compensate for that wear because of flexing. As the eccentric stud contacts the sideframe and the compensating arm keeps moving, the sideframe will oppose much of the spring tension of the system and the rotate arm and compensating arm are then allowed to relax. However, the nylon roller will still be held between them. In the flexed position they hold the roller very tightly. In the relaxed position they hold the roller loosely, but they do hold it. This develops into a situation where wear or drift in the system has not caused compensating to occur but rather has only allowed the parts with stress on them to relax. Therefore, something must be done to relax the pressure on the nylon roller before compensation. In other words, stress must be removed before compensating occurs. This will allow compensating to occur for even minute amounts of wear.

Wear Compensator Ratio Change

If the amount of motion supplied to the compensator arm can be increased sufficiently to relax the nylon roller and still not allow it to drop, then the roller will be prepared to drop if just the slightest amount of wear is detected in the system.

This is accomplished by means of a "ratio change" in the leverage supplied to the compensating arm. Through all rotate movements, from +5 to -4, there is a constant leverage ratio between a given amount of motion supplied by the rotate link to the bottom of the compensating arm, and the movement of the top of the rotate arm (which directly depends on the movement of the top of the compensating arm through the nylon roller). However, from a -4 to a -5 position, a ratio change will occur by allowing the compensating arm to rotate about a point lower (closer to the rotate link) than the pivot pin. When this occurs sufficient extra motion will be supplied to the top as compared to the bottom, of the compensating arm to remove the stress. The nylon roller will then drop for even small amounts of wear.

The rotate eccentric arm (Figure 1-81) is utilized to provide the ratio change to the compensating arm. The rotate eccentric arm is spring-loaded to the right and has a hole in it which fits around the pivot pin. An eccentric shoulder protrudes from the arm with the center of the shoulder

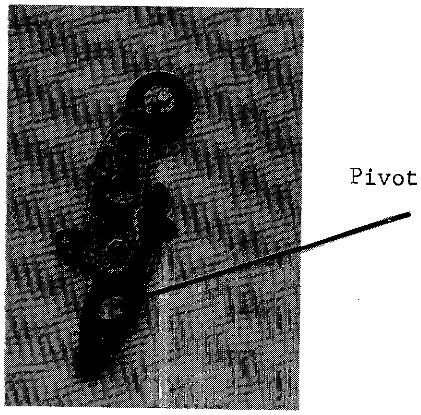


Figure 1-80. Compensating Arm Pivot Hole

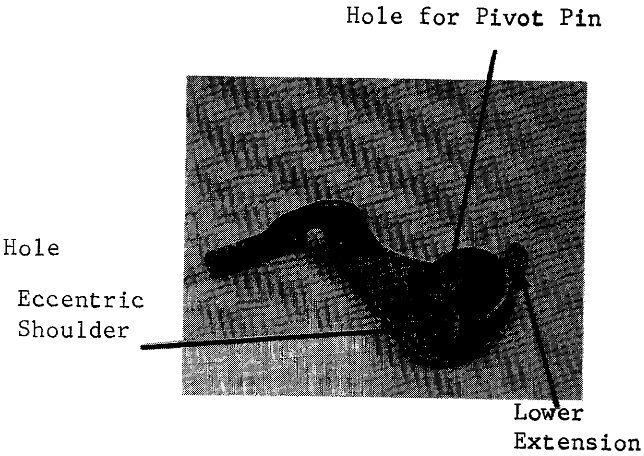


Figure 1-81. Rotate Eccentric Arm

lower than the pivot hole. The compensating arm contains a large pivot hole (Figure 1-80) which fits around the eccentric shoulder of the rotate eccentric arm. Between the +5 and -4 positions the compensating arm and the eccentric arm act as one as they pivot about the pivot pin. However, at approximately the negative four position, the lower extension of the eccentric arm will come in contact with a stop lug on the wear compensator bracket, which is bolted to the side frame (Figure 1-82). When this occurs, the eccentric arm will be restricted from moving any farther and the compensating arm must now pivot about the eccentric shoulder of the eccentric arm (Figure 1-83). Since the center of the eccentric shoulder

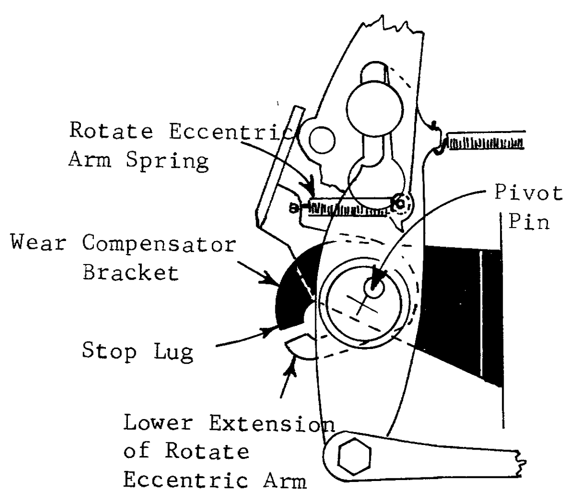


Figure 1-82. Zero Rotate Position

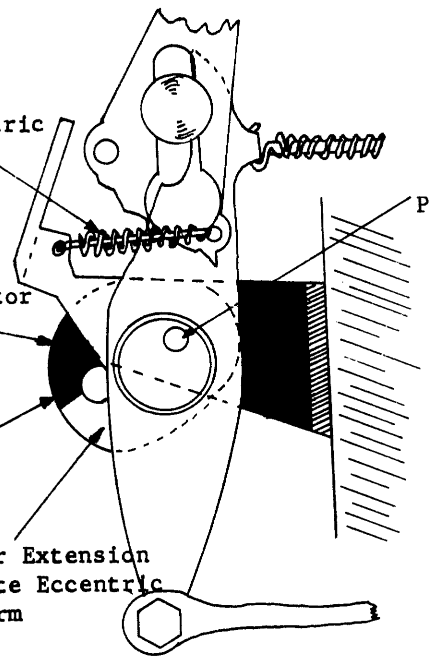


Figure 1-83. Negative-5 Position

is lower than the pivot pin, the compensating arm has now undergone a ratio change and the top of the compensating arm will move farther for a given amount of motion to the bottom of the compensating arm.

Because the rotate eccentric arm is spring loaded against the rotate arm by its extension spring (Figure 1-83) and the rotate arm is spring-loaded against the compensating arm by the rotate pulley spring, through the nylon roller, all three will act as one until a negative five character is selected. When this occurs, the eccentric arm will be stopped by the stop lug. But the rotate arm will continue to follow the compensating arm until the eccentric stud contacts the sideframe. The compensating arm will move slightly farther, however, to use up the extra motion supplied by the leverage ratio change. At this time the roller will be completely relaxed and held lightly in place. Any drift (slack) now felt in the system will cause the compensator arm to be pulled farther by its spring and the roller will immediately drop in the slot. Thus, wear has been compensated for.

The wear compensator compensates for wear in the system from the rotate arm, through the linkage and up to the -5 cam. It cannot compensate for wear in the positive latches, the latch bail and the positive cams because these components are not used for a negative five operation. Wear at these points constitutes a part of the bandwidth and must be considered when adjusting for an allowable bandwidth.

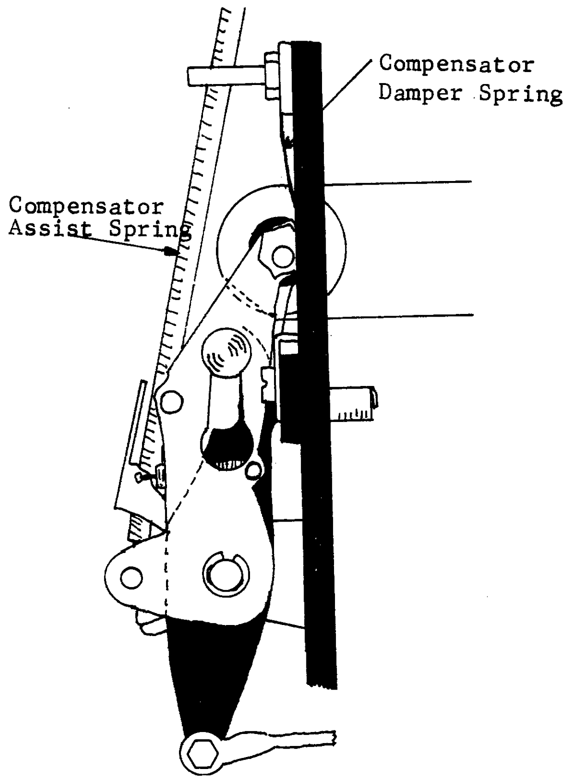


Figure 1-84. Wear Compensator

Two other springs are also included in the wear compensator which have not been previously discussed (Figure 1-84). One is the compensator assist spring which is connected between the rotate arm and the sideframe. Its purpose is to keep constant pressure on the rotate arm, against the roller, when doing a positive operation. Oherwise, momentum, built up by the rotate arm, could cause the rotate arm to overthrow far enough to allow the roller to drop. This cannot be allowed to happen. The second spring, called the compensator damper spring, is a leaf spring and is mounted to the sideframe. Its purpose is to dampen out the shock caused by the eccentric stud contacting the sideframe. This prevents unnecessary stress on the system and eliminates rebounding which could cause the slot to open and the roller to drop.

PRINT MECHANISM

The print mechanism is powered by a double-lobed cam which is located on the far right of the print sleeve (Figure 1-87). For our purposes, only the right side of the cam, called the high velocity cam, will be discussed.

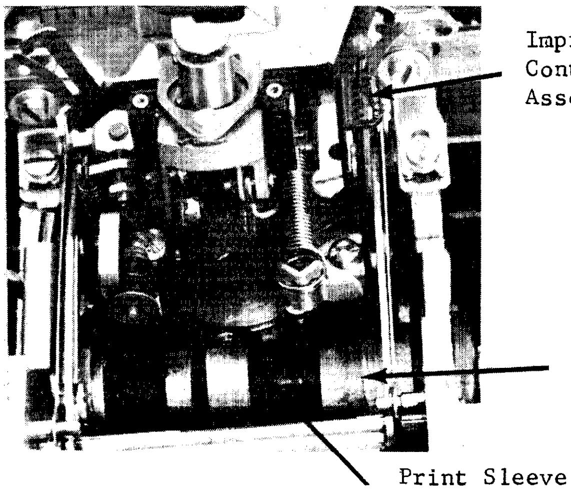


Figure 1-87. Print Sleeve and Cams

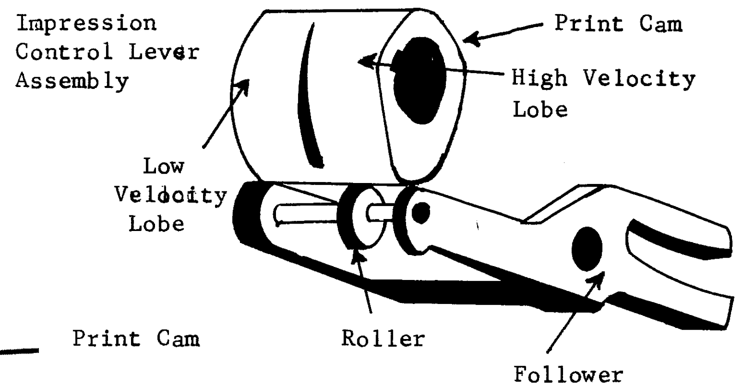


Figure 1-88. Print Cam Follower Assembly

The print cam follower assembly (Figure 1-88) is mounted by means of a forked assembly on a pivot pin, below and to the rear of the print cam, in the right side of the carrier. The print cam follower roller is mounted on a pin on the print cam follower and is held in position, underneath the high velocity cam, by a yoke which straddles the roller (Figure 1-89), and the yoke actuating lever which is spring loaded to the right and holds the yoke to the right. (Figure 1-90).

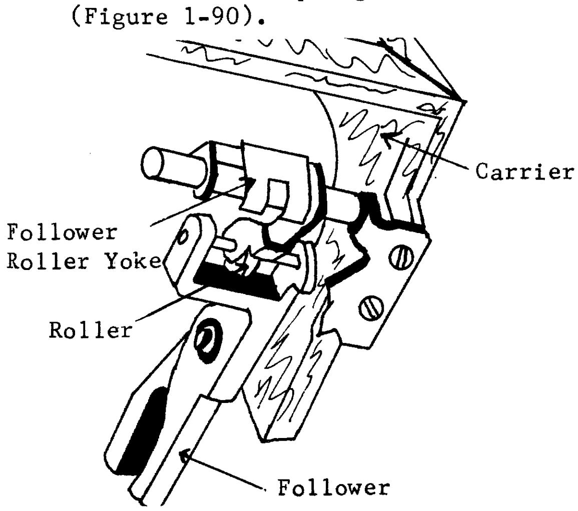


Figure 1-89. Print Cam Follower Roller Yoke

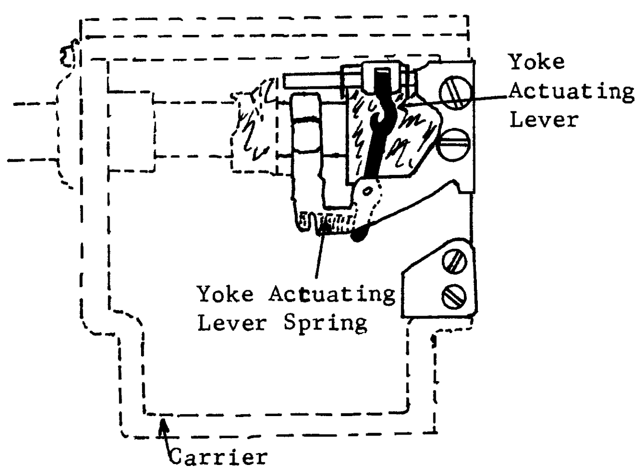


Figure 1-90. Yoke Actuating Lever

The pivot pin, on which the forked end of the cam follower arm is mounted, extends from the lower portion of the impression control lever assembly. The impression control lever assembly (Figure 1-87) is mounted on the right side of the rocker by means of a pivot screw. Extending from the top of the assembly and through the detent plate, is the impression control lever topped with a red button. The lever is adjustable to any of five positions and is held in place by detent notches in the detent plate (Figure 1-87). Changing the position of the lever will cause the pin on the lower end of the lever to move back or forward in the fork of the cam follower arm.

During a print operation, the print sleeve will begin rotating. As the high point of the print cam contacts the print cam follower, it will be forced downward, pivoting the forked end up. This causes the rocker to rise, driving the typehead to the rear, toward the platen. The contour of the cam is such, that the typehead will be powered to within a few thousandths of an inch of the platen and will be carried the rest of the way by momentum.

Varying the position of the impression control lever pin in the forked end of the cam follower will vary the velocity with which the typehead is driven toward the platen and, thus, will vary the impression (darker or lighter) of the character on the paper.

As the impression control lever is moved forward (toward the number five on the detent plate), the pin will move backward in the forked slot (Figure 1-91).

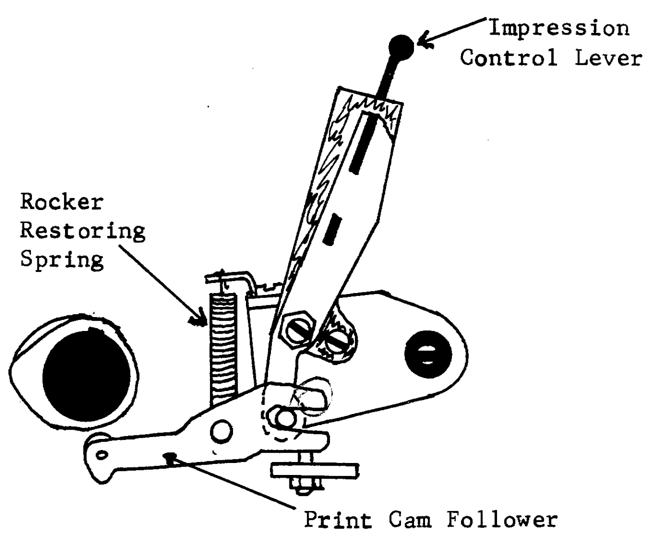


Figure 1-91. Impression Control

This will increase the amount of powered flight to the typehead and create a heavier impression on paper. However, increasing or decreasing the amount of powered flight could change the time relationship between type-head detenting and typehead printing. The timing must remain relatively constant. The contour of the forked slot in the cam follower arm assures this by allowing most of the change in powered travel to be felt as a change in the rest position of the typehead rather than a change in free flight time. The free flight time should vary only about .015" throughout the five different impression control settings. In other words, by increasing or decreasing the flight time minutely, to make it proportional to the amount of powered flight time, the print time will remain the same for all characters, regardless of the impact velocity of the typehead.

Platen

The purpose of the platen is to provide a solid backing for the paper during a print operation and to feed the paper vertically. Two latches, one at either end of the platen, lock it in place and remove all vertical and horizontal play from the platen. These latches are pivot attached to the left and right carrier plates (Figure 1-92).

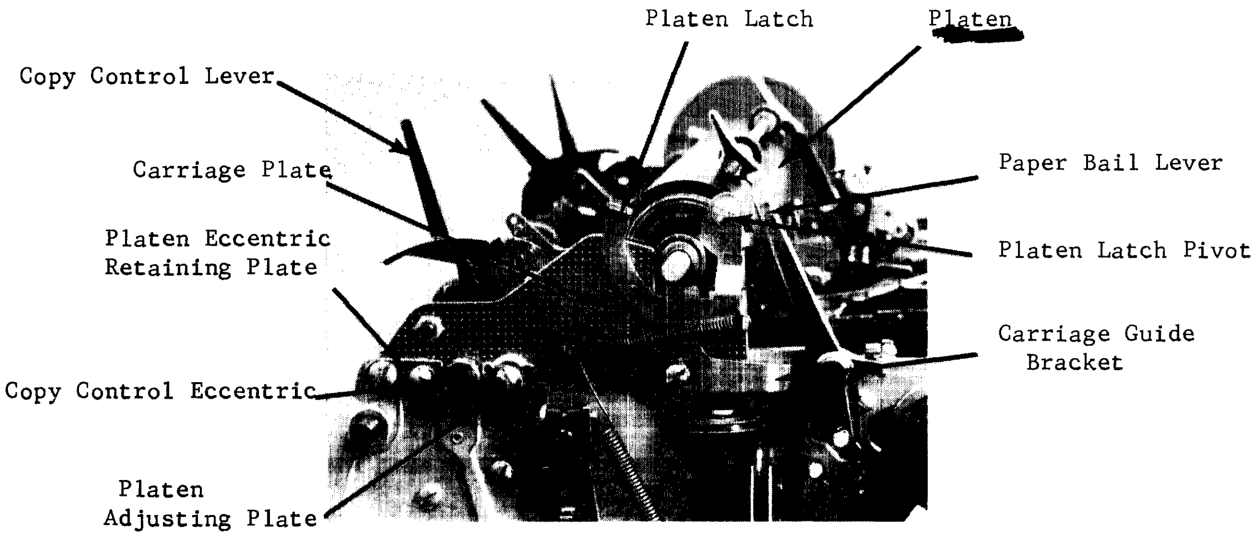


Figure 1-92. Copy Control Mechanism

Copy Control

The copy control mechanism positions the platen front to rear to compensate for different thicknesses of typing material. This maintains the proper relationship of the paper to the impression control mechanism. The copy control lever, located at the left top of the printer, operates the copy control by means of an eccentric collar. The lever is attached to the copy control shaft which extends the width of the printer, through both sideframes. An eccentric collar is attached to each outside end of the shaft and fits between adjusting parts attached to the carriage ends (Figure 1-92). As the lever is moved to the rear, to any of five positions, both eccentrics will be rotated against the back sides of the platen adjusting plates forcing the entire carriage, including platen and feed mechanism, to the rear. Moving the lever forward forces the carriage forward. The most forward position is the normal print position.

