

# IBM<sup>®</sup>

## Customer Engineering Manual of Instruction

Issued to: \_\_\_\_\_

Branch Office: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

If this manual is mislaid, please return it to the above address.

**Selectric I/O<sup>®</sup>**  
**Keyboard Printer**

## PREFACE

This manual has been written to include the maximum hardware or mechanisms that can be incorporated in the "Selectric" I/O Keyboard Printer thru October 1964.

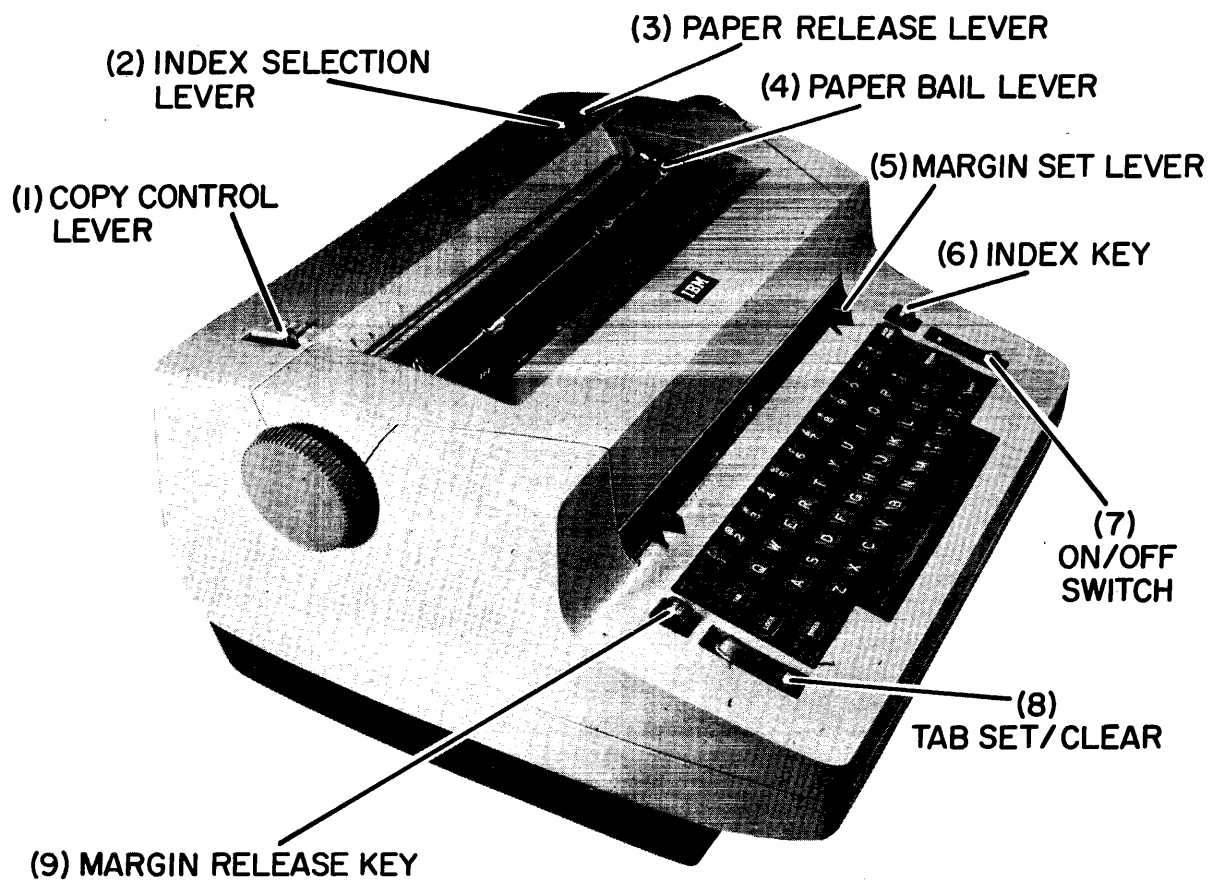
The particular model you are concerned with may not use all of the mechanisms described.

This manual covers models 731, 735, 765, 775, 1415, 1014, Sabre, Stretch, 7040/44, 1620 Mod. II.

All rights to reproduce this material are reserved by IBM.  
Address comments regarding the contents of this publication to:  
IBM Office Products Division, Lexington, Kentucky 40507

# CONTENTS

- Motor and Drive ..... 1
- Typehead ..... 3
- Tilt Mechanism ..... 5
- Rotate Mechanism ..... 8
- Keyboard Section and Character Selection ..... 12
- Print Selection Unit ..... 16
- Selection Contact Assembly ..... 18
- Keyboard Lock ..... 20
- Shift ..... 22
- Cycle Clutch Operation ..... 28
- Alignment ..... 29
- Print Mechanism (Early Style) ..... 39
- Print Mechanism (Late Style) ..... 41
- Print Escapement ..... 41.5
- Mainspring ..... 44
- Operational Cams and Control Mechanism ..... 45
- Operational Selection Unit ..... 49
- Operational Contact Assembly (Late Style) ..... 50.1
- Spacebar ... ..... 51
- Spacebar Mechanism (Print Escapement) ..... 54
- Backspace ..... 54.1
- Carrier Return (Early Style) ..... 55
- Carrier Return (Late Style) ..... 58.1
- Indexing ..... 59
- Platen Variable ..... 62
- Tabulator ..... 63
- Margin Control ..... 69
- Paper Feed and Release Mechanism ..... 73
- Fabric Ribbon (Early Style) ..... 75
- Red Ribbon Shift ..... 79
- Fabric Ribbon (Late Style) ..... 80



**SELECTRIC I/O KEYBOARD PRINTER**

## Operating Controls

1. Copy Control Lever - To compensate for the thickness of multiple forms, the copy control lever is provided. As the copy control lever is moved to the rear, the platen will move farther away from the typehead.
2. Index Selection Lever - You may control the indexing (line space movement) of the platen by setting the index selection lever forward for single space and back for double space.
3. Paper Release Lever - Move the paper release lever forward to position or remove paper.
4. Paper Bail Lever - Holds the paper against the platen to prevent buckling. Should be moved forward when inserting paper.
5. Margin Set Lever - Provides the operator with a means of changing the margin settings.
6. Index Key - Provides vertical indexing of the paper without changing the position of the carrier assembly.
7. On-Off Switch - Turns the printer on and off.
8. Tab Set/Clear - Used to set or clear tab stops.
9. Margin Release Key - Provides a means of operating the printer beyond the margin settings without changing the settings.



## MOTOR AND DRIVE

The motor used in the Selectric I/O Printer is a three-inch shaded pole, induction type motor that requires 115 volts, 60 cycles A.C. (Fig. 1). It is rated at 1/35 h.p. The motor is mounted at the left rear corner of the machine with the pulley toward the right. It is attached to an adjustable bracket at each end by ring shaped spring retainers that encircle the rubber motor mounts.

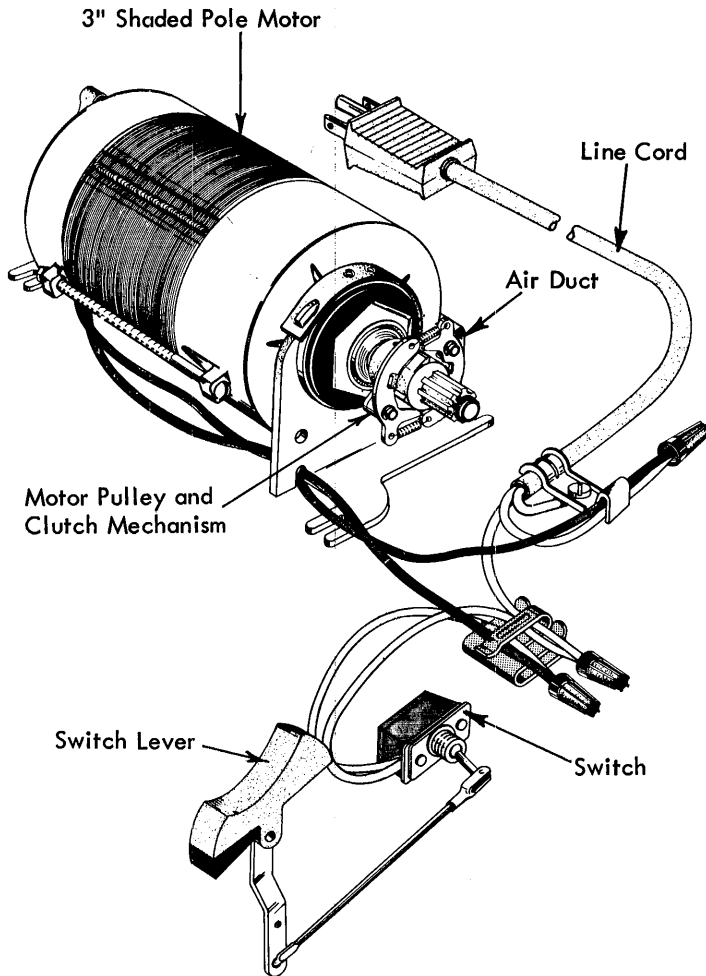


FIGURE 1. Shaded Pole Motor

The motor may be removed easily after snapping the retainers off the brackets. With the belt removed the right end of the motor may be moved to the rear, and the motor may be removed toward the right. With this bracket design, the force of the motor in operation is against the bracket rather than against the retaining clips.

The motor bearings are babbit inserts pressed solidly into the motor end bells. Each bearing is completely surrounded by a saturated oil wick. A small square wick fits into a notch in the top of each bearing to supply oil directly to the rotor shaft.

It should seldom be necessary to disassemble the motor; however, care should be taken in replacing either end bell that is not inverted when installed. The oil hole in the left end bell and the notch in the bearing would then be on the bottom.

The starting torque for the motor is provided by the shaded pole principle. No capacitor is required.

The motor has an internal circuit breaker to prevent damage to the field coil in the event the switch is left ON with the machine stalled. The circuit will open only if the motor is allowed to remain stalled for a period of time; therefore there is no danger of an open circuit during normal operation. The motor will stall only in rare cases where a maladjustment or parts breakage causes the machine to lock. After the motor has regained normal temperature, the circuit breaker will again close the circuit. The circuit breaker will continue to open and close as long as the motor is stalled and the switch is left ON.

Because of its design, the shaded pole motor tends to run at a higher temperature than other IBM typewriter motors. Care should be taken in handling the motor to prevent being burned. In order to prevent over-heating, a cooling system is incorporated in the design of the motor. A fan attached to the right end of the rotor pulls air through the left end bell and across the field coils. The air is then discharged through a duct at the right rear corner of the motor. The air escapes through a grill in the rear of the machine cover. The hot air being discharged pulls cool air with it from within the machine. The air that ultimately emerges from the machine is cooled to near room temperature so that no objectionable heat results.

The three wire grounded system has the third line cord lead attached to the powerframe at the cord clip screw. A short jumper wire is connected between the motor and powerframe (Fig. 2).

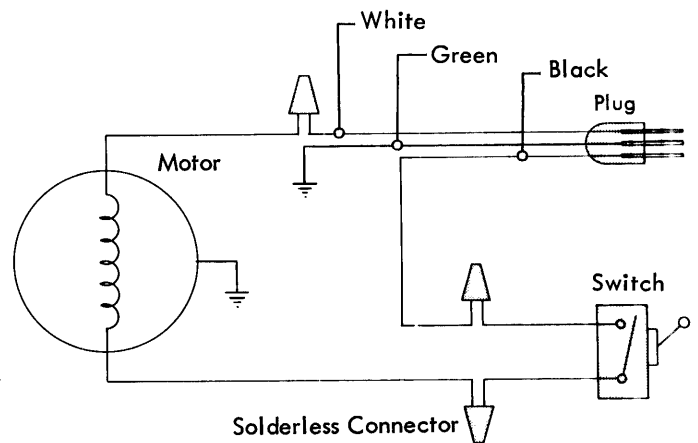


FIGURE 2. Shaded Pole Motor Diagram

In some Selectric I/O Printers, a capacitor-start induction type motor is used (Fig. 3). A capacitor, in the starting winding circuit, provides a starting torque for the motor and controls the direction of rotation. The capacitor also remains in the circuit while the motor is running. The capacitor is mounted in a vertical position by a bracket at the right rear corner of the machine.

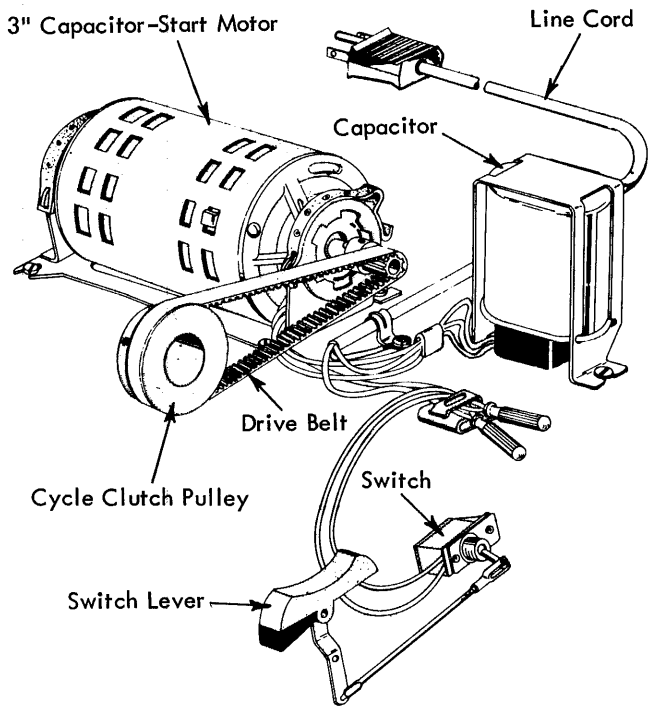


FIGURE 3. Capacitor-Start Motor

The capacitor start three wire grounded system has in addition to the three wire line cord and jumper wire a grounded capacitor mounting bracket. This is done by using metal mounting screws (Fig. 4).

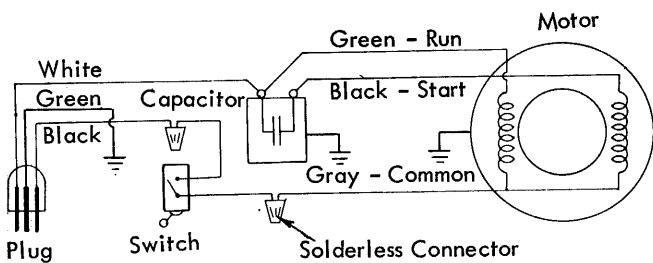


FIGURE 4. Capacitor-Start Motor Diagram

The switch and switch lever are mounted on the right side of the keyboard. The switch lever operates the electrical switch by means of a short link extending to the rear. It is operated by pressing down on the rear of the lever to turn the machine ON and the front to turn the machine OFF. The switch lever is labeled ON and OFF. When the switch lever is in the ON position, a contrasting color at the front of the switch lever shows just above the case. This calls attention to the fact that the machine is ON to minimize chances of the machine being left running when not in use.

In addition to operating the typewriter switch, the switch lever also controls the keyboard lockout mechanism. This mechanism is discussed in the keyboard section.

### Motor Contactor (835 Printer)

Mounted underneath the printer near the shift feedback contact bracket is the motor contactor (Fig. 4.1). The motor contactor is a 48V relay that works in conjunction with the associated electronics. If the printer ON/OFF switch is in the ON position and the Communicate-Local switch is in Communicate, the printer motor can be turned OFF and ON by the motor contactor (Fig. 4.2).

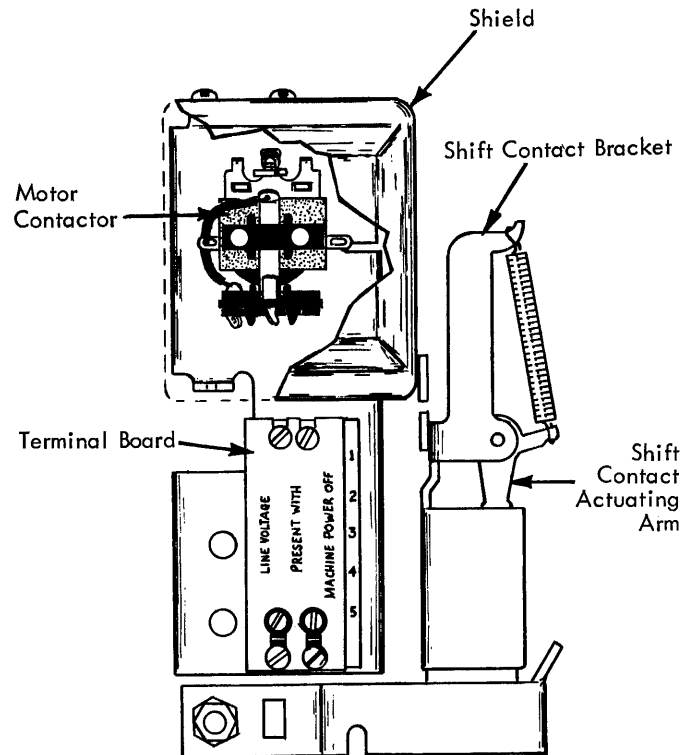


FIGURE 4.1 Motor Contactor

●

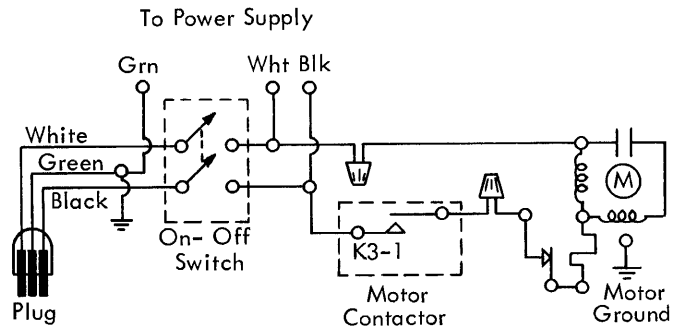


FIGURE 4.2 Motor Diagram (835 Printer)

●



## Drive

An eight-toothed motor pulley provides positive drive for the operation of the machine. A positive-drive belt transfers the rotation of the motor pulley to the cycle clutch pulley with a speed reduction of  $3\text{-}5/8$  to 1.

The shaded pole motor has less starting torque than the capacitor-start motor. To insure that the motor will be allowed to start under a heavily loaded condition, a centrifugal clutch has been incorporated in the motor pulley design. The motor is allowed to approach normal operating speed, then the clutch engages to drive the machine. The momentum developed by the rotor causes the machine to start even though several mechanisms may have been tripped. Capacitor start motors do not require a centrifugal clutch.

The motor pulley operates freely on the end of the rotor shaft and is held in place by a grip ring retainer. Three ratchet teeth extend radially from the left end of the pulley (Fig. 5). A clutch plate hub assembly is set-screwed to the rotor shaft just to the left of the motor pulley. Pivoted on the plate are two clutch pawls (Fig. 5). When the motor is OFF, the pawls are spring loaded against stop lugs on the clutch plate. When the motor is turned ON, the clutch plate turns with the rotor. Centrifugal force causes the clutch pawls to pivot on the studs of the clutch plate so that the tip of one of the pawls engages a tooth of the motor pulley (Fig. 5). The pulley is then caused to rotate and drive the machine by means of the cycle clutch pulley.

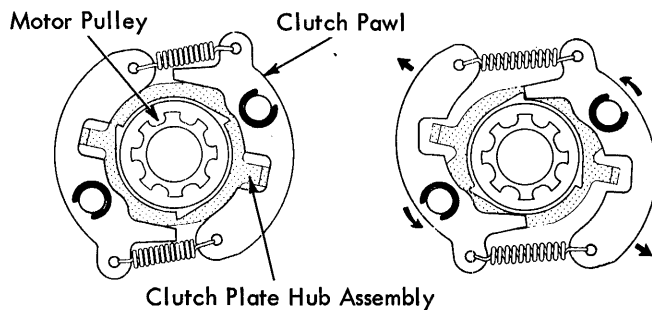


FIGURE 5. Motor Pulley Clutch

The cycle clutch pulley is mounted to a hub in the center of the powerframe. The hub is supported by a porous bronze bearing and is in continuous rotation with the pulley whenever the motor is running.

On either side of the cycle clutch pulley hub is a shaft extending into and supported by the hub (Fig. 6). The shaft to the left of the hub is called the cycle shaft. The cycle shaft is driven by means of a spring clutch. The clutch is allowed to engage whenever a character keylever is depressed. The cycle shaft powers the positioning of the typehead to the desired character. Its rotation is restricted to  $180^\circ$  each time a character prints. After  $180^\circ$  rotation the spring clutch is disengaged allowing the shaft to remain stationary. The cycle clutch is discussed fully in a later section.

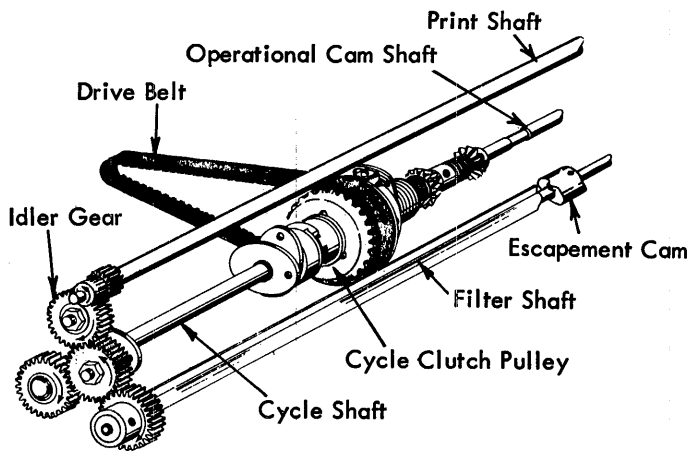


FIGURE 6. Drive Mechanism

Through a series of idler gears at the left, two other shafts are driven by the cycle shaft each time it operates (Fig. 6). They are the filter shaft and the print shaft. The filter shaft operates the character selection mechanisms, the print escapement, the shift interlock, and a spacebar lockout device. The print shaft operates the print mechanism, type aligning mechanism, and ribbon feed and lift mechanisms.

The shaft to the right of the cycle clutch pulley hub is the operational cam shaft (Fig. 6). All powered functional operations are driven by its rotation. The functions involved are spacebar, backspace, tabulation, carrier return, indexing, and shift. The shaft also controls the speed of the carrier during a tab operation. Each of the functions is discussed in detail in its own section.

The operational cam shaft is driven by the cycle clutch pulley hub and is in continuous rotation whenever the motor is running. The right end of the shaft operates in a self-aligning porous bronze bearing. The left end extends into the cycle clutch pulley hub where it is supported by a vinyl sleeve (Fig. 7). The sleeve provides a snug fit for the shaft in the hub to pre-

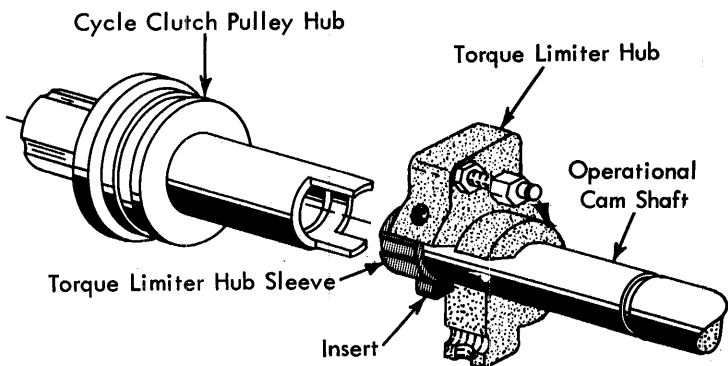


FIGURE 7. Operational Cam Shaft Drive Connection

vent any noise due to vibration. The driving connection between the cycle clutch pulley hub and the operational shaft is made by two extensions of the hub that fit into cut-outs in the left side of the torque limiter hub. The torque limiter hub is held in position at the extreme left end of the shaft by two set screws. Two nylon inserts fit into the cut-outs of the torque limiter hub (around the extensions of the cycle clutch pulley hub). The inserts provide a noiseless driving connection between the two hubs.

Just to the right of the torque limiter hub are three spring clutches and two small pinion gears. These components are part of the carrier return and tab mechanisms and are discussed in their particular sections.

## TYPEHEAD

### Carrier Assembly

The printing element is a ball shaped typehead containing eighty-eight characters. The type head is supported in front of the paper by a framework called the carrier. The carrier is the box-shaped casting that moves laterally just in front of the platen (Fig. 8). Its purpose is to transport the type head and other related mechanisms along the writing line. Almost the entire print mechanism is contained within the carrier assembly. In addition, the carrier also supports the ribbon, ribbon feed and lift mechanisms, and a bracket that controls the left and right margins on the paper.

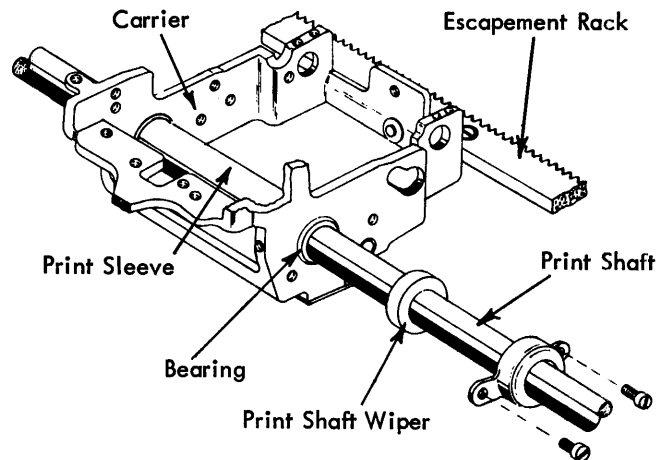


FIGURE 8. Front Carrier Support

At the front of the carrier, a sleeve fits into two bronze bearings in the carrier (Fig. 8). The sleeve, called the print sleeve, must rotate within the carrier. It also slides left to right on the print shaft to provide the front support for the carrier. An oil soaked felt ring surrounds the print shaft and is enclosed in a retaining cup at each side of the carrier. As the carrier moves, the felt ring, called the print shaft wiper, spreads a light film of oil on the shaft to lubricate the sliding of the print sleeve. Oil from the print shaft wipers is also absorbed by the bearings in the carrier casting to lubricate the rotation of the print sleeve.

### Carrier Support - Early

The front edge of the escapement rack serves as a rail on which the rear of the carrier rides (Fig. 9). The escapement rack is located on the powerframe just to the rear of the carrier. A square block attached to the rear of the carrier slides along the escapement rack. A similar block beneath the escapement rack prevents upward movement of the carrier. The mounting stud for the upper block has an eccentric shoulder to provide an adjustment for the up and down play at the rear of the carrier.

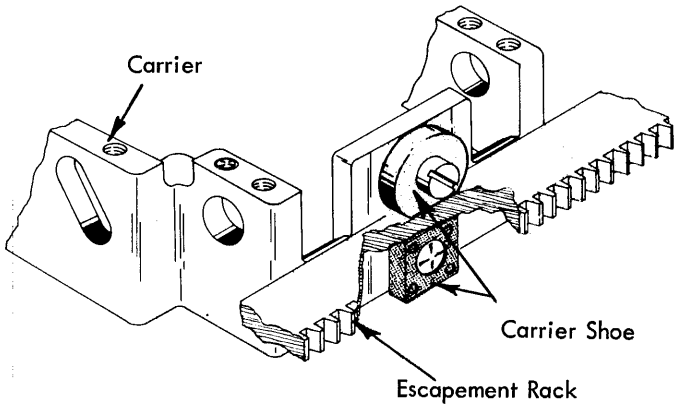


FIGURE 9. Rear Carrier Support (Early)

### Carrier Support - Late

The late carrier support (Fig. 10) differs from the early style in that the upper shoe fits loosely on its eccentric mounting stud and is spring loaded against the top surface of the escapement rack. This spring load, provided by a leaf spring, removes the play between the lower shoe and the bottom of the escapement rack thereby eliminating any vertical play of the rear of the carrier during a print operation. The bottom shoe is a nylatron block mounted to a plate that is fastened to the rear of the carrier by the same stud that mounts the upper shoe. A stud, riveted to the plate, anchors the left end of the leaf spring. The right end of the spring presses against the underside of the escapement bracket (Fig. 10).

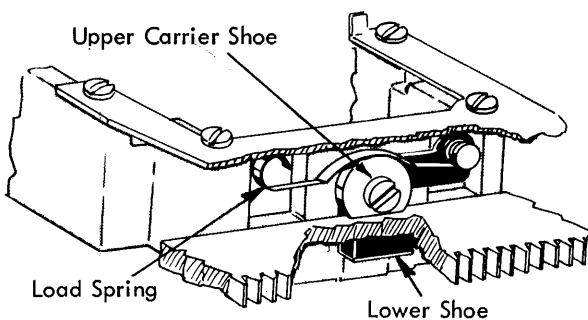


FIGURE 10. Rear Carrier Support (Late)

### Rocker

The rocker is a pivoting platform located within the rear portion of the carrier (Fig. 11). Its purpose is to carry the typehead to and from the platen for the print operation. Components involved in the typehead positioning and aligning operations are also contained within the rocker. The rocker pivots on the rocker shaft at the rear of the carrier. Two bushings, pressed into the rocker, pivot on the shaft and act as the bearing surface for the rocker. A C-clip on the right side of the rocker shaft prevents side play in the rocker. A steel thrust washer at the left of the rocker acts as a lateral bearing surface for the rocker.

Attached solidly to the top of the rocker platform is the yoke (Fig. 11). The yoke has two arms that extend up to provide a pivot mount for the tilt ring. Mounted at the top of the tilt ring is the upper ball socket to which the typehead is attached. As the rocker pivots up in front, the yoke moves the tilt ring and the typehead toward the platen.

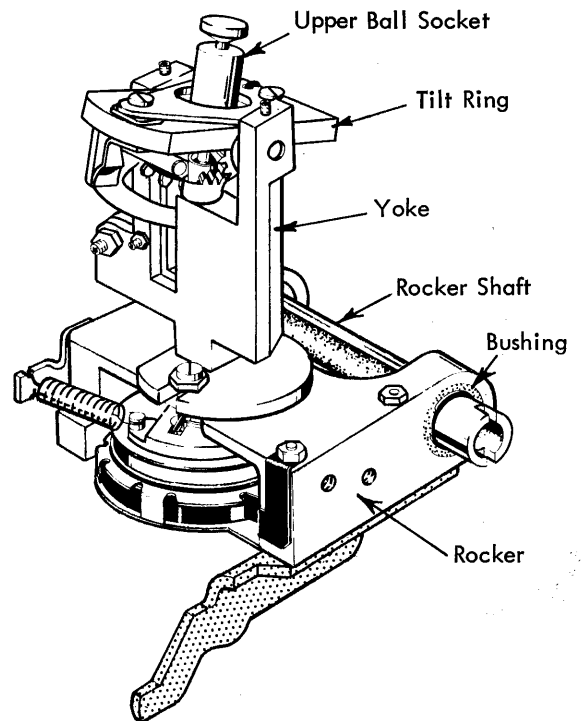


FIGURE 11. Rocker Assembly (Gear Tilt)

### Typehead

Before printing can occur, the desired character must be in position to strike the paper. The surface of the typehead contains four bands of characters with twenty-two in each band (Figs. 12 and 13). Each band has eleven lower case characters in the hemisphere facing toward the platen and eleven upper case characters in the hemisphere facing away from the platen.

At rest, the position of the typehead is such that the middle character of the upper band is in position to strike the platen. This is the home position. If any character other than the

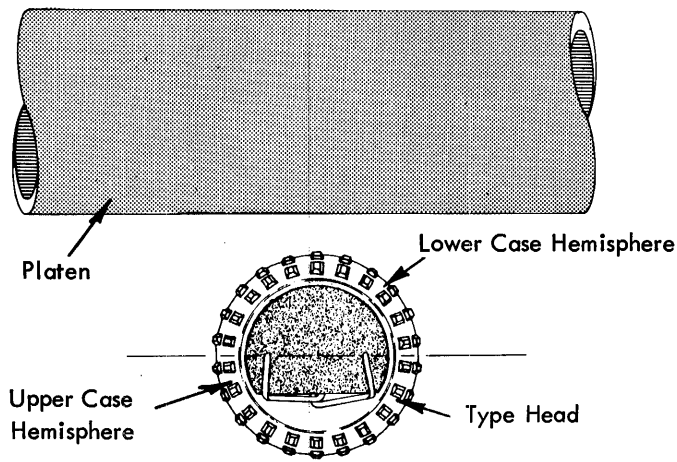


FIGURE 12. Type Head and Platen - Top View

home position is desired, the head must be tilted up and/or rotated in either direction until the desired character is in the printing position. Any lower case character may be reached by rotating the typehead up to five positions in either direction and tilting the head as much as three bands from the rest position. The typehead always rotates back to the home or rest position after a character has been typed. If an upper case character is desired, the head must be rotated counterclockwise an additional 180° so that the upper case hemisphere of the typehead is toward the platen. The single-unit typehead has the advantage over conventional typebars of being relatively inexpensive and easily detached from the print mechanism. This enables the operator to change quickly and easily from one type style to another merely by replacing the typehead.

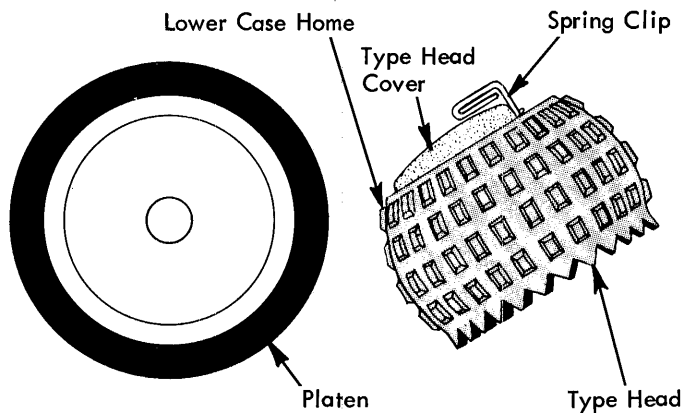


FIGURE 13. Type Head and Platen - Side View

The typehead fits around a post called the upper ball socket at the top of the rocker assembly and is held in place by a spring clip. The spring clip is located on top of the typehead and fits into a groove in the top of the post (Fig. 14). A convex disc, covers the spring clip except for two ears (Fig. 12 and 13). The ears of the spring clip are used in removing and installing the head. By pressing the two ears together the spring clip is disengaged from the groove in the mounting post allowing the head to be slipped up and off.

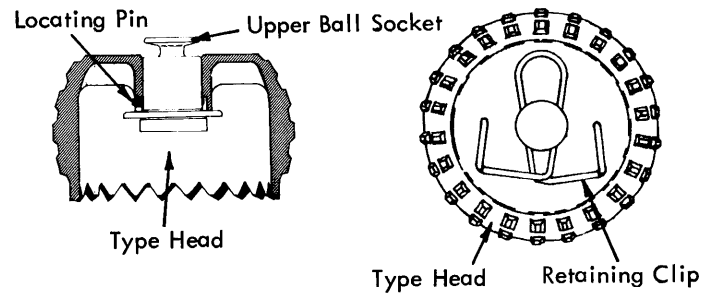


FIGURE 14. Type Head Mounting

The typehead may be installed by pressing the ears of the spring clip together and slipping the head into place. The typehead is keyed to the upper ball socket by a pin so that it can be installed in one position only (Fig. 14). The head must be rotated as it is installed until it drops into position on the pin. The spring clip is then released to lock the head in place. When the mechanism is at rest, the typehead is always in the home position. When the shift mechanism is in the lower case position, the ears of the head clip are toward the front of the machine.

## TILT MECHANISM

### Tilt Operation

The purpose of the tilt mechanism is to raise the rear of the typehead to the desired character band so that a character in that band may be brought to the printing point.

The upper ball socket is attached to a platform-like part called the tilt ring. The tilt ring pivots on two pins between yoke arms that fit up inside the hollow of the typehead. The yoke assembly is fastened to the rocker to complete the typehead mounting (Fig. 11).

The tilt ring is located at about the center of the typehead. As the tilt ring pivots on its pins, it causes the typehead to tilt. Because the typehead rests with the upper band in the print position, all tilt operations are upward from the rest position.

### Early Style (Gear Tilt)

Movement of the tilt ring is accomplished by the operation of two beveled gear sectors located directly beneath the tilt ring (Fig. 15). One sector forms part of the tilt ring, while the other is a part of the tilt sector tube. Rotation of the tilt sector tube causes the tilt ring and typehead to be tilted.

The tilt sector tube operates through the yoke and extends below the rocker. A pulley called the tilt sector pulley is attached to the bottom of the tube. The pulley is held to the tube by a set screw that presses a small T-shaped block against a flat surface on the tube. The pulley is held in a clockwise direction (looking from the top) by an extension spring. A small steel tape encircles the pulley and has one end attached to it. When the tape is pulled, it causes counterclockwise rotation of the tilt tube and an accompanying tilt of the typehead. When the pull on the tape is relaxed, the tilt pulley

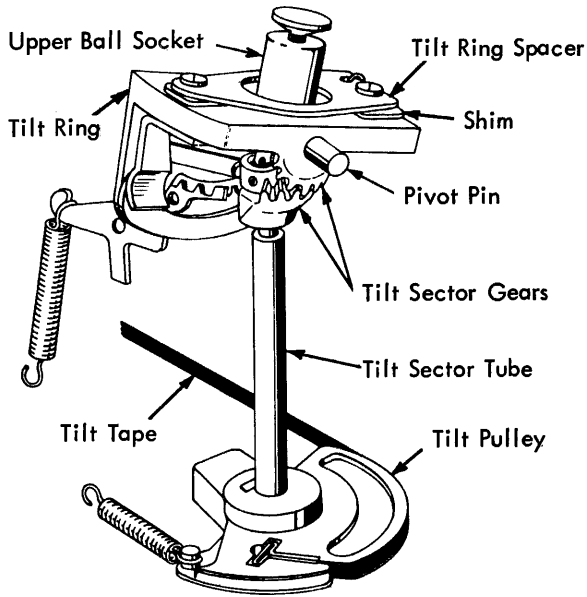


FIGURE 15. Tilt Mechanism (Early) - Rocker Portion

is restored by its spring causing the typehead to return to the rest position. From the pulley, the tilt tape is guided through the hollow left end of the rocker shaft by a rounded tape guide block attached to the bottom of the rocker. The tilt tape extends to the left around a small pulley, back to the right around a similar pulley, and is attached to the right side of the carrier. This arrangement allows left to right movement of the carrier without disturbing the position of the typehead (Fig. 16).

The pulley on the right is solidly mounted and is moved for adjustment only. The left pulley is attached to a pivoting arm called the tilt arm. Movement of the arm to the left exerts a pull on the tilt tape to cause a rotation of the tilt tube and a tilt to the typehead.

Late Style (Gearless Tilt)

The "gearless tilt mechanism" operates basically the same as the previous mechanism. Movement of the tilt ring is accomplished by the operation of the tilt pulley (Fig. 17). A pull on the tape causes the tilt pulley to rotate (about its mounting stud) transferring motion to the tilt ring by means of the tilt pulley link. When the pull on the tape is relaxed the tilt pulley is restored to rest by its extension spring.

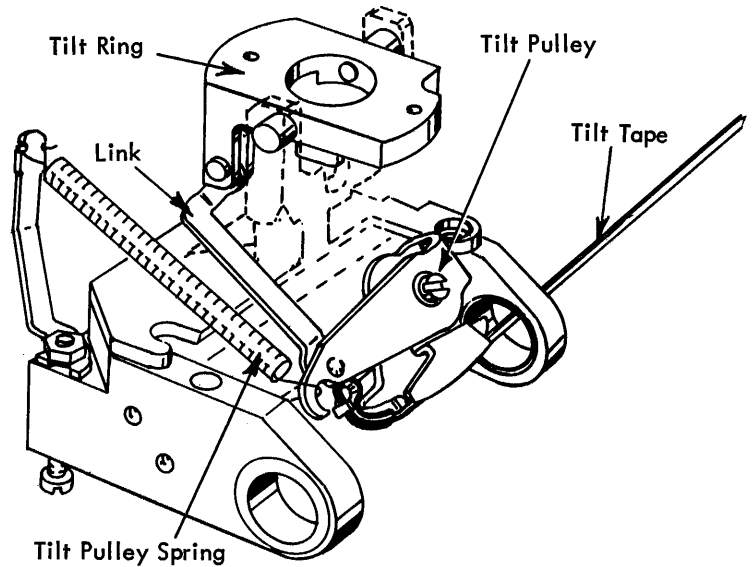


FIGURE 17. Gearless Tilt (Late)

The tilt pulley link is fastened to the tilt pulley by a ball shouldered rivet to allow the link to pivot in all directions. The other end of the link is fastened to the tilt ring by a pin and C-clip.

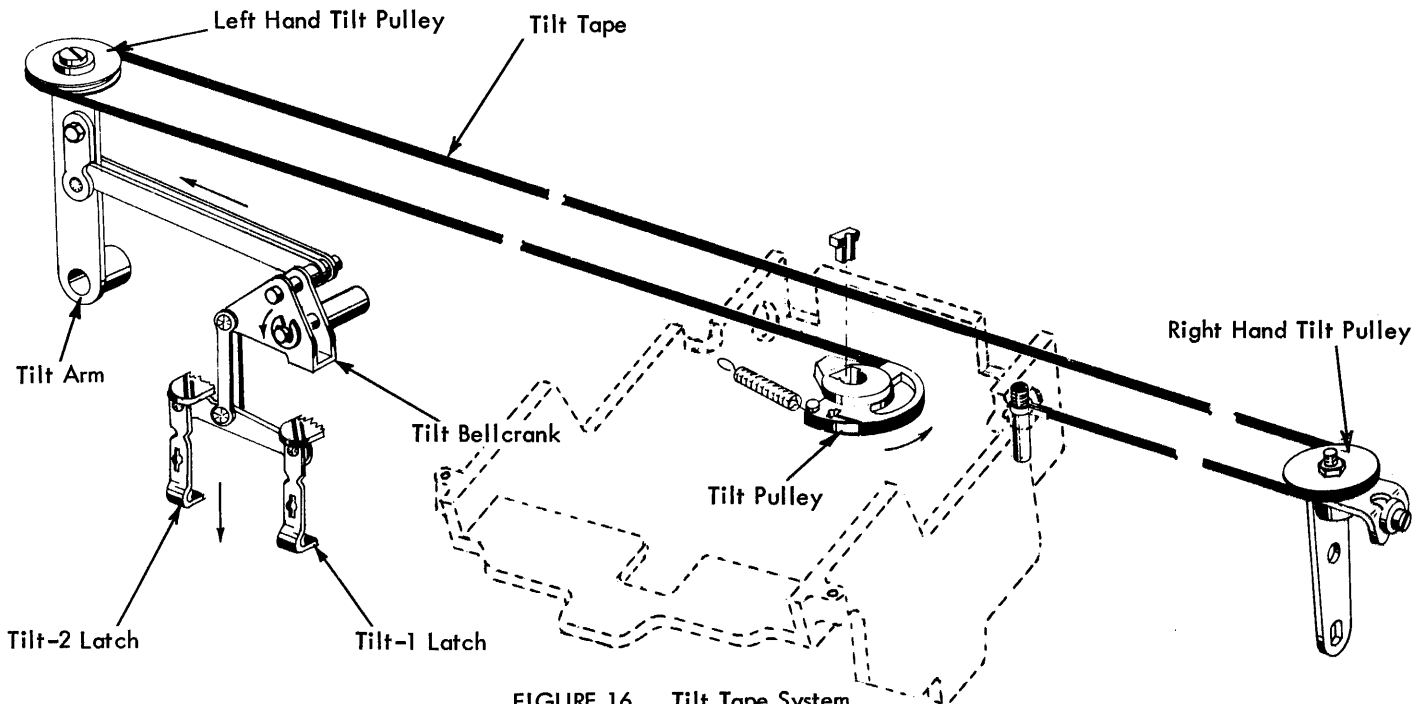


FIGURE 16. Tilt Tape System

## Latch Bail

The cycle shaft has five double lobed cams mounted on it (Fig. 18). Two positive cams, one 5-unit cam and two latch pusher cams. The two positive and one 5-unit cam provide the motion to position the typehead. The positive cams are paired to operate the latch bail located beneath the cycle shaft. The 5-unit and latch pusher cams will be discussed later.

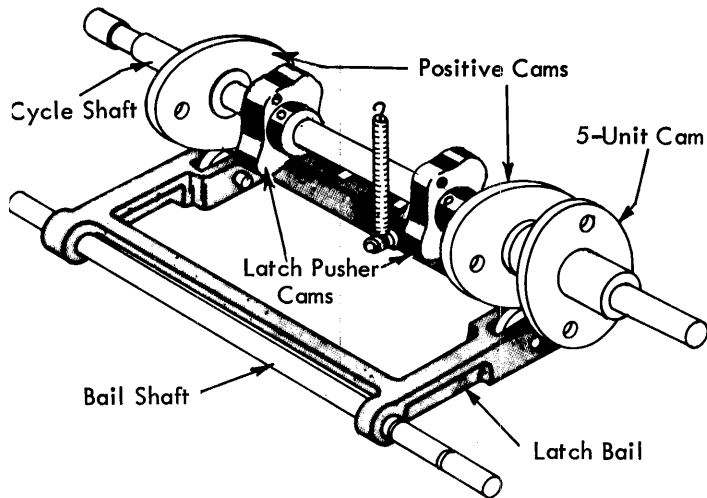


FIGURE 18. Cycle Shaft and Latch Bail

The cycle shaft powers the positioning of the typehead by operating the selector latch bail. The latch bail is a box-shaped frame located just beneath the cycle shaft (Fig. 18). Two short arms of the frame extend forward where they pivot on a shaft mounted to the powerframe. Each side of the latch bail contains a roller that is constantly in contact with its respective cycle shaft cam. An extension spring at the rear of the latch bail applies a constant upward pressure to hold the rollers against the cams. Each time the cycle shaft operates 180°, the bail is forced down pivoting about the bail shaft and is allowed to return to its upward position.

The rear of the latch bail is recessed at six points. All six of the recesses contain selector latches. Across the rear of the latch bail is a plate attached by two screws. Each selector latch has a lip formed to the rear just under the bail plate (Fig. 19). An extension spring holds each latch to the rear. Five of the selector latches are components of the differential

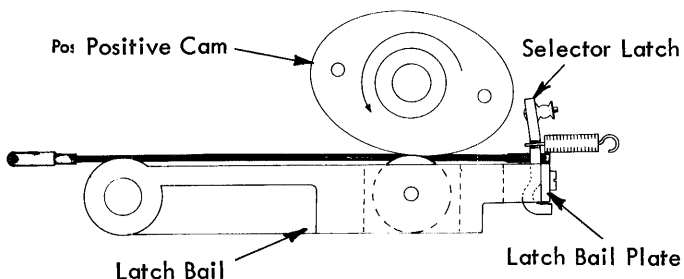


FIGURE 19. Latch Bail - Side View

lever assembly that determines how much tilt and rotate the head will receive. The first and third latches to the left are concerned with tilting the head, while the three on the right deal with rotating the head. The second latch from the left is referred to later.

If the latches remain to the rear under the plate, they will be pulled down when the bail is operated. If any latch is held forward, it is not hooked under the bail plate and will not be pulled down during an operation of the latch bail. The method of operating the various latches forward is discussed in later sections.

## Tilt Differential

The two tilt latches are attached at each end of a short lever by ball shouldered rivets (Fig. 20). The ball shape of the shoulders allows the latches to pivot in all directions. The lever is attached by a double vertical link to the tilt bellcrank. The bellcrank pivots on a stud at the top of the differential bracket. The connection of the double link is not in the middle of the lever; therefore the leverage developed by one tilt latch is greater than that of the other.

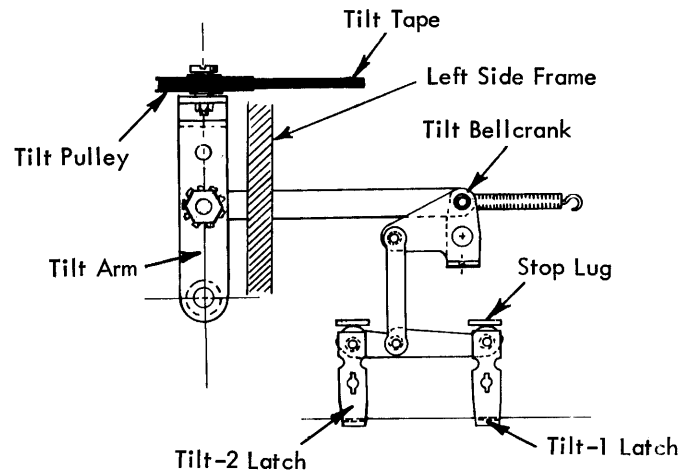


FIGURE 20. Tilt Differential At Rest

A horizontal link connects the top of the tilt bellcrank to the tilt arm. Operation of the bellcrank forces the tilt arm to the left to exert a pull on the tilt tape. The tilt arm is sometimes referred to as the tilt multiplying arm, because the movement of the horizontal link is increased at the pulley due to the leverage developed.

The left hand tilt pulley is mounted to the tilt arm on a ball shouldered pivot screw. This allows the pulley to remain horizontal regardless of the position of the tilt arm. It must remain horizontal to prevent the tilt tape from coming off the pulley.

The tilt bellcrank is rotated by a pull on the tilt latches. When the left latch is held to the front while the right one remains to the rear, only the right latch is forced down by the latch bail (Fig. 21). As the latch pulls down on its attached lever, the left end of the lever pivots against a stop lug formed out from the differential bracket. The vertical link from the lever is

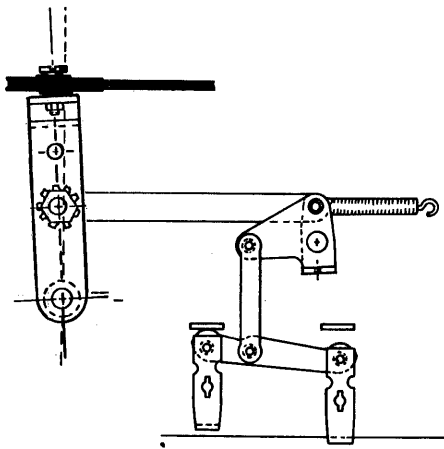


FIGURE 21. Tilt - 1 Operation

then pulled to operate the tilt bellcrank. The same action occurs if the left latch is pulled down by the latch bail while the right latch is held forward. The distance the vertical link is pulled is not the same for both latches, because the link is not connected to the middle of the lever.

When only the right latch is being operated by the bail, the left end of the lever is not pulled down and acts as a pivot point. The vertical link is attached to the lever one-third of the distance from the pivot point to the right latch. This causes the link to be pulled down only one-third as far as the latch is pulled by the bail. The movement of the link is sufficient to cause the typehead to tilt a distance of one band of characters. This places the second band from the top in the printing position.

When only the left latch is operated, the right end of the lever acts as a pivot point (Fig. 22). The vertical link is then two-thirds of the distance from the pivot point to the operating latch and is moved two-thirds as much as the latch. This movement is sufficient to cause the typehead to tilt a distance of two bands of characters. The third band is then in the printing position.

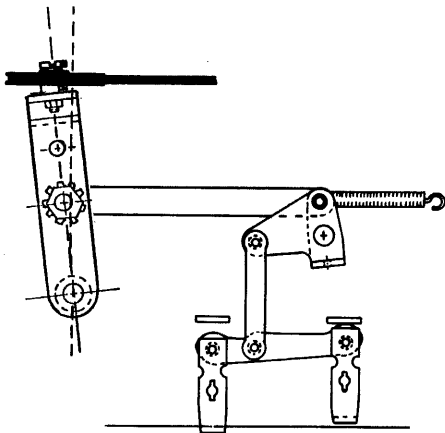


FIGURE 22. Tilt - 2 Operation

When both latches remain to the rear under the latch bail, both are operated. The lever moves straight down and neither end acts as a pivot point (Fig. 23). This causes the double vertical link to receive the same motion as the latches, resulting in three character bands of tilt. The fourth band is then in the printing position.

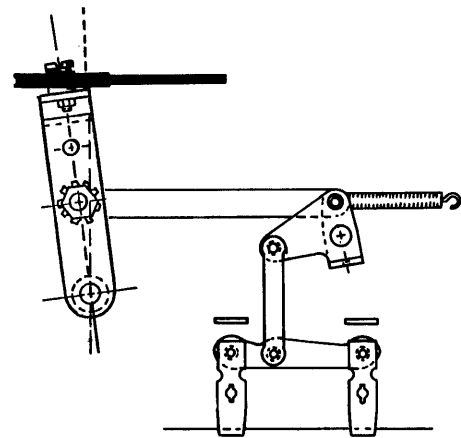


FIGURE 23. Tilt - 3 Operation

When operated by itself, the right tilt latch causes a tilt of one character band; therefore it is referred to as the tilt-one latch. Because the left latch causes a tilt of two character bands, it is called the tilt-two latch. Both latches operated together cause a tilt-three action.

## ROTATE MECHANISM

### Rotate Operation

The rotate mechanism rotates the typehead clockwise or counterclockwise to the desired character within a tilt band.

The upper ball socket to which the typehead is attached has a shoulder at the bottom fitted into a hole in the tilt ring (Fig. 24A). The fit is very close yet permits free rotary motion of the upper ball socket. The upper ball socket is held in place by the tilt ring spacer. The spacer attaches directly to the tilt ring and fits around a flange of the upper ball socket. The tilt ring spacer is shimmed to allow rotation of the upper ball socket yet restrict up and down play.

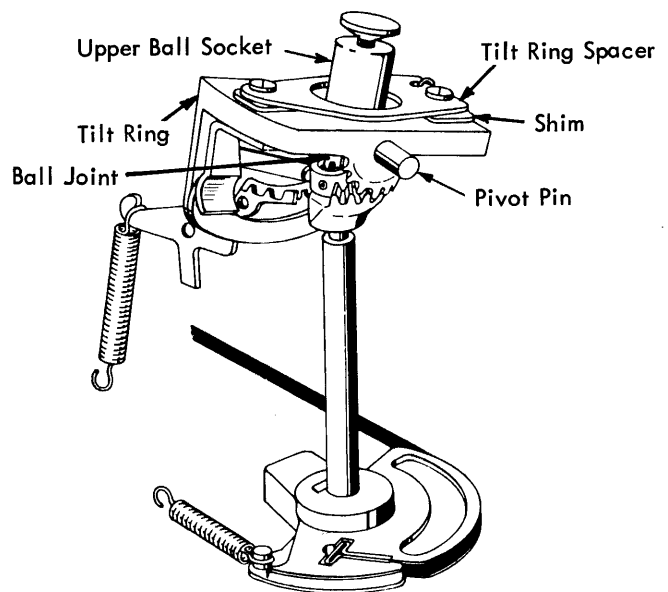


FIGURE 24A. Rotate Mechanism (Early)-Rocker Portion

The under side of the upper ball socket is hollow and forms the socket for a ball joint connection (Fig. 24B). A dog-bone shaped ball joint fits into the socket over a pin that extends through the socket. The ball joint is identical at both ends. The lower end fits over a pin in the lower ball socket. These two ball and socket connections act as universal joints to permit the typehead to be rotated and tilted at the same time.

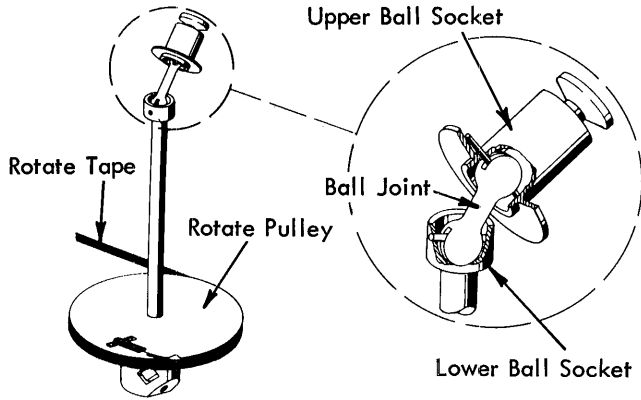


FIGURE 24B. Rotate Mechanism - Rocker Portion

The lower ball socket is part of a shaft called the rotate shaft. The shaft operates inside the hollow of the tilt sector tube and extends well below the tilt sector pulley. (On the gearless tilt, the tilt sector tube and the tilt pulley have been eliminated. The rotate shaft operates directly inside the hollow of the yoke.) On both styles the bottom of the shaft pivots in a hole in a plate attached to the bottom of the rocker. This plate acts as a bearing for the bottom of the rotate shaft. Attached near the bottom of the shaft is the rotate pulley similar in operation to

the tilt sector pulley (Fig. 24B). By means of the upper and lower ball sockets and the ball joint, the rotate pulley operates to rotate the typehead in either direction.

As on the tilt mechanism, the rotate pulley is operated by a steel tape that passes around two side pulleys and attaches to the carrier. When either of the side pulleys moves away from the other, the typehead is rotated counterclockwise by the pull of the tape. When either side pulley moves toward the other, the typehead is rotated clockwise by the tension of the rotate pulley spring (Fig. 25).

The rotate spring is of the mainspring type enclosed in a stationary cage, with the outer end of the spring attached to the cage. The inner end of the spring is connected to a hub on the rotate pulley. A spring of this type must be used here rather than an extension spring as is used on the tilt sector pulley, because the typehead is required to rotate almost a full revolution.

The right hand rotate pulley is attached to the shift arm and moves only during the shift operation; therefore consider it to be stationary for the present. The left hand rotate pulley is attached to the rotate arm. When the arm moves away from the side frame, it exerts a pull on the tape to rotate the typehead counterclockwise. This direction is known as the positive direction of rotation.

When the left hand rotate pulley moves towards the sideframe, the rotate spring turns the rotate pulley rotating the typehead in a clockwise direction. This direction is known as the negative direction of rotation.

#### Positive Rotate Differential

The rotate differential is much the same as the tilt differential. The latches are operated by the latch bail if they are allowed to remain to the rear under the bail. Each operates with a different leverage for different amounts of rotation. Rotation of up to five characters is sometimes required on either side of the rest position. This requires more latches and levers than for a tilt operation.

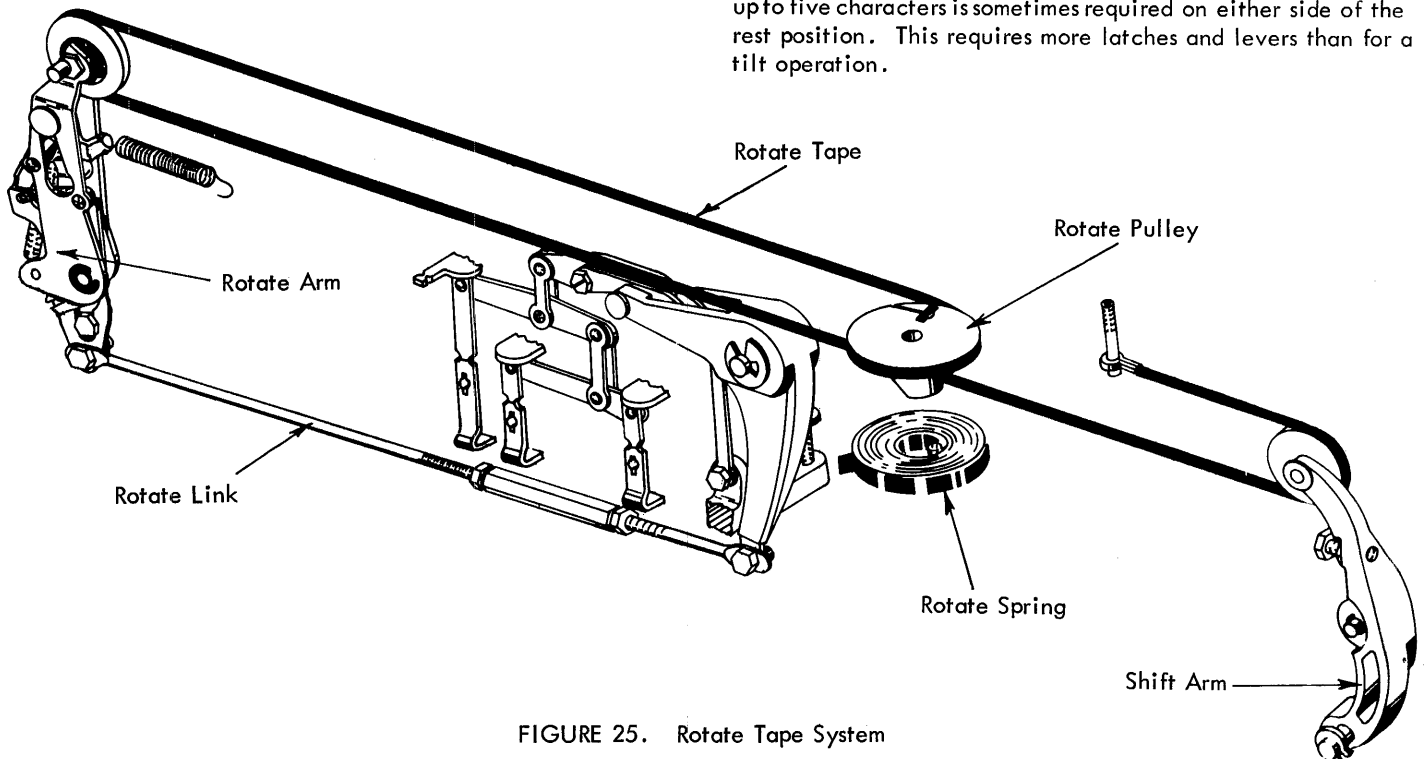


FIGURE 25. Rotate Tape System



Consider the positive rotation of the typehead first. Three latches and a series of three levers are involved in positive rotation (Fig. 26). The three latches are those farthest to the right in the latch bail. All the latches are spring loaded to the rear under the latch bail and are operated by the bail unless they are pulled forward.

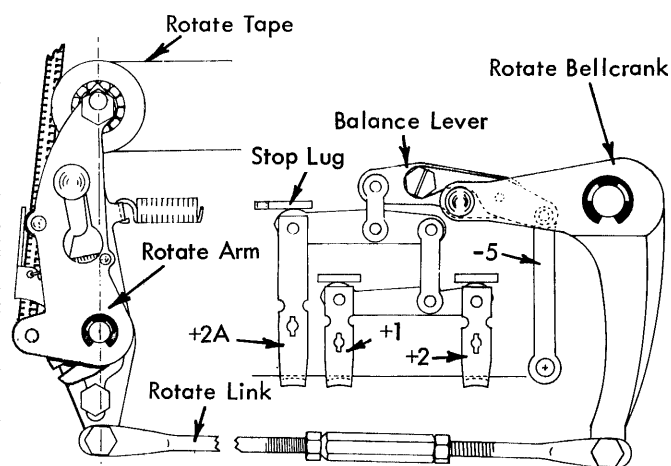


FIGURE 26. Rotate Differential At Rest

The two latches on the extreme right are mounted by ball shouldered rivets to a short lever similar to the tilt latch mounting. A flat double link extends vertically from the lever to a second lever above it. The connection is at the right end of the second lever and one-third of the distance from the right end of the first lever.

The third latch is connected by a ball shouldered rivet to the left end of the second lever. Because its mounting point is higher than the other latches, the third latch is much longer than the others to permit latching under the bail at the bottom.

A second vertical link connects the second lever to the left end of the third lever in the series. The link is attached to the second lever two-fifths of the distance from the right end.

The third lever is an adjustable lever connected at the middle to the horizontal arm of the rotate bellcrank. It is referred to as the balance lever, because its adjustment balances the amount of motion between positive and negative rotation. The right end of the balance lever is held stationary during positive rotation. A downward pull at the left end causes the rotate bellcrank to operate. A heavy link connects the bottom of the rotate bellcrank to the bottom of the rotate arm. The rotate arm is sometimes referred to as the rotate multiplying arm because the movement of the rotate link is increased at the pulley as a result of the leverage. Operation of the bellcrank counter-clockwise causes the rotate arm to pivot about its fulcrum point and exert a pull on the rotate tape.

In order to operate the balance lever for a positive rotate cycle, one or more of the latches must be pulled down by the latch bail. Consider the latches one at a time starting with the middle of the three rotate latches. When only the middle latch is allowed to remain under the latch bail, it is the only one pulled down when the bail operates (Fig. 27). As the middle latch is pulled down, its attached lever moves down

at the left and pivots at the right on a stop lug formed out from the differential bracket. The vertical link is attached to the lever one-third of the distance from the pivot point to the latch. This causes the link to be moved down one-third as much as the latch.

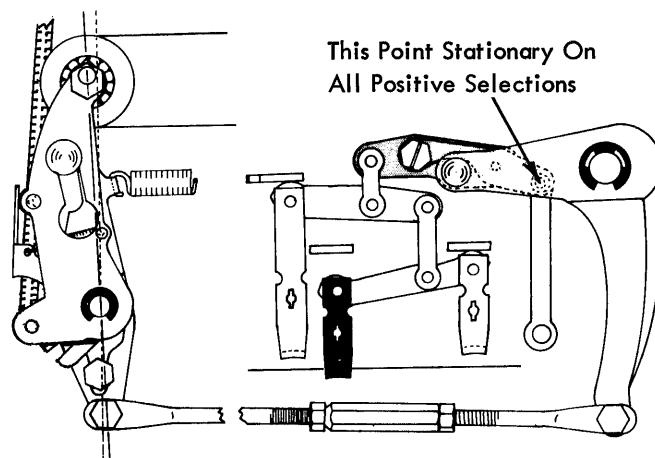


FIGURE 27. Positive - One Rotate Operation

The link exerts a pull on the right end of the second lever causing it to pivot on its stop lug at the left end. The second vertical link is attached to the lever three-fifths of the distance from the pivot point to the operating end of the lever. The second link moves three-fifths as much as the right end of the lever. The right end of the second lever moves one-third as much as the latch. Multiplying the two together, the second vertical link moves three-fifteenths or one-fifth as much as the latch.

The second vertical link operates the left end of the balance lever which, in turn, actuates the rotate bellcrank. This movement is sufficient to cause a positive rotation of one character on the type head. The movement is caused by operation of the middle rotate latch, so it is referred to as the rotate-one latch.

When only the right hand latch is operated, the movement of the rotate bellcrank is doubled, and a positive rotation of two characters is obtained on the type head. The increased movement is obtained at the first lever. When the right hand latch moves down, the lever pivots on a stop lug at the left. The vertical link is attached two-thirds of the distance from the pivot point to the latch; therefore the link moves down two-thirds as much as the latch. This is twice as much as for the rotate-one latch. The right hand latch is referred to as the rotate-two latch.

When both the rotate-one and rotate-two latches are operating together, the first lever moves straight down without pivoting at either end (Fig. 28). This gives the same amount of motion to the first vertical link as is given to the two latches. Movement of the link is three times as much as when operated by the rotate-one latch alone. The additional movement is transferred to the rotate bellcrank to rotate the type head three characters in the positive direction.

When additional rotation is required, the third rotate latch must be used. The left hand latch is never used alone; but to clarify its leverage in relation to the other latches, consider it to be the only one in operation.

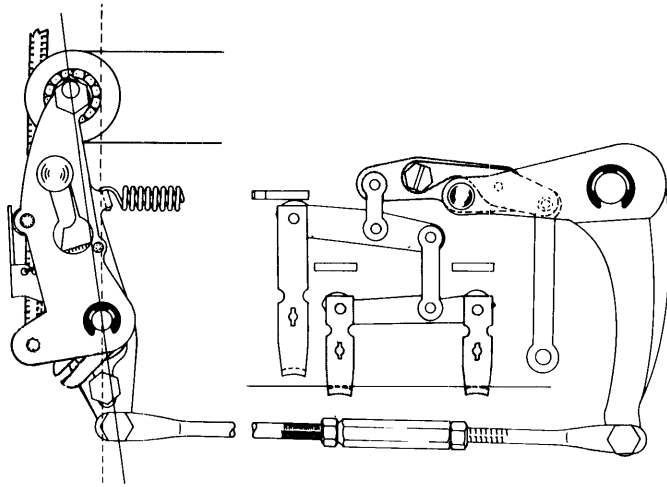


FIGURE 28. Positive - Three Rotate Operation

The left hand latch is attached directly to the end of the second lever. When operated, the latch causes the left end of the second lever to move down. The right end of the lever cannot rise so it acts as a pivot point. The second vertical link is attached to the lever two-fifths of the distance from the pivot point to the latch; therefore the link moves down two-fifths as much as the latch.

