PART II

FLEXOWRITER MODEL FL

DESCRIPTION

The Model FL Flexowriter was primarily designed to type repetitive information automatically as a by-product of routine typing. Some examples of Model FL Flexowriter applications are: letter writing, invoicing, payroll systems, etc. In these applications, the Flexowriter is equipped to automatically record information in a paper tape as it is being typed. This perforated tape may then be used to automatically reproduce the typed information as many times as desired.

There are three available combinations of the Model FL, namely: Recorder, Reproducer and Recorder - Reproducer. The latter has the combined capabilities of the Recorder and the Reproducer in that it will type copy, punch tape, read tape and make a tape from a tape. The Model FL Recorder - Reproducer, then, consists of a writing machine (typing unit), a tape recorder (punch), code selector, a tape reproducer (reader) and a code translator.

BASIC FUNCTIONAL PRINCIPLES (Figure 1-2)

When a key lever is depressed on the Model FL Recorder - Reproducer keyboard, a series of mechanical and electrical operations take place which result in a character or function operation, and a binary code for that character or function is perforated in a paper tape. To accomplish this operation, three mechanisms are necessary;

Figure 1-1 Flexowriter-Model FL

Description

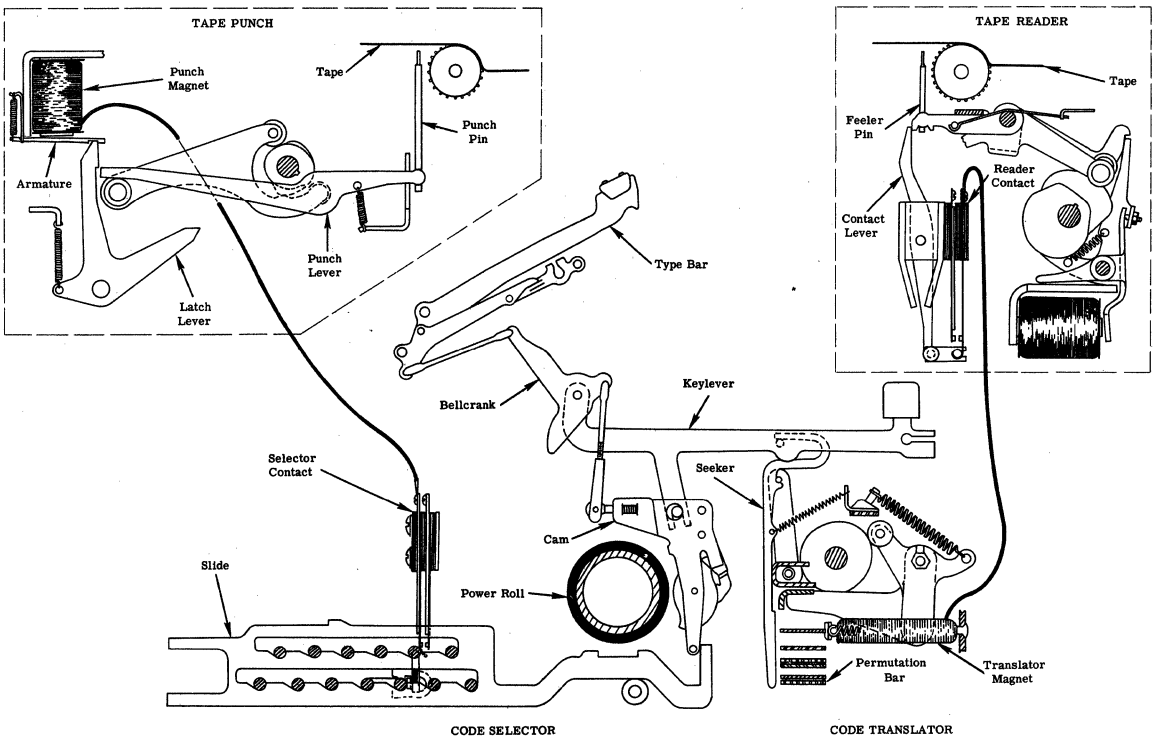


Figure 1-2 Functional Principles

namely, the writing machine, the code selector and the tape punch. The writing machine is necessary for the normal typing operation, wherein, the key lever operation trips a cam, in turn operating a bell crank and type bar or functional operation.

The cam, having an extended arm, operates a selector slide which is a part of the code selector. The code selector changes the mechanical motion of the cam to an electrical impulse representing a predetermined binary code for the particular character or function operated. The code is represented by one or more contacts (total of six contacts, plus a common contact) and are connected directly to corresponding magnets in the tape punch. These magnets are energized, thus conditioning the tape punch to perforate the previously mentioned character or function codes in a paper tape.

Before a record tape can be made, however, the tape punch must be ready for operation as follows:

1. The tape must be properly placed in the tape punch as shown in Figure 1-3.
2. The power switch and the punch on switch must be in the On position.
3. The tape feed switch must be depressed to give approximately three inches of tape with feed holes only.

The keyboard will lock up preventing operation if any of the three following tape conditions arise:

1. If the hold down arm is not down against the tape.
2. If there is a bind in the tape, thus, moving the tape tension arm forward.
3. If the tape tears or runs out, the run-out arm will drop down.

There are two other switches not previously mentioned which pertain to punch or recording

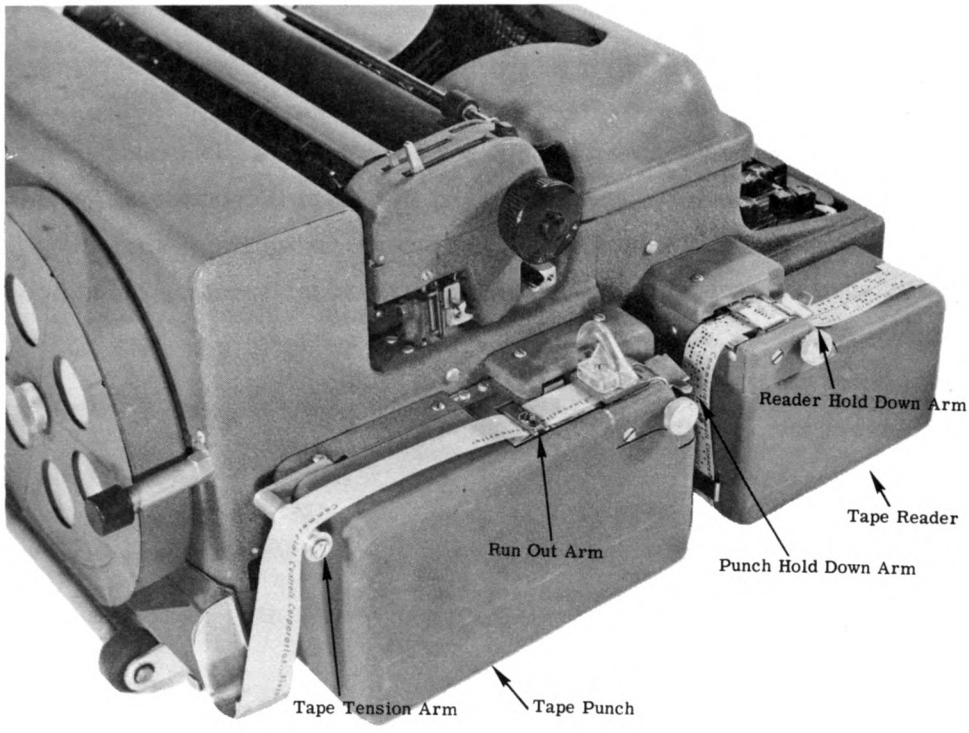


Figure 1-3 Punch and Reader Tape Installation

operation. These switches are the code delete and the stop code. The code delete switch may be used whenever an error is made in recording, i.e., misspelling a word, thus perforating the wrong code in the tape. This code, which is 1-2-3-4-5-6, when reproducing the tape, will not result in any character or functional operation. The stop code switch may be used at any point in the tape and a 4-5-6 code will be perforated. When reproducing, this stop code will automatically stop the Flexowriter operation for such purposes as manual fill-ins or for a stop signal at the end of letters.

After the copy has been typed and recorded in the tape, the tape may be placed in the reader and the typed information automatically reproduced as many times as desired. To accomplish this, the tape reader is electrically connected to the code translator, and the translator, in turn, is mechanically connected to the writing machine keyboard. The codes in the tape are sensed or read by the reader pins (there are six reading pins which correspond to the six unit binary code) which operate related contacts. These contacts, when closed, energize corresponding magnets in the code translator, thus conditioning the translator to select and operate the seeker corresponding to the character or function code. The seeker operation, in turn, operates its related keylever, causing a typing or functional operation of the writing machine.

To start automatic reproducing operation it is necessary to have the record tape properly inserted as shown in Figure 1-3. With the tape

properly inserted, the start read switch must be depressed and then released, after which, the tape reader will automatically read and feed the tape continuously. The reader operation may be stopped by depressing the stop read switch, or if a 4-5-6 stop code is read, the reader will stop operation automatically. After a stop code is read, it will be necessary to manually depress the start read switch to resume operation.

KEYBOARD

The Model FL is available in both Standard and President (Proportional Spacing) models. The keyboard on each is similar to, and operates with the ease, speed and simplicity of any electric typing machine.

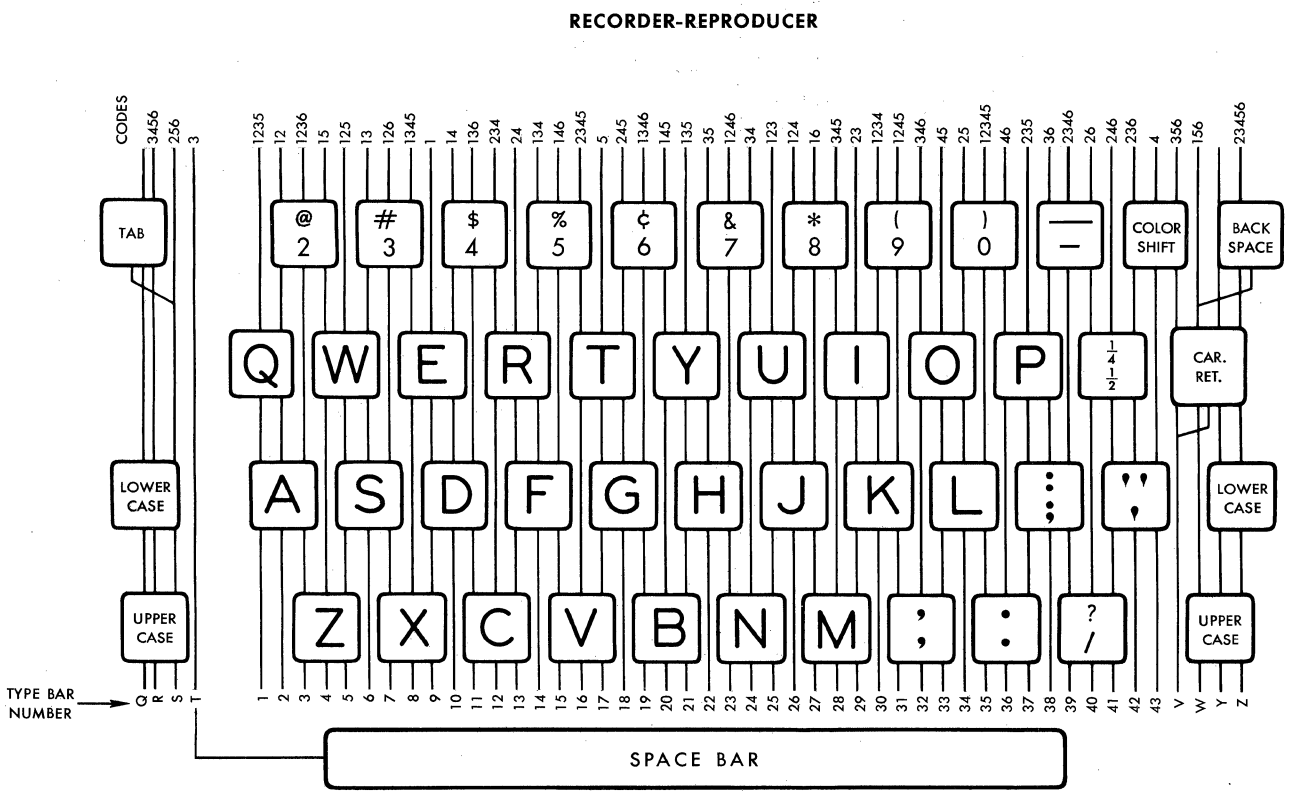


Figure 1-4 Standard Keyboard

The Standard Model FL keyboard is shown in Figure 1-4. It uses a total of 51 key lever positions, 42 of which are used for character operation. The remaining nine positions are used for functional operation including; carriage return, back space, tabulation, space, upper case shift, lower case shift and color shift.

Variations in the characters on certain keys may be made if necessary. This would include the signs and symbols shown on the numeral keys in the upper case position. Also, the characters in positions 32, 36, 38, 40, 41, and 42 may be changed in both upper and lower case positions.

The President Model FL keyboard is shown in Figure 1-5 and is identical to the Standard keyboard with the exception of the following: a three unit space key is provided in position U and a one unit space key is in place of the color shift. Also, characters in positions 41 and 42 are different.

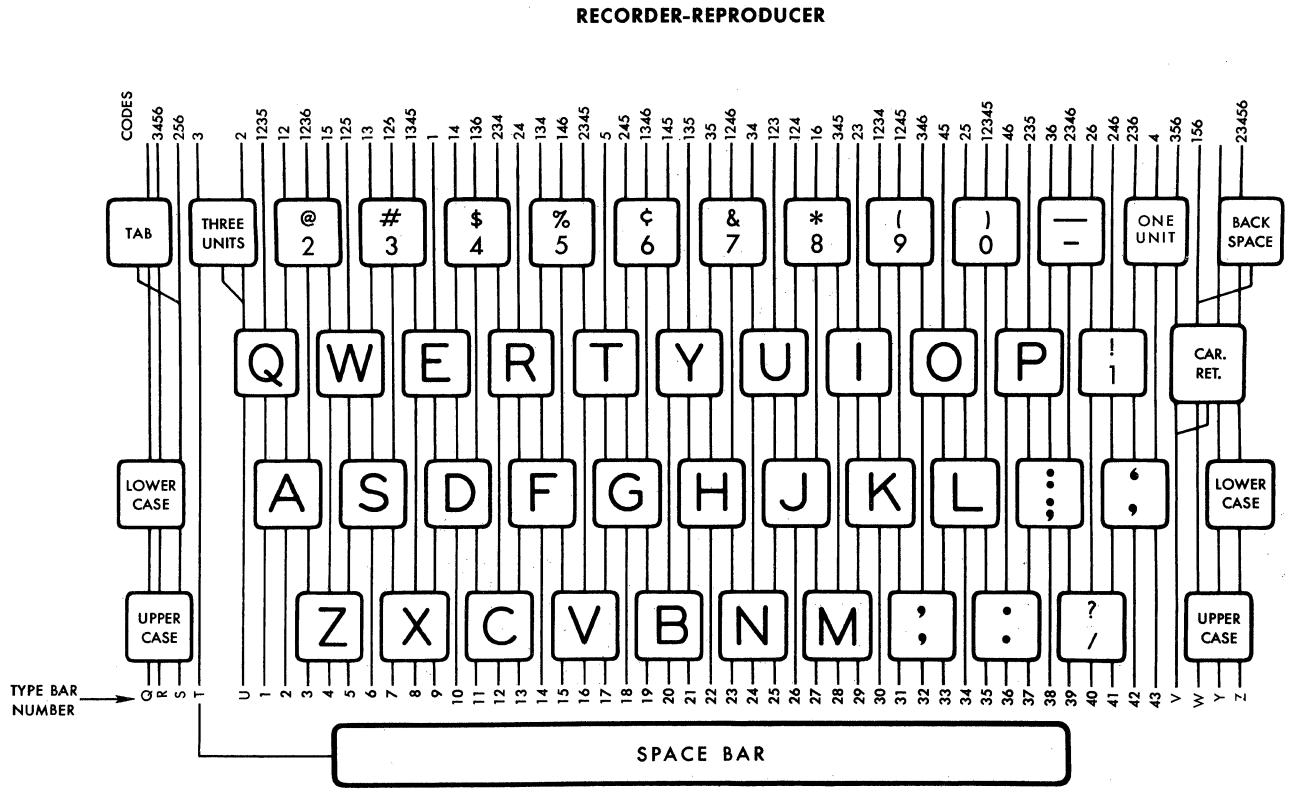


Figure 1-5 President Keyboard

Description

The codes shown on both keyboard charts are assigned to specific keyboard positions and do not change when a character change takes place.

CODE SYSTEM

The Model FL uses a six unit binary code which provides 64 possible combinations. As shown in the Standard keyboard chart, 42 of these code combinations are used for characters. Seven more combinations are used for functional operations which were described as; carriage return, back space, space, tabulation, lower case shift, upper case shift and color shift. The code combination 1-2-3-4-5-6 is used for a code delete operation and the 4-5-6 code is used for a stop code. A seven-eighth inch wide paper tape is used and the code holes are numbered 6-1-2-3-4-5 facing the leading edge of the tape (see Figure 1-6). The feed hole is between the 2 and 3 holes and is .394 inch from the right edge and its center line is even with the center line of the code holes.

Sample tapes from the Standard and President models are shown in Figure 1-6. These tapes

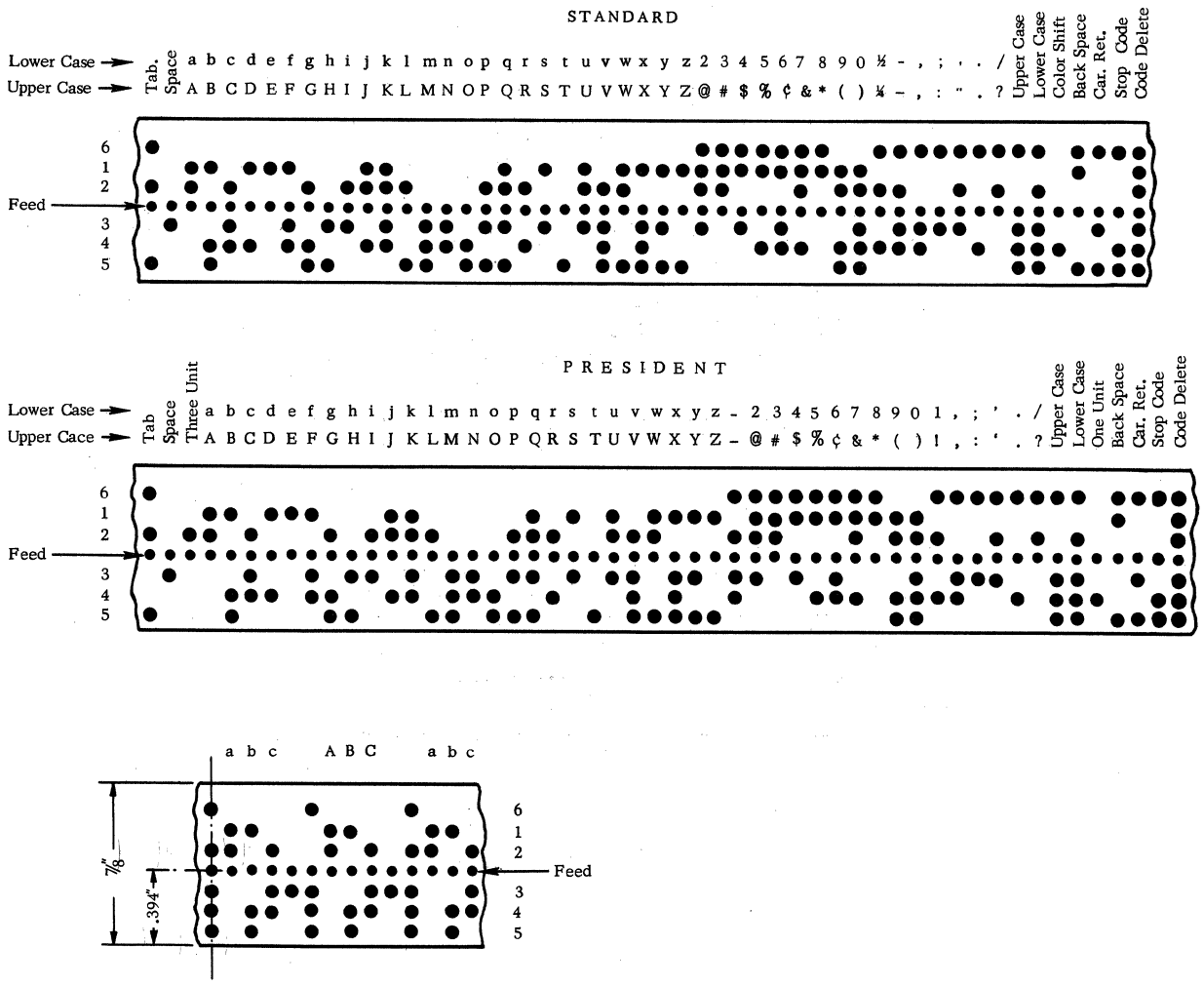


Figure 1-6 Sample Coded Tapes

are the same except the Standard model does not have the number two code (for three unit space). Also, the 2-3-4-6 code will not type the same character in both tapes.

The upper and lower case shift codes provide a means of shifting the type basket, giving a total of 84 characters available. Therefore, the same code may be used for characters in both upper and lower case position. For example, if an upper case shift code (3-4-5-6) precedes the 1-2 code in the tape (as shown in Figure 1-6), the upper case A will be represented in the tape. All the following codes will represent upper case characters until a lower case code 2-3-4-5-6 appears, after which, the codes will represent lower case characters.

CONTROL PANEL

The Model FL Recorder - Reproducer control panel is shown in Figure 1-7 and consists of the following switches:

Punch On - The punch on switch controls the tape punch for automatically perforating a paper tape. When this switch is depressed, each character or function operated on the keyboard is automatically perforated in the tape in the form of a predetermined binary code.

Tape Feed - When installing a new roll of tape for punch operation, it is necessary to "feed out" the tape approximately three inches. The tape feed switch, when depressed, automatically feeds out the tape with a feed hole only.

Code Delete - When this switch is depressed a 1-2-3-4-5-6 code is perforated in the tape to delete a code perforated in error. When the delete code is read in the tape reader, no character or function operation will take place.

Stop Code - When this switch is depressed, a stop code 4-5-6 is perforated in the tape, which, when read by the reader, will automatically stop the reader operation.

Start Read - This switch, when depressed, and released, automatically starts the tape reader operation. By stepping (depressing and releasing rapidly) this switch, the tape may be moved one code position at a time.

Stop Read - When this switch is depressed, the reader will stop operation and in order to resume automatic operation, the start read switch must be depressed.

SPECIFICATIONS

Power Supply - The Model FL may be specified with one of the following power supplies:

Figure 1-7 Control Panel

Description

Volts	Cycles	Phase	Amperes
115	DC	-	2.3
115	60	1	2.3
115	50	1	2.3
115	25	1	2.3
230	60	1	1.5
230	50	1	1.5

Weight and Dimensions - The width of the Model FL is 17½", the depth is 20", and the height is 10". The shipping weight of all 12" carriage Flexowriters is approximately 115 pounds while the unpacked weights of the three Model FL combinations are as follows:

Recorder - Reproducer - 85 lbs.

Recorder - 74 lbs. Reproducer - 78 lbs.

Type Style - The Standard Model FL may be specified with one of the following type styles:

Pica - 10 characters to the inch

Elite - 12 characters to the inch

Facsimile Gothic No. 2 - 6 2/3 characters to the inch (5/32" escapement) Micro Gothic Condensed - 16 characters to the inch (.062" escapement)

The President Model FL may be specified with one of the following type styles, each based on the 1/32" unit spacing: Secretarial, Bold Face, Modern, Galvin, Rogers and Documentary.

Keyboard - The Model FL may be specified with either of two standard four bank keyboards, the Standard Model shown in Figure 1-4 and the President Model shown in Figure 1-5.

Carriage - The Model FL may be equipped with any one of the following carriages:

12 inch carriage - will accept an 11 inch wide sheet with a maximum writing line of 9½ inches.

16 inch carriage - will accept a 15 inch wide sheet with a maximum writing line of 13½ inches.

20 inch carriage - will accept a 19 inch wide sheet with a maximum writing line of 17½ inches.

Platens and Ratchets - The Model FL is normally equipped with a No. 2 platen with a 33 tooth ratchet. Other platens and ratchets are available according to customer applications as explained in Part II, Section 2, page 2-57.

Tabulation - A tabular mechanism is provided with a minimum between tab settings of two letter spaces on the Elite, Pica and Facsimile Gothic machines. The President Models and Micro Gothic Condensed have a minimum between tab settings of an eighth inch (4 units).

Back Space - The back space mechanism is provided which will move the carriage back one letter space on the Pica, Elite and Micro Gothic Condensed machines, while on the President models and Facsimile Gothic No. 2 the carriage is moved one unit (1/32").

Case Shift - The type basket shifts to select printing between upper and lower case characters with duplicate shift keys on each side of the keyboard. The operation of each shift key is required for shifting in each direction.

Carriage Return - The carriage return function is power operated with line spacing incidental to carriage return operation. The left hand margin can be adjusted in increments of one letter space on the Pica, Elite and Facsimile Gothic No. 2 machines, while the President models and Micro Gothic Condensed can be adjusted in increments of one-eighth inch (4 units).

Operating Speed - The operating speed of the tape punch is approximately 890 cycles per minute and will respond to any two isolated key operations occurring at the rate of 1200 per minute. The tape reader speed is approximately 570 cycles per minute, thus resulting in an automatic typing operation at the rate of approximately 570 characters per minute.

WRITING MACHINE

MOTOR (Figure 2-1)

Description and Operation - The motor (17) supplies all the mechanical power for the complete machine.

It is a 35 M.H.P. (mili-horsepower), constant speed motor, which is mounted to a cradle (17A).

Extension on the cradle, a bracket on the rear base plate (17D), together with a pin (17C), form a hinge by which the motor is fastened to the machine.

A clearance hole in the rear base plate permits adjusting screw (17B) to thread into the upper part of the cradle. This secures the motor assembly to the machine and at the same time provides a means by which the tension of the drive belt (18) may be controlled.

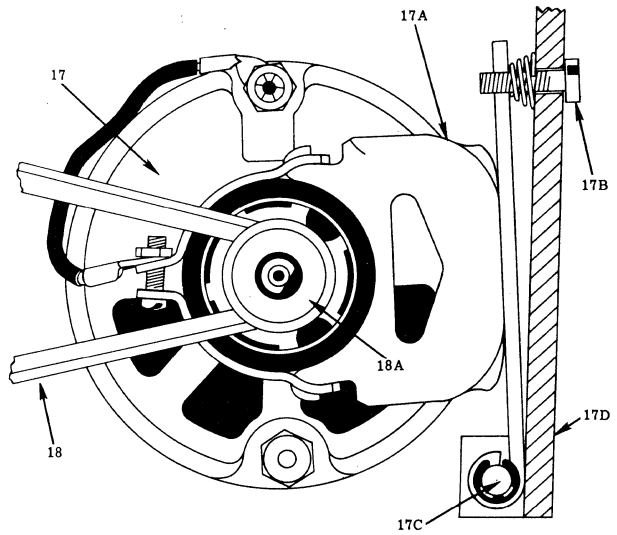


Figure 2-1 Motor Mounting

The motor is controlled by a power switch, located on the right side of the keyboard. The starting is controlled by a relay mounted on the rear base, just to the right of the motor mounting. (See Section 8, A.C. Motor Circuit.)

Note: A D.C. motor is available for those customers having a D.C. power supply. This motor operates at the same speed and uses the same mounting as the standard A.C. motor.

A 300 ohm field control rheostat is mounted on the right hand side plate (rear relay compartment). For practical purposes, this is called an "Impression Control" because the speed of the motor can be manually adjusted to give proper impression. (See Section 8 - D.C. Motor Circuit.)

Removal

1. Remove adjusting screw and tension spring.
2. Tip machine up. Remove the selector unit.
3. Remove the belt from the motor pulley.
4. Swing the motor on its hinge and disconnect motor lead. (See Power Circuit).
5. Remove Tru-Arcs on end and slide pin out.
6. The motor can be removed from the cradle by loosening the screws and removing clamp.

Assembly and Adjustment - Assemble the motor in the reverse procedure of disassembly.

Adjust the motor belt (18) (by turning the adjusting screw) until the belt does not slip on the pulley. To check for belt slippage, operate the carriage return keylever. The belt should have a minimum tension, but should allow positive carriage return operation.

The motor pulley (18A) is a split pulley and may be adjusted to change the overall speed of the machine. It should be remembered, however, that the pulley is set at the factory for the best operating speed of all the units (reader, punch, translator and power roll) on each machine. Therefore, do not attempt to increase or decrease the speed for the purpose of increasing or decreasing the overall type impression without first considering the effect the speed change will have on the reader, punch and translator operation.

POWER DRIVE (Figure 2-2)

Purpose - The power drive mechanism is used to furnish the driving force necessary to operate the power roll, reader, translator and punch at their proper operating speed.

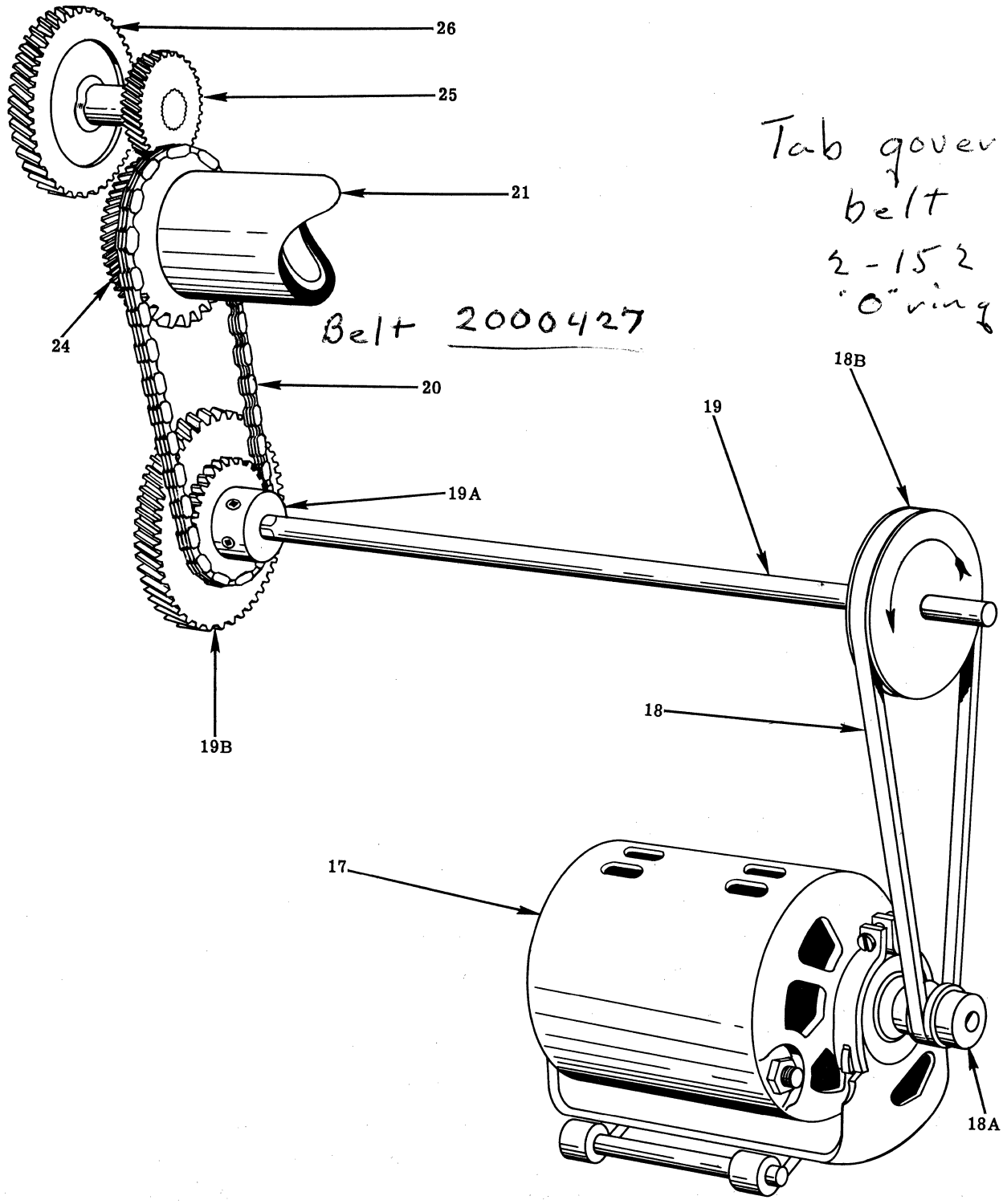
The motor is connected by a belt to a transverse shaft, which is connected by silent gears to the tape punch. A chain connects the transverse shaft to the power roll, which is, in turn, connected by silent gears to the reader drive shaft. The reader drive shaft is then connected by silent gears to the translator. The individual gears for driving each of these units not only afford the proper relative speed, but also permit easy removal of each unit from the base.

Operation - When the power switch is turned on, the motor (17) revolves at approximately 1750 R.P.M. Power is transmitted through the V-belt (18), riding over motor pulley (18A) and right hand power shaft pulley (18B) to turn the power shaft (19) at a speed of approximately 700 R.P.M. Mounted on the left end of the lower shaft is the clutch sprocket and gear assembly (19A). The nylon gear (19B) on this assembly drives the punch, while the chain (20) rides on the sprocket to drive the hub, gear and sprocket assembly (24). The power roll (21) is driven from the hub part of this assembly, while the gear meshes with the intermediate gear assembly (inner) (25). The inner intermediate gear drives the intermediate gear assembly (outer) (26). This outer gear will, in turn, furnish the driving power for the reader and translator.

On machines where the punch is not attached, the nylon gear on sprocket and gear assembly will not be a part of this assembly and will carry a different part name and number.

Removal - The following procedure is given in the event it is necessary to remove the power drive mechanism:

1. Remove the selector unit. Remove the belt from motor pulley by sliding it over the side of pulley after it has been loosened by unscrewing motor adjusting screw.
2. Loosen two set screws which hold right hand pulley to power shaft.
3. Loosen two set screws which hold sprocket and gear assembly to power shaft.
4. Remove the punch unit (this is explained in Section 5 of the Manual). This is necessary in order to pull the power shaft out of the machine. Remove the oil felt cap and felt from the left hand end of shaft.
5. With the punch removed, push the power shaft out through the casting on the left side of machine.
6. Remove power roll by forcing it to the right against spring tension and pulling forward. (See Power Roll removal).


26
25
21
24
20
19A
19B
18B
19
18
17
18A
Belt 2000427
Tab governor belt
2-152 "O" ring

7. Remove the first two cams on the left side of the front row. This is necessary if the power roll hub, gear and sprocket assembly is to be removed. (See Cam removal.)
8. The power roll hub, gear and sprocket assembly can now be removed by pulling it out of the oilite bearings in which it rotates.
9. Remove the Reader unit. Remove screw which holds intermediate gear (inner) to intermediate gear (outer). Both of these gears can now be removed by lifting out of position. Identify and save shim located between inner gear and frame.

Assembly and Adjustment - Reverse the procedure for removal, noting the following points.

1. Before inserting power shaft, it is necessary to have the chain positioned in both sprockets, also, the drive belt should be in place. Line up the sprocket and gear assembly and push power shaft in from left side of machine. Make certain that the right hand pulley is placed on the shaft before it is inserted all the way.
2. Fasten sprocket and gear assembly and right hand pulley to power shaft by tightening set screws into the two flats on the shaft. Allow enough motion from end to end so it can just be noticed. This end play should be approximately .003".
3. Adjust the V-belt as explained under "Motor."

POWER ROLL

Purpose - The purpose of the power roll is to furnish the driving power for all the cam units.

Operation - The power roll turns continuously in a counterclockwise (viewed from clutch end) direction at a speed of approximately 300 R.P.M. when the motor switch is turned on. When a cam is released by operation of the key lever, the serrated surface of the cam engages the rubber surface of the roll, which forces the cam unit away from the power roll. This, in turn, provides the movement necessary to operate the characters and functions of the machine.

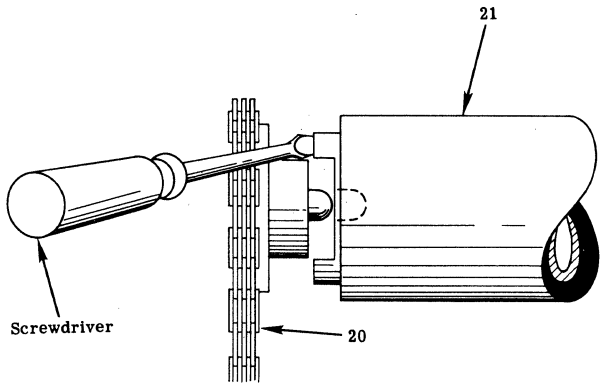


Figure 2-3 Power Roll Removal

Removal and Installation- To remove the power roll, insert a screwdriver between the hub and the end of the power roll. Force the roll to the right and pull forward on the left end. The roll will disengage from right hand shaft and can be removed (see Figure 2-3).

To insert power roll, place the right end in position in the shaft keyway. Now push the roll to the right against the spring tension of the hub. At the same time, push forward so the left end of the roll lines up with the hub. When it is properly positioned, it will snap into place.

SEQUENCE OF TYPING OPERATION

In order to give a clear understanding of the next four sections, key lever, cam units, bell cranks and type bars, the sequence of operation is given with reference to figure 2-4.

When the key lever is depressed, the forked end moves sufficiently to operate the release lever of cam unit assembly. This allows the cam to come in contact with the power roll, the rotation of which will cause the cams to be rotated. Through the rotation of this cam, the cam unit assembly will be moved on its pivot away from the power roll, which will exert a downward pull on the link (42). This will cause the bell crank (34) to move on its pivot (30) exerting a pull on link (35). This movement will cause the toggle (45-46) to be broken and also pull the type bar (36) upward and forward to the typing surface.

Adjustment and maintenance of the components mentioned above will be covered in detail in the following paragraphs.

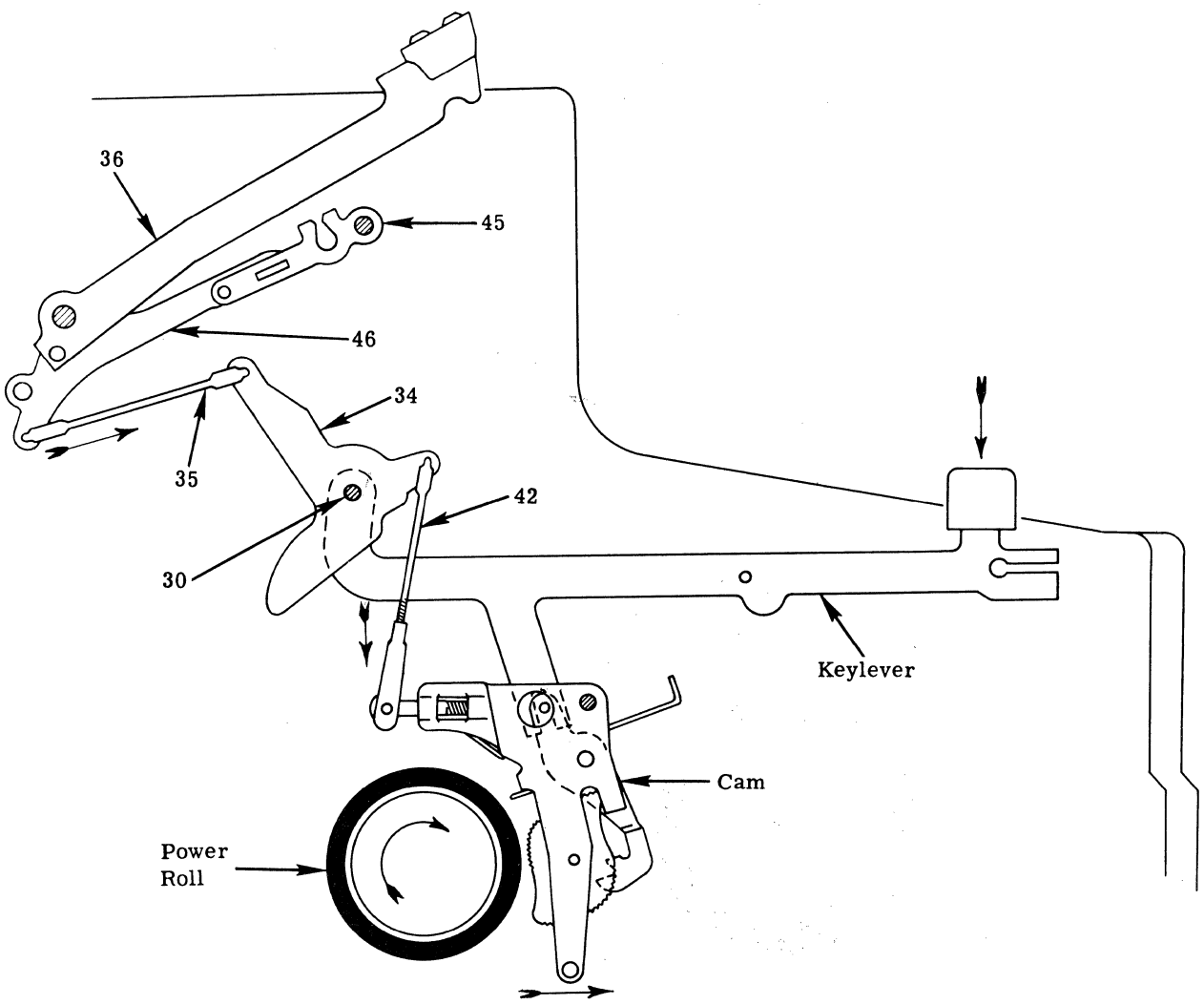


Figure 2-4 Keylever, Cam, Bellcrank and Typebar

KEY LEVERS (Figure 2-5)

Purpose - The purpose of the key levers is to control the different cam units which, in turn, operate various functions of the machine as outlined under cam units.

There is a key lever (27) associated with each character and function of the Writing Machine. Each key lever controls the operation of its respective cam unit (12).

Figure 2-5 illustrates the numbering of the key lever rows. Key lever rows 1 and 2 operate the rear row of cams, while key lever rows 3 and 4 operate the front row of cams.

The key levers are mounted on a key lever bearing wire (30), which is held in the key lever bearing support. This is a pivot for the key levers and the bell cranks (34). The key levers are guided by the front guide comb and by the slot in the chassis of the power frame. They are normally held against the top of the slot in the front guide comb by springs and adjusting screws. Their lower ends, which are forked, extend through the power frame to engage the release levers on the various cam units. When the key lever is pushed down, the forked end moves the release lever on the cam, allowing the cam to engage the power roll. Key levers must move freely and have the proper tension to insure uniform touch.

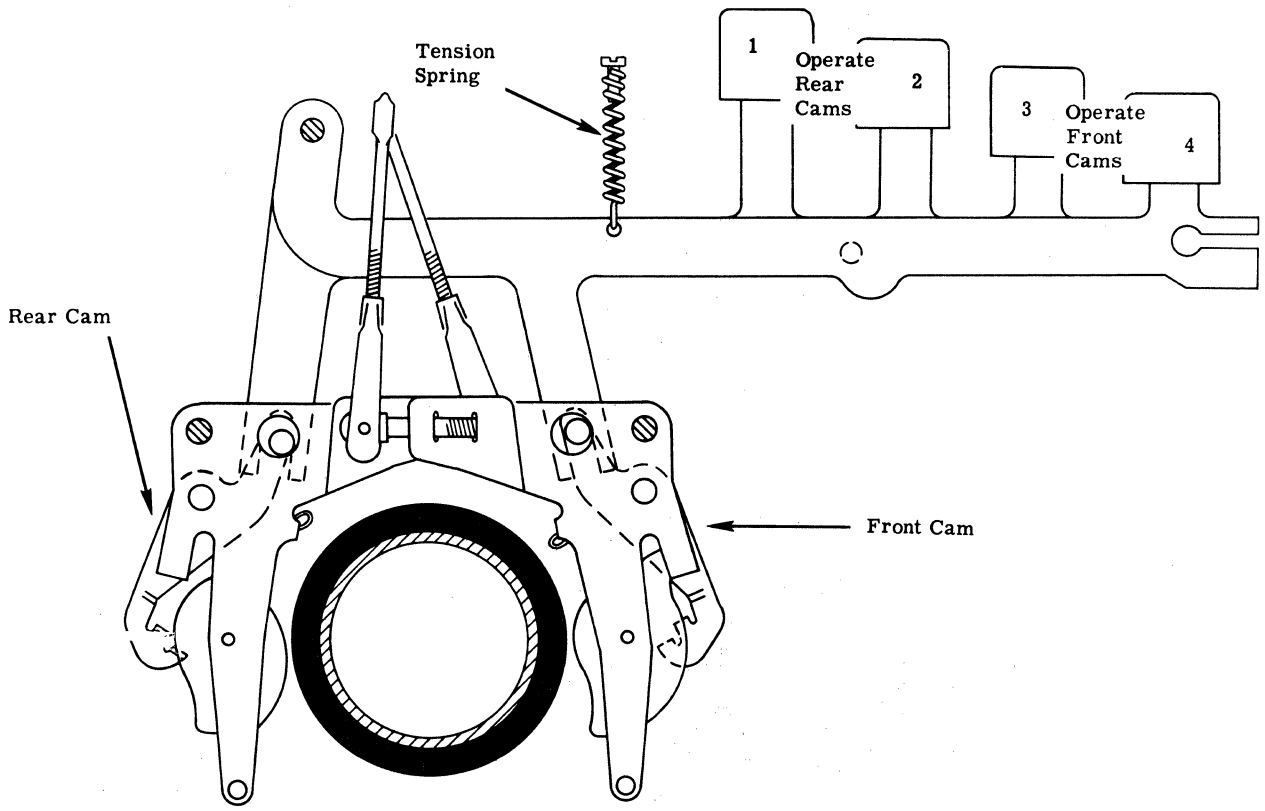


Figure 2-5 Keylever Position

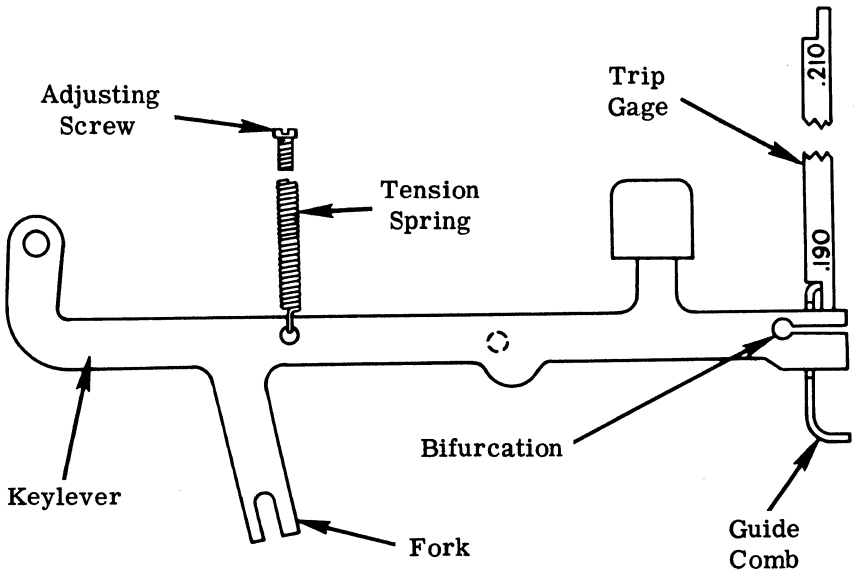


Figure 2-6 Keylever Adjustment

Adjustments

1. Check all key levers to see if they work freely in the guide comb and do not rub hard on either side. Binds can be removed by reforming the key lever with two T-benders.
2. Using key lever gage, check to see that the cams will trip .210" downward movement of the key lever, but will not trip at .190" downward movement. (Check both lobes of a double lobe cam.) If a key lever does not operate within these values, the top bifurcation at the front end may be raised or lowered to provide proper operation. (See Figure 2-6.)
3. Place a $2\frac{1}{2}$ oz. weight on any key, and with the correct tension the key lever should move just far enough to trip the cam. After adjusting all keys with the $2\frac{1}{2}$ oz. weight, place the 2 oz. weight on the key. With the correct tension on the spring, the 2 oz. weight should not trip the cam. To adjust for correct tension, turn adjusting screw on top of spring.

Note: The front guide comb is properly set at the factory and ordinarily needs no further adjustment.

In the event an adjustment is necessary, the correct setting for the front guide is such that the key levers will still have approximately 1/64" to travel after they have released the cams. The guide comb can be raised or lowered by the screws which hold it on each side.

KEY LEVER LOCK (Figure 2-7)

Purpose - The purpose of the key lever lock is to lock up the keyboard when the power is off, thereby preventing the keys from accidentally being operated and tripping the cams. The cams being tripped would cause piling of type or jamming of the power roll when the machine is turned on.

Operation - The key lever lock (29) is a bail pivoted on the ends of the front guide comb. It extends across the guide comb under the key

levers. When it is in a vertical position, it will not allow sufficient motion of the key lever to trip its associated cam.

An arm on the right hand end of the bail is connected by linkages to the key lock magnet (28) which is mounted on the right side plate of the machine. When this key lock magnet is operated, the bail is moved in an arc a sufficient distance so that the ends of the key levers will clear and can be moved to permit the cams to operate.

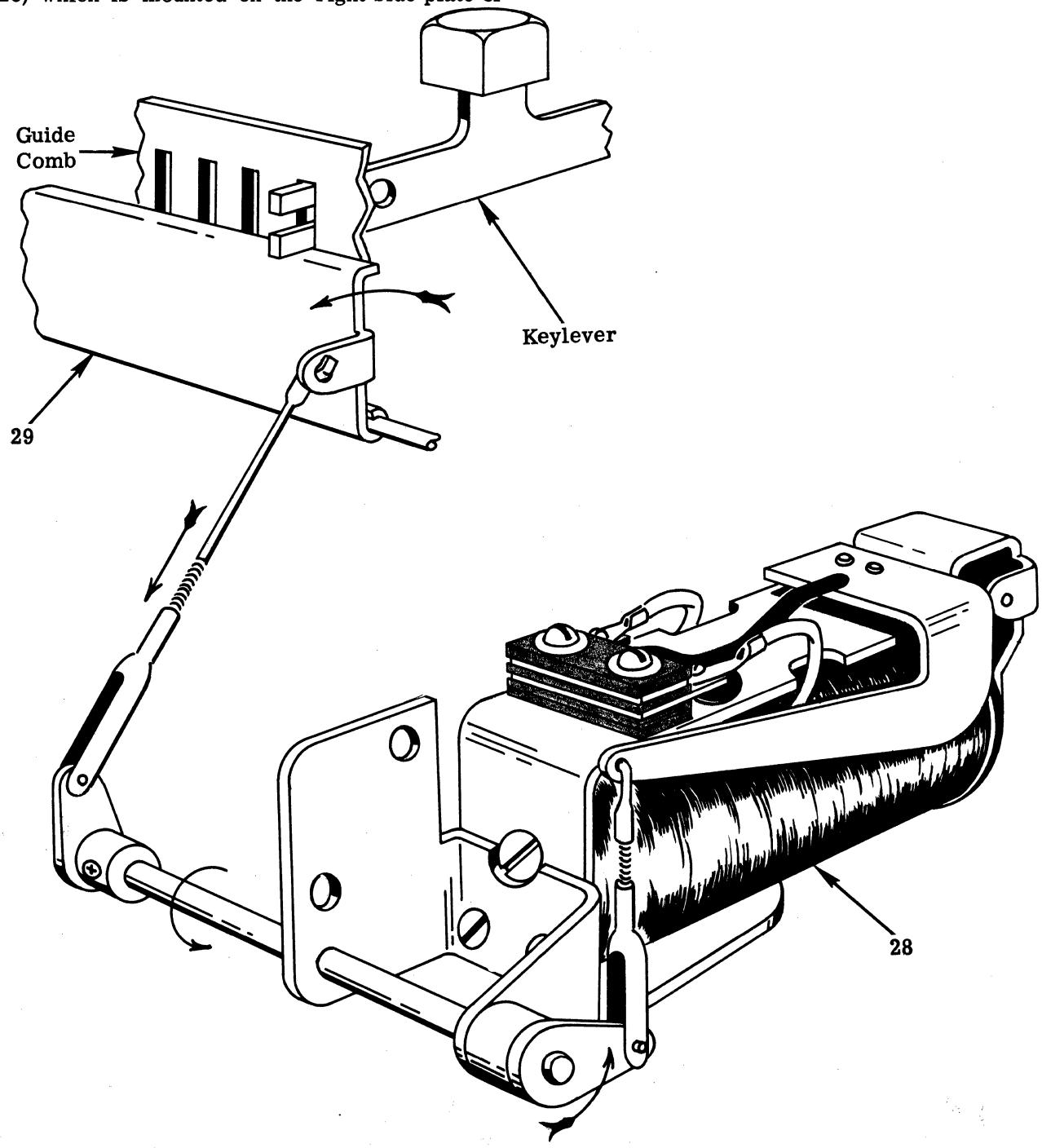


Figure 2-7 Keylever Lock Mechanism

Adjustments

1. The key lever lock magnet linkage is adjusted at the factory so that the keyboard will be locked at 85 volts A.C., but will unlock at 95 volts A.C.
2. The magnet armature air gap should be set at .030".

CAM UNITS

Purpose - The purpose of the cam units (12) is to actuate mechanical linkage which, in turn, performs various functions of the Writing Machine.

Types of Cams - The cam units mount on each side of the power roll (21). Those nearest the front of the machine are termed "Front" cams and those toward the back are termed "Rear" cams (Figure 2-8).

Two types of cams are used, namely single lobe and double lobe. The functions of both are the same but on carriage return, back space, tab, or similar operation, where more motion or more cam operating time is an advantage, a single lobe cam is used (Figure 2-9).

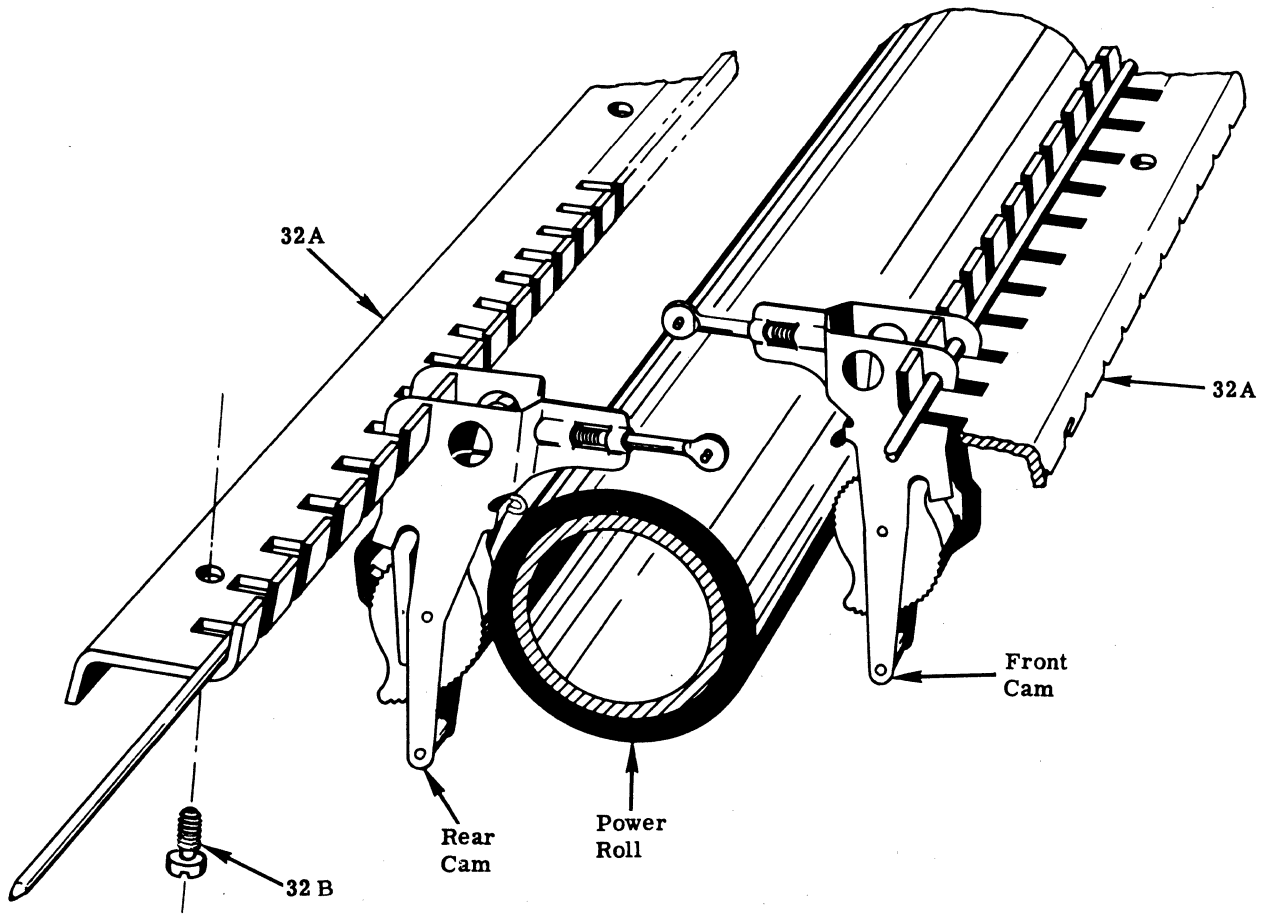


Figure 2-8 Front and Rear Cams

The single lobe cam requires 360 degrees rotation, while the double lobe cam requires 180 degrees rotation for complete operation.

The most important parts of the cam unit assemblies are the cam (31), release lever (31A) and spring lever (31B) (Figure 2-10).

Operation - A lug extends from the edge of each single lobe cam and two from each double lobe cam. The release lever (31A), which resembles a finger with two turned-over lips, engages these lugs of the cams. One lip engages the lug when the cam is in the normal position and releases it when the release lever (31A) is operated (when key lever is depressed). The second lip is so arranged that it will engage the lug of the cam while the release lever is in the operated position. When the release lever returns to the normal position, the cam is allowed to move until the lug engages the lip that was holding it before operation.

Therefore, if a key lever is operated and held depressed, its associated cam is released and permitted to rotate and complete its function. The cam, however, cannot repeat operation until the release lever is restored (by releasing key lever), allowing the cam to complete its final few degrees of rotation to its normal position.

On a double lobe cam, where there are two lugs, they are so located that they alternate, engaging the release lever.

On the side of a cam there is an additional round protruding point (C) which in the assembly engages the spring lever. As a cam is restored to its normal position, this point rides against the spring lever, moving it enough to build up tension on its spring.

When the cam comes to rest in its normal position, this spring tension is such that there is a slight pressure against the cam. When the release lever is operated, this pressure will rotate the cam sufficiently so that the serrated surface will come in contact with the power roll and cause operation.

Adjustment - All cam units should be adjusted so that when the cams are in the normal position, their faces are as close to the power roll as possible without rubbing it. This adjustment is checked with the cam unit in the normal position with the power roll running (approximately .003" clearance).

The cam units are set in relation to the power roll by means of adjusting links. To obtain the proper setting of a cam, proceed as follows:

1. Lift the machine upright and drop the selector unit.
2. Insert a piece of bond paper or .004" feeler gage between the serrated cam surface and the power roll. If the paper is pinched heavily between the two surfaces, it indicates the cam is too close to the power roll.
3. Remove the power roll.
4. Disconnect the adjustable link (42) from the cam unit.
5. With the link disconnected, turning it to the right brings the cam closer to the power roll; turning to the left moves it away.
6. If the cam surface was too far away from the power roll, adjust it close enough so that it just rubs the paper and then adjust one-half turn on the link to remove the rubbing condition.

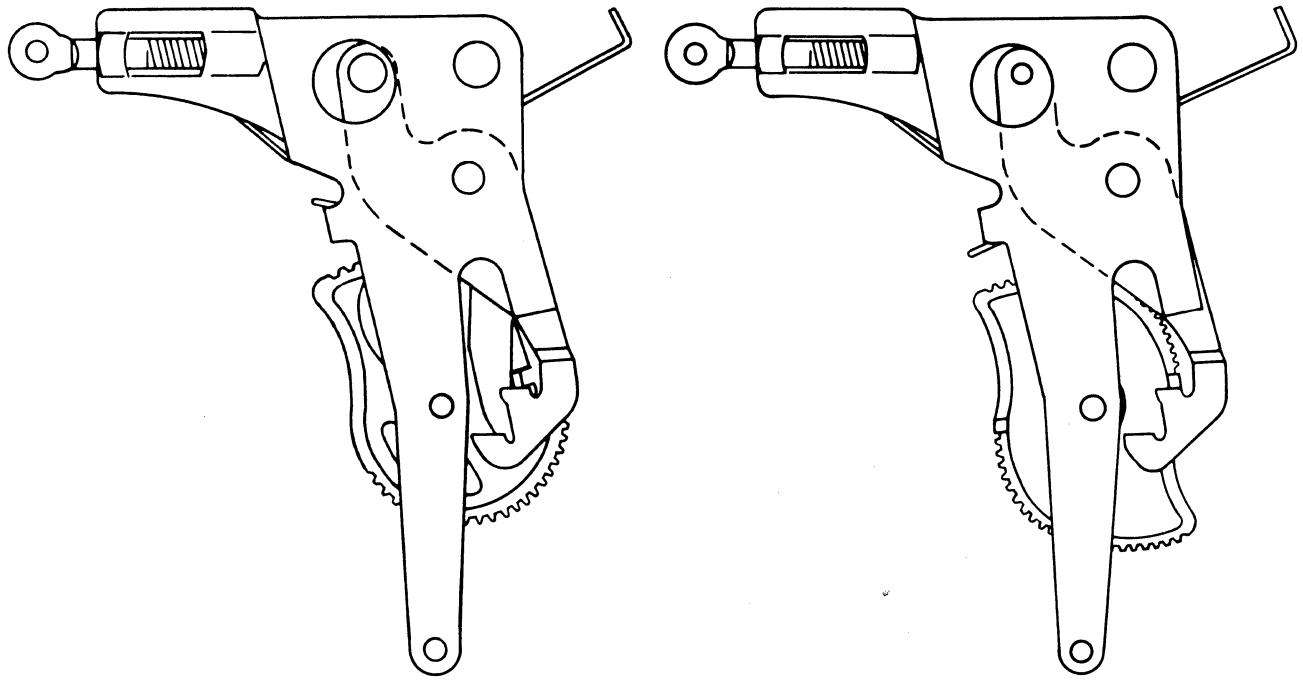


Figure 2-9 Single and Double Lobe Cams

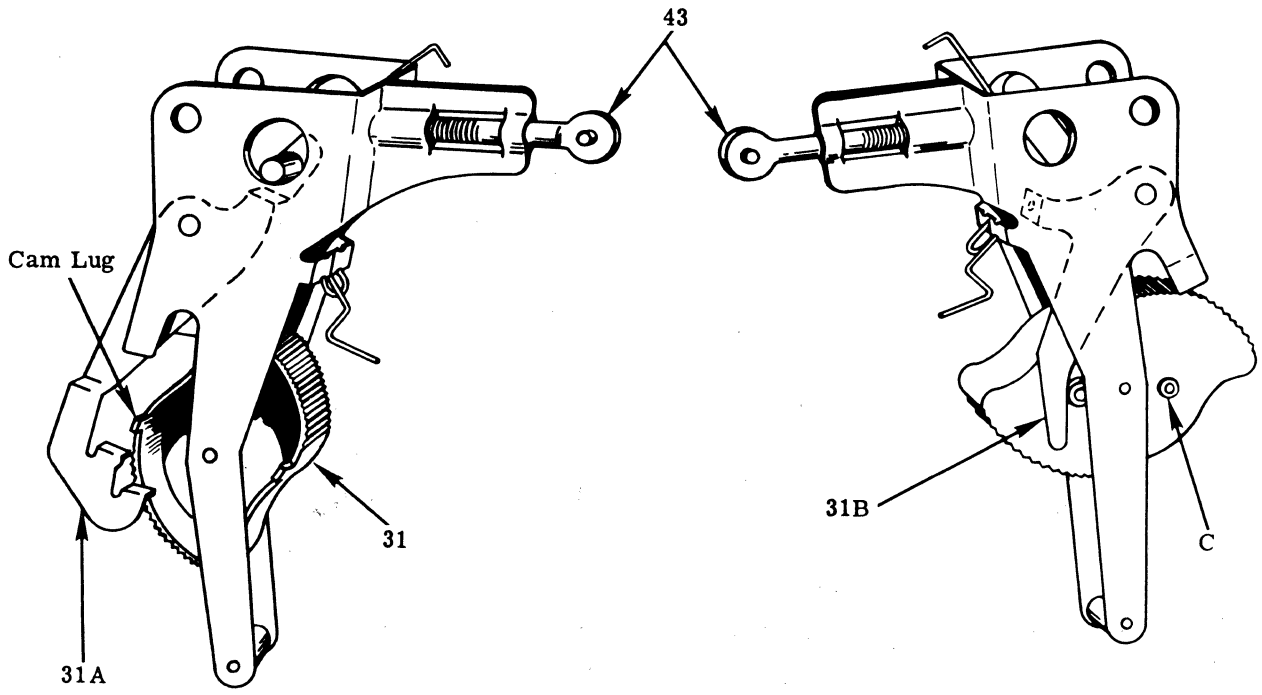


Figure 2-10 Cam Parts

7. After making an adjustment, recheck for cam clearance. When adjusting double lobe cams, check each lobe for clearance. If there is a noticeable difference, adjust to an average for each lobe.

The screw (43) installed in the cam unit is known as an impression adjusting screw and is turned in or out to control the impression on any individual type bar. When installing a new cam, adjust the screw to a middle position. After installation, adjust the screw for the correct impression. This impression screw increases or decreases the power transmitted by the cam, thus increasing or decreasing the impression of a type bar.

The adjustment can be made by disconnecting link (42) as above and turning the impression screw "in" to make the character lighter, or "out" to make it heavier.

Removal - To remove a cam unit from the Writing Machine, proceed as follows:

If a "Front" cam is to be removed:

1. Remove the Reader Unit. Remove the outer intermediate gear.
2. Remove the R. H. side cover.
3. Remove the Translator unit.
4. Drop the Selector unit.
5. Remove the power roll.
6. Loosen three screws which hold cam bearing plate in position.
7. Push an extra cam bearing wire through the hole in the side casting (nearest cam being removed) and push against the bearing wire in the machine. Continue pushing until the joint between the two wires is opposite the cam to be removed.
8. Pull the two bearing wires apart until the cam falls free. Unhook the adjusting link (42) from the cam.

If a "Rear" cam is to be removed, proceed as above, but:

1. Do not remove Translator Unit.
2. Remove the Selector contact assembly.

When replacing a cam unit, take the following precautions:

1. Make certain that the stud on the release lever (31A) is positioned in the fork of the key lever (27).
2. When cam is in position and the cam bearing wire is in normal position, be sure to tighten the three screws (32B) which hold the cam bearing plate (32A) in position.
3. Reassemble the cam in the reverse procedure.
4. Adjust the cam as described in "Adjustments".

BELL CRANKS (Figure 2-11)

Purpose - The purpose of the bell cranks is to transfer motion from the cam unit to the type bar and to operate the ribbon lift and feed mechanisms.

Operation - Each bell crank is designed to actuate the type bar either heavily or lightly, depending upon the size of the printing area of the type. The large characters will print with the same density as the small ones. For example, the "W" has four printing lines and the "I" only one, thus the "W" type bar must strike a heavier blow than the "I". This is accomplished by installing a bell crank in the "W" position, which can exert more leverage on the type bar.

The bell cranks are mounted on the same fulcrum rod (30) as the key levers. The lower end is connected to the cam unit link (42). The upper end is connected by link (35) to the type bar.

The rear extension rests under the ribbon lift bar assembly and as a pull is exerted on link (33), the rear position of the bell crank is moved upward. This upward motion moves the ribbon lift bar (41) upward on its pivot points. This motion, in turn, operates the ribbon guide lever and ribbon feed mechanism (explained in their separate sections in the Manual).

Adjustment - The adjustment of bell cranks should not be necessary except as a last resort. They are hardened and tempered and consequently will break easily.

Removal - If it is necessary to remove a bell crank, use the following procedure:

1. Remove the Reader Unit.
2. Remove the R. H. side cover.
3. Remove the Selector Unit.
4. Remove the Translator Unit.
5. Remove the two screws from the base, which are mounted in line with the fulcrum rod (30). There is one of these screws on each side of the base. With screws removed, an extra fulcrum rod can be pushed through these holes, which will strike the end of the rod holding the bell cranks and key levers in position.
6. Remove the cam unit associated with the bell crank to be removed.
7. Remove the type bar associated with the bell crank to be removed.
8. Unhook the key lever tension spring and also three or four additional springs on either side.

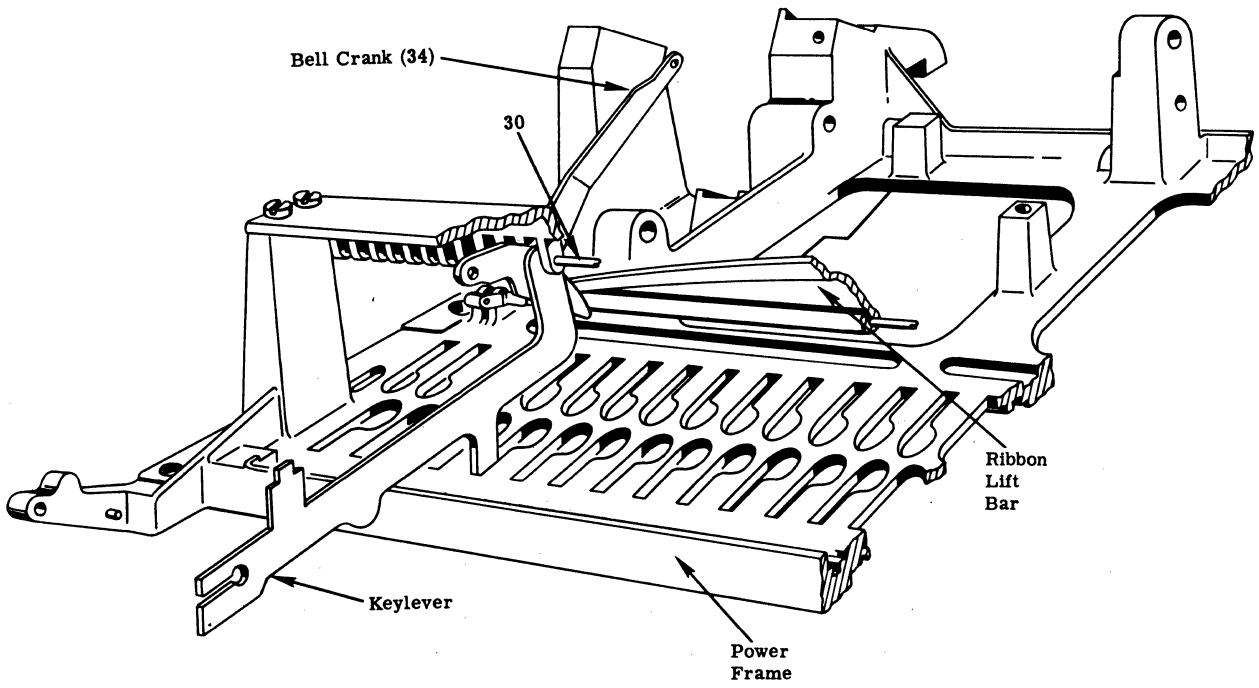


Figure 2-11 Bell Crank Location

9. With the extra fulcrum rod inserted in from the side of the machine, push it through until the joint between the two rods is lined up with the bell crank to be removed. By carefully pulling the rod back the width of the bell crank, it will be free to drop down. The bell crank may then be removed through the front of the machine between the key levers and the key lever tension spring holder.

   Caution: Unless pressure is kept against rod (30) with another, other bell cranks and key levers will drop out of their position and make the job unnecessarily hard.

Reassemble in the reverse procedure, making certain the key lever is on the right side of the bell crank. Each bell crank and its associated key lever rest in one slot in the key lever bearing support.

TYPE BAR AND TOGGLE (Figures 2-12 and 2-13)

Purpose - The type bars (36) carry the type slug to the platen for printing. They are designed to operate in a specific position in the machine. They are numbered, beginning at the left, from one to forty-two.

Operation - A toggle is formed by toggle lever (46) and toggle link (45) riveted together, one of which is then riveted to each type bar. The action of this toggle is that when it is straightened out, a type bar cannot be lifted by its outer end. The toggle must be broken by a pull from link (35). The toggle prevents rebound-collision of type bars and permits faster operation. These type bars are assembled in a type bar segment (39) by the fulcrum wire (38) which provides a pivot point for them. The segment is slotted, which provides a lower guiding surface for each type bar.

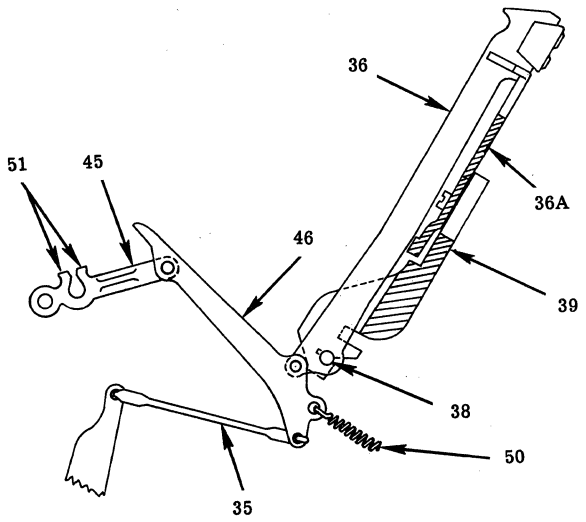


Figure 2-12 Type Bar in Guide

A type bar guide (36A) is assembled on the segment, which guides the upper end of the type bar to the platen when the bar is operated. Spring (50) exerts tension on the toggle lever which returns the type bar to its rest position.

Figure 2-13 shows a type bar in the normal position, with the toggle locked and the head of the type bar resting on the type bar rest, which is part of the segment support assembly.

The toggle link (45) has two extending ends (51) which may be adjusted to lengthen or shorten the link by spreading or drawing together. This tightens or loosens the toggle.

