

SELECTRIC INSTRUCTION MANUAL

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MOTOR AND DRIVE

Motor and Electrical

The motor used in the Series 72 Selectric Typewriter is a three-inch shaded pole, induction type motor that requires 115 volts, 60 cycles A.C. (Fig. 1). It is rated at 1/40 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.

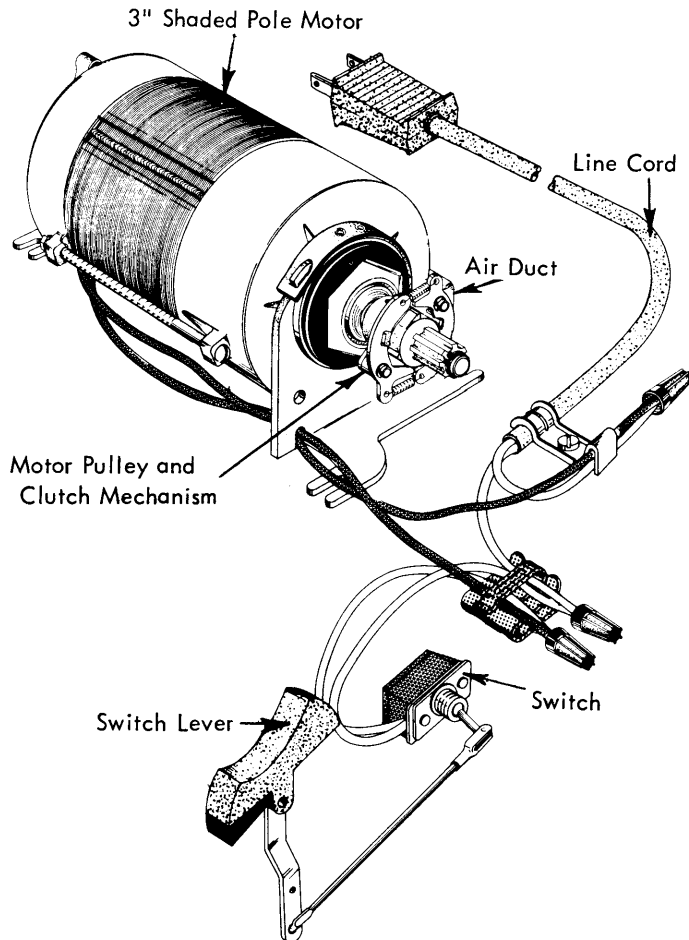


FIGURE 1. Shaded Pole Motor

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 moved 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 babbitt 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 as in motors used with previous models of IBM Electric Typewriters.

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.

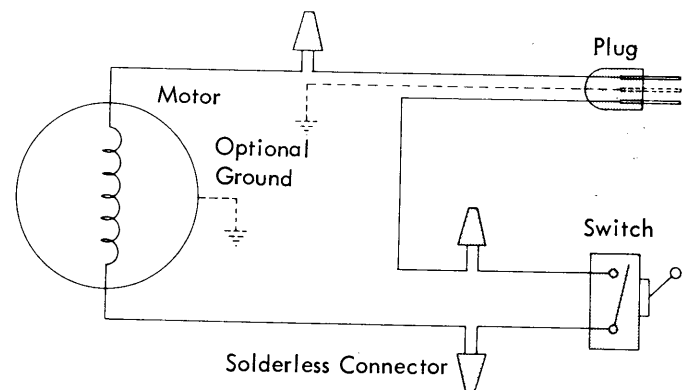


FIGURE 2. Shaded Pole Motor Diagram

In two-wire, ungrounded systems the motor is insulated from the powerframe by its rubber motor mounts. In order to convert to a three-wire grounded system, the line cord must be replaced with a three-wire cord and the ground lead must be attached to the powerframe at the cord clip screw. To complete the grounding a metal clip must be inserted in the motor mount so as to contact the hexagon end of the motor and the metal ring surrounding the rubber mount (Fig. 2).

In the early production Series 72 Selectric Typewriters, a capacitor-start induction type motor is used (Fig. 3). A three mfd. 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.

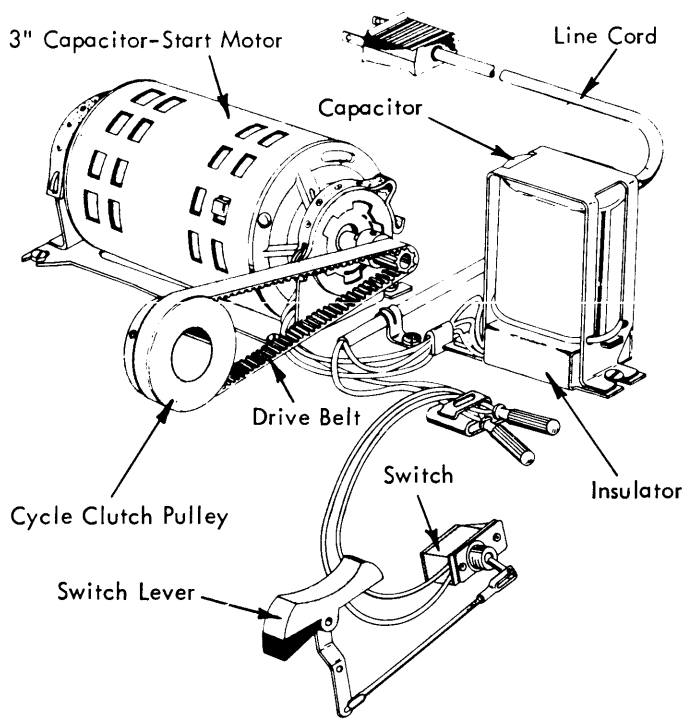


FIGURE 3. Capacitor-Start Motor

In ungrounded systems, the capacitor is isolated from the powerframe by a fiber insulator and nylon mounting screws. The motor is insulated from the powerframe by its rubber ring mounting. To convert an ungrounded system to a grounded one, three steps must be taken: the two-wire line cord must be replaced with a three-wire cord and the ground lead must be attached to the powerframe at the cord clip, a short jumper wire must be connected from the motor to the powerframe, and the capacitor must be grounded to the powerframe by replacing the nylon mounting screws with metal ones (Fig. 4).

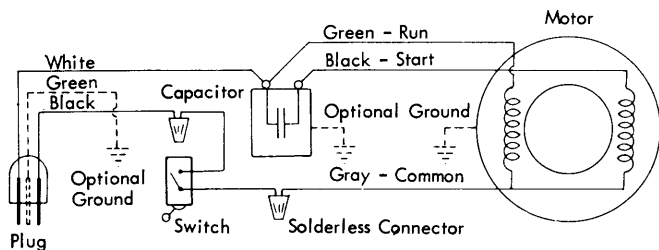


FIGURE 4. Capacitor-Start Motor Diagram

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.

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 $3\frac{5}{8}$ to 1.

The shaded pole motor has slightly 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 with the machine ON while disconnected from the electrical outlet.

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.

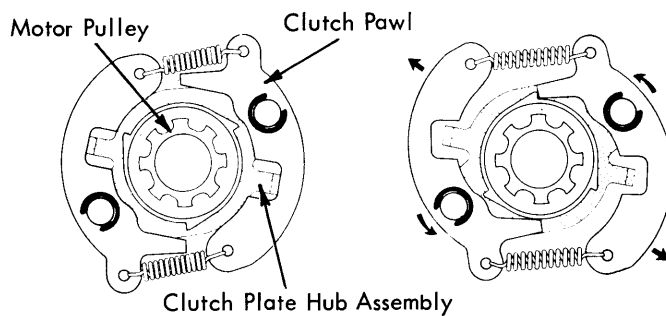


FIGURE 5. Motor Pulley Clutch

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 letter keylever is depressed. The cycle shaft powers the positioning of the type head to the desired character. Its rotation is restricted to 180° each time a character prints. After 180° rotation the spring clutch is disengaged allowing the shaft to remain stationary. The cycle clutch is discussed fully in a later section.

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, 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.

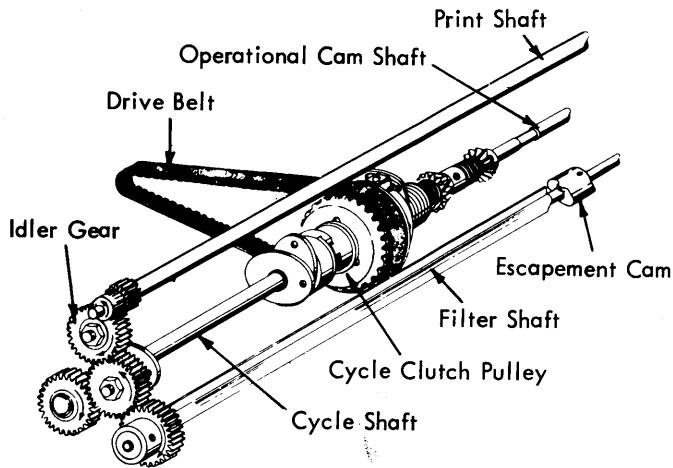


FIGURE 6. Drive Mechanism

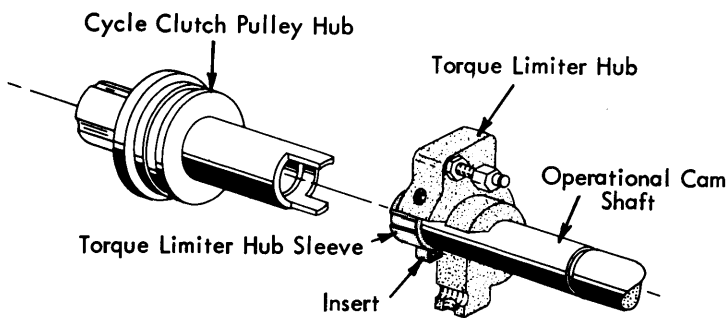


FIGURE 7. Operational Cam Shaft Drive Connection

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 prevent 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.

TYPE HEAD

Carrier Assembly

The printing element is a ball shaped type head 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.

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 bronze bearings in the carrier casting to lubricate the rotation of the print sleeve.

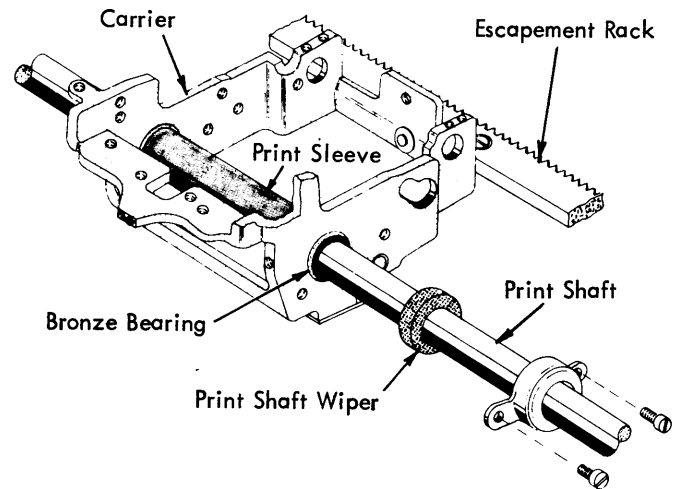


FIGURE 8. Front Carrier Support

Old Style Carrier Support

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.

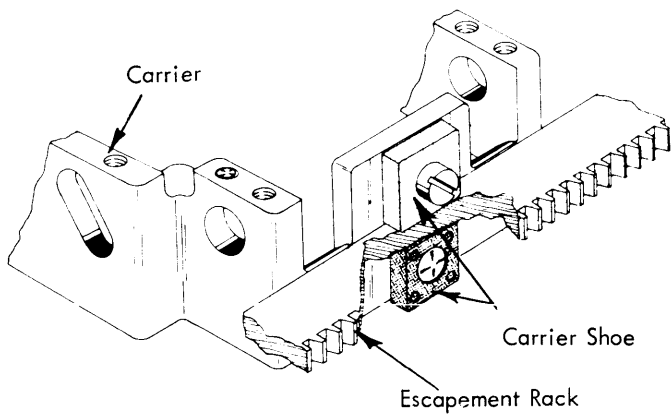


FIGURE 9. Rear Carrier Support (old style)

New Style Carrier Support

The new style carrier support (Fig. 10) differs from the old 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 at the rear of the carrier during a print operation. The bottom shoe is a nylatron block tenoned 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).

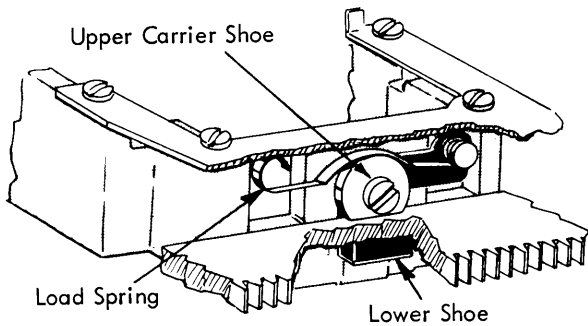


FIGURE 10. Rear Carrier Support (new style)

Rocker

The rocker is a pivoting platform located within the rear portion of the carrier (Fig. 11). Its purpose is to carry the type head to and from the platen for the print operation. Components involved in the type head positioning and aligning operations are also contained within the rocker. The rocker pivots on the rocker shaft at the rear of the carrier. Two bronze 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 type head is attached. As the rocker pivots up in front, the yoke moves the tilt ring and the type head toward the platen.

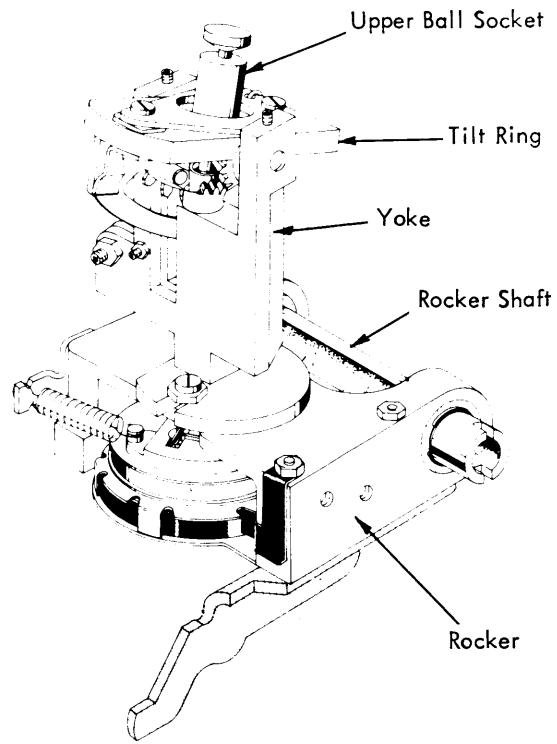


FIGURE 11. Rocker Assembly

Type Head

Before printing can occur, the desired character must be in position to strike the paper. The surface of the type head 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.

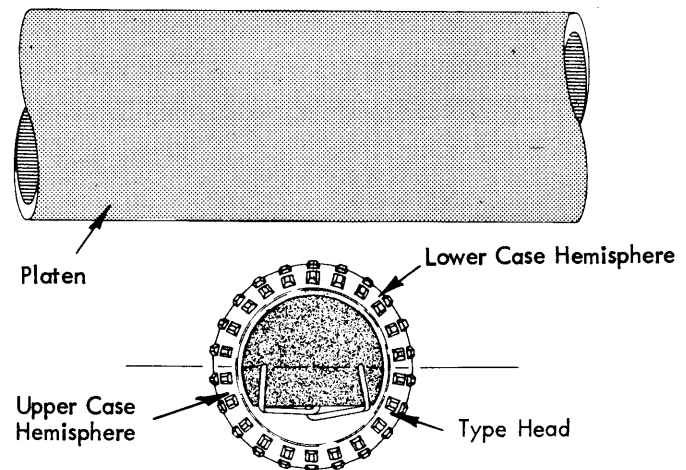


FIGURE 12. Type Head and Platen - Top View

At rest, the position of the type head is such that the middle character of the upper band is in position to strike the platen. This is the letter "z". If any character other than the "z" 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 type head up to five positions in either direction and tilting the head as much as three bands from the rest position. The type head always rotates back to the "z" 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 type head is toward the platen. The single-unit type head 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 type head.

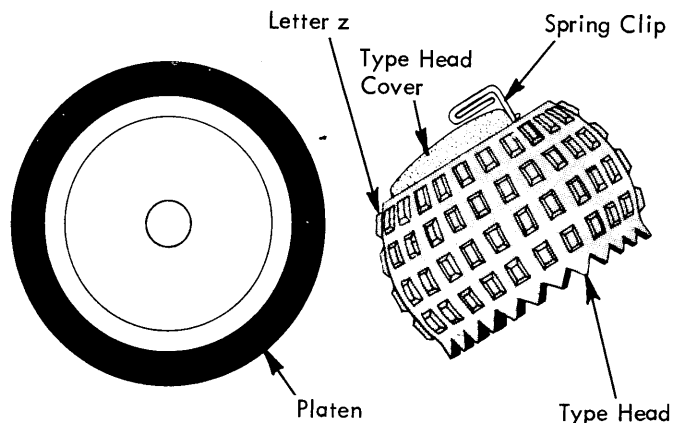


FIGURE 13. Type Head and Platen - Side View

The type head 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 type head and fits into a groove in the top of the post (Fig. 14). A convex disc, covers the spring clip except for two ears (Figs. 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.

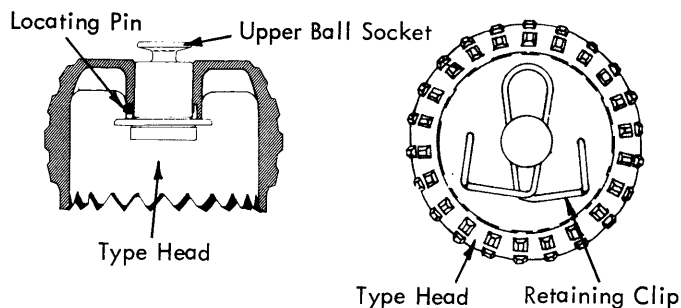


FIGURE 14. Type Head Mounting

The type head may be installed by pressing the ears of the spring clip together and slipping the head into place. The type head 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 type head is always in the "z" 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 Operation

The purpose of the tilt mechanism is to raise the rear of the type head 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 type head. The yoke assembly is fastened to the rocker to complete the type head mounting (Fig. 11).

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

Old Style

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 type head to be tilted.

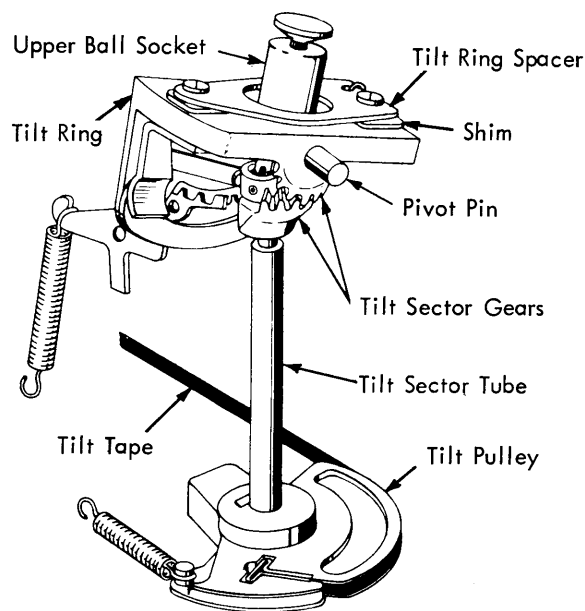


FIGURE 15. Tilt Mechanism - Rocker Portion

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 type head. When the pull on the tape is relaxed, the tilt pulley is restored by its spring causing the type head 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 type head (Fig. 16).

When a tilt operation is required, the distance between the two side pulleys is increased by moving one of the pulleys away from the other. This causes a pull on the tilt tape. 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 type head.

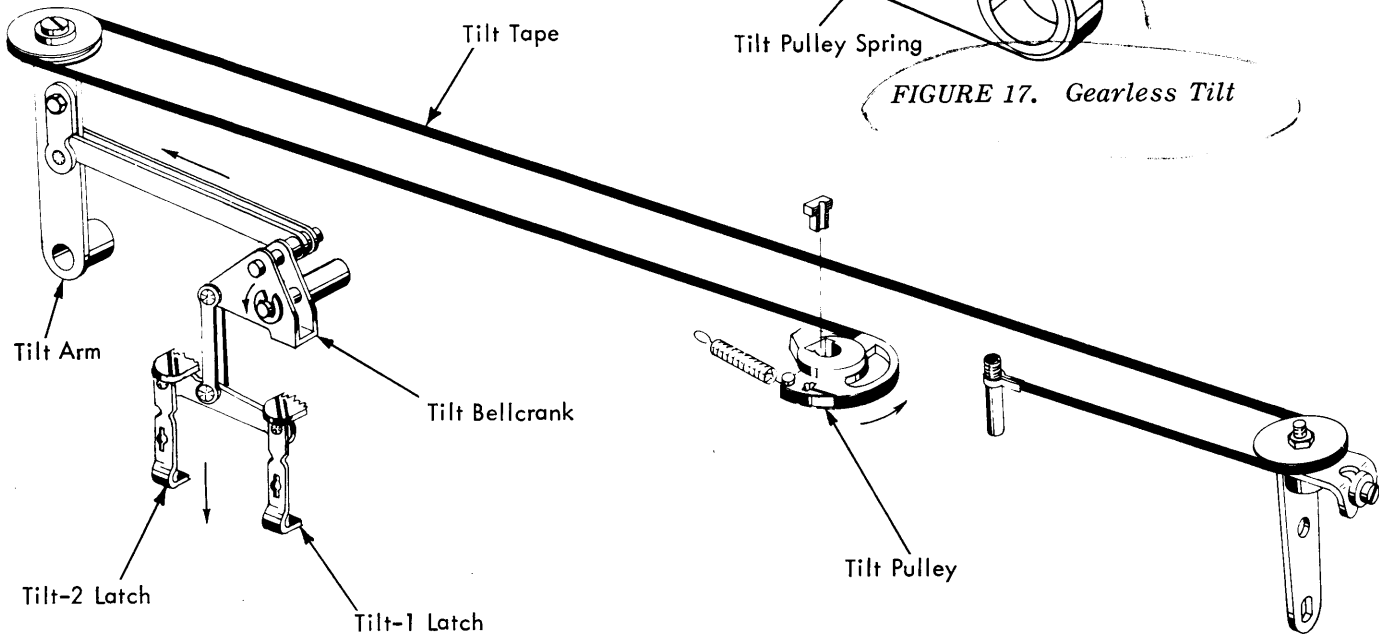


FIGURE 16. Tilt Tape System

New Style (Gearless Tilt)

The "gearless tilt mechanism" operates basically the same as the early style 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.

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.

Latch Bail

The cycle shaft has three double lobed cams on it that power the positioning of the type head (Fig. 18). The three cams are separated on the cycle shaft, one on the left and two on the right. The left cam and the middle cam are paired to operate the latch bail located just beneath the cycle shaft. The right cam can be disregarded for the moment.

The cycle shaft powers the positioning of the type head by operating the selector latch bail. The latch bail is a box-

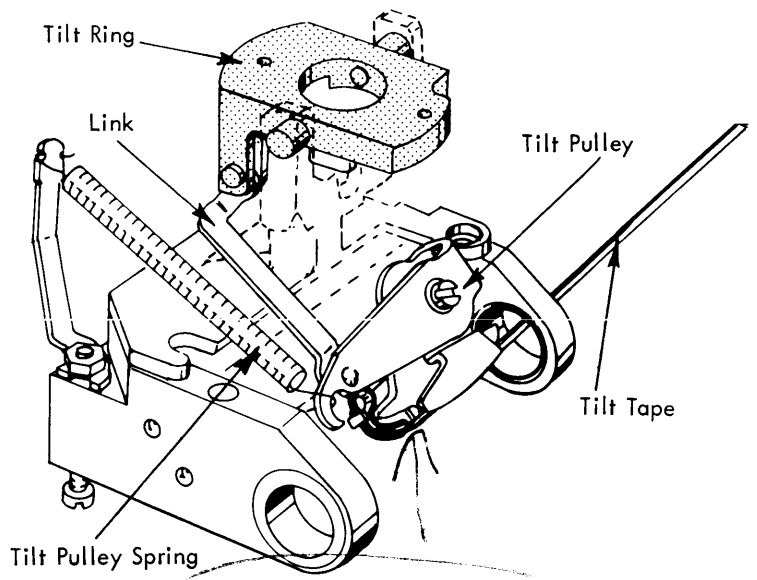


FIGURE 17. Gearless Tilt

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 at the rear pivoting about the bail shaft.

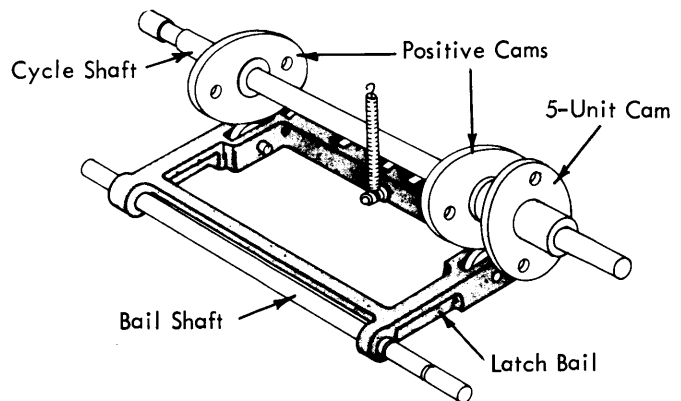


FIGURE 18. Cycle Shaft and Latch Bail

The rear of the latch bail is recessed at six points. Five of the recesses contain selector latches. The sixth recess is for special applications of the machine. Across the rear of the latch bail is a plate attached by four 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. The five selector latches are components of the differential lever assembly that determines how much tilt and rotate the head will receive. The two latches to the left are concerned with tilting the head, while the three on the right deal with rotating the head.

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 pulling the various latches forward is discussed in a later section.

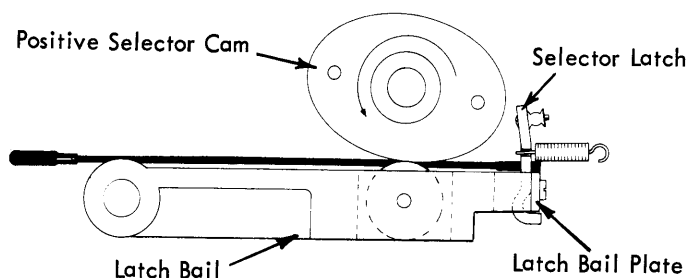


FIGURE 19. Latch Bail - Side View

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.

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

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.

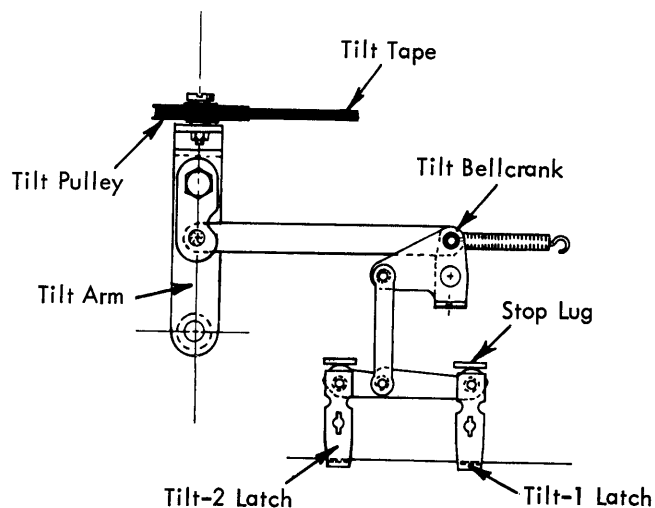


FIGURE 20. Tilt Differential At Rest

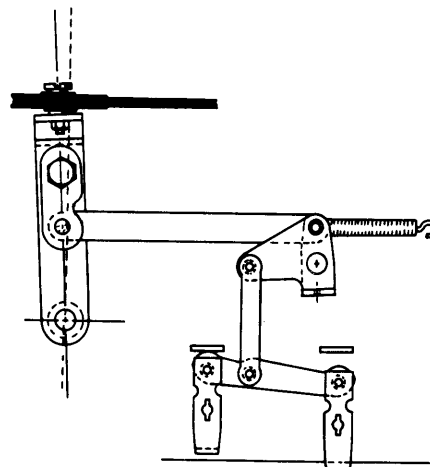


FIGURE 21. Tilt - 1 Operation

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 type head 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 type head to tilt a distance of two bands of characters. The third band is then in the printing position.

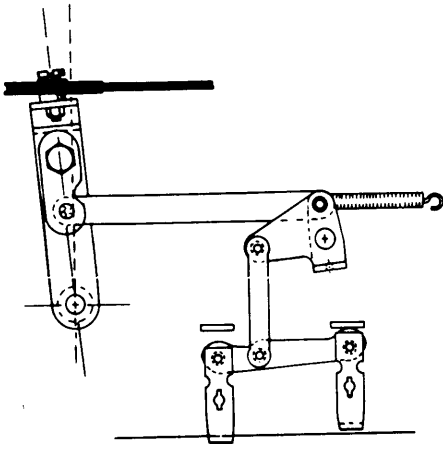


FIGURE 22. Tilt - 2 Operation

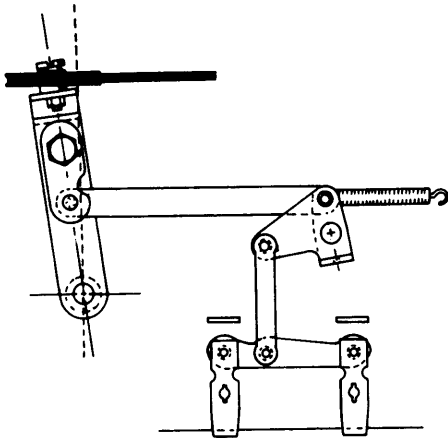


FIGURE 23. Tilt - 3 Operation

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.

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 positions the rear of the type head left or right to the desired character within a tilt band.

The upper ball socket to which the type head is attached has a shoulder at the bottom fitted into a hole in the tilt ring. 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 attached 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.

The underside of the upper ball socket is hollow and forms the socket for a ball joint connection (Fig. 24). 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 type head to be rotated and tilted at the same time.

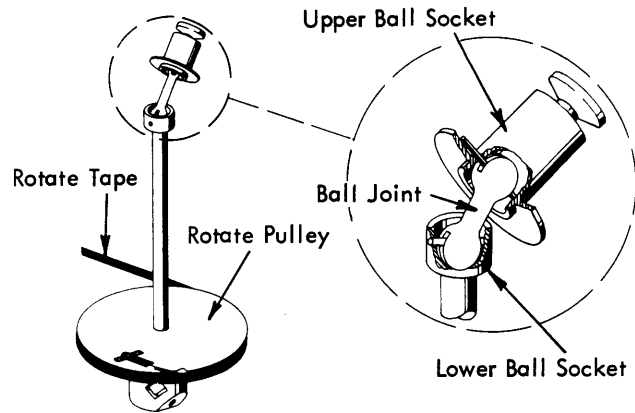


FIGURE 24. Rotate Mechanism - Rocker Portion

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. 24). By means of the upper and lower ball sockets and the ball joint, the rotate pulley operates to rotate the type head 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 type head is rotated counterclockwise by the pull of the tape. When either side pulley moves toward the other, the type head is rotated clockwise by the tension of the rotate pulley spring (Fig. 25).

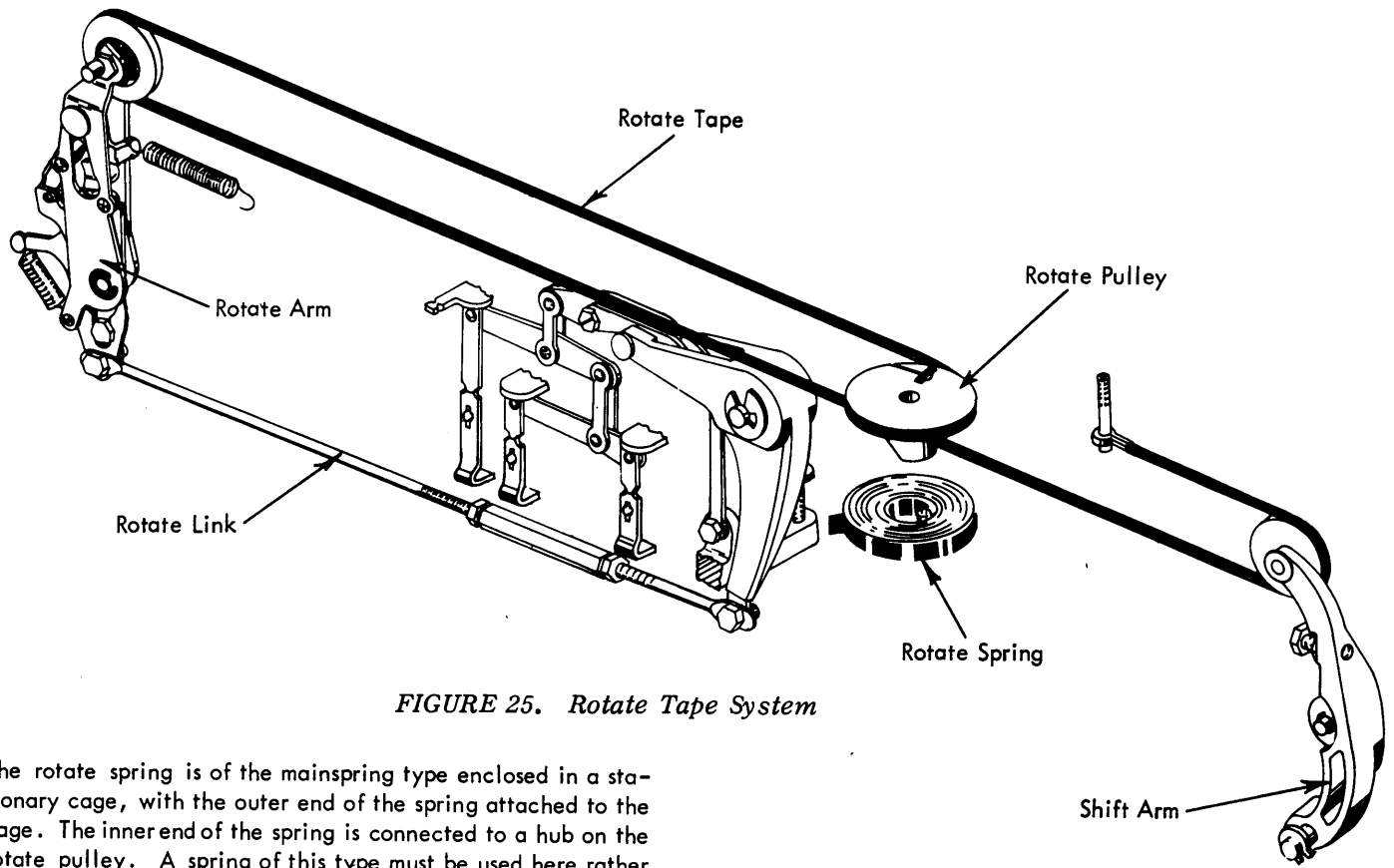


FIGURE 25. Rotate Tape System

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 type head 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.

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.

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.

Consider the positive rotation of the type head 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.

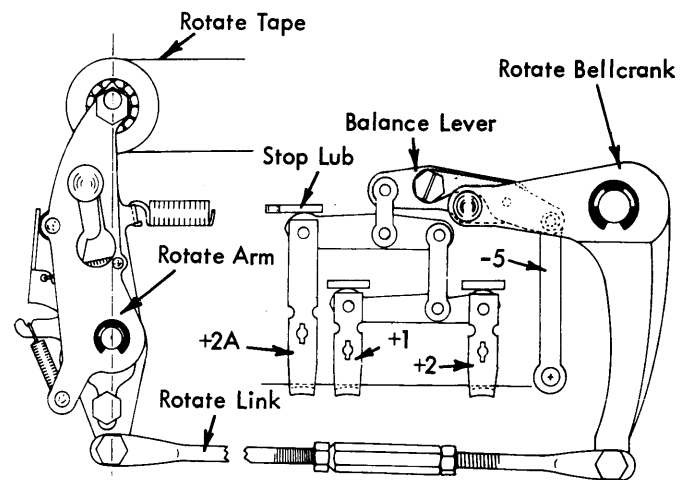


FIGURE 26. Rotate Differential At Rest

The 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.

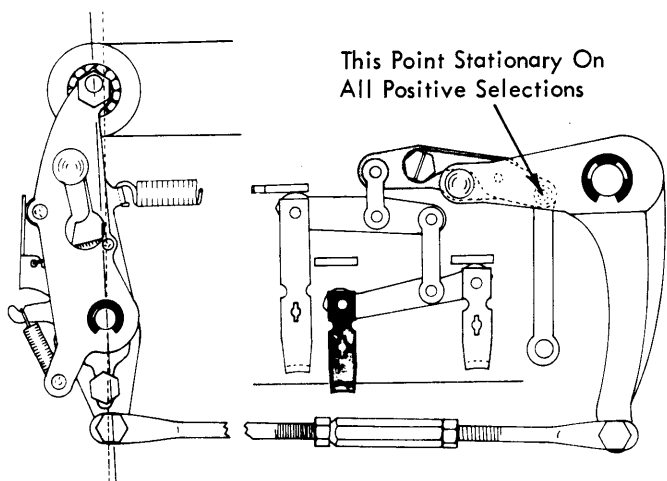


FIGURE 27. Positive - One Rotate Operation

In order to operate the balance lever, 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.

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.

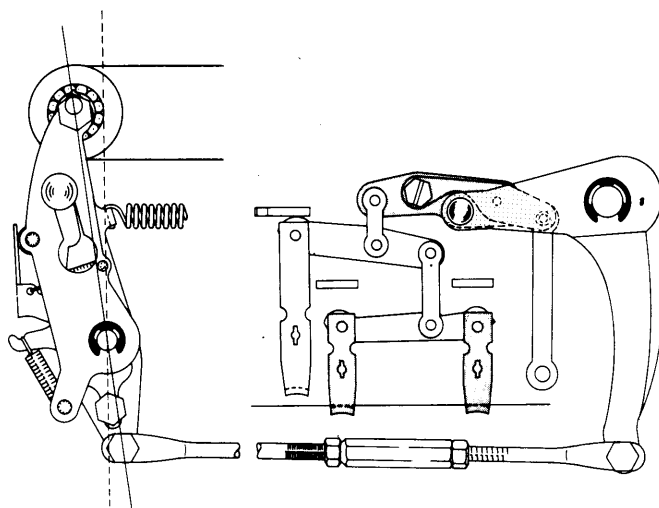


FIGURE 28. Positive - Three Rotate Operation

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.

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).

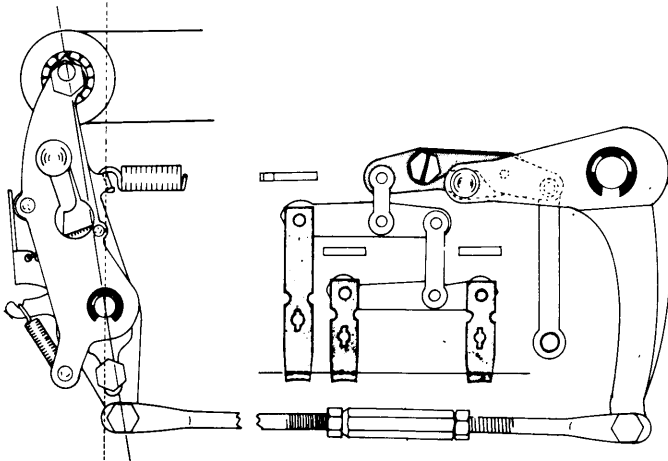


FIGURE 29. Positive - Five Rotate Operation

Negative Rotation

Positive rotation of the type head 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.

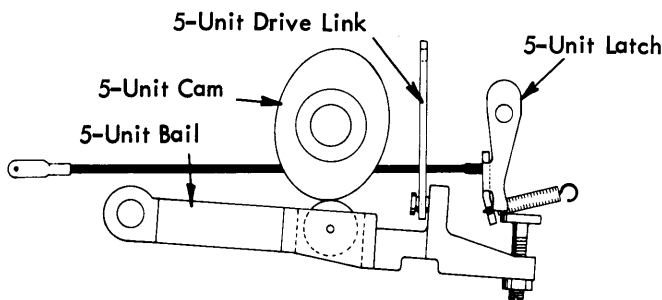


FIGURE 30. Five Unit Bail At Rest

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 rear of the five-unit bail. When the latch is pulled 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.

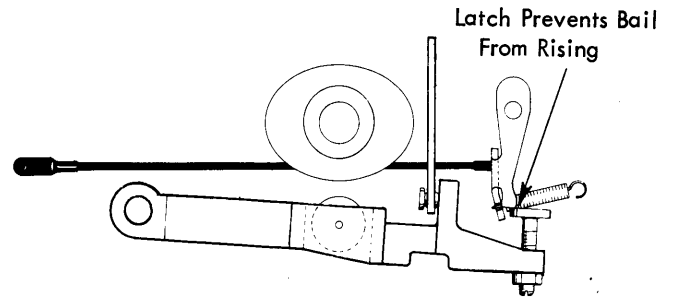


FIGURE 31. Five -Unit Bail During Positive Rotate Cycle

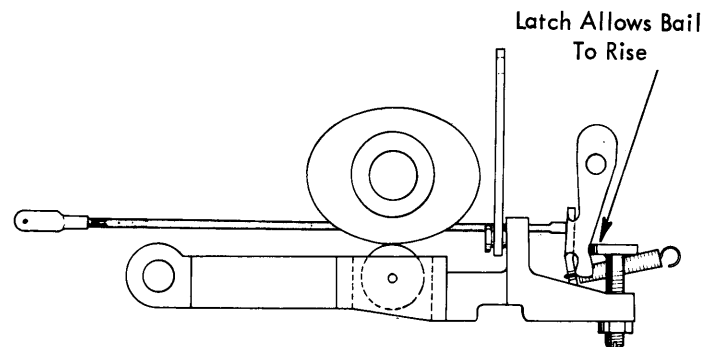


FIGURE 32. Five Unit Bail During Negative Rotate Cycle

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.

