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TELETYPE

PRINTING TELEGRAPH SYSTEMS

RETURN TO

F. R. MCMURRY

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DESCRIPTION

OF THE

TYPE WHEEL PAGE PRINTER

(Model 24)



CORPORATION

SUBSIDIARY OF

Western Electric Company

CHICAGO, U.S.A.

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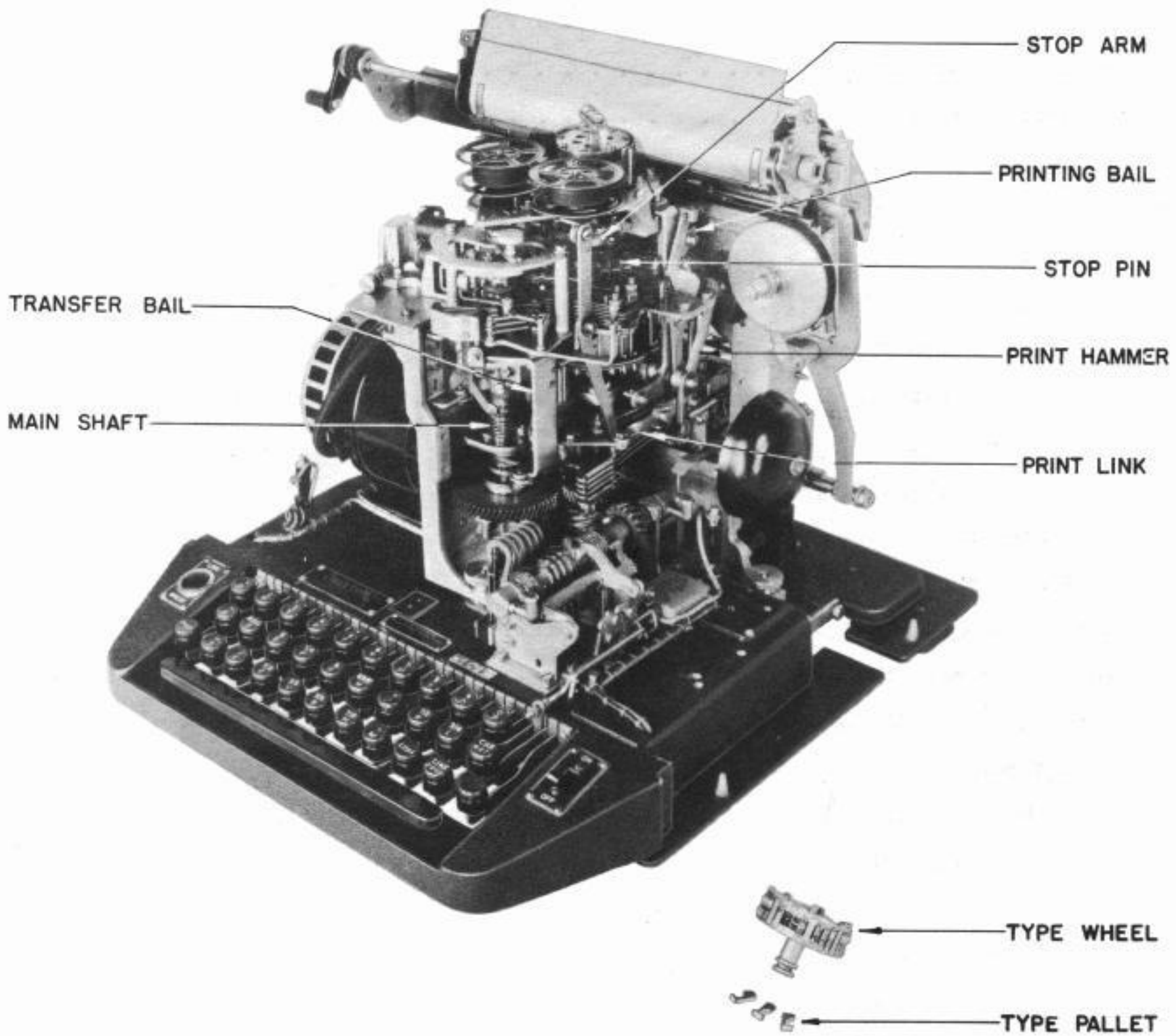


ILLUSTRATION I

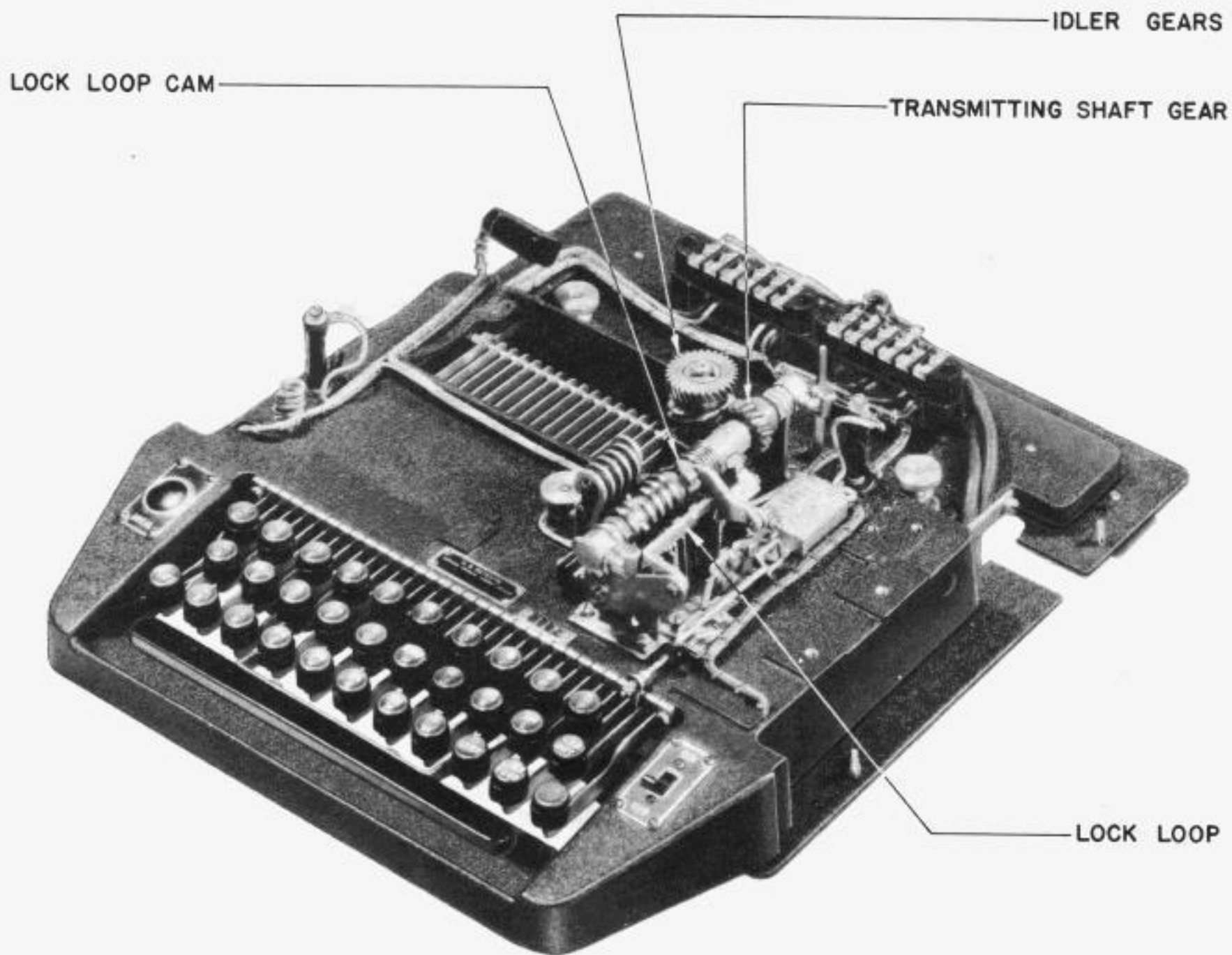


ILLUSTRATION 2



FIGURE 1

DESCRIPTION OF THE TYPE WHEEL PAGE PRINTER
(MODEL 24)

GENERAL

The Model 24 Teletype Type Wheel Page Printer is a machine designed for interchanging messages between two or more points. A sending-receiving station consists of a keyboard transmitting unit and a printer or typing unit (Illus. 1).

The keyboard transmitting unit provides a base for the typing unit and is used to transmit electrical impulses of the five unit code to the receiving mechanism of the typing unit at any station. These received signals will cause the typing unit to print a copy of the message sent by the keyboard operator. Receiving-only stations use a base unit in place of the keyboard unit.

Signaling Code

The signaling code used to transmit characters is the "Start-Stop" five unit code which consists of five selecting impulses used in various combinations of current and no-current intervals. Each group of five selecting impulses is preceded by a start impulse and followed by a stop impulse used to maintain synchronism between all stations on the circuit. Impulses which energize the selector magnet are known as "marking" and those which do not are known as "spacing." The code used is shown graphically on Figure 1.

Keyboard Transmitter

The keyboard (Illus. 2) consists of a set of key levers, a bank of sending contact springs, operating cams, clutch, and gears which mesh with the main shaft gear of the typing unit. The sending cams are normally held stationary because the clutch members on the driving shaft are held apart by the clutch throw-out lever (Figure 2). When a key lever is depressed, the driven member of the clutch is permitted to move into mesh with the driving member, causing the transmitting cam assembly to revolve. At the end of the revolution, the driven member of the clutch is disengaged by the clutch throw-out lever and the cam assembly brought to a stop until the next key lever is depressed.

Beneath the key levers are five selector bars and a universal bar extending across the width of the keyboard (Fig. 2). The selector bars are provided with saw tooth shaped notches as shown in Figure 3 according to the requirements of the signaling code. These bars rest on rollers and are guided at each end so that they may be easily moved endwise. When a key lever is depressed it strikes the slanting sides of these notches moving the bars either to the right or left depending upon whether the impulses corresponding to the bars are to be "spacing" or "marking" impulses.

The universal bar is pivoted at each end in such a way that the depressing of any key lever rotates it. As the universal bar rotates, the trip-off pawl is moved forward against the lower end of the intermediate pawl. The rear extension on the intermediate pawl will then move the clutch throw-out lever out of engagement with the driven clutch member. Thus, whenever a key lever is depressed, the selector bars are set and the transmitting cam assembly starts to rotate (Fig. 2).

Each selector bar engages a vertical locking lever at its right extremity and positions it to correspond with the signal impulses to be transmitted (Fig. 3). Each locking lever controls the motion of a contact lever by either allowing the contact lever to close its contact when the cams revolve or restricting the motion of the contact lever. If the upper end of the locking lever is positioned to the left corresponding to a "spacing" impulse, it engages the contact lever and prevents it from rising into the indent of the cam as it rotates, thus holding the circuit open for that impulse (Fig. 3-A). If the locking lever is positioned to the right corresponding to a "marking" impulse, it does not interfere with the movement of the contact lever (Fig. 3-B). Then as the cam revolves, the contact lever rides on the cam surface and rises into an indent, thereby allowing its contact to close sending out a "marking" impulse. As the cams rotate the impulses, either "marking" or "spacing", are transmitted in succession.