Adjustment - The correct adjustment of the toggle link (45) is determined by operating the type

bar by hand and allowing it to ease back to its rest position. This should permit the toggle to lock. Lifting the head of the type bar will determine if the toggle is locked. The type bar should not be held against the type bar rest by the toggle, but should be able to be moved away slightly, approximately 1/8 inch.

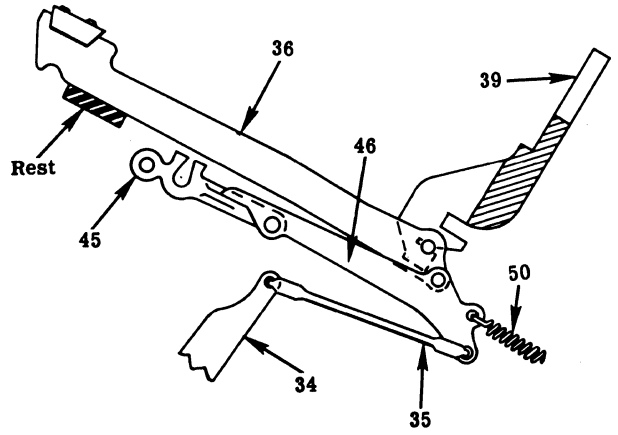


Figure 2-13 Type Bar in Rest Position

Toggles adjusted to lock too tight will cause the type bar to operate with a snap action, which increases the type bar speed to the platen, causing uneven printing.

Toggles will fail to lock if the type bar does not return to the type bar rest.

Removal and Assembly - The following procedure may be used when removing a type bar:

1. Shift the basket to the lower case position.
2. Unhook from the spring plate the spring (50) of the type bar to be removed.
3. Loosen fulcrum wire stop screws in segment support.
4. Insert an extra wire in side of segment from which bar is to be removed, forcing out fulcrum wire so that bar is on the inserted wire. Back up wire so that only bar that is to be removed and next five adjacent bars drop from segment.
5. Loosen clamp plate screws about $\frac{1}{2}$ turn, just enough so wire can be moved in groove.
6. Insert an extra wire in groove and force front fulcrum wire around until bar to be removed is on inserted wire. Back up inserted wire so that only toggle link connecting the bar to be removed drops.
7. With spring hook under the front end of toggle lever, pull up until it is against the type bar, which is held in left hand. Push down on the back end of the bar, turn to the right or left, depending upon which side of the segment bar is to be removed from, and pull forward on the bar. This brings the bar assembly, with link still attached, to the front of the segment and up between the type bars. It is then easily unhooked from the link.
8. Oil the bearing points on the new bar and assemble in reverse manner from which removed.

UNIVERSAL BAR ASSEMBLY (Figure 2-14)

Purpose - The purpose of the universal bar is to transfer motion from the type bar to the escapement mechanism, allowing the carriage to move at each operation of the type bar.

Operation - The universal bar assembly is mounted on the rear of the segment with screws (39E) and support (39D). The screw (39B) holds the rear spring of the assembly to the support.

The U section of the universal bar assembly fits in a slot extending completely around the segment. Spring tension from the two flat springs holds this U section against the forward face of this slot.

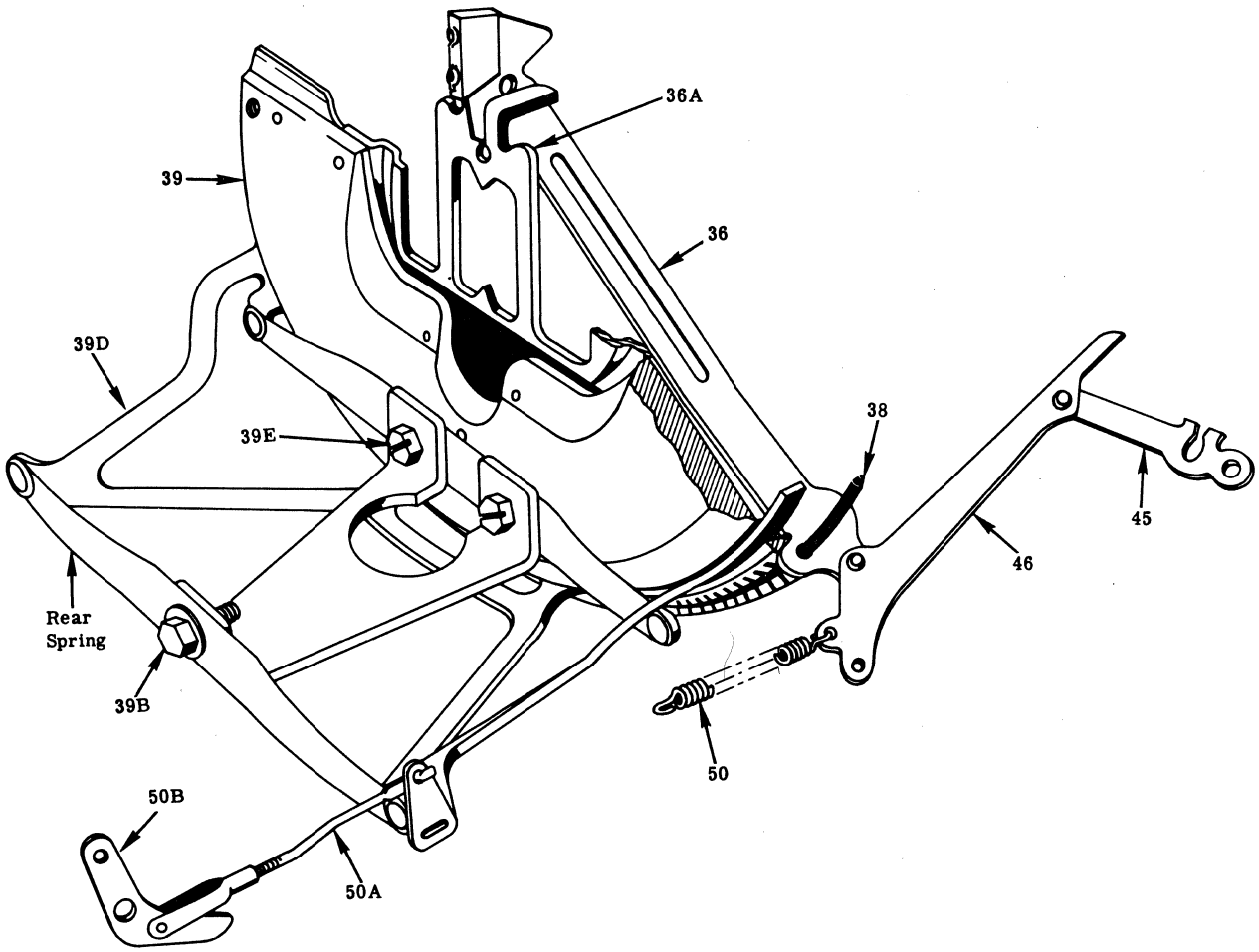


Figure 2-14 Universal Bar Mechanism

The type bar guide slots in the segment are so cut and the fulcrum wire so located that the forward edge of a type bar contacts this U bar to be moved slightly against its spring tension, approximately 1/8 inch.

This motion is carried through the U bar to link (50A) and then to the escapement lever (50B).

Adjustment - The U bar is set at the factory and should give no trouble. If the variation is too great, however, proceed as follows:

1. Raise rear U bar spring to make center bars give less motion.
2. Move rear U bar spring to the left to give right hand bars less motion.
3. Move rear U bar spring to right to give left hand bar less motion.

This movement should be very slight and screws must be tightened before movement can be checked.

Removal and Assembly -

1. Remove carriage and rail assembly. (See Carriage Removal.)
2. Disconnect link (50A).
3. Loosen screw (39B).
4. Remove screws (39E) and slide U bar from segment.

To replace U bar, reverse above procedure, making sure spacers are in place.

The universal bar should be installed so as to rest as high as possible without binding against the segment. It may be adjusted so that all type bars trip the escapement at an equal tripping point. The left side of the universal bar should rest a few thousandths away from the segment, while the right side should rest on the segment.

To obtain an equal tripping point, install a marker under the rear rail mounting screw.

Move the number one bar up to the ring and hold it there. Adjust the marker to touch the end of the universal bar (at the point where the escapement link connects - see Figure 2-15).

Now check the number 22 and number 42 bar individually in the same manner. Loosen the hex screw and adjust the rear spring until the bars are moving the universal bar the approximate same distance. The right hand bar number 42 should move the universal bar a slight amount more than the number one bar to compensate for the amount of yield that is characteristic of the universal bar design.

MAIN SPRING AND HOLDER

Purpose - The purpose of the main spring is to draw the carriage to the left through the tension tape, which is fastened to the right end of the escapement rack, which forms part of the carriage frame. Two springs, in series, are used to insure an even tension over the entire movement of the carriage.

Removal - (Figure 2-16)

1. Grasp the main spring drum firmly and push it downward against the spring tension. Unhook the tension tape from the drum. CAUTION: Release the drum slowly, being careful not to let it release and spin.

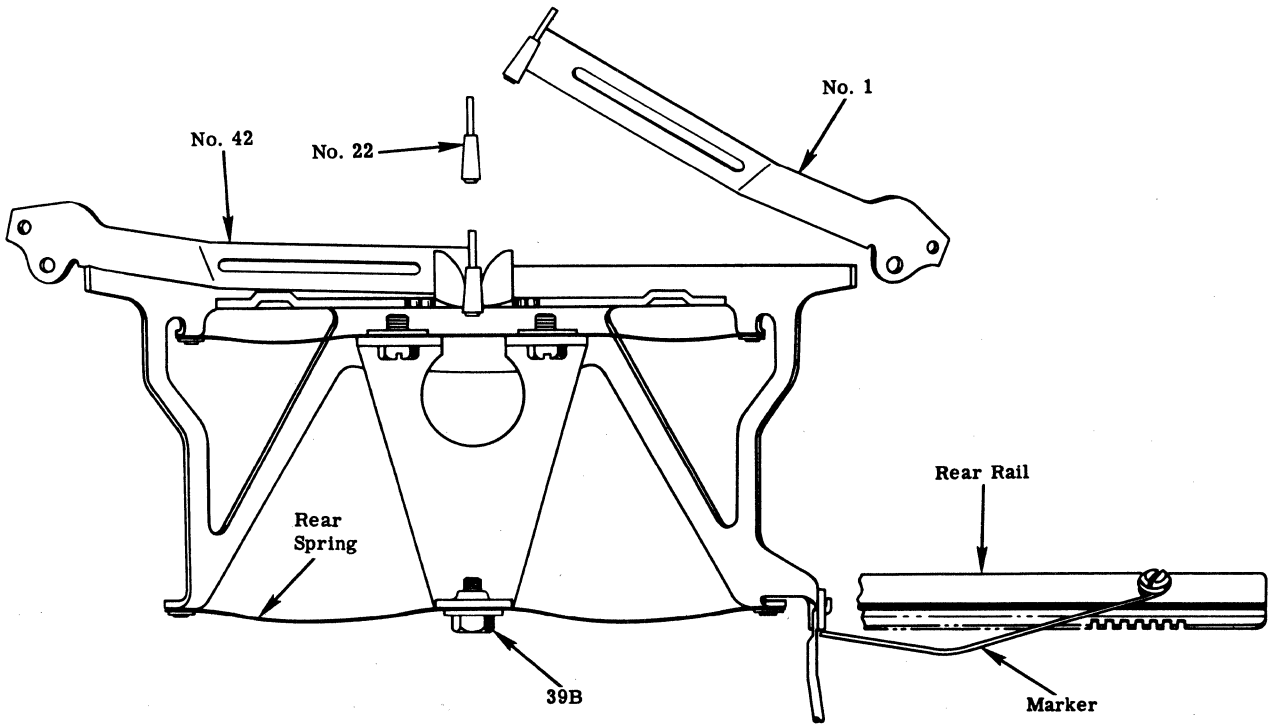


Figure 2-15 Universal Bar Adjustment

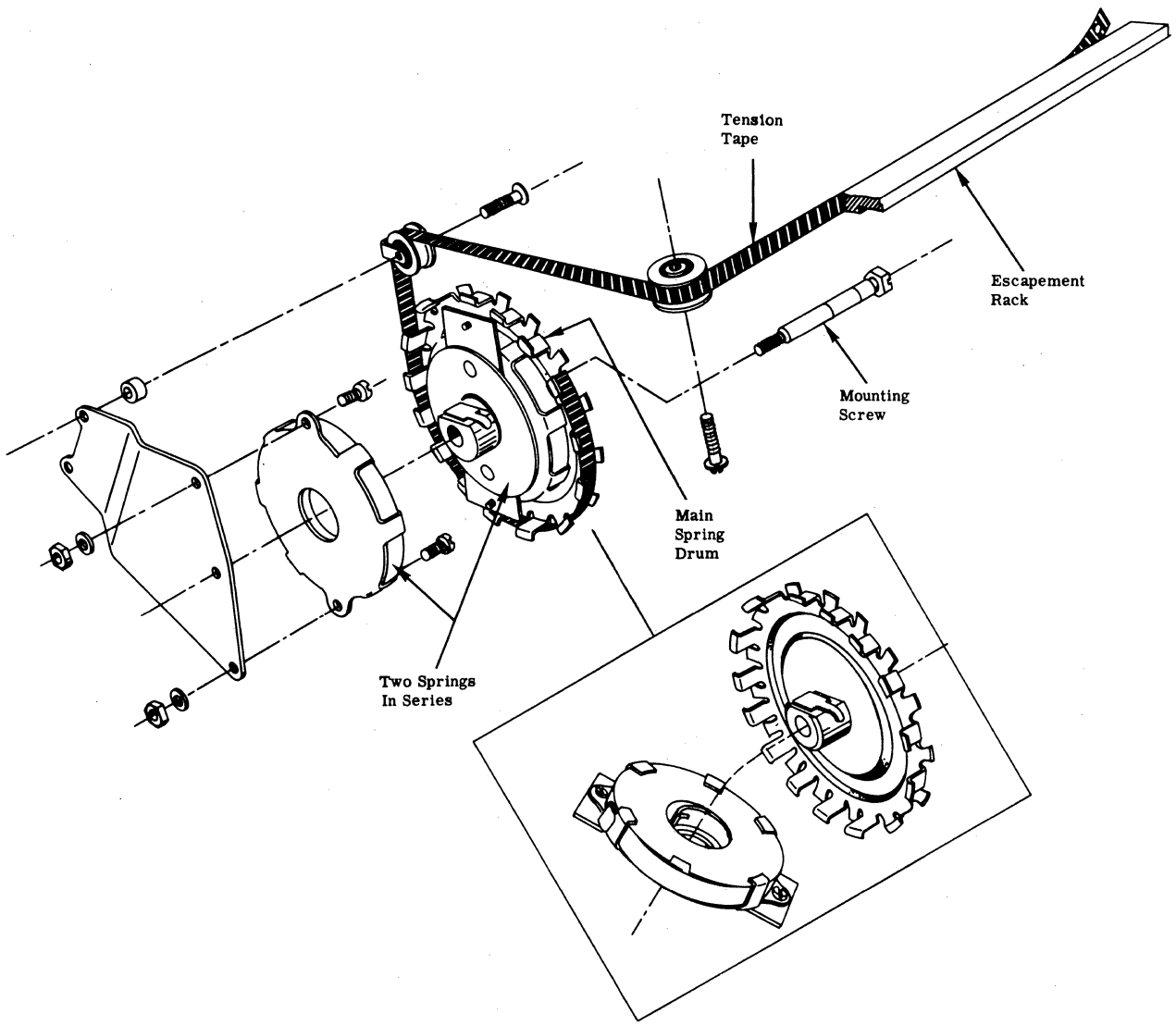


Figure 2-16 Main Spring and Holder

2. Remove the mounting stud and remove the drum and the outside spring assembly.
3. The inner spring and plate assembly may be removed by removing the mounting screw holding the plate to the base.

Assembly - Assemble the main spring and holder in the reverse manner as above. Be sure there is freedom of movement of the outer spring adapter plate over the entire length of the carriage.

Check for proper tension of 12", 16" and 20" carriages as follows:

Hook a scale (T62617) to the right hand side of the carriage.

Pull the carriage from the left to the right side.

If the machine is not equipped with a carbon ribbon attachment, the tension should start at approximately $2\frac{3}{4}$ lbs. and should not increase in tension to more than 4 lbs. over the entire movement. This should be tested with the carriage return clutch pulley spring set at normal tension.

If the machine is equipped with a carbon ribbon attachment, the tension should start at approxi-

mately $3\frac{1}{2}$ lbs. and increase to no more than 5 lbs.

CARRIAGE AND RAILS

Purpose - The carriage and rails is a major assembly of the Writing Machine. It consists of several other assemblies, which in themselves should be considered major assemblies. These are as follows: carriage assembly, rails (rear and front) and escapement.

The purpose of the carriage and rails may best be stated by giving the purpose of its individual assemblies.

1. The carriage provides a means of holding a platen which will hold a sheet of paper so that its surface will always be in correct relation to a particular type bar when operated.
2. Rails (front and rear) provide a means by which the carriage may be moved laterally with a minimum of friction and hold the surface of the platen correctly at the printing point.
3. Escapement is used to provide a method of holding the carriage and permitting it to move a uniform distance for each operation of a type bar or space bar.

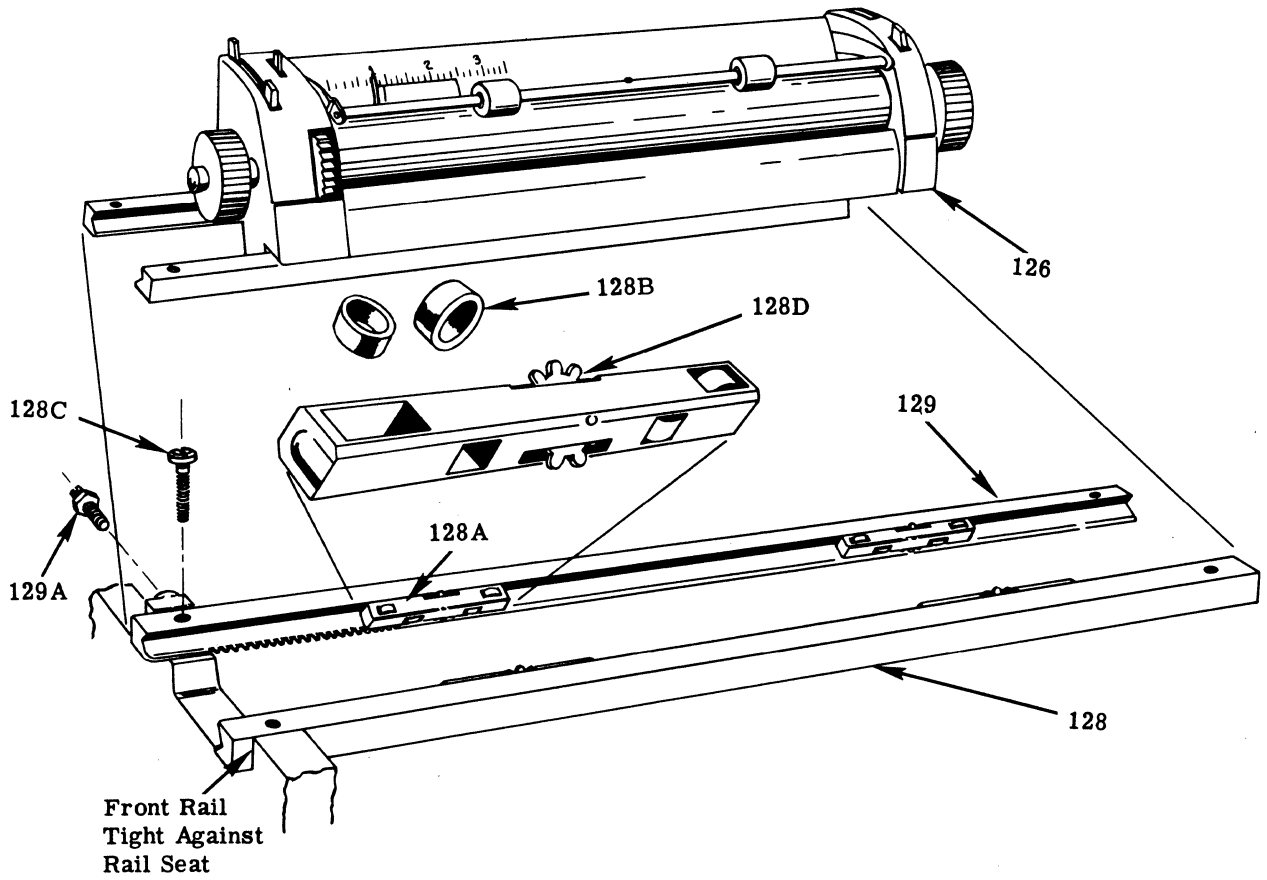


Figure 2-17 Carriage and Rails

Operation - Figure 2-17 shows the front (128) and rear rails (129) and carriage (126). Four surfaces are formed by a rail and the side of the carriage adjoining that particular rail. A square opening is formed, within which the trucks (128A) move. All of these edges are ground to a close tolerance. Four steel rollers (128B) are located on each truck assembly. The rollers ride along two opposite ground surfaces.

Four truck assemblies are used in the Standard 12″ carriage assembly.

The star wheel (128D) of the truck assembly engages a rack on the bottom of each rail and on the top edge of the truckways in the carriage frame.

As the carriage moves to the left or right, the complete truck assemblies move right or left. The trucks are so located in assembly that when the carriage is in the extreme right position, the ends of the right hand trucks are approximately $\frac{1}{4}$″ from the ends of the rails.

When the carriage is in the extreme left hand position, the left hand trucks are approximately $\frac{1}{4}$″ from the left hand ends of the rails. This results in the carriage being supported on all sixteen rollers, regardless of its position along the rails.

The right and left hand castings of the base assembly have milled surfaces to hold the rails in true relation to the power frame and type bar segment. The rails are fastened to the base by screws (128C).

The position of the rear rail can be adjusted forward or backward with adjusting screws (129A). This permits adjustment for true lateral motion as well as keeping the rails spaced so the carriage will not become loose (due to rollers not riding on both of their ground surfaces).

Removal - To remove the carriage and rails, it is best to remove the Punch, Reader, Translator and Selector units. Then proceed as follows:

1. Remove the front cover.
2. Remove the left top carriage cover.
3. Remove the right hand carriage cover.
4. Remove the platen and pressure roller assembly.
5. Remove the paper table (remove two springs from pins and lift from slots in carriage tie rod).
6. Remove left lower carriage cover.
7. Remove rear cover.
8. Remove the nylon back space contact operator (this is located in the right rear section of the machine. It is best removed with a spring hook, applying pressure to the contact spring and sliding out the operator which can then be removed from the back space operating pin).
9. Disconnect the back space operating link (830) at the bell crank (Figure 2-39).
10. Disconnect the CR toggle knockout link (185) at the bell crank (184) (Figure 2-30).
11. Disconnect the tab operating link (240) from latch operating lever (239) (Figure 2-33).
12. Disconnect tab unlatch link (256) from the unlatching lever (257) (Figure 2-33).
13. Disconnect the tab unlatching cam operating link (252) at point 251 (Figure 2-33).
    Note: It may be advantageous to disconnect the last two links at their upper points also. Before doing this, the cam operating link (252) and the tab unlatching link (256) should be noted and marked to insure proper replacement.
14. Remove the escapement trip link (50A) (Figure 2-20).

15. Disconnect the two leads to the CRTC contact.
16. Remove the carriage tension tape from the main spring drum (hold drum securely and unwind slowly). Remove screw holding tape to right end of carriage (Figure 2-16).
17. Remove the carriage return tape (120) from hook lever (121). (Hook carriage return tape to right hand base of machine with a paper clip or other suitable device.) (Figure 2-32)
18. Remove two screws which hold rear rail (129) to base (Figure 2-17).
19. Remove two screws which hold front rail (128) to base.
20. Position the carriage in center of rails and grasp carriage at both ends. Gently work the carriage and rails upwards until the rails work out of their seats. This will release the assembly, but a check should be made to be sure all links are disconnected.

It is also important to note the shims under each rail and carefully identify them so that they may be replaced in the same location. This will insure correct carriage position and eliminate a great amount of unnecessary adjustment.

With PSM models, it will be necessary to disconnect the escapement pawl (195) operating links before removing the carriage and rail assembly.

Assembly and Adjustment -

1. Loosen the two mounting screws for the tab governor. (On PSM machines loosen the mtg screws for the carbon ribbon gear.)
2. Loosen the front escapement mounting screws.
3. Grasp carriage and rails assembly at each end and lower it into position on the rail seats with the positioning holes in the proper place. (Be sure to replace shims under the rails exactly as they were removed.)
4. Make certain the carriage assembly is moved as far to the front of the machine as possible (front rail should be tight against the side of the rail seats, see Figure 2-17). Tighten the front rail screws.
5. Assemble the rear rail screws but do not tighten.
6. Remove the escapement rack (138) by removing the four mounting screws (138A) and backing off the adjusting screws (138B) until they are flush with the carriage frame (Figure 2-28).
7. Place the carriage so that the trucks are positioned in line with the left hand rail screws. Press the rear rail forward tightly by hand and drive the left rear rail screw down tight. Repeat this operation on the right hand side. Turn the rear rail adjusting screws up snug against the rear rail. Tighten the lock nuts. Tighten the front escapement mechanism mtg screws.
8. Check the carriage for side play. The carriage should be free to travel, without binds, from one extreme to the other. (Make sure the dust cover is not binding the carriage movement).
9. Replace and adjust the escapement rack as explained on page 2-31.
10. Adjust the governor and tighten the mounting screws (page 2-40). Also, on PSM machines, tighten the mtg screws for the carbon ribbon gear.
11. Replace the carriage tension tape by attaching to the right hand end of the escapement rack. Wind the main spring drum up a few turns and attach the tape to the drum. Check

for proper carriage tension of 12", 16", and 20" carriages as follows:

Hook a scale (T62617) to the right hand side of the carriage.

Pull the carriage from the left to the right side.

If the machine is not equipped with a carbon ribbon attachment, the tension should start at approximately $2\frac{3}{4}$ lbs. to a maximum of 4 pounds with the clutch pulley spring set at normal tension.

If the machine is equipped with a carbon ribbon attachment, the tension should start at approximately $3\frac{1}{2}$ lbs. to a maximum of 5 lbs. with the clutch pulley spring set at normal tension.

12. Hook the carriage return tape to the hook lever (on the indexing mechanism).
13. Connect the escapement trip slide link to the trip slide and check the escapement for proper adjustment (see page 2-29).
14. Replace the nylon operators for the B.S. contact. Also, connect the two leads to the CRTC contact.
15. Connect and adjust all links in proper sequence as described under Complete Tab and CR Adjustments on page 2-40.
16. Connect the back space operating link and check the adjustment of the Back Space Mechanism described on page 2-45.
17. Adjust the platen to ring and cylinder (page 2-58). Place a single sheet of paper in the machine and check for alignment of type, type bars entering the guide properly and the proper ring and cylinder adjustment of each type bar.
18. Check all operations manually and automatically.

Removal and Replacement of Carriage Trucks- If it is necessary to remove the carriage trucks proceed as follows:

1. Unhook the carriage return tape and remove the carriage tension tape.
2. Loosen the rear rail adjusting screws (one at each end).
3. Remove the two rear rail mounting screws.
4. Remove the front escapement mechanism mounting screws.
5. Move the carriage to the extreme left and remove the rear and front trucks. Move the carriage to the extreme right and remove the remaining trucks. (Note position of trucks when removing.) Lift off carriage.

When replacing the carriage trucks proceed as follows:

1. In order to have the star wheel properly engage the racks of both the rails and the carriage ways, the star wheel must be vertical. To meet this condition, the truck must be inserted the same way that it was removed. Observe that the recesses for the rollers are larger at the top and smaller at the bottom, thereby preventing the rollers from dropping through the trucks.

   The trucks are equipped with star wheels carrying ten teeth which engage the milled teeth in the racks to keep the trucks from running out either end of the rails.

   Replace the carriage and trucks. The trucks should be assembled in the rails so as to be approximately $\frac{1}{4}$" from the carriage ends at either extreme of the carriage travel. The number of trucks required depends on

the length of the carriage:

12″ carriage requires four

16″ carriage requires six

20″ carriage requires eight

2. Check the front rails for position against the side of the rail seats (it should be as far forward as possible, see Figure 2-17).
3. Replace the two front escapement mechanism mounting screws. Do not tighten them yet.
4. Place the carriage so that the trucks are positioned in line with the left hand rail screws. With the rear rail screws loose, press the rear rail forward tightly by hand and drive the rear rail screw down tight. Repeat this operation on the right hand side.
5. Tighten the two front escapement mechanism mounting screws.
6. Remove the governor assembly. Remove the escapement rack by removing the four mounting screws and backing off the adjusting screws until they are flush with the carriage frame.
7. Test the carriage fit for free travel without side play. Secure the adjusting screws against the rear rail so that the carriage will be free to travel, without side play, from one extreme to the other. Carriage rails longer than sixteen inches will have end brackets which must be adjusted in the same manner.
8. Replace and adjust the escapement rack as explained on page 2-31.
9. Replace the governor assembly.
10. Replace the carriage return tape.
11. Check the complete CR and Tab adjustments, also, the Rack and Scale Adjustments.
12. Adjust the platen to proper ring and cylinder (see page 2-58). Place a single sheet of paper in the machine and check for alignment of type, type bars entering the guide proper, and the proper ring and cylinder adjustment of each type bar.

ESCAPEMENT

Purpose - The term "Escapement" refers to the movement of the carriage for the correct spacing on the paper upon each operation of a type bar or space bar. The escapement mechanism is the unit which controls this spacing. The mechanism is of the same general design for all machines.

Types of Escapement - There are two general classifications of escapement which cover all machines. The first is the mono-spacing machines on which all characters, either in lower case or upper case, have exactly the same spacing. The machines using this type of escapement are those having Elite (twelve characters to the inch) or Pica (ten characters to the inch) type.

The second is the variable spacing machines (proportional spacing) on which the characters have different spacing, depending on their design and whether they are lower case or upper case. The machines using this escapement will be all Justowriters and President Model Flexowriters.

Unlike the mono-spacing machines, the proportional spacing system provides several widths of letters or characters. The width taken by each character consists of one or more units. Any movement of the carriage must be measured in units, a unit being 1/32″. The least spacing used for any one character is two units, and the great-

est is five units. Normal spacing between words is two units but may be varied.

The character spacing is illustrated in Figure 2-18, which compares proportional and standard spacing and shows how the distortion of narrow and wide letters is eliminated in using proportional spacing. Spacing for upper case and lower case letters or characters is not necessarily the same. The correct spacing for any character is entirely automatic in its selection and operation.

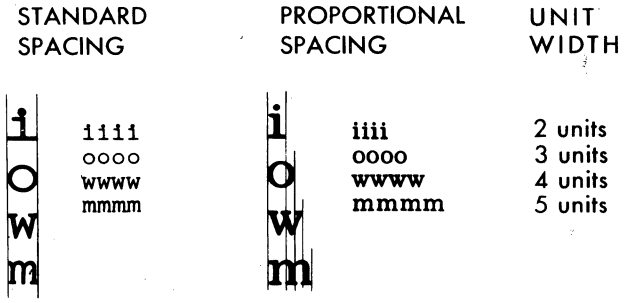


Figure 2-18 Character Spacing, Standard and Proportional

In standard spacing the illusion of vertical lines is formed by the white space between the characters. These white vertical bars offer resistance to easy scanning of a page of typed material and set up an impedance to fast reading (Figure 2-19).

Proportional spacing overcomes the illusion of these white vertical bars and renders the material easier to read and more attractive to the eye.

Mono-Spacing Operation - Figure 2-20 shows an escapement mechanism for a mono-spacing machine, together with (A) escapement trip lever, (B) slide assembly and (C) escapement rack.

Standard Spacing

Vertical lines are formed by the white spaces between the rows of characters as shown by the ruled lines.

Proportional Spacing

In the proportionally typed page there are no vertical lines to distract the eye of the reader.

Figure 2-19 Example Lines Standard and Proportional

One end of the carriage tension tape (D) is fastened to the escapement rack when the machine is completely assembled which causes a force to be exerted at all times on the rack in the direction shown by the arrow. The escapement rack itself is fastened firmly to the carriage assembly of the machine and meshes with the pinion gear of the escapement pinion and ratchet wheel assembly (E). Therefore, the carriage can only move in direct relation with the escapement rack.

Two escapement shaft bushings (F and G) mounted in the escapement mechanism frame (H) hold the escapement shaft (I). Mounted on the shaft are the escapement pinion and ratchet wheel assembly (E), the escapement wheel - hub and carriage return ratchet assembly (J) and spacer (K).

All of the above are free to rotate on the escapement shaft. The ratchet pawl (150), though, on the carriage return ratchet (149) engages the ratchet wheel of the escapement pinion and ratchet wheel assembly (137) so that the pinion will rotate in one direction without movement of the escapement wheel, but cannot move in the opposite direction without motion of this escapement wheel. The escapement wheel is kept from rotating by the escapement pawl carrier assembly (L).

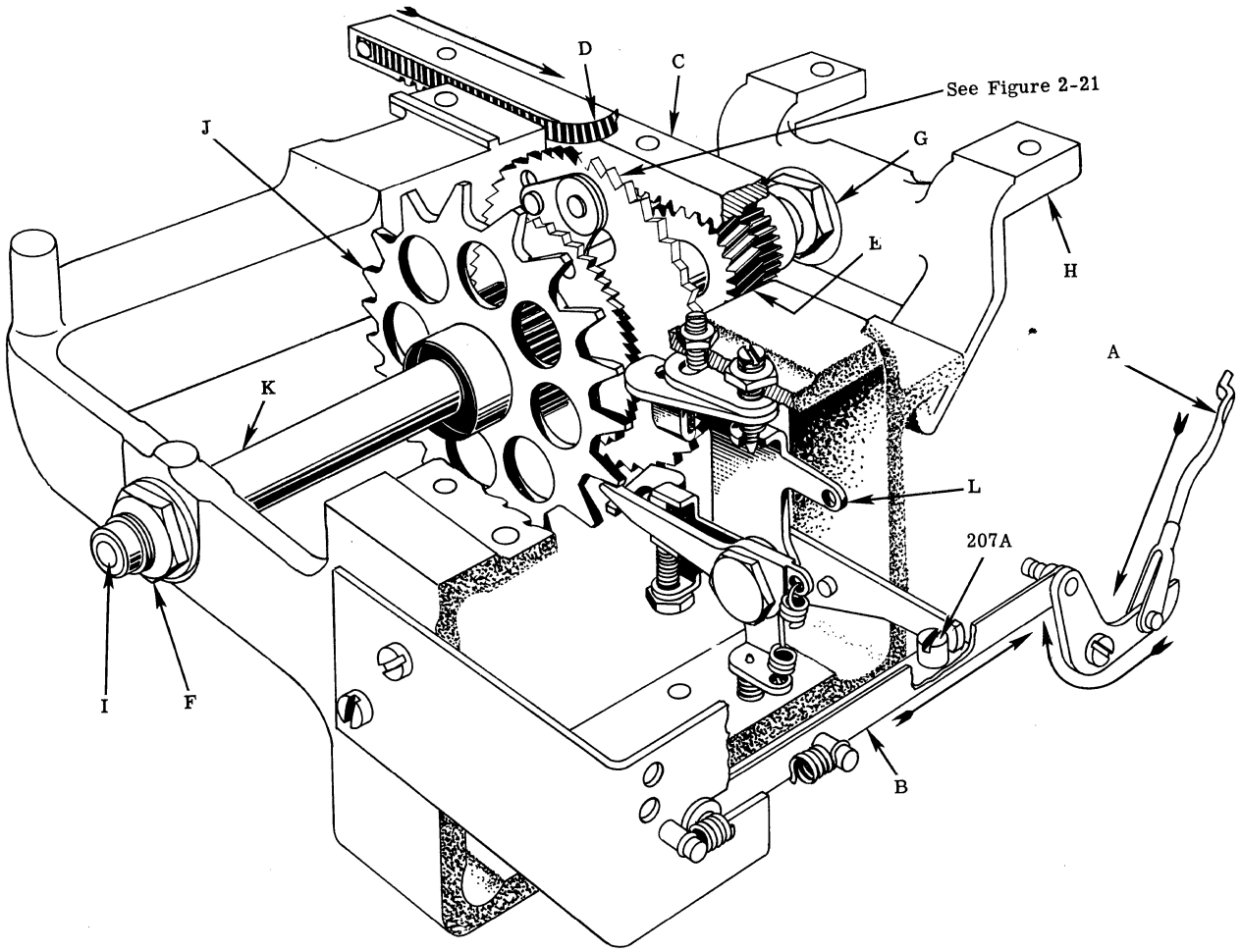


Figure 2-20 Mono-Spacing Escapement

Therefore, carriage movement for type spacing is controlled by rotating the escapement wheel. Figure 2-20 shows the escapement wheel engaged with the escapement pawl of the escapement pawl carrier (L).

Note: For tabular operation (movement of the carriage to the left) the carriage return ratchet pawl (150), is disengaged from the carriage return ratchet wheel (137) (Figure 2-21).

The pawl is also disengaged during carriage return operation and when operating the manual release levers.

The releasing mechanism for disengaging the pawl is explained on page 2-40.

The pawl carrier is designed so that it will move on two pivots and the side motion is limited by two pawl carrier stops. It is moved by the motion of the trip slide. This motion is just enough to allow the pawl (201) to clear the escapement wheel and move to its upper stop (200). The escapement wheel itself is kept from moving while the pawl carrier is operated by a stop (201A), which engages one of the teeth. When the pawl carrier is returned to normal position, one tooth of the escapement wheel engages the pawl itself and moves it to its lower stop. This movement will always be one tooth space movement of the escapement wheel. The movement is then

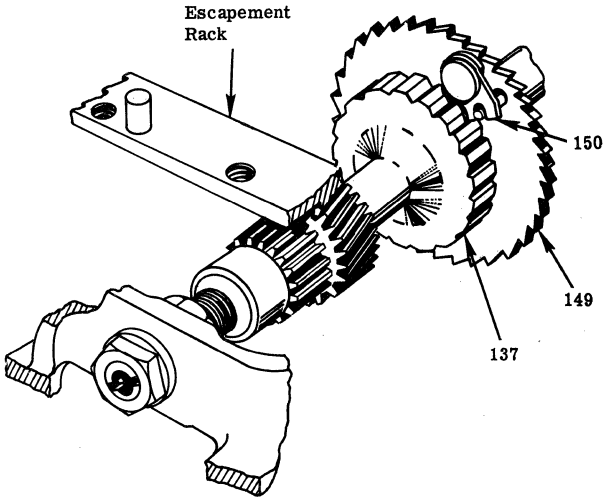


Figure 2-21 Carriage Return Pawl and Ratchet

carried through the assembly to the escapement rack.

Each forward operation of a type bar moves the trip slide link (A) as indicated in Figure 2-20. Trip slide (B) will move in the direction shown and eccentric stud (207A) will move the pawl carrier (195). This will allow the pawl of the pawl carrier to move clear of the escapement wheel (J) and move to its upper stop while the wheel is held by the stop on the pawl carrier frame.

When the type bar returns to rest position, the escapement trip link will return to normal. As it does, it will allow spring (210) to pull the pawl carrier assembly to its normal position. This will allow the pawl to engage the next tooth of the escapement wheel.

Spring tension on the escapement rack (C) in direction shown in Figure 2-20 will cause the pinion (E) to rotate. This will, in turn, cause the escapement wheel (J) to rotate until the pawl reaches its stop.

Figure 2-22 shows a pawl carrier assembly engaged with an escapement wheel. The pawl carrier (195), as stated previously, is mounted in the escapement mechanism with two pivot screws (196).

The non-operated position of the pawl holds the escapement wheel in position regardless of any force tending to rotate in the direction indicated.

The top view of Figure 2-22 shows the pawl carrier pivoted and the pawl carrier frame stop has engaged the same tooth of the escapement wheel, thus preventing the wheel from rotating. It has, however, released the pawl (201) which is pivoted on stud (198) and under tension of spring (199). The tension of spring (199) will move the pawl to the upper stop (200).

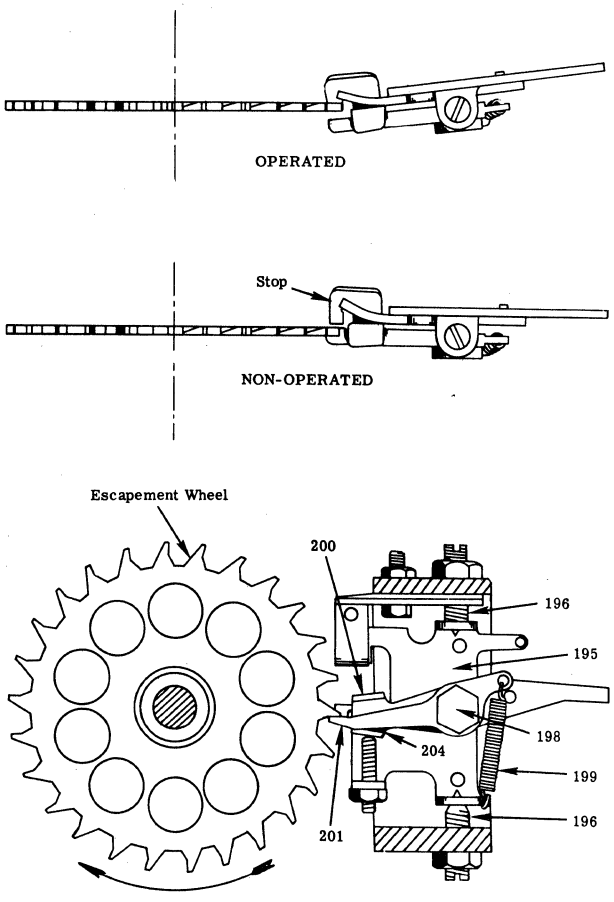


Figure 2-22 Pawl Carrier

As the carrier assembly returns to its normal position, the inclined holding edge (the stop) of the carrier frame slides out of the tooth, releasing the escapement wheel. At this point, however, the escapement pawl will be in a position to engage the following tooth of the wheel.

The carriage tension, which exerts the force on the escapement wheel, will cause rotation of the wheel until the pawl strikes the bottom stop (204) where it is held.

Each operation of the escapement pawl allows the wheel to rotate one tooth, therefore, the amount of escapement will depend upon the spacing of the teeth on the escapement wheel.

Proportional Spacing Operation

(See Figure 2-23.)

The President Model Flexowriters and all Justowriters have proportional spacing escapements. This mechanism has three differentially connected escapement wheels and can be used in combinations to provide from one to five units of spacing (one unit equals 1/32″).

The selection of the proper combinations of operations of the three escapement wheels is made for each character by three magnets LE1, LE2 and LE3, which are under control of the selector contacts (see Section 8, Escapement Circuits). Three contacts (SE7, SE8 and SE9) on the selector unit control the lower case spacing, while three other contacts (SE10, SE11 and SE12) on the selector, control the upper case spacing. A double set of transfer contacts (CSC, case shift contacts) which is operated by the shifting movement of the basket, selects either the lower case contacts or the upper case contacts, depending on the position of the type basket.

Each magnet armature is connected to the pawl carrier trip arm by an adjustable link. When a magnet is energized, the pawl trip arm is pulled down in the path of a corresponding eccentric stud (207A) which is mounted on the trip slide (207B). As stated previously, the movement of the trip slide moves the pawl carrier, which in turn, allows one tooth rotation of the escapement wheel.

The frame (127) which is the same as used on the standard escapement, supports the three escapement wheels (130, 131 and 132). These escapement wheels are rotatably mounted on a shaft (133).

The carriage is under tension in the same manner as in the standard model. That is, the main spring drum tension is carried through the carriage tension tape. The tension tape in turn, is fastened to the right hand end of the escapement rack (138). The escapement rack, mounted to the under side of the carriage, meshes with the drive pinion (136). The drive pinion (136) is a part of the carriage return ratchet (137). Thus, the tension of the main spring drum tends to rotate the ratchet (137). The ratchets 137 and 149 are normally connected for driving purposes by means of a carriage return pawl (150) which is mounted to ratchet 149. The ratchet 149 is attached to the pinion 147 and therefore the tension of the main spring will be transmitted through the gears mentioned to the three escapement wheels via the intermeshing pinions (140, 141, 143, 144 and 145). The escapement wheels, however, are normally prevented from rotating by their respective pawl carriers (in the same manner as explained for the standard escapement).

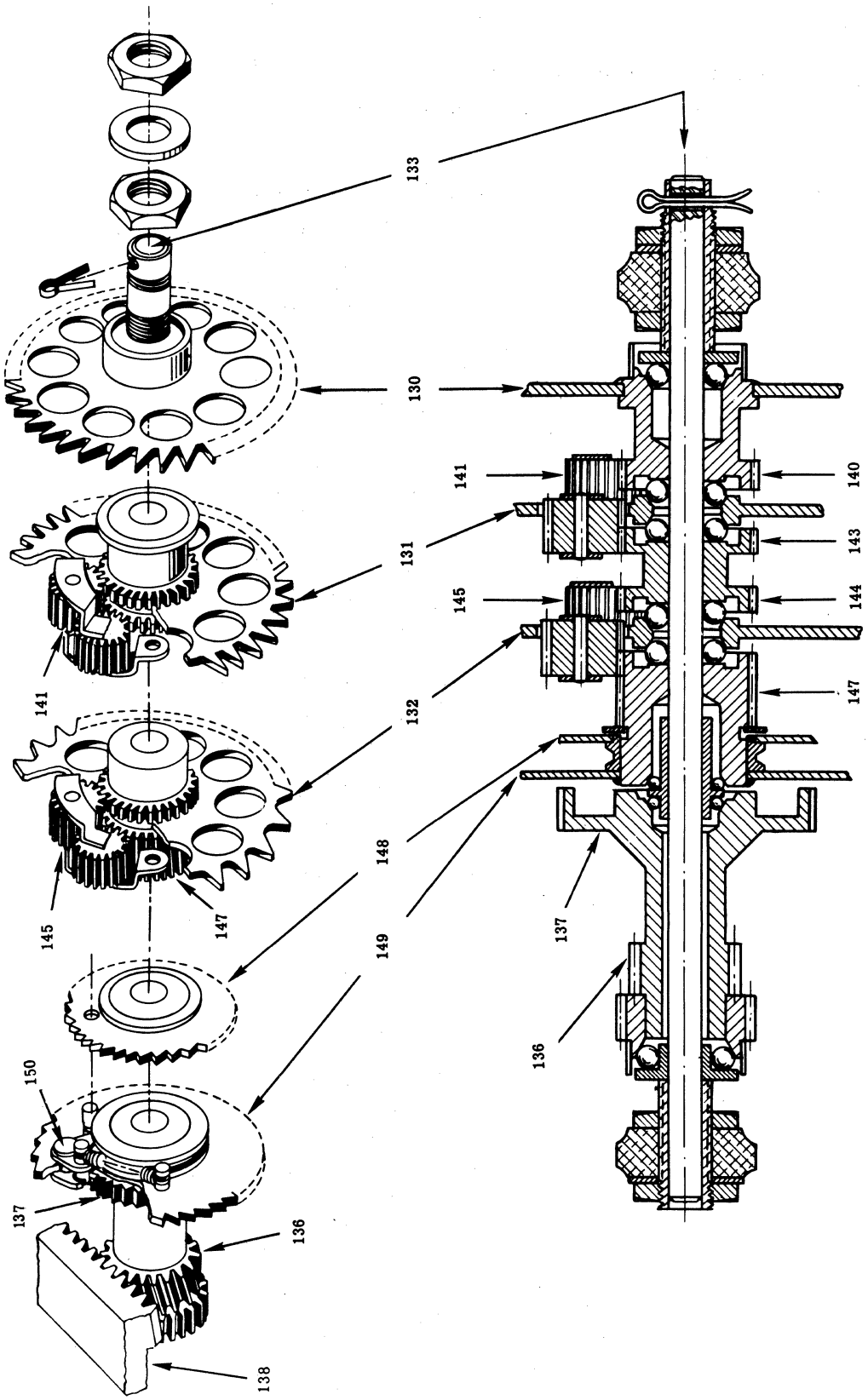


Figure 2-23 PSM Escapement

Reverse rotation of the ratchet 149 and pinion 147 is prevented by means of a detent pawl assembly which is explained on page 2-46.

The escapement wheels 130 and 131 have 54 teeth, while the escapement wheel 132 has 36 teeth. Therefore, the amount of movement transmitted to the carriage may be varied. The escapement wheel 131 rotates in a direction opposite to the wheels 130 and 132 due to the method of interconnecting the wheels by means of the intermeshing pinions.

For an example escapement operation, assume that only the 132 escapement wheel was allowed to rotate one tooth space while the 130 and 131 wheels were held by their respective pawl carrier assemblies. This would allow one of the pinions 145 to roll around pinion 144 (pinion 144 is locked against rotation). The companion pinion 145 will therefore allow pinion 147 to rotate in the same direction as the escapement wheel 132, but pinion 147 will rotate twice as much as wheel 132.

If escapement wheels 130 and 132 were locked against rotation and wheel 131 was allowed to rotate one tooth space, one of the pinions 141 will roll around the pinion 140 and cause pinions 143 and 144 to be rotated. The rotation of pinion 144 is transmitted to pinion 147 via intermeshing pinions 145. Pinion 147 will rotate twice as much as escapement wheel 131.

In still another operation, if wheels 131 and 132 are held against rotation and wheel 130 rotates, the same amount of movement will be transmitted from wheel 130 to pinion 147 through the pinions 141, 143, 144 and 145 acting as idlers.

Due to the fact that wheel 130 has 54 teeth, the pinions 147 and 136 will be rotated 1/54th of a revolution for each tooth space rotation of wheel 130. Wheel 131 has 54 teeth also, but due to a 1:2 ratio between wheel 131 and pinion 147, the pinions 147 and 136 will be rotated 1/27th of a revolution for each tooth space rotation of wheel 131. Likewise, the escapement wheel 132, having 36 teeth, pinions 147 and 136 will be rotated 1/18th of a revolution for each tooth space rotation of wheel 132. Therefore, it is apparent that the movements of pinions 147 and 136 produced by the escapement wheels (130, 131 and 132) are so designed and the spacing of the escapement wheel teeth so selected that carriage movement will result as follows:

One tooth rotation of wheel 130 - one unit (1/32″) of spacing of carriage.

One tooth rotation of wheel 131 - two units (2/32″) of spacing of carriage.

One tooth rotation of wheel 132 - three units (3/32″) of spacing of carriage.

One tooth rotation of wheels 130 and 132 - four units (4/32″) of spacing of carriage.

One tooth rotation of wheels 131 and 132 - five units (5/32″) of spacing of carriage.

Therefore, it is possible to obtain five different spacings of the carriage which can be accommodated to the different widths of the characters used.

Adjustment

Pawl Carrier Stops - Adjust the front stops for all pawl carriers so that it positions the escapement pawl flush with the front surface of the escapement wheel (see Figure 2-24). The rear stop should be adjusted to limit the travel of the pawl carrier to a position where there is .030″ clearance between the front surface of the pawl and the rear surface of the escapement wheel (Figure 2-25). (Move the pawl carrier by hand.)

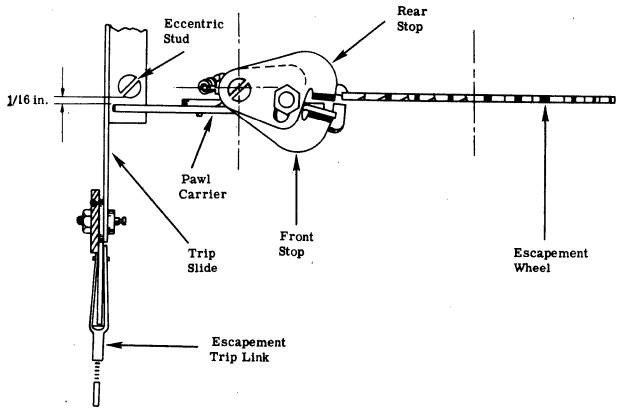


Figure 2-24 Front Stop Adjustment

Escapement Trip Slide - Turn the eccentric studs to approximately midposition (toward the escapement mechanism). Adjust the link connecting segment universal bar to escapement trip slide so that the pivoted arms on the pawl carriers, when moved downwardly, will clear eccentric stud by approximately 1/16". (Figure 2-24)

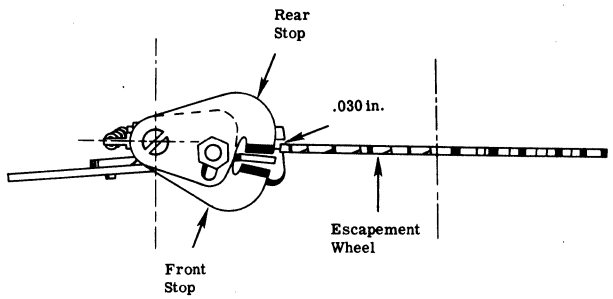


Figure 2-25 Rear Stop Adjustment

Note: On Elite and Pica machines, the "pivoted arm" referred to above is stationary but is adjusted to 1/16" also.

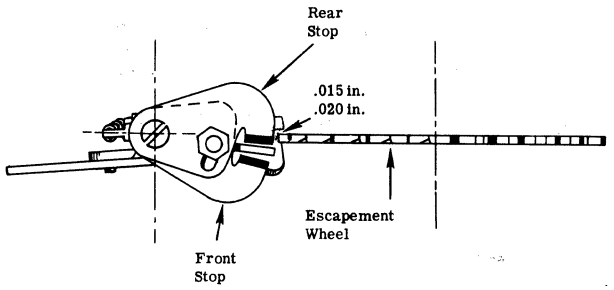


Figure 2-26 Pawl Clearance Adjustment

Hold a type bar in the printing position against the ring. Adjust each eccentric stud to move its associated pawl carrier so there is .015" to .020" clearance between the front surface of the pawl and the rear surface of the escapement wheel. With the pawl carrier adjusted to this clearance, check to see that there is an additional .010" clearance between the pawl carrier and the rear pawl carrier stop. (Figure 2-26)

Magnet and Linkage Adjustment - In PSM machines, check to see that there is .028" air gap between the armature and coil with stop screw against its stop. Adjust each link between the pivoted pawl carrier arm and armature so that with the armature in normal position against its stop screw, the pawl carrier arms are 1/16" above the tops of their associated eccentric pins. (Figure 2-27)

Removal - The escapement pawl carriers can be removed as an assembly by first disconnecting the springs and links and then backing away the upper cone screws only. The lower screw must be left in place so as to locate the new unit in its

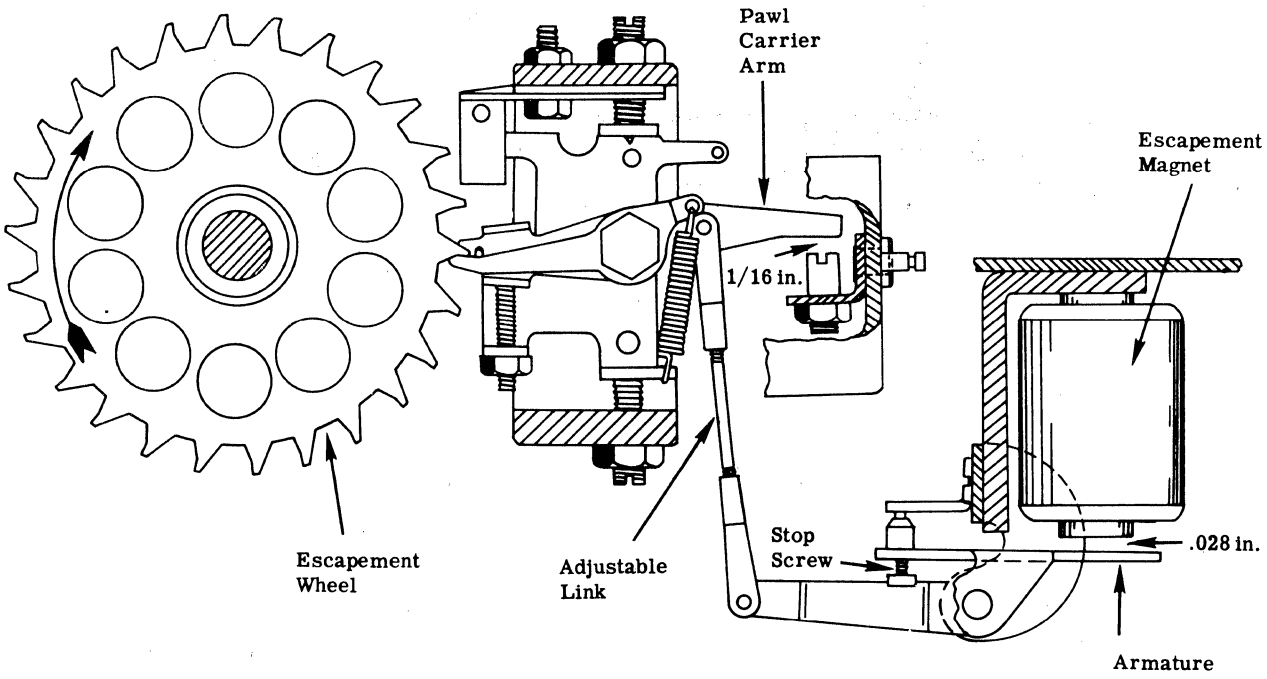


Figure 2-27 Magnet Armature Gap and Arm Adjustment

proper position.

If it is necessary to remove the complete escapement mechanism, the carriage assembly will have to be removed first. (See Carriage and Rails Removal.)

After the carriage and rails has been removed, the escapement mechanism may be removed by removing two mounting screws from the front rail and two from the rear rail.

Identify the position of the trucks for exact replacement.

When the new escapement is assembled to the rails and the carriage and rails is again mounted to the Writing Machine (see page 2-21 for assembly procedure), it will be necessary to adjust the escapement rack.

Escapement Rack (Figure 2-28) - The escapement rack is attached to the carriage by adjustable screws. The adjusting screws act as adjustable spacers by means of which the escapement rack can be set to have correct clearance with the escapement pinion.

By correct clearance is meant that there must be sufficient clearance between the rack and pinion so there will not be interference to cause a bind in the carriage and still the clearance must be kept to a minimum to prevent back lash in the gear teeth.

When testing for proper clearance, move the carriage to the right until stopped by the margin stop. Hold the carriage firmly against the stop with the carriage release lever held down. Test the back lash in the escapement pinion ratchet wheel by trying its movement with a feeler such as a thin screwdriver or rod.

Move the carriage $1\frac{1}{2}$ to two inches to the left, move the margin stop to the right and check for clearance at this position. Test for back lash

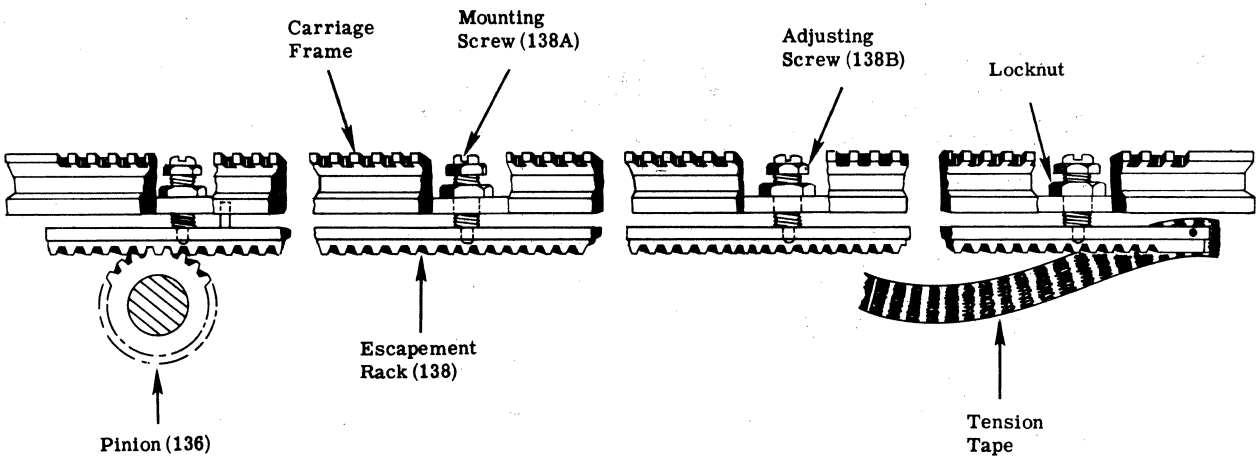


Figure 2-28 Escapement Rack

over the entire carriage length. There must be a slight movement in the escapement pinion ratchet wheel.

When adjusting for proper clearance, loosen the mounting screws and lock nuts. Turn the adjusting screws up or down to obtain the proper clearance.

This adjustment must be made carefully, a slight bind here will cause the characters to pile.

When removing or replacing the escapement rack, remove the mounting screws and back the adjusting screws until they are flush with the carriage frame.

CARRIAGE RETURN

Operation - The operation of the carriage return key lever returns the carriage to the left hand margin. This operation also indexes the platen.

The carriage return is accomplished by the use of a clutch which winds up the carriage return tape (120). This tape is connected to the carriage at the line space hook lever (121), causing it to operate and index the platen before pulling the carriage to the right.

When the carriage return key lever is depressed, the carriage return cam is released and engages the power roll. A downward pull is exerted on link (218) (Figure 2-29). This motion is transferred to lever (214), causing it to move downward, contacting lever (215) which will be rotated counter-clockwise on its pivot (212). This will rotate its opposite end (213) upward, locking the toggle (consisting of 209, 210 and 213). A tension will be exerted on spring (207) which will hold the toggle in the locked position. The motion of arm (209) will bring it in contact with adjusting screw (206), causing arm (208) to be rotated clockwise on its pivot (204), exerting a pressure at point 201. This will be carried through the spider spring (199A) to the clutch plate (199) and friction disc (197). The friction disc is constantly rotating, being driven by a shaft (195) extending from the power roll. When the clutch plate (199) engages the friction disc, the plate will rotate and, due to the pins on the plate engaging the clutch pulley, the pulley will rotate also. The carriage return tape, being attached to the pulley, will be wound up, pulling the carriage to the right.

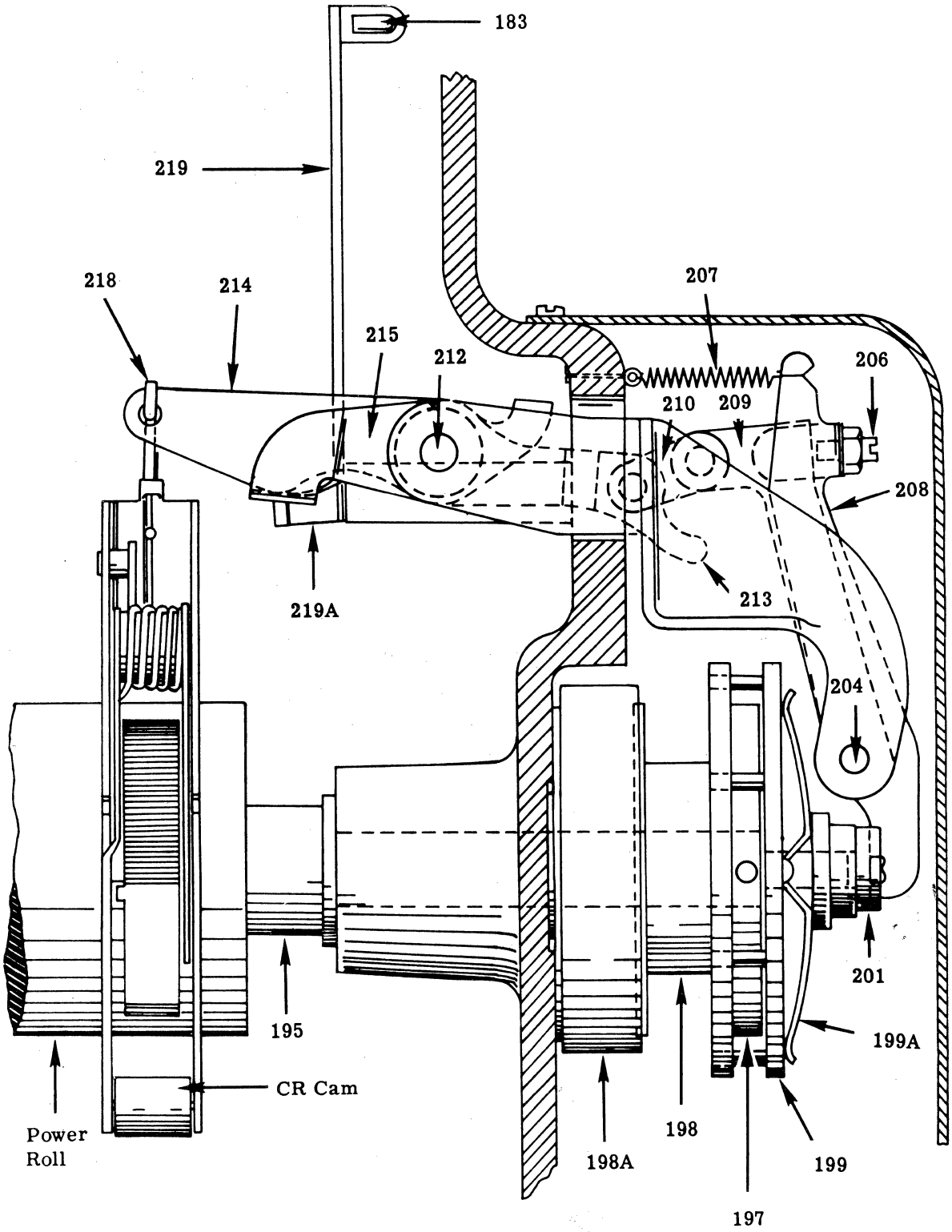


Figure 2-29 Carriage Return Clutch

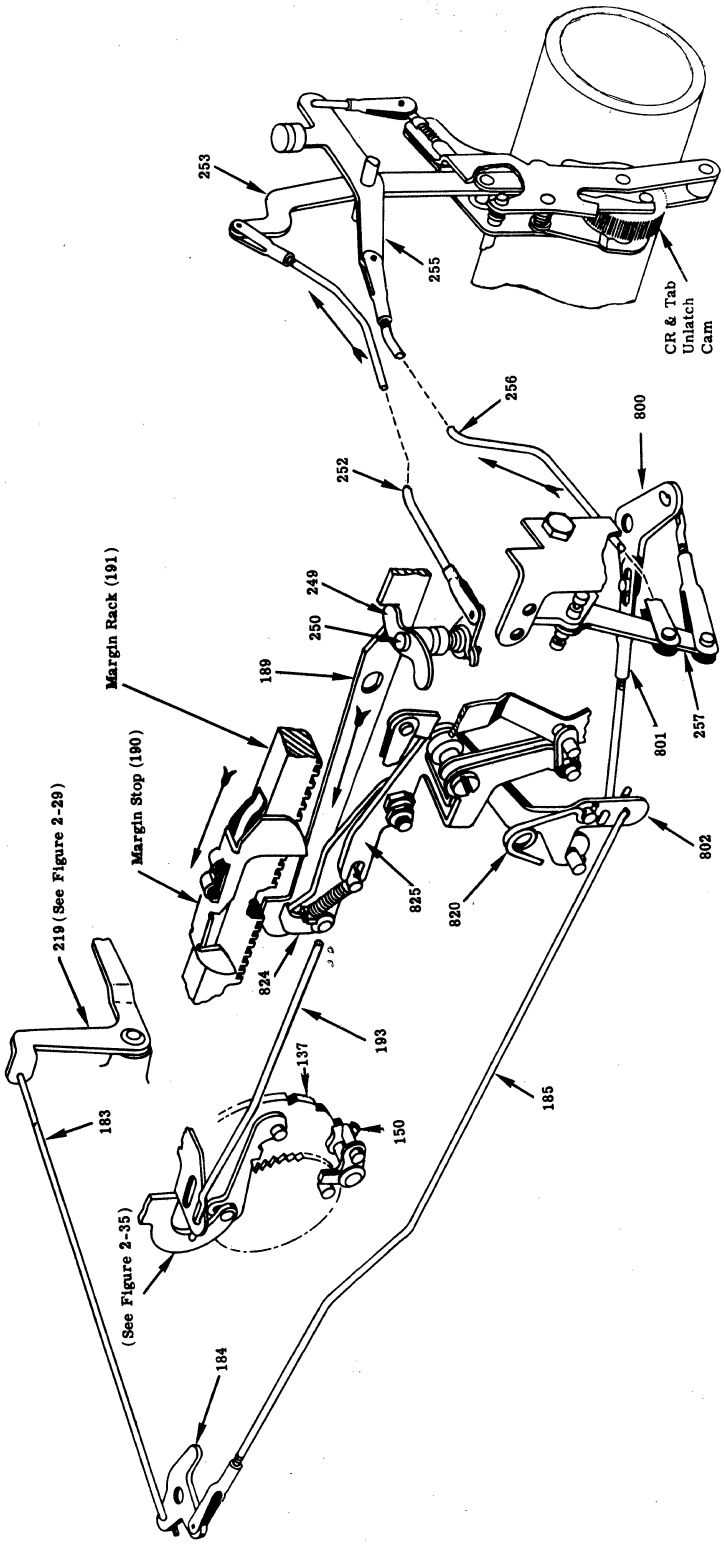


Figure 2-30 CR Linkage

The clutch pulley spring (198A) exerts a pressure against the pulley rotation, which holds the carriage return tape (120) taut when the clutch is non-operative.

The motion of arm (215) not only operates the toggle but also moves 219A downward on its pivot. This moves the side toggle lever (219) and link (183) forward. The motion of link (183) will rotate the intermediate bell crank (184). This position will be held due to the clutch toggle action explained above.

The motion of bell crank (184) will pull link (185), which will pull lever (802). Lever (802) will move the slotted link (801). The slotted link (801) will not move far enough to rotate the bell crank (800). (See Figure 2-30).

The pull of link 185 on lever 802 will also pivot the carriage return bail stop arm (825) upward. This motion does not have any effect on operation except when the carriage is at the left hand margin and a line space operation is necessary. At this position the upward movement of arm 825 will carry the bail 824 up and in contact with the lower surface of the margin stop (190). The upward push of bail 824 against stop 190 will cause a back pressure to and contract spring 820. This back pressure will overcome tension of spring 207 (toggle spring - Figure 2-29), thus, the clutch toggle will drop out after the CR cam has rotated past its high lobe.

The motion of the carriage, due to the clutch winding the carriage return tape (120), will move the margin rack in the direction indicated (Figure 2-30). The margin stop (190) will strike the margin release lever (189) and move it in the same direction as the margin rack. This movement of the margin release lever will, in turn, rotate cam operating lever (249), which pivots at point 250, and pull on link 252, cam release link (253), releasing CR and tab unlatch cam. The unlatch cam will engage the power roll and rotate bell crank (800) through links 255, 256 and lever 257. The motion of bell crank (800) will have a backward pull on link 801, lever 802, link 185, link 183 and lever 219. This backward pull will unlock the clutch toggle, releasing the pull on the carriage return tape.

Removal of Clutch Mechanism (Figure 2-31).

1. Remove the right side cover.
2. Remove the spring (207) from toggle arm.
3. Remove the carriage return tape (120) from the pulley by removing the screw which holds it (be sure to hold pulley in position when tape is removed). Let pulley revolve slowly to remove spring tension.
4. Unhook the link on CR cam. Remove the two clutch toggle mounting screws and remove clutch toggle.
5. Remove thrust bushing (201), clutch plate (199), friction disc (197) and key way pin.
6. Slide pulley toward end of shaft and guide spring out of pulley slot (to prevent spring from being unwound). The pulley can be removed from the end of shaft after the spring has been released. Remove the spring.

Assembly and Adjustment -

1. Install spring.

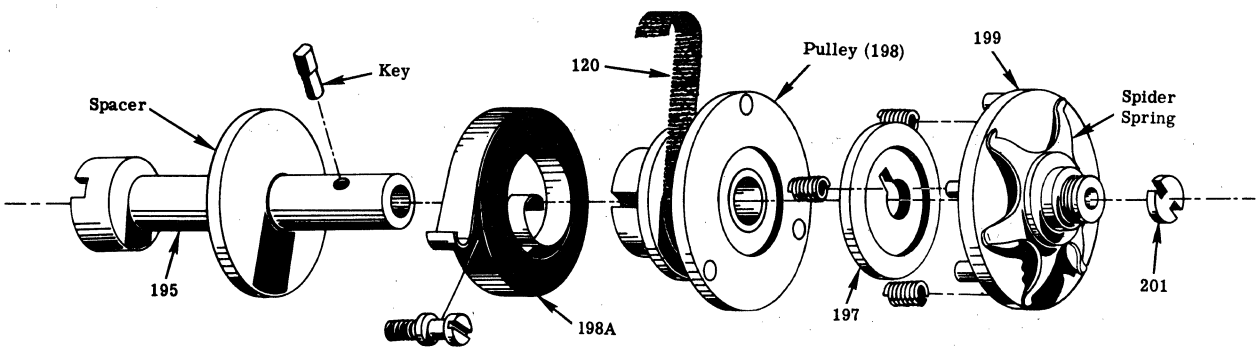


Figure 2-31 CR Clutch Parts

2. Slide pulley on shaft and engage end of spring.
3. Insert key way pin in shaft. Slide friction disc on shaft.
4. Slide clutch plate into position on shaft.
5. Start toggle screws into position (do not tighten).
6. Insert thrust bushing.
7. Position clutch toggle arm in proper location and hold while tightening two screws.
8. Replace spring on clutch toggle arm.
9. Using hole as a guide, wind up pulley as far as possible and release five turns. Fasten carriage return tape to pulley.
10. Disconnect the following links: pawl release link (193), link 185 and link 801.
11. Adjust the carriage return cam (see Cam Adjustments) to lock the clutch toggle, but not have the cam choke off when at its high point of operation (turn the power roll over by hand).
12. Adjust the clutch toggle screw (206) to provide .005" - .007" clearance between the friction disc and the clutch plate. (Check the clearance between the thrust bushing and the hub of the clutch plate.)
13. Adjust the clutch spider spring to give a pull on the carriage of 7 - 8 lbs. with the clutch locked and slipping. (Use pull scale T62617. Hook scale to left hand carriage frame and apply a fifteen pound pull. With power "On", depress the carriage return key lever.)

For further carriage return adjustment, see "Complete Carriage Return and Tab Adjustment".