MAINSPRING

The mainspring (Figure 1-93), which is located at the right rear of the printer, supplies all the tension necessary to move the carrier to the right during an escapement operation. A shaft, called the escapement shaft (Figure 1-96), extends through a bearing assembly in the back plate of the printer into the center of the mainspring. A hub, which is set screwed to the rear of the shaft is grooved to allow the inner part of the mainspring to hook into it. The mainspring is wound so that the inner portion of the spring will create a counterclockwise rotary force to the escapement shaft. The escapement shaft extends forward through another ball bearing assembly in the powerframe and has a geared drum assembly set-screwed to its front end. This assembly is called the escapement/tab cord drum. The drum is spirally grooved to allow the drum to take up the escapement/tab cord. The escapement/tab cord is knotted and fits into a slot in the drum. It takes several turns around the drum, then runs over a guide roller, around a pulley assembly on the outside right of the powerframe and connects to the right side of the carrier. As the mainspring rotates the escapement shaft in the counterclockwise direction, the escapement/tab cord drum will take up cord, causing the carrier to move to the right. Attached to the escapement shaft, between the powerframe and the back plate, is the carrier return cord drum. The carrier return cord, which is attached to the drum in the same manner as the escapement/tab cord, takes several turns around the drum, over a guide roller assembly, around two pulleys at the left of the printer, and is attached to the left side of the carrier. During an escapement operation, this cord drum must pay out cord to allow the carrier to move to the right. However, on a carrier return operation, this drum must rotate clockwise against the pressure of the mainspring to allow cord to be taken up and move the carrier to the left. This is the purpose of the gears on the escapement/tab cord drum and will be discussed later. On the outside right of the powerframe, the escapement/tab cord pulley (Figure 1-93) is mounted to the cord tension arm. A set of spiral springs connects the cord tension arm to the pulley mounting bracket and exert a constant pressure, on the pulley, to the right. This pressure is necessary to take up any slack which may develop in the cords because of the fast movements of the carrier to the left and right. The cords also tend to stretch, somewhat. The springs allow a steady tension on the cords which permits the carrier to move smoothly.

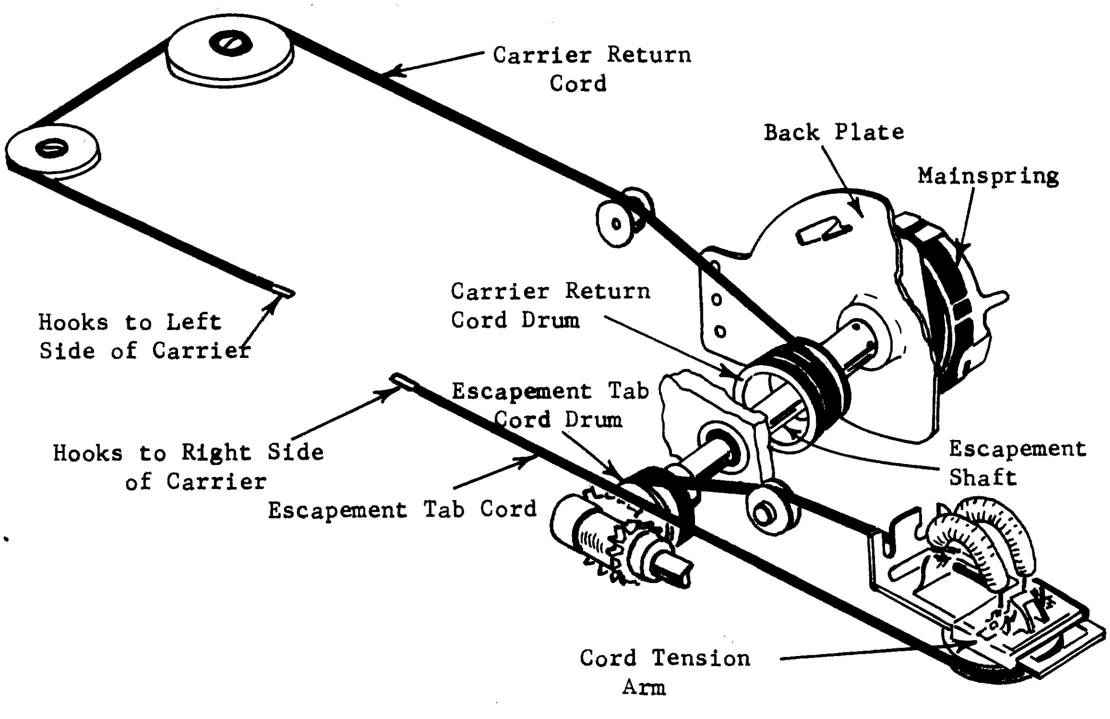


Figure 1-93. Mainspring and Cord System

PRINT ESCAPEMENT

Print escapement is the moving of the carrier one space to the right upon completion of a character print. Assemblies contributing to print escapement are (Figure 1-94):

a. Escapement bracket assembly
b. Escapement rack
c. Escapement torque bar
d. Escapement trigger lever assembly
e. Escapement cam and cam follower

Escapement Bracket Assembly and Escapement Rack

The escapement bracket assembly moves with, and is attached to the top rear of, the carrier. Attached to it are the escapement and backspace pawls, the tab lever and tab lever trigger plus various springs.

The escapement rack is located to the rear of the carrier and beneath the escapement bracket (Figure 1-94). It is connected solidly to each sideframe of the printer. Across the entire back edge of the rack are notches or teeth.

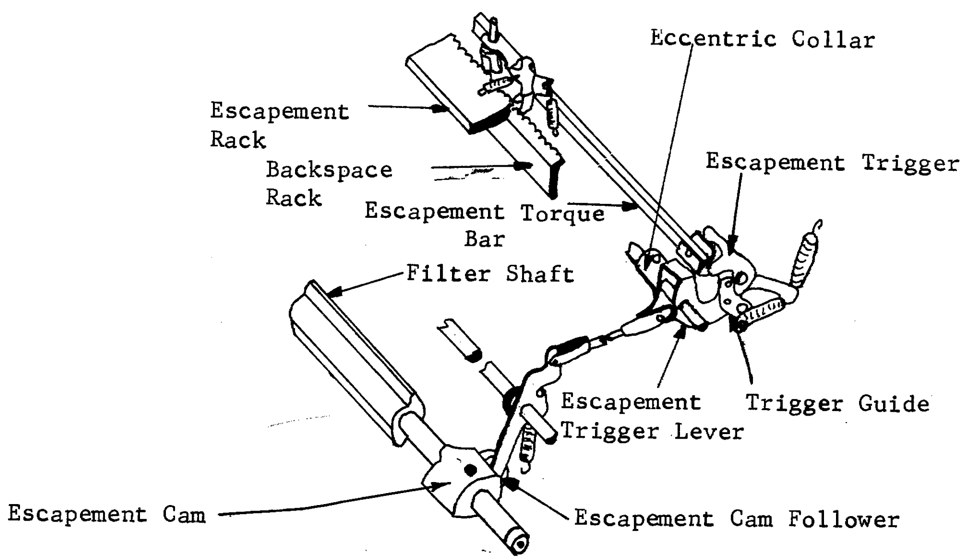


Figure 1-94. Print Escapement Mechanism

The escapement and backspace pawls contain elongated holes which fit over a stud on the left side of the escapement bracket. Both pawls are spring loaded to the right, and forward, into the escapement and backspace racks. The backspace rack is located immediately below the escapement rack. In the rest position, the escapement pawl will be engaged in a notch of the escapement rack. Because of the pressure on the carrier from the mainspring, the pawl will be pushed against the right edge of the notch which will prevent the carrier from moving. In this position, the stud on the escapment bracket will be pushed, by the carrier, against the right edge of the elongated slot in the escapment pawl, (Figure 1-95A) and the backspace pawl.

In order to permit the carrier to escape, the escapement pawl, along with the backspace pawl, must be forced out of the rack. This is accomplished by the escapement torque bar. As the pawls leave their racks (Figure 1 -95B) their relatively light weight allows them to be immediately pulled to the right by their extension springs (Figure 1 -95C) and into position to enter the next notch in the rack. The carrier will then begin to move, allowing the pawls to seat in the next notch of the racks (Figure 1-95D) and the carrier will come to a stop. Note: Only the escapement pawl restricts the carrier from moving. The backspace pawl sits loosely in the backspace rack. It must, however, be pivoted out of the rack for an escapement operation or the backspace rack would then restrict the movement of the carrier and a half-space operation would occur. Figure 1-95D shows the clearance of the backspace pawl in its rack when the carrier is stopped by the escapement pawl. The backspace and escapement pawls are connected to each other by a pin which is part of the escapement pawl and which fits through an elongated slot in the backspace pawl (Figure 1-95). This arrangement forces them to move left and right together but allows them to move front to rear freely. The reason for this will be covered in the backspace section.

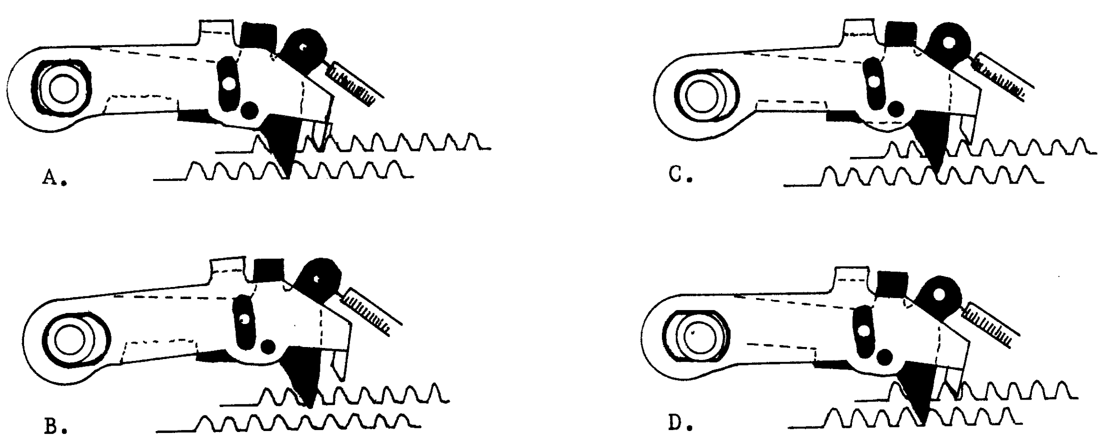


Figure 1-95. Escapement Pawl Operation

Torque Bar

The torque bar is a flat bar that pivots between the sides of the printer frame. It is located just to the rear of the escapement and backspace racks and pivots at the bottom with the top towards the rear. The torque bar must trip the escapement and backspace pawls from their racks to permit escapement to occur. Both pawls have a lug (Figure 1-94) which extends over the top of the torque bar and down the back. As the torque bar pivots to the rear it contacts these lugs and forces the pawls from their racks.

The torque bar is held in the rest position by an extension spring on the right side of the bar. Rotation of the torque bar to the rear is very fast and immediately upon tripping the pawls it will be restored by its extension spring. Failure of the torque bar to restore immediately will result in incorrect spacing, as the pawls will not be allowed to reseat in their racks.

The stud, on which the pawls pivot, is also used to brace the torque bar to overcome the tendency to bow to the front rather than push the pawls to the rear. This bowing tendency is present because of the force required to trip the pawls from their racks.

Escapement Trigger Lever Assembly

The escapement trigger, which operates the torque bar, is mounted to the escapement trigger lever by means of a pivot connection. In the rest position, a hooked tip of the escapement trigger sits over a lug on the right end of the torque bar. To rotate the torque bar to the rear, it is necessary to pull the escapement trigger downward. As the trigger is pulled downward, a lower extension of the trigger will contact the trigger guide (Figure 1-96A and 1-96B). The trigger guide is attached to the inside of a rearward portion of the operational bracket. A small stud of the trigger guide extends to the left, just in front of the escapement trigger. When the downward moving trigger contacts the stud on the trigger guide, the trigger can no longer go down and is then cammed to the rear. As this occurs, the tip of the escapement trigger will be cammed off of the torque bar lug, allowing the torque bar to restore by its extension spring (Figure 1-96). The escapement trigger lever, rotating downward, causes the escapement trigger to be pulled downward. The escapement trigger lever pivots on a shaft on the operational latch bracket which is mounted, just below the right end of the torque bar, to the powerframe. Connected to the front of the escapement trigger lever is the escapement link. The other end of the escapement link connects to the escapement cam follower arm. A pull on the link, toward the front, will cause the rear of the trigger lever to move downward, pulling the trigger downward. As the trigger is cammed off of the torque bar lug by the trigger guide, an extension spring (Figure 1-96). connecting the bottom of the trigger to the rear of the trigger lever, will restore the trigger forward. Another extension spring, on the rear of the trigger lever, is connected to a rear extension of the operational latch bracket and restores the trigger lever to the rest position. When this occurs, the hooked tip of the trigger will restore over the tip of the torque bar lug.

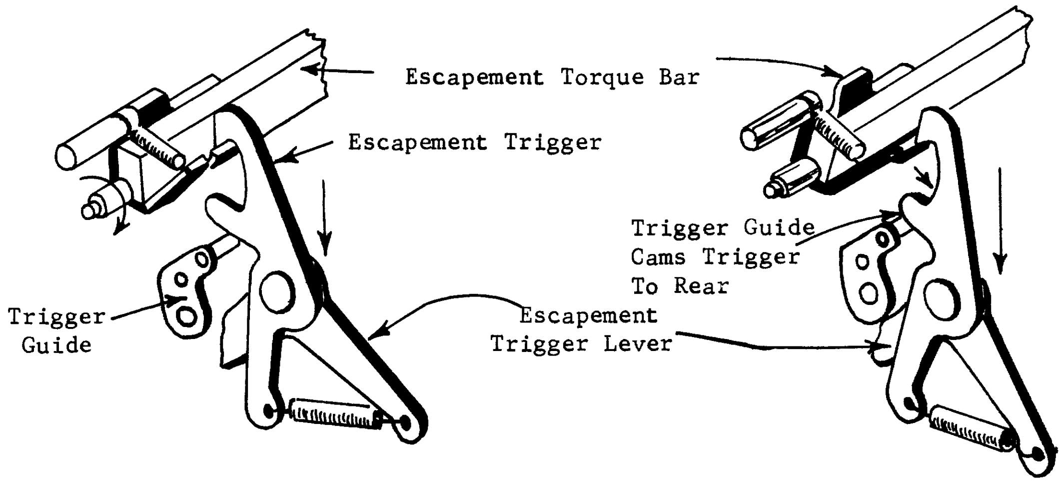


Figure 1-96. Escapement Trigger Operation

Escapement Cam

The escapement cam is mounted on the right side of the filter shaft because a spacing or escapement operation is needed after each character print and the filter shaft must rotate 180° for each character print. The escapement cam follower pivots on a pin in a bracket located just to the rear of the filter shaft. A roller on the bottom of the cam follower rides on the escapement cam. As the high point of the cam is rotated against the cam follower roller, by the filter shaft, the roller will be forced to the rear, pivoting the top of the cam follower arm to the front. The escapement link, which connects to the top of the cam follower, will also be pulled to the front. The pivot point of the trigger lever is above the escapement link connection and, thus, a pull on the link will cause the rear of the trigger lever to pivot downward.

The escapement cam timing is such that it will not cause an escapement operation to occur until the typehead is beginning to leave the platen after the print operation. This insures that the carrier will not be moving while a print operation is occurring.

OPERATIONAL CAMS AND CONTROL MECHANISMS

Operational Cams

Two cams (Figure 1-97) located on the right side of the operational shaft, power five of the six operational functions. The function not controlled by the two cams is shift which has been discussed previously. The cam on the left, a double-lobed cam, will rotate 180° for each operation it drives. This cam controls the space bar, tabulation and backspace functions. The cam on the right, a single-lobed cam, will rotate 360° for each operation. It controls the carrier return and indexing operations. The left hand cam rotates only 180° to allow a space operation to keep up with a print operation. Likewise, a backspace or tab operation. This is not necessary for a carrier return or indexing operation.