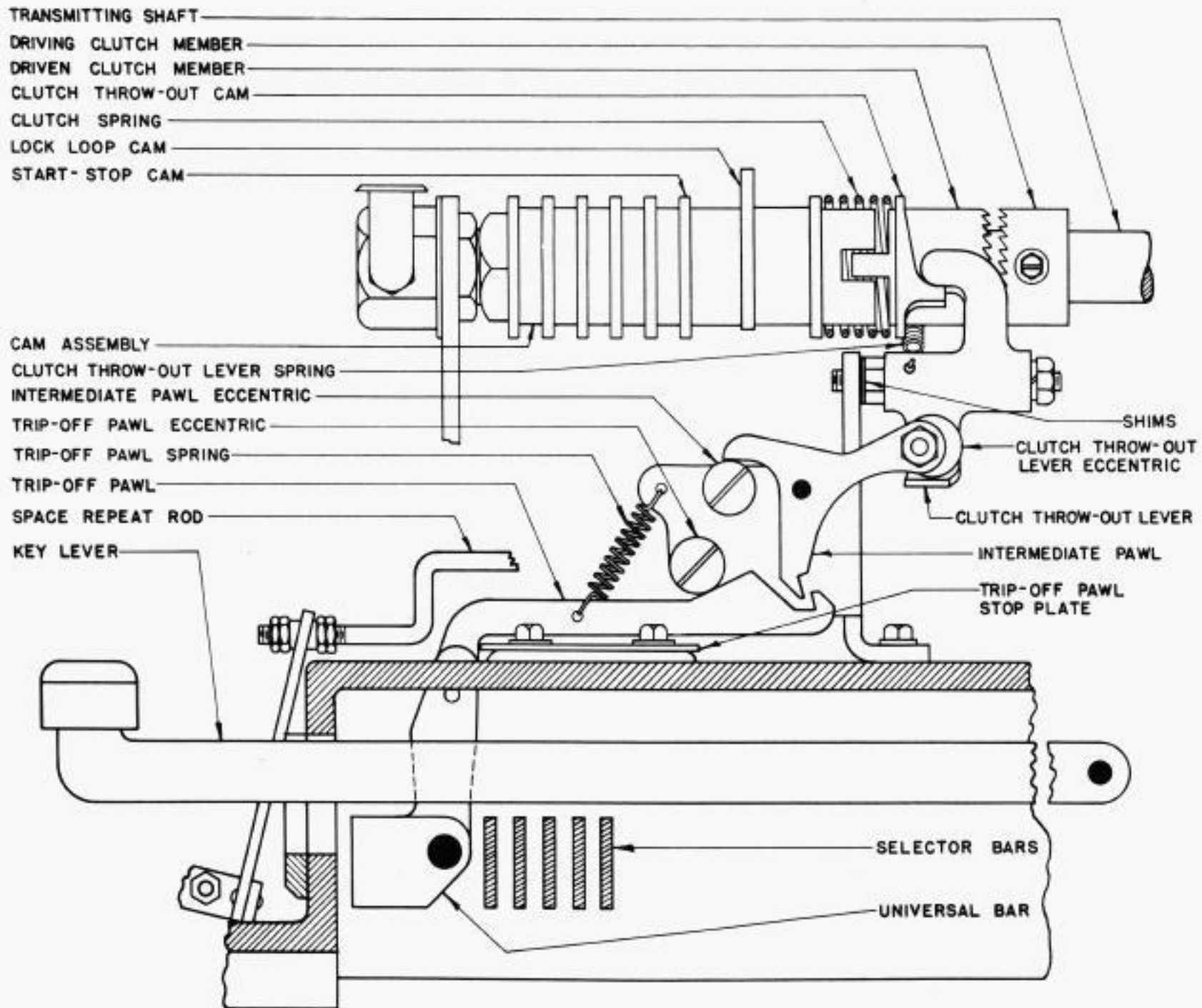


FIGURE 2

The start-stop cam (Fig. 2) controls an additional contact lever which actuates the start-stop contacts. These contacts are opened at the beginning of each revolution of the cam shaft to transmit the "start" impulse (spacing) and remain open during the transmission of the five selecting impulses. After the fifth impulse has been transmitted, the start-stop contacts will again close sending the "stop" impulse (marking) to the line. These contacts will remain closed until the next key lever

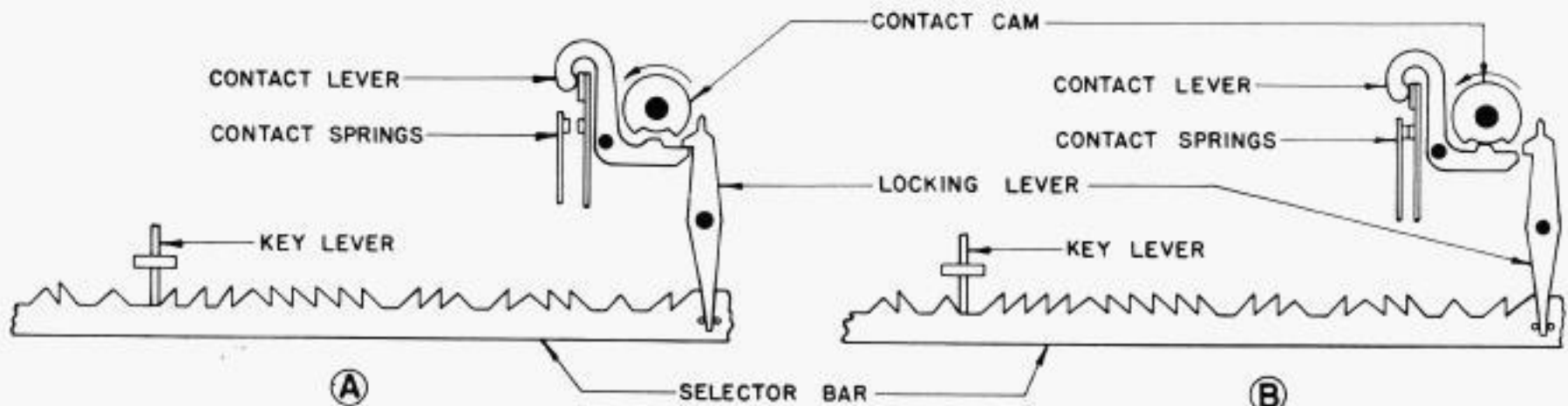


FIGURE 3

is depressed. At the end of the revolution the driven clutch member is cammed out of mesh with the driving clutch member and prevents the cam assembly from rotating further until the next key lever is depressed. The lock loop which is raised by the lock loop cam at the end of each revolution is used while in its down position to engage the locking levers, thus preventing a change in the selection while the cam assembly is rotating (Illus. 2). This arrangement also makes it impossible to depress another key lever until the signal for the previous character has been transmitted.

The keyboard is equipped with a space repeat device which permits the transmission of continuous spaces (Fig. 2). When the space key lever is depressed, the space repeat rod attached to the space key lever extension will rotate the intermediate pawl in turn holding the clutch throw-out lever out of engagement with the projection on the driven clutch. Thus the transmitter cam assembly will be permitted to revolve continuously until the space key lever is released.

TYPING UNIT

The type pallets of the model 24 typing unit (printer) are guided in grooves in the type wheel (Illus. 1) so that the selected type pallet may be moved mechanically against the platen. The type pallet to be selected is determined by the setting of five code discs, which are actuated by line signals through the medium of the selector mechanism. The code discs are so arranged that notches on their outer edges will be lined up permitting a selected stop pin to move into the path of a stop arm located on the type wheel shaft. Thus, the type wheel will be stopped so that the selected type pallet will be positioned opposite the print arm which pushes the pallet against the platen. The various functions; line feed, space, carriage return, figure shift, letters shift, etc., are also accomplished mechanically. A motor drives the type wheel and main shafts, which supply power to all mechanically operated parts.

The main shaft and type wheel shaft gears are located near the lower ends of the shafts and mesh with the motor pinion. The main shaft gear is attached to the main shaft, but the type wheel shaft gear is attached to a friction clutch which is mounted on the lower end of the type wheel shaft. Thus, it may be seen that the main shaft will be caused to rotate continuously during the period the printer is in operation, but the type wheel shaft will be rotated only when the stop arm is not engaged with a stop pin. The main shaft gear also drives the keyboard cam shaft through the medium of the idler gears and shaft and transmitting shaft gear (Illus. 2).

Main Shaft Assembly

The selector cam sleeve is fitted over the upper end of the main shaft and is driven through the medium of a friction clutch (Fig. 4). The operating cam operates the printing bail, and the transfer and function cams operate their respective bails. These three bails are operated through the main shaft clutch which is controlled by the selector cam.

Selecting Unit

The purpose of the selecting unit is to receive the signals from the transmitting station, distributing them mechanically, thereby setting up various combinations on the swords. These combinations will determine the character to be printed or the function to be operated. The selector mechanism is controlled by the selector magnet which receives the code impulses from the line (Fig. 5 & 6). Normally the armature of this magnet is pulled up and the stop arm is against the stop lever which in turn is held by the trip latch. Because the stop arm, which is a part of the selector cam sleeve, is engaged with the stop lever, the cam sleeve is prevented from revolving. When the "Start" impulse ("spacing," no-current) is received, the armature is released and pulled away from the magnet pole pieces by the armature spring. This will move the trip latch out of engagement with the stop lever, thereby releasing the stop lever and arm, allowing the cam sleeve to revolve with the main shaft. As the cam sleeve revolves, the armature cam moves the armature momentarily against the selector magnet. If the impulse received is "marking," the magnet will continue to hold the armature in the attracted position during that impulse. However, if the impulse received is "spacing," the armature will be pulled away from the magnet by the armature spring.

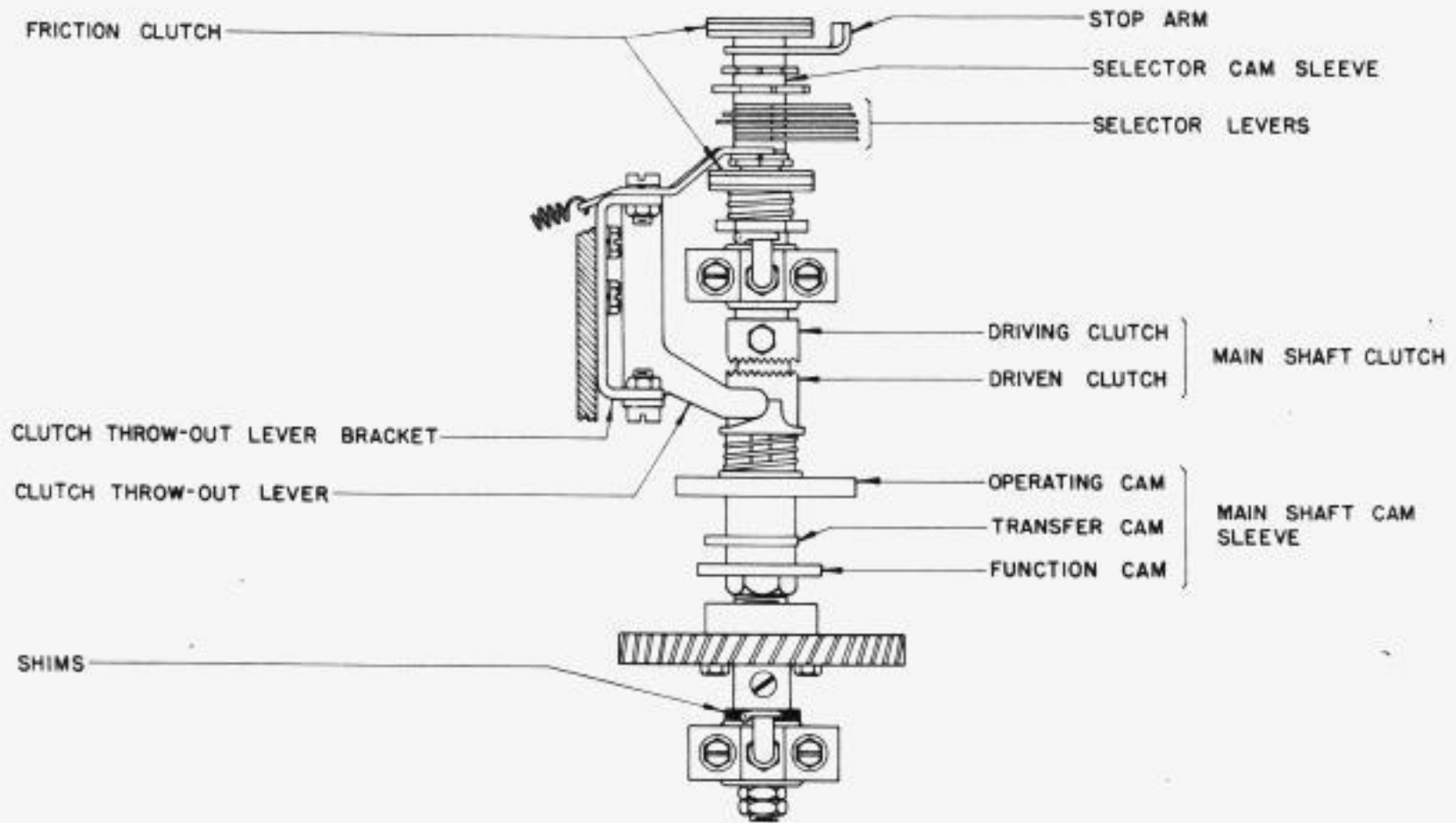


FIGURE 4

Each sword is operated by a selector cam through a selector lever (Fig. 6). For instance, suppose that the code for the letter "E" is received. Upon the reception of the "start" impulse (a no-current impulse), the armature is moved away from the magnet, imparting motion first to the trip latch plunger (Fig. 5) which in turn causes the bell crank to move the trip latch out of engagement with the stop lever releasing the stop arm as explained previously. The selector cam sleeve starts to revolve and the No. 1 selector cam engages the No. 1 selector lever when the first impulse of the letter "E" ("marking" or current impulse) has already been received by the magnets from the line. The magnet armature which had been moved against the pole pieces by the armature cam remains in that position, bringing the rear extension of the selector arm (Fig. 6) into the path of the rear sword arm. When the No. 1 cam passes the No. 1 selector lever, this lever is rotated counterclockwise, carrying with