Movement of the link is twice as much as when the rotate-one latch is operated alone. Therefore the movement obtained from the left hand latch is sufficient to rotate the type head two characters in the positive direction. Since the right hand latch is called the rotate-two latch, the left hand latch is referred to as the rotate-2A latch.

The 2A latch is never used by itself. When its motion is added to that of one or both the other latches, rotation of four or five characters can be obtained. The rotate-one latch is used for one-character rotation and the rotate-two latch for two-character rotation. Both are operated together for three-character rotation. The rotate-two and rotate-2A latches are operated for a four-character rotation. The rotate-one, rotate-two, and rotate-2A are operated for a five-character rotation (Fig. 29).

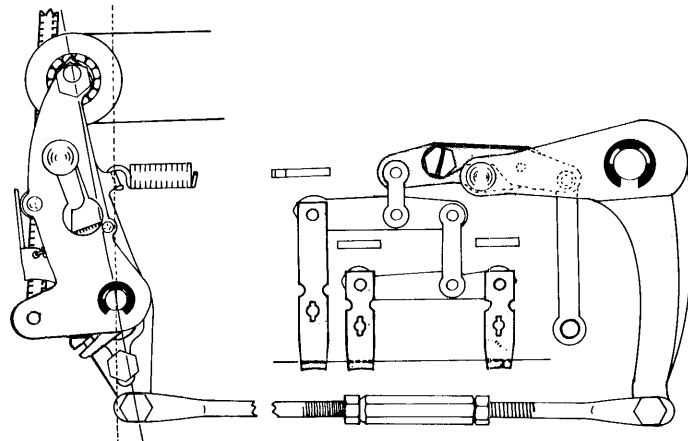


FIGURE 29. Positive - Five Rotate Operation

### Negative Rotation

Positive rotation of the typehead is achieved, by operating the rotate bellcrank counterclockwise so as to create a pull on the rotate tape. It follows then that operating the rotate bellcrank clockwise will allow the rotate pulley spring to rotate in a negative direction.

The rotate bellcrank is controlled by the balance lever in the differential series. In order for the bellcrank to operate clockwise, the balance lever must be raised. The left end of the lever cannot rise, because the stop lugs on the bracket prevent any upward movement in the lever series. Therefore if the bellcrank is to operate clockwise, the right end of the lever must be raised.

The right end of the balance lever has a flat link connection to the five-unit bail assembly (Fig. 30). The bail is a single arm located under the cycle shaft and pivoted in front on the bail shaft. When the five-unit bail is allowed to rise, the right end of the balance lever rises to allow clockwise operation of the rotate bellcrank.

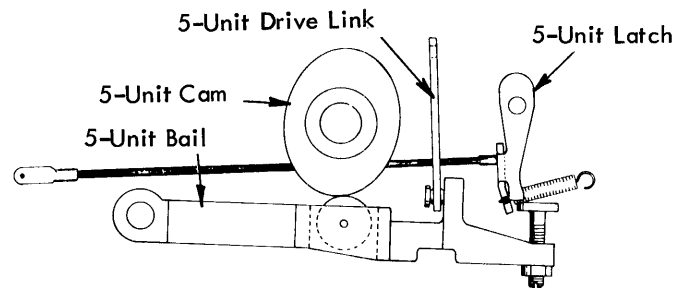


FIGURE 30. Five Unit Bail At Rest

The five-unit bail is prevented from rising by the five-unit latch at the rear (Fig. 31). The latch is mounted to the differential bracket and pivots front to rear. In the rest position the latch is positioned above the head of an adjusting screw at the

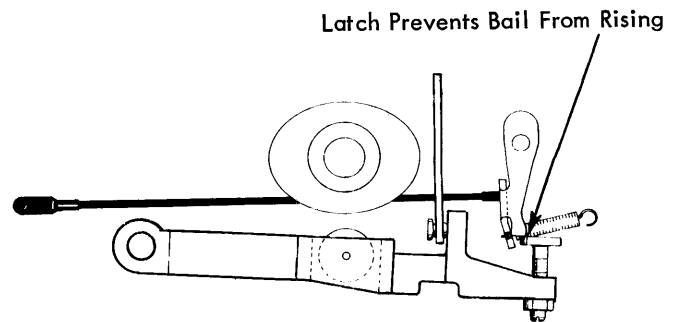


FIGURE 31. Five-Unit Bail During Positive Rotate Cycle

rear of the five-unit bail. When the latch is operated forward the bail is allowed to rise (Fig. 32). The force which raises the bail comes from the rotate pulley spring and the spring attached to the rotate arm. These springs are applying a constant force on the rotate bellcrank in the clockwise direction.

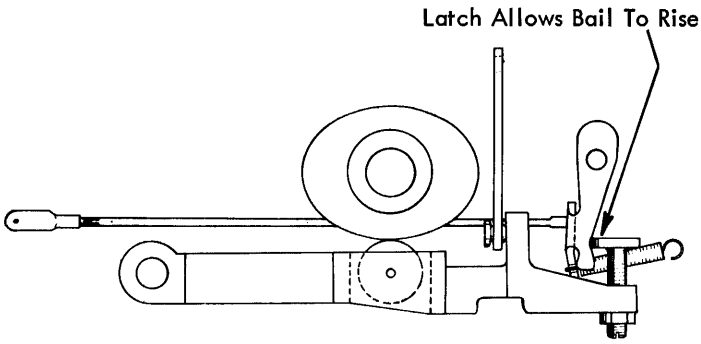


FIGURE 32. Five-Unit Bail During Negative Rotate Cycle

The five-unit bail is restored down by the extreme right hand cam on the cycle shaft. The high point of the cam is 90° from the high point of the other two cams. This insures that when the latch bail is driven DOWN in the active position, the five-unit bail can be UP in the active position. Conversely, when the latch bail is UP in the rest position, the five-unit bail will be DOWN in the rest position.

It should be noted that the five-unit bail is held down in the rest position by the cam rather than by the five-unit latch. In the rest position there is a clearance between the latch and the adjusting screw in the five-unit bail. The clearance must be present to insure resetting of the latch at the completion of a cycle. During a positive rotate or no rotate cycle, the five-unit bail rises slightly before being restricted by the five-unit latch (Fig. 31). This upward movement of the five-unit bail allows a slight clockwise, or negative rotation of the type head. The type head rotates from the rest position to a position known as the "latched-home" position. Consider all positive and negative rotations to occur from the latched-home position.

Movement of the five-unit bail from the latched-home point to the low point of the cam allows sufficient clockwise movement of the rotate bellcrank to permit a five character negative rotation of the typehead (Fig. 33). If less than five units of nega-

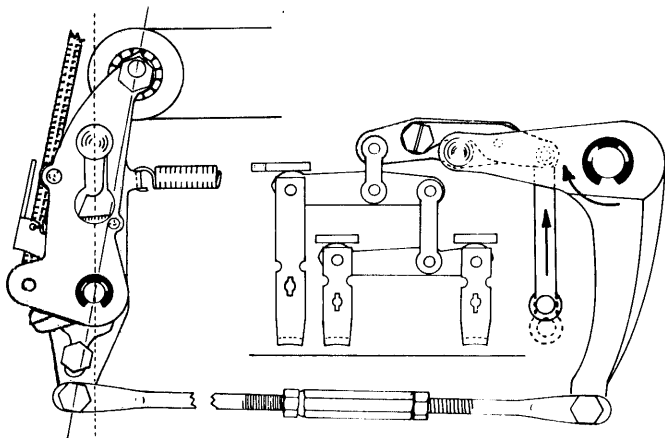


FIGURE 33. Negative-Five Rotate Operation

tive rotation is desired, it is necessary to pull down on the left end of the balance lever as the right end goes up. This reduces the amount of clockwise movement of the rotate bellcrank. Operating one or more positive rotate latches down in conjunction with allowing the five-unit bail to rise allows different amounts of negative rotation. The positive rotate-one and negative-five combine to allow a negative-four rotation. A positive-two and negative-five combination gives a negative-three rotation (Fig. 34). A positive-three and a negative-five operation permits a negative-two rotation. A positive-four plus a negative-five combination gives a negative-one rotation.

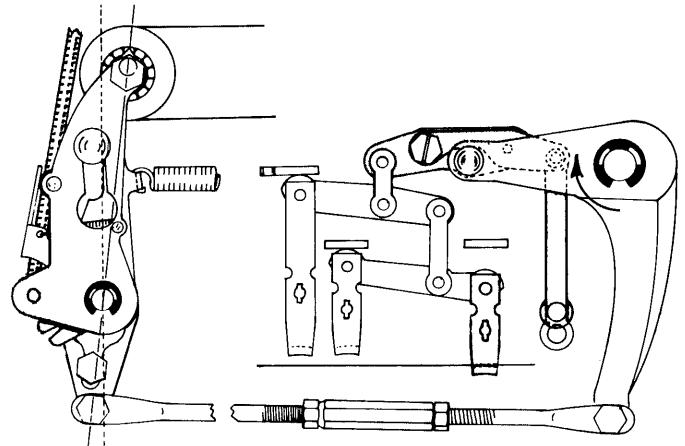


FIGURE 34. Negative-Three Rotate Operation

#### KEYBOARD SECTION AND CHARACTER SELECTION

The keyboard section is a compact unit that contains all the keylevers and allied parts, and a selection mechanism for the differential latches. Depression of any printing keylever prepares the selection mechanism for operation and trips the cycle clutch latch to allow a cycle operation.

#### Keylevers

The keylevers pivot on a fulcrum rod at the rear (Fig. 35). A rubber covered rod limits the upward travel of the keylevers and the bottom of the guide comb slots limit the downward travel of the keylevers in the front guide comb. A lower extension on each keylever operates in the keylever bearingsupport to stabilize the keylever.

The keybuttons are designed in the shape of a pyramid to make the use of a keyplate unnecessary. The tops of the keybuttons form a concave slope to the keyboard for ease of operation. Keylever tension is supplied by a set of flat spring fingers under the front of the keylevers. The forward end of each spring finger is cupped so that the spring will maintain its position under the keylever. Different spring tension is supplied to the four rows of letter keylevers by auxiliary leaf springs under the keylever springs. The auxiliary spring fingers vary in length to offset the leverage difference among the four rows of keylevers. This variation in spring tension results in a uniform operating force requirement for all keylevers.

A shoulder rivet attaches a keylever pawl to each keylever at the rear. A small spring attached from the pawl to the keylever holds the pawl in the rest position. The pawl extends below and is formed under the keylever in position to strike the top of an interposer (Fig. 35).

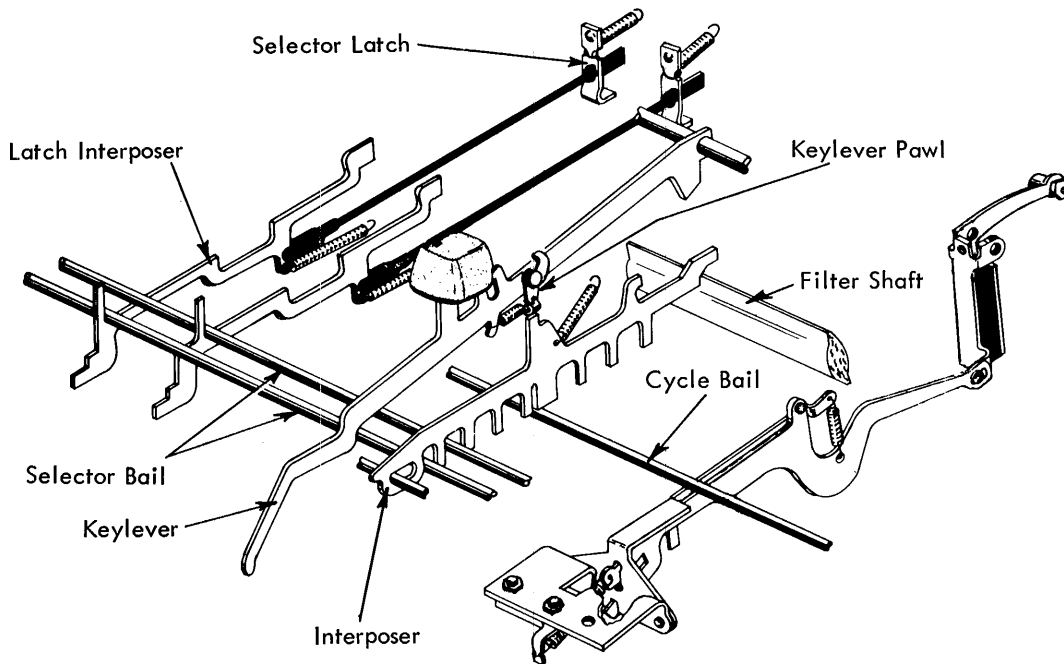


FIGURE 35. Keyboard Section and Character Selection

Adjusting lugs just to the rear of the top row of keybuttons make it possible to adjust the relative height of each individual keylever and keylever pawl.

Interposers

Each keylever has a character interposer located just below it (Fig. 35). The purpose of the interposers is to select the amount of tilt and rotate needed to bring the desired character to the printing point. A large fulcrum rod passes through an elongated hole in the front of each interposer and provides a support on which the interposers can pivot and slide. A guide comb at the front and rear separates the interposers. The interposers are allowed to move up and down in the rear guide comb as well as front to rear. An extension spring from each interposer to the top of the rear guide comb loads the interposer to the rear and up into the rest position.

The interposers have several lugs extending from them, each with its own operation to perform (Fig. 36). Each interposer has a lug on top in position to be struck by the keylever pawl. On the bottom of the interposers are positions for eight lugs. Seven of the lugs are selective lugs. The absence or presence of these lugs in different position combinations makes the interposers different. There are no two alike. The rearmost selective lug is for special applications of the machine.

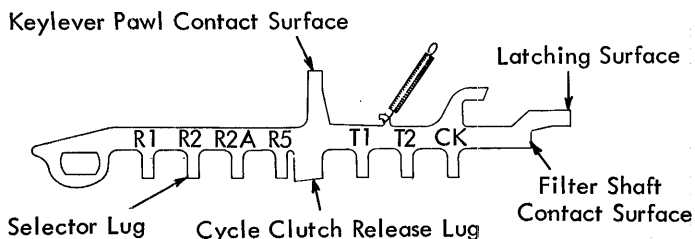


FIGURE 36. Selector Interposer

One lug on the bottom is common to all interposers. It is a wide lug located at the middle of the interposers. Its purpose is to release the cycle clutch for a cycle operation whenever a keylever is depressed. Directly below the lug is the cycle bail that pivots up and down (Fig. 35). Downward movement of any character interposer forces down on the cycle bail to release the cycle clutch latch and allow a cycle operation. The cycle clutch release lug is cut at an angle on the bottom to prevent interference between the lug and the cycle bail as the parts are restoring to the rest position.

Filter Shaft

When the interposer is depressed it pushed the cycle bail down to unlatch the cycle clutch and cause a 180° rotation of the cycle shaft (Fig. 35). Rotation of the cycle shaft 180° also rotates the filter shaft 180°. The filter shaft is a two-bladed shaft located at the rear of the keyboard section and just below the ends of the interposers. It rotates in a bearing at each end and is connected by a gear train on the left side of the cycle shaft.

When an interposer is depressed, the rear of the interposer is moved down in front of one blade of the filter shaft. As the filter shaft turns, the blade drives the interposer forward to operate the character selection mechanism.

Interposer Latch Springs

Resting against the rear of each interposer is a spring finger called the interposer latch spring (Fig. 37). The spring fingers are slightly deflected to the rear when the interposers are at rest. When any interposer moves down at the rear, the spring snaps forward over the interposer and holds it down. The interposer remains down until it is pushed forward enough to clear the spring finger. At that time it is raised and restored by its extension spring.

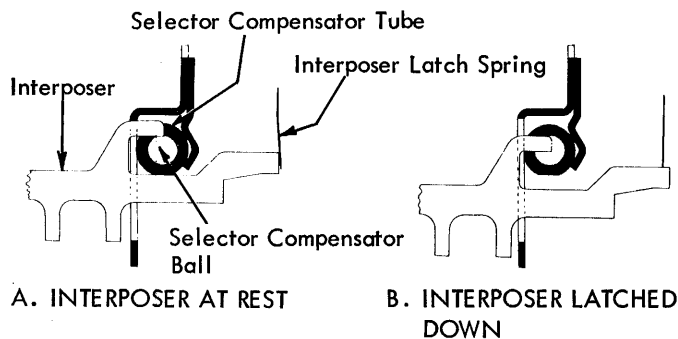


FIGURE 37. Interposer Latch and Selector Compensator

An interposer must be latched down to insure that it will remain in the path of the filter shaft blade until the cycle operation occurs. Unless latched down, the interposer could restore upward without being driven forward. This would result in an erroneous character because of no character selection (+ 5 rotate tilt 3).

With this latching device, one interposer can be latched down just as the previously depressed interposer is being operated forward. The second interposer will then be operated forward as soon as the cycle operation for the first interposer is completed. This is known as character storage and tends to even erratic typing rhythm.

#### Selector Compensator

The selector compensator prevents simultaneous depression of two keylevers insuring that only one interposer at a time can be operated down and then forward. If more than one interposer at a time were depressed, they would be operated forward together and a selection error would result causing the wrong character to print. A hook shaped lug at the rear of each interposer operates in a device called the selector compensator attached to the rear interposer guide comb (Fig. 37). The compensator contains closely spaced steel balls that prevent downward movement of two or more interposers simultaneously (Fig. 38a). When an interposer is down, the steel balls shift in the tube of the compensator to block the downward movement of any other interposer (Fig. 38b).

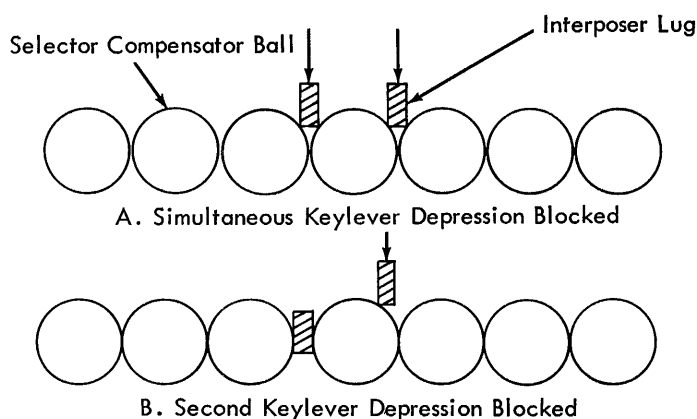


FIGURE 38. Selector Compensator Action

The hook portion of the interposer lugs extends to the rear just to the center line of the steel balls (Fig. 37). When an interposer is driven forward after being depressed at the rear, the lug will not be between the steel balls and another interposer can be depressed. With this arrangement, the operator does not have to wait until an interposer is restored upward before actuating another.

An adjustable stop at each end of the compensator tube keeps the balls somewhat centered between the interposers. The balls are thus prevented from shifting too far left or right. If the balls were allowed to move too far under the interposer lugs, they would partially block the depression of an interposer and the keyboard touch would suffer. The stops are removable so that the steel balls may be removed and cleaned if necessary.

#### Selector Bails and Links

Seven selector bails are mounted between the side frames so they can operate forward and back (Fig. 35). Each bail is in front of a selector lug position on the interposers. When an interposer containing all its lugs is driven forward, all the selector bails are moved forward. If any lug is absent from an interposer, the bail for that position will not be operated forward by that interposer.

Seven sliding interposers called the latch interposers are located under the left end of the selector bails (Fig. 35). These interposers operate

Each latch interposer has a lug that extends up directly in front of a selector bail. As the selector bail is moved forward, the latch interposer is moved forward by the bail. The bails and latch interposers are paired so that each bail operates only one interposer. An extension spring at the bottom of each latch interposer loads the interposer and its selector bail to the rear. The latch interposers rest against adjustable lugs at the rear to prevent the bails from being forced against the selector interposer lugs. This prevents the selector interposers from binding against the bails as the interposers are depressed. The stop lugs also help prevent the selector bails from bouncing as they are restored to the rear.

An adjustable link connects each latch interposer to one of the selector latches of the differential mechanism (Fig. 35). When a latch interposer is moved forward, the selector latch connected to that interposer is pulled forward to prevent its being operated downward by the latch bail.

#### Cycle Clutch Latch

Although not actually a part of the keyboard section, the cycle clutch latch is directly related to the keyboard mechanisms. It is through depression of a keylever that the cycle clutch is allowed to operate.

The cycle clutch latch pivots on a bracket at the front of the power frame. It pivots from the top and rests in a vertical position just in front of the cycle clutch sleeve. A thin metal plate, mounted in rubber on the rear of the latch prevents rotation of the sleeve thereby preventing the cycle clutch spring from tightening on the cycle clutch pulley hub (Fig. 39). The latch is held in this position by the cycle clutch latch pawl and link assembly that extends forward from the latch. The cycle clutch latch pawl pivots on the link. An extension spring between the two parts rotates the front of the pawl up into a latched

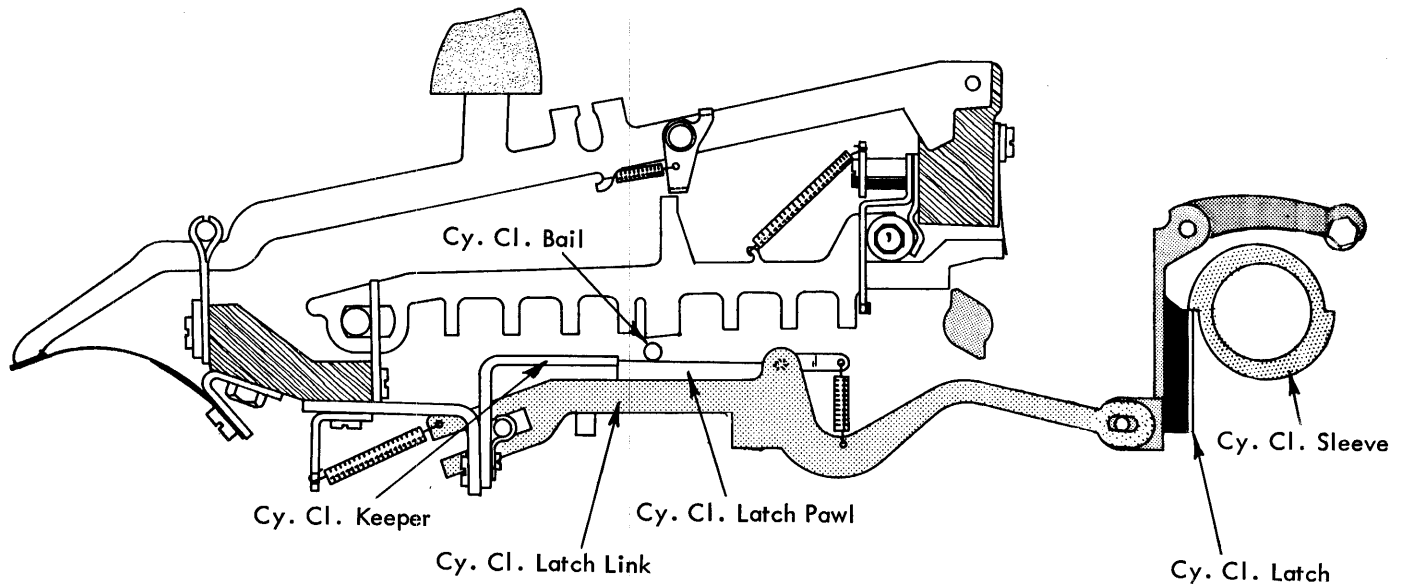


FIGURE 39. Cycle Clutch Latch Mechanism

position behind the cycle clutch keeper (Fig. 39). The cycle clutch keeper is an adjustable plate mounted, by means of the cycle clutch keeper bracket, to the guide comb support under the front of the keyboard section. An extension spring exerts a pull toward the front on the cycle clutch latch link. The pawl, being attached to the link, prevents the link from being pulled forward.

When the keylever is depressed, the interposer beneath the keylever forces the cycle bail to pivot downward. The cycle bail moves the cycle clutch latch pawl down disengaging it from the keeper. The extension spring at the front of the link is then allowed to snap the link and cycle clutch latch forward disengaging the latch from the clutch sleeve. This allows the clutch spring to tighten and begin a cycle operation.

A small lever, called the cycle bail damper, pivots at each side of the keyboard just above the cycle bail (Fig. 40). An extension of each lever rests against the front of the bail. An extension spring connected between the cycle bail and each damper has the dual purpose of restoring the cycle bail upward and holding the damper against the bail. The purpose of the dampers is to lightly retard the upward movement of the cycle bail so as to prevent the bail from bouncing as it reaches its upward limit. Without the dampers the bail has a tendency to bounce down and retrip the cycle clutch creating an additional cycle.

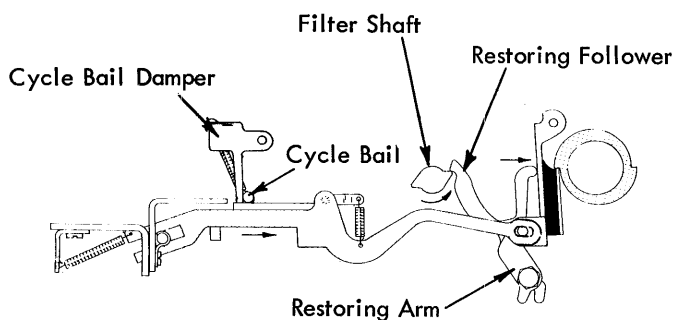


FIGURE 40. Cycle Clutch Latch Restoring Operation (Early Style)

#### Early Style Restoring Mechanism

For a cycle operation, the cycle shaft must be limited to 180° rotation. This means that the cycle clutch latch must be restored and held to the rear into the path of the second step on the cycle clutch sleeve. A two-piece adjustable restoring device pivots on the cycle clutch latch bracket. As the filter shaft rotates during a cycle operation, a blade of the filter shaft forces the restoring follower to the rear (Fig. 40). The follower and restoring arm acts as one piece; thus the restoring arm moves to the rear and pushes the cycle clutch latch back into position to stop the cycle clutch sleeve. The latch is restored far enough to the rear to permit the cycle clutch latch pawl to reset on the cycle clutch keeper and maintain the parts in the rest position.

#### Late Style Restoring Mechanism

The new style cycle clutch latch restoring mechanism consists of a cam and a cam follower. The cam, called the cycle clutch latch restoring cam, is a double lobed nylon cam mounted on the cycle shaft (Fig. 41). The cam follower is an extension of the cycle clutch latch which protrudes to the rear of the machine just above the restoring cam. The extension has a small adjustable steel roller mounted on it which rides on the cam during a restoring operation.

When the machine is at rest the low point of the restoring cam is directly below (but not in contact with) the steel roller (Fig. 41). When a keylever is depressed the cycle clutch latch pawl is pushed off its keeper allowing the cycle clutch latch to swing forward releasing the cycle clutch sleeve. When the cycle clutch latch swings forward the steel roller on the extension drops down onto the restoring cam. As the cam rotates

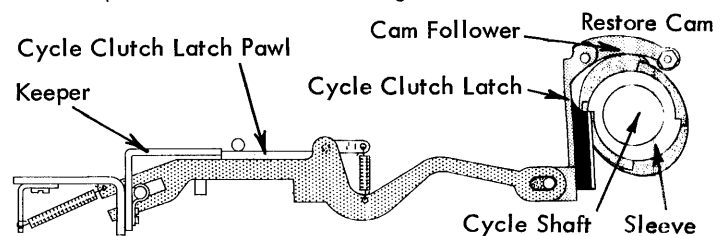


FIGURE 41. Cycle Clutch Latch Restoring Operation (Late Style)

towards its high point the steel roller is forced up swinging the cycle clutch latch to the rear into the path of the cycle clutch sleeve. The latch is restored far enough to the rear to permit the cycle clutch latch pawl to reset on its keeper.

### Operation

Depression of a letter keybutton causes the front of the key-lever to move down as the rear end pivots about the fulcrum rod. The keylever pawl at the rear of the keylever contacts the top lug of an interposer. Further movement of the keylever causes the rear of the interposer to move down as the front pivots about the interposer fulcrum rod. As the interposer moves down, a lug on the bottom of the interposer forces the cycle bail and the cycle clutch latch pawl down. Further movement of the interposer allows the interposer latch spring to snap forward over the top of the interposer to maintain its downward position. At about the same time that the interposer latches down, the cycle bail trips the cycle clutch latch pawl off its keeper to allow the cycle clutch to begin an operation.

As the cycle shaft turns, the cams of the cycle shaft force the latch bail down. However, the contour of the cams is designed so that cycle shaft rotation does not cause immediate downward movement of the latch bail. During the "dwell" on the cycle shaft cams, the filter shaft is operated to drive the depressed interposer forward.

As the interposer is driven forward, the selector lugs that are present on the interposer push their respective selector bails forward. The bails cause the latch interposers to pull the selector latches forward.

The latches are pulled forward only for an instant. As soon as the interposer has been pushed forward far enough to clear its interposer latch spring, it becomes free to restore vertically. The fact that the interposer cannot move up instantly out of the path of the filter shaft allows it to be driven farther forward. The interposer spring then raises the interposer and restores it to the rear. This allows the latches to restore to the rear. By this time the latch bail will have been forced down by the cycle shaft cams far enough to prevent resetting of the latches under the bail plate. The latches merely rest against the bail plate until the cycle operation has been completed and the latch bail has restored. The same action applies to the negative-5 latch except that its bail is allowed to rise in the operated position. The negative-5 latch resets above its bail when the bail has been driven down to its rest position.

If the keylever has been held down throughout the operation, the rear edge of the interposer lug strikes the keylever pawl as the interposer restores to the rear. The keylever pawl is then deflected to the rear and remains in this position until the key-lever is released (Fig. 42). At that time it snaps forward above

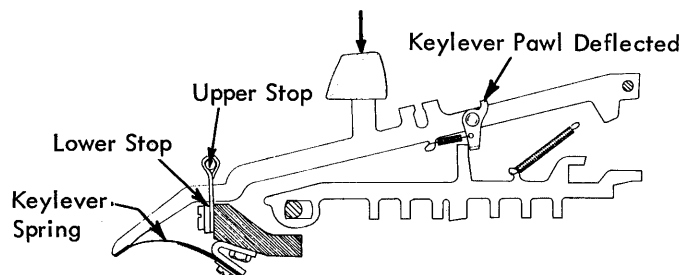


FIGURE 42. Keylever Held Depressed

the interposer lug ready for the next operation. This arrangement insures a single operation regardless of how long the key-lever is held depressed by the operator.

### Key-Lever Contacts

Some machines require key levers to operate N/O contacts located in the right front corner of the keyboard. The end of the key lever that normally operates against the flat key-lever tension spring instead operates against the operating strap of the N/O contacts.

### PRINT SELECTION UNIT

The print selection unit is mounted to the power frame in the lower left corner. It consists of three basic assemblies.

1. Selector magnet assembly
2. Selector latch pusher assembly
3. Selection contact assembly

### Selector Magnets

There are seven magnets used in this unit, one for each tilt and rotate selection latch, plus one for code check (Fig. 43).

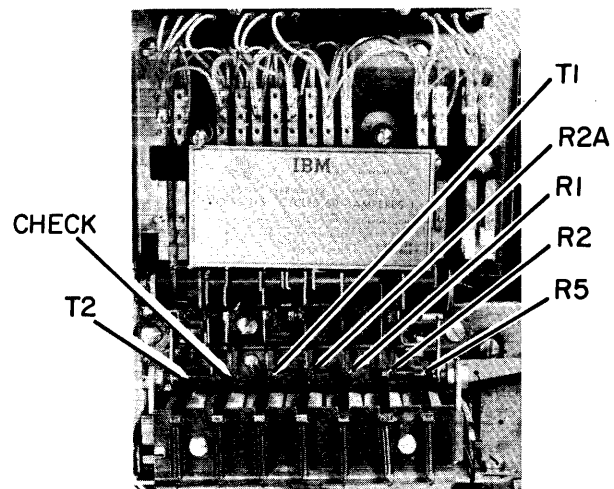


FIGURE 43. Selector Magnets

### Trip Mechanism

Impulsing a magnet causes its armature to move to the rear. The operating end of the armature strikes the cycle clutch trip bail. As the bail is operated to the rear, it pulls a link that is connected to the latch lever (Fig. 44). The latch lever pivots about its pivot point and the hook on the end of the latch lever disengages with the trip lever. The trip lever is spring loaded toward the cycle-clutch latch, so when the latch lever moves off the lug on the trip lever, the trip lever moves forward against the cycle clutch latch. As the trip lever pivots toward the cycle clutch latch the inhibitor trip lever pivots through an arc and pulls the inhibitor pawl down out of the path of the cycle clutch latch. The cycle clutch latch restoring will restore the trip lever and also allows the inhibitor pawl to restore into the path of the cycle clutch latch. At this time, the latching surface of the latch lever will restore behind the lug on the trip lever because of the restore spring on the latch lever and the mechanical restoration of the cycle clutch trip bail.

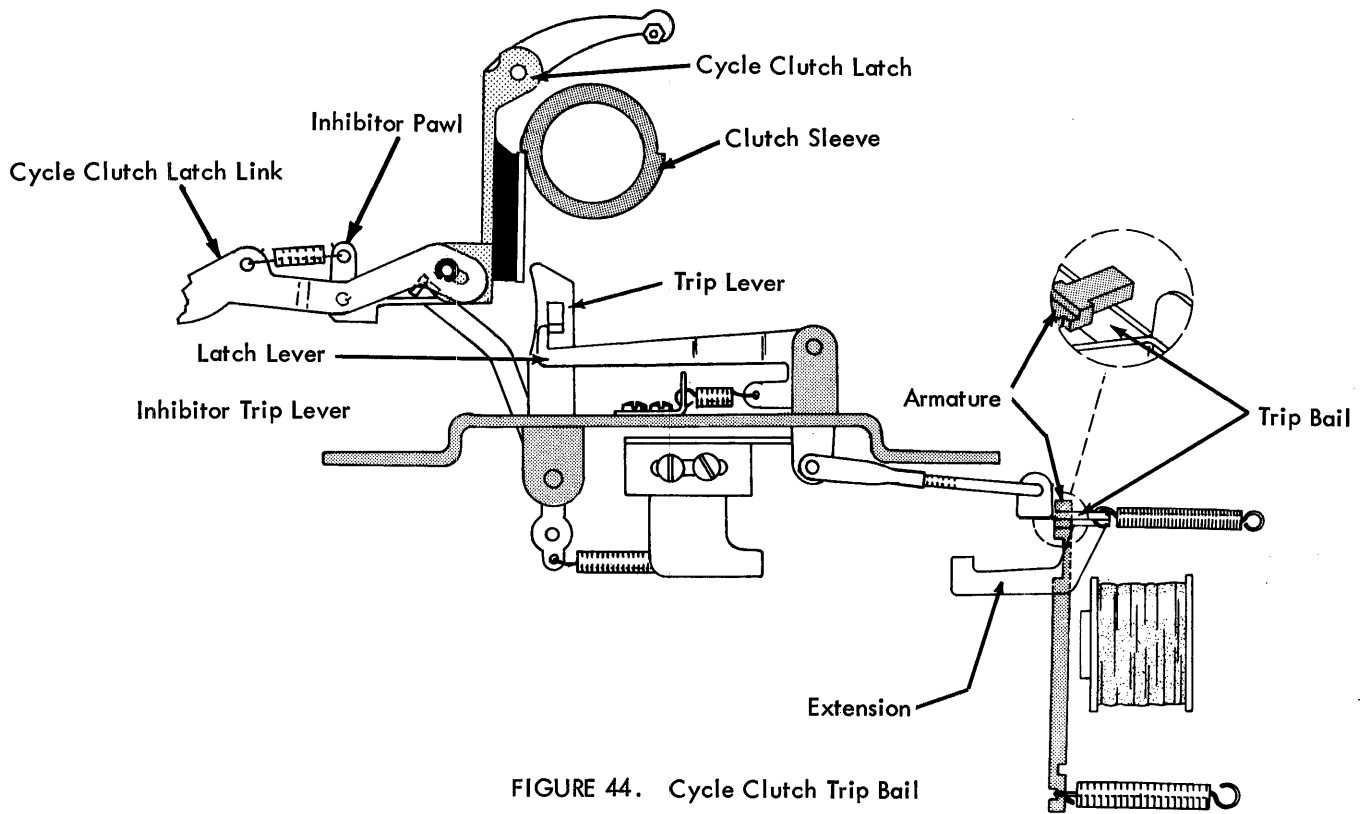


FIGURE 44. Cycle Clutch Trip Bail

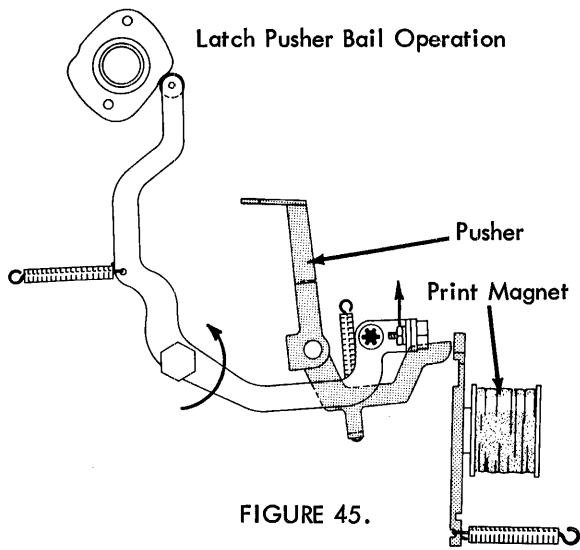


FIGURE 45.

Latch Pusher Cams

Two other cams are on the cycle cam shaft assembly. They are located between the positive cams on the cycle shaft. They are called latch pusher cams.

The purpose of the cams is to operate the selector-latch pusher bail.

As the cycle shaft begins to turn, the cam follower arms raise the latch pusher bail (Fig. 45). Further rotation of the cycle shaft causes the pusher bail to lower (Fig. 46). When the cycle clutch latches, the bail is restored to its rest position (Fig. 47).

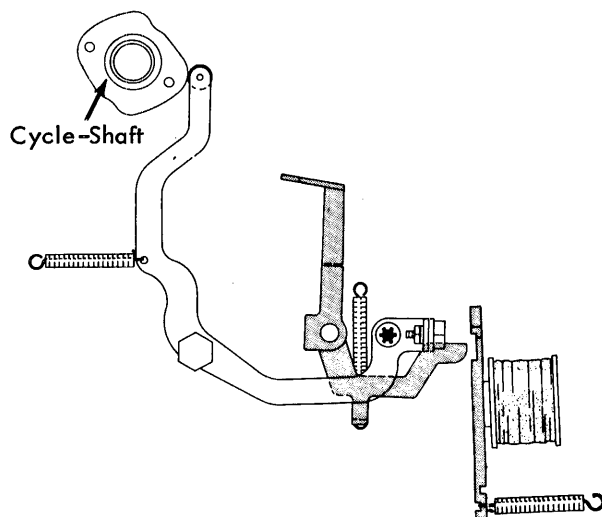


FIGURE 46.

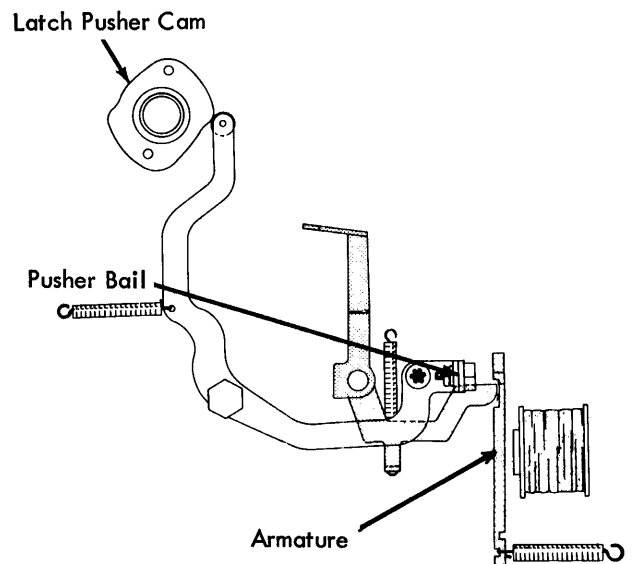


FIGURE 47.



### Selector Latch Pusher

The selector latch pushers pivot on a shaft that is mounted to the power frame by a bracket.

There are seven latch pushers; one for each selector latch, including the code check latch.

The purpose of the latch pusher is to move the unwanted selector latches forward from under the selector-latch bail.

The latch pushers are spring loaded toward the pusher bail. When the bail rises, the tail of the pusher follows the bail. As the pusher pivots on the shaft, the operating end or top of the pusher moves forward, contacting a selector latch. The latch will be pushed forward, away from the bail (Fig. 48).

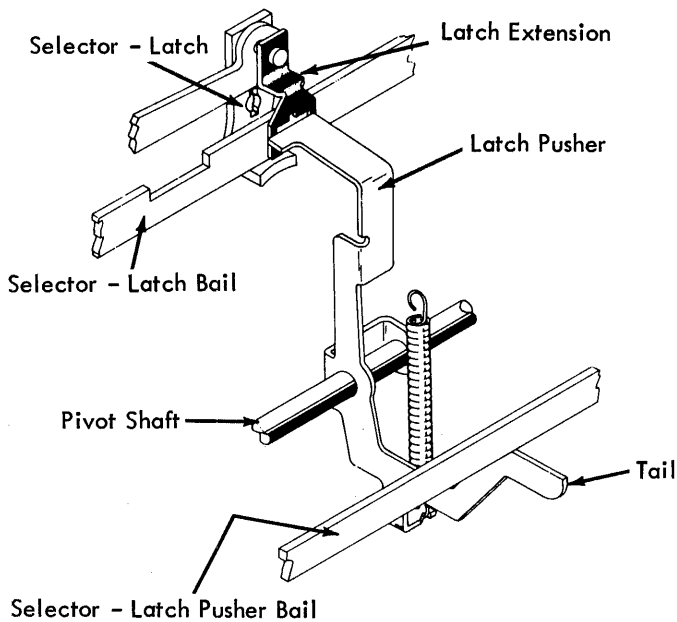


FIGURE 48. Selector - Latch Pusher

It is important to note that the selector armatures that were not attracted will keep their respective latches from being operated. This is accomplished by the tail of the pusher contacting the latching surface in the notch of the armature as the pusher starts to rise (Fig. 47).

Because the armature kept the tail of the pusher from rising, the pusher could not push the latch away from the bail. Therefore, the selector latch is left under the selector-latch bail to be operated as the bail moves down.

### Restoring the Selector Latch Pushers

The selector latch pushers are restored by the selector-latch pusher bail. The bail forces the tails of the pushers down, causing the pushers to pivot on a shaft. The top of the pusher moves to the rear, allowing the selector latches to return under the selector-latch bail.

The pusher bail must restore the pushers far enough to allow the armatures to fully restore. The tails of the pushers should be in the notch of the armatures. At rest, the tails of the pushers are against the pusher bail and should not be touching the armatures (Fig. 49).

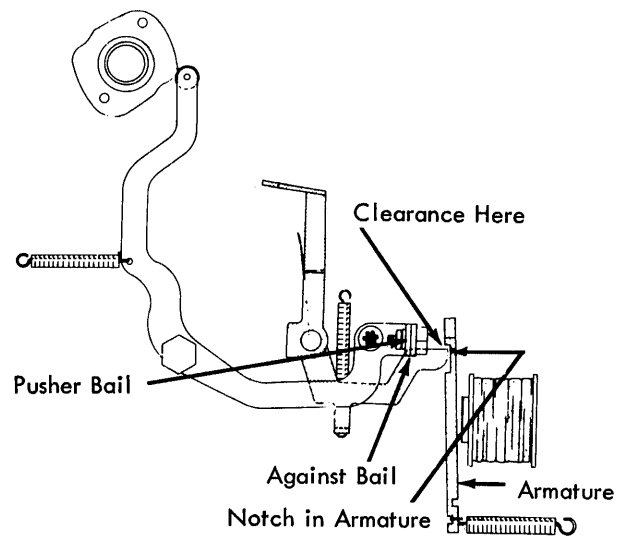


FIGURE 49. Latch Pusher Restoring

### Selector Armature Knock-off

Armature knock-off is provided to overcome any residual magnetism and to insure that the armatures restore quickly.

The cycle clutch trip bail provides a positive knock-off for the selection magnet armatures. An eccentric knock-off stud on the pusher-bail cam-follower arm restores the cycle clutch trip bail. The trip bail restoring imparts the knock-off to the selector armatures (Fig. 50).

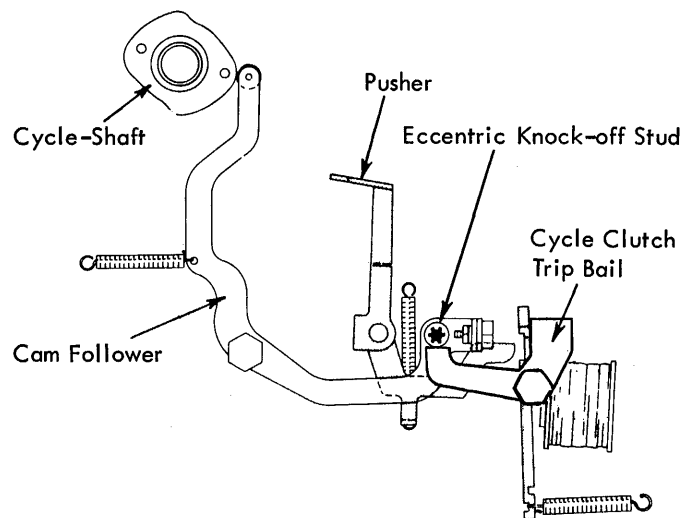


FIGURE 50. Selector Armature Knock-off

### SELECTION CONTACT ASSEMBLY

The selection contact assembly is mounted to a bracket that is fastened to the power frame. It is located directly below the selector latches. The upper contacts are used for code check and the bottom contacts are the transmitting contacts (Fig. 51).

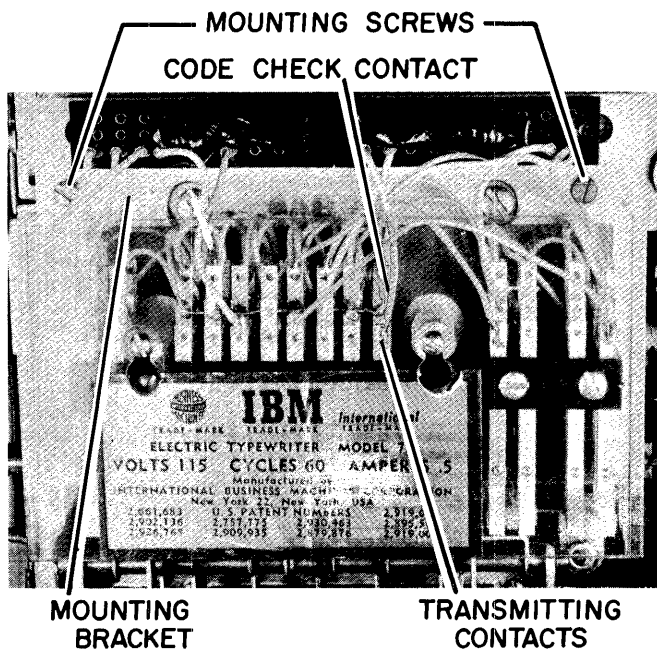


FIGURE 51. Print Selection Contact Assembly

Contact Actuator

A contact actuator will be operated by the selector-latches that remain under the selector-latch bail during a selection.

The extension of the latch that is being carried down by the latch bail strikes the contact actuator. The actuator will be pushed down in its guide. The bottom of the actuator has two cross bars that operate the contacts (Fig. 52). When the selector-latch bail restores, the contact actuators rise under the spring tension of the contacts.

The five unit actuator is operated when the five unit latch is not pulled forward. Operating the -5 unit latch allows the five unit bail to rise. The contact actuator rises under the tension of the contacts (Fig. 52).

Code Check (Parity Check)

The purpose of code check is to determine if the correct number of selector latches are active during a print selection cycle.

Code checking requires the addition of another selector bail, selector latch, latch pusher and magnet (Fig. 53). The selector latch has no mechanical function, other than to operate a contact. When in the out-put mode the code check magnet is used to trip the cycle clutch when a plus 5 rotate, 3 tilt character is selected.

In a machine where more than one selector latch must be active (pulled down by the bail), if a failure occurs, an unwanted latch may be pulled down, or a desired latch may pop out from under the bail. By always transferring an odd number of contacts, failures of this type can be recognized immediately.

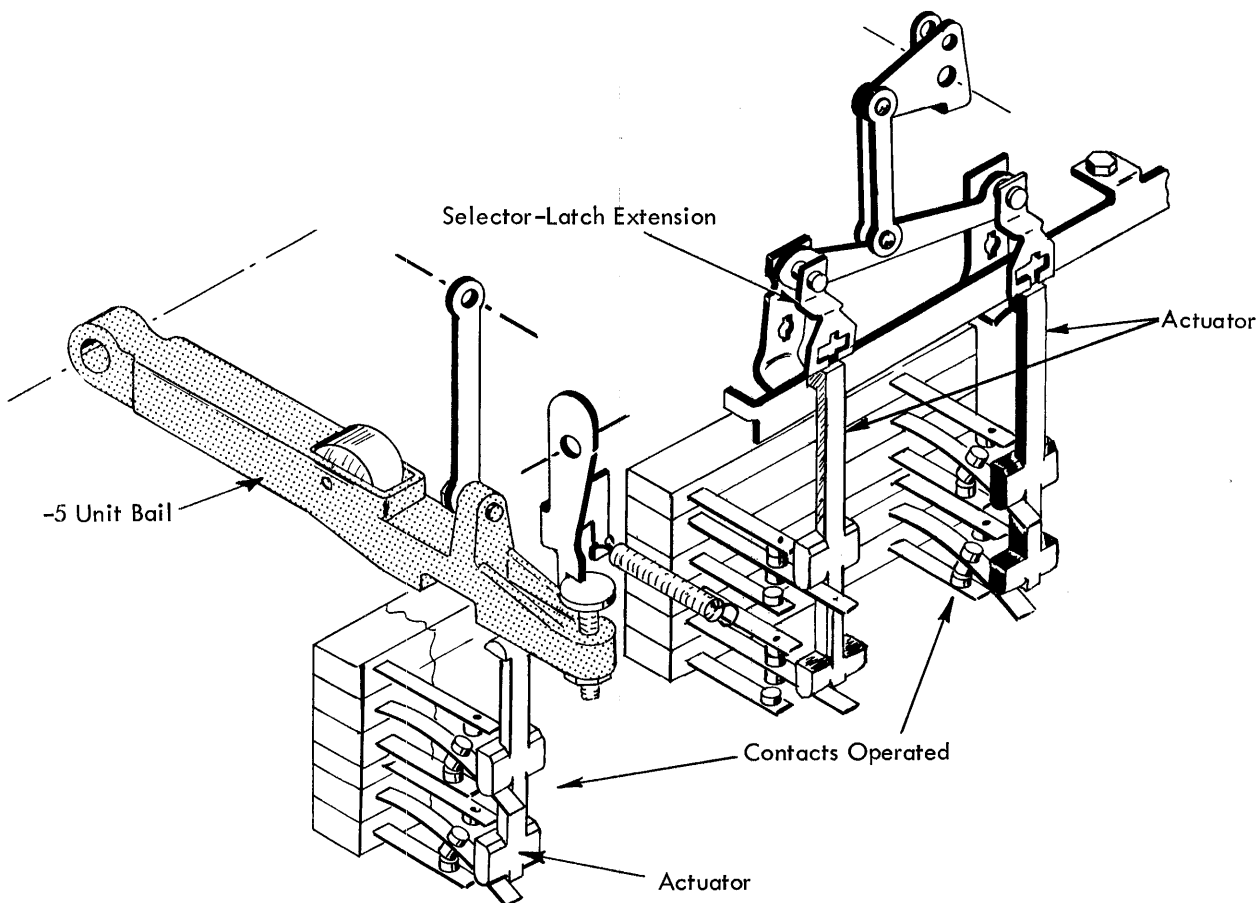


FIGURE 52. Contact Actuators

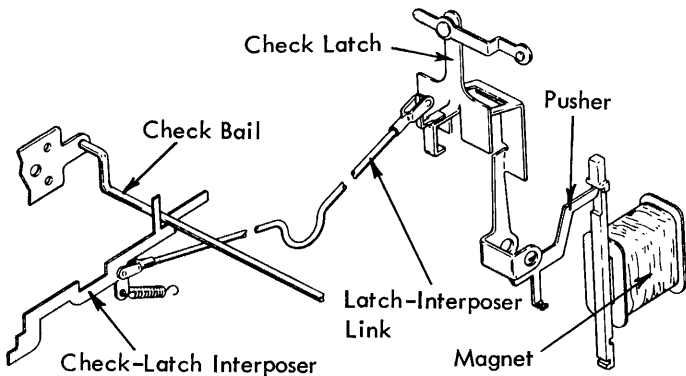


FIGURE 53. Check Latch

Depending on the printer wiring either "odd" or "even" bit check may be used.

Code check does not insure that the correct character has been printed, only that the correct number of selector latches are active.

Feedback Contacts (C1-C2)

This contact assembly is located on the left hand side of the printer. The purpose of C1 is to provide a gating time for the selection and checking contacts. The purposes of C2 are to provide gating of the print magnet pulse and to electrically prevent any other function from taking place during a print operation.

**KEYBOARD LOCK**

On some machines when the ON/OFF switch is turned OFF, the keyboard must be locked to prevent mechanisms from being tripped while the motor is not running. This is to prevent the motor from having to start under a load and to prevent an unwanted operation the next time the switch is turned ON.

Operation of the switch level controls the keyboard lock mechanism by rotating the lockout bail that extends across the bottom of the keyboard section (Fig. 54A). When the switch lever is in the OFF position, the lockout bail is moved

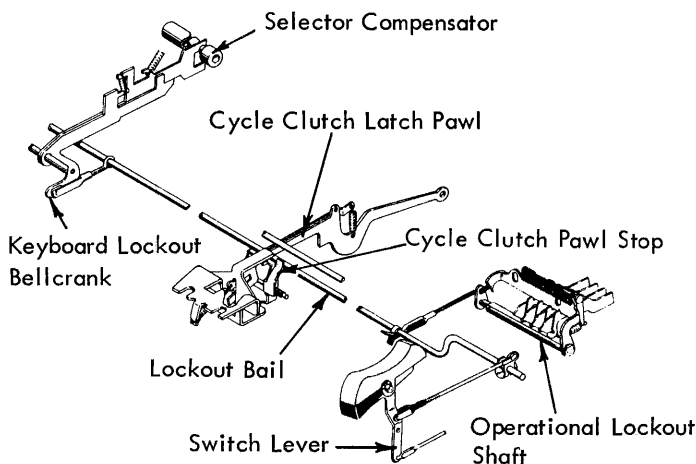


FIGURE 54A. Keyboard Lock Mechanism - ON Position (Early)

forward contacting the pawl stop which is positioned below an extension of the cycle clutch latch pawl, and prevents the cycle clutch from being released.

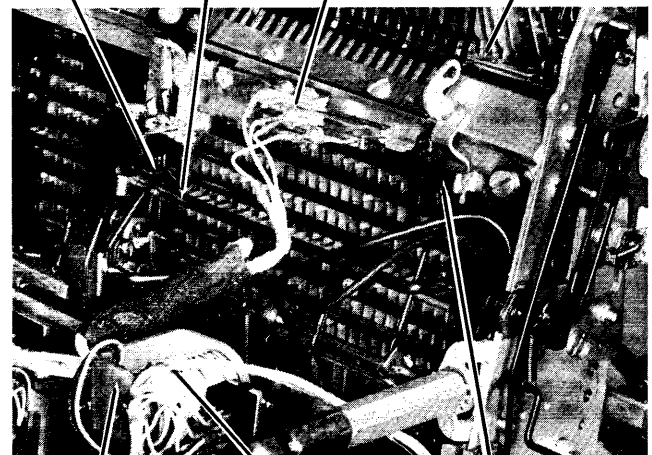
As additional insurance against an interposer being latched down, a special bellcrank at the left side of the keyboard is rotated into the selector compensator by a link from the lock-out bail. This forces the steel balls to shift in the tube and block the downward movement of all interposers. When the switch is ON, the keyboard lock bellcrank is spring-loaded out of the selector compensator.

A link from the right side of the lockout bail rotates a D-shaped shaft beneath the operational mechanism. The shaft locks the backspace, spacebar, carrier return and indexing keylevers when the switch is OFF. The tab and shift keylevers are not locked.

Keyboard Lock Solenoid

The keyboard lock solenoid is mounted to the bottom side of the powerframe. The solenoid is held by a U-shaped bracket that is bolted to the frame (Fig. 54B).

**PAWL STOP LOCK BAIL CONTACT LOCKOUT COMB.**



**MOUNTING BRKT. SOLENOID BELLCRANK**

FIGURE 54B. Keyboard Lock Mechanism

Lockout Lever

A bracket holds the lock-out lever in place. The bracket is fastened to the top of the power frame and to the solenoid mounting bracket. The lock-out lever is fastened to the bracket by a shoulder pivot screw.

The lock-out lever is positioned front to rear. The front of the lock-out lever contacts the keyboard lock bail roller. A spring is fastened to the rear of the lever, pulling it down. This causes the front of the lever to move up anytime the solenoid is not energized.

The sloped surface of the lock-out lever contacts the bail roller. As the lever moves up or down, depending on which way it is installed, the roller will be cammed forward. Figure 55

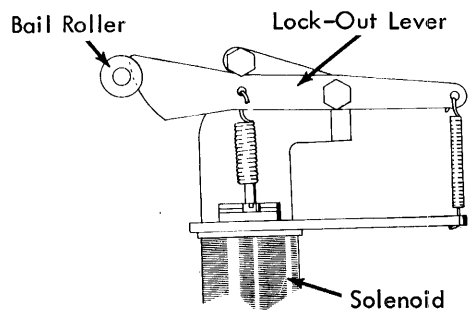


FIGURE 55. Lockout Lever - Solenoid Energized

shows the lever installed to lock the keyboard with the solenoid energized. Figure 56 shows the lever installed to lock the keyboard with the solenoid de-energized.

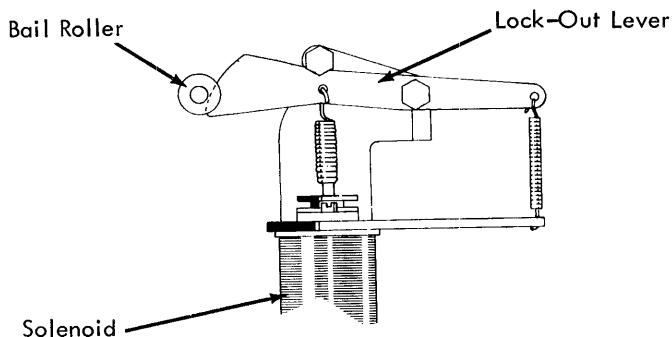


FIGURE 56. Lockout Lever - Solenoid De-energized

#### Keyboard Lock Bail

A bail is installed in the "Selectric" I/O Printer to provide a means of locking the various functions. The bail is operated by the lockout lever and as the bail is rotated to the front of the printer, three links and a slide assembly fastened to the bail cause the following (Fig. 57A).

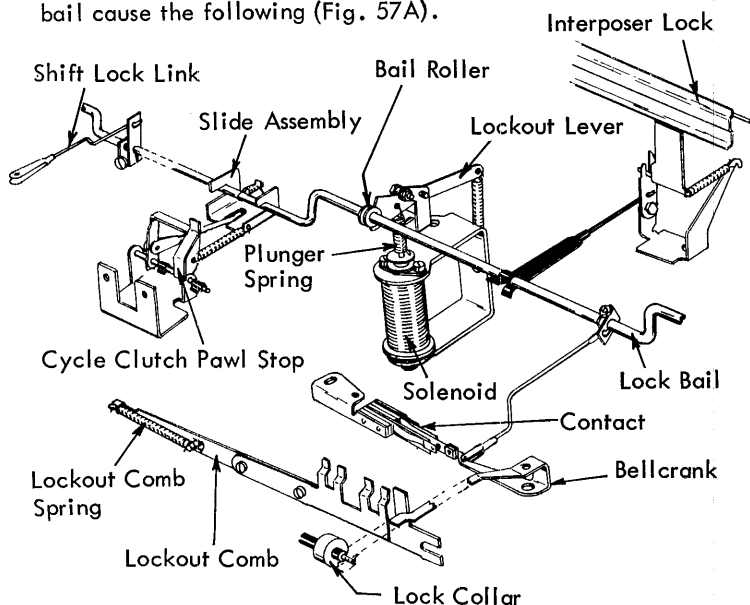


FIGURE 57A. Keyboard Lock Mechanism (Late)

1. The functional keylevers are locked.
2. The keyboard lock contact is operated.
3. All 44 character interposers are locked.
4. The machine will be returned to lower case if it is locked in upper case.
5. Cycle clutch pawl is locked.

#### Functional Keylevers

The functional keylevers are locked by the link on the right end of the bail. The link is fastened to the bail by an adjustable clamp. The end of the link that extends to the front, fastens to a bellcrank. The bellcrank pivots around the screw that mounts it to the keylever support. As the link moves toward the front, the bellcrank is rotated in a counterclockwise direction. The arm on the bellcrank, that extends to the front, moves to the right. The bellcrank allows the lockout comb to move to the right under its spring tension (Fig. 57A).

The lugs on the comb move under their keylevers to prevent them from being depressed.

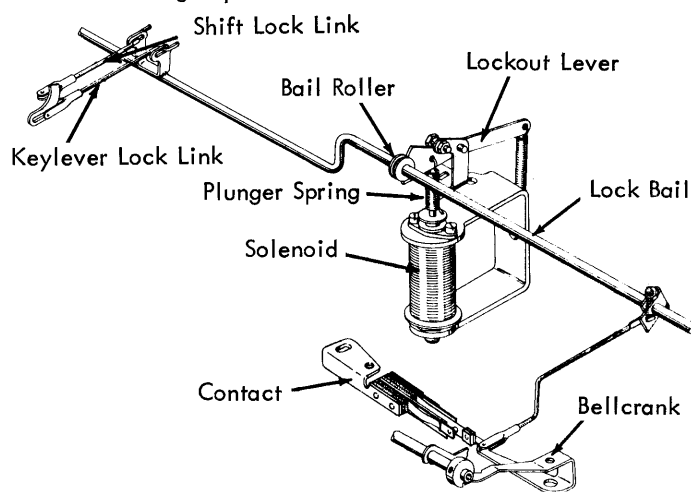


FIGURE 57B. Keyboard Lock Mechanism (Early)

#### Spacebar

Because the spacebar does not operate a keylever and cannot be locked with the comb, a lock collar is fastened to the space-bar shaft. When the keyboard lock bellcrank rotates, the arm on the bellcrank moves to the right under the step on the spacebar lock collar. This prevents the spacebar from being depressed (Fig. 58).

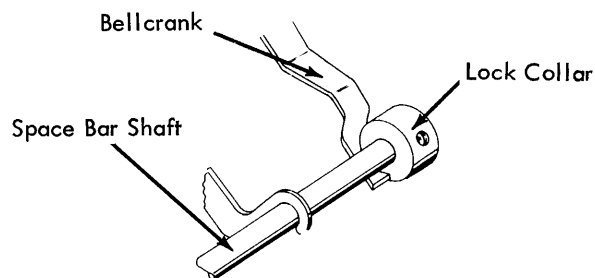


FIGURE 58. Spacebar Lock Collar

## Keyboard Lock Contact Assembly

A contact is transferred when the keyboard lock is operated. This is accomplished by a tab on the bellcrank that is operated by the keyboard lock bail (Fig. 57A).

### 44 Character Keylever Lock (Early) - Figure 57B

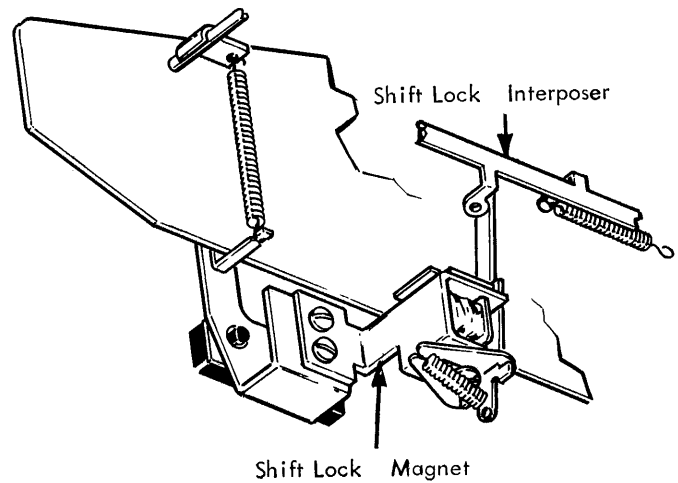
A bracket on the left end of the keylever lock bail operates the keylever lock. The keyboard lock bail pushes the link forward. The link operates the keylock interposer which locks the keyboard as previously described.

### 44 Character Interposer Lock (Late)

When the lock bail moves forward it pulls on the link which is connected to the interposer lock. The bottom of the interposer lock pivots forward under the character interposers and prevents depression of all character interposers.(Fig. 57A).

### Shift Lock Release

A bracket on the left end of the keyboard lock bail operates the shift lock latch. When the bail moves to the front, the shift lock link moves forward. The link operates the shift lock interposer (Fig. 59).



● FIGURE 59.1 Shift Lock Release (835 Printer)

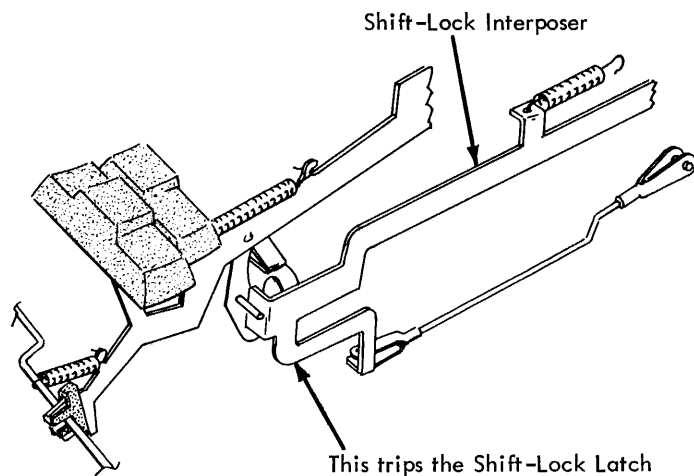


FIGURE 59. Shift-Lock Interposer

The shift lock interposer moves front to rear. It is supported at both ends by a guide comb. As the link pushes the interposer to the front, the interposer contacts a stud on the lock. The lock is pushed away from the shift stop, releasing the shift key. The machine will return to lower case.

### Shift Lock Release (835 Printer)

A magnet assembly is used to release the shift lock. The magnet is mounted to a bracket on the lower left keyboard side frame. The magnet armature extends upward and contacts a lug on the shift-lock interposer (Fig. 59.1). When the magnet is energized the armature moves forward, pulling the shift-lock interposer forward, releasing the shift-lock latch.

### Cycle Clutch Pawl Stop

Mounted on the lock bail and spring loaded to operate with the bail is the slide assembly. The slide assembly has a link which connects to the cycle clutch pawl stop (Fig. 57A).

As the slide assembly moves forward with the lock bail the pawl stop is positioned under an extension of the cycle clutch pawl, and prevents the cycle clutch from being released.

### SHIFT

The purpose of the shift mechanism is to rotate the typehead 180° in the counterclockwise direction. This action places the upper case hemisphere of the typehead near the platen for typing upper case characters. Each upper case character is in the same tilt band as its lower case counterpart, but 180° from it. Thus, depression of a keylever with the shift in operation causes an upper case character to print.