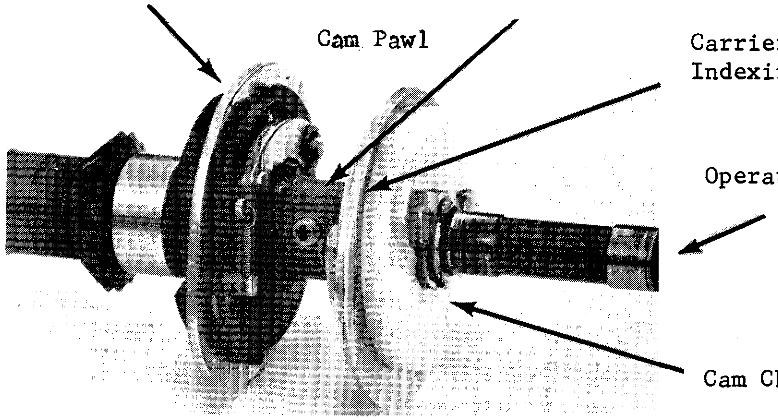


Figure 1-97. Operational Cams

A ratchet assembly (Figure 1-97) with teeth on either end, is set-screwed to the operational cam shaft which is in continuous rotation with motor power on. The two cams are located on either side of the ratchet, but are held from rotating by their clutch release arms - one for each cam (Figure 1-98). Rotation of a cam will only take place when one of the operational functions, for that cam, is selected. Mounted to each cam is a pawl called the cam pawl (Figure 1-98). The cam pawl is mounted to allow it to pivot into engagement with the rotating clutch ratchet. When this occurs, the cam will rotate. The clutch wheel (Figure 1-98), which is attached to and forms a part of the cam assembly, prevents the cam pawl from engaging with the clutch ratchet. Three oversize holes are located in the clutch plate. The pivot point of the cam pawl is a pin connected to the cam through one of the oversize holes in the clutch wheel. The free end of the pawl has an extension pin connected to

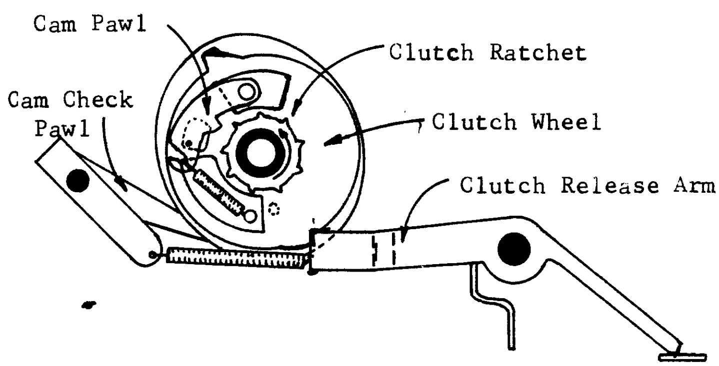


Figure 1-98. Operational Cam at Rest

it which fits through another oversize hole in the clutch wheel. This end of the pawl is spring-loaded toward the ratchet by an extension spring which is connected to the cam through the third oversize hole. The clutch release arm, however, holds the clutch wheel from moving. As long as the clutch wheel is prevented from rotating, the extension pin of the cam pawl is held by the edge of the slot in the clutch wheel which prevents the cam pawl from pivoting into the ratchet. Disengaging the clutch release arm (Figure 1-99) from the clutch wheel allows the cam pawl to be pivoted into the clutch ratehet by its extension spring. A tooth on the inside of the cam pawl will then engage the moving ratchet causing the entire cam assembly to rotate with the operational shaft. The clutch release arm is spring-loaded upward by an extension spring. When it is allowed to restore, its tip will be in the path of a lug on the clutch wheel. Upon contact with the release arm, the clutch wheel will be stopped. This will drive the cam pawl away from the ratchet as the extension pin on the pawl will be forced to ride outward on the edge of the hole in the clutch wheel. Thus, the cam's rotation is stopped. However,

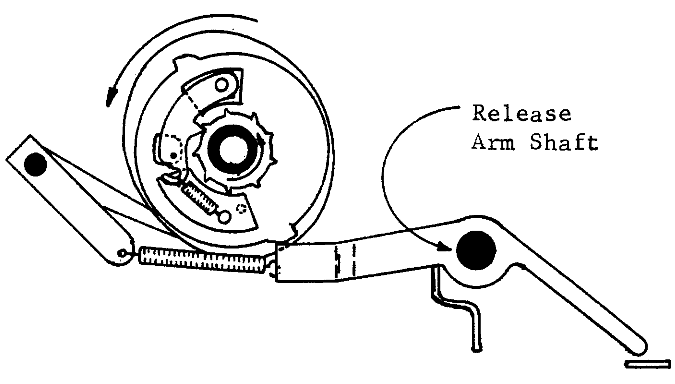


Figure 1-99. Operational Cam Active

the cam pawl spring always trys to pull the cam pawl into engagement with the clutch ratchet and if the cam is not prevented from moving backward, the pawl will be allowed to rotate, somewhat, into the moving ratchet, causing a buzzing sound. This backward creep of the cam is prevented by the cam check pawl (Figure 1-100), which will engage with a notch on the outside of the cam, as soon as the pawl is disengaged from the ratchet. The notch is part of the cam check ring which is held in position on the outside of the cam by two screws. An eccentric collar on one of the screws allows adjustment of the cam check ring. This arrangement permits positive locking of the cam in the rest position.

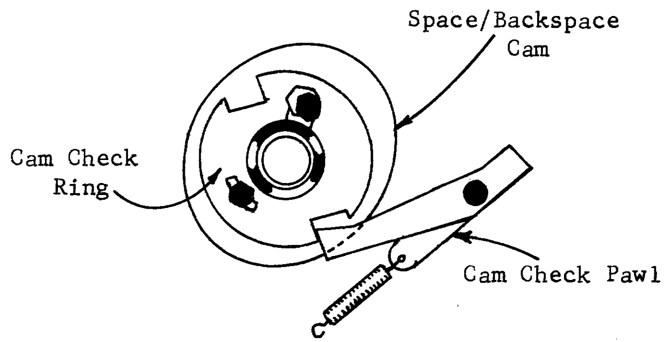


Figure 1-100. Operational Cam Check Pawl

Operational Control Mechanism

The purpose of the operational control mechanism, which is located under the operational cams, is to:

a. Select function to be operated
b. Control the movement of the cam
c. Transfer the motion of the cam to the operation selected

To accomplish these purposes, each cam must have four basic parts in its control mechanism. They are:

1. An interposer which will select the operation
2. A clutch release arm
3. A method of restoring the interposer
4. A cam follower to drive the operations

All five operations work, basically, the same.

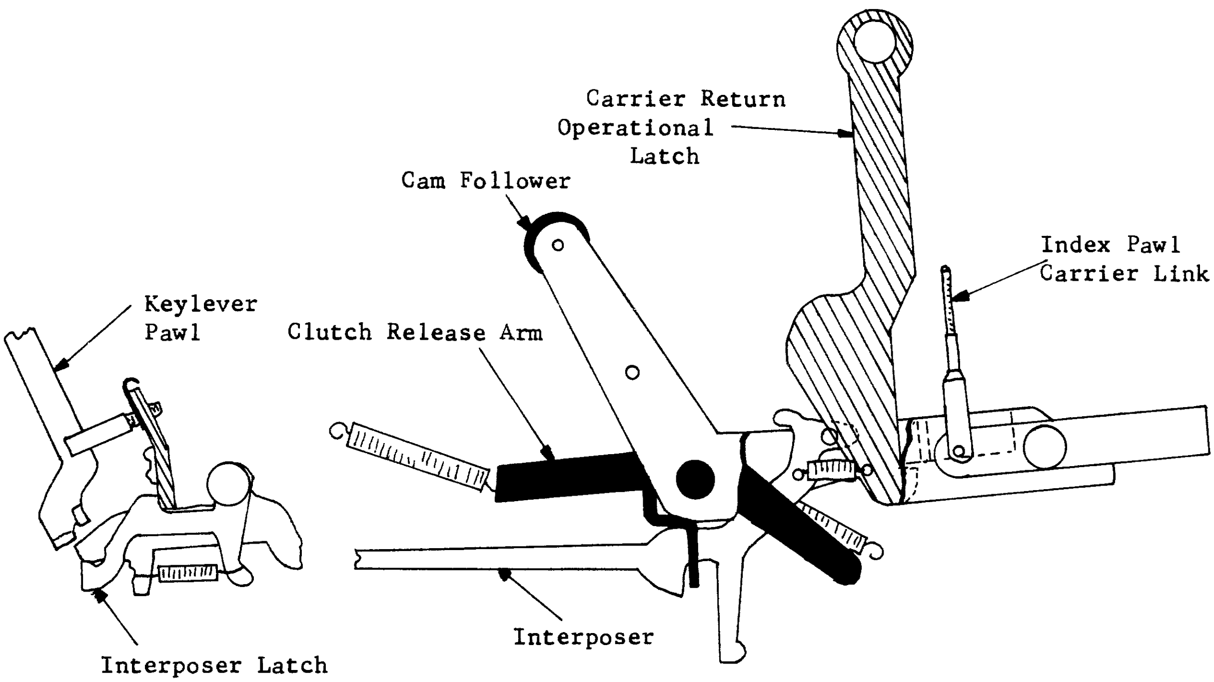


Figure 1-101. Indexing/Carrier Return Operational Control

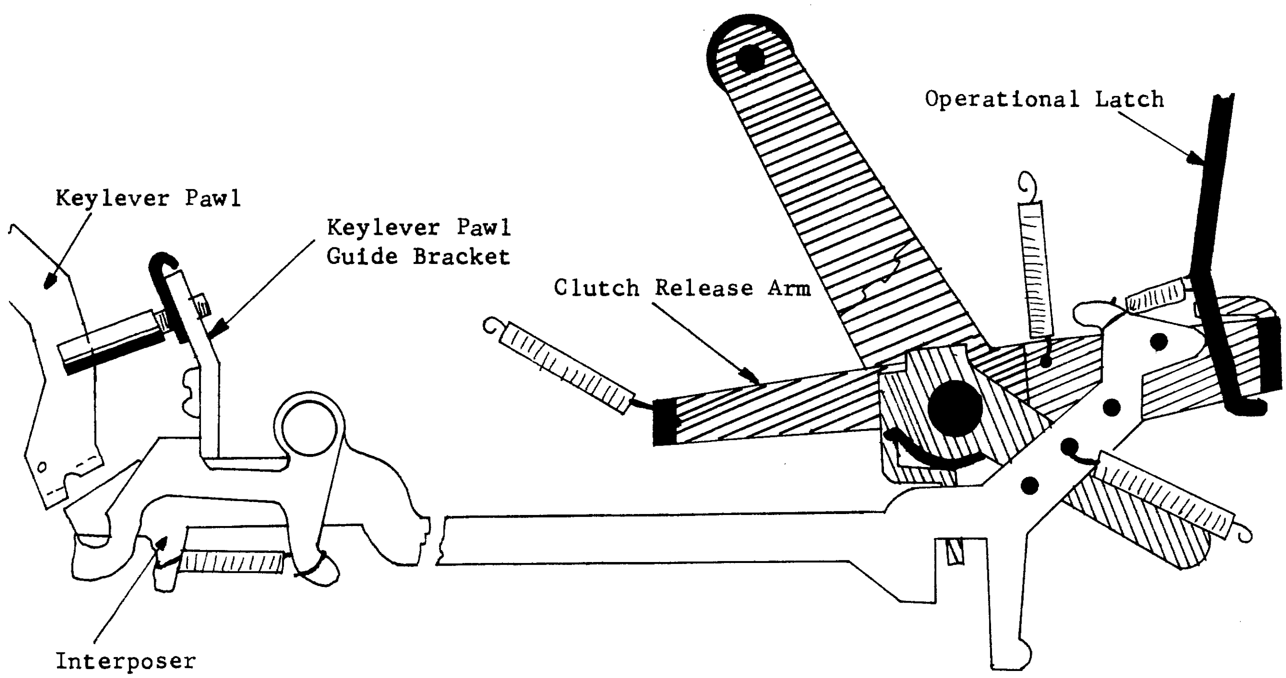


Figure 1-102. Space/Backspace/Tab Operational Control

Interposer

There are five interposers (Figure 1-102), one for each operation. The interposers operate, front to rear, in slots in the operational control bracket. They are held latched forward by an adjustable guide which is attached to the front of the operational bracket (Figure 1-102). The interposers are spring loaded to the rear by an extension spring (Figure 1-102) which is attached to an extension at the rear of the operational bracket. The interposer latch (Figure 1-102), pivot mounted to the front of the interposer, is spring loaded up, in front of the keylever pawl guide bracket, by an extension spring which is connected from a bottom extension of the latch to a lug on the interposer. This locks the interposer forward, against its spring tension. Each of the five operational control keylevers has a pawl, attached at the rear, which extends through a slotted guide stud in the guide bracket. The pawl extends just above the front of the interposer (Figure 1-102). Depressing a keylever will cause the lug to push the interposer downward, freeing the latch from the guide bracket. This will allow the interposer to spring load to the rear.

Clutch Release Arm

Each cam has a clutch release arm (Figure 1-102). Both clutch release arms pivot on a shaft to the rear of the cams and each has three extensions from the pivot point. The forward extension is the stopping surface for the clutch wheel. It is spring loaded upward. The bottom extension, when contacted by an interposer, causes the front of the clutch release arm to pivot downward, releasing the clutch wheel. This extension, on the left hand release arm, will extend through lugs on three interposers. On the right hand release arm, this extension will extend through the lugs of the two interposers. The rear extension of the release arms contact the operational control bracket lug, which acts as a stop lug for the release arm and controls the amount of "bite" between the front of the release arm and the tooth on the clutch wheel. The extension spring (Figure 1-102) on the clutch release arm is attached to the cam check pawl and holds the arm in contact with the clutch wheel tooth.

Cam Follower

There are two cam followers (Figure 1-101 and 1-102), one for each cam. Both cam followers pivot on the same shaft as the clutch release arms. A roller at the top of each cam follower arm, is in contact with its particular cam. The cam followers are bell crank type devices mounted to the rear of the cams. As a cam is operated, the top of its cam follower will be forced to the rear, pivoting the rear of the cam follower downward. On the rear of the carrier return/indexing cam follower, a link is attached which operates the indexing mechanism. This link will be pulled downward by the cam follower arm each time the cam rotates. The cam follower is restored by an extension spring in the indexing mechanism, holding the roller against the cam.

The space, backspace, tab cam follower is wider than the carrier return/indexing cam follower because it must control three operations. It also is spring loaded upward, against the cam, by an extension spring which is attached to the operational latch bracket.

Interposer Restoring Lever

After an interposer has been released to the rear to begin an operation, it must be immediately restored to enable the clutch release arm to return to the rest position to stop the rotation of the cam. The interposer restoring lever (Figure 1-103), which pivots between the sides of the operational control bracket, and is located just to the rear of the interposers, causes the interposers to be restored. A lug on either side of the restoring lever is in contact with both cam followers. Another lug, on the bottom of the restoring lever, is in contact with the rear portion of the five interposers. Either cam follower being rotated backward by a cam will force the top of the restoring lever backward and pivot the bottom forward, pushing the interposer forward and allowing it to latch on the guide bracket.

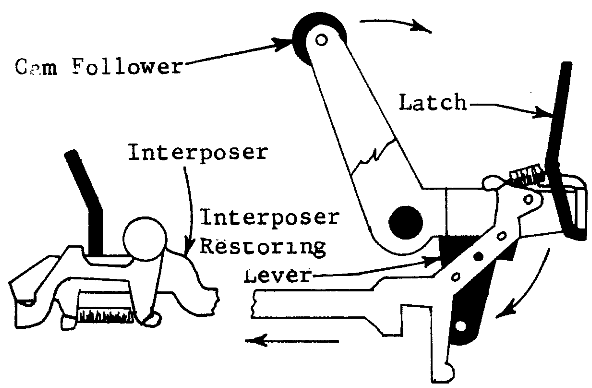


Figure 1-103. Interposer Restoring

Operational Selection

All of the operations, except index, have a small, hook-like latch, located to the rear of, and resting against, the interposers. These latches are called the operational latches, and are attached, at the top, to their individual operational mechanisms. Indexing does not require an operational latch because it will be operated, through its link, whenever the carrier return/indexing cam rotates. Releasing an interposer to the rear not only trips a cam, permitting it to rotate, but will also push the latch for that interposer to the rear. As the latch is pushed to the rear, its hooked portion will extend beneath an extension on the cam follower arm. As the cam follower is forced to the rear by the cam, the rear of the cam follower arm will pivot downward, forcing the operational latch down with it. This activates that particular mechanism for the latch. However, as the cam follower is forced to the rear, the interposer immediately begins to restore to the front. As this happens, an extension spring, connected from the rear of the interposer to the latch, exerts a pull forward on the latch, attempting to pull it from beneath the cam follower arm. This is prevented by a lug on the operational bracket (Figure 1-104), which will extend in front of the latch when it is forced down by the cam follower. As the low point of the cam allows the cam follower to restore upward, at the rear, the operational latch will then be clear of the lug and will immediately be restored to the rest position against the interposer by its extension spring.

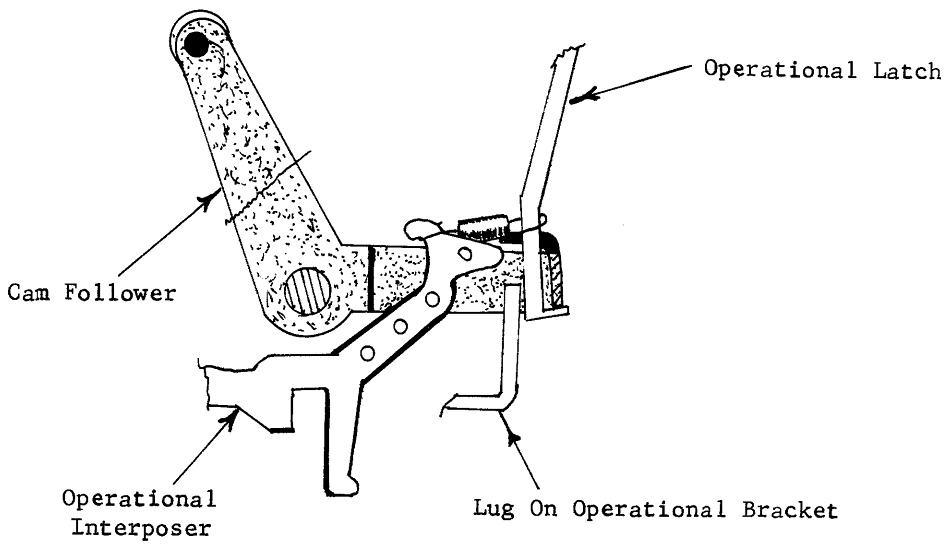


Figure 1-104. Operational Latch Locked to the Rear

Operating Sequence

Depressing an operational key causes the keylever pawl to trip its interposer from the keylever pawl guide bracket. As this occurs, the interposer is pulled to the rear by an extension spring. As the interposer spring loads to the rear, a lug on the interposer contacts the middle extension of the clutch release arm and forces it to the rear. This causes the front of the clutch release arm to pivot out of engagement with the clutch wheel and begins a cam rotation. The interposer will also push its operational latch to the rear, beneath the cam follower arm extension. As the cam rotates, it forces the top of the cam follower to the rear, pivoting the rear of the cam follower downward. This forces the operational latch downward, activating its mechanism. At the same time, the interposer is restored to the front by the interposer restoring lever which frees the middle extension of the clutch release arm and allows the arm to restore upward, into the path of the next lug on the clutch wheel, to stop the rotation of the cam. The low point of the cam, coming under the cam follower arm, allows the rear of the arm to restore upward, which allows the selected operational latch to restore against its interposer. This completes an operation.

OPERATIONAL SELECTION UNIT

The operational selection unit consists of two assemblies: a magnet unit and a contact assembly (Figure 1-105). The entire unit is mounted to the powerframe directly beneath the operational interposers.

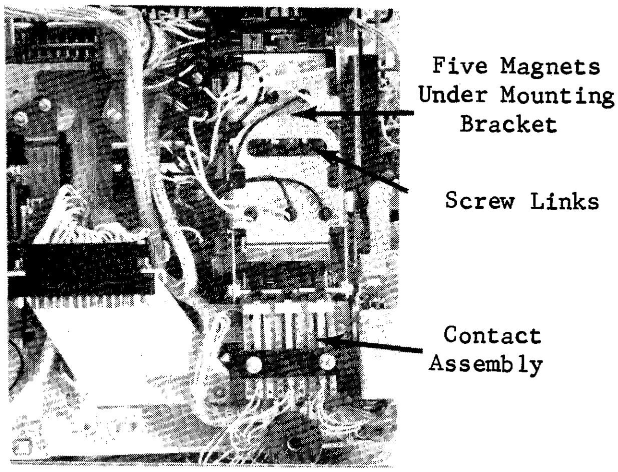


Figure 1-105. Operational Magnet Unit

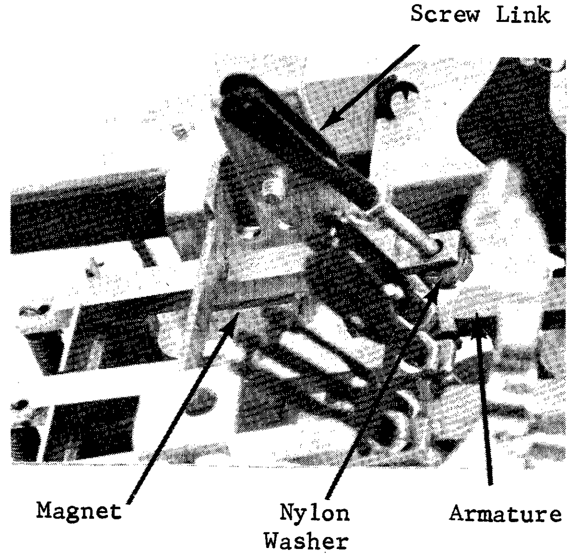


Figure 1-106. Operational Magnet Operation

Magnet Unit

The magnet unit consists of five magnet assemblies--one for each of the operational interposers. The purpose of the magnet unit is to permit selection of an operational function from an external device without depressing a keylever. The magnets are mounted to a bracket on the powerframe. A link, connected to the operating end of the armatures of each magnet (Figure 1-106), is also connected to each of the interposers. Latching a magnet will create a downward pull on the link, tripping the interposer from the guide bracket, and permitting a normal operational sequence. The link is mounted to allow complete movement of the interposer without changing the length of the link.