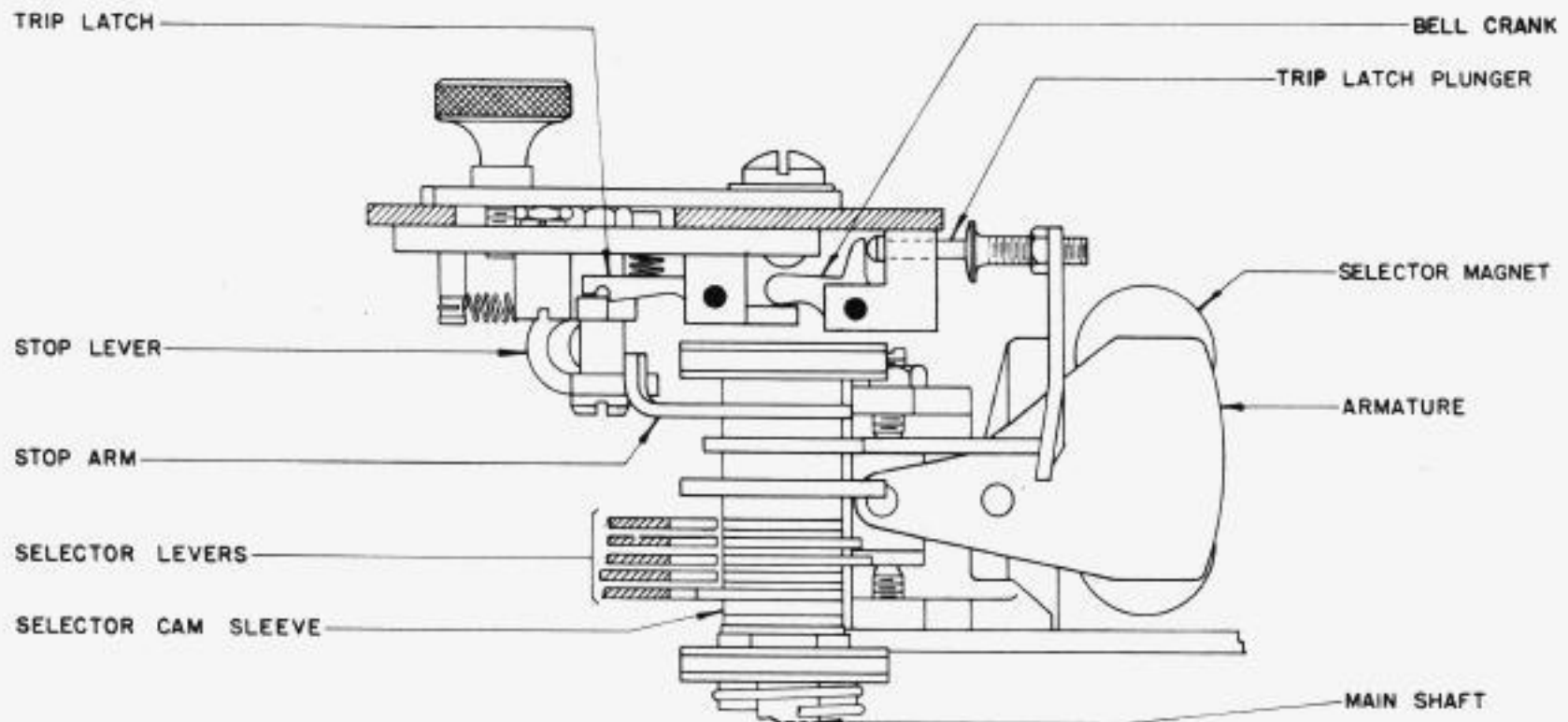


FIGURE 5

it the sword which strikes the rear extension of the selector arm and the sword is in turn rotated clockwise about its pivot point "A." This positions the sword with its right (pointed) end near the front stop. As no current is received while the No. 2,3,4, and 5 cams are passing their selector levers, the magnet armature is released each time, and the selector arm moves forward so that the front extension of the selector arm is in the path of the front sword arm. As the No. 2,3,4, and 5

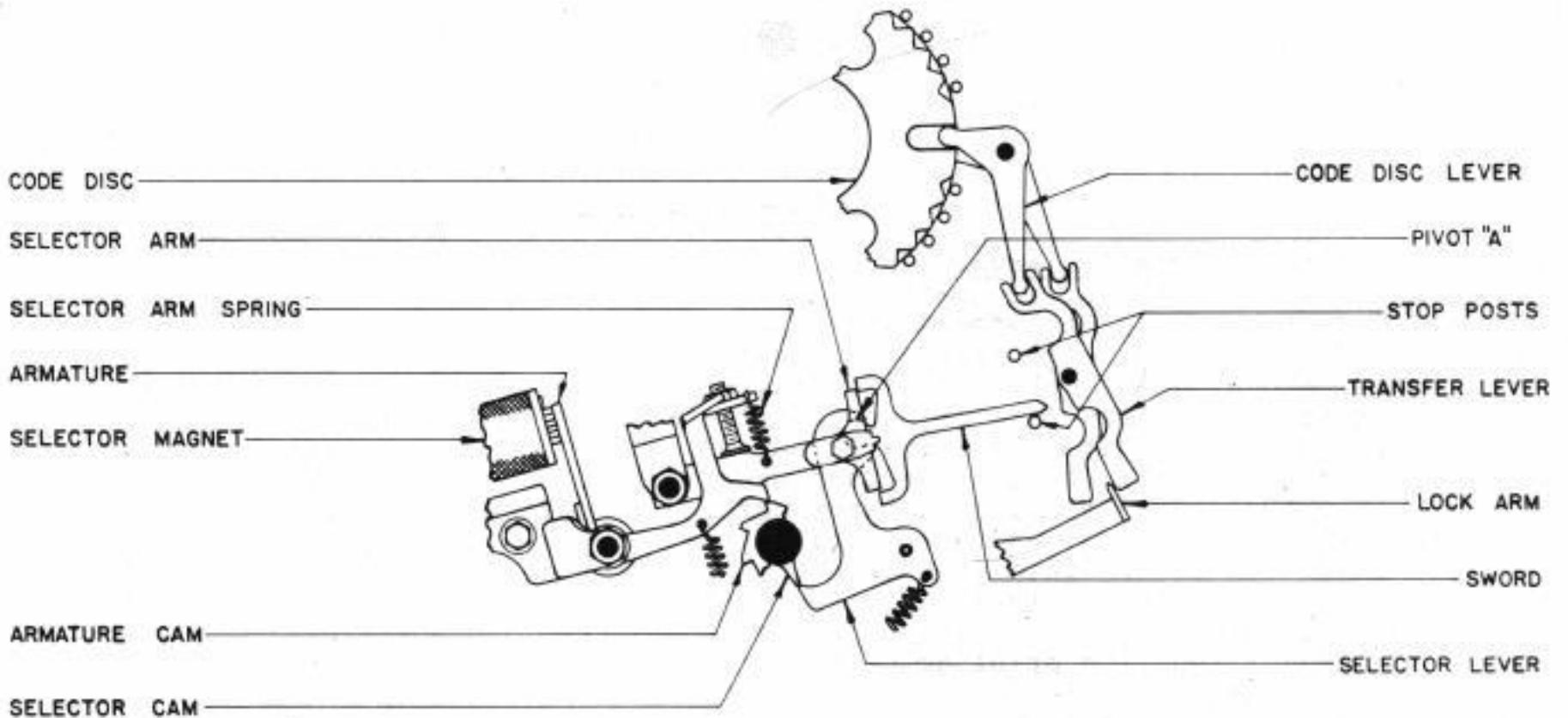


FIGURE 6

cams pass the No. 2,3,4, and 5 selector levers, the corresponding swords will be positioned with their right ends near the rear stop. During the rotation of the selector cam sleeve and after the reception of the fourth impulse, the sixth cam releases the main shaft clutch allowing the operating cam and sleeve to be rotated one complete revolution (Fig. 4). Shortly after the reception of the fifth impulse, the operating cam will rotate far enough to operate the printing mechanism. However, the letter printed will not be the one just selected but the character selected by the previous rotation of the selector cam sleeve. Immediately after the printing of the character, the transfer bail will be operated and the selector levers will be rotated clockwise, by the transfer bail yield springs, moving the right ends of the swords against the transfer levers (Fig. 8). The transfer levers will now be positioned as follows for the letter "E": Number 1 will have its forward end towards the right and numbers 2,3,4, and 5 will be towards the left. The rear ends of each of the transfer levers engage code disc levers, which in turn engage the five code discs, rotating the number 1 code disc counterclockwise and numbers 2,3,4, and 5 code discs clockwise. In assuming their new positions, the code discs will move the previously selected stop pin out of engagement with the stop arm on the type wheel shaft and permit the shaft to revolve until the stop arm strikes the "E" pin. The type wheel will then be stopped so that the letter "E" is opposite the platen. The printing of the letter "E" will take place when the next selection is received and the operating cam revolves far enough to operate the printing mechanism.

Locking Cam

The locking cam has five low and five high portions on its periphery against which the locking lever is held by its spring (Fig. 7). During that part of each impulse when the swords are set by striking against the selector arm extension (at the time the peak of any selector cam is operating the corresponding selector lever) a low portion of the locking cam is opposite the locking lever. The selector arm will then be held firmly in position by the rear arm of the locking lever engaging the locking wedge on the selector arm. When the locking lever is riding on the high portion of the locking cam, the locking lever rear arm will be held away from the locking wedge and the selector arm will be free to move in response to the next impulse. Because the armature cam starts to move the armature toward the selector magnet before the locking lever releases the selector arm, the selector arm spring is provided as a yield between the armature and selector arm.

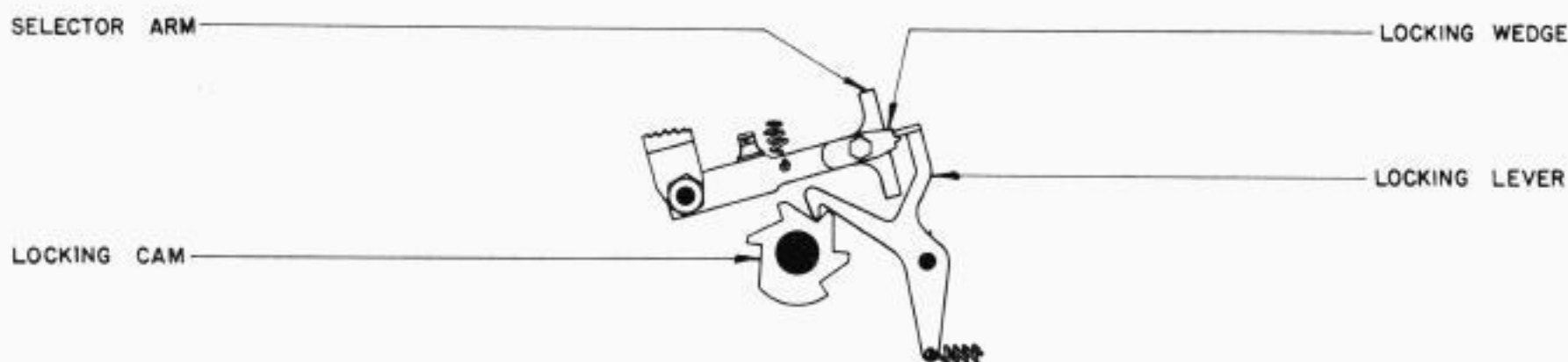


FIGURE 7

Main Shaft Clutch Throw-Out Lever

As previously stated, the sixth cam on the selector cam sleeve releases the main shaft clutch allowing the operating cam and the transfer and function bails cams to complete one revolution (Fig. 4). At the end of each revolution of the main shaft cam sleeve, the lower arm of the clutch throw-out lever engages with the projection on the driven clutch and cams it out of mesh with the driving clutch. Shortly after the fourth impulse has been received, the peak of the sixth cam strikes the upper arm of the clutch throw-out lever, moving the lower arm out of engagement with the projection on the driven clutch. This will permit the spring to move the driven clutch into mesh with the driving clutch. Thus, it may be seen that shortly before the completion of the selection of any character or function, the operating, transfer, and function cams will be permitted to revolve one revolution which will effect the printing of the character or the operation of the function selected during the preceding cycle. Shortly after the completion of the selection, the transferring of the new selection to the code discs takes place. The new selection will then be in readiness for printing during the next cycle (revolution) of the main shaft cam sleeve.