LINE SPACE MECHANISM

Operation - The initial pull on the carriage return tape (120) operates the platen indexing mechanism through the medium of the hook lever assembly (121) and the index pawl carrier assembly (105) to cause the pawl to enter a platen ratchet tooth and rotate the platen (Figure 2-32). Provision is made for spacing different numbers of ratchet teeth with each operation of the line space mechanism by changing the position of the line space lever (113) to vary the position of the index pawl (103) and allow it to enter the ratchet (102) at a different point. An adjustable stop (103C) is provided to prevent overthrow.

Adjustment - The index pawl carrier (105) may

MANUAL ADDENDUM

Date: July 13, 1956

Reference: To be inserted in Part II, Section 2, between Pages 2-36 and 2-37.

Purpose: More positive CR adjustment.

Information:

Part II, Section 2, Page 2-36

Under:

12. Adjust the clutch toggle screw (206) to provide .005" to .007" clearance between the friction disc and the clutch plate. (Check the clearance between the thrust bushing and the hub of the clutch plate.)

Change:

.005" - .007"

To Read:

.005" plus or minus .002"

Note:

See Technical News - Issue #5 dated July 16, 1956 for further CR adjustment information.

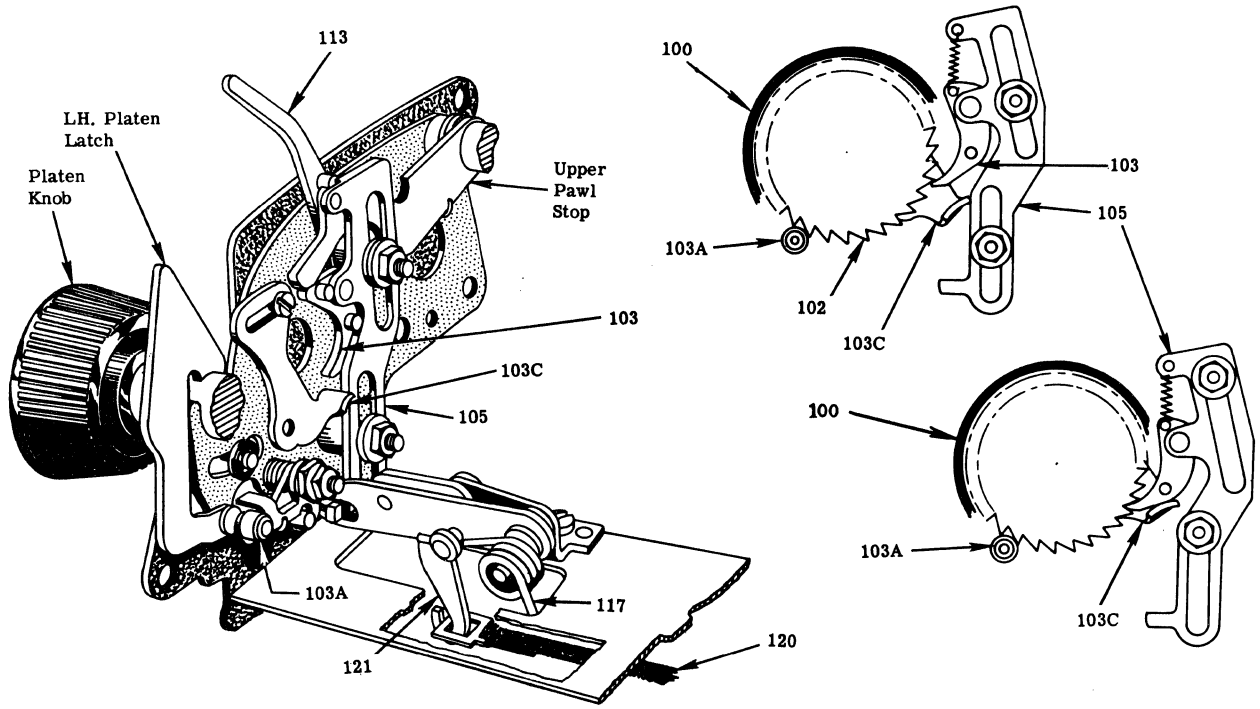


Figure 2-32 Line Space Mechanism

be removed by removing the two small nuts and washers which retain the carrier on mounting studs. In replacing the washers, the burr side of the washers should be mounted away from the carrier so as to permit the carrier to travel freely without the possibility of binding on the washers. The hook lever spring (117) should be formed so that it will positively restore the carrier up to the upper stop in the highest line space setting, but will not be too strong so that it causes the carriage return tape to whip excessively.

The platen detent arm (103A) should be adjusted, by means of the eccentric nut on which it is mounted, so that the index pawl (103) may enter the ratchet (102) one-third of the distance down on a tooth. The platen (100) must be removed to make the adjustment. The high point of the eccentric nut should be kept in the upper half of its circle.

The lower index pawl stop (103C) must be adjusted after any change in the detent adjustment, so that it stops the travel of the index pawl carrier at the same instant when the ratchet has positioned itself securely on the detent roller with no play forward or backward. Adjust the lower index pawl stop (103C) with the platen installed, by loosening the locking screw and moving the stop bracket. Lock the screw and check the adjustment by moving the carriage to the extreme left and operating the line space mechanism by hand. A sharp pull on the carriage return tape will actuate the index pawl and rotate the platen. Hold the pawl carrier down with the tape and try to rotate the platen with the left hand platen knob. Any play that is felt should be removed by further adjustment of the lower pawl stop.

TABULAR MECHANISM

Purpose - The tabular mechanism is a device to permit the operator to place typing in accurate

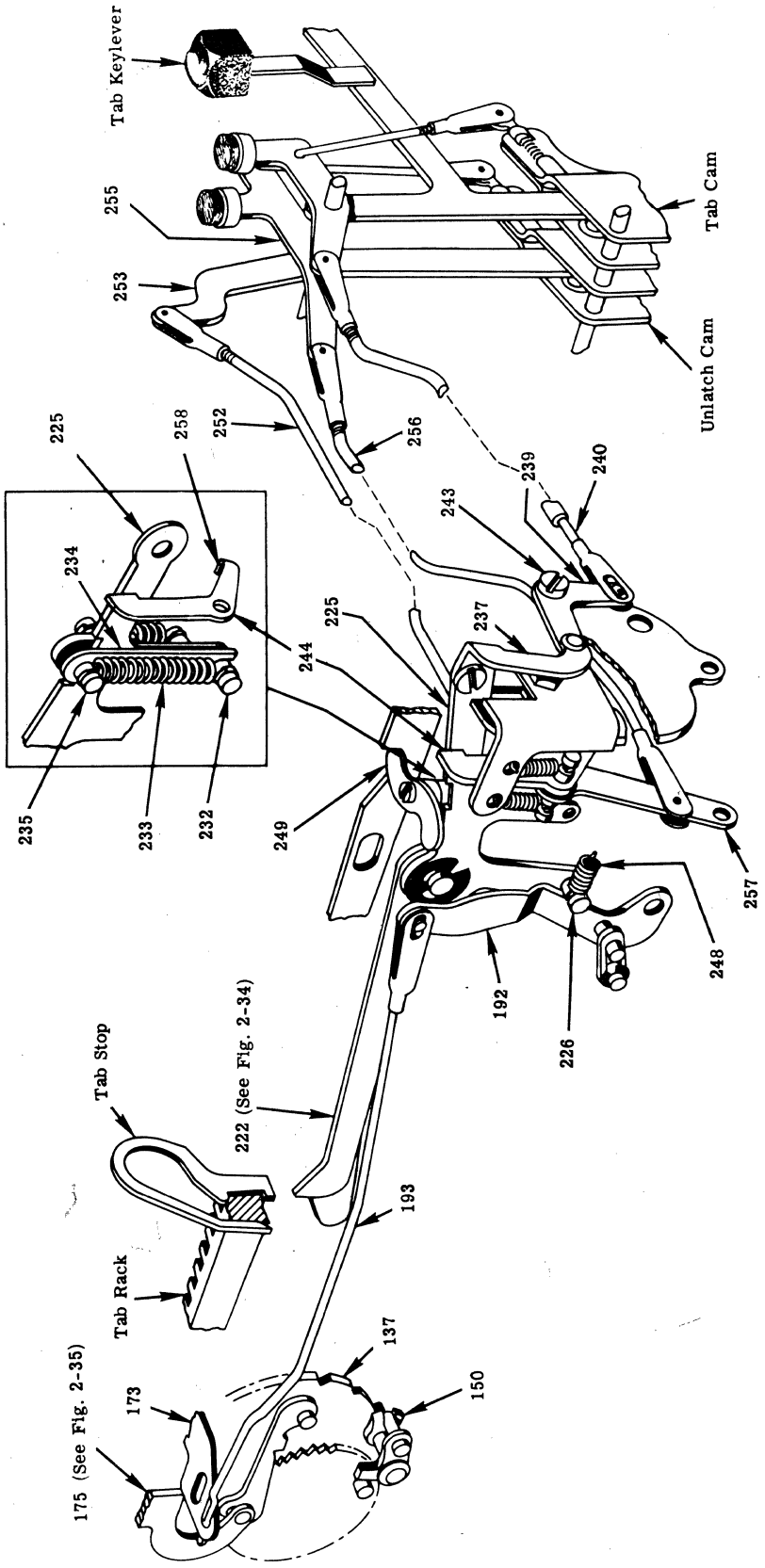


Figure 2-33 Tabular Cam Linkage

orderly columns at a minimum of two spaces between columns for Pica and Elite machines, and four units for PSM machines.

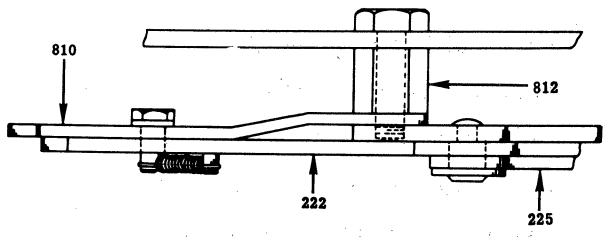
Operation - When the tabular key lever is depressed, the tab cam is released, engaging the power roll. Leverage developed by this engagement is transmitted by linkage (240) to the left of the rear rail where it pulls on lever (239) which pivots on stud (243) which, in turn, pulls downward on link 237 (Figure 2-33). Link 237 is fastened to tab operating lever (225), which will transmit the motion to the tab lever (222). This is accomplished by a short downward extension arm (on lever 225), provided with a pin (232) connected by a spring (233) to a pin (235) on the tab lever (222). A guard plate (234) is loosely pivoted on the pin (235) and slotted to embrace the pin (232) and is placed between the extension of the arm (225) and the spring (233). Opposite the front or upper face of the tab lever (222), there is provided a similar spring which, with spring 233, causes levers 222 and 225 to normally move in unison. When the striking edge of the tab lever (222) hits the tab stop (224), the spring (233) stretches and prevents damage to the parts.

Also, when the arm (225) is rocked clockwise, the pin (226) engages the arm (192), causing it to rock counterclockwise, thereby pushing the link (193) to the left and operating the arm (173). The arm 173, in turn, operates the arm 175, which will disengage the pinion from the escapement mechanism. This will allow the carriage to move freely under the tension of the main spring.

The tab lever is held in the operated position by means of a latch (244) (Figure 2-33). When the tab operating arm (225) is pulled downward, the latch (244) snaps over the upper edge of the lever (225) and prevents it (and the tab lever) from returning to the normal position. Spring (248) tends to restore the levers (222 and 225) as a unit to the normal position, but the latch (244) prevents this from taking place.

When the tab lever strikes the tab stop, a tab lever unlatching operation takes place. This will unlock the tab lever and allow the carriage return pawl to engage the pinion, holding the carriage in that particular tab position. This is accomplished due to the fact that the tab lever (222) is slotted horizontally at the point where the stud (220) passes through. Therefore, when the tab lever strikes a stop, the tab lever moves to the right, pushing against cam operating lever (249) and rocking it in a counterclockwise direction. This causes the arm (251) to be similarly rotated, thereby pushing the link (252) to the right (Figure 2-33), thus rocking the trip lever (253), for the unlatch cam, in a clockwise direction. This will allow the unlatch cam to engage the power roll. The resultant movement of the cam will rock the lever (255) in a clockwise direction, drawing the link (256) to the right (Figure 2-33) rocking arm 257 in a counterclockwise direction. The lug (258) will rock the latch (244) to disengage it from the tab operating lever (225). Thus, the spring tension of spring 248 will disengage the tab lever (222) from the tab stop, and return to the non-operate position.

A rebound check lever (810) is employed when tabulating in order to keep carriage rebound to a minimum. (See Figure 2-34.) As the tab lever (point 223) engages the tab stop (224), the hooked portion (814) of check lever (810) rides under and behind the tab stop (224). This means that the upturned end (223) of the tab lever (222) engages



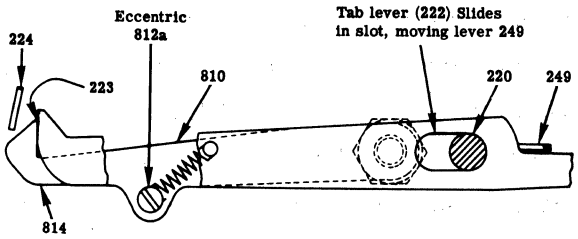


Figure 2-34 Tabular Lever and Rebound Check

one face of the stop (224), while the hooked end (814) of check lever (810) engages the opposite face. Therefore, carriage rebound is effectively minimized during tab operation.

Adjustments - See Complete Carriage Return and Tab Adjustments.

TABULAR GOVERNOR

Purpose and Operation - The purpose of the governor is to retard the motion of the carriage during tabulation. The governor is of the centrifugal type, the braking action increasing as the speed of the carriage tends to increase.

The governor is driven from a gear on the escapement pinion through an idle gear (the large gear) which engages a small gear on the governor.

When the carriage is moved to the right such as return of the carriage, the governor is turned backward and does not set up enough friction to interfere.

Removal - The governor can be removed by removing two screws and two spacers which mounts the governor assembly to the rear of the power frame.

When replacing a governor, adjust the governor bracket to a position where the idle gear meshes loosely with the driving gear. Be sure there is some backlash in this gear train so as not to cause a bind.

COMPLETE TAB AND CR ADJUSTMENTS

Carriage Return Pawl Operating Mechanism - To release the carriage for movement to the left such as tabulating or movement by hand, it is necessary to raise the carriage return pawl (150). When the carriage return is operated, the carriage return pawl (150) is raised to prevent its dragging on the escapement pinion ratchet wheel.

The carriage release pawl lever can be operated in three ways; by the carriage release levers for moving the carriage by hand, by the toggle knockout linkage for carriage return, and by the tabular pawl release (192).

The release ratchet (148) revolves with the carriage return ratchet assembly (149). The release ratchet also can move relative to the return ratchet assembly, and it is this relative movement which raises the carriage return pawl (150).

This movement is brought about by the carriage release pawl (177) engaging the release ratchet (148) as shown in Figure 2-35.

When adjusting the release pawl bracket assembly (174) it must be adjusted so the carriage release pawl (177) properly engages the release ratchet. To watch the pawl engage the ratchet it is necessary to line up the holes in the three escapement wheels (PSM) by operating the pawl

#9

Friden — *Customer Service Engineering*

MANUAL ADDENDUM

Date: March 8, 1956

Reference: To be inserted in Part II, Section 2, between Pages 2-40 and 2-41.

Purpose: To help eliminate tab failures

Information:

Part II, Section 2, Page 2-41

Under:

4. Adjust the latch (244) vertically so that when the tab lever is operated and latched, it will be .015'' to .025'' below the tab rack at both ends.

Change:

.015'' to .025''

To Read:

.020'' to .025''

Part II, Section 2, Page 2-42, Figure 2-36

Under:

Adj. No. 4

Change:

.015'' to .025'' dimension

To Read:

.020'' to .025''

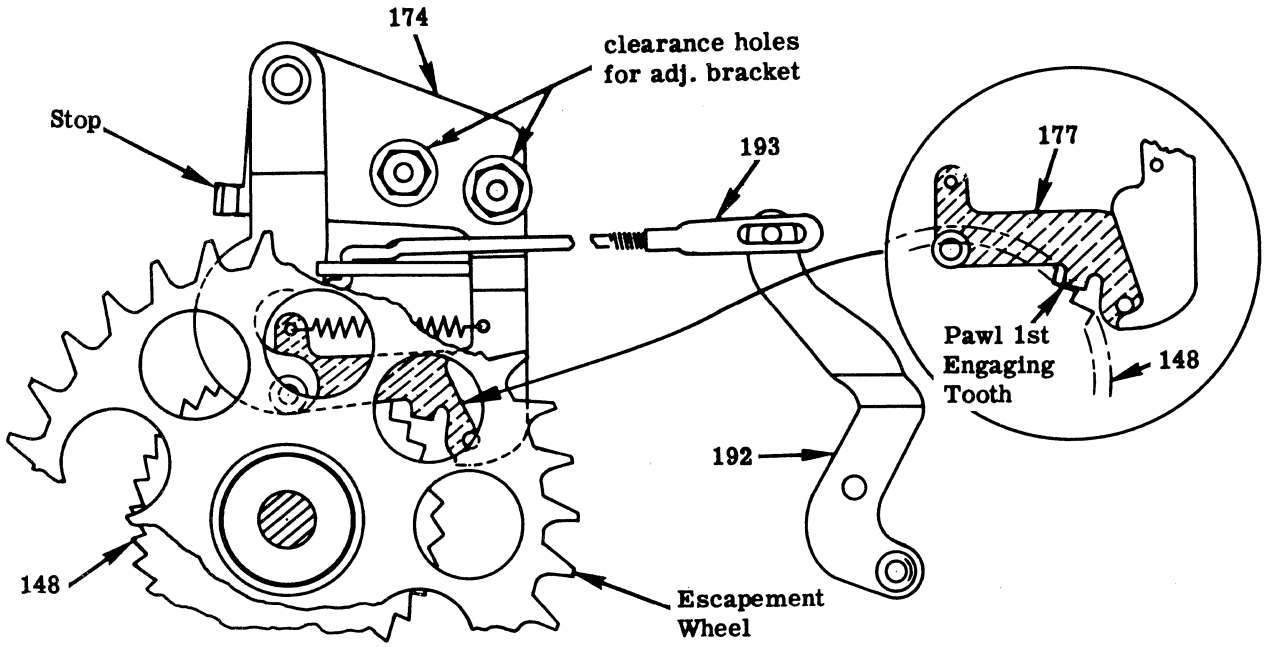


Figure 2-35 Carriage Return Pawl - Operating Mechanism

carriers of the escapements by hand. The release pawl must be clear of the teeth when in its normal position. When operated, it should engage a tooth as shown in Figure 2-35.

To obtain this adjustment, loosen the two nuts and position the bracket assembly (174) until the proper position is found.

Check the Detent Pawl Adjustment (see page 2-46).

Combined Tab and CR Adjustments -

1. Check adjustments ten through thirteen of Carriage Return - Assembly and Adjustments.
2. Adjust the unlatching operating link (256), from the carriage return and tab unlatch cam, so that when the cam is at its maximum operating position (high lobe of cam), the latch (244) will have moved .015" minimum clear of the tab operating lever (225). Make sure the latch (244) does not choke off on the spring bracket (247) (Figure 2-36).
3. Adjust the unlatching trip link (252) to trip the carriage return and tab unlatch cam .015" distance before the end of the horizontal sliding motion of the margin release lever (189) (Figure 2-36).

Note: Make sure that both links (252 and 256) are free of binds.

4. Adjust the latch (244) vertically so that when the tab lever is operated and latched, it will be .015" to .025" below the tab rack at both ends. Adjust the tab operating link (240) to pull the tab lever .005" below the latch to insure positive locking (Figure 2-36).
5. Adjust the pawl release link (193) (with the tab latched) so that the carriage return pawl (150) is 1/32" distance away from the pinion gear (137). Also, with the tab latched, the

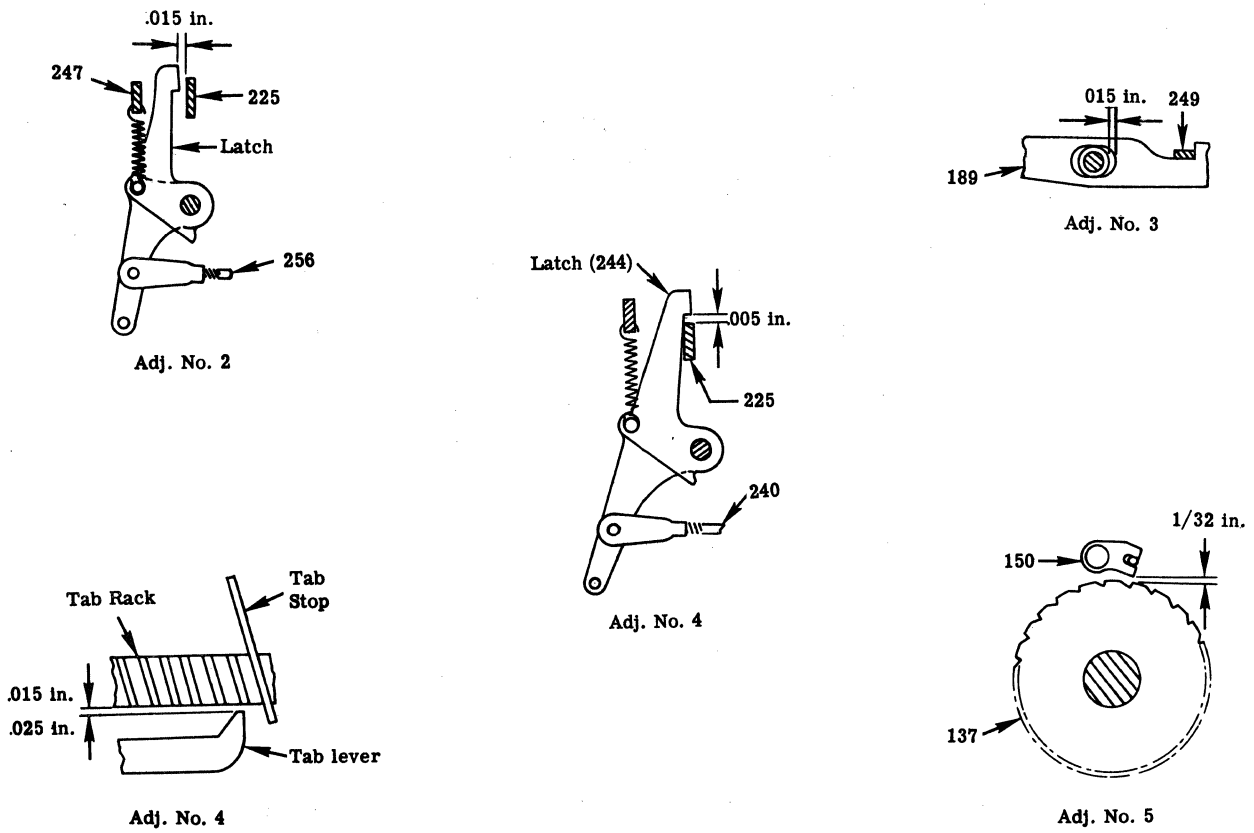


Figure 2-36 CR and Tab Adjustments

pawl release link (193) must have 3/32″ movement before choking off (Figure 2-36).

6. Adjust the toggle knockout link (185) so that the carriage return pawl (150) is approximately 1/32″ distance away from the pinion gear (137) with the clutch toggle locked. (To lock toggle, depress carriage return key lever and turn off the power switch.) Also, with the toggle locked up, the pawl release link (193) must have 3/32″ movement before choking off.
7. The washers on the ends of the margin rack should be adjusted so that the carriage return pawl (150) is allowed to come safely out of the escapement pinion wheel when either carriage release lever is pressed down.

Note: If the above adjustments, number five, six and seven cannot be obtained it is because the release pawl bracket assembly (174) has not been correctly positioned.

8. With carriage return clutch toggle locked up, adjust the eccentric (see Figure 2-30) so that the carriage return bail stop arm (824) does not hit the margin rack. Release the carriage return clutch toggle and move the carriage to the left hand margin. Check to see that the carriage return clutch toggle does not lock up when the carriage return key lever is operated.
9. Adjust the slotted link (801) so that when the tab and CR unlatch cam is at its high point, the clutch toggle unlocks. (Check by releasing cam and turning power roll by hand.)

Release the carriage return cam and operate

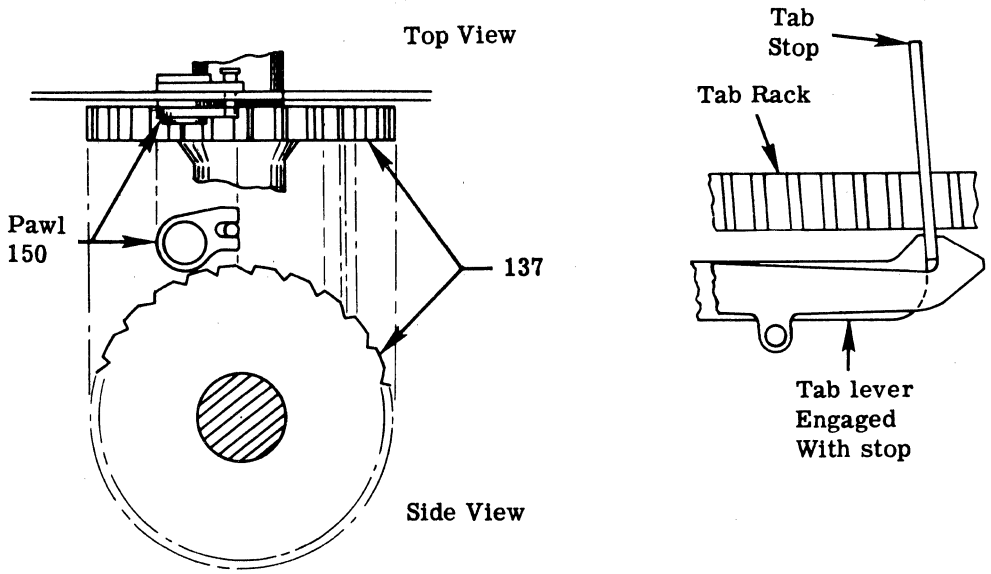


Figure 2-37 C R Pawl - Tab Rack Adjustment

the power roll by hand and check to see that the CR cam is not choked off by the end of slot in link 801 (Figure 2-30).

Tabular and Margin Rack Adjustments - The tabular rack and the margin rack must correspond since one position on each represents four units on the PSM, and two spaces on the Pica and Elite machines.

If both the margin rack and tab rack are to be set, set the tabular rack first, and then set the margin rack to correspond.

Adjust the tab rack roughly so that each end extends about equal distances beyond the end plates of the carriage.

Operate the escapement by hand until the carriage return pawl is at the top. With the power off, depress the tabular operating lever and allow the carriage to be held by the tabular lever engaging a stop. Then, watching the carriage return pawl, trip the tabular latch and notice what part of the tooth the pawl engages. Adjust the rack so that the pawl will engage the tooth far enough back to always drop safely into the same tooth (see Figure 2-37). This could cause uneven tabulation if not correctly adjusted.

Adjust the front paper guide so that the scale corresponds to the scale on the tabular rack.

Adjust the margin rack roughly so that its scale corresponds to the tab rack and front paper guide scale. Move the carriage to engage the margin stop with the margin release lever. Set the margin rack so there is as little motion as possible between the margin stop and the margin release lever. This motion should not exceed the point where it will trip the CR and Tab unlatch cam. Also, the motion should not be small enough to prevent the margin stop from being pressed down or slid into position.

When the racks are properly adjusted, the tab rebound checklever (810) should be adjusted to positively lock the stop against movement away from the tab lever.

This is accomplished by loosening stud 813 and adjusting eccentric 812 (Figure 2-34). Be very careful when tightening stud 813. Due to a small amount of threads it is easily damaged.

The eccentric 812 will move the rebound check lever (810) in a vertical and horizontal direction. If it is necessary to raise the check lever (810) further, the 812a eccentric stud may be used. Care should be taken, however, not to raise the check lever high enough to catch on a tab stop when the carriage is returning (tab lever latched).

CRTC Contact Adjustment - Adjust the carriage return and tab contacts (CRTC) to be normally closed so that the movable spring holds the stationary spring an appreciable distance away from its stop strip. Check to see that the contact points open at least .020" by operation of either the carriage return or tab mechanism.

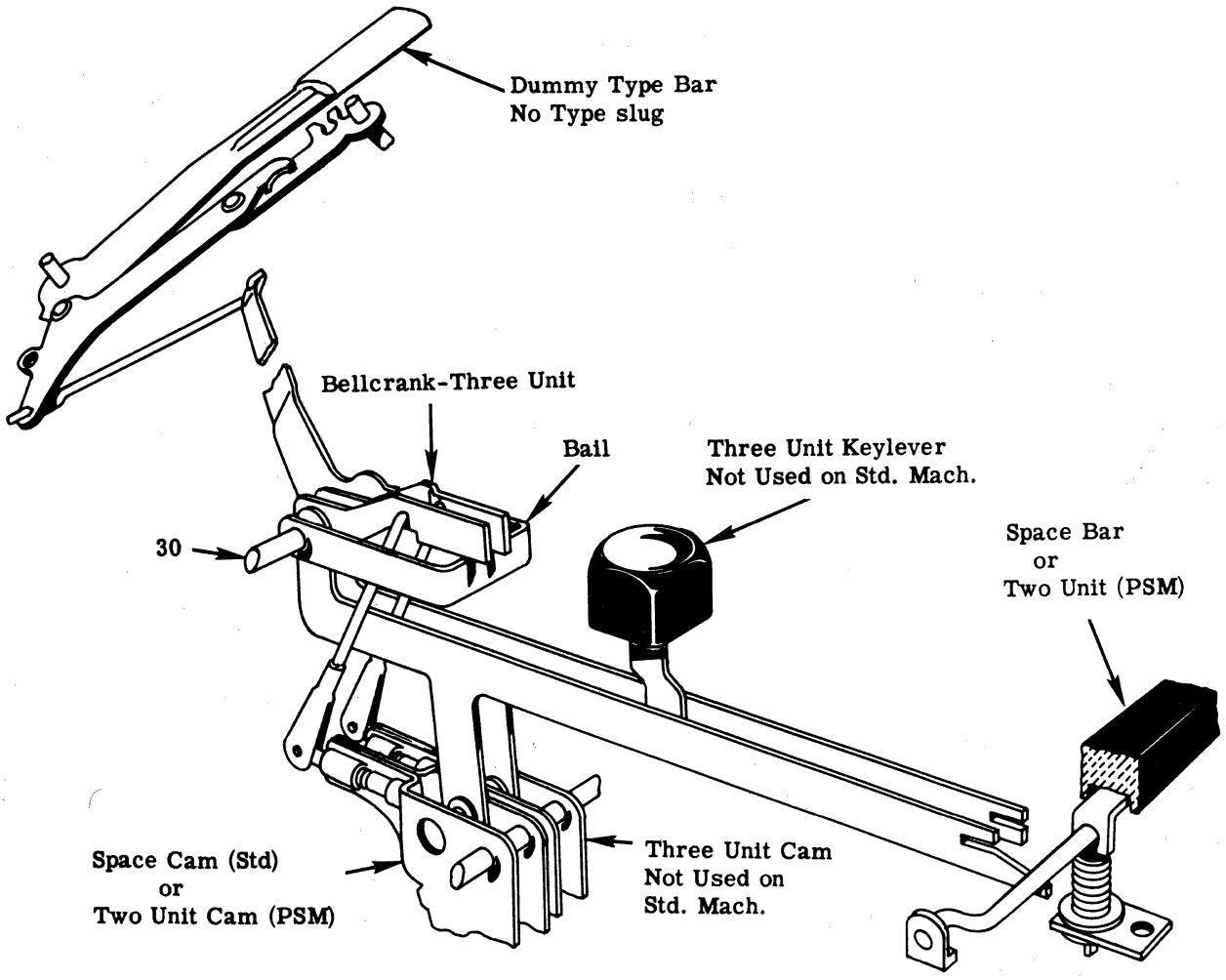


Figure 2-38 Space Bar Mechanism

SPACE BAR MECHANISM (Figure 2-38)

Purpose - The purpose of the space bar mechanism is to operate the escapement mechanism for letter spacing without printing characters.

Operation - Depressing the space bar cam unit will cause the cam to engage the power roll. Leverage developed on the cam frame pulls the cam link which, in turn, pulls a dummy bellcrank downward striking the escapement bail. The upper portion of the bail operates similar to a type bar. It moves in the segment toward the platen and operates the U bar and escapement mechanism in the same manner as the other type bars. There is no type head or slug, therefore no character will print. Solder is added to give the bail the necessary weight for operation.

On the Pica machines for each space operation, the carriage will escape 1/10". On the Elite machines for each space operation, the carriage will escape 1/12".

There are two space operations available on the PSM machines; namely, two unit and three unit.

The two unit functions in the same manner as the Pica and Elite machines, with the exception that the LE2 magnet is energized by the operation of the escapement contacts for two unit escapement.

The three unit space operates when the "Three Unit" key lever is depressed. A cam and dummy bell crank is operated similar to the two unit operation. The bell crank strikes the same escapement bail as that used for two unit space operation. The function of the "Selector" unit controls the circuit to the LE3 escapement magnet, thereby allowing three units escapement of the carriage.

Adjustment -

1. Cam adjustment (see Cam Adjustments).
2. Key lever (see Key Lever Adjustments. The key lever tension for the space bar should be set at approximately five ounces.)

BACK SPACE MECHANISM (Figure 2-39)

Purpose - The purpose of the back space mechanism is to move the carriage to the right one (1) space for Pica and Elite machines or one (1) unit for PSM machines.

Operation - When the back space key lever is depressed, the back space cam is released, engaging the power roll. The pivot movement of the cam pulls link 830, which rotates bell crank 831. The back space connecting link 833 connects between one leg of bell crank 831 and the back space pawl 834. Therefore, the rotating movement of bell crank 831 will move the back space pawl 834 downward, engaging a tooth of the escapement pinion ratchet wheel 137. The pawl 834 rotates the ratchet wheel 137 until it strikes the pawl stop. At this point, the carriage return pawl 150 has engaged the next tooth and holds the carriage in its new position.

Adjustments -

1. Check the cam for correct power roll clearance. (See Cam Adjustments.)
2. Operate the escapement by hand until the carriage return pawl (150) is at the bottom of the ratchet wheel (137).
3. Operate the back space by hand and hold the pawl against the pawl stop. This is the full travel of the back space pawl. Check to see that the carriage return pawl has moved approximately a tooth and a half (see Figure

2-40). To obtain this adjustment, raise or lower the back space pawl assembly by loosening the two screws and moving the complete assembly in the elongated slots.

4. Adjust the link (833) so that when the cam has nearly reached its highest point, the back space pawl will have completed its travel. Check this adjustment by turning the power roll over by hand and watching the position of the CR pawl.
5. The eccentric determines the entering position of the back space pawl relative to the teeth of the escapement pinion wheel. This adjustment is set at the factory and should not have to be disturbed.

Back Space Contact Adjustment - Adjust the back space contacts (BS) to be normally closed with the movable spring holding the stationary spring an appreciable distance away from its stop strip. Check to see that the contact points open at least .020" by operation of the back space mechanism.

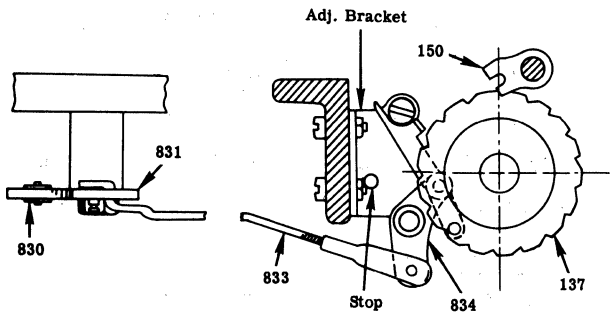


Figure 2-39 Back Space Assembly

DETENT PAWL ASSEMBLY

Purpose - The purpose of the detent pawl is to prevent backward rotation of the escapement mechanism. The carriage return ratchet is allowed to turn in one direction only.

Adjustment of Single Pawl (Figure 2-41) - Adjust the detent pawl bracket assembly so that with escapement pawls in the normal position and pressure applied on the pinion gear, the detent pawl will drop in behind a tooth on the carriage return ratchet wheel with minimum clearance. Due to an accumulation of tolerances, the pawl will have a different clearance with various teeth of the ratchet wheel. It is therefore necessary to make the adjustment to that tooth which gives the least clearance.

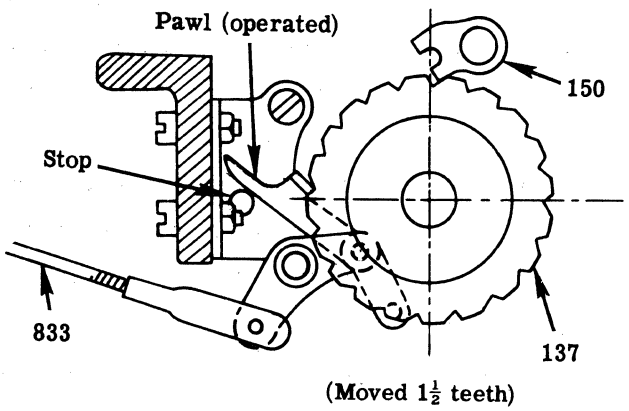


Figure 2-40 CR Pawl Engaging ½ Tooth

The leather stop should be adjusted so there will be a small clearance between the under side of the pawl and the face of the tooth. This adjustment is made by loosening the nut on the detent pawl and the screw holding the detent pawl bracket.

Adjustment of Double Detent Assembly - (Figure 2-42) - The PSM machines are equipped with a double detent pawl to provide a more accurate adjustment of the detent.

Adjust the number one detent pawl (Figure 2-42) by loosening the mounting screws and moving the bracket until the pawl engages every tooth on the carriage return ratchet wheel with a minimum clearance, from end of pawl to ratchet wheel teeth. After adjusting the number one pawl, operate the one unit escapement for one complete revolution of the ratchet wheel. Step the one unit escapement wheel and check the number one

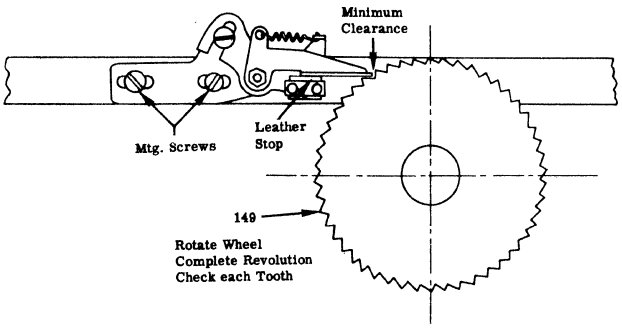


Figure 2-41 Detent Pawl (Single)

detent pawl after stepping to see that it falls into the next tooth. Be sure that the pawl does not hang up at any position on the escapement.

A number of teeth on the ratchet wheel may be at a wide setting with the number one detent pawl. Adjust the number two detent pawl to engage the greater majority of these teeth. Do not set the number two detent pawl to check only the tooth with the greatest gap as this may not correct all adjustments.

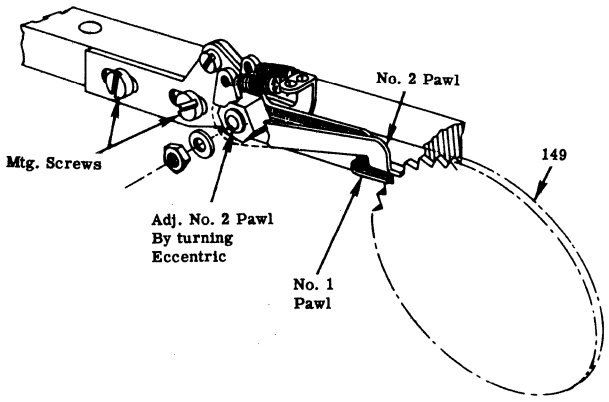


Figure 2-42 Detent Pawl (Double)

RIBBON FEED MECHANISM (Figures 2-43 and 2-44)

Operation - When any character key lever is depressed, its associated cam and bell crank is operated. The tail of the bell crank operates a ribbon lift bar which extends across the width of the power frame.

A ribbon feed lever at each side of the machine is pivoted on the key lever bearing wire and has a lug bent at a right angle on each end. The lower lug engages a roller on the ribbon lift bar and the upper lug carries the ribbon feed pawl which, in turn, engages the teeth in the ribbon spool. A ribbon feed check pawl mounted directly under the feed pawl and on a fixed pivot also engages the

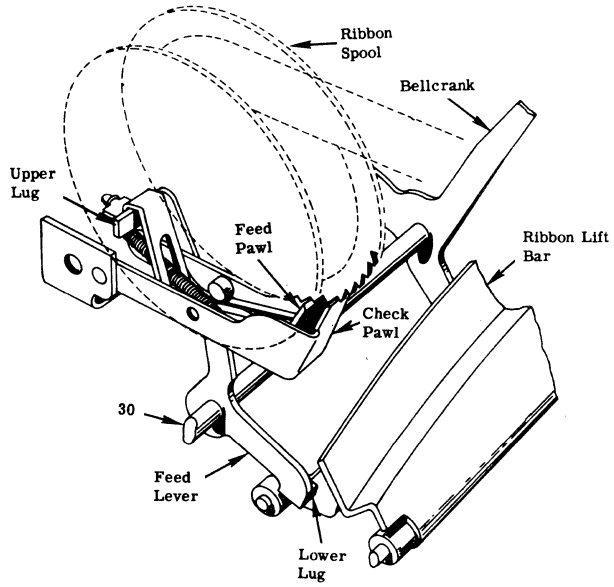


Figure 2-43 Ribbon Feed and Check Pawls

spool. The rocking motion of the ribbon feed levers causes the spools to feed two teeth at a time and the check pawl prevents a reverse motion of the spool.

A ribbon reverse bar carries a pin at either end which has a ribbon reverse pawl freely mounted to it. This same pin serves to control the position of the feed and check pawls so that only the pawls for one spool can be engaged at a time. The rear end of the reverse pawls is forked and supported by a stud on a two piece ribbon reverse lever. When the ribbon is unwound from one spool, a continued pull on the ribbon pulls the lever toward the rear and raises the front end of the reverse pawls so that the hook of one engages the bent lug on the ribbon feed pawls. As these move

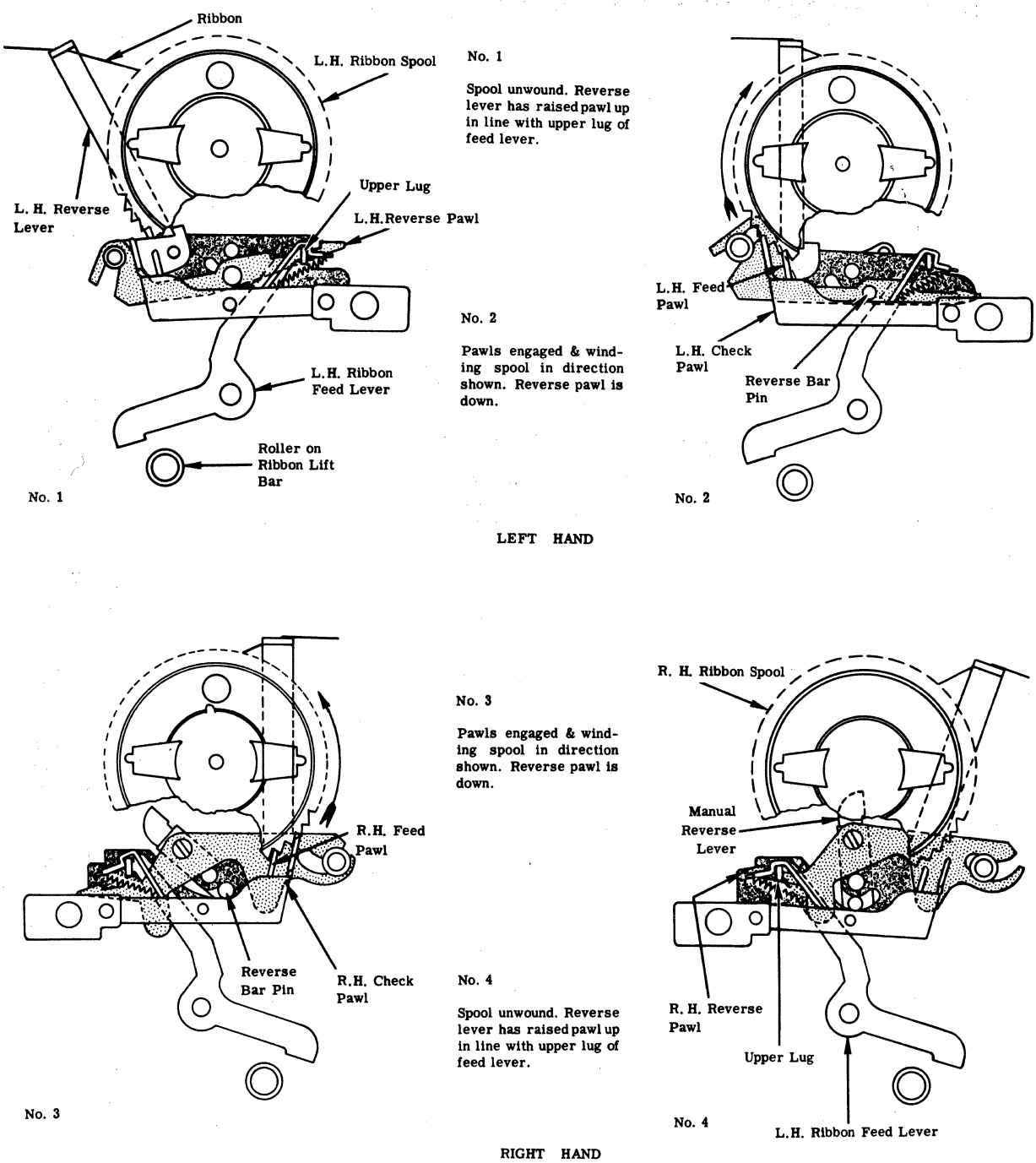


Figure 2-44 Ribbon Reverse Mechanism

forward they pull the ribbon reverse bar over, so that the feed pawls which were engaged are thrown out of engagement and the ones on the opposite spool become engaged, thus changing the direction of the ribbon feed. A hairpin spring serves to hold the ribbon reverse bar in either position.

Adjustments -

1. The feed and check pawls must be well into the spool teeth when feeding. Also, when not feeding, the pawls must clear the spool teeth with the nearest type bar against the platen. Feeding operation should cause two teeth operation of the spool. To test, move a type bar to the platen by hand, trying bars at each end of the type basket. It may be necessary to reform the pawls to obtain positive feeding operation.
2. The tension on the reverse lever springs should be as light as possible and yet retain the reverse levers safely in position.
3. The spool retaining springs should have sufficient pressure against the side of the spool to prevent the spool from overrunning. If there is too much pressure on the retaining springs, there may be more friction on the ribbon spools than the feed pawl springs can pull.
4. The ribbon reverse pawls must be free from binds so as to raise easily.
5. The ribbon reverse arms must be clear of the ribbon spool teeth. Their position can be adjusted by bending the lug against which the lever rests.
6. Test the reverse mechanism by pressing back the left reverse lever, with the ribbon feeding to the right, and operate the number 42 type bar. When the ribbon is feeding to the left, press back the right reverse lever and operate the number one type bar. The ribbon should be reversed by this action.

Note: When the ribbon has traveled back and forth from one spool to the other several times, it becomes loosely wound on the spools and will not reverse readily. The ribbon feed winds up ribbon slack before the reversing mechanism will operate. Therefore, when this happens, the ribbon does not travel at all and a faint line will be typed across the sheet. To correct this, wind up the slack ribbon on the spool. There is a manual ribbon reverse lever to help operators reverse their ribbons when they become loosely wound on the spool.

AUTOMATIC COLOR CONTROL

Purpose - The purpose of automatic color control is to change the ribbon position automatically from black to red by inserting a code in the perforated tape. The ribbon will change position each time the code is read.

Color Control Operation - A double lobe letter cam is used for operation of the mechanism. This cam is located on the rear row of cams, the second from the right.

When the key lever, marked "Color Shift" (94) is depressed, the cam lever is released, allowing the cam to rotate a half turn. This motion exerts a pull on the color shift bell crank (92) (Figure 2-45), rotating it counterclockwise on its pivot (30) which, in turn, moves the color shift T lever (90) forward. When the color shift is in a position to print black, the end of the T lever (91) is up and engaging the top pin (83) on the color shift toggle (82). The T lever is held in the upward

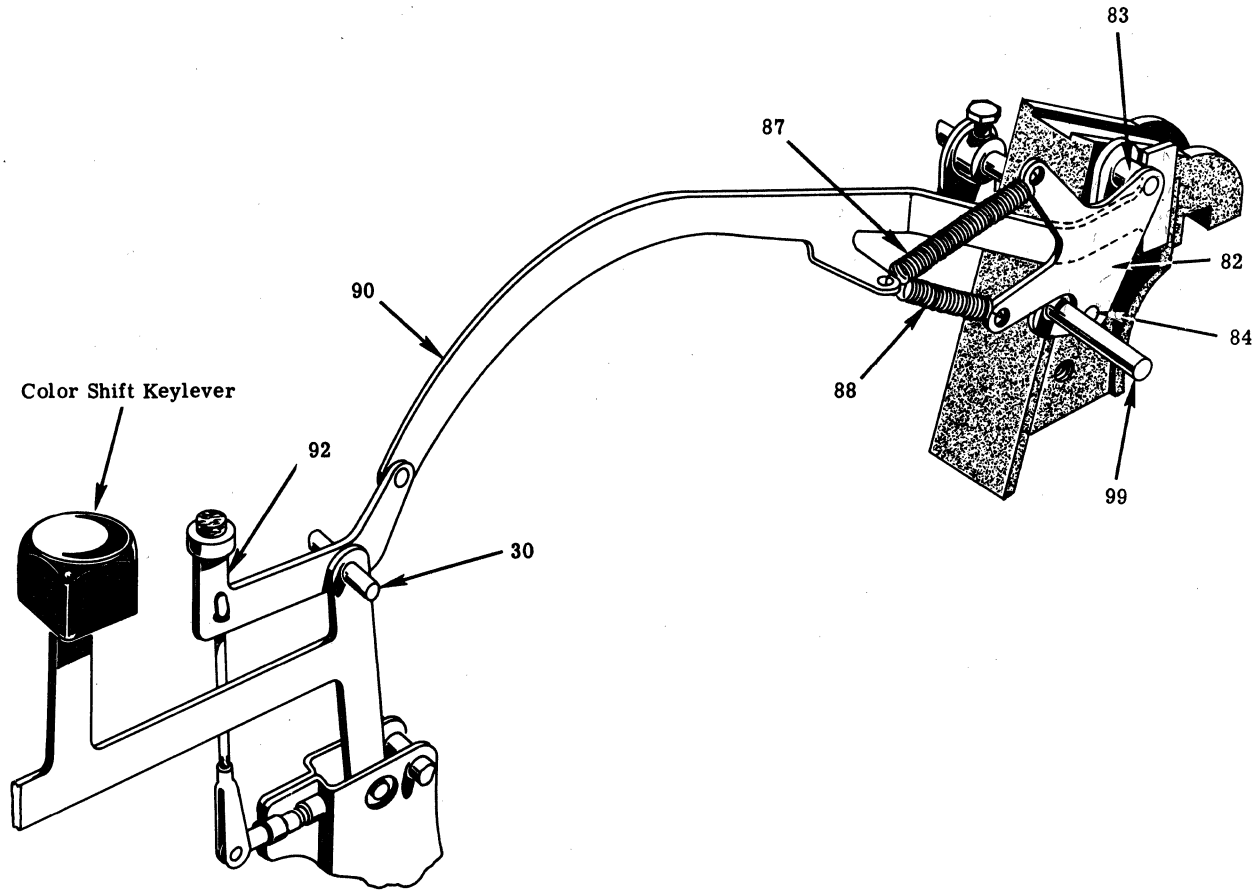


Figure 2-45 Color Control Linkage From Cam

position by the increased tension on the spring (87) and as the T lever moves forward, the shift toggle plate is pulled forward on the top, decreasing the tension on the upper spring (87) and increasing the tension on lower spring (88). As the shift toggle passes a central position, it is carried down by the action of the hairpin spring (96), located on the shift toggle shaft. The increased tension on spring 88 pulls the T lever (91) to its lower position, where it is engaged behind the lower pin 84, on the shift toggle plate.

The pivoting motion of the shift toggle plate will rotate the shift toggle shaft in the direction shown in Figure 2-46. The movement of the shaft will reposition the ribbon position lever in the "R" (for red copy) slot of the ribbon lift control plate.

A second operation of the cam will reverse the position of the T lever and toggle in the same manner so that the ribbon position lever will locate in the "B" slot of the ribbon lift control plate.

A stud (99) extends through the right side of the base and may be used to manually position the color shift in the "Stencil" position (ribbon position lever in the "S" slot of the ribbon lift control plate).

Ribbon Lift Operation - When a type bar moves to the platen, the bell crank (which connects it to the cam unit), operating through a tail extending to the rear, swings the ribbon lift bar which extends across the machine. The movement of the ribbon lift bar pivots the ribbon lift control plate. When the ribbon lift control plate swings, it

carries the ribbon guide up to the printing point. The amount of total movement is governed by the position of the roller (part of ribbon position lever) in the slot in the ribbon lift control plate and this position is controlled by the "Color Control Operation" (the operation of the color shift key lever for black or red copy).

Adjustments -

1. Adjust the color shift cam as per "Cam Adjustments".
2. Place the extension stud (on right ride of the base) in the center position and adjust the roller (part of the ribbon positioning lever) so that it is directly over the vertical slot in the ribbon lift control plate. Check the T lever to be sure it is centered between the upper and lower studs on the shift toggle plate.
3. Check all levers for binds. Adjust the ribbon guide for upper and lower writing position. Be sure the ribbon guide does not choke off with a type bar against the platen. Also, check to see that the ribbon guide does not bind on the line gage card holder. Remove the guide and reform if necessary.

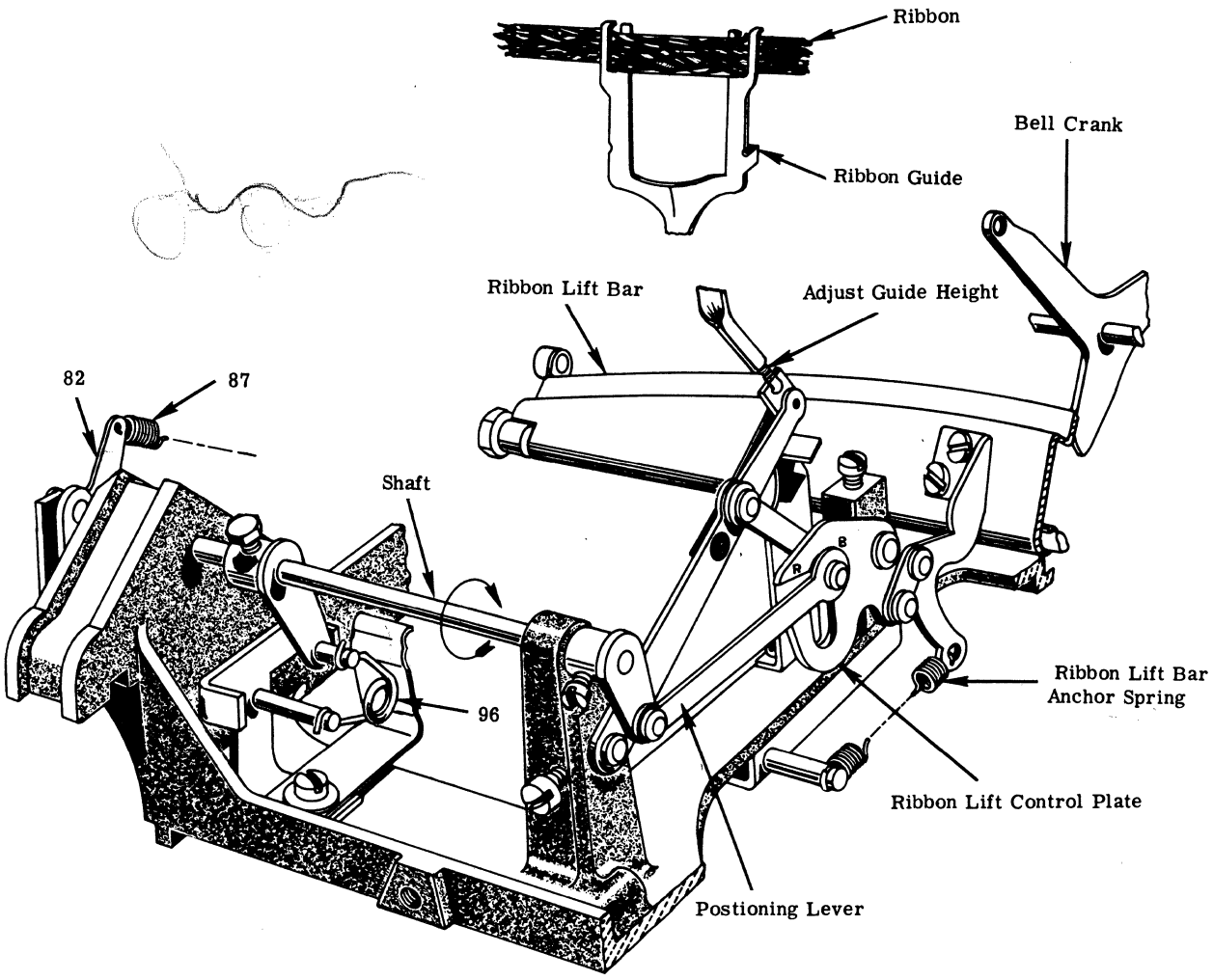


Figure 2-46 Color Control - Ribbon Lift Operation

SHIFT MECHANISM

Purpose - The purpose of the type basket shift is to raise or lower the type basket when it is desired to print upper and lower case characters.

When the basket is in the upward position, the lower case characters (small letters) will print. In the down position the capital letters will print.

Operation - To effect the operation of the basket shift, two double lobe letter cams are used, one for the shift down, the other for the shift up. The shift down cam is located in the front row of cams, first one on the left side. The shift up cam is located in the front row of cams, first one on the right.

The key lever marked "Upper Case", located on the left side of the keyboard, operates the shift down cam directly. The key lever on the right side of the keyboard, marked "Upper Case", will also operate the shift down cam through the equalizing rod (54), extending from one side of the machine to the other.

The shift up cam is operated directly from the right hand key lever marked "Lower Case", while the lower case key lever on the left side operates the shift up cam through equalizing rod (53). This rod transfers the key lever motion from the left side of the machine to the right.

When either of the shift key levers marked "Upper Case" is depressed, the shift cam on the left side of the power roll operates. As the cam rotates, a pull is exerted on the left hand toggle release lever (69), which pivots on the ribbon lift bar fulcrum wire bearing (60). As the toggle release lever (69) pivots, its upper inturned finger (70), which abuts toggle lever (56), moves the lever (56) in a clockwise direction (Figure 2-47). As lever (56) pivots, it breaks the toggle linkage consisting of lever (59), lever (56) and lever (58). Lever (59) exerts a downward push on bracket (55) so that the basket is started down toward its upper case position. The downward motion of bracket (55) also moves lever (58) which is connected to the rock shaft (67), thereby transmitting the motion to the opposite side of the basket, resulting in a parallel basket motion.

In Figure 2-47 the tension of spring 63 is holding the basket in the up position, but as the basket moves downward, the tension of spring 63 decreases until it reaches the position shown in Figure 2-48 where it no longer has a holding effect on lever 59 (it has reached a dead center position with respect to the toggle lever 59). However, a similar spring (63) on the right hand side, is acting on the right hand lever 59 (which is reversed). This spring moves from a dead center position (Figure 2-50) to an effective position on its lever 59 so that the basket, when it reaches the down position, will be held there under substantial tension of spring 63 (Figure 2-49).

The adjustable stops 72, limits the amount of movement of the basket travel. This is accomplished by the lever (56) striking the inturned finger 70, which, in turn, applies pressure to extension 71. Stop 72, therefore, prevents extension 71 from moving further.

To return the basket to the up position, either of the shift key levers marked "Lower Case", when depressed, will operate the right hand shift cam. The same action as explained above will take place, except the toggle will be broken on

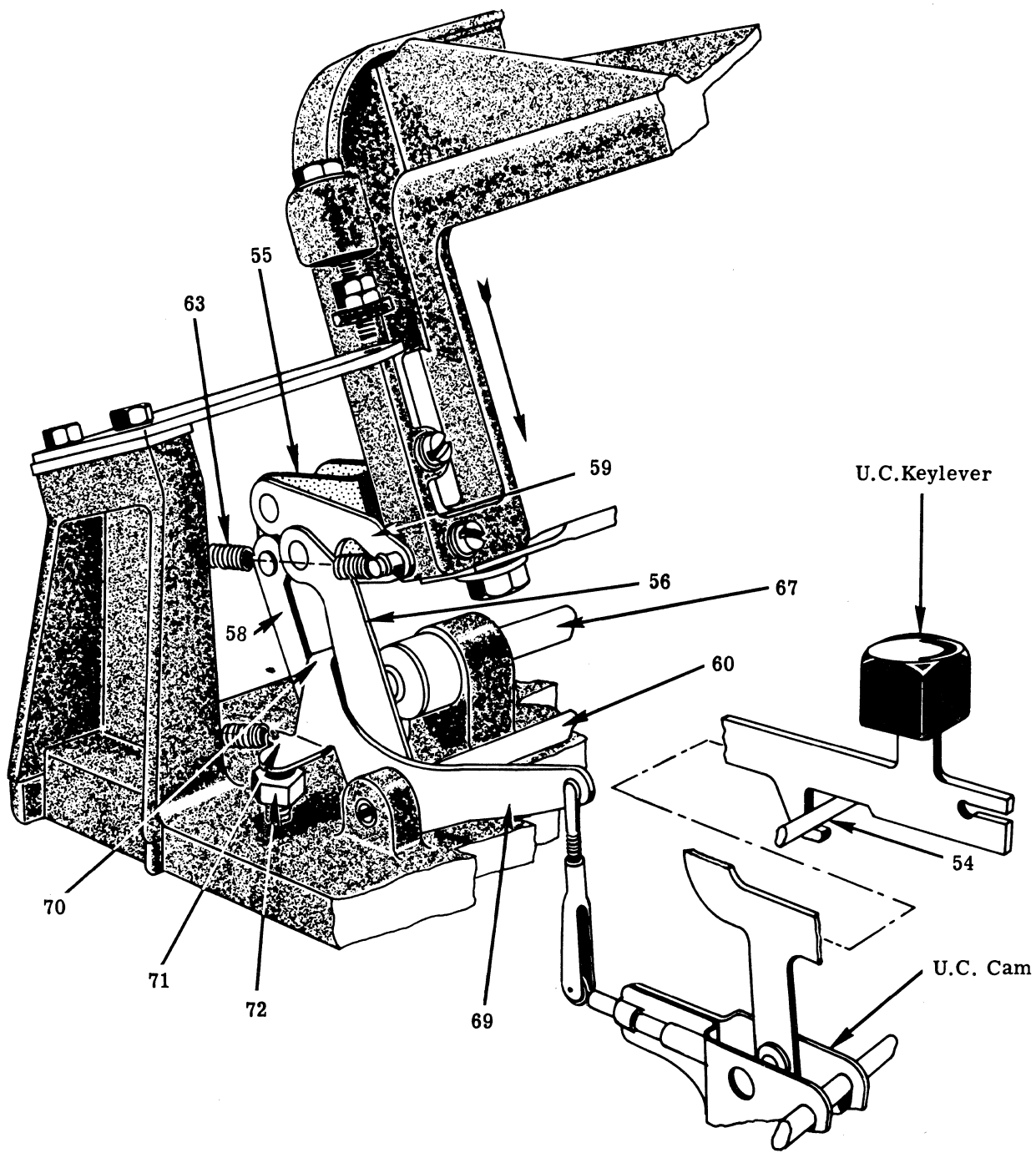


Figure 2-47 Shift L. H. View (L.C. Position)

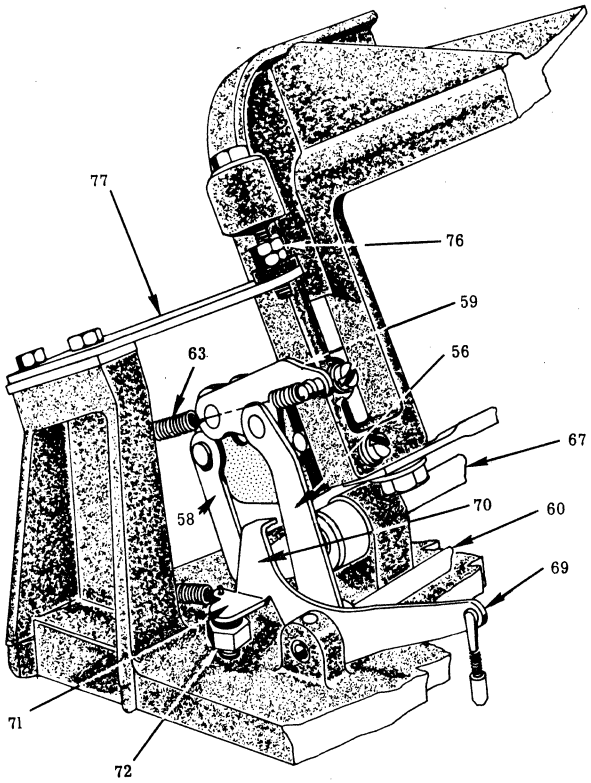


Figure 2-48 Shift L. H. View (U.C. Position)

the right side, while the left hand toggle will hold the basket in the up position.

Adjustments -

1. Turn the adjusting screw (75, right hand) down sufficiently so the R.H. basket bracket (77), when in the lower case position (up) will not strike the R.H. washer. Turn the nuts (76, left hand) upward on the L.H. screw so the L.H. basket bracket (77) will not strike the L.H. washer when in the upper case position (down).
2. Adjust the equalizing spring on the right side of the rock shaft (67) to counteract any unequalness in the four basket leaf springs.

   To adjust the equalizing spring, first remove the right and left toggle tension springs (63). With these springs removed, the basket should float - a position midway between upper and lower position. This adjustment is made by turning the hexagon collar on the rock shaft which carries one end of the equalizing spring.
3. Type Basket Motion - The type basket motion is the travel of the basket from lower case position to the upper case position. It is necessary to adjust the motion so the feet of the small letters and the capital letters will be in line (nNnNnNnN).

   To obtain this adjustment: lift the machine on end. Drop the selector unit. Loosen the lock nut and turn the adjusting stop screw (72 right or left) up or down, until the letters line up. When making this adjustment, it is also necessary to have equal toggle action in both positions of the basket, on both right and left side.
4. When the adjustment of the motion is complete, both shift cams must be checked for proper clearance to the power roll (see Cam Adjustment). This is necessary because when either stop (72) is changed, this change is transmitted to the cam through lever 69 and link 68, necessitating readjustment of the cam.
5. Adjust the R.H. screw 75 so that when the basket is in the lower case position, the R. H. washer will just touch the R. H. bracket 77. Adjust the L.H. nuts 76 so that when the basket is in the upper case position the L.H. washer will just touch the L.H. bracket 77.

Note: Adjustment five does not control the motion of the basket, therefore, do not have the washers stop the basket in its amount of travel.

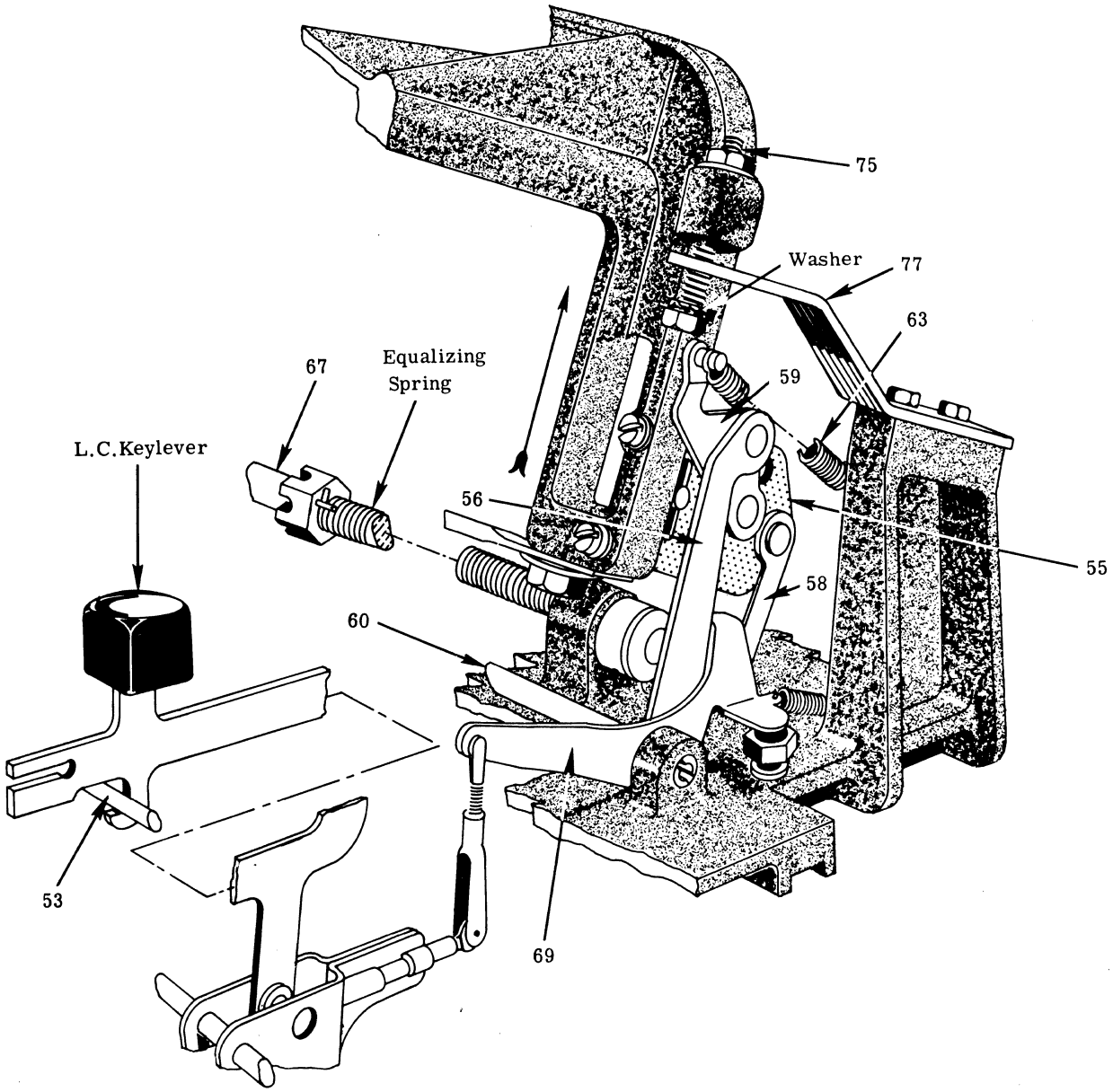


Figure 2-49 Shift R. H. (U.C. Position)

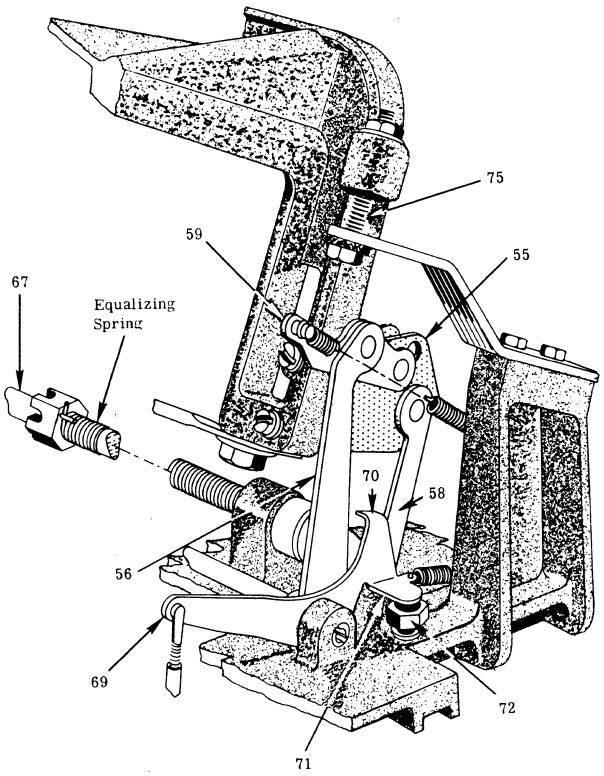


Figure 2-50 Shift R. H. (L. C. Position)

Case Shift Contact (CSC) Adjustment - Set the contact operating cam on the rock shaft so that the flat portion engages flatly against the edge of the contact operating arm with the basket in the up position. With the basket in this position, adjust the open contact points to a gap of .020" to .025". Move the basket to the down position and set the open contacts to a gap of .020" to .025". Move the basket to each position and check the closed contacts to see that the stationary straps move away from their stop strips an appreciable distance.

PLATENS AND RATCHETS

Types of Platens - Platens are supplied in various sizes and grades of hardness for different types of work. In order to establish the number of carbon copies that may be written on any grade of platen, the following factors must be carefully considered: weight of paper, weight of carbon paper, size and face of type and size and grade of platen. In general, the information following will prove useful in selecting the proper platen.

No. 1. Standard diameter and hardness for general typewriting applications and stencil writing using most type faces.

No. 2. Standard diameter platen, slightly firmer than No. 1, for use on general correspondence and some stencil applications.

No. 3. Hard platen of the same diameter as the No. 1, for writing a small number of carbon copies requiring sharp impression. This platen is not suitable for stencil writing or similiar applications.

No. 4. Hard platen 1/32" undersize in diameter. For writing a large number of carbon copies.

No. 7. Hardness the same as No. 4 except 1/16" undersize in diameter. For writing the maximum number of carbon copies.

No. 8. Standard diameter but more firm than No. 2 and not as hard as No. 3.

No. 9. Standard diameter, slightly less firm than No. 1, designed for use with stencils because of its greater resistance to stencil oils.

In selecting a platen for a particular application, one general recommendation should be followed. Bolder face types will require harder platens. This is explained by the fact that, if the type is permitted to bury its face into the cushion of a soft platen, the paper will begin to wrap around the type face and will thus lose the sharpness of its outline. A softer platen will often result in a bolder type impression which may have definite appeal to some customers, but it will lack the definition and sharpness that a harder platen will provide.