Contact Assembly

The contact assembly consists of five sets of contacts, each having its own latch (Figure 1-107). Each contact set has three separate contacts that make with three separate contacts. A bail, called the contact bail, (Figure 1-108) holds the contacts open. Two arms, called contact actuating

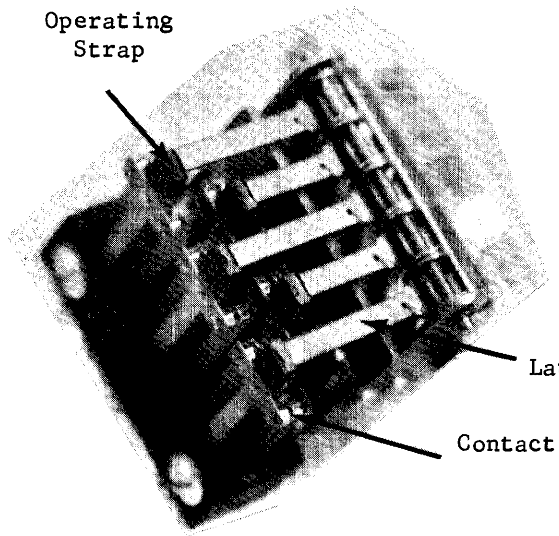


Figure 1-107. Operational Control Assembly

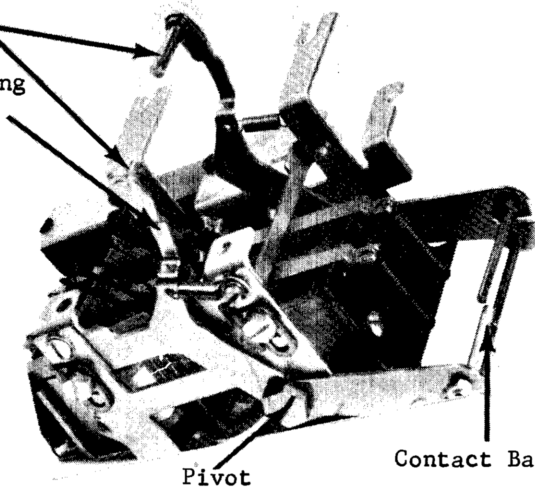


Figure 1-108. Actuating Arm

arms, are operated by the two cam check pawls (Figure 1-109). One arm, called the right hand actuating arm is operated by the carrier return/ index check pawl and controls two sets of contacts. The other arm, called the left hand actuating arm, is operated by the space/backspace/tab check pawl and controls three sets of contacts. A shouldered screw mounts the two arms to either side of the contact assembly. Both arms are shaped in a 90° angle and pivot near the bottom (Figure 1-109). Riveted to the top

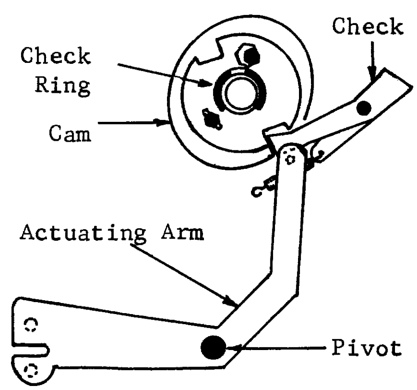


Figure 1-109. Actuating Arm Operated by Check Pawl

of each arm is a pin which is in contact with the bottom of the cam check pawl (Figure 1-108). Two contact bails are mounted to the bottom of each contact arm by means of eccentric nuts which permit adjustment of the bails. As a cam begins to rotate, its check pawl will be forced downward by the surface of the cam check ring. This forces the top of its actuating arm downward, pivoting the bottom up. When this occurs, whichever contacts the arm controls will then be held open by their respective latches except whichever latch was tripped by an interposer. This particular set of contacts will then spring closed. As the cam completes its rotation, the cam check pawl will again seat in a notch in the check ring, allowing the actuator arm to rise, through the action of its extension spring. The bails, on the bottom of the arm,will then drop and hold all contacts, which they control, open.

Contact Latches

The contact latches (Figure 1-110) pivot on a shaft that is mounted to the contact assembly. In the rest position, the lower end of each latch is in the path of the operating straps of the sets of contacts, but not contacting the operating straps. The contact bails hold the operating straps.

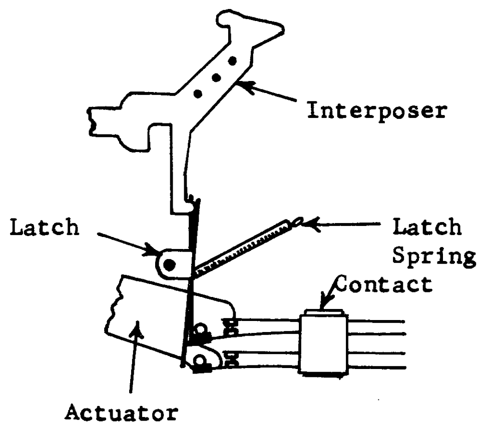


Figure 1-110. Contact Pawl and Latch Operation

This prevents drag when the contact latch is pivoted out of the path of the strap. As an operational key is depressed, releasing an interposer to the rear, a lower extension of the interposer trips the top of the latch to the rear causing the bottom end of the latch to pivot out of the path of the contact strap. As the actuator arm begins to move, the set of contacts, whose latch was pivoted by the interposer, will close. The other contacts operated by that particular actuator arm, however, will then be held open by their respective latches. When the actuator arm fully restores the contacts back to the open position, the bottom of the tripped latch will again seat to the rear in the path of the actuator strap, by means of an extension spring.

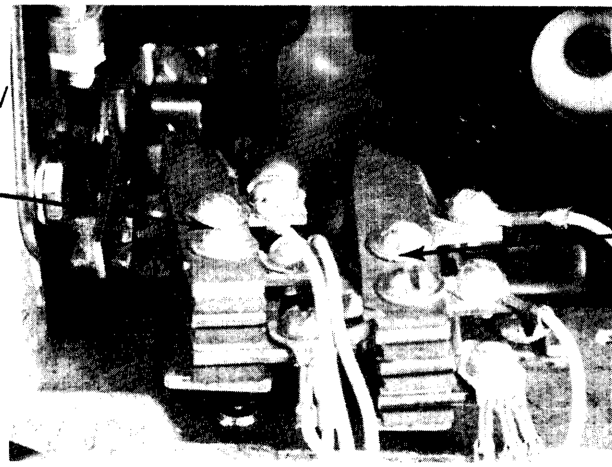


Figure 1-111. Operational Feedback Contacts

Feedback Contacts

The feedback contacts (Figure 1-111) are located at the right rear corner of the powerframe, next to the mainspring. The contact closest to the powerframe is the carrier return/index contact (C-6) and the other is the space/backspace/tab contact (C-5). The C-6 contacts are operated by a tab on the cam follower lever and the C-5 contacts are operated by an auxiliary cam follower lever. As either lever moves down, by rotation of the cam, the contacts will close. Restoring either lever allows the contacts to spring open. The purpose of the feedback contacts is to generate a busy signal to the computer while their cams are rotating.

SPACE BAR

The space bar mechanism allows the carrier to be moved to the right without typing a character. It can be used to space between characters or to move the carrier quickly to the right along the typing line. Space bar operation is identical to a print escapement operation in that the pawls must be tripped out of the escapement and backspace racks. The way the two operations differ is in the method of tripping the escapement trigger from the tab on the torque bar. The space bar, (Figure 1-112) located

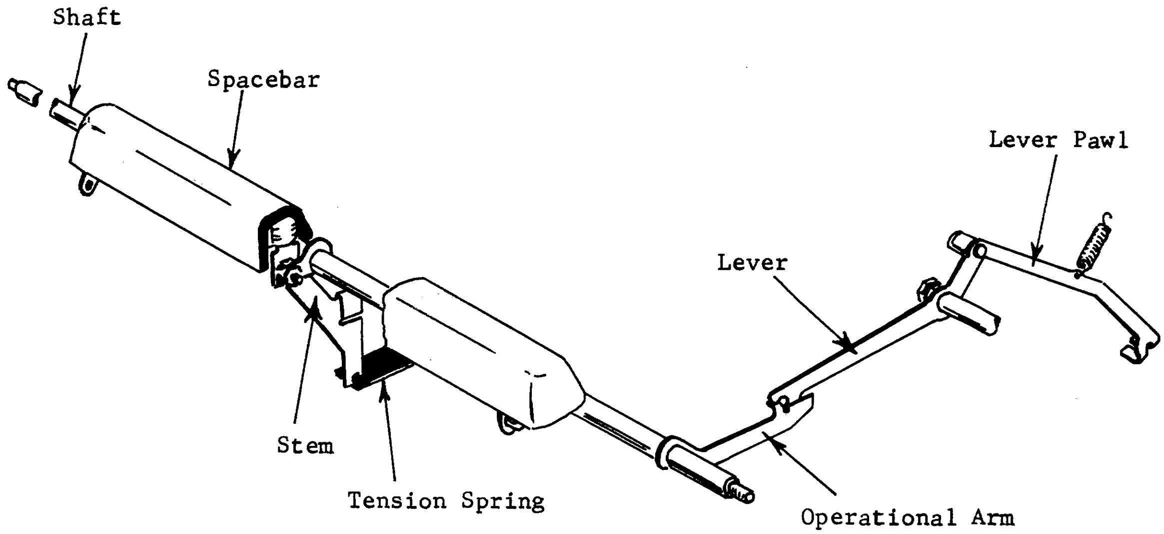


Figure 1-112. Spacebar Lever Mechanism

at the front of the printer, is suspended on two lugs which extend forward from the space bar shaft. The space bar shaft pivots on the left and right frames of the printer. A downward push on the spacebar will cause the space bar shaft to rotate. An extension of the space bar shaft, called the space bar stem, extends downward and contacts the spacebar tension spring (Figure 1-112). The purpose of the spacebar tension spring is to allow the spacebar to restore upward when it is released. Attached to the right end of the spacebar shaft is the spacebar operating arm. Connected to the spacebar operating arm, by means of a forked slot, is the spacebar lever. The spacebar lever pivots on a shaft toward the rear of the printer. At the rear of the spacebar lever is connected the spacebar lever pawl, which rides in the forked slot of the key lever pawl guide bracket. A push downward on the spacebar will cause the space bar operating arm to rise. As the space bar operating arm rises, the back of the spacebar lever will be pivoted downward forcing the spacebar lever pawl downward. This will contact the front of the spacebar interposer tripping it from the guide bracket. As the interposer is spring loaded to the rear, it will push the spacebar latch beneath the cam follower arm allowing the latch to be operated downward by the cam follower arm. The spacebar latch is mounted to a horseshoe-shaped bracket called the spacebar latch lever (Figure 1-113)

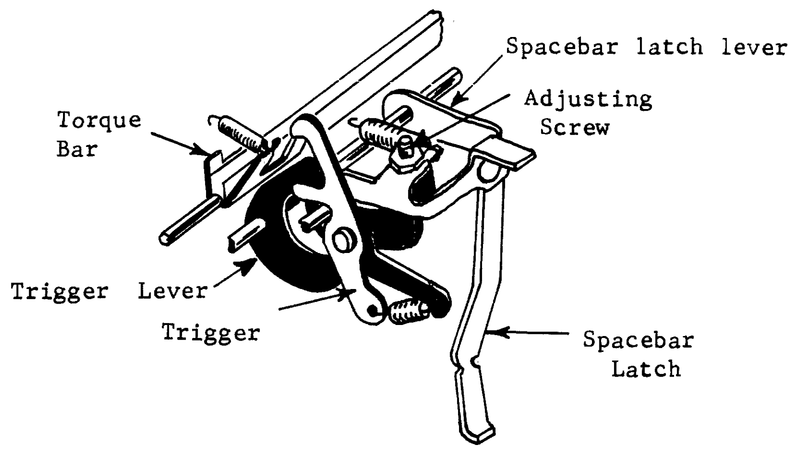


Figure 1-113. Spacebar Latch Operation

by a rivet joint which permits free movement of the latch. The spacebar latch lever pivots on a pin on the operational latch bracket assembly, which is located to the rear of the powerframe, just in front of the main spring. As the latch is operated downward by the cam follower arm, the spacebar latch lever will pivot downward. An adjusting screw, which is located on the spacebar latch lever, will contact the trigger lever causing it to pivot downward. As the trigger lever pivots downward it will force the trigger to cam the torque bar to the rear in the same manner as in the print escapement mechanism. This will unseat the escapement and backspace pawls from their racks and cause an escapement operation to occur.

Spacebar Lockout

Because both the spacebar mechanism and the print escapement mechanism operate by actuating the trigger lever, it is possible to allow but one space to occur. For instance, if a character key lever and the space bar were depressed, one immediately after the other, the trigger lever would be cammed downward by the print escapement mechanism. However, before the trigger could restore to the top of the torque bar lug, the space bar would immediately cam the trigger lever down again but not pull the torque bar down as the trigger would not be above the lug on the torque bar. As a result, no space would occur between words on the print line. In order to insure that the space bar will always actuate an escapement operation the spacebar mechanism must be placed in storage until the print operation is complete. The space bar lockout mechanism (Figure 1-114) is located just below the filter shaft within the operational control bracket. It consists of an interlock interposer, a cam, and a bracket. The cam is mounted on the filter shaft. When the filter shift is in its rest position, an upper

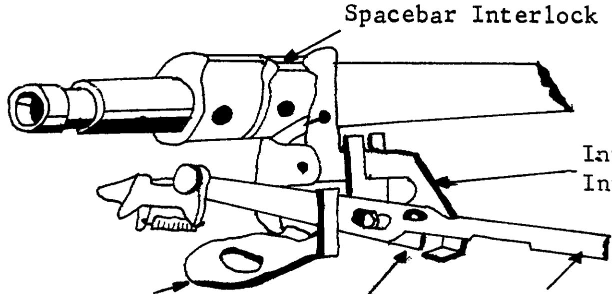


Figure 1-114. Spacebar Lockout

extension of the interlock interposer contacts the high point of the interlock cam. This permits a lower extension of the interlock interposer to just clear the spacebar interposer to allow it to move to the rear during a spacebar operation; however, when a print operation occurs, the filter shaft rotates. As the filter shaft rotates, the spacebar interlock cam rotates, allowing the upper extension of the interlock interposer to be spring-loaded forward far enough for the lower extension of the interlock interposer to swing into the path of the spacebar interposer. At this time, if the spacebar is depressed, the spacebar interposer will contact the lower extension of the interlock interposer and will be prevented from moving to the rear and initiating a spacebar operation. As the filter shaft completes its rotation, the highpoint of the spacebar interlock cam will again force the upper extension of the interlock interposer to the rear, pivoting the lower extension of interlock interposer downward. This releases the spacebar interposer, allowing it to move to the rear and initiate a spacebar operation. Should a character key lever and the spacebar be depressed simultaneously, a collision could occur between the spacebar interposer and the lower extension of the interlock interposer. To prevent parts breakage, the upper extension of the interlock interposer is spring-loaded into its active position but is power driven to the rest position. This is the only instance that the spacebar interposer will not be stored. Only a single space operation will occur.

BACKSPACE

The purpose of the backspace mechanism (Figure 1-115) is to position the carrier to the left one space at a time. Unlike the escapement rack which is anchored solidly to the sideframes of the printer, the backspace rack moves. In the rest position, the escapement pawl is held tightly to the right in the escapement rack by the weight of the carrier. The backspace

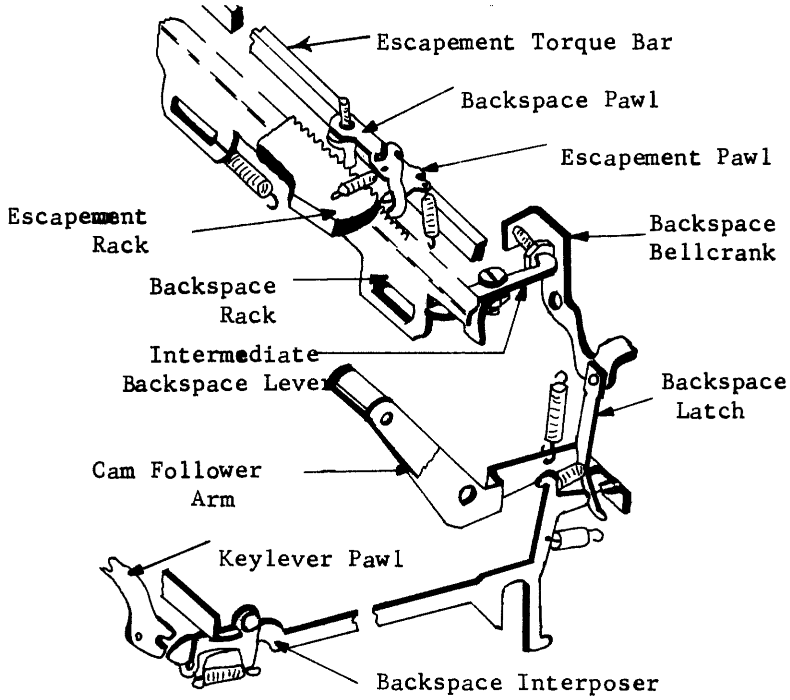


Figure 1-115. Backspace Mechanism

pawl, however, sits freely in the backspace rack. For a backspace operation to occur, the backspace rack must be pushed to the left. As the rack contacts the backspace pawl, the carrier is forced to the left. As the carrier moves to the left, the escapement pawl pivots out of the escapement rack. The pin, which is part of the escapement pawl, and which fits into a slot in the backspace pawl, forces both pawls to move to the left together. At the same time, however, it allows the escapement pawl to pivot out of its rack while leaving the backspace pawl in the backspace rack (Figure 1-116A). As the backspace rack continues to push to the left, the escapement pawl begins to drop into a tooth one notch back in the escapement rack. At the same time, the backspace rack begins to restore to the right. As this occurs the escapement pawl, which has already dropped into a new notch in the escapement rack, prevents the carrier from being pulled to the right. Thus, as the backspace rack continues restoring to the right, the backspace pawl slides out of the

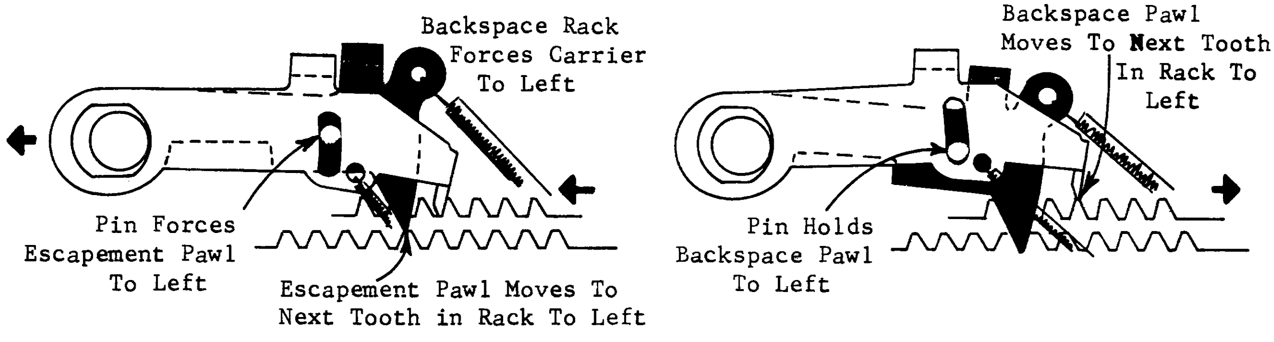


Figure 1-116. Backspace Operation

backspace rack (Figure 116B) and seats into the backspace rack one notch to the left. This is the rest position, the completion of the backspace operation. Depression of the backspace key lever (Figure 1-117) causes the key lever pawl to trip the front of the interposer from the guide bracket.