Type Wheel Shaft and Stop Unit

The type wheel shaft assembly consists of a driving gear, shaft, friction clutch, type wheel stop unit, type wheel stop arm, and type wheel. The type wheel stop unit consists of code discs, type wheel stop pins, and tension springs. The five code discs which are a part of the stop unit have a series of notches on their outer edges (Illus.1).

At right angles to the code discs and equally spaced around their circumference are thirty-two stop pins. These pins are located in slots in three guide discs, two below and one above the code discs. Tension springs pull the pins against the edges of the code discs and to minimize friction, small rollers are placed on the pins at the points of contact with the code discs. The code discs are rotated slightly in a counterclockwise direction for "marking" and in the opposite direction for "spacing." With the code discs set in any combination, their notches will be lined up to permit one stop pin to move towards the center into the path of the type wheel stop arm, thus determining the character to be printed. With the five code discs there are thirty-two possible combinations with which any one of the thirty-two stop pins may be selected and the type wheel stopped in any one of thirty-two positions. Twenty-six of the positions are used for printing characters and the remaining ones are used for operating the various functions, such as figures shift, carriage return, etc., as described under "Functions" on page 8.

The type wheel shaft is driven through the medium of a friction clutch. The type wheel is attached to the type wheel shaft so that it cannot rotate on the shaft but so that it may be moved up and down to print upper and lower case characters. The stop arm is clamped to the type wheel shaft in a position to bring the selected character opposite the platen. While the character is being printed, the stop arm is resting against the selected stop pin and the type wheel shaft is stationary. To allow ample time for the type wheel to rotate from one position to the next, the type wheel shaft is geared to run 50% faster than the main shaft.

Printing

The printing bail is pivoted on the type wheel shaft unit upper casting. The left side of the bail extends upward through the printing bail guide into the type wheel, directly behind the printing position of the type pallets. The right side of the printing bail extends downward into the path of the print hammer. The printing bail spring normally positions the bail so that its printing arm will clear the type pallets.

The print hammer is pivoted on the print hammer shaft which is located on the right side of the type wheel shaft unit lower casting. The print hammer spring, attached to the lower end of the print hammer, holds the print hammer against the eccentric on the print link. The forward end of the print link is connected to the operating bail and the roller on the operating bail engages in the operating cam (Illus. 1).

At the end of each revolution of the operating bail cam, the operating bail roller is held in the low portion of its cam and the print link is in its forward position. As the operating cam starts to revolve, the operating bail roller will be moved toward the right as it rides up on the high portion of the cam, and the print link will be pushed toward the rear, releasing the print hammer. The print hammer spring will then rotate the print hammer against the printing bail, moving the printing arm against the type pallet, printing the selected character. The operating bail roller will again be brought to the low portion of its cam, allowing the printing bail and print hammer springs to return the bail and hammer to their unoperated positions. The type pallet is returned to its unoperated position by a garter spring located within the type wheel.

Transfer

After printing any character and before printing the succeeding character (except in the case of a repeated character), it is necessary to allow the type wheel to be rotated to the new position. This is done by transferring the new selection from the swords to the code discs, and takes place after the completion of the new selection.

The transfer bail (Illus. 1) rotates on its vertical shaft, located to the right of the main shaft. The transfer cam follower arm, located on the lower end of the transfer bail, has a roller which is held against the transfer cam by a spring. When the transfer bail cam roller is on the low part of its cam, the transfer bail yield

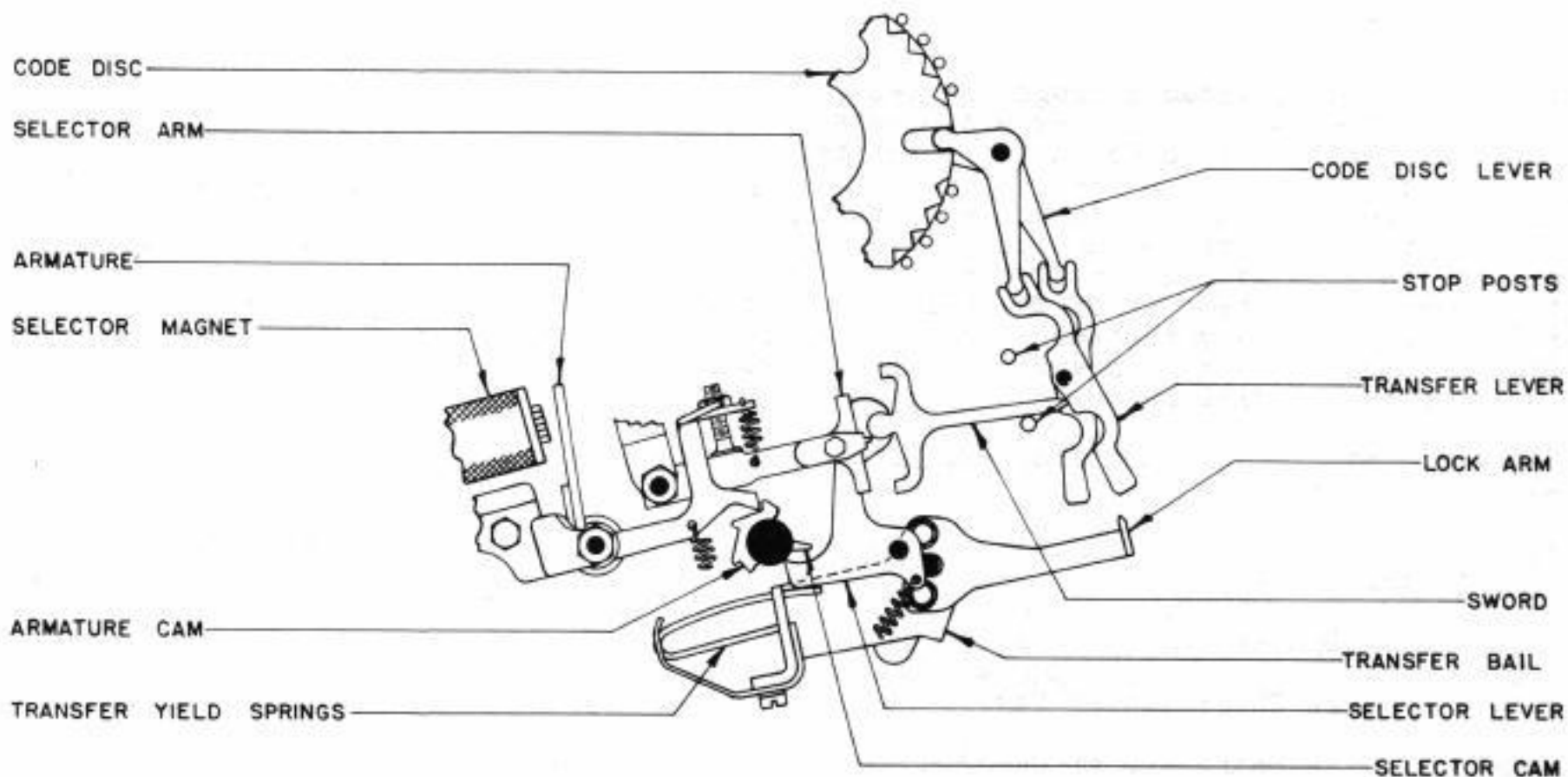


FIGURE 8

springs are held away from the selector levers, and the transfer levers lock arm, mounted on the transfer bail, is in engagement with the transfer levers (Fig. 8). Immediately after the printing of any character, while the operating bail roller is riding down off the peak of its cam, the transfer bail roller starts riding up the high part of its cam. The transfer bail is rotated clockwise, the transfer levers lock arm being moved out of engagement with the transfer levers and the transfer bail yield springs are moved against the selector levers. The selector levers will then be rotated clockwise, moving the swords against the transfer levers. The motion imparted to the transfer levers will be carried to the code discs by the code disc levers and the discs will be positioned in accordance with the new selection.

Spacing

On the Model 24 Printer, spacing between characters is provided by moving the platen. The platen (carriage) is supported by two "L" shaped rails, one of which is located below the platen at the front and the other above and to the rear. The carriage is moved by the spacing gear which is meshed with the spacing rack. The spacing rack is mounted beneath the platen, and the spacing gear which engages it is located on the upper end of the spacing shaft. On the lower end of the spacing shaft is the spacing ratchet which is rotated by the spacing pawl (Figure 9). The forward end of the spacing pawl is attached to the function bail which is pivoted on the function bail shaft, and the lower left extension of the function bail is equipped with a roller which rides on the function cam (Fig. 10).

At the end of the revolution of the function cam, the function bail roller is on the lowest portion of the cam. As the function cam revolves, the function bail starts to rotate, moving the spacing pawl toward the rear into engagement with a tooth on the spacing ratchet. The actual rotation of the spacing ratchet will not start until shortly after the printing of the character. The spacing ratchet and shaft will then be rotated sufficiently to permit the space retaining pawl to engage the next ratchet tooth, spacing the carriage one character space. Near the end of each revolution of the function cam, the function bail roller moves onto the low portion of the cam and the spacing pawl is returned to its forward position.

When the carriage is spaced to the right end of the line, the carriage stop plate located above the rack moves against the right margin adjusting screw, and the carriage cannot be moved any farther. Any additional characters received will print over each other - the movement of the spacing pawl, however, is taken up by its yield spring.

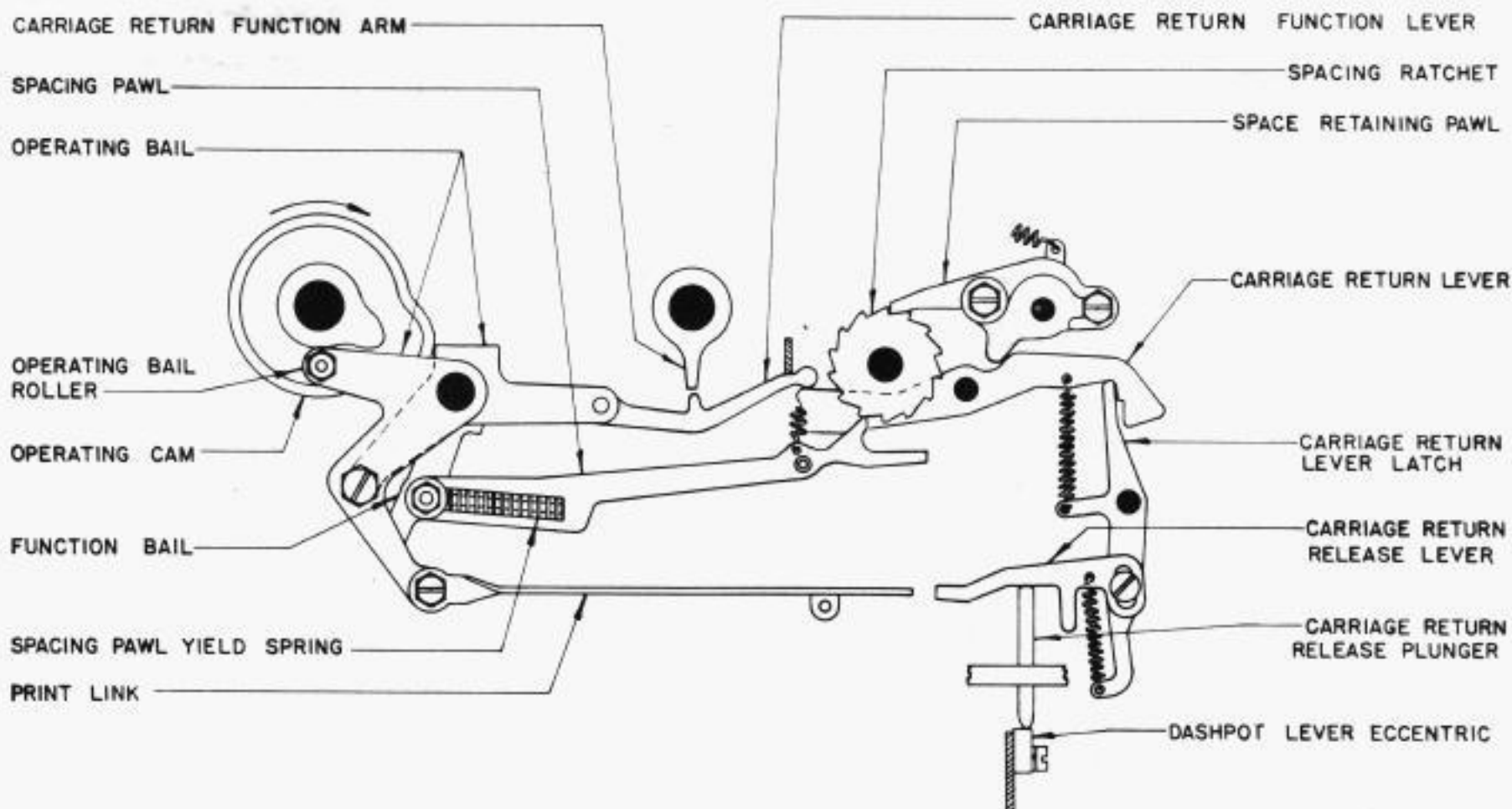
Functions

Functions are operated through the medium of function levers and function arms (Fig. 9 & 10). The function levers are pivoted on the rear of the operating bail, and the function arms are located on the lower end of the type wheel shaft. When the operating bail roller is on the low part of its cam, the function levers are held away from the function arms. When the operating bail is rotated by its cam, the function levers are moved toward the function arms. If the type wheel shaft is positioned by a function stop pin, a function arm will be lined up with the extension on a function lever, and the rear of the selected function lever will be moved farther to the right than the other function levers, and that particular function will be operated. The operating bail roller will then ride down to the low portion of its cam, and the function levers will be moved away from the function arms on the type wheel shaft.