The hardness of the platen is indicated by the

Number of Spaces in One Inch of Form

Count the number of spaces in 10" of form, move decimal point one space to left and find nearest number in chart.

Platen Ratchet Part Number	No. of Teeth	1 Tooth	2 Teeth	3 Teeth	4 Teeth	5 Teeth	Upper Index Pawl Stop	Detent Arm Assembly	Index Pawl Carrier
1002224	24	4.37	2.18	1.45			1076865	1072875	1073401
	25	4.55	2.27	1.52					
	26	4.73	2.37	1.58					
1002227	27	4.91	2.46	1.64			1076865	1072875	1073401
	28	5.09	2.55	1.70					
1002229	29	5.25	2.64	1.76			1000325	1076864	1073401
1002230	30	5.46	2.73	1.82			1076865	1076880	1073401
1002231	31	5.64	2.82	1.88			1000325	1076880	1073401
1002232	32	5.82	2.91	1.94			1000325	1072875	1073401
1002233	33	6.00	3.00	2.00			1000325	1076864	1073401
1002234	34	6.18	3.09	2.06			1000325	1076882	1073401
1002235	35	6.37	3.18	2.12			1000325	1072875	1073401
1002236	36	6.55	3.27	2.18			1000325	1076880	1073401
	37	6.73	3.37	2.24					
1002238	38	6.91	3.46	2.30			1000325	1076864	1073401
1002239	39	7.09	3.55	2.37			1000325	1076880	1073401
1002240	40	7.28	3.64	2.43			1000325	1076880	1073401
1002241	41		3.73	2.49	1.86		1000325	1076882	1073401
	42		3.82	2.55	1.91				
1002243	43		3.91	2.61	1.95		1000325	1072875	1073401
1002244	44		4.00	2.66	2.00		1000325	1076864	1073401
1002244		8.00	4.00	2.66			1002273	1076864	1073401
1002245	45	8.18	4.09		2.05		1076866	1076880	1073401
1002246	46	8.37	4.18		2.09		1076866	1072880	1073401
	47	8.55	4.28		2.14				
1002248	48		4.37	2.91		1.75	1076865	1072875	1073401
1002249	49		4.46	2.97		1.78	1000325	1076864	1073401
1002250	50		4.55	3.03	2.27		1002272	1076884	1076862
1002251	51		4.64	3.09	2.32		1002272	1076884	1076862
1002252	52		4.73	3.15	2.37		1002272	1076884	1076862
1002253	53		4.82	3.21	2.41		1002272	1076884	1076862
	54		4.91	3.27	2.46				
1002255	55		5.00	3.33	2.50		1002272	1076886	1076862
1002256	56		5.09	3.40	2.55		1002272	1076884	1076862
1002257	57		5.18	3.46	2.59		1002272	1076884	1076862
1002258	58		5.28	3.52	2.64		1002272	1076886	1076862
1002259	59		5.37	3.58	2.68		1002273	1076886	1076862
1002260	60		5.46	3.64	2.73		1002273	1076886	1076862
1002261	61		5.55	3.70	2.77		1002273	1076884	1076862
1002262	62		5.64	3.76	2.82		1002273	1076884	1076862
	63		5.73	3.82	2.87				
	64		5.82	3.88	2.91				
	65		5.61	3.94	2.96				
1002266	66		6.00	4.00	3.00		1002273	1076884	1076862

number on the righthand end of the rubber.

The platen should be as hard as can practically be used and not cause excessive embossing. Embossing to a minor degree will be expected, but when it is so strong as to cause cutting of ribbons and originals, then steps should be taken to stop it. When embossing shows on only a few characters, it may be because of too heavy impression adjustment or too sharp type faces. These should be investigated before changing to a softer platen.

Ratchets - Platen ratchets are supplied with various numbers of teeth to facilitate selection of suitable line spacing. The Flexowriters are normally equipped with a 33-tooth ratchet, permitting six lines per inch, and the Justowriters are equipped with a 55-tooth ratchet, permitting five lines per inch.

The chart shown in Figure 2-51 lists the more commonly used ratchets and the parts necessary to change.

A standard 33T detent arm was provided on all standard machines until experience proved that the 29T detent arm can be made a common part for the 29, 33, 38 and 44-tooth ratchets (see chart), as well as for some other ratchets. Since the 29T detent arm has become a common part, the stamped figure 29 is not required. To avoid confusing a 29T detent arm with a 33T detent arm, compare the lengths of the two arms. The 29T will be shorter by approximately 1/64".

The choice of a ratchet will be governed by the size of type and the amount of material required to the page. Executive type faces vary in boldness as well as size and must be typed in the correct line spacing to present a proper appearance.

Adjustment to Ring and Cylinder - The platen is called a cylinder. The flat surface on the segment is called on anvil or ring. The purpose of the ring is to prevent over-printing or to give the type bars a stop, so the type will not emboss the paper excessively or cause the characters to be blurred.

The type bars will emboss the back of the paper if the platen is too far forward. The type bars will print too lightly if they strike the ring harder than the platen, caused by the platen being too far back.

The platen rests on two yokes which are adjustable either forward or backward by eccentric screws located on each end of the carriage frame.

To secure good results on any application, it is necessary to have the platen parallel in relation to the type; that is, so the type will strike with the same impression on both ends of the platen. The period and comma are good characters to use when checking the platen for being parallel.

Proceed as follows for ring and cylinder adjustment.

1. Insert a piece of bond paper and tear off a piece of the corner about $\frac{1}{2}$" wide and 4" long.
2. Place the piece of paper between the cylinder and the type and hold the type bar against the platen with the thumb below the ring. (The paper must be between the ribbon and the platen). Pull the paper out slowly so as to get the feel of the friction at that point.
3. Place the paper between the type bar and the flat surface on the segment (ring), pulling it out slowly so as to get the feel of friction at this point. Hold the type bar in the same manner as above.
4. The type bar should touch the segment with

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MANUAL ADDENDUM

Date: March 8, 1956

Reference: To be inserted in Part II, Section 2, between Pages 2-58 and 2-59.

Subject: Platen Ratchets

Purpose: Ratchets not available

Information:

Part II, Section 2, Page 2-57, Figure 2-51

Platen ratchets for the following number of teeth are available and in stock: 27, 29, 33, 36, 38, 39, 40, 44, 48, 49, 50, 51, 52, 55, 57, 58, 59, 62, 66.

All other ratchets listed in the Platen Ratchet Chart, Figure 2-51 on Page 2-57 are to be deleted.

a little more pressure than it does the platen. Try this adjustment on both ends of the platen, using the same bar. Try several bars, especially those with a large type area, so as to get an average setting.

5. Turn the eccentric screws, moving the platen yokes forward or backward, until the correct setting is obtained. This adjustment must be made with great care if good typing is to be expected.
6. If the application on which the machine is installed requires the typing of a number of carbon copies, the ring and cylinder must be adjusted to that number of copies.

Removal of Ratchet - To remove the platen ratchet, first unscrew the platen variable button from the left-hand platen knob, using a variable button tool (Figure 2-52). The platen knob may then be removed by loosening the set screws which secure it to the shaft. This will permit access to four screws which hold the platen clutch cover and sleeve assembly. Removal of this assembly permits the ratchet to be removed.

PAPER FEED MECHANISM (Figure 2-53)

Operation - Paper is fed by the platen as it is rotated. Pressure of the paper against the platen is maintained by feed rolls mounted in deflector yokes under the platen. Compression springs supported by screws in the carriage base provide the necessary lift, assisted by a torsion spring attached to the left-hand end of the feed roll actuating arm.

The paper release is accomplished by moving the paper release lever toward the front. This action moves a toggle lever assembly on the left-

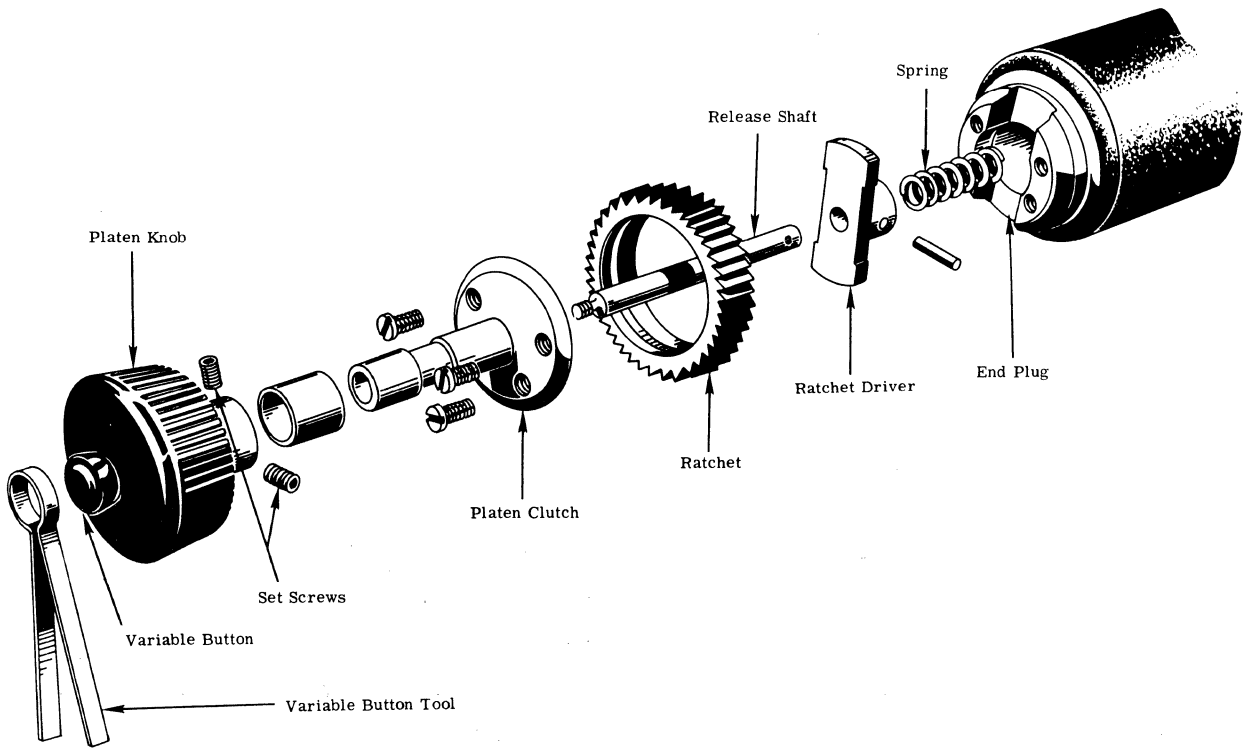


Figure 2-52 Platen and Rachet

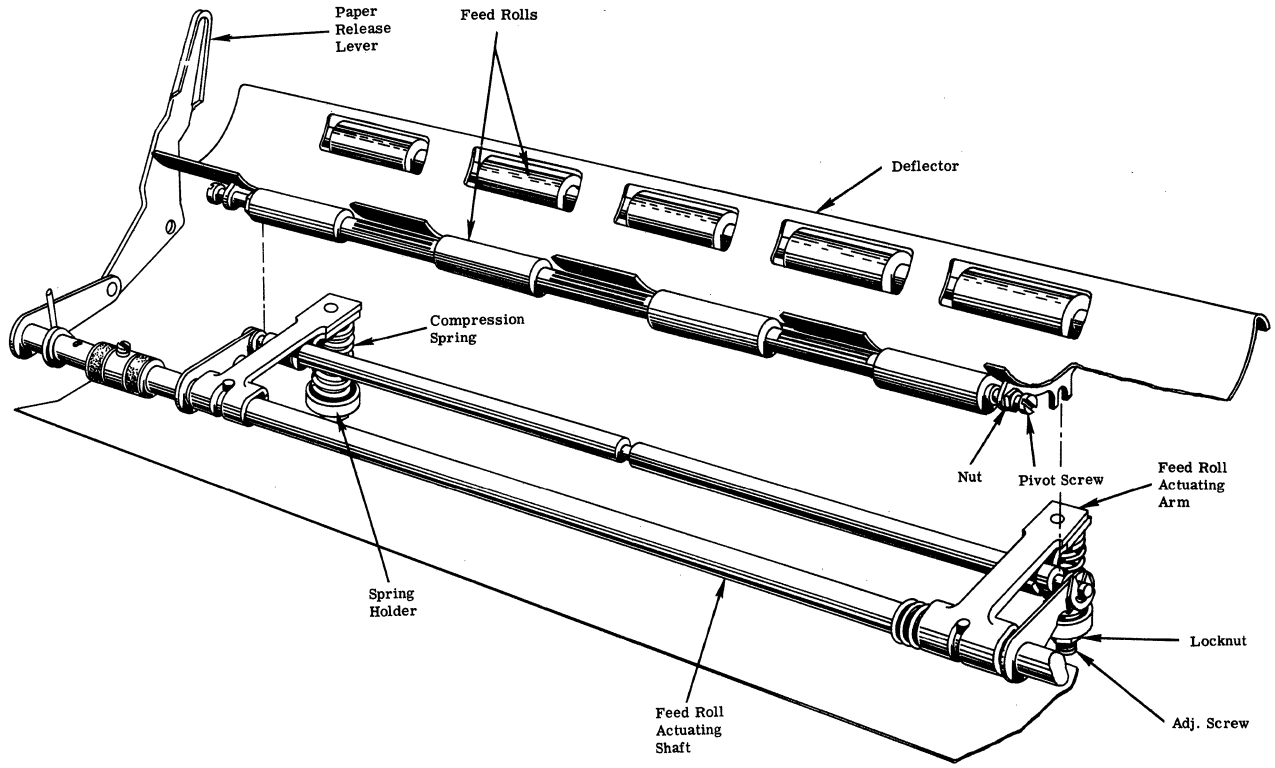


Figure 2-53 Paper Feed Mechanism

hand end of the carriage so as to rotate the feed roll actuating shaft downward toward the rear. The feed roll actuating arm will be lowered, causing the deflector and feed rolls to drop away from the platen.

Removal, Assembly and Adjustment - To remove the deflector and feed roll assembly, first remove the platen, then simply lift the deflector and feed roll off the equalizing shaft.

The feed rolls may be removed from the deflector yoke by loosening the locking nut on the feed roll pivot screw and turning the screw out of the deflector yoke. Upon replacing the feed rolls, all end play must be removed by adjusting the pivot screws. However, the feed rolls must be free to spin. Grease should be used as a lubricant, because oil would travel and destroy the rubber.

Feed roll pressure is adjusted by means of pressure springs and adjusting screws located in the bottom of the carriage. For the best pressure adjustment, turn the locking nuts up until they touch the spring holder caps and turn the adjusting screws until the locking nuts are resting against the bottom of the carriage.

LINE GAGE CARD HOLDER (STANDARD)

Purpose - The purpose of the line gage card holder is to hold cards and multiple copies close to the platen. Also, to line up copies when a correction is necessary in order that the character will strike in the exact position of the original character. It will also enable the operator to locate a desired writing line.

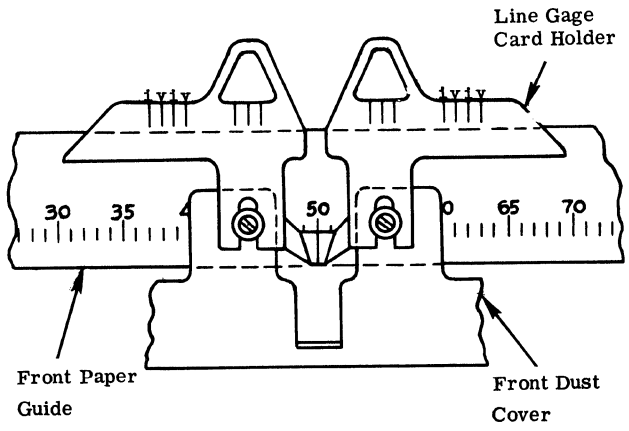


Figure 2-54 Card Holder (Standard)

Adjustments - Strike up several characters and align the small vertical lines on the line gage card holder to the center of the character as described in Figure 2-54. Two mounting screws can be loosened and the card holder moved in any direction because of the oversized slot. The card holder should be formed so that the clearance between the platen and the holder will be about 1/32".

LINE GAGE CARD HOLDER (PSM)

Purpose - Same as Standard.

Adjustments - To set the card holder to act as a guide, type a series of "H's". Space the carriage twenty to thirty units and type another series of "H's". Move the carriage back and type two "H's". Back space the carriage 16 units and position the card holder so that the straight line or positioner is placed accurately between the two "H's" (see Figure 2-55).

ALIGNING TYPE

Preparation for Type Alignment - Prior to undertaking the alignment of type, the condition of the Writing Machine for printing should be carefully checked. The power roll speed must be properly adjusted to a speed of approximately 290 R.P.M. (permissable range is 285 to 295 or the reader speed is 561 to 581 with standard gears). (See page 2-1). Also check ring and cylinder adjustment (See page 2-58).

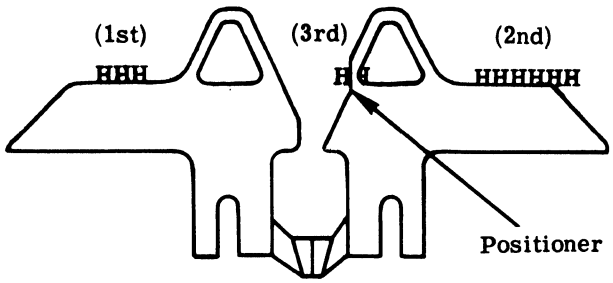


Figure 2-55 Card Holder (PSM)

Insert a single sheet of paper and make a test strike-up to determine the alignment of the type faces (see Figure 2-56).

The shift mechanism must permit even printing of the top and bottom of all type. The shift motion must be correctly set so that the upper and lower case characters type on the same line as described on Page 2-54.

The universal bar must permit all type bars to trip the escapement at an equal tripping point and the selector slides must not bind off the action of the type. This adjustment is explained in Section 3.

The ribbon lift bar must be free of binds.

The impression of all characters should be as uniform as possible. The threaded arm of the cam should be turned in or out the required amount to obtain a dense black printing without showing any sharp embossing on the back of the paper. Excessive impression can also be detected by observing

NnNnNnNnNnNnNnNnNnNnNnNnNnNnNnNnNnN

NANBNCNDNENFNGNHNINJNKNLNMNONPNQ

nanbncndnenfngnhninjnknlnmnonpnq

NRNSNTNUNVNWNXNYNZN&N/N$N¢N?N!N*N

nrnsntnunvnwnynxnzn2n3n4n5n6n7n8n

N(N)N½N¼N' N:N—N.N,N

n9n0n1n¾n' n;n-n n,n

AMARANTH SASESOSUS ORONOCO SECEDES

amaranth sasesosus oronoco secedes

URUGUAY INITIATION PHILADELPHIA
uruguay initiation philadelphia

Figure 2-56 Type Aligning Strike Up

Figure 2-57 Check of Letter N

the cutting action of the type on the carbon paper ribbon (when used). Slight embossing by the periods, commas and other extremely small characters will have to be tolerated in order to obtain reliable operation.

After each change of adjustment of the threaded arm of a cam, the clearance between the cam and the power roll should be checked.

If the overall impression of the characters is too heavy or too light, some compensation may be obtained by adjusting the ribbon lift universal bar spring anchor. Also, the power roll speed may be shifted toward its lower or upper limits in order to change the overall impression.

Alignment - The type bars are aligned in relation to each other by using the N as a guide. The small n serves as a guide for the lower case characters while the large N is used to align capital and special characters above the numbers.

The letter N must be carefully checked to insure its accuracy as a guide (Figure 2-57). Using the platen variable button, place the second writing line close under the first and type several capital N's under each other. If the sides of the letters align themselves, then the N will usually make a suitable guide. The height of the N should compare favorably with the average height of the other type bars.

There is no set procedure which must be followed in aligning type, because each type bar may need a slightly different adjustment. Until experience has been acquired, it is advisable to follow the procedure outlined here for the alignment of a single bar after installation.

1. Adjust the type bar for ring and cylinder.
2. Center the type bar in the type guide.
3. Twist the type so that it strikes evenly on both sides.
4. Center the lower case characters between two lower case n's.
5. Center the upper case characters between two capital N's.
6. Raise or lower the type to the writing line.
7. Cut the type only when necessary.

Each of these steps is explained in detail in the following paragraphs of corresponding number.

1. When a type bar is replaced, it should be aligned by first testing ring and cylinder adjustment. Place a piece of bond paper, about $\frac{1}{2}$" wide and 4" long, between the type bar and ring. The paper should be gripped tightly when the type bar is held up to the platen with the thumb against the type bar at the ring. Place the paper between the ribbon and the paper on the platen, and holding the

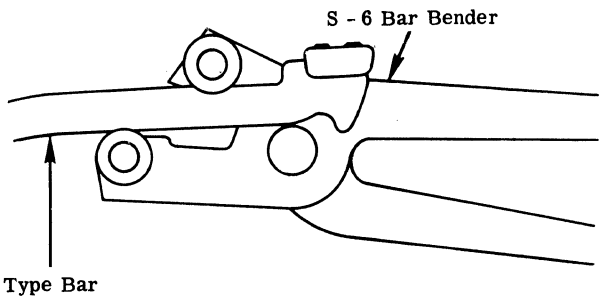


Figure 2-58 Bending Bar Toward Platen

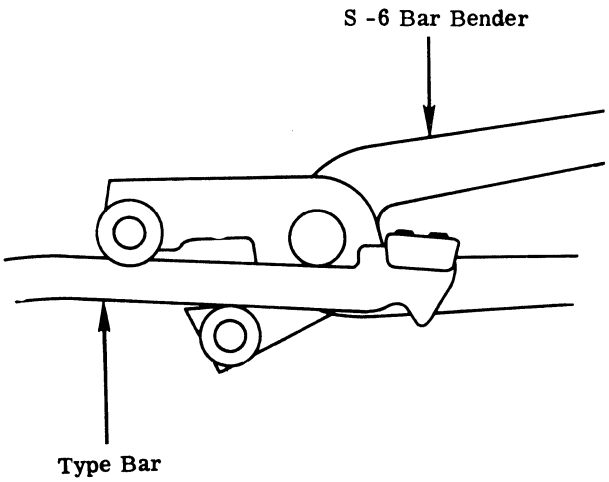


Figure 2-59 Bending Bar Away From Platen

type bar as before, a noticeable drag should be felt as the test paper is withdrawn. If ring and cylinder are out of adjustment, correction may be obtained by using the S-6 bar bender in the following manner: By placing a forward bend toward the platen near the top of the bar, the type may be lowered considerably (Figure 2-58), and by placing a backward bend away from the platen near the top of the bar, the type may be raised slightly (Figure 2-59). In view of this characteristic, if no change in elevation is desired, it is advisable to keep the S-6 bar bender low on the type bar when adjusting for ring and cylinder only. (Note: do not put the bender below the milled surface of the type bar. This is likely to cause a burr on the bar.)

A type bar may be shortened considerably, to secure a lower elevation, by placing the two bends in the type bar with the S-6 bar bender. The first bend should be low and backward, away from the platen, with the second bend high and forward, toward the platen, so as to regain the ring and cylinder adjustment.

After each adjustment of a type bar, ring and cylinder must be tested, and the type must be checked to see that it enters the guide freely and squarely. Also, a careful check should be made to see that the bar benders have not nicked the type bar so that it sticks in the segment. A file may be used to remove any such marks.

2. Center the type bar in the type guide by pushing the bar into the guide slowly with the finger tip near the bottom of the bar. A piece of white paper, placed behind the guide, but in front of the ribbon, will aid in observing how the type clears the guide. The type may be sent to the right or to the left (Figure 2-60) until it enters the guide perfectly. Three pronged pliers should be used for this purpose, but if these are not readily available, the correction may be made by holding the type bar near the bottom with a pair of pliers, and with a type aligning wrench, adjust the upper part of the type bar enough to align it with the guide.

Ordinarily the throat of the type bar will be straight and true so that the bar will respond to the three-pronged pliers. If the bar tends

to stick in the guide, closer examination may reveal that the bar is bent at an angle (Figure 2-60). Application of the three pronged pliers just below the throat will straighten out the bar.

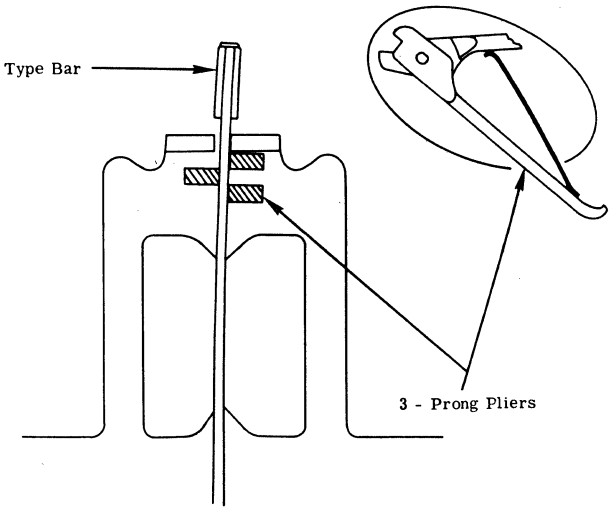


Figure 2-60 Type Bar Bent at Throat

3. Twist the type on its feet so that it strikes evenly on both sides of the character. Catch the type bar at the throat with the narrow slot of one type wrench, then with the wide slot of the wrench, twist the type head either to the right or left (Figure 2-61).

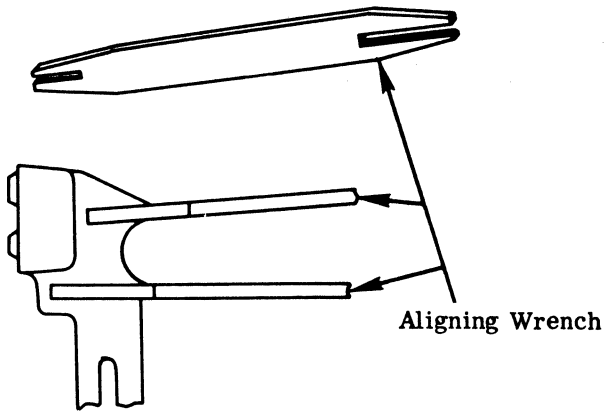


Figure 2-61 Two Type Aligning Wrenches

4. The lower case letters should center between two lower case n's nananan. If a type bar fails to center equally between two lower case n's, it may be necessary to use knock-over pliers and move the type to either the left or the right (Figure 2-62).

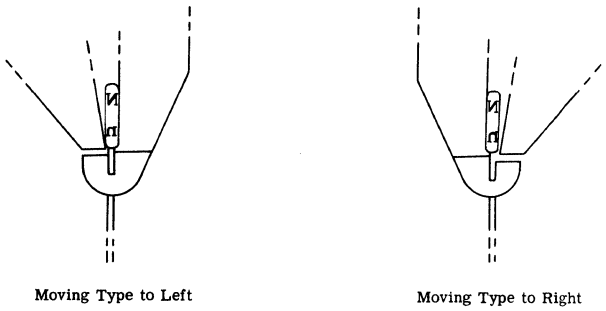


Figure 2-62 Use of Knock-Over Pliers

5. After using the knock-over pliers, it is necessary to straighten the upper case character and observe that it is centered between two capital N's. For this purpose, place the type in the guide and pull the upper case type lightly to either side with aligning wrench (Figure 2-63).
6. To raise or lower type to the writing line, two methods are available. One method requires the use of the S-6 bar bender and was described in paragraph one. The other method, which employs the peening pliers or maulers, is recommended when a minor adjustment is required in raising or lowering a type without changing its ring and cylinder adjustment. Place the tool on the edge of the bar and peen (Figure 2-64).

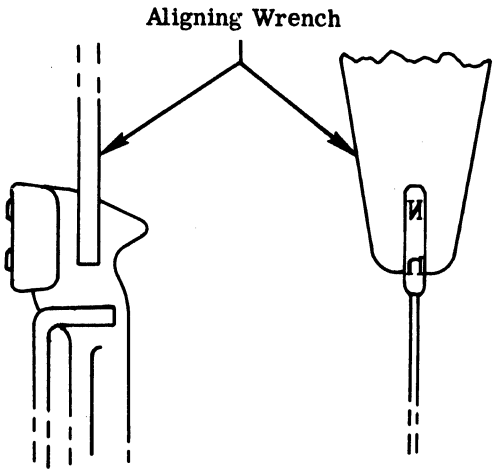


Figure 2-63 Straightening Upper Case

There is a limit to the effectiveness of the peening pliers. Their use should be confined to three marks for either direction. The jaws should be adjusted, by means of the adjusting screw in one of the handles, and by setting the jaws in the proper location so that the points of the jaws lock 1/64" of meeting when the pliers are closed. If a type bar near either end of the basket prints too high, hold the type face up to the platen with the ribbon in stencil position. Observe the amount of clearance between the platen and and type face in both upper and lower case. If either character is off cylinder, the bar may be twisted slightly with a type aligning wrench to equalize the ring and cylinder adjustment of each of the two type faces. If an end bar is slightly high or low, place an aligning wrench on the bar just below the throat extending toward the front of the machine. Place a second aligning wrench on the throat of the bar and allow it to extend toward the type bar guide. By holding the first wrench, the type throat may be twisted

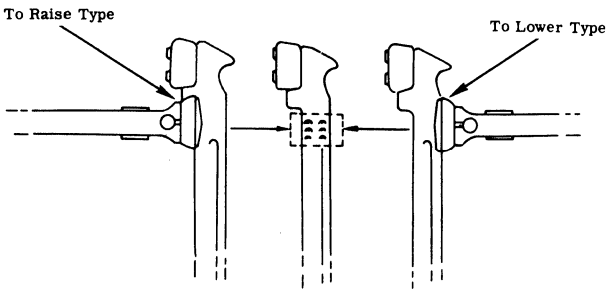


Figure 2-64 Peening Type

slightly to the left to lower, or to the right to raise a left hand type bar. This technique may be applied in reverse order for the right hand type bars. After this treatment, the normal type aligning adjustments should be followed, observing that the bar must enter the guide perfectly and that ring and cylinder adjustment is accurate.

It will be noticed that it is easier to raise a type by peening the front edge nearest the platen than to raise it by bending it away from the platen with the S-6 bender. It will also be noted that it is easier to lower a type by using the S-6 bender in the manner described than to lower it by peening the back edge, away from the platen.

The end type bars, from No. 1 to about No. 8, and from No. 34 to No. 42 may be lowered somewhat by peening the back edge, away from the platen, but in order to raise them a small amount, the S-6 bender will be more effective. For a greater change, the technique of using two aligning wrenches will serve.

7. When a type character appears to have correct ring and cylinder in both upper and lower case, but a part of the type face does

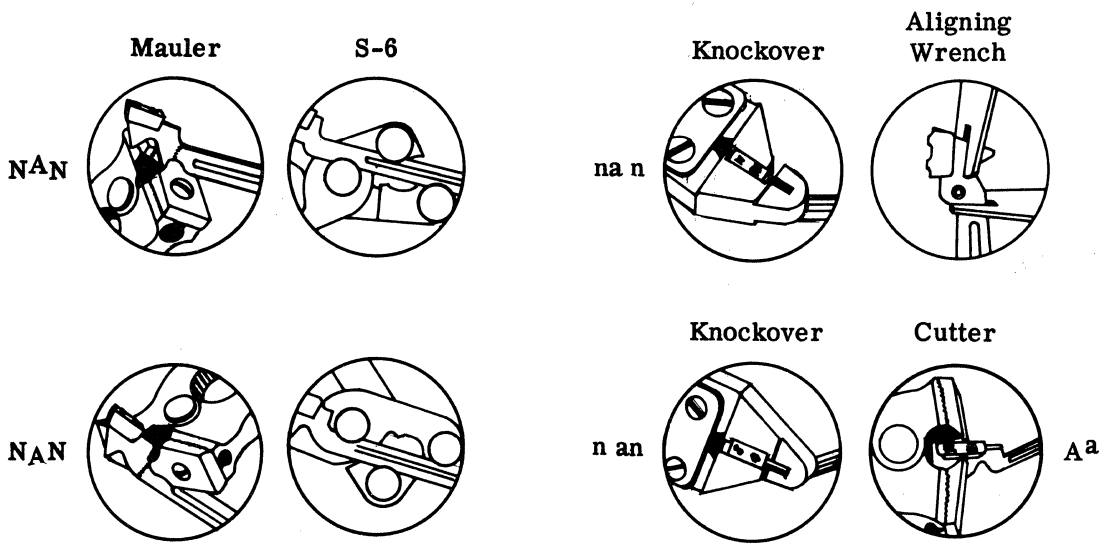


Figure 2-65 Use of Aligning Tools

not print, or prints lightly, then the type cutters should be used. Place the cutter jaws on the type head about 1/32" behind the face of the type and cut. The cutters should have been adjusted to prevent the jaws from closing to less than 1/16".

Type Soldering Fixture - A type soldering fixture (Figure 2-66) may be used to hold a type slug in place, or to guide it into proper position during re-soldering. It is not necessary to remove the type bar from the machine.

To raise the slug, place the guide on the type bar with its flat surface squarely against the face of the type and lock the screws tight. Heat the slug and carefully pry the slug upward the required amount with a screwdriver. To lower a slug, use the same procedure but lock the fixture in place far enough below the slug to permit the slug to be pressed down, while hot, the required amount. To solder a slug on a new bar, install the bar and solder the slug in a trial position. Adjust the slug up or down by first adjusting the fixture. A slug may be tilted toward or away from the platen by first setting the fixture to the desired position and moving the slug to the fixture.

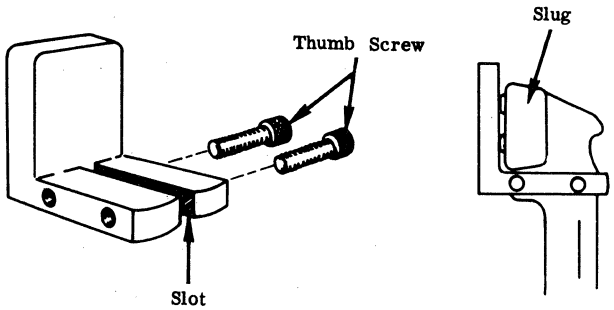


Figure 2-66 Soldering Fixture

Impression Control Adjustment - The tendency in adjusting impression control screws (on cam units) is to use them too frequently when a correction in the alignment of a type bar is clearly indicated. All of the requirements of good alignment, as outlined under the standard machine adjustments, are essential to proper control of type impression.

A number of factors influence impression, and these factors must be studied and understood thoroughly in order to apply them properly to the control of impression.

Failure of the power drive mechanism, such as failure of the motor, motor belt slippage, bind in shaft or gears, would cause poor impression. Low voltage can contribute to uneven impression and should not be disregarded.

The power roll cover must be tight, must run true and concentric, and the surface must be clean and free from greasy or oily substance.

The cams must have the proper clearance to the power roll. At the high lobe of the cam operation, the selector bar must not choke off the cam.

The linkages between the cam and the bell crank, the bell crank and the type bar toggle, and the type bar toggles should be free from binds to insure good impression.

The type bar segment slots must be kept free from binds. Precaution should be taken, in clearing a bind from one segment slot, to insure that adjacent slots are not closed so as to cause a bind. One means of clearing a bind is to hold the bar firmly against one side and then the other of the segment slot and move it back and forth between the type guide and the type rest. Check the adjacent bars after this treatment. An effective cleaning tool for removing dirt from segment slots may be made from a discarded type bar by grinding a hook on the bottom end.

The type guide must to open enough to permit free passage of all type bars. During testing of this feature, if most bars pass and only a few seem to stick, the difficulty can be overcome by straightening the type bars.

The escapement mechanism, universal bar and escapement trip link must be carefully checked for binds which might reflect in poor type impression. This check should include bars on the left, center and right.

If a type bar shows light and dark impression for no apparent reason, remove the bar and examine it at the point where the universal bar meets the type bar. If there appears to be a worn spot where the universal bar could bind the type, stone off the edges of the spot so as to permit smooth operation.

The ribbon lift mechanism should be checked for binds, or too little or too much tension on the ribbon lift universal bar spring anchor.

The platen is one of the greatest single factors in determining type impression. If the platen is soft, the type impression will be less clear at the edges, will have a softer outline and will not have the tendency to cut. The applications being performed on the machine must dictate whether a harder or softer platen is required on a given machine. Never leave a machine with the impression set so light that the impression will fail a short time later. Always leave the impression set strong enough to insure that it will print dark and clear.

The carriage must be adjusted properly to insure uniform type impression. The carriage rails must hold the carriage from side play, but without

binding. If defective, it will cause the type impression to appear uneven by allowing the platen to rock back and forth. For example, if the platen rocks back, the type impression appears low and light. If the platen rocks forward, type impression appears high and heavy. If impression appears uneven but not above or below the line, then the trouble cannot be traced to these items. The platen eccentrics on the ends of the carriage must be set so that ring and cylinder is correct and equal on both ends of the platen.

Finger prints, although not always visible, can contribute to poor impression by rendering paper surface repellent to the impression of carbon paper ribbon. This difficulty would show up as irregular, spotty sections of poor type impressions.

After having checked all of the conditions mentioned, the impression adjusting screws (on the cams) should be adjusted so as to provide a strong dark impression without cutting through the paper or the carbon ribbon when it is used. In deciding where to set the screw when it is difficult to secure both of these condtions, it is best to leave the screw set slightly heavy.

CODE SELECTOR

PURPOSE AND DESCRIPTION

The purpose of the code selector is to select a different binary code for each individual character and function of the Flexowriter. This mechanism is designed to select any combination of units in a code up to a maximum of 12 units. The Model FL Flexowriter, however, uses only a six unit code which would result in a maximum of 64 code combinations.

The selector operation produces a binary code which is represented by an open or closed position of an electrical contact. To operate the contacts, the selector consists of an assembly of sliding members which are mechanically operated by the cams of the writing machine. A cam operation causes a sliding movement of its associated selector slide only. All the selector slides are positioned to operate a group of transverse bails. One bail is employed for each unit of the code being used plus a common bail which is always operated by every selector slide. Therefore, if a six unit code is used, there would be seven transverse bails, and each bail being adapted to operate a normally open electrical contact.

The selector slides are coded by means of cam surfaces on the slide which operate the code bails. A different combination of bails are operated by each selector slide simply by removing the cam surfaces associated with certain code bails.

Therefore, when a character or functional key lever is depressed, its associated cam and selector slide is operated and in turn closes the code contacts corresponding to the code arrangement for that particular keylever position.

The electrical impulses, which are the result

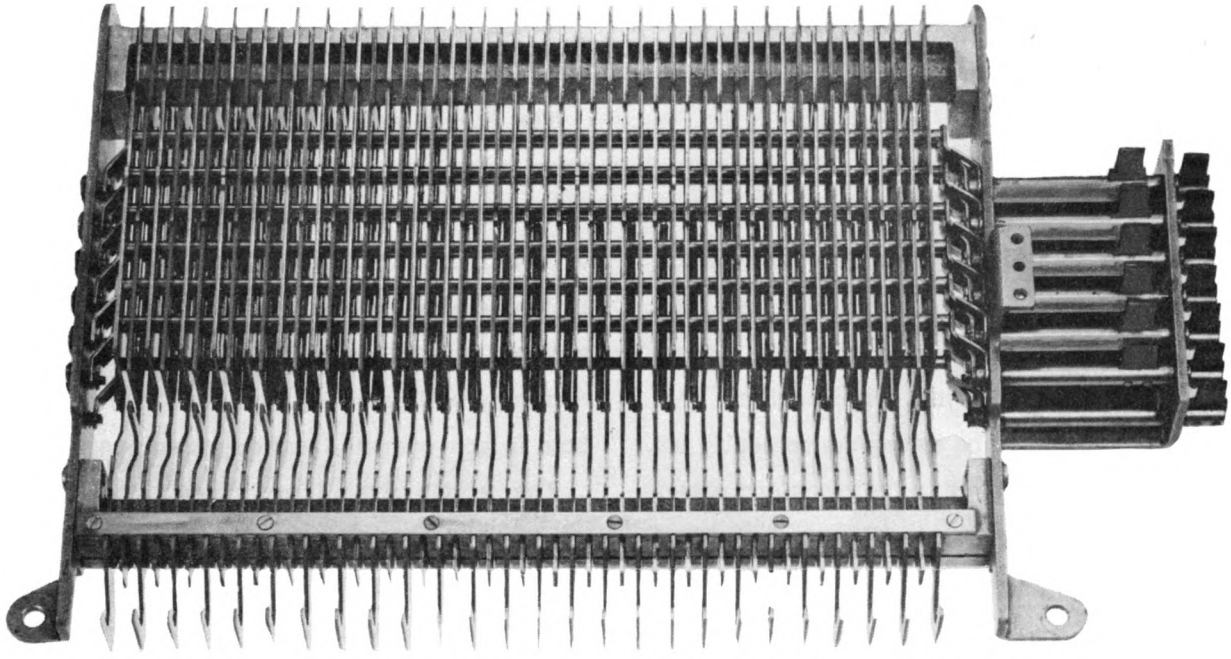


Figure 3-1 Code Selector

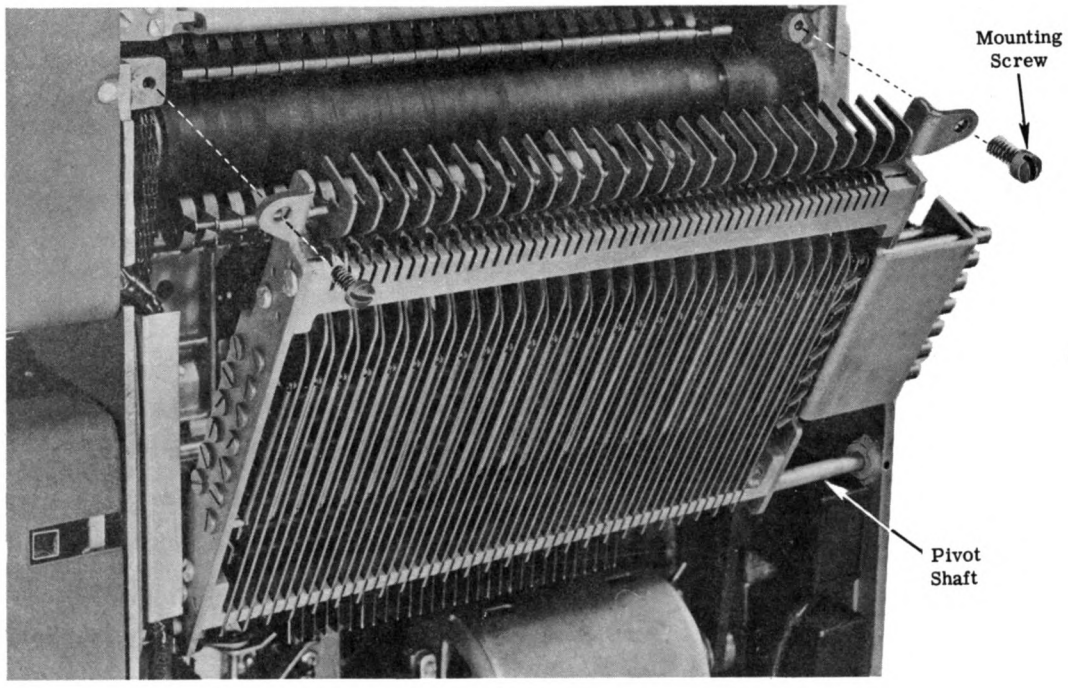


Figure 3-2 Selector-Pivoted on Shaft

of closing the code contacts, are connected directly to the punch magnet on the Model FL Tape Punch.

The President Model FL uses six additional upper bails and corresponding contacts which selectively operate three escapement magnets for proportional spacing operation.

GENERAL CONSTRUCTION

The selector is a single contained unit which is mounted under the Writing Machine. (Figure 3-1). The rear of the selector is pivoted on a shaft which extends the entire width of the machine. This allows the selector to be swung conveniently out of the way for easy access to the cams and power roll of the Writing Machine. (Figure 3-2). Two screws through the front end hold the selector in its operating position.

A rigid frame is formed by the assembly of end plate L. H. (279), end plate R.H. (281), space bar rear (266), and space bar front (265). (Figure 3-3). The space bar front and rear are slotted for assembly of the slides. These slots are so spaced that each slide will center with its corresponding cam unit on the Writing Machine when the selector is in its operating position.

The forked end of the slides is guided by the rear space bar.

The front space bar is slotted so that the slides drop in from the top. They are held in their slots by the retaining strip (269) and six screws. Due to a small cut-out section in each selector slide, the retaining strip also acts as a stop for each slide, both in non-operated and operated position.

The slides are of two types, front (261) and rear (262), see Figure 3-3 and 3-4. They are in alternate slots, and a spring pin in two adjoining slides allows one spring (272) to hold one rear and one front slide in the non-operating position.

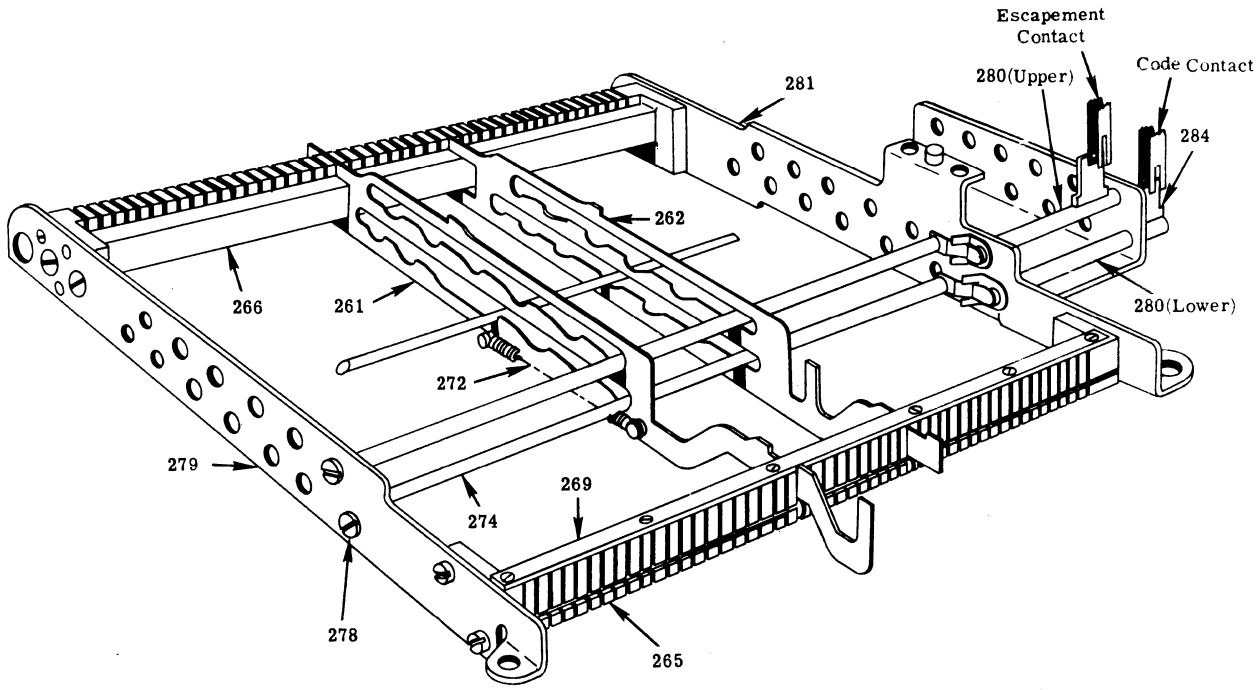


Figure 3-3 Selector Construction

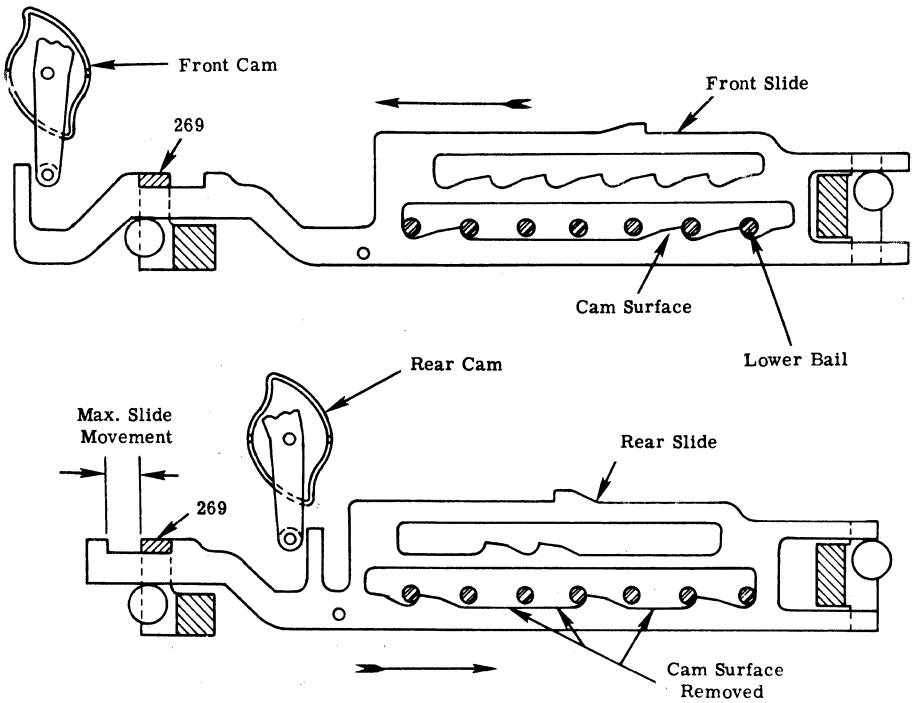


Figure 3-4 Front & Rear Slides

Contact shaft assemblies (280) are mounted in the R. H. selector end plate. There are seven lower shaft assemblies which are used to operate the contacts for the circuit to the punch magnets. (Standard Flexowriter).

There are six upper contact shaft assemblies used for operating the escapement contacts. (PSM). Either or both groups of these shafts are used on the selector units, depending on what machine the selector is to be installed. If the machine is to be used to perforate a tape and is a proportional spacing machine, both upper and lower shaft assemblies will be required.

In the L. H. end plate there is provision for thirteen pivot screws (278). These screws are in line with the pivot ends of the contact shaft assemblies, permitting bails (274) to be pivoted from these points. These bails extend through each slide, seven through the lower section of the slide and six through the upper section.

OPERATION

A side view of a front slide (261) with some of its cam surfaces removed is shown in Figure 3-5. The bails (274) are shown as they would be positioned when all selector slides are in their normal position. The numbers on the lower bails refer to the contact selected with reference to punch magnets. The letter "C" is the common contact. The letters on the upper bails refer to the contacts selected with reference to the escapement magnets.

When the cam for the above mentioned slide is operated, the slide will move in the direction indicated.

The bails C, 1, 3 and 6 in the lower section,

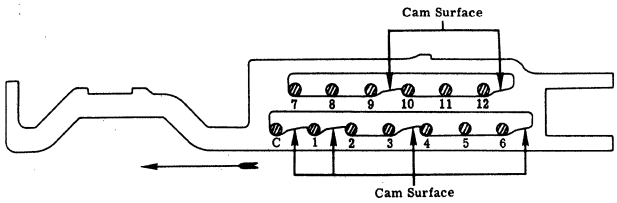


Figure 3-5 Front Slide-Side View

and bails 9 and 12 in the upper section will be raised because of the cam surfaces of this particular slide.

One end of each of the bails, besides pivoting on the contact shaft, also rests in a forked end of the shaft assembly. Therefore, the motion of the bail rising on the cam surface of a slide is transferred through this fork to the shaft, causing the contact operator (284) to move and operate its related contact. The closing of a contact completes a circuit to a related punch magnet. (See Punch Magnet Circuits - Section 8.)

DISASSEMBLY AND ASSEMBLY (Figures 3-6 and 3-7)

1. Remove the two positioning screws from the base.
2. Loosen the set screw in the right side plate of the machine.
3. Slide out the pivot shaft.

There is a possibility that it will be necessary to change a slide in the selector unit. This is not difficult and can be accomplished in the following manner (selector removed from machine):

1. Remove all the springs from one end of the slides and lay the unit flat.
2. Remove the L. H. end plate (279) by removing four screws and tapping it out from the four dowel pins.

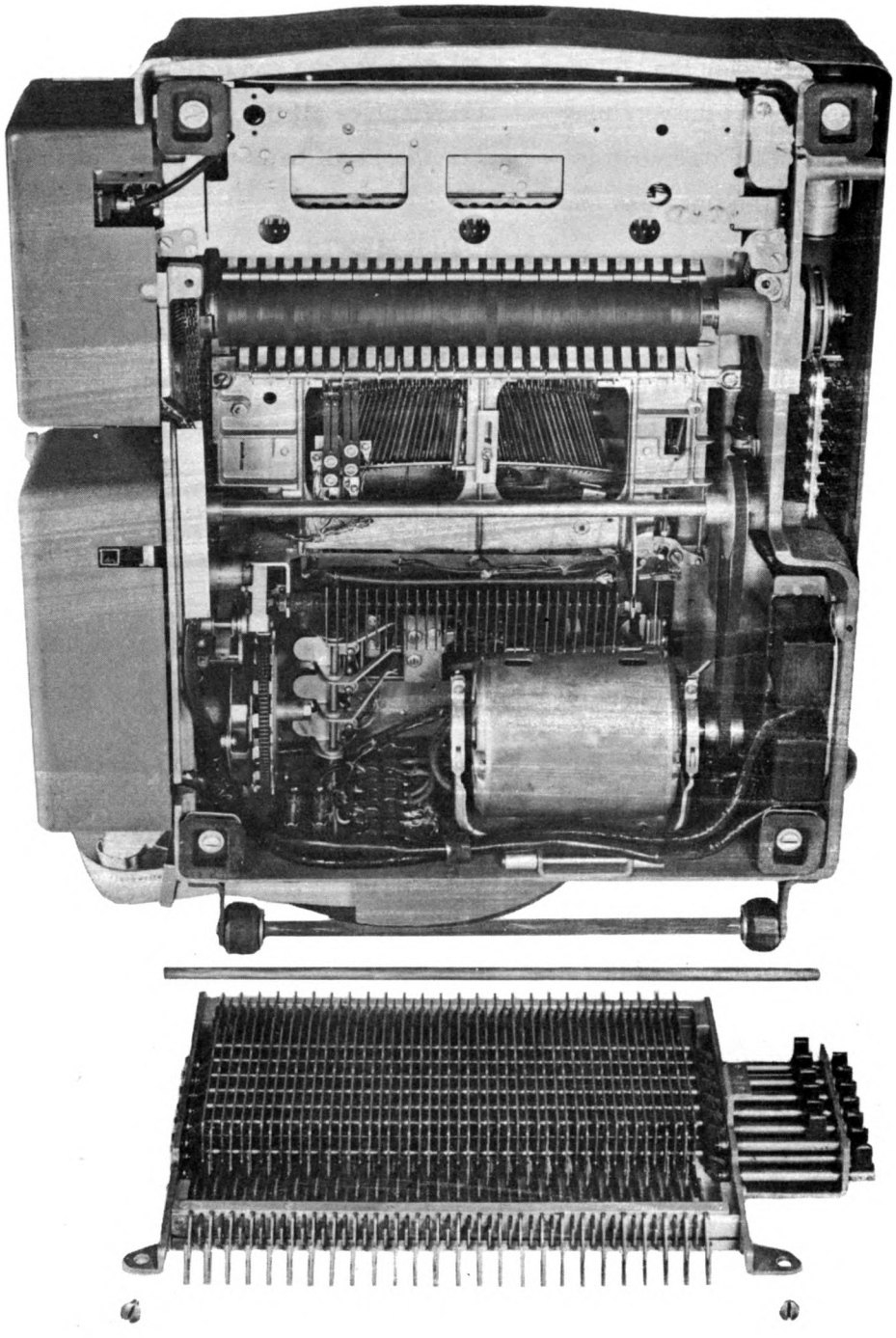


Figure 3-6 Selector Removed

3. Remove all the bails (274) by sliding them out one by one from the left end. It will be necessary to release each bail and slide them all toward the rear of the unit to obtain clearance for the bails through the slides.
4. Remove six screws and lift off the retaining strip (269). It is then possible to remove any individual slide by lifting the front end and sliding it forward.
5. Replace the slide.
6. Replace the retaining strip (269). Care should be taken so that all slides are positioned to permit the retaining strip to clear the slides and line up in its proper position.
7. Replace all bails in the same manner in which they were removed. Insert the bail ends into the forked ends of their respective contact shaft assemblies, starting at the front and keeping them as near parallel as possible.
8. Replace the L. H. end plate on the dowel pins and start one front and rear screw.
9. Replace the L. H. ends of the bails on their respective pivot studs.
10. Tighten the end plate securely.
11. Replace all the slide springs.
12. Check all bails and slides for binds.

ADJUSTMENTS

Selector Mounted To Writing Machine.

Selector Slides -

1. Form each selector slide so that there will be a minimum of .005" clearance between the cam roller and the operating extension of the slide in the non-operate position. (See Figure 3-8.)
2. Place each cam on high lobe and check selector to see if there is additional motion (Figure 3-9).

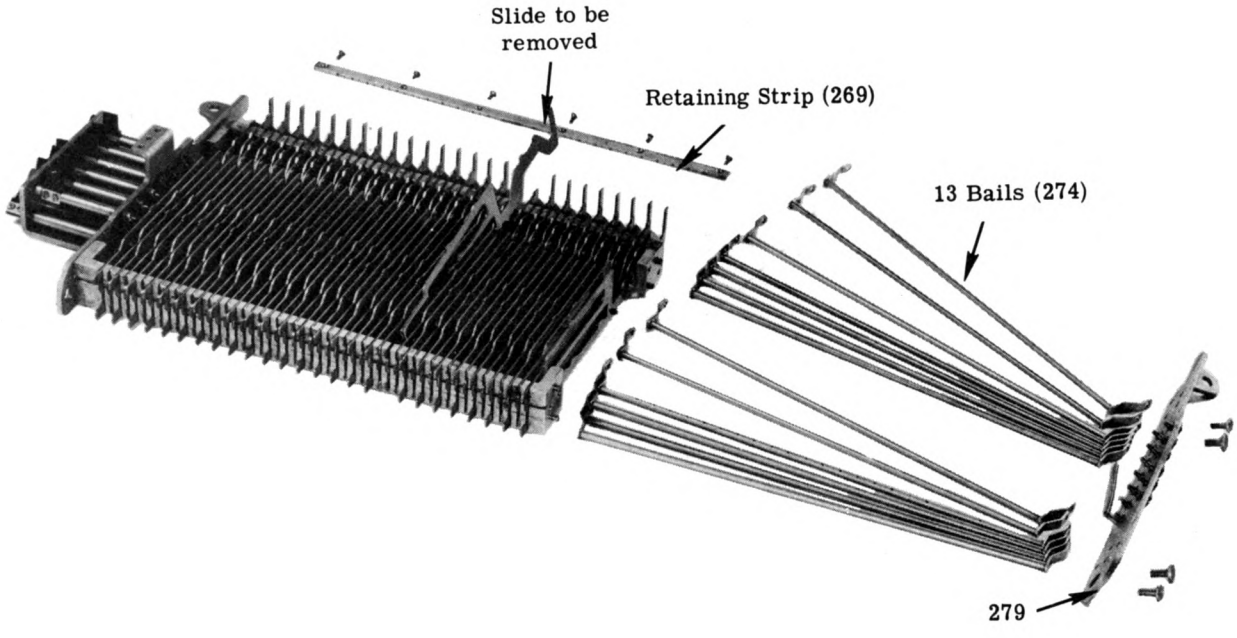


Figure 3-7 Selector Disassembled

Friden — Customer Service Engineering

#1

MANUAL ADDENDUM

Date: August 23, 1954

Reference: To be inserted in Part II, Section 3, between Pages 3-6 and 3-7.

Subject: Code Selector Adjustments

Purpose: To correct error in Code Selector Adjustments.

Information:

Part II - Flexowriter - Model FL

Section 3 - Code Selector Adjustments.

Page 3-6 - Adjustments

1. Unchanged.

2. Changed as follows:

   Delete present adjustment number two in its entirety and add the following:

2. Move each type bar to platen and check to see that each selector slide has additional motion away from its cam. Also, on functional operations such as, carriage return, back space, etc., place each cam on its high lobe and check selector slide to see if there is additional motion. (Figure 3-9).

3. Unchanged.

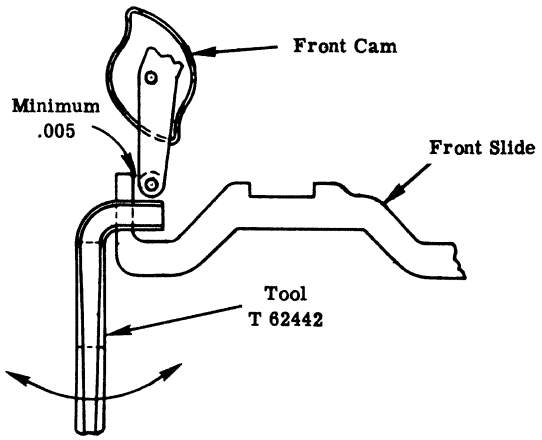


Figure 3-8 Cam & Slide Clearance - Nonoperate

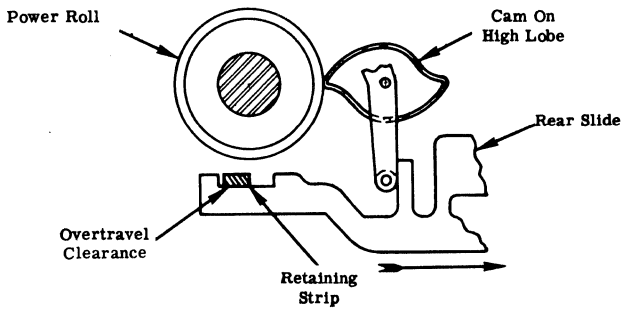


Figure 3-9 Cam & Slide Clearance - Operate

3. On PSM machines with electrical trip mechanisms, the slide adjustment may have to be held to a minimum to assure proper escapement.

Selector Contacts

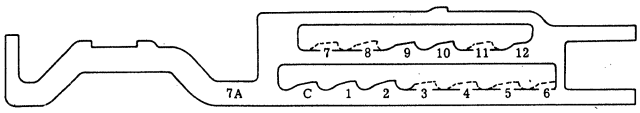
1. Adjust the contact mounting plate on the base casting to obtain the best average condition of the contacts (movable contacts should be just touching the operators).
2. Adjust each contact individually, so that with the machine resting on its feet the movable contact just touches the operator without altering the normal gap at the contact points.
3. Adjust each set of code contacts to a normal gap of .020″ to .024″ and see that a full operation of selector slide closes the contact points with at least an appreciable movement of the stationary contact spring away from its stop strip.
4. Adjust each escapement contact to a normal gap of .016″ to .020″.
5. Adjust the common contact to a normal gap of .030″ to .035″ and check to see that all code contacts close before the common contacts close, and open after the common contacts open. Check to see that a full operation of a selector slide closes the common contact points with at least an appreciable movement of the stationary contact spring away from its stop strip.

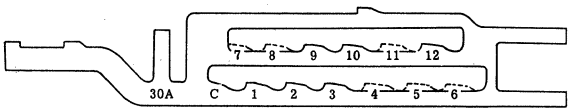
SELECTOR CODE ARRANGEMENT

The chart in Figure 3-10 shows the Standard and President model arrangement of the selector slide cams. The lower row of cams represent the code for the particular character or function position. The upper row of cams represent the code for the particular character escapement for upper and lower case (President machines only).

The chart in Figure 3-11 shows the escapement code, escapement magnets operated and the units of escapement for each character on a President model machine. The Escapement Code column represents the selector escapement contacts as explained in Part II, Section 8, Page 8-10.

Code Selector





FRONT SLIDE

Position Number	Cam Surface
1A	C-3-4-5-6
3A	8-11 C-3
5A	9-12 C-2
7A	9-10-12 C-1-2
9A	9-10-12 C-1-5
11A	9-12 C-1-3
13A	9-10-12 C-1-3-4-5
15A	9-10-12 C-1-4
17A	9-10-12 C-2-3-4
19A	8-10-12 C-1-3-4
21A	9-10-12 C-2-3-4-5
23A	9-10-12 C-2-4-5
25A	9-10-12 C-1-4-5
27A	9-10-12 C-3-5
29A	9-10-12 C-3-4
31A	8-12 C-1-2-4
33A	8-9-11-12 C-3-4-5
35A	9-10-12 C-1-2-3-4
37A	8-11 C-3-4-6
39A	8-10-12 C-2-5
41A	8-11 C-4-6
43A	8-11 C-3-6
45A	9-12 C-2-6
47A	8-11 C-2-3-6
49A	C-3-5-6
51A	C-2-3-4-5-6

REAR SLIDE

Position Number	Cam Surface
2A	C-2-5-6
6A	9-10-12 C-1-2-3-5
8A	9-10-12 C-1-2-3-6
10A	7-9-11-12 C-1-2-5
12A	9-12 C-1-2-6
14A	9-10-12 C-1
16A	9-12 C-1-3-6
18A	9-10-12 C-2-4
20A	9-10-12 C-1-4-6
22A	8-10-12 C-5
24A	9-12 C-1-3-4-6
26A	9-10-12 C-1-3-5
28E	9-10-12 C-1-2-4-6
30A	9-10-12 C-1-2-3
32A	9-12 C-1-6
34A	8-11 C-2-3
36A	9-11 C-1-2-4-5
38A	9-10-12 C-4-5
40A	9-11 C-1-2-3-4-5
42A	9-10-12 C-2-3-5
44A	9-12 C-2-3-4-6
46F	9-11 C-2-4-6
48A	7-10 C-4
50A	C-1-5-6

Figure 3-10 Selector Slide Coding

Friden — Customer Service Engineering

MANUAL ADDENDUM

Date: August 30, 1954

Reference: To be inserted in Part II, Section 3, between Pages 3-8 and 3-9.

Subject: Code Selector - Selector Code Arrangement

Purpose: To correct error on PSM Character Spacing Chart.

Information:

Part II - Flexowriter - Model FL

Section 3 - Code Selector

Pages 3-9 - PSM Character Spacing Chart

Make change on character "W" under column "Escapement Magnets Operated", delete number "4" under "LC" and add "1-3" under "LC".

Character LC	Character UC	Character Code	Escapement Code	Escapement Magnets Operated LC	Escapement Magnets Operated UC	Unit Width LC	Unit Width UC
a	A	12	9-10- 12	3	1-3	3	4
b	B	1 45	9-10- 12	3	1-3	3	4
c	C	234	9-10- 12	3	1-3	3	4
d	D	1 4	9-10- 12	3	1-3	3	4
e	E	1	9-10- 12	3	1-3	3	4
f	F	1 34	8- 10- 12	2	1-3	2	4
g	G	2 45	9-10- 12	3	1-3	3	4
h	H	3 5	9-10- 12	3	1-3	3	4
i	I	23	8- 11	2	2	2	2
j	J	12 4	8- 12	2	3	2	3
k	K	1234	9-10- 12	3	1-3	3	4
l	L	2 5	8- 10- 12	2	1-3	2	4
m	M	345	8-9- 11-12	2-3	2-3	5	5
n	N	34	9-10- 12	3	1-3	3	4
o	O	45	9-10- 12	3	1-3	3	4
p	P	23 5	9-10- 12	3	1-3	3	4
q	Q	123 5	9-10- 12	3	1-3	3	4
r	R	2 4	9-10- 12	3	1-3	3	4
s	S	1 3	9- 12	3	3	3	3
t	T	5	8- 10- 12	2	1-3	2	4
u	U	123	9-10- 12	3	1-3	3	4
v	V	2345	9-10- 12	3	1-3	3	4
w	W	12 5	7- 9- 11-12	4	2-3	4	5
x	X	1 345	9-10- 12	3	1-3	3	4
y	Y	1 3 5	9-10- 12	3	1-3	3	4
z	Z	1 5	9-10- 12	3	1-3	3	4
-	—	6 234	9- 12	3	3	3	3
2	@	6123	9-10- 12	3	1-3	3	4
3	#	612	9- 12	3	3	3	3
4	$	61 3	9- 12	3	3	3	3
5	%	61 4	9-10- 12	3	1-3	3	4
6	¢	61 34	9- 12	3	3	3	3
7	&	612 4	9-10- 12	3	1-3	3	4
8	*	61	9- 12	3	3	3	3
9	(	12 45	9- 11	3	2	3	2
0	)	12345	9- 11	3	2	3	2
.	.	6 4	8- 11	2	2	2	2
,	,	6 34	8- 11	2	2	2	2
;	:	6 3	8- 11	2	2	2	2
'	‘	6 23	8- 11	2	2	2	2
1	!	6 2 4	9- 11	3	2	3	2
/	?	6 2	9- 12	3	3	3	3

Figure 3-11 PSM Character Spacing Chart

CLUTCH MECHANISM

PURPOSE

The purpose of the clutch is to permit mechanical power to be transmitted from a continuous rotating gear to a drive shaft when the clutch magnet is energized, but allows this gear to rotate freely when the magnet is de-energized.

The punch and translator clutch parts are identical but the driven gear and drive shafts will be different in their respective units. Figure 4-1 shows the location of the punch clutch mechanism while Figure 4-2 shows the location of the translator clutch mechanism.

DESCRIPTION OF PARTS

Figure 4-3 shows the clutch mechanism disassembled.

The clutch spring (301) is close wound and made from rectangular wire. The dimension of the inside diameter when the spring is not expanded is held very accurately. This insures a secure grip on both the gear hub and the clutch collar (297) on which the ends of this spring assemble.

The end of the spring (301) which the clutch collar assembles has a right angle bend. This bend fits into a slot in the collar. The length of

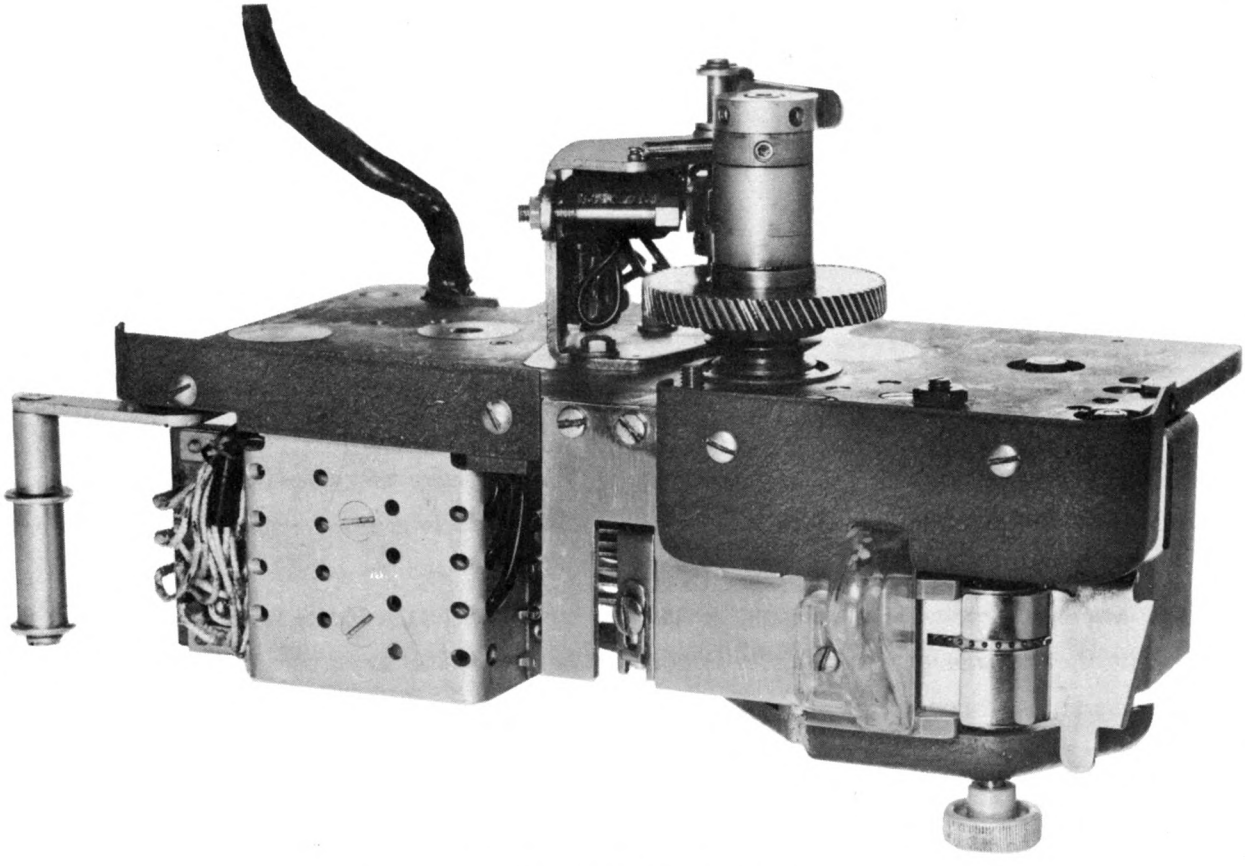


Figure 4-1 Punch Clutch Mechanism

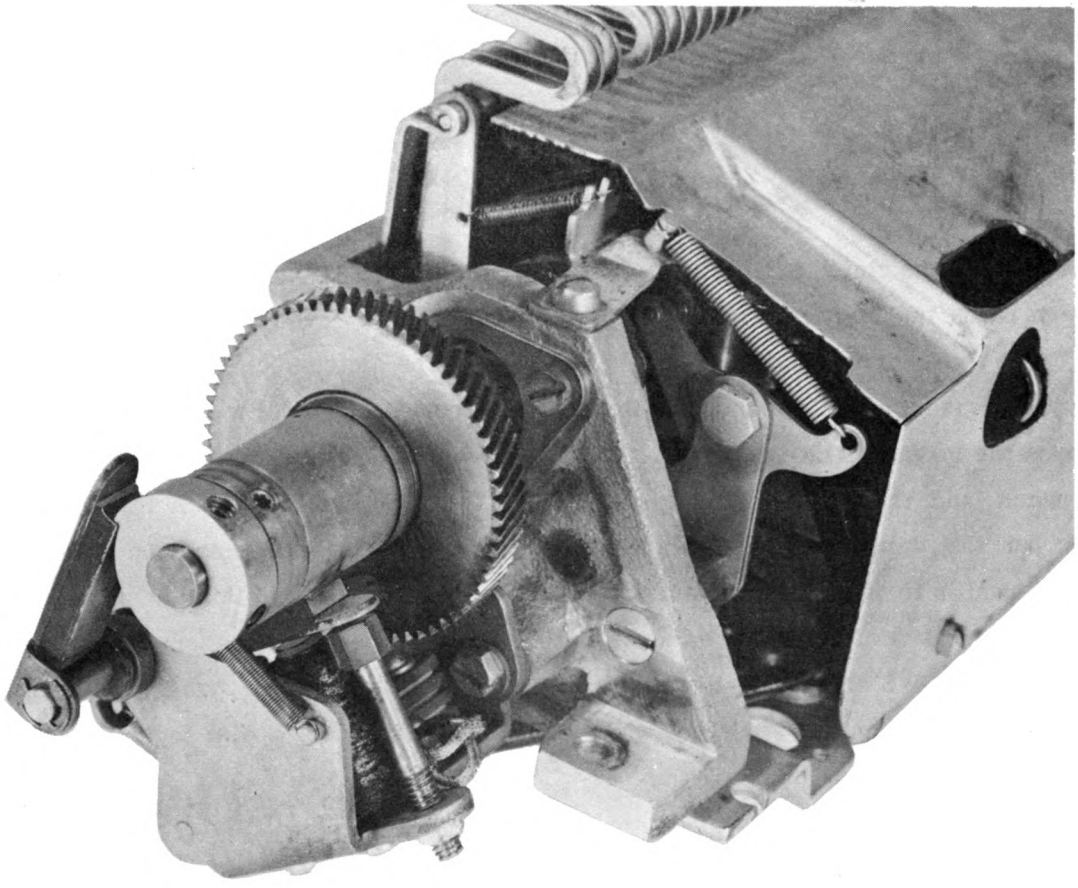


Figure 4-2 Translator Clutch Mechanism

the bend, however, must not be too long or it will not permit the assembling of the clutch detent (294) on the clutch collar (297).