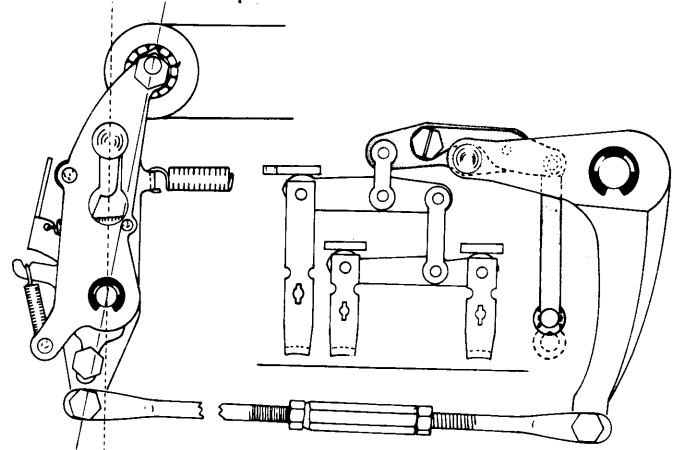


FIGURE 33. Negative-Five Rotate Operation

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 non-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 negative 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.

KEYBOARD SECTION AND CHARACTER SELECTION

The keyboard section is a compact unit that is detachable as a unit from the rest of the machine. Contained in the keyboard section are all keylevers and allied parts, and a selection mechanism for the differential latches. Depression of a letter keylever prepares the selection mechanism for operation and trips the cycle clutch latch to allow a cycle operation.

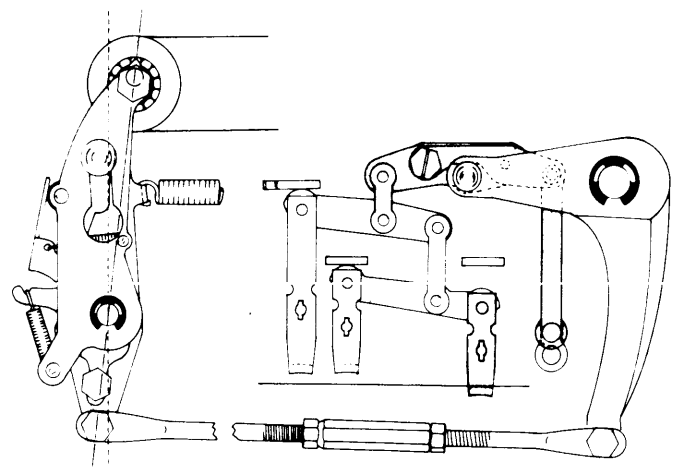


FIGURE 34. *Negative-Three Rotate Operation*

Keylevers

The keylevers pivot on a fulcrum rod at the rear (Fig. 35). A nylon rod at the top and the bottom of the guide comb slots limit the travel of the keylevers in the front guide comb. A lower extension on each keylever operates in the keylever bearing support 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.

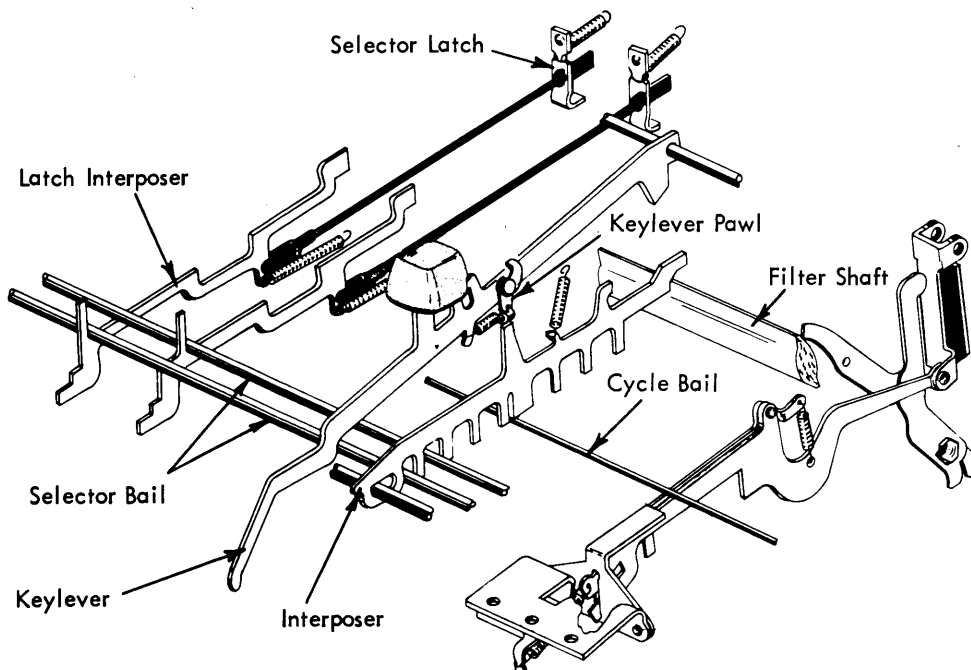


FIGURE 35. *Keyboard Section and Character Selection*

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).

Adjusting lugs at the rear of the keylevers 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.

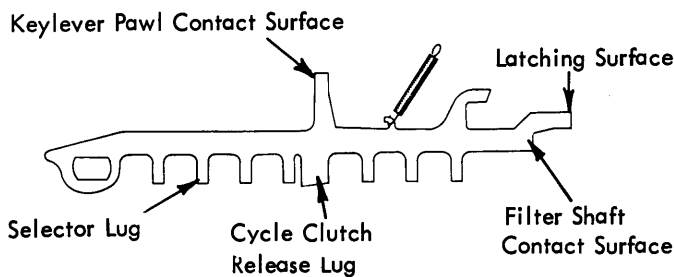


FIGURE 36. *Selector Interposer*

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 pushes the cycle bail down to unlatch the cycle clutch and allow 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 pivots in a bronze 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

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.

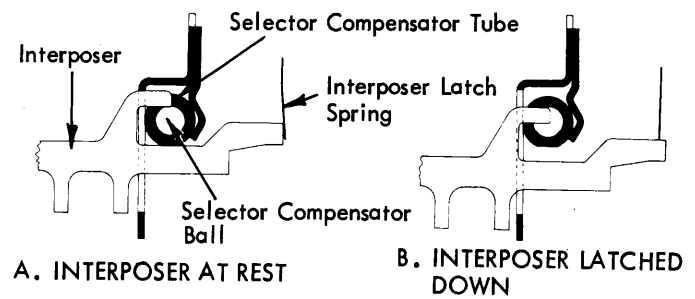


FIGURE 37. *Interposer Latch and Selector Compensator*

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.

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).

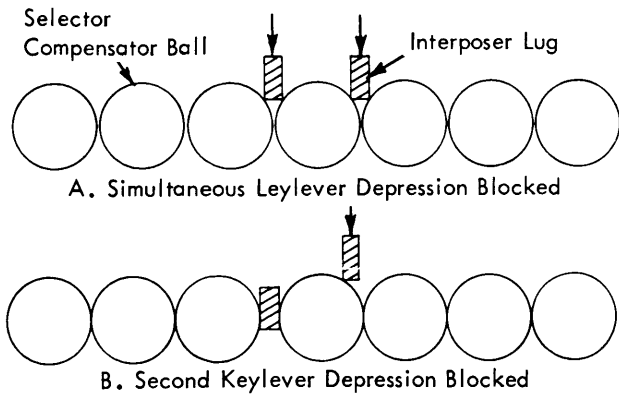


FIGURE 38. Selector Compensator Action

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

Six 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.

Six sliding interposers called the latch interposers are located under the left end of the selector bails (Fig. 35). These interposers operate front to rear in the bottom of the interposer guide comb.

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 pawl pivots on the link. An extension spring between the two parts rotates the front of the pawl up into a latched 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.

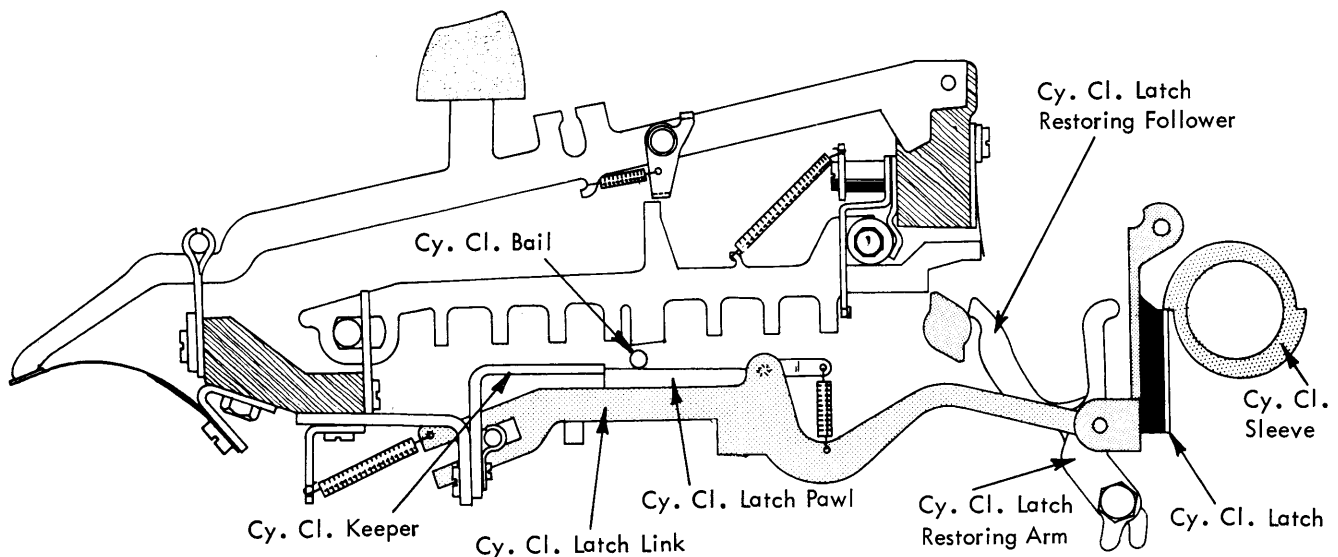


FIGURE 39. Cycle Clutch Latch Mechanism

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.

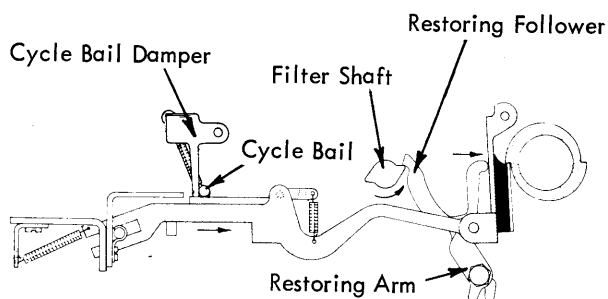


FIGURE 40. Cycle Clutch Latch Restoring Operation (old style)

Old 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.

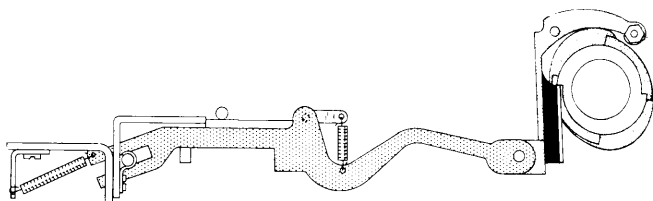


FIGURE 41. Cycle Clutch Latch Restoring Operation (new style)

New 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 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 keylever 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.

As the selector mechanism is being operated forward, the cycle shaft cams start to force the latch bail down. All latches that remain to the rear are operated down by the latch bail. This does not apply to the negative-5 latch which must be pulled forward in order to allow a negative rotation.

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 keylever is released (Fig. 42). At that time it snaps forward above the interposer lug ready for the next operation. This arrangement insures a single operation regardless of how long the keylever is held depressed by the operator.

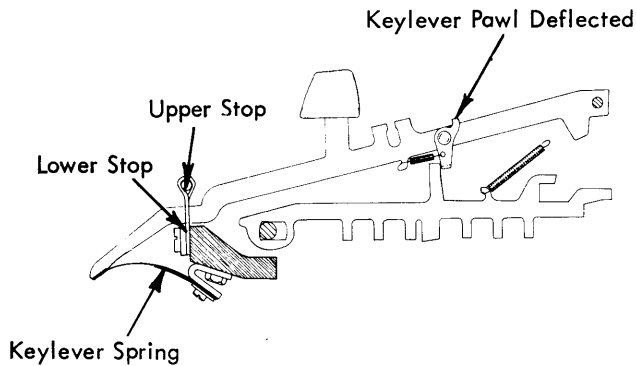


FIGURE 42. Keylever Held Depressed

Repeat/Non-Repeat Keylevers

A repeat/non-repeat operation is provided as a standard feature in the hyphen/underscore position. The operation requires a special, two-piece keylever (Fig. 43). One part of the keylever pivots about the keylever fulcrum rod at the rear and extends forward through the guide comb. It contains no keybutton but has the keylever pawl attached similar to the normal keylever. The second part of the keylever is a short lever containing the keybutton. It pivots on a shouldered rivet at the rear of the long keylever. The front of the short lever is restricted by a shouldered rivet through an elongated hole. A compression spring between the two pieces acts to hold the short lever up in its elongated hole.

When the keybutton is depressed, the two pieces act as one and a single operation results. If the keylever is held down, the keylever pawl is deflected to the rear as the interposer restores (Fig. 43). Additional pressure applied to the keybutton overcomes the compression spring and causes the short lever to pivot downward. A special lug on the bottom of the short lever forces the interposer down for a second operation (Fig. 44). The special lug is wide enough so that the interposer is not allowed to restore upward as long as the keylever is held in the repeat position. The interposer merely travels front to rear. As it does so, it prevents the cycle clutch latch pawl from resetting, and results in a continuous operation.

The repeat/non-repeat feature may be removed from the machine by replacing the two-piece keylever with a conventional keylever.

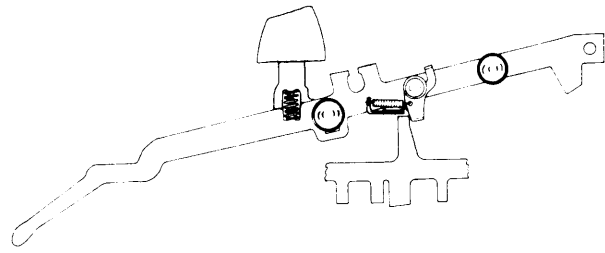


FIGURE 43. Repeat Keylever After Single Operation

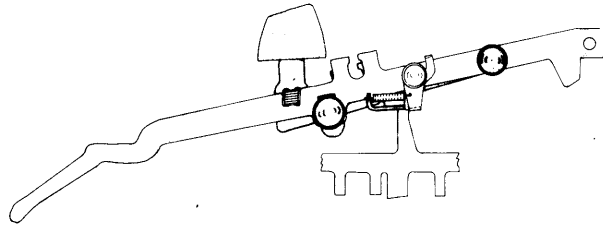


FIGURE 44. Repeat Keylever Held Depressed

Keyboard Lock

When the 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 lever controls the keyboard lock mechanism by rotating the lockout bail that extends across the bottom of the keyboard section (Fig. 47). When the switch lever is in the OFF position, the lockout bail is moved forward into position 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 lockout 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.

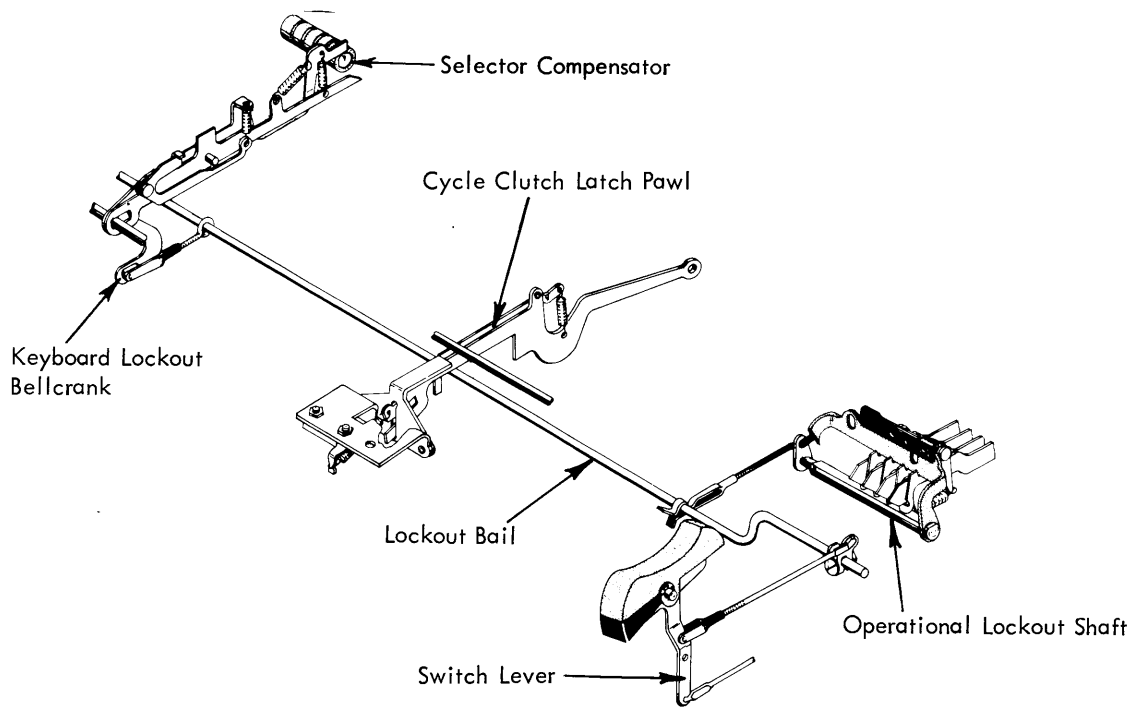


FIGURE 45. Keyboard Lock Mechanism - ON Position

SHIFT

The purpose of the shift mechanism is to rotate the type head 180° in the counterclockwise direction. This action places the upper case hemisphere of the type head near the platen for typing capital letters. 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. 46). The movement of the pulley creates sufficient pull on the rotate tape to cause 180° type head rotation. The pulley remains in this position as long as the shift keylever is held depressed.

Two keybuttons, one at each front corner of the keyboard, can be used to actuate the shift mechanism (Fig. 47). 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 left 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. 48). 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.

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. 48). The roller to the left of the cam is in a fixed position on the powerframe and serves as a back-up roller for the cam. The roller on the right 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. 48a). The cam is operated 180° to the high point in order to force the arm into upper case (Fig. 48b).

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.

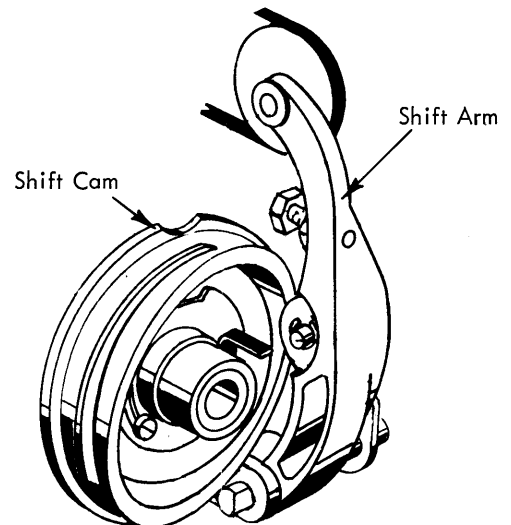


FIGURE 46. Shift Cam and Shift Arm

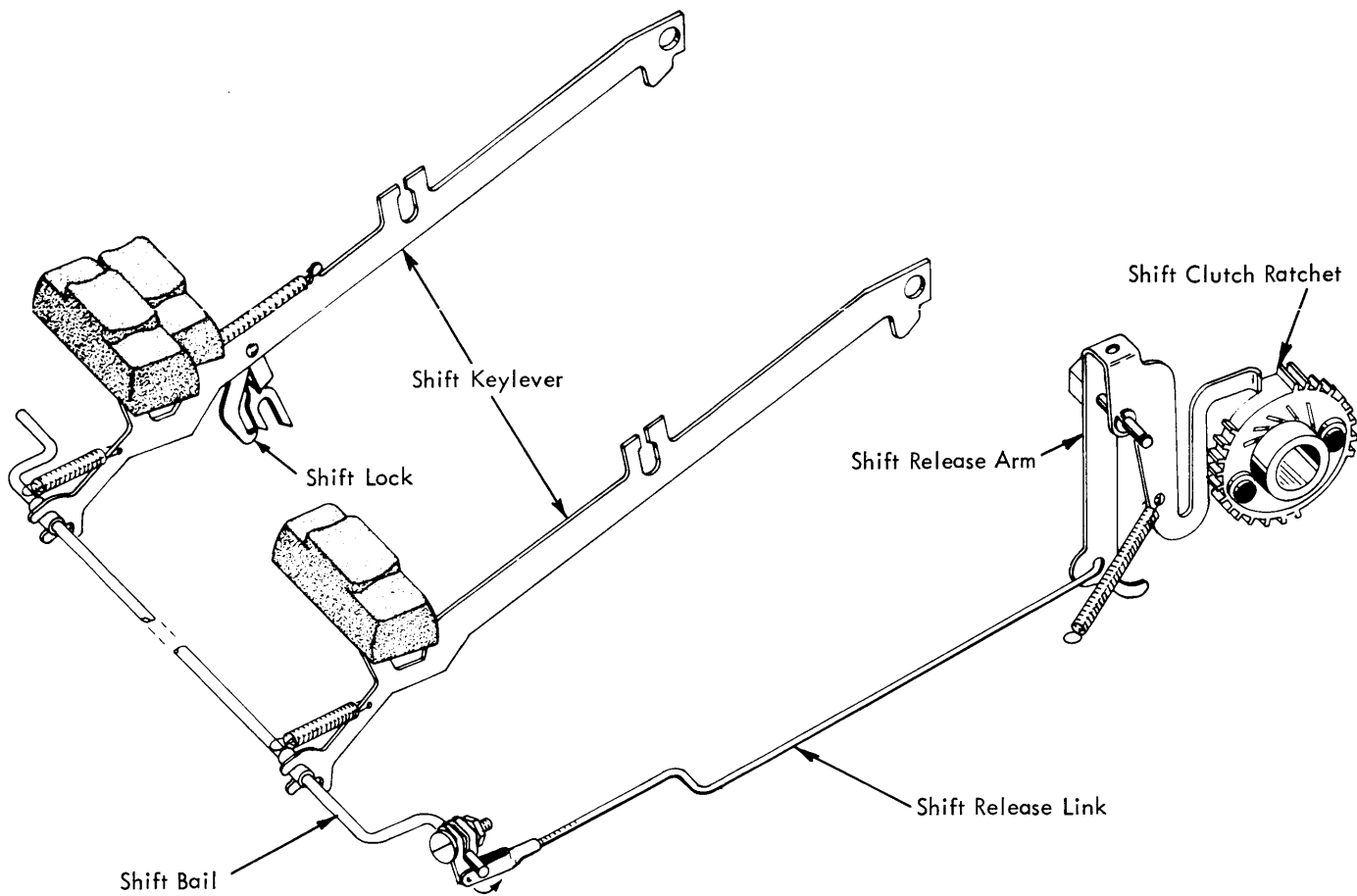


FIGURE 47. Shift Release Mechanism

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. 49). 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. 49). 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, anytime 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.

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.

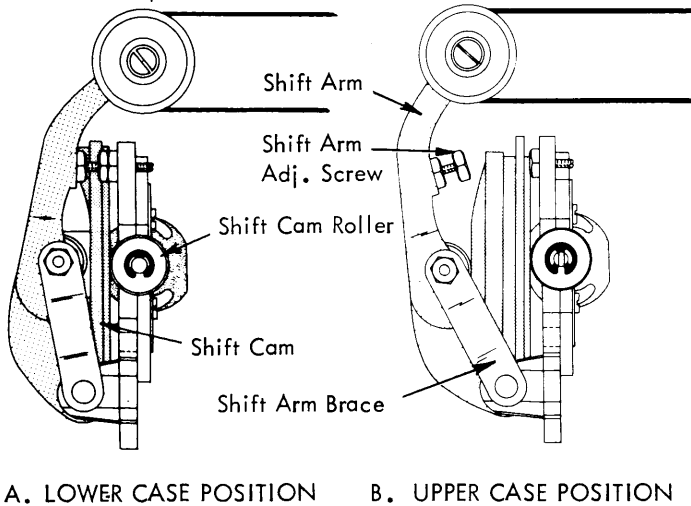
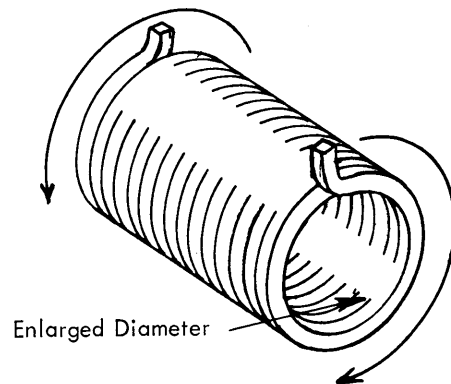


FIGURE 48. Shift Operation - Rear View



Spring Clutch - Unwinding Direction

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. 49). The right end of the spring is formed to the right and fits into a hole in the shift clutch ratchet (Fig. 49). The shift clutch ratchet is a 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.

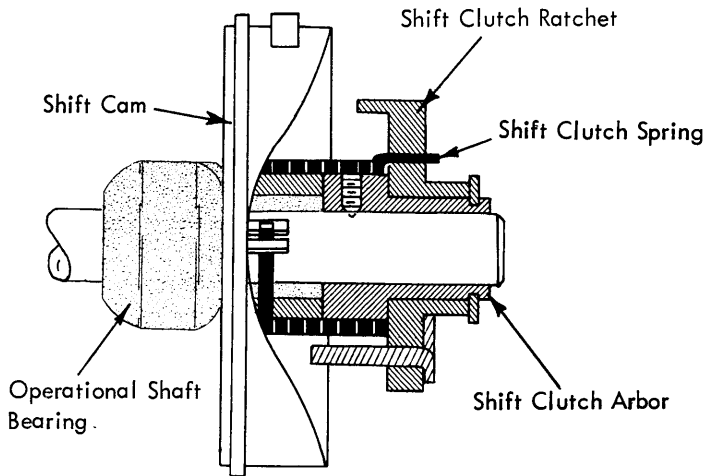
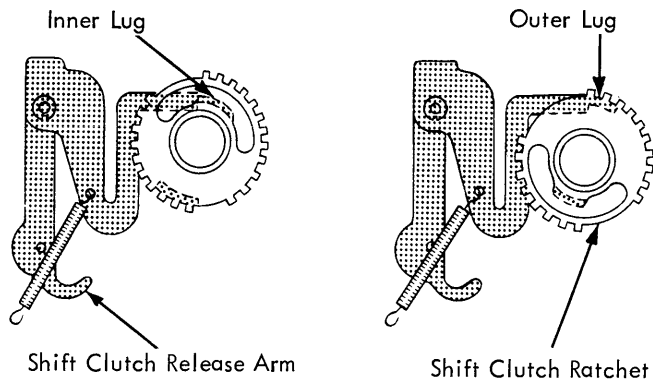


FIGURE 49. Shift Clutch

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 the rotation of the ratchet (Fig. 50).

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. 47). When a shift keylever is depressed, the bail rotates to force the link to the rear and operate the shift release arm. When the keylevers are at rest, the release arm is in position to stop the inner lug of the shift clutch ratchet (Fig. 48a). 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. 48b).



A. LOWER CASE POSITION B. UPPER CASE POSITION

FIGURE 50. 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. 51).

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.

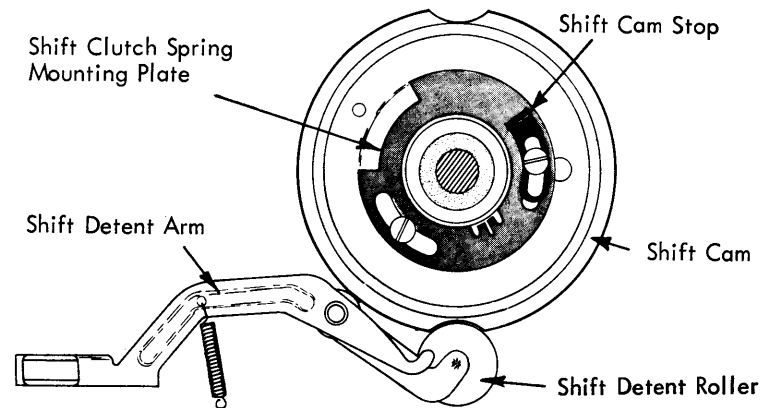


FIGURE 51. Shift Arm and Detent

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 overthrow 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. 51). 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 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. 52). 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.

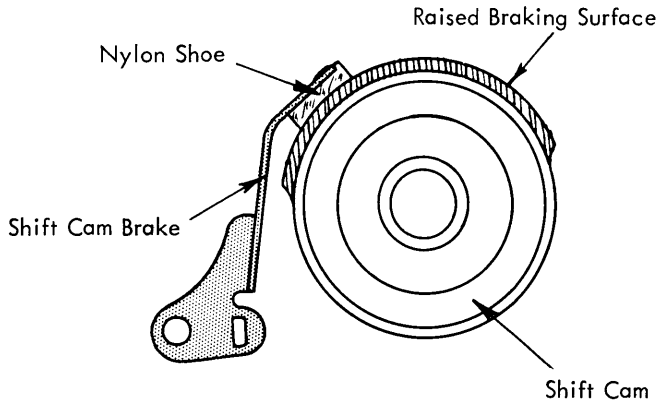


FIGURE 52. Shift Cam Brake

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-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. 53). 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. 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.

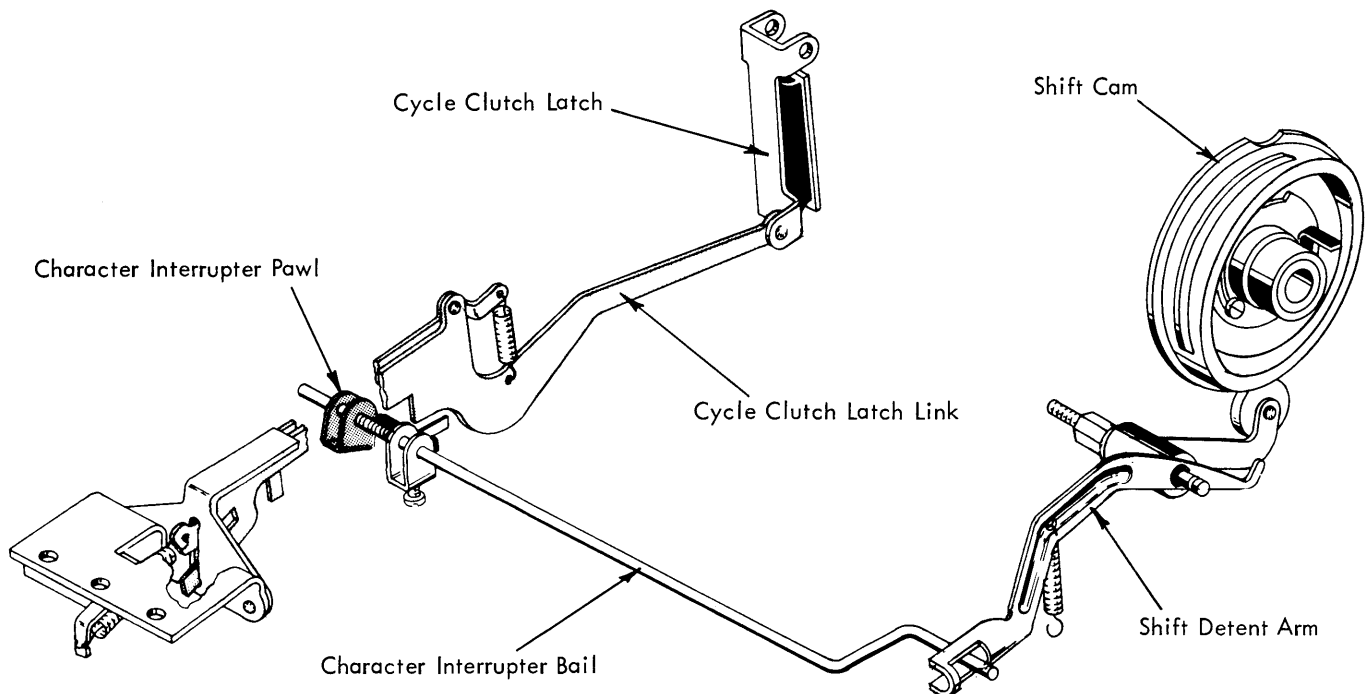


FIGURE 53. Character Interrupter

Shift Interlock

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

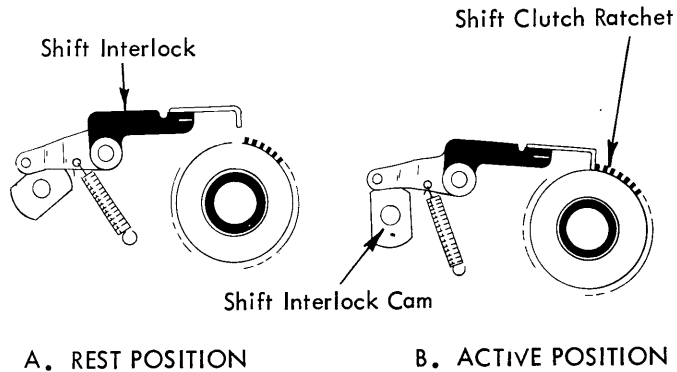


FIGURE 54. Shift Interlock

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. 54). 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 rests near the low point of the interlock cam allowing free operation of the shift mechanism (Fig. 54a). 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. 54b). This interrupts the shift operation until the cycle operation is completed.

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.

To overcome the problem of "beating the shift" coming out of upper case a redesigned shift cam has been incorporated in the Selectric. This redesigned cam has a longer upper case dwell than the former style cam. The longer dwell allows the filter shaft sufficient time to operate the shift interlock before the shift arm begins to move, thus overcoming the problem.

The new style shift cam requires a different shift clutch ratchet because the cam now rotates 220° going from upper to lower case and 140° going from lower to upper case. With this longer cam rotation when shifting from upper to lower case, the detent notch in the cam (that operates the character interrupter) has been elongated by 40° . This elongation of the notch allows a character to come out of storage a short period of time before the shift operation has completed. This can be done without

any ill effects because under dynamic conditions there is a time delay between cycle clutch release and cycle shaft operation. Without early storage release (going to lower case) the operator's typing rhythm could be affected.

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 porous bronze bearing. The right end fits into the cycle clutch pulley hub in the center of the machine. A bronze sleeve inside the hub acts as a bearing for the cycle shaft.

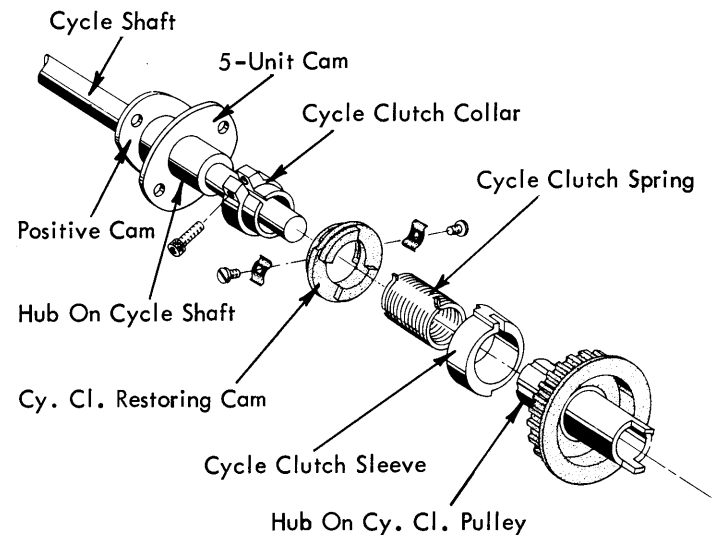


FIGURE 55. Cycle Clutch - Exploded View

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. 55) 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. The cycle clutch spring operates exactly the same as the spring clutch in the shift mechanism.

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 collar does exactly the same job as the spring clutch retaining plate on the shift cam.)

The right end of the cycle clutch spring encircles a hub on the cycle clutch pulley (Fig. 55). (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 ro-

tates. 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 sleeve performs the same function as the shift clutch ratchet.)

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. 56). 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 sleeve and latch operate the same as the shift clutch ratchet and shift release arm.) 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.

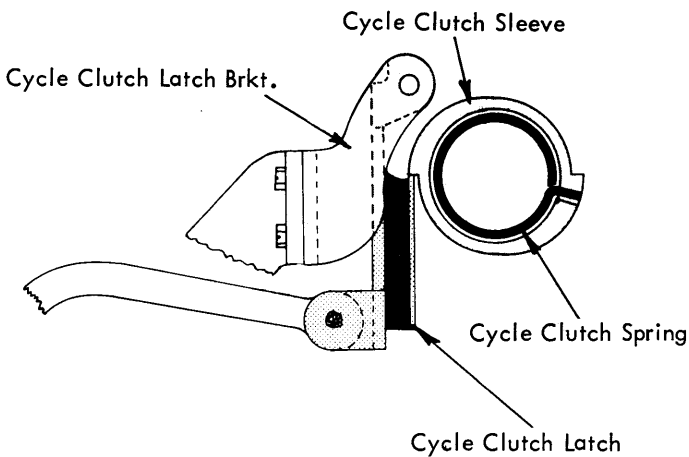


FIGURE 56. Cycle Clutch Latch - Side View

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. 57). 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.

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. 58). The pawl drops in when the clutch is disengaged. (It performs the same function as the shift detent roller.)

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.)

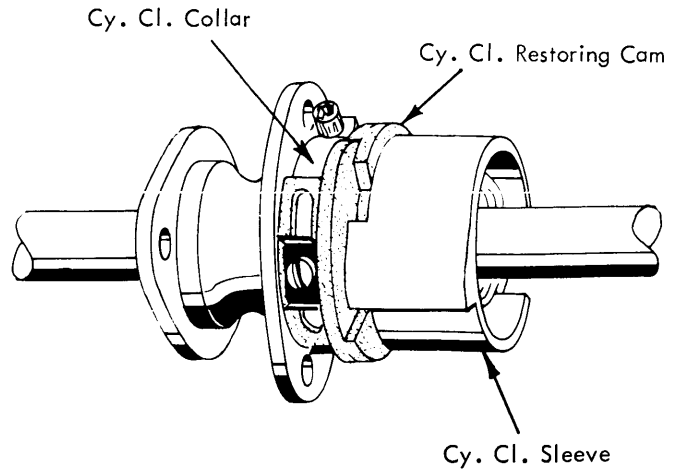


FIGURE 57. Cycle Clutch Stop

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.)

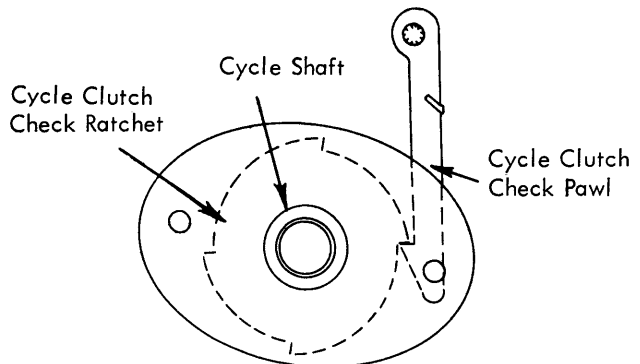


FIGURE 58. Cycle Clutch Check Pawl

The same effect is true in the shift mechanism. The shock of stopping the momentum of the shift 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 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 tilt 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. 59). 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.

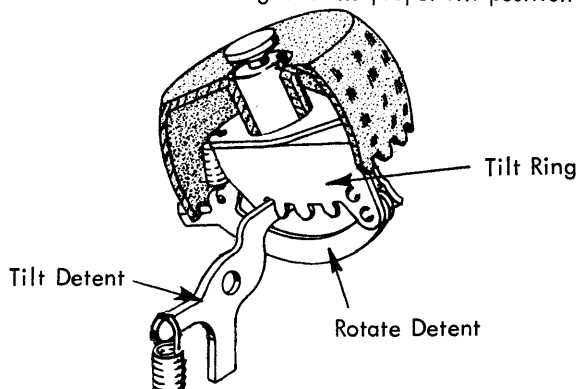


FIGURE 59. Tilt Ring Detenting

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 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 a 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. 60). Of the factors mentioned that affect the tilt ring position, only the accuracy of adjustments can be controlled by the Customer 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.

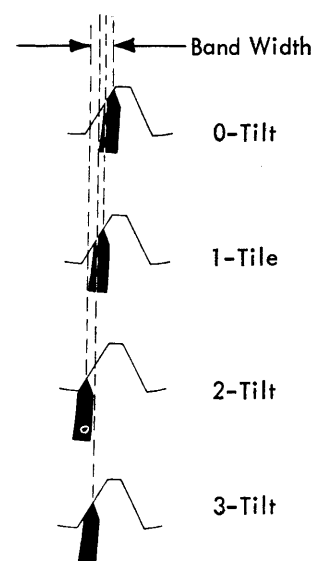
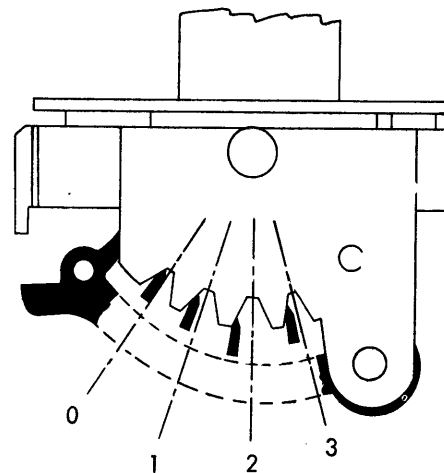


FIGURE 60. Band Width

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

- a. Half-cycle the machine under power by placing the Hooverometer handle in position to block the cycle clutch sleeve before striking a keylever (Fig. 61).

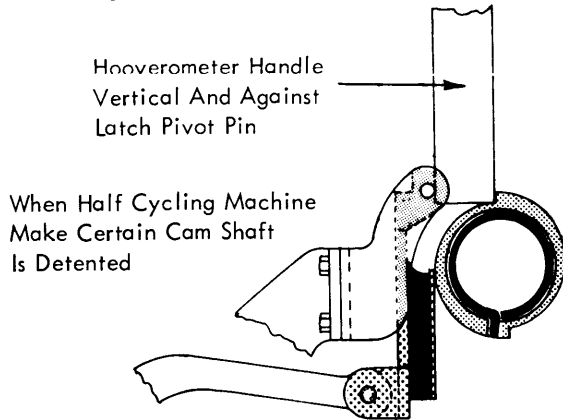


FIGURE 61. Half Cycling Operation

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. 62).

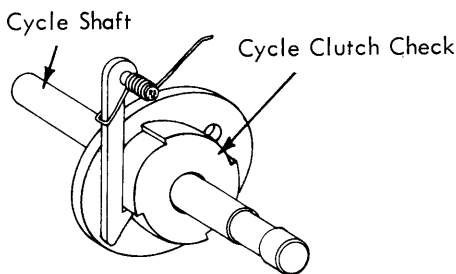


FIGURE 62: Half Cycle Operation

Half-cycling is done under power so as to include all the stresses on the system.