The shift mechanism consists of a shift arm, shift cam, spring clutch, clutch control mechanism and interlocks. The shift mechanism takes its power from the right end of the operational shaft. All the components are concentrated in that area.

### Shift Operation

The shift operates by moving the right hand rotate pulley toward the right (Fig. 60). The movement of the pulley creates sufficient pull on the rotate tape to cause 180° typehead rotation. The pulley remains in this position as long as the shift keylever is held depressed.

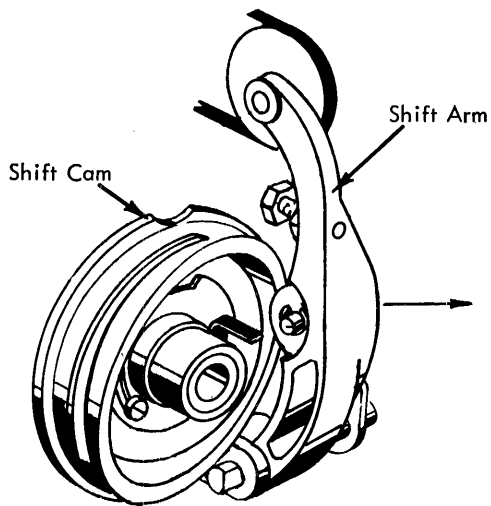


FIGURE 60. Shift Cam and Shift Arm

Two keybuttons, one at each front corner of the keyboard, can be used to actuate the shift mechanism (Fig. 61). A bail between the two keylevers causes both of them to move together regardless of which one is depressed by the operator. If the operator desires to keep the mechanism in the upper case position, a shift lock is provided for this purpose. The shift lock is attached to the left keylever and may be locked by depressing the shift lock keybutton. The shift lock may be released by depressing and releasing either shift keybutton.

The right hand rotate pulley is fastened to the top of the shift arm. The arm pivots to right on a pin at the bottom. A strap from the shift arm to the pivot pin acts to stabilize the shift arm to minimize front to rear movement of the pulley (Fig. 62). In the lower case position, an adjusting screw near the top of the arm rests against the head of a mounting screw on the side of the powerframe.

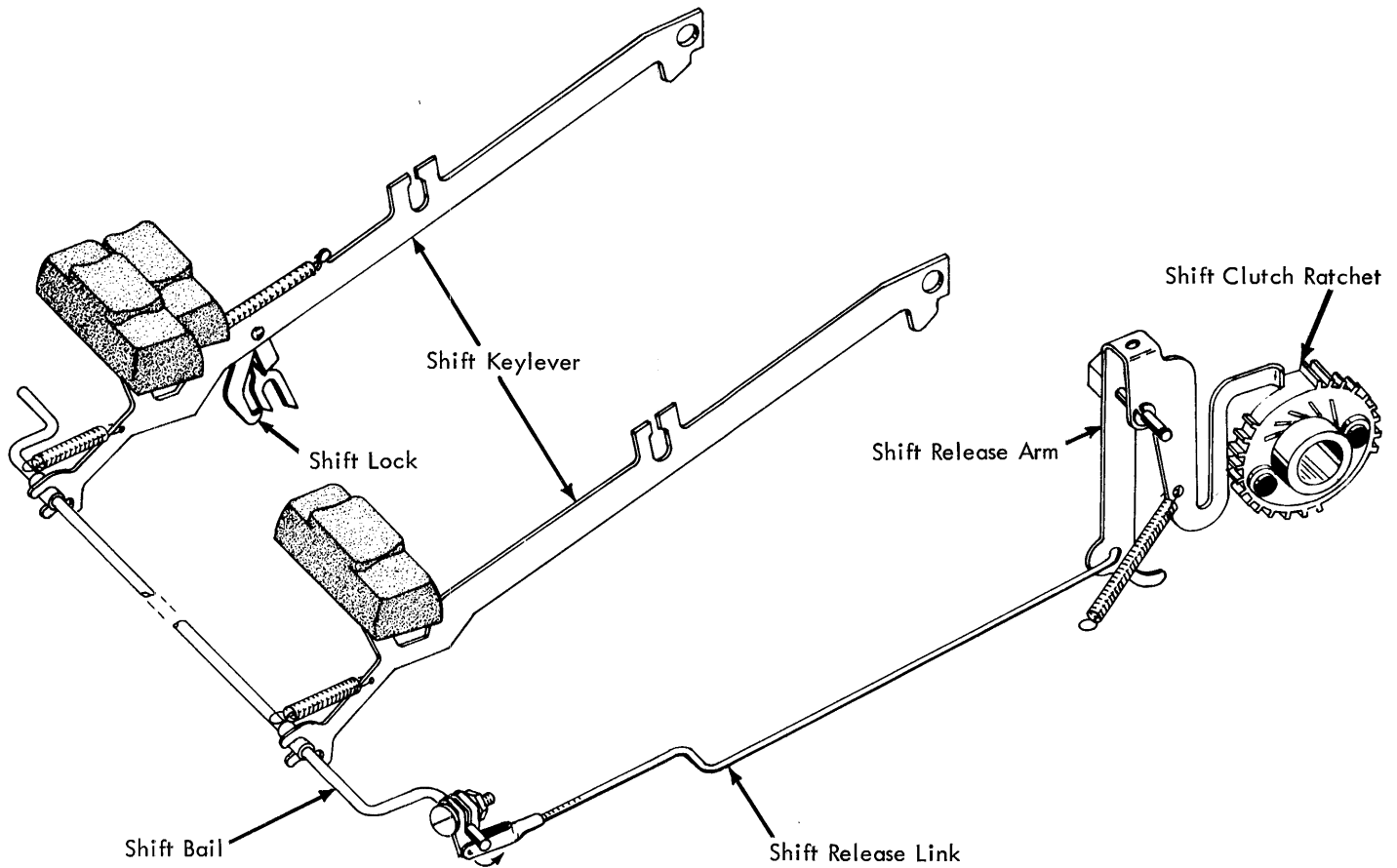
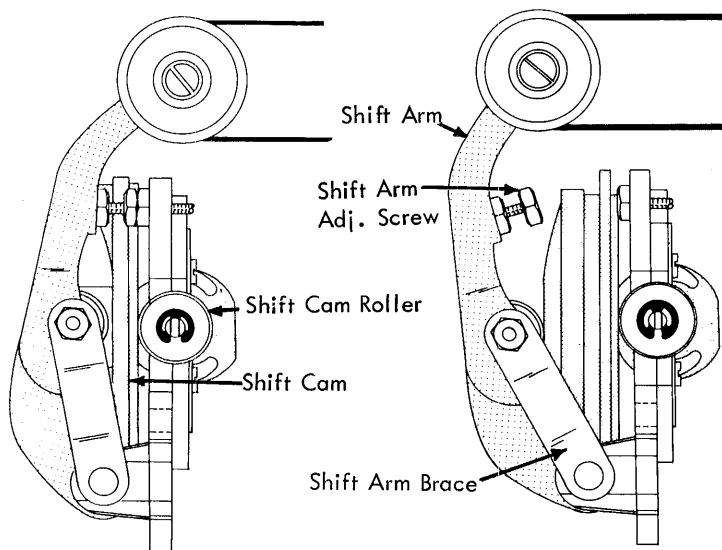


FIGURE 61. Shift Release Mechanism

The shift arm must be forced to pivot outward for a shift operation. A disc-shaped shift cam fits around an extension of the operational shaft bearing outside the sideframe. The cam operates between two rollers located at the rear of the cam (Fig. 62). The roller to the left of the cam is in a fixed position on the power frame and serves as a back-up roller for

the cam. The roller on the right hand is attached to the shift arm and rides the camming surface of the cam. The camming surface is on the right side of the cam rather than on the perimeter. When the low point of the cam is between the two rollers, the shift arm is in lower case (Fig. 62). The cam is operated 180° to the high point in order to force the arm into upper case (Fig. 62b).



a. LOWER CASE POSITION      b. UPPER CASE POSITION

FIGURE 62. Shift Operation - Rear View

The shift cam rotates only during a shift operation and receives its motion from the operational shaft. Since the operational shaft turns continuously when the motor is running, a clutch mechanism is required to engage and disengage the shift cam from the operational shaft when a shift operation is desired. A spring clutch "makes" and "breaks" the driving connection between the operational shaft and the shift cam.

The shift cam mounts on a shoulder on the right hand side of the operational shaft bearing and is free to rotate about this shoulder (Fig. 63). The operational shaft extends through the center of this bearing beyond the right side of the shift cam. An arbor (shift clutch arbor) is set screwed to the shaft just to the right of the shift cam and turns with the shaft continuously (Fig. 63). The driving force to the shift cam comes from this arbor by means of a spring clutch that is fastened to the cam and encircles the arbor. The spring clutch is undersized and wound in the same direction that the arbor is turning. Therefore, any time that the spring clutch is allowed to collapse about the arbor, it will turn with the arbor driving the cam. The cam is driven 180° each time a shift operation occurs.

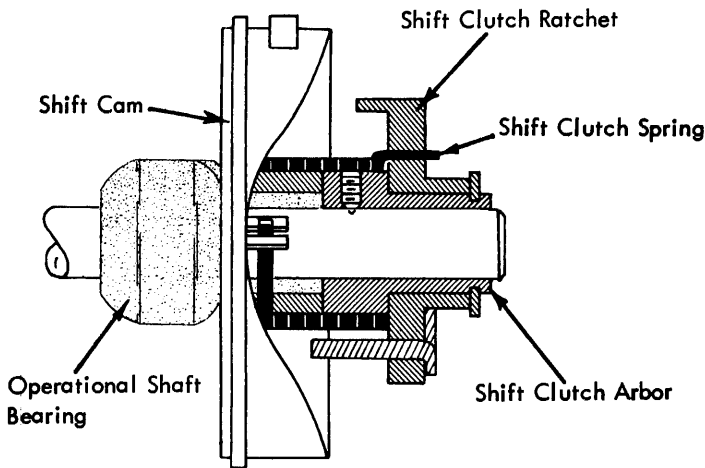


FIGURE 63. Shift Clutch

Usually a spring clutch is considered to be one that tightens when its driving hub turns in the direction that the spring clutch is wound and slips if the hub stops or rotates back in the opposite direction. This is not true of all spring clutches. In the shift mechanism, the driving hub (the shift clutch arbor) is rotating continuously in the direction that the spring clutch is wound. In order to stop the shift cam, the spring clutch must be allowed to slip while the arbor continues to rotate. The only way to do this is to enlarge or expand the inside diameter of the spring clutch so that the driving action will stop.

In the shift mechanism, the shift spring clutch must be held in the unwound position so that it will be enlarged enough to allow the arbor to slip freely inside it. To enlarge the spring clutch, one end of the spring must be held while the other is rotated in the unwinding direction of the spring. The left end of the spring is formed out and fits into an adjustable plate attached to the cam (Fig. 63). The right end of the spring is formed to the right and fits into a hole in the shift clutch ratchet (Fig. 63). The shift clutch ratchet is gear-like part mounted on the end of the shift clutch arbor. A large C-clip holds it in place. The arbor turns freely inside the ratchet when the shift is not being operated. Rotation of the ratchet counterclockwise causes the clutch spring to decrease in size. Conversely, if the ratchet is held stationary while the cam is rotated counterclockwise, the spring diameter is increased.

The shift clutch ratchet has two lugs 180° apart on its left surface. One lug is nearer the center than the other and is referred to as the inner lug. The other lug is called the outer lug. The shift release arm pivoted just in front of the cam blocks the movement of the ratchet lugs to stop to rotation of the ratchet (Fig. 64).

The position of the shift release arm determines the lug of the ratchet that will be stopped. The position of the shift-release arm is controlled by a link from the arm to a lever attached to the end of the shift bail (Fig. 61). When a shift keylever is depressed, the bail rotates to force the link to the rear and operate the shift release arm. When the key-levers are at rest, the release arm is in position to stop the inner lug of the shift clutch ratchet (Fig. 64). Depression of a keylever causes the release arm to rise out of the path of the inner lug into the path of the outer lug (Fig. 64).

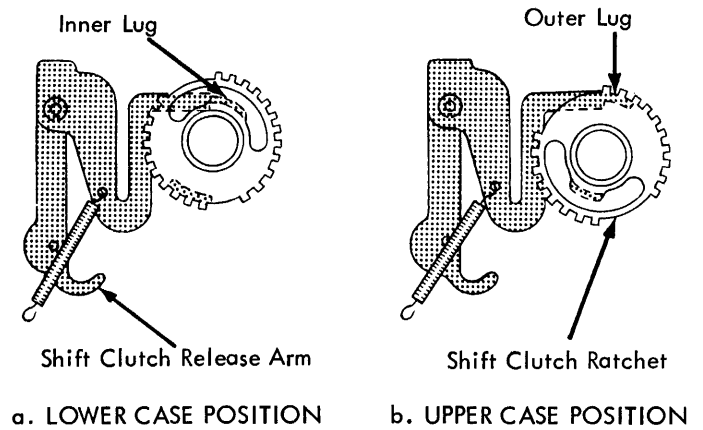


FIGURE 64. Shift Clutch Release Arm

When the inner lug is released, the clutch spring is allowed to decrease in diameter by its own spring tension. It then tightens around the rotating shift clutch arbor and the hub of the cam to drive the cam. The shift clutch ratchet rotates with the cam and clutch spring 180°. The outer lug of the ratchet then contacts the shift release arm, that has been raised into its path, and its rotation is stopped. The momentum of the shift cam causes it to rotate slightly farther. This further rotation causes the clutch spring to unwind and increase in diameter to allow the shift clutch arbor to slip freely inside the spring.

Once the shift cam's momentum has carried the cam far enough to properly disengage the spring clutch the cam must be restricted from overthrowing its rest position. Overthrow is controlled by the shift cam stop which is attached to the cam and operates against the inner lug of the shift clutch ratchet (Fig. 65).

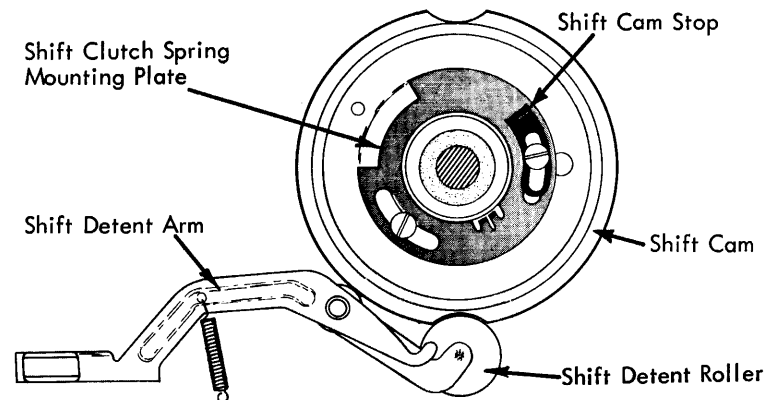


FIGURE 65. Shift Arm and Detent

As long as the shift keylever is held depressed, the high point of the shift cam remains to the rear holding the shift arm to the right. When the keylever is released, the shift release arm moves down out of the path of the outer lug and back into the path of the inner lug. This allows the clutch spring to again tighten and drive the shift cam and ratchet 180° back to the lower case position. The inner lug of the ratchet then contacts the release arm to disengage the spring clutch as before. The shift cam stop again controls overthrow of the cam.



Note that the shift cam stop always follows behind the inner lug of the ratchet when the ratchet and cam are operating. Whenever the ratchet is stopped by the release arm (on either lug) the momentum of the cam carries the stop further until the stop strikes the rear side of the inner lug. The horse shoe shaped release arm absorbs the shock of stopping the over-throw of the shift cam through the shift clutch ratchet.

Mounted on a pivot stud below and to the front of the shift cam is a small arm called the shift detent arm (Fig. 65). Although the detent arm's primary function is to operate the character interrupter mechanism, it is also used as a detent for the shift cam. As the cam approaches either the upper or lower case position a nylon roller mounted on the shift detent arm is spring loaded into corresponding detent notches located on the outside surface of the cam. This detenting action helps to place the cam in its proper rest position for both upper and lower case.

Cam overthrow is a greater problem in returning to the lower case than in shifting to upper case. As the cam returns to the lower case position, the roller of the shift arm is rolling from the high point to the low point of the cam. The pressure of the roller against the receding surface tends to accelerate the movement of the cam. Excessive speed of the cam could cause a noisy operation and parts breakage. To prevent cam acceleration, a braking action is necessary the same as an automobile must be braked in descending a hill. A heavy spring steel shift arm brake operates just in front of the shift cam. A nylon brake shoe, attached to the end of the brake, rides a raised surface on the circumference of the cam (Fig. 66). The friction applied by the brake prevents acceleration of the cam and causes the shift action to be the same for both upper and lower case.

#### Character Interrupter

If the shift is already in process when a letter key is depressed, the character must be delayed until the shift is completed. Otherwise the shift would be interrupted in mid-

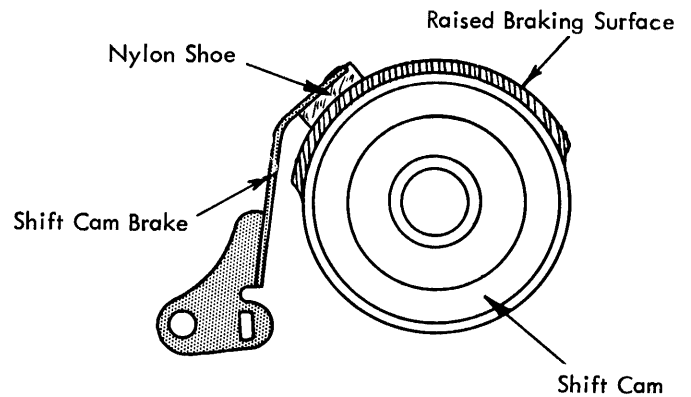


FIGURE 66. Shift Cam Brake

operation and an erroneous character would result. The character is delayed by blocking the cycle clutch release during a shift operation. When the shift cam starts an operation, the detent must move out of the recess in the cam. A forward extension of the detent lever operates a bail under the right side of the keyboard (Fig. 67). A small pawl on the left end of the bail is rotated up into the path of the cycle clutch latch link. The pawl blocks the forward movement of the link and prevents the release of the cycle clutch. This interlocking action does not prevent the depression of the keylever nor the interposer. The interposer is merely latched down into storage. When the shift action is completed, the detent enters the recess in the cam. The bail is rotated back to the rest position and the pawl moves out of the path of the cycle clutch latch link. The cycle clutch latch link is then pulled forward by its extension spring and the stored character is printed.

If the shift keylever and a character keylever are depressed simultaneously, both will operate for an instant until the filter shaft has a chance to actuate the shift interlock. During that time a collision will occur between the character interrupter pawl and the bottom of the cycle clutch latch link.

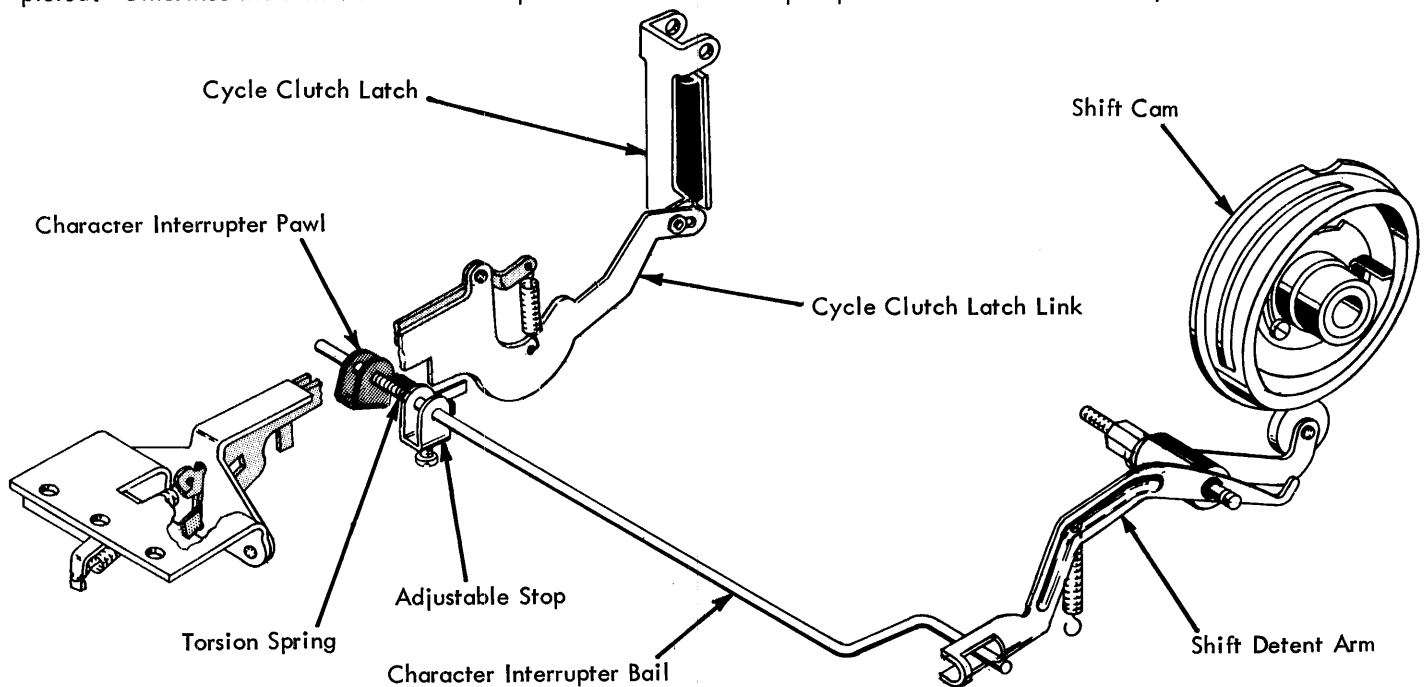


FIGURE 67. Character Interrupter

The character interrupter mechanism must yield in order to prevent parts damage. A torsion spring around the character interrupter bail loads the interrupter pawl against an adjustable stop on the bail. If a collision occurs, the interrupter pawl can yield by overcoming the torsion spring as the interrupter bail rotates.

### Shift Interlock

Operating the shift mechanism when the typehead is in the process of printing would result in parts damage. The rotate detent would be engaged in a notch of the typehead and the typehead could be against the platen. At this time no rotation of the typehead can be allowed; therefore the shift must be prevented from operating once the typehead has started toward the platen.

We have seen that the shift spring clutch remains disengaged as long as the shift clutch ratchet is prevented from rotating. An interlock arm is operated by a cam on the right end of the filter shaft (Fig. 68). The interlock engages the teeth of the shift clutch ratchet and prevents rotation of the ratchet. When the cycle mechanism is at rest, a roller on the interlock cam allows free operation of the shift mechanism (Fig. 68a). As soon as a cycle operation begins, the filter shaft rotates causing the interlock cam to actuate the interlock into the teeth of the shift clutch ratchet (Fig. 68b). This interrupts the shift operation until the cycle operation is completed.

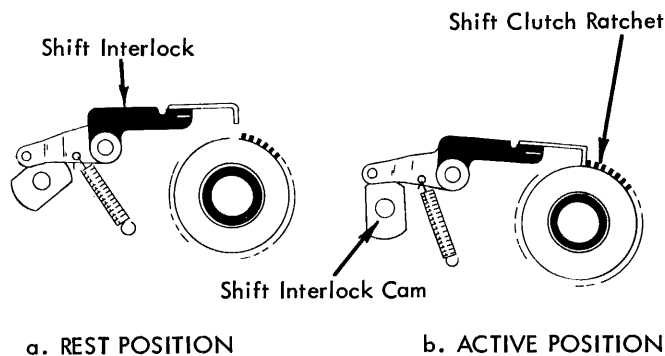


FIGURE 68. Shift Interlock

If an operator should operate the shift immediately after striking a character, the shift cam could begin to rotate before the filter shaft had sufficient time to actuate the shift interlock. This could cause an erroneous character to print because the shift arm had already begun to move. This is known as "beating the shift." This condition occurs mostly in shifting from upper to lower case. Shifting from lower to upper case is no problem because the shift arm does not rest against the cam in lower case. The cam must rotate somewhat before it begins to move the shift arm, thereby allowing the filter shaft sufficient time to actuate the shift interlock.

### Shift To Print Interlock (835 Printer)

The shift to print interlock provides a means for delaying a print operation until the shift motion is complete. It mounts on the cycle clutch trip mounting bracket.

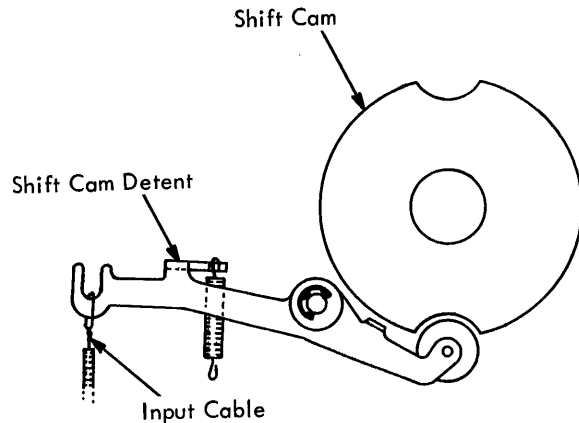


FIGURE 68.1 Shift Cam Detent

When the shift cam starts to rotate, the shift cam detent roller rides up onto the high surface of the shift cam (Fig. 68.1). This rotation of the shift cam detent pulls on the input cable which transfers motion to the input interlock arm. As the input interlock arm moves to the rear the shift interlock arm rotates forward over the rear step on the cycle clutch sleeve (Fig. 68.2).

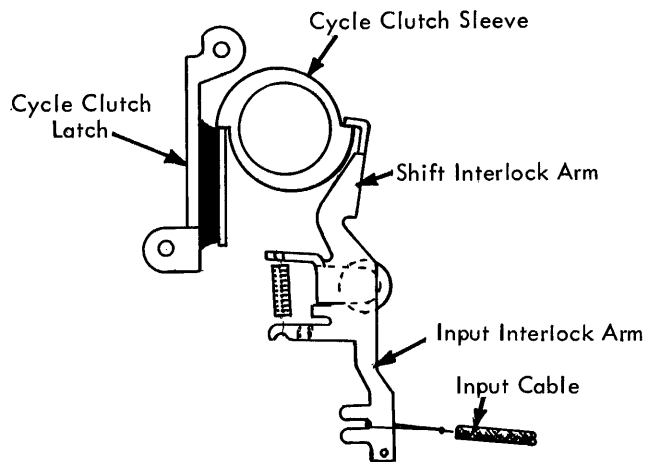


FIGURE 68.2 Shift To Print Interlock (Shown Operated)

The shift interlock arm will remain engaged until the shift cam detent roller enters the detent of the shift cam. This insures that the cycle clutch sleeve will not be released until a shift operation is complete.

### Shift Magnets Assembly

The shift magnet assembly is mounted to the right side of the power frame below the shift cam. It consists of two magnets and their armatures (Fig. 69).

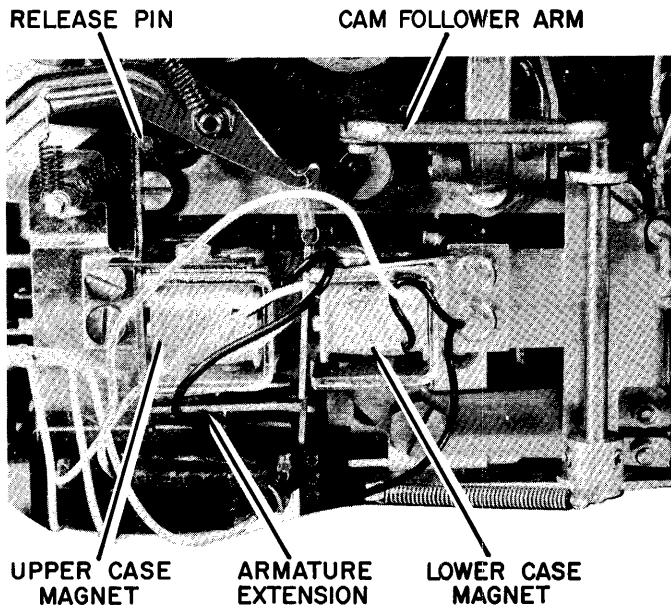


FIGURE 69. Shift Mechanism

The upper case armature has a formed end that extends to the rear and serves as a latching surface (Fig. 70). The lower case magnet armature is spring loaded to the front against the formed end of the upper case armature (Fig. 71).

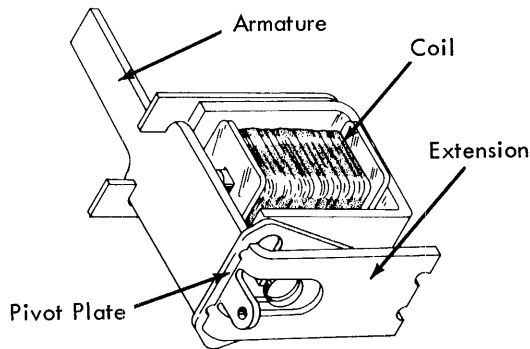


FIGURE 70. Upper Case Magnet

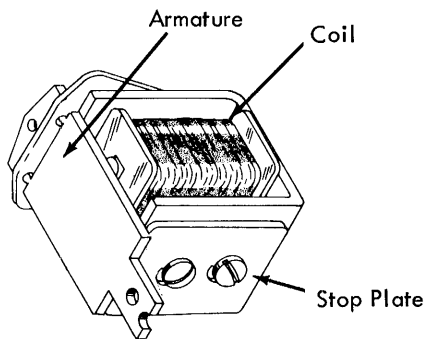


FIGURE 71. Lower Case Magnet

When the upper case magnet is energized two actions take place. One, the upper case magnet armature moving to the rear contacts a stud on the shift release arm pushing the arm to the rear. Once the shift release arm is pushed to the rear, the shift takes place as normal. Two, the formed end of upper case armature moves down. The lower case armature moves to the front, to its de-energized position. In this position, the lower case armature mechanically latches the upper case armature in the energized position, by moving forward into the path of the upper case armature's formed end (Fig. 72).

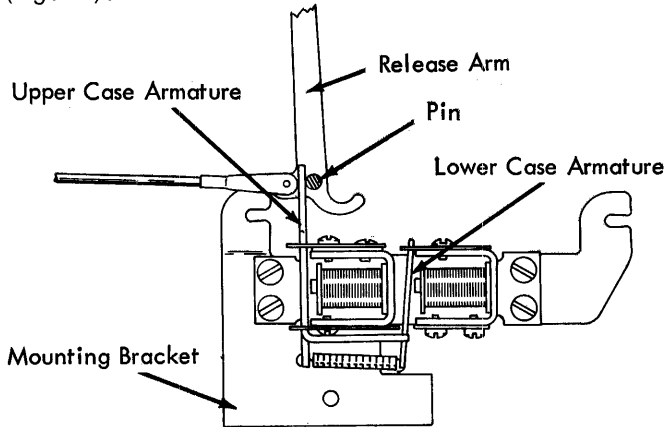


FIGURE 72. Shift Magnet Assembly

Attracting the lower case armature to the rear unlatches the upper case armature. This allows the formed end to snap up and the operating end to move forward, allowing the release arm which is under spring load to return to the lower case position.

Shift Contact Assembly

The shift contact assembly consists of a cam follower and two contact assemblies mounted to a plate. The plate is mounted to the right side of the power frame (Fig. 73).

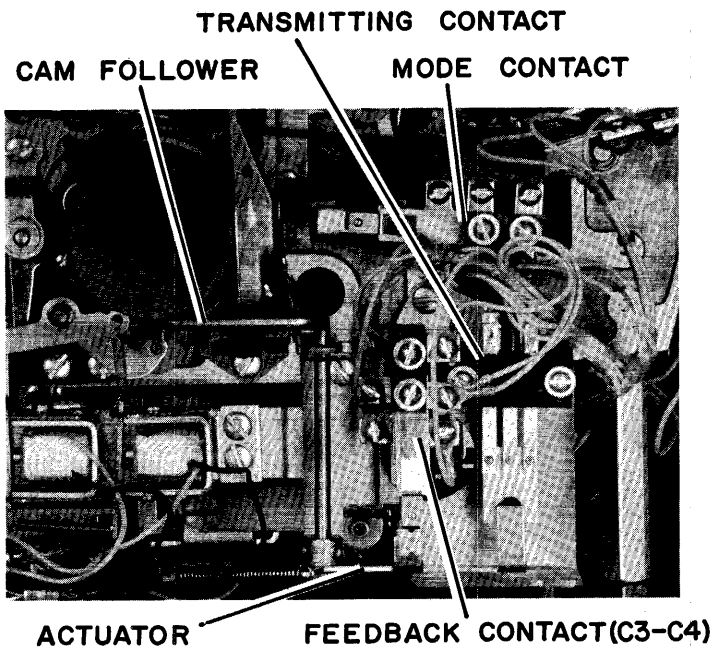


FIGURE 73. Shift Contact Assembly

Contact Cam Follower Actuating Arm

The cam follower arm rides the periphery of the shift cam. It is spring loaded toward and follows the contour of the cam.

The contact cam follower arm is positioned on the cam to lead the shift arm by 90°. In upper case, the shift cam is detented so the shift arm rests on the high point of the shift cam (Fig. 74). In lower case, the cam is detented so the shift arm rests on the low point (Fig. 75). Since the cam follower arm leads the shift arm by 90°, it will rest midway between the high and low point of the cam in either detent position. The contour of the cam is such that Points A and B (Figs. 74 & 75) are in the same plane. Therefore, the cam follower arm will be in the same relative position when the shift cam is detented in upper or lower case.

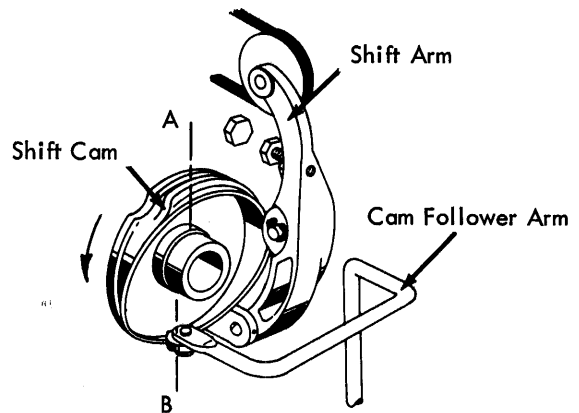


FIGURE 74. Shift Cam Detented Upper Case

Assume a shift operation from lower to upper case. The shift cam rotates 180° and will detent with the shift arm on the high point. As the high point moves past the cam follower arm, the arm is moved to the right and back to its rest position.

Returning to lower case, the shift cam rotates 180° and will detent with the shift arm resting in the low dwell. As the shift cam rotates, the cam follower arm moves to the left into the low dwell and back to its rest position.

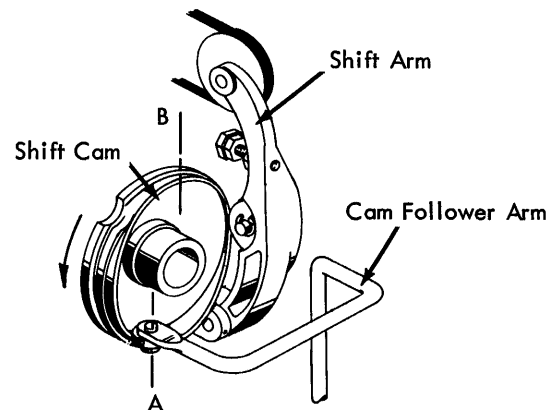


FIGURE 75. Shift Cam Detented Lower Case

center position. As the follower arm moves in and out of the low dwell, the actuating arm moves to the right and back to its center or rest position.

NOTE: The actuating arm operates only during the movement of the shift cam.

### Shift Contact Assemblies

The contact assemblies operated by the actuating arm are feedback and transmitting contacts.

The assemblies nearest the front are the feedback contacts. The assembly to the rear is the transmitting contacts (Fig. 76).

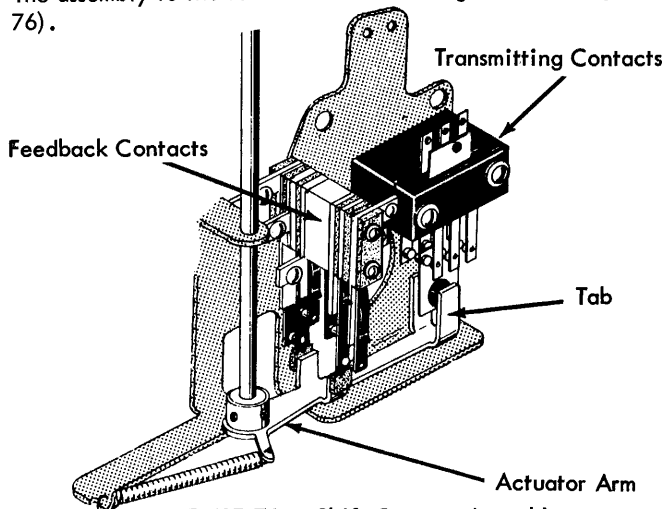


FIGURE 76. Shift Contact Assembly

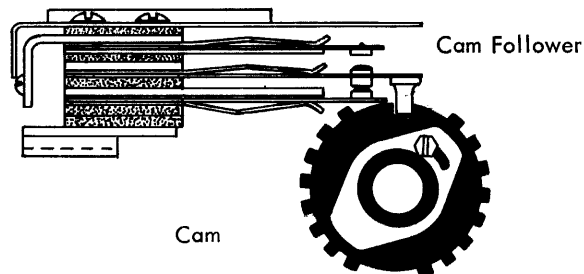
Shifting to upper case, the inner set of feedback and transmitting contacts are operated by the actuating arm. Shifting to lower case, the outer set of feedback and transmitting contacts are operated by the actuating arm.

### Shift Mode Contacts

The shift mode contacts are located just above the feedback and transmitting contact assemblies (Fig. 73). These contacts indicate whether the printer is in upper or lower case. This is accomplished by the shift arm tab (Fig. 73). This tab is bolted to the rear of the shift arm, and moves left to right with the shift arm. The mode contacts are positioned so that the tab will always hold one of the contacts transferred depending upon whether the printer is in upper or lower case.

### C-7 Contact Assembly (835 Printer)

This assembly consists of N/O and N/C contacts and a cam which is mounted to the shift ratchet (Fig. 76.1).



● FIGURE 76.1 C-7 Contact Assembly (835 Printer)

When the ratchet is released the cam turns with the ratchet. They both turn 180° on each shift operation. The cam follower rides on the C-7 cam causing transfer of the contacts.

### CYCLE CLUTCH OPERATION

The cycle operation occurs each time a character prints. Everything concerned with printing a character on the paper is powered by the cycle shaft either directly or indirectly.

The cycle shaft extends from the center of the machine out through the left side frame. The left end of the shaft is supported by a self-aligning bearing. The right end fits into the cycle clutch pulley hub in the center of the machine. A sleeve inside the hub acts as a bearing for the cycle shaft.

The cycle clutch pulley is in continuous rotation whenever the motor is running, but the cycle shaft operates only during a print operation. A spring clutch called the cycle clutch spring (Fig. 77) is the driving connection between the hub on the cycle clutch pulley and a hub on the cycle shaft. The cycle clutch spring provides a means of engaging and disengaging the cycle shaft from the cycle clutch pulley.

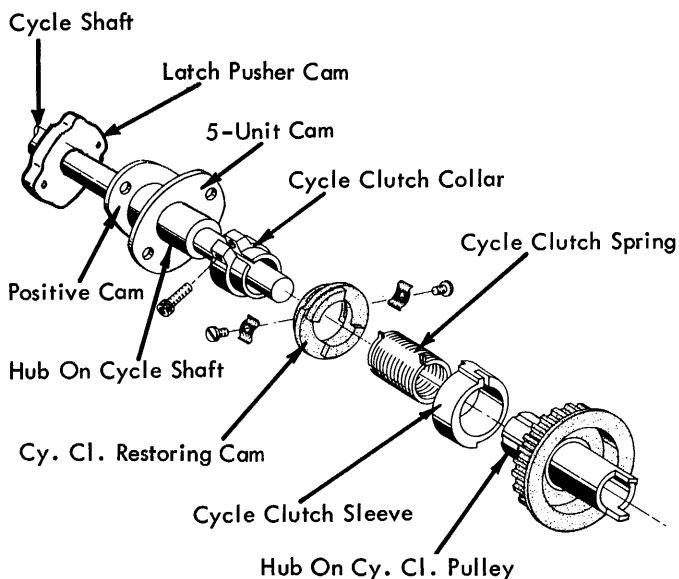


FIGURE 77. Cycle Clutch - Exploded View

The left end of the cycle clutch spring fits around the hub on the cycle shaft and is clamped to this hub by the cycle clutch collar. The tip of the spring is turned up so as to fit into a slot in the collar. This arrangement prevents any slippage at the left end of the spring clutch and makes it possible to adjust the position of the spring in relation to the shaft.

The right end of the cycle clutch spring encircles a hub on the cycle clutch pulley (Fig. 77). (The hub on the cycle clutch pulley functions the same as the shift clutch arbor on the shift mechanism.) The inside diameter of the cycle clutch spring is slightly less than the diameter of the hub on the cycle clutch pulley so that the spring clutch will tighten when the hub rotates. The right hand tip of the spring clutch projects into a notch in the cycle clutch sleeve. The sleeve fits loosely around, enclosing the spring clutch and acts as a control for the right end of the cycle clutch spring.

The cycle clutch sleeve has two steps on its exterior surface 180° apart. As the cycle clutch is driving the cycle shaft, one of the steps on the clutch sleeve contacts a vertical latch that is placed in the path of the sleeve (Fig. 78). This latch, called the cycle clutch latch, stops the rotation of the clutch sleeve thereby stopping the right end of the cycle clutch spring. The left end of the cycle clutch spring rotates farther after the right end is stopped because of the momentum built up in the cycle shaft, filter shaft, and print shaft. This additional rotation given to the left end of the cycle clutch spring is in the unwinding direction and causes the spring to expand about the hub on the cycle clutch pulley. This unwinding breaks the driving connection between the hub and the spring.

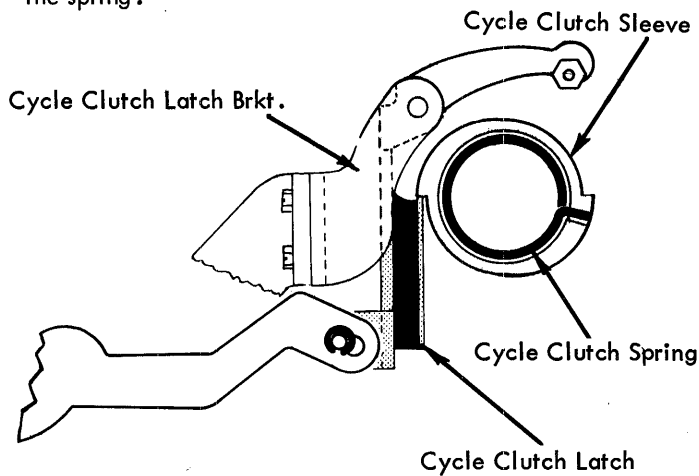


FIGURE 78. Cycle Clutch Latch - Side View

Since the shaft tends to travel beyond its rest position due to momentum, an overthrow stop is required. Two lugs on the side of the nylon cycle clutch restoring cam project into notches in the left side of the cycle clutch sleeve and operate as an overthrow stop (Fig. 79). When the sleeve is stopped by its latch, the cycle shaft continues to rotate under momentum (expanding the cycle clutch spring) until the nylon stop contacts the lugs on the sleeve stopping the overthrow of the shaft.

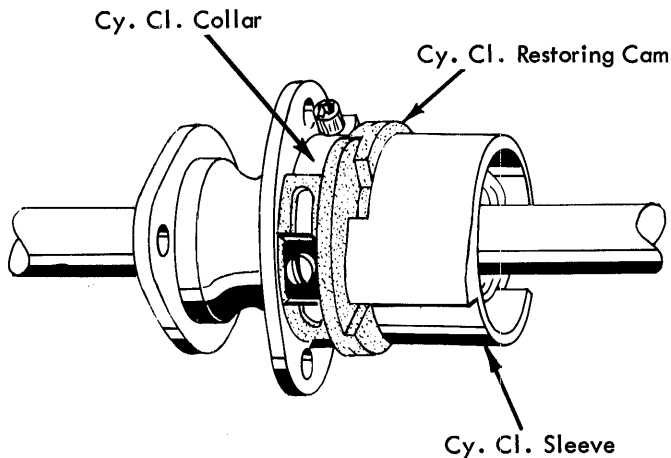


FIGURE 79. Cycle Clutch Stop

The shock of stopping the overthrow of the cycle shaft tends to bounce the cycle shaft backwards. To prevent this from occurring, a check pawl drops into a notch in a check ratchet located on the left end of the cycle shaft (Fig. 80). The pawl drops in when the clutch is disengaged.

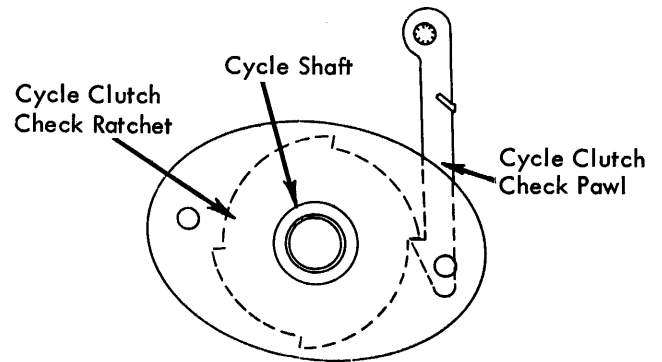


FIGURE 80. Cycle Clutch Check Pawl

Both the overthrow stop and the check pawl assure that the cycle shaft will return exactly to its rest position at the completion of each cycle operation. (The cycle shaft is in its rest position when the positive selector cams are on their low dwells and the working face of a notch on the check ratchet is against the working face of the check pawl.)

The shock of stopping the overthrow of the cycle shaft, filter shaft, and print shaft is transmitted from the cycle shaft through the collar, the overthrow stop, the sleeve, and to the cycle clutch latch. This is why the cycle clutch latch is designed to absorb shock (vulcanized rubber mounting).

The same effect is true in the shift mechanism. The shock of stopping the momentum of the shaft cam is transmitted from the shift cam through the overthrow stop, the lug on the ratchet, and to the shift release arm. The release arm is shaped like a horseshoe so that it can absorb this shock.

The cycle clutch is allowed to engage by pivoting the cycle clutch latch forward out of the path of the step on the clutch sleeve. The clutch spring then quickly decreases in diameter because of its own spring tension. The rotating clutch pulley hub tightens the spring and drives the cycle shaft. The entire clutch assembly rotates through 180°. The second step of the clutch sleeve then contacts the cycle clutch latch which has been moved back to the rear into its path. This causes the cycle clutch to be disengaged again as previously described.

#### ALIGNMENT

Alignment is the process of positioning the typehead, both horizontally and vertically, to an exact printing point. This process cannot be accomplished by simply rotating and tilting the typehead because each rotate and tilt position is affected differently by adjustment of tolerances, inertia, momentum, elasticity of the system, changing spring loads, and many other factors. All these factors cause the alignment of the typehead to vary in a haphazard way. Any variation in alignment of the typehead directly affects the print quality of the machine. Alignment variation is undesirable and must be eliminated.

The same method is used to eliminate alignment variations in both the tilt and rotate mechanisms. Since the tilt mechanism operates basically the same as the rotate mechanism and is simpler in structure, most of the alignment concepts will be discussed in the tilt mechanism. A good understanding of these concepts is required in order to properly diagnose an alignment problem.

### Tilt Alignment

To insure that any character in one of the four bands of characters on the typehead is properly aligned vertically when the typehead prints, the tilt ring must be tilted to an exact position and locked. As previously mentioned, the tilt ring cannot be accurately positioned by its mechanism alone because of uncontrollable factors. To overcome this condition, the detent mechanism can refine and lock the tilt ring in the exact position desired, after the tilt mechanism coarsely positions the tilt ring. This is accomplished by placing a specific amount of play in the tilt ring and using a detenting mechanism to refine and lock the tilt ring into position. This built-in play is located in the tilt pulley link on the gearless tilt and is commonly referred to as "tilt ring play". On the old style tilt mechanism, the tilt ring play is felt as backlash in the tilt ring sector gears. If the tilt mechanism tends to supply too much or too little motion to the tilt ring for a given tilt selection, the detenting mechanism will correct this error by utilizing the tilt ring play. The left side of the tilt ring contains four V-shaped notches that correspond to the four tilt positions. A small arm called the tilt detent mounts in a slot on the left side of the yoke and operates in the notches on the tilt ring. When the tilt ring is operated to approximately the correct tilt position, the tilt detent is allowed to enter one of the notches in the tilt ring (Fig. 81). A heavy extension spring causes the detent to seat in the V-shaped notch; thus camming the tilt ring into, and locking it in an exact print position. It is the built-in "tilt ring play" that enables the tilt detent to cam the tilt ring into the proper tilt position.

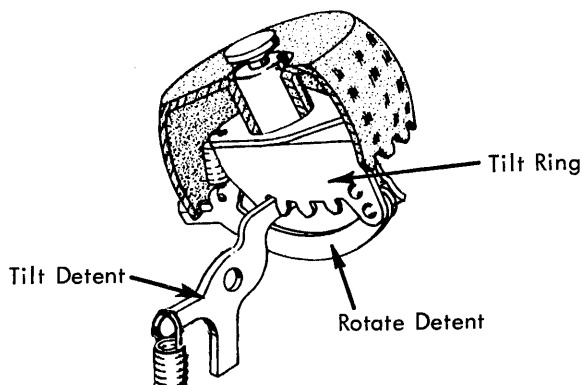


FIGURE 81. Tilt Ring Detenting

not exceed the tilt ring play, or a detenting failure will result. To insure that detenting failure will not occur after a certain amount of wear comes into the tilt mechanism, the amount of coarse alignment variation must be within specific tolerance. The tilt mechanism should be adjusted so that the "band width" of the tilt mechanism will be within this tolerance. Band width in the tilt mechanism is defined as the maximum amount of coarse alignment variation measured between any two of the four tilt positions (Fig. 82). Of the factors mentioned that affect the tilt ring position, only the accuracy of adjustments can be controlled by the Customer

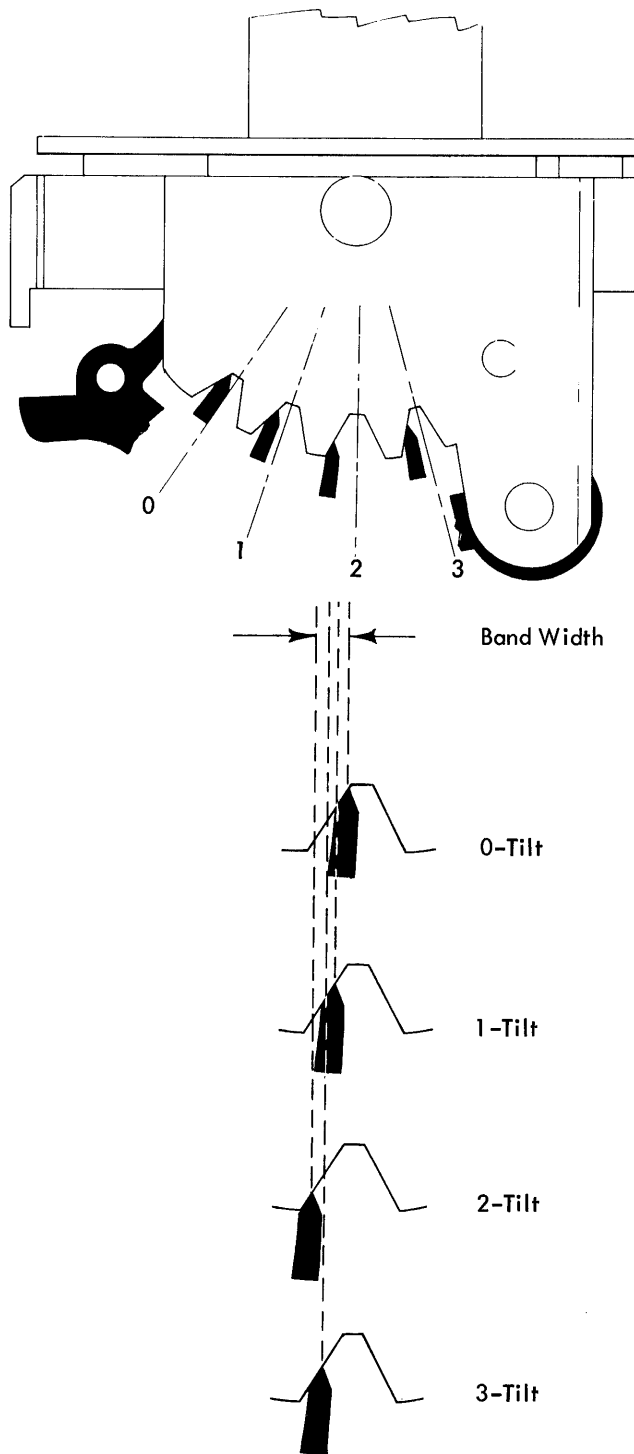


FIGURE 82. Band Width

Since the tilt detent assumes the responsibility of refining the position of the tilt ring to the proper place, the requirement of the tilt mechanism is only to coarse align the tilt ring (to each tilt position when selected) so that the tilt detent can enter and bottom in the correct notch without utilizing all the tilt ring play. This means that the largest coarse alignment variation between any two of the four tilt positions must

Engineer. The more accurate the adjustments, the less variation there will be in the tilt ring position for the different characters and the more narrow the band width will be. It is not necessary to achieve a band width any smaller than the given set up tolerance.

Coarse alignment for each tilt position can be observed in the following manner:

- a. Half-cycle the machine under power by placing the Hoovermeter handle in position to block the cycle clutch sleeve before striking a keylever (Fig. 83).

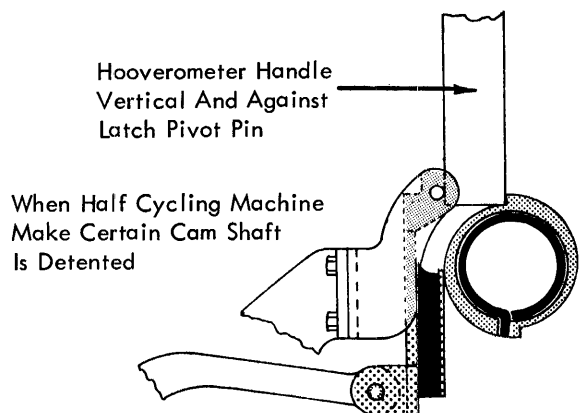


FIGURE 83. Half Cycling Operation

After half-cycling, turn the machine off and make certain that the cycle shaft is resting in a half cycled position by observing the position of the check pawl in the cycle shaft check ratchet. The check pawl should be detented in the half cycle notch on the check ratchet (Fig. 84).

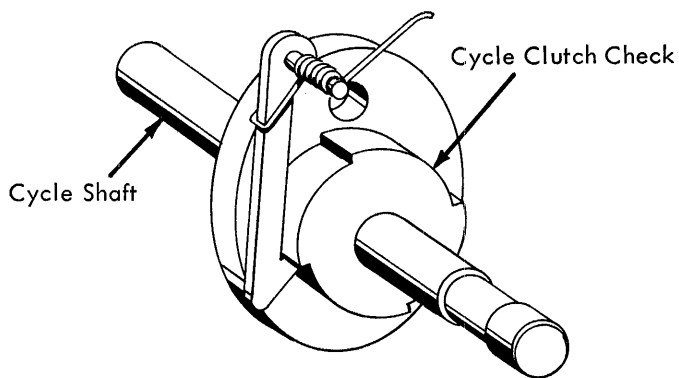


FIGURE 84. Half Cycle Operation

- b. Manually withdraw the detent and remove the tilt ring play by pressing lightly to the rear on the upper ball socket.
- c. Allow the detent to re-enter the tilt ring notch while observing the point where the detent first contacts the side of the V-shaped notch.

Performing this check for each tilt position provides a method of visually measuring how much coarse alignment variation there is in the system, and also which adjustment (or adjustments) is causing the variation. Each adjustment in the system affects coarse alignment in a different manner and shows up in a definite pattern. By observing the pattern, a maladjustment in system can easily be diagnosed.

Example: Figure 85 illustrates a coarse alignment check of the four tilt positions.

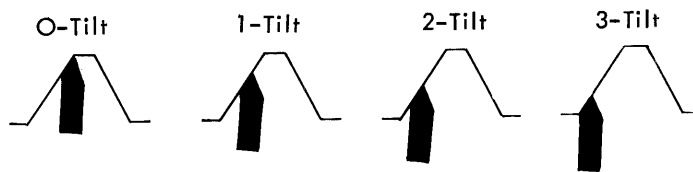


FIGURE 85. Course Alignment Check

Note that there is a progressive loss of motion to the tilt ring from a tilt zero to a tilt three. This indicates that the tilt arm (Fig. 86) is receiving equal increments of motion from the tilt differential system, but is not multiplying the motion enough to satisfy the tilt ring.

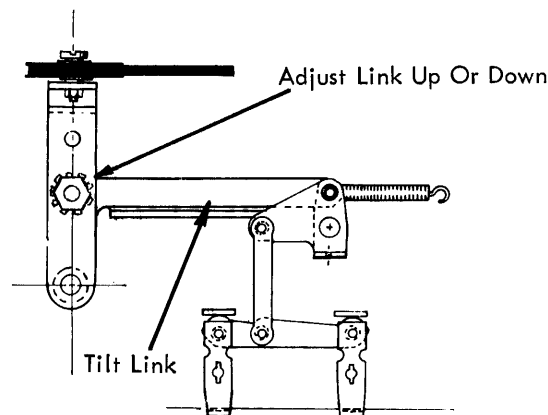


FIGURE 86. Tilt Differential

By moving the tilt link down in the elongated slot on the tilt arm, more motion will be produced to the tilt ring for the same increments of motion produced by the tilt differential system.

Alignment can be separated into two stages: "coarse alignment" and "fine alignment". Coarse alignment is the introduction of the detent into the wide portion of the detent notch. Fine alignment occurs after the detent moves up into and seats in the notch. Once the tilt detent has fully seated in the tilt ring notch, any vertical misalignment problems cannot be attributed to coarse alignment adjustments. The problem lies in the carrier and rocker area and usually is caused by one of the following: too much upper ball socket



play; side play in the tilt detent; vertical play in the rear carrier shoe; tilt ring side play; loose typehead latch; improper detent timing; or worn rocker shaft bearings. Any of these conditions can cause poor vertical alignment.

### Rotate Alignment

Since the rotate mechanism must position the typehead to eleven positions, it is a great deal more complex than the tilt mechanism. The alignment concepts brought out under the tilt mechanism also apply to the rotate mechanism regardless of its complexity. Like the tilt ring, the typehead is also detented after it has been coarse aligned to approximately the correct position (which is within the allowable band width). Built-in play of the typehead allows the rotate detent to refine the selected typehead position after the head has been coarse aligned. This play comes from backlash between the slots in the ball joint and the pins in the upper and lower ball sockets. The rotate detent mounts on the tilt ring and operates in V-shaped notches cut into the skirt of the typehead (Fig. 87). It is spring loaded at the rear into engagement with the typehead.

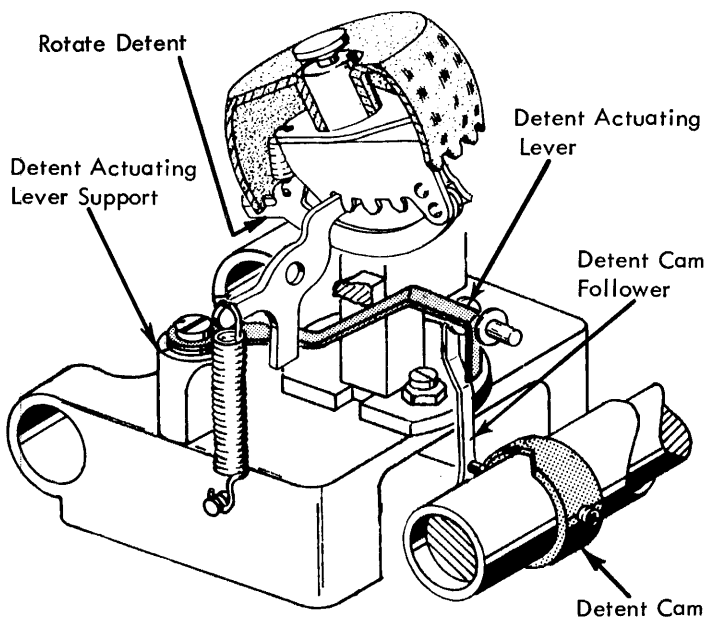


FIGURE 87. Detent Mechanism

As in the tilt mechanism, once the rotate detent has fully seated in the typehead notch any horizontal misalignment problems cannot be attributed to coarse alignment adjustments. The problem lies in the carrier and rocker area and usually is caused by one of the following: side play in the rotate detent; improper detent timing; excessive side play of the rocker; binds in the rear carrier shoe; or anything that will restrict the carrier from escaping properly.

### Detenting

The typehead cannot be tilted or rotated with the detents engaged. They must be held out of engagement until the typehead has been completely positioned. They must also be removed from engagement before the typehead can be restored to rest position. The rotate detent operates against the tilt detent. As long as the tilt detent is not allowed to rise, the

rotate detent cannot enter the notches of the typehead. The tilt detent is controlled by a small lever called the detent actuating lever located under the left side of the yoke (Fig. 87). The lever pivots at the rear and extends forward along the right side of a lower extension of the tilt detent. When the detent actuating lever is operated to the left, the tilt detent moves down pushing the rotate detent down with it. When the actuating lever moves to the right, both detents are allowed to rise.

Movement of the detent actuating lever is controlled by the detent cam through the detent cam follower (Fig. 87). The cam follower is pivoted on a bracket below and to the rear of the print sleeve and extends up alongside the detent cam in position to operate the detent actuating lever. The camming surface of the detent cam is on the left side so that operation of the cam follower is toward the left against the detent actuating lever.

The rotate detent does not pivot into engagement as the tilt detent does. It contains an elongated hole at the front which allows both the front and rear of the detent to move up and down (Fig. 88). A small flat link at the top stabilizes the detent. If the rotate detent were pivoted at the front, the amount of travel and timing of the detent would vary with the tilt selection. With the sliding arrangement, the rotate detent action is approximately the same for all tilt selections.

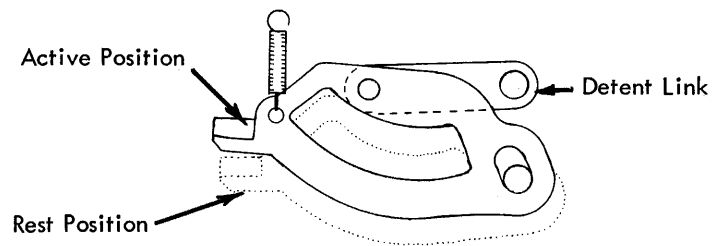


FIGURE 88. Rotate Detent

While the typehead is being positioned, the cam follower is against the high part of the detent cam. This causes the detent actuating lever to be held to the left to prevent the detents from engaging their notches. During the positioning of the typehead, the detent cam is rotating, but it maintains the same high point for the cam follower. As soon as the rotate and tilt operations have been completed, the cam follower is allowed to move to the right into a recess in the detent cam. This allows the detent actuating lever to move to the right to permit operation of the tilt and rotate detents. As the typehead is being moved toward the platen the detent cam continues to turn, but it maintains the same low point for the follower.

As soon as the character has printed, locking the typehead in position is no longer necessary; therefore the detents can be disengaged to allow the typehead to restore to the rest position. As the rocker is restoring to the rest position, the detent cam moves the cam follower back to the left onto the high part of the cam. This action causes the detent actuating lever to disengage the detents from their notches. Timing of the detenting is such that both detents begin to engage their notches just as the typehead completes its positioning and are disengaged just as the typehead starts to rotate and/or tilt back to the rest position.

## Wear Compensator

A wear compensator is a device that senses a position and makes a correction whenever it detects any change from this position. The rotate arm assembly is constructed so as to compensate for wear in the rotate differential system and related components. Because of this aspect of its operation, the rotate arm assembly is referred to as the wear compensator.

Before going into the details of the operation of the wear compensator, it is necessary to understand the alignment problem created by wear in the rotate system.

The rotate pulley spring beneath the typehead and the compensating arm spring apply a constant pressure on the rotate system in the negative direction. Whenever wear occurs at any of the pivot points, bearings, stop pads, or linkage connections that oppose the combined tension of the rotate pulley spring and the compensating arm spring, the play (caused by wear) will be removed by these springs in a negative direction.

Removing the play (which is due to normal wear) allows the rotate pulley spring to turn the typehead (Fig. 89) slightly in the negative direction. This is commonly referred to as head "drift".

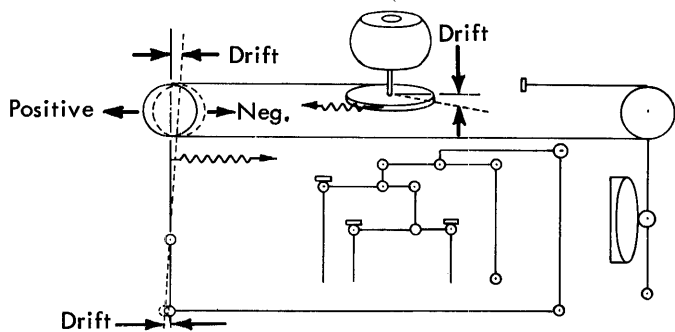


FIGURE 89. Rotate System Drift

As wear increases, head drift could become excessive and failure of coarse or fine detenting would occur. Detenting failure would necessitate a readjustment (re-homing) of the typehead.

The wear compensator cannot prevent wear but it does prevent head drift which is due to wear in the system. The wear compensator is composed of three basic parts: the rotate arm, the compensating arm, and a nylon roller between them (Fig. 90). Other components are present that are indirectly involved in the wear compensator action. At this time, consider only the three parts mentioned.

The rotate arm (Fig. 90) pivots on a large pivot pin in a bracket mounted to the left side of the power frame. The left-hand rotate pulley operates at the top of the rotate arm. The compensating arm pivots at the same point as the rotate arm and extends in two directions from the pivot. The rotate link is fastened to the lower extension of the compensating arm. The upper extension of the compensating arm fits between the side-frames of the rotate arm. The nylon roller operates in a long vertical slot in the rotate arm. This slot and the upper extension of the compensating arm are at a

slight angle to each other, thus forming a V-shaped wedging slot. The roller is retained in position in the wedging slot by the rotate tape tension.

"The Basic Compensator Action of the Wear Compensator"

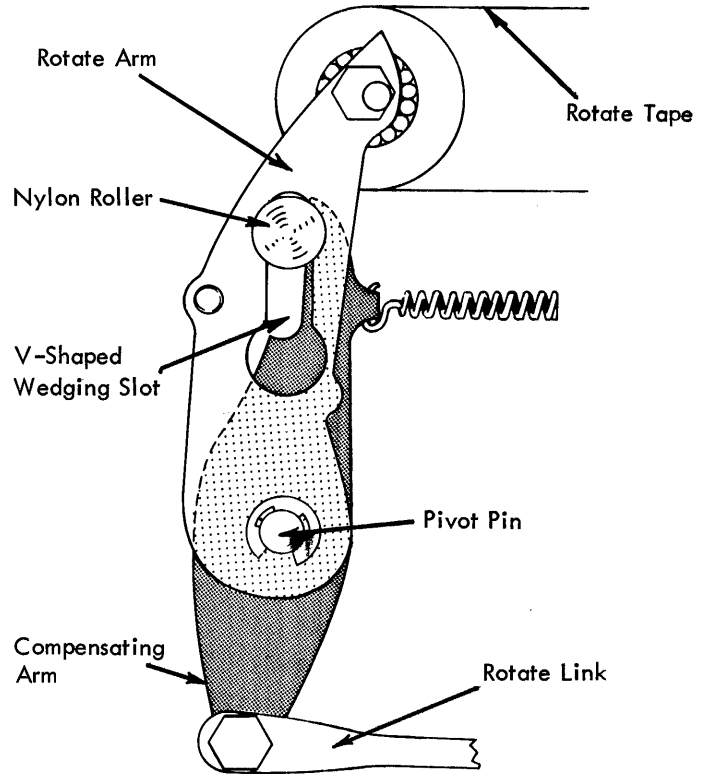


FIGURE 90. Basic Components Of The Wear Compensator

Figure 91-A shows the wear compensator in a zero rotate position. Note the following in Figure 91-A:

- The compensating arm spring is applying tension on the upper extension of the compensating arm in a negative direction.
- The rotate tape is applying tension (by means of the rotate pulley spring) to the top of the rotate arm in a negative direction also.
- The rotate link attached to the lower extension of the compensating arm is opposing the compensating arm spring tension. The rotate link is also opposing the rotate tape tension through the compensating arm and the nylon roller.
- The nylon roller is positioned near the top of the V-shaped wedging slot.