The opposite end of the clutch spring strikes against a protruding point on the inside of sleeve 302.

The spring, when assembled, will ride over the clutch collar as far as the end of the slot. The other end will ride the gear hub. The sleeve itself will assemble over the spring and the two ends will fit the surface provided for it on both the gear hub and the clutch collar.

OPERATION (Figures 4-4 and 4-5)

When the clutch magnet is not energized and its armature is resting against the raised edge of the clutch sleeve (302), the spring (301) is expanded enough so that it does not grip the hub of gear (23 or 26). Therefore, the gear is allowed to rotate freely without turning the shaft (315 or 492).

If the armature is operated (due to the clutch magnet being energized) the tension of the spring (301), due to it being slightly forced in an unwound position, will be exerted against the sleeve (302) by the end of the spring in the slot. This will cause the sleeve to start to rotate, allowing the spring to grip the hub of the gear. The gear's motion will rotate the spring and also tend to wind the spring tighter.

The rotation of the spring will be transferred to the collar (297), the detent (294), and finally

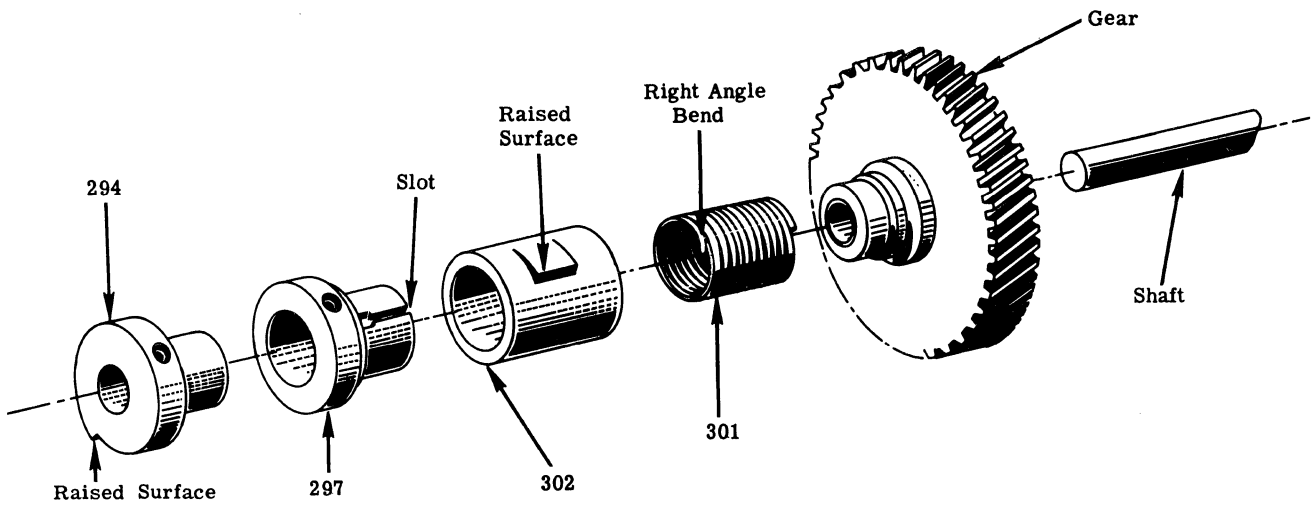


Figure 4-3 Clutch Mechanism Disassembled

the shaft. (A complete punch cycle is explained under the heading "Sequence of Operation," Section 5. The translator "Sequence of Operation" is in Section 7.)

The spring rotation also causes the rotation of sleeve 302, due to the end of the spring riding against the protruding point on the sleeve's inner surface.

When the clutch armature is released, it will engage the raised edge on the sleeve (302) (near the end of the punch or translator cycle), and the rotation of the sleeve will be stopped.

The rotation of the spring will exert a pressure against the edge of the slot which will tend to unwind the spring. This will increase the I. D. such that the spring no longer grips the gear hub, thus allowing the gear to run free again.

The speed of rotation will cause the detent (294) to overthrow and lock in position so that the spring is held with this enlarged I. D. until the armature is again released.

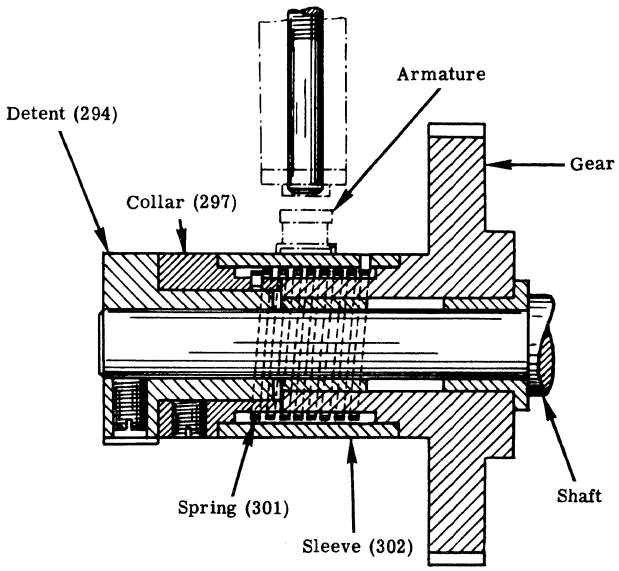


Figure 4-4 Cut-away Side View

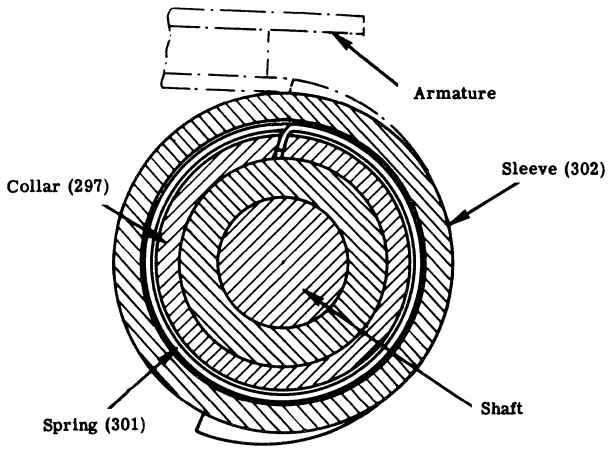


Figure 4-5 Cut-away End View

TAPE PUNCH

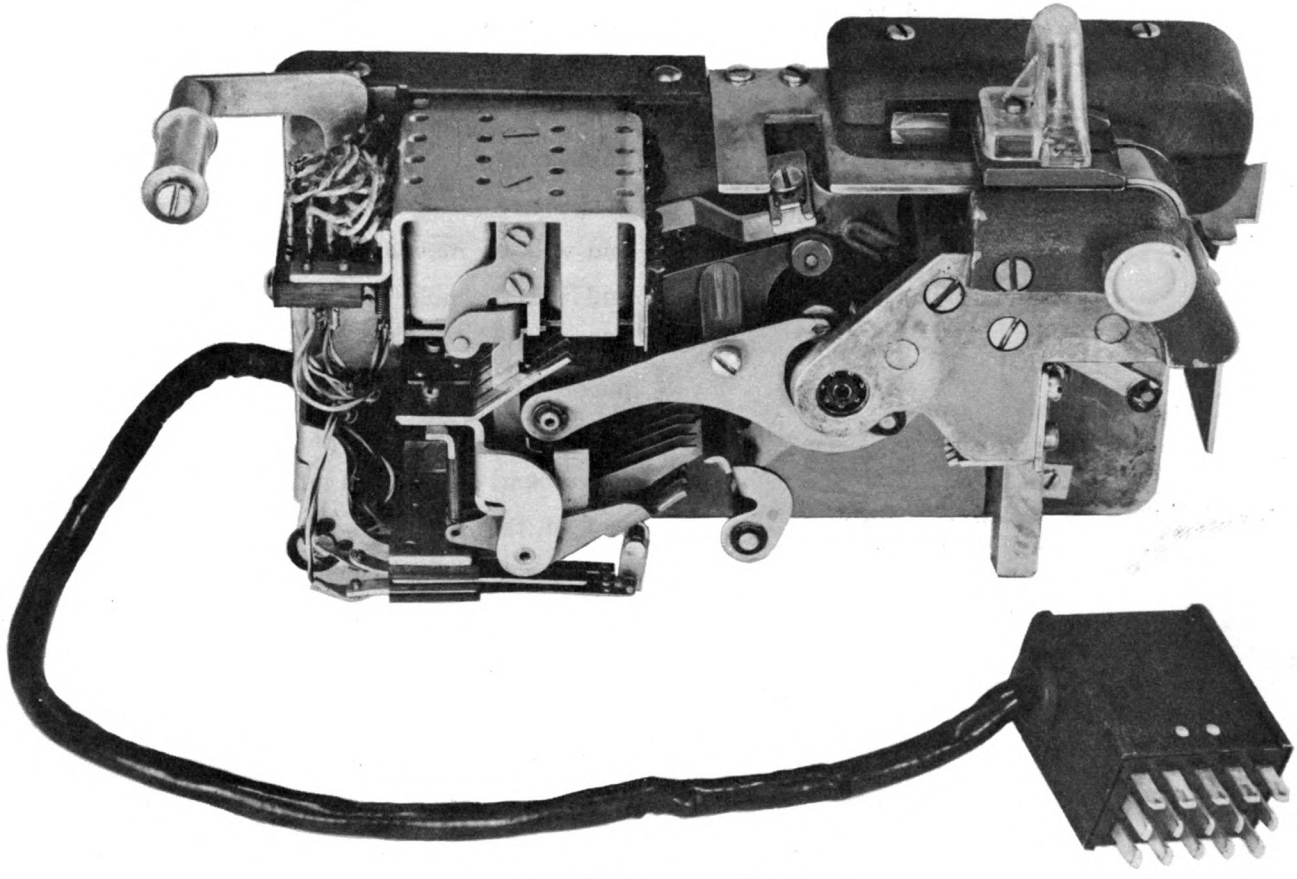


Figure 5-1 Tape Punch

PURPOSE

The purpose of the Tape Punch in the Model FL Flexowriter is to perforate a predetermined set of code holes in a 7/8 inch wide paper tape representing a character or function operated in the Writing Machine.

SEQUENCE OF OPERATION

The tape punch receives the electrical impulses originating at the selector unit contacts. These pulses represent a character or function code and energize corresponding punch magnets in the punch.

For example, assume that a character "E" keylever was depressed on the writing machine keyboard. This would, by the closing of the SC1 contact (on Selector), energize the No. 1 punch magnet (LP1). (See Punch Magnet Circuit, Section 8.) Also, the punch clutch magnet (LPC) would be energized.

When a punch magnet is energized, its armature (351) will be attracted to the core. In so doing, the latch lever (342) will pivot in a clockwise direction (Figure 5-2) because of the tension of spring (346). The point 353 of the latch lever will engage with the tip of punch lever (322). Also, the movement

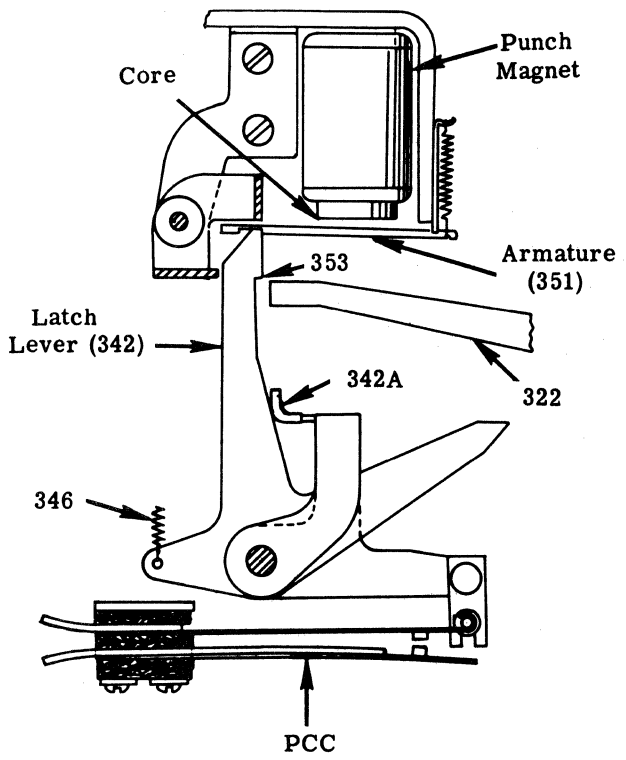


Figure 5-2 Punch Magnet and Latch Lever

of latch lever (342) will move the bail (342A). This bail, in turn, will close a set of contacts (PCC).

When the punch clutch magnet (LPC) is energized, the clutch (337) connects the constantly running drive gear (23) with the punch operating shaft (315). Note: The operation of the punch clutch is explained in detail in Part II, Section 4.

When the punch operating shaft (315) starts its rotation, the following actions take place:

The roller (358) of the latch lock bail (357) reaches the low side of cam 354 a short period after the start of shaft 315. This will move the latch lock bail so that it will lock the latch levers in their latched or unlatched position. (See Figure 5-3.) Also, the movement of the latch lock bail will operate the punch lock contacts (PLC).

Following the locking of the punch latch levers, the punch lever and frame assembly (324) begins to rise by action of cam 335 (Figure 5-4). During the upward movement of lever and frame assembly (324), the rod (323), on which the punch levers (322) are pivoted, is also moved upward. If the left hand ends of the punch levers (322) are not held down against the stop rod (327) by their respective latch levers (342), then the left hand end will be moved upward while the right hand end will be held down by the tension of spring 328. On the other hand, if the left hand ends of the punch levers are engaged by their respective latch levers and held against stop 327, the upward movement of rod 323 will move the right hand end of the punch levers upward. This upward movement of the punch levers will carry their respective code punches upward through the tape, perforating a code for those positions for which the punch magnet has been energized. (In the example stated earlier; if the "E" keylever was depressed, the No. 1 punch magnet would be energized. Therefore, the No. 1 code position in the tape would be perforated.)

The punch lever corresponding to the feed punch position is permanently held down against stop 327 by the outer end of arm 340. Therefore, for each revolution of shaft 315, a feed hole will be perforated in the tape.

When the punches have traveled their maximum upward movement, the latch lock bail (357), due to cam 354, starts its movement away from the latch levers (342).

During the unlocking of the punch latch levers, cam 336 returns the punch lever and frame assembly (324). This causes the punches to be returned from the die and to their normal position.

During the mid-part of the punch cycle (the

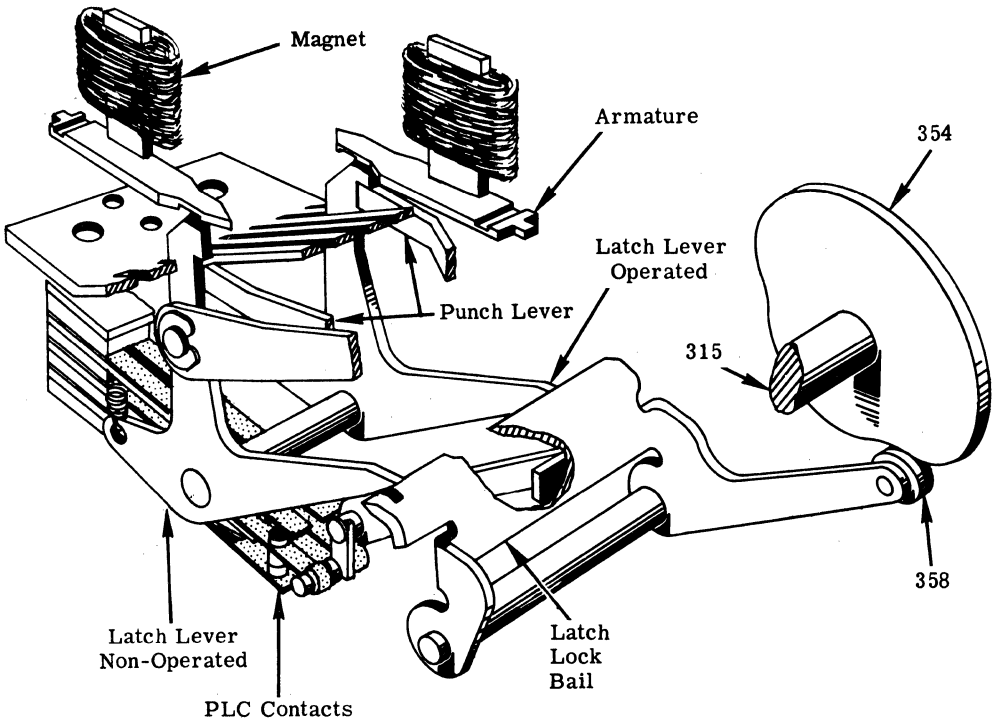


Figure 5-3 Latch Lock Bail

latch lock bail (357) has moved back past the tip of the latch levers), the stud (380) engages the outer end of latch lever restoring bail (379). (Figure 5-5) This action pivots the restoring bail counterclockwise on its pivot (343). Thus, the restoring bail engages all of the latch levers (342) and moves them counterclockwise past their armature latching position. In so doing, the lowermost latch lever engages an arm of the knockoff bail (382) which pivots on a rod (383). The knockoff bail (382) will pivot in a clockwise direction and engage and release any armature which may be stuck against its punch magnet core. Thus, all armatures (351) will be positioned against the ends of their related latch levers and held there by their related springs (352).

When the knockoff action is completed, stud 380 allows the restoring bail (379) to return to its normal position. Thus, the latch levers (342), due to their related springs (346), will move clockwise until they engage in the notch of their respective armatures.

During the latch restoring and armature knockoff operation just explained, the feed pawl lever arm (364) starts rotating in a counterclockwise direction, due to cam 363. (Figure 5-6) This moves the feed pawl (367) into the teeth of ratchet wheel 372, engaging a tooth and indexing the ratchet wheel in a clockwise direction. The rotation of the ratchet wheel (372) will rotate the tape feed sprocket (331) and, in turn, advance the tape 1/10 of an inch.

A detent lever (373) is adapted to engage the teeth of a detent gear (376) which is fastened on the shaft of the tape feed sprocket. The spring (377) keeps the roller of lever (373) in contact

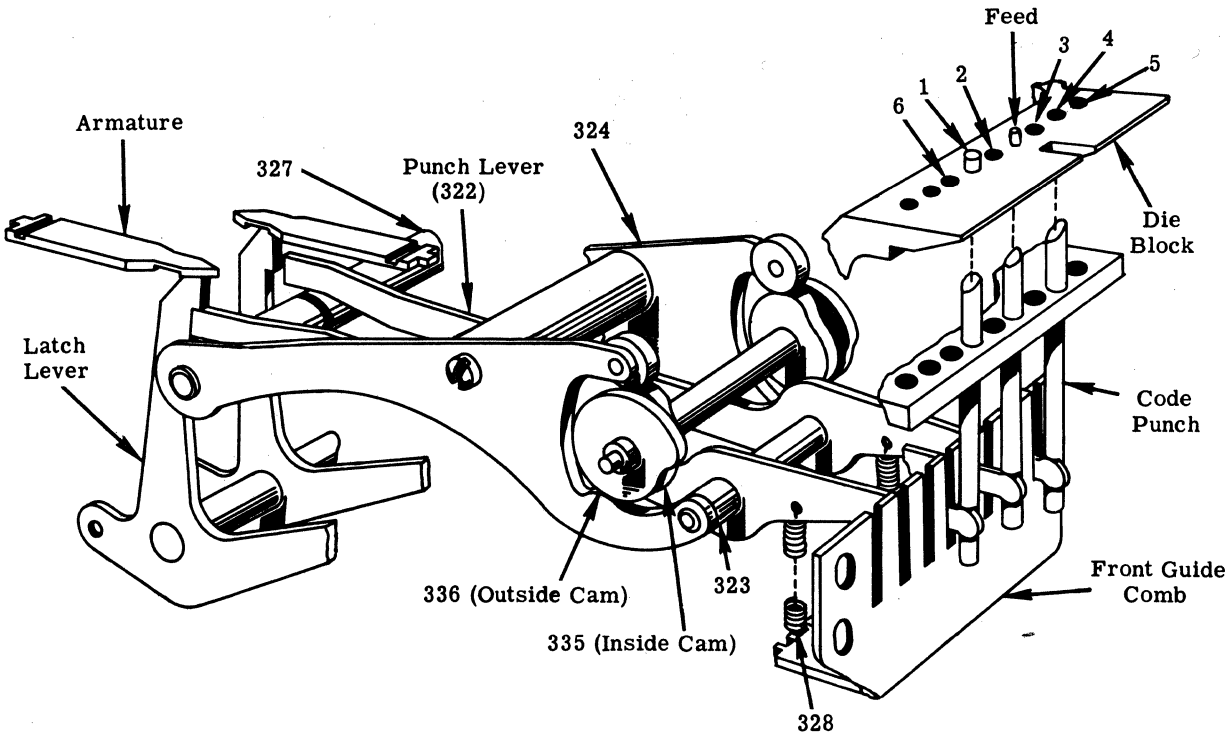


Figure 5-4 Latch, Operating Lever and Punch

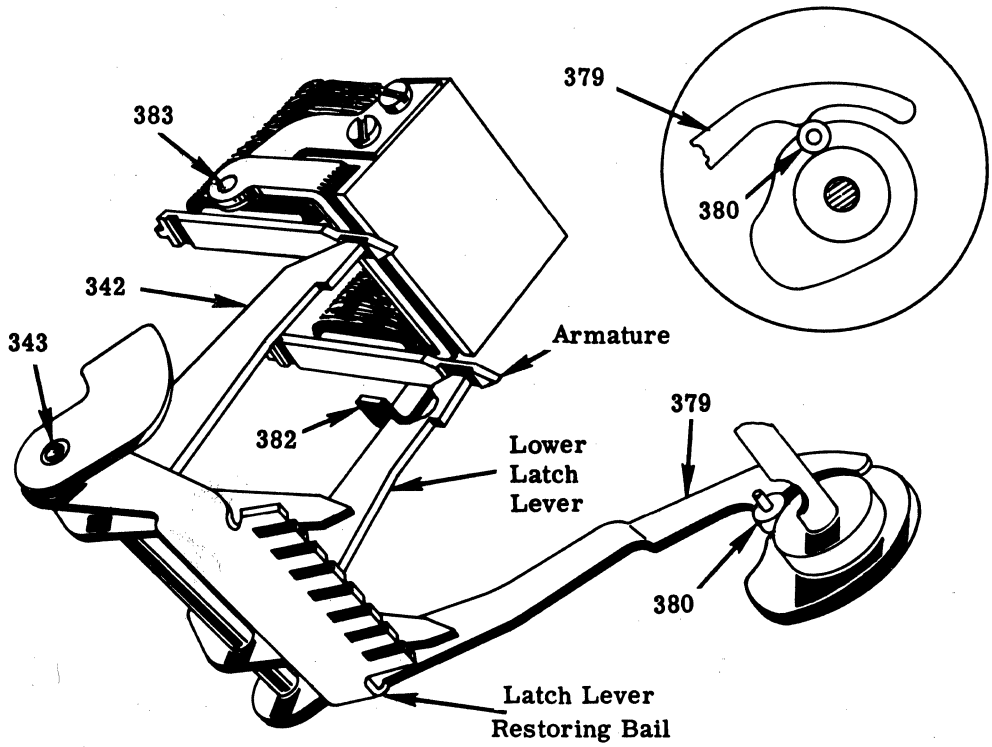


Figure 5-5 Latch Lever Restoring

with the teeth of the detent gear (376) and thereby stabilizing the operation of the tape feed mechanism.

PUNCH TAPE CONTACT MECHANISM

To prevent the machine from operating when the tape runs out, the tape binds or the hold down arm is not in operating position, there are provided three arms, namely: the run-out arm, the tension arm and the tape hold down arm.

The following explains the operation of each of the above mentioned levers: (See Figure 5-7.)

Hold Down Arm - When the tape hold down arm is pivoted clockwise, link 391 moves in the direction shown. The link (391) will move the run-out arm upward, pulling link 398 in the direction shown. This will pivot bail 400 clockwise, opening the PTC contact. (See Key Lock Magnet Circuit, Part II, Section 8.)

Run-Out Arm - If the tape tears or runs out, the run-out arm will drop below the tape table, pulling on arm 398 and pivoting bail 400 so that the PTC contact will open.

Tape Tension Arm - If the tape binds during operation, the tension arm will move in the direction shown, contacting bail 400 and opening the PTC contact.

REMOVAL, ASSEMBLY AND ADJUSTMENTS

Punch Removal - To remove the punch unit, proceed as follows:

1. Remove the punch cover.
2. Unplug the punch cable from the socket in the writing machine.
3. Unscrew two punch mounting screws and remove punch.

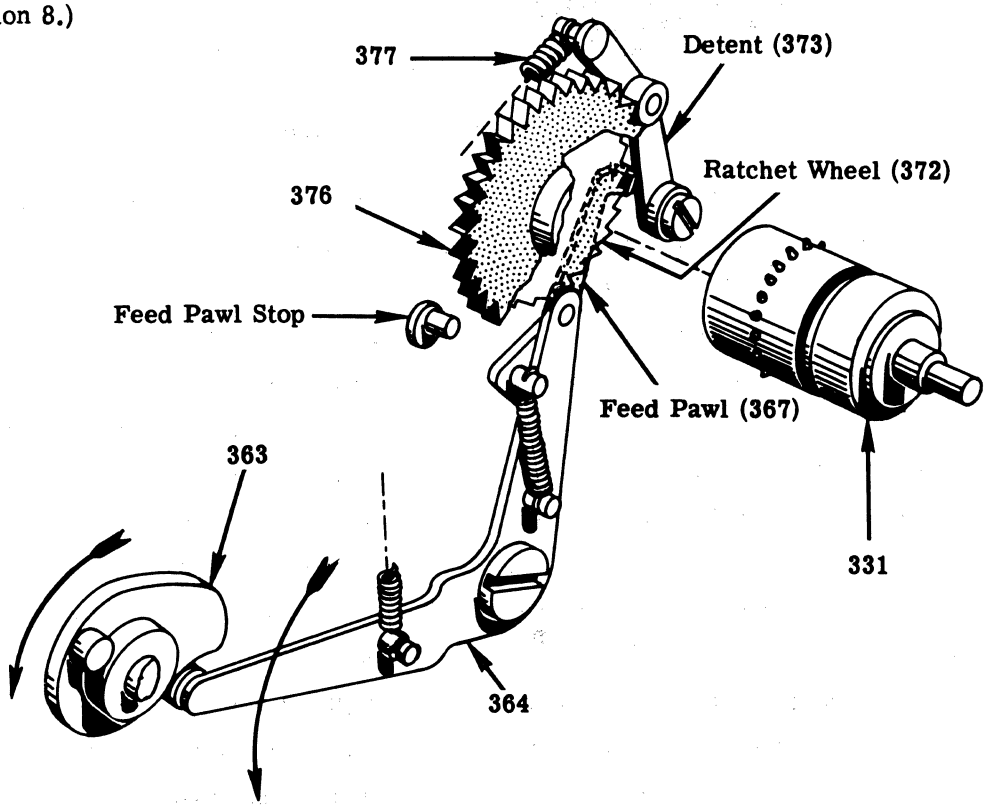


Figure 5-6 Tape Feed Mechanism

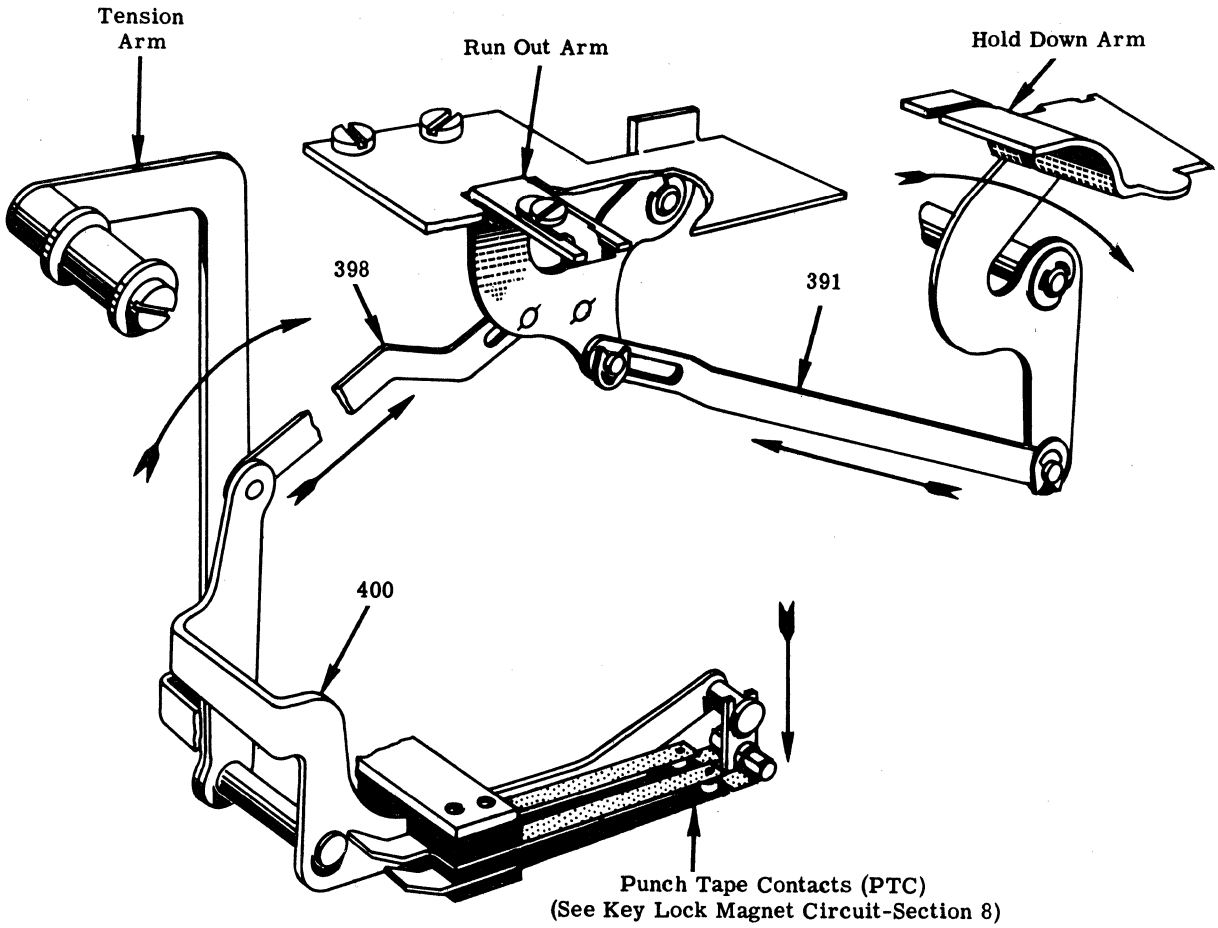


Figure 5-7 Punch Tape Contact Mechanism

Punch Installation - Proceed in the reverse of punch removal, being careful to align gears properly, leaving a slight amount of back-lash.

Punch Clutch Mechanism - To remove the punch clutch parts, proceed as follows: (Refer to Figure 5-8.)

1. Loosen two set screws on collar (297) and two set screws on detent (294) and remove the detent.
2. Remove the collar (297) and spring (301) and sleeve (302).
3. Remove two mounting screws and remove the complete clutch magnet and armature assembly.
4. Remove the gear (23).

To assemble and adjust the punch clutch parts, proceed as follows:

1. Slide the gear (23) onto the shaft (315).
2. Hold the clutch spring (301) in the left hand, with the right angle bend toward you.
3. With the clutch collar (297) in the right hand, start the bend of the spring in the slot of the collar. Turn the collar slightly, tending to unwind the spring. At the same time, exert pressure with the left hand so that the first turn or two of the spring will slide over the collar. (It is important not to turn the collar too much, as this will cause the spring to be twisted out of shape.)
4. Hold the collar, with the spring attached,

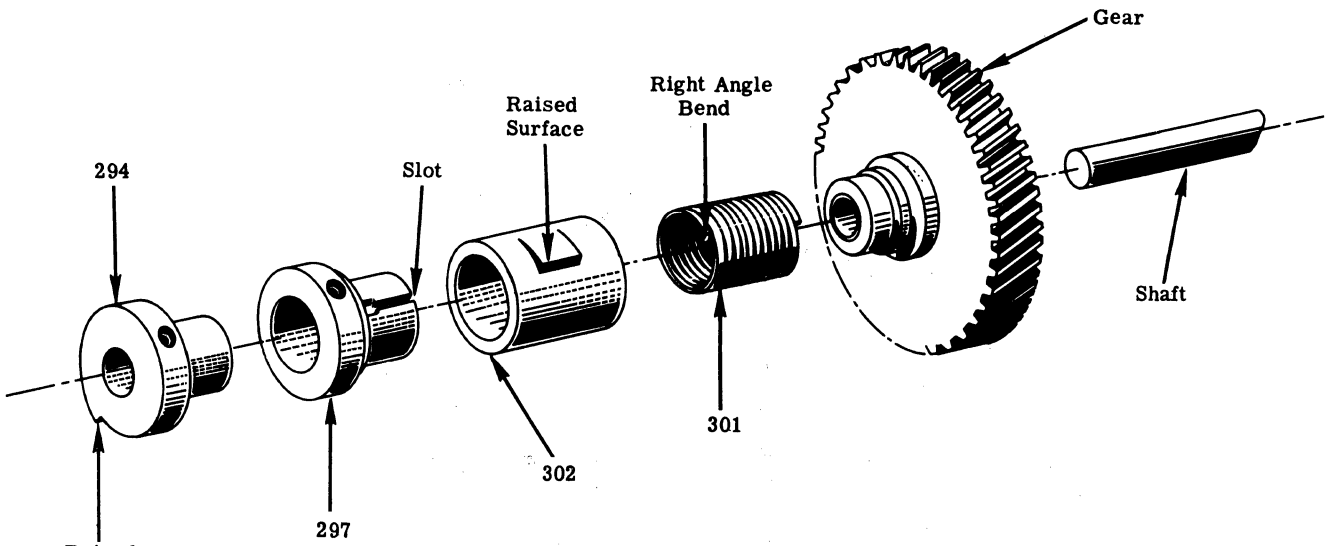


Figure 5-8 Punch Clutch Mechanism

in the right fingers. Pick up the sleeve (302) in the left fingers with the inside lug on the left.

Insert the end of the spring and turn the collar counterclockwise (viewed from sleeve end) until the sleeve rides into position on the collar. Twist the assembly so the end opposite the collar may be viewed and continue to turn the collar counterclockwise until the end of the spring drops into its slot.

5. Hold the sleeve firmly with the left fingers and move the collar clockwise with the fingers of the right hand (move approximately 3/8 inch). Let the fingers of the right hand ride over and grip the sleeve so that it will not slip.
6. Holding the sleeve and collar in the above position, carefully slide it onto the hub of gear (23) until the sleeve slides into place.
7. Insert the clutch detent (294) into the clutch collar (297).
8. Assemble the clutch magnet and armature assembly with two mounting screws.

To adjust the complete clutch mechanism, proceed as follows:

1. Turn the punch shaft (315) until the roller of the feed pawl lever arm (364) is just past the high lobe of cam (363). (See Figure 5-9.)
2. With the shaft in the above position, set the clutch detent (294) so its raised surface (cam) engages the detent arm. Tighten the two detent set screws. Check to be sure there is approximately .001″ to .003″ end clearance on the clutch sleeve (302).
3. Adjust the clutch armature stop to limit the armature movement to the core to within .001″ to .003″. (Figure 5-10.)
4. Loosen the two mounting screws and position the clutch magnet yoke on the punch casting so that the tip of the clutch armature, when in the attracted position, clears the high point of the clutch sleeve (302) by approximately .010″ to .015″.
5. Turn the punch shaft (315) until the detent (294) is approximately 1/32″ short of latching the tip of the detent arm. Hold the detent and shaft in this position and turn the sleeve (302) until it latches with the tip of the

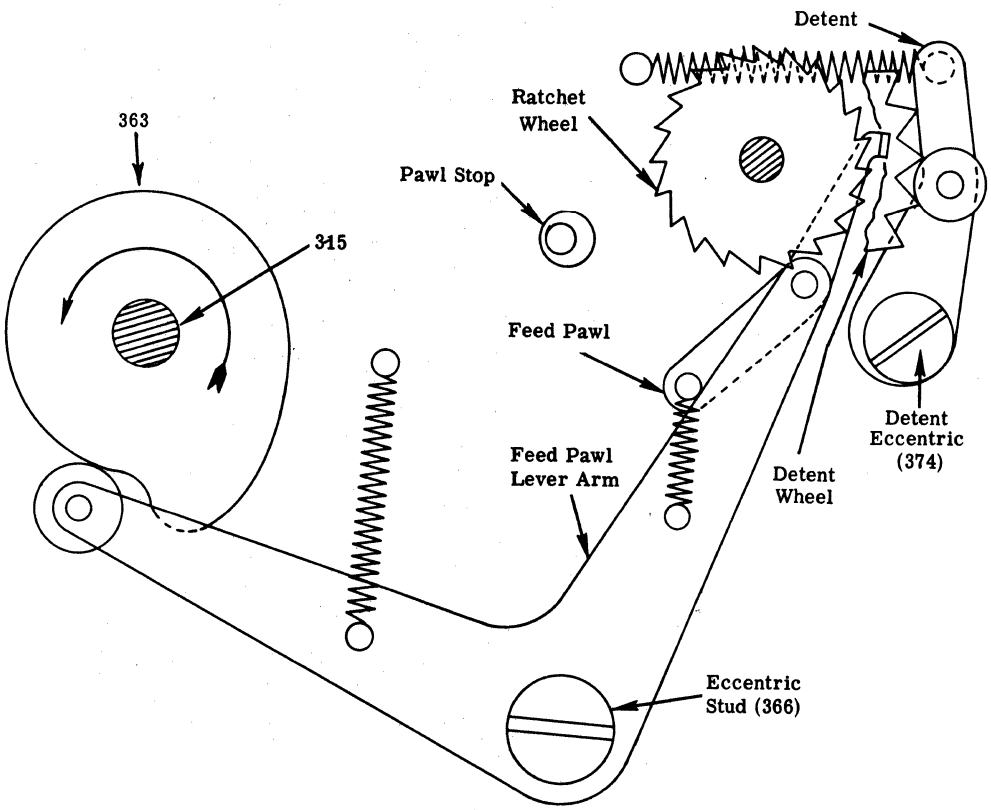


Figure 5-9 Feed Lever Position

clutch armature. Tighten the two collar set screws, being sure to retain the normal free relation between the gear hub and the clutch sleeve.

Punch Magnet Assembly - To remove the complete punch magnet assembly, proceed as follows:

1. Remove all cable leads from the punch terminal board (TP). (See Figure 5-11.)
2. Remove two screws and remove the small rear cover.
3. Remove two mounting screws and carefully remove the punch magnet assembly. Be sure to identify and save any shims that may be located between the punch magnet frame and the punch base.

If it is necessary to change a punch magnet coil, proceed as follows:

1. Using a thin sharp knife, cut the insulation on the coil to be replaced. Be very careful not to injure the adjoining coils.
2. Unravel the coil, starting from the front. Remove the coil leads from the terminal board.
3. Clean the core thoroughly of any insulation or glue. Be careful not to injure the front face of the core.
4. Place a light coating of glue on the core. Press the new coil on the core, being sure to thread the leads through the frame holes provided.

To assemble and adjust the complete magnet and armature assembly, proceed as follows:

1. Before mounting, check the knockoff bail to be sure it moves all armatures simul-

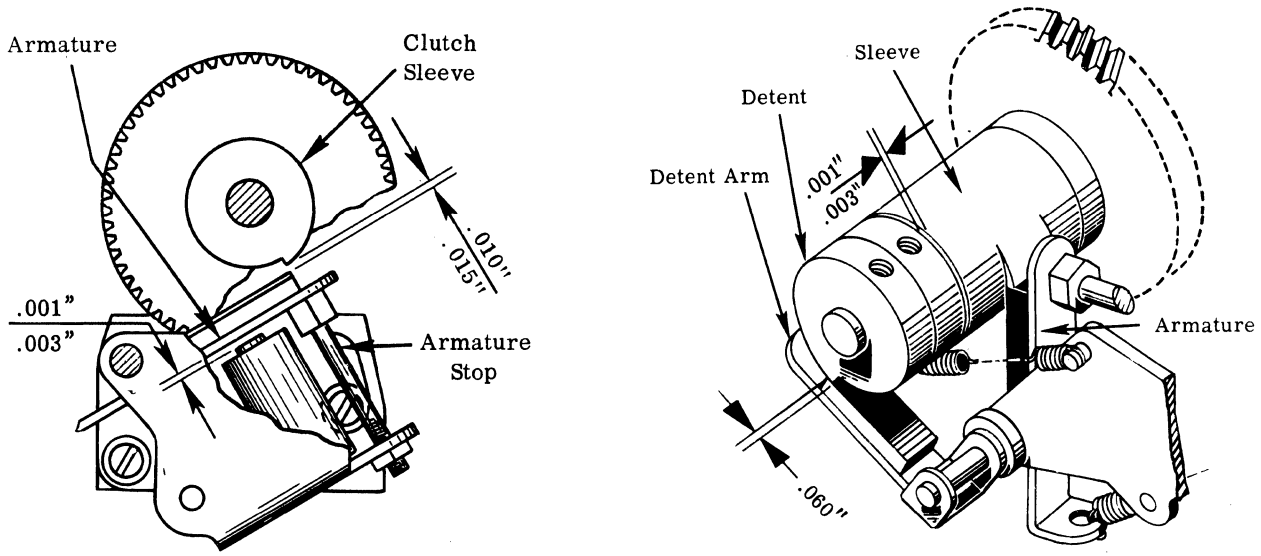


Figure 5-10 Clutch Magnet Yoke Adjustment

taneously. Move the upper and lower pivot brackets to obtain the correct movement of the bail (Figure 5-12).

2. Mount the magnet assembly to the punch base with two screws. Place shims between the magnet frame and the punch base to provide a .003" to .005" clearance between the tip of the latch levers and the armatures (armatures attracted, see Figure 5-13).
3. For proper knockoff action, adjust the magnet assembly horizontally on the casting so there is approximately .001" to .003" movement of the armatures when the latch restoring bail is in its extreme operated position. (See Figure 5-14.)

   The above adjusted position of the magnet assembly should provide at least .020" clearance between the rear ends of the punch levers and the front edges of the latch levers in their latched position.

   If the proper knockoff action cannot be obtained by moving the magnet assembly, the inside finger (for No. 5 latch) of the restoring bail may be bent slightly to alter the movement of the inside latch which operates the knockoff bail. Care should be taken not to bend this finger so far that it will limit the proper latching action of the inside latch over the rear end of the punch lever. (See Figure 5-15.)
4. Adjust the eccentric pivot stud for the latch lock bail so the bail has equal holding action on a latch in the tripped position, as well as a latch in the normal position. (See Figure 5-16.)
5. Adjust the front punch lever guide comb (329) so that the levers properly engage the punch pins. Also, when the punches are withdrawn from the die, the rear ends of the punch levers should not be able to move upwardly far enough to prevent latching. (See Figure 5-17.)
6. Connect the wiring to the terminal block and contacts.

Punch Lever and Frame Assembly (Figure 5-18) - If it is necessary to remove the punch lever and

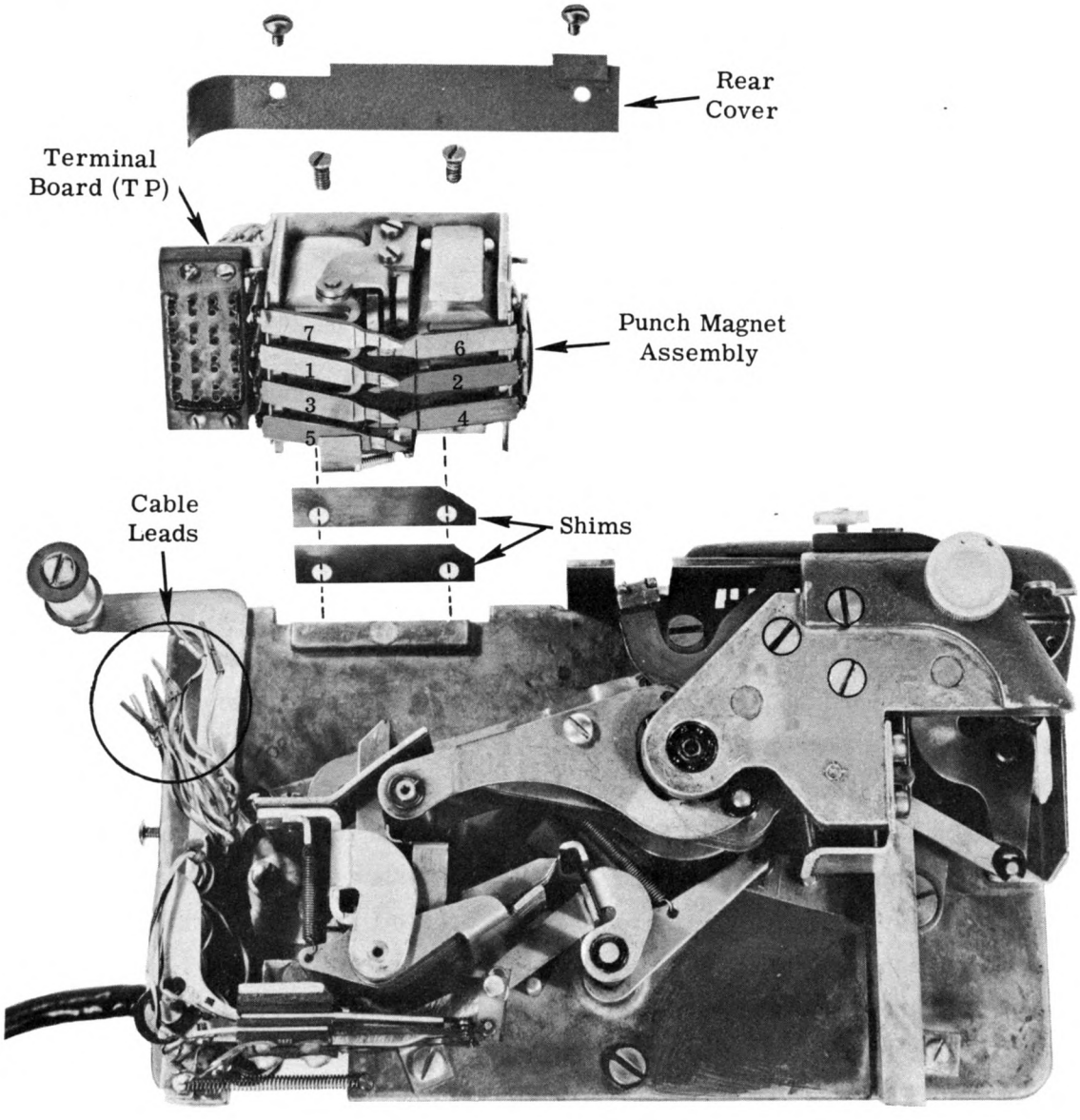


Figure 5-11 Removal of Punch Magnet Assembly

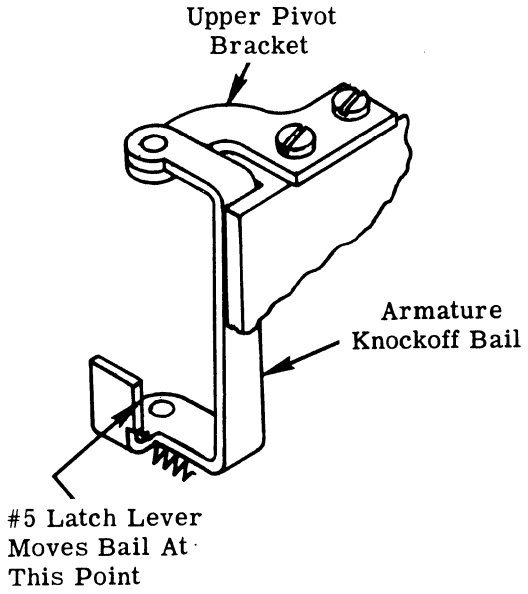


Figure 5-12 Adjustment of Knockoff Bail

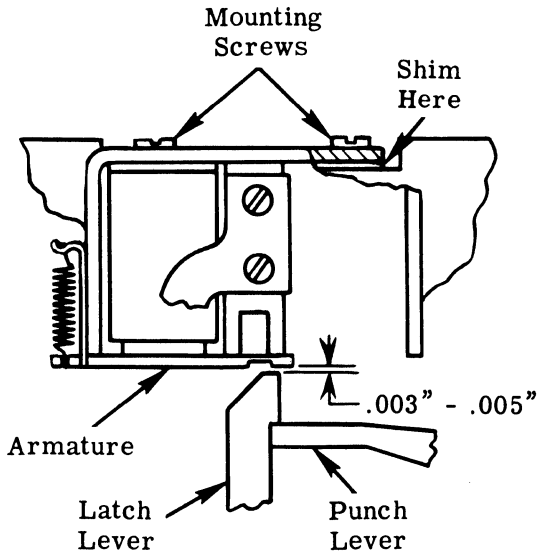
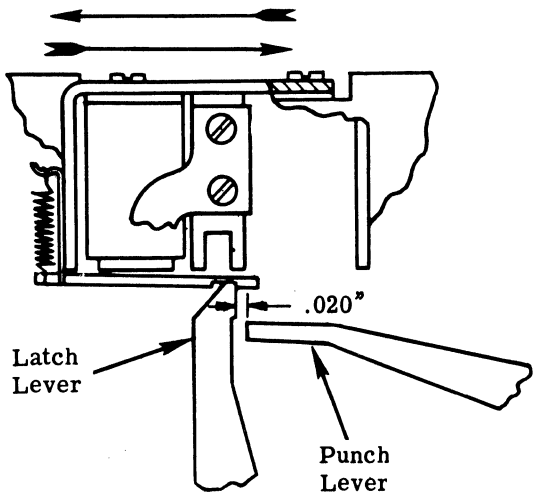


Figure 5-13
Shimming of Punch Magnet Assembly

frame assembly, the following removal procedure is recommended:

1. Unhook the punch lever tension springs (328) from the front punch lever guide comb (329).
2. Remove two screws and remove the front guide comb (329).
3. Loosen the set screw and remove the feed shaft knob. Remove three screws and remove the outside casting.
4. Remove the punch magnet assembly. (Refer to Page 5-8).
5. Remove two screws and remove the rear guide comb (345).
   This will also allow the latch lever spring bracket (348) to fall free.
6. Starting with the top punch lever, move the lever up until it is free of the punch slot and remove the punch from the guide and die block. Remove all punches in this manner.



See Figure 5-15 also.

Figure 5-14 Horizontal Adjustment

Be sure to identify the position of each punch in the guide and die block and replace the punches in exactly the same position.

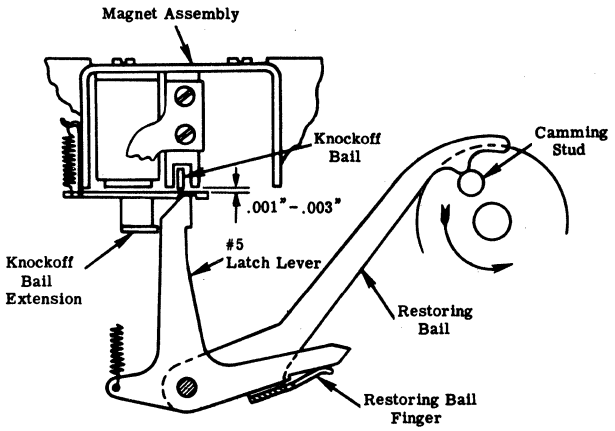


Figure 5-15 Knockoff Adjustment

7. Remove the Tru-Arc retainer on shaft 327. Carefully raise the punch lever and frame assembly upward off shaft 327.

To assemble the punch lever and frame assembly, proceed in the reverse of disassembly and then refer to the following:

Assemble and adjust the magnet and armature assembly as explained on Page 5-8.

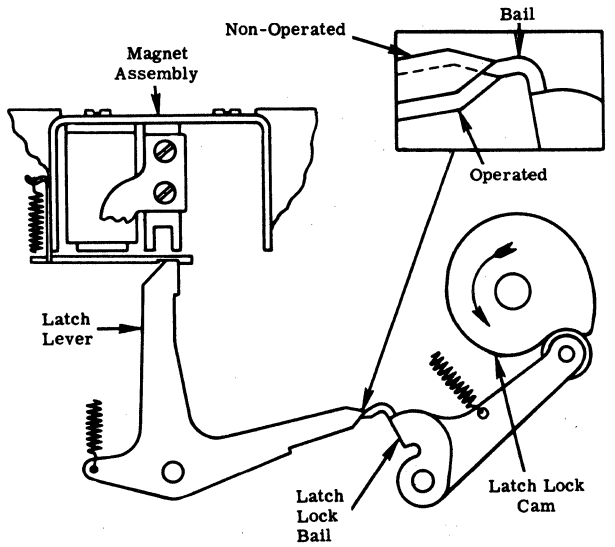


Figure 5-16 Latch Lock Adjustment

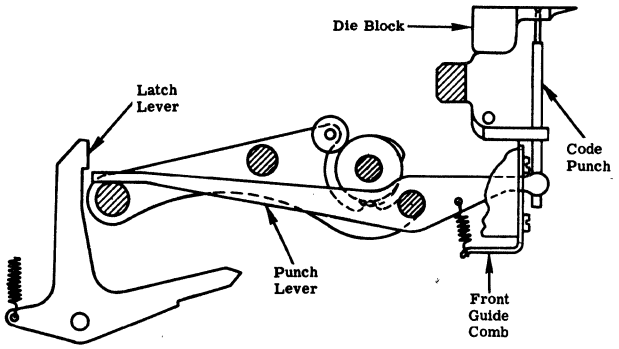


Figure 5-17 Guide Comb Adjustment

Punch Shaft and Cam Assembly (Figure 5-19) - If it is necessary to remove the complete punch shaft and cam assembly, proceed as follows:

1. Remove the punch lever and frame assembly, as explained on Page 5-9.
2. Unhook the latch lock bail spring (359) from the latch lock bail (357).
3. Loosen the set screws on the clutch detent (294). Pull the complete shaft and cam assembly out through the front of the punch. The assembled clutch parts will fall free. When removing the shaft assembly, be sure to move the restoring bail arm, the feed lever arm and the latch lock bail arm clear of the cams on the shaft.

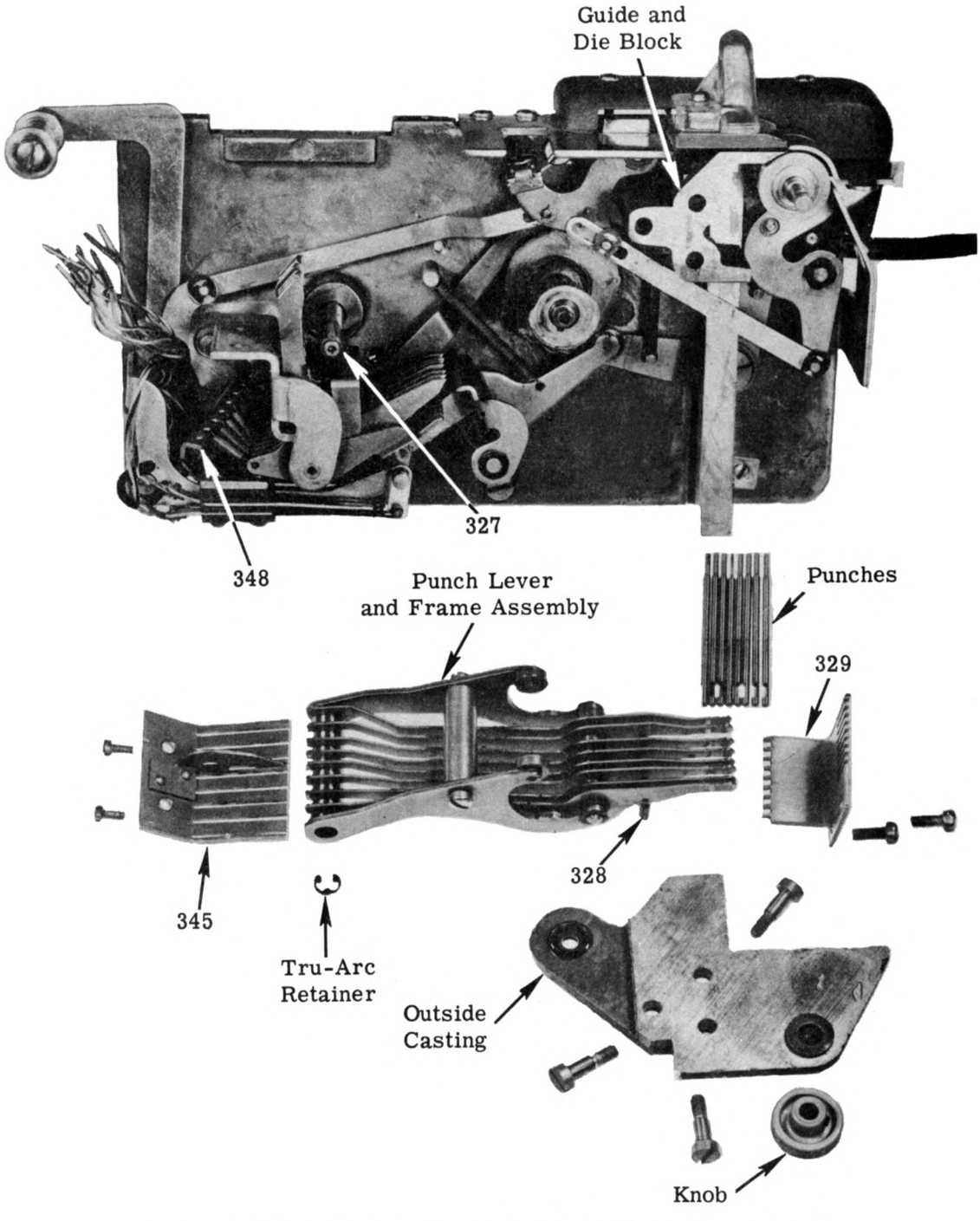


Figure 5-18 Removal of Punch Lever and Frame Assembly

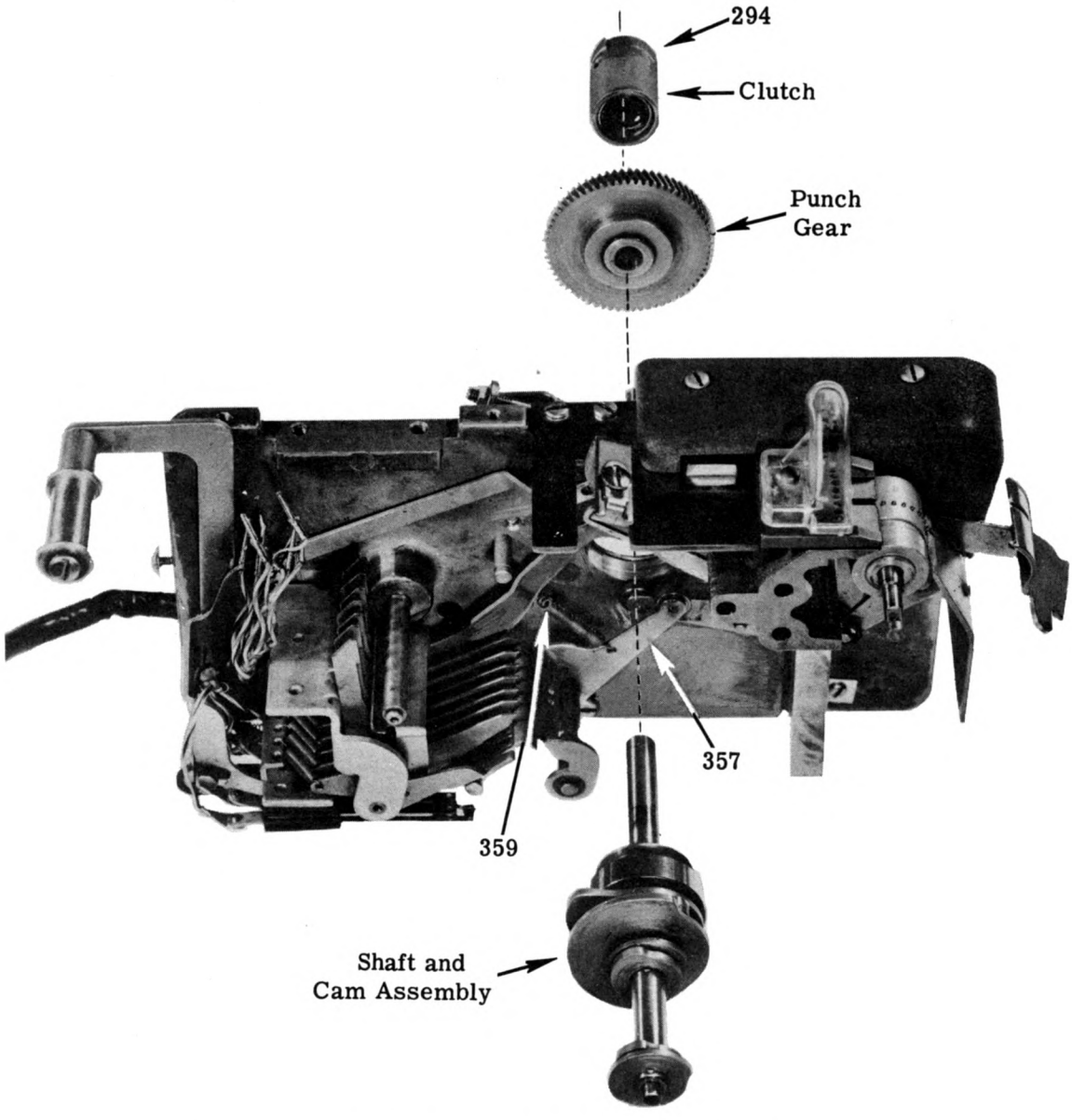


Figure 5-19 Removal of Punch Shaft and Cams

To remove the cams, bearing and pulley from the punch shaft, proceed as follows:

1. To remove the three cam clusters from the shaft, loosen the set screws and slide the cams carefully off the shaft. (Note their location on the shaft before removing.) The keys in most cases will not have to be removed.
2. Remove the taper pin and slide the pulley off the shaft.
3. Carefully pull the bearing off the shaft.

To reassemble the parts on the punch shaft, proceed as follows:

1. Hold the keyed end of the shaft in the left hand.
2. Slide bearing on the shaft and center it on the hub.
3. Slide the pulley on the shaft with the large flange out. Insert the taper pin.
4. Hold the pulley end of the shaft in the left hand.
5. Slide the large cam cluster on the shaft with the "V" stamp (on face of cam) out. Locate cam flush against the bearing and tighten the set screw.
6. Slide on one of the remaining cam clusters with the large lobe first. Center this cam on the key next to the large cam cluster and tighten the set screw.
7. Slide on the remaining cam cluster with the large lobe out. Center the cam on the key and tighten the set screw.

To assemble and make necessary adjustments of the complete punch shaft and cam assembly, proceed as follows:

1. Hold the gear and the clutch parts (as an assembly) in place next to the large hole in the punch casting. Slide the shaft assembly through the casting and through the gear and clutch assembly. It will be necessary to move the three levers clear of the cams. Seat the bearing in the casting hole.
2. Hook the latch lock bail spring (359) to the latch lock bail (357).
3. Assemble the punch lever and frame assembly (324) as explained on Page 5-12.
4. After all of the assembly and adjustments are completed in step No. 3, adjust the clutch mechanism, as explained in steps 1 through 5 on Page 5-6.

Latch Lever and Bail Assembly (Figure 5-20)- To remove the latch lever and bail assembly as a unit, proceed as follows:

1. Remove the punch shaft and cam assembly, as explained in steps 1, 2 and 3 on Page 5-12.
2. Remove the nylon contact operator from the punch lock contact. Also, remove the nylon contact operator from the punch common contact. Unhook the latch restoring bail spring (379) from the spring post. Remove the Tru-Arc retainer and remove the latch lock bail (357) from shaft (356).
3. Remove two screws and remove the guide and bracket (341).
4. Slide the latch levers (342) off shaft (343) (the springs (346) are still attached to the levers and the bracket 348).
5. Slide the restoring bail (379) and the punch common contact bail off shaft 343.

To assemble the latch lever and bail assembly and make the necessary adjustments, proceed in the reverse of disassembly.

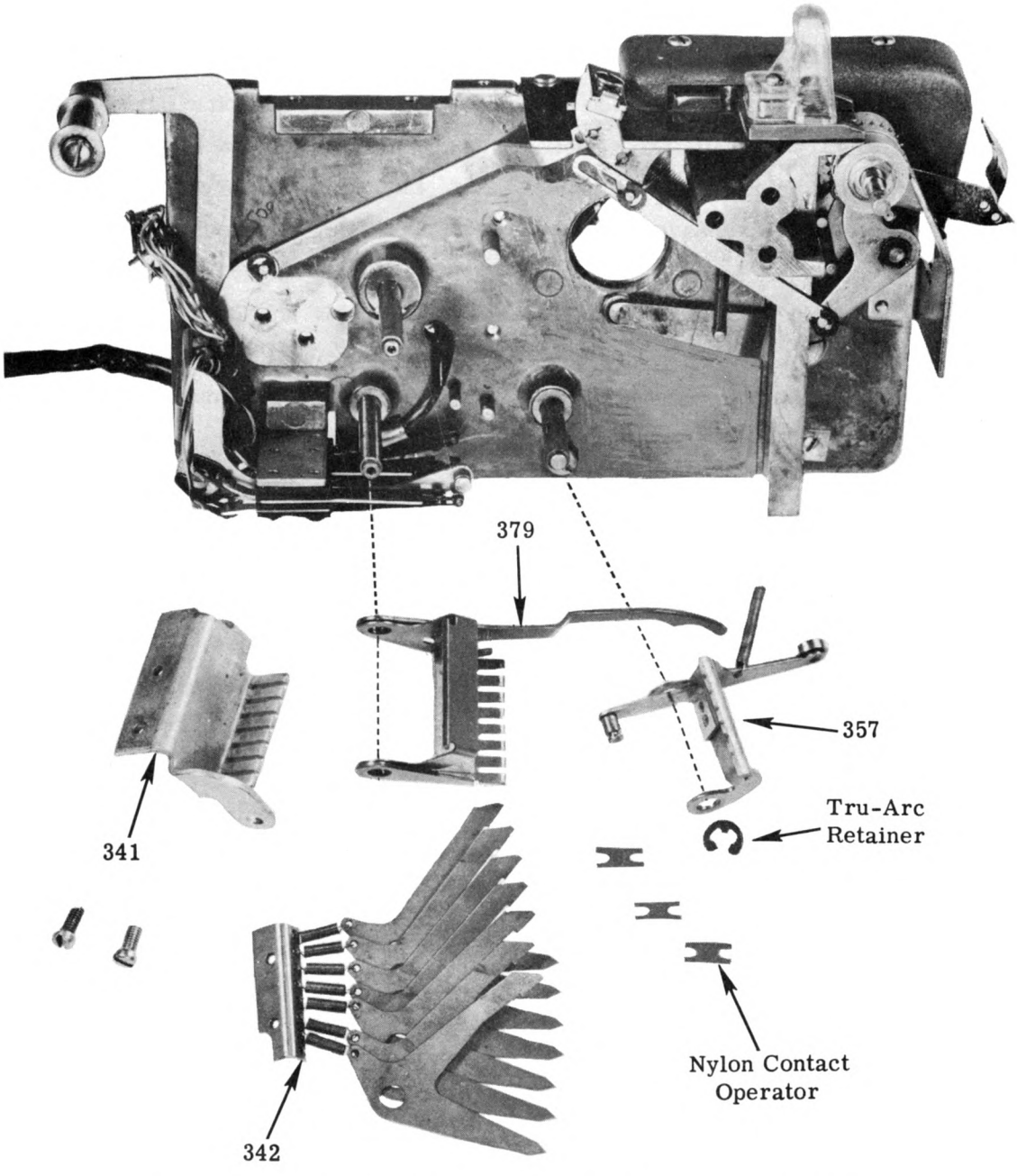


Figure 5-20 Removal of Latch Lever and Bail Assembly

Tape Feed Mechanism (Figure 5-21) - If it is necessary to remove the tape feed mechanism, proceed as follows:

1. Remove one screw and remove plastic cover.
2. Remove two screws and remove the small front cover.
3. Loosen the set screw and remove the feed shaft knob.
4. Unhook springs (328) from the front guide comb (329).
5. Remove two mounting screws and remove the front guide comb (329).
6. Remove three mounting screws and remove the outside casting.
7. Remove one screw and remove the chad chute (321B).
8. Unhook the detent arm spring (377) from the detent arm (373).
9. Pull the tape down arm back and carefully remove the tape feed shaft assembly, this assembly includes the pinwheel (331), the detent wheel (376) and the ratchet wheel (372).
10. Remove the locking nut and remove the eccentric stud (374) and the detent arm (373).
11. Unhook spring (371) from the feed lever arm.
12. Remove the locking nut and remove the eccentric stud (366) and feed lever arm (364).