Eight function levers and arms are provided and they are used as follows, starting at the bottom:

- #1 & 2 Contact and Bell Functions - Ring signal bell or operate contacts for locking the keyboard with a break signal and controlling the power to the motor.
- #3 Line Spacing (Line Feed).
- #4 Letters Shift (Lower Case).
- #5 Figures Shift (Upper Case).
- #6 Lower Case Space Cut-Out } To suppress spacing during
- #7 Upper Case Space Cut-Out } the operation of
- #8 Carriage return. } functions.

Because a soft (gradual) action is desirable for the operation of the first five functions, they are operated by the function bail through the medium of the five function pawls, function pawl latches, and the function intermediate levers instead of being operated directly by the function levers (Fig. 10). The function intermediate levers are in turn operated by the function levers previously described. The five function intermediate levers are pivoted to the rear of the function levers so that the one corresponding to the selected function lever will be caused to rotate counterclockwise, in turn moving a function pawl to the right, where it will be engaged by its latch. The function pawls are mounted on a shaft beneath the spacer pawl, on the function bail and are held against the function intermediate levers by springs. As the function bail cam roller rides up its cam, the function pawls will be moved to the rear, and the latched pawl will operate its function. The function bail will then return the function pawls to their forward position.



CARRIAGE RETURN FUNCTION

FIGURE 9

Carriage Return Function

When the carriage return function lever (first from the top) is moved against its function arm, the rear end of the lever rotates the carriage return lever into its latching position with the carriage return lever latch (Fig. 9). With the carriage return lever in the latched position, the space retaining pawl and the spacing pawl are cammed away from the spacing ratchet. The spacing ratchet and shaft will then be free and the carriage is returned to the beginning of the line by the carriage return spring, drum, and drawstrap. In the meantime, the function levers are moved away from the function arms.

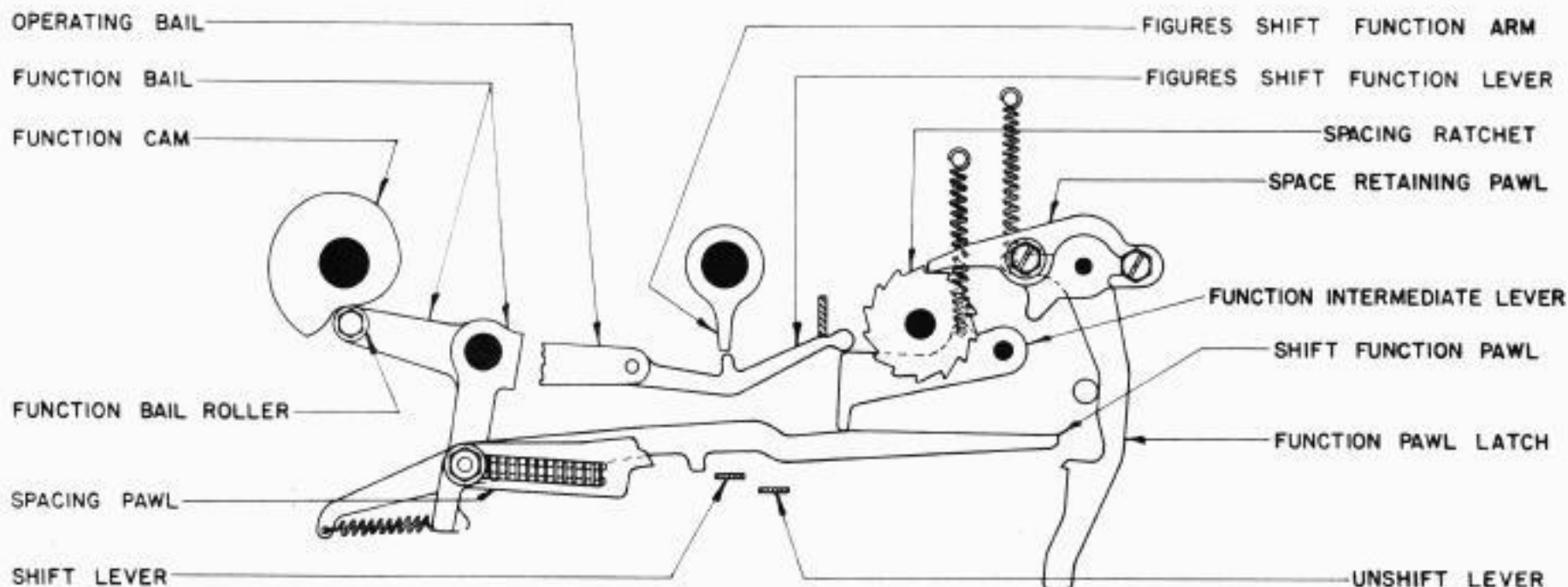
One end of the dashpot lever is engaged with the dashpot plunger and the other end projects into the path of the carriage. Just before the carriage has returned to the beginning of the line, a projection on the carriage stop plate strikes the upper end of the dashpot lever driving the plunger into the dashpot air chamber, thereby absorbing the shock.

To insure the complete return of the carriage, the carriage return lever latch has mounted on it the carriage return release lever. Near the end of the stroke of the dashpot plunger, an eccentric located on the dashpot lever moves the carriage return release plunger against the carriage return release lever. The forward end of the release lever will then be in the path of the print link. When the print link moves to the rear to print the first character of the printing line, the carriage return

release lever is also moved to the rear and the carriage return lever latch is disengaged from the latch on the carriage return lever. The carriage return release lever returns to its normal (unoperated) position, permitting the spacing and space retaining pawls to move into engagement with the spacing ratchet.

Figures and Letters Shift Functions

The upper extension of the shift bail engages the type wheel collar so as to control the vertical position of the type wheel on its shaft. The lower end of the shift bail has two arms, the forward one of which is engaged by the unshift lever and the rear one by the shift lever. These shift and unshift levers are pivoted on the print hammer shaft and their lower extensions are located in the paths of projections on the shift and unshift function pawls, respectively (Fig. 10).



FIGURES AND LETTERS SHIFT FUNCTIONS

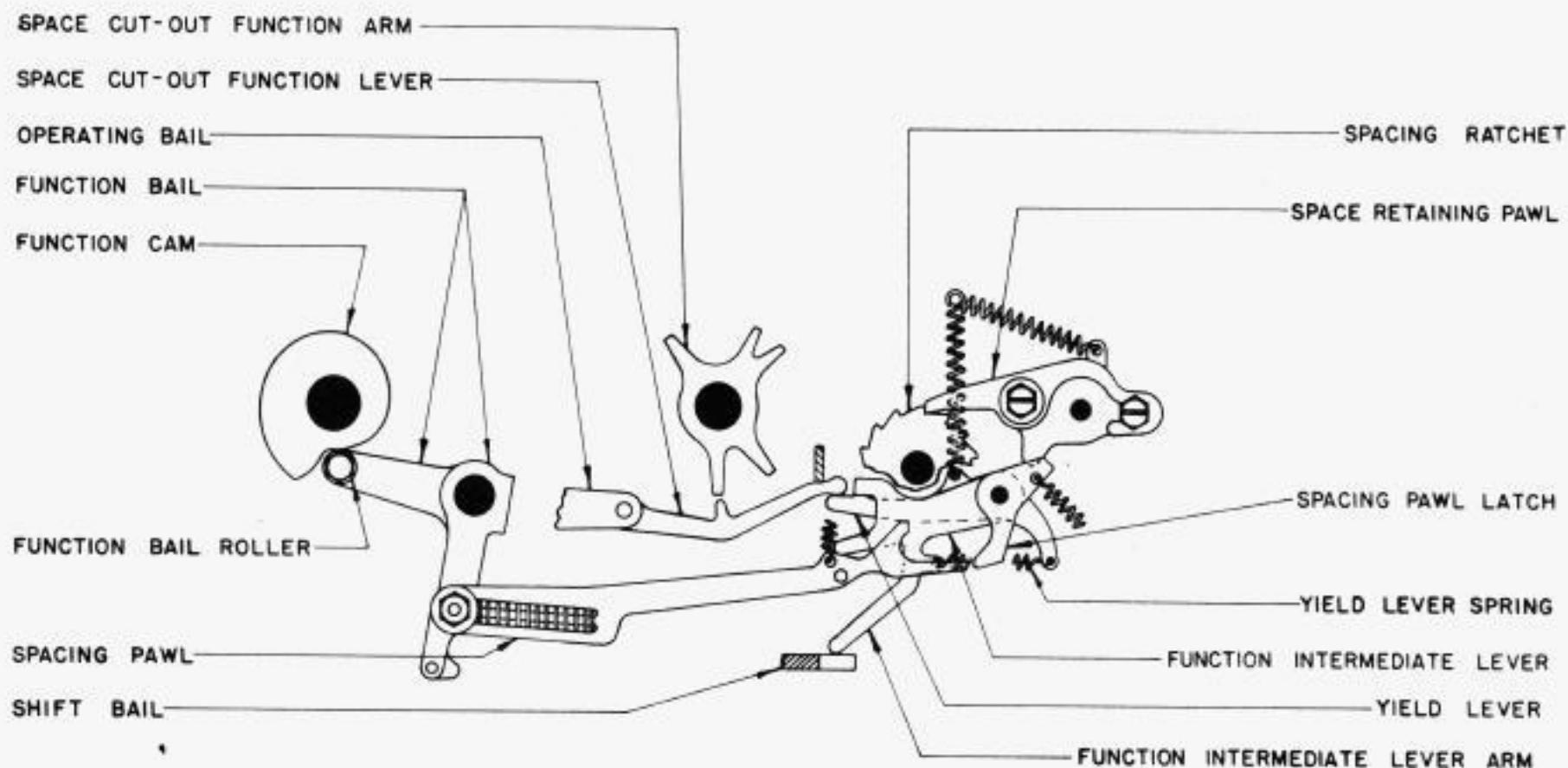
FIGURE 10

When the figures shift function lever (4th from the top) is moved against its function arm, the rear end of the lever rotates the shift function intermediate lever against the shift function pawl. This pawl will then be moved to the right at the same time the function bail cam moves the function pawls towards the rear and the shift function pawl will be engaged by its latch. The operating bail roller will now ride down to the low portion of its cam and the function levers will be moved away from the function arms. As the function pawls continue to be moved toward the rear, the projection on the shift function pawl will engage the lower end of the shift lever and rotate it, thus raising the shift bail and type wheel to the "figures" position. The function bail cam roller will then ride down to the low portion of its cam and the function pawls will be returned to their forward position.

In a similar manner, the letters shift function arm, lever (5th from the bottom), function pawl, and unshift lever will cause the shift bail and type wheel to be lowered to the "letters" position. The shift bail detent and spring are provided to hold the shift bail in either position.

Lower Case and Upper Case Space Cut-Out Functions

To suppress spacing during the operation of functions, the spacing pawl latch is provided (Fig. 11). The spacing pawl latch is pivoted on the same shaft with the functions intermediate levers. Two function arms (2nd and 3rd from the top) and two intermediate and function levers are provided so that spacing can be suppressed in either the upper or lower case or on an upper case selection without affecting the same selection in the lower case. An example is the operation of the signal bell on upper case "S"; when the letter "S" is to be printed, spacing is required, but when the same selection is received preceded by the "upper case" selection, spacing will be suppressed.