Figure 91-B shows the wear compensator in the negative 5 position. Note that the eccentric stud mounted on the top of the rotate arm is just barely touching the machine side frame when the wear compensator is in the negative 5 position.

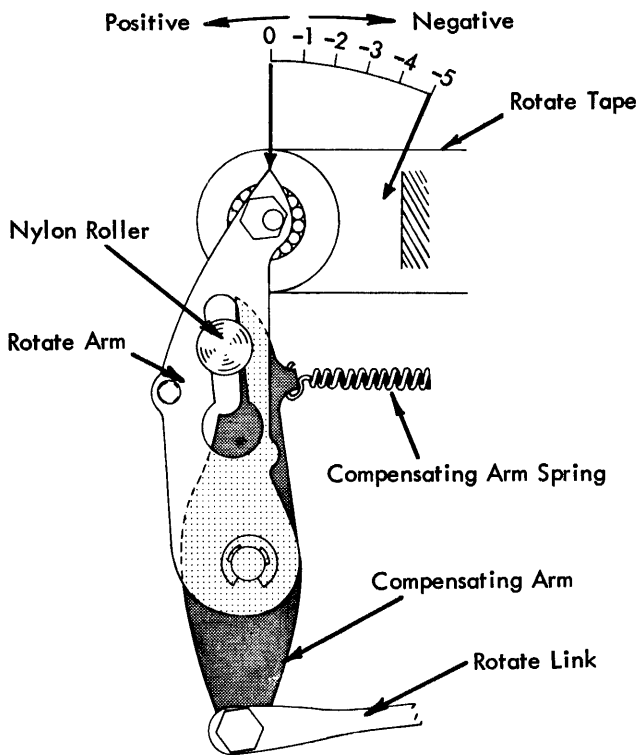


FIGURE 91A. Zero Rotate Position

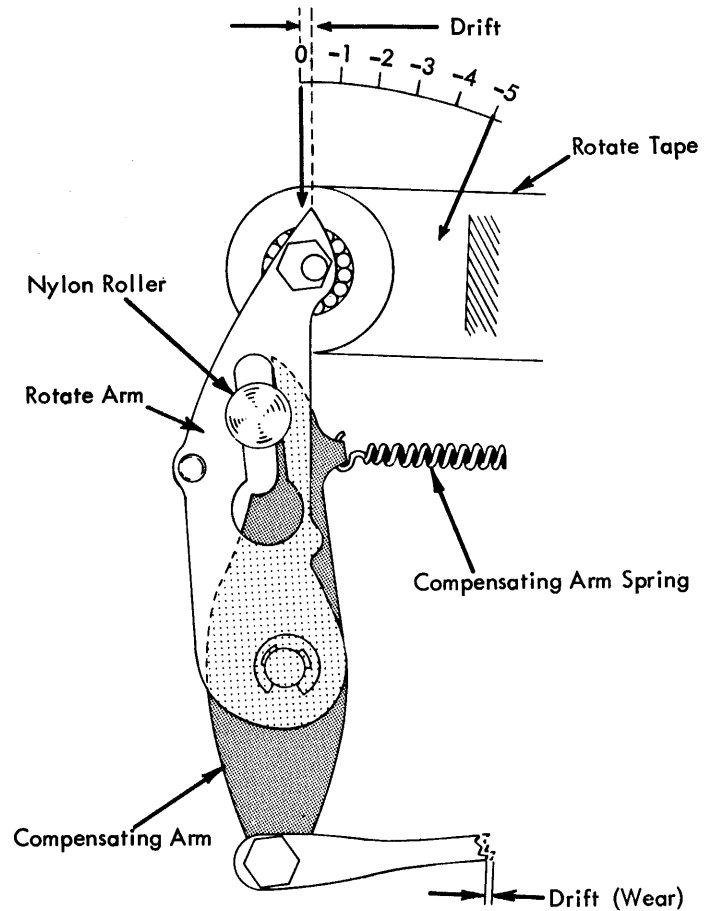


FIGURE 91C. Zero Rotate Position With Drift

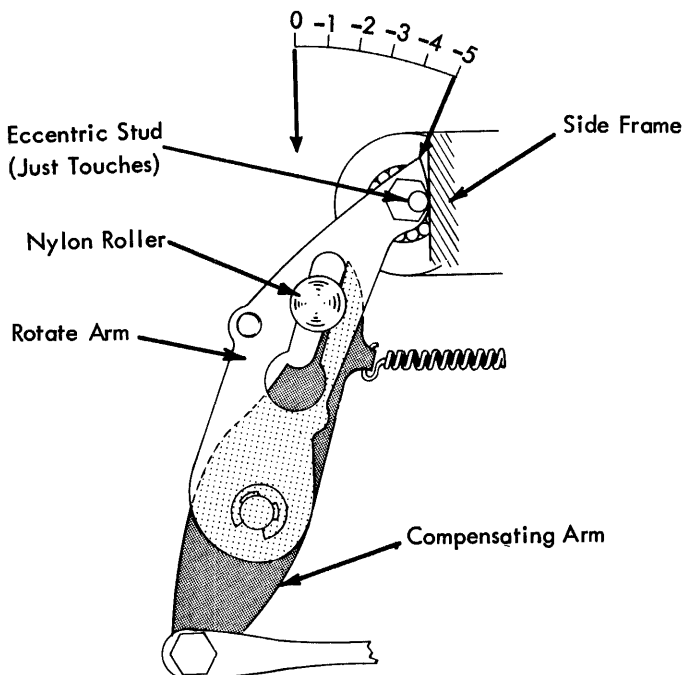


FIGURE 91B. Negative 5 Position

Figure 91-C shows the wear compensator in the zero rotate position with wear introduced into the rotate differential system.

Note that the wear compensator has drifted away from the zero rotate position in a negative direction. The wear that

was introduced into the rotate system was felt as play in the system. The rotate tape tension and the compensating arm spring removed the play in a negative direction which allowed the wear compensator to "drift" in a negative direction. This places the rotate arm less than five units away from the side frame when the rotate differential system is in the zero position. The rotate differential system is not aware of this and wants to supply five units of motion to the compensating arm when a negative 5 character is selected. The rotate arm cannot travel a full five units because this would carry it beyond the sideframe. The sideframe limits the motion of the rotate arm at exactly the rotate negative five position. Since there is nothing to stop the motion of the compensating arm, it continues to travel the full five units of motion supplied to it by the rotate differential system. The V-shaped wedging slot opens up and the nylon roller drops lower in the slot (Fig. 91-D). When the wear compensator returns to the zero rotate position, the drift has been eliminated and wear has been compensated for.

Basically, this is how the wear compensator works. In order for the wear compensator to operate efficiently, we must overcome the effects of a changing spring load on the rotate differential system as the eccentric stud on the rotate arm contacts the sideframe.

In the zero rotate position, there are many parts in the rotate differential system that are resisting the combined spring tension of the rotate pulley spring and the compensating arm

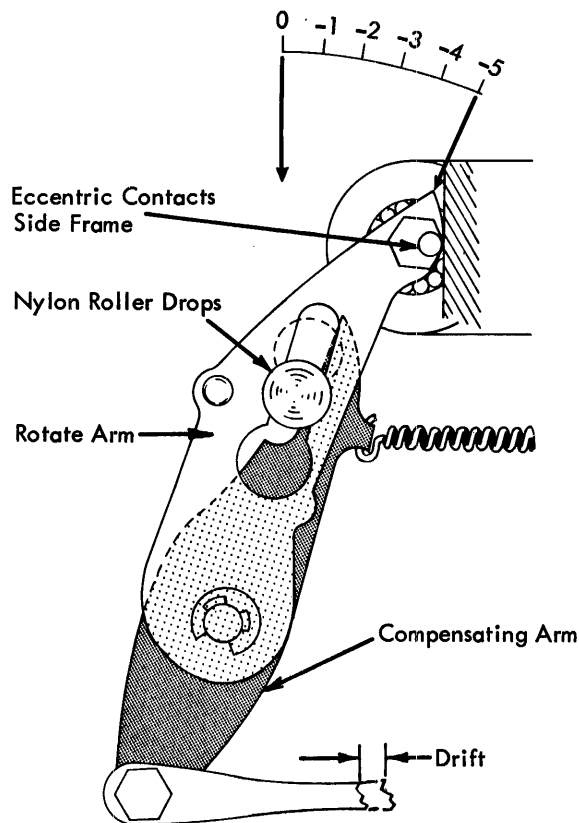


FIGURE 91D. Negative 5 Position With Drift  
(Nylon Roller Drops)

spring. All the parts that are opposing this spring tension are being stressed (flexed) slightly. Although steel parts appear to be extremely strong and rigid, they do have a measurable amount of elasticity when placed under a stress. Should the stress (spring tension) be reduced, the steel parts will tend to return to their original shape and position.

During a negative 5 selection, the eccentric stud on the rotate arm contacts the machine sideframe. The sideframe now starts to oppose the rotate pulley spring tension; and the spring load on the rotate differential starts to reduce to that of the compensating arm spring. When the spring load on the rotate differential starts to reduce (due to the rotate arm contacting the sideframe), the flexing of the rotate differential begins to reduce also. Even though a portion of the rotate pulley spring tension is being opposed by the sideframe, the rest of the rotate pulley spring tension is still applying tension to the rotate differential through the nylon roller. This keeps the system in a flexed condition maintaining pressure against the nylon roller. Under these conditions, a small amount of wear in the rotate differential would not allow the roller to drop. The wear would only be absorbed in reducing the flexing of the rotate differential at the negative 5 rotate position. The wear compensator would not compensate for wear and "drift" would be apparent in all rotate positions except negative 5 (sideframe would prevent drift at the negative 5 rotate position).

To summarize the above, let's simplify the situation by making an assumption. Suppose that all the flexing in the rotate differential could be placed at one point. Let's assume that the nylon roller is made out of soft rubber that can be compressed easily. With the wear compensator arm assembly in

the zero rotate position, the rotate pulley spring tension is squeezing the rubber roller between the rotate arm and the compensating arm. Pretend that the amount the rubber roller is squeezed is the flexing of the differential system. Now, half cycle the machine to a negative 5 position. The eccentric stud just touches the sideframe and the rubber roller remains compressed. At this time, let's assume that a large amount of wear came into the rotate differential system.

(Wear shows up as play.) The compensating arm spring would pull the top of the compensating arm in a negative direction, removing the play from the differential system. The rotate arm, restricted by the sideframe, could not follow the compensating arm and the pressure on the rubber roller would be relieved allowing it to expand. The play (caused by wear) in the system was just enough to allow the rubber roller to expand without dropping. Now, if the rotate link starts to pull the arm assembly back to a zero rotate position, some of the rotate link motion is going to be used to compress the rubber roller before the rotate arm leaves the sideframe. This means that the rotate arm will not receive sufficient motion to return to the zero rotate position. Wear has caused the rotate arm to drift in a negative direction.

#### Conclusion:

- a. Flexing in the system is inherent.
- b. Any lost motion from the rotate differential to the rotate arm will cause "drift".
- c. The pressure on the roller must be relaxed before compensation takes place.

#### "Wear Compensator Ratio Change"

In the wear compensator, there is a constant leverage ratio between the amount of motion supplied to the bottom of the compensating arm (by the rotate link) and that amount of motion produced at the top of the rotate arm. (The movement of the rotate arm directly depends upon the movement of the upper extension of the compensating arm through the nylon roller.)

If the pivot point of the compensating arm is changed to a lower position (closer to the rotate link) the leverage ratio of the compensating arm will increase. This will cause a greater amount of motion to be produced to the top of the compensating arm for a given amount of motion supplied to the bottom of the arm. When this occurs, it is correct to say that the compensating arm has undergone a "ratio change". The ratio change is required in order to relax the pressure on the nylon roller while maintaining the correct output to the rotate arm at a negative 5 position.

The ratio change begins approximately at the negative 4 position and occurs as the arm sweeps through to a negative 5 position. It provides the upper extension of the compensating arm with sufficient motion to relax the pressure on the nylon roller (without allowing it to drop so that it is ready to drop as soon as the slightest amount of wear is felt in the differential system. With the pressure relaxed on the roller, any wear coming into the differential system allows the compensating arm spring to pull the top of the compensating arm further in a negative direction opening up the V-shaped wed-

ging slot. This causes the roller to move down in the slot compensating for the wear.

In order to relax all of the pressure on the nylon roller when the rotate arm contacts the machine sideframe, the sideframe must oppose all of the rotate spring tension (plus the compensator assist spring which will be covered later). This causes the spring load on the differential system to reduce to just that of the compensating arm spring thereby causing the system, from the nylon roller on down, to partially relax.

This partial relaxing of the differential system creates a slight amount of motion to the rotate link in the opposite direction that the link is moving, thus resulting in a reduction of output of the rotate link to the bottom of the compensating arm between a negative 4 and negative 5 rotate position. The ratio change of the compensating arm overcomes this effect by producing more motion to the top of the arm for a reduced amount of motion from the rotate link, thus the rotate arm reaches the negative 5 position and the pressure on the nylon roller is relaxed.

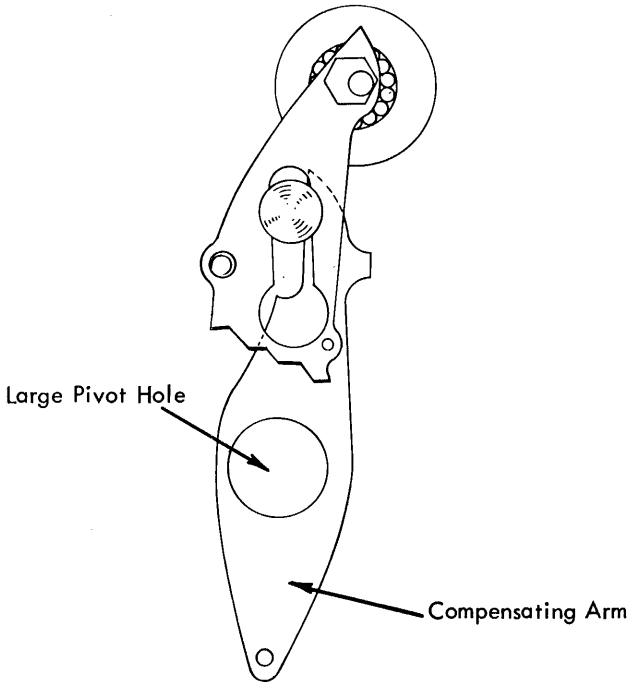


FIGURE 92. Compensating Arm Pivot Hole

The compensating arm contains a large pivot hole (Fig. 92). Fitted inside the large pivot hole is an eccentric shoulder which is part of the rotate eccentric arm (Fig. 93). The compensating arm and the rotate eccentric arm act as one solid piece as they rotate about the pivot pin for all positive and negative rotate positions up to approximately the negative 4 position. If a negative five character is selected, the rotate eccentric arm will be restricted from rotating (about the pivot pin) beyond the negative 4 position and the compensating arm will then begin to rotate about the eccentric shoulder on the rotate eccentric arm.

Since the center of the eccentric shoulder is lower than the pivot pin (closer to the rotate link) and the compensating arm pivot point is shifted (between negative 4 and negative 5) from the pivot pin to the eccentric shoulder, it is correct to say that the compensating arm has undergone a ratio change.

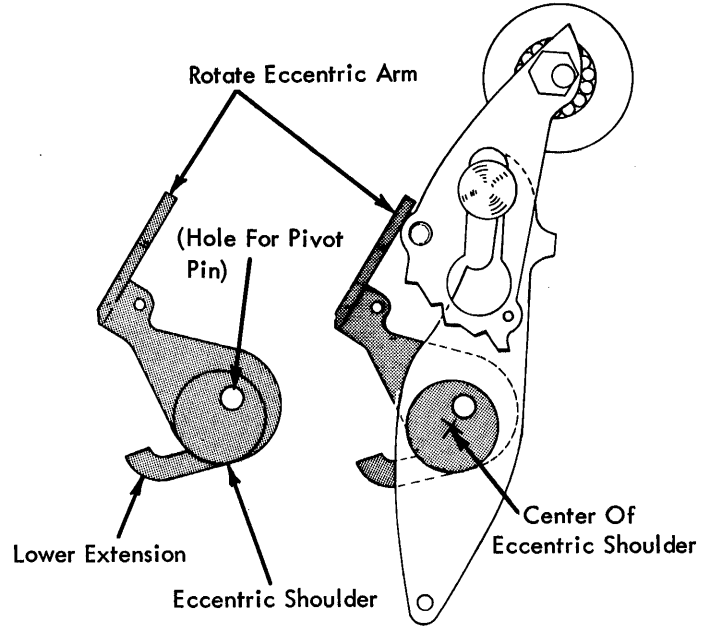


FIGURE 93. Mounting Of Rotate Eccentric Arm

The rotate eccentric arm is spring loaded against the rotate arm by means of the rotate eccentric arm spring (Fig. 94). The rotate arm is spring loaded against the compensating arm by means of the rotate pulley spring. Therefore, the rotate

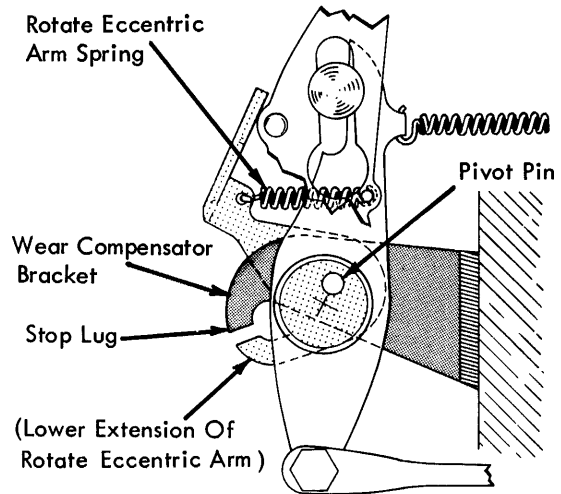


FIGURE 94. Zero Rotate Position

eccentric arm, rotate arm, and compensating arm act as one solid arm rotating about the pivot pin from a positive 5 to the negative 4 rotate position. During a negative 5 selection, the lower extension of the rotate eccentric arm (Fig. 95) contacts the stop lug on the wear compensator bracket (at the negative 4 position). The rotate eccentric arm is stopped and the compensating arm ratio change begins. The rotate arm continues to follow the compensating arm because the rotate pulley spring is stronger than the rotate eccentric arm spring. The rotate arm is stopped by the machine sideframe when it reaches the negative 5 position. The additional motion given to the compensating arm (due to the ratio change) is used up in partially relaxing the rotate differential system. Thus, wear can be compensated for.

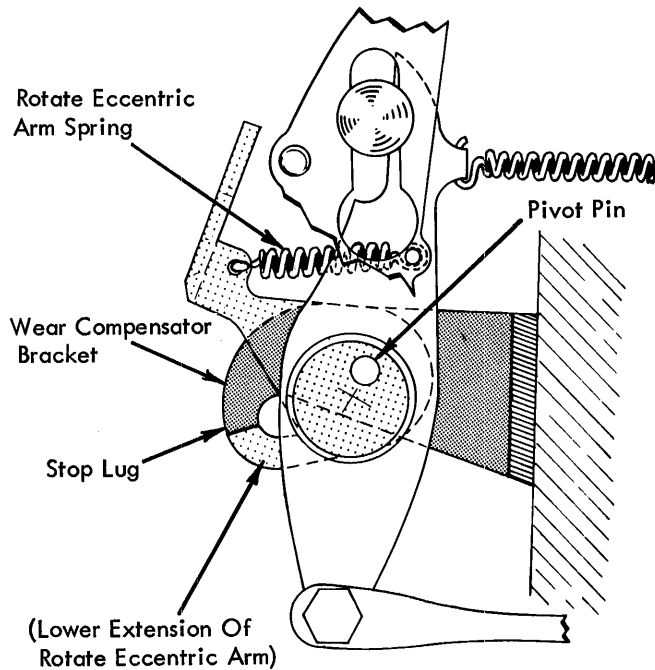


FIGURE 95. Negative 5 Position

The wear compensator compensates for drift due to the wear in the system from the rotate arm down through the linkage to the negative 5 cam. Although wear occurs throughout this whole area, the major portion of wear comes from the differential system and related linkages. Compensating for wear in these areas is the major requirement of the wear compensator. Wear in the tape system constitutes only a small portion of the total wear in the system.

Because there is some drift due to the wear in the tape system, the typehead is initially set ("homed") to favor the positive direction, relative to the rotate detent. As wear comes into the tape system, the typehead will drift slightly in the negative direction.

After the initial break-in period, the rate of wear levels off in both the differential system and the tape system. Although wear still occurs, it progresses at a very slow rate.

The wear compensator cannot compensate for wear in the positive latches, the latch bail, and the positive cams because these components are not in use during a compensating operation (negative 5). Wear at these points constitute a portion of the band width and must be considered when achieving an allowable band width.

Figure 96 points out two other springs which have a direct bearing on the wear compensator operation.

An extension spring called the compensator assist spring is connected between the rotate arm and the carriage side frame. The purpose of this spring is to keep the rotate arm in contact with, and applying pressure against, the nylon roller throughout a positive operation. Without the assist spring, the rotate arm tends to overthrow beyond the positive position selected because of a momentum built up in the rotate arm, tape system, rotate pulley, typehead, etc. This overthrow allows the V-shaped wedging slot to open up resulting in unwanted roller droppage.

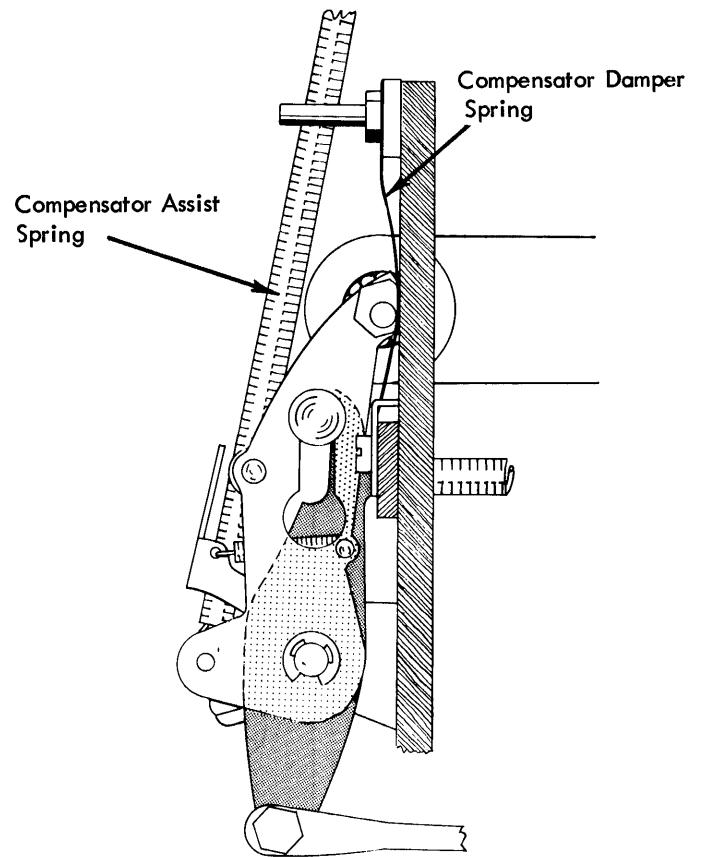


FIGURE 96. Wear Compensator

The compensator damper spring (Figure 96) is a leaf spring designed to absorb the shock of stopping the rotate arm at the negative 5 position. This prevents unnecessary stress on the components and eliminates vibrations in the tape system that would otherwise result. It also prevents the rotate arm from rebounding off the side frame. Rebounding would cause the V-shaped wedging slot to open, resulting in slight roller droppage.

#### Detent Timing

The timing of the print shaft with respect to the cycle shaft controls the timing of the detents. Detent timing must be set accurately in order to prevent damage from occurring in the tape system or the typehead. If the rotate detent is allowed to engage the typehead too soon, it may enter the wrong detent notch. If this occurred during a negative rotation of the typehead, the rotate tape would tend to slacken and jump off its pulleys. This could lead to tape breakage or roller droppage in the wear compensator. If the detent is allowed to engage the typehead too soon during a positive rotation, tape or typehead breakage may result due to the continued pull on the tape. Also, retarding the detent timing may lead to breakage or roller droppage because the detent would remain in the typehead notch when the head is trying to restore. Detent timing can also affect print alignment. It is possible for the detents to begin to withdraw before the typehead prints. For this reason the detent timing should be adjusted as late as possible without restricting the typehead from restoring.

Several factors affect detent timing. Some of the most important are: the adjustments of the rotate and tilt systems, typehead homing, detent actuating lever and cam adjustments, and timing of the print shaft relative to the cycle shaft. If any of these are changed, the machine MUST ALWAYS be cycled by hand to check the detenting action before it is operated under power.

It should be noted that the detents are spring loaded into engagement, but they are driven out of engagement by the cam. This is to prevent parts breakage should the typehead not be properly positioned when the detents try to engage.

### Head Play

Figure 97 illustrates typehead play by showing a single detent notch (of the typehead). This built in play should be approximately .045".

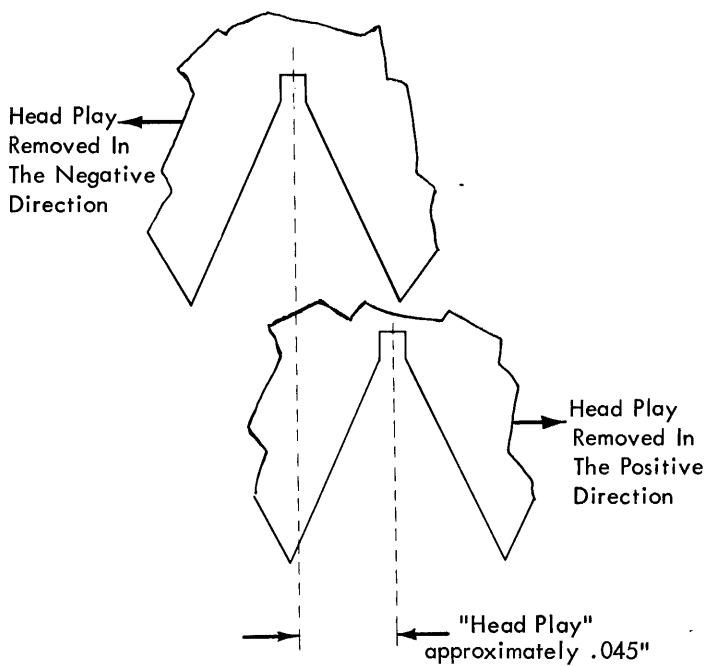


FIGURE 97. Typehead Play

### Band Width

Band width is defined as the difference in detenting between the rotate selection that detents the least negative and the rotate selection that detents the most negative with respect to the rotate detent. The head play must be removed in a clockwise (negative) direction when the comparison is made (Fig. 98).

### Homing

The typing element is "homed" to the rotate selection that will coarse align the most positive (with respect to the rotate detent) when the head play is removed in the negative direction. It is "homed" so that this rotate selection will detent .010" to .020" on the negative side of the detent notch when the head play is removed in the negative direction (Fig. 99).

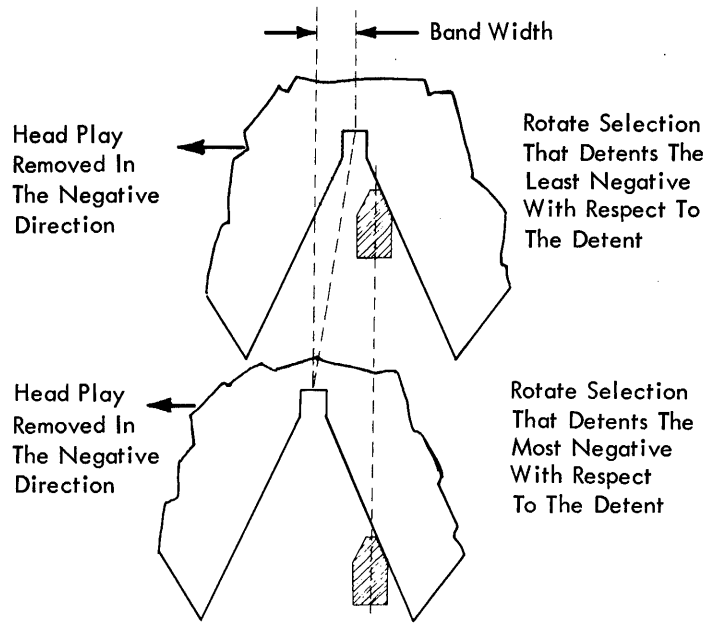


FIGURE 98. Band Width

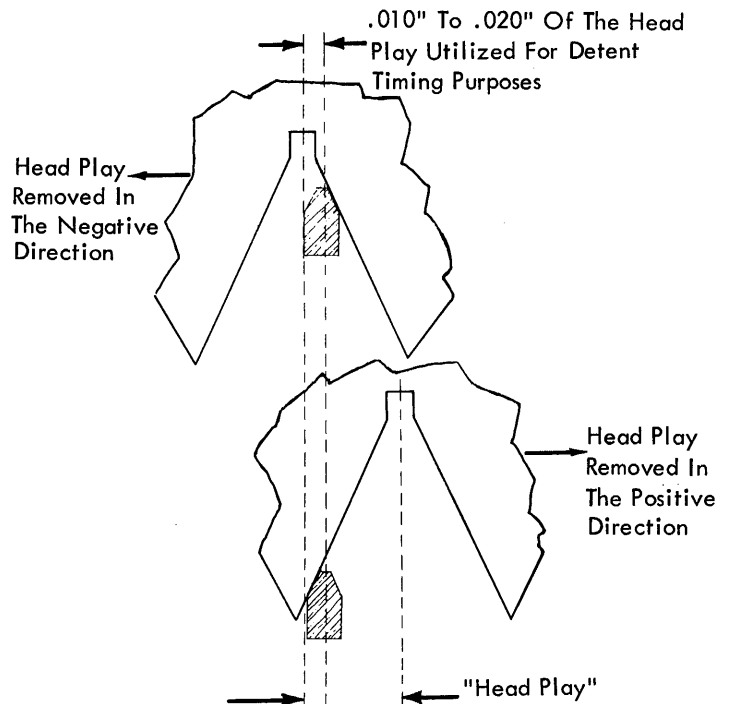


FIGURE 99. Typehead Homing

The purpose of this adjustment is to slightly retard the restoring of the typehead whenever it restores in the positive direction so that the rotate detent can begin to withdraw before the typehead starts to restore. If the withdrawal of the detent did not lead the restoring of the typehead, the detent would restrict the head from restoring causing breakage in the system. This homing adjustment uses up approximately 1/4 of the typehead play.

## PRINT MECHANISM - EARLY STYLE

The purpose of the print mechanism is to actuate the typehead against the platen and restore it to the rest position. The print mechanism consists of the print shaft, print sleeve, print cam and follower, velocity control plate, and rocker assembly. The anvil and striker operate to limit the amount of character embossing. A copy control mechanism allows the operator to select the front to rear position of the platen to correspond to the thickness of the typing material.

### Print Shaft and Print Sleeve

The print shaft extends between the side frames just to the rear of the keylever fulcrum rod. It is supported at each end by a self-aligning bearing. A small gear outside the left side frame connects the shaft, through idler gears, to the cycle shaft gear. The ratio between the two gears is 2:1. This means that each time the cycle shaft completes a cycle operation (180° rotation), the print shaft is rotated 360° (one complete revolution).

The print sleeve of the carrier assembly rides on the print shaft. A keyway throughout the length of the print shaft provides a rotary connection between the sleeve and the shaft yet permits lateral movement of the carrier. A key fits through a hole in the print sleeve and into the keyway of the print shaft (Fig. 100). Whenever the print shaft is rotated, the print sleeve is rotated by the key connection.

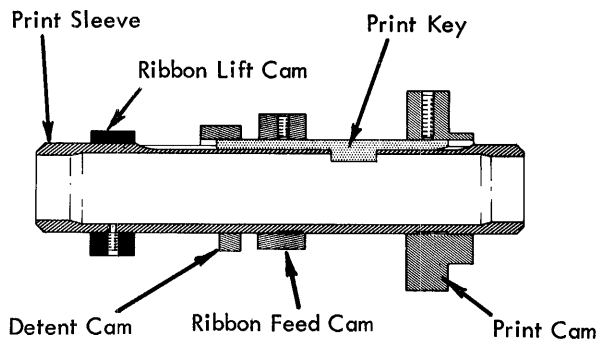


FIGURE 100. Print Sleeve And Cams

The print sleeve contains four cams (Fig. 100). The two middle cams are the ribbon feed cam and the detent cam for the type head alignment. Both of these cams are keyed to the print sleeve by the same key that extends into the print shaft. Each cam is secured to the sleeve by set screws. (On present production printers the detent and ribbon feed cams are one cam.)

The cam at the left is the ribbon lift cam. It is set-screwed to the print sleeve causing the cam to rotate with the sleeve. The set screw mounting also prevents the print sleeve from shifting toward the left.

The cam at the right is a double cam called the print cam. Its function is to power the typehead toward the platen and restore it to rest. Two camming surfaces are necessary for this operation. The smaller surface to the right is called the print cam and moves the typehead to the platen. The larger

cam surface called the restoring cam restores the typehead and prevents it from rebounding. The print cam is also keyed to the print sleeve to provide rotation with the sleeve. The print cam is held in position by two set screws to prevent the print sleeve from moving to the right and to provide a solid driving connection between the sleeve and the cam.

### Print Cam and Follower

The rocker assembly is powered by the print cam on the print sleeve. A yoke-shaped part called the print cam follower pivots on a stud inside the right side of the carrier (Fig. 101).

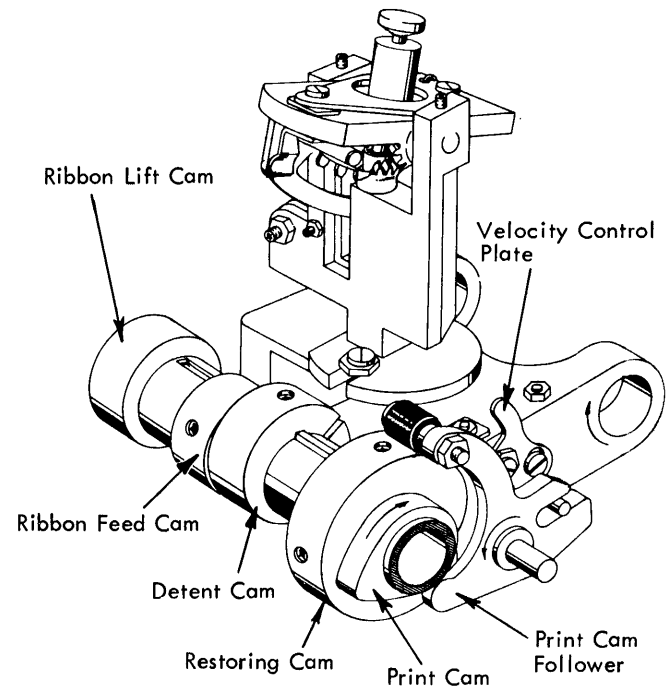


FIGURE 101. Print Mechanism

The two arms of the follower are operated by the print cam. The rear of the print cam follower contains a forked slot. The velocity control plate which is fastened to the right side of the rocker has a stud that projects into and operates in this forked slot (Fig. 102). When the print cam rotates, it forces the front of the follower down causing the rear of follower (slot) to move up creating a rising action to the front of the rocker by means of the stud on the velocity control plate. This rising action powers the typing element to the platen resulting in a print operation.

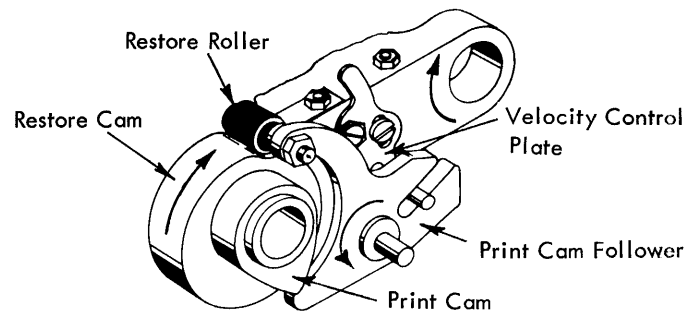


FIGURE 102. Print Cam Action



When the machine is at rest the high point of the print cam is facing toward the front of the machine. This makes the print operation occur late in the cycle which allows sufficient time for the selection and differential mechanisms to position the typing element before the print operation begins.

The larger camming surface on the left of the print cam is called the restoring cam (Fig. 102). Its purpose is to power the rocker back to the rest position after the typehead prints thereby preventing any rebounding from occurring. This is accomplished by the restoring roller on the upper arm of the cam follower.

The camming surface of the print cam is designed so that the typehead is powered to within a few thousandths of an inch of the platen. To prevent any choking action, the momentum of the rocker carries the typehead the remaining distance. The contour of the rebound cam is such that it allows "free flight" of the rocker and typehead, when the typehead is near the platen. Because the typehead is powered nearly all the way to the platen, all the characters are forced to emboss the paper slightly, even those with a large surface area.

#### Anvil and Striker

Because the type head is powered nearly all the way to the platen, it is necessary to restrict the amount of free travel of the typehead so that the amount of embossing for all characters will be the same. A heavy arm called the anvil striker attached to the bottom of the rocker acts as a stop for the rocker (Fig. 103). Just under the front of the carrier and extending between the side frames is the anvil. It is an angle-shaped bar with the lip extending to the rear. As the

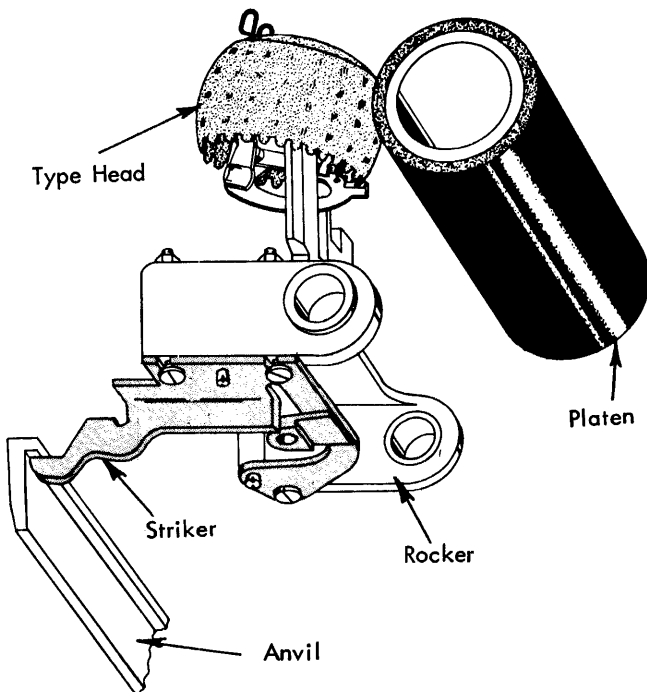


FIGURE 103. Anvil And Striker

typehead embosses the paper to the correct depth, the striker hits the bottom of the anvil and prevents further travel of the rocker and typehead. This means that the impression for each character will be consistent with little variation between the characters.

Whenever the carrier prints in the middle of the writing line on long carriage machines, downward flexing of the print shaft occurs resulting in a loss of impression. Carrier buffers (Fig. 104) located on each side (at the front) of the carrier casting limit this flexing action by operating against the top surface of the anvil.

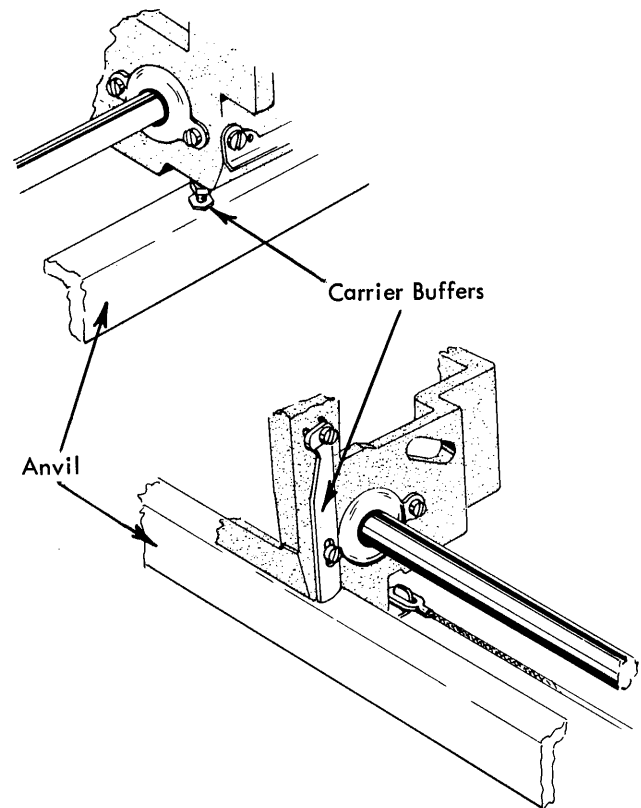


FIGURE 104. Carrier Buffers (Long Carriage)

#### Platen

The purpose of the platen is to feed the paper vertically and to provide a solid backing for the paper during a typing operation. The quality of type impression obtained is determined to a large extent by the condition of the platen. Platen rubber may be adversely affected by numerous factors such as light, heat, chemicals, etc. An old or worn platen may be considerably harder than a new platen and may also vary slightly in diameter. This machine is equipped with a platen with a hardness density comparable to the number 2 platen.

The platen is held in position on the machine by a latch pivoted at the front on each carriage plate (Fig. 105). The platen may be removed by pressing the rear of the latches down and lifting the platen out. It may be installed by snapping it into position without depressing the latches. The camming action of the latches causes them to remove all vertical as well as horizontal play from the platen.

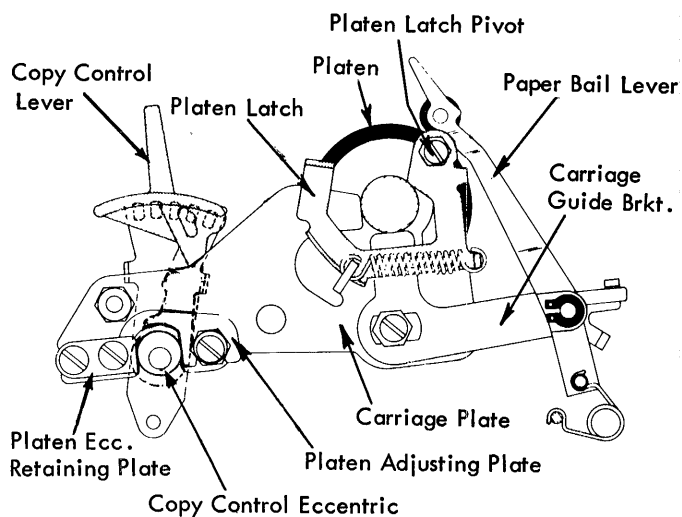


FIGURE 105. Copy Control Mechanism

### Copy Control

The purpose of the copy control mechanism is to position the platen forward or back for different thicknesses of typing material. Positioning the platen maintains the correct relationship between the anvil and the point of impact of the typehead with the paper.

The copy control is operated by means of the copy control lever located at the left end of the carriage (Fig. 105). The lever is attached to the copy control shaft that extends out through the sides of the powerframe. An eccentric collar at each end of the shaft operates between adjusting parts attached to the carriage ends. When the lever is moved to the rear, the shaft rotates causing the eccentric collars to contact the platen eccentric retaining plates and force the carriage ends to the rear. The platen and entire paper feed mechanism move with the carriage. When the copy control lever is pulled forward, the eccentric collars contact the platen adjusting plates and force the carriage forward into the normal position.

The copy control lever can be set in five different positions. A spring detent attached to the powerframe acts against a knob on the copy control lever to hold it in place.

### PRINT MECHANISM - LATE STYLE

The new style print mechanism contains an operator impression control lever which permits the operator to regulate the impression for any application she may type. The operator may change the over-all impression of the typehead by merely positioning the impression control lever to one of five settings.

In addition, the new style print mechanism is equipped with an automatic velocity selection mechanism. The purpose of this mechanism is to provide a lighter impression for the periods, commas, colon, semi-colon, quotation mark, apostrophe, hyphen, and underscore; regardless of where the impression control lever may be set.

Before going into any detail on the impression control mechanism it is necessary to first understand how the automatic velocity selection mechanism operates since both mechanisms are directly related.

### Automatic Velocity Selection - ("Dual Cam")

The printing operation of all the upper and lower case characters in positions 32, 36, 38, 39, and 42 produce a lighter impression on the typed copy than all the other positions. The reason for this is to improve the general appearance of the typed copy by producing a more uniform impression between all characters, large or small. This is accomplished by using a print cam that has two different camming surfaces (Fig. 105.1).

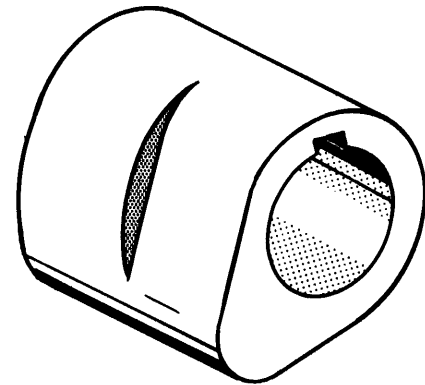


FIGURE 105.1 Print Cam (dual velocity)

The low and high points of both camming surfaces are identical. The only difference is in the contour (profile) between their low and high points. The contour of one camming surface provides the type head with a lower impact velocity than the other. Thus, a lighter impression is produced when this camming surface is used. The difference in type head velocities produced by the two camming surfaces remains proportional regardless of the impression control lever setting.

A selection mechanism positions the print cam follower roller under the proper camming surface of the dual velocity print cam whenever a character is selected at the keyboard. The print cam follower assembly (Fig. 105.2) is mounted on a pivot pin located in the right side of the carrier below and to the rear of the print cam (just as it is in the old style print mechanism). The print cam follower roller mounts on a pin on the print cam follower and is free to slide left or right on this pin.

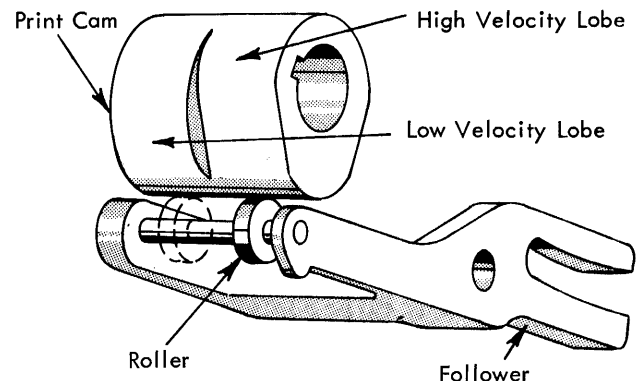
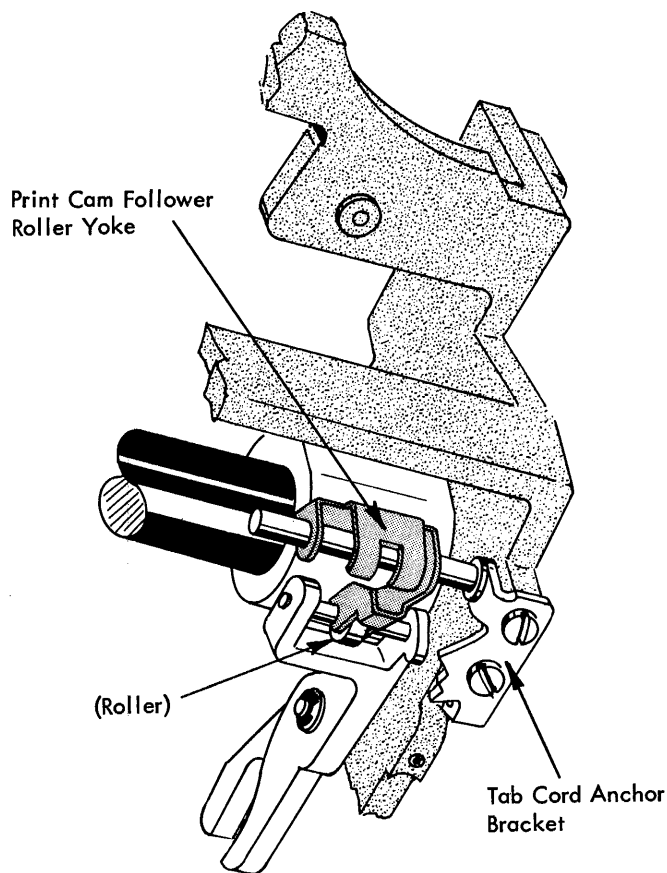


FIGURE 105.2 Print Cam Follower Assembly

The camming surface or lobe on the print cam that produces the greatest impact velocity is called the high velocity lobe. This is the right hand lobe on the print cam. The left hand lobe (producing less impact velocity) is called the low velocity lobe (Fig. 105.2).

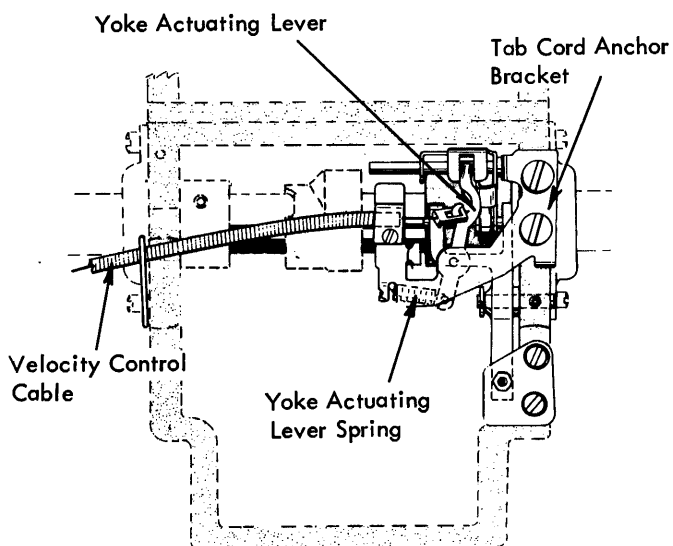
The roller is positioned (left or right) under either camming surface of the print cam by the print cam follower roller yoke which straddles the roller (Fig. 105.3). The yoke is mounted on a pin that protrudes from the tab cord anchor bracket assembly. The yoke is also free to slide left or right on its mounting pin.



● FIGURE 105.3 Print Cam Follower Roller Yoke

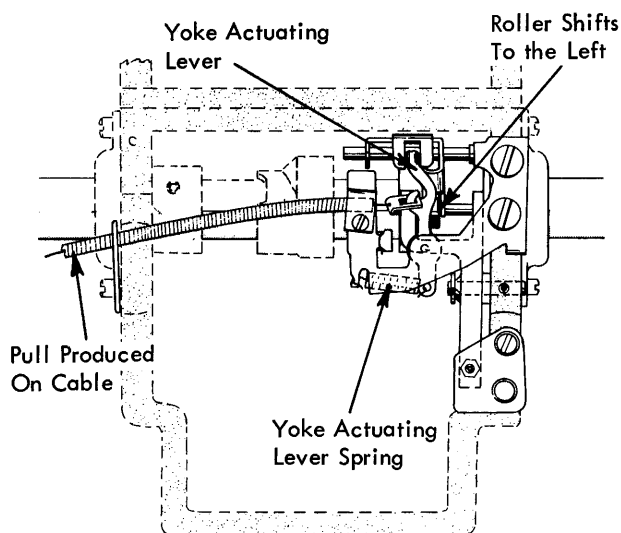
A lever, which controls the lateral position of the yoke and roller, mounts on the tab cord anchor bracket by a shouldered rivet. This lever is called the yoke actuating lever (Fig. 105.4).

The yoke actuating lever is spring loaded at the rear in a clockwise direction (observed from the bottom of the machine) by the yoke actuating lever spring. This spring tension positions the roller directly beneath the high velocity lobe of the print cam as shown in (Fig. 105.4).



● FIGURE 105.4 Yoke Actuating Lever And Spring

A sheathed cable called the velocity control cable fastens to hooked portion of the yoke actuating lever (Fig. 105.4). Whenever a pull is produced on the velocity control cable, the yoke actuating lever will rotate counterclockwise, (stretching its spring) shifting the print cam follower roller from the high velocity lobe to the low velocity lobe of the print cam as shown in (Fig. 105.5).



● FIGURE 105.5 Low Velocity Operation

When the pull on the velocity control cable is relaxed, the yoke actuating lever spring shifts the roller back to the right, positioning it under the high velocity lobe of the print cam (Fig. 105.4).

Whenever a low velocity character is selected, (at the keyboard) a pull on the velocity control cable is produced to shift the roller to the low velocity lobe on the print cam. This pull on the cable is initiated at the keyboard. When any one of the selector interposers that are in positions 32, 36, 38, 39, or 42 are powered forward by the filter shaft, a knob on the forward end of that interposer contacts an upright lug on the low velocity vane causing it to rotate forward (Fig. 105.6).

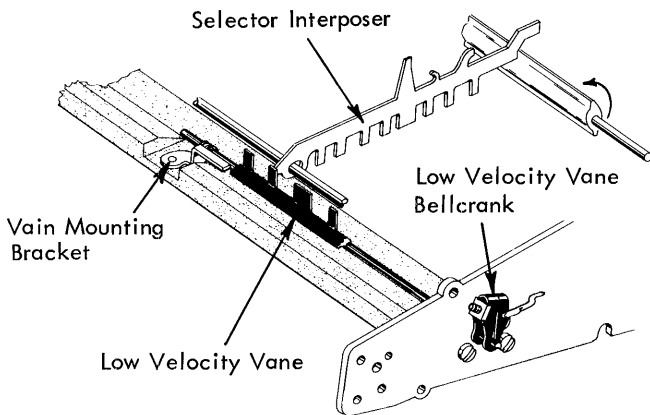


FIGURE 105.6 Low Velocity Selection

The left end of the low velocity vane pivots in a mounting bracket fastened to the top surface of the front keylever guide comb support. The right end of the vane pivots in a hole in the right hand keyboard sideframe. (The vane extends only half way across the keyboard.) The lateral position of the vane is controlled by a C-clip located on each side of the vane mounting bracket.

The low velocity vane bellcrank is fastened to the right end of the vane outside the keyboard sideframe (Fig. 105.6). Rotation of the vane and bellcrank, during a low velocity operation, creates a pull on the link causing the low velocity latch to rotate counterclockwise about its mounting stud. The rotation of the latch swings it out of the operating path of an adjustable stop on the low velocity cam follower. The cam

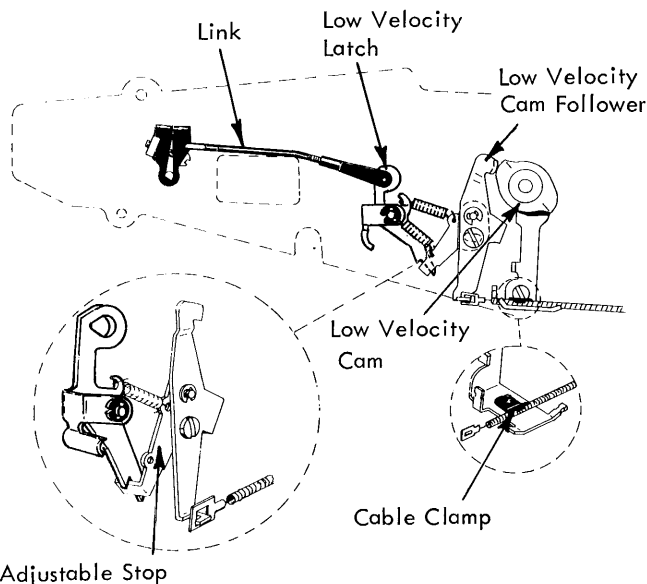


FIGURE 105.7 Machine At Rest

follower and the adjustable stop operates as one piece pivoting about a stud on the keyboard sideframe (Fig. 105.7). A heavy spring hooked to the adjustable stop and anchored to the latch mounting stud, spring loads the follower in a clockwise direction.

The velocity control cable is hooked to the lower extension of the follower. The upper extension of the follower is spring loaded against the low velocity cam which is a double-lobed cam set screwed to the right end of the filter shaft directly to the left of the shift interlock cam (Fig. 105.7). The radial position of the cam is set so that the cam follower will be on the high part of one of the cam lobes when the filter shaft is at rest. Whenever the follower is allowed to follow the contour of the cam towards its low point, a pull will be produced on the velocity control cable by the heavy spring load on the follower.

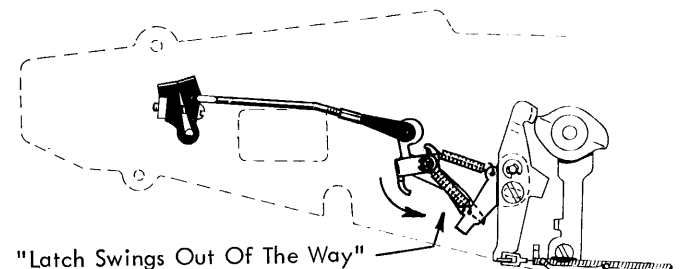


FIGURE 105.8 Beginning Of A Low Velocity Operation

The cam follower will begin to follow the contour of the cam towards its low point whenever the low velocity latch is rotated out of the path of the adjustable stop as shown in Fig. 105.8). This occurs each time a low impression character is selected at the keyboard.

(Fig. 105.9) shows the low velocity cam follower riding down toward the low dwell of the low velocity cam, thereby causing a pull to be produced on the velocity control cable. Note that the low velocity latch is attempting to restore back to its rest position but cannot fully restore until the cam follower is powered back to its rest position. The latch restoring spring between the latch and the adjustable stop provides the restoring action not only for the latch but for the low velocity vane also.

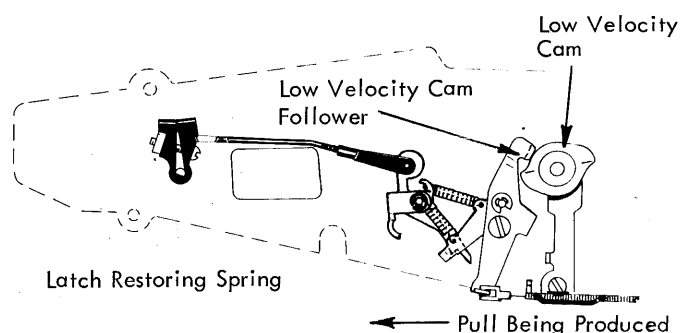
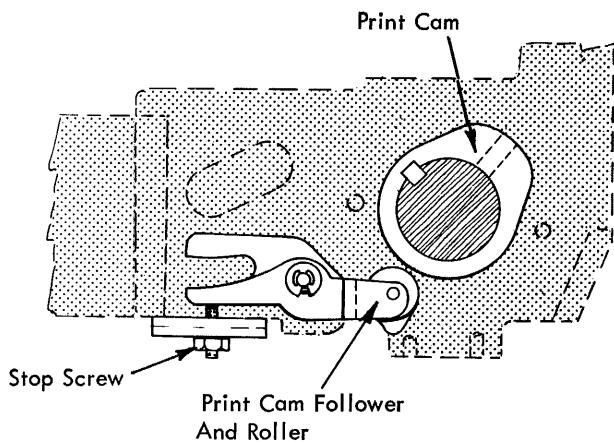


FIGURE 105.9 Low Velocity Operation

As the low velocity print operation is completing, the follower restores back to the high part of one of the cam lobes on the low velocity cam. This relaxes the pull on the velocity control cable so that the yoke actuating lever spring (Fig. 105.4) will shift the print cam follower roller back to the right under the high velocity lobe of the print cam.

If a high velocity character is selected at the keyboard, the low velocity latch will remain at rest in the operating path of the stop on the cam follower. The cam follower is restricted from following the contour of the cam towards its low point therefore, no pull is felt on the velocity control cable. The print cam follower remains to the right under the high velocity lobe of the print cam and a high velocity print operation results.

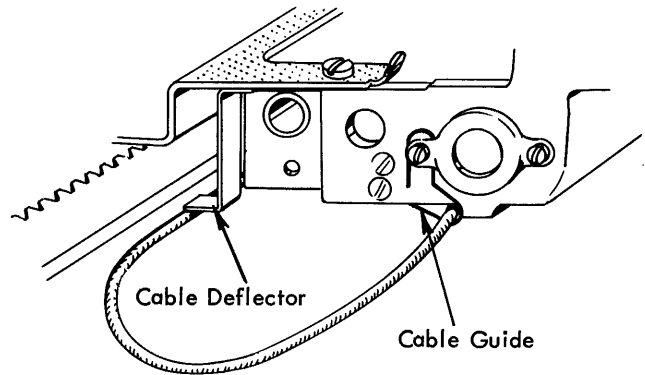
To prevent the print cam from interfering with the print cam follower roller as it shifts from one cam lobe to the other during a velocity selection operation, the print cam follower and roller is held disengaged from the print cam until the roller has shifted. This is accomplished by an adjustable stop screw located directly under the rear portion of the print cam follower (Fig. 105.10). The stop screw, which is threaded through a triangular shaped screw, disengages the print cam follower roller from the print cam as the cam approaches its rest position. The shifting of the roller occurs at the beginning and at the end of a low velocity print cycle which is just when the print cam is leaving or approaching its rest position.



● FIGURE 105.10 Print Cam Follower Stop Screw

The velocity control cable consists of a thin strand of wire (with eyelets at each end) running through the center of a flexible plastic-coated sheath. The wire slides freely within the sheath transmitting motion from the low velocity cam follower to the yoke actuating lever on the carrier. Both ends of the cable sheath are clamped rigidly to their respective mechanisms by cable clamps (Fig. 105.5 and 105.7). Clamping the ends of the sheath allows the velocity control cable to operate efficiently as a motion transmitting device.

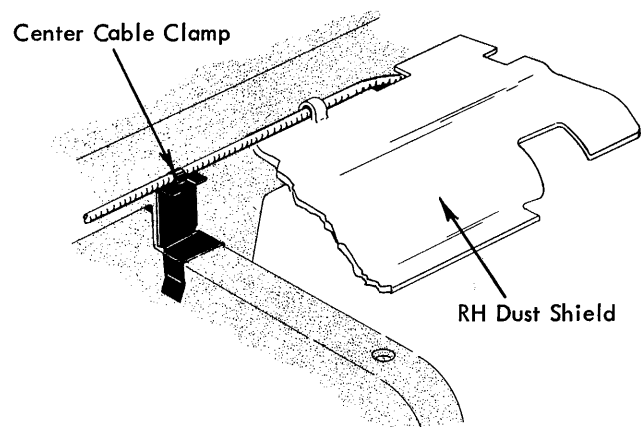
The velocity control cable passes through a wire guide located on the left side of the carrier as shown in (Fig. 105.11). The guide retains the cable against the underside of the carrier so that the cable will not hand down and rub on the dust shields or catch in the mechanism while the dust shields are removed.



● FIGURE 105.11 Cable Guide And Cable Deflector

A cable deflector attached to the escapement bracket (Fig. 105.11) prevents the velocity control cable from getting behind the carrier.

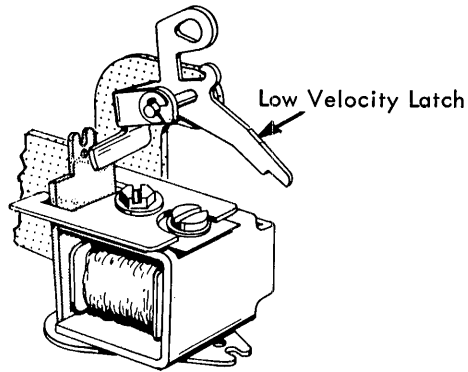
The cable is also clamped along the rear edge of the dust shields by a center cable clamp on the powerframe and a guide lug on the right hand dust shield (Fig. 105.12). The center cable clamp maintains the cable in its correct lateral position so that the carrier is free to travel the entire length of the carriage without being restricted by the cable.



● FIGURE 105.12 Center Cable Clamp

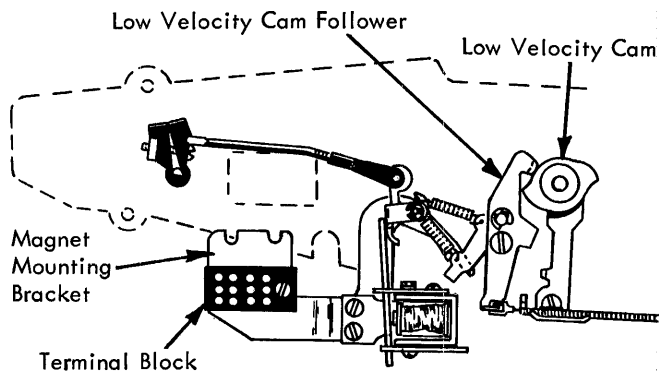
#### Low Velocity Magnet Assembly

This magnet is mounted on the right hand keyboard frame, under the low velocity latch (Fig. 105.13).



● FIGURE 105.13 Low Velocity Magnet

When the armature is attracted, it contacts an extension on the low velocity latch and rotates the latch out of the way of the adjustable stop on the low velocity cam follower (Fig. 105.14).



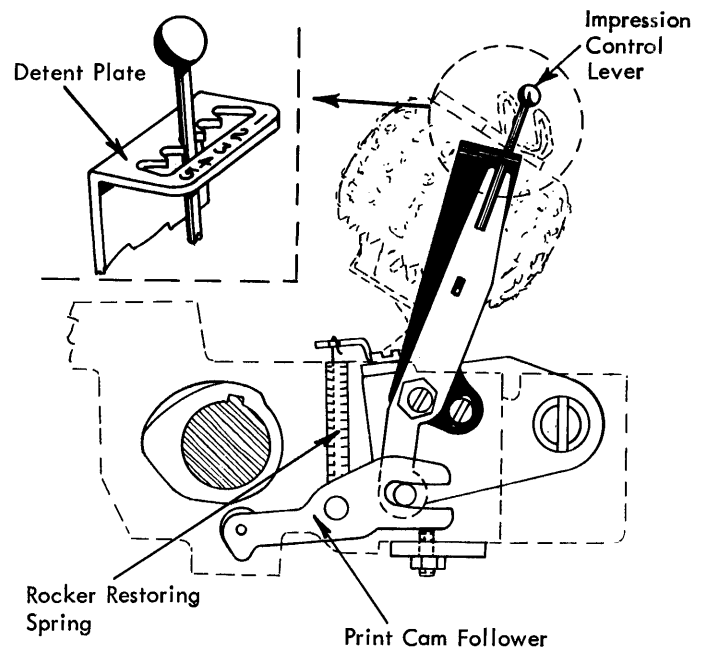
● FIGURE 105.14 Low Velocity Magnet Assembly Operation

The rest of the low velocity operation is exactly the same as previously described.

#### Impression Control Mechanism - ("Stick Shift")

The impression made by the typing element is determined by the velocity of the typing element upon impact with the paper, the impression control lever is none other than a type head velocity control. By increasing or decreasing the velocity of the typing element with the impression control lever, the impression for all characters can be changed equally regardless of the automatic velocity selection mechanism.