To assemble and adjust the tape feed mechanism, proceed as follows:

1. Assemble the tape feed parts in the reverse manner of disassembly. When replacing the outside casting, be sure there are no binds in the feed shaft.
2. When the front guide comb (329) is reassembled, check the adjustment of the comb to see that the punch levers properly engage the punch pins. Also, when the punches are withdrawn from the die, the rear ends of the punch levers should not be able to move upwardly far enough to prevent latching.
3. Make a preliminary adjustment of the eccentric stud (366) so that the feed pawl will engage the feed ratchet and rotate the feed shaft without causing a bind in the punch shaft (315).
4. Mount the Punch Unit to the Writing Machine (the front cover on the Punch should be removed and the Reader Unit should be removed).
5. Feed out a length of tape (approximately one foot) and, using gage T41011, check the registration of the tape. The registration should be .100" tape feed or 60 feed holes in 6.000" $\mp$ .005".(See Figure 5-22.) To obtain the proper registration, loosen the lock nut and adjust the detent arm eccentric stud (374). The tape support plate should be adjusted so that the center line of the feed hole will be approximately .394" from the inside edge of the tape (edge nearest number five code

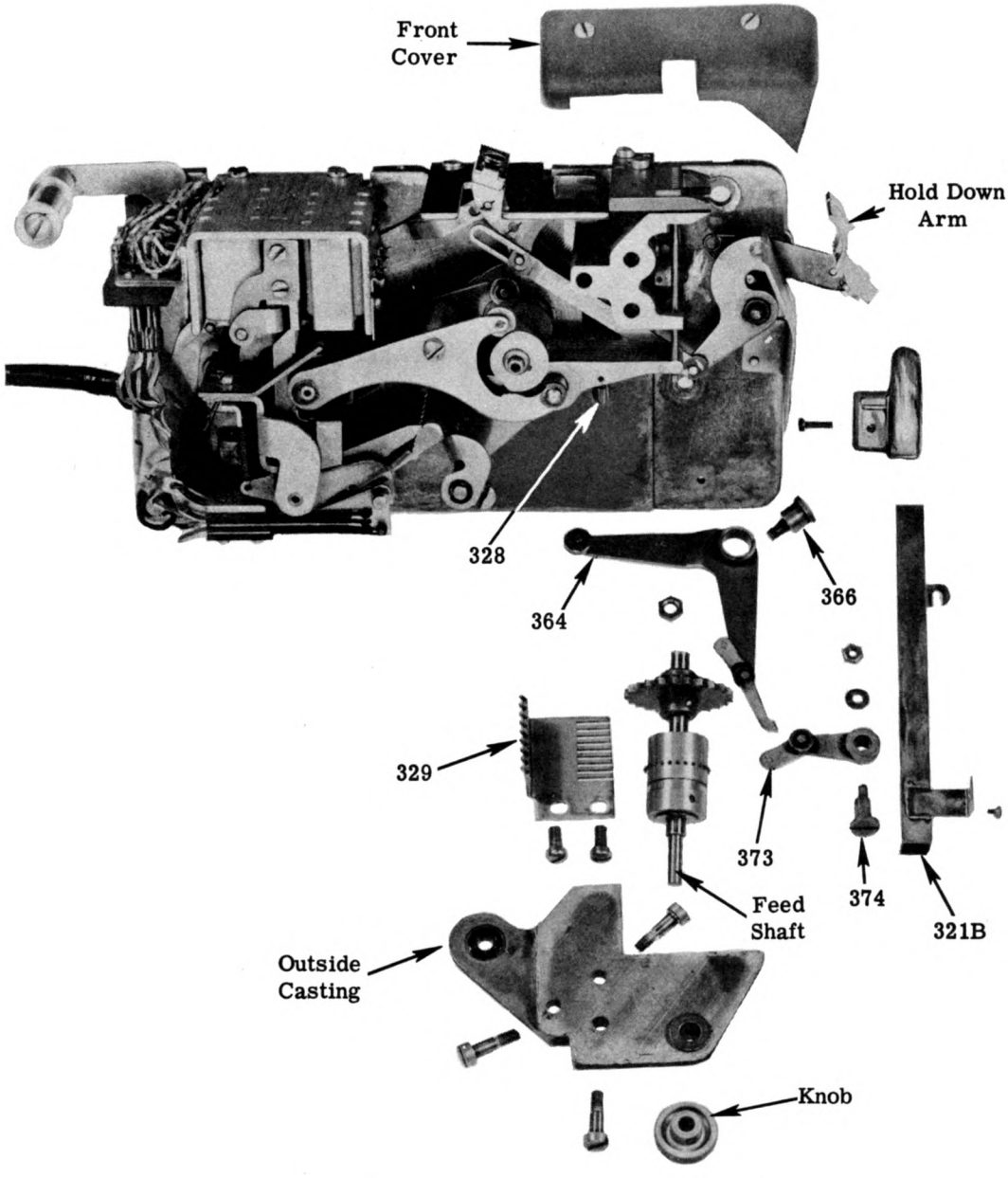


Figure 5-21 Removal of Tape Feed Mechanism

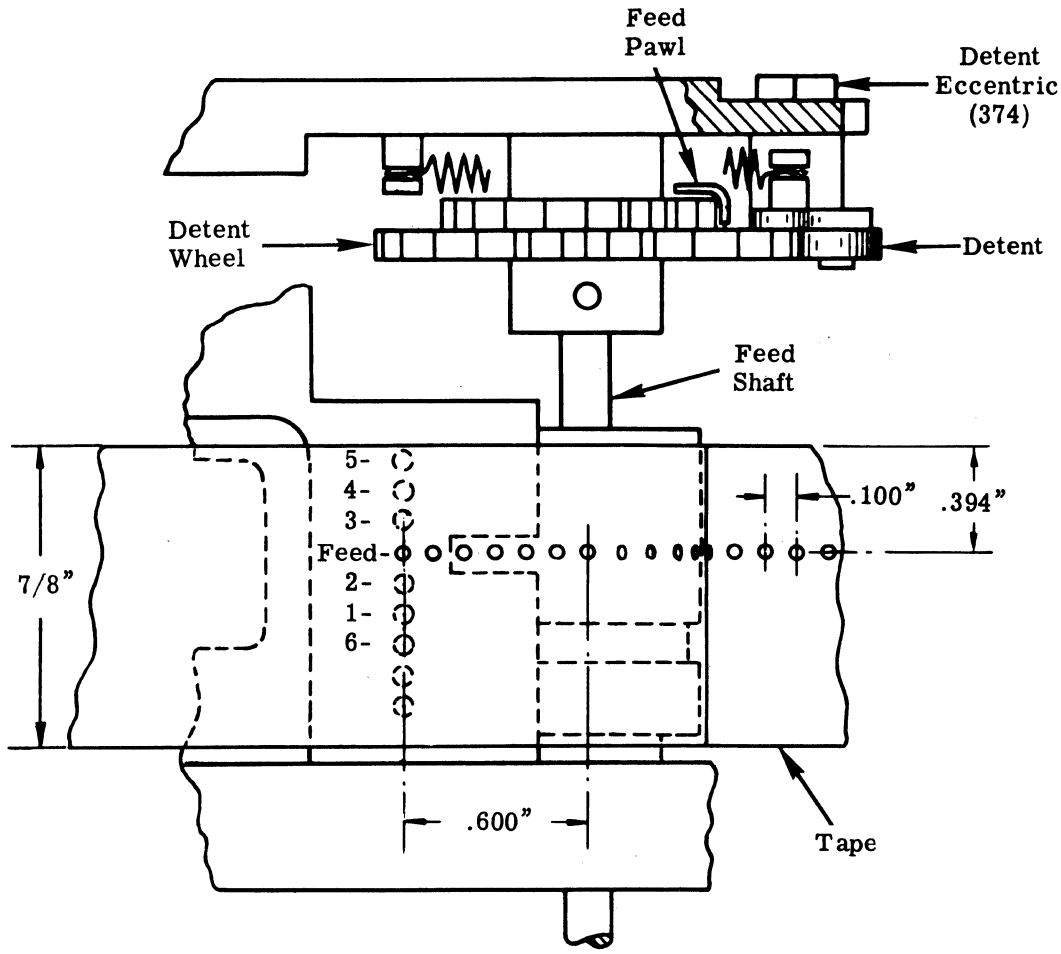


Figure 5-22 Tape Registration

hole). This can be checked on the T41011 gage.

6. Adjust the eccentric stud (366) so that the feed pawl moves the detent wheel to within less than .010" of detent position. The feed pawl must not move the detent wheel beyond detent position.
7. Adjust the eccentric stop pin to clear the

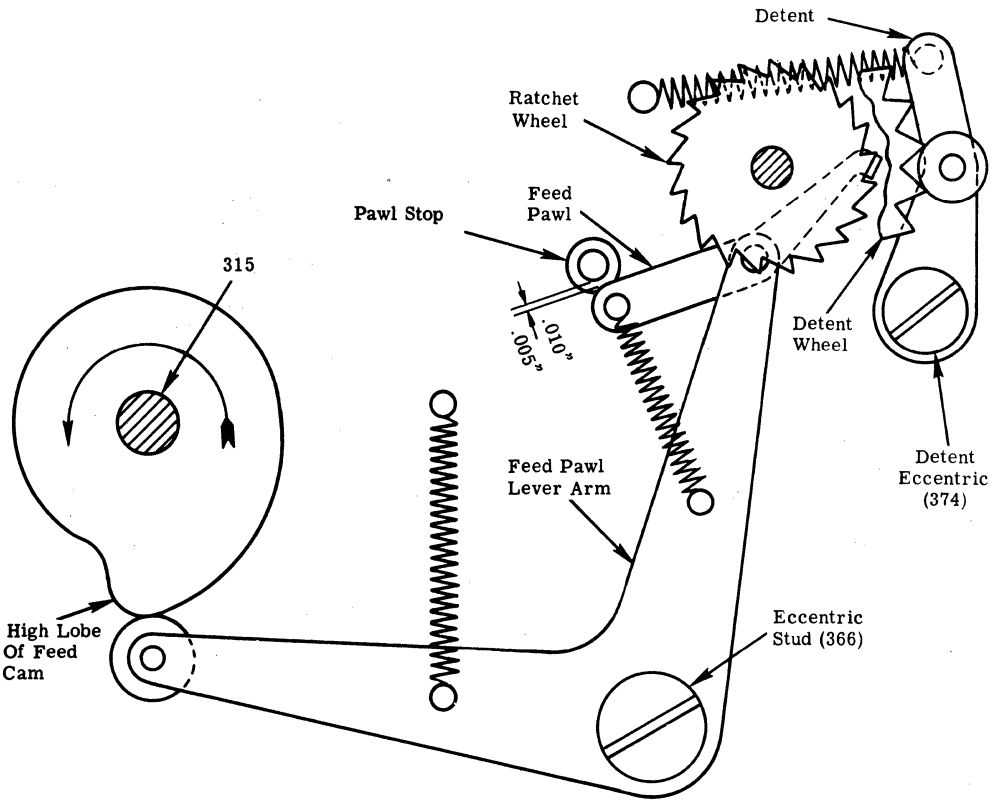


Figure 5-23 Feed Pawl Adjustment

feed pawl by .005" to .010" with feed pawl in the extreme operated position. (Figure 5-23)

CONTACT ADJUSTMENT

PCC Contacts - The PCC contacts should be adjusted to have .020" to .025" air gap with the latches in their normal position against the armatures. Check to see that the contacts close when only one latch is released. Also, the stationary strap should move an additional.002" away from its support strap after the contacts close.

PLC Contacts - The PLC contacts should have a make-before-break adjustment. The normally open silver contacts should have an air gap of .020" to .025" with the latch lock bail in normal position. As the latch lock bail moves toward locking position, the silver contacts should close just before the tungsten contacts open. When the bail is in its extreme operated position, the tungsten contacts should have an air gap of .020" to .025".

PTC Contacts - The outside break contacts (PTC) should be closed when the tape is properly conditioned (see Punch Tape Contact Mechanism). Check to see that the stationary contact moves an additional .002" when the contacts close. There should be a .020" air gap when the contacts are open.

Friden — Customer Service Engineering

MANUAL ADDENDUM

Date: June 1, 1955

Reference: To be inserted after Page 5-20, Part II, Section 5.

Subject: Model 2 Tape Punch Adjustments

Purpose: New Model 2 Tape Punch Unit

Information:

The Model 2 Tape Punch was designed for higher speed operation than the Model 1 Tape Punch described in Section 5.

The Model 2 Tape Punch is basically the same as the Model 1 except for the following part changes (refer to Figure 1 of this addendum):

> NOTE: The Model 2 Tape Punches are now being used on all Motorized Tape Punches and Programatic Flexowriters. They will be used on all Flexowriters in the near future.

1. Outside Casting - this was made larger to strengthen the entire punch.

2. Tape Feed Shaft - to lighten the feed shaft for faster operation, the overall pinwheel was reduced in size and only one ratchet wheel is used (for detent and ratchet feed).

3. Feed Pawl and Operating Arm - the feed pawl was redesigned for more positive operation and longer life. The pawl and the arm are made lightweight for high speed operation.

4. Detent Arm - the detent arm is redesigned to conform with the new ratchet wheel.

5. Front Guide Comb - because of the change in the outside casting, the front guide comb has been altered. It requires the use of shims for adjustment purposes.

6. Tape Stripper - due to the change (reduced size) in the tape pin wheel, the tape stripper curves up under the tape hold down arm as a guide for the tape.

7. Bearings - ball bearings are used on moving shafts and cam follower rollers for freer, longer life.

8. Drive Gear - (not shown in Figure 1) Reduced in size for higher speed operation (approximately 1000 r.p.m.).

9. Clutch Mechanism - (not shown in Figure 1) The clutch parts have been altered to obtain more positive control at higher speed operation. An armature knockoff and clutch overthrow cam has been added.

ADJUSTMENTS

The adjustments for the Model 2 Tape Punch are similar to the Model 1 adjustments described in Part II, Section 5 of this manual. Where the adjustments are the same reference will be made to Section 5.

Punch Magnet Assembly - (refer to Part II, Section 5, Page 5-8 and Page 5-9)

1. Same

2. Same

3. Same except: The .020" gap between the front edge of the latches and the rear end of the punch levers should be .015" to .025" (see Figure 5-14).

   Also, the full operated position of the latch restoring bail should allow .015" to .031" overtravel between front edge of the latch lever and the armature latching surface (see Figure 5-15).

4. Same

5. Same except in order to adjust the front guide comb it must be shimmed.

Tape Feed Mechanism - The tape feed mechanism is changed completely (for reference see Figure 5-21 in the manual and Figure 1 of this addendum.

The adjustment procedure for the Model 2 tape feed mechanism should be as follows:

1. With the tape punch mounted, feed out a length of tape (approximately one foot) and, using gage T 41011, check the registration of the tape, the registration should be .100" tape feed or 60 feed holes in 6.000" $\mp$.005". To obtain the proper registration, loosen the lock nut and adjust the detent arm eccentric stud.

NOTE: If a detent adjustment is made, be sure and check steps 2 and 3.

The tape support plate should be adjusted so that the center line of the feed hole will be approximately .394" from the inside (or guide) edge of the tape. This can be checked on the T 41011 gage.

Also, adjust the outside tape guide (on the tape runout arm) to insure even feed of the tape.

2. Adjust the eccentric stud for the feed pawl lever so that the feed pawl moves the ratchet wheel to within less than .010" of detented position. The extent of feed motion should never be beyond detented position.

3. With the feed roller (on feed lever) on the high point of the feed cam, adjust the feed pawl stop to stop the motion of the feed pawl, without choking off, just as soon as the detent roller is fully seated between two teeth of the ratchet wheel.

4. Adjust the tape stripper so that the curved portion is even with or below the surface of the pin wheel.

Punch Clutch Mechanism - The clutch parts have been altered and an additional roller has been added to obtain more positive control at higher speeds. The adjustments are as follows:

1. Set the clutch detent cam on the punch shaft to engage the detent arm at the point where the feed lever roller has moved 15 degrees ($\mp$ 1°) past the low dwell of the feed cam (use timing dial T 18088).

NOTE: 15 degrees equals 1/8" with a $\mp$ .010" tolerance.

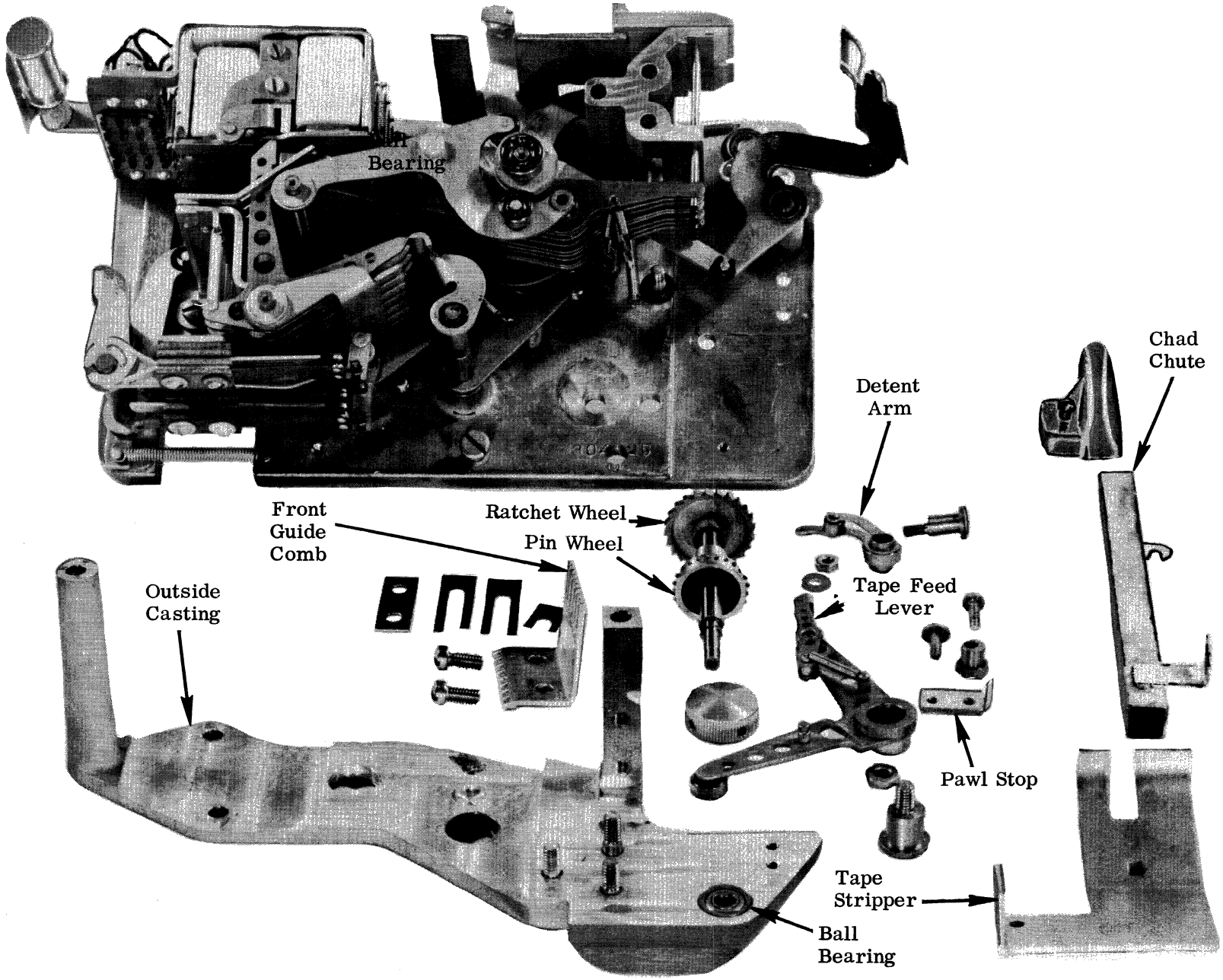
Check the end clearance of .001" to .003" between the gear and the sleeve before tightening the detent set screws.

2. Position the clutch magnet yoke on the casting so that the tip of the armature, when in attracted position, clears the high point of the clutch sleeve by .005" to .007".

3. When the armature knock-off roller is on the high dwell of the cam, there should be .005"to .010" gap between the armature and the knock-off. Reform the knock-off to obtain this gap.

4. Position the clutch collar on the clutch shaft so that when the latch point of the sleeve just engages the armature tip, the latch point of the detent cam is 1/32" short of latching on the tip of the detent arm. When making this adjustment, and before tightening the set screws, the clutch sleeve and its collar should have their normal free relationship to each other.

5. Adjust the knock off cam (radially on the shaft) so that the clutch will not overtravel more than 4-1/2 degrees 1 degree, from latched position (equal to 1/64" to 1/32" of movement).


Bearing
Front
Guide
Comb
Ratchet Wheel
Pin Wheel
Outside
Casting
Detent
Arm
Tape Feed
Lever
Chad
Chute
Pawl Stop
Tape
Stripper
Ball
Bearing

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MANUAL ADDENDUM

Date: August 26, 1955

Reference: To be inserted in Part II, Section 5, after Page 5-20.

Subject: Edge Card Punch

Purpose: Adjustment Procedure

Information:

The edge card punch is the same basic Model 2 punch explained in Manual Addendum dated June 1, 1955 and located in Part II, Section 5 of this Manual, except as follows:

Pin Wheels (Front and Rear) and Idler Gear

1. If it is necessary to disassemble and assemble the forward feed shaft, the adjustment procedure would be as follows:

   With punch die block removed (die block must be removed with screw from plastic chad cover - DO NOT PRY UP WITH SCREWDRIVER). First, align the front pin wheel assembly by moving the feed pin up in the guide block and using a prepunched card (all code holes) drop the card over the feed pin. Shim the feed shaft as required to align the center line of the pins on feed pin wheel with the center line of the feed punch pin.

   Align the rear pin wheel assembly to be in line with the extended feed punch pin and the front pin wheel assembly. Use shims on rear pin wheel shaft if necessary.

2. Mesh the front pin wheel gear with the idler gear (card in position over extended feed punch pin) and tighten set screw.

   Place the feed holes of the prepunched card over the pins of the rear pin wheel assembly (card held by extended feed punch pin). Tighten the rear pin wheel gear being sure to have backlash, if any, to the rear. All the gears should mesh with a minimum backlash, but be free of binds. This is accomplished by moving the idler before tightening the rear pin wheel gear.

Card Guide Assembly

1. By the use of shims and spacers, adjust the card guide assembly vertically to be flush to .005" below the top surface of the punch guide block.

2. Adjust the card guide assembly horizontally to position guiding edge (inside edge) of card guide so that when the card is inserted this guiding edge will be approximately .005" to .010" distance from the card. Be sure to check that edge of guide assembly is parallel with casting.

   Note: The punch die block must be removed when making the above adjustment. Also, when making the above adjustments, be sure the card guide assembly is positioned far enough to the rear to allow room for the outside card guide.

3. Adjust the card hold down spring so that it is centered on the rear pin wheel assembly.

4. Adjust the tape guide for correct tape width.

Outside Card Guide

1. Adjust the outside card guide for the width of the card (the card is placed over the extension only when punching original feed holes). Also, adjust the guide parallel to the card guide table.

Micro Switch Adjustments

The micro switch should be adjusted using a standard fan fold card with the last row of holes (in first card) located in punching position (over punch pins).

1. Adjust the switch arm by means of the switch adjusting plate so that when the detent roller has started toward the next detented position, the apex of the switch arm will come up in the large hole in the card. This should turn off the switch before the roller has become fully detented.

2. When the roller has started toward the next detent position, the card must depress the switch arm, turning on the switch before the roller has again become fully detented.

3. When the card has depressed the switch arm and switch is on, and roller is fully detented as in #2 above, the machine should have stopped and the card should be in punching position. Punching position is where the second line of holes in the second card lines up with the punch pins.

   The last line of holes in the first card will not contain any codes as it will be almost entirely trimmed off (if the card is cut) as will be the first line of holes in the second card.

Tape Pressure Arm and Stripper Plate

1. Adjust the tape stripper plate to be flush or below curved surface of the front pin wheel assembly and be sure the two sides are even.

2. Adjust the tape pressure arm by the adjusting screw to provide clearance for the tape between front pin wheel and tape pressure arm. Insert a card in the card guide assembly and over the front pin wheel and check to see that both ends of the pressure arm rests evenly on the card. Also, the point of contact of the pressure arm on the card should be on the top three pins.

Punch Contact Adjustment

1. PTC - The PTC contacts should be closed with the tape tension arm in normal position (to the rear). The overtravel of these contacts (when closing) should move the spring at least .002" from its support. The forward operation of the tape tension arm should open these contacts with an air gap of at least .020".

2. PLC - The middle transfer contacts (PLC) should be adjusted to break before make, with .005" to .010" follow on the break contacts. With PLC restored, the make contacts should have a .040" air gap.

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#3

MANUAL ADDENDUM

Date: August 30, 1954

Reference: To be inserted in Part II, Section 5, after Page 5-20.

Subject: Tape Punch - Contact Adjustment

Purpose: To correct error in Contact Adjustment.

Information:

Part II - Flexowriter - Model FL

Section 5 - Tape Punch

Page 5-20 - Contact Adjustment

PCC Contacts: Change as follows:

Delete present adjustments entirely and add the following:

PCC Contacts:

Check to see that the contacts close when each individual latch is released. Also, the stationary strap should move not more than .002" away from its support strap after the contacts close.

Friden — Customer Service Engineering

#13

MANUAL ADDENDUM

Date: January 24, 1958

Reference: To be inserted in Part II, Section 5, after Page 5-20.

Subject: Tape Punch - Contact Adjustment

Purpose: Additional adjustments for the SPL (PLC) contacts

Information:

The SPL contacts on all Justowriter punches and punches with PCC contacts will remain the same as before.

On all other punches the transfer contact of SPL should be adjusted to break before make. With the contacts in normal position the break contacts should have .005 to .010 follow and the make contacts should have .040 air gap.

TAPE READER

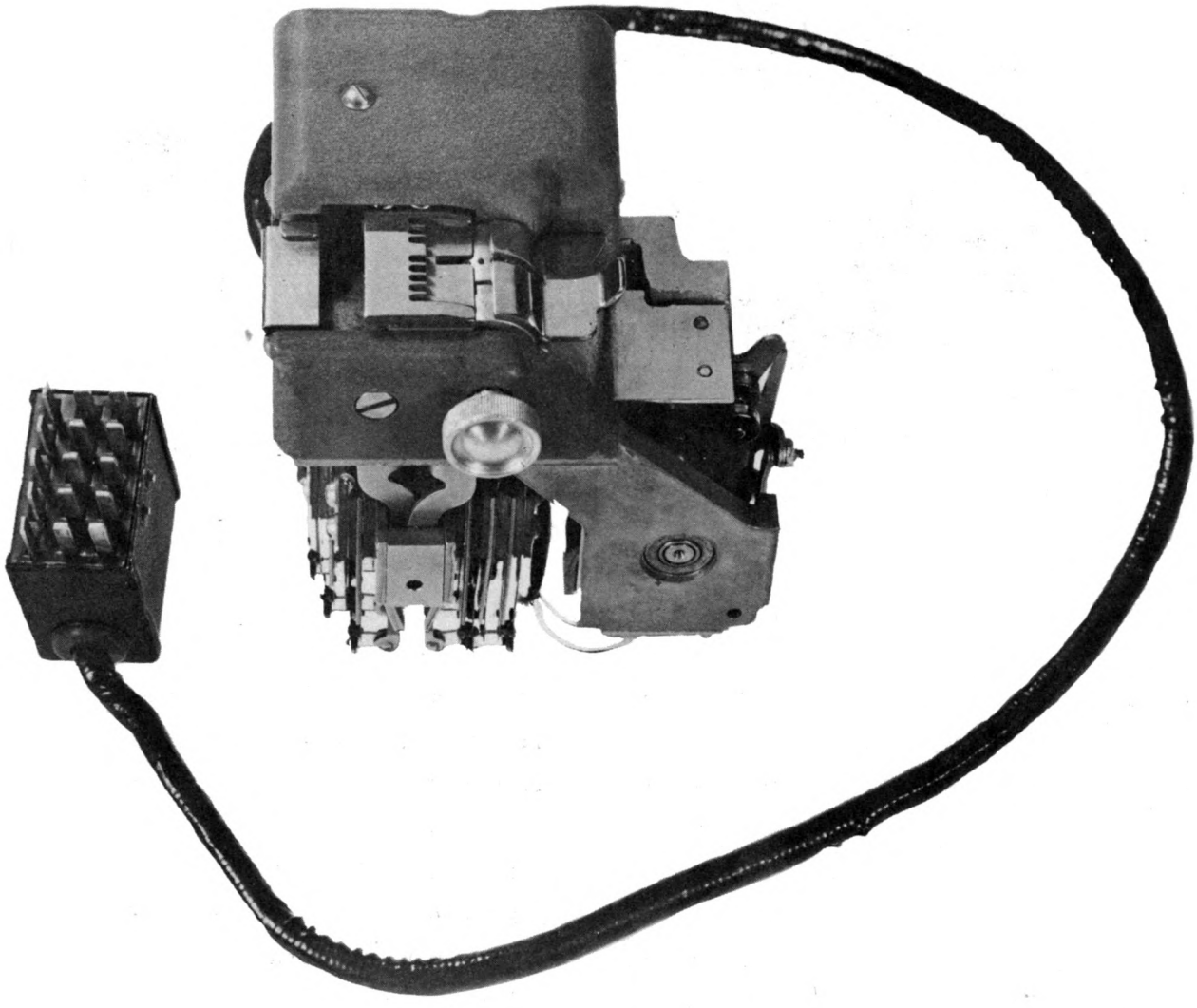


Figure 6-1 Tape Reader

PURPOSE AND DESCRIPTION

The reader is that unit of the Flexowriter which senses the recorded codes of a perforated tape and operates electrical contacts. In the Standard Flexowriter, the contact operation pulses the translator to automatically control the writing machine for each code read, thus reproducing the text recorded in the tape.

SEQUENCE OF OPERATION

A reading cycle is briefly defined as follows:

When the reader magnet is energized, the feeler pins are allowed to move up in their guides toward the tape. If there is no code hole above a feeler pin, the tape will prevent any further upward movement of the pin. If a code hole in the tape is above a feeler pin position,

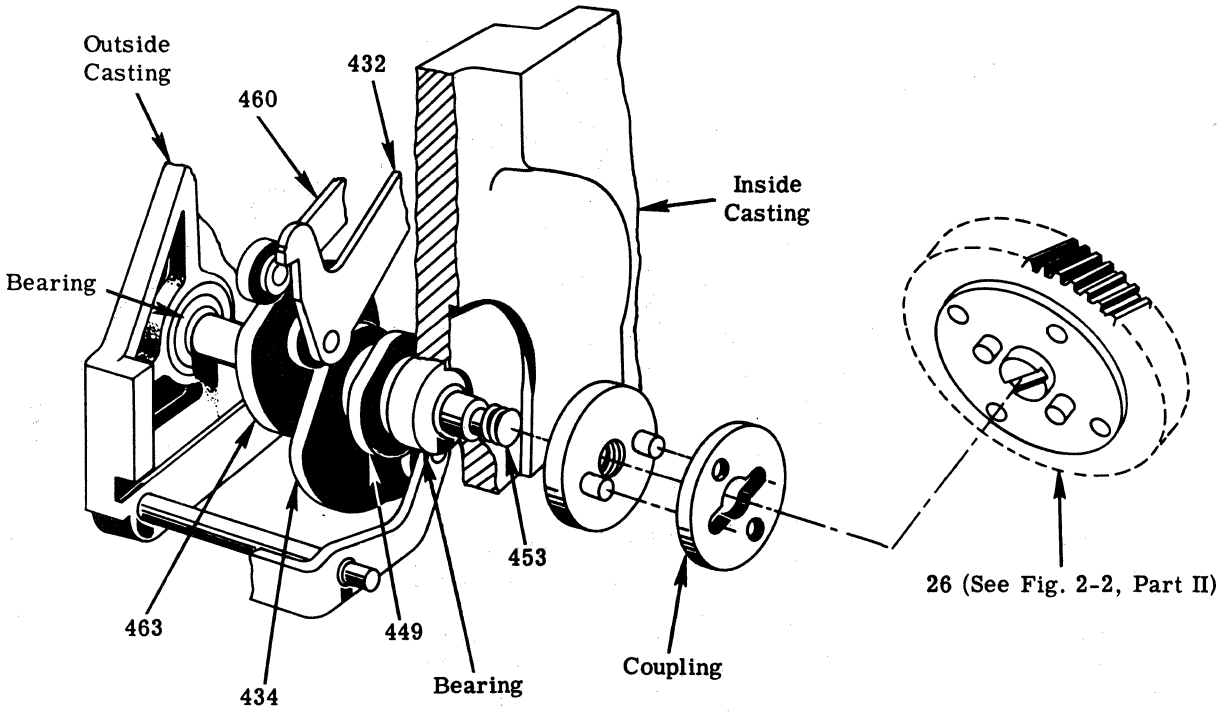


Figure 6-2 Reader Shaft and Cams

the pin will move up through the hole, thus allowing that corresponding feeler pin contact to be operated. The operation of the contact will complete circuits to a corresponding magnet in the translator unit, and in some cases circuits will be completed to operate relays.

The contacts will remain operated for approximately 50 milliseconds, after which, by cam action, the feeler pins will be forced down below the tape and locked in that position until the next cycle.

After the pins are definitely below the bottom surface of the tape, the feed pinwheel is then rotated .100 inch (or one code hole) so that the following code hole is aligned with the feeler pins, ready for the next reader cycle.

Reader Shaft and Cams - (Figure 6-2)

The shaft (453) rotates on roller bearings, which are mounted in the inner and outer castings of the reader. The shaft extends through the inner casting, where it is coupled to the power drive of the writing machine, causing it to rotate continuously.

Mounted on the shaft is a cam cluster having three separate cam surfaces, which operate three separate cam followers:

Cam surface 434 operates arm 432 - interposer bail arm.

Cam surface 463 operates arm 460 - feed pawl operating arm.

Cam surface 449 operates arm 448 - armature knockoff.

This cam cluster rotates with the shaft and one rotation completes one cycle of the reader operation.

The three cams described control all the separate functions of the reader and will follow in correct sequence during the cycle.

Start of Cycle - The starting point in a cycle of operation is controlled by cam surface 449 and arm 448 which is an extension of the reader magnet armature (445). (See Figure 6-3.)

The armature (445) is pivoted on the shaft (444) and held away from the core of the magnet by the tension of spring 450, which is connected to arm 448 (an extension of armature 445).

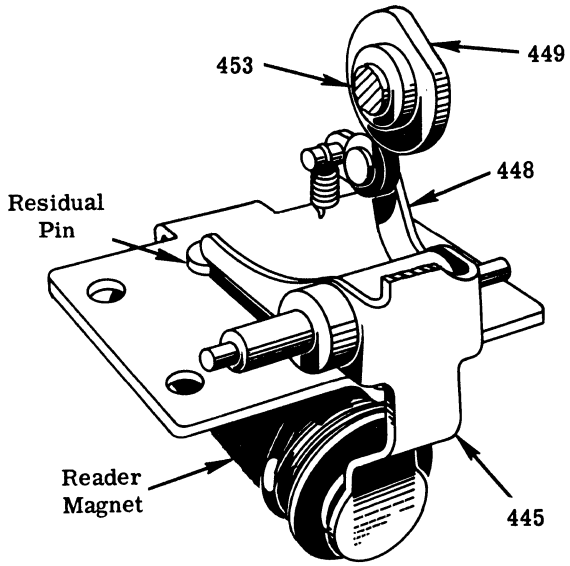


Figure 6-3 Magnet Armature Control

If the magnet is energized at a point in the rotation of shaft 453 where the follower of arm 448 is riding on the high lobe of cam 449, the armature (445) cannot be moved to the core of the magnet. Therefore, the reading cycle cannot take place until the follower of arm 448 is riding on the low side of cam 449, allowing the armature (445) to be attracted to the energized magnet.

The above action also serves as an armature knockoff for each reading cycle as follows: With the armature attracted to the magnet core, the follower of arm 448 will ride on the cam surface (449) until it reaches the high lobe. At this point, the armature (445) will be pulled away from the magnet core. This action, therefore, provides a definite starting and ending of a reading cycle, even though the reader magnet is held energized continuously.

Feeler Pin Operation - When the armature (445) is allowed to move to the magnet core, the upper arm of the armature contacts adjusting screw (452) of the control arm (435) (also pivoted on shaft 444). This causes control arm (435) to be moved in a clockwise direction, releasing interposer bail arm (432) which will follow its cam contour (434). As the cam (434) rotates, the interposer bail arm (432) rocks about the pivot shaft (429) and raises the interposer bail assembly (431). This action will cause the interposers (428) to rise due to the spring tension of their respective springs (442), thus allowing the feeler pins (439) to rise in the guide block (440) and enter any tape perforations

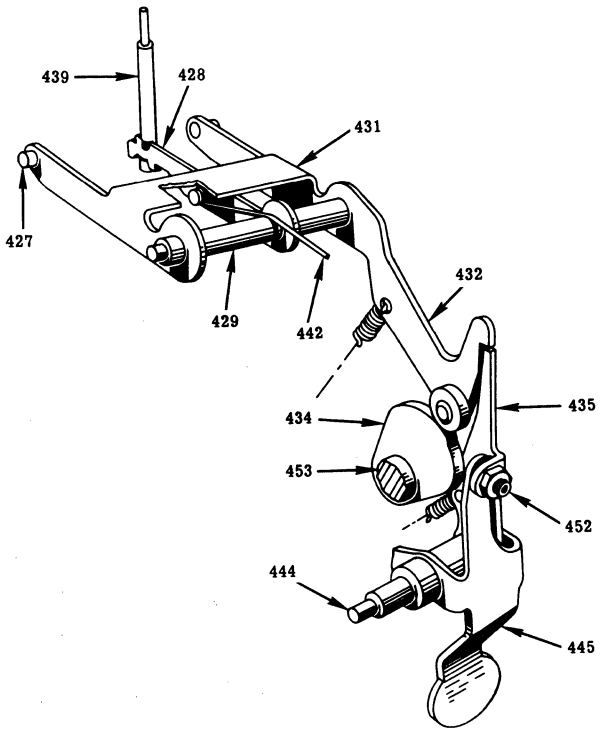


Figure 6-4 Interposer Bail Operation

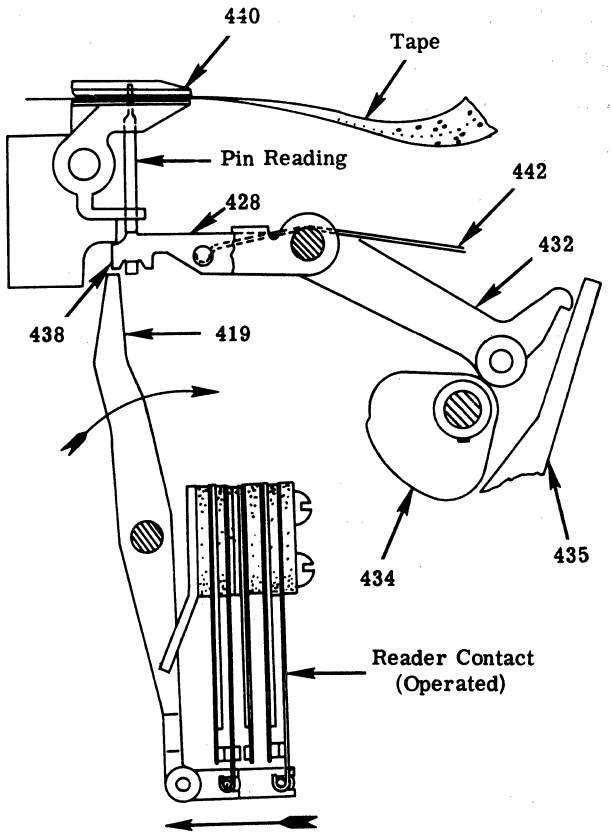


Figure 6-5 Feeler Pin Reading Code

that are in alignment with the respective pins. (See Figure 6-4.) When one or more of the pins enters a perforation in the tape, the associated interposer (428) rises sufficiently to free the interposer shoulder (438) from blocking engagement in the path of its associated contact lever (419). Therefore, when the interposer studs (427) move from between the contact lever bail rollers (426), the contact lever or levers, now freed of the interposer shoulders, will move inwardly under tension of the spring contact straps (416) and close or open contacts as the case may be. (See Figure 6-5 and 6-6.)

If there is no perforation in alignment with a feeler pin, the pin will come up to the tape and make light contact with it, due to the tension of spring (442), which is insufficient to force the pin through the tape. Thus, the interposers will not release the contact arms and the contacts will not be allowed to operate. (See Figure 6-7.)

As the interposer bail cam (434) rotates and its high point rides in contact with the interposer bail cam follower (433), the interposer bail arm assembly is rocked in a counterclockwise direction about its pivot shaft (429). The control arm (435) at this point is moved inwardly by the tension of spring (451) so as to be in position to engage the latch end of the interposer bail arm (432) as it is lowered, thus holding it out of further contact with the interposer bail cam (434). In this position, the reading cycle has been completed as follows: The interposer bail (431) lowers the interposer arms (428) into contact lever blocking

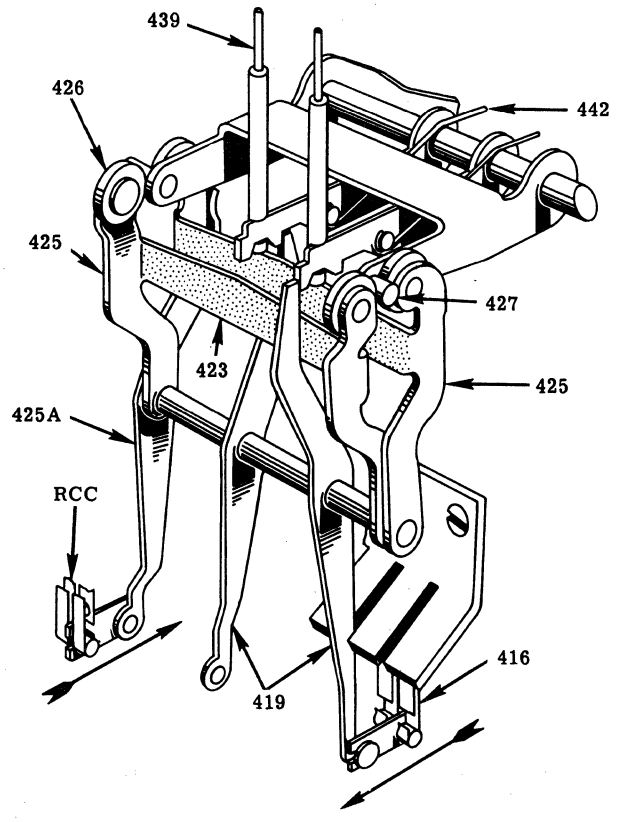


Figure 6-6 Feeler Pin and Contact Operation

position. Also, the lowering of the interposer arms (428) pulls the feeler pins down below the tape level. The above action of bail (431), causes the studs (427) to separate the contact lever bails (423). This movement will restore the contacts to the non-operated position.

The common contact RCC, under control of the arm (425A) is permitted to operate during each reading cycle. The extension (425A) is a downward extension of the bail arm (425).

Tape Feed Operation - (Figure 6-8) The tape feed mechanism is used to feed the tape one code position (or column) at a time. For each operation of the reader, the tape must be advanced one position. The codes in the tape are read at the beginning of a reader cycle and the tape is fed during the latter part of the cycle. The feeding of the tape is under control of the tape feed cam (463). As the cam roller follows the contour of the tape feed cam, the feed pawl operating arm (460) pivots in a counterclockwise direction by the action of a spring (458A). This causes the feed pawl to become engaged with the feed ratchet wheel (457) and rotate it in a counterclockwise direction. The feed pawl stop (467), which is adjustable, controls the amount of movement of the feed pawl so that only one column movement of the tape will take place. The detent assembly (475) is used to hold the feed ratchet wheel in position between spacing operations.

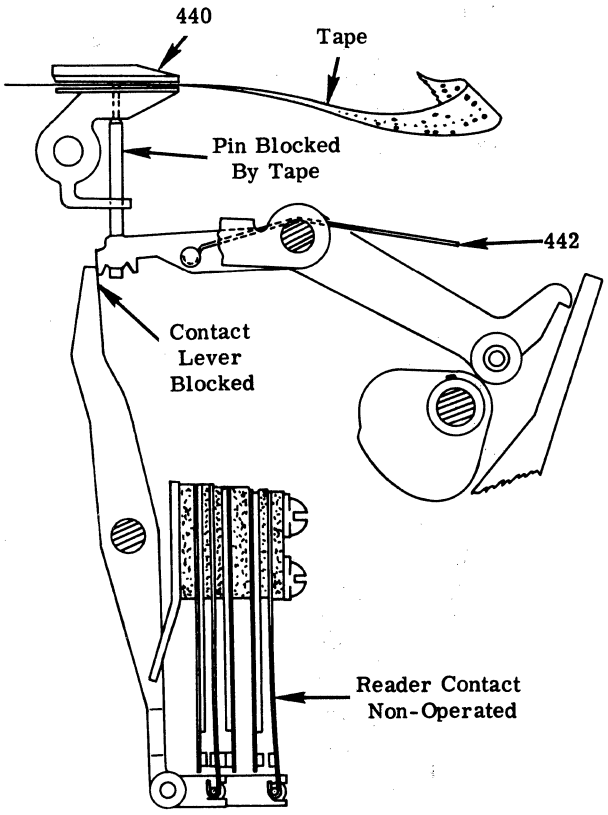
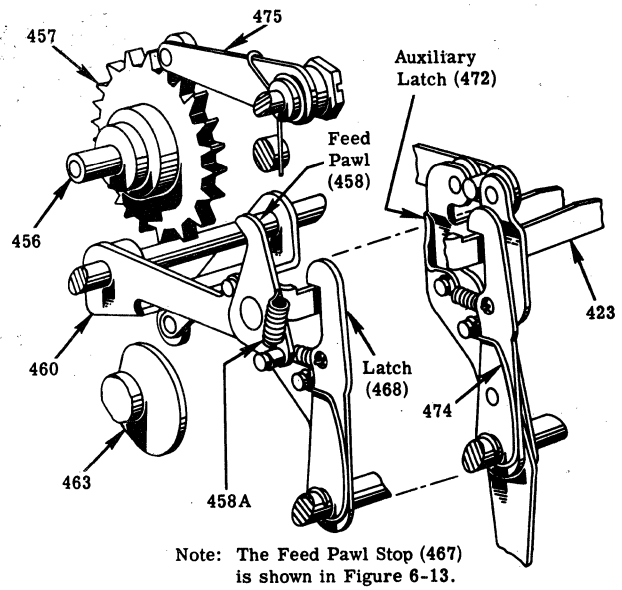


Figure 6-7 Feeler Pin Stopped by Tape

The above operations take place only if the control arm (435) latching point is disengaged with the interposer bail arm (432) and the interposer bail is operating. If the control arm (435) is not disengaged, the feed pawl operating arm (460) will not pivot, thus, no feeding of the tape will take place. The feed pawl latch (468) keeps the feed pawl operating arm (460) in a latched position, therefore, keeping the feed pawl (458) free of the feed ratchet wheel (457).

The feed pawl latch (468) remains in the latched position until the pin contact lever bails (423) are operated. When the bails (423) operate (move toward each other), an auxiliary latch (472) moves to the right. Therefore, when the roller end of the operating arm (460) is at the high point of cam (463), the latch end moves downward allowing the feed pawl latch (468), under tension of spring (474), to move to the right, completely disengaging with the operating arm (460). This action allows the feed pawl operating arm (460) to follow the contour of the tape feed cam (463) thus operating the feed pawl (458), the ratchet wheel (457) and the pin wheel (455).



Note: The Feed Pawl Stop (467) is shown in Figure 6-13.

Figure 6-8 Tape Feed Mechanism

The pin wheel (455) is attached to the pin wheel shaft (456) as is the feed ratchet wheel (457). As the feed ratchet wheel is rotated by the feed pawl action, the pin wheel is rotated an amount sufficient to advance the tape one column. The pin wheel has small pins which project in a sprocket-like fashion into the feed holes of the tape. As the pin wheel revolves, the feed pins advance the tape according to the amount of rotation of the feed ratchet and pin wheel. As explained, the feed ratchet (457) should rotate far enough to advance the tape one complete column at a time. The tape must be advanced to position the holes in the tape in a central position in relation to the reading pins.

Tape Hold Down Lever - The tape hold down lever (479) is used to hold the tape against the pin wheel and to guide the tape as it is being advanced. When the tape hold down lever is in its opened position, the reader tape contact (RTC) is opened preventing the reader from operating. (See Figure 6-9.)

REMOVAL AND ASSEMBLY OF THE TAPE READER

Removal of Reader Unit

1. Remove the reader cover.
2. Drop the selector unit and unplug the reader cable plug.
3. Open the tape hold down lever (479).
4. Loosen the mounting screw located just above the pin contact assembly. (See Figure 6-10.) This is the only screw that holds the main unit to the base casting. This screw

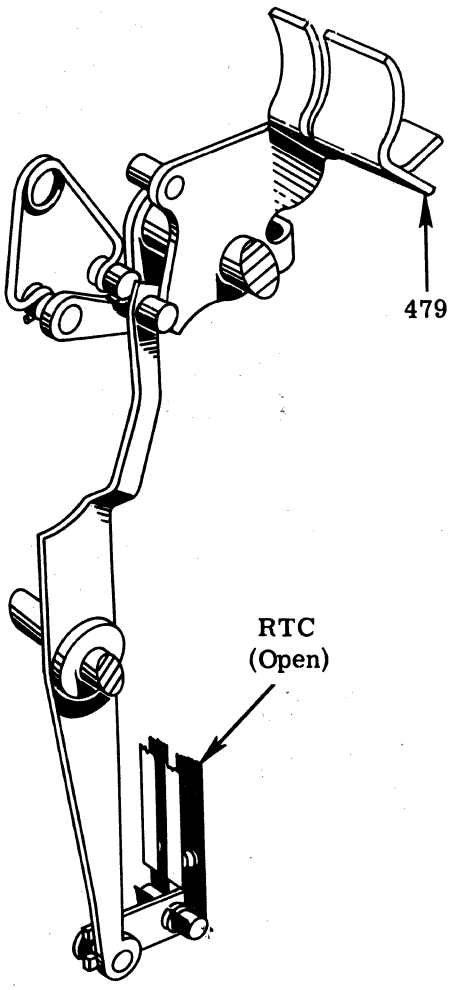


Figure 6-9 Tape Hold Down Lever

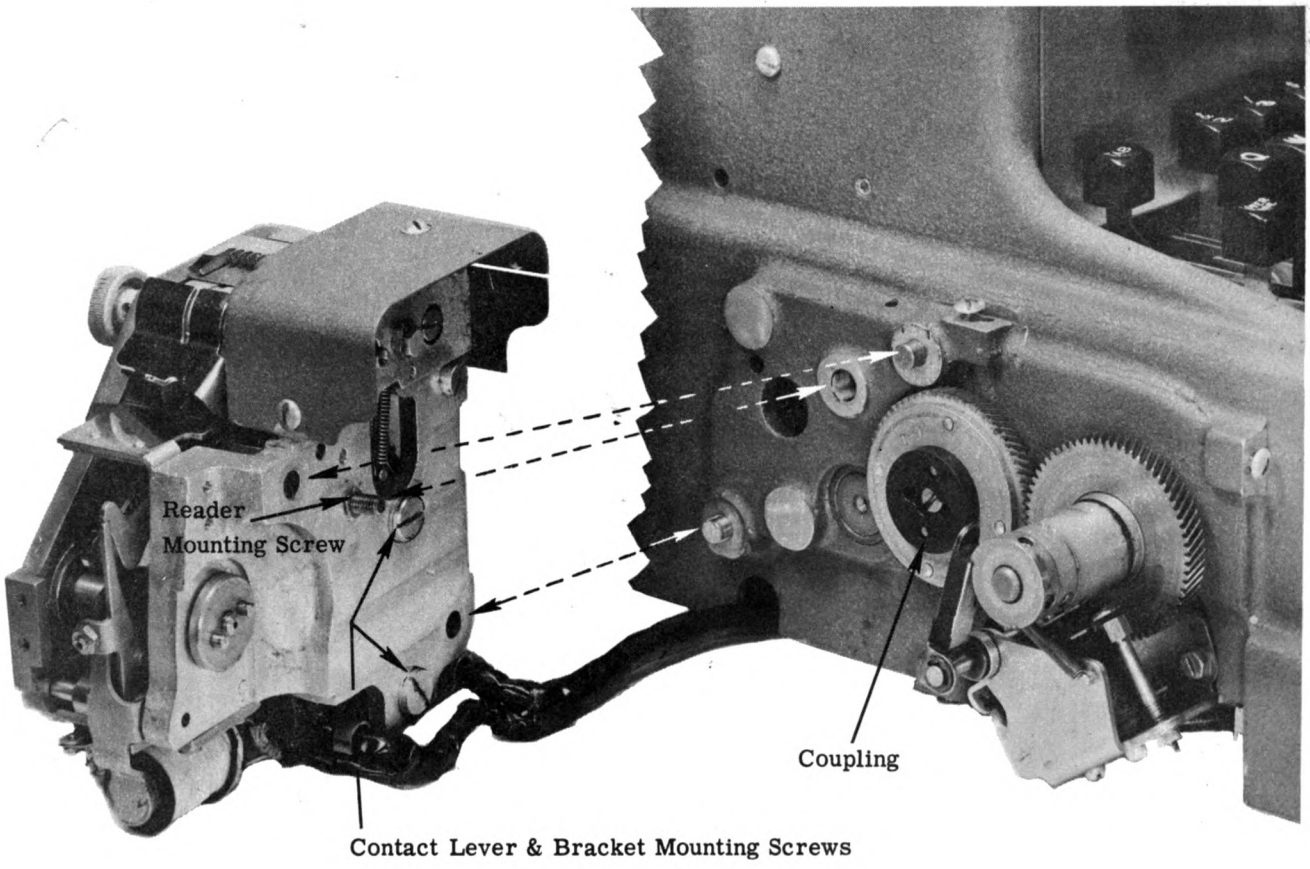


Figure 6-10 Reader Removal

cannot be completely removed.

5. Lift the unit off the locating dowels.

Removal of the Operating Cam (Figure 6-11)

1. Remove the tape reading mechanism as above.
2. Remove the coupling from the drive shaft (453).
3. Remove the feed shaft knob.
4. Remove the outside casting by removing the top screw to the left of the feed shaft and two screws located just below the cam shaft. The cam shaft may be removed from the casting.
5. Loosen the set screw and slide the cam from the shaft.

Removal of the Contact Lever and Bracket Assembly.

1. Remove the tape reader.
2. Remove two screws and remove the cable clamp.
3. Remove two mounting screws (Figure 6-10) and lift the contact lever and bracket assembly out of position.

NOTE: When replacing the assembly, make certain that the tape hold down lever is against the pin wheel before the bracket assembly is fitted

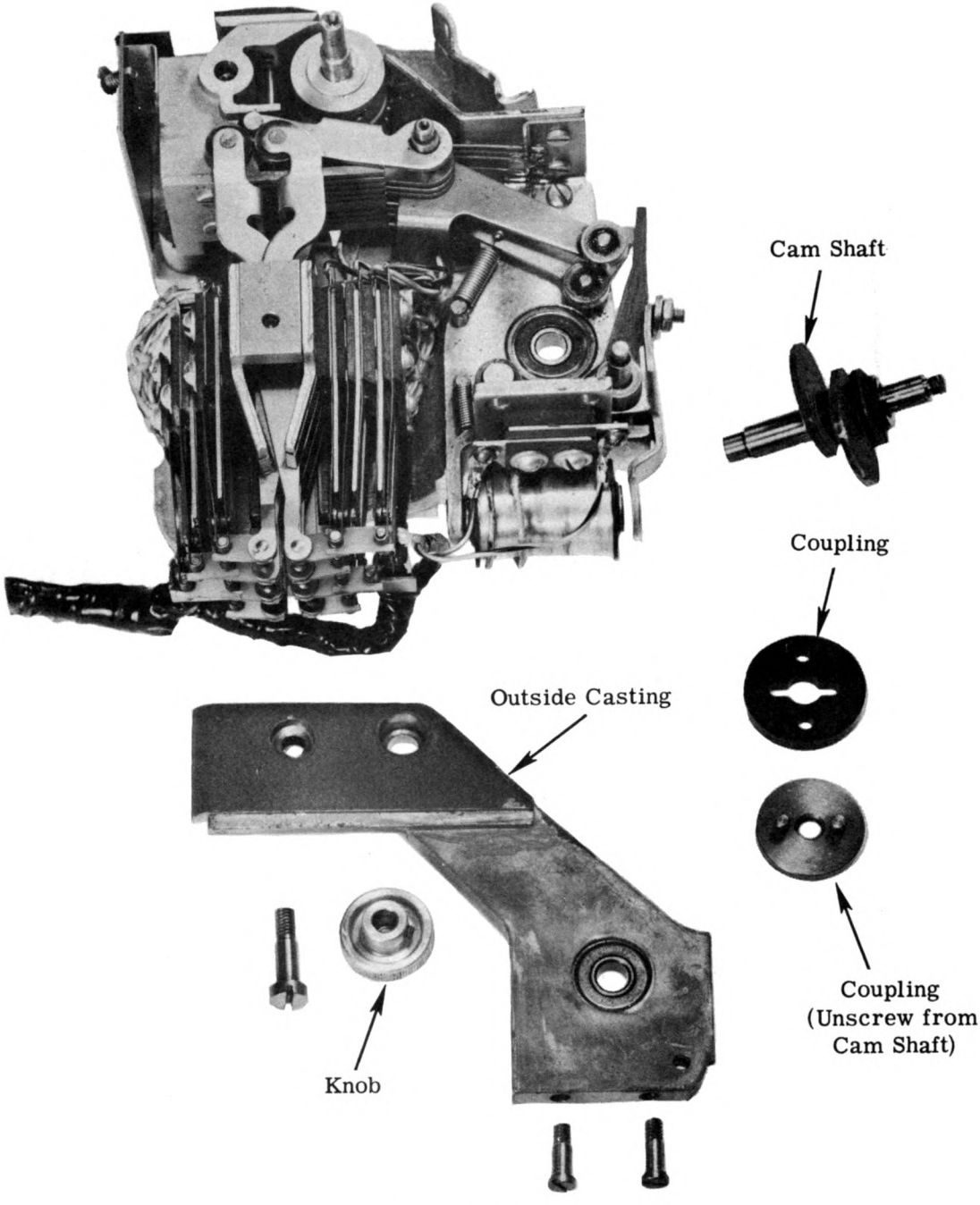


Figure 6-11 Removal of Operating Cams

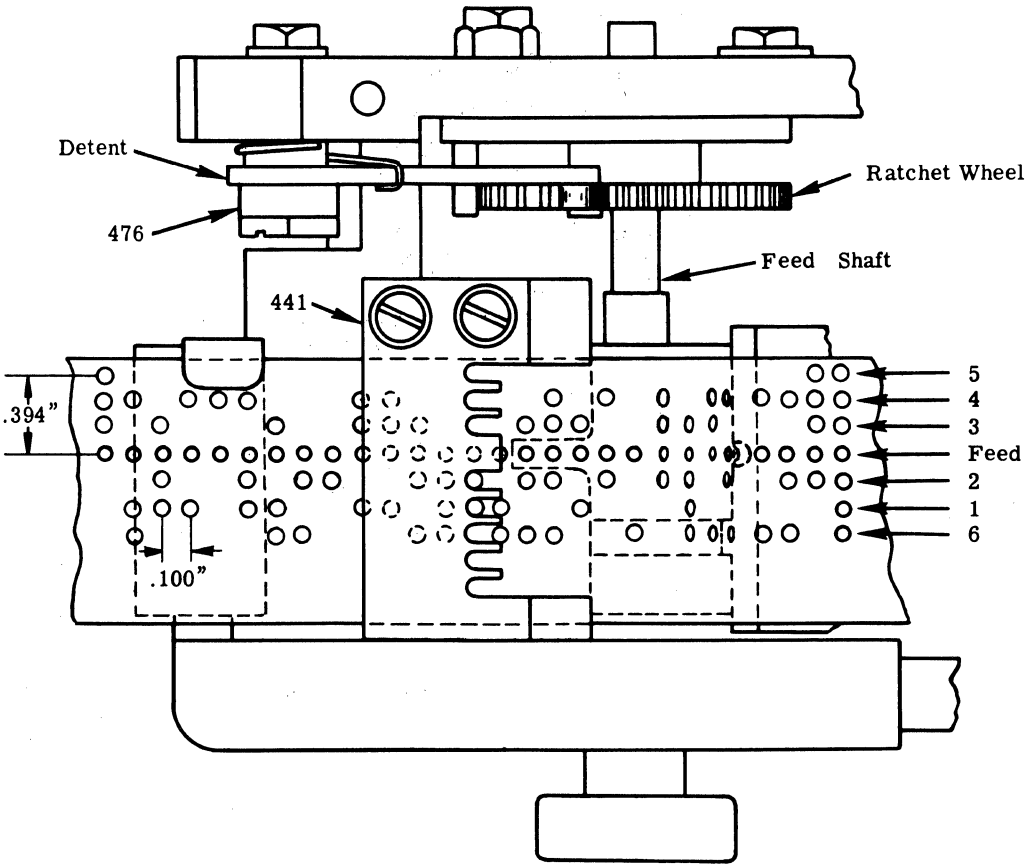


Figure 6-12 Tape Registration

into position. Otherwise, the reader tape contact lever may be positioned on the wrong side of the tape hold down lever stud.

Removal of a Feeler Pin

1. Remove the contact lever and bracket assembly.
2. Remove the feeler pin interposer guide comb.

Move the feeler pin end of the interposer (437) clear of the feeler pin and pull the pin out of the guide block. The end positions must be removed first to allow room for removing the adjacent positions.

Removal of the Feed Pin Wheel

1. Remove the taper pin from the ratchet wheel.
2. Remove the outside casting.
3. Pull the feed pin wheel and shaft out. The ratchet wheel will fall free.

ADJUSTMENTS OF THE TAPE READER

Speed Adjustment - The reader shaft speed should be between 561 and 581 RPM with the motor operating on rated voltage. This speed can be adjusted by the split pulley on the motor shaft

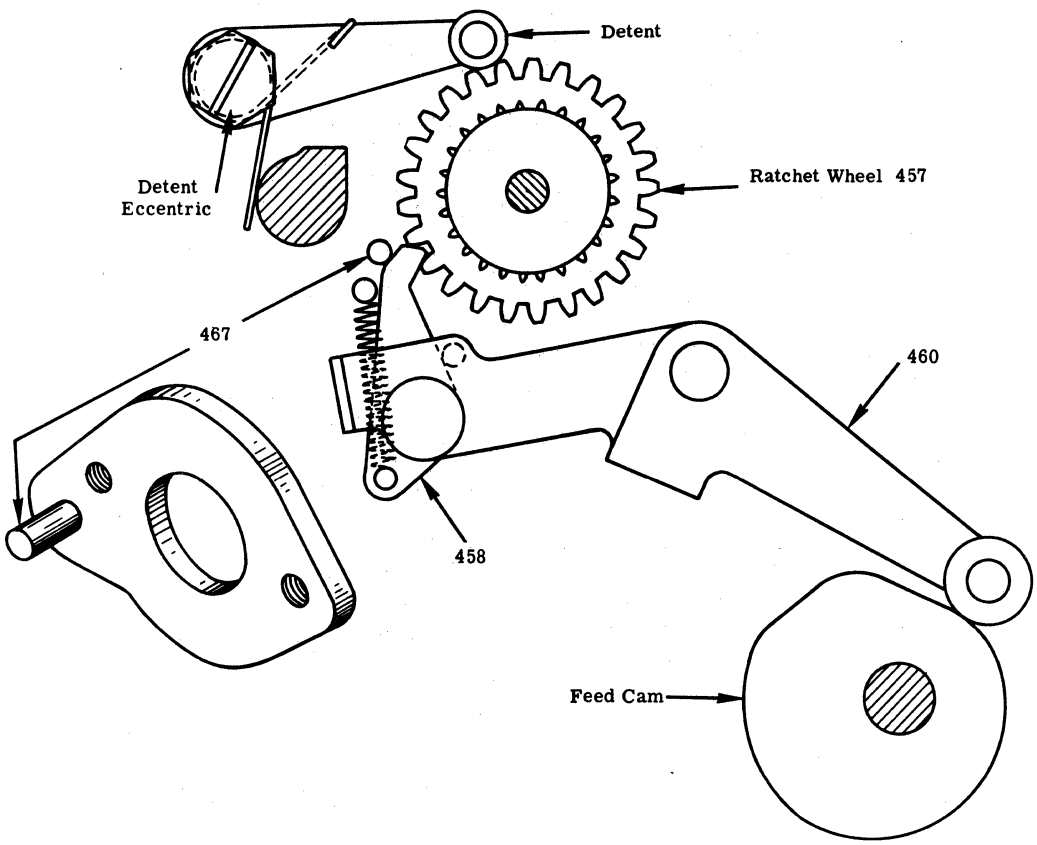


Figure 6-13 Adjustment of Feed Mechanism

(it should be remembered that by changing the split pulley, the speeds of the power roll, translator and punch will change also).

Tape Registration Adjustments

1. The tape support plate (441) should support the inside edge of a properly perforated tape so that the code holes in the tape are concentric with the reader pins. The tape support plate is adjustable to obtain this result and care should be taken to be sure the support is square with the guide block before the screws are tightened. In a properly perforated tape, the center line of the feed holes is .394″ plus or minus .005″ from the inside edge of the tape (edge nearest number five code). (See Figure 6-12.)
2. The spacing of holes in a properly punched tape is .100″ or 60 holes in 6.000″ plus or minus .010″, therefore, it is necessary to have the code holes of a perforated tape concentric with the reader pins. To obtain this registration, adjust the detent eccentric (476).
3. The feed pawl stop (467) should be adjusted to stop the motion of the feed pawl (458) just as the detent roller is fully seated between two teeth of the ratchet wheel (457). (See Figure 6-13.)

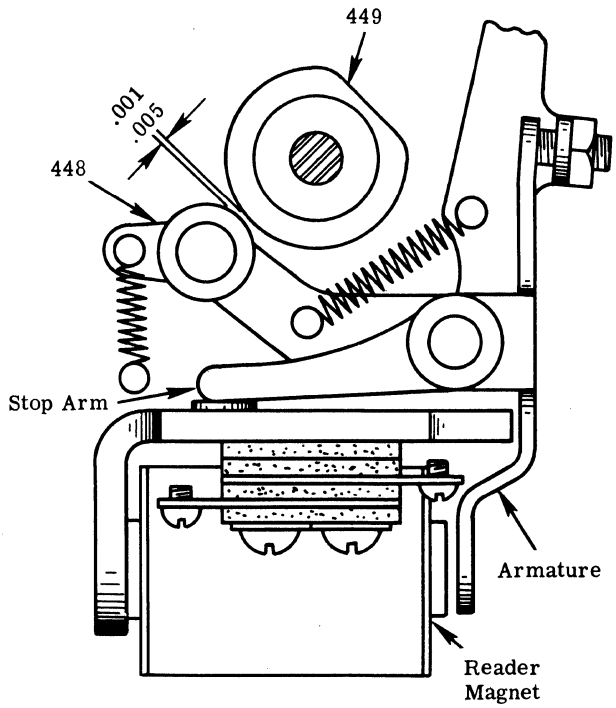


Figure 6-14 Magnet Armature Adjustment

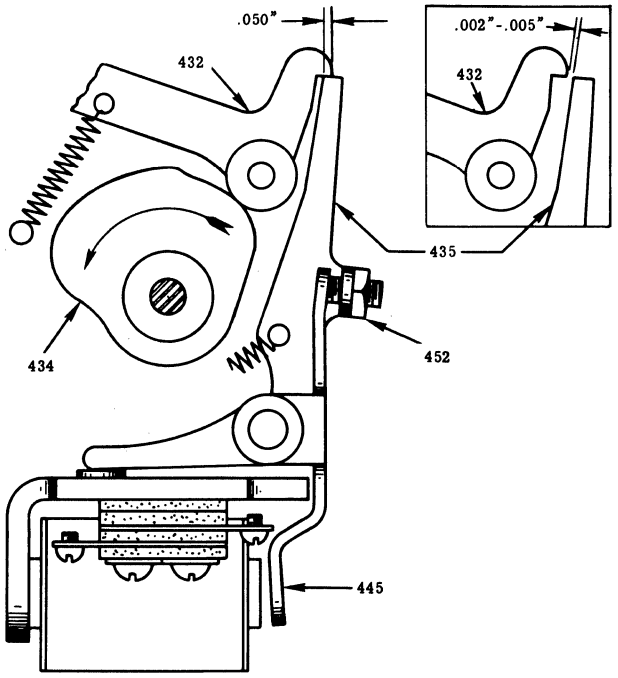


Figure 6-15 Control Arm Adjustments

Control Armature Adjustments

1. The roller on armature arm (448) should clear the high dwell of the knockoff cam (449) by .001" to .005". If an adjustment is necessary, reform the armature stop arm. (See Figure 6-14.)
2. The adjusting screw (452) in the control arm (435) should be adjusted so that when the armature (445) is in non-operated position, the tip of the control arm (435) overlaps the interposer bail arm (432) by at least .050". (See Figure 6-15.)
3. When the armature (445) is fully attracted there should be a clearance of .002" to .005" between the control arm (435) and the interposer bail arm (432). (See Figure 6-15.) The portion of the armature (445) between the yoke and the magnet core may be formed to obtain this adjustment. Check to be sure that the armature operates freely without binds. Also, with the above adjustments completed, check to see that the armature air gap is approximately .025".

Feed Control Adjustments

1. The maximum operated position of the tape feed yoke (460) should allow the latch lever (468) to move freely over the lip of the end of the tape feed yoke. If there is any interference between the latch lever and this lip, the roller arm of the tape feed yoke may be reformed slightly to provide clearance. (See Figure 6-16.)
2. With contact bail in the normal position (pins withdrawn from the tape), the hook of the latch lever (468) should have a full bite on the lip of the tape feed yoke (460). The

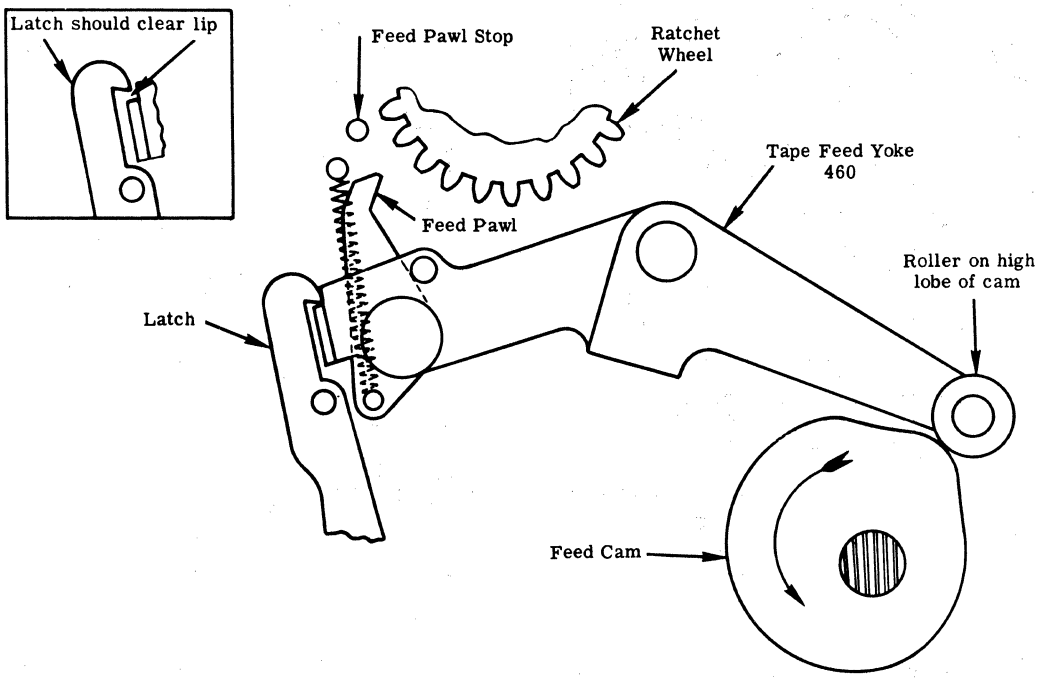


Figure 6-16 Feed Yoke Arm Adjustment

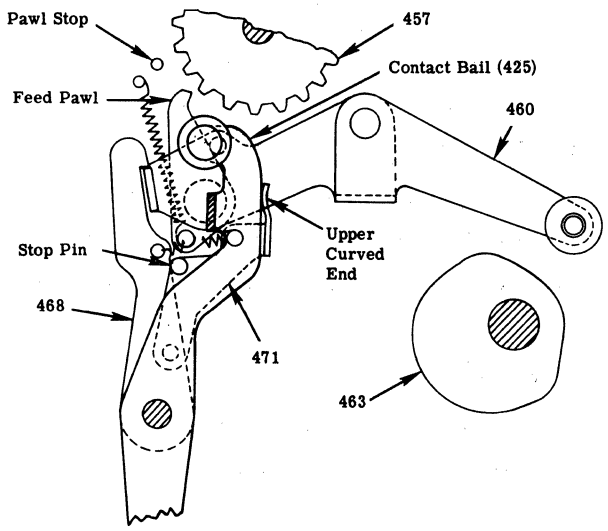


Figure 6-17 Latch Lever Adjustment

latch lever (468) should be resting against the stop pin of the feed latch arm (471). Also, the upper curved end of the feed latch arm should just engage the front contact bail. The upper curved end of the feed latch arm may be reformed if necessary to obtain the above adjustment. (See Figure 6-17.)

Contact Adjustment

1. Place a piece of tape (without code holes) in the reader to block all the feeler pins. Turn the cam shaft (453) until the interposer bail roller engages the low dwell of cam (434). Adjust all the normally open

contact points to a gap of .020″ to .025″ except number five and six which should be .030″.

2. Remove the tape from the reader and adjust all normally closed contact points to gap of .020″ to .025″.

   Adjust the normally closed break contact on the number four reader pin contacts to open before the normally open make contacts on reader pin contacts 5 and 6 make. Check normally open contact points at this time to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.
3. Replace the tape in the reader. With the interposer bail roller against the low dwell of the cam, check the normally closed contact points to see that they are all closed with additional motion of the stationary contacts away from the backing straps.
4. Move the tape hold down arm away from the pin wheel and adjust the reader tape contacts (RTC) to a gap of .020″ to .025″. Move the tape hold down arm against the pin wheel and check to see that the reader tape contacts close with additional motion of the stationary straps away from the backing strap.

   Check to see that the two contact points on each strap engage their mating contact points as near simultaneously as possible. It is also important that there should be no noticeable difference in the point at which the contacts in various stacks make or break during the rotation of the reader cam shaft.

Friden — *Customer Service Engineering*

MANUAL ADDENDUM

Date: August 29, 1955

Reference: To be inserted in Part II, Section 6, after Page 6-13.

Subject: Edge Card Reader

Purpose: Adjustment Procedure

Information:

The edge card reader is the same basic reader explained in Part II, Section 6 of this manual except as follows:

Tape Registration

1. Refer to Part II, Section 6, Page 6-10, steps 2 and 3 for feed adjustments.

2. If necessary, shim the pin wheels so the rear pin wheel assembly lines up properly with the front pin wheel assembly. Be sure that the pin wheels are centered between the code holes (use a card with all holes punched to check this).

Control Armature

Same as steps 1, 2 and 3, Part II, Section 6, Page 6-11 of this manual.

Feed Control

Same as steps 1 and 2, Part II, Section 6, Page 6-11.

Idler Assembly Adjustment

1. Place a card in the card guide assembly and loosen the rear pinion gear. Move the idler gear until there is a minimum of backlash between the idler and the two pinions. Rotate the rear pin wheel to align with the front pin wheel and tighten rear pinion set screws.

Card Guide Assembly

1. Adjust the height of the card table by the use of the fulcrum shaft (at rear) and eccentric sleeve on the front pin wheel.

2. There should be a .007" clearance above the front guide block

to the bottom of the upper plate (adjust by using eccentric sleeve).

3. There should be a .007" clearance above the rear pin wheel and the upper plate (adjust by using fulcrum shaft).

Note: When adjusting the fulcrum shaft, because of its eccentric motion, check the alignment of the code holes in the upper plate with the code holes in the guide block.

4. Adjust the card stop so that when guide table is in up position and card is up against the stop, the card will drop into proper registration with rear pin wheel when guide table is put down into reading position.

Contact Adjustment

Check contact assemblies to see that all springs are assembled in proper sidewise registration in each stack. The moveable contact springs should all have sufficient tension to follow their contact levers to their extreme inward position without lost motion in their nylon operators.

1. Place piece of tape without holes in reader to block all pins, and turn cam shaft until interposer bail roller engages low dwell of cam. Adjust all normally open contact points to a gap of .020" to .025".

2. Remove tape from reader and adjust all normally closed contact points to a gap of .020" to .025". Check normally open contact points at this time to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

3. Replace tape in reader and with interposer bail roller against low dwell of cam, check normally closed contact points to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

4. Common Contact Adjustment - Turn power shaft until normally open contacts give a .020" to .025" gap, then holding power shaft at this point adjust common contact to the same gap of .020" to .025". Care should be taken to see that the two contact points on each spring engage their mating points as near simultaneously as possible. It is also important that there should be no noticeable difference in the point at which contacts in various stacks make or break during rotation of the cam shaft.

Friden — Customer Service Engineering

MANUAL ADDENDUM No. 17

Date: September 8, 1958

Reference: To be inserted in Part II, Section 6, after Page 6-13.

Subject: Tab Card Reader.

Purpose: Adjustment Procedure.

Information:

The following adjustments apply to the Tab Card Reader, which may be substituted for either the Tape or Edge Card Reader, on any of the Systems Model Flexowriters.