- b. Manually withdraw the detent and remove the tilt ring play in the negative direction by depressing lightly on the rear of the tilt ring.
- 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 the system can easily be diagnosed.

Example: Figure 63 illustrates a coarse alignment check of the four tilt positions.

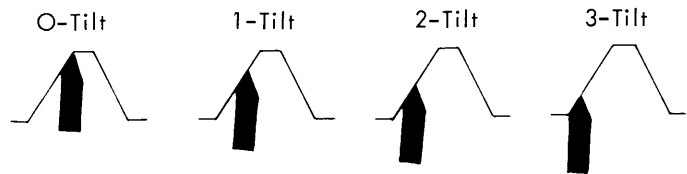


FIGURE 63. Course Alignment Check

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. 64) is receiving equal increments of motion from the tilt differential system, but is not multiplying the motion enough to satisfy the tilt ring.

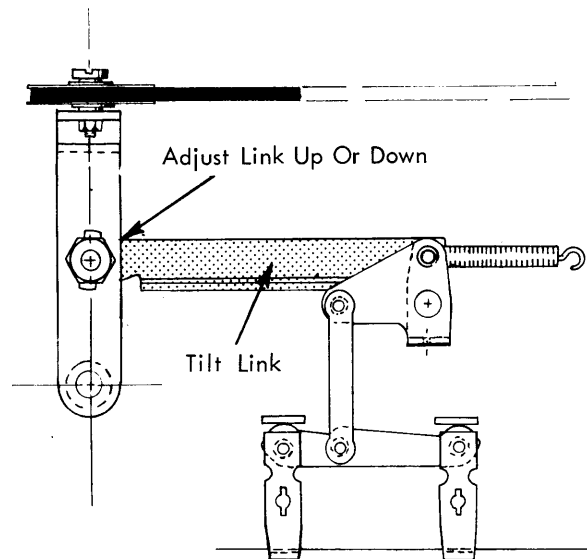


FIGURE 64. Tilt Differential

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 irregardless 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. 59). It is spring loaded at the rear into engagement with the typehead.

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 type head cannot be tilted nor rotated with the detents engaged. They must be held out of engagement until the type head has been completely positioned. They must also be removed from engagement before the type head 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 type head. The tilt detent is controlled by a small lever called the detent actuating lever located under the left side of the yoke (Fig. 65). 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.

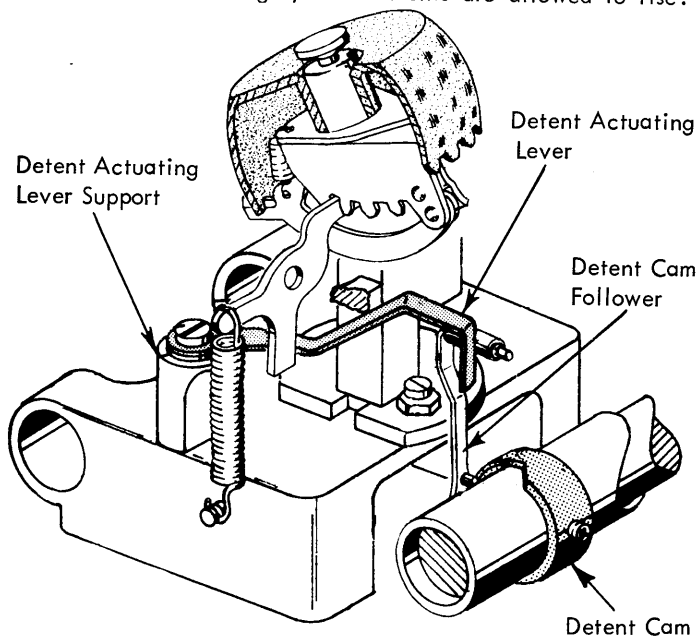


FIGURE 65. Detent Mechanism

Movement of the detent actuating lever is controlled by the detent cam through the detent cam follower (Fig. 65). 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 the rear of the detent to move up and down (Fig. 66). 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.

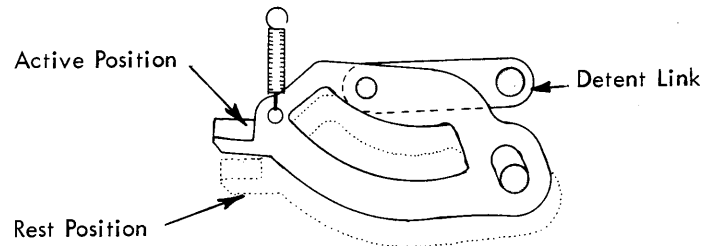


FIGURE 66. Rotate Detent

While the type head 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 type head, 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 type head 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 type head in position is no longer necessary; therefore the detents can be disengaged to allow the type head 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 type head completes its positioning and are disengaged just as the type head 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 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 type head 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 type head (Fig. 67) slightly in the negative direction. This is commonly referred to as head "drift".

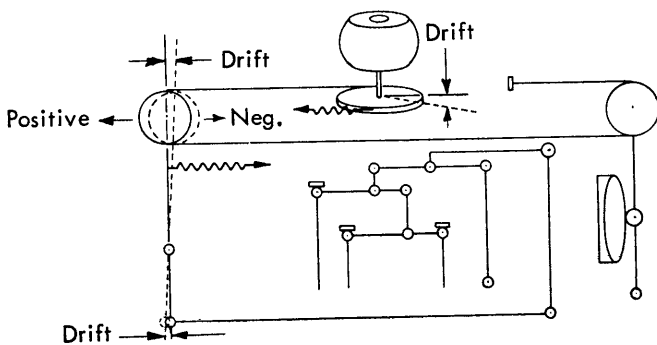


FIGURE 67. Rotate System Drift

As wear increases, head drift becomes excessive and failure of course or fine detenting occurs. Detenting failure necessitates a readjustment (re-homing) of the type head.

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. 68). 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. 68) 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.

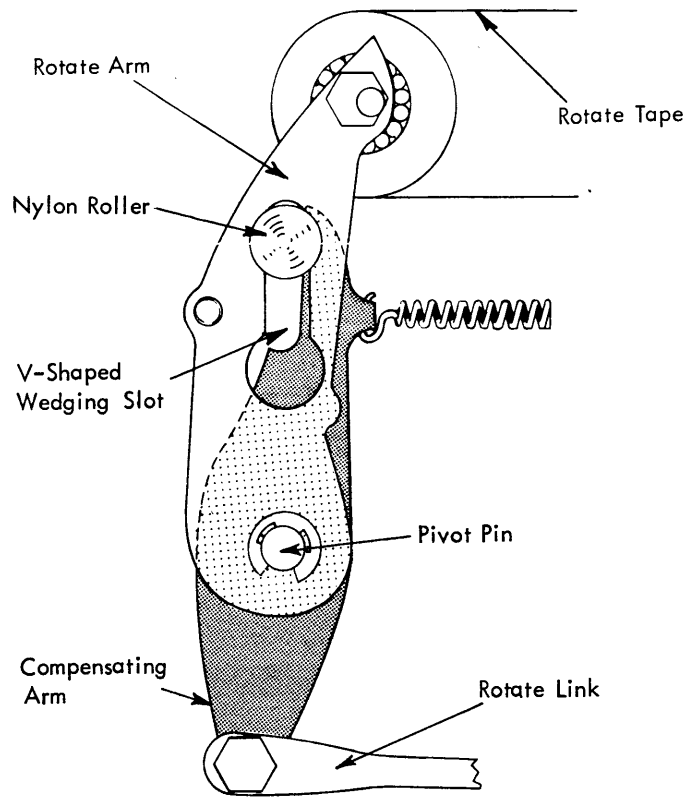


FIGURE 68. Basic Components Of The Wear Compensator

"The Basic Compensator Action of the Wear Compensator"

Figure 69-A shows the wear compensator in a zero rotate position. Note the following in Figure 69-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.

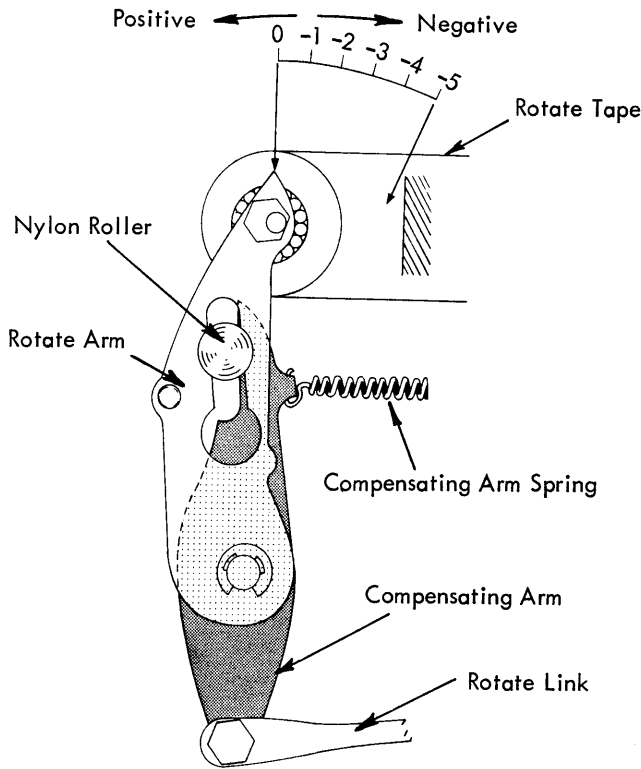


FIGURE 69A. Zero Rotate Position

Figure 69-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 sideframe when the wear compensator is in the negative 5 position.

Figure 69-C shows the wear compensator in the zero rotate position with wear introduced into the rotate differential system.

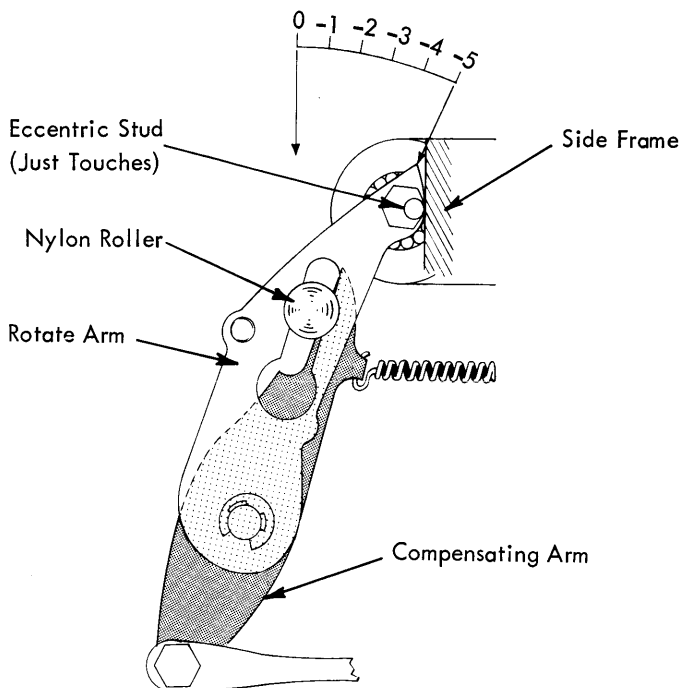


FIGURE 69B. Negative 5 Position

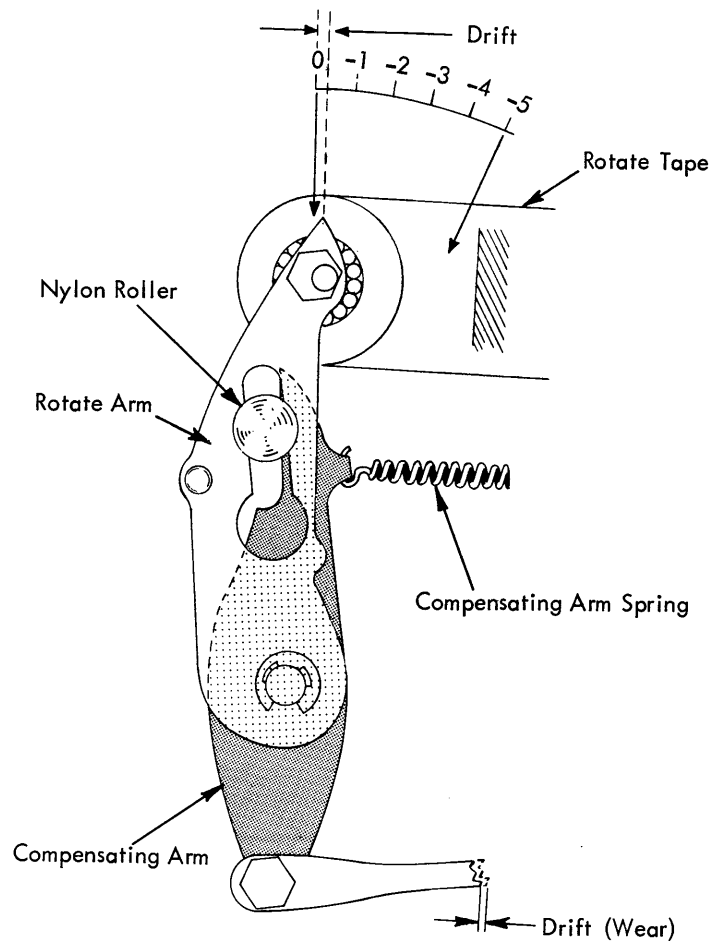


FIGURE 69C. Zero Rotate Position With Drift

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 sideframe 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. 69-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.

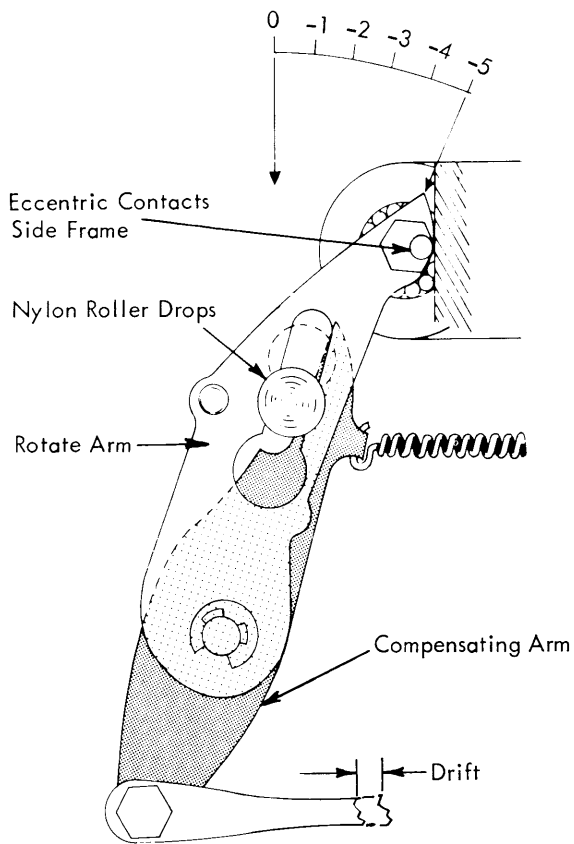


FIGURE 69D. *Negative 5 Position With Drift
(Nylon Roller Drops)*

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 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 wedging 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.

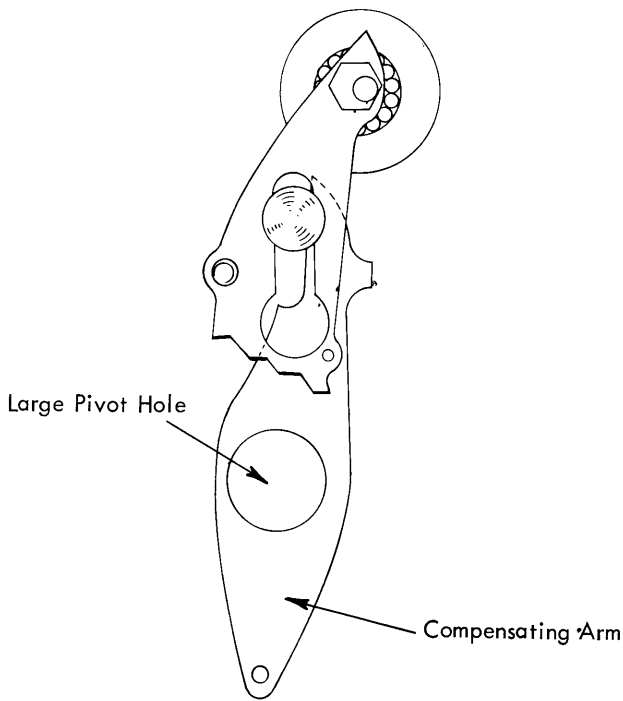


FIGURE 70. Compensating Arm Pivot Hole

The compensating arm contains a large pivot hole (Fig. 70). Fitted inside the large pivot hole is an eccentric shoulder which is part of the rotate eccentric arm (Fig. 71). 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.

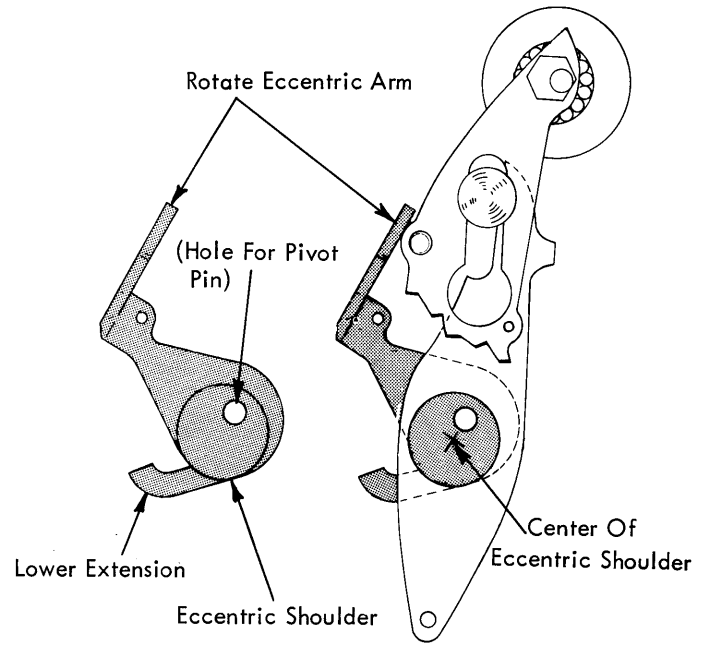


FIGURE 71. Mounting Of Rotate Eccentric Arm

The rotate eccentric arm is spring loaded against the rotate arm by means of the rotate eccentric arm spring (Fig. 72). The rotate arm is spring loaded against the compensating arm by means of the rotate pulley spring. Therefore, the rotate 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. 73) 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.

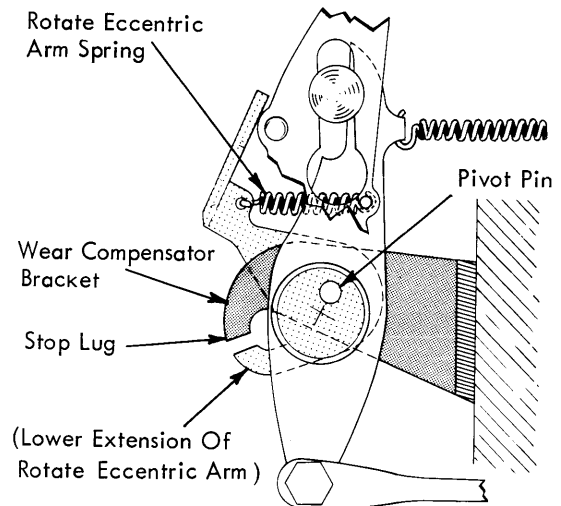


FIGURE 72. Zero Rotate Position

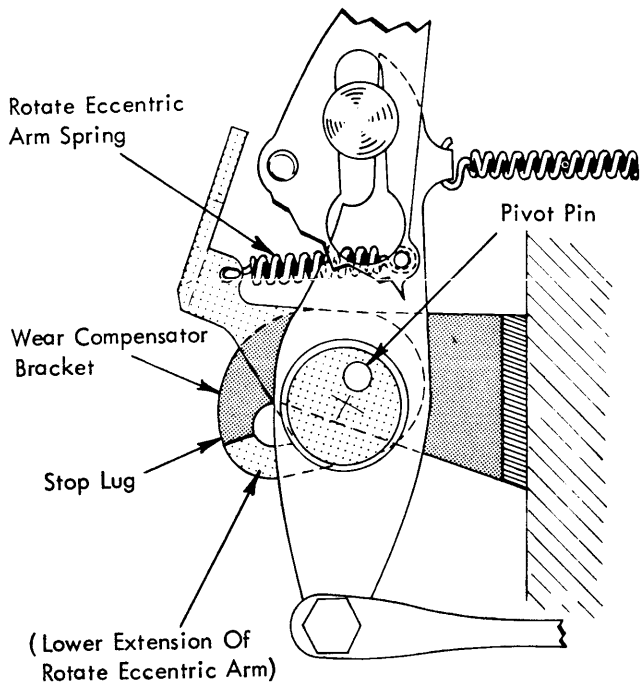


FIGURE 73. Negative 5 Position

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 and the cycle shaft bearing. 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 type head is initially set ("homed") to favor the positive direction, relative to the rotate detent. As wear comes into the tape system, the type head will drift slightly in the negative direction. The type head notch will then tend to become centered relative to the rotate detent.

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 74 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

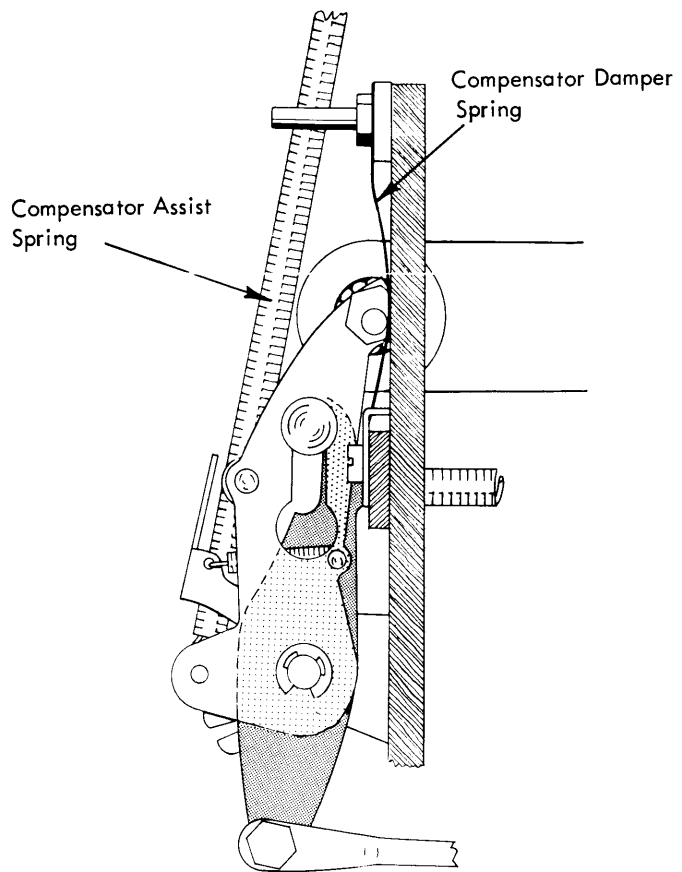


FIGURE 74. Wear Compensator

pulley, type head, etcetera. This overthrow allows the V-shaped wedging slot to open up resulting in unwanted roller droppage.

The compensator damper spring (Figure 74) 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 type head not be properly positioned when the detents try to engage.

Wear Potential

Wear potential in the tilt and rotate mechanism is defined as: the ability of the tilt and rotate mechanisms to properly coarse align the typehead after a measurable amount of uncompensated wear is felt in either mechanism. Although wear potential is designed into both mechanisms it will only be discussed in the rotate mechanism.

A portion of the typehead play provides the rotate system with a substantial amount of wear potential. In order to explain how this is accomplished, it is necessary to understand the relationship between typehead play, typehead homing and band width.

Figure 75 illustrates the typehead play by showing a single detent notch (of the typehead) in the two positions as allowed by the built in play.

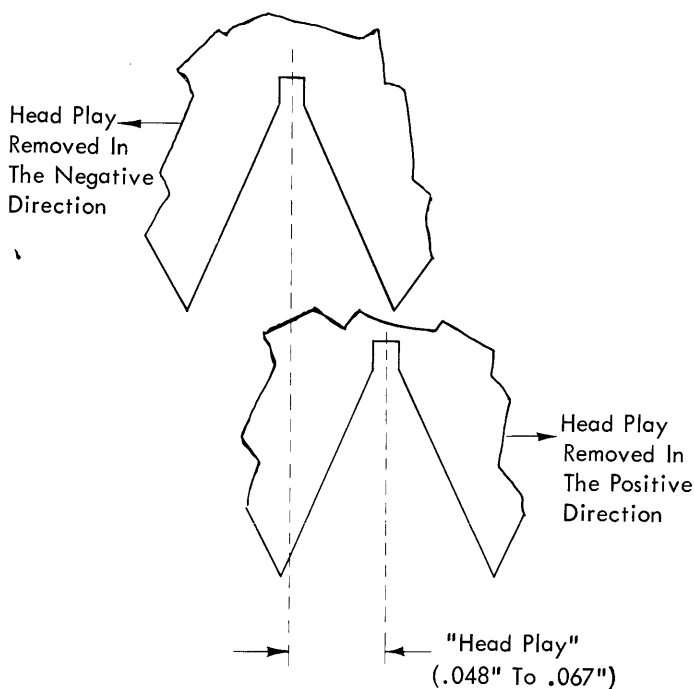


FIGURE 75. Typehead Play

The typehead play, which is approximately .060" measured at the typehead skirt, can be separated into three sections or segments each having their own function. The first segment of head play is spent for detent timing purposes by the typehead homing adjustment (Fig. 76).

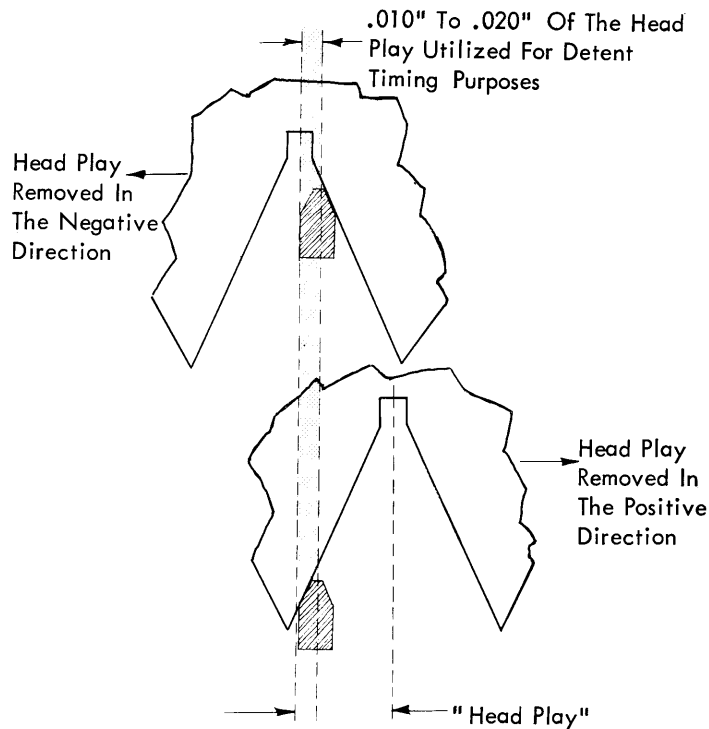


FIGURE 76. Typehead Homing

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. 76).

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.

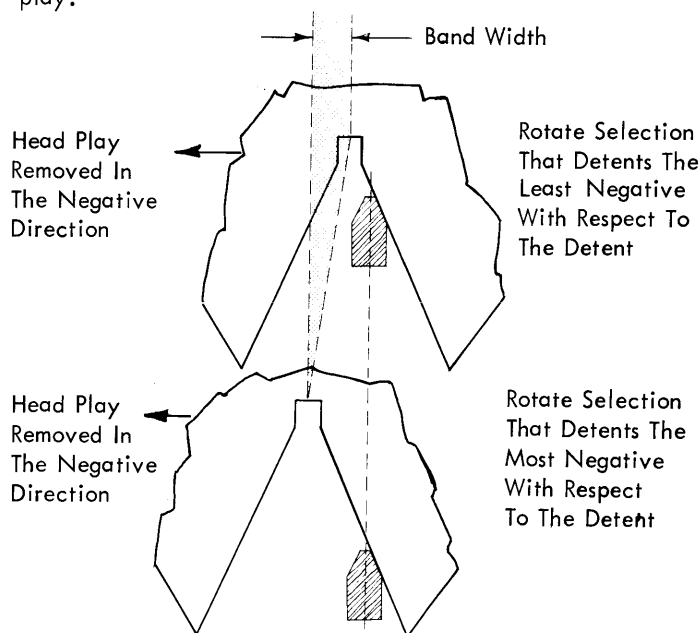


FIGURE 77. Band Width

The second segment of head play is spent on "band width". With head play removed in the negative direction, Fig. 77 illustrates band width by showing the amount of variation (in coarse alignment) between the rotate selection that detents the least negative and the rotate selection that detents the most negative with respect to the rotate detent.

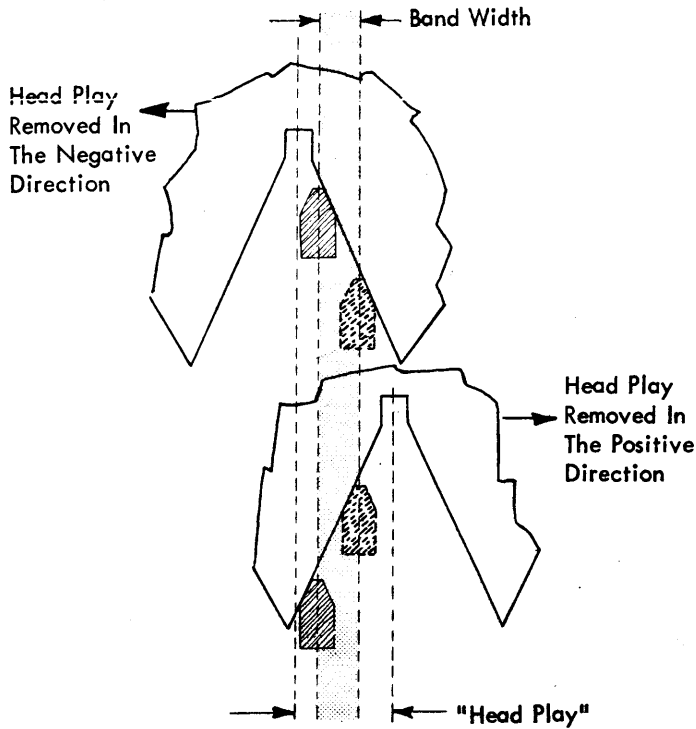


FIGURE 78. Band Width

Fig. 78 illustrates band width in relation to head play. The allowable band width of the rotate system may utilize as much as 1/2 of the typehead play. Note that almost 3/4 of the head play is spent for typehead homing and band width (Fig. 76 and 78). The remaining head play that is left is used for wear potential (Fig. 79).

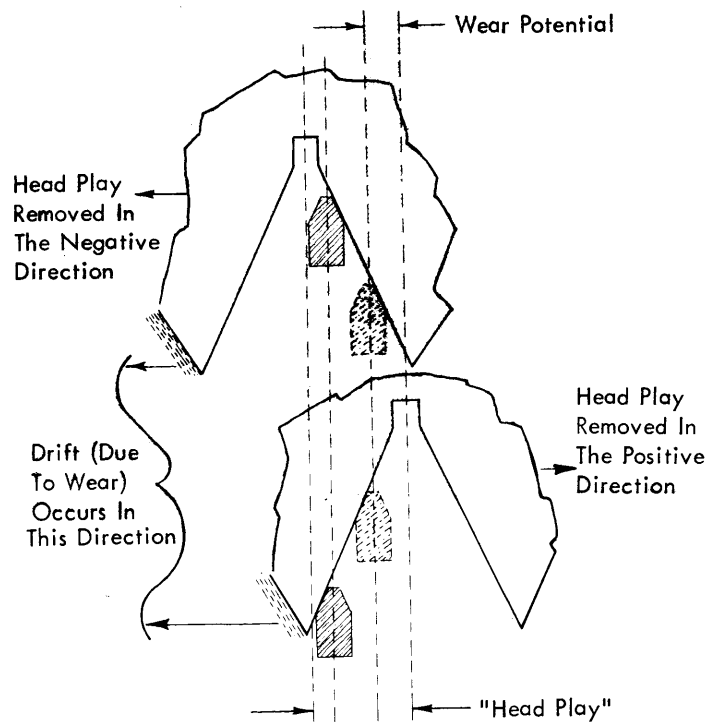


FIGURE 79. Wear Potential

When wear occurs in the system the typehead drifts in the negative direction with respect to the detent. This also causes the head play and band width to drift in the negative direction with respect to the detent. As long as this drift does not exceed the wear potential portion of the head play the detent will continue to fine align the typehead. Once it has exceeded the wear potential, the rotate selection that coarse aligns the most negative with respect to the detent will fail to seat in the detent notch. The detent will then fail to seat causing that character to print out of alignment.

PRINT MECHANISM - OLD STYLE

The purpose of the print mechanism is to actuate the type head 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 porous bronze 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. 80). Whenever the print shaft is rotated, the print sleeve is rotated by the key connection.

The print sleeve contains four cams (Fig. 80). 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.

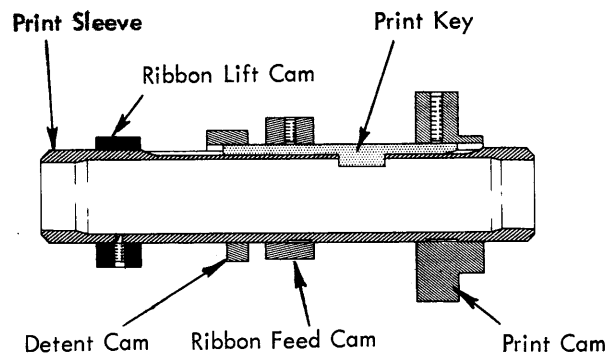


FIGURE 80. Print Sleeve And Cams

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 type head 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 type head to the platen. The larger cam surface called the restoring cam restores the type head 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. 81). 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. 82). 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.

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.

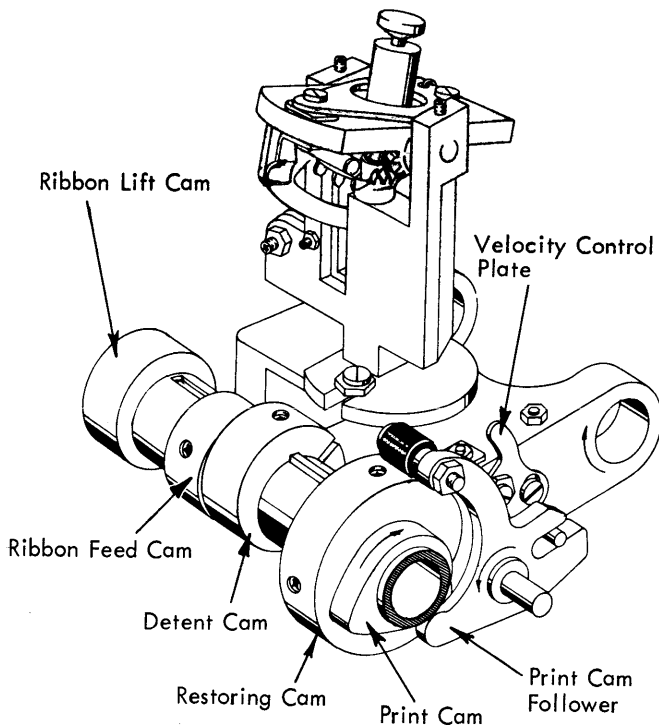


FIGURE 81. Print Mechanism

The larger camming surface on the left of the print cam is called the restoring cam (Fig. 82). Its purpose is to power the rocker back to the rest position after the type head prints thereby preventing any rebounding from occurring. This is accomplished by the restoring roller on the upper arm of the cam follower.

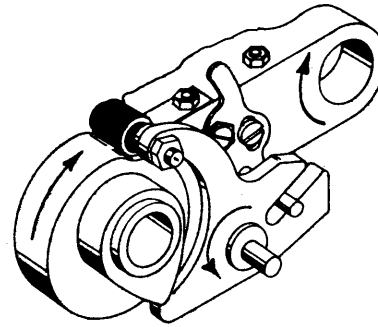


FIGURE 82. Print Cam Action

The camming surface of the print cam is designed so that the type head 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 type head the remaining distance. The contour of the rebound cam is such that it allows "free flight" of the rocker and type head, when the type head is near the platen. Because the type head 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 type head 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. 83). Just under the front of the carrier and extending

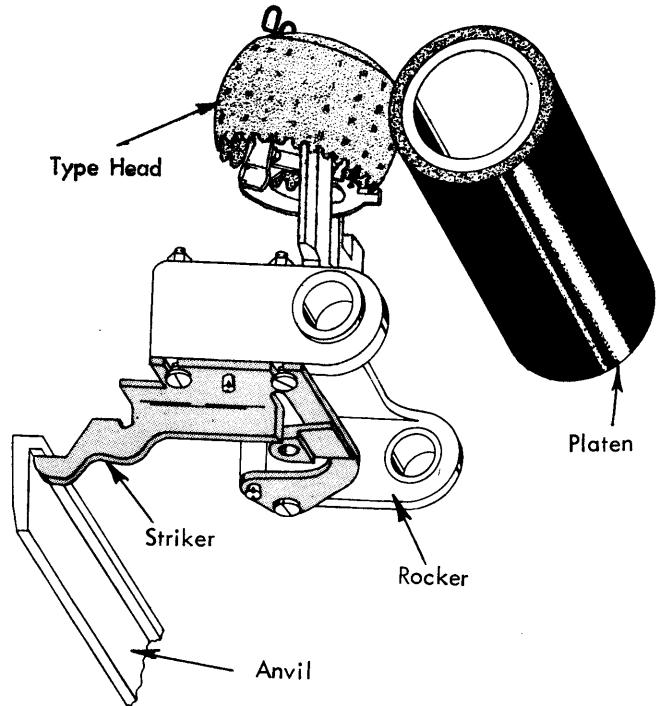


FIGURE 83. Anvil And Striker

between the side frames is the anvil. It is an angle-shaped bar with the lip extending to the rear. As the type head embosses the paper to the correct depth, the striker hits the bottom of the anvil and prevents further travel of the rocker and type head. This means that the impression for each character will be consistent with little variation between 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. 84) located on each side (at the front) of the carrier casting limit this flexing action by operating against the top surface of the anvil.

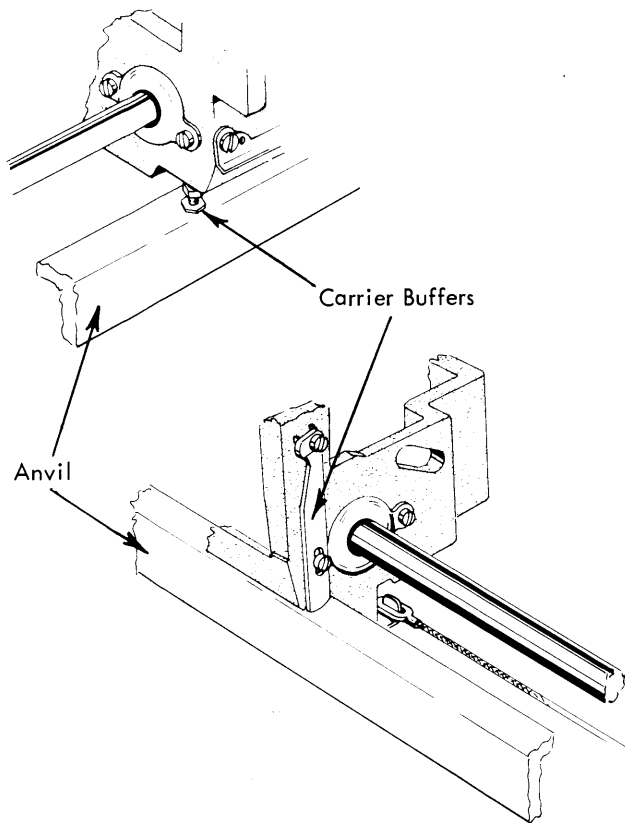


FIGURE 84. Carrier Buffers (long carriage)

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 used with the standard IBM Electric Typewriter.

The platen is held in position on the machine by a latch pivoted at the front on each carriage plate (Fig. 85). 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.

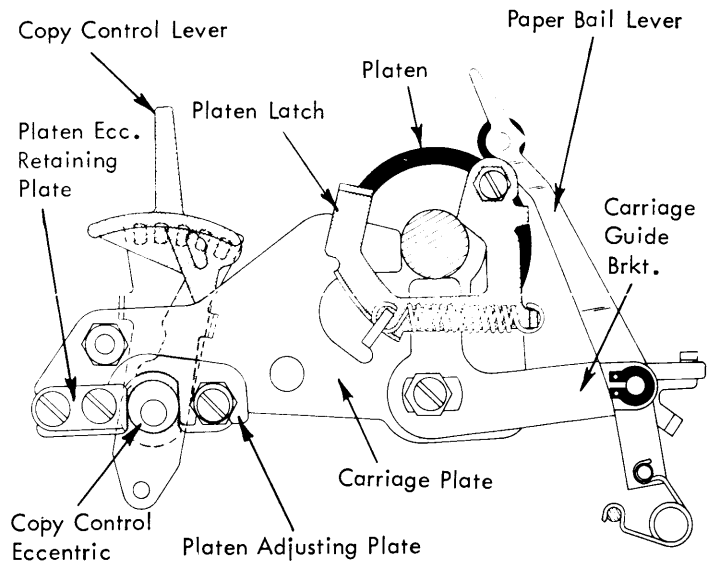


FIGURE 85. Copy Control Mechanism

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 type head with the paper.

The copy control is operated by means of the copy control lever located at the left end of the carriage (Fig. 85). 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 - NEW 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. 86).

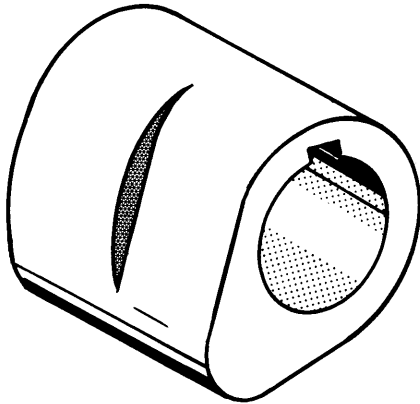


FIGURE 86. Print Cam (dual velocity)

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. 87) 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.