The impression control lever may be positioned by the operator to one of five different impression settings. The lever is held in its selected position by detent notches cut into a detent plate as shown in Fig. 105.15. When changing the lever to a new setting it must be pushed to the right (disengaging it from the detent notches) before moving it forward or back. Do not ratchet the impression control lever across the teeth on the detent plate as this could cause the plate to become loose.



● FIGURE 105.15 Impression Control Mechanism

Changing the position of the impression control lever causes the pin on the lower portion of the lever to move forward or back to a new position in the forked slot of the print cam follower (Fig. 105.15). Just as in the early style print mechanism, the front to rear position of the pin determines the amount of powered travel that the typehead receives from the print cam follower. This plus the amount of free flight that is in the system determines the velocity of the typehead upon impact with the paper.

When the impression control lever is pulled forward to a new position, the pin on the lower extension moves toward the rear in the forked slot of the follower thereby increasing the amount of powered travel that the typing element will receive. The forked slot in the follower is designed so that most of the change in powered travel will be felt as a change in the rest position of the type head and not as a change in the amount of free flight (determined by the limit of powered travel). Throughout the entire range of the impression control lever the free flight of the type head should change slightly (approximately .015). This is necessary in order to maintain the correct timing relation between type head detenting and type head printing as the velocity of the type head is increased or decreased by the impression control lever. In other words, by increasing or decreasing the amount of free flight to compensate for a change in type head velocity, the print time of the type head requires constant in the machine cycle regardless of the impact velocity of the typing element.

Note in Figure 105.15 that the anvil striker, the restoring cam, and the restoring roller has been eliminated. The rocker is now spring loaded back to rest by a large extension spring (rocker restoring spring). The dual velocity print cam eliminates the need for the anvil and striker. The anvil is now used only as a carrier support for long carriage machines (Fig. 105.16). The carrier buffers have been eliminated and the bottom of the ribbon feed bracket serves as a buffer.

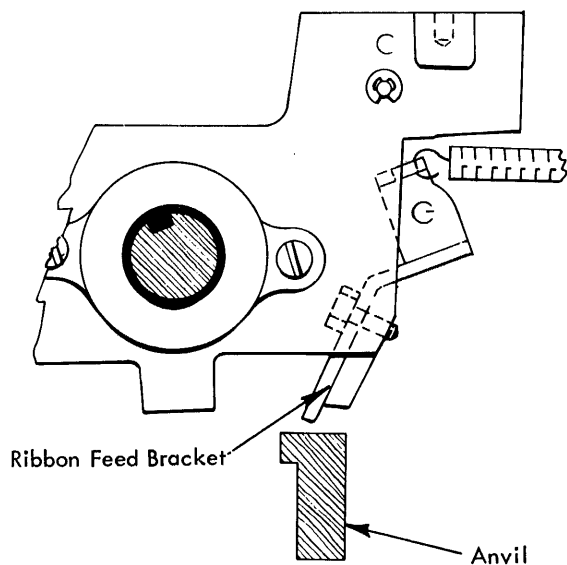


FIGURE 105.16 Carrier Support (723-725)

### PRINT ESCAPEMENT

The escapement mechanism controls the movement of the carrier along the writing line. The print escapement mechanism consists of the escapement bracket assembly, escapement rack, escapement torque bar, escapement trigger lever assembly, and the escapement cam and follower (Fig. 106).

#### Escapement Bracket Assembly

The escapement bracket assembly is a plate attached to the rear of the carrier so that it moves with the carrier. The escapement rack is mounted solidly to the power frame just behind the carrier and beneath the escapement bracket (Fig. 106). A stud at the left rear corner of the escapement bracket mounts the escapement pawl to the bottom of the bracket so that it pivots front to rear. A small spring from the pawl to the bracket exerts a force to the right and forward on the escapement pawl.

Other components are present on the escapement bracket that are only indirectly related to the escapement mechanism. Pivoting on the same stud with the escapement pawl are the backspace pawl, the tab lever, and the tab lever trigger. The tab lever latch mounts on the right side of the escapement bracket.

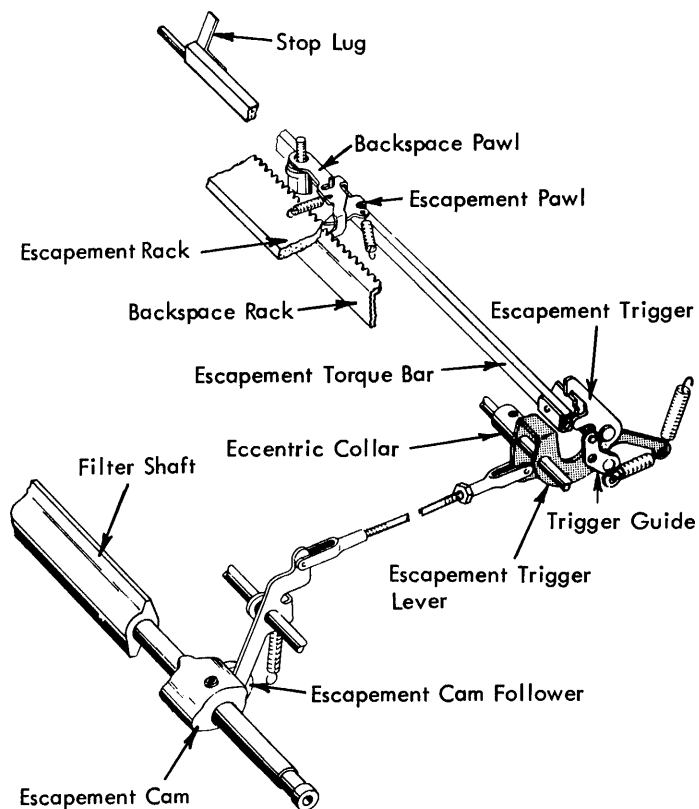


FIGURE 106. Print Escapement Mechanism

The escapement pawl contains an elongated hole at its mounting point that allows lateral movement in the pawl. While the pawl is engaged in the rack, the force of the mainspring holds the carrier to the right so that the pivot stud rests against the end of the elongated hole (Fig. 107A).

An escapement operation is obtained by forcing the escapement pawl to the rear out of engagement with the rack teeth (Fig. 107B). Because it is relatively light in weight, the pawl is snapped to the right by the pawl spring as soon as the pawl clears the rack tooth. The escapement pawl is allowed to move back to the front into engagement with the next tooth (Fig. 107C). The carrier then moves to the right until it comes to rest against the escapement pawl (Fig. 107D).

The amount the carrier is allowed to move is determined by the distance from one escapement rack tooth to the next. This is known as the pitch of the machine and is expressed in terms of teeth or spaces per inch. Two pitches are available. They are ten and twelve pitch. The type style to be used is determined largely by the pitch of the machine, because the larger type styles require more space for each character. The pitch and type style together are determined by the operator's preference and by the application for which the machine is to be used.

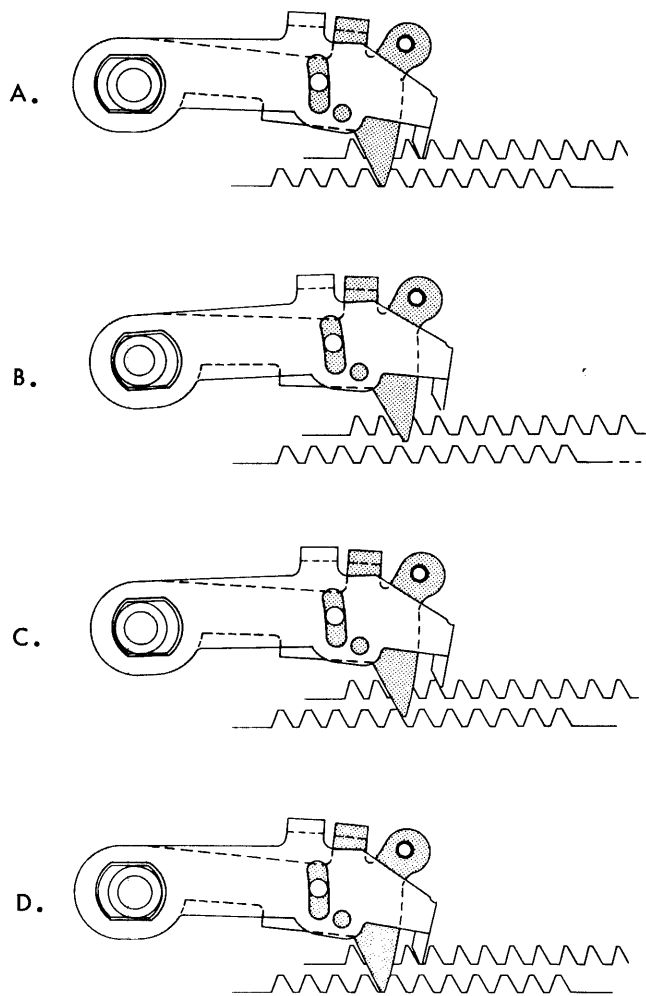


FIGURE 107. Escapement Pawl Operation

Having the escapement rack stationary and the escapement pawl movable is directly opposite to the arrangement on conventional machines. The carrier and escapement pawl must be moved to the left for a backspace operation. Because the backspace pawl is mounted to the escapement bracket, movement of the backspace pawl to the left forces the carrier and escapement pawl to the left.

The backspace pawl is just above the escapement pawl, but its tooth extends below the escapement pawl. It is held in mesh with the backspace rack by a small extension spring similar to that of escapement pawl. The backspace rack is mounted to the rear of the power frame by shouldered screws through elongated holes in the rack. This mounting arrangement allows lateral movement of the rack. Movement of the rack toward the left forces the backspace pawl to the left to cause a backspace operation.

The backspace operation is pointed out here because of its close association with the escapement mechanism. It is discussed more fully in the backspace section. The backspace pawl is in mesh with its rack when in the rest position. This means that both the backspace and escapement pawls must be removed from their racks in order for the carrier to move to the right.

Figure 107A illustrates a slight clearance between the working surfaces of the backspace pawl and a tooth on the backspace rack when the escapement pawl is holding the carrier. This clearance is necessary for proper operation of the backspace mechanism. The clearance insures that the backspace pawl will properly re-enter the backspace rack at the completion of each backspace operation during a repeat operation (this is when the escapement pawl is holding the carrier and the backspace rack is restoring back to its rest position).

The backspace pawl requires an elongated mounting hole so that it will operate in unison with the escapement pawl during an escapement operation. Without the elongated motion, the backspace pawl could restore back into the same rack tooth before the carrier began to move during an escapement operation. This could cause partial or half spacing as the two pawls would alternate holding the carrier during an escapement operation.

The backspace and escapement pawl are pinned together so that they will always move together laterally but front to rear independently. The reason for this is covered in the backspace mechanism.

#### Torque Bar

The torque bar is a flat bar that pivots between the sides of the powerframe just to the rear of the backspace and escapement racks (Fig. 106). Its purpose is to trip the backspace and escapement pawls out of their respective racks. The left end pivots in a hole in the powerframe casting. A small C-clip holds the right end in a large mounting plate on the powerframe.

The rest position of the torque bar on early level machines is determined by a lug on the left end of the torque bar that contacts the tab rack. On late level machines, the rest position is controlled by an adjustable stop which mounts on the right hand tab rack mounting plate and contacts a lug on the right hand end of the torque bar.

The pivot point of the torque bar is near the bottom of the bar. When the torque bar pivots, the top of the bar moves to the rear. The escapement pawl and backspace pawl each have a lug that extends down just behind the torque bar. As the top of the torque bar pivots to the rear, it forces the lugs of the pawls to the rear causing the tips of the pawls to be tripped out of their racks.

Rotation of the escapement torque bar is instantaneous and just sufficient to trip the pawls out of their racks. The torque bar is immediately rotated back to the rest position by an extension spring located at the right end. This allows the pawls to re-enter their racks to limit the carrier movement to one space.

Because of the force required to trip the pawls out of their racks, the torque bar tends to bow toward the front instead of pushing the pawls to the rear. The tendency increases as the carrier moves toward the middle of the torque bar. Bowing of the torque bar could result in a failure of the escapement trip to occur. To overcome this, the pawl pivot stud has a large head that extends down in front of the torque bar to stop any bowing toward the front (Fig. 106). The torque bar actually pries against the pawl stud to trip the pawls



from the rack. The head of the pawl stud is flat sided so that the escapement trip in the center of the torque bar can be adjusted to be the same as at the ends. (On late level machines the flat sided head has been replaced with a stud that has an eccentric head.)

On long carriage machines additional support is given to the escapement torque bar to prevent it from bowing to the rear (Fig. 108). A back stop mounted to a stud in the machine powerframe provides the necessary backing.

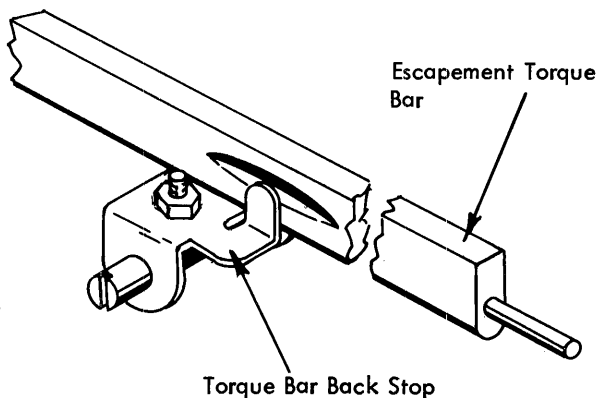
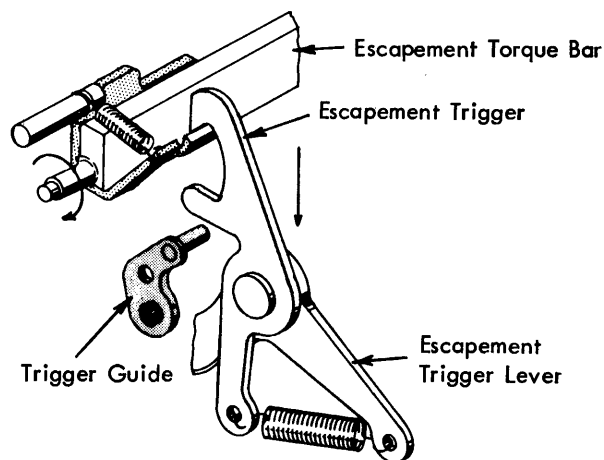


FIGURE 108. Torque Bar Back Stop

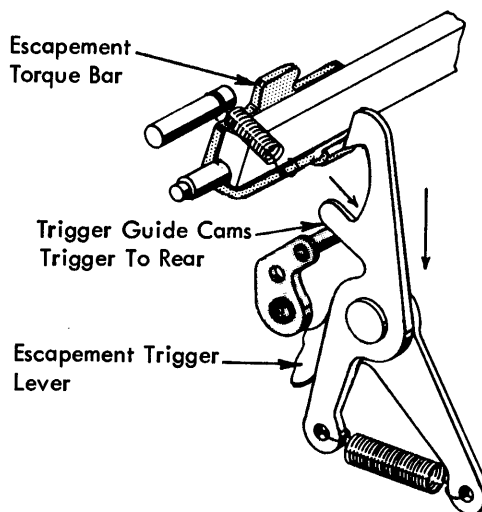
#### Escapement Trigger

The escapement trigger operates to rotate the torque bar in order to obtain an escapement operation. The right end of the torque bar contains a lug that extends to the rear. The escapement trigger hooks over the lug and pulls downward to cause the torque bar to rotate (Fig. 109). The trigger pivots on the escapement trigger lever and is held forward over the torque bar lug by an extension spring between the bottom of the trigger and a rear extension of the trigger lever. The trigger lever pivots on a shaft on the operational latch bracket mounted to the rear of the powerframe just below the right end of the torque bar. Downward movement of the trigger lever carries the trigger down to rotate the torque bar. The trigger lever is restored and held in the rest position by an extension spring from the rear of the lever up to a rear extension of the operational latch bracket.

The trigger lever is cam operated; therefore, it can only restore as fast as the cam can rotate from the high point to the low point. The torque bar must be allowed to restore more quickly in order to re-enter the escapement pawl to the correct rack tooth. Delaying the torque bar restoration can result in escapement skipping, especially on 12 pitch machines. To insure that the torque bar can restore quickly enough, the trigger is disengaged from the torque bar lug just after the escapement trip occurs. The operational latch bracket is formed to the rear at the right side. Attached to the inside of this rearward portion is a small plate called the trigger guide (Fig. 109A). The trigger guide has a stud extending to the left just in front of the escapement trigger. A beveled portion of the trigger contacts this stud as the trigger moves down causing the trigger to be cammed to the rear off of the lug on the torque bar (Fig. 109B). The torque bar can then restore without waiting for the restoration of the trigger and trigger lever.



A. REST POSITION



B. ACTIVE POSITION

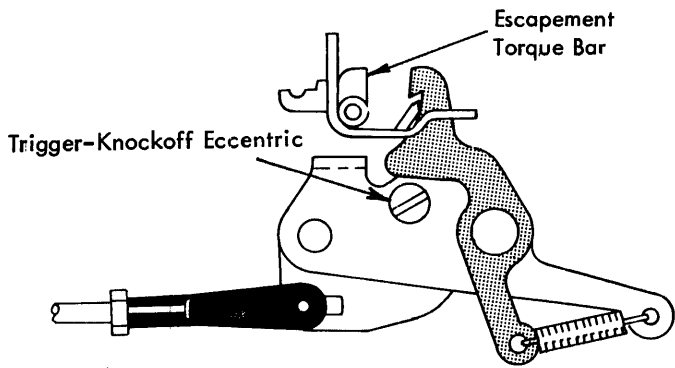
FIGURE 109. Escapement Trigger Operation (Early Style)

The late style escapement trigger operation is basically the same as the early style except that the trigger knockoff action comes from a screw with an eccentric head that mounts on and moves with the escapement trigger lever (Fig. 110).

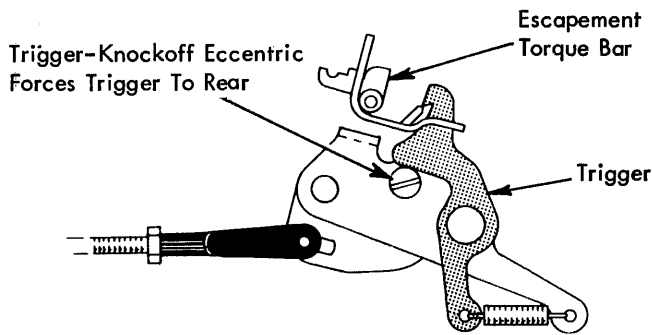
#### Escapement Cam

Because an escapement operation is necessary each time a character prints, the power to trip the escapement is taken from a portion of the cycle mechanism. A small double lobed cam, called the escapement cam, is attached to the right end of the filter shaft just inside the powerframe (Fig. 106). Each time a cycle operation occurs, the filter shaft operates the cam 180°.

The escapement cam follower pivots on a long pin located in a bracket just to the rear of the filter shaft. A roller at the bottom of the follower is operated to the rear by a lobe of the cam each time a cycle operation occurs. This causes the link at the top of the cam follower to pull forward on the bottom of the escapement trigger lever. The link is connected to the trigger lever below its pivot point; therefore a forward



A. REST POSITION



B. ACTIVE POSITION

FIGURE 110. Escapement Trigger Operation (Late Style)

pull causes the trigger to move down at the rear and operate the torque bar.

Because the carrier is relatively light and moves quickly, the escapement trip must not occur before the character print. If it did, the carrier might move before the character printed or might be moving when the character is printing. This would result in an uneven left margin or poor horizontal alignment and possible smearing of the character depending upon the timing of the trip. To eliminate this possibility, the escapement cam is timed so that the escapement trip occurs just after the type head leaves the platen to restore to rest.

On 11 inch machines only, a small eccentric collar on the pivot pin (Fig. 106) prevents the pin from bowing forward due to the pull of the escapement trip link. The collar braces the pivot pin by resting against the bracket in which the pivot pin is mounted. Without the collar, some of the trip link motion would be lost in the flexing of the pivot pin. Escapement failure would result, if not enough trip link travel remained to remove the pawls from the rack.

### MAINSRING

Any time the escapement and backspace pawls are removed from their racks, the carrier is pulled toward the right. The mainspring supplies the tension for all movement of the carrier toward the right. It is located at the right rear corner of the machine. Notched lugs of the mainspring cage fit into slots in the backplate (Fig. 111). Tension of the mainspring is changed by turning the entire mainspring cage to a new location. When working with the mainspring, extreme care should be taken to keep it under control.

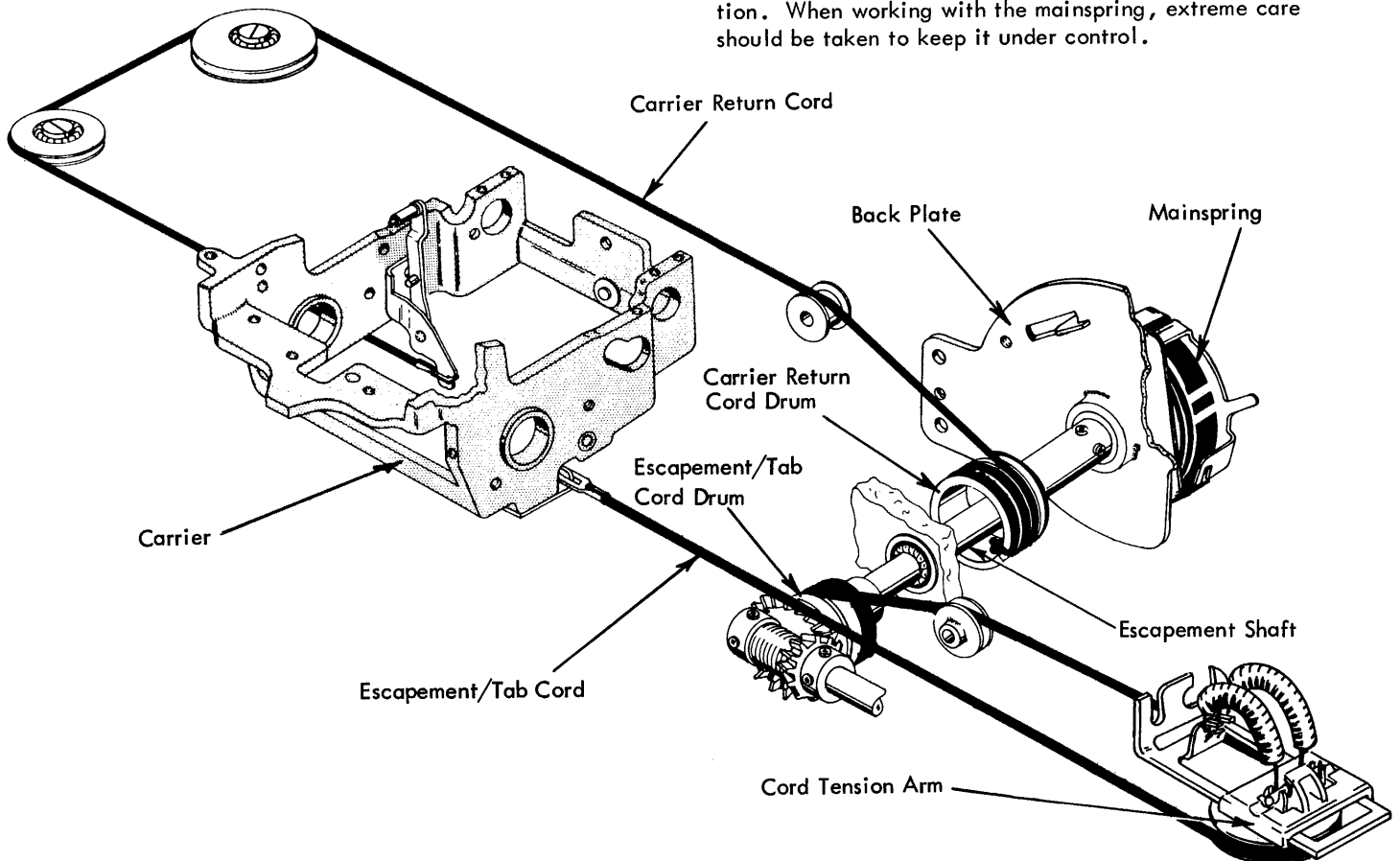


FIGURE 111. Mainspring And Cord System

The center of the backplate contains a ball bearing assembly that supports the rear end of the escapement shaft. The shaft extends to the rear into the mainspring where a hub is set-screwed to the shaft. The inner end of the mainspring is rolled so that it fits into a groove in the hub and supplies a rotary force to the hub and escapement shaft.

The escapement shaft extends forward through another ball bearing assembly in the powerframe and has a drum attached at the forward end. This drum is called the cord drum gear and is spirally grooved to accept the escapement/tab cord. The grooves prevent the cord from piling up on the drum insuring uniform tension and minimum wear.

The escapement/tab cord is a small, round nylon-covered linen cord. The drum end of the cord is knotted and fits into a slot at the rear of the drum. The cord makes several turns around the drum and rides up over a guide roller before passing through the right side of the machine (Fig. 111). Just outside the machine the cord passes around a pulley and extends back to the left where it is attached to a hook on the carrier assembly. As the mainspring turns the escapement shaft, the drum winds up the cord to move the carrier to the right.

More than one operation is performed by the escapement shaft. The gear teeth at the front of the cord drum are involved in both the carrier return and tabulator operations. Between the powerframe and the backplate is another cord drum with a cord attached to it similar to the escapement/tab cord (Fig. 111). This cord is attached to the left side of the carrier and exerts a pull to the left during carrier return. These operations are fully covered in their particular sections. However, the carrier return cord drum is significant in the escapement mechanism, because it must pay out cord in order for the carrier to move to the right. Likewise, the escapement/tab cord must be paid out from its drum in order for the carrier to return to the left.

The constant jerk and pull to which the cords are subjected may tend to stretch them slightly. This could cause the cords to become slack creating erratic movement of the carrier. A method has been provided whereby the slack is automatically removed from both cords. Outside the powerframe, the pulley that guides the escapement cord is mounted to the cord tension arm (Fig. 111). A pair of spiral springs arched between the arm and the pulley mounting bracket apply a constant pressure toward the right. The pressure is sufficient to keep the slack out of the escapement cord. This, in turn, rotates the escapement shaft enough to keep the carrier return cord tight.

#### OPERATIONAL CAMS AND CONTROL MECHANISM

All powered service operations are driven by the operational cam shaft located on the right side midway back in the machine. The powered operations are the spacebar, backspace, tabulation, carrier return, indexing, and shift.

The spacebar, backspace, tabulator, carrier return, and indexing mechanisms are operated by two cam assemblies mounted on the operational cam shaft. The shift is driven by a spring clutch at the right end of the shaft outside the powerframe.

#### Operational Cams

The two operational cams are located on the right side of the operational shaft just inside the powerframe (Fig. 112). The left hand cam is a double lobed cam that requires only 180° rotation to complete one operation. Its purpose is to power the spacebar, backspace and tabulation mechanisms. The right hand cam is a single lobed cam requiring 360° rotation to complete one operation. It powers the engaging of the carrier return mechanism and operates the indexing mechanism.

Each operational cam must power more than one function. The mechanism to be operated is determined by a selection system released by depressing the desired keylever. The selection operation is discussed later in this section.

Both the single and the double lobed cams have the same rise from the low point to the high point. The double lobed cam completes an operation sooner than the single lobed cam, because it requires only 180° rotation compared to 360° for the single lobed cam. The faster double lobed cam is used in the spacebar mechanism because the spacebar action must be as fast as the print action in order to maintain typing rhythm. The backspace and tabulation operations must operate quickly in order to provide rapid positioning of the carrier; therefore they also employ the double lobed cam. Both the carrier return and indexing keylevers have a repeat/non-repeat feature. When operated in the repeat position, they cause rapid indexing of the platen. Operating too rapidly could create inaccurate indexing due to platen overthrow and failure of the index pawl to restore quickly enough; therefore the slower single lobed cam is used to operate the carrier return and indexing mechanisms.

A ratchet, called the operational clutch ratchet, is set-screwed to the operational cam shaft (Fig. 112). The cam assemblies are C-clipped into position on shoulders of the ratchet, one on each end. The operational cam shaft and clutch ratchet are allowed to turn while the cam assemblies remain stationary. Steel sleeves fitted into the cam bodies act as bearings for the cams.

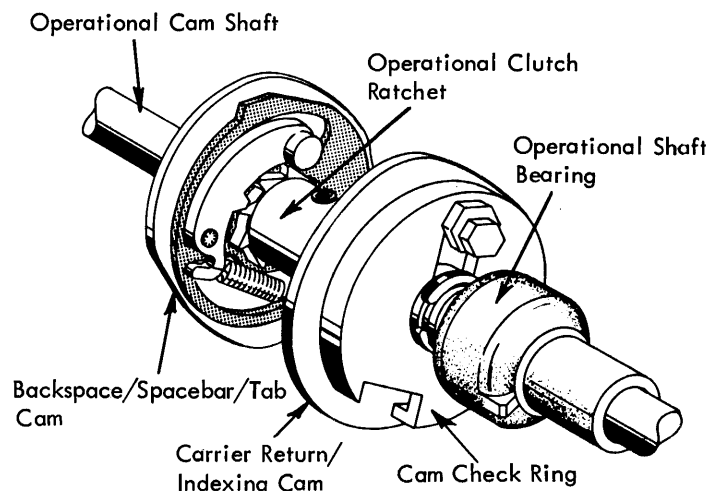


FIGURE 112. Operational Cams

A cam rotates only when a particular operation is desired. In order for the cam to rotate it must be "locked" to the operational clutch ratchet. Each cam has a pawl mounted to it in such a manner that the pawl can be pivoted into engagement with the rotating operational clutch ratchet (Fig. 113). Whenever the pawl is permitted to engage in the clutch ratchet, the cam will rotate with the ratchet (Fig. 114).

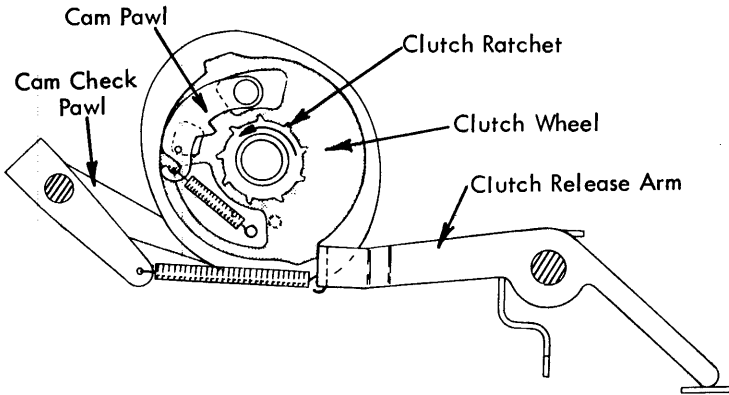


FIGURE 113. Operational Cams At Rest

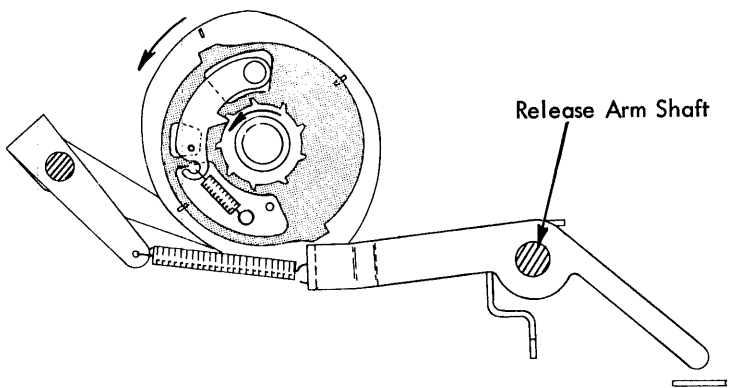


FIGURE 114. Operational Cam Active

The operational cam pawl is prevented from engaging the clutch ratchet by a disc called the clutch wheel (Fig. 113). The clutch wheel is attached to and forms a part of the cam assembly. The disc is mounted to the cam assembly so that the cam pawl operates through an oversized hole in the disc. The clutch wheel is free to rotate on the cam assembly, but its movement is restricted by contact with the cam pawl. A pin at the tip of the pawl fits into another hole in the clutch wheel that has one side beveled (Fig. 114). Movement of the cam while the clutch wheel is held stationary causes the pin on the pawl to slide up the beveled side of the hole and disengage the pawl from the ratchet (Fig. 115).

Movement of the clutch wheel is controlled by the clutch release arm pivoted on a shaft below and to the rear of the cam assembly (Fig. 113). The clutch wheel has a tooth that contacts the end of the clutch release arm as the cam assembly rotates. The clutch release arm stops the movement of the wheel. Further rotation of the cam causes the pawl to be disengaged from the ratchet as described. When the clutch release arm is moved down, the clutch wheel is released (Fig. 114). The cam pawl spring is then allowed to pull the pawl into engagement with a tooth of the clutch ratchet by

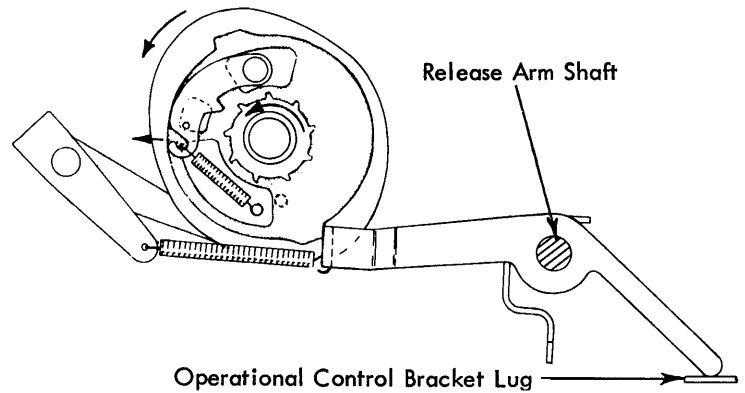


FIGURE 115. Clutch Pawl Being Disengaged

merely rotating the clutch wheel out of the way. As soon as the clutch release arm is allowed to restore, it is pulled by its spring back up into position to contact a tooth of the clutch wheel. There are only two such teeth for the double lobed cam and only one for the single lobed cam. The cam assembly is driven 180° for the double lobed cam and 360° for the single lobed cam before the clutch release arm contacts and stops a tooth of the clutch wheel. Rotation of the double lobed cam through 180° and the single lobed cam through 360° allows the high point of the cam to operate the particular function involved.

The cam pawl spring tries to pull the pawl into engagement with the clutch ratchet. Unless the cam is held in position after the pawl is disengaged from the ratchet, the spring will cause the cam to creep backward allowing the pawl to partially engage the ratchet and create a loud buzzing sound. It cannot fully engage the ratchet because it would be disengaged immediately as previously described.

To prevent backward creep of the operational cams and the resulting noise, a cam check pawl is provided for each cam. The check pawl engages a notch in the cam assembly as soon as it has rotated far enough for the cam pawl to be disengaged from the ratchet (Fig. 116). The check pawls extend to the rear from a pivot pin located just in front of the cams. An extension spring from each check pawl to the clutch release arm maintains the two parts in the rest position. The notch engaged by the cam check pawl is in a disc-shaped part called the cam check ring. The ring is attached to the cam by two screws. An eccentric collar on one of the screws facilitates the adjustment of the cam check ring.

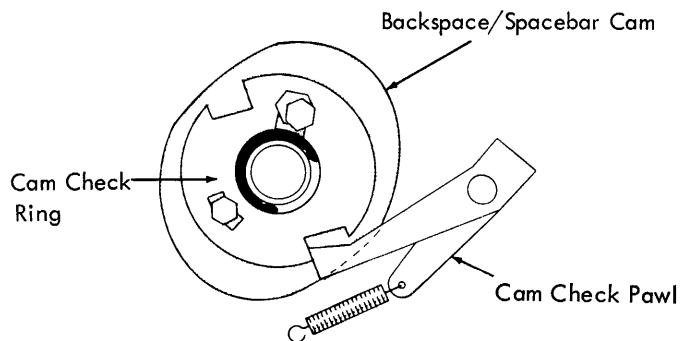


FIGURE 116. Operational Cam Check Pawl

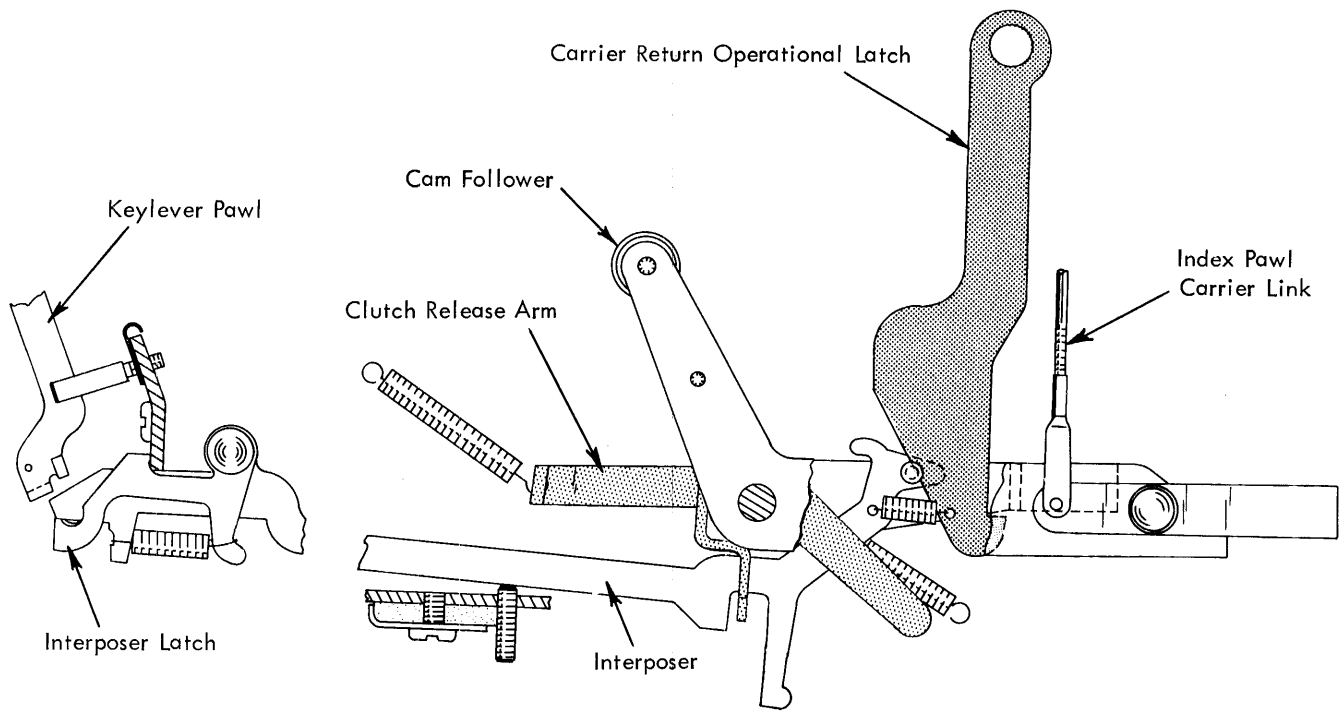


FIGURE 117. Carrier Return/Indexing Operational Control Mechanism

Operational Control Mechanism

The operational control mechanism is a compact unit contained in a bracket located under the operational cams. The purpose of the mechanism is to select the function to be operated, control the movement of the cam, and transfer the cam motion to the selected operation. To fulfill these three purposes, each cam requires four basic parts in its control mechanism. They are: an interposer to select the operation and to help with the cam control, a clutch release arm to control the cam, a restoring device for the interposer, and a cam follower to transfer the cam motion to the operations. The principle of operation for both cam control mechanisms is the same; however, the parts design differs slightly.

1. Interposers

Each mechanism operated by the cams requires an interposer to select the mechanism to be operated and to cause the cam to be engaged. These five interposers operate front to rear through slots in the operational control bracket and are latched forward on an adjustable guide attached to the front of the bracket (Figs. 117 and 118). The interposers are each spring loaded to the rear by an extension spring between the interposer and the rear of the operational control bracket. Attached to the front of each interposer is a small pivoting latch. The latch is spring loaded upward against the interposer so that the top portion forms a hook for the interposer. The latch hooks under the keylever pawl guide bracket to

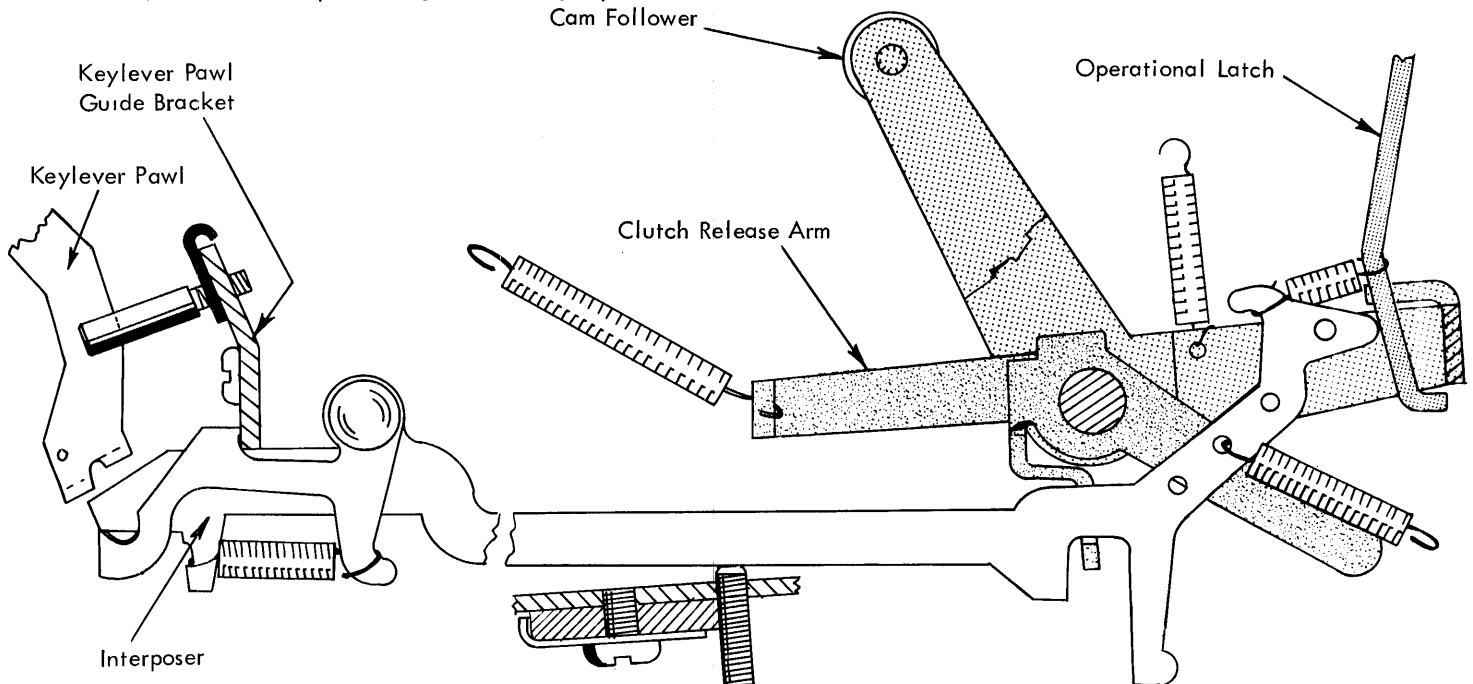


FIGURE 118. Backspace/Space/Tab Operational Control Mechanism

hold the interposer forward. When the interposer is pushed down, the latch clears the bracket allowing the interposer to be pulled to the rear to perform its function. The latch pivots on the interposer so that the entire interposer will not have to move down to allow the latch to relatch on the guide bracket as the interposer restores to the front. This insures positive relatching as the latch can very quickly snap back up into the latched position after it has been cammed down by the guide bracket.

The carrier return, indexing, backspace, tabulating, and spacebar keylevers each have a pawl attached at the rear that extends down through a slotted guide stud to a position just above its own particular interposer (Figs. 117 and 118). Depression of one of the keylevers causes a lug at the bottom of the keylever pawl to depress the interposer and release it to the rear.

## 2. Clutch Release Arm

Two clutch release arms are present, one for each cam. The arms are identical in operation but slightly different in design to conform to their position in the machine. The release arms pivot on a shaft at the rear of the cams (Fig. 115).

Each clutch release arm has three extensions from the pivot. The forward extension blocks the clutch wheel to disengage the cam pawl from the ratchet. The lower extension is contacted by an interposer. The interposer pivots the forward extension down out of the path of the clutch wheel to allow the cam to be driven. In the rest position, the rear extension of the clutch release arm contacts the bottom of the operational control bracket (Fig. 115). This controls the "bite" between the release arm and the clutch wheel to insure positive release action.

The clutch release arm is restored and held at rest by an extension spring between the forward extension and the cam check pawl (Fig. 115).

## 3. Cam Follower

Each cam has a cam follower designed to convert the rotary motion of the cam into vertical linear motion at the rear. The cam followers are bellcrank devices mounted just to the rear of the cams (Figs. 117 and 118). The cam followers pivot about the same pivot shaft that supports the clutch release arms. A roller at the top of each cam follower is in continuous contact with its particular cam.

The carrier return/indexing cam follower extends to the rear where it is designed in the form of a bail (Fig. 117). When the cam operates, the rear of the follower is moved down as the roller is forced to the rear by the cam. A link attached near the rear of the cam follower operates the indexing mechanism. Each time the cam operates, an indexing action occurs. A return spring in the indexing mechanism restores the cam follower and holds the roller against the cam.

The backspace/spacebar/tab cam follower is designed to operate three mechanisms. Because it has three positions to operate, the cam follower must be wider than that of the carrier return. An extension spring from the cam follower to the operational latch bracket acts to restore the cam follower and maintain the position of the roller against the cam (Fig. 118).

Pressure of the cam follower roller against the cam is essential for proper operation of each cam. The spring tension forces the cam follower from the high point to the low point of the cam. This accelerates the cam enough to give the overthrow required to disengage the cam pawl from the ratchet and to allow the check pawl to engage the check ring.

## 4. Interposer Restoring Lever

After an interposer has been released to the rear to begin an operation, it must be restored forward so that the clutch release arm may pivot back to its rest position to stop the action of the cam.

The interposers are restored by a bail-shaped part that pivots between the sides of the operational control bracket and is located just to the rear of the interposers (Fig. 119). A lug at each side of the interposer restoring lever is in contact with the cam followers. Operation of either cam follower pivots the bottom of the restoring lever forward (Fig. 119). The restoring lever, in turn, forces the interposer forward where it can latch in the rest position.

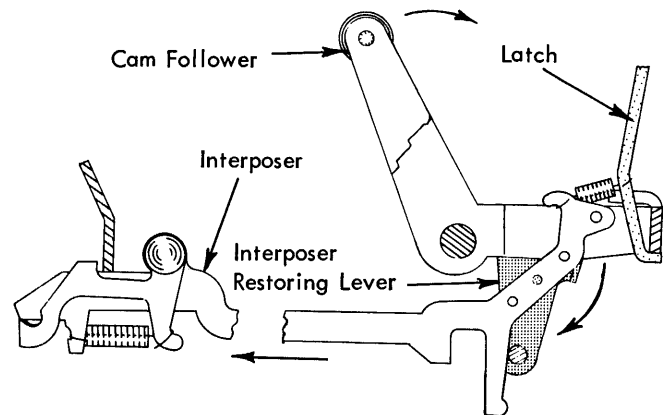


FIGURE 119. Interposer Restoring Operation

## 5. Operational Selection

In addition to causing cam release, the interposer must set up the mechanism to be operated. This is true of all except the indexing interposer. Because the indexing mechanism is directly connected to the cam follower (Fig. 117), merely releasing the cam results in an indexing operation.

The backspace, spacebar, tabulating, and carrier return interposers each have a small, hook-like latch resting against the rear of the interposer (Figs. 117 and 118). A small extension spring maintains the latch against the interposer.

Each latch is suspended from its own particular mechanism located above the rear of the interposer. Pulling any one of the latches down causes it to operate the mechanism involved. The hook portion of the operational latches rests just in front of the cam follower. When one of the interposers is snapped to the rear, the latch for that interposer is pushed to the rear where it hooks under the cam follower. The cam follower is then operated to pull down on the latch and actuate the selected mechanism (Fig. 119).

As the cam follower is operated, the interposer is restored to the front by the restoring lever. This causes the spring between the interposer and the operational latch to extend (Fig. 119). Extending the spring tends to pull the latch out from under the cam follower before the operation is completed. To insure a complete operation, the latch is locked to the rear as soon as the operation begins. As the latch is pulled down by the cam follower, it moves down behind a lug of the operational control bracket (Fig. 120). The lug prevents any forward movement of the latch until the operation is completed and the cam follower restores. The latch is then pulled forward into its rest position against the interposer. The carrier return latch is not locked to the rear, because its beveled forward edge permits it to remain in contact with the interposer throughout the operation (Fig. 117).

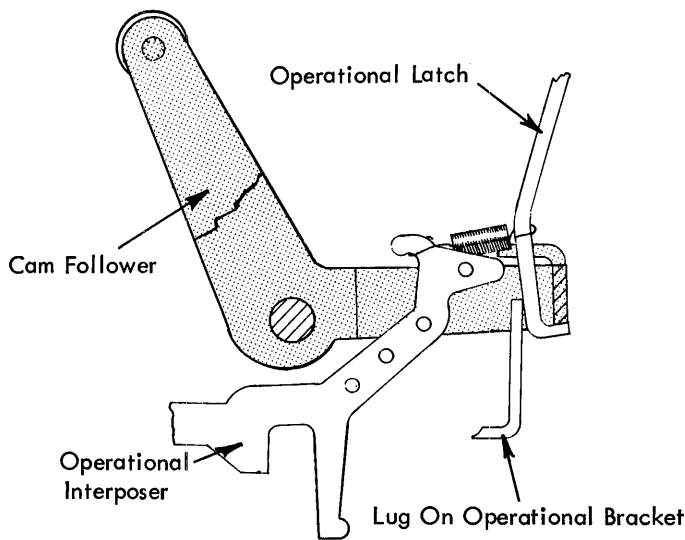


FIGURE 120. Operational Latch Locked To The Rear

## 6. Operating Sequence

As the desired keylever is depressed, a lug of the keylever pawl contacts an interposer forcing it down to release it from the guide bracket. The interposer is pulled to the rear by its spring. A lug on the interposer contacts the clutch release arm rotating it down to allow the cam clutch to be engaged. At the same time, the interposer forces its selective latch to the rear pushing it under the cam follower. The cam is driven by the clutch ratchet causing the cam follower to move from the low point to the high point of the cam. Movement of the cam follower pulls down on the operational latch to power the mechanism and, at the same time, actuates the interposer restoring lever to restore the interposer forward. The clutch release arm restores into the path of the clutch wheel ready to disengage the cam clutch. The cam follower passes the high point of the cam and restores to the rest position as it reaches the low point. The operational latch is snapped forward against its interposer into the rest position and the operation is completed.

### OPERATIONAL SELECTION UNIT

This unit is mounted to the power frame directly below the operational interposers and consists of a magnet unit and a contact assembly (Fig. 121).

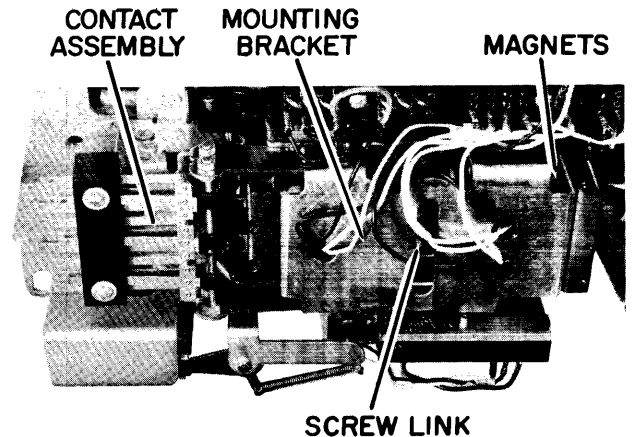


FIGURE 121. Operational Magnet Unit

### Magnet Unit

The magnet unit contains five magnet assemblies, one for each operational interposer. The magnets are mounted to a bracket that is fastened to the power frame (Fig. 121).

When the armature is attracted, it moves away from the power frame pulling down on a link (Fig. 122).

This causes an interposer to be tripped without moving a keylever. The slotted head on the lower end of the link provides a means of adjusting the link without removing either end. The link extends through a hole in the armature, and

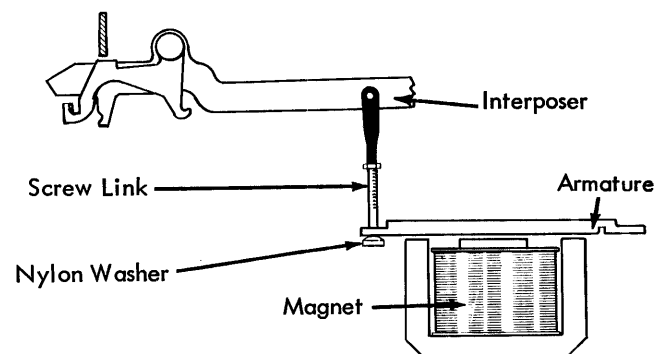


FIGURE 122. Operational Magnet Operation

the upper end is connected to the interposer by a clevis. A crowned nylon washer serves as a bearing point between the armature and the head on the link. This allows the top of the link to move front to rear with the interposer without changing the effective length of the link. Once the interposer is tripped the operational control is the same as previously described.

Contact Assembly

This assembly is comprised of five sets of contacts, each having its own latch (Fig. 123).

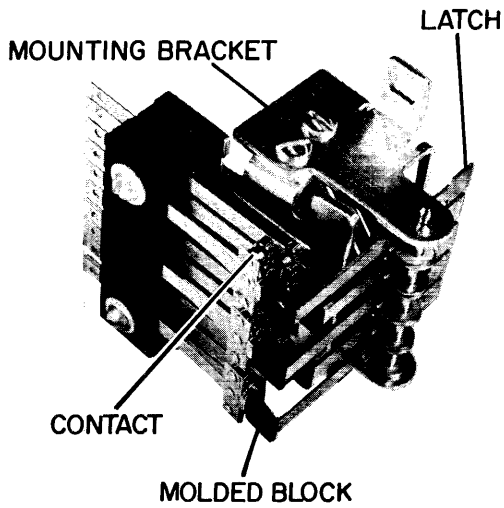


FIGURE 123. Operational Contact Assembly

The operating strap of each contact set has three contact points that make with three separate contacts (Fig. 124). The contacts are closed contacts held open by a bail. A block is molded on the end of the operating straps to provide an insulated operating surface for the bail and a latching surface for the contact latches.

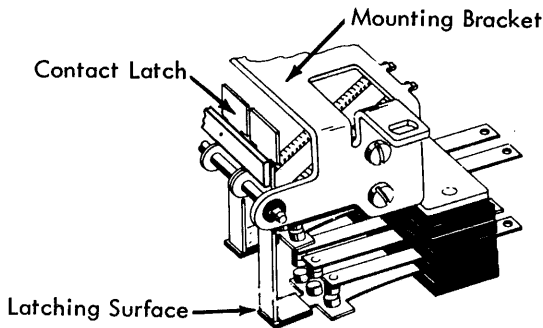


FIGURE 124. Operational Contact Assembly

There are two contact actuating arms. One is operated by the carrier return-index check pawl and called the right hand contact actuating arm. The other is operated by the tab-spacebar-backspace check pawl and called the left hand actuating arm.

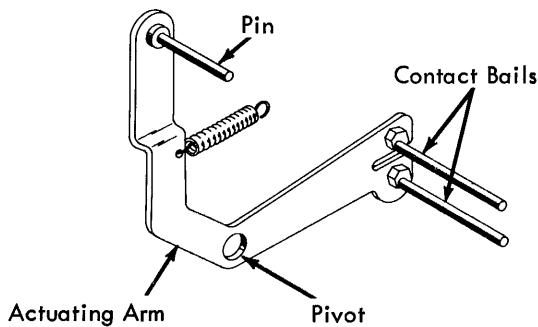


FIGURE 125. Actuating Arm

The arms are mounted to the contact assembly by a shouldered screw. The shouldered screw provides a pivot point for the arms. The top of the arm has a pin riveted to it, and the lower end has two eccentric pins that serve as contact bails (Fig. 125).

The pin on the upper end of the arm rides underneath the operational check pawl. As the cam rotates, the check pawl rides out of the notch in the check ring (Fig. 126). This causes the check pawl to move down, pushing the top of the actuating arm down. The actuating arm pivots on the shouldered screw, raising the lower end. As the bail rises, the contact that has its latch operated, will close. The other contacts will be held inoperative by their latches (Fig. 127).

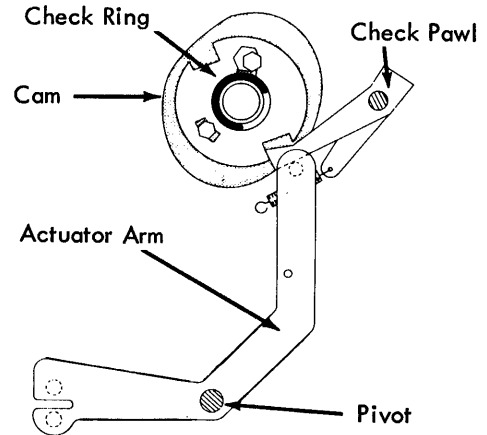


FIGURE 126. Actuating Arm Operated By Check Pawl

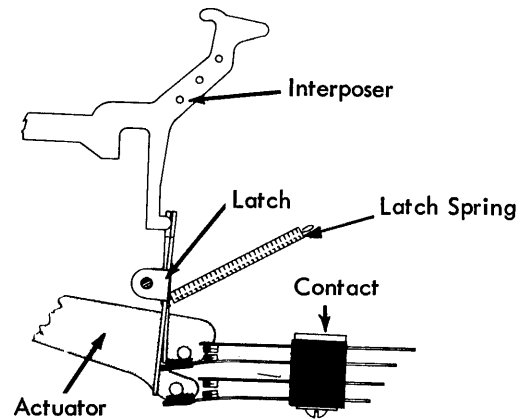


FIGURE 127. Contact Bail and Latch Operation

When the check pawl returns into the notch in the check ring, the actuating arm will restore under its own spring tension. As the top of the actuating arm moves up, the lower end moves down. The contact bails lowering will restore the contact. With the actuating arm restored, the contact bail keeps the contacts from resting against their latches. The purpose of this is to allow the latches to be moved away from the contact by the interposer without any drag.

Contact Latches

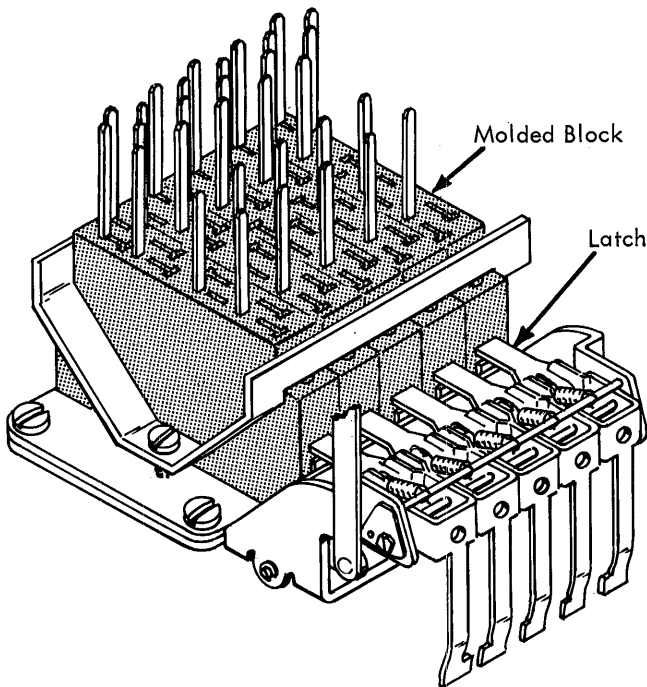
The latches rotate on a shaft that is mounted to the contact assembly by a bracket. The interposer moving to the rear,



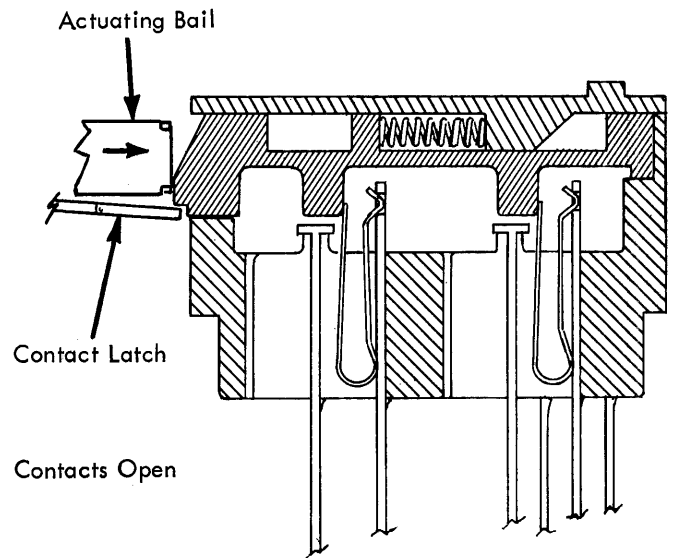
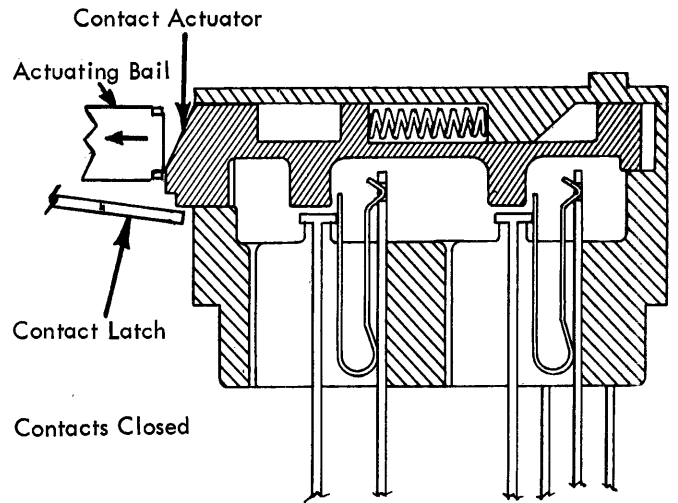
pushes the top of the latch to the rear. This is accomplished by an arm on the interposer that extends down in front of the latch. As the top of the latch is pushed to the rear, the latch pivots on the shaft causing the lower end of the latch to move to the front. As the interposer restores, the latch restores by its spring tension (Fig. 127).

**OPERATIONAL CONTACT ASSEMBLY (Late Style)**

This assembly is comprised of five sets of contacts, each set being in a separate molded block and having its own latch (Fig. 127.1).



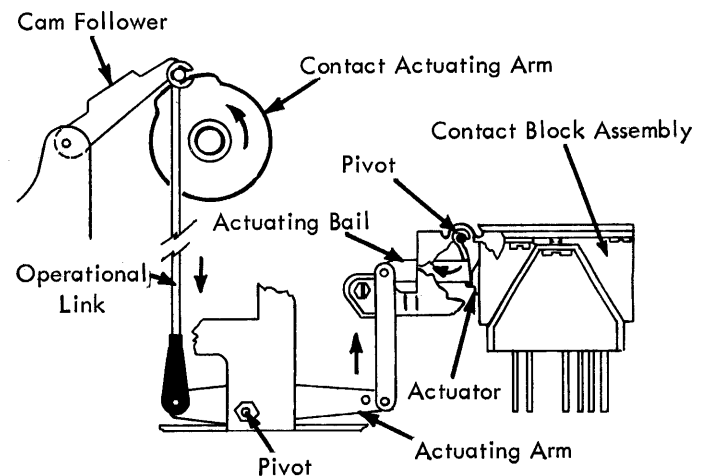
● FIGURE 127.1 Operational Contact Block Assembly



● FIGURE 127.2 Contact Operation

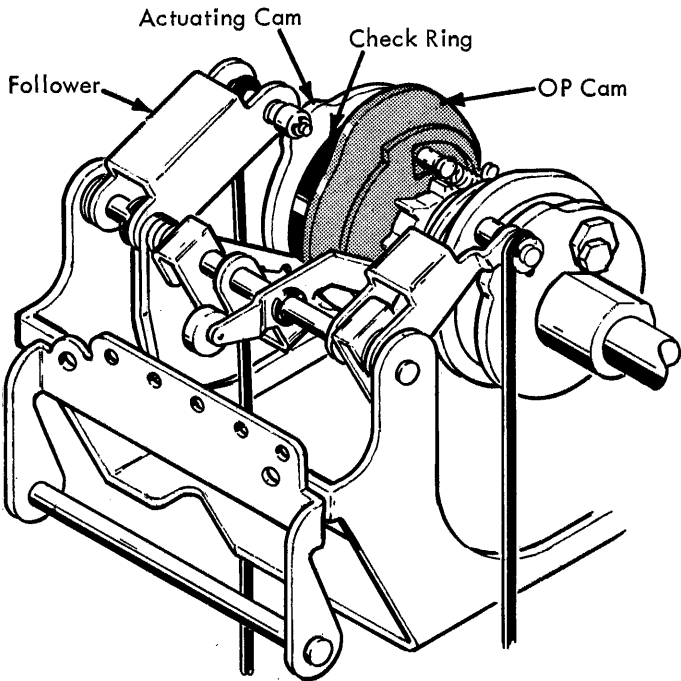
The contacts are normally closed contacts held open by an actuator. As the actuator moves outward the contacts are permitted to make. (Fig. 127.2)

There are two contact actuating bails. One is operated by the carrier return-index contact actuating cam and called the right hand contact actuating bail. The other is operated by the backspace-spacebar-tab contact actuating bail. Both of these bails are operated through linkage from the actuating cams. (Fig. 127.3)



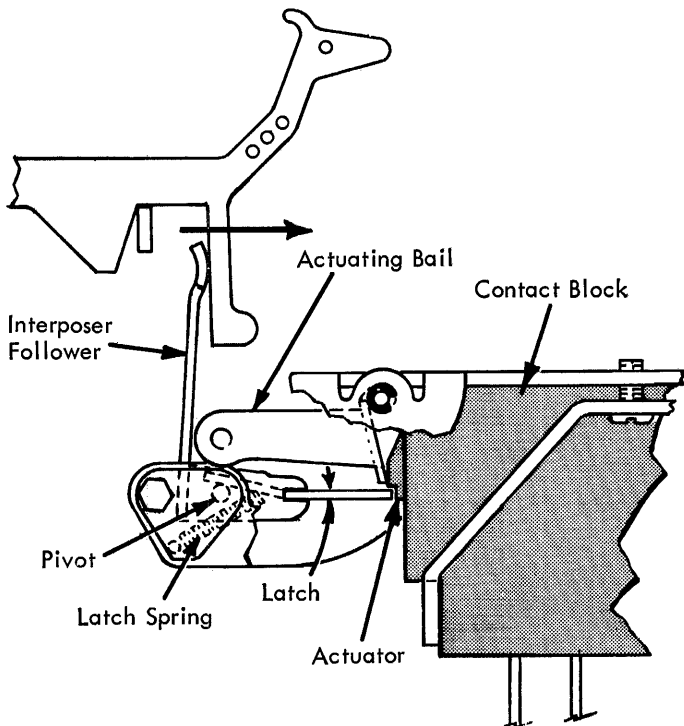
● FIGURE 127.3 Actuating Bail Operated By Actuating Cam

Each operational cam has a contact actuating cam attached to it. Each cam has its own follower and actuating linkage. (Fig. 127.4)



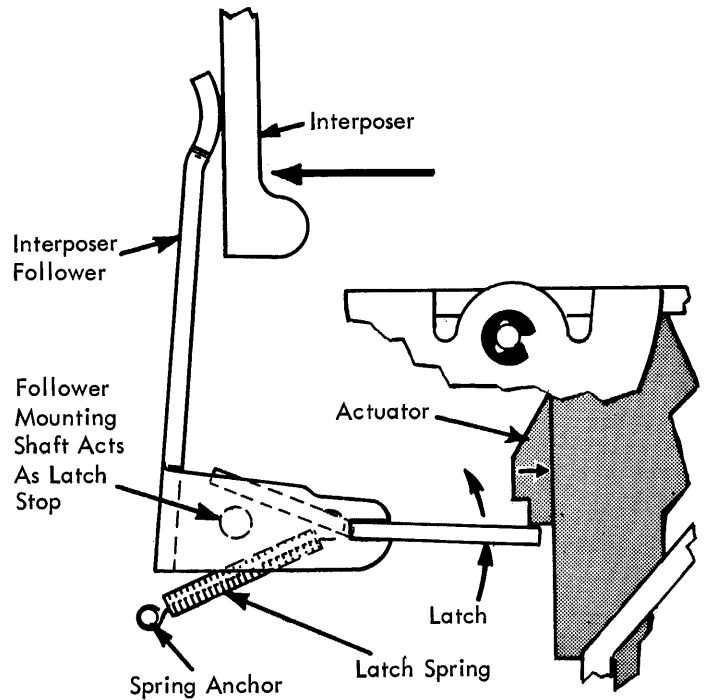
● FIGURE 127.4 Operational Cam And Actuating Cam

When an operational interposer is tripped, it will move rearward. The tail of the interposer follower will follow the interposer rearward under the load of the latch spring. The actuator latch will move down out of the path of the actuator. The actuator is still held depressed (rearward) by the actuating bail. (Fig. 127.5)



● FIGURE 127.5 Contact Latch Operation

When the operational interposer is tripped, the operational cam will begin to rotate. The actuating cam follower will go to the low dwell of actuating cam (Fig. 127.3). The operating link will move downward, pivoting the actuating arm. The rear of the actuating arm will move upward. This will pivot the actuating bail away from the contact block assembly and permit the actuators to move toward the front of the machine. Only the unlatched actuator will move far enough to transfer the contacts. The remainder of the actuators will be held by their respective latches. As the operational cam continues to rotate, the cam follower will be driven upward by the high dwell of the actuating cam. This will pivot the actuating bail rearward and depress the actuator rearward into the contact block. The interposer will be driven forward and latched during the early part of the cycle. The interposer follower will be driven to its rest position by tension to snap in front of the actuator as the actuator is driven rearward by the actuator bail (Fig. 127.6).