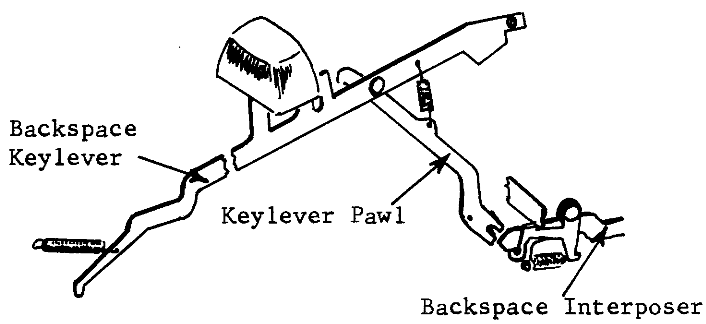


Figure 1-117. Backspace Keylever Mechanism

The interposer then moves to the rear, pushing the backspace latch beneath the cam follower arm. The top of the backspace latch is connected to the backspace bellcrank (Figure 1-115) in such a manner that a pull downward on the latch causes the backspace bellcrank to pivot clockwise. Connected to the backspace bellcrank is an adjustable screw. This screw contacts the intermediate backspace lever, which pivots at the top of the operational latch bracket. As the backspace bellcrank, and the adjustable screw on the bellcrank, force one end of the intermediate backspace lever to the right, the other end of the intermediate lever forces the backspace rack to the left, beginning a backspace operation. The purpose of the adjustable screw on the backspace bellcrank is to obtain the proper throw for the backspace rack. The backspace rack is spring loaded to the right by an extension spring, and as it completes its travel, its extension spring restores the backspace rack and mechanism.

CARRIER RETURN

The carrier return mechanism (Figure 1-118) accomplishes two things: It powers the carrier to the left margin and indexes (line spaces) the paper.

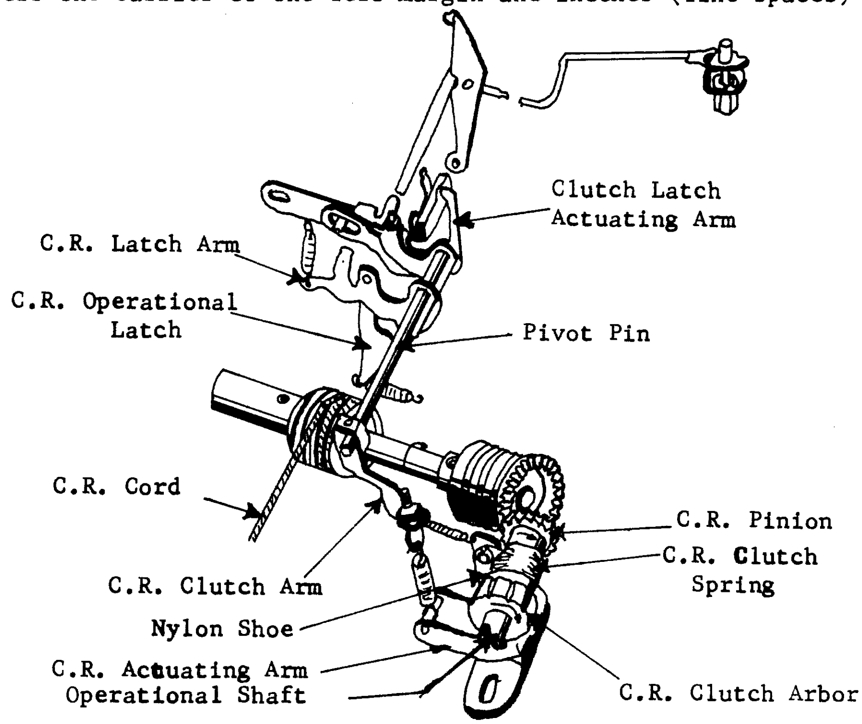


Figure 1-118. Carrier Return Mechanism

The carrier is moved to the left by the carrier return cord which is wound onto the carrier return cord drum as the drum rotates in a clockwise direction.

Rotating the drum clockwise opposes the tension of the mainspring so it must be forced to rotate by the operational shaft. This is accomplished by the beveled gear on the space/tab cord drum. This gear meshes with a small pinion gear (Figure 1-118) on the operational shaft. The pinion gear rotates freely on the operational shaft and is driven by a spring clutch. When the pinion gear is forced to rotate with the operational shaft by means of the spring clutch, it will rotate the space/tab cord drum in a clockwise direction, causing the carrier return drum to wind up the cord. A hub, on the pinion gear, fits inside of the carrier return clutch spring. The left side of the spring fits around, and is clamped tightly to, a hub on the operational shaft. This allows the clutch spring to be in continuous rotation with the operational shaft. If the right end of the spring is pushed against the hub of the pinion gear, the friction developed will cause the spring to wrap around the hub and drive the pinion gear. A nylon shoe, mounted to the rear of the spring, applies the pressure to the spring which forces it to wrap around the pinion hub. Removing the shoe from contact with the spring allows the spring to spring back to its normal position which releases the drive to the pinion gear. The nylon shoe must compress the spring until the carrier is returned to the left margin, at which time the shoe will then release the spring, dropping the drive to the pinion gear.

Depression of the carrier return keylever causes the carrier return interposer to trip the carrier return/index cam and also pushes the carrier return operational latch beneath the cam follower arm. As the cam operates the cam follower arm downward, it also activates the index mechanism, linespacing the paper. The carrier return operational latch is attached to the carrier return latch arm which pivots on a shaft on the operational latch bracket at the right rear of the printer. This same shaft is also the pivot point for the escapement trigger lever and the spacebar latch lever. Attached solidly to the right end of the pivot pin is a bellcrank-type device called the clutch latch actuating arm. As the operational latch is pulled down, an adjusting screw on the right side of the carrier return latch arm forces the rear of the clutch latch actuating arm downward. This causes the following to occur:

1. The escapement torque bar will be rotated to the rear by the top extension of the clutch latch actuating arm. This drives the escapement and backspace pawls from their racks to prevent a ratcheting effect as the carrier moves to the left.

2. The pivot pin, being solidly attached to the clutch latch actuating arm, will rotate toward the rear. The other end of the pivot pin is set-screwed to the carrier return clutch arm, which, in turn, is connected to the carrier return actuating arm by a heavy extension spring. The upward extension of the carrier return actuating arm contains the nylon shoe (Figure 1-120). As the pivot pin rotates to the rear it forces the carrier return clutch arm upward. This, in turn, pulls up on the carrier return actuating arm and causes the nylon shoe to pivot against the carrier return clutch spring, forcing it to drive the pinion gear. The heavy extension spring, being extended somewhat, maintains a constant pressure on the nylon shoe against the clutch spring.

3. The clutch latch actuating arm (Figure 1-119) is locked into position to allow the carrier return operation to continue, even after the cam ceases rotating, until the carrier reaches the left hand margin. At this time the actuating arm is released and the carrier return operation ceases. Attached to the rear of the actuating arm, by means of a slotted hole and eccentric adjusting screw, is the carrier return clutch latch which has an extension to the right. Spring-loaded against this extension of the clutch latch is the carrier return latch keeper, which has a notch in its rear surface. As the rear of the clutch latch actuating arm is pivoted downward, the carrier return clutch latch pivots down far enough to allow the notch in the latch keeper to snap over

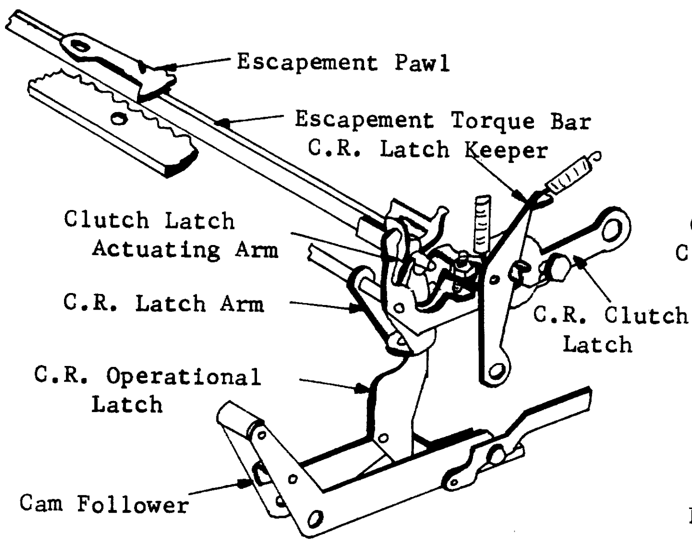


Figure 1-119. Carrier Return Latch Operation

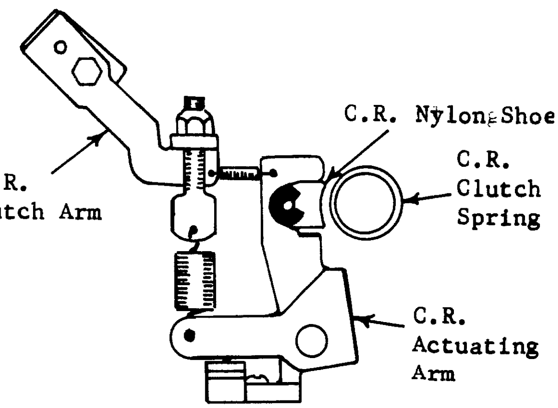


Figure 1-120. Carrier Return Clutch Actuating Mechanism

the extension. This locks the actuating arm downward. Attached to the carrier return latch keeper is a link which extends toward the front of the printer and connects to the carrier return unlatching bellcrank, located on the right side of the margin rack (Figure 1-121).

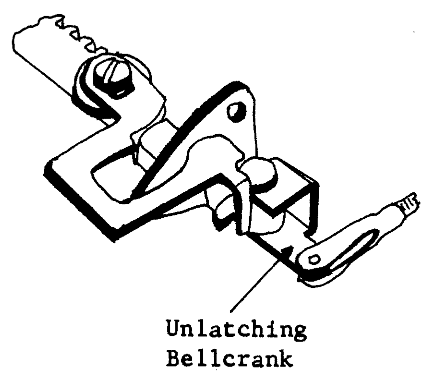


Figure 1-121. Carrier Return Unlatching Bellcrank

The margin rack is located in front of the carrier and is mounted between the sideframes. The left end of the margin rack is spring-loaded to the right in the rest position. As the carrier strikes the left margin stop, the margin rack is forced to the left. An adjustable horse-shoe shaped right hand extension of the rack contacts an arm of the carrier return unlatching bellcrank causing it to pivot forward. This exerts a pull on the unlatching link which pulls the latch keeper far enough forward to allow the carrier return clutch latch to restore upward. This restores the rest of the carrier return mechanism. A small extension spring then pulls the nylon shoe to the rear, in the rest position, away from the clutch spring. If the carrier return keylever is depressed while the carrier is in the midst of another carrier return operation, only an indexing operation will occur.

Depressing the carrier return keylever while the carrier is at the left margin will not allow the clutch to latch as the latch keeper will be pulled forward by its link. However, the cam will still rotate, causing a carrier return operation to begin. But, with the carrier at the left margin, the cord drum cannot take up any more cord although the pinion gear trys to drive it. Slippage must be allowed to occur in the clutch mechanism to prevent parts breakage. This is accomplished by the torque limiter spring (Figure 1-122).

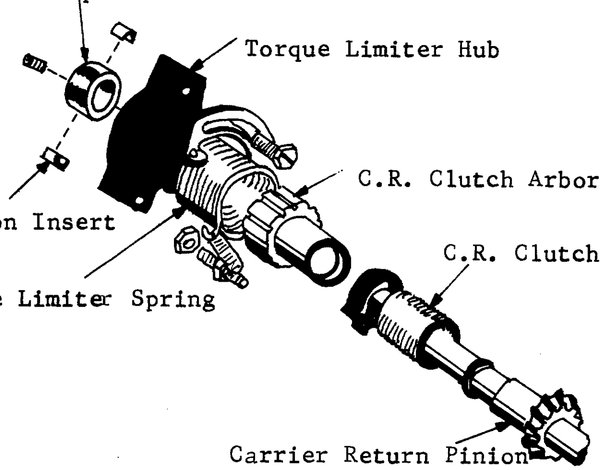


Figure 1-122. Torque Limiter - Exploded View

The carrier return clutch arbor, to which the carrier return clutch spring is tightly fastened by a collar, is not directly driven by the operational shaft. The arbor shoulder fits into a heavy spring called the torque limiter spring. The left end of the spring is clamped to the torque limiter hub which is set-screwed to the operational shaft. The inside diameter of the torque limiter spring is considerably smaller than the clutch arbor and drives the clutch arbor. Even though the rotation of the operational shaft is in the unwinding direction of the spring, enough friction is developed between the spring and the arbor to drive the arbor. However, unwanted slippage can still occur, with this arrangement so an extension spring is connected from an eye hole in the right end of the torque limiter spring to a lug on the torque limiter hub. This prevents any slippage from occurring during normal operation.

When the pinion gear can no longer drive the cord drum, due to the carrier being at the left margin, the clutch arbor is also prevented from rotating and the torque limiter spring will then slip around the clutch arbor. This slippage will also occur at the beginning of a carrier return operation to allow smooth acceleration and prevent a jerky start.

Carrier Return Contacts

Two types of contacts are located in the carrier return mechanism. One type is the feedback contacts (C-6) which were discussed earlier. The second type of contact is an interlock contact (Figure 1-123) which prevents the printer from being outputted to by an external device while in the midst of a carrier return operation. The carrier return interlock contact is mounted to the right side of the powerframe and is operated by the carrier return clutch latch. As the clutch latch is forced downward by the clutch latch actuating arm, it transfers the interlock contacts which will stay transferred until the keeper unlatches the clutch latch at which time the contacts will return to their rest position.

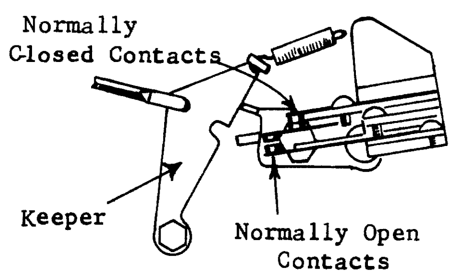


Figure 1-123. Carrier Return Interlock Contacts

INDEXING

The purpose of the indexing mechanism (Figure 1-124) is to line space the paper vertically one or two spaces depending upon the position of the index selector lever. Indexing will occur whenever the carrier return or indexing operational buttons are depressed. A ratchet is attached solidly to the right side of the platen. Indexing is accomplished by moving this ratchet by means of the indexing pawl. As either the carrier return or indexing buttons are depressed the carrier return/indexing cam will begin to rotate. As it rotates, the rear of the cam follower arm will be forced downward causing a downward pull on the index link which is connected to the rear of the cam follower arm. Regardless of whether the indexing operation is set for single or double space, the downward travel of the indexing link will always be the same. The top of the index link is connected to a bellcrank type device called the index pawl carrier which pivots on a pin at the right side of the powerframe. Attached to the other side of the index pawl carrier, by means of a rivet joint connection, is the index pawl. This arrangement allows free movement of the indexing pawl as compared to the index pawl carrier. If the indexing link is to move the same distance for single space operation as for a double space, then the indexing pawl must be allowed to enter the ratchet sooner on a double space operation than on a single space operation. This is controlled by the line

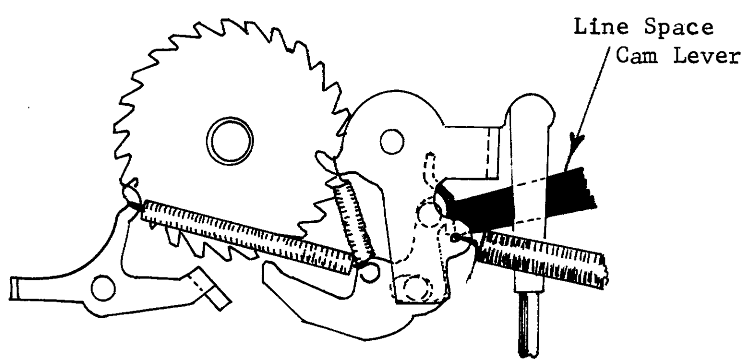


Figure 1-124. Index Mechanism Rest Position

space cam lever which is controlled by the index selector lever. Sufficient pull is exerted on the indexing link to always cause a double space operation. To perform a double space operation the indexing pawl is allowed to immediately enter the ratchet. As the link is pulled downward, the ratchet will be cammed forward by the pawl until the pawl contacts the platen overthrow stop (Figure 1-125). At this time the ratchet will not be allowed to rotate further as it will have rotated two notches. For a single space operation the pawl is restricted from immediately entering the ratchet and will first pass over one ratchet tooth. It will then enter the ratchet, driving the ratchet until the pawl contacts the platen overthrow stop. At this time the ratchet will stop rotating. A stud at the side of the index pawl contacts one of two steps on the forward end of the cam lever. With the index selector lever forward, in the single space position, the upper step of the line space cam lever

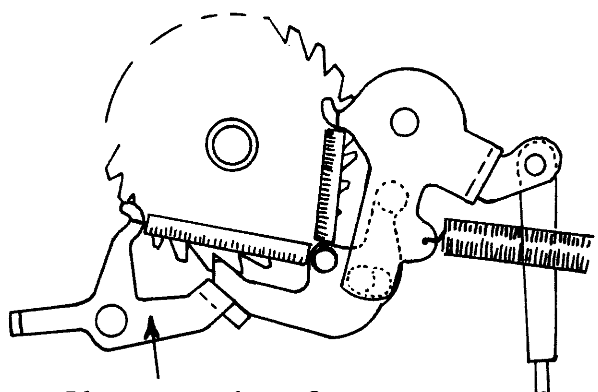
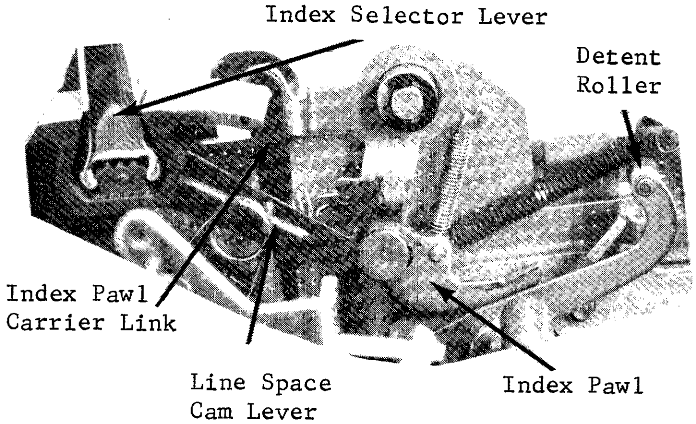
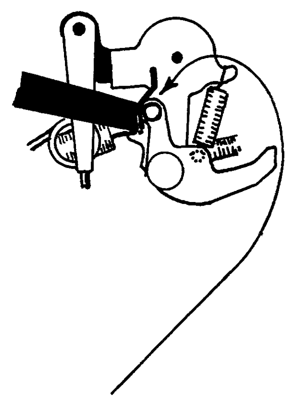


Figure 1-125. Index Mechanism-Active Position

(Figure 1-126) contacts the extension of the index pawl. This forces the index pawl to rest some distance from the ratchet. As the index link is pulled downward the index pawl will drive the distance of one ratchet tooth before entering the ratchet. It then drives one more ratchet tooth performing a single line space operation.