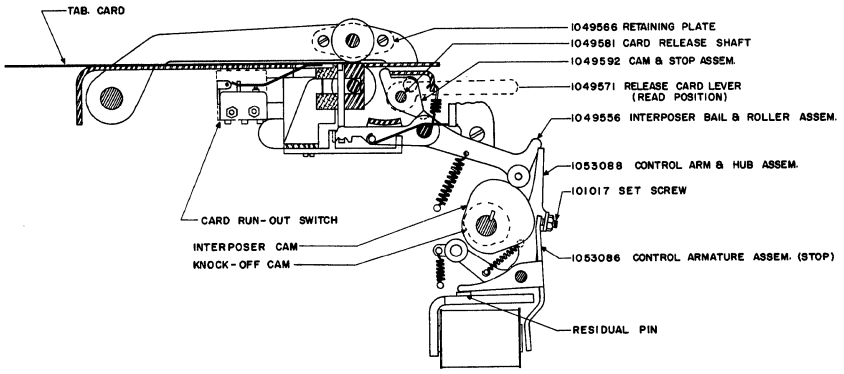
Pressure Feed (Fig. 1)

1. Adjust cam and stop assem., on the card release shaft (1049581), to allow full pressure between feed and pressure rollers on both sides Allow a slight play when release lever is down to insure a full pressure condition.
2. Adjust pressure roller shaft retaining plate (1049566) to give an equal pressure of Pressure Rollers on Feed Rollers.
3. Adjust card run-out switch, so that it will actuate when the card leaves its 80th position.

Control Armature (Fig. 1)

1. With the armature stop arm (1053086) against the residual pin, the armature roller should clear the high dwell of the knock-off cam by .001 to .005. If necessary, bend the stop arm relative to the roller arm to obtain this adjustment.
2. Adjust the crew (101017) on the control arm (1053088), to engage the armature extension when the interposer bail arm (1049556), overlaps the end of the control arm by at least .050.
3. In a fully attracted position of the armature, the control arm should move clear of the interposer bail arm from .002 to .005. The portion of the armature between the yoke and the magnet core may be bent to obtain this adjustment. The armature should operate freely and engage flat against the magnet core.

Figure 1

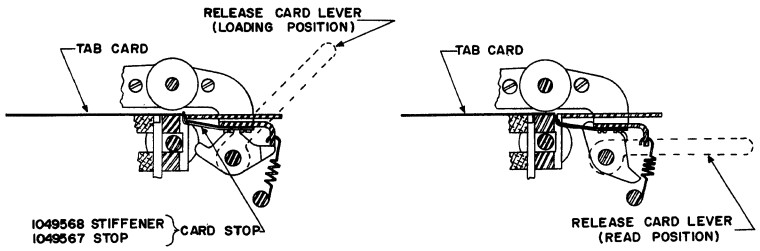


CONTROL ARMATURE & PRESSURE FEED FIG. 1

Card Stop (Fig. 2)

1. Adjust the card stop, so that the tab card will rest against the card stop when the reader pins are centered on the first row of code holes.
2. When the release lever is down; the card stop edge must be flush, or below in relation to the table. (This adjustment is to be made with card between the rollers.)

Figure 2



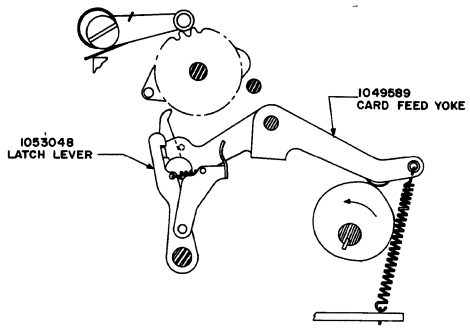
CARD STOP FIG. 2

Feed Control (Fig. 3 and 4)

1. The maximum operating position of the card feed yoke (1049589) should allow the latch lever (1053048) to move freely over the lip of the card feed yoke by .010 to .015 clearance. If any interference exists between the latch lever and this lip, the roller arm of the card feed yoke may be bent slightly to provide this clearance. (Fig. 3).
2. With the front contact bail in the normal position (pins with-drawn from card), the hook of the latch lever should have a full bite on the lip of the card feed yoke with the stop pin of the feed latch arm engaging the edge

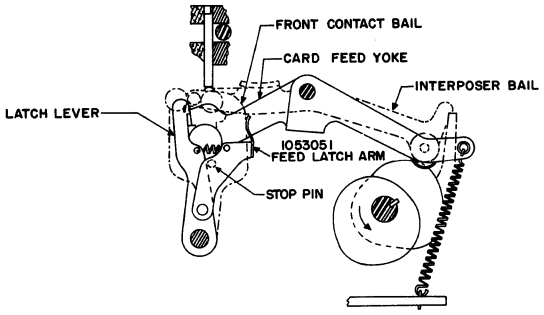
of the latch lever. At this time, the upper curved end of the feed latch arm (1053051) should just engage the front contact bail. This upper curved end of the feed latch arm may be bent if necessary to obtain this adjustment. (Fig. 4).

Figure 3



FEED CONTROL FIG.3

Figure 4



DENOTES INTERPOSER BAIL & CONTACT BAILS

FEED CONTROL FIG. 4

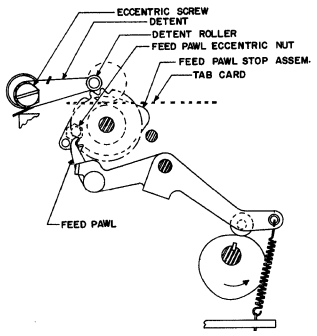
Longitudinal Registration (Fig. 5)

Registration is to be maintained through the entire (80 position) length of the tab card, as set in the card stop adjustment. (1)

1. Adjust the feed pawl eccentric nut to a "mean" position. At this setting, when the feed pawl is in its acutated position (moving the ratchet wheel to that the detent roller is between the ratchet teeth, allowing no movement of the ratchet wheel as the feed pawl is returned. Check for a "long" or "short" registration, and adjust eccentric nut (1049605) to correct the position of the feed pawl stop assem.

Note: Detent should be adjusted to above procedure for each adjustment of the feed pawl eccentric nut and must be adjusted to above procedure when final adjustment on feed pawl eccentric nut is made.

Figure 5

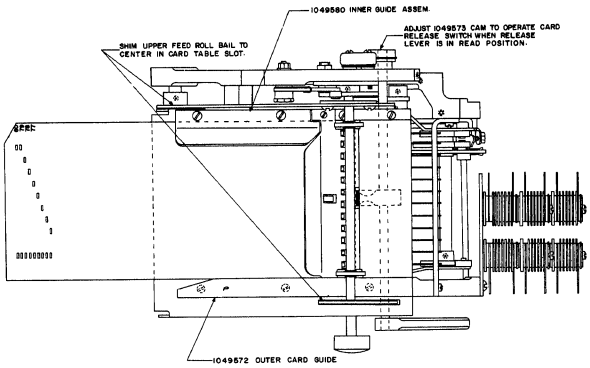


LONGITUDINAL REGISTRATION FIG. 5

Lateral Registration (Fig. 6)

1. Adjust the inside guide (1049580), and the outside guide (1049572) to center the code holes of the tab card over the reader pins. Adjust guides to allow sufficient, (Approx. .015) side play of the tab card.

Figure 6



Card Release Switch (Fig. 6)

1. Adjust cam (1049573) on card release shaft (1049581) so that switch will be operated when card release lever is in reading position.

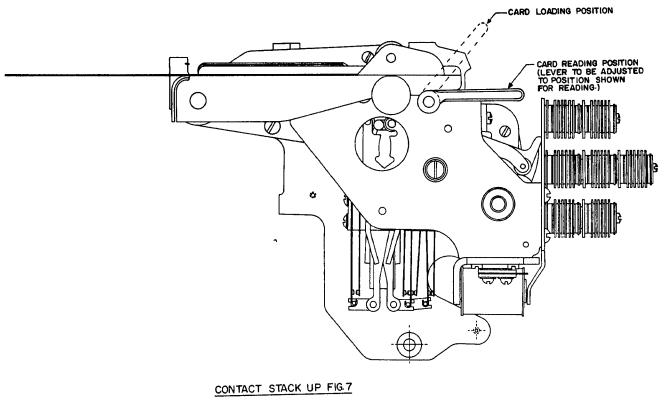
Contact Adjustment (Fig. 7)

Check contact assemblies to see that all springs are assembled in proper sidewise registration in each stack. Check to see that springs are properly formed so that 20 to 25 grams pressure is required to break each engaged contact point. The moveable contact springs should all have sufficient tension to follow their contact levers to their extreme inward position without lost motion in their nylon operators.

1. Place piece of card without holes in reader to block all pins, and turn cam shaft until interposer bail roller engages low dwell of cam. Adjust all normally-open contact points to a gap of .015 to .020.
2. Remove card from reader and adjust all normally-closed contact points to a gap of .015 to .020. Check normally-open contact points at this time to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.
3. Replace card in reader and with interposer bail roller against low dwell of cam, check normally-closed contact points to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

4. Common contact adjustment-turn power shaft until normally-open contacts give a .015 to .020 gap, then holding power shaft at this point, adjust common contact to the same gap of .015 to .020. Care should be taken to see that the two contact points on each spring engage their mating points as near simultaneously as possible. It is also important that there should be no noticeable difference in the point at which contacts in various stacks make or break during rotation of the cam shaft.

Figure 7



Friden — *Customer Service Engineering*

MANUAL ADDENDUM

Date: August 29, 1955

Reference: To be inserted in Part II, Section 6, after Page 6-13.

Subject: Edge Card Reader

Purpose: Adjustment Procedure

Information:

The edge card reader is the same basic reader explained in Part II, Section 6 of this manual except as follows:

Tape Registration

1. Refer to Part II, Section 6, Page 6-10, steps 2 and 3 for feed adjustments.

2. If necessary, shim the pin wheels so the rear pin wheel assembly lines up properly with the front pin wheel assembly. Be sure that the pin wheels are centered between the code holes (use a card with all holes punched to check this).

Control Armature

Same as steps 1, 2 and 3, Part II, Section 6, Page 6-11 of this manual.

Feed Control

Same as steps 1 and 2, Part II, Section 6, Page 6-11.

Idler Assembly Adjustment

1. Place a card in the card guide assembly and loosen the rear pinion gear. Move the idler gear until there is a minimum of backlash between the idler and the two pinions. Rotate the rear pin wheel to align with the front pin wheel and tighten rear pinion set screws.

Card Guide Assembly

1. Adjust the height of the card table by the use of the fulcrum shaft (at rear) and eccentric sleeve on the front pin wheel.

2. There should be a .007" clearance above the front guide block

to the bottom of the upper plate (adjust by using eccentric sleeve).

3. There should be a .007" clearance above the rear pin wheel and the upper plate (adjust by using fulcrum shaft).

Note: When adjusting the fulcrum shaft, because of its eccentric motion, check the alignment of the code holes in the upper plate with the code holes in the guide block.

4. Adjust the card stop so that when guide table is in up position and card is up against the stop, the card will drop into proper registration with rear pin wheel when guide table is put down into reading position.

Contact Adjustment

Check contact assemblies to see that all springs are assembled in proper sidewise registration in each stack. The moveable contact springs should all have sufficient tension to follow their contact levers to their extreme inward position without lost motion in their nylon operators.

1. Place piece of tape without holes in reader to block all pins, and turn cam shaft until interposer bail roller engages low dwell of cam. Adjust all normally open contact points to a gap of .020" to .025".

2. Remove tape from reader and adjust all normally closed contact points to a gap of .020" to .025". Check normally open contact points at this time to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

3. Replace tape in reader and with interposer bail roller against low dwell of cam, check normally closed contact points to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

4. Common Contact Adjustment - Turn power shaft until normally open contacts give a .020" to .025" gap, then holding power shaft at this point adjust common contact to the same gap of .020" to .025". Care should be taken to see that the two contact points on each spring engage their mating points as near simultaneously as possible. It is also important that there should be no noticeable difference in the point at which contacts in various stacks make or break during rotation of the cam shaft.

CODE TRANSLATOR

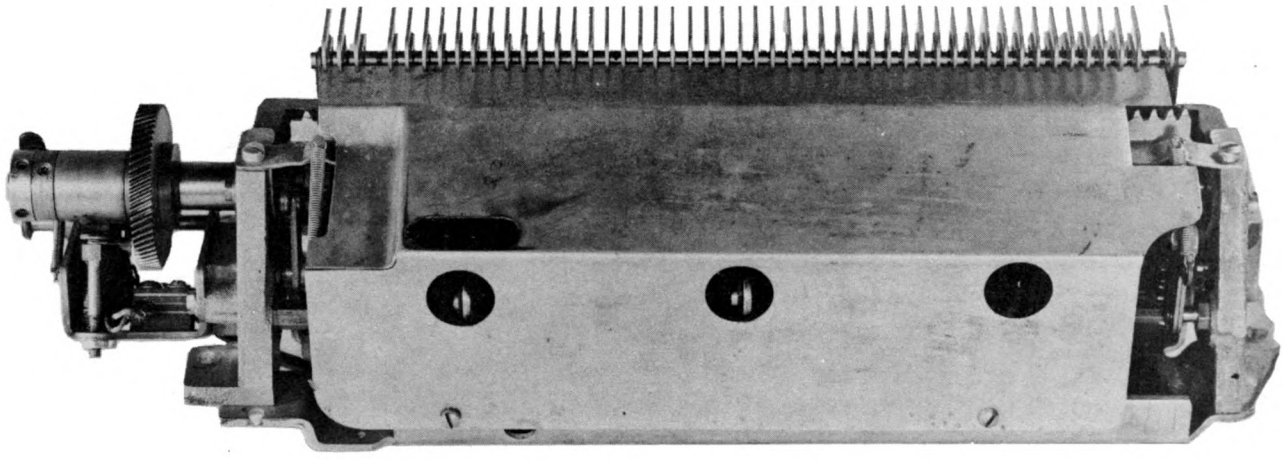


Figure 7-1 Code Translator

PURPOSE AND DESCRIPTION

The purpose of the code translator is to respond to coded electrical impulses for mechanically selecting and operating key levers of the Flexowriter. The translator includes a code magnet for each unit of the binary code plus a magnet for operating a single revolution mechanical clutch.

The translator is a single contained unit mounted by four screws under the keyboard of the writing machine. A group of levers called seekers hook over studs in the key levers of the writing machine. A drive gear meshes with a power gear and provides rotation of the translator shaft when the clutch armature is released. In the cycle of the shaft operation, a selected seeker is moved so as to operate its associated keylever.

The Flexowriter normally receives the electrical impulses from the tape reader. These impulses operate individual magnets in the translator corresponding to the unit of the code sensed by the tape reader. The operated magnets release permutation bars which select an individual seeker for operation. This seeker motion will cause the operation of its related key lever.

SEQUENCE OF OPERATION

The following sequence is for a translator with magnets connected directly to contacts on the tape reader:

Translator Code Magnets - When using the six unit binary code, the translator consists of two magnet yoke assemblies. These are identical except for the mounting plate and the number of coils and armatures. The magnet yoke assembly nearest the clutch end of the translator consists of four magnets and four armatures. These magnet coils are energized by the closing of reader contacts 1, 2, 3, and 4. The other magnet yoke assembly consists of two coils and two armatures and is energized by the closing of

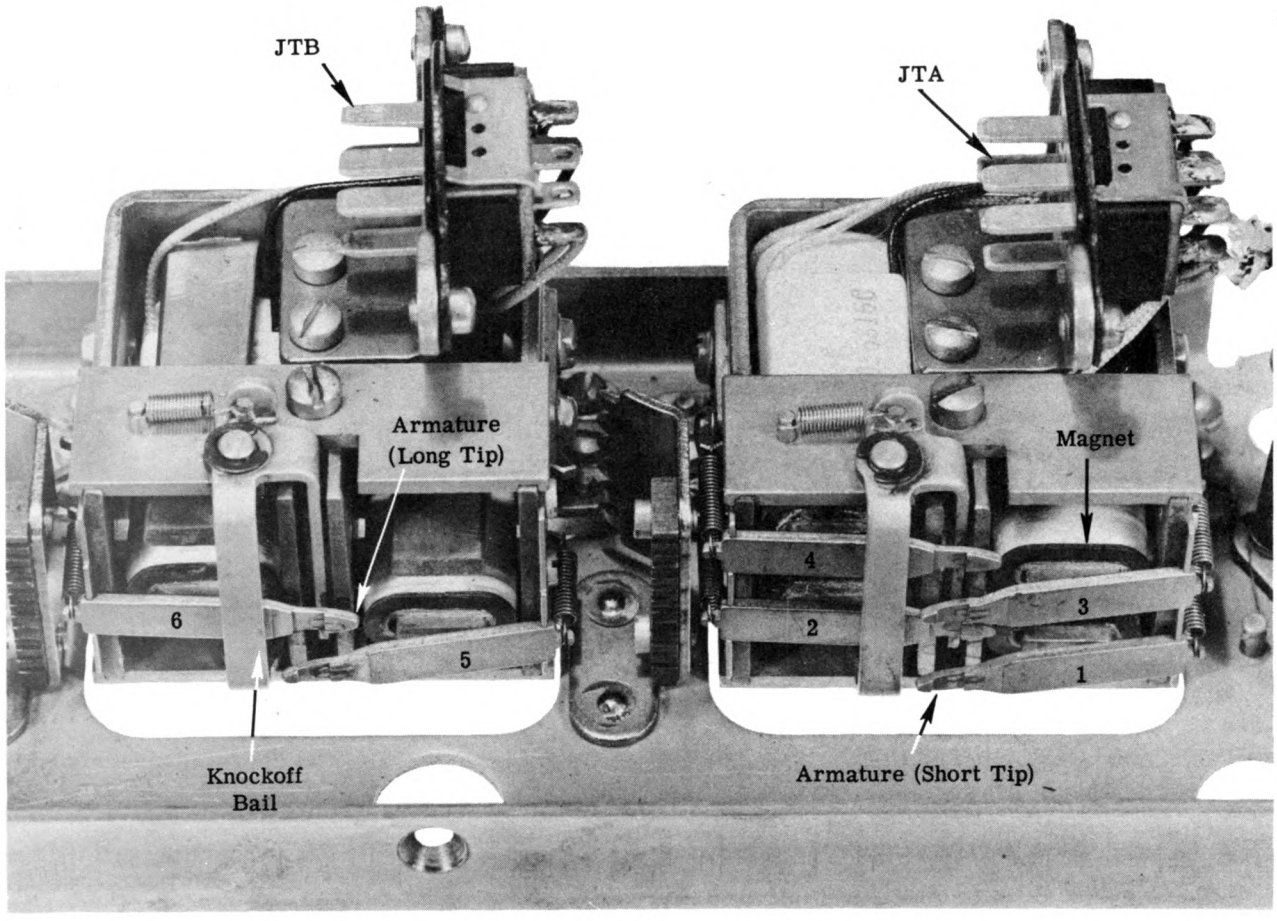


Figure 7-2 Magnet Positions

reader contacts 5 and 6. The magnet and armature locations are shown in Figure 7-2.

During a cycle of the reader, if the number one code hole is read in the tape, a circuit will be completed to the coil of the number one code magnet (see Section 8, Translator Magnet Circuits). There is a similar circuit for each of the six magnet coils.

Therefore, when a code hole is read in the reader, a corresponding code magnet is energized in the translator. When these magnets are energized, their respective armatures will be magnetically drawn toward the pole face.

Permutation Bars - Each of the code magnet armatures mentioned above control a permutation bar by holding it in a non-operated (latched) position. When the magnet is energized, the armature is attracted releasing the bar. (See Figure 7-3.) A plunger spring moves the bar horizontally until the restoring stud (on the bar) strikes the restoring bail.

The six permutation bars are similar except for their projections (or notched end) which are so arranged that they prevent horizontal motion of some seekers when in the normal position and other seekers when in the operated position. Figure 7-4 shows a sample permutation bar.

Figure 7-5 shows a view of the permutation bars looking at the projection end. As can be seen, the bars are not arranged in numerical

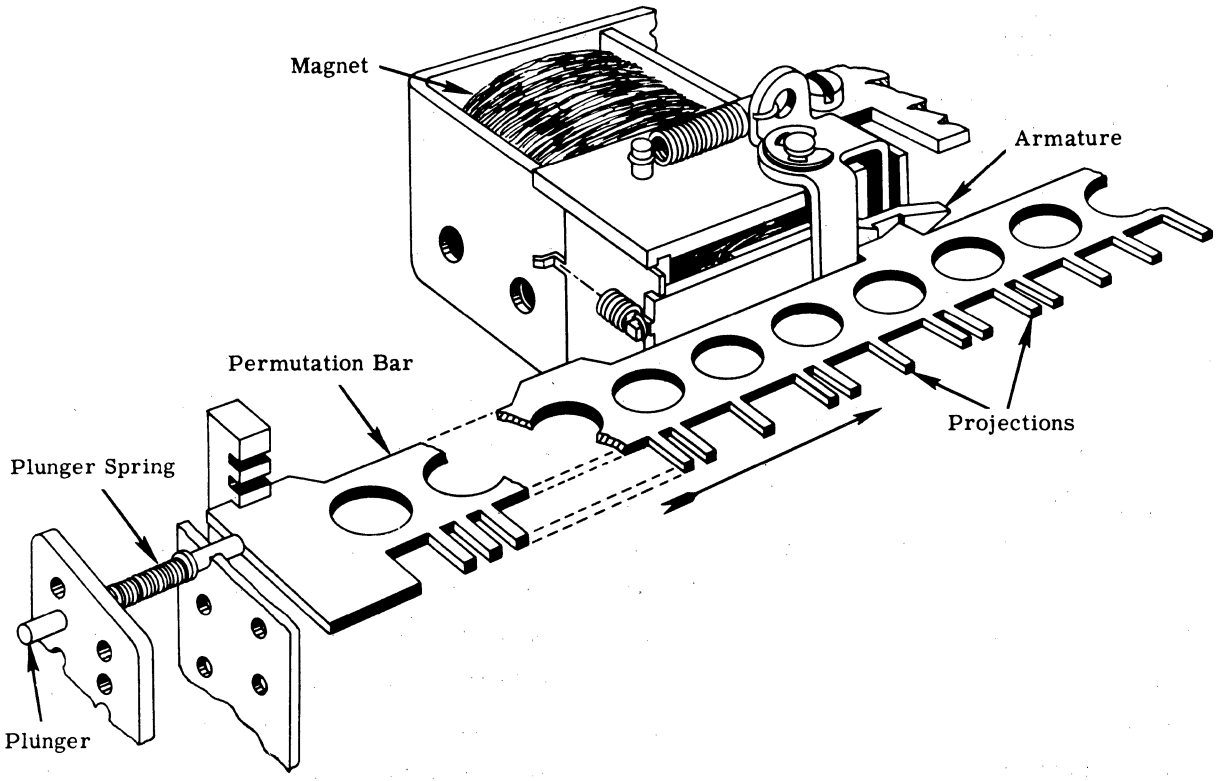


Figure 7-3 Permutation Bar Latched

order. This is due to the magnet positions as shown in Figure 7-2. The projections are arranged so that whatever combination of operated and non-operated bars exist, there will be only one seeker position without projections (a labeled column in Figure 7-5 represents a seeker position). In other words, for each cycle of the translator, no matter which bars are operated or non-operated, only one seeker will be allowed to operate and pull down its corresponding keylever.

For an example operation of the permutation bars, if the bars 2, 3 and 4 (in Figure 7-5) were released (moved to the left), the space opposite the "C" seeker would be cleared while the remaining seekers would be blocked out. This particular example operation is also shown in detail in Figures 7-6 and 7-7. Figure 7-6 shows all bars in the non-operated position. Note that the seeker shown, which operates the keylever for the character "C," is blocked out by a projection on bars 2, 3 and 4. Figure 7-7 shows the bars 2, 3 and 4 released and bars 1, 5 and 6 non-operated. Note that the seeker "C" has now been pulled between the projections by seeker spring (520).

When the reader code contacts are operated, a common contact is also made which completes a circuit to the translator clutch magnet. Even though the electrical circuit to the translator magnets and the clutch magnet coil is completed simultaneously, the bars will operate before the clutch because of the slower operating characteristics of the clutch.

Translator Clutch - The operation of the translator clutch is exactly the same as on the tape

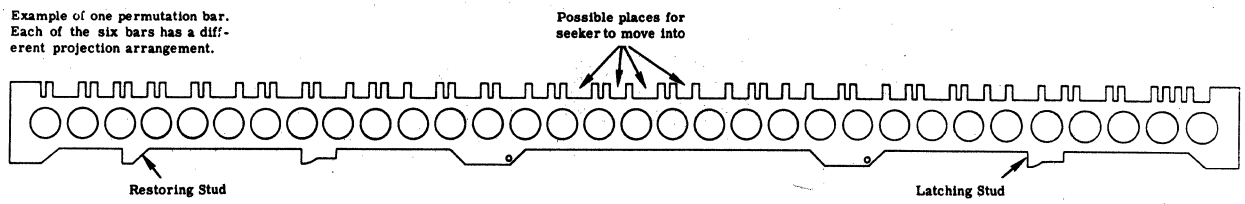


Figure 7-4 Sample Permutation Bar

punch and is explained in detail in Section 4 of this Manual. When operated, it permits one complete rotation of the translator shaft (492).

Translator Shaft - There are two cams (494) one at each end of the translator shaft (492) which are identical. When the shaft is at rest (clutch disengaged), these two cams hold the restoring bail (523) against the seekers so that the seekers do not engage the projections of the permutation bars. (See Figure 7-8.)

The cam contour is so designed that when the shaft (492) rotates, the spring (520A) will hold the cam follower against the surface of the cam permitting bail (523) to move inward. This will permit the seekers to move so as to engage the permutation bar projections. As the shaft nears the end of its cycle, the bail (523) moves the seekers back away from the bar projections, thus restoring the seekers.

As stated previously, if any of the bars have been released, one seeker will not be blocked by the bar projections and will be allowed to follow the bail (523) inward.

If a seeker is allowed to move inward during the shaft cycle, just after it reaches its maximum inward movement an operating bail (530) will engage the notch on the seeker and pull the seeker downward. (See Figure 7-9.) This action will in turn pull the corresponding keylever downward. The operating bail (530) is operated by two identical cams (495), one located at each end of the shaft (492).

There is another cam (493) located on the translator shaft at the clutch end. This cam operates the bar restoring bail (512). (See Figure 7-10.) During the latter part of the shaft cycle, the bar restoring bail (512) moves all the bars back beyond the latching point of their respective armatures before allowing them to latch. This overtravel movement of the permutation bar

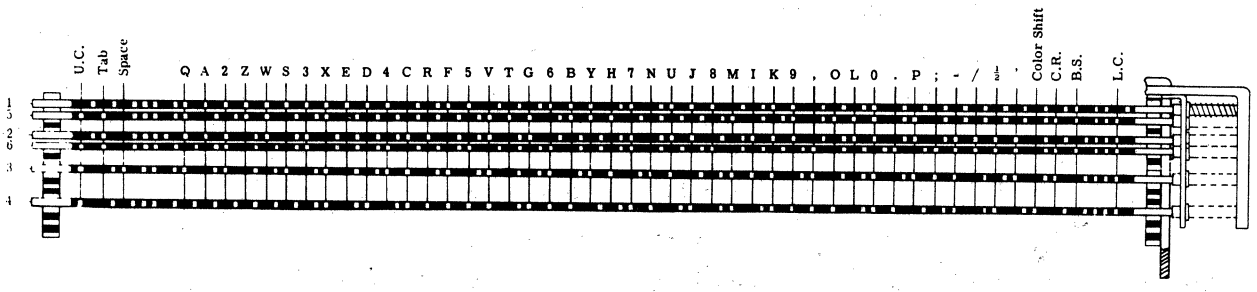


Figure 7-5 Bar Coding Arrangement

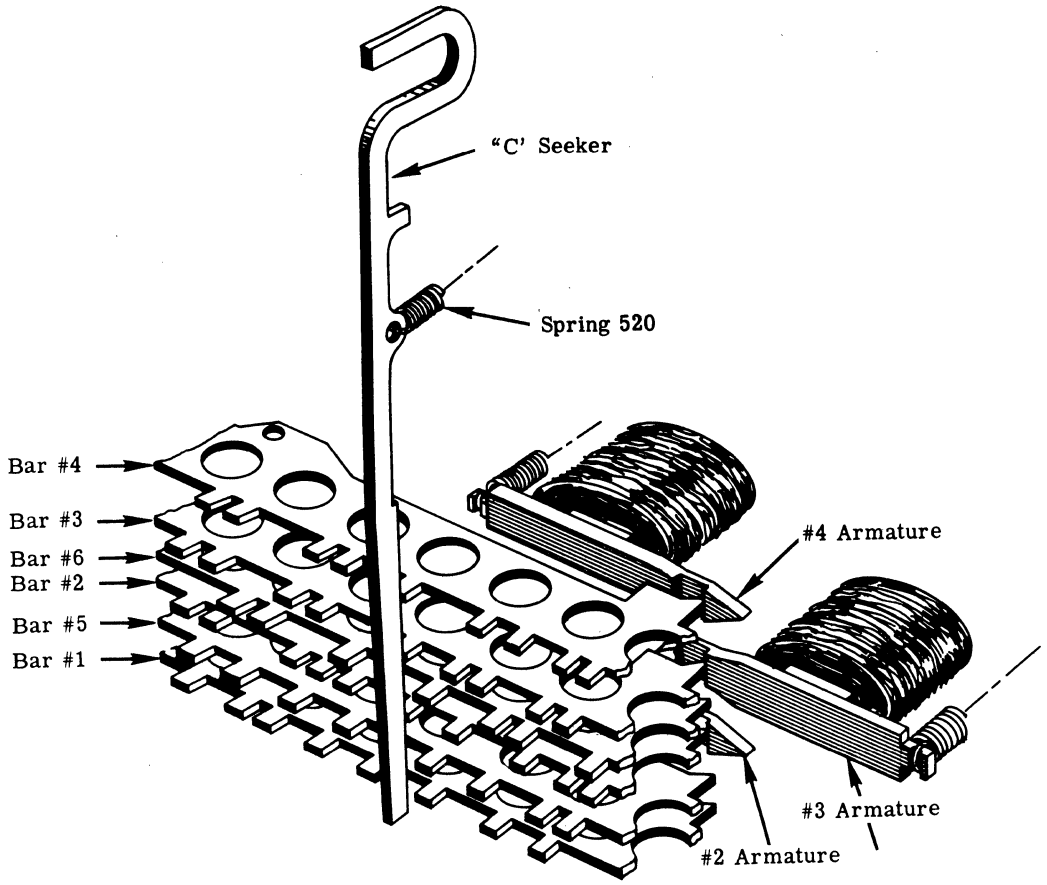


Figure 7-6 Bars - Non Operated

results in the restoring stud of the bar to contact the knock off bail arm of the magnet yoke assembly. The arm is moved on its pivot, causing the knock off bail (542) to contact all the armatures and move them away from the magnet cores. (See Figure 7-11.) This knock off action insures positive latching of the bars with their respective armatures.

REMOVAL, ASSEMBLY AND ADJUSTMENT

Translator Removal - To remove the translator from the writing machine, proceed as follows:

1. Tip the machine up on end.
2. Remove the reader cover.
3. Remove the left front foot.
4. Remove four mounting screws as shown in Figure 7-12. Carefully pull the translator out of the base by rotating the unit forward slightly. This is necessary to allow the seekers to move freely past the studs on the keylevers.
5. Remove two screws and remove the dust cover.
6. Disconnect the cable from the translator by unplugging two Jones plugs.

Translator Installation - To install a complete translator to the base of the writing machine, proceed in the reverse of removal, noting the

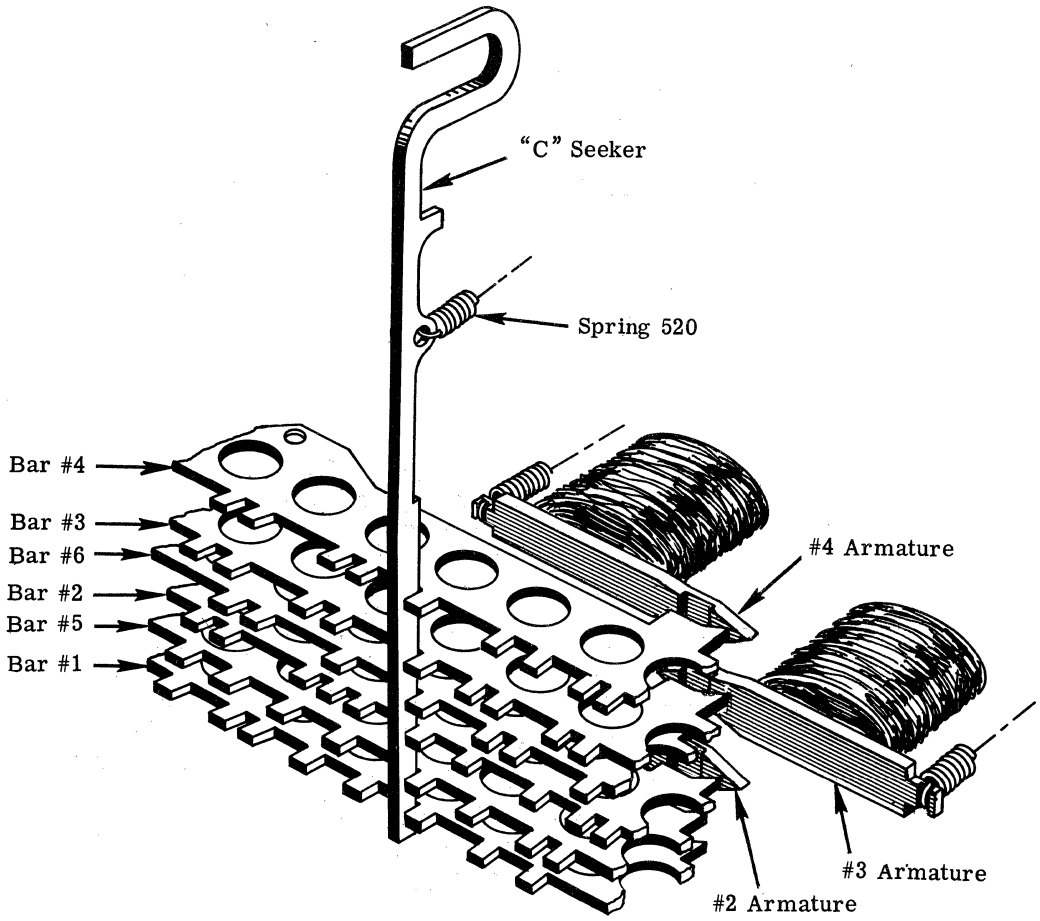


Figure 7-7 Bars - Operated

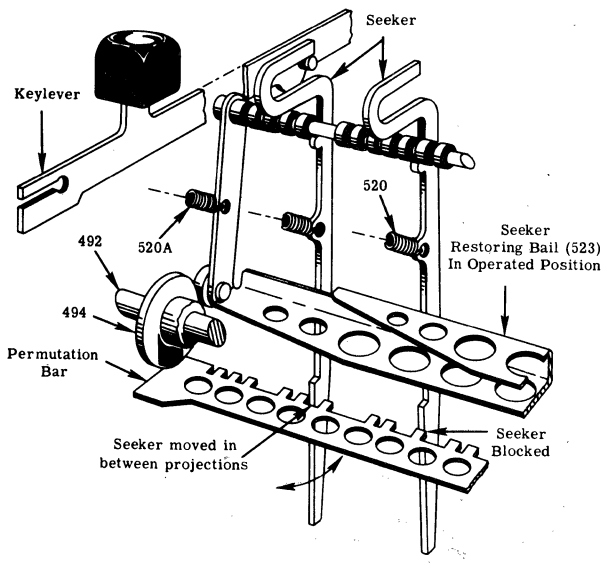


Figure 7-8 Seeker Restoring Bail

following:

1. Be sure all of the seekers are positioned properly with their respective keylevers. The seekers should clear the studs on the keylevers by .001 to .003 of an inch. If a new translator is installed, and the majority of seekers are not within the above clearance, washers may be placed between the base and the mounting screws. (See Figure 7-12.) If, on the other hand, only a few seekers are not within the above mentioned clearance, the individual seekers may be reformed with tool number 62406. (See Figure 7-13.)

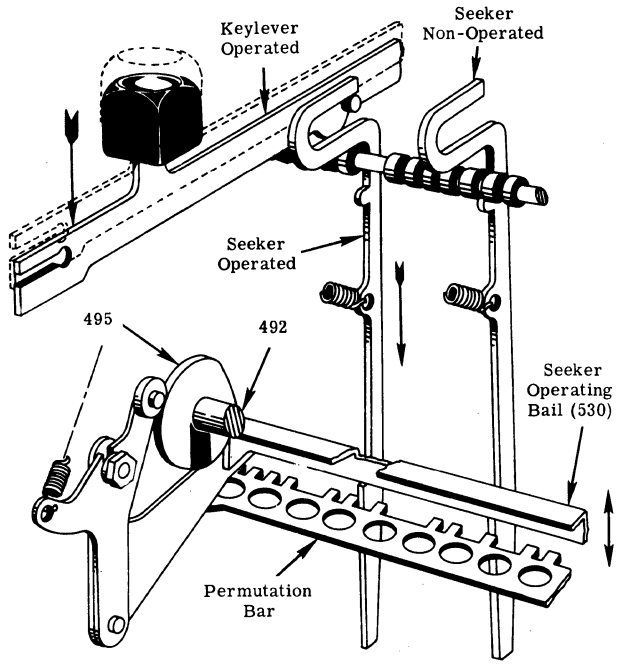


Figure 7-9 Seeker Operating Bail

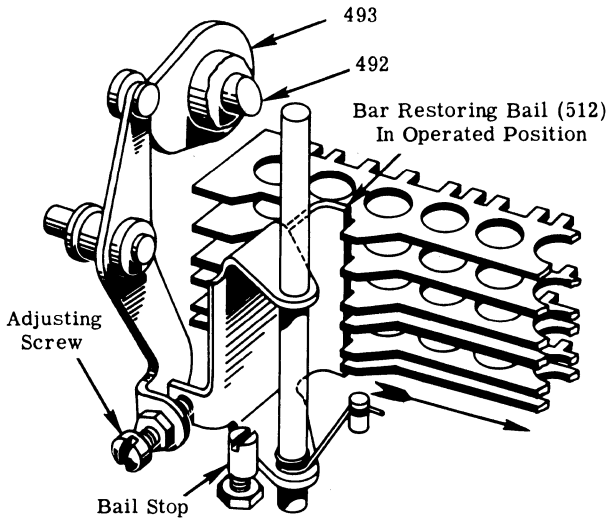


Figure 7-10 Bar Restoring Bail

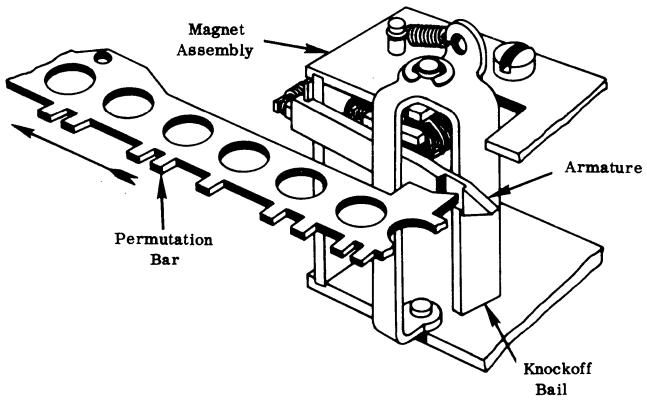


Figure 7-11 Armature Knockoff

2. Before tightening the mounting screws, be sure there is a slight amount of back lash between the two gears. If a new translator is installed, the two lower mounting positions have adjustable plates. These plates may be loosened and the translator aligned to the proper position with the keylevers. Once the translator has been aligned properly to a machine, the plates mentioned need not be disturbed if the translator needs to be removed and installed for some reason.
3. Check translator for proper operation.

The translator may be disassembled into two major assemblies by removing four screws. (See Figure 7-14.) These assemblies are Permutation Assembly and Frame Assembly.

Permutation Assembly - To adjust the component parts on the permutation assembly, proceed as follows:

1. The rear guide blocks (496) should be adjusted so that the permutation bars are free but do not have more than .003" sidewise clearance. (See Figure 7-15.)
2. Adjust the spring plunger brackets so the bars are forced to their extreme left hand position with .005" minimum clearance between the shoulders of the pins and the inner bracket. (See Figure 7-16.)

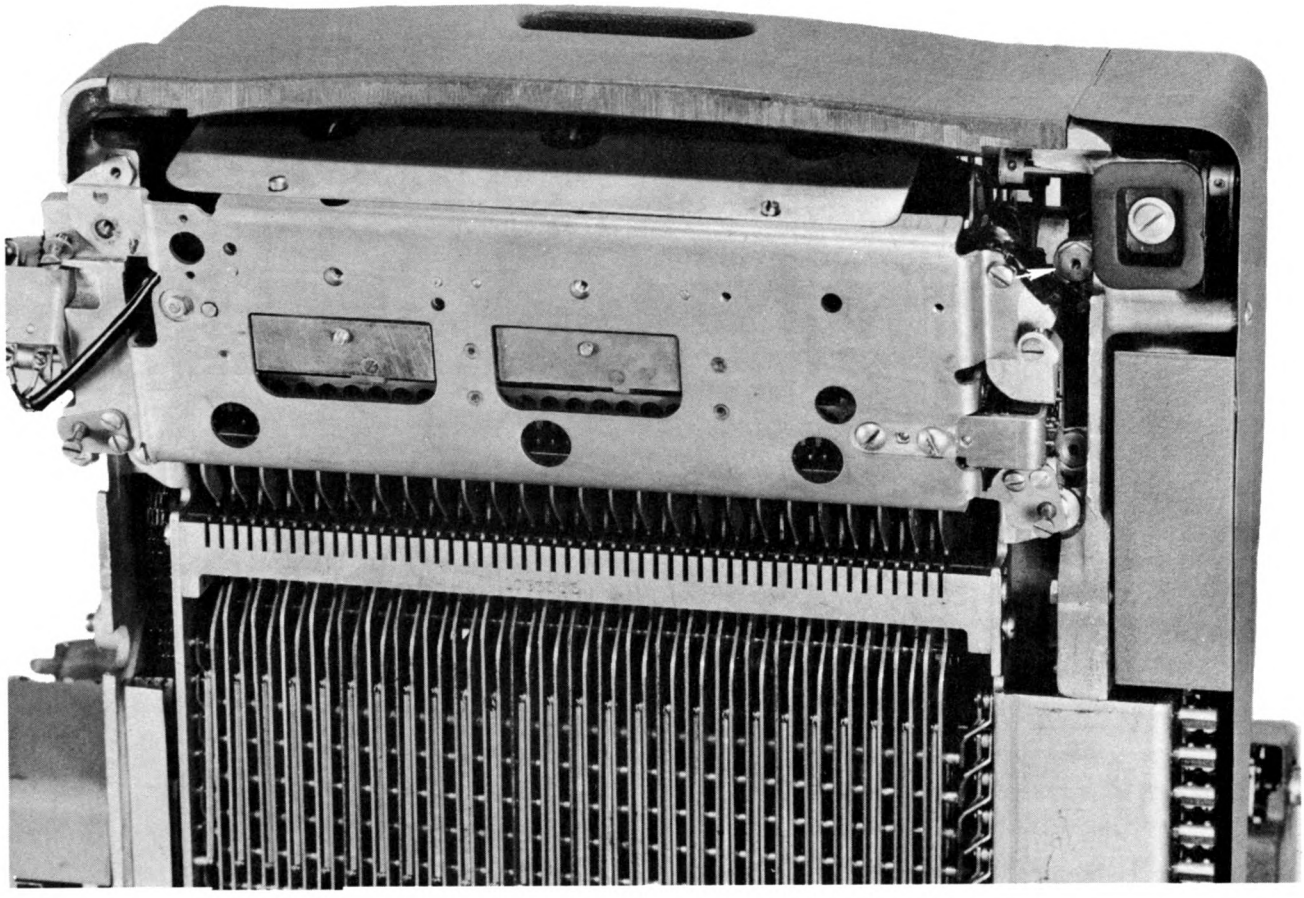


Figure 7-12 Translator Removal

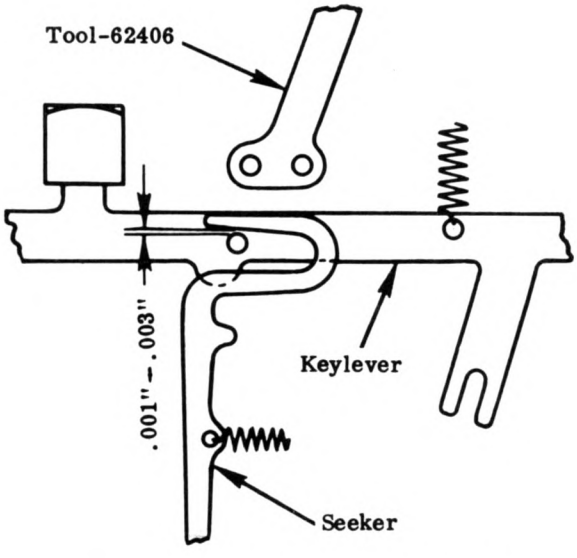


Figure 7-13 Seeker Adjustment

3. The top and bottom armatures in their attracted position must clear their respective bars by the same amount (within .001" of each other). This adjustment is obtained by loosening the four hex head screws holding the two brackets to each magnet yoke and pivoting the yoke about its dowel pin. (See Figure 7-17.)

Frame Assembly - To adjust the component parts on the frame assembly, proceed as follows:

1. Adjust the eccentric pivot studs (532) for the operating bail (530) so that with the seekers in their extreme position, the shoulder of all

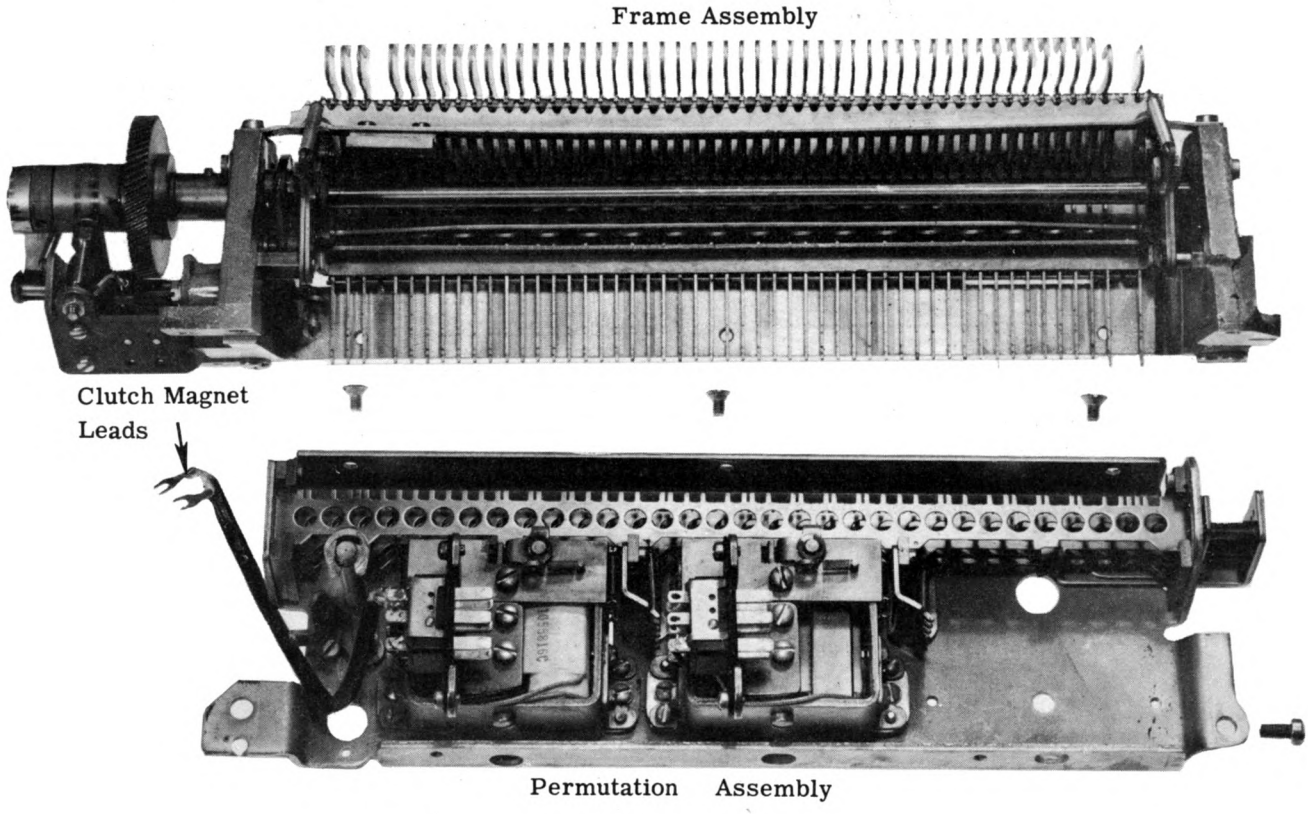


Figure 7-14 Translator Disassembly

seekers overlap at least two-thirds the thickness of the operating bail. This adjustment should be as nearly equal as possible across the machine. (See Figure 7-18.)

2. Adjust the eccentric studs (535) between the two cam follower arms and the operating bail arms so that the lower edge of the operating bail is .005"to .010" above the shoulder of all seekers just as the seekers reach their extreme forward position. The lower edge of the operating bail should engage the shoulder of all seekers as nearly simultaneously as possible. (See Figure 7-19.)

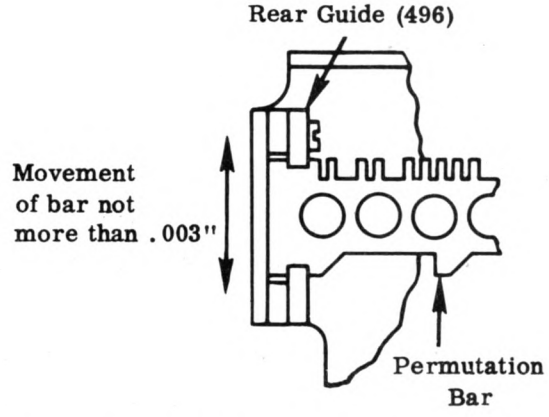


Figure 7-15 Rear Guide Block Adjustment

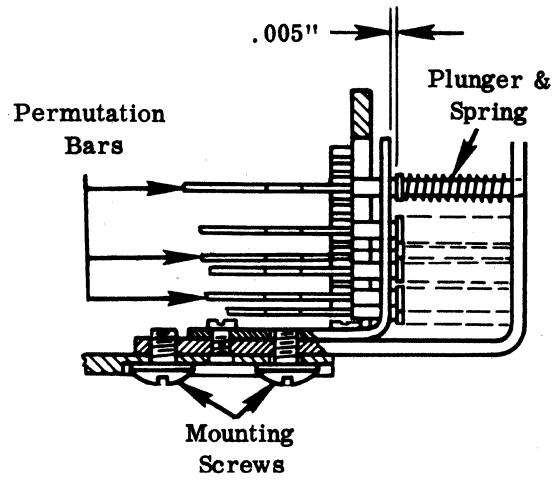


Figure 7-16 Plunger Bracket Adjustment

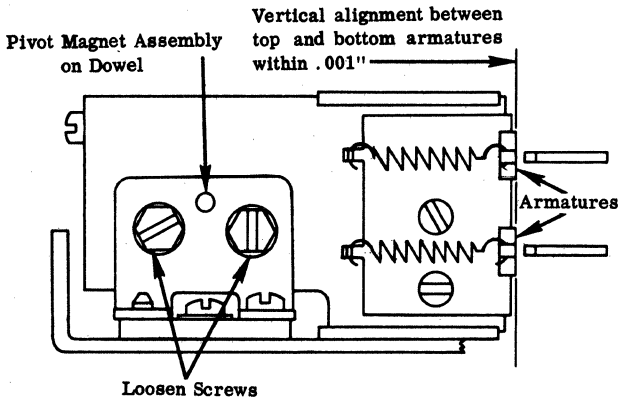


Figure 7-17
Top and Bottom Armature Adjustment

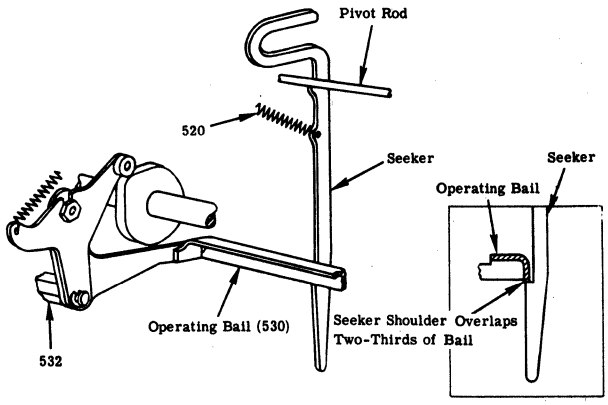


Figure 7-18 Operating Bail Adjustment

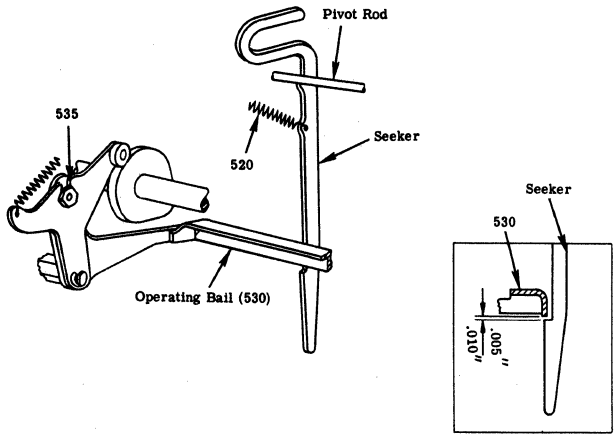


Figure 7-19 Operating Bail Adjustment

Translator Assembly Complete - When the permutation assembly and frame assembly are reassembled, the following adjustments should be made:

1. Release the permutation bars by attracting the armatures. Place the restoring arm follower roller on the low dwell of its cam. Check to see that the bars are stopped in their spring operated position where the projections on the bars align with the seekers. This adjustment may be obtained by moving the bar restoring bail eccentric stop. A slight adjustment of the upper pivot bearing block is possible in order to have the restoring bail engage all the bars simultaneously. (See Figure 7-20.)
2. Check to see that there is .005" to .010" clearance between the armature and the permutation bars (with the armatures attracted). The magnet assemblies may be moved to obtain this adjustment. Also, with armatures in their latched position, check

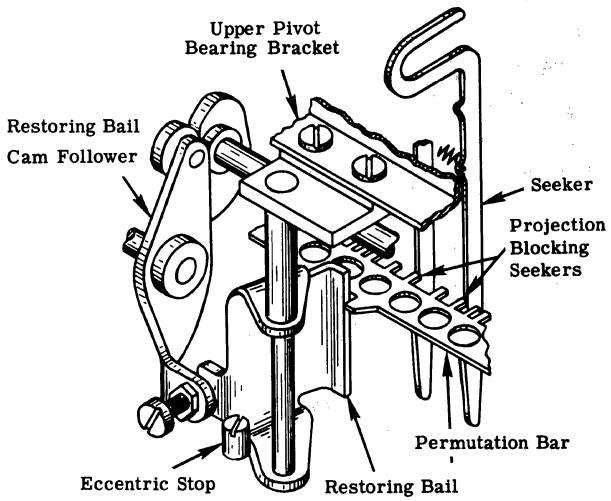


Figure 7-20 Restoring Bail Eccentric

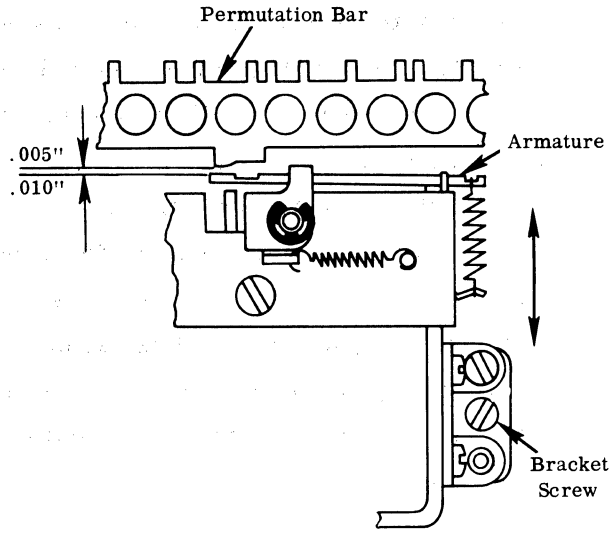


Figure 7-21 Magnet Assembly Adjustment

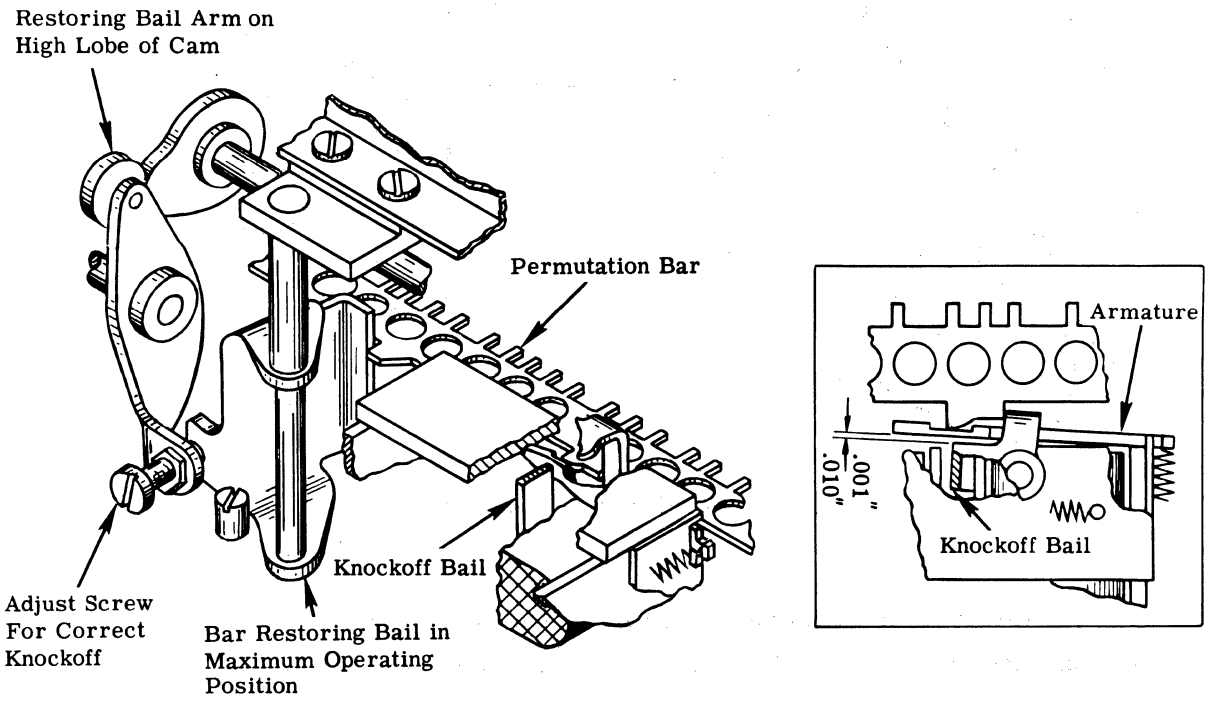


Figure 7-22 Restoring Bail Adjusting Screw

to see that the projections on the bars align with the seekers. The magnet assemblies may be moved horizontally to obtain this adjustment. (See Figure 7-21.)

Note: If the above adjustments are all right, but for some reason the removal of a magnet assembly is necessary, remove the assembly from the spacer plates. When reassembling, no adjustment will be necessary because the assembly is dowel connected to the spacer plates.

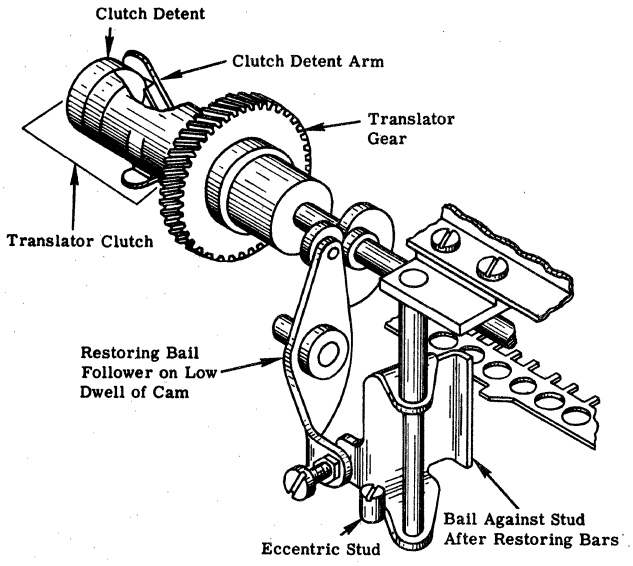


Figure 7-23 Clutch Adjustment

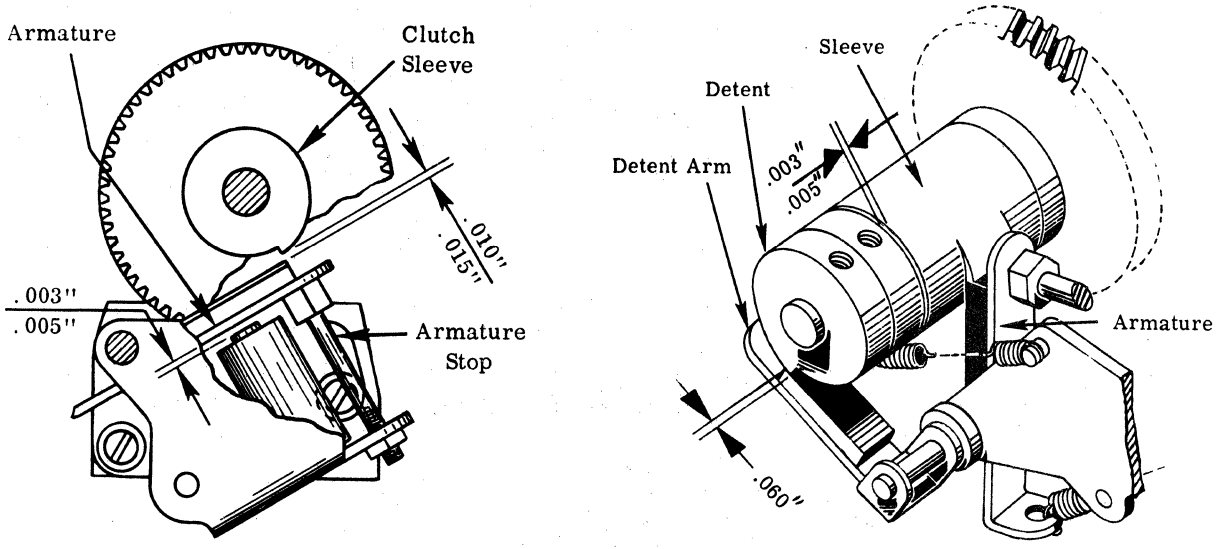


Figure 7-24 Clutch Magnet Adjustment

3. Adjust the restoring bail operating screw to obtain sufficient movement of the knock off bail during the restoring movement of the bars. The maximum movement of the knock off bail should allow .001" to .010" movement of the armatures away from the bars. (See Figure 7-22.)

Clutch Adjustments -

1. Rotate the shaft until the bar restoring bail reaches its eccentric stop (after restoring the bars and leaving them in their latched position). At this position, move the detent until the notch engages the detent arm. (See Figure 7-23.)

2. Adjust the armature stop so that the armature just engages the brass stop with .003″ to .005″ clearance between the armature and core. Loosen the mounting screws and position the clutch magnet yoke on the frame so the tip of the armature, when attracted, clears the high point of the clutch sleeve by .010″ to .015″. (See Figure 7-24.)

3. Position the clutch sleeve so that when the latch point of the sleeve just engages the armature tip, the latch point of the detent is 1/32″ to 1/16″ short of latching on the tip of the detent arm. When making this adjustment, be sure there is .003″ to .005″ endwise movement of the sleeve before tightening the set screws.

Friden — Customer Service Engineering

#15

MANUAL ADDENDUM

Date: August 15, 1958

Reference: To be inserted in Part II, Section 7, after Page 7-13.

Subject: Code Translator - Switch Delay Control

Purpose: Adjustment Procedure

Information: On all Code Translators that have the SDC, should be adjusted to break before make. With the contacts in normal position the break contacts should have .005 to .010 follow, and the make contacts should have .025 to .030 air gap.

CIRCUIT DESCRIPTION

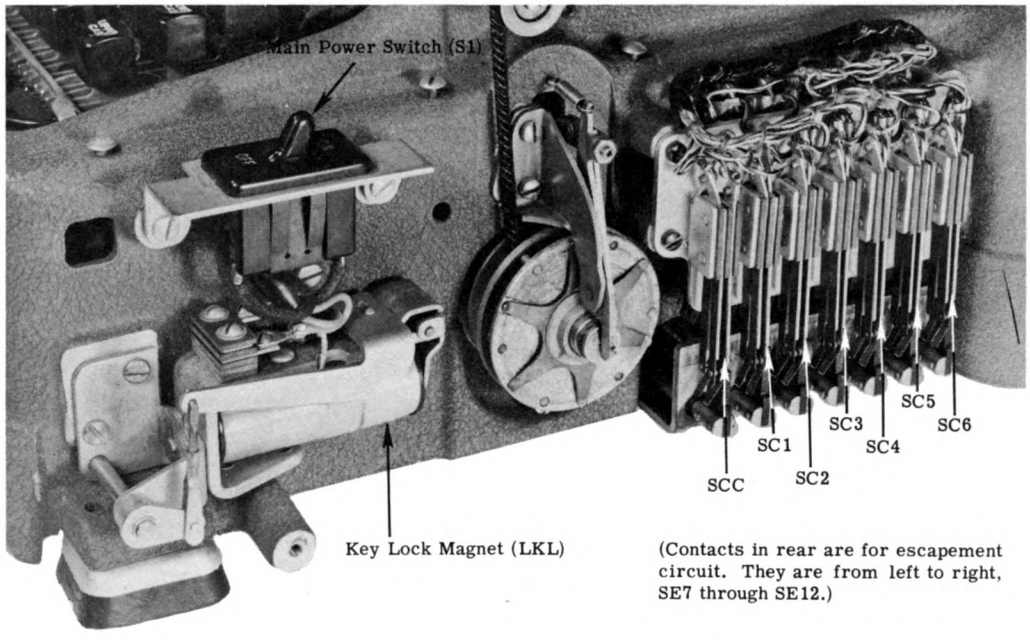


Figure 8-1 S1, LKL and Selector Contacts

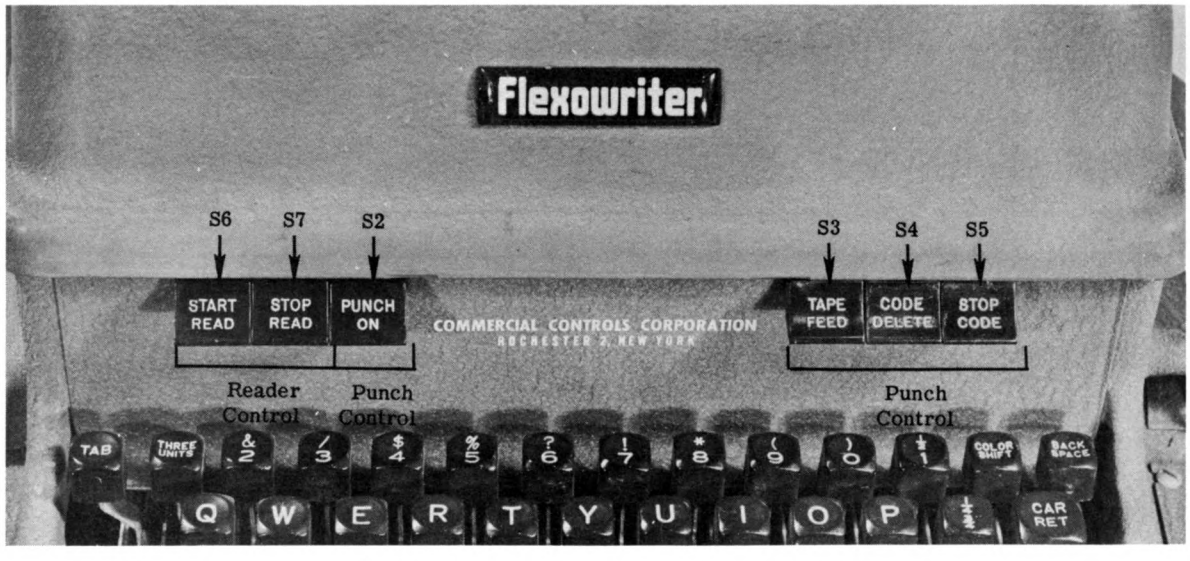


Figure 8-2 Control Panel

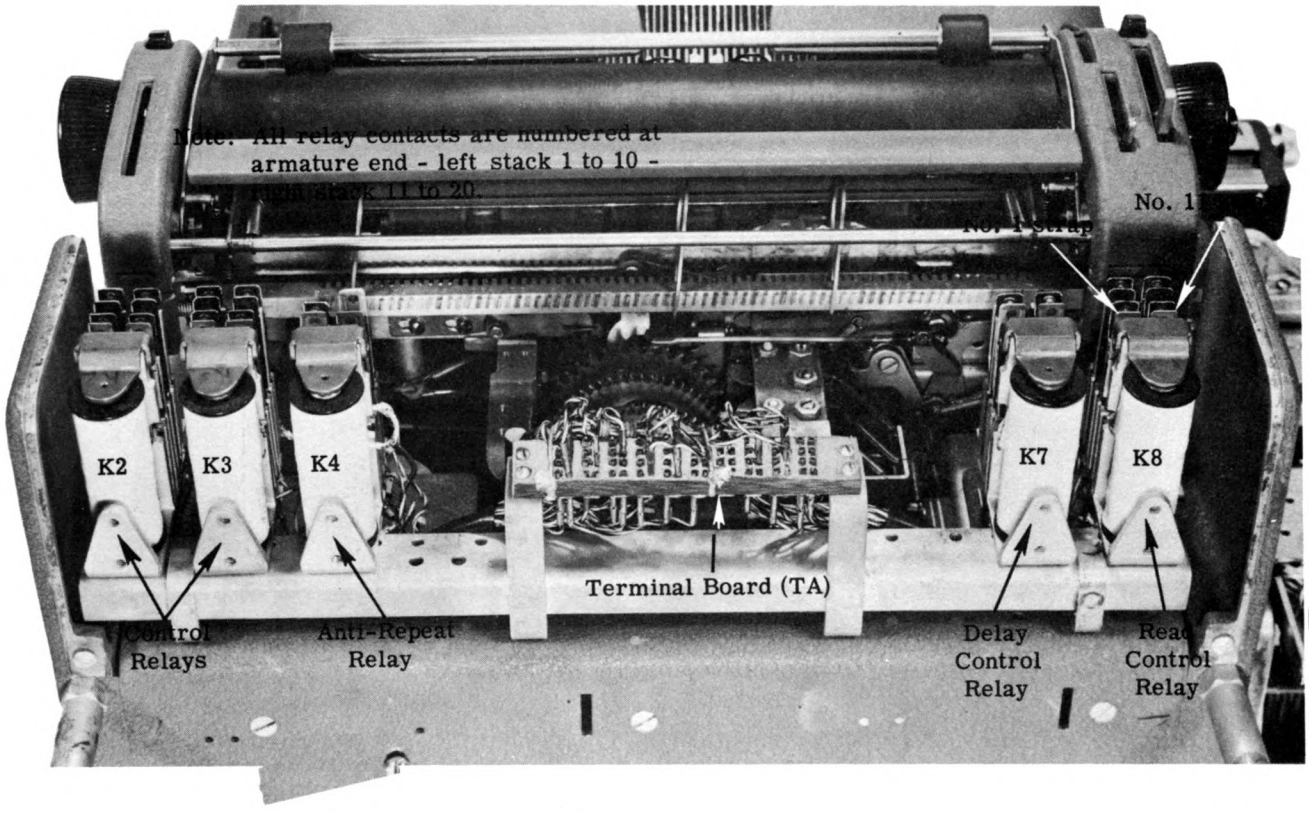


Figure 8-3 Relay and Plugboard

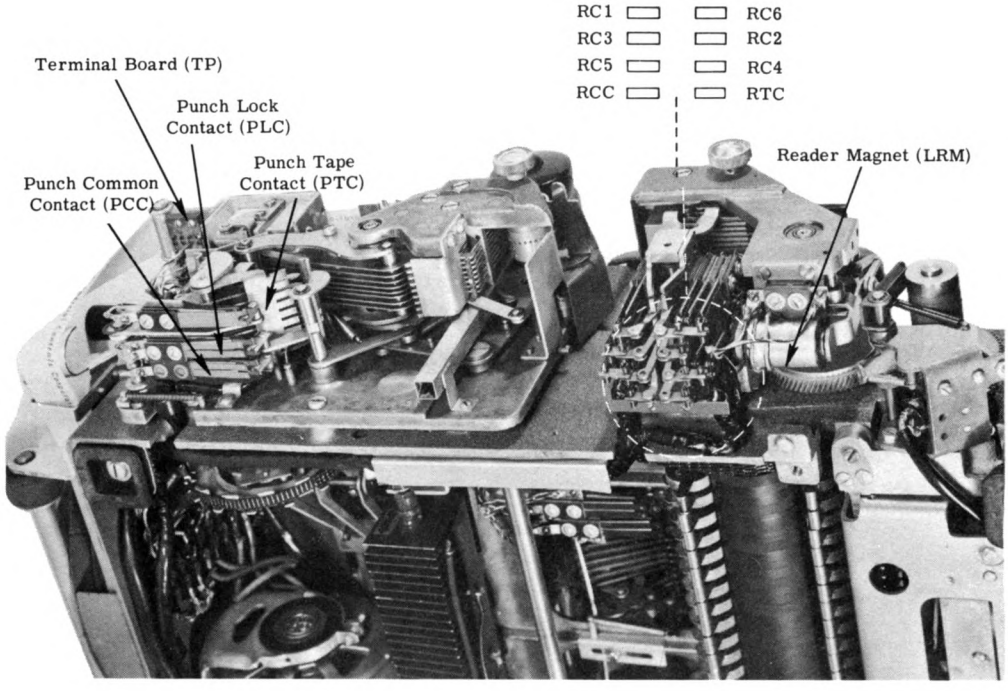


Figure 8-4 Reader and Punch Contacts

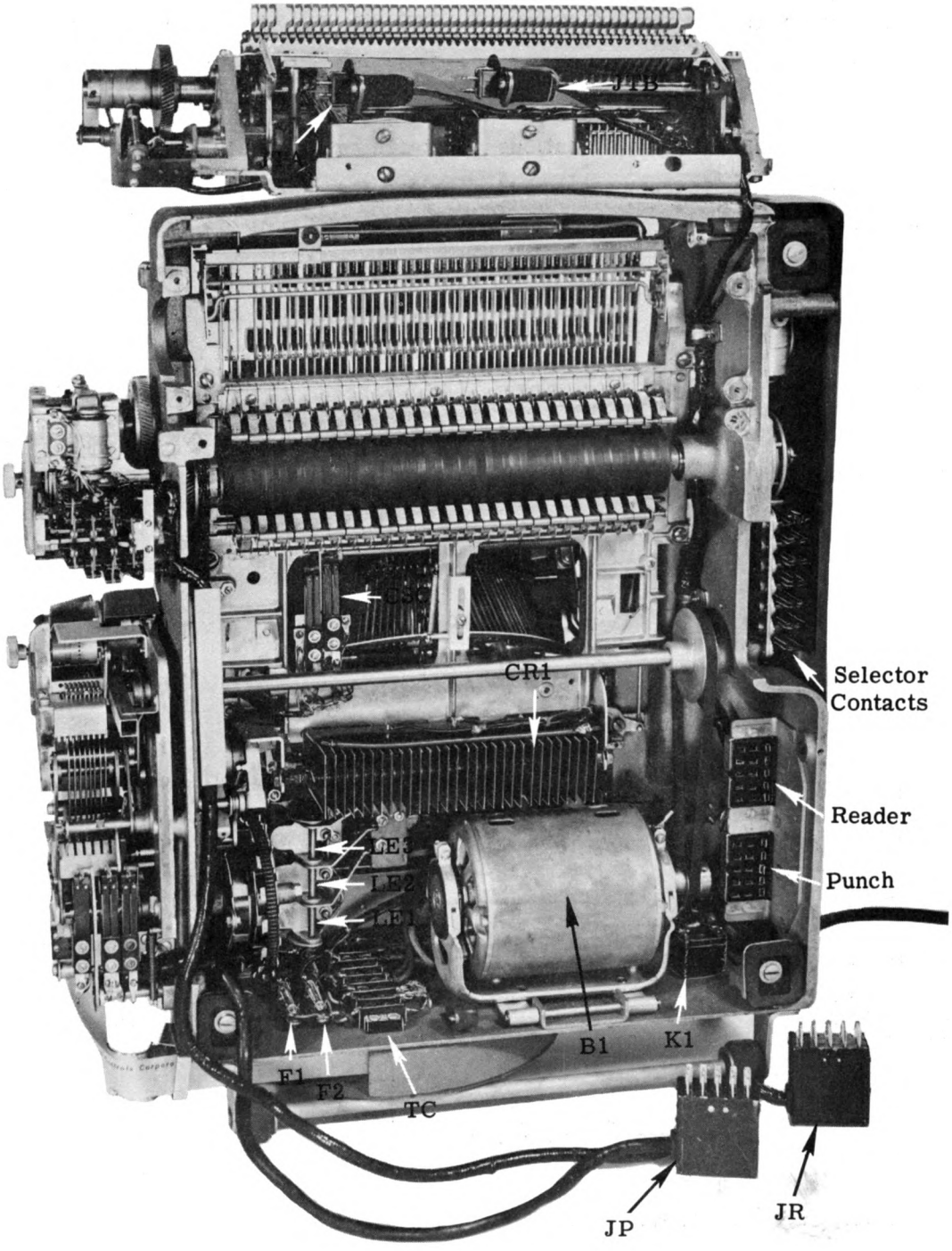


Figure 8-5 Electrical Component Locations

This section contains the breakdown of wiring diagram 1053751 (Figure 8-19) into individual circuits and their explanations. (The D C Power Circuit is extracted from wiring diagram 1055761.)