● FIGURE 127.6 Contact Latch Operation

Feedback Contact

The feedback contacts are located in the right rear corner on top of the power frame. The contact on the left is the carrier return-index contact and the one on the right is the tab-spacebar-backspace contact (Fig. 128).

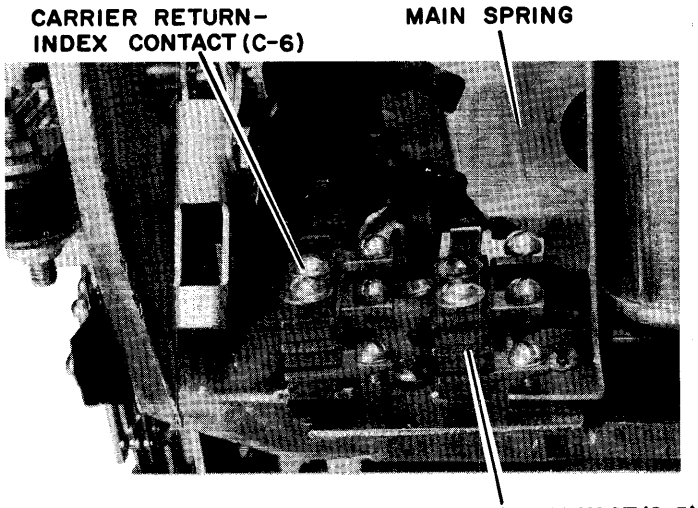


FIGURE 128. Operational Feedback Contacts

The carrier return-index contacts are operated by a tab on the cam follower lever. The tab-spacebar-backspace contacts are operated by an auxiliary cam follower lever.

As the cam follower lever or the auxiliary cam follower lever are operated, the bail moves down, closing the contacts. The follower lever restoring allows the contact to open (Fig. 129).

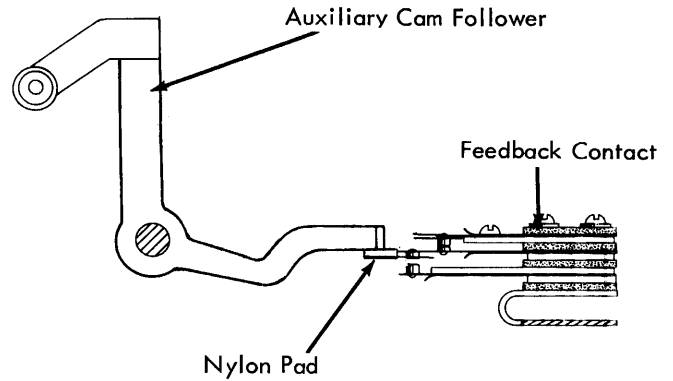


FIGURE 129. Feedback Contact Operation

SPACEBAR

The spacebar mechanism provides the operator with a means of moving the carrier to the right one space at a time without typing a character on the paper. It is used mainly for spacing between words, but it may also be used to space the carrier quickly to any point toward the right on the writing line.

The spacebar operates by tripping the escapement pawl and backspace pawl out of their racks as on a print escapement operation. The two escapement operations are identical except for the method of actuating the escapement trigger lever.

Spacebar Lever Mechanism - Early Level

The spacebar mounts on the keyboard just in front of the keybuttons. It is suspended from two arms extending forward from the spacebar shaft (Fig. 130). The spacebar shaft is shouldered at the left end and pivots in a hole in the left keyboard sideframe. The right side pivots on a pivot screw in the right keyboard sideframe. Vertical motion of the spacebar causes the spacebar shaft to rotate.

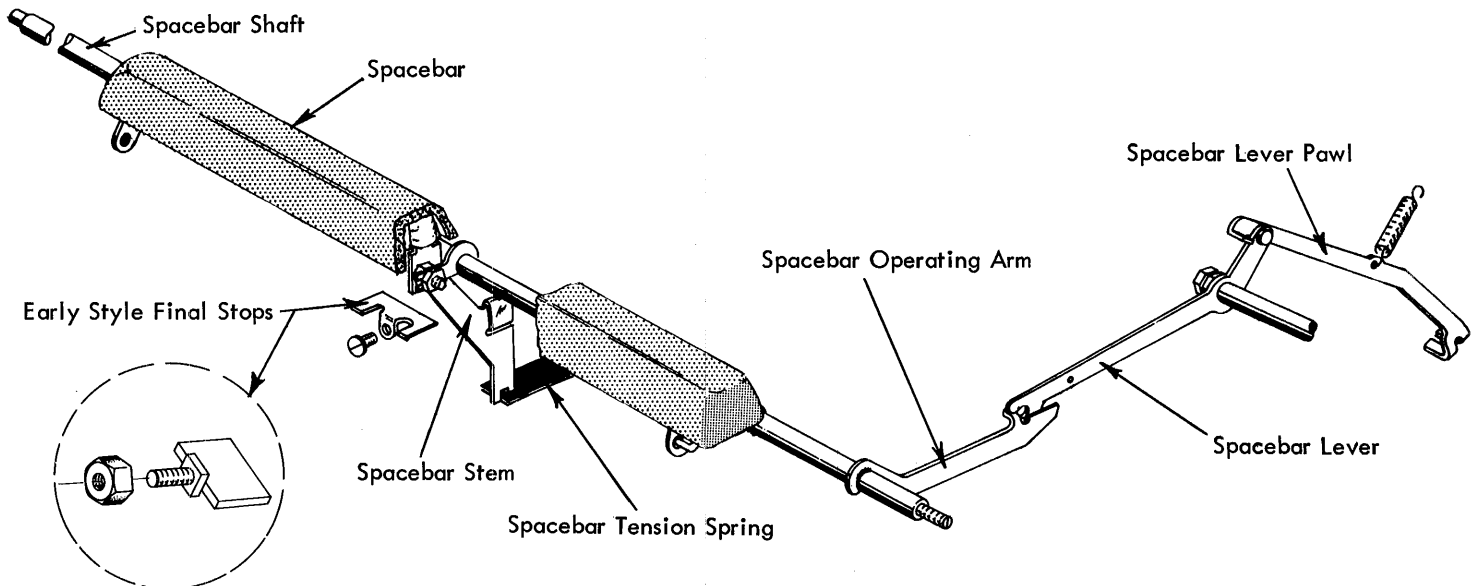


FIGURE 130. Spacebar Lever Mechanism

The spacebar contains a metal stem pressed into the body of the spacebar (at the center). The stem extends down into a slot in the spacebar return spring. The spacebar return spring is a flat, leaf-type spring that is mounted to the front key-lever guide comb support by two screws and performs the function of restoring the spacebar to its rest position. This spring also guides the bottom of the spacebar stem to prevent tipping of the spacebar forward or back. Additional support is provided by a lever that extends forward from the spacebar shaft. A guide stud on the lever fits through an elongated hole in the spacebar stem.

Attached to the right end of the spacebar shaft is the spacebar operating arm which extends to the rear through a slot in the front keylever guide comb (Fig. 130). When the spacebar is depressed the operating arm is raised. The arm contains a slot in the end that fits into a fork in the forward end of an intermediate lever called the spacebar lever. When the spacebar is depressed, the rear of the spacebar lever and the attached spacebar lever pawl are lowered. The spacebar lever pawl then pushes down on the spacebar interposer causing the interposer to unlatch from the keylever pawl guide bracket. The interposer snaps to the rear, releases the spacebar/backspace/tabulating cam, and pushes the spacebar operational latch under the cam follower.

The spacebar latch is mounted to the spacebar latch lever by a ball shouldered rivet to permit free movement of the latch (Fig. 131). The spacebar latch lever is mounted on a pivot pin on the operational latch bracket assembly which is attached to the rear of the powerframe just in front of the mainspring.

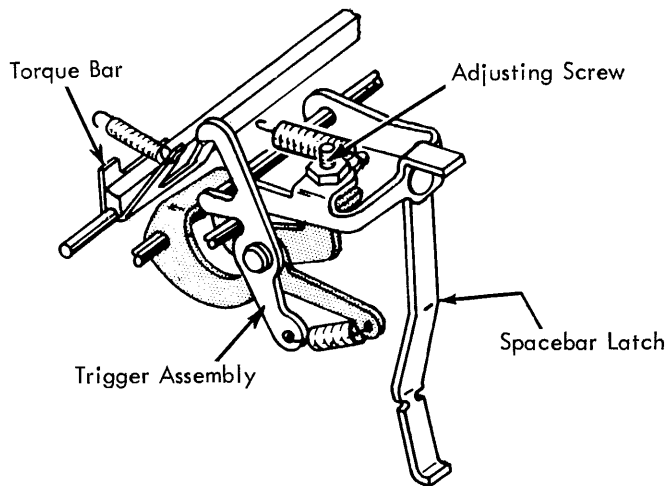


FIGURE 131. Spacebar Latch Operation

When the spacebar latch is operated down by the cam follower, the spacebar latch lever pivots about its pivot pin. An adjusting screw on the latch lever contacts the trigger lever causing the trigger lever to rotate about its pivot pin (Fig. 131). This causes the triggers on the trigger lever to rotate the escapement torque in the same manner as it does during a print escapement operation. Thus the escapement and backspace pawls are removed from their racks and an escapement operation takes place.

#### Spacebar Stops

Two styles of final stops have been produced and used on the

early style spacebar mechanism. Both styles attach to the middle of the keylever guard at the front of the machine and function by blocking the downward travel of the spacebar stem (Fig. 130).

Upward travel of the spacebar is limited by the spacebar stem. A step in the stem contacts the bottom of the spacebar shaft (Fig. 133). A vinyl sleeve on the stem cushions the spacebar in the rest position to prevent noise.

#### Repeat - Optional

The downward travel of the spacebar is limited at two positions. The first limit allows a single operation only. Further depression of the spacebar causes the first limit to yield to permit a repeat operation. A final limit prevents further depression.

An extension spring at the front of the spacebar lever acts as a first limit for the mechanism (Fig. 132). The lower end of the spring is formed into a long hook. The hook is connected into an elongated slot in the repeat spring stud. As the spacebar is depressed, the front of the spacebar lever and the repeat spring are raised. The spacebar reaches the first limit when the repeat spring contacts the top of the elongated slot in the repeat spring stud. Further depression of the spacebar causes the repeat spring to yield and allow the spacebar to move into the repeat position.

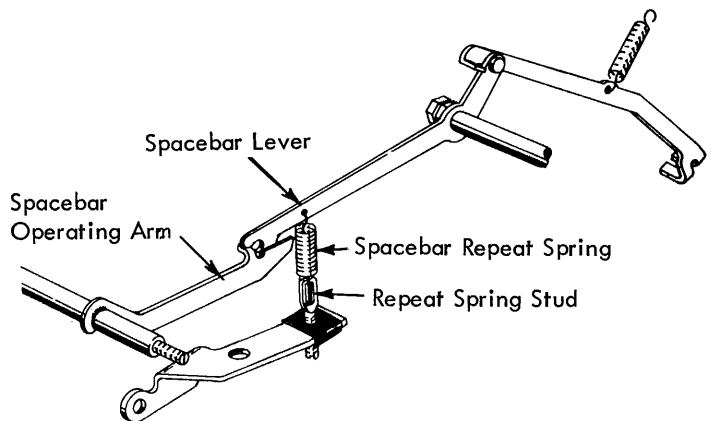


FIGURE 132. Spacebar Repeat Stop - New Style (Optional)

#### Spacebar Lever Mechanism - Late Level

The late level spacebar mechanism is basically the same as the early level. The main difference is in the spacebar stem. A stabilizing link has been attached to the bottom of the stem by a shouldered rivet (Fig. 133). The rear portion of the link mounts on and pivots about an adjustable guide stud. This stud is fastened to a support on the front keylever bearing support by two screws. The stabilizing link controls the bottom of the spacebar stem to prevent the spacebar from tipping forward or back.

The spacebar restoring action is supplied by an extension spring that is attached to the spacebar operating arm and anchored to one of three holes in the carrier return/backspace repeat bail. In addition, the spacebar guide stud and the final stop as found on the early level mechanism has been eliminated from the late level spacebar mechanism.

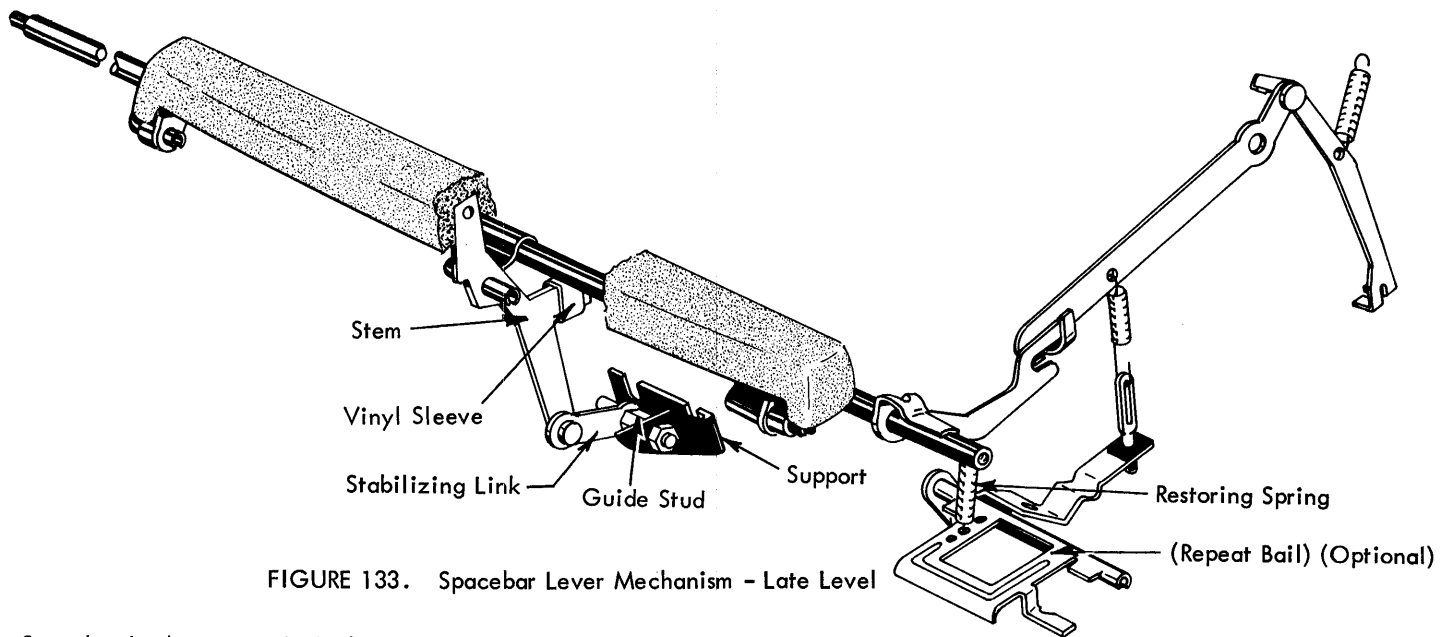


FIGURE 133. Spacebar Lever Mechanism - Late Level

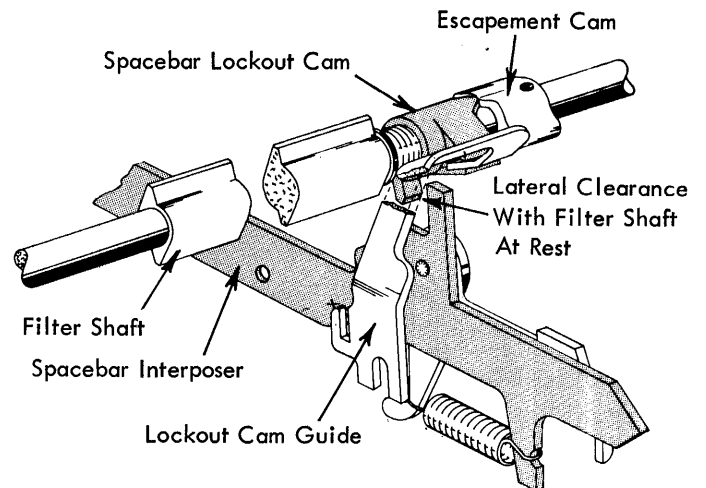
### Spacebar Lockout - Early Style

As previously mentioned, both the spacebar escapement and the print escapement operate by actuating the escapement trigger lever to cause an escapement operation. Because of the inter-relationship of these two mechanisms, operating both of them together causes only one space of escapement. Likewise if they are alternately operated too rapidly in succession, only one space of escapement will result. This happens occasionally when the operator hits the spacebar too soon after striking a letter keylever. As a result no space appears between the words. The spacebar fails to operate the escapement trip because the escapement trigger does not have sufficient time to reset above the lug on the torque bar before being actuated down again. Operator timing seldom causes the print escapement to fail after a spacebar operation.

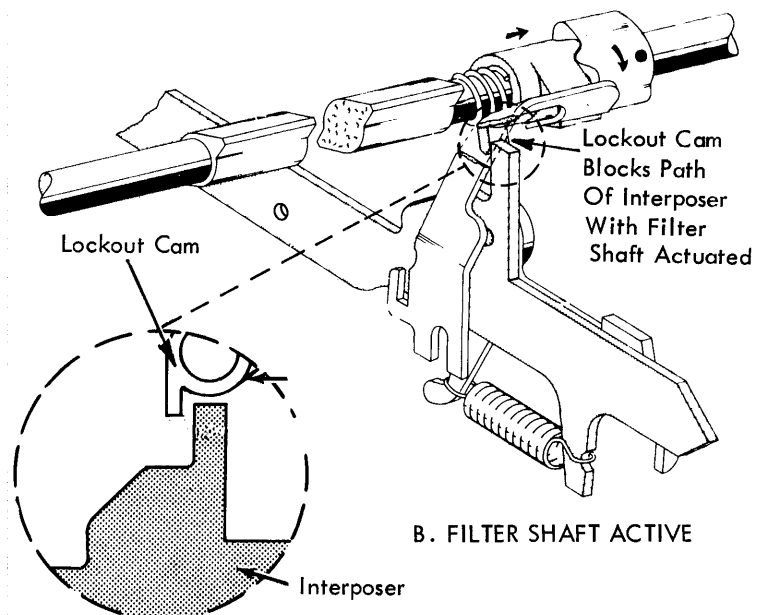
In order to insure that the spacebar will always actuate the escapement following a print operation, it is necessary to place the spacebar mechanism into storage until the print escapement is completed. The spacebar can then operate to space the carrier. The spacebar storage feature greatly reduces the possibility of spacebar failure during a letter-space-letter operation. Failure results only if the spacebar operation is not stored. The spacebar will fail to store only if the spacebar and letter keylever are depressed simultaneously.

Spacebar storage is accomplished by blocking the rearward movement of the spacebar interposer. The interposer travel is blocked by the spacebar lockout cam on the filter shaft (Fig. 134). The lockout cam is spring-loaded toward the right against the escapement cam. In the rest position, the lockout cam is held to the left by the lateral camming surfaces on the two cams. In this position, the spacebar interposer is free to operate without interference (Fig. 134A).

During a character operation, rotation of the filter shaft allows the lockout cam to move toward the right because the high points of the lateral camming surfaces are no longer in contact (Fig. 134B). The lockout cam is prevented from rotating with the filter shaft by a guide bracket that fits in a slot in the front of the cam. As the lockout cam slides to the right an extension at the bottom of the cam moves into the path of a lug on the spacebar interposer (Fig. 134B).



A. FILTER SHAFT AT REST  
FIGURE 134A. Spacebar Lockout Mechanism



B. FILTER SHAFT ACTIVE  
FIGURE 134B. Spacebar Lockout Mechanism

If the spacebar interposer is tripped, it will move to the rear slightly until it contacts the lockout cam extension. The interposer will remain tripped against the lockout cam until the print cycle has been completed. As the filter shaft approaches the rest position, the lockout cam is forced back to the left by the escapement cam. The spacebar interposer is then released to the rear for a spacebar operation.

### Spacebar Lockout - Late Style

The spacebar interlock mechanism is mounted within the operational control bracket just below the filter shaft. It consists of a bracket, an interlock interposer (which acts as a cam follower) and an interlock cam mounted on the filter shaft (Fig. 135).

When the filter shaft is in its rest position the upper extension of the interlock interposer is resting on the high point of one of the lobes on the interlock cam. This allows the horizontal lug on the lower extension of the interlock interposer to just clear the adjustable stop on the spacebar interposer as it operates to the rear during a spacebar operation (Fig. 135).

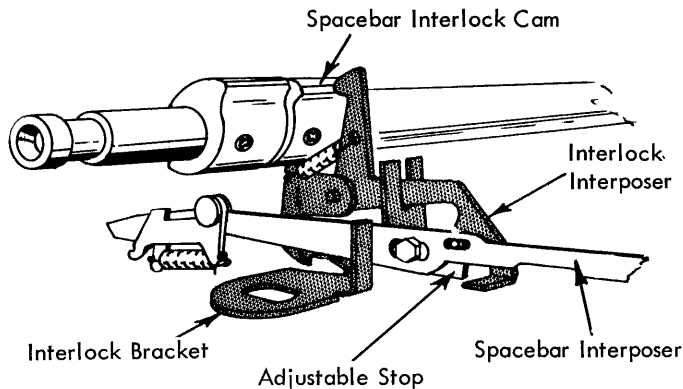


FIGURE 135. Spacebar Lockout - (Late Style)

Whenever a print operation occurs, the filter shaft and interlock cam will begin to turn causing the rear portion of the interlock interposer to rise into the operating path of the spacebar interposer. If the spacebar interposer were then released the interlock interposer would interrupt and store the rearward travel of the spacebar interposer until the filter shaft completes its cycle. At this time the spacebar interposer would be released to finish its rearward travel and the spacebar operation would complete. Note that the interlock interposer is spring loaded into its active position and powered to its rest position. This is to prevent breakage should both the spacebar and print operation be operated simultaneously.

### Spacebar Mechanism (Print Escapement - 835 Printer)

The spacebar mechanism of the 835 Printer uses print escapement to operate the trigger assembly. The spacebar operation now requires the same amount of time as a character operation.

Located on the left end of the spacebar shaft is the spacebar operating arm and a lug to provide for a spacebar tension

spring (Fig. 135.1). Depression of the spacebar, rotates the spacebar shaft and moves the operating arm downward. A pin on the spacebar operating arm fits in a slot on the spacebar keylever and as the operating arm rotates downward, the keylever is depressed (Fig. 135.1). The keylever pawl contacts the spacebar interposer and forces it downward in front of the filter shaft. At this point the cycle clutch is tripped

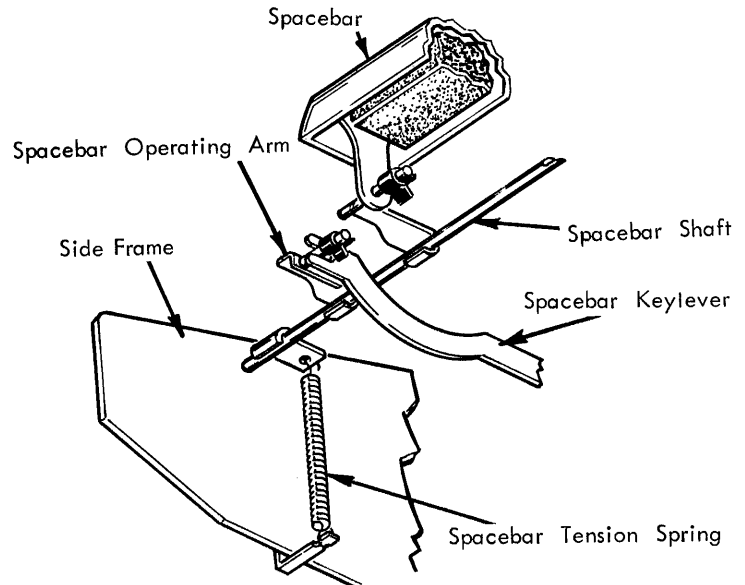


FIGURE 135.1 Spacebar Keylever Mechanism

and the filter shaft drives the spacebar interposer forward. An extension on the front of the interposer moves a lug on the no-print vane, rotating the no-print bellcrank and pulling on the no-print link (Fig. 135.2). Forward movement of the link

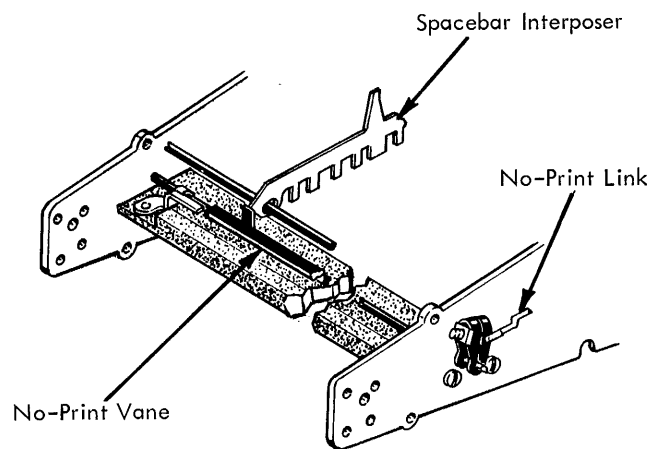


FIGURE 135.2 Spacebar Interposer

will rotate the no-print latch high enough to clear the stop on the no-print cam follower (Fig. 135.3). Operation of the no-print mechanism from this point on is similar to the late-style print mechanism (dual-velocity). The no-print cam is designed so that when the follower roller shifts to the left during a no-print operation, the rocker assembly will not be driven far enough toward the platen to cause printing (Fig. 135.4).

The "home" character is selected by the spacebar interposer to reduce wear in the selection mechanism.

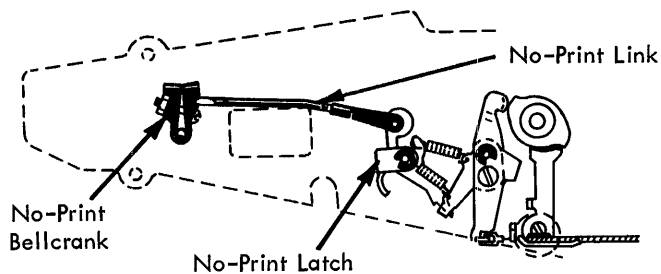


FIGURE 135.3 No-Print Mechanism

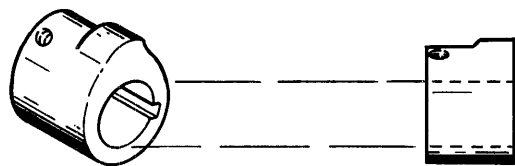


FIGURE 135.4 No-Print Cam

#### Spacebar Mechanism Magnet Assembly (835 Printer)

The check magnet is used to pick the cycle clutch and determine selection for a space operation. The no-print magnet operation is the same as the low velocity magnet assembly.

### BACKSPACE

The backspace mechanism provides the operator with a method of positioning the carrier to the left one space at a time. It is used primarily in error correction and in centering headings, but it may also be used to position the carrier quickly to any point toward the left on the writing line.

The backspace operates by forcing the carrier to the left until

the escapement pawl clicks from one tooth of the escapement rack to the next. The backspace pawl is mounted on the escapement bracket with the escapement pawl so that movement of the backspace pawl to the left also moves the carrier and escapement pawl to the left (Fig. 136). The tip of the backspace pawl engages the teeth of a sliding backspace rack located on the back of the power frame just below the escapement rack. Movement of the backspace rack to the left forces the backspace pawl to the left to cause the backspace operation.

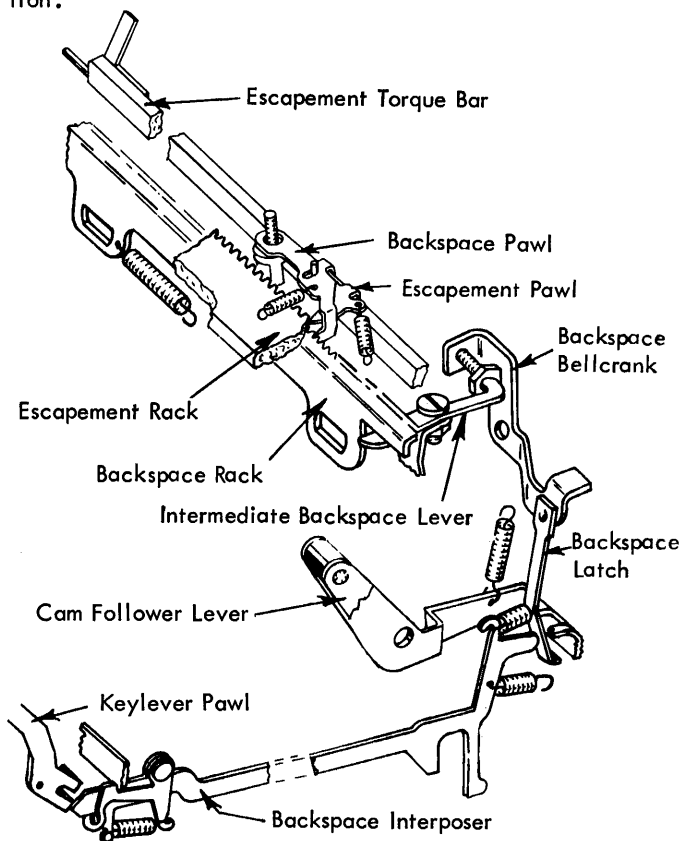
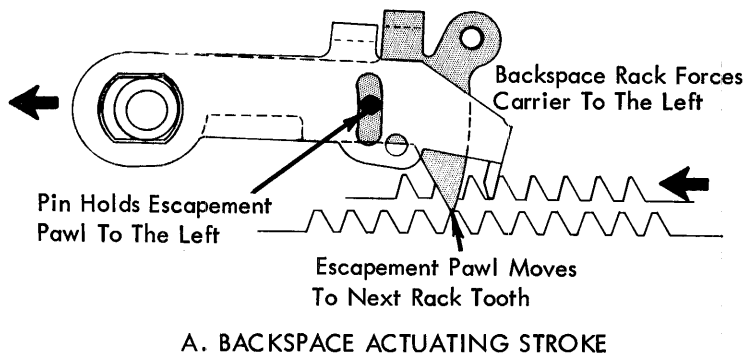


FIGURE 136. Backspace Mechanism

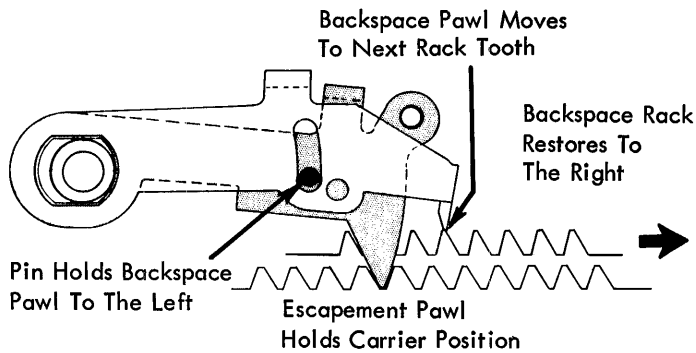
The backspace rack is spring loaded toward the right by an extension spring between the rack and the operational latch bracket. Upon completion of the operation, the backspace rack restores to the right causing the backspace pawl to click from one tooth to the next in preparation for the next operation.

The escapement pawl has a small stud on its upper surface that fits into a slot in the backspace pawl (Fig. 137). The slot is elongated front to rear to allow the escapement pawl to click from one escapement rack tooth to the next as the backspace rack forces the carrier to the left (Fig. 137A).

The slot also permits the backspace pawl to click into the next tooth as the backspace rack restores (Fig. 137B). Because of the elongated pivot holes in the two paws, the stud connection is necessary to insure that the paws move together during a backspace operation and to prevent the backspace pawl from moving to the right as the backspace rack restores. Without the stud connection, the backspace rack would require additional travel to compensate for the elongation in each pawl.



A. BACKSPACE ACTUATING STROKE



B. BACKSPACE RESTORING STROKE

FIGURE 137. Backspace Operation

The backspace rack is actuated by a bellcrank pivoted on the front of the back plate (Fig. 136). The bellcrank operates the rack through an adjustable intermediate lever pivoted at the top of the operational latch bracket. The backspace operational latch is mounted to the horizontal arm of the backspace bellcrank by a ball shouldered rivet to permit free rotation of the latch. The latch extends down into position to hook under the bail of the operational cam follower. When the backspace interposer is released, the latch is pushed to the rear under the cam follower. Operation of the cam causes the cam follower to pull the latch down rotating the backspace bellcrank. A large headed adjusting screw on the vertical arm of the bellcrank operates the intermediate backspace lever to force the backspace rack to the left.

The intermediate backspace lever is adjustable forward or back to obtain the proper throw of the backspace rack. The intermediate lever is adjusted farther forward on the 12 pitch machines than on the 10 pitch. The 12 pitch intermediate lever is shorter than the 10 pitch to prevent interference with the power frame. It is too short to be used on 10 pitch machines. The 12 pitch intermediate lever is identified by a notch in the right side. The 10 pitch lever is unmarked.

The backspace interposer is released by depression of the backspace keybutton located at the upper right hand corner of the keyboard (Fig. 138). The backspace keylever is mounted in the keyboard assembly in the same manner as the letter keylevers. An extension spring between the keylever and the keylever guard restores the keylever to the rest position. A keylever pawl attached to the rear of the keylever

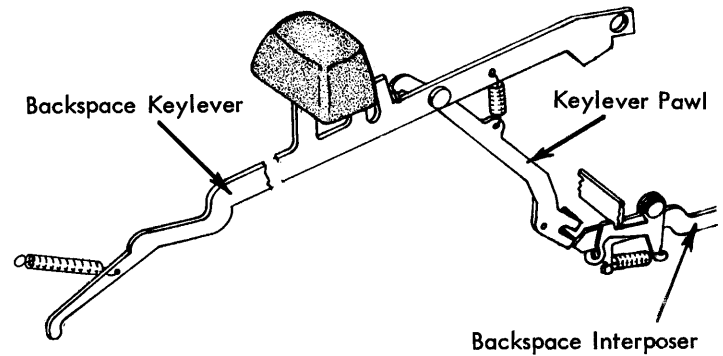


FIGURE 138. Backspace Keylever Mechanism

extends down through a slotted guide stud in position just above the backspace interposer. Depression of the keylever causes the interposer to be released to the rear to begin the operation.

The upward travel of the keylever is limited by a fulcrum rod located at the top of the guide comb. The final travel of the keylever is reached when the keylever bottoms in the guide comb.

#### CARRIER RETURN

##### 11 Inch Printer

The carrier return mechanism provides the operator with a powered return of the carrier to the left margin and an automatic line spacing of the paper.

The carrier return operates by winding the carrier return cord onto a drum at the rear of the machine (Fig. 139). The carrier return cord is hooked to the bottom of the carrier, passes around two pulleys at the left, extends back to the right over a guide roller, and attaches to the carrier return cord drum. The drum has spiral grooves for winding up the cord as on the escapement cord drum. The carrier return cord drum is attached by set screws to the escapement shaft just in front of the mainspring. Rotation of the escapement shaft causes the drum to wind up the cord and move the carrier to the left.

Movement to the left opposes the mainspring tension causing the mainspring to tighten. The power to rotate the escapement shaft in opposition to the mainspring is taken directly from the operational cam shaft. The escapement cord drum (at the front of the escapement shaft) has a beveled gear molded on its front (Fig. 139). This beveled gear meshes with a small pinion gear on the operational shaft. The pinion gear pivots freely on the shaft between two C-clips. By means of a spring clutch the pinion is made to rotate with the operational shaft. The pinion gear drives the escapement cord drum in a clockwise direction causing the carrier return cord to be wound onto its drum. The carrier return pinion has a hub that forms a part of the spring clutch. A second hub just to the left of the pinion is in continuous rotation with the operational shaft. A clutch spring fits around the two hubs to complete the spring clutch. A steel band clamps the left end of the spring around its hub so that no slippage can occur at that point. The clamp causes the spring to rotate with the operational shaft. The shaft turns in the tightening direction of the spring; but no tightening occurs, because the pinion hub is smaller than the inside diameter of the clutch spring.



If the clutch spring is to tighten, friction must exist between the spring and the hub it is to drive. By pressing the loose end of the carrier return clutch spring against the pinion hub, friction is applied causing the spring to tighten around the hub and drive the pinion. The spring is pressed against the pinion hub by a nylon shoe just to the rear of the carrier return pinion (Fig. 139). The clutch spring decreases in diameter as it tightens around the pinion hub. The tension of the spring resists any change in size; therefore, when the pressure from the shoe is relaxed, the spring snaps back to normal size and ceases to drive the pinion.

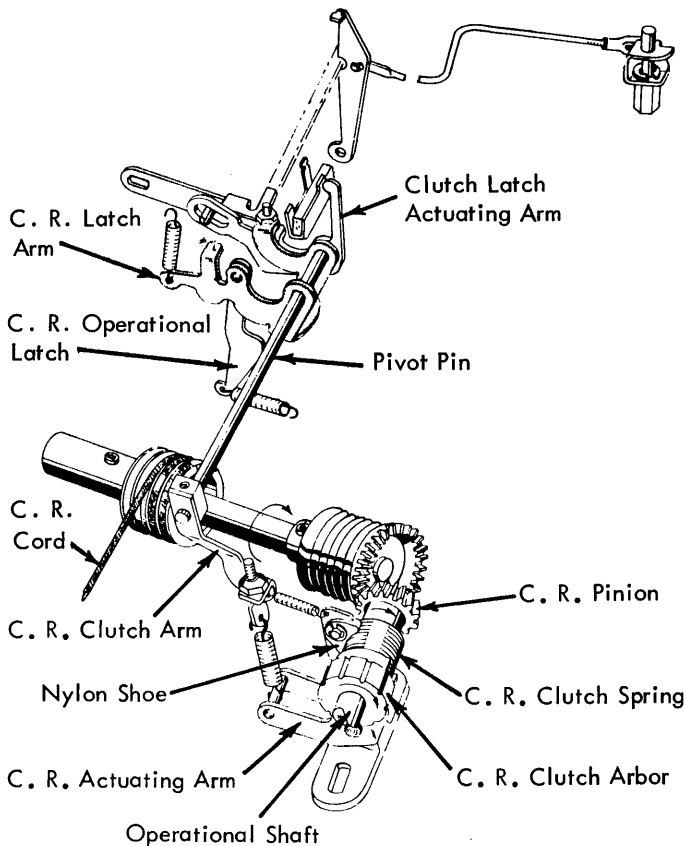


FIGURE 139. Carrier Return Mechanism

In order to obtain a full carrier return, the carrier return shoe must press the spring against the pinion hub and hold it there until the carrier has reached the left margin. It must then release the clutch spring to end the carrier return operation.

The power to operate the shoe against the clutch spring is taken from the single lobed operational cam. Depression of the carrier return keylever sets the mechanism into operation. The keylever operates at the right side of the keyboard beside the backspace keylever. The keylever pivots around the fulcrum rod at the rear and operates in the keylever guide comb at the front. The limits of the keylever travel are the same as for the backspace lever.

When the keylever is depressed, the keylever pawl attached at the rear of the keylever releases the carrier return interposer to the rear. The interposer causes the cam to be engaged and pushes the carrier return operational latch under the cam follower into position to be pulled down. When the

cam operates, the cam follower pulls down on the latch. It also pulls down on the index pawl carrier link, attached at the rear of the follower, causing a line space operation.

The carrier return operational latch is mounted on the carrier return latch arm that pivots around a shaft on the operational latch bracket at the rear of the powerframe (Fig. 140). The shaft is called the pivot pin and also acts as a pivot point for the escapement trigger lever and the spacebar latch lever.

Attached solidly to the right end of the pivot pin is a bell-crank called the clutch latch actuating arm (Fig. 140). As the cam follower moves the operational latch down, an adjusting screw at the right side of the carrier return latch arm rotates the clutch latch actuating arm and pivot pin. This action causes three things to occur.

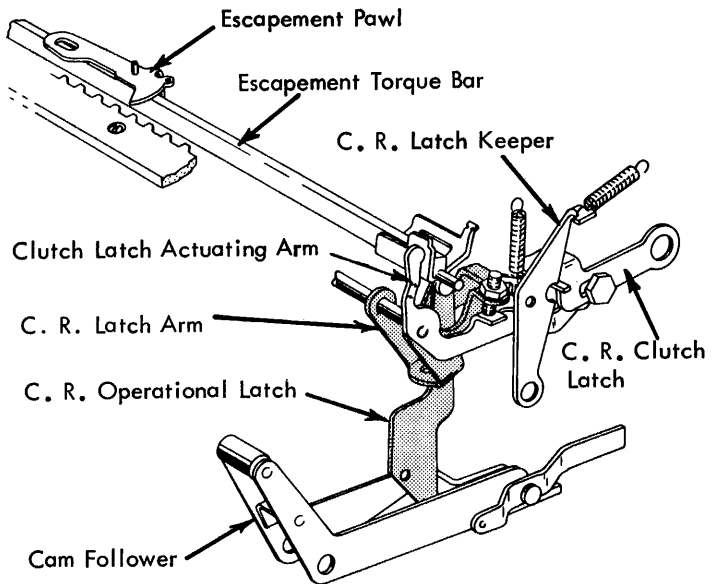


FIGURE 140. Carrier Return Latch Operation (11 Inch)

1. The top of the clutch latch actuating arm forces a lug of the escapement torque bar to the rear rotating it to remove the escapement and backspace pawls from their racks (Fig. 140). This prevents the pawls from dragging along their racks as the carrier is returned.
2. The carrier return clutch spring tightens around the pinion hub and drives the carrier return operation. An arm called the carrier return clutch arm, at the left end of the pivot pin pulls up on a heavy extension spring (Fig. 141). The lower end of the spring is connected to a bellcrank-like part called the carrier return actuating arm. The upward pull on the spring rotates the nylon shoe (at the top of the arm) against the clutch spring forcing the spring to tighten and drive the pinion gear. After the shoe is pressing against the clutch spring, the heavy carrier return actuating spring is extended slightly to maintain a constant pressure against the clutch spring.
3. The clutch latch actuating arm is latched in the operated position to maintain pawl release and to continue the pressure of the shoe against the clutch spring (Fig. 140). The

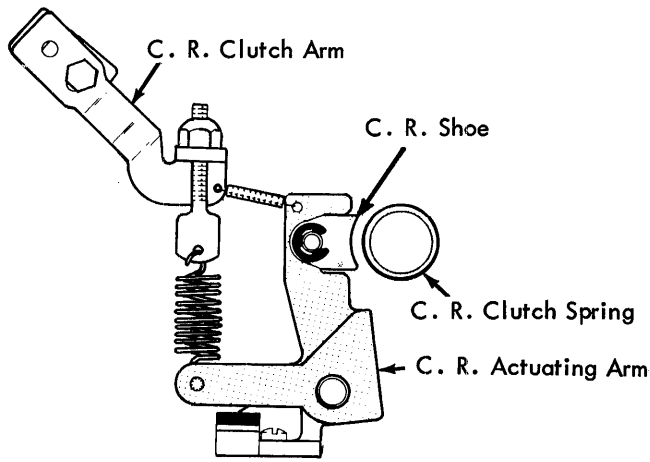


FIGURE 141. Carrier Return Clutch Actuating Mechanism

rear of the clutch latch actuating arm contains an elongated hole. An eccentric adjusting screw connects the arm to the carrier return clutch latch which pivots at the rear of the powerframe. As the actuating arm moves down the clutch latch is also lowered. Spring loaded against the forward edge of the clutch latch is a hook-like part called the carrier return latch keeper. When the clutch latch has been pulled down into its active position, the keeper hooks over the latch to hold it down (Fig. 140).

The carrier return mechanism remains latched in the active position until the carrier reaches the left margin. At that time the clutch is unlatched and the escapement pawl is restored to the escapement rack ready for a typing operation.

The margin rack is mounted between the side frames just in front of the carrier. The margin rack has a small amount of lateral movement. When the carrier is away from the left margin, a spring located at the left end of the rack loads the margin rack to the right. As the carrier moves to the left during a return operation, the carrier strikes the left margin stop forcing the margin rack to the left. The extreme right end of the margin rack contains a roll pin. Movement of the rack to the left causes the pin to operate the carrier return unlatching bellcrank that pivots on a stud outside the right side frame (Fig. 142). A link connects the bellcrank to the carrier return latch keeper at the rear. As the bellcrank operates, the unlatching link pulls the keeper forward releasing the clutch latch. The latch is restored to the rest position by its spring and the action of the escapement torque bar spring. A small spring connected near the carrier return shoe holds the shoe away from the clutch spring in the rest position (Fig. 141).

The clutch latch does not hold the cam follower in the active position during a return operation; therefore the cam and follower immediately restore to the rest position ready for the next operation. Depression of the keylever with the carrier in motion releases the interposer to cause another carrier return operation. Because the carrier is already in motion, this reduces to nothing more than another line space operation.

If the carrier is already resting at the left margin when a carrier return operation begins, the clutch is prevented from latching. The cam is not prevented from operating, however,

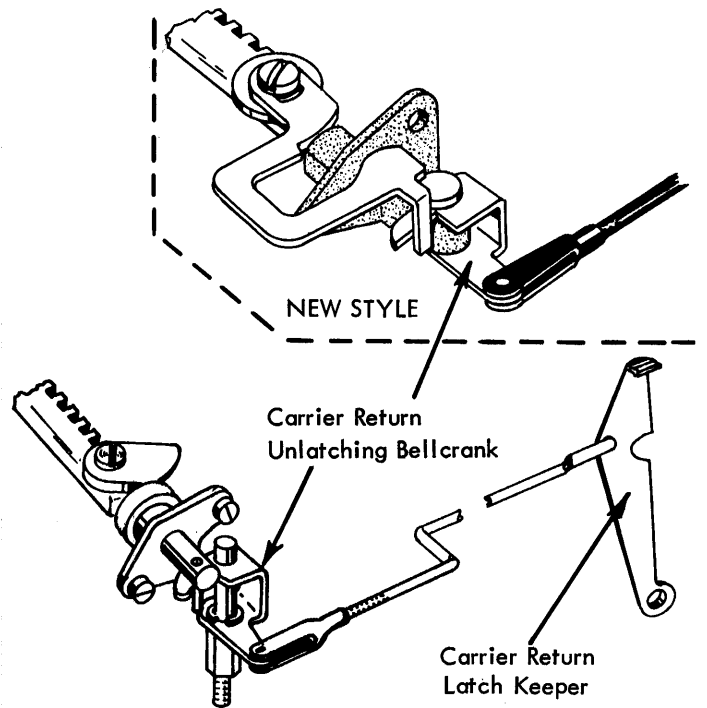


FIGURE 142. Carrier Return Clutch Unlatching Mechanism

so a carrier return operation must occur. The platen is indexed and the carrier return spring clutch attempts to wind the carrier return cord onto the drum. The carrier cannot be pulled farther to the left, because it is already against the left margin. The pull continues to be exerted on the cord until the cam follower passes the high point of the cam at which time it restores and allows the shoe to move away from the clutch spring.

During the time the cord is being pulled without being able to move the carrier, the carrier return clutch mechanism must be allowed to slip in order to reduce the strain and prevent breakage to the parts. The carrier return clutch arbor is indirectly driven by the operational shaft. The large shoulder on the arbor fits into a heavy clutch spring at the left called the torque limiter spring (Figs. 143 & 144). The left end of the spring is clamped to the torque limiter hub and the torque limiter hub is set screwed to the operational shaft. The carrier return clutch arbor is then driven by means of the torque limiter spring.

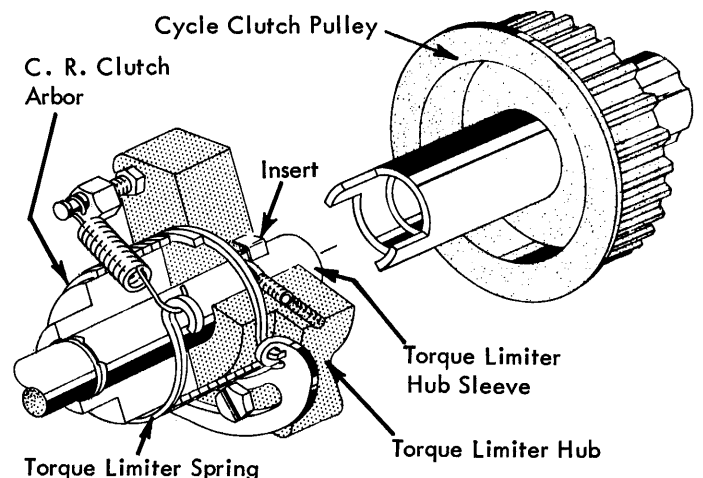


FIGURE 143. Torque Limiter - Cut Away View

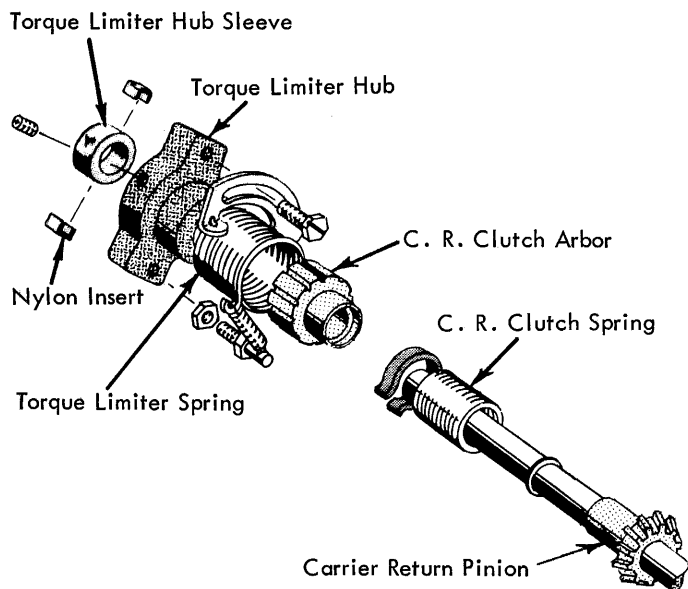


FIGURE 144. Torque Limiter - Exploded View

The operational shaft turns in the unwinding direction of the torque limiter spring. This tends to expand it allowing it to slip. The spring is heavy and considerably smaller than the carrier return clutch arbor over which it fits. The friction present between the arbor and the spring tends to drive the arbor even though it is in the unwinding direction of the spring. However, insufficient driving force is obtained from this arrangement.

The right end of the torque limiter spring is formed into an eye to accept an extension spring connected from the eye to an eccentric adjusting stud on the torque limiter hub (Figs. 143 & 144). The extension spring increases the force required to unwind the torque limiter spring so that no slippage occurs during normal carrier return. The torque limiter spring slips when the carrier cannot move to the left. It also slips at the beginning of a carrier return operation to allow smooth acceleration and prevent a jerky start.

#### Carrier Return - Late Style 11 Inch Machines

The carrier return operation remains the same. Parts have been re-designed to provide easier accessibility for adjustments and will hold these adjustments longer.

The transfer of motion has changed in the operational latch mechanism (Fig. 144.1).

When the carrier return operational latch is pulled down by the cam follower, the latch arm presses the carrier return lever down. A stud on the carrier return lever fits in a slot of the intermediate latch actuating arm, and as the lever moves down it rotates the arm and pivots the carrier return latch pin and clutch latch. As the carrier return latch moves downward, it rotates the latch actuating arm which contacts the escapement torque bar causing the escapement pawl to be removed from its rack. Further motion causes the clutch latch to be held in the operated position by the latch keeper.

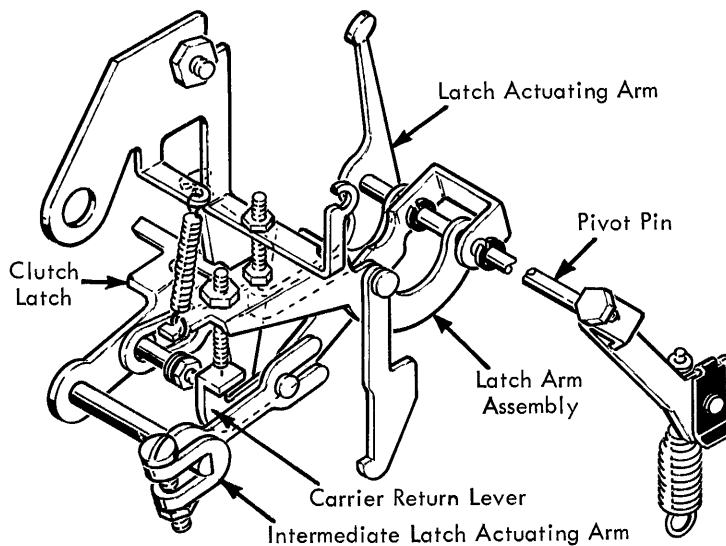


FIGURE 144.1 Carrier Return (Late)

Attached solidly to the left side of the latch actuating arm and rotating with the arm is the pivot pin for the operational latches (Fig. 144.1). As the operational pivot pin rotates, the carrier return clutch arm attached to its left end moves up, forcing the carrier return shoe into the spring clutch (Fig. 144.2).

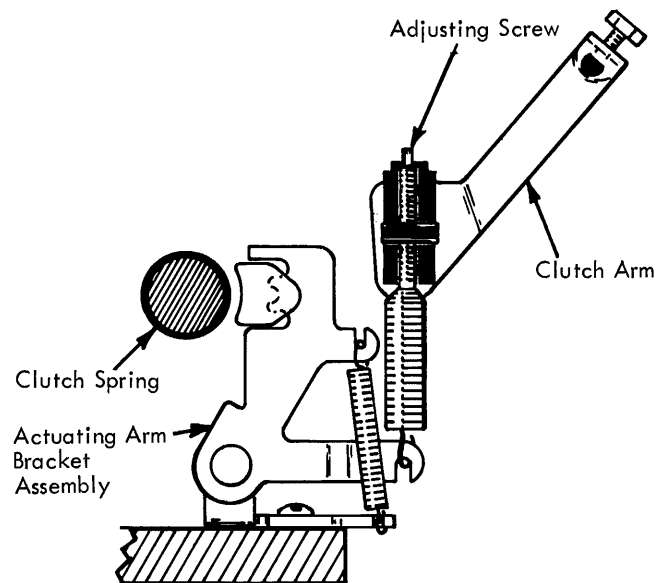


FIGURE 144.2 Carrier Return Shoe (Clearance)

The carrier return mechanism remains latched in the active position until the carrier reaches the left margin. At that time, the clutch is unlatched and the escapement pawl is allowed to restore back into the rack.

#### Carrier Return (15 In.)

The following section concerns the operational section of the carrier return mechanism on the long carriage machines. This section of the mechanism is different than that of the 11 in. printer because of the longer carriage.

The carrier return operational latch is mounted on the carrier return latch arm which pivots freely about a pivot pin mounted

in the right hand operational latch bracket at the rear of the powerframe. The carrier return latch arm straddles the carrier return lever (Fig. 145) which is tightly fastened to the same pivot pin by a bristo screw. The bristo screw tightens against a flat spot on the pivot pin. An adjusting screw threaded through the top of the latch arm contacts the top of the horizontal lug on the carrier return lever (Fig. 145). A spring between these two pieces loads them together. When the carrier return latch is pulled down by the cam follower, the latch arm forces down on the carrier return lever causing the pivot pin to rotate.

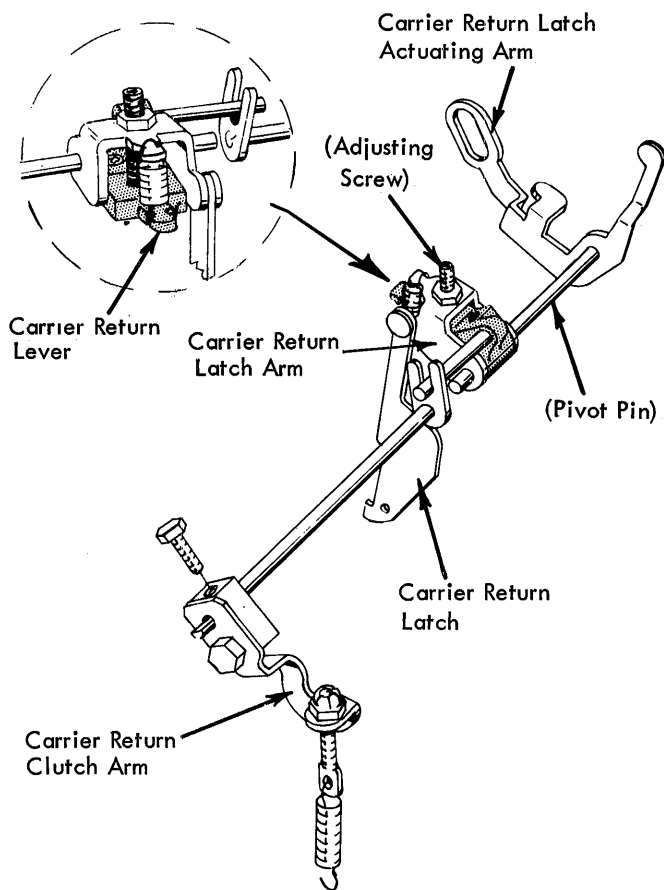


FIGURE 145. Carrier Return (15 Inch)

Riveted to the right hand end of the pivot pin and rotating with it is an arm called the carrier return latch actuating arm. This arm performs the same function on the long carriage machines as it does on the short carriage. It rotates the escapement torque bar (removing the escapement and backspace pawls from their racks) plus operates the carrier return clutch latch down to its latched position.

The carrier return lever has a pin that projects to the left into a forked arm located on the right hand end of the carrier return clutch arm pivot pin (Fig. 145). This provides a solid driving connection between the two pivot pins. Whenever the carrier return latch is pulled down, the carrier return clutch arm pivot pin rotates the clutch arm to produce a pull on the heavy spring attached to the carrier return actuating arm. From this point on the operation is the same on long carriage machines as on the short carriage.

## CARRIER RETURN - LATE STYLE

The carrier return operation remains the same. Parts have been re-designed to provide easier accessibility for adjustments, and will hold these adjustments longer.

The transfer of motion has changed in the operational latch mechanism (Fig. 145.1). When the carrier return operational latch is pulled down by the cam follower, the latch arm presses the carrier return lever down. A stud on the carrier return lever fits in a slot of the intermediate latch actuating arm, and as the lever moves down it rotates the arm and pivots the carrier return clutch latch shaft and clutch latch. As the carrier return clutch latch moves downward, it rotates the latch actuating arm which contacts the escapement torque bar causing the escapement pawl to be removed from its rack. Further motion causes the clutch latch and latch actuating arm to be latched in the operated position.

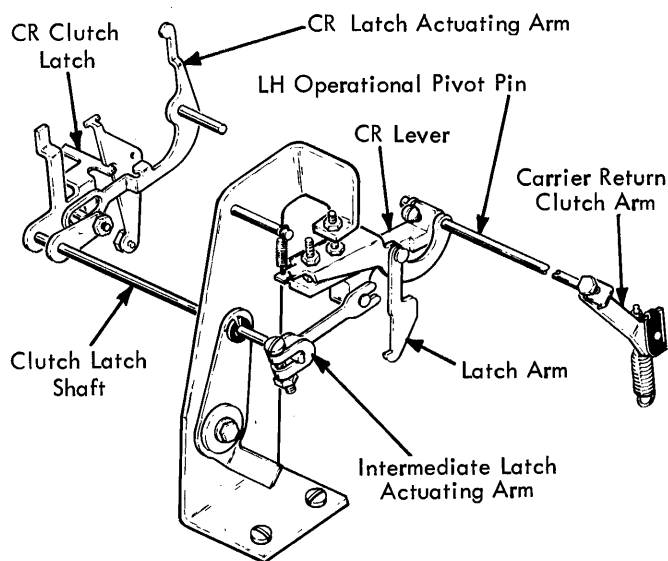


FIGURE 145.1 Carrier Return (Late)

The carrier return lever also rotates the left-hand operational pivot pin and the carrier return clutch arm forcing the carrier return shoe into the spring clutch. The shoe is held in this position by the carrier return clutch latch.

The carrier return mechanism remains latched in the active position until the carrier reaches the left margin. At that time, the clutch is unlatched and the escapement pawl is allowed to restore back into the rack.

### Carrier-Return Contacts

The carrier return operation requires two kinds of contacts. One, the feedback contact is usually called C6. This contact is actuated by the carrier return indexing cam follower the same as the C5 contact. The second contact is a carrier return interlock contact.

The carrier return interlock contact is mounted to the right side of the power frame in the upper corner (Fig. 146).

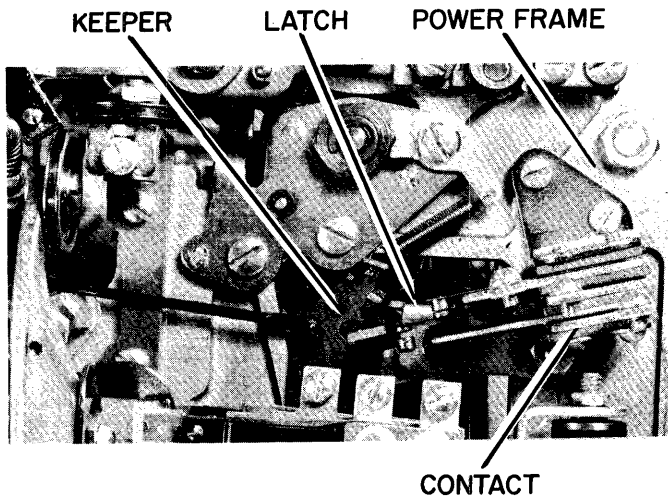


FIGURE 146. Carrier-Return Interlock Contact

The interlock contact is operated by the carrier return clutch latch. An extension has been added to the latch for this purpose (Fig. 147).

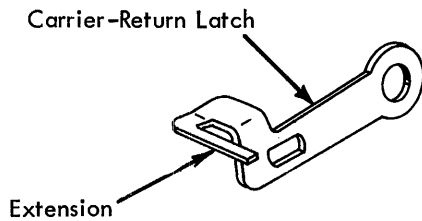


FIGURE 147. Carrier-Return Clutch Latch

When the latch is in its rest position, the contact is in its normal position. As the latch is operated, the extension moves down, transferring the contact. In the latched position the extension holds the contact transferred (Fig. 148). When the carrier return operation is completed, the latch unlatches and the contact returns to normal (Fig. 149).

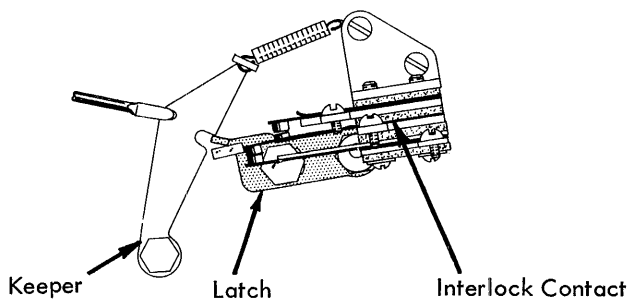


FIGURE 148. Carrier-Return Interlock When Latched

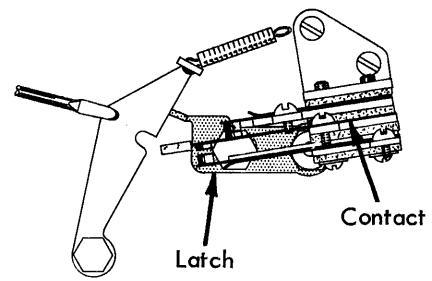


FIGURE 149. Carrier-Return Interlock When Unlatched

## INDEXING

### Indexing

The indexing mechanism operates to line space the paper vertically. An indexing operation can be obtained by depressing either the carrier return keylever or the special indexing keylever. Depressing the carrier return keylever also causes the carrier to move to the left margin; whereas depressing the index keylever (not used on some printers) causes a line space operation only.

The index selector lever, located to the rear of the right end of the platen, may be positioned so that the mechanism will space either one or two spaces during each operation. With the lever forward, single line spacing will occur. Double spacing will take place if the lever is to the rear.

Indexing is achieved by a pawl that engages and rotates a ratchet at the right end of the platen. The ratchet is locked to the platen so that the platen is also rotated. Two styles of indexing mechanisms have been produced.

### Early Style Indexing

The index pawl pivots on a bellcrank called the index pawl carrier (Fig. 150). The carrier pivots just behind the platen on the right hand carriage plate. A small extension spring at the top of the index pawl spring-loads the pawl toward the platen ratchet. The index pawl is held clear of the ratchet in the rest position by a lug on the upper index stop located just to the rear of the pawl (Fig. 150). As the pawl carrier is operated down by the link attached at the rear, the

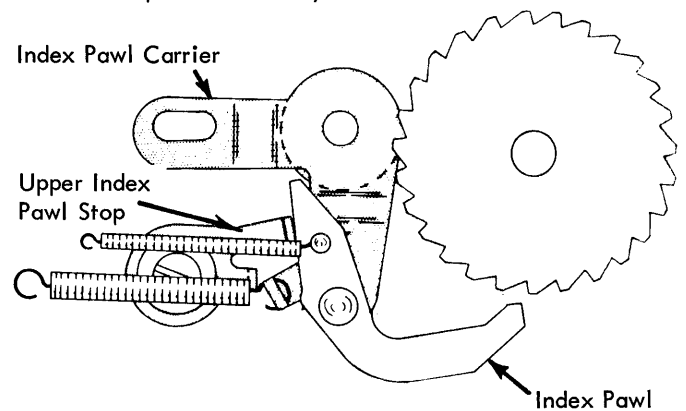


FIGURE 150. Index Pawl Rest Position

index pawl moves forward away from the index stop. The spring is then allowed to rotate the pawl into engagement with the platen ratchet. Further movement of the carrier causes the index pawl to rotate the platen ratchet and platen.

The index detent lever located just below the platen has a roller attached at the front that seats between two teeth of the platen ratchet. The lever is spring-loaded to hold the roller into the bottom of the teeth. The roller insures that the platen will not creep out of position and that indexing will be accurate. As the ratchet is rotated, the detent roller moves from one tooth to the next. The detent lever spring forces the roller to the bottom of the teeth to insure equal spacing on each operation.