A. Single Space Position
Figure 1-126



B. Double Space Position
Figure 1-127

Index Selection Mechanism

When the index selector lever is pushed to the rear the stud on the index pawl contacts the lower step on the line space cam lever (Figure 1-127). This will hold the tip of the index pawl very close to the platen ratchet. When the index link is pulled downward the pawl will immediately enter the platen ratchet and drive two spaces. A hairpin-type spring (Figure 1-126) holds the index selection lever in the single or double space position. Two lower extensions of the selection lever limit the travel of the lever to one of two positions as they will contact a stud on which the hairpin spring is mounted. The purpose of the platen overthrow stop,(Figure 1-126) which is mounted securely to the sideframe of the printer, is to prevent the platen from overthrowing farther than the one or two space positions. As the index pawl rotates the ratchet the pawl contacts the overthrow stop which wedges the pawl into the ratchet tooth forcing the ratchet to stop moving. Operation of the indexing mechanism occurs upon depression of the indexing key lever. The key lever pawl, which is spring-loaded to the index key lever, rides in the slot of the guide bracket. As the indexing button is depressed the key lever pawl is forced downward, tripping the indexing interposer from the guide bracket and allowing it to initiate an indexing operation. A spring attached from the indexing pawl to the platen overthrow stop spring loads the index pawl toward the platen. As the indexing link begins its downward movement, it actually tends to kick the platen ratchet, accelerating it. The spring will allow the pawl to catch up to the ratchet so that they both reach the platen overthrow stop at the same time and the ratchet is prevented from moving any further.

The platen is held firmly in place and kept from creeping by the index detent lever which is located just below the platen. Mounted to the front end of the detent lever is a roller which is spring-loaded into the teeth of the ratchet by an extension spring at the rear of the detent lever. As the ratchet rotates, the roller moves from one tooth to the next. This insures even spacing at all times.

TABULATOR

The purpose of the tabulator mechanism is to quickly position the carrier to the right along the writing line. The space/tab/backspace cam powers the tab operation. Several things occur during a tab operation:

a. A preset stopping point
b. Escapement and backspace pawls are released
c. Escapement and backspace pawls are held latched
d. Speed of carrier is controlled
e. Restoration of pawls to their racks at correct time

Tab Set and Clear

The tab rack (Figure 1-128), located just to the rear of the carrier, contains tab stops--one for each escapement position of the carrier.

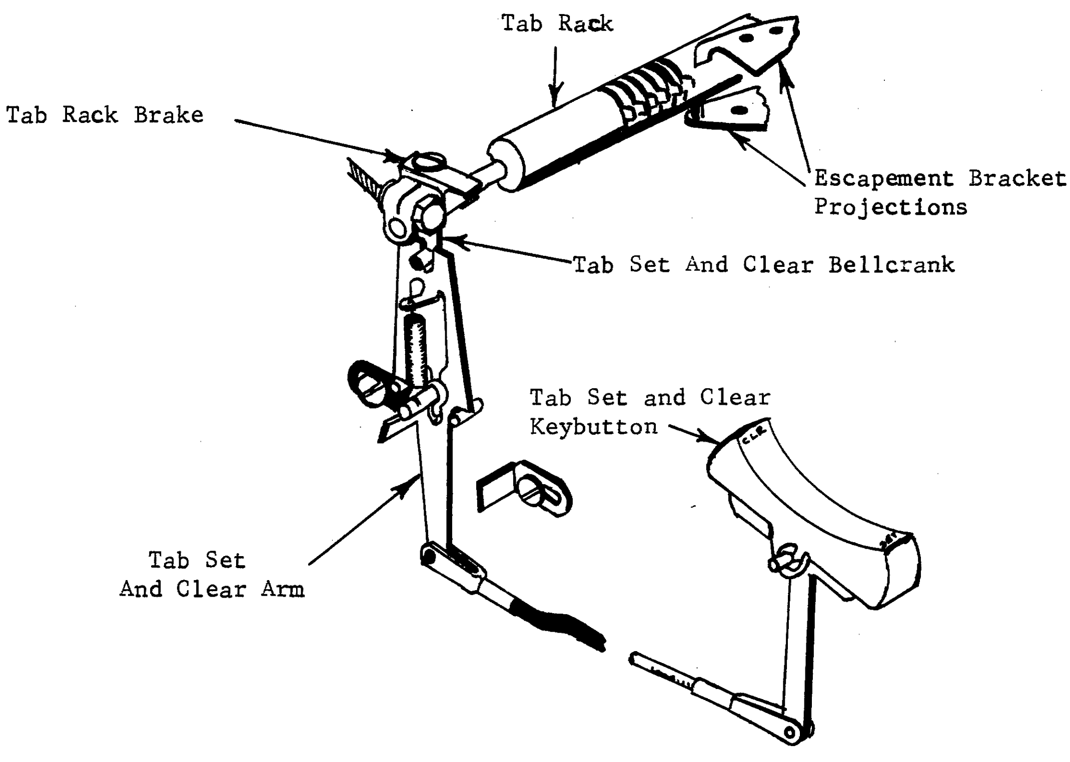
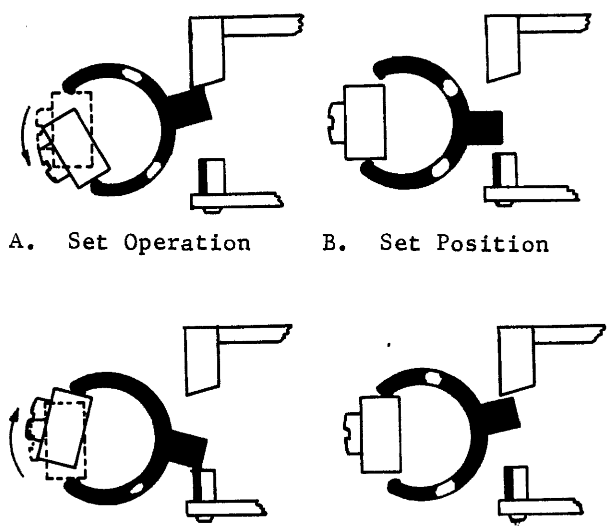


Figure 1-128. Tab Set and Clear Mechanism

These tab stops operate friction tight in grooves of the tab rack. Depressing the tab keylever allows the carrier to move to the right until it contacts a set tab stop at which time the carrier stops. To set or to clear a tab stop is the function of the tab set/clear button on the left of the keyboard. Depressing the set portion of the button causes the front of the tab rack to rotate upward (Figure 1-129A). As this



A. Set Operation B. Set Position

C. Clear Operation D. Clear Position

Figure 1-129. Tab Set and Clear Operation

occurs, one of the tab stops contacts an upper projection of the escapement bracket. The tab stop is then prevented from rotating with the tab rack and is forced downward in the tab rack. When the set button is released, the tab rack rotates back to its rest position leaving the tab stop lower than the other stops and in a position to be contacted by the carrier on a tab operation (Figure 1-129B). Depressing the tab clear keybutton rotates the front of the tab rack downward. The set tab stop, which is lower than the other stops, contacts a lower projection of the escapement bracket and is prevented from rotating with the tab rack. The tab stop then is forced upward in the tab rack (Figure 1-129C). When the clear button is released, the tab stop is in the cleared position (Figure 1-129D). To set or clear a tab stop, the carrier must be in position as it is projections from the carrier which cause the operation to occur. A tab stop, which remains set at all times, is located at the far right of the tab rack and is the tab final stop. This disengages the tab operation when the carrier has reached the limit of its travel to the right.

Gang Clear

The function of the gang clear is to clear all of the tab stops in one operation. This is accomplished by positioning the carrier to the far right, depressing and holding the clear button, and performing a carrier return operation or manually moving the carrier to the left.

This gang clear operation calls for a slightly different tab rack and a "gang clear finger". The tab stops operate freely about a shaft which runs through the tab rack and each stop rides in a slot of the tab rack. Sections of spring fingers (Figure 1-130) are mounted to the entire length of the tab rack and operate against upper projections of each tab stop. The purpose of the spring fingers is to hold the tab stops detented in a set or clear position. The projection of the gang clear finger extends to just below the projections of the tab stops (Figure 1-130). A set

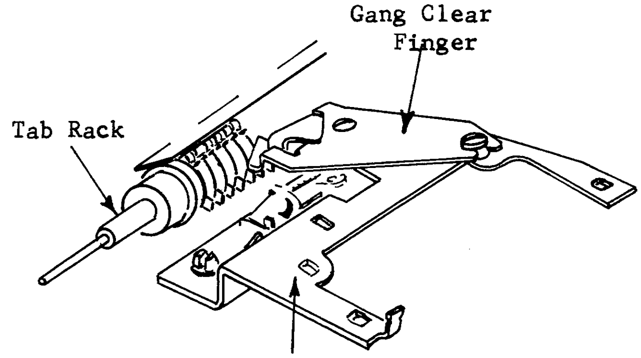


Figure 1-130. Gang Clear Finger

operation operates in the same manner as described above in that a tab stop will contact an upper projection of the escapement bracket and be prevented from rotating upward with the tab rack (Figure 1-131A & 1-131B). When the clear button is depressed, the front of the tab rack rotates downward and the set tab stop contacts the gang clear finger and is prevented from rotating farther. As the tab rack still rotates, the tab stop is then pushed into the rest position (Figure 1-131C & 1-131D).

During a gang clear operation, the tab rack is held rotated in the clear position. As the carrier is moved to the left, the left side of the gang clear finger, which is beveled, contacts the projections of the set tab stops and cams them upward, into the rest position.

An extention spring on the tab set and clear arm restores the tab rack to the rest position from either a set or clear operation. A leaf spring, at the left end of the tab rack, applies a braking action to the tab rack to prevent its overthrowing the rest position and either partially setting or clearing a tab stop.

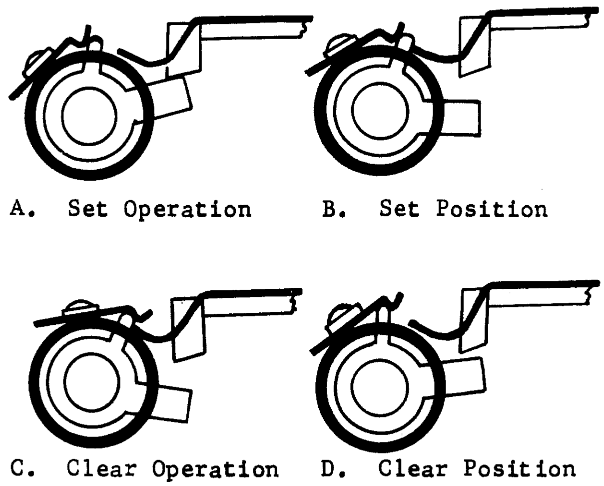


Figure 1-131. Tab Set And Clear -- Gang Clear

Keylever and Release Assembly

The tab keylever, located on the left of the keyboard, operates a bail which extends across the front of the printer (Figure 1-132). A keylever

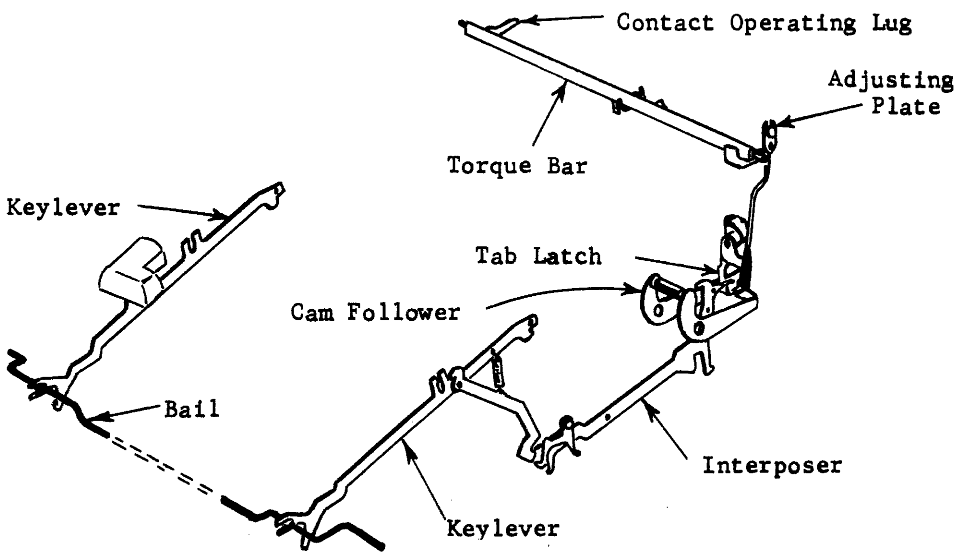


Figure 1-132. Tab Operational Mechanism

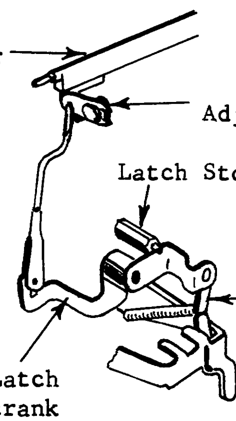


Figure 1-133. Tab Latch

on the right actuates the tab interposer which releases the space/tab/backspace cam and pushes the tab latch beneath the cam follower arm. The upper end of the tab operational latch is connected to a bellcrank and as the operational latch is pulled downward by the cam follower, the other end of the bellcrank moves up. A link is connected from this end of the bellcrank to an adjusting plate on the right end of the tab torque bar (Figure 1-133). As the link is pushed upward by the bellcrank the bottom of the tab torque bar is rotated to rhe rear, tripping the escapement and backspace pawls from their racks. The tab torque bar is mounted the same as the escapement torque bar although higher with its pivot point at the top.

Tab Latching

As the tab torque bar pivots to the rear it contacts the tab lever trigger (Figure 1-134) which moves the tab lever to the rear. The tab lever pivots on the escapement bracket on the same pivot pin as do the escapement and backspace pawls. As the tab lever is pivoted toward the rear, a lug on the front contacts the escapement and backspace pawls and trips them from their racks. A small latch, the tab-lever latch, pivots on the

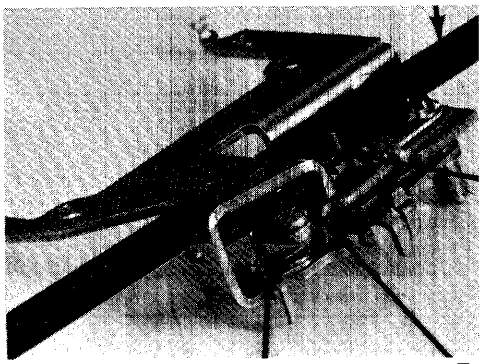


Figure 1-134. Tab Lever Trigger

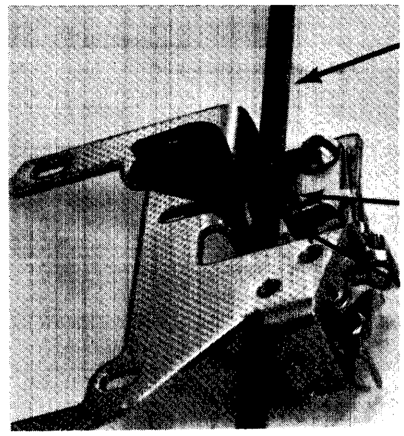


Figure 1-135. Tab Overthrow Stop

escapement bracket and is spring-loaded against the side of the tab lever assembly. As the tab lever is pushed for enough to the rear to trip the escapement and backspace pawls, the tab lever latch springs into a notch at the rear of the tab lever assembly and locks the tab lever assembly, along with the pawls, to the rear. The carrier is then free to move to the right.

Overthrow Stop

The tab overthrow stop (Figure 1-135) is mounted on the top of the escapement bracket and extends to the rear and down behind the tab lever trigger. The stop is adjustable and prevents the tab lever from over-throwing into the tab rack.

Tab Governor

The purpose of the tab governor is to regulate the speed of the carrier during a tab operation. Excessive speed can cause a noisy operation, an inaccurate tab or even parts breakage due to excessive shock or vibration on components.

The pinion gear on the right side of the escapement cord drum meshes with the drum (Figure 1-136). The pinion gear rides freely between two collars, both of which are set-screwed to the operational shaft. A clutch spring encloses, on the left, a hub of the left collar and, on the right, a hub of the pinion gear. The pinion gear rotates freely on the operational shaft. When the pinion is held stationary while the operational shaft turns, the spring will slip around the hub of the pinion.

During a tab operation, the mainspring tension will force the escapement cord drum to rotate counterclockwise causing the pinion gear to rotate in the same direction as the operational shaft. The pinion gear, due to

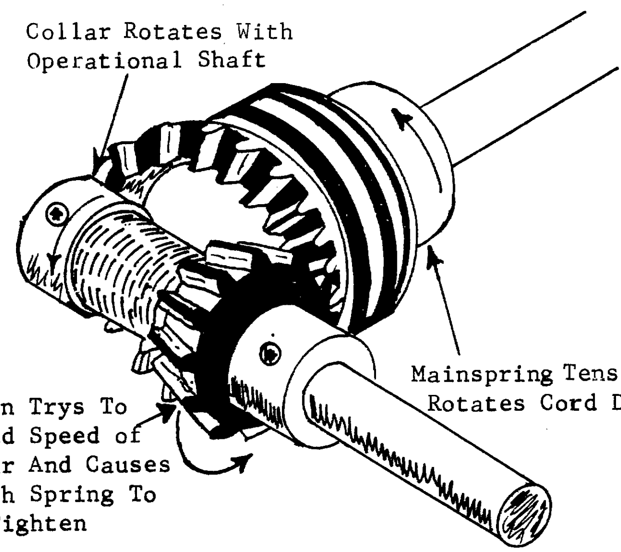


Figure 1-136. Tab Governor Mechanism

the mainspring tension, begins to rotate faster than the operational shaft. When this occurs, friction causes the clutch spring to tighten about the two hubs. The mainspring then trys to accelerate the operational shaft but cannot because of drag in the system. This forces the pinion to be slowed and driven at the same speed as the motor. Slowing the pinion forces the cord drum to slow down in its taking up of cord and, thus, the carrier will travel at the speed of the operational shaft.