SPACE CUT-OUT FUNCTIONS

FIGURE 11

When the space cut-out function lever (second from the top) is moved against its function arm, the rear end of the function lever rotates the function intermediate lever through the medium of a yield lever and spring. The intermediate lever cams the spacing pawl away from the spacing ratchet and as the pawl moves towards the rear, the end of the pawl is positioned opposite the spacing pawl latch. The operating bail roller will then ride down the low portion of its cam, the function levers will be moved away from the function arms, and the intermediate lever away from the spacing pawl. The spacing pawl will then be held away from the spacing ratchet by the spacing pawl latch until the pawl returns to its forward position. When the intermediate lever was being rotated by the function lever, the arm on the right of the function intermediate lever passed through a rectangular opening in the shift bail.

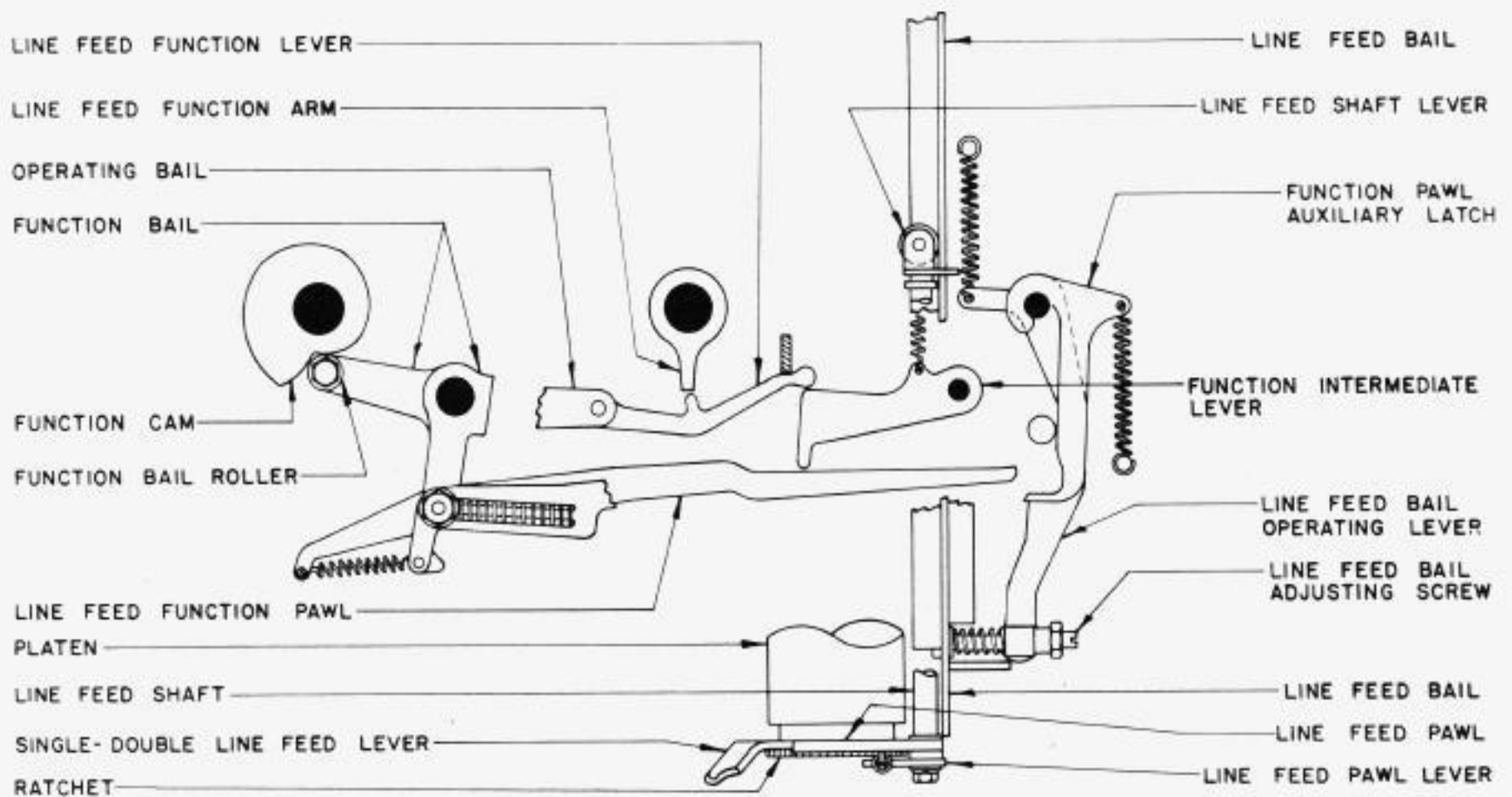
In a similar manner, the lower case space cut-out function arm, lever (third from the top), intermediate lever, and spacing pawl latch, will suppress space with the shift bail in the lower case position.

Line Feed Function

The line spacing (feeding) of the paper is accomplished by rotating the platen, the paper being held against the platen by four pressure rollers. The platen is rotated by the line feed pawl and ratchet, located at the right end of the platen. The line feed pawl is actuated by the line feed function pawl through the medium of the line feed bail operating lever, line feed bail, and line feed shaft with its associated line feed shaft lever and line feed pawl lever (Fig. 12).

When the line feed function lever (third from the bottom) moves against its function arm, the intermediate lever is rotated against the line feed function pawl and as the function pawls are moved toward the rear by the function cam, the line feed function pawl is engaged by its auxiliary latch. This latch is provided to prevent any premature movement of the line feed bail operating lever while the line feed pawl is moving into engagement with the latch. Shortly after the line feed function pawl is engaged by its latch, the function levers are moved away from the function arms by the operating cam and the function intermediate lever is returned to its unoperated position.

As the function pawls continue traveling towards the rear, the line feed function pawl rotates the line feed bail operating lever. The right end of the line feed bail operating lever has the line feed bail linked to it by means of the line feed bail



LINE FEED FUNCTION

FIGURE 12

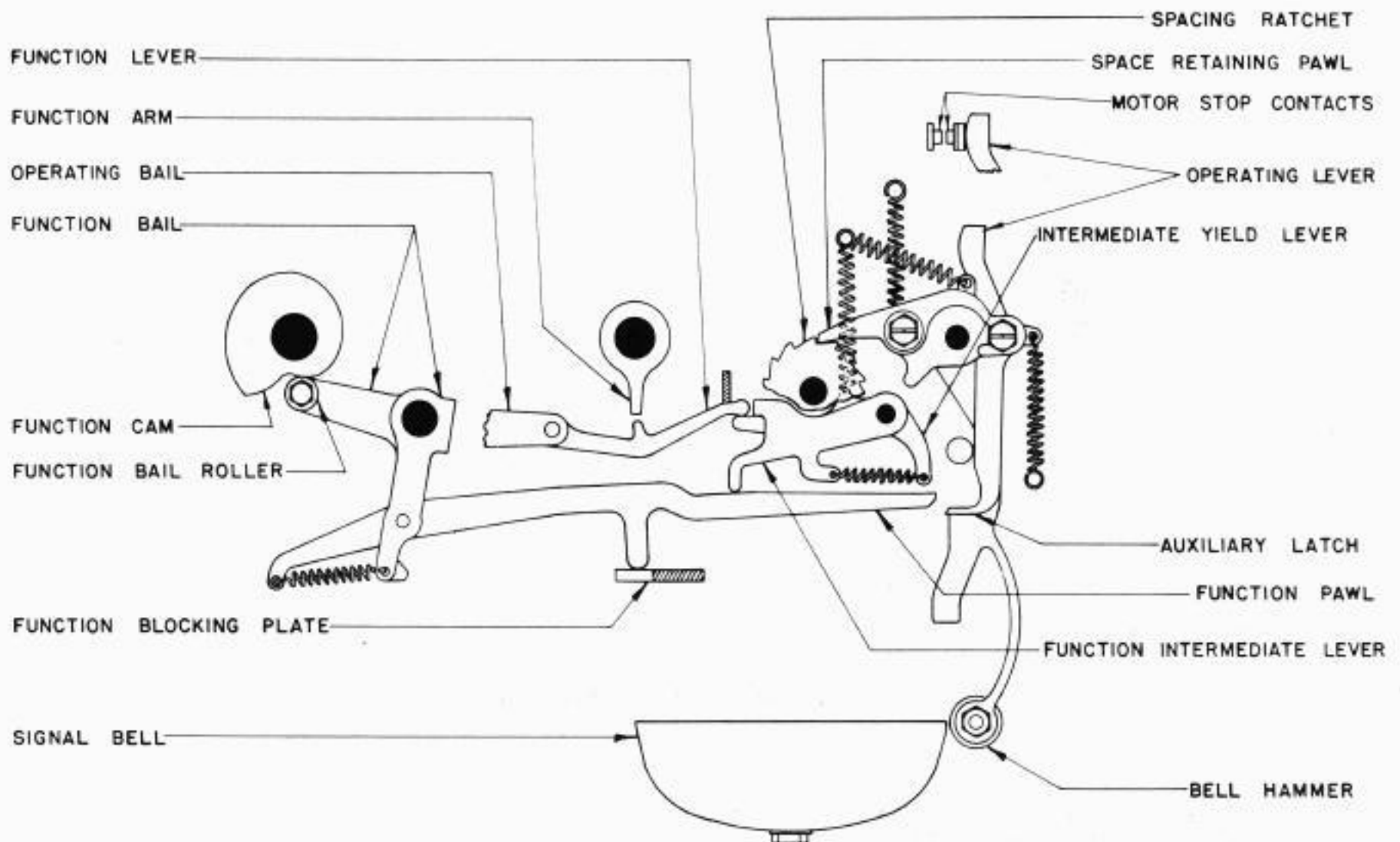
adjusting screw. Normally, the front end of the line feed pawl is resting against the single-double line feed lever above the line feed ratchet. The rear end of the pawl is pivoted on the line feed pawl lever which is attached to the right end of the line feed shaft. Attached to the left end of the line feed shaft is the line feed shaft lever and the roller on this lever is located in the path of the line feed bail. Thus it may be seen that when the line feed bail operating lever is rotated by the function pawl, the line feed bail will be moved against the roller on the line feed shaft lever. The line feed shaft will in turn be rotated and the line feed pawl will be moved toward the rear away from the single-double line feed lever. As the pawl moves, the line feed pawl spring will pull the pawl downward into engagement with a tooth on the line feed ratchet and the platen will be rotated. The function pawls will then be returned to their forward position, allowing the line feed bail operating lever and bail to return to their unoperated positions. The line feed pawl and shaft with its associated parts will be returned to their unoperated positions by the line feed detent lever spring. After each line feed operation, the detent lever roller locates itself between two teeth on the line feed ratchet, holding the platen firmly in position during each line of printing.

When the single-double line feed lever is in its upper position, the line feed pawl will be permitted to engage the ratchet at a position which will cause the platen to rotate a single line space. With the single-double line feed lever in its lower position, a double line space will be obtained.

Signal Bell Function

When the function lever (2nd from the bottom) moves against its function arm, the intermediate lever is rotated against the function pawl, and as the function pawls are moved toward the rear by the function cam, the function pawl that operates the signal bell is latched by its auxiliary latch (Fig. 13). This latch is provided to prevent any premature movement of the signal bell operating lever while the function pawl is moving into engagement with the latch. As the function pawls continue travelling toward the rear, the operating lever is rotated, moving the bell hammer away from the bell. When the function bail roller rides down the low portion of its cam, returning the function pawls to their forward position, the operating lever is pulled to its unoperated position by its spring, ringing the bell.

NOTE: The opposite end of the operating lever is used on some printers to operate the motor stop contacts.



SIGNAL BELL AND MOTOR STOP FUNCTION

FIGURE 13

Motor Stop Function

On those printers equipped with motor stop contacts, the operating lever operates the motor stop contacts (Fig. 13).

NOTE: On those printers which are arranged to operate both motor stop contacts and the signal bell, the No. 1 (first from the bottom) function position is used for the motor stop function.