The index is operated by a link that extends down from the index pawl carrier to the rear of the operational cam follower (Fig. 151). When the single lobed cam rotates, the cam follower pulls down on the link to effect a line spacing operation.

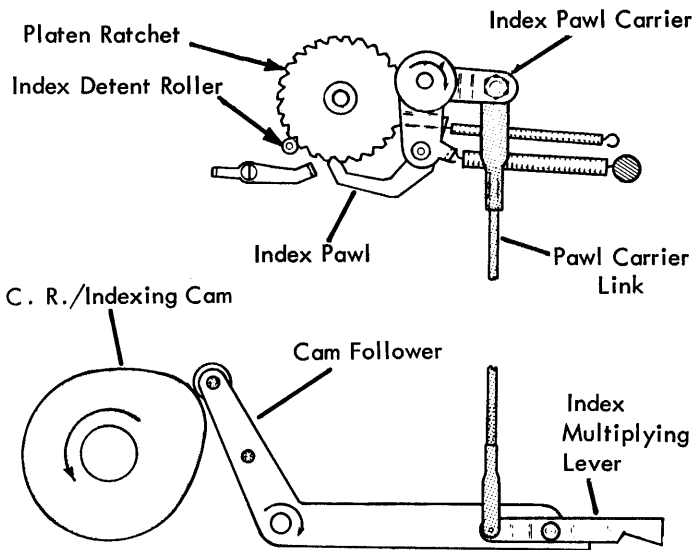


FIGURE 151. Single Space Indexing Operation

Whether a single or a double space operation occurs is determined by how far the index pawl carrier link is pulled. Because the cam follower always moves the same distance on each operation, a system of multiplying the leverage must be utilized. The index pawl carrier link is attached to the front of the index multiplying lever that pivots at the rear of the cam follower (Fig. 151). A lug at the rear of the cam follower prevents the multiplying lever from pivoting up in front. During a single line spacing operation, the multiplying lever moves down the same amount as the cam follower (Fig. 151).

When the index selector lever is pushed to the rear for a double space operation, it pivots the multiply control lever forward under the end of the multiplying lever blocking its downward movement (Fig. 152). When the cam follower operates, the multiplying lever pivots where it attaches to the cam follower. This causes the front of the multiplying lever to pull down on the index pawl carrier link sufficiently to cause two line spaces of movement to the platen (Fig. 152).

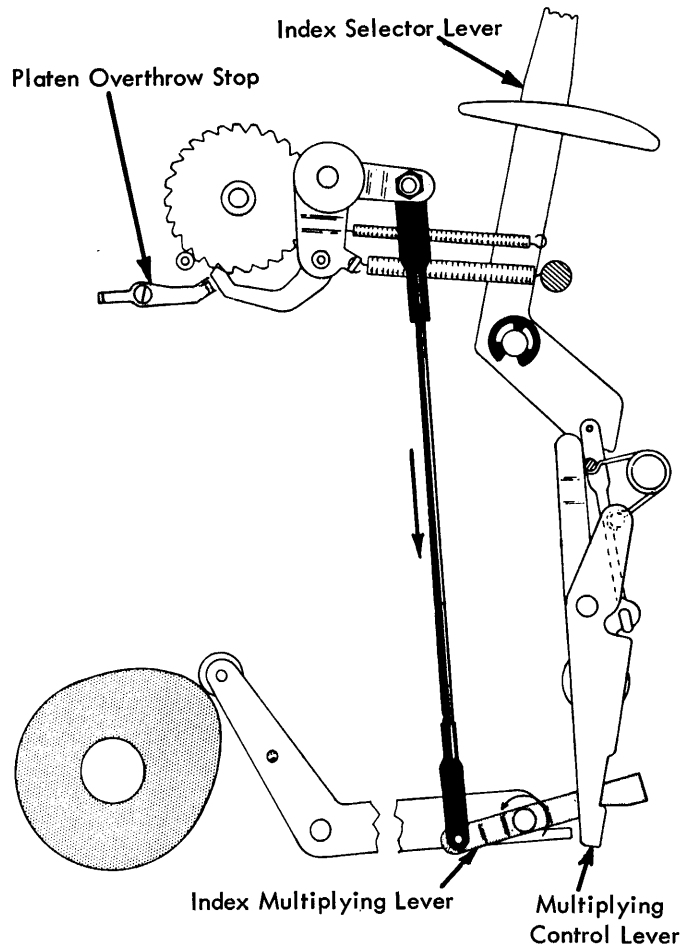


FIGURE 152. Double Space Indexing Operation

A double and single space operation require the same time lapse, because both are operated by the same rotation of the cam. The platen rotation must be accelerated for double spacing, because of the added distance it is to be rotated. This extra speed of rotation tends to cause the platen to space too far because of the momentum developed. To prevent overthrow, an index pawl stop is provided at the end of the double spacing stroke (Fig. 153). Upon contact with the stop, the index pawl is stopped and locked into mesh with the platen ratchet to block further rotation of the platen.

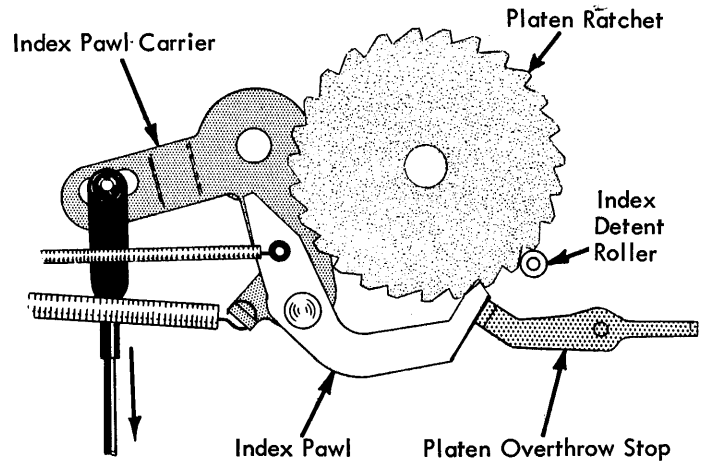


FIGURE 153. Platen Overthrow Stop

## Late Style Indexing

The new indexing mechanism is designed to improve the accuracy and reliability of the indexing operation. It differs from the earlier design mainly in the index pawl and the method of selecting single or double spacing.

The index mechanism is operated by the cam follower by means of the index pawl carrier link connected to the front of the index multiplying lever. The rear of the multiplying lever is always in contact with multiplying lever stop attached solidly to the powerframe (Fig. 154). As the cam follower operates, the multiplying lever pivots on the cam follower and pulls down on the index pawl carrier link (Fig. 155).

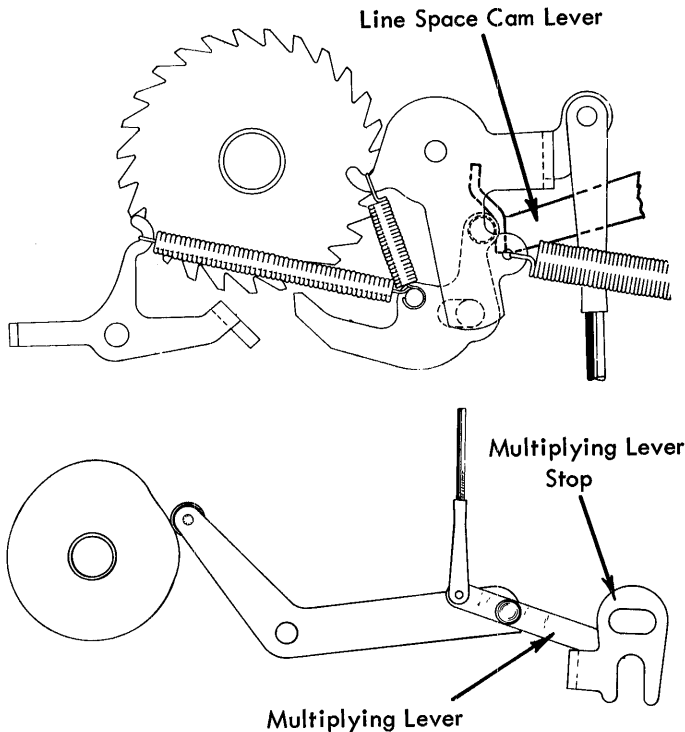
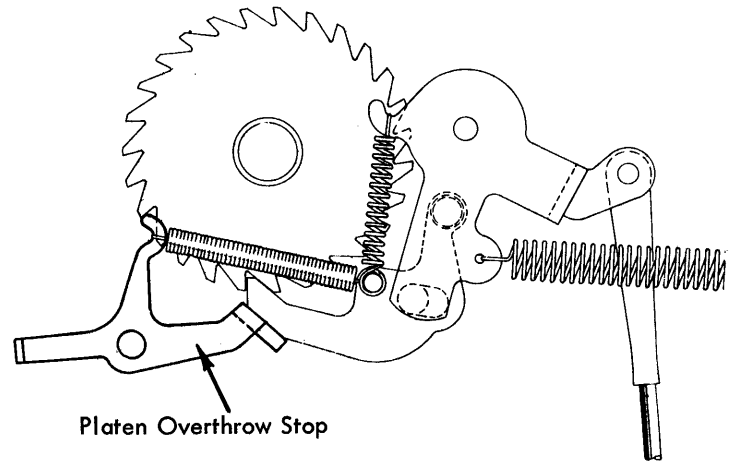


FIGURE 154. Index Mechanism - Rest Position

The index pawl carrier link always receives the same amount of motion each time it operates regardless of whether the mechanism is set for single or double spacing. The amount of travel is sufficient to cause double space rotation of the platen.

During a double space operation, the index pawl is allowed to enter the platen ratchet immediately. The index pawl then forces the ratchet tooth forward two spaces until the pawl contacts the platen overthrow stop. The overthrow stop wedges the pawl into the ratchet teeth to lock the platen in position (Fig. 155).

If only a single space operation is desired, the index pawl must be prevented from entering the ratchet until it has passed one tooth of the ratchet. The remaining travel after the index pawl enters the ratchet is only sufficient to cause one tooth of rotation to the platen. The index pawl contacts the platen overthrow stop at the end of the stroke as on a double space operation.



Cam At High Point

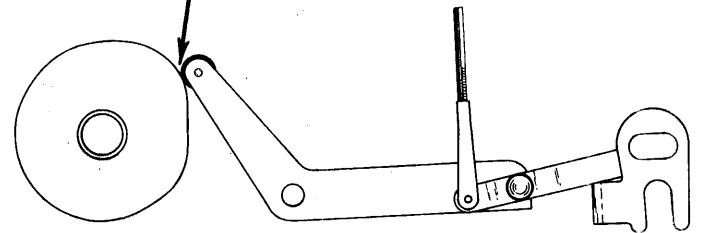
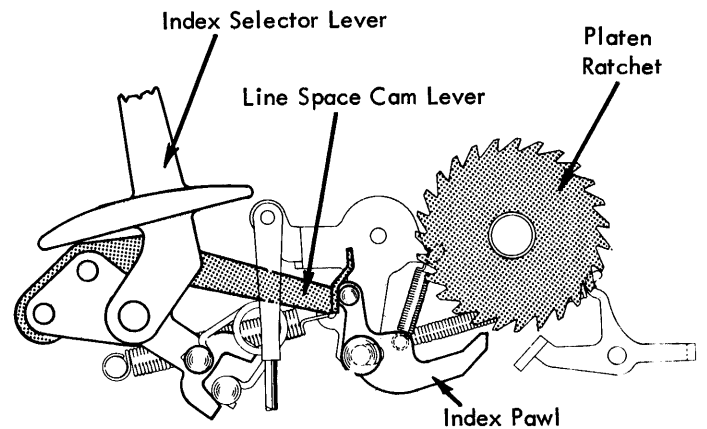


FIGURE 155. Index Mechanism - Active Position

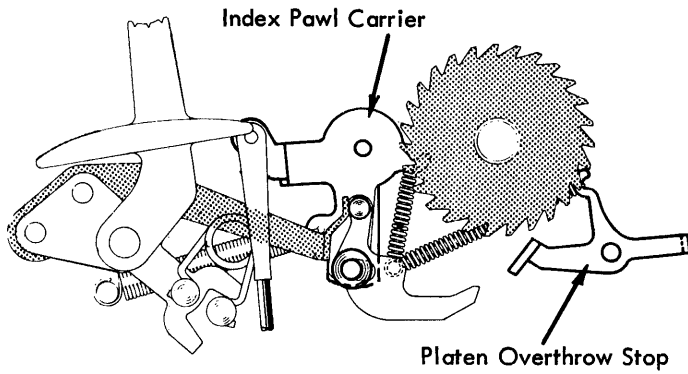
The index pawl entry into the platen ratchet is controlled by the line space cam lever attached to the index selection lever (Fig. 156). The cam lever has two steps at the forward end in position to contact a stud on the side of the index pawl. A small spring between the index pawl and the pawl carrier spring-loads the pawl toward the platen. With the index selection lever to the rear in the double space position, the index pawl stud contacts the lower step of the cam lever allowing the pawl to rest near the platen ratchet (Fig. 156A). In the single space position, the index pawl stud contacts the upper step of the cam lever causing the index pawl to rest farther from the platen (Fig. 156B). Thus in the single space position, the index pawl stud maintains contact with the line space cam lever longer and delays the entry of the pawl into the platen ratchet.



A. DOUBLE SPACE POSITION

FIGURE 156A. Index Selection Mechanism

The index selection lever is held in the single or double space position by a toggle hairpin spring (Fig. 156). Movement of the index selection lever is restricted by two extensions at the bottom of the lever that contact the hairpin spring mounting stud.



B. SINGLE SPACE POSITION

FIGURE 156B. Index Selection Mechanism

The index pawl is designed with an elongated pivot hole so that it "floats" forward during a portion of the index stroke. The pawl is spring-loaded forward in the rest position by an extension spring between the pawl and a hook on the platen overthrow stop (Fig. 156). A heavier spring between the index pawl carrier and the base tie rod holds the mechanism in the rest position.

As the index mechanism operates, the pawl engages the ratchet tooth. There is then a slight delay until the pawl carrier reaches the end of the elongated slot in the index pawl. The pawl carrier is operated so sharply that it actually "kicks" the platen. The platen is thus caused to move ahead of the index stroke. Without the elongated hole in the index pawl, the platen ratchet would reach the final position ahead of the index pawl. With the floating index pawl, the pawl is spring-loaded forward against the ratchet tooth. As the ratchet moves ahead of the index stroke, the pawl is able to move with it and reach the overthrow stop at the same time the platen reaches the final position. The pawl is then able to wedge into the ratchet and block any further rotation due to the momentum of the platen.

#### Index Keylever Mechanism

An indexing operation occurs any time the cam operates the cam follower. The cam may be caused to operate by releasing either the index or carrier return interposer to the rear.

The carrier return operation has been discussed in another section; therefore the index alone will be dealt with here. The index keylever pivots on the keylever fulcrum rod at the rear and extends toward the front only to the first row of keybuttons. An offset in the keylever places the end of the keylever and keybutton outside the right side frame (Fig. 157). A stud in the side frame fits through an elongated hole in the keylever to limit the over-all travel of the keylever. An extension spring from a lug on the keylever to the stud restores the keylever to the rest position.

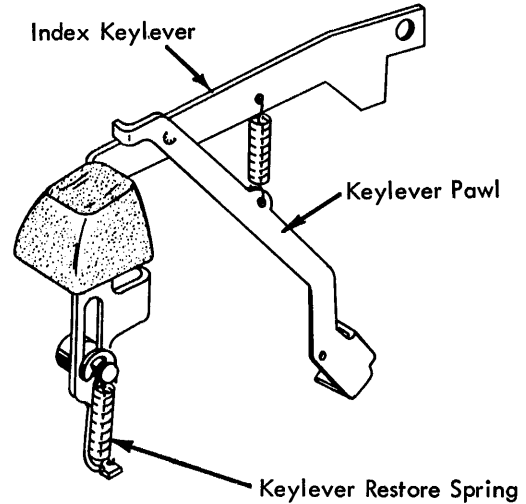


FIGURE 157. Index Keylever Mechanism

When the keylever is depressed, the keylever pawl at the rear of the keylever depresses the index interposer to release it to the rear. This releases the cam allowing the operation to occur.

### PLATEN VARIABLE

#### Standard

The platen variable mechanism provides the operator with a means of rotating the platen to a position other than the normal writing line. The variable is used for typing above or below the writing line, locating the writing line after reinserting the paper, and for typing on lines of other than six lines per inch spacing.

The platen ratchet must remain stationary when selecting a new writing line so that the detent roller will be seated between two teeth of the ratchet at the new position. A clutch mechanism connects the ratchet to the platen so that it can be engaged for line spacing and disengaged for the variable operation. The clutch can be disengaged by pushing the left hand platen knob toward the right. As long as the knob is held to the right, the platen can be rotated freely while the ratchet remains stationary. When the knob is released, the clutch is automatically re-engaged by spring tension.



The left side of the platen ratchet contains two heavy lugs that form a channel (Fig. 158). The platen variable driver operates left to right in the slot and always turns with the ratchet. A compression spring between the ratchet and the driver loads the driver to the left so that serrations on the outer surface of the driver mesh with matching serrations inside the platen end plug (Fig. 158). The meshing of the serrations causes the platen, the driver, and the ratchet to be locked together and turn as a unit.

When the driver is disengaged from the platen end plug, the platen can be turned to the desired position. The driver can then engage different serrations and lock the platen in the new position. The left hand platen knob is mounted to a shaft that slides left or right inside the platen. A light compression spring holds the shaft toward the right to prevent free play. The shaft has two pins attached to the right end that operate through holes in the platen end plug (Fig. 158). The pins on the push rod extend through the end plug to the right and rest against the platen variable driver. Movement of the platen knob toward the right is transferred to the driver to disengage it from the platen end plug.

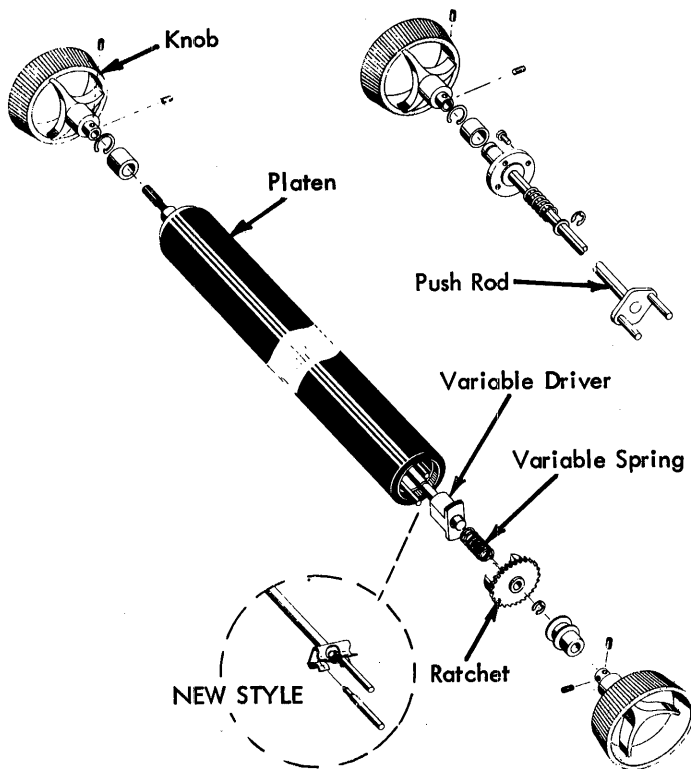


FIGURE 158. Platen Variable Mechanism

#### Platen Variable - Pin Feed

The variable is used for typing above or below the writing line, for locating the writing line after reinserting the paper, and for typing on lines of other than six-lines-per-inch spacing.

The platen ratchet must remain stationary when selecting a new writing line so that the detent roller will be seated be-

tween two teeth of the ratchet at the new position. A clutch mechanism connects the ratchet to the platen so that it can be engaged for line spacing and disengaged for the variable operation. The clutch can be disengaged by pushing the right-hand platen knob toward the left. As long as the knob is held to the left, the platen can be rotated freely while the ratchet remains stationary. When the knob is released, the clutch is automatically re-engaged by spring tension.

A compression spring keeps the right-hand platen knob toward the right (Fig. 159). The platen-variable drive is attached to the same shaft as the platen knob. When the variable drive is to the right, the serrations on the outer surface of the driver mesh with matching serrations inside the platen ratchet. The variable driver is also engaged in two slots in the platen guide. The platen guide is attached to the platen. Moving the variable driver then causes the platen to move. When the variable driver is engaged with the ratchet, the ratchet drives it and causes normal spacing. When the right-hand platen knob is pushed toward the left, the variable driver is disengaged from the ratchet and the platen can be turned by turning the platen knob.

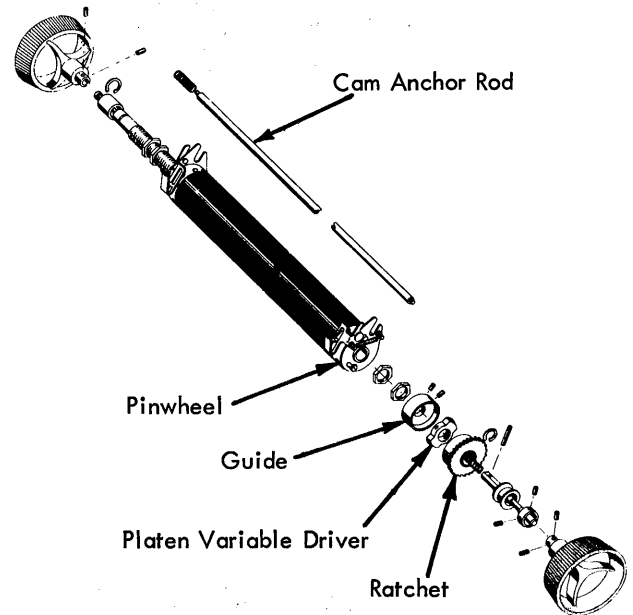


FIGURE 159. Pin-Feed Platen Assembly

#### TABULATOR

##### Tabulator Operation

The tabulator mechanism facilitates positioning the carrier quickly to a predetermined point on the writing line.

For a tabulator operation to take place, several basic things must occur. The stopping point must be predetermined. The escapement and backspace pawls must be released for carrier movement. The pawls must be latched in the released position to continue the movement. The speed of the carrier must be controlled, and the pawls must restore to their racks at the proper time.

The power for a tab operation is furnished by the same cam that operates the backspace and the spacebar mechanisms.

## Tab Set and Clear - Early Style

A rack of tab stops located just to the rear of the escapement rack allows the operator to select the positions where the carrier will stop when the tab keylever is depressed. The tab stops operate friction tight in grooves of the tab rack -- one corresponding to each escapement position. The tab set and clear button located to the left of the keyboard may be rocked forward or back to set or clear a tab stop (Fig. 160). When the front of the button is depressed (set), the set and clear arm at the rear operates to rotate the front of the tab rack up.

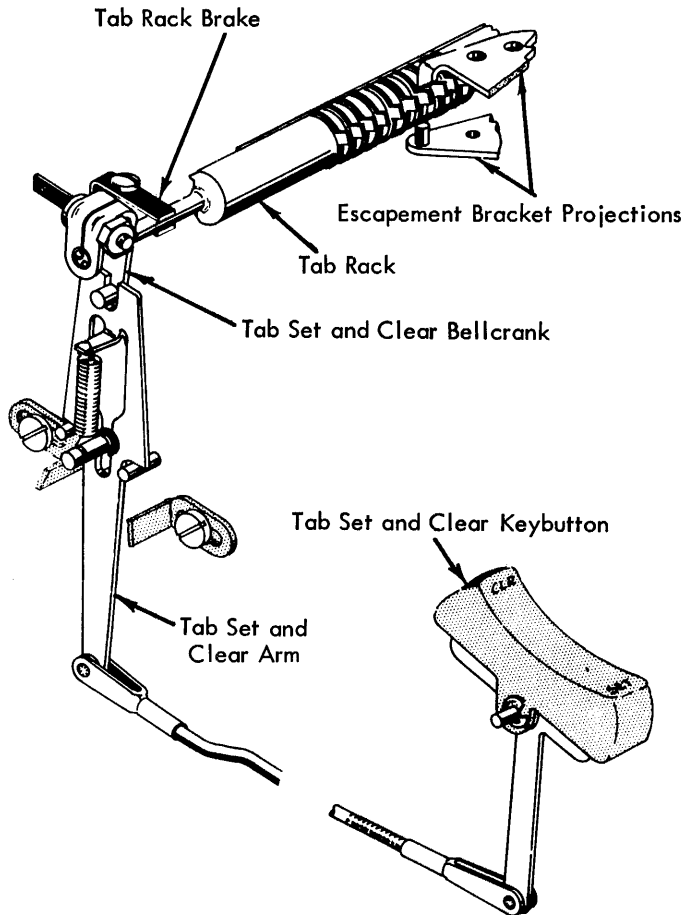


FIGURE 160. Tab Set And Clear Mechanism

A tab stop strikes a projection on the escapement bracket blocking the movement of the tab stop (Fig. 161A). As the tab rack continues to rotate, it is forced to rotate inside the tab stop. When the set and clear button is released, the tab rack is restored to the rest position leaving the set tab stop lower than the others (Fig. 161B). Depressing the rear of the button (clear) causes the tab stop to strike a stud at the bottom of the escapement bracket blocking its movement while the tab rack is rotated further (Fig. 161C). When the set and clear lever is released, the tab rack is restored to the rest position, leaving the tab stop in the cleared position (Fig. 161D). Because it is the escapement bracket that sets or clears the tab stop, the carrier must be positioned to the desired tab stop before the set or clear action can occur. The stop at the extreme right end of the tab rack is the tab final stop and remains in the set position at all times to disengage the tab mechanism at the right hand limit of travel.

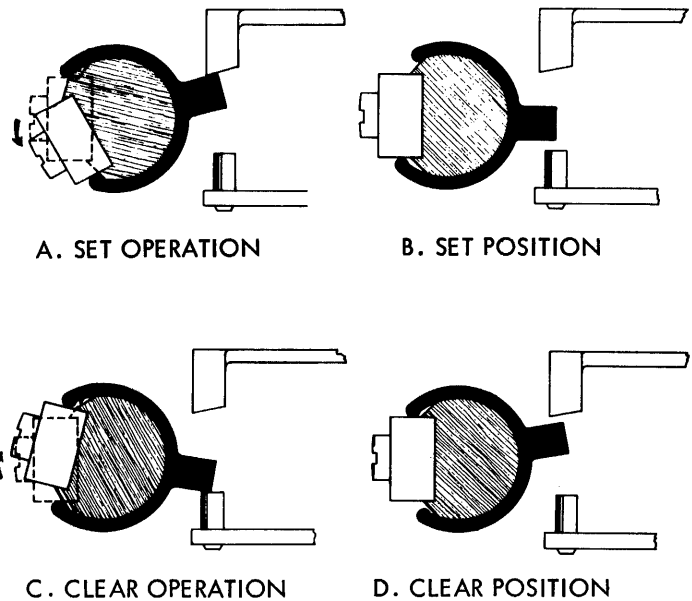


FIGURE 161. Tab Set And Clear Operation

## Tab Set and Clear - "Gang Clear"

Both the tab rack and the tab clear mechanism has been redesigned on late level machines so that the tab stops may be "gang cleared". Gang clearing tab stops is the term given to the procedure for clearing all of the set tab stops in one operation. This is accomplished by positioning the carrier at the extreme right hand margin, depressing the tab clear button and (while holding the tab clear button depressed) actuating the carrier return mechanism. As the carrier travels toward the left hand margin it will clear every set tab stop across the entire length of the tab rack.

Figure 162 illustrates a cross section of the tab rack. Notice that the tab stops encircle and operate freely about a round shaft that runs through the center of the tab rack. The tab rack is a slotted tube that mounts on shouldered bushings which are set screwed to each end of the shaft. The slots in the tube are guide slots for each individual tab stop (Fig. 163). Sections of spring fingers mounted across the entire length of the tab rack operate against small detent lugs (projections) on each tab stop. The function of the spring fingers is to detent each tab stop in either its set or cleared position.

The tab set operation on the gang clear mechanism remains the same as on the old style. The tab stop strikes a projection of the escapement bracket blocking the movement of the tab stop as the tab rack rotates top to the rear (Fig. 162A). The clear operation is slightly different. A gang clear finger mounted to the top of the escapement bracket (Fig. 163) projects to the rear just below the detent lugs on the tab stops (Fig. 162B). When the tab rack rotates top to the front during a clear operation, the gang clear finger which is in the path of the detent lug restricts the tab stop from rotating with the rack thereby causing the tab stop to rotate up to its cleared position (Fig. 162D).

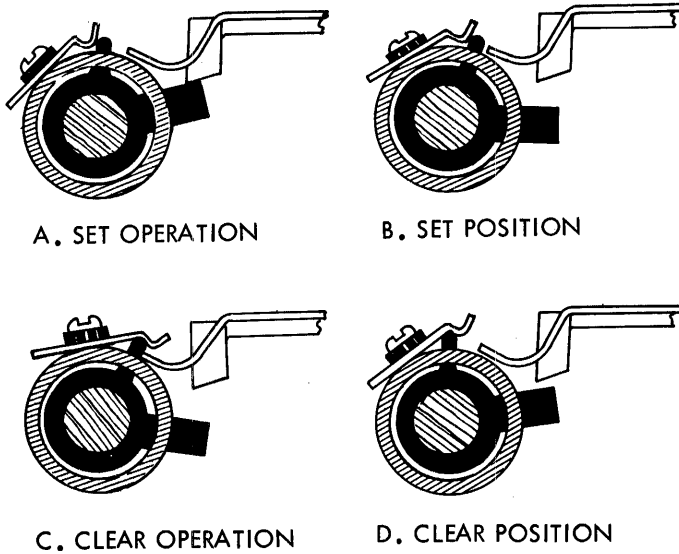


FIGURE 162. Tab Set and Clear Operation (Gang Clear)

During a gang clear operation the tab rack is held rotated in its cleared position as the gang clear finger slides along the rack (with the carrier) camming each set tab stop back to its cleared position. The angle on the left side of the tip of the gang clear finger provides the means for this camming action.

The tab rack is restored to rest from either the set or clear operation by an extension spring on the set and clear arm (Fig. 160). The spring pulls the arm down against two pins on the powerframe so that it maintains a vertical position.

The tab rack is restored rather quickly when released and has a tendency to flip past the rest position. This could partially

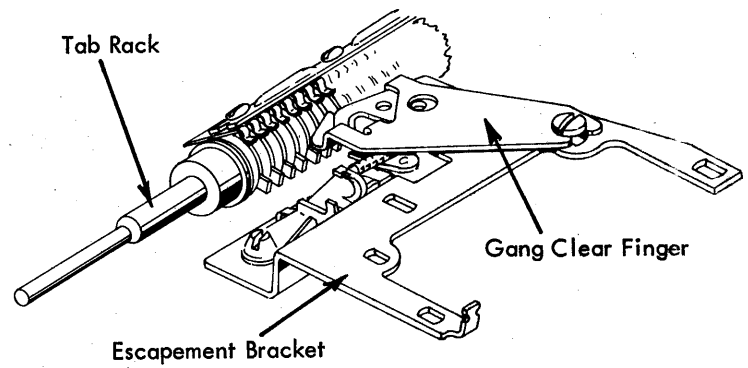


FIGURE 163. Gang Clear Finger

clear a stop that had just been set or partially set a stop that had just been cleared. To prevent the rack from restoring past the rest position, a leaf spring at the left end of the rack applies a slight braking action (Fig. 160).

Keylever Assembly

The tab keylever operates a bail that extends from left to right above the shift bail (Fig. 164). The bail operates a keylever on the right side of the keyboard. This keylever does not have a stem for a keybutton and is used only to trip the tab interposer.

Pawl Release

The tab interposer engages the backspace/spacebar cam and pushes the tab operational latch under the backspace/spacebar cam follower.

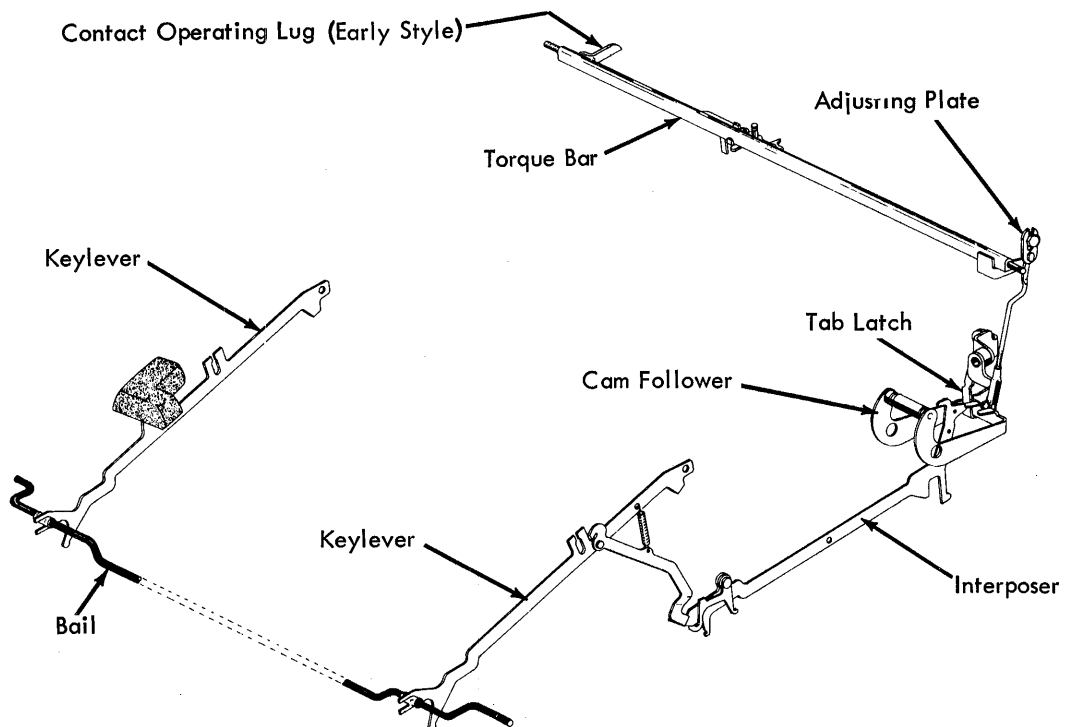


FIGURE 164. Power Tab Mechanism

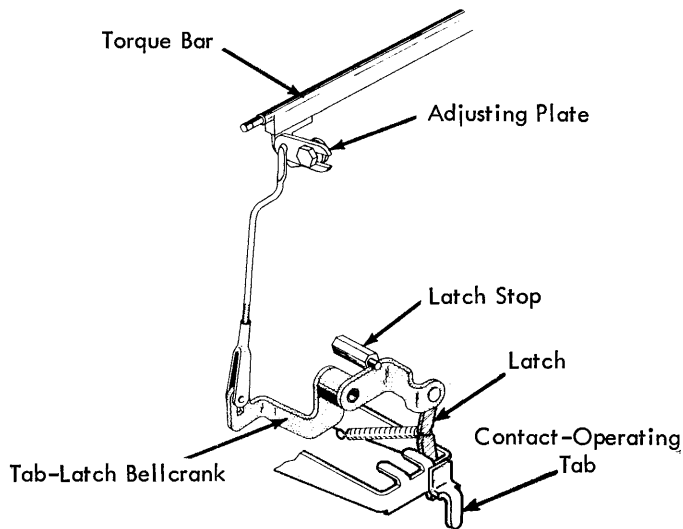


FIGURE 165. Power-Tab Latch

The tab operational latch is connected to the latch bellcrank and, as the latch is carried down by the backspace/spacebar cam-follower lever, the bellcrank rotates clockwise (Fig. 165).

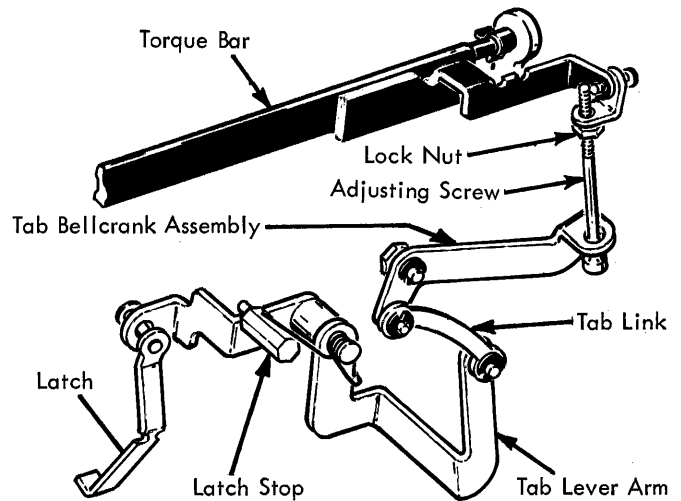
A link connects the tab torque bar to the latch bellcrank (Fig. 165). Rotating the bellcrank, raises the link. The link rotates the bottom of the torque bar to the rear.

The tab torque bar is mounted the same as the escapement torque bar. The pivot point is near the top of the torque bar so that the bar swings to the rear.

Late Style - Tab Operational Mechanism - 731

The tab torque bar actuating mechanism on 11 inch machines has been redesigned to be compatible with the late style carrier return mechanism. The parts which transmit motion up to the torque bar are brought out in front of the center section of the power frame. The right-hand dust shield has been redesigned so as not to interfere with the mechanism.

The tab operational latch is connected to the tab lever arm and bearing assembly. As the latch is carried down by the cam follower, the tab lever arm rotates in a counterclockwise direction, pushing up on the tab link (Fig. 165.1). The link connects to the tab bellcrank assembly, rotating it in a clockwise direction. An adjusting screw connects the tab bellcrank to an extension of the tab torque bar and as the right end of the bellcrank moves down the bottom of the tab torque bar is rotated to the rear. The remainder of the tab operation is unchanged.



● FIGURE 165.1 Late Level Tab Operational Mechanism (11 Inch Machine)

Early Level

A small flat spring attached to the left rear corner of the escapement bracket braces the torque bar to prevent it from flexing toward the front.

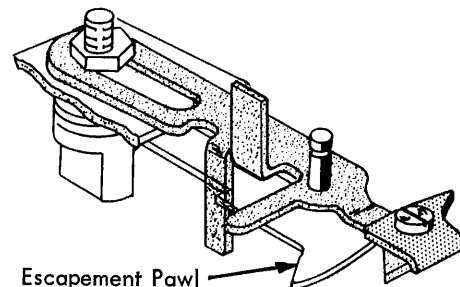
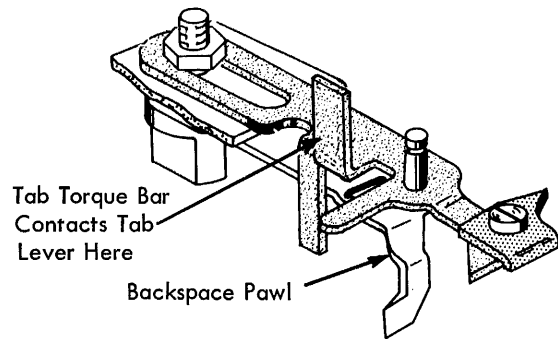


FIGURE 166. Pawl-Release Operation (Early)

The tab lever is operated to the rear by the tab torque bar.

The tab lever is a small lever pivoted on the top of the escapement bracket at the rear. The tab lever releases both the escapement and backspace pawls from their racks and holds them in the released position. As the tab lever pivots toward the rear, a lug at the front of the tab lever contacts the escapement and backspace pawls and forces them to the rear out of mesh with their racks (Fig. 166). A small latch pivots on the escapement bracket at the right end of the tab lever. When the tab lever has moved far enough to the rear to release the pawls, the tab latch swings into a notch in the tab-lever assembly to hold it to the rear, thus latching the pawls out of their racks (Fig. 167). A torque bar lockout tab on the tab lever holds the torque bar to the rear as long as the tab lever is latched out (Fig. 168). This is necessary to keep the tab Interlock contact operated for the duration of a tab cycle.

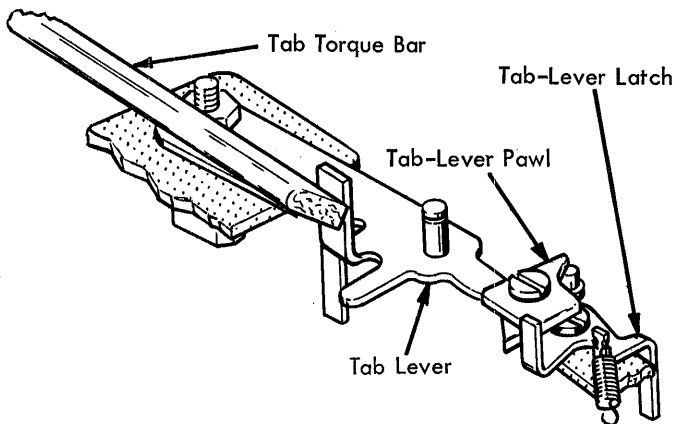


FIGURE 167. Tab-Latch Operation (Early)

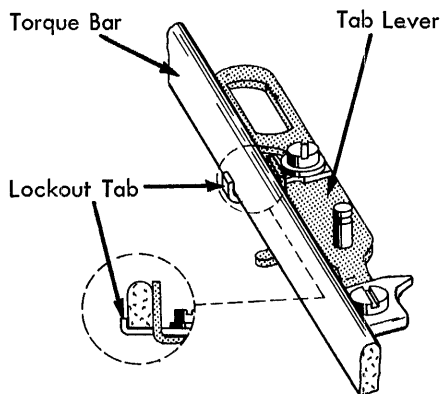


FIGURE 168. Torque-Bar Lockout Tab (Early)

#### Late Level

The late tab mechanism operates very similar to the early. Instead of the torque bar contacting the tab lever lug it contacts a trigger which, in turn, moves the tab lever to the rear (Fig. 169).

The trigger also has an upright lug toward the front (Fig. 169), which takes the place of the lockout tab (Fig. 168). The rest of the tab operation is the same on both old and new mechanism except the interlock contact which is covered under a separate heading.

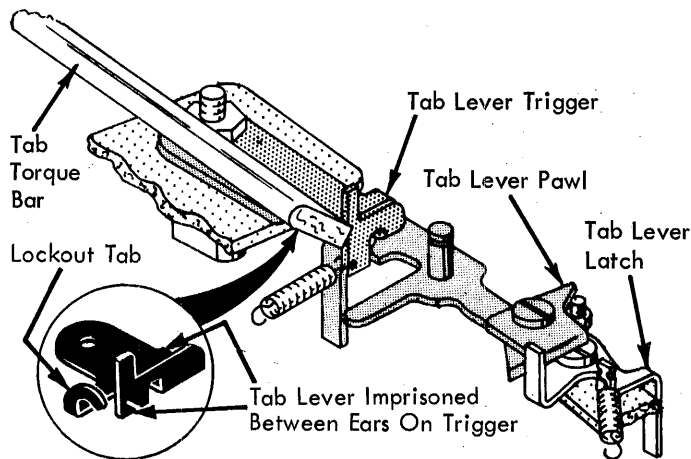


FIGURE 169. Tab Lever Trigger (Late)

#### Tab Lever Overthrow Stop

An overthrow stop is mounted on the escapement bracket. It extends to the rear and down behind the trigger (Fig. 170). The stop prevents the tab lever from being thrown into the tab rack.

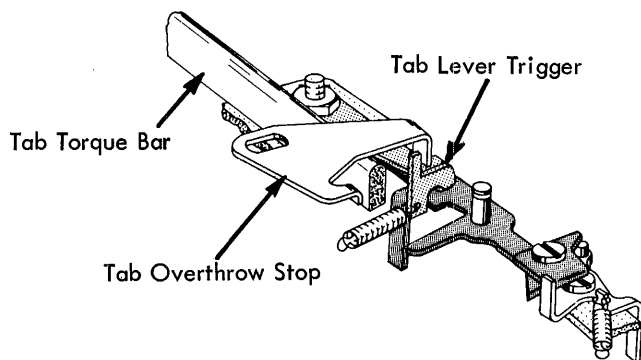


FIGURE 170. Tab Overthrow Stop

#### Tab Governor

The carrier speed during a tab operation must be controlled to insure an accurate tab, reduce the noise, and prevent excessive wear and shock on the components. During a tab operation, the carrier is pulled to the right by the tension of the mainspring as during an escapement operation. The tab governor operates by limiting the speed with which the escapement cord drum winds up the cord.

The beveled gear on the escapement cord drum meshes with the tab governor pinion located on the operational shaft to the right of the cord drum (Fig. 171). The pinion gear operates between two collars. The left collar and the pinion gear have hubs enclosed by a clutch spring. The left collar is set-screwed to the shaft and the pinion gear pivots freely on the shaft. The spring is wound so that it slips when the pinion is held stationary and the operational shaft is turning.

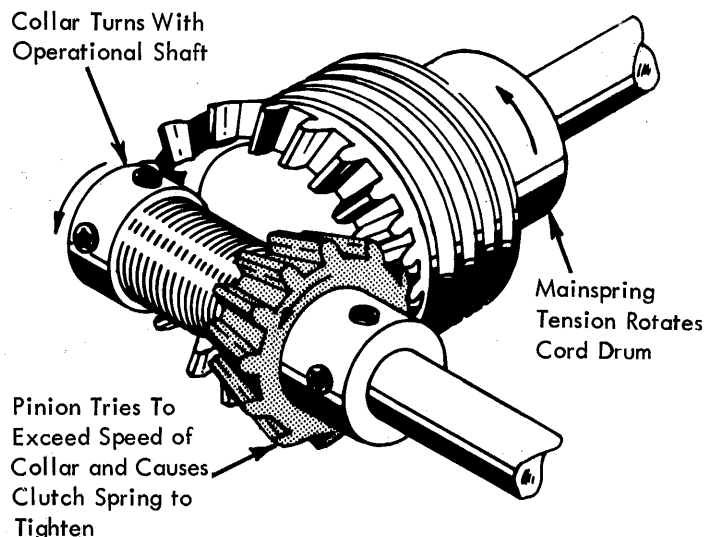


FIGURE 171. Tab Governor Mechanism

If the pinion gear is turned in the same direction as the operational shaft but at a faster rate of speed, the friction of the clutch spring causes it to tighten around the two hubs locking them together. During a tab operation, the cord drum drives the pinion gear in the same direction as the operational shaft. The mainspring tension causes the pinion to speed up and tighten the clutch spring. The mainspring then tries to accelerate the operational shaft. The mainspring does not have sufficient tension to drive the operational shaft, because of the drag present in the system. The shaft must be driven by the motor; therefore the speed of the tab governor pinion can be no faster than the normal speed of the operational shaft. The escapement cord drum can wind up the cord only as fast as the pinion will let it. The gear ratio between the pinion gear and the escapement cord drum allows the carrier to be moved at the proper speed during a tab operation. No governing action is obtained during approximately the first inch of carrier travel, because a short distance is required to tighten the tab governor clutch spring.

The tab governor pinion is the same size as the carrier return pinion gear. This makes the speed of the carrier the same for both tab and carrier return.

#### Tab Unlatching

When the carrier reaches the desired stopping point, the escapement pawl must be allowed to re-enter the escapement rack and stop the movement of the carrier. The tab lever is mounted in an elongated hole at its pivot point. An extension spring holds the tab lever to the right. As the carrier moves toward the right, the tip of the tab lever contacts the set tab stop and is prevented from moving further (Fig. 172A). The carrier continues to the right carrying the pawls and the tab latch with it. Movement is allowed by the elongated hole at the tab lever pivot. As the escapement pawl moves to the right in relation to the tab lever, a notch in the pawl allows it to drop off the lug of the tab lever and restore to the escapement rack (Fig. 172B). Further movement of the carrier moves the tab latch to the right out of the notch of the tab lever (Fig. 172C). The tab lever then restores and allows the backspace pawl to re-enter its rack.

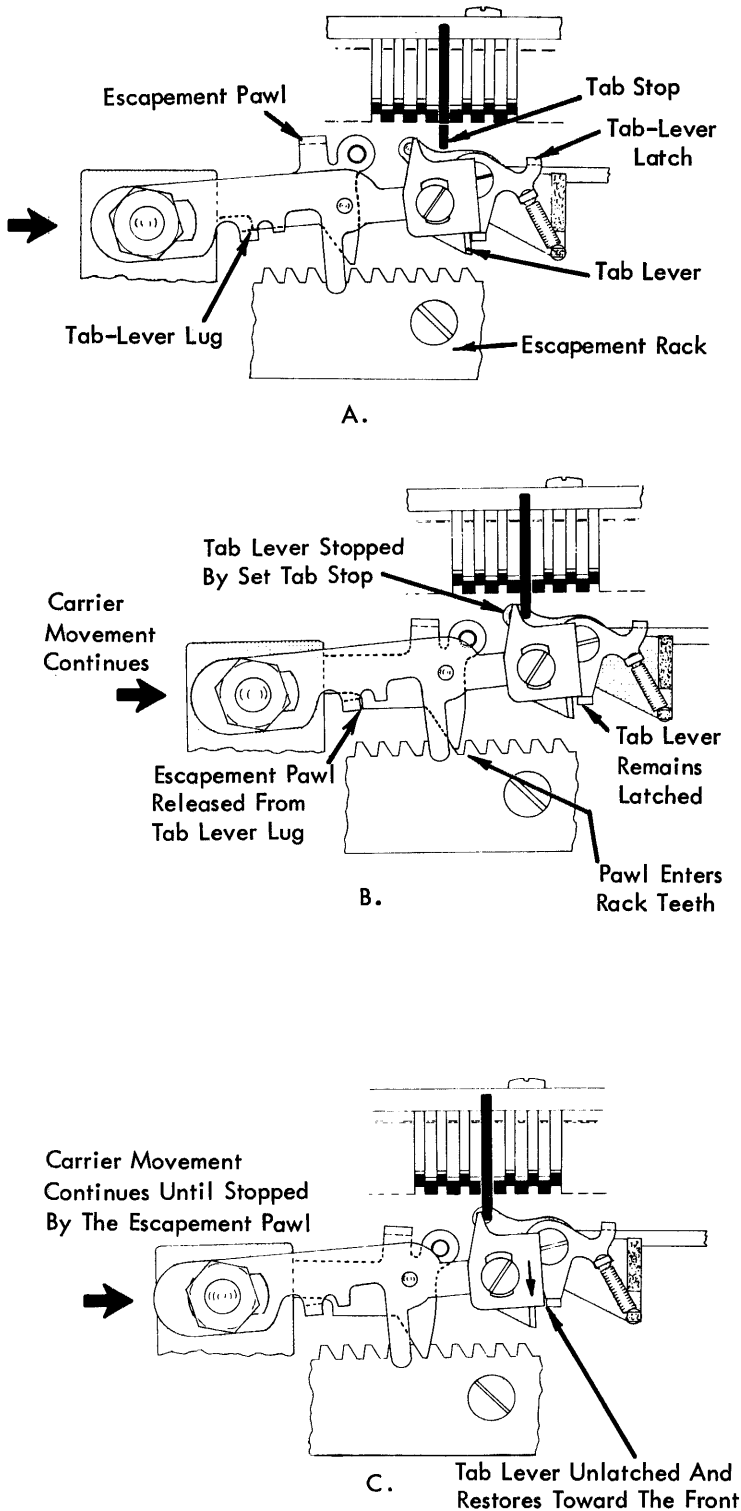


FIGURE 172. Tab-Unlatching Operation

It should be noted that the escapement pawl is allowed to enter the rack before the backspace pawl. The escapement pawl must be allowed to enter early to insure that it will enter the correct tooth of the escapement rack. If the backspace pawl were allowed to enter at the same time, the adjustment of the backspace rack could allow the backspace pawl to enter its rack stopping the carrier slightly to the left of the desired point. Delaying the entry of the backspace pawl prevents this possibility.

The trigger moves to the right with the carrier during the unlatching travel of the carrier. At about the same time the tab lever is released by the tab latch, the tab lever trigger moves in front of a notch in the tab lever (Fig. 173). The tab lever is then allowed to move forward into the rest position. The tab lever is restored by the action of the springs on the tab lever and the backspace pawl.

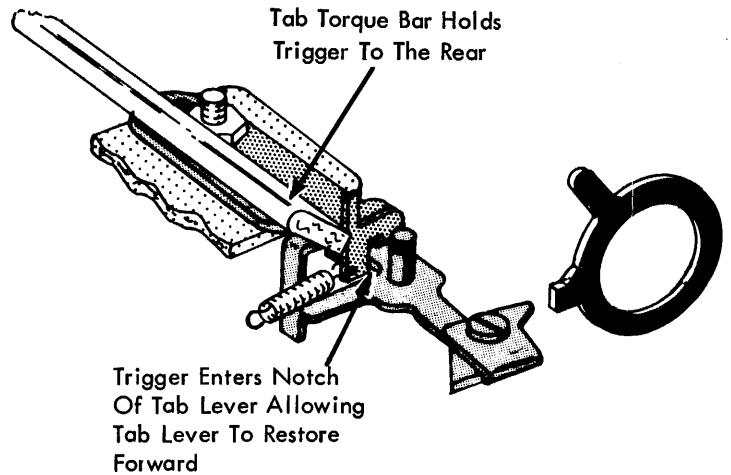


FIGURE 173. Tab Lever Trigger Operation

When the tab lever trigger restores, the tab lever is allowed to reset for the next operation. As the trigger moves out of the notch in the tab lever, the tab lever is snapped to the right by its spring into position to be operated by the trigger. At the same time, the tab lever lug resets to the right in front of the escapement pawl ready for pawl release on the next operation. A forward extension of the tab lever rests against the escapement bracket. A lug at the rear of the tab lever trigger rests against the tab lever to prevent the trigger from resting against the tab torque bar. Improper rest position of the tab lever can cause backspace problems if the backspace pawl is not allowed to mesh deeply enough into its rack. The tab lever will also fail to reset to the right in front of the escapement pawl, if the tab lever rests too far to the rear. The tab mechanism would then be inoperative, because no pawl release could be obtained.

#### Tab Interlock

The tab lever is prevented from latching to the rear during a carriage return operation. If the tab lever were allowed to latch, the tab lever pawl attached to the end of the tab lever would strike the right side of a set tab stop locking the carrier. The tab lever is prevented from latching by restricting the tab latch from rotating into its latching position. A lug at the rear of the tab latch extends down behind the escapement torque bar (Fig. 174). Whenever the escapement torque bar is operated, as during a carrier return, the tab latch is rotated counterclockwise away from the tab lever. Thus, the tab lever cannot latch.

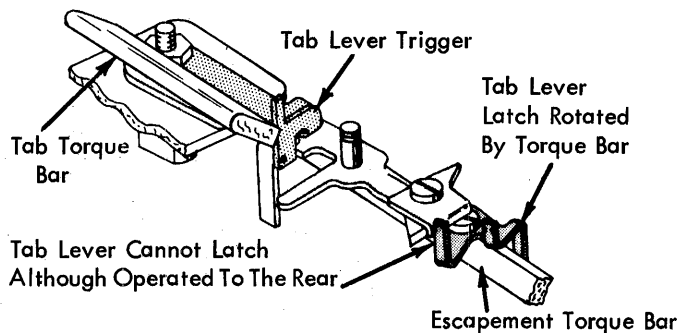


FIGURE 174. Carrier Return Tab Interlock

Tab Contacts

Tab operation may operate three kinds of contacts. These are C-5 (feedback contact), a latch type contact (transmitting contact) which identifies the operation and a tab interlock contact. The first two (C-5, transmitting) were covered under "Operational Selection Unit". The third is a tab-interlock contact that stays made to interlock the machine through the whole tab operation.

Tab-Interlock Contact (Early)

The tab-interlock contact is a microswitch (Fig. 175). It is mounted inside the left side of the power frame by a bracket.

The tab on the left end of the torque bar operates the interlock-contact (Fig. 175).

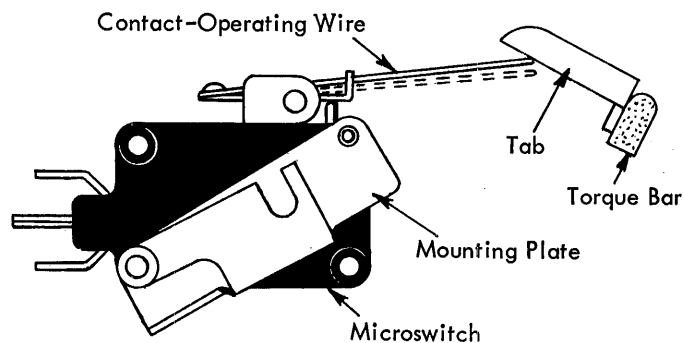


FIGURE 175. Tab-Interlock Contact (Early)

With the torque bar latched, the tab rises allowing the contact to operate under its own spring tension. When the torque bar restores, the tab lowers opening the contact.

Tab Interlock Contact (Late)

The tab interlock contact is a snap action switch. It is mounted in the same place as the old style interlock. The main difference is the manner in which the contact is transferred.

As the tab torque bar is rotated the tab arm (Fig. 176) moves upward pulling upward on the trigger lever. Since the torque bar rotates through an arc the trigger lever will cam off the tab arm. However, the trigger will be in contact with the rear side of the tab arm and will be cammed toward the rear as the torque bar continues to rotate.

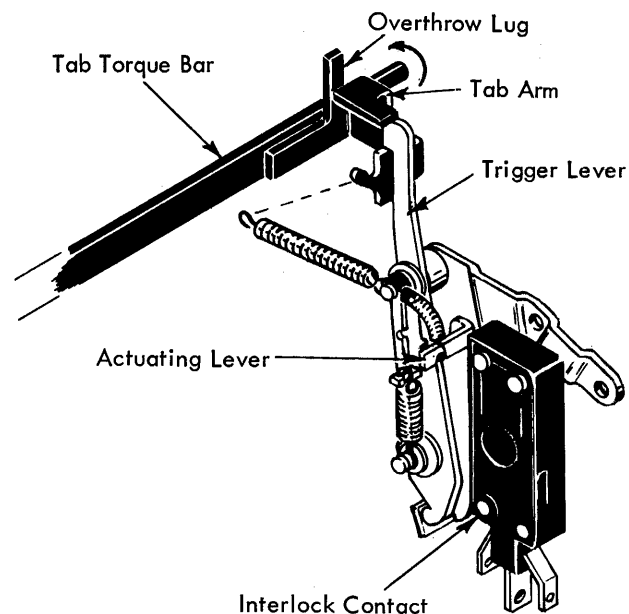


FIGURE 176. Tab Interlock (Late)

The motion from the trigger is transferred through the actuating lever (Fig. 176) to the interlock contact transferring the contact. When the tab lever is unlatched the torque bar restores. As the torque bar restores the trigger lever resets over the tab arm and allows the contact to re-transfer.

The new interlock is considered positive action. Either upward or rearward motion applied to the trigger lever will transfer the contact.

MARGIN CONTROL

The term "margin" denotes the distance between the edge of the paper and the typewritten material. The left and right margins are determined by the position of the margin stops on the margin rack. The carrier travel is restricted by contacting the margin stops.



## Margin Stops

The margin stops are mounted on the margin rack. The rack is positioned horizontally in the machine in front of the carrier. Each margin stop has a slider and pin assembly that meshes with teeth at the rear of the margin rack (Fig. 177). The number of teeth per inch in the margin rack corresponds to the pitch of the machine.

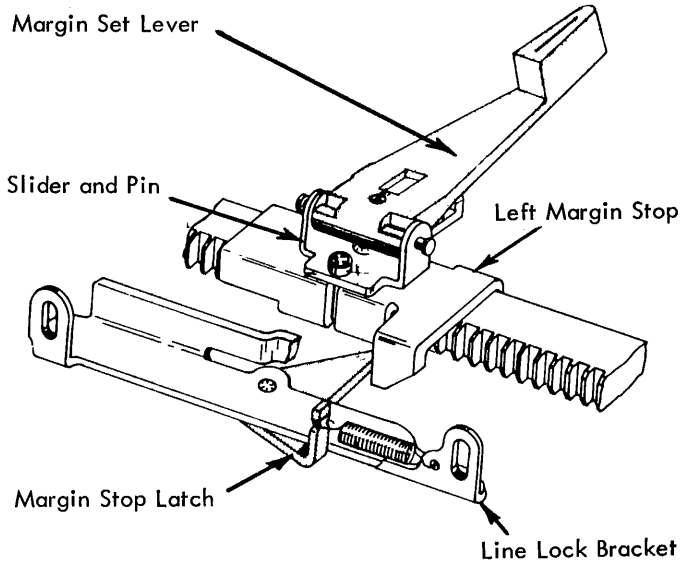


FIGURE 177. Left Margin Mechanism

Each margin stop has a margin set lever attached to the slider and pin assembly. The margin set levers extend through a slot in the front case so as to be accessible to the operator. Either margin stop may be repositioned by pushing the margin set lever to the rear to disengage the pin from the rack and then by sliding the margin stop along the rack to the desired location. A scribe line on the margin set lever acts as a pointer to indicate the position of the margin stop in relation to the scale on the front of the case. A pointer on the front of the carrier indicates the position of the carrier.

The left hand margin stop controls the left margin on the paper. An extension of the stop is struck by the margin stop latch pivoted on a bracket attached to the carrier (Fig. 177). This action forces the margin rack to the left to unlatch the carrier return leaving the carrier resting at the left margin position.

## Line Lock - (Early)

The purpose of the line lock mechanism is to lock the keyboard when the carrier has reached the right hand margin on the paper. With the keyboard locked, the operator cannot inadvertently continue typing at that position.

The line lock mechanism is operated by the right hand margin stop. In addition to operating the line lock, the margin stop also rings a bell several spaces before the line lock action occurs. The bell warns the typist that the carrier is near the margin stop. In most cases this allows sufficient space to complete a word or phrase before the line lock occurs. The typist can then return the carrier to begin the next line.

If the typist continues typing after the bell rings, the keyboard is locked after a few spaces to prevent typing on the margin. The keyboard is locked by forcing a special bellcrank into the selector compensator (Fig. 178). The keyboard lock bellcrank forces the steel balls of the compensator to shift in the tube and block the depression of any other interposer.

The keyboard lock bellcrank is actuated indirectly by an arm welded to the bellringer bail near the left end. A camming surface on the front of the line lock bracket forces the bail to pivot farther forward after ringing the bell (Fig. 179). The arm welded to the bail moves downward forcing down on the keyboard lock interposer. The keyboard lock interposer and the keyboard lock bellcrank pivot on the character interposer fulcrum rod. The keyboard lock interposer and bellcrank are connected at the rear by an extension spring. When the interposer is forced down, the extension spring pulls the bellcrank down into the selector compensator.

Because of the machine's character storage feature and the speed with which the interposers can be depressed, it is not

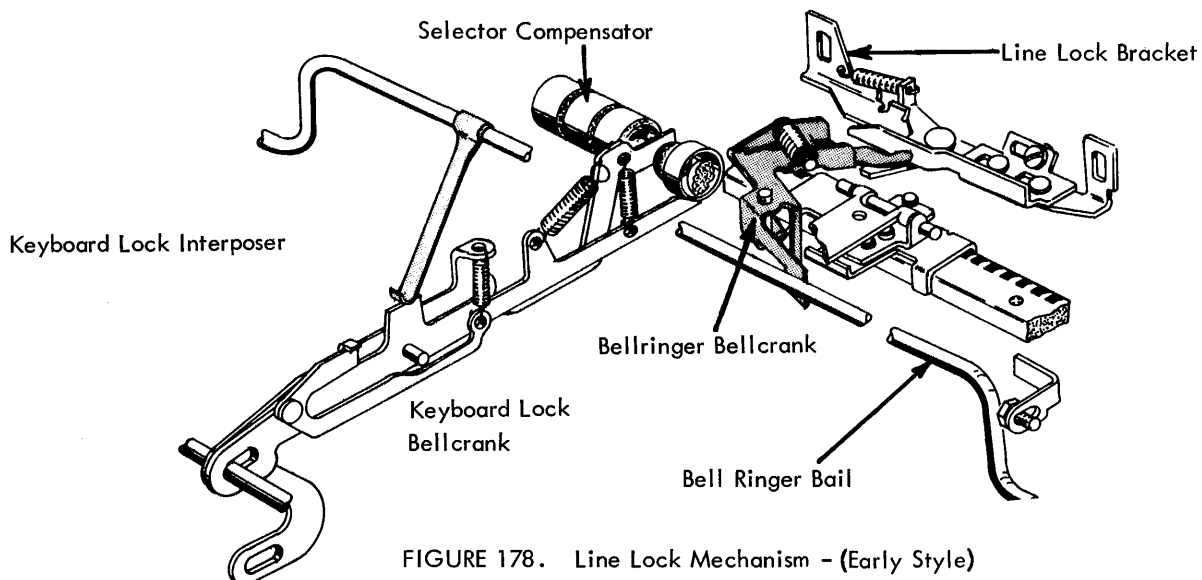


FIGURE 178. Line Lock Mechanism - (Early Style)

always possible for the keyboard lock bellcrank to enter the selector compensator. If a character is in storage when the keyboard lock interposer is pivoted down, the keyboard lock bellcrank stops against the top of the steel balls (Fig. 179). The light spring connecting the interposer to the bellcrank is extended slightly.

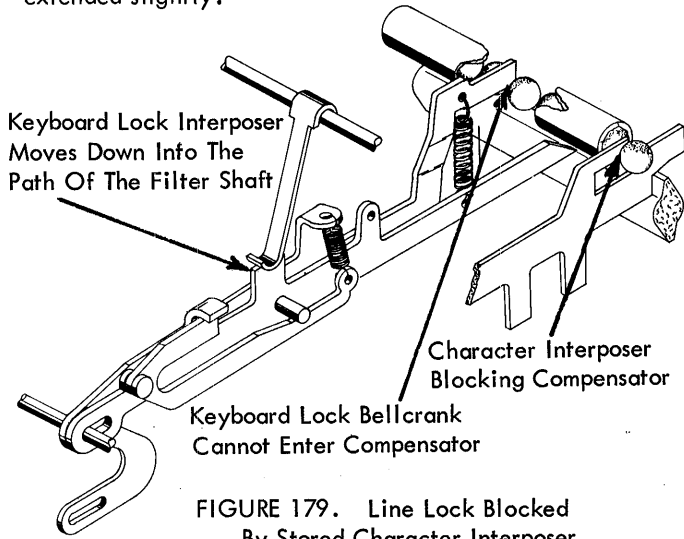


FIGURE 179. Line Lock Blocked By Stored Character Interposer

To be sure that the keyboard is locked before another character can enter storage, the keyboard lock bellcrank is driven into position by the keyboard lock interposer. The interposer contains an elongated pivot hole the same as a character interposer. A stud in the interposer is in position just above a spring-loaded arm on the keyboard lock bellcrank (Fig. 179). The arm is relieved to permit downward movement of the interposer. When the keyboard lock interposer is down, it is positioned in the path of the filter shaft (Fig. 179). As the filter shaft operates the stored character interposer, the keyboard lock interposer is also driven forward (Fig. 180). The stud on the keyboard lock interposer cams the arm of the keyboard lock bellcrank down. The heavy extension spring between the arm and the bellcrank is extended and creates a strong downward pull on the bellcrank (Fig. 180).

The keyboard lock bellcrank is then snapped into the selector compensator at the earliest possible instant. The keyboard is

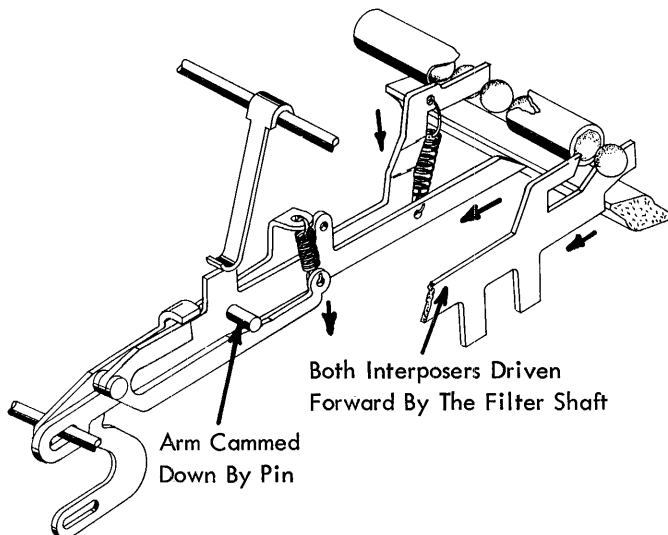


FIGURE 180. Keyboard Lock Interposer Operation

locked with the carrier at the margin stop position of one space later depending upon whether or not a character has been stored at the beginning of the line lock operation.

No type piling will occur as a result of a linelock failure, because the margin stop does not block the movement of the carrier. No operational keys are affected by the line lock. The carrier may be moved through the line lock zone by use of the spacebar, backspace, carrier return, or tabulator. The line lock is usually released by operating the backspace or carrier return or by depressing the margin release keylever. Moving the carrier to the left or right allows all the line lock parts to restore and unlock the keyboard. Depressing the margin release keylever rotates the margin rack to move the bellringer bellcrank out of the path of the line lock bracket. This allows the line lock parts to restore to rest unlocking the interposers.

The keyboard lock interposer is restored up and to the rear by an extension spring the same as a character interposer. The stud on the interposer extends to the left under the keyboard lock bellcrank in position to restore the bellcrank into the rest position.

#### Line Lock - (Late)

On the new style line lock mechanism the keyboard lock interposer and its operation have been eliminated. It has been found that a sufficient amount of spring tension can be placed on the keyboard lock bellcrank, by the operation of the bellringer bail, to snap the bellcrank into the compensator tube at the earliest possible instant. The keyboard may still lock one space late after the carrier reaches the right hand margin because of the character storage feature.

The new line lock consists of two pieces, the keyboard lock lever and the keyboard lock bellcrank (Fig. 181). Similar to the old style, the bellringer bail operates the keyboard lock lever down (as the carrier approaches the right hand margin) causing the keyboard lock bellcrank to be loaded into the selector compensator tube by the tension of the spring between the lever and the bellcrank. The mounting of the bellcrank and lever remains the same as the old style.

Note in Figure 181 that the bellringer bellcrank has been redesigned and is now one piece as compared to the old style in Figure 178. The new style helps to reduce lost motion between the line lock bracket and the bellringer bail. Because of this new style bellringer bellcrank, the entire margin rack must tip each time the carrier is returned through the right hand margin. The rear extension of the bellcrank must ride up and over the camming surface on the line lock bracket causing the margin rack to rotate too. A back-up spring is added to restore the bellringer bail. The bellringer bail has been redesigned to reduce flexing which caused loss of motion at the contact. Lost motion caused a variation in timing.

The line lock bracket assembly has also been redesigned to simplify the margin release operation at the left margin. The mounting hole in the margin stop latch has been elongated. This allows the stop latch to float to the left under its restoring spring tension whenever the margin release is operated while the carrier is against the left hand margin stop. This eliminates the necessity of holding the margin release button depressed until the carrier is moved to the left.

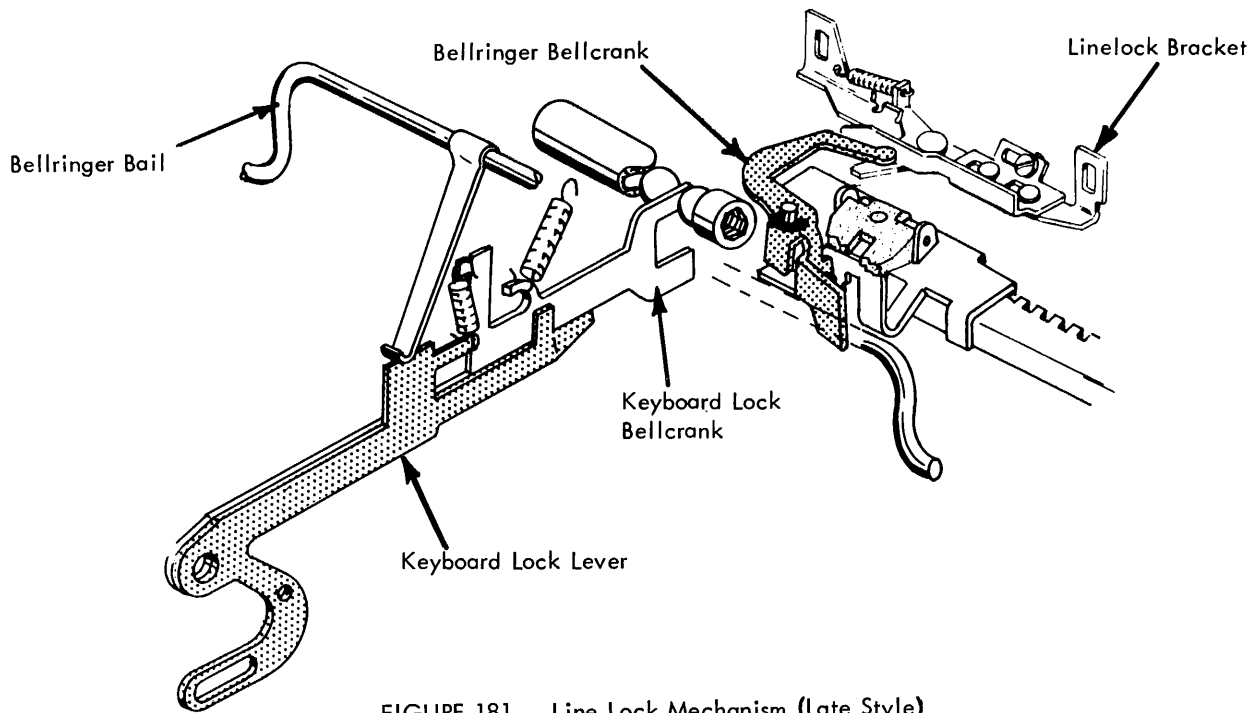


FIGURE 181. Line Lock Mechanism (Late Style)

Bell

The bell is located on the left side of the keyboard section and is rung by the bell clapper attached to a bellcrank above the bell (Fig. 182). The bell clapper bellcrank is operated by the action of the bellringer bail located across the machine just in front of the margin rack. The bellringer bellcrank pivoted on the right margin stop is contacted by the line lock bracket attached to the front of the carrier (Fig. 178). As the carrier moves to the right, the bellcrank pivots causing the bellringer bail to rotate forward. A small lever at the left end of the bail operates the bell clapper into the active position (Fig. 182). Further rotation of the bail causes the bail lever to slip off the bell clapper bellcrank allowing it to restore. An arm of the bellcrank contacts the bell mounting stud causing the bellcrank to stop suddenly. The momentum of the bell clapper causes it to spring over and strike the bell one time. When the bellringer bail is allowed to restore, the bail lever resets above the bell clapper bellcrank ready for the next operation.

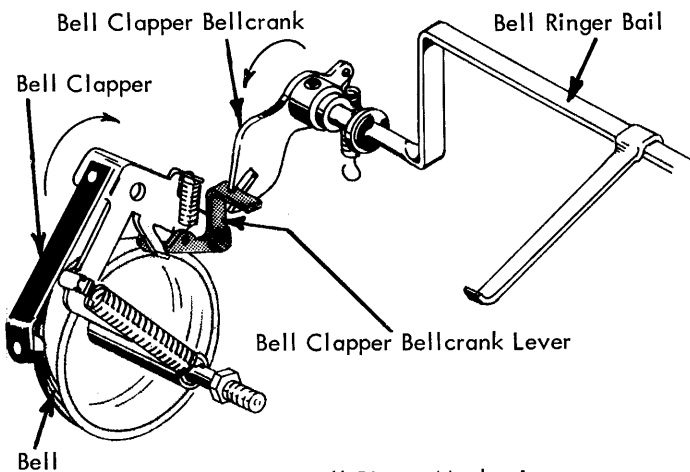


FIGURE 182. Bell Ringer Mechanism

Margin Release

The purpose of the margin release mechanism is to allow typing on either margin of the paper without repositioning the margin stops. The margin release operates by rotating the margin rack so that the margin stops move upward out of the path of the line lock bracket on the carrier.

The margin release keylever pivots at the left side of the keyboard (Fig. 183). A stud at the rear of the keylever operates in a slot in the margin release lever. The margin release lever is attached to the margin rack. Depression of the keylever causes the margin release lever to be raised. This action rotates the margin rack raising the rear of the margin stops. A lug on the left end of the margin rack remains in the path of the carrier return if it is operated with the margin release keylever depressed.

An extension spring from the keylever down to a lug on the keyboard side frame restores the mechanism and holds it in the rest position.

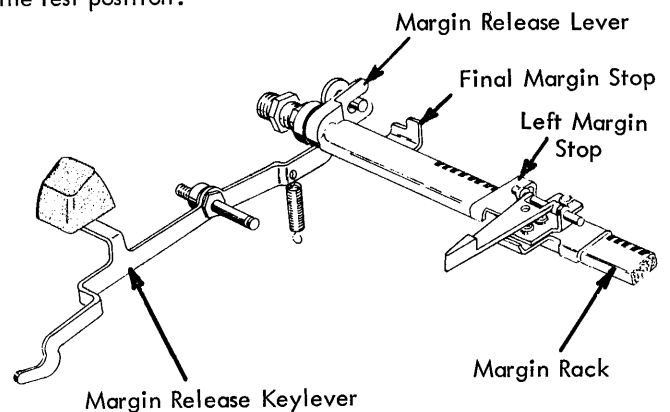


FIGURE 183. Margin Release Mechanism

Last Column Contact - (Early)

This contact is located on the left side of the machine and is transferred by the contact actuating arm attached to the bell-ringer bail (Fig. 184). The bell-ringer bail is located across the machine just in front of the margin rack. The bell-ringer bellcrank pivoted on the right margin stop is contacted by the line-lock bracket attached to the front of the carrier (Fig. 185). As the carrier moves to the right, the bellcrank pivots causing the bell-ringer bail to rotate forward. The contact-actuating arm at the left end of the bail operates the contact.

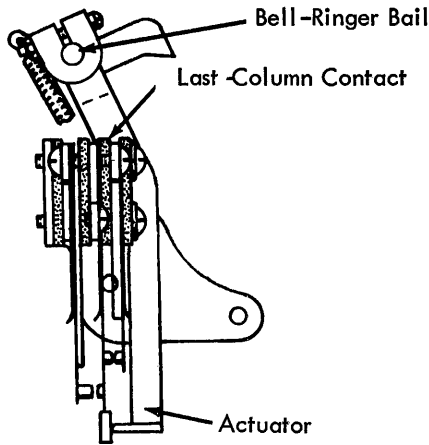


FIGURE 184. Last Column Contact (Early)

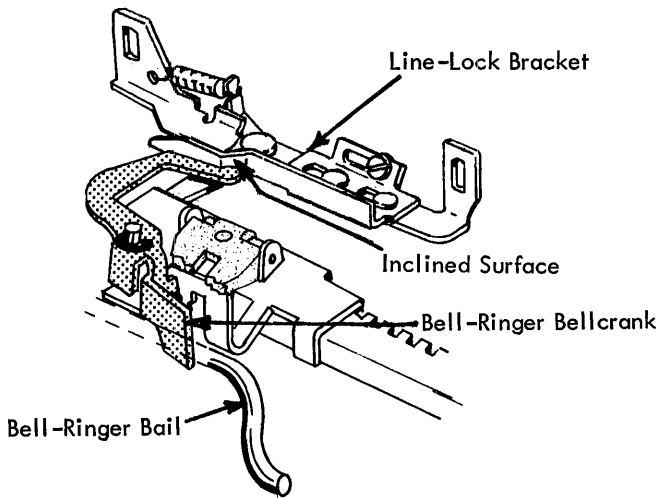


FIGURE 185. Actuating The Last-Column Contact

Last Column Contact - (Late)

This mechanism operates in the same manner as the old style. The major difference is the use of a snap-action switch in place of contacts (Fig. 186).

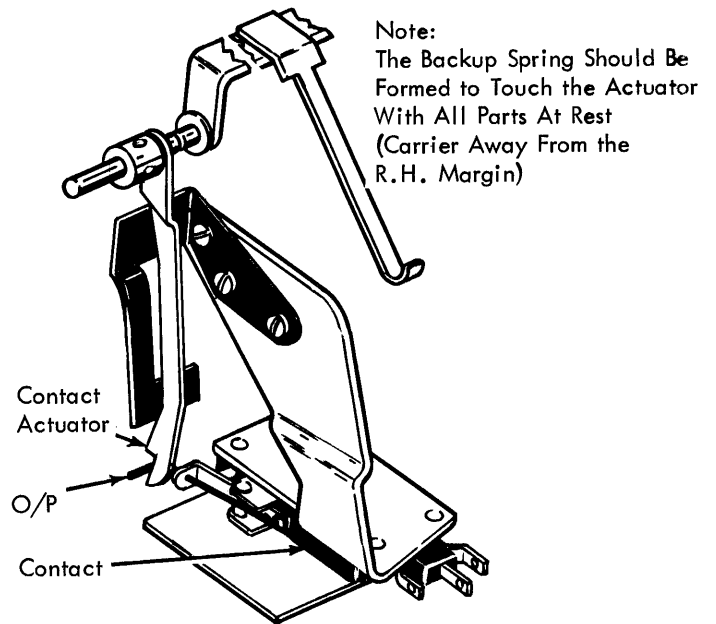


FIGURE 186. Last Column Contact (Late)

PAPER FEED AND RELEASE MECHANISMS

Paper Feed

The purpose of the paper feed mechanism is to control both the horizontal and the vertical positions of the paper in the machine and to feed the paper vertically.

The paper feed operates by pressing the paper tightly against the platen so that it must move as the platen rotates. The paper is held against the platen by a front and rear feed roll assembly located beneath the platen (Fig. 187). Each feed roll assembly contains four rubber rollers equally spaced along the feed roll shaft and molded to the shaft.

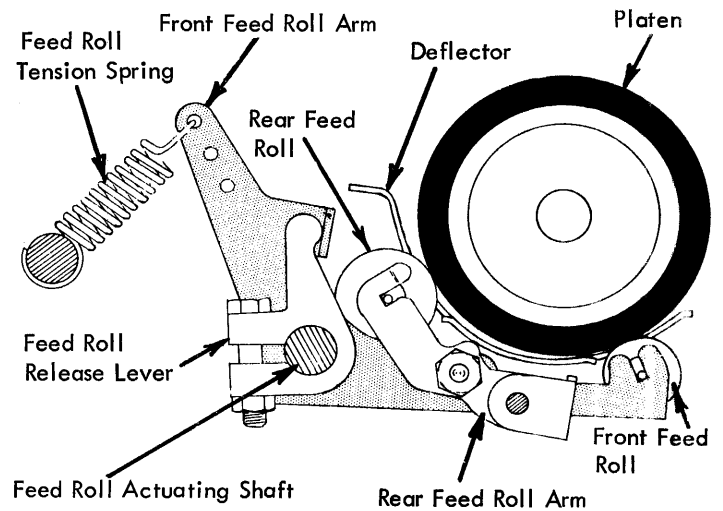


FIGURE 187. Paper Feed Mechanism

The front feed roll shaft rests in notches of the front feed roll arms. The front feed roll arms pivot on the feed roll actuating shaft. A heavy extension spring from each front feed roll arm to the carriage tie rod supplies the pressure of the front feed roll against the platen. Various holes in the feed roll arms provide a means of adjusting the pressure.

The rear feed roll shaft rests in notches of the rear feed roll arms. The rear feed roll arms pivot on studs at the front of the paper feed mounting arms that extend forward from the carriage tie rod (Fig. 189). A shoulder screw at each side connects the rear feed roll arms to the front feed roll arms. Pressure of the rear feed rolls against the platen is supplied by the front feed roll arms.

The paper deflector acts as a chute to guide the paper around the platen (Fig. 187). It is supported beneath the platen by the front and rear feed roll arms. A lug at each end of the deflector fits over a stud on the paper feed mounting arm to maintain the correct position of the deflector.

As the paper is inserted into the machine, an adjustable guide mounted on the case at the rear of the platen serves to position the paper for its left margin position. The paper deflector guides the paper between the rear feed roll and the platen. As the platen is turned, the paper is forced to move with the platen. The deflector guides the paper around the platen into position between the front feed roll and the platen.

As the paper is fed farther, the end of the paper is guided upward by the line gage card holder attached at the rear of the carrier (Fig. 188). The line gage card holder assists in holding the typing material against the platen in the printing area. A scale on each side of the holder assists the typist in reinserting material into the machine to a specific printing point. The marks on the scale indicate the middle of a character space and the horizontal edge on the scale indicates the bottom of the writing line. A single mark in the middle at the top of the card holder indicates the middle of the next character to be typed.

Above the writing line the paper is engaged by two rubber rollers mounted on the paper bail. These rollers hold the paper against the platen above the writing line so as to reduce the possibility of overprinting on the paper. The rollers

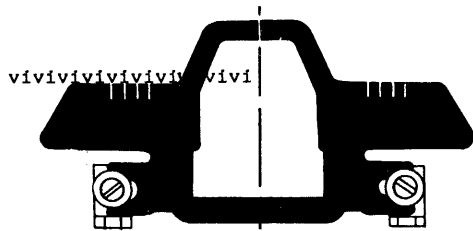


FIGURE 188A. Standard

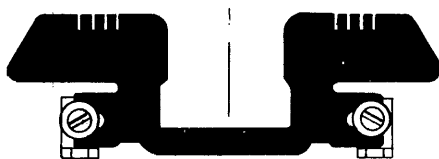


FIGURE 188B. Pin Feed

FIGURE 188. Line Gage Card Holder

also feed the paper vertically after the bottom of the paper has left the front feed roll.

The paper bail is supported by a lever at each end that pivots front to rear on the side of the machine. A hairpin spring operates each bail lever as a toggle to hold the bail rolls either to the rear against the platen or forward in the released position.

The bail rolls are free to rotate around the bail shaft. A spring band inside each bail roll grips the bail shaft to restrict the lateral motion of the bail rolls. The bail rolls may be positioned along the bail shaft by exerting sufficient pressure to overcome the friction of the spring band on the bail shaft.

### Paper Release

The pressure of the front and rear feed rolls is released from the platen to allow the operator to position the paper more accurately and to allow easier insertion and removal of the paper. Paper release is accomplished by pulling forward on the paper release lever located at the right end of the carriage (Fig. 189). The front of the paper release lever cams the top of the feed roll release arm forward to rotate the feed roll actuating shaft.

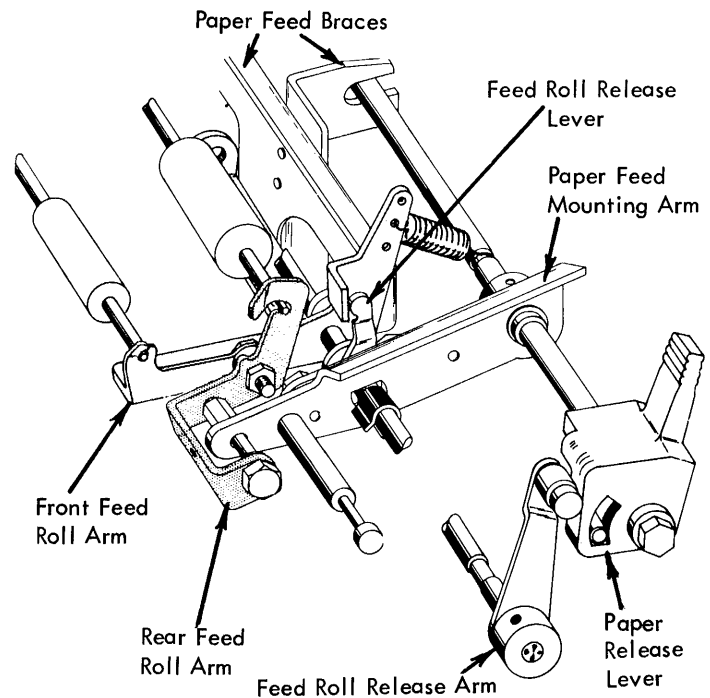
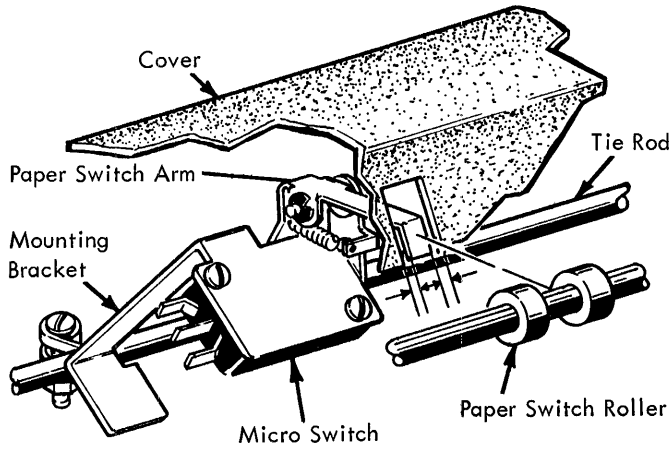


FIGURE 189. Paper Release Mechanism

Two feed roll release levers are clamped to the feed roll actuating shaft and rest behind a lug of each front feed roll arm. As the shaft rotates, the feed roll release levers rotate the front feed roll arms down, away from the platen. The rear feed roll arms are, in turn, forced away from the platen by their connection to the front feed roll arms. When the paper release lever has been pulled all the way forward, the end of the feed roll release arm detents over the point at the front of the paper release lever to hold it in the released position.

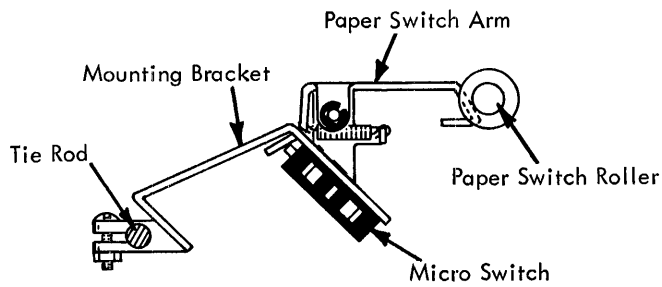
### Paper Switch (835 Printer)

The paper switch is a microswitch used to indicate the presence of paper in the printer. The switch is mounted to the carriage tie rod and is independent of cover removal (Fig. 189.1).



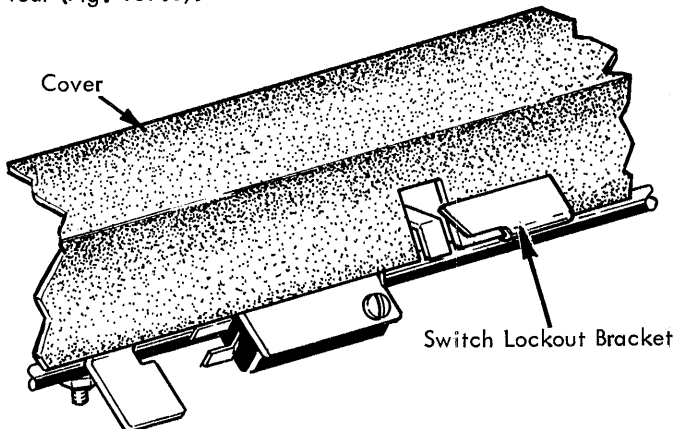
● FIGURE 189.1 Paper Switch Assembly

The paper switch arm extends through the cover and into the slot of the paper switch roller (Fig. 189.2). Insertion of paper in the printer will cause the leading surface of the paper switch arm to rotate to the rear. The rear tab of the arm raises and allows the microswitch to operate. Re-transfer of the microswitch takes place when there is insufficient paper in the printer.



● FIGURE 189.2 Paper Switch Assembly (Side View)

A switch lockout bracket can be used to inhibit the operation of the paper switch by holding the paper switch arm to the rear (Fig. 189.3).



● FIGURE 189.3 Switch Lockout Bracket

## Pin Feed Platen

The pin feed platen allows the use of continuous forms. A pin wheel assembly (Fig. 190) is located at each end of the platen cylinder. A cam in the pin wheel lifts the pins and causes them to project above the hub of the pin wheel. The pins project into a slot in the paper clamp which is attached to the pin wheel. The clamp holds the perforated paper down over the pins and assures that the paper will be pulled up as the platen turns. The pin wheel cam is prevented from turning by the cam anchor rod (Fig. 190). The anchor rod is mounted to the cover just to the rear of the platen.

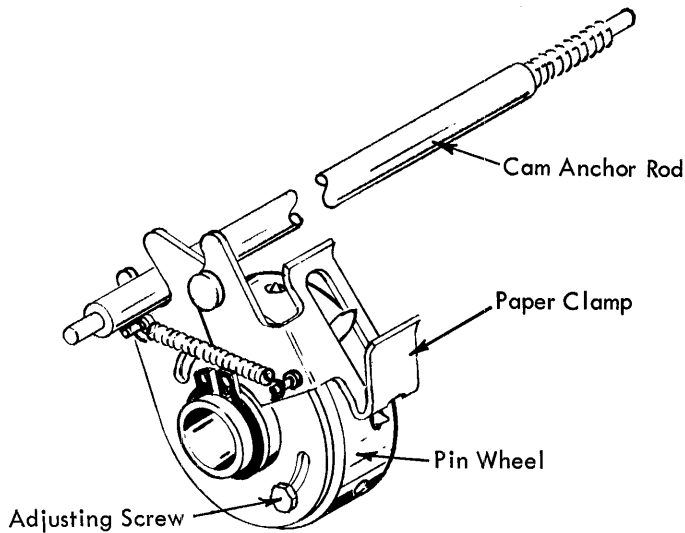


FIGURE 190. Pin Wheel Assembly

Figure 191 shows an inside view of the pin wheel assembly. It should be noted that the cam is held stationary and the pins turn with the platen around the cam.

When a pin feed platen is used the paper release lever should be in the forward or released position. This prevents paper feed interference from the feed rolls.

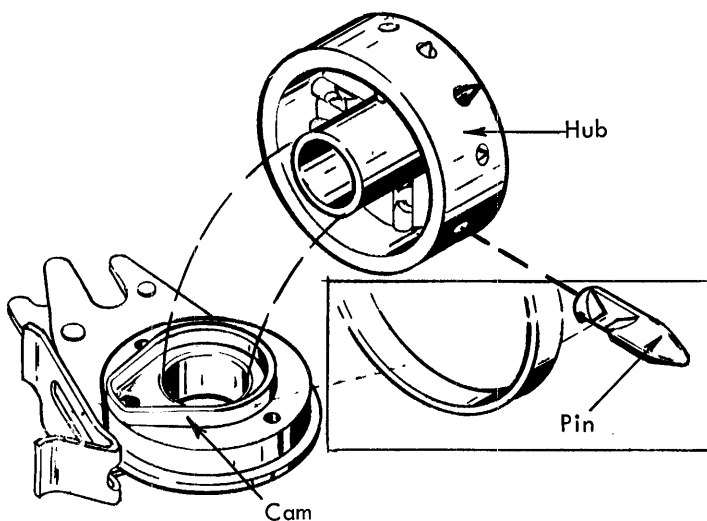


FIGURE 191. Pin Wheel Assembly

## FABRIC RIBBON

The ribbon mechanism is divided into two separate distinct mechanisms. They are the ribbon lift mechanism and the ribbon feed and reverse mechanism. The ribbon lift mechanism raises the ribbon to the printing point before the typehead prints and then lowers it to allow a visible writing line. The feed and reverse mechanism moves the ribbon laterally past the printing point to provide an unused portion for the next typing operation. It also reverses the feeding direction when the end of the ribbon is reached.

The ribbon is a 9/16" fabric ribbon enclosed in a disposable cartridge unit for clean handling. The cartridge unit contains two spools on which the ribbon is wound. The ribbon is constantly fed from one spool to the other and back again until the ink supply has been depleted. Replacing the ribbon is a clean, effortless operation.

Located to the right of the pointer on the carrier assembly is the ribbon load lever (Fig. 192).

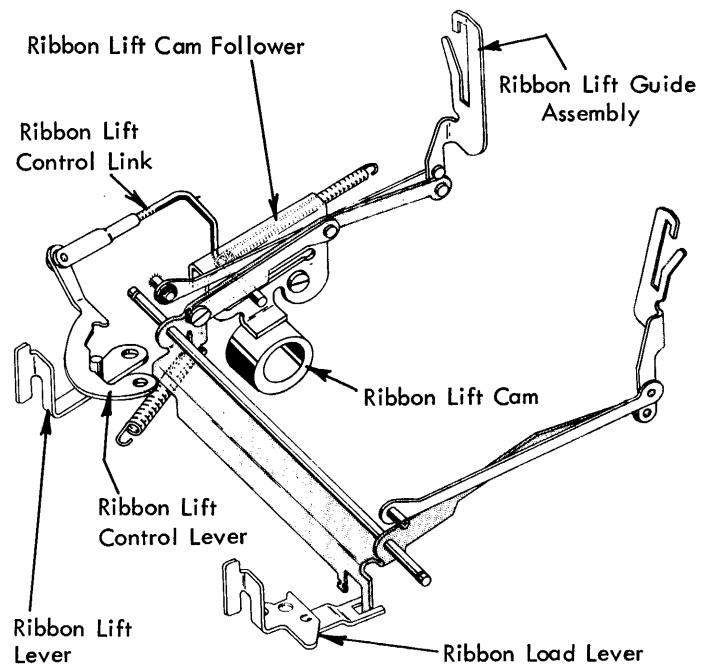


FIGURE 192. Ribbon Lift Mechanism

When pushed to the right, the load lever forces the ribbon lift guide into an extreme lift position for accessibility. The ribbon load lever is detented to hold the ribbon lift guide in the high lift position. The cartridge can be removed from the ribbon feed plate by simply lifting it off. The ribbon can then be easily removed from the guide without touching the ribbon.

Installing a new ribbon is just the reverse of the above. With the ribbon lift guide still in the extreme lift position, the ribbon can be inserted into the guide and the cartridge snapped into place all in one motion. Tapered lugs on the sides of the ribbon feed ratchet cores automatically guide the ribbon spools into the correct position. Guide lugs at each side of the feed plate maintain the lateral position of the cartridge. Retainer springs attached to the guide lugs

hold the cartridge down to prevent vibration. After the ribbon is installed, the load lever is moved back to the left to allow the ribbon lift guide to restore to its normal position ready for a typing operation.

### Ribbon Lift

The ribbon lift mechanism consists of a cam, cam follower, control mechanism, and the ribbon lift guide assembly (Fig. 192).

The mechanism is mounted to the carrier assembly and is transported by the carrier along with the typehead. The ribbon lift cam is a single lobed cam set-screwed to the left end of the print sleeve. The cam has a punch mark on the right side that must line up with the print sleeve key-away to insure that the cam is not out of time with the print operation. Care must be taken if the cam is replaced, to insure that it is not installed in a reversed position.

The cam makes one complete revolution each time a cycle operation occurs. The ribbon lift cam follower pivots on the carrier casting above and to the rear of the cam (Fig. 192). Each operation of the cam raises the cam follower. The cam follower contains a long slot. In the slot is the end of the ribbon lift control link. The ribbon lift guide assembly rests directly above the control link. As the cam follower is raised, the control link forces up on the ribbon lift guide assembly. The guide assembly pivots on the carrier casting at the front causing the ribbon to be raised at the rear. A flat link from each side of the ribbon lift guide attaches to two pins at the front of the carrier to maintain the ribbon lift guide in a vertical position.

The height to which the ribbon will be raised is determined by the position of the ribbon lift control link in the slot of the cam follower. When the link is in the extreme rear of the slot, very little motion is obtained from the cam follower; consequently, the ribbon lift guide is not raised at all. This is called the stencil position. It is so called because the ribbon is not used in typing stencils.

As the ribbon lift control link is moved toward the front in the slot, more and more motion is obtained from the cam follower. The link is also moved nearer the pivot point of the ribbon lift guide assembly so that the motion obtained from the follower is more effective in raising the ribbon. The nearer the front the link is moved, the higher the ribbon will be raised.

In addition to the stencil position there are three ribbon lift positions which may be selected by the operator. The ribbon lift control link is attached to the ribbon lift control lever pivoted under the front of the carrier casting (Fig. 192). The control lever is spring-loaded to the rear against a stud on the ribbon lift lever. The ribbon lift lever has a button located just to the left of the carrier pointer. Moving the button to the left causes the stud on the lever to force the ribbon lift control lever and link toward the front. The stud of the ribbon lift lever seats into notches in the control lever to maintain its position until changed by the operator.

The extreme right hand position of the button is the stencil position where no ribbon lift is available. The next position to the left is the low lift position used for typing on the top

half of the ribbon. The third position allows typing in the middle of a single colored ribbon to get maximum life from the ribbon. The extreme left position of the button is the high lift position and is used for typing on the bottom half of the ribbon.

The ribbon lift guide assembly is spring loaded into the rest position to insure that it will restore rapidly and to prevent overthrow of the ribbon due to the momentum of the lift mechanism.

### Ribbon Feed and Reverse

#### 1. Ribbon Feed

The ribbon feed and reverse mechanism is a compact unit mounted at the top of the carrier just in front of the typehead. The mechanism is detachable as a unit for repair or replacement purposes.

Each ribbon spool of the ribbon cartridge unit fits over the core of a nylon ribbon feed ratchet (Fig. 193). Rotation of a ratchet causes the spool to turn and wind up the ribbon. The ratchets are operated by a pawl that moves front to rear between them to force the ratchet teeth to the rear.

The position of the feed pawl determines which ratchet is fed as the pawl moves to the rear. The feed pawl pivots on a pin beneath the ribbon feed plate and extends up through a hole in the plate. The mounting of the pawl permits left to right as well as front to rear movement. An extension spring attached to the pawl restores the pawl to the rest position each time it operates (Fig. 193). The spring also holds the pawl left or right into engagement with the correct ribbon feed ratchet depending upon the direction of pull of the spring. The forward end of the spring is attached to a lever called the ribbon feed detent lever. The detent lever pivots on the ribbon feed plate.

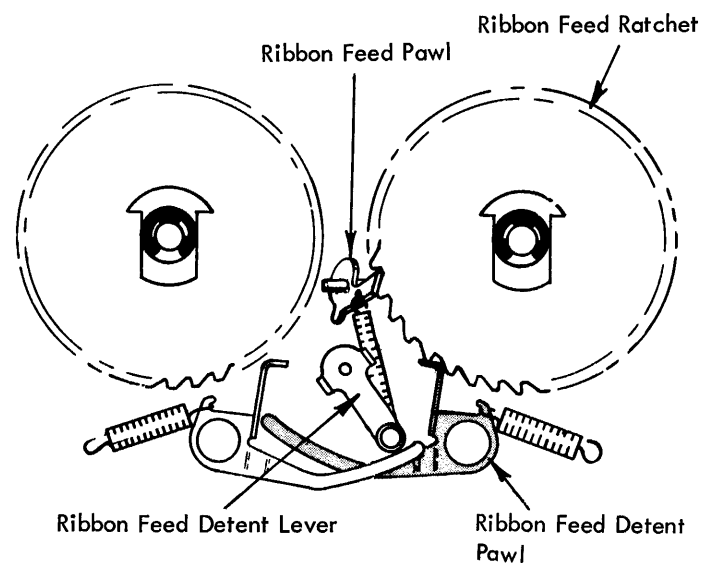


FIGURE 193. Ribbon Feed Mechanism - Top View



When the lever is moved to the right, the feed pawl is pivoted into engagement with the right hand feed ratchet (Fig. 193). When the detent lever is moved to the left, the feed pawl engages to feed the left hand ratchet.

The ribbon feed pawl is powered to the rear by the action of the ribbon feed cam located directly in the middle of the print sleeve. The cam is keyed to the sleeve and rotates one complete revolution on each operation. A sliding cam follower transfers the motion of the cam to the ribbon feed bellcrank which actuates the feed pawl to the rear (Fig. 194). Sufficient motion is available from the cam to cause a two teeth feed of the ratchet. The timing of the ribbon feed cam causes the ribbon feed action to occur early in the cycle operation. At the time the typehead prints, the ribbon has completed its feeding operation except for the restoring of the feed pawl. Care must be taken in replacing the feed cam to insure that it is not installed in a reverse position. A V-shaped notch in the large part of the cam must be toward the right. Reversing the cam will change the timing of the ribbon feed.

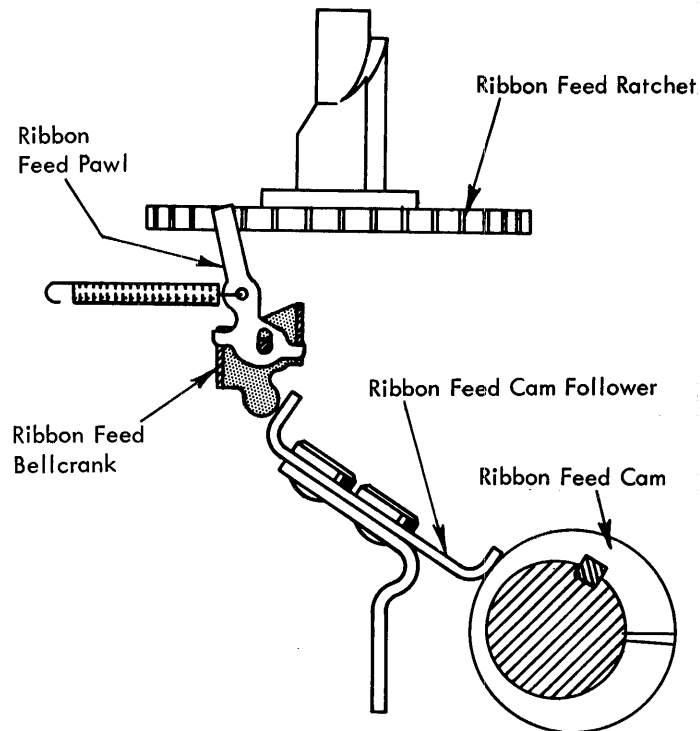


FIGURE 194. Ribbon Feed Mechanism - Side View

As the feed pawl restores to the front, it slides along the teeth of the ratchet into the rest position. The drag of the pawl along the teeth tends to rotate the ratchet backward and unwind the ribbon. To prevent any backward rotation, a detent pawl is spring-loaded into the teeth of the ratchet to allow feed in one direction only (Fig. 193).

In order for the ribbon to wind onto one spool it must be unwound from the other spool. Each ratchet has a detent pawl to prevent rotation in the unwinding direction. The detent pawl must be disengaged from the supply side in order for ribbon feed to occur. Each detent pawl has a long curved extension resting against a roller on the ribbon feed detent lever (Fig. 193). When one detent pawl is engaged with its ratchet, the other is disengaged depending upon the position of the ribbon feed detent lever.

Two flat springs are mounted to the ribbon feed plate at the rear so that they rest against the ribbon feed ratchets. The slight drag applied by the springs prevents the jerk of the ribbon feed operation from spinning the supply spool and spilling off excessive ribbon.

## 2. Ribbon Reverse

The ribbon is fed from one spool to the other until the supply spool is emptied. The ribbon feed pawl must then be moved to the ratchet of the empty spool to begin feeding the ribbon in the opposite direction. To achieve a ribbon reversing operation, it is merely necessary to move the ribbon feed detent lever from one position to another. The ribbon feed pawl spring then pulls the pawl into the reversed position. The reversing operation is the same for both sides except that the direction of parts movement is opposite.

The reversing operation requires a sensing mechanism to determine when the reverse is to take place and a means of powering the detent lever from one position to the other. Each ribbon feed ratchet core contains a small bellcrank called the ribbon reverse trigger (Fig. 195). As long as there is ribbon around the spool, the ribbon holds the reverse trigger into the core in the inactive position. When the ribbon spool is emptied, a hairpin spring forces the reverse trigger out of the core through a slot in the ribbon spool. A portion of the reverse trigger pivots down through a hole in the ratchet into position below the ratchet.

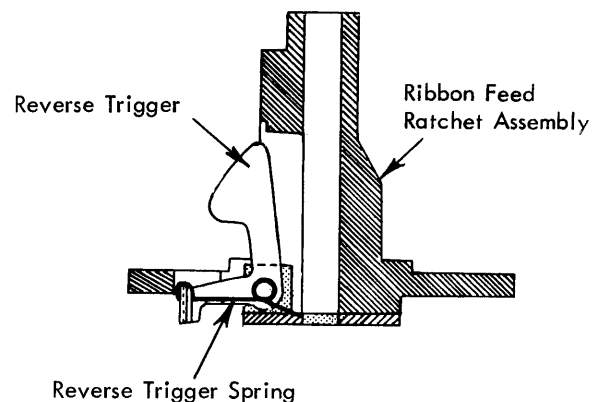


FIGURE 195. Ribbon Reverse Trigger

The empty spool rotates slightly farther causing the reverse trigger to contact and actuate the reverse lever which pivots just below the ratchet (Fig. 196). The reverse lever is connected, by means of a flat link, to an arm of the reverse yoke beneath the ribbon feed plate. The yoke is pivoted by operation of the reverse lever. A stud on the yoke at the rear of the pivot point extends up through the feed plate into a slot in the reverse interposer. Movement of the yoke positions the front of the reverse interposer left or right depending upon which ribbon spool is being emptied (Fig. 197).

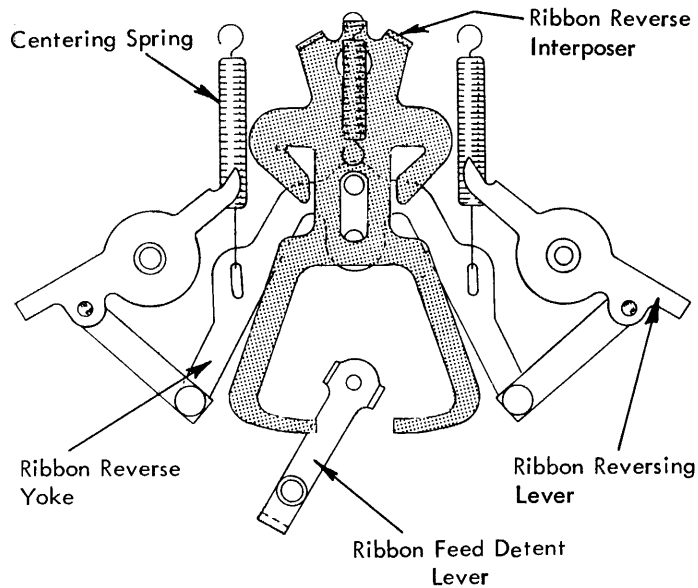


FIGURE 196. Ribbon Reverse Mechanism - Rest Position

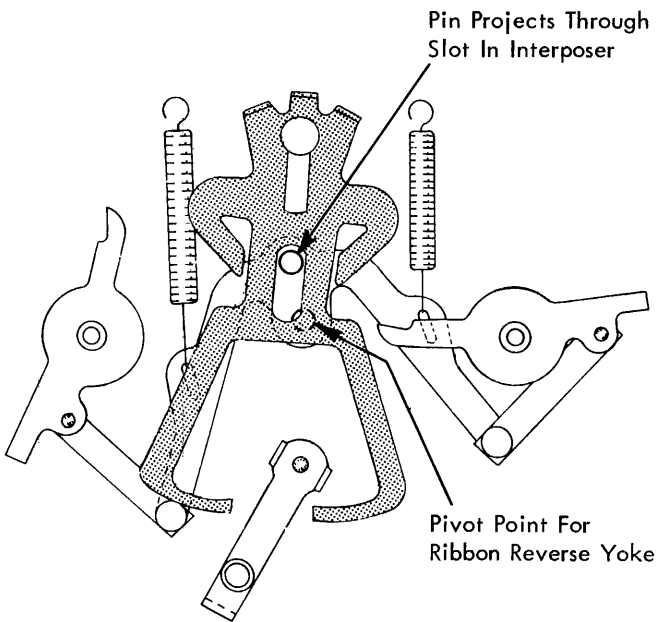


FIGURE 197. Ribbon Reverse Mechanism - Active Position

Positioning the reverse interposer does two things. A hook at the front of the interposer hooks around a lug on the ribbon feed detent lever (Fig. 198). The interposer lever, mounted on the interposer, is positioned into the path of the ribbon

feed pawl. The next operation of the ribbon feed cam causes the feed pawl to drive the reverse interposer to the rear. The hook at the front of the interposer pulls the lug of the detent lever to the rear causing the detent lever to pivot to the opposite position. Movement of the detent lever disengages the detent pawl at the full spool and allows the pawl to engage the ratchet at the empty spool. As the feed pawl restores, its spring pivots it over into engagement with the opposite ratchet.

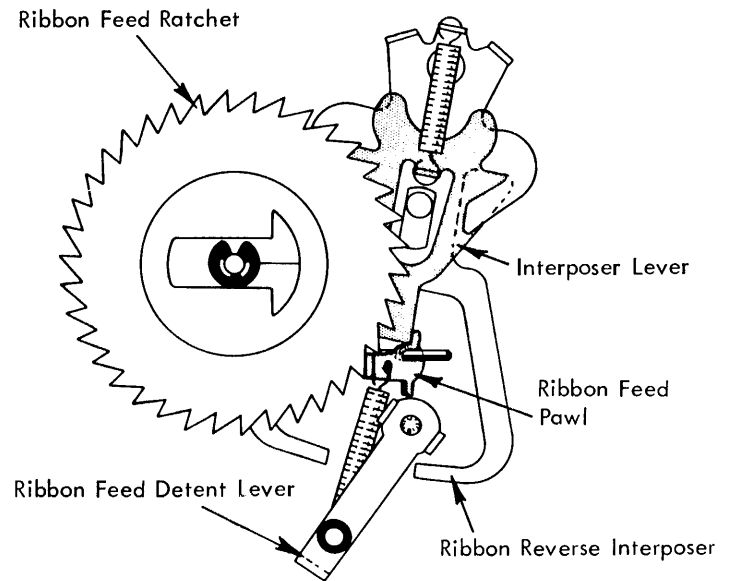


FIGURE 198. Ribbon Reverse Interposer And Lever

The purpose of the interposer lever is to prevent the motion of the ribbon reverse interposer from being choked off during a reversing operation by the ribbon feed pawl, if the feed pawl should become trapped between the ribbon feed ratchet and the interposer lever.

#### Stencil Lockout

When the ribbon lift lever is placed in its no lift or stencil position, a latch called the ribbon feed latch is allowed to interrupt and hold the ribbon feed cam follower from following the ribbon feed cam back to its low point (Fig. 199). This causes the ribbon feed cam follower to become crippled thereby locking out the ribbon feed operation. The ribbon feed latch mounts on a stud on the ribbon feed follower mounting bracket and is spring loaded into its active position by a small hairpin spring. The ribbon lift lever controls the position of the latch. When it is pushed to the right into the stencil position, it allows the latch to rotate against the top surface of a lug on the cam follower. As the follower is operated forward by the feed cam, the latch hooks behind the lug on the follower and prevents the follower from following the cam back to its low point. This cripples the feed operation because the cam follower no longer receives enough motion to operate the ribbon feed pawl effectively. Pushing the ribbon lift lever to the left (out of the stencil position) cams the latch into its inactive position, thereby releasing the follower so that it can be operated by the feed cam.

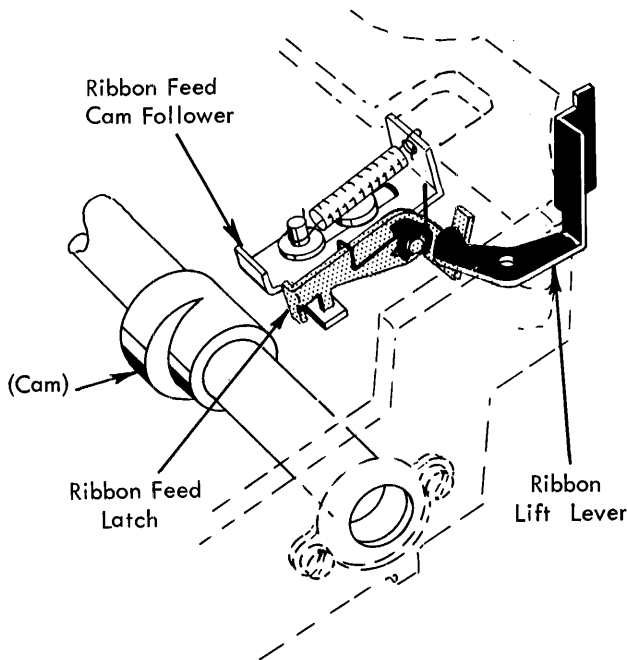


FIGURE 199. Stencil Lockout Mechanism

### RED RIBBON SHIFT

A two-color ribbon is available for the printer. The upper half of the ribbon is black and the lower half is red. The ribbon-lift lever can be set to print either red or black. The red ribbon-shift mechanism provides a magnet-controlled method for changing color. Attached to the ribbon-lift cam follower is the cam-follower latch (Fig. 200). The cam-follower latch is spring-loaded to the rear of the machine. Riding in the slot in the cam-follower latch is a stud located on the ribbon-lift-arm assembly. This assembly is attached to the ribbon-guide assembly.

With the cam-follower latch toward the rear, the stud on the ribbon-lift-arm assembly rides in the vertical slot in the cam-follower latch. When the ribbon-lift cam pushes the cam follower up, the vertical slot in the latch prevents the stud on the arm assembly from being pushed up. Therefore the ribbon lifts only to the black portion, as in a normal ribbon lift. Note that the manual ribbon-lift lever must be set to print black.

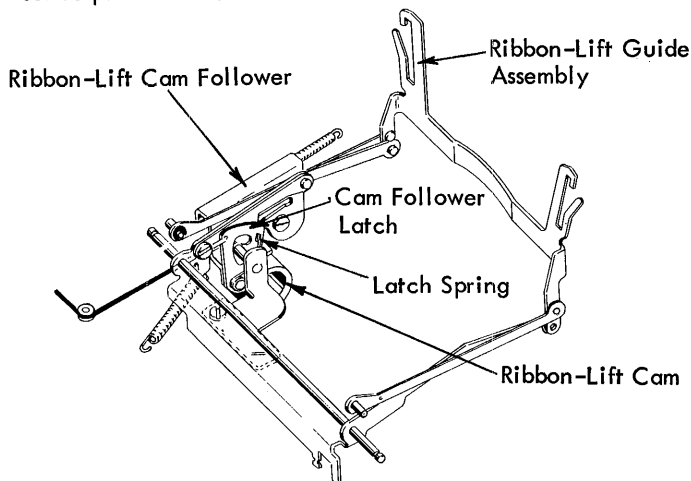


FIGURE 200. Red-Ribbon-Shift Mechanism

Energizing the red-shift magnet pulls the cam follower latch forward so that when the cam follower is pushed up, the slot in the cam-follower latch pulls the ribbon-lift-arm assembly up. This pulls up the ribbon-guide assembly causing more ribbon-lift motion. This places the red portion of the ribbon in front of the typehead.

### Shift-Magnet Assembly

The magnet assembly pulls the cam-follower latch toward the front of the machine and holds it there as long as the printing is to be done in red. To print in black, the cam-follower latch must be free to be spring-returned to the rear.

Because the cam-follower latch is on the carrier, the control for the latch must be movable. This is done by looping a tape (similar to the rotate and tilt tapes) around pulleys. One end of the tape is attached to the right side of the carrier. From there the tape goes around a pulley on the right-hand power frame, back across to a pulley on the left-hand power frame, down to a pulley on the end of the red-magnet armature, up to another pulley on the left-hand power frame, to a pulley on the carrier, and is attached to the cam-follower latch. The loop of tape allows the carrier to move without changing the pull on the cam-follower latch.

To operate the latch forward, the red-magnet armature is pulled down (Fig. 201) which pulls on the tape to pull on the latch. To shift back to black, the red-magnet armature goes back up. The spring on the cam-follower latch pulls the latch toward the rear, taking up the slack in the tape.

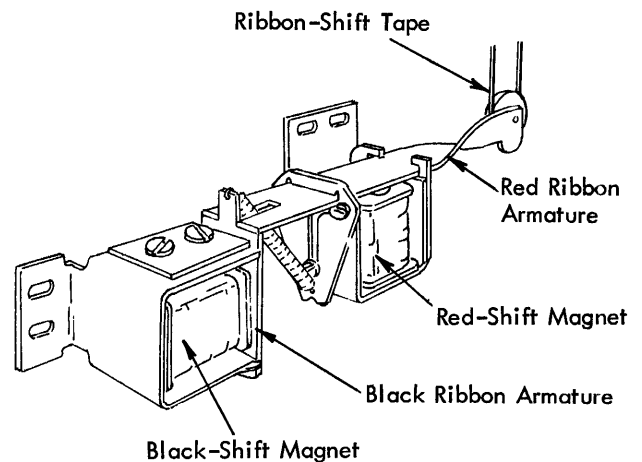


FIGURE 201. Shift-Magnet Assembly

When the two magnet assembly is used on a pulse to the red magnet it causes the rear of the red ribbon armature to move up (Fig. 201). This motion allows the black ribbon armature to snap forward latching the mechanism in red ribbon position. It is then necessary to pulse the black magnet to unlatch the red ribbon armature.

When a one magnet ribbon shift assembly is used a pulse must be maintained on the magnet for the duration of red printing. This is due to the absence of any latching mechanism.

## FABRIC RIBBON MECHANISM (LATE STYLE)

The design and operation of the new style fabric ribbon mechanism is basically the same as the earlier level mechanism except for the areas of feed and reverse. Therefore, only these areas will be covered in this section.

### Ribbon Feed

The motion for a feed operation is provided by a cam on the print sleeve called the ribbon feed and detent cam. As the cam rotates during a print cycle, it causes a cam follower called the ribbon feed lever to pivot in the counterclockwise direction about its mounting stud (Fig. 202). The ribbon feed lever is C-clipped to its mounting stud which is located on a heavy vertical support riveted to the underside of the ribbon feed plate. An extension spring fastened to the feed lever and anchored to the support loads the lever in a clockwise direction, causing the lower lug to ride against the cam throughout a feed operation (Fig. 202). The reason for the upper lug will be explained in the reverse operation.

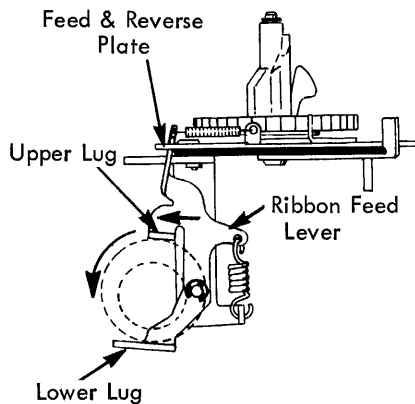


FIGURE 202 Ribbon Feed Lever (Beginning of Feed Operation)

As the ribbon feed lever is rotated in the counterclockwise direction by the cam, its upper extension, which projects through a window in the feed and reversing plate, slides the plate toward the rear (Fig. 202). The feed and reverse plate is mounted on the top side of the ribbon feed plate in a manner that permits it to slide back and forth with each revolution of the cam. A shouldered rivet anchored to the feed plate passes through an elongated slot in the feed and reverse plate (Fig. 203). This rivet acts as a guide for the rear of the plate as it operates back and forth. The front of the plate is secured and guided by a recessed pin that is riveted to a part of the reversing mechanism called the "ratchet detent lever" (Fig. 203).

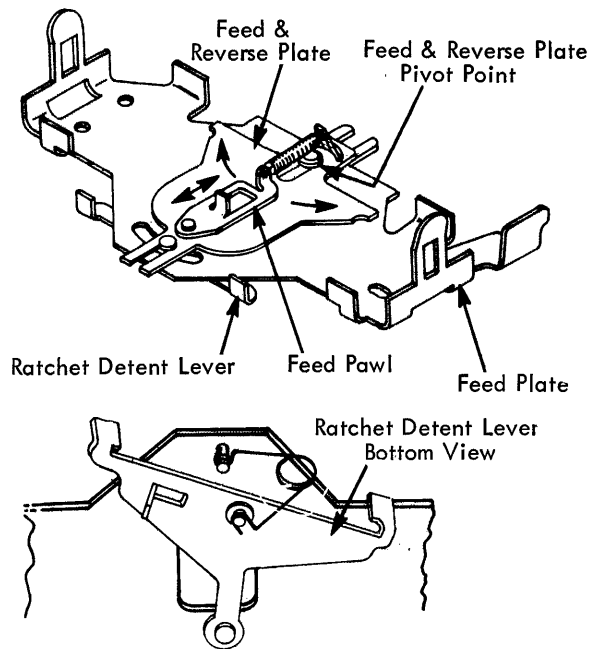


FIGURE 203 Ribbon Feed & Reverse Plate Mounting

The back and forth movement of the feed and reverse plate is transmitted to the ratchet teeth of a ribbon feed ratchet by a feed pawl. This pawl is attached to the feed and reverse plate by a shouldered rivet. An extension spring anchored to the vertical lug of the ribbon feed lever loads the feed pawl into engagement with the ratchet teeth (Fig. 204). Each time the feed cam makes one revolution, the feed pawl will drive the ribbon feed ratchet approximately 2-1/2 teeth. The timing of the cam causes the ribbon feed action to occur early in the print cycle. At the time the typehead prints, the ribbon has completed its feeding operation except for the restoring of the feed pawl. As the feed pawl restores to the front, it slides along the teeth into its rest position. The drag of the pawl over the ratchet teeth tends to rotate the ribbon feed ratchet backwards, thus, unwinding the ribbon. To prevent this from occurring a lug on the ratchet detent lever is spring-loaded into the ratchet teeth (Fig. 204). This lug acts as a check pawl.

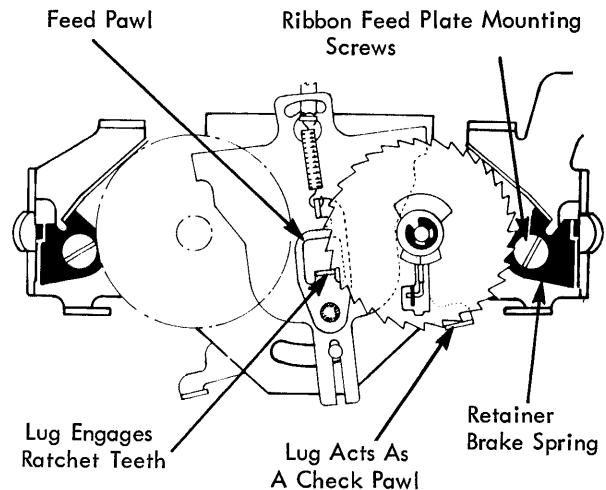


FIGURE 204 Feed Pawl & Ratchet Checking

Since feed is not a smooth operation but occurs in a series of jerks, the ribbon spool that is acting as a supply spool would tend to over-spin or "spool off" between feed operations unless a drag or braking action were placed upon it. This necessary drag is provided by placing a leaf-type spring against the ratchet teeth of the ribbon feed ratchet (Fig. 204). This leaf is an extension of the retainer/brake spring which also functions as a clamping device for the ribbon cartridge. Both retainer/brake springs are held in place on top of the ribbon feed plate by the same screws that mount the feed plate to the carrier (Fig. 204).

### Ribbon Reverse

The ribbon is fed from the supply spool onto the take-up spool until the supply spool becomes empty (Fig. 205). At this time, the process must be reversed; that is, the "empty" supply spool becomes the take-up spool and the "full" take-up spool becomes the supply spool. To achieve this reversing process, it is merely necessary to shift the ribbon feed pawl to the ribbon feed ratchet that contains the empty spool. Since the feed pawl is riveted to the feed and reverse plate, the reversing operation is accomplished by shifting the front of the feed and reverse plate to either the left or right depending on which spool is empty (Fig. 206).

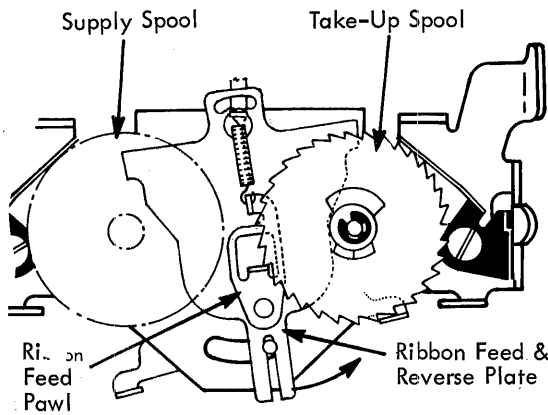


FIGURE 205 Right Hand Ratchet Driver

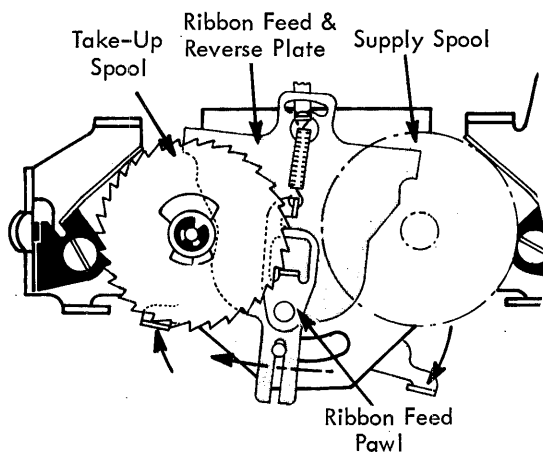


FIGURE 206 Ribbon Feed Pawl Transferred To L.H. Ratchet

A small bellcrank mounted in the core of each ribbon feed ratchet acts as a sensing device to determine when the reversing operation is to take place. As long as there is ribbon wrapped around the core of the supply spool, the ribbon will hold this bellcrank called the reverse trigger in its inactive position. Once the last loop of ribbon is pulled off the supply spool core, a spring finger causes the reverse trigger to pivot out of the core. This action causes the lower portion of the trigger to protrude below the bottom surface of the ribbon feed ratchet (Fig. 207). The reverse trigger actually drops down and rides on the top surface of the ribbon feed plate.

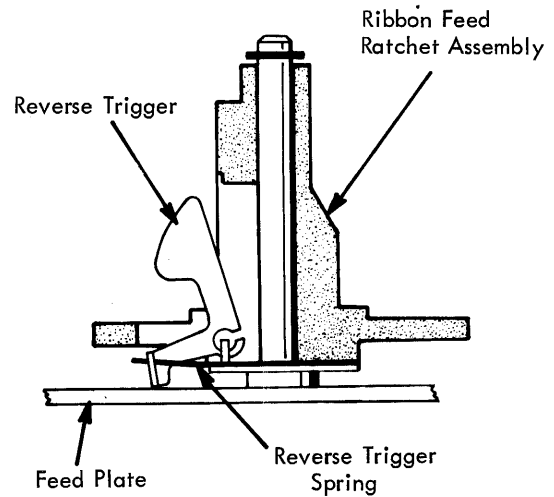


FIGURE 207 Reverse Trigger (Activated)

As the ribbon continues to feed, the almost empty spool rotates slightly further. This causes the lower extension of the reverse trigger to swing into the path of a notch in the feed and reverse plate as the plate is operating back and forth during the feed operation. On the forward or restoring stroke of the plate, the reverse trigger restricts one side of the plate from sliding forward (Fig. 208). The other side continues to slide forward, thereby causing a pivoting action to the entire plate about the point of restriction. This makes the front of the plate swing towards the opposite side, positioning the feed pawl in line with the ratchet teeth of the ribbon feed ratchet containing the empty ribbon spool.

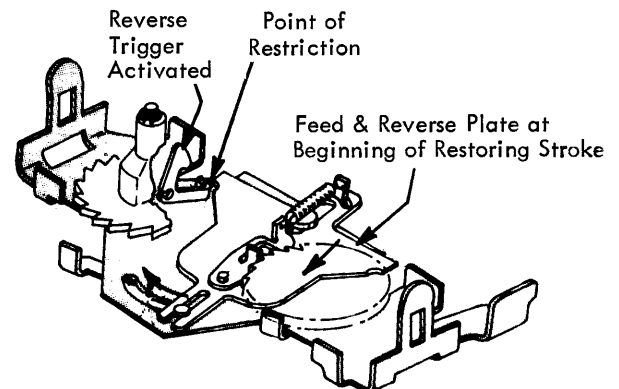


FIGURE 208 Reverse Action

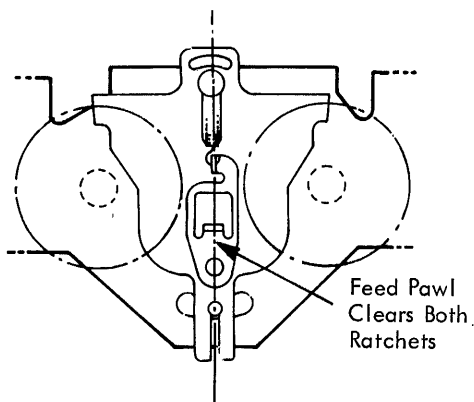
On the next feed stroke, the feed pawl will engage the ratchet teeth of the empty spool, causing it to begin to take on ribbon. Thus, the reversing operation is accomplished.

When you read the explanation of ribbon feed, you found that it was necessary to restrict the ribbon feed ratchet from being dragged backwards by the feed pawl during the restoring portion of a feed cycle. This is accomplished by a ratchet detent lever that is spring loaded into engagement with the teeth of whichever ribbon feed ratchet is operating as the "take up" spool. Since the reversing action makes the "full" take up spool become the supply spool and the "empty" supply spool become the take up spool, it is necessary to disengage the ratchet detent lever from one feed ratchet and engage it with the other. This is done in step with the reversing operation. As the front of the feed and reverse plate swings, causing the feed pawl to engage with the opposite feed ratchet, it pivots the ratchet detent lever to the opposite spool. A stud riveted to the lever protrudes up through a slot in the feed and reversing plate linking the two together. A hairpin spring fastened to this stud and anchored to the feed plate provides a toggling action to both the feed and reverse plate and the ratchet detent lever. In addition, the hairpin spring keeps the ratchet detent lever constantly spring loaded against the teeth of the feeding ratchet.

Assurance of a positive reverse operation is dependent entirely upon the ribbon feed lever following the ribbon feed cam back to rest. During a reverse operation, the extension spring which loads the lower lug of the ribbon feed lever against the feed cam might not be strong enough to keep it against the cam during the restoring portion of the feed cycle. If this should occur, the upper lug (Fig. 202) on the feed lever will come in contact with the cam causing the feed lever to be powered back to rest. Therefore, this upper lug assures that the reversing operation is a powered operation and not dependent upon the action of an extension spring.

### Stencil Lockout

Ribbon feed is interrupted during the stencil mode of operation. This is done by centering the feed pawl between the ratchet spools so it can move freely back and forth without engaging a ratchet tooth (Fig. 209). The feed pawl is caused to operate in this manner by the ribbon lift lever when it is in the no lift or stencil position.



Two lugs on the ribbon lift lever form a "V" which trap a lug on the ratchet detent lever (Fig. 210). As the ribbon lift lever is placed in the stencil position, one or the other of the lugs, depending upon which spool is being driven, will contact the lug on the ratchet detent lever and cam it to the center of the "V" (Fig. 210). At this point, the ribbon lift lever will be in a detented position and the ratchet detent lever will be centered. With the ratchet detent lever in this position, the feed pawl will be guided between the ratchet spools.

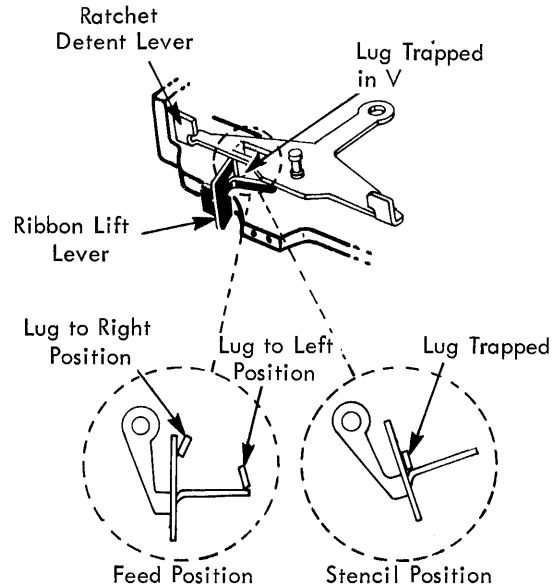


FIGURE 210 Stencil Lockout

FIGURE 209 Ribbon Feed Pawl (No Feed Position)