Figure 8-1 through 8-5 illustrates the locations of the various electrical components mentioned throughout this section.

POWER CIRCUIT - A C Machine (Figure 8-6)

The power circuit is controlled by a SPST switch located on the right hand front portion of the base. When the power switch (S1) is turned on, a 110 V AC circuit is completed to the 35 mili-horse power motor (B) as follows: from JACP, TC2, S1, F1, K1 Coil, TC3, main motor winding, TC1, to JACP. The initial surge of current through the circuit just described builds up a flux in the starting relay (K1) coil which is strong enough to close the starting relay contacts. The closing of K1 contacts will complete a circuit through the starting winding of the motor. Due to the characteristics of the motor and starting relay (K1), the K1 contacts will remain closed until the motor has reached its running speed of 1725 RPM. At this speed, the current flow through the K1 coil will have reduced to a point, whereat the coil will no

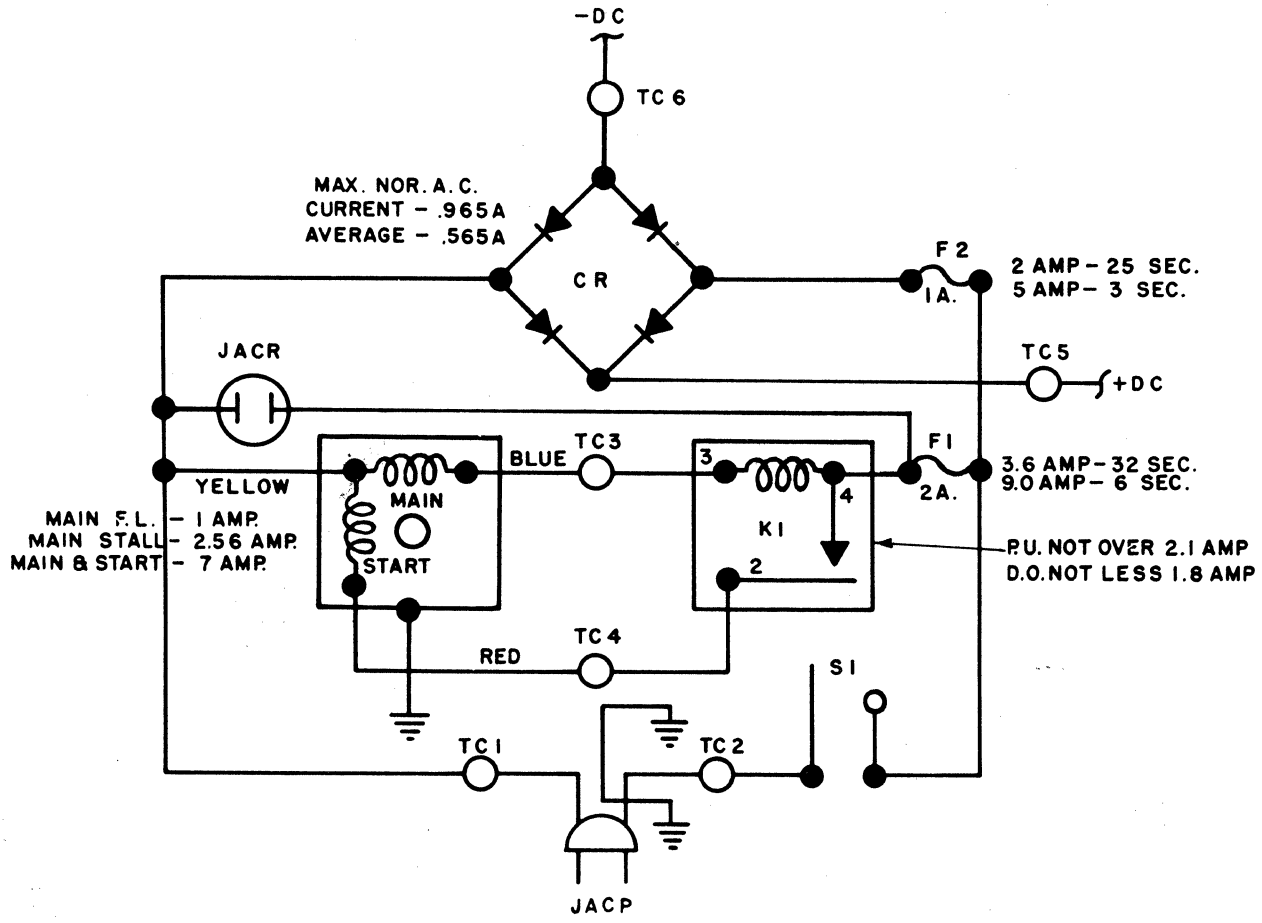


Figure 8-6 Power Circuit - AC Machine

longer hold the K1 contacts closed. Thus, the motor, once it reaches its running speed, will operate by a circuit through its main winding.

The A C supply is protected by a 2.0 amp Slo-Blo fuse (F1). There is a 110 V AC potential across the input terminals of the rectifier (CR) when the power switch (S1) is on. This is a full wave selenium rectifier with a D C output of approximately 90 volts. It is the D C power supply to all the relay and magnet coils within the Flexowriter.

The D C supply circuit is protected by a 1.0 amp Slo-Blo fuse (F2).

There is a 110 volt A C outlet (JACR) located on the left rear side frame of the Flexowriter. This plug may be used to connect a 10 watt tape rewind motor for the purpose of rewinding tape.

POWER CIRCUIT - D C Machine (Figure 8-7)

The D C Flexowriter uses a 1/30 H.P. field control, shunt wound motor. This motor operates at the same speed (1725 RPM) and uses the same mounting as the A C motor.

When the main power switch (S1) is on, a 115 V D C circuit is completed to the motor as follows: from JACP, TC2, S1, F1, TC3, armature and field of motor (B), TC1, to JACP. The shunt field circuit from the motor is through a 350 ohm, 25 watt, impression control rheostat. The impression control rheostat controls the field current and may be used to adjust the speed of the motor when necessary to obtain proper typing impression.

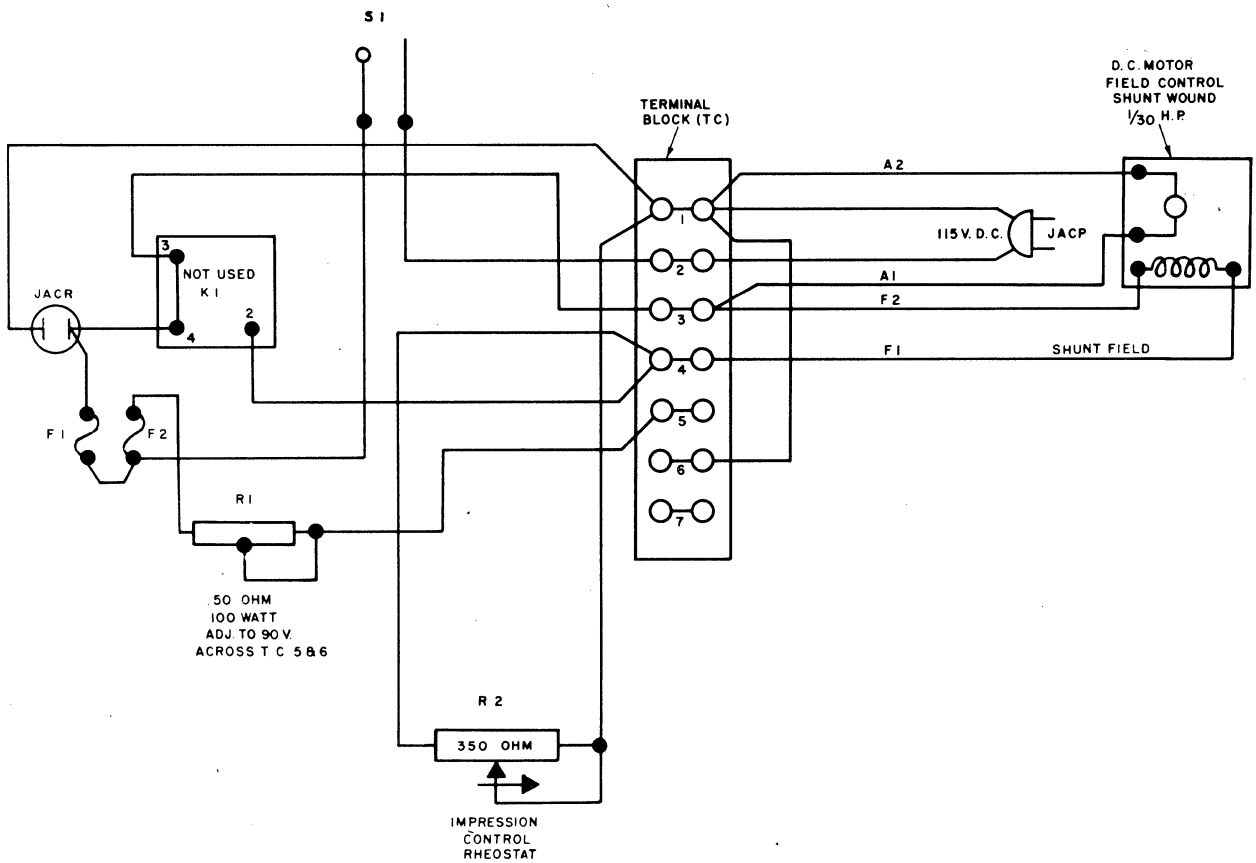


Figure 8-7 Power Circuit - DC Machine

A 50 ohm adjustable resistor is used to reduce the line voltage to the required 90 volts D.C. An adjustment of approximately 43 ohms on this resistor should give a reading across TC5 and TC6 of 75 V D.C. to 90 V D.C. when the line voltage varies between 100 V D.C. and 120 V D.C. This must be measured with the tape punch and tape reader in operation.

PUNCH CIRCUITS

Key Lock Magnet - (Figure 8-8 and 8-9) - When the punch on switch (S2) is in the Off position, the key lock magnet (LKL) is energized as follows: from -DC, TC6, N/C S2, TC7, key lock magnet (LKL), TC5, to +DC.

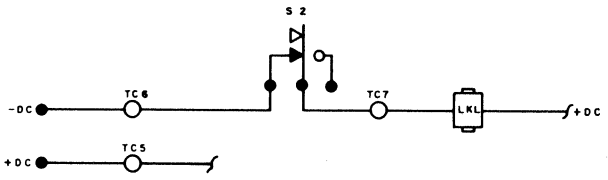


Figure 8-8 Key Lock Magnet - S2 Off

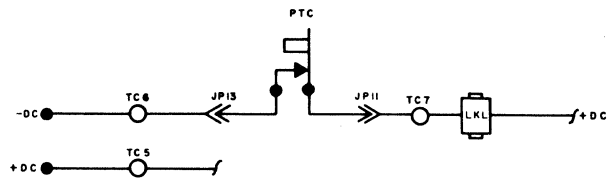


Figure 8-9 Key Lock Magnet - S2 On

When the S2 switch is in the On position, the key lock magnet (LKL) is energized as follows: from -DC, TC6, JP13, punch tape contact (PTC), JP11, TC7, LKL, TC5, to +DC. In this circuit, the PTC contact controls the LKL, therefore, if the PTC contact should open, due to an unnatural condition of the tape in the punch, the key lock magnet will de-energize, locking the key board.

Punch Magnet Circuit - (Figure 8-10) When a keylever is depressed, one or more selector contacts will close, depending upon the binary code given that particular keylever position. There are six selector code contacts (one for each unit of code), plus one selector common contact (SCC). The common contact (SCC) will close after the code contacts to insure all circuits to the punch magnets will be completed simultaneously.

For an example circuit, assume that the "A" character keylever was depressed. A D. C. circuit will be completed to the LP1 and LP2 (No. 1 and No.2 punch magnets) as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, N/C PLC, JP14, SCC, TA 3 and 4, K4-2 and 1, TA 31 and 32, SC 1 and SC 2, JP1 and JP2, TP1 and TP2, LP1 and LP2, TPCOM, JP15, TC5, to +DC. Therefore, the 1-2 code will be perforated in the tape during the punch cycle of operation.

Clutch Magnet Circuit - (Figure 8-11) The clutch magnet (LPC) is energized after each initial operation of a keylever through the following circuit: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, N/C PLC, JP14, SCC, TA 3 and 4, K4-12 and 11, TA5, JP8, LPC, TPCOM, JP15, TC5, to +DC. When the clutch magnet is energized, the punch starts a cycle of operation. Note that the same circuit applies for both the punch magnets and the clutch magnet. Thus, they are energized at the same time, but due to the slow operating characteristics of the clutch magnet, the punch magnets will perform their function before the punch shaft starts to rotate.

A punch common contact (PCC) is connected in parallel with the selector common contact (SCC)

in the clutch magnet circuit. This contact (PCC) is closed when any one or more of the latch levers is tripped due to its associated punch magnet being energized. The closing of contact PCC will cause a punch cycle to occur by completing a circuit to the clutch magnet (LPC) regardless of whether or not the selector common contact (SCC) is closed. Thus, contact (PCC) acts to insure an operation of the punch in the event the SCC is closed for a short time which is sufficient to trip the punch latch levers, but insufficient to energize and engage the clutch.

Anti-Repeat Circuit - (Figure 8-12) It is possible during operation of a Flexowriter that the punch will finish a cycle of operation before the selector common contact (SCC) opens. This would cause a repeat operation of the punch. To prevent this, an anti-repeat circuit is used in the following manner: At the start of the punch cycle, the punch lock contacts (PLC) transfer completing a circuit to the anti-repeat relay (K4), also, the circuit to the clutch magnet (LPC) and the punch magnets is broken due to the operation of the PLC contacts. When the PLC contact returns to its normal position, if the selector common contact is still closed, the anti-repeat relay (K4) is held energized by its own transfer contacts 2 and 3 (this is due to the PLC being a Make Before Break contact). Therefore, the K4 will remain energized as long as contact SCC remains closed, thus preventing energization of the punch magnets even though the PLC contact has returned to the normal position. This prevents a repeat operation of the punch regardless of how long the selector contacts are held closed.

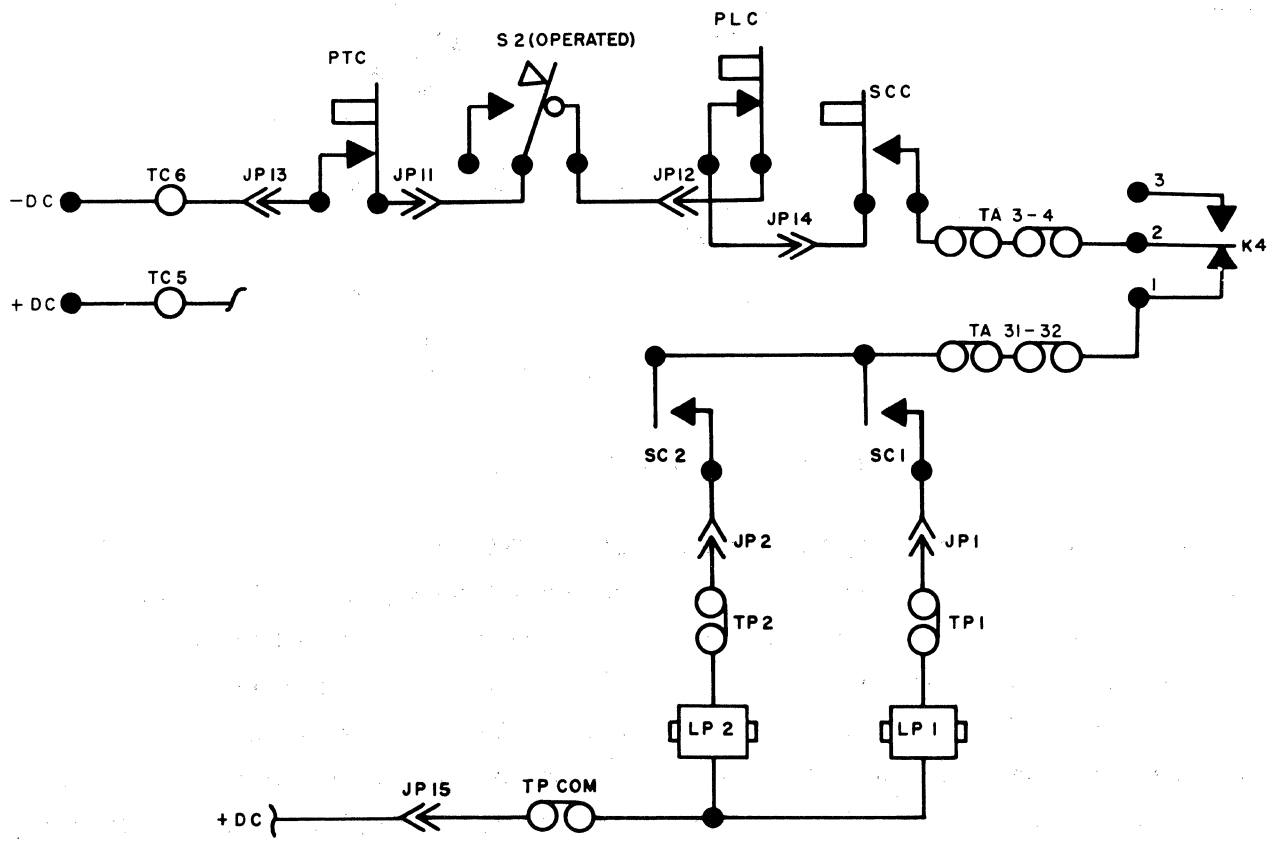


Figure 8-10 Punch Magnet Circuit

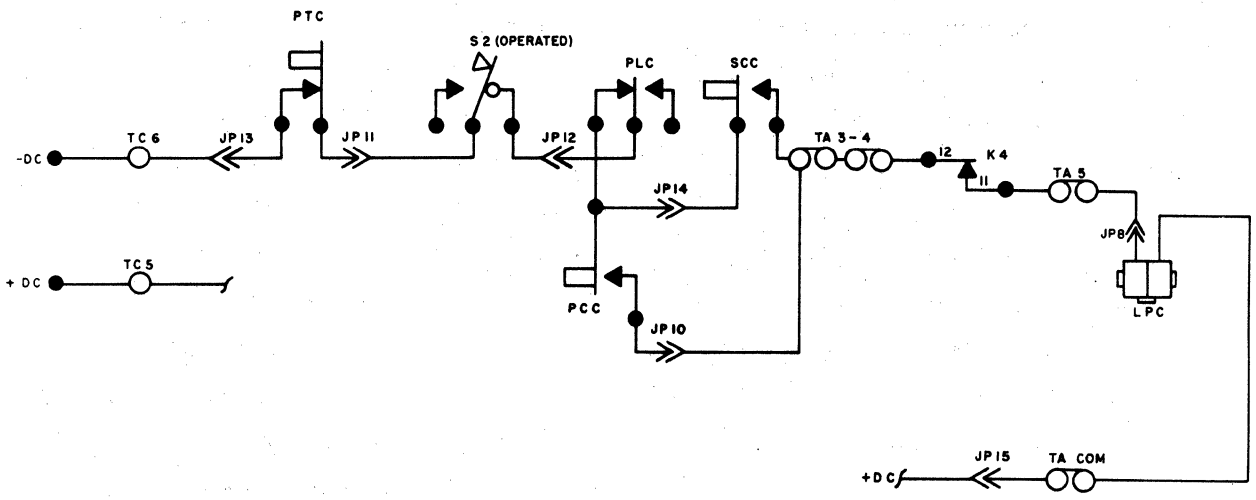


Figure 8-11 Punch Clutch Magnet Circuit

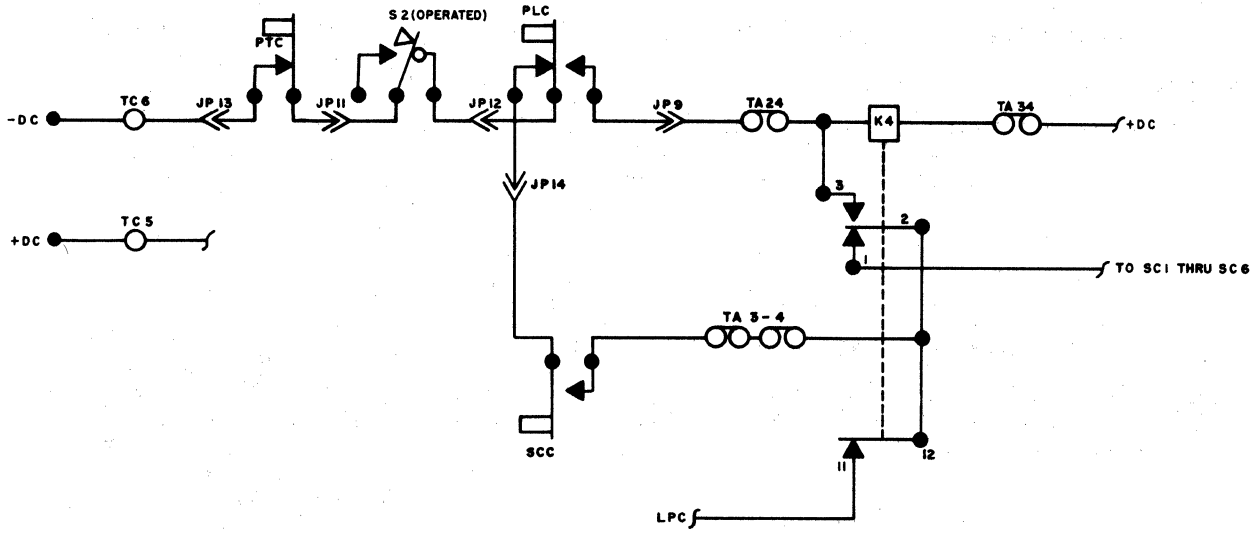


Figure 8-12 Anti-Repeat Circuit

Stop Code Circuit - (Figure 8-13) This circuit is used to perforate a 4-5-6 code in the tape, which, when read by the tape reader, will automatically stop the reader operation.

When it is desired to perforate a stop code in the tape, the stop code switch (S5) is depressed. This will energize the code relay (K2 and K3)- two relays in parallel as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S5, TA35-36, coils of K2 and K3, TA33, TC5, to +DC. When the code relay is energized, all seven of its normally open contacts close, completing a circuit to punch magnets LP4, LP5 and LP6, also to the clutch magnet LPC as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, N/C PLC, JP14, N/C S3, TA2, K3-11 and 12, K4 2 and 1, K3 2 and 1,

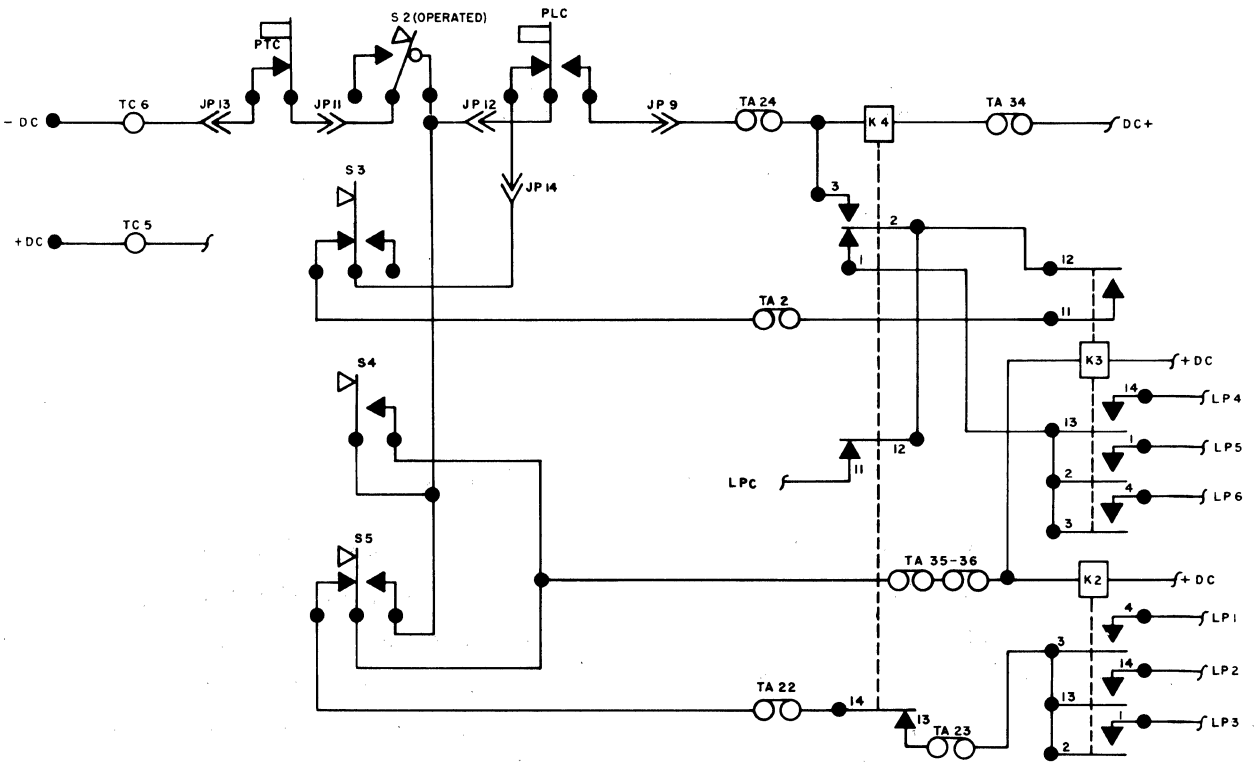


Figure 8-13 Stop Code and Code Delete

3 and 4, 13 and 14, TA12-TA13 and TA14, JP 6 - JP5 and JP4, TP6 - TP5 and TP4, LP6 - LP5 and LP4, TPCOM, JP15, TC5, to +DC. The circuit to the clutch magnet (LPC) is through K4 - 11 and 12, TA5, JP8, LPC, TPCOM, JP15, TC5, to +DC.

Note that even though all seven of the code relay contacts are closed when the stop code switch is depressed, only the LP4, LP5 and LP6 punch magnets are energized.

Punch magnets LP1, LP2 and LP3 are not energized because the circuit is broken to these magnets due to the opening of N/C S5 contacts.

As long as the stop code switch S5 is held depressed, only one cycle of the punch is allowed due to the anti-repeat relay (K4) being energized. The K4 will remain energized through contacts 11 and 12 of the code relay (K3). This anti-repeat operation functions in the same manner as the anti-repeat circuit explained previously, but in this circuit the stop code switch replaces the selector common contact.

Code Delete - (Figure 8-13) This circuit is used to perforate a 1-2-3-4-5-6 code in the tape, which when read by the tape reader, will not cause any operation of the writing machine. Therefore, this code is used for deleting a code in the tape which was an error by the operator.

When the code delete switch (S4) is depressed, the code relay is energized as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, S4, TA 35 and 36, coils of K2 and K3 , TA33, TC5, to +DC.

When the code relay is energized, the LP4, LP5 and LP6 punch magnets and clutch magnet are energized in the same manner as explained in the Stop Code Circuit. Also, the LP1, LP2, and

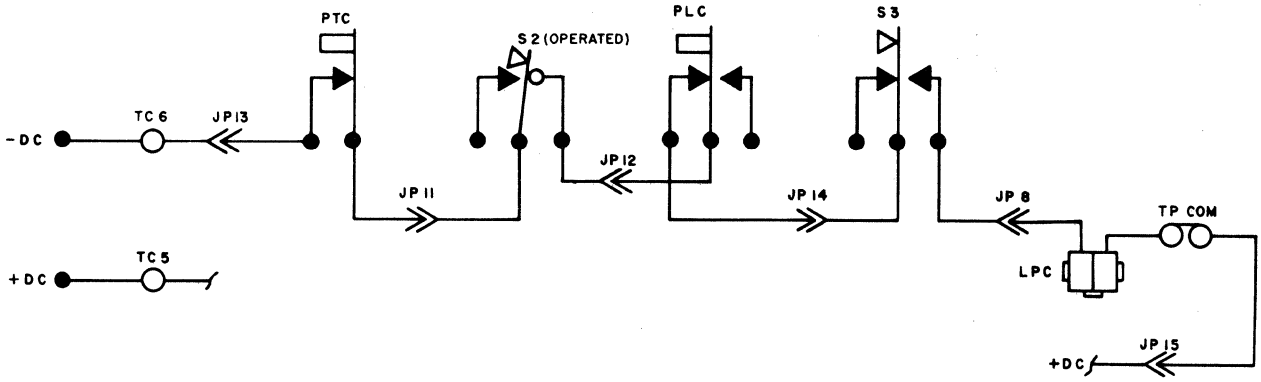


Figure 8-14 Tape Feed Circuit

LP3 punch magnets are energized as follows: from -DC, TC6, JP13, PTC, PJ11, N/O S2, S4, N/C S5, TA22, K4-14 and 13, TA23, K2-3 and 4 - 13 and 14 - 2 and 1, TA1-TA2 and TA3, JP1-JP2-JP3, TP1 - TP2 - TP3, LP1 - LP2 - LP3, TPCOM, JP15, TC5, to +DC.

The code delete circuit operates in the same manner as the stop code circuit, whereby, as long as the code delete switch (S4) is held depressed only one punch cycle is allowed. This is also due to the anti-repeat relay being held energized.

Tape Feed Circuit - (Figure 8-14) The tape feed switch (S3) may be used to feed out the tape with feed holes only. When the S3 switch is depressed, the punch clutch magnet LPC is energized as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, N/O S3, JP8, LPC, TPCOM, JP15, TC5, to +DC. As long as the S3 switch is held depressed, the clutch magnet will remain energized, allowing continuous operation of the punch, perforating feed holes only.

Escapement Magnet Circuit - (Figure 8-15) This circuit is used on proportional spacing machines. It is not used on Monospacing machines.

The contacts SE7 through SE 12 are operated by the upper row of selector bails on the selector unit. The CSC (case shift contacts) are operated by a cam mounted on the shift equalizing shaft. When the shift basket is in the lower case position (basket up), the operate straps of SE7, SE8 and SE9 have a Neg. DC potential. When the shift basket is in the upper case position (basket down), the operate straps of SE10, SE11 and SE12 have a Neg. DC potential. Therefore, when the basket is in the lower case position, contact SE7, SE8, and SE9 control the escapement magnets LE1, LE2 and LE3, and in the upper case position, contacts SE10, SE11 and SE12 control the escapement magnets LE1, LE2 and LE3.

For an example operation of the escapement magnet circuit, assume that the basket is in lower case position and the "A" keylever is depressed. The case shift contacts A and B will be in the normal position and a circuit will be complete to the LE 3 escapement magnet as follows: from -DC, TC 6, CSC -N/C A, SE9, LE3, TC5, to +DC. Contacts SE 10 and SE 12 also close during the selector slide operation, but due to the position of the case shift contacts (CSC), only a circuit through SE 9 is allowed.

If the basket were moved to the upper case

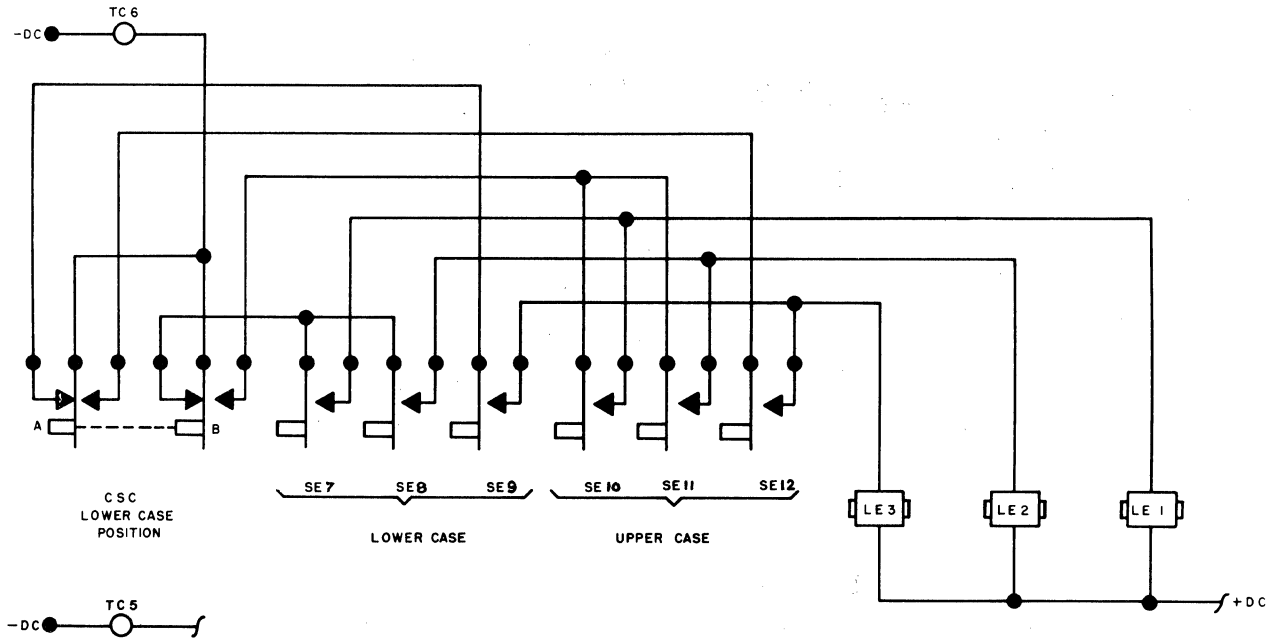


Figure 8-15 Escapement Magnet Circuit

position, the CSC A and B contacts would transfer and if the "A" keylever was again depressed, a circuit would be complete to the LE 1 and LE 3 escapement magnets. The three contacts SE 9, SE10 and SE12 would close but due to the position of the CSC contacts only a circuit through contacts SE 10 and SE 12 is allowed.

The character A, therefore, would have three units of escapement in lower case position and four units of escapement in the upper case position.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits - (Figure 8-16) The start read switch (S6), when depressed and released will energize the tape reader magnet (LRM) and start a reader cycle of operation. In order to energize the reader magnet when the S6 switch is depressed, a circuit is first completed to the reader control relay (K8) as follows: from -DC, TC6, JR10, RTC, JR13, N/O S6, N/C S7, TA29, K8 coil, TA40, TC5, to +DC. The K8 relay is energized, closing all three of its normally open contacts. When K8 contacts 3 and 4 close, a holding circuit to K8 is completed as follows: from -DC, TC6, JR10, RTC, RC4 N/C - RC5 N/C - RC6 N/C, JR8, TA18, K8-3 and 4, TA 8, S7 N/C, TA29, K8 coil, TA40, TC5, to +DC. When the S6 switch is allowed to return to its normal position, the reader magnet is energized as follows: from -DC, TC6, JR10, RTC, JR13, N/C S6, CRTC, BSC, TA19, K7-2 and 1, TA20, K8-12 and 11, TA28, JR11, LRM, JR12, TC5 to +DC,

Once the circuit to the reader magnet (LRM) is established, the magnet will remain energized and the reader will operate continuously until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or by

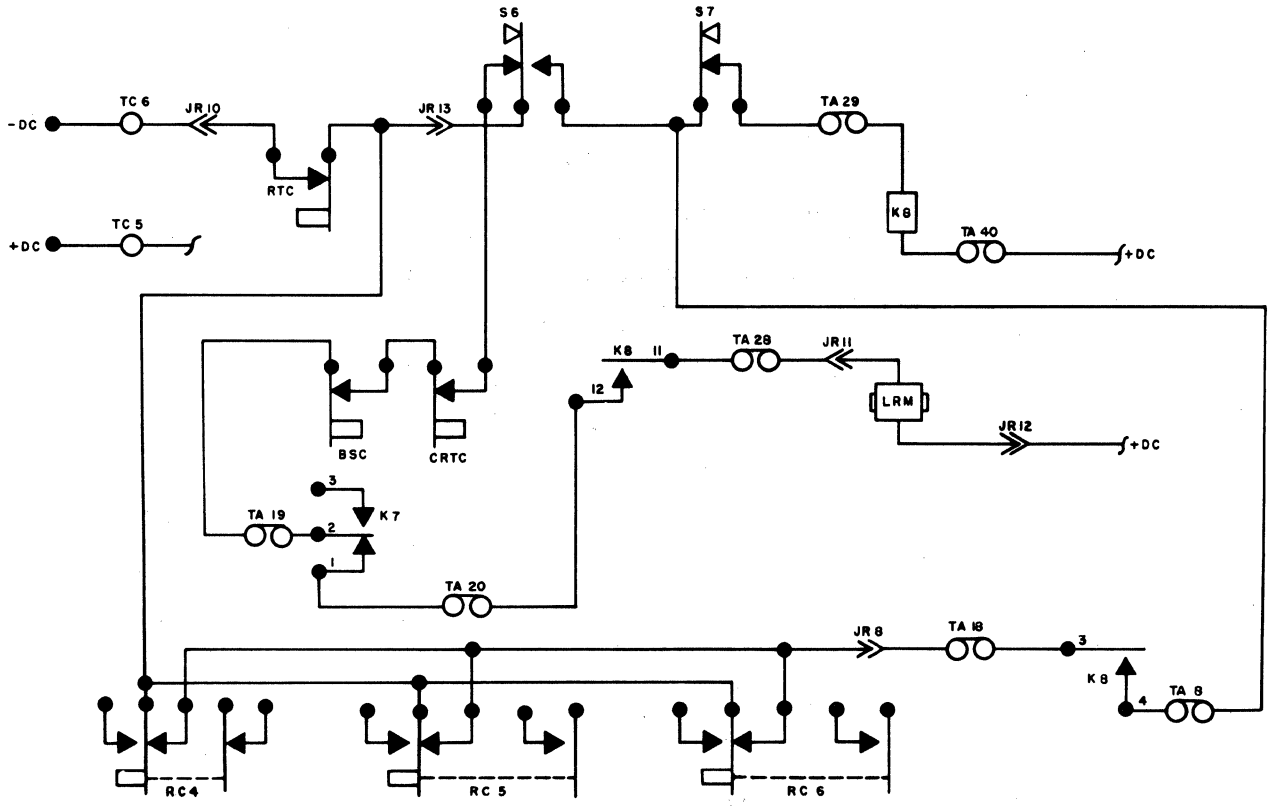


Figure 8-16 Start and Stop Circuits

manually depressing the stop read switch (S7).

When the stop read switch (S7) is depressed, the holding circuit to the reader control relay (K8) is broken. Thus, when K8 contacts 11 and 12 open, the reader magnet is de-energized, stopping the reader operation.

Translator Magnet Circuits - (Figure 8-17) When a reader pin senses a code in the tape, a corresponding reader contact closes completing a circuit to the translator magnet related to the reader contact.

For an example circuit, assume that a 1-2 code is read in the reader tape. The translator magnets LT1 and LT2 will be energized as follows: from -DC, TC6, JR10, RTC, RC1 and RC2, JR1 and JR2, JTA1 and JTA2, LT1 and LT2, JTA5, to +DC. The reader common contact (RCC) closes during each reader cycle of operation, completing a circuit to the translator clutch magnet as follows: from -DC, TC6, JR10, RTC, RCC, JR7, JTA6, LTC, JTA5, TC5, to +DC.

Delay Control Circuit - (Figure 8-18) It is essential to have an automatic delay control circuit incorporated in the Flexowriter in order to delay the operation of the tape reader until a function in the Writing Machine has been completed. There are three functions which require more operating time than the regular characters. These functions are: back space (1-5-6 code), carriage return (3-5-6 code) and tabular (2-5-6 code). Note that the 5 and 6 units are common in each of the three codes. The RC5 and RC6 will operate when each of these codes is read. When both RC5 and RC6 operate without RC4 operating, a circuit is

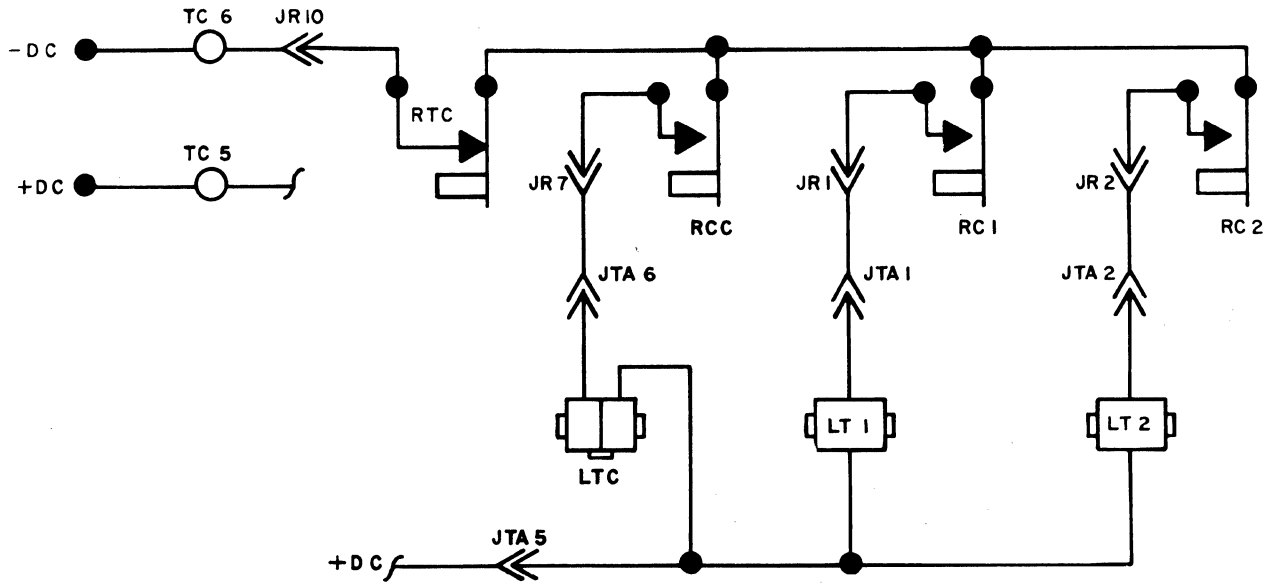


Figure 8-17 Translator Magnet Circuits

completed to the delay control relay (K7) as follows: from -DC, TC6, JR10, RTC, JR13, N/C S6, CRTC, BSC, JR14, RC6, RC4, RC5, JR9, TA9 and 10, K8-1 and 2, TA30, K7, TA39, TC5, to +DC. When K7 is energized, contact strap 2 breaks with 1 and makes with 3. The energizing circuit to the reader magnet (LRM) is broken, thus, de-energizing the reader magnet and stopping reader operation. Also, when K7 contacts 2 and 3 make, a holding circuit to K7 is established (the original pick up circuit to K7 will be open when contacts RC5 and RC6 return to normal).

If we assume the CR code 3-5-6 was read in the reader, then, at the same time the above mentioned circuit was complete to K7, a circuit would also be complete to the translator magnets LT3, LT5, and LT6, and the translator clutch magnet LTC. The translator would operate, pulling down the CR keylever and starting a carriage return function. The operation of the CR mechanism would open contacts CRTC, thus breaking the holding circuit to K7. The K7 contacts would return to their normal position, but the circuit to the reader magnet will not be complete until the carriage returns to the left hand margin and the clutch toggle unlocks. When this happens, the CRTC contact closes, completing the energizing circuit to the reader magnet, starting the reader operation again.

Therefore, with the above circuit operation, when a Tab, CR or BS code is read by the reader, the reader operation will automatically stop and will not start again until that particular function is complete.

Stop Code Circuit - When a stop code 4-5-6 is read by the reader, the holding circuit for the K8 relay (reader control relay) will be broken, thus, de-energizing the reader magnet and stopping the reader operation. A normally closed contact on RC4, RC5 and RC6 completes the holding circuit through K8 contact 3 and 4 to the K8 coil. If all three contacts (RC4, RC5 and RC6)

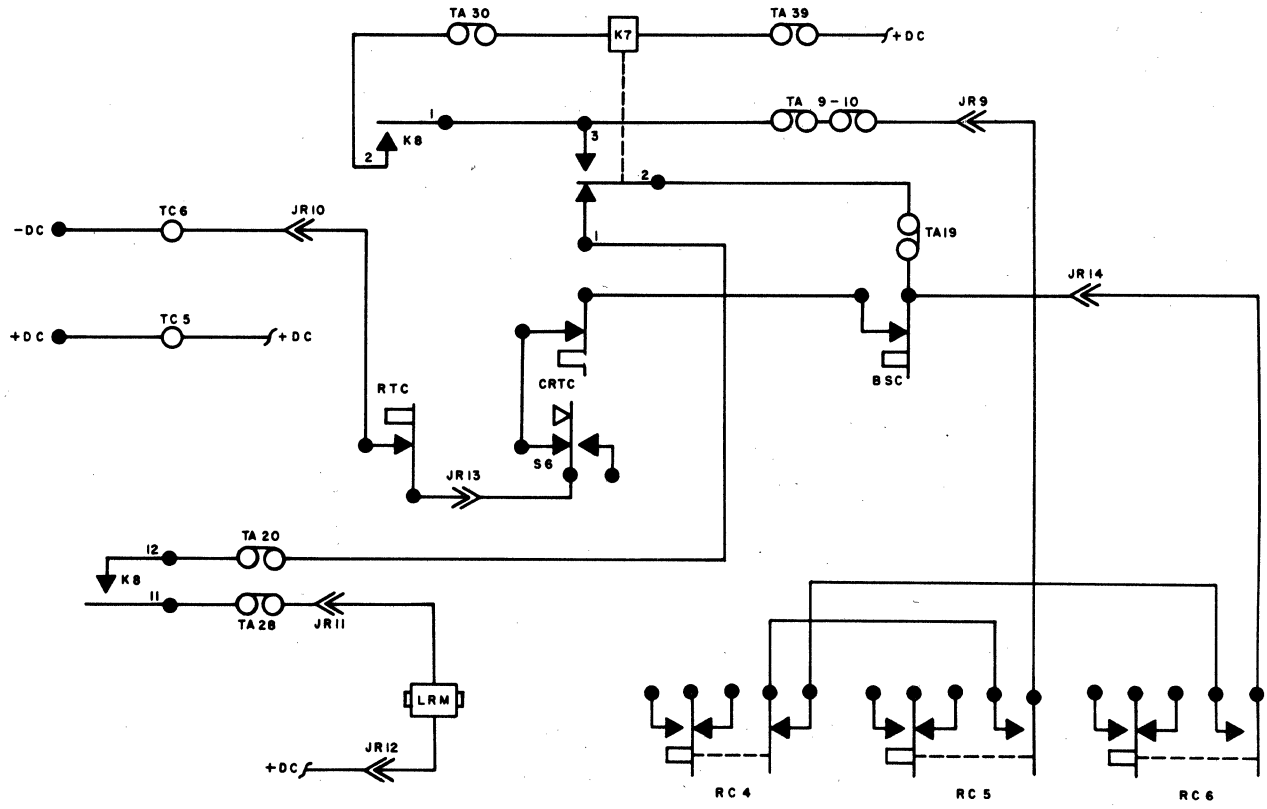


Figure 8-18 Delay Control Circuit

were to open simultaneously, the K8 relay would de-energize, opening contact K8 - 11 and 12, breaking the circuit to LRM. The start read switch (S6) would have to be depressed to start the reader operation again. (See Figure 8-16.)

A normally open contact on RC3 is provided in the event the codes 3-4-5-6, 2-3-4-5-6, or 1-2-3-4-5-6 are read by the reader. The 4, 5 and 6 units are used in all three of these codes and it is obvious, that if the RC4, RC5 and RC6 contacts operate simultaneously, an additional normally open contact is necessary to maintain the holding circuit to K8 to prevent the reader from stopping.

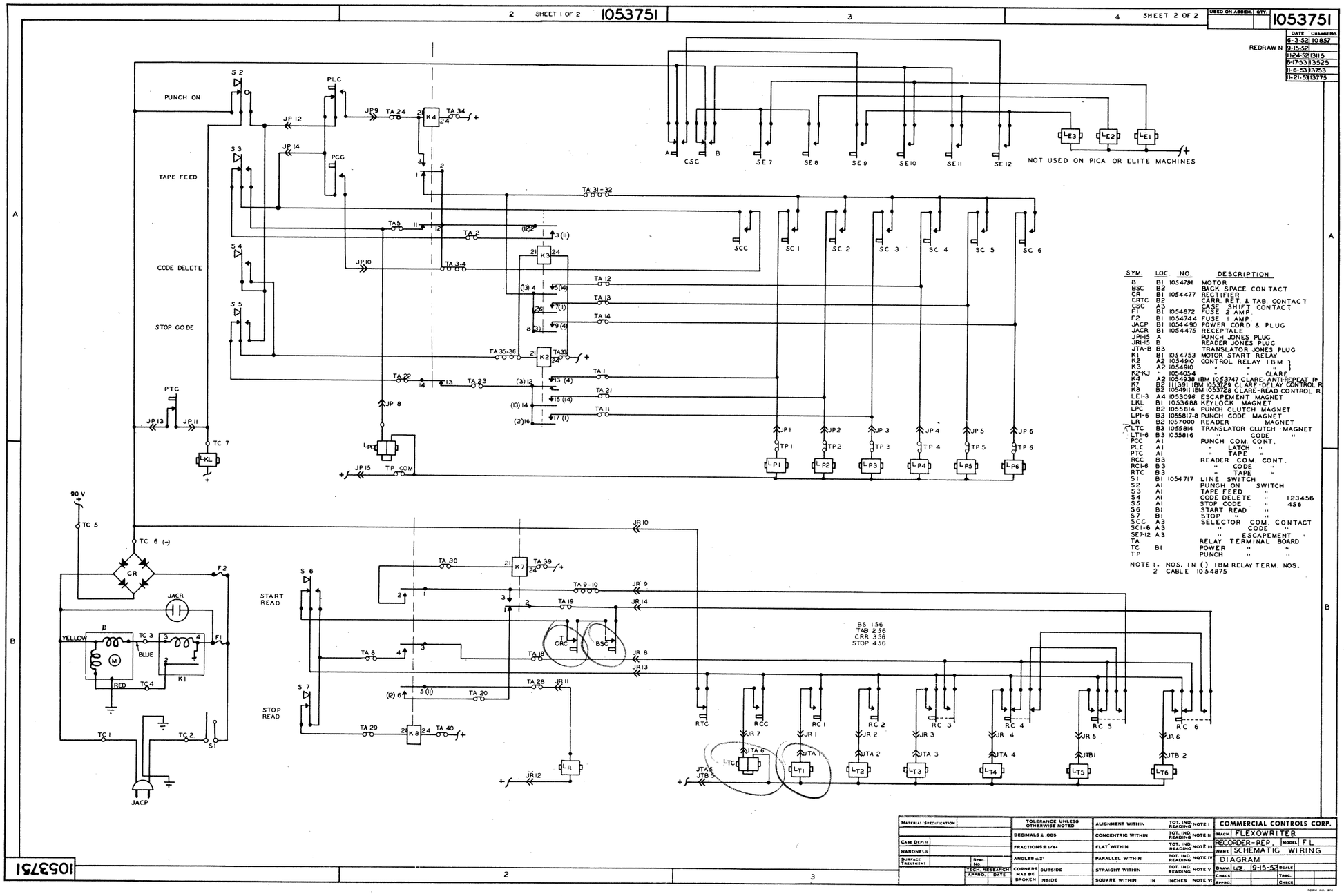


Figure 8-19 Flexowriter Wiring Diagram

FLEXOWRITER TIMING CHART

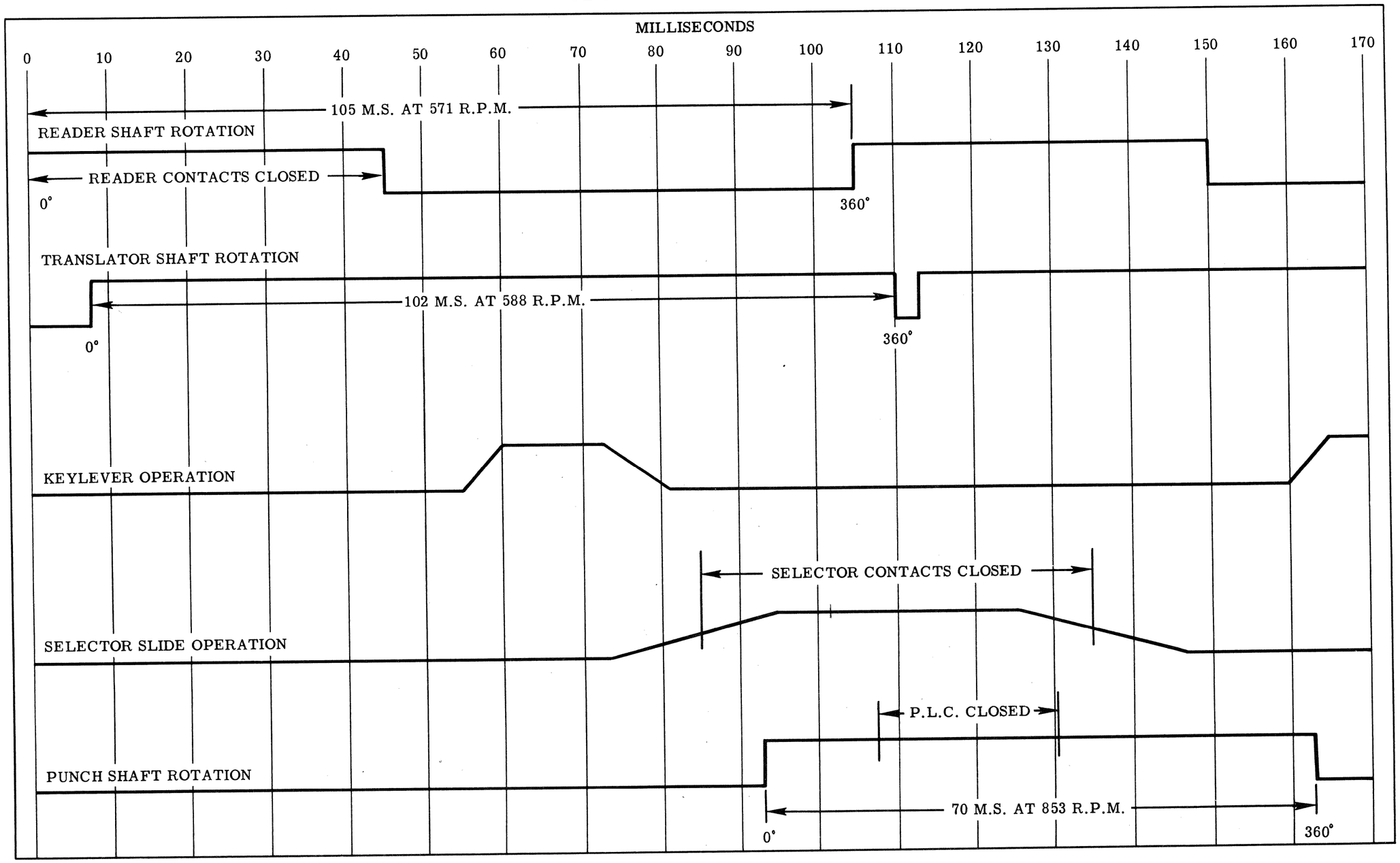


Figure 8-20 Flexowriter Timing Chart

Friden — Customer Service Engineering

Date: January 6, 1957

Reference: To be inserted in Part II, Section 8
after Page 8 - 16.

Purpose: Engineering Standards

Information:

The attached Engineering Standards will be helpful in becoming familiar with the procedure and symbols used on all Electrical Circuitry.

ELECTRICAL DRAWING

PURPOSE AND ORIGIN

The object of this bulletin is to insure uniformity of graphic symbols used on Commercial Controls wiring diagrams. The result should be the elimination of confusion, due to a diversity of symbols, both in reading and drawing wiring diagrams.

Symbols are shown only for devices and conditions likely to be encountered in Commercial Controls wiring. Devices not specifically represented can probably be symbolized by combination and modification of elementary symbols.

Most of the symbols are based on usage by Commercial Controls or the American Standards Association. In view of the extensive use of wiring diagrams by the factory and field, clarity and ease of reading were primary considerations in the selection and modification of symbols.

Existing Commercial Controls symbols were given first consideration. Many were discarded as being unnecessarily complicated, difficult to read, or subject to disfiguration in reproduction. American Standards were chosen when they seemed more practical. In some instances, the best solution appeared to be a modification of an A.S.A. or a Commercial Controls symbol.

The symbols tend toward simple conventions rather than pictorial figures. Actual mechanical representations have been avoided, due to the complications involved in trying to illustrate the many different designs. To differentiate among various relays, for example, would also lead to an endless variety of symbols, with a new symbol required for each new relay.

DRAFTING

Drafting time and cost are very small in comparison with that spent in development, manufacturing and maintenance. Therefore, wiring diagram layout and drawing should be done with care. Wiring diagrams should be drawn to represent conditions with the power OFF and the machine in normal position. This need not be stated on the diagram. If there is more than one normal position, the position represented must be indicated on the drawing.

An attempt should be made to maintain the proportionate sizes of symbols as shown on the following pages. The sizes indicated are the smallest considered suitable for drafting, or for reproduction by processes used in the blueprint department.

The symbols may be drawn in any convenient position as long as the elements having definite mechanical interconnection are shown in alignment and indicated by dotted lines as being mechanically related to each other. For example, all contacts operated by a single relay magnet should be drawn on a single vertical center line which should also be on the center line of the symbol of the relay coil. These contacts can then be all interconnected by dotted lines, and contacts may be drawn both above and below the coil symbol.

The deenergized position of a movable relay contact is drawn always as a horizontal line to simplify drafting. If a movable relay contact is positioned below the coil, it is considered as moving upwardly when the relay is energized, and if positioned above the coil, it is considered as moving downwardly when the relay is energized.

COMPONENT DESIGNATION

A standard letter designation of each electrical device should be used in connection with the graphic symbol. The first letter of this designation should define the kind of device according to the accompanying table of Standard Component Designations.

Whenever it is useful and practical, this first letter designation should be followed by one or two additional letters indicating as abbreviations the usage or function of the component in the particular circuit. Whenever several components have the same usage or function, they should be designated by a numeral following the last letter designation.

Whenever terminals are designated by numbers or letters on the component itself, such as terminal strips or connectors, the same designations should be used on the diagram following the descriptive letter designations of the component. When terminals are not designated on the part itself, the numbering sequence should be from the mounting means outward, or from right to left, or from top to bottom, or from front to back.

STANDARD COMPONENT DESIGNATIONS

FIRST LETTER	COMPONENT
A	Structural parts, panels, frames, castings, etc.
B	Motors, and prime movers, self-synchronous motors, etc.
C	Capacitors of all types.
D	Dynamotors, rotary converters.
E	Miscellaneous electrical parts: insulators, knobs, brushes, etc.
F	Fuses
G	Generators, exciters, etc.
H	Hardware, screws, bolts studs, pins, etc.
I	Indicating devices, pilot lamps, etc.
J	Jacks or Plug Connectors. (Male or female)
K	Relays.
L	Electromagnets, Solenoids.
M	Meters of all types, gauges, etc.
N	Name plates, dials, charts, etc.
O	Mechanical parts; bearings, shafts, couplings, gears, etc.
P	Power plugs or power sources.
Q	Diaphragms (microphone, telephone, projector, etc.)
R	Resistors, fixed and variable, potentiometers, attenuators, etc.
S	Switches or contacts (manual switches, stepping switches, cam contacts, lever contacts, relay contacts, etc.)
T	Transformers
U	Hydraulic parts

STANDARD COMPONENT DESIGNATIONS
(Continued)

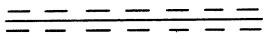
FIRST LETTER	COMPONENT
V	Vacuum and gaseous discharge tubes.
W	Wires, interconnecting cables, etc.
X	Sockets for electron tubes, pilot lamps, fuses, etc.
Y	Mechanical oscillators, crystals.
Z	Filters, i-f transformers, compound-tuned circuit assemblies, etc., in a common container.
BT	Batteries.
CR	Rectifiers and Diodes of all types except vacuum or gaseous tubes.
HR	Heater
MG	Motor generators (single unit)
TB	Terminal boards.
TY	Surge eliminators (special discharge resistors).
VR	Voltage regulators (except vacuum or gaseous tubes).

WIRE SYMBOLS

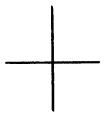
All Standard Wiring

Lines must be sufficiently dense and wide for good reproduction, .020 to .025 wide. Parallel lines should be spaced as widely as practical, and not closer than one-quarter inch.

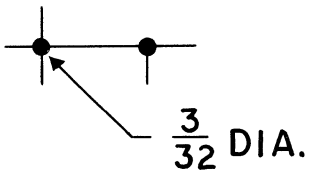
Shielded Wire



Crossed Wires, Not Connected



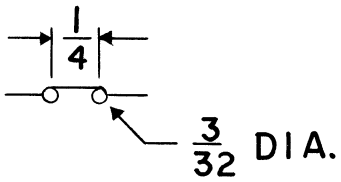
Wires Connected



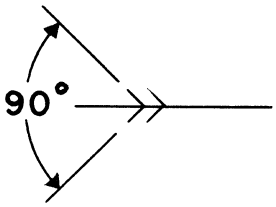
Break In Wire Symbol

TERMINALS

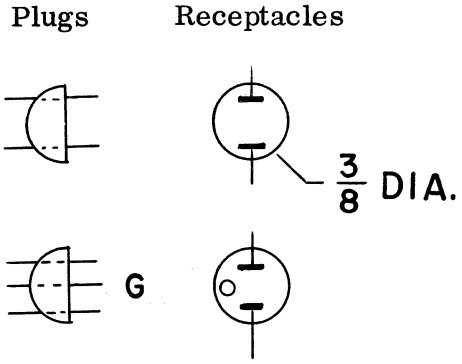
Plug Hub



Plug Connector

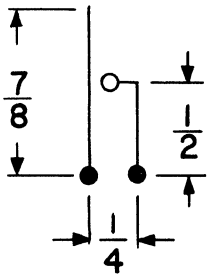
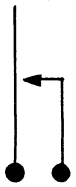
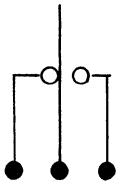
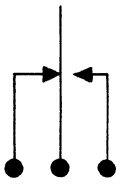
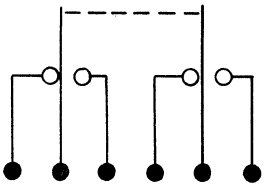
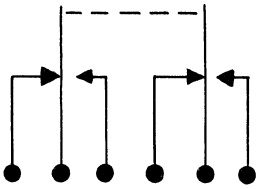
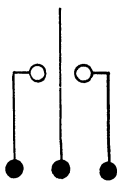
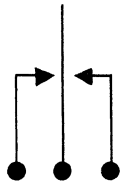


Power Plugs and Receptacles

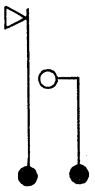
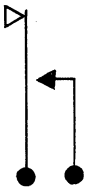
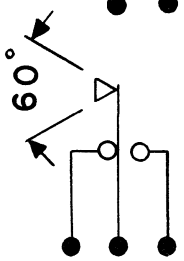
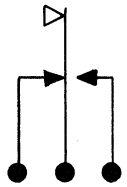


MANUAL SWITCHES

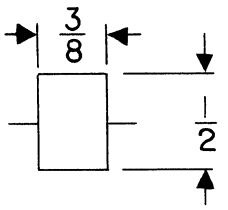
LEVER TYPE

	LOCKING	NON-LOCKING
S.P.S.T Single Pole Single Throw		
S.P.D.T. Single Pole Double Throw		
D.P.D.T. Double Pole Double Throw		
Center Off		

PUSH TYPE

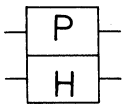
S.P.S.T. Single Pole Single Throw		
S.P.D.T. Single Pole Double Throw		

RELAY COILS



Standard Single Winding

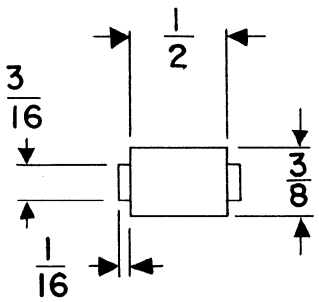
Double Winding



Special Feature Designations

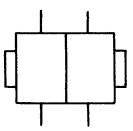
AC	-	Alternating Current
EP	-	Electrically Polarized
FO	-	Fast Operating
FR	-	Fast Releasing
H	-	Holding Winding
P	-	Pick-up Winding
MP	-	Magnetically polarized
SO	-	Slow Operating
SR	-	Slow Releasing
SA	-	Slow Acting

ELECTROMAGNET OR SOLENOID COIL



Single Winding

Double Winding



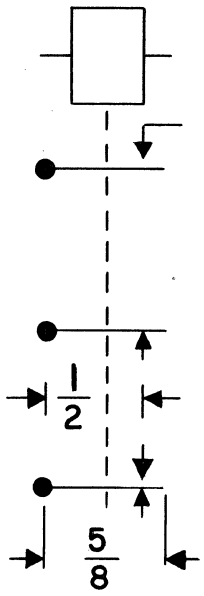
RELAY CONTACTS

Coil

Form A or Make or Normally Open

Form B or Break or Normally Closed

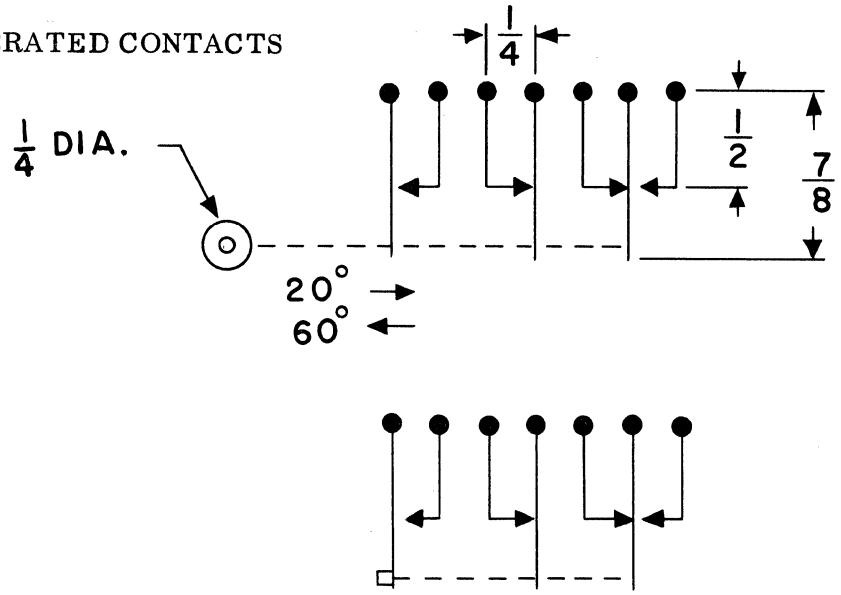
Form C or Transfer



MECHANICALLY-OPERATED CONTACTS

Cam-Operated

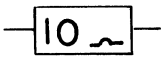
Lever-Operated



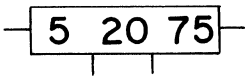
These symbols may be drawn with Terminals either top or bottom.

RESISTORS

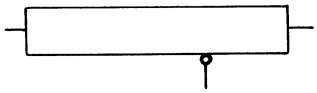
Fixed



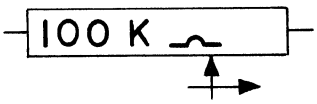
With Fixed Taps



Adjustable (Clamp)



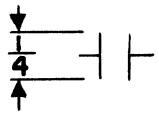
Rheostat or Potentiometer



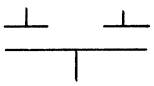
Arrow indicates clockwise rotation.

CAPACITORS

Fixed



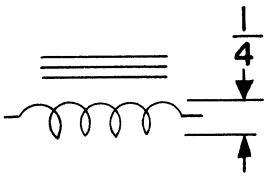
Double (Common Tap)



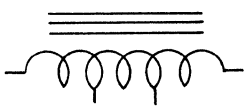
Variable

INDUCTORS

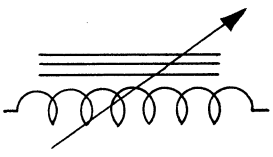
Fixed



Tapped

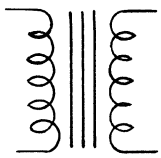


Variable

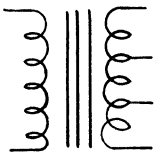


TRANSFORMERS

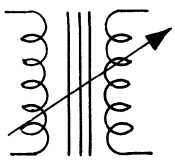
Fixed



Tapped

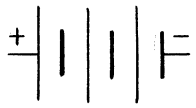


Variable



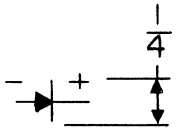
Omit core symbol on Air Core Units

BATTERY (Indicate Volage)

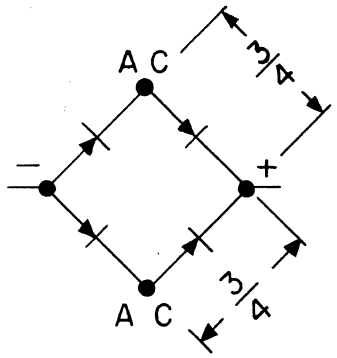


DRY RECTIFIER

Half Wave



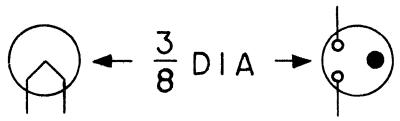
Bridge



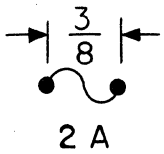
LAMPS

Filament

Neon



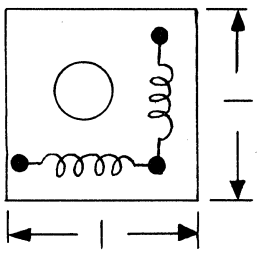
Fuse (Show Amp. Rating)



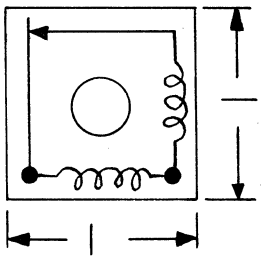
MOTORS

A. C. Single Phase

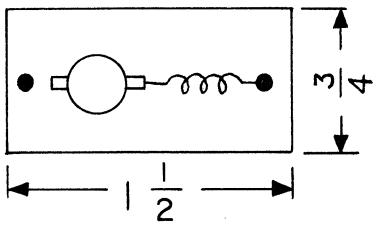
External Start Control



Internal Start Control



D. C. Series



D. C. Shunt