The tab governor pinion gear, being the same size as the carrier return pinion gear, makes the speed of a tab operation the same as that of a carrier return operation.

Tab Unlatching

When the carrier reaches a set tab stop, the escapement pawl must be immediately allowed to re-enter its rack to stop the carrier. An elongated hole in the pivot end of the tab lever allows it to move left and right, the same as the escapement and backspace pawls. The tab lever is also spring loaded to the right. As the carrier moves to the right (Figure 1-137A) the tip of the tab lever, called the tab lever pawl, contacts the tab stop, preventing the tab lever from moving any farther. The carrier, however, continues to move. As the escapement pawl also continues to move, a slot in the pawl allows it to drop off of the lug on the tab lever and restore into the escapement rack (Figure 1-137B). Further carrier movement frees the tab lever latch from the notch in the tab lever pawl. The tab lever then restores and allows the backspace pawl to restore (Figure 1-137C).

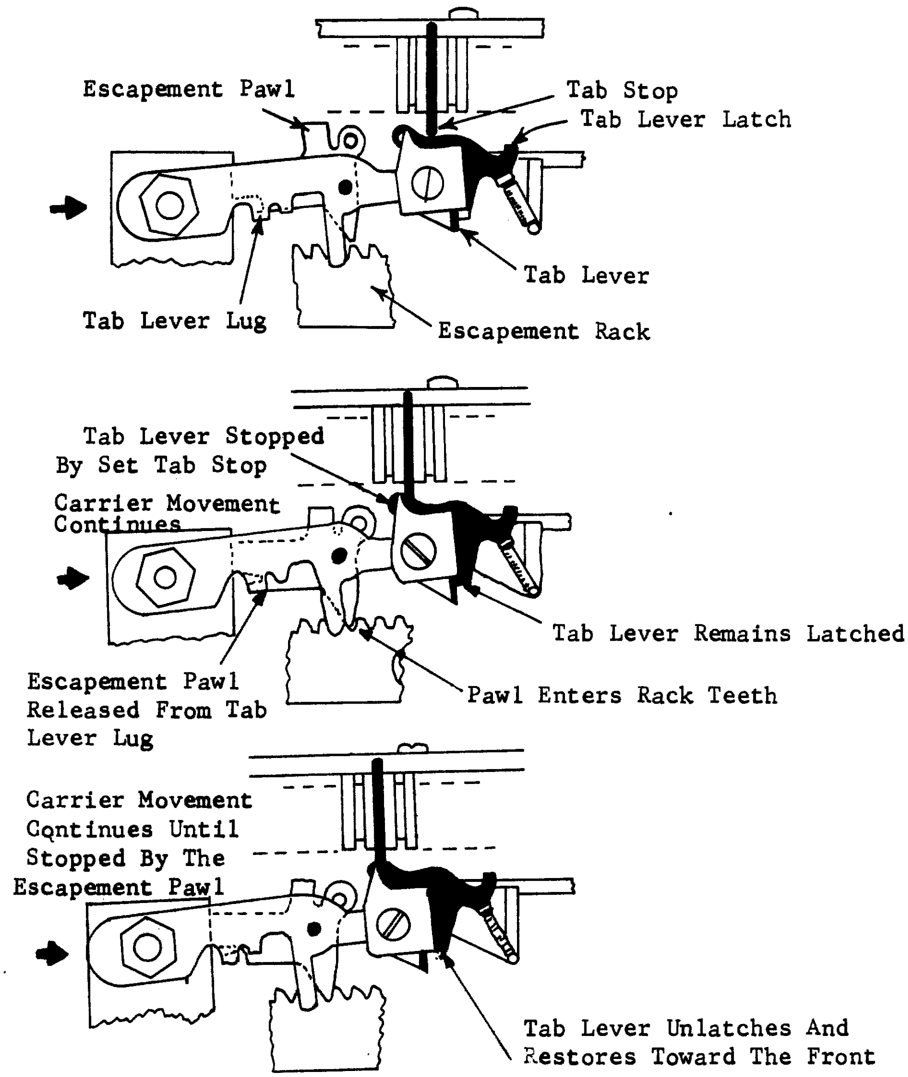
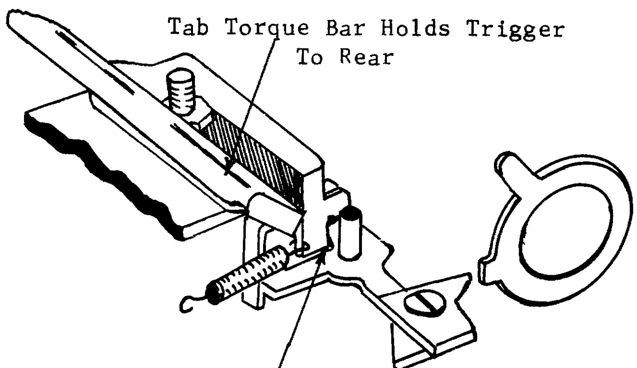


Figure 1-137. Tab Unlatched Operation

The escapement pawl must restore before the backspace pawl or it would be possible for the carrier to be off by one-half space due to the position of the backspace rack in relation to the escapement rack.

As the tab latch releases the tab lever, the tab lever trigger (which also moves with the carrier) moves in front of a notch in the tab lever (Figure 1-138) and allows the tab lever to restore forward by its extension spring and that of the back space pawl. As the tab trigger begins to restore and the tab lever is snapped to the right by its extension spring into position for a new operation, the lug on the tab lever resets in front of the escapement pawl. The trigger is prevented from resting against the tab torque bar by a lug at the rear of the trigger which rests against the tab lever. The tab lever must be properly positioned to prevent escapement and/or backspace problems.



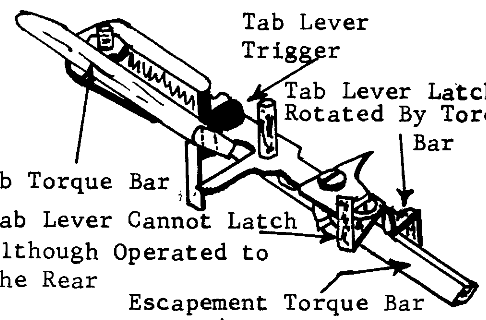


Figure 1-138. Tab Lever Trigger Operation

Figure 1-139. Carrier Return Tab Interlock

Tab Interlock

A lug on the rear of the tab lever latch prevents the tab lever from latching during a carrier return operation, thus, preventing a tab (Figure 1-139). If the tab were not locked out during a carrier return operation, the tab lever pawl would jam against a set tab stop and lock the carrier. During a carrier return operation, the lug on the tab lever latch is contacted by the escapement torque bar and pivoted to the rear, preventing the latch from latching behind the tab lever pawl.

Tab Contacts

Three types of contacts are used in a tab operation. The first two, C5 and transmitting were covered previously. The third is the tab interlock contact which stays made until the tab operation is complete.

Tab Interlock Contact

The tab interlock contact is mounted inside the left rear of the powerframe by a bracket. An extension of the left rear of the torque bar, called the tab arm, sits below a formed lip on the trigger lever of the switch (Figure 1-140). As the torque bar rotates to the rear it pulls up on the trigger lever. Further rotation of the torque bar causes the trigger lever to cam off of the tab arm but it will still contact the rear of the tab arm, holding it to the rear. This forces the actuating lever to the rear transferring the contact. When the tab lever restores, the torque bar is allowed to restore, permitting the trigger lever to snap forward, over the tab arm, by the tension of its extension spring. The actuating lever then moves forward allowing the contact to re-transfer.

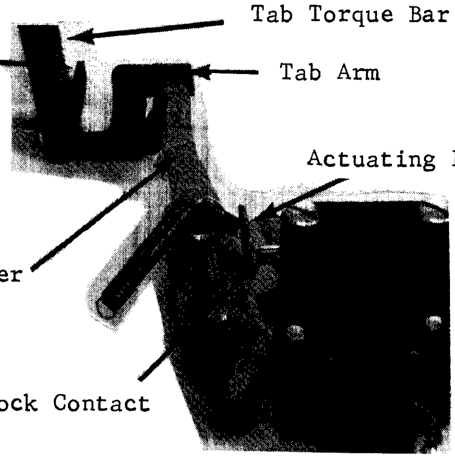


Figure 1-140. Tab Interlock

This is called a positive action interlock in that the contact will transfer when upward or rearward motion is applied to the trigger lever.

MARGIN CONTROL

Margin is the distance between the printed material and the edges of the paper and is controlled by the positioning of the margin stops along the margin rack. The margin stops restrict the travel of the carrier - the left margin stop directly restricts the carrier travel and the right margin stop, indirectly.

Margin Stops

The margin stops (Figure 1-141) are located on the margin rack, which is located at the front of the printer and connects to the two side frames. A slider and pin assembly on each of the two margin stops mesh with teeth in the rear of the margin rack. Attached to each slider and pin assembly is a lever which extends forward through a slot in the front case to allow easy accessibility. A small extension spring from the margin lever to the margin stop spring loads the lever forward, engaging the slider and pin assembly in the teeth of the margin rack. Either stop can be repositioned by pushing the lever toward the rear and sliding the entire stop assembly left or right along the margin rack. Releasing the lever allows the pin to reseat in the rack, locking the margin stop. A scribe line on the front of the lever indicates the position of the margin stop in relation to a scale on the front cover of the printer. A pointer, on the carrier, indicates the position of the carrier.

An extension of the left margin stop is contacted by the margin stop latch which is located on the front lower portion of the carrier. This prevents the carrier from moving any farther to the left and causes the unlatching of the carrier return mechanism.

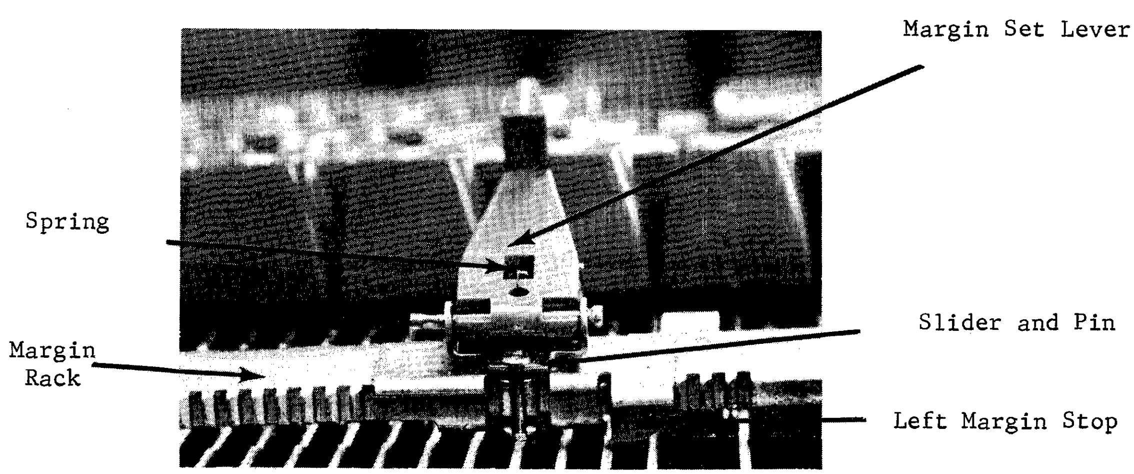


Figure 1-141. Left Margin Mechanism

Line Lock

Preventing the carrier from printing past the right hand margin is the function of the line lock mechanism which is covered in the Keyboard Lock section.

Bell

The bell is located at the left side of the printer and is rung by the bell clapper which is attached to a bellcrank (figure 1-142). The bell clapper bellcrank lever is attached to, and operated by, the bell ringer bail. As the carrier contacts the right margin stop, the bellringer bell crank (Figure 1-142) forces the bellringer bail forward. This pivots the bell clapper bellcrank lever downward against the bell clapper bellcrank. As the bellcrank is pivoted downward, the bell clapper and an extension arm are forced away from the bell. Further rotation of the bell clapper bell-crank lever causes it to slip off of the bellcrank. When this occurs, the bell clapper and the extension arm are spring loaded downward by an extension spring. The extension arm strikes the bell mounting stud causing the bellcrank to stop suddenly but momentum allows the bell clapper to strike the bell once. Allowing the bell ringer bail to restore causes the bell clapper bellcrank lever to restore above the bellcrank.

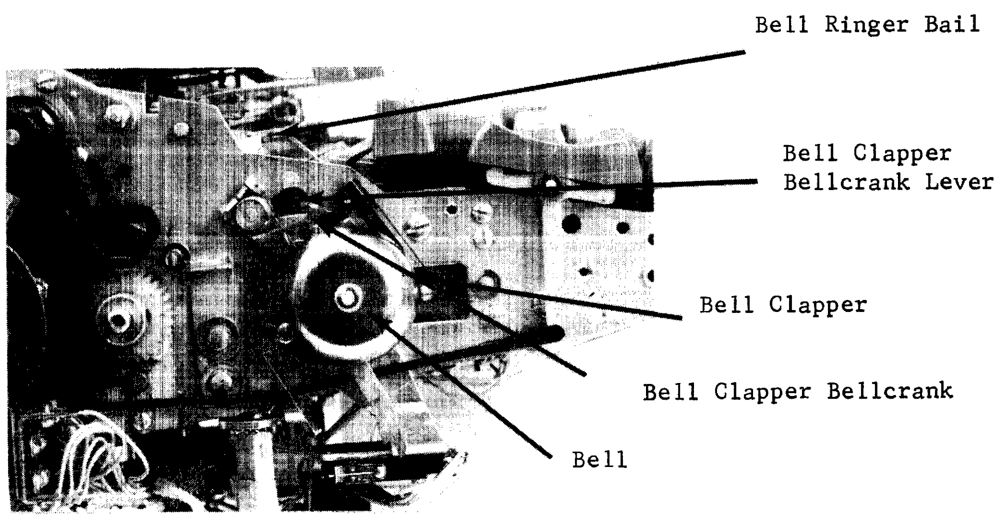


Figure 1-142. Bell Ringer Mechanism

Margin Release

The margin release keylever is located on the left of the keyboard and is attached to the margin rack (Figure 1-143). Its purpose is to allow printing on either margin without moving the margin stops. This is accomplished by rotating the margin rack to pivot the stops up and out of the path of the line lock bracket on the carrier. A stud in the rear of the keylever rides in a slot of the margin release lever (Figure 1-143). Depressing the keylever pivots the rear of the margin rack upward, which pivots the rear of the margin stops upward. A lug on the left end of the margin rack, called the final margin stop (Figure 1-143), remains in the path of the carrier in the event that the carrier return is operated while the margin release keylever is held depressed.

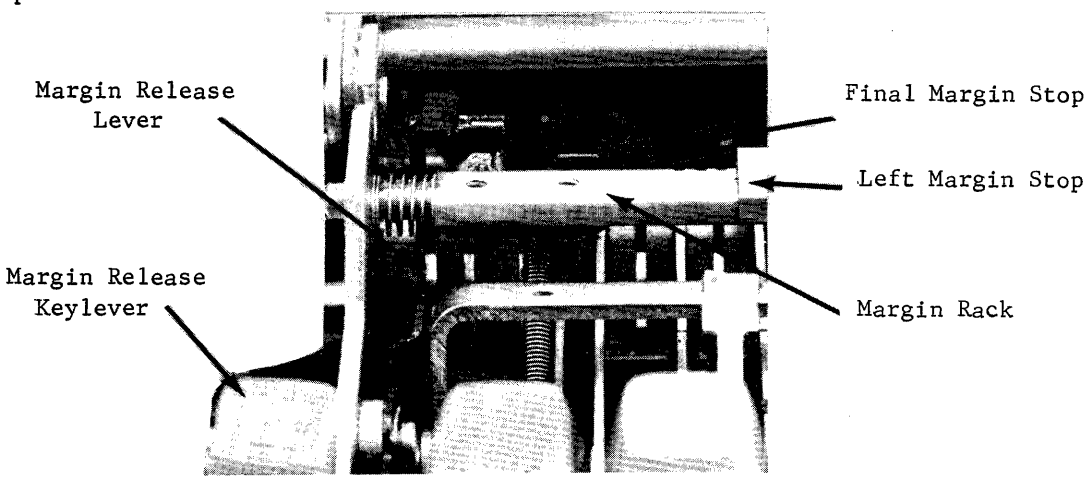


Figure 1-143. Margin Release Keylever

Last Column Contact

The last column contact (Figure 1-144) is located at the left side of the printer. Its purpose is to generate a signal to the computer upon the carrier reaching the right margin stop. An arm, called the contact actuator arm (Figure 1-144) is set-screwed to the left end of the bell-ringer bail. As the bail is pivoted forward by the bellringer bellcrank, the acutator arm pivots backward, operating the contact.

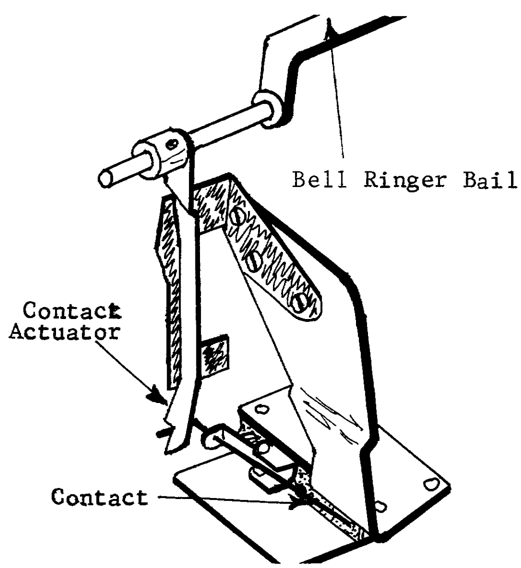


Figure 1-144. Last Column Contact

PAPER FEED AND RELEASE MECHANISM

The paper feed mechanism (Figure 1-145) controls the position of the paper both vertically and horizontally and feeds the paper vertically. Paper feed is accomplished by the front and rear feed rolls which press the paper tightly against the platen so that the paper must move with the platen when an indexing operation or manual turning of the platen occurs. Both feed rolls (the rear is larger) contain four rubber rollers spaced equally apart and molded to their roller shafts.