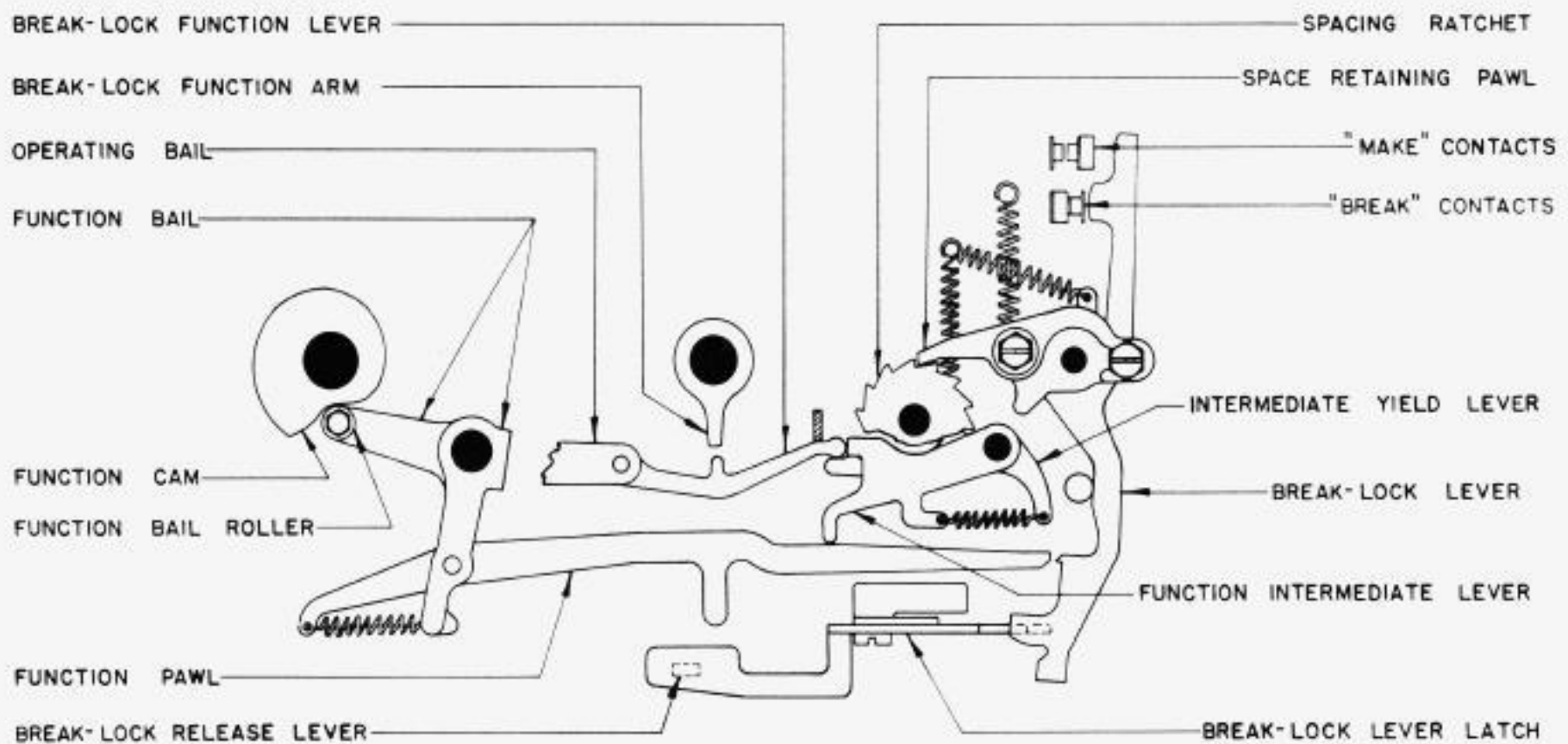
Function Blocking Plate

To prevent the operation of the signal bell or motor stop functions on the lower case selection, the function blocking plate is provided on the lower end of the shift bail (Figure 13). With the Shift bail in the lower case position, the "L" shaped extension on the lower end of the function blocking plate will be opposite the extension on the function pawls used to operate the signal bell and motor stop. When the function intermediate levers are moved against their pawls, by the function levers, the pawls will be blocked by the function blocking plate, thus being prevented from engaging with their auxiliary latches and operating levers. The motion of the function levers is taken up by the intermediate yield lever and spring.

Break-Lock Function

On those printers equipped with the break-lock function, the keyboard transmitting contacts will be short-circuited and the transmitter-distributor will be stopped on receipt of the blank signal or when the line is opened. This is accomplished by closing one pair of contacts which are connected in multiple with the keyboard transmitting contacts and simultaneously opening another pair of contacts which are connected in series with the stop magnet circuit of the transmitting distributor. Transmission cannot be resumed until the "letters" key is depressed which permits the contacts to be restored to their unoperated positions.

When the break-lock function lever (first from the bottom) moves against its function arm, the rear end of the lever rotates the function intermediate lever against the break-lock function pawl and as the function pawls move towards the rear, the break-lock function pawl engages in the latch on the break-lock lever (Fig. 14). As the



BREAK-LOCK FUNCTION

FIGURE 14

function pawls continue to move towards the rear, the break-lock lever will be rotated, closing the "make" and opening the "break" contacts. The other end of the break-lock lever will move into engagement with the break-lock lever latch and the contacts will be held in their operated positions. The forward end of the break-lock lever latch extends over the break-lock release lever which is attached to the "letters" key lever on the keyboard. When the "letters" key lever is depressed, the upper end of the release lever moves against the break-lock latch, allowing the break-lock lever and contacts to return to their unoperated positions.

Margin Bell

Before the platen carriage reaches the end of its travel, it operates the margin bell as a warning to the operator that the end of the line is near. The margin bell adjusting bracket, located on the left end of the spacing rack, will depress the margin bell hammer pawl, moving the bell hammer away from the bell. When the carriage has been spaced beyond the bell hammer pawl, the pawl and bell hammer will be released and the bell hammer spring will pull the hammer against the bell.

Ribbon Feeding

The lower end of the ribbon feed operating lever is held against the function bail by the ribbon feed pawl spring (Fig. 15). The upper end of the ribbon feed operating lever engages the right end of the ribbon feed lever through the medium of the ribbon feed operating link. Pivoted at the left end of the ribbon feed lever is the ribbon feed pawl which engages one of the ribbon feed ratchets. The upper portions of the shafts to which the ratchets are attached are arranged to mount the ribbon spools.

With each operation of the function bail, the lower end of the ribbon feed operating lever is moved toward the rear. The upper end of the operating lever will then rotate the ribbon feed lever, moving the ribbon feed pawl against a tooth on a ratchet, rotating the ratchet, shaft, and ribbon spool. The ribbon feed check pawl is provided to prevent turning of the ratchet while the feed pawl is moving into a new ratchet tooth.

Ribbon Reverse

The ribbon reverse lever has four arms, and is pivoted on the ribbon bracket, in front of the type wheel (Fig. 15). The arms in the rear which are used for guiding the ribbon are the reverse arms, and the two front arms are the operating and detenting arms. Assuming that the ribbon is being wound on the left-hand spool and

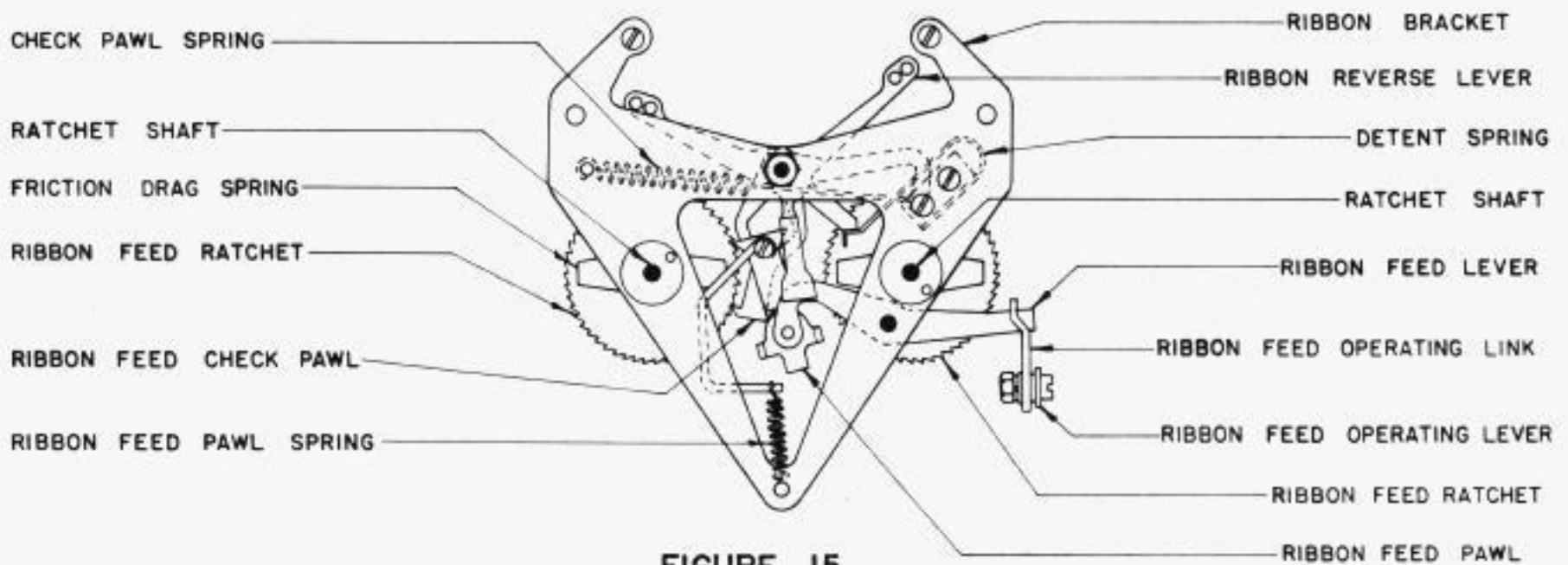


FIGURE 15

the right spool is almost empty, an eyelet which is attached to the ribbon will engage the right reverse arm. The ribbon reverse lever is then rotated counterclockwise as shown in Fig. 15 and will be held there by the detent spring. The operating arm on the reverse lever will now be in the path of the right-hand vertical lug on the ribbon feed pawl. With the succeeding operation of the ribbon feed lever, the right lug on the pawl will be moved against the reverse lever operating arm and the pawl will be rotated so that it will move out of engagement with the left feed ratchet and into engagement with the right feed ratchet. Because the screw at the rear end of the feed pawl extends downward into the ribbon feed check pawl, the check pawl will also be moved against the right feed ratchet. The ribbon will then be wound on the right spool. The reversing takes place in a similar manner on the left side when the eyelet in the other end of the ribbon engages with the left reverse arm.

The ribbon feed ratchet friction drag springs are provided to prevent unwinding of the ribbon from the "free" spool.

MOTOR SPEED CONTROL

In order to maintain the transmitting and receiving stations at the proper speed, the driving motor (excepting synchronous motors), is equipped with a governor attached to one end of the motor shaft (Fig. 16).

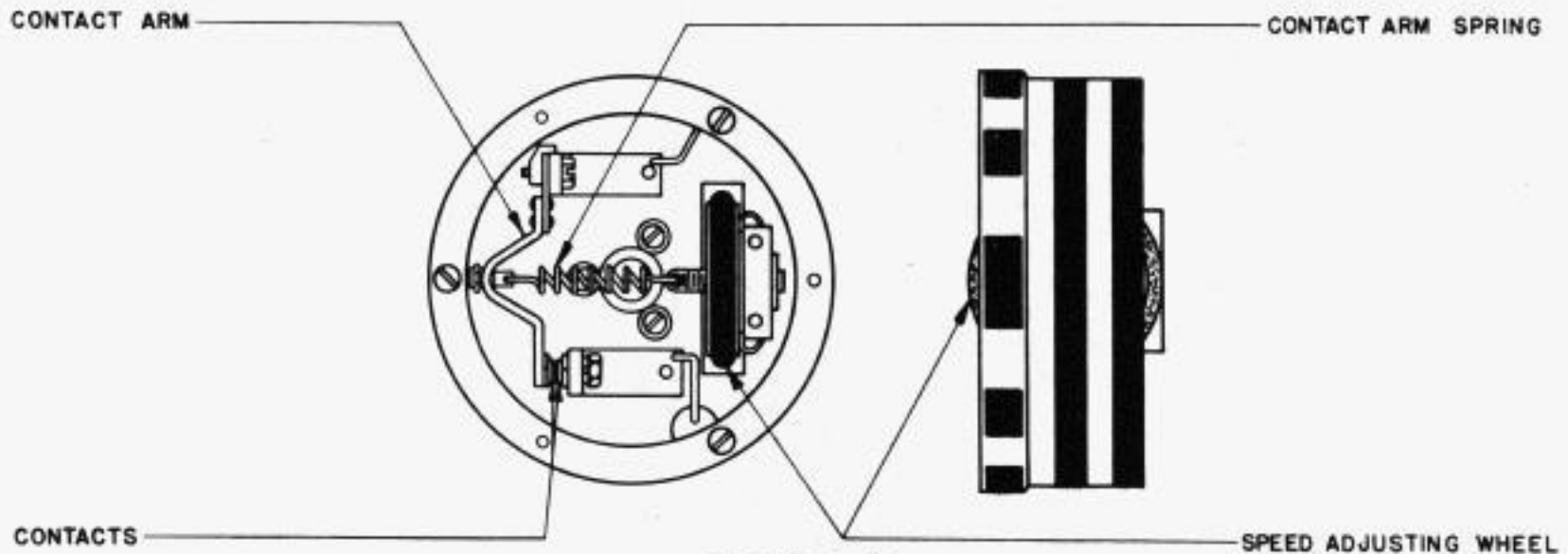


FIGURE 16

The governor contact arm has a contact mounted on one end and is fastened by a flat spring at the other end. The contact arm spring holds this contact against a companion contact until the centrifugal force of the contact arm overcomes the tension of the spring. When the contacts open, a resistance is connected into the motor circuit which tends to reduce the speed of the motor. The closing and opening of the contacts holds the motor speed constant to the value of the tension at which the spring is set. The spring tension is adjusted by turning the speed adjusting wheel which extends through the cover of the governor.