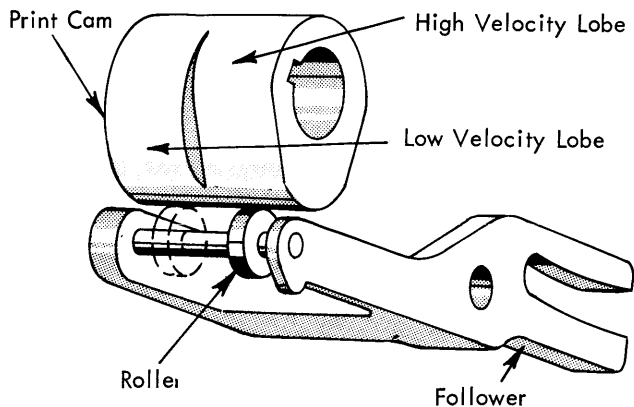


FIGURE 87. Print Cam Follower Assembly

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. 87).

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. 88). 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.

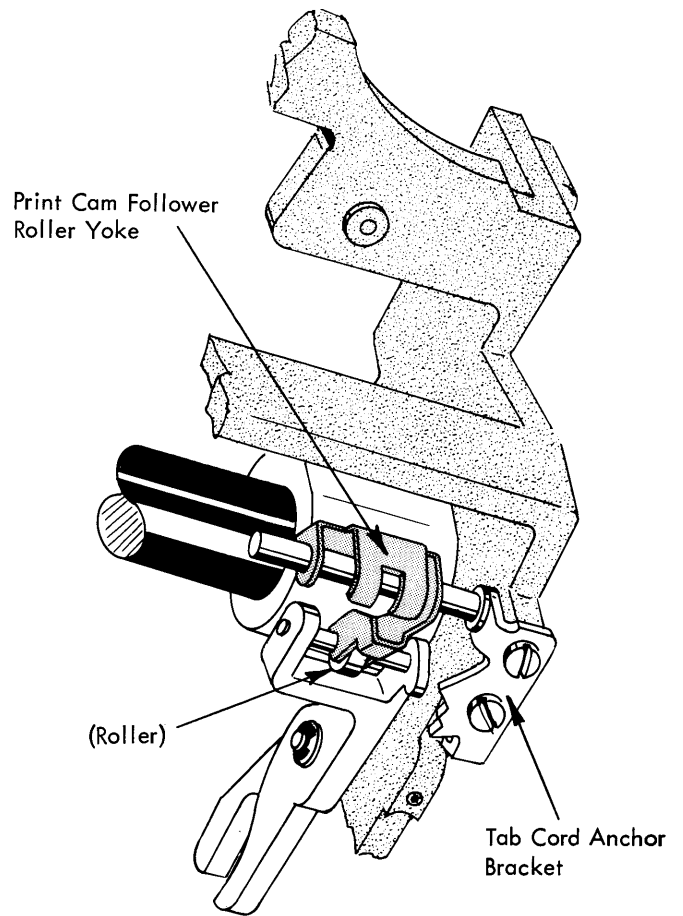


FIGURE 88. Print Cam Follower Roller Yoke

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. 89).

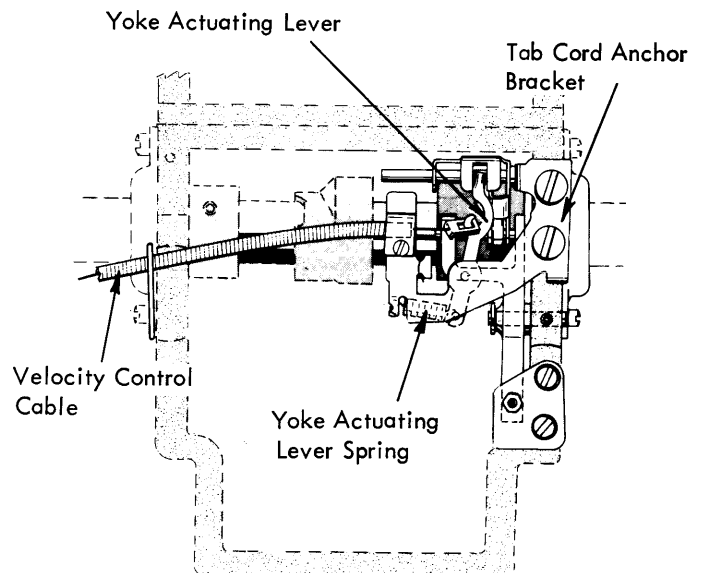


FIGURE 89. Yoke Actuating Lever And Spring

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. 89.

A sheathed cable called the velocity control cable fastens to hooked portion of the yoke actuating lever (Fig. 89). 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. 90.

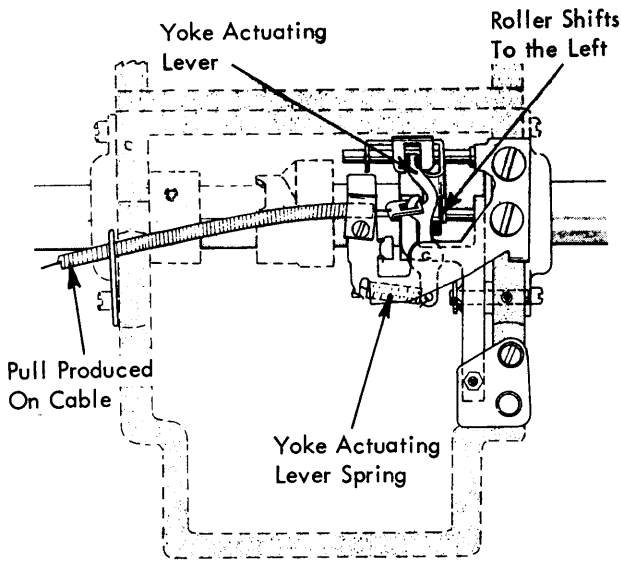


FIGURE 90. Low Velocity Operation

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. 89).

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. 91).

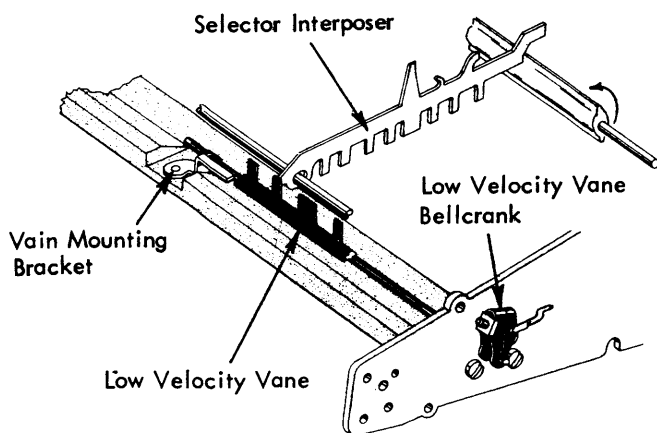


FIGURE 91. Low Velocity Selection

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. 91). 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 follower and the adjustable stop operates as one piece pivoting about a stud on the keyboard sideframe (Fig. 92). A heavy spring hooked to the adjustable stop and anchored to the latch mounting stud, spring loads the follower in a clockwise direction.

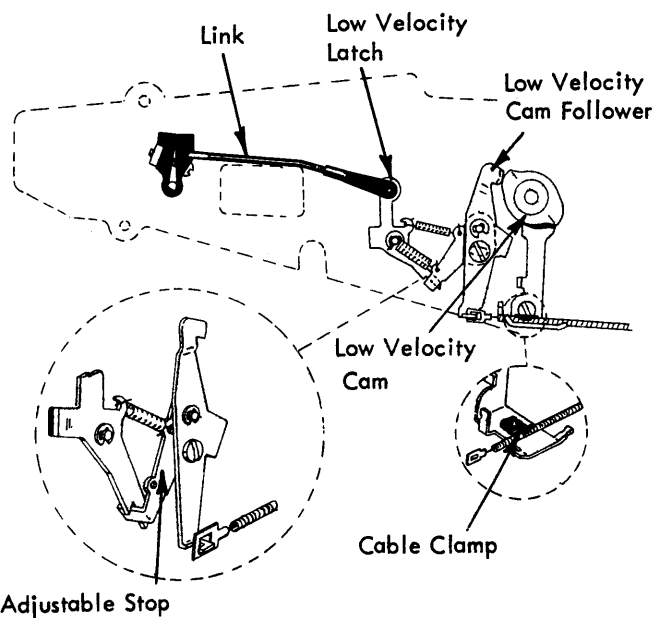


FIGURE 92. Machine At Rest

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. 92). 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.

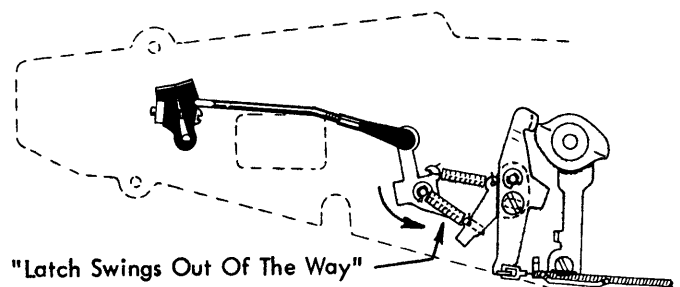


FIGURE 93. Beginning Of A Low Velocity Operation

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. 93. This occurs each time a low impression character is selected at the keyboard.

Figure 94 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.

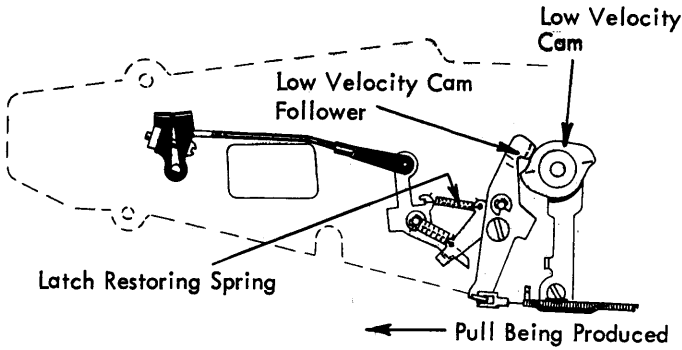


FIGURE 94. Low Velocity Operation

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. 89) 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 roller 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. 95). The stop screw, which is threaded through a triangular shaped screws, 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.

The velocity control cable consist 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. 90 and 92). Clamping the ends of the sheath

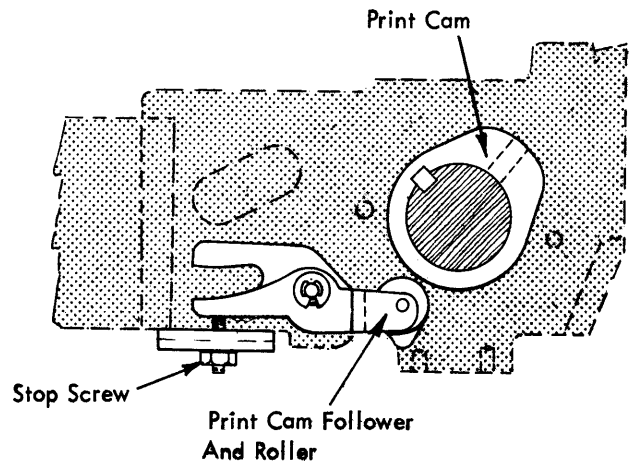


FIGURE 95. Print Cam Follower Stop Screw

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. 96. 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.

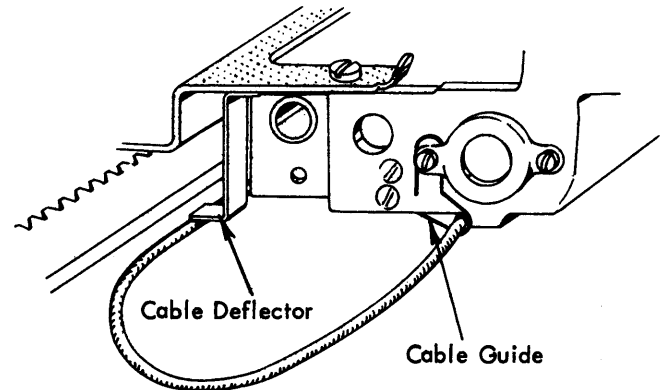


FIGURE 96. Cable Guide And Cable Deflector

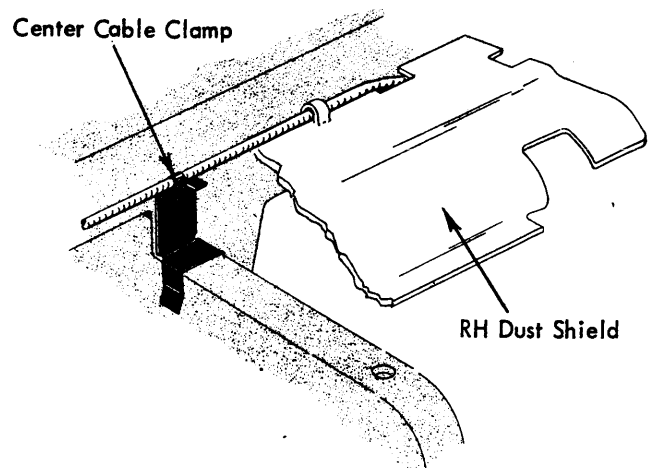


FIGURE 97. Center Cable Clamp

A cable deflector attached to the escapement bracket (Fig. 96) 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. 97). 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.

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. 98. 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.

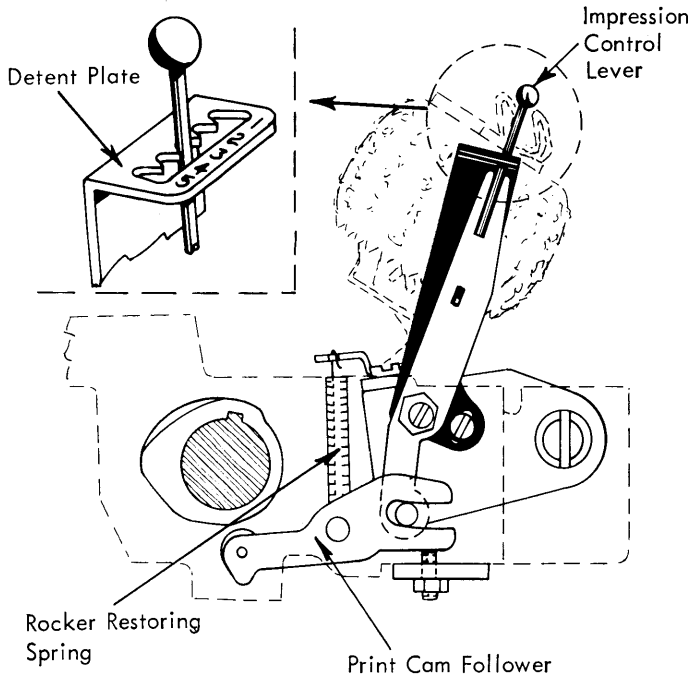


FIGURE 98. Impression Control Mechanism

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. 98). 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 remains constant in the machine cycle regardless of the impact velocity of the typing element.

Note in Figure 98 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. 99). The carrier buffers have been eliminated and the bottom of the ribbon feed bracket serves as a buffer.

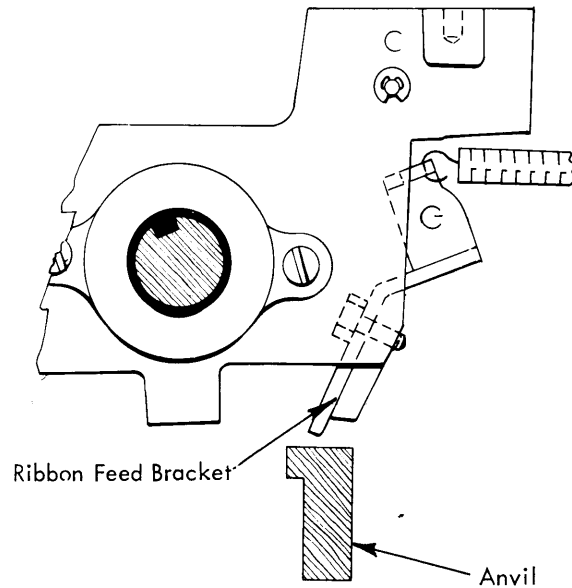


FIGURE 99. Carrier Support (723-725)

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. 100).

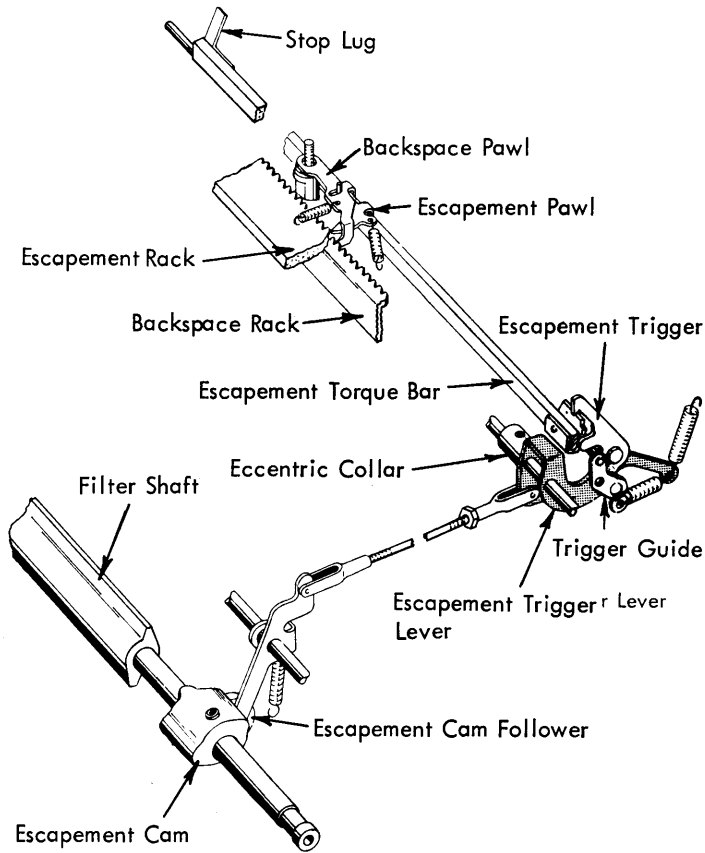


FIGURE 100. *Print Escapement Mechanism*

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. 100). 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.

The escapement pawl contains an elongated hole at its mounting point that allows .022" 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. 101a).

An escapement operation is obtained by forcing the escapement pawl to the rear out of engagement with the rack teeth (Fig. 101b). 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. 101c). The carrier then moves to the right until it comes to rest against the escapement pawl (Fig. 101d).

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 on the Series 72. 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.

Having the escapement rack stationary and the escapement pawl moveable 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.

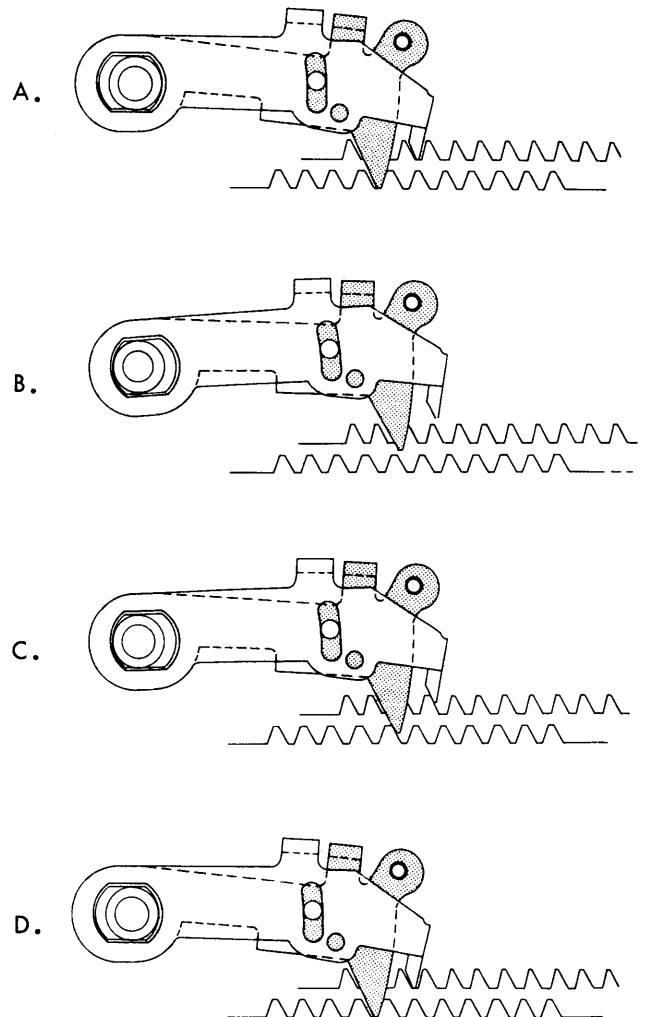


FIGURE 101. *Escapement Pawl Operation*

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 101a 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 .022" of elongated motion in its 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. 100). 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. 100). 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. 102). A back stop mounted to a stud in the machine powerframe provides the necessary backing.

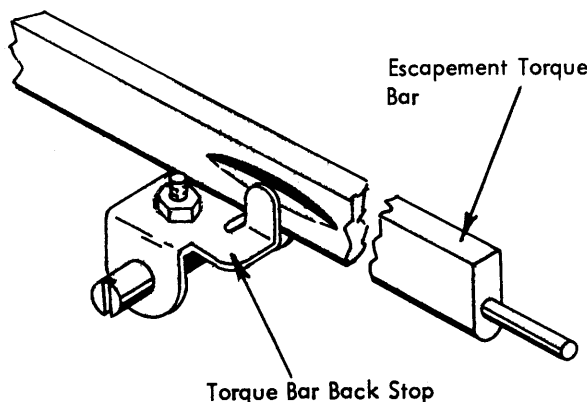
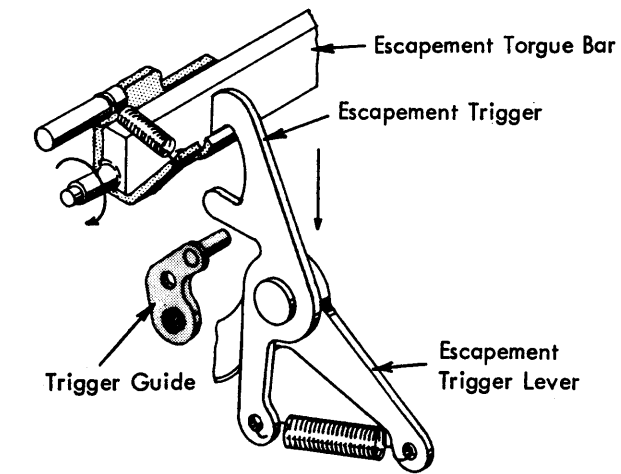


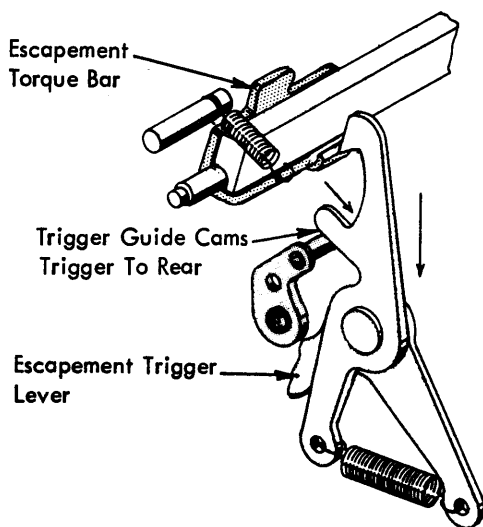
FIGURE 102. Torque Bar Backspace

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. 103). 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.



A. REST POSITION

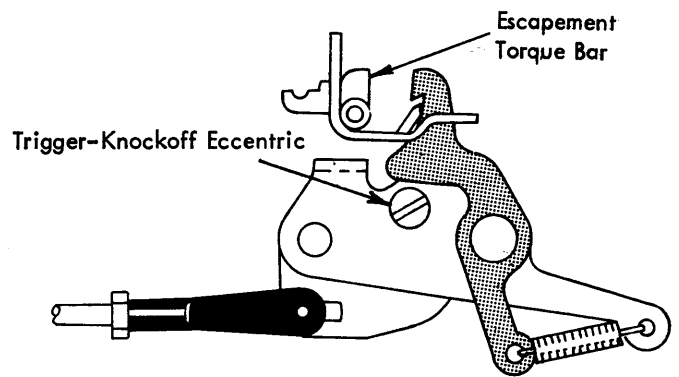


B. ACTIVE POSITION

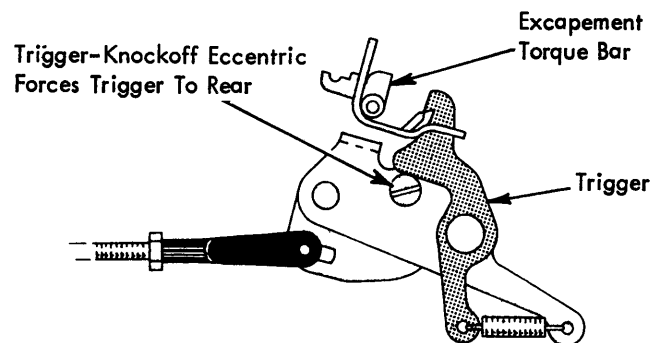
FIGURE 103. Escapement Trigger Operation (old style)

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 into 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. 103a). 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. 103b). The torque bar can then restore without waiting for the restoration of the trigger and trigger lever.

The new style escapement trigger operation is basically the same as the old 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. 104).



A. REST POSITION



B. ACTIVE POSITION

FIGURE 104. Escapement Trigger Operation (new style)

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. 100). 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 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 prints. 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 the 721 only, a small eccentric collar on the pivot pin 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. 105). The cage is turned counterclockwise (facing the rear) so that it locks into position. 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.

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 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. 105). 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. 105). 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.

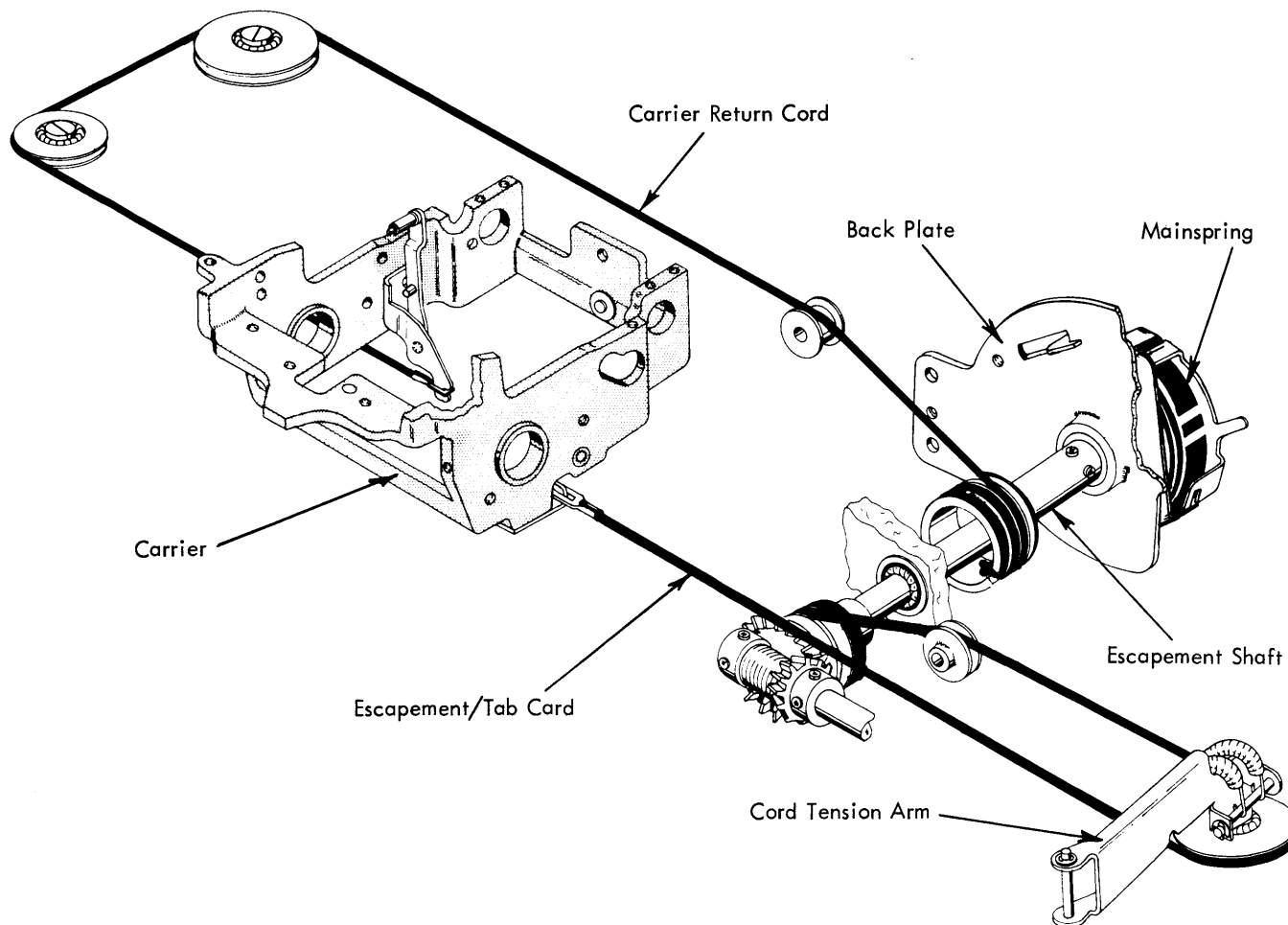


FIGURE 105. Mainspring And Cord System

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 pivoted at the front (Fig. 105). A pair of spiral springs arched between the arm and a pin on the powerframe 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, carrier return, indexing, and shift. The tabulator is manually operated and the only non-powered service operation.

The spacebar, backspace, 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. 106). 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 and backspace 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 two functions. 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.

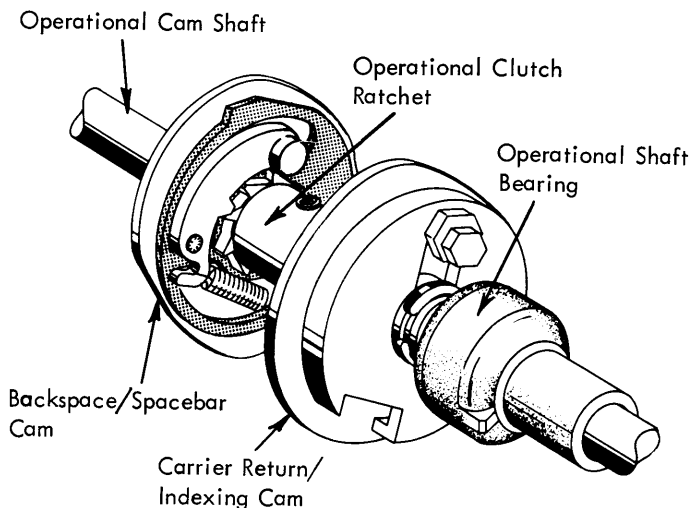


FIGURE 106. Operational Cams

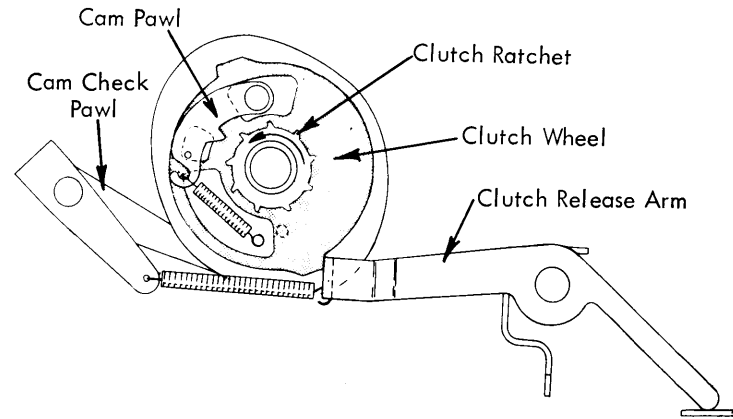


FIGURE 107. Operational Cams At Rest

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 operation must operate quickly in order to provide rapid positioning of the carrier; therefore it also employs the double lobed cam. Both the carrier return and indexing key-levers 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.

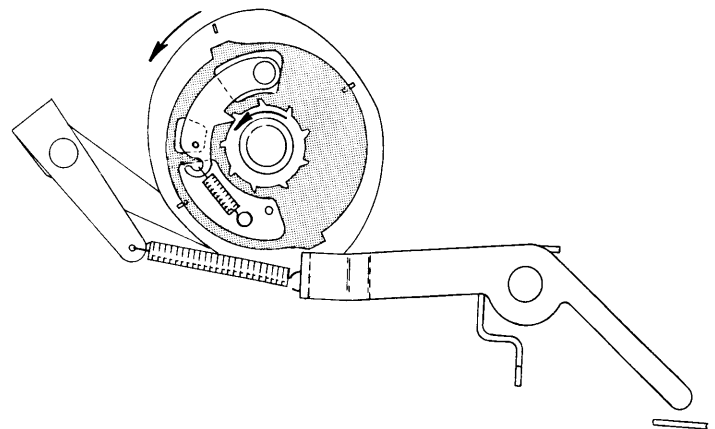


FIGURE 108. Operational Cam Active

A ratchet, called the operational clutch ratchet, is set-screwed to the operational cam shaft (Fig. 106). 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.

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. 107). Whenever the pawl is permitted to engage in the clutch ratchet, the cam will rotate with the ratchet (Fig. 108).

The operational cam pawl is prevented from engaging the clutch ratchet by a disc called the clutch wheel (Fig. 107). 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. 108). 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. 109).

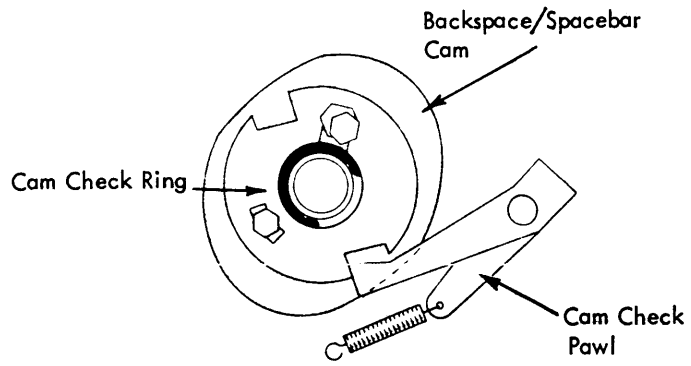


FIGURE 110. Operational Cam Check Pawl

the ratchet (Fig. 110). 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.

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 four 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. 111 and 112). A position for a fifth interposer is present in the operational control bracket. The fifth interposer is used in special applications of the machine and is not normally included in the mechanism. 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 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

FIGURE 109. Clutch Pawl Being Disengaged

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. 107). 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. 108). The cam pawl spring is then allowed to pull the pawl into engagement with a tooth of the clutch ratchet by 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

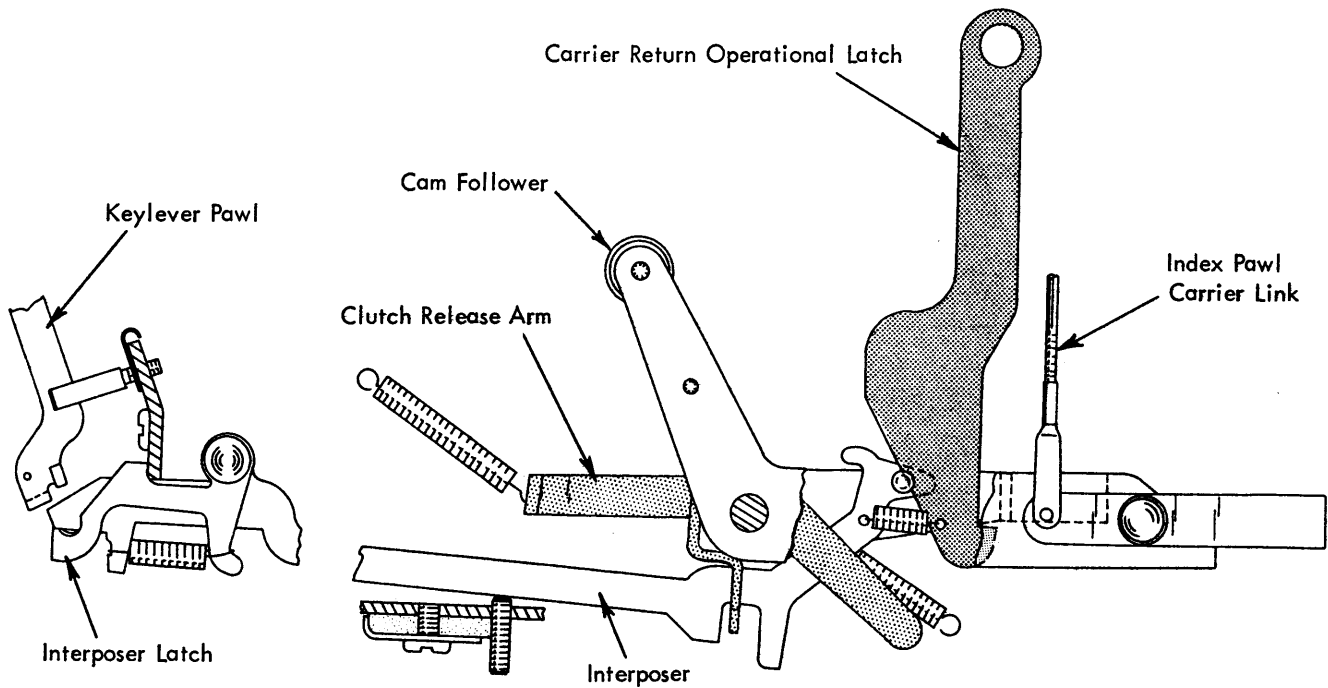


FIGURE 111. Carrier Return/Indexing Operational Control Mechanism

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, and spacebar key-levers 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. 111 and 112). 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. 107).

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

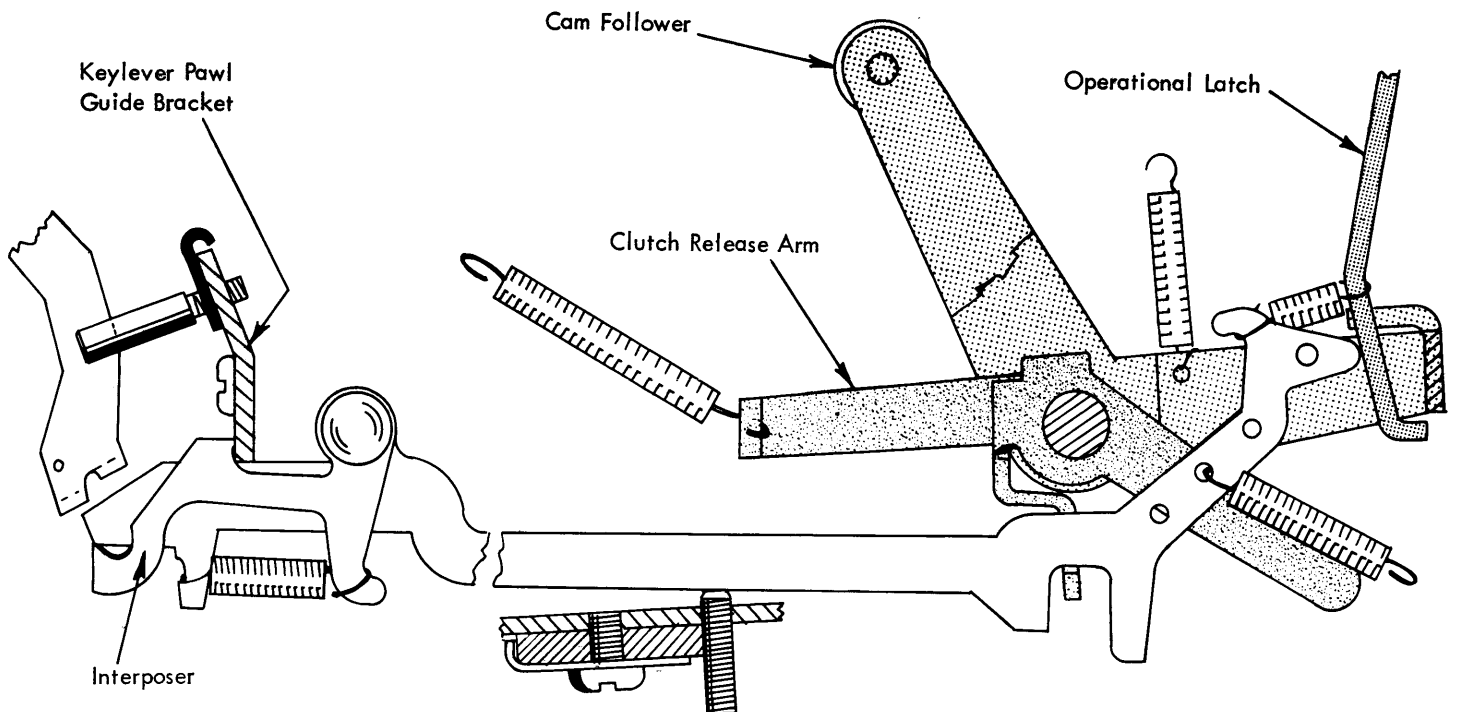


FIGURE 112. Back / Spacebar Operational Control Mechanism

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. 107). 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. 107).

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. 111 and 112). 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. 111). 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.

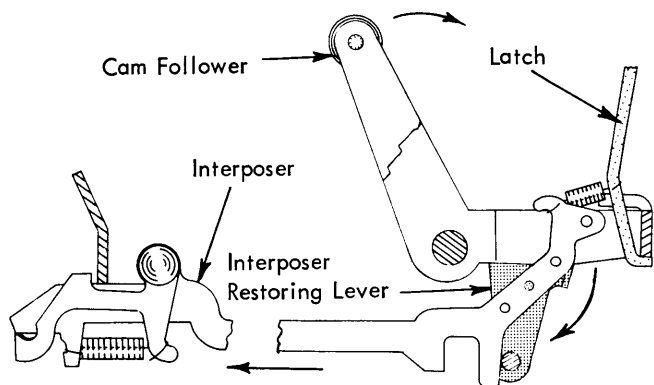


FIGURE 113. Interposer Restoring Operation

The backspace/spacebar cam follower is designed to operate three mechanisms. In normal applications of the machine, only the backspace and spacebar are present. In input/output typewriters the tabulator is also powered by the cam. 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. 112).

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. 113). 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. 113). The restoring lever, in turn, forces the interposer forward where it can latch in the rest position.

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. 111), merely releasing the cam results in an indexing operation.

The backspace, spacebar, and carrier return interposers each have a small, hook-like latch resting against the rear of the interposer (Figs. 111 and 112). 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. 113).

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. 113). 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

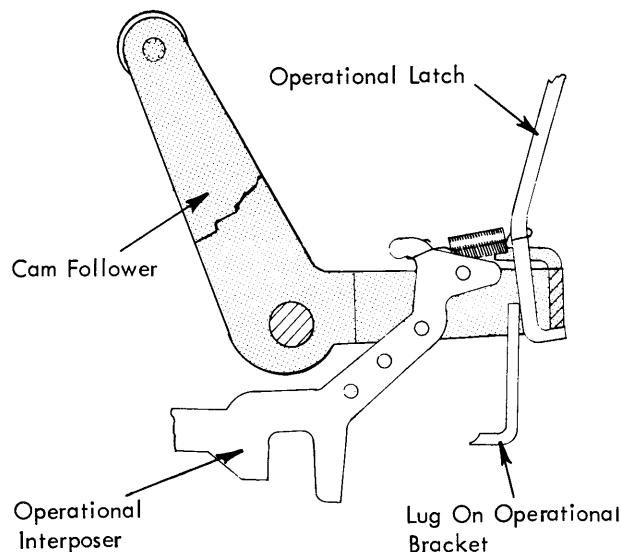


FIGURE 114. Operational Latch Locked To The Rear

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. 114). 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. 111).

6. Operating Sequence

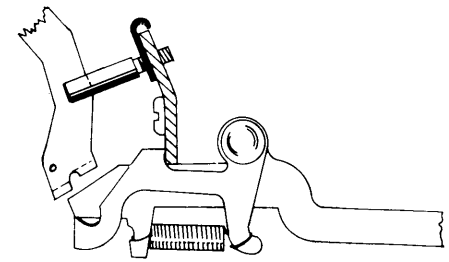
As the desired keylever is depressed, a lug of the keylever pawl contacts an interposer forcing it down to release it from the guide bracket. The interposer is pulled to the rear by its spring. A lug on the interposer contacts the clutch release arm rotating it down at the front to allow the cam clutch 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.

Repeat/Non Repeat

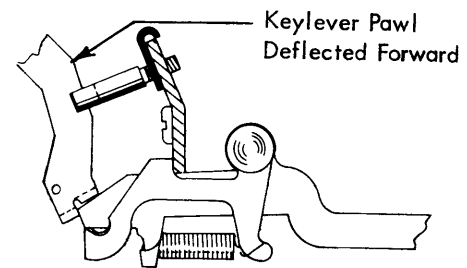
All four mechanisms operated by the operational cams are equipped with a repeat/non repeat feature. When the keylever is depressed to its first limit, only a single operation occurs. Further depression of the keylever causes the first limit to yield and allow a repeating action. Three different methods are used to determine the first limit for the keylevers. Each of the methods is discussed in the mechanism to which it applies.

In order to obtain either a single or a repeating operation, two lugs are needed on each keylever pawl. The front lug is just above the tip of the interposer when both are at rest (Fig. 115a). When the keylever is depressed, this lug causes the interposer to be released. As the interposer snaps to the rear, it moves out from under the lug of the keylever pawl. If the keylever is held depressed to its first limit, the end of the interposer will contact the lug of the keylever pawl as it restores to the front. The interposer will force the pawl forward and relatch on the keylever pawl guide bracket (Fig. 115b). When the keylever is released, the keylever pawl will then reset to the rear above the interposer.

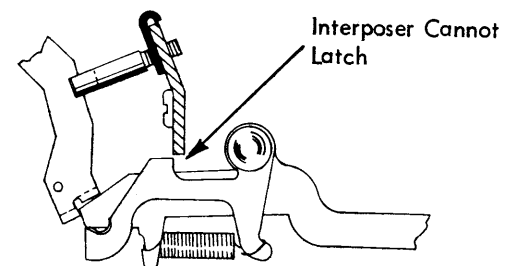
When the keylever is not released, the rear lug on the keylever pawl is now in position to release the interposer (Fig. 115b). Depression of the keylever past its first limit causes the rear lug to trip the interposer from the latch bracket (Fig. 115c). The interposer moves to the rear as before, but it cannot move far enough to get out from under the rear lug of the keylever pawl. Each time the interposer is restored to the front it is prevented from latching because the lug of the keylever pawl continues to hold it down. Because the interposer cannot latch, it is snapped back to the rear by its spring to operate the clutch release arm and to push the operational latch under



A.



B.



C.

FIGURE 115. Keylever Pawl Operation

the bail of the cam follower. Each time the cam operates, this action of the interposer is repeated causing a continuous operation. There is no operational latch for the indexing mechanism; therefore the index interposer only operates the clutch release arm to cause a continuous cam operation.

When the carrier return keylever is operated in the repeat position, it is always for the purpose of creating a repeat indexing operation with the carrier at the left margin. This is more convenient for the operator than using the index keylever which was designed primarily for indexing with the carrier away from the left margin.

One operation of the carrier return interposer causes an index operation plus a carrier return operation. Only an indexing operation is desired thereafter. Each time the carrier return interposer moves to the rear, the operational latch is moved under the cam follower to cause a carrier return operation. It is undesirable and unnecessary to have a repeating carrier return action at the left margin, because of the shock of the carrier repeatedly striking the left margin. Therefore, the carrier return interposer is not used for a repeating operation.

When the carrier return keylever is depressed and held down for a single operation, the interposer operates to the rear and is restored as on the other mechanisms. The interposer forces

the keylever pawl forward slightly in order to latch. The rear of the keylever pawl, instead of being above the carrier return interposer, is formed to the right above the index interposer (Fig. 116). Depression of the carrier return keylever past its first limit causes the keylever pawl to release the index interposer and hold it down. The index continues to repeat as long as the keylever is held in the repeat position.

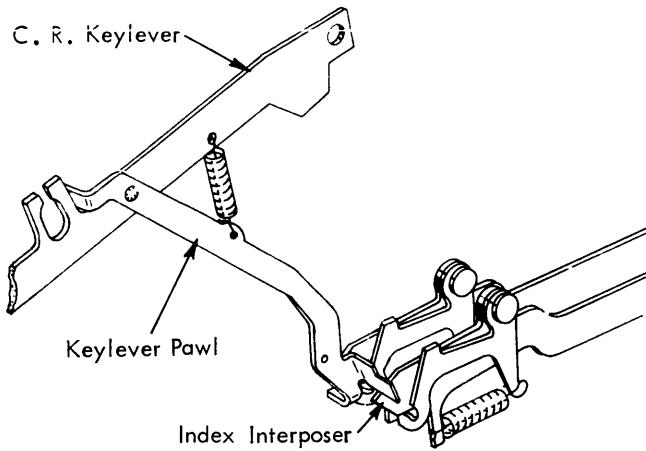


FIGURE 116. Repeat Carrier Return Operation

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.

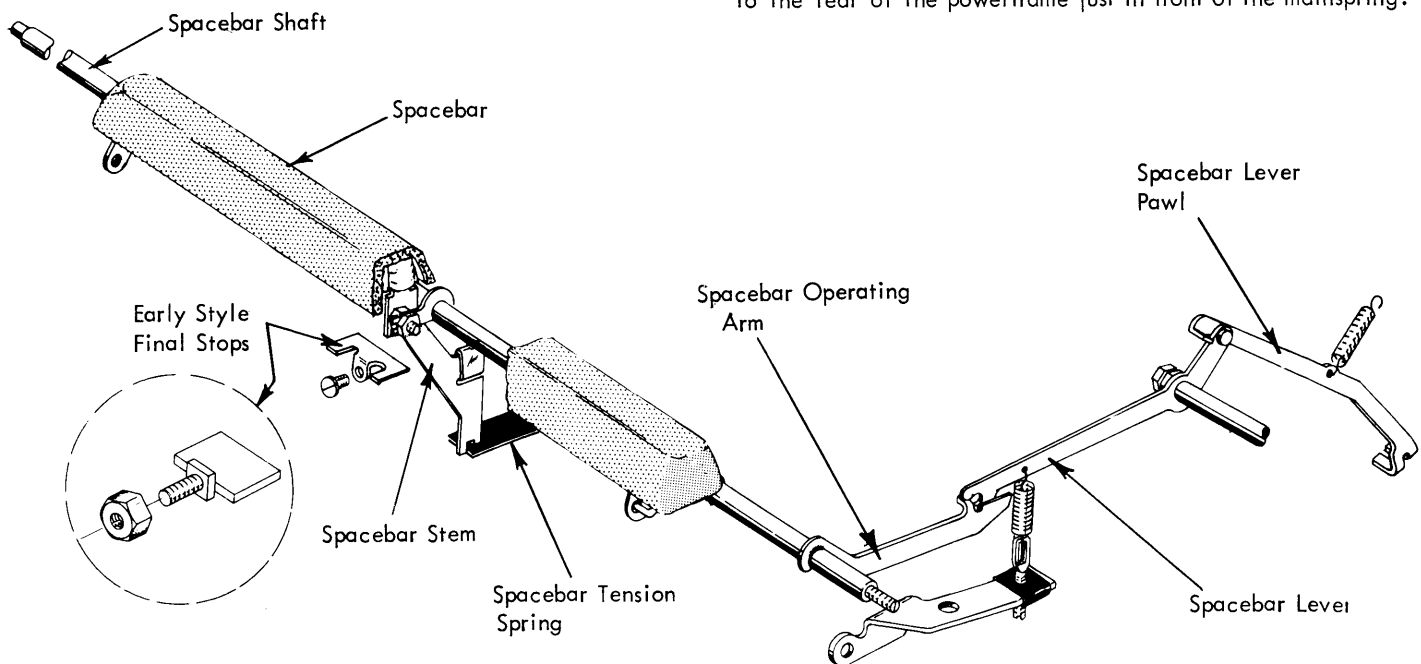


FIGURE 117. Spacebar Lever Mechanism

Spacebar Lever Mechanism - Early Level

The spacebar mounts on the keyboard just in front of the key-buttons. It is suspended on two arms extending forward from the spacebar shaft (Fig. 117). 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.

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 keylever 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. 117). 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 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. 118). 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.

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. 118). This causes the trigger 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.

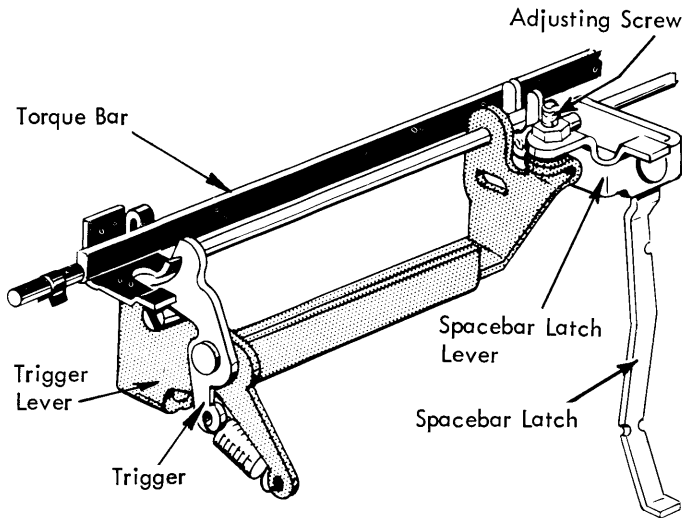


FIGURE 118. Spacebar Latch Operation

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. 117).

Upward travel of the spacebar is limited by the spacebar stem. A step in the stem contacts the bottom of the spacebar shaft

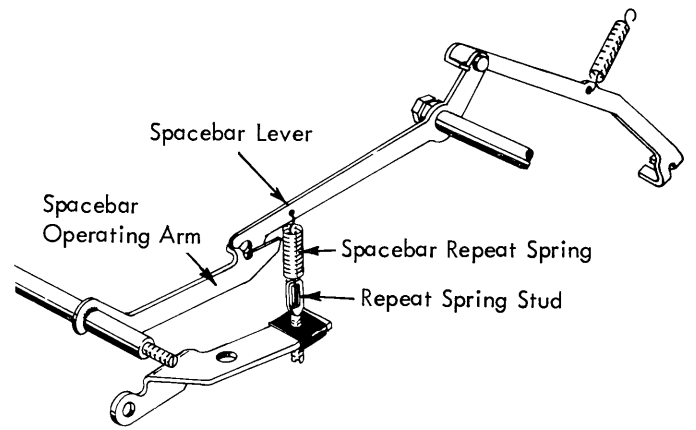


FIGURE 119. Spacebar Repeat Stop - New Style

(Fig. 117). A vinyl sleeve on the stem cushions the spacebar in the rest position to prevent noise.

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. 119). 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 lever to move into the repeat position.

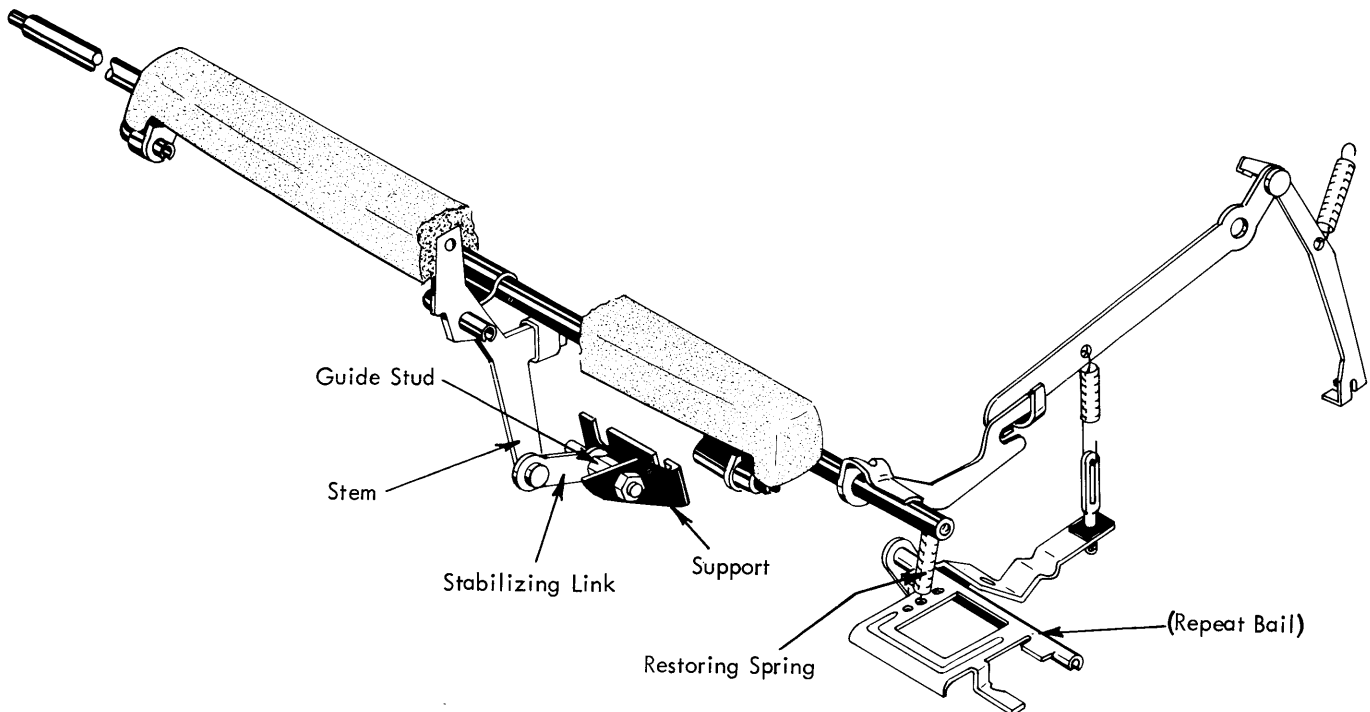


FIGURE 120. Spacebar Lever Mechanism - Late Level

Spacebar Lever Mechanism - Late Level

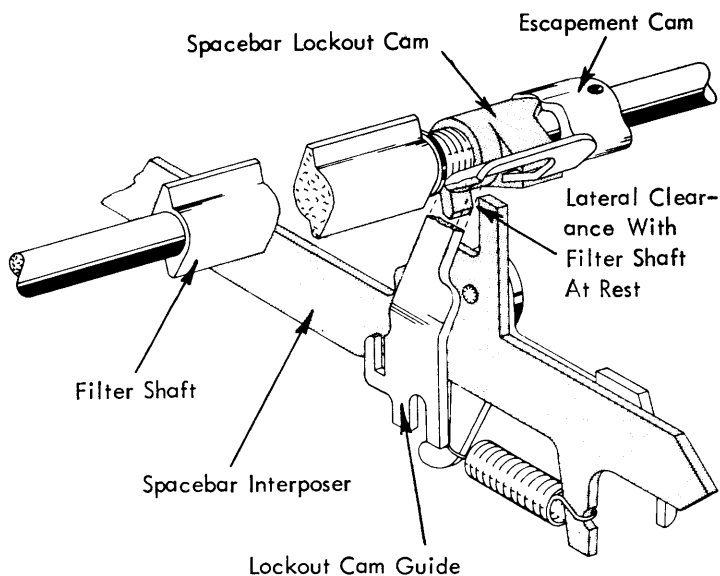
The late level spacebar mechanism is basically the same as the early level. The main difference is in the spacebar stem. A stabilizing link has been attached to the bottom of the stem by a shouldered rivet (Fig. 120). The rear portion of the link mounts on and pivots about an adjustable guide stud. This 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.

Spacebar Lockout - Old Style

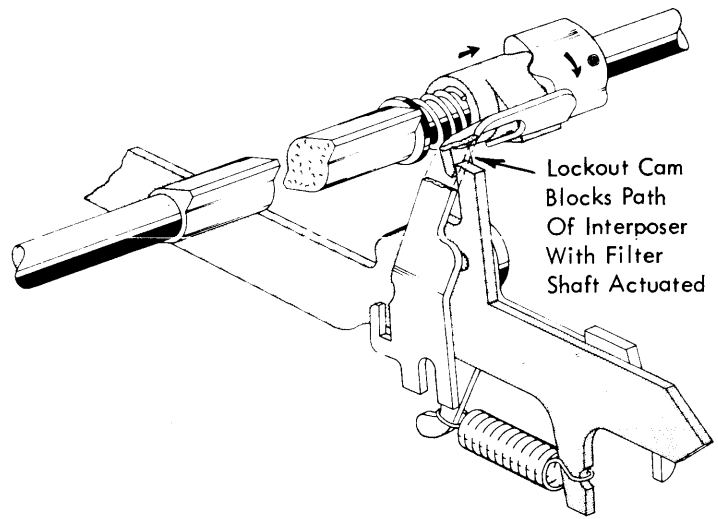
As previously mentioned, both the spacebar escapement and the print escapement operate by actuating the escapement trigger lever to cause an escapement operation. Because of the inter-relationship of these two mechanisms, operating both of them together causes only one space of escapement. Likewise if 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 car-



A. FILTER SHAFT AT REST

FIGURE 121a. Spacebar Lockout Mechanism



B. FILTER SHAFT ACTIVE

FIGURE 121b. Spacebar Lockout Mechanism

rier. 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. 121). 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. 121a).

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. 121b). 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. 121b). 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 - New 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. 122).

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. 122).

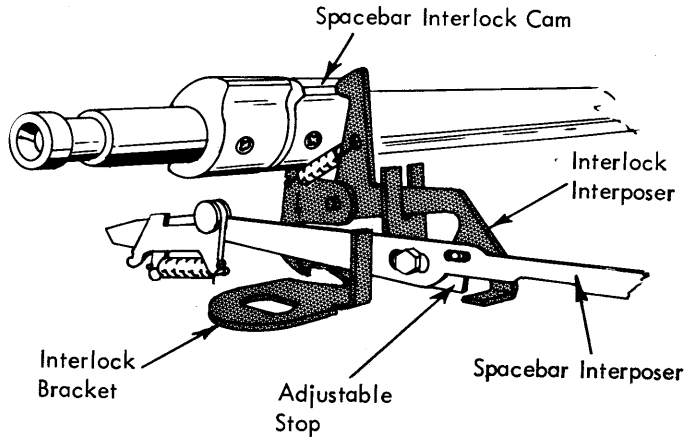


FIGURE 122. Spacebar Lockout - New Style

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.

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. 123). 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.

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. 124). 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. 124a).

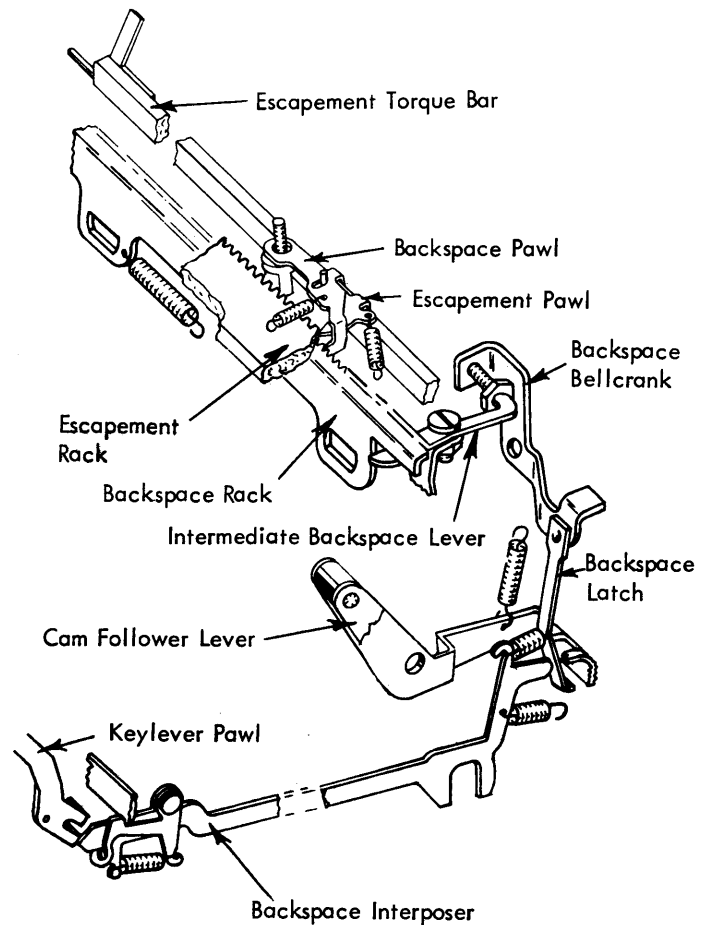


FIGURE 123. Backspace Mechanism

The slot also permits the backspace pawl to click into the next tooth as the backspace rack restores (Fig. 124b). Because of the elongated pivot holes in the two pawls, the stud connection is necessary to insure that the pawls 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 .044" additional travel to compensate for the .022" elongation in each pawl.

The backspace rack is actuated by a bellcrank pivoted on the front of the back plate (Fig. 123). 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. 125). 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 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. A bail, located under the right front corner of the keyboard, determines the first limit for the keylever depression. The left end of the bail pivots in a small bracket attached to the bottom of the guide comb support. The right end pivots in a hole in the keyboard sideframe. A lug on the right side of the repeat bail limits against the keyboard sideframe to determine the rest position of the repeat bail. An extension spring inside the sideframe holds the repeat bail in the rest position and offers a resistance to further depression of the keylever.

When the keylever is depressed, the front of the keylever is forced down against the repeat bail. This stops the travel of the keylever and allows a single operation of the mechanism. Additional pressure on the keylever causes the repeat bail to yield allowing the keylever to move into the repeat position. Holding the keylever in the fully depressed position causes the keylever pawl to hold the interposer down allowing a continuous operation of the mechanism. The final travel of the keylever is reached when the keylever bottoms in the guide comb.

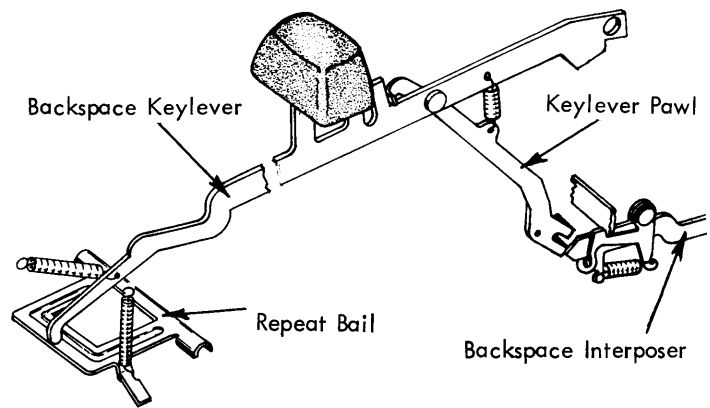
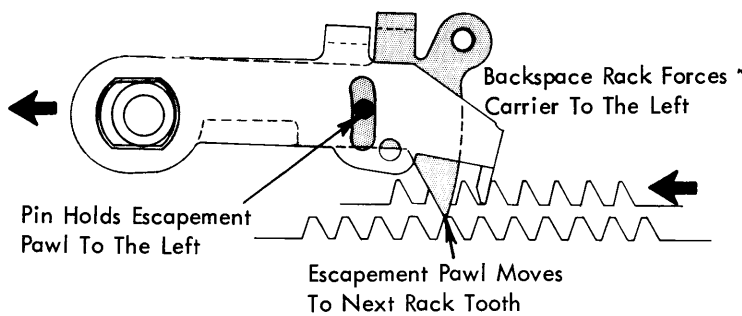
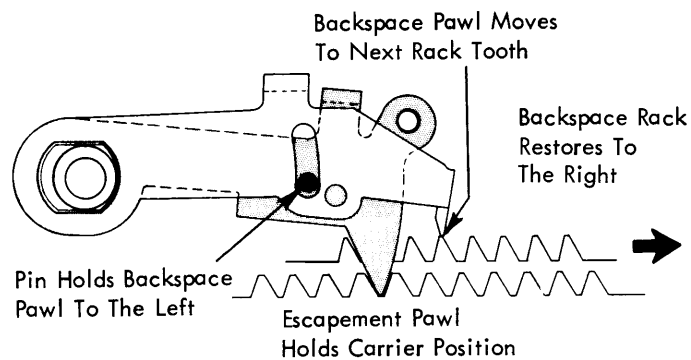


FIGURE 125. Backspace Keylever Mechanism
CARRIER RETURN (721)



A. BACKSPACE ACTUATING STROKE



B. BACKSPACE RESTORING STROKE

FIGURE 124. Backspace Operation

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. Depressing the carrier return keylever into the repeat position causes additional line space operations, if so desired. This can be done while the carrier is being returned making it unnecessary for the operator to wait until the carrier reaches the left margin.

The carrier return operates by winding the carrier return cord onto a drum at the rear of the machine (Fig. 126). 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. 126). 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

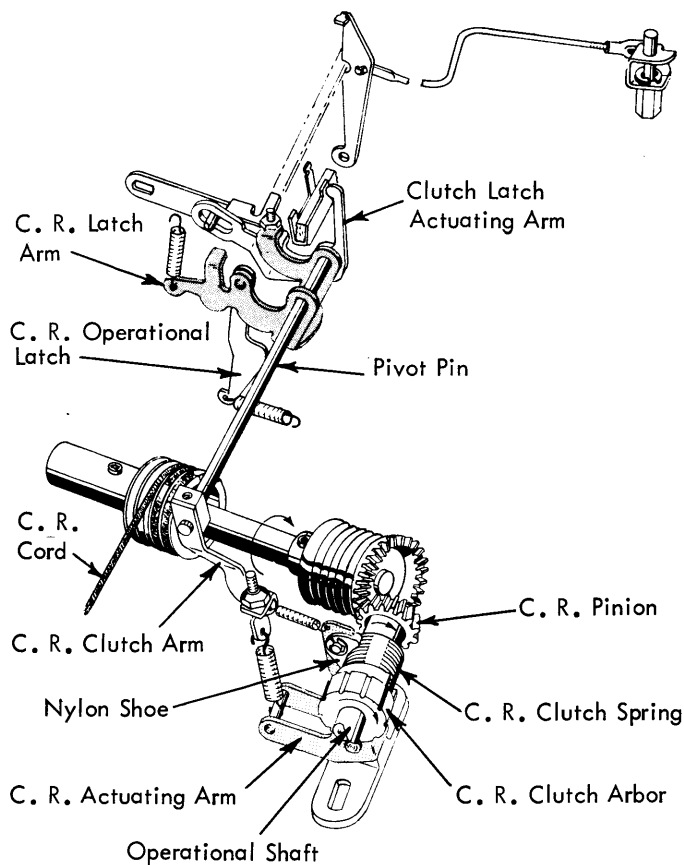


FIGURE 126. Carrier Return Mechanism

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. 126). 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.

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 (Fig. 111). 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. 127). 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 bellcrank called the clutch latch actuating arm (Fig. 127). 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.

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. 127). This prevents the pawls from dragging along their racks as the carrier is returned.

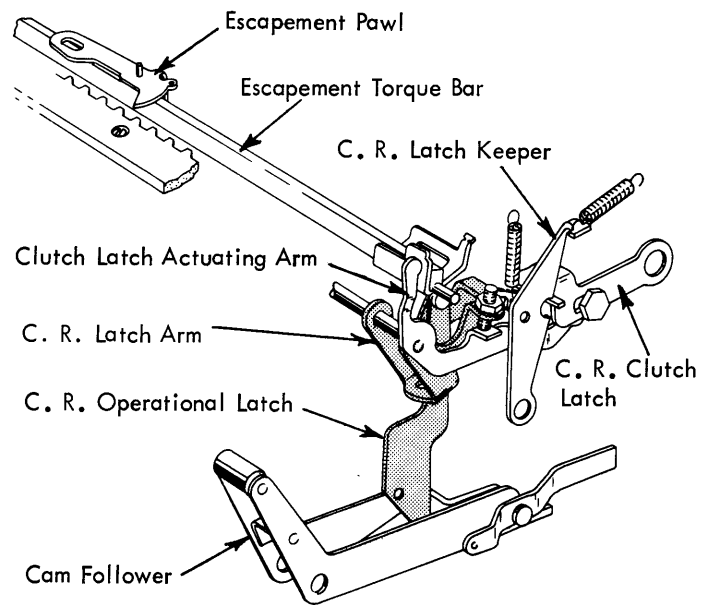


FIGURE 127. Carrier Return Latch Operation (721)

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. 128). 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.

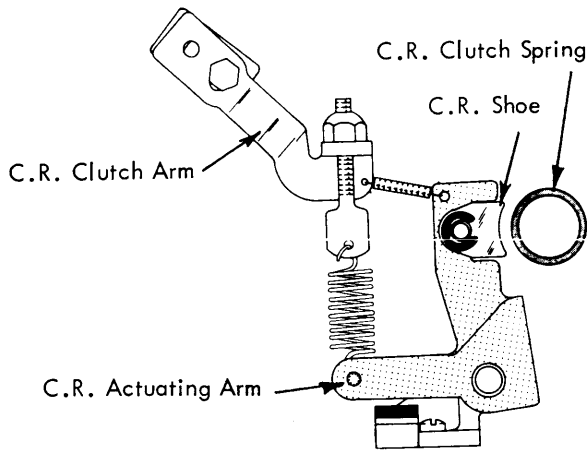


FIGURE 128. *Carrier Return Clutch Actuating Mechanism*

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. 127). The 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 on 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. 127).

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. 129). 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. 128).

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.

Depression of the keylever into the repeat position causes the repeat bail to yield and allows the rear lug of the keylever pawl to release the index interposer to the rear. This causes an index operation only, without operating the carrier return clutch mechanism. A repeat operation can be achieved either with the carrier at the left margin or as the carrier is moving toward the left.

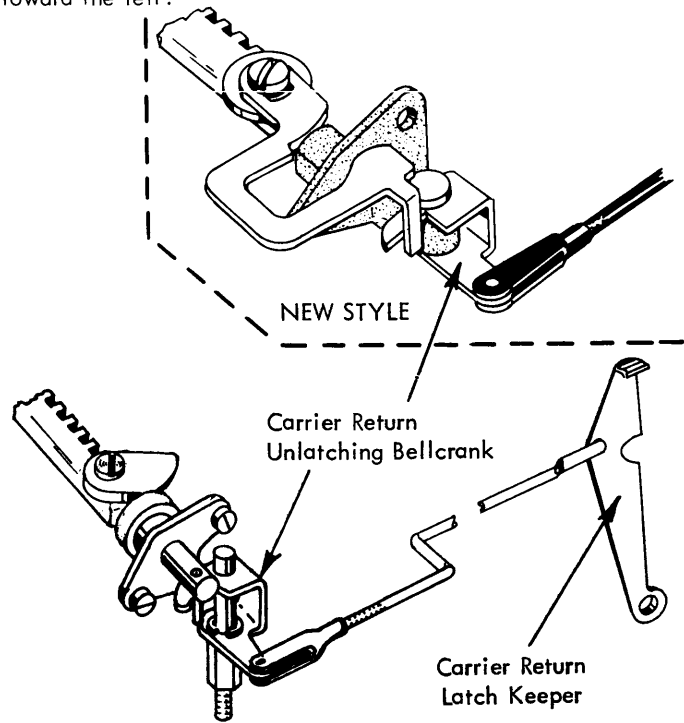


FIGURE 129. *Carrier Return Clutch Unlatching Mechanism*

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, 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.

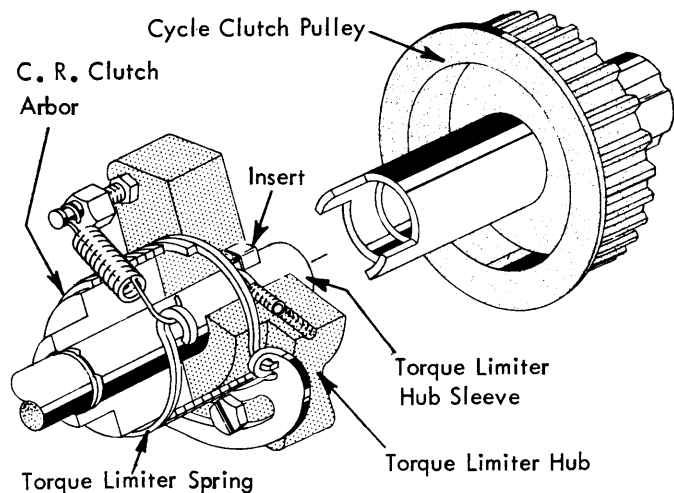


FIGURE 130. *Torque Limiter - Cut Away View*

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. 130 and 131). 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.

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.

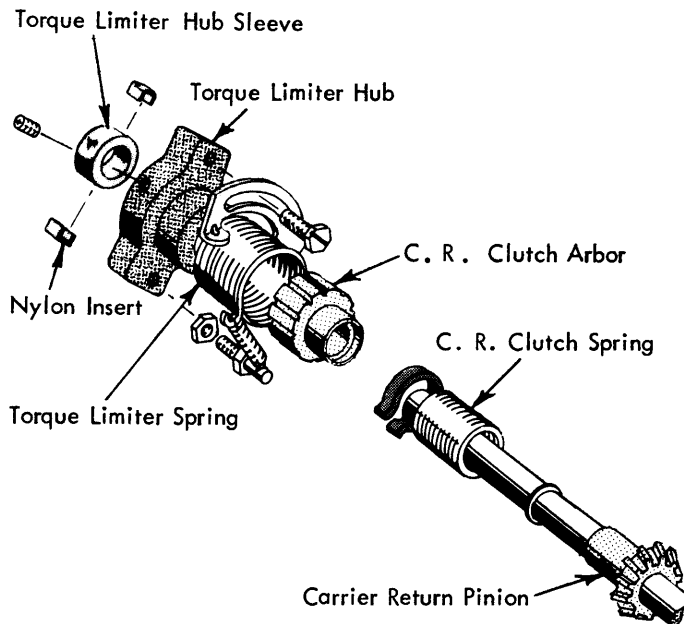


FIGURE 131. Torque Limiter - Exploded View

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. 130 and 131). 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 (723 and 725)

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 721 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. 132) 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. 132). 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.

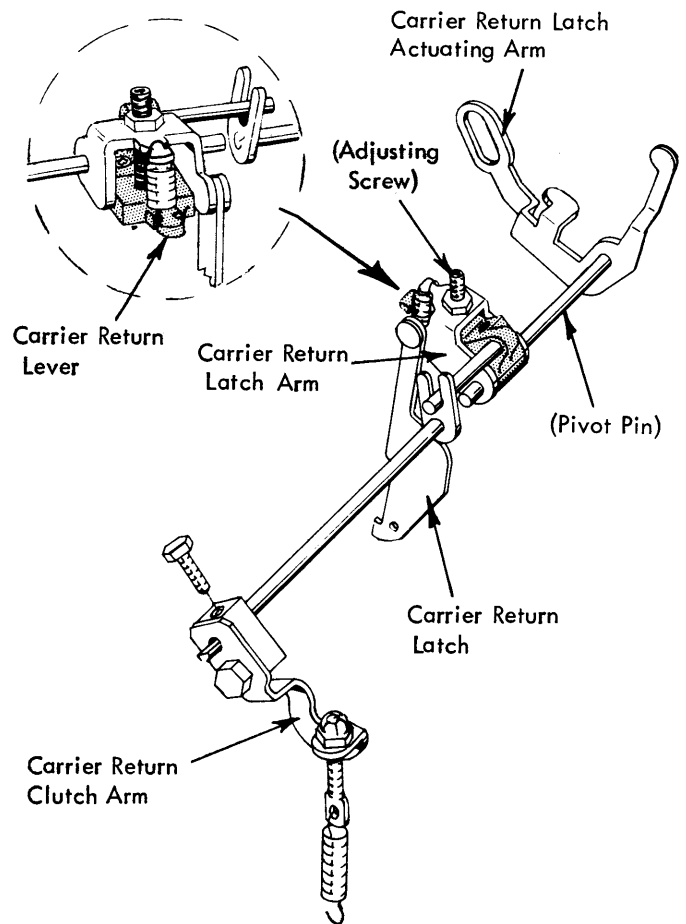


FIGURE 132. Carrier Return (723 & 725)

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 721. 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. 132). 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 causing 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 721.

INDEXING AND PLATEN VARIABLE

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 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. 133). 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. 133). As the pawl carrier is operated down by the link attached at the rear, the 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. 134). When the single lobed cam rotates, the cam follower pulls down on the link to effect a line spacing operation.

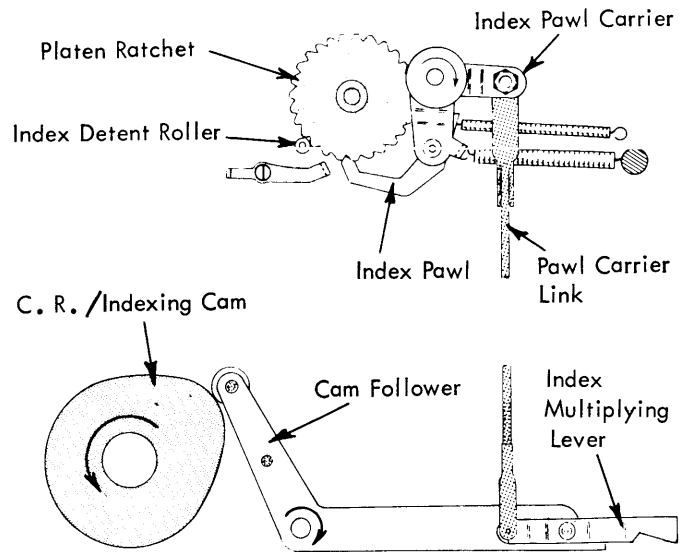


FIGURE 134. Single Space Indexing Operation

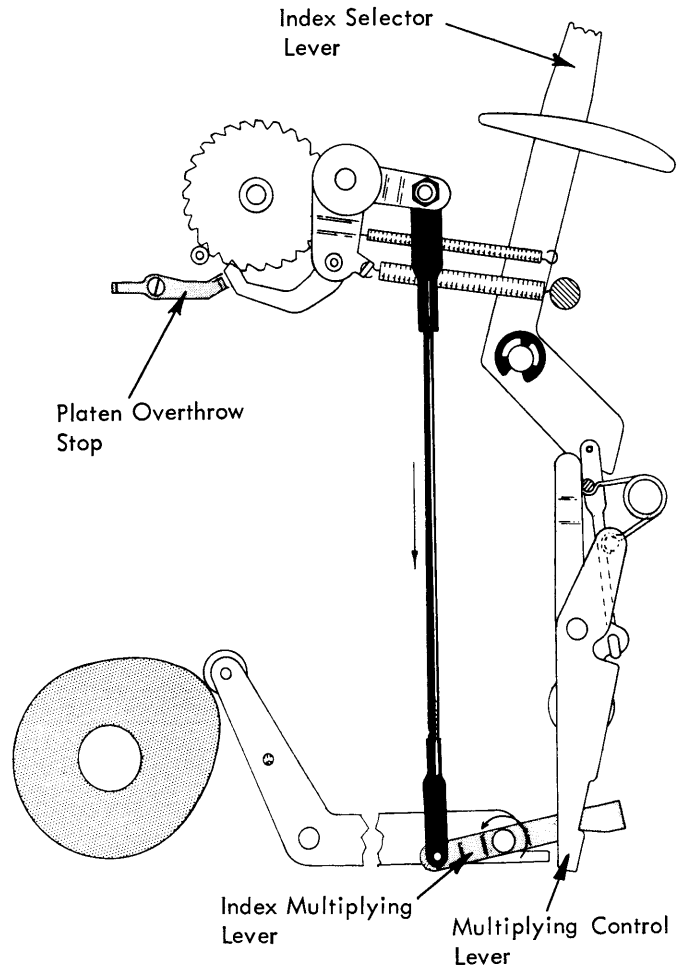


FIGURE 135. Double Space Indexing Operation

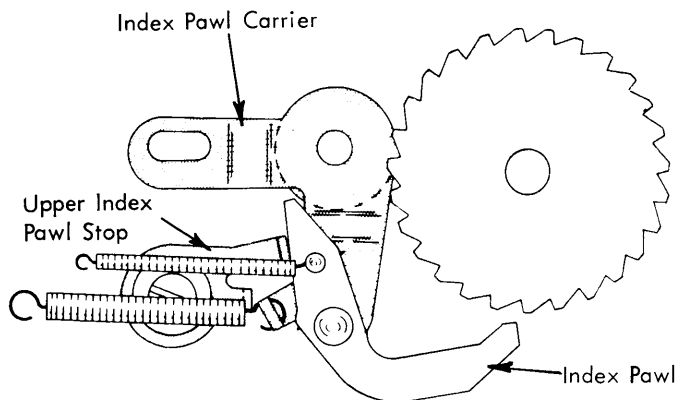


FIGURE 133. Index Pawl Rest Position

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. 134). 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. 134).

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. 135). 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. 135).

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. 136). 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.

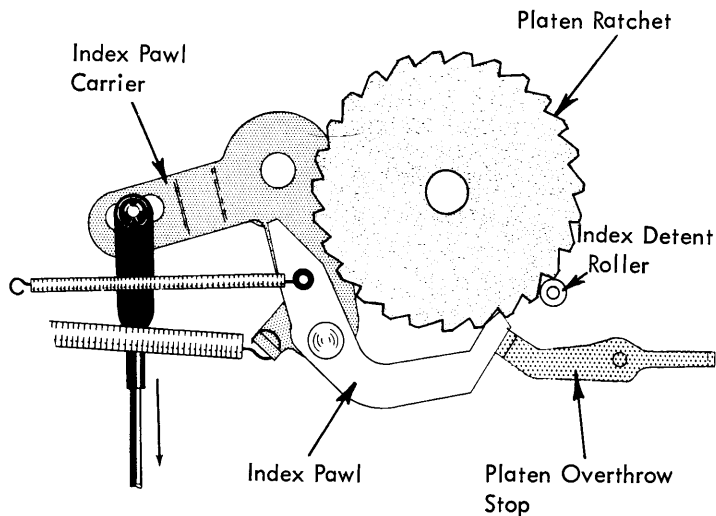


FIGURE 136. *Platen Overthrow Stop*

New 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. 137). As the cam follower operates, the multiplying lever pivots on the cam follower and pulls down on the index pawl carrier link (Fig. 138).

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. 138).

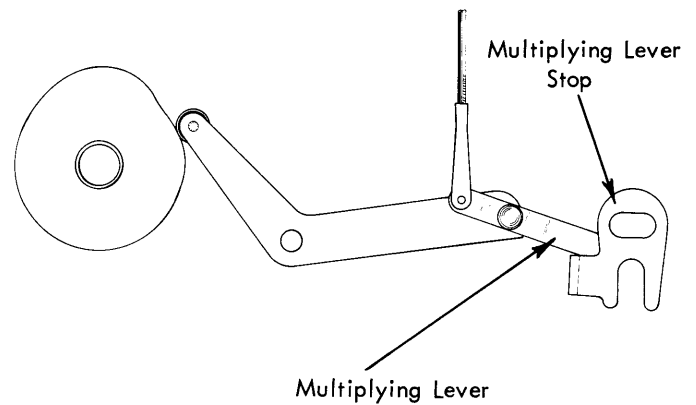
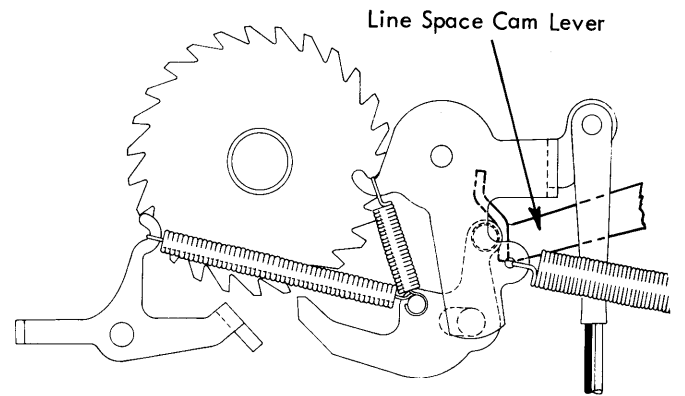
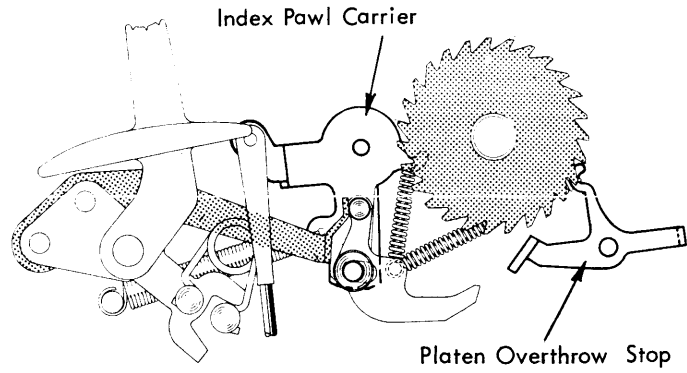
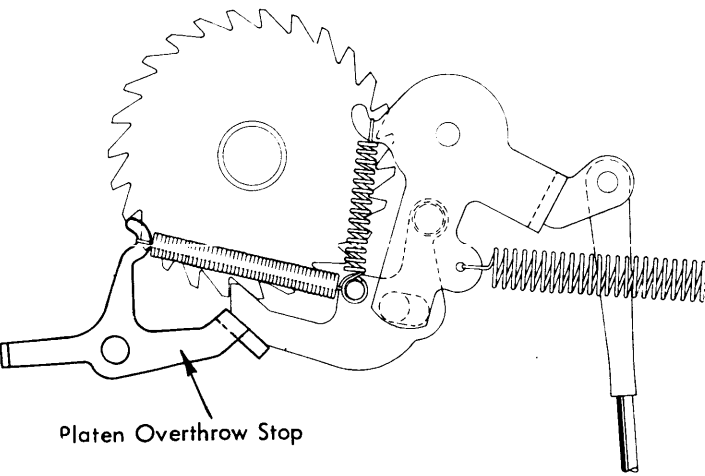


FIGURE 137. *Index Mechanism - Rest Position*

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.

The index pawl entry into the platen ratchet is controlled by the line space cam lever attached to the index selection lever (Fig. 139). 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



B. SINGLE SPACE POSITION

FIGURE 139b. 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. 139). 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. 140). A stud in the side frame fits through an elongated hole in the keylever to limit the overall travel of the keylever. An extension spring from a lug on the keylever to the stud restores the keylever to the rest position.

A small spring loaded arm called the index repeat lever operates in a slot in the side frame under the keylever and acts as a first limit for the keylever depression (Fig. 140). When the keylever is depressed to the first limit, 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. If additional pressure is applied to the key-

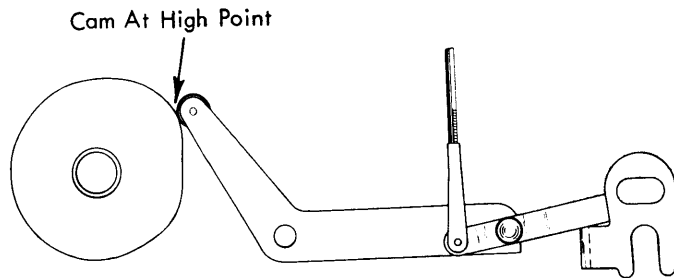
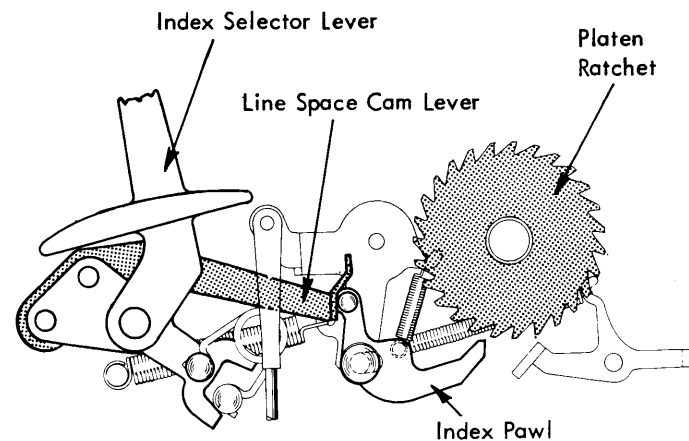


FIGURE 138. Index Mechanism - Active Position

the pawl to rest near the platen ratchet (Fig. 139a). 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. 139b). 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.

The index selection lever is held in the single or double space position by a toggle hairpin spring (Fig. 139). Movement of the index selection lever is restricted by two extensions at the bottom of the lever that contact the hairpin spring mounting stud.



A. DOUBLE SPACE POSITION

FIGURE 139a. Index Selection Mechanism

button, the index repeat lever will yield allowing further depression of the keylever. The rear lug of the keylever pawl will then hold the interposer down so that it cannot re-engage forward on the guide bracket. The interposer will continue to operate forward and back creating a repeat cam operation and a repeat indexing of the platen.

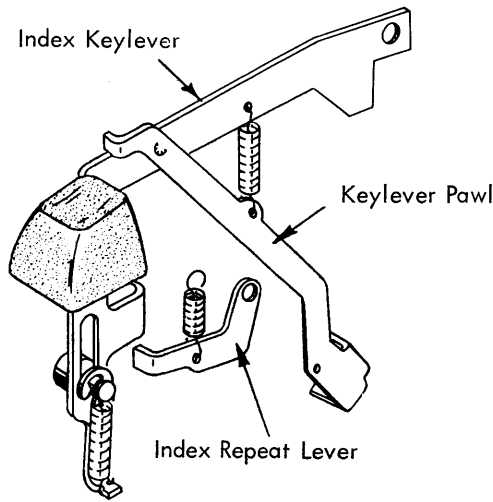


FIGURE 140. Index Keylever Mechanism

Platen Variable

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. 141). 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. 141). 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. 141). 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.

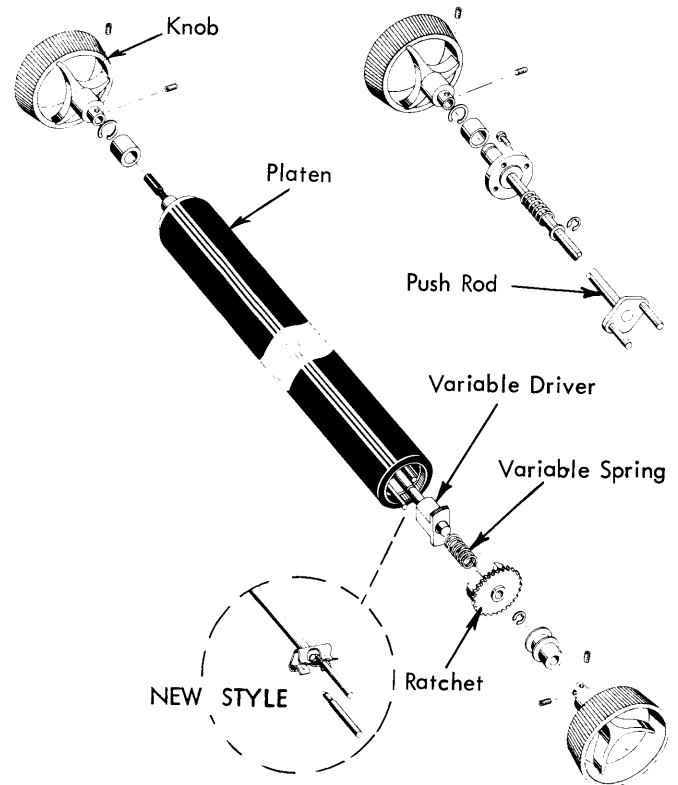


FIGURE 141. Platen Variable Mechanism

TABULATOR

The tabulator mechanism permits the operator to position the carrier quickly to a predetermined point on the writing line by depressing the tab keybutton one time. The tabulator is used in typing columns of figures, indenting paragraphs, or any other operation that requires positioning the carrier to a specific point each time.

In order 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 to allow 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 be allowed to restore to their racks at the proper time.

Tab Set and Clear - Old 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 at the left of the keyboard may be rocked forward or back to set or clear a tab stop (Fig. 142). When the

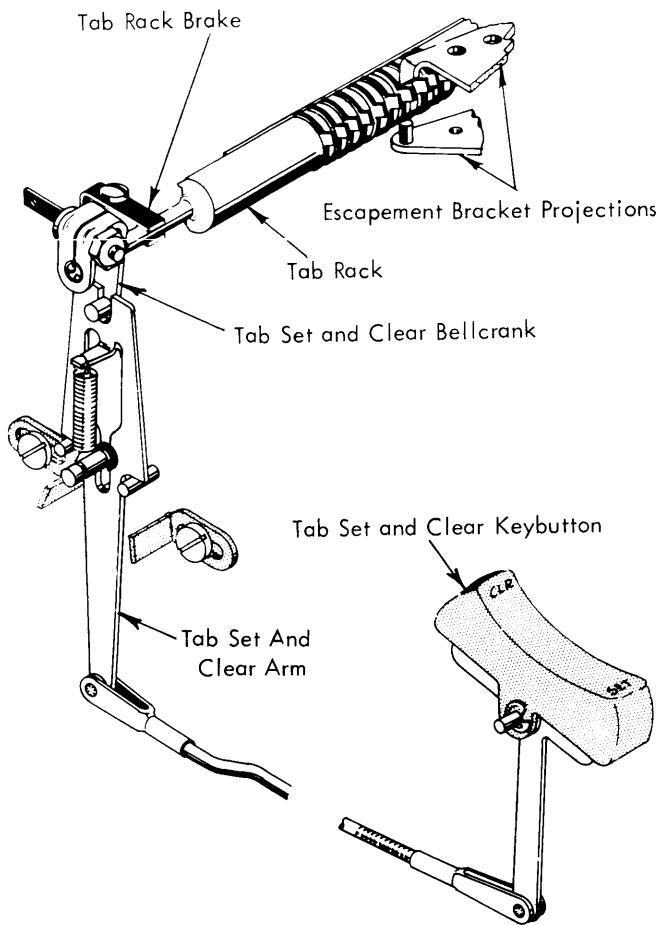


FIGURE 142. Tab Set And Clear Mechanism

front of the button is depressed, the set and clear arm at the rear operates to rotate the front of the tab rack up. A tab stop strikes a projection on the escapement bracket blocking the movement of the tab stop (Fig. 143a). 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. 143b). A reverse operation 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. 143c). 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. 143d). 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.

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.

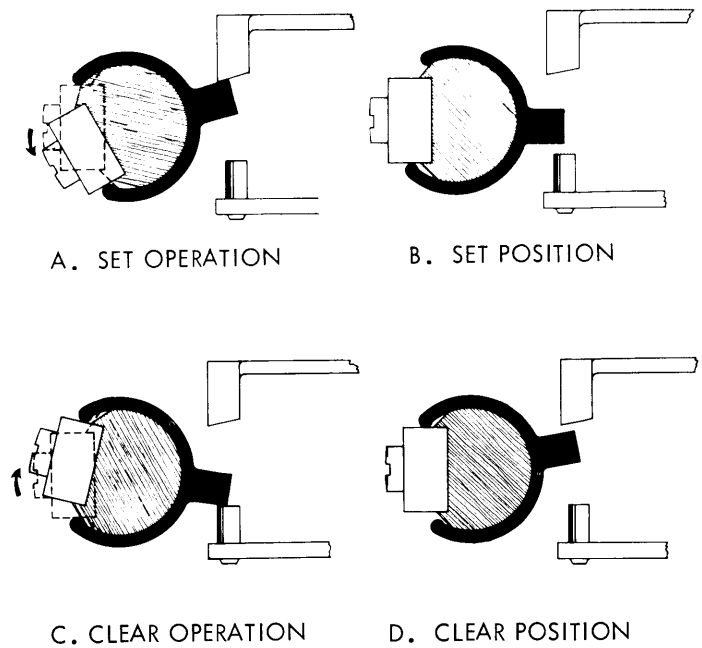


FIGURE 143. Tab Set And Clear Operation

Figure 144 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. 145). 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 tabset 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. 144a). The clear operation is slightly different. A gang clear finger mounted

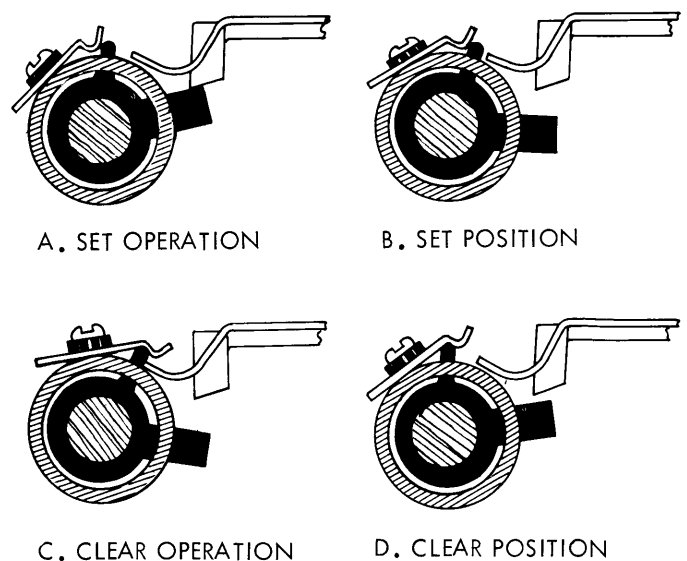


FIGURE 144. Tab Set and Clear Operation (gang clear)

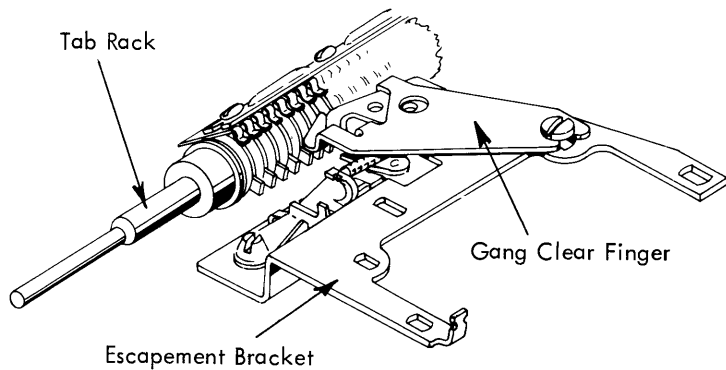


FIGURE 145. Gang Clear Finger

to the top of the escapement bracket (Fig. 145) projects to the rear just below the detent lugs on the tab stops (Fig. 144b). When the 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. 144d).

During a gang clear operation the 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. 142). 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 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. 142).

Pawl Release

The main purpose of the tab lever is to remove the backspace and escapement pawl from their racks during a tab operation. The tab lever mounts at the rear of the escapement bracket on the same mounting stud as the backspace and escapement pawls do.

The tab lever is very easily operated to the rear by a manual process. The tabkeylever operates at the left side of the keyboard the same as the letter keylevers. A lower extension makes the keylever operate as a bellcrank (Fig. 146). When the keylever is depressed, a link connected to the extension operates the tab bellcrank located on the powerframe at the rear. Through a vertical connecting link, the bellcrank rotates the tab torque bar. The tab torque bar is mounted the same as the escapement torque bar. It pivots at each end and operates just above the tab lever. The pivot point is near the top of the torque bar so that depressing the keylever causes the bottom of the bar to swing to the rear. The tab torque bar contacts a lug of the tab lever trigger located just above the tab lever. A lower lug of the trigger forces the tab lever to the rear as the keylever is depressed further (Fig. 147). 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

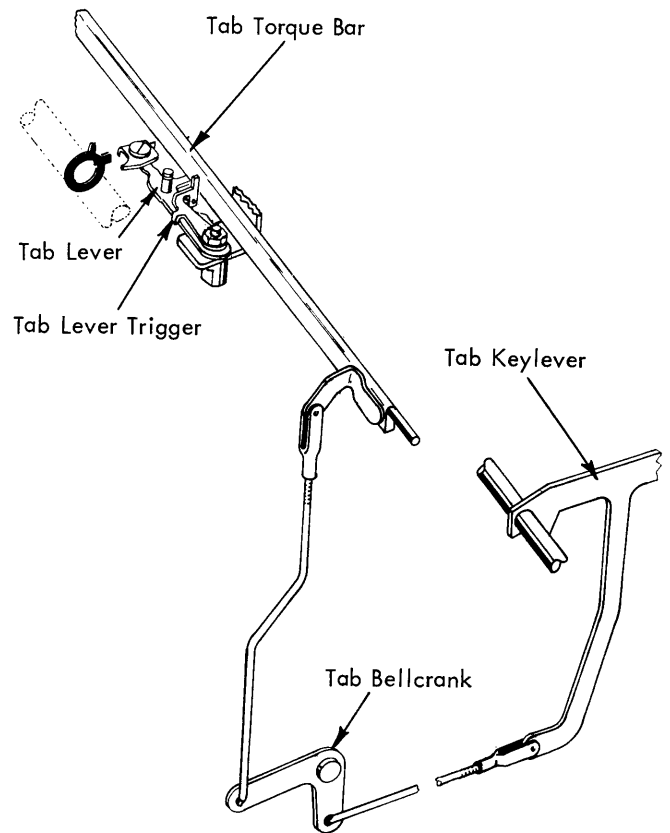


FIGURE 146. Tab Keylever Mechanism

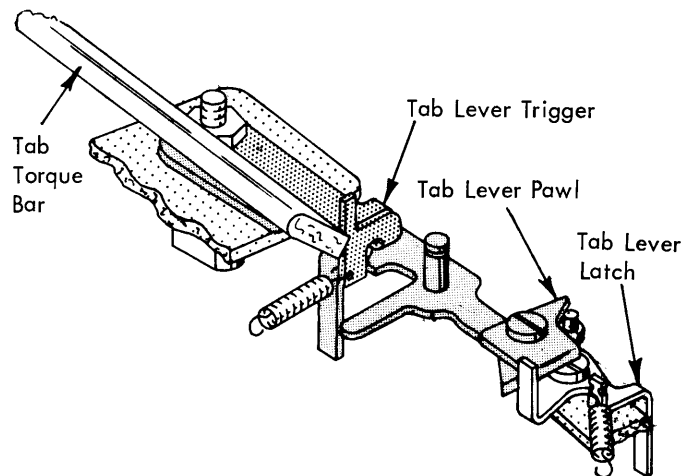
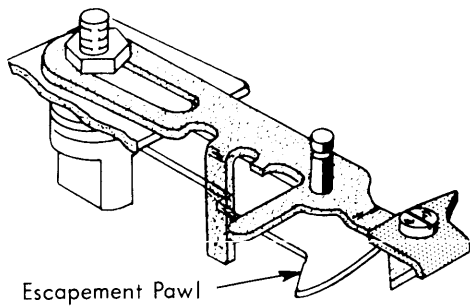
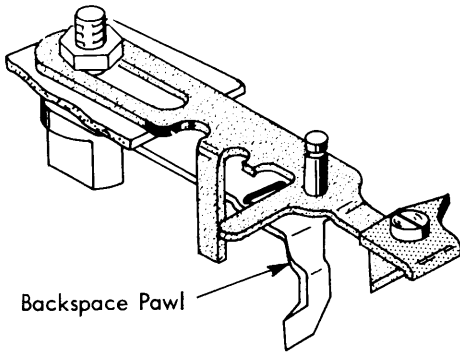


FIGURE 147. Tab Latch Operation

the rear out of mesh with their racks (Fig. 148). 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. 147). A tab lever overthrow stop is mounted on the escapement bracket. It extends to the rear and down behind the trigger (Fig. 149). The stop prevents the tab lever from being thrown into the tab rack if the keylever is struck hard.



Escapement Pawl



Backspace Pawl

FIGURE 148. Pawl Release Operation

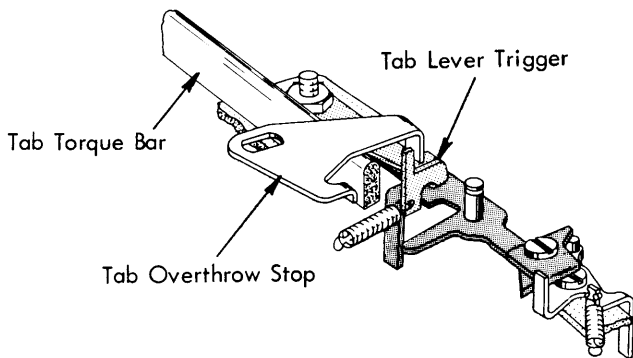


FIGURE 149. Tab Overthrow Stop

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. 150). 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.

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.

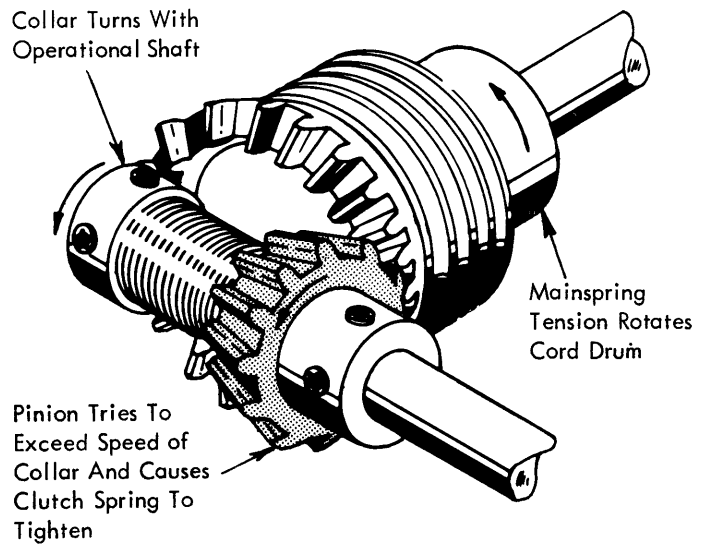
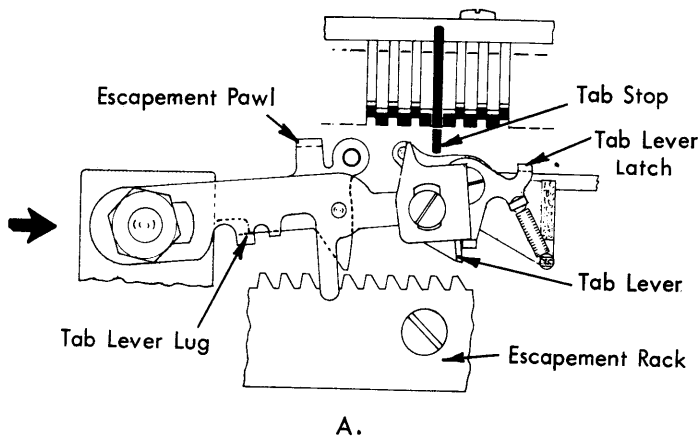


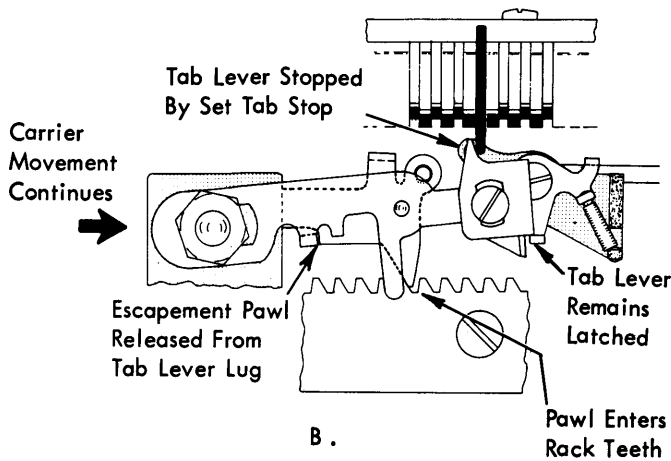
FIGURE 150. Tab Governor Mechanism

Tab Unlatching

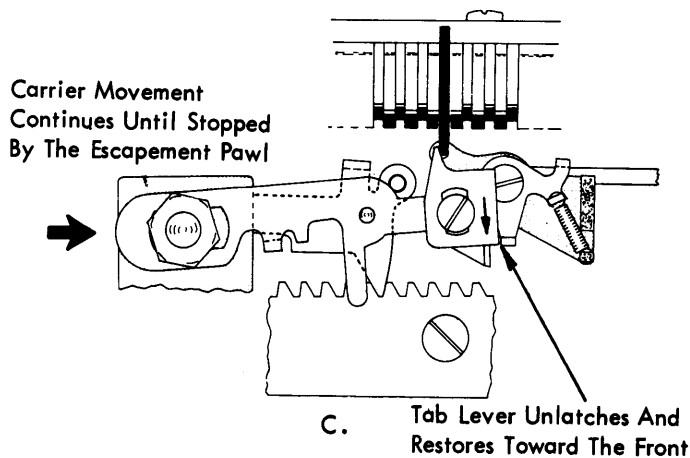
When the carrier reaches the desired stopping point, the escapement pawl must be allowed to re-enter the escapement rack and stop the movement of the carrier. The tab lever is mounted in an elongated hole at its pivot point. An extension spring holds the tab lever to the right. As the carrier moves toward the right, the tip of the tab lever contacts the set tab stop and is prevented from moving further (Fig. 151a). 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. 151b). Further movement of the carrier moves the tab latch to the right out of the notch of the tab lever (Fig. 151c). The tab lever then restores and allows the backspace pawl to re-enter its rack.



A.



B.



C.

FIGURE 151. 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.

During a rapid tab/typing operation, it is possible for the typist to delay releasing the tab lever until after a few characters have been typed. If this happened, the carrier could reach the right side of the elongated hole in the tab lever and be stopped by the tab lever against the set tab stop. To prevent blocking the carrier in this manner, the tab lever and tab lever trigger are designed to allow the tab lever to restore, even though the key lever is held depressed. 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. 152). 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.

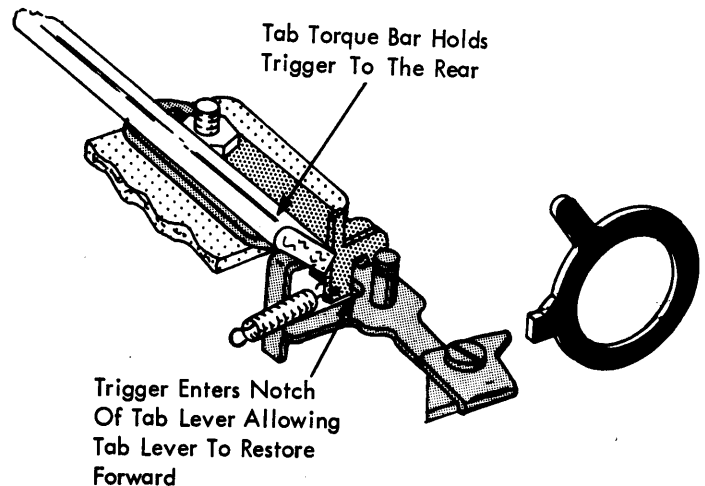


FIGURE 152. Tab Lever Trigger Operation

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. 153). 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.

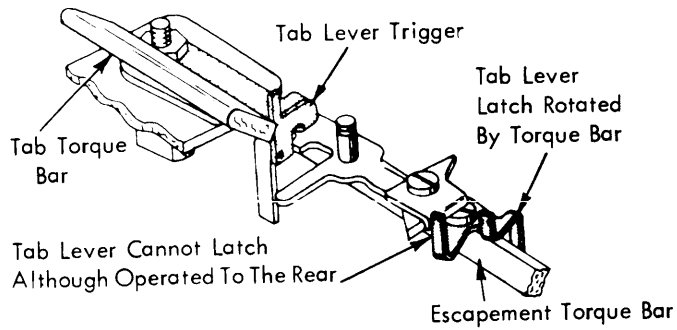


FIGURE 153. Carrier Return Tab Interlock

Carrier Return/Tab Interlock

The carrier return/tab interlock allows a tab operation to supersede or unlatch a carrier return operation. An operator can use this interlock feature to obtain a partial carrier return that will be followed by a tabulation operation to a desired set tab stop. This gives the operator a helpful short-cut when typing a column of figures or listing at the right side of the paper. The operation is achieved by depressing the tab keylever immediately after the carrier passes the desired set tab stop as the carrier is returning toward the left hand margin during a return operation.

This interlocking action is produced by a bellcrank, called the carrier return/tab interlock, which mounts to the side frame by a shouldered screw. The upper arm of the interlock extends behind a clip on the tab torque bar while the lower arm extends behind the carrier return latch keeper (Fig. 154). When

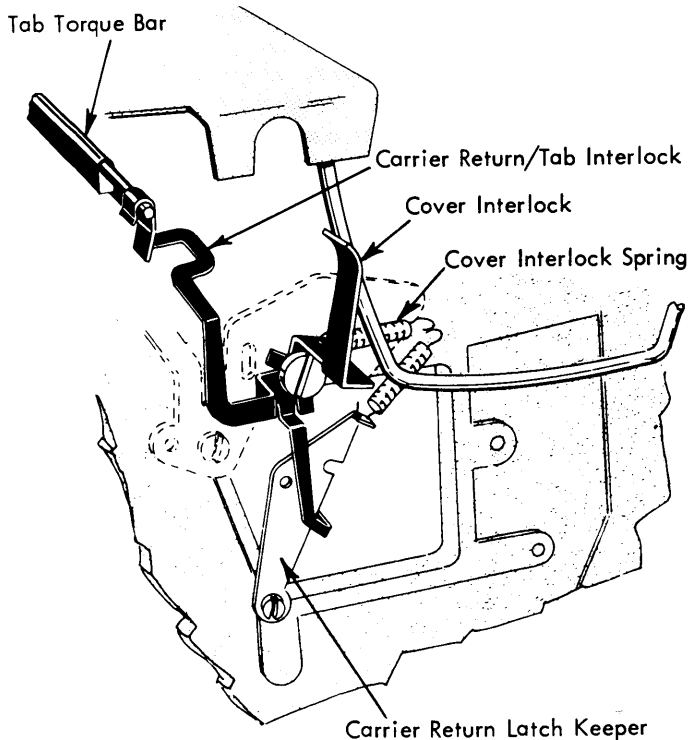


FIGURE 154. Carrier Return / Tab Interlock

the tab torque bar is rotated it produces a push on the upper arm of the interlock causing the lower arm to pull the keeper forward to unlatch the carrier return.

(The additional arm mounted on the same shouldered screw is for interlocking the carrier return whenever the top cover is raised. This is a "safety" interlock.)

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. 155). The number of teeth per inch in the margin rack corresponds to the pitch of the machine.

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. 155). This action forces the margin rack to the left to unlatch the carrier return leaving the carrier resting at the left margin position.

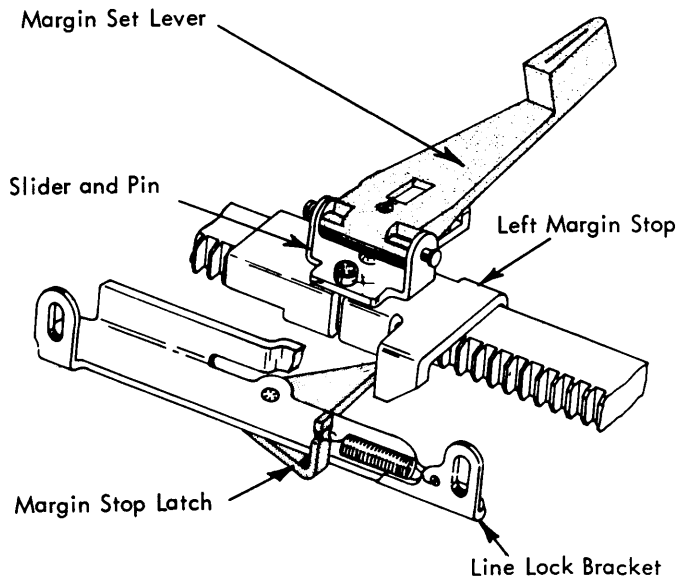


FIGURE 155. Left Margin Mechanism

Line Lock - (Old Style)

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. 156). 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. 156). 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 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. 157). The light spring connecting the interposer to the bellcrank is extended slightly.

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. 157). 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. 157). As the filter shaft operates the stored character interposer, the keyboard lock interposer is also driven forward (Fig. 158). 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. 158).

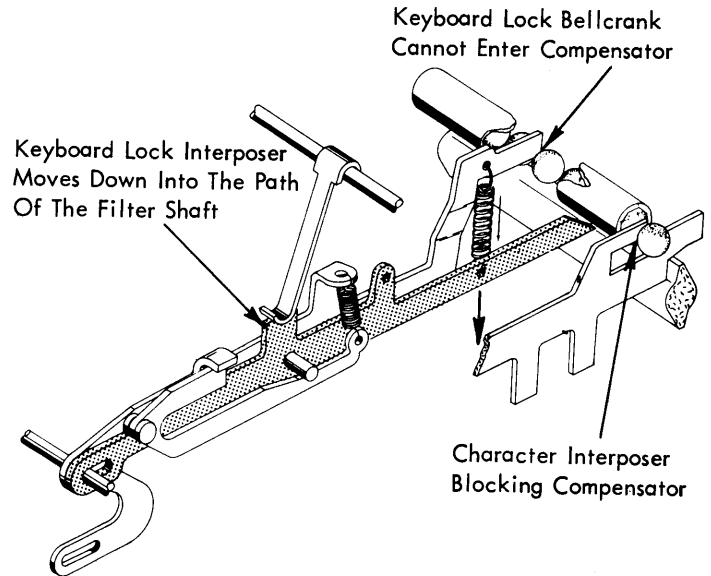


FIGURE 157. Line Lock Blocked By Stored Character Interposer

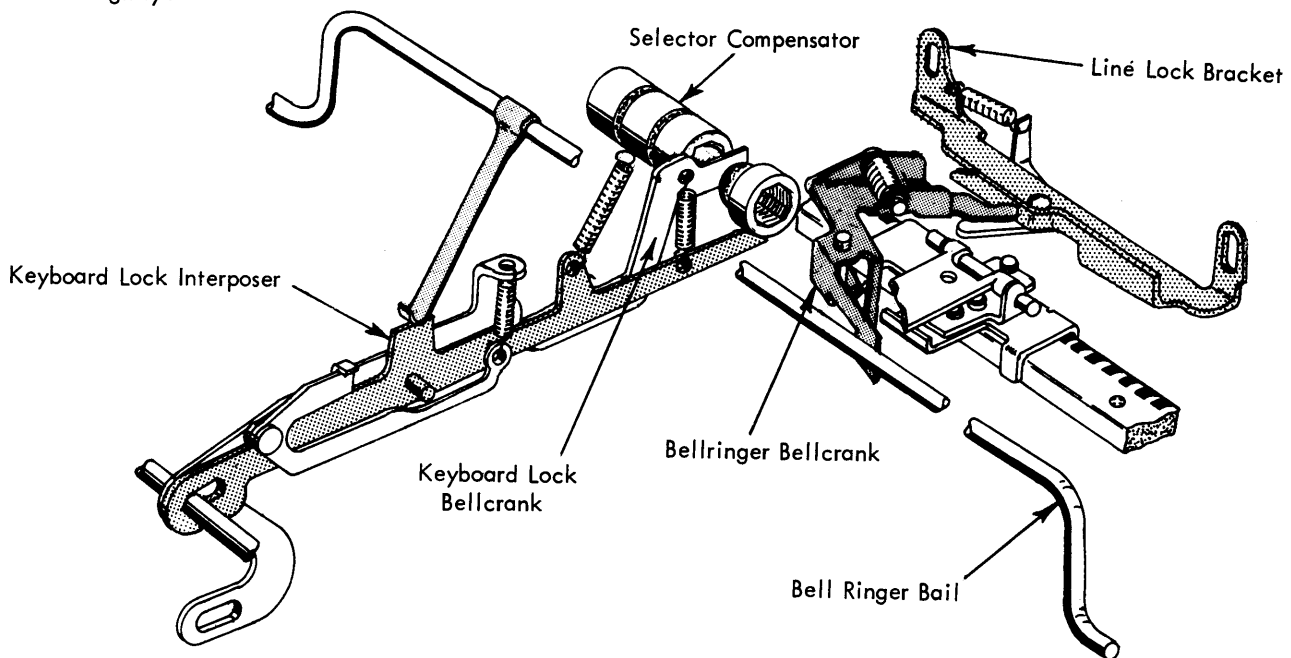


FIGURE 156. Line Lock Mechanism - Old Style

The keyboard lock bellcrank is then snapped into the selector compensator at the earliest possible instant. The keyboard is locked with the carrier at the margin stop position or one space later depending upon whether or not a character has been stored at the beginning of the line lock operation.

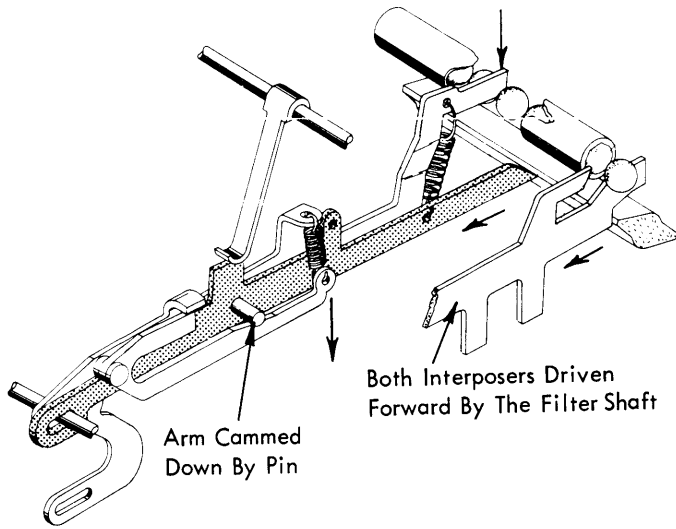


FIGURE 158. Keyboard Lock Interposer Operation

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 - (New Style)

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. 159). 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 159 that the bellringer bellcrank has been redesigned and is now one piece as compared to the old style in Figure 156. 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.

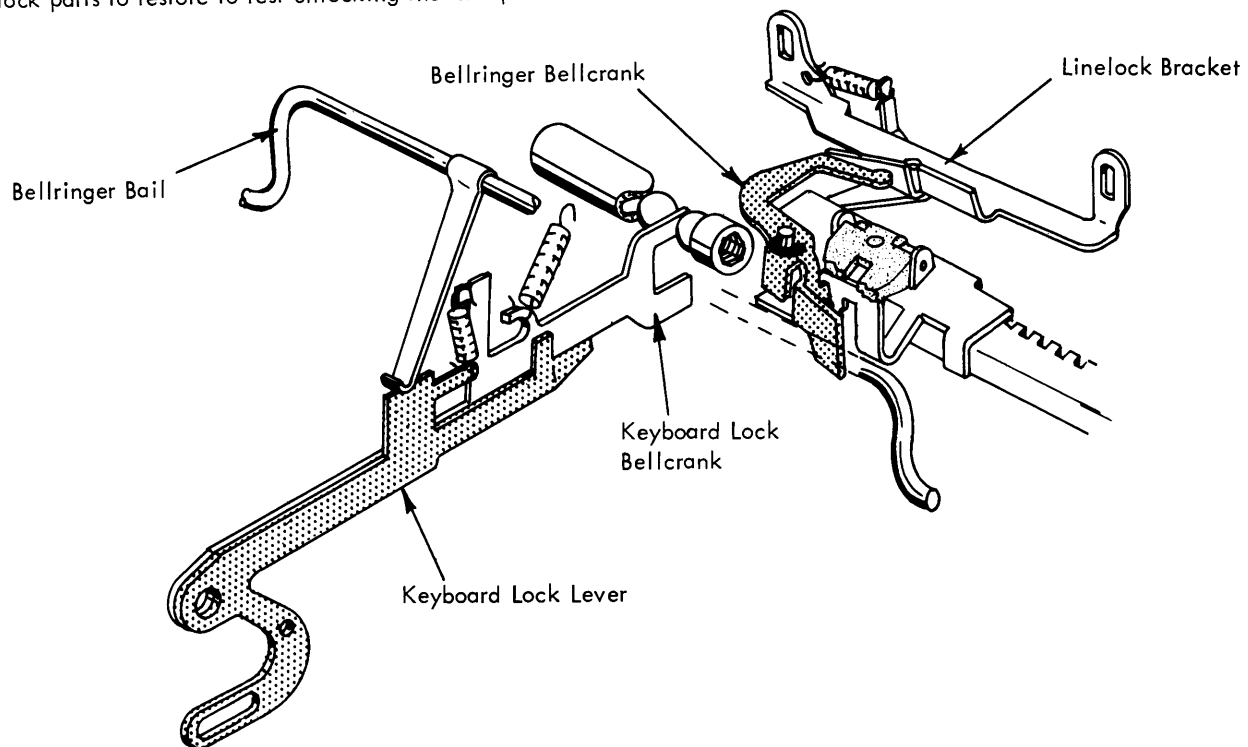


FIGURE 159. Line Lock Mechanism (new style)

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.

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. 160). 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. 156). 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. 160). 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.

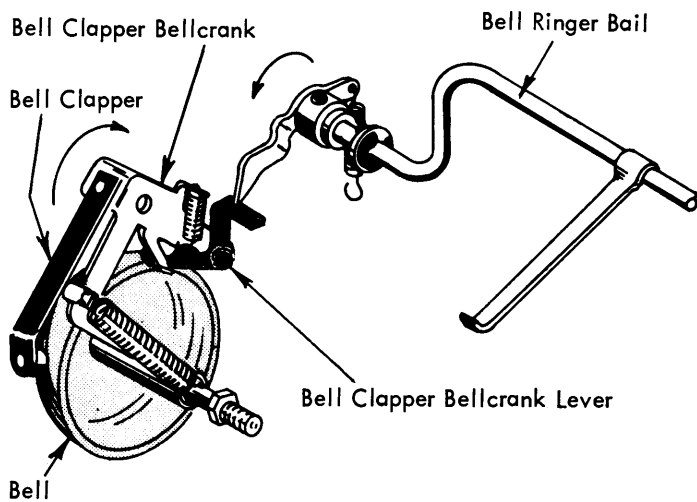


FIGURE 160. *Bell Ringer Mechanism*

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. 161). 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 to unlatch the carrier return if it is operated with the margin release keylever depressed.

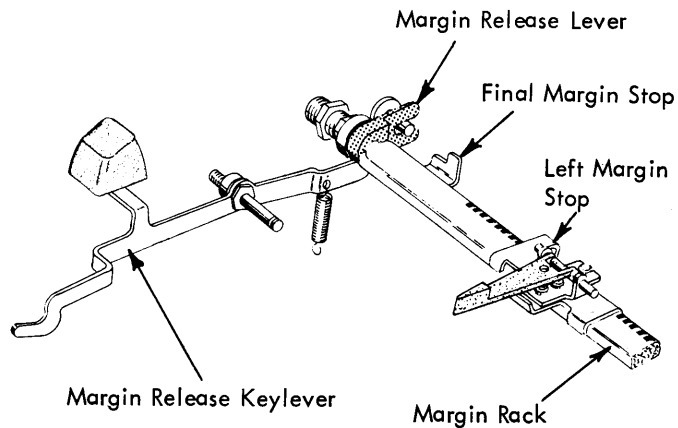


FIGURE 161. *Margin Release Mechanism*

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.

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. 162). Each feed roll assembly contains four rubber rollers equally spaced along the feed roll shaft and molded to the shaft.

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.

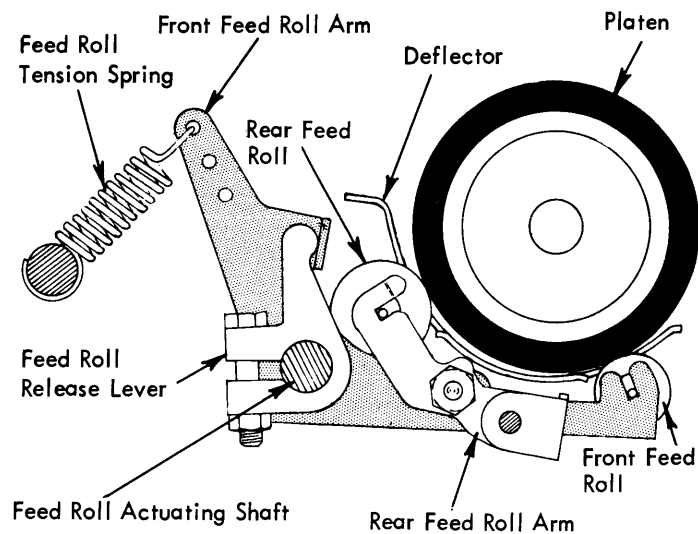


FIGURE 162. *Paper Feed Mechanism*

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. 164). 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. 162). 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. 163). 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 line 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.

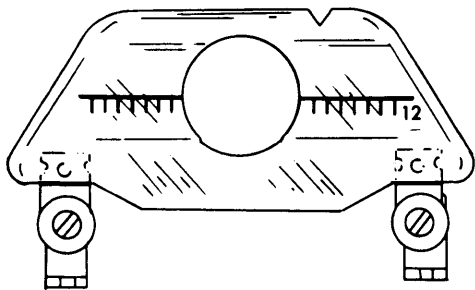


FIGURE 163. Line Gage Card Holder

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 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. 164). The front of the paper release lever cams the top of the feed roll release arm forward to rotate the feed roll actuating shaft.

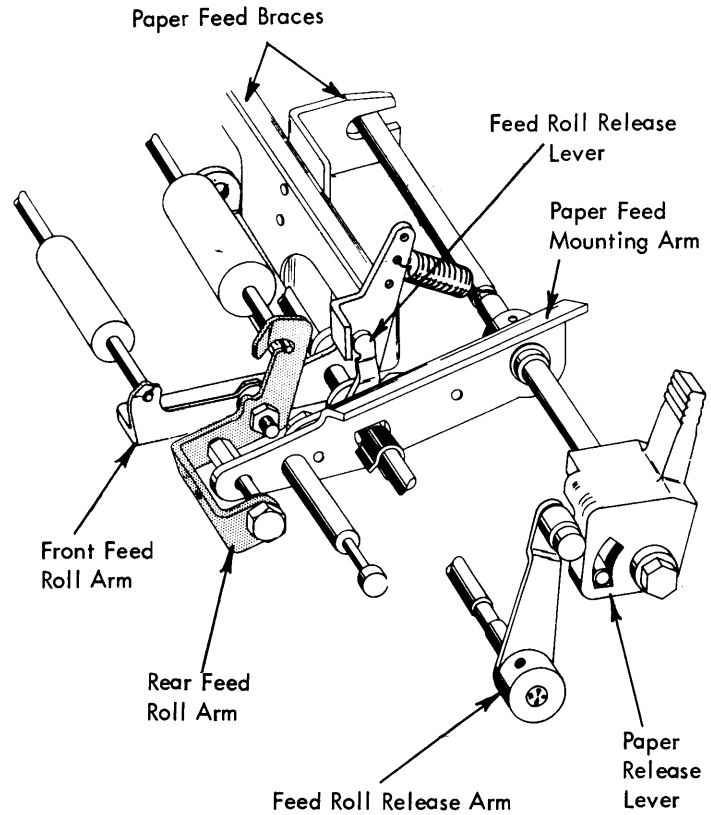


FIGURE 164. Paper Release Mechanism

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.

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 type head prints and then lowers 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.

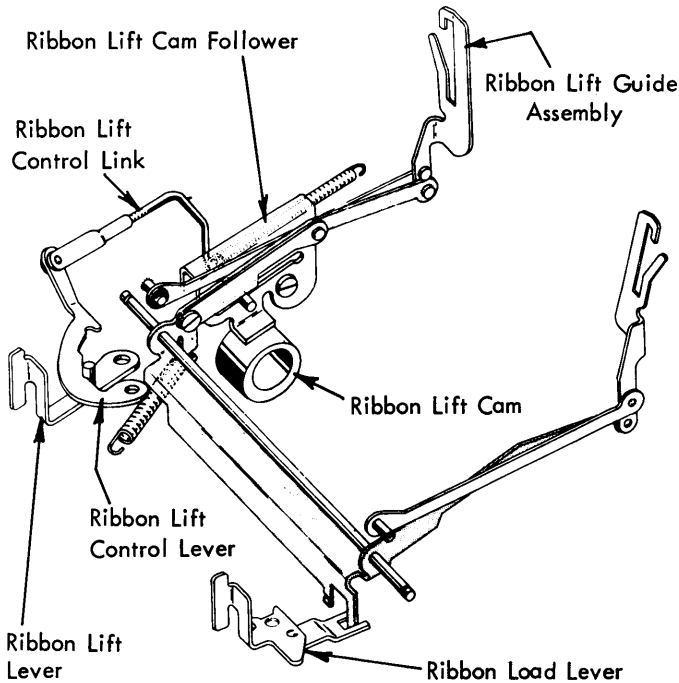


FIGURE 165. Ribbon Lift Mechanism

Located to the right of the pointer on the carrier assembly is the ribbon load lever (Fig. 165).

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. 165).

The mechanism is mounted to the carrier assembly and is transported by the carrier along with the type head. 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-way 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. 165). 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. 165). 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 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 type head. 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. 166). 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. 166). 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.

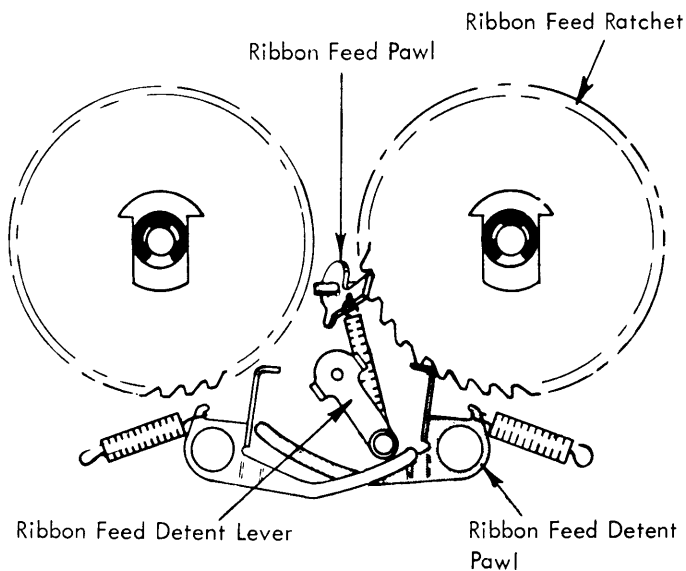


FIGURE 166. Ribbon Feed Mechanism - Top View

When the lever is moved to the right, the feed pawl is pivoted into engagement with the right hand feed ratchet (Fig. 166). 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. 167). 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 type head 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.

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. 166).

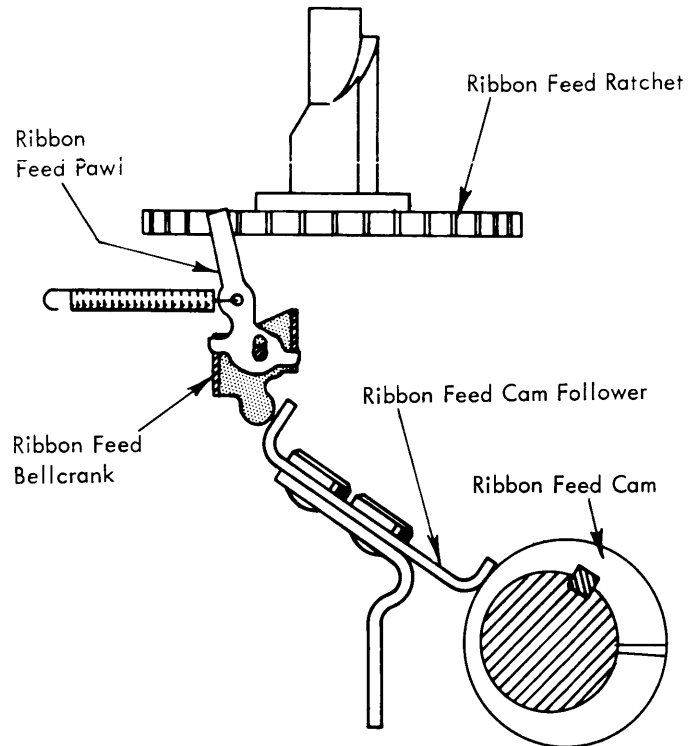


FIGURE 167. Ribbon Feed Mechanism - Side View

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. 166). 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 the other. 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. 168). 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.

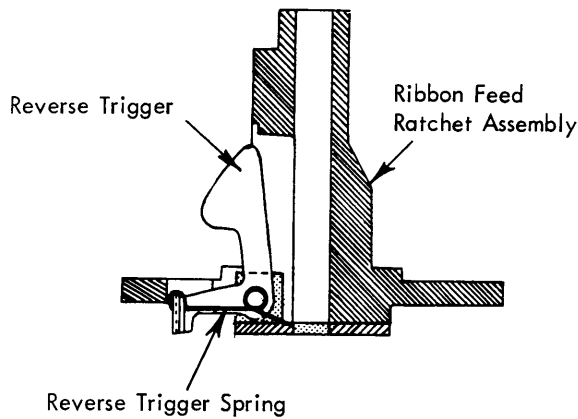


FIGURE 168. Ribbon Reverse Trigger

The empty spool rotates slightly farther causing the reverse trigger to contact and actuate the reverse lever which pivots just below the ratchet (Fig. 169). 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. 170).

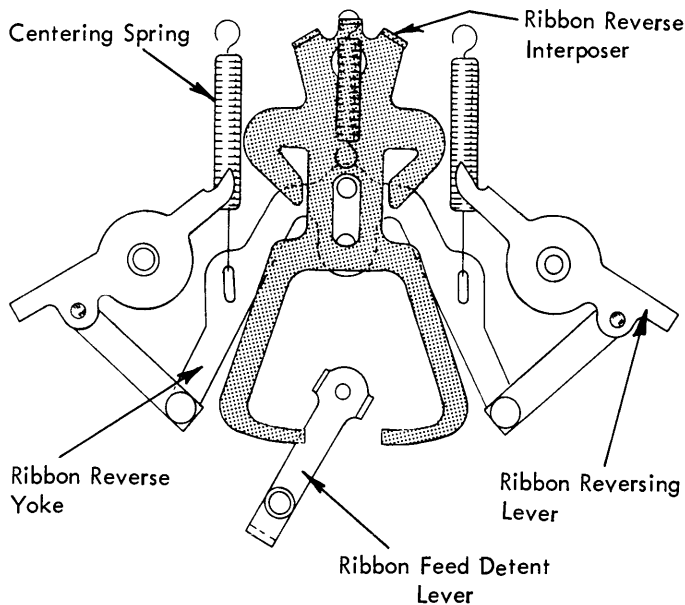


FIGURE 169. Ribbon Reverse Mechanism - Rest Position

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. 171). 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

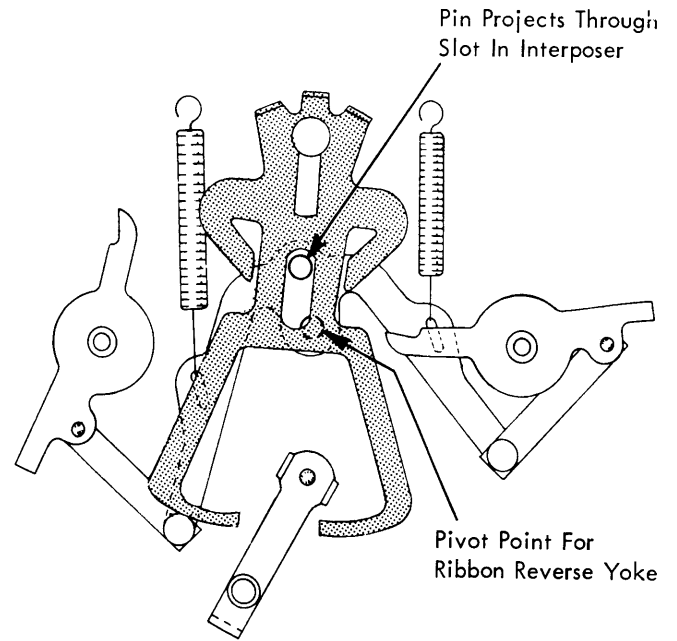


FIGURE 170. Ribbon Reverse Mechanism - Active Position

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.

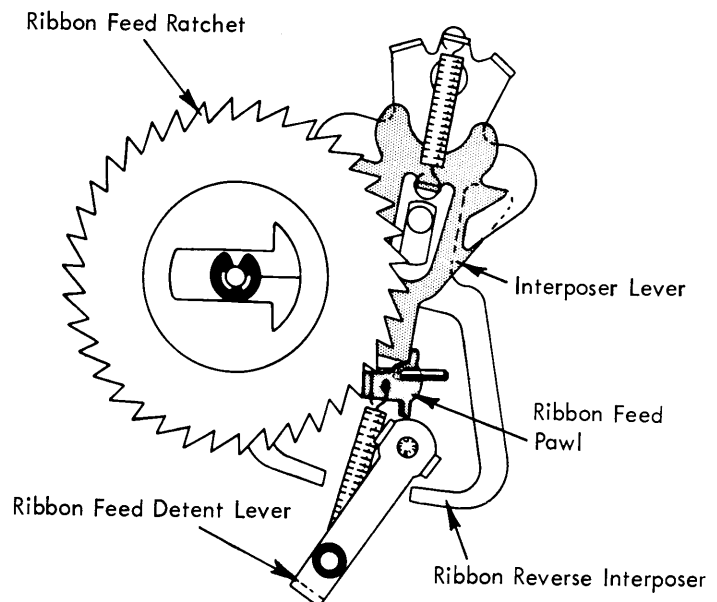


FIGURE 171. Ribbon Reverse Interposer and Lever

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. 172). 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.

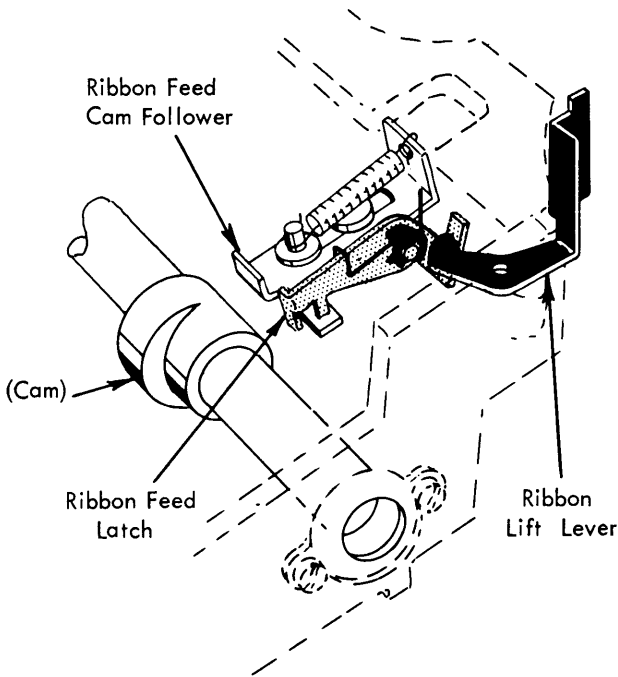


FIGURE 172. Stencil Lockout Mechanism

FILM RIBBON

The film ribbon mechanism in its entirety mounts on and moves with the carrier in a similar manner as the fabric ribbon mechanism. The spool of ribbon, which consists of approximately 240 feet of film ribbon wrapped tightly about a plastic core, mounts on a permanent supply spool on the left side of the carrier (Fig. 173). Matching flutes, between the plastic core of the spool of ribbon and the permanent supply spool, causes both the spool of ribbon and the permanent supply spool to rotate together during a ribbon feed operation.

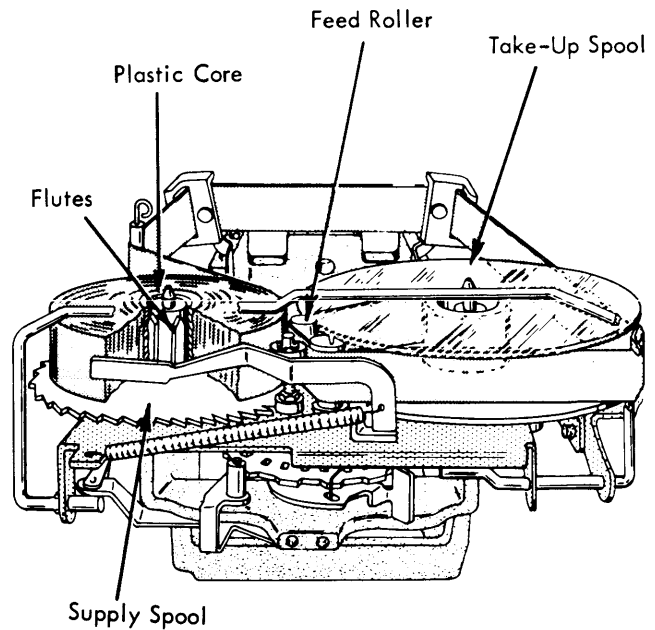


FIGURE 173. Film Ribbon Mechanism

As the ribbon comes off the supply spool it threads around the ribbon circuit to the take-up spool. The take-up spool is a disposable transparent spool mounted on the right side of the carrier (Fig. 173). Once the ribbon has been completely used and fed onto the take-up spool, both the take-up spool and the plastic core from the supply side are removed and discarded. The new spool of ribbon, to be installed, comes equipped with its own take-up spool fastened to the end of the clean leader.

Ribbon Feed

Clockwise rotation of the feed roller causes the ribbon to feed from the supply spool to the take-up spool (Fig. 173). The feed roller is directly connected to a star shaped wheel called the feed and lift wheel (Fig. 174). This wheel, which is lo-

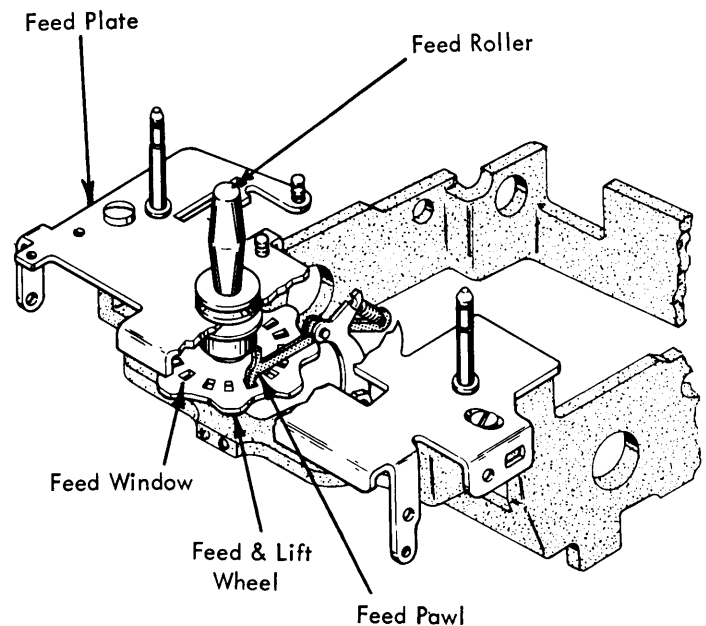


FIGURE 174. Ribbon Feed Operation

cated on the underside of the ribbon feed plate, fastens to the bottom of the feed roller by a bronze hexagon-headed screw that has a left handed thread.

The feed and lift wheel contains sixteen feed windows laid out in a circular pattern. A feed pawl operates in these windows in a manner similar to an index pawl operating in a platen ratchet. Each time the feed pawl is powered forward, it pushes on one of the feed windows causing both the wheel and the feed roller to rotate.

The ribbon feed cam located on the print sleeve supplies the motion to the feed pawl (Fig. 175). The motion from the cam is transmitted to the feed pawl through a cam follower. A barrel shaped roller mounted on the cam follower by an eccentric stud rides against the ribbon feed cam. The follower mounts on a bracket which is fastened to the front carrier casting by two hexagon headed screws. An extension spring, anchored to one of these screws, loads the follower against the cam. The feed pawl mounts at the top of the cam follower by a shouldered rivet and is spring loaded into engagement with the feed and lift wheel.

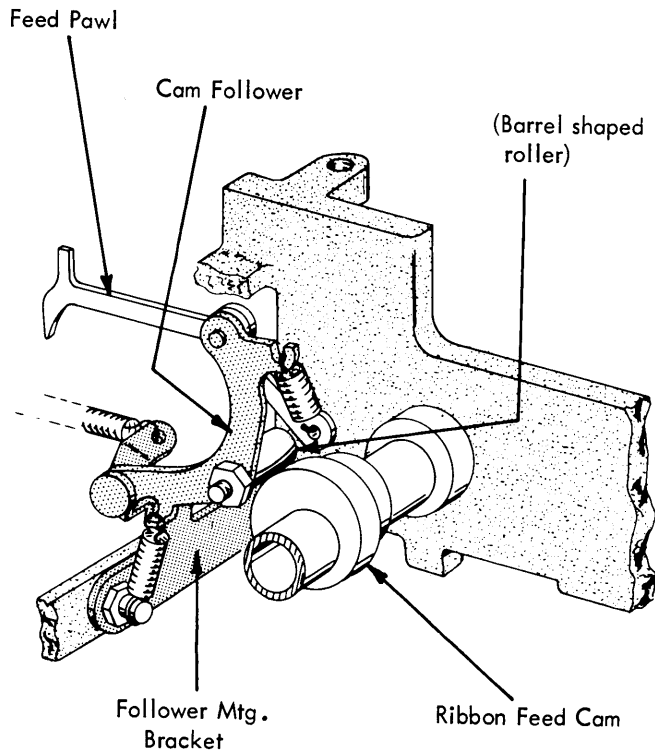


FIGURE 175. Ribbon Feed Mechanism

A ribbon feed operation occurs in the following manner: When the machine is at rest, the barrel shaped roller on the cam follower is on the high point of the feed cam (Fig. 176). In this position the feed pawl is all the way forward, and is engaged with one of the feed windows in the feed and lift wheel.

As the feed cam begins to rotate clockwise towards its low point, the feed pawl will begin to move toward the rear of the machine. This movement causes the feed pawl to be cammed up and out of the feed window. The pawl then slides along the top surface of the wheel towards the next feed window (Fig. 177).

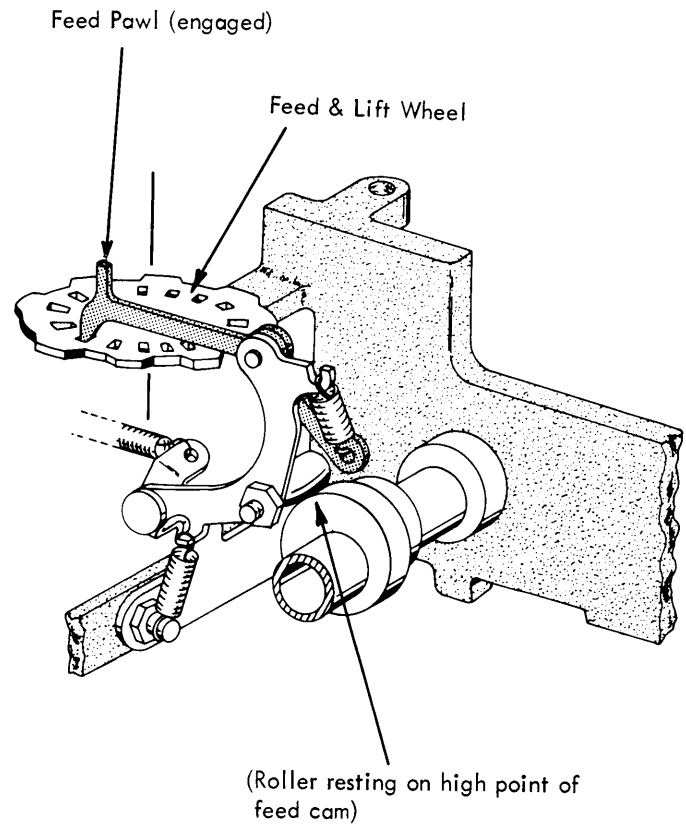


FIGURE 176. Feed Cam at Rest

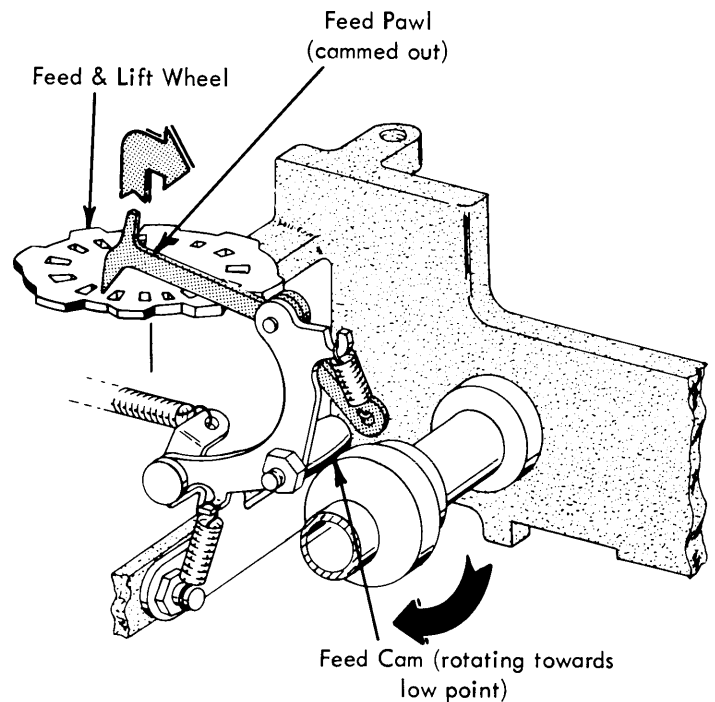


FIGURE 177. Follower Approaching Low Point

Slightly before the barrel shaped roller on the cam follower reaches the low point of the feed cam, the feed pawl drops into the next feed window (Fig. 178). Continued rotation of the feed cam back to its high point causes the feed pawl to rotate the feed and lift wheel 1/16 of a turn resulting in a ribbon feed operation.

Notice that the timing of the ribbon feed cam causes the ribbon feed action to occur late in a print cycle. At the time the type head prints the ribbon feed pawl has just begun to rotate the feed and lift wheel to cause a ribbon feed operation. By the time the print cycle completes the feed pawl is in its extreme forward position (Fig. 176) and the ribbon feed operation is accomplished.

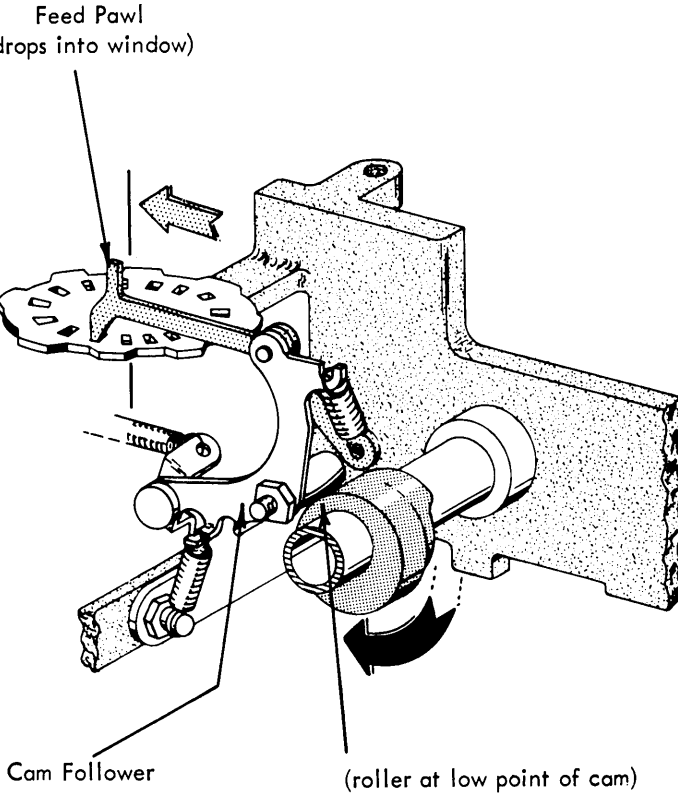


FIGURE 178. Follower at Low Point

During the early portion of a print cycle the feed and lift wheel tends to rotate backwards with the feed pawl when the feed pawl is being cammed out of the feed window as it travels toward the rear of the machine. To prevent the feed and lift wheel from rotating backwards the wheel is detented in position at the completion of each feed operation. This is accomplished by a detent spring that fastens to the underside of the feed plate and operates in the feed windows of the wheel (Fig. 179).

Beginning at the supply spool, let's trace the path of the ribbon to the take-up spool. As the ribbon comes off the spool of ribbon on the supply spool it immediately passes around a wire shock spring (Fig. 180). This shock spring is mounted to the top of the feed plate by a binding screw. Its purpose is to absorb the shock given to the ribbon during a feed operation plus eliminate all slack in the ribbon during a ribbon lift operation. The function of the black roller on the shock spring is to reduce friction as the ribbon slides over the shock spring.

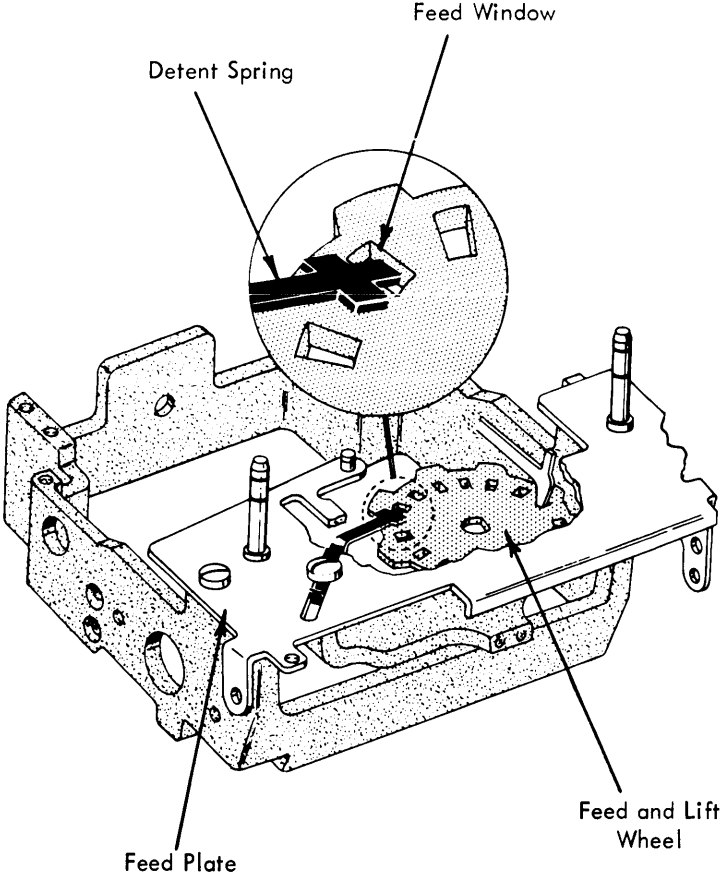


FIGURE 179. Feed & Lift Wheel Detent Spring

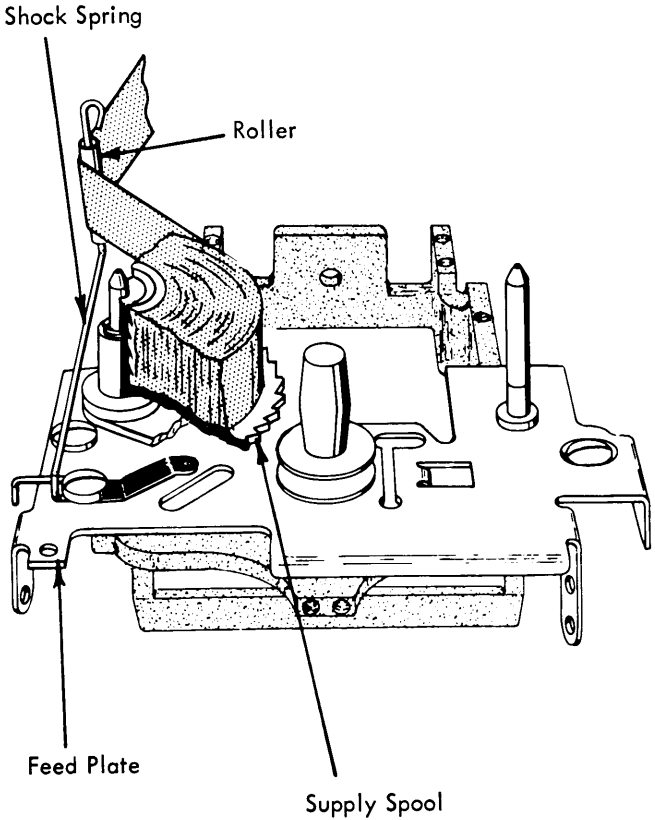


FIGURE 180. Ribbon Shock Spring

After passing around the shock spring the ribbon threads through two plastic guides on the ribbon lift guide assembly (Fig. 181). The guide assembly pivots about a fulcrum wire mounted at the front of the carrier casting. The function of the guide assembly is to elevate and guide the ribbon in front of the typehead during a print operation. A flat link running from each guide arm is anchored to a pin at the front of the carrier. These links maintain the plastic guides in a vertical position throughout a ribbon lift operation. The plastic guides, mounted on the guide arms, pivot freely on shouldered rivets. This type of mounting permits the tension on both the top and bottom of the ribbon to automatically equalize and remain equal throughout a ribbon lift operation.

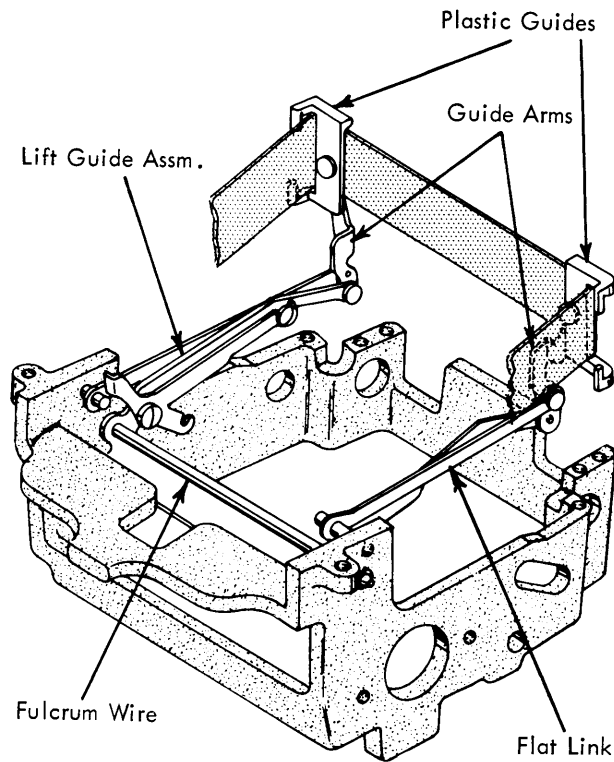


FIGURE 181. Ribbon Lift Guide Assembly

From the guide assembly the ribbon threads forward passing around the right hand corner guide (Fig. 182). This corner guide helps to dampen out the effects of the lift operation that is felt on the ribbon as it leaves the lift guide assembly. The corner guide stabilizes the ribbon before it enters the tracking post.

Before the ribbon enters the feed and pressure rollers it passes over a flanged post called the tracking post (Fig. 182). The purpose of this post is to make the ribbon engage the feed roller at the same angle throughout the use of an entire spool of ribbon. As you can see in Figure 182 the ribbon is being deflected between the corner guide and the tracking post by the used ribbon that has accumulated on the take-up spool. Without the tracking post, the angle that the ribbon enters the feed roller would be constantly changing as the diameter of the used ribbon on the take-up spool increased. This condition could cause ribbon tracking problems at the feed roller. The tracking post aids the system in maintaining a constant ribbon tracking characteristic at the feed and pressure rollers.

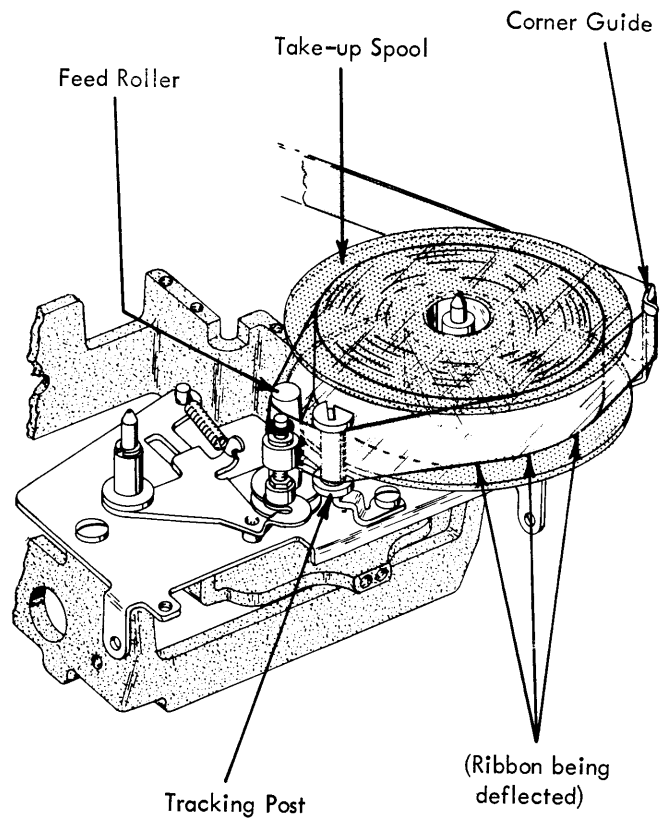


FIGURE 182. Corner Guide & Tracking Post

As the used ribbon leaves the tracking post and passes around the feed roller, a small rubber roller called the pressure roller loads the ribbon against the feed roller (Fig. 183). The function of the pressure roller is to insure that there will be no ribbon slippage at the feed roller during a ribbon feed operation.

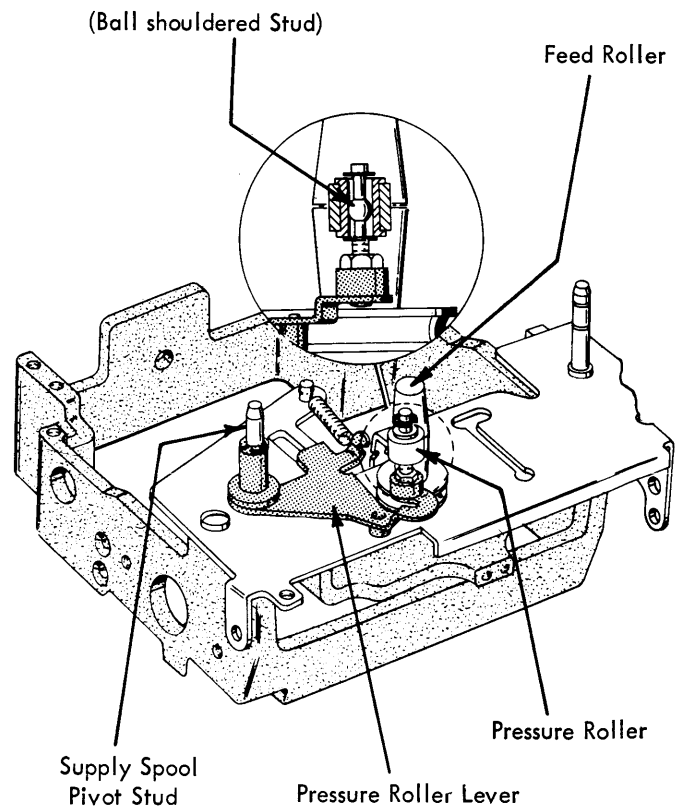


FIGURE 183. Pressure Roller Mtg.

The pressure roller mounts on a lever which pivots on the supply spool pivot stud. A heavy extension spring fastened to the lever loads the pressure roller against the feed roller. The pressure roller mounts freely on a ball shouldered portion of its adjustable mounting stud. This ball shouldered type mounting permits the rotational axis of the pressure roller to change as the roller rides over the embossed portions of the used ribbon during a feed operation. By giving the pressure roller the freedom to seek its own position, a better tracking characteristic is achieved at the feed roller.

Once the ribbon leaves the feed and pressure roller, the used ribbon is wound onto the transparent take-up spool. The take-up spool receives its motion from the feed mechanism by a friction type drive system.

A drive pulley located directly below the feed roller rotates with the feed roller during a ribbon feed operation (Fig. 184). This drive pulley supplies the motion to the take-up pulley by means of a drive spring. The take-up pulley, driven by the drive spring, rotates about the take-up spool pivot stud and is held in place by a "C"-clip. The shape of the belt groove in the take-up pulley is designed slightly different as compared to that of the drive pulley. This is to permit all of the necessary slippage of the drive spring to occur at the take-up pulley and not at the drive pulley. Two hooked lugs on the top face of the take-up pulley project into corresponding slots in the bottom of the transparent take-up spool. These lugs provide a locking type connection between the take-up pulley and the disposable take-up spool. Thus, a constant take-up drive is insured at the take-up spool.

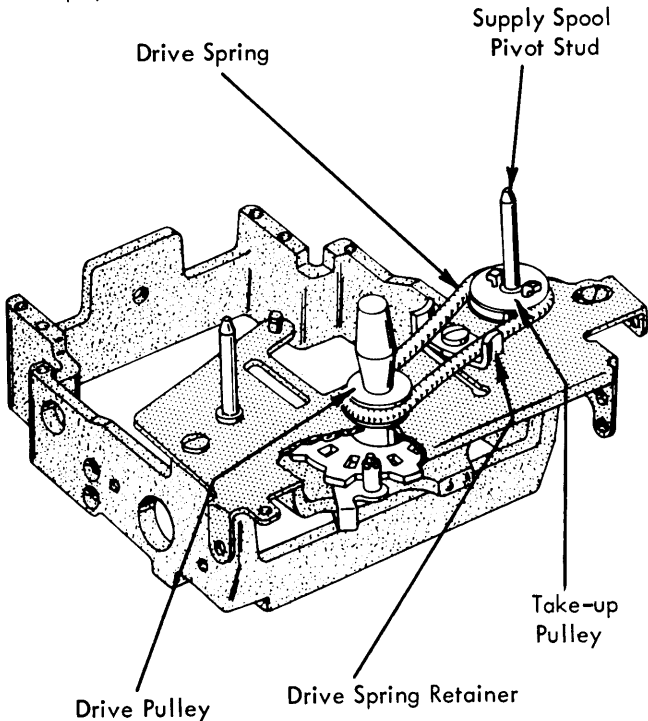


FIGURE 184. Take-Up Spool Drive

The function of the drive spring retainer is to dampen the oscillations of the drive spring during an operation. Without the retainer, oscillations of the drive spring would cause the spring to strike other components mounted nearby. This would result in damage to the drive spring which may lead to erratic take-up tension.

To maintain a stable ribbon tracking characteristic from the supply spool to the feed and pressure rollers, the ribbon must be kept slightly taut throughout the ribbon circuit. Any slackness in the system will affect the tracking of the ribbon. Maintaining the ribbon taut is accomplished by means of the supply drag lever in conjunction with the shock spring (Fig. 185). The supply drag lever is mounted on the feed plate by the same screw that mounts the tracking post. The drag lever pivots freely about a shoulder on this screw and is spring loaded against the spool of ribbon on the supply spool. Its function is to provide a constant drag on the outer wraps of ribbon. This drag plus the effects of the shock spring eliminate any slackness in the ribbon circuit during a ribbon feed operation.

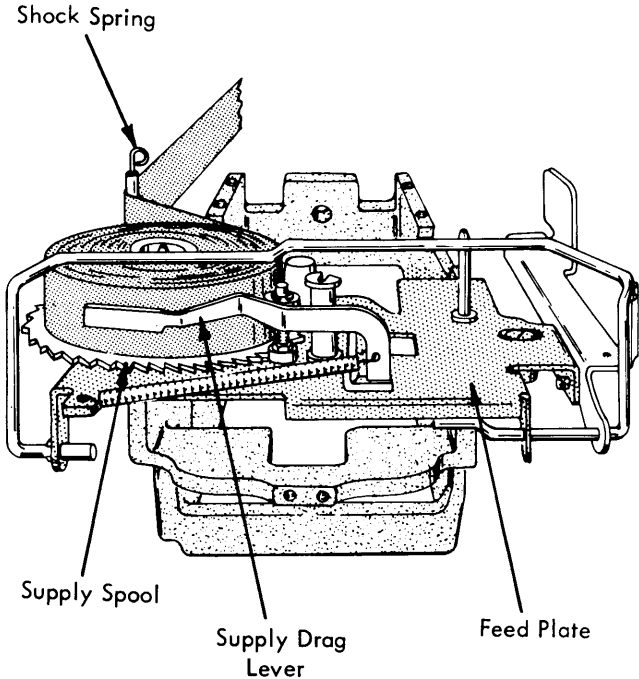


FIGURE 185. Supply Drag Lever

To keep the spool of ribbon tightly wrapped on the supply spool, a slight drag must be felt at the core of the ribbon supply. This is achieved by the supply spool drag spring which fastens to the feed plate by the same screw that anchors the shock spring. The drag spring provides a frictional drag to the underside of the ribbon supply spool. Without this drag, both the core and the inner wraps of ribbon would tend to turn within the outer wraps of ribbon on the supply spool. The end result would be a tendency for the spool of ribbon on the supply spool to grow in diameter which may eventually lead to ribbon spillage. This effect is mostly due to the momentum that is developed within the spool of ribbon during a ribbon feed operation.

The carrier vibrations that inherently occur during a repeat spacebar or backspace operation causes the ribbon supply spool to rotate in the unwinding direction, thereby permitting the ribbon to become slack in the circuit. To prevent this from occurring, a brake called the supply spool brake (Fig. 186) engages the ratchet teeth on the supply spool whenever the ribbon mechanism is not in a feed operation. The brake pivots on a stud on the feed plate and is spring loaded into engagement with the ratchet teeth on the supply spool.

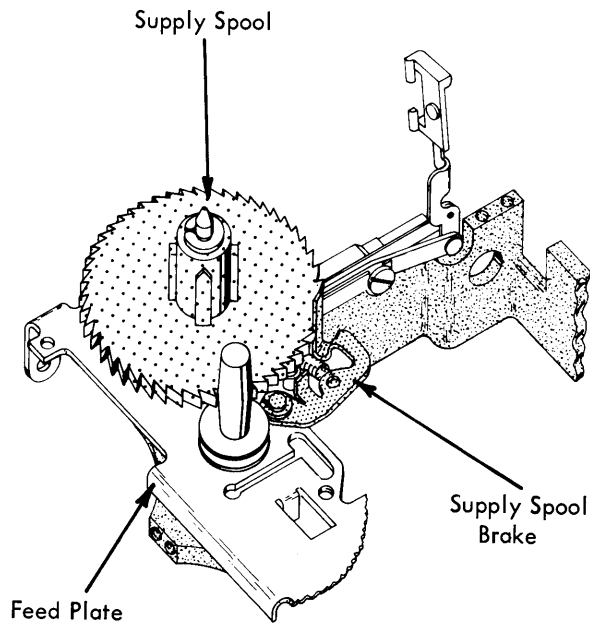


FIGURE 186. Supply Spool Brake

During a feed operation the supply spool brake must be disengaged from the supply spool. The mechanical motion required to disengage the brake is taken from the ribbon lift mechanism. A vertical lug, which is part of the lift guide plate on the lift guide assembly projects up through a window in the feed plate (Fig. 187). Each time the ribbon lift guide assembly is raised the vertical lug on the lift guide plate operates the brake actuating lever which in turn disengages the brake from the supply spool. Since the feed operation does not occur until well after the lift operation is underway, the brake will always be disengaged from the supply spool at the beginning of a feed operation.

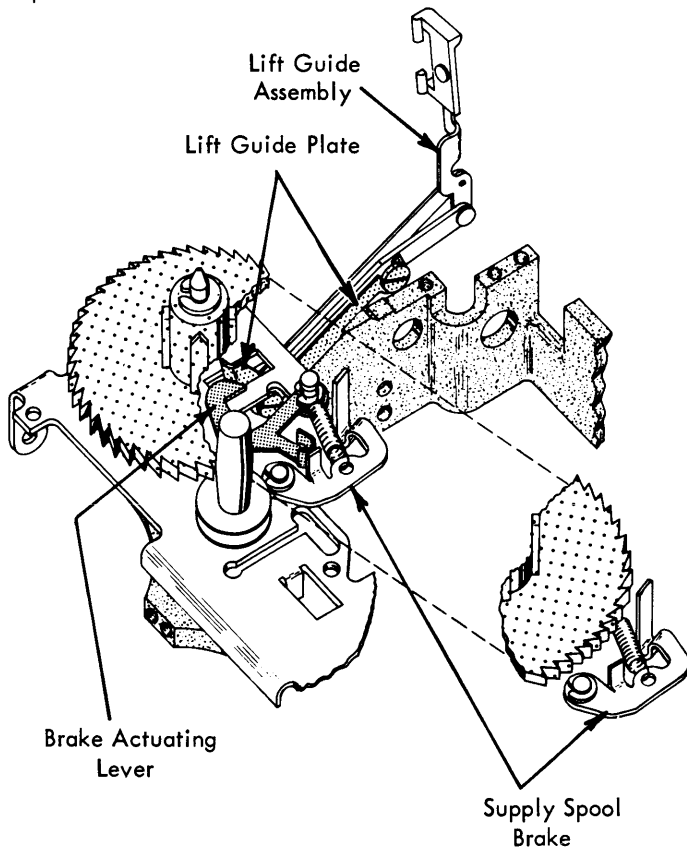


FIGURE 187. Brake Actuating Lever

Ribbon Lift

Because the entire ribbon mechanism is mounted on and moves with the carrier, the diameter of the supply spool is necessarily limited. To obtain the desired number of characters per spool of ribbon, a 9/16" wide ribbon is used. By using a wider ribbon and varying the ribbon lift position for each character (Fig. 188), a greater number of characters can be typed on a given length of ribbon.

The 3121 polyethylene film ribbon used on the Model "71" Selectric is a modification of the current 5121 ribbon used on the Model "C" typewriter. Character yield is approximately 52,000 characters per spool of 3121 film ribbon as compared to an average of 94,000 characters per spool of 5121 film ribbon on a Model "C" standard ET. This results in a consumption ratio of 1.8 spools of 3121 to each spool of 5121.

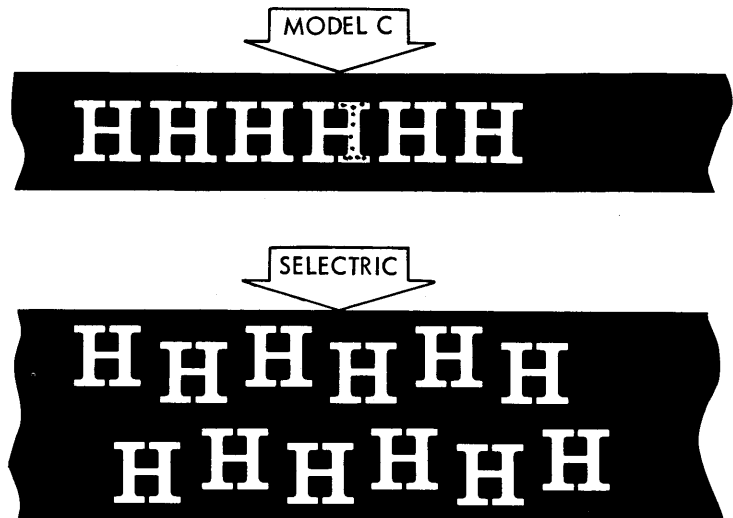


FIGURE 188. Lift Pattern

The lift mechanism for the film ribbon machines is similar to the lift mechanism on the fabric ribbon machines. That is, the lift motion is supplied by a cam on the print sleeve and the amount of lift that is produced is determined by the position of the control link in the slot of the cam follower (Fig. 189). The film ribbon lift mechanism differs only in that the lift position is automatically changed to one of four different lift positions during each print cycle.

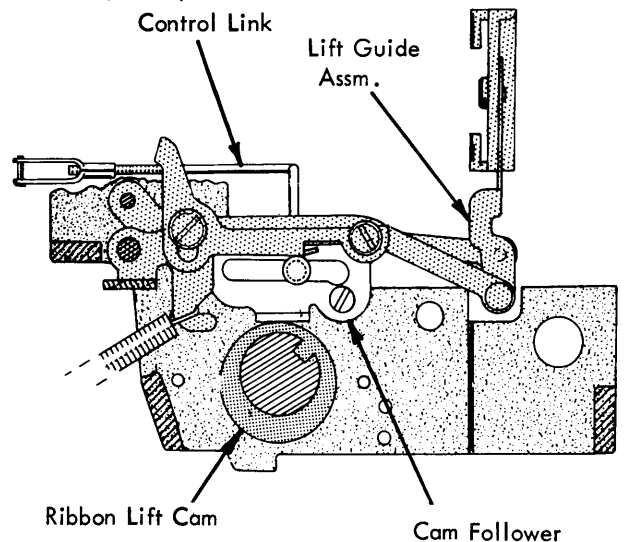


FIGURE 189. Ribbon Lift Mechanism

This is achieved by changing the location of the control link in the slot of the cam follower. The four lift positions obtained by moving the control link are designated by "A", "B", "C", and "D" (Fig. 190).

"A" and "C" are low lift positions while "B" and "D" are high lift positions. These four lift positions occur in a definite order during a typing operation. It takes four print operations to complete a lift cycle which is from "A" to "B" to "C" to "D" (Fig. 190). On the fifth print operation the lift cycle would begin all over again with lift position "A". Changing the location of the lift control link in the slot of the cam follower produces these lift positions.

The motion produced by the camming lobes on the feed and lift wheel is transmitted to the control link by the lift control lever (Fig. 192). The control lever is mounted to the front of the carrier by a shouldered screw and is spring loaded against the camming lobes of the feed and lift wheel. The steel roller "C" clipped to a pin on the control lever operates as a cam follower for the control lever.

The selected ribbon lift position for each print operation is always established by the ribbon feed operation from the previous print cycle. This is because the rotation of the feed and lift wheel (which produces the change in the ribbon lift position) does not occur until after the typehead has printed.

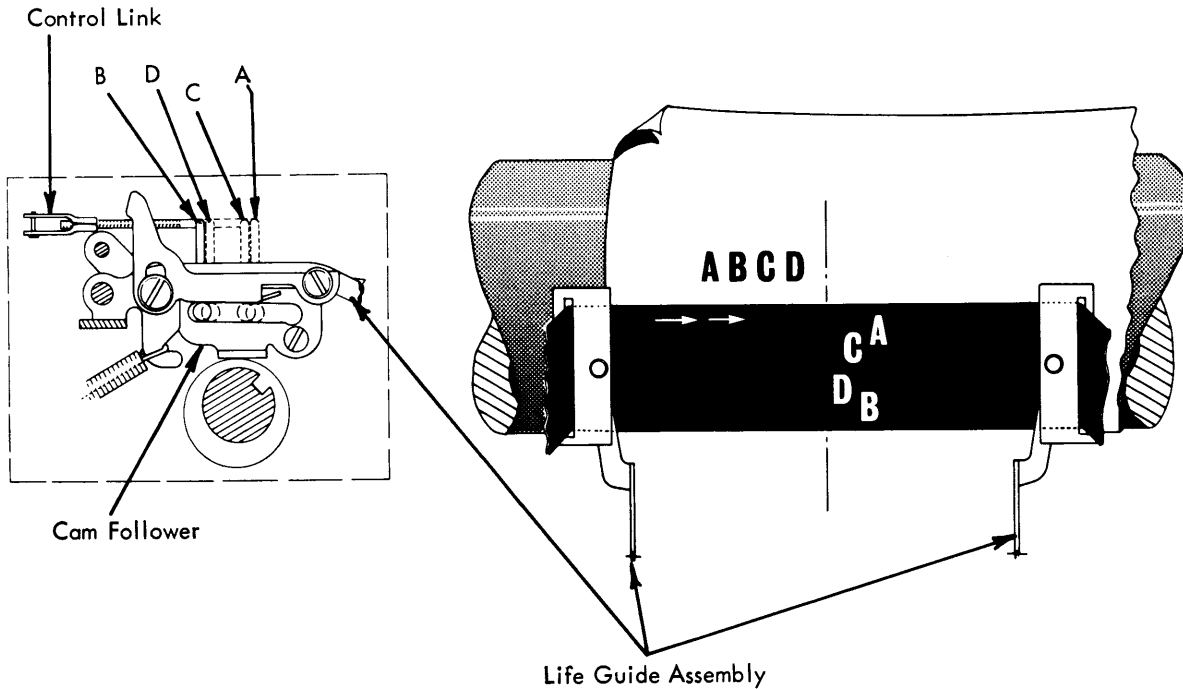


FIGURE 190. Ribbon Lift Positions

When the control link is positioned near the rear of the slot in the cam follower such as when it is in lift position "A", very little motion is obtained from the cam follower. Also, when the control link is in this position it is further away from the pivot point of the lift guide assembly than the other lift positions. Therefore, when the control link is in this position the least amount of motion is produced to the lift guide assembly and the character prints near the top of the ribbon.

Rotation of the feed and lift wheel during a ribbon feed operation produces the change in the lift operation. The camming lobes on the perimeter of the wheel governs the position of the control link during each ribbon feed operation (Fig. 191). These lobes which correspond to each feed window produce the four lift positions in a consecutive order as the wheel rotates 1/16 of a turn for each ribbon feed operation.

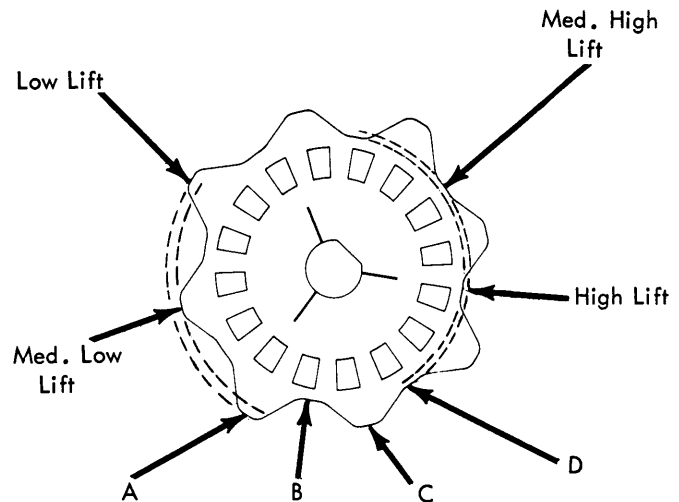


FIGURE 191. Feed & Lift Wheel

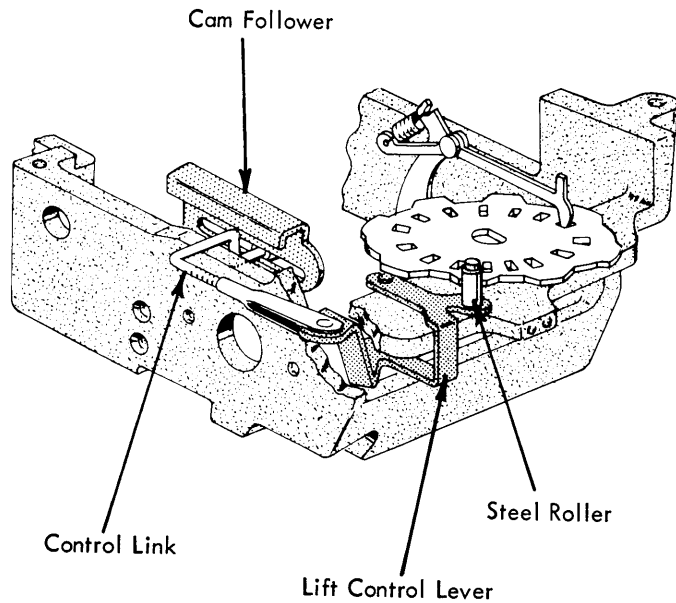


FIGURE 192. Lift Control Lever

Stencil Lockout

Whenever the machine is used for typing stencils, the ribbon feed and lift operation must be locked out. This is accomplished by a stencil lever located on the front of the carrier just above the carrier pointer. The stencil lever pivots about a shoulder on the feed and lift wheel mounting screw and is spring loaded into its rest position. When the lever is pushed to the left into its stencil position (Fig. 193) the feed and lift mechanism becomes inoperative.

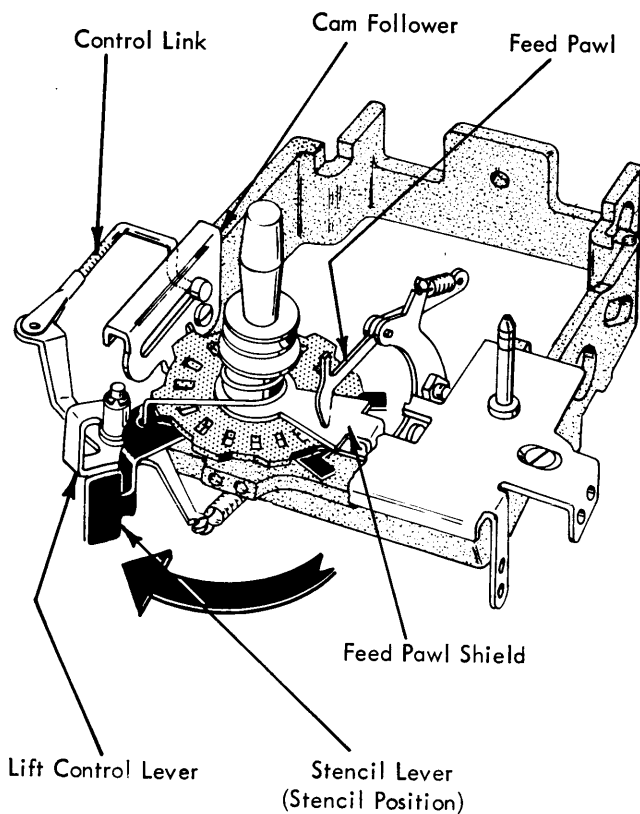


FIGURE 193. Stencil Lockout

The lockout of the feed mechanism is achieved through a feed pawl shield. Two lugs on the rear of the stencil lever position the shield over the feed windows in the area where the feed pawl operates during a ribbon feed operation. The feed mechanism becomes locked out because the shield prevents the pawl from dropping into the next feed window when the pawl is operated to the rear (as shown in Fig. 193) during a ribbon feed operation.

Lockout of the lift operation is achieved by a camming surface on the left side of the stencil lever. As the lever is pushed to the left into its stencil position, the steel roller on the lift control lever is cammed away from the feed and lift wheel (Fig. 193). This causes the control link to move to the rear of the slot in the cam follower where no lift motion will be produced to the ribbon lift guide assembly. The steel roller on the lift control lever detents the stencil lever in the stencil position even though a slight load is being applied to the lever in the restoring direction by the hairpin spring fastened to the front of the lever.

Ribbon Load Operation

When the operator desires to change the ribbon, she begins by pulling the load bail forward into its load position (Fig. 194). This causes the ribbon lift guide assembly to rise above the typing element so that the ribbon may be threaded through the guides with ease.

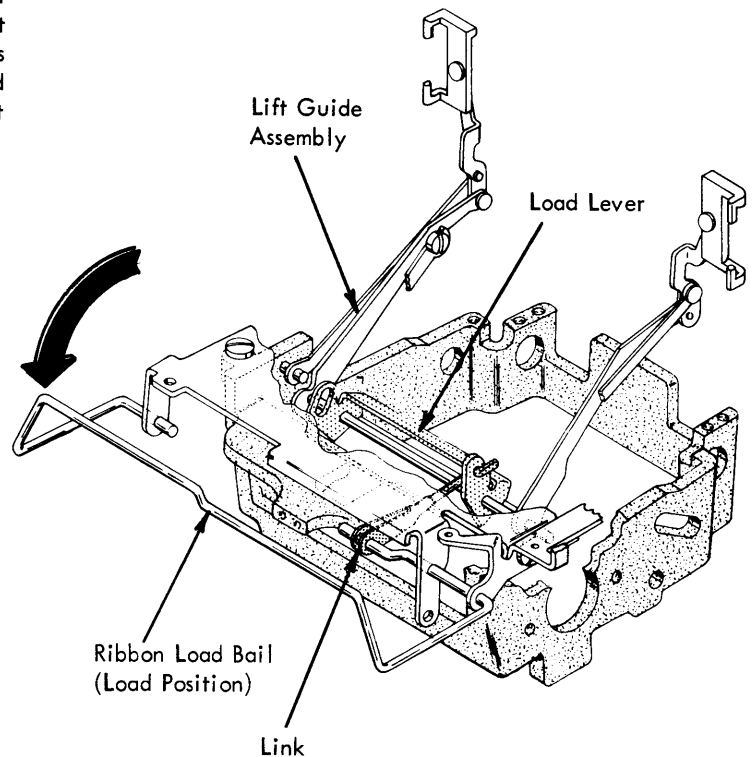


FIGURE 194. Ribbon Load Operation

Rotating the load bail forward into its load position creates a pull on the load lever link causing the load lever to rotate counterclockwise. The load lever then rotates the lift guide assembly into its elevated position. At the same time that the guide assembly rises, the supply spool brake is disengaged from the ratchet teeth on the supply spool. This action occurs in the same manner as it does during a normal ribbon lift operation (Fig. 187).

Pulling the load bail forward into its load position also causes the pressure roller and the supply drag lever to pivot out of the way as illustrated in Figure 195. A small arm called the pressure roller release arm fastens to the left end of the load lever. This arm extends up through a slot in the ribbon feed plate directly behind the pressure roller lever. Rotation of the load lever causes the release arm to push the pressure roller lever forward disengaging the pressure roller from the feed roller (Fig. 195). As the pressure roller swings forward, it forces the supply drag lever to pivot away from the supply spool. The operator may now install a ribbon with no obstructions.

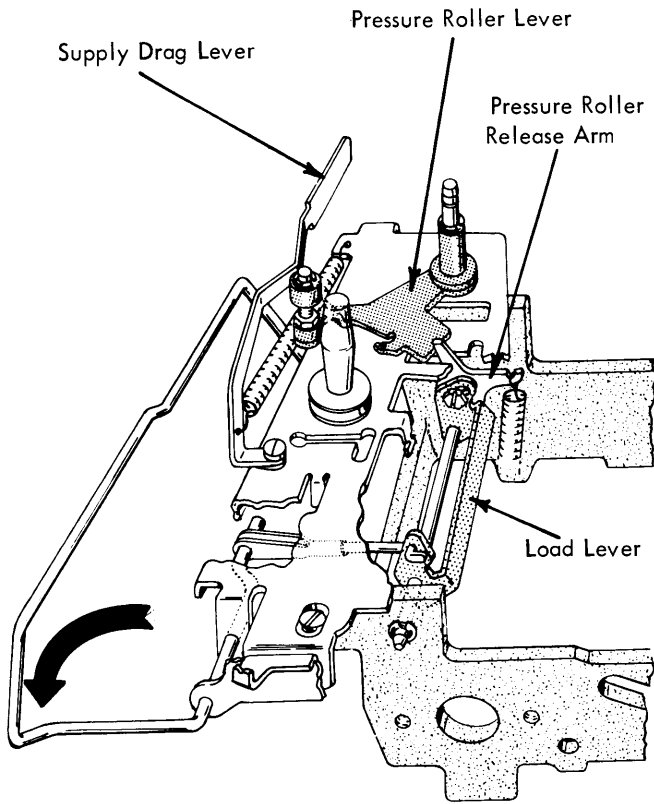


FIGURE 195. Pressure Roller Release

FABRIC RIBBON MECHANISM (NEW 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 (Figure 196). 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 (Figure 196). The reason for the upper lug will be explained in the reverse operation.

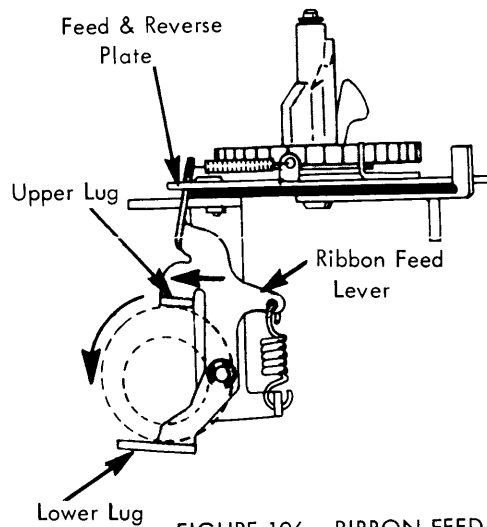


FIGURE 196 - RIBBON FEED LEVER (BEGINNING OF FEED OPERATION)

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 reverse plate, slides the plate toward the rear (Figure 196). 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 (Figure 197). 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" (Figure 197).

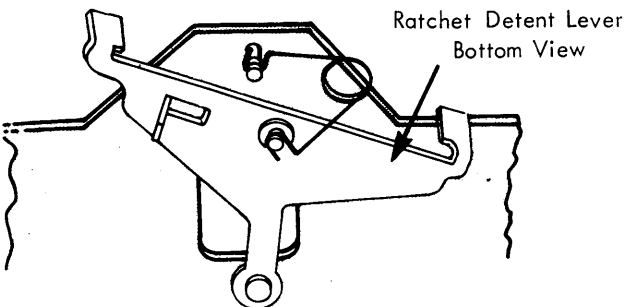
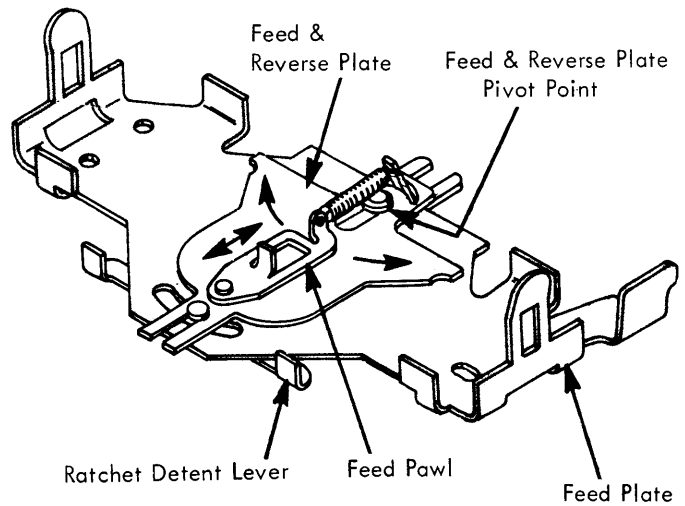


FIGURE 197 - RIBBON FEED & REVERSE PLATE MOUNTING

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 (Figure 198). 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 (Figure 198). This lug acts as a check pawl.

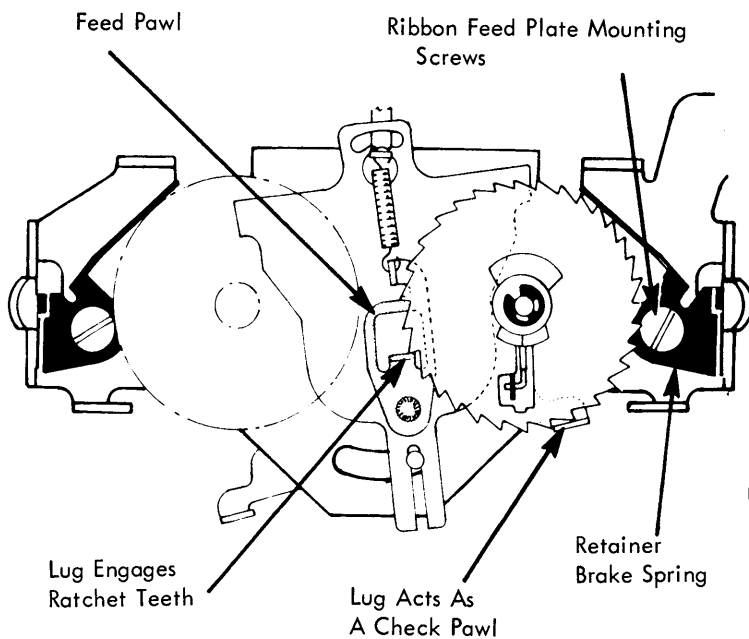


FIGURE 198 - FEED PAWL & RATCHET CHECKING

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 (Figure 198). 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 (Figure 198).

Ribbon Reverse

The ribbon is fed from the supply spool onto the take-up spool until the supply spool becomes empty (Figure 199-A). 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 (Figure 199-B).

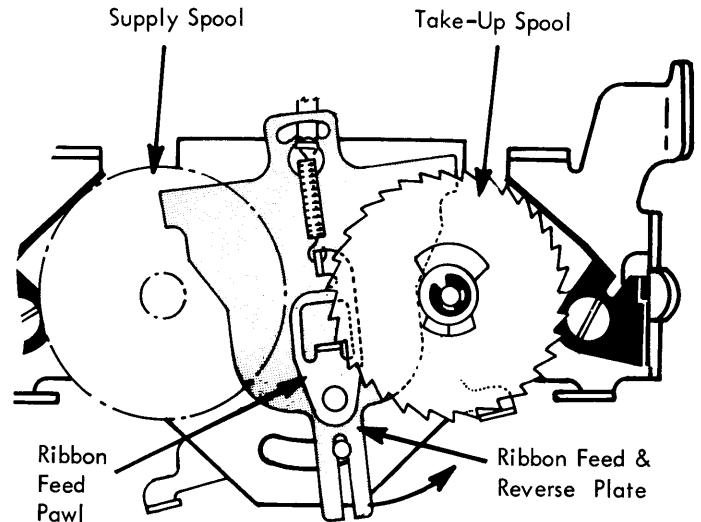


FIGURE 199-A - RIGHT HAND RATCHET DRIVEN

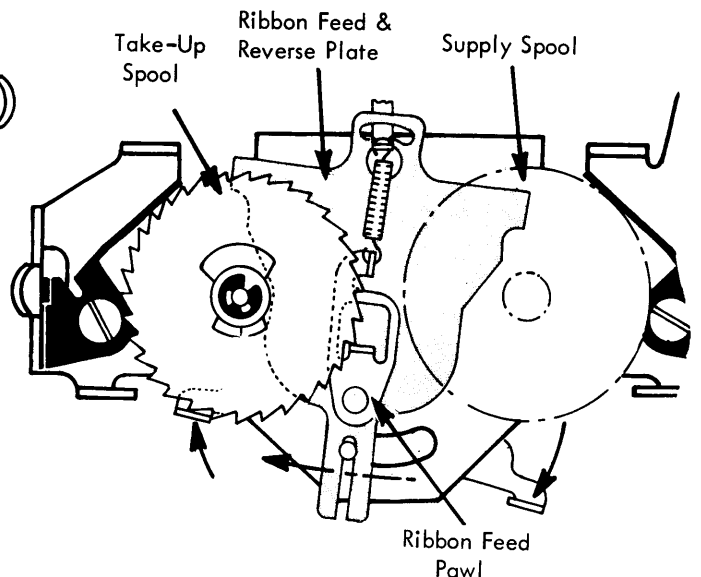


FIGURE 199-B - RIBBON FEED PAWL TRANSFERRED TO L.H. RATCHET

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 (Figure 200). The reverse trigger actually drops down and rides on the top surface of the ribbon feed plate.

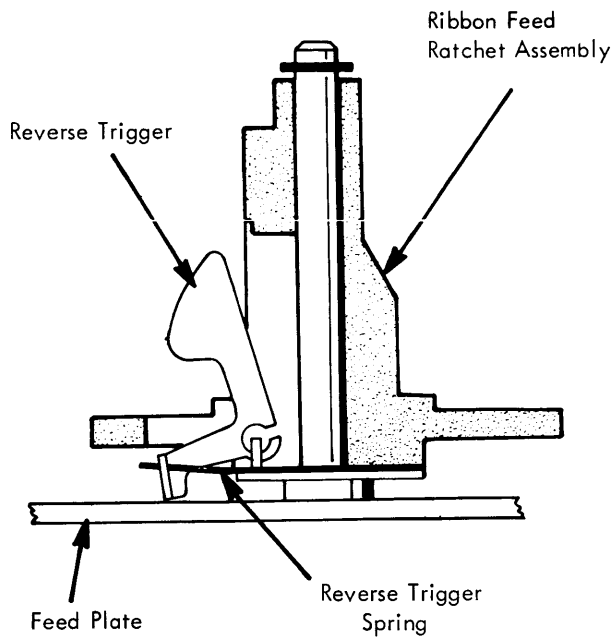


FIGURE 200 - REVERSE TRIGGER (ACTIVATED)

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 (Figure 201). 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 toward the opposite side, positioning the feed pawl in line with the ratchet teeth of the ribbon feed ratchet containing the empty ribbon spool.

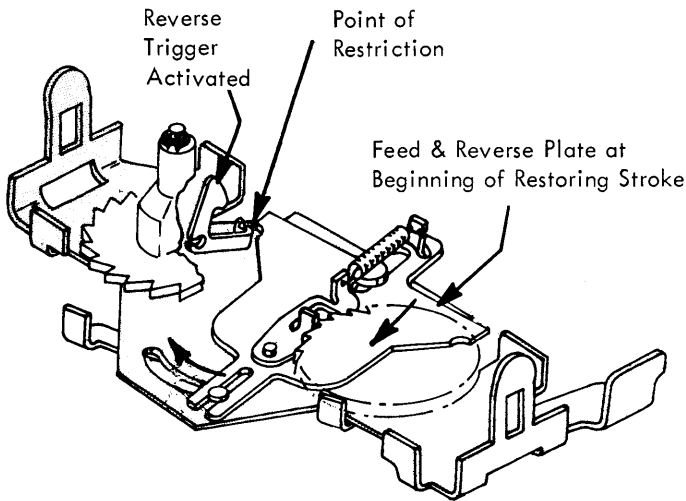


FIGURE 201 - REVERSE ACTION

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 (Figure 196) 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 front to rear without engaging a ratchet tooth (Figure 202). 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.

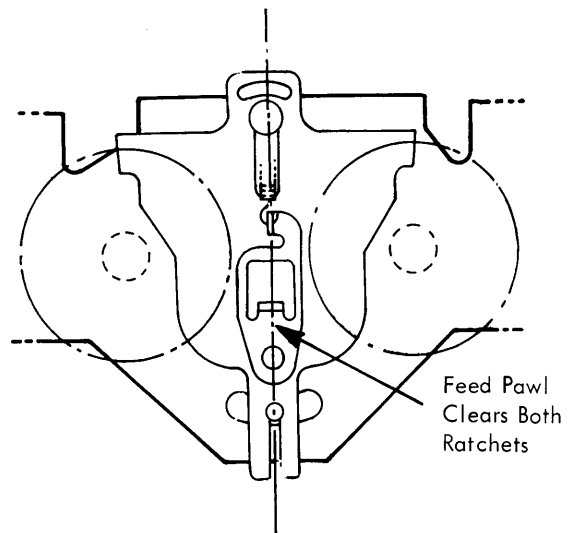


FIGURE 202 - RIBBON FEED PAWL (NO FEED POSITION)

Two lugs on the ribbon lift lever form a "V" which traps a lug on the ratchet detent lever (Figure 203). 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" (Figure 203). 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.

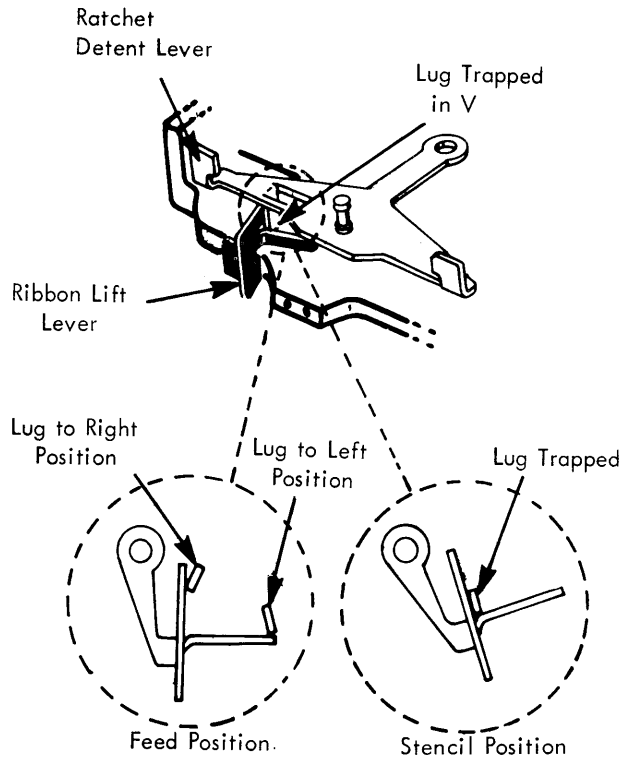


FIGURE 203 - STENCIL LOCKOUT