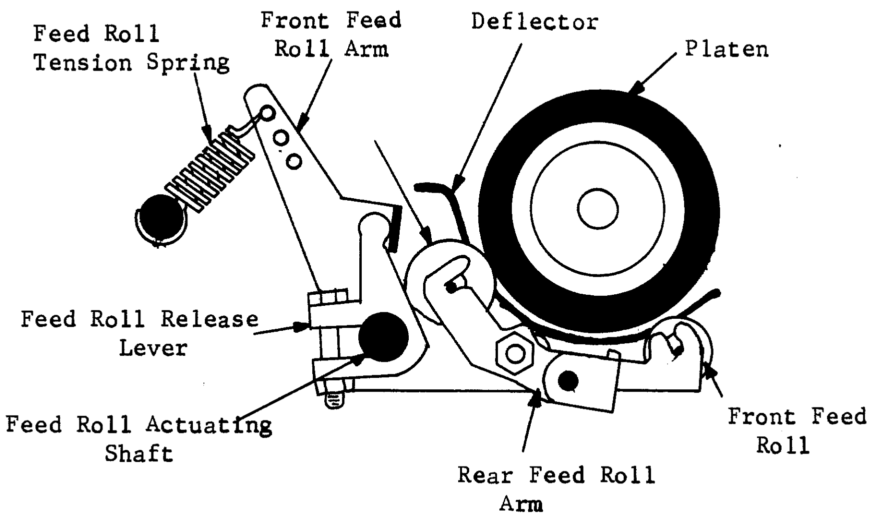


Figure 1-145. Paper Feed Mechanism

The front feed roll shaft is supported by two notches in the front feed roll arms (Figure 1-146). The front feed roll arms pivot on the feed roll actuating shaft. Pressure of the front feed roll against the platen is supplied by two heavy extension springs which connect from one of several holes in both of the front feed roll arms to the carriage tie rod. The holes provide a means of varying the pressure.

The rear feed roll shaft is supported by two notches in the rear feed roll arms which pivot on studs at the front of the paper feed mounting arms which extend forward from the carriage tie rod. The front and rear feed roll arms are connected, at each side, by a shoulder screw. This arrangement allows the front feed roll arm extension springs to also supply pressure to the rear feed roll against the platen.

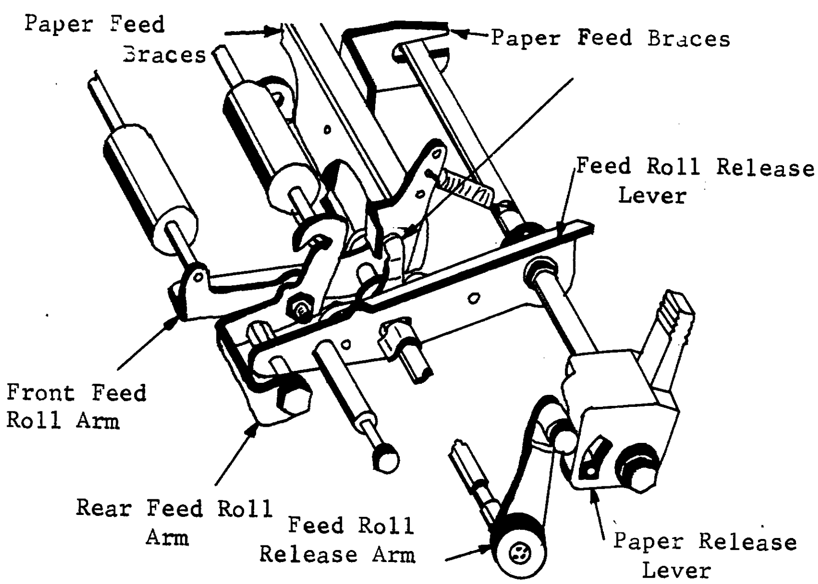


Figure 1-146. Paper Release Mechanism

The paper deflector (Figure 1-145), which is situated between the platen and the feed rolls, guides the paper around the platen. It is supported by the feed rolls. A slotted lug at each end of the paper deflector fits over a stud on the paper feed mounting arm. An adjustable guide, mounted at the left rear of the platen, on the case, positions the paper for the correct left margin. The line gage card holder, attached to the top, rear, of the carrier assists in holding the paper against the platen in the typing zone. It is scaled and each mark represents the middle of a typed character space. The horizontal edge of the card holder marks the bottom of the print line. A mark at the top middle of the card holder indicates the middle of the next print space.

Operation (Paper Insertion)

The paper is inserted into the top, rear of the platen, between the platen and the paper deflector, against the adjustable guide. Turning the platen allows the paper deflector to guide the paper between the front feed roll and the platen. The paper is then guided upward by the line gage card holder and is engaged by two rollers on the paper bail which hold the paper against the platen and also help to feed the paper vertically when the bottom of the paper has left the front feed roll.

Paper Release

The paper release lever (Figure 1-146), located at the right end of the carriage, is used to release the pressure of the feed rolls against the platen. This permits easier insertion and positioning of the paper. Pulling the paper release lever forward cams the top of the feed roll release arm forward and rotates the feed roll actuating shaft. As the feel roll acutating shaft rotates, two feed roll release levers, which are clamped to it, will push forward on two lugs of the front feed roll arms, forcing the front feed roll away from the platen. The rear feed roll is also forced away from the platen by means of the connection between the front and rear feed roll arms. Pulling the paper release lever to its forward stop allows the end of the feed roll release arm to detent over a point at the front of the paper release lever and hold it forward, in the released position.

RIBBON

The ribbon mechanism consists of two separate mechanisms; the ribbon lift mechanism and the ribbon feed and reverse mechanism. Both mechanisms are powered by cams on the print sleeve and are both located entirely within the carrier. The function of the ribbon lift mechanism is to raise the ribbon to the print point before the typehead strikes the platen and then to lower it again to make the print line visible. The function of the ribbon feed and reverse mechanism is to move the ribbon horizontally, keeping an unused portion at the print point, and to reverse the direction of the ribbon feed when the end of a spool has been reached. This unit is easily detachable from the carrier. The ribbon is 9/16" and wound around two spools which are enclosed in a cartridge unit which is disposable. The ribbon load lever, located to the right front of the carrier, when pushed to the right, forces the ribbon lift guide assembly into an extreme upward position. This facilitates easy and clean ribbon cartridge replacement. Pushing the ribbon load lever back to the left drops the ribbon lift guide back to its normal position.

Ribbon Lift Mechanism

The ribbon lift cam, a single lobed cam, is set-screwed to the print sleeve and is located to the far left of the print sleeve. The cam rotates 360° for each print cycle. The cam follower is mounted on the left carrier casting and pivots up and down. In the cam follower is a long slot (Figure 1-147) in which the end of the ribbon lift control link rides.

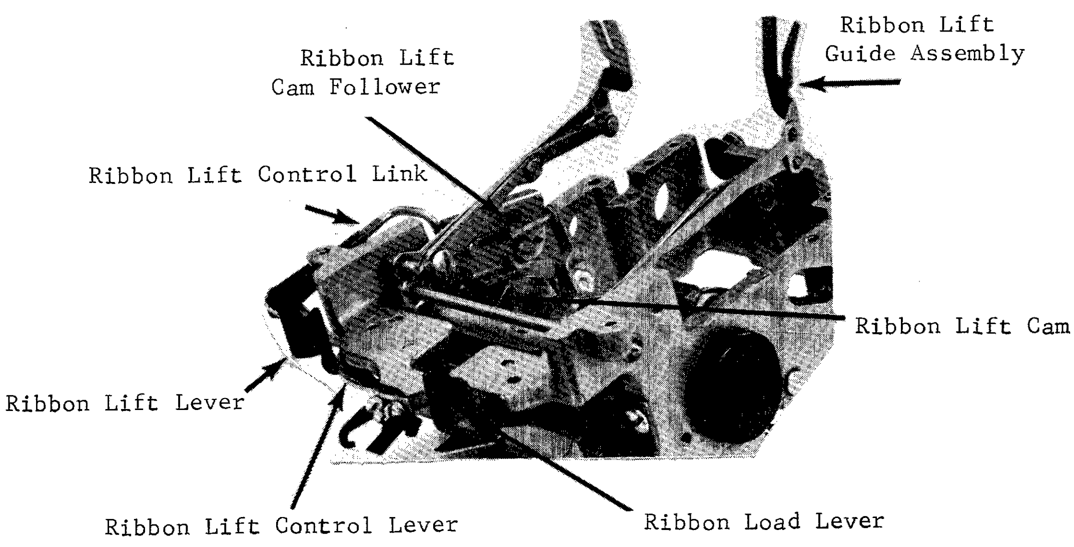


Figure 1-147. Ribbon Lift Mechanism

Directly above the control link rests the ribbon lift guide assembly (Figure 1-147). Raising the cam follower, by means of the cam forces the control link up against the guide assembly, raising the rear of the guide assembly, which pivots at the front of the carrier casting. The ribbon guide assembly is held in a vertical position by a flat link on each side of the ribbon lift guide. The flat links are attached to two pins at the front of the carrier.

The position of the ribbon lift control link, in the slot of the cam follower, determines the height to which the ribbon will be raised for a print operation. It is controlled by a button located at the left front of the carrier. The ribbon lift control is attached to the ribbon lift control lever (Figure 1-147) which is pivot mounted on the underside of the front, carrier casting. The control lever is spring-loaded, to the rear, against a stud on the ribbon lift lever which is also pivot mounted on the front underside of the carrier casting (Figure 1-147). As the button on the ribbon lift lever is moved to the left, the left side of the control lever is forced forward pulling the control link forward. This causes the other end of the control link to move forward in the slot of the cam follower, closer to the pivot point of the guide assembly. The closer the control link to the pivot point of the guide assembly, the higher the guide assembly will be raised by the cam follower. The control lever has four notches on the surface which rides against the lug on the ribbon lift lever. As the lever is moved, left or right, the lug will detent into one of the notches. When the lever is at its far right position, the lug will detent into the far right notch in the control lever. This will cause no pull on the link, allowing it to seat at the rear of the slot in the cam follower. As the cam follower is raised by the cam, practically no motion will be transferred to the link and the guide assembly will not raise at all. This is called the stencil position as the ribbon is not used when typing stencils. The next three positions, to the left, are print positions and will raise the ribbon high enough to be struck by the typehead. The second position, to the left of the stencil position, raises the ribbon high enough to allow the upper half to be struck. The third position allows printing in the middle of the ribbon, and the fourth position raises the ribbon high enough for the lower half to be used. As the lever is moved to the left, the link is pulled forward in the slot allowing more motion to be supplied to the guide assembly by the cam follower creating more lift to the guide assembly. This arrangement allows maximum usage of a ribbon before replacement is necessary.

Ribbon Feed and Reverse

Ribbon Feed

The two ribbon spools fit over the cores of two ratchets (Figure 1-148). Operation of either ratchet, by a pawl that moves front to rear, causes the spool of that ratchet to wind up ribbon. The position of the feed pawl determines which ratchet will feed. As the ribbon feed cam rotates it comes in contact with and forces downward a lug on the ribbon feed lever. The ribbon feed lever is a bellcrank-type device, which is pivot-mounted on a bracket that extends downward from the ribbon feed plate (Figure 1-149). A top extension of the ribbon feed lever extends upward

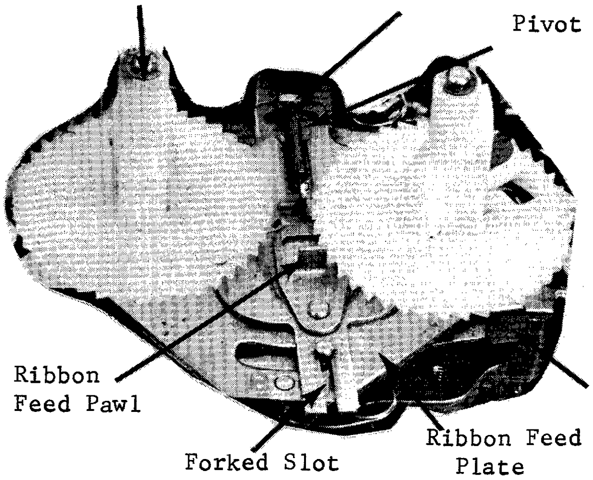


Figure 1-148. Ribbon Feed Mechanism-Top (New Style)

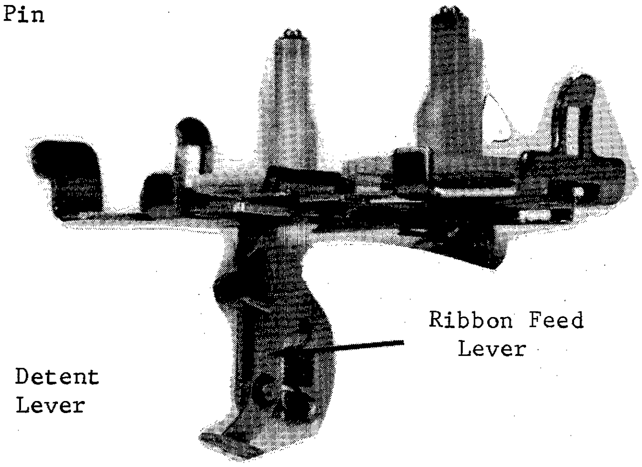


Figure 1-149. Ribbon Feed Mechanism-Bottom

through a forked slot in the plate bracket and also through an elongated hole in the feed pawl plate. This extension is spring-loaded forward, against the rear of the ribbon feed plate by the ribbon feed lever spring which is attached to a hole above the pivot point in the lever to the bottom of the plate bracket. As the bottom of the feed lever is forced down by the cam, the upper extension pivots to the rear, pulling the feed pawl plate with it. As the feed pawl plate is pulled to the rear, the feed pawl, which is pivot-mounted on the plate, will rotate one of the ratchets two notches, which is the amount of drive that the cam supplies. As the feed pawl restores forward, after the operation, it slides across the teeth of the ratchet and attempts to turn the ratchet in the opposite direction. This is prevented by the detent lever (Figure 1-148) which pivots on the underside of the ribbon feed plate. A lug, which extends upward from the detent lever, fits through a slotted hole in the ribbon feed plate and on into a forked slot in a front extension of the feed pawl plate. As the feed pawl plate pivots to the left, allowing the pawl to feed the left ratchet counter-clockwise, the left end of the detent lever will pivot to the rear into the left ratchet which prevents the ratchet from turning clockwise. When the feed pawl plate is pivoted to the right, the pawl will then be in position to feed the right ratchet clockwise while the right end of the detent lever will prevent the ratchet from turning counter-clockwise. One end or the other of the detent lever will always be engaged with its ratchet. Two leaf springs, called the retaining brake springs, are screwed to the plate and extend to the rear and against both ratchets. These springs act as a brake to prevent the ratchets from spinning and possibly spilling ribbon.

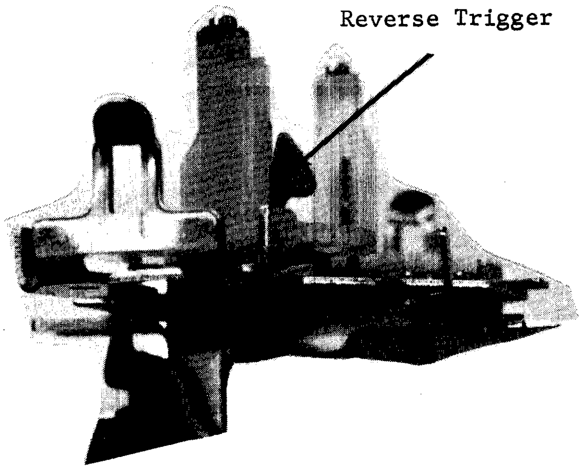


Figure 1-150. Ribbon Reverse Trigger

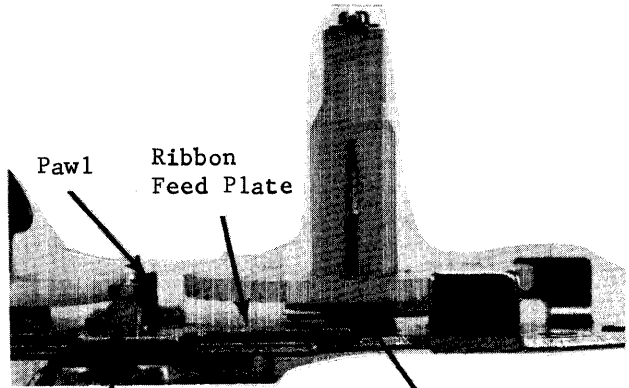


Figure 1-151. Reverse Trigger Dropped On To Plate

Ribbon Reverse

As the ribbon feeds from one spool to another, the supply spool becomes exhausted. The direction of the ribbon feed operation must then be changed to allow the full spool to become the supply spool. This is accomplished by the ribbon reverse mechanism.

Reversing the direction of ribbon feed is accomplished by moving the ribbon feed pawl from one ratchet to the other. Located in the core of each ratchet is a bellcrank called the reverse trigger (Figure 1-150). With ribbon around the spool the trigger is held into the core. However, as a spool empties of ribbon a hairpin spring forces the trigger out of the core through a slot in the ribbon spool. A lower extension of the trigger will then pivot down through a hole in the ratchet, and contact the ribbon feed plate (Figure 1-151). The empty spool rotates slightly farther causing the reverse trigger to be stopped by the side of the feed pawl plate. The trigger is then in the restoring path of the feed pawl plate. As the feed pawl plate begins to restore, one side of it is stopped by the reverse trigger (Figure 1-152) as the other side continues forward. This causes the front of the plate to pivot, flipping the pawl and the detent arm in the same direction. The feed pawl is then in position to feed the empty spool. Figure 1-153 illustrates the old style ribbon feed mechanism which works basically the same as the new style mechanism.

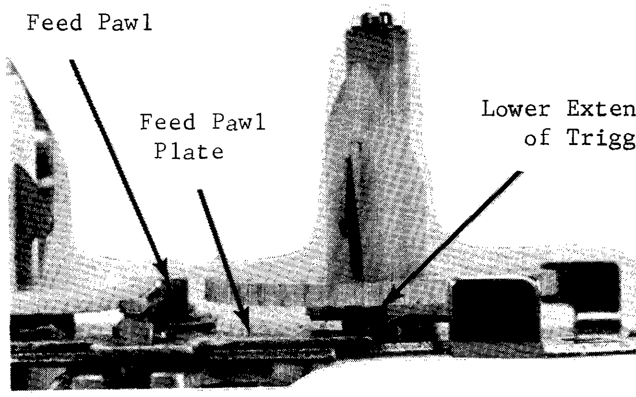


Figure 1-152. Trigger In Path Of Feed Pawl Plate

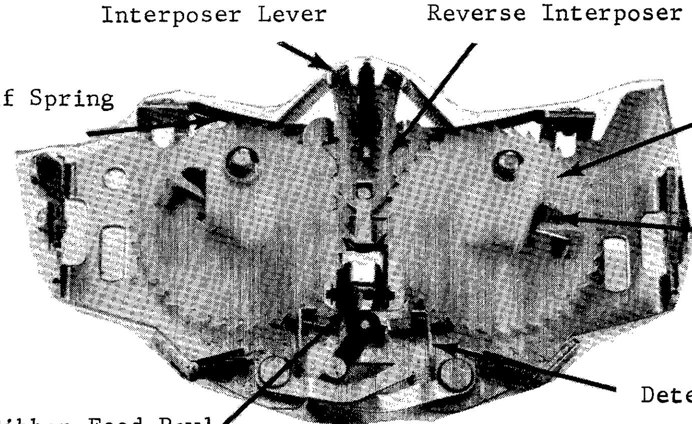


Figure 1-153. Ribbon Feed Mechanism - Old Style