The governor is equipped with a speed target, consisting of alternate black and white spots, and a tuning fork with shutters attached to the ends of the tines is provided to visually check the motor speed. With a properly adjusted governor, the spots on the target appear to be stationary when observed through the shutters of the tuning fork set in vibration.

SYNCHRONISM

In order that the character and function signals sent out by the transmitter may be interpreted by the printing unit, it is necessary to keep the transmitting and receiving machines running in synchronism. This is accomplished by the use of a start and stop signal.

The transmission of the start impulse, which is a spacing impulse, starts the selector cam sleeve on the printer revolving. The speed of rotation is such that when the transmitting cam shaft has revolved far enough to send out the first impulse, the selector cam sleeve has revolved to the proper position to receive it. When the transmitter has revolved to the position to send out the second impulse, the selector cam sleeve also will have rotated to the corresponding position and so on. At the end of the revolution after the fifth impulse has been received, the reception of the stop impulse stops the selector cam sleeve.

The selector cam sleeve is geared to rotate one-seventh faster than the transmitter cam shaft, but it is so constructed that the distance from the position where it can receive one impulse and where it can receive the next impulse is one-seventh greater than the distance between the position where the keyboard cam shaft can control the sending out of one impulse and the next impulse.

The reason that the selector cam sleeve is made to rotate one-seventh faster than the transmitting cam shaft is this: It is not possible to maintain several units at exactly the same speed. In a short time even a slight speed difference would cause the transmitting mechanism and receiving mechanism to get out of unison so that when the transmitting keyboard was sending out the first impulse of a character signal, the selector cam sleeve might be in a position to receive the second. This is avoided by arranging the selector cam sleeve to rotate faster than the transmitting keyboard which allows it to complete its revolution sooner than the transmitting distributor completes the corresponding one. In other words, if the transmitting keyboard cam shaft has to travel $48\frac{1}{2}^{\circ}$ to get from the position where it sends out the first impulse to the position where it sends out the second, the selector cam sleeve must travel $55\frac{1}{2}^{\circ}$ to get from the position where it can receive the first impulse to the position where it can receive the second, but as the selector cam sleeve travels one-seventh faster, it will reach this second position at the same time the transmitting keyboard reaches its second position.

When the selector cam sleeve has completed a revolution, it comes to a stop until the transmitting keyboard again sends out a start impulse. Now, if the speed of the selector cam sleeve is slightly faster than its proper speed, the only effect will be that it will remain at rest slightly longer. If its speed is slightly slower than the proper speed, it will remain at rest just that much less time. Of course, there will be a slight error in the position of the selector cam sleeve in the various positions but the mechanism is so constructed to provide for this and due to the fact that the selector cam sleeve starts each revolution in unison with the transmitting cam shaft, this error does not become any greater.

ORIENTATION

In order to properly operate the selector mechanism, it is necessary to place the starting point of the selector cam sleeve in the most favorable position. This is accomplished by means of the range finding mechanism which is used to orient or take a range.

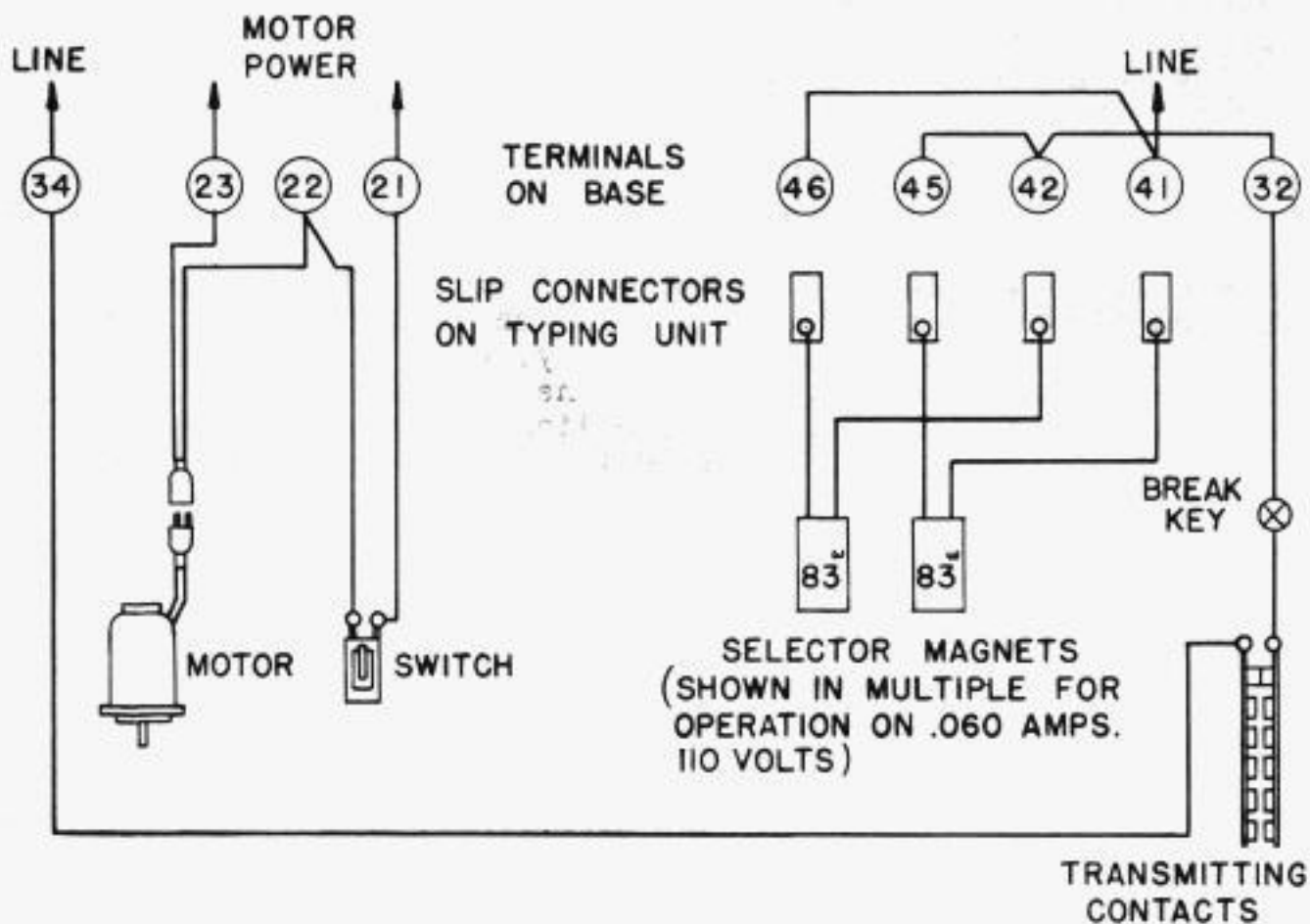
Mounted on the stop lever plate (which is a part of the range finding mechanism) are the stop lever and the trip latch which may be rotated, thereby varying the relation between the start of the selector cam sleeve and the time the selector cams operate the selector levers (Fig. 5). A graduated scale indicates the setting of the stop mechanism, and the clamping plate screw holds it in place after having been set.

The range is determined while receiving "RY" on the printer, by first moving the range finder in one direction until errors begin to appear and then back slowly until the errors disappear and noting the position on the scale. In a similar manner the other limit of the range is located by moving the range finder toward the opposite end of the scale. The proper setting is the point midway between these two limits.

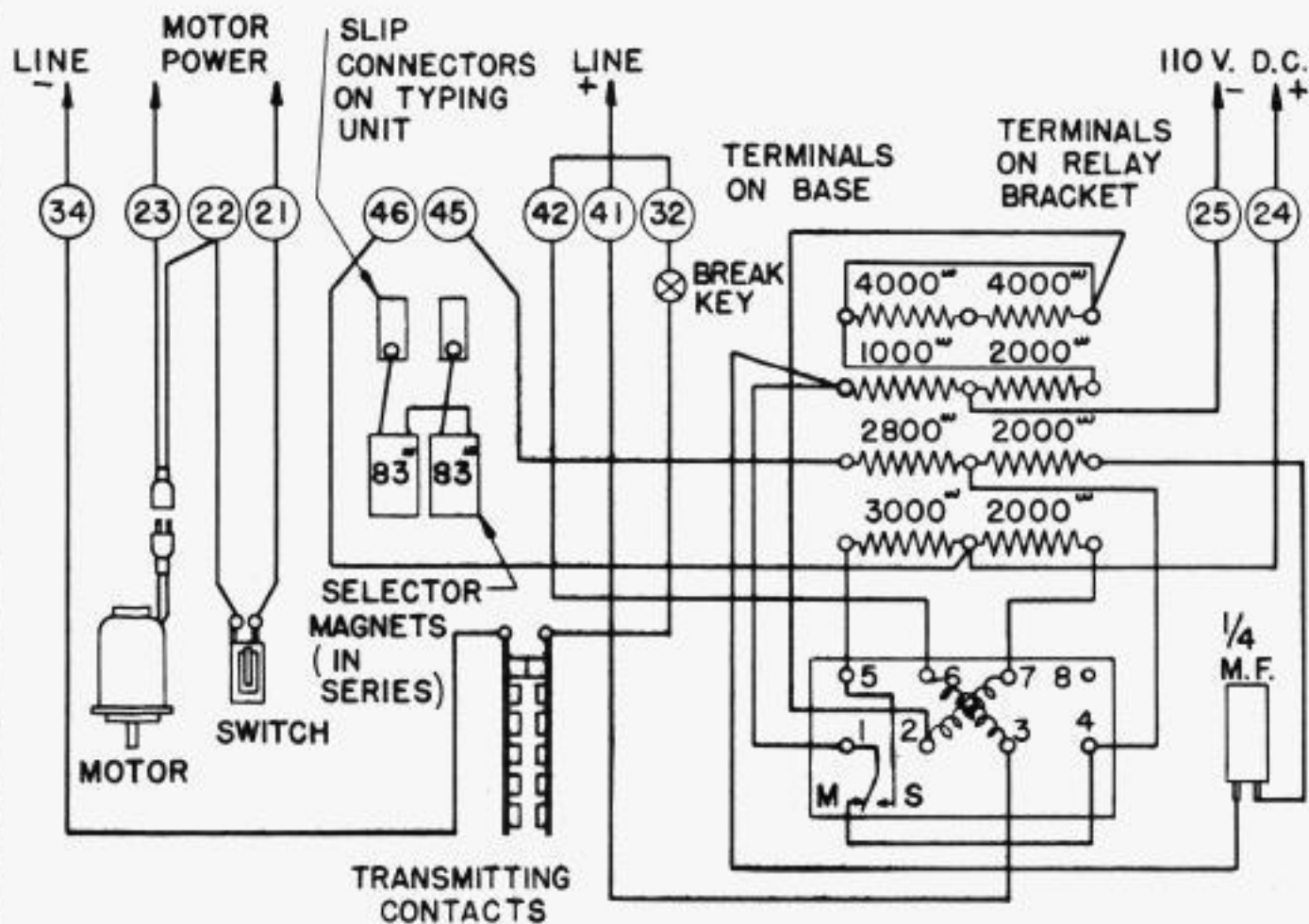
WIRING DIAGRAM

Wiring diagram 1677 on the following page shows the schematic circuits of typical model 24 printers. The top figure on the wiring diagram shows the schematic circuits of a sending-receiving station without a line relay, with the selector magnet for a .060 ampere operation. The bottom figure shows the schematic circuits of a sending-receiving station equipped with a .060 ampere line relay. When a .020 ampere relay is used, the strap across the 4000-4000 (8000) ohm resistor is removed.

REVISIONS



24 TYPE PRINTER
(WITHOUT LINE RELAY)



24 TYPE PRINTER
(WITH LINE RELAY)

TELETYPE CORPORATION
WD-1677 4-20-37

24 TYPE PRINTER SCHEMATIC CIRCUITS

DRAWN J.R.N.
TRACED H.J.K.
CHECKED E.P.K.
ENG'RD.
APPROVED E.